12d® Model
Civil and Surveying Software

What's New in 12d Model 15

December 2024

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What's New in 12d Model 15

Disclaimer

12d Model is supplied without any express or implied warranties whatsoever.

No warranty of fitness for a particular purpose is offered.

No liabilities in respect of engineering details and quantities produced by ***12d Model*** are accepted.

Every effort has been taken to ensure that the advice given in this manual and the program ***12d Model*** is correct, however, no warranty is expressed or implied by 12d Solutions Pty Ltd.

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1 About This Manual

The section 1.1 Read This Section First highlights important information that you need to be aware of being moving to ***12d Model 15.***

This manual then contains information on:

(a) details on some of the new, or modified, options in ***12d Model 15.***

Chapter 2 General Items is general information.

Chapter 3 Starting Up describes the new start up screen for ***12d Model 15.***

Chapter 4 Tools and Concepts explains new or modified concepts.

Chapter 5 Menus on Views has information about the menus on Plan, Section and Perspective views.

The chapters 6 Project to 24 Help are set out in the order that options appear on the ***12d Model 15*** **menus**, **Reference** manual.

(b) the following sections contain information you need when installing and moving across to ***12d Model 15.***

31.1 Hardware Locks for 12d Model 15

31.2 Installers for Lock Drivers and 12d Model

31.3 User, User_Lib and env.4d for 12d Model 15

31.4 Network Hardware Locks and 12d Model

IMPORTANT NOTE:

Some of the links in this file may not be valid as they are links to information in the ***12d Model 15 Reference*** manual.

Continue to the section 1.1 Read This Section First.

1.1 Read This Section First

See

1.1.1 Getting Started Manuals and Videos Now on SPOT

The ***Getting Started for Design*** pdf and ***Getting Started for Surveying*** pdf are no longer shipped with ***12d Model 15*** but are now available, with videos, as **FREE Self Paced Online Training** (**SPOT**) at www.civilandsurveying.com/civil-and-surveying-institute.

The number of **free** ***Getting Started*** course is being continually expanded and currrently includes:

The free **SPOT** courses now include:

(a) ***12d Model*** Fundamentals

(b) Getting Started for Design

(c) Getting Started for Surveying

(d) Getting Started for 12d Field

(e) Getting Started for Utility Modelling

(f) Videos from the sessions of the ***12d Technical Forum 2021***

(g) Coming soon: videos from the sessions of the ***12d Technical Forum 2024***

Each **SPOT** course includes videos, documentation and quizzes, plus, a ***12d Model*** licences to use for the course, and a ***Certificate of Completion*** at the successful end of the course.

SPOT also includes more advanced paid course including

(a) Civil Design Basics

(b) Civil Design Features

(c) Pavements

(d) ALDE Introduction to Land Development

Each paid course includes videos, documentation and quizzes, plus, a ***12d Model*** licences to use for the course, and a ***Certificate of Completion*** at the successful end of the course

Certificates of Competency based on an online proctored exam are also available.

Instructor Led Online or **Instructor Led Face-to-Face** training is also available and the courses and the dates for these courses are on www.12d.com/training.

1.1.2 Windows Operating Systems Supported

(a) There is only a ***64-bit*** version of ***12d Model 15***.

(b) ***12d Model 15*** **WILL RUN** on **Windows 11**

Windows 11 is now our development platform and all our staff and our Test Suite use Windows 11.. Please let us know if you have any problems on **Windows 11** that didn't occur on **Windows 10.**

(c) ***12d Model 15*** **should run** on **Windows 10**

It is exected that ***12d Model 15*** will run on **Windows 10** but as time passes and **Windows 11** diverges more and more from **Windows 10**, problems may occur.

(d) ***12d Model 15*** **SHOULDN NOT BE RUN** on Windows 8.0.

Windows 8.0 is very buggy and no one should be using it for ***12d Model 15***.

(a) ***12d Model 15*** **MAY RUN** on 64-bit **Windows 8.1** but that is not recommended.

Windows 8.1 is better than Windows 8 but is still very buggy so there is no guarantee that everything will run as expected for ***12d Model 15***.

(b) ***12d Model 15*** will **NOT RUN** on Windows **Vista**, **XP** or **earlier versions of Windows**.

1.1.3 The old Hardlock dongles will **NOT** work with ***12d Model 15***.

If you still use the brand ***Hardlock*** dongles (they were parallel dongles or purple USB dongles) which were used with ***12d Model 10*** and earlier versions, then they will not work with ***12d Model 15***. Please contact your ***12d Model Reseller***.

1.1.4 CodeMeters Need Drivers of at Least Version 8.20

To obtain new CodeMeter drivers, see 31.2 Installers for Lock Drivers and 12d Model.

1.1.5 Installer Deletes the Program Files 15.00 Areas

The ***12d Model 15 Installer*** first deletes everything in the ***15.00*** Area before starting the installation. That is, the ***12d Model 15*** Installer **delete all files** in the 32-bit or 64-bit folders

Program Files\12d\12dmodel\15.00

or

Program Files (x86)\12d\12dmodel\15.00

So **do not** add or modify any files in those areas because they will be deleted by the next ***12d Model 15 Install***.

1.1.6 New Guid File Naming Convention

In previous versions of ***12d Model***, model and tins were saved on disk with the same file name as the model or tin followed by a dot and a file ending to indicate if it was a model or a tin.

For ***12d Model 15*** this has been changed and the files on disk for models and tins have a guid as their name. The actual model or tin name is now inside the guid named file.

This is a totally new concept for ***12d Model*** and because names of models, tins, functions and templates can no longer be known by just looking at the file name on the disk using Windows **File Explorer**.

For more information go to 2.2 Guid Naming Convention for 12d Model 15.

1.1.7 12d Model 15 Projects

12d Model 15 writes a ***V15 Project*** which means that the **V15** project can not be opened by any earlier versions of ***12d Model***. For example, ***12d Model 14 CAN NOT*** open a **V15** Project.

A ***V15 Project*** CAN NOT be converted to an earlier ***12d Model*** Project. For example, a ***V15 Project*** can not be converted to a ***V14 Project.***

1.1.8 Using V15 Projects with 12d Synergy

12d Model Projects with a ***V15 database*** can be used with ***12d Synergy 4*** and above***.***

However, it requires at least ***12d Synergy 5.1.1.48*** or ***12d Synergy 4.3.10.141***, both of which have been released.

Note: both Server AND Client must be on the appropriate version for it to work.

2 General Items

See

2.1 Object Tree

As projects increased in size and the number of models, tins and functions in a project have rapidly increased, many users have asked about the possibility of models, tins and functions having groups like linestyles, and to any number of levels. This would make it much easier to group these objects together, and make pop-up lists etc more readable and usable.

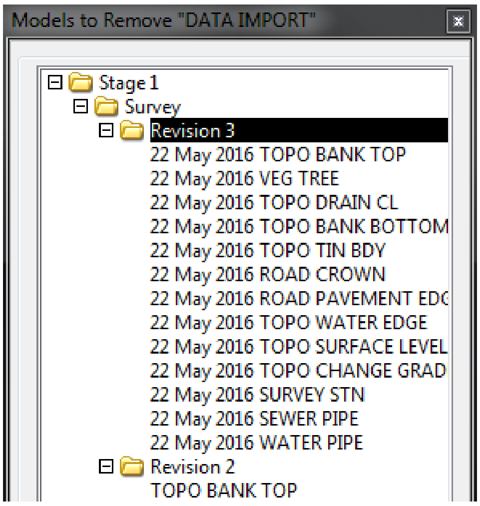
That is, the wish is to allow some object names to have a tree structure and full path names like attributes or Windows folders so that it is easier to group the objects together in pop-up lists.

For example, if the models were called:

"Stage 1/Survey/Revision 3/22 May 2016 TOPO BANK TOP"

"Stage 1/Survey/Revision 3/22 May 2016 VEG TREE" etc

then when looking at a list of models, the list would have a four level tree structure showing "Stage 1" at the top level, with "Survey" at the second level, "Revision 3" at the third level and finally "22 May 2016 TOPO BANK TOP", "22 May 2016 VEG TREE" as sub nodes of "Revision 3" at the fourth level.



This grouping is being called **Object Tree**, and the example above is the case of ***Object Tree*** being used for ***model names***.

In ***12d Model 15***, this ability to use a tree path name has been implemented for:

(a) models

(b) tins

(c) functions

(d) templates

When a new ***12d Model 15*** is created it is automatically ***Object Tree*** enabled.

Note

Any pre and post spaces in the each part of the object tree path will be removed but imbedded spaces are not.

That is, "   fred jones / joe /   lee   " is the same as "fred jones/joe/lee"

but

"fred   jones" is different to "fred jones"

2.2 Guid Naming Convention for 12d Model 15

In previous version of ***12d Model***, models, tins, functions and templates were saved on disk with the same file name as the model, tin, function or template followed by a dot and a special file ending to indicate if it was a model, tin, function or template.

For ***12d Model 15*** this has been changed and the files on disk for models, tins, functions and templates have a guid as the unique part of their file name, followed by a dot and a special file ending to indicate if it was a model, tin, function or template.

For example,

C45EDEB2-0110-4FEB-9699-37EE0364DFDF.model

The actual name of the item is now **inside** the file and so is no longer easily recognised using tools such as Windows **File Explorer**.

These new names will be referred to as the **guid naming convention** and ***12d Model*** projects using it are called **guid projects.**

This change can have important ramifications for anyone replying on the name of the file on disk for a model, tin, function or template to use for another purpose.

For example, in a back up of your data, you can't tell the name of the model, tin, function or template just by looking at the file name.

Another consequence of the new guid naming convention is that models and tins from earlier versions of ***12d Model*** can not be shared into ***12d Model 15***. All non-guid projects must be migrated to ***12d Model 15*** projects before any of their tins or models can be shared into a ***12d Model 15*** project. For information on migrating a project, see 2.3 Migrating a Project.

However the ***12d Model 15*** options **Copy Project /Folder** for ***models***, ***tins***, ***functions*** and ***templates*** can be used to bring data from non-guid projects into a ***12d Model 15*** project.

Also ***12dXML*** and ***12da*** can be used to bring data from earlier versions of ***12d Model*** into ***12d Model 15***.

This change to a guid file naming convention for models, tins, functions and templates could have unforeseen consequences so if you run into any difficulties please contact your ***12d Model Reseller ASAP*** so that is can be looked into.

For information on migrating a project, see 2.3 Migrating a Project.

2.3 Migrating a Project

When ***12d Model 15*** attempts to open a **non-V15** project, rather than trying to convert the project and saving on top of the old project, the user is asked if the old project is to be ***migrated*** to **V15**.

What **migration** does is:

(a) for the existing project called XXX, renames it to XXX_old

(b) in the same working folder as the existing project, creates a new V15 project with the original project name XXX

(c) copies the models, tins, functions and templates from the original project to the new project. In the new project all elements are given the same element id's as in the existing project but the models, tins, functions are given guid names.

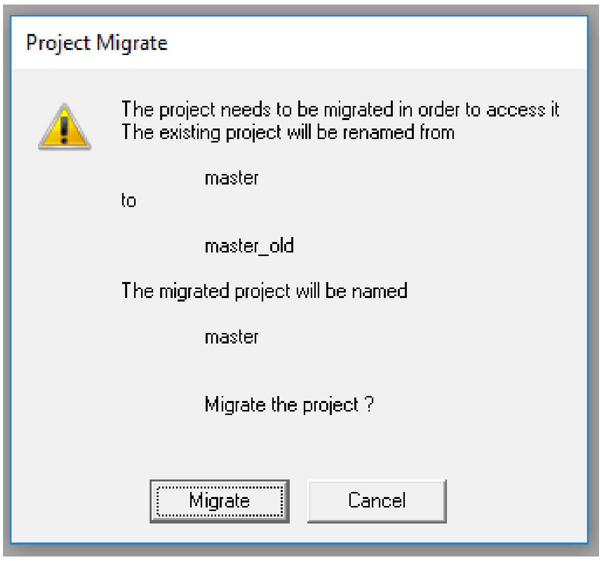
(d) copies all the other files in the old project folder over to the new project folder.

Consequently migration will not destroy the original project.

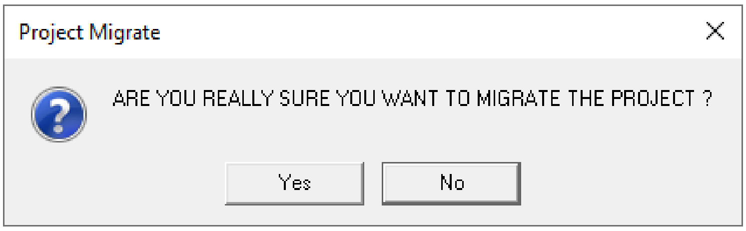
Notes

1. Migration will be triggered if the project is selected from the list in the **Open a Recent Project** panel, from the walk-right list in ***Project =>Recent projects*** and when you ***Drag and Drop*** a project onto a V15 desktop shortcut.
2. Migration is also necessary for **V15** projects that were created **BEFORE** the **V15** guid version was available. That is, those created by V15 versions before **15.0.0.689**.
3. Migration is also necessary for **V15** projects that were created as non-Object Tree projects **BEFORE** it was decided that **all V15 projects must be Object Tree**.
4. Because the original project is renamed to XXX_old, you can only migrate a project once. But you can get around it by renaming XXX_old to a different name.

When a project that requires migration is selected for opening then the **Project Migrate** panel is displayed.



When **Migrate** is pressed, a confirmation panel is displayed:



if **Yes** is selected then the migration proceeds.

2.4 Themes

Before ***12d Model 15***, ***12d Model*** was shipped with a fixed set of menus on the **Main** menu and fixed menus on each type of View. The icons were 16x16 pixels.

Users could change the size of the icons for toolbars but the resulting icons were the traditional ***12d Model 14*** icons blown up to the larger size.

In ***12d Model 15***, there are sets of different Main menus, submenus and toolbars, with a variety of icon sizes. The different sets are called **Themes**.

One **Theme** called **Classic** has the set of menus, submenus and toolbars as used in ***12d Model 14*** and using the 16x16 pixel icons from ***12d Model 14***.

There is another **Theme** called **Neo Classic**, or **Neo**, which has the same menu and toolbar structure as **Classic** but has new 16x16 pixel icons that match the icons used in the other Themes.

For all **Themes** other than **Classic** and **Neo**, **Themes** allow for:

(a) different menus and submenus for the **Main** menu across the top of ***12d Model***.

(b) different menus and submenus for each of the **View** types.

(c) different icon sets for the standard Microsoft choices 125%, 150%, 175% and 200%.

The icon sets are tailored for each icon size.

(d) changing between the different **Themes** without leaving ***12d Model***

(e) changing icons sizes for a **Theme** without leaving ***12d Model***

For all **Themes** other than **Neo Classic** or **Classic**, the choice of icon sizes are:

(a) Small (**S**) - 20x20 pixels

(b) Medium (**M**) - 24x24 pixels

(c) Large (**L**) - 32x32 pixels

and

(d) Extra Large (**XL**) - 36x36 pixels

The available **Themes** are:

(a) Classic

The **Classic** theme uses a similar layout for the top menu and submenus as that used in ***12d Model 14.*** The icons and size of icons, are the 16x16 icons used in ***12d Model 14.***

All ***12d Model*** options appear in the **Classic** theme.

(a) Neo Classic

The **Neo Classic**, or ***Neo***, theme uses a similar layout for the top menu and submenus as that used in ***12d Model 14*** and the size of icons is 16x16. However the icons are the new icons used in the other Themes in ***12d Model 15.***

All ***12d Model*** options appear in the **Neo Classic** theme.

(b) Standard

has the same menu layout as Classic but the icons are different and the size of the icons can be selected as **small**, **medium**, **large** and **extra large**. The small size is slightly larger than for ***12d Model 14*** and **Classic** so that they can have more detail in the icons.

(c) Design

a theme set up with the Design options on the main menu. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(d) Water

a theme set up with Water options on the main menu. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(e) Survey

a theme set up with Survey options on the main menu. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(f) 12d Field

a theme set up for working with 12d Field. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(g) CAD

a theme set up for drafting. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(h) BIM

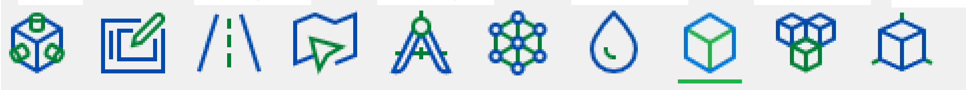
a theme set up for BIM work. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

(i) Tin

a theme set up with Tin options on the main menu. The icon size can be selected from **small**, **medium**, **large** and **extra large**.

Each theme has its own icon

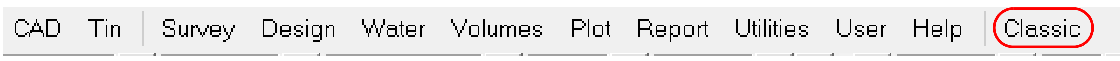
BIM **Design** **Survey** **Water** **Classic** **Neo Classic**



CAD **12d Field** **Tin** **Standard**

The **BIM**, **CAD**, **Design**, **12d Field**, **Survey**, **Tin** and **Water** themes each has a different menu structure that is tailored to the type of work being undertaken but this means that not all ***12d Model*** options appear in each theme. However all ***12d Model*** options can still be found using the **Search Bar,** or by changing back to the **Neo**, **Classic** or **Standard** themes.

The **Theme** that is currently being used is shown as the next item after ***Help*** on the ***Main*** menu, and for themes other than **Neo** or **Classic**, the choice of icon sizes is displayed after the name of the current **Theme**, and the icon size currently being used for the theme is surrounded by square brackets **[ ]**.



For information on changing ***Themes*** and ***icon sizes***, see 2.4.1 Changing Themes and Icon Size.

For information on changing the **size of the text** on menus, see 2.4.2 Changing Text Size on Menus.

Note - If there are any problems with the **Neo**, **Classic** or other ***Themes***, please report them to **12d Solutions** on support@12d.com ASAP.

In the meantime you can switch to the **Inbuilt** menu structure until the problem is fixed. See 2.4.3 Accessing the Inbuilt 12d Model Menus.

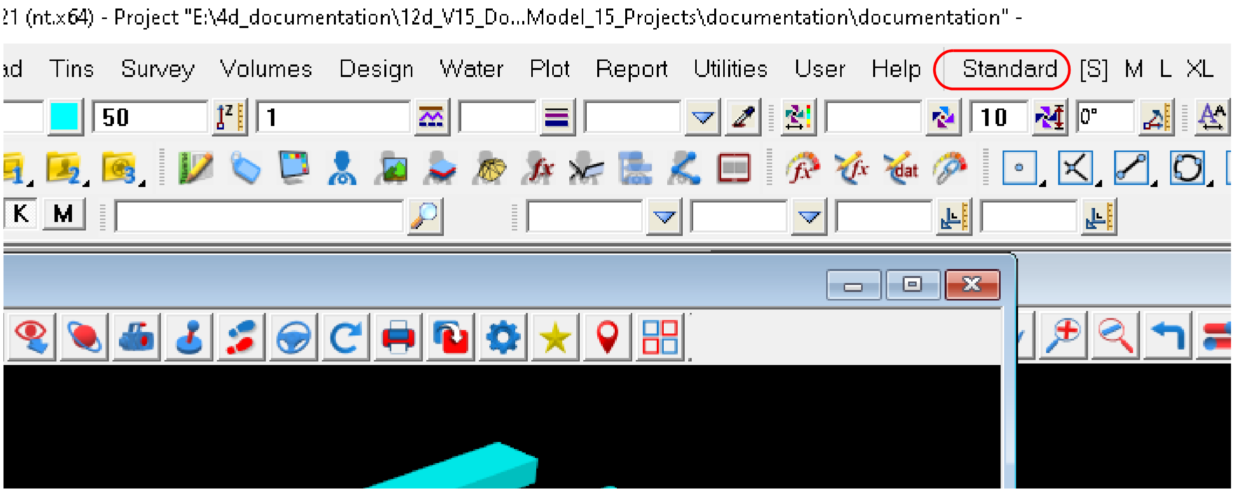
Continue to 2.4.1 Changing Themes and Icon Size or return to 2 General Items.

2.4.1 Changing Themes and Icon Size

The **Theme** that you are currently using is shown as the next item after ***Help*** on the ***Main*** menu and clicking on the current Theme name will bring up a menu of the available Themes.

Clicking on another **Theme** on the menu will change to that **Theme**.

For example, **Standard**.



For all **Themes** other than **Neo** and **Classic** (which use 16x16 pixel icons), there is also a choice of icon size to sue for the selected **Theme**. The choices are:

(a) Small (**S**) - 20x20 pixels

(b) Medium (**M**) - 24x24 pixels

(c) Large (**L**) - 32x32 pixels

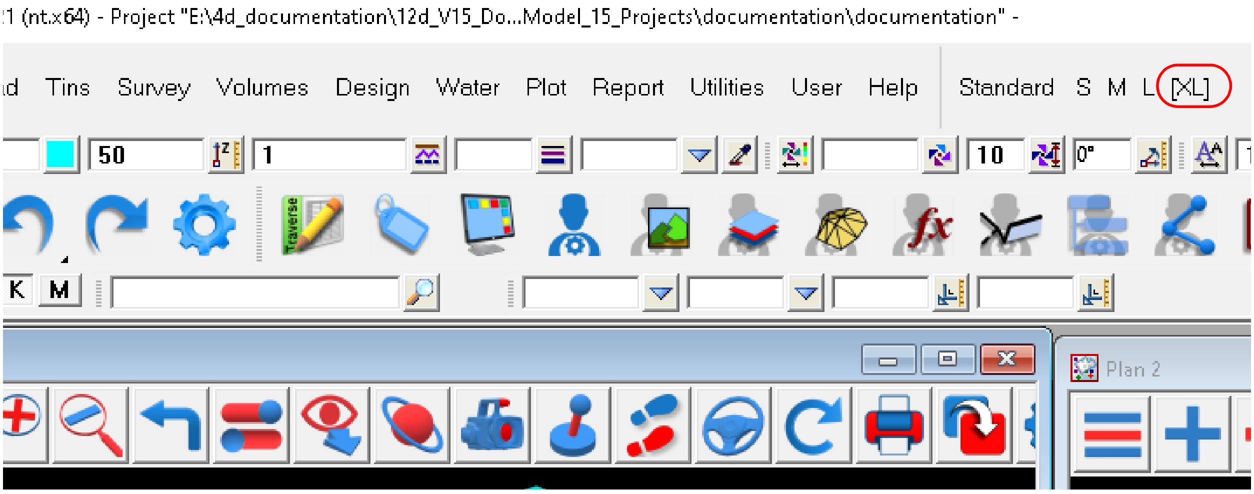
and

(d) Extra Large (**XL**) - 36x36 pixels

The choice of icon sizes is displayed after the name of the current **Theme**, and the icon size currently being used is surrounded by square brackets **[ ]**.

To change to different size icons for the same **Theme**, simply click on the **S**, **M**. **L**, or **XL** to select the new icon size and ***12d Model*** will then replace the icons and text with the new size.

For example, after changing to **XL**:



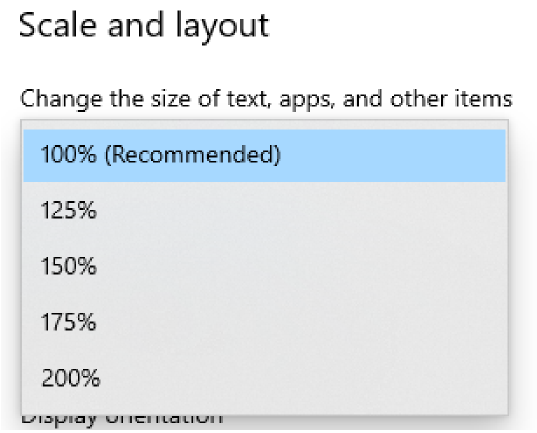
Note: The **Standard** Theme has the same menu structure as the **Neo** and **Classic** Theme but the icons are the new icons with the selected icon size.

Note: The size of the text on menus is independent to the size of the icons and is changed separately. See 2.4.2 Changing Text Size on Menus.

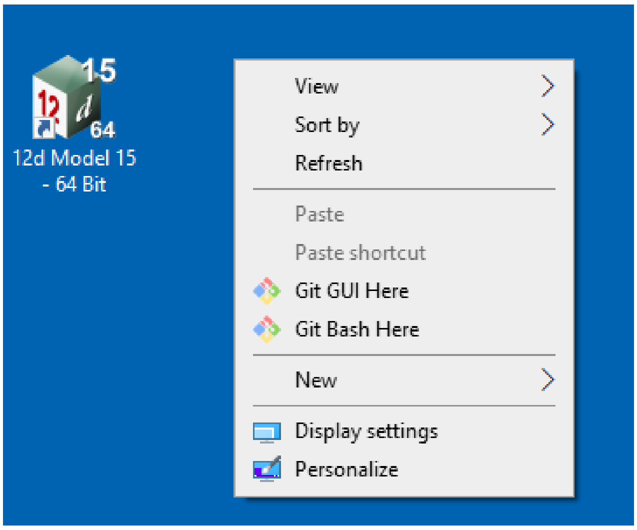
Continue to 2.4.2 Changing Text Size on Menus or return to 2.4 Themes.

2.4.2 Changing Text Size on Menus

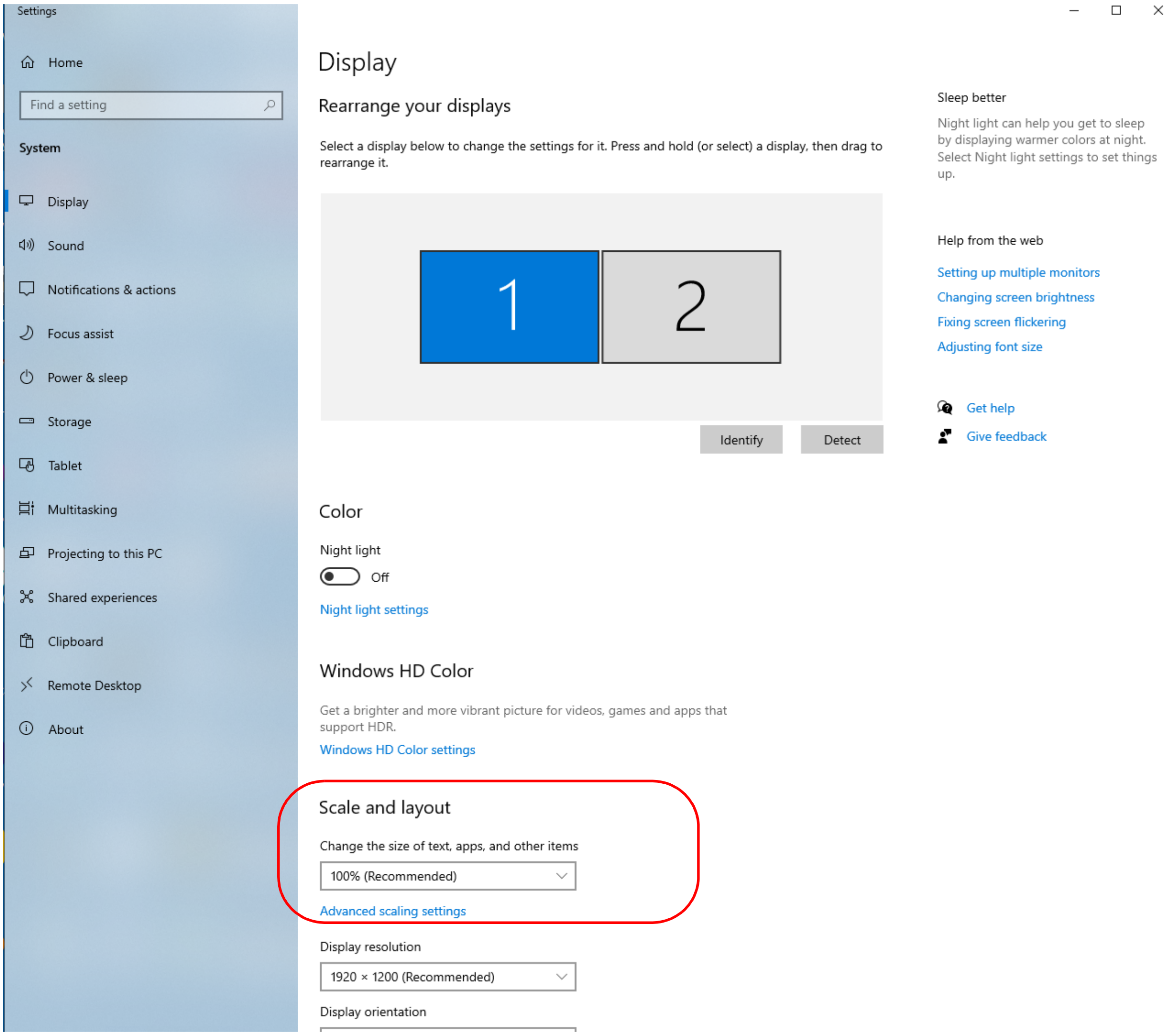
The size of the text on menus is controlled separately to the size of the icons and is controlled by the **Microsoft Display Settings**.



To access the **Microsoft Display setting**, click RMB (right mouse button) in the Microsoft window to bring up the menu:

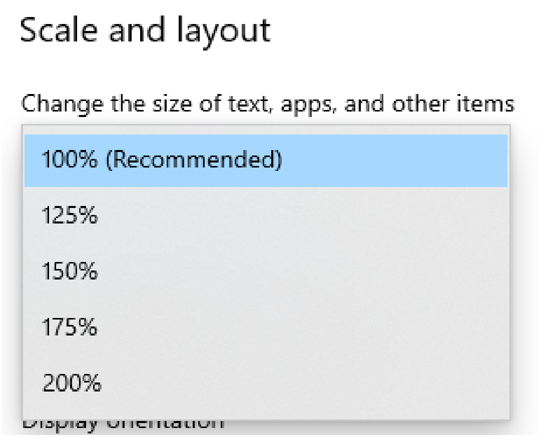


Click on **Display settings** to bring up the **Windows Setting** panel.



Under **Scale and layout,** click on the choice chevron beside **Change the size of text, apps, and other items** and a pop-up with the choices 100%, 125%, 175% and 200% is displayed.

,

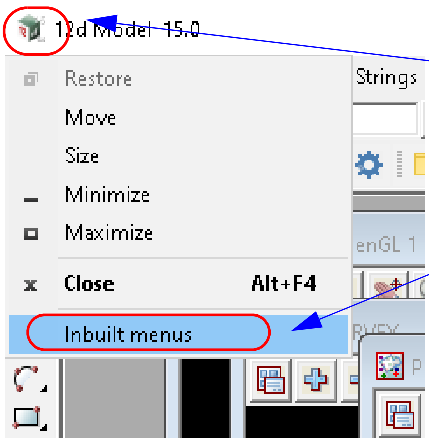


Select the percentage that you want the text size to become.

Continue to 2.4.3 Accessing the Inbuilt 12d Model Menus or return to 2.4 Themes.

2.4.3 Accessing the Inbuilt 12d Model Menus

Whilst in a ***12d Model Theme***, if there are any problems you can return to the **Inbuilt *12d Model Main Menu and View menus*** for the rest of the session by clicking on the **12d** icon in the top left hand corner of the ***12d Model*** window and select ***Inbuilt menus***.



Click on **12d** icon to bring up the menu

Click to return to the traditional menus

However when ***12d Model*** is restarted, it will revert to the last **Theme** that was being used.

Please report any problems with a **Theme** to 12d Solutions on support@12d.com ASAP so they can be fixed.

Continue to 2.5 E Snap or return to 2.4 Themes.

2.5 E Snap

E for Extrusion snap

In ***12d Model 14***, ***Face*** snap (**F**) was introduced and when turned on, allowed you to pick on the triangle face of a trimesh. So using **P**, **L** and **F** snap, you can select the vertex, edge or face a Trimesh.

For ***12d Model 15***, a new snap call ***Extrusion*** snap (**E**) was introduced and its use will now be explained.

In ***12d Model super string extrusions*** are created in a number of ways.

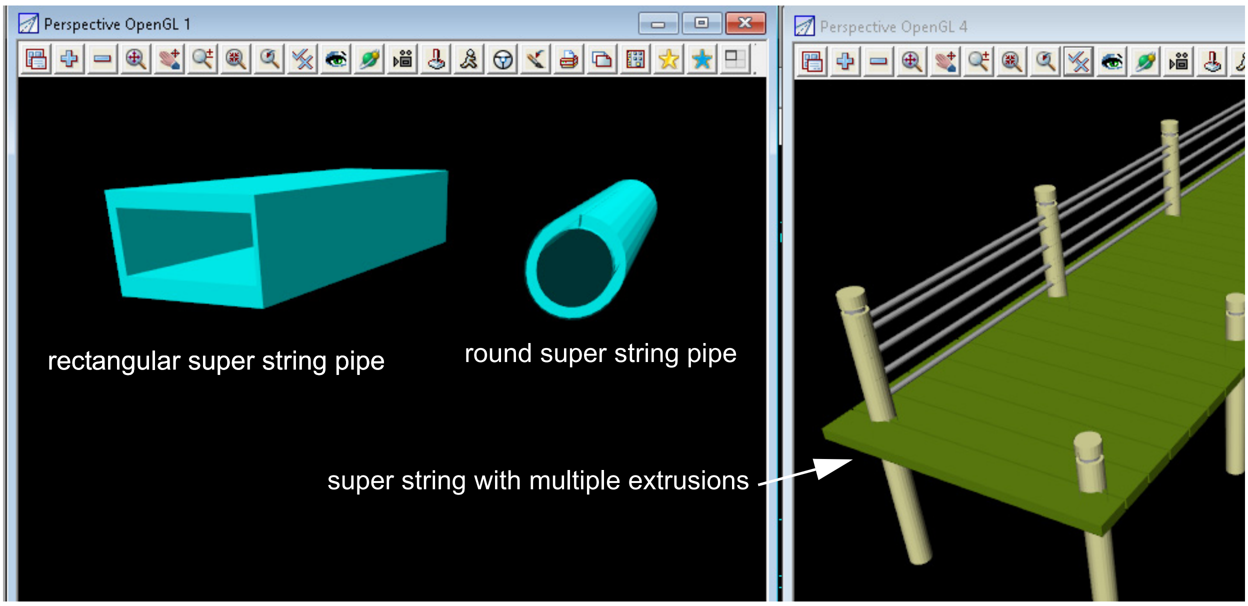
(a) super string as a round pipe

(b) super string as a rectangular pipe

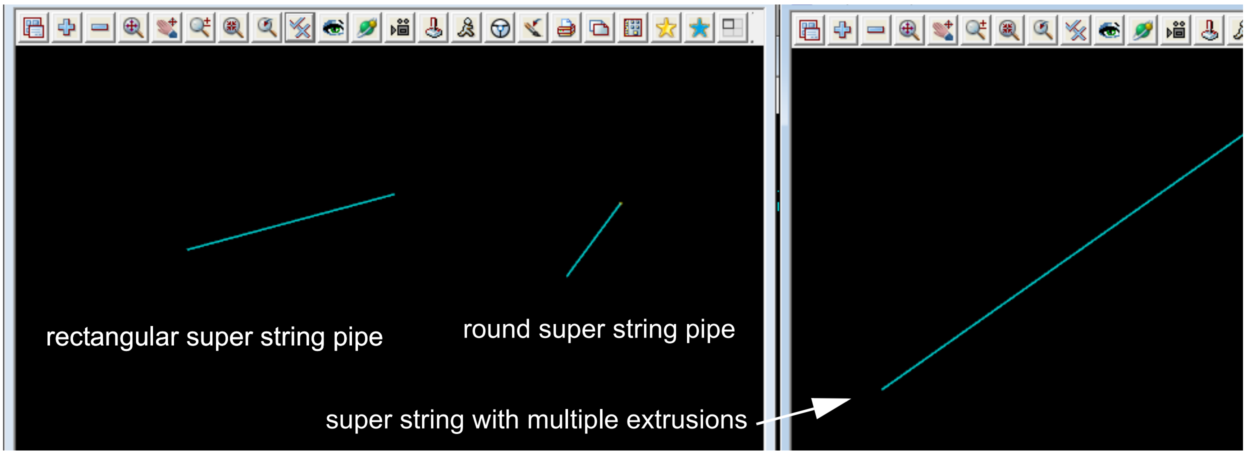
(c) super string with a 2D super string (with and without holes) swept along the super string

(d) super string with multiple extrusion

Round and rectangular pipes are special cases of (c) but because they are easily defined with a few parameters, they exist as special cases of the super string. Similarly multiple extrusions includes (c).



In each case there is only one super string and this become obvious is Extrusions are turned off on the perspective views:



The super string itself is referred to as the **spine** of the super string.

In ***12d Model 14***, when picking a super string, with or without an extrusion, the pick only selected the **spine** of the super string and not the surface of the extrusion.

To overcome this limitation, in ***12d Model 15*** a new snap, **Extrusion** (**E**) snap, has been introduced.

When **E** snap is **off**, picking a super string is the same as in ***12d Model 14***.

That is, when **E** snap is **off**:

(a) you can only pick the **spine** of the super string

(b) **P** snap picks vertices of the super string

(c) **L** snap picks on a segment of the super string.

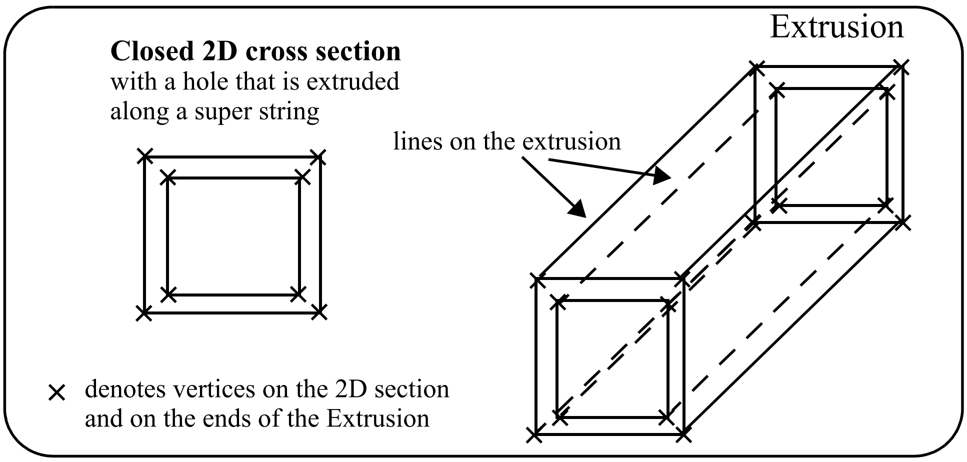
When **E** snap is **on**:

(a) you can only pick **on the extrusion** itself and not the spine.

(b) **P** snap picks vertices of the 2D section at the beginning and the end of the super string segment

(c) **L** snap picks on the lines on the extrusion created by a point on the 2D section as it is swept along the super string spine.

(d) **F** snaps picks on the surface of the extrusion



Continue to 2.6 AutoUpdater for 12d Model 15 or return to 2 General Items.

2.6 AutoUpdater for 12d Model 15

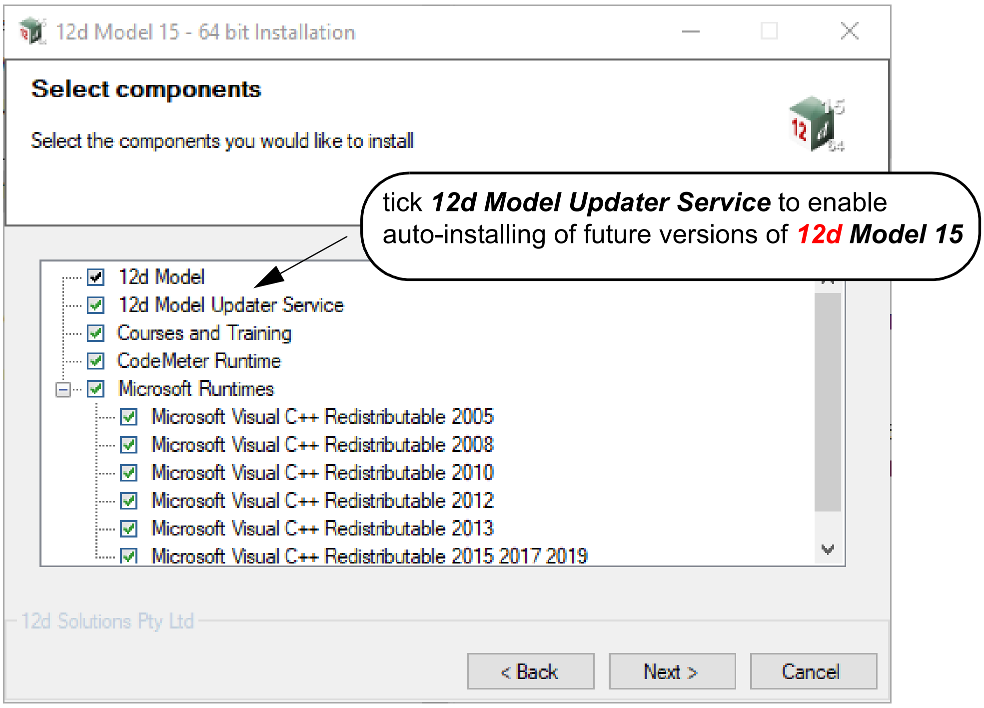
For ***12d Model 15***, there is a new background service on your computer called ***12d Model Updater Service*** that removes the requirements that Administrator rights are needed for subsequent installs.

When implemented, the ***12d Model Updater Service*** checks for newer versions of ***12d Model 15*** and can automatically download and **install** the new version.

You can set whether the installation exe is automatically deleted after the installation, or it is left in case you want to use it for a manual install at a later time.

The installation exes are downloaded to a default folder but this can also be changed to the folder you want.

Installing the ***12d Model Updater Service*** and setting up the ***AutoUpdater*** is done automatically if ***12d Model Update Service*** is left **ticked** when the Adminstrator installs ***12d Model 15***: See 31.2.2 Installers for 12d Model.



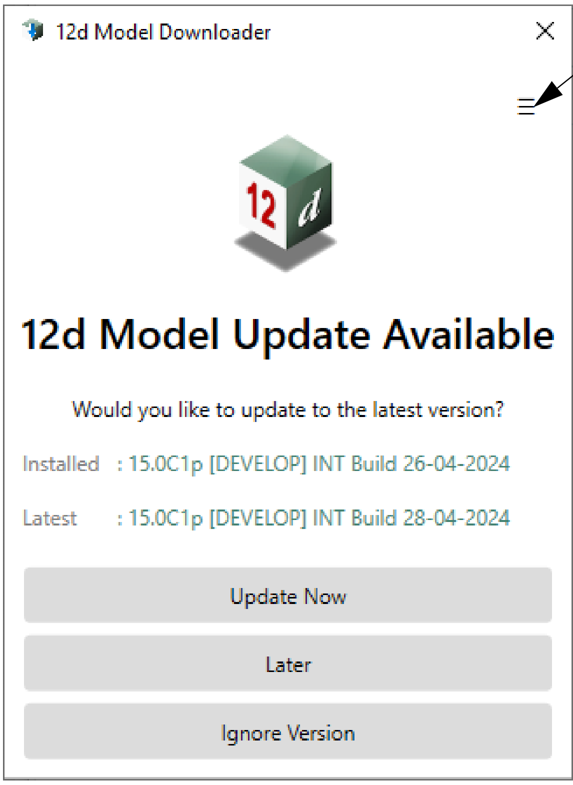
This creates a background service on your computer that has Administrator rights, and each time ***12d Model 15*** is started, it checks if a new version is available and if so, asks if you would like it to automatically download and install the new version.

The ***12d Model Update Service*** remembers the answers made during this installation and apart from the Microsoft Redistributables that are only needed to be installed once, reuses the answers for any future installation made by the ***12d Model Update Service***.

After these steps are done, each time ***12d Model 15*** is started a check is made to see if a newer version of is ***12d Model 15*** available. See 2.6.1 12d Model AutoUpdater in Action.

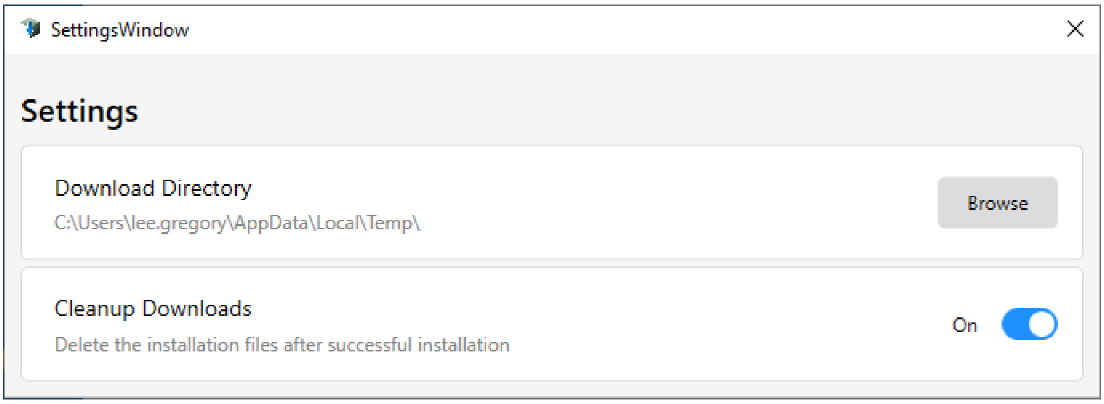
2.6.1 *12d Model* AutoUpdater in Action

Once the ***12d Model Updater Service*** (*background task* ***TDUpdaterService***) is running on the computer, each time ***12d Model 15*** is started, or the option **Help =>Check for updates** is run, a check is made to see if a newer subversion of ***12d Model*** available and, if one is available, the following **12d Model Downloader** panel is displayed:



Settings icon

Clicking the **Settings** icon brings up the **Settings Window**:



The **Browse** button allows you to change the location that the installation file will be downloaded to, and the **Cleanup Downloads** specifics if the installation file is to be deleted, or not, after the installation is completed.

On the **12d Model Downloader** panel, if **Update Now** is selected, the ***12d Model Update Service*** first checks to see if any copies of ***12d Model 15*** are open. If any are open then they must be closed before the installation can take place.

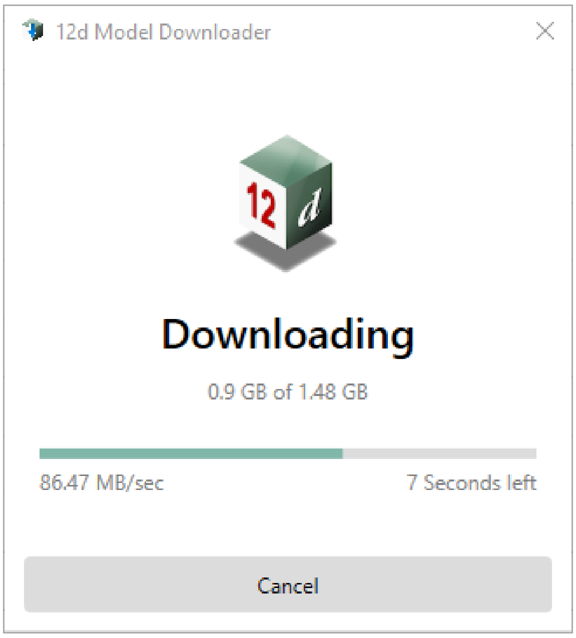
For the **12d Model Downloader** panel:

If **Later** is selected the newer subversion of ***12d Model*** is not installed now but the question is asked again when ***12d Model*** is next started up, or **Help =>Check for updates** is selected.

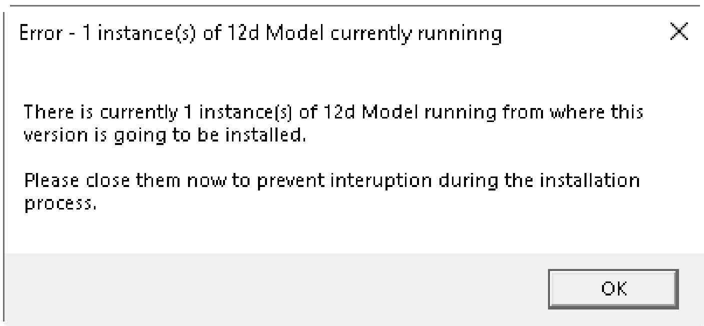
If **Ignore Version** is selected then this subversion of ***12d Model*** is not installed but when a newer subversion of ***12d Model*** is available, the question is asked again when ***12d Model*** is then started up, or **Help =>Check for updates** is selected.

If **Update Now** is selected, the newer subversion of ***12d Model*** is then installed. See 2.6.1 12d Model AutoUpdater in Action.

If **Update Now** is selected, the downloading of the ***12d Model*** installer begins

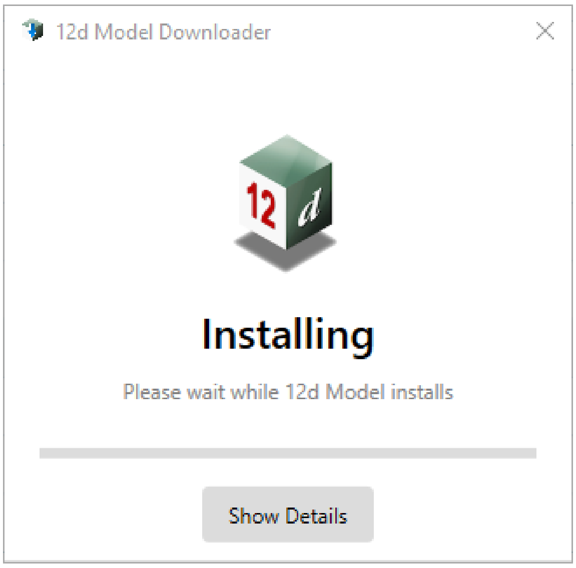


If any copies of ***12d Model***, including the ***12d Model*** **Project Launcher**, are already running, the **Error - X instance(s) of 12d Model currently running** panel is displayed:



Pressing **OK** closes the panel but once the download is finished, if there are still copies of ***12d Model*** running then the message will appear again.

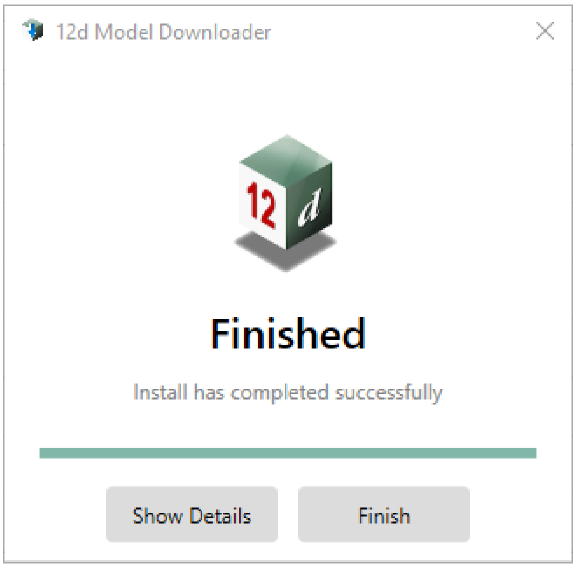
Once the download is complete and all instances of ***12d Model*** closed, the **AutoUpdater** will proceed with the installation and posts the message ***Please wait while installing...:***



Because the ***12d Model Update Service*** is doing the installation, there are no questions to answer as they are remembered from when ***12d Model*** was installed by the Administrator.

During the installation, the ***12d Model*** icon is deleted from the screen but it is replaced before the installation ends.

Once the installation is completed, the message **"Install has completed successfully"** is displayed.



Click on **Finish** to remove the panel.

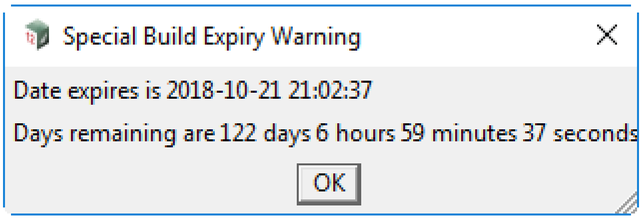
NOTES

1. The installation exe downloaded by the ***AutoUpdater*** is given a name with the date (in the form ***dd_mmm_yy***) as part of the name.
2. The ***AutoUpdater*** remembers the location for the downloaded installation exe, and if the installation exe is to be deleted or not, after the installation finishes.

   Both of these can be modified at any time by clicking on **Settings** icon on the **12d Model Downloader** panel that comes up when ***12d Model*** starts up, or by selecting **Help =>Check for Updates.**

2.7 Time Warning When NOT a Release Version

If your version of ***12d Model 15*** is **NOT** a **Release Version** then the version will only run for a maximum of three months from the date that the version was built.

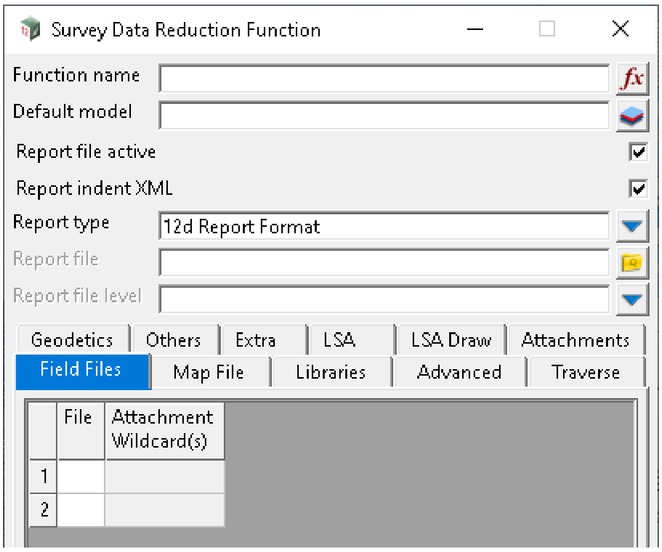


The only way to continue running after the three months has expired is to install full Release version or non Full Release version that was built in the last three months.

Non Release versions include Alpha versions, Beta versions, Technical Release versions, INT versions, Develop versions and Ad Hoc versions.

2.8 Active Tab Coloured Blue

With Microsoft changes over time, what tab on a panel is actually the highlighted tab has become very hard to determine and so for ***12d Model 15***, the active tab is highlighted in blue.



2.9 Options Log Files Saved & Emailed to 12d

This was introduced in ***12d Model 14.***

Whilst ***12d Model*** is running, a log of each option used in the session is written to a temporary file ***Options.txt*** in a subfolder of %TEMP%\12d.

At the end of the ***12d Model*** session, the options log file is stored on your computer, and also emailed back to ***12d Solutions*** at the end of the session.

If a crash occurs, this log file is included in the Crash email that is sent back to ***12d Solutions***. These options log files have proved to be invaluable in helping to find crashes.

IMPORTANT NOTE:

To **turn options logging off** and **NOT EMAIL** the log file back to ***12d Solutions***, set the env variable **USE_OPTIONS_LOGFILE_4D** to **0**.

The log file is stored in the folder ***options_logs*** in the working folder for the last project used. The options log file is renamed to give it a unique name in the folder.

The information that is recorded in the options log file and sent back to ***12d Solutions*** includes:

Microsoft User name:

12d Model Client name

Hardware lock used:

Full path name of the ***12d Model*** project.

Path to the ***12d Model*** executable

12d Model version

and

a line of detail each time an option is used

the number of times certain modules were used in the session.

When you exit ***12d Model*** or have a crash, the options log for that session is emailed to ***12d Solutions.***

As the number of logs can build up over time, there is an option to delete unwanted options log files from the ***options_logs*** folder in the working folder of a project.

IMPORTANT NOTE:

To **turn options logging off** and **NOT EMAIL** the log file back to ***12d Solutions***, set the env variable **USE_OPTIONS_LOGFILE_4D** to **0**.

2.10 Preventing Open GL Views

At times graphics drivers for a graphics card may be shipped with bugs in their OpenGL routines and they may be so bad as to prevent ***12d Model*** from even starting up when there is an existing OpenGL view in the project.

The environment variable **ALLOW_OPENGL_VIEWS_4D** has been introduced to allow users with problems with their graphics cards that cause regular crashes with OpenGL views, to run ***12d Model*** by replacing OpenGL views by non-OpenGL views.

If set to **0**, the environment variable **ALLOW_OPENGL_VIEWS_4D** will

(a) stop OpenGL Plan and OpenGL Perspective views from being created.

(b) if OpenGL Plan and OpenGL Perspective views already exist in a project, they will be replaced by Plan and Perspective views respectively on opening the project.

.

ALLOW_OPENGL_VIEWS_4D value 0 or **1**

If **0**, then any Perspective OpenGL views are only opened as Perspective views, and any Plan OpenGL views are only opened as Plan views.

If **1**, then Perspective OpenGL views are opened as OpenGL Perspective views, and any Plan OpenGL views are opened as OpenGL Plan views. That is, the standard behaviour of ***12d Model***

The default is **1**.

2.11 Outputting Missing Super Tin Components

In all write **12d Solutions Data** panels, there is a new tick box **Output missing super tin components.**

If the box is ticked then for every super tin in the data source, ***12d Model*** will write out all the super tin components, even if they are not included in the data source.

The default for this tick box is **not ticked.**

2.12 Trimeshes and Drafting Elements Working with Polygon Choices in Source Boxes

Trimeshes and drafting elements are new type of elements in version 11. Since they are not strings, there are some conflicting ideas about the definition when they are in/out/cutting polygons.

In version 15, we enable some simple logic rules to define the relationship of trimeshes and drafting elements relative to source boxes polygon.

A trimesh is inside a polygon if all its vertices are inside the polygon. A trimesh is outside a polygon if all its vertices are outside the polygon. A trimesh with some vertices are inside and some vertices are outside a polygon is call cutting the polygon.

Note that the above definition does not take into account of trimesh edges and faces. Hence a trimesh inside a polygon might have part of some edges or faces being out of the polygon - similar things happen with the outside definition.

Since some drafting elements might use paper-size or device-size similar to texts; the interaction of those with polygon choices in source boxes will have additional problem as texts,

Two typical examples

Example 1: Global change panel.

Using **lasso** will pick up trimeshes and drafting elements.

Example 2: Flip trimeshes faces panel.

The data source for trimesh in v15 will be a full one (with polygon choices and filters enables).

2.13 Additional Items for Attribute Manipulator

More ***12d Model*** element properties have been added to the attribute manipulator so that the properties can be set using attributes and the attributes can be created using properties.

Some additions are:

1. Water link name (segment property)
2. Water node name (vertex property)
3. Internal, external diameter of round pipe for super string, super alignment (string or segment property)
4. Thickness of round pipe for super string, super alignment (string or segment property)
5. Internal, external width of culvert (rectangular pipe) for super string, super alignment (string or segment property)
6. Internal, external height of culvert (rectangular pipe) for super string, super alignment (string or segment property)
7. Left, right, top and bottom thicknesses of culvert (rectangular pipe) for super string, super alignment (string or segment property)
8. Segment bearing for string (segment property)
9. Segment grade for string (segment property)

3 Starting Up

This chapter contains information about how to start ***12d Model***, organising ***12d Model*** error logging and how to run chains and macros when starting up ***12d Model***.

See

3.1 12d Model Start Up Icon
3.2 Project Launcher
3.3 Organizing Working Areas
3.4 Project Shortcuts
3.5 Creating Project Shortcuts by Hand
3.6 Environment Variables Shortcut
3.7 Error Logging File
3.8 Running Macros and Chains on Start Up

3.1 12d Model Start Up Icon

When ***12d Model*** is installed, the ***12d Model 15*** icon is created.

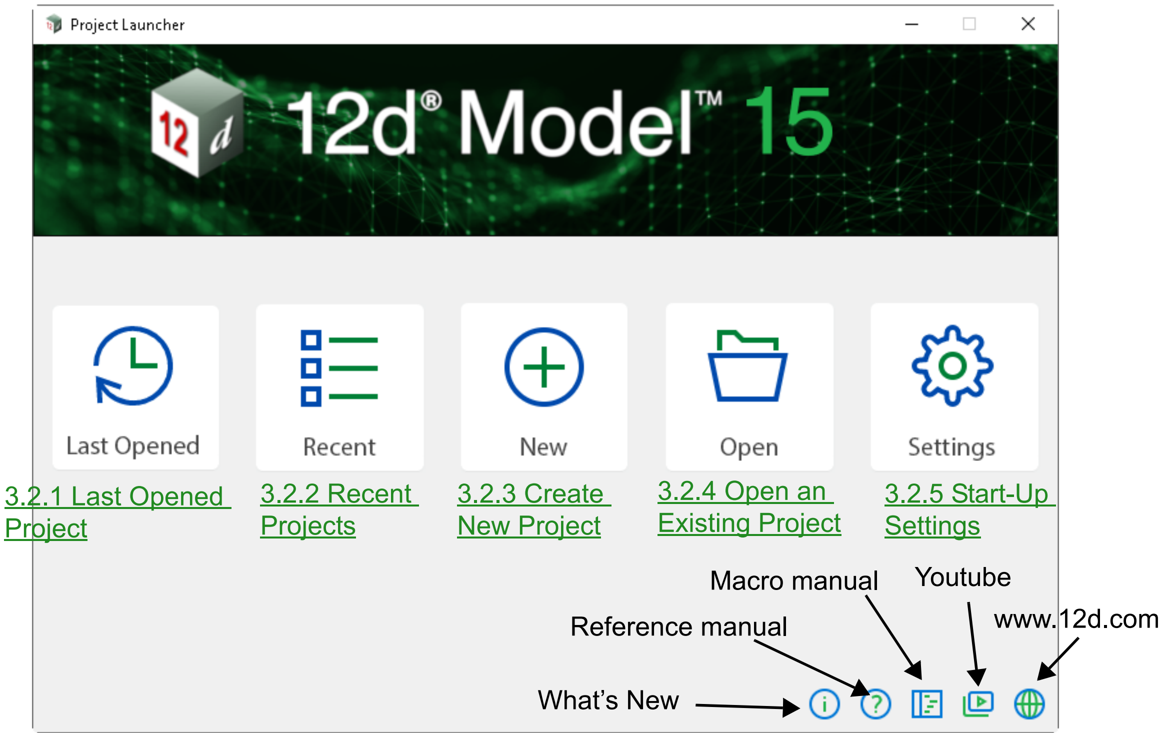
icon for 12d Model 64 bit exe

The ***12d Model*** icon is a **shortcut** to start ***12d Model*** and then attach to the folder ***C:\12d\15.00***

Double clicking the ***12d Model*** icon starts ***12d Model*** and brings up the **Project Launcher** panel (3.2 Project Launcher).

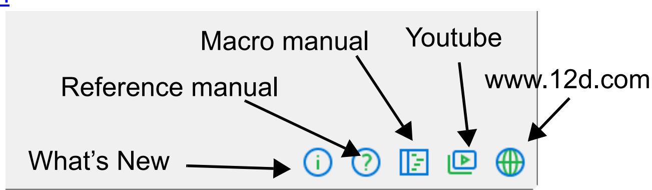
3.2 Project Launcher

The **Project launcher** panel is used to access existing ***12d Model*** projects and create new projects.



Note: If there are no projects that have been previously opened, the **Last Opened** and **Recent** icons will not appear on the **Project launcher**:

The icons in the bottom right hand corner open the ***What's New in 12d Model 15*** pdf, the ***12d Model 15 Reference Manual***, the ***12d Model*** section of ***Youtube*** and the **12d** website www.12d.com



Clicking on the icons ***Last Opened, Recent***, ***New***, ***Open*** and ***Settings*** accesses the functionality of the ***Project Launcher***.

See

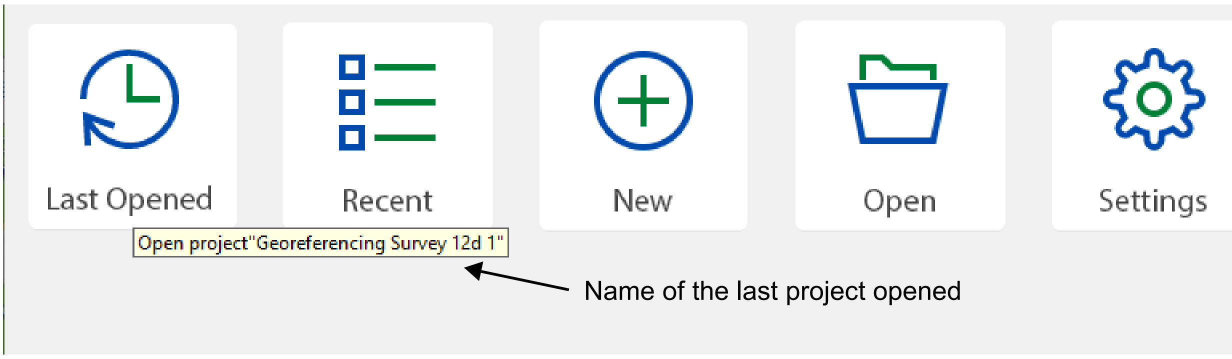
3.2.1 Last Opened Project
3.2.2 Recent Projects
3.2.3 Create New Project
3.2.4 Open an Existing Project
3.2.5 Start-Up Settings
3.2.6 Selecting a Theme Using the Theme Icons
3.2.7 Recent Projects List

3.2.1 Last Opened Project

Clicking **Last Opened** opens the last ***12d Model*** project you opened and uses the same settings as when that project was last opened.

That is, it opens the first project in the ***Recent Projects*** list (see 3.2.2 Recent Projects).

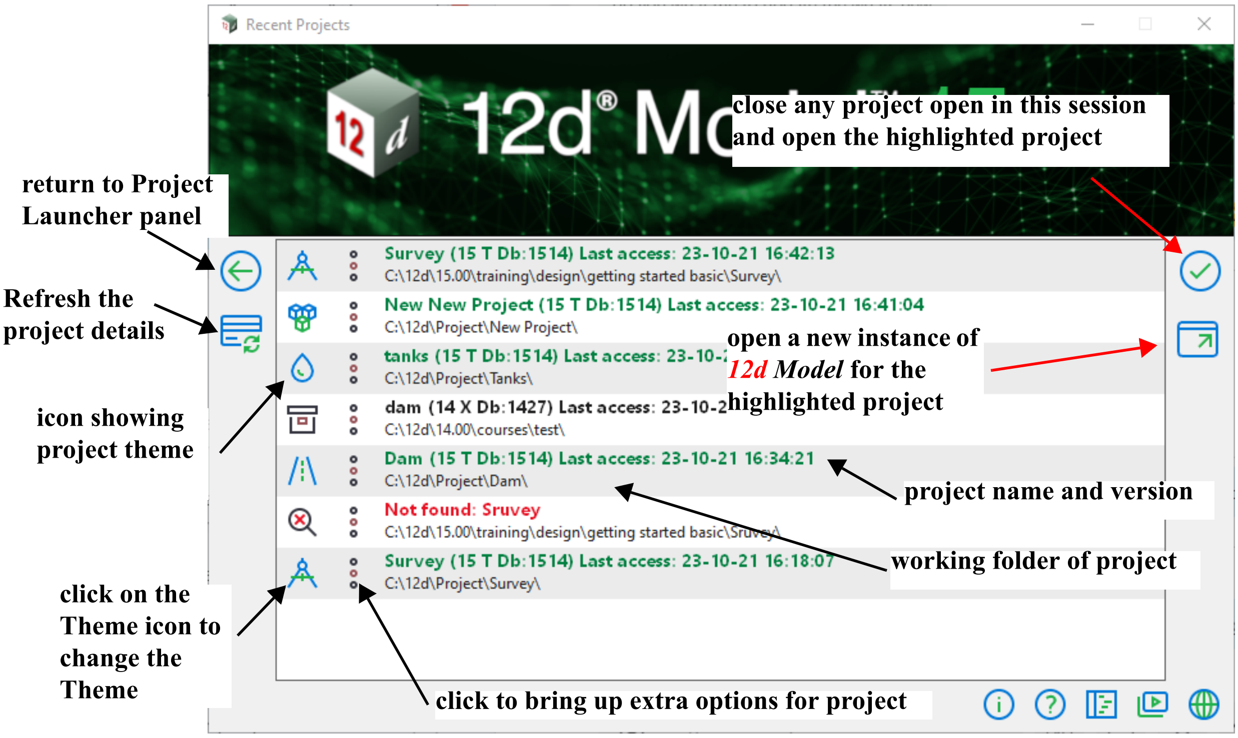
Hovering over the **Last Opened** icon displays the name of the last opened project as a **tool tip**.



Continue to 3.2.2 Recent Projects or return to 3.2 Project Launcher.

3.2.2 Recent Projects

Clicking **Recent** accesses the **Recent Projects** panel which displays a list of your recently opened projects sorted in the reverse date order of when the projects were last opened.



For each project in the **Recent Projects** list, there are two icons and two lines of information about each project.

(a) On the left is an icon displaying the Theme being used for the project.

Clicking on the **Theme** icon brings up a panel to change the **Theme**, **Environment configuration** and the **Dongle** for the project. See 3.2.2.1 Change Theme.

(b) In the middle is an icon that when clicked brings up extra options that can be performed on the project. See 3.2.2.4 Extra Options for the Project.

(c) On the right, there are two lines of information about the project.

The **first line** gives the project name, the project view, the project database number and finally the date that the project was last accessed.

The first line is **coloured** to provide additional information about the project. The line is:

orange if the project is already open and hence locked

green if the project is a V15 Object Tree project

red if the project no longer exists

blue if the project is a V15 non-object Tree project which will need to be migrated to a V15 Object Tree project before use

black if the project is an earlier ***12d Model*** version that needs to be migrated to a V15 project

The **second line** gives the path of the working folder that contains the project.

Double clicking on the lines of information closes any existing project in the session and **opens the project**.

When the **project lines** are selected (and hence **highlighted**), click on an Open icon or , to open the project.

For documentation on the Open icons, and , see 3.2.2.3 Open and Open New Instance Icons

Click the refresh icon to refresh the details of the projects in the **Recent Projects** list.

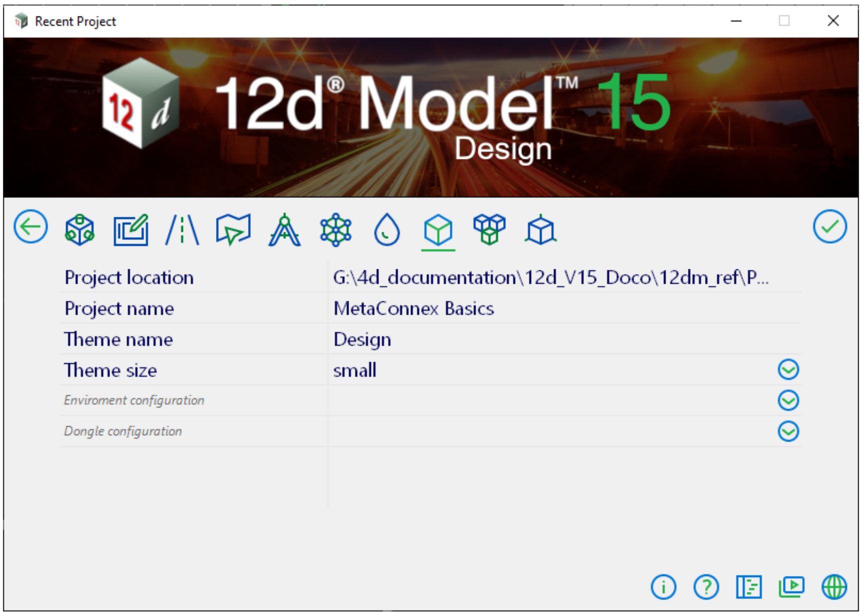
Click the left arrow icon to return to the **Project launcher** panel.

Continue to 3.2.2.1 Change Theme or return to 3.2 Project Launcher.

3.2.2.1 Change Theme

Clicking on the Theme icon beside the project name displays more information about the project and allows the theme for the project to be changed by selecting the new theme from the **Theme** icons on top.

The **Environment configuration** and the **dongle** to be used can also be changed using the **Environment configuration** and **Dongle configuration** pop-ups



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Project location	output only		

Location of the working folder for the project.

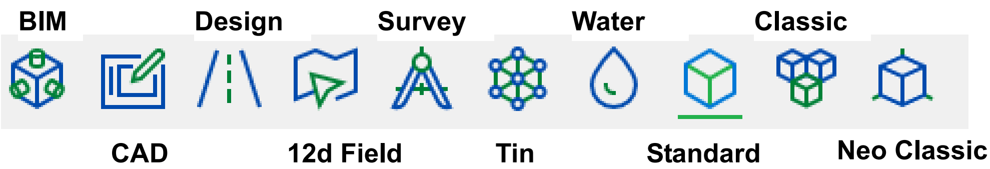
Project name	output only		

Name of the project.

Theme name	Theme select		

Name of the theme for the project.

The theme can be changed by clicking on the required Theme icon just above ***Project location*** *field.*



For more information on Themes, see 3.2.6 Selecting a Theme Using the Theme Icons.

Environment configuration and **Dongle Configuration fields**

The ***Configuration file*** *given in the* **Configuration file** *field in the* **Start-up Settings** *panel is used for the pop-ups for the* **Environment configuration** *and* **Dongle configuration** *fields in this panel. See* 3.2.5 Start-Up Settings.

For information on the **Environment configuration** *and* **Dongle configuration** *fields, see* 3.2.2.2 Environment Configuration and Dongle Configuration fields.

If any of the fields are changed then for the changes to take effect you need to click on an Open icon or , to open the project.

For documentation on the Open icons, and , see 3.2.2.3 Open and Open New Instance Icons.

Clicking the left arrow icon returns to the **Project Launcher** panel but **the changes** will **not be displayed** in the Recent project list **until** the **refresh** icon is pressed.

Continue to 3.2.2.2 Environment Configuration and Dongle Configuration fields or return to 3.2 Project Launcher.

3.2.2.2 Environment Configuration and Dongle Configuration fields

*The **Configuration file** given in the* **Configuration file** *field in the* **Start-up Settings** *panel is used for the pop-ups for the* **Environment configuration** *and* **Dongle configuration** *fields in this panel. See* 3.2.5 Start-Up Settings.

Environment configuration

*To tailor **12d Model,** there are a large number of environment variables in a file called **env.4d**.*

*For most users, one **env.4d** file provides enough customisation for their site but for users with customers requiring very different set ups, a more flexible system is required.*

For example, one project may be for a Main Roads Department which requires its own mapping files, linestyle files, ppf files etc, and another project is for a Local Authority who has totally different standards and requirements.

*For this more complex situation, different **env.4d** files and environment variable overrides can be defined for each project using **Environment configurations,** and any number of different Environment configurations can be defined in a Configuration file so they are easily accessible as pop-up in the* **Environment configuration** *field.*

*If the project already has an **Environment configuration** then it will be displayed in this field.*

A new value can be selected from the pop-up for this field that comes from the **Configuration file**.

For more information on Environment configuration settings, go to 6.10.4 Creating/Editing Environment Configurations*, and for more information on the **Environmental configuration** section in particular, go to* Creating/Editing an Environments Set Up.

Dongle configuration

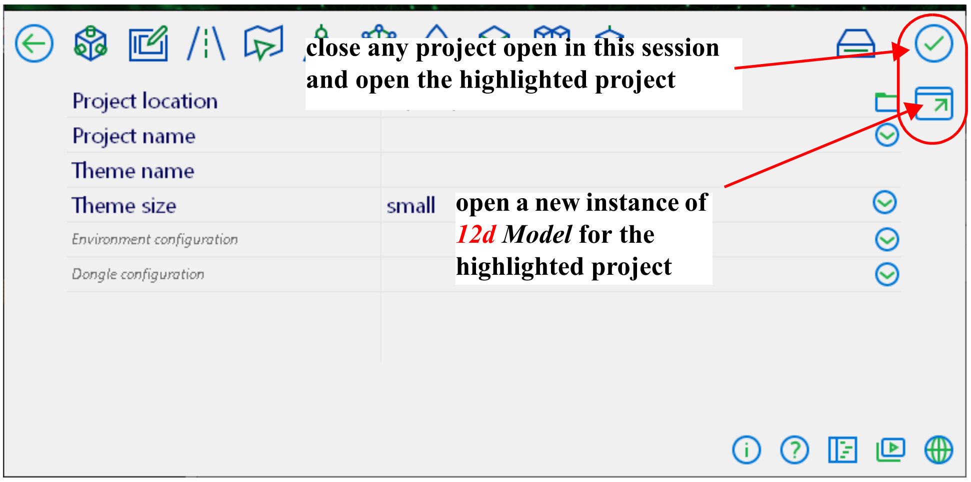
*If the project already has a **Dongle configuration** then it will be displayed in this field.*

A new value can be selected from the pop-up for this field that comes from the **Configuration file**.

Dongles configuration is part of Environment configuration settings so for more information see 6.10.4 Creating/Editing Environment Configurations *and for more information on the **Dongle** section in particular, go to* Creating/Editing a Dongles Set Up.

Continue to 3.2.2.3 Open and Open New Instance Icons or return to 3.2 Project Launcher.

3.2.2.3 Open and Open New Instance Icons



After filling in the details for the project to be opened, there are two icons on the right hand side of the panel to open the project.

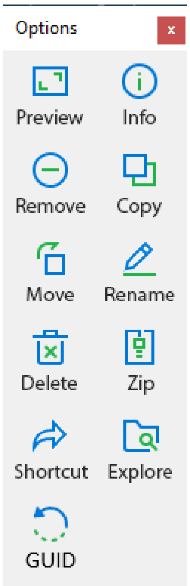
Click: on the:

(a) **Open** icon  to first close any project opened in the current session of ***12d Model***, and then open the project.

(b) **Open new instance** icon  opens a new instance of ***12d Model*** for the selected project

Continue to 3.2.2.4 Extra Options for the Project or return to 3.2 Project Launcher.

3.2.2.4 Extra Options for the Project



Preview - display the preview of the project. See 3.2.2.4.1 Preview icon.

Info - display the project description. See 3.2.2.4.2 Info icon.

Remove the project from the **Recent Projects** list.

Copy the project and optionally copy the working folder with the project in it. See 3.2.2.4.3 Copy Project icon.

Move the project and optionally the working folder to a new folder. See 3.2.2.4.4 Move Project icon.

Rename the project and optionally rename the working folder. See 3.2.2.4.5 Rename Project icon.

Delete the project and optionally delete the working folder. See 3.2.2.4.6 Delete Project icon.

Zip the project and optionally zip the working folder with the project in it. See 3.2.2.4.7 Zip Project icon.

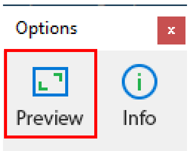
Shortcut - create a desktop shortcut that starts ***12d Model*** and opens the project. See 3.4 Project Shortcuts.

Explore - Open Windows explorer at the working folder.

GUID - Change all the GUID filenames in the project to new GUID names.

Click the left arrow icon  to return to the **Project Launcher** panel.

3.2.2.4.1 Preview icon

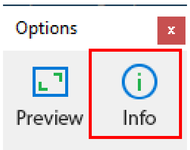


Clicking on the **Preview** icon displays the **preview** of the **project**

Click the left arrow icon  to return to the **Project Launcher** panel.

Continue to 3.2.2.4.2 Info icon or return to 3.2.2.4 Extra Options for the Project.

3.2.2.4.2 Info icon



Clicking on the **Info** icon displays the **description** for the **project**

Click the left arrow icon  to return to the **Project Launcher** panel.

Continue to 3.2.2.4.3 Copy Project icon or return to 3.2.2.4 Extra Options for the Project.

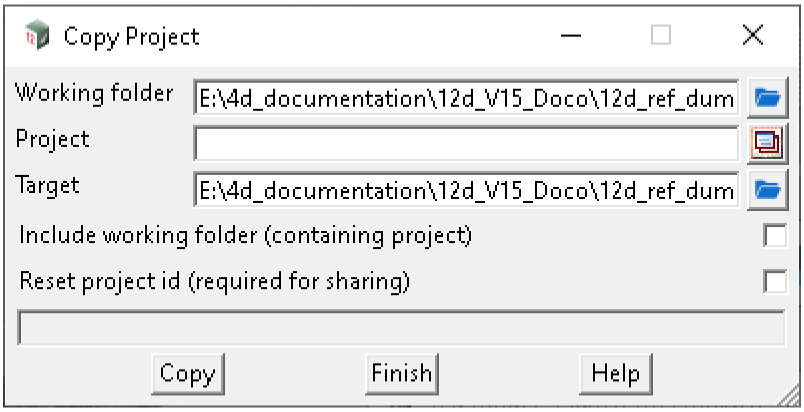
3.2.2.4.3 Copy Project icon

Position of option on menu: **Project Launcher =>Recent =>Copy Project icon**

This option copies a project to a new location. If you are attempting to copy the project you are currently in, ***12d Model*** will prompt you to save and restart.

Selecting 

brings up the **Copy Project** panel:



The fields and buttons used in this panels have the following functions.

Field Description	Type	Defaults	Pop-Up
Working folder	file		

The folder containing the project.

Project

The name of the project to copy.

Target file

Where the project should copied to.

Include working folder (containing project) tick box

*If **ticked**, the folder containing the project (and all sub folders) will also be copied.*

Reset project id (required for sharing) tick box

If you are intending to share the copied project, you must reset the ID - otherwise sharing will not be allowed from the copied project.

Buttons at Bottom

Copy button

Copies the project.

Additional Information

Example:

If

Working folder is: "d:\4d_test\one\job1234"

project is: "detailed survey"

target is: "e:\4d_test\two\three"

*When **Include working folder (containing project)** is **ticked**, the resulting folder will be copied from*

d:\4d_test\one\job1234

to

e:\4d_test\two\three\job1234

This includes all files and folders recursively, including the nominated project.

*When **Include working folder (containing project)** is **not ticked,** the resulting folder will be copied from*

d:\4d_test\one\job1234\detailed_survey.project

to

e:\4d_test\two\three\detailed_survey.project

Additional checks made.

That there is sufficient disk space on the target volume.

Continue to 3.2.2.4.4 Move Project icon or return to 3.2.2.4 Extra Options for the Project.

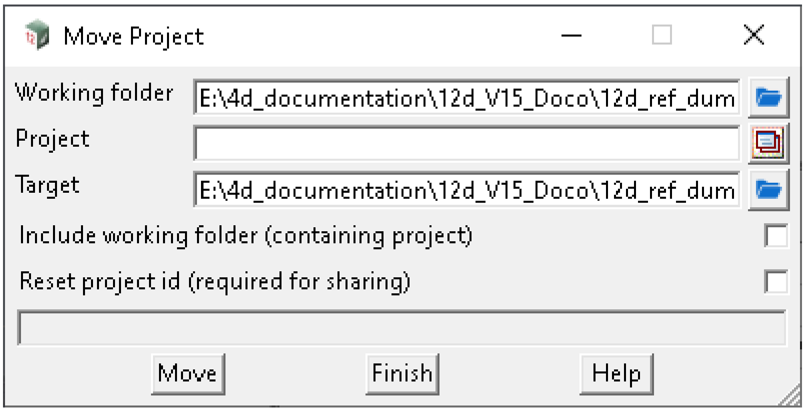
3.2.2.4.4 Move Project icon

Position of option on menu: **Project Launcher =>Recent =>Move Project icon**

This option moves a project to a new location. If you are attempting to move the project you are currently in, ***12d Model*** will prompt you to save and restart.

Selecting 

brings up the **Move Project** panel:



The fields and buttons used in this panels have the following functions.

Field Description	Type	Defaults	Pop-Up
Working folder	file		

The folder containing the project.

Project

The name of the project to move.

Target file

Where the project should moved to.

Include working folder (containing project) tick box

*If **ticked**, the folder containing the project (and all sub folders) will also be moved.*

Reset project id (required for sharing) tick box

If you are intending to share the moved project, you must reset the id - otherwise sharing will not be allowed from the moved project.

Buttons at Bottom

Move button

Moves the project.

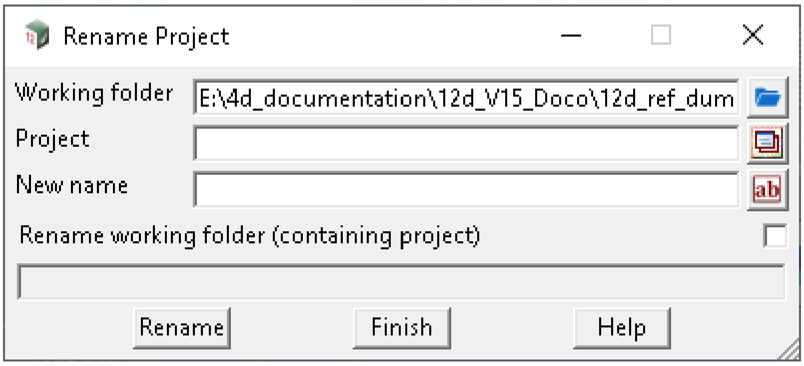
Continue to 3.2.2.4.5 Rename Project icon or return to 3.2.2.4 Extra Options for the Project.

3.2.2.4.5 Rename Project icon

Position of option on menu: **Project Launcher =>Recent =>Rename**
Project =>Utilities =Rename

The **Rename** option is used to rename any project (other than the current project) in a given folder (a working folder), and if required, the contents of the working folder as well.

Selecting  brings up the **Rename Project** panel:



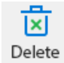
For documentation, see 6.13.7 Rename Project.

Continue to 3.2.2.4.6 Delete Project icon or return to 3.2.2.4 Extra Options for the Project.

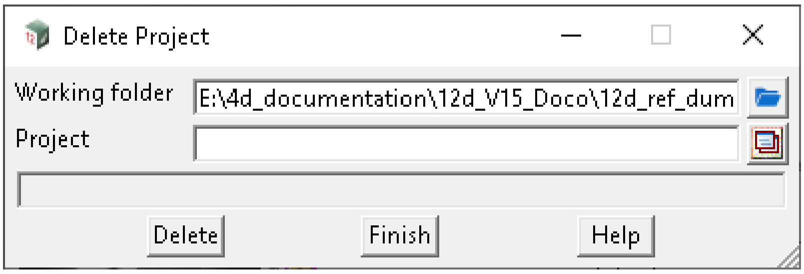
3.2.2.4.6 Delete Project icon

Position of option on menu: **Project Launcher =>Recent =>Delete Project icon**

This will delete a project. This cannot be the current open project.

Selecting 

brings up the **Delete Project** panel:



The fields and buttons used in this panels have the following functions.

Field Description	Type	Defaults	Pop-Up
Working folder	file		

Folder containing the project to be deleted.

Project

Name of the project to delete.

Buttons at Bottom

Delete button

Delete the project.

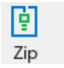
Continue to 3.2.2.4.7 Zip Project icon or return to 3.2.2.4 Extra Options for the Project.

3.2.2.4.7 Zip Project icon

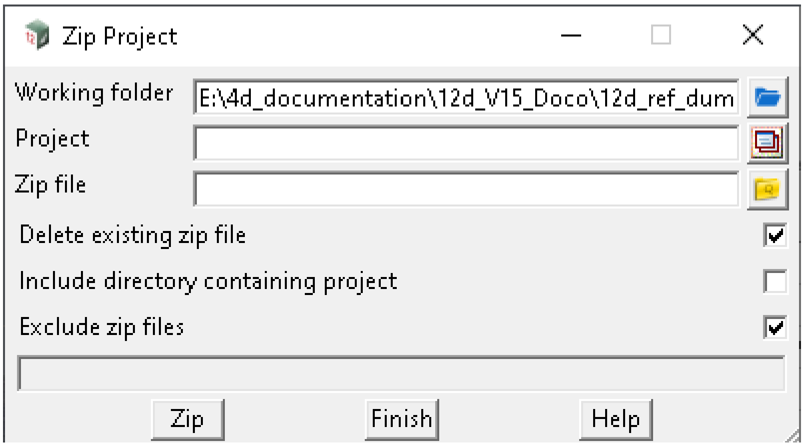
Position of option on menu: **Project Launcher=> Recent =>Zip Project icon**

Position of option on menu: **Project =>Open=> Zip Project icon**

This option zips a project. If you attempt to zip the current project, ***12d Model*** will prompt you to save and restart.

Selecting 

brings up the **Zip Project** panel:



The fields and buttons used in this panels have the following functions.

Field Description Type Defaults Pop-Up

Working folder file box

Folder where the project resides.

Project project box

Name of the project you wish to zip.

Zip file file box

The file to zip to.

Note:
*If a **folder path is provided** along with the zipped file name the project will be zipped to that location on the PC.*
*If **no folder path is provided** with the file name the zipped project will be saved to the "C:\12d\XX.00\" location by default. XX is the **12d Model** major version.*

Delete existing zip file tick box

*If **ticked**, any existing zip file will be deleted.*

Include directory containing project tick box

*If **ticked**, the directory containing the project (the working directory) will also be zipped, along with all sub folders.*

Buttons at Bottom

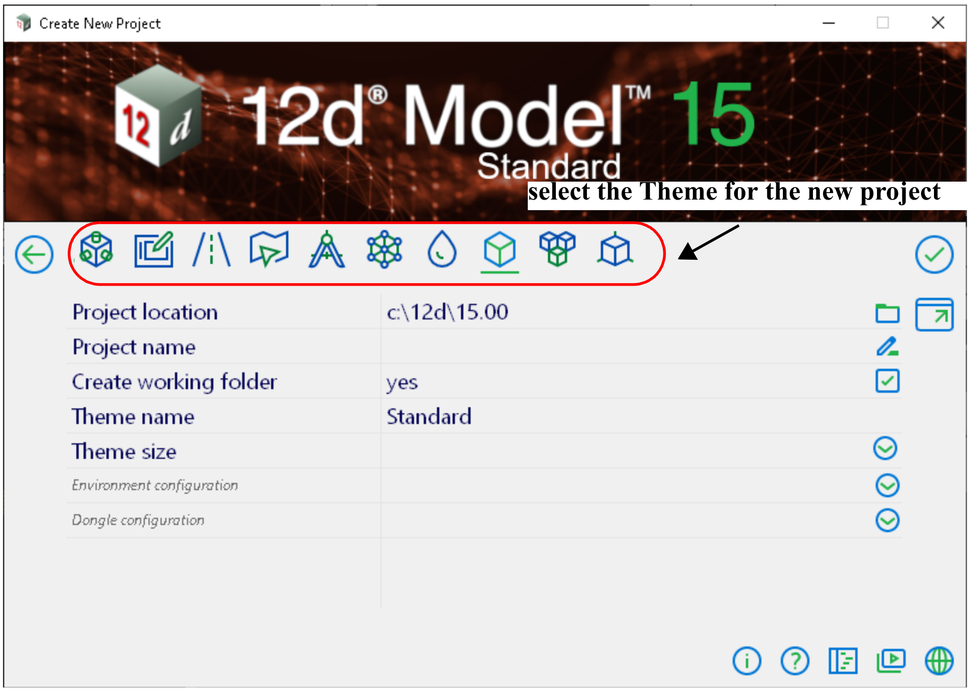
Zip button

Zips the project.

Continue to 3.2.3 Create New Project or return to 3.2.2.4 Extra Options for the Project.

3.2.3 Create New Project

Clicking on **New** displays the **Create New Project** panel which is used to create a new ***12d Model 15*** project.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Project location folder box

Folder location for the new project.

The field will initially be filled with the **Default project location field** *from the* 3.2.5 Start-Up Settings *panel (which may be blank).*

Project name text box

Name of the new project.

Create working folder tick box

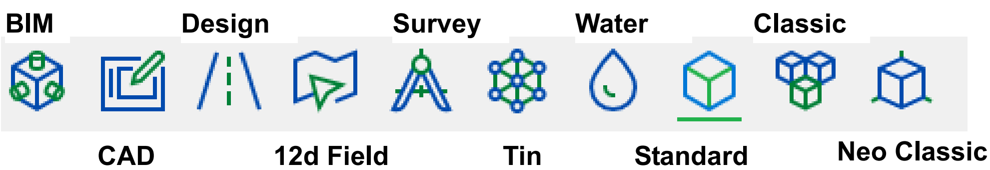
*If **ticked** then a folder of the same name as the **Project name** is created in the **Project location** and the project is created inside that folder. In that case the working folder and the project will have the same name.*

*If **not ticked** then the project is created in the **Project location.** In that case, the working folder is the* **Project location**.

Theme name Theme select

Name of the theme for the project.

*The theme can be selected by clicking on the required Theme icon just above **Project location** field.*



For more information on Themes, see 3.2.6 Selecting a Theme Using the Theme Icons.

Environment configuration and **Dongle Configuration fields**

> *The **Registry file** given in the* **Registry file** *field in the* **Start-up Settings** *panel is used for the pop-ups for the* **Environment configuration** *and* **Dongle configuration** *fields in this panel.*
>
> *For information on the* **Environment configuration** *and* **Dongle configuration** *fields, see* 3.2.2.2 Environment Configuration and Dongle Configuration fields.

After filling in the details for the project to be opened, click on an Open icon or , to open the project.

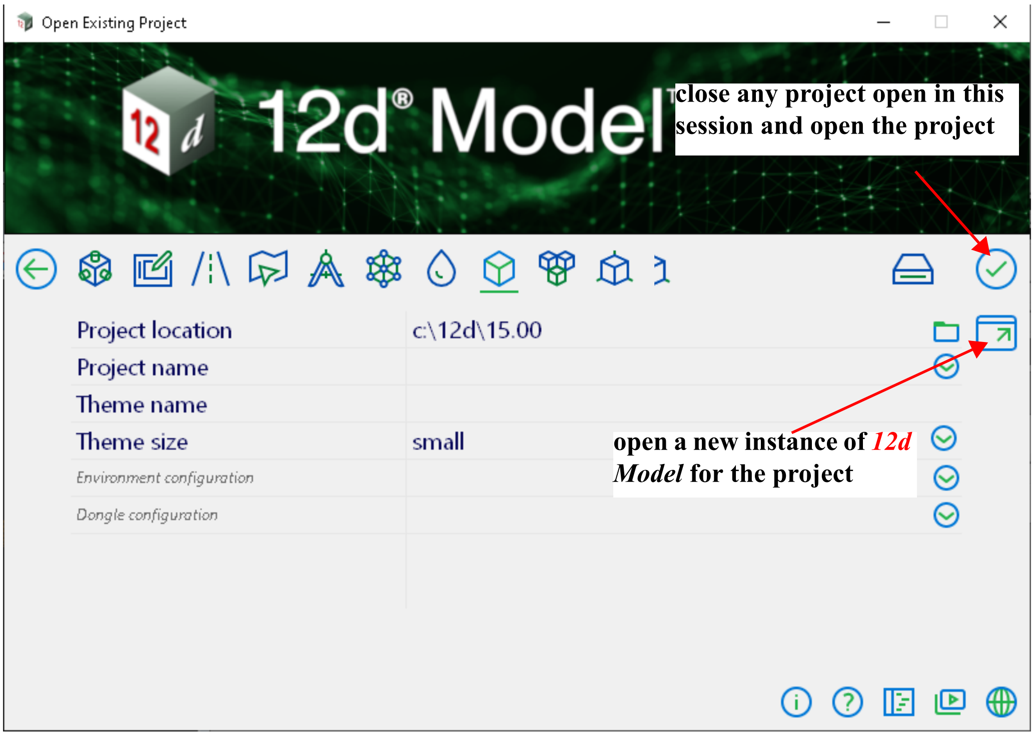
For documentation on the Open icons, and , see 3.2.2.3 Open and Open New Instance Icons

Click the left arrow icon to return to the **Project Launcher** panel **without** creating a new project.

Continue to 3.2.4 Open an Existing Project or return to 3.2 Project Launcher.

3.2.4 Open an Existing Project

Clicking on **Open** allows brings up the **Open Existing Project** panel that allows you to open an existing ***12d Model 15*** project.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Project location	folder box		

Location for the project to be opened.

The field will initially be filled with the **Default project location field** *from the* 3.2.5 Start-Up Settings *panel (which may be blank).*

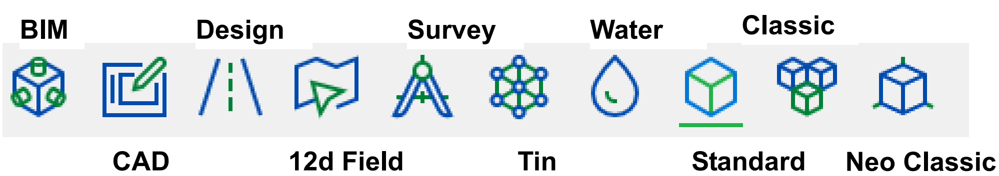
Project name	project box		projects in **Project location**

Name of the project to be opened.

Theme name	Theme select		

After a project is selected, the name of the Theme for the project is displayed in this field.

A new theme can be selected by clicking on the required Theme icon just above ***Project location*** *field.*



For more information on Themes, see 3.2.6 Selecting a Theme Using the Theme Icons.

Environment configuration and **Dongle Configuration fields**

The ***Registry file*** *given in the* **Registry file** *field in the* **Start-up Settings** *panel is used for the pop-ups for the* **Environment configuration** *and* **Dongle configuration** *fields in this panel.*

For information on the **Environment configuration** *and* **Dongle configuration** *fields, see* 3.2.2.2

Environment Configuration and Dongle Configuration fields.

3.2.2.2 Environment Configuration and Dongle Configuration fields.

After filling in the details for the project to be opened, click on an Open icon or , to open the project.

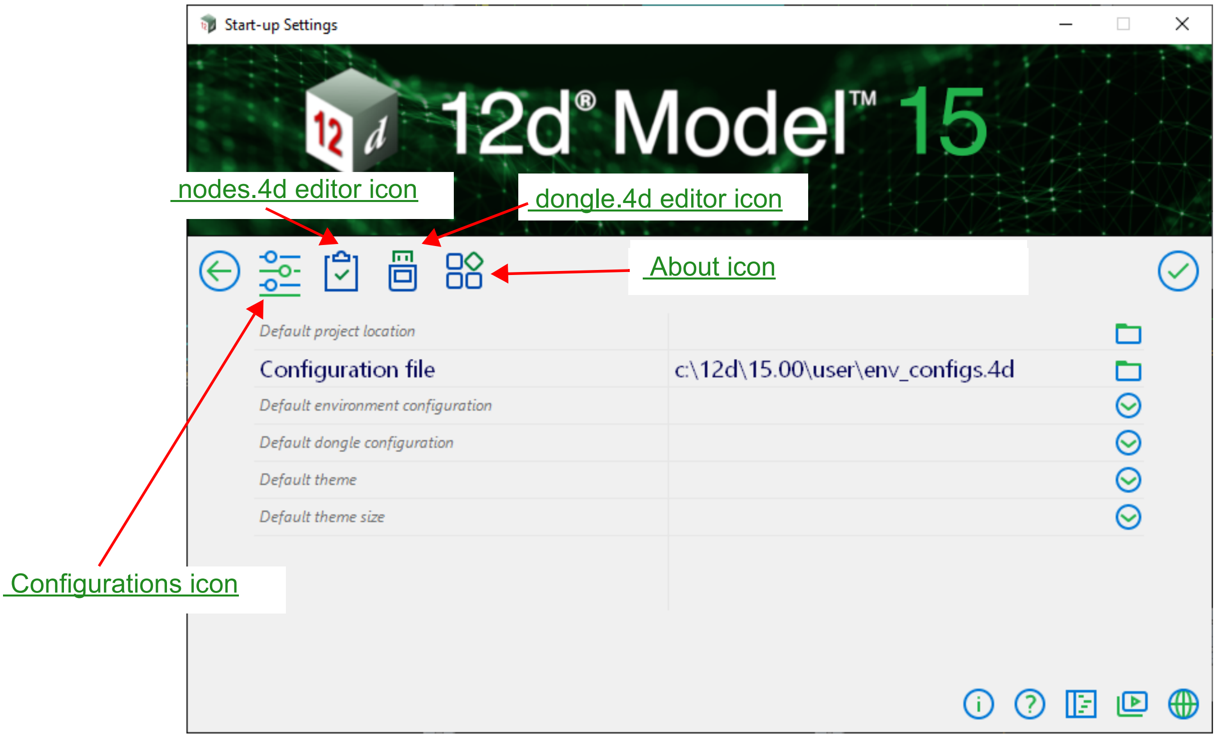
For documentation on the Open icons, and , see 3.2.2.3 Open and Open New Instance Icons

Clicking the left arrow icon will return to the **Project Launcher** panel **without** opening a project.

Continue to 3.2.5 Start-Up Settings or return to 3.2 Project Launcher.

3.2.5 Start-Up Settings

Clicking on **Settings** displays the **Start-up Settings** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Default

Configurations icon

Default project location folder box

*Common location where **12d Model** projects are stored.*

*If **not blank**, the folder in the* **Default project location** *field will be used in the* **Project location** *field on the* 3.2.3 Create New Project *and* 3.2.4 Open an Existing Project *panels.* 3.2.4 Open an Existing Project.

Configuration file folder box $USER\env_configs.4d

*If a **Configuration file** is selected then it is used for the pop-ups for the* **Default environment configuration** *and* **Default dongle configuration** *fields in this panel and for the pop-ups for the* **Environment configuration** *and* **Dongle configuration** *fields in other panels in the **Project Launcher**.*

Default environment configuration

*A value can be selected from the pop-up for this field (the pop-up is taken from the **Configuration file**.*

*This value will be used as the default value in the **Environment configuration** fields in the **Project Launcher**.*

Default dongle configuration

*A value can be selected from the pop-up for this field (the pop-up is taken from the **Configuration file**.*

*This value will be used as the default value in the **Dongle configuration** fields in the **Project Launcher**.*

For information on the **Environment configuration** *and* **Dongle configuration** *fields, see* 3.2.2.2 Environment Configuration and Dongle Configuration fields.

Default theme

The Theme to use for a new project.

Default theme size

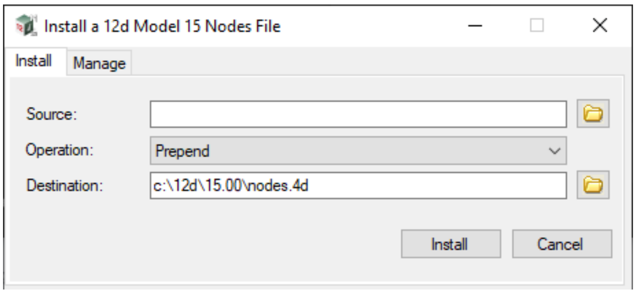
The size of the Theme to use for a new project.

After filling in the any of optional setting for the **Configuration file**, **Default environment configuration** and **Default dongle configuration** fields, click the tick icon to **save** the settings.

Click the left arrow icon to return to the **Project Launcher** panel.

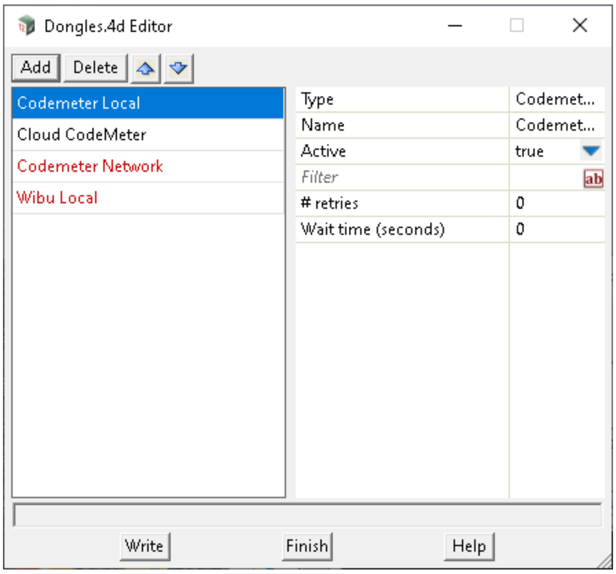
nodes.4d editor icon

Clicking on the **nodes.4d editor** icon brings up the **Installing a 12d Model 15 Nodes File** panel



dongle.4d editor icon

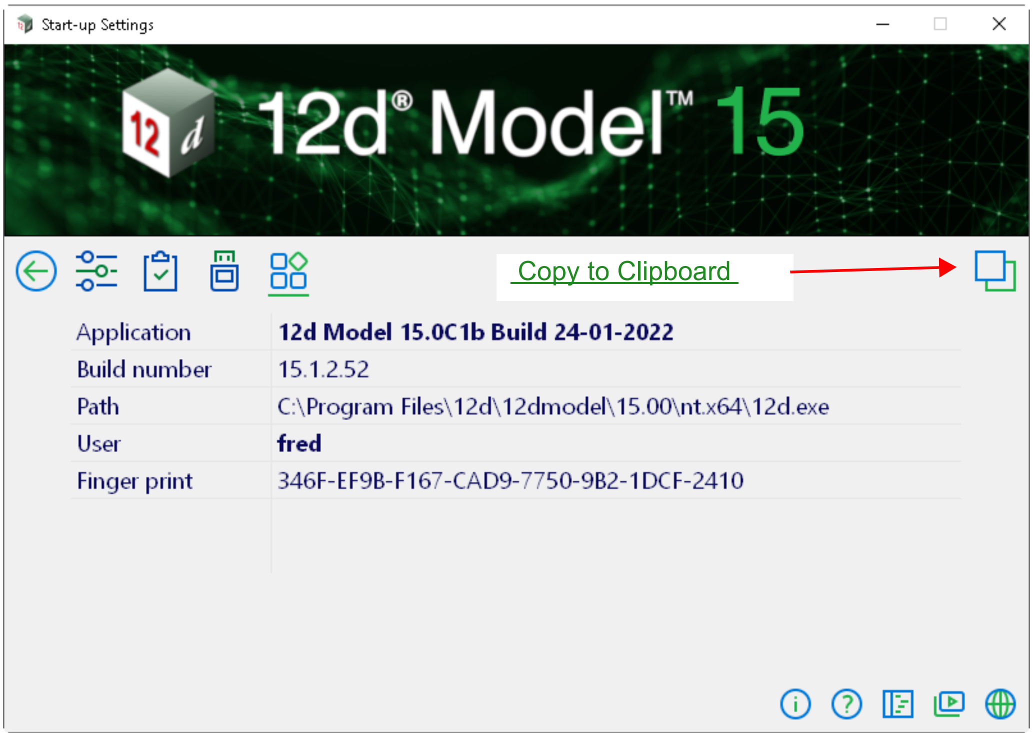
Clicking on the **dongles.4d editor** icon brings up the **Installing a 12d Model Nodes File** panel



Click the left arrow icon to return to the **Project Launcher** panel.

About icon

Clicking on the **About** icon changes to the **About** information



Copy to Clipboard icon

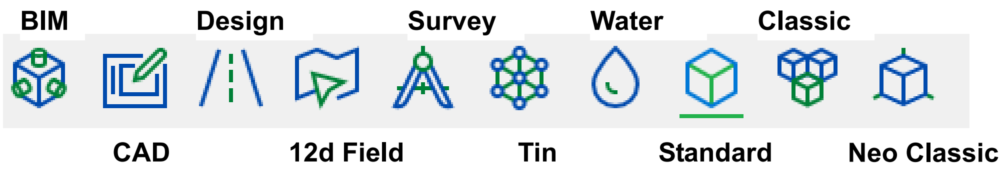
Clicking on the **Copy to clipboard** copies the information on the panel to the clipboard.

Click the left arrow icon  to return to the **Project Launcher** panel.

Continue to 3.2.6 Selecting a Theme Using the Theme Icons or return to 3.2 Project Launcher.

3.2.6 Selecting a Theme Using the Theme Icons

For some options, the available themes are displayed as a toolbar of icons.



To select a **Theme** from the toolbar of icons, simply click on the icon for the required theme. The selected theme will then be displayed with a bar below the theme icon.

For example, in the above image, **Design** has been selected.

The **Classic** theme uses the same top menu arrangements, icons and size of icons (16x16 pixels), that is used in ***12d Model 14.*** All options appear in the **Classic** theme.

The **Neo Classic** theme uses the same top menu arrangements as in **Classic** except the icons are the new icon in 16x16 pixels.

The **Standard** theme uses the same top menu arrangements as **Neo Classic** but the size of the icons can be selected as **small**, **medium**, **large** and **extra large**. The small size is slightly larger than for ***12d Model 14*** and **Neo Classic** so that they can have more detail in the icons.

The **BIM**, **CAD**, **Design**, **12d Field**, **Survey**, **Tin** and **Water** themes each have a different top menu structure and tool bars that are more tailored to the type of work being undertaken. This means that many options will not appear in some Theme menus but all the available options can still be found using the **Search Bar,** or by changing back to the **Neo Classic**, **Classic** or **Standard** themes.

Continue to 3.3 Organizing Working Areas.

Continue to 3.2.7 Recent Projects List or return to 3.2 Project Launcher.

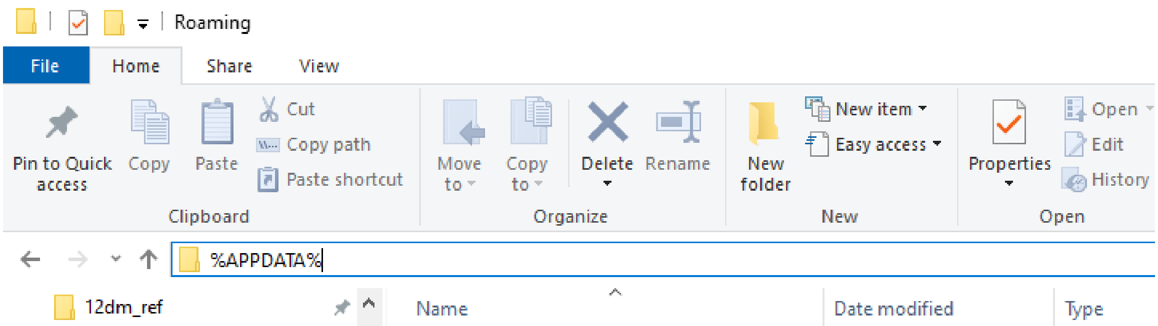
3.2.7 Recent Projects List

The list of recent projects is shared between all versions of ***12d Model***.and is recorded in the file "**Recent Projects.4d**" stored in the folder %APPDATA%.

The maximum number of entries stored in "**Recent Projects.4d**" is controlled by the environment variable RECENT_PROJECTS_4D,

Note:

To access %APPDATA%., type **%APPDATA%** into Microsoft's File Explorer and press <Enter>.



Continue to 3.3 Organizing Working Areas or return to 3.2 Project Launcher.

3.3 Organizing Working Areas

For each project, ***12d Model*** creates a unique sub-folder of the working folder with the name consisting of the project_name followed by ***.project***. For example, for the project ***Olympic***, and folder called ***Olympic.project*** is created.

This sub-folder (Olympic.project) is called the **project area**. All the internal ***12d Model*** information for that project is kept inside the project area.

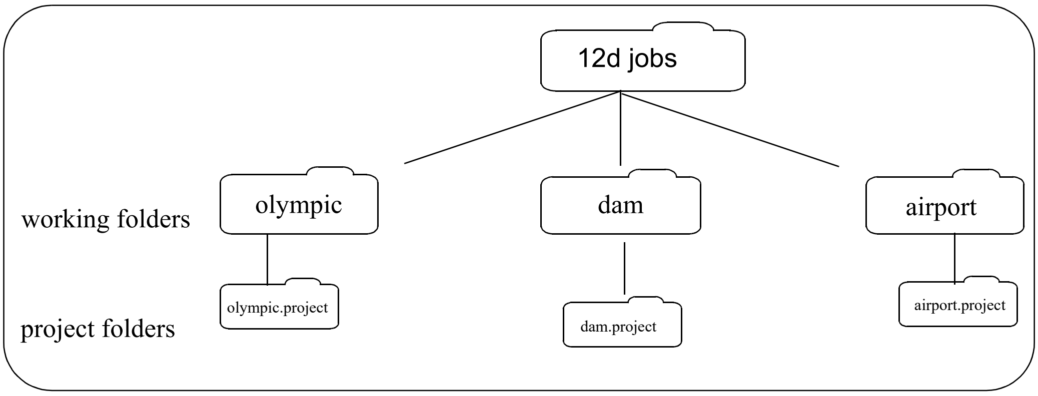
All outputs, reports and plots are written to the working folder (the folder containing the project) and are **not** held inside the project area.

Hence to get a complete backup of the project and all associated information, it is best to ***backup the entire working folder***.

The project name, which can be up to 256 alphanumeric characters and can include spaces, must be unique within the working folder but other folders may include ***12d Model*** projects with the same name - these projects are distinct and are not related in any way.

There is no limit to the number of projects in a particular working folder but because all the outputs, reports and plots for each project in the same working folder would be mixed in together, ***it is recommended to have each project in its own working folder***. That way the inputs files, output files, plots, reports *etc*. from the separate projects do not end up in the same working folder. Each separate working folder can then be easily backed up.

As an example, if three unrelated projects - olympics, airport, and dam - are to be created in a folder called **12d jobs**, it is suggested that the project ***olympic*** is created in a **sub folders** of **12d jobs** called ***olympic***, ***dam*** is created in a **sub folders** of **12d jobs** called ***dam*** and ***airport*** is created in a **sub folders** of **12d jobs** called ***airport***.

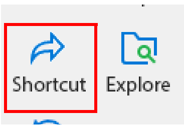


To help users adhere to this convention, when creating new projects, there is a **Create working folder** tick box which if ticked, will first create a folder of the same name as the project being created and then create the project in that folder.

Continue to 3.4 Project Shortcuts.

Continue to 3.4 Project Shortcuts or return to 3 Starting Up.

3.4 Project Shortcuts



The list of most recent projects makes it very easy for ***12d Model*** operators to get into their projects.

However if there is a folder of projects, or even a particular project, that a user wants to get into by simply double clicking on an Icon on the screen, then a Windows shortcut can be used to do it.

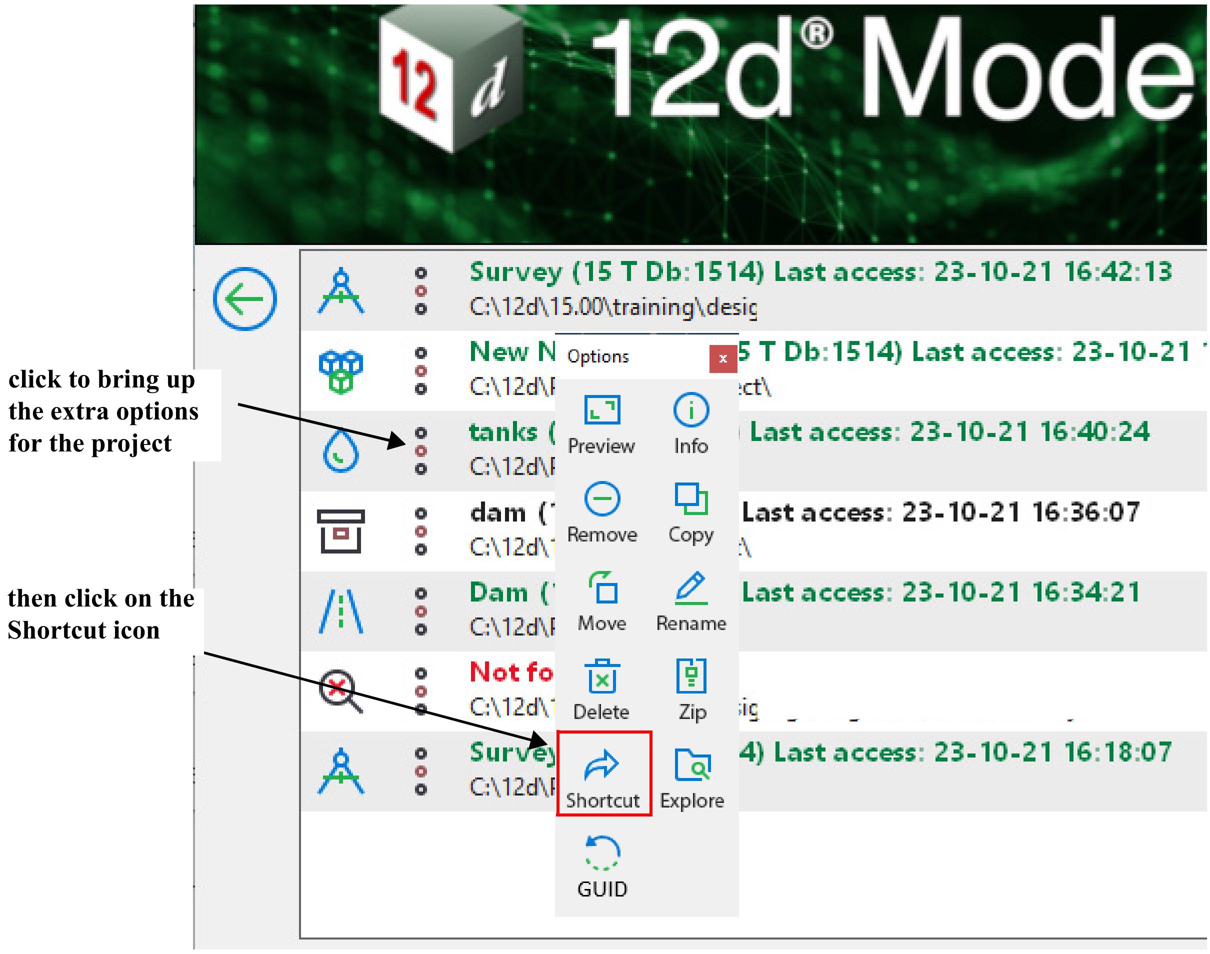
The easiest way to create the Windows shortcut is to

(a) first make sure that the project is in the recent projects list. To do this, just open up the project and then exit ***12d Model***.

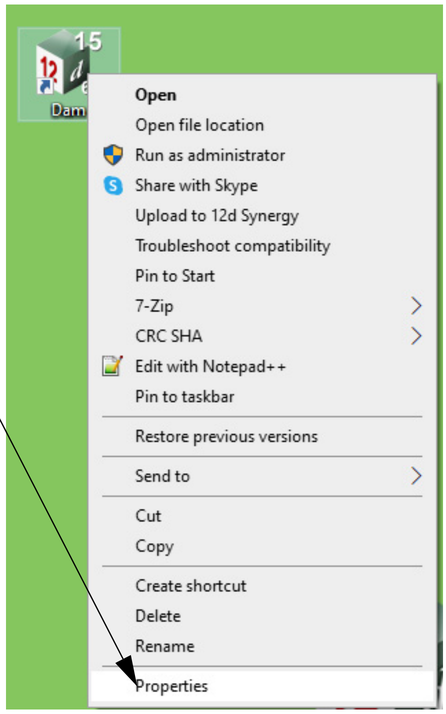
(b) start up ***12d Model*** again by clicking on the ***12d*** icon on the desktop,

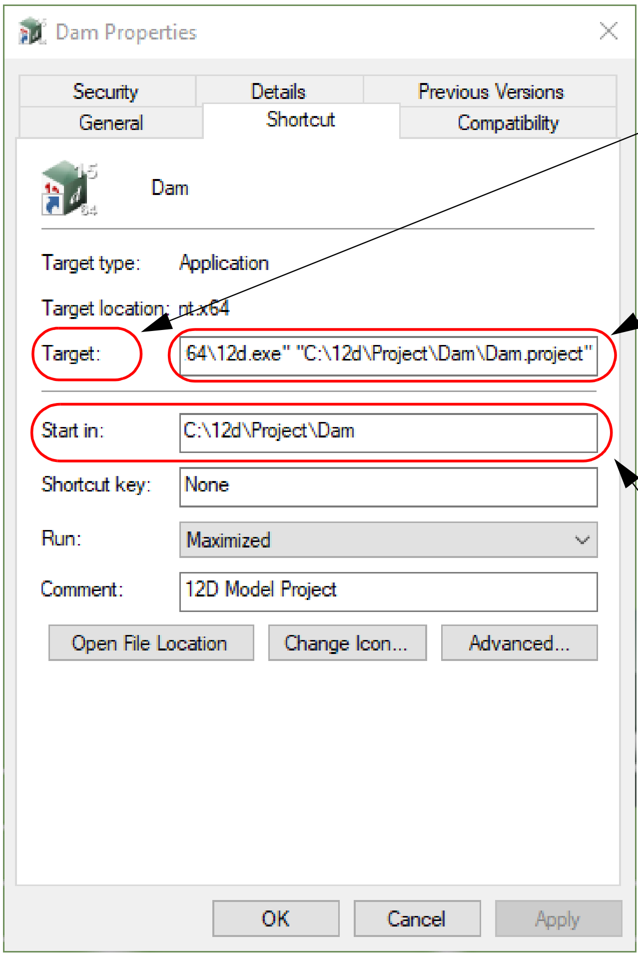
(c) highlight the project in the ***recent projects list*** and select the icon for Shortcut on the right hand side of the project list.

This will create a **shortcut** on the desktop with the **name of the project,** and the shortcut is set to open up the project when the icon is double clicked.



To see what has been created with the new ***12d Model*** icon, highlight the icon and click RB to bring up the icon menu and then select **Properties** and click on the **Shortcut** tab





Target: has the path to **12d.exe**

And as well as the path to 12d.exe, **Target:** has optionally

(a) a full path name to an existing project (including the project name) and this is opened when the icon is clicked

OR

(b) just the name of an existing project and this must be in the folder given in **Start in:** and it is opened when the icon is clicked

Start in: is used as the working folder when no full project path is given in **Target:**

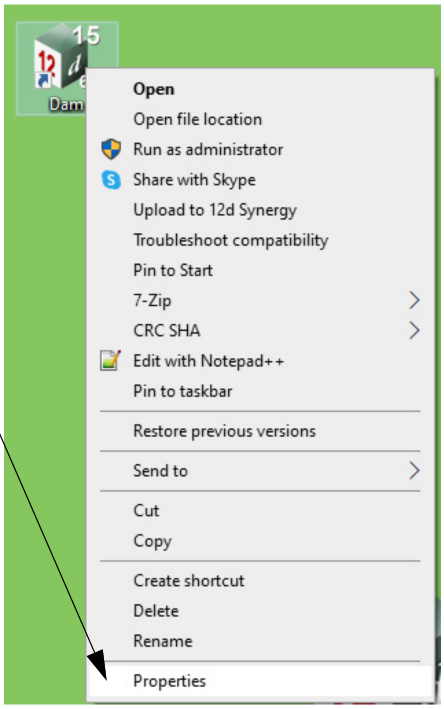
Continue to 3.5 Creating Project Shortcuts by Hand or return to 3 Starting Up.

3.5 Creating Project Shortcuts by Hand

Creating an icon to open up in an existing ***12d Model*** project can also be done by hand by copying a ***12d*** icon that is already on the screen, and then renaming the copied icon to the name of the project (say *survey).*

To display and modify the properties of a **12d** desktop icon, click RB over the ***12d*** icon and select **Properties** from the menu.

Then click on the ***Shortcut*** tab



The Properties for the icon *survey* is then modified by changing what is in the **Target:** box and maybe the **Start in:** box.

To display and modify the properties of a desktop icon, click RB over the ***12d*** icon and select *Properties* from the menu. Then click on the *Shortcut* tab

The Properties for the icon *survey* can now be modified to:

(a) open an existing project by giving the full path name

If an icon is to open a given project, then the full path to the projects (including the project folder name) in given in the **Target:** field after the path to the 12d exe.

For example, if the ***12d Model*** project *survey* was in the folder "12d jobs\survey ", set the **Target:** for the icon ***survey*** to:

"C:\Program Files\12d\12dmodel\15.00\nt.x86\12d.exe" "C:\12d jobs\survey\wurvey.project"

The icon *survey* would then automatically open up the project

C:\12d jobs\survey\survey.project

Note that if the path name for the project in **Target:** contain spaces, then it must be enclosed in double quotes (**"**).

If the *survey* icon was double clicked on, it would now open the project *survey.*

The **Start in:** is ignored.

(b) open an existing project given in the **Start in:** field

Another way that an existing project can be opened is that if a project such as *survey* already exists in the folder given by the **Start in:** field, then in the **Target:** field, the project name is added after the path to 12d. exe.

For example, the **Target**:

"C:\Program Files\12d\12dmodel\15.00\nt.x86\12d.exe"   survey

would automatically open the project **survey** in the **Start in:** folder of the shortcut.

So **Target:** and **Start in:** are used to obtain the existing project to open whereas in (a), only Target: is used.

Note that if either the path names for the **Target:** or **Start in:**, or the project name contain spaces, then they must be enclosed in double quotes (**"**).

A Note on Target: Field

The **Target:** field is actually a command line to use when starting up ***12d Model***. For more information on what can be done in such a command line, see 32.7 Arguments When Starting 12d Model in Appendix 32 Setting Up and Configuring 12d.

Continue to 3.6 Environment Variables Shortcut or return to 3 Starting Up.

3.6 Environment Variables Shortcut

If a file of ***12d Model*** environment variables has been set up by the user (see 31 Environment Variables in Appendix 32 Setting Up and Configuring 12d), then instead of setting the environment variable ENVIRONMENT_4D to point to the file or setting it up with the default name, env.4d, the environment file can be passed to ***12d Model*** using the **Target** of the icon properties.

For example, the **Target**:

"C:\Program Files\12d\12dmodel\15.00\nt.x64\12d.exe"   -env F:\12d\env.4d

would fire up the 64-bit ***12d.exe*** using the file of environment variables called F:\12d\env.4d

The **Target**:

"C:\Program Files\12d\12dmodel\15.00\nt.x64\12d.exe"   -env F:\12d\env.4d   airport

would fire up the 64-bit ***12d.exe*** using the file of environment variables called F:\12d\env.4d **and** also automatically open the project **airport** in the **Start in:** folder of the shortcut.

Again if any of the path names contain spaces, then they must be enclosed in double quotes (**"**).

The **Target:** field is actually a command line to start up ***12d Model***. For more information see 32.7 Arguments When Starting 12d Model in Appendix 32 Setting Up and Configuring 12d.

Continue to 3.7 Error Logging File or return to 3 Starting Up.

3.7 Error Logging File

When ***12d Model*** starts up, it tries to create an **error logging file**, called

logxxxxx.4de

where xxxxx is a hashed number using your login name, process id & the current time.

When ***12d Model*** terminates, the error log file is deleted if no errors were logged.

The **folder** that the error log file is created in is given by the environment variable LOG_DIR_4D.

If LOG_DIR_4D is **not used**,***12d Model*** tries to create the log file in the current folder, the **HOME** folder, the **TMP** folder and the **TEMP** folder.

If creating a **error log file** fails in all these areas, ***12d Model*** will not start up. This should never happen.

Continue to 3.8 Running Macros and Chains on Start Up or return to 3 Starting Up.

3.8 Running Macros and Chains on Start Up

To allow for tailoring ***12d Model*** when a new project is created or an existing project opened, ***12d Model*** can be set up to run user supplied files of macros and/or chains both for new projects or when an existing project starts up.

For more information see 32.6 Running Macros and Chains on Start Up.

Continue to 3 Tools and Concepts or return to 3 Starting Up.

4 Tools and Concepts

There has been changes to the **Tools and Concepts** chapter in the ***12d Model Reference manual***.

See

4.1 Attribute Data Panel

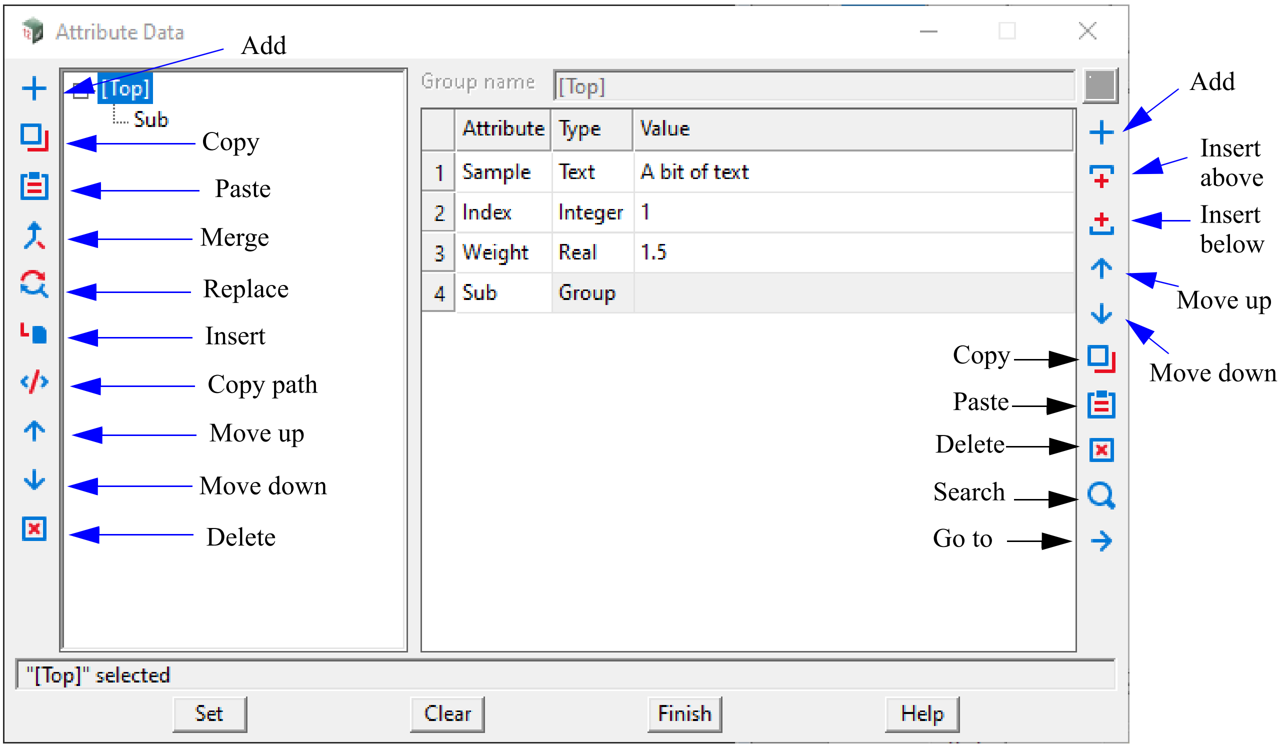
In many options when attributes are to be defined, the **Attribute Data** panel is displayed. Or similar panels with the name of the Object having attributes added to it. For example, Project, or Model, or String.

The **Attribute Data** panel can create and edit attributes.

On the left hand side of the panel, the attribute groups are displayed as the nodes on a tree structure.

The attributes for a highlighted group (node) on the left hand side are displayed on the right-hand side of the panel,

When no attributes exist for an object, the **Attribute Data** panel just shows the [Top] node of the attribute tree.



New attributes are added for the top level node by highlighting the node **Top** and then adding the attributes to the grid displayed on the right hand side.

The attribute name is entered in the **Attribute** column.

The type of the attribute is entered using the pop up in the **Type** column.

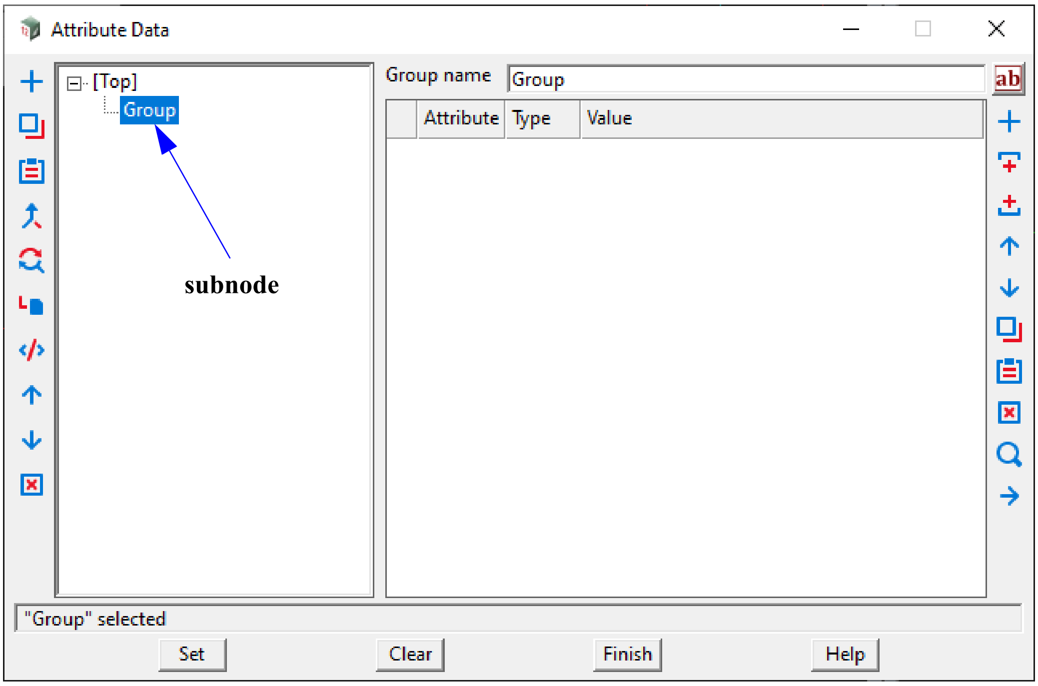
The value for the attribute is entered using the pop up in the **Value** column.

Click on **Set** to save the attributes.

Subnodes:

Subnodes (the lower levels of the attribute tree) can be created for any node.

A subnode of an attribute node is created by highlighting it and clicking the **Add** icon.

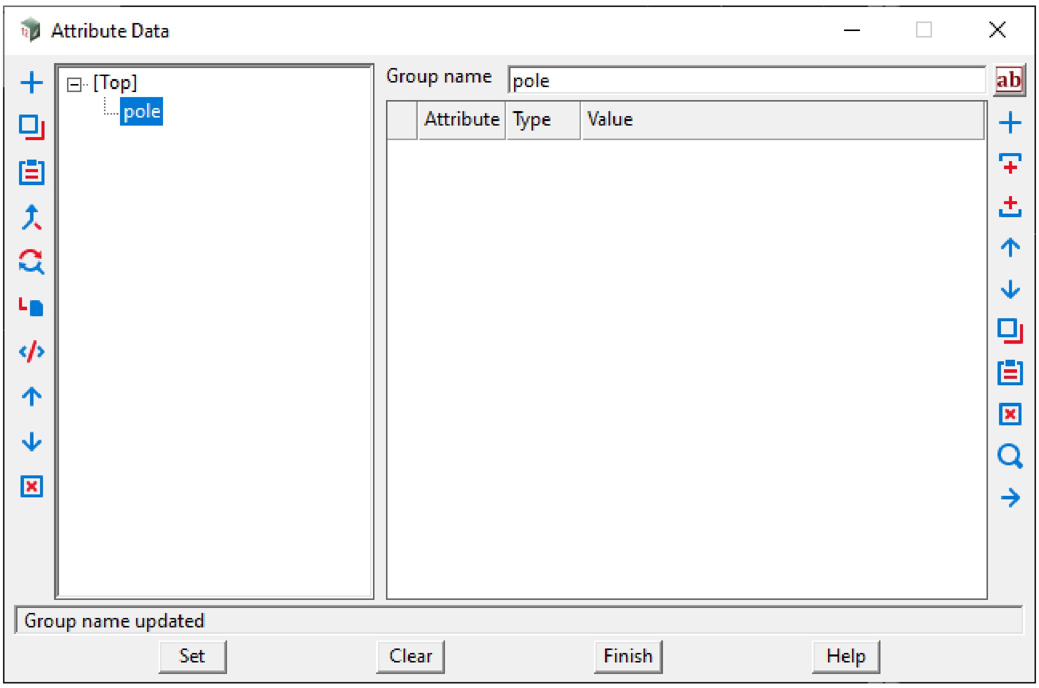


A subnode call **Group** is then created.

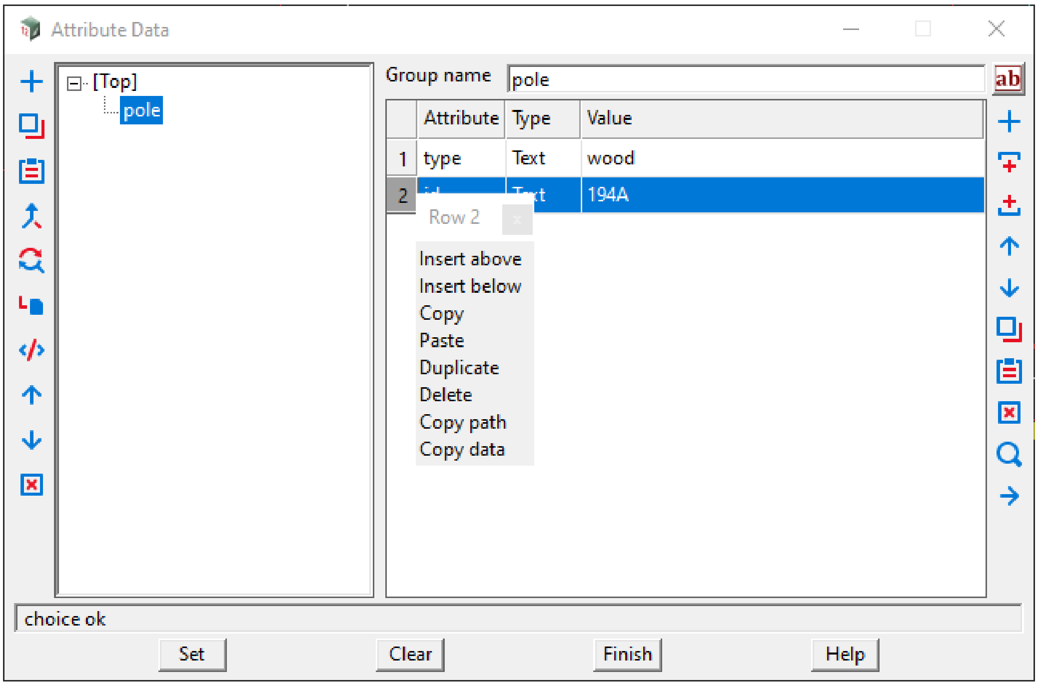
Any attributes for the subnode are then entered into the right hand grid that displays when the subnode is highlighted. Clicking the **Set** button saves the attributes.

To change the name of the subnode Group, you need to either edit the **Group name** box and click **Set** or you need to click on the node above it where 'Group' will be displayed as an attribute of type Group. Under the **Attribute** column, change **Group** to the new name and then click **Set**.

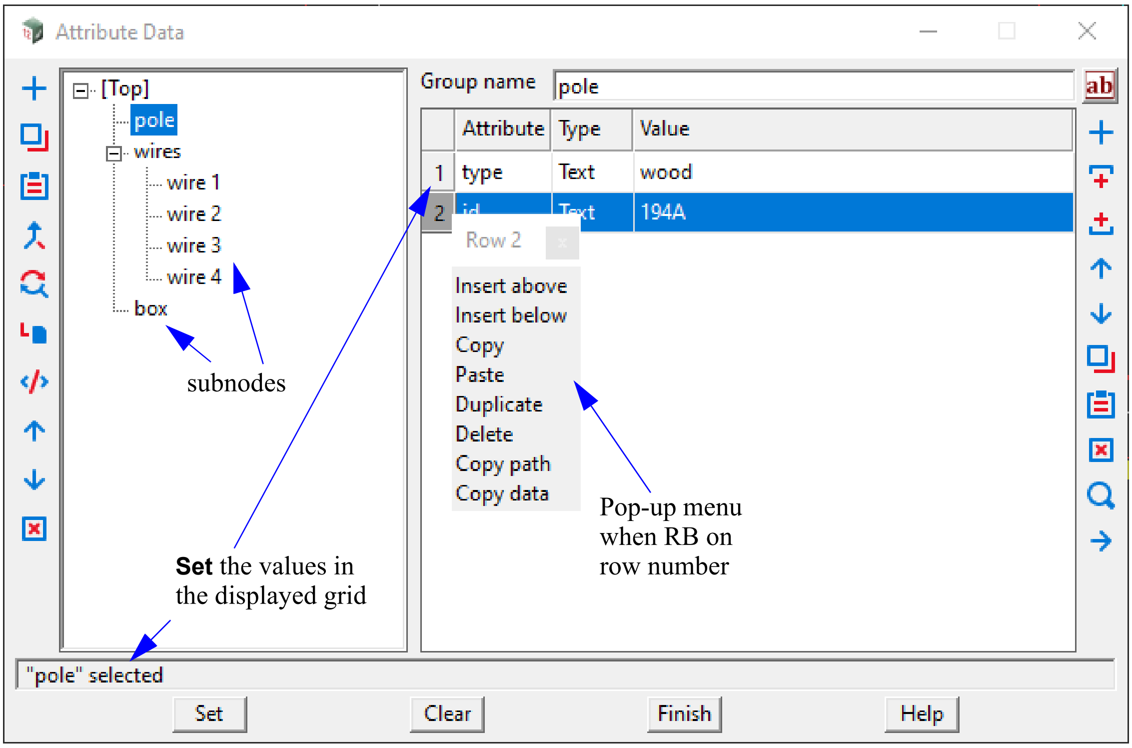
The subnode will then be displayed with the new name.



Attributes can be added to the new subnode



Each subnode is a node in its own right and can have attributes and subnodes.



The buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Icons on Left Hand Side

Add icon

Create a new attribute node (sub node) beneath the highlighted attribute node.

Copy icon

*Copy the highlighted attribute node into clipboard, which can be later paste, merge or insert into other attributes across **12d Model**.*

Paste icon

Paste the attribute buffer to the highlighted attribute node, a new attribute is added.

Merge icon

Merge the attribute buffer with the highlighted attribute node.

Replace icon

Replace the highlighted attribute node with the attribute buffer.

Insert icon

Insert the attribute buffer as a child to the highlighted attribute node.

Copy path icon

Copy the highlighted attribute node path to clipboard.

Move up icon

Move the highlighted attribute node up the tree.

Move down icon

Move the highlighted attribute node down the tree.

Delete icon

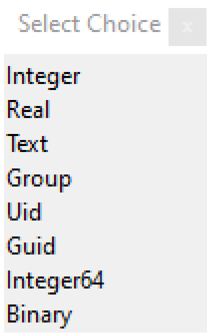
Delete the highlighted attribute node.

Grid on Right Hand Side

Attribute

Name of the attribute.

Type i



Type of attribute.

Value

Value for the attribute.

Icons on Right Hand Side

Add icon

Create a new attribute row at the bottom of the table.

Insert above icon

Create a new attribute above the currently selected row.

Insert below icon

Create a new attribute below the currently selected row.

Move up icon

Move the selected attribute rows up the table.

Move down icon

Move the selected attribute rows down the table.

Delete icon

Delete the selected attribute rows.

Search icon

Open the Find and Replace attributes panel. For information on the Find and Replace panel see 6.14.1.8 Finding an Entry the Names.4d File.

Copy icon

Copy the selected attribute rows or cell range to clipboard, which is available for 12d Model and other software to use.

Paste icon

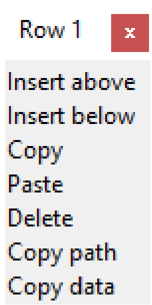
Paste the content of the current clipboard from 12d Model and other software (tab delimited format) to the currently selected cells and create new attributes if the clipboard buffer has more data.

Go to icon

Go to the hyperlink specified in the "Value" field of the current row. Hyperlink can be a web address, Synergy URL or command line argument to launch a Windows application.

Attribute row menu

Right click on selected attribute rows open the row menu.



Insert above icon

Create a new attribute above the currently selected row.

Insert below icon

Create a new attribute below the currently selected row.

Copy icon

Copy the selected attribute rows to clipboard.

Paste icon

Paste attribute data from clipboard to the selected rows.

Delete icon

Delete the selected attribute rows.

Copy path icon

Copy the attribute path of the selected attribute row.

Copy data icon

Copy attributes of the selected attribute rows to clipboard.

Buttons at Bottom

Set button

Set the values given in the current grid in the attribute tree.

Clear button

Clears out the entire attribute tree.

Continue to 4.1.1 Comparing Attribute Data or return to 4.1 Attribute Data Panel.

4.1.1 Comparing Attribute Data

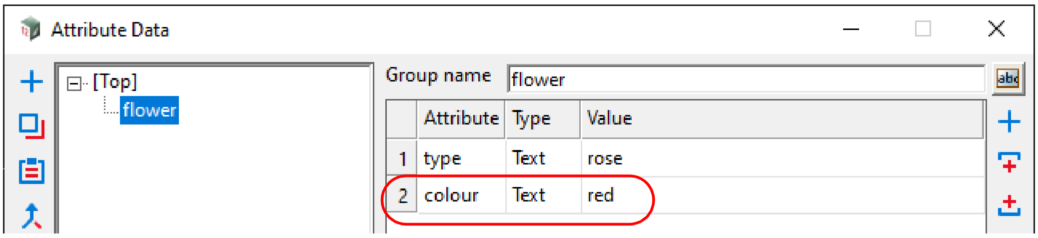
Two ***Attribute Datas*** are the same if each **Attribute Data** has:

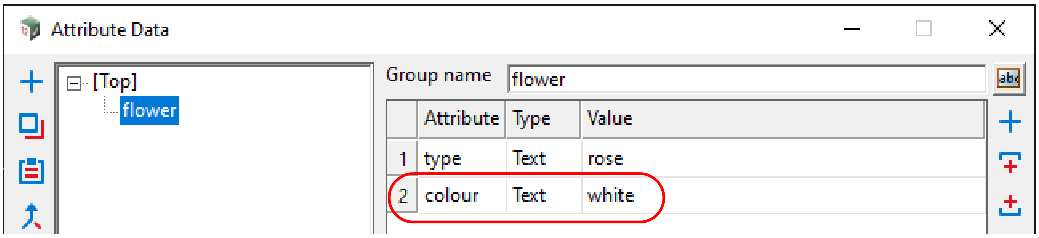
(a) exactly the same nodes (groups) with exactly the same names

(b) each node (group) has exactly the same attributes in them

and

(c) each identical attribute has ***exactly the same value***.





For example, the two attribute data shown above have exactly the same attribute group "flower" and the group "flower" has exactly the same attributes "type" and "colour".

But the attribute data is **not the same** because the value of "colour" is "red" for one attribute data, and "white" for the other attribute data.

Continue to 4.1.2 Accessing Attribute Values or return to 4.1 Attribute Data Panel.

4.1.2 Accessing Attribute Values

In some options, in particular in the **Map File,** the actual ***value*** of a given attribute (the column called **Data** in the **Attribute Data** panel), is specified by putting a **$** in front of the attribute path name.

That is

$earth/australia/sydney/lee

refers to the actual value of the attribute given by the path name *earth/australia/sydney/lee.*

Continue to 4.2 Polymesh or return to 4 Tools and Concepts.

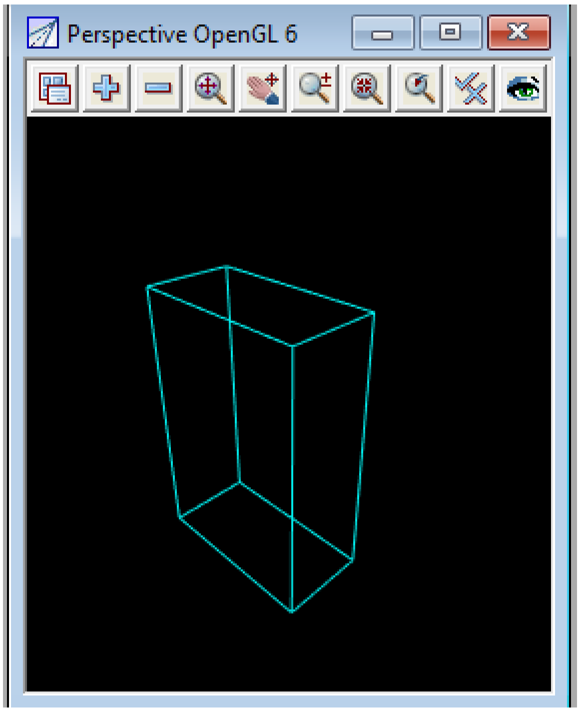
4.2 Polymesh

The Trimesh was introduced in V11 and for V15, it has been generalised to a ***polymesh***.

A ***polymesh*** is a 3D object that is composed of Jordan (simple) polygons (**polyfaces**) and **triangles**. The polygons and triangles are connected to each other to form a mesh that defines the shape. The whole shape can be open, where some edges belong to only one polygon or triangle, or closed, where all edges belong to two polygons or triangles so that the mesh is watertight.

So a ***trimesh*** is a ***polymesh*** where all the polygons are ***triangles***.

An example of a polymesh that is not a trimesh is a box.



The polygons that make up the polymesh are the ***polymesh faces*** and a face can be:

(a) a **planar face of more than three vertices**.

That is, the face is bounded by a simple polygon of more than three vertices that is in the **one** plane.

Because it is in the one plane, a planar face uniquely defines the z-values of all the points inside the bounding polygon. In ***12d Model*** a planar face does have a triangle decomposition but how the triangles are defined does not affect the z-values - they are all in the one plane.

(b) a **non-planar face**.

That is, the face is bounded by a simple polygon that is not in the one plane.

Unlike a planar face, for a non-planar face there is no uniquely defined surface within the bounding polygon. So to ensure the 3D surface represented by a non-planar polygon is unique, in ***12d Model*** a non-planar face must also have a triangle decomposition to uniquely represent the 3D surface of the non-planar face.

So in ***12d Model***, a **polymesh** is made up of **triangles** and **polyfaces** but internally, each polyface is decomposed into triangles.

The polygon boundary of a polyface can have a name and a colour

To display a polymesh on an ***OpenGL Perspective view***, the ***Toggles*** menu on an ***OpenGL Perspective view*** has an extra walk-right menu called ***Polymesh drawing*** that are used when ***Drawing wirefame*** is **[on]**.

The three toggles on the **Polymesh drawing** walk-right menu **Polymesh Drawing Toggle** are:

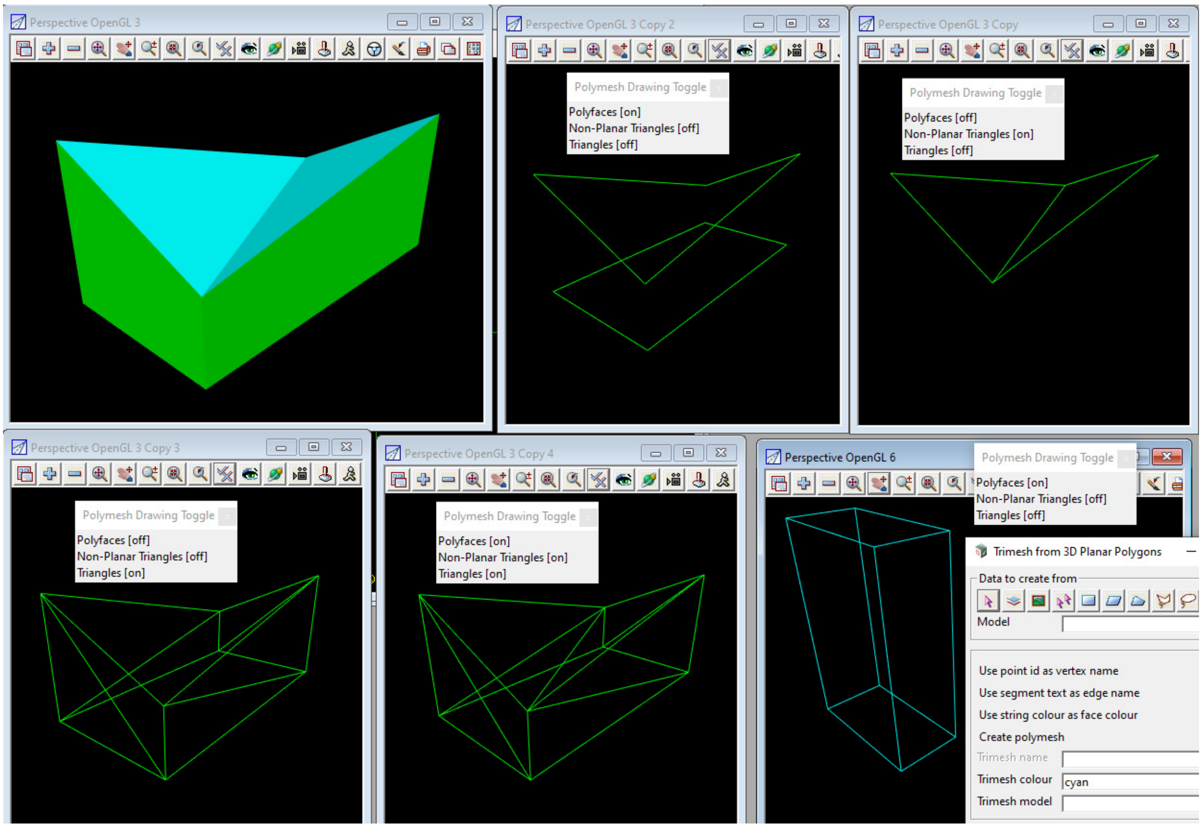
Polyfaces - when toggled on, the boundary polygon of any planar faces are drawn on the view. This probably should say Planar polyfaces.

Non-Planar Triangles - when toggled on, the boundary polygon of any non-planar face, plus the enclosed triangles of the non-planar faces, are drawn on the view. This probably should be Non-planar polyfaces and their internal triangles.

Triangles - when toggled on, the faces that are not polyfaces are drawn on the view.

So to see all the components that are contained in a polymesh, you need all three toggled on.

In the image below, the polymesh in view **3** consists of a non-planar face on the top (cyan) and a planar face on the bottom.



So in view ***3 Copy 2*** which has only ***Polyfaces turned on,*** you only see the bounding polygons of the top and the bottom of the object.

In view ***3 Copy*** which has only ***Non-Planar triangles turned on,*** you only see the bounding polygon of the top and its triangle decomposition.

In view ***3 Copy 3*** with only ***Triangles turned on,*** you only see the triangles that are not polyfaces which is how the sides of the object were constructed.

In view ***3 Copy 4, Polyfaces, Non-Planar triangles*** and ***Triangles*** are all ***turned on*** so you can see all the triangles that make up all the polyfaces of the polymesh.

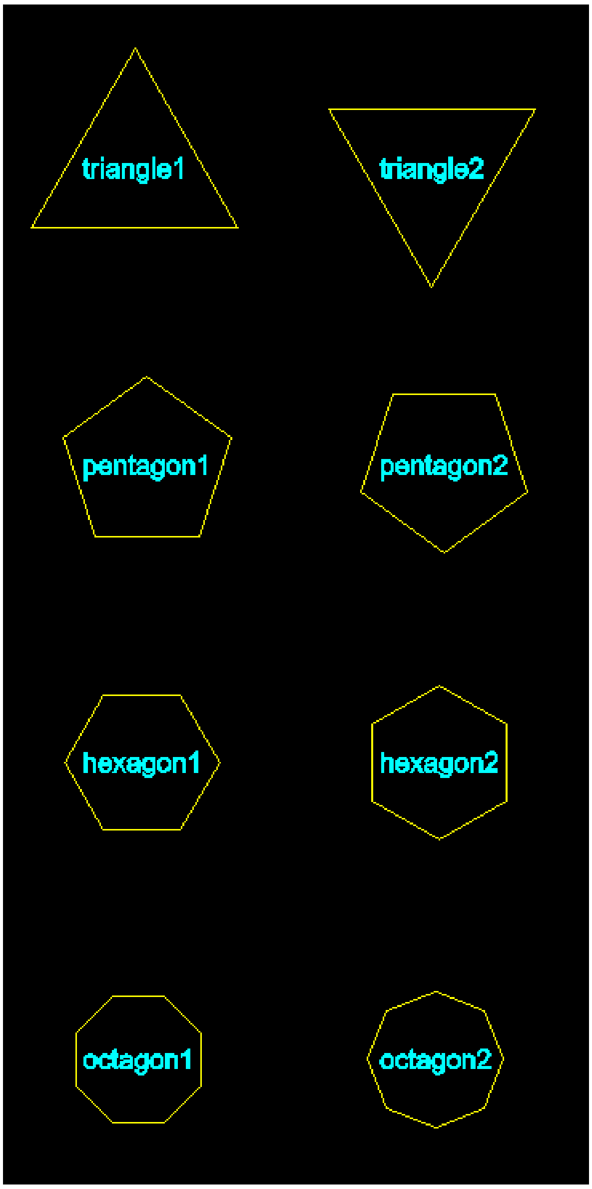
Note: a polymesh could be converted into a trimesh but then all the polygon boundaries of the polyfaces would be lost.

Continue to 4.3 Border and Border Style or return to 4 Tools and Concepts.

4.3 Border and Border Style

Additional styles include:

Triangle1, Triangle2, Pentagon1, Pentagon2, Hexagon1, Hexagon1, Octagon1, Octagon2



Continue to 4.4 Panel Fields or return to 4 Tools and Concepts.

4.4 Panel Fields

See

[4.4.1 Unit Conversions in Real Value Fields](#)
[4.4.2 Choice Box](#)

4.4.1 Unit Conversions in Real Value Fields

Conversions from various distance units into metres are possible by post-fixing a valid real value with a defined single character, these combined values can be freely used in expressions.

For example, to find the width in metres of a standard gauge railway, **4' 8 ½"** we need to convert the feet and inch parts to metres and add them together.

Post fixing a value with **f** indicates the value is in feet, i it is in inches, (full list follows further down), the expression first converts the values into metres then performs any operations on the resulting values. So, the above example can be written in 2 ways, **4f + 8.5i or 4f + 8i + 1i/2**.

Note how to enter fractions, for example 5/8 of an inch will be entered as **5i/8**. **(5/8)i** is not a valid syntax and **5/8i** is actually 5 divided by 8 inches.

Due to the small differences between international, (imperial) and US feet an environment variable **TYPED_UNITS_MODE_4D** controls which unit is used.

if **0**, the default value, only international units are supported, for example **4f** and **4F** will both represent 4 international feet.

if **1** only US units are supported, for example **4f** and **4F** will both represent 4 US feet.

if **2** both international and US units are supported, lower case for international units and upper case for US units, for example **4f** is 4 international feet and **4F** US feet.

Units that support both international and US versions

i/I - inches

f/F - feet

y/Y - yards

m/M - miles

l/L - links

c/C - chains

p/P - perches

r/R - rods

Units that do not have US versions, the upper case version is an error and the expression will fail

k - kilometres,

n - nautical mile

4.4.2 Choice Box

The **Choice Box** is for a general tool for displaying a list of items that the user can select from.

A choice can be typed in, or the list of available choices displayed in a pop-up by clicking on the **Choice** icon at the right hand end of the Choice box

Being a general box, what choices are in the pop-up is different for each **Choice** box and are documented for each option that includes a Choice box.

There are three different styles of Choice Boxes:

(a) Choice Box with a select field on the **Select Choice** pop-up

This is the most general purpose Choice Box and is used when there is a large number of choices and depending on the application, more than one choice can be selected.

The required choices can often be more easily selected by first typing in selection criteria into a search field and then the required choice(s) selected from the smaller list.

Searches can be by whole or partial words, and case can be ignored or not ignored.

See 4.4.2.1 .Choice Box with Search Field on Select Choice Pop-Up

(b) Select choice without a search field on the **Select Choice** pop-up

This is used when there is a small number of choices and so a search field is not needed.

See 4.4.2.2 Choice Box With No Search Field on Select Choice Pop-Up

(c) Older Style Choice Box

This is the original Choice box and is still used in some panels, especially when the number of choices is very limited and only can be selected.

See 4.4.2.3 Older Style Choice Box

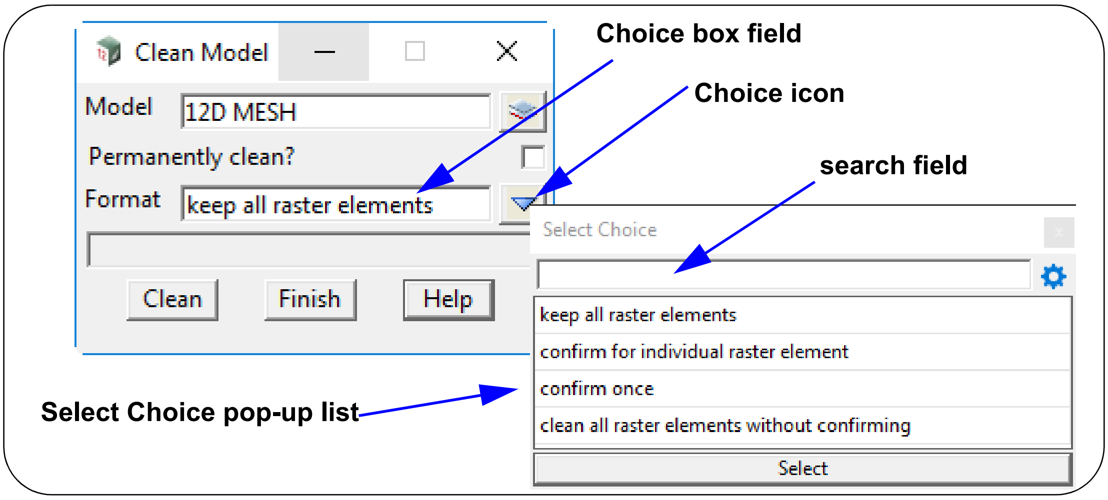
Note:
There are other specialised boxes such as **Model box** or a **Tin Box** that also allow users to select from a pop-up list.

4.4.2.1 .Choice Box with Search Field on Select Choice Pop-Up

This is the most general purpose **Choice Box** and is used when there is a large number of choices and depending on the application, more than one choice can be selected.

The required choices are often more easily selected by first typing selection criteria into a **search field** and then the required choice(s) selected from a smaller list.

Searches can be by whole or partial words, and case can be ignored or not ignored.



Click on one the Choice icon at the end of the Choice Box brings up the **Select Choice** pop-up with the search field at the top, followed by the list of choices satisfying the search criteria, and a **Select** and possibly other buttons such as **Clear**, at the bottom.

Clicking on the **X** at the top right hand corner of the **Select Choice** pop-up removes it.

Clicking and **dragging** on the **title area** of the pop-up allows you to **move** and **pin** the **Select choice** pop-up.

When there is a **[Clear]** button, clicking on it will clear what is in the **Choice box** field when having no selection is allowed.

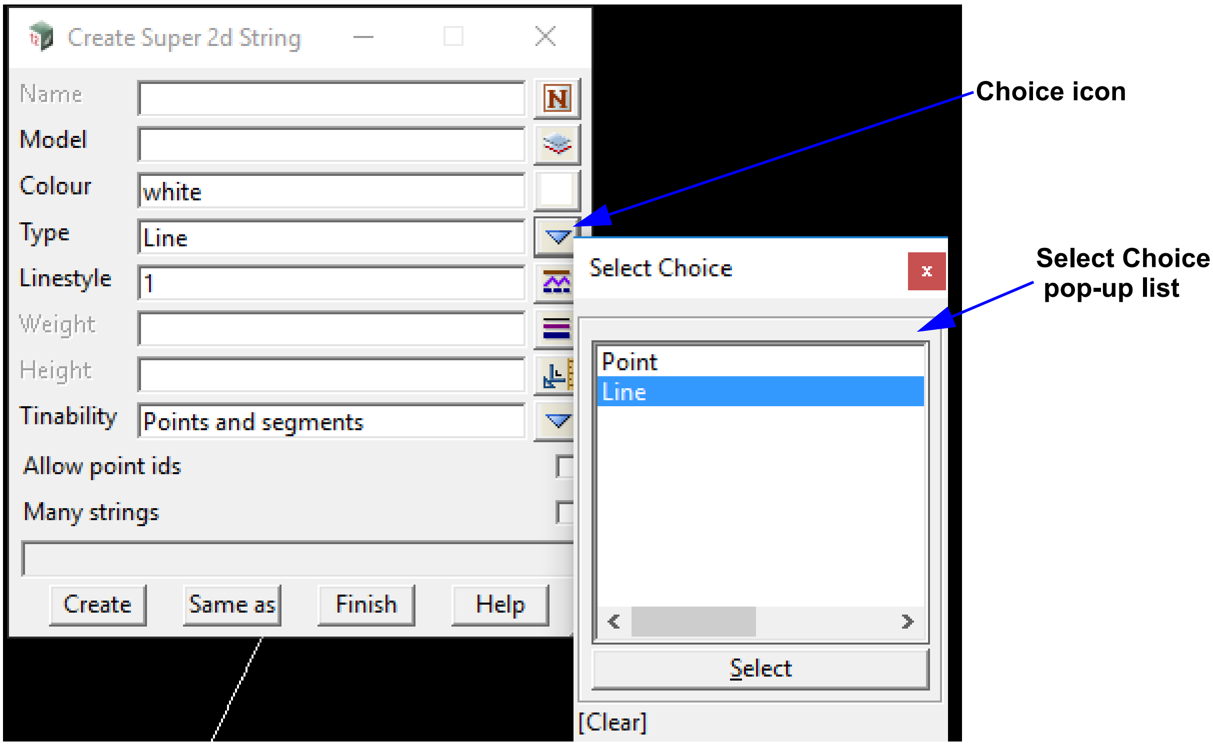
The choices above **[Clear]** will be different for each option.

If nothing is typed into the search field then all the choices are displayed in the pop-up list but there is a special syntax using the characters **plus** (+), **comma** (,) and **minus** (-) for AND, OR and NOT logical operators to restrict what is shown in the pop-up. See 4.6.3.6 Search Field Syntax for Selects.

For a **Choice Box with a search field,** full information on the search settings **Match Case**, **Whole Word, Search field** and on **Save Selects** is in 4.6 Select for Model, Tin, Template, Function, Name Boxes & Views.

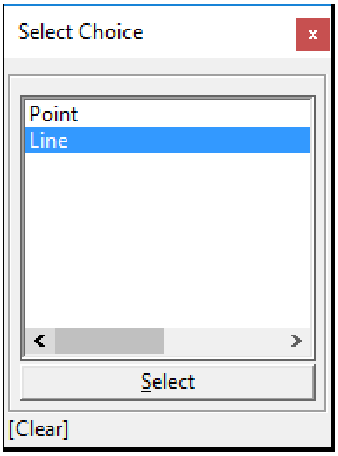
Continue to4.4.2.2 Choice Box With No Search Field on Select Choice Pop-Up or return to 4.4.2 Choice Box or 4.4 Panel Fields.

4.4.2.2 Choice Box With No Search Field on Select Choice Pop-Up



Clicking on the **Choice icon** will display the pop-up choice list.

As an example:



Clicking on the **X** at the top right hand corner removes the option.

Clicking and **dragging** on the title area of the menu allows you to **pin** the menu.

Clicking on the **[Clear]** button will clear the current field.

For the meaning of the buttons above it, refer to the help for the specific option.

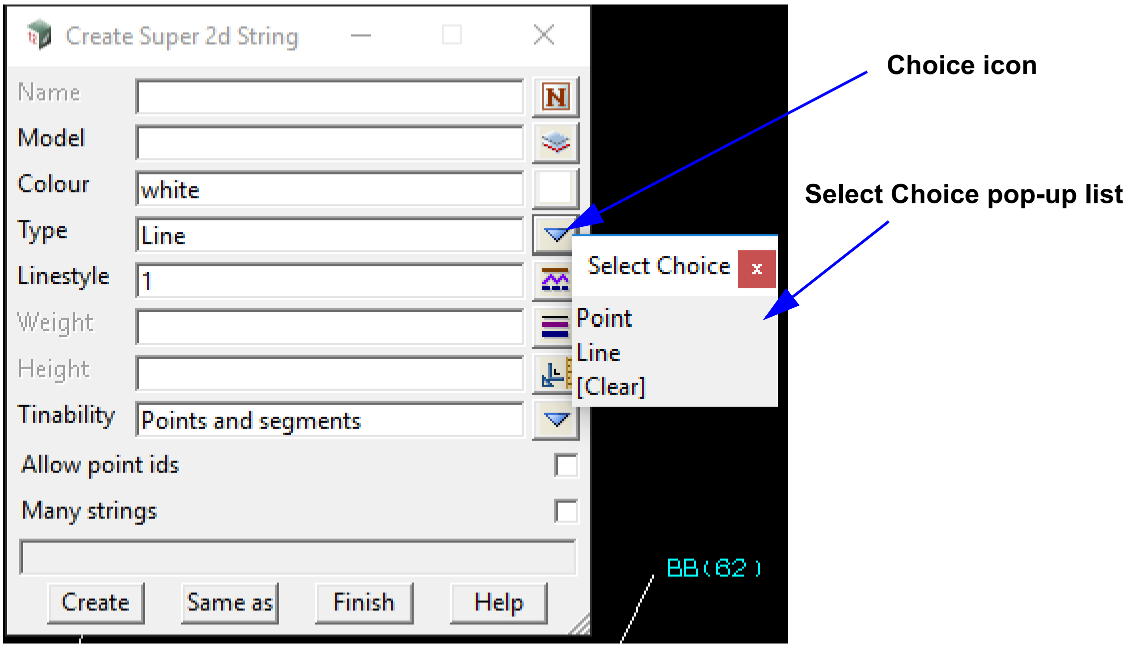
The **Select** button uses the current selection in the list and populates the panel field.

This style is used when the there is a large number of choices, usually greater than 26.

Double clicking on a choice, populates the panel field directly.

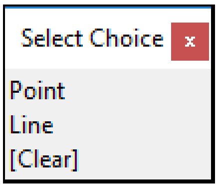
Continue to4.4.2.3 Older Style Choice Box.

4.4.2.3 Older Style Choice Box



Clicking on the **Choice** icon will display the choice list.

As an example:



Clicking on the **X** at the top right hand corner removes the option.

Clicking and **dragging** on the **title area** of the menu allows you to **pin** the **Select choice** menu.

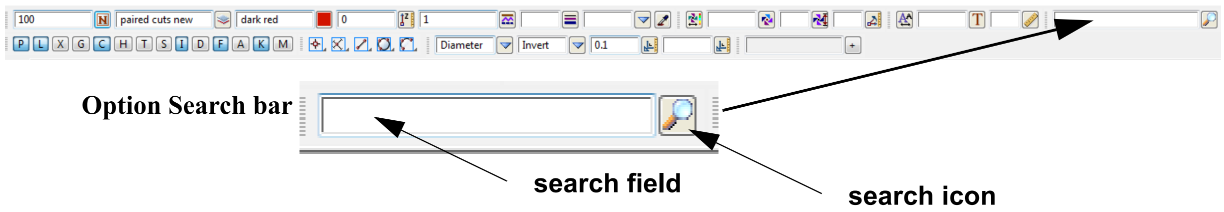
Clicking on **[Clear]** will clear what is in the Choice box field.

The choices above **[Clear]** will be specific to the particular choices required in an option.

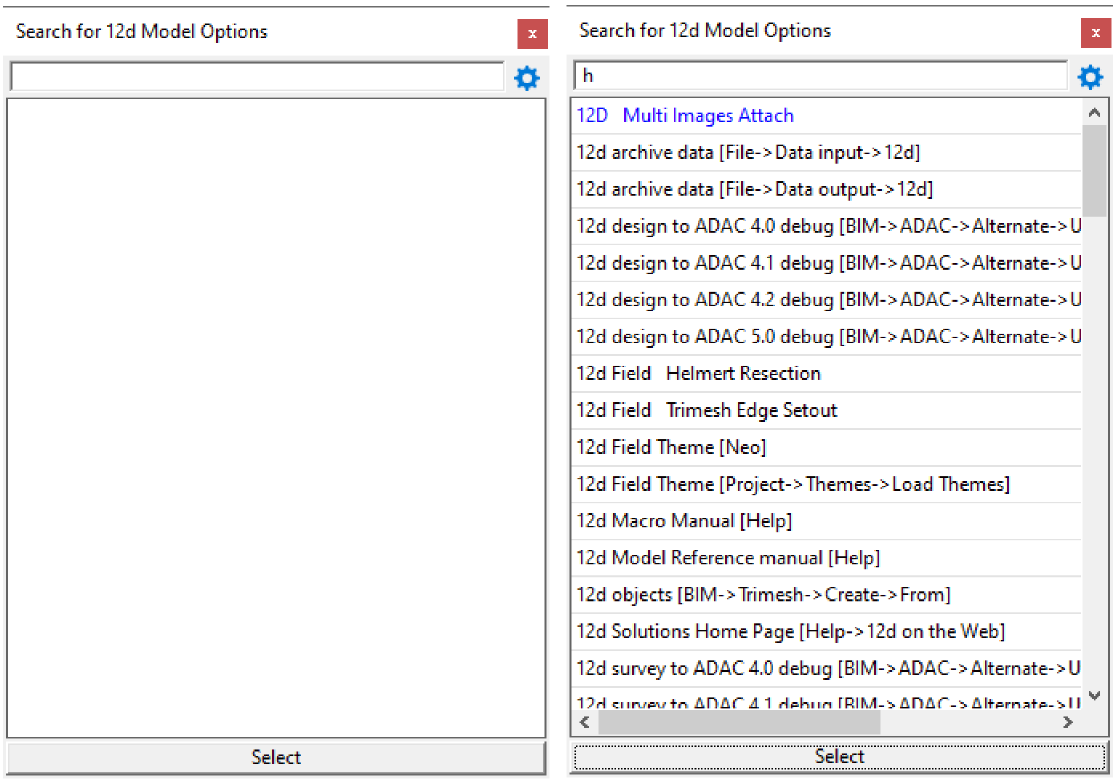
Continue to 4.5 Options Search Bar or return to 4 Tools and Concepts.

4.5 Options Search Bar

The **Option Search Bar** allows quick access to most options in ***12d Model***.



Clicking **LB** in the **Search bar** or on the **Search** icon, or typing in the **Search** bar, brings up the **Search for 12d Model Options** panel.



The **Options Search bar** uses **key words** separated by spaces and the logic operators ***comma*** (","), ***plus*** ("+") or ***minus*** ("-") (see 4.5.1 Options Search Bar Syntax) to define the accepted matches in the text being searched for from:

(a) the **titles of the hard coded panels** (i.e. not macros) that satisfy the search criteria

The full title of the panel is shown

(b) the **full path names of menu items on the Main menus** in the current ***Theme*** that satisfy the search criteria

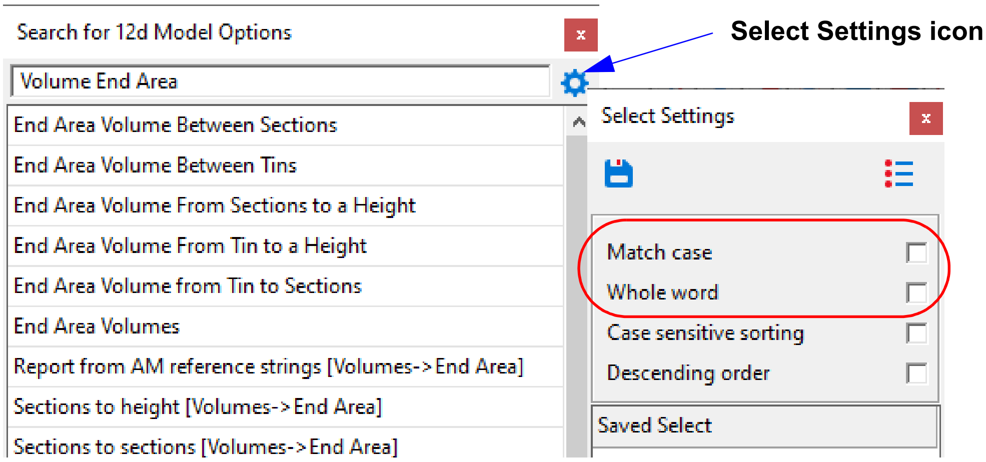
The final text on the menu is displayed followed by the full menu path name in square brackets.

(c) the **name of the options** in the ***Classic Theme*** that satisfy the search criteria

The final text on the menu is displayed.

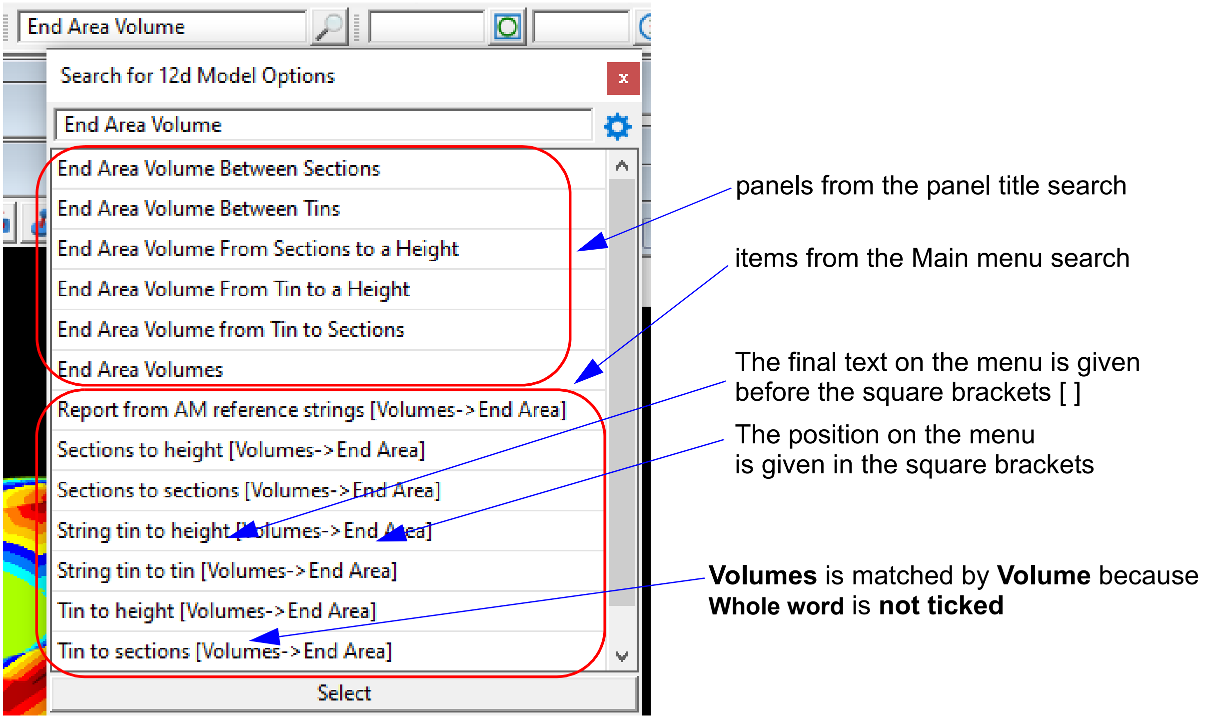
So even if an option is not on any menu for the ***current Theme***, it can still be found in the ***Classic Theme***.

How matches are made is controlled by the **Match case** and **Whole word** fields that are set in the **Select Settings** panel brought up by clicking on the **Select Setting** icon:



Double clicking on an item in the list **brings up the panel** for that option.

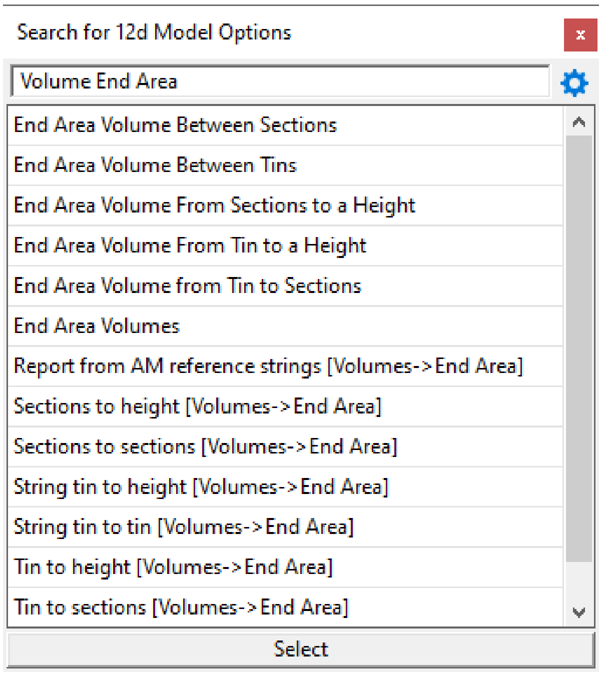
For example, typing in the key words **End Area Volume** into the **Search field** with **Whole word not ticked** will bring up the list of found options in the **Search for 12d Model Options** panel:



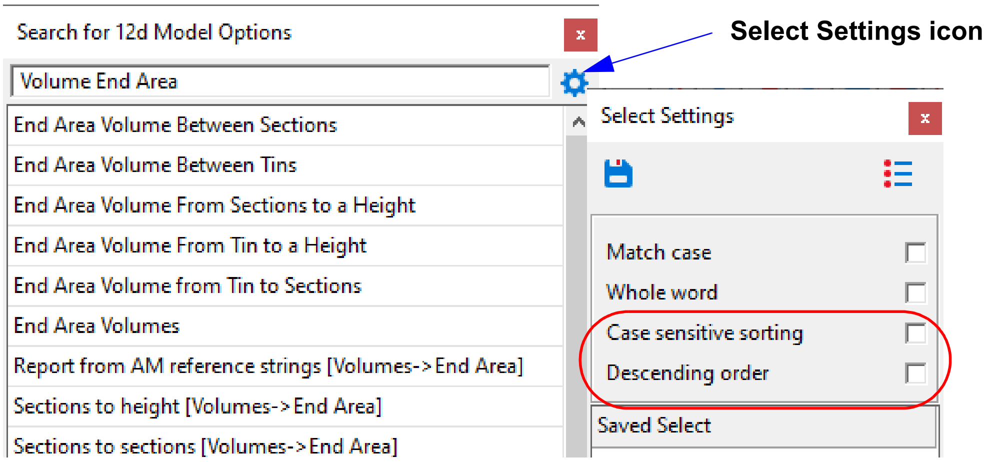
Because **Whole word** is **not ticked** in the **Select Settings**, **Volume** matches with **Volumes.** For more information, see 4.6.3.2 Select Settings - Match Case and Whole Word.

Important Note

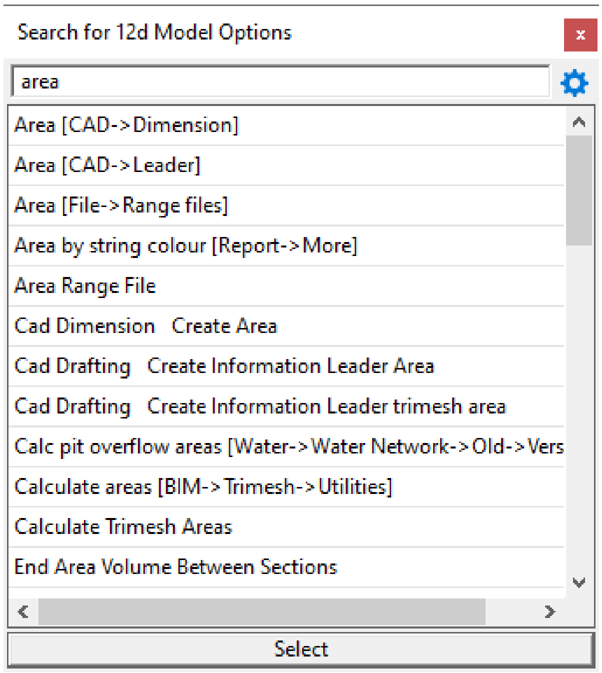
The **order** of the key words for **selecting options** is **not important**.Typing **Volume End Area** brings up exactly the same list.



The **sorting order** of the items in the list is controlled by the **Case sensitive sorting** and **Descending order** fields that are set in the **Select Settings** panel brought up by click on the **Select Setting** icon:



It was just luck that in this list all the panel names came before the Main menu path names. Typing in **area** with **Match case not ticked** and **Case sensitive sorting not ticked**, mixes them up.

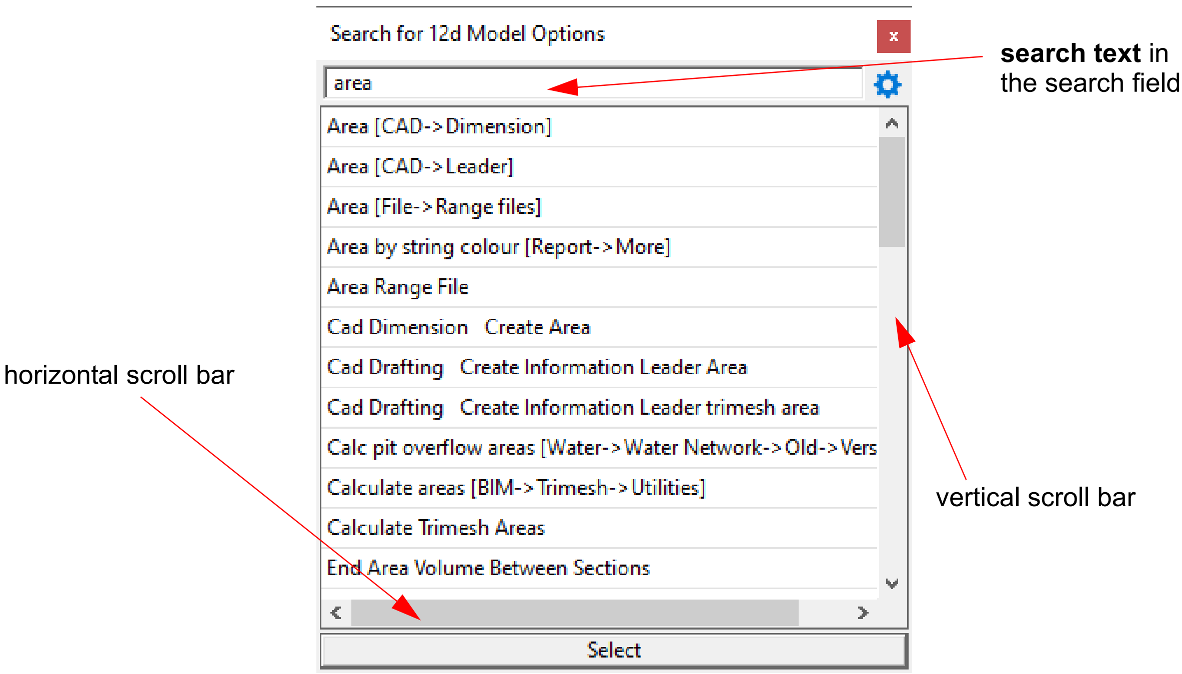


For more information, see 4.6.3.3 Select Settings - Case Sensitive Sorting and Descending Order.

Note: The values for the **Match case, Whole word**, **Case sensitive** and **Descending order** fields are saved for the project in ***Project Settings -*** see 6.8.2.7 Search Bar Settings.

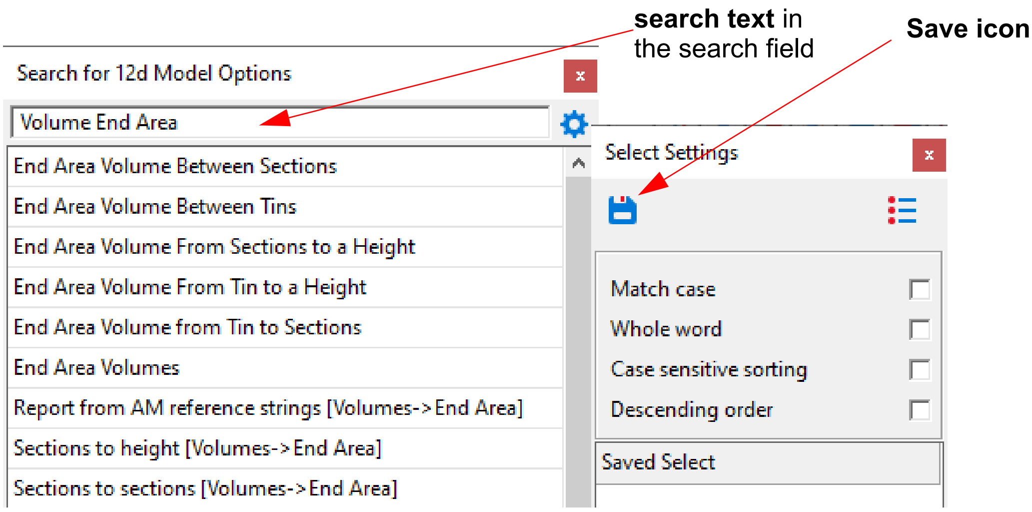
Horizontal and Vertical Scroll Bars:

The settings for controlling the **horizontal** and **vertical size** of the list of options before **horizontal** and **vertical scroll bars** are added to the **Search for 12d Model Options Bar *panel*** are stored in ***Project Settings*** - see 6.8.2.7 Search Bar Settings.



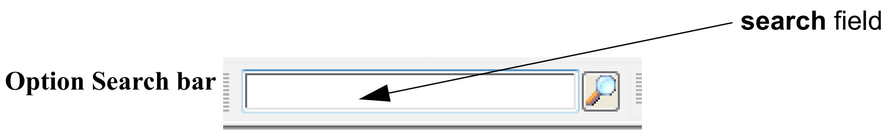
The **Search for 12d Model Options** panel can be pinned (4.5.2 Moving the Search for 12d Model Options Panel).

The **Search text** can also be saved for reuse using the **Save icon** on the **Select Settings** panel. See 4.5.3 Saving and Reusing Option Searches:



Continue to 4.5.1 Options Search Bar Syntax or return to 4.4 Panel Fields.

4.5.1 Options Search Bar Syntax



The **search** field in the **Options Search Bar** allows for one or more words separated by spaces.

When you type alpha numeric keywords into the search field of the **Options Search Bar,** the words can be separated by the special characters **space** ' ', **comma** ',', **plus** '+' or **minus** '-' and ***12d Model*** will interpret them to perform the following **logic operations**:

AND use **space** ' ' **or plus** '+'

For example:

X Y will search for text that contain **BOTH X and Y**.

X+Y will also search for text that contain **BOTH X and Y**.

That is, the search will return only results that have both X and Y in them.

OR use **comma** ','

For example:

X,Y will search for text that contain **EITHER X or Y** or **BOTH X and Y.**

That is, the search will return results that have X or Y, or both X and Y in them.

NOT use **minus** '-'

For example:

-X will exclude text that has **X in them**

That is, the search will return results that don't contain X.

The syntax is evaluated from left to right.

That is, you can have things like:

X Y,Z-A

which means the search will find text with

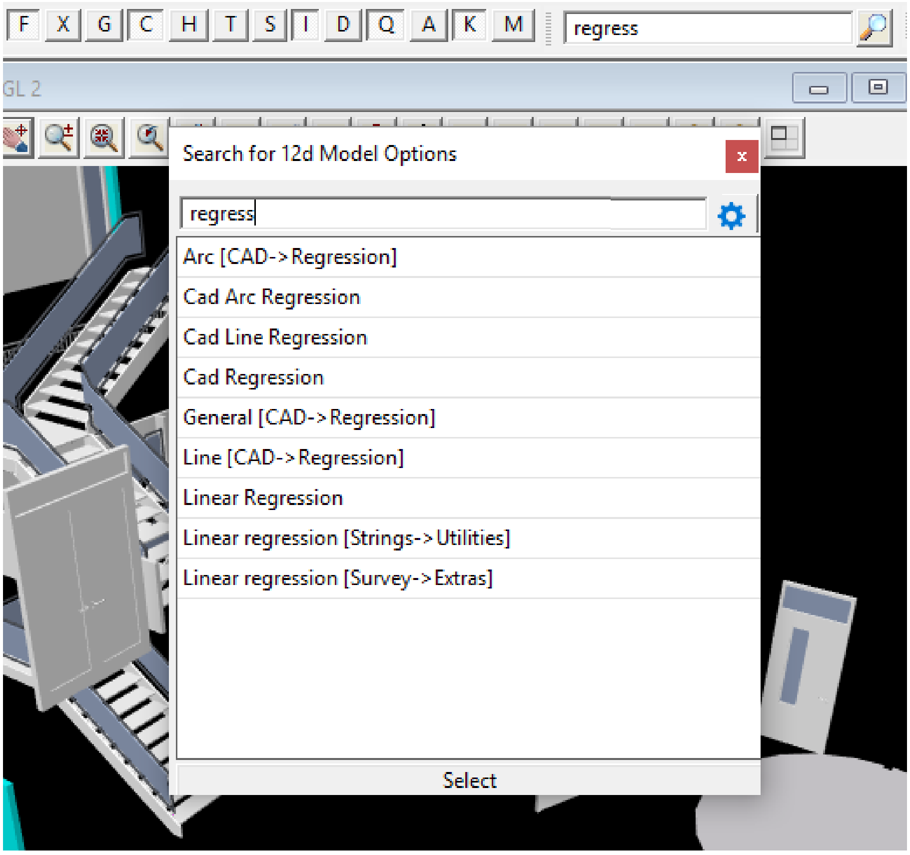
(X and Y) or Z, but none of them containing A

Continue to 4.5.2 Moving the Search for 12d Model Options Panel or return to 4.4 Panel Fields.

4.5.2 Moving the Search for 12d Model Options Panel

When information is typed into the **Options Search bar,** the **Search for 12d Model Options** panel comes up.

If the **Search for 12d Model Options** panel is moved, it is automatically pinned. That is, it stays at the new position until the panel is deleted (by clicking on the **x**).



This means that any number of options can be selected from the **Search for 12d Model Options** panel and it won't be removed from the screen until the **X** button is selected.

If you click in the Search bar whilst the **Search for 12d Model Options** panel is up, the cursor is automatically moved to the **Search** field in the **Search for 12d Model Options** panel.

When the pinned panel is removed, the text in the **Search** field of the **Search for 12d Model Options** panel is written to the **Options Search Bar**.

Any text in the **Search** field text can be saved and reused for future **Search for 12d Model Option** panels (see 4.5.3 Saving and Reusing Option Searches).

Continue to 4.5.3 Saving and Reusing Option Searches or return to 4.4 Panel Fields.

4.5.3 Saving and Reusing Option Searches

When text is typed into the **Search** field in the **Search for 12d Model Options** panel, the text typed in can be saved and reused for future Searches.

For further information, see 4.6.3.7 Saving and Reusing Searches with Select Settings.

Continue to 4.6 Select for Model, Tin, Template, Function, Name Boxes & Views or return to 4 Tools and Concepts.

4.6 Select for Model, Tin, Template, Function, Name Boxes & Views

See

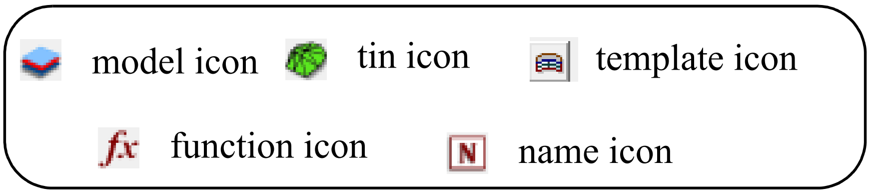
[Select for Model, Tin, Template, Function and Name Boxes]
[View Select, Add (+) and Remove (-) View Buttons]
[Select Settings]

4.6.1 Select for Model, Tin, Template, Function and Name Boxes

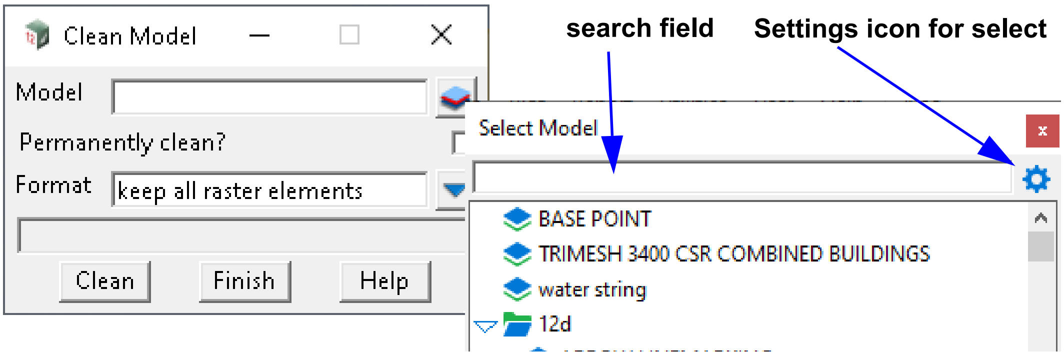
For a model/tin/template/function box, typing characters into the panel field and then typing **<ctrl>+d** brings ups a select list of all the items that start with the typed characters.

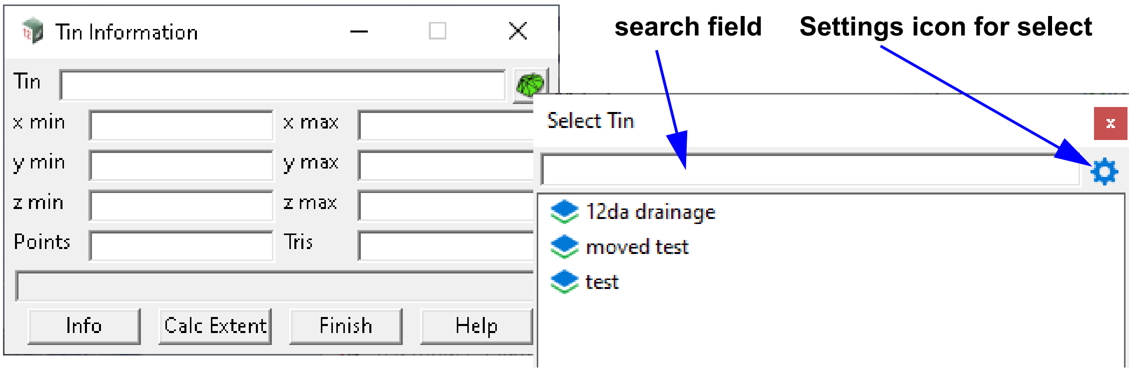
By clicking on the icon at the end of the **Model** box, **Tin** box, **Template** box, **Function** box or **Name** box, a **Select Model/Tin/Template/Function/Name** panel is displayed so that a model/tin/template/function/Name can be selected.

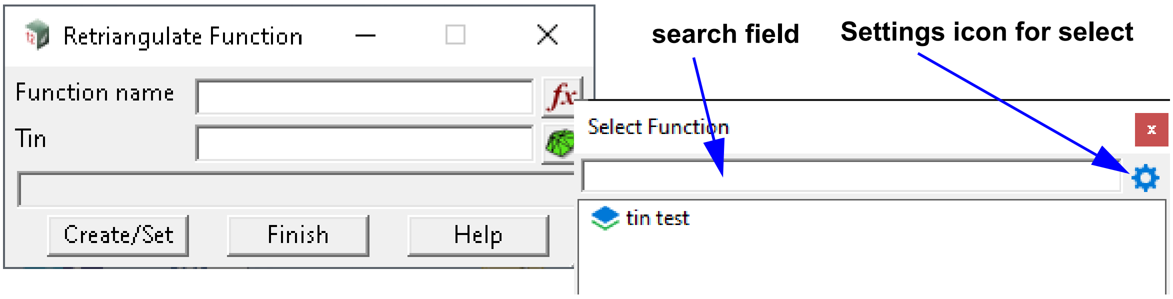
,

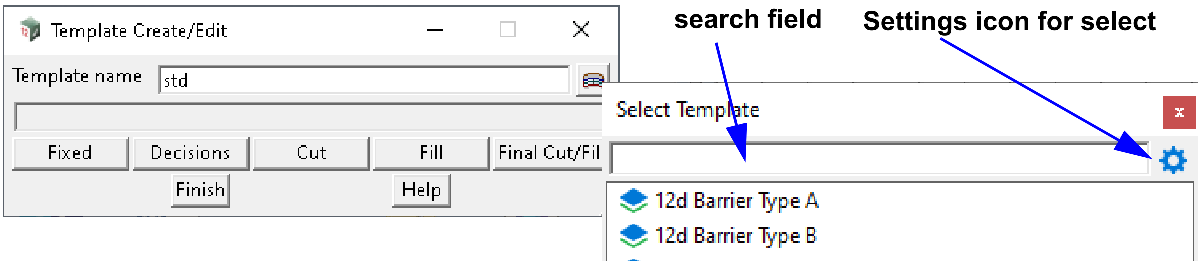


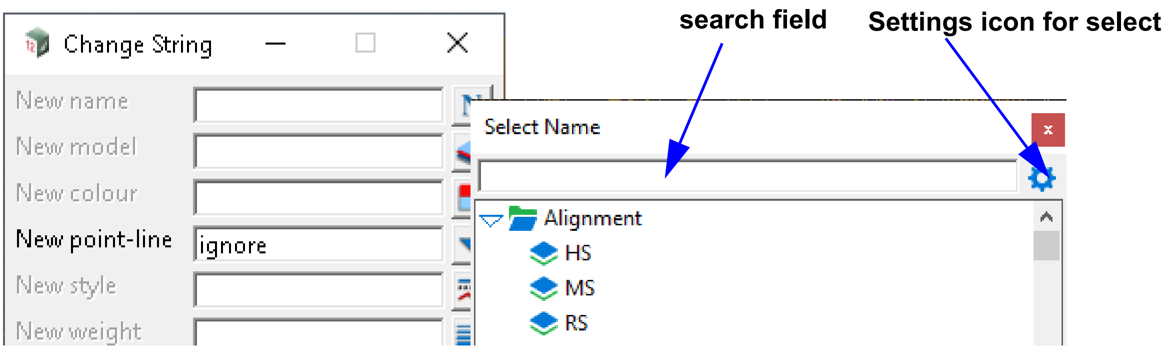
The **Select Model/Tin/Template/Function** panel has a **Search** field and a **settings** icon above the list of models/tins/functions/template, and also menu items at the bottom of the **Select** panel (see 4.6.1.1 Menu Items on the Bottom of Model, Tin, Template and Function Selects.





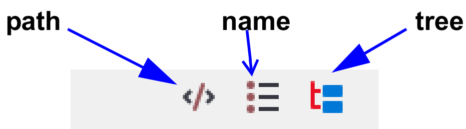


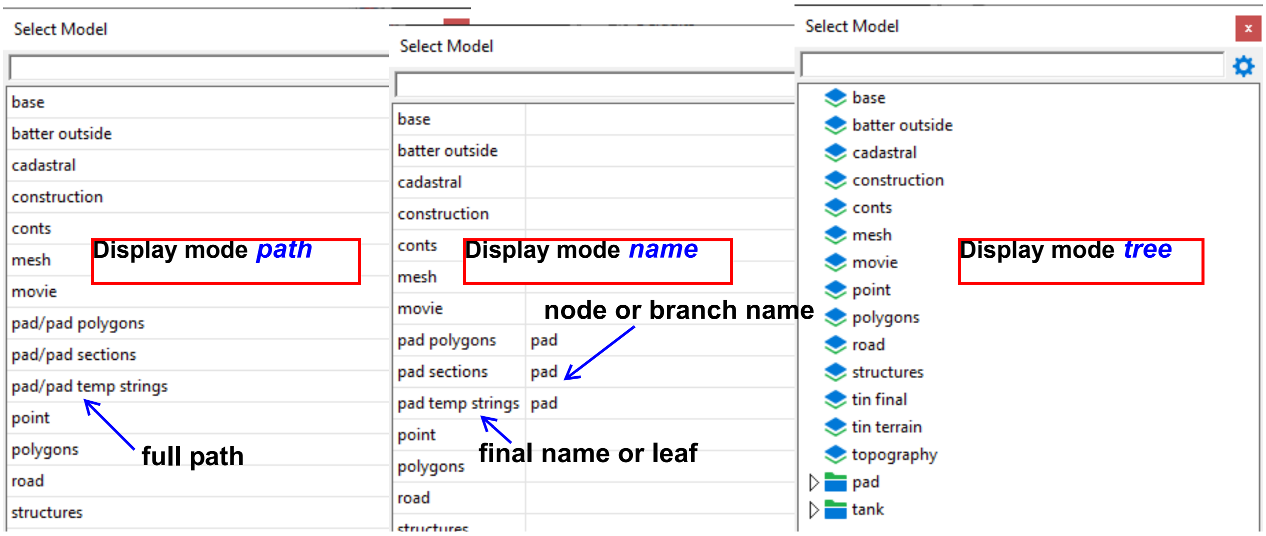




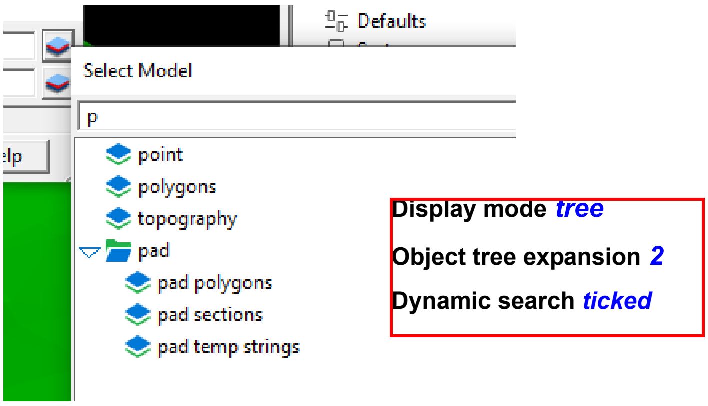
The **Select Settings** icon controls the:

(a) **Display mode:** whether the list is displayed as **full path name**, **final name and node name**, or **tree name**

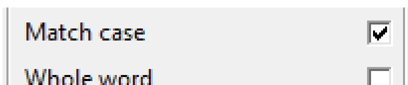




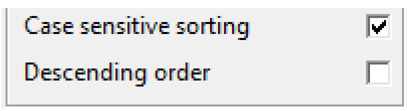
(b) when the choice is a **tree name**, the **level of tree expansion** to use



(c) search setting for dynamic search, match case and whole word

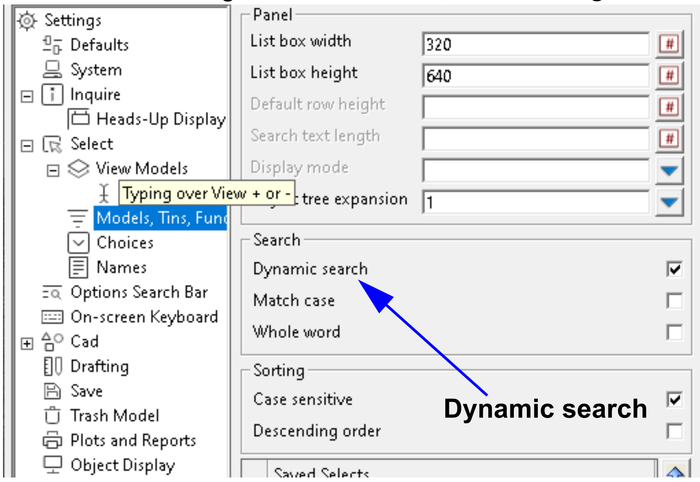


(d) display sorting setting for case sensitive and descending order.



(e) **Dynamic search** is currently only set in **Project Setting >Select >Models, Tins, Functions, Templates**

This also contains extra setting for **List box width, List box height** etc.



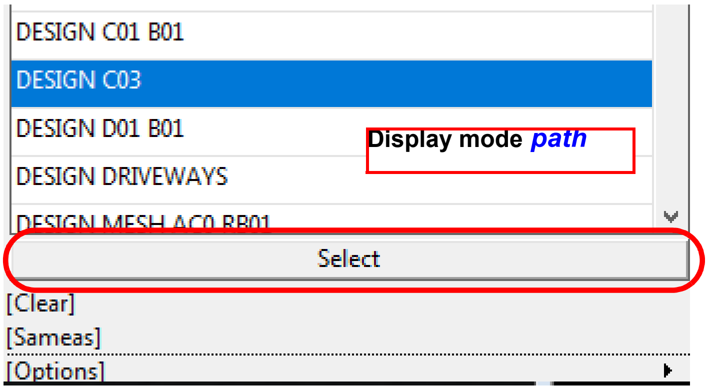
For a detailed description, see[4.6.3 Select Settings](#).

When there are **model/tin/function/template names** displayed in the list, one item is selected from the list by either:

(a) **double clicking** on the item in the list

or by

(b) clicking on an item in the list to highlight it and then clicking on **Select** at the bottom of the list.

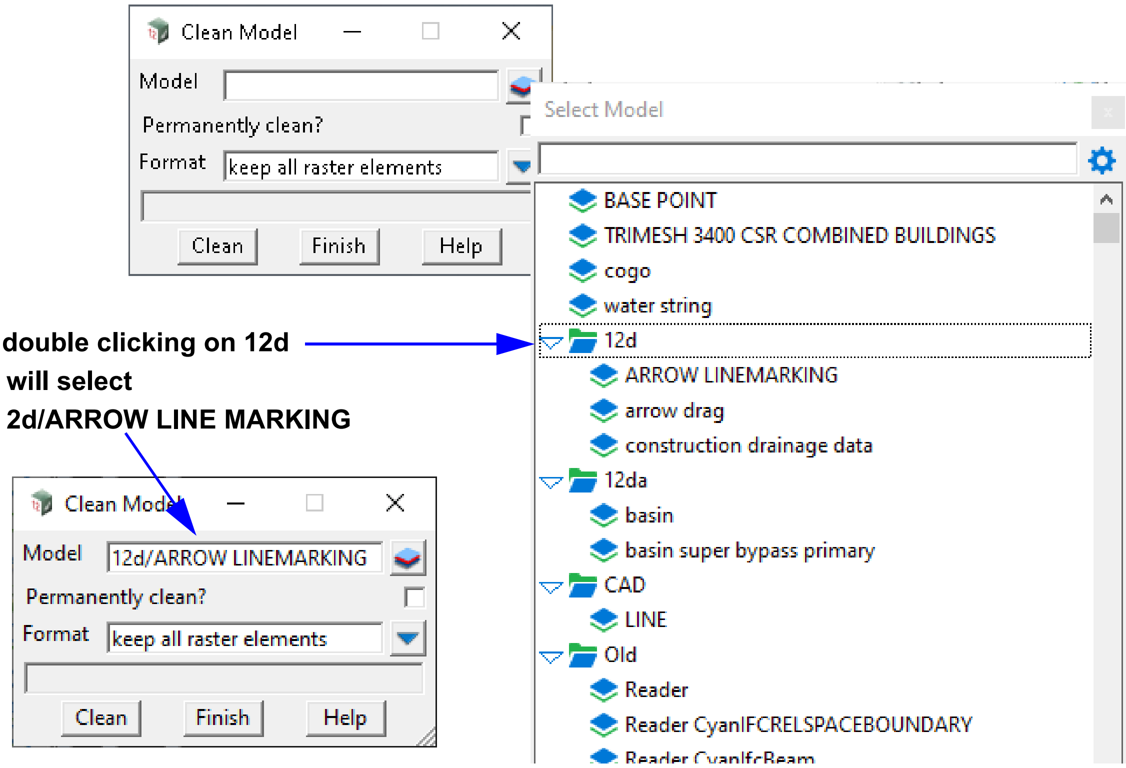


The selected item is then written to the panel field.

Note

If the display setting is [Tree](#) and a node is selected that contains sub levels and that node is clicked on, then the first node under that node that has no subnodes is selected.

For example,



Note

The documented **Search** was introduced in ***12d Model 12***.

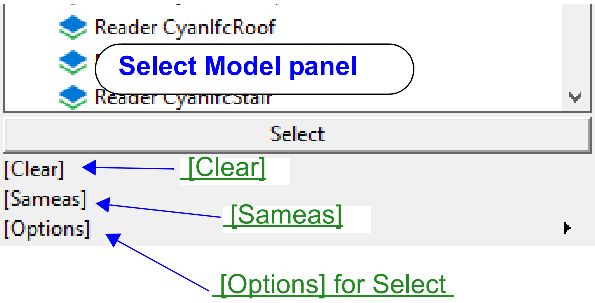
If the old **Search** is wanted, the environment variable ***model_search_4d*** must be set to ***0***

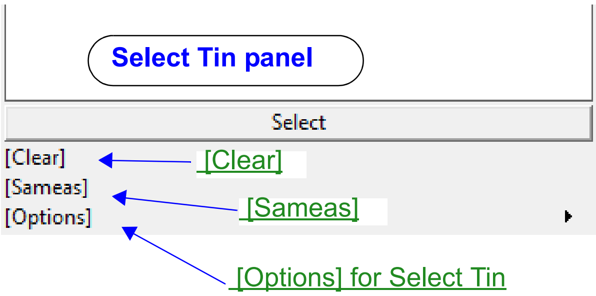
The default for ***model_search_4d*** is ***1*** which uses the new **Search**. The old Search method is **NOT** documented.

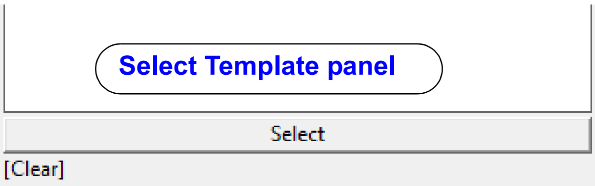
To set this environment variable, see the Variables section in the 6.10.2 Create/Edit env.4d.

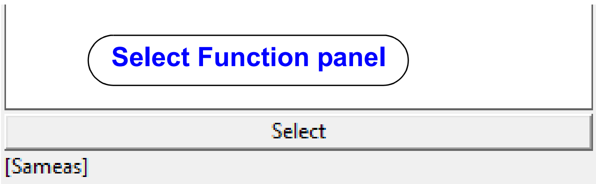
4.6.1.1 Menu Items on the Bottom of Model, Tin, Template and Function Selects

There are extra menu items at the bottom of the **Select Models**, **Select Tin**, **Select Template** and **Select Function** panels.









see [Clear]

see [Sameas]

[Clear]

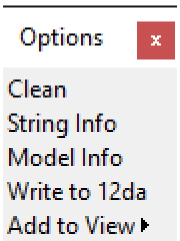
If **[Clear]** is clicked on, any text in the selected Model/Tin/Template/Function box is cleared.

[Sameas]

If **[Sameas]** is clicked on, a select element is started and the name of the select element is added to the Model/Tin/Template/Function box.

[Options] for Select Model

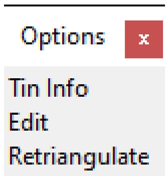
If **[Options]** is selected on the **Select Model** panel,



?? it is not obvious what those options do with respect to the any models selected. The Clean is a worry because it just comes up with "Are you sure you wish to clean this model"

[Options] for Select Tin

If **[Options]** is selected on the **Select Tin** panel,

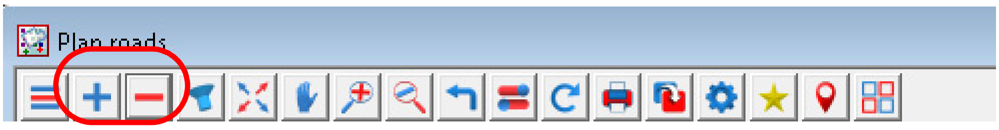


?? it is not obvious what those options do with respect to the any tins selected. The Clean is a worry because it just comes up with "Are you sure you wish to clean this model"

Continue to 4.6.2 View Select, Add (+) and Remove (-) View Buttons or return to 4.6.3 Select Settings.

4.6.2 View Select, Add (+) and Remove (-) View Buttons

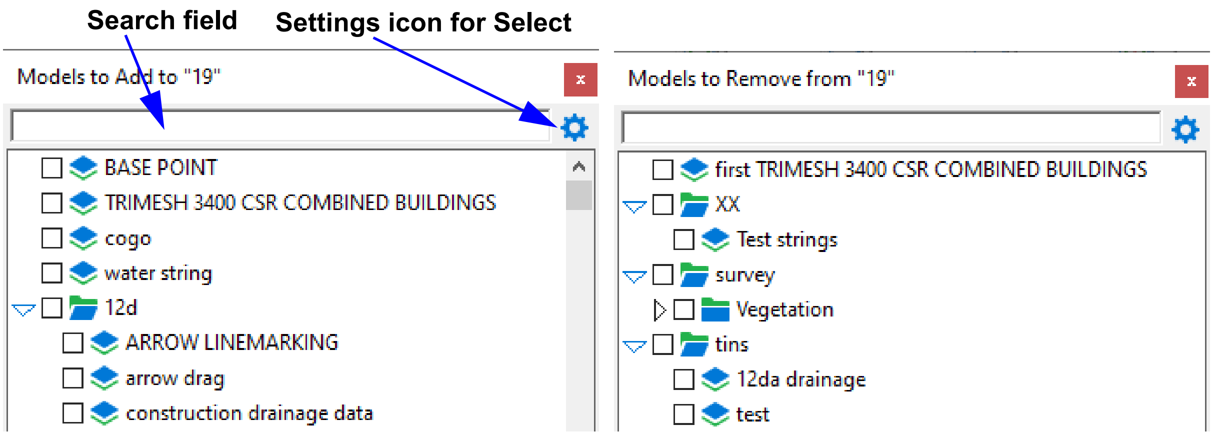
Plan, Section and Perspective views have two special View buttons: **+** for **adding** models to the view and **-** for **removing** models from the view.



The **+** and **-** view buttons can be activated in five ways:

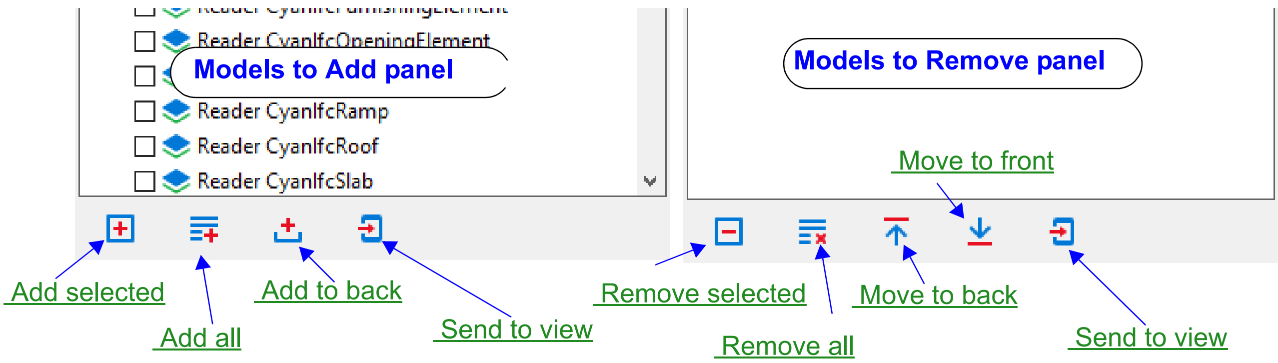
1. **Clicking LB over the + or -**

   Brings up the **Models to Add to** or **Models to Remove from** panels which have **Search** bars



   How the data appears in the list, what the sorting order is and how to select data is controlled by the 4.6.3 Select Settings.

   There are also icons on the bottom of the **Models to Add to** and the **Models to Remove from** panels for adding models/removing models etc. See 4.6.2.1 Icons on Bottom of Models to Add, Models to Remove Panel.



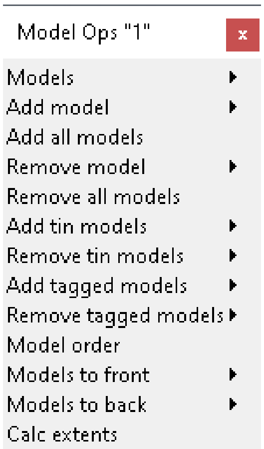
2. **Clicking MB over the + or -**

   Brings up the **Add Models to View by Pick** or **Remove Models from View** by Pick panels where the mouse can be used to select the models to added to the view, or removed from the view

   See 5.4.9 Same As for Views.

3. **Clicking RB over the + or -**

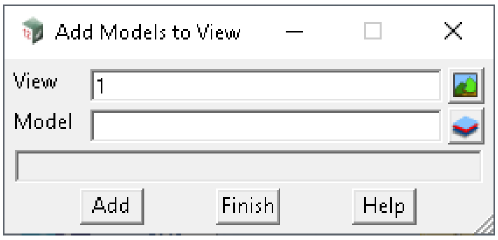
   Brings up the **Models Ops** menu for that view

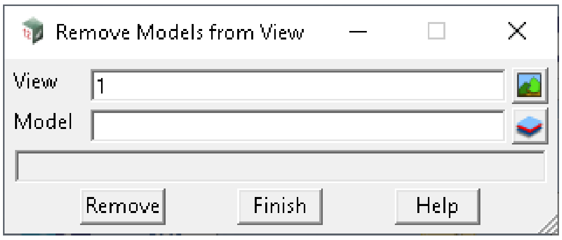


   See 5.4.1 Model Ops.

4. Typing a * over the + or the -

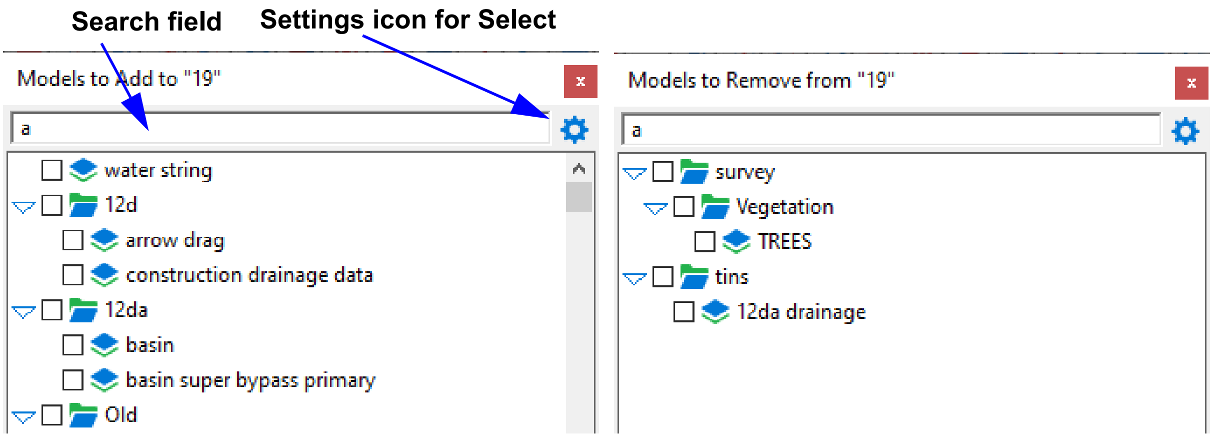
   Brings up the **Add Models to View** or **Remove Models from View** panels where wild cards (*) and wild characters (?) can be used to add models to a view, or remove models from a view.





   See 9.8.2.3 Add Model to View and 9.8.5.3 Remove Model From View.

5. Typing an **alphanumeric character** or over the **+** or the **-** brings up the **Models to Add** or **Models to Remove from View** panels with the **Search** bar already containing the typed character.



Once the **Search** panel is up, more typing after the **a** puts extra characters into the **Search** field and they are immediately used (**Dynamic select**). To change ***Dynamic Select***, see 4.6.3.4 Dynamic Search.

How the data appears in the list, what the sorting order is and how to select data is controlled by 4.6.3 Select Settings.

Note

The documented **Search** was introduced in ***12d Model 12***.

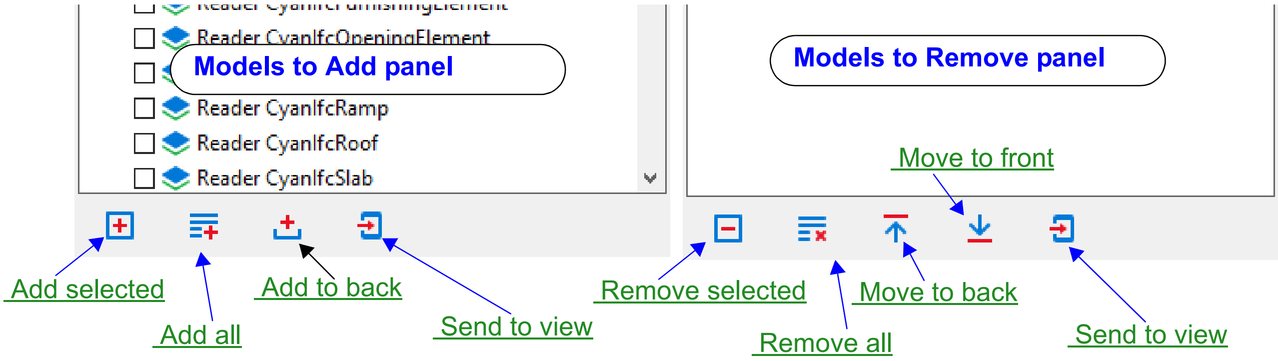
The default for ***model_search_4d*** is ***1*** which uses the new **Search**. The old Search method is **NOT** documented.

To set this environment variable, see the Variables section in the 6.10.2 Create/Edit env.4d.

Continue to 4.6.2.1 Icons on Bottom of Models to Add, Models to Remove Panel or return to 4.6 Select for Model, Tin, Template, Function, Name Boxes & Views.

4.6.2.1 Icons on Bottom of Models to Add, Models to Remove Panel

For a view, the icons at the bottom of the **Models to Add to** and the **Models to Remove from** panels are used to add models to/remove models from the view, add models to the back of the view, send models to another view, and move models to the back or front of the view:



Add selected

If **Add** , is clicked on, the selected (highlighted) models are added to the view.

Multiple selects of models is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Add all

If **Add all** , is clicked on, all the models in the list are added to the view.

Add to back

If **Add to back** , is clicked on, the selected (highlighted) models are added to the back of the view.

Multiple selects of model is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Send to view

If **Send to view** , is clicked on, a list of existing views is popped up and when one is double clicked on, the selected models are added to the selected view.

Multiple selects of models is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Remove selected

If **Remove** , is clicked on, the selected (highlighted) models are removed from the view.

Multiple selects of models is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Remove all

If **Remove all** , is clicked on, all the models in the list are removed from the view.

Move to back

If **Move to back** , is clicked on, the selected (highlighted) models are moved to the back of the view. This is on the **Models to Remove** panel so all the models are already on the view.

Multiple selects of model is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Move to front

If **Move to front** , is clicked on, the selected (highlighted) models are moved to the front of the view. This is on the **Models to Remove** panel so all the models are already on the view.

Multiple selects of model is only possible when the ***Select Setting*** setting is Path , or Name but not Tree .

Continue to 4.6.3 Select Settings or return to 4.6 Select for Model, Tin, Template, Function, Name Boxes & Views.

4.6.3 Select Settings

There are **Select Settings** for

(a) Model, Tin, Template and Function boxes

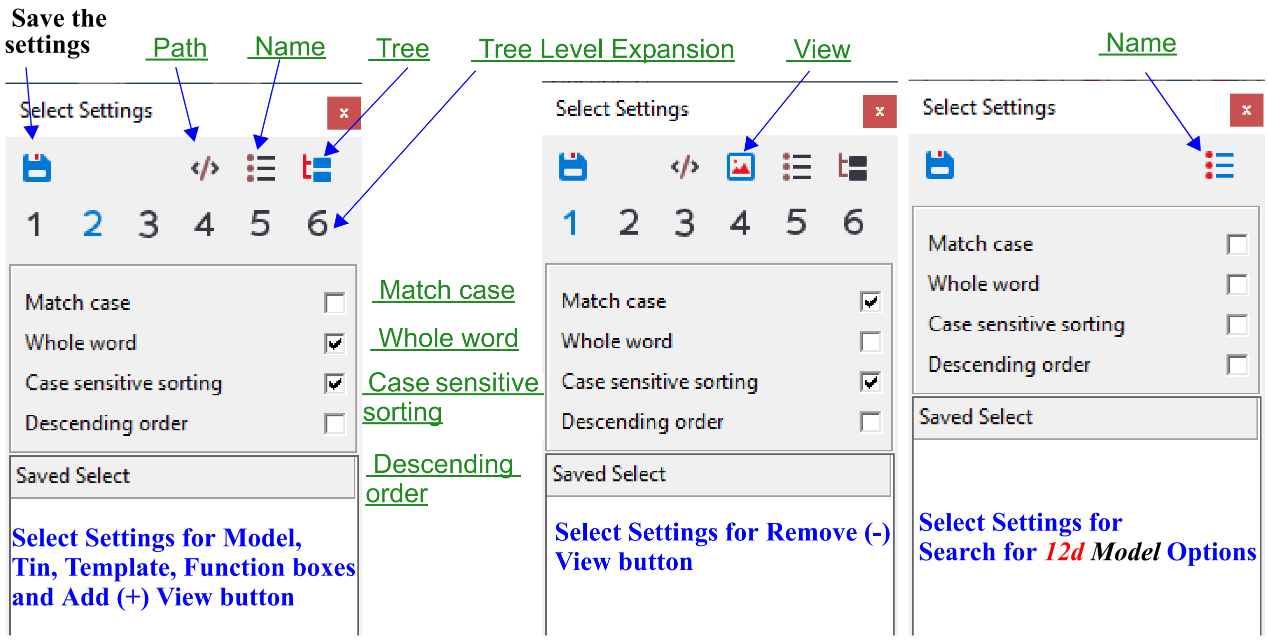
(b) Name box which uses the ***Names.4d*** file

(c) Add (**+**) View button

(d) Remove (**-**) View button

(e) Choice boxes

(f) Search for ***12d Model* Options** panel



The **Select Settings** control:

(a) How the items in the pop-up list are displayed

The icons control how the 2.1 Object Tree names are displayed. See 4.6.3.1 Select Settings - Displaying Path Name.

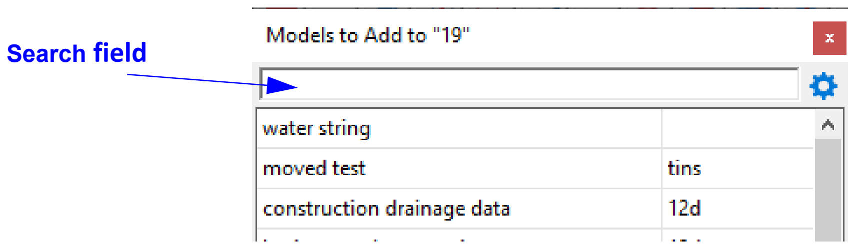
(b) The order that the items are displayed

The tick boxes Case sensitive sorting and Descending order control the order of the items in the list.

For **Remove** (**-**) View button, the View icon displays the models in the order that the models have been added to the view. The models are only displayed as Path.

(c) How **typing** into the **Search** field works

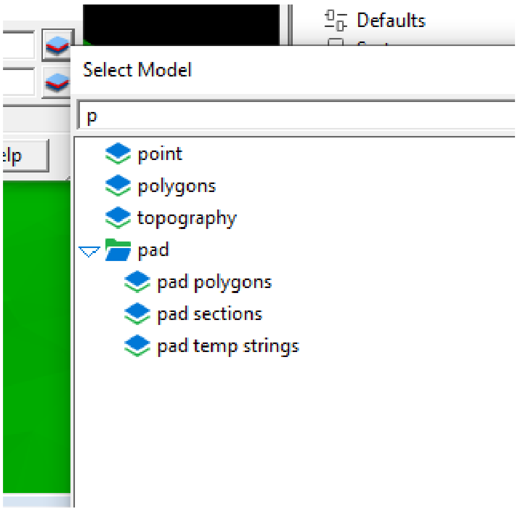
When typing in the **Search** field, Match case and Whole word restrict the items in the list and makes it easier to make selections.



The **Search field** in conjunction with the **Match case**, **Whole word**, **Case sensitive sorting** and **Descending order** adds **increased functionality** for controlling what is in the pop-up for existing Models/Tins/Functions/Templates.

(d) **Typing** into the **Search** field - Dynamic mode

When **Dynamic search** is turned on, the search is done as **each character** is typed into the **Search** field.



By default **Dynamic search** is set to **on** and can not be changed in the **Select Settings** but is changed in the subnodes of 6.8.2 Project =>Settings. See 4.6.3.4 Dynamic Search

For a description of the behaviour of each icon and tick box on the Select Settings panel:

Path, Name, Tree icons and Remove (-) view button, *see* 4.6.3.1 Select Settings - Displaying Path Name

Match Case see 4.6.3.2.1 Select Setting Match Case

Whole Word see 4.6.3.2.2 Select Setting Whole Word

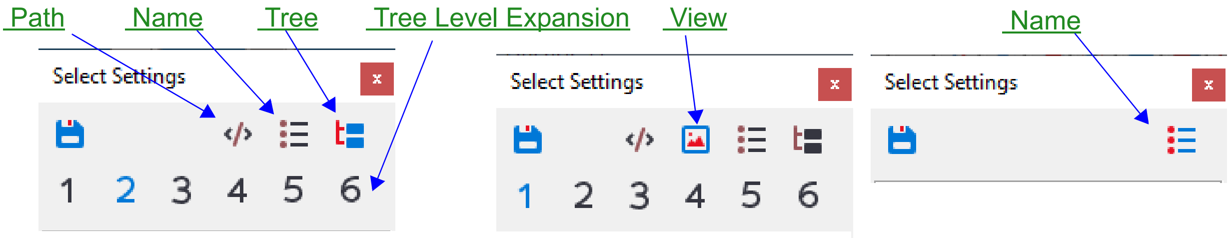
Case sensitive sorting see 4.6.3.3.1 Select Setting Case Sensitive Sorting

Descending Order see 4.6.3.3.1.1 Select Setting Descending Order

Dynamic search see 4.6.3.4 Dynamic Search

Continue to 4.6.3.1 Select Settings - Displaying Path Name or return to 4.6.3 Select Settings.

4.6.3.1 Select Settings - Displaying Path Name



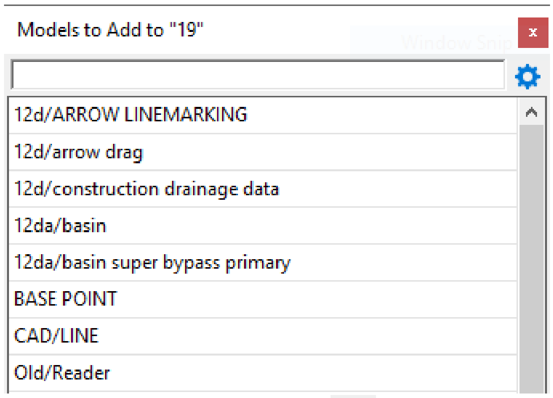
Select settings for Model, Tin, Template, Function boxes and Add (+) View button

Select settings for Remove (-) View button

Select Settings for Search for *12d Model* Options

Path

If **Path**, the full path name of the object tree is displayed as text.

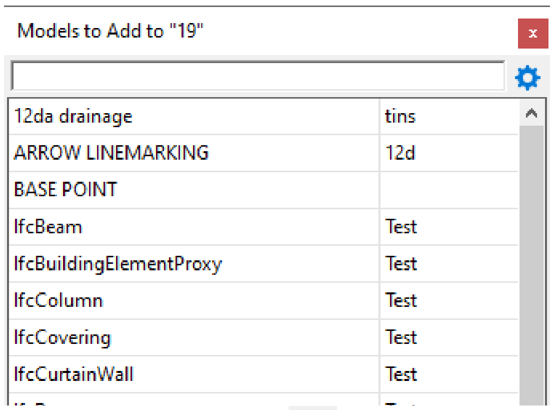


When this is the **NOT** selected, it is displayed as

Name

If **Name**, the **final name in path name** (**leaf**) is shown in the **first column** and the **full name of the node containing the leaf** is shown in the **second** column.

.

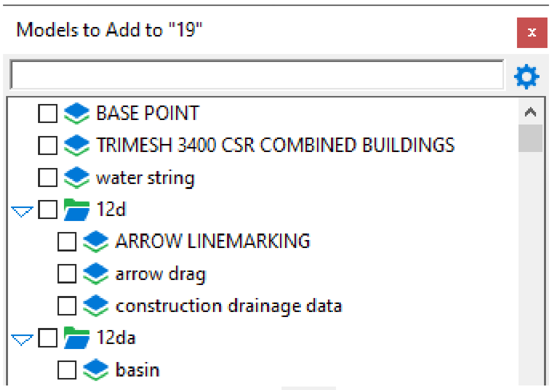


When this is **NOT** selected, it is displayed as

Tree

If **Tree** , the path name is displayed in a tree form.

.



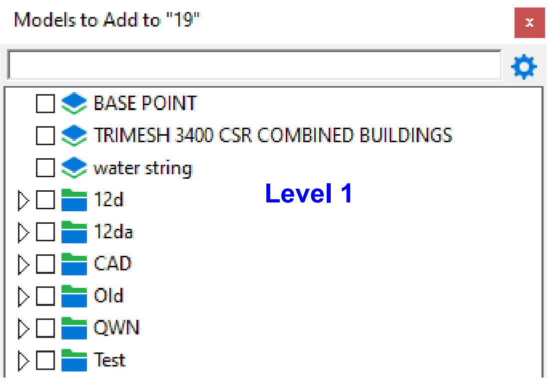
When this is **NOT** selected, it is displayed as .

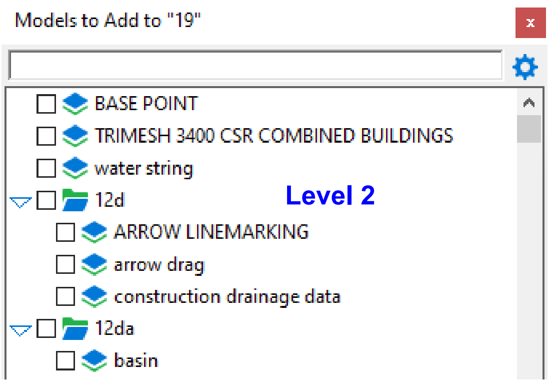
Tree Level Expansion

This is only used when **Tree** has been selected.

The **Tree Level Expansion** 1 2 3 4 5 6 , sets the number of levels that the tree path is expanded to when the list is displayed. It can only take the integer value 1 to 6.

.

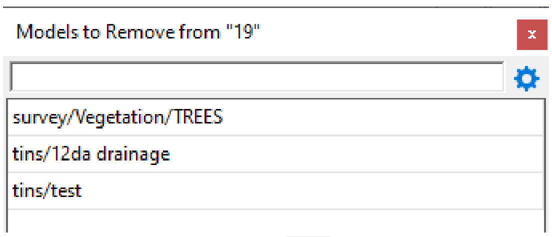




View

This icon is only displayed when the **Select** is for a **Remove (-) View button.**

If **View** , the models are displayed in the order that they were added to the view.



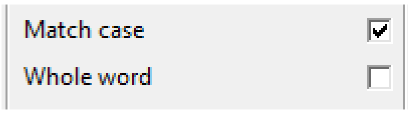
When this is **NOT** selected, it is displayed as .

For **View**, the names are only displayed in **Path** form.

Continue to 4.6.3.2 Select Settings - Match Case and Whole Word and 4.6.3.3 Select Settings -

Case Sensitive Sorting and Descending Order or return to 4.6.3 Select Settings.

4.6.3.2 Select Settings - Match Case and Whole Word



Match case

*If **Match Case** is **ticked**, the search matches on alphabetical case. That is, the search is case **sensitive**.*

*If **Match Case** is **not ticked**, the search does not match on alphabetical case. That is, the search is case **insensitive**.*

For more information and examples, see 4.6.3.2.1 Select Setting Match Case.

Whole word

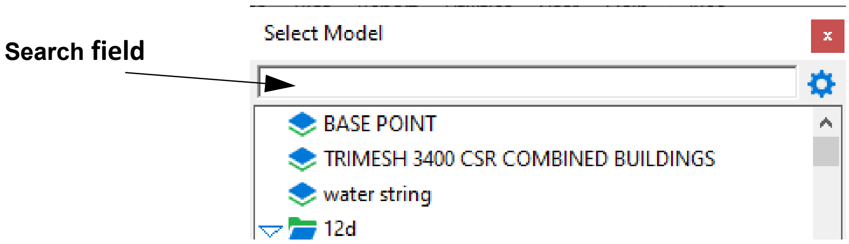
*If **Whole word** is **ticked**, the search is against the entire names. Wild cards (*) and wild characters (?) can be used.*

*If **Whole word** is **not ticked**, the search is for the typed characters **anywhere** in the names.*

For more information and examples, see 4.6.3.2.2 Select Setting Whole Word.

4.6.3.2.1 Select Setting Match Case

The **Match case** tick box, in conjunction with the tick box **Whole word,** controls how typing into the **Search** field works



When the **Match Case** is ticked **on**, the search matches on case. That it, the search is case **sensitive**.

When the **Match Case** is ticked **off**, the search does not match on case. That is, the search is case **insensitive**.

The setting for **Match Case** is the same for Models, Tins, Functions and Templates and any change to the setting is automatically made to the ***Project Settings >Model, Tins, Functions*** setting and so if a save is done for the project, the new **Match Case** setting are be remembered. See 6.8.2.6.2 Select >Models, Tins, Functions Settings.

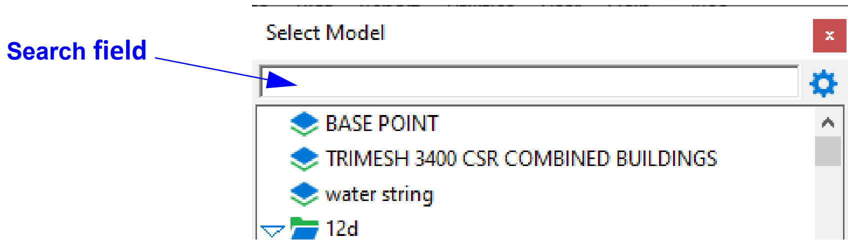
The setting for **Match Case** is the same adding models to a view and removing models from a view and any change to the setting is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new **Match Case** setting are be remembered. See 6.8.2.6.1 Select >View Models Settings.

For examples, see 4.6.3.2.2.1 Whole Word is Off - Anywhere Search and 4.6.3.2.2.2 Whole Word is On - Pattern Search.

Continue to 4.6.3.2.2 Select Setting Whole Word or return to 4.6.3 Select Settings.

4.6.3.2.2 Select Setting Whole Word

The **Whole word** tick box, in conjunction with the tick box ***Match case***, controls how typing into the Search field works



If **Whole word** is ***ticked***, the search is then against the entire name in the list. Wild cards (*) and wild characters (?) can be used. For examples, see 4.6.3.2.2.2 Whole Word is On - Pattern Search.

If **Whole word** is ***not ticked*** the search is then for the typed characters anywhere in the name in the list. For examples, see 4.6.3.2.2.1 Whole Word is Off - Anywhere Search.

Continue to 4.6.3.2.2.1 Whole Word is Off - Anywhere Search or return to 4.6.3 Select Settings.

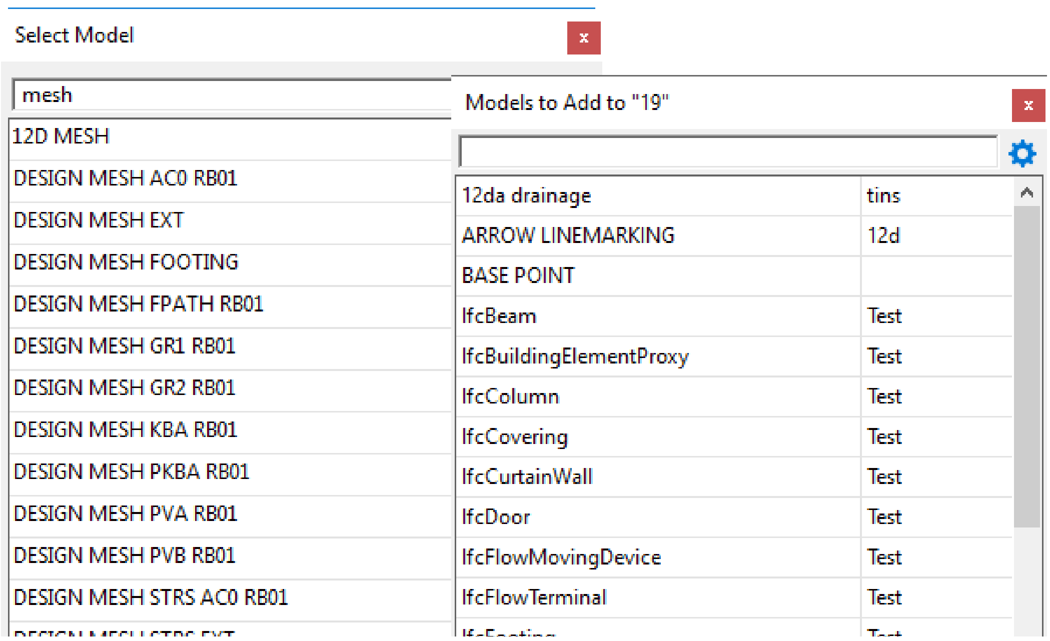
4.6.3.2.2.1 Whole Word is Off - Anywhere Search

When the **Whole word** is ticked **off**, the search looks for the characters **anywhere** in the item names.

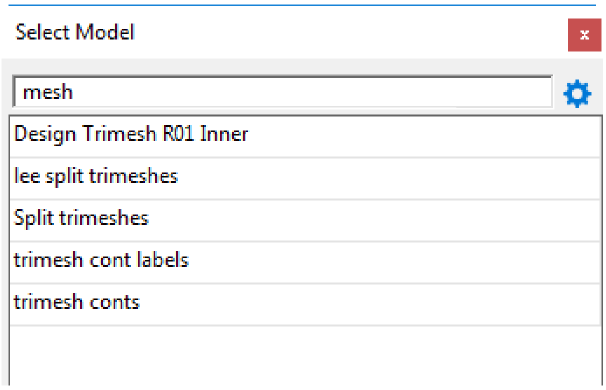
That is, if **Whole word** is **off**, when text is typed into the search field it will display in the list the items that **contain** the typed letters **anywhere** in the item name.

Note: The search will only consider case if the **Match Case** is ticked **on**.

For example, typing in “mesh" with **Match Case off** displays



For example, typing in “mesh" with **Match Case on** displays



Match Case is **on**

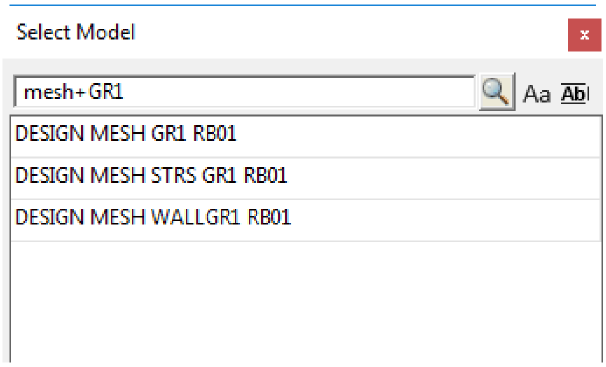
Whole word is **off**

None of the models containing **MESH** are then listed.

Having one of more sets of letters separated by a **plus** sign (**+**) will list only the appropriate items containing each of the sets of letters on each side of the **+**. For example

mesh+GR1

only selects items that contain the letters **mesh AND** the letters **GR** in them.



Match Case is **off**

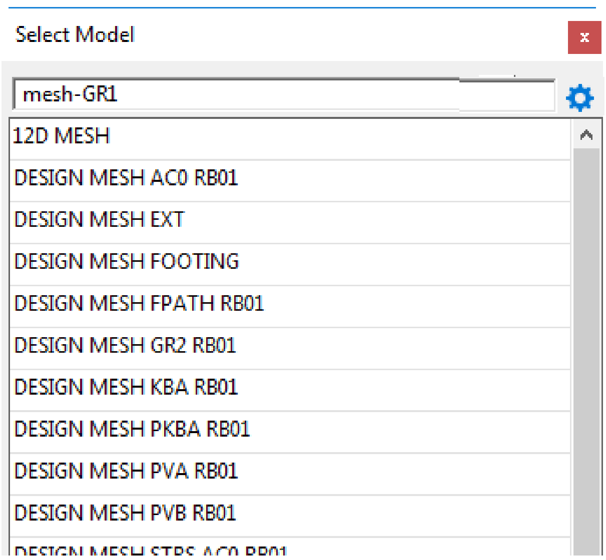
Whole word is **off**

Using a **minus** sign (**-**) means that the following letters will **NOT** appear in the list.

For example

mesh-GR1

only selects items that contain **mesh** but do **not** contain **GR**



Match Case is **off**

Whole word is **off**

The setting for **Whole Word** is the same for Models, Tins, Functions and Templates and any change to the setting is automatically made to the ***Project Settings >Model, Tins, Functions*** setting and so if a save is done for the project, the new **Whole Word** setting are be remembered. See 6.8.2.6.2 Select >Models, Tins, Functions Settings.

The setting for **Whole Word** is the same adding models to a view and removing models from a view and any change to the setting is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new **Whole Word** setting are be remembered. See 6.8.2.6.1 Select >View Models Settings.

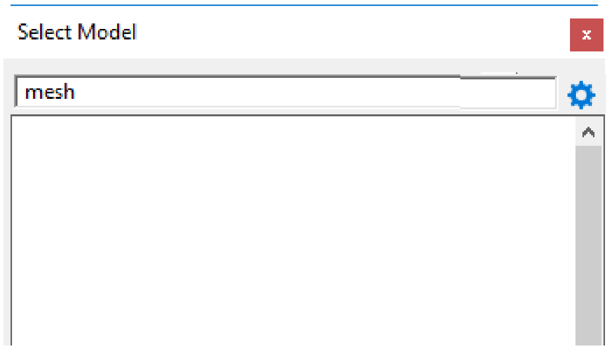
Continue to 4.6.3.2.2.2 Whole Word is On - Pattern Search or return to 4.6.3 Select Settings.

4.6.3.2.2.2 Whole Word is On - Pattern Search

When the **Whole word** is ticked **on** the search is switched to **pattern** mode and the text searched for must exactly match the typed in text. Wild cards (*) and wild characters (?) can be included in the search text.

Note: The search will only consider case if **Case sensitive** is ticked **on**.

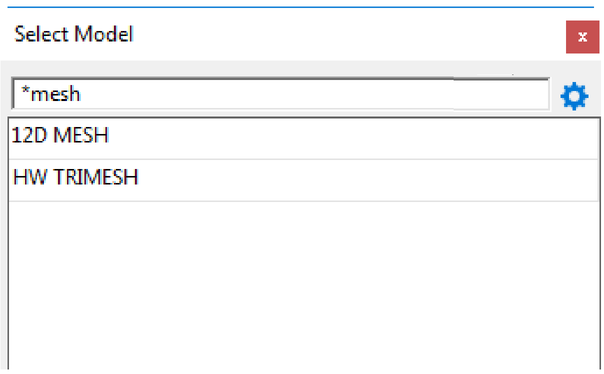
So when **Whole word** is **on**, typing **mesh** does not select any items.



Match Case is **off**

Whole word is **on**

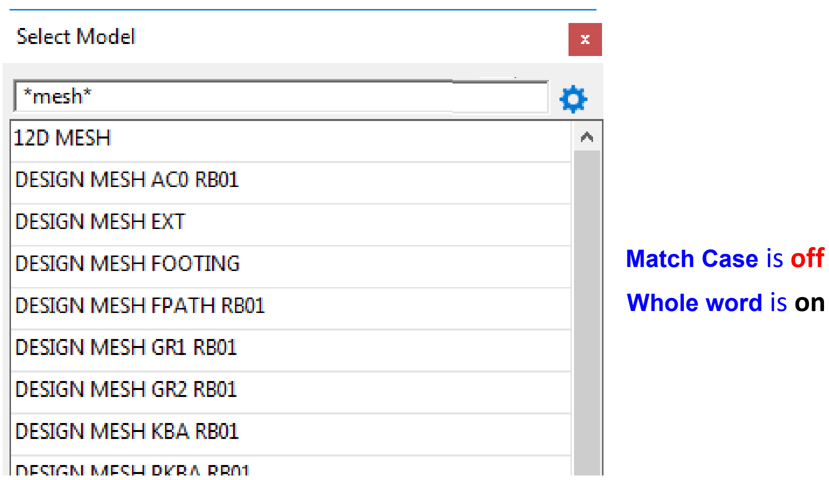
But typing ***mesh** when **Whole word** is **on**, selects all items ending in **mesh**.



Match Case is **off**

Whole word is **on**

Typing ***mesh*** when **Whole word** is **on**, selects all items that include the text **mesh**.



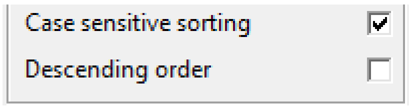
So typing characters into the **Search** field in **Anywhere search** (**Whole word off**) is equivalent to typing * before and after the characters in **Pattern Search** (**Whole word on**).

The setting for **Whole Word** is the same for Models, Tins, Functions and Templates and any change to the setting is automatically made to the ***Project Settings >Model, Tins, Functions*** setting and so if a save is done for the project, the new **Whole Word** setting are be remembered. See 6.8.2.6.2 Select >Models, Tins, Functions Settings.

The setting for **Whole Word** is the same adding models to a view and removing models from a view and any change to the setting is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new **Whole Word** setting are be remembered. See 6.8.2.6.1 Select >View Models Settings.

Continue to 4.6.3.3 Select Settings - Case Sensitive Sorting and Descending Order or return to 4.6.3 Select Settings.

4.6.3.3 Select Settings - Case Sensitive Sorting and Descending Order



Case sensitive sorting

If **Case sensitive sorting** *is* ***ticked****, the display order of the items in the list is case sensitive.*

If **Case sensitive sorting** *is* ***not ticked****, the display order of the items in the list is case sensitive. That is, it is as though all characters are in upper case.*

For more information and examples, see 4.6.3.3.1 Select Setting Case Sensitive Sorting.

Descending order

If **Descending order** *is* ***ticked****, the display order of the items in the list is in descending alphanumeric order according to the ascii sort sequence.*

If **Descending order** *is not* ***ticked****, the display order of the items in the list is in ascending alphanumeric order according to the ascii sort sequence.*

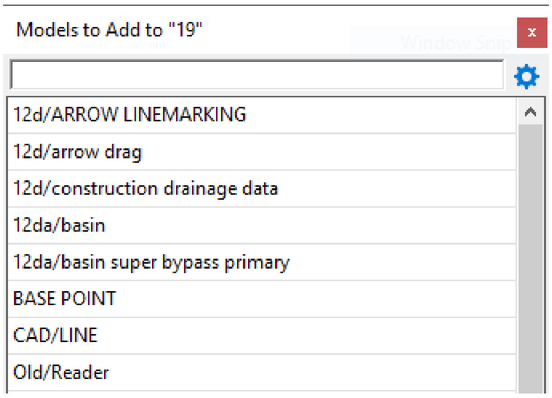
For more information and examples, see 4.6.3.3.1.1 Select Setting Descending Order.

4.6.3.3.1 Select Setting Case Sensitive Sorting

If **Case sensitive sorting** is **ticked**, the display order of the items in the list is case sensitive.

If **Case sensitive sorting** is **not ticked**, the display order of the items in the list is case sensitive.

For Path, the sorting is done on the **path name**



Path

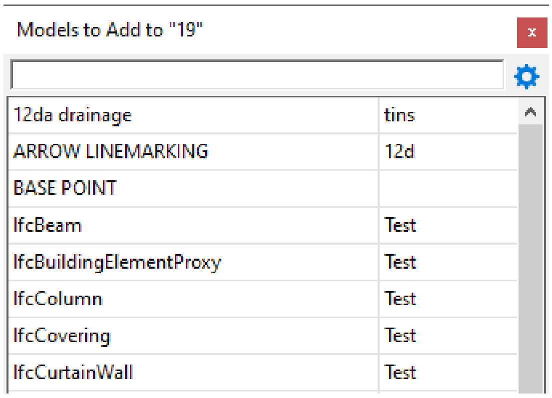
Case sensitive sorting is **on**

Descending order is **off**

.

For Name, the sorting is done on the **first column** (**leaf**).

.



Name

Case sensitive sorting is **on**

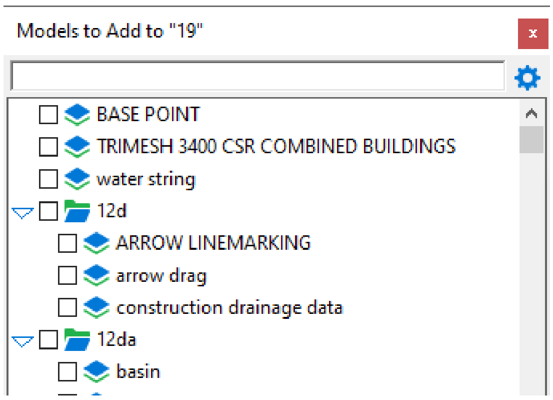
Descending order is **off**

For [Tree](#), the sorting order is:

Not descending order - Ascending:
All the items that have only the one level are displayed first and are sorted in ascending order using the value of ***case sensitivity***. The items with more than one level come next and are sorted using the top level name in ascending order using the value of ***case sensitivity***.

Descending order:
The items with more than one level are displayed first and are sorted first in are sorting using the top level name in descending order using the value of ***case sensitivity***. All the items that have only the one level come next and are sorted in descending order using the value of ***case sensitivity***.

.



Tree

Case sensitive sorting is **on**

Descending order is **off**

Whether the sorting in the list is sorted case sensitive or not, is controlled by ***Project Settings***. See 6.8.2.6.1 Select >View Models Settings.

The choice for ***Case sensitive sorting*** is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new setting are remembered. See 6.8.2.6.1 Select >View Models Settings.

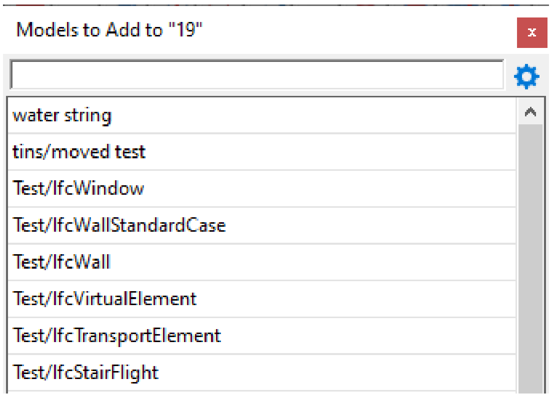
Continue to 4.6.3.3.1.1 Select Setting Descending Order or return to 4.6.3 Select Settings.

4.6.3.3.1.1 Select Setting Descending Order

If **Descending order** is **ticked**, the display order of the items in the list is in descending alphanumeric order according to the ascii sort sequence.

If **Descending order** is **not ticked**, the display order of the items in the list is in ascending alphanumeric order according to the ascii sort sequence.

For Path, the sorting is done on the **path name**

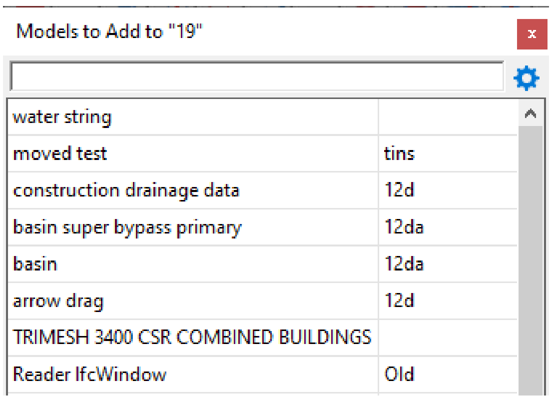


Path

Case sensitive sorting is **on**

Descending order is **on**

For Name, the sorting is done on the **first column**.(**leaf**)



Name

Case sensitive sorting is **on**

Descending order is **on**

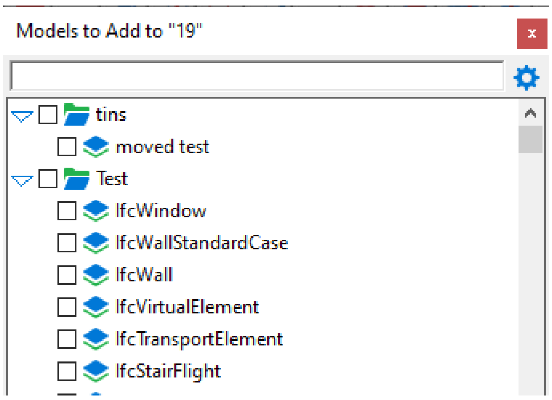
.

For Tree, the sorting order is:

Not descending order - Ascending:
All the items that have only the one level are displayed first and are sorted in ascending order using the value of ***case sensitivity***. The items with more than one level come next and are sorted using the top level name in ascending order using the value of ***case sensitivity***.

Descending order:
The items with more than one level are displayed first and are sorted first in are sorting using the top level name in descending order using the value of ***case sensitivity***. All the items that have only the one level come next and are sorted in descending order using the value of ***case sensitivity***.

.



Tree

Case sensitive sorting is **on**

Descending order is **on**

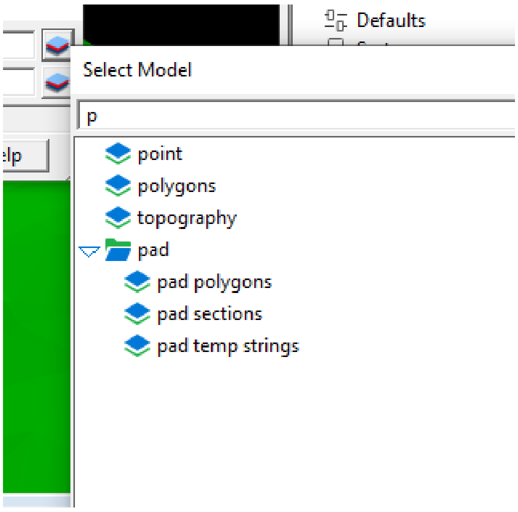
Whether the list is sorted in ascending or descending order is controlled by **Project Settings**. See 6.8.2.6.1 Select >View Models Settings.

(e) clicking on the **View Order** icon means that the item list is in the order that the models were added to the view.

The choice of **Name Order** or **View Order** is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new setting are be remembered. See 6.8.2.6.1 Select >View Models Settings.

4.6.3.4 Dynamic Search

When **Dynamic search** is turned on, the search is done as each character is typed into the **Search** field.



Dynamic search is by default set to **on** and can not be changed in the **Select Settings** but can only be changed in the subnodes of 6.8.2 Project =>Settings.

That is, in the subnodes:

(a) View Models

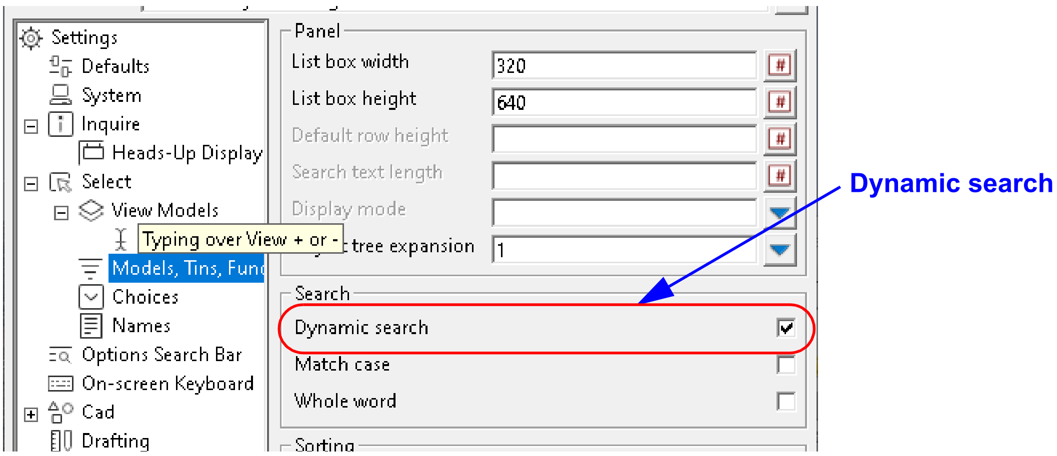
(b) View Models >Typing over View + or -,

(c) Models, Tins, Functions, Templates

(d) Choices

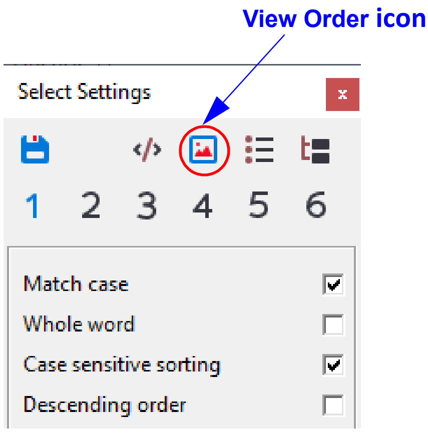
and

(e) Names.

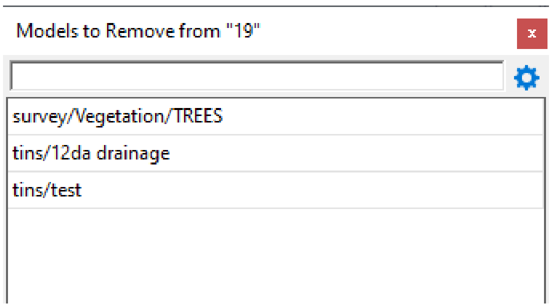


See 6.8.2 Project =>Settings.

4.6.3.5 View Order Icon on for Removing (-) on View Buttons



Clicking on the **View Order** icon means that the model list is displayed in the order that the models were added to the view.



The choice of **View Order** is automatically made to the ***Project Settings >View Models*** setting and so if a save is done for the project, the new setting are remembered. See 6.8.2.6.1 Select >View Models Settings.

Continue to 4.6.3.6 Search Field Syntax for Selects or return to 4.6.3 Select Settings.

4.6.3.6 Search Field Syntax for Selects

The following documentation applies to the **Search field** for the **Select** on:

(a) **+** and **-** buttons on Views

(b) Model boxes

(c) Tin boxes

(d) Function boxes

(e) Template boxes

(f) Choice boxes

The search for the **Options Search Bar** is different and is discussed separately in 4.5.1 Options Search Bar Syntax).

To search for special text among a list of text items, the following rules apply:

When you type alpha numeric keywords into the search box, the words can be separated by the special characters **space** ' ', **comma** ',', **plus** '+' or **minus** '-' and ***12d Model*** will interpret them to perform the following **logic operations**:

AND use **space** ' ' **or plus** '+'

For example:

X Y will search for text that contain **BOTH X and Y**.

X+Y will also search for text that contain **BOTH X and Y**.

That is, the search will return only results that have both X and Y in them.

OR use **comma** ','

For example:

X,Y will search for text that contain **EITHER X or Y** or **BOTH X and Y.**

That is, the search will return results that have X or Y, or both X and Y in them.

NOT use **minus** '-'

For example:

-X will exclude text that has **X in them**

That is, the search will return results that don't contain X.

The syntax is evaluated from left to right.

That is, you can have things like:

X Y,Z-A   or   X+Y,Z-A

which means the search will find text with

(X and Y) or Z, but none of them containing A

Continue to 4.6.3.7 Saving and Reusing Searches with Select Settings or return to 4.6.3 Select Settings.

4.6.3.7 Saving and Reusing Searches with Select Settings

When text is typed into a **Search** field, the typed text can be saved as a **Saved Select** and reused for future selects.

There are distinct sets of **Saved Selects** for the:

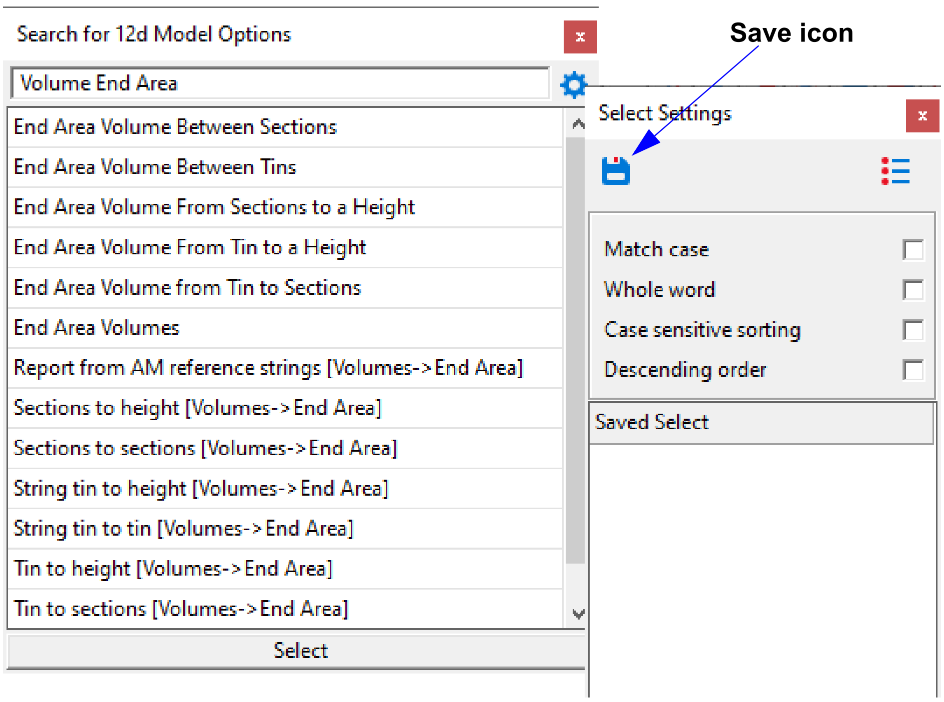
(a) panels **Models to Add to View** and Models to **Remove from View** that are brought up when **LB** is pressed over the **+** or **-** icon on a View

(b) panels **Models to Add to View** and **Models to Remove from View** that are brought up when a character is typed over the **+** or **-** icon on a View

(c) **Select Model**, **Select Tin**, **Select Template** and **Select Function** panels that come up when you click **LB** on the icon on the right hand side of a Model, Tin, Template, or Function box

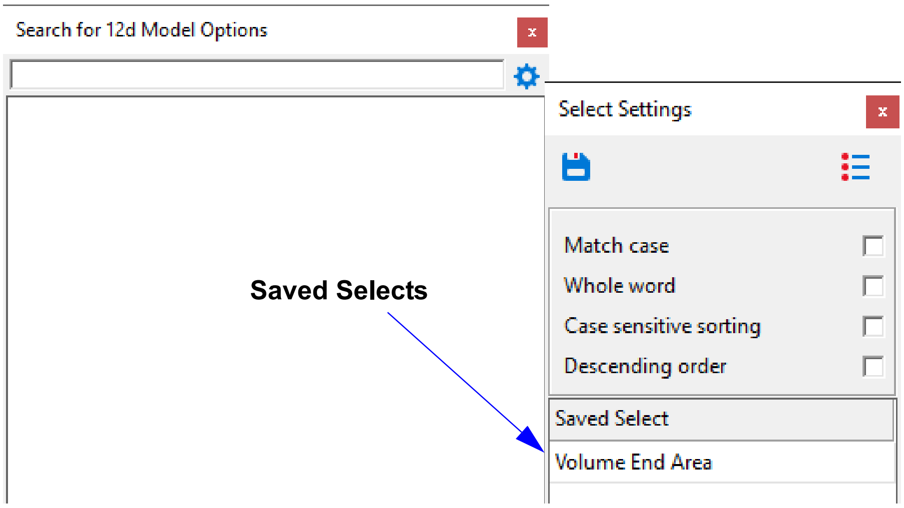
(d) **Search for 12d Model Options** panel when you start typing into the **Search bar**.

To create a **Saved Select,** after the text is typed in the **Search** field of any of the above panels, click on the **Select Setting** icon to bring up the **Select Settings** panel and then click on the ***Save*** icon.

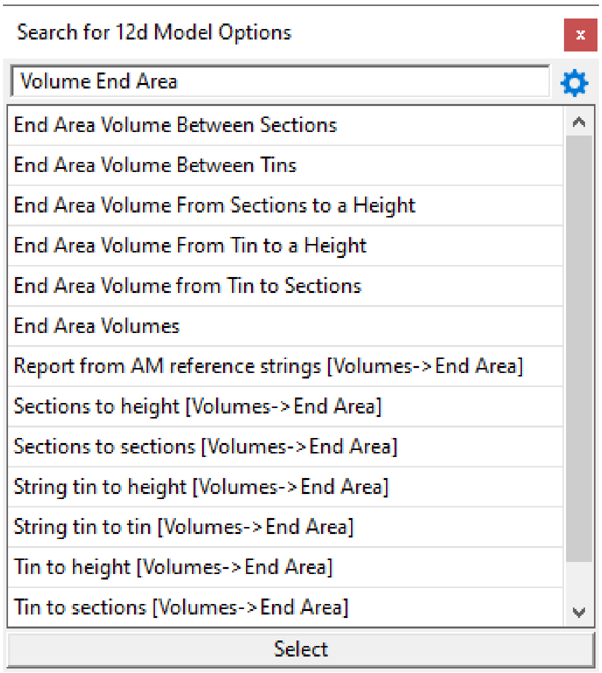


The text will be saved in **Project Settings** when a Project **Save** is one.

In future, for any **Searches** of the same type, clicking on the **Select Setting** icon will display the list of saved **Search** texts in the **Save Select** grid.



Clicking on one of the Saved Selects will pipe the text into the Search field of the panel and apply it.



Notes:

1. The **Search Selects** are only saved for the Project when a ***Project =>Save*** is done.
2. The ***Saved Option Searches*** can also be displayed, created and modified in the **Saved Selects** grid in the **Project Settings** nodes 6.8.2.6.1 Select >View Models Settings, 6.8.2.6.1.1 Select >View Models >Typing over View + or - Settings, 6.8.2.6.2 Select >Models, Tins, Functions Settings, 6.8.2.6.3 Select >Choices and 6.8.2.7 Search Bar Settings.

Continue to 4.7 Chainage Equalities or return to 4 Tools and Concepts.

4.7 Chainage Equalities

In some Jurisdictions, **Chainage Equalities** are called **Station Equations**, or **Broken Chainages**.

See

4.7.1 Natural/Raw Chainage
4.7.2 Chainage Equalities
4.7.3 Internal Equality
4.7.4 K-Post
4.7.5 Zones

4.7.1 Natural/Raw Chainage

When designing and using an alignment, the horizontal distance (plan or 2D distance) along the alignment is regularly used to define and position objects in 2D that are on the alignment, or near the alignment.

For an alignment, the **natural chainage (raw)** is defined to be the horizontal distance along the alignment as measured from the start of the alignment **plus** a given start chainage value for the alignment.

Natural/Raw chainage of a place on the alignment = **Start chainage** + **Horizontal distance from the start of the alignment to the place**

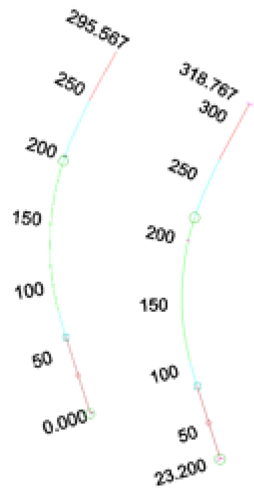
In Example 1, the alignment on the left has a start chainage of **0.000** and an end chainage of **295.567**.

Labelling of the chainages on the left occur in intervals of 50.

The alignment on the right has a start chainage of **23.200** and an end chainage of **316.767**.

Labelling of the chainages on the right also occur in intervals of 50.

Example 1



Continue to 4.7.2 Chainage Equalities or return to 4.7 Chainage Equalities

4.7.2 Chainage Equalities

One issue with natural chainages is that whenever the horizontal section of an alignment is modified, the natural chainages of positions on the alignment may be affected.

This can be a problem in some industries, especially railways, were the places of objects along the railway alignment is often only recorded as a chainage value and a perpendicular offset at that chainage. In this case, having the chainages change would invalidate all those records.

To overcome this problem, the concept of **Chainage Equalities** evolved to allow some of the original chainages to be maintained.

So **chainage equalities**, also known as **chainage equations** or **station equations**, are used so that even when the horizontal geometry, and hence raw chainages, change for an alignment, labels can still be produced that reflect the original, or recorded, chainages.

In ***12d Model***, the **super alignment** supports chainage equalities.

A ***chainage equality*** is a place on the super alignment where the **chainage value is reassigned** and given a **new chainage value** at that place. This new chainage will normally be different to the natural/raw chainage.

The new chainage (**equality chainage**) for a position on the alignment **after** a chainage equality is the new chainage value at the preceding chainage equality **plus** the horizontal distance of the position from the preceding chainage equality.

That is:

Chainage of a position after a chainage equality (equality chainage) = **New chainage at the chainage equality** + **Horizontal distance from the chainage equality**

So when **chainage equalities** are involved, the equality chainage of a place on the super alignment depends on the chainage equalities, especially the last one, that proceeds it.

Equality chainage of a position after a chainage equality = **New chainage at the chainage equality** + **Horizontal distance from the chainage equality**

So for a position on an alignment, there is its **natural/raw chainage** and its **equality chainage**.

In ***12d Model,*** the super alignment supports two types of chainage equalities: 4.7.3 Internal Equality and 4.7.4 K-Post.

What the **equality chainage** is after a **chainage equality** depends on whether the chainage equality is an 4.7.3 Internal Equality or a 4.7.4 K-Post.

Continue to 4.7.3 Internal Equality or return to 4.7 Chainage Equalities

4.7.3 Internal Equality

An **internal equality** is a **chainage equality** where a **Before value** and an **After value** is provided.

The **value** in the **Before value** is the equality chainage where the chainage equality occurs. That is, the **Before value** takes into account the previous chainage equalities.

The **value** in **After value** is the new chainage that the place where chainage equality occurs, takes.

All subsequent chainages beyond the **internal equality** point are adjusted to be **relative** to the **After value**.

That is:

Chainage of a place after an internal equality = **"After" chainage at the internal equality** + **Horizontal distance from the internal equality**

An **Internal equality** is written as:

Before value = After value

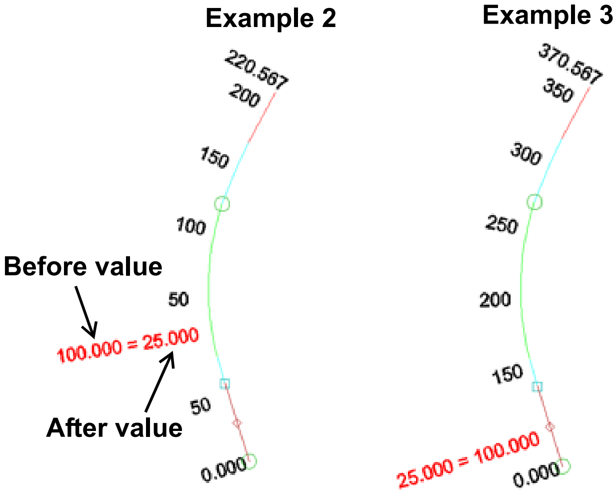
where the **value** in **Before value** is the **equality chainage of where the chainage equality occurs**. That is, the **Before value takes** into account the previous chainage equalities.

In Example 2, the **Before value** is **100** and the **After value** is **25**.

Therefore, chainage 50 is repeated twice - once before the Internal equality and once after the internal equality.

In Example 3, the **Before value** is **25** and the **After value** is **100**.

Hence chainage 50 does not exist at all.



Continue to 4.7.4 K-Post or return to 4.7 Chainage Equalities

4.7.4 K-Post

K-post stands for **Kilometre post.**

In ***12d Model***, a **K-post** is a place on a super alignment where **the chainage (and Zone number) is reset to zero** and all subsequent chainage values until the **next K-post** include the **unique Name** of the **K-post** as **text before the chainage value**.

This is:

Chainage of a place after a K-post = **K-Post name followed by Horizontal distance from the K-post equality**

A **K-post** is written as:

Before value = K-Post name

where **value** in **Before value** is the **equality chainage where the K-post occurs**. That is, **Before value** takes into account the previous chainage equalities.

In ***12d Model***, the position of a **K-post** can be defined in three ways - 4.7.4.1 K-post coord, 4.7.4.2 K-post chainage and 4.7.4.3 K-post relative

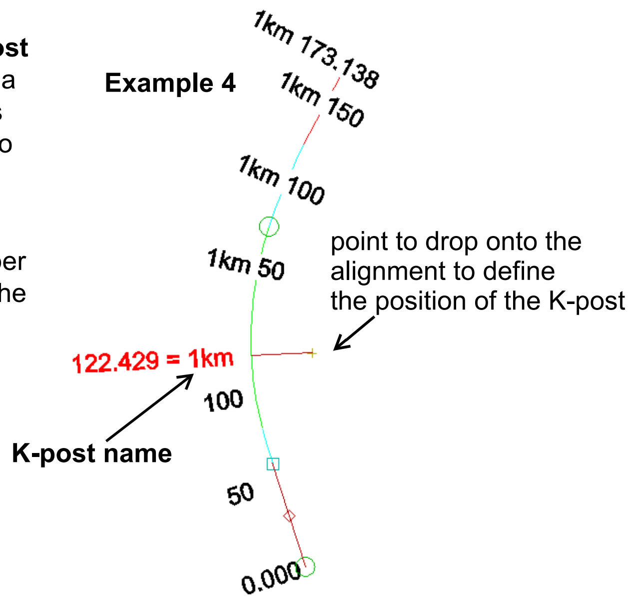
Note: If the preceding chainage equality to an **internal equality** is a 4.7.4 K-Post, the **Before value** is the horizontal distance from that **K-post**.

Continue to 4.7.4.1 K-post coord or return to 4.7 Chainage Equalities

4.7.4.1 K-post coord

For **K-post coord**, the position of the **K-post** is calculated by giving the **coordinates** of a point near the alignment and the **K-post** is where that point drops perpendicularly onto the alignment.

In Example 4, the point drops onto the super alignment at equality chainage **122.429**. The **K-post name** (used as pretext) is **1km**.

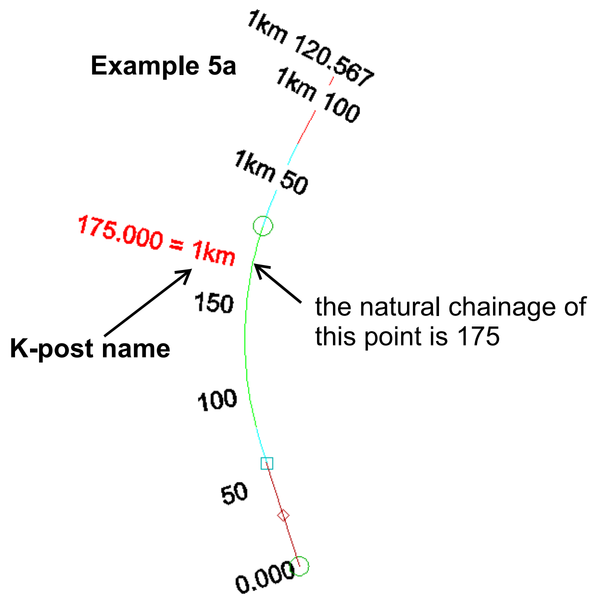


Continue to 4.7.4.2 K-post chainage or return to 4.7 Chainage Equalities

4.7.4.2 K-post chainage

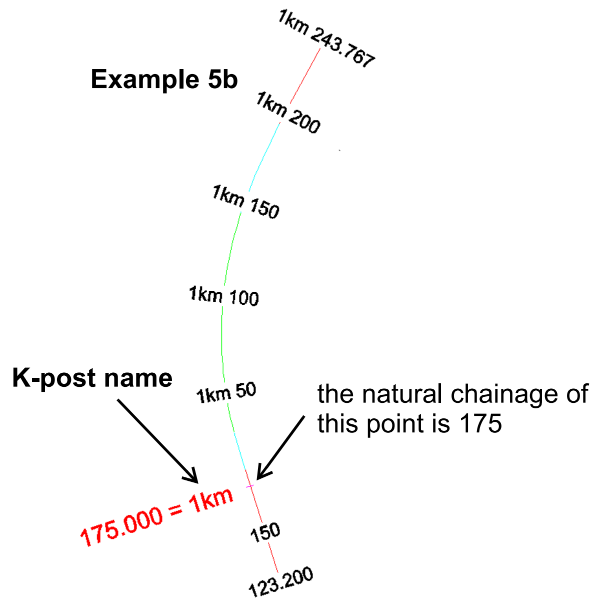
For **K-post chainage**, the position of the **K-post** by giving its 4.7.1 Natural/Raw Chainage.

In Example 5a the position of the **K-post chainage** is at natural chainage **175** and the **K-post name** is **1km**.



In Example 5b the position of the **K-post chainage** is at chainage **175** and the **K-post name** is **1km**.

Note that because the start chainage is not zero, the position of natural chainage 175 changes from where it was in Example 5a.



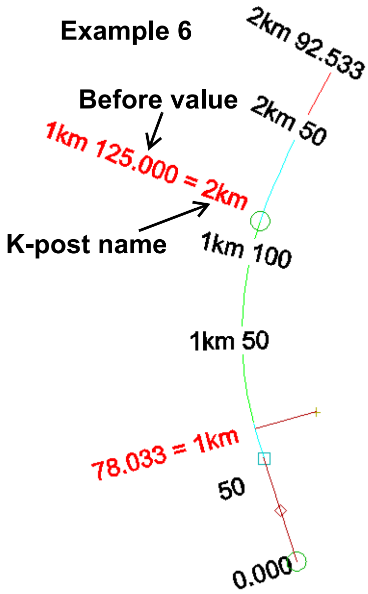
4.7.4.3 K-post relative

For **K-post relative**, a **distance** is given and a **K-post** is created at that **horizontal distance from the previous chainage equality** in the list in the super alignment editor.

If there is no previous chainage equality, the distance of the **K-post** is calculated from the start chainage:

In Example 6 the **K-post relative** has a **Before value** of **125** which represents a horizontal distance from the previous chainage equality which is a **K-post** at raw chainage 78.033 and with a K-post name of **1Km.**

The **K-post name** for the new K-post is **2km**.

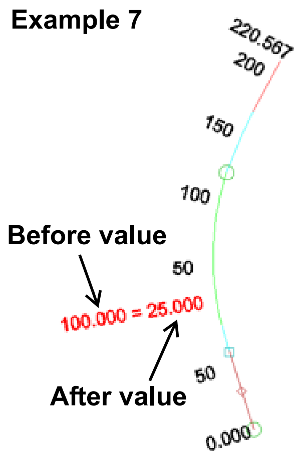


Continue to 4.7.5 Zones or return to 4.7 Chainage Equalities

4.7.5 Zones

When **Chainage equalities,** either **Internal Equalities** and/or **K-posts**, are allowed, a chainage value can be repeated multiple times.

For example in Example 7, chainage **50** refers to two places.



To distinguish between the duplicated chainages, the concept of **Zones** is used.

A **Zone** is the section of the alignment from **a chainage equality until the next chainage equality**.

The first **Zone 0** (or zoneless) by default occurs from the start chainage to the following chainage equality.

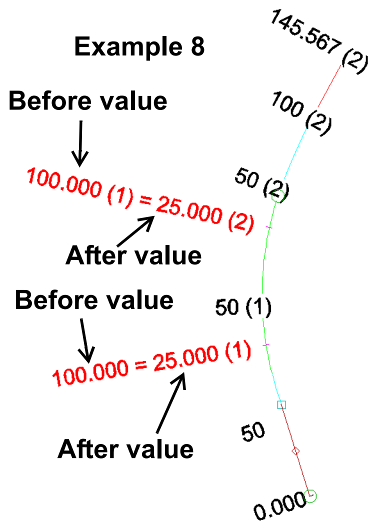
The following **Zones** are labelled as 1, 2, 3, etc until a **K-post** occurs and then the **Zone numbering is reset to Zone 0** (or zoneless) and the **chainage is reset to zero**.

If there are chainage equalities prior to the start chainage then Zone 0 will begin at the first chainage equality and not the start chainage.

For zone numbers other than Zone 0, the zone number is written in round brackets after the chainage value.

In Example 8, there are three chainages equal to 50 but each is in a different Zone.

They are **50**, **50 (1)** and **50 (2)**.



In Example 9, there are two chainage equalities for the super alignment.

The first chainage equality is a **K-post Chainage** with a **Before value** of **125** and a **K-Post name** of **1 km**.

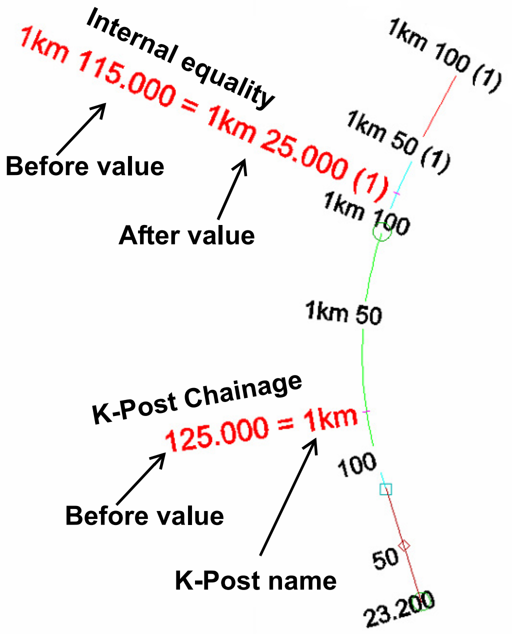
Subsequent chainages are displayed with a **horizontal distance relative** to the **K-post** and the prepended **K-post name**.

For example, **1km 50**

The second chainage equality is an **Internal Equality** with a **Before value** of **1 km 115** and an **After value** of **1 km 25**.

Subsequent chainages to the second chainage equality are displayed with an **horizontal distance relative** to the **After value** of the internal equality (ie 25.0 + horizontal distance from the internal equality), with the **prepended K-post name** from the first chainage equality. Plus an appended zone label of **(1)** to indicate it a new zone with an incremented number starts after an internal equality.

Example 9



In example 10, there are two chainage equalities for the super alignment.

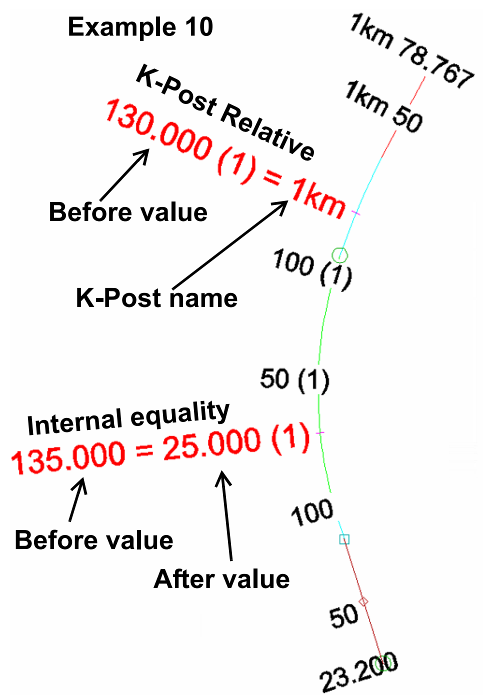
The first chainage equality along the super alignment is an **Internal Equality** with a **Before value** of **135** and an **After value** of **25**.

Subsequent chainages **until the K-post** are displayed with an offset relative to the **After value** with an appended zone label of **(1)** to indicate the new zone after the internal equality.

The second chainage equality is a **K-post Relative** with a **Before value** of **130**. The subsequent chainages along the super alignment are displayed with a horizontal distance from the **K-post** and the prepended **K-post name** of **1 km**.

Note: Zoning is reset to **0** (Zoneless) after each **K-post**

Example 10



Continue to 4.8 Sharing of Models and Tins or return to 4.7 Chainage Equalities or 4 Tools and Concepts.

4.8 Sharing of Models and Tins

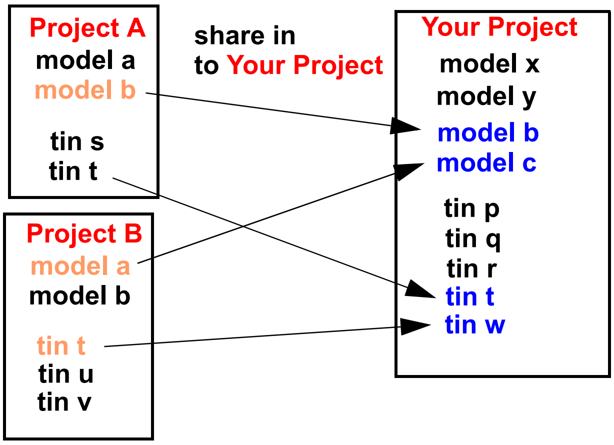
See

[4.8.1 Share In](#)
[4.8.2 Share Out](#)
[4.8.3 Share In and Out](#)
[4.8.4 Object Tree Object With Shared In and Shared Out Objects](#)
[4.8.8 Sharing Cache Folder](#)
[4.8.5 Master Share Files](#)

4.8.1 Share In

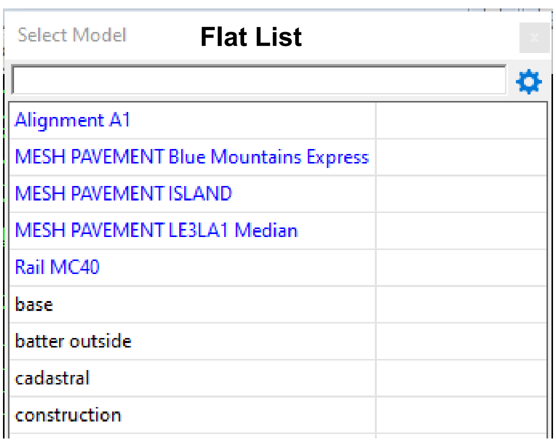
Models and **Tins** can be **shared into your project** from other projects.

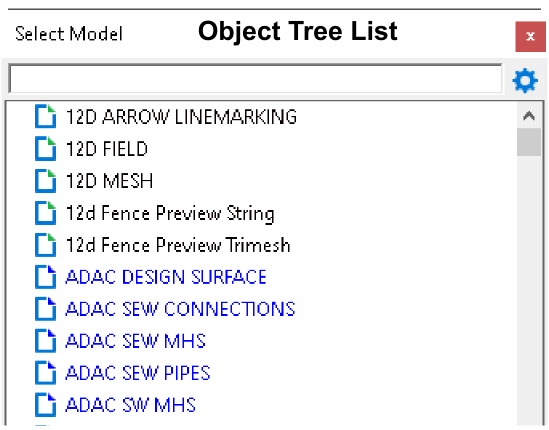
What that means is that in your project, you can have models and tins that are not created in your project, but are **copies** of the models and tins from the other project.



And when the models and tins are modified in the other project, they can be **automatically updated** in your project.

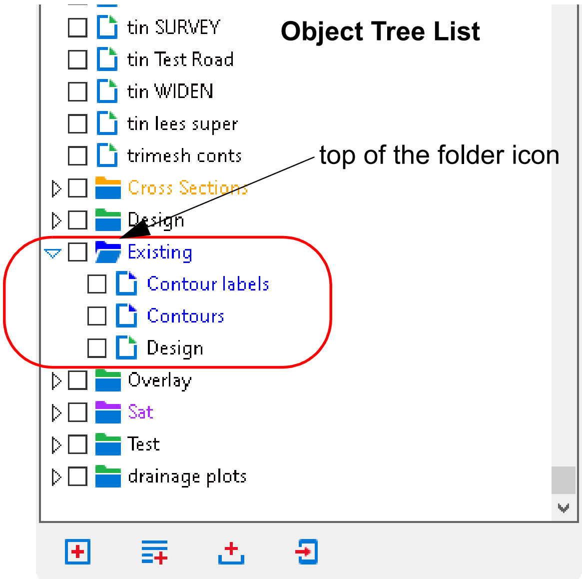
In the pop-up lists for models and tins, the models and tins that have been **shared in** to your project are shown in **blue**.





If the list is being displayed as a tree and an **object** includes **one or more shared in objects** in its tree, and **no shared out objects** (see 4.8.2 Share Out) in its tree, the **higher level object** is displayed in **blue**.

The top of the folder icon is also coloured **blue.**



Note: the colour denoting **shared out** models and tins can be changed in the env.4d file. See Projects > Sharing or SHARED_BOTH_ELEMENT_COLOUR_4D.

To share in models, see 9.8.7.2 Share In Other Models.

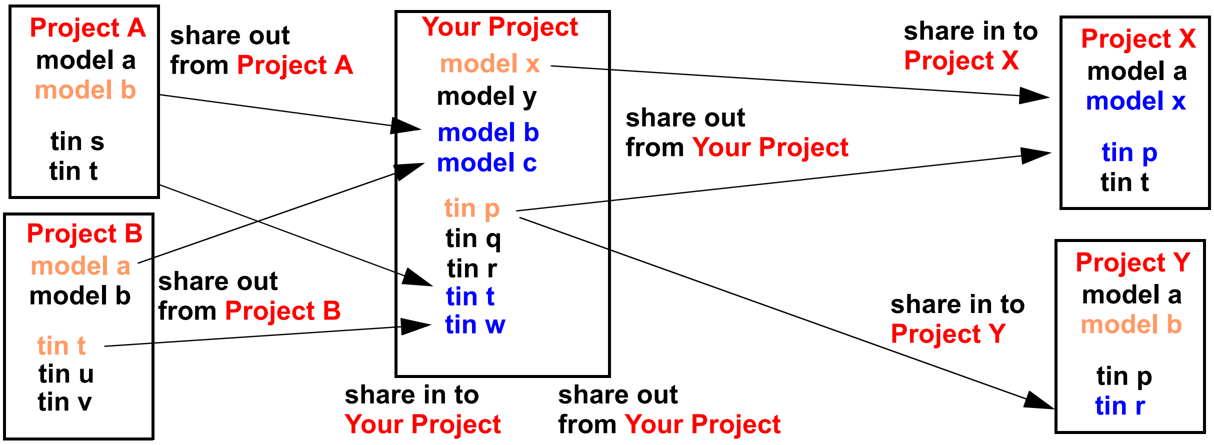
To share in tins, see 13.14.16.2 Share In Other Tins.

Continue to 4.8.2 Share Out or return to 4.8 Sharing of Models and Tins.

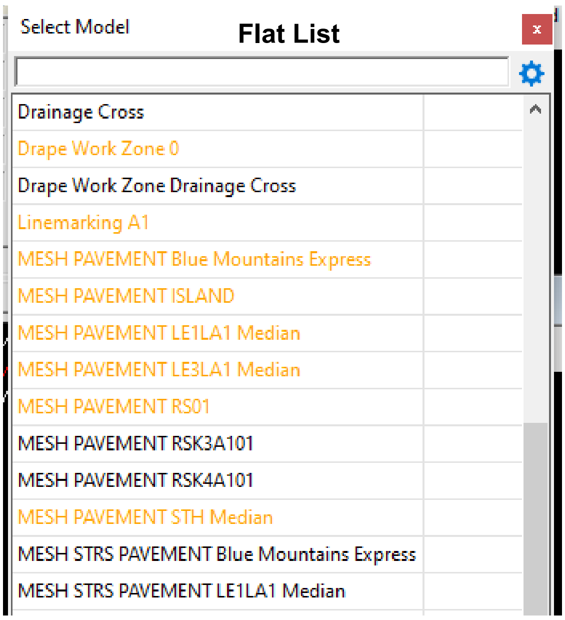
4.8.2 Share Out

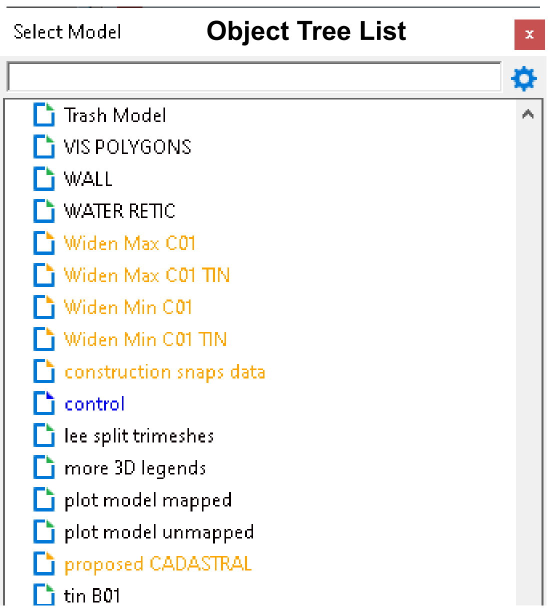
In a project, which models and tins are available to be shared in to other projects is totally controlled.

This is done by specifying in the project, which models and tins can be **shared out** and hence available to be shared in to other projects.



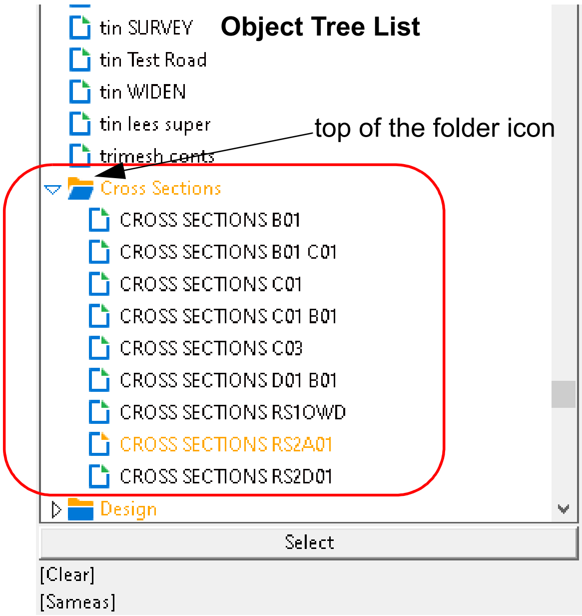
In the pop-up lists for models and tins, the models and tins in a project that have been designated as **share out** models are shown in orange.





If the list is being displayed as a tree and a **object** includes **one or more shared in objects** in its tree, and **no shared out objects** in its tree, the **higher level object** is displayed in orange.

The top of the folder icon is also coloured orange.



Note: the colour denoting **shared out** models and tins can be changed in the env.4d file. See Projects > Sharing or SHARED_ELEMENT_COLOUR_4D.

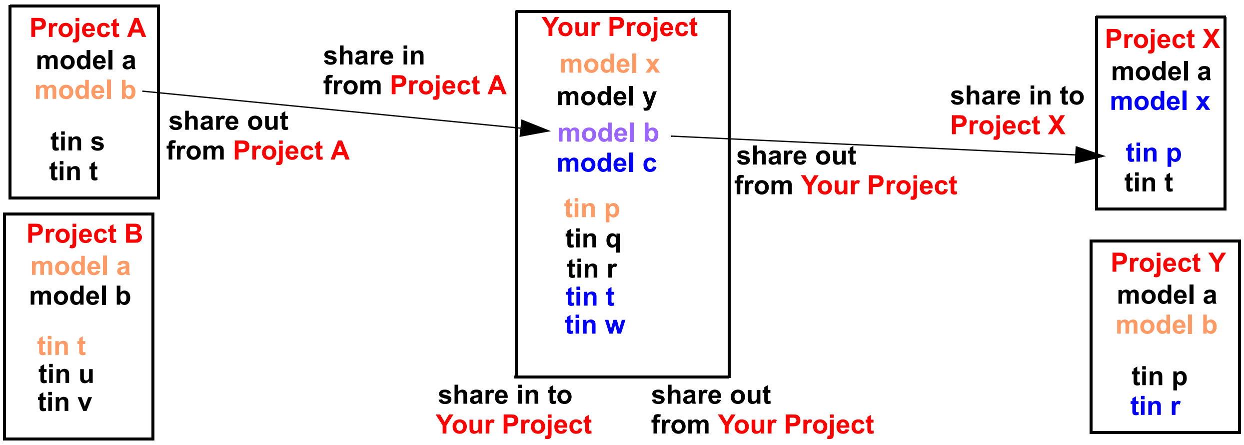
To share out models, see 9.8.7.1 Share Out Models and 6.12.2 Share Manager.

To share in tins, see 13.14.16.1 Sharing Out Tins and 6.12.2 Share Manager.

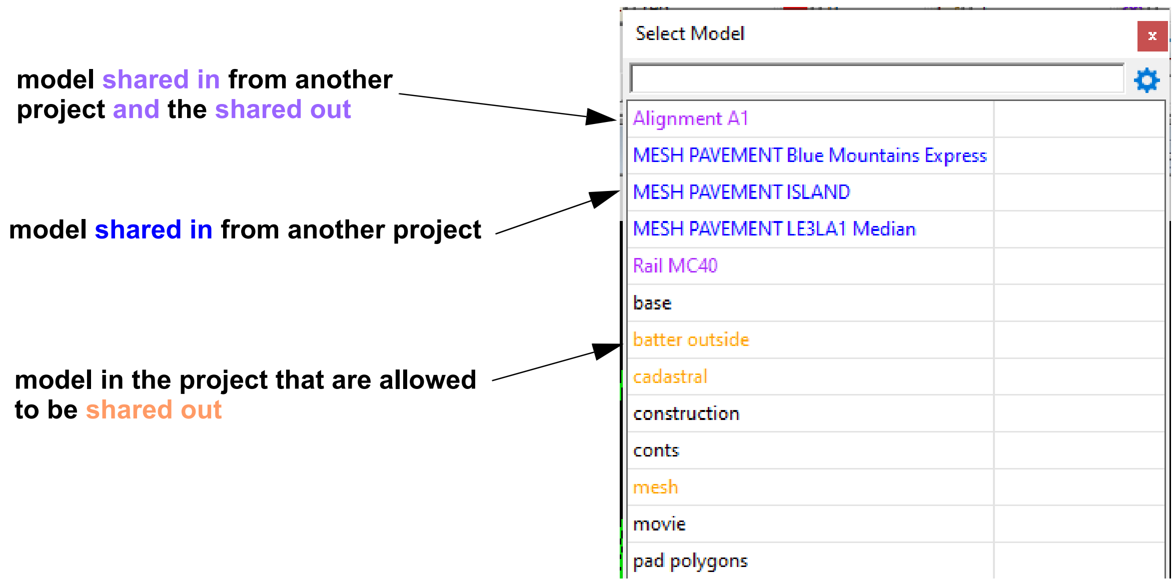
Continue to 4.8.3 Share In and Out or return to 4.8 Sharing of Models and Tins.

4.8.3 Share In and Out

It is possible to have **Shares of Shares**. That is, you share a model or tin **in to your project**, and then that model or tin is **shared out to another project**.



In the pop-up lists for models and tins, the models and tins that have been shared in to your project, and then made available to be **share out** from your project, are shown in **mauve**. This colour can be changed in the env.4d file - see [Projects > Sharing].

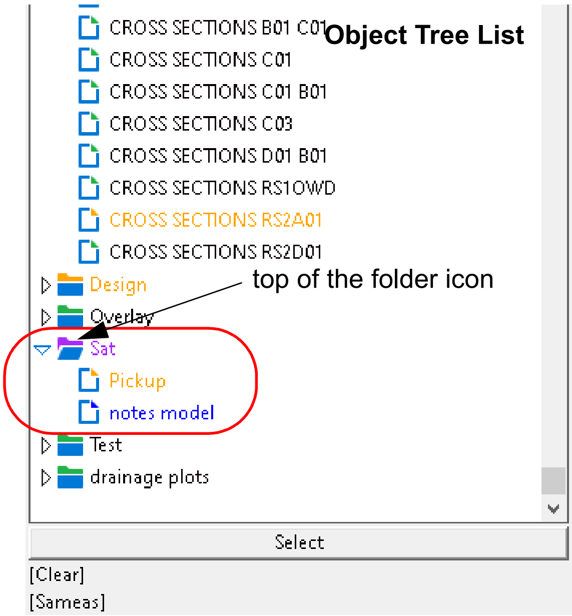


Continue to 4.8.4 Object Tree Object With Shared In and Shared Out Objects or return to 4.8 Sharing of Models and Tins.

4.8.4 Object Tree Object With Shared In and Shared Out Objects

If the list is being displayed as a tree and an **object** includes **one or more shared in objects** in its tree, and **one or more shared out objects** in its tree, the **higher level object** is also displayed in **mauve**.

The top of the folder icon is also displayed in **mauve.**



Continue to 4.8.5 Master Share Files or return to 4.8 Sharing of Models and Tins.

4.8.5 Master Share Files

Although the models and tins that are shared into a project can be defined for each project, this can become unwieldy when there are a number of projects sharing in data from a many other projects.

Master share files can be used in these situations.

A ***Master Share File*** is a file that contains a list of projects, and for each project, the models and tins that are to be ***shared in*** from that project. There can be more than one master share file.

When a project uses a master share file, all the models and tins listed in all the projects in the master share file are shared in to the project without each model or tin needing to be shared in individually.

A project can use one or more master share files, and different projects can use the same master share files.

So master share files are an easy way to set up a list of models and tins that are be shared in by a group of projects.

Master share files are created and edited using the ***Share Out*** tab of the **Share Manager** panel.

For a particular project, the ***Share In*** tab of the **Share Manager** panel specifies which master share files are to be used by the project. See 6.12.2 Share Manager.

Important Note

If a project is listed in a master share file, all the models and tins in a master share file for that project must be **shared out in that project**.

That is, a master share file **CAN NOT** make a model or tin in any project available for sharing out. This is strictly under the control of each individual project.

So even though a model or tin is listed for a particular project in a master share file, it is only when the model or tin has been shared out in the project itself, that the model or tin can be share into another project using the master share file.

For more information on sharing, see 4.8 Sharing of Models and Tins.

Continue to 4.8.6 Direct Share Ins and Master Share Ins or return to 4.8 Sharing of Models and Tins.

4.8.6 Direct Share Ins and Master Share Ins

Models and tins can be **shared into** a project in two ways: **direct share ins** and **master share file share ins** (also known as **master share ins**).

Direct Share Ins need to be done in each project using the options 9.8.7.2 Share In Other Models and 13.14.16.2 Share In Other Tins.

Master share ins are done using the ***Share In*** tab on the **Share Manager** panel. See 6.12.2 Share Manager.

Important Note

A model or tin can not be shared in unless it has first been shared out in the project that it is being shared in from.

Continue to 4.8.7 Synchronising Shares or return to 4.8 Sharing of Models and Tins.

4.8.7 Synchronising Shares

When models and tins that are shared in to your project are modified in their original projects, the shared in models and tins in the project need to be updated to match the modified models and tins.

Updating the models and tins that have been share in to a project so that they are the same as in their original projects is called **synchronisation**.

When synchronising occurs, models and/or tins shared in to the current project are checked to see if the model or tin has been modified in their original projects since the models or tins were last copied to the current project. If any model and/or tin has been modified, it is re-copied to the current project

There are a number of options to synchronise models and tins so that the appropriate method can be used at a particular time.

1. Manually synchronising direct shared in models

   Direct shared in models can be manually synchronised at anytime using the option **Synchronize Shared In Models** (9.8.7.4 Synchronize Shared In Models). The option allows each shared in model to be individually synchronised.

2. Manually synchronising direct shared in tins

   Direct shared in tins can be manually synchronised at anytime using the option **Synchronize Shared In Tins** (6.12.6 Synchronize Shared In Tins). The option allows each shared in tin to be individually synchronised

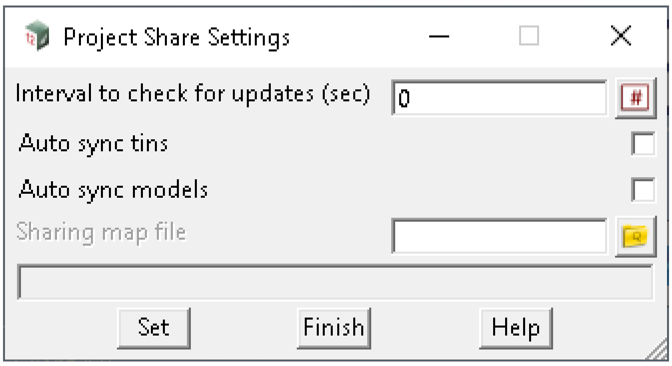
3. Manually synchronising all the direct and master shared in models and tins

   All the direct shared in models and tins and the models and tins in the master share files used in the project can be manually synchronised at anytime using the option **Sync all shared ins - direct and MSF**.

4. Automatically synchronising shared in models and/or tins at a user specified time interval

   Synchronising of shared in models and tins can be automated and done at a user specified time interval.

   The **Project Share Settings** panel is used to control whether synchronising shared in models and tins automatically occurs, and if it does, what the time interval is to check for updated models and/or tins



The time, in **seconds**, between checks is given by the environment variable 9.8.7.4 Synchronize Shared In Models. There are also two other environment variables, AUTO_MODEL_SYNC_4D and AUTO_TIN_SYNC_4D, to control if synchronization is done or not done for models and tins respectively.

The three (3) environment variables SHARE_CHECK_INTERVAL_4D, AUTO_MODEL_SYNC_4D and AUTO_TIN_SYNC_4D are set in the Projects > Sharing section of the env.4d editor (6.10.2 Create/Edit env.4d).

For more flexibility, the values of the three environment variables can be modified for the current session using the panel **Project Share Settings** found at ***Project =>Sharing =>Settings*** (6.12.3 Project Share Settings).

Continue to 4.8.8 Sharing Cache Folder or return to 4.8 Sharing of Models and Tins.

4.8.8 Sharing Cache Folder

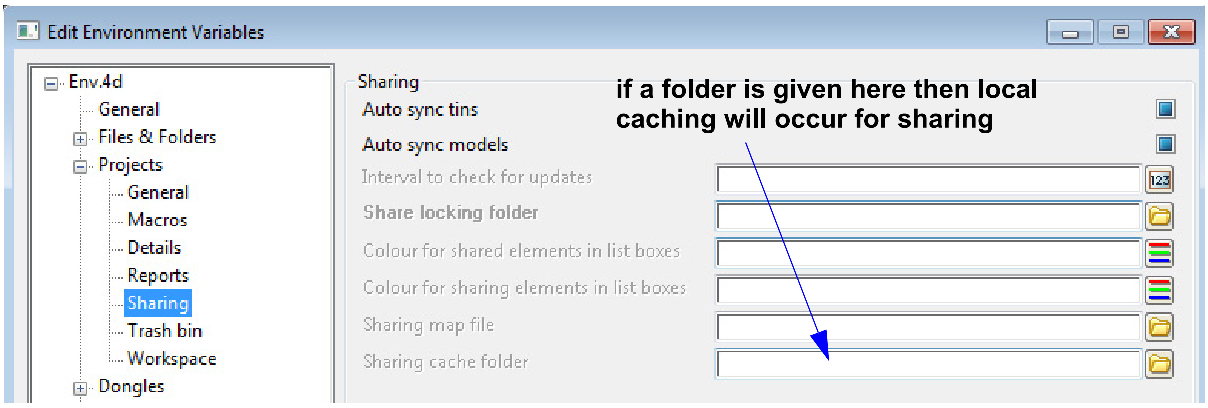
NOT YET IMPLEMENTED FOR V15

When models and tins are shared into your project, a copy of the models and tins are copied over into your project. And each time one of the models or tins is modified in the original project, a new copy is made in your project.

However when you exit a project, the next time you start the project the models and tins that are shared into your project may not have changed. Rather than copying the models and tins again, it is possible to have the models and tins saved in a special folder, called a **Sharing Cache Folder**, so they do not have to be copied over again when ever a project is restarted.

There is an environment variable, **SHARING_CACHE_4D**, which gives the full path name to the local folder to use as the ***Sharing Cache Folder***.

In the ***Edit Environment Variables*** panel, it is the field ***Sharing cache folder*** in Projects > Sharing



If ***Sharing cache folder*** is left blank then local caching does not occur.

Continue to 4.9 Enabling Long Paths in Windows or return to 4.8 Sharing of Models and Tins or 4 Tools and Concepts.

4.9 Enabling Long Paths in Windows

Starting in Windows 10, version 1607, **MAX_PATH** limitations have been removed from common Win32 file and directory functions. However, you must opt-in to the new behaviour.

To enable the new long path behaviour, both of the following conditions must be met:

The registry key

Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem\LongPathsEnabled

must exist and be set to **1** (Type: REG_DWORD).

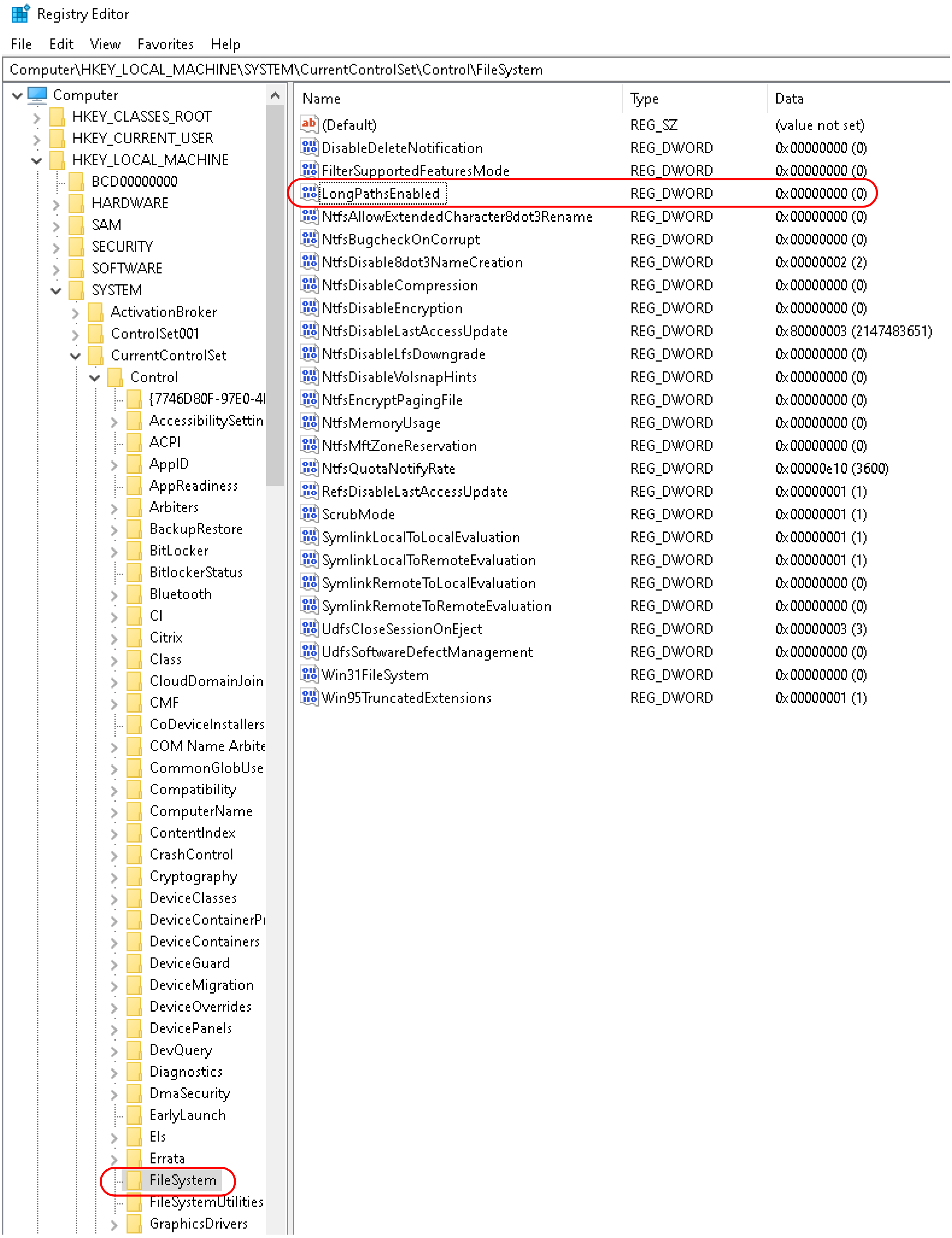
The key's value will be cached by the system (per process) after the first call to an affected Win32 file or directory function.

The registry key will not be reloaded during the lifetime of the process.

In order for all apps on the system to recognise the value of the key, a reboot might be required because some processes may have started before the key was set.

See

https://docs.microsoft.com/en-us/windows/win32/fileio/maximum-file-path-limitation?tabs=cmd



Continue to 4.10 Migration of Projects From Command Line or return to 4 Tools and Concepts.

4.10 Migration of Projects From Command Line

Lets assume there is a project in

"c:\4d_test\projects\job 1234"

and the project folder is

emu_park.project

1st rename the folder to

emu_park_old.project

then run the command line

"c:\program files\12d\12dmodel\15.00\nt.x64\12d.exe" -create "c:\4d_test\projects\job 1234\emu_park.project" -migrate_offline "c:\4d_test\projects\job 1234\emu_park_old.project"

this will create the V15 project, from the old, and once the migration is finished, 12d will exit.

Note the command line:

"c:\program files\12d\12dmodel\15.00\nt.x64\12d.exe" -create "c:\4d_test\projects\job 1234\emu_park.project" -migrate "c:\4d_test\projects\job 1234\emu_park_old.project"

will also migrate the project, however 12d will continue to run.

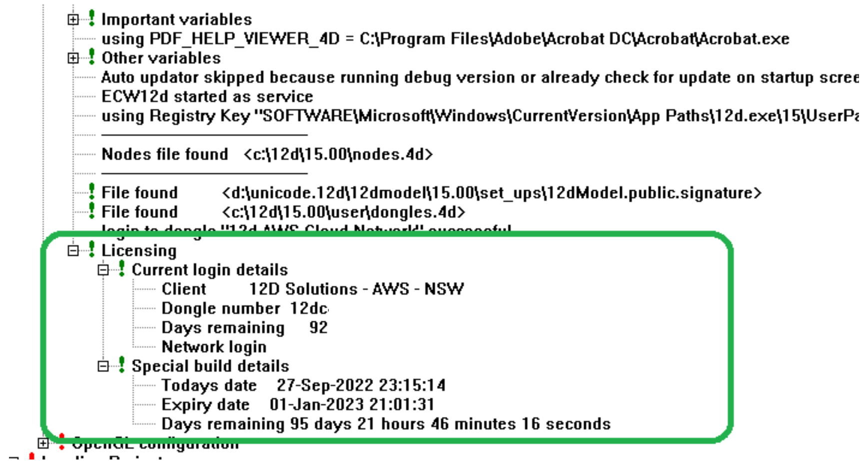
Note:

A file called, **emu_park_migration_output_window.xml w**ill be created which is the contents of the output window. This is handy if you are migrating many project as a single batch operation. So as you can see, for the project folder "emu_park.project", the folder name minus.project is uses as the stem for the file name. So for the project folder "fred_blogs.project", the xml file name will be "fred_blobs_migration_output_window.xml".

Continue to 4.11 Startup Information in Output Window or return to 4 Tools and Concepts.

4.11 Startup Information in Output Window

The logline group Licensing contains information about the current licensing.



Two sub groups are as below and contains the information:

1) Current login details

Client

Dongle number

Days remaining

Local login, or Network login

2) Special build details

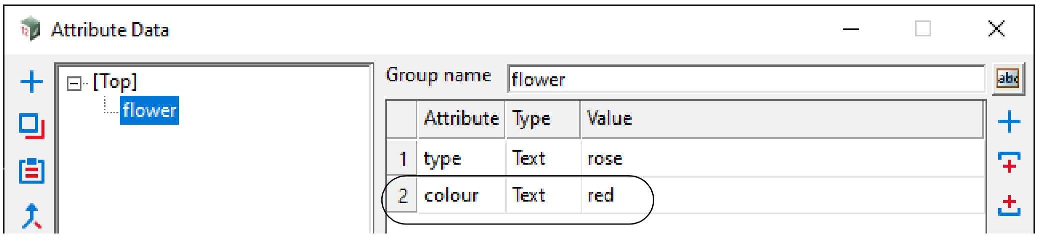
Todays date

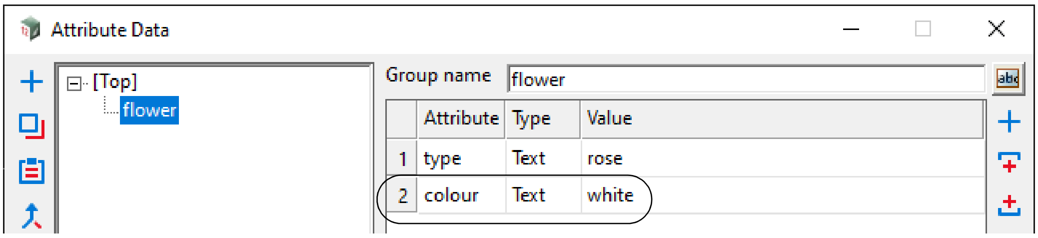
Expiry date

Continue to 4.12 Comparing Attribute Data or return to 4 Tools and Concepts.

4.12 Comparing Attribute Data

The following images have been updated.





Continue to 4.13 Writing XSLT Files or return to 4 Tools and Concepts.

4.13 Writing XSLT Files

As of C1m, 3 parameters are passed into every XSLT file. These are:

Inbuilt_Parameter_Input_Filename

Inbuilt_Parameter_XSLT_Filename

Inbuilt_Parameter_Output_Filename

Input is the original XML file name to be transformed.

XSLT is the file name of the XSLT.

Output is the file name being output to.

All file names are full paths:

A sample **XSLT** file showing how to access these parameters follows below. If you did not add these parameters, you will get errors when attempting to apply the XSLT.

```
<?xml version="1.0" encoding="utf-8"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">
  <xsl:output method="xml" indent="yes" />
  <xsl:param name="Inbuilt_Parameter_Input_Filename"></xsl:param>
  <xsl:param name="Inbuilt_Parameter_XSLT_Filename"></xsl:param>
  <xsl:param name="Inbuilt_Parameter_Output_Filename"></xsl:param>
  <xsl:param name="User_Parameter_CEO"></xsl:param>
  <xsl:param name="User_Parameter_CTO"></xsl:param>

  <xsl:template name="print_newline">
    <xsl:text>&#xA;</xsl:text>
  </xsl:template>

  <xsl:template match="/">
    <out>
      <xsl:call-template name="print_newline" />

      <xsl:text>Input file </xsl:text>
      <xsl:value-of select="$Inbuilt_Parameter_Input_Filename" />
      <xsl:call-template name="print_newline" />

      <xsl:text>XSLT file </xsl:text>
      <xsl:value-of select="$Inbuilt_Parameter_XSLT_Filename" />
      <xsl:call-template name="print_newline" />

      <xsl:text>Output file </xsl:text>
```

```
      <xsl:value-of select="$Inbuilt_Parameter_Output_Filename" />
      <xsl:call-template name="print_newline" />

      <xsl:text>CEO is </xsl:text>
      <xsl:value-of select="$User_Parameter_CEO" />
      <xsl:call-template name="print_newline" />

      <xsl:text>CTO is </xsl:text>
      <xsl:value-of select="$User_Parameter_CTO" />
      <xsl:call-template name="print_newline" />

      <!--
      <xsl:text>CFO is </xsl:text>
      <xsl:value-of select="$User_Parameter_CFO" />
      <xsl:call-template name="print_newline" />
      -->

    </out>
  </xsl:template>

</xsl:stylesheet>
```

Continue to 5 Menus on Views or return to 4 Tools and Concepts.

5 Menus on Views

There has been changes to the **View** chapter in the ***12d Model Reference manual***.

See 5.1 Plan View Menu

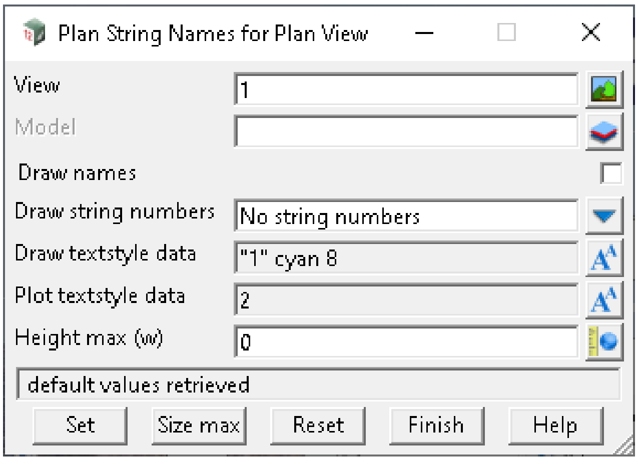
See 5.2 Perspective View Menu

See 5.3 Section View Menu

5.1 Plan View Menu

5.1.1 Single for Values Text, Crosses and Text on Plan Views

The option **Draw string numbers** has changed from a tick box to a choice box.



For Plan String Names

Draw string numbers	choice box	No strings	No string numbers, All string numbers String numbers excluding 0 or blank

*If **No string numbers** is selected, then the view does not display any objects assigned a string number.*

*If **All string numbers** is selected, then the view displays (?) after the string name, even if string number is 0 or blank.*

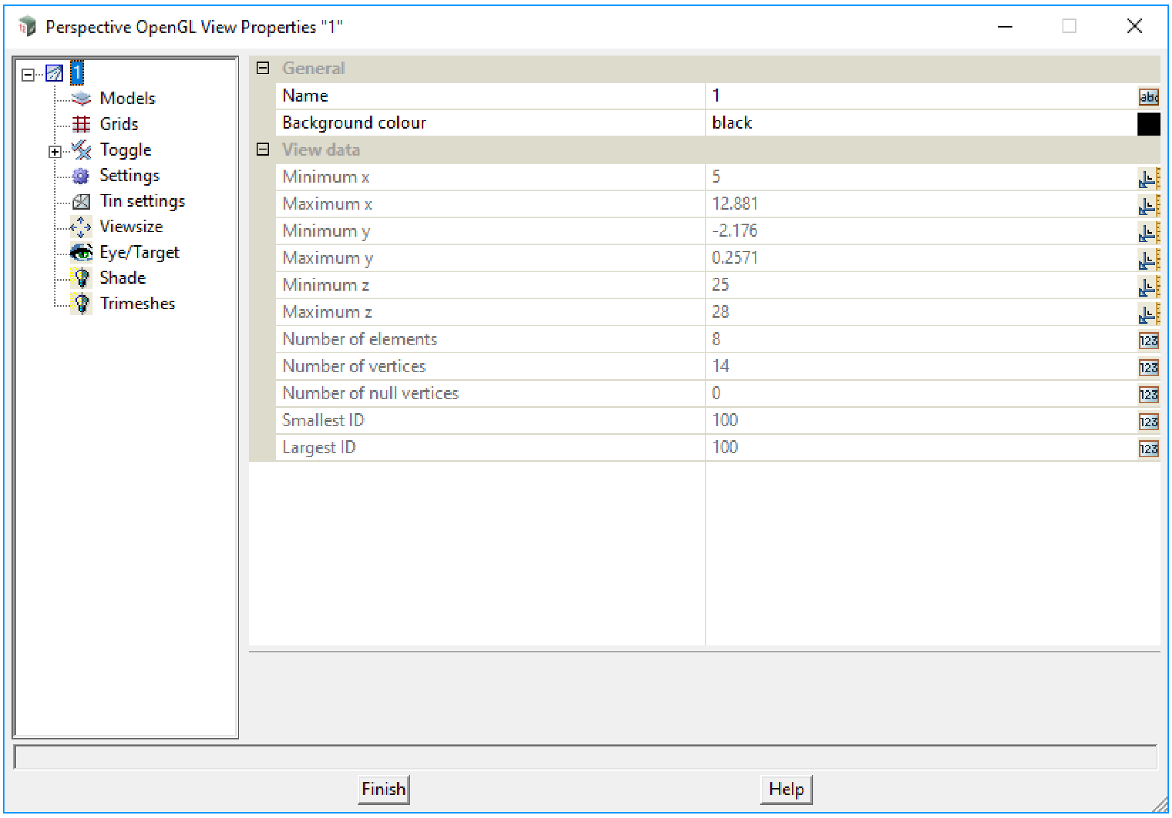
*If **String numbers excluding 0 or blank**, then the view on display (?) after the string name, but will not display (?) if the string number is 0 or blank.*

Continue to 5.2 Perspective View Menu or return to 4 Tools and Concepts.

5.2 Perspective View Menu

See 5.2.1 Perspective/Perspective Opengl View Properties
See 5.2.2 Perspective View Settings

5.2.1 Perspective/Perspective Opengl View Properties



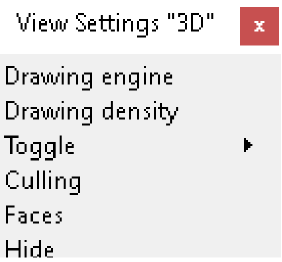
Continue to 5.2.2 Perspective View Settings or return to 5.2 Perspective View Menu or 4 Tools and Concepts.

5.2.2 Perspective View Settings

Position of menu: **Perspective View Menu** **View =>Settings**

If the **Settings** option is clicked rather than moving onto the **Settings** walking right, then the **Toggle** menu from the **Toggle** walk-right menu is displayed on the screen. The **Toggle** menu will be described in the next section (see 5.2.2.1 Perspective Toggle).

The **Settings** walk-right menu for the perspective view is



See

5.2.2.1 Perspective Toggle

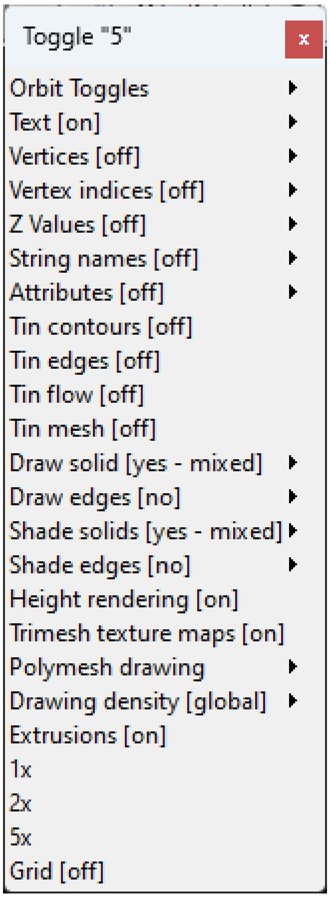
Continue to 5.2.2.1 Perspective Toggle or return to 5.2 Perspective View Menu or 4 Tools and Concepts.

5.2.2.1 Perspective Toggle

Position of menu: **Perspective View Menu =>Settings =>Toggle**

Toggle button **on Perspective View buttons**

The **Toggle** walk right brings up the **Toggle** perspective view menu with a number of new options:



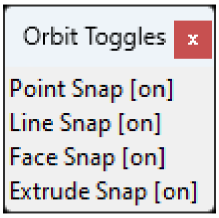
See
5.2.2.1.1 Orbit Toggles

5.2.2.1.2 Toggle Draw Solid Coloured Faces
5.2.2.1.3 Toggle Draw Edges
5.2.2.1.4 Toggle Shade Solids
5.2.2.1.6 Toggle Shade Edges

5.2.2.1.7 Toggle Displaying Trimeshes with Texture Mapping
5.2.2.1.8 Polymesh Drawing
5.2.2.1.9 Drawing Density Toggle
5.2.2.1.10 Toggle Extrusions

5.2.2.1.1 Orbit Toggles

The options on the **Orbit Toggles** menu allows you to configure what elements are selected with extrudes when using the perspective orbit option.



Point Snap - When on will allow the picking to snap to points generated by the extrude.

Line Snap - When on will allow the picking to snap to lines generated by the extrude.

Face Snap - When on will allow the picking to snap to faces generated by the extrude.

Extrude Snap - When on will allow the previous 3 options to work. When off all the previous 3 options will be treated as if they were turned off.

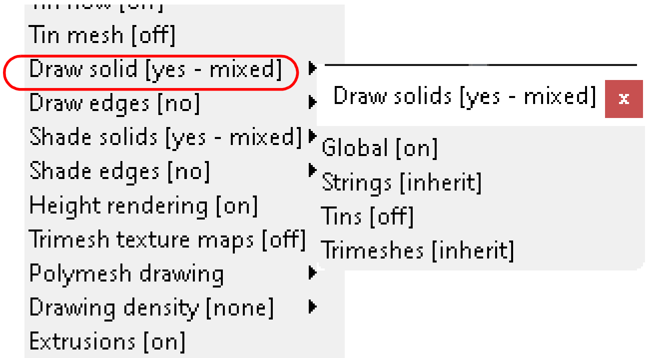
Continue to 5.2.2.1.2 Toggle Draw Solid Coloured Faces or return to 5.2.2.1 Perspective Toggle.

5.2.2.1.2 Toggle Draw Solid Coloured Faces

On Open GL views, **solid colour filled faces** such as in super pipes, tins, trimeshes, water strings, and super alignment pipes can be displayed or not displayed.

It is possible to separately define if super pipes, tins or trimeshes are **drawn** or **not drawn**.

So the **Draw solid** menu item has a walk-right menu as well:



Clicking the **Draw solid** menu item itself toggles the **displaying coloured faces on** and **off**.

Note: This toggle is for the coloured faces but there is also a toggle for the edges of faces. So even if the faces are not drawn, the edges of the faces can be drawn. See 5.2.2.1.3 Toggle Draw Edges and 5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids.

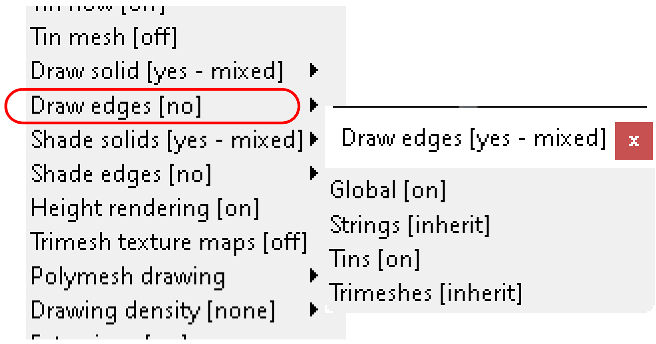
Continue to 5.2.2.1.3 Toggle Draw Edges or return to 5.2.2.1 Perspective Toggle.

5.2.2.1.3 Toggle Draw Edges

On Open GL views,   the edges **solid colour filled faces** such as in super pipes, tins, trimeshes, water strings, and super alignment pipes can be displayed or not displayed.

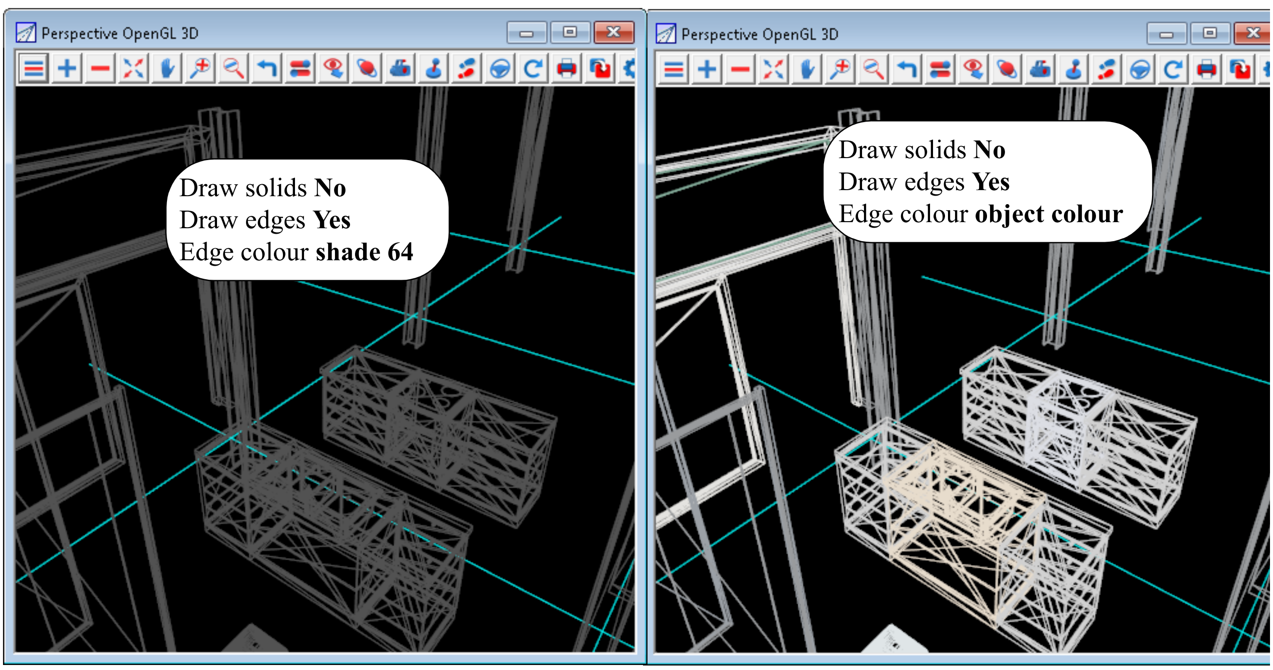
It is possible to separately define if the edges of super pipes, tins or trimeshes are **drawn** or **not drawn**.

So the **Draw edges** menu item has a walk-right menu as well:



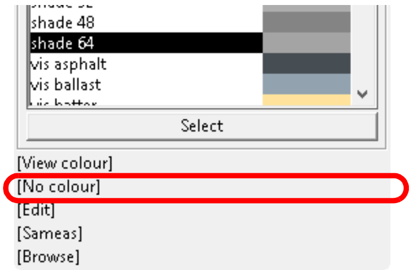
Clicking on **Draw edges** menu items itself toggles the **displaying of edges on** and **off**.

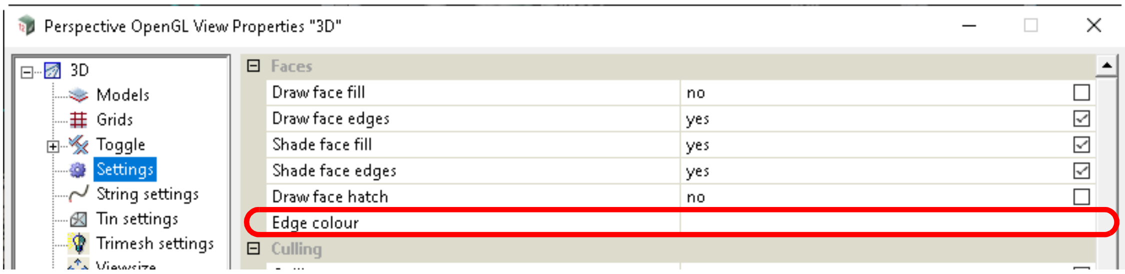
Note:
The colour of the edges can be a set colour, or the edges can be drawn in the colour of the object that it is an edge for.



The edge colour is set in the file **Settings > Edge colour** in the view **Properties**.

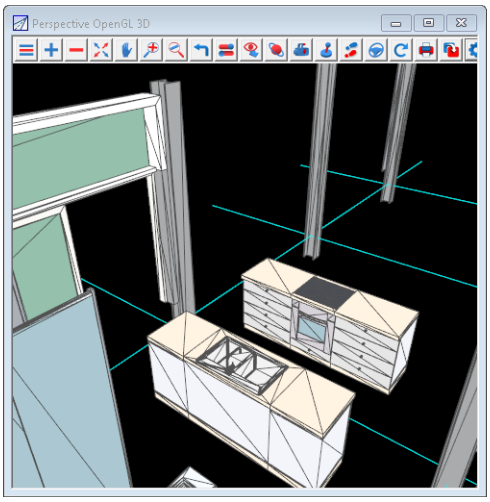
To select **object colour**, select **[No colour]** from the colour pop-up





This toggle is for the edges of faces but there is also a toggle for drawing the coloured faces.So even if the edges are not drawn, the solid faces can be drawn. See 5.2.2.1.2 Toggle Draw Solid Coloured Faces. and 5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids.

For situations where the edges and the solid coloured faces are **both** drawn, a very dark grey edge colour works well.



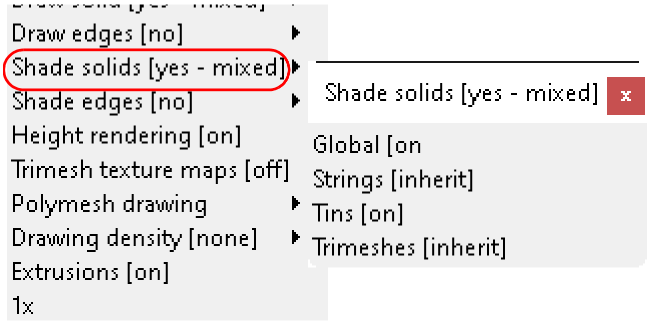
Continue to 5.2.2.1.4 Toggle Shade Solids or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.2.2.1.4 Toggle Shade Solids

On Open GL views, **solid colour filled faces** such as in super pipes, tins, trimeshes, water strings, and super alignment pipes can be displayed as if there was a sun at a certain angle or position in the sky.

It is possible to separately define if super pipes, tins or trimeshes are shaded or not shaded.

So the **Shade solids** menu item has a walk-right menu as well:



Clicking on **Shade solids** menu items itself toggles the **drawing with shading on** and **off**.

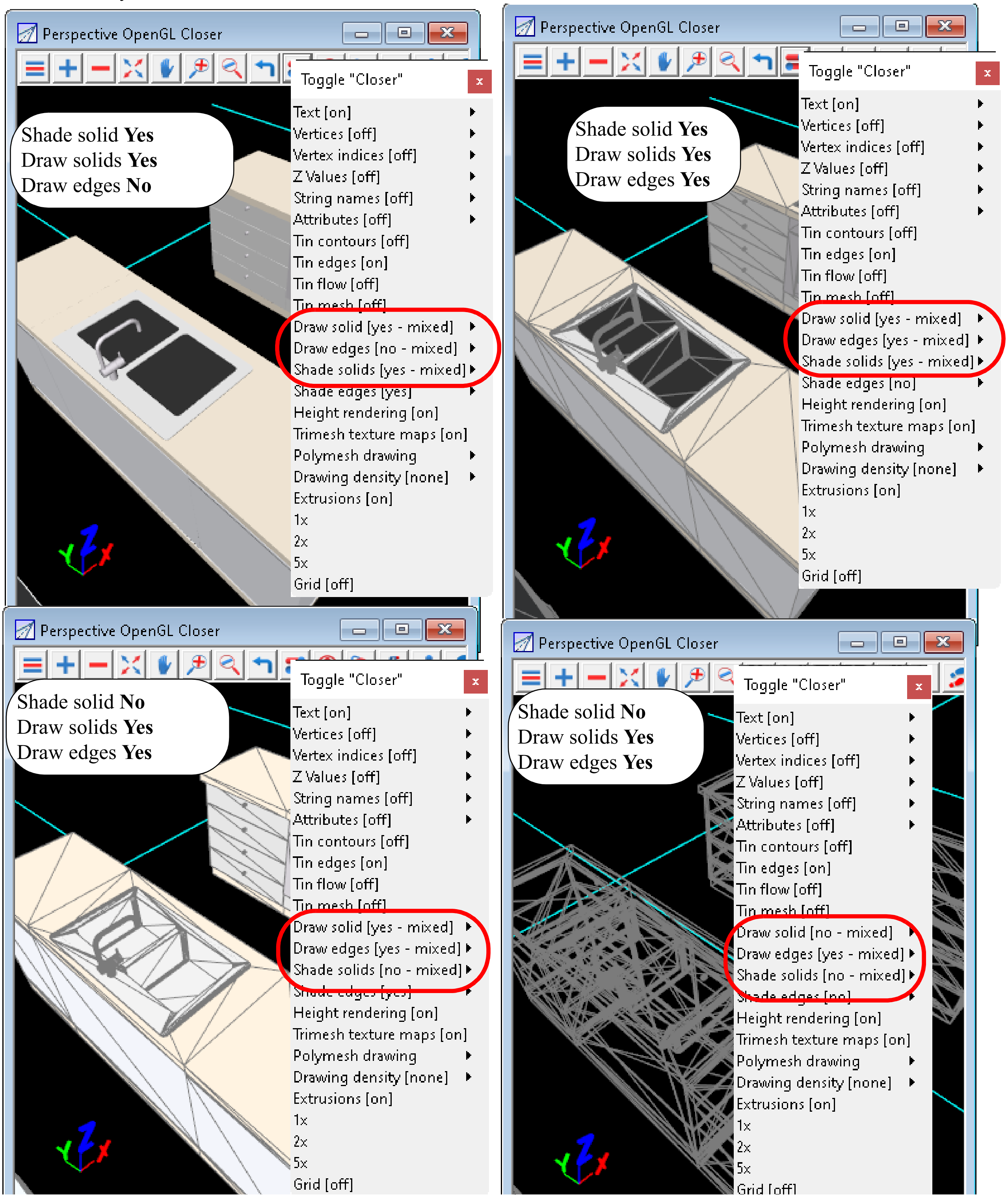
Continue to 5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids

There are two important represent.tions of objects that can be displayed, or not displayed, in an Perspective OpenGL view:

1. objects with solid colour filled faces (super pipes, extrusions, tins, trimeshes, water strings and super alignment pipes) can have their faces drawn or not drawn.
2. objects can have their edges drawn or not drawn

Often when solid filled faces and edges are both drawn, **Shading** can be off and the objects are still very well defined.



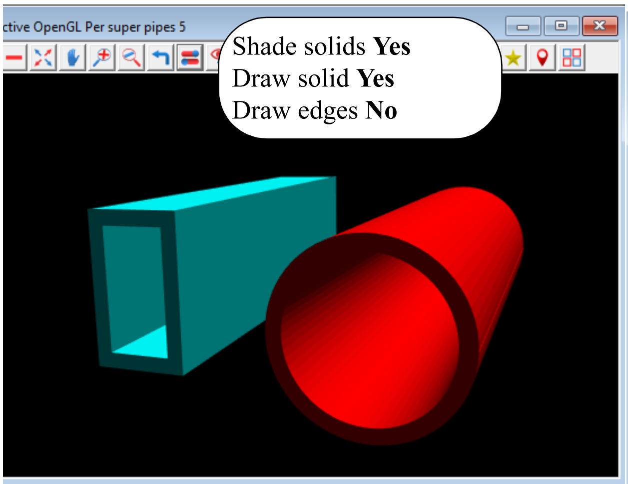
In the given example, the colour for drawing of the edges was set to a grey colour (pen 018). This stands out fairly well on most coloured solid faces.

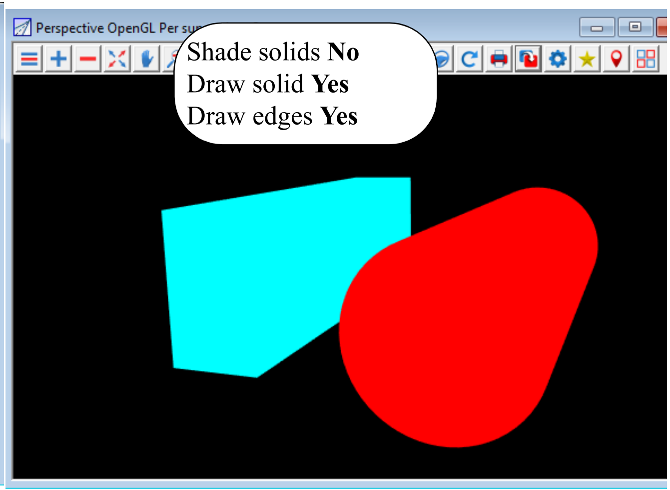
However, it is possible to change the colour that the edges are drawn in and when only the edges are drawn, it is useful to set the colour to draw the edges as the colour of faces themselves.

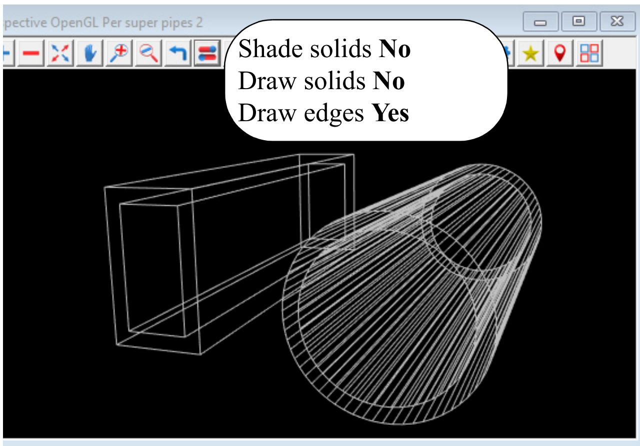
Which combination of toggles is best to use depends on what the view is for, the type of objects in the view, the viewing angle etc.

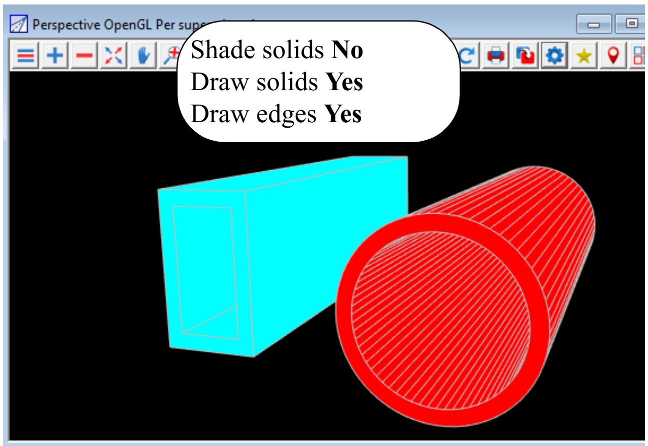
Examples of the effect of the different settings for a round and rectangular super pipe are:

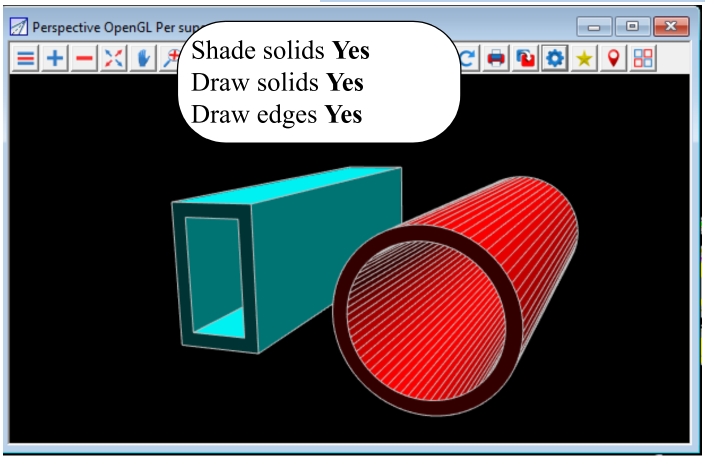
.





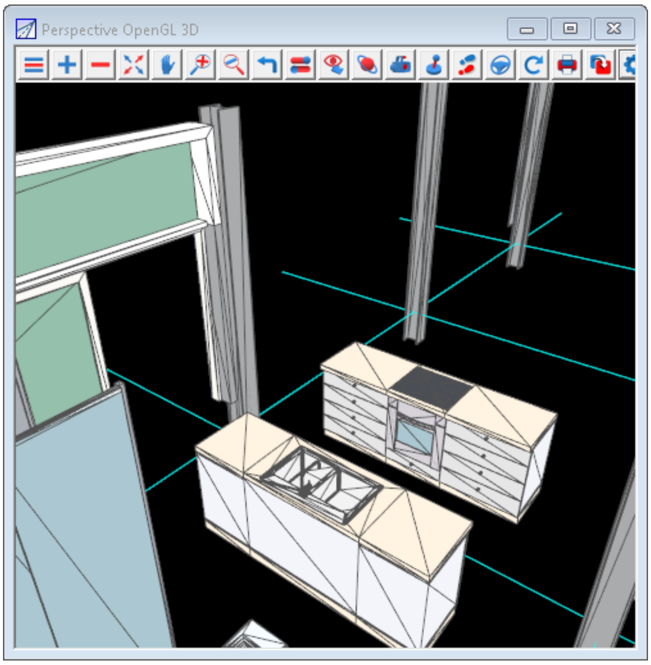




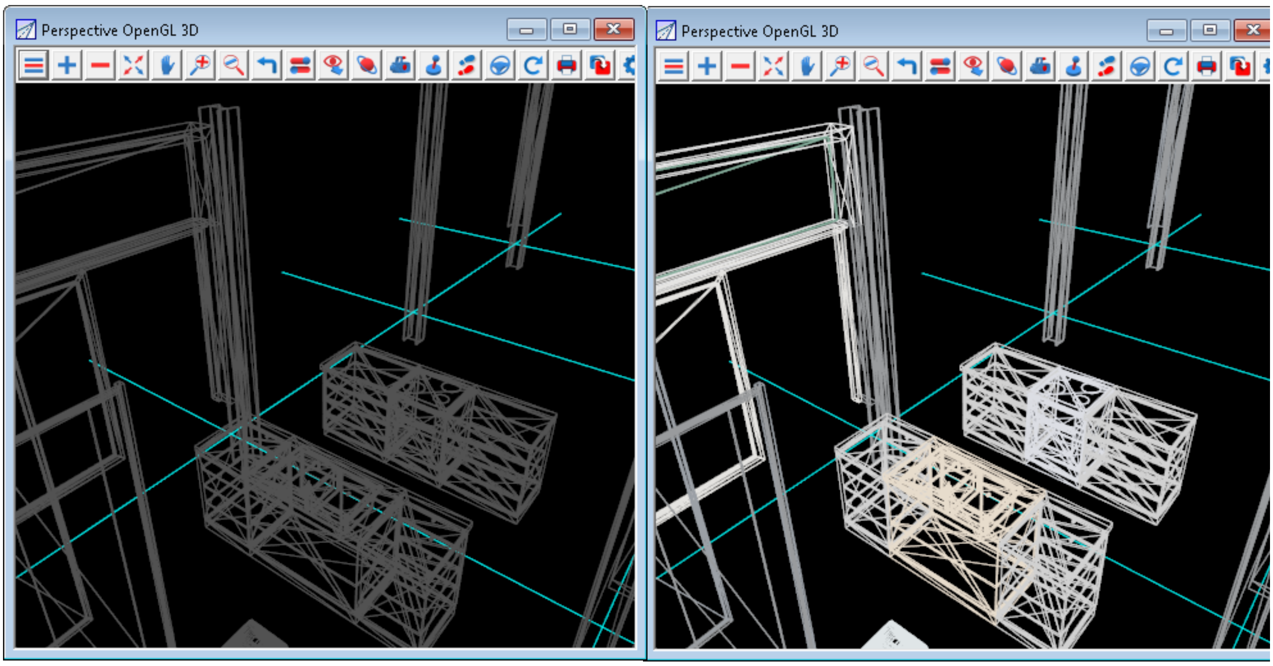


Note that for edges, the colour of the edges can be a set colour, or the edges are drawn in the colour of the object that it is an edge for.

For situations where the edges and the solid coloured faces are both drawn, a dark grey edge colour works well.



If only the edges are drawn, then have the edges drawn in the colour of the objects allows different coloured objects to be more easily differentiated.



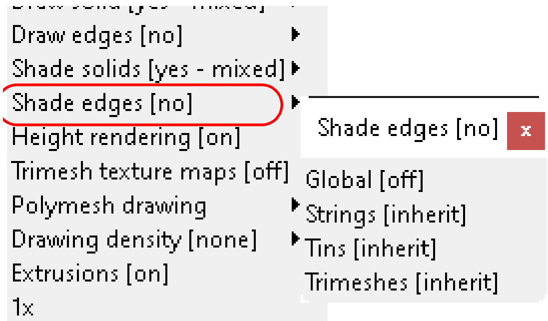
Continue to 5.2.2.1.6 Toggle Shade Edges or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.2.2.1.6 Toggle Shade Edges

On Open GL views, edges if **solid colour filled faces** such as in super pipes, tins, trimeshes, water strings, and super alignment pipes can be displayed as if there was a sun at a certain angle or position in the sky.

It is possible to separately define if the edges of super pipes, tins or trimeshes are shaded or not shaded.

So the **Shade edges** menu item has a walk-right menu as well:



Clicking on the **Shade edges** menu item itself toggles the **drawing edges with shading on** and **off**.

Continue to 5.2.2.1.6 Toggle Shade Edges or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

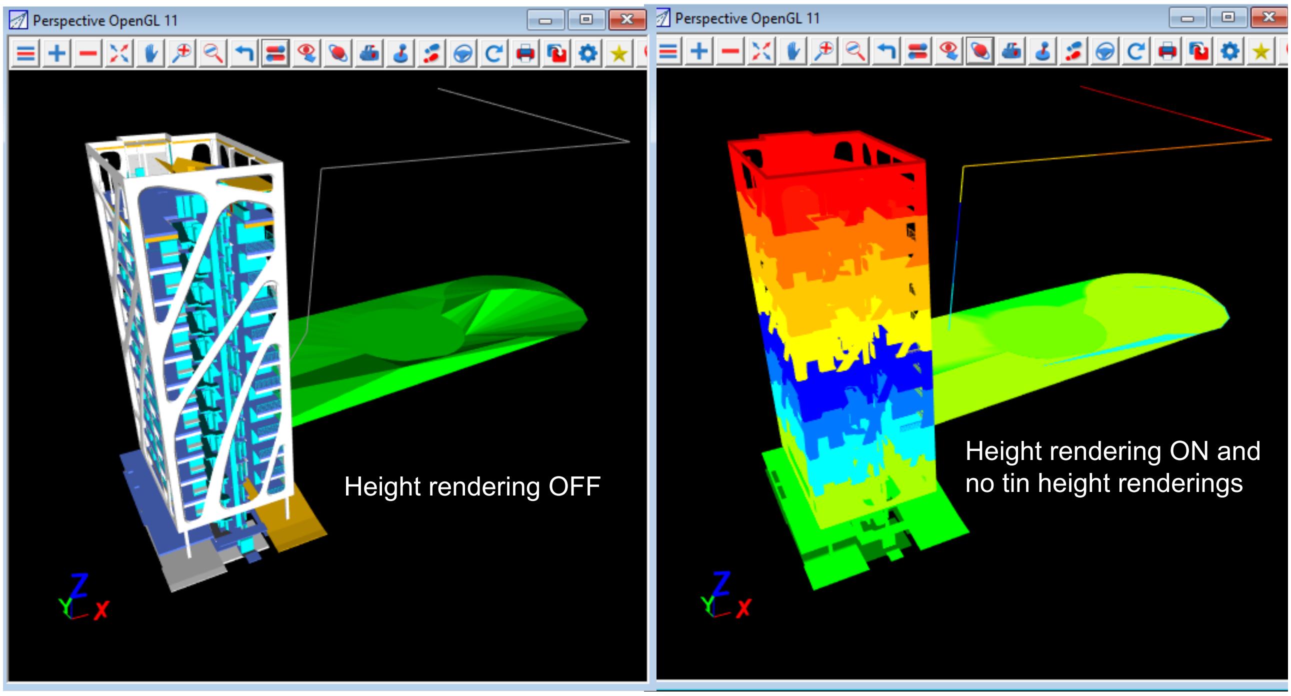
5.2.2.1.6.1 Toggle Height Rendering

When **Height rendering** is toggled **ON** (the **default**), the height map texture is applied to the data on the view. This will not apply to a tin if the tin has its own ***tin render settings***. In that case, the tin's height render settings are used. See 11.6.3 Tin Height Render Settings

When **Height rendering** is toggled **OFF**, the height map texture is NOT applied to the data on the view.

For information on setting the view height render settings for a view, see 11.6.4 View Height Render Settings.

In the example below, the height map texture ***$Lib\height rainbow.png*** is used for each view.



For an example with view height rendering ON but with a Tin with its own tin height rendering, see More Height Rendering Examples.

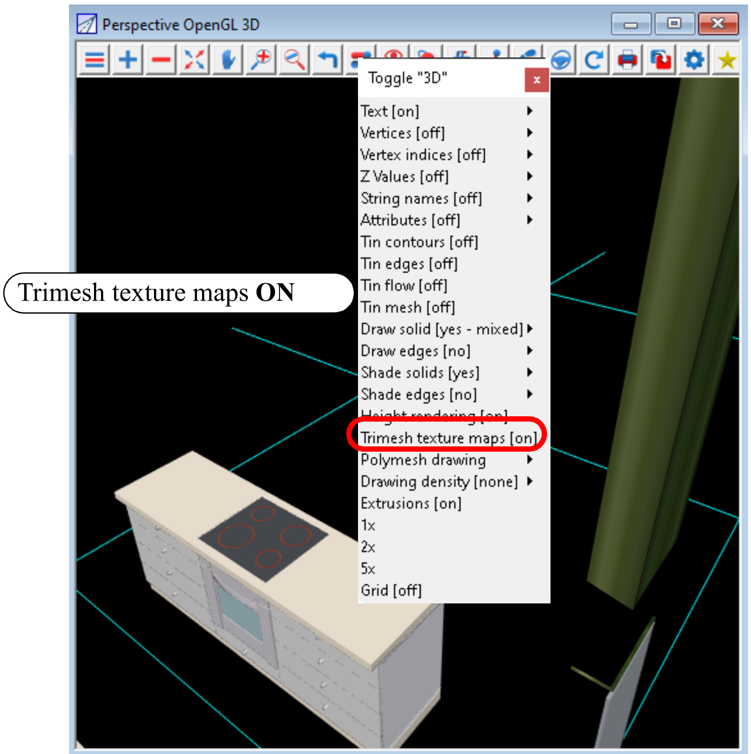
Continue to 5.2.2.1.7 Toggle Displaying Trimeshes with Texture Mapping or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

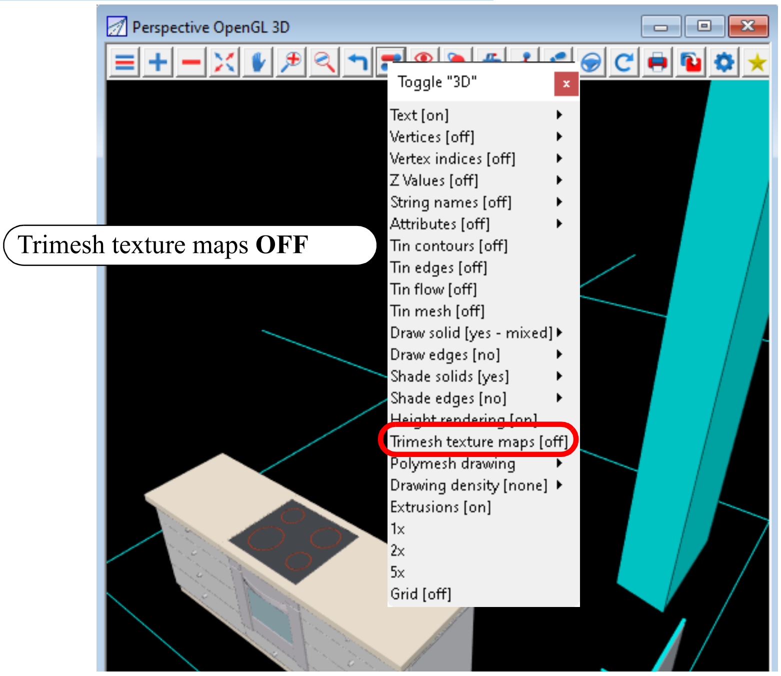
5.2.2.1.7 Toggle Displaying Trimeshes with Texture Mapping

When **Trimesh texture maps** is toggled **ON** (the **default**), the mapping of colours to textures is applied to the faces of the trimeshes.

When **Trimesh texture maps** is toggled **OFF**, the mapping of colours to textures is NOT applied to the faces of the trimeshes.

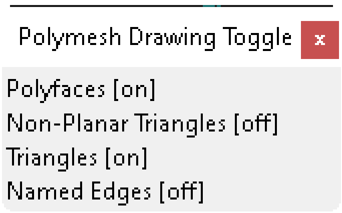
In the example below, the colour **cyan** is mapped to the texture **Grass1**





Continue to 5.2.2.1.8 Polymesh Drawing or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.2.2.1.8 Polymesh Drawing



The three toggles on the **Polymesh drawing** walk-right menu **Polymesh Drawing Toggle** are:

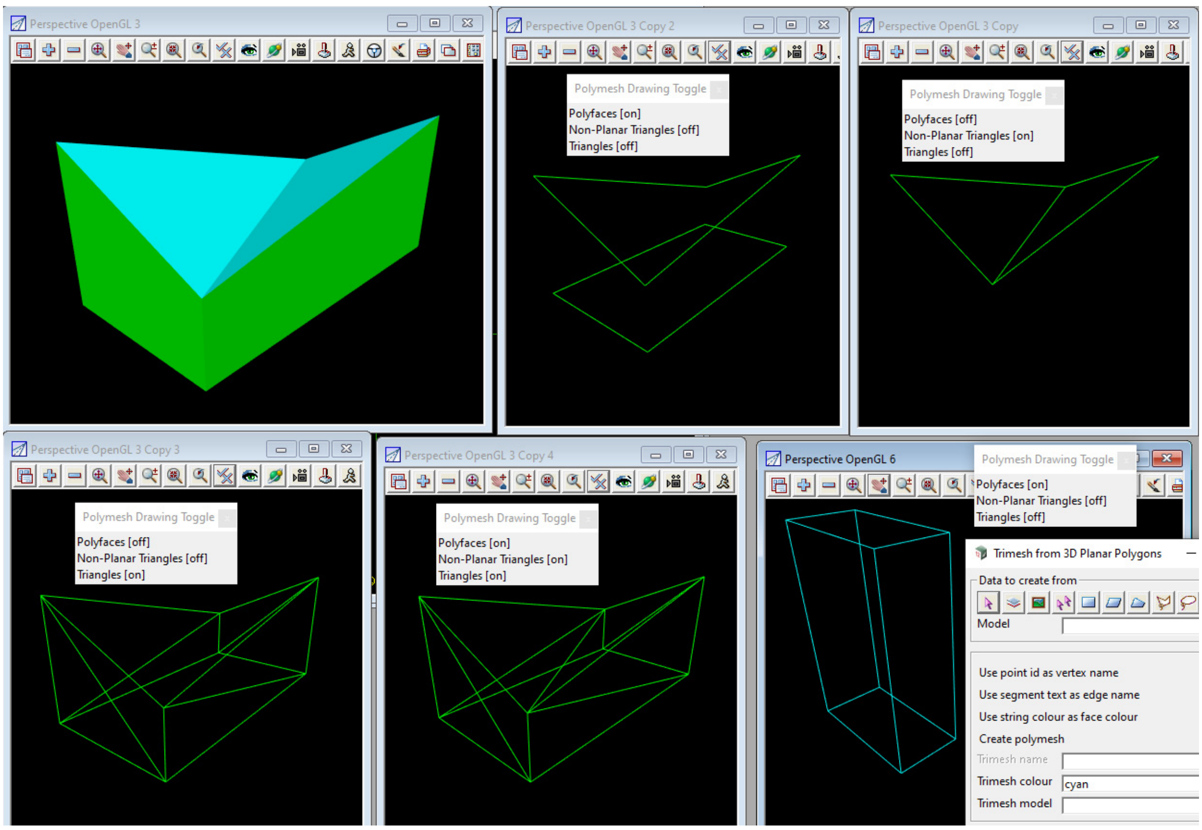
Polyfaces - when toggled on, the boundary polygon of any planar polyfaces are drawn on the view. This probably should say Planar polyfaces.

Non-Planar Triangles - when toggled on, the boundary polygon of any non-planar polyface, plus the enclosed triangles of the non-planar polyfaces, are drawn on the view. This probably should be Non-planar polyfaces and internal triangles.

Triangles - when toggled on, the triangles that are not polyfaces are drawn on the view.

So to see all the components that are contained in a polymesh, you need all three toggled on.

In the image below, the polymesh in view **3** consists of a non-planar face on the top (cyan) and a planar face on the bottom.



So in view ***3 Copy 2*** which has only ***Polyfaces turned on,*** you only see the bounding polygons of the top and the bottom of the object.

In view ***3 Copy*** which has only ***Non-Planar triangles turned on,*** you only see the bounding polygon of the top and its triangle decomposition.

In view ***3 Copy 3*** with only ***Triangles turned on,*** you only see the triangles that are not polyfaces which is how the sides of the object were constructed.

In view ***3 Copy 4, Polyfaces, Non-Planar triangles*** and ***Triangles*** are all ***turned on*** so you can see all the triangles that make up all the polyfaces of the polymesh.

For the definition of a polymesh, see 3.7.3.2 Polymesh.

Continue to 5.2.2.1.9 Drawing Density Toggle or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

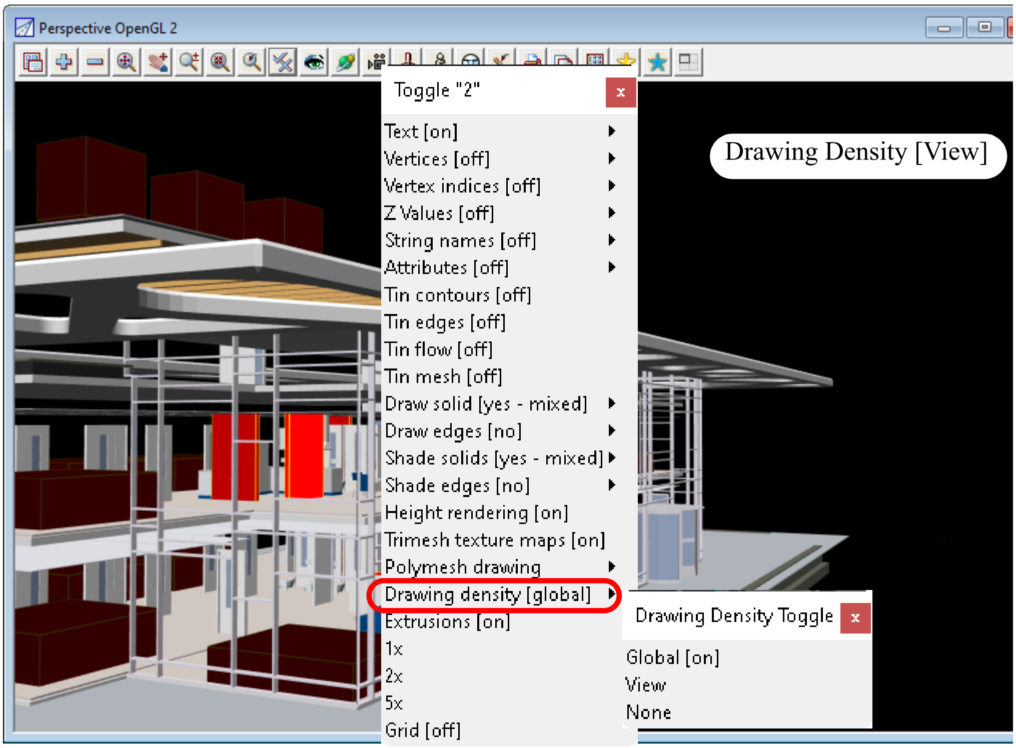
5.2.2.1.9 Drawing Density Toggle

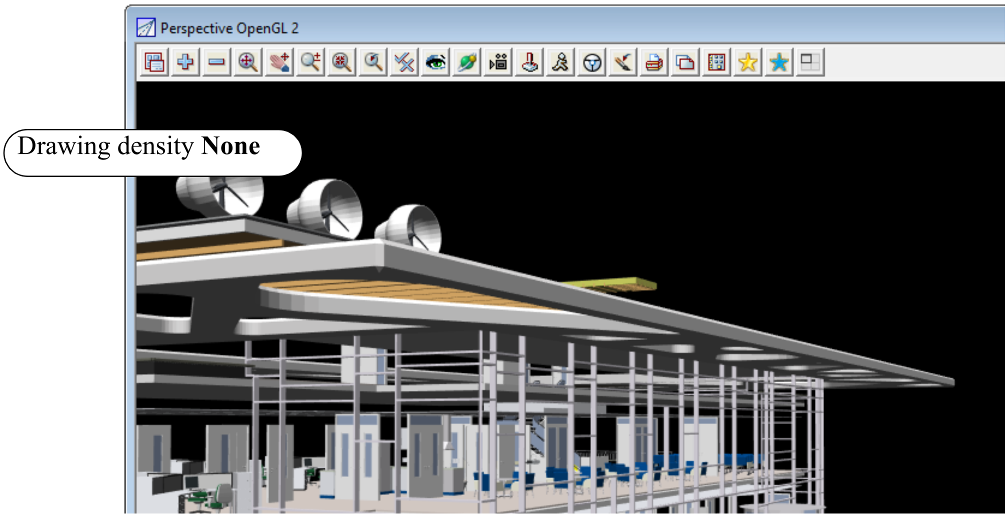
When **Drawing density** is set to **None**, Drawing Density is not used for the view.

When **Drawing density** is set to **View** the values from the **View Drawing Density** panel for the view are used. See 8.8 View Drawing Density.

When **Drawing density** is set to **Global**, the **Drawing Density** is taken from the environment variables used when the project is opened.

Changing the ***Drawing Density*** toggle also updates the **Mode** on the **View Drawing Density** panel (8.8 View Drawing Density).





Continue to 5.2.2.1.10 Toggle Extrusions or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.2.2.1.10 Toggle Extrusions

12d Model super string extrusions are created in a number of ways:

(a) super string as a round pipe

(b) super string as a rectangular pipe

(c) super string with a 2D super string (with and without holes) swept along the super string

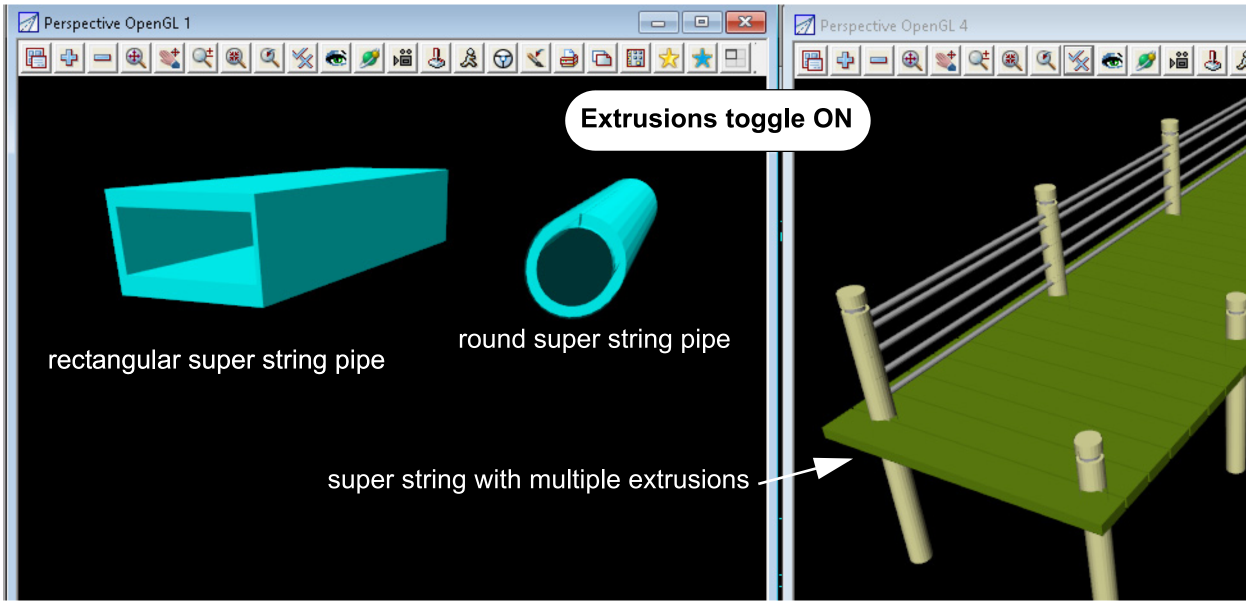
(d) super string with multiple extrusions

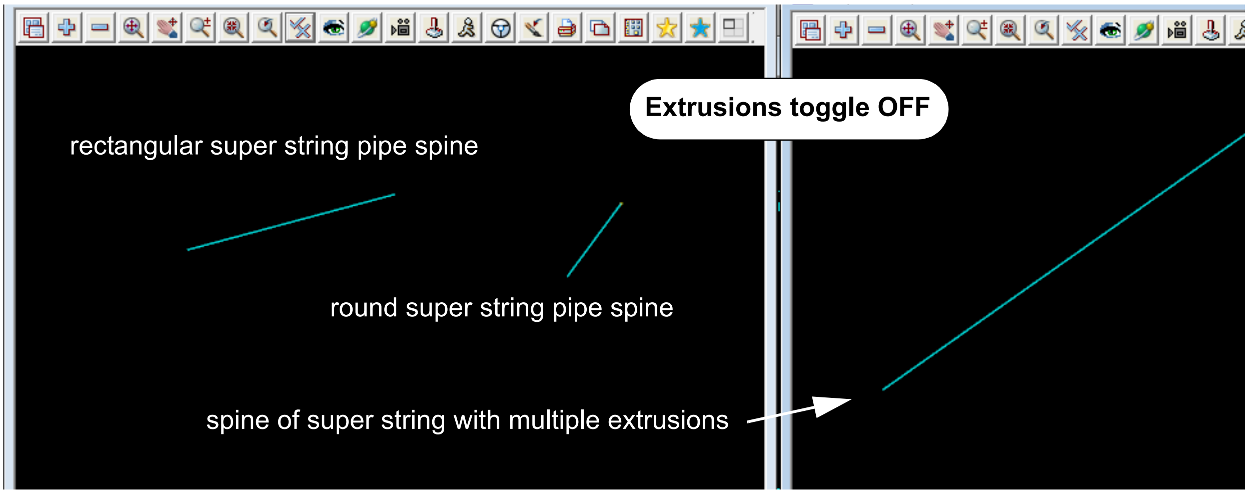
Round and rectangular pipes are special cases of (c) but because they are easily defined with a few parameters, they exist as special cases of the super string. Similarly multiple extrusions includes (c).

In each case there is only one super string which is called the **spine** of the extrusion.

When the **Extrusions toggle** is set to **on**, the extrusion is drawn on the view

When the **Extrusions toggle** is set to **off**, only the super string **spine** of the extrusion is drawn on the view



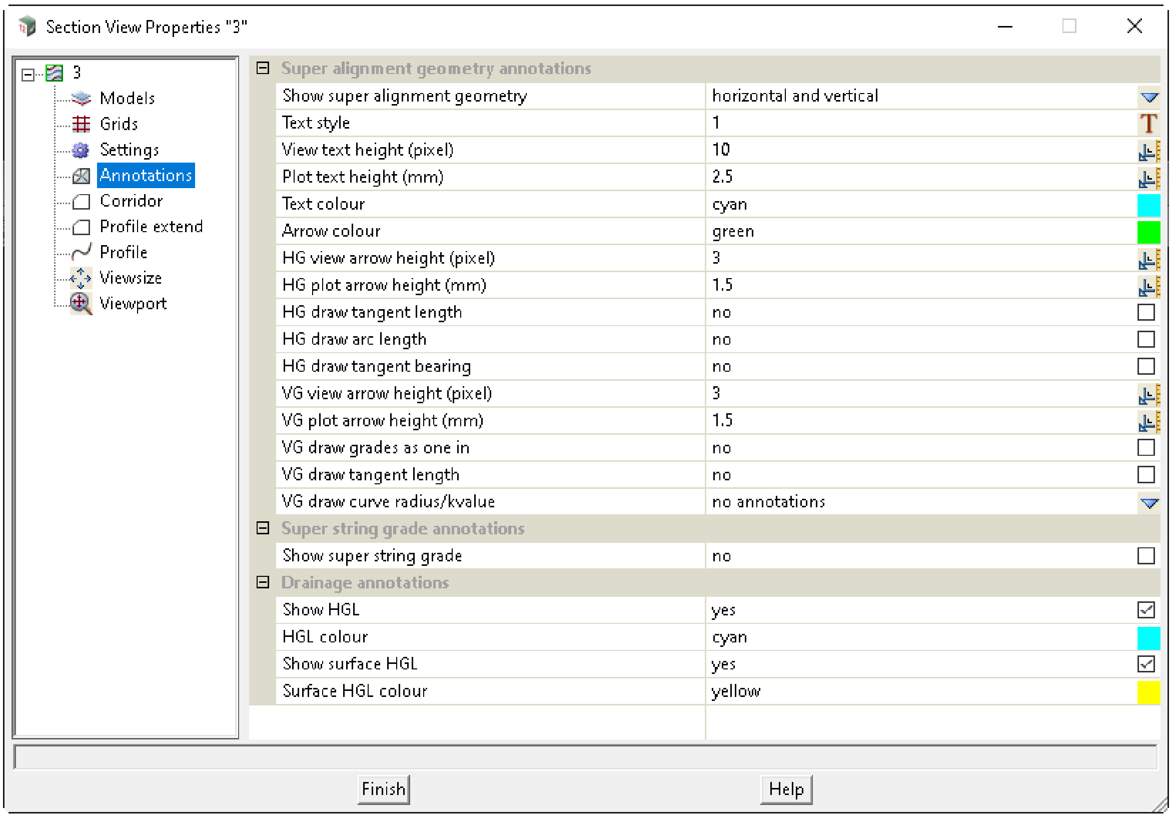


Continue to 5.3 Section View Menu or return to 5.2.2.1 Perspective Toggle or 5.2.2 Perspective View Settings.

5.3 Section View Menu

5.3.1 Section View Properties

There are now more choices on the **Annotations** tab on the **Section View Properties** panel for setting what is displayed in the Section View for the Horizontal and Vertical geometry.

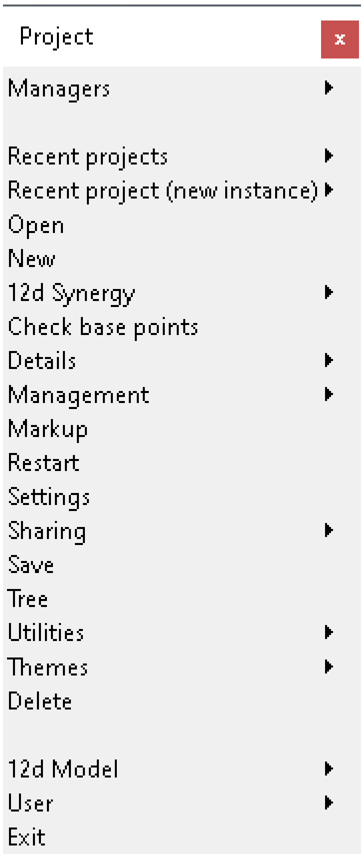


Continue to 6 Project or return to 5.3 Section View Menu.

6 Project

There has been changes to the **Project** chapter in the ***12d Model Reference manual***.

The **V14** menu pinned menu was called **Projects** and in **V15** this has been renamed to **Project**.



The **Managers** menu from **Management**

6.1 Recent Projects - New Instance

6.3 Management

6.4 12d Markup

6.5 Project Settings

6.6 Project Sharing

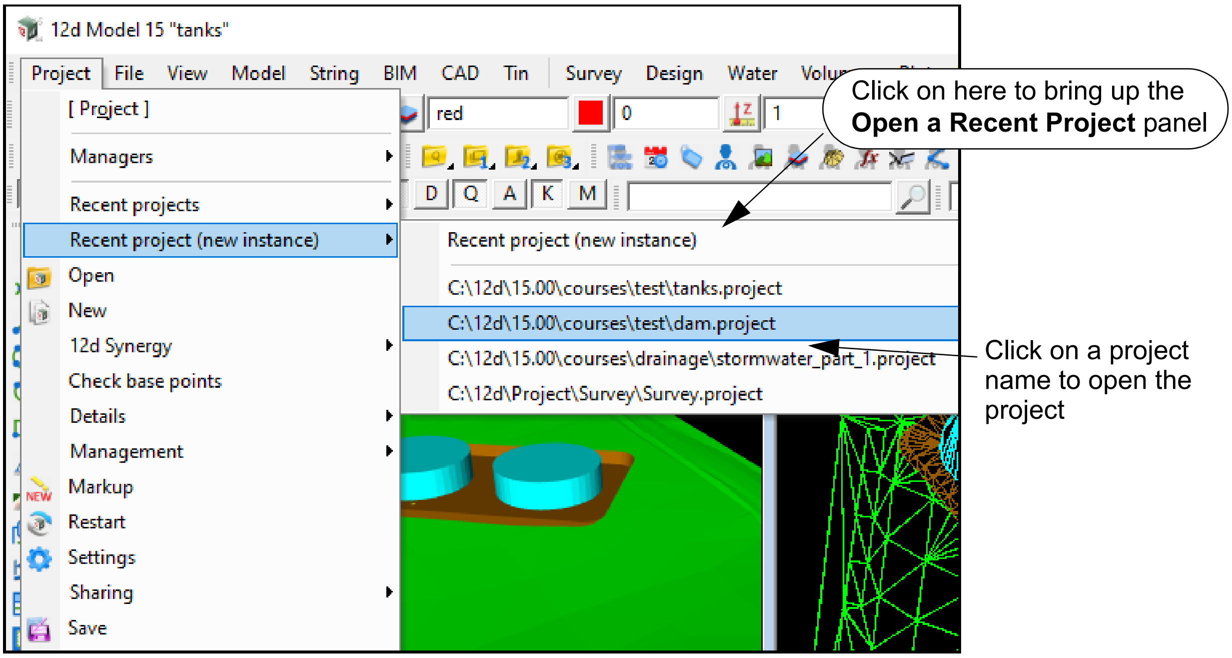
6.2 Themes

See 6.1 Recent Projects - New Instance
See 6.2 Themes
See 6.3 Management
6.3.1 Create/Edit env.4d
6.3.2 Projections
6.3.3 Create/Edit N-Value Definitions
See 6.4 12d Markup
See 6.5 Project Settings
See 6.6 Project Sharing

6.1 Recent Projects - New Instance

Position of option on menu: **Project =>Recent projects (new instance)**

Walking right on the ***Project =>Recent project (new instance)*** lists the projects recently accessed by ***12d Model***.



Clicking on a project in the list will start a new instance ***12d Model*** and open the project selected project. The existing instance of ***12d Model*** with the current project will still be left open.

Clicking on the ***Recent Projects*** heading on the ***Main Menu*** or on the **Recent projects** item when the **Projects** menu is pinned up, brings up the **Open a Recent Project** panel which shows the recent project list.
The list of recent projects is shared between all versions of ***12d Model***.and is recorded in the file "**Recent Projects.4d**" stored in the folder %APPDATA%. See 3.2.7 Recent Projects List.

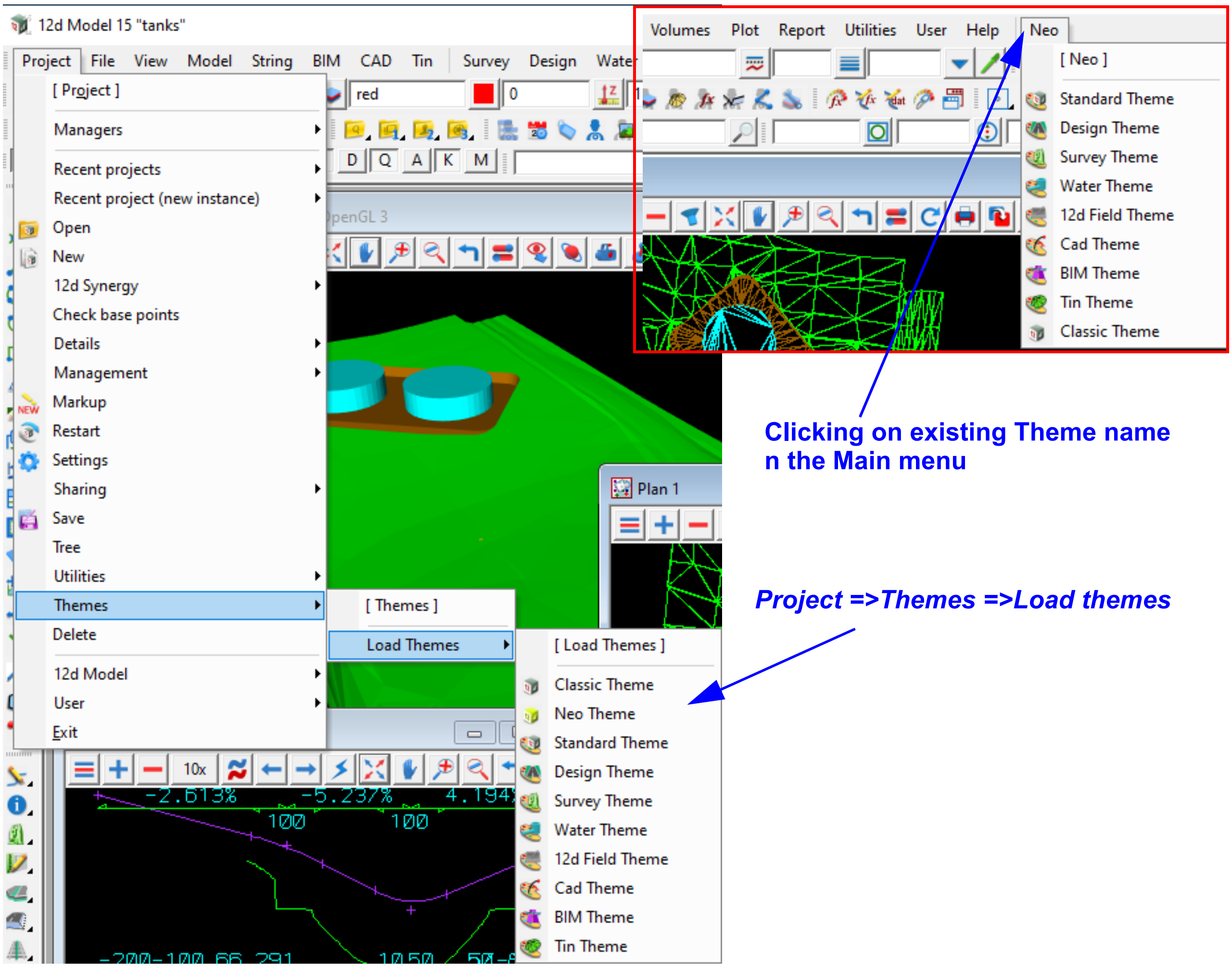
Continue to 6.2 Themes or return to 6 Project.

6.2 Themes

Position of option on menu: Project =>Themes

The **Themes** option changes the ***Theme*** being used for ***12d Model***.

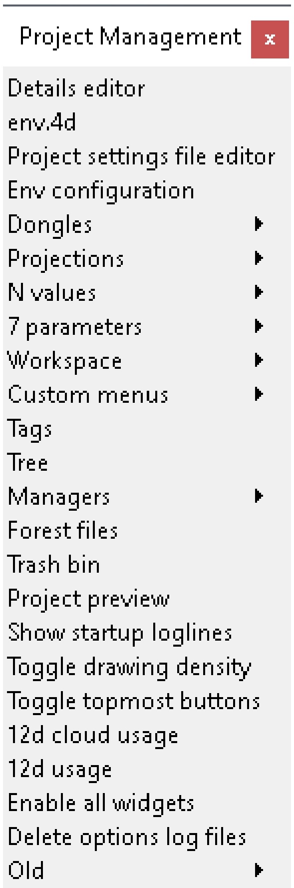
Selecting a new Theme from the **Themes** menu removes all the menus and toolbars for the current Theme and replaces them with the selected Theme.



Continue to 6.3 Management or return to 6 Project.

6.3 Management

There has been the following additions to the **Project Management** menu:



6.3.1 Create/Edit env.4d

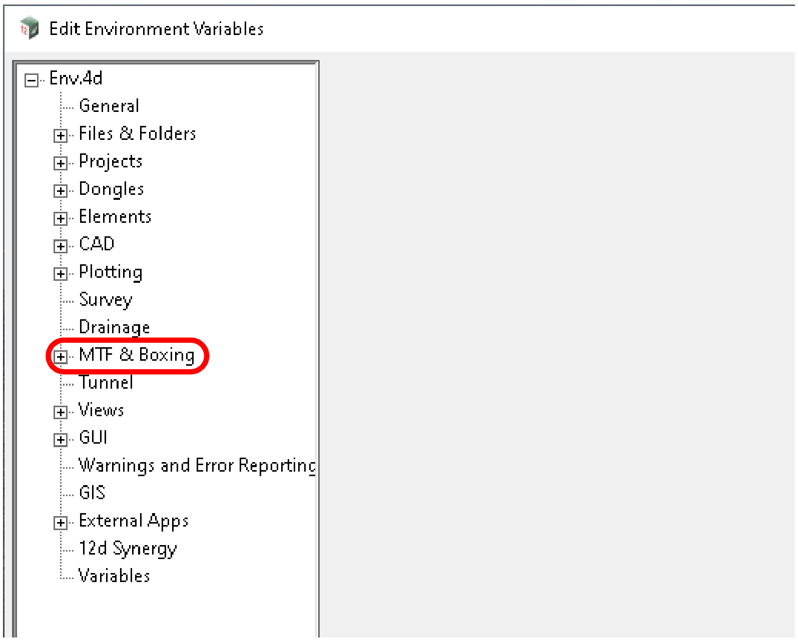
6.3.2 Projections

6.3.3 Create/Edit N-Value Definitions

6.3.1 Create/Edit env.4d

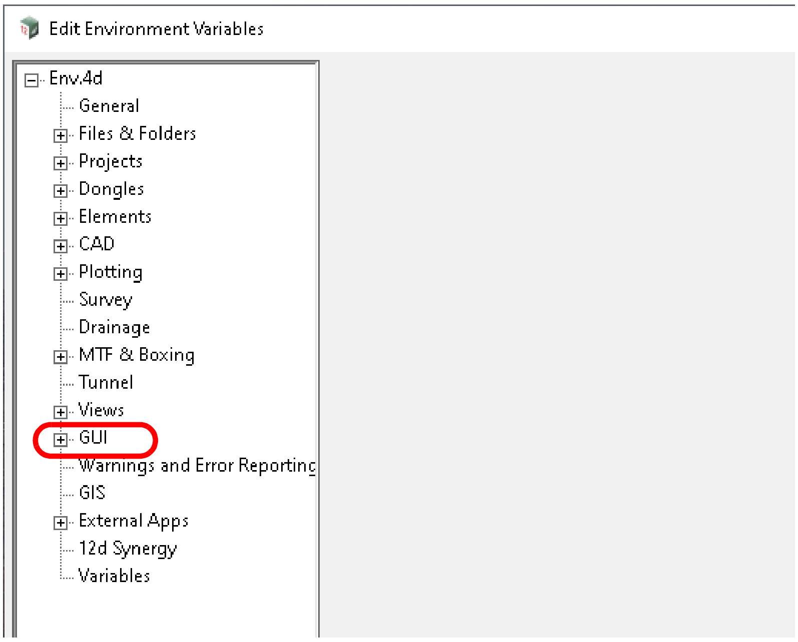
Position of option on menu: **Project =>Management =>env.4d**

Selecting **env.4d** displays the **Edit Environmental Variables** panel.



Show convert chainages to dropped xy in ’Edit now’ menu tick box ticked

*If **ticked**, when RB on the row number column in the template modifiers edit panel the option to convert the highlighted chainage/s to Drop Point to Reference String smart chainages will be shown.*



GUI > Topmost buttons

Use topmost buttons tick box

*If **ticked**, topmost buttons will be displayed.*

Visible buttons/text input default blank

The list of buttons and screen text for the buttons to display.

Position choice box

If basic orientation of the buttons, vertical left/right or horizontal from top of screen.

Side offset integer box

*If **not blank**, the offset from the left/right of the screen.*

Top offset integer box

*If **not blank**, the offset from the top of the screen.*

Button width integer box

*If **not blank**, the width of the button.*

Button height integer box

*If **not blank**, the height of the button.*

Gap between buttons integer box

*If **not blank**, the gap between buttons.*

Transparency (0-255) integer box

*If **not blank**, the transparency applied to the buttons.*

Continue to 6.3.2 Projections or return to 6.3 Management or 6 Project.

6.3.2 Projections

Position of option on menu: **Project =>Management =>Projections**

In ***12d Model 14*,** the list of projections that could be selected were defined in the one file **carto.4d** which was searched for in the standard user search order **Working folder**, **Customer User folder** (if it exists), **User folder** and finally **set_ups** folder. As soon as a **carto.4d** was found, that one file was used and the search stopped.

This meant that if users wanted to add their own projections, or not include some that are in the shipped **carto.4d** in **set_ups,** users had to create their own carto.4d and place it in one of **Working folder**, **Customer User folder** (if it exists), or **User folder**.

This has been changed for ***12d Model 15***.

In ***12d Model 15***, **carto.4d** has been replaced by a new file **carto.12dcarto** which has more information about the projections than in **carto.4d.**

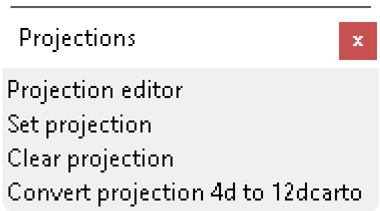
However the major difference is that the projection list is no longer coming from just the one file, but is accumulated from the **carto.12dcarto** files in **Working folder**, **Customer User folder** (if it exists), **User folder** and **set_ups folder**.

And if there is a projection of the same name, the one in **Working folder** takes priority over the one in **Customer User folder**, which takes priority over the one in **User folder,** which takes priority over the one in **Set_ups** folder.

Finally because of the accumulation, the projections in **set_ups** are always be included and so to limit the projections from **set_ups** appearing in the projection list, there are filters to restrict the ones that are included.

Consequently you no longer need to touch the ***carto.12dcarto*** file in ***set_ups***.

Similarly there are filters for the ones from the **Working folder**, **Customer User folder** and **User folder**.



See
6.3.2.1 Projection Editor
6.3.2.2 Set Projection
6.3.2.3 Clear Projection
6.3.2.4 4 Convert projection 4d to 12dcarto

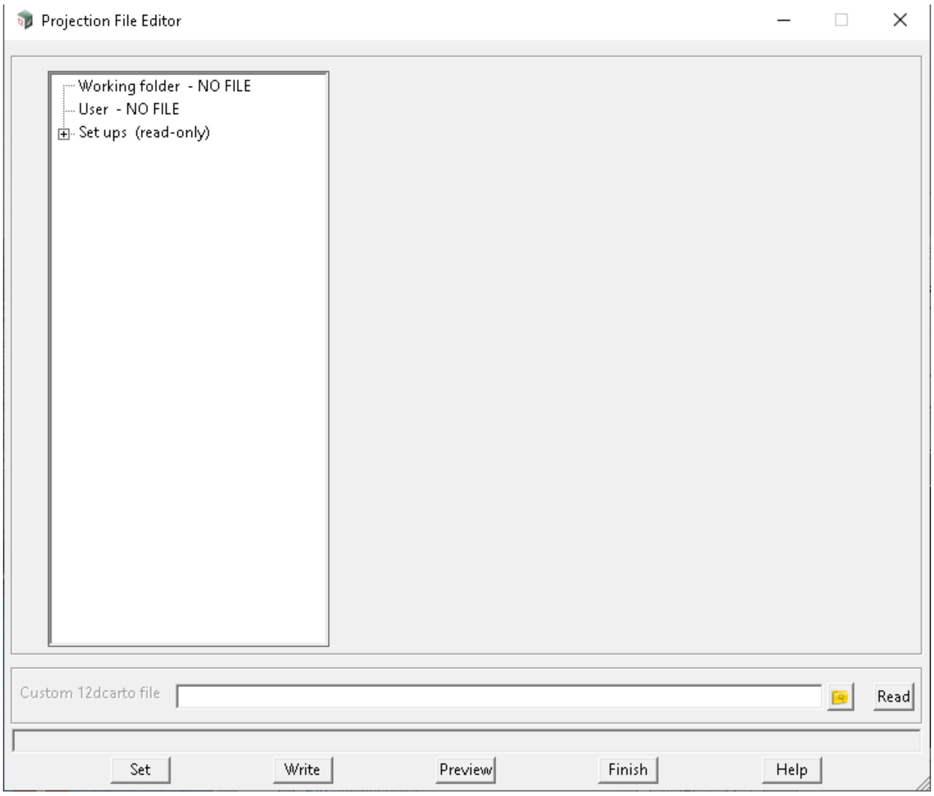
6.3.2.1 Projection Editor

Position of option on menu: **Project => Management => Projections => Projection editor**

The ***Projection File Editor*** edits the ***12dcarto*** files in either the **Working folder**, **Customer User folder** (if it exists) or the **User folder**. No file can be edited in the **set_ups folder**.

However in the editor, projections in the **set_ups** folder can be copied into files in the other folders.

Selecting **Projection editor** brings up the **Projection File Editor** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Custom projection .12dcarto	file box	*.12dcarto files	

A custom 12dcarto file can be imported for editing by using this file box.

Read	button		

Read in the custom projection file.

See 6.3.2.1.1 Root Folder.

See 6.3.2.1.2 Group of Projections.

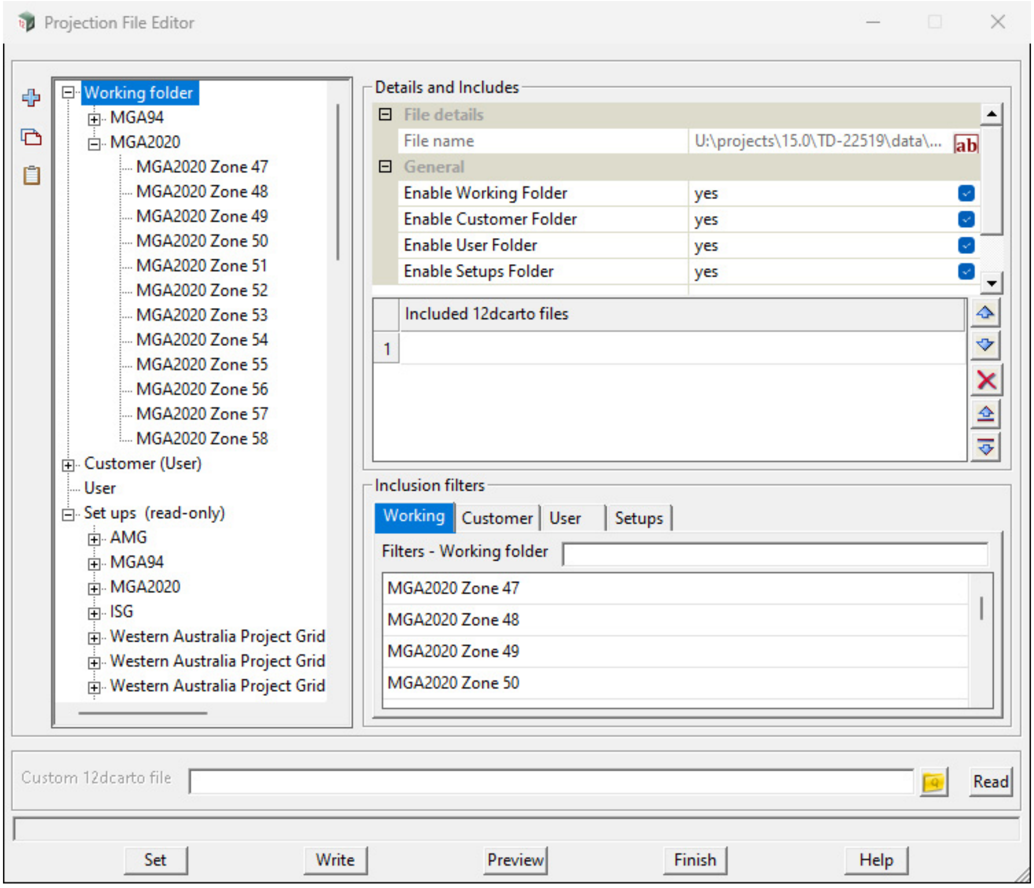
See 6.3.2.1.3 Projection.

See 6.3.2.1.4 Special Functionality.

6.3.2.1.1 Root Folder

If any folder is selected, the panel will display as:

The fields and buttons used in this panel have the following functions.



Field Description Type Defaults Pop-Up

Details and Includes

File name text box

Showing the path to the file's location.

Enable Working Folder tick box ticked

*If **ticked**, all Projection from **Working folder** will be included in Projection choice box pop-up (Projection Box).*

Enable Customer Folder Folder tick box ticked

*If **ticked**, all Projection from User folder will be included in Projection choice box pop-up (Projection Box).*

Enable User Folder tick box ticked

*If **ticked**, all Projection from **User folder** will be included in Projection choice box pop-up (Projection Box).*

Enable Setups Folder tick box ticked

*If **ticked**, all Projection from **Setups folder** will be included in Projection choice box pop-up (Projection Box).*

***Note**: See* 6.3.2.1.4 Special Functionality *for more detail on Enable/disable each folder.*

Inclusion Filter

Filter - Working folder search box

*If **filled**, Projection Box will only include those projection from **Working Folder** that contain the filled* *content.*

Filter - User folder search box

*If **filled**, Projection Box will only include those projection from **User Folder** that contain the filled content.*

Filter - Setups folder search box

*If **filled**, Projection Box will only include those projection from **Setups Folder** that contain the filled content.*

Filter - Customer folder search box

*If **filled**, Projection Box will only include those projection from User Folder that contain the filled content.*

Buttons

Set button

Select this button after any change to the panel so set change.

Write button

Permanently saves all changes to the file.

Preview button

*Bring up **Preview Projection Choices** panel to check the origin of each projection in the choice box pop up Projection Box.*

***Note**: see* 6.3.2.1.4 Special Functionality *for more detail on **Preview Projection Choices** panel.*

Finish button

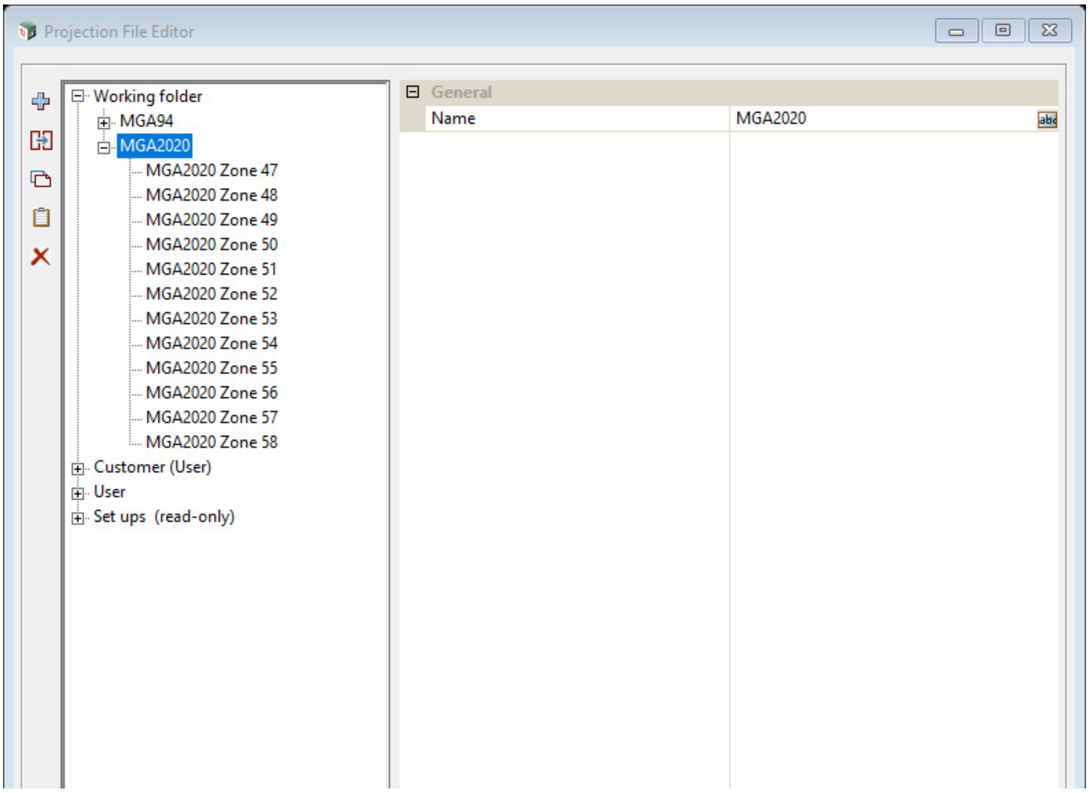
Finish editing, close down the panel.

Note: The file is structured as a tree where the top node is the file itself. The top node can have 2 types of children as 6.3.2.1.3 Projection and/or 6.3.2.1.2 Group of Projections.

Continue to 6.3.2.1.2 Group of Projections or return to 6.3.2.1 Projection Editor or 6.3.2 Projections.

6.3.2.1.2 Group of Projections

When selecting a group the panel will display:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Name	text box		

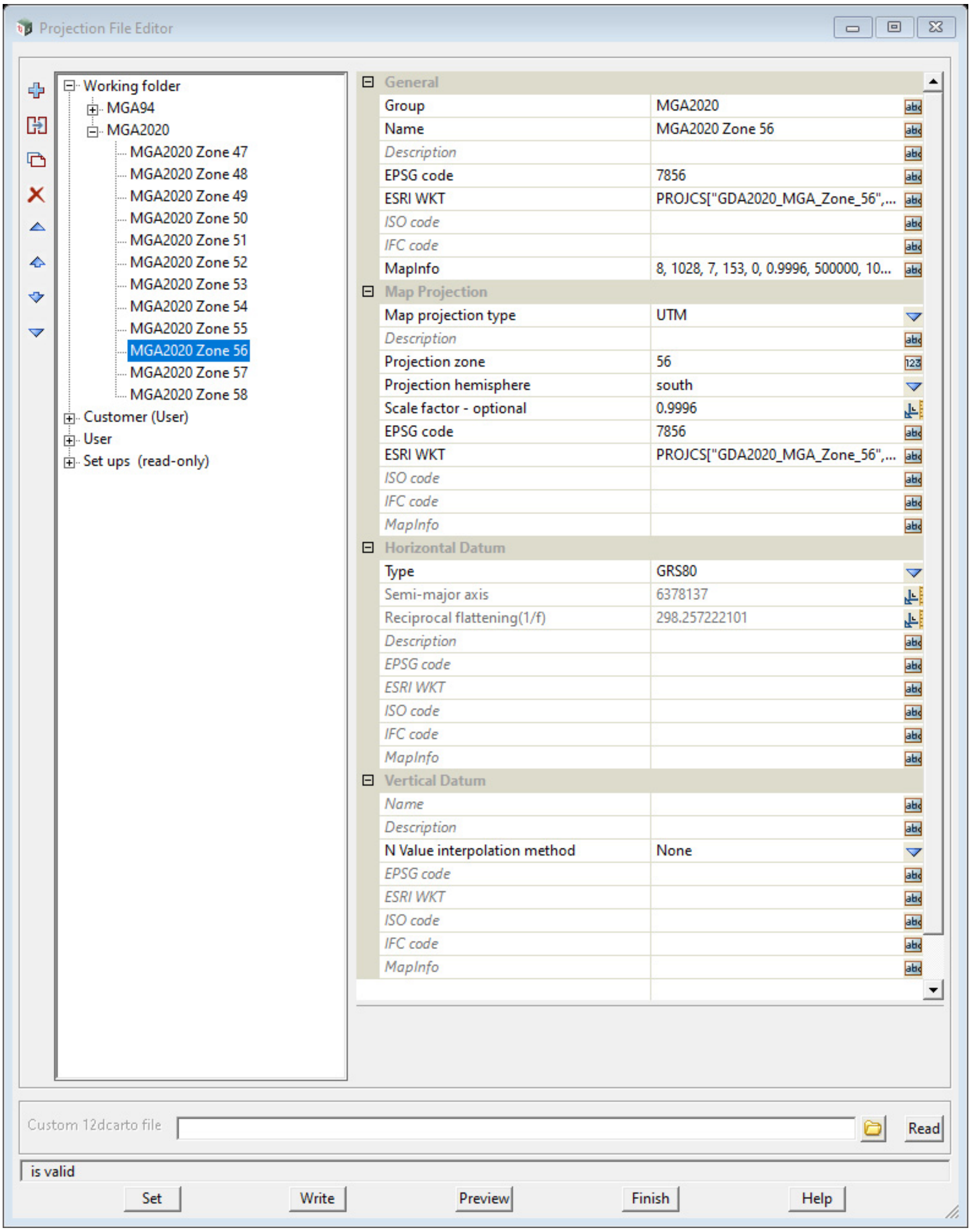
The name of the group.

Note: Each of the **group of projections** node also has 1 or many 6.3.2.1.3 Projection.

Continue to 6.3.2.1.3 Projection or return to 6.3.2.1 Projection Editor or 6.3.2 Projections.

6.3.2.1.3 Projection

Selecting **Projection** displays the **Project FIle Editor** panel:



When clicking on a projection on the left hand side, information about the selected projection is displayed on the right hand side of the panel.

The area on the right hand side are:

(a) General

General information about the projection. See General for more information.

(b) Map Projection

Information about map projection type used in this projection. See Map Projection for more information.

(c) Horizontal Datum

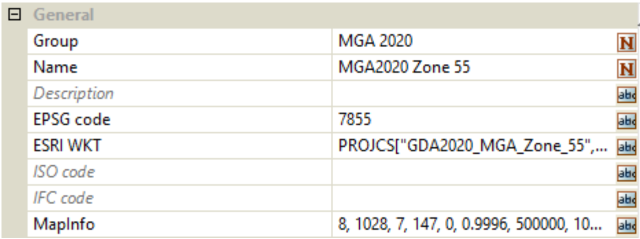
Information about ellipsoid used in this projection. See Horizontal Datum for more information.

(d) Vertical Datum

N value interpolation method used in this projection. See Vertical Datum for more information.

Depending on the type of ellipsoid and map projection, different fields need to be filled in.

General



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Group	name box	optional	
Name of group where this projection belongs to.			
Name	name box		
*Name of projection **(must be unique)**.*			
Description	text box	optional	
Description of the projection.			
EPSG code	text box	optional	
*The **EPSG** code for this projection.*			
ISO code	text box	optional	
*The **ISO** code for this projection.*			
ESRI WKT	text box	optional	
*The **ESRI WKT** format for this projection.*			
IFC code	text box	optional	
*The **IFC code** for this projection.*			
Map Info	text box	optional	
***MapInfo** for this projection.*			

Map Projection

There are 4 supported types, 1 **General** type to support manual input of proj strings and 1 **None** type to show all available supported parameters.

4 supported types are:

Transverse Mercator - *see* Transverse Mercator

UTM - see UTM

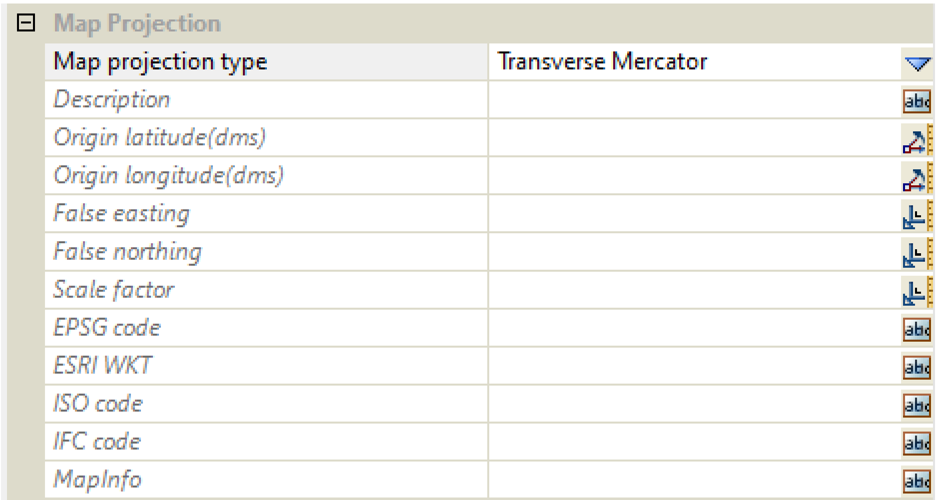
RSO - *see* RSO

Lambert Conformal - *see* Lambert Conformal

See Generals for information on **General** type.

See None Type for information on **None** type.

Transverse Mercator



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Origin latitude (dms)	angle box	optional	

Latitude of projection centre (+lat_0). If blank, default to 0.0

Field Description	Type	Defaults	Pop-Up
Origin longitude (dms)	angle box	optional	

Longitude of projection centre (+lon_0). If blank, default to 0.0

Field Description	Type	Defaults	Pop-Up
False Easting	double box	optional	

False easting (+x_0). If blank, default to 0.0

Field Description	Type	Defaults	Pop-Up
False Northing	double box	optional	

False northing (+y_0). If blank, default to 0.0

Field Description	Type	Defaults	Pop-Up
Scale factor	double box	optional	

Scale factor used in the projection (+k_0).
*If **blank**, default to 1.0*

Field Description	Type	Defaults	Pop-Up
EPSG code	text box	optional	

The EPSG code of the projection.

ESRI WKT text box optional

The ESRI WKT format of proj for this projection.

ISO code text box optional

The ISO code of the projection.

IFC code text box optional

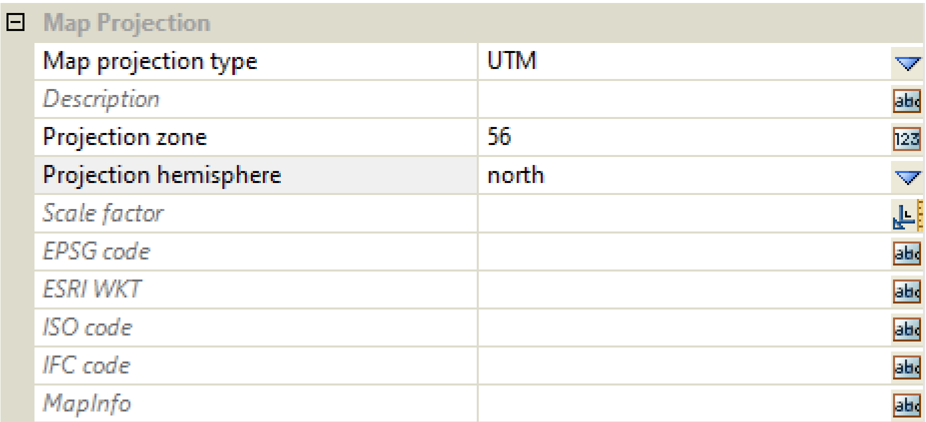
The IFC code of the projection.

Mapinfo text box optional

MapInfo of the projection.

For more information about Transverse Mercator, see [https://proj.org/operations/projections/tmerc.html.](https://proj.org/operations/projections/tmerc.html)

UTM



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Projection zone angle box optional

The UTM zone (+zone). Value can be from 1 to 60.

Projection hemisphere choice box north North, South

The hemisphere of which the projection is on.

Scale factor double box optional

Scale factor used in the projection (+k_0).
*If **blank**, default to 0.9996.*

EPSG code text box optional

The EPSG code of the projection.

ESRI WKT text box optional

The ESRI WKT format of proj for this projection.

ISO code text box optional

The ISO code of the projection.

IFC code text box optional

The IFC code of the projection.

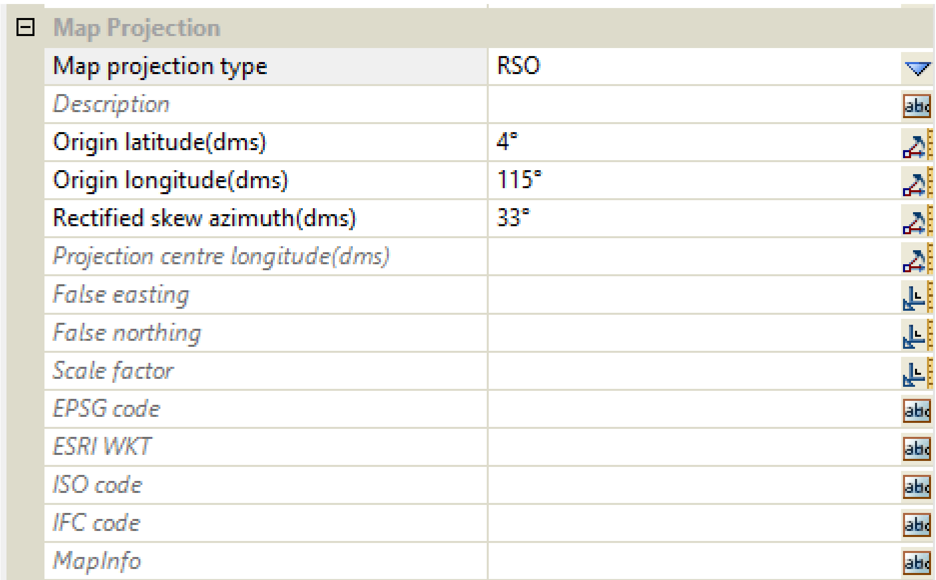
Mapinfo text box optional

MapInfo of the projection.

For more information about UTM projection, see https://proj.org/operations/projections/utm.html.

RSO

The editor can only handle Central point and azimuth method. For the use of Two point method, please use General type to manually input required parameters.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Original latitude (dms) angle box optional

Latitude of central point (+lat_0).

Original longitude (dms) angle box optional

Longitude of central point (+lonc).

Rectified skew azimuth (dms) angle box optional

Azimuth of centreline clockwise from north at the centre point of the line (+alpha).

False Easting double box optional

False easting (+x_0). If blank, default to 0.0

False Northing double box optional

False northing (+y_0). If blank, default to 0.0

Scale factor double box optional

Scale factor used in the projection (+k_0).

*If **blank**, default to 1.0*

EPSG code text box optional

The EPSG code of the projection.

ESRI WKT text box optional

The ESRI WKT format of proj for this projection.

ISO code text box optional

The ISO code of the projection.

IFC code text box optional

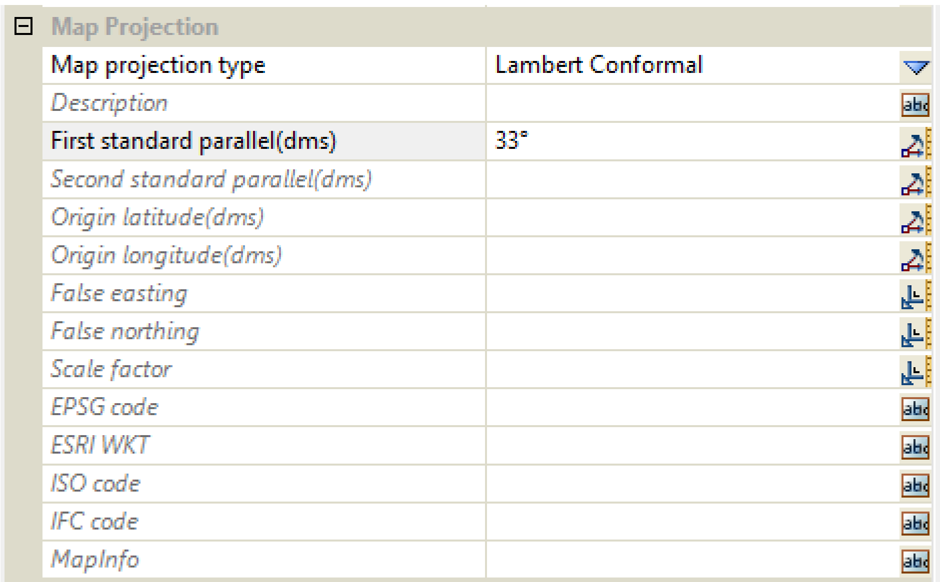
The IFC code of the projection.

Mapinfo text box optional

MapInfo of the projection.

For more information about RSO, see https://proj.org/operations/projections/omerc.html.

Lambert Conformal



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

First standard parallel (dms) angle box optional

First standard parallel (+lat_1).

Second standard parallel (dms) angle box optional

*Second standard parallel (+lat_2). If **blank**, default to 0.0.*

Origin latitude (dms) angle box optional

*Latitude of projection centre (+lat_0). If **blank**, default to 0.0*

Origin longitude (dms) angle box optional

*Longitude of projection centre (+lon_0). If **blank**, default to 0.0*

False Easting double box optional

*False easting (+x_0). If **blank**, default to 0.0*

False Northing double box optional

*False northing (+y_0). If **blank**, default to 0.0*

Scale factor double box optional

*Scale factor used in the projection (+k_0). If **blank**, default to 1.0*

EPSG code text box optional

The EPSG code of the projection.

ESRI WKT text box optional

The ESRI WKT format of proj for this projection.

ISO code text box optional

The ISO code of the projection.

IFC code text box optional

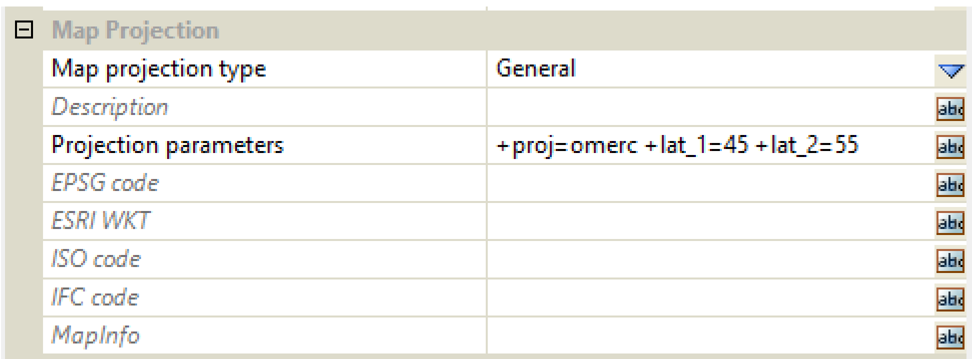
The IFC code of the projection.

Mapinfo text box optional

MapInfo of the projection.

For more information about Lambert Conformal, see https://proj.org/operations/projections/lcc.html.

Generals



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Projection parameter text box optional

Contains the proj string for any unavailable projections in **12d Model**.

EPSG code text box optional

The EPSG code of the projection.

ESRI WKT text box optional

The ESRI WKT format of proj for this projection.

ISO code text box optional

The ISO code of the projection.

IFC code text box optional

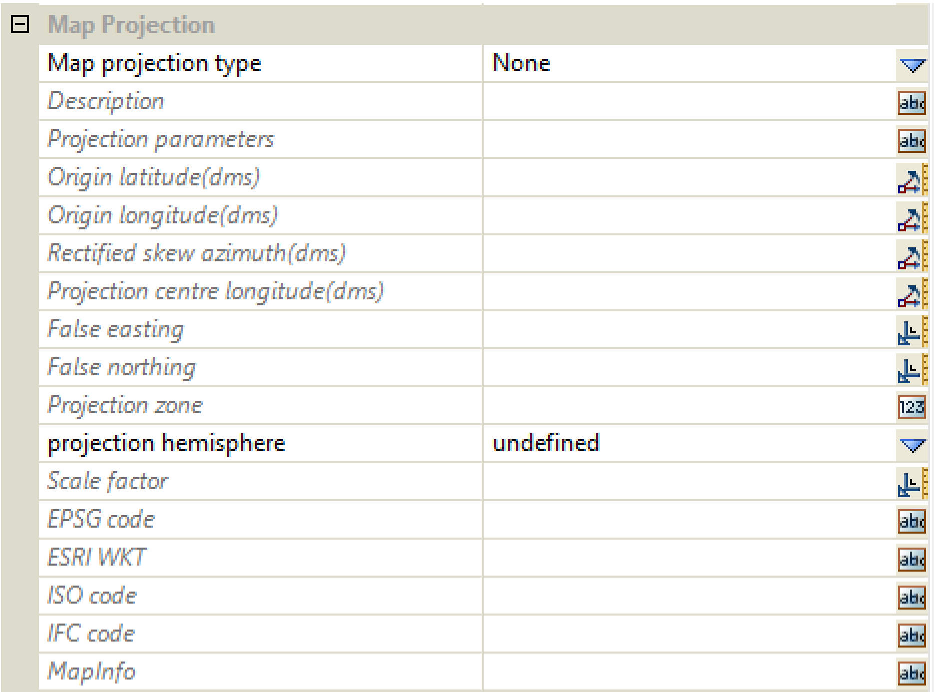
The IFC code of the projection.

Mapinfo text box optional

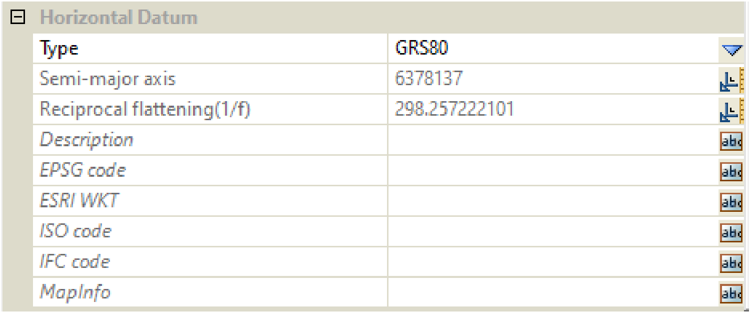
MapInfo of the projection.

None Type

None type shows all available parameters within ***12d Model***. However, if None type is used, 12d won't be able to generate proj string from input parameters. Please use **General** type for any unavailable types.



Horizontal Datum



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Type	choice box		Airy1830, Airy1839(Modified) ANS, GRS80 International 1924(aka Hayford 1909) NZ Geodetic 1949(Adjusted) Timbalai Everest 1830(Modified) Everest 1830(1967 Definition) WGS72, WGS84, Custom

*if **Custom** is chosen, **Semi-major axis** and **Reciprocal flattening** can be defined by user.*

*If other ellipsoids are chosen, the parameters for that ellipsoid are displayed in **Semi-major axis** and **Reciprocal flattening**.*

Semi-major axis	double box	read only	

*If **Custom** is selected, read-write is enabled.*

Reciprocal flattening (1/f)	double box	read only	

*If **Custom** is selected, read-write is enabled.*

EPSG code	text box	optional	

EPSG code of the ellipsoid.

ISO code	text box	optional	

ISO code of the ellipsoid.

ESRI code	text box	optional	

ESRI WKT of the ellipsoid.

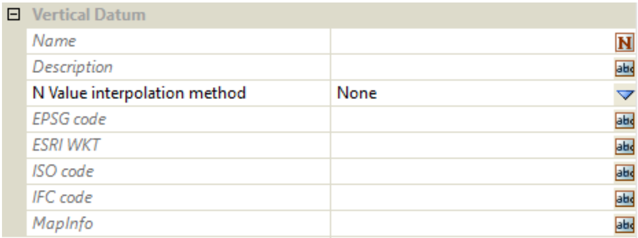
IFC code	text box	optional	

IFC code of the ellipsoid.

Map Info	text box	optional	

Mapinfo of the ellipsoid.

Vertical Datum



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
N value interpolation method	choice box	optional	all defined N values

N value interpolation method for projection. The choices can be setup using N value settings.

EPSG code	text box	optional	EPSG code

*The **EPSG** code of the vertical datum.*

ISO code	text box	optional	ISO code

*The **ISO** code of the vertical datum.*

ESRI code	text box	optional	ESRI code

*The **ESRI WKT** format of proj for this vertical datum.*

IFC code	text box	optional	IFC code

*The **IFC** code of the vertical datum.*

Map Info	text box	optional	Map Info

MapInfo of the vertical datum.

Continue to 6.3.2.1.4 Special Functionality or return to 6.3.2.1 Projection Editor or 6.3.2 Projections.

6.3.2.1.4 Special Functionality

Note: the priority of execution is **from top to bottom.**

That is, **Working folder** takes priority over **User folder** which takes priority over **Setups folder**.

The **Projection choice box** displays all the projections from the *Working folder*, *User Folder* and *Setups folder* subject to:

(a) If there are projections with the same name, the choice box will only display the one with higher priority.

(b) If a folder is disabled via the enable/disable functionality in the Projection editor, the choice box will ignore that folder.

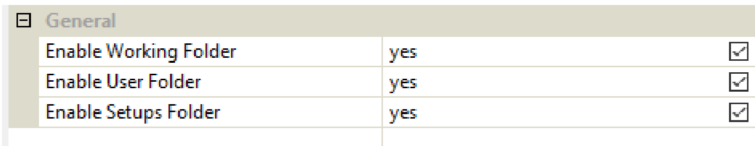
(c) If an **Inclusion filter** is used for a specific folder, the choice box will only include those from the folder which contain the inclusion filter content.

See Enable/Disable a Folder.

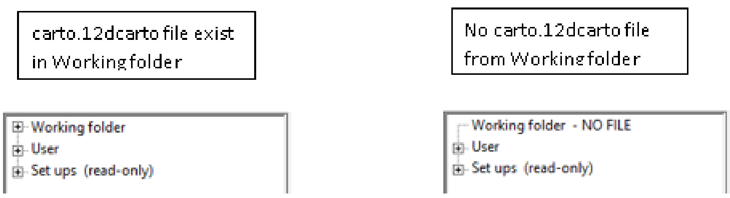
See Inclusion Filter.

See Preview Projection Choices Panel.

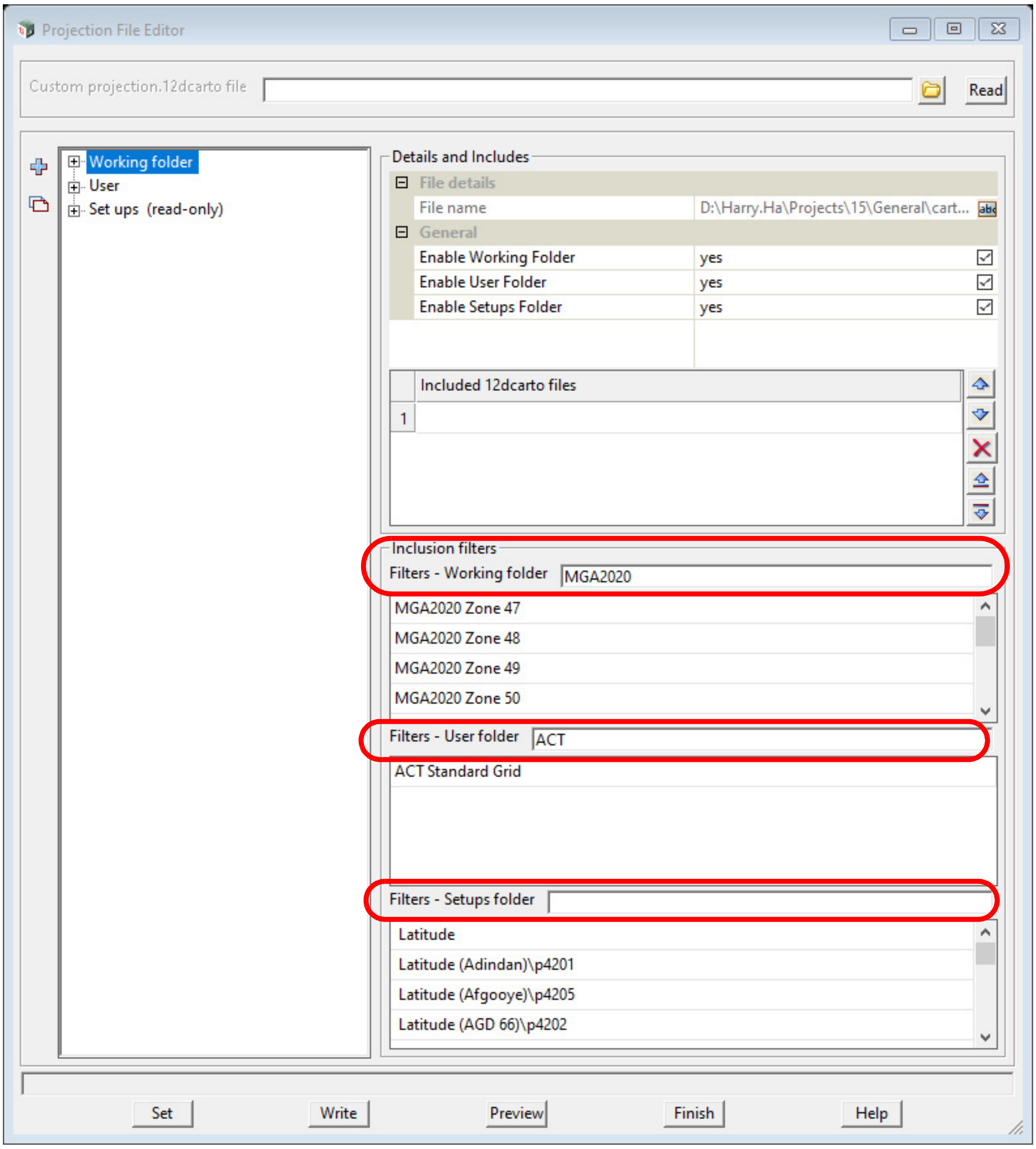
Enable/Disable a Folder



*The enable/disable setting will be used from the top priority folder that is available. For example, if **Working folder** exists, enable/disable will use the setting from **working folder**. If there is no **Working Folder** (indicate with "NO FILE", shown in image below), enable/disable functionality will use the setting from **User folder**.*



Inclusion Filter

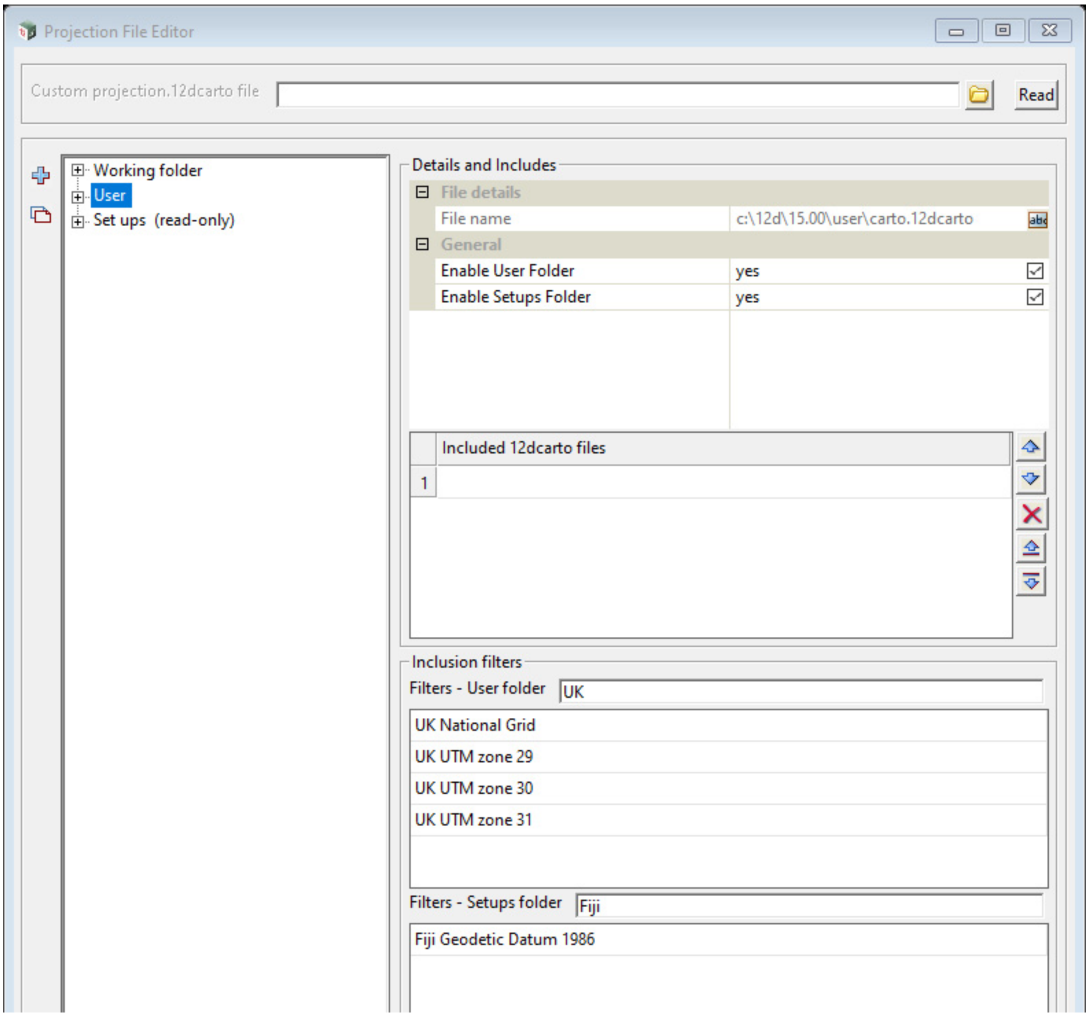


*The Inclusion filter will get the filter from the top priority folder that is available first. In this case, the top priority is **Working Folder**. How text typed into the Filters field is interpreted is described in* 6.3.2.1.5 Inclusion Filters Syntax.

*In the example above, the **Inclusion Filters** mean that*

> ***Working Folder**: only include projections in the carto12d file in the Working folder that contain the text "mga2020" in the projection name*
>
> ***User Folder**: only include projections in the carto12d file in the User folder that contain the text "ACT" in the projection name*
>
> *The filter for **Setups Folder** is empty.*

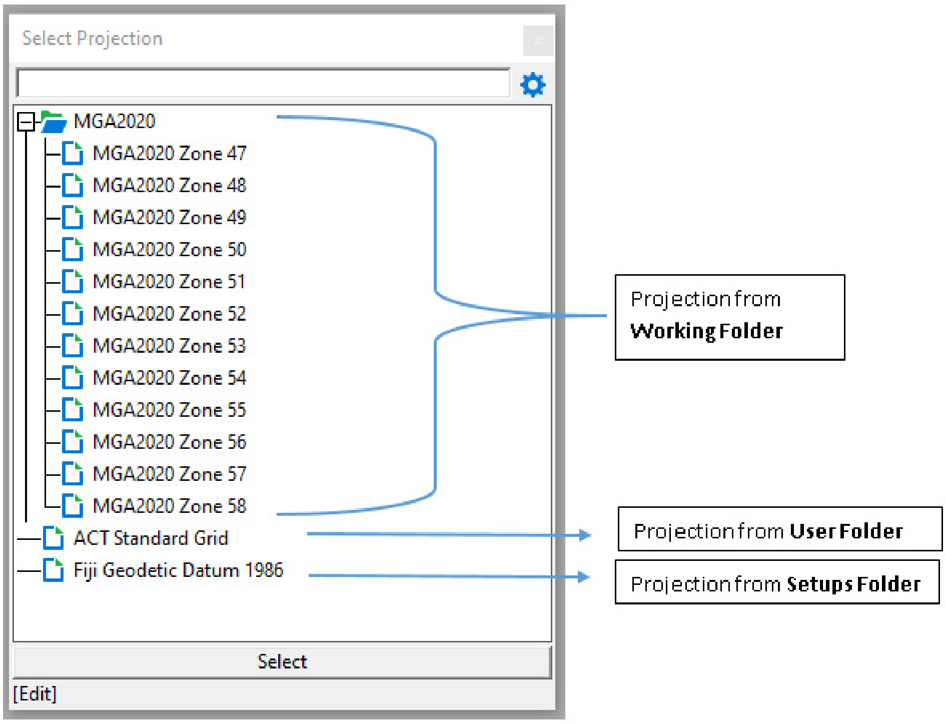
*If there is an empty filter (**Setups Folder** in this example), the projection choice box will look for the filter in the next priority location that is available (in this case, **User**).*



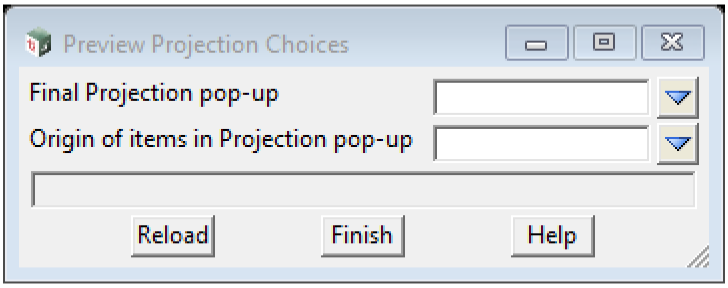
*In **User** (next priority location), there are 2 filters:*

> ***User Folder** has "UK" filter. However, this filter will be ignored because **User Folder filter** has been used by the higher priority folder*
>
> ***Setups Folder** has "Fiji" filter. The Projection choice box will use this filter because **Setups Folder filter** was not used in the higher priority location. The Projection choice box will take those **Setups folder** that contain the keyword "Fiji"*

The results of applying the filters in the example above are:


Select Projection
MGA2020
MGA2020 Zone 47
MGA2020 Zone 48
MGA2020 Zone 49
MGA2020 Zone 50
MGA2020 Zone 51
MGA2020 Zone 52
MGA2020 Zone 53
MGA2020 Zone 54
MGA2020 Zone 55
MGA2020 Zone 56
MGA2020 Zone 57
MGA2020 Zone 58
ACT Standard Grid
Fiji Geodetic Datum 1986
Select
[Edit]
Projection from Working Folder
Projection from User Folder
Projection from Setups Folder

Preview Projection Choices Panel



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Final Projection pop-up choice box

Show all projection with applied enable/disable setting, and filters.

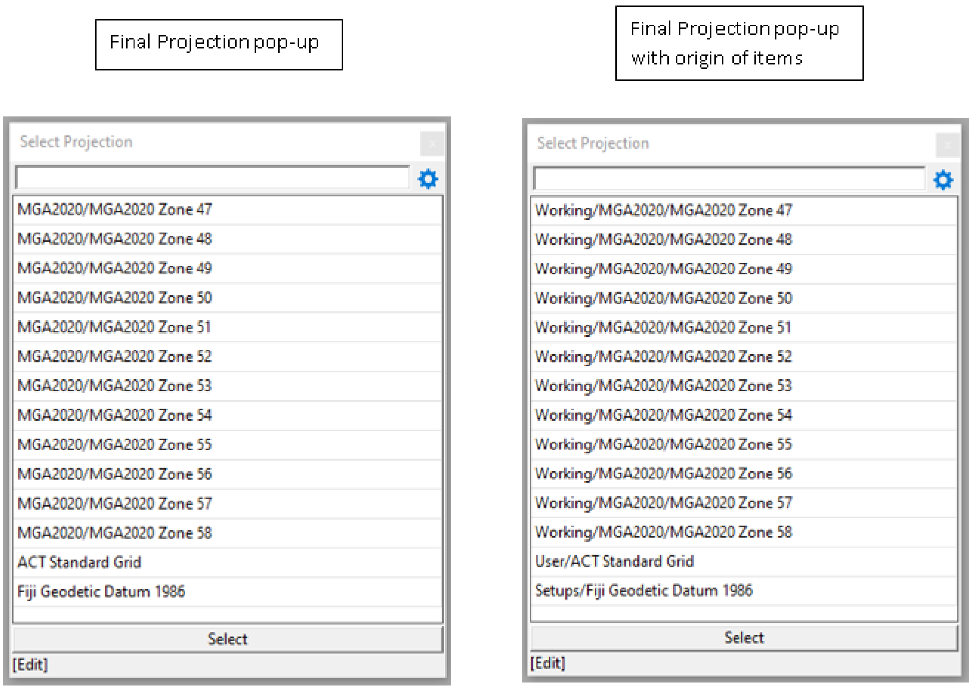
Origin of items in Projection pop-up choice box

*Show all projection same as **Final Projection pop-up**, with extra information about the origin of each projection.*

Buttons at Bottom

Reload button

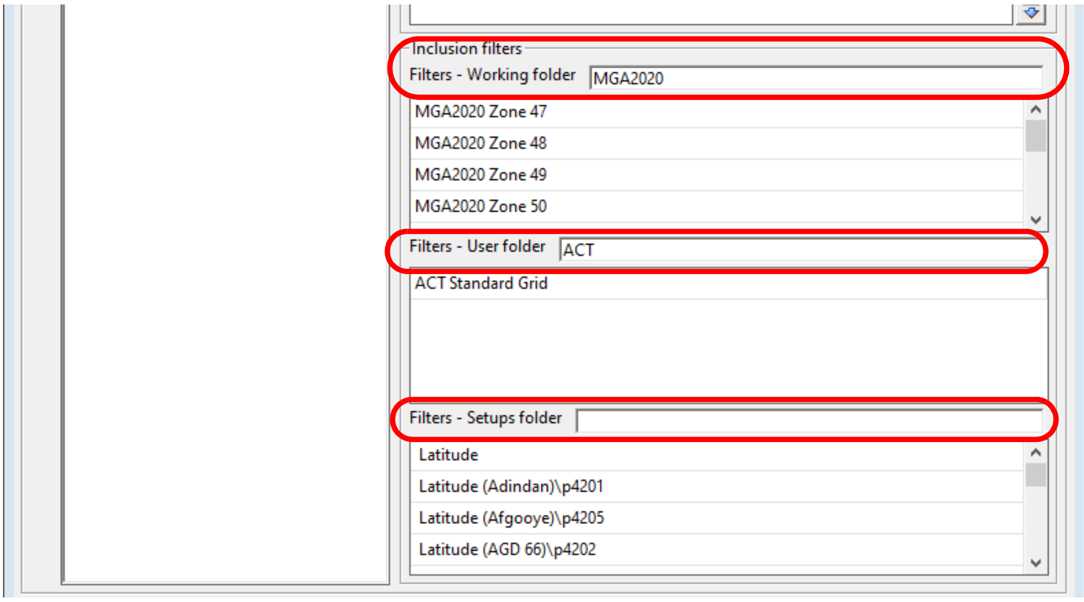
To reload after changes/updates to projection editor settings.



Continue to 6.3.2.1.5 Inclusion Filters Syntax or return to 6.3.2.1 Projection Editor or 6.3.2 Projections.

6.3.2.1.5 Inclusion Filters Syntax

The text in the fields for the ***Inclusion Filters*** determine what projections are selected from the carto12d file that is in the corresponding folder ***Working***, ***Custom***, ***User*** or ***Setups***.



The **Filters** fields uses **key text** separated by the logic operators ***comma*** ",", ***plus*** "+" or ***minus*** "-", to determine a subset of matches amongst all the projections in the particular folder.

The matches for the **key text** are **case insensitive** and **partial**.

The key text can included spaces which must then be part of the match.

For example **MGA Zone 47** will **MGA Zone 47 (GDA 94)** but not **MGA Zone 48.**

The **logic operations** are interpreted as follows:

AND use **plus** '+'

For example:

X+Y will also search for text that contain **BOTH X and Y**.

That is, the search will return only results that have both X and Y in them.

OR use **comma** ','

For example:

X,Y will search for text that contain **EITHER X or Y** or **BOTH X and Y.**

That is, the search will return results that have X or Y, or both X and Y in them.

NOT use **minus** '-'

For example:

-X will exclude text that has **X in them**

That is, the search will return results that don't contain X.

The syntax is evaluated from left to right.

That is, you can have things like:

X Y,Z-A

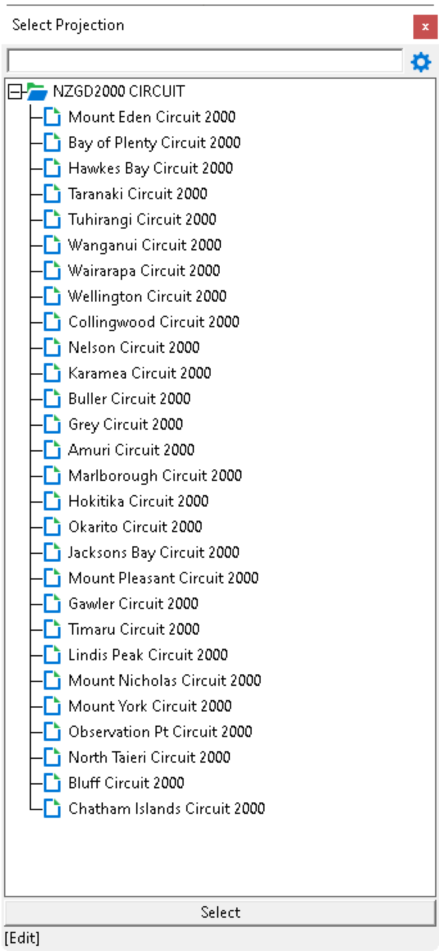
which means the search will find text with

(X space Y) or Z, but none of them containing A

For example, the text

circuit 2000-wellington

will select the New Zealand Circuits for 2000 but leave out the one for Wellington.



Important Notes

1. The match is **case insensitive** and **partial**.
2. It is **key text** and not **key words** as used in the **Options Search Bar**.

   The difference is crucial because **key text** can include spaces which **must be part of the match** whereas in the **Options Search Bar**, the space between **key words** is an **AND** logic operation.
3. **X Y** (that is X space Y) is different to **X+Y**

   X Y looks for projection names containing **X space Y** somewhere in the name

   X+Y looks for projection names that contain **X somewhere** in the names **and** also **Y somewhere** in the name.

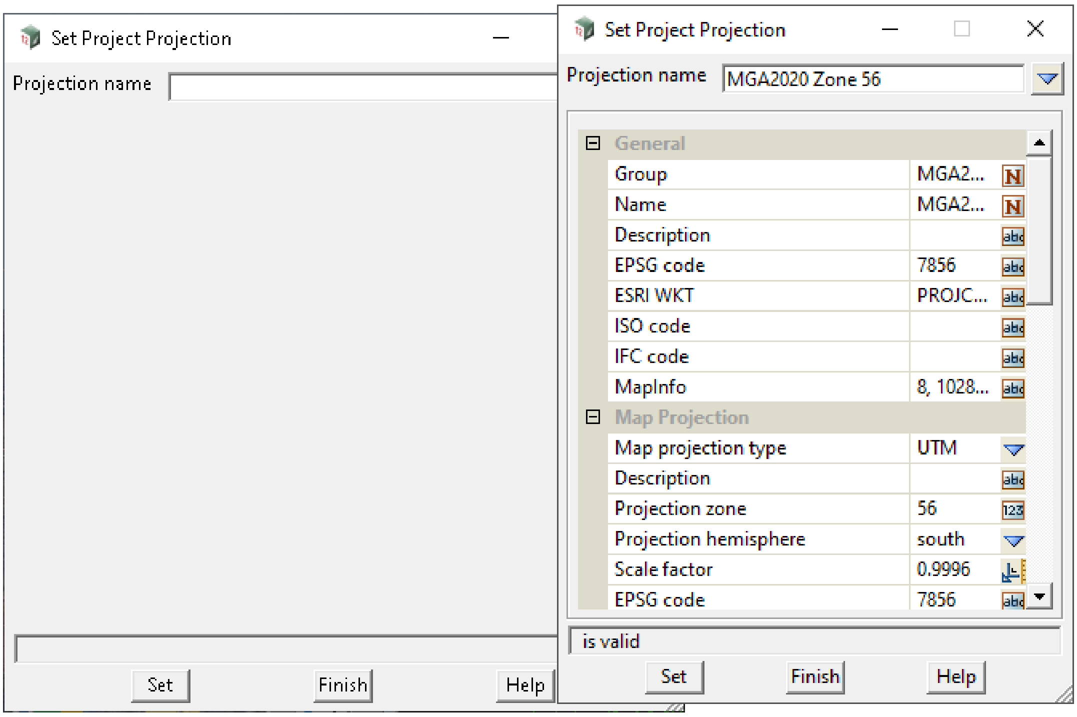
Continue to 6.3.2.2 Set Projection or return to 6.3.2.1 Projection Editor or 6.3.2 Projections.

6.3.2.2 Set Projection

Position of option on menu: **Project => Management => Projections => Set projections**

This option is used to set the projection for the project.

Selecting **Set projection** brings up the **Set project projection** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Projection name	choice box		all defined projections

The projection that is to be saved at the projection for the project.
When a projection is selected from the pop-up of available projections, the information about the selected projection is displayed on the panel. See the above example for ***MGA2020 Zone 56***

Buttons at Bottom

Set	button

Set the projection for the project.

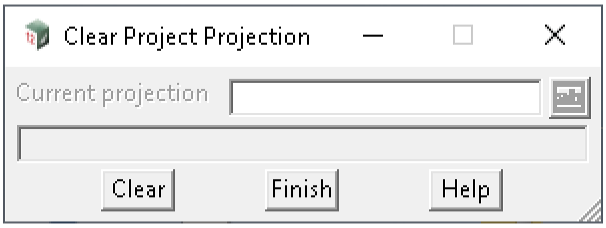
Continue to 6.3.2.3 Clear Projection or return to 6.3.2 Projections or 6.3 Management.

6.3.2.3 Clear Projection

Position of option on menu: **Project => Management => Projections => Clear projection**

This option removes the Project Projection.

Selecting **Clear projection** brings up the **Clear project projection** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Current projection	choice box		

Name of the current projection set for the project.

Buttons at Bottom

Clear	button

Remove the current projection from the project.

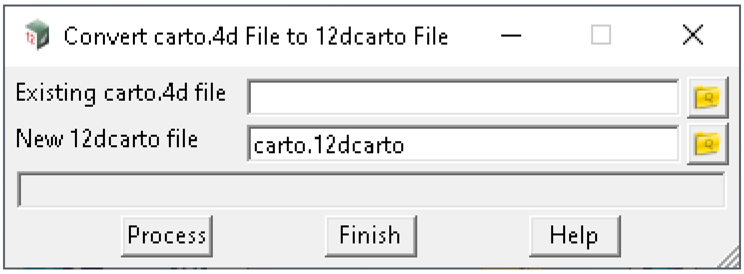
Continue to 6.3.2.4 4 Convert projection 4d to 12dcarto or return to 6.3.2 Projections or 6.3 Management.

6.3.2.4 4 Convert projection 4d to 12dcarto

Position of option on menu: **Project => Management => Projections => Convert projection 4d to 12dcarto**

This option converts your custom file carto.4d to the XML file carto.12dcarto

Selecting **Convert projection 4d to 12dcarto** brings up the **Convert carto File from 4d to XML Format** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Existing carto.4d file	file box		*.4d files

Choose old carto file (4d format) to convert into new carto file (12dcarto format).

New 12dcarto file	file box		*.12dcarto files

New name for the converted carto file. New carto file will have format 12dcarto.

Buttons at Bottom

Process button

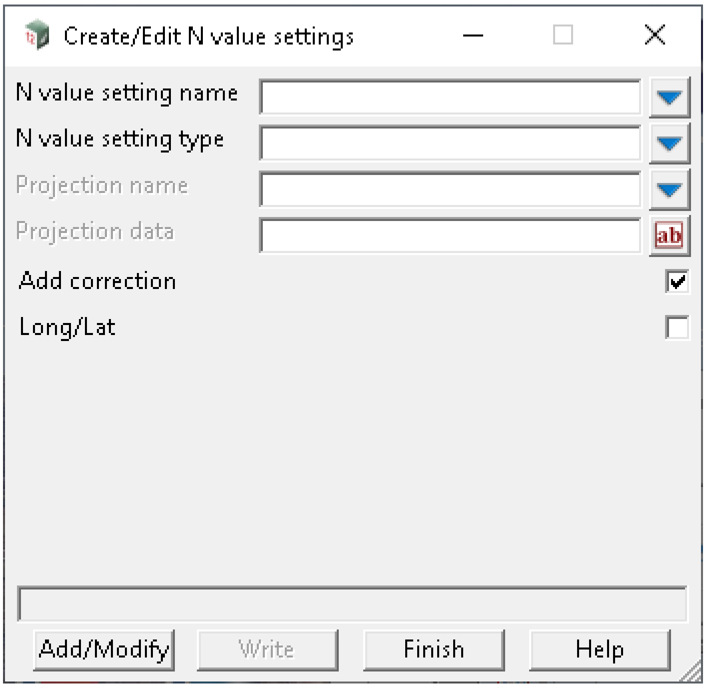
*On **process**, the old carto file will be converted into 12dcarto file with the XML format.*

Continue to 6.3.3 Create/Edit N-Value Definitions or return to 6.3.2 Projections or 6.3 Management.

6.3.3 Create/Edit N-Value Definitions

Position of option on menu: **Project =>Management =>N values =>Create/Edit**

On selecting the **Create/edit** option, the **Create/edit N value settings** panel is displayed.

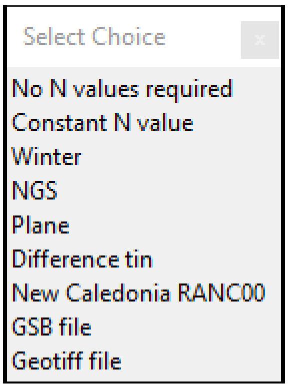


Field Description	Type	Defaults	Pop-Up
N value setting name	choice box		all defined N value settings

Name of the n value setting to be set as the Project N value setting.

N value setting type	choice box		defined N value types

There are various methods for the determination of the N values. These are given in the choice box:



No N values required
Constant N value
Winter
NGS
Plane
Difference tin
New Caledonia RANC00
GSB file
Geotiff file

Depending on the setting type chosen, the panel will display the appropriate fields. See 6.3.3.1 N value Setting Types.

Projection name	choice box		

The projection as selected from carto.12dcarto

Projection data	input box		

*If **not blank**, this field is in the format of +proj4 data.*

Note: both Project name and Project data cannot be both defined. It is an error to attempt.

Note: both Project name and Project data may be blank, but may result in errors when the N value definition is used. Depending on the context of use, 12d needs to know how to transform between map coordinate and long lat.

Add correction tick box ticked

*If **ticked**, N value is added to the height.*

*If **not ticked**, the N value is subtracted from the height.*

Long/Lat tick box not ticked

*If **ticked**, the expected coordination to be used with this setting is in longitude, latitude.*

Buttons at Bottom

Add/Modify button

After selecting this button, the user defined N value settings are added to the current list or the existing N value settings is modified. using the entered values. A number of new settings can be added by simply entering the relevant data and selecting the add/modify button.

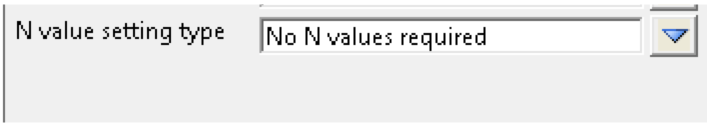
Write button

*After selecting this button, all the defined N value settings are written out to the file **nvalues.4d** in a user selected folder. This means that the defined N value settings will be available after a restart is done and when opening other projects. For more information on the* **Write** *button, go to the section* 32.2.6 Writing Out Setup Files *in the Appendix* 32 Setting Up and Configuring 12d.

Continue to 6.3.3.1 N value Setting Types or return to 6.3.3 Create/Edit N-Value Definitions or 6.3 Management.

6.3.3.1 N value Setting Types

No N values required



This is for data that already has ellipsoid heights and requires no interpolation for N values so no extra information is required.

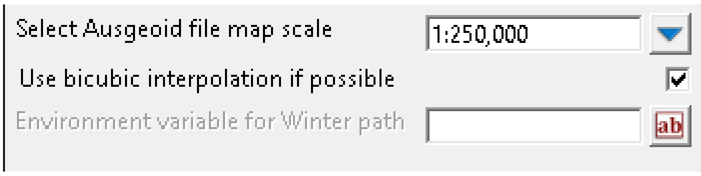
Constant N value

Field Description	Type	Defaults	Pop-Up
Constant N value	input box		

This N value will be used for the entire n value interpolation process. (i.e. it will not change).

Winter

This method uses the same method as the Winter interpolation software supplied by Auslig. The data files used should be winter compatible and reside in a folder that is pointed to by the WINTER_DATA_4D parameter in the env.4d file. The data files can be downloaded from the Auslig website.



Field Description	Type	Defaults	Pop-Up
Select Ausgeoid file map scale	choice box		1:100,000 1:250,000 1:1,000,000

This value will be dependant on the type of files to be used by winter. ***The files themselves should be in a folder that is pointed to by the WINTER_DATA_4D parameter in the setup area of the env.4d file.***

Field Description	Type	Defaults	Pop-Up
Use bicubic interpolation if possible	tick box	ticked	

If ***ticked****, the bicubic interpolation method will be used if possible.*

Field Description	Type	Defaults	Pop-Up
Environment variable for Winter path	text box		

The environment variable name containing the path to where the custom Winter files reside.

This means now you can have multiple sets of Winter files used in **12d Model** *at the same time.*

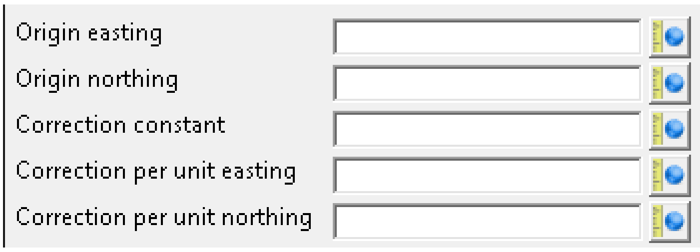
As an example: you may have a variable name of WINTER_2020_FILES_4D where the value of this variable is c:\12d\14.00\user\winter_2020_data.

NGS

This method is currently under development.

Plane

This method allows a plane to be defined allowing N values to be derived from that plane.



Field Description	Type	Defaults	Pop-Up
Origin easting	input box		

Origin easting value.

Origin northing input box

Origin northern value.

Correction constant input box

Constant Z value of the plane.

Correction per unit easting input box

Z value correction per unit easting.

Correction per unit northing input box

Z value correction per unit nothing.

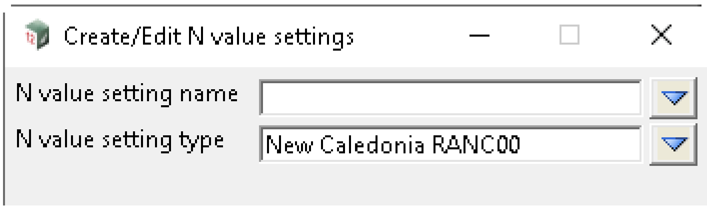
Difference tin

This method allows value to be interpolated from a difference tin. A difference tin is simply a tin of difference values (N values). This tin can be re-triangulated as new points become available, thus introducing more points than a regular grid.

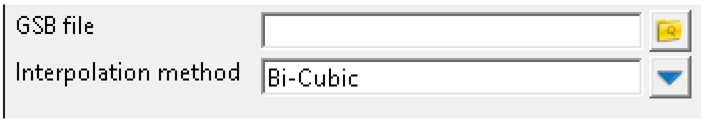
Field Description	Type	Defaults	Pop-Up
Difference tin	tin box		Available tins

The difference tin from which the N values will be interpolated.

New Caledonia RANC00



GSB file



Field Description	Type	Defaults	Pop-Up
GSB file	file box		*.gsb

A gsb file to find N value according to provided longitude/latitude or easting/northing.

Field Description	Type	Defaults	Pop-Up
Interpolation method	choice box	Bi-Cubic	Bi-Linear, Bi-Cubic

*If **Bi-Linear** is chosen, a 4-point-calculation is used to calculate the element's N value.*

*If **Bi-Cubic** is chosen, a 16-point-calculation is used to calculate the element's N value.*

Geotiff file

Field Description	Type	Defaults	Pop-Up
Geotiff file	file box		*.tif

A geotiff file to find N value according to the provided coordinates. The calculation is to be done with bi-linear method (4-point-calculation).

Continue to 6.4 12d Markup or return to 6.3.3 Create/Edit N-Value Definitions or 6.3 Management.

6.4 12d Markup

Position of menu: **Project =>Markup**

The purpose of **12d Markup** is to provide users with functionality to digitally Markup/Review ***12d Model*** information and to track and store the history of these markups.

The digital tracking of these markups and reviews include.

Who issued the markup/review?

When did they issue it?

Who has been assigned to undertake the changes to the data?

When did they do this?

Has the change been completed?

Has the completed change been verified?

Was the verified change plotted on a drawing?

The tracking of these gateways is done digitally and remains on the markup/review to enable digital transfer from both ***12d Model*** Projects, as well as outside ***12d*** in other BIM systems.

The **12d Markup** option works within ***12d Model*** and ***12d View***.

Markups versus Reviews

Markups

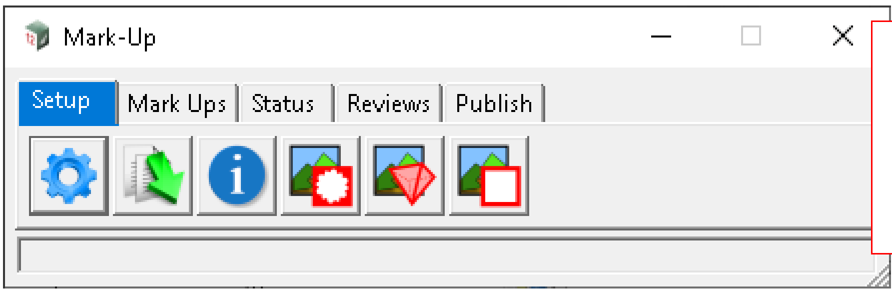
Markups are intended to follow historical markup procedures that users may be familiar with. Traditionally these markups are created to present on a final submitted plan drawing as **tracked Revisions**.

The **Markup** option reflects these traditional practices but aims to store the usual hard copy tracking in a digital realm.

Reviews

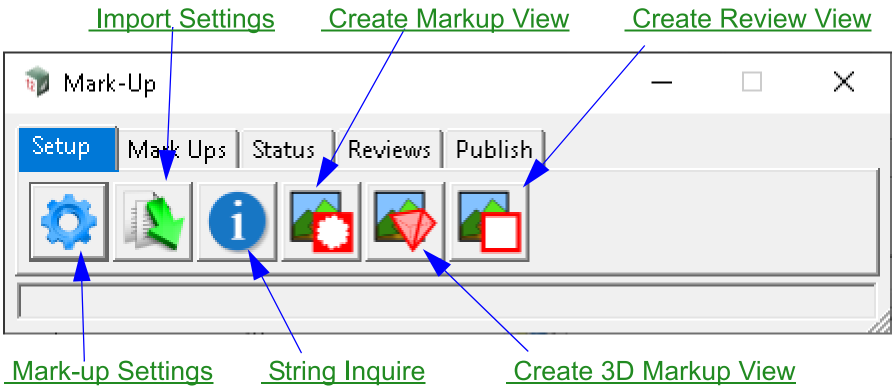
Reviews are like markups with regards to tracking and status gateways but are aimed more for digital storage transfer rather than hard copy plotting.

Selecting **Markup** brings up the **Mark-up** panel



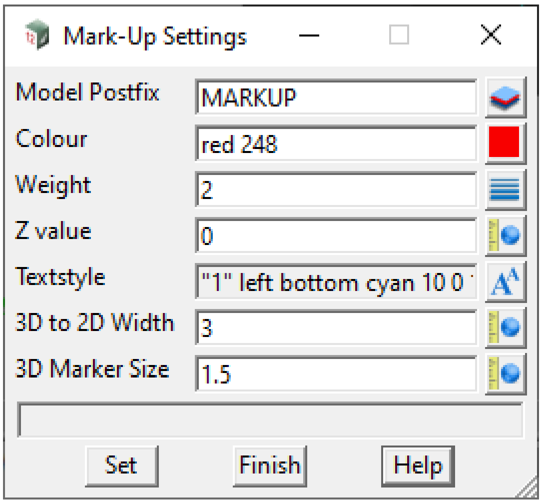
[Setup tab]
[Mark Ups tab]
[Status tab]
[Reviews tab]
[Publish tab]

Setup tab



Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

Mark-up Settings



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model postfix	model box		available models

This text is added as a Model postfix to the automatic markup Model name.

Colour	colour box	red	available colours

Initial colour for the markup objects.

Weight	real box	2	

Line weight for the markup objects.

Z value	real box	0	

A constant Z value (height value) for the markup and review objects. This is especially helpful for viewing the markups in a 3D perspective view or when exporting out to other BIM systems.

Textstyle	textstyle box		

Default text properties used when creating Markup text or Review automatic labelling.

3D to 2D width	real box		

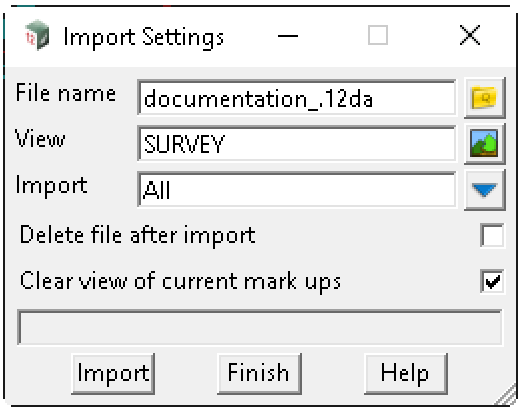
Size in metres of the side of the square around the 3D marker. The square has the (x,y,z) coordinates of the *picked point.*

3D marker size real box

Height in metres of the pyramid for the 3D marker. The inverted pyramid is placed with its vertex on the picked point.

Continue to Import Settings or return to Setup tab or 6.4 12d Markup.

Import Settings



File name file box

Selection of a previously published 12d Markup file to import into the Project (see publishing).

View real box

The View to import the published markup Model data in to.

Import	choice box	All	All, Started Reviews, Reviews in Progress, Completed Reviews, Verified Reviews, Reviews, Mark Ups, Revisions

The status of the markups/reviews to be imported. Default is All.

Delete file after import	tick box	not ticked

If ticked, the original12d markup file will be deleted.

Clear view of current mark ups	tick box	ticked

This will remove all markup Models currently on the selected import View.

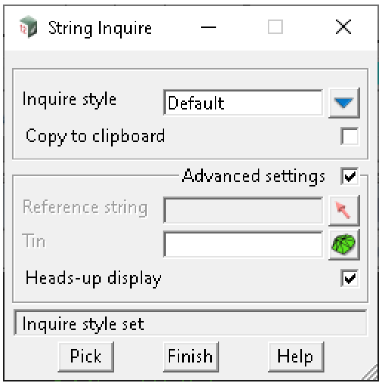
Import button

When clicked, read in the 12d Markup file given in **File name**.

Continue to String Inquire or return to Setup tab or 6.4 12d Markup.

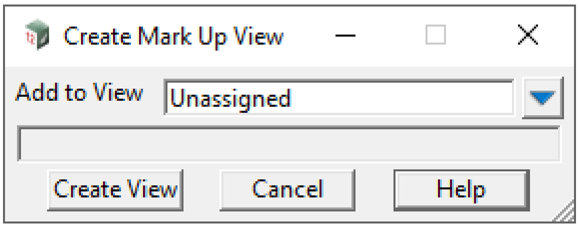
String Inquire

This brings up the 10.10 String Inquire option.

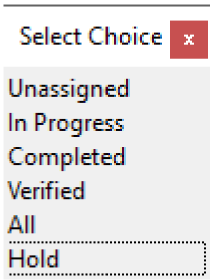


Continue to Create Markup View or return to Setup tab or 6.4 12d Markup.

Create Markup View



Add to view choice box



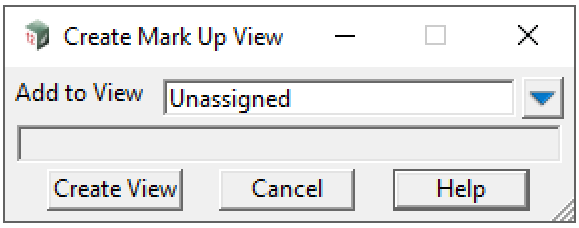
The type of Markup information to automatically add to the created view.

Create View button

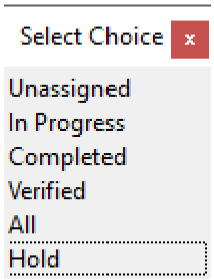
*When clicked, if it does not exist, a **plan** view called by the choice from* **Add to View** *followed by " Mark Ups View". For example, "Unassigned Mark Ups View".*

Continue to Create 3D Markup View or return to Setup tab or 6.4 12d Markup.

Create 3D Markup View



Add to view choice box



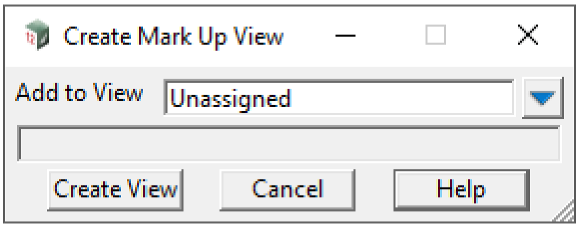
The type of 3D Markup information to automatically add to the created view.

Create View button

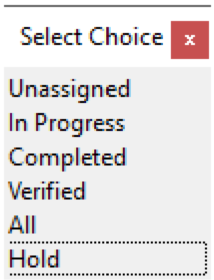
When clicked, if it does not exist, a ***plan*** *view called by the choice from* **Add to View** *followed by " 3D View". For example, "In Progress 3D View".*

Continue to Create Review View or return to Setup tab or 6.4 12d Markup.

Create Review View



Add to view choice box



The type of Review information to automatically add to the created view.

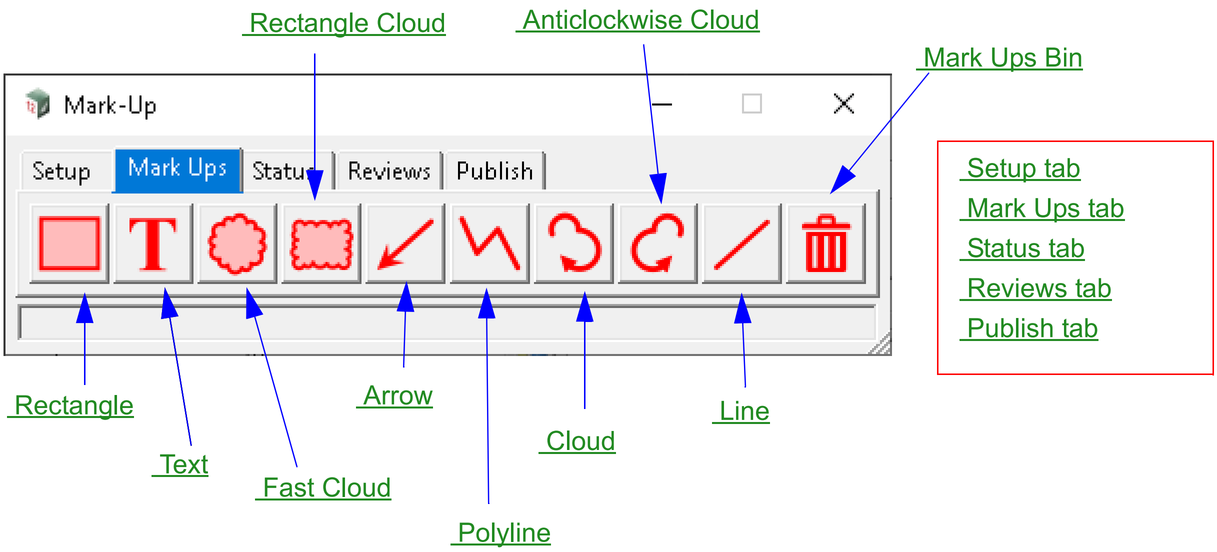
Create View button

When clicked, if it does not exist, a ***plan*** *view called by the choice from* **Add to View** *followed by " Review View". For example, "Completed Review View".*

Continue to Mark Ups tab or return to Setup tab or 6.4 12d Markup.

Mark Ups tab

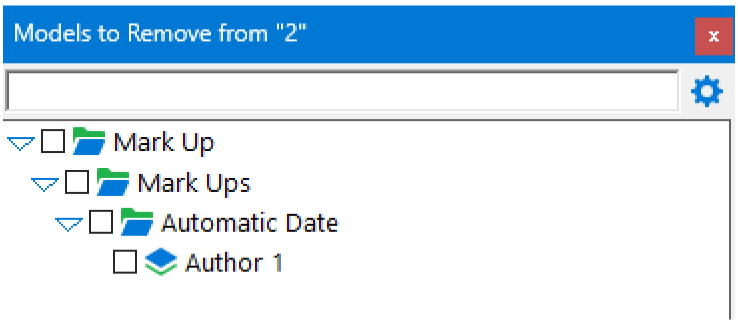
This panel provides various markup display tools to be created on the currently active View.



Markup Model Naming

When a markup is created, an automated Model name will be produced to assist in tracking the author of the markup. The Model name is in 3.10 Object Tree format and will be.

Mark Up/Mark Ups/Automatic Date/Automatic Author postfix



A separate model postfix will be created for each markup type unless a Model other then MARKUP has been specified in the Mark-Up Settings panel. In this case, the postfix in the Model name will be as entered in this panel.

Rectangle

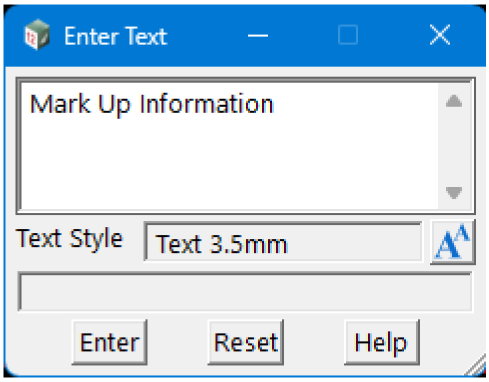
Creating a rectangle requires three cursor picks. The first two pick and accepts define the side of the rectangle and the third pick and accept creates the final side of the markup rectangle. So the created rectangle can be a rotated rectangle

Continue to Text or return to Mark Ups tab or 6.4 12d Markup.

Text

Pick and accept on a View the location for markup text to be created.

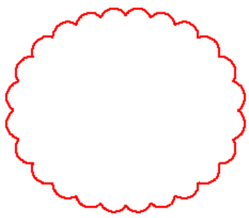
This will then pop up a text entry panel to enter the text to be displayed.



Continue to Fast Cloud or return to Mark Ups tab or 6.4 12d Markup.

Fast Cloud

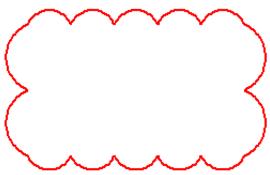
Pick and accept the left-hand cloud extent, the pick and accept the right-hand extent to complete the creation of a fast cloud markup.



Continue to Rectangle Cloud or return to Mark Ups tab or 6.4 12d Markup.

Rectangle Cloud

Pick and accept the left-hand cloud extent, the pick and accept the right-hand extent to complete the creation of a rectangular cloud markup.



Continue to Arrow or return to Mark Ups tab or 6.4 12d Markup.

Arrow

Pick and accept on the far end (non-arrow) location for the arrow, then pick and accept the location for the arrow end to be created.

Note: If the line of the arrow cannot be seen on the View, make sure the "Draw edges" in the View settings *is active*

Continue to [Polyline] or return to [Mark Ups tab] or [6.4 12d Markup].

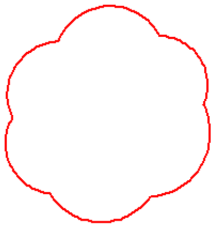
Polyline

Pick and accept on multiple vertex locations for the creation of a polyline object. Choose the ESC key on the keyboard to finish the creation.

Continue to [Cloud] or return to [Mark Ups tab] or [6.4 12d Markup].

Cloud

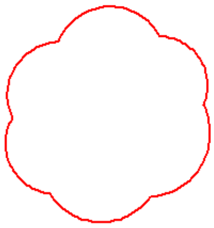
Pick and accept on multiple vertex locations in a ***clockwise*** *direction for the creation of a user defined cloud shape. Choose the ESC key on the keyboard to close the cloud shape and finish the creation.*



Continue to [Anticlockwise Cloud] or return to [Mark Ups tab] or [6.4 12d Markup].

Anticlockwise Cloud

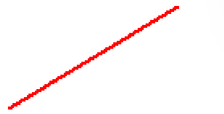
Pick and accept on multiple vertex locations in an ***anticlockwise*** *direction for the creation of a user defined cloud shape. Choose the ESC key on the keyboard to close the cloud shape and finish the creation.*



Continue to [Line] or return to [Mark Ups tab] or [6.4 12d Markup].

Line

Pick and accept on a start location and then pick and accept on the final location for the creation of a line *object.*



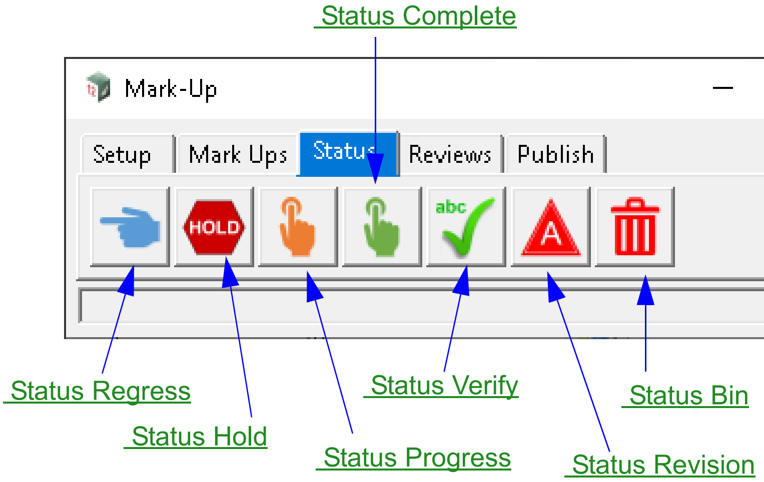
Continue to Mark Ups Bin or return to Mark Ups tab or 6.4 12d Markup.

Mark Ups Bin

Select and then pick and accept on a markup object to delete the object. Choose the ESC key on the keyboard to finish the selection(s).

Continue to Status tab or return to Mark Ups tab or 6.4 12d Markup.

Status tab

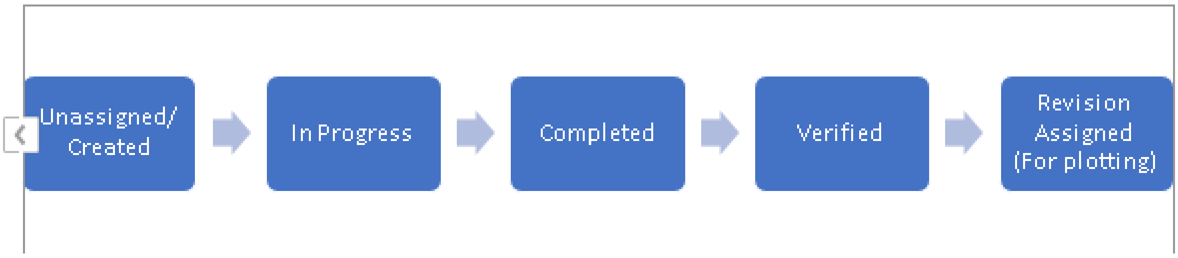


Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

Status Options

The purpose of the status panel is to send the markup objects through defined gateways to enable Users to ascertain the progress status of a markup.

This will provide an inbuilt quality control system to capture whether required changes have been done and completed changes captured. These Status Gateways are.



These Status Gateways are sequential, so for example a markup or review cannot be set to Completed status unless it has already been through the In Progress status.

Digital attribution of Markup status

When assigning the status of the markups, attributes will be automatically added to the object itself. This provides digital tracking of the status and answers the questions posed at the start of this help.

Who issued the markup/review?

When did they issue it?

Who has been assigned to undertake the changes to the data?

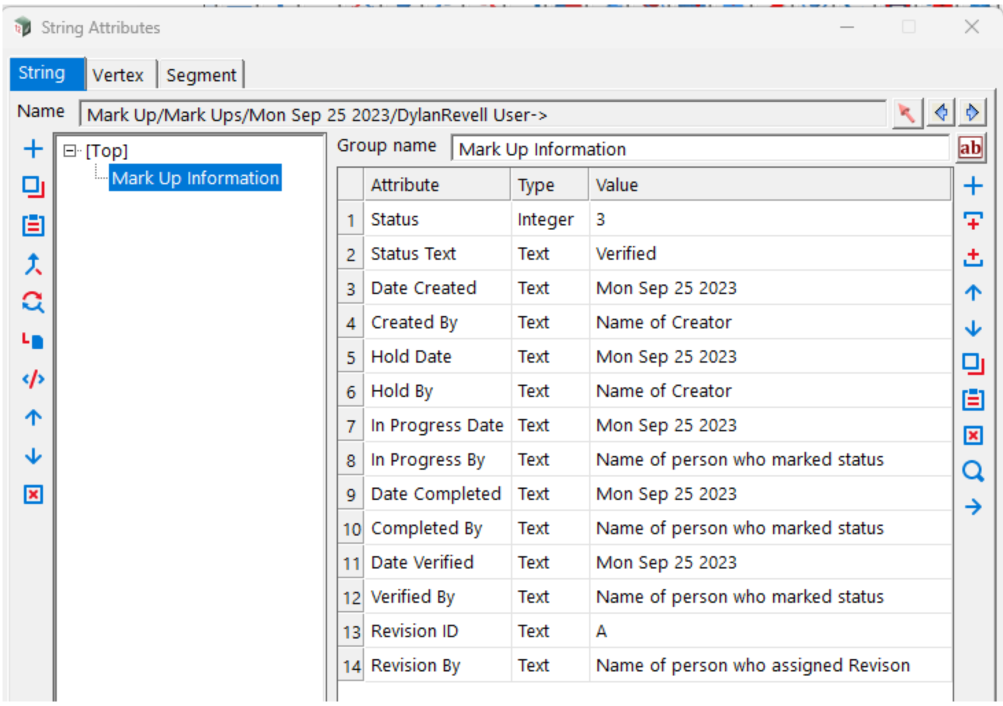
When did they do this?

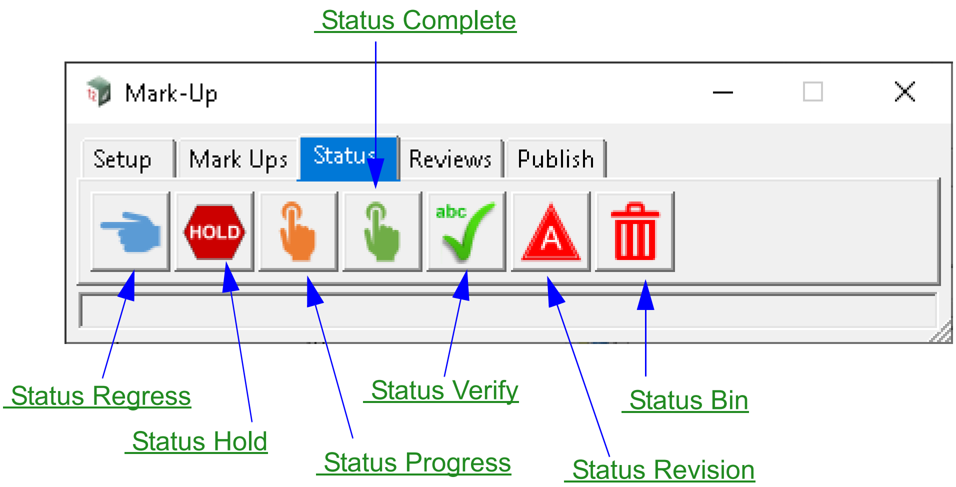
Has the change been completed?

Has the completed change been verified?

Was the verified change plotted on a drawing?

The status attributes of a markup can be viewed at any time using String=> Properties=> Attributes.





Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

Status Regress

When the regress option is selected, the User will select a markup, and this will regress the Gateway status of the markup back one step. E.g., Regress status from Completed back to In Progress.

Continue to Status Hold or return to Status tab or 6.4 12d Markup.

Status Hold

This option will create an inverted cloud with the text hold within the cloud.

Pick and accept the left-hand cloud extent, the pick and accept the right-hand extent to complete the *creation of an inverted hold cloud.*

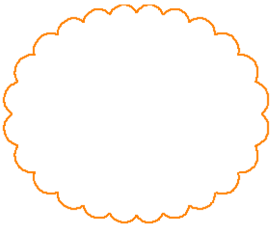
Continue to Status Progress or return to Status tab or 6.4 12d Markup.

Status Progress

Choose and select markup which has been created/unassigned. Selecting the markup will:

Change the colour of the markup to Orange.

Automatically add attributes to the object with the User name and Date that the status was assigned.



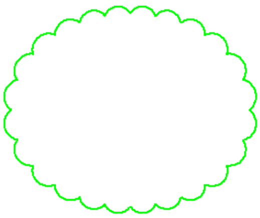
Continue to Status Complete or return to Status tab or 6.4 12d Markup.

Status Complete

Choose and select markup which has been marked as In Progress. Selecting the markup will

Change the colour of the markup to Green.

Automatically add attributes to the object with the User name and Date that the status was assigned.



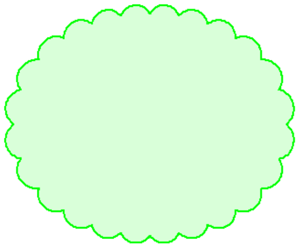
Continue to Status Verify or return to Status tab or 6.4 12d Markup.

Status Verify

Choose and select markup which has been marked as Complete. Selecting the markup will

Fill the markup with a green transparent fill.

Automatically add attributes to the object with the User name and Date that the status was assigned.



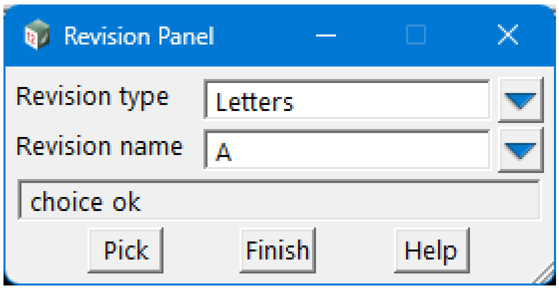
Continue to Status Revision or return to Status tab or 6.4 12d Markup.

Status Revision

This option is for creating a drawing plot capable version of the markup to match the assigned drawing revision to be plotted.

Note: This option should not be run in 12d View as the Revision data Model will not be saved!

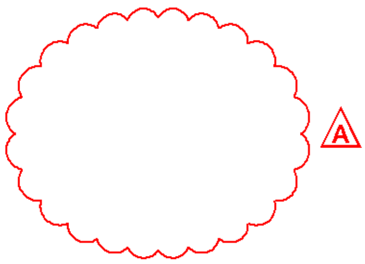
The User will be presented with the Revision letter/numbers option.



Choose the Pick button and then select a markup which has been marked as Verified. This will

Copy the verified markup object into a new Model with a vertex symbol matching the Revision letter/ number.

Automatically add attributes to the object with the User name and Revision ID for tracking purposes



Moving the Revision vertex symbol

If the vertex symbol created by the Revision tool is not in the ideal location, the User can reposition this symbol by using the Cad > Symbol > Edit option in 12d Model.

Type 'v' for vertex

Select the vertex on the markup object nearest to the symbol.

Adjust the position of the symbol via the edit grips.

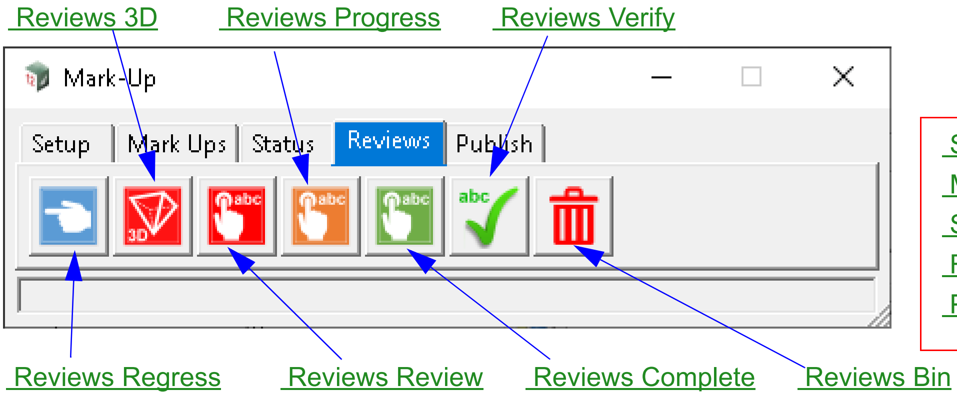
Continue to Status Bin or return to Status tab or 6.4 12d Markup.

Status Bin

Select and then pick and accept on a markup object to delete the object. Choose the ESC key on the keyboard to finish the selection(s).

Continue to Reviews tab or return to Status tab or 6.4 12d Markup.

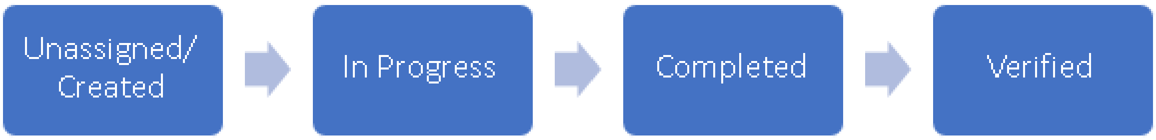
Reviews tab



Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

As mentioned in the **Markups** versus **Reviews** area, **Reviews** are like markups with regards to tracking and status gateways but are aimed more for **digital storage transfer** rather than hard copy plotting.

Reviews follow the same Gateway Status workflow as Markups. This provides an inbuilt quality control system to capture whether required changes have been done and completed changes captured. These Status Gateways are.



When assigning the status of the reviews, attributes will be automatically added to the object itself. This provides digital tracking of the status and answers the questions posed at the start of this help.

Who issued the markup/review?

When did they issue it?

Who has been assigned to undertake the changes to the data?

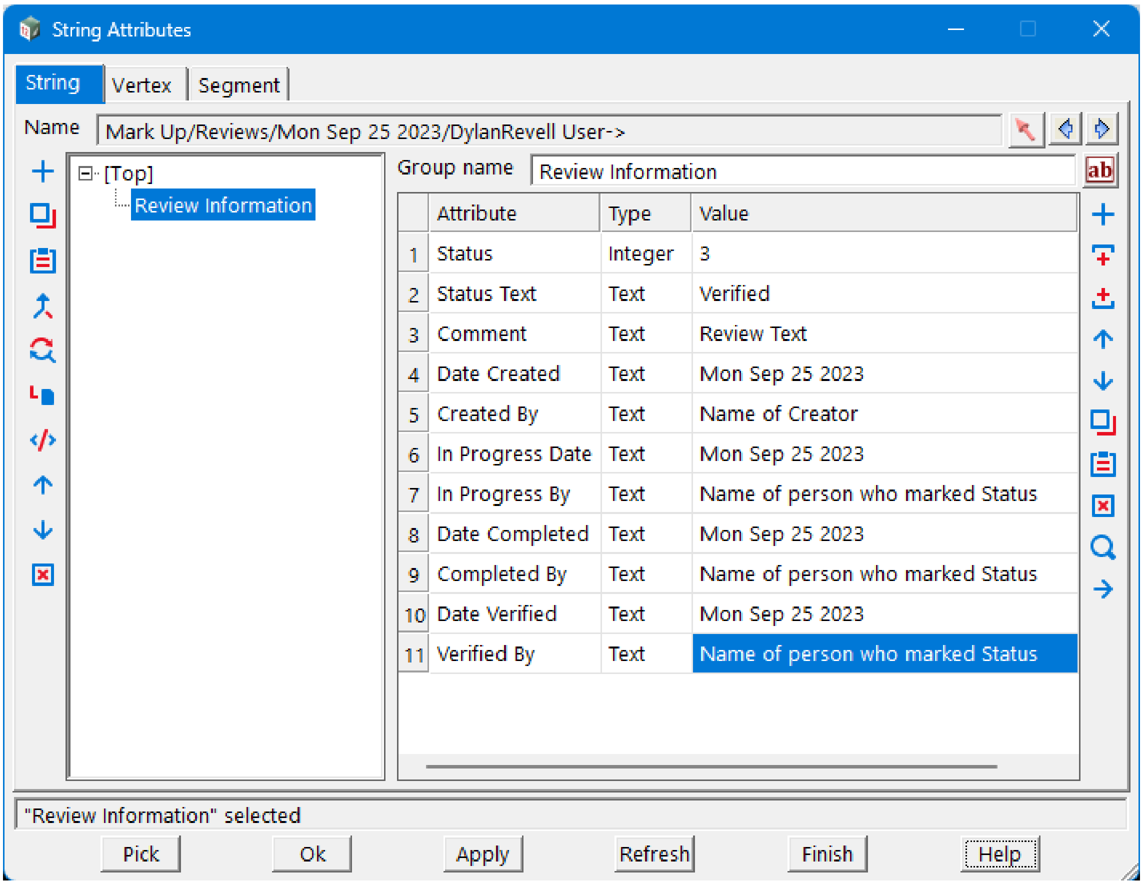
When did they do this?

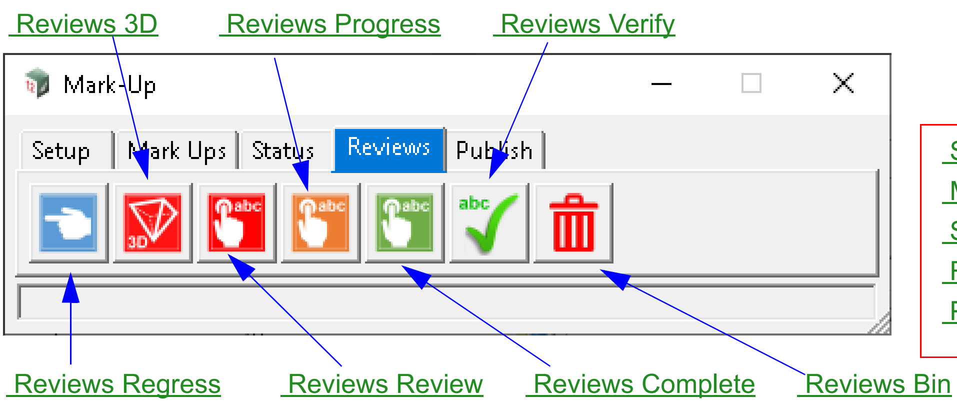
Has the change been completed?

Has the completed change been verified?

Was the verified change plotted on a drawing?

The status attributes of a markup can be viewed at any time using:
String=> Properties=> Attributes.





Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

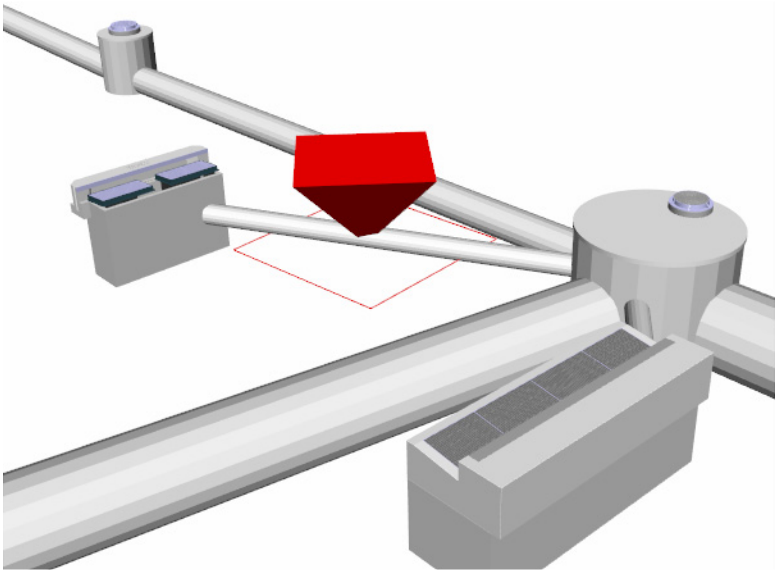
Reviews Regress

When Regress option is selected, the User will select a review, and this will regress the Gateway status of the review back one step. E.g., Regress status from Completed back to In Progress.

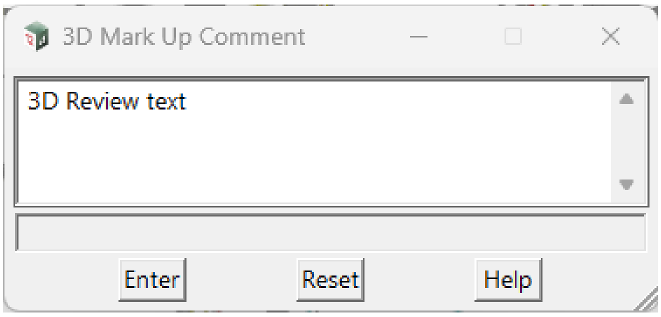
Continue to Reviews 3D or return to Reviews tab or 6.4 12d Markup.

Reviews 3D

When 3D is selected, the User selects a 3D position and a red inverted pyramid is placed at the selected *position and a square with the z-coordinate of the 3D position drawn.*



The User is then prompted to enter to enter the review comment about the mark up.



***Note** the Text Style will be pre-populated with the text style information entered in the Mark-up Settings panel.*

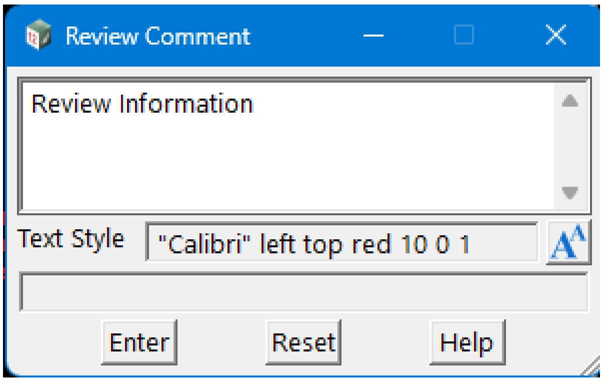
Continue to Reviews Review or return to Reviews tab or 6.4 12d Markup.

Reviews Review

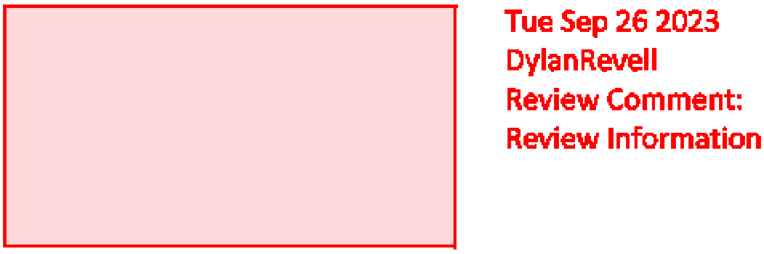
Choose and then pick and accept the left-hand review extent, the pick and accept the right-hand extent to complete the creation of a review area.

The User will then be prompted to enter the review comment about the review.

Note the text Style will be pre-populated with the text style information entered in the Mark-up Settings *panel.*



This review comment will be displayed automatically in the top-right corner of the review rectangle.



Continue to [Reviews Progress] or return to [Reviews tab] or [6.4 12d Markup].

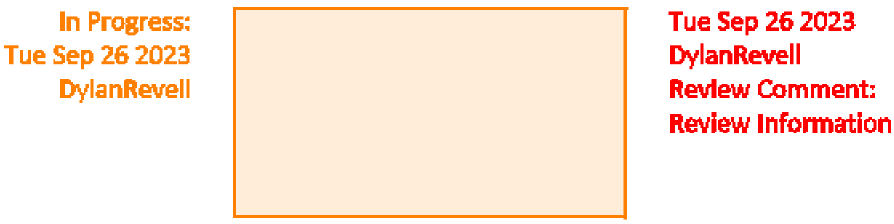
Reviews Progress

Choose and select review which has been created/unassigned. Selecting the review will

Change the colour and transparent fill of the review to Orange.

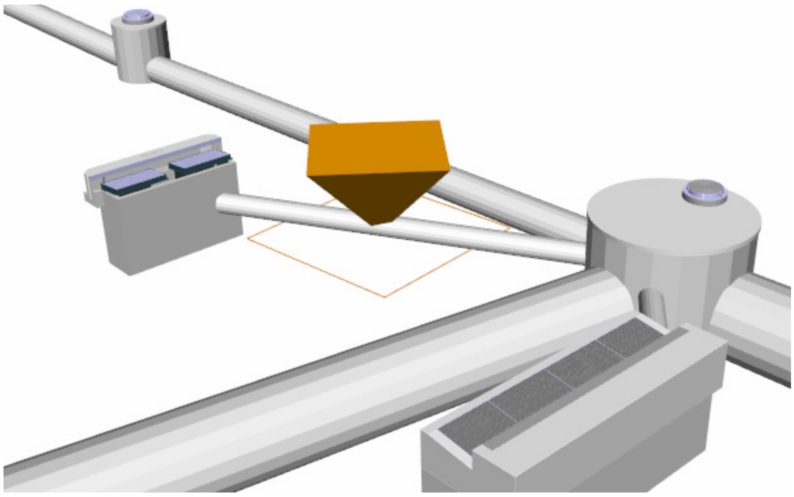
Automatically add attributes to the object with the User name and Date that the status was assigned.

Automatically add the User name and Date as vertex text in the top-left corner of the review rectangle



*Selecting a **3D markup review** will.*

*Change the colour of the pyramid and surrounding rectangle to **Orange**.*



Automatically add attributes to the object with the User name and Date that the status was assigned as well as add attributes recording the x,y and z coordinate position of the 3D mark up.

Continue to Reviews Complete or return to Reviews tab or 6.4 12d Markup.

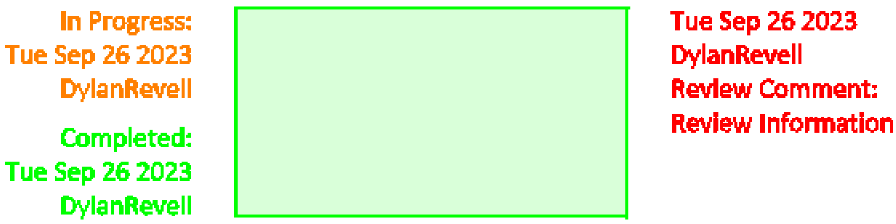
Reviews Complete

Choose and select review which has been marked a In Progress. Selecting the review will

Change the colour and transparent fill of the review to Green.

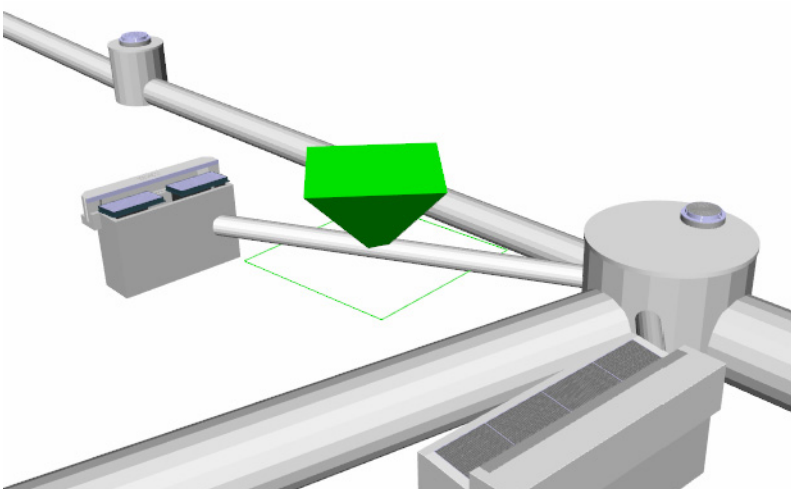
Automatically add attributes to the object with the User name and Date that the status was assigned.

Automatically add the User name and Date as vertex text in the bottom-left corner of the review rectangle



*Selecting a **3D markup review** will.*

*Change the colour of the pyramid and surrounding rectangle to **Green**.*



Automatically add attributes to the object with the User name and Date that the status was assigned.

Continue to Reviews Verify or return to Reviews tab or 6.4 12d Markup.

Reviews Verify

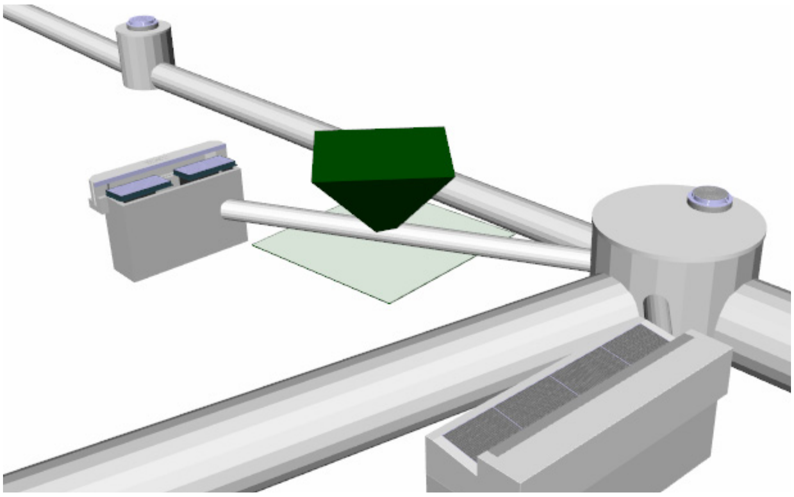
Choose and select review which has been marked as Complete. Selecting the review will

Automatically add attributes to the object with the User name and Date that the status was assigned.

Automatically add the User name and Date as vertex text in the bottom-right corner of the review rectangle

*Selecting a **3D markup review** will.*

*Change the colour of the pyramid and surrounding rectangle to **Dark Green**. and add a fill to the surrounding rectangle.*



Automatically add attributes to the object with the User name and Date that the status was assigned.

Continue to Reviews Bin or return to Reviews tab or 6.4 12d Markup.

Reviews Bin

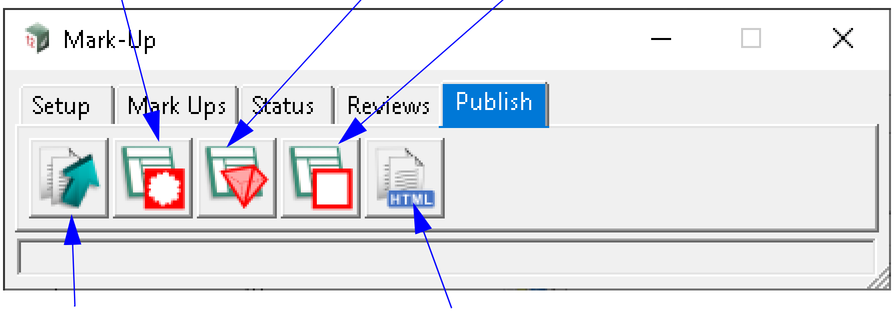
Selecting this option will bring up a panel for the creation/editing of either a new or existing markup file.

Continue to Publish tab or return to Reviews tab or 6.4 12d Markup.

Publish tab

*The purpose of publishing the markup/review information is to be able to share the reviews between projects and between **12d View** and **12d Model**. It will also create a record of all the markup/review data that can be managed and stored outside of a **12d Model** Project.*

Mark Up Table   3D Table   Review Table

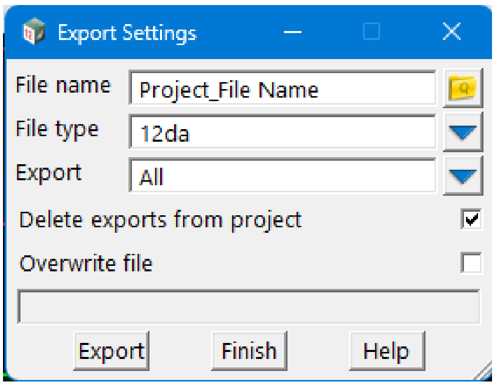


Export/Publish Markups   Report

Setup tab
Mark Ups tab
Status tab
Reviews tab
Publish tab

Export/Publish Markups

Selecting this option brings up a panel for the creation of a new markup file, overwriting an existing mark up file, or appending to an existing markup file.



File name file box

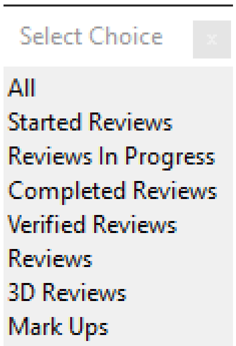
The file location and name of the markup file to be written. The name of the project followed by an underscore (_) is automatically written into the field.

***Note**: the markup file MUST have the name of the Project to be created. This allows easier tracking of the project data that has been marked up or reviewed.*

File type choice box

Choose the file type to be exported.

Export choice box



Choice of the content to publish.

Delete exports from project tick box ticked

*If **ticked**, all the **Markup** and **Review** model information is deleted from the project on export. This is recommended as it will prevent errors for duplicate Models when trying to Import the markup file back into the Project.*

*If **not ticked** then no models are deleted on export.*

Overwrite file tick box not ticked

If no file of the same name exists, then the new file is created and this field is ignored.

*If **ticked** and a file of the same name exists, then the existing file will be overwritten and any existing contents lost.*

*If **not ticked** and a file of the same name exists, it will append the Model data to the existing Markup file.*

***Note:** The **Revision Plot Models** will not be exported in the file or deleted and will remain with the Project when saved.*

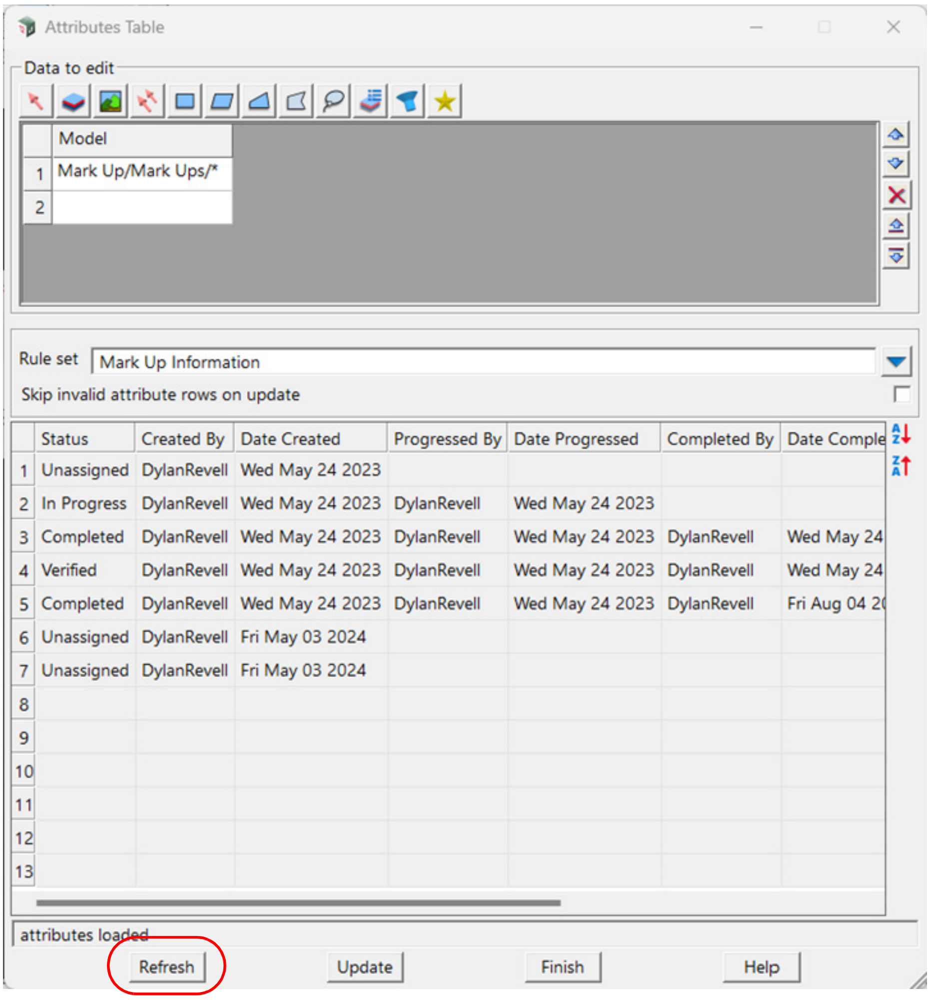
Continue to Mark Up Table or return to Publish tab or 6.4 12d Markup.

Mark Up Table

*The **Mark Up Table** is a way for users to view a complete list of the mark up models currently within the Project It also provides a list of the status and details about the selected type.*

Upon selecting this option, the user must select the **Refresh** *button.*

Doing so will initiate a search within the Project for markup information display the list of the searched data.



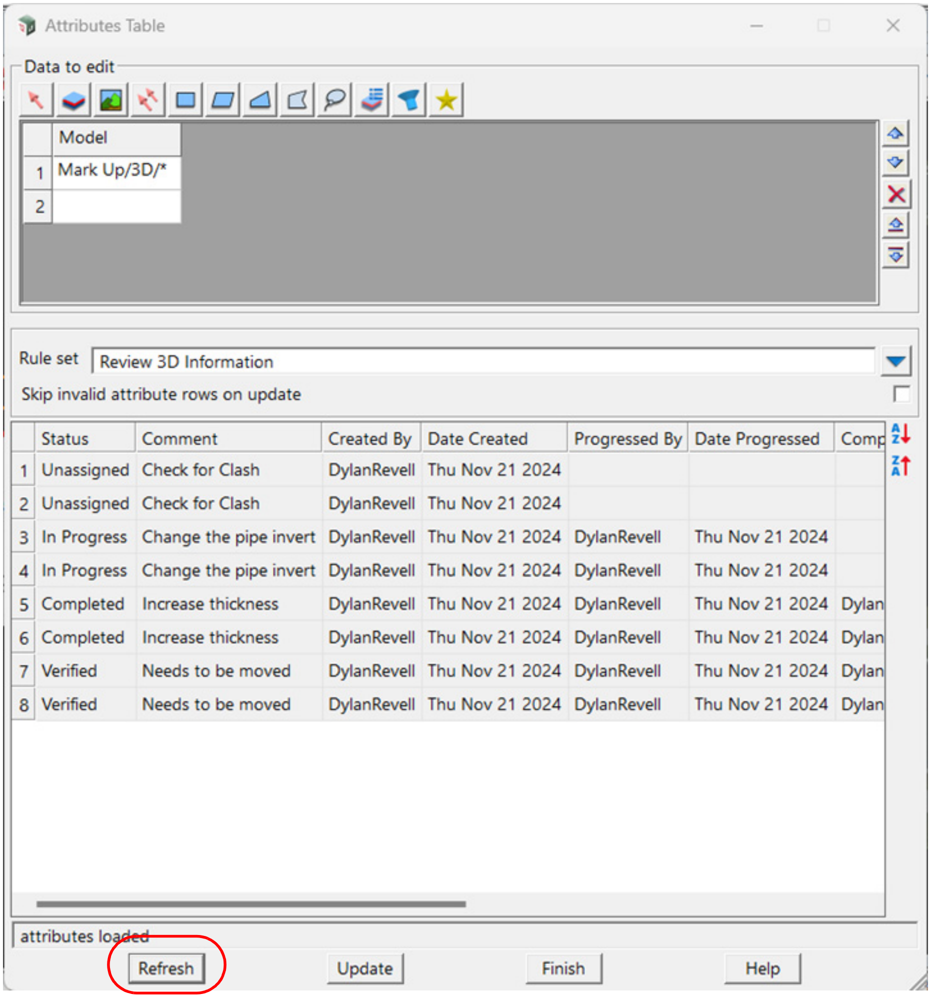
Continue to 3D Table or return to Publish tab or 6.4 12d Markup.

3D Table

*The **3D Table** is a way for users to view a complete list of the 3D mark up models currently within the Project It also provides a list of the status and details about the selected type.*

Upon selecting this option, the user must select the **Refresh** *button.*

Doing so will initiate a search within the Project for markup information display the list of the searched data.



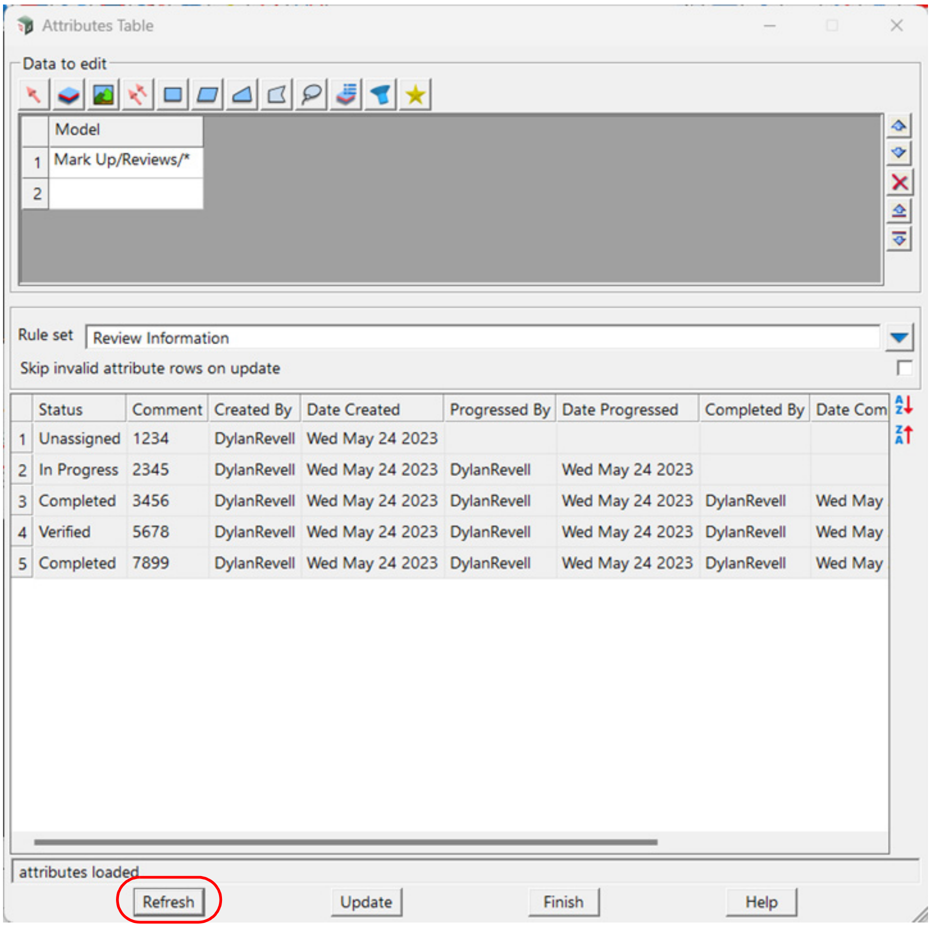
Continue to Review Table or return to Publish tab or 6.4 12d Markup.

Review Table

*The **Review Table** is a way for users to view a complete list of the Review models currently within the Project It also provides a list of the status and details about the selected type.*

Upon selecting this option, the user must select the **Refresh** *button.*

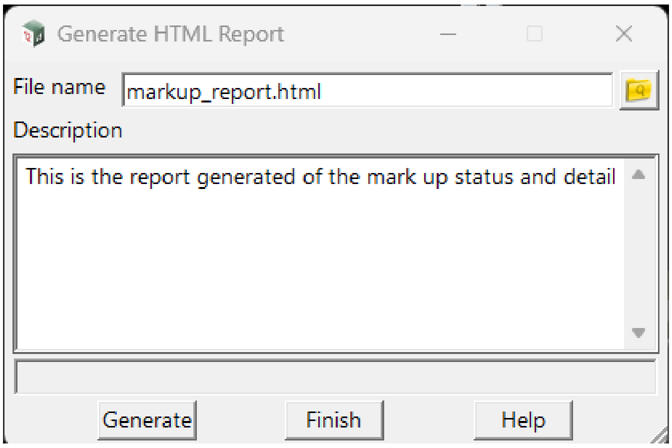
Doing so will initiate a search within the Project for markup information display the list of the searched data.

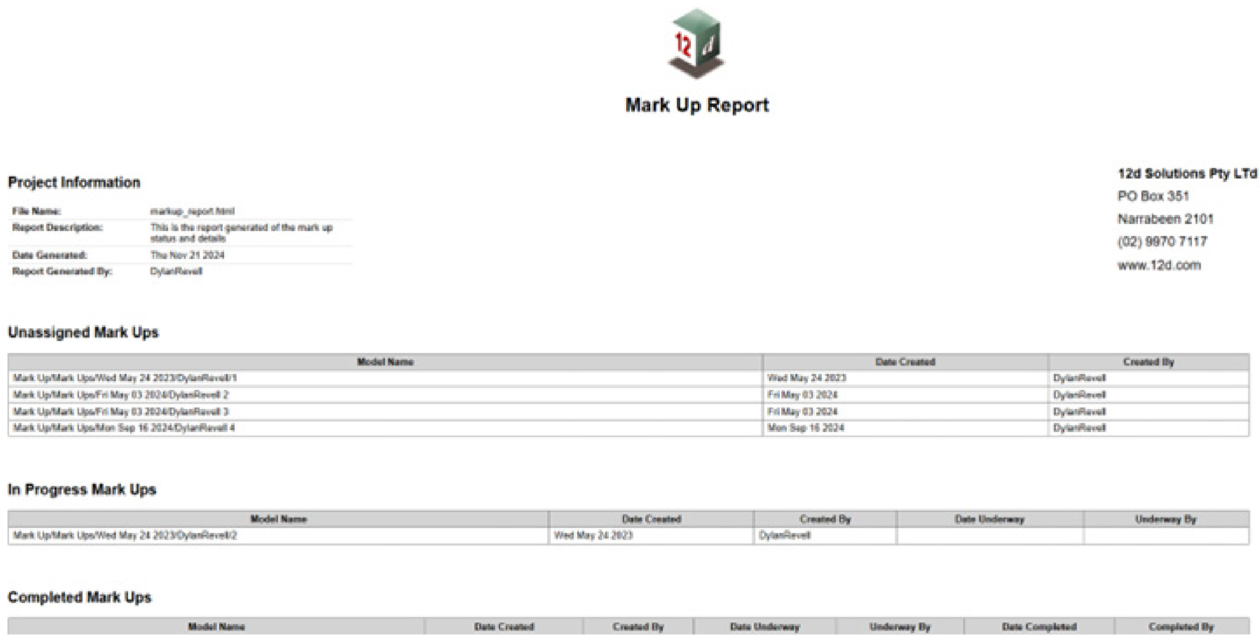


Continue to Report or return to Publish tab or 6.4 12d Markup.

Report

The Mark Up report will create a detailed HTML report of all the currently loaded mark up models. Any user entered text within the description area will populate the appropriate area within the report.





Mark Up Report

Project Information

File Name:	markup_report.html
Report Description:	This is the report generated of the mark up status and details
Date Generated:	Thu Nov 21 2024
Report Generated By:	DylanRevell

12d Solutions Pty LTd
PO Box 351
Narrabeen 2101
(02) 9970 7117
www.12d.com

Unassigned Mark Ups

Model Name	Date Created	Created By
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/1	Wed May 24 2023	DylanRevell
Mark Up/Mark Ups/Fri May 03 2024/DylanRevell 2	Fri May 03 2024	DylanRevell
Mark Up/Mark Ups/Fri May 03 2024/DylanRevell 3	Fri May 03 2024	DylanRevell
Mark Up/Mark Ups/Mon Sep 16 2024/DylanRevell 4	Mon Sep 16 2024	DylanRevell

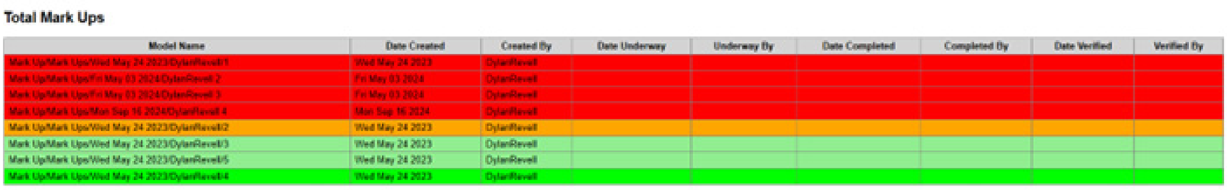
In Progress Mark Ups

Model Name	Date Created	Created By	Date Underway	Underway By
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/2	Wed May 24 2023	DylanRevell		

Completed Mark Ups

Model Name	Date Created	Created By	Date Underway	Underway By	Date Completed	Completed By

The report item summary area is colour coded to the same specifications of the mark up items, allowing easier determination of the item status.



Total Mark Ups

Model Name	Date Created	Created By	Date Underway	Underway By	Date Completed	Completed By	Date Verified	Verified By
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/1	Wed May 24 2023	DylanRevell						
Mark Up/Mark Ups/Fri May 03 2024/DylanRevell 2	Fri May 03 2024	DylanRevell						
Mark Up/Mark Ups/Fri May 03 2024/DylanRevell 3	Fri May 03 2024	DylanRevell						
Mark Up/Mark Ups/Mon Sep 16 2024/DylanRevell 4	Mon Sep 16 2024	DylanRevell						
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/2	Wed May 24 2023	DylanRevell						
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/3	Wed May 24 2023	DylanRevell						
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/5	Wed May 24 2023	DylanRevell						
Mark Up/Mark Ups/Wed May 24 2023/DylanRevell/4	Wed May 24 2023	DylanRevell						

Continue to 6.5 Project Settings or return to 6.4 12d Markup or 6 Project.

6.5 Project Settings

Each ***12d Model*** project has its own group of settings that are used by various options. These are called ***Project Settings***.

When in a ***12d Model*** project, the values of the individual ***Project Settings*** for that project are displayed and modified by the **Project Settings** panel which is brought up by the menu item

Project =>Settings *See* 6.5.2 Project =>Settings.

When a value of a Project Setting is modified for a project and the project is saved, the new value of the setting is recorded with the project.

Hence the individual values of the Project Settings are project specific and can vary from project to project.

New Projects Versus Existing Projects

When a **new project** is created, the initial values of the **Project Settings** are loaded from the file ***defaults.12dsettings.*** The initial values are then saved within the project itself.

For an **existing project**, whenever a value in **Project Settings** is changed and a **Save** is done, the new value is saved within the project so that the next time the project is opened, the new value is used.

Hence the values in **Project Settings** are **specific** to a **project**.

So *Project Settings* are totally different to environment variables which in most cases, are used each time a project, new or existing, is opened.

Project Settings Profiles and the Active Profile

Even within the one ***12d Model*** session, a user may want to use a different set of Project Settings. So for a project, it is possible to have more that one set of values for all the Project Settings.

A set of values for the Project Settings is called a **Project Settings Profile** and any number of profiles can be defined for a project, and it is possible to switch **Profiles** at any time in a ***12d Model*** session.

The **current Project Settings Profile** being used is called the **Active Profile.**

The file ***defaults.12dsettings*** can contain any number of Project Settings Profiles.

Summary

For a new project, the values for all the Profiles of Project Settings are loaded from a file, the default name of which is ***defaults.12dsettings.*** *See* 6.5.1 Project Settings Defaults File.

Once a new project is created, the values for the **Profiles** of Project Settings being used and saved with the project can be modified using the ***Project =>Settings*** option. *See* 6.5.2 Project =>Settings.

Project Settings files can be created and edited by the ***Project Settings Editor*** which is brought up by ***Project =>Management => Project setting file editor***.

Continue to 6.5.1 Project Settings Defaults File or return to 6.5 Project Settings or 6 Project.

6.5.1 Project Settings Defaults File

For a new project, the default file containing all the Profiles of Project Settings is ***defaults.12dsettings*** and the file is searched for in the standard set up folders search paths.

However there are environment variables to change both the name of the file, and the folder to look in, for the file of Project settings.

The environment variable DEFAULT_12D_PROJECT_SETTINGS_4D changes the name of the file that is searched for in the standard set up folders search paths.

DEFAULT_12D_PROJECT_SETTINGS_4D *project_settings_file_name*

The environment variable DEFAULTS_PROJECT_SETTING_FILE_4D is the full pathname of the file to be used as the default project settings file. So no other areas are searched.

DEFAULT_PROJECT_SETTINGS_FILE_4D *project_settings_file*

The environment variable DEFAULTS_PROJECT_SETTINGS_PROFILE_4D gives the name of the Profile in the project settings file that is to be used for the new project.

DEFAULT_PROJECT_SETTINGS_PROFILE_4D *project_settings_Profile*

If DEFAULTS_PROJECT_SETTINGS_PROFILE_4D is not defined, or is not the name of a Profile in the selected project settings file, then the first Profile in the project settings file is used as the starting Profile to be used for a new project.

If no project settings file is found then any old default files are used. If no old default files exist, then hard wired default values are used.

Once the new project is created, the values for all the Profiles of Project Settings being used and saved with the project can be modified using the ***Project =>Settings*** option.

Project Settings files can be created and edited by the ***Project Settings File Editor.***

Continue to 6.5.2 Project =>Settings or return to 6.5 Project Settings or 6 Project.

6.5.2 Project =>Settings

Position of option on menu: **Project =>Settings**

Each ***12d Model*** project has its own group of settings that are used by various options. These are called ***Project Settings***.

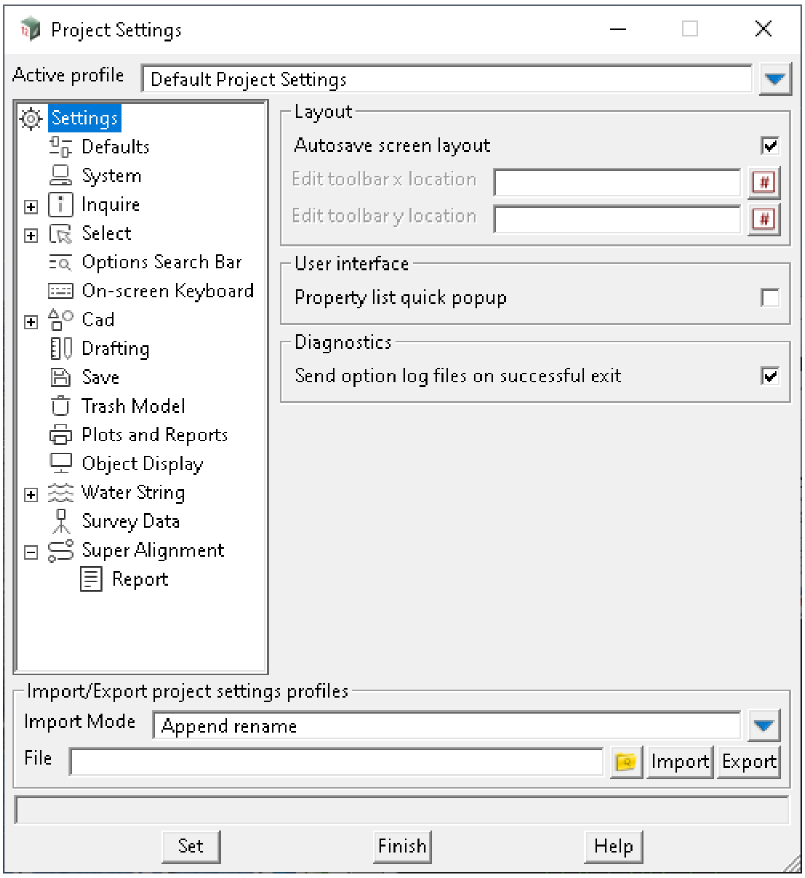
When in a ***12d Model*** project, the values of the individual ***Project Settings*** for that project are displayed and modified by the **Project Settings** panel which is brought up by the menu item

Project =>Settings *See* 6.5.2 Project =>Settings

When a value of a Project Setting is modified and **Set** pressed, the new value of the setting is used for the rest of the session. If the project is saved, the new value of the setting is recorded with the project.

Hence the individual values of the Project Settings are project specific and can vary from project to project.

Selecting **Settings** brings up the **Project Settings** panel:



See

6.5.2.1 Fields and Buttons at the Top and Bottom of Project Settings

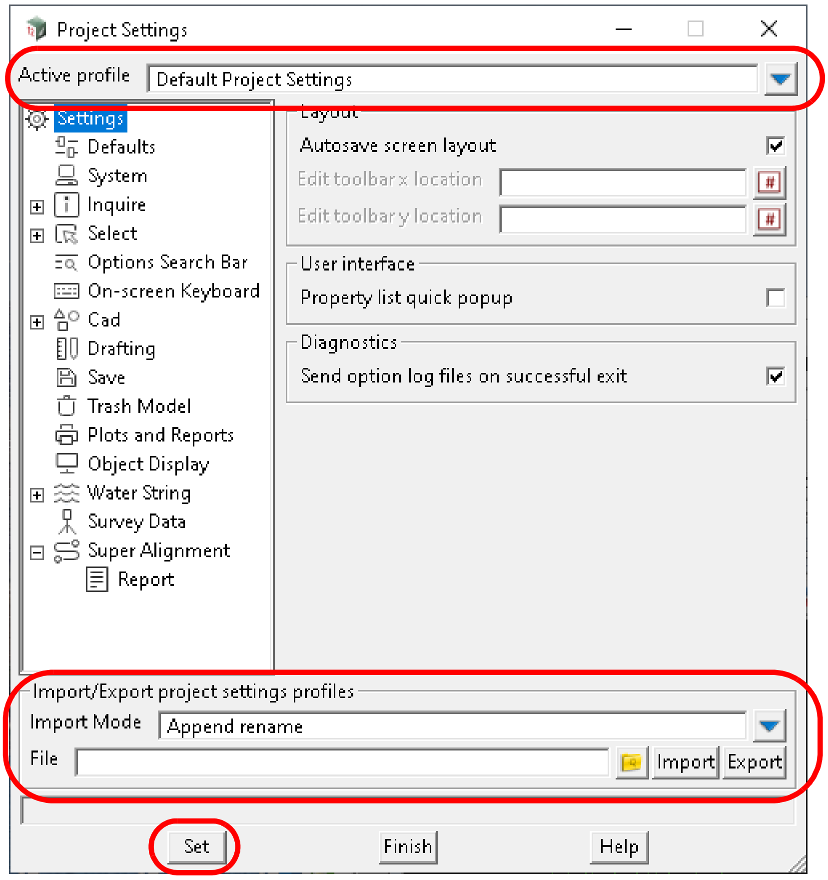
6.5.2.2 Main Page Settings

6.5.2.3 Defaults Settings

6.5.2.4 System Settings

6.5.2.6.1 Select >View Models Settings

6.5.2.1 Fields and Buttons at the Top and Bottom of Project Settings



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Field on Top

Active profile	choice box		list of the projects Project Settings Profiles

This field displays the name of the project settings Profile that is currently being used.
*When **Set** is pressed, any changes to the values in the displayed Settings node or sub node are be modified in this Profile and used for the duration of the session. The new values are saved when the project is saved.*

If another named Profile is selected from the pop-up, it becomes the Active Profile, and any changes to the values in the panel will be for the new Active Profile.

The name of the Profile that is the Active Profile is saved with the Project and when the project is reopened, it will again be the Active Profile.

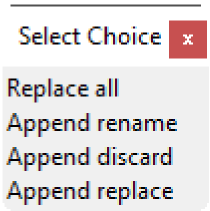
For more information on Project Settings and Project Settings Profiles, see 6.5 Project Settings.

Fields and Buttons on Bottom:

Import/Export project settings profiles

Another file of named Profiles can be imported (read in), or the existing named Profiles for the current project can be exported (written out) to a file.

Import mode choice box



*If **Replace all**, **all the existing Profiles** in the current project are **deleted** and replaced by the profiles in the project settings file given in the* **File** *field. Hence the Profiles in the given file become the Project Settings Profiles for the current project. The first Profile in the file marked becomes the Active Profile for the current project.*

*If **Append rename**, read in the project settings file (12dsettings) given in the* **File** *field and add all the Profiles in the given file in to the list of named Project Settings for the current project. If a **name already exists**, then give the new named Profile a different name to the existing named Profile.*

*If **Append discard**, read in the project settings file (12dsettings) given in the* **File** *field and add all the Profiles in the given file in to the list of named Project Settings for the current project. If a **name already exists**, then leave the existing named Profile and do not use the new named Profile.*

*If **Append replace**, read in the project settings file (12dsettings) given in the* **File** *field and add all the Profiles in the given file in to the list of named Project Settings for the current project. If a **name already exists**, then delete that named Profile and replace it with the one read in the from the file.*

File file box *.12dsettings files

Name of the file to write the named Profiles for the current project out to, or a file of Project Setting to read in.

Import button

Read in the project settings file (12dsettings) given in the **File** *field with the behaviour given by the* **Import mode** *field.*

Export button

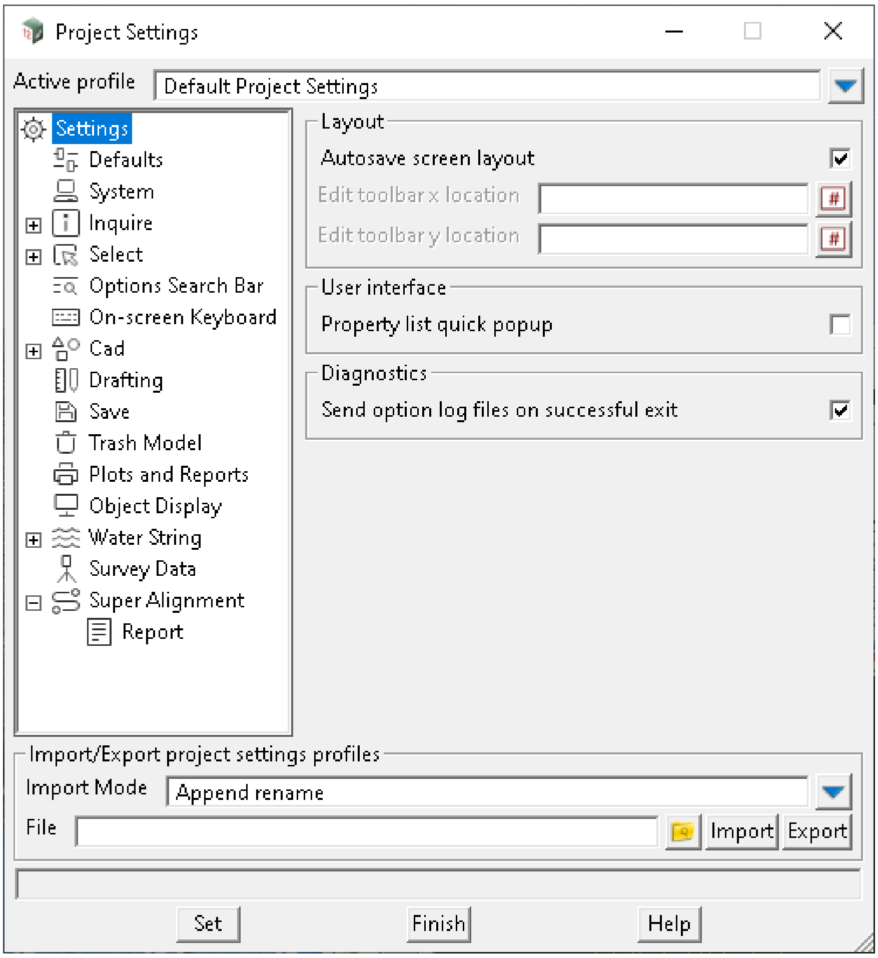
*Write out the named Project Setting Profiles in the **current** project to the file with the name given in the* **File** *field. The file is given the ending **12dsettings**.*

Set button

*The values in the fields displayed on the right side page of the **node** become the active values and set as the values for the current Active Profile.*

Continue to 6.5.2.2 Main Page Settings or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project.

6.5.2.2 Main Page Settings



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Layout section

Autosave screen layout.4d tick box

*If **ticked**, when the project is saved, all the menus and panels on the screen that are slx-able, are saved to a special layout file. And when the project is next opened, the special layout file is read back and the panels and menus restored to the screen.*

*If **not ticked**, no information about the menus and panels on the screen is saved.*

Edit toolbar x location integer box

*If **not blank**, the X location is the position of string or element edit toolbar on the x-axis of the application screen. The top left corner below the top menu is 0.*

*If **blank**, the X location "0" is used.*

Edit toolbar y location integer box

*If **not blank**, the Y location is the position of string or element edit toolbar on the y-axis of the application screen. The top left corner below the top menu is 0.*

*If **blank**, the Y location "0" is used.*

User interface section

Property list quick pop up tick box

*If **ticked**, clicking on the Property List choices icon will pop-up the choice list.*
*If **not ticked**, to access the pop-up choice list for Property List, the user needs to click on the Selection icon.*

Diagnostics section

Send option log files on successful exit tick box

*If **ticked**, then when 12d Model successfully exits (that is, did not crash) a log file will be sent back to 12d Solutions.*
The log file contains information about how 12d Model was used during the session. This information includes what panels and options were used, how long they took to execute, what modules were accessed along with license and dongle information.

*If **not ticked** then a log file will not be sent back to 12d Solutions when 12d Model successfully exits.*

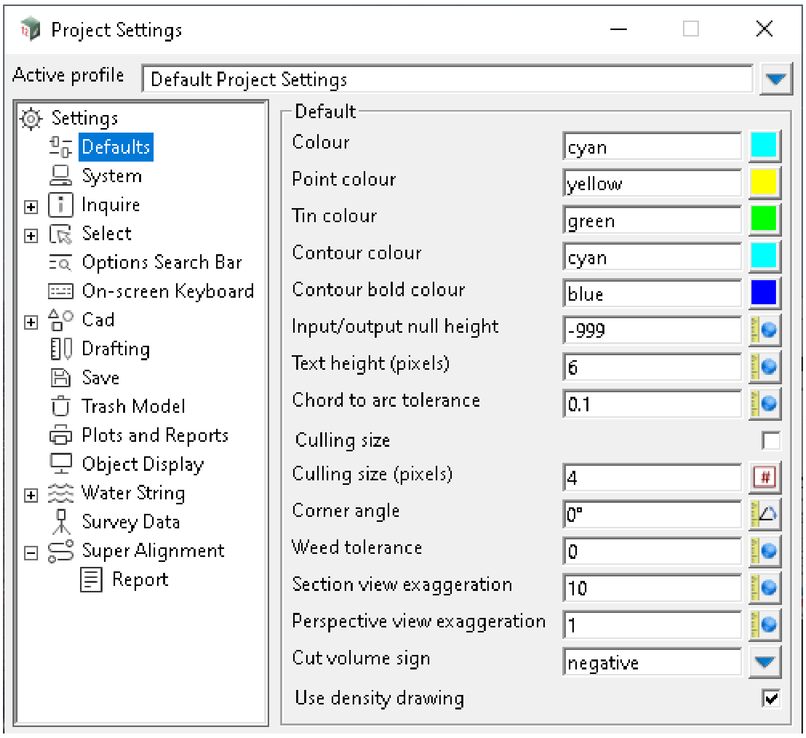
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.3 Defaults Settings or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project

6.5.2.3 Defaults Settings

*these setting are the same as, and replace, the ones of the same name on the **Default Settings** tab on the **Defaults** panel.*



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Colour	colour box	default colour	available colours

Name of the current default colour used for line strings.

Point colour	colour box	def point colour	available colours

Current default colour used for point strings.

Tin colour	colour box	def tin colour	available colours

Default tin colour used in the triangulate model and view panels.

Contour colour	colour box	default cont colour	available colours

Default contour colour used in the contour panel.

Contour bold colour	colour box	default cont index colour	available colours

Default contour bold colour is used in the contour panel.

Input/Output null height	real box	-999.0	

This field contains the value of the value recognised as a null height when reading in and writing out data.

Text height (pixels)	real box	6	

Default text height used in the sewer option and other panels.

Chord to arc tolerance	real box	0.1	

Maximum value of a chord to arc distance. If this distance is exceeded when approximating curves by chords, extra points are inserted into the curve so that the chords all have chord/arc distances less than this value. A value of zero disables the chord/arc test. See 3.25.2 Chord-to-Arc Tolerance.

Culling size tick box

*If **ticked**, use the* **culling** *setting for any new perspective or plan views.*

Culling size (pixels) real box 5

culling size *for any new perspective or plan views.*

Corner angle angle box 1 degree

When applying templates or calculating interfaces along a string, extra sections may be required at string vertices with no horizontal curve on them. If the **corner angle** *is non-zero, extra sections are added in at multiples of the* **corner angle** *value for the plan angle at the vertex.*

Weed tolerance real box 0

If two points on a string (with the same bearing) are closer that this distance then the second point is left out. This applies to the extra points added in at chainage points in interfacing and corner angles.

Section view exaggeration real box 10

Default **vertical exaggeration** *used for any new section views.*

Perspective view exaggeration real box 1

Default **vertical exaggeration** *of any new perspective views.*

Cut volume sign choice box negative negative, positive

Sign (positive or negative) used for cut volumes and areas. The sign for fill is the opposite.

Use density drawing tick box

If **Use density drawing** *is ticked, the data density for a model is calculated and if it is too high, a red rectangle is drawn around the model instead of the individual vertices of the strings in the model.*

If the data density of the model is low enough not to replace the entire model by a red rectangle, a data density is calculated for each string in the model and if the data density is too high, the string is replaced by a red rectangle.

Note**: This setting is only applicable to the Bigfoot version of **12d Model.

The default for a new project is given by the environment variable USE_DENSITY_CHECKS_4D.

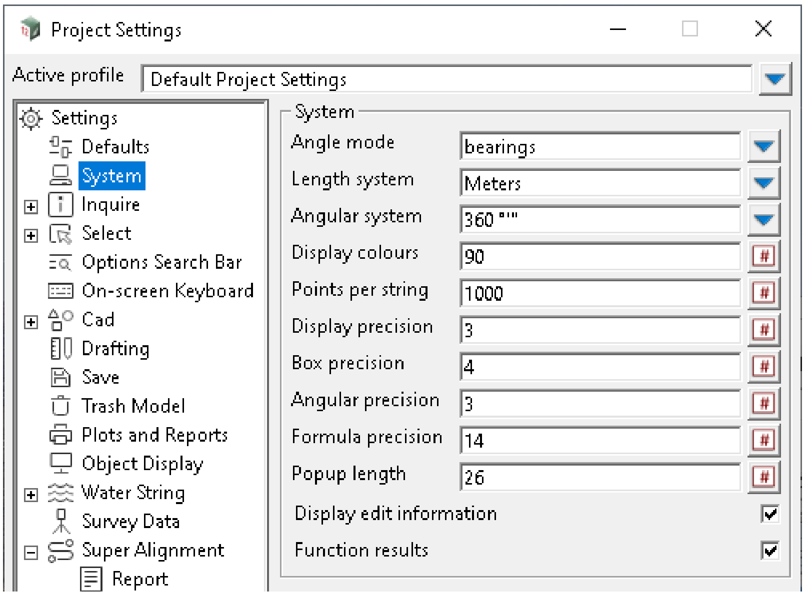
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.4 System Settings or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project.

6.5.2.4 System Settings

*These setting are the same as, and replace, the ones of the same names on the **System Settings** tab of the **Defaults** panel.*



The fields and buttons used in this panel have the following functions.

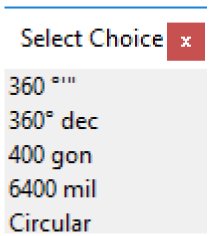
Field Description	Type	Defaults	Pop-Up
Angle mode	choice box	bearings	cartesian, bearings

Specifies whether bearings or cartesian angles are used in reporting the instantaneous direction of the selected string in the **information** *menu.*

Field Description	Type	Defaults	Pop-Up
Length system	choice box	Meters	

Length System
Specifies the default units for use in

Field Description	Type	Defaults	Pop-Up
Angular system	choice box	bearings	



Angular System
Specifies the default units for use in Angle boxes (used for entering/displaying angles or bearings.

*If **360 deg min sec**, then degrees, minutes and seconds in* 3.23.2 HP Notation.

*If **360 dec**, then 3.23.3 Decimal Degrees.*

*If **400 gon**, then 3.23.4 Gons. There are 400 gons to a full circle.*

*If **6400 mil**, then 3.23.5 Military mils. There are 6400 mils to a full circle.*

*The **6400** is used in **6400 mils** so there is no confusion with the definition of mils as **milliradians** where a milliradian is one thousandth of a radian. There are approximately 6283 milliradians to a full circle.*

*If **Circular**, then 3.23.6 Circular or Radians.*

Display colours colour box 80

Number of colours from the colours.4d file that are displayed in a **Select Colour** *pop-up.*

*If **0**, all colours are displayed.*

The order that the colours are selected is given by the Pop-up number in the colours.4d file. See 3.31.3 Editing Colours.4d.

Points per string integer box 1000

*When reading in data from say an xyz file and there are individual points, for efficiency these are collected in a super string with point linestyle and a new super string is started when there are more than **Points per string** vertices in the super string.*

Display precision integer box 3

Number of decimal places used for values displayed in the information menus.

Box precision integer box 4

Number of decimal places used for values displayed in real boxes and real panel fields. The minimum value for the box precision is 3, e.g. the actual precision will 3 if the setting value is less than 3.

Angular precision integer box 3

Number of decimal places used for values displayed in angle boxes and angle panel fields.

Formula precision integer box 14

Number of decimal places used for.

Popup length integer box 28

This is no longer used - the maximum number of items in a pop-up before breaking the pop-up into walk-rights.

Display edit information tick box tick

*If **ticked**, the Edit Info panel is automatically displayed whenever a string is created or edited. See 10.3.1.2 Super Edit Info Panel.*

Function results tick box tick

*If **ticked**, function results such as volumes will be displayed on the screen every time a recalc is done. If **not ticked**, no function results as displayed on a function recalc.*

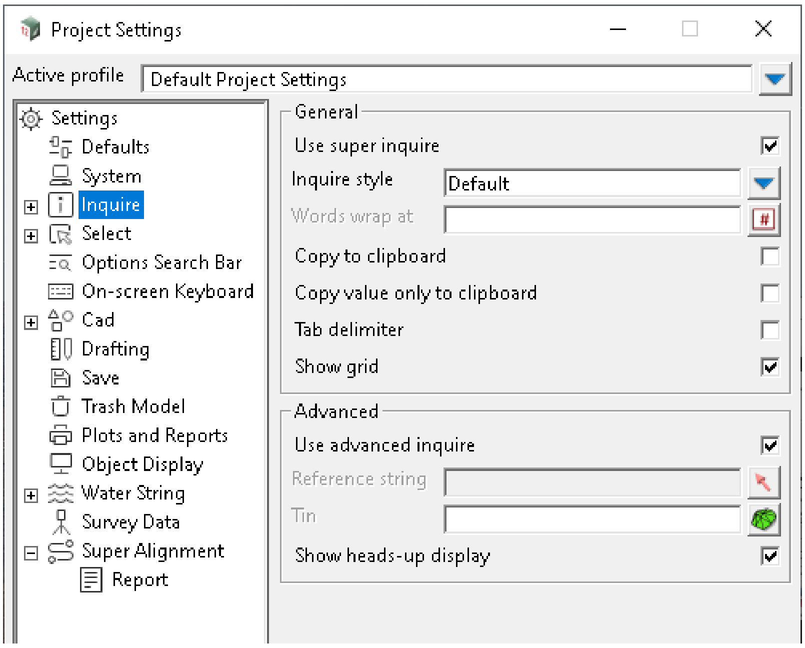
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.5 Inquire Settings or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project.

6.5.2.5 Inquire Settings

These setting are for use with 10.10 String Inquire.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Inquire section

Use super inquire tick box

*If **ticked**, user defined information is displayed when selecting an object. See* 3.16.7 Information Displayed When Picking an Object.
*If **not ticked**, the pre-Super Inquire of V11 is displayed. See* 3.17.5 Non Inquire Style Information.

Inquire style inquire style box

*If **Use super inquire** is **ticked**, the given **Inquire style** is used when displaying information in object **Selects**.*

Word wrap at integer box

When Grid display is ticked, various rows of text data such as string name, text attribute values in the String Inquire Information panel with more characters than this value with wrap onto more rows.

Copy to clipboard tick box

*If **ticked**, the **Copy to clipboard** mode is set to **yes** for object **Selects**.*
*If **not ticked**, the **Copy to clipboard** mode is set to **no** for object **Selects**.*

Copy value only to clipboard tick box

*If **ticked**, only copy the values of the items in the Inquire style to clipboard.*
*If **not ticked**, copy the names of the items and their values in the Inquire style to clipboard. The two are separated by either a space or a tab depending upon **Tab delimiter**.*

Tab delimiter tick box

*If **ticked**, use a tab between the item names and the item values when both are copied to the clipboard.*
*If **not ticked**, use a space between the item names and the item values when both are copied to the clipboard.*

Show grid tick box

*If **ticked**, the String Inquire Information panel has two column grid display for names and values*
*If **not ticked**, the String Inquire Information panel has no grid display, the name and value in each line is*

separated by the = sign

Advanced section

Use advanced inquire tick box

*If **ticked**, the* **Advanced setting** *tick box in* 10.10 String Inquire *is ticked on.*
*If **not ticked**, the* **Advanced setting** *tick box in* 10.10 String Inquire *is not ticked on.*

Reference string string select box

*If **not blank**, the string to use in the* **Reference string** *field in* 10.10 String Inquire.
*If **blank**, no string is being used in the* **Reference string** *field in* 10.10 String Inquire.

Tin tin box

*If **not blank**, the tin to use in the* **Tin** *field in* 10.10 String Inquire.
*If **blank**, no tin is being used in the* **Tin** *field in* 10.10 String Inquire.

Show heads-up display tick box

*If **ticked**, the* **Heads-up display** *tick box in* 10.10 String Inquire *is ticked on.*
*If **not ticked**, the* **Heads-up display** *tick box in* 10.10 String Inquire *is not ticked on.*

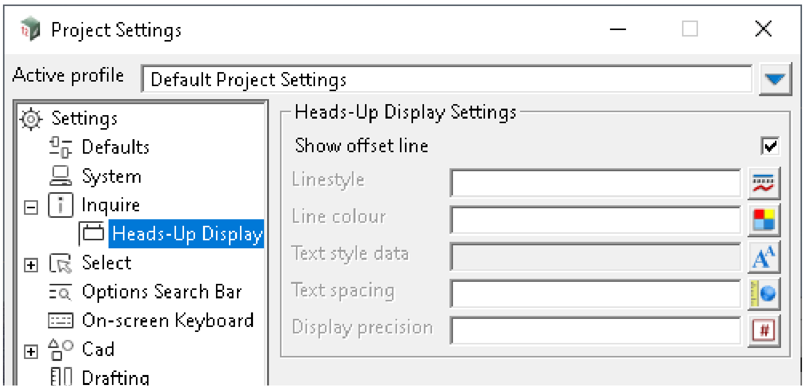
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.5.1 Inquire Settings >Heads-Up Display or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project.

6.5.2.5.1 Inquire Settings >Heads-Up Display

These setting are for use with 10.10 String Inquire *when* **Heads-up display** *is ticked on.*



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Show offset lines tick box

*If **ticked**, offset lines are displayed in the heads-up display.*

Linestyle linestyle box

*If **not blank**, the linestyle to use for drawing the line from current position to the reference string when* **Head-up display** *is used in* 10.10 String Inquire.

*If **blank**, the Linestyle "1" is used.*

Line colour colour box

*If **not blank**, the colour to use for drawing the line from current position to the reference string when* **Head-up display** *is used in* 10.10 String Inquire.

*If **blank**, the colour "green" is used.*

Textstyle data inquire style box

*If **not blank**, the Textdata to use for the chainage and offset values when* **Head-up display** *is used in* 10.10 String Inquire.

*If **blank**, the Text style "1" is used for the chainage and offset values when* **Head-up display** *is used in* 10.10 String Inquire.

Text spacing double box

*If **not blank**, the spacing to use between text lines of chainage and offset values.*

The spacing value is a factor applied to the text size defined in the **Textstyle data** *above. That is, a value of 1.0 is equal to 100% of the text size and a value of 0.5 is equal to 50% of the text size.*

*If **blank**, the* **Text spacing** *value "0.5" is used. That is 50% of the text size.*

Display precision double box

*If **not blank**, the* **Display precision** *is the number of decimal places to use when showing chainage and offset values.*

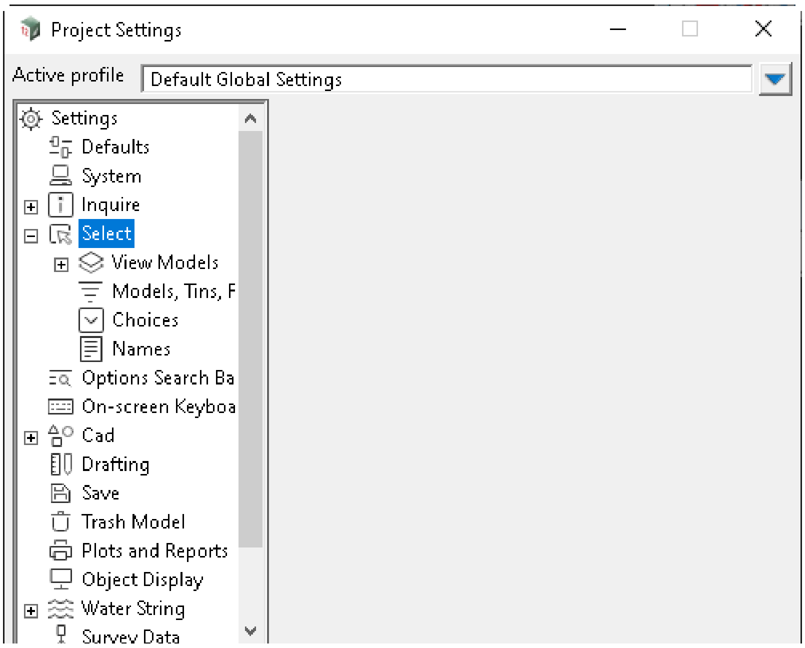
*If **blank**, the* **Display precision** *is "3". That is, 3 decimal places is used.*

Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

6.5.2.6 Select Settings

These setting are the selecting the names of modes, tins, functions, templates, choices and names in the Names box.

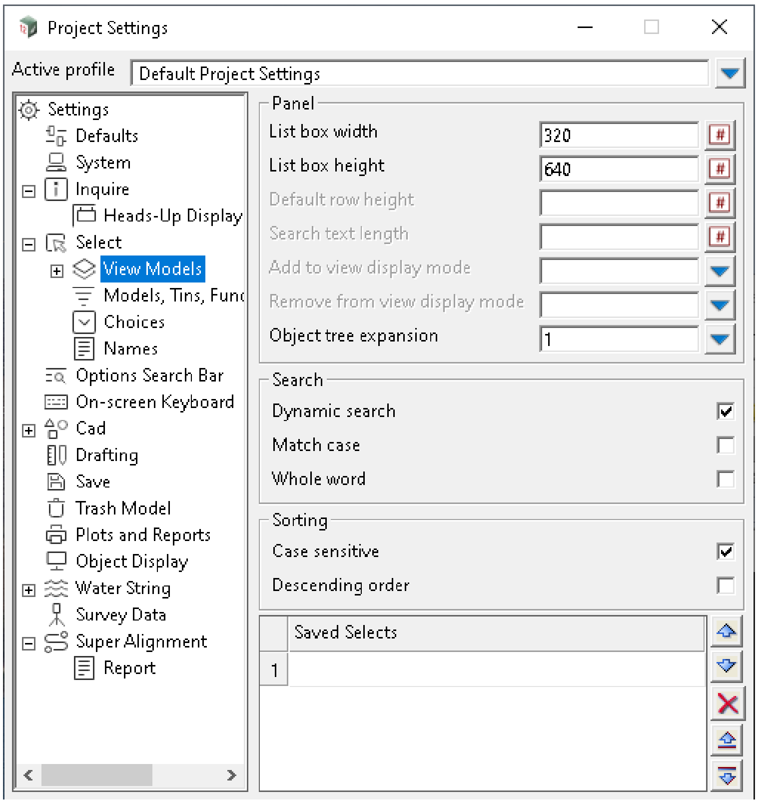


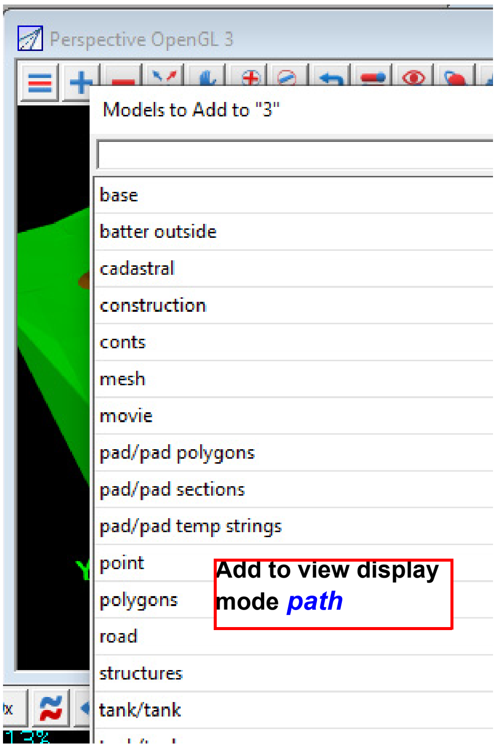
Continue to 6.5.2.6.1 Select >View Models Settings or return to 6.5.2 Project =>Settings or 6.5 Project Settings or 6 Project.

6.5.2.6.1 Select >View Models Settings

*These setting are used by the **Models to Add** and **Models to Remove** panels that come up by **clicking LB** over the + and - buttons on any View.*

*If a setting is changed then the change is used for the **Models to Add** and **Models to Remove** panels that come up by **clicking LB** over the + and - buttons on **ANY** View.*





The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Add to view display mode choice box tree, path, name

*How to display the model name in the list when clicking **LB** over a +.*

*If **tree**, the path name of the model is displayed in object tree form.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **path**, the full path name of the model is displayed as text.*

Remove from view display mode choice box tree, name, path, view

*How to display the model name in the list when clicking **LB** over a -.*

*If **tree**, the path name of the model is displayed in object tree form.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **path**, the full path name of the model is displayed as text.*

*If **view order**, the models are displayed in the order that they were added to the view.*

Object tree expansion Integer box

Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive See 3.28.3.1 Select Settings - Displaying Path Name *and* 3.10 Object Tree.

Search section

Dynamic search tick box

*If **ticked**, the search results are shown dynamically as the query is type in.*

*If **not ticked**, after the search query in typed in you need to click on the Search button to show search results*

Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Sorting section

Case sensitive, Descending order tick boxes

See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order

Saved Selects

see 6.5.2.23 Saved Selects.

Important Note

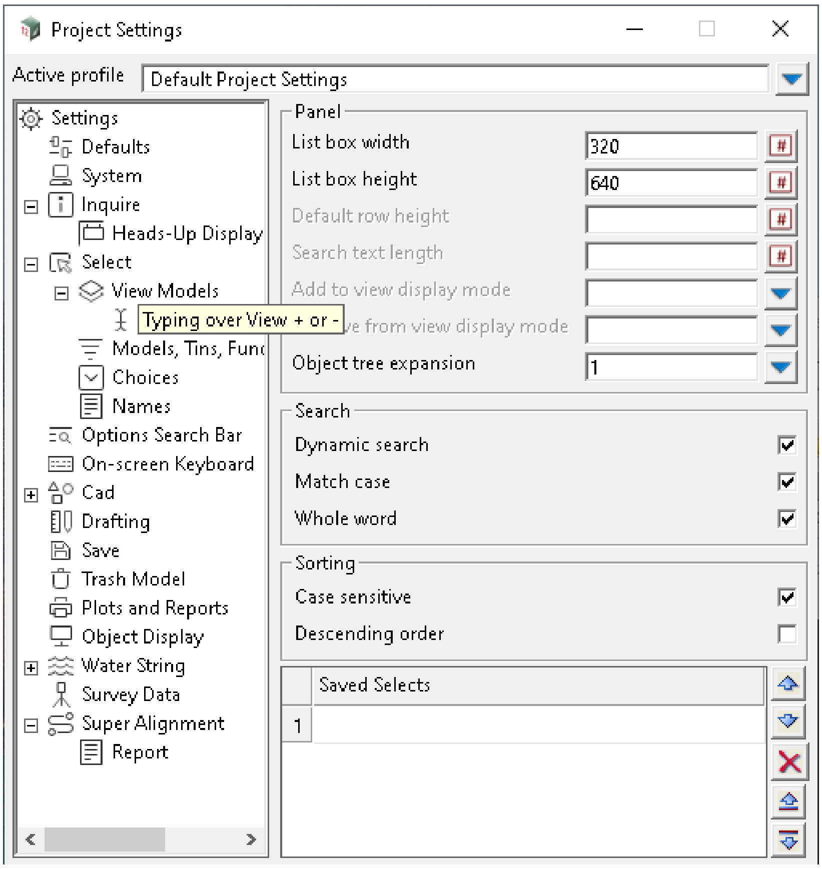
*when the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

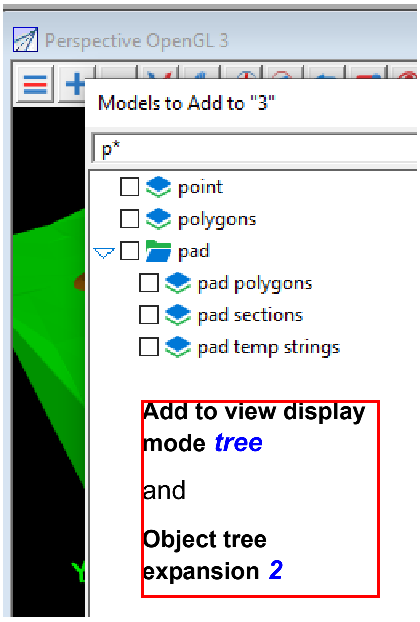
Continue to 6.5.2.6.1.1 Select >View Models >Typing over View + or - Settings or return to 6.5.2 Project =>Settings.

6.5.2.6.1.1 Select >View Models >Typing over View + or - Settings

*These setting are used by the **Models to Add** and **Models to Remove** panels that come up by **typing one character** over the + and - buttons on any View.*

If a setting is changed then the change is used when typing a character over the + and - buttons on all Views.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Object tree expansion Integer box

*Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive.*3.10 Object Tree.

Add to view display mode choice box tree, name, path

*How to display the model name in the list when **typing** over a +.*

*If **tree**, the path name of the model is displayed in object tree form.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **path**, the full path name of the model is displayed as text.*

Remove from view display model choice box tree, name, path, view order

*How to display the model name in the list when **typing** over a -.*

*If **tree**, the path name of the model is displayed in object tree form.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **path**, the full path name of the model is displayed as text.*

*If **view order**, the models are displayed in the order that they were added to the view.*

Object tree expansion Integer box

Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive See 3.28.3.1 Select Settings - Displaying Path Name *and* 3.10 Object Tree.

Search section

Dynamic search tick box

*If **ticked**, the search results are shown dynamically as the query is type in.*

*If **not ticked**, after the search query in typed in you need to click on the Search button to show search results*

Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Sorting section

Case sensitive, Descending order tick boxes

See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order

ascii sort sequence.

Saved Selects

see 6.5.2.23 Saved Selects.

Important Note

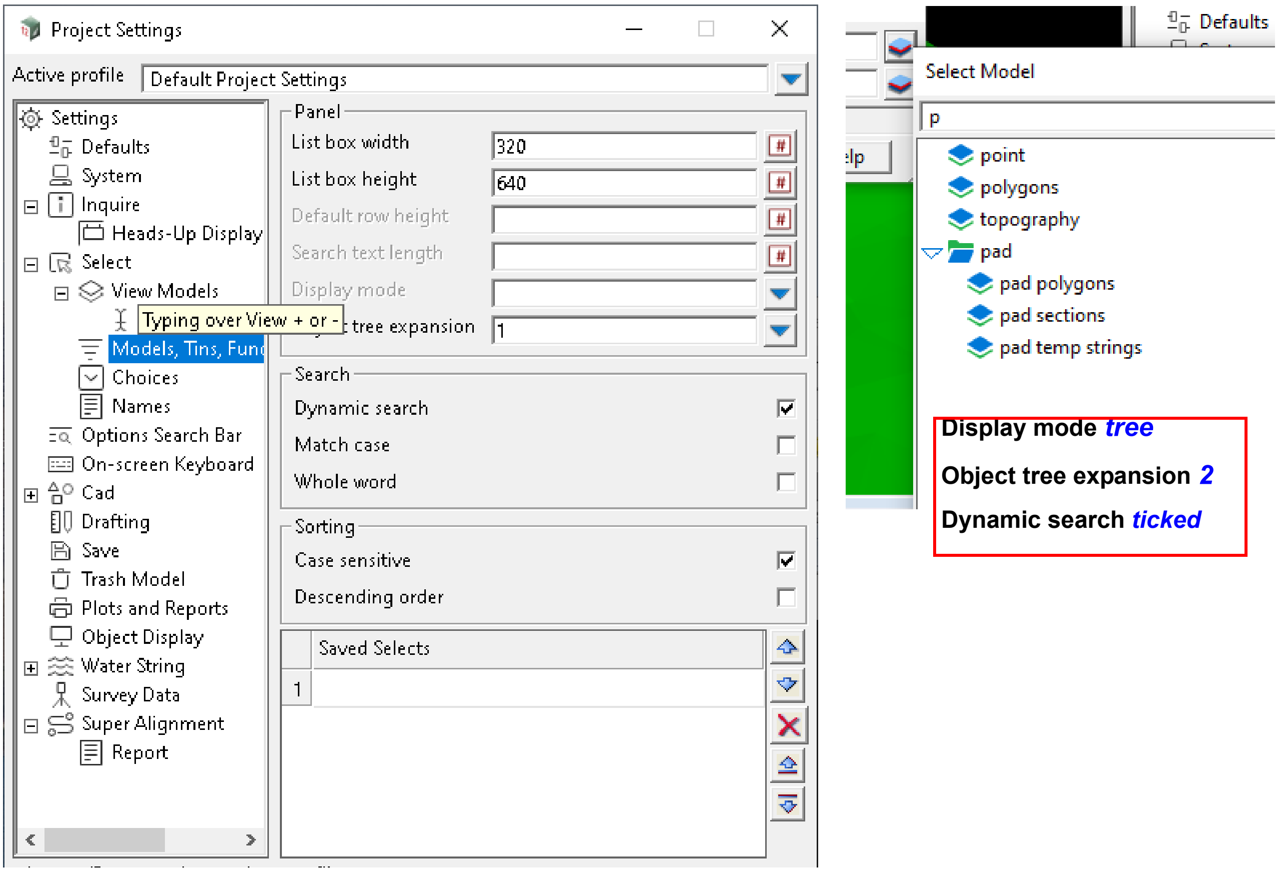
*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.6.2 Select >Models, Tins, Functions Settings or return to 6.5.2 Project =>Settings.

6.5.2.6.2 Select >Models, Tins, Functions Settings

*These setting are used by the Select panels when clicking LB over the icon at the right hand end for **Model** boxes, **Tin** boxes and **Function** boxes.*

*If a setting is changed then the change is used for the icons on all the **Model**, **Tin** and **Function** boxes.*



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Display mode choice box tree, name, path

How to display the model name in the list. See 3.28.3.1 Select Settings - Displaying Path Name

*If **tree**, the path name is displayed in object tree form.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **path**, the full path name is displayed as text.*

Object tree expansion Integer box

Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive See 3.28.3.1 Select Settings - Displaying Path Name *and* 3.10 Object Tree.

Search section

Dynamic search tick box

*If **ticked**, the search results are shown dynamically as the query is type in.*

*If **not ticked**, after the search query in typed in you need to click on the Search button to show search* *results*

Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Sorting section

Case sensitive, Descending order tick boxes

See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order

Saved Selects

See 6.5.2.23 Saved Selects.

Important Note

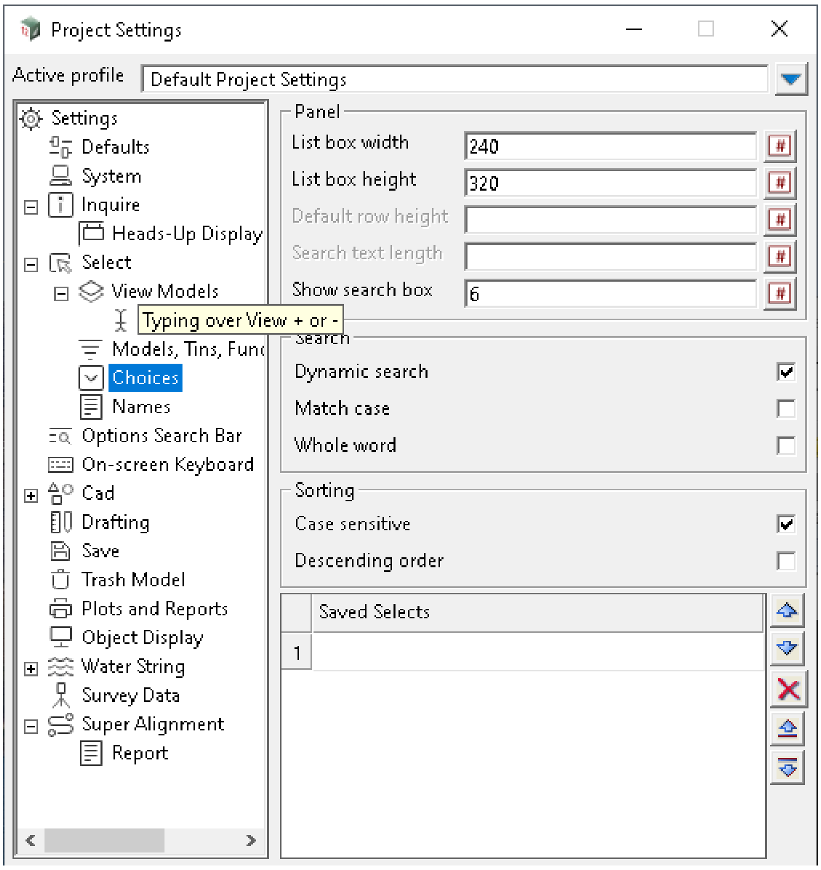
*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.6.3 Select >Choices or return to 6.5.2 Project =>Settings.

6.5.2.6.3 Select >Choices

This setting is used by the Select panels when clicking LB over the icon at the right hand end for Choice boxes.

If a setting is changed then the change is used for the icons on all the Choice boxes.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Show search box Integer box

??

Search section

Dynamic search tick box

*If **ticked**, the search results are shown dynamically as the query is type in.*

*If **not ticked**, after the search query in typed in you need to click on the Search button to show search results*

Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Sorting section

Case sensitive, Descending order tick boxes

See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order

Saved Selects

See 6.5.2.23 Saved Selects.

Important Note

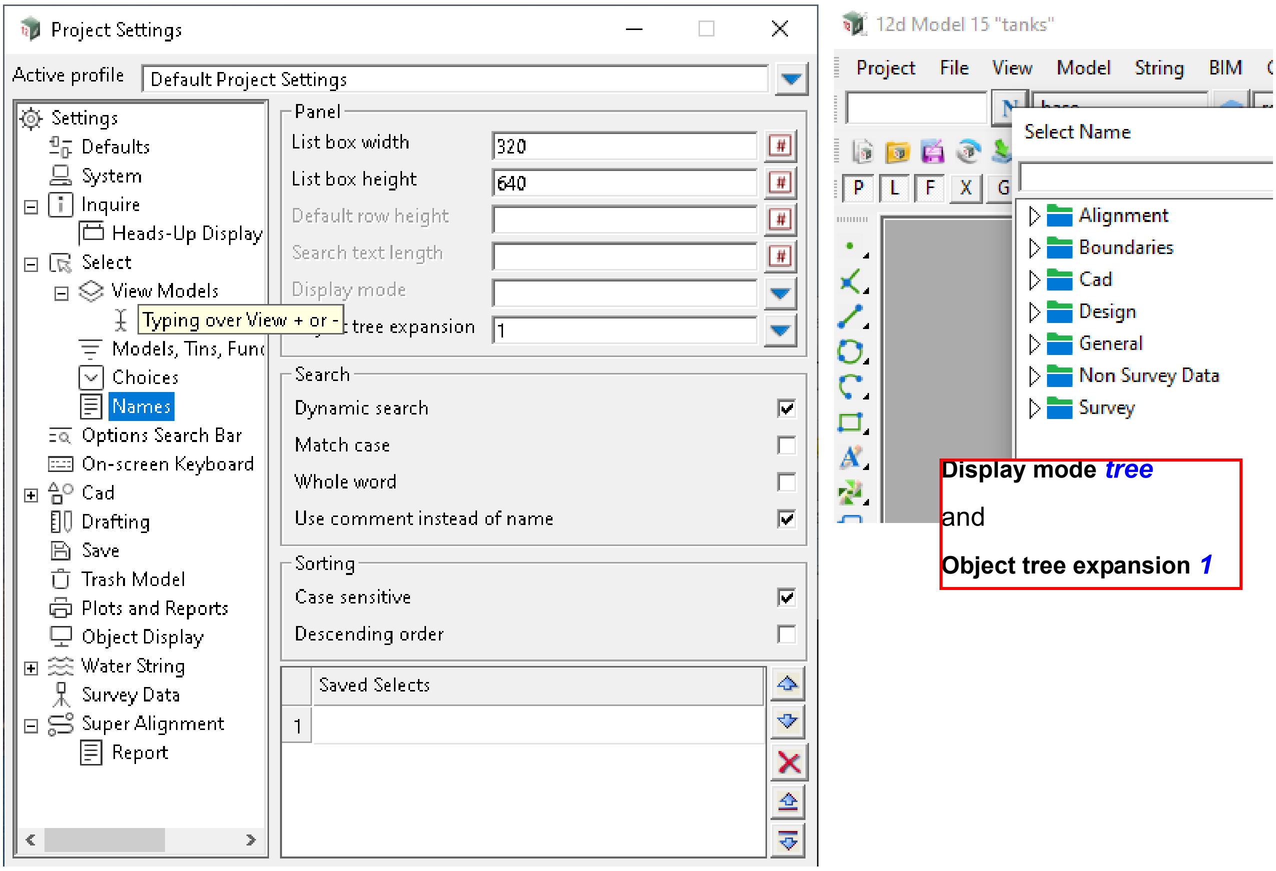
*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.6.3 Select >Choices or return to 6.5.2 Project =>Settings.

6.5.2.6.4 Select >Names

This setting is used by the Select panels when clicking LB over the **Names** *icon.*

If a setting is changed then the change is used for the icons on all the Names boxes.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Display mode choice box tree, name, path

How to display the name in the list. See 3.28.3.1 Select Settings - Displaying Path Name

If ***tree****, the path name is displayed in object tree form.*

If ***name****, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

If ***path****, the full path name is displayed as text.*

Object tree expansion Integer box

Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive See 3.28.3.1 Select Settings - Displaying Path Name *and* 3.10 Object Tree.

Search section

Dynamic search tick box

If ***ticked****, the search results are shown dynamically as the query is type in.*

If ***not ticked****, after the search query in typed in you need to click on the Search button to show search results.*

Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Use comment instead of name tick box

*If **ticked**, the **Comment** field from the names.4d file is used in the pop-ups.*

*If **not ticked**, the **Names** field from the names.4d file is used in the pop-ups.*

Sorting section

Case sensitive, Descending order tick boxes

See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order

Saved Selects

See 6.5.2.23 Saved Selects.

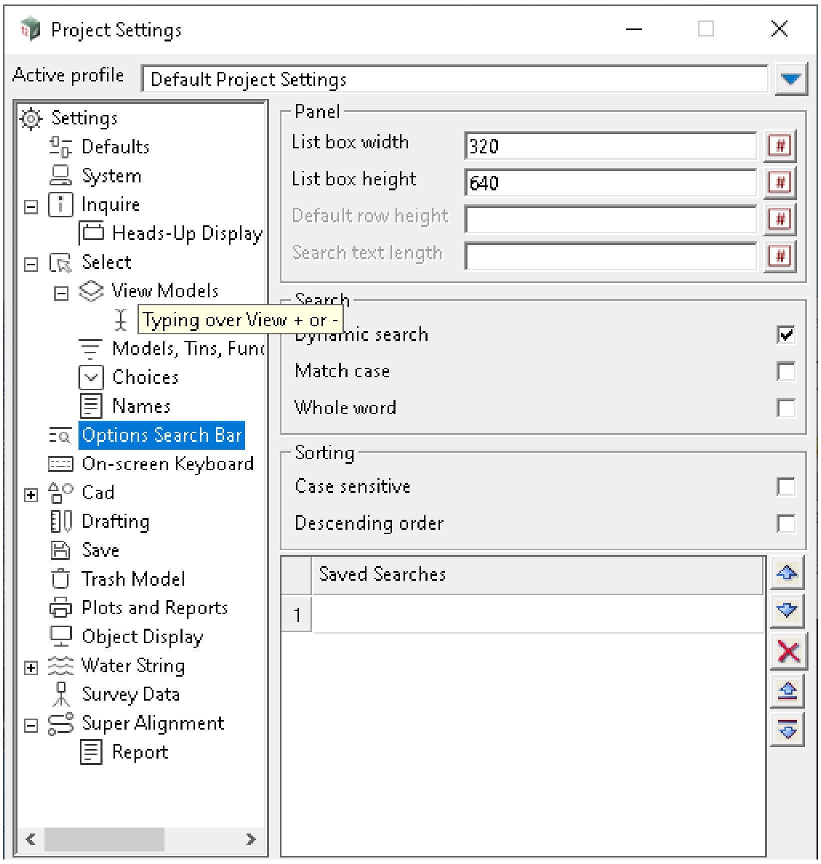
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.7 Search Bar Settings or return to 6.5.2 Project =>Settings.

6.5.2.7 Search Bar Settings

These setting are used by the ***Search for 12d Model Options*** *panel that is brought up by typing into the* ***Options Search Bar****. See* 3.27 Options Search Bar.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Panel section

List box width, List box height, Default row height, Search text length

See 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length.

Search section

Dynamic search tick box

If ***ticked****, the search results are shown dynamically as the query is type in.*

If ***not ticked****, after the search query in typed in you need to click on the Search button to show search results*

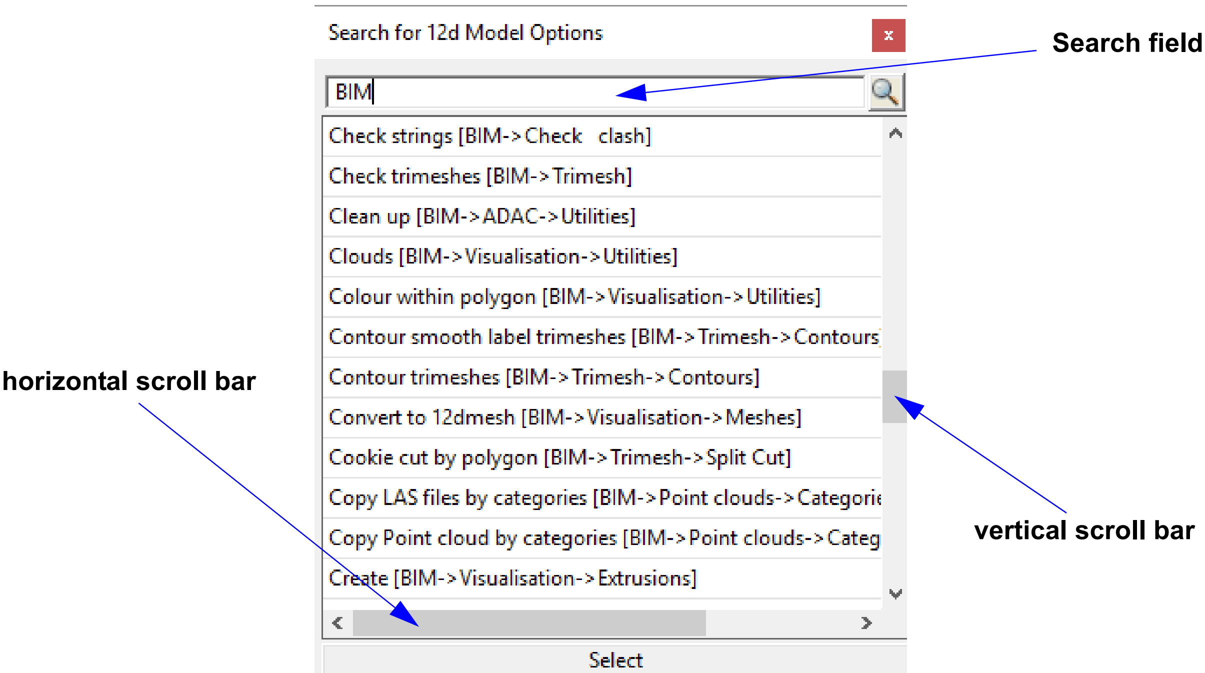
Match case, Whole word tick boxes

See 3.28.3.2 Select Settings - Match Case and Whole Word

Sorting section

Case sensitive, Descending order tick boxes

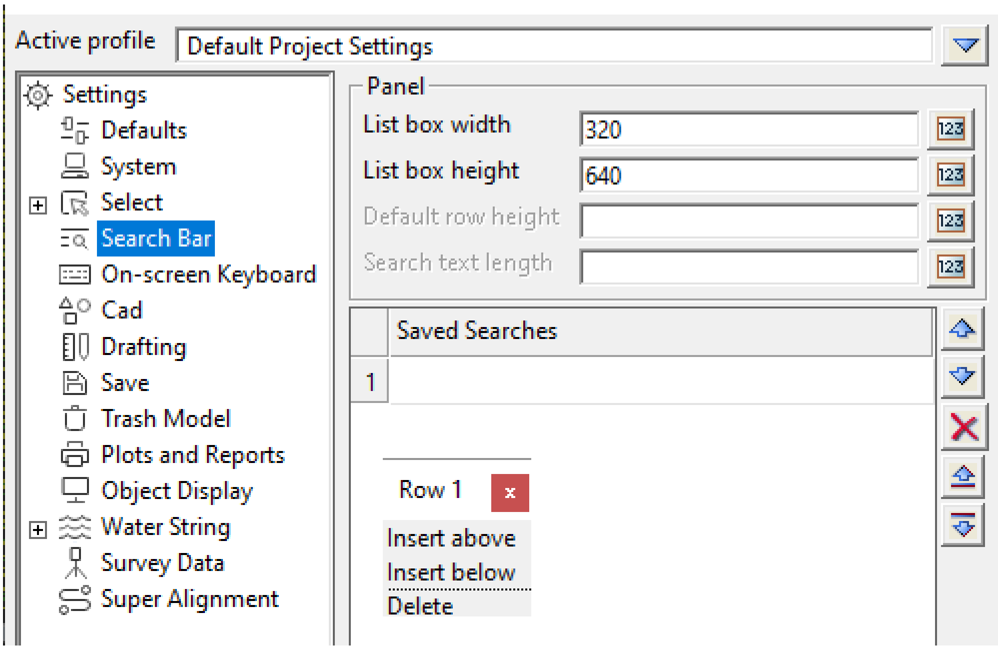
See 3.28.3.3 Select Settings - Case Sensitive Sorting and Descending Order



Saved Searches

See 6.5.2.23 Saved Selects.

If any Search text for the **Search for 12d Model Options** *has been saved, it will be listed here.*



New **Search text** *can be added by typing into a row but the new Search text is only available for use by the* ***Search for 12d Model Options*** *panel by clicking on the* **Set** *button.*

Similarly rows of existing Search text can be edited but the edited Search text is only available for use by clicking on the **Set** *button.*

There are icons on the right hand side to move a row up and down, ***delete*** *a row and* ***insert blank*** *rows* ***above*** *or* ***below*** *a row.*

*Clicking on a number icon on the left hand side also brings up the menu to **Insert above**, **Insert Below** or **Delete** rows.*

*Any updates to the Search Texts are only saved with the project when a **Project =>Save** is done.*

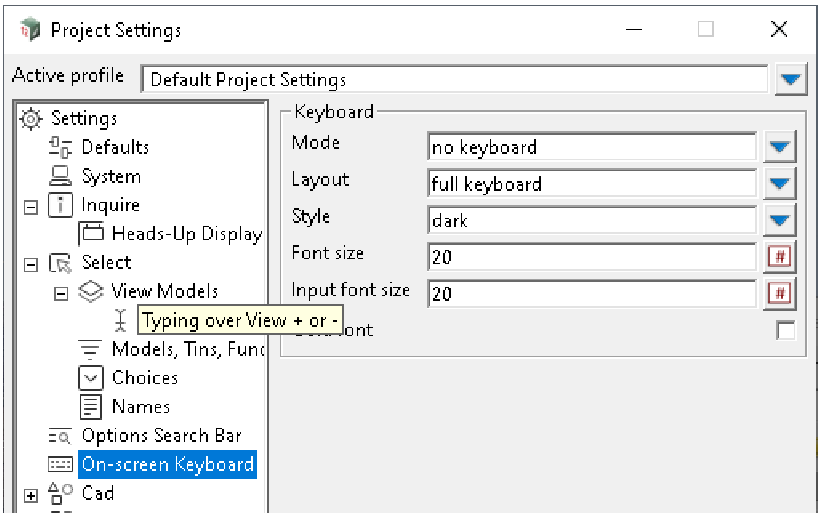
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.8 On-Screen Keyboard Settings or return to 6.5.2 Project =>Settings.

6.5.2.8 On-Screen Keyboard Settings

*These setting are used by the on-screen keyboard. When the **Mode** is **dockable** or **full screen**, double clicking in any input field will bring up the keyboard.*



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Keyboard section

Mode choice box no keyboard, full screen

*If **no keyboard**, then no on-screen keyboard is used.*
*If **full screen**, then when a value is to be typed in, a full screen keyboard appears.*

Layout choice box full keyboard, numeric pad

*If **full keyboard**, then a full keyboard is used. See* Full Keyboard.

*If **numeric pad**, then only a numeric pad is used. See* Numeric Pad.

***Note**: when either the full keyboard or numeric pad is up, there is a button to change to the other style.*

Style choice box dark, light, classic, white

*If **dark**, then the background to the keys is black and the text is white.*
*If **light**, then the background to the keys is grey and the text is black.*
*If **classic**, then the background to the keys is grey and the text is black, with black borders around the keys.*
*If **white**, then the background to the keys is white and the text is black.*

Font size integer box

Size of the font to use on the on-screen keyboard.

Input Font size integer box

Size of the font to use for typed in values.

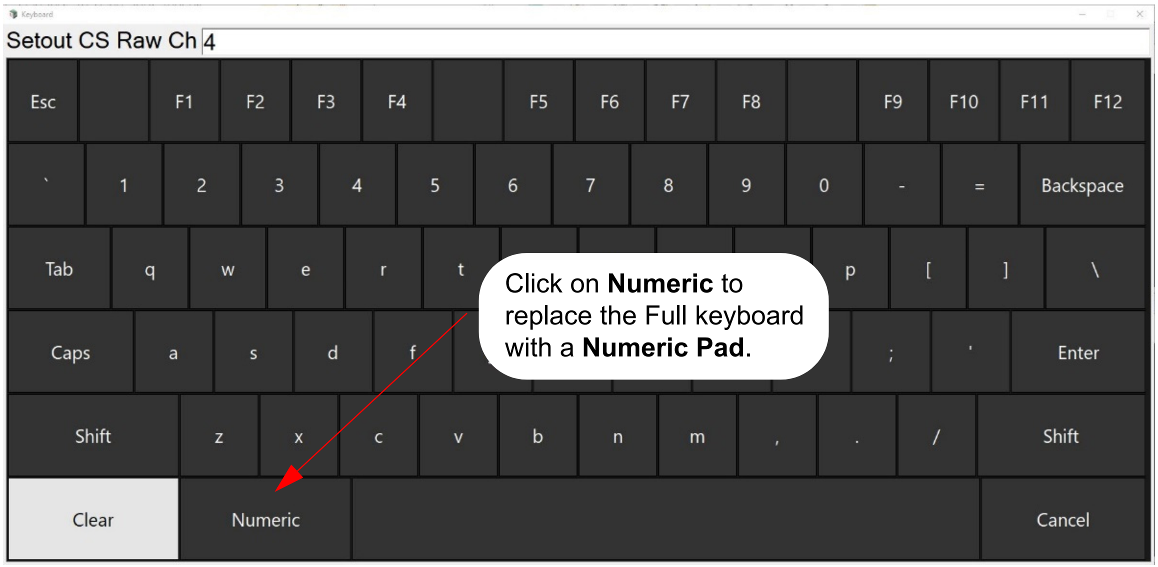
Bold Font tick box

*If **ticked**, the text and keyboard font is bold.*
*If **not ticked**, the text and keyboard font is normal.*

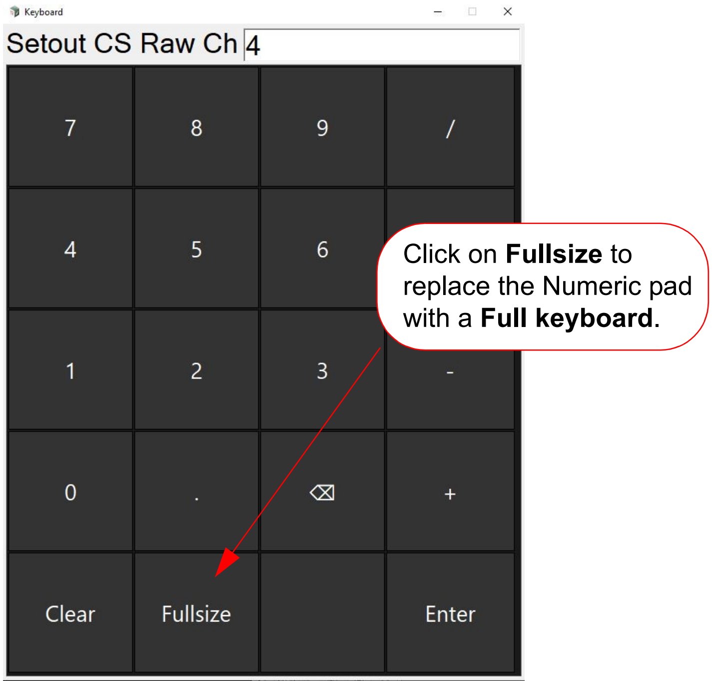
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Full Keyboard



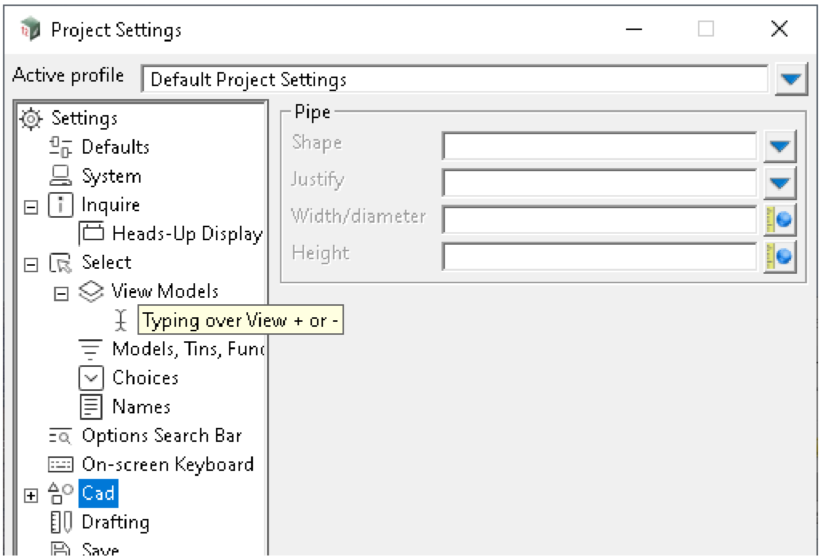
Numeric Pad



Continue to 6.5.2.9 Cad Settings or return to 6.5.2 Project =>Settings.

6.5.2.9 Cad Settings

These setting are used for the values in the CAD ControlBars.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Pipe node

Values to use for the Pipe ControlBar. The values can be left blank. See 12.1.4 Pipe Controlbar.

Shape choice box diameter, culvert

Value for the ***Default Pipe Shape*** *field in the Pipe ControlBar.*
The value can be blank.

Justify choice box

Value for the ***Default Pipe Justify*** *field in the Pipe ControlBar.*
The value can be blank.

Width/Diameter choice box

Value for the ***Default Pipe Size 1*** *field in the Pipe ControlBar.*
This is used for the diameter of a round string and the Width for a culvert (box) string.
The value can be blank.

Height choice box

Value for the ***Default Pipe Size 2*** *field in the Pipe ControlBar.*
This is used for Height for a culvert (box) string and ignored for a round string.
The value can be blank.

Important Note

When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

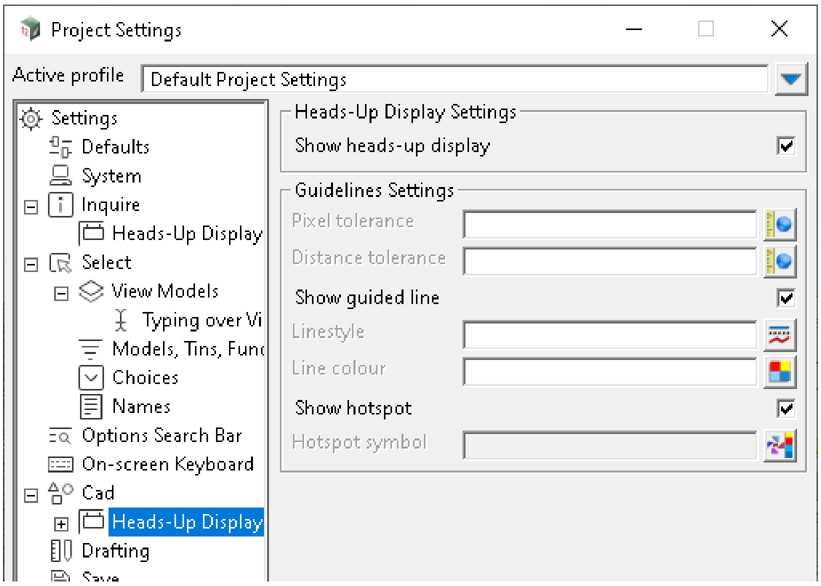
Continue to 6.5.2.9.1 CAD >Heads-Up Display Settings or return to 6.5.2 Project =>Settings.

6.5.2.9.1 CAD >Heads-Up Display Settings

The Heads-Up Display has setting for CAD options to show coordinates and angles and distances as you are dynamically creating a new vertex or segment, and also guides for the values of angles and distances.

Note: ***Heads-Up Display*** is currently only implemented for:

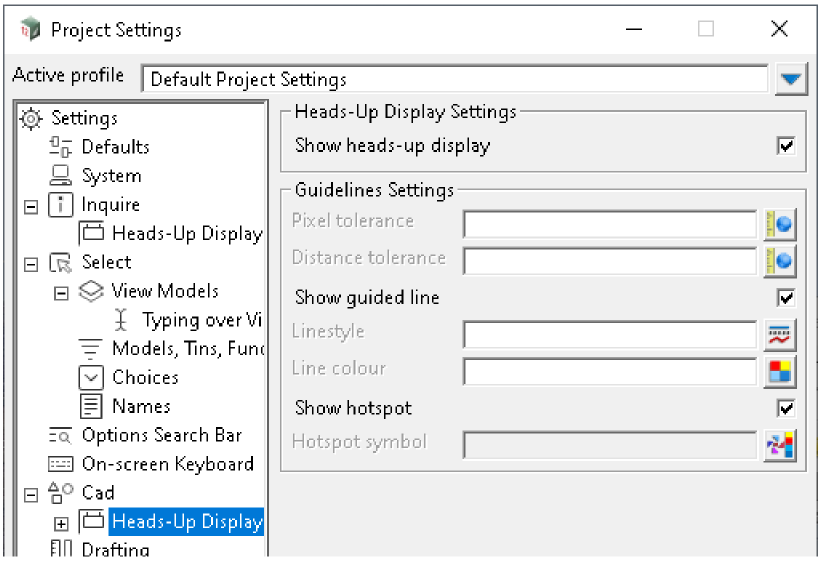
1. ***CAD =>Point =Point, Mid-segment, Mid position, Bearing and distance, drop perpendicular***
2. ***CAD =>Line =>2 points, Line string, Traverse***
3. ***CAD =>Circle =>3 points***
4. ***CAD =>Arc =>3 pts***
5. ***CAD =>Polygon =>Rectangle from 2 points, Rectangle from 2 points, Parallelogram, Polygon freehand***



See

[6.5.2.9.1.1 CAD >Heads-Up Display - Main]
[6.5.2.9.1.2 CAD >Heads-Up Display >Coordinates]
[6.5.2.9.1.3 CAD >Heads-Up Display >Angle]
[6.5.2.9.1.4 CAD >Heads-Up Display >Distance]
[6.5.2.9.1.5 CAD >Heads-Up Display >Text]

6.5.2.9.1.1 CAD >Heads-Up Display - Main



The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Heads-Up Display Settings section

Show heads-up display   tick box   ticked

*If **ticked**, the heads-up information is displayed near the cursor.*
for example, coordinates can be displayed, angle and distance when creating a new segment, and guide lines for angles, distances and text.

*If **not ticked**, no heads-up information is displayed.*

Guidelines Settings section

Pixel tolerance   real box

??

Distance tolerance   real box

??

Show guide line   tick box

*If **ticked**, guide lines are displayed for placing segments and text.*

*If **not ticked**, guide lines are not displayed.*

Linestyle   linestyle box

Linestyle for the guidelines.

Line colour   colour box

Colour for the guidelines.

Show hotspot   tick box   ticked

*If **ticked**, the* **Hotspot symbol** *is drawn at the hotspot.*

*If **not ticked**, no Hotspot symbol is drawn.*

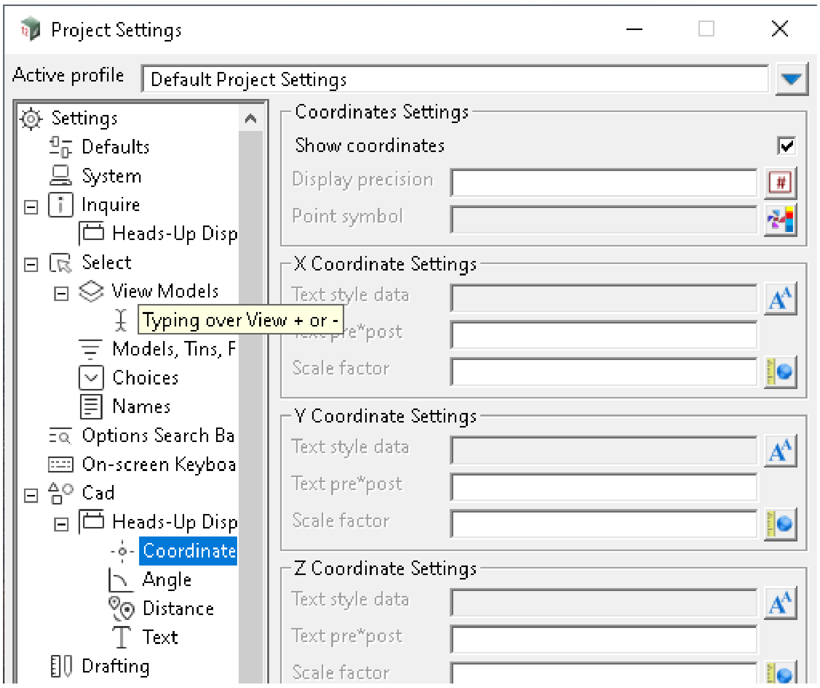
Hotspot symbol   symbol box

Symbol to use at the hotspot.

Continue to 6.5.2.9.1.2 CAD >Heads-Up Display >Coordinates or return to 6.5.2.9.1 CAD >Heads-Up Display Settings or 6.5.2.9 Cad Settings or 6.5.2 Project =>Settings.

6.5.2.9.1.2 CAD >Heads-Up Display >Coordinates

This section defines how the X, Y and Z coordinates are displayed in the Heads-Up information.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Coordinate Settings section

Show coordinates tick box

*If **ticked**, the X, Y and Z coordinates are shown in the heads-up information*
*If **not ticked**, the X, Y and Z coordinates are **not** shown in the heads-up information*

Display precision integer box

The number of decimal places to show for the X, Y and Z coordinates.
*If **blank**, "2" is used.*

Point symbol symbol box

Symbol to use at the cursor position.

X/Y/Z Coordinate Settings section

Textstyle data textstyle data box

Textstyle data to use for the X /Y/Z coordinate.
*If **blank**, a reasonable textstyle data is used so this can be left blank.*

Text pre*post input box

Text to use before and after the X/Y/Z coordinate value.
*If **blank**, "X /Y /Z " is used.*

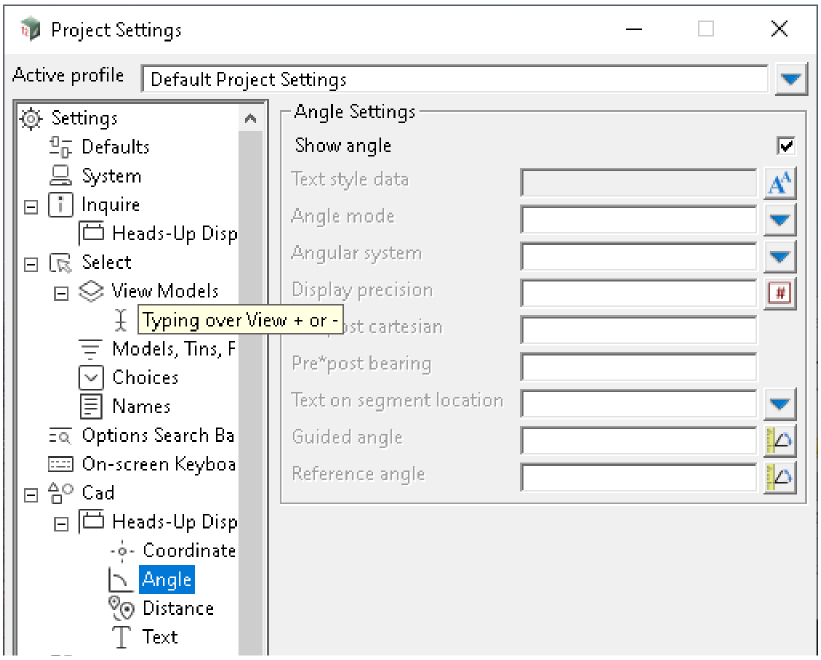
Scale factor real box

*Value of the X/Y/Z coordinate is multiplied by **Scale factor** before being displayed.*
*If **blank**, "1" is used.*

Continue to 6.5.2.9.1.3 CAD >Heads-Up Display >Angle or return to 6.5.2.9.1 CAD >Heads-Up Display Settings or 6.5.2.9 Cad Settings or 6.5.2 Project =>Settings.

6.5.2.9.1.3 CAD >Heads-Up Display >Angle

This section defines how the angle of a segment being drawn is displayed in the Heads-Up information.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Angle Settings section

Show angle — tick box

*If **ticked**, the angle of the segment being drawn is shown in the heads-up information*

*If **not ticked**, the angle of the segment is **not** shown in the heads-up information*

Textstyle data — textstyle data box

Textstyle data to use for angle.

*If **blank**, a reasonable textstyle data is used so this can be left blank.*

Angle mode — choice box — Pop-Up: cartesian, bearing

How the angle is calculated.

*If **cartesian**, the angle is measured from the positive x-axis and in a counter-clockwise direction.*

*If **bearing**, the angle is measured from the positive y-axis and in a clockwise direction.*

Angular system — choice box — Pop-Up: 360 deg min sec, 360 dec, 400 gons, 6400 mil, Circular

The system of units is used for the angle.

*If **blank**, "**360 deg min sec**" is used.*

*If **360 deg min sec**, the angle is measured degrees, minutes and decimal seconds.*

*If **360 dec**, the angle is measured in decimal degrees.*

*If **400 gons**, the angle is measured in decimal gons.*

*If **6400 mil**, the angle is measured in military mils.*

*If **Circular**, the angle is measured in radians.*

Display precision — integer box

Number of decimal places to use.

*If **blank**, "2" is used.*

Pre*post cartesian text box

*the text is use before and after the angle value when **Angle mode** is **cartesian**.*

*If **blank**, "c " is used.*

Pre*post bearing text box

*Text to use before and after the angle value when **Angle mode** is **bearing**.*

*If **blank**, "b " is used.*

Text on segment location choice box start, middle, end

The positioning of the angle text with respect to the segment being drawn. The Textstyle data is then applied to this position.

*If **blank**, the text is positioned at the end of the segment being drawn.*

*If **start**, the text is positioned at the start of the segment being drawn.*

*If **middle**, the text is positioned at the middle of the segment being drawn.*

*If **end**, the text is positioned at the end of the segment being drawn.*

Guide angle angle box

*If **not blank,** when the angle that the segment makes is close to*

***Reference angle** + **n*Guide angle** where n is an integer*

*then a guide line is drawn at that angle and the segment is snapped to the guide line and remains there until the cursor is outside the **Distance tolerance** or **Pixel Tolerance**. Note that guide angle will be cartesian or bearing depending on **Angle mode**.*

*If **blank**, no guide lines are shown.*

Reference angle angle box

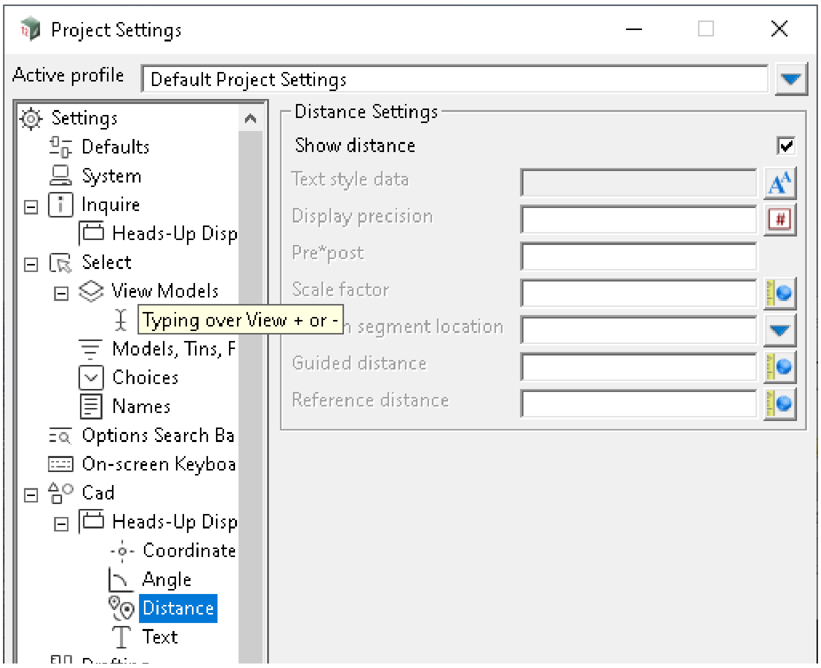
*Used with **Guide angle** for calculating when a guide line is displayed.*

*If **blank**, "0" is used.*

Continue to 6.5.2.9.1.4 CAD >Heads-Up Display >Distance or return to 6.5.2.9.1 CAD >Heads-Up Display Settings or 6.5.2.9 Cad Settings or 6.5.2 Project =>Settings.

6.5.2.9.1.4 CAD >Heads-Up Display >Distance

This section defines how the length of a segment being drawn is displayed in the Heads-Up information.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Distance Settings section

Show distance tick box

*If **ticked**, the length of the segment being dawn is shown in the heads-up information*

*If **not ticked**, the length of the segment is **not** shown in the heads-up information*

Textstyle data textstyle data box

Textstyle data to use for the length of the segment.

*If **blank**, a reasonable textstyle data is used so this can be left blank.*

Display precision integer box

Number of decimal places used.

*If **blank**, "2" is used.*

Pre*post text box

Text to use before and after the length value.

*If **blank**, "d " is used.*

Factor measure box

??

Text on segment location choice box start, middle, end

The positioning of the distance text with respect to the segment being drawn. The Textstyle data is then applied to this position.

*If **blank**, the text is positioned at the end of the segment being drawn.*

*If **start**, the text is positioned at the start of the segment being drawn.*

*If **middle**, the text is positioned at the middle of the segment being drawn.*

*If **end**, the text is positioned at the end of the segment being drawn.*

Guide distance angle box

*If **not blank,** when the length of the segment is close to*

***Reference distance** + **n*Guide distance** where n is an integer*

*then the cursor is snapped to the point at that distance and remains there until the cursor is outside the **Distance tolerance** or **Pixel Tolerance**.*

*If **blank**, no guide lines are shown.*

Reference distance angle box

*Used with **Guide distance** for calculating when a guide line is displayed.*

*If **blank**, "0" is used.*

Continue to 6.5.2.9.1.5 CAD >Heads-Up Display >Text or return to 6.5.2.9 Cad Settings or 6.5.2 Project =>Settings.

6.5.2.9.1.5 CAD >Heads-Up Display >Text

When CAD text is being created hots pots and guidelines drawn relative to nearby text to allow text to be easily lined up with respect to other text.

There are two guidelines:

(a) a base guideline that goes through the justify position of the nearby text and is parallel to the base line of the nearby text

(b) a vertical guideline that goes through the justify position of the nearby text and is perpendicular to the base line of the nearby text

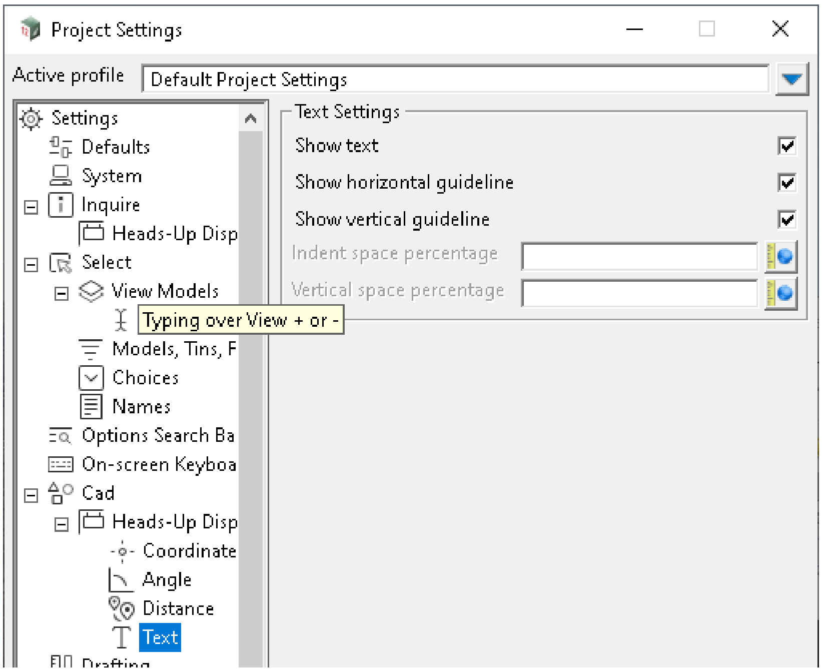
A Hotspot is then drawn relative to the two guidelines and is positioned:

(a) ***Indent space percentage*** along the base guideline

(b) ***Vertical space percentage + Character height*** along the vertical guideline when the cursor is above the guideline.

(c) ***Vertical space percentage + 2 x Character height*** along the vertical guideline when the cursor is below the base guideline

The base angle of the text is the taken from the nearest guideline.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Text Settings section

Show text tick box

*If **ticked**,??*

*If **not ticked**,??*

Show horizontal guideline tick box

*If **ticked**, the guidelines on* 6.5.2.9.1.1 CAD >Heads-Up Display - Main *are used for horizontal guidelines when creating CAD text.*

*If **not ticked**, no horizontal guidelines are used when creating CAD text.*

Show vertical guideline tick box

*If **ticked**, the guidelines on* 6.5.2.9.1.1 CAD >Heads-Up Display - Main *are used for vertical guidelines when creating CAD text.*

*If **not ticked**, no vertical guidelines are used when creating CAD text.*

Indent space percentage real box

When placing text, the hotspot is indented this distance along the guideline.

Vertical space percentage real box

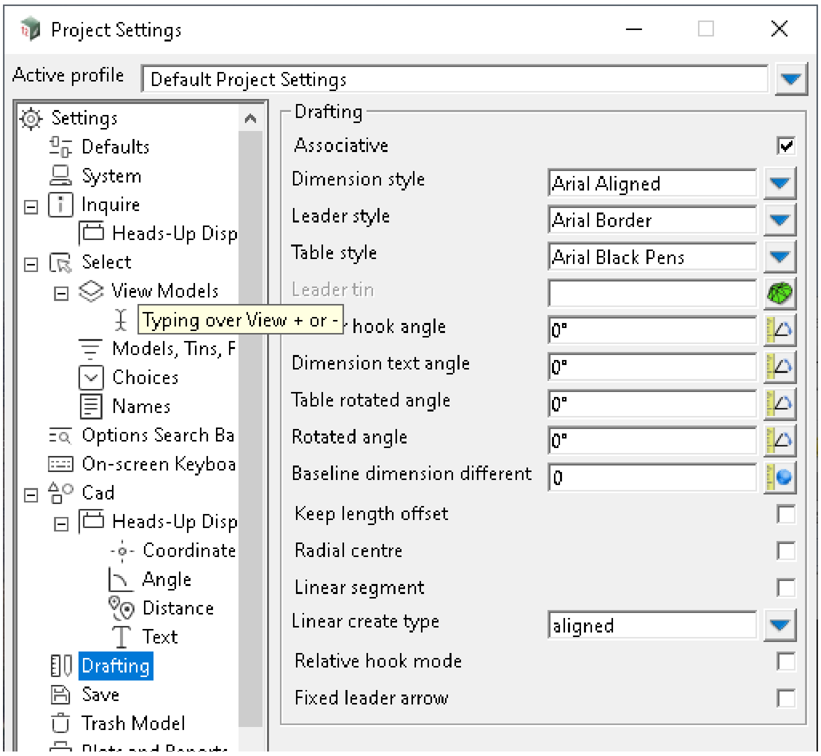
When placing text, the hotspot is displayed this distance up and down the guideline.

Continue to 6.5.2.10 Drafting Settings or return to 6.5.2 Project =>Settings.

6.5.2.10 Drafting Settings

These setting are used for the values in Drafting.

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Text Settings section

Associative tick box

If ***ticked***, *??*

If ***not ticked***, *??*

Dimension style choice box — Dimension styles pop-up

If **Associative** *is* ***ticked***, *the default Dimension style to use.*

Leader style choice box — Leader styles pop-up

If **Associative** *is* ***ticked***, *the default Leader style to use.*

Table style choice box — Table styles pop-up

If **Associative** *is* ***ticked***, *the default Table style to use.*

Leader tin tin box — available tins

If ***not blank***, *??*

If ***blank***, *??*

Leader hook angle angle box

If **Associative** *is* ***ticked***, *the default leader hook angle to use.*

Dimension text angle angle box

If **Associative** *is* ***ticked***, *the default dimension text angle to use.*

Table rotated angle angle box

If **Associative** *is* ***ticked***, *the default table rotated angle to use.*

Rotated angle angle box

??

Baseline dimension difference real box

If **Associative** *is* ***ticked****, the default baseline dimension difference to use.*

Keep length offset tick box

If ***ticked****,??*

If ***not ticked****,??*

Radial centre tick box

If ***ticked****,??*

If ***not ticked****,??*

Linear segment tick box

If ***ticked****,??*

If ***not ticked****,??*

Linear create type choice box linear create type pop-up

If **Associative** *is* ***ticked****, the default* ***Linear create type*** *to use.*

Relative hook mode tick box

If ***ticked****,*

If ***not ticked****,??*

Fixed leader arrow tick box

If ***ticked****,*

If ***not ticked****,??*

Important Note

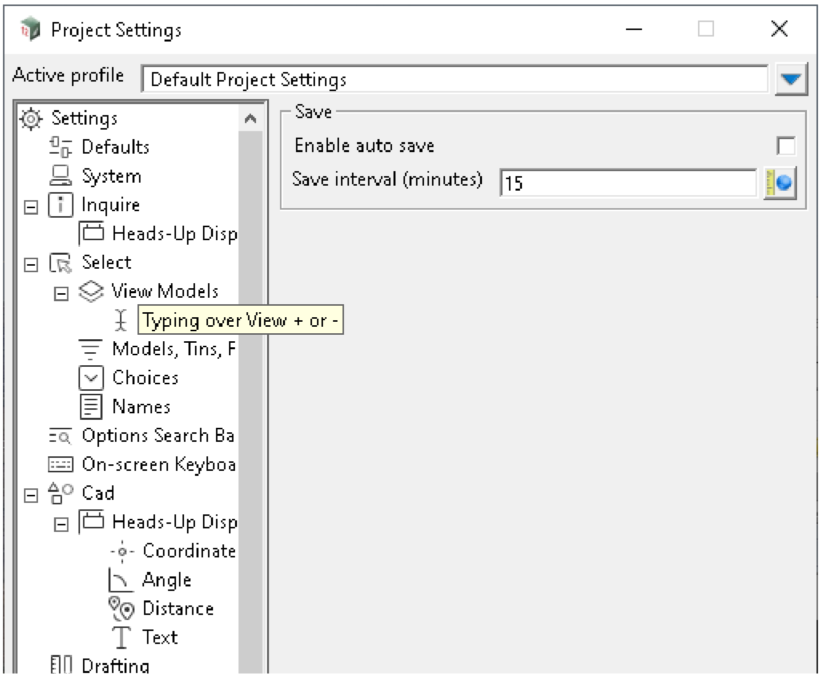
When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.11 Save Settings or return to 6.5.2 Project =>Settings.

6.5.2.11 Save Settings

*These setting replaces the **Save interval (minutes)** field on the **System Settings** tab of the **Defaults** panel. But to make things clearer, the **Save interval (minutes)** field has been replaced by an **Enable autosave** tick box and a **Save interval (minutes)** field.*

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Enable autosave	tick box		

*If **ticked**, the project is automatically saved at the interval given in the **Save interval (minutes)** box.*

*If **not ticked**, the project is not automatically saved.*

Save interval (minutes) integer box

The value must be zero or positive. It can not be negative.

*If **positive**, the number of minutes that elapse after a save before the* **Save Project Reminder** *panel comes up.*

*If **0**, the* **Save Project Reminder** *panel never comes up.*

Important Note

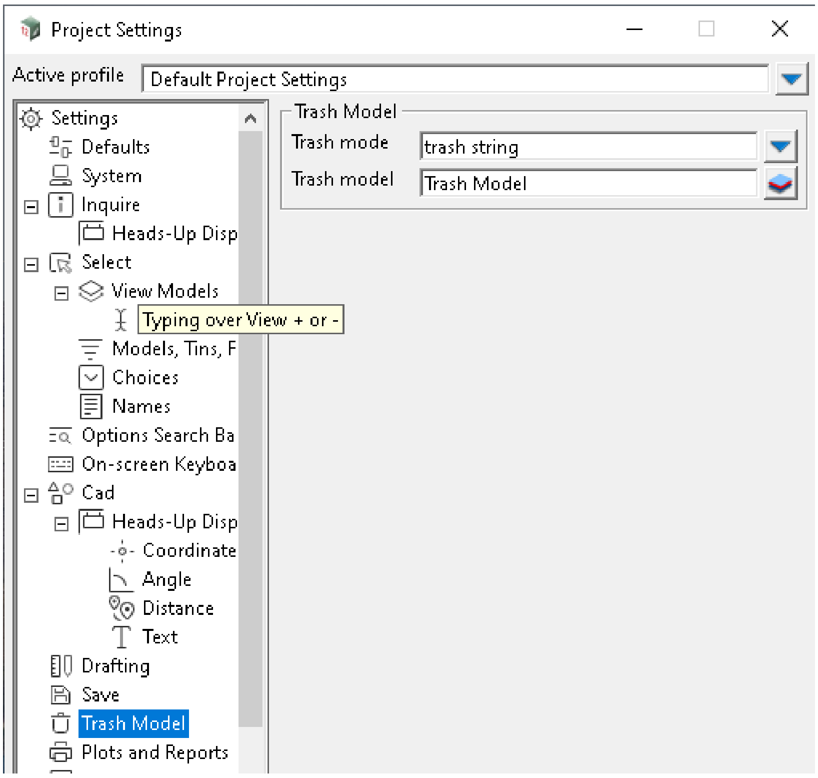
*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.12 Trash Model Settings or return to 6.5.2 Project =>Settings.

6.5.2.12 Trash Model Settings

*These setting replace the settings on the **Trash Settings** tab of the **Defaults** panel.*

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Trash mode	choice box	trash string	keep string, trash string, delete string

In many string options, new strings are created from existing strings. What happens to the original strings may be determined by the **trash mode**.
*If set to **keep string**, the original strings will not be touched*
*   **trash string**, the original strings will be moved to the trash model*
*   **delete string**, the original strings will be deleted.*

Field Description	Type	Defaults	Pop-Up
Trash model	model box	Trash Model	available models

The model that trashed strings are put into. This model needs to be cleaned or deleted to permanently remove the strings.

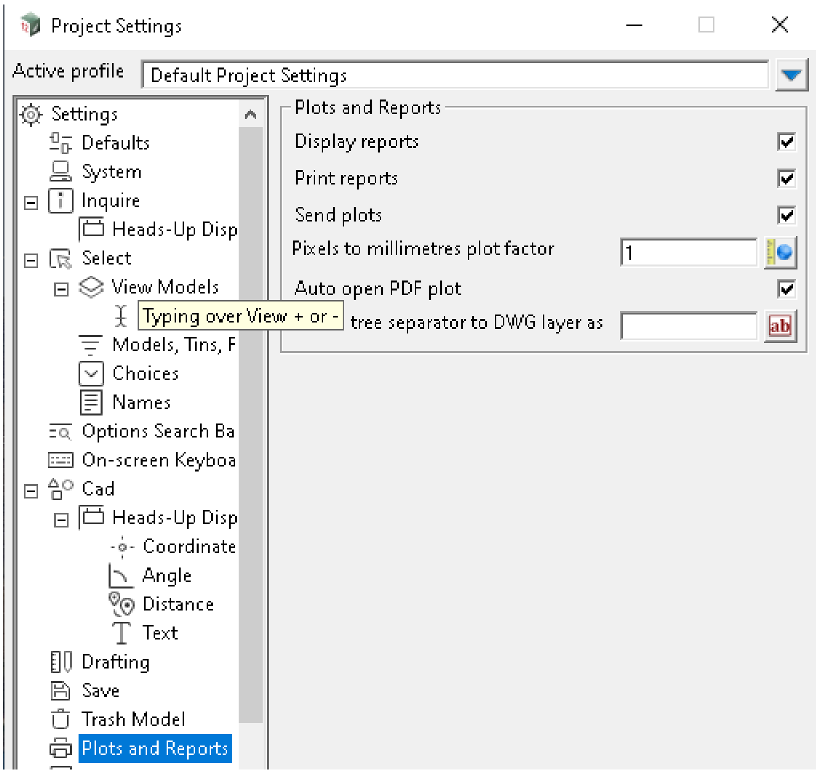
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.13 Plots and Reports Settings or return to 6.5.2 Project =>Settings.

6.5.2.13 Plots and Reports Settings

*These setting are the same as, and replace, the ones of the same names on the **System Settings** tab of he **Defaults** panel.*



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Display reports	tick box	tick	

*If **ticked**, as soon as a report is produced, it will be displayed in the editor defined by the environment variable, EDITOR_4D.*

Print reports	tick box	tick	

*If **ticked**, as soon as a report is produced, it will be passed to the script/program defined by the environment variable, PRINTER_4D.*

Send plots	tick box	tick	

*If **ticked**, as soon as a plot is produced, it will be passed to the script/program defined by the environment variable, PLOTTER_4D.*

Pixel to millimetres plot factor real box

When items have a pixel (screen units) size, when plotting the pixel size is multiplied by this value to get a millimetre size for plots.

Auto open PDF plot	tick box	tick	

*If **ticked** and a pdf plot is produced, the pdf is opened straight away.*

Model tree separator to DWG layers as text box

When a model path is a tree and the model is being written out to a DWG layer, the "/" is replaced by this text.

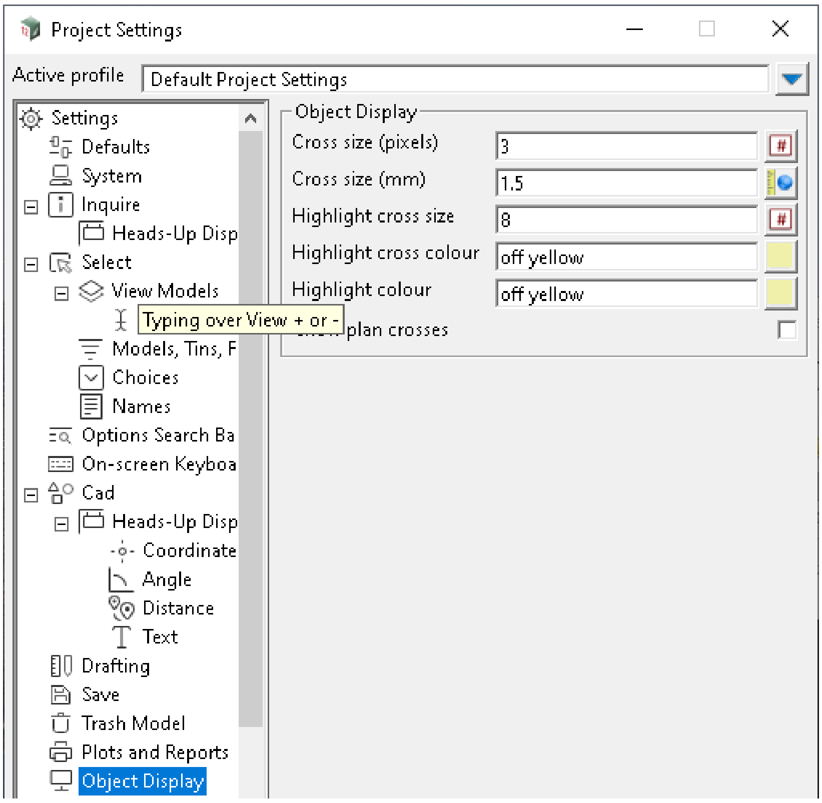
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed* *for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.14 Object Display Settings or return to 6.5.2 Project =>Settings.

6.5.2.14 Object Display Settings

These setting are the same as, and replace, the ones of the same names on the ***System Settings*** *tab of the* ***Defaults*** *panel.*



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Cross size (pixels)	input/output	2	

Size in pixels that crosses (for points etc.) are drawn on the screen.

Cross size (mm)	input/output	2.5	

Size in millimetres that crosses (for points etc.) are drawn on any plots.

Highlight cross size	input/output	8	

Size in pixels of the cross used for highlighting objects in views.

Highlight cross colour	colour box	yellow	available colours

Colour of the cross used for highlighting objects in views.

Highlight colour	colour box	white	available colours

Colour used to display objects in views when they are highlighted.

Show plan crosses	tick box		

If ***ticked****, when the cursor is in a plan or perspective view, it is projected onto any section views as well.*

This can be ticked off if things look messy when editing in a section view with plan crosses turned on.

Important Note

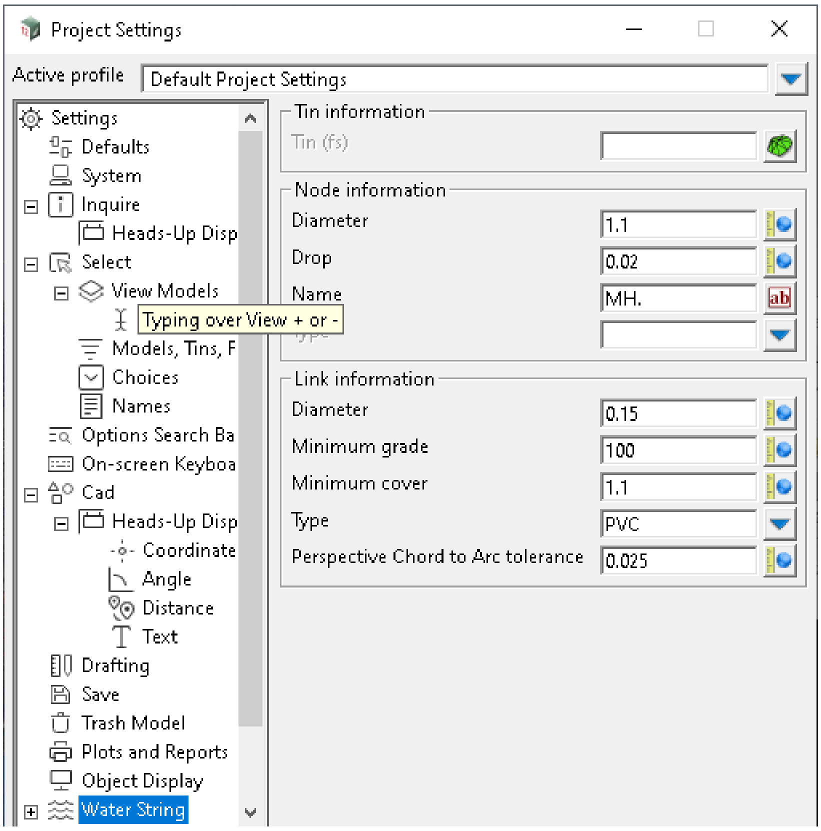
When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.15 Water String Settings or return to 6.5.2 Project =>Settings.

6.5.2.15 Water String Settings

These setting are used for the default values when creating Water strings.

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Tin information

For the water string, the finished surface tin is used as the surface that nodes automatically sit on when z float is set on, and for defining cover when placing controls and connections.

Tin (fs)	tin box		available tins

Tin to use as the default finished surface tin.

Node information

This section is used as defaults when creating nodes (maintenance holes etc) in a water string.

Diameter	real box	1.1	

Default diameter of a water node

Drop	real box	0.02	

Drop (metres) through the node

Name	real box	MH.	

Default name for the node.

***Note**: if a node name is EOL or eol, then the diameter of the node is forced to be zero.*

Type	choice box	CONC COVER	CONC COVER, GATIC etc

??Default cover or lid type of the nodes

Link information

This section is used for defaults when creating links (e.g. pipes) in a water string.

Diameter real box 0.1

Default diameter of the link.

Minimum grade real box 1.0

Minimum grade (measured as 1: value) used when laying down the link.

Minimum cover real box 1.0

Minimum cover, measured in world units from the surface to the top of the link (obvert); used when laying down the link.

Type link type choice box link types pop-up

Default Type of the link.

Perspective Chord to Arc Tolerance real box 0.025

The OpenGL Perspective view uses straight lines to approximate pipes with a radius. 12d Model determines the length of the straight to keep the maximum distance between that curve and the straight less the specified value. Small values produce a closer drawing approximation but slow down the drawing process. This value does not affect any hydraulic computations. See 3.25.2 Chord-to-Arc Tolerance.

Important Note

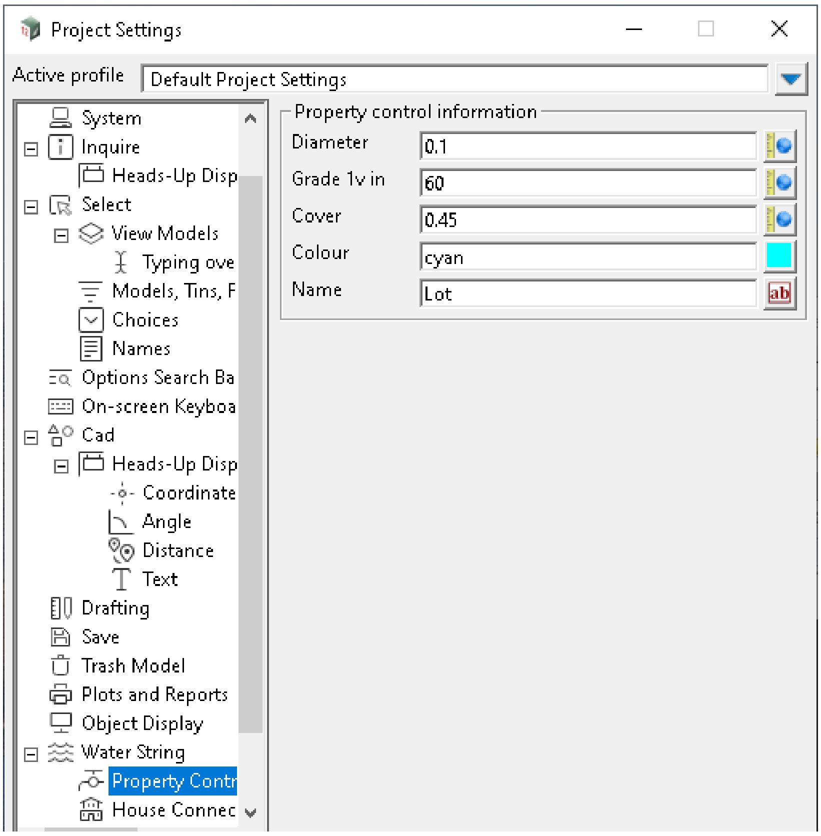
When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.16 Water String >Property Controls Settings or return to 6.5.2 Project =>Settings.

6.5.2.16 Water String >Property Controls Settings

These setting are used for the default values when creating Property Controls for Water strings.

t



The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Diameter   real box   0.1

Default diameter of the property control.

Grade 1v in   real box   60

Grade (units are "1v in" given value) to use for the property control

Cover   real box   1.0

Cover measured from the surface to the ***top*** *of the property control (world units) to be maintained from the end of the property control in the house block to the drainage string.*

Colour   colour box   cyan   available colours

Colour to use to draw the property control

Name   text box   Lot

Name for the property control.

Important Note

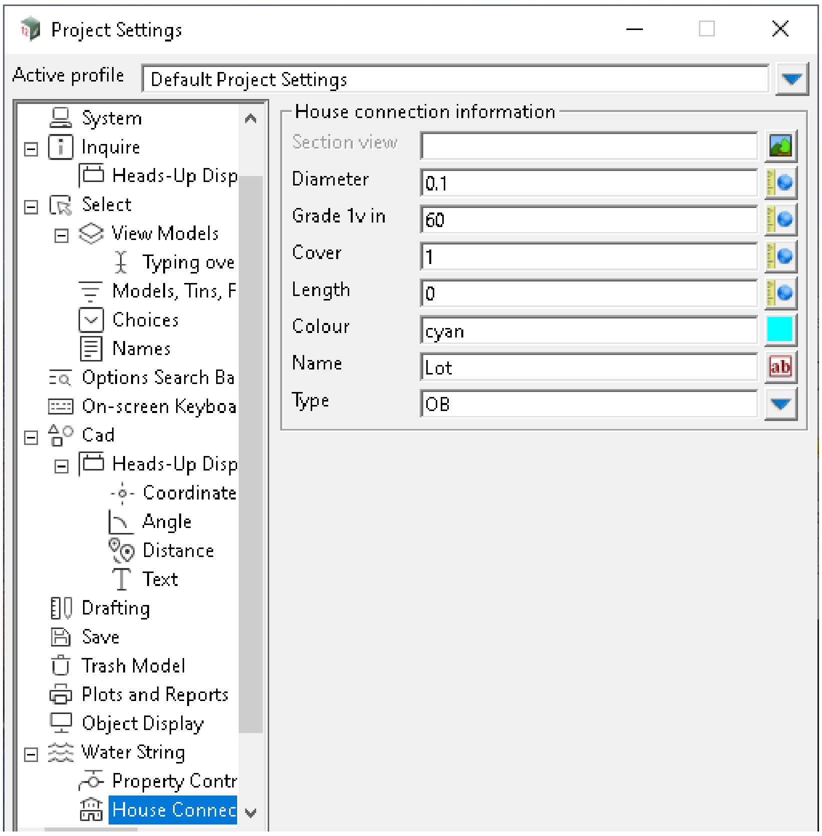
When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.17 Water String >House Connections Settings or return to 6.5.2 Project =>Settings.

6.5.2.17 Water String >House Connections Settings

These setting are used for the default values when creating House Connections for Water strings.

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Section view	view box		

Section view used to profile along the house connections as the house connections are placed in plan view.

Diameter	real box	0.1	

Default diameter of the house connection.

Grade 1v in	real box	60	

Grade (units are "1v in") to use for the house connection

Cover	real box	1.0	

Cover (world units) to use for the house connection

Length	real box	2.0	

Length (metres) to use for some types of house connections

Colour	colour box	cyan	available colours

Default colour used for the house connection

Name	text box	Lot	

Name for the house connection - usually the lot number

Type	HC choice box	A special	A, A special, B, C, OB, Special Jump Up etc

Default type of house connection. See 17.3.13.1.6.1 House Connection Types *for a description of each connection type*

Important Note

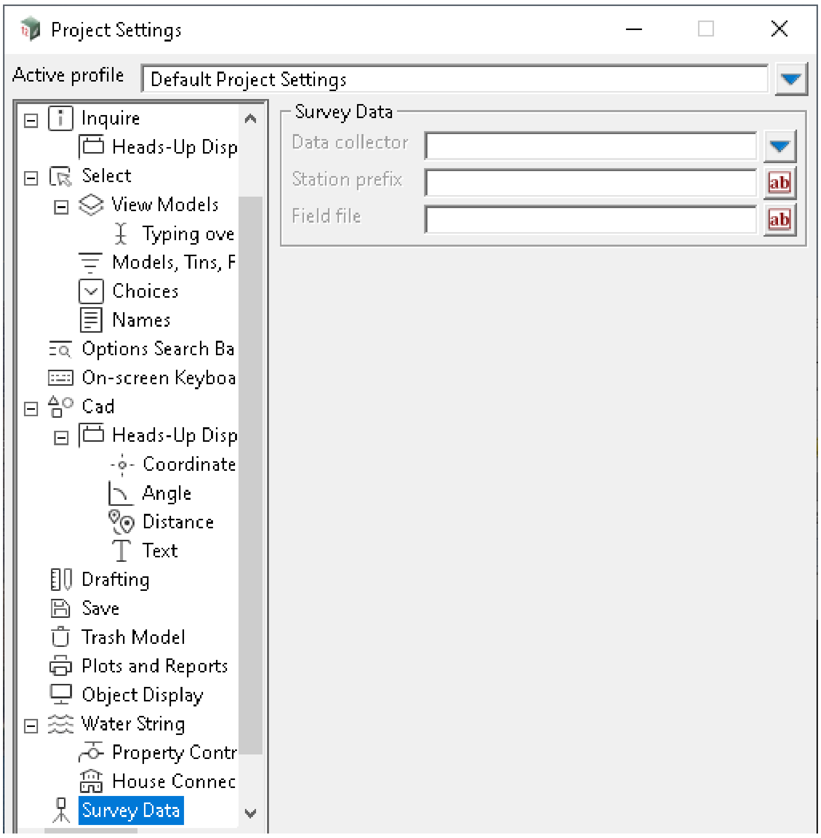
When the values of any fields are changed on a right side page for a node, the ***Set*** *button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.18 Survey Data Settings or return to 6.5.2 Project =>Settings.

6.5.2.18 Survey Data Settings

These setting are used for the default values for Survey Data collectors.

t



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data collector	choice box		available data collectors

Name of the data collector definition used to define how to read and interpret the raw survey data file. The list of available data collectors definitions is given in the file pointed to by the environment variable DATA_COLLECTORS_4D.

*A data collector definition can be created/edited by the **Survey.4d Edit/Create** panel which is brought up by:*
*(a) clicking on the choice button at the end of the **Data collector** field and selecting [Edit] at the bottom of the pop-up list of defined data collector*

or

*(b) clicking **Project =>Tree** and then selecting **Survey data collectors** > **Create data collector**.*

See 42.1 Data Collector Definitions *of Appendix* 42 12d and Survey Instruments *for more information on the **Survey.4d Edit/Create** panel and setting up a data collector definition.*

Station prefix	text box		

*If **not blank**, the prefix to be used for any text given for new instrument stations.*

Field file	text box		

*If **not blank**, ??*

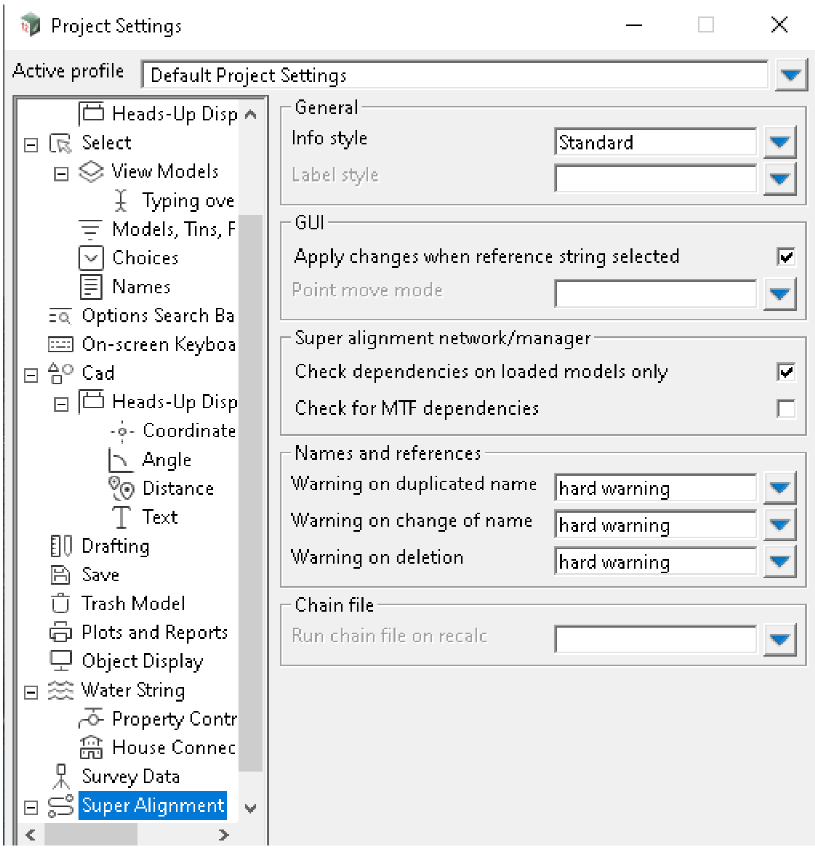
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed* *for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.19 Super Alignment or return to 6.5.2 Project =>Settings.

6.5.2.19 Super Alignment

??



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

General

Info Style choice box — Default, Position, Standard

Default style for super alignment Info panel.

Label style choice box — ??

Default style for super alignment labels.

GUI

Apply changes when reference string selected tick box

Picking a reference string while editing a computator will apply the changes immediately.

Point move mode — default, x-axis, y-axis, forward tangent, backward tangent

*If **default**, allows any movement in the selected HIP or VIP point*

*If **X-axis**,*

constrains an HIPs to only move along the x-axis. That is, the y coordinate is fixed.

constrains a VIPs to only move along the chainage-axis. That is, the height coordinate is fixed.

*If **Y-axis**,*

constrains an HIPs to only move along the y-axis. That is, the x coordinate is fixed.

Constrains a VIPs to only move along the height-axis. That is, the chainage coordinate is fixed.

*If **forward tangent**,*

constrains an HIPs to only move along the incoming straight to the HIP.

constrains a VIPs to only move along the incoming straight to the VIP.

*If **backward tangent**,*

constrains an HIPs to only move along the outgoing straight from the HIP.

constrains a VIPs to only move along the outgoing straight from the VIP.

Super alignment network/manager

Check dependencies on loaded models only tick box ticked

*If **ticked**, 12d Model only look at loaded models for super alignment dependencies, otherwise, unloaded models will be loaded and all models will be looked at.*

Check for MTF dependencies tick box not ticked

*If **ticked**, 12d Model will open MTF files and scan for super alignment dependencies.*

Names and References

Warning on duplicate name choice box ignore, simple message, hard warning, block, silent block

There are 4 different modes:

*If **ignore**, no error or warning given.*

*If **simple message**, a message will appear in the output window.*

*If **hard warning**, a warning dialog is given and the user can choose to proceed.*

*If **block**, an error dialog is given and block the user from proceeding.*

*If **silent block**, not allow the change to be made.*

Warning on change of name choice box ignore, simple message, hard warning, block, silent block

There are 4 different modes:

*If **ignore**, no error or warning given.*

*If **simple message**, a message will appear in the output window.*

*If **hard warning**, a warning dialog is given and the user can choose to proceed.*

*If **block**, an error dialog is given and block the user from proceeding.*

*If **silent block**, not allow the change to be made.*

Warning on deletion choice box ignore, simple message, hard warning, block, silent block

There are 4 different modes:

*If **ignore**, no error or warning given.*

*If **simple message**, a message will appear in the output window.*

*If **hard warning**, a warning dialog is given and the user can choose to proceed.*

*If **block**, an error dialog is given and block the user from proceeding.*

*If **silent block**, not allow the change to be made.*

Chain file

Run chain file on recalc tick box

*If **ticked**,??*

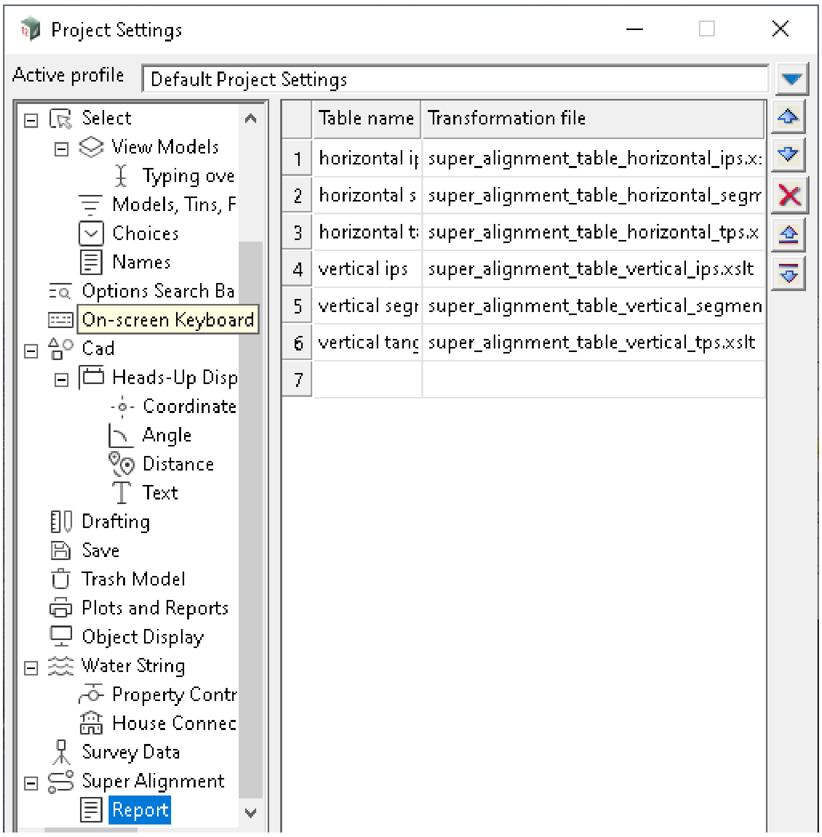
Important Note

*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to 6.5.2.20 Super Alignment >Report or return to 6.5.2 Project =>Settings.

6.5.2.20 Super Alignment >Report

??



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Grid

Table name	?? column		??

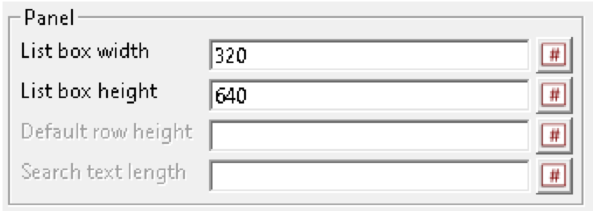
??

Transformation file	?? column		??

??

Continue to 6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length or return to 6.5.2 Project =>Settings.

6.5.2.21 List Box Width, List Box Height, Default row Height, Search Text Length



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Panel section

List box width Integer box

Default width (in pixels) of the area listing the items in the panel that comes up.
If the width is exceeded, then a horizontal scroll bar is added to the panel

List box height Integer box

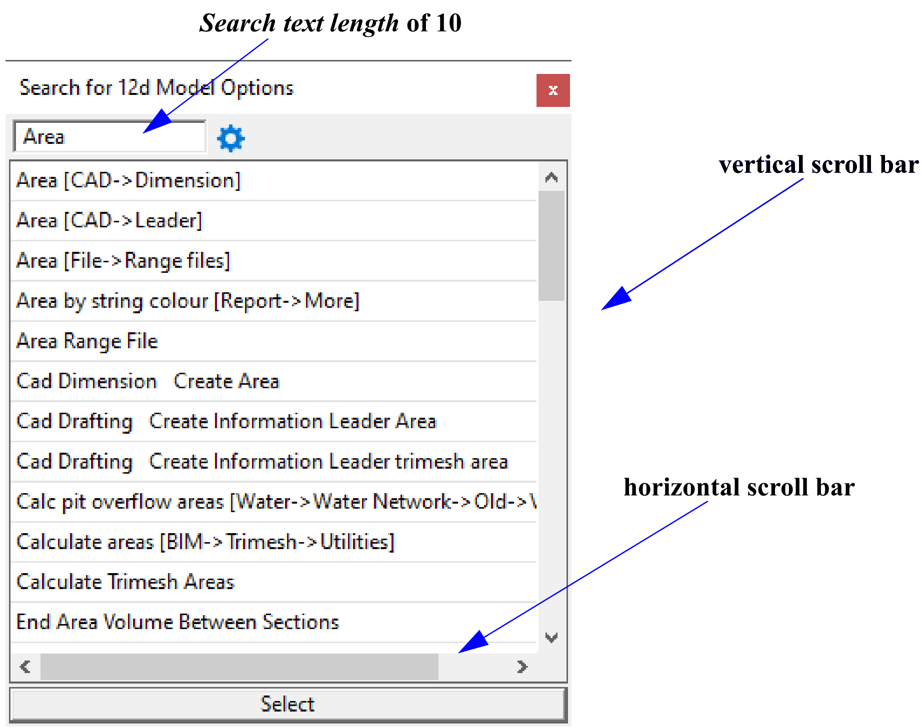
Default height (in pixels) of the area listing the items in the panel that comes up.
If the height is exceeded, then a vertical scroll bar is added to the panel

Default row height Integer box

*If **not blank**, the height of each row (in pixels) in the list of items.*
*If **blank**, ?*

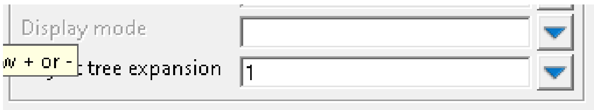
Search text length Integer box

*If **not blank**, the length (in characters) of the **Select** box in the panel.*
*If **blank**, the Search box is the width of the panel.*



Continue to 6.5.2.22 Display Mode and Object Tree Expansion or return to 6.5.2 Project =>Settings.

6.5.2.22 Display Mode and Object Tree Expansion



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Add to view display mode	choice box		path, name, tree

How to display the names in the list.

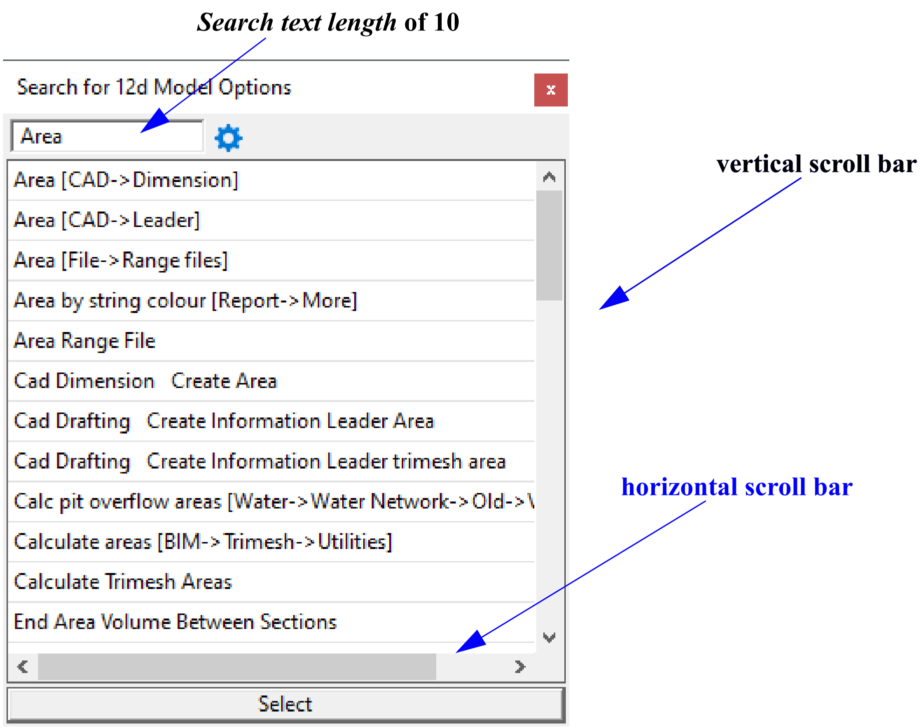
*If **path**, the full path name is displayed as text.*

*If **name**, the final node of the full path name is shown in the first column and the rest of the path name in a second column.*

*If **tree**, the path name is displayed in object tree form.*

Object tree expansion Integer box

Number of levels that object tree path are expanded to when the list is displayed. Value between 1 and 6 inclusive See 3.28.3.1 Select Settings - Displaying Path Name *and* 3.10 Object Tree.

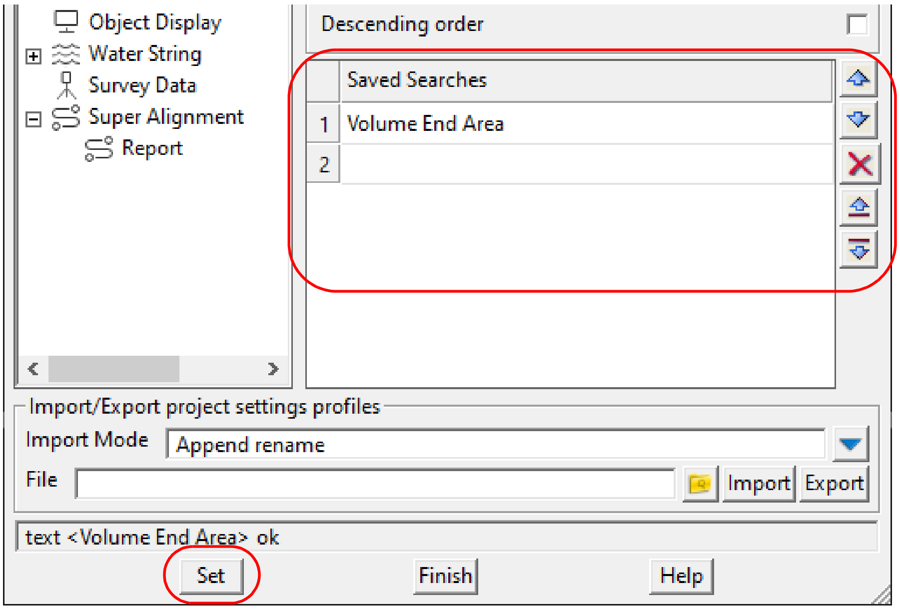


Continue to 6.5.2.23 Saved Selects or return to 6.5.2 Project =>Settings.

6.5.2.23 Saved Selects

Each of the following **Project Settings** nodes has a **Saved Selects** grid:

1. 6.5.2.6.1 Select >View Models Settings
2. 6.5.2.6.1.1 Select >View Models >Typing over View + or - Settings
3. 6.5.2.6.2 Select >Models, Tins, Functions Settings
4. 6.5.2.6.3 Select >Choices
5. 6.5.2.7 Search Bar Settings



Existing text in the **Saved Searches** grid can be modified by editing the appropriate row of the **Saved Searches** grid.

New text can be added by typing into a row.

There are icons on the right hand side to move a row up and down, **delete** a row and **insert blank** rows **above** or **below** a row. Clicking on a number icon on the left hand side also brings up the menu to **Insert above**, **Insert Below** or **Delete** rows.

The **Saved Searches** and made available for the session by clicking on the **Set** button.

After the **Set**, the **Saved Searches** can then be used by the corresponding **Select** or **Option Search** bar that the **Project Settings** node was for.

That is, the **Saved Searches** are used with:

1. 6.5.2.6.1 Select >View Models Settings are used with the **Models to Add** panel that comes up when LB is clicked on the **+** or **-** view buttons.
2. 6.5.2.6.1.1 Select >View Models >Typing over View + or - Settings are used with the **Models to Add** panel that comes up when typing over the + or - view buttons.
3. 6.5.2.6.2 Select >Models, Tins, Functions Settings are used with the **Select Model**, **Select Tin**, **Select Template** and **Select Function** panels.
4. 6.5.2.6.3 Select >Choices are used with the **Select Choices** panel.
5. 6.5.2.7 Search Bar Settings are used with the **Search for 12d Model Options** panel.

Important note: Any updates to the **Saved Searches** grids are only saved for future use of the project when a **Project =>Save** is done.

For information on creating and using the **Saved Searches**, see 3.28.3.7 Saving and Reusing Searches with Select Settings.

Continue to 6.6 Project Sharing or return to 6.5 Project Settings.

6.6 Project Sharing

Position of menu: **Project =>Sharing**

Important note:

Sharing has been totally rewritten for V15.

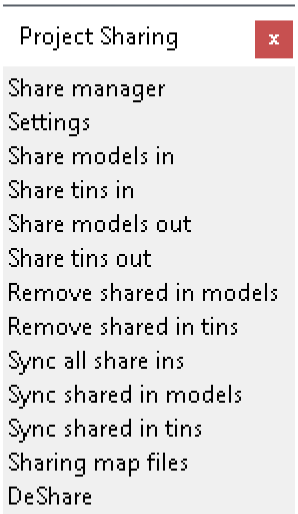
For information about sharing, see 6.6.1 Information on Sharing of Models and Tins.

The Sharing walk-right menu has been rearranged so that all the sharing options are in the one place.

Share Manager is a new option that creates and edits master share files. It also adds into the current project, the master share files that are to be used by the current project.

There are also options in the ***Share Manager*** to shared out models and tins and to list the models and tins that are share into the current project.

The **Sharing** walk-right menu is:



6.6.2 Share Manager

6.6.3 Synchronize All Shared In Models and Tins

6.6.1 Information on Sharing of Models and Tins

Models and Tins can be **shared into your project** from other projects. That means that in your project, the models an tins that are shared in from another project are not created in your project, but are copies of the models and tins from the other project.

And when the models and/or tins are modified in the other project, they can be **automatically updated** in your project.

In your own project, you decide which models and tins are available to be shared into other peoples projects. That is, you say which or your models and tins can be **shared out to another project**.

It is possible to have Shares of Shares. That is, you share a model or tin **into your project**, and then that model or tin is **shared out to another project**.

When models and tins are being shared into your project, a copy of the models and tins are copied over into your project. And each time one of the models or tins is modified in the original project, a new copy is made in your project.

For more information on sharing, see 3.44 Sharing of Models and Tins.

Continue to 6.6.2 Share Manager or return to 6.6 Project Sharing or 6 Project.

6.6.2 Share Manager

Position of option on menu: **Project =>Sharing =>Share manage**

The **Share Manager**

(a) creates master share files that can be used by any project

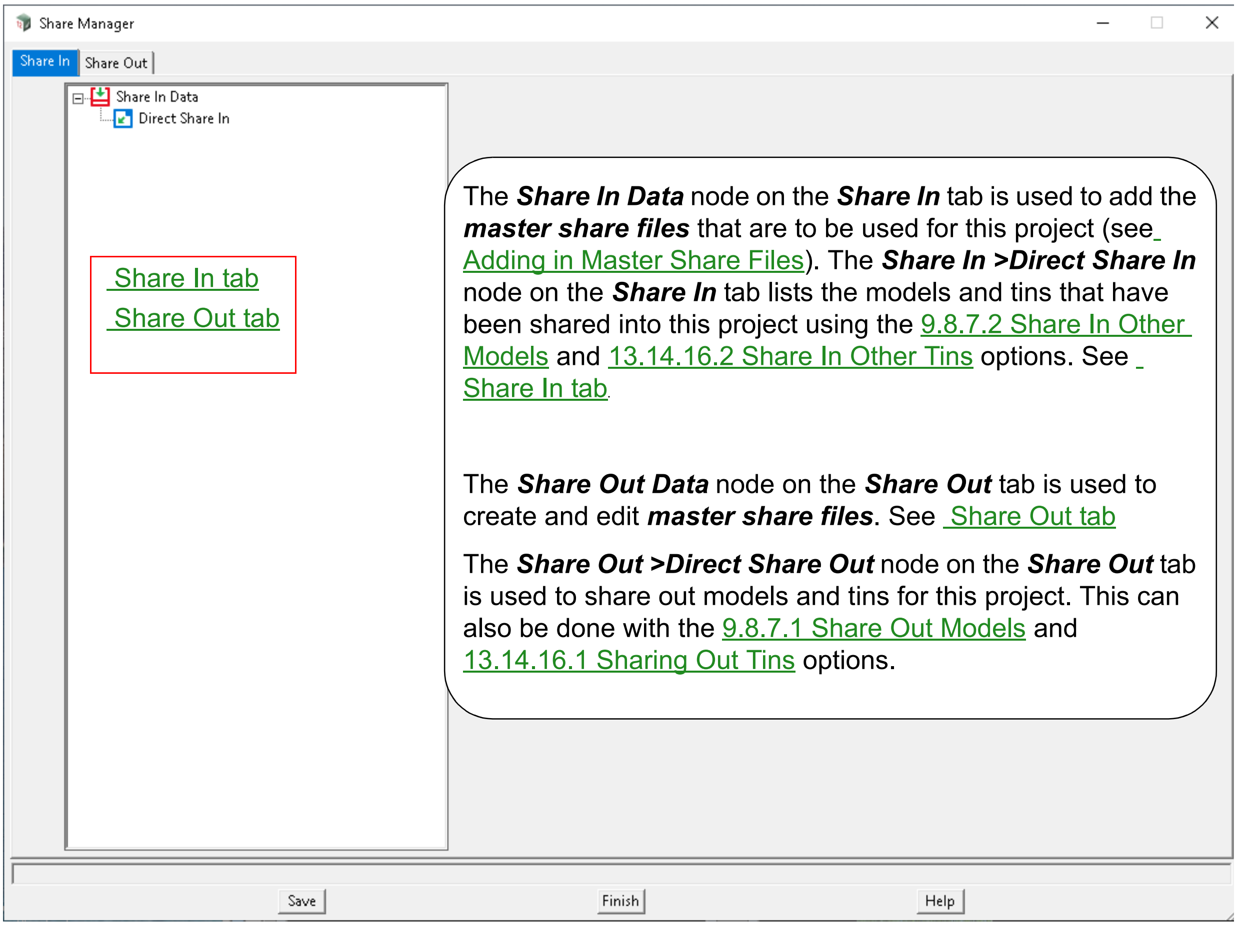
(b) for the current project: defines the master share files that are used for the project.

(c) for the current project: make models and tins available/not available for sharing out

(d) for other projects, lists the models and tins that have been made available for sharing out and hence available for sharing in to the current project.

For information on sharing of models and tins, and master share files, see 3.44 Sharing of Models and Tins.

Selecting **Share manage** brings up the **Share Manager** panel

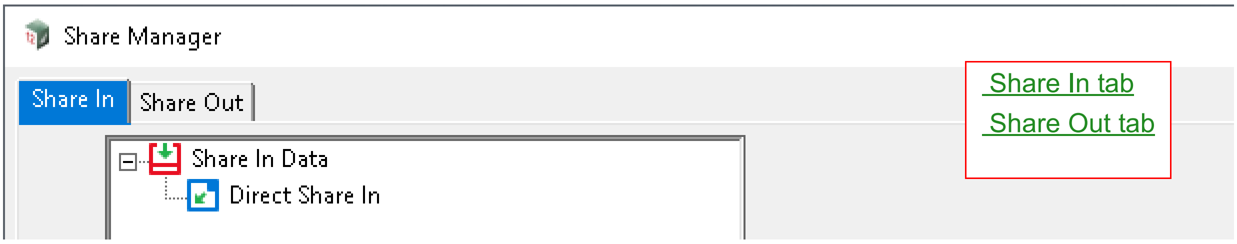


Button at Bottom

Field Description	Type	Defaults	Pop-Up
Save	button		

*Click **Save** to save the information in the panel.*

Share In tab



Models and tins can be shared into the current project in two ways:

1. **Direct Share In**

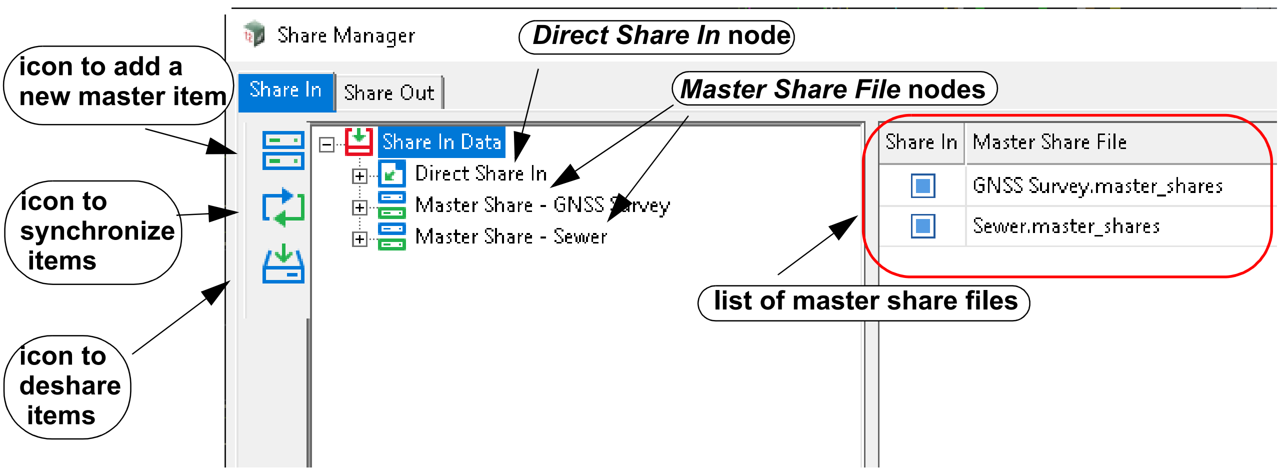
   Models and tins that have been shared into the current project using 9.8.7.2 Share In Other Models and 13.14.16.2 Share In Other Tins options are know as **Direct Share Ins** or just **Direct Shares**.

2. **Master Share FIles**

   For each ***master share files*** that has been added to the current project, the models and tins from other projects that are listed in the master share file are automatically shared in whenever the project is restarted. See Adding in Master Share Files.

Share in Data node

*The **Share in Data** tree has one **Direct Share In** node for displaying the models and tins that have been shared into the current project using the options* 9.8.7.2 Share In Other Models *and* 13.14.16.2 Share In Other Tins *(see* Share In Data >Direct Share In node*), and a **Master share file** node for each **master share file** being used for the current project (see* Adding in Master Share Files*).*



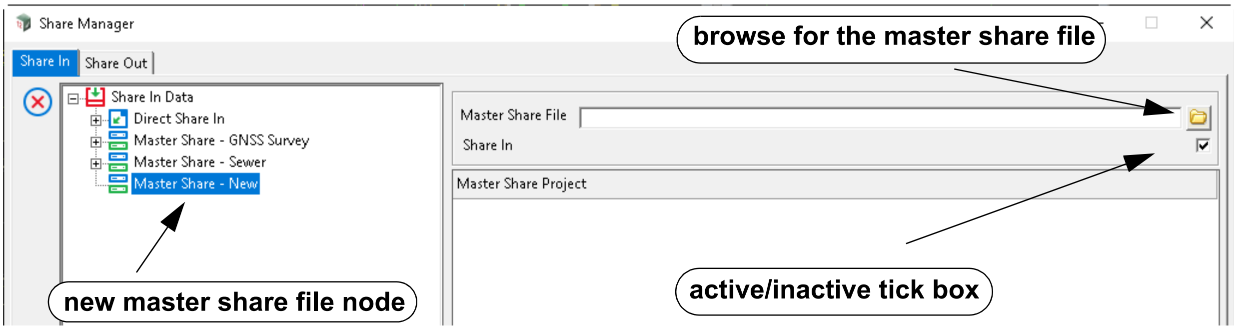
See

 Adding in Master Share Files
 Synchronize Items
 DeShare Items

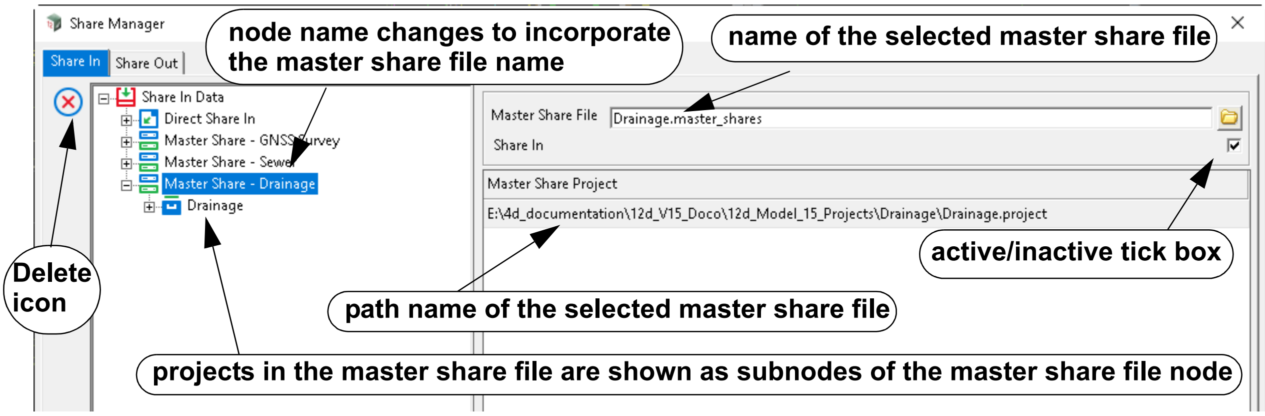
Adding in Master Share Files

To add a master share file to the current project, click on the ***Share in Data*** *node and the* ***New master item*** *icon will appear on the left hand side.*

Clicking on the ***New master item*** *icon creates a new* ***Master Share File*** *node with the name* ***Master share-new.*** *The panel fields* ***Master Share File*** *and* ***Active*** *are displayed on the right hand side.*



Use the browse button on the ***Master Share File*** *field to search for the master share file to be add to the current project.*



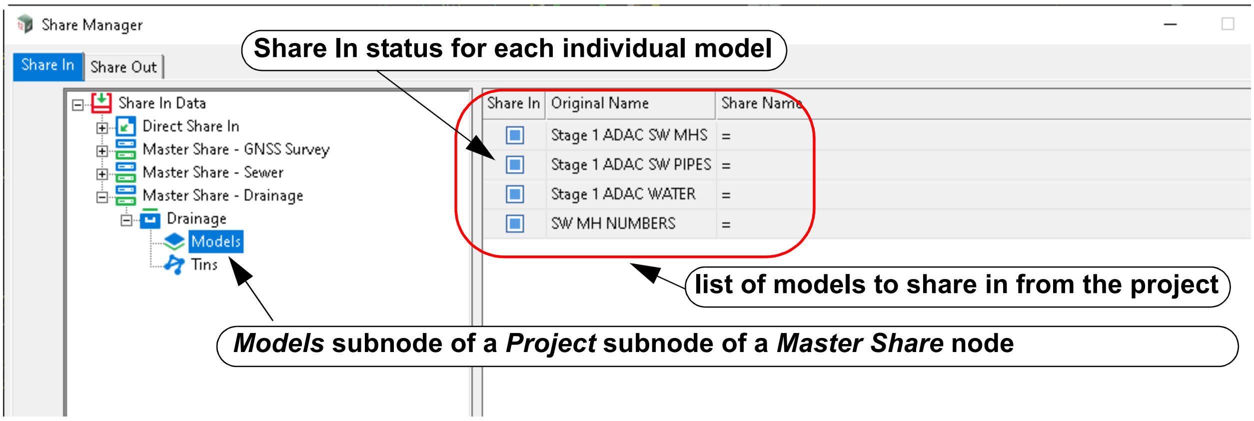
After selecting a master share file, the master share file node changes to ***Master share - master_share_file_name****, and the full path name of the selected master share file is displayed on the right hand side of the panel under the* ***Master Share Project*** *heading.*

The ***Active*** *tick box can be used to turn off the use of the master share file without having to delete it from the* ***Share In Data*** *subnodes.*

The ***Master Share File*** *node can be deleted by clicking on the node and then selecting the* ***Delete*** *icon that is then displayed on the left hand side.*

Subnodes of the ***Master Share File*** *node are created for each of the projects listed in the selected master share file, and each project node has* ***Models*** *and* ***Tins*** *subnodes showing the models and tins that will be shared in using the master share file.*

The ***Share In*** *status column is for* ***display purposes only****.*



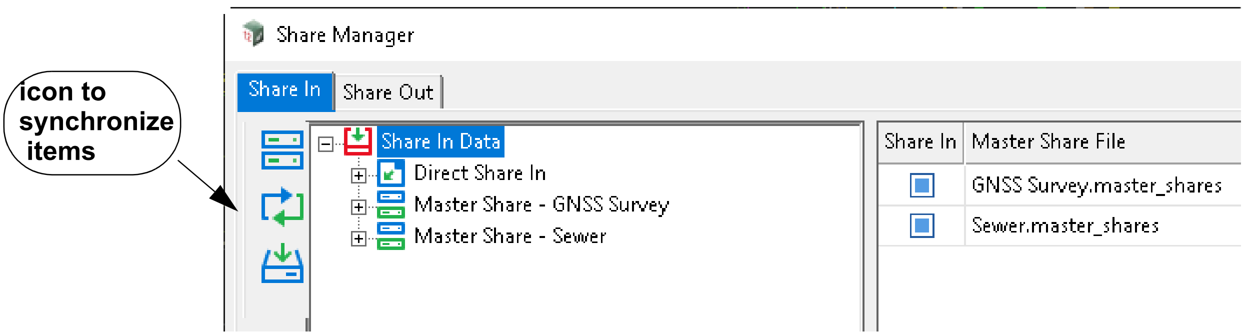
Continue to [Synchronize Items]() or [Share In Data >Direct Share In node]() or return to [6.6.2 Share Manager]().

Synchronize Items

The ***synchronize item*** *icon is used to synchronise shared in models and/or shared in tins. That is, shared in models and/or shared in tins that are older that the original models and/or tins, can be updated to again be identical to the original models and/or tins.*

Which models and/or tins are synchronized depends on what part of the tree is highlighted when the ***synchronize item*** *icon is pressed.*

For example, when ***Share in Data*** *is highlighted, ALL direct shared in modes and tins and ALL master shared in models and tins, are synchronized.*



Continue to [DeShare Items]() or [Share In Data >Direct Share In node]() or return to [6.6.2 Share Manager]().

DeShare Items

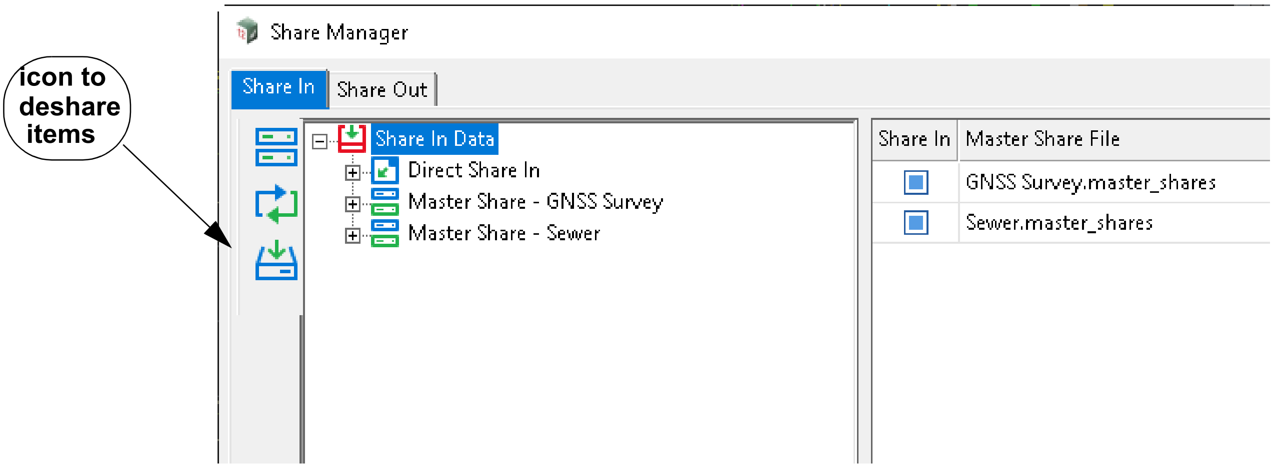
*The **deshare item** icon is used to create copies of shared in models and/or shared in tins in the current project and removed them from being shared in.*

*If a model and/or tin was **directly shared in**, then it is removed from being directly shared in.*

*If a model and/or tin was **shared in by a master share file**, then it is made **inactive** in the master share file.*

*Which models and/or tins are deshared depends on what part of the tree is highlighted when the **deshare item** icon is pressed.*

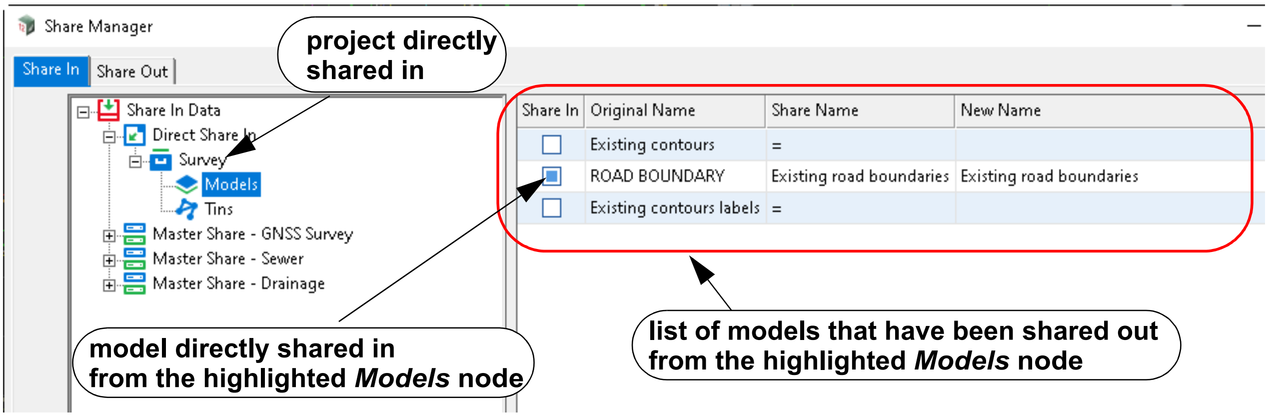
*For example, when **Share in Data** is highlighted, ALL direct shared in modes and tins and ALL master shared in models and tins, are deshared.*



Continue to Share In Data >Direct Share In node or return to 6.6.2 Share Manager.

Share In Data >Direct Share In node

*The **Direct Share In** node is used for displaying the models and tins that have been shared out from other projects and denote which ones have been shared into the current project using the options* 9.8.7.2 Share In Other Models *and* 13.14.16.2 Share In Other Tins. *These models and tins are known as **Direct Share Ins**, or just **Direct shares**.*



*All the listed models/tins have been shared out of the selected project but only the models/tins ticked **on** in the **Share In** column have been shared in by the* 9.8.7.2 Share In Other Models *and* 13.14.16.2 Share In Other Tins options.

***Note**: The **Share In**, **Original Name**, **Share Name** and **New Name** columns are display only.*

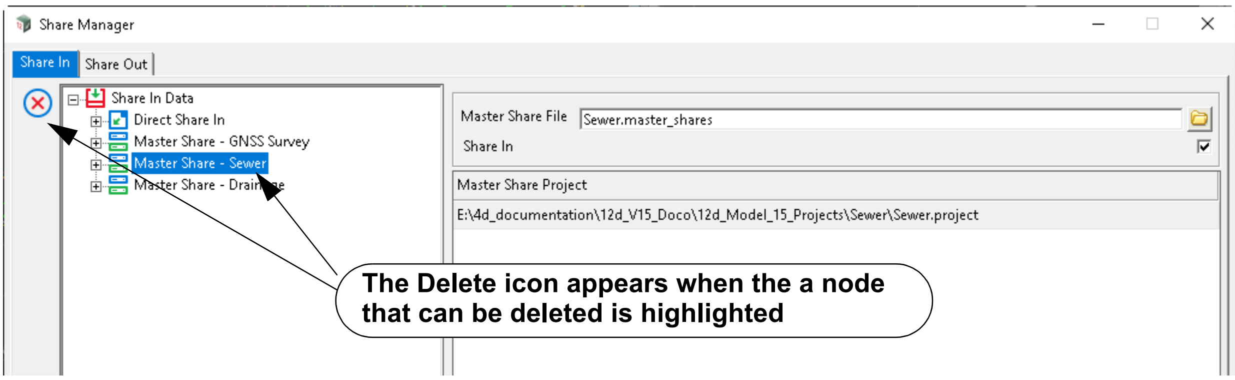
Deleting a Subnode of the *Share In Data* Node

*Currently only the **Master Share** nodes under the **Share In Data** node can be deleted.*

*To indicate that deleting a node is possible, a **Delete** icon appears on the left hand side whenever a node that can be deleted is highlighted.*

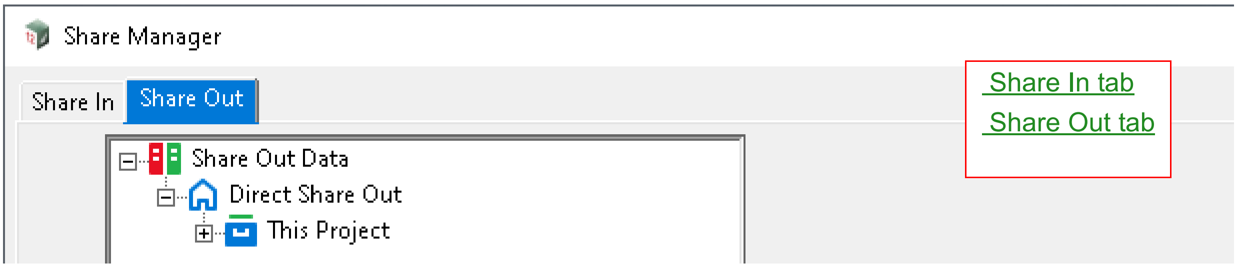
*For example, the **Delete** icon appears when the **Master Share** node **Master share - GNSS Survey** is highlighted.*

***NOTE**: deleting a Master Share File node **DOES NOT** delete the maser share file itself.*



Continue to Share Out tab or return to 6.6.2 Share Manager.

Share Out tab



The ***Share Out*** tab is be used to make models and tins available for sharing out (see Share Out Data >Direct Share Out node), and also to create and edit master share files (see Creating a Master Share File and Editing a Master Share File). Some **nodes** under the ***Share Out Data*** node can also be deleted (see Deleting a Subnode of the Share Out Data Node).

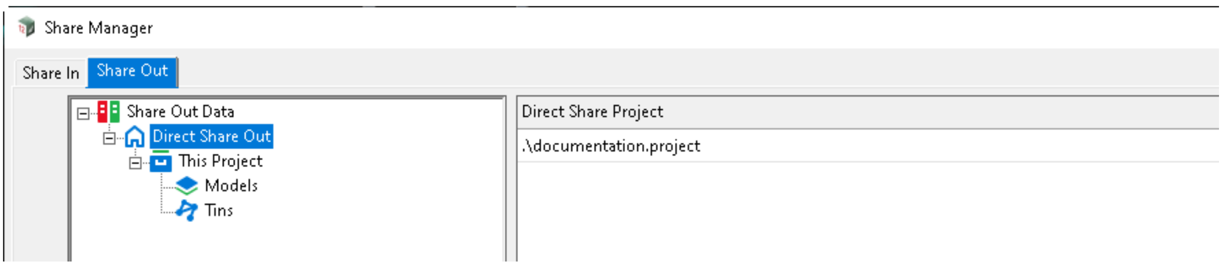
Share Out Data >Direct Share Out node

*For a project, models and tins that have been made available for sharing out of a project are called **Direct Share Outs,** or just **Direct Shares,** for the project. Models and tins can be shared out in two ways:*

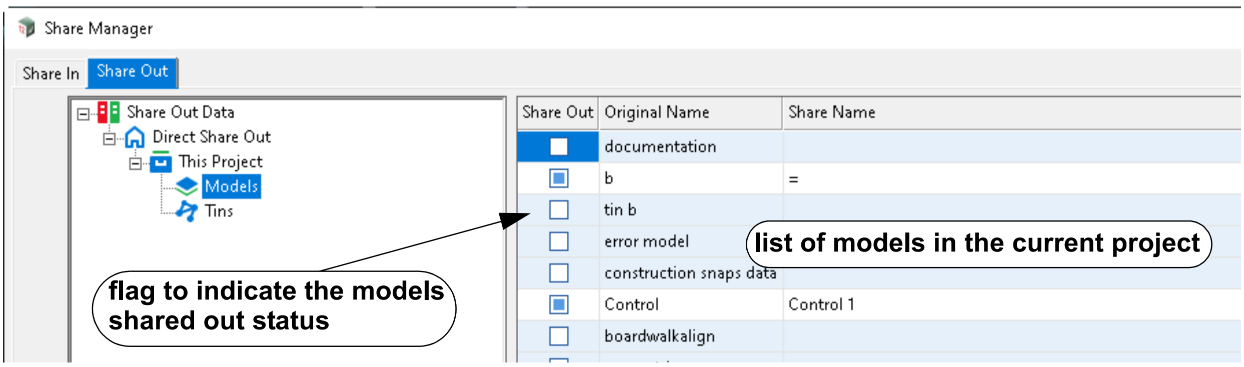
1. **Using the panels Share Out Models and Share Out Tins**
   See 9.8.7.1 Share Out Models and 13.14.16.1 Sharing Out Tins
2. **Using the Direct Share Out node in the Share Manager**
   Using the ***Direct Share Out*** node will now be discussed.

*The **This Project** node under the **Direct Share Out** node is used for making models and tins in the current project available for sharing out. When a model or tin is available for sharing out, the model or tin is said to be **shared out**.*

*By clicking on the + on the left of the **Direct Share Out** node, the **This Project** node is displayed. And clicking on the + on the left of the **This project** node displays **Models** and **Tins** nodes.*



*Clicking on the **Models/Tins** node displays a list of **models/tins** in the current project.*



*The **Share Out** flag indicates whether the mode/tin on the row has been shared out (on) or not shared out (off).*

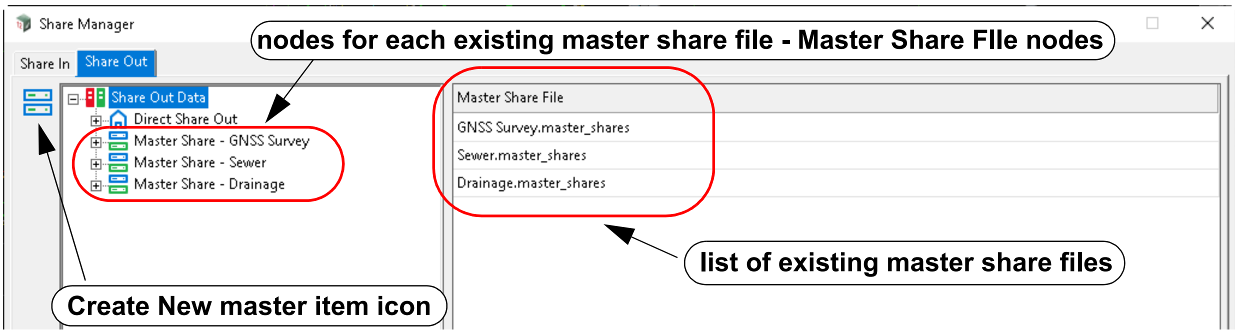
*To change the **Share Out** status for a mode/tin, click on the **Shard Out** flag to the status is required, and then click on **Save**.*

Creating a Master Share File

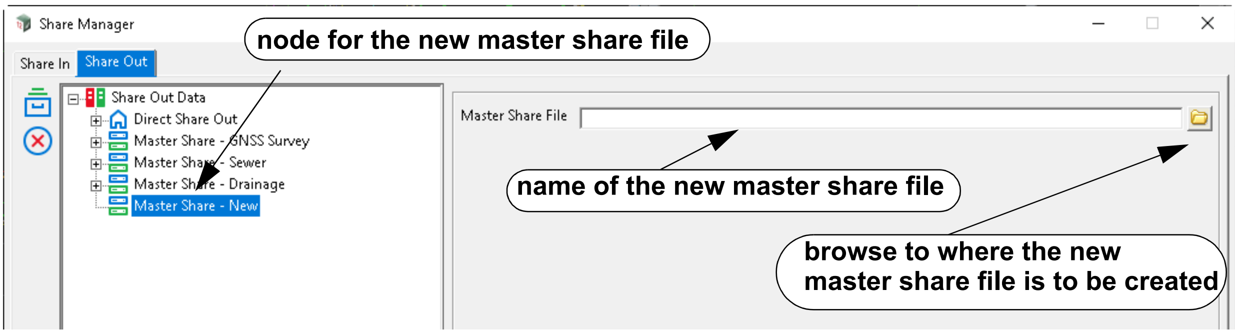
A master share file contains a list of projects, and the models and tins in those projects, that are to be automatically shared into any project that uses the master share file. When a master share file is used by a project, The sharing in occurs every time the project using the master share file is restarted.

*To create a **new master share file**, click on the **Share Out Data** node and the **New master item** icon will appear on the left hand side.*

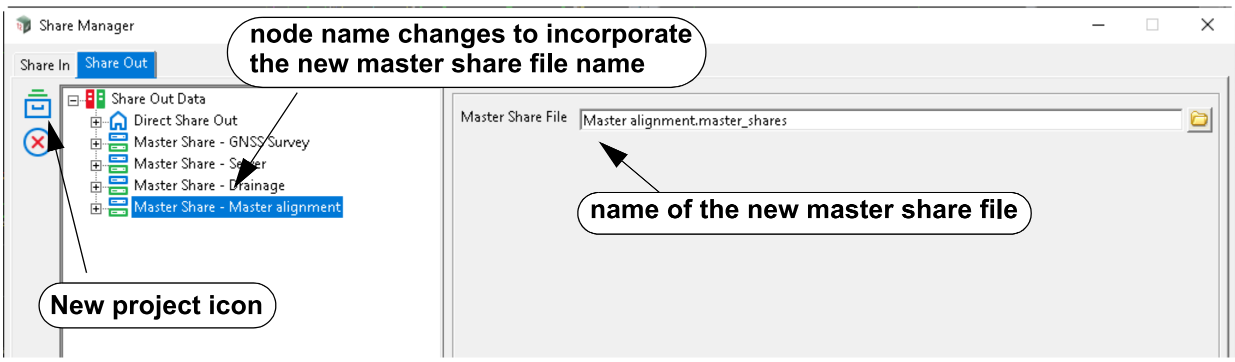
*Clicking on the **New master item** icon creates a new **Master Share File** node with the name **Master share-new.***



*Clicking on the **New master item** icon creates a new **Master Share File** node with the name **Master share-new.** The panel field **Master Share File** is displayed on the right hand side.*



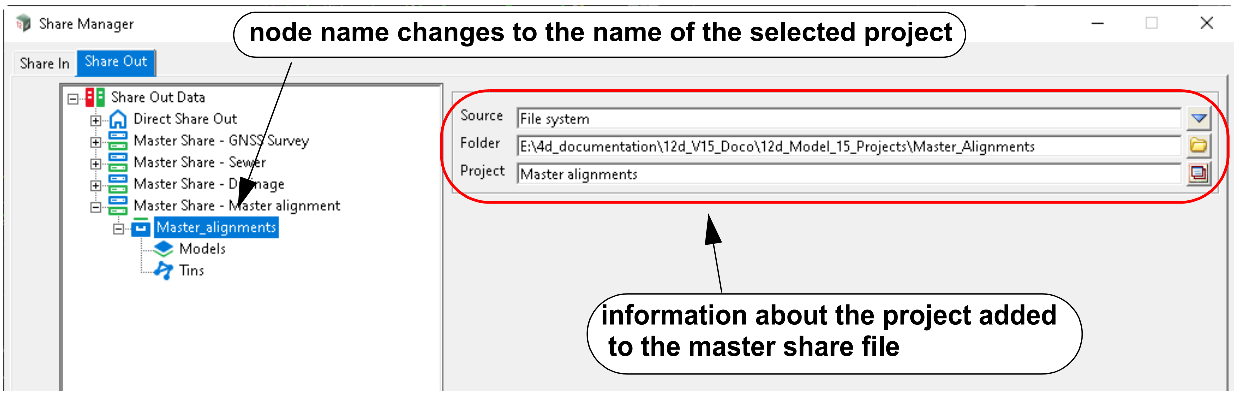
*Typed in a name for the new master share file into the **Master Share File** field and when <Enter> is pressed, the master share file node name changes to **Master share - master_share_file_name**.*



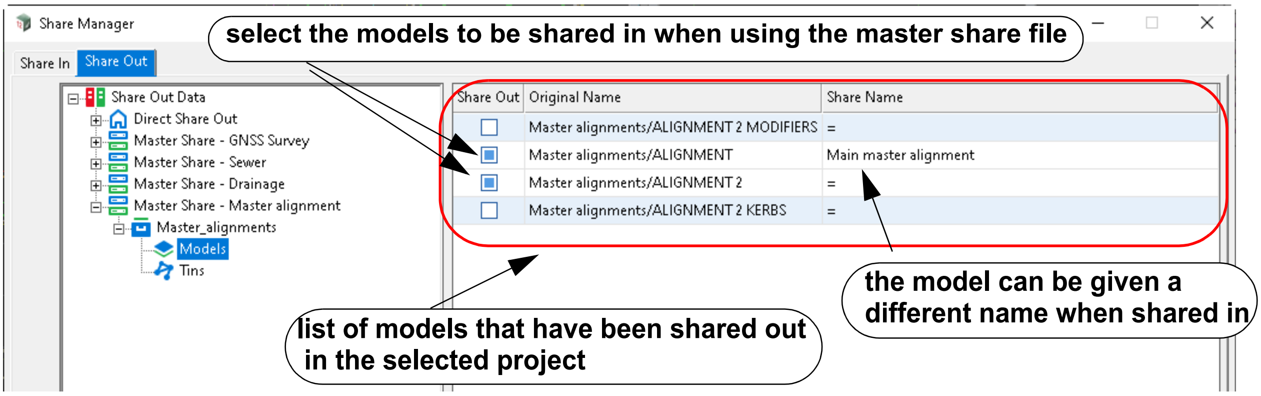
*Click on the **New project** icon on the left had side, to **add a project** to the master share file so that models and/or tins to add to the master share file can be selected from the project.*

*A subnode called **New Project** is then added to the **Master Share File** node and the fields required to select a project, from either a file system or 12d Synergy, are displayed on the right had side of the panel.*

*After selecting a project, the **New project** node name changes to the name of the selected project, and the subnodes **Models** and **Tins** are created.*

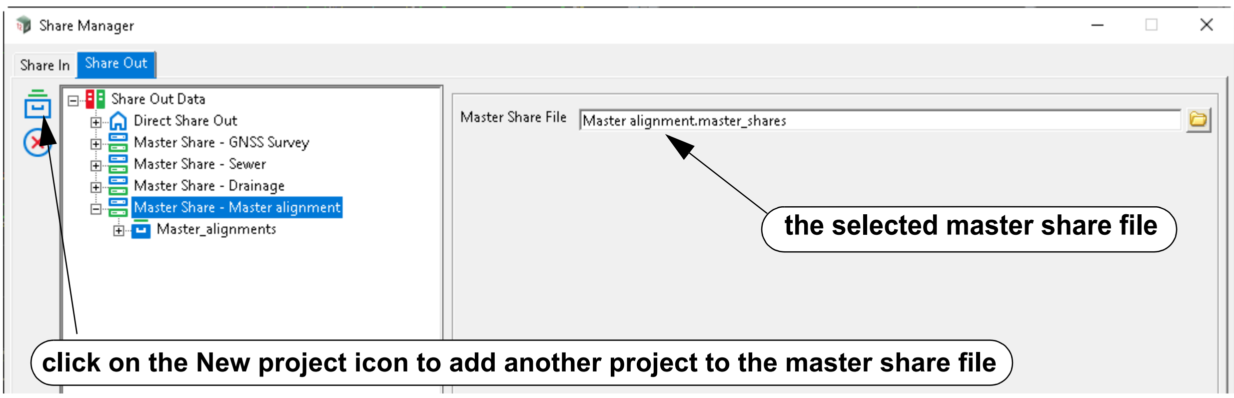


*Clicking on the **Models/Tins** node will show all the models/tins that have been shared out of the selected project and hence available to be shared into other projects.*
*Click the **Shared In** flags to **on** for all the models/tins that are required to be shared in to a project that uses this master share file.*

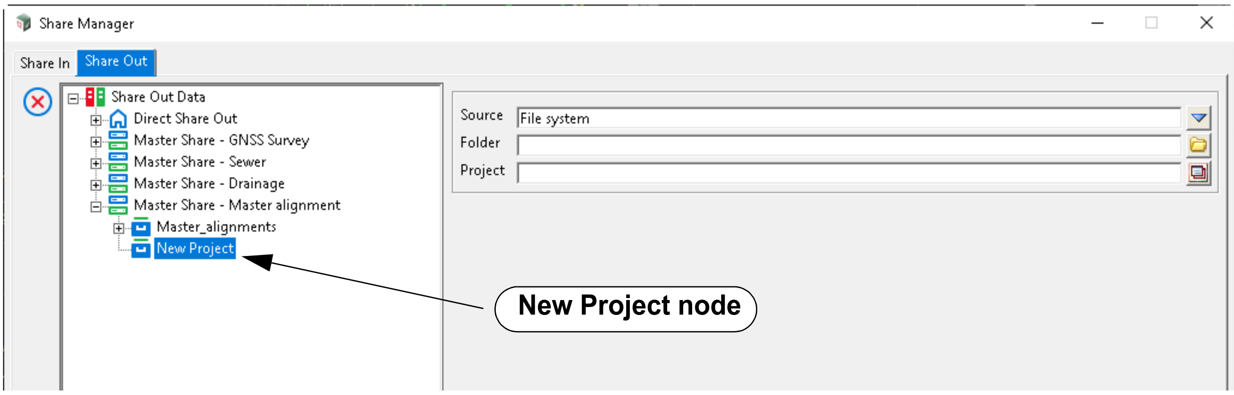


*Click on **Save** to update the master share file and the information in the **Share Manager.***

*More projects can be added to the share master file by clicking on the **Master Share File** node for the master share file, and then clicking the **New project item** icon again.*



*A **New Project** node is added to the highlighted **Master Share File** node.*



Continue as described before by first selecting a project, and then selecting for that project, the models and tins to be shared in when using this master share file.

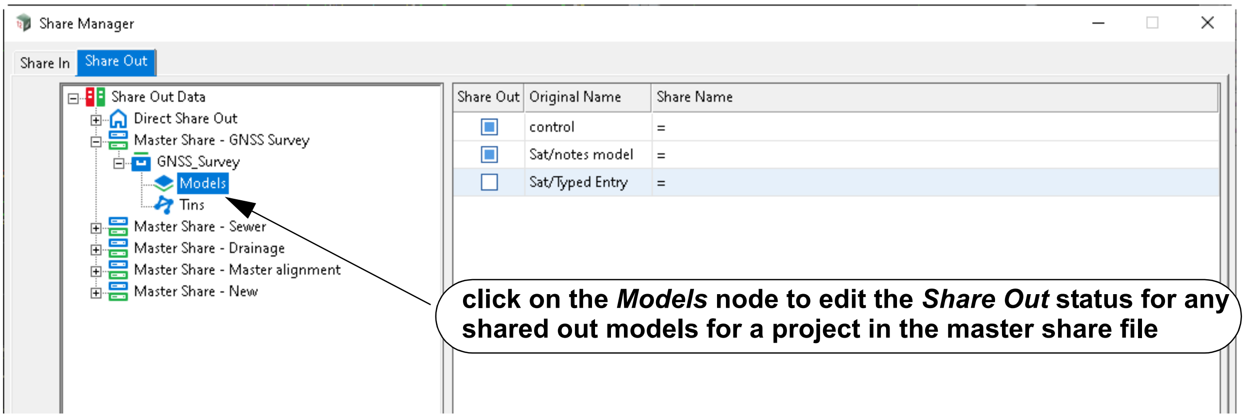
*Click on **Save** to update the master share file and the information in the **Share Manager**.*

Editing a Master Share File

*To edit an existing master share file, click on the appropriate subnode of the **Master Share File** node that displays the data that needs to be edited.*

*For example, click on the **Master Share File** node for a master share file if another project is be added to the master share file.*

*Or click on the **Models** node of the **Project** node of the **Master Share File** node if the **Share In** status of any model is to be modified.*



*After any edits are made, click on **Save** to update the master share file and the information in the **Share Manager**.*

***Note**: if the master share file to be edited is not listed under the Share Out Data tab, see* Editing an Existing Master Share File Not Under the Direct Share Out Node

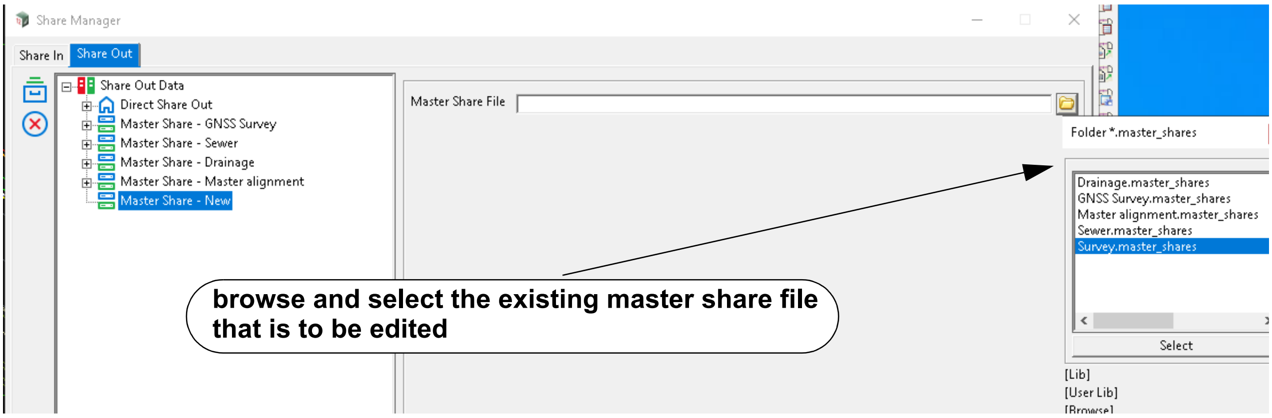
Editing an Existing Master Share File Not Under the Direct Share Out Node

*The master share file to be edited may not be under the **Share Out Data** node. If this is the case, the master share file must first be added to the* **Share Out Data** *node before it can be edited.*

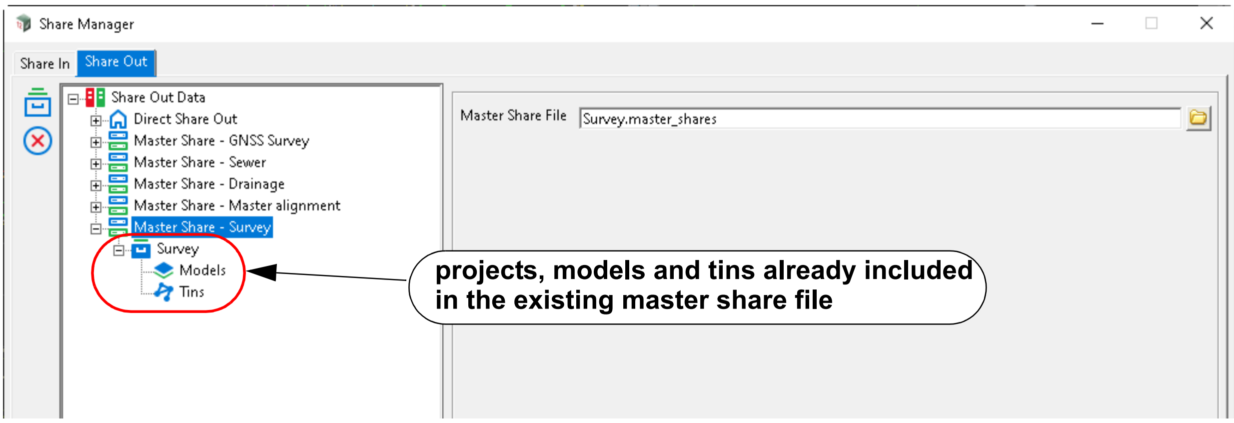
*To add an existing master share file to the **Direct Share Out** node, first click on the **Direct Share Out** node and then select the **New master item** icon that appears on the left had side of the panel.*

A new Master Share File node is then created and the Master Share File field displayed on the right hand side of he panel. So far the steps are the same as for creating a new master share file.

The difference is that instead of create a new master share file, the Browse button is used to find a select an existing master share file.



*When an existing master share file is selected, the **Master Share File** node name is changed to **Master Share - master_share_file_name** and the projects, models and tins already included in the existing master share file are added as subnodes.*



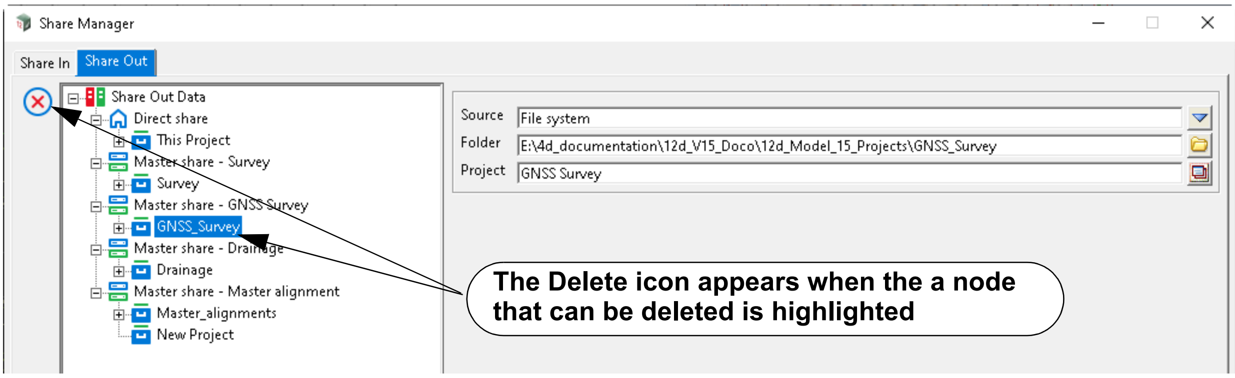
The master share file can then be edited. See Editing a Master Share File.

Continue to Deleting a Subnode of the Share Out Data Node or return to 6.6.2 Share Manager.

Deleting a Subnode of the Share Out Data Node

*Some nodes under the **Share Out Data** node can be deleted, and to indicate that deleting a node is possible, a **Delete** icon appears on the left hand side whenever a node that can be deleted is highlighted.*

*For example, the **Project** subnode of a **Master Share** node.*



*The nodes that can't be deleted are the **Share Out Data** node, the **Direct Share Out** node, the **This Project** node and the **Models** and **Tins** nodes.*

Continue to 6.6.3 Synchronize All Shared In Models and Tins or return to 6.6 Project Sharing or 6 Project.

6.6.3 Synchronize All Shared In Models and Tins

Position of option on menu: **Project =>Sharing =>Sync all share ins**

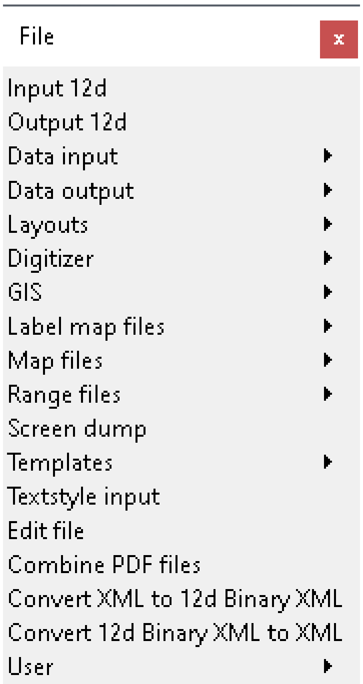
The **Sync all share ins** option is used to update any shared in models and tins in the project.

This includes models and tins that are directly shared in and models and tins that have been shared in using a master share file.

Continue to 7 File or return to 6.6 Project Sharing or 6 Project.

7 File

There has been changes to the **File** chapter in the ***12d Model Reference manual***.



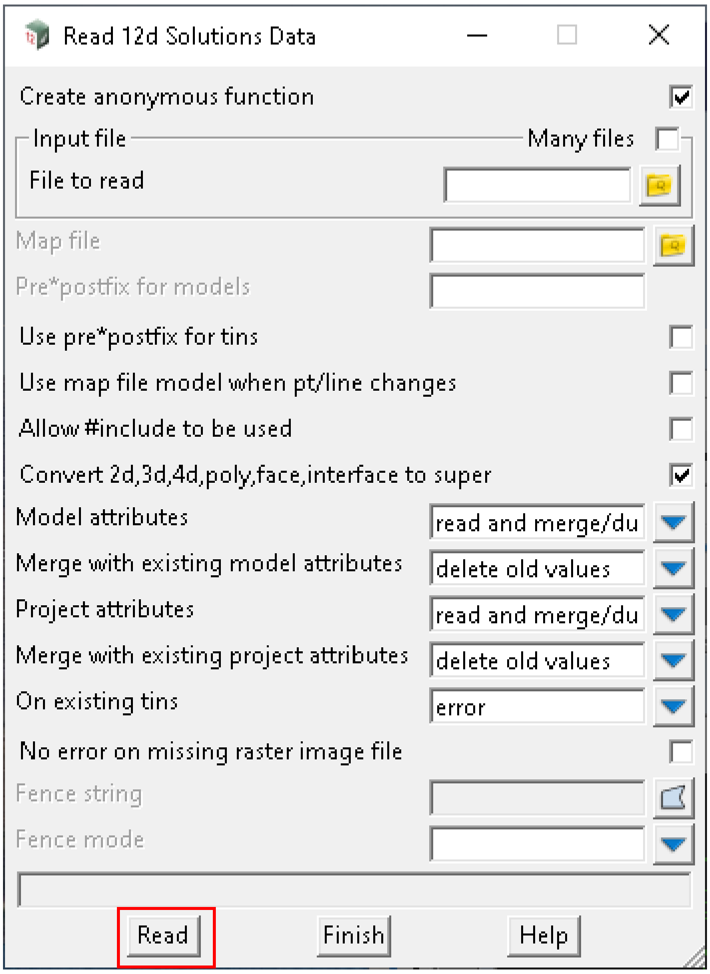
See

7.1 Read 12d Solutions Data
7.2 Write 12d Solutions Data
7.3 Genio Input
7.4 KML Reader
7.5 Import LAS
7.6 ArcView SHP New Output
7.7 GIS
 7.7.1 Read WMTS Data
 7.7.2 Read WMS Data
 7.7.3 Read WFS Data
 7.7.4 Read REST Features Data
7.8 MapInfo Write Tab/MIF Files
7.9 Map File Create/Edit
7.11 12d Binary XML Files

7.1 Read 12d Solutions Data

Position of option on menu: **File =>Input 12d**

Documentation has been added on the **Read** button.



The fields and buttons used in this panel have the following functions.

Field DescriptionType Defaults Pop-Up

Buttons at Bottom

Read button

Reads in the data. The display of the imported data is controlled by how the panel was launched. Either via a drag and drop or from the menu system.

Menu system panel launch:

The display action is set via the env.4d settings (Project>Management>env.4d).

Files & Folders > File input*.*

The shipped mode adds the data to a named plan gdi view, DATA IMPORT. The view is created, if needed, or if it exists, all models are removed from it. The imported models are then added to the view.

Drag and drop panel launch:

When the file is dropped onto the output window or the grey work space, the Menu system panel launch actions above are used.

When the file is dropped onto a non section view, all models are removed from the view and the imported models are added to the view.

Note: Imported data will not be added to the views if:

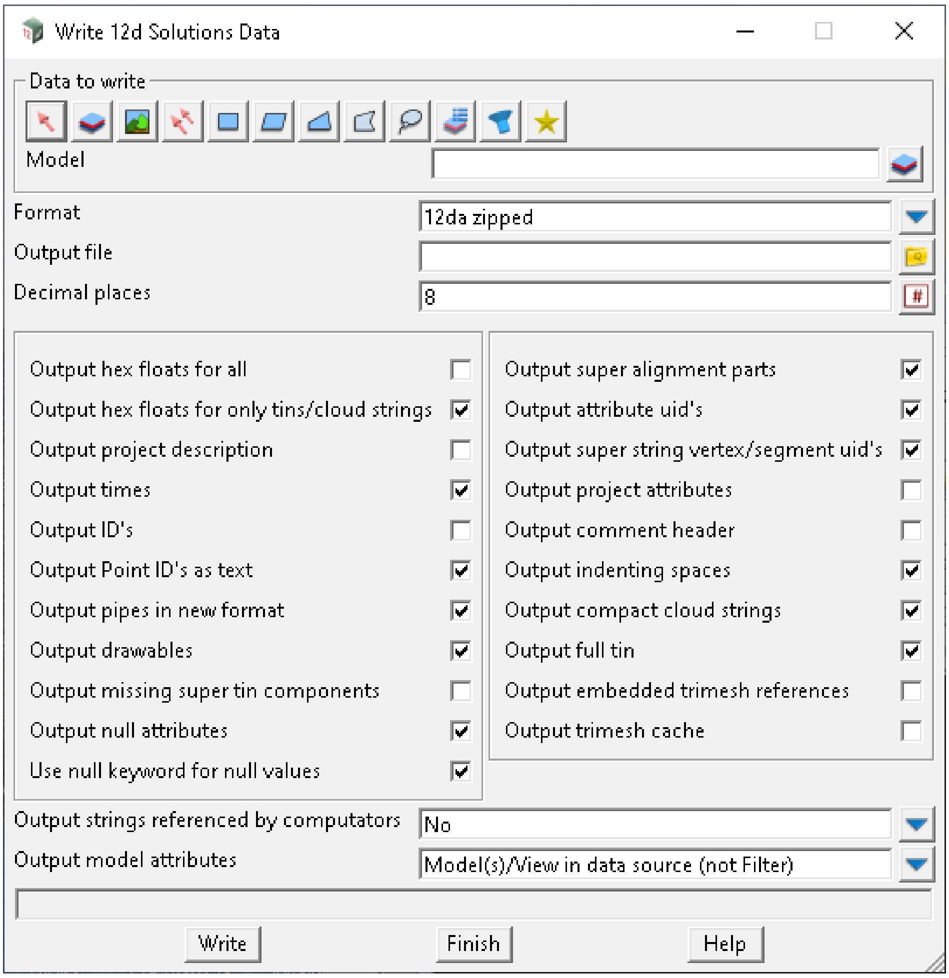
1. ***Add file input data to a view** mode is set to **Do nothing** or*
2. ***Use anonymous functions for file inputs** is not select.*

Continue to 7.2 Write 12d Solutions Data or return to 7 File.

7.2 Write 12d Solutions Data

Position of option on menu: **File =>Output 12d**

The tick boxes **Output null attributes**, **Use null keyword for null values** and **Output object tree paths** have been added to the **Write 12d Solutions Data** panel.



Output null attributes tick box

*If **ticked**, any real attribute of the value null will be written out.*

*If **not ticked**, any real attribute of the value null will not be written out.*

Use null keyword for null values tick box

*If **ticked**, any null value is written out as the keyword "null", not the current Project Settings "Input/output null height" value. Note, some 3rd party packages may not support this.*

*If **not ticked**, any null value is written out as the current Project Settings "Input/output null height" value.*

Output object tree paths tick box

*If **ticked**, preserve the object tree paths including /.*

*If **not ticked**, convert the object tree path / characters to spaces. Note it is possible to create duplicate models.*

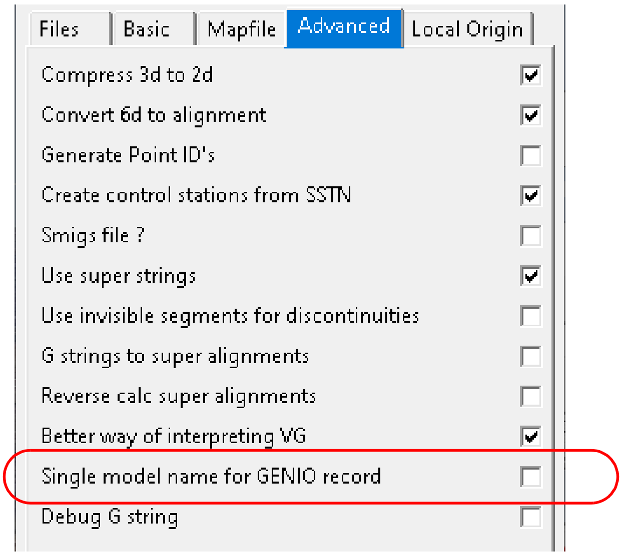
Continue to 7.3 Genio Input or return to 7 File.

7.3 Genio Input

Position of option on menu: **File =>Data input =>Genio**

The panel field **Single model name for GENIO record** has been added to the panel under the Advanced tab.

Advanced tab



Single model name for GENIO record tick box not ticked

*If **ticked**, the GENIO record defines a single model name.*

*If **not ticked**, the GENIO record defines two model names with maximum length of 29 characters.*

Remarks

The MOSS Genio record consists of two model names, a primary and secondary. This means that the 80 characters are split into two fields.

This places an upper limit of the allowable model names lengths. So this tick changes the behaviour of the GENIO record to non-standard.

*Thus, if **ticked** and the GENIO record did in fact have separate primary and secondary model names, the resulting model in 12d Model will look odd.*

Continue to 7.4 KML Reader or return to 7 File.

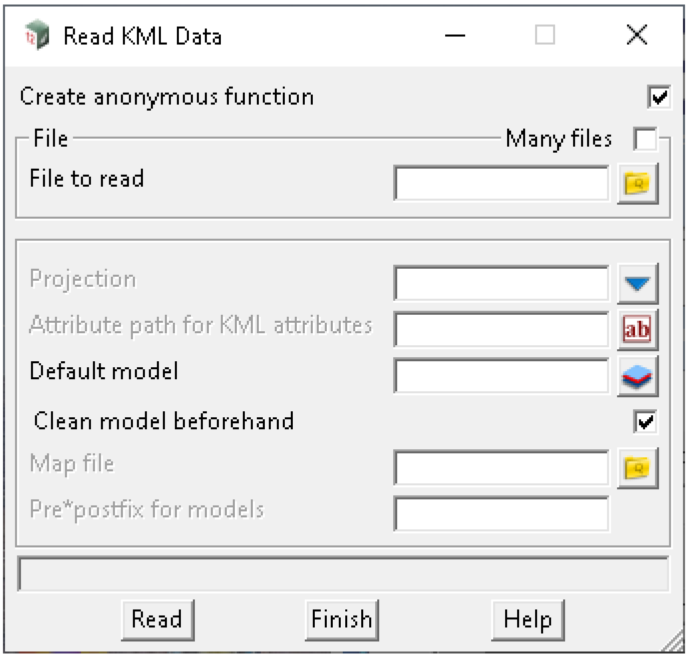
7.4 KML Reader

Position of option on menu: **File =>Data input =>KML**

Position of option on menu: **BIM =>Import =>KML**

The ***Read KML Data*** option reads in KML files.

Selecting **KML reader** brings up the **Read KML Data** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Panel Fields			
Create anonymous function	tick box	ticked	

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

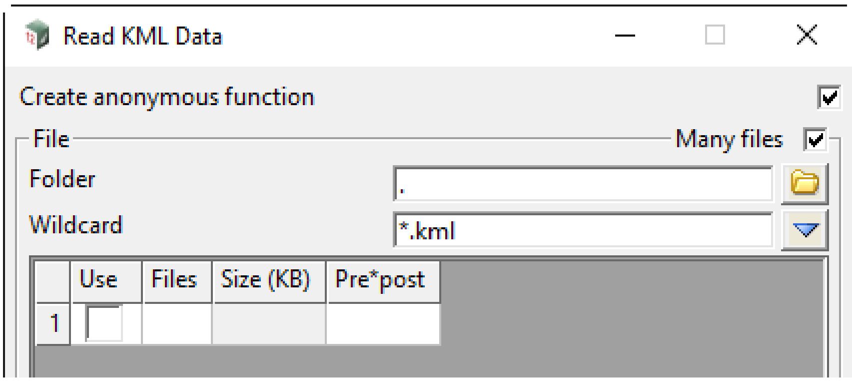
File section			
Many files	tick box	not ticked	

*If **not ticked**, **File To Read** field is visible.*

File to read	file box		kml, kmlz files

*name of the file to process. This is only displayed and used if **Many files** is **NOT** ticked.*

*If **ticked**, the **Many Files** grid is displayed and used to select many files to process.*



Folder folder box .

Folder to search for files to process.

Wildcard text box *.kml, *.kmlz, *

*Wildcard to restrict files select from **Folder**.*

Files file column

Name of the file to process.

Pre*post text column

***Note** that this grid has a **Pre*post** column and if it is blank then the **Pre*postfix for models** field is used.*

Other Panel Fields

Projection Projection box

The project to use to convert the longitude and latitude in the KML file to Easting and Northing (x and y) coordinates.

Attribute path for KML attributes text box

The path name of the attribute node to put all the KML attributes into.

Default model model box available models

Name of the model to add the KML data to.

Clean Default model beforehand? tick box not ticked

*If **ticked**, the Default model to put the KML data into is cleaned out before the KML file is read in.*

Map file file box *.mapfile, *.mf files

*If **not blank**, the name of the 12d Map File to be used for all strings read in.*
When using a map file, the name of the KML object is used as the entity-name for matching with the keys in the map file.

Pre*postfix for models pre*postfix box

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file.*
Go to the section 3.26.2 Pre*Postfix in Panel Fields *for information on using pre*postfix.*

Buttons at Bottom

Read button

Read in the KML file.

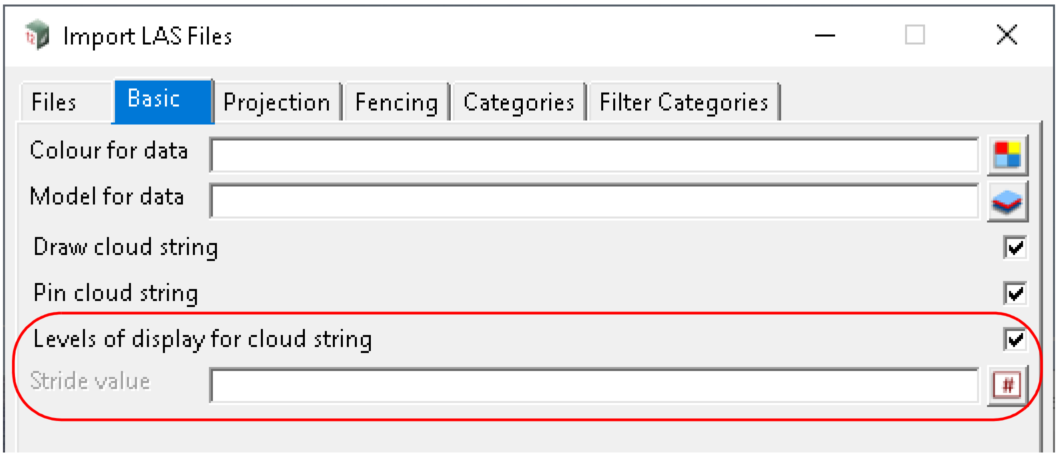
Continue to 7.5 Import LAS or return to 7 File.

7.5 Import LAS

Position of option on menu: **File =>Data input =>Point clouds => LAS =>Import LAS**

Position of option on menu: **BIM =>Point clouds =>Import =>LAS =>Import LAS**

The panel fields **Stride value** and **Levels of display for cloud string** have been added under Basic tab on the Import LAS Files panel.



Levels of display for cloud string tick box ticked

This tick controls whether less details version of point clouds are created for faster drawing.

*If **ticked**, for each point cloud created, an associated series of less detailed clouds is created.*

*If **not ticked**, no associated series of less detailed clouds is created.*

Stride value

This field is optional, and the default value is 1.

If a value of 2, then every second point from the LAS file is imported.

Value	*Even nth Points*
2	*2nd*
3	*3rd*
4	*4th*
5	*5th*
6	*6th*
7	*7th*
etc	

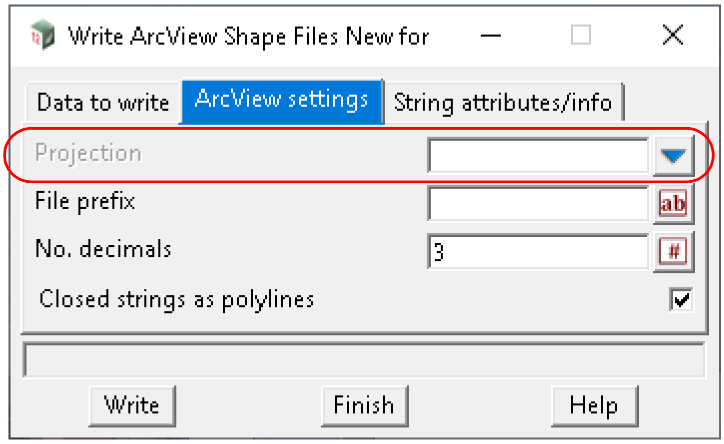
Continue to 7.6 ArcView SHP New Output or return to 7 File.

7.6 ArcView SHP New Output

Position of option on menu: **File =>Data output =>ArcView =>ArcView SHP (new)**

The panel field **Projection** has been added to the **ArcView settings** tab on the **Write ArcView Shape Files New** panel.

Selecting **ArcView SHP (New)** displays the **Write ArcView Shape Files New for** panel.



see ArcView Settings tab

The fields and buttons used in the **Write ArcView Shape Files New for** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
ArcView Settings tab			
Projection	choice box		All defined projections

OPTIONAL - if a projection is chosen, the RSRI WKT string of the projection (if available) shall be written out to a .prj file.

Continue to 7.7 GIS or return to 7 File.

7.7 GIS

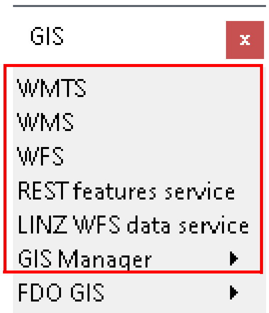
Position of option on menu: **File =>GIS**

Depending on the services provided by the external data source, vector data may be downloaded.

Raster images may also be downloaded and displayed via the **WMTS** (Web Mapping Tile Service), **WMS** (Web Mapping Service), **WFS** (Web Feature Service) and **Rest**.

Some server types may not be available if you do not have the required third party components, as installed with the third party software. You may need to contact the vendors of the data source if you experience difficulty.

The **GIS** walk-right menu containing these options is:



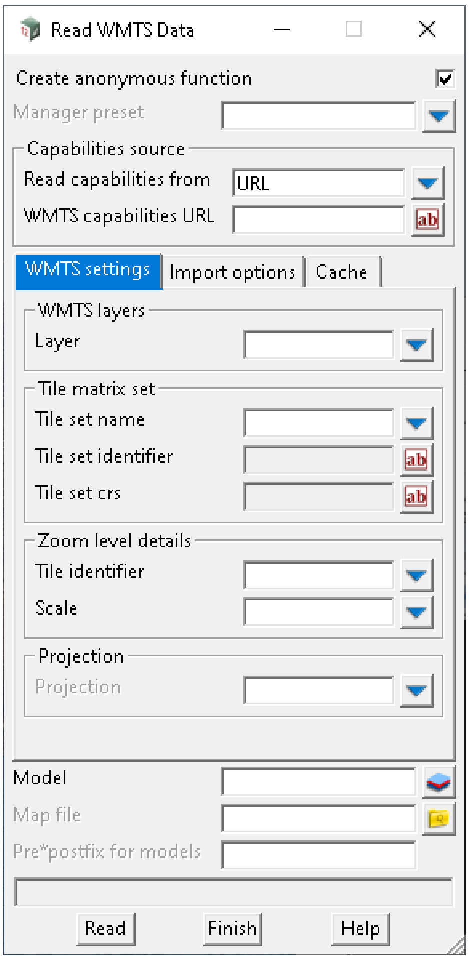
See
7.7.1 Read WMTS Data
7.7.2 Read WMS Data
7.7.3 Read WFS Data
7.7.4 Read REST Features Data
7.7.5 Read LINZ WFS Data
7.7.6 GIS Manager

7.7.1 Read WMTS Data

Position of option on menu: **File =>GIS =>WMTS**

This option reads raster data using the Web Map Tile Service (WMTS) protocol.

Selecting **WMTS** brings up the **Read WMTS Data** panel.



WMTS Top
WMTS Settings tab
Import Options tab
Cache tab
Model for WMTS
Buttons at Bottom

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

WMTS Top

Create anonymous function tick box ticked

*If **ticked**, a function using all the fields in the panel is automatically created when data is read in.*

Manager preset choice box optional

Contains list of GIS filters as setup in 7.7.6.1 GIS Download Manager.

Capabilities source

Read capabilities from choice box URL URL, File

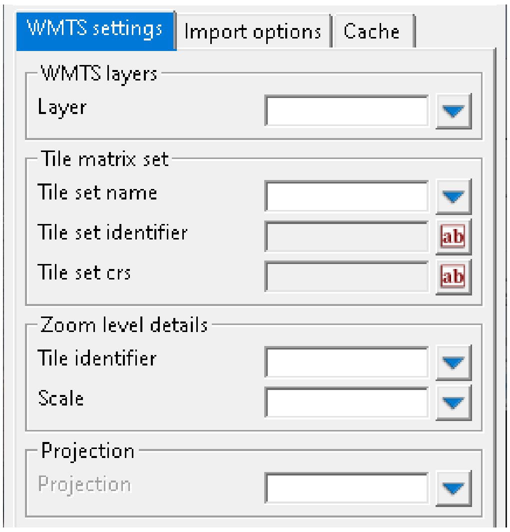
Capabilities can be access directly from the URL or local file.

WMTS capabilities URL input box

Capabilities URL for WMTS.
*Set project attribute **GIS_WMTS_CAPABILITIES_URL** to auto fill this field.*

Continue to WMTS Settings tab or return 7.7.1 Read WMTS Data or 7.7 GIS.

WMTS Settings tab



[WMTS Top](#)
[WMTS Settings tab](#)
[Import Options tab](#)
[Cache tab](#)
[Model for WMTS](#)
[Buttons at Bottom](#)

WMTS layers

Layer directory box

List of available layers from the capabilities file.

Tile matrix set

Tile set name choice box

List of available matrix sets for map images.
Each matrix set will have a pre-determined projection where the output images will be in.

Tile set identifier input box Read-only

Alias name for tile set name.

Tile set crs input box Read-only

Projection identifier (often shown as EPSG code) for the selected matrix set.

Zoom level details

Tile identifier choice box

Level of detail for map tile images.

Scale choice box

Map scale value for the level of detail from Tile Identifier.
Change of the scale choice will also change the tile identifier to another choice that match the new scale value.

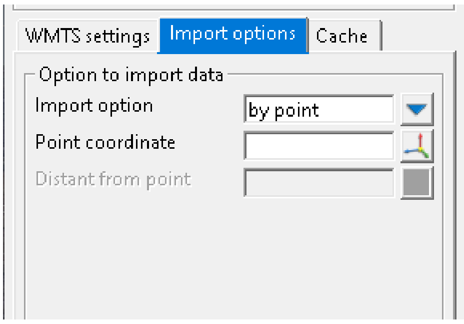
Projection

Projection projection box optional

Projection for input reference geometry and output images.

Continue to [Import Options tab](#) or return [7.7.1 Read WMTS Data](#) or [7.7 GIS](#).

Import Options tab



WMTS Top
WMTS Settings tab
Import Options tab
Cache tab
Model for WMTS
Buttons at Bottom

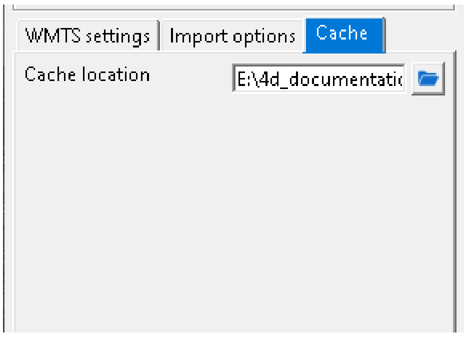
Import option choice box by point, by extent, by boundary, by tile range

Options for importing tile images. See WMTS Import Options Choices:.

If ***by point*** *see* By point.
If ***by extent*** *see* By extent.
If ***by boundary*** *see* By boundary.
If ***by tile range*** *see* By tile range.

Continue to Cache tab or return 7.7.1 Read WMTS Data or 7.7 GIS.

Cache tab



WMTS Top
WMTS Settings tab
Import Options tab
Cache tab
Model for WMTS
Buttons at Bottom

Cache location directory box

Copies of downloaded images will be cached for reusability.

Continue to Model for WMTS or return 7.7.1 Read WMTS Data or 7.7 GIS.

Model for WMTS

Model	model box	available models

Model to read the GIS data into.

Map file	map file box	available mapfiles

Model to read the GIS data into.

Pre*postfix for models	text box

*If **not blank**, pre*post text to use for the models. See* 3.26.2 Pre*Postfix in Panel Fields.

Continue to Buttons at Bottom or return 7.7.1 Read WMTS Data or 7.7 GIS.

Buttons at Bottom

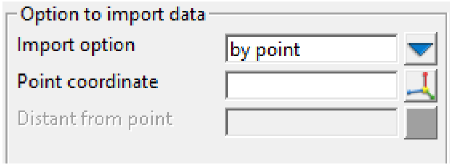
Read	button

Reads in the GIS data.

Continue to WMTS Import Options Choices: or return 7.7.1 Read WMTS Data or 7.7 GIS.

WMTS Import Options Choices:

By point



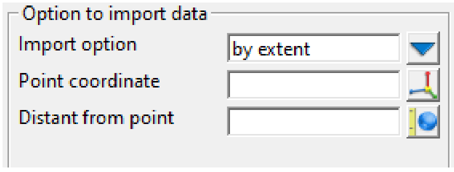
Point coordinate XYZ box

*A single tile image that contains the point's XY coordinate will be read into **12d Model**.*

Distance from point real box

??

By extent



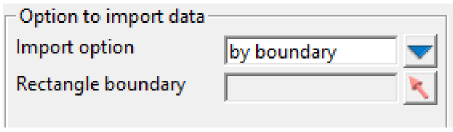
Point coordinate XYZ box

Coordinate of the point in the centre of an extent.

Distance from point XYZ box

Distance from four corners of a rectangular extent to the centre point.
*All the tiles that overlap the rectangular extent will be read into **12d Model**.*

By boundary



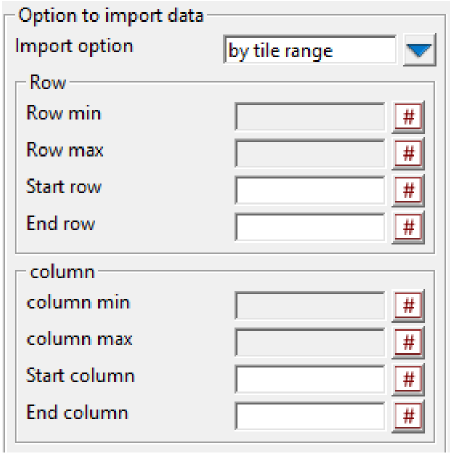
Rectangle boundary select box

The selected must be a closed super string, forming a rectangle from 4 points.
*This rectangle is used as an extent and import any tile image that overlap with it into **12d Model**.*

By tile range

Map are formed from tile images that stack together in a from of a grid. Tiles could be read in using row and column values to determine the start and end tiles and how many tiles to be imported.

*All tile images overlap with the extent formed using (start row, start column) to (end row, end column) coordinates of the map grid will be imported into **12d Model**.*



Row

Row min number box Read-only

Lowest row value that has imagery data.

Row max number box Read-only

Highest row value that has imagery data.

Start row number box

Row where the map image grid should start.
The value should be greater than or equal to Row min.

End row number box

Row where the map image grid should end.
The value should be smaller than or equal to Row max.

column

column min number box Read-only

Lowest column value that has imagery data.

column max number box Read-only

Highest column value that has imagery data.

Start column number box

Column where the map image grid should start.
The value should be greater than or equal to Column min.

End column number box

Column where the map image grid should end.
The value should be greater than or equal to Column max.

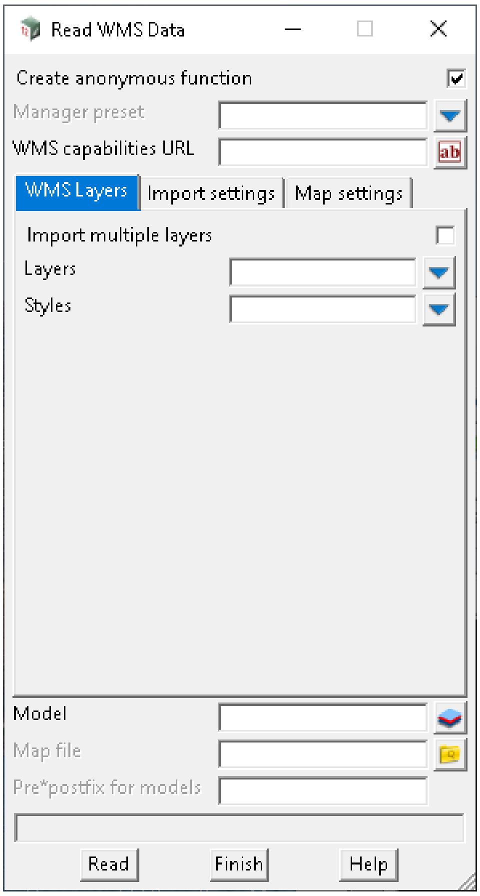
Continue to 7.7.2 Read WMS Data or return to 7.7.1 Read WMTS Data or 7.7 GIS.

7.7.2 Read WMS Data

Position of option on menu: **File =>GIS =>WMS**

This option reads raster data using the Web Map Service (WMS) protocol.

Selecting **WMS** brings up the **Read WMS Data** panel.



WMS Top
WMS Layers tab
Import settings tab
Map settings tab
Model for WMS
Buttons at Bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

WMS Top

Create anonymous function tick box ticked

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

Manager preset choice box optional

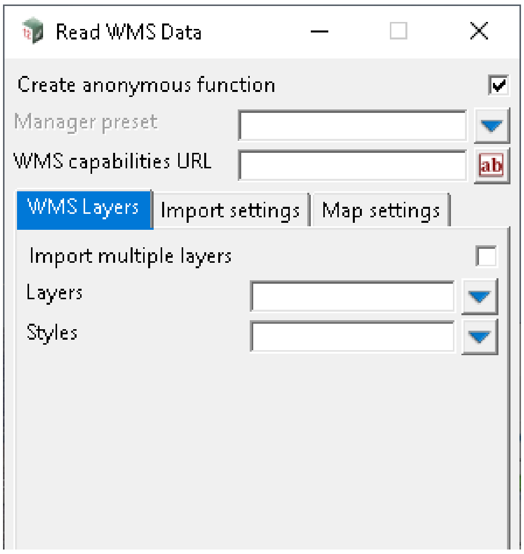
Contains list of GIS filters as setup in 7.7.6.1 GIS Download Manager.

WMS capabilities URL input box

Capabilities URL for WMS.

Continue to WMS Layers tab or return 7.7.2 Read WMS Data or 7.7 GIS.

WMS Layers tab



WMS Top
WMS Layers tab
Import settings tab
Map settings tab
Model for WMS
Buttons at Bottom

Import multiple layers tick box not ticked

*If **ticked**, multiple layers can be imported all at once.*

WMS has an option to import multiple layers on top of each other and feed back a single image that contains all required layers.

Layers choice box

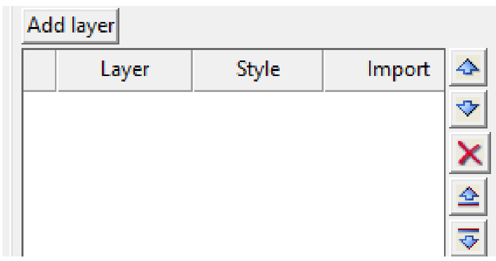
List of available layers from capabilities URL.

Styles choice box

List of available style for a chosen layer.

If Import multiple layers is ticked:

*These fields are hidden unless "Import multiple layers" is **ticked**.*



Add layer button Hidden

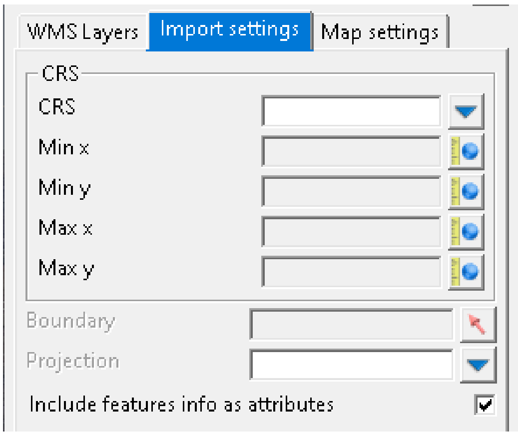
*To import multiple layers, choose each layer and its style from Layers and Styles choice box above and press **Add layer** to add the layer into the table below.*

*All layers in the table will be acquired when **Read**.*

Position of the layers in the table will determine which layer will be put on top. First layer in the table will be place at the back and the last layer in the table will be place at the front of the image.

Continue to Import settings tab or return 7.7.2 Read WMS Data or 7.7 GIS.

Import settings tab



WMS Top
WMS Layers tab
Import settings tab
Map settings tab
Model for WMS
Buttons at Bottom

CRS

CRS choice box

List of available CRSs for chosen layer
If multiple layers are chosen, the CRS list will only contain the common CRS between chosen layers.

Min x double box Read-Only

Minimum X value of the chosen extent.
The field is empty if multiple layers are chosen since each layer have different bounding values.

Min y double box Read-Only

Minimum Y value of the chosen extent.
The field is empty if multiple layers are chosen since each layer have different bounding values.

Max x double box Read-Only

Maximum X value of the chosen extent.
The field is empty if multiple layers are chosen since each layer have different bounding values.

Max y double box Read-Only

Maximum Y value of the chosen extent.
The field is empty if multiple layers are chosen since each layer have different bounding values.

Boundary select box Optional

A boundary must be selected to indicate the location where the image should be downloaded.
*If **Import multiple layers** is **not ticked**, this field is optional. Is this field is left empty then the CRS extent will be used as the boundary to acquire the WMS image.*

Projection projection box optional

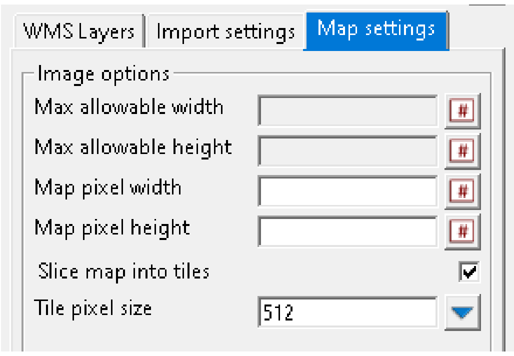
Projection for input reference geometry and output images.

Include features info as attributes tick box ticked

*If **ticked**, the information of imported image will be included into the 12d imported raster image as attributes.*

Continue to Map settings tab or return 7.7.2 Read WMS Data or 7.7 GIS.

Map settings tab



[WMS Top](#)
[WMS Layers tab](#)
[Import settings tab](#)
[Map settings tab](#)
[Model for WMS](#)
[Buttons at Bottom](#)

Image options

Max allowable width number box Read-Only

Maximum number of pixels for the image's width that WMS server can accept.

Max allowable height number box Read-Only

Maximum number of pixels for the image's height that WMS server can accept.

Map pixel width number box

Number of pixels for image's width.

Higher value gives better map details/image quality.

*Must be less than or equal to **Max allowable width**.*

***Map pixel height** will then be set automatically to ensure the image is not being stretched/ distorted.*

Map pixel height number box

Number of pixels for image's height.

Higher value gives better map details/image quality.

*Must be less than or equal to **Max allowable height**.*

***Map pixel width** will then be set automatically to ensure the image is not being stretched/ distorted.*

Slice map into tiles tick box ticked

*If **ticked**, the imported image will be sliced into smaller tiles. Each tile will be in the form of a square with tile's size to be set to 256 or 512 pixels.*

Tile pixel size choice box 256, 512

Size of each image tile if the map is being sliced into smaller image tiles.

Continue to [Model for WMS](#) or return [7.7.2 Read WMS Data](#) or [7.7 GIS](#).

Model for WMS

Model model box available models

Model to read the GIS data into.

Map file file box

*If **not blank**, the name of the 12d Map File to be used for all strings read in, including any files given with the **Many files** mode ticked on.*

*If **blank**, no map file is used*

Pre*postfix for model pre*postfix box

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file. See* 3.26.2 Pre*Postfix in Panel Fields.

?? Use pre*postfix for tins pre*postfix box

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file. See* 3.26.2 Pre*Postfix in Panel Fields.

??Use map file model when pt/line changes tick box not ticked

*If **not ticked** and the pt/line type of the string does not match that in the map file, then the string is placed in.*

??Convert 2d, 3d, 4d, poly, face, interface to super tick box ticked

*If **ticked**, non super string versions of 2d/3d/4d/poly/face/interface strings are converted to super strings.*

Continue to Buttons at Bottom or return 7.7.2 Read WMS Data or 7.7 GIS.

Buttons at Bottom

Read button

Reads in the GIS data.

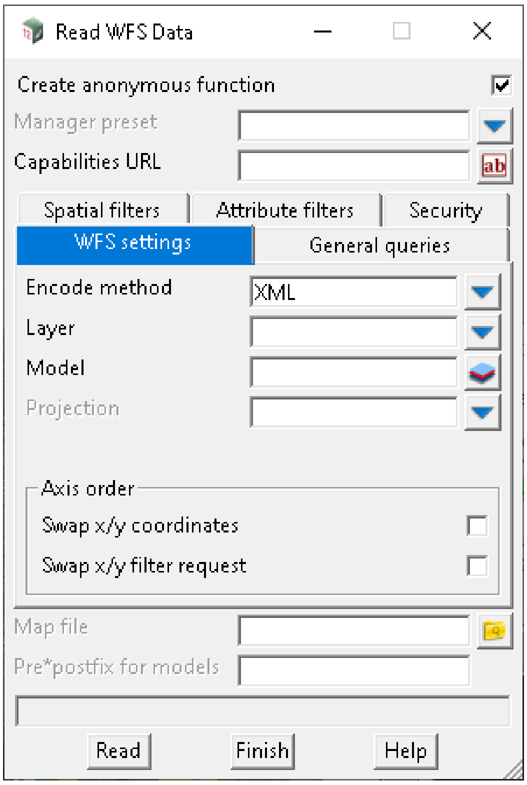
Continue to 7.7.3 Read WFS Data or return to 7.7.2 Read WMS Data or 7.7 GIS.

7.7.3 Read WFS Data

Position of option on menu: **File =>GIS =>WFS**

This option reads geographical features using the Web Feature Service (WFS) protocol.

Selecting **WFS** brings up the **Read WFS Data** panel.



WFS Top
WFS settings tab
General queries tab
Spatial filters tab
Attribute filters tab
Security
Model for WFS
Buttons at Bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

WFS Top

Create anonymous function	tick box	ticked	

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

Manager preset	choice box	optional	

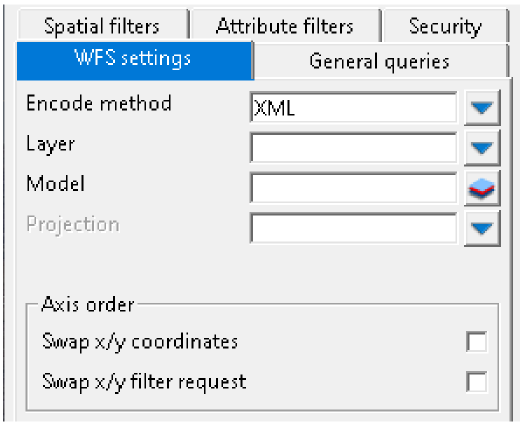
Contains list of GIS filters as setup in 7.7.6.1 GIS Download Manager.

Capabilities URL	input box		

Capabilities URL for WFS.

Continue to WFS settings tab or return 7.7.3 Read WFS Data or 7.7 GIS.

WFS settings tab



[WFS Top](#)
[WFS settings tab](#)
[General queries tab](#)
[Spatial filters tab](#)
[Attribute filters tab](#)
[Security](#)
[Model for WFS](#)
[Buttons at Bottom](#)

Encode name choice box XML XML, KVP

Data can be queried with POST method using XML encoding or GET method using KVP encoding.

Layer choice box list of layer names

Show list of layer names after downloading from LINZ server.

Model model box available models

Model to keep the imported GIS data.
Note: *model name must not exist.*

Projection projection box optional list of projections

Projection that the output data should be converted to.

Filter type choice box OGC filter, CQL filter

Type of filter to be used to query data.
For more details, see https://docs.geoserver.org/stable/en/user/filter/syntax.html

Swap x/y coordinates tick box not ticked

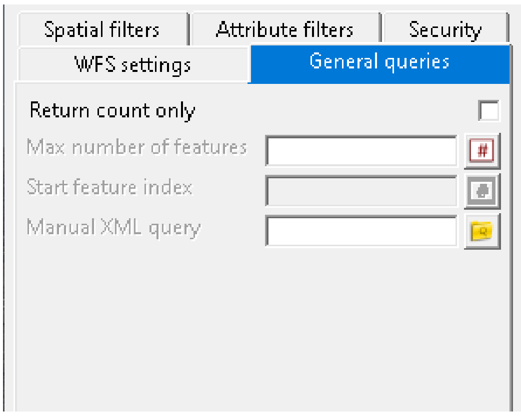
*If **ticked**, x and y values of output data will be swapped.*

Swap x/y filter request tick box not ticked

*If **ticked**, x and y value of input data will be swapped.*

Continue to [General queries tab](#) or return [7.7.3 Read WFS Data](#) or [7.7 GIS](#).

General queries tab



WFS Top
WFS settings tab
General queries tab
Spatial filters tab
Attribute filters tab
Security
Model for WFS
Buttons at Bottom

Return count only tick box

*If **ticked**, ??*

Max number of features number box optional

Maximum amount of feature to be downloaded from a chosen layer.

Start feature index number box optional

Indicate which feature should the panel start reading in first.
Max number of features must not be empty to use this field.

e.g. "Start index" is 10 and "max number of feature" is 50, panel will import all feature from 10 to 59 inclusively.

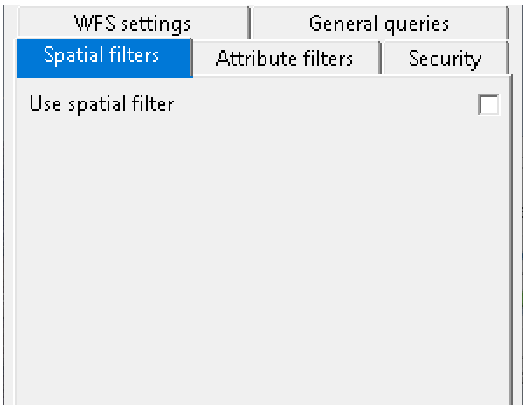
Manual XML query file box optional

All filtered are being built into the request URL to the server in the form of OGC encoding or ECQL (see https://docs.geoserver.org/stable/en/user/filter/filter_reference.html and https://docs.geoserver.org/stable/en/user/filter/ecql_reference.html).

If this field is used, built-in spatial filters and attribute filters will be ignored and the filter in this field will be used instead.

Continue to Spatial filters tab or return 7.7.3 Read WFS Data or 7.7 GIS.

Spatial filters tab



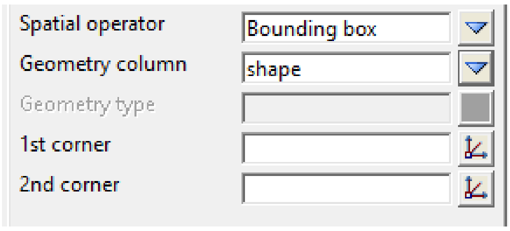
WFS Top
WFS settings tab
General queries tab
Spatial filters tab
Attribute filters tab
Security
Model for WFS
Buttons at Bottom

Use spatial filter tick box ticked

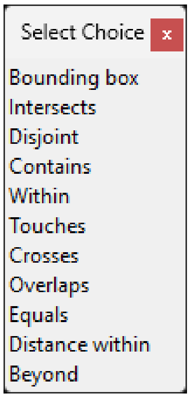
*If **not ticked**, don't turn on the spatial functionality.*
*If **ticked**, turn on the spatial functionality.*

If Use spatial filter is ticked:

*These fields are hidden unless "Use spatial filter" is **ticked**.*



Spatial operator choice box Bounding box



Spatial predicate for data filtering. Details are divided into smaller section below. See 7.7.5.1 Spatial Operator Options.

Geometry column choice box shape shape, Shape, geometry, Geometry, geo,.the geom

"Shape" is used to get property and ownership, street address and geodetic data.
"Geometry" can be used for most other layers, including hydrographic and topographic data.

1st corner XYZ box

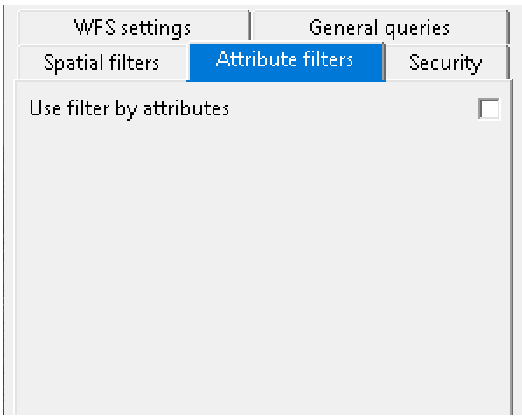
First corner of the rectangular bounding box. It must be diagonal to the 2nd corner.

2nd corner XYZ box

Diagonal corner to the first corner of the rectangular bounding box.

Continue to Attribute filters tab or return 7.7.3 Read WFS Data or 7.7 GIS.

Attribute filters tab



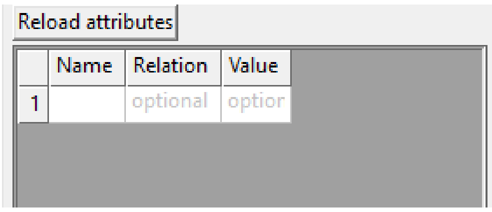
WFS Top
WFS settings tab
General queries tab
Spatial filters tab
Attribute filters tab
Security
Model for WFS
Buttons at Bottom

Use filter by attributes tick box not ticked

*If **not ticked**, don’t turn on the filter by attributes functionality.*
*If **ticked**, turn on the filter by attributes functionality.*

If Use filter by attributes is ticked:

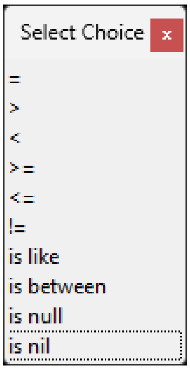
*These fields are hidden unless "Use filter by attributes" is **ticked**.*



Reload attributes button

Re-download a list of attribute names of a chosen layer.

Relation choice box



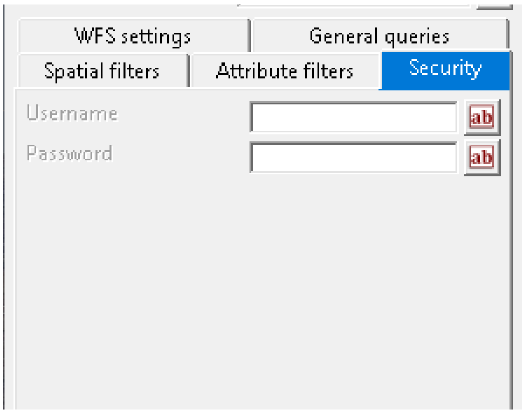
Relation between the attribute on the LHS and the value on the RHS.

Value input box optional

Value of an attribute of features to be imported.

Continue to Security or return 7.7.3 Read WFS Data or 7.7 GIS.

Security



WFS Top
WFS settings tab
General queries tab
Spatial filters tab
Attribute filters tab
Security
Model for WFS
Buttons at Bottom

Username input box optional

Username to access private data set.

Password input box optional

Password to access private data set.

Continue to Model for WFS or return 7.7.3 Read WFS Data or 7.7 GIS.

Model for WFS

Map file file box

*If **not blank**, the name of the 12d Map File to be used for all strings read in, including any files given with the **Many files** mode ticked on.*

*If **blank**, no map file is used.*

Pre*postfix for model pre*postfix box

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file.*

??Use pre*postfix for tins pre*postfix box

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file.*

??Use map file model when pt/line changes tick box not ticked

*If **not ticked** and the pt/line type of the string does not match that in the map file, then the string is placed in.*

??Convert 2d, 3d, 4d, poly, face, interface to super tick box ticked

*If **ticked**, non super string versions of 2d/3d/4d/poly/face/interface strings are converted to super strings.*

Continue to Buttons at Bottom or return 7.7.3 Read WFS Data or 7.7 GIS.

Buttons at Bottom

Read button

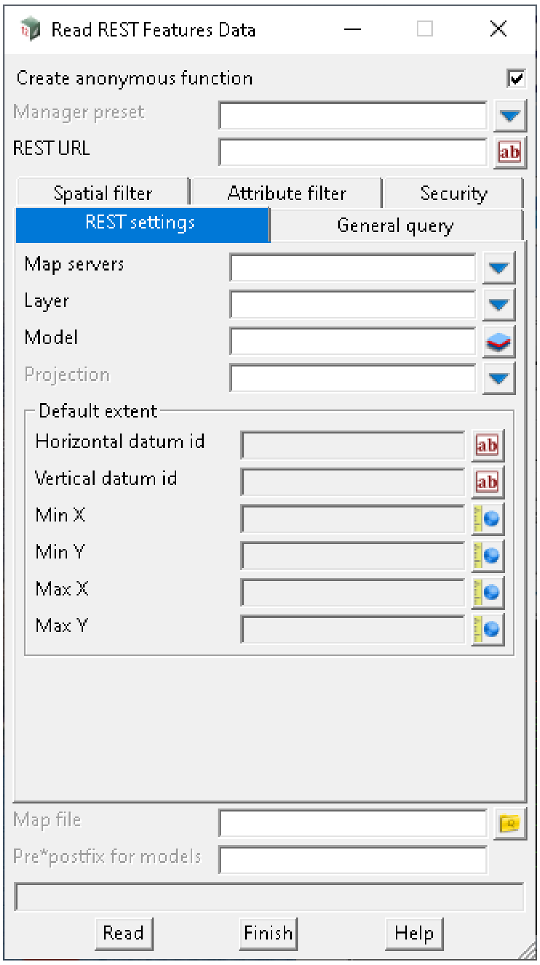
Reads in the GIS data.

Continue to 7.7.4 Read REST Features Data or return to 7.7.3 Read WFS Data or 7.7 GIS.

7.7.4 Read REST Features Data

Position of option on menu: **File =>GIS =>REST features service**

Selecting **REST features service** brings up the **Read REST Features Data** panel.



REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

REST Top

Create anonymous function tick box ticked

*If **ticked**, a function using all the fields in the panel is automatically created when data is read in.*

Manager preset choice box optional

Contains list of GIS filters as setup in 7.7.6.1 GIS Download Manager.

REST URL input box

URL to REST services folder from GIS server.

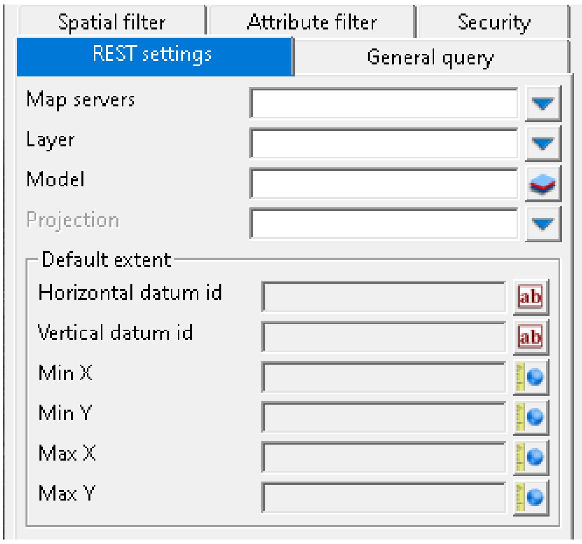
*Set project attribute **GIS_REST_URL** to auto fill this field.*

??REST token input box

The token (or API key) to be used as authentication method for accessing private data set.

Continue to REST settings tab or return 7.7.4 Read REST Features Data or 7.7 GIS.

REST settings tab



REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

Map servers choice box

List of available map servers downloaded from the REST URL.

Layers choice box

List of available layers.

Model model box available models

Name of a new model to contain feature data to be read in from REST server.

Projection projection box optional available projections

*Projection where the input geometry is in (if used in **Spatial filter**) and the output data should be set to. If no projection is chosen, the default extent (if available) provided by the server will be used.*

Default extent

Horizontal datum id input box Read-only

ID number of defaults horizontal datum, It is often EPSG code.

Vertical datum id input box Read-only

ID number of defaults vertical datum, It is often EPSG code.

Min X double box Read-only

Minimum X coordinate of the bounding box.

Min Y double box Read-only

Minimum Y coordinate of the bounding box.

Max X double box Read-only

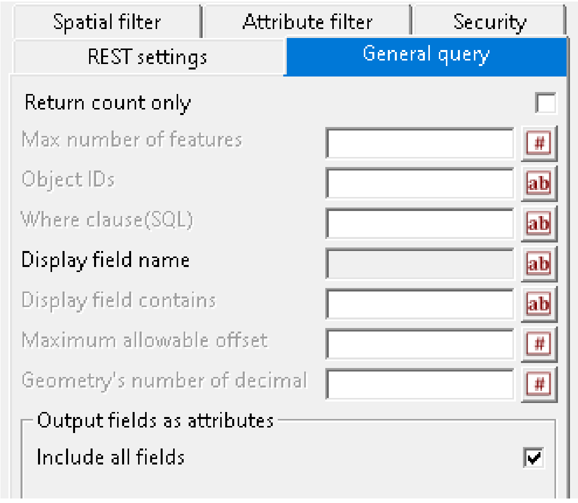
Maximum X coordinate of the bounding box.

Max Y double box Read-only

Maximum Y coordinate of the bounding box.

Continue to General query tab or return 7.7.4 Read REST Features Data or 7.7 GIS.

General query tab



REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

Return count only tick box

*If **ticked**, ??*

Max number of features integer box

*If **blank**, ??*

Object IDs text box

*If **blank**, ??*

Where clause(SQL) text box optional

The Where Clause condition in SQL format to query data from the server.

Display field name text box Read-only

Display field (if available) associated with chosen layer.

Display field contains text box optional

Any feature/layers that which its display field contains this value will be read in.

Maximum allowable offset integer box optional

It's used for generalising geometries returned in the read process.

Geometry’s number of decimal integer box optional

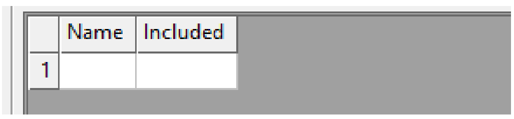
The number of decimal places in the output geometry.

Include all fields tick box

*If **ticked**, all available fields will be imported as attribute.*
*If **not ticked**, user can specify individually which field to be imported as attribute.*

If Include all fields is NOT ticked:

*These fields are hidden unless "Include all fields" is **NOT ticked**.*



Name text box

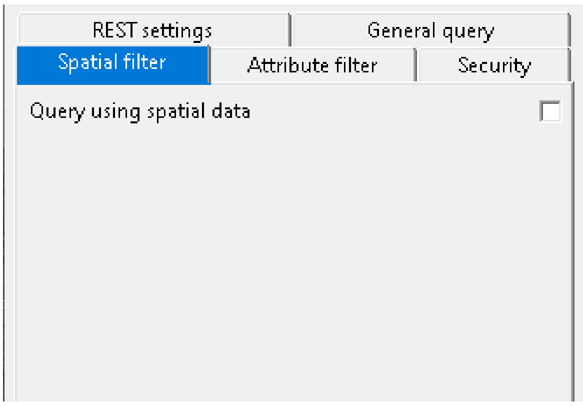
??

Included yes, no box

??

Continue to Spatial filter tab or return 7.7.4 Read REST Features Data or 7.7 GIS.

Spatial filter tab



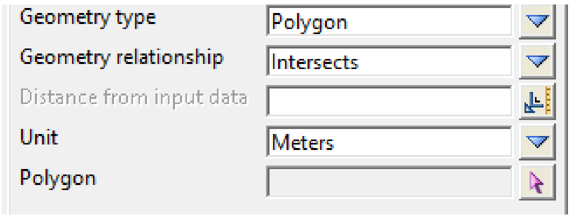
REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

Query using spatial data tick box not ticked

*If **ticked**, geometry will be used as reference to read data from server.*
The following fields will then be displayed.

If Query using spatial data is ticked:

*These fields are hidden unless "Query using spatial data" is **ticked**.*



Geometry type choice box Polygon Point, Line, Polygon, Envelope, Multipoint

Type of geometry to be used as reference to import data from server.
See Additional REST Geometry Type Choices.

Geometry relationship choice box Intersects Intersects, Contains, Crosses
Envelop intersects
Index Intersects, Overlaps,
Touches, Within, Relation

Relationship between reference geometry and the output geometry.

See https://developers.arcgis.com/documentation/mapping-apis-and-services/spatial-analysis/geometry-analysis/spatial-relationship/ for more details.

Distance from input data double box

Buffer distance for the reference geometry. Any geometry that overlap with reference geometry and its buffer distance will be read in.

Unit choice box Meters Feet, Meters, Kilometers
Miles, Nautical miles
US Nautical Miles

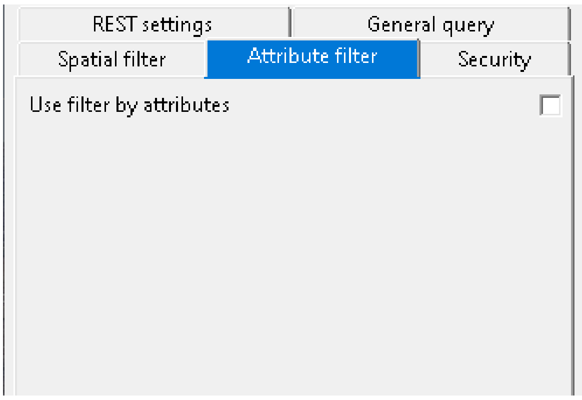
Unit used for distance when query data from server.

Polygon polygon select

??

Continue to Attribute filter tab or return 7.7.4 Read REST Features Data or 7.7 GIS.

Attribute filter tab



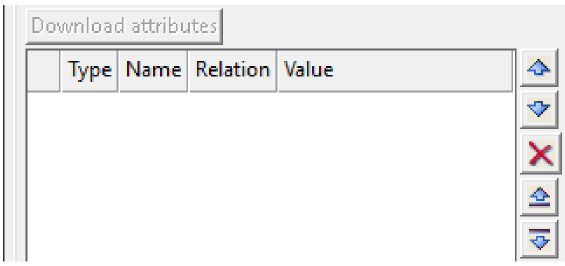
REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

Use filter by attributes tick box not ticked

*If **not ticked**, don’t turn on the filter by attributes functionality.*
*If **ticked**, turn on the filter by attributes functionality.*

If Use filter by attributes is ticked:

*These fields are hidden unless "Use filter by attributes" is **ticked**.*



Download attributes button

Download all available attributes for the chosen layer and display them in the table.

Grid

Type output box Read-Only

Data type of an attribute. It is used as user reference only and will not affect the actual query.

Name input box

Name of an attribute.

Relation choice box =, !=, <=, >=, <, >, IS, IS_NOT IN, NOT_IN, LIKE

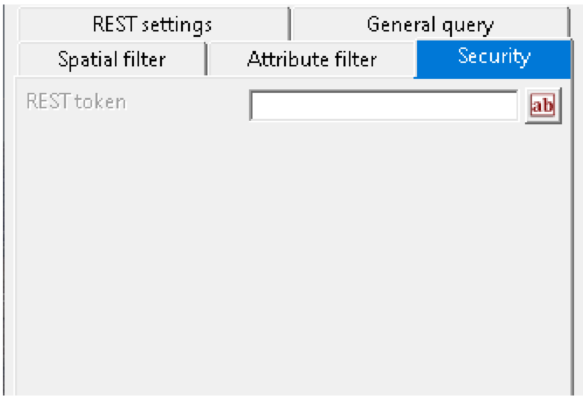
The relation between the attribute on the LHS and the value on the RHS.

Value input box optional

Value of an attribute of features to be queried.

Continue to Security tab or return 7.7.4 Read REST Features Data or 7.7 GIS.

Security tab



REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

REST token text box

??

Continue to Model for REST or return 7.7.4 Read REST Features Data or 7.7 GIS.

Model for REST

REST Top
REST settings tab
General query tab
Spatial filter tab
Attribute filters tab
Security tab
Model for REST
Buttons at Bottom

Map file file box

*If **not blank**, the **Map file** is used to map **feature codes** to string names, models, colours, line styles, etc.*

Pre*postfix for models pre*postfix box

*If **not blank**, the **pre*postfix for models** text is applied to all model names in the Map file.*

??Use pre*postfix for tins tick box not ticked

*If **ticked**, a prefix and a postfix are to be applied to any tin names.*

??User map file model when pt/line changes tick box not ticked

*If **ticked** and a **Map file** is used, the **column** in the map file that specifies the point/line type of the string is used to set the point/line type of the string.*

*If **not ticked** and a **Map file** is used, the **column** is ignored. That is, it is not used for setting the point/line type of the string.*

??Convert 2d,3d,4d,poly,face, interface to super tick box ticked

*If **ticked**, non super string versions of 2d/3d/4d/poly/face/interface strings are converted to super strings.*

Continue to Buttons at Bottom or return 7.7.4 Read REST Features Data or 7.7 GIS.

Buttons at Bottom

Read button

Reads in the GIS data.

Continue to Additional REST Geometry Type Choices or return 7.7.4 Read REST Features Data or 7.7 GIS.

Additional REST Geometry Type Choices

Point

Point coordinate XYZ box

Coordinate of reference point. Any geometry that has relation with this point will be read in.

Line

Line select box

Any geometry that has relation with this string super will be read in.

Polygon

Polygon select box

Any geometry that has relation with this rectangular, closed super string will be read ins.

Envelope

1st corner XYZ box

The first corner of the bounding box.
It must be a diagonal corner to the 2nd corner.

2nd corner XYZ box

The second corner of the bounding box.
It must be a diagonal corner to the 1st corner.

Multipoint

Select point select box

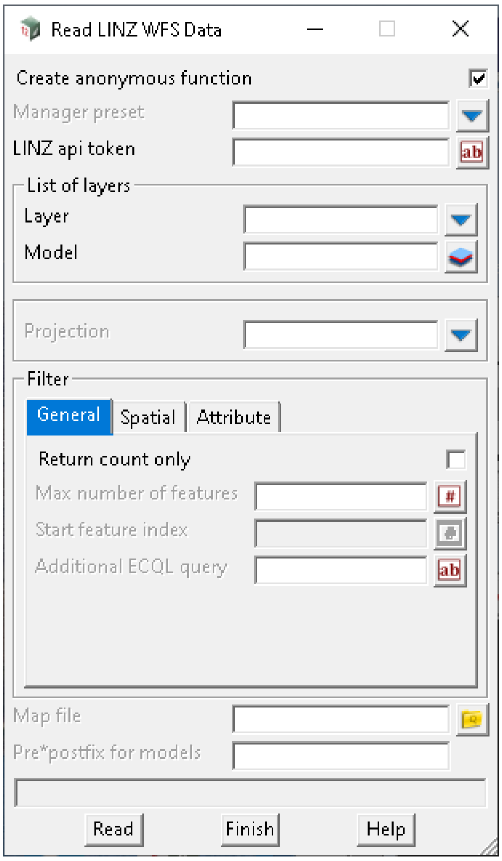
Selected points will have its coordinate stored in a table to be used in data query at the read process.

Continue to 7.7.5 Read LINZ WFS Data or return to 7.7.4 Read REST Features Data or 7.7 GIS.

7.7.5 Read LINZ WFS Data

Position of option on menu: **File =>GIS =>LINZ WFS data service**

Selecting **LINZ WFS data service** brings up the **Read LINZ WFS Data panel**.



LINZ Top
General tab
Spatial tab
Attribute tab
Model for LINZ
Buttons at Bottom

The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

LINZ Top

Create anonymous function tick box ticked

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

Manager preset choice box optional

Contains list of GIS filters as setup in 7.7.6.1 GIS Download Manager.

LINZ api token input

*Set project attribute **LINZ_API_TOKEN** to auto fill the input at startup.*

List of layers

Layers choice box list of layer names

Show list of layer names after downloading from LINZ server.

Model model box available models

Model name must not exist.

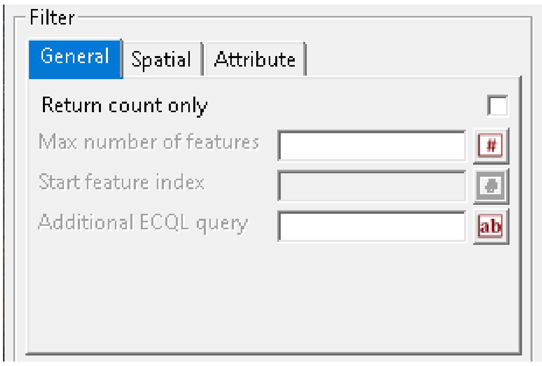
Name of model to store all imported data

Projection	optional	list of projections

Projection that the output data should be converted to.

Continue to General tab or return 7.7.5 Read LINZ WFS Data or 7.7 GIS.

General tab



LINZ Top
General tab
Spatial tab
Attribute tab
Model for LINZ
Buttons at Bottom

Return count only tick box

*If **ticked**, ??*

Max number of feature integer box

Maximum number of features to be downloaded from a chosen layer.

Start feature index integer box optional

Indicate which feature should the panel start reading in first.
Max number of feature must not be empty to use this field.

e.g. "Start index" is 10 and "max number of feature" is 50, panel will import all feature from 10 to 59 inclusively.

Additional ECQL query text box optional

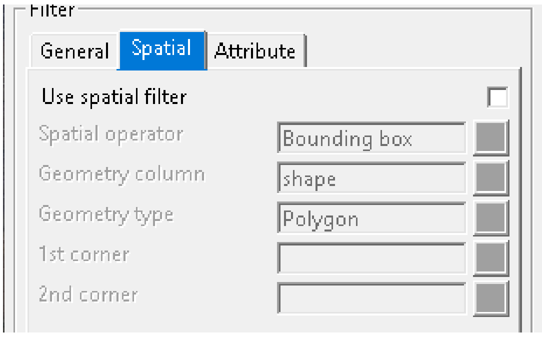
All filtered are being built into the request URL to the server in the form of ECQL (see https://www.linz.govt.nz/guidance/data-service/linz-data-service-guide/web-services/wfs-filter-methods-and-parameters and https://docs.geoserver.org/stable/en/user/filter/ecql_reference.html for more details).

This field allows user to customise the filter using ECQL query.

This method will work in addition to all other filtering techniques existing in the panel.

Continue to Spatial tab or return 7.7.5 Read LINZ WFS Data or 7.7 GIS.

Spatial tab



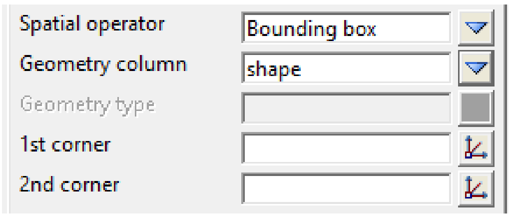
[LINZ Top](#)
[General tab](#)
[Spatial tab](#)
[Attribute tab](#)
[Model for LINZ](#)
[Buttons at Bottom](#)

Use spatial filter	tick box	ticked

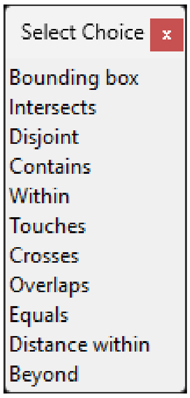
*If **not ticked**, don't turn on the spatial functionality.*
*If **ticked**, turn on the spatial functionality.*

If Use spatial filter is ticked:

*These fields can't be used unless "Use spatial filter" is **ticked**.*



Spatial operator	choice box	Bounding box



Spatial predicate for data filtering. Details are divided into smaller section below. See [7.7.5.1 Spatial Operator Options](#).

Geometry column	choice box	shape	shape, Shape, geometry, Geometry, geo,.the geom

"Shape" is used to get property and ownership, street address and geodetic data.
"Geometry" can be used for most other layers, including hydrographic and topographic data.

1st corner	XYZ box

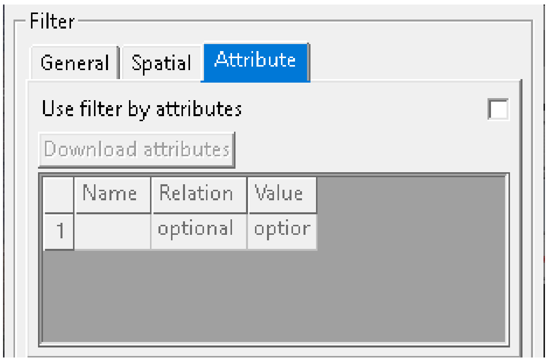
First corner of the rectangular bounding box. It must be diagonal to the 2nd corner.

2nd corner	XYZ box

Diagonal corner to the first corner of the rectangular bounding box.

Continue to [Attribute tab](#) or return [7.7.5 Read LINZ WFS Data](#) or [7.7 GIS](#).

Attribute tab



LINZ Top
General tab
Spatial tab
Attribute tab
Model for LINZ
Buttons at Bottom

Use filter by attributes tick box not ticked

Turn on and off the filter by attributes functionality.

Download attributes button

Download a list of attribute names of a chosen layer.

Grid information

Name input

Name of an attribute downloaded from LINZ server.

Relation choice box **=**, >, <, >=, <=, <>

The relation between the attribute on the LHS and the value on the RHS.

Value optional

Value of an attribute of features to be imported.

Continue to Model for LINZ or return 7.7.5 Read LINZ WFS Data or 7.7 GIS.

Model for LINZ

LINZ Top
General tab
Spatial tab
Attribute tab
Model for LINZ
Buttons at Bottom

Map file file box

*If **not blank**, the **Map file** is used to map **feature codes** to string names, models, colours, line styles, etc.*

Pre*postfix for models pre*postfix box

*If **not blank**, the **pre*postfix for models** text is applied to all model names in the Map file.*

Continue to Buttons at Bottom or return 7.7.5 Read LINZ WFS Data or 7.7 GIS.

Buttons at Bottom

Read button

Reads in the GIS data.

Continue to 7.7.5.1 Spatial Operator Options or return 7.7.5 Read LINZ WFS Data or 7.7 GIS.

7.7.5.1 Spatial Operator Options

See

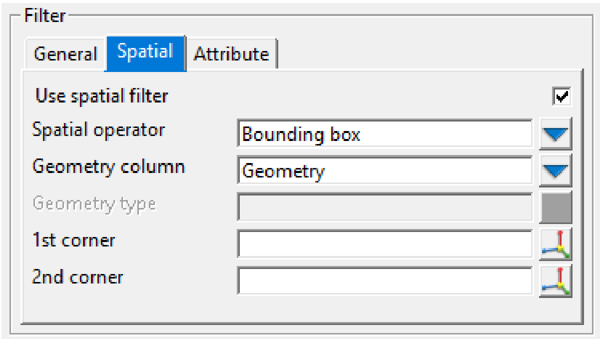
Bounding box	Intersects	Disjoint
Contains	Within	Touches
Crosses	Overlaps	Equals
Distance within	Beyond	

Bounding box

Functionality: Data to be imported using Bounding box are:

Within the bounding box and

Intersects with the bounding box



1st corner XYZ box

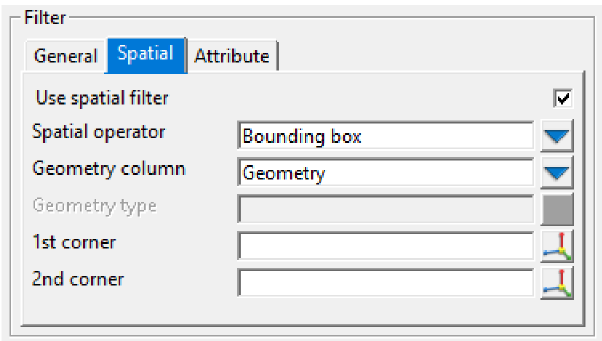
"X Y Z value of first corner of the box.

2nd corner XYZ box

X Y Z value of second corner of the box.

Intersects

Functionality: Data to be imported are intersecting with the referencing geometry.



Geometry type choice box Point, Line, Polygon

Type of geometry to use as reference for filtering.

Point XYZ box

Coordinate of point.

Line select box

Selecting line to use as reference for filtering.

Polygon select box

Selecting polygon to use as reference for filtering.

Disjoint

*Functionality: The converse of **Intersects**.*

Same data fields as [Intersects](#).

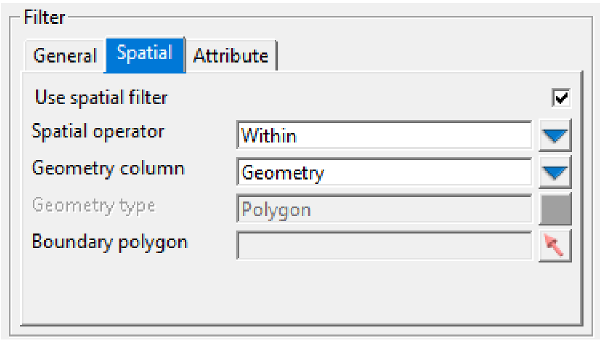
Contains

*Functionality: Importing any data that **contains** the chosen reference geometry.*

Same data fields as [Intersects](#).

Within

*Functionality: Importing any data that is **within** the chosen polygon.*



Geometry type choice box Polygon Disable

Can only be polygon type (a closed string supers).

Boundary polygon select box

Polygon to be used as the boundary for imported data.

Touches

Functionality: importing any data that touches, which has at least 1 point in common but doesn't intersect in the interior with, the reference geometry.

Same data fields as [Intersects](#).

Crosses

Functionality: importing any data that have some but not all interior points in common with reference geometry.

Same data fields as [Intersects](#).

Overlaps

Functionality: Data to be imported and the reference data must have the same dimension (same Z value), have at least 1 point each not shared by the other, and the intersection of the interiors of the 2 has the same dimension (same Z value) as the data themselves.

Same data fields as [Intersects](#).

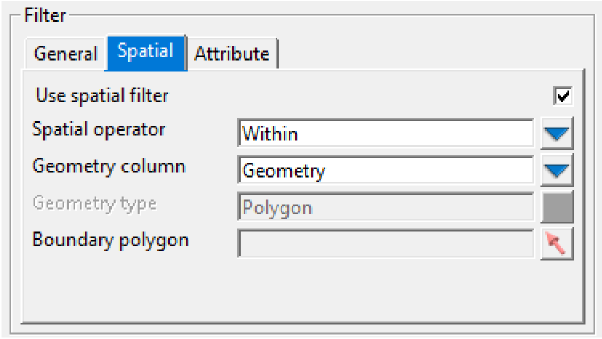
Equals

Functionality: Imported data and reference data must be topologically equal.

Same data fields as [Intersects](#).

Distance within

Functionality: Importing all data lies within the distance of a coordinate.



Geometry type choice box Point Disable

Can only be point type.

Point coordinate XYZ box

Coordinate of a point to be used as reference geometry for filtering.

Distance double box

The radius in metre from the point coordinate.

Beyond

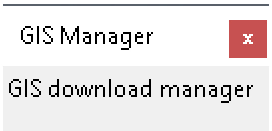
Functionality: importing any data that is outside of the distance from a chosen coordinate

Same data fields as Distance within.

Continue to 7.7.6 GIS Manager or return to 7.7 GIS.

7.7.6 GIS Manager

The **GIS Manager** walk-right menu is:



See
7.7.6.1 GIS Download Manager

Continue to 7.7.6.1 GIS Download Manager or return to 7.7 GIS.

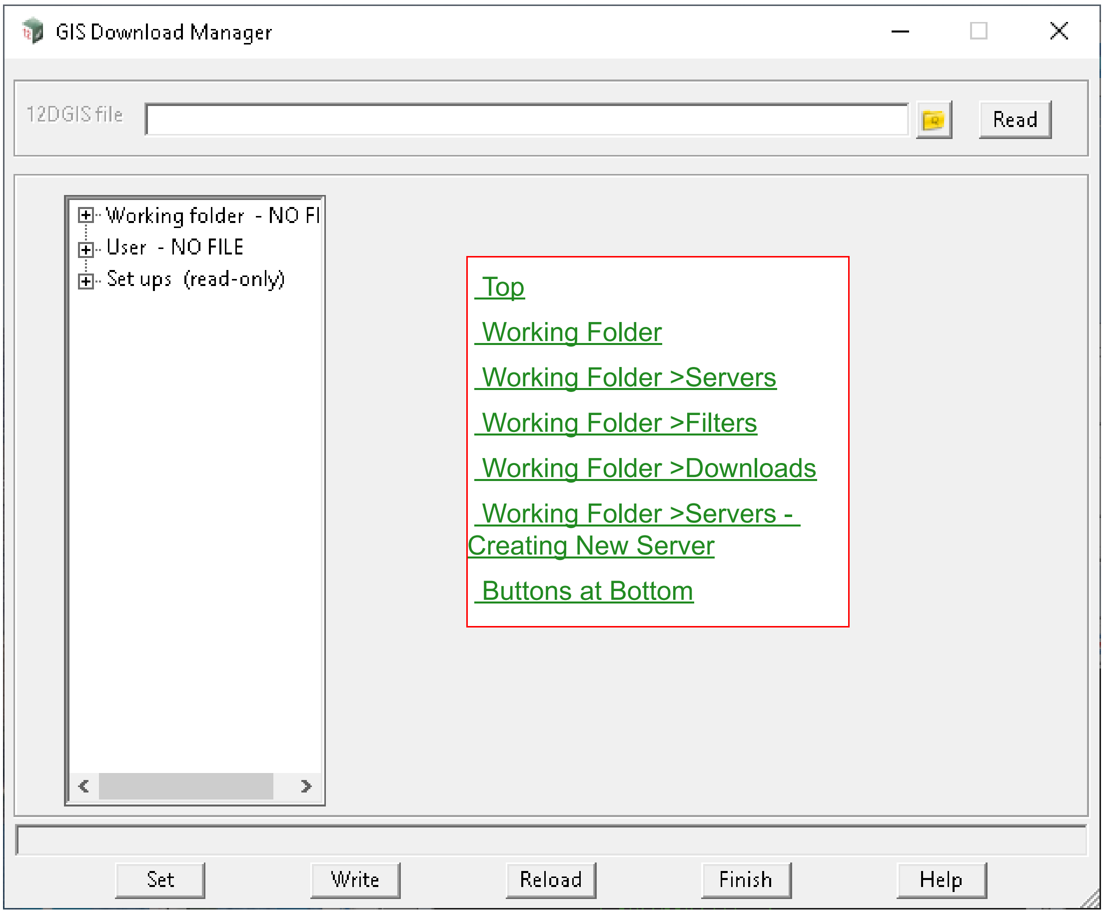
7.7.6.1 GIS Download Manager

Position of option on menu: **File =>GIS =>GIS Manager =>GIS download manager**

The **GIS Download Manager** allows users to set up the information (preset) under a user defined preset name on how to access various GIS servers.

The preset names can then used in the **Manager preset** field of the 7.7.1 Read WMTS Data, 7.7.2 Read WMS Data, 7.7.3 Read WFS Data, 7.7.4 Read REST Features Data and 7.7.5 Read LINZ WFS Data options.

Selecting **GIS download manager** brings up the **GIS Download Manager** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Top

12D GIS file	file box		*.12dgis files

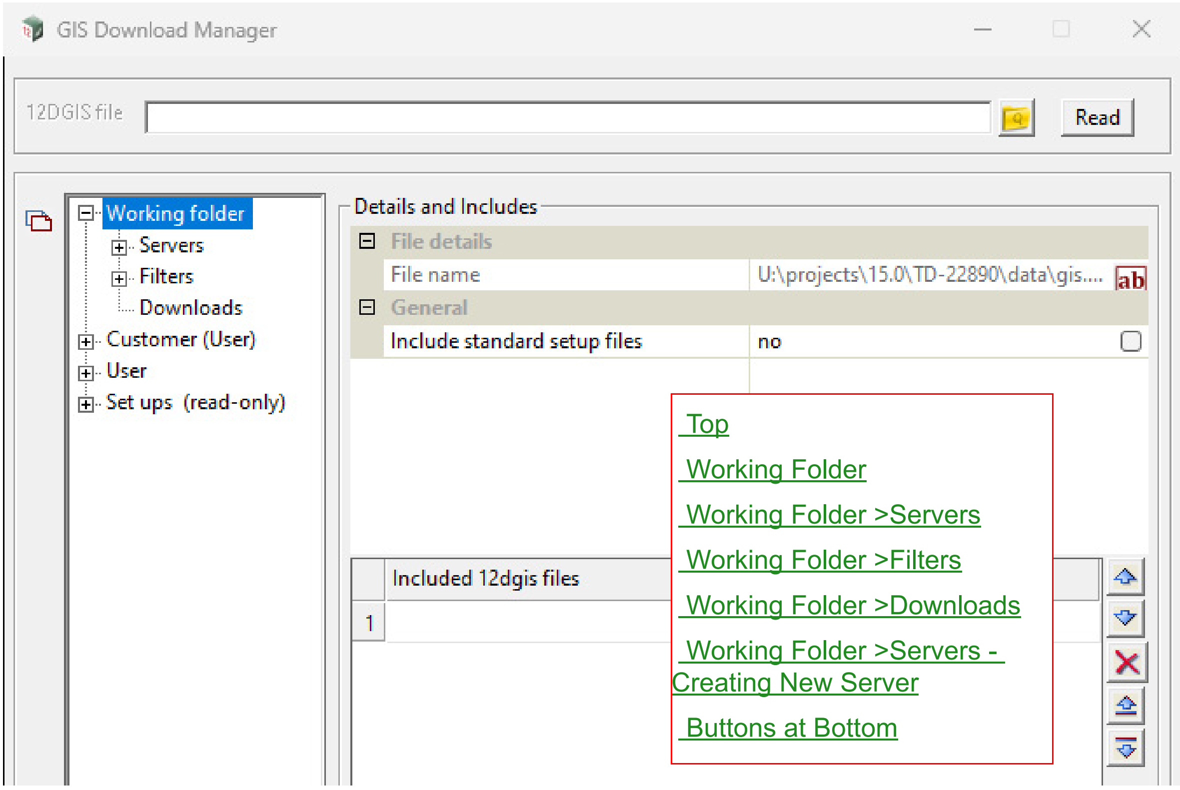
Import and edit a custom 12dgis file.

Read	button		

Read in the values from the **12D GIS File**.

Continue to Working Folder or return to 7.7.6 GIS Manager or 7.7 GIS.

Working Folder



[Top](#)
[Working Folder](#)
[Working Folder >Servers](#)
[Working Folder >Filters](#)
[Working Folder >Downloads](#)
[Working Folder >Servers - Creating New Server](#)
[Buttons at Bottom](#)

File name file box

Showing the path to the file location.

Include standard setup files tick box

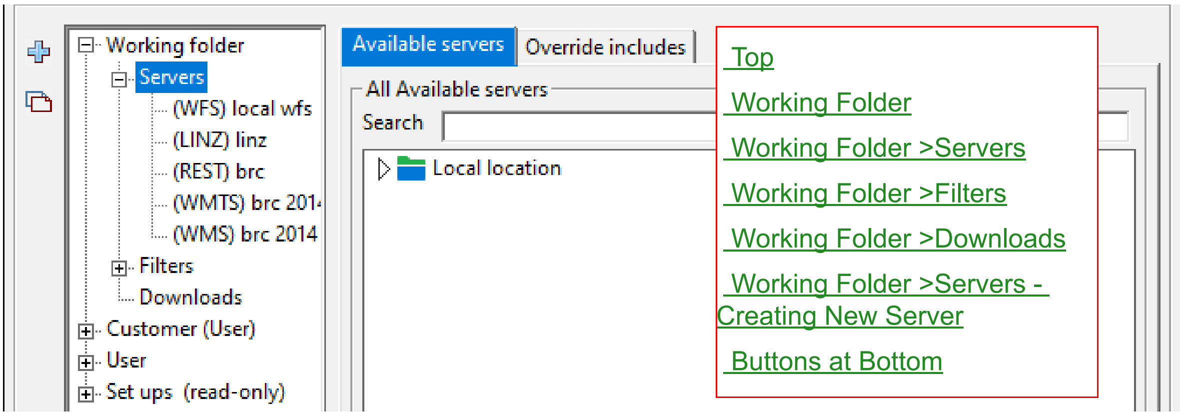
*If **ticked**, include servers and filters from Customer, User and Setup folder.*

Continue to Working Folder >Servers or return to 7.7.6 GIS Manager or 7.7.6 GIS Manager or 7.7 GIS.

Working Folder >Servers

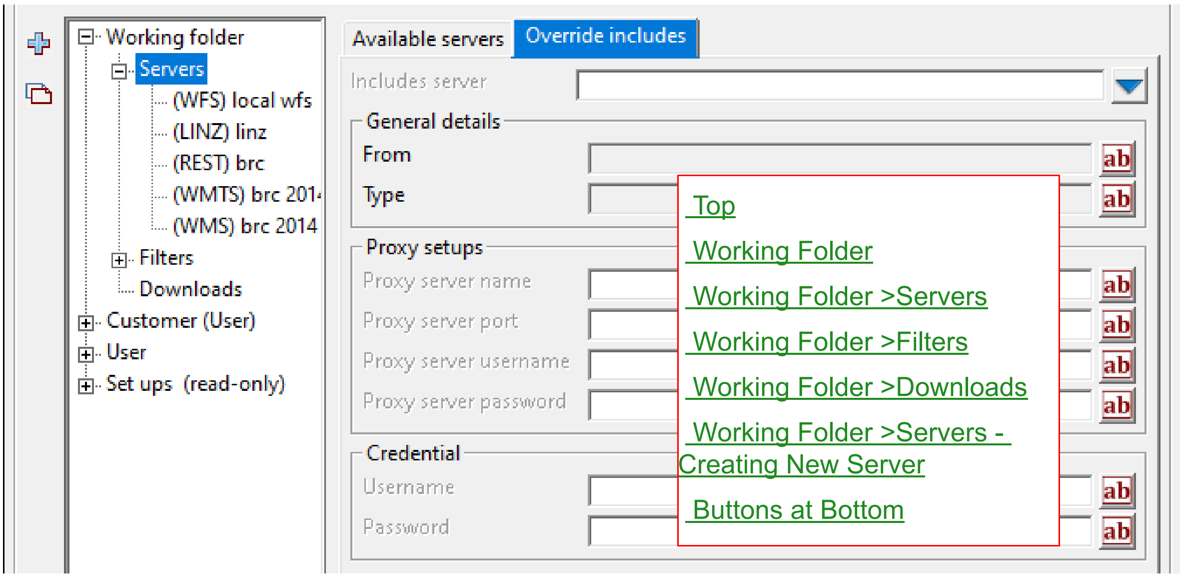
Available Servers tab

Showing all available servers, including servers from currently chosen root and servers from all included 12dgis files.



Override includes tab

Servers included from other 12dgis files could have their login credentials or Proxy server setup override with the current user’s setup details.



Includes server choice box

List of all servers from standard includes and custom includes.

General details

From output only

12dgis file where the server comes from list of all servers from standard includes and custom includes.

Type output only

GIS type of the server.

Proxy setups

Proxy server name text box

Name or URL of the proxy server.

Proxy server port text box

Port number of the proxy server.

Proxy server username text box

Username to use proxy server.

Proxy server password text box

Password for the Username for using the proxy server.

Credential

Username text box

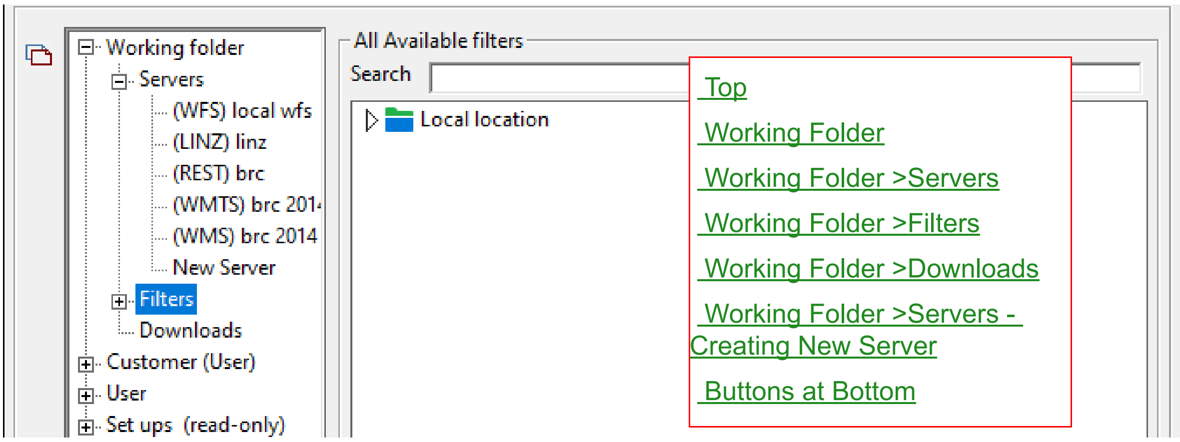
Username to access the GIS server.

Password text box

Password to access the GIS server.

Continue to Working Folder >Filters or return to 7.7.6 GIS Manager or 7.7.6 GIS Manager or 7.7 GIS.

Working Folder >Filters



Top
Working Folder
Working Folder >Servers
Working Folder >Filters
Working Folder >Downloads
Working Folder >Servers - Creating New Server
Buttons at Bottom

All Available filters

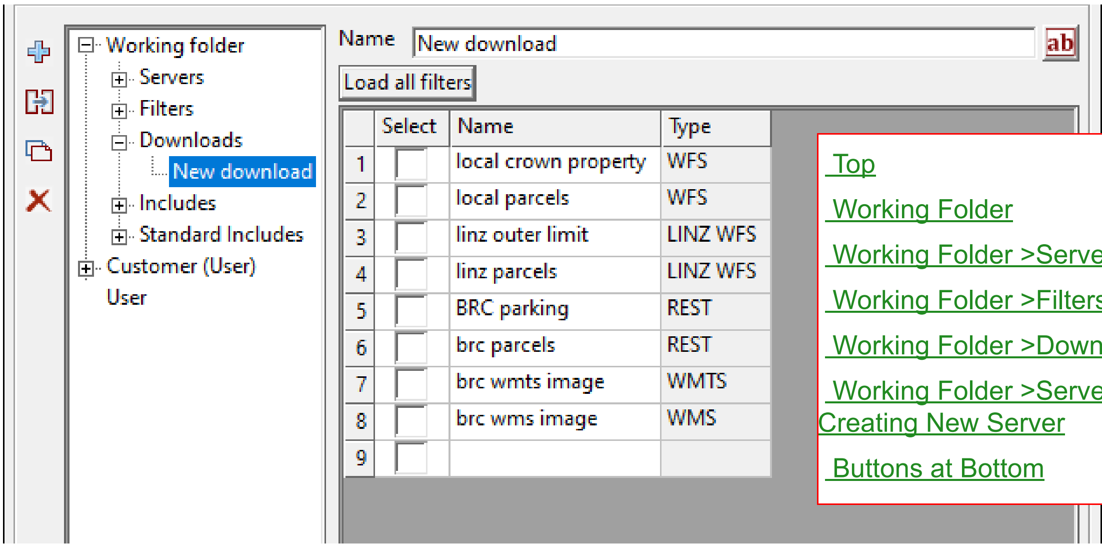
Showing all available filters, including filters from currently chosen root and filters from all included 12dgis files.

Continue to Working Folder >Downloads or return to 7.7.6 GIS Manager or 7.7.6 GIS Manager or 7.7 GIS.

Working Folder >Downloads

Downloads *option allow the user to setup a few presets to be used later with* ***GIS Download*** *Panel. This is optional and does not need to be setup.*

.



Top
Working Folder
Working Folder >Servers
Working Folder >Filters
Working Folder >Downloads
Working Folder >Servers - Creating New Server
Buttons at Bottom

Name text box

Name of the download preset.

Load all filters button

When pressed, all available filters are loaded into the table below

Select column tick box

If ***ticked****, the filter is chosen to be downloaded later.*

Name output only

Name of the filters. The choice box includes all of the root parent filters.

Type text box

GIS type of the filter.

Continue to Working Folder >Servers - Creating New Server or return to 7.7.6 GIS Manager or 7.7.6 GIS Manager or 7.7 GIS.

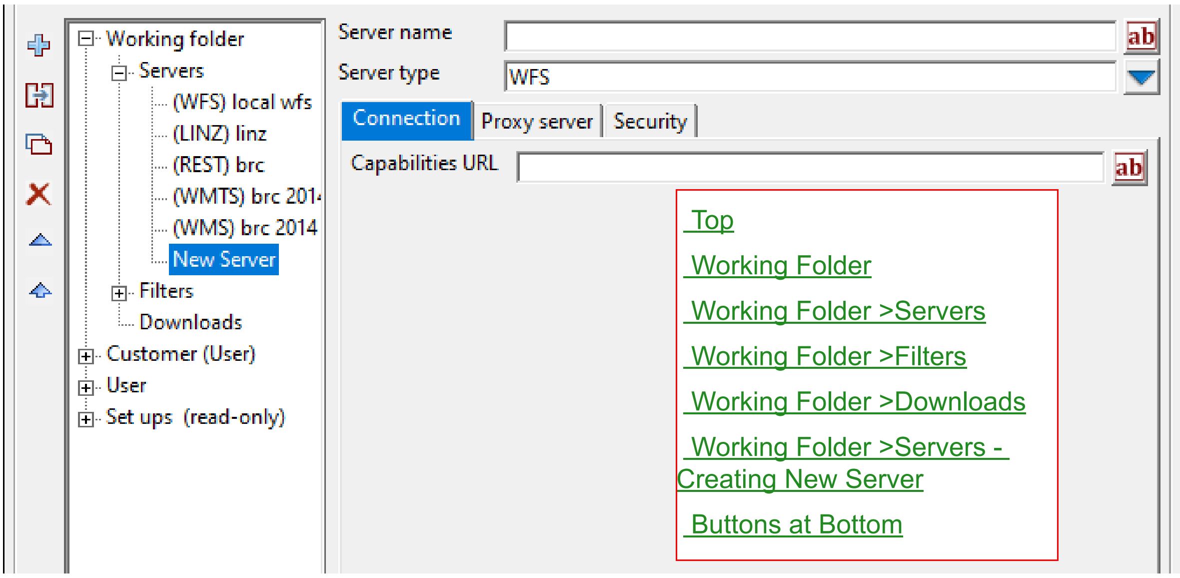
Working Folder >Servers - Creating New Server

Steps for creating a new GIS server.

Click on the ***Working folder Services*** *node and then the* + *button on the left.*

This will add a new ***subnode*** *to the* ***Server*** *node and the user defined preset name typed into the* **Server name** *field on the right.*

The relevant information in then entered in the New Server Connection tab*,* New Server Proxy server tab *and the* New Server Connection tab*.*



Top
Working Folder
Working Folder >Servers
Working Folder >Filters
Working Folder >Downloads
Working Folder >Servers - Creating New Server
Buttons at Bottom

New Server Connection tab

Server name	text box	

User-defined name for server.

Server type	choice box	WFS, TEST, WMS, WMSTS, LINZ WFS

GIS type for the server.

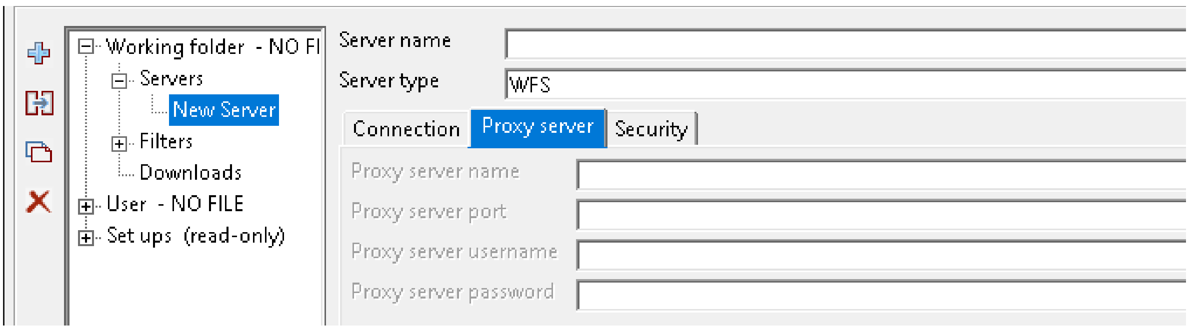
Capabilities URL	text box	

Capabilities URL for WFS, WMS, WMTS, or LINZ_WFS, or URL to REST server.

LINZ API	text box	

If LINZ WFS is chosen, the API needed to access LINZ.

New Server Proxy server tab



Proxy server name	text box	

Name or URL of the proxy server.

Proxy server port text box

Port number of the proxy server.

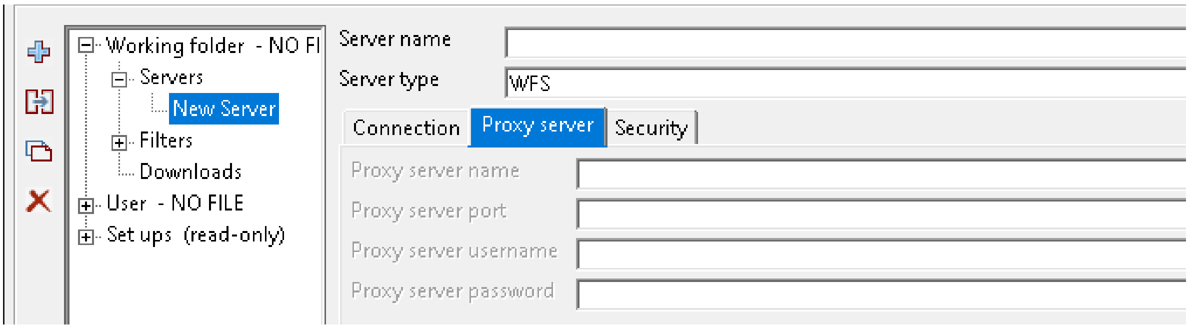
Proxy server username text box

Username to use proxy server.

Proxy server password text box

Password for the Username for using the proxy server.

New Server Security tab



Username text box

Username to access the GIS server.

Password text box

Password to access the GIS server.

Continue to Buttons at Bottom or return to 7.7.6 GIS Manager or 7.7.6 GIS Manager or 7.7 GIS.

Buttons at Bottom

Set button

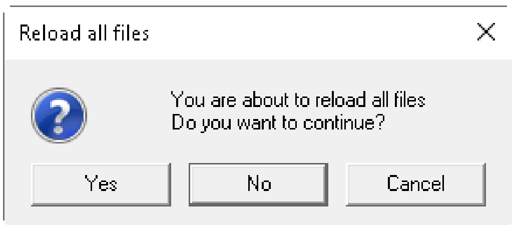
Set the changes.

Write button

Save changes to file.

Reload button

Brings up a **Reload all Files** ***Yes No Cancel*** *panel to check if all GIS files are to be reloaded.*



If ***Yes****, reread all system GIS files.*

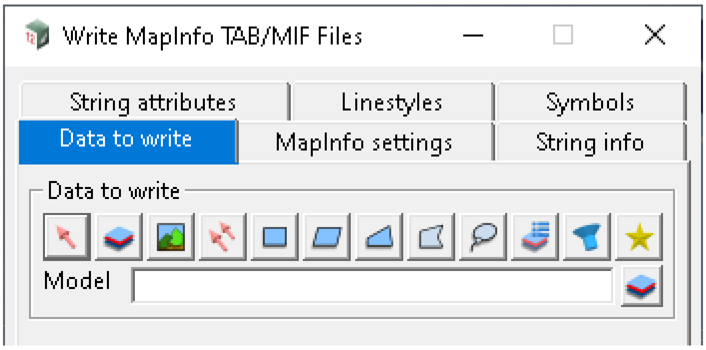
Continue to 7.8 MapInfo Write Tab/MIF Files or return to 7.7 GIS or 7 File.

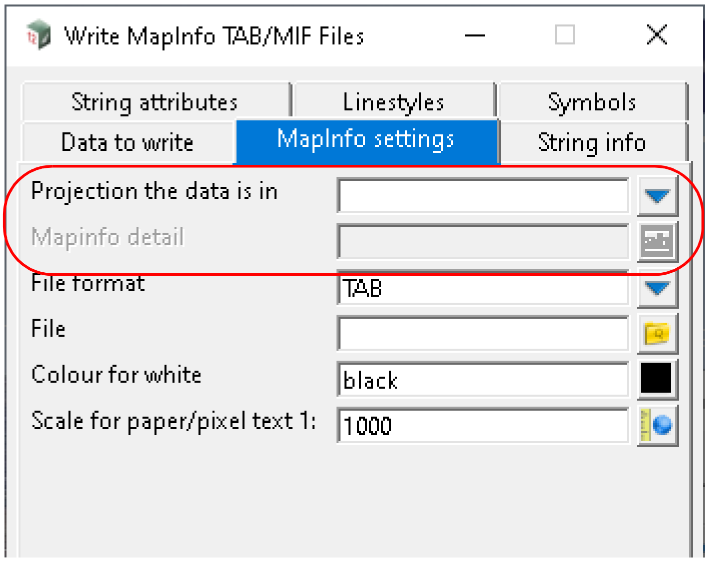
7.8 MapInfo Write Tab/MIF Files

This panel uses the new Projection file (carto.12dcaro) for the field **Projection the data is in** which replaces the old field **Coordinate system**.

When selecting a projection form this file, the Mapinfo required for that particular projection can also be in the file and if so, it is written to the **Mapinfo detail** field and the information in that field is written to the Map Info file.

Selecting **Mapinfo** brings up the **Write MapInfo Tab/Mif Files** panel.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Continue to 7.9 Map File Create/Edit or return to 7 File.

7.9 Map File Create/Edit

Position of option on menu: **File =>Map files =>Create/Edit**

There is a new ***Segment Properties*** node in the **Map File Create/Edit** panel which can be used to change the colour or linestyle of a super string segment or a water link by using:

(a) String name and/or string attribute name and/or ***vertex attribute*** from the ***vertex at the start of the segment***

(b) String name and/or string attribute name and/or ***segment attribute*** *of the segment*

For more information, go to 7.9.0.1 Segment/Link Properties.

7.9.0.1 Segment/Link Properties

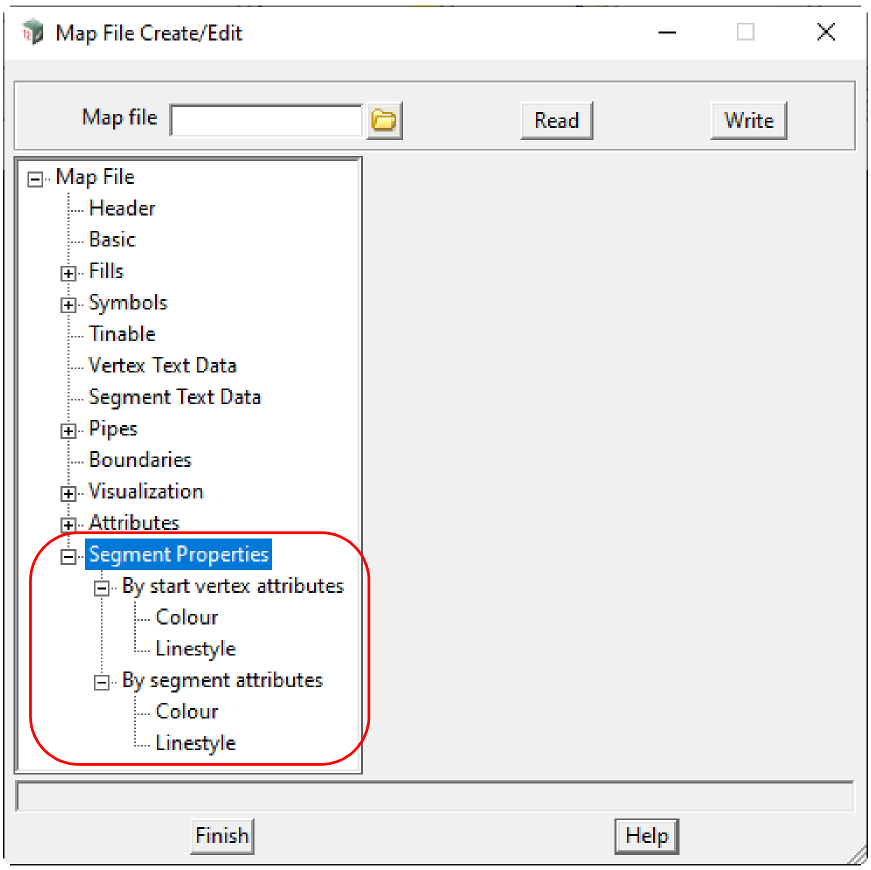
The ***Segment Properties*** node in the **Map File Create/Edit** panel is used to change the colour or linestyle of a super string segment by using:

(a) String name and/or string attribute name and/or ***vertex attribute*** from the ***vertex at the start of the segment***

See 7.9.0.2 By Start Vertex Attribute - Colour/Linestyle

(b) String name and/or string attribute name and/or ***segment attribute*** *of the segment*

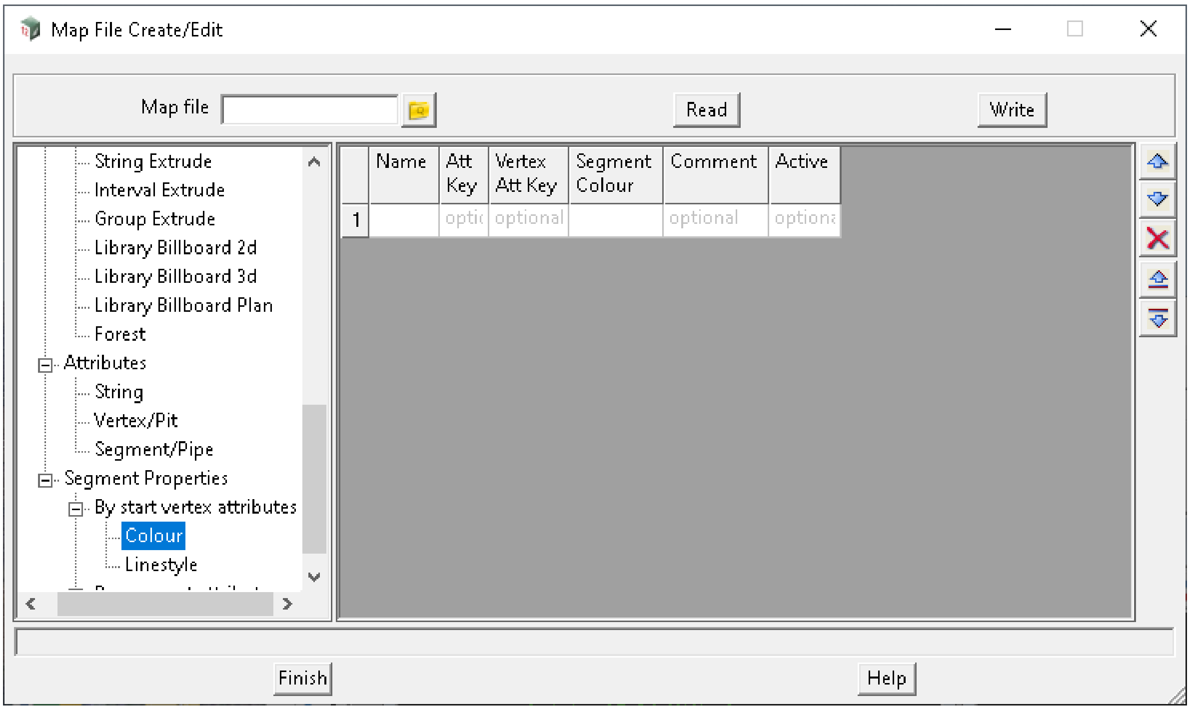
See 7.9.0.2 By Start Vertex Attribute - Colour/Linestyle

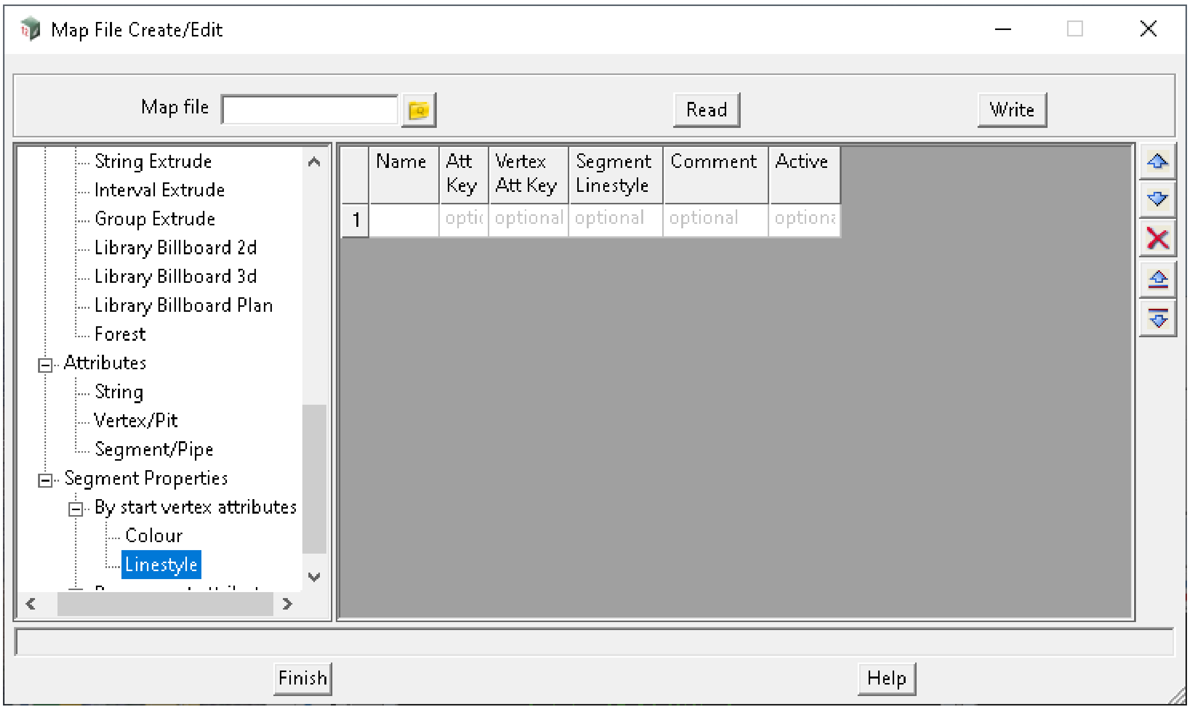


7.9.0.2 By Start Vertex Attribute - Colour/Linestyle

Colour sets the colour of a given segment of a super string or link of a water string, that matches a string name and/or a string attribute value and/or a vertex/node attribute value for the vertex/node at the start of the segment/link.

Linestyle sets the linestyle of a given segment of a super string that matches a string name and/or a string attribute value and/or a vertex attribute value for the vertex at the start of the segment. This has no effect on a water string link.





Processing Using Name, Att Key and Vertex Att Key

When a string finds a first match in the grid with **Name**, **Att Key** *and* **Vertex Att Key** *for the vertex attribute of the start of a segment (see* [Matching Using Name, Att Key and Vertex Att Key:](#)*), each matching segment/link of the string is given the colour/linestyle (not linestyle for water string) as defined in the* ***Segment Colour/Linestyle*** *parameter of the matching row in the grid.*

Name, Att Key and Vertex Att Key

Name *is a Text grid cell and the text entered into* **Name** *can include wild cards* ***** *and wild characters* ***?***.

The string name is matched against **Name**. *This field can not be blank.*

Att Key *is an Attribute Data grid cell which contains the definition of the attributes and their values that are to be matched against. There can be more than one attribute in the Attribute Data but they must have unique names.*

The ***string*** *attributes are matched against the attribute details in* **Att Key.**

Vertex Att Key *is an Attribute Data grid cell which contains the definition of the vertex attributes and their values that are to be matched against the vertex attributes at the* ***start of a string segment***. *There can be more than one vertex attribute in the Attribute Data but they must have unique names.*

The ***vertex*** *attributes at the start of the string segment are matched against the attribute details in* **Vertex Att Key**.

To access ***Att Key*** *or* **Vertex Att Key** *data, click LB on the* ***Att Key/*** **Vertex Att Key** *field to highlight the field, then click LB again to bring up the* **Attribute Data** *panel. To enter data, see* 3.9.3 Attribute Data Panel.

Matching Using Name, Att Key and Vertex Att Key:

Starting with the row line of the grid, matching and processing occurs as follows

If **Name, Att Key** *and* **Vertex Att Key** *are not blank, and a match of the string name occurs with* **Name**, *a match of the string attributes occurs with* **Att Key** *and a match of the vertex of the start of the segment occurs with* **Vertex Att Key**, *then the rest of the fields for this row of the Map File grid are used on this string segment.*

If **Name** *and* **Att Key** *are not blank, and* **Vertex Att Key** *is **blank**, and a match of the string name occurs with* **Name** *and a match of the string attributes occurs with* **Att Key***, then the rest of the fields for this row of the Map File grid are used on each string segment.*

If **Name** *and* **Vertex Att Key** *are not blank, and* **Att Key** *is blank, and a match of the string name occurs with* **Name** *and a match of a vertex attribute at the start of a string segment occurs with* **Vertex Att Key***, then the rest of the fields for this row of the Map File grid are used on this string segment.*

If **Name** *in not blank and* **Att Key** *and* **Vertex Att Key** *are blank, and a match of the string name occurs with* **Name***, then the rest of the fields for this row of the Map File grid are used on each string segment.*

If **Name** *in blank then no match occurs and this row of the Map File grid is ignored.*

*If a **match occurs**, then no further tests for matches against* **Name***,* **Att Key** *and* **Vertex Att Key** *are made. That is, no rows further down in the grid are used.*

*If **no match occurs**, then this row of the map file grid is ignored and a test for a match is made against the next row of the grid.*

Colour/Linestyle **select Colour/Linestyle**

The colour/linestyle of the super string segment is set to **Colour/Linestyle.**

*To access **Colours/Linestyles**, click LB on the **Colour/Linestyle** field to highlight the field, then click LB again to bring up the* **Select Colour/Choice** *panel.*

Comment and Active

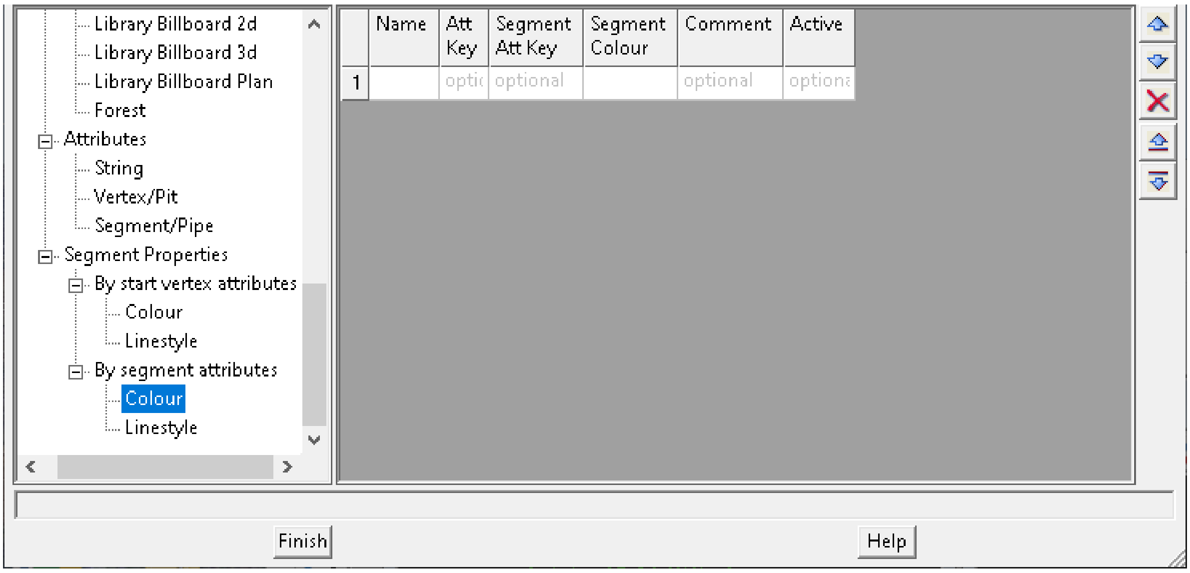
See .

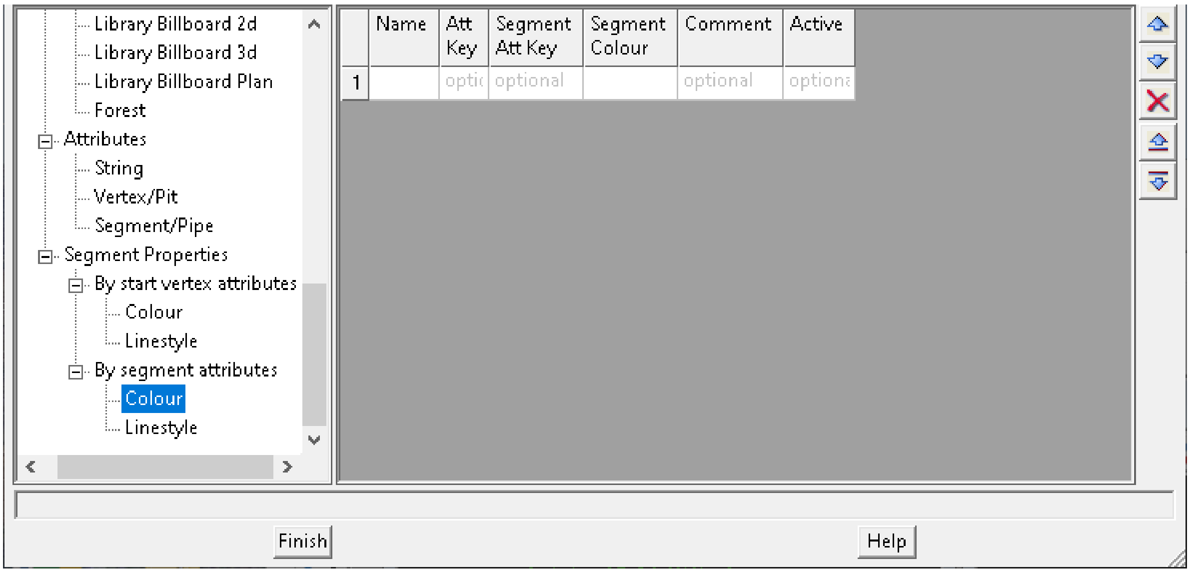
To assist is debugging a ***Map File***, match logging can be turned on.

Continue to 7.9.0.3 By Segment Attributes - Colour or Linestyle or return to 7.9.0.1 Segment/Link Properties or 7.9 Map File Create/Edit.

7.9.0.3 By Segment Attributes - Colour or Linestyle

Colour/Linestyle sets the colour/linestyle of a super string segment that matches a string name and/or a string attribute value and/or a segment attribute value for the string segment.





Processing Using Name, Att Key and Segment Att Key

When a string finds a first match in the grid with **Name**, **Att Key** *and* **Segment Att Key** *for the segment attribute of the super string (see* Matching Using Name, Att Key and Vertex Att Key:*), each matching segment of the string is given the colour/linestyle as defined in the* ***Segment Colour/Linestyle*** *parameter of the matching grid row.*

Name, Att Key and Segment Att Key

Name *is a Text grid cell and the text entered into* **Name** *can include wild cards* ***** *and wild characters* **?**.

The string name is matched against **Name**. *This field can not be blank.*

Att Key *is an Attribute Data grid cell which contains the definition of the attributes and their values that are to be matched against. There can be more than one attribute in the Attribute Data but they must have unique names.*

*The **string** attributes are matched against the attribute details in* **Att Key.**

Segment Att Key *is an Attribute Data grid cell which contains the definition of the segment attributes and their values that are to be matched against the segment attributes a super string segment. There can be more than one segment attribute in the Attribute Data but they must have unique names.*

*The **segment** attributes are matched against the attribute details in* **Segment Att Key**.

*To access **Att Key** or* **Segment Att Key** *data, click LB on the **Att Key/*** **Segment Att Key** *field to highlight the field, then click LB again to bring up the* **Attribute Data** *panel. To enter data, see* 3.9.3 Attribute Data Panel.

Matching Using Name, Att Key and Segment Att Key:

Starting with the first row of the grid, matching and processing occurs as follows

If **Name, Att Key** *and* **Segment Att Key** *are not blank, and a match of the string name occurs with* **Name**, *a match of the string attributes occurs with* **Att Key** *and a match of the segment attribute with* **Segment Att Key**, *then the rest of the fields for this row of the Map File grid are used on this string segment.*

If **Name** *and* **Att Key** *are not blank, and* **Segment Att Key** *is blank, and a match of the string name occurs with* **Name** *and a match of the string attributes occurs with* **Att Key**, *then the rest of the fields for this row of the Map File grid are used on each string segment.*

If **Name** *and* **Segment Att Key** *are not blank, and* **Att Key** *is blank, and a match of the string name occurs with* **Name** *and a match of a segment attribute occurs with* **Segment Att Key**, *then the rest of the fields for this row of the Map File grid are used on this string segment.*

If **Name** *in not blank and* **Att Key** *and* **Segment Att Key** *are blank, and a match of the string name occurs with* **Name**, *then the rest of the fields for this row of the Map File grid are used on each string segment.*

If **Name** *in blank then no match occurs and this row of the Map File grid is ignored.*

*If a **match occurs**, then no further tests for matches against* **Name**, **Att Key** *and* **Vertex Att Key** *are made. That is, no rows further down in the grid are used.*

*If **no match occurs**, then this row of the map file grid is ignored and a test for a match is made against the next row of the grid.*

Colour/Linestyle **select Colour/Linestyle**

The colour/linestyle of the super string segment is set to **Colour/Linestyle.**

*To access **Colours/Linestyles**, click LB on the **Colour/Linestyle** field to highlight the field, then click LB again to bring up the* **Select Colour*/Choice*** *panel.*

Comment and Active

See .

To assist is debugging a ***Map File***, match logging can be turned on.

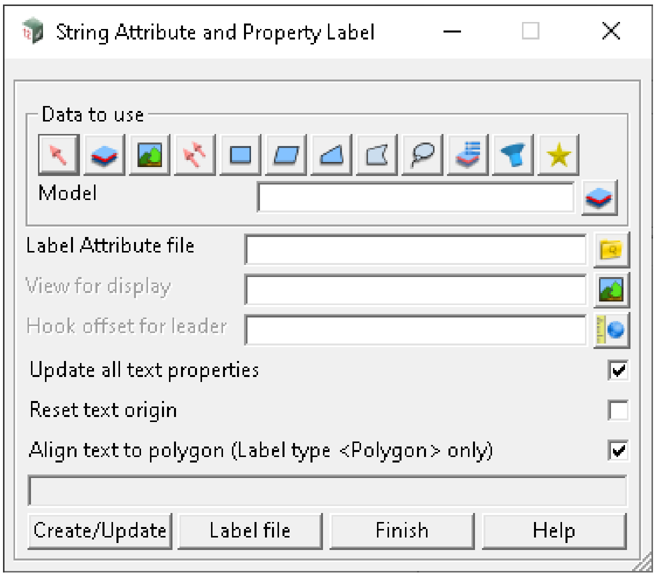
Continue to 7.10 Apply String Attribute and Property Label or return to 7 File.

7.10 Apply String Attribute and Property Label

Position of option on menu: **File =>Label Map files =>Apply string attribute/property label file**

This option runs the string and properties label map file to label string attributes and properties with leaders and dimensions.

Selecting **Apply string attribute/property label file** displays the **String Attribute and Property Label** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type DefaultsPop-Up

Data to use data source

Data selection type - for a full description go to 3.26.3 Data Source.

Label Attribute file file box *.12dlf

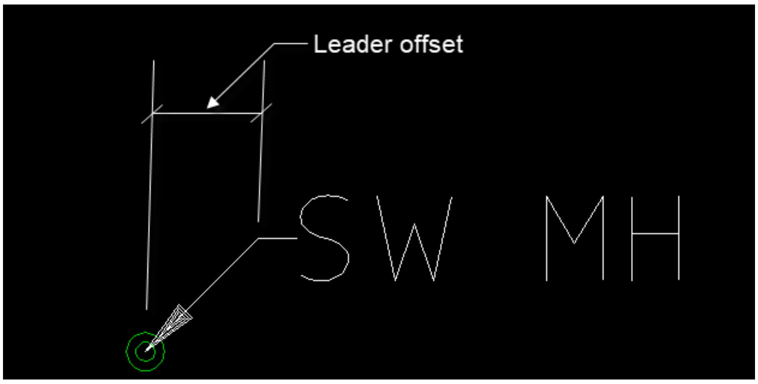
Label file to be applied.

View for display view box

View for displaying the result.

Hooks offset for leader tick box ticked

*If **not blank**, entry will be used as the hook offset when a leader is used.*



Update all text properties tick box ticked

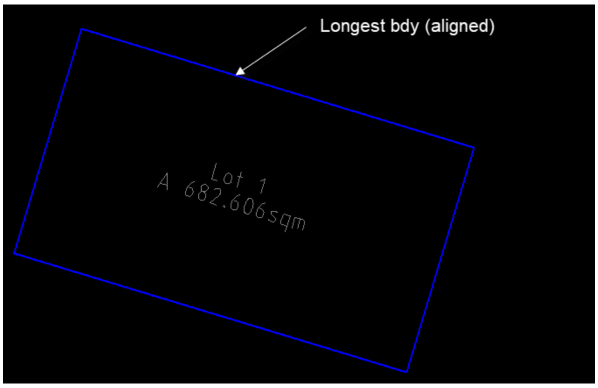
*If **ticked**, any changes to text parameters (Style, Height etc) that may have been set in the label file, will be applied to any existing text.*

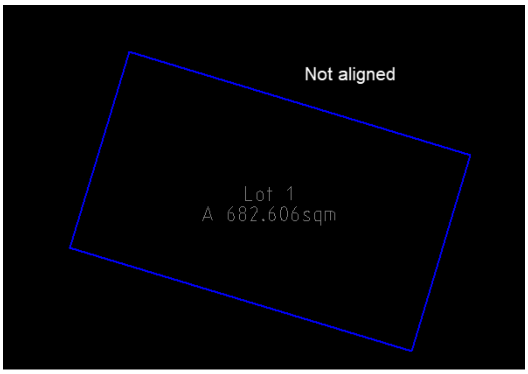
Reset text origin tick box not ticked

*If **ticked**, any text that had been moved using the cad text edits after creation, will be re-positioned back to the standard location.*

Align text to polygon (Label type <Polygon> only) tick box ticked

*If **ticked**, labels for Polygon will be aligned to the longest side of the polygon.*





Buttons at Bottom

Create/Update button

Create or update the result.

Continue to 7.11 12d Binary XML Files or return to 7 File.

7.11 12d Binary XML Files

Position of option on menu: **File =>Convert 12d Binary XML Files**

XML is a W3C standard. W3C does not define the concept of binary XML files. It has been thrown about for 15 years now.

12d Binary XML files are a proprietary format with the following goals.

1) Much faster load times

2) Smaller files

3) Cannot be altered

4) The potential for security attributes to prevent IP theft, limiting time frames of usage in Joint Ventures

5) A subset of 5 is preventing the conversion from binary to text.

At the current time, #4 and #5 has not been implemented.

First, good practise. Always keep safe copies of the text XML somewhere.

If anything goes wrong with binary files, they are usually lost for ever.

Warning: 12d Binary XML files cannot be used by external tools.

So XSLT processing is not possible.

For Information on converting **XML** to **12d Binary XML** see 7.11.1 Convert XML File to 12d Binary XML File.

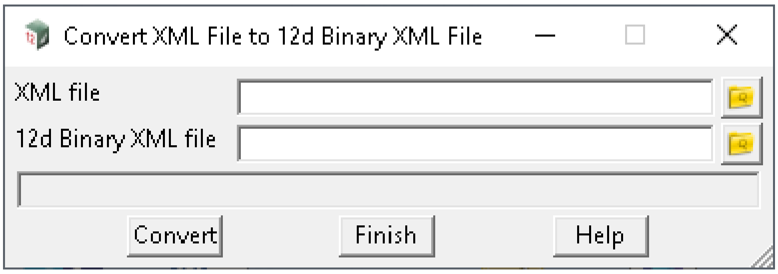
For information on converting 1**2d Binary XML** file to **XML** see 7.11.2 Convert 12d Binary XML File to XML File.

7.11.1 Convert XML File to 12d Binary XML File

Position of option on menu: **File =>Convert XML to 12d Binary XML**

The ***Convert XML to 12d Binary XML*** option converts **XML** file to a **12d Binary XML** file.

On selecting the **Convert XML to 12d Binary XML** option, the **Convert XML File to 12d Binary XML File** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
XML file	file box		*.xml files

The file to be converted into binary.

12d Binary XML file	file box		*.xml files

The resulting binary file.

Buttons at Bottom

Convert button

The resulting text file.

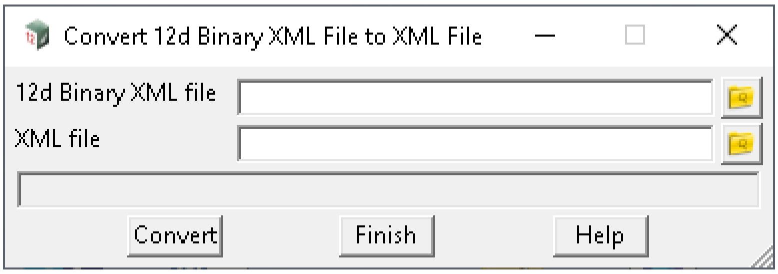
Continue to 7.11.2 Convert 12d Binary XML File to XML File or return to 7.11 12d Binary XML Files or 7 File.

7.11.2 Convert 12d Binary XML File to XML File

Position of option on menu: **File =>Convert 12d Binary XML to XML**

The ***Convert 12d Binary XML to XML*** option converts **12d Binary XML** file to a **XML** file.

On selecting the **Convert 12d Binary XML to XML** option, the **Convert 12d Binary XML File to XML File** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
12d Binary XML file	file box		*.xml files
The file to be converted into text.			
XML file	file box		*.xml files
The file to be converted into binary.			

Buttons at Bottom

Convert	button		
The resulting text file.			

Continue to 8 View or return to 7.11 12d Binary XML Files or 7 File.

8 View

There has been changes to the **View** chapter in the ***12d Model Reference manual***.

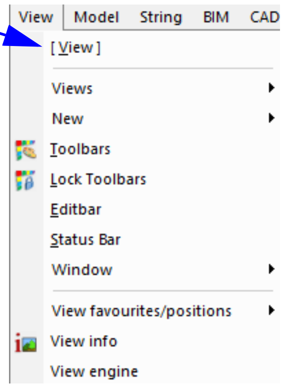
In **V14** the menu was called **Views** and this has been renamed to **View**.

The **View** menu is

floating View menu

Create floating **View** menu

on Main menu



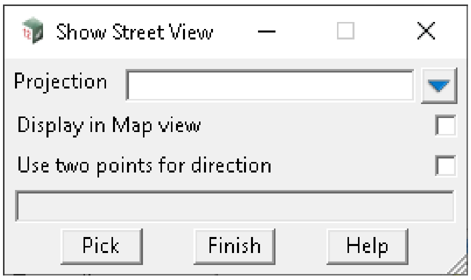
8.1 Street View display a Google Map Street View

8.1 Street View

Position of option on menu: **View =>Street view**

This option allows the user to select one or two points with map coordinates and will then display the Google Maps street View using the selected point or points.

Selecting the **Street view** displays the **Show Street View** panel.



The fields and buttons used in this panels have the following functions.

Field Description	Type	Defaults	Pop-Up
Projection	projection box	project projection	available projections

The Projection that the picked point, or points, is in.

This is necessary so that when a point is selected, its longitude and latitude can be calculated. If a Projection has been set for the project then that Projection is automatically entered into the field. See 6.10.6.2 Set Projection.

Use two points for direction tick box

*If **ticked** then when **Pick** is selected, two points are selected to determine the Street View.*

*If **not ticked** then when **Pick** is selected, one point is selected to determine the Street View.*

Pick button

*If **User two points for direction** is **ticked**, then a Street View from Google Earth is displayed looking in the direction from the first picked point to the second picked point.*

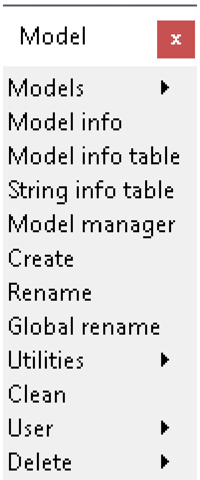
*If **User two points for direction** is **not ticked**, then a Street View from Google Earth is displayed for the picked point.*

Continue to 9 Model or return to 8 View.

9 Model

There has been changes to the **Model** chapter in the ***12d Model Reference manual***.

In **V14** the menu was called **Models** and this has been renamed to **Model**.



See 9.1 Strings in Model Information Table

See 9.2 Share Out Models

9.1 Strings in Model Information Table

Position of option on menu: **Model =>String info table**

The option **String #** has been added to the column between Name and Type.

String # column **sort** menu

This column displays any string number that is available for the object.

*If **blank**, either no string number is available or it is blank.*

*If **non blank**, it usually will be a positive integer number, or zero for a point string.*

***Note**: string numbers are allowed to be alpha numeric, so could be something like S7.*

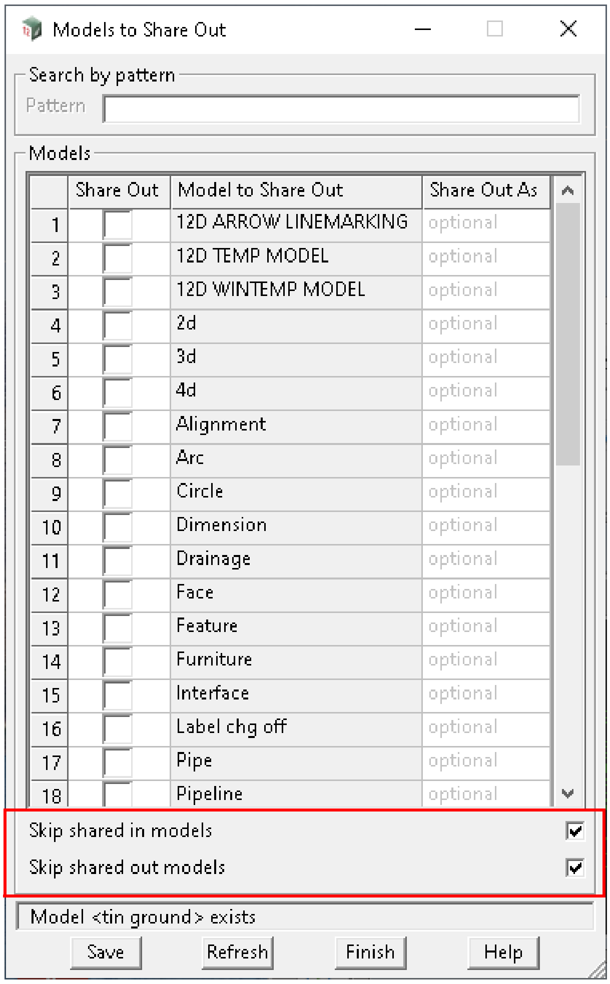
Continue to 9.2 Share Out Models or return to 9 Model.

9.2 Share Out Models

Position of option on menu: **Model =>Utilities =>Sharing =>Share out**

The options **Skip shared in models** and **Skip shared out models** have been added to both the **Models to Share Out** and **Tins to Share Out** panels.

Selecting **Share out** displays the **Models to Share Out** panel.



Skip shared in models tick box

*If **ticked**, any model shared into the current project is not displayed.*

*If **not ticked**, any model shared into the current project is displayed and will be shared out. This is known as a share of a share. This means that when you share in a model that is a "share of a share", 12d must follow the chain of projects to the final "source" project. So note that it is possible to have a share chain that can be many projects long.*

Skip shared out models tick box

*If **ticked**, any model already shared out is not displayed. This allows for use of the Pattern field to be used without altering any existing shared out model.*

*If **not ticked**, all models are displayed, and any models already shared out will have the "Share Out" tick on.*

Notes

Both ***Skip shared in models and Skip shared out models*** *act together so that it is possible to skip all shared in models and skip all shared out models.*

Any Search pattern alters the "Share Out" tick for all displayed models. As such one should be careful not to remove the shared out status for models that still require sharing.

*Thus, ticking on "****Skip shared out models"*** *prevents removing any share outs.*

Continue to 10 String or return to 9 Model.

10 String

There has been changes to the **String** chapter in the ***12d Model Reference manual***.

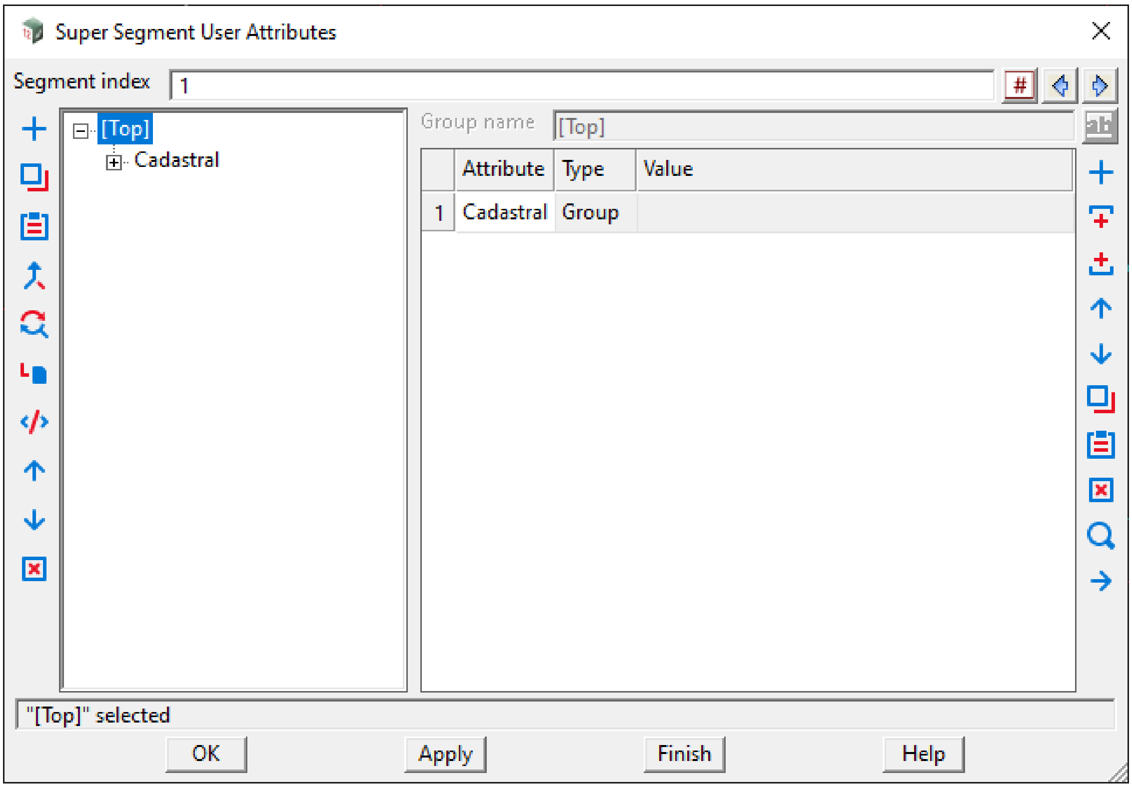
In **V14** the menu was called **Strings** has been renamed to **String**.

Position of menu: **String**

10.1 Segment Attributes

Selecting **Attributes** brings up the **Super Segment User Attributes** panel which is used to display and edit user defined attributes at segments of the super string.

As soon as **Attributes** is chosen, the attributes for the first segment are shown.



A particular segment can be selected by first clicking on the icon at the end of the **Segment index** field, and then selecting the required segment, or by typing a number into the **Segment index** field and pressing <Enter>.

Similarly the **Prev** and **Next** buttons can be used to move to adjacent segments.

When a segment is selected, its *attribute* information is written to the appropriate panel fields.

If any panel fields are modified, selecting either **OK** or **Apply** will store the new information for the segment.

General information on attributes is given in 3.9 Attributes (Meta Data) and the description of how to add attributes and groups of attributes in an **Attributes** panel is given in the section 3.9.3 Attribute Data Panel. In these descriptions, the **Set** button replaces the **OK** and **Apply** button used in this panel.

The fields and buttons used in this panel that are different to the **Attributes Data** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Segment index	number box	selected vertex	

If a segment is selected, then its segment index is displayed in this field.

Prev button

Move to the previous segment (predecessor). The information for the new segment is displayed in the panel fields.

Next button

Move to the next segment (successor). The information for the new segment is displayed in the panel fields.

Attribute mode choice box no attributes, each segment

*If **no attributes**, then no segments have user attributes.*
*If **each segment**, then each segment can have user attributes.*

Buttons at Bottom

Pick button

Pick the segment to display/edit the attributes for.

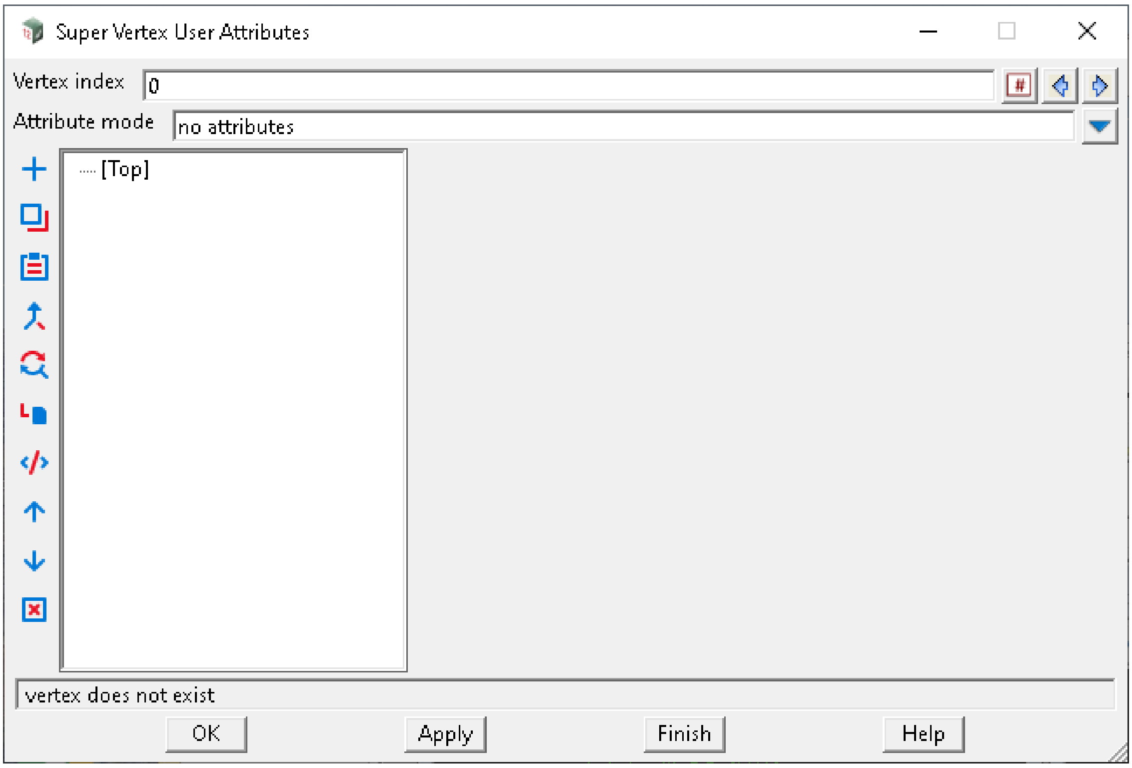
OK/Apply button

For the segment being edited, **OK** *sets the segment with the values in the panel fields and removes the panel.* **Apply** *sets the segment with the values in the panel fields and leaves the panel on the screen.*

Continue to 10.2 Vertex Attributes or return to 10 String.

10.2 Vertex Attributes

Selecting **Attributes** brings up the **Super Vertex User Attributes** panel which is used to display and edit user defined attributes at vertices of the super string.
As soon as Attribute is chosen, the attribute information for the first vertex is shown.



A particular vertex can be selected by first clicking on the icon at the end of the Vertex index field, and then selecting the required vertex, or by typing a number into the Vertex index field and pressing <Enter>.

Similarly the **Prev** and **Next** buttons can be used to move to adjacent vertices.

When a vertex is selected, its attribute information is written to the appropriate panel fields.

If any panel fields are modified, selecting either **OK** or **Apply** will store the new information for the vertex.

General information on attributes is given in 3.9 Attributes (Meta Data) and the description of how to add attributes and groups of attributes in an Attributes panel is given in the section 3.9.3 Attribute Data Panel. In these descriptions, the **Set** button replaces the **OK** and **Apply** button used in this panel.

The fields and buttons used in this panel that are different to the **Attributes Data** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Vertex index	input box	selected vertex	

If a vertex is selected, then its vertex number is displayed in this field.

Prev	button	

Move to the previous vertex (predecessor). The information for the previous vertex is displayed in the panel fields.

Next	button	

Move to the next vertex (successor). The information for the next vertex is displayed in the panel fields.

Attribute mode	choice box	no attributes, each vertex

*If **no attributes**, then no vertices have user attributes.*
*If **each vertex**, then each vertex can have user attributes.*

Buttons at Bottom

Pick	button	

Pick the vertex to display/edit the attributes for.

OK/Apply	button	

For the vertex being edited, **OK** *sets the vertex with the values in the panel fields and removes the panel.*
Apply *sets the vertex with the values in the panel fields and leaves the panel on the screen.*

Continue to 10.3 Create/Edit Service Conduit or return to 10 String.

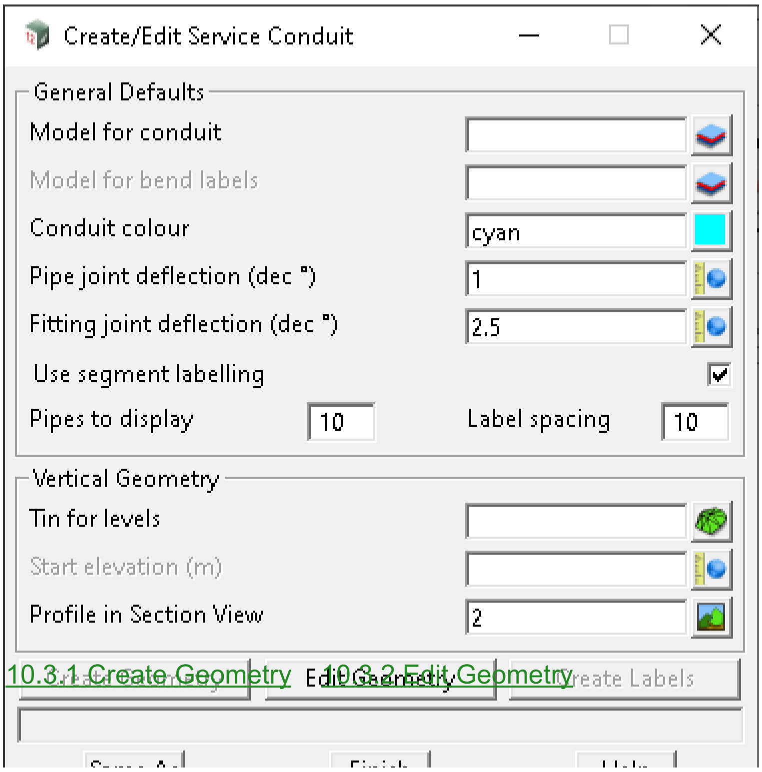
10.3 Create/Edit Service Conduit

Position of menu: **String =>Create =>Conduit-service**

Create/edit service conduit is used to generate a string which defines the horizontal and vertical geometry for service conduits. Standard bend angles are able to be turned on/off for the string creation and a default pipe length is used to assist with bend positioning.

The **main panel** has basic defaults for creation of the service conduit. It allows for parameters such as the angle labels for geometry option strings to be used and the spacing of the labels to be controlled. The number of standard pipe lengths created for the geometry option strings is also controlled by the defaults. Note that larger numbers of pipe lengths will result in slower update of geometry options. The defaults can be dynamically updated during string creation.

On selecting the **Conduit-service** option, the **Create/Edit Service Conduit** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
General defaults			
Model for conduit	model box		
The model that the string will be added to.			
Model for bend labels	model box		available colours
[Optional] The model that bend labels will be added to.			
Conduit colour	colour box	cyan	available colours
The colour the new string will have.			

Pipe joint deflection (dec*) real box 1.0

The maximum deflection allowable for pipe joints.

Fitting joint deflection (dec*) real box 1.0

The maximum deflection allowable through fitting (i.e. bend) sockets.

Use segment labelling tick box ticked

Is segment labelling required for geometry options strings.

Pipe lengths to display Integer box 10

Number of standard pipe lengths to use for geometry options strings.

Segment label spacing Integer box 10

For geometry options string labels, what segment spacing is required.

Vertical Geometry

Tin for levels tin box

The tin to be used for vertical geometry calculations.

Profile in Section View tin box

The view to display a profile of the conduit as it's created.

Create Geometry button

Opens the Create Geometry panel. See 10.3.1 Create Geometry.

***Note**: Not active until a Model and Tin have been selected.*

Edit Geometry button

Opens the Edit Geometry panel. See 10.3.2 Edit Geometry.

Create Labels button

Opens the Edit Geometry panel. See 10.3.2 Edit Geometry.

***Note**: Not active until geometry has been created.*

Buttons at Bottom

Same As button

Sets the defaults widgets to match the selected service conduit properties (if applicable).

Finish button

Close the panel.

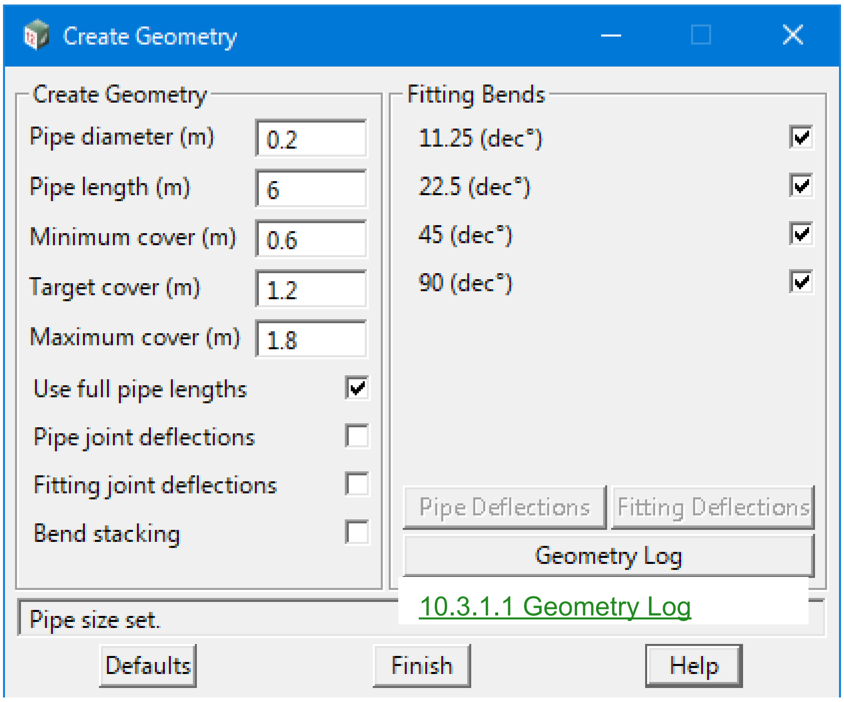
Help button

Opens the reference manual.

Continue to 10.3.1 Create Geometry

10.3.1 Create Geometry

The **Create Geometry** panel contains widgets related to creation of the service conduit. Widgets on this page may be dynamically adjusted during string creation. Typical bend sizes can be selected, along with the default conduit diameter and conduit length. Cover settings for the vertical grading are also assigned on this panel.



10.3.1.1 Geometry Log

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Create Geometry			
Pipe Diameter (m)	real box	0.2	
Pipe length (m)	real box	6	

Field Description Type Defaults Pop-Up

Create Geometry

Pipe Diameter (m) real box 0.2

The diameter of the conduit.

Pipe length (m) real box 6

The standard length of one pipe.

Minimum cover (m) real box 0.6

The minimum allowable cover for the conduit. This will form the upper limit of the vertical corridor.

Target cover (m) real box 1.2

The target for grading. It is recommended that this value be kept as close as practicable to the centre of the vertical corridor.

Maximum cover (m) real box 1.8

The maximum allowable cover for the conduit. This forms the lower limit of the vertical corridor.

Use full pipe lengths tick box ticked

Determines whether full pipe lengths or partial pipe lengths may be used for the geometry

Pipe joint deflections tick box not ticked

Determines whether pipe joint deflections should be used for the geometry. If selected then standard bends, stacking and fitting joint deflections are disabled.

Fitting joint deflections tick box not ticked

Determines whether pipe fitting socket deflections should be allowed. Geometry strings will reflect the limits of the socket deflections.

Bend Stacking tick box not ticked

Determines whether bends may be stacked. Geometry strings will reflect angles available with bends stacked. May be used in conjunction with fitting joint deflections.

Fitting Bends

11.25 (dec) tick box ticked

Determines whether 11.25 decimal degree bends will be included in the geometry.

22.5 (dec) tick box ticked

Determines whether 22.5 decimal degree bends will be included in the geometry.

45 (dec) tick box ticked

Determines whether 45 decimal degree bends will be included in the geometry.

90 (dec) tick box ticked

Determines whether 90 decimal degree bends will be included in the geometry.

Pipe Deflections button

Allows the vertical and horizontal components of the pipe socket deflections to be specifically set. Only available when Pipe joint deflections are selected.

Fitting Deflections button

Allows the vertical and horizontal components of the fitting socket deflections to be set. Only available when Fitting joint deflections are selected.

Geometry Log button

Opens the Geometry Log panel. See 10.3.1.1 Geometry Log.

Buttons at Bottom

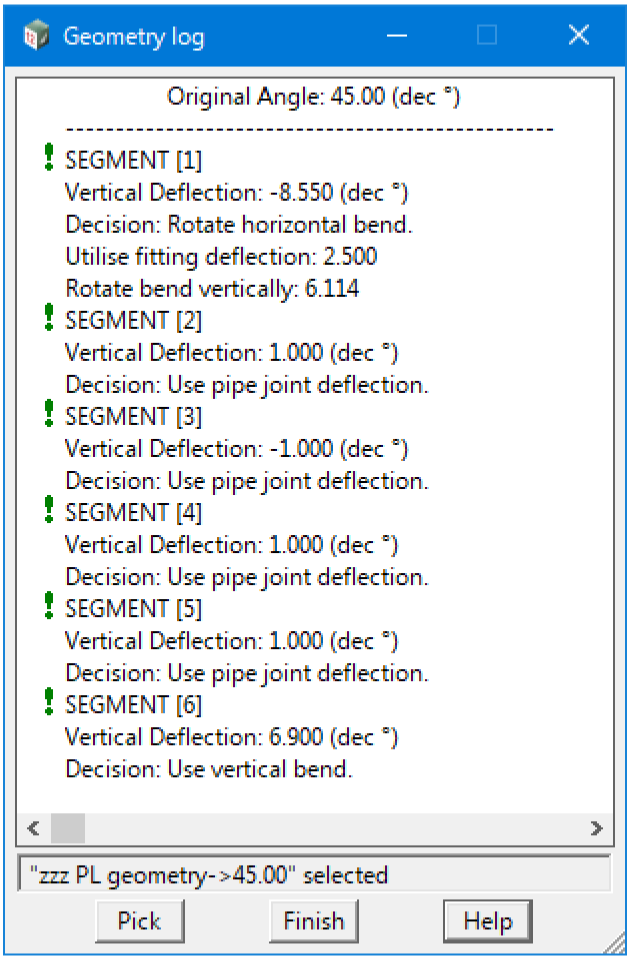
Defaults button

Returns to the General Defaults (main) panel.

Continue to 10.3.1.1 Geometry Log.

10.3.1.1 Geometry Log

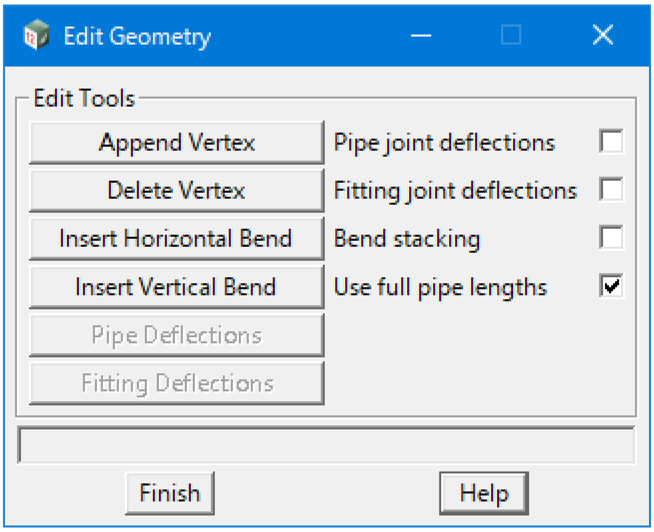
The **Geometry Log** panel allows the constraints and decision behind each segment of the geometry options strings to be reviewed prior to selecting the next fitting location. The original angle of the geometry option string is displayed at the top. Each segment of the geometry option string is then recorded with its vertical deflection and geometric decisions associated with the end result. Selecting the Segment number in the list (with a green exclamation point beside it) will highlight the segment in the plan and section views. The user may select the various geometry option strings to review the geometry and decisions for each.



Continue to 10.3.2 Edit Geometry or go back to 10.3.1 Create Geometry.

10.3.2 Edit Geometry

The **Edit Geometry** page contains widgets related to editing existing service conduit geometry. This includes insertion of horizontal and vertical bends within the current geometry along with appending vertices to the end of the current geometry and deleting vertices.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Edit Tools

Append Vertex	button		

Allows the user to append a vertex to the end of the current geometry.

Delete Vertex	button		

Allows the user to delete a vertex from the current geometry.

Insert Horizontal Bend	button		

Allows the user to insert a horizontal bend within the current geometry.

Insert Vertical Bend	button		

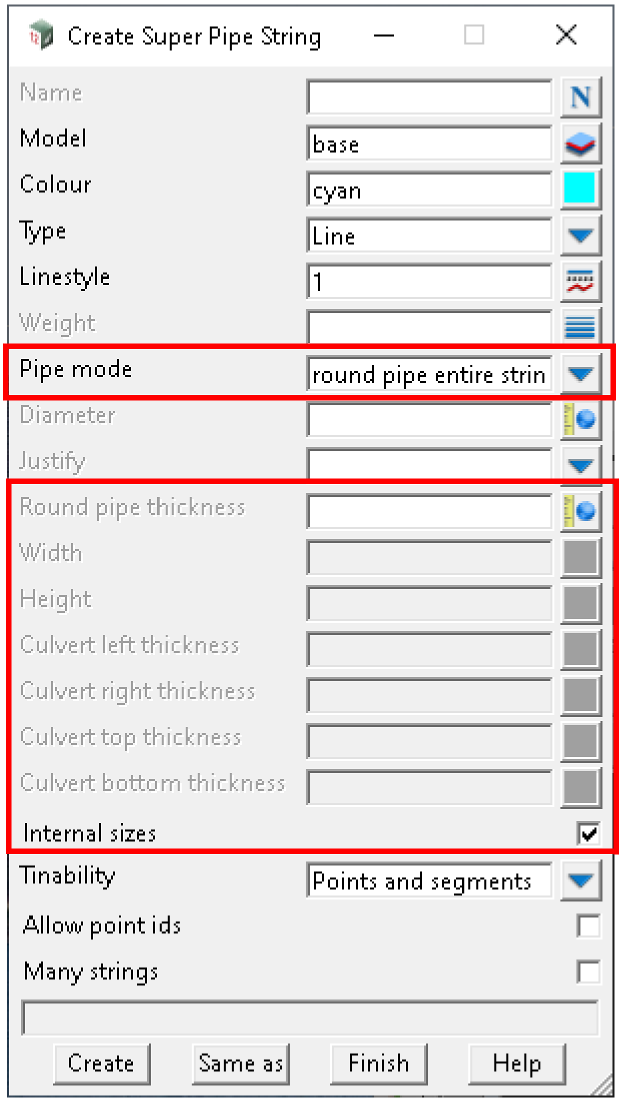
Allows the user to insert a vertical bend within the current geometry.

The remaining widgets on the Edit Geometry panel operate in the same manner as described for the Create Geometry panel above. See 10.3.1 Create Geometry.

Continue to 10.4 Create - Pipe Super or return to 10 String.

10.4 Create - Pipe Super

Position of option on menu: **String =>Create =>Pipe**



The fields and buttons used in the **Create Super Pipe String** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pipe mode	choice box	Round Pipe entire string	round pipe entire string, pipe each segment, culvert entire string, culvert each segment

*If **round pipe entire string**, there is one diameter for all segments in the string.*
*If **round pipe each segment**, here is a different diameter for each segments of the string.*
*If **culvert entire string**, there is one width and a height for all segments in the string.*
*If **culvert each segment**, there is a different width and height for each segment of the string.*
*If the **Pipe mode** choice is **round pipe entire string** then the fields **Diameter** and **Round pipe thickness** are enabled.*

Round pipe thickness real box

The thickness of the pipe for every segment of the string. This is added or subtracted from the ***Diameter*** *depending on the tick box* ***Internal sizes****.*

Width/Height real box

Width/height to use for every segment of the culvert pipe.

Culvert left/right/top/bottom/thickness real box

The thickness of the left/right/top/bottom of the culvert. The values are added or subtracted from the ***Width/Height*** *depending on the tick box Internal sizes.*

Internal sizes tick box not ticked

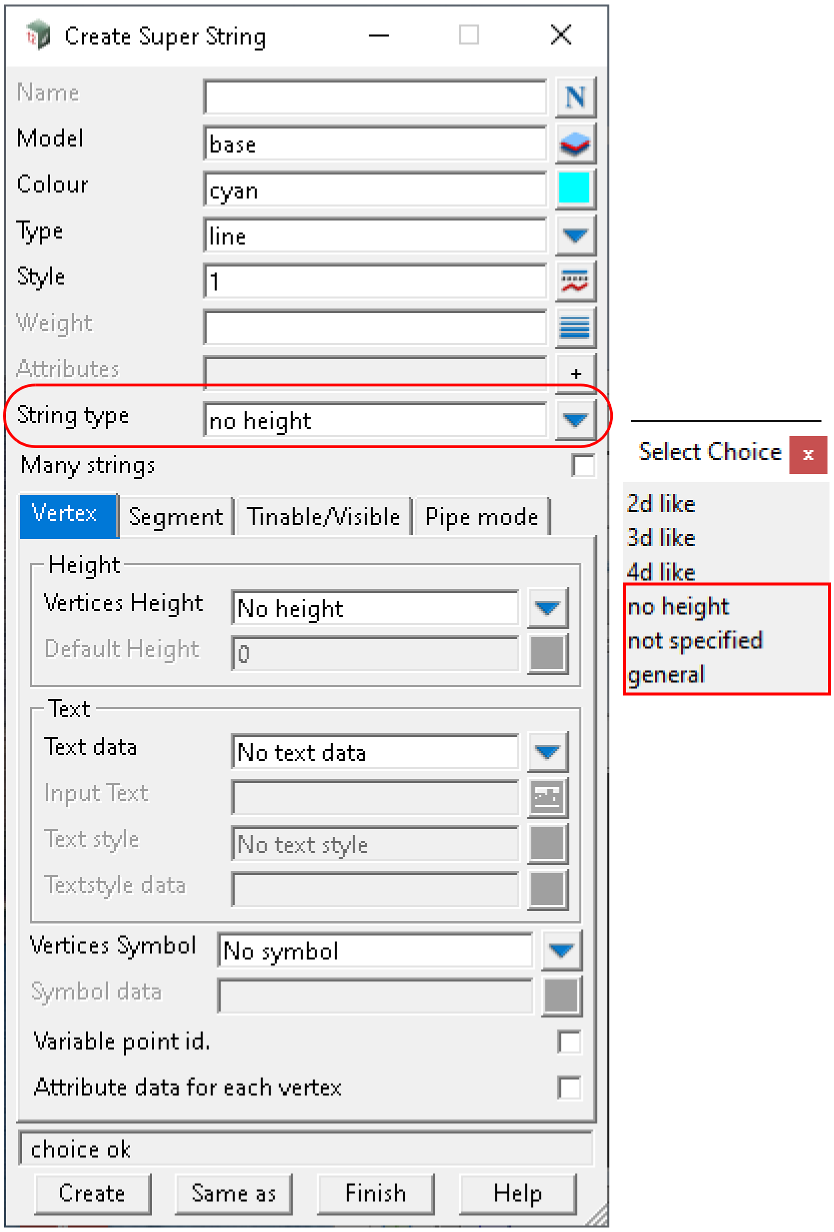
If ***ticked****, the thickness are* ***added*** *to Diameter/Width/Height to give the external Diameter/Width/ Height. Hence the values of Diameter/Width/Height are the* ***internal*** *values.*
If ***not ticked****, the thickness are* ***subtracted*** *from Diameter/Width/Height to give the internal Diameter/ Width/Height. Hence the values of Diameter/Width/Height are the* ***external*** *values.*

Continue to 10.5 Create - Super or return to 10 String.

10.5 Create - Super

Position of option on menu: String =>Create =>Super

On selecting the **Super string** option, the **Create Super String** panel is displayed.



clicked.

The new fields and buttons used in the **Create Super String** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
String type	choice box	no height	2d like, 3d like, 4d like, no height, not specified,

general

*If **2d like**,* **Variable Height** *is set to "Varied" and* **Default Height** *to "0",*
Text data *is set to "No text data" and* **Vertices Symbol** *is set to "No symbol",*
Pipe mode *is set to "no round pipe or culvert".*
*So a **2d like** super string simulates a Genio 2D string. For example, a contour string.*

*If **3d like**,* **Variable Height** *is set to "Varied",*
Text data *is set to "No text data" and* **Vertices Symbol** *is set to "No symbol",*
Pipe mode *is set to "no round pipe or culvert".*
*So a **3d like** super string simulates a Genio 3D string.*

*If **4d like**,* **Variable Height** *is set to "Varied",*
Text data *is set to "Constant for all",* **Text style** *set to "Varied"*
Vertices Symbol *is set to "No symbol",*
Pipe mode *is set to "no round pipe or culvert".*
*So a **4d like** super string simulates a Genio 4D string which can have text at each vertex.*

*If **no height**, vertices height is set to "no height",*
text data is set to "no text data", Vertices Symbol is set to "No symbol"
Pipe Mode is set to "no round pipe or culvert"
There is no definite String type

*If **not specified**, the setup is the same with no height except Vertices Height is set to "Varied"*
There is no definite String type either

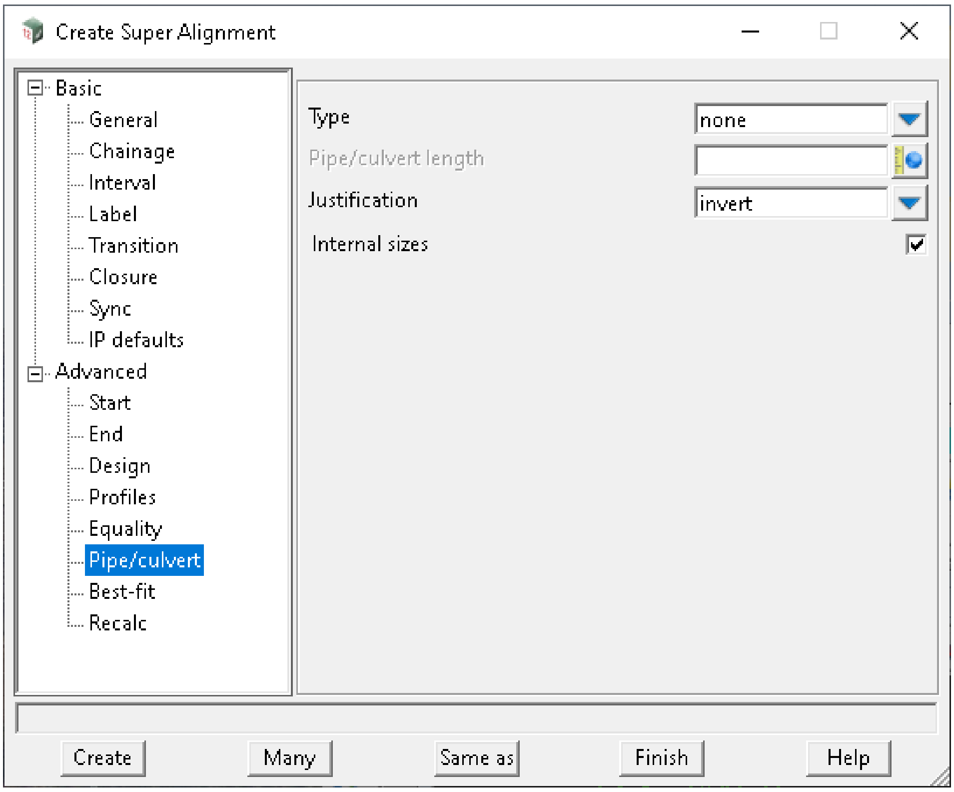
*If **general**, most of the fields are set to "varied"*
`Variable point id` and `Attribute data for each vertex` are ticked
`Radius/Major` and `Attribute data for each segment` are ticked
`Visibility` attributes are all set to "yes"
`Pipe mode` is set to "round pipe entire string", `Justify` is set to centre and Internal size is unticked.

Continue to 10.6 Create Super Alignment or return to 10 String.

10.6 Create Super Alignment

Position of option on menu: **String =>Super Alignments =>Create super alignment**

Advanced > Pipe/culvert node



The fields and buttons used in the **Advanced > Pipe/culvert** node of the **Create Super Alignment** panel or the **Super Alignment Properties** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Internal sizes	tick box	ticked	

*If **ticked**, sizing parameters are for the inside, otherwise they are for the outside.*

Type: Pipe

Field Description	Type	Defaults	Pop-Up
Internal sizes	tick box	ticked	

*If **ticked**, pipe diameter is for the inside of the pipe, otherwise it is for the outside.*

Field Description	Type	Defaults	Pop-Up
Pipe thickness	real box		measure box

*This field only appears if Type is **pipe**.*

The thickness of the pipe. Pipe thickness is in metres.

Type: Culvert

Field Description	Type	Defaults	Pop-Up
Culvert left thickness	real box		measure box

*This field only appears if Type is **culvert**.*

The left thickness of the culvert. Culvert left thickness is in metres.

Culvert right thickness	real box	measure box

*This field only appears if Type is **culvert**.*

The right thickness of the culvert. Culvert right thickness is in metres.

Culvert top thickness	real box	measure box

*This field only appears if Type is **culvert**.*

The top thickness of the culvert. Culvert top thickness is in metres.

Culvert bottom thickness	real box	measure box

*This field only appears if Type is **culvert**.*

The bottom thickness of the culvert. Culvert bottom thickness is in metres.

Continue to 10.7 Super Alignment Style Output or return to 10 String.

10.7 Super Alignment Style Output

Position of option on menu: **String =>Super alignments =>Tools =>Explode and process labels**

Changed text for 15C1m

One output model per input Super Alignment string is produced, named:

"<Output model(s) prefix> <input model name> <input string name>"

Note that if <Output model(s) prefix> and <input model name> both contain slashes (object tree naming) the leading branches which match, are removed from <input model name> in the resultant output model name. For example:

<Output model(s) prefix>= "AAA/BBB/LABEL CH/"

<input model name> = "AAA/CCC/ALIGN"

Output model name = "AAA/BBB/LABEL CH/CCC/ALIGN" <input string name>

Continue to 10.8 Equality Query or return to 10 String.

10.8 Equality Query

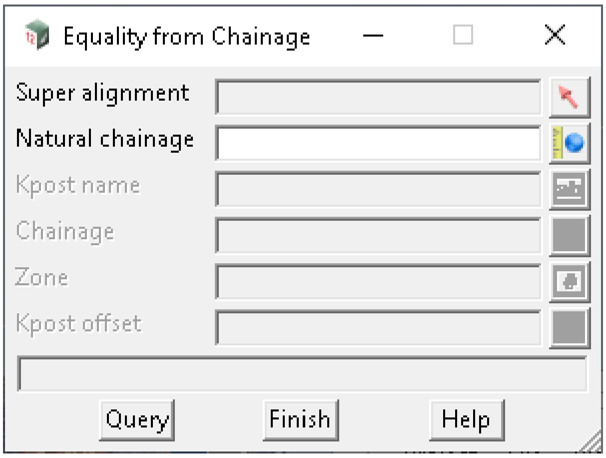
Position of option on menu: **String =>Super alignments =>Tools =>Equality query**

When position is selected on a super alignment the panel displays the natural chainage, K-post name, equality chainage, chainage equality zone and offset horizontal distance from the previous K-post.

After a super alignment is selected, filling in a natural chainage and selecting **Query** will find the K-post name, equality chain, Zone and K-post offset for the natural chainage.

For information on chainage equalities, internal equalities and K-posts, see 3.42 Chainage Equalities.

Selecting **Equality query** displays the **Equality From Chainage** panel.



The new fields and buttons used in the panel have the following functions.

Field Description Type Defaults Pop-Up

Super alignment string select

Select the super alignment to display chainage equality information for. The natural chainage and chainage equality information for the position where the super alignment is selected is display.

Natural chainage real box

*The selected raw chainage to get the **Kpost name**, **Chainage**, **Zone** and **Kpost offset**.*

Kpost name

Prefix for interval labels for a given chainage on a super alignment defined by a K-post. For more information see 3.42.4 K-Post.

Chainage

The chainage length from the selected chainage to previous chainage equality.

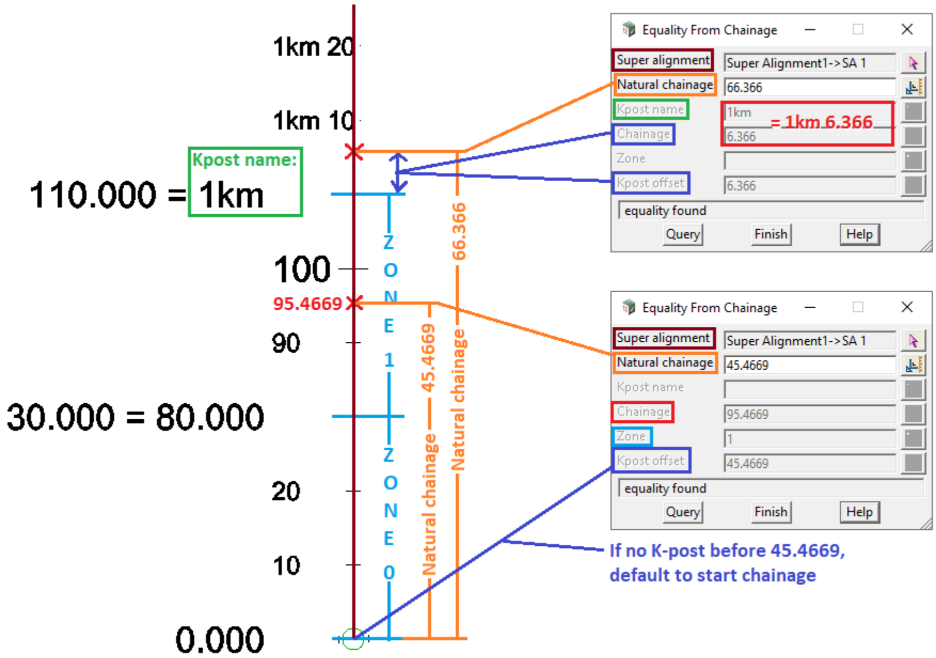
Zone

Displays chainage region the selected chainage is located in. For more information see 3.42.5 Zones.

Kpost offset

The chainage length from the selected chainage to previous K-post chainage equality. If there are no K-posts, the chainage length is measured from the start of the super alignment.

Two examples:



Buttons at Bottom

Query button

*Using the **Natural chainage**, get the K-post name, modified chainage, zone for chainage equalities and offset from K-post.*

Continue to 10.9 Chainage Query or return to 10 String.

10.9 Chainage Query

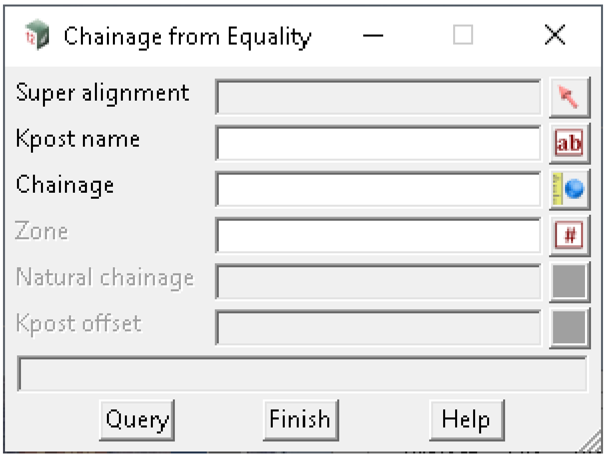
Position of option on menu: **String =>Super alignments =>Tools =>Chainage query**

When a super alignment is selected, the panel displays the breakup of the equality chainage for that position.

After a super alignment is selected, filling in Kpost name (could be blank), chainage from the chainage equality and zone selecting **Query** will find for those values, the natural chainage of that position on the super alignment.

For information on chainage equalities, internal equalities and K-posts, see 3.42 Chainage Equalities.

Selecting **Chainage query** displays the **Chainage From Equality** panel.



The new fields and buttons used in the panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Super alignment	string select		

Select the super alignment to display chainage information for. The natural chainage and chainage equality information for the position where the super alignment is selected is display.

Kpost name	input box	disabled	

Prefix for interval labels for a given chainage on a super alignment defined by a K-post. For more information see 3.42.4 K-Post.

Chainage

The chainage length from the selected chainage to previous chainage equality.

Zone

Displays chainage region the selected chainage is located in. For more information see 3.42.5 Zones.

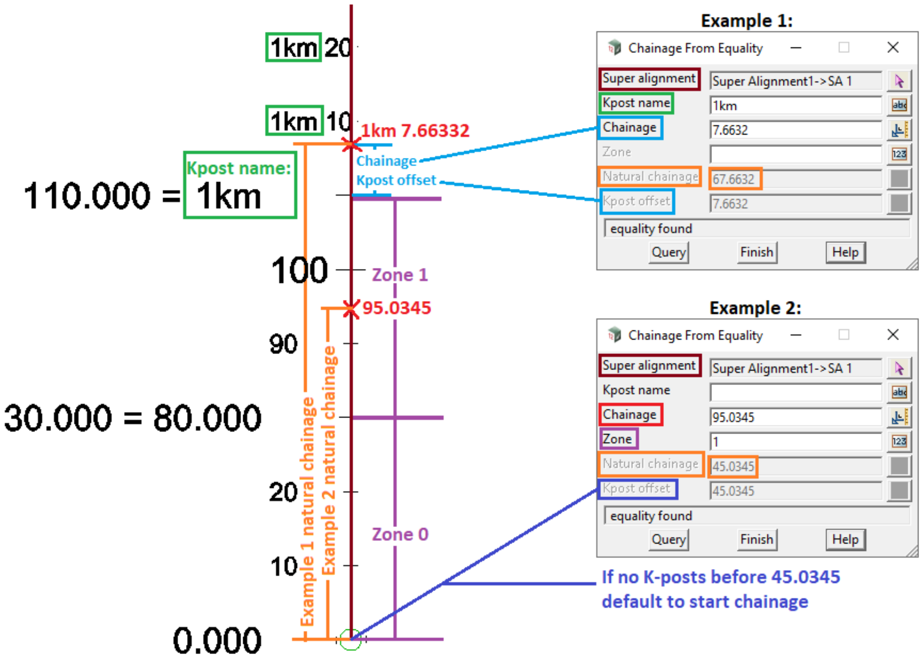
Natural chainage

The raw chainage of the selected point on the super alignment.

Kpost offset

The chainage length from the selected chainage to previous K-post chainage equality. If there are no K-posts, the chainage length is measured from the start chainage.

Two examples:



Button at Bottom

Query button

Measure the raw chainage of a point on the given super alignment using: K-post name, chainage length from previous chainage equality and Zone.

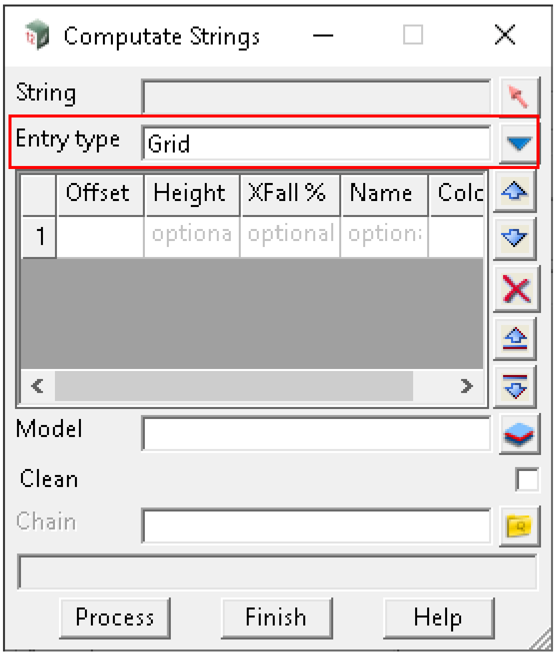
Continue to 10.10 Computate Strings or return to 10 String.

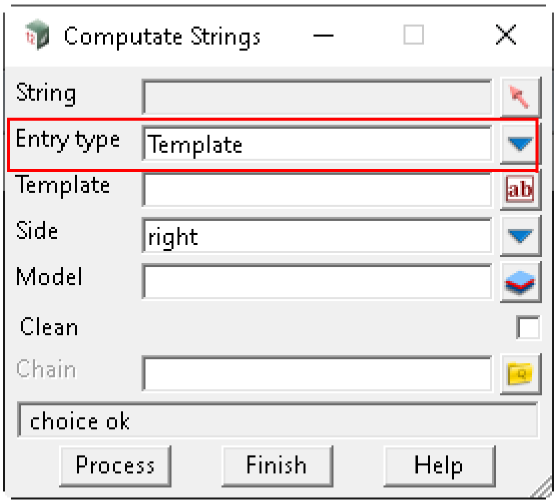
10.10 Computate Strings

Position of option on menu: **String =>Super alignments =>Tools =>Computate strings**

This option has been written for use with the Design "Create ramps/driveways" option and generates computated super alignments from a set string to form a defined number of links that form a user defined shape. Users can add their shape via the grid entry or via a template and the produced strings are all created as Element method strings. Meaning if the base kerb return/traffic island was to be modified these links/strings would also be modified.

Selecting **Computate strings** displays the **Computate Strings** panel.





The fields and buttons used in the **Computate Strings** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
String	string select		

Selection must be a String (Super or Super Alignment) containing vertical heights/geometry. The string selected is used in the calculation as the "base" string from which the new strings will be generated.

Entry Type	choice box		Grid or Template

The default is "Grid", requiring the user to input string information in the grid cells below. Similar to a Design template, the User is required to enter the geometry using two of the three "Width, Height and Xfall", provide a name and string colour. These entries will be created when the panel is processed.

The alternate choice option is to use a Design template, which would contain the links required to be created. Note: If a Template is selected the side to apply the offset information needs to be selected base on the direction of travel of the selected string above.

Side	choice box		

??.

Model	model box		

The model into which the newly created Super Alignment strings will be produced when processed.

Clean tick box not ticked

*If **ticked**, the model name entered above will be cleaned prior to the creation of the new Super Alignment strings. If not ticked, the model name entered above will not be cleaned.*

Buttons at Bottom

Process button

Process data selected with values entered and produces resulting stings in the model nominated.

Continue to 10.11 Grids and DEMS or return to 10 String.

10.11 Grids and DEMS

See 10.11.1 12d Grid, Grid String and Grid Tin.
See 10.11.2 Raster and Cell-Based Systems.

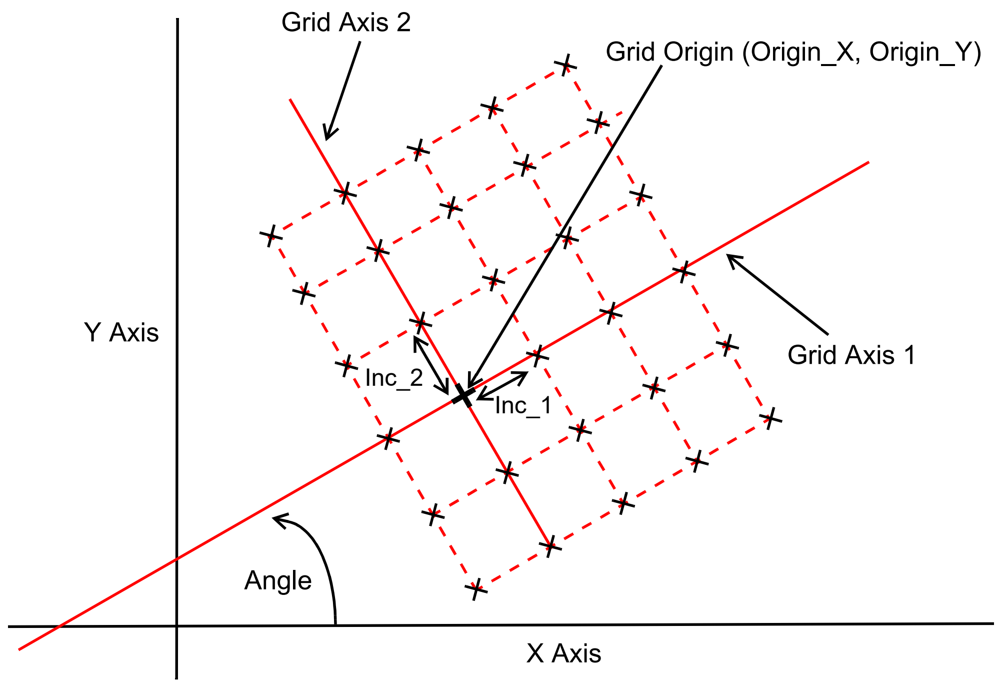
10.11.1 12d Grid, Grid String and Grid Tin

A ***12d Model*** Grid consists of z-values at points that are spaced at regular increments in two perpendicular axis about a particular point of the grid (the Grid Origin).

That is, there are two axis at right angles, Grid Axis 1 and Grid Axis 2, with their origin at the Grid origin, and with Axis 1 making an angle Angle with the X Axis. The increment in the Axis 1 direction is Inc_1 and the increment in the Axis 2 direction is Inc_2.

Note that Inc_1 and Inc_2 do not have to be the same value.

.



For the moment it is probably easier to ignore the rotation angle and take it to be zero. Axis 1 and Axis 2 are then the X and Y axes respectively.

In that case the ***12d Model*** Grid consists of z-values at regular X increment (Inc_X) and regular Y increment (Inc_Y).

The (x,y) position of the grid points are then:

X Grid point = Origin_X + N * Inc_X   where N is an integer (positive or negative)

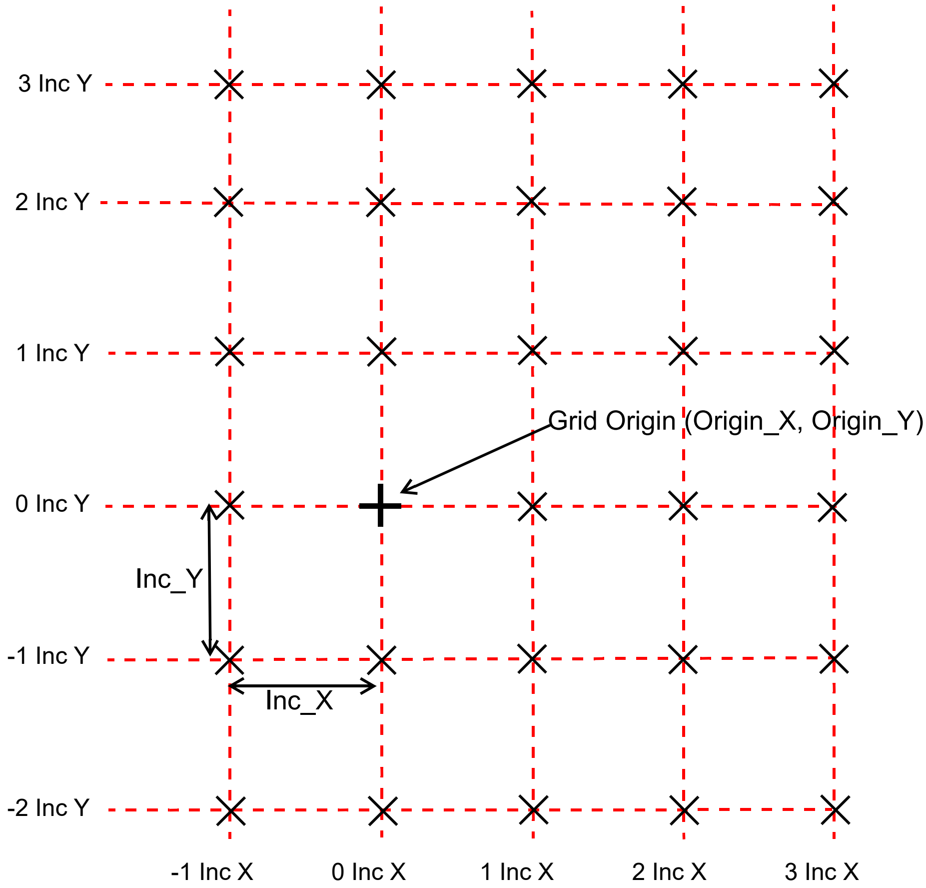
Y Grid point = Origin_Y + M * Inc_Y   where M is an integer (positive or negative)

The Grid Origin is at 0 increments in X and Y.

The Range of the ***12d Model*** Grid is specified by giving the minimum and maximum number of Increments of X and the minimum and maximum number of increments of Y.

For example, in the ***12d Model*** Grid drawn below, points of the grid are denoted by **X**. The angle of

the Grid is 0 and the grid goes from -1 to 3 increments in X, and -2 to 3 increments in Y.
.



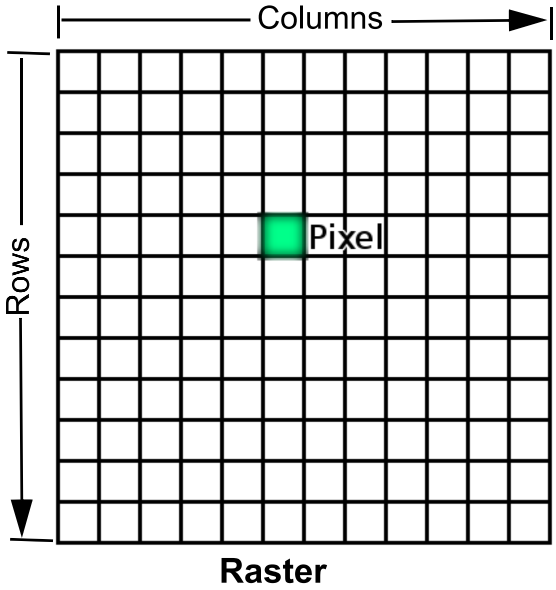
A ***Grid String*** is a special type of string where each of the vertices is a point of a ***12d Model*** Grid. The values for a Grid string often come from a tin.

A ***Grid Tin*** is a special type of tin where each of the vertices of the tin is a point of a ***12d Model*** Grid.

Continue to 10.11.2 Raster and Cell-Based Systems or return to 10.11 Grids and DEMS or 10 String.

10.11.2 Raster and Cell-Based Systems

A Raster consists of a matrix of cells organised into rows and columns where each cell (pixel) contains one value representing information. The numbering for the cells is from the top left corner of the cells.



What the value in each cell represents depends on the application.

The value in the cell may be a discrete value or it may be a sample from continuous data. In either case, depending on the application, the value may apply to the entire cell, or only apply at a particular position in the cell.

Digital aerial photographs are rasters where the value for each cell is a colour and the colour applies to the entire cell. Similarly for imagery from satellites, digital pictures and most computer screens where each cell (pixel) on the screen has one colour (see 10.11.2.1 Rasters as Background Images).

For other applications where the cell value represents a measured value and does not apply to the entire cell then that position within the cell must be specified. Usually the cell value representing a measured value is at the centre point of the cell (see 10.11.2.2 Rasters as Elevation Models).

10.11.2.1 Rasters as Background Images

The most common use for rasters in ***12d Model*** is as a background image to other data being displayed. For example an aerial photograph.

However before a raster can be displayed with other data in a given coordinate system, the raster data must be mapped to the same coordinate system as the other data and this may involve a translation, rotation and possibly scales in two directions being applied to the raster. This process is referred to as geolocating the raster.

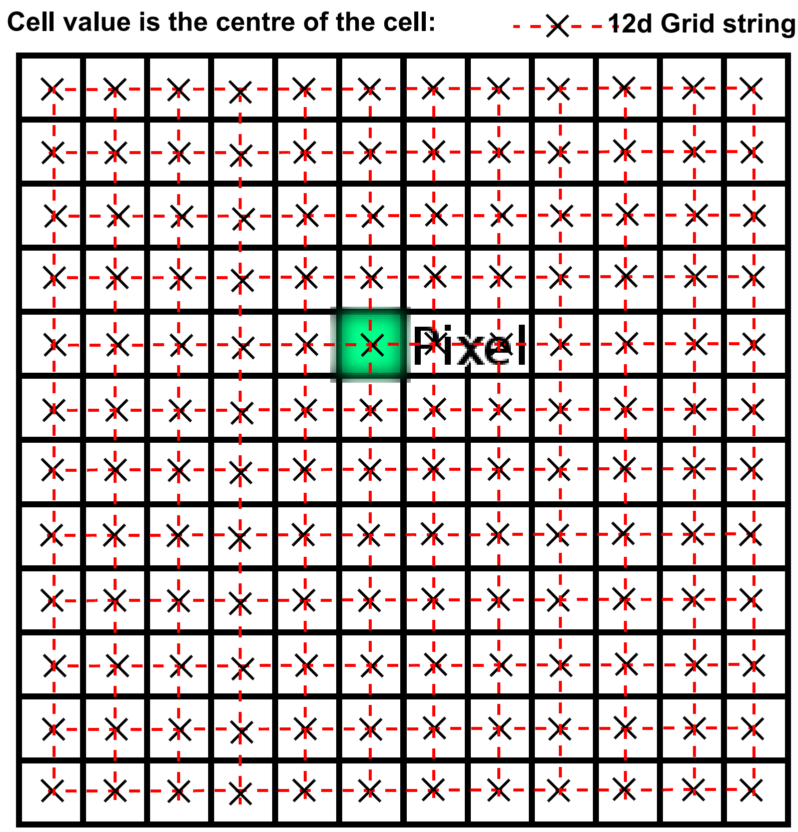
Sometimes this geolocation information is part of the raster format, at other times it is in a separate file and often it is entirely missing and must be calculated after the raster is loaded into ***12d Model***.

10.11.2.2 Rasters as Elevation Models

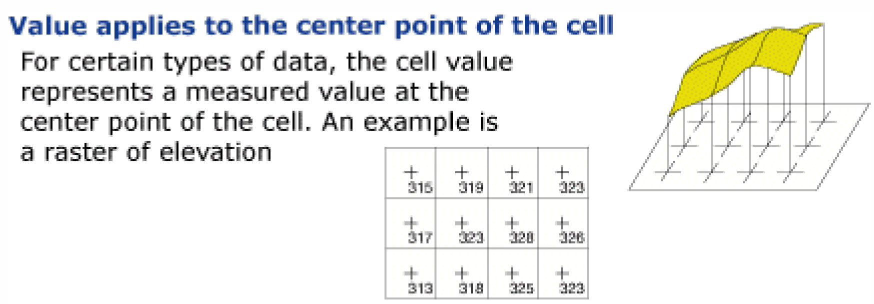
Another application of rasters is where the cell value represents a continuous measurement such as a z-value (height or elevation).

In this case the data could be read in as a ***12d Model*** Grid String or Grid Tin, but the user must be certain of where in the cell the z-value is located.

For example, if the value of the cell is the z-value at the centre of the pixel, the ***12d Model*** Grid string and Grid tin consists of the z-value at the **X** in the cells in the raster diagram.



This is how an ESRI raster file is to be interpreted when the data is considered to represent a measured value.

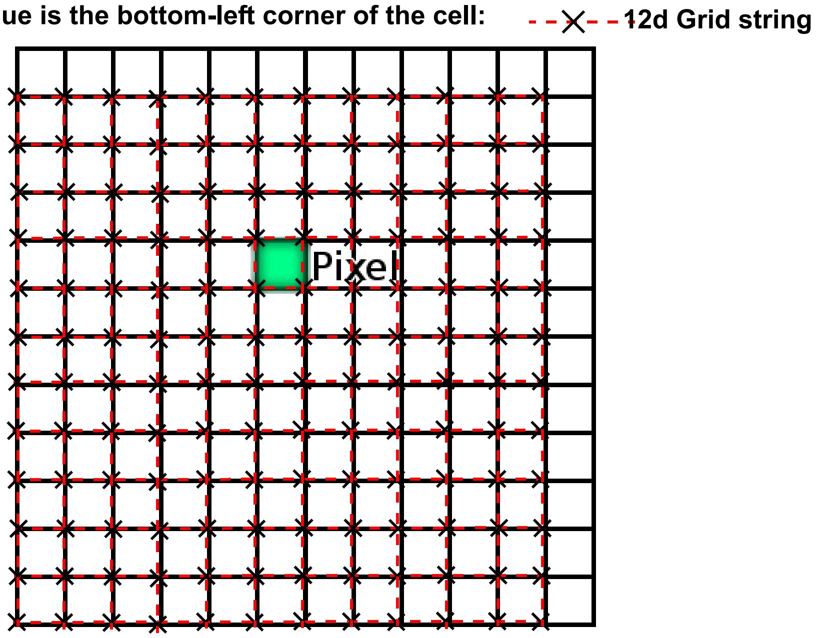


From ArcGIS documentation "General characteristics of raster data"

Note that the lines of the ***12d Model*** Grid string and Grid tin DO NOT line up with the edges of the cells (pixels). In fact the z-values anywhere in the cell except at the centre are meaningless.

If the value of the cell is the z-value at the bottom-left hand corner of the cell (pixel), the ***12d Model*** Grid string and Grid tin consists of the z-value at the X in the cells in the raster diagram.

Cell value is the bottom-left corner of the cell:



In this case the lines of the ***12d Model*** Grid string and Grid tin do line up with the edges of the cells (pixels) except there is no grid lines at the top and bottom of the cells. The z-values in the cell are meaningless anywhere in the cell except at the bottom-left corner.

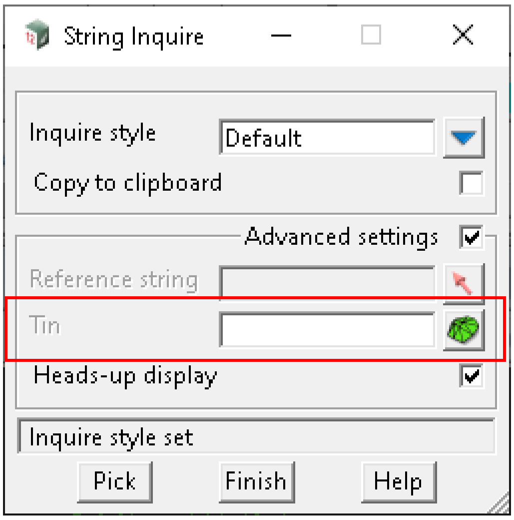
Continue to 10.12 String Inquire or return to 10 String.

10.12 String Inquire

Position of option on menu: **Strings =>Inquire**

There is an extra field in the **String Inquire** panel.

On selecting the **Inquire** option, the **String Inquire** panel is displayed.



The fields and buttons used in this panel have the following functions.

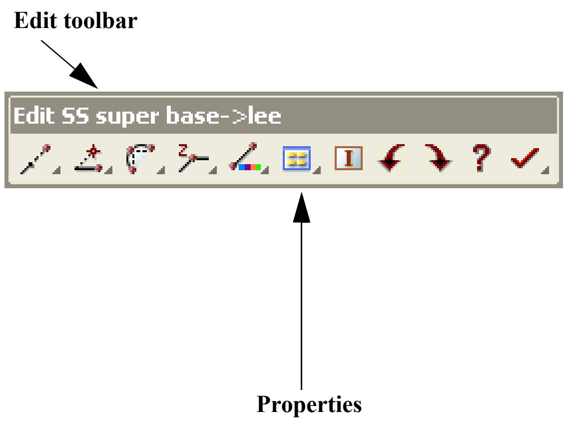
Field Description	Type	Defaults	Pop-Up
Reference string	string select		

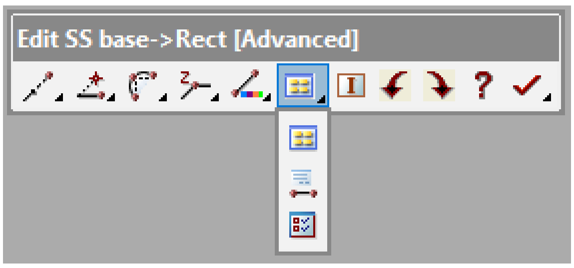
Select a reference string. If the reference string is selected and the current style has reference information, the relevant information such as offset and chainage of the selected reference string will be shown.

Continue to 10.13 Super Edit - Properties Toolbar or return to 10 String.

10.13 Super Edit - Properties Toolbar

The option **Super String User Attributes** has been added to the properties toolbar, located under the **Super Edit** menu.





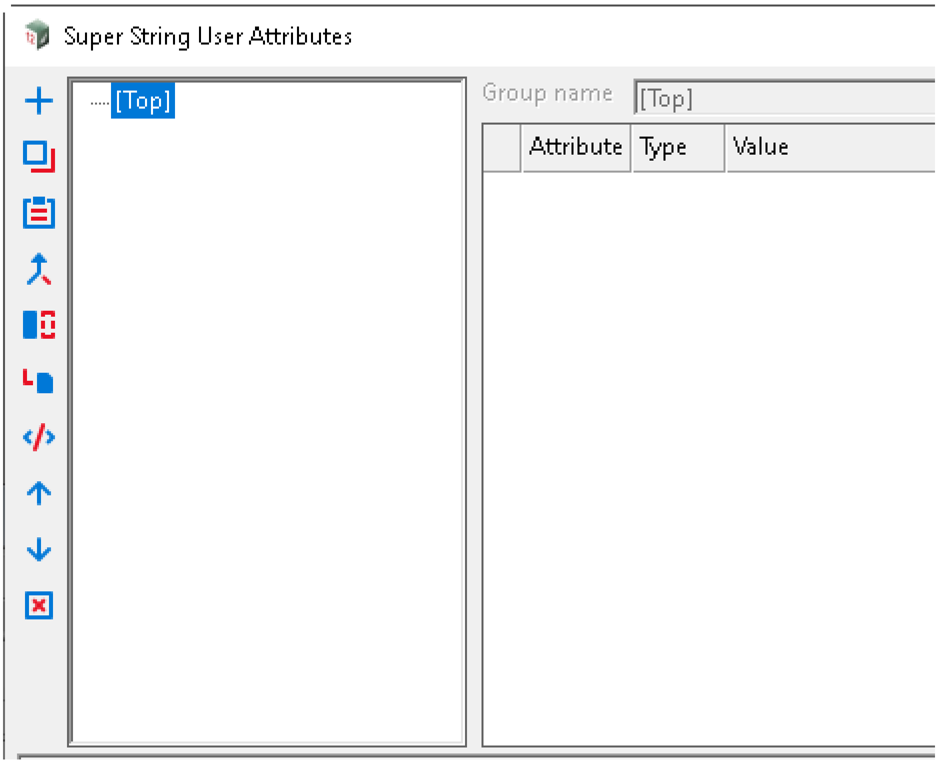
See

10.13.1 Super String User Attributes

10.13.1 Super String User Attributes

Selecting **String Attribute** brings up the **Super String User Attributes** panel which is used to display and edit user define attributes of the whole string.

As soon as the attribute is chosen, the attributes for the whole string is shown.



The string's attribute information is written to the appropriate panel fields. If any panel fields are modified, selecting either **Apply** or **OK** will store the new attribute information for the string.

General information on attributes is given in 3.9 Attributes (Meta Data) and the description of how to add attributes and groups of attributes in an Attributes panel is given in the section 3.9.3 Attribute Data Panel. In these descriptions, the Set button replaces the OK and Apply button used in this panel.

The fields and button that are different from Attributes Data panel have the following functions:

Field Description	Type	Defaults	Pop-Up
OK/Apply	button		

For the string being edited, **OK** *sets the string with the values in the panel fields and removes the panel.* **Apply** *sets the string with the values in the panel fields and leaves the panel on the screen.*

Continue to 10.14 Generate Unique String Names or return to 10 String.

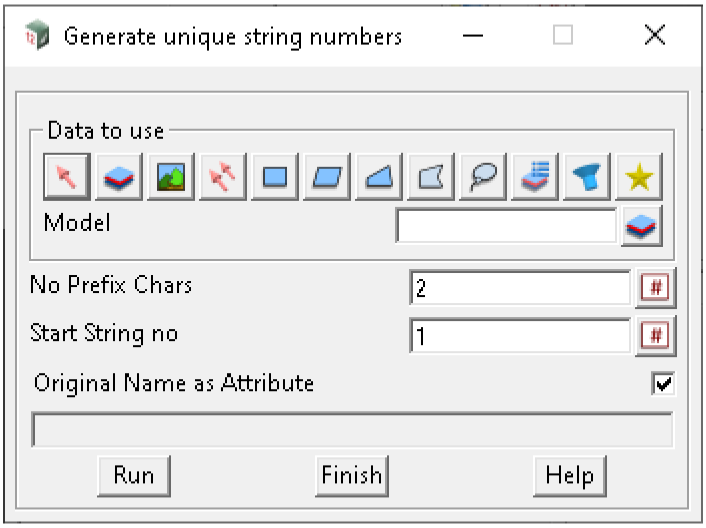
10.14 Generate Unique String Names

Position of option on menu: **String =>Utilities =>Generate unique string names**

This option renames selected strings to be unique. The renaming method is based on the old MOSS software format of four characters (0 to 9 and A to Z) 36². The option will only increase to five or more characters if the maximum number of strings selected with the same "prefix" is present. Eg, more than 1,036 "BB" strings selected.

Note: Using the Source Box "Filter" option to select the data to be renamed. Users can set "Name Masks" allowing for such strings as "P???" (Point codes) and "M*" (Master control strings) to be skipped in the renaming process, while all other strings are modified to the four character setting.

Selecting **generate unique string names** fires up the **unique string names** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to use	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to be changed.

No Prefix Chars	integer box		

The number of characters currently on the string to be maintained. Example shown, the first 2 string name characters are maintained. The naming/numbering will then be generated after these characters.

Start String no	integer box		

The starting number for the generation of the naming/numbering.

Note*: The generated string numbers are set at a maximum of four character length. If more than 9999 string names are generated, the numbers will continue to be unique with the introduction of alpha characters (A to Z).*

Original Names as Attribute	tick box	ticked	

This tick box allows for the original name to be stored.

If ***ticked****, all strings selected are saved with string attributes with the original string name. Using the* *attribute manipulator can return to the original name is possible.*

*If **not ticked**: the strings selected are changed, but the original name is not recorded.*

Buttons at Bottom

Run button

Change the string names of any selected strings.

***Note**, there is no undo available for this option. Once process, the Attribute manipulator can be used to restore old names (from attributes) if required.*

Continue to 11 BIM or return to 10 String.

11 BIM

There has been changes to the **Bim** chapter in the ***12d Model Reference manual***.

Main BIM menu and floating BIM menu

11.2 Trimesh
11.3 Point Clouds
11.4 Visualisation

See 11.1 IFC

See 11.2 Trimesh

- 11.2.1 Create Trimesh
- 11.2.3 Trimesh Edit
- 11.2.4 Convert Trimesh
- 11.2.5 Trimesh Union/Difference
- 11.2.6 Contour Trimeshes
- 11.2.7 Trimesh Intersection Lines
- 11.2.8 Trimesh Utilities

See 11.3 Point Clouds

- 11.3.1 Create Levels of Display

See 11.4 Visualisation

- 11.4.1 Remove all Duplicate Extrudes in Project

11.1 IFC

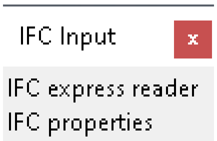
The **IFC** walk-right menu is

[11.1.1 IFC Input]
[11.1.2 IFC Output]
[11.1.3 IFC Spatial Structure]

11.1.1 IFC Input

Position of menu: **File =>Data input =>IFC**

The **IFC** walk-right menu is



11.1.1.1 IFC Express Reader
11.1.1.2 IFC Properties

11.1.1.1 IFC Express Reader

Position of option in menu: **BIM =>Import =>IFC Express Reader**

In ***12d Model 15*** the **IFC express reader** option reads in data from an IFC file in the **IFC 2x3**, **IFC 4x1** and **IFC 4x3** format. For some relevant IFC definitions, see 30.4 Structure of IFC.

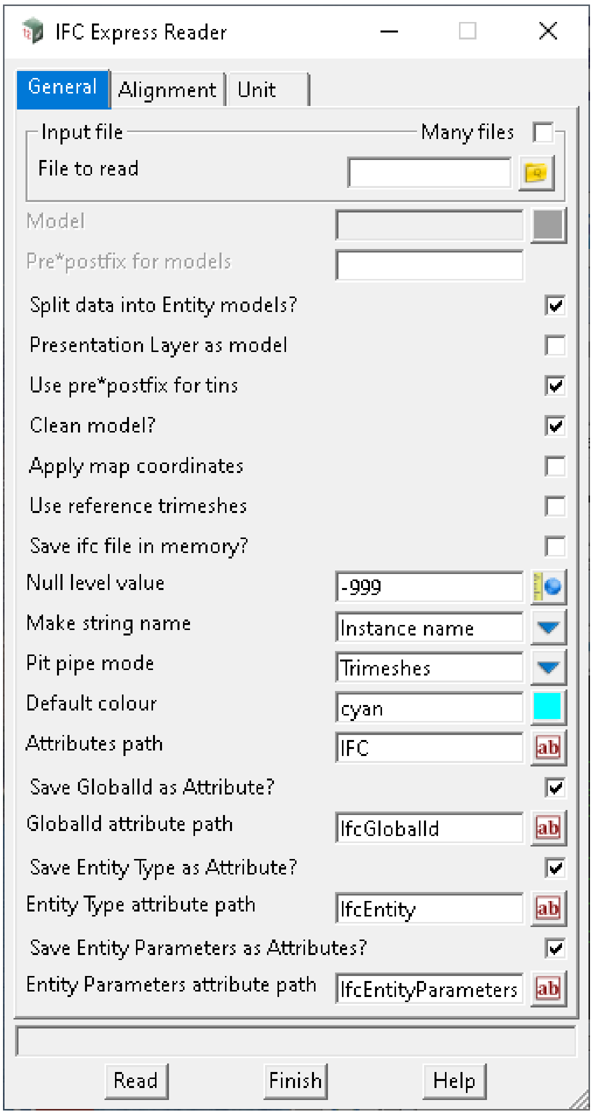
The IFC data can be added to just one model or can be split into models according to the **IFC Entity types** or if IFC ***PresentationLayers*** are included in the IFC file, the entities in each ***PresentationLayer*** can go to the ***12d Model*** model of the same name as the ***PresentationLayer***.

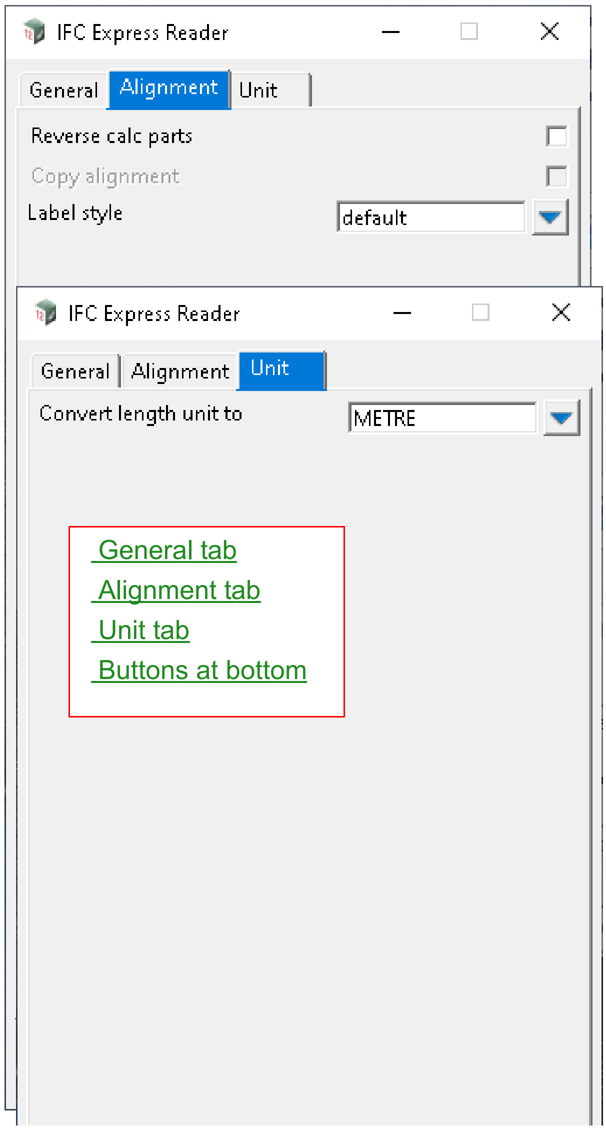
IFC spatial structure is not currently read in by the **IFC Express Reader** but if the IFC file is kept with the project, the IFC spatial structure can be examined by the **IFC Properties** option (see 11.1.1.2 IFC Properties).

NOTE AND WARNING REGARDING REFERENCE TIMESHES

*Reference trimeshes were only introduced in **12d Model 15** and are still under development. Please let us know if you encounter any problems with them.*

Selecting **IFC Express Reader** brings up the **IFC Express Reader** panel.





The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

General tab

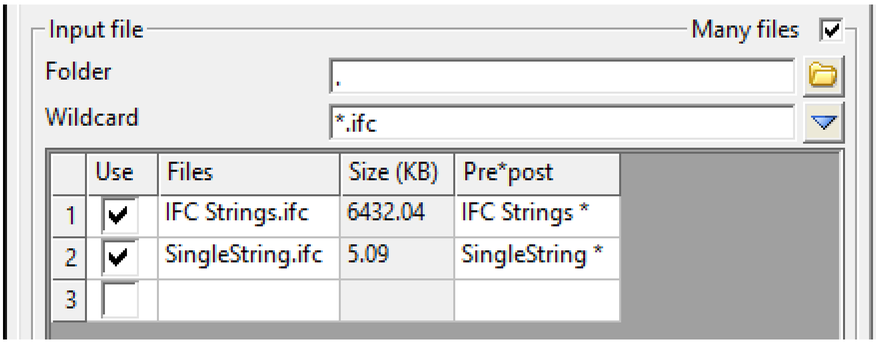
Many files tick box not ticked

*If **not ticked**, **File To Read** field is visible.*

File to read file box *ifc, *ifczip, *ifcxml files

*IFC 2x3, IFC 2x4, IFC 4, IFC 4x1, or IFC 4x3 file to read in. This is only displayed and used if **Many files** is **NOT** ticked.*

*If **ticked**, the **Many Files** grid is displayed and used to select many files to process. See* 3.26.8 Many Files Box.



Files file column *ifc, *ifczip, *ifcxml files

Name of the file to process.

Pre*post text column

***Note** that this grid has a **Pre*post** column and if it is blank then the **Pre*postfix for models** field is used.*

IFC file file box available files

IFC 2x3, IFC 4x1 or IFC 4x3 file to read in.

Model model box available models

*If **not blank** and* **Split data into Entity models** *is **NOT** ticked, the IFC data is added to this model.*

Pre*postfix for models text box

*If **not blank** and* **Split data into Entity models** *is ticked on, the Entity model names have the Pre*postfix applied to them.*

Split data into Entity models tick box ticked

*If **ticked**, the IFC data is split up by IFC entity type and into models based on the entity name.*

Presentation Layer as model tick box not ticked

*If **ticked**, if the IFC data is part of a PresentationLayer the data is read into a model with the same name as the layer. See* 30.5.1 IfcPresentationLayerAssignment.

***NOTE:** if any IFC data is not part of a PresentationLayer then either the **Entity model** or the **Model** will be used to store the IFC data depending on whether **Split data into Entity Models** is **ticked**.*

Use pre*postfix for tin tick box ticked

*If **ticked**, the tin names have Pre*postfix applied to them.*

Clean model? tick box ticked

*If **ticked**, the models to put the IFC data into are cleaned out first.*

Apply map coordinates tick box not ticked

*If **ticked**, the map coordinates that are specified in the IFC file are applied to the imported IFC data.*

Use reference trimeshes tick box not ticked

*If **not ticked**, a separate 12d trimesh is created for each IFC element read in. This is how things worked in V14 and is the default.*

*If **ticked**, instead of creating a separate 12d trimesh for each IFC element read in, a trimesh is created in the trimesh library and a one vertex super string created with a reference to the trimesh in the library.*

The reason for using referenced trimeshes is that when the IFC data is read in for buildings, often the same IFC geometry is repeated hundreds of times. For example windows, chairs, toilets, chairs and pipe fittings. By using a reference trimesh, the amount of disc space used for storing IFC's in the 12d Model project can be greatly reduced. However drawing times may be slightly slower as the reference to the trimesh has to be manipulated before drawing takes place.

If a reference trimesh is used, it will currently only be treated like a one vertex super string so trimesh operations will not work on it - for example, picking it (except at the vertex), editing it, 12d elements to trimesh. The Attribute Manipulator will only treat it as a super string so none of the trimesh options in the Attribute Manipulator will work for a referenced trimesh.

Save IFC file in memory? tick box not ticked

*If **ticked**, the IFC file is loaded into memory so it is ready to be used by the **IFC Properties** panel.*
***Warning**: if large IFC files are loaded into memory then* **12d Model** *can start to slow down. If this happened then restart* **12d Model** *and the IFC files will no longer be in memory. The **IFC Properties** panel will still work but the IFC files will only be loaded into memory as required.*

*If **not ticked**, the IFC file is not loaded into memory.*
***Note** that when the **IFC Properties** panel is used and an IFC object selected, if the IFC file that contained the object is not already in memory then it is read in.*

Null level value real box -999

When reading in 12d elements, if there is a z-value with the given null level value, replace it with the default 12d Model null level value.

Make string name choice box Entity name, Instance name

*If **Instance name**, the created 12d elements are given the **Name** of the IFC entity that they are created from. See* 30.4.2 IfcRoot and SubTypes.

***Important Note**: If the IFC data was written by* **12d Model** *then the **Instance** name will be the original **string/trimesh/tin name** so using **Instance name** will preserve the original 12d element name.*

*If **Entity name**, the created 12d elements are given the name of the IFC entity that they represent.*
This mode could be useful when the **Split data into Entity models** *is **not ticked** and the Entity name is kept as the 12d element name.*

Pit pipe mode choice box Trimeshes, SS pipes and pits
Drainage/sewer network

*If **Trimeshes**, trimeshes are created for the IFC entities.*
*If **SS pipes and pits**, wherever possible, pipes (round and rectangular) and drainage pits are created for the IFC data. All other IFC data is created as trimeshes.*
*If **Drainage/sewer network**, wherever possible a* **12d Model** *drainage network is created from the IFC data, and pipes (round and rectangular). All other IFC data is created as trimeshes.*

Default colour colour box available colours

If a colour for an entity is not given in the IFC file, then this colour is used for the entity.

Attribute path text box

When an IFC entity has property sets, the property sets will be create as groups (subnodes) under this attribute path. The name of the group is the property set name. See 30.4.7 IFC Property Sets, IFC Properties and Psets.

Save GlobalId as attribute? tick box ticked

*If **Save GlobalId as attribute?** is **ticked**, then when reading in an IFC entity, the* GlobalId *of the IFC entity is saved to the attribute* **GlobalId attribute path** *of the created* **12d Model** *element.*

*If **Save GlobalId as attribute?** is **not ticked**, then the* GlobalId *of the IFC entity is NOT saved to the attribute* **GlobalId attribute path** *of the created* **12d Model** *element.*

***NOTE**: when reading in an IFC file, the* GlobalId *is always stored in the created attribute group IFC for the created element. This is more as a history of the IFC entities read in. It is possible that the GlobalId could be changed for an element when it is next written out.*

GlobalId attribute path text box ifcGlobalId

The attribute of the created **12d Model** *element to use for saving the* GlobalId *of the IFC entity read in.*

Save Entity Type as attribute? tick box ticked

*If **Save Entity Type as attribute** is **ticked**, then when reading in an entity from the IFC file, the **IFC Element Type** is saved to the attribute* **Element Type attribute path** *of the created* **12d Model** *element.*

Entity type attribute path text box

The attribute of the created **12d Model** *element to use for saving the Entity Type of the IFC entity read in.*

Save Entity Parameters as attribute? tick box ticked

*If **Save Entity Parameter as attribute** is **ticked**, then when reading in a an entity from the IFC file, the name attributes (parameters) of the IFC entity read in are saved to the attribute group* **Entity Parameters attribute path**.

Entity Parameters attribute path text box

The attribute group to use for saving the Entity Parameters to.

Alignment tab

Reverse calc parts tick box not ticked

*If **ticked**, for any IFC Alignments with IFC Horizontal and/or IFC Vertical Geometry, an attempt will be made to create Horizontal and Vertical parts for the Alignment from the Horizontal and/or Vertical segments.*
*If **not ticked**, no attempt is be made to create Horizontal and Vertical parts for the Alignment.*

Copy alignment tick box not ticked

*If **ticked**, for any IFC Alignments with IFC Horizontal and/or IFC Vertical Geometry, a copy of the alignment with the suffix 'copy' added to the string name will be stored before attempting to create Horizontal and Vertical parts for the alignment.*

Label style choice box available label styles

The super alignment style controls the way the super alignment draws and highlights on the screen. For more information please go to the section 10.2.4 Super Alignment Style.
Sets the label style for any imported IFC Alignments.
***Note**: The **Reverse calc parts** option must be **ticked** in order to view the **label style**.*

Unit tab

Convert length unit to choice box METRE, MILLIMETRE, KILOMETRE

*If **METRE** and the length unit in the IFC file is millimetres, then lengths are multiplied by 0.001as the IFC file is read in.*
*If **MILLIMETRE** and the length unit in the IFC file is metres, then lengths are multiplied by 1000 as the IFC file is read in.*

*If **KILOMETRE**, the lengths are written out in kilometres.*

Buttons at bottom

Read button

Read in the IFC file.

Continue to 11.1.1.2 IFC Properties or return to 11.1.1 IFC Input.

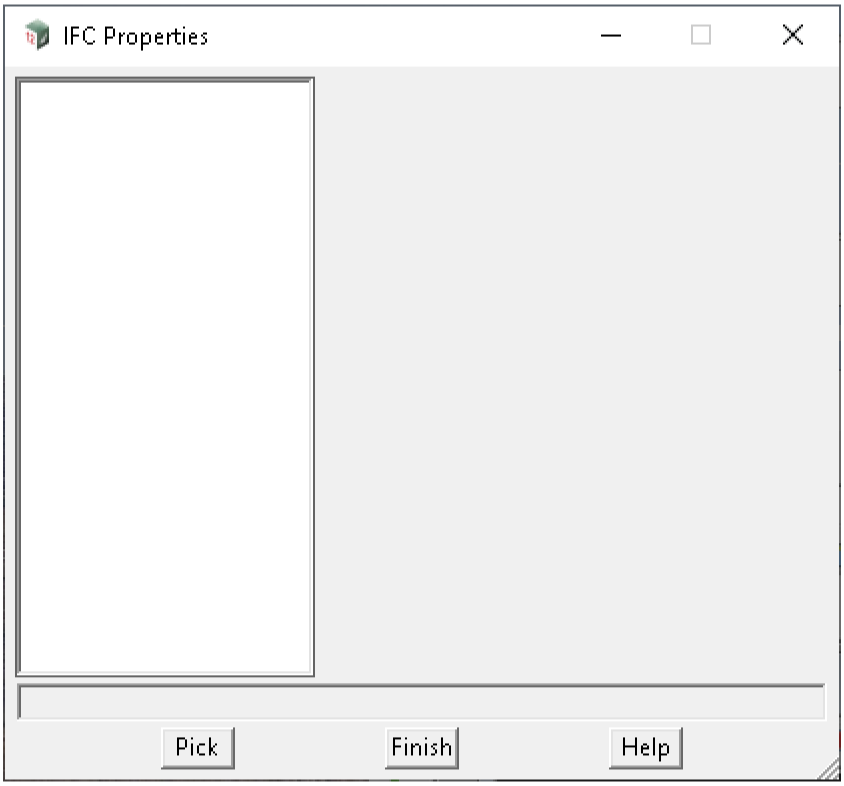
11.1.1.2 IFC Properties

Position of option on menu: **BIM =>Import =>IFC Properties**

When an IFC file is read in with the **IFC Express Reader** (see 11.1.1.1 IFC Express Reader), each ***12d Model*** element that is created keeps a link to where it was in the IFC file.

Although the IFC spatial structure is not used by the **IFC Express Reader**, if the IFC file is kept with the project and a 12d element created by the file is selected using the **IFC Properties** option, all the information in the IFC file is loaded into the panel and the information about the picked ***IFC Entity*** is displayed in right hand side of the panel.

Selecting **IFC properties** brings up the **IFC Properties** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pick	button		

Pick a ***12d Model*** *element that was created by reading in an IFC file and the information in the IFC file for the picked IFC Entity is displayed in the right hand side of the panel.*

Note*: the original IFC file must be kept with.*

Continue to 11.1.2 IFC Output or return to 11.1 IFC.

11.1.2 IFC Output

Position of menu: **BIM =>Export =>IFC**

The **IFC Output** options write out ***12d Model*** data in the IFC STEP format versions up to **IFC 4x3**.

Industry Foundation Classes (***IFC)*** is a platform neutral, open file format specification that is not controlled by a single vendor or group of vendors.

It is an object-based file format with a data model developed and controlled by **buildingSMART** (formerly the International Alliance for Interoperability, IAI) to facilitate interoperability in the architecture, engineering and construction (AEC) industry, and is a commonly used collaboration format in **Building Information Modeling** (**BIM**) based projects.

The IFC data model was initially intended to describe building data (vertical BIM) but with the release of ***IFC 4x3*** in 2024, has been extended to linear infrastructure (horizontal BIM).

The data in ***12d Model*** that can be written out to IFC's includes super strings, super alignments, TINs, drainage strings and trimeshes.

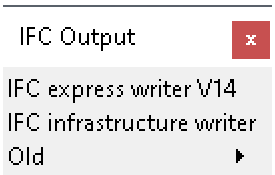
For more information on:

(a) BIMs, see 30 BIM and Digital Engineering and http://www.buildingsmart-tech.org

(b) IFC's, see 30.4 Structure of IFC

(c) the writing of IFC from ***12d Model*** data including how each element type is written out, see 30.3 12d Model and IFC's.

The **IFC Output** walk-right menu is



See

11.1.2.1 IFC Infrastructure Writer

For information on what ***12d Model*** elements are written out to IFCs, and how they are written, see 30.3.1 Representing 12d Model Elements in IFC.

11.1.2.1 IFC Infrastructure Writer

Position of option on menu: **BIM =>Export =>IFC write infrastructure**

The **Write Infrastructure IFC FIle** option is a rewrite of the **V14 IFC Write IFC File**.

The **Write Infrastructure IFC File** option has all the capabilities as the **Write IFC File** plus additional capabilities such as writing out as **IFC 4x3**. **IFC 4x3**, which was released in 2024, is the more suited to ***CIvil BIM*** as it includes georeferencing, and IFC entities for **alignments**, **tins** and **trimeshes**.

Things to be Careful About When Writing Out IFC Files

Unfortunately not all software reads IFC's in the same way so how ***12d Model*** elements need to be written to an IFC file can depend on what software reading the IFC file.

The Cloud IFC Reader from **ACCA** is one of the most comprehensive IFC Readers up to and including IFC 4x3 and it is regularly used to test out the IFC files produced by ***12d Model***.

To handle differences in IFC Readers, there are a number of tick boxes on the **Write Infrastructure IFC File** panel that control how ***12d Model*** elements are written to the IFC file.

For example, to output super strings with no pipes to **Solibri**, **Revit** or **NavisWorks**, **Output polylines as tiny pipes?** needs to be **ticked** and a value entered into the **Tiny pipe diameter** field.

Warnings for Large Horizontal Civil Projects

IFC has no limitation on the size or coordinates or the horizontal or vertical size of projects but be aware that not all software can handle data for large horizontal projects and display the data correctly. For example **Revit** and **Solibri** have problems with data that extends over more than a ten Km circle.

Also not all software supports the concept of null z-values and so null z-values need to be substituted with some other z-value as the data is written out to IFCs.

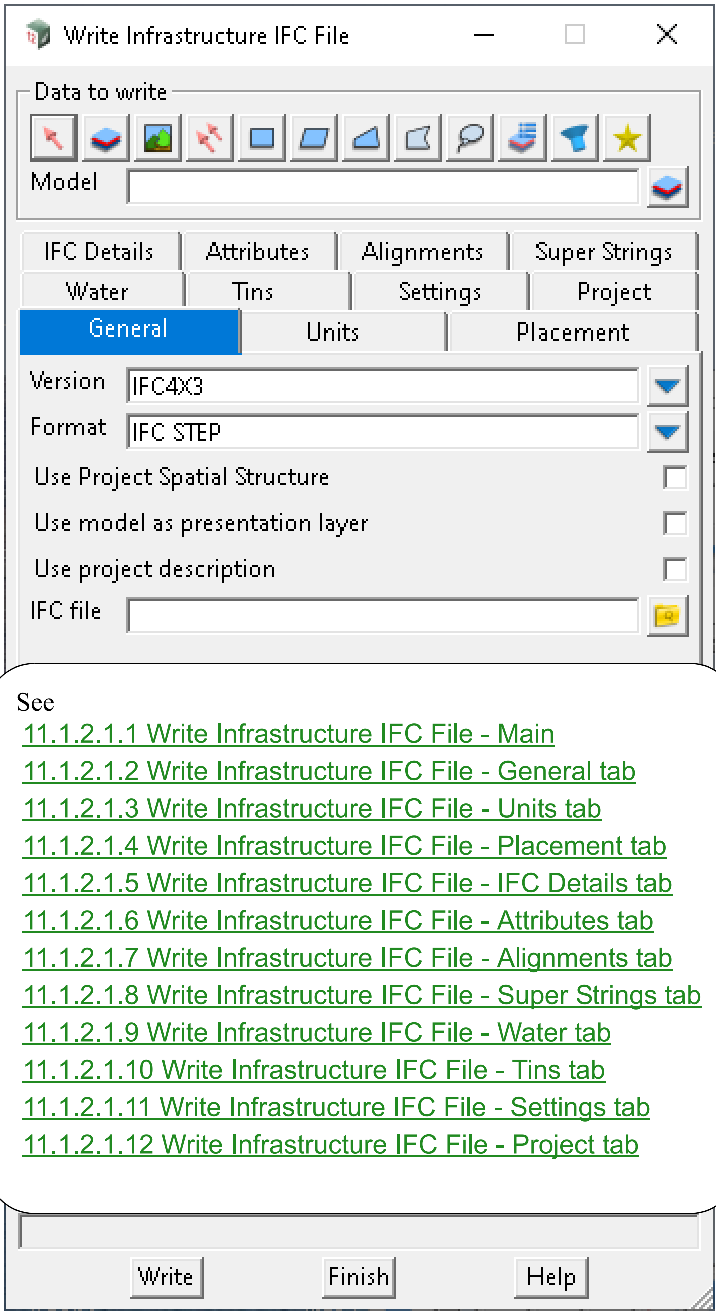
Attributes as IFC Property Sets

IFC entities have attributes and they are the stored in **IFC Property Sets** and each **IFC Property Set** must have a **non blank** name.

NOTE

*The **Write IFC File** option from V14 has been kept for upwards compatibility.*

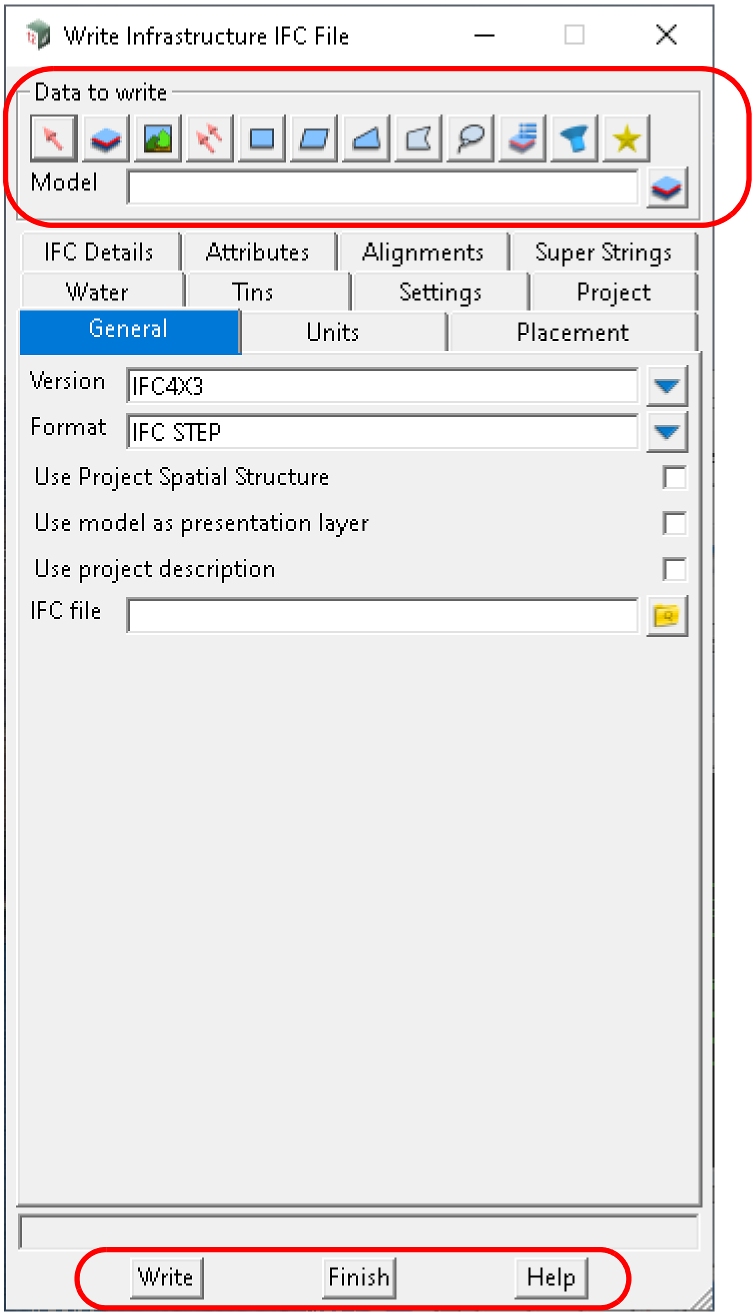
Selecting **IFC Write Infrastructure** brings up the **Write Infrastructure IFC File** panel.



See
11.1.2.1.1 Write Infrastructure IFC File - Main
11.1.2.1.2 Write Infrastructure IFC File - General tab
11.1.2.1.3 Write Infrastructure IFC File - Units tab
11.1.2.1.4 Write Infrastructure IFC File - Placement tab
11.1.2.1.5 Write Infrastructure IFC File - IFC Details tab
11.1.2.1.6 Write Infrastructure IFC File - Attributes tab
11.1.2.1.7 Write Infrastructure IFC File - Alignments tab
11.1.2.1.8 Write Infrastructure IFC File - Super Strings tab
11.1.2.1.9 Write Infrastructure IFC File - Water tab
11.1.2.1.10 Write Infrastructure IFC File - Tins tab
11.1.2.1.11 Write Infrastructure IFC File - Settings tab
11.1.2.1.12 Write Infrastructure IFC File - Project tab

Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

11.1.2.1.1 Write Infrastructure IFC File - Main



[Main](#)
[General tab](#)
[Units tab](#)
[Placement tab](#)
[IFC Details tab](#)
[Attributes tab](#)
[Alignments tab](#)
[Super Strings tab](#)
[Water tab](#)
[Tins tab](#)
[Settings tab](#)
[Project tab](#)

The circled fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Main			
Data to write	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Data source of data to be written out to IFC.

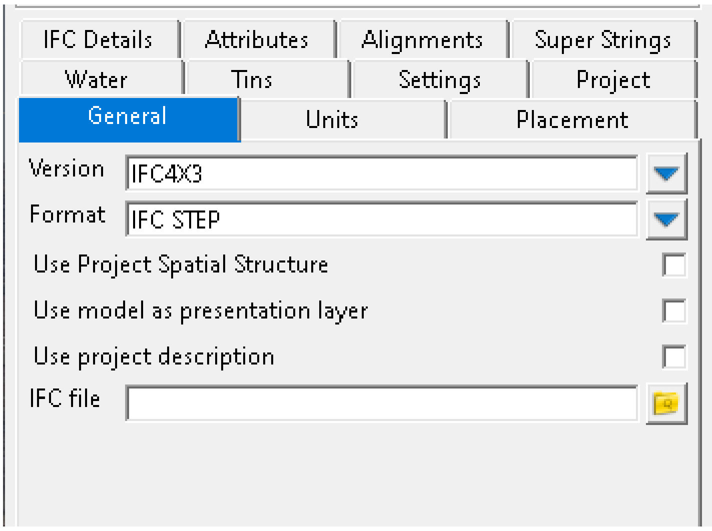
Buttons at Bottom

Write button

Write out the IFC file.

Continue to 11.1.2.1.2 Write Infrastructure IFC File - General tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.2 Write Infrastructure IFC File - General tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

General tab

Version choice box IFC2x3, IFC4, FC4x3

*If **IFC 2x3**, the data is written out as an **IFC 2x3** file.*

*If **IFC 4**, the data is written out as an **IFC 4** file.*

*If **IFC 4x3**, the data is written out as an **IFC 4x3** file.*

*If **IFC 4x4**, the data is written out as an **IFC 4x4** file. This format has not yet been released by buildingSMART International.*

***Note**: for versions **IFC 4x3** and later there are specific IFC Entities for Super Alignments and Tins.*

Format choice box IFC STEP, IFC XML
IFC STEP ZIP, IFC XML ZIP

*If **IFC STEP,** the data is written out in the IFC STEP format.*
*If **IFC XML,** the data is written out in the IFC XML format.*
*If **IFC STEP ZIP**, the data is written out in the IFC STEP format, then compressed to a zip file.*
*If **IFC XML ZIP,** the data is written out in the IFC XML format, then compressed to a zip file.*

Use Project Spatial Structure tick box not ticked

*If **ticked**, the Spatial Structure defined for any 12d Model element that written out to the IFC file is also written out and the entity for that element added to the spatial structure. See* 30.4.5 IFC Spatial Structure *and* 11.1.3 IFC Spatial Structure.

Use model as presentation layer tick box not ticked

*If **ticked**, the exported elements are assigned an IFC PresentationLayer with the name of the model that contains the element. See* 30.5.1 IfcPresentationLayerAssignment.

Use project description tick box not ticked

*If **ticked**, the data in the Project Description panel (*6.9.1 Project Description*) is written to the named attribute **Description** of* 30.4.2.1.1.2 IfcProject.

IFC file input *.ifc file

Name for the file to write the IFC data to.

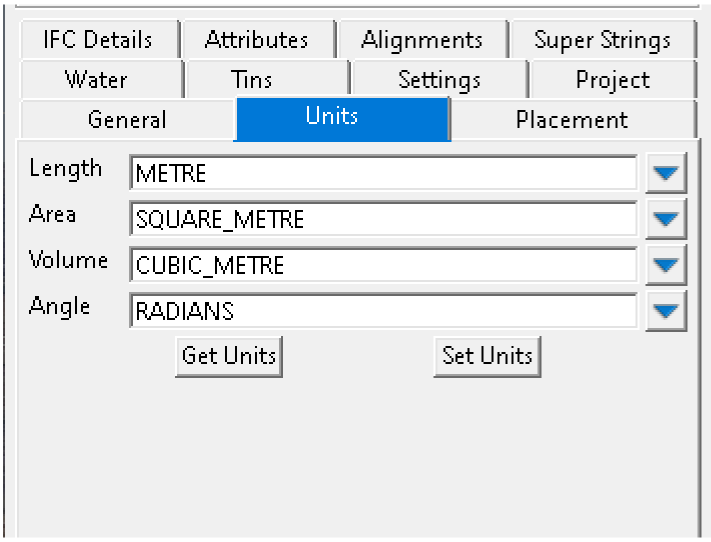
Continue to 11.1.2.1.3 Write Infrastructure IFC File - Units tab or return to 11.1.2.1 IFC Infrastructure

Writer.

11.1.2.1.3 Write Infrastructure IFC File - Units tab

The ***Units*** tab is used to supply data that is used in the Units section of the IFC file.

Note: when the **Write Infrastructure IFC File** panel is started, the values from the **Project** attribute group ***ifc_attributes/ifc_project_units*** are automatically loaded into the fields of the ***Units*** tab.



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Units tab

Length choice box METRE, MILLIMETRE, KILOMETRE

*If **METRE**, the lengths are written out in metres.*
*If **MILLIMETRE**, the lengths are written out in millimetres.*
*If **KILOMETRE**, the lengths are written out in kilometres.*

Area choice box SQUARE_METRE, SQUARE_MILLIMETRE, SQUARE_KILOMETRE

*If **SQUARE_METRE**, the areas are written out in* metre^2.
*If **SQUARE_MILLIMETRE**, the areas are written out in* millimetre^2.
*If **SQUARE_KILOMETRE**, the areas are written out in* kilometre^2.

Volume choice box CUBIC_METRE, CUBIC_MILLIMETRE, CUBIC_KILOMETRE

*If **CUBIC_METRE**, the volumes are written out in* metre^3
*If **CUBIC_MILLIMETRE**, the volumes are written out in* millimetre^3.
*If **CUBIC_KILOMETRE**, the volumes are written out in* kilometre^3.

Angle choice box RADIANS, DEGREES

*If **RADIANS**, the plane angles are written out in radians.*
*If **DEGREES**, the plane angles are written out in **decimal** degrees.*

Get Units button

*Pressing the button loads the values from the **Project** attribute group **ifc_attributes/ifc_project_units** into the fields of this tab.*

***Note:** when the* **Write Infrastructure IFC File** *is started, the values from the **Project** attribute group **ifc_attributes/ifc_project_units** are automatically loaded into the fields of **Units** tab so this button only needs to be used if the Project attributes **ifc_attributes/ifc_project_units** have been modified after the panel has started and the new values are required.*

Set Units button

*After pressing the button, the values in the **Units** tab are loaded into the **Project** attributes group **ifc_attributes/ifc_project_units***

***Note:** this is only necessary if you have changed any values in the **Units** tab and the new values are to be stored in the Project attribute **ifc_attributes/ifc_project_units**.*

These are written out to the IFC file in the STEP format as

Units for the project are assigned at #7

```
#1 = IFCPROJECT('04P1_IPYbDSOWnTArB5goB', #2, 'ifc Data', '', $, $, $, (#12, #375), #7);

#2 = IFCOWNERHISTORY(#3, #6, $, .NOCHANGE., $, $, $, 1727696961);
#3 = IFCPERSONANDORGANIZATION(#4, #5, $);
#4 = IFCPERSON($, $, 'lee.gregory', $, $, $, $, $);
#5 = IFCORGANIZATION($, '12d Solutions', '12d Solutions', $, $);
#6 = IFCAPPLICATION(#5, '15.0C1q', '12d Model', '12d Model');
#7 = IFCUNITASSIGNMENT((#8, #9, #10, #11));
#8 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#9 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#10 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#11 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);
```

Units

For information on the STEP format see 30.4.1 IFC STEP File Format:

Continue to 11.1.2.1.4 Write Infrastructure IFC File - Placement tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.4 Write Infrastructure IFC File - Placement tab

When the ***12d Model*** data is written to an IFC file, the (x,y,z) coordinates can be written out:

(a) with the same values as they have in ***12d Model***

(b) be rotated in the (x,y) plane and translated in x,y and z and before being writing out

If the resultant data is georeferenced then the following information can be written to the IFC file

(a) geodetic (horizontal) datum

(b) vertical datum

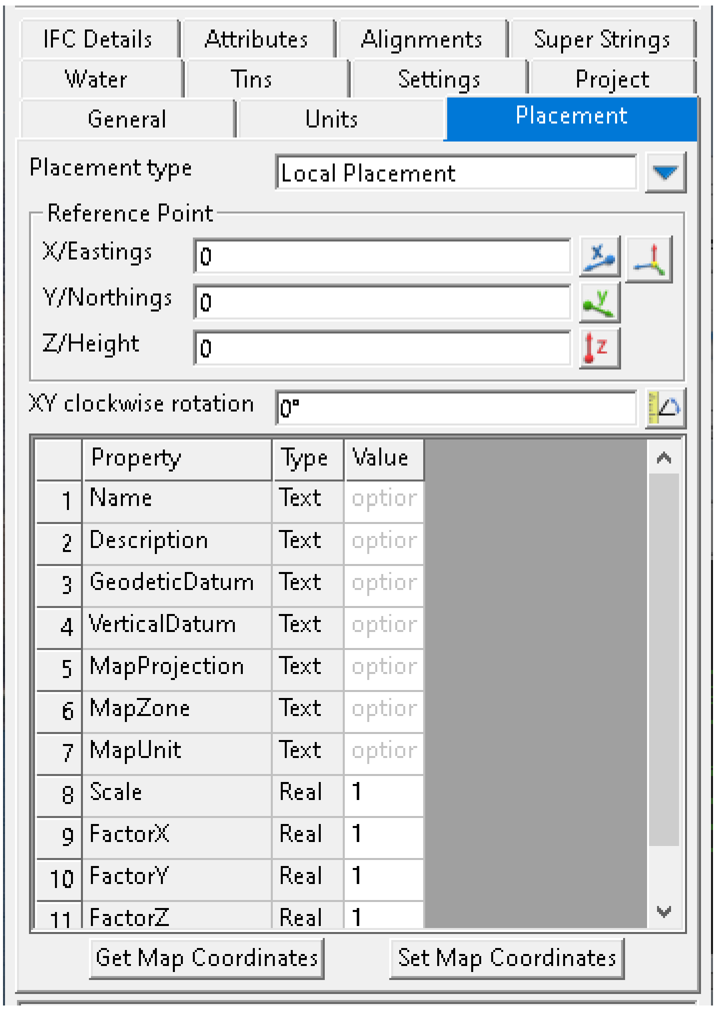
(c) map projection and zone

(d) multiplication factors for x, y and z

These combinations can be used to:

(a) modify the data that is written out to the IFC file

(b) set up the IFC file so that the data in the IFC file is georeferenced as it is being read in



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Placement tab

Placement type	choice box	Local Placement, Local to Map Coordinates

Map Coordinates to Map Coordinates

*If **Local Placement**: **for all IFC versions***

In this case the data is normally in local engineering coordinates and is staying in a local engineering coordinate system.

*The **Reference Point** values* **X/Eastings**, **Y/Northings** *and* **Z/Height** *are subtracted from the (x,y,z) coordinates of the data and the then rotated clockwise by the **XY clockwise rotation before** the **data** is **written** to the IFC file.*

*The **Reference Point** and **XY rotation** values are written out to an **IfcLocalPlacement** so that when the data is read into another system, the other system knows what the **Reference point** is. The values in the Property-Type-Value Grid are not used.*

This is often used when the coordinate values are too large for the system reading the IFC file to handle and hence the coordinates in the IFC file are made smaller by subtracting the Reference Point values.

*If **Local to Map Coordinates**: **for IFC 4x3***

*In this case the data in **12d Model** that is written to the IFC file is in local engineering coordinates but the parameters are known to covert the (x,y) data to map coordinates and the z data to the vertical datum. These parameters can be written to the IFC file in **IfcMapConversionScaled** so when the IFC file is **read in**, the **IfcMapConversionScaled** parameters in the IFC file are used to convert the local engineering coordinates in the file to map coordinates.*

IfcMapConversionScaled.Eastings = **X/Eastings**

IfcMapConversionScaled.Northings = **Y/Northings**

IfcMapConversionScaled.OrthogonalHeight = **Z/Height**

*IfcMapConversionScaled.XaxisOrdinate = cos(***XY clockwise rotation***)*

*IfcMapConversionScaled.XaxisAbscisscar = sin(***XY clockwise rotation***)*

IfcMapConversionScaled.Scale = **Scale**

IfcMapConversionScaled.FactorX = **FactorX**

IfcMapConversionScaled.FactorY = **FactorY**

IfcMapConversionScaled.FactorZ = **FactorZ**

*The definition of the map system, which consists of the Horizontal Datum, the Vertical Datum, the Map Projection and Zone, are written out to the IFC file in **IfcProjectedCRS**.*

IfcProjectedCRS.Name = **Name**

IfcProjectedCRS.Description = **Description**

IfcProjectedCRS.GeodeticDatum = **GeodeticDatum**

IfcProjectedCRS.VerticalDatum = **VerticalDatum**

IfcProjectedCRS.MapProjection = **MapProjection**

IfcProjectedCRS.MapMapZone = **MapZone**

IfcProjectedCRS.MapUnit = **MapUnit**

Notes:

In most cases, the parameters for going from local coordinates to map coordinates would be a 2D Helmert and a translation in Z. That is, to get to map coordinates, the data requires a rotation in XY, the same scale applied to X and Y (the combined scale factor), followed by a translation in X, Y and Z. Hence **FactorX = FactorY**.

*As the IFC file is being **read in**, the **IfcMapConversionScaled** parameters in the IFC file are applied to the coordinates in the file to convert them to map coordinates. So the data read in is in map coordinates.*

For an example, see 30.4.4.3.3 Data in Local Engineering Coordinates but is Required in Map Coordinates.

*If **Local to Map Coordinates**: **for IFC 2x3***

*If local engineering coordinates and **IFC 2x3,** the* **Reference point** *values **AND** the data in the grid box are written out to the property sets 'EPset_ProjectedCRS' and 'EPset_MapConversion' attached to the top level IfcSite.*

*If **Translate to Map Coordinates**: **for IFC 4x3 only***

*In this case the data in **12d Model** is such that it **only needs a translation in (x,y) to produce valid map coordinates, and a translation in z to produce heights in the vertical datum.***

*The data in **12d Model** is written out as is and:*

*The required translation is written out to the IFC file in **IfcRigidOperation:***

IfcRigidOperation.FirstCoordinate = **X/Eastings**

IfcRigidOperation.SecondCoordinate = **X/Northings**

IfcRigidOperation.Height = **Z/Height**

*The definition of the map system, which consists of the Horizontal Datum, the Vertical Datum, the Map Projection and Zone, is written out to the IFC file in **IfcProjectedCRS**.*

IfcProjectedCRS.Name = **Name**

IfcProjectedCRS.Description = **Description**

IfcProjectedCRS.GeodeticDatum = **GeodeticDatum**

IfcProjectedCRS.VerticalDatum = **VerticalDatum**

IfcProjectedCRS.MapProjection = **MapProjection**

IfcProjectedCRS.MapMapZone = **MapZone**

IfcProjectedCRS.MapUnit = **MapUnit**

Note:

***XY clockwise rotation, Scale**, **FactorX**, **FactorY** and **FactorZ** are ignored.*

*As the IFC file is being **read in**, the **IfcRigidOperation** parameters in the IFC file are used to translate the coordinates in the file to map coordinates. So the data read in is in map coordinates.*

For an example, see 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates.

*If **Map Coordinates to Map Coordinates**: **for IFC 4x3 only***

*In this case the data in **12d Model** that is written to the IFC file is **already in map coordinates and the height datum**.*

*The definition of the map system, which consists of the Horizontal Datum, the Vertical Datum, the Map Projection and Zone, is written out to the IFC file in **ifcProjectedCRS**.*

IfcProjectedCRS.Name = **Name**

IfcProjectedCRS.Description = **Description**

IfcProjectedCRS.GeodeticDatum = **GeodeticDatum**

IfcProjectedCRS.VerticalDatum = **VerticalDatum**

IfcProjectedCRS.MapProjection = **MapProjection**

IfcProjectedCRS.MapMapZone = **MapZone**

IfcProjectedCRS.MapUnit = **MapUnit**

*To create a valid IFC file, an **IfcRigidOperation** is also needed in IFC file with the translations in x, y and z all set to 0.0.*

That is,

IfcRigidOperation.FirstCoordinate = **0.0**

*IfcRigidOperation.SecondCoordinate =***0.0**

IfcRigidOperation.Height = **0.0**

Note:

***X/Easting, Y/Northing, Z/Height, XY clockwise rotation, Scale**, **FactorX**, **FactorY** and **FactorZ** are ignored.*

*Although this is a special case of **Translate to Map Coordinates**, many of the parameter are already known and so don't have to be set. This is the normal situation for most infrastructure projects.*

For an example, see 30.4.4.3.1 Data is Already in Map Coordinates.

Reference Point group

X/Easting measure box

If Placement type *is **Local Placement**, **Value** to be **subtracted** from the x coordinate of all the data before the value is written to the IFC file.*

If Placement type *is **Local to Map Coordinates, Value** is written to IfcMapConversionScaled.Eastings*

If Placement type *is **Translate to Map Coordinates, Value** is written to IfcRigidOperation.FirstCoordinate*

Y/Northing measure box

If Placement type *is **Local Placement**, **Value** to be **subtracted** from the y coordinate of all the data before the value is written to the IFC file.*

If Placement type *is **Local to Map Coordinates, Value** is written to IfcMapConversionScaled.Northings*

If Placement type *is **Translate to Map Coordinates, Value** is written to IfcRigidOperation.SecondCoordinate*

Z/Height measure box

If Placement type *is **Local Placement**, **Value** to be **subtracted** from the z coordinate of all the data before the value is written to the IFC file.*

If Placement type *is **Local to Map Coordinates, Value** is written to IfcMapConversionScaled.OrthogonalHeight*

If Placement type *is **Translate to Map Coordinates, Value** is written to IfcRigidOperation.Height*

If (X coordinate, Y coordinate) are defined but not Z coordinate then the value of z will be set to zero ??.

XY clockwise rotation angle box

If Placement type *is **Local Placement**, the clockwise rotation in the XY plane to apply to the XY data before it is written to the IFC file.*

If Placement type *is **Local to Map Coordinates,** the cos and sin of the value is written to IfcMapConversionScaled.XaxisAbscissa and IfcMapConversionScaled.Ordinate respectively.*

If Placement type *is **Translate to Map Coordinates** or **Map Coordinates to Map Coordinates,** this field is not used.*

Grid box

***Property:** the name of the property or parameter that is written to ifcProjectedCRS and/or IfcMapConversionScaled and/or IfcRigidOperation, or for before Ifc 4x3, IfcMapConversion EPset.*

***Type:** the type of the property or parameter. The **Type** can not be changed.*

***Value:** the value to write out to ifcProjectedCRS/IfcMapConversionScaled/IfcRigidOperation.*

,**Get Map Coordinates** button

*Pressing this button loads the values from the **Project** attribute group **ifc_attributes/Map Coordinates** into the fields of this tab.*

***Note:** when the* **Write Infrastructure IFC File** *is started, the values from the **Project** attribute group **ifc_attributes/Map Coordinates** are automatically loaded into the fields of the **Placement tab** so this button only needs to be used if the Project attributes are modified after the panel has started and the new values are required.*

Set Map Coordinates button

*Pressing this button loads the values in the **Placement** tab into the **Project** attributes group **ifc_attributes/Map Coordinates***

> ***Note:*** *this is only necessary if you have changed any values in the* ***Placement*** *tab and the new values are to be stored in the Project attribute group* ***ifc_attributes/Map Coordinates.***

Important Note

If the ***12d Model*** data is **already in Map Coordinates** (which most infrastructure data is), then the **Placement type** of ***Map Coordinates to Map Coordinates*** is used. The values for **X/Eastings**, **Y/Northings**, **Z/Height**, ***XY clockwise rotation***, **Scale**, **FactorX**, **FactorY** and **FactorZ** are ignored.

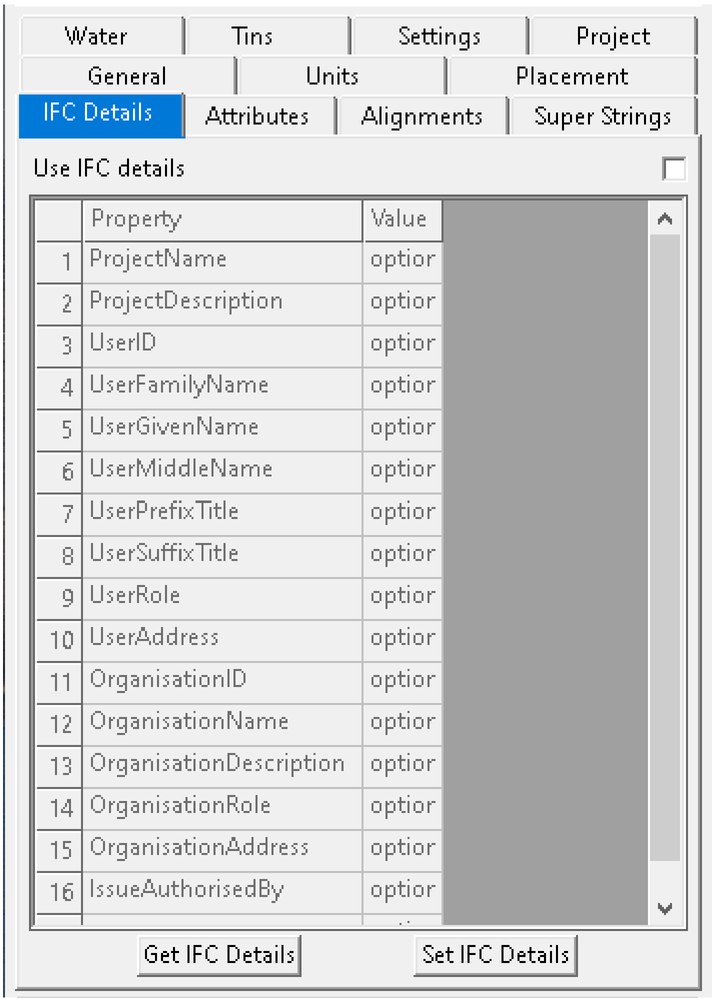
If the ***12d Model*** data is in **truncated Map Coordinates**, then the **Placement type** of ***Translate to Map Coordinates*** is used, and the translation values to reverse the truncation are placed in **X/Eastings, Y/Northings** and **Z/Height**. But ***XY clockwise rotation***, **Scale**, **FactorX**, **FactorY** and **FactorZ** are ignored.

Continue to 11.1.2.1.5 Write Infrastructure IFC File - IFC Details tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.5 Write Infrastructure IFC File - IFC Details tab

The ***Project Details*** tab is used to supply data used in the header records of the IFC file.

Note: when the **Write Infrastructure IFC File** panel is started, the values from the **Project** attribute group ***ifc_attributes/Project Details*** are automatically loaded into the fields of **IFC Details** tab.



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

IFC Details tab

Use IFC details tick box not ticked

*If **ticked**, IFC files will include information specified in the Grid box.*

***Note**: When exporting project details, the details will be updated when exporting the IFC file for the current project ??.*

Get IFC Details button

*Pressing this button loads the values from the **Project** attribute group **ifc_attributes/Project Details** into the fields of this tab.*

***Note:** when the* **Write Infrastructure IFC File** *is started, the values from the **Project** attribute group **ifc_attributes/Project Details** are automatically loaded into the fields of the **IFC Details** tab so this button only needs to be used if the Project attributes have been modified after the panel has started and the new values are to be stored.*

Set IFC Details button

*After pressing the button, the values in the **IFC Details** tab are loaded into **Project** attributes group*

ifc_attributes/Project Details

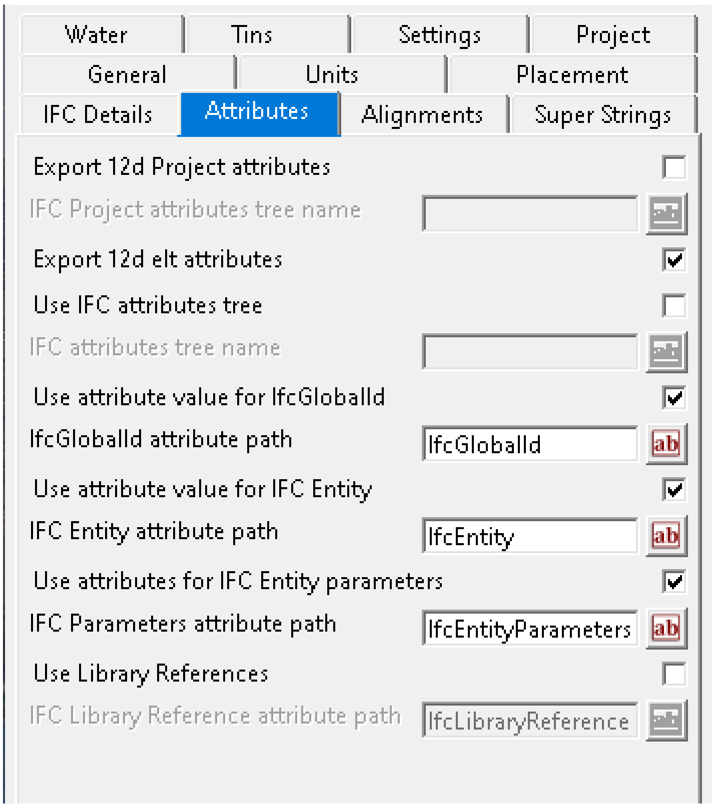
Note: *this is only necessary if you have changed values in the* ***Project Details*** *tab and the new values are to be stored in the Project attribute group* ***ifc_attributes/Project Details****.*

These are written out to the IFC file in the STEP format as:

ISO-10303-21;
HEADER;
FILE_DESCRIPTION (('ViewDefinition[CoordinationView]'), '2;1');
FILE_NAME ('test.ifc', '2020-11-18T13:52:09', ('user given name user family name'),
('organisation name'), 'IFC Engine rev 1198', '12d Model 15.0', '**issue authorised by**');
FILE_SCHEMA (('IFC4'));
ENDSEC;
DATA;
#1 = IFCPROJECT('2PBQkp0JP64RiSzyDBG3TM', #2, '**project name**', '**project description**',
$, $, $, (#16), #11);
#2 = IFCOWNERHISTORY(#3, #10, $, .ADDED., $, $, $, 1605667929);
#3 = IFCPERSONANDORGANIZATION(#4, #7, $);
#4 = IFCPERSON($, '**user family name'**, '**user given name'**, ('**middle name**'), ('**user prefix**'),
('**user suffix'**), (#5), (#6));
#5 = IFCACTORROLE(.CIVILENGINEER., '**user role'**, $);
#6 = IFCPOSTALADDRESS(.OFFICE., $, $, $, ('**user address**'), $, $, $, $, $);
#7 = IFCORGANIZATION($, '**organisation name**', '**organisation description**', (#8), (#9));
#8 = IFCACTORROLE(.CONSULTANT., '**organisation role'**, $);
#9 = IFCPOSTALADDRESS(.OFFICE., $, $, $, ('**organisation address**'), $, $, $, $, $);
For information on the STEP format see 30.4.1 IFC STEP File Format:

Continue to 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.6 Write Infrastructure IFC File - Attributes tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Attributes tab

Export 12d Project attributes tick box not ticked

*If **Export 12d Project attributes** is **ticked**, then* **12d Model** *Project attributes in the attributes tree given in **IFC Project attributes tree name**, are written out as **IfcPropertySet's** on **IfcProject**. See the field* **IFC project attributes tree name** *for more details.*

IFC project attributes tree name text box

If **Export 12d Project attributes** *is **ticked**, then those project attributes in the nodes under the attribute tree* **IFC Project attributes tree name** *are written out to the IFC file. And for **each node** a Property set is created with that **node name**, and all the attributes **under that node are written out** to that property set. See* 11.1.2.1.6.1.1 Writing 12d Project Attributes *for more details.*

If **Export 12d project attributes** *is **not ticked**, then no project attributes are written out to the IFC file.*

Export 12d elt attributes tick box ticked

*If **ticked**, the attributes of the selected* **12d Model** *elements are written to the IFC file.*

Use IFC attributes tree tick box not ticked

*If **Use IFC attributes tree** is **NOT ticked**, then the string attributes of a* **12d Model** *element that is written out, are written to an IfcPropertySet called **12d Model**. The attributes have the same tree structure in the Property Set as they have inside* **12d Model**.

*If **Use IFC attributes tree** is **ticked**, then only the string attributes that are in nodes under **IFC attributes tree name** are written out. For more information, see the documentation on the field* **IFC attributes tree name**.

IFC attributes tree name text box

*If **Export attributes** and* **Use IFC attribute tree** *are ticked, then only those string attributes in the nodes under the attribute tree* **IFC attributes tree name** *are written out to the IFC file.*

*And then for **each node** under the attribute tree given in I***FC attributes tree name***, a Property set is created with that **node name**, and all the attributes **under that node are written out** to that property set.*

For example, a 12d element had the following string attributes:

Description/Name
Water/Type
Water/SEW/Owner
IFC Data/SH/Properties/Name
IFC Data/SH/Properties/Diameter
IFC Data/SH/Connections/Type

then if **IFC attributes tree name** *was **"IFC Data/SH"** there would be **two** Property Sets created called **Properties** (with the attributes **Name** and **Diameter**) and **Connections** (with the attribute **Type**).*

*The attributes **Water/SEW/Owner**, **Description/Name** and **Water/Type** would not be written out.*

For an example, see 11.1.2.1.6.1.2 Writing 12d Element Attributes.

Use attribute value for IfcGlobalId tick box ticked

*If **Use attribute value as IfcGlobalId** is **ticked**, then when writing out an element, the value in the* **IfcGlobalId attribute path** *is checked and if it is **not blank**, its value is used as the* GlobalId *of the IFC entity created when writing the element out. If* **IfcGlobalId attribute path** *is **blank**, the **GlobalId** is calculated and used as the* GlobalId *of the IFC entity created when writing the element out. The calculated GlobalId is also saved to the attribute* **IfcGlobalId attribute path** *of the* **12d Model** *element. For an example, wee* 11.1.2.1.6.1.3 Writing Attribute for IfcGlobalId.

*If **Use attribute value for IfcGlobalId** is **not ticked**, then when writing out an element, a GlobalId is calculated and used as the IfcGlobalId when writing the element out. The calculated GlobalId is not saved in the attribute* **IfcGlobalId attribute path.**

IfcGlobalId attribute path text box ifcGlobalId

Attribute to use for the GlobalId *of the IFC entity that each 12d element written to in the IFC file.*

Use attribute value for IFC Entity tick box ticked

*If **Use attribute value for IFC Entity** is **ticked**, then when writing out an element, the value in the **IfcEntity attribute path** is checked and if it is **not blank**, its value is used as the IFC entity when writing the 12d element out to the IFC file.*

*If **Use attributes as IFC Element Type** is **not ticked**, then the **ifcBuildingElementProxy** is used.*

IFC Entity attribute path text box ifcEntity

Attribute to use as the IFC entity.

*If **IFC Entity attribute path** is **blank** or **invalid**, then the IFC entity type defaults to **ifcBuildingElementProxy**. An Entity type may be **invalid** if the given Ifc Entity does not exist for that version of IFC or is abstract. For a list of the non-abstract IFC entities that can be used in IFC 4x3, see* 30.4.8 List of Non-Abstract Entities Derived from IfcProduct. *For an example of using 12d element attributes, see* 11.1.2.1.6.1.4 Writing Attribute for IFC Entity.

***Note**: this is **not** used for Super Alignments or Tins in **IFC4x1** and later. In that case **IfcAlignment** and ?? are automatically are used.*

Use attributes for IFC Entity parameters tick box ticked

*if **ticked**, the parameters of the ifcEntity can be set using the attribute group specified by the **IFC Parameters attribute path**. Only valid parameters will be set as the ifcEntity parameter - to check which attributes you can set see https://standards.buildingsmart.org/IFC/RELEASE/ and pick the IFC version and ifcEntity type.*

Note: only numeric and text attributes, such as Enums, can be set.

IFC Parameters attribute path text box IfcElementParameters

Path to the attribute group where the ifcElement parameters are defined. For an example, see 11.1.2.1.6.1.5 Writing Attributes for IFC Entity Parameters.

Use attributes for IFC Assembly parameters tick box ticked

*If **ticked**, the parameters of the ifcElementAssembly can be set using the attribute group specified by the IFC Assembly Parameters attribute path. Only valid parameters will be set for the ifcElementAssembly.*

Note: only numeric and text attributes, such as Enums, can be set.

IFC Assembly Parameters attribute path text box IfcAssemblyParameters

Path to the attribute group where the ifcElementAssembly parameters are defined.

Use Library References tick box ticked

*If **ticked**, ??*

IFC Library Reference attribute path text box IfcLibraryReference

??

For examples of setting up information for the Attributes tab, see 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File.

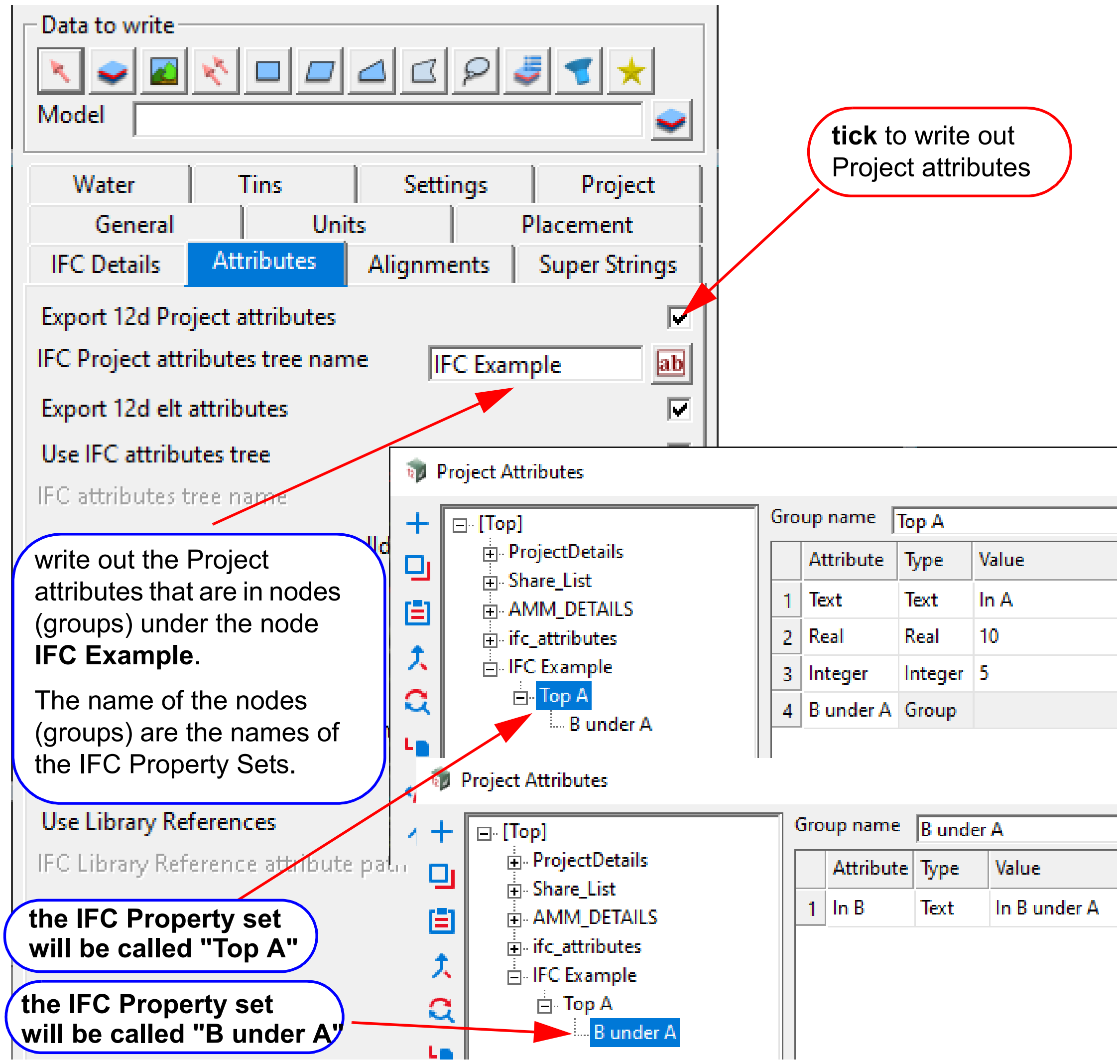
Continue to 11.1.2.1.7 Write Infrastructure IFC File - Alignments tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File

See

11.1.2.1.6.1.1 Writing 12d Project Attributes
11.1.2.1.6.1.2 Writing 12d Element Attributes
11.1.2.1.6.1.3 Writing Attribute for IfcGlobalId
11.1.2.1.6.1.4 Writing Attribute for IFC Entity
11.1.2.1.6.1.5 Writing Attributes for IFC Entity Parameters

11.1.2.1.6.1.1 Writing 12d Project Attributes



The record in the IFC STEP file for the trimesh "AC" is:

Property Set called "Top A" **"Top A" contains four items**

```
#1 = IFCPROJECT('3cIB6Zas1CIvOsV8A1CUXZ', #2, 'DESIGN ROADS', '', $, $, $, (#12), #7);
#19 = IFCPROPERTYSET('17j2TvEf5CG8Y$8b1nC4dG', #2, 'Top A', $, (#20, #21, #22, #23));

#20 = IFCPROPERTYSINGLEVALUE('Text', $, IFCLABEL('In A'), $);
#21 = IFCPROPERTYSINGLEVALUE('Real', $, IFCREAL(10.), $);
#22 = IFCPROPERTYSINGLEVALUE('Integer', $, IFCINTEGER(5), $);

#23 = IFCCOMPLEXPROPERTY('B under A', $, '12d_attribute_group', (#24));
#24 = IFCPROPERTYSINGLEVALUE('In B', $, IFCLABEL('In B under A'), $);

#25 = IFCRELDEFINESBYPROPERTIES('0kBbQe6ILEQ9xviqPtctdj', #2,'Prj Prop Sets', 'Custom', (#1), #19);
```

#23 is Complex and so contains other items

"B under A" contains on item

the Property Set defined by #19 is attached to IfcProject #1

Import Notes:

1. The only attributes under **IFC Example** are nodes (groups) and the node (group) name is the name of the **IFC Property Set.** So a Ifc Property Set called "Top A" is created.

2. Any non-node (group) attributes under **IFC Examples** will not be written out.

For information on the STEP format for an IFC file, see 30.4.1 IFC STEP File Format.

For a description of ***IFC Property Sets*** see 30.4.7 IFC Property Sets, IFC Properties and Psets.

Continue to 11.1.2.1.6.1.4 Writing Attribute for IFC Entity ore return to 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File or 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab.

11.1.2.1.6.1.2 Writing 12d Element Attributes

For the example in the Alignments tab, the 12d element has the following string attributes:

Description/Name

Water/Type

Water/SEW/Owner

IFC Data/SH/Properties/Name

IFC Data/SH/Properties/Diameter

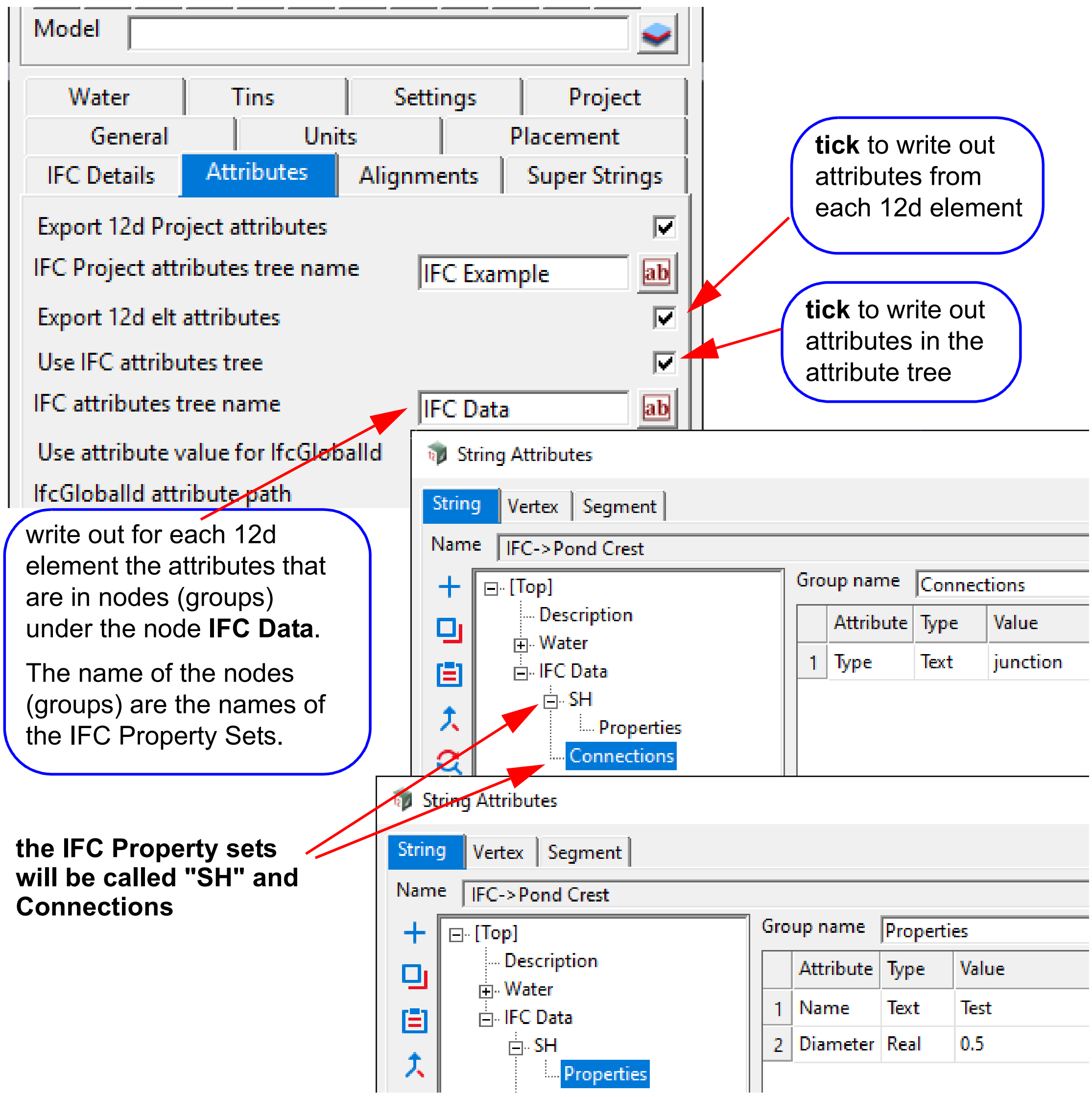
IFC Data/SH/Connections/Type

The string "Pond Crest" has been given that attribute structure and is selected for writing out to the IFC file.

The **IFC attributes tree name** is given as **IFC Data**.

Then in the IFC file there will be **two *IFC Property Sets*** created called **Properties** (with the attributes **Name** and **Diameter**) and **Connections** (with the attribute **Type**) for the string "Pond Crest".

The attributes **Description/Name**, **Water/Type** and **Water/SEW/Owner** would not be written out.



The record in the IFC STEP file for the string "Point Crest" is:

Property Set called "SH"

"SH" contains one item#1115

```
#26 = IFCANNOTATION('37H4sfW7f8Pe0f6jAkWQF$', #2, 'Pond Crest', $, 'Super', #13, $, .NOTDEFINED.);

#1114 = IFCPROPERTYSET('0oeTAlPgn9kB39zwCyVz3V', #2, 'SH', $, (#1115));

#1115 = IFCCOMPLEXPROPERTY('Properties', $, '12d_attribute_group', (#1116, #1117));

#1116 = IFCPROPERTYSINGLEVALUE('Name', $, IFCLABEL('Test'), $);
#1117 = IFCPROPERTYSINGLEVALUE('Diameter', $, IFCREAL(5.E-1), $);

#1118 = IFCRELDEFINESBYPROPERTIES('1yfQqQBVT22w60WcjOCX0P', #2, '12d Prop Sets',
                                   'Str Att', (#26), #1114);

#1119 = IFCPROPERTYSET('11H2pcmbn8Lu975dNoGOL5', #2, 'Connections', $, (#1120));
```

#1115 is Complex and contains two items #1116, #1117

Property Set SH is added to #26

Property Set called "Connections"

"Connections" contains one item#1120

```
#1120 = IFCPROPERTYSINGLEVALUE('Type', $, IFCLABEL('junction'), $);
#1121 = IFCRELDEFINESBYPROPERTIES('17UX7rpd54RO7f3YOxcvNo', #2, '12d Prop Sets',
                                          'Str Att', (#26), #1119);
```

Property Set Connections defined by #1119 is attached to #26 which is string "Pond Crest"

Import Notes:

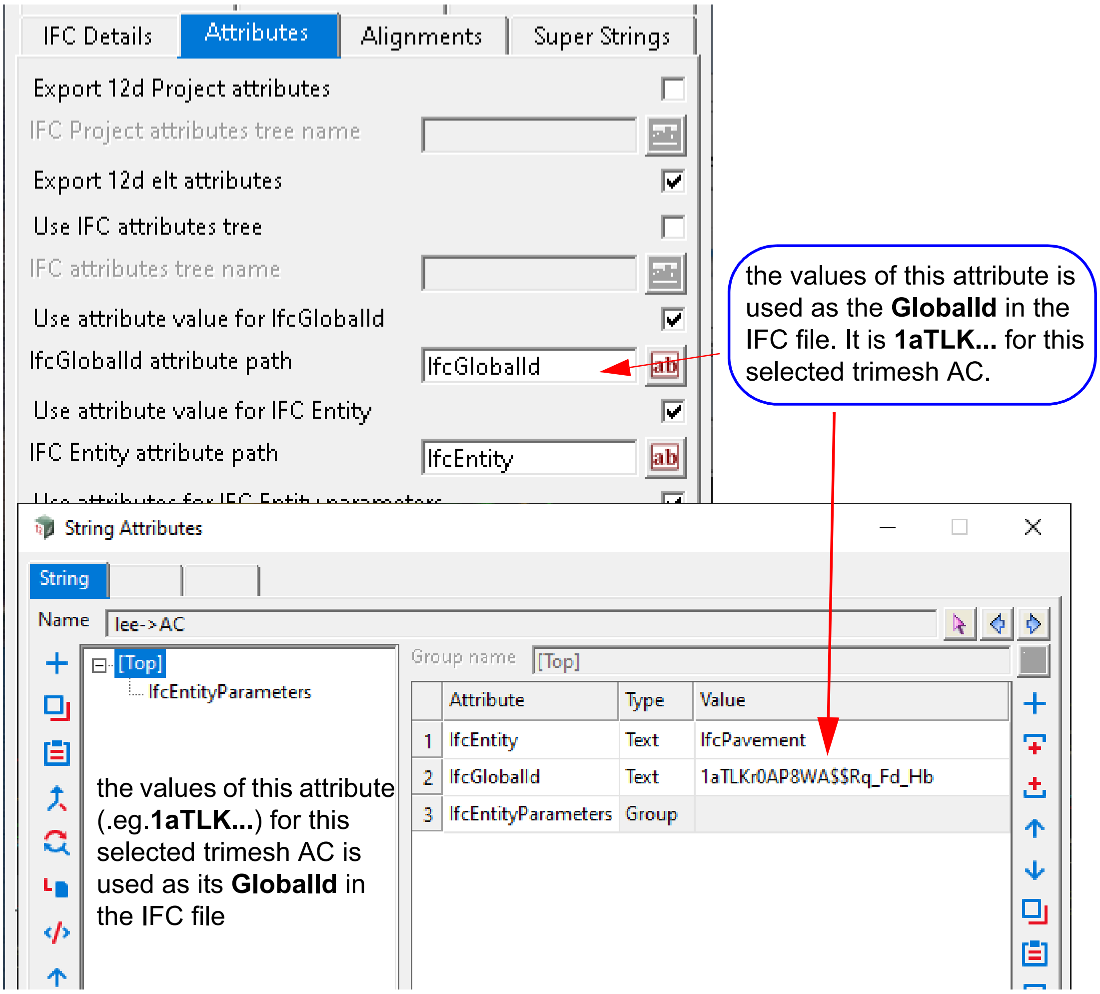
1. For each selected 12d element being written out to the IFC file, the node (group) **IFC Data** is looked for, and if found, used for writing out IFC Property Sets. The attributes under **IFC Data** can be different for different 12d elements.
2. For the string "Pond Crest", the only attributes under **IFC Data** are nodes (groups) and the node (group) names are used as the names of the **IFC Property Set’s.** So IFC Property Sets called "SH" and "Connections" are created.
3. For the string "Pond Crest", the nodes (groups) **Description** and **Water** attributes are not under **IFC Data** and so are not written out to the IFC file.

For information on the STEP format for an IFC file, see 30.4.1 IFC STEP File Format.

For a description of ***IFC Property Sets*** see 30.4.7 IFC Property Sets, IFC Properties and Psets.

Continue to 11.1.2.1.6.1.3 Writing Attribute for IfcGlobalId ore return to 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File or 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab.

11.1.2.1.6.1.3 Writing Attribute for IfcGlobalId



The record in the IFC STEP file for the trimesh "AC" is:

IfcEntity **Att 1 GlobalId** **Att 3 Name - this is given the name of the trimesh**

```
#26 = IFCPAVEMENT('1aTLKr0AP8WA$$Rq_Fd_Hb', #2, 'AC', '27 Dam St', 'Trimesh', #13, #27, $, .FLEXIBLE.)
```

Import Notes:

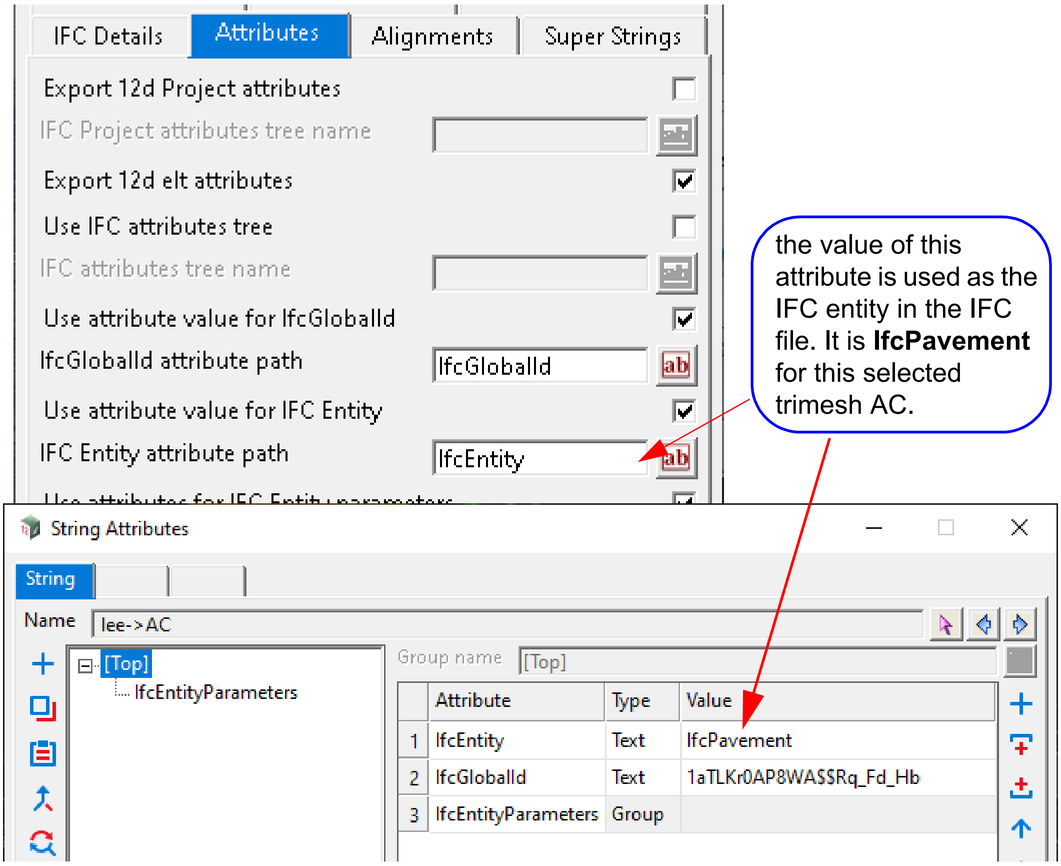
1. The value of GlobalId is automatically generated and written into the given attribute when the data is first written to the an IFC file. It will then already exist the next time another IFC is written.

For information on the STEP format for an IFC file, see 30.4.1 IFC STEP File Format.

For a description of ***IfcPavement***, see 30.4.2.1.2.1.2.1.3 IfcPavement.

Continue to 11.1.2.1.6.1.4 Writing Attribute for IFC Entity ore return to 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File or 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab.

11.1.2.1.6.1.4 Writing Attribute for IFC Entity



The record in the IFC STEP file for the trimesh "AC" is:

IfcEntity **Att 1 GlobalId** **Att 3 Name - this is given the name of the trimesh**

```
#26 = IFCPAVEMENT('1aTLKr0AP8WA$$Rq_Fd_Hb', #2, 'AC', '27 Dam St', 'Trimesh', #13, #27, $, .FLEXIBLE.)
```

Import Notes:

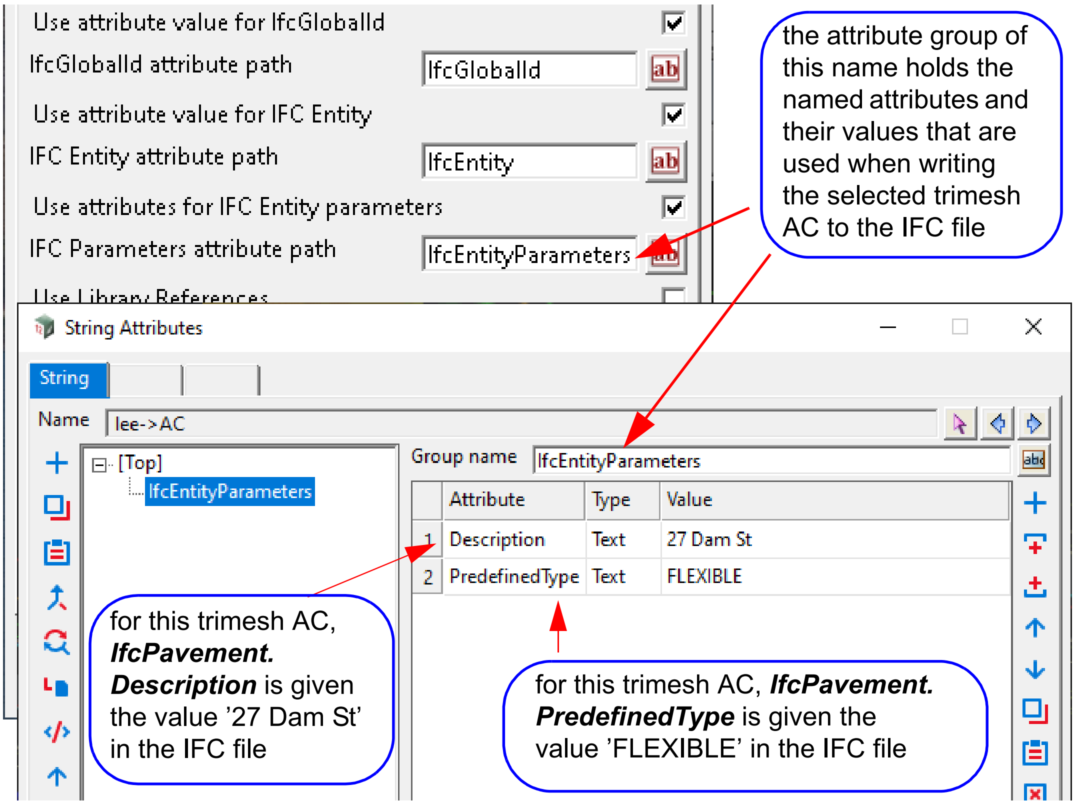
1. The valid names for IFC entities is given in the IFC Specification. For some examples, see 30.4.8.2 Non-Abstract Entities Derived from IfcProduct in IFC 4x3 in 11 BIM.
2. Att 3 Name - the default is to use the ***12d Model*** element name but this can be overridden by IFC Entity Parameters. See 11.1.2.1.6.1.5 Writing Attributes for IFC Entity Parameters.

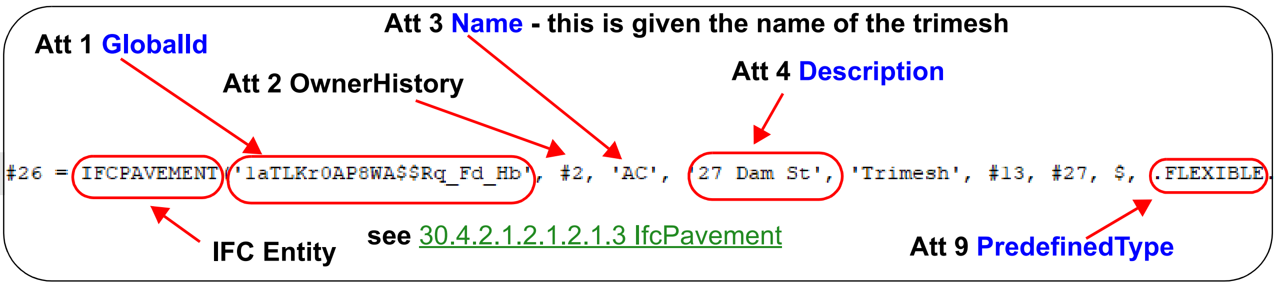
For information on the STEP format for an IFC file, see 30.4.1 IFC STEP File Format.

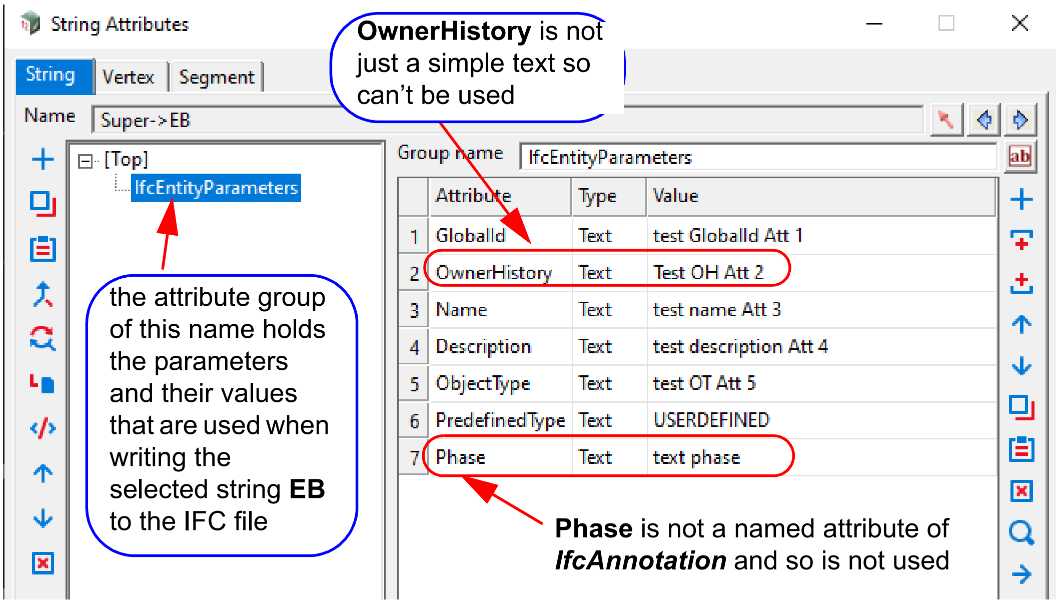
For a description of ***IfcPavement***, see 30.4.2.1.2.1.2.1.3 IfcPavement.

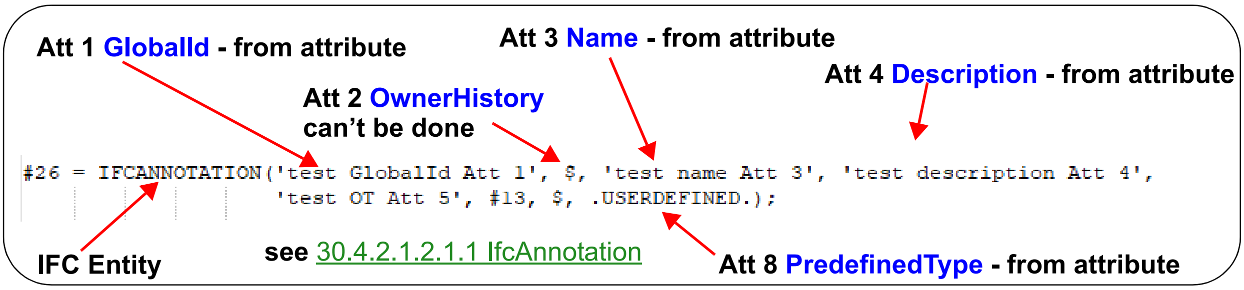
Continue to 11.1.2.1.6.1.5 Writing Attributes for IFC Entity Parameters ore return to 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File or 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab.

11.1.2.1.6.1.5 Writing Attributes for IFC Entity Parameters









Notes

1. **OwnerHistory** is not just simple text so can’t be set by **IfcEntityParemeters**
2. Named Attribute 6 **ObjectPlacement** and named attribute 7 **Representation** can’t be set by **IfcEntityParemeters**
3. **PredefinedType** can only have certain values (enumerations)
4. **PredefinedType** is named attribute 9 in ***IfcPavement*** but is named attribute 8 in ***IfcAnnotation***.

Import Note:

The valid names for the **IfcEntityParameters** are given in the IFC Specification. For some examples, see 30.4.2 IfcRoot and SubTypes in 11 BIM.

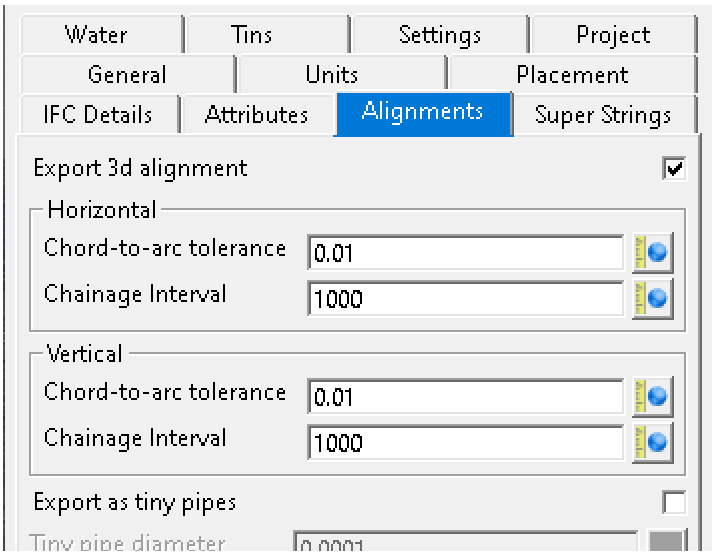
For information on the STEP format for an IFC file, see 30.4.1 IFC STEP File Format.

For a description of ***IfcPavement***, see 30.4.2.1.2.1.2.1.3 IfcPavement.

For a description of ***IfcAnnotation***, see 30.4.2.1.2.1.1 IfcAnnotation.

Continue to 11.1.2.1.7 Write Infrastructure IFC File - Alignments tab ore return to 11.1.2.1.6.1 Examples of Setting up 12d Model Attributes for the IFC File or 11.1.2.1.6 Write Infrastructure IFC File - Attributes tab or 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.7 Write Infrastructure IFC File - Alignments tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Alignments tab

Export 3D alignment tick box not ticked

*If **ticked**, an IFC 3D alignment is also written out for each super alignment.*
*If **not ticked**, an IFC 3D alignment is not written out for each super alignment.*

Horizontal

Chord to arc tolerance real box

*If **non-zero** and **Output 3D alignment** is **ticked** and the Version is **not IFC 4x3**, the horizontal arcs of super alignments are broken up using this chord-to-arc tolerance interval when written as an IFC 3D alignment (basically a series of 3D straights).*

*If the version **is IFC 4x3,** then **this option is ignored** and a parametric representation of the alignment's horizontal and vertical geometry is used for the 3D alignment.* 3.25.2 Chord-to-Arc Tolerance.

Chainage Interval real box

*If **non-zero** and **Output 3D alignment** is **ticked** and the Version is **not IFC 4x3**, the horizontal straights of super alignments are broken up using this chainage interval when written as an IFC 3D alignment (basically a series of 3D straights).*

*If the version **is IFC 4x3**, then this **option is ignored** and a parametric representation of the alignment's horizontal and vertical geometry is used for the 3D alignment.* 3.25.1 Chainage Interval.

Vertical

Chord to arc tolerance real box 0.01

*If **non-zero** and **Output 3D alignment** is **ticked** and the Version is **not IFC 4x3**, the vertical arcs and parabolas of super alignments are broken up using this arc-to-chord tolerance when written as an IFC 3D alignment (basically a series of 3D straights).*

*If the version **is IFC 4x3**, then **this option is ignored** and a parametric representation of the alignment's horizontal and vertical geometry is used for the 3D alignment.* 3.25.2 Chord-to-Arc Tolerance.

Chainage interval real box 10

*If **non-zero** and **Output 3D alignment** is **ticked** and the Version is **not IFC 4x3**, the vertical straights of super alignments are broken up by this chainage interval when written as an IFC 3D alignment (basically a series of 3D straights).*

*If the version **is IFC 4x3**, then **this option is ignored** and a parametric representation of the alignment's horizontal and vertical geometry is used for the 3D alignment.* 3.25.1 Chainage Interval.

Export as tiny pipes tick box not ticked

*If **ticked**, all super alignments with zero diameter are written out with the diameter given in* **Tiny pipe diameter**.

*This is needed because some software (for example **Solibri**, **Revit** and **NavisWorks**) can not display IFC's of strings with no diameter.*

*So this needs to be **ticked** when writing out IFC's to **Solibri**, **Revit** and **NavisWorks**.*

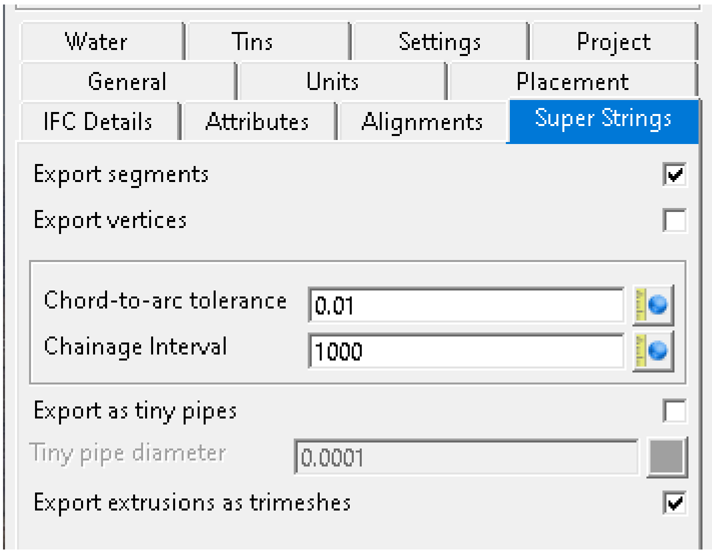
Tiny pipe diameter real box 0.0001

A small diameter for super strings that do not have a diameter.

See For example, for the Horizontal Geometry: and For example, for the Vertical Geometry:.

Continue to 11.1.2.1.8 Write Infrastructure IFC File - Super Strings tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.8 Write Infrastructure IFC File - Super Strings tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Super Strings tab

Export segments tick box ticked

*If **ticked**, each super string segment will be exported as its own IfcEntity attached to the IfcEntity for the super string via IfcRelNests. Each segment can optionally have properties exported if **Export Attributes** is selected in the **Attributes tab**. If **Chord to arc tolerance** is **non-zero** then each chord will be associated with the IfcEntity for the super string segment.*

*If **not ticked,** all super string geometry is associated with the IfcEntity for the entire super string, however segment attributes **will not** be included in the generated IFC file.*

*When this option is set as **not ticked** the **Arc to chord** option will also be set to **not ticked**.*

Export vertices tick box ticked

*If **ticked**, each super string vertex will be exported as its own IfcEntity attached to the IfcEntity for the super string via IfcRelNests. Each vertex can optionally have properties exported if **Export Attributes** is selected in the **Attributes tab**.*

*If **not ticked**, all super string geometry is associated with the IfcEntity for the entire super string, however **vertex attributes will not** be included in the generated IFC file.*

Chord to arc tolerance real box 0.01

*If **non-zero,** the* **chord to arc tolerance** *is used to break arcs into straight segments.* 3.25.2 Chord-to-Arc Tolerance

Chainage interval real box 10

*If **non-zero**, the* **Chainage interval** *is used to split straight segments.* 3.25.1 Chainage Interval

Export as tiny pipes tick box not ticked

*If **ticked**, all super alignments with zero diameter are written out with the diameter given in* **Tiny pipe diameter**.

*This is needed because some software (for example **Solibri**, **Revit** and **NavisWorks**) can not display IFC's of strings with no diameter.*

*So this needs to be **ticked** when writing out IFC's to **Solibri**, **Revit** and **NavisWorks**.*

Tiny pipe diameter real box 0.0001

A small diameter for super strings without an actual diameter.

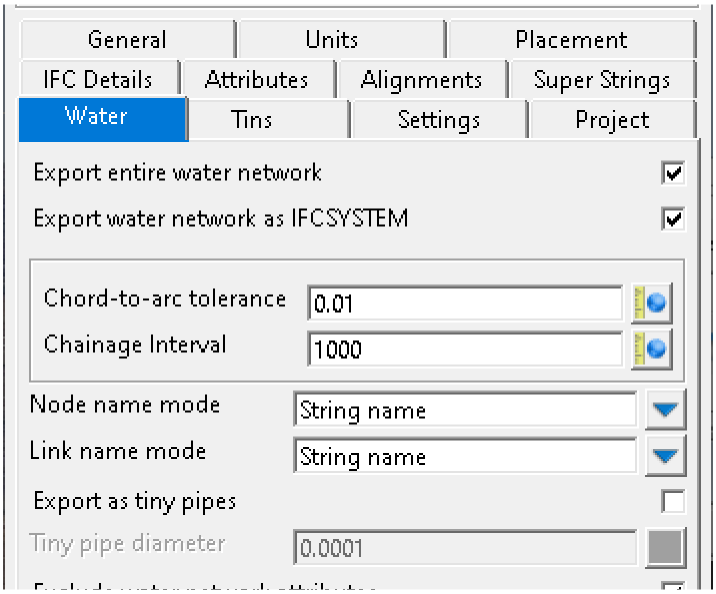
Export extrusions as trimeshes tick box ticked

*If **ticked**, convert string extrusions to trimeshes before exporting.*

*If **not ticked**, export the string extrusion as a swept solid with the profile defined by the extrude for the string.*

Continue to 11.1.2.1.9 Write Infrastructure IFC File - Water tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.9 Write Infrastructure IFC File - Water tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Water tab

Export entire water network tick box ticked

*If **ticked**, the whole water network is exported.*

*If **not ticked**, only the individual water strings that have been selected are exported.*

Export water as IFCSYSTEM tick box ticked

*If **ticked**, water links and nodes are written out as IfcDistributionChamberElement in IFC 4+ and IfcFlowStorageDevice in version IFC2x3.*

*If **not ticked**, water links and nodes are written out as IfcBuildingElementProxy.*

This is needed because some software (for example Revit and NavisWorks) will not read in all of the entities in IfcSystem

*When writing out IFC's to **NavisWorks** this needs to be **not ticked** because **NavisWorks** does not support IfcFlowStorageDevice. See 30.4.2.1.2.1.2.1.5 IfcBuildingElementProxy and 30.5.2.1.1 IfcFlowStorageDevice.*

Chord to arc tolerance real box

*If **non-zero**, water string arcs are broken up by this chord-to-arc tolerance before writing them out to the IFC File (basically a series of 3D straights). See 3.25.2 Chord-to-Arc Tolerance.*

Chainage Interval real box

*If **non-zero,** water string straights are broken up by the Chainage interval before writing them out to the IFC File (basically a series of 3D straights). See 3.25.1 Chainage Interval*

Node name mode choice box String name, String name ->Node name, Node name

Naming convention to use when writing out nodes for a Water string.

Link name mode choice box String name, String name ->Link name, Link name

Naming convention to use when writing out links for a Water string.

Export as tiny pipes tick box not ticked

*If **ticked**, all links with zero diameter are written out with the diameter given in* **Tiny pipe diameter**.

Tiny pipe diameter real box 0.0001

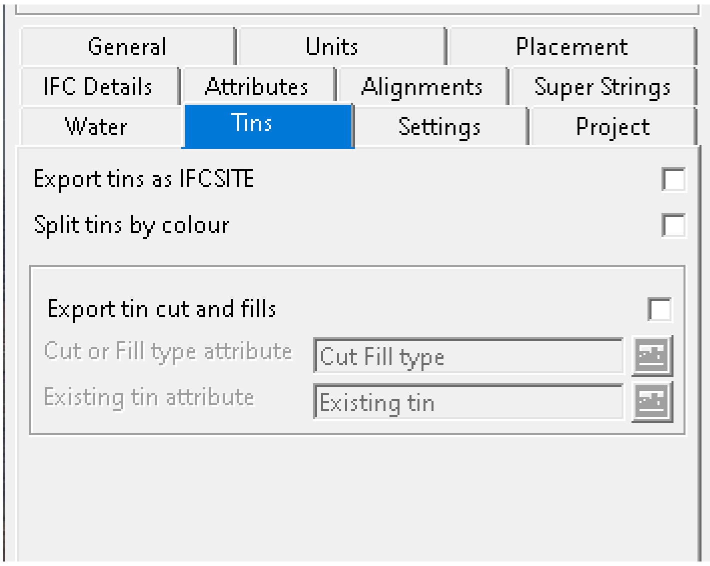
A small diameter for super strings without an actual diameter.

Exclude water network attributes tick box not ticked

*If **ticked**, the water network attributes are **NOT** written out.*
*If **not ticked**, the water network attributes are written out.*

Continue to 11.1.2.1.10 Write Infrastructure IFC File - Tins tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.10 Write Infrastructure IFC File - Tins tab



[Main]
[General tab]
[Units tab]
[Placement tab]
[IFC Details tab]
[Attributes tab]
[Alignments tab]
[Super Strings tab]
[Water tab]
[Tins tab]
[Settings tab]
[Project tab]

The fields and buttons used in this panel have the following functions.

Tins tab

Export tins as IFCSITE tick box not ticked

*If **ticked**, tins are written out to the Spatial Structure IFCSITE.*
*This needs to be **ticked** when writing out IFC's to **Revit**.*

Split tins by colour tick box not ticked

*If **ticked**, tins are split into triangulations of each unique colour.*

*This option is only valid when exporting in versions **IFC4x1**+.*

Export tin cut and fills tick box not ticked

*If **ticked**, trimeshes tagged with attributes from Cut or Fill type attribute and Existing tin attribute will exported as **IfcFeatureElementSubtraction** or **IfcFeatureElementAddition** entities for cut and fills respectively.*

***Note**: elements that contain an IFC element mapping that is not an IfcFeatureElement will be overridden.*

Cut or Fill type attribute text box Cut Fill type

Path to the attribute that holds either 'cut' or 'fill' depending on whether the element is a cut or a fill.

Existing tin attribute text box Existing tin

Path to the attribute that holds the name of the tin which the element is a cut or fill.

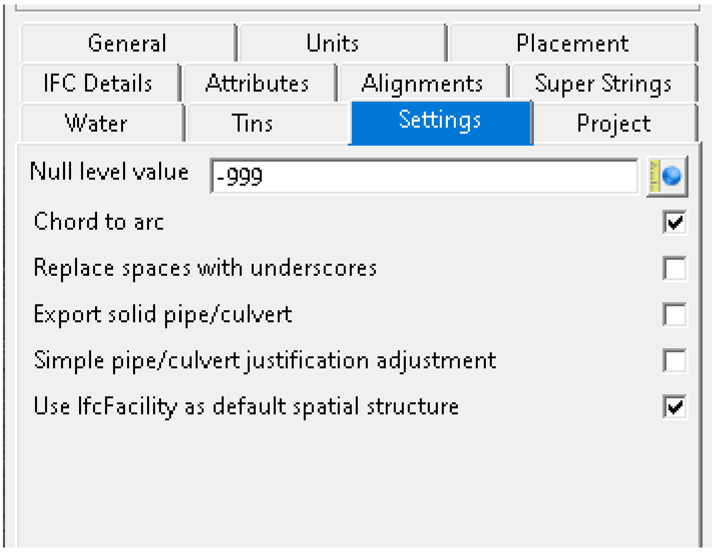
Note:

IFC 4x1 introduced an entity 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork.

For an example of a tin in an ***IFC 4x3*** STEP file, see 30.4.3.3.1.4.1.2.1.1 IFC STEP File Format For IfcTriangulatedIrregularNetwork.

Continue to 11.1.2.1.11 Write Infrastructure IFC File - Settings tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.11 Write Infrastructure IFC File - Settings tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Settings tab

Null level value real box -999

*Use this value in IFC for writing out **12d Model** null levels.*

***Warning:** many IFC reading software packages do not support null values.*

Chord to arc tick box ticked

*If **ticked**, super string will be broken into straight segments according to **Chord to arc tolerance** and **Chainage Interval** values. See* 3.25 Chainage Interval & Chord-to-arc Tolerance.

*If **not ticked**, curved segments of the super string will be exported as a profile swept along the segment or string.*

When **Export segments** *is **not ticked** in the **Super Strings tab,** the string profile will be swept over the whole string.*

***Warning**: Many IFC viewers do not support profiles swept along a defined path.*

Replace spaces with underscores tick box not ticked

*If **ticked**, replace the spaces in the element name with underscores for the exported IFC element.*

Export solid pipe/culvert tick box not ticked

*If **ticked**, super string pipes and culverts are written out as solid IFC elements.*

*If **not ticked**, super string pipes and culverts are written out as hollow IFC elements.*

Simple pipe/culvert justification adjustment tick box not ticked

*If **ticked**, super string pipes and culverts are adjusted vertically.*

*If **not ticked**, super string pipes and culverts are shifted along the direction of the pipe/culvert segment according to their grade.*

For a pipe/culvert defined along the invert, the first position of the pipe/culvert is taken as the physical invert of the profile.

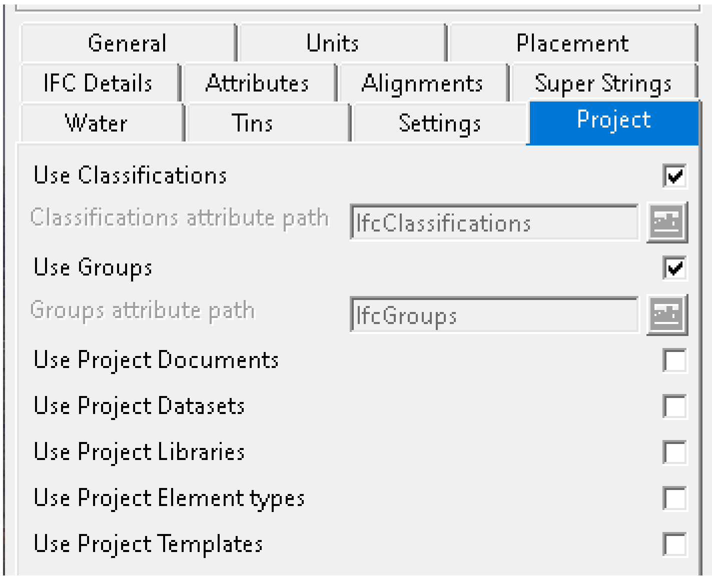
Use IfcFacility as default spatial structure tick box ticked

*If **ticked** this is a 4x3 only option that will replace IfcBuilding with IfcFacility as the default spatial* *structure for exported models.*

Note: if **Use Project Spatial Structure** *is ticked on the* 11.1.2.1.2 Write Infrastructure IFC File - General tab *then this field is ignored.*

Continue to 11.1.2.1.12 Write Infrastructure IFC File - Project tab or return to 11.1.2.1 IFC Infrastructure Writer.

11.1.2.1.12 Write Infrastructure IFC File - Project tab



Main
General tab
Units tab
Placement tab
IFC Details tab
Attributes tab
Alignments tab
Super Strings tab
Water tab
Tins tab
Settings tab
Project tab

The fields and buttons used in this panel have the following functions.

Project tab

Use Classifications tick box ticked

If ***ticked****, ??*

Classification attribute path text box

If ***not blank****, ??*

Use Groups tick box ticked

If ***ticked****, ??*

Groups attribute path text box

If ***not blank****, ??*

Use Project Documents tick box not ticked

If ***ticked****, ??*

Use Project Datasets tick box not ticked

If ***ticked****, ??*

Use Project Libraries tick box not ticked

If ***ticked****, ??*

Use Project Element types tick box not ticked

If ***ticked****, ??*

Use Project Templates tick box not ticked

If ***ticked****, ??*

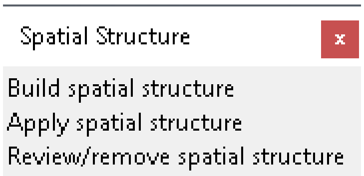
For information on what ***12d Model*** elements are written out to IFCs, and how they are written, see 30.3.1 Representing 12d Model Elements in IFC.

Continue to 11.1.3 IFC Spatial Structure or return to 11.1.2.1 IFC Infrastructure Writer or 11.1.2 IFC Output.

11.1.3 IFC Spatial Structure

[/Dest /spatial_structure /DEST pdfmark

Position of menu: **BIM =>IFC => Spatial structure**



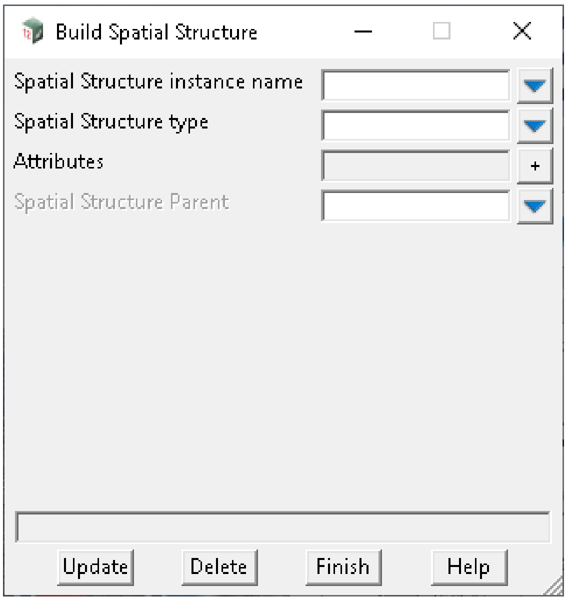
See
11.1.3.1 Build IFC Spatial Infrastructure
11.1.3.2 Apply IFC Spatial Infrastructure
11.1.3.3 Review/Remove Spatial Structure Elements

11.1.3.1 Build IFC Spatial Infrastructure

Position of option on menu: **BIM =>IFC =>Spatial structure =>Build spatial structure**

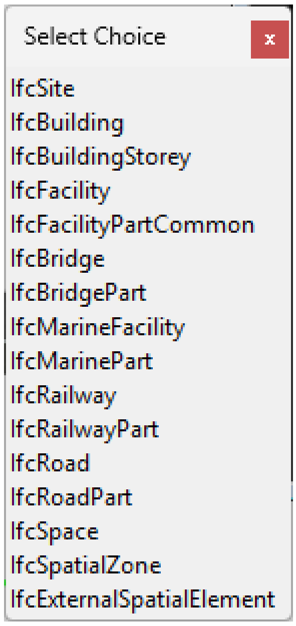
The **Build Spatial Structure** option is for defining the IFC Spatial Structure used in the current project.

Selecting **Build spatial structure** brings up the **Build Spatial Structure** panel.



Build SS Main

Spatial Structure type choice box



11.1.3.1.0.1 Build SS IfcSite

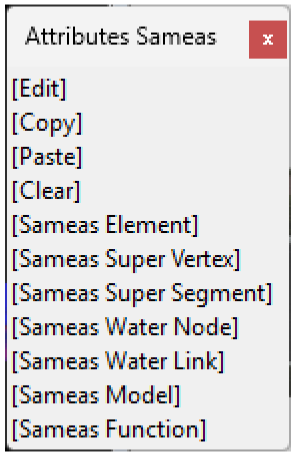
11.1.3.1.0.3 Build SS IfcRoad
11.1.3.1.0.4 Build SS IfcRoadPart

An instance of this **Spatial Structure type** *is created with the name given in the* **Spatial Structure instance name** *field.*

Spatial Structure instance name text box

Name of the instance of the Spatial Structure type to create.

Attributes choice box



Option to create attributes to attach to the instance of the Spatial Structure.

Buttons at Bottom

Update button

Create a subnode with the name given in the **Spatial Structure instance name** *under the Project attributes node **Ifc_attributes/Spatial Structure**.*

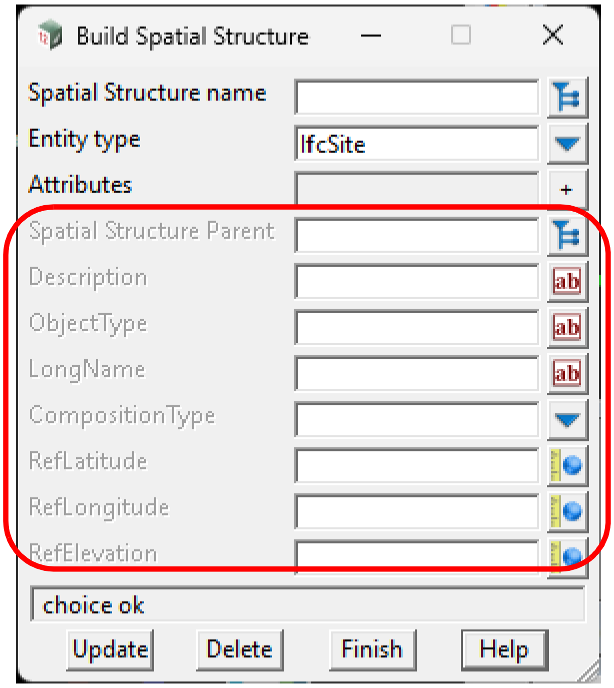
*Attributes **IfcEntity** and **IfcEntityParameters** and subnodes **IfcProperties** and **IFC Parent** are created under the new subnode with values that will depend on the* **Spatial Structure type**.

Delete button

Delete the subnode with the name given in the **Spatial Structure instance name** *field from the Project attributes node **Ifc_attributes/Spatial Structure**.*

Continue to 11.1.3.1.0.1 Build SS IfcSite or return to 11.1.3.1 Build IFC Spatial Infrastructure.

11.1.3.1.0.1 Build SS IfcSite



For each Spatial Structure type, see
11.1.3.1.0.1 Build SS IfcSite

11.1.3.1.0.3 Build SS IfcRoad
11.1.3.1.0.4 Build SS IfcRoadPart

The circled fields and buttons used in this panel are described below and the other fields and buttons are described in Build SS Main.

Field Description	Type	Defaults	Pop-Up

Build SS IfcSite

See 30.4.5.2.1.1 IfcSite

Spatial Structure Parent	choice box		list of already defined instances of spatial structures

Select the existing Spatial Structure that is the parent of this spatial structure. If the parent of this instance of IfcSite is IfcProject then this field is left blank.

Description, ObjectType, LongName, CompositeType

See 11.1.3.1.0.1.1 Description, ObjectType, LongName and CompositionType.

CompositionType	choice box		COMPLEX, ELEMENT, PARTIAL

See CompositionType.

RefLatitude

*If **not blank**, the latitude of a known point in the site. See* 30.4.5.2.1.1 IfcSite.

RefLongitude

*If **not blank**, the longitude of the same point as used in* **RefLongitude**. *See* 30.4.5.2.1.1 IfcSite.

RefElevation

*If **not blank**, the elevation of the same point as used in* **RefLongitude**. *See* 30.4.5.2.1.1 IfcSite.

Continue to 11.1.3.1.0.2 Build SS IfcFacility or return to 11.1.3.1 Build IFC Spatial Infrastructure.

11.1.3.1.0.1.1 Description, ObjectType, LongName and CompositionType

Description text

Text for **Description** *for this instance of the entity given in* **Spatial Structure type**. *See* 30.4.2 IfcRoot and SubTypes.

ObjectType text

Text for **ObjectType** *for this instance of the entity given in* **Spatial Structure type**. *See* 30.4.2.1.2 IfcObject.

If a field **PredefinedType** *exists for the panel and is* USERDEFINED *then the value of* **ObjectType** *is used for the* ***PredefinedType***. *See* 30.4.2.1.2 IfcObject.

LongName text

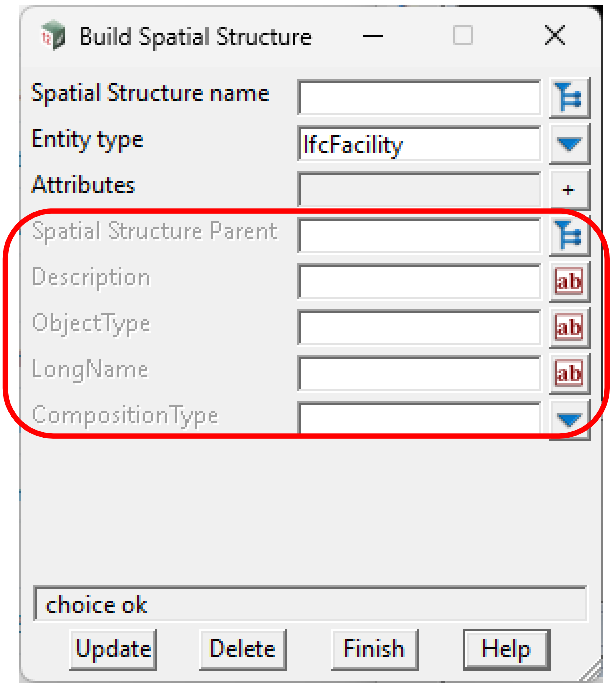
Text for **LongName** *for this instance of the entity given in* **Spatial Structure type.** *See* 30.4.5.2 IfcSpatialElement.

CompositionType choice box COMPLEX, ELEMENT, PARTIAL

See CompositionType.

Continue to 11.1.3.1.0.2 Build SS IfcFacility or return to 11.1.3.1.0.1 Build SS IfcSite or 11.1.3.1 Build IFC Spatial Infrastructure.

11.1.3.1.0.2 Build SS IfcFacility



The circled fields and buttons used in this panel are described below and the other fields and buttons are described in Build SS Main.

Field Description	Type	Defaults	Pop-Up

Build SS IfcFacility

See 30.4.5.2.1.2 IfcFacility

Spatial Structure Parent	choice box		list of already defined instances of spatial structures

Select the existing Spatial Structure that is the parent of this spatial structure.

Description, ObjectType, LongName, CompositeType

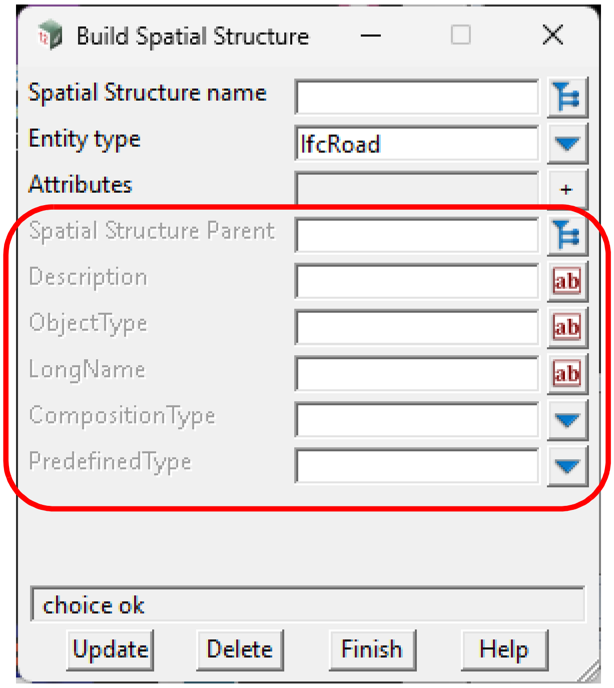
See 11.1.3.1.0.1.1 Description, ObjectType, LongName and CompositionType.

CompositionType	choice box		COMPLEX, ELEMENT, PARTIAL

See CompositionType.

Continue to 11.1.3.1.0.3 Build SS IfcRoad or return to 11.1.3.1 Build IFC Spatial Infrastructure.

11.1.3.1.0.3 Build SS IfcRoad



The circled fields and buttons used in this panel are described below and the other fields and buttons are described in [Build SS Main](#).

Field Description	Type	Defaults	Pop-Up

Build SS IfcRoad

See [30.4.5.2.1.2.1 IfcRoad](#)

Spatial Structure Parent	choice box		list of already defined instances of spatial structures

Select the existing Spatial Structure that is the parent of this spatial structure.

Description, ObjectType, LongName, CompositeType

See [11.1.3.1.0.1.1 Description, ObjectType, LongName and CompositionType](#).

CompositionType	choice box		COMPLEX, ELEMENT, PARTIAL

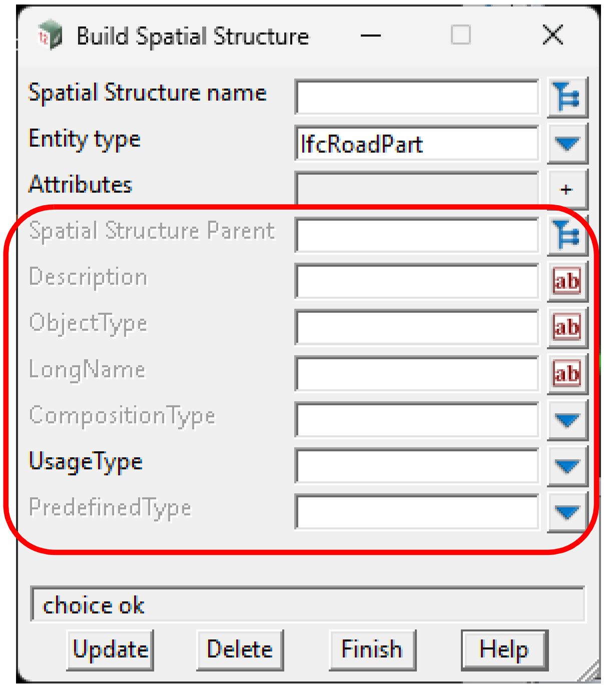
See [CompositionType](#).

PredefinedType	choice box		USERDEFINED, NOTDEFINED

*If **not blank**, the value for* **PredefinedType** *for this instance of the entity given in* **Spatial Structure type**.
See [30.4.5.2.1.2.1 IfcRoad](#)

Continue to [11.1.3.1.0.4 Build SS IfcRoadPart](#) or return to [11.1.3.1 Build IFC Spatial Infrastructure](#).

11.1.3.1.0.4 Build SS IfcRoadPart



The circled fields and buttons used in this panel are described below and the other fields and buttons are described in Build SS Main.

Field Description	Type	Defaults	Pop-Up

Build SS IfcRoadPart

See 30.4.5.2.1.3.1 IfcRoadPart

Spatial Structure Parent — choice box — list of already defined instances of spatial structures

Select the existing Spatial Structure that is the parent of this spatial structure.

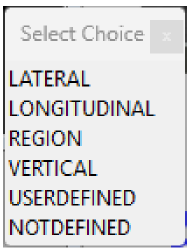
Description, ObjectType, LongName, CompositeType

See 11.1.3.1.0.1.1 Description, ObjectType, LongName and CompositionType.

CompositionType — choice box — COMPLEX, ELEMENT, PARTIAL

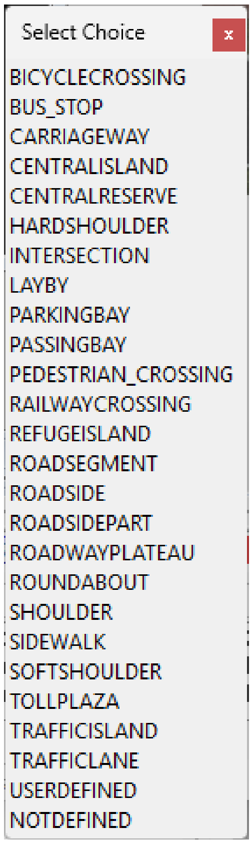
See CompositionType.

UsageType — choice box



*If **not blank**, the text for* **UsageType** *for this instance of the entity given in* **Spatial Structure type.** *For the definition of each choice, see* 30.4.5.2.1.3.1 IfcRoadPart.

PredefinedType choice box



*If **not blank**, the text for* **PredefinedType** *for this instance of the entity given in* **Spatial Structure type**. *For the definition of each choice, see* 30.4.5.2.1.3.1 IfcRoadPart.

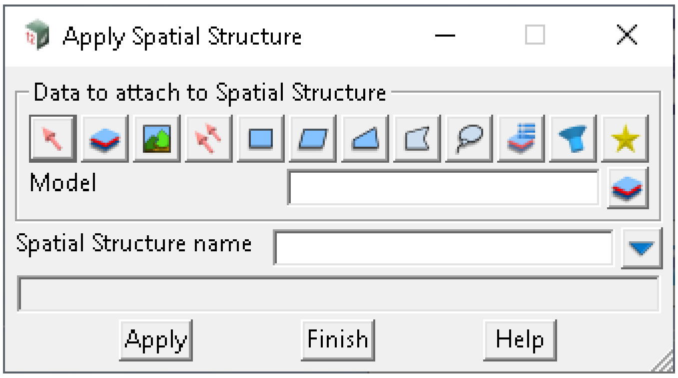
Continue to 11.1.3.2 Apply IFC Spatial Infrastructure or return to 11.1.3.1 Build IFC Spatial Infrastructure or 11.1.3 IFC Spatial Structure or 11.1 IFC.

11.1.3.2 Apply IFC Spatial Infrastructure

Position of option on menu: **BIM =>IFC =>Spatial structure =>Apply spatial structure**

The **Apply Spatial Structure** option applies the names of spatial structure element to ***12d Model*** element.s

Selecting **Apply spatial structure** brings up the **Apply Spatial Structure** panel.



Data to write data source

Data to search - for a full description go to 3.26.3 Data Source.

Selected data source input Model

Source of data to have an spatial structure instance name applied to it.

Spatial Structure instance name text box

Name of the instance of the Spatial Structure type to apply to the selected elements.

Apply button

Apply the **Spatial Structure instance name** *to the selected elements.*

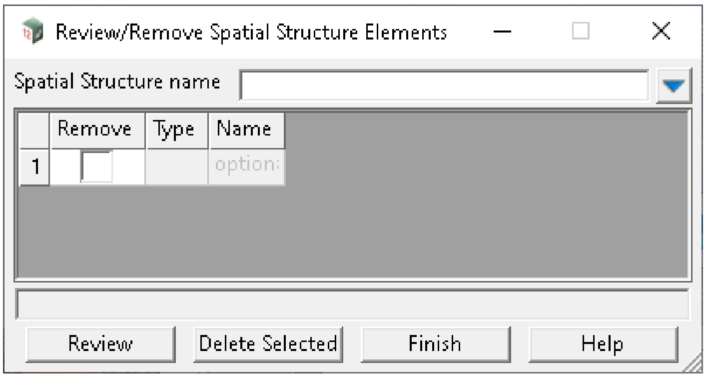
Continue to 11.1.3.3 Review/Remove Spatial Structure Elements or return to 11.1.3 IFC Spatial Structure or 11.1 IFC.

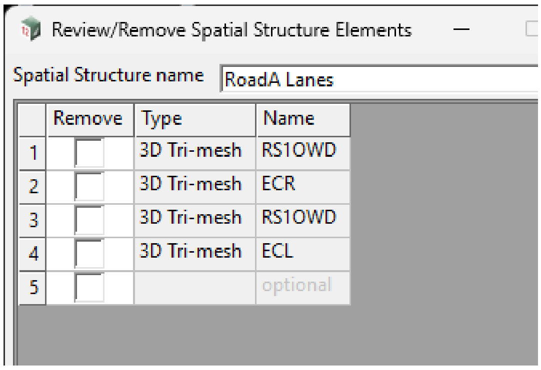
11.1.3.3 Review/Remove Spatial Structure Elements

Position of option on menu: **BIM =>IFC =>Spatial structure =>Review/Remove spatial structure**

The **Review/remove spatial structure elements** option display and optionally removes the elements that have a selected spatial structure name.

Selecting **Review/remove spatial structure elements** brings up the **Review/Remove Spatial Structure Elements** panel.





Spatial Structure name choice box defined spatial structures

Name of the instance of the defined Spatial Structure to displayed the elements in that spatial structure.

Grid

Remove tick column

*If **ticked**, the element on that row is removed from the given instance of spatial structure when the* **Delete Selected** *button is pressed.*

Type

***12d Model** element type.*

Name text box

*Name of the **12d Model** element.*

Review button

*When pressed, a list of all the **12d Model** element in the given* **Spatial Structure name** *is displayed in the grid.*

Delete Selected button

When pressed, any elements with a tick in the **Remove** *column are removed from the spatial structure.*

Continue to 11.2 Trimesh or return to 11.1.2 IFC Output or 11 BIM.

11.2 Trimesh

The **Trimesh** Menu has been completely rearranged and many new options added.

The options in the Trimesh menu create trimeshes and perform various operations on trimeshes such as contouring and flipping the normals of the triangles in a trimesh.

11.2.1 Create Trimesh
11.2.3 Trimesh Edit
11.2.4 Convert Trimesh
11.2.5 Trimesh Union/Difference
11.2.6 Contour Trimeshes

11.2.7 Trimesh Intersection Lines
11.2.8 Trimesh Utilities

See

11.2.1 Create Trimesh
- 11.2.1.2 Create/Edit BIM Objects
- 11.2.1.4 Create/Edit BIM Objects Map File
- 11.2.1.6 Cut and Fill Trimeshes Between Two Tins
- 11.2.1.1 Create Trimesh From
- 17.5.16 Create Culvert Headwalls
- 11.2.1.7 Trimesh Traffic Signals

11.2.2 Trimesh Editor.

11.2.3 Trimesh Edit
- 11.2.3.2 Flip a Trimesh Face
- 11.2.3.3 Flip Trimeshes Faces
- 11.2.3.1 Colour Trimesh

11.2.4 Convert Trimesh
- 11.2.4.1 Get Spines from Trimeshes
- 11.2.4.2 Top and Bottom Tins From Trimeshes
- 11.2.4.3 Convert Trimesh to Polymesh
- 11.2.4.4 Convert Trimesh Named Faces to Polymesh

11.2.5 Trimesh Union/Difference
- 11.2.5.1 Trimeshes Union

11.2.6 Contour Trimeshes

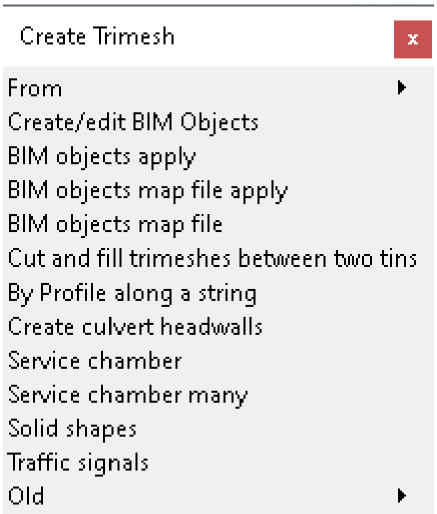
11.2.7 Trimesh Intersection Lines

11.2.8 Trimesh Utilities

11.2.1 Create Trimesh

Position of option on menu: **BIM =>Trimesh =>Create**

The Create Trimesh options create trimeshes directly, or create snippets that create trimeshes, when used in an Apply MTF.



See
11.2.1.1 Create Trimesh From
11.2.1.2 Create/Edit BIM Objects
11.2.1.3 Apply BIM Objects
11.2.1.5 Apply BIM Objects Map File
11.2.1.4 Create/Edit BIM Objects Map File
11.2.1.6 Cut and Fill Trimeshes Between Two Tins

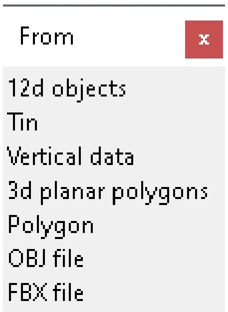
17.5.16 Create Culvert Headwalls

11.2.1.7 Trimesh Traffic Signals

Continue to 11.2.1.1 Create Trimesh From or return to 11.2.1 Create Trimesh.

11.2.1.1 Create Trimesh From

Position of option on menu: **BIM =>Trimesh =>Create =>From**



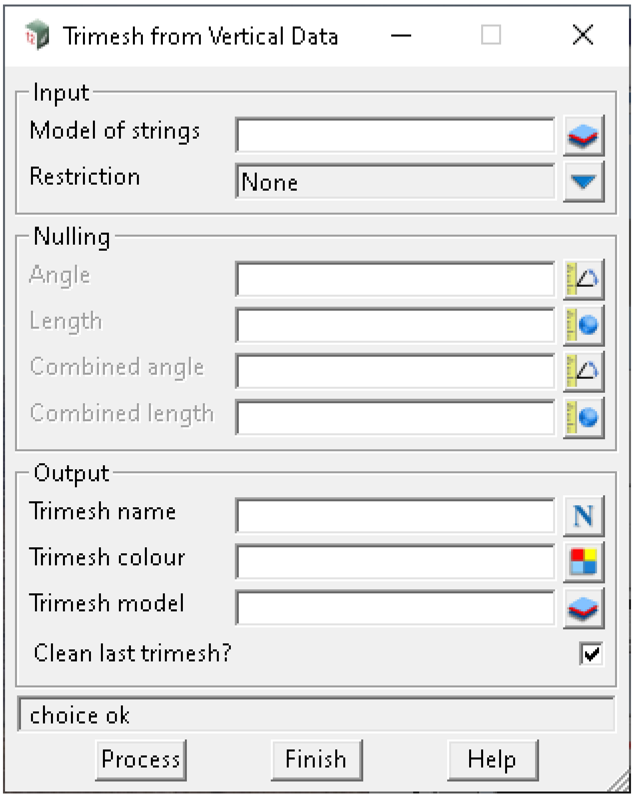
See

11.2.1.1.1 Trimesh from Vertical Data
11.2.1.1.2 Trimesh From 3D Planar Polygons

11.2.1.1.1 Trimesh from Vertical Data

Position of option on menu: **BIM =>Trimesh =>Create =>From =>Vertical data**

Selecting **Vertical data** brings up the **Trimesh from Vertical Data** panel.



The fields and buttons used in this panel have the following functions.

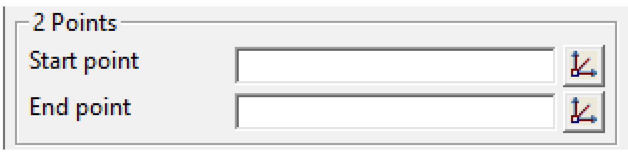
Field Description	Type	Defaults	Pop-Up
Input			
Model of strings	model box		available models

Model of super strings that contain the points to create the trimesh from.

Restriction	choice box	None	None, 2 Points

*If **None**, do not exclude input points from the trimesh triangulation.*

*If **2 Points**, exclude input points from the trimesh triangulation if they cannot be dropped perpendicularly to the user defined 2 point line.*



This restriction will exclude from the trimesh triangulation any points that cannot be dropped perpendicularly to the user defined 2 point line.

Start point	xyz box

The start point of the 2 point line to drop all the input points to.

End point xyz box

The end point of the 2 point line to drop all the input points to.

Nulling

***Note**: If this panel's inbuilt nulling is insufficient, use the trimesh editor's 12.5.3.3.6 Delete Face to manually pick and delete faces on the created trimesh.*

Angle angle box

*If a triangle has an external side with an angle on it less than **Angle**, then the triangle is nulled.*

*If **blank**, then no triangles are nulled by this test.*

Length real box

*If a triangle has an external side greater than **Length**, then the triangle is nulled.*

*If **blank**, then no triangles are nulled by this test.*

Combined angle angle box

Combined length real box

For the Combined case, a triangle is nulled if it:
*Has an external side and the sum of the two angles on it is less than **Combined angle***

and

*has an external side whose length is greater than **Combined length**. A suggested value is one third to one half of **Length**.*

*If either **Combined angle** or **Combined length** is **blank**, then no triangles are nulled by this test.*

Output

Trimesh name name box

Name of the created trimesh.

Trimesh colour colour box

Colour of the created trimesh.

Trimesh model model box available models

Model of the created trimesh.

Buttons at Bottom

Process button

Process the option.

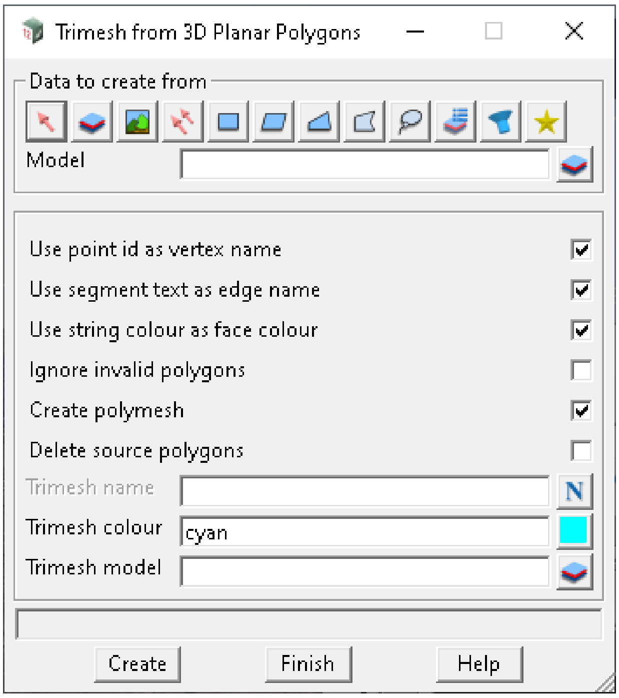
11.2.1.1.2 Trimesh From 3D Planar Polygons

Position of option on menu: **BIM =>Trimesh =>Create =>From =>3D planar polygons**

This option allows you to build a trimesh by giving all the closed simple, planar polygons that make up the Trimesh.

The trimesh inside ***12d Model*** is also an intelligent trimesh (intellimesh) because it can not only have metadata as trimesh attributes but also have names on vertices and segments so that they can be used for setting out with 12d Field.

Selecting **Trimeshes from 3D planar polygons** brings up the **Trimesh from 3D Planar Polygons** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type

Data to create from data source

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source input Model

Selected data to use.

That is, all the simple, closed, counter clockwise planar polygons that are to make up the trimesh.
For an closed trimesh, counterclockwise is defined to be with respect to the normal to the planar polygon where the normal points OUT of the closed trimesh.
For an open trimesh, counterclockwise is defined to be with respect to the normal to the planar polygon where the normal points OUT of what you consider to be the top of the open trimesh.

The polygons must have all the individual common sides of the trimesh.

A polygon is a closed superstring. It is not a string with the first and last vertices are the same.

A planar polygon has all the vertices in the one plane. For example a 3D triangle or the side of a cube.

A simple polygon can have no common vertices, no intersecting sides and no holes. See 3.40 Simple (Jordan) Polygons.

Use point id as vertex name tick box

*If **ticked**, then the names of the vertices of the trimesh is given the ids of the point of corresponding polygon. If the same vertex has different names in different polygons then just one will be used.*

Use segment text as edge name tick box

*If **ticked**, then the segment of the trimesh is given that name. If the same segment has different names in different polygons then just one will be used.*

Use string colour as face colour tick box

*If **ticked**, then the triangles that will make up that polygon will have the colour of the polygon.*

*If **not ticked**, then the Trimesh colour is used for all triangles in the trimesh.*

Trimesh name name box

Name for the created trimesh.

Trimesh colour colour box

Base colour for the created trimesh.

Trimesh model model box

Model to add the created trimesh to.

Create button

Create trimesh from the polygon.

Example:

Vertices of Closed Polygon 1 – this is the square at the base of the pyramid:

-1.000 -1.000 0.000

1.000 -1.000 0.000

1.000 1.000 0.000

-1.000 1.000 0.000

Vertices of Closed Polygon 2 – one of the triangle sides of the pyramid:

0.000 0.000 2.000

1.000 1.000 0.000

-1.000 1.000 0.000

Vertices of Closed Polygon 3 – one of the triangle sides of the pyramid:

0.000 0.000 2.000

-1.000 1.000 0.000

-1.000 -1.000 0.000

Vertices of Closed Polygon 4 – one of the triangle sides of the pyramid:

0.000 0.000 2.000

1.000 -1.000 0.000

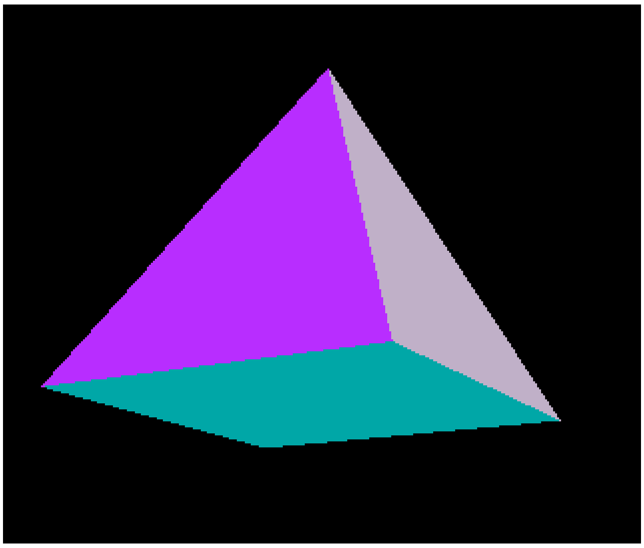
1.000 1.000 0.000

Vertices of Closed Polygon 4 – one of the triangle sides of the pyramid:

0.000 0.000 2.000

-1.000 -1.000 0.000

1.000 -1.000 0.000



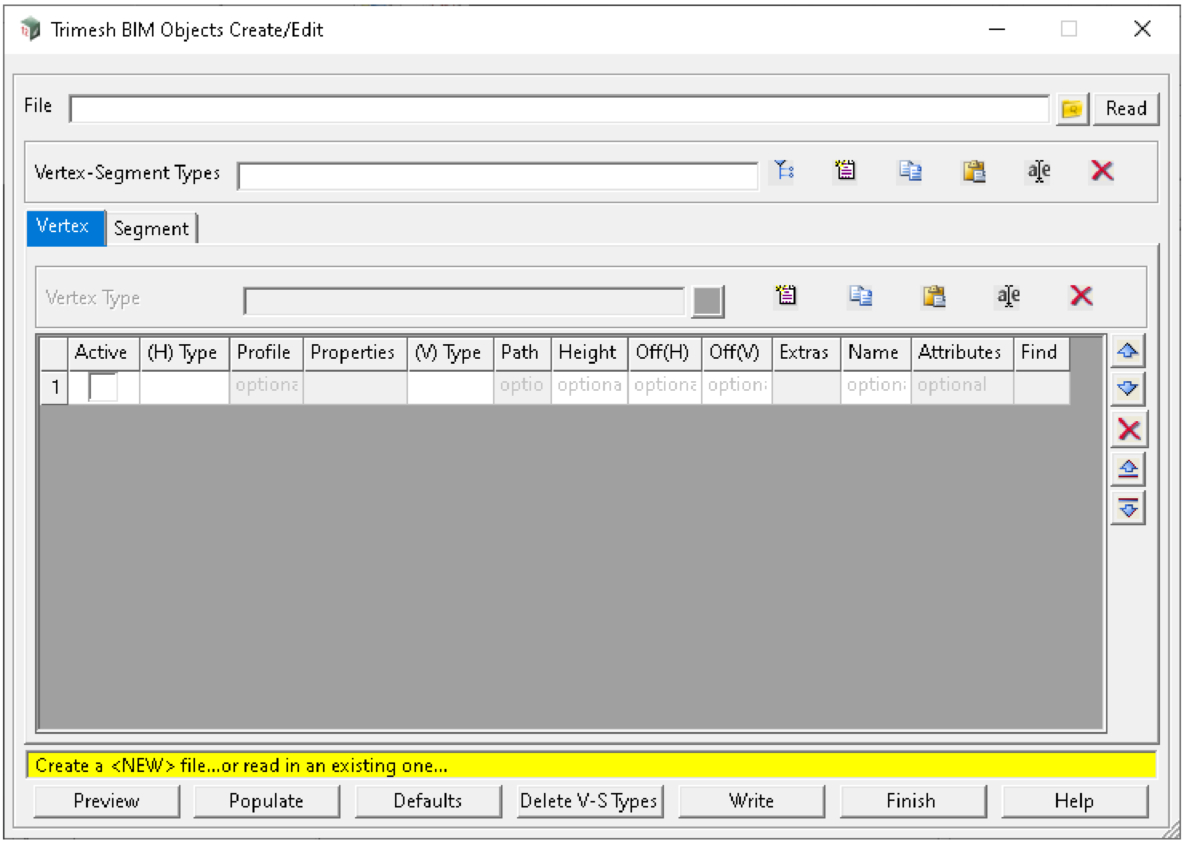
11.2.1.2 Create/Edit BIM Objects

Position of option on menu: **BIM =>Trimesh =>Create =>Create/edit BIM objects**

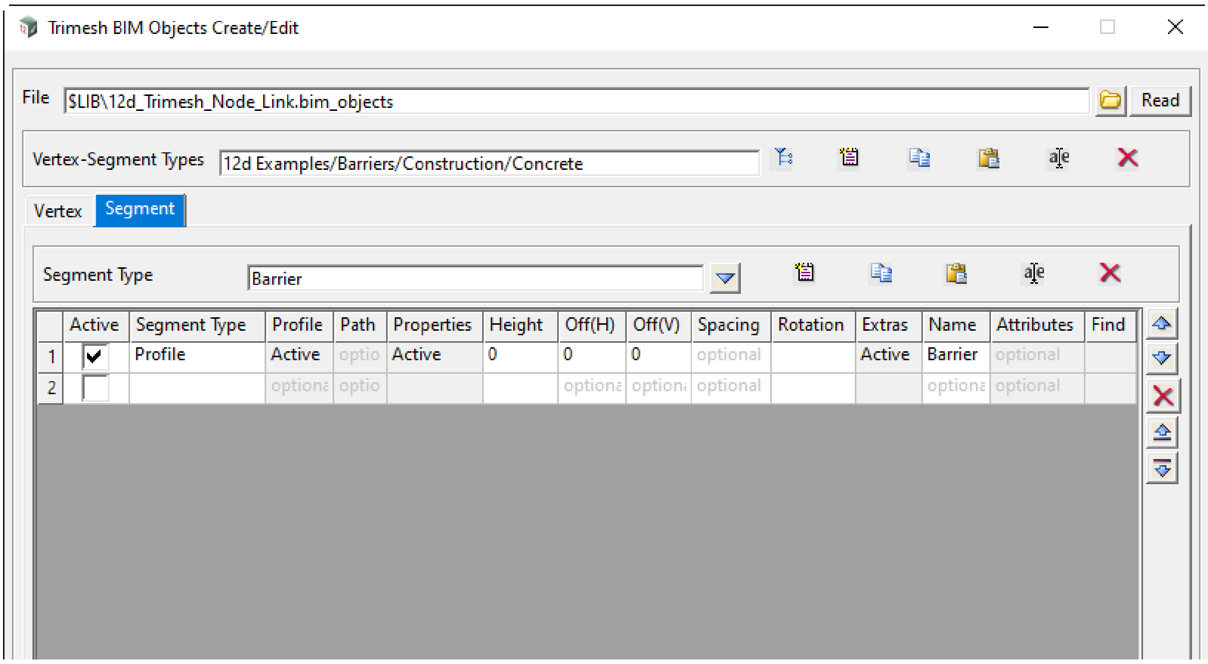
For information on **how to create a user defined vertex type using a 12da file**, see 11.2.1.2.1 How to create a user defined vertex type using a 12da file.

For information on **how to create a user defined pipe trench trimesh from a profile string, using** a 12da file, see 11.2.1.2.2 How to create a user defined pipe trench trimesh from a profile string, using a 12da file.

Selecting **Trimesh BIM create/edit** brings up the **Trimesh BIM Create/Edit** panel.



Example file is library… **12d_Trimesh_Node_Link.bim_objects**



This option can create a variety of user defined Trimesh combinations, to form such features as:

Construction fences (with footings)

Safety Barriers (Guard rail, Wire rope & Concrete)

Retaining walls

Bridge profiles (decking, headstocks & piles)

Road profiles (Kerb, Pavement)

Service / drainage trenches etc

NOTE:

In previous versions (v14) there was a standard file name that resided in setups, or could be copied to User or Working Folder.

12d_Trimesh_Node_Link.4d

In order to use a previous file format, just rename the extension from **.4d** to **.bim_objects**.

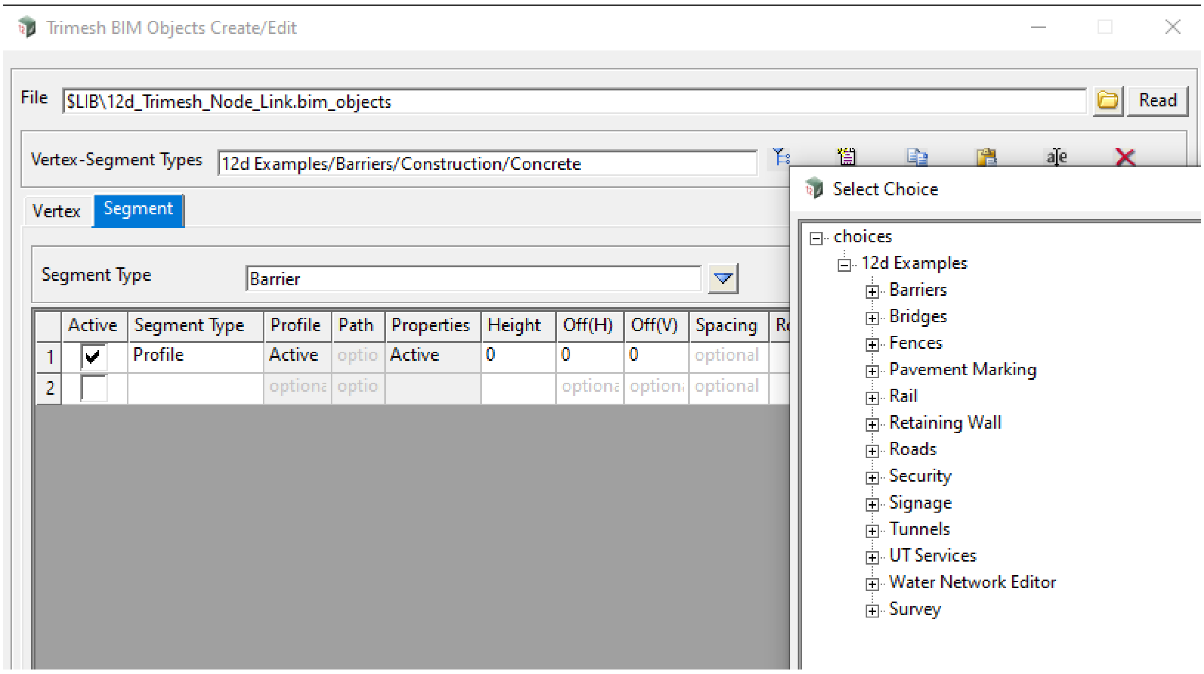
The benefit of this is you can now name the file whatever you want and simply browse to its location.

Note:

At start up, you are able to either **Create a <NEW> file**, create some Vertex-Segment Types, and save that file.

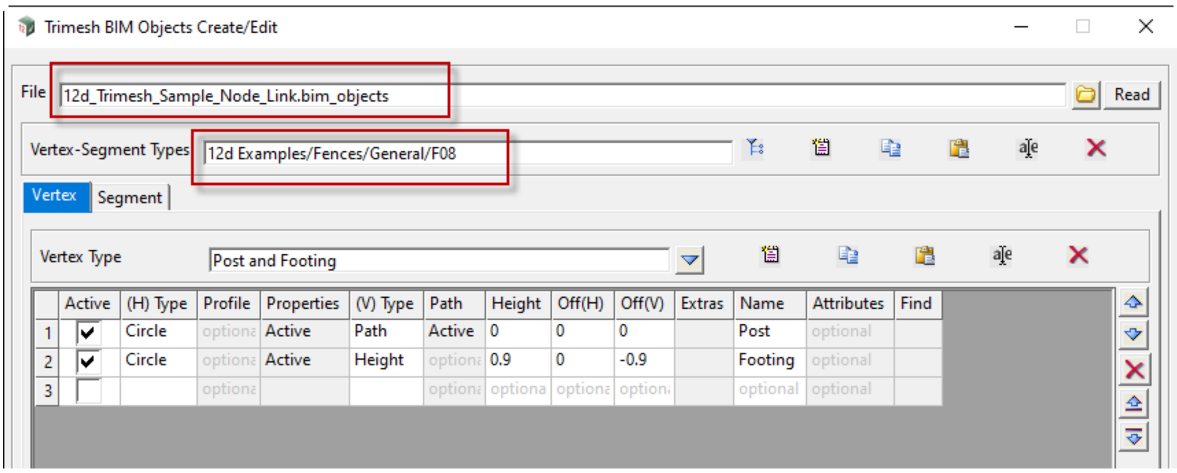
That way you do not have to include all the example types shipped in the library file.

Expanded below is a list of the types available in the library file



To save this file (under any name), simple click in the File field, and overwrite the name.

Select the "Write" button to save it to the working directory, or to wherever you may have browsed to.



The **Vertex-Segment Type** contains a combination of Vertex & Segment definitions.

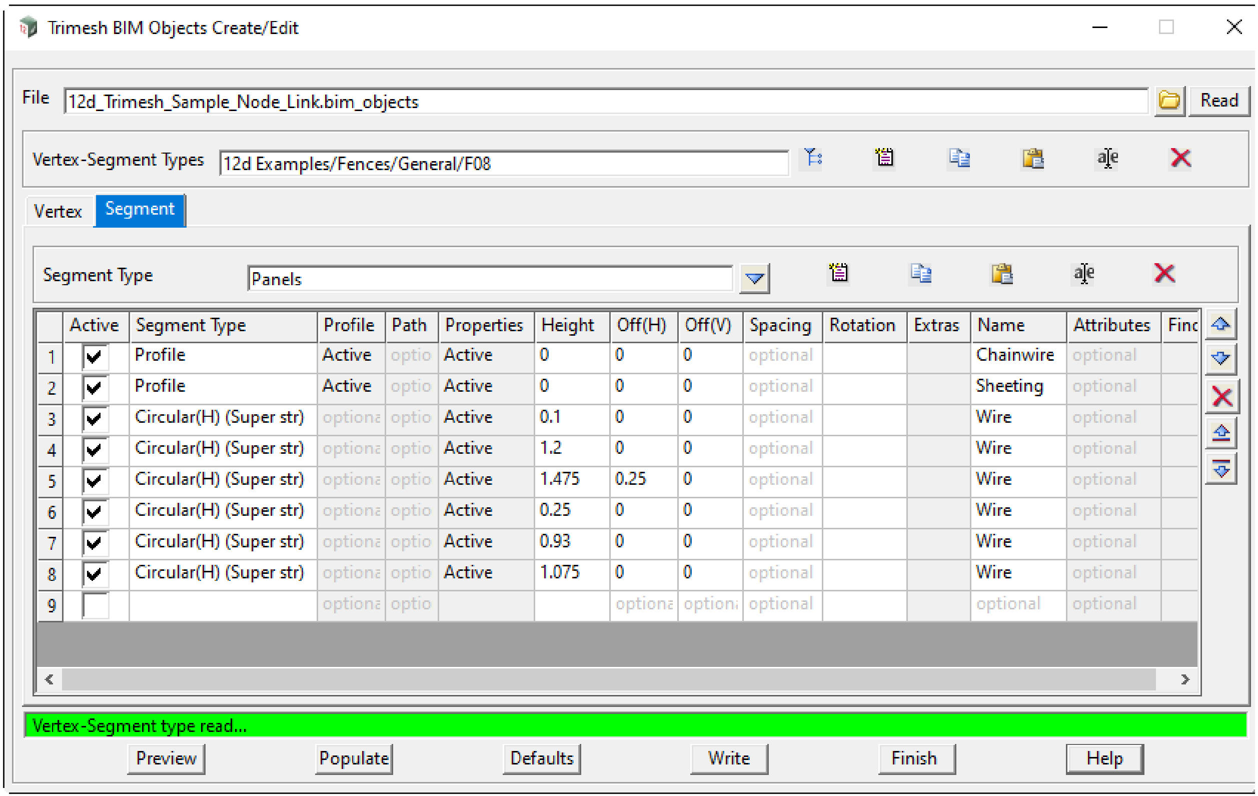
The drop-down lists for the **Vertex Type** & **Segment Type**, are read and the grids populated.

In the previous image, we have changed the file name (**12d_Trimesh_Sample_Node_Link.bim_objects**), and written out the file to the working directory.

A type "**General Fences (F08)**" …has been selected.

The **Vertex Type** displayed is "Post and Footing", which has two active entries in the grid.

In the image below, the **Segment** tab has been selected, where the **Segment Type** called "Panels" is displayed with 8 active entries in the grid.



Vertex-Segment Type edits:

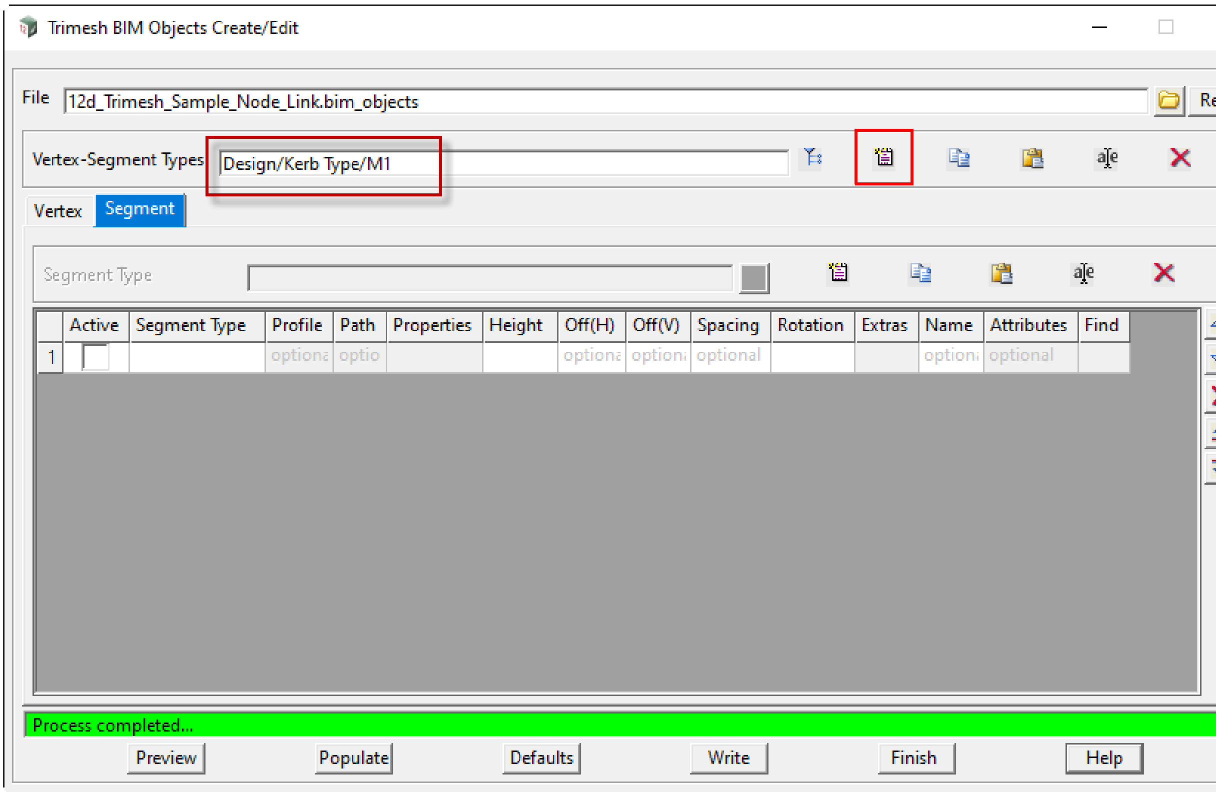
Create

Once selected the panel below will be displayed.

A valid name should explain what type of feature you are creating e.g Design/Kerb Type/M1.

*Once **Set**, the panel below will be displayed, where your choice is displayed in Vertex-Segment Types and the Vertex and Segment grids are empty.*

*The heading above is available on the drop-down list even if you change from one choice to another…**BUT** must be **Written** out before finishing or reading another file.*

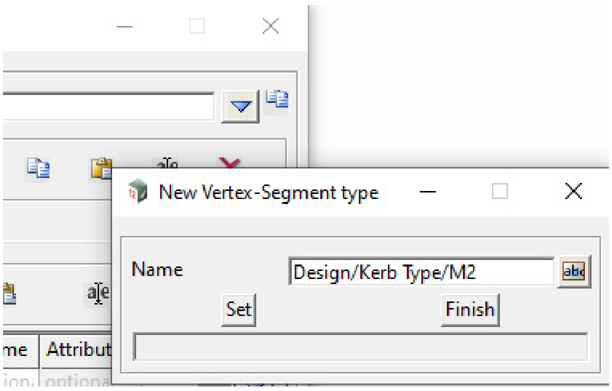


Copy button

Makes a copy of whatever is in the Vertex-Segment Types field.

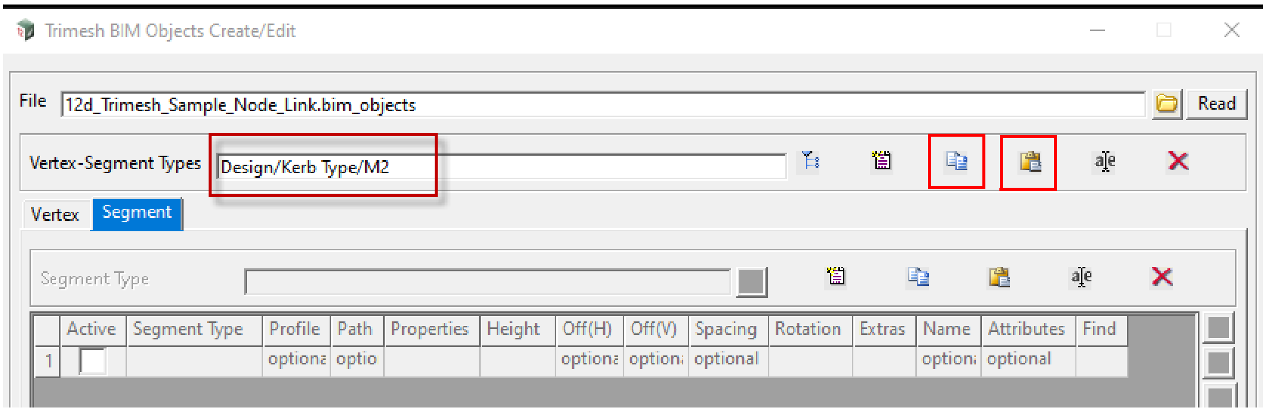
Paste button

Will display the panel below, allowing you to enter an appropriate name for your new type.



A check is done as to whether or not that entry already exists.

If so, a warning will be given as to whether or not you wish to overwrite.



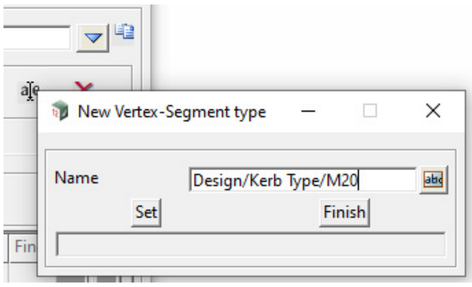
*The heading above is available on the drop-down list even if you change from one choice to another…**BUT** must be **Written** out before selecting another type.*

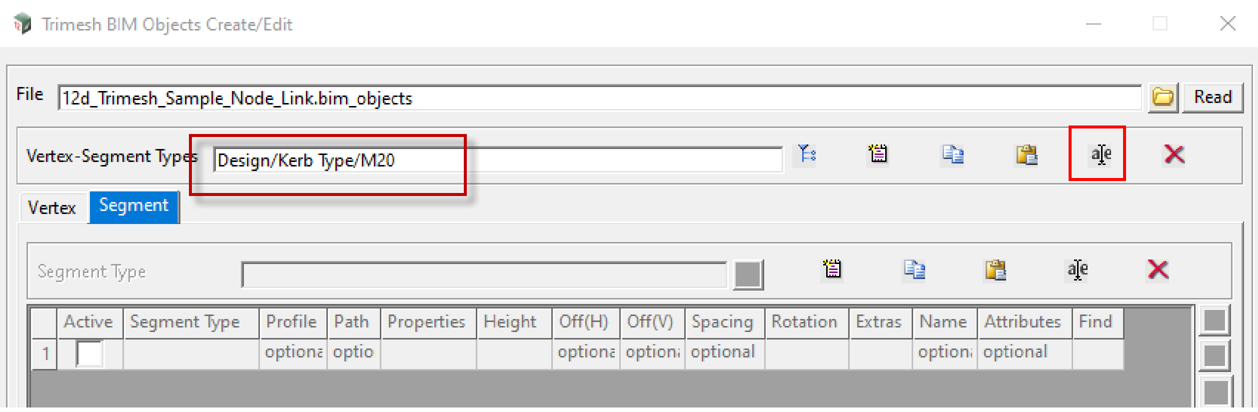
Rename button

The panel below will be displayed. A new field can be entered.

A check is done as to whether or not that entry already exists.

If so, a warning will be given as to whether or not you wish to overwrite

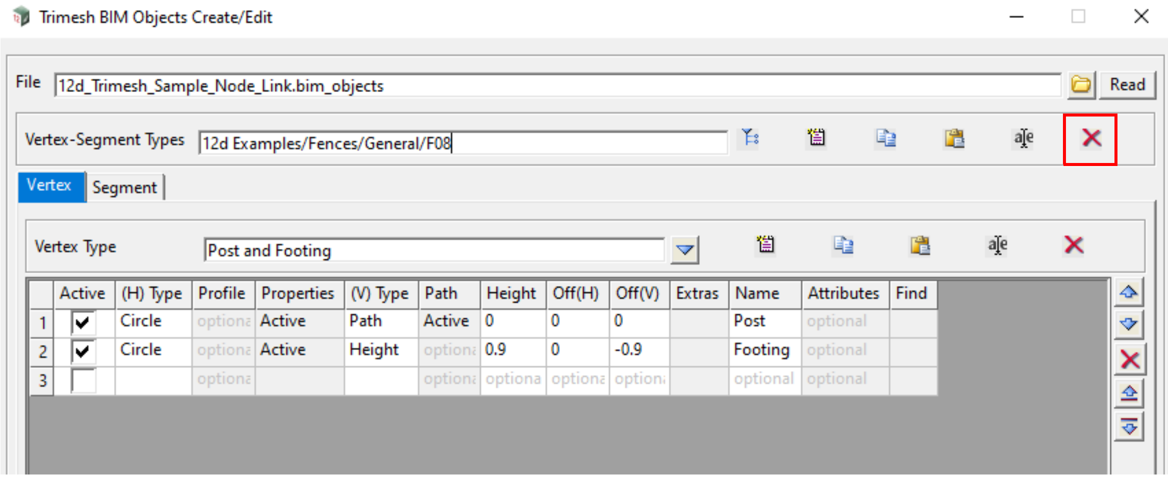




*The heading above is available on the drop-down list even if you change from one choice to another…**BUT** must be **Written** out before selecting another type.*

Delete button

*Will delete the current type displayed in the field and return you to the **first** listing in the Vertex-Segment Types field as per below.*



*The deleted entry is now not available on the drop-down list even if you change from one choice to another…**BUT** must be **Written** before selecting another type.*

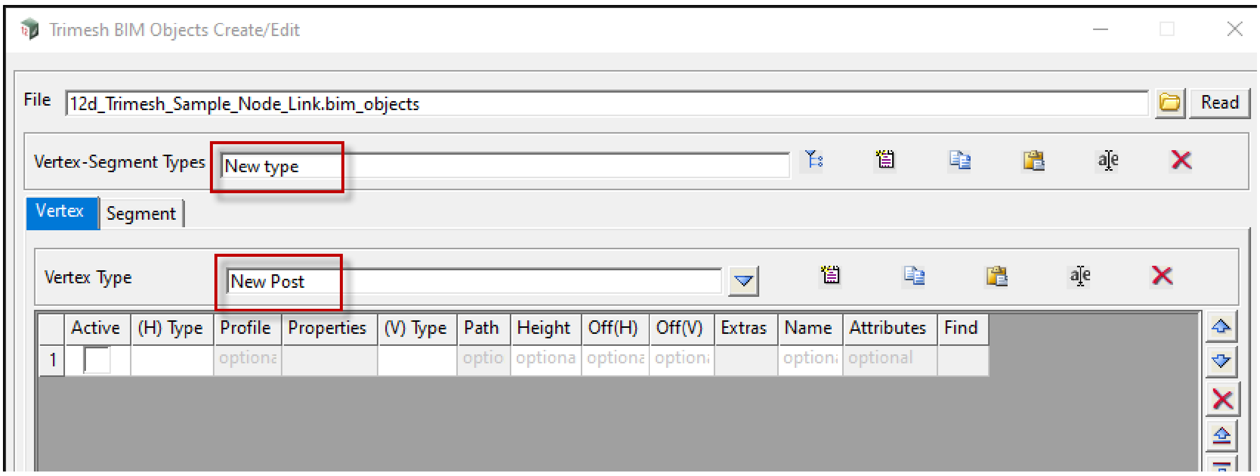
Vertex edits:

__NOTE__: Edits in this grid area __MUST__ be __written__ out in order to __Save__ any data, before __changing types__.

Edits: Similar to the previous create, copy, paste, rename and delete for Vertex-Segment Types. See Vertex-Segment Type edits:.

Create button

Example panel displayed below, where grid is empty.



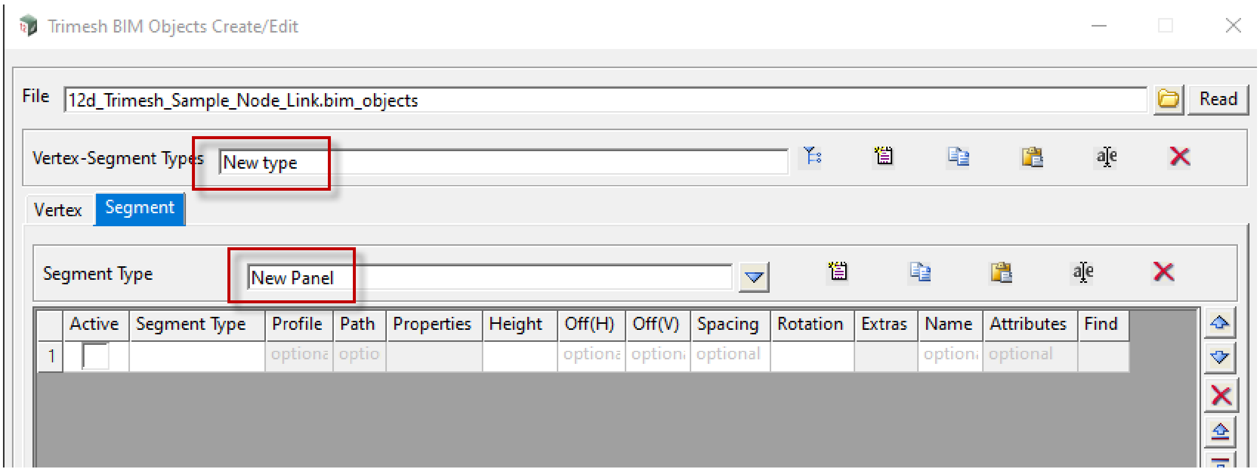
Segment edits:

__NOTE__: Edits in this grid area __MUST__ be __written__ out in order to __Save__ any data, before __changing types__.

***Edits:** Similar to the previous create, copy, paste, rename and delete for Vertex-Segment Types. See* Vertex-Segment Type edits:.

Create button

Example panel displayed below, where grid is empty.



Buttons at Bottom

Write button

*Write out the displayed data to the file **12d_Trimesh_Sample_Node_Link.bim_objects***

The Write button is required to save, not only a newly created feature, but any changes done in the Vertex & Segment grids, to an existing feature.

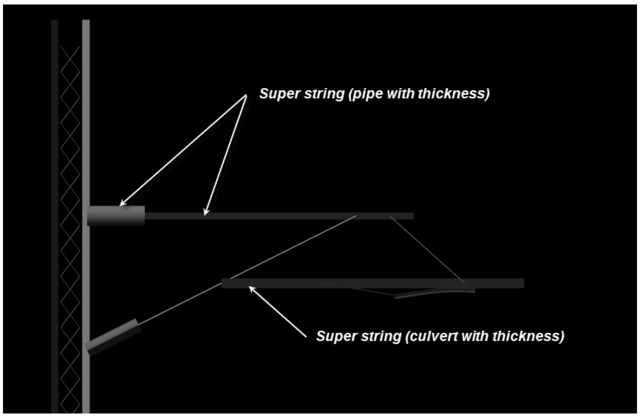
Populate button

*The **Populate** button on the Vertex & Segment tabs.*

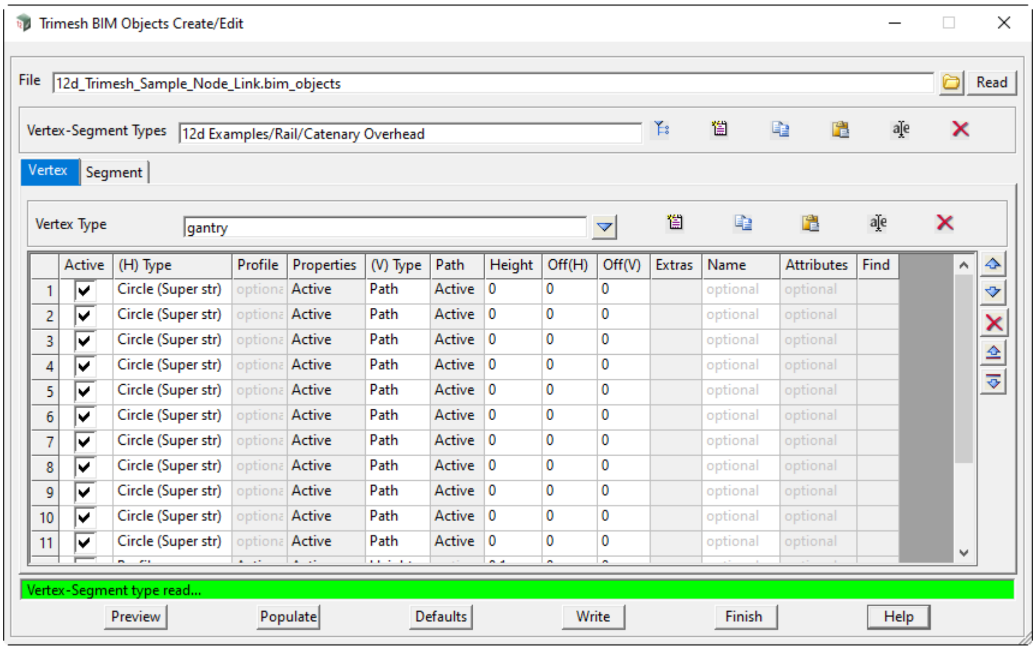
Vertex Tab:

Once selected the panel below is displayed. This feature will allow the multiple selection of path shapes, normally drawn on a model relative to origin 0,0.

Rail overhead e.g



Once completed, "**(H) Type**" and "**Path**" entries are made in the **Vertex** grid e.g



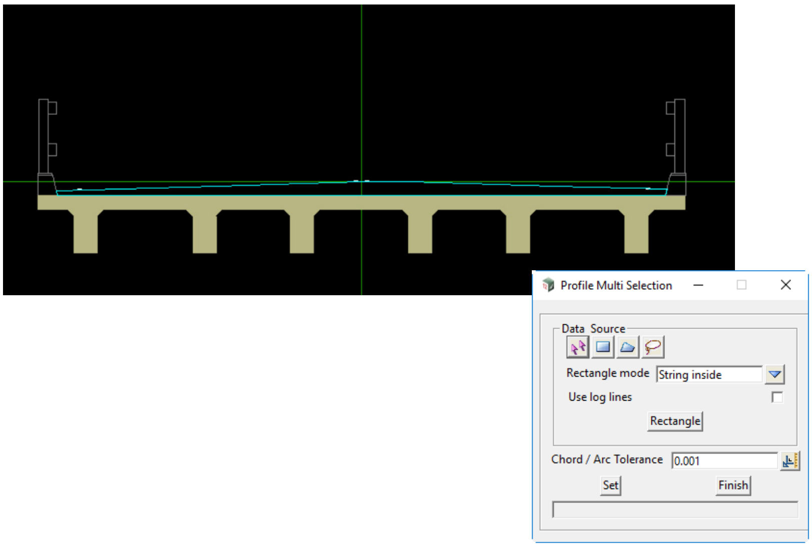
Most profiles that are drawn in plan view, require a rotation at each vertex when applied. **Perpendicular** to the selected string (90 degrees) or at the **half vertex angle**, if a bend is encountered.

If **not ticked**, then no rotation is done.

Value: Refers to any additional rotational angle required. A 90 degree extra rotation is sometimes required if rotating to a symbol

Segment Tab:

Once selected the panel below is displayed. This feature will allow the multiple selection of profile shapes, normally drawn on a model at origin 0,0.



Once completed, "**Profile**" entries are stored in the **Segment** grid.

Vertex Tab:

The Vertex tab has a selection of **Shape(H)** that can be extruded along a **Shape(V)**…Path or Height.

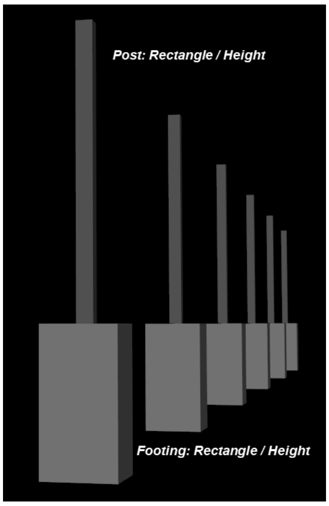
Height is a real value (2m high fence post e.g.)

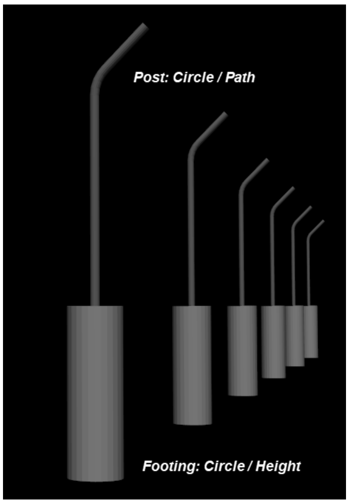
Path is a user defined and selected string, with an origin typically at 0,0.

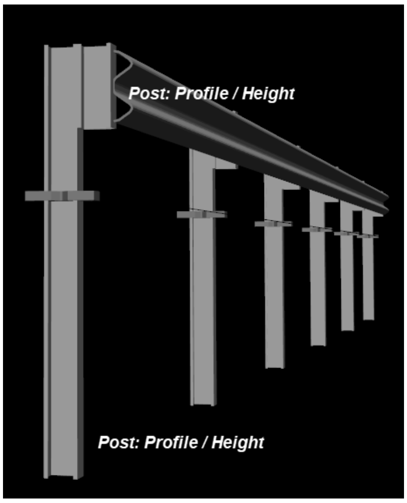
The other parameters like Offsets, Extras, Attributes etc are used to define the vertex Trimesh in more detail.

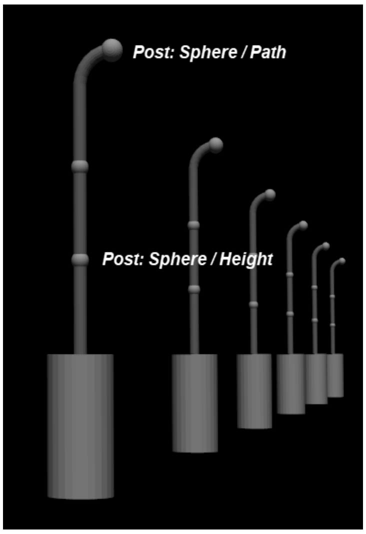
Vertex Examples:

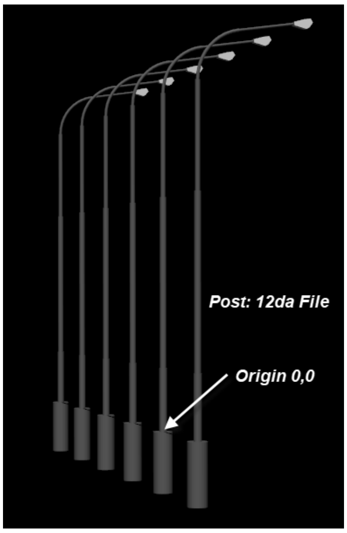
Post: Rectangle **[Shape(H)]** / Height **[Shape(V)**











The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Active	tick box		

*If **ticked**, line is active.*

Shape(H)	choice box		

A list of types of shapes that can be used, in combination with a type from Shape(V) to form a Trimesh (except 12da File).

Rectangle *(Width & Depth required)*

Rectangle (Super str) *(Width & Depth required)*

Circle *(Diameter required)*

Circle (Super str) *(Diameter required)*

Sphere *(Diameter required)*

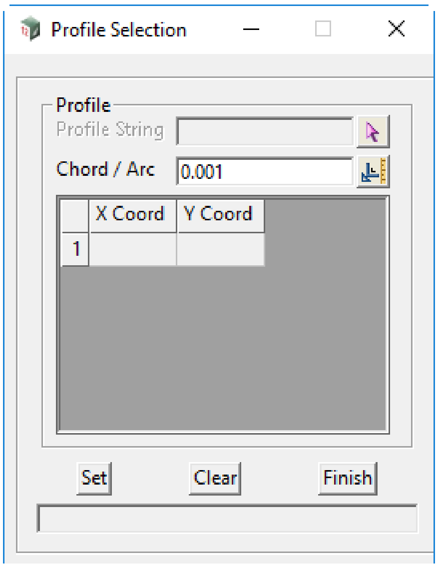
Profile *(String shape required)*

Capping *(Width & Depth or Diameter required)*

12da File

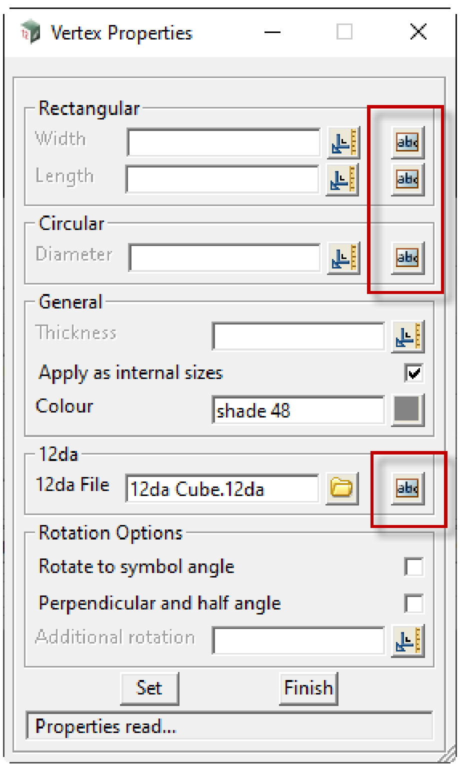
Profile select

LMB will activate the panel below in order to select a profile string (usually drawn at origin 0,0).



Properties select

LMB will activate the panel below to enter a selection of properties used to define the Shape(H) and the Trimesh features.



*Fields required for **Shape(H)** type Rectangle*

*Field required for **Shape(H)** type Circle*

General properties for Trimesh

File input where data is usually created at an origin of 0,0

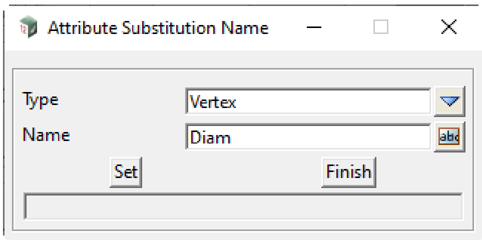
Rotate to a symbol

Rotate perpendicular & half angle refers to the angle at a vertex when placed

Rotation value at a vertex when placed

Note: In the above panel, the red areas define a link (abc) to a panel where you can use a vertex attribute. The attribute would have to exist on the final strings selected during the Apply stage.

Example:



A default **diameter** (0.025 in the case above) is required in case the attribute doesn't exist on the final strings, and for previewing.

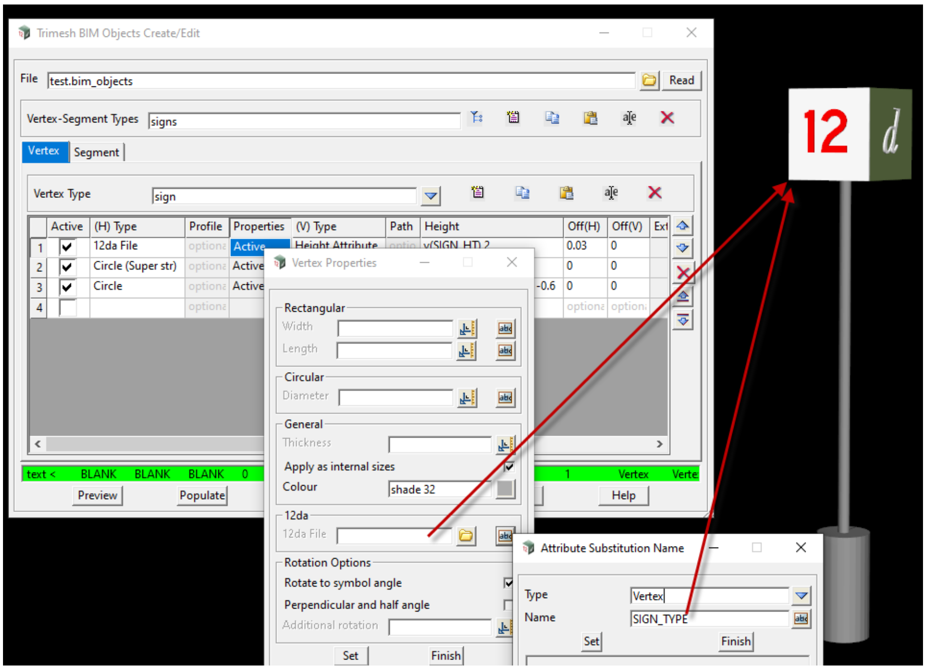
For **rectangular** parameters: a default Width and Length is required, if using an attribute.

This allows a shape to be shown, when previewing, and a shape to be created if the attribute does not exist at the final apply stage.

For **12da File** parameters: **NO** default file is required if using an attribute

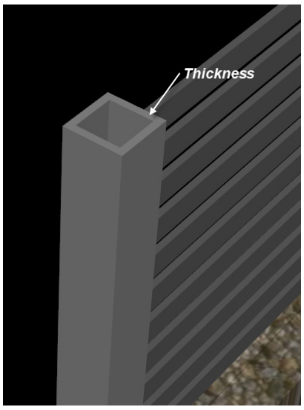
As the attribute value is not known for previewing, a **12da cube insert** is used.

This enables previewing, and is also used as a locator, if the attribute file name does not exist at the final apply stage.

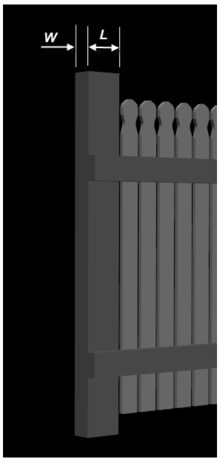


Note: 12da and 12daz files can be used

Link: **Use of attributes in the BIM Map File and Apply->**



Thickness can be applied to Rectangles, Circles, Profiles & Capping



Fields required for **Shape(H)** type Rectangle

Length is defined as "along the string", on which the Trimesh is finally placed

Shape(V) choice box

Three choices that define what vertical source is used to form the Trimesh using the Shape(H) chosen.

Height

Height Attribute

Path

Height real box

Height measured from the final placement string of the Trimesh.

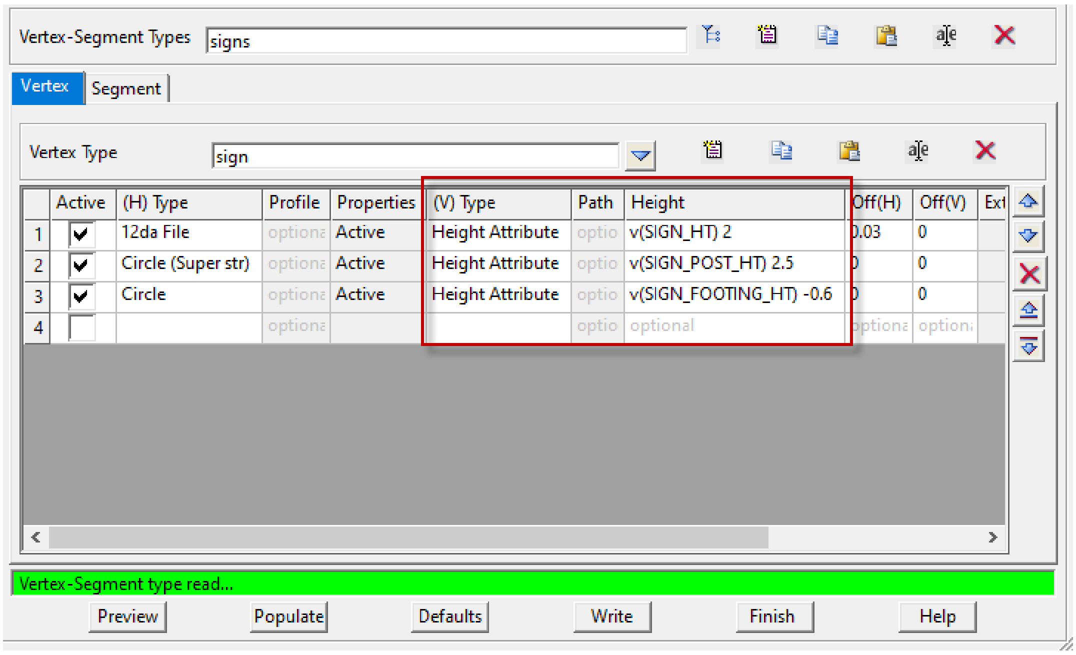
+ve and -ve values allowed.

Height Attribute real box

Height measured from the final placement string vertex attribute.

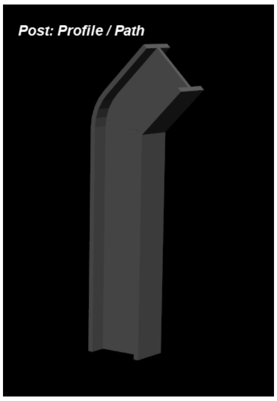
e.g. ***v(Ht) 1***

*A vertex attribute called "**Ht**" and a default value of "**1**", for previewing and if the attribute doesn't exist on the final string selected.*



Path select

LMB will activate the panel below in order to select a path string (usually drawn at origin 0,0).



Off(H) real box

Horizontal offset measured from the final placement string of the Trimesh.

+ve and -ve values allowed.

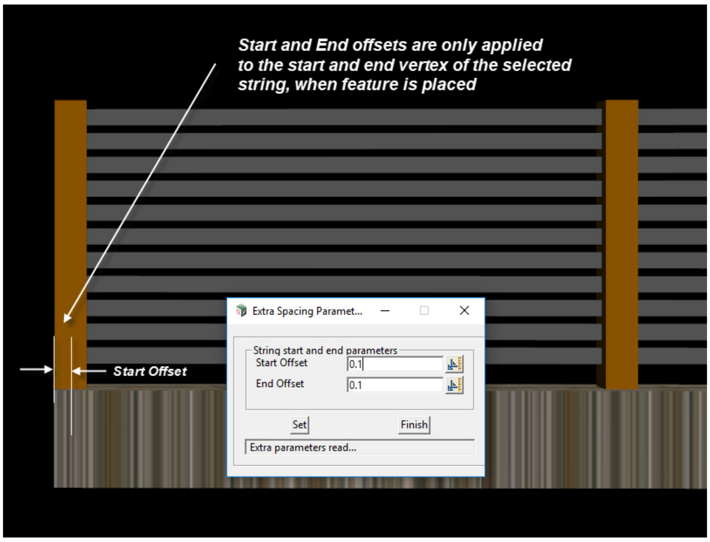
Off(V) real box

Vertical offset measured from the final placement string of the Trimesh.

+ve and -ve values allowed.

Extras select

LMB will activate the panel below.



Name input

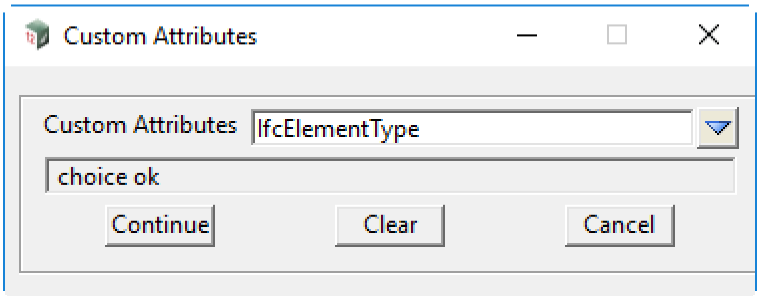
Name of the trimesh.

Attributes select

This option activates a selection of attributes created from the option below.

Menu: Utilities->Attributes->Global Attributes->Set global attributes

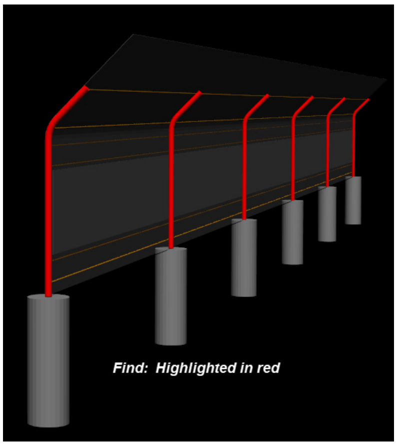
The attributes are set to all the Trimesh elements and are typically BIM attributes.



Find select

This option will highlight the Trimesh created from the row in the grid.

*The **Preview** button must be activated first though.*

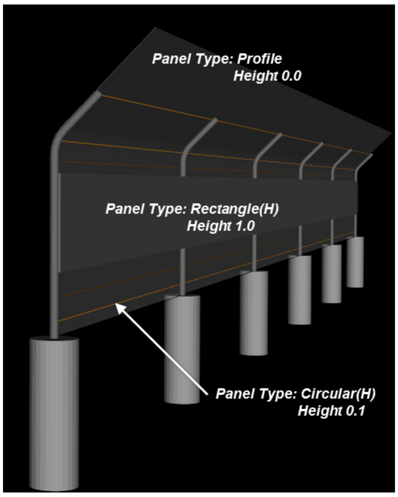


Segment Tab

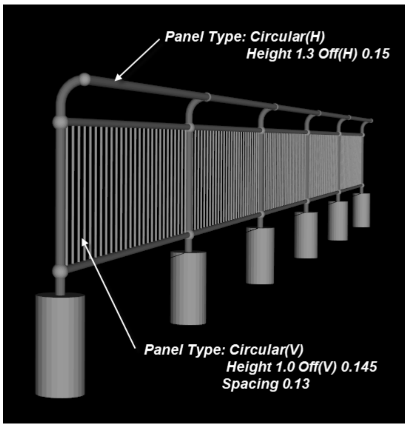
The Segment tab has a selection of **Panel types** that can be extruded along a selected string.

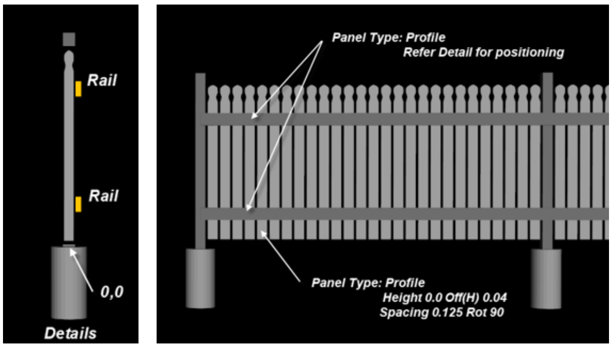
The panel type (or shape) is positioned along that string using the **Height** & **Offsets**, all referenced to the selected string.

The **Spacing** parameter can also be used to array shapes [Rectangle(H), Rectangle(V) e.g.] in the vertical and longitudinally along the selected string.



Segment Examples:

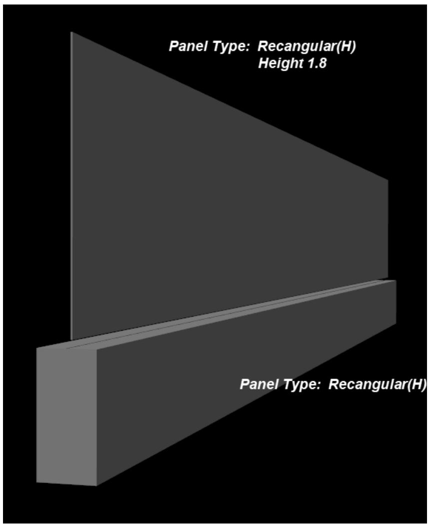




Rails and palings above, were drawn in position, referenced to 0,0

Profiles with a low level of detail

This feature can be used at the preliminary or concept stage and replaced with a more detailed one later.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Active	tick box		

*If **ticked**, line is active.*

Panel Type	choice box		

A list of types of shapes that can be used, to form a Trimesh along a selected string.

Rectangle(H) *(Width & Depth required)*

Rectangle(V) *(Width & Depth required)*

Circular(H) *(Diameter required)*

Circular(V) *(Diameter required)*

Profile *(String shape required)*

Path *(String shape required)*

Rectangle(H) (Super str) *(Width & Depth required)*

Rectangle(V) (Super str) *(Width & Depth required)*

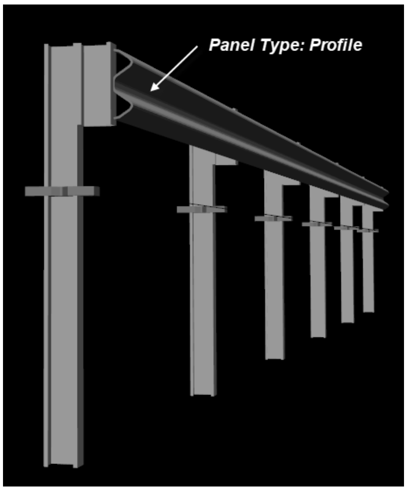
Circular(H) (Super str) *(Diameter required)*

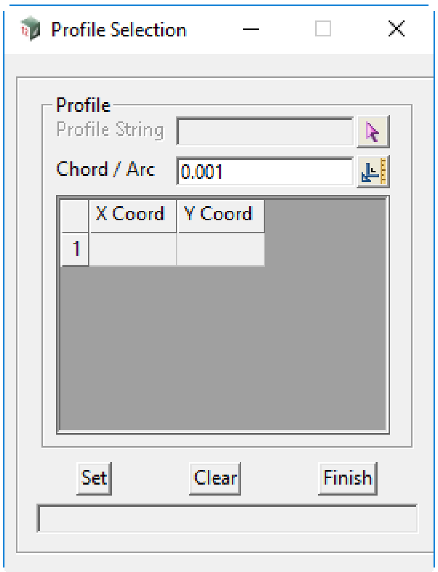
Circular(V) (Super str) *(Diameter required)*

12da Profile(s)

Profile select

LMB will activate the panel below in order to select a profile string (usually drawn at origin 0,0).

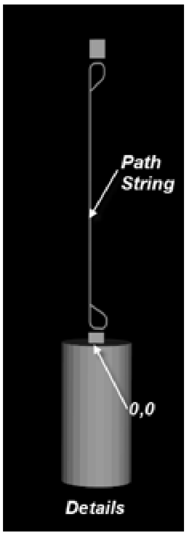


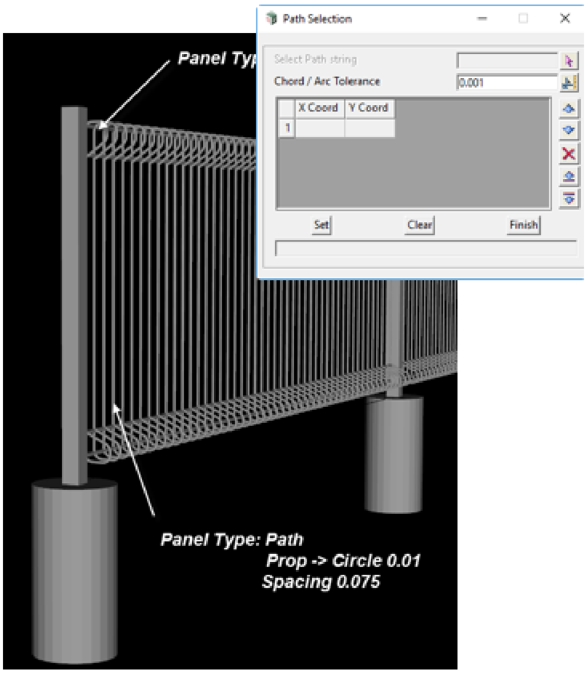


Profile string (W Beam) was drawn in position, referenced to 0,0

Path select

LMB will activate the panel below in order to select a path string (usually drawn at origin 0,0).

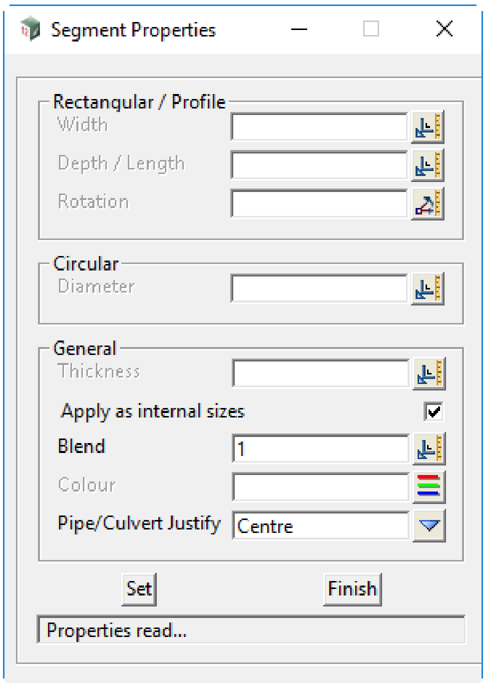




Path string was drawn in position, referenced to 0,0

Properties select

LMB will activate the panel below to enter a selection of properties used to define the Shape(H) and the Trimesh features.



Fields required for type **Rectangle**

Depth is vertical, "along the string"

Length of profile "along the string",

if spacing is used.

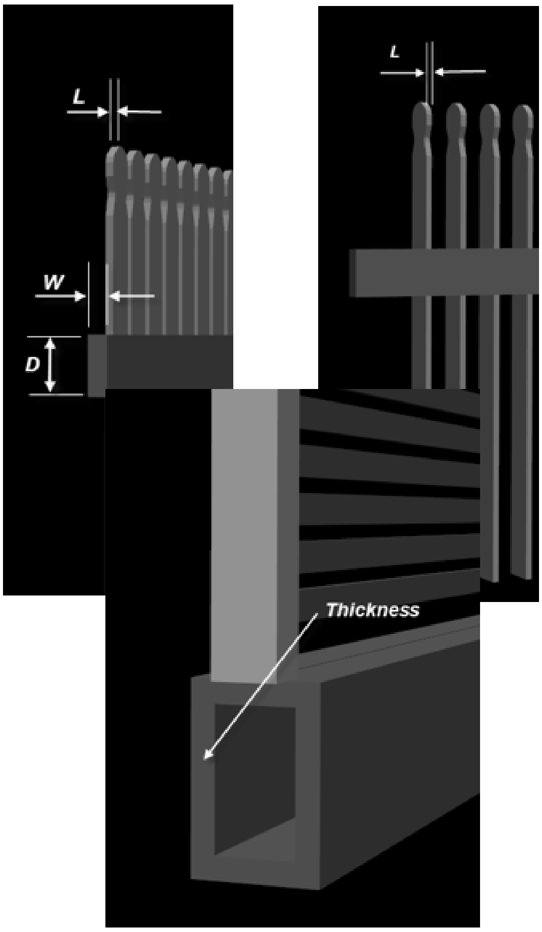
Field required for type **Circular**

General properties for Trimesh

Thickness application

Blend range 0 -> 1.

*Rotation property is for the **Rectangle** or **Profile** shape only.*



Rectangle & Profile parameters

Rectangle Width & Depth as shown

Profile thickness is measured as a length along the selected string

A **rotation** can be applied after **<L>** parameter has been set

Thickness can be applied to Rectangles, Circles & Profiles

Height real box

Height measured from the final placement string of the Trimesh.

+ve and -ve values allowed.

Off(H) real box

Horizontal offset measured from the final placement string of the Trimesh.

+ve and -ve values allowed.

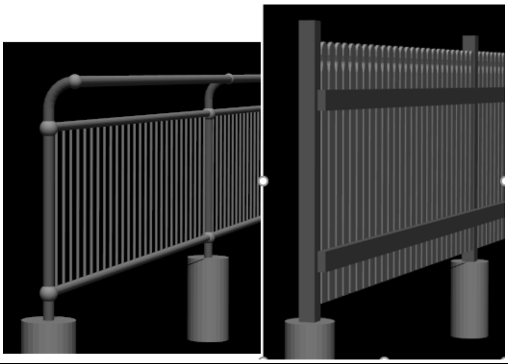
Off(V) real box

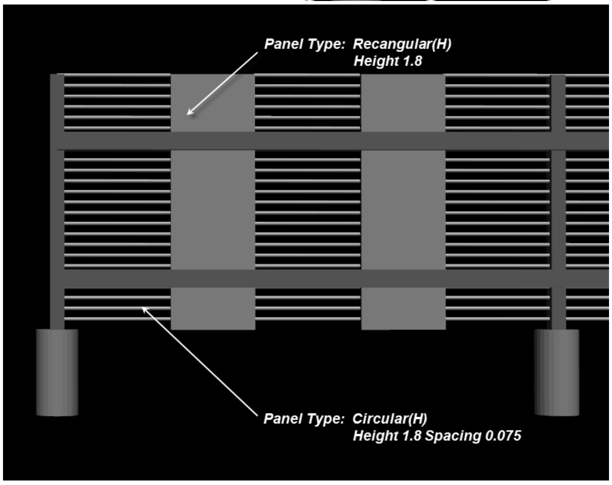
Vertical offset measured from the final placement string of the Trimesh.

+ve and -ve values allowed.

Spacing real box

Distance between Rectangular, Circular and Profile shapes (typically palings & bars).





Rotation angle box

Rotation in the vertical, along the direction of selected string.

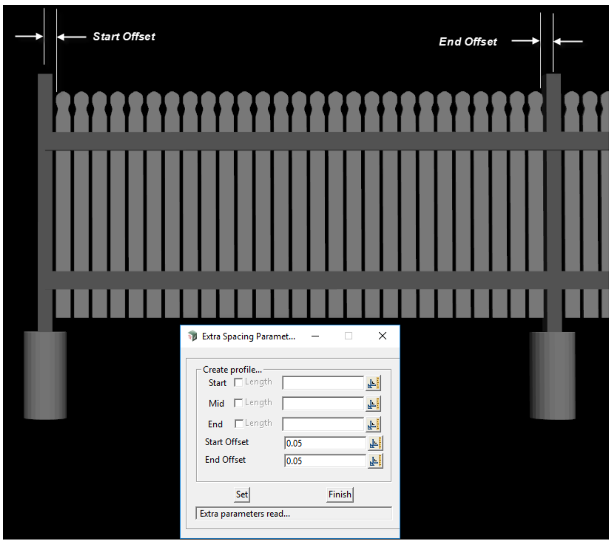
Extras select

LMB will activate the panel below.

Segment Extras:

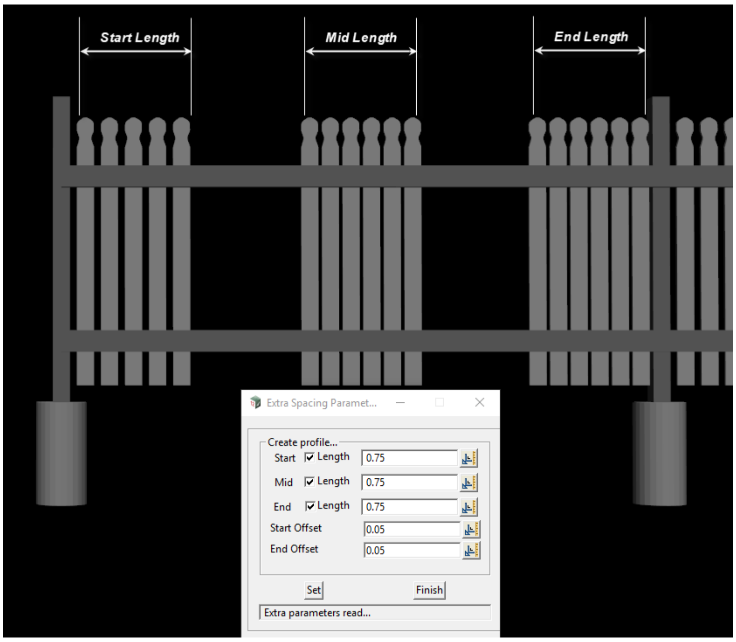
Extra parameters are used to space any Panel Type, between two vertices.

Start Offset and End offset



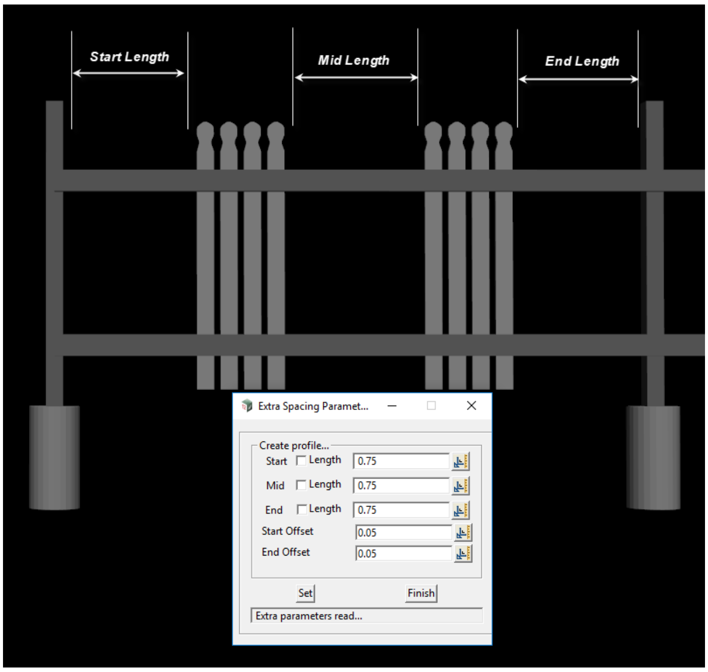
*The **Start & End Offsets** are measured from each vertex, or in this case the centre of the post.*

Start Mid and End



The **Start, Mid & End** parameters can be used together, on their own or any combination thereof.

Start Mid and End (Intermediate)

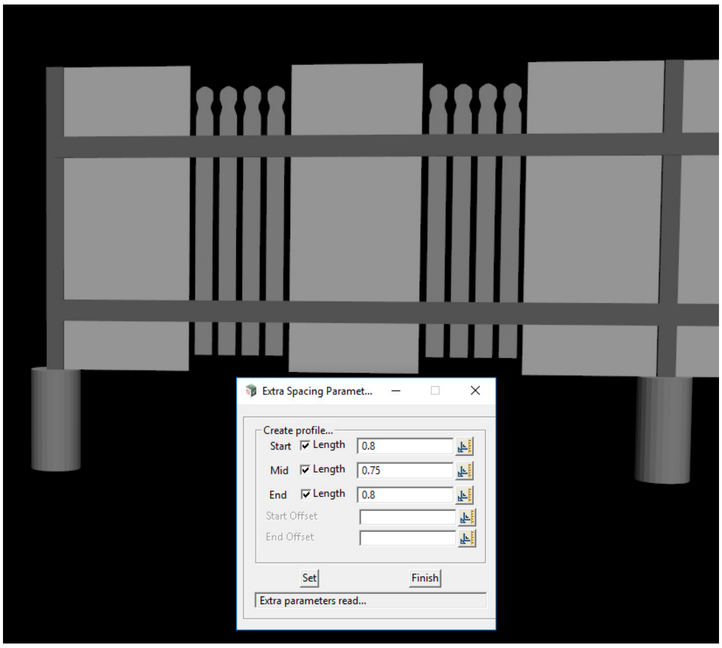


When the **Start, Mid & End** boxes are **inactive**, then intermediate distances are calculated, and the panel type is applied over those distances **only**.

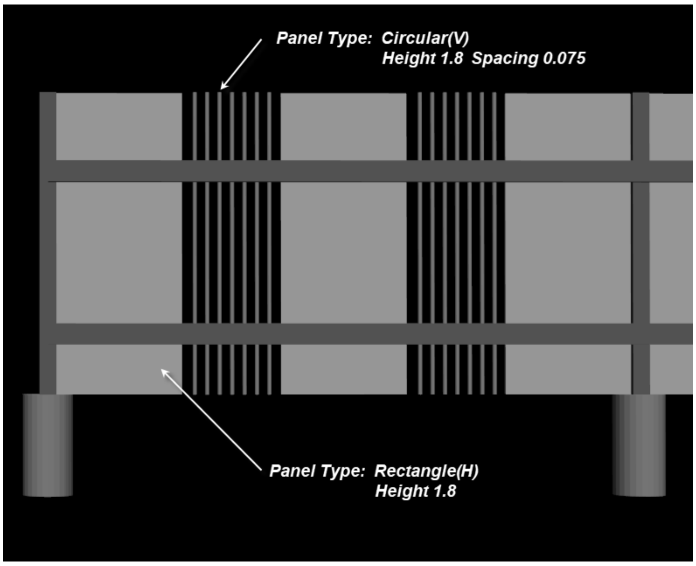
The **Start, Mid & End** parameters can be used in this way either together, on their own or any combination thereof.

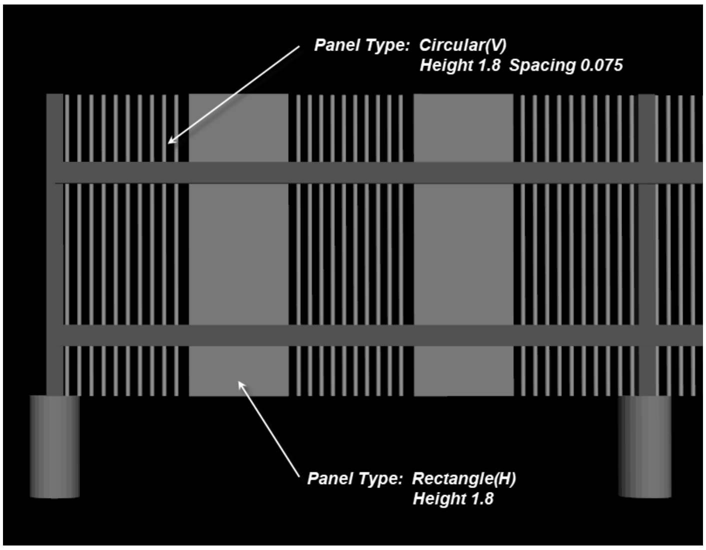
Combining two Panel types using

Start Mid and End (Intermediate)



The sold panels are type **Rectangle(H)** and use similar **Extras** as the paling type. This allows a seamless combination as long as the segment length of the selected string, can accommodate the length combination, set in the extras.



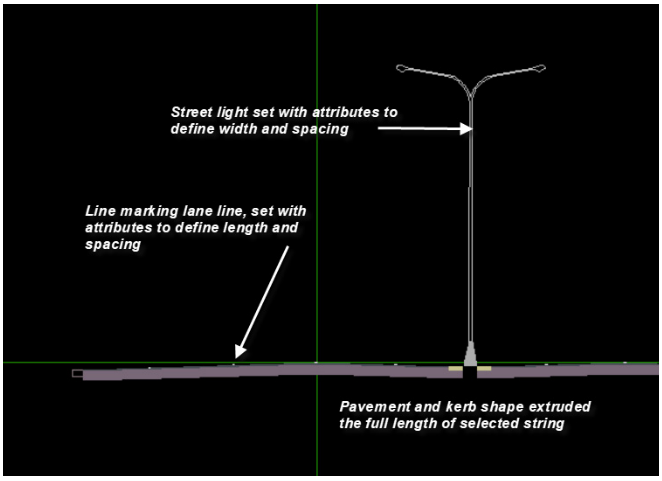


12da Profiles(s) select

Profiles generally drawn at origin 0,0 and define shapes that are to extruded along a selected string.

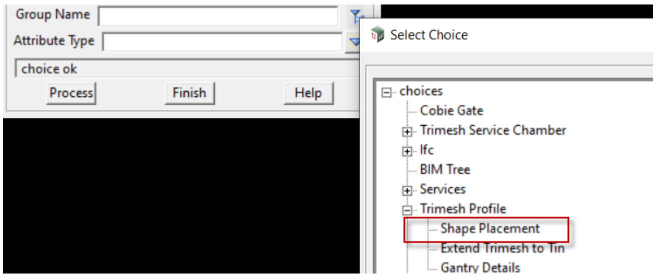
Attributes can also be set to shapes that like street lights in the example below, that define a thickness and placement interval.

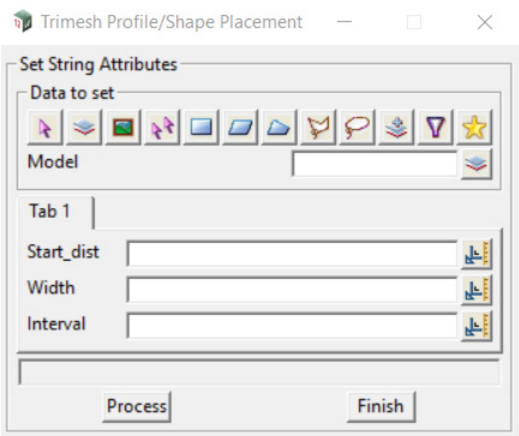
The same can be set for linemarking.

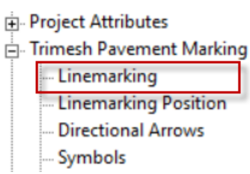


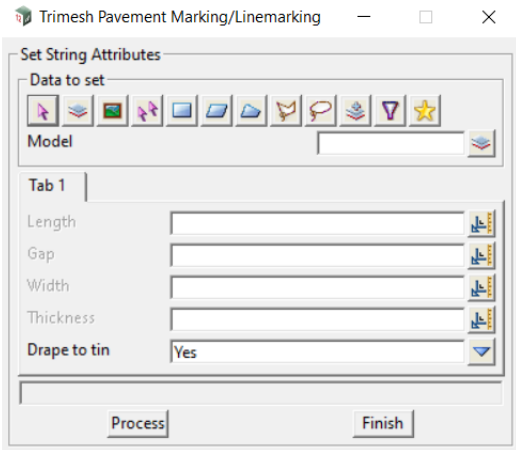
Attributes for the above settings are available from the menu item below

Menu: Utilities->Attributes->Global Attributes->Set global attributes









Name input

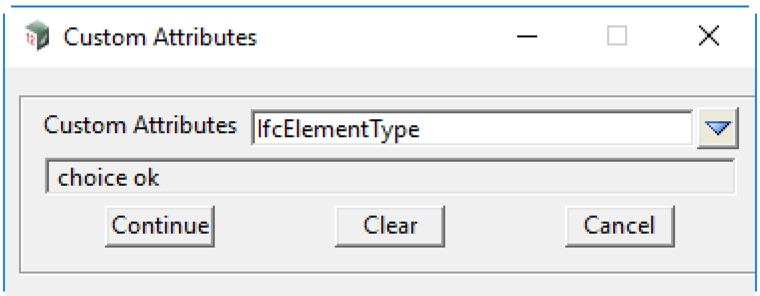
Name of the Trimesh.

Attributes select

This option activates a selection of attributes created from the option below.

Menu: Utilities->Attributes->Global Attributes->Set global attributes

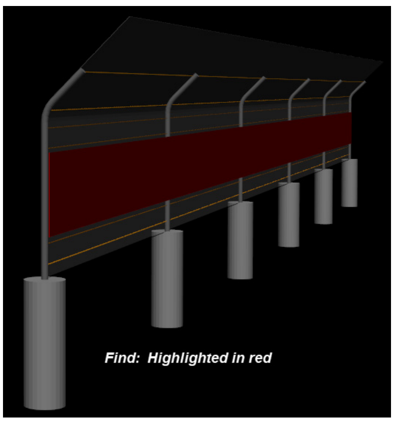
The attributes are set to all the Trimesh elements and are typically BIM attributes.



Find select

This option highlights the Trimesh created from the row in the grid.

*The **Preview** button must be activated first though.*



Process button

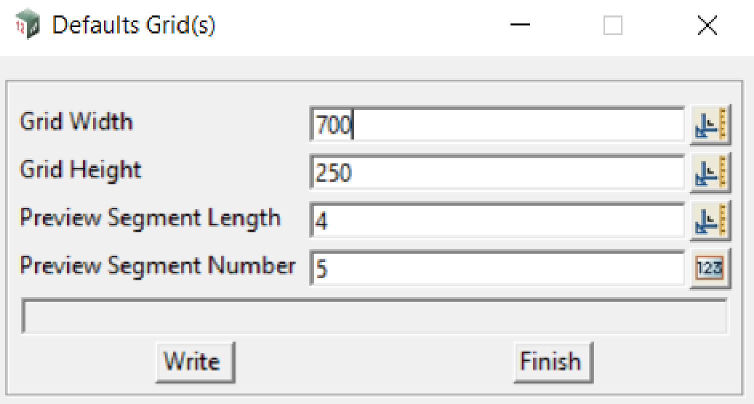
Creates an open GL perspective view titled "Preview".

The Trimesh(s) are created from the active Vertex & Segment grids, and added to the view.

Defaults button

LMB will activate the panel below to enter defaults for the size of the main panel. These will take effect the next time the panel is opened from the menu.

Preview details for segment length and number displayed.

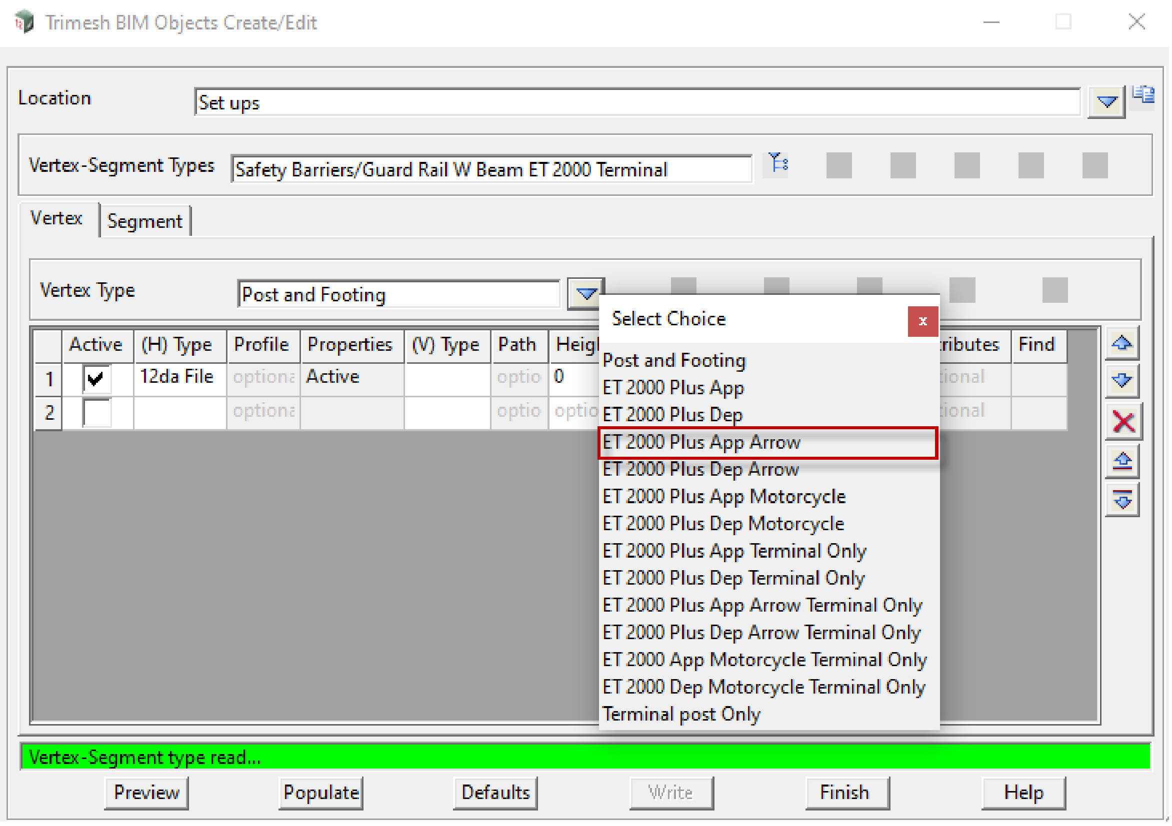


Finish button

Finish button.

11.2.1.2.1 How to create a user defined vertex type using a 12da file

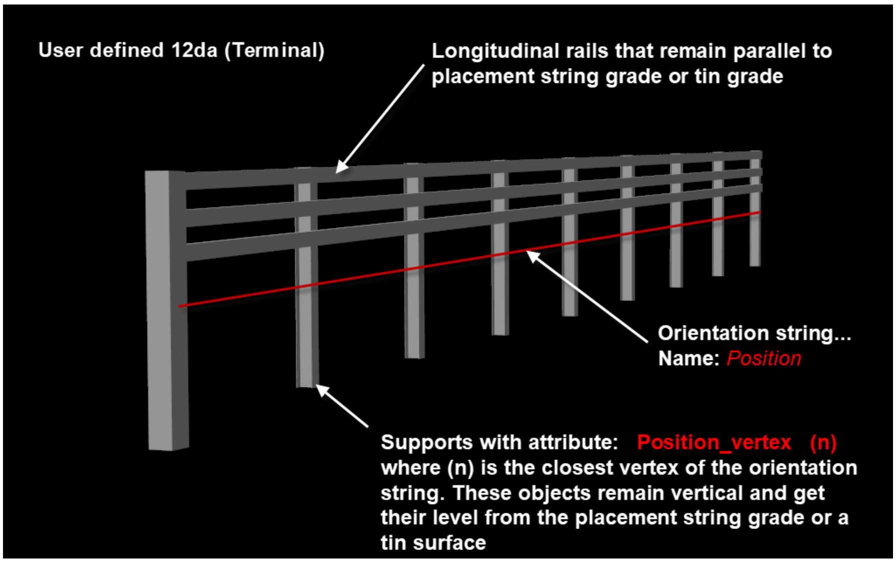
Below is an example of a **12da file** that is part of the install.



You may want to create your own terminal end and be able to place it in the same manner you placed the install type.

Below is an example of a **user defined terminal**, with a few necessary tips on how to prepare the data.

We will focus on a terminal that is to be positioned at the start of a string, with vertical supports or posts and some longitudinal rails that will follow the tin surface.



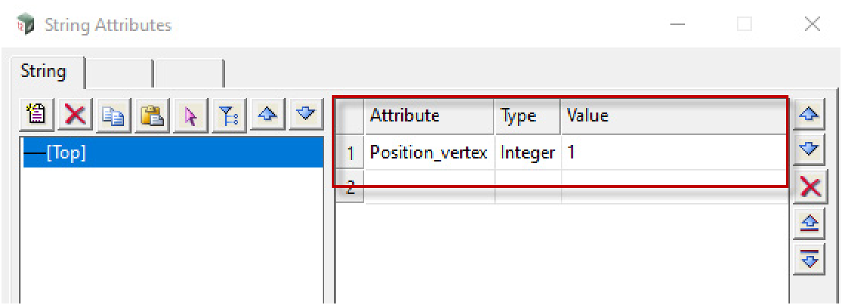
The terminal is located at 0,0 origin, and runs from North to South.

•"Create a super string with the name 'Position"

•"Take care with the name as it is the basis of a search when the terminal is placed. This string is however deleted once placement is complete.

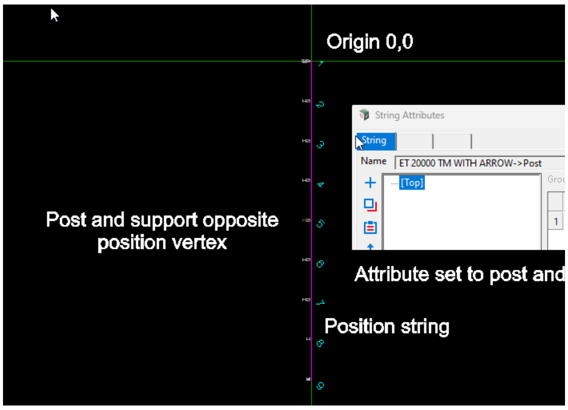
•"If you have posts or supports that need to be positioned **vertically** at placement, then create a **vertex** along the "Position" string **opposite** each post or support.

Attribute syntax:



The value above comes from the 'position" string, that the post or support is opposite.

Refer image below:



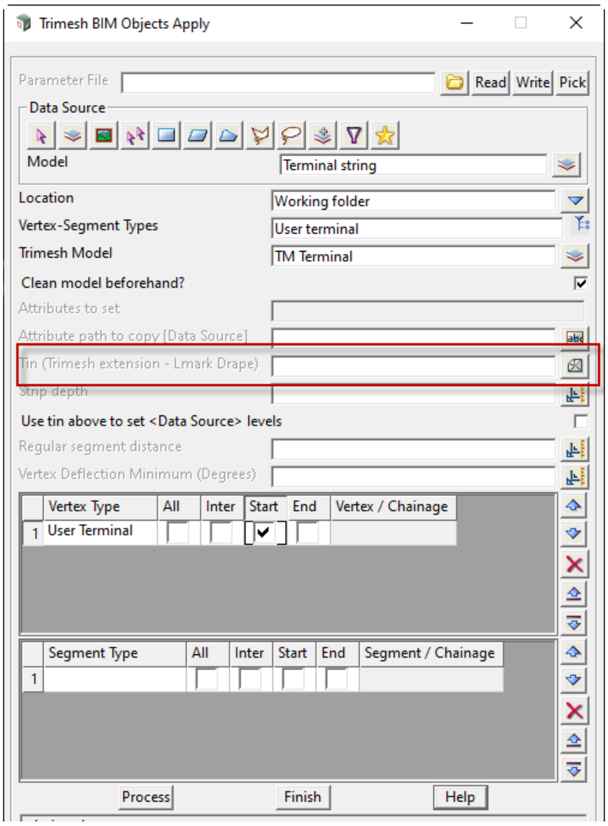
As the rails run in a longitudinal direction, there is no need to set any attributes to them.

So, any elements that have the attribute set, are treated as posts or supports and remain in a vertical position when placed.

Their final level, and that of the longitudinal rails, come from either a tin surface or the extended grade of the placement string.

Finally write out the terminal data as a **12da file**, stored wherever you can access it easily.

Create a definition, similar to that shown below.



Again, the final level, and that of the longitudinal rails, come from either a tin surface or the extended grade of the placement string.

11.2.1.2.2 How to create a user defined pipe trench trimesh from a profile string, using a 12da file

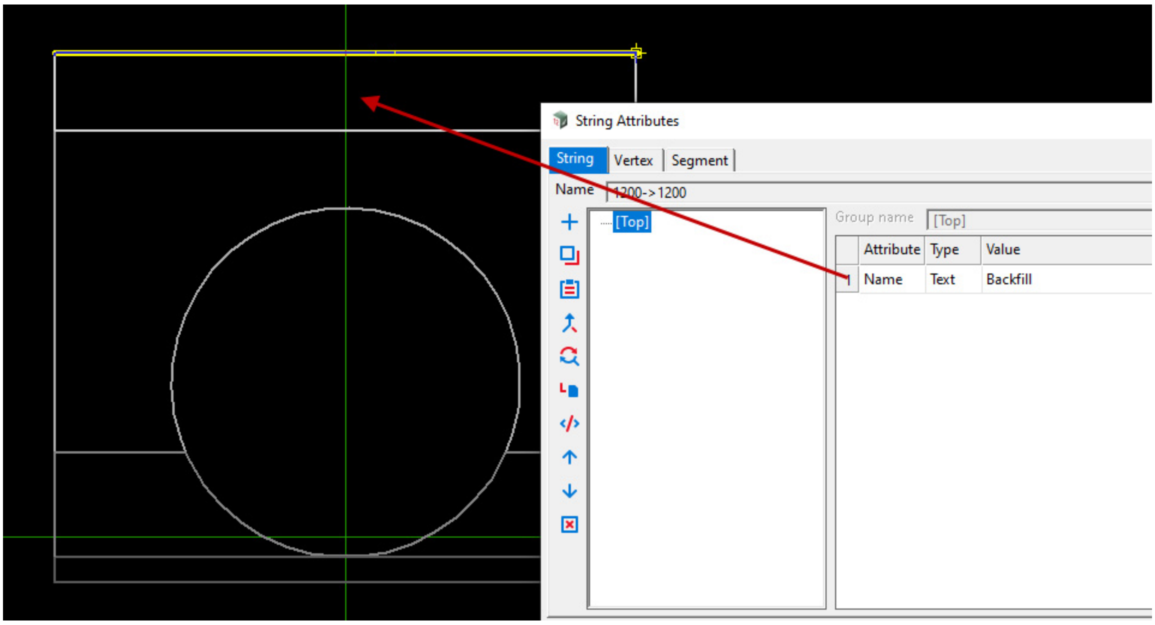
Example 12da file that is part of the install.

12d Drainage Trench.12da

12da Profiles(s)

Profiles generally drawn at origin 0,0 and define shapes that are to extruded along a selected super string.

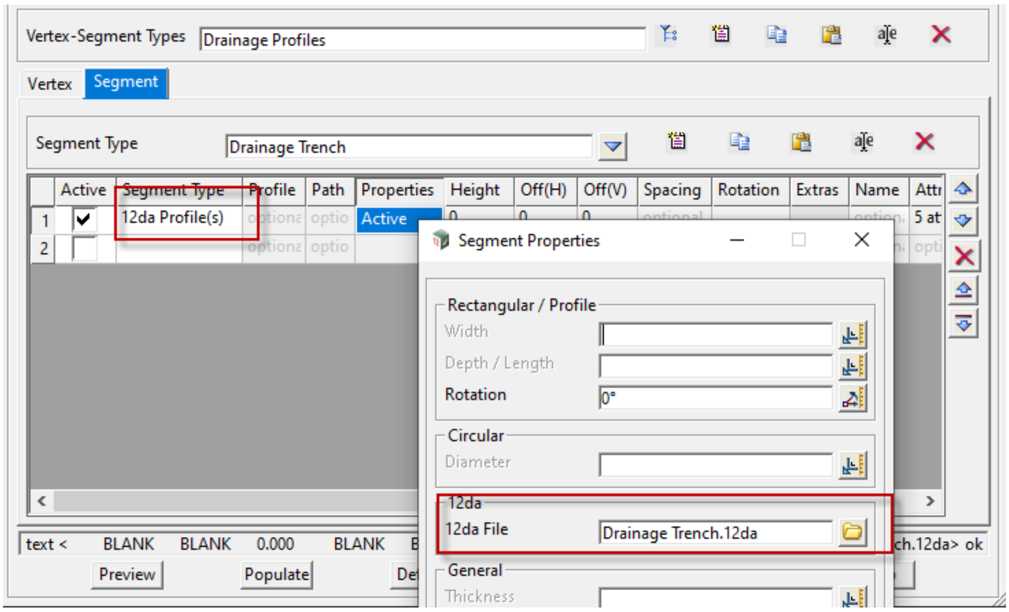
Attributes are to be set to each profile that defines the name of the trimesh trench profile



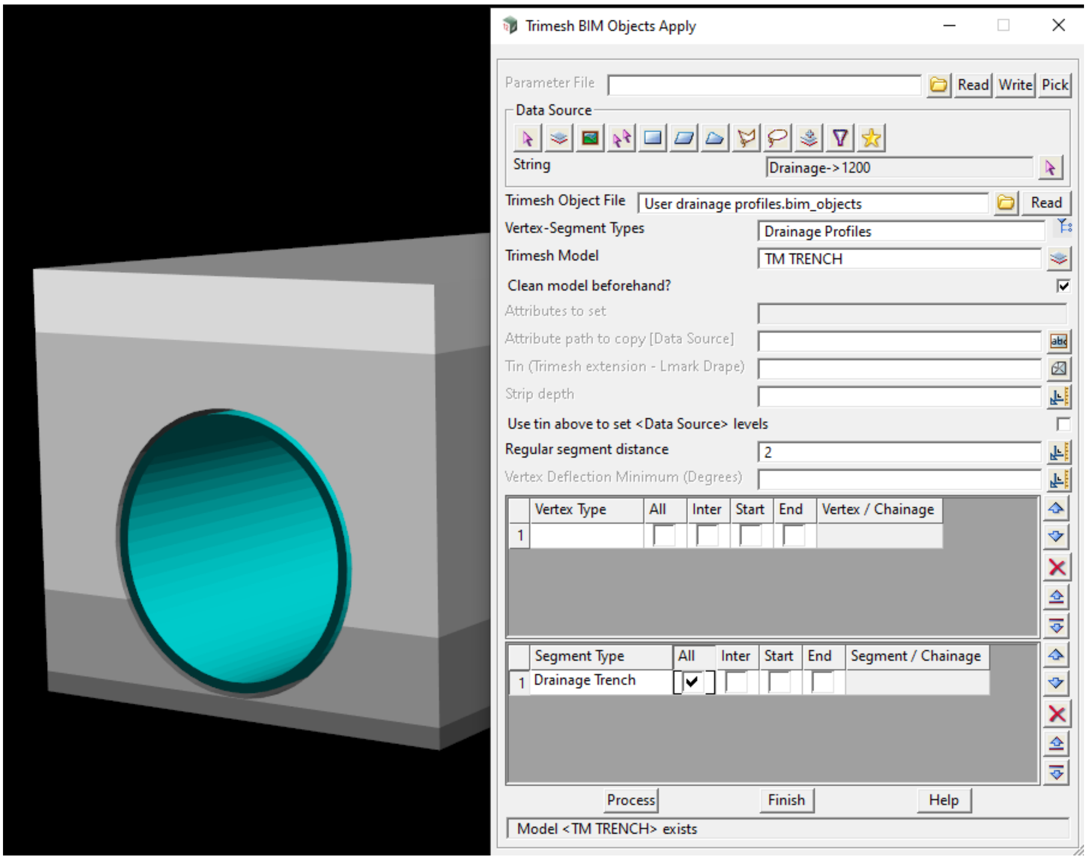
e.g. For a 1200 diameter pipe, its profiles are drawn on a model called 1200 with a name 1200.

Write out a 12da file of the profiles.

Create a Vertex Segment Type ->Segment…as per below



Note: When applying the above, the name of the super string must be called **1200**.



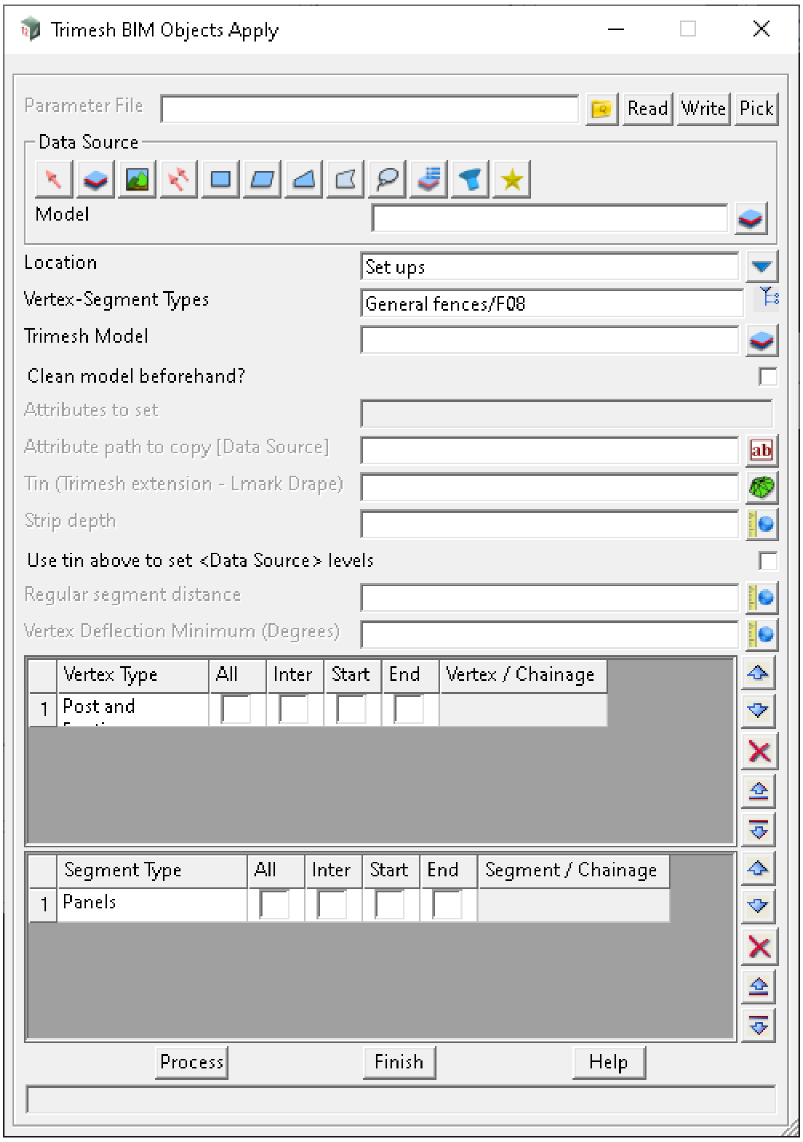
Continue to 11.2.1.3 Apply BIM Objects or return to 11.2.1 Create Trimesh.

11.2.1.3 Apply BIM Objects

Position of option on menu: **BIM =>Trimesh =>Create =>BIM objects apply**

This option places trimeshes from a ***12d_Trimesh_Node_Link.4d*** file at user selected vertices and segments of super strings.

Selecting **Trimesh BIM objects apply** brings up the **Trimesh Node-Link Placement** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Parameter File	file	optional	*.12dvsa files

All selections in the panel can be saved to a file. This file will have the extension ".12dvsa".*

Data source	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Select string data to apply trimesh(s) along.

Location choice box Setups, User

*This relates to where the standard file called **12d_Trimesh_Node_Link.4d** resides.*

Set ups, user, working folder or customer if defined.

Vertex-Segment Types choice box

The choice list is created from the above file selected.

Trimesh Model input

Model to place Trimesh(s) on.

*Be aware that there is a **"Clean model beforehand"** following.*

Clean model beforehand? tick box

*If **ticked**, the model for trimeshes is cleaned before the trimeshes are calculated.*

Attributes to set select box optional

This option will activate a selection of attributes created from the option below:

Menu: Utilities->Attributes->Global Attributes->Set global attributes

The attributes are set to all the Trimesh elements and are typically BIM attributes.

Attribute path to copy (Data source) select box optional

If the data source has some attribute information, those attributes can be copied onto any trimesh created.

*Example: **Survey**/Surveyor **Survey**/Date of survey*

*In the case above type the heading **Survey** in the field.*

Tin (Trimesh extension - Lmark Drape tin box optional

Pavement markings will be draped onto the tin.

Any trimesh (typically) trenches etc can have the top or bottom of the trimesh surface extended to the tin.

Strip depth real input optional

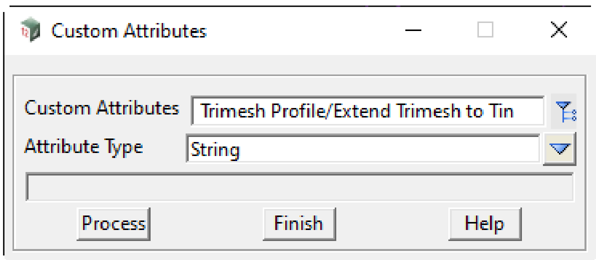
Strip applied to tin (+ve down).

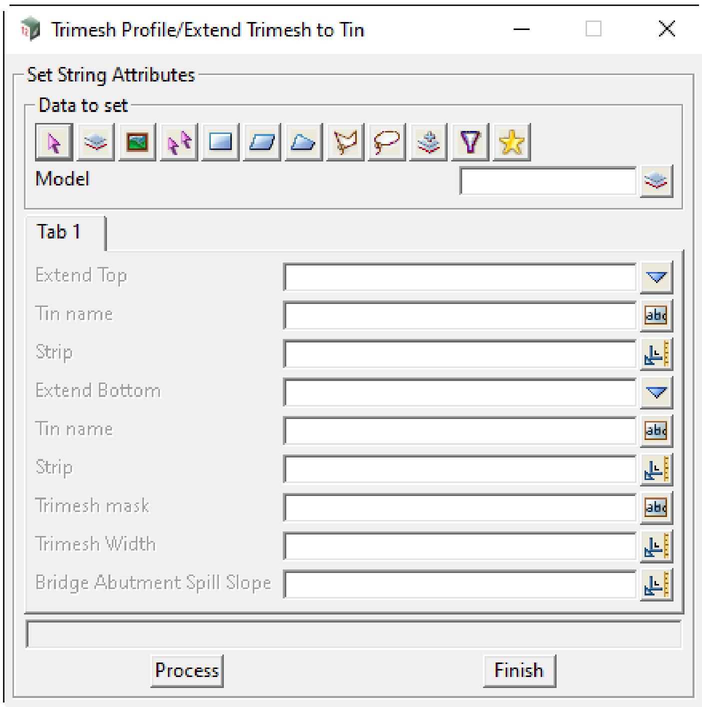
Attributes options using a Tin and strip value

This option will activate a selection of attributes created from the option below:

Menu: Utilities->Attributes->Global Attributes->Set global attributes

A selection called "Trimesh to Tin" is available as per below

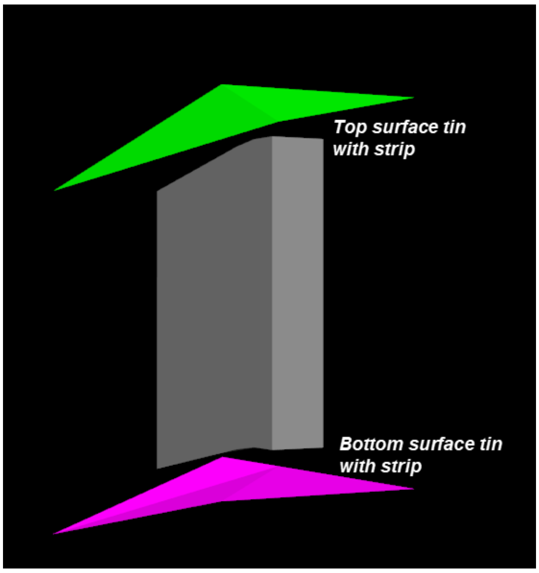




The attributes, when set, can be used to extend a Trimesh top surface or bottom surface to a tin.

The attributes can be activated from the panel option:

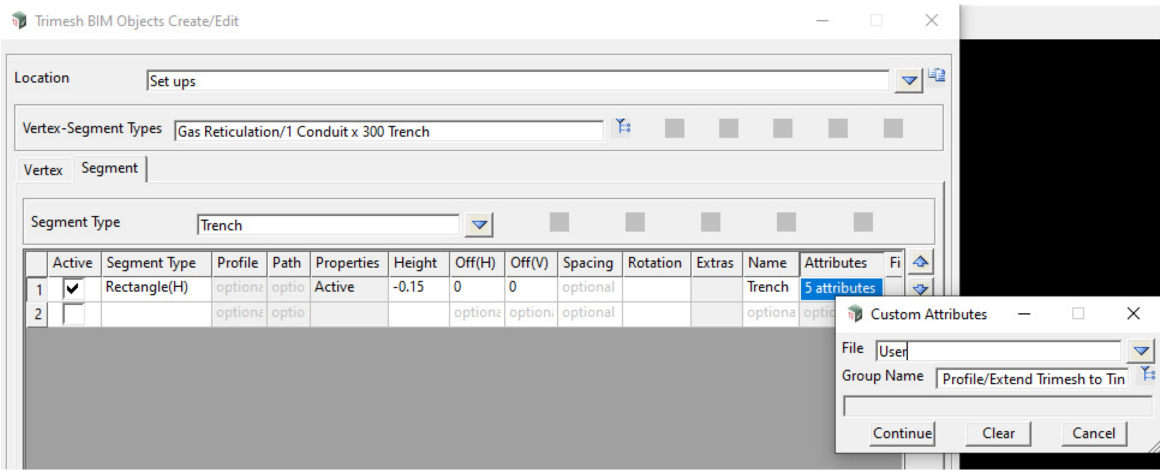
Attribute to set



The attributes can however be set when the feature is first created in the Create/Edit option.

Attributes can be set to any individual Vertex or Segment part.

As long as the tin(s) specified exist… then the tin extension is automatic, on placement.



Use tin above to set <Data Source> levels toggle   active

All strings in the data source selected will be draped onto the tin before a trimesh is created. The data string levels are not actually altered however.

Regular segment distance   real box   optional

This value is used to place vertex and segment types.

e.g. Fence posts / Railings and Palings

*If **blank**, then vertex intervals on the data string is used.*

Vertex Deflection Minimum (Degrees)   real box   optional

A default value is used that caters for small changes of direction along a string.

So small defections are ignored e.g.

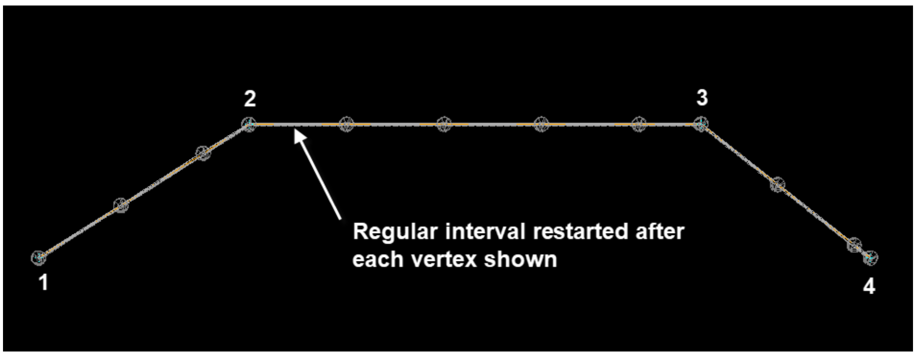
An Apply Many string (created around a large radius curve).

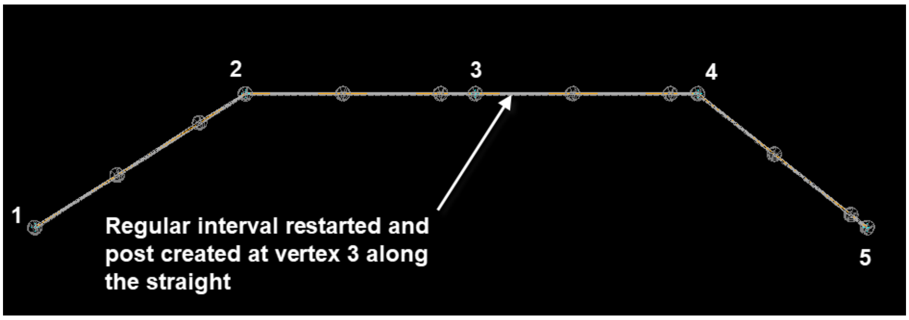
A value can be set at the user's discretion.

***Zero** (0) can be set as the value if you require all horizontal points to be included.*

The regular segment distance is restarted after each horizontal point.

***Hint**: Particularly useful, if e.g. you require a vertex post at a HIP that falls on a straight.*





Grid information - Vertex Type

Vertex type choice box

The list is generated from the location directory Vertex-segment Type chosen.

Positioning options

__Note__: All positioning types relate to points on the data source string selected, or points created along the string when a __Regular segment distance__ is used.

All Inter Start End Vertex No toggle

__All__ - places the node type selected at every vertex on the data source selection

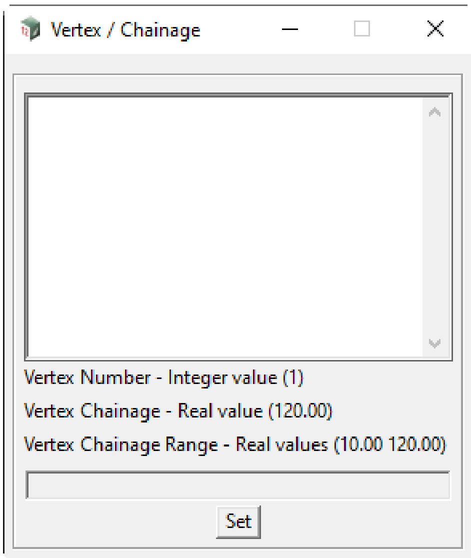
__Inter__ - places the node type selected at every vertex on the data source selection, except at the start and end.

__Start__ - places the node type selected at the first vertex only.

__End__ - places the node type selected at the last vertex only.

__Vertex / Chainage__ - places the vertex type selected, in a variety of ways including by chainage and chainage range.

LMB will activate the panel below.



A __vertex number__ is entered as a __single integer__ (one per line).

A __chainage value__ is entered a __real number with a decimal value__ (one per line).

A __chainage range__ is entered as __two real values, separated by a space__.

__Note__: The surrounding brackets are __not__ required (as shown on the panel).

When a __chainage range__ is used, the Regular segment distance is then used to calculate the points in *between.*

Grid information - Segment Type

Segment type choice box

The list is generated from the location directory Vertex-segment Type chosen.

Positioning options

***Note**: All positioning types relate to segments on the data source string selected, or segments created along the string when a **Regular segment distance** is used.*

All Inter Start End Vertex No toggle

***All** - places the link type selected at every segment on the data source selection.*

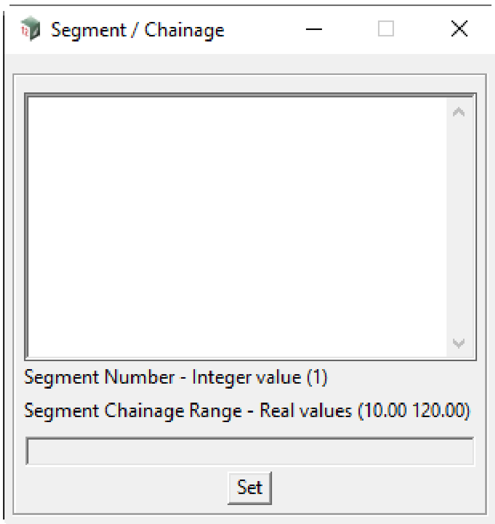
***Inter** - places the link type selected at every segment on the data source selection, except at the start and end.*

***Start** - places the link type selected at the first segment only.*

***End** - places the link type selected at the last segment only.*

***Vertex / Chainage** - places the segment type selected, in a variety of ways including by chainage and chainage range*

LMB will activate the panel below



*A **segment number** is entered as a **single integer** (one per line).*

*A **chainage range** is entered as **two real values, separated by a space**.*

***Note**: The surrounding brackets are **not** required (as shown on the panel).*

*When a **chainage range** is used, the Regular segment distance is then used to calculate the segments in between.*

Additional note:

Chainages entered, relate to chainages on data selected.

Start chainages should be ascertained from the data as it can vary, depending on the origin of the data (Survey, design apply many etc).

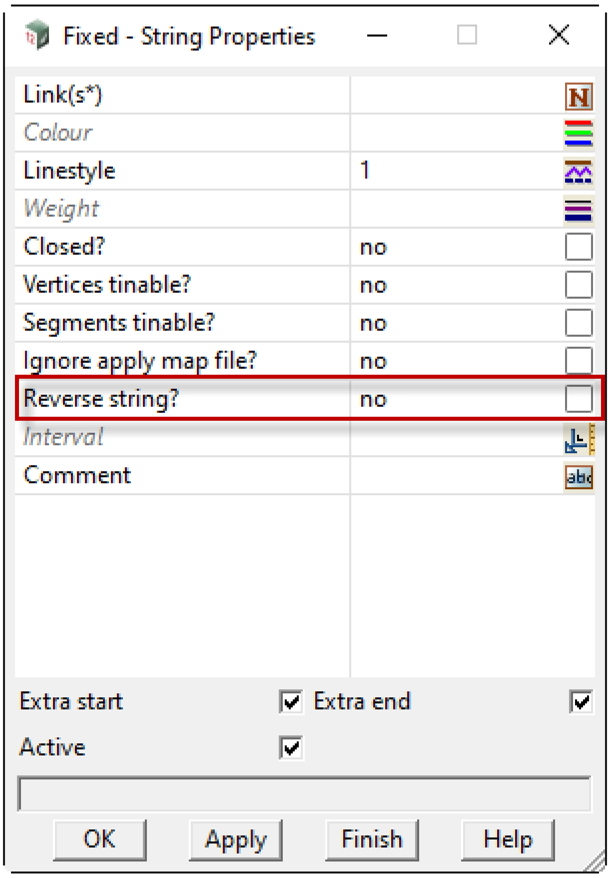
It should also be noted that all example features such as fences, safety barriers and terminals etc, shipped within 12d, are designed for Left Side orientation along a string.

The string will need to reversed, if a Right-Side orientation is required.

Apply Many MTF:

It should be noted that links can be reversed in the MTF as a modifier

Create->String Properties



Buttons at Bottom

Process button

Applies the types and creates the Trimesh.

Note: Complex Vertex and Segment types may take longer to be created

So be patient…

Finish button

Finish button.

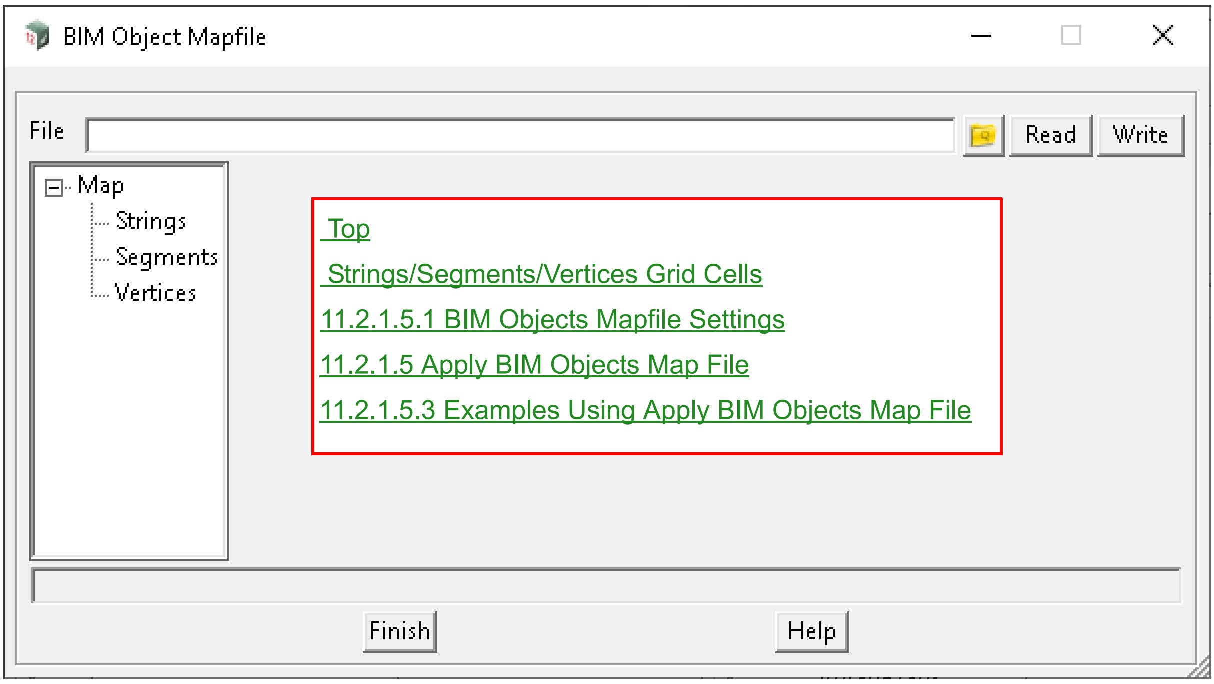
Continue to 11.2.1.4 Create/Edit BIM Objects Map File or return to 11.2.1 Create Trimesh.

11.2.1.4 Create/Edit BIM Objects Map File

Position of option on menu: **BIM =>Trimesh =>Create =>BIM objects map file**

This option creates and edits the BIM Objects Map File that is applied using the 11.2.1.5 Apply BIM Objects Map File.

Selecting **BIM objects map file** brings up the **BIM object Mapfile** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Top

File	file box		*.bim_mapfile

File to read/write.

Read	button		

*Reads a *bim_mapfile and loads it into the fields of the panel.*

Write	button		

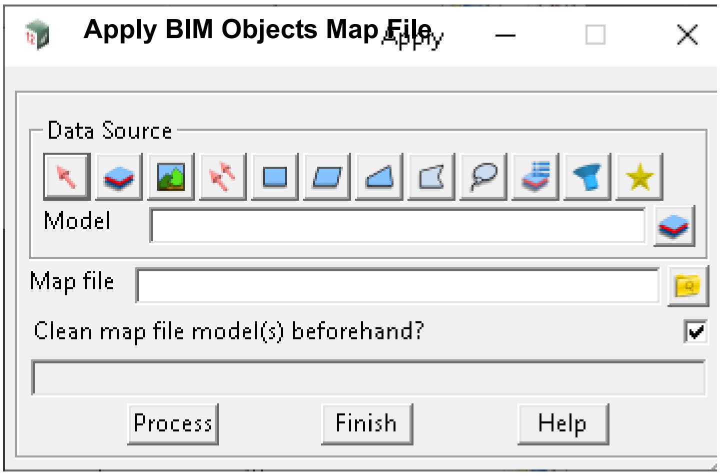
*Writes the data in the panel to the *.bim_mapfile given in the* **File** *field.*

Continue to Strings/Segments/Vertices Grid Cells.Continue to 11.2.1.5 Apply BIM Objects Map File or return to 11.2.1 Create Trimesh.

11.2.1.5 Apply BIM Objects Map File

Position of option on menu: **BIM =>Trimesh =>Create =>BIM objects map file**

Selecting **BIM objects map file apply** brings up the **Trimesh BIM Objects Apply Mapfile** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to write	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	selected source	Model	

Data source of data to apply the BIM Objects map file to.

Map File	BIM map file box		*.bim_mapfile

BIM map file to apply to the selected data.

Clean map file model(s) beforehand? tick box

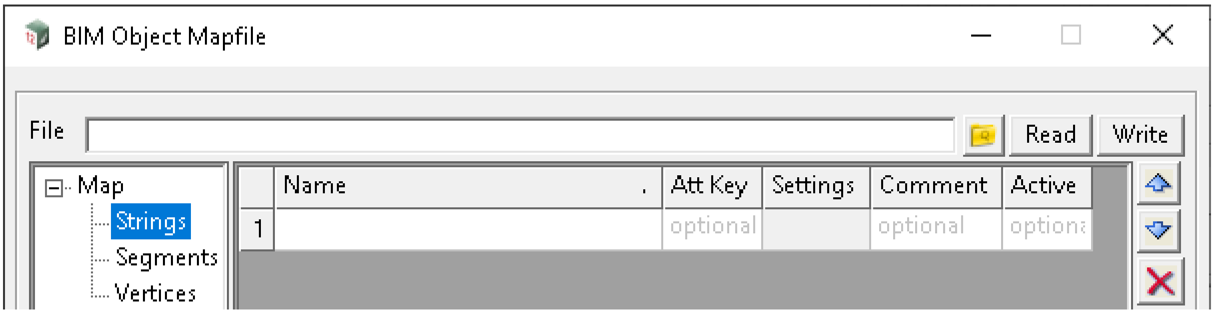
*If **ticked**, all the models that will be created by applying the BIM Objects map file will be cleaned before processing.*

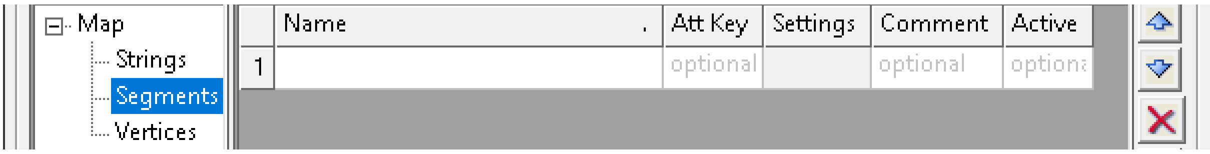
Process button

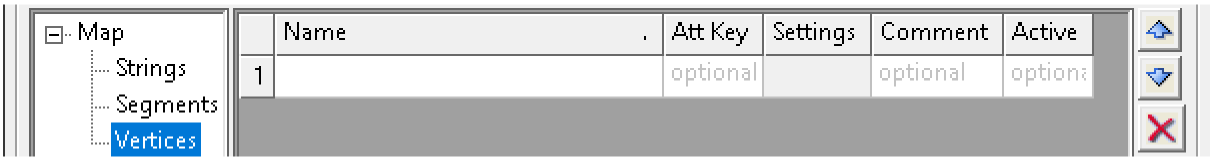
Apply the bim_mapfile map file.

For examples of using ***Trimesh BIM Objects Apply Map File***, see 11.2.1.5.3 Examples Using Apply BIM Objects Map File.

Strings/Segments/Vertices Grid Cells







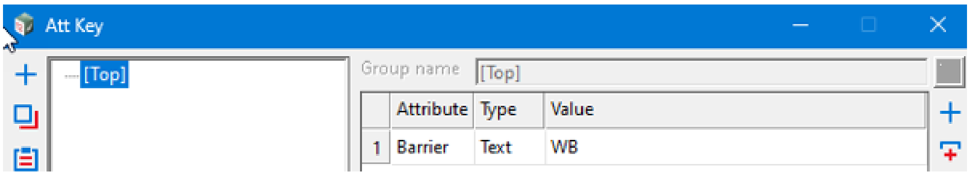
Name text box .

Text to match against the name of an element when the BIM Object Mapfile is applied. See 11.2.1.5 Apply BIM Objects Map File.

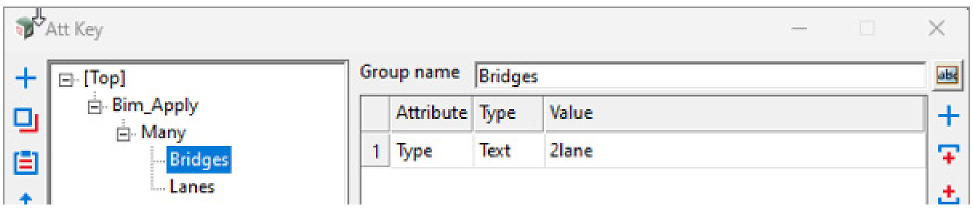
Att Key input optional

Att Key *(Attribute key) is used in conjunction with the* **Name** *field for matching with the elements to apply the BIM Object Mapfile to.* ***Att Key*** *can be a multi-level attribute.*

For example, Att key ***Barrier***



or Att Key ***BIM_Apply/Many/Bridges/Type***



Settings pop up panel

Clicking in the Settings column for a row brings up the ***Settings*** *panel. See* 11.2.1.5.1 BIM Objects Mapfile Settings.

Comment text box

An optional comment to explain what this row is used for.

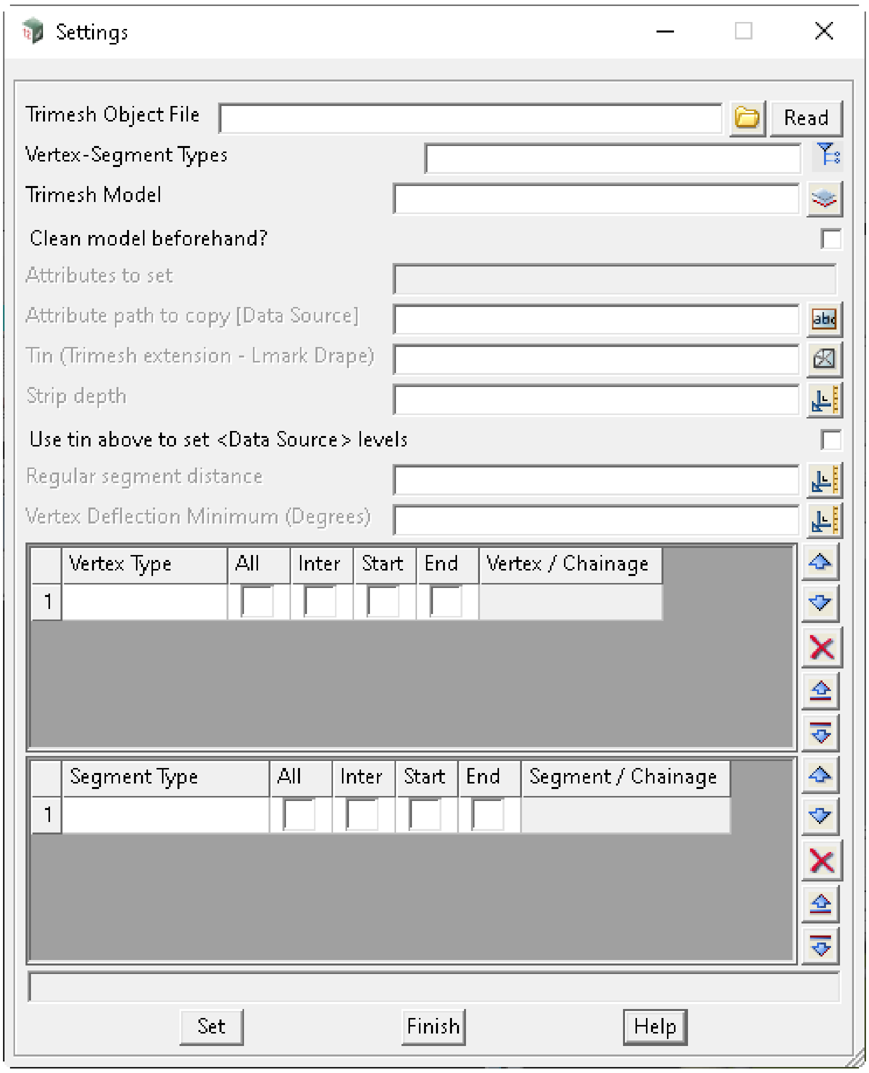
Active yes-no box

If ***yes****, the row is used in the Apply.*

If ***no****, the row is* ***NOT*** *used in the Apply.*

Continue to 11.2.1.5.1 BIM Objects Mapfile Settings or return to 11.2.1.4 Create/Edit BIM Objects Map File.

11.2.1.5.1 BIM Objects Mapfile Settings



Trimesh object file file box *.bim_objects files

**.bim_ojects file created by _.*

Vertex-Segment types

Choice list created from the BIM Objects file selected in the **Trimesh object file** *field.*

Trimesh model model box

Model to place trimesh(s) in.

Be aware that there is a ***"Clean model beforehand"*** *following.*

Clean model beforehand? tick box

If ***ticked****, the model for trimeshes is cleaned before the trimeshes are calculated.*

Attributes to set select box optional

This option will activate a selection of attributes created from the option below:

Menu: Utilities->Attributes->Global Attributes->Set global attributes

The attributes are set to all the Trimesh elements and are typically BIM attributes.

Attribute path to copy (Data source) select box optional

If the element being used from the data source of the 11.2.1.5 Apply BIM Objects Map File *has some attribute information, those attributes can be copied onto any created trimesh.*

For example, if the element has the attributes: ***Survey****/Surveyor and* ***Survey****/Date of survey, then an* **Attribute path to copy (Data source)** *value of Survey will copy both the attributes to the element.*

Tin (Trimesh extension - Lmark Drape tin box optional

Pavement markings will be draped onto the tin.

Any trimesh (typically) trenches etc can have the top or bottom of the trimesh surface extended to the tin.

Strip depth real box optional

Strip applied to the tin (positive is down).

Use tin above to set <Data Source> levels toggle active

All strings selected by the data source of the 11.2.1.5 Apply BIM Objects Map File *will be draped onto the tin before a trimesh is created. However the data string z-values are not actually altered.*

Regular segment distance real box

Value to use to place vertex and segment types.

e.g. Fence posts / Railings and Palings

If ***blank****, then vertex intervals on the data string are used.*

Vertex Deflection Minimum (Degrees) real box optional

The value is in decimal degrees and should be greater of equal to zero.

If ***non-zero*** *and the absolute value of the deflection angle at a vertex is* ***less than*** *the* **Vertex Deflection Minimum** *then the vertex is not used for placing the BIM object.*

If ***zero*** *then all vertices are used.*

So the **Vertex Deflection Minimum** *is used so that small deflections are ignored.*

For more information, see 11.2.1.5.2 Vertex Deflection Minimum.

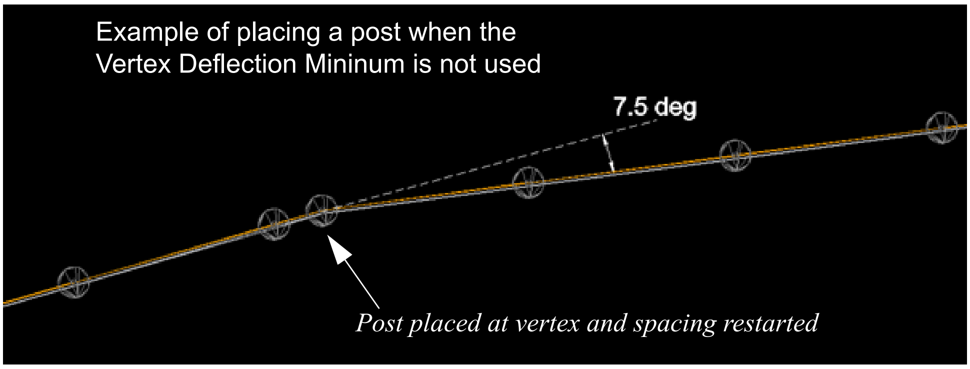
Continue to 11.2.1.5.2 Vertex Deflection Minimum or return to 11.2.1.4 Create/Edit BIM Objects Map File.

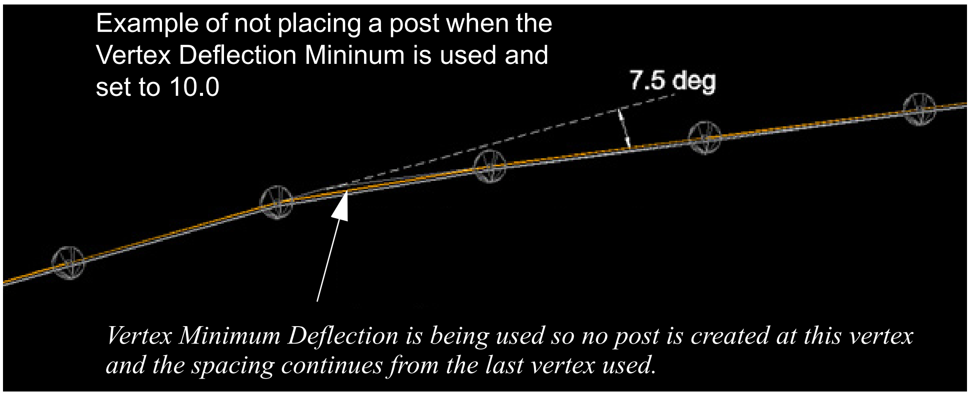
11.2.1.5.2 Vertex Deflection Minimum

The **Vertex Deflection Minimum** is used so that small defections angles at a vertex are ignored and not used for playing a BIM object.

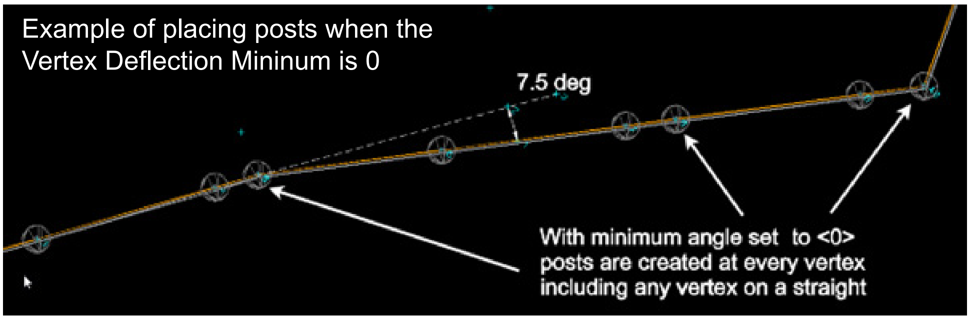
The value of the **Vertex Deflection Minimum** is in decimal degrees and should be greater of equal to zero.

If the value is **non-zero** and the absolute value of the deflection angle at a vertex is **less than** the **Vertex Deflection Minimum** then the vertex is not used for placing the BIM object.





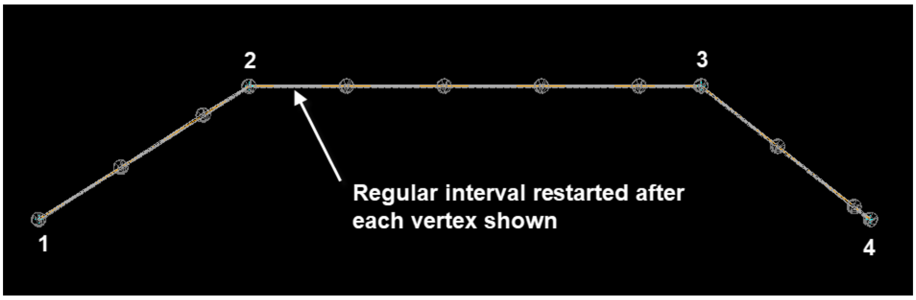
If **zero** then all horizontal vertices are used.

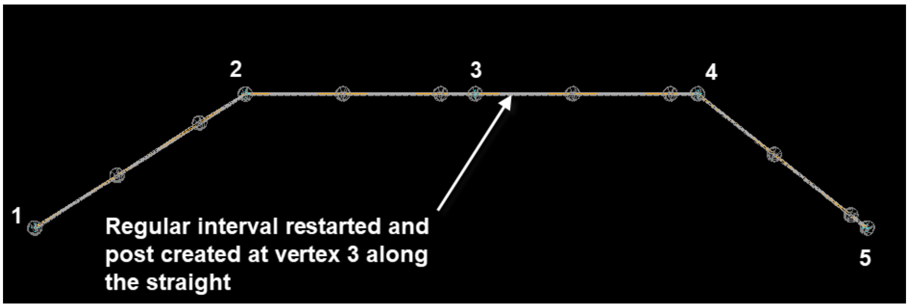


So using a value of **zero** allows you to place a BIM object at a HIP that falls on a straight.

Note:

The regular segment distance is restarted after each horizontal point.





Continue to 11.2.1.5.3 Examples Using Apply BIM Objects Map File or return to 11.2.1.4 Create/Edit BIM Objects Map File.

11.2.1.5.3 Examples Using Apply BIM Objects Map File

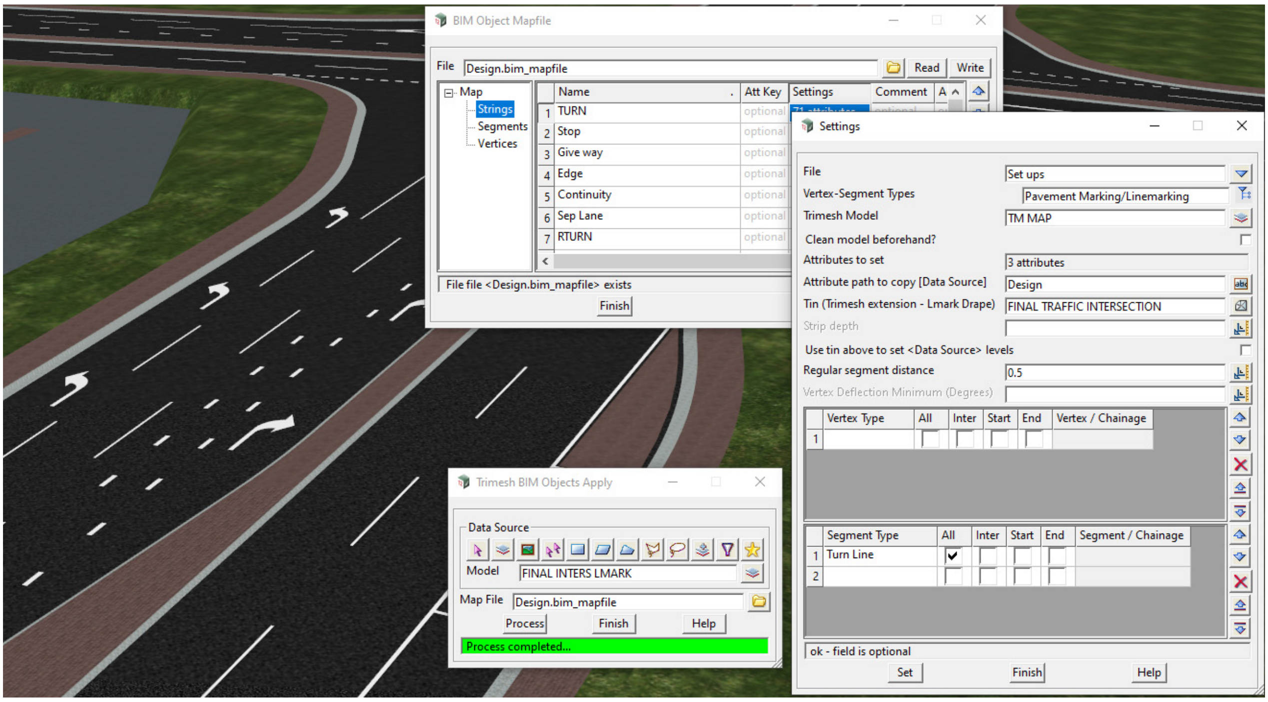
See

- 11.2.1.5.3.1 Apply BIM Objects Mapfile for String Mapping
- 11.2.1.5.3.2 Apply BIM Object Mapfile for Segment Attribute Mapping
- 11.2.1.5.3.3 Apply BIM Objects Mapfile for Vertex Attribute Mapping

11.2.1.5.3.1 Apply BIM Objects Mapfile for String Mapping

This option pertains to a complete string that can be defined using the string name along with a string attribute.

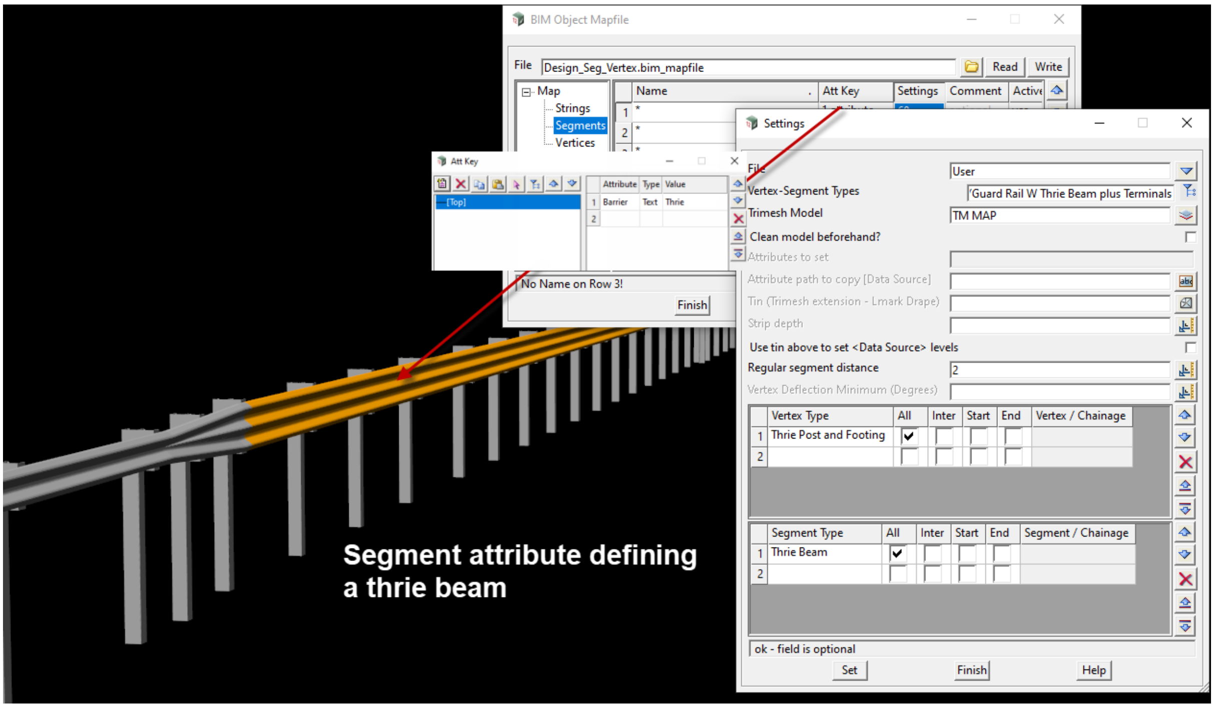
The image below uses **Name** only, but the name could have been for example "lmark" and the string attribute could have been the type of line marking (e.g. "turn").



11.2.1.5.3.2 Apply BIM Object Mapfile for Segment Attribute Mapping

This option pertains to segment attributes along a string. The image below uses a wildcard (*) as the Name, and a segment attribute called "Barrier"

A separate grid entry is required for each different attribute.

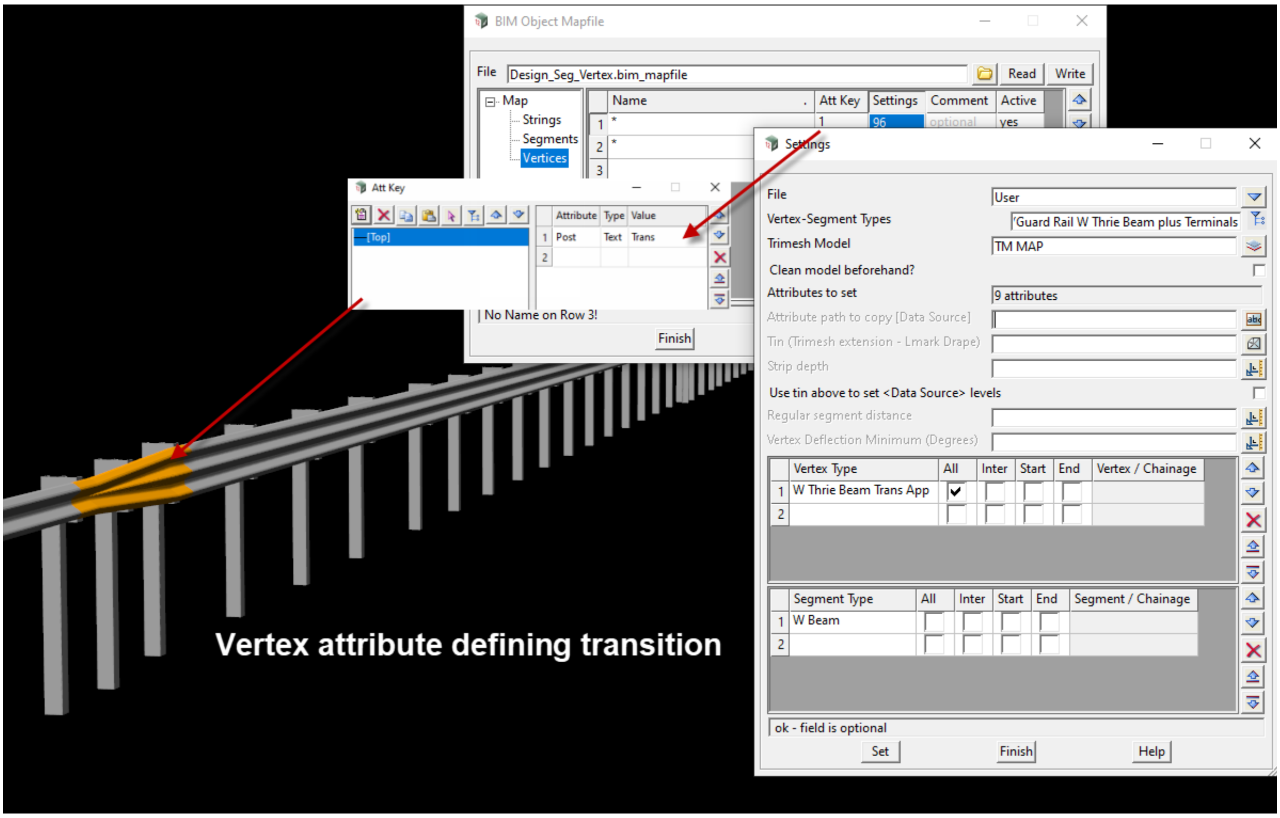


11.2.1.5.3.3 Apply BIM Objects Mapfile for Vertex Attribute Mapping

This option pertains to vertex attributes along a string.

The image below uses a wildcard (*) as the Name, and a vertex attribute called "Post"

A separate grid entry is required for each different attribute.



Continue to 11.2.1.6 Cut and Fill Trimeshes Between Two Tins or return to 11.2.1 Create Trimesh.

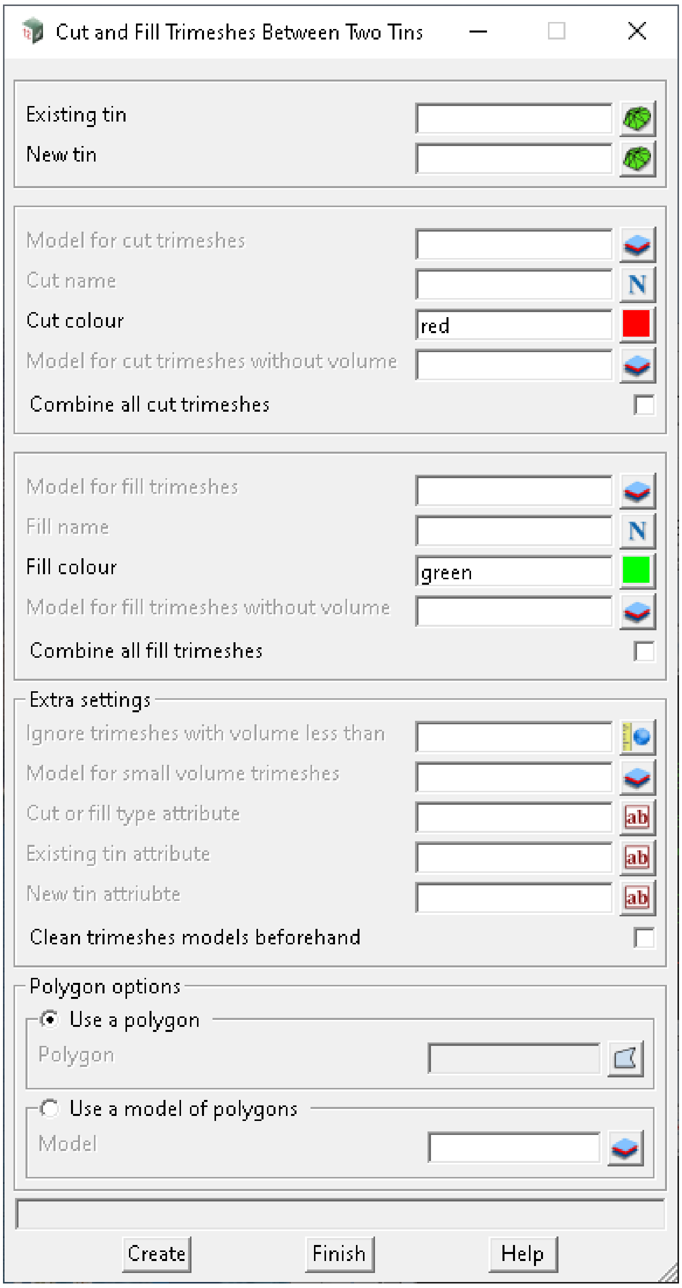
11.2.1.6 Cut and Fill Trimeshes Between Two Tins

Position of option on menu: **BIM =>Create =>Cut and fill trimeshes between two tins**

This option creates the cut trimeshes and fill trimeshes between two tins.

The area to process for cut and fill can be restricted by a single polygon or a model of polygons.

Selecting **Cut and fill trimesh between two tins** displays the **Cut and Fill Trimesh Between Two Tins** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Existing tin	tin box		available tins

Name of the tin to be considered to be the existing surface.

z-values below this surface are in cut and z-values above this surface are in fill.

New tin tin box available tins

Name of the tin to be considered the design or modified surface.

Model for cut trimeshes model box available models

Model for the resulting cut trimeshes.

Cut name name box names.4d

Name for the cut trimeshes.

Cut colour colour box available models

Colour of the resulting cut trimeshes.

Model for cut trimeshes without volume model box available models

If a trimesh does not closed then it will have no volume.

*If **not blank** any cut trimeshes that are not closed will be added to this model.*

***Note**: this is for checking if there are any ill-formed trimeshes.*

Combine all cut trimeshes tick box not ticked

*If **ticked**, all the cut trimeshes will combined into the one trimesh.*

Model for fill trimeshes model box available models

Model for the resulting fill trimeshes.

Fill name name box names.4d

Name for the fill trimeshes.

Fill colour colour box available models

Colour of the resulting fill trimeshes.

Model for fill trimeshes without volume model box available models

If a trimesh does not closed then it will have no volume.

*If **not blank** any fill trimeshes that are not closed will be added to this model.*

***Note**: this is for checking if there are any ill-formed trimeshes.*

Combine all fill trimeshes tick box not ticked

*If **ticked**, all the fill trimeshes will combined into the one trimesh.*

Extra settings

Ignore trimeshes with volume less than real box

*If **not blank**, all cut and fill trimeshes with volume less than this value will not be added to the cut and fill models.*

Model for small volume trimeshes model box available models

*If **not blank** any trimesh with volume less than **Ignore trimeshes with volume less** that will be added to this model.*

Clean trimeshes models beforehand tick box not ticked

*If **ticked**, the models are cleaned before the cut and fill calculations are done.*

Polygon options

Use a polygon radio button

*If **set**, and a string has been selected or a polygon is selected, the polygon is used to restrict the area for calculating cut and fill trimeshes. If no string is selected, the area common to both the Existing tin and the new tin is used.*

Polygon polygon select polygon pop-up

Polygon to restrict the calculations.

For information on selecting a polygon and the polygon pop-up, see 3.26.13 Polygon Select Box.

Use a model of polygons radio button

*If **set**, a model of strings will be used as the polygons to restricted where the cut and fill trimeshes will be calculated.*

Model model box available models

Model of strings to provide the polygons used to restrict the calculating of cut and fill.

Buttons at Bottom

Create button

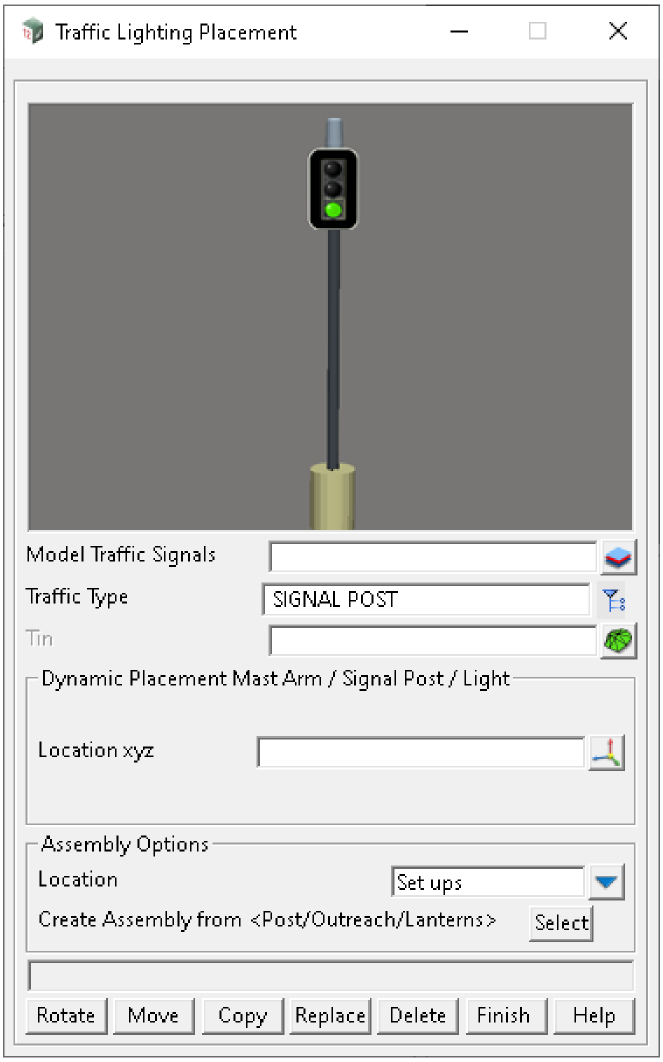
The option is run when **Create** *is pressed.*

11.2.1.7 Trimesh Traffic Signals

Position of option on menu: **BIM =>Trimesh =>Create =>Traffic signals**

This option creates trimeshes representing traffic signals.

Selecting **Traffic signals** brings up the **Traffic Light Placement** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model Traffic Signals	model box		available models

Model to place signals on.

Traffic type	choice box	SIGNAL POST	

Selection of signals posts, outreach and lanterns.

Tin	tin box		

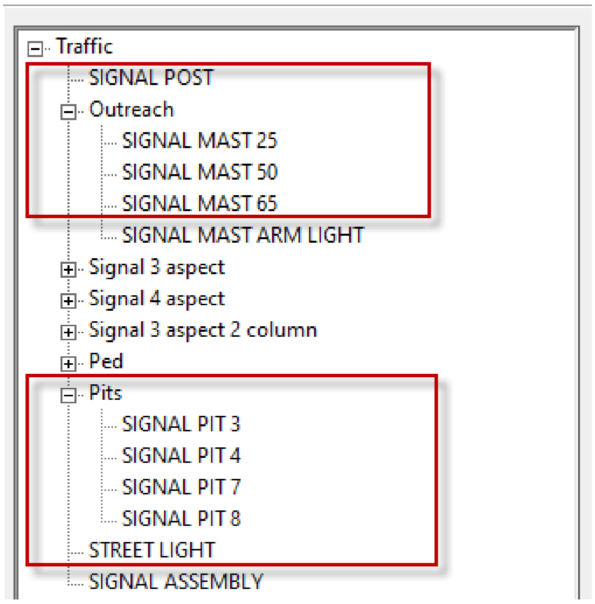
If tin is used then the level insert selection point is taken from the tin, otherwise a selection with a valid x,y and z is required.

Dynamic Placement (Mast Arm/Signal Post and Light)

Location xyz pick

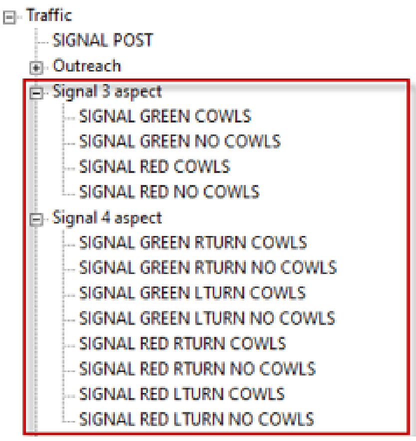
The Traffic types below require a "Location xyz".

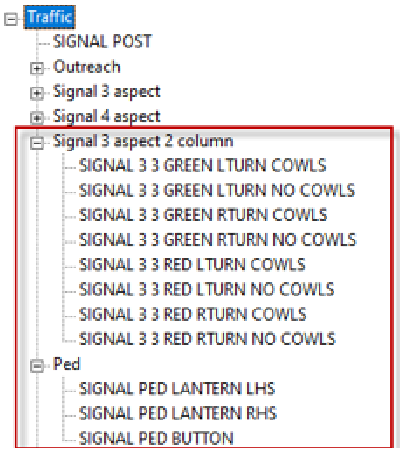
For ease of operation, select from a plan view, as once the position point is accepted, a dynamic rotation of the part is activated. A second selection is required to finalise the rotation.



Select Arm, Post or Light pick

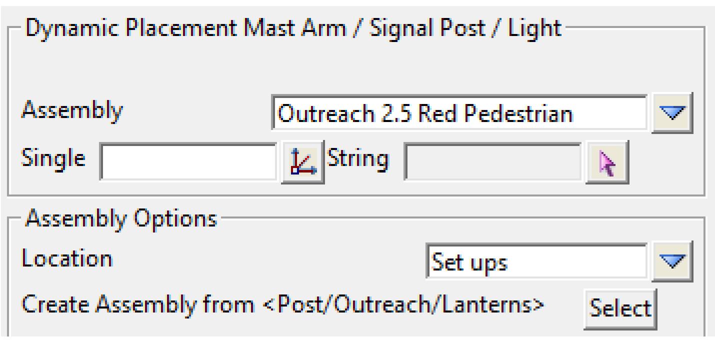
The Traffic types below require you to select a trimesh already placed from the previous list.





Signal Assembly pick

The Traffic type (Signal assembly) displays the options below:



Dynamic Placement Mast Arm/Signal Post and Light

Assembly choice box

Choice list from the location option under Assembly Options.

Single real box

Location xyz selection.

String string select

String selection where assembly is placed at each vertex.

Assembly Options

Location choice box

Location of assembly file: Setups, User or Working folder.

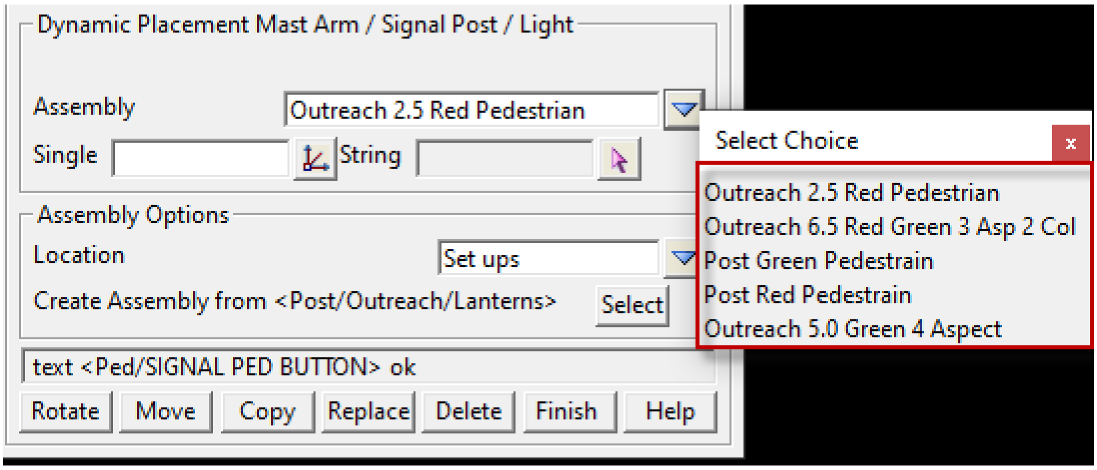
Assembly file: 12d_Traffic_Assembly.

Create Assembly from <Post/Outreach/Lanterns>

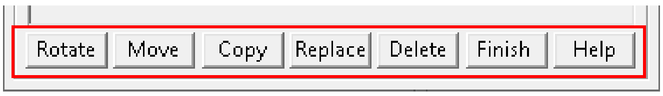
Select button

An assembly can be created and saved by selecting a group of trimesh parts that make up the assembly.

Examples shown below from the install setups area.



Edit Buttons



Rotate button

Signal parts can be rotated as one complete object or as individual parts

If a post or outreach is selected then the complete signal will rotate about its insertion point. (Any lanterns or crossing buttons will rotate with it)

If a lantern is selected, it will rotate independent of the post or outreach, but maintain its connection and insertion point.

Move button

The entire signal assembly, is able to be moved, not as individual parts.

A valid xyz point is required as the final position.

Copy button

The entire signal assembly, is able to be copied, not as individual parts.

A valid xyz point is required as the final position.

Replace button

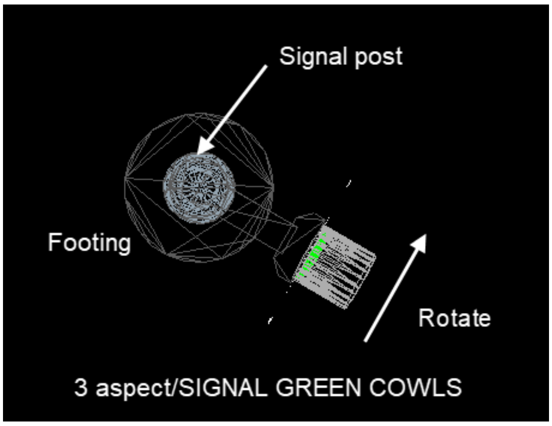
Parts of the entire signal assembly, can be replaced by another.

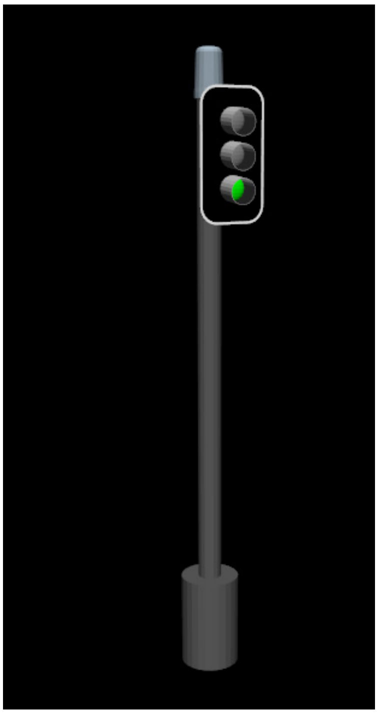
e.g., a 3-phase lantern could be replaced with a 4 phase etc.

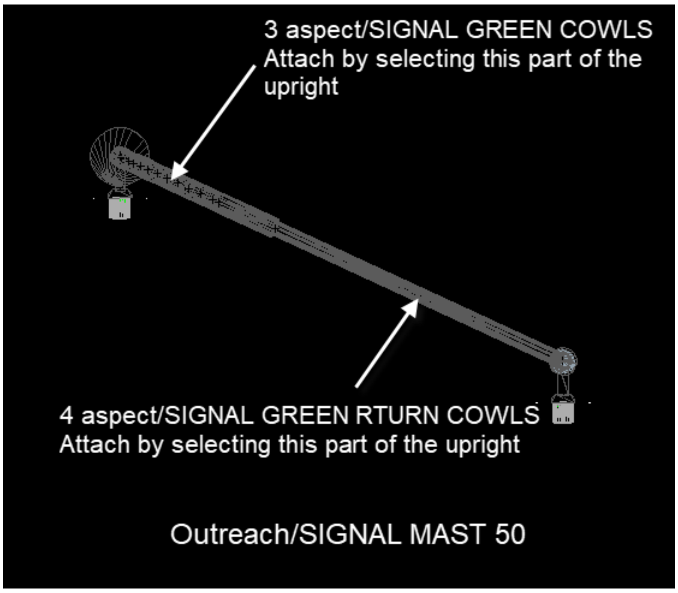
Delete button

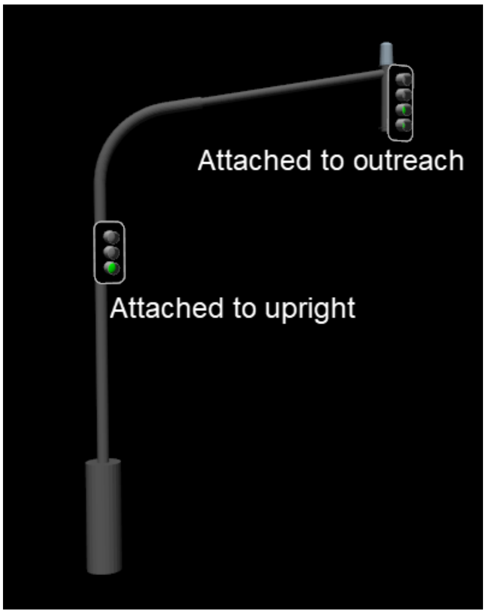
Individual parts can be deleted from a signal assembly, already placed.

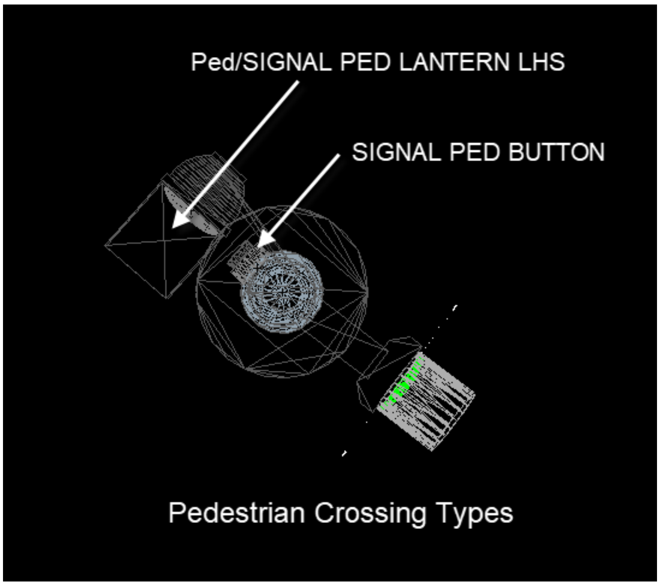
General Placement

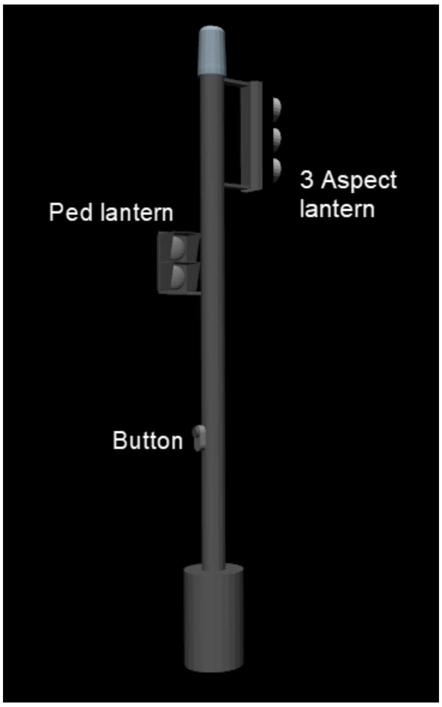





3 aspect/SIGNAL GREEN COWLS
Attach by selecting this part of the upright
4 aspect/SIGNAL GREEN RTURN COWLS
Attach by selecting this part of the upright
Outreach/SIGNAL MAST 50

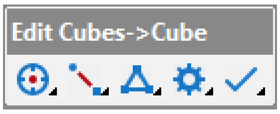

Attached to outreach
Attached to upright


Ped/SIGNAL PED LANTERN LHS
SIGNAL PED BUTTON
Pedestrian Crossing Types


3 Aspect
lantern
Ped lantern
Button

11.2.2 Trimesh Editor

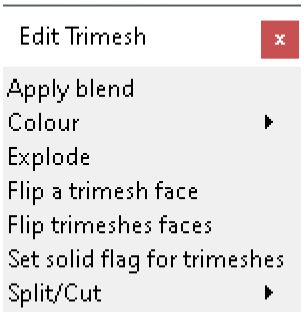
The **Undo** and **Redo** buttons have been removed from the **Trimesh Editor** toolbar.



11.2.3 Trimesh Edit

Position of option on menu: **BIM =>Trimesh =>Edit**

The Edit Trimesh options edits trimeshes directly.



See

11.2.3.1 Colour Trimesh

11.2.3.2 Flip a Trimesh Face
11.2.3.3 Flip Trimeshes Faces
11.2.3.4 Set Solid Flag for Trimeshes

Continue to 11.2.3.1 Colour Trimesh.

11.2.3.1 Colour Trimesh

Position of option on menu: **BIM =>Trimesh =>Edit => Colour**

These options are to colour trimeshes.

See

11.2.3.1.1 Colour Trimesh By Slope
11.2.3.1.2 Colour Trimesh by Aspect

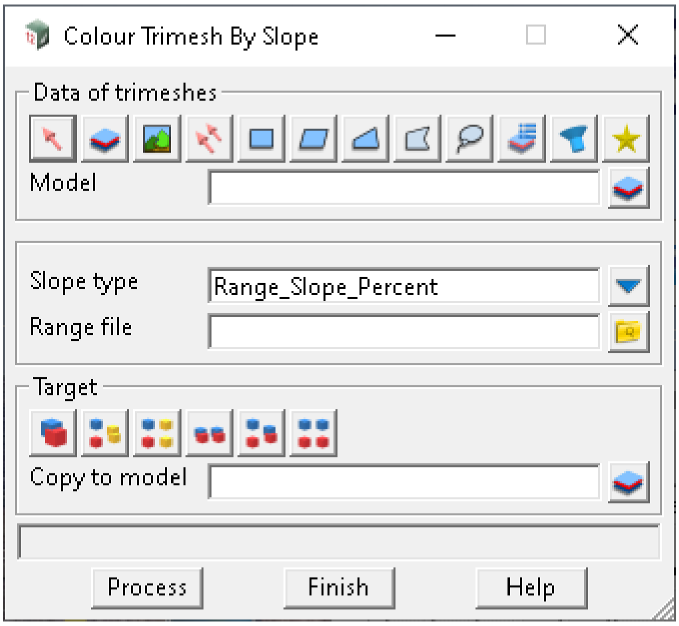
11.2.3.1.3 Colour Trimesh Sides

11.2.3.1.1 Colour Trimesh By Slope

Position of option on menu: **BIM =>Trimesh =>Edit =>Colour =>Colour by slope**

The ***Colour Trimesh by Slope*** option calculates the slope of each face of the trimesh and uses the slope range file to define a colour for the face.

Selecting **Colour Trimesh by slope** displays the **Colour Trimesh By Slope** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data of trimeshes

Data selection type - selects the trimeshes to get the slope of. For a full description go to 3.26.3 Data Source.

Selected data source	Input	Model	

Data source

Slope type	choice box		Range_Slope_Percent, Range_Slope_1v in, Range_Slope_Degrees

The units used for slope in the range file.

Range file	slope range file		*.srf

The user supplied range file is used to define the range colours used for colouring the trimesh faces. See 7.11 Range Files.

Target type

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Target info	input	Copy to model	

*Extra information required to fully define where the processed data is going to. For example **Copy to model** or **Replace existing data.***

Buttons at bottom

Process button

The option is run when **Process** *is pressed.*

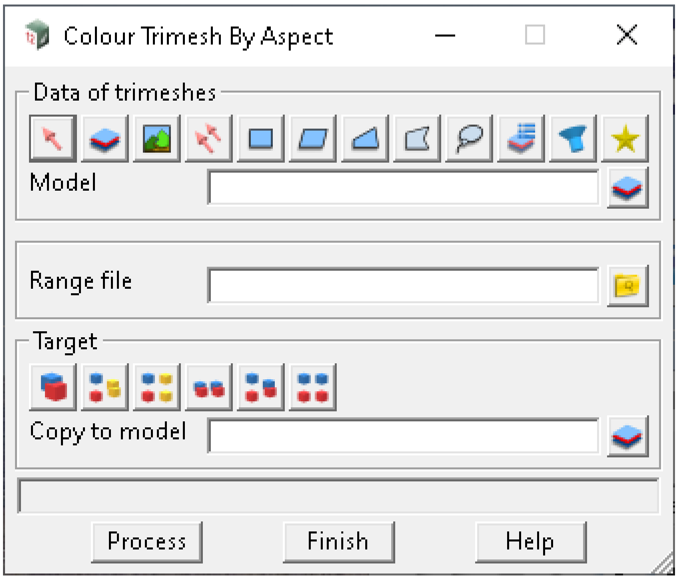
Continue to 11.2.3.1.2 Colour Trimesh by Aspect or return to 11.2.3.1 Colour Trimesh.

11.2.3.1.2 Colour Trimesh by Aspect

Position of option on menu: **BIM =>Trimesh =>Edit =>Colour =>Colour by aspect**

The ***Colour Trimesh by Aspect*** option calculates the aspect of each face of the trimesh and uses the aspect range file to define a colour for the face.

Selecting **Colour trimesh by aspect** displays the **Colour Trimesh By Aspect** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data of trimeshes			

Data selection type - selects the trimeshes that are to have their edge info's modified. For a full description go to 3.26.3 Data Source.

Selected data source	Input	Model	

Data source

Range file	slope range file		*.srf

The user supplied range file is used to define the range colours used for colouring the trimesh faces. See 7.11 Range Files.

Target type

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Target info	input	Copy to model	

*Extra information required to fully define where the processed data is going to. For example **Copy to model** or **Replace existing data.***

Buttons at bottom

Process	button		

The option is run when **Process** *is pressed.*

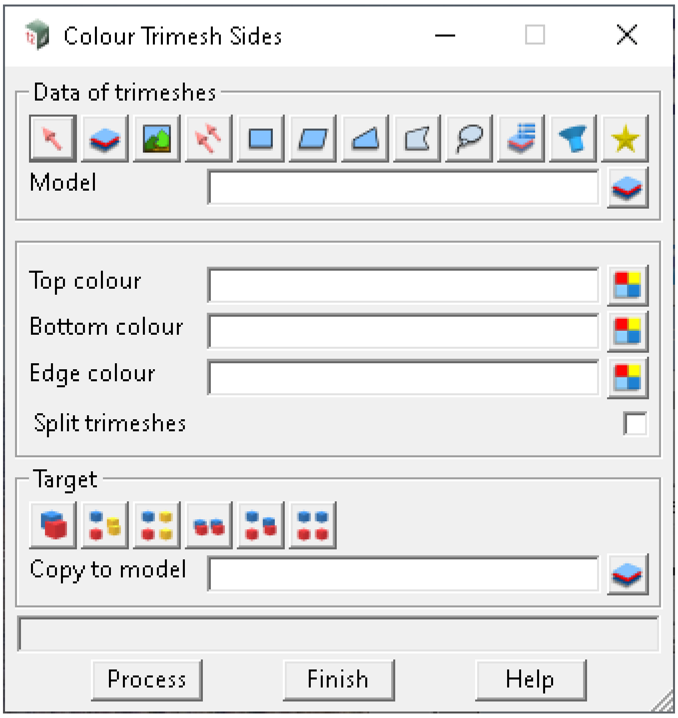
Continue to 11.2.3.1.3 Colour Trimesh Sides or return to 11.2.3.1 Colour Trimesh.

11.2.3.1.3 Colour Trimesh Sides

Position of option on menu: **BIM =>Trimesh =>Edit =>Colour =>Colour sides**

The ***Colour Trimesh Sides*** option calculates whether a face of a trimesh is on the top, the bottom or on the side of the trimesh, and coloured accordingly.

Selecting **Colour trimesh sides** displays the **Colour Trimesh Sides** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data of trimeshes		Model	

data selection type - selects the trimeshes to get the top, bottom and sides for. For a full description go to 3.26.3 Data Source.

Selected data source	Input	Model	

Data source.

Top colour	colour box		available colours

Colour for the top faces of the trimeshes.

Bottom colour	colour box		available colours

Colour for the bottom faces of the trimeshes.

Edge colour	colour box		available colours

Colour for the side faces of the trimeshes.

Target type

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Target info	input	Copy to model	

*Extra information required to fully define where the processed data is going to. For example **Copy to model** or **Replace existing data.***

Buttons at Bottom

Process button

The option is run when **Process** *is pressed.*

11.2.3.2 Flip a Trimesh Face

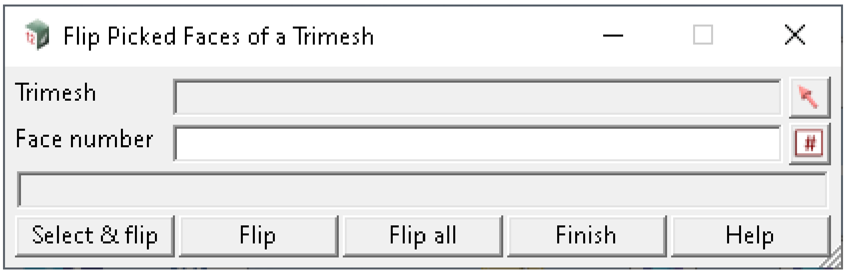
Position of menu: **BIM =>Trimesh =>Edit =>Flip a trimesh face**

This option reverses the order of the vertices in a selected face in a trimesh.

That means that the normal of the face is reversed and hence whether the face is pointing towards the eye, or away from the eye, is reversed.

This is needed when the normal to a face in the trimesh is pointing the wrong way and it shows up as being very dark in an OpenGL Perspective view with **Shade** **ON**.

Selecting **Flip a trimesh face** brings up the **Flip Picked Faces of a Trimesh** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

*When the option is started, the **Select and flip** mode is already running.*

Trimesh trimesh pick box

If the Select icon is pressed, the user then picks the face of a a trimesh and the Face number is displayed in the Face Number box and the model and name of the trimesh displayed in the Trimesh box.

Face number integer box

*The number of the face in the trimesh given in the **Trimesh** field. This value can be changed.*

Flip button

*When **Flip** is pressed, the face **Face number** of the trimesh given in the **Trimesh** field, is reversed.*

Flip all button

*When **Flip all** is pressed, all the faces of the trimesh given in the **Trimesh** field are reversed.*

Select & flip button

*When pressed the **Select and flip** mode is started and the user only needs to select a face of a trimesh and when accepted, the select face is reversed (the Pick only picks trimeshes).*

*After a face is accepted, the **Select and flip** sequence starts again and another face can be selected. The cycle continues until either <ESC > is pressed or RMB is pressed and **Cancel** selected from the **Pick Ops** menu.*

Continue to 11.2.3.3 Flip Trimeshes Faces or return to 11.2.3 Trimesh Edit.

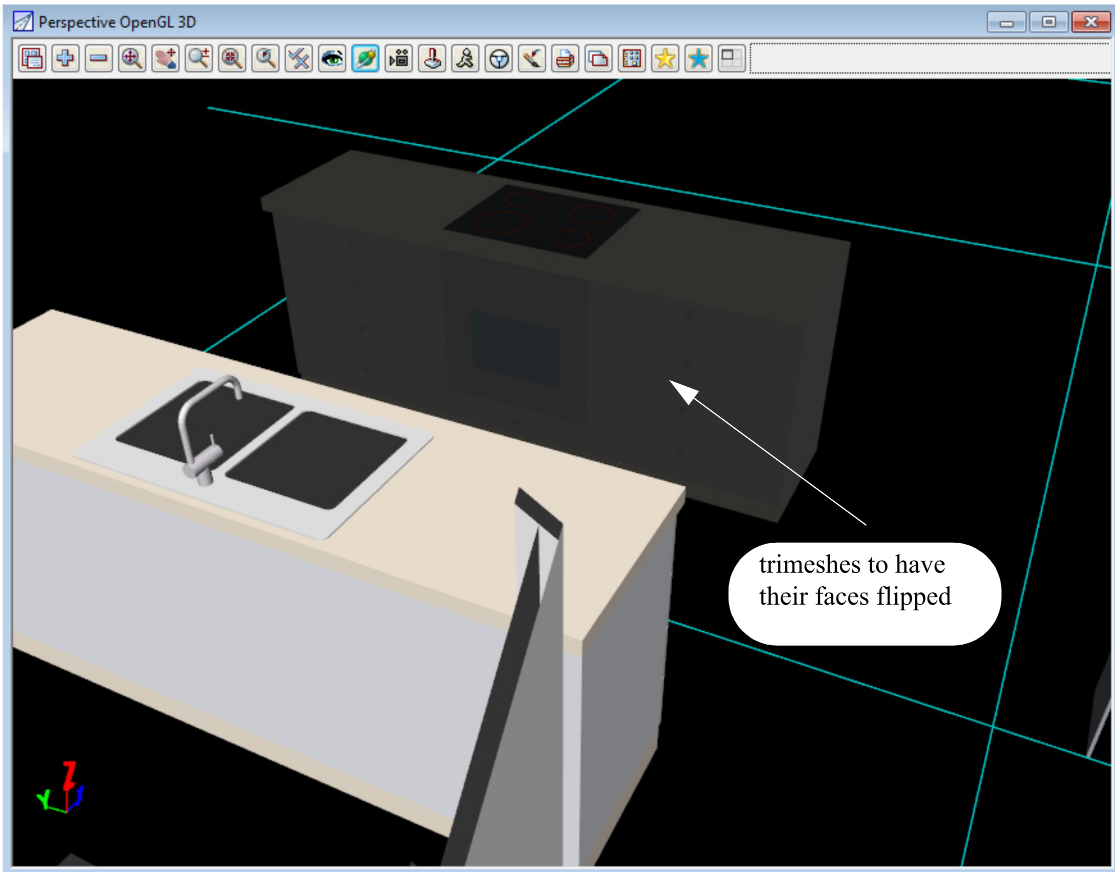
11.2.3.3 Flip Trimeshes Faces

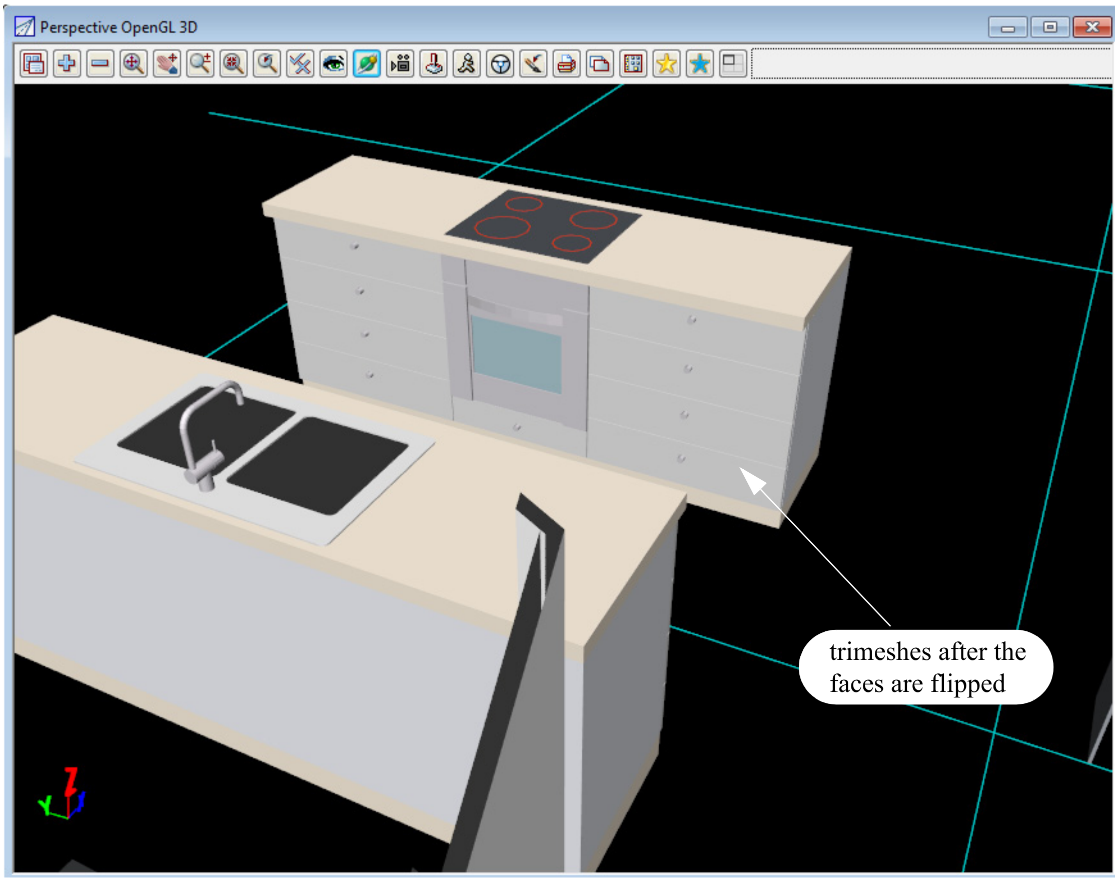
Position of menu: **BIM =>Trimesh =>Edit =>Flip trimeshes faces**

This option reverses the order of the vertices in **all** the triangles in a trimesh.

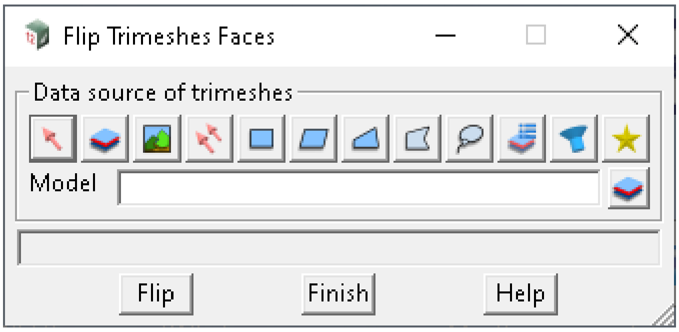
This is often needed when the triangles in the trimesh are ordered the wrong way and the normal to the triangles face inward instead of outward.

This would show up as being very dark in an OpenGL Perspective view with **Shade** **ON**.





Selecting **Flip trimeshes faces** brings up the **Flip Trimeshes Faces** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data source of trimeshes	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Data source of trimeshes to be have all their faces flipped.

Flip	button		

Reverse the order of the vertices in all the triangles in the selected trimeshes.

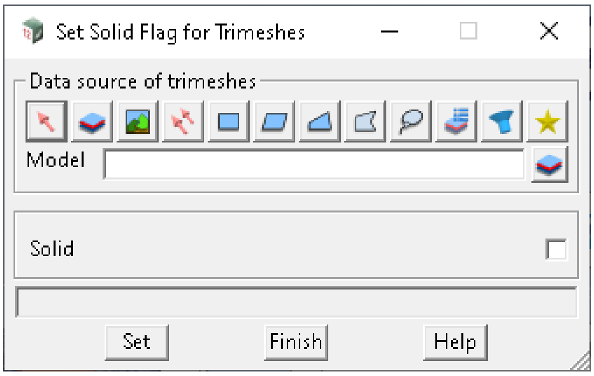
Continue to 11.2.3.4 Set Solid Flag for Trimeshes or return to 11.2.3 Trimesh Edit.

11.2.3.4 Set Solid Flag for Trimeshes

Position of menu: **BIM =>Trimesh =>Edit =>Set solid flag for trimeshes**

This option sets a flag for a trimesh to show as solid (a filled polygon) or not solid (just a polygon outline) when it is sectioned in Section View.

Selecting **Set solid flag for trimeshes** brings up the **Set Solid Flag for Trimeshes** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data source of trimeshes	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	model box	Model	

Data source of trimeshes to be have all their solid flags set to on or off.

Solid	tick box	not ticked	

*If **ticked**, the solid flag for the selected trimeshes is set to on and when the trimesh is sectioned then it is shown as a filled in polygon.*

*If **not ticked**, the solid flag for the selected trimeshes is set to off and when the trimesh is sectioned then it is shown as a polygon with no fill.*

Buttons at Bottom

Set	button		

Process the selected trimeshes according to the **Solid** *tick box.*

Continue to 11.2.4 Convert Trimesh or return to 11.2 Trimesh.

11.2.4 Convert Trimesh

Position of option on menu: **BIM =>Trimesh =>Edit => Colour**

These options that work on trimeshes.

Convert Trimesh	See
Explode	
Create trimesh spines	11.2.4.1 Get Spines from Trimeshes
Get strings from trimesh edges	
Get strings from un-named trimesh edges	
Set trimesh edge info by strings	
Top/bottom tin from trimeshes	11.2.4.2 Top and Bottom Tins From Trimeshes
Trimesh section to plan	
Convert to polymesh	11.2.4.3 Convert Trimesh to Polymesh
Convert named faces to polymesh	11.2.4.4 Convert Trimesh Named Faces to Polymesh

11.2.4.1 Get Spines from Trimeshes

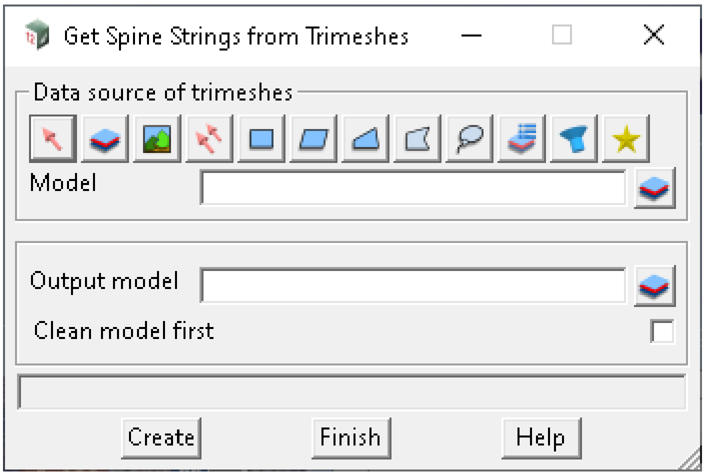
Position of menu: **BIM =>Trimesh =>Convert =>Create trimesh spine**

For each trimesh in the data source of trimeshes, the option tries to create a super string that is the **spine** of the trimesh.

For example, if the trimesh is a vertical pole, the option tries to create a super string that is at the centre of the pole.

The option works beat on when the trimesh represents a one segment round or rectangular pipe.

Selecting **Create trimesh spines** brings up the **Get Spine Strings from Trimeshes** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data source of trimeshes	data source		

Data selection type - selects the trimeshes that super strings spines are to be calculated for. For more information on Data Sources, go to [3.26.3 Data Source](#).

Selected data source	input	Model	

Source of trimeshes.

Output model	model box		available models

The model to put the created spine strings into.

Clean model first	tick box	not ticked	

If ***ticked****, the* ***Output model*** *is cleaned before the option is run.*

If ***not ticked,*** *the* ***Output model*** *is not cleaned before the option is run*

Create	button		

The option is run when **Create** *is pressed.*

Continue to 11.2.4.2 Top and Bottom Tins From Trimeshes or return to 11.2.4 Convert Trimesh.

11.2.4.2 Top and Bottom Tins From Trimeshes

Position of option on menu: **BIM =>Trimesh =>Convert =>Top/bottom tin from trimesh**

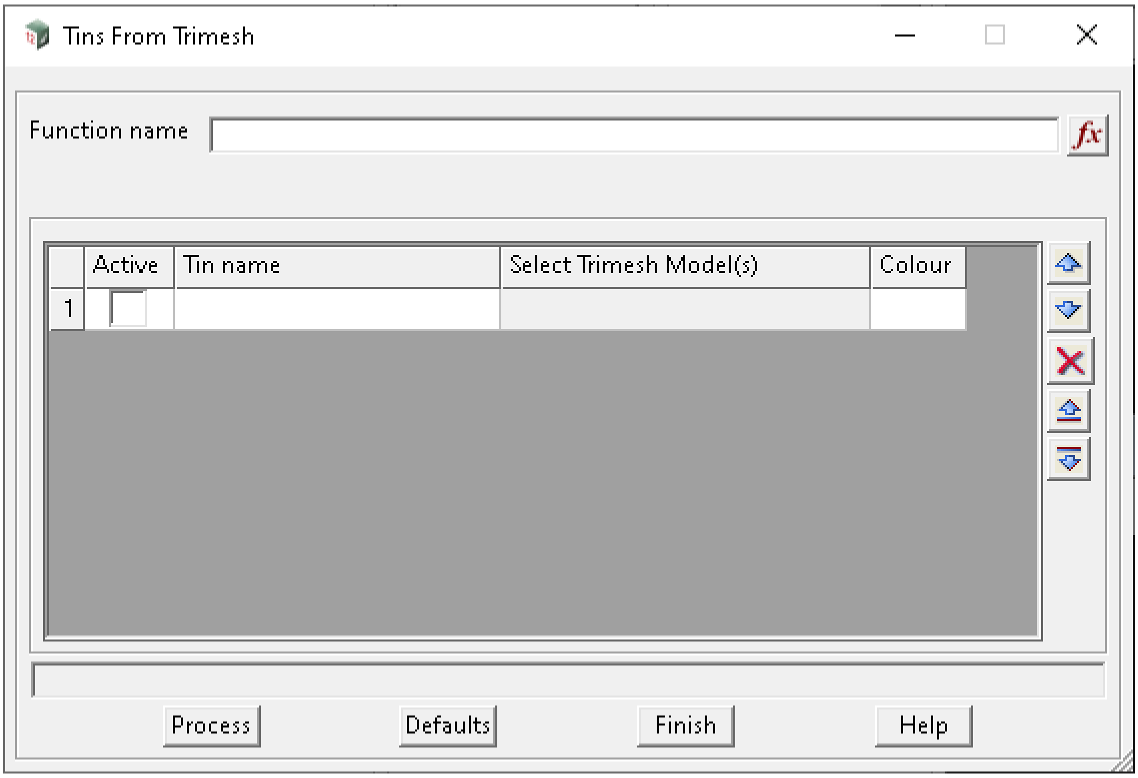
Trimeshes are now often created, or provided from another source, for many objects including the various pavement layers for a road.

However in that case, and other cases, it is often convenient to be able to create a tin that represents the top or the bottom of certain trimeshes.

For example, you have all the trimeshes for the bottom of the road formation but want a subgrade tin that is bottom of all the trimeshes.

Similarly you may have all the trimeshes for the top of the road formation and want a road surface tin that is top of all the trimeshes.

Selecting **Create tin from trimeshes top/bottom** brings up the **Tins from Trimesh** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function name	function box		

Save as a function that can be recalced at anytime.

Main Grid information

Field Description	Type	Defaults	Pop-Up
Active	toggle		

Make line in grid active or inactive.

Field Description	Type	Defaults	Pop-Up
Tin name	tin select		available tins

Name of the tin to be created from this row of information.

Note: *Refer to "Defaults" button info below for any Prefix/Suffix naming.*

Colour colour column cyan available colours

Colour for the tin.

*If **blank**, a default of cyan is used.*

Select Trimesh model(s) grid column

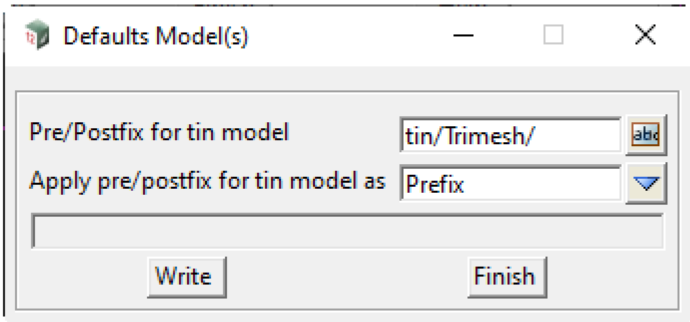
***Click** in this column to bring up the **Trimesh Selection** grid to define the trimeshes used to create the tin or this row. See 11.2.4.2.1 Trimesh Selection Panel.*

Buttons at Bottom

Process button

Process data selected with values entered.

Defaults button



Pre/Postfix for tin model input box tin/Trimesh/

[Object tree shown above].

Apply tin model Pre/Postfix as choice box Prefix, Suffix

*If **Prefix**, use the text in* **Pre/Postfix for Tin model** *as a prefix.*

*If **Suffix**, use the text in* **Pre/Postfix for Tin model** *as a suffix.*

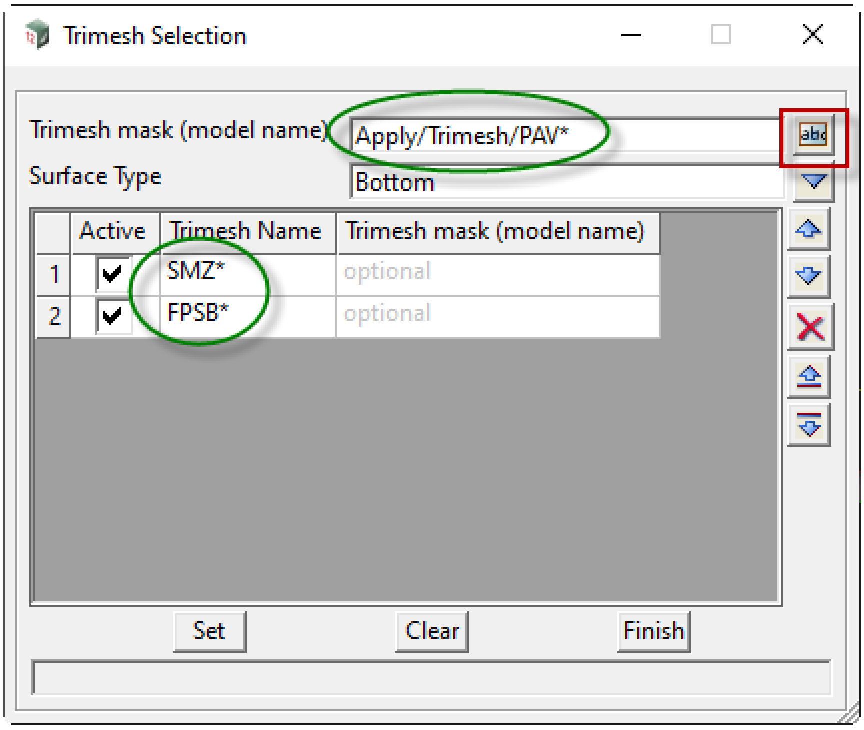
Buttons at Bottom

Write button

Defaults entered will be written to the <.project> folder
Tins_From_Trimesh_Panel.def
This file can be copied into the $user folder, as a default.

Continue to 11.2.4.2.1 Trimesh Selection Panel or return to 11.2.4 Convert Trimesh.

11.2.4.2.1 Trimesh Selection Panel



Trimesh mask (model name) text box optional

Used as a global Trimesh model for any Trimesh names entered in the grid below.

Any Trimesh model entered in the grid however will be used instead.

*Wildcard can be used e.g. Apply/Trimesh/Pav/RS**

***Use the "abc" icon on the RHS to select a trimesh*.**

Surface type choice box Bottom Top, Bottom

Surface used to create the tin.

Grid information

Active toggle

Make line in grid active or inactive.

Trimesh name text column

Name of Trimesh (wildcard can be used e.g. SMZ).*

Middle mouse button in this field will allow you to select a trimesh.

*Its details will be displayed in the message bar below the **Set**, **Clear** and **Finish**.*

e.g. "Apply/Trimesh/PAV RS2B01->SMZ-R-A-RS2B01" selected enabling cut and paste.

Trimesh Model text column optional

Can be used instead of any global model entered previously.

*Wildcard can be used e.g. Apply/Pav/RS**

Buttons at Bottom

Set button

Set all the entries above.

Clear button

Clear all the entries above.

Finish button

Closes the **Trimesh Selection** *panel. All the information from the last* ***Set*** *is saved in the function.*

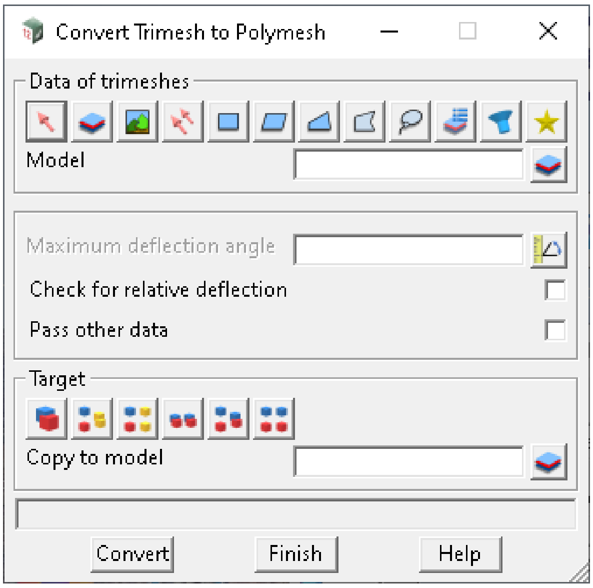
Continue to 11.2.4.3 Convert Trimesh to Polymesh or return to 11.2.4 Convert Trimesh.

11.2.4.3 Convert Trimesh to Polymesh

Position of option on menu: **BIM =>Trimesh =>Convert =>Convert to polymesh**

This option takes a trimesh and joins adjacent triangles that are in the same plane (or close to it) and replaces them with a polyface. See 3.7.3 Trimesh and Polymesh.

Selecting **Convert to polymesh** brings up the **Convert Trimesh to Polymesh** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data of trimeshes	source box	mode	

Trimeshes to process. For more info 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to process.

Check for relative deflection	tick box	not ticked	

*If **ticked**,??*

Maximum deflection angle	angle box	0	measures menu

??

Pass other data	tick box	not ticked	

*If **ticked** then any data in the Data Source that is not a Trimesh will continue to the Target.*
*If **not ticked** then any data in the Data Source that is not a Trimesh will **NOT** continue to the Target.*

Target type

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Target info	input	Copy to model	

*Extra information required to fully define where the processed data is going to. For example **Copy to model** or **Replace existing data.***

Buttons at Bottom

Convert	button		

Run the option.

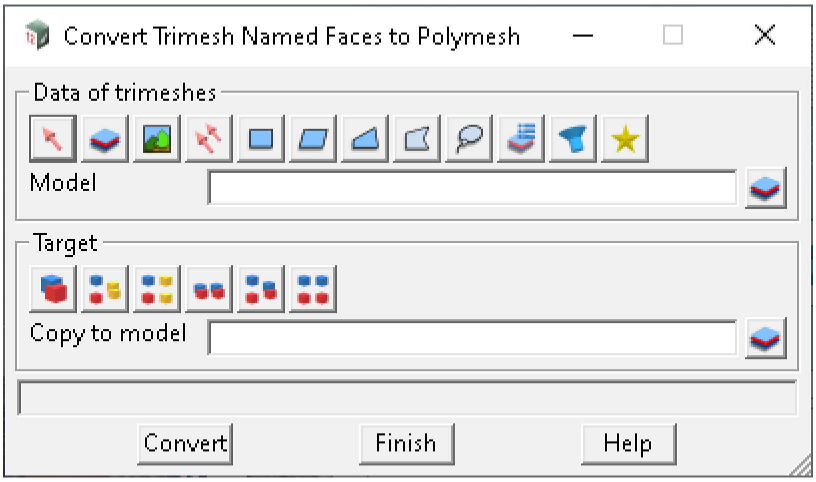
Continue to 11.2.4.4 Convert Trimesh Named Faces to Polymesh or return to 11.2.4 Convert Trimesh.

11.2.4.4 Convert Trimesh Named Faces to Polymesh

Position of option on menu: **BIM =>Trimesh =>Convert =>Convert named faces to polymesh**

This option takes a trimesh and joins adjacent named triangles of the same name and replaces them with a polyface. See 3.7.3 Trimesh and Polymesh.

Selecting **Convert named faces to polymesh** brings up the **Convert Trimesh Named faces to Polymesh** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data of trimeshes	source box	mode	

Trimeshes to process. For more info 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to process.

Target type

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Target info	input	Copy to model	

*Extra information required to fully define where the processed data is going to. For example **Copy to model** or **Replace existing data.***

Buttons at Bottom

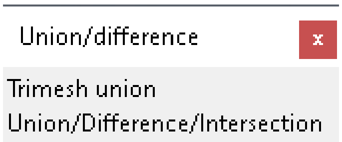
Convert	button		

Run the option

Continue to 11.2.5 Trimesh Union/Difference or return to 11.2.4 Convert Trimesh.

11.2.5 Trimesh Union/Difference

Position of option on menu: **BIM =>Trimesh =>Union/Difference**



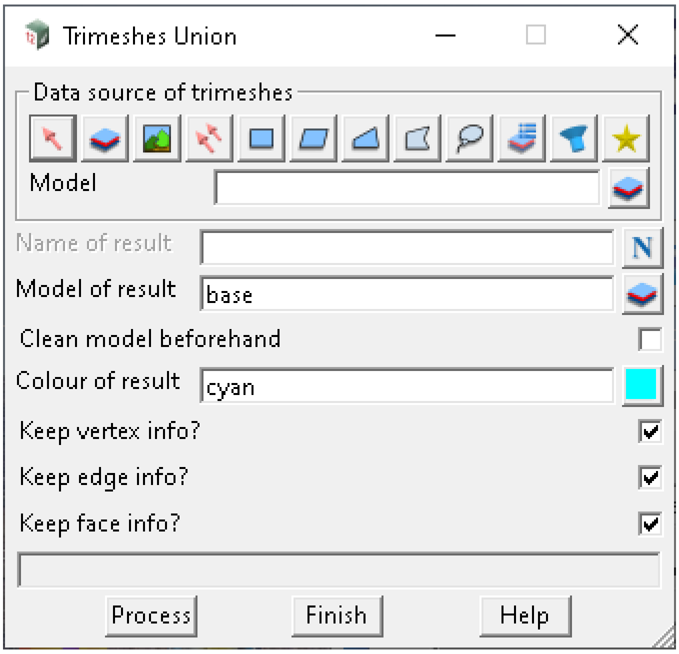
See
11.2.5.1 Trimeshes Union

11.2.5.1 Trimeshes Union

Position of option on menu: **BIM =>Trimesh =>Union/Difference =>Trimeshes union**

This option performs the union of all the selected trimeshes.

Selecting **Trimeshes Union** displays the **Trimeshes Union** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data source of trimeshes		Model	

Data selection of trimeshes - for a full description go to 3.26.3 Data Source.

Data source	input		

Data source of trimeshes to union.

Name of result	names box	CAD name	names.4d

Name of the resulting trimesh.

Model of result	model box	CAD model	available models

Model for the resulting trimesh.

Colour of result	colour box	CAD colour	available models

Colour of the resulting trimesh.

Keep vertex info	tick box	ticked	

*If **ticked**, as much as possible keep the **vertex info** from the original trimeshes in the resultant trimesh.*
*If **not ticked**, don't keep the **vertex info** from the original trimeshes in the resultant trimesh.*

Keep edge info	tick box	ticked	

*If **ticked**, as much as possible keep the **edge info** from the original trimeshes in the resultant trimesh.*
*If **not ticked**, don't keep the **edge info** from the original trimeshes in the resultant trimesh.*

Keep face info	tick box	ticked	

*If **ticked**, as much as possible keep the **face info** from the original trimeshes in the resultant trimesh.*

*If **not ticked**, don't keep the **face info** from the original trimeshes in the resultant trimesh.*

Process button

The option is run when **Process** *is pressed.*

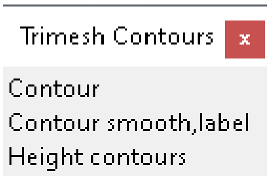
Continue to 11.2.6 Contour Trimeshes or return to 11.2.5 Trimesh Union/Difference.

11.2.6 Contour Trimeshes

Position of option on menu: **BIM =>Trimesh =>Contours**

This menu is the same as in **V14**

.



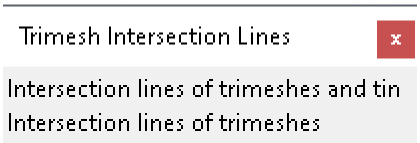
See

Continue to 11.2.7 Trimesh Intersection Lines or return to 11.2 Trimesh.

11.2.7 Trimesh Intersection Lines

Position of option on menu: **BIM =>Trimesh =>Intersection Lines**

This menu is the same as in **V14**.

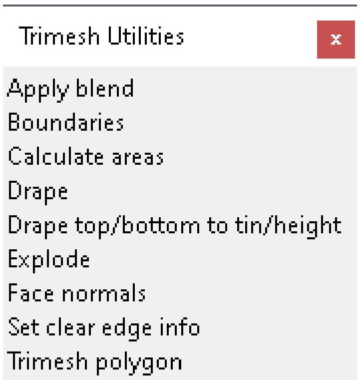


See

Continue to 11.2.8 Trimesh Utilities or return to 11.2.7 Trimesh Intersection Lines.

11.2.8 Trimesh Utilities

Position of option on menu: **BIM =>Trimesh =>Utilities**

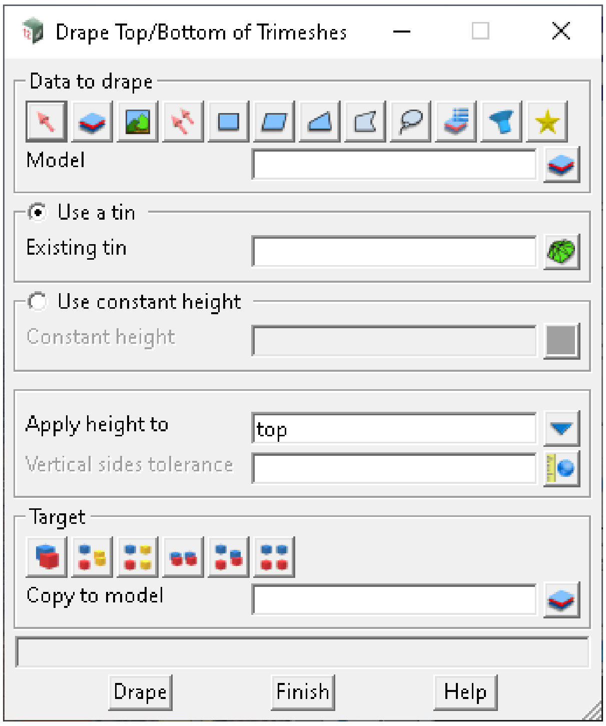


See

11.2.8.1 Trimesh Drape Top/Bottom

11.2.8.1 Trimesh Drape Top/Bottom

Position of menu: **BIM =>Trimesh =>Utilities =>Drape top/bottom to tin/height**



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data to drape data source data source

Data selection type - selection of trimeshes to drape. For a full description go to 3.26.3 Data Source.

Use a tin radio button

*When selected, the **Existing tin** box is enabled and selection of a tin to drape trimeshes top or bottom is allowed.*

Existing tin tin button

Select a tin to drape trimeshes. Top or bottom vertices of any trimesh in the data source will have the same z-values as the selected tin if the vertices are within the tin boundary.

Use constant height radio button

When selected, the Constant height box is enabled and selection of a height to set the top or bottom of trimeshes is allowed.

Constant height double box

The top or bottom vertices of a trimesh from the source will have the specified height applied to them.

Apply height to choice box Top, Bottom

*If **top**, the top surface of each trimesh will have the height applied to.*

*If **bottom**, the bottom surface of each trimesh will have the height applied to.*

Vertical sides tolerance double box

*The optional **Vertical sides tolerance** indicating how much 'tilting' is allowed for vertical sides of the trimesh. The default value is 0.001 or 1mm over 1m.*

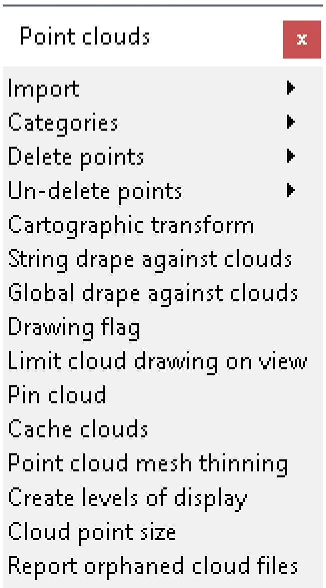
Target target box

Sets where the processed data goes to. For a full description go to 3.26.3 Data Source.

Continue to 11.3 Point Clouds or return to 11.2.8 Trimesh Utilities.

11.3 Point Clouds

There has been additions to Point Clouds.



See

11.3.1 Create Levels of Display

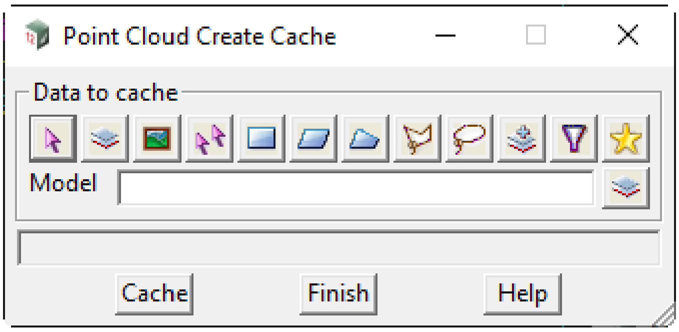
11.3.1 Create Levels of Display

Position of option on menu: **Bim =>Point clouds =>Cache clouds**

Position of option on menu: **String =>Point clouds =>Cache clouds**

Imported point cloud strings can be processed to cache information that may speed drawing.

Selecting **Create Levels of Display** fires up the **Point cloud create cache** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to cache	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to be processed.

Buttons at bottom

Cache	button		

Attempts to create caching information for all the points clouds points in the selected point clouds.

Additional information

Benefits split into:

1)Plan Views

2)Perspective Views

3)Non view based “options”

First for (3), caching is not used at all. Who knows if there are good uses?

Now generally, for any individual point cloud string, there is a set of cache levels. So if you do a “Fit” on a plan view, it may be able to choose the most “course” level.

Note, only one level can be selected for a cloud string. (see footnote 1).

Now

For (1), this is fine since it is an orthographic projection, hence the entire view has the same “level of display”.

For (2), this is not true since it depends on whether you are looking at something close, or something far away. Doing the calculations on both of these yield very different levels of display.

Alas we can only select 1, thus we have to "be conservative" and choose a level of display – displaying more.

In the case that Peter Murray reported, where draw times on a plan view went from 75 seconds to 1, and 100+ seconds on a perspective view to about 2 seconds, the massive gains here was because his job was not 1 single cloud string. Peter had a hundred cloud strings.

So instead of 1 cloud string with 7 billion points, he had 100 cloud strings with an average of 70 million points. This came about because they did 100 odd scanner setups with the scanner (over may days) and when reading the E57 file, chose to create 1 cloud string for each setup, (i.e.) choosing not to combine them all into one cloud string. Since each cloud string was only covering a "constant" or "limited" distance from the set up point, this means when the entire cloud string is completely off the plan view, or not in the view volume of a perspective view, the drawing is instantly rejected, and you get a massive "speed up". When it's all jammed into one string, that optimization is lost.

Now getting back to (2), for cloud strings that are far off into the distance on a perspective view, a much courser level of display will be chosen, and thus draw much faster. For cloud strings up close to the eye, yes way more points are drawn, but that's what we want. A close up cloud string, draws with more detail, a faraway cloud string, much less detail.

Continue to 11.4 Visualisation or return to 11.3 Point Clouds.

11.4 Visualisation

11.4.1 Remove all Duplicate Extrudes in Project

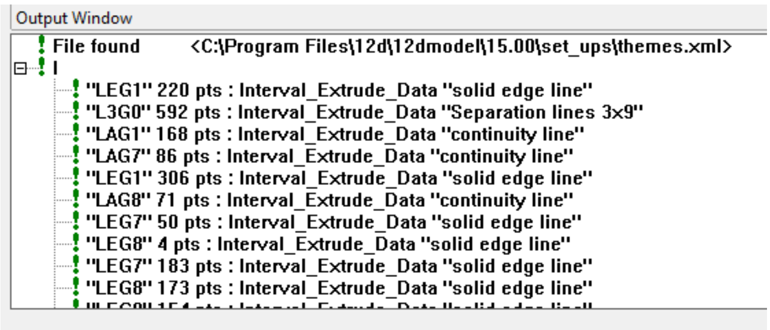
Position of option on menu: **BIM =>Visualisation => Extrusions =>Remove duplicates**

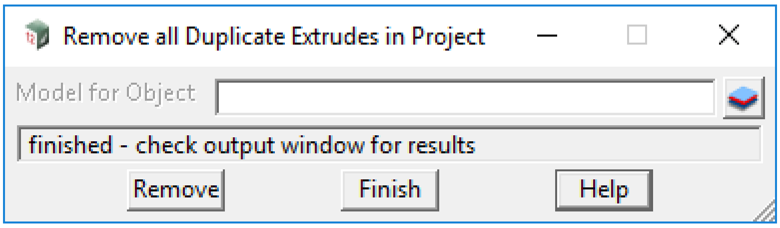
The model or entire project is scanned for duplicate extrudes on individual strings.

If a string has 2 identical "string extrudes", one of them is removed since drawing the same thing twice does not change the result,

but just takes twice as long. The same applies for interval extrudes, and group extrudes.

As an example, the drawing time of a model which had extrudes duplicated upwards of 900 times, dropped from 20 seconds down to sub-second.





The fields and buttons used in the panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model for Object	model box		available models

Input the name of the model to remove duplicate extrudes. If left blank, the entire project is searched.

Buttons at Bottom

Remove	button

Processes the model given in the Model field, or the entire project.

12 CAD

Position of menu: CAD

There has been changes to the **CAD** chapter in the ***12d Model Reference manual***.

See 12.1 Remove Drafting Association
See 12.2 Create Incremental Text
See 12.3 Tabulate Names.4d
See 12.4 Weight from Conduit Width

12.1 Remove Drafting Association

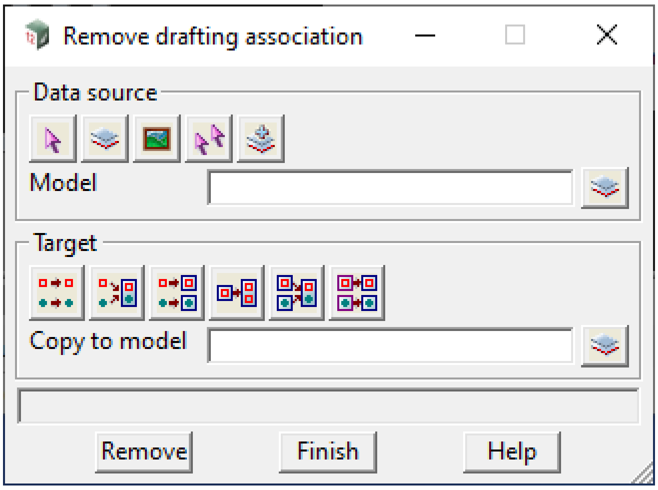
Position of option on menu: CAD =>Dimension =>Utilities =>Remove drafting association

CAD =>Leader =>Utilities =>Remove drafting association

CAD =>Table =>Remove drafting association

This option removes the associations that exists for the selected drafting elements.

Selecting **Remove drafting association** displays the **Remove Drafting Association** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to cache	data source		

data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

source of drafting elements to be processed.

Target type

sets where the processed data goes to.

Target info	input	Copy to model	

extra information required to fully define where the processed drafting elements are going to.

Buttons at bottom

Remove	button		

remove the associations of the selected drafting elements.

Continue to 12.2 Create Incremental Text or return to 12 CAD.

12.2 Create Incremental Text

Position of option on menu: **CAD =>Text =>Create incremental text**

The **create incremental text** option allows you to place text that has an incremental integer component.

The integer part of the text is incremented each time another text is placed.

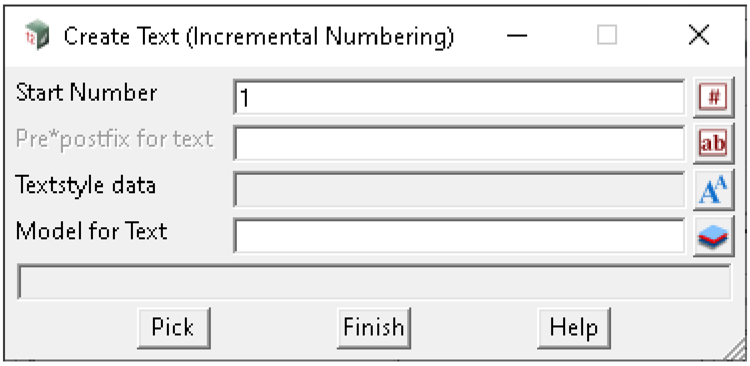
The text can have a Pre*postfix, which can include "\n", for a new line

e.g. Lot * \n RP 23456

Result: Lot 1

RP 23456

Selecting **Create incremental text** brings up the **Create Text (Incremental Numbering)** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Start number	integer box	1	
Enter start number (default set to 1).			
Pre*postfix for text	text box	optional	
*If **blank**, only number is used.*			
Textstyle data	textstyle box		
Font, height etc for text.			
Model for Text	model box		available models
Model to place text on.			

Buttons at Bottom

Pick button

Select a position for text insertion <RMB to cancel>

Cursor snap only

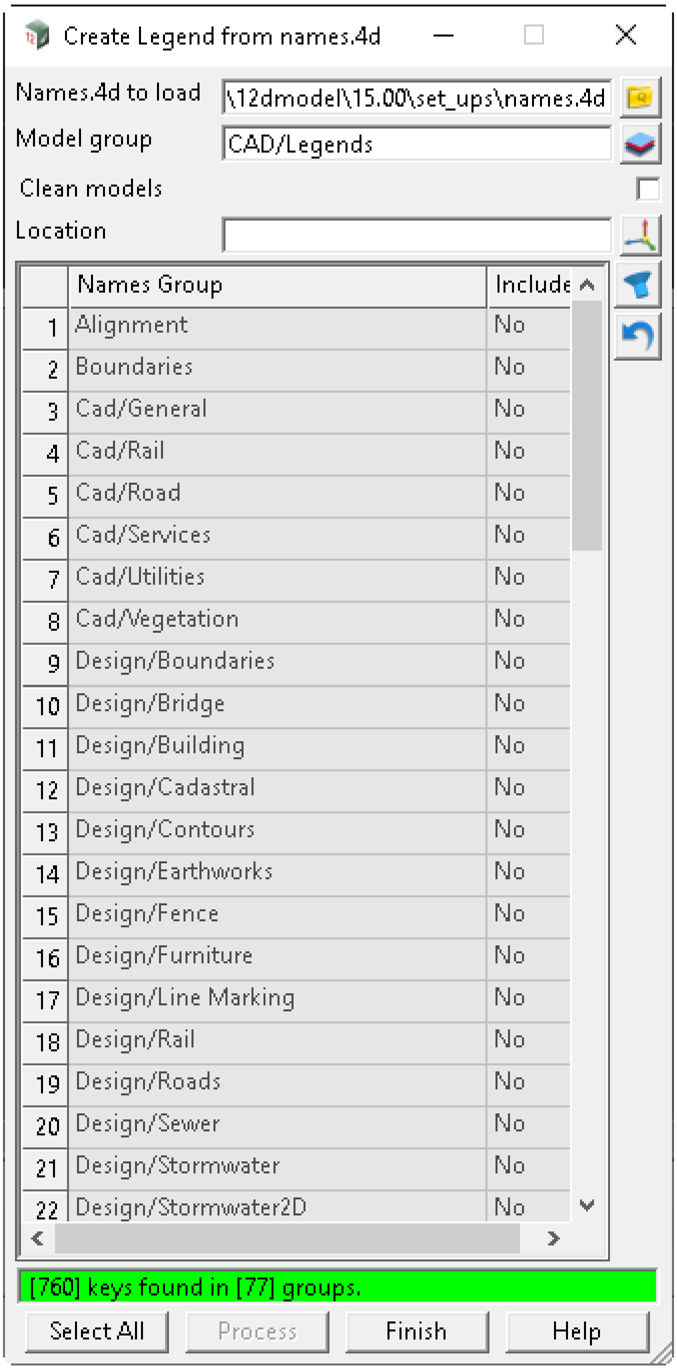
As each pick is completed, the Start Number is incremented on the panel

Continue to 12.3 Tabulate Names.4d or return to 12 CAD.

12.3 Tabulate Names.4d

Position of option on menu: CAD =>Drafting =>Text and Tables =>Tabulate names.4d

This panel provides the option to auto-generate legends for various groups that exist within a names.4d file. By toggling different names fields in the macro panel, users can quickly generate legends information for various CAD features in their projects.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Names.4d to load file box Names.4d in 12d set_ups folder

The names.4d file used to populate this panel.

Model group model box CAD/legends

The default model pathway for all legends created by the panel.

Clean models tick box not ticked

Should existing models be cleaned before processing?

Location XYZ box

Where the generated legend should be positioned in the view.

Names group/Include Grid box

A list of every group in the names.4d. Can be configured to show specified groups in the legend.

Filter button Filter settings

Open the filter settings panel. See 12.3.1 Filter Settings Panel.

Reset button

Disable all filter settings and reset any changes made to the names groups.

Buttons at Bottom

Select all/Remove all button

Toggle all visible name groups to yes/no.

Process button

Create legend models for all currently enabled names groups.

Finish button

Close the panel.

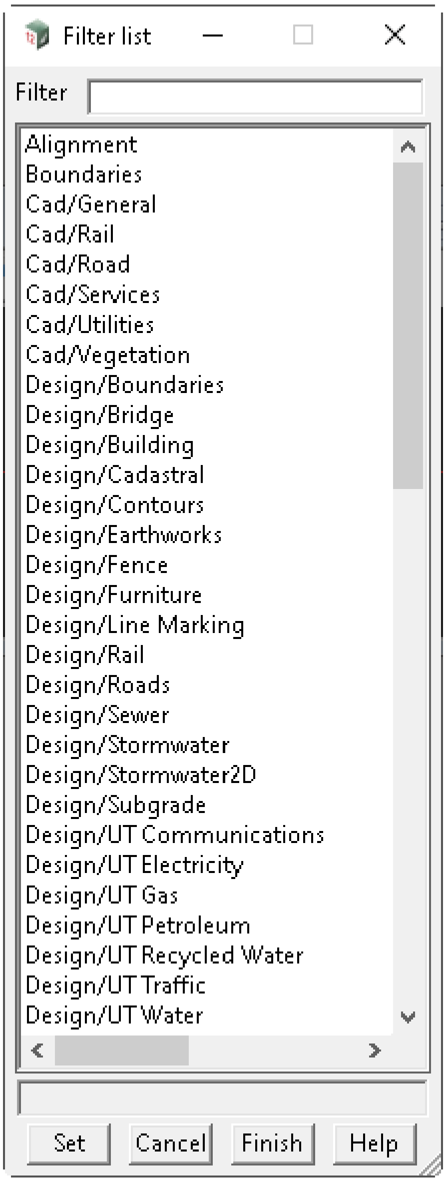
Help button

Access this help section in the 12d Reference Manual.

Continue to 12.3.1 Filter Settings Panel or return to12.3 Tabulate Names.4d or 12 CAD.

12.3.1 Filter Settings Panel

The **filter settings** panel can be used to refine the names.4d group entries on the main panel. The filter search bar also supports the use of wildcards (* and ?) to more easily sort through available names groups.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Filter	input box		

Only show data matching text input in this field.

Buttons at Bottom

Set	button		

Filter the main panel data by the currently selected names groups.

Cancel button

Close the filter panel without applying any changes.

Finish button

Close the filter panel without applying any changes.

Help button

Access this help section in the 12d Reference Manual.

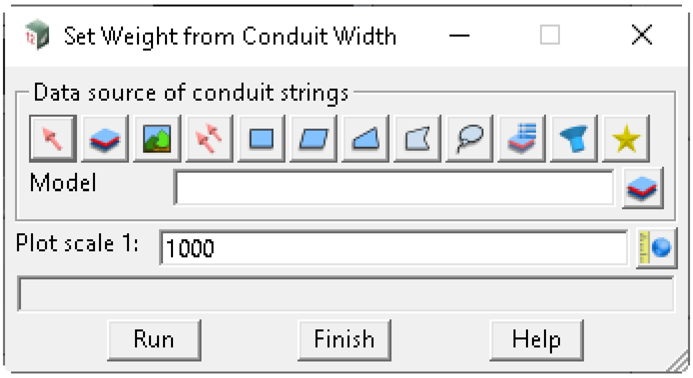
Continue to 12.4 Weight from Conduit Width or return to 12 CAD.

12.4 Weight from Conduit Width

Position of option on menu: **CAD =>Drafting =>Weight from conduit width**

This option sets the string weight (in mm when plotted) on "conduit strings", to match the internal width (in metres) of the conduits, at a specified plot scale. Only those conduit strings are processed, which have a uniform width and which can be represented with a linestyle, that is, conduits of the following types only: Super (with uniform conduit width), Super Alignment (with pipeline dimensions) and Pipe.

Selecting **Weight from conduit width** brings up the **Set Weight from Conduit Width** panel.



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Data source of conduit stings data source

Data selection type - for a full description go to [3.26.3 Data Source](#).

Selected data source input Model

Source of data is to be processed.

Plot scale 1: real box 1000

The plot scale is used to convert the conduit width (in metres) to a string weight (in mm) for plotting, via the formula:

*<string weight> = 1000 * <conduit width> / <plot scale>*

Buttons at Bottom

Run button

Runs the option.

Finish button

Removes the panel from the screen.

Help button

Launches the 12d help for the option.

Continue to [13 Tin](#) or return to [12 CAD](#).

13 Tin

There has been changes to the **Tin** chapter in the ***12d Model Reference manual***.

In **V14** the menu was called **Tins** and the pinned menu was called **Triangles**. In V15 these have both been to **Tin**.

See

See

- 13.1 Tin Information Table
- 13.2 Tin Aspect Colouring
- 13.3 Tin Slope Colouring
- 13.4 Drape Strings
- 13.5 Label Flow Arrow
- 13.6 Depth Range Polygons
- 13.7 Adding Removed Tins
- 13.8 Deconstruct Tin

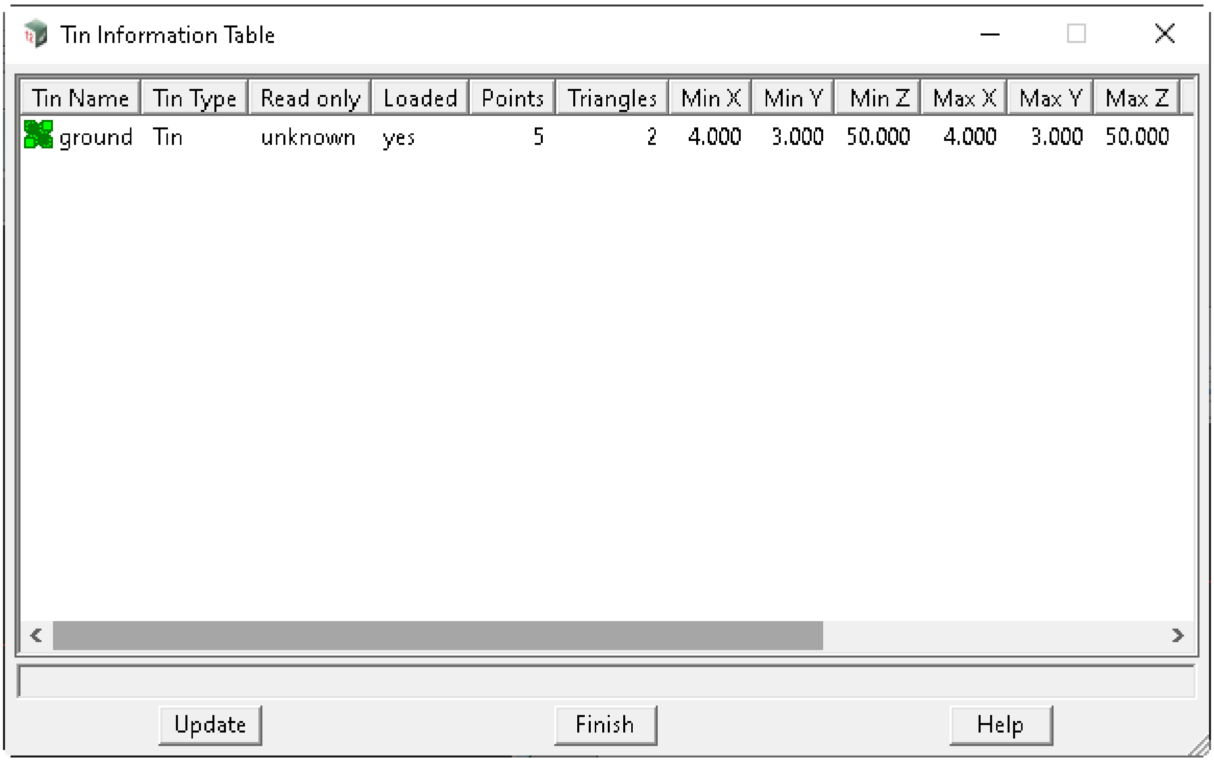
13.1 Tin Information Table

Position of option on menu: **Tin =>Tin Info Table**

The **Tin info table** option displays the minimum and maximum x, y and z values for every tin in the project in one scrolling table.

The tins and minimum and maximum columns can be sorted into ascending or descending order by using bringing up the **sort** menu on the **column header** fields.

Selecting **Tin info table** fires up the **Tin Information Table** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin name	column		**sort** menu

*All the tins in the project are listed in the **tin** column.*

Tin type	column		**sort** menu

Type of the tin. Tin, Supertin, Gridtin.

Read only	column		**sort** menu

The tin is read only if true, modifiable if false otherwise unknown.

Loaded	column		**sort** menu

*If **no**, in this current opening of the project, the model has not yet been fully loaded into **12d Model**.*

Points	column		**sort** menu

Number of points in the tin.

Triangles	column		**sort** menu

Number of triangles in the tin.

Min X, Min Y, Min Z columns **sort** menu
Max X, Max Y, Max Z

Minimum/maximum values for the tin are displayed in the columns.

Created/Updated columns dates

Date the tin was first created/updated.

Buttons at Bottom

Update button

Recalculate the minimum/maximum information in the table.

Notes

1. This is a scrolling panel. If there is too much information to fit into the table, then the scrolling arrow on the right hand side of the table must be used to display the extra information
2. The grid can be sorted by any of the columns.

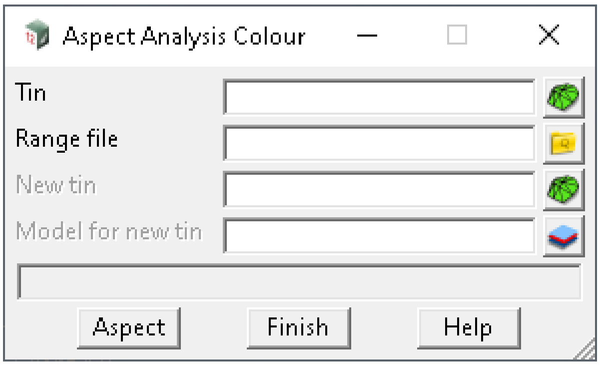
Continue to 13.2 Tin Aspect Colouring or return to 13 Tin.

13.2 Tin Aspect Colouring

Position of option on menu: **Tin =>Colour =>Aspect colouring**

The **aspect colouring** option has been enhanced so that rather than colouring the selected tin, a new tin can be created and coloured.

On selecting the **Aspect colouring** option, the **Aspect Analysis Colour** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin	tin box		available tins

Name of the tin for which the aspects of the triangles will be calculated and either this tin or New tin is coloured.

Range file	aspect range file box		*.arf

The user supplied range file is used to give the colour ranges for aspects to use to colour the triangles.

New tin	tin box		available tins

*If **not blank**, a new tin of this name is created and it is this new tin that is coloured.*
*If **blank**, the tin given in **Tin** is coloured.*

Model for new tin	tin box		available tins

*If **not blank** and a new Tin is created, the new tin is added to this model.*
*If **blank** and a new Tin is to be created then the option won't run.*

Buttons on bottom

Aspect button

On selecting this button, the aspects of the triangles of the tin are calculated and the triangle coloured according to the range file.

<esc> can be used to terminate the option during aspect calculations.

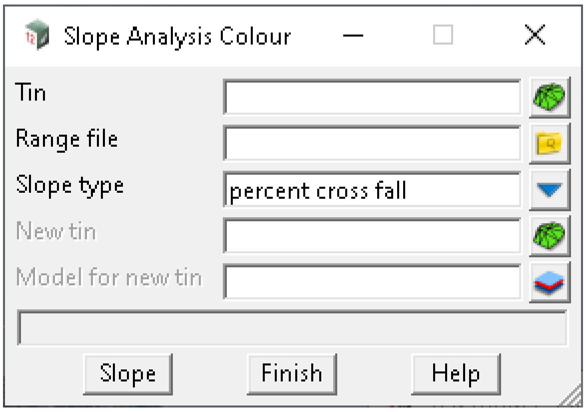
Continue to 13.3 Tin Slope Colouring or return to 13 Tin.

13.3 Tin Slope Colouring

Position of option on menu: **Tin =>Colour =>Slope colouring**

The **slope colouring** option has been enhanced so that rather than colouring the selected tin, a new tin can be created and coloured.

On selecting the **Slope colouring** option, the **Slope Analysis Colour** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin	tin box		available tins

*Name of the tin for which the slope of the triangles will be calculated and either this tin or **New tin** is coloured.*

Range file	slope range file		*.srf

The user supplied range file is used to give the colour ranges for slopes to use to colour the triangles.

Slope type	input	percent cross fall	percent cross fall, degrees, 1v in

The units used for slope in the range file.

New tin	tin box		available tins

*If **not blank**, a new tin of this name is created and it is this new tin that is coloured.*

*If **blank**, the tin given in **Tin** is coloured.*

Model for new tin	model box		available tins

*If **not blank** and a new Tin is created, the new tin is added to this model.*

*If **blank** and a new Tin is to be created then the option won't run.*

Buttons on bottom

Slope	button		

On selecting this button, the slopes of the triangles of the tin are calculated and coloured according to the slope range file.

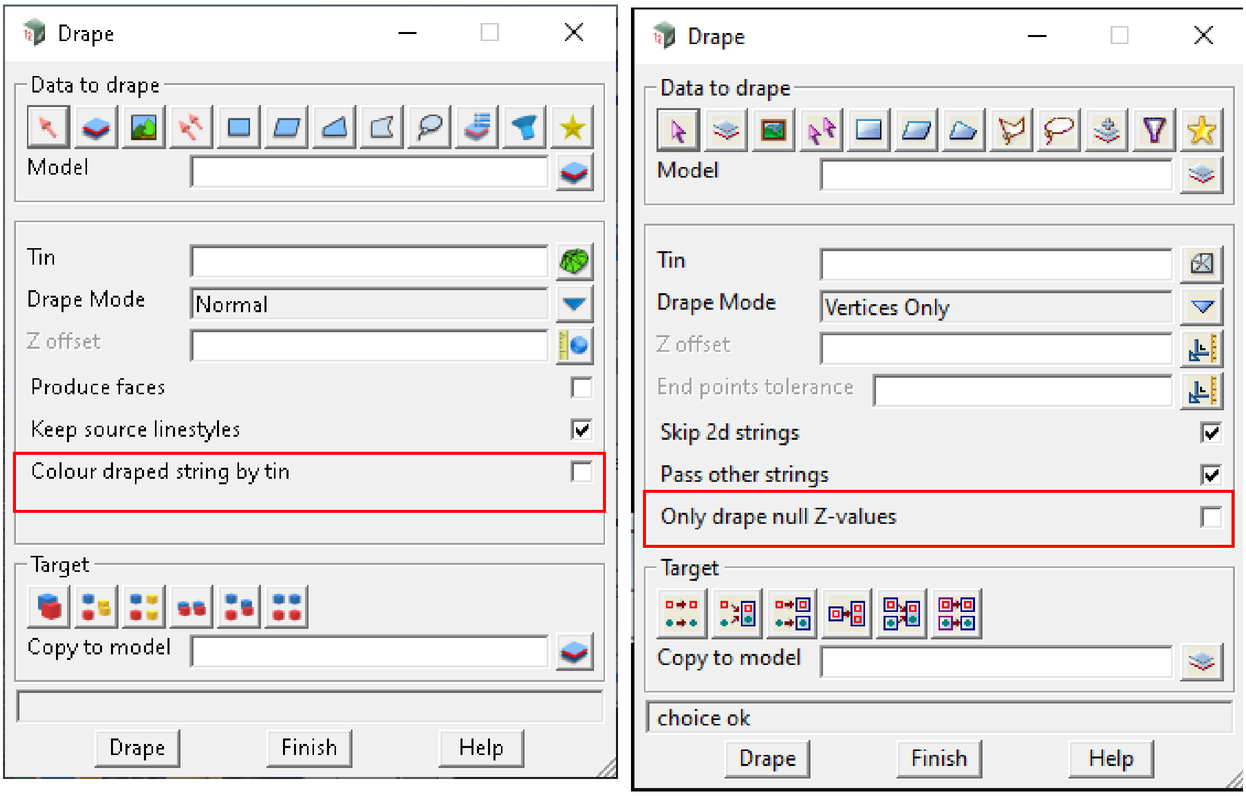
<esc> can be used to terminate the option during aspect calculations.

Continue to 13.4 Drape Strings or return to 13 Tin.

13.4 Drape Strings

Position of option on menu: **Tin =>Drape =>Drape**

Selecting **Drape** displays the **Drape** panel.



The fields and buttons used in the panel have the following functions.

Field Description Type Defaults Pop-Up

If *Drape mode* is Normal

Colour draped string by tin tick box not ticked

*If **ticked**, each segment of draped string is given the colour of the triangle that it is on.*

If *Drape mode* is Vertices Only

Only drape null Z-values tick box not ticked

*If **ticked**, the panel will still include entire data source but only vertices with null Z-values will be draped. Non-null vertices remain unchanged.*

Continue to 13.5 Label Flow Arrow or return to 13 Tin.

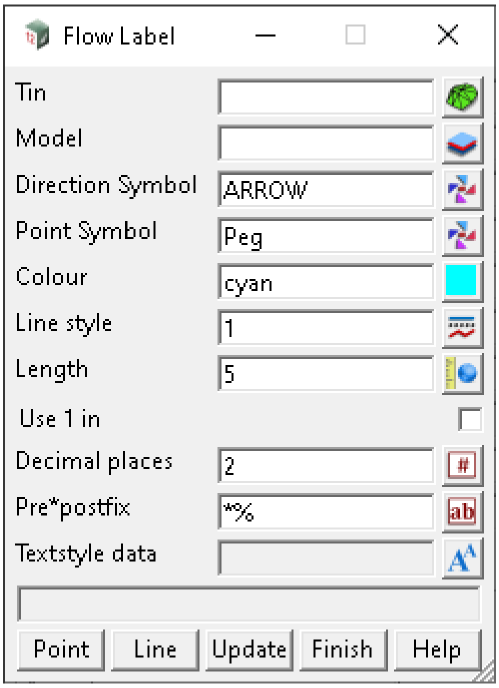
13.5 Label Flow Arrow

Position of option on menu: Tin =>Tin analysis =>Label flow arrow

The Label flow arrows option draws arrows and labels the grade indicating the flow direction across triangles of the tin selected.

The flow arrows are only drawn at a selected "Point", or the user can draw a "Line" (nominate two points) to nominate the labelling locations.

On selecting the **Label flow arrows** option, the **Flow label** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin	tin box		available tins

Name of the tin to calculate flow arrows label values.

Model	model box		available models

Model name of the produced arrows and labels. Must not be blank.

Direction Symbol	symbol box		available symbols

Symbol name of the produced arrow (at the end of the line) to indicate the direction of slope or crossfall.

Point Symbol	symbol box		available symbols

Symbol name at the selected coordinate if the user selects the "Point" method to label the tin. The label and line produced indicate the direction of slope or crossfall at the point.

If you don't wish for a "peg", "cross" or other symbol to be displayed at the coordinate selected, place the number "0" in the field and no symbol will be applied.

Colour	colour box	cyan	available colours

The colour selected is used for the symbols and line work at all locations using either the "point" or "line" method.

Linestyle linestyle box 1 available linestyles

The line style selected is used for the line produced to indicate the direction of slope or crossfall.

Length measure box 5 length value

Is the length of the line produced to indicate the direction of slope or crossfall. Some though should be given to plotting size as the length is in world units and will not scale given changes to plotting scale. This field cannot be left blank.

Use 1 in tick box not ticked

When not ticked (default) the text label value for the slope/crossfall will be calculated and display as a percentage (%). If ticked, the text label value will be calculated and displayed as a 1v / ?? h value.

Decimal places number box 2

The number of decimal places to be displayed for the text label produced when calculated. This field cannot be blank.

Pre*postfix text box *%

When displaying the text label calculated as either a percentage % or a 1 in value. The user can add additional pre or post text information to the value and have this displayed in the label.

Textstyle data textstyle data box available textstyles

The user must select a textstyle to be used to label the slope or grade at the point or line as nominated. The usual edits to font, colour, height, offset etc can all be further set as per the standard 12d textstyle settings. This field cannot be left blank.

Buttons on Bottom

Point button

*After selecting **Point**, a flow arrow is drawn at each selected point (x,y) location in a plan view. This continues until cancel is selected from the menu or the user "Esc" the command.*

Line button

After selecting the Line option, the user is required to select two points (x,y) locations in a plan view. Between these two points a line with the arrow will be drawn and the grade labelled from the heights of the tin calculated from either end of the line.

Update button

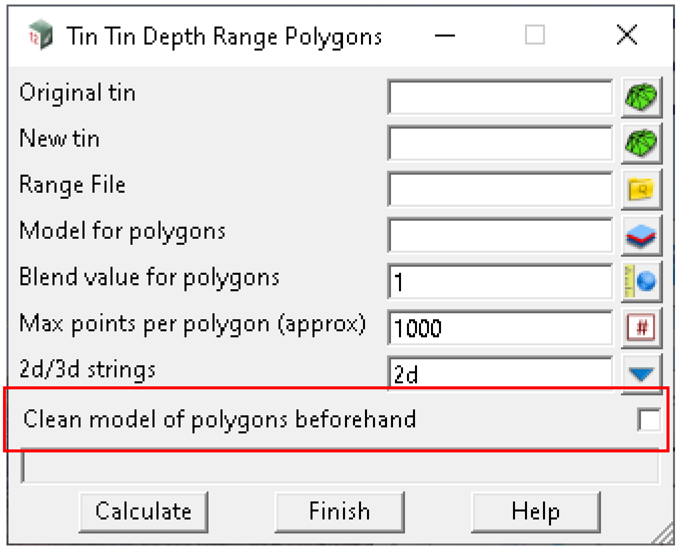
When the Flow labels are first produced (for both Point and Line methods) an attribute is stored on the elements produced. When the "Update" button is selected the Model (as selected within the panel) containing any labels is recalculated against the tin selected and grade information will be updated if the levels or grades of the surface have been changed.

Continue to 13.6 Depth Range Polygons or return to 13 Tin.

13.6 Depth Range Polygons

Position of option on menu: **Tin =>Tin analysis =>Depth range polygons**

On selecting the **Depth range polygons** option, the **Tin Tin Depth Range Polygons** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Clean model of polygons beforehand	tick box	not ticked	

*If **ticked**, the model will be clean before drawing a new polygon. If the model is locked, error will appears preventing the cleaning model and drawing polygons action from proceeding.*

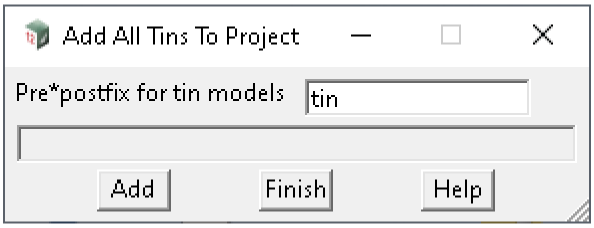
Continue to 13.7 Adding Removed Tins or return to 13 Tin.

13.7 Adding Removed Tins

Position of option on menu: **Tin =>Utilities =>Add =>Add all to project**

Also updated in V15 Reference manual.

Pre*postfix filed added that is used to create the models for the added tins.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pre*postfix for tins modelst	text box		

*If **blank**, tins added to the project are not added to any model.*
*If **non blank**, for each tin added to the project, the tin is added to the model based on the tin name.*

*So if the value is "Fred * Joe" and the tin name is "Bob", the tin "Bob" is added to the model "Fred Bob Joe".*

Note:
the initial value of the field comes from the environment variable MODEL_FOR_TIN_PREFIX_4D.

Continue to 13.8 Deconstruct Tin or return to 13 Tin.

13.8 Deconstruct Tin

Position of option on menu: **Tin =>Utilities =>Deconstruct tin**

A tin is made up of a network of non-overlapping triangles and each triangle is a set of three clockwise vertices connected by edges.

Some of the triangles are not used for any processes and are effectively not there. These triangles are called **null triangles**.

The other triangles, which are used in all processing, are the **non-null triangles**.

An each of a non-null triangle may be a segment of a breakline in the data that was used for constructing the tin. Such an edge is called a **breakline segment**. The vertices of a non-null triangle that are not part of breakline segments are called **non-breakline points**.

So the vertices of non-null triangle are either included in the breakline segments or the non-breakline points.

Even through a triangle is null, some of its vertices may also be vertices of non-null triangles and so included in either the breakline segments or the non-breakline points.

The vertices of a null triangle that are not shared with any non-null triangles are called **isolated points**. So an isolated point is surrounded by null triangles.

Hence the triangles of a tin are either null or non-null triangles and the vertices of any triangle will be either a breakline edge, a non-breakline point or an isolated point.

The **Deconstruct Tin** option breaks a tin into these various parts.

(a) non-null triangles

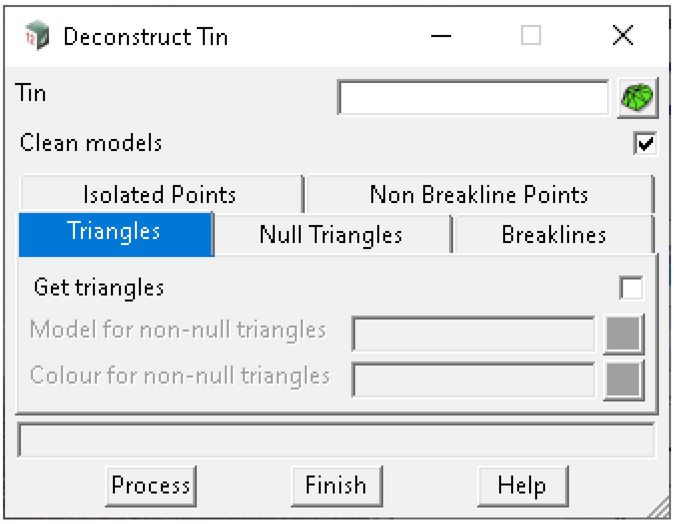
(b) null triangles

(c) breakline edges of non-null triangles

(d) non-breakline points of non-null triangles

(e) isolated points of null triangles

Selecting **Deconstruct Tin** displays the **Deconstruct Tin** panel



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Clean models tick box

*If **ticked**, all the models referred to in the panel are cleaned before processing occurs.*

Triangles

Get triangles tick box

*If **ticked**, a closed super string is created for each of the non-null triangles in the tin.*

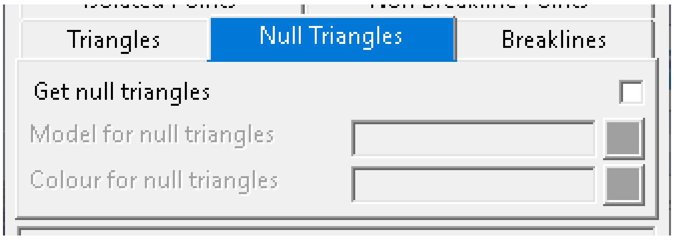
Model for non-null triangles model box available models

Model for the super strings of non-null triangles.

Colour for non-null triangles colour box available colours

Colour for the super strings of non-null triangles.

Null Triangles



Get null triangles tick box

*If **ticked**, a closed super string is created for each of the null triangles in the tin.*

Model for null triangles model box available models

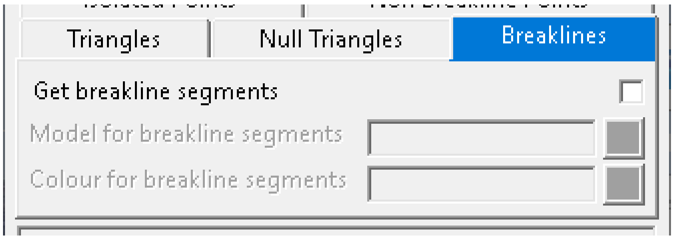
Model for the super strings of null triangles.

Colour for null triangles colour box available colours

Colour for the super strings of null triangles.

Breaklines

Null Triangles



Get breakline segments tick box

*If **ticked**, a super string segment is created for each edge of a triangle in the tin that is flagged as being a breakline edge.*

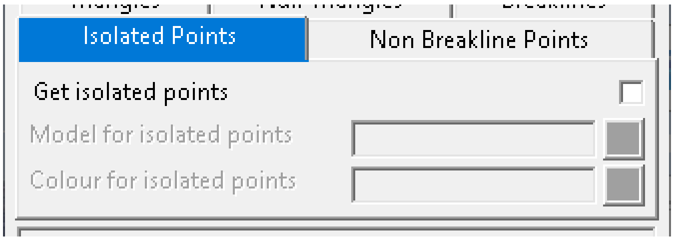
Model for breakline segments model box available models

Model for the breakline segments.

Colour for breakline segments colour box available colours

Colour for the breakline segments.

Isolated Points



Get tin points tick box

*If **ticked**, a super string point is created for each vertex of a null triangle that is NOT part of any non-null triangle. That is, the vertex is only a vertex of null triangles.*

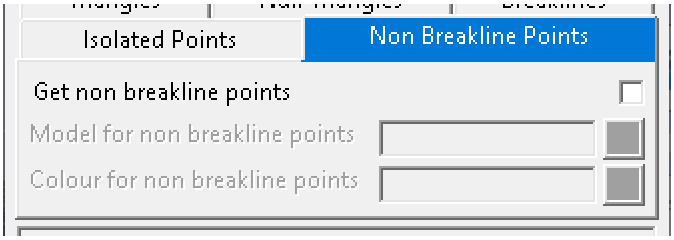
Model for isolated points model box available models

Model for the isolated points.

Colour for isolated points colour box available colours

Colour for the isolated points.

Non-Breakline Points



Get tin points tick box

*If **ticked**, a super string point is created for each vertex of a non-null triangle that is NOT part of a breakline edge.*

Model for non-breakline points model box available models

Model for the non-breakline points.

Colour for non breakline points colour box available colours

Colour for the non-breakline points.

Button at bottom

Process button

Run the option.

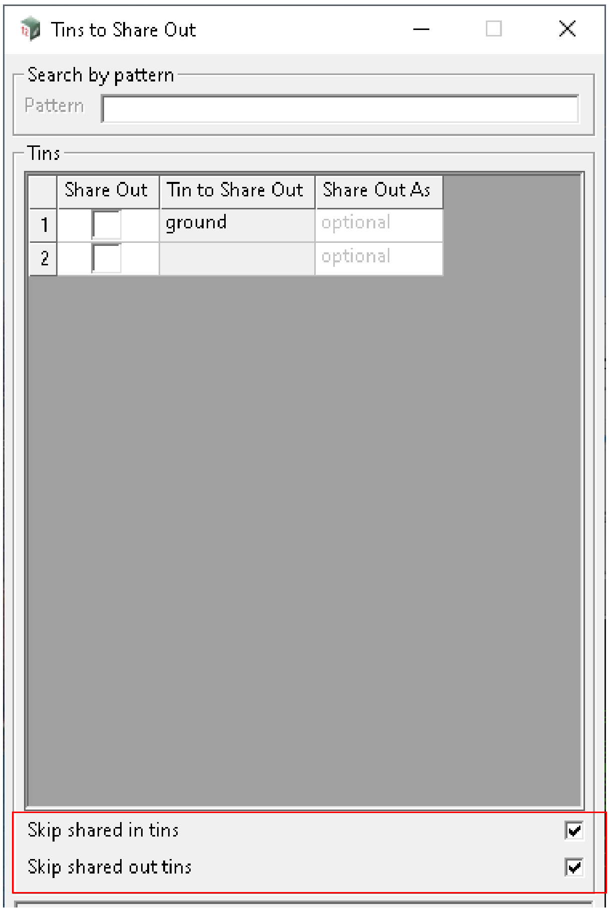
Continue to 13.9 Share Out Tins or return to 13 Tin.

13.9 Share Out Tins

Position of option on menu: **Tin =>Utilities =>Sharing =>Share out**

The options **Skip shared in tins** and **Skip shared out tins** have been added to both the **Model to Share Out** and **Tins to Share Out** panels.

Selecting **Share out** displays the **Tins to Share Out** panel.



Skip shared in models tick box

*If **ticked**, any model shared into the current project is not displayed.*

*If **not ticked**, any model shared into the current project is displayed and will be shared out. This is known as a share of a share. This means that when you share in a model that is a "share of a share", 12d must follow the chain of projects to the final "source" project. So note that it is possible to have a share chain that can be many projects long.*

Skip shared out models tick box

*If **ticked**, any model already shared out is not displayed. This allows for use of the Pattern field to be used without altering any existing shared out model.*

*If **not ticked**, all models are displayed, and any models already shared out will have the "Share Out" tick on.*

Notes

*Both **Skip shared in tins and Skip shared out tins** act together so that it is possible to skip all shared in tins and skip all shared out tins.*

Any Search pattern alters the "Share Out" tick for all displayed tins. As such one should be careful not to remove the shared out status for tins that still require sharing.

*Thus, ticking on "**Skip shared out tins**" prevents removing any share outs.*

Continue to 14 Survey or return to 13 Tin.

14 Survey

There has been changes to the **Survey** chapter in the ***12d Model Reference manual***.

The section 26 12d Survey Guide has been totally rewritten for V15.

The format of the ***12dfield*** file, as well the ***fld*** file, is now included in the chapter 28 12d Field File Format.

The section 29 Geodetics Summary has been substantially updated for V15.

The **Survey** menu in the ***Classic*** Theme is:

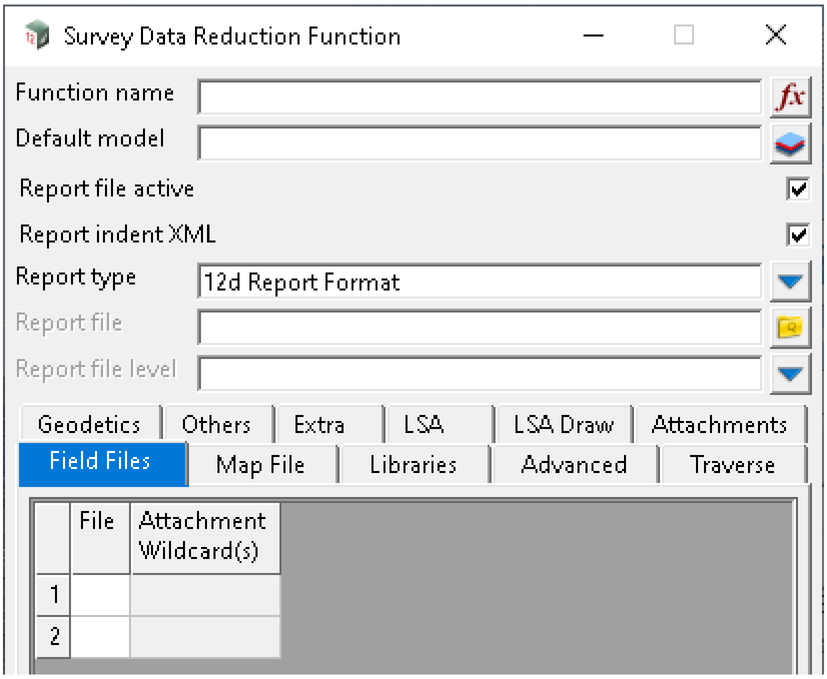
See

See

- 14.1 Reduction Quick Start and Config Start
- 14.2 Recalc Tick on Survey Data Reduction Editor
- 14.3 Height Adjustment
- 14.4 Conversions/Transformations
- 14.5.2 Chainage Offset Filter
- 14.6 Create SDR Function from a 12d Field File
- 14.7 Survey Data Reduction Editor

14.1 Reduction Quick Start and Config Start

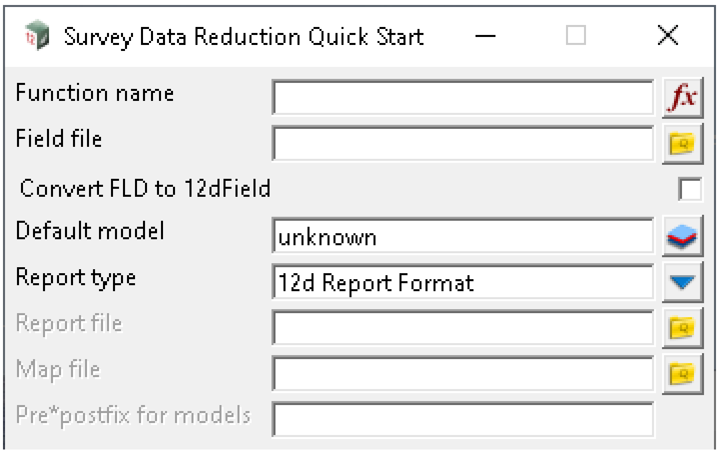
For ***12d Model 14***, the **Field file** option for reducing survey data brings up the **Survey Data Reduction Function** panel which has tabs for **all** the possible settings that a user could use in a reduction.



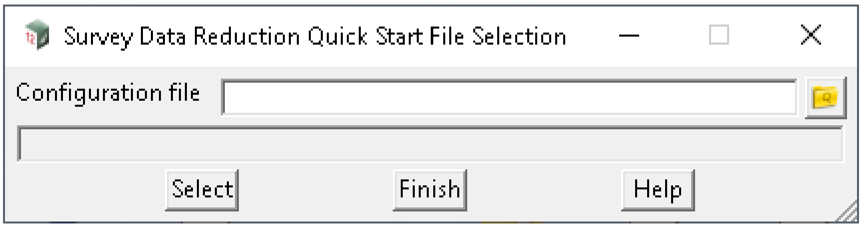
In ***12d Model 15***, a SDR configuration file (.12d_sdr_config) can be used to supply in advance many of the answers and reduce the amount of information displayed.

There are two options that use the ***12d_sdr_config*** file, ***Quick start*** and ***Config Start.***

Quick Start brings up the **Survey Data Reduction Quick Start** panel using the config file ***default.12d_sdr_config***:



Config Start brings up the **Survey Data Reduction Quick Start File Selection** panel:



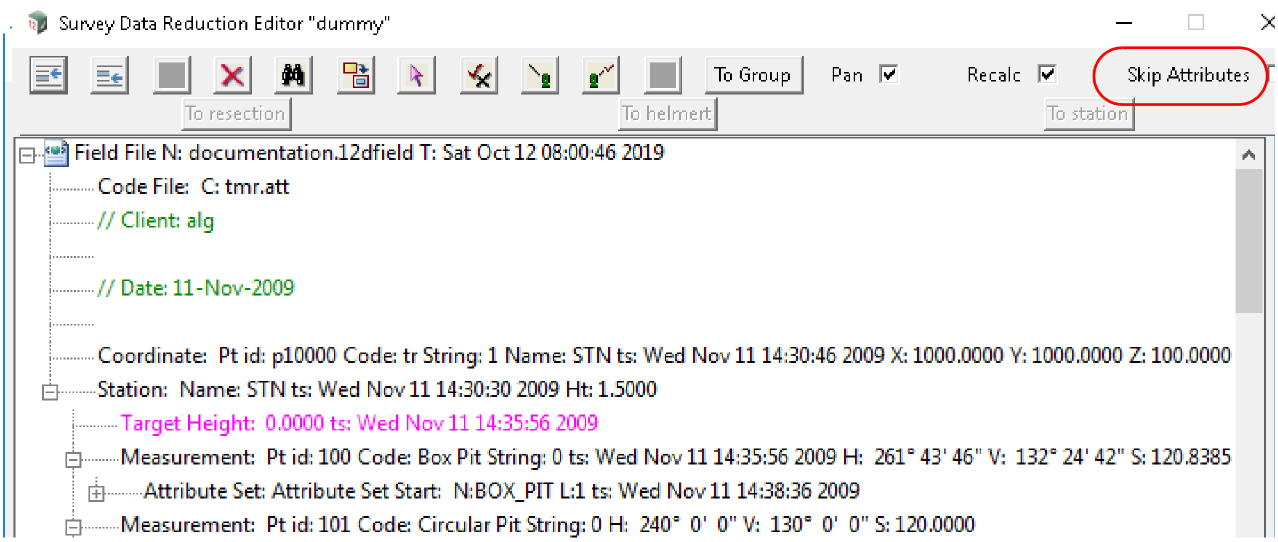
A ***12d_sdr_config*** file is then selected using the **Configuration file** pop-up and when **Select** is pressed, the **Survey Data Reduction Quick Start** panel is brought up using the selected config file.

Continue to 14.2 Recalc Tick on Survey Data Reduction Editor or return to 14 Survey.

14.2 Recalc Tick on Survey Data Reduction Editor

The **Survey Data Reduction Editor** is used to edit the field data commands in a ***Survey Data Reduction Function*** that has been created from ***12d Field Pickup*** or a ***12dfield*** file (not a ***fld*** file).

A ***Recalc*** tick box has been added to the top of the **Survey Data Reduction Editor**.



In V14, when a change was made to the field data commands in the **Survey Data Reduction Editor**, the associated ***SDR Function*** automatically recalcs so that effect of the edit can be immediately seen and checked.

For ***V15***, with the ***Recalc*** box, when changes are made and the ***Recalc*** tick box is ***ticked***, the ***SDR Function*** automatically recalcs.

However if changes are made and the ***Recalc*** tick box is ***not ticked***, the ***SDR Function*** does **not** automatically recalc.

Continue to 14.3 Height Adjustment or return to 14 Survey.

14.3 Height Adjustment

Position of option on menu: **Survey =>Adjustments =>Height adjustment**

GSB file has been added to the adjust method choice box options.

GeoTIFF file has been added to the adjust method choice box options.

Add value to height and **Subtract value from height** have been added to the following adjust method options:

Constant adjustment method

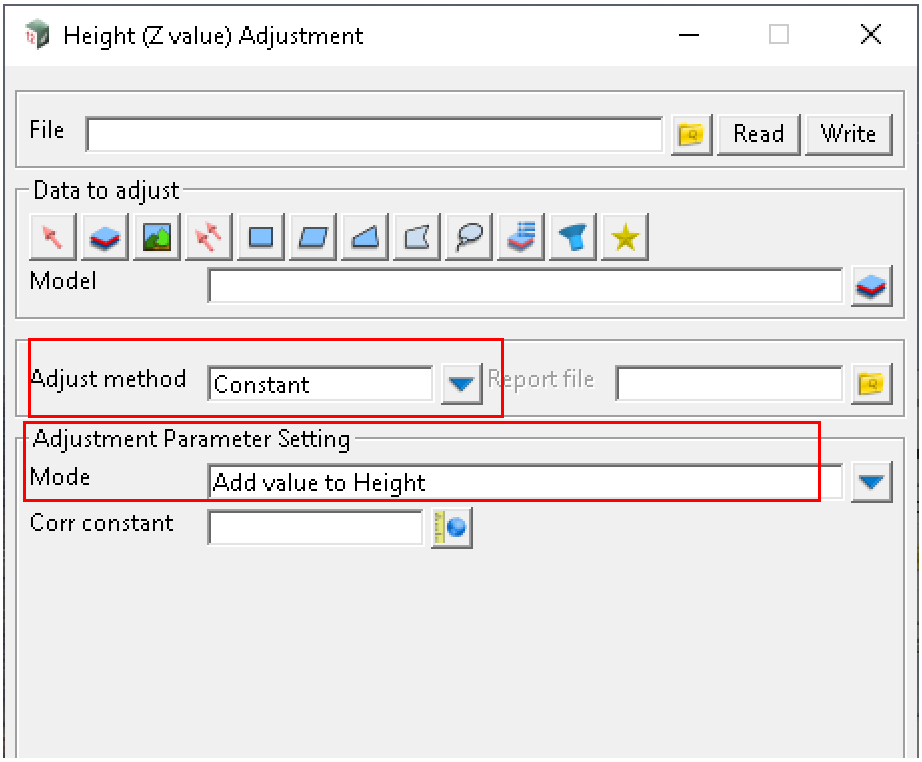
Plane parameters adjustment method

Plane by points adjustment method

GSB file

GeoTIFF file

Selecting **Height adjustment** brings up the **Height (Z value) Adjustment** panel



Adjustment Parameter Setting

Add value to height radio box ticked

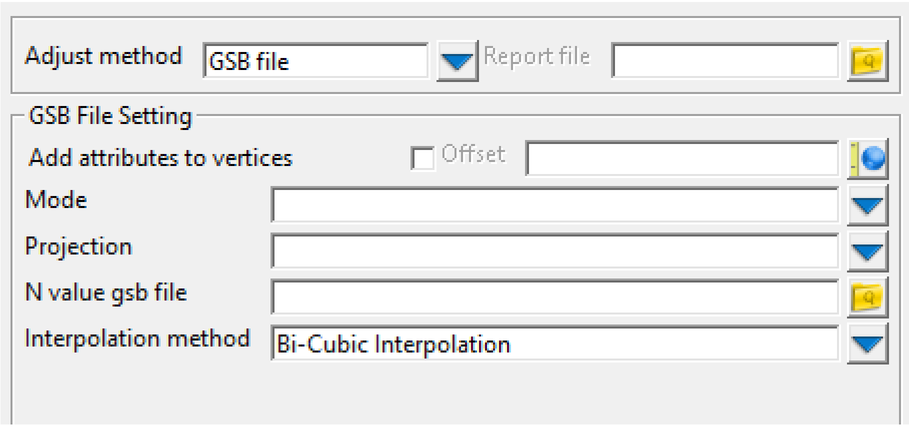
*if **ticked**, the **Corr constant** will be added to element's Z value.*

Subtract value from height radio box unticked

*if **ticked**, the **Corr constant** will be subtracted from element's Z value.*

GSB file adjustment method

This option allows a GSB file to be used to collect the N value based on the coordinate of each element in the data source. The N value can then be added to or subtracted from the height of each element from the data source.



Field Description	Type	Defaults	Pop-Up

GSB File Setting

Add attribute to vertices	tick box	not ticked	

*If **ticked**, vertex attributes are added showing the original and the new Z value for each vertex.*

Offset	real box		

*If **offset** is used, offset value will be added to the new height z value.*

Mode	choice box		Add value to Height Subtract value from Height Use value as Height

*If **Add value to Height**, the interpolated value from the difference tin will be added to the existing z-values of the points.*

*If **Subtracts value to Height**, the interpolated value from the difference tin will be subtracted from the existing z-values of the points.*

*If **Use value to Height**, the interpolated value from the difference tin will be used as the z-values of the points.*

Projection	projection box		

The local projection for input data from "Data to adjust".

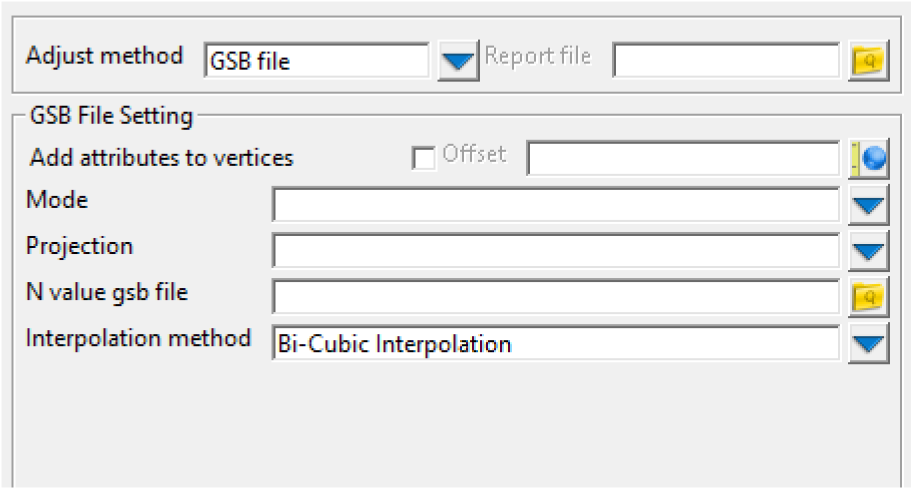
N value gsb File	file box		

GSB file to extract N values at the (x,y) coordinates of the vertices of the elements.

Interpolation method	choice box		Bi-Cubic Interpolation Bi-Linear Interpolation

*If **Bi-Linear** is chosen, the calculation is done on 4 points around each element coordinate.*
*If **Bi-Cubic** is chosen, the calculation is done on 16 points around each element coordinate.*

GeoTIFF file adjustment method



Field Description	Type	Defaults	Pop-Up
GeoTIFF file setting			
Add attribute to vertices	tick box	not ticked	

*If **ticked**, vertex attributes are added showing the original and the new Z value for each vertex.*

Offset	real box		

*If **offset** is used, offset value will be added to the new height z value.*

Mode	choice box		Add value to Height Subtract value from Height Use value as Height

*If **Add value to Height**, the interpolated value from the difference tin will be added to the existing z-values of the points.*

*If **Subtracts value to Height**, the interpolated value from the difference tin will be subtracted from the existing z-values of the points.*

*If **Use value to Height**, the interpolated value from the difference tin will be used as the z-values of the points.*

Projection	projection box		

The local projection for input data from "Data to adjust".

N value geoTIFF file	file box		

GeoTIFF file to extract N values at the (x,y) coordinates of the vertices of the elements.

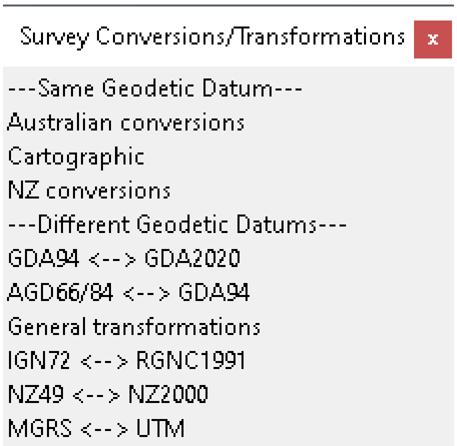
Continue to 14.4 Conversions/Transformations or return to 14 Survey.

14.4 Conversions/Transformations

The name of the **Survey Conversions** menu has been changed to **Survey Conversions/ Transformation** and the wording **Same Ellipsoid** and **Different Ellipsoid** on the panel have been changed to **Same Geodetic Datum** and **Different Geodetic Datums**.

This is to reflect the fact that although two geodetic datums may have the same ellipsoid (eg GRS80), they are different geodetic datums and a cartographic conversion can not be used to go between a projections on one geodetic datum to projections on the other different geodetic datum.

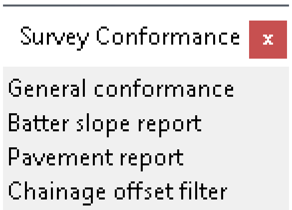
For example, GDA94 and GDA2020 have the same ellipsoid but the coordinates are defined to be where the positions on the earth are at the different epochs 1st January 1994 and 1st January 2020.



See

Continue to 14.5 Conformance or return to 14 Survey.

14.5 Conformance



See
14.5.1 General Conformance

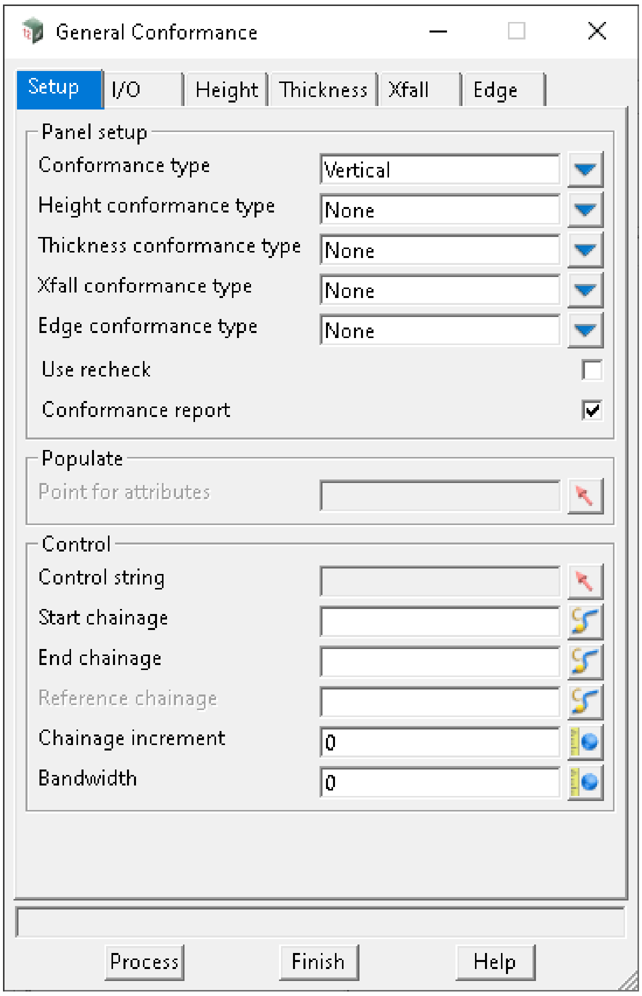
14.5.2 Chainage Offset Filter

14.5.1 General Conformance

Position on menu: **Survey =>Conformance =>General conformance**

This panel has the inputs of a control string, survey points and (string/s or surface/s) to conform to. There are four different types of conformances that can be applied to the survey points. The conformance types are the **Height conformance**, the **Thickness conformance**, the **Xfall conformance** and the **Edge conformance**. Each conformance type has its own respective tab that is dynamically populated based on the corresponding choice box on the Setup tab. When the Process button is pressed the panel will output an XML report with optionally another report type if an XSLT is provided.

Selecting **General conformance** brings up the **General Conformance Panel**



Setup Tab
I/O Tab
Height Tab
Thickness Tab
Xfall Tab
Edge Tab

The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Setup Tab

Populate

Point for attributes   select box

*Point that is used to populate the panel with 12d **Field** attribute data.*

Control

Control string select box

Control string that all chainage and offset calculations will be relative to.

Start chainage chainage box start chainage of control string

If the chainage of a given point dropped to the control string is less than the Start chainage then that point is not included in the report and will not be attributed.

End chainage chainage box end chainage of control string

If the chainage of a given point dropped to the control string is greater than the End chainage then that point is not included in the report and will not be attributed.

Reference chainage real box

The chainage that the chainage increment will be applied relative to.

If blank, the reference chainage will default to the start chainage.

Chainage increment real box 0

Interval distance that the bandwidth is applied to.

Bandwidth real box 0

If a point chainage is not within bandwidth/2 on the left and right of an interval chainage the point is not included in the report and will not be attributed.

For a point to be included in the report it must satisfy the following two equalities:

r = "Reference chainage"

N = any integer

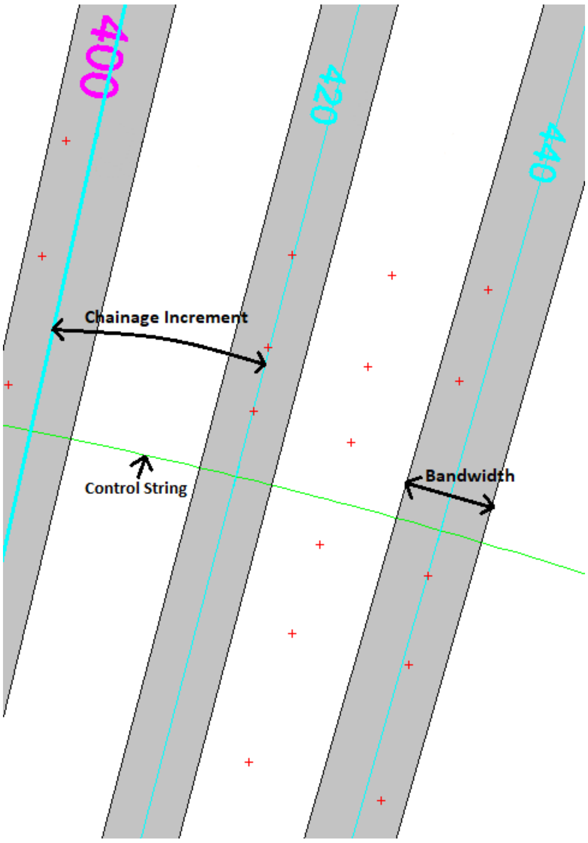
i = "Chainage increment"

b = "Bandwidth"

P = chainage of the given point

$$(1) \rightarrow \left(r + N \times i - \frac{b}{2}\right) \leq P \leq \left(r + N \times i + \frac{b}{2}\right)$$
$$(2) \rightarrow (Start\ chainage) \leq P \leq (End\ chainage)$$

This is represented is the following diagram:



Conformance

Conformance type	choice box	vertical	Vertical, Perpendicular

*If **Vertical**, when a given point is dropped to a surface for calculation it is a 2d drop where the x & y coordinates of the point retain the same value after the drop.*

*If **Perpendicular**, when a given point is dropped to a surface for calculation it is a 3D drop where the point is dropped normal to the surface.*

Height conformance type	choice box	None	None, Height, Tin, 2 strings/edges, Crown, 2 polymesh named edges Polymesh, Polyface, Points xy&z

Types of Height conformances to populate Height tab.

For more information on Height conformances see Height Tab.

Thickness conformance type	choice box	None	None, Height, Tin, Polymesh, Polyface, Points

Types of Thickness conformances to populate Thickness tab.

For more information on Thickness conformances see Thickness Tab.

Xfall conformance type	choice box	None	None, Simple

Types of Xfall conformances to populate Xfall tab.

For more information on Xfall conformances see Xfall Tab.

Edge Conformance type	choice box	None	None 1 string/edge 2 strings/edges

1 polymesh named edge
2 polymesh named edges

Types of Edge conformances to populate Edge tab.

For more information on Edge conformances see Edge Tab.

Attribute points tick box ticked

*If **ticked**, 12d **Field** attributes will be generated for all processed points.*

*If **not ticked**, attributes on processed points will stay unchanged unless Use recheck is ticked.*

Use recheck tick box not ticked

*If **ticked**, display the Recheck points group on the I/O tab.*

*If **not ticked**, hide the Recheck points group on the I/O tab.*

For more information on Recheck points see Recheck points.

Conformance report tick box ticked

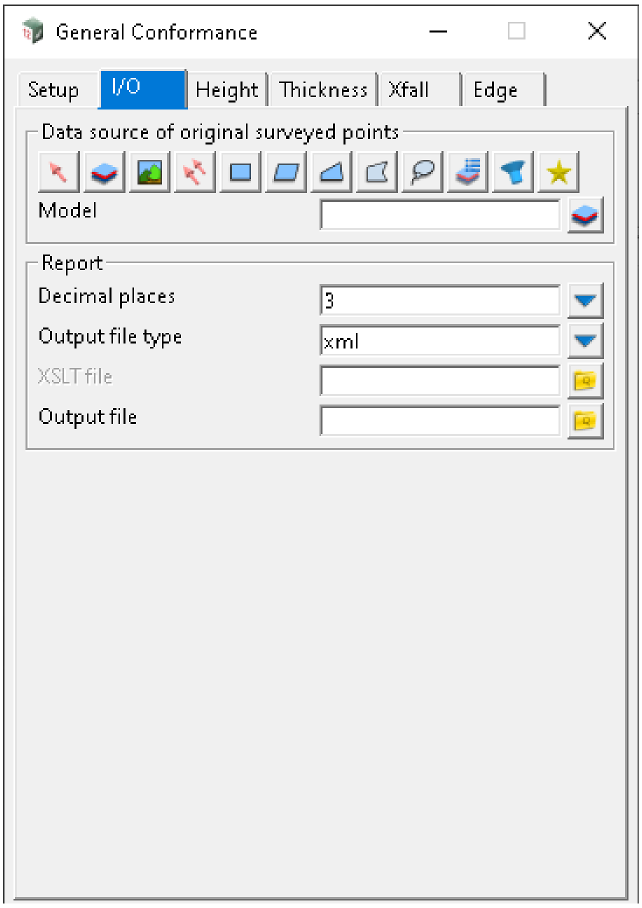
*If **ticked**, display the Report group on the I/O tab.*

*If **not ticked**, hide the Report group on the I/O tab.*

For more information on Report see Report.

I/O Tab

Note: to see this configuration of the I/O tab the Use recheck and Conformance report tick boxes must be both be checked.



Setup Tab
I/O Tab
Height Tab
Thickness Tab
Xfall Tab
Edge Tab

Data source of original surveyed points source box model

The points to be conformed against the string/s or surface/s from the Height, Thickness and Edges tabs.

For a full description go to 3.26.3 Data Source.

Recheck points

Data source of recheck surveyed points source box model

The points that will be compared against each original surveyed point to perform a recheck.

For a full description go to 3.26.3 Data Source.

Radius tolerance real box

If a recheck point lies within the Radius tolerance of an original surveyed point, the recheck point will replace the original surveyed point. All attributes of the original point are moved to an attribute group named "Original_Points".

Target output target output Move to original model/s
Copy to one model

How the recheck points merge with the original surveyed points. The recheck points will remain constant.

*If **Move to original model/s**, a given original survey point will be replaced with the recheck point if the points are within the Radius tolerance of each other.*

*If **Copy to one model**, all original survey points will be copied to a new model. A given survey point in the* *new model will be replaced with the recheck point if the points are within the Radius tolerance of each other.*

For a full description go to 3.26.4 Data Target.

Clean output model tick box not ticked

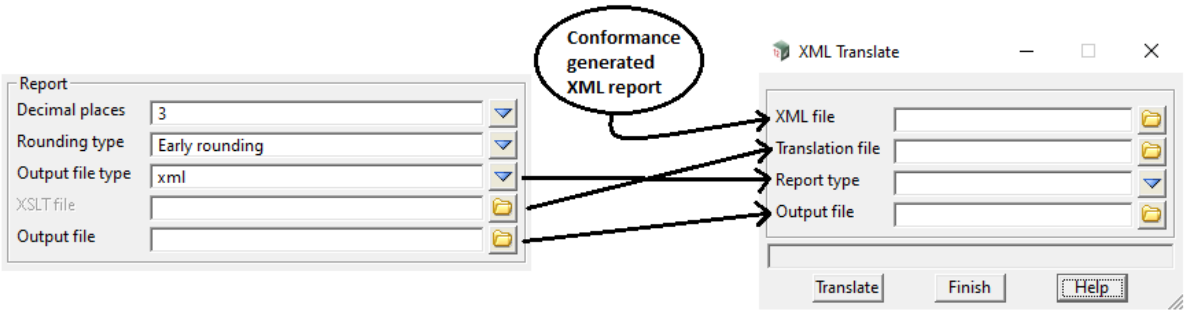
***Note**: This box is only enabled if the Target output mode is set to Copy to one model.*

*If **ticked**, clean the model before the original survey points are copied to the model.*

*If **not ticked**, copy the original survey points to the model regardless of whether there is existing.*

Report

*This panel uses Report =>Utilities =>XML translate to produce the **Output report file** via a provided XSLT from the basic XML report that is always produced if the **Conformance report** box is **ticked**.*



For more information see 24.9.2 XML Translate.

Decimal places choice box 3 0, 1, 2, 3, 4, 5, 6

*The number of decimal places to be outputted to the XML report for all **Real** type numbers.*

Rounding type choice box Early rounding Early rounding
Late rounding

*If **Early rounding**, the input data will be rounded before internal calculations are performed. This will result in a report where all the numbers look visually correct.*

*If **Late rounding**, the input data will be rounded after internal calculations are performed. The report numbers produced by Late rounding are more accurate than Early rounding however these numbers may appear visually incorrect due to the limitations of floating point numbers on computers.*

Output file type choice box xml xml, htm, pdf, txt, csv, rpt

Type of the report file.

XSLT file file box *.xslt files

***Note**: If the Output file type is not xml, txt or csv then the XSLT file is not optional.*

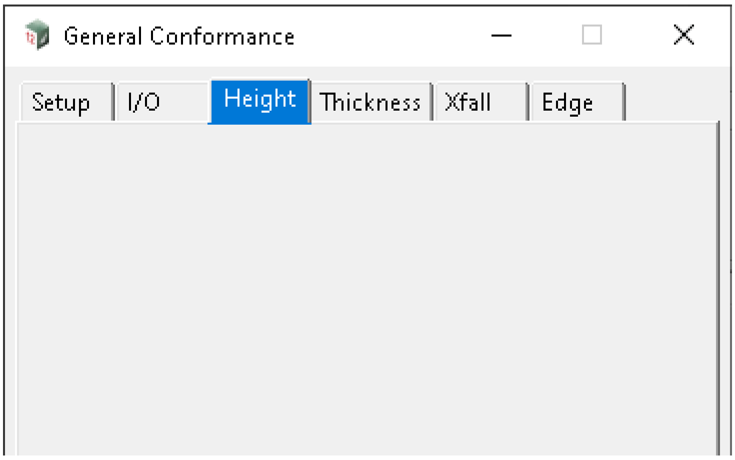
*If **blank**, use the default XSLT for the given Output file type.*

*If **not blank**, use the given XSLT that must be compatible with the Output file type.*

Output file file box *.(output file type) file directory

Name of the outputted report file.

Height Tab



[Setup Tab]
[I/O Tab]
[Height Tab]
[Thickness Tab]
[Xfall Tab]
[Edge Tab]

See Common height widgets.

See Height.

See Tin.

See 2 strings/edges.

See Crown.

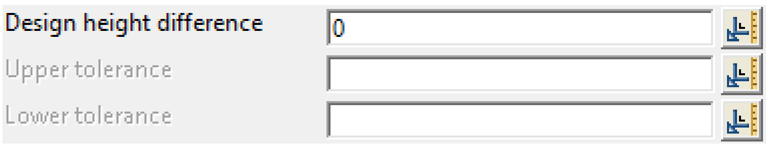
See 2 polymesh named edges.

See Polymesh.

See Polyface.

See Points XY & Z.

Common height widgets



Design height difference real box 0

An adjustment to all height conformance numbers.

Upper tolerance real box

An upper tolerance of how far above a given point can deviate from the design surface.

If left blank, there is no upper limit to any deviation from the design surface.

Lower tolerance real box

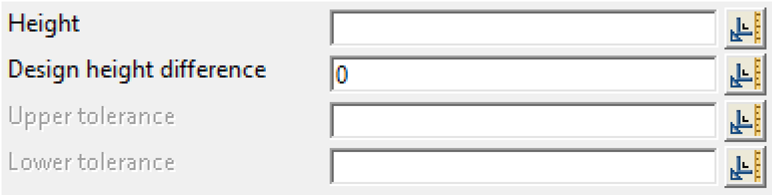
A lower tolerance of how far below a given point can deviate from the design surface.

If left blank, there is no lower limit to any deviation from the design surface.

None

A blank page is displayed, and no height conformance data is outputted.

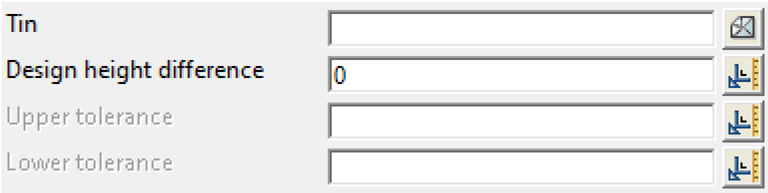
Height



All points will be conformed against a constant z value.

For more information on the other widgets, see Common height widgets.

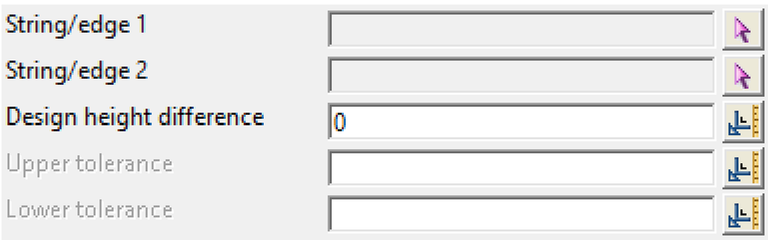
Tin



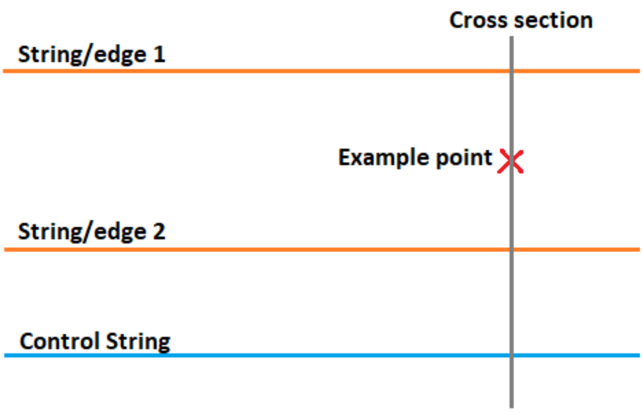
All points will be conformed against a tin surface.

For more information on the other widgets, see Common height widgets.

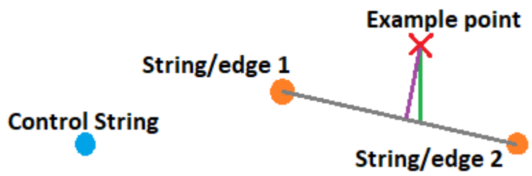
2 strings/edges



Plan View:



Cross section view:



Note: The green line represents the 2d drop, the purple line represents the 3D drop determined by the option chosen in the Conformance type choice box on the Setup tab.

String/edge 1 select box

Edge of surface that points are conformed against.

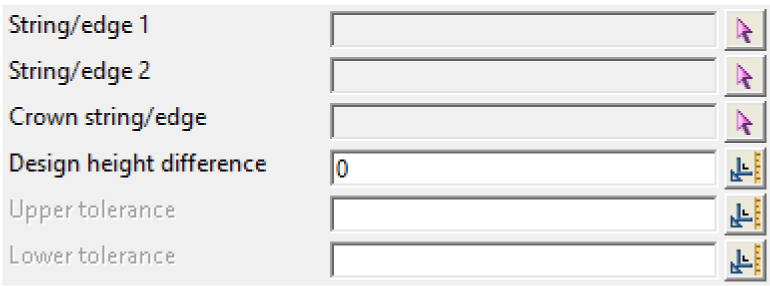
String/edge 2 select box

Edge of surface that points are conformed against.

For more information on the other widgets, see Common height widgets.

Crown

Note: This is conceptually a highly similar conformance to the 2 strings/edges.



String/edge 1 select box

Edge of surface that points are conformed against.

String/edge 2 select box

Edge of surface that points are conformed against.

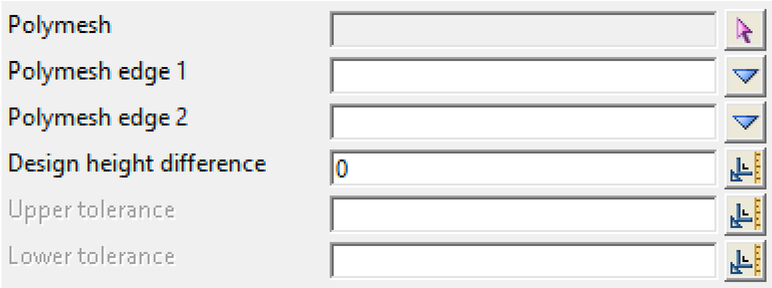
Crown string/edge select box

Crown edge of surface that points are conformed against.

For more information on the other widgets, see Common height widgets.

2 polymesh named edges

Note: This is conceptually a highly similar conformance to the 2 strings/edges.



Polymesh select box

The polymesh from which the polymesh edge choice boxes are populated from.

Polymesh edge 1 choice box Selected polymesh's edges

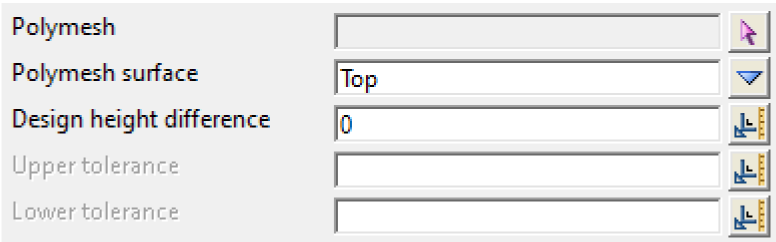
Polymesh edge of surface that points are conformed against.

Polymesh edge 2 choice box Selected polymesh's edges

Polymesh edge of surface that points are conformed against.

For more information on the other widgets, see Common height widgets.

Polymesh



Polymesh select box

All points will be conformed against a polymesh.

Polymesh surface choice box Top Top, Bottom

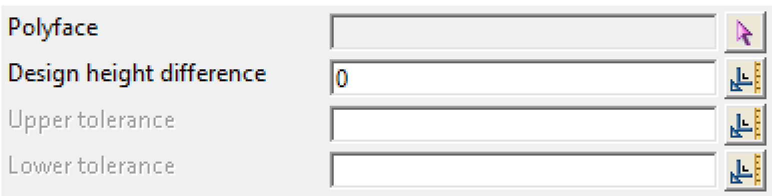
This choice box is important when a given point is dropped to the polymesh and there is more than one valid surface the point can be dropped to.

Top*, corresponds to the nearest drop to the polymesh surface.*

Bottom *corresponds to the furthest drop to the polymesh surface.*

For more information on the other widgets, see Common height widgets.

Polyface



Polyface select box

All points will be conformed against a polyface.

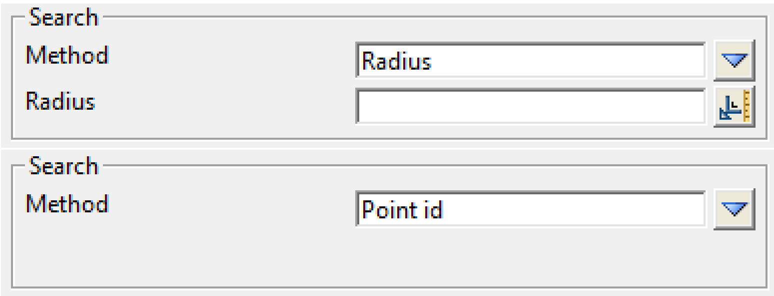
For more information on the other widgets, see [Common height widgets](#).

Points XY & Z

Data source of points source box model

The points that the original surveyed points will be conformed against.

For a full description go to [3.26.3 Data Source](#).



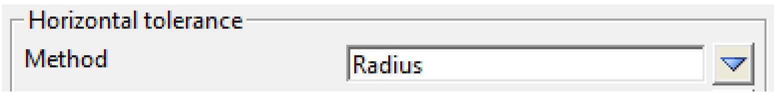
Method choice box Radius Radius, Point id

*If **Radius**, each point will be compared against each original survey point. If any pair of points is within the radius of each other then the original survey point will become a candidate for the conformance.*

*If **Point id**, match the point ids of the points against the point ids original survey points. If there is a match, then the original survey point will become a candidate for the conformance.*

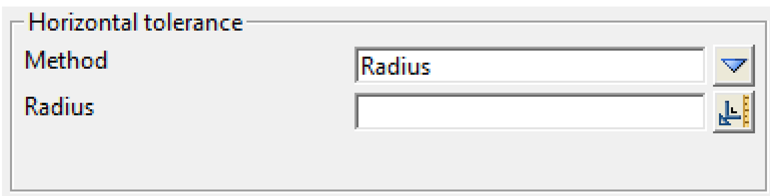
Radius real box

The original survey point will be included in the conformance if it falls within the Radius of the other point.



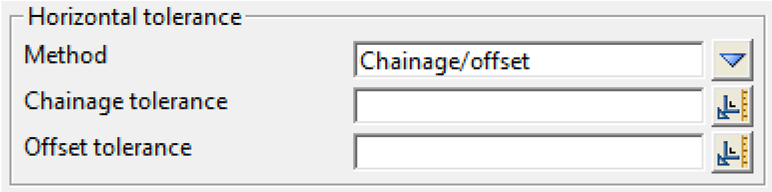
Method choice box Radius Radius, Chainage/offset, X/Y

Types of horizontal tolerancing methods original survey points accepted for conformance.



Radius real box

The original survey point will be within horizontal tolerance if it falls within the Radius of the other point.

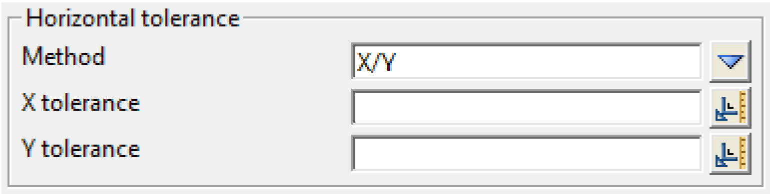


Chainage tolerance real box

The original survey point will not be within the horizontal tolerance if it's chainage falls outside ± the Chainage tolerance of the chainage of the other point.

Offset tolerance real box

The original survey point will not be within the horizontal tolerance if it's offset falls outside ± the Offset tolerance of the offset of the other point.

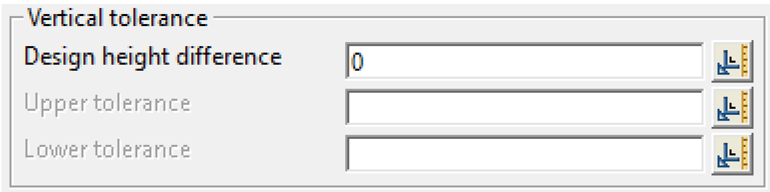


X tolerance real box

The original survey point will not be within the horizontal tolerance if it's x-coordinate falls outside ± the X tolerance of the x-coordinate of the other point.

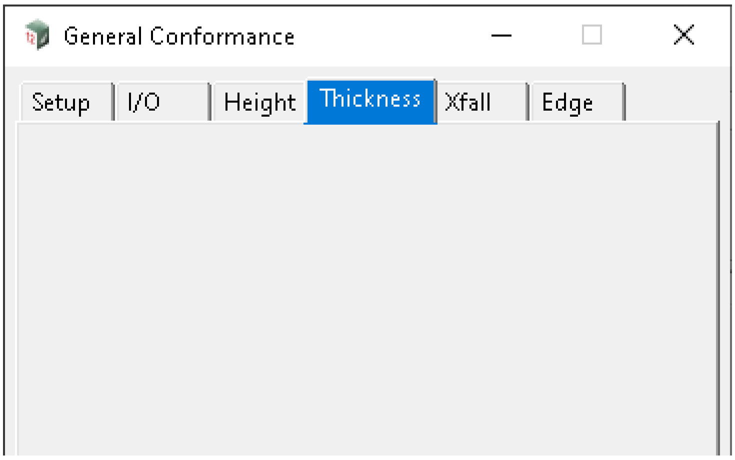
Y tolerance real box

The original survey point will not be within the horizontal tolerance if it's y-coordinate falls outside ± the Y tolerance of the y-coordinate of the other point.



For more information on the other widgets, see Common height widgets.

Thickness Tab



Setup Tab
I/O Tab
Height Tab
Thickness Tab
Xfall Tab
Edge Tab

See Common thickness widgets.

See Height.

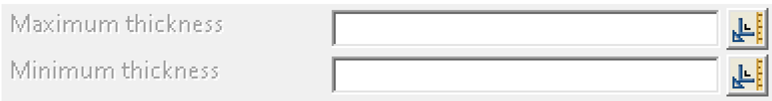
See Tin.

See Polymesh.

See Polyface.

See Points.

Common thickness widgets



Maximum thickness real box

An upper tolerance of how far above a given point can deviate from the design surface.

If left blank, there is no upper limit to any deviation from the design surface.

Minimum thickness real box

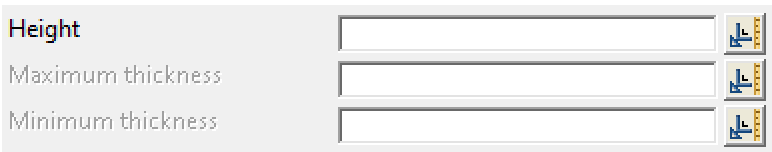
A lower tolerance of how far below a given point can deviate from the design surface.

If left blank, there is no lower limit to any deviation from the design surface.

None

*A blank page is displayed, and no **thickness conformance** data is outputted.*

Height

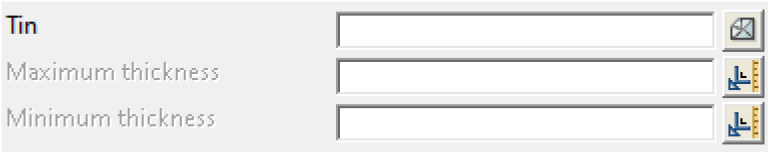


Height real box

All points will be conformed against a constant z value.

For more information on the other widgets, see [Common thickness widgets].

Tin

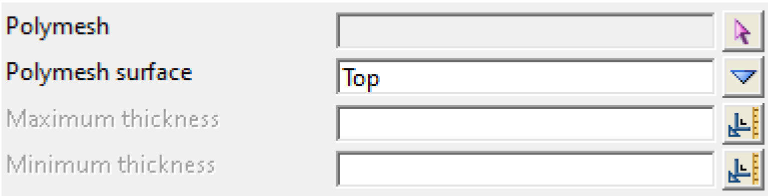


Tin tin box

All points will be conformed against a tin surface.

For more information on the other widgets, see [Common thickness widgets].

Polymesh



Polymesh select box

All points will be conformed against a polymesh.

Polymesh surface choice box Top Top, Bottom

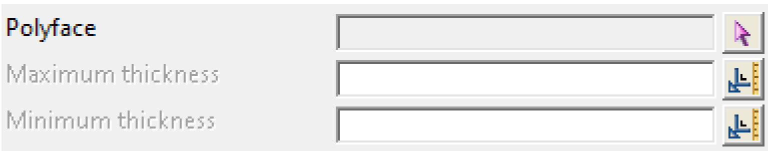
This choice box is important when a given point is dropped to the polymesh and there is more than one valid surface the point can be dropped to.

***Top**, corresponds to the nearest drop to the polymesh surface.*

***Bottom**. corresponds to the furthest drop to the polymesh surface.*

For more information on the other widgets, see [Common thickness widgets].

Polyface



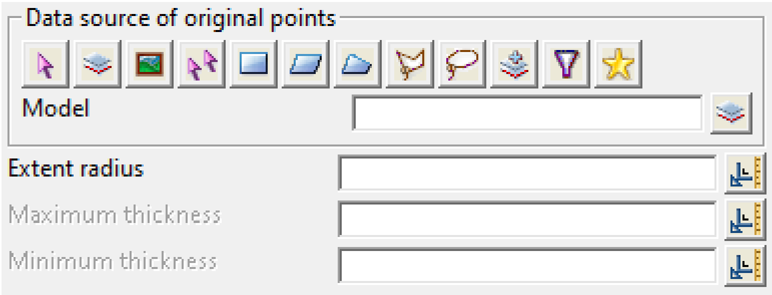
Polyface select box

All points will be conformed against a polyface.

For more information on the other widgets, see [Common thickness widgets].

Points

***Note**: Thicknesses are calculated here as: (Design - Original) - (Design - Survey)*



Data source of original points source box model

Points that will be compared against the survey points.

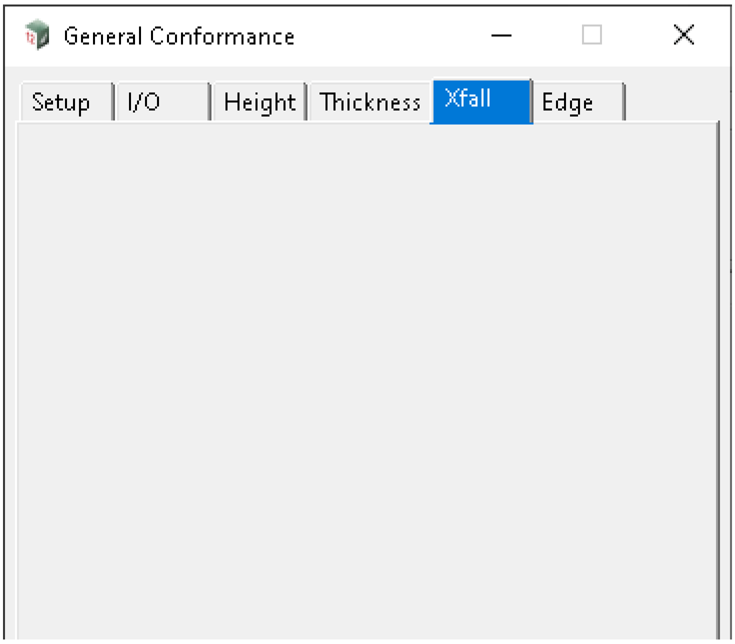
For a full description go to 3.26.3 Data Source.

Extent radius real box

If the surveyed point is within the Extent radius of the original point, then the survey point will become a candidate for the conformance.

For more information on the other widgets, see Common thickness widgets.

Xfall Tab

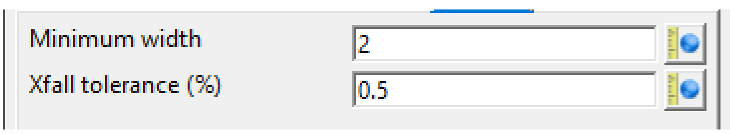


Setup Tab
I/O Tab
Height Tab
Thickness Tab
Xfall Tab
Edge Tab

None

A blank page is displayed, and no Xfall conformance data is outputted.

Simple



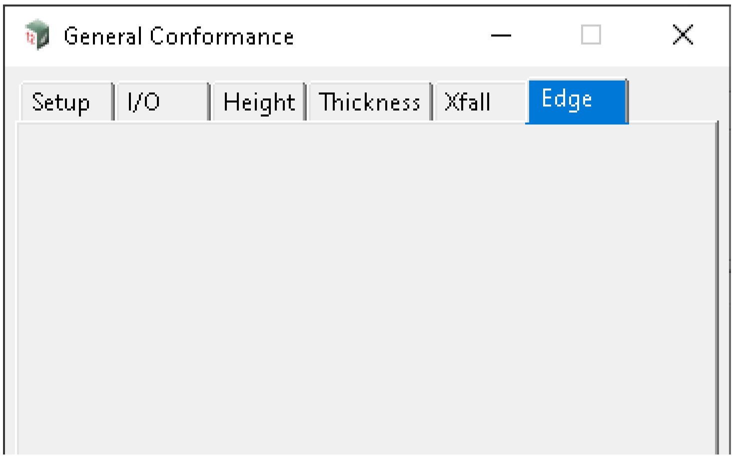
Minimum width real box 2

Do not measure the Xfall between any 2 adjacent points in a chainage band if they are less than this width apart from each other.

Xfall tolerance (%) real box 0.5

Plus and minus of this value makes the range of tolerances of how far the point xfall is allowed to deviate from the xfall of the previous point in the chainage band.

Edge Tab



Setup Tab
I/O Tab
Height Tab
Thickness Tab
Xfall Tab
Edge Tab

See Common edge widgets.

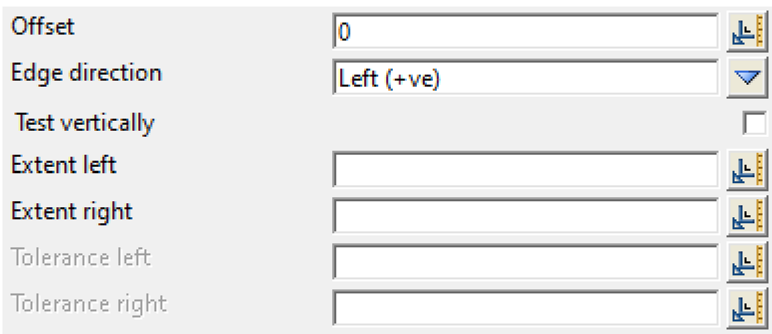
See 1 string/edge.

See 2 strings/edges.

See 1 polymesh named edge.

See 2 polymesh named edges.

Common edge widgets

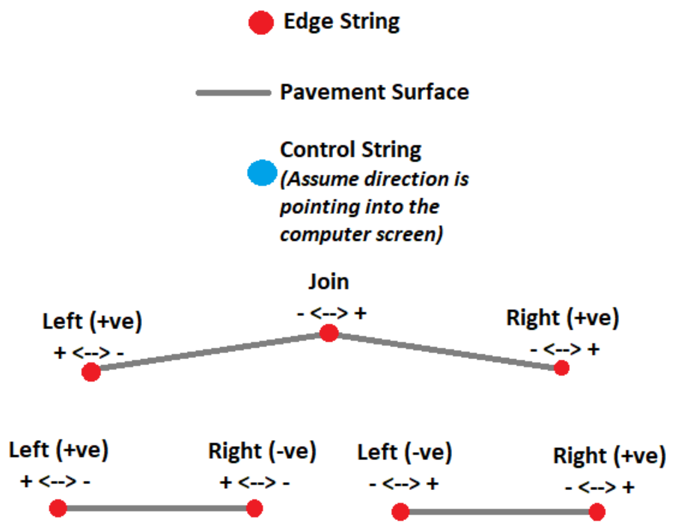


Offset real box

Calculation when an edge conformance is run will have their offset shifted by this value.

Edge direction choice box Left or Right (+ve) Left (+ve), Join Right (+ve), Left (-ve), Right (-ve)

Determines how the edge difference calculations will be plus or minus signed on the report and attributes for a given edge string.



Test vertically tick box not ticked

*If **ticked**, vertical conformances such as the **Height conformance** and **Thickness Conformance** can be run on an edge point.*

Extent left real box

*If a given survey point falls within this distance left of the edge string, it will be considered an edge point and an **Edge conformance** can be run on this point.*

Extent right real box

*If a given survey point falls within this distance right of the edge string, it will be considered an edge point and an **Edge conformance** can be run on this point.*

Tolerance left real box

If a given edge point falls within this distance left of the edge string, it will be reported as within tolerance.

*If **blank**, all points left of the edge string will be reported as within tolerance.*

Tolerance right real box

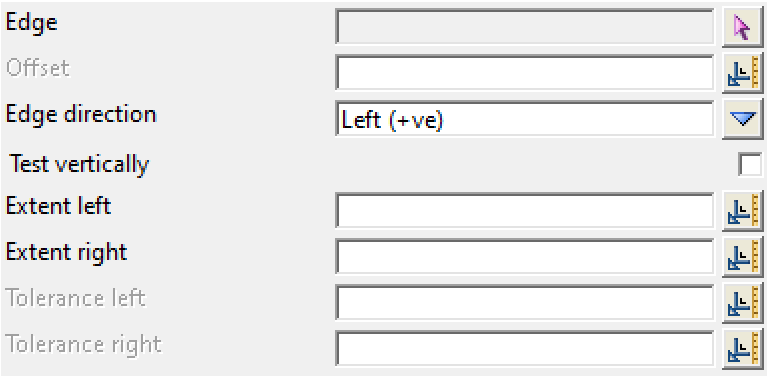
If a given edge point falls within this distance right of the edge string, it will be reported as within tolerance.

*If **blank**, all points right of the edge string will be reported as within tolerance.*

None

A blank page is displayed, and no edge conformance data is outputted.

1 string/edge

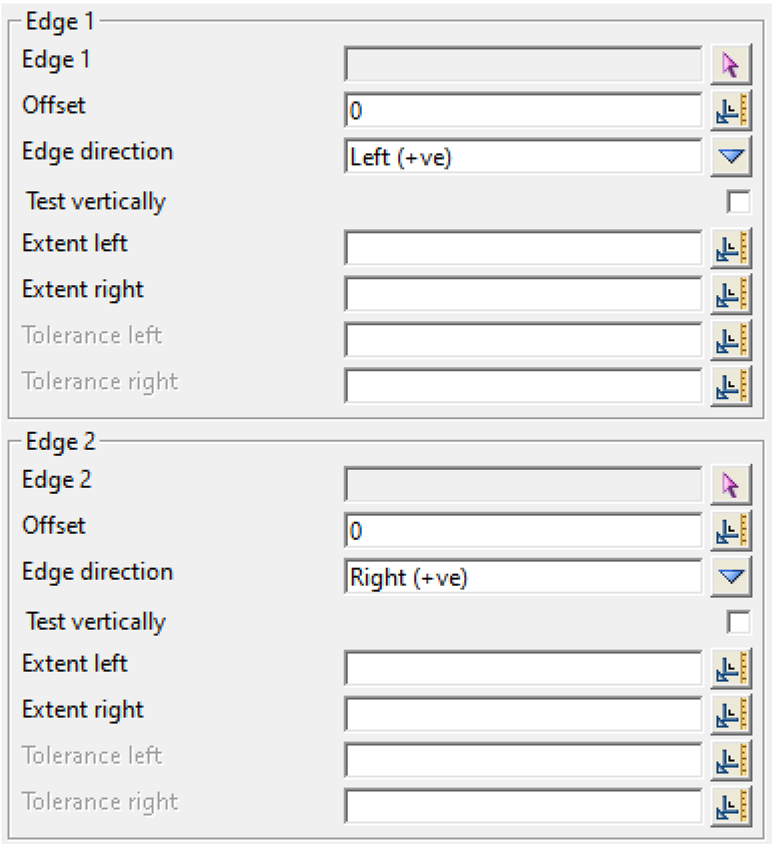


Edge

Surveyed points within extent range with be horizontally conformed to this edge.

For more information on the other widgets, see Common edge widgets.

2 strings/edges



Edge 1

Edge 1

Surveyed points within extent range with be horizontally conformed to this edge.

For more information on the other widgets, see Common edge widgets.

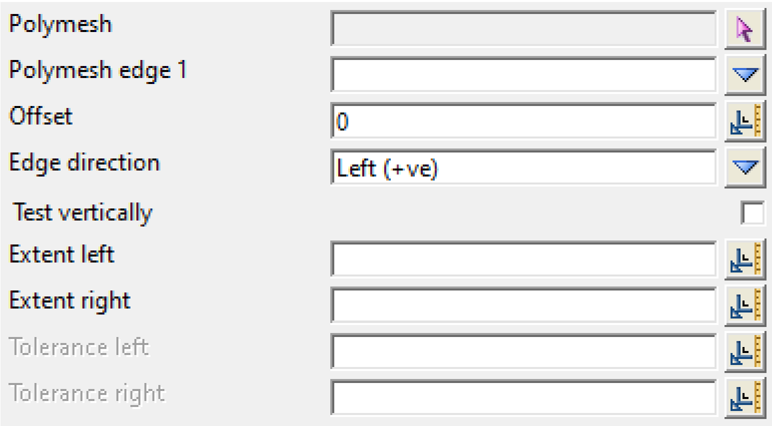
Edge 2

Edge 2

Surveyed points within extent range with be horizontally conformed to this edge.

For more information on the other widgets, see Common edge widgets.

1 polymesh named edge



Polymesh select box

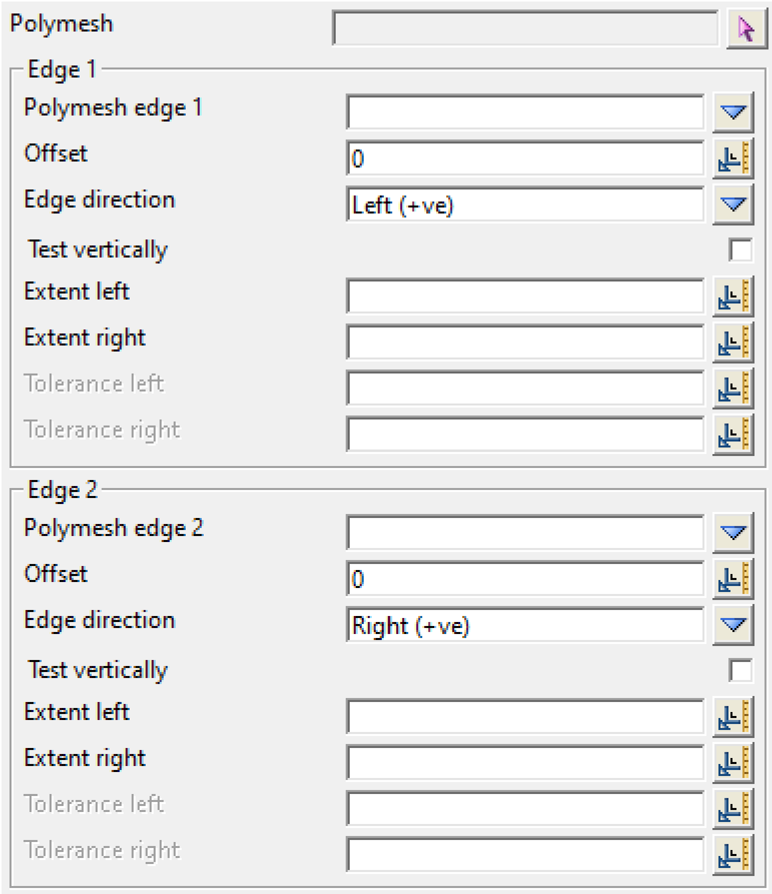
The polymesh from which the polymesh edge choice boxes are populated from.

Polymesh Edge 1 select box selected polymesh’s edges

Surveyed points within extent range with be horizontally conformed to this edge.

For more information on the other widgets, see Common edge widgets.

2 polymesh named edges



Polymesh select box

The polymesh from which the polymesh edge choice boxes are populated from.

Polymesh Edge 1 select box selected polymesh's edges

Surveyed points within extent range with be horizontally conformed to this edge.

Polymesh Edge 2 select box selected polymesh's edges

Surveyed points within extent range with be horizontally conformed to this edge.

Continue to 14.5.2 Chainage Offset Filter or return to 14.5 Conformance or 14 Survey.

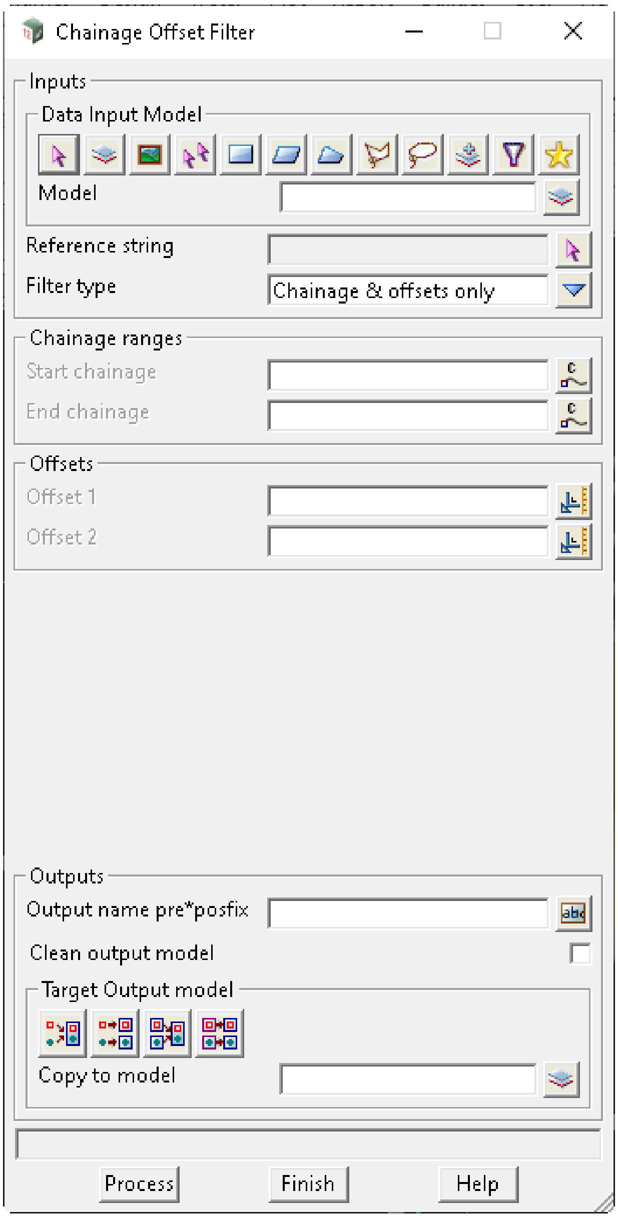
14.5.2 Chainage Offset Filter

Position on menu: **Survey =>Conformance =>Chainage offset filter**

Chainage Offset Filter filers vertices of strings according to user supplied restrictions involving a chainages and offsets from a user supplied reference string.

has inputs of an input model, reference string and filter type. The input model is the data that will be filtered by the panel. The reference string is what the input model will be filtered against. The filter type is how the model will be filtered. After the filtering process the user can choose how the data should be outputted using the target box. The filtered data can be moved or copied to one or many models.

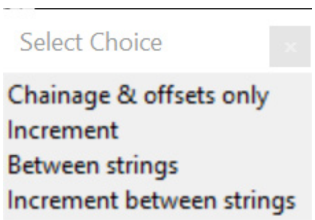
Selecting the **Chainage Offset Filter** brings up the **Chainage Offset Filter** panel.



The fields and buttons used in this panel have the following functions.

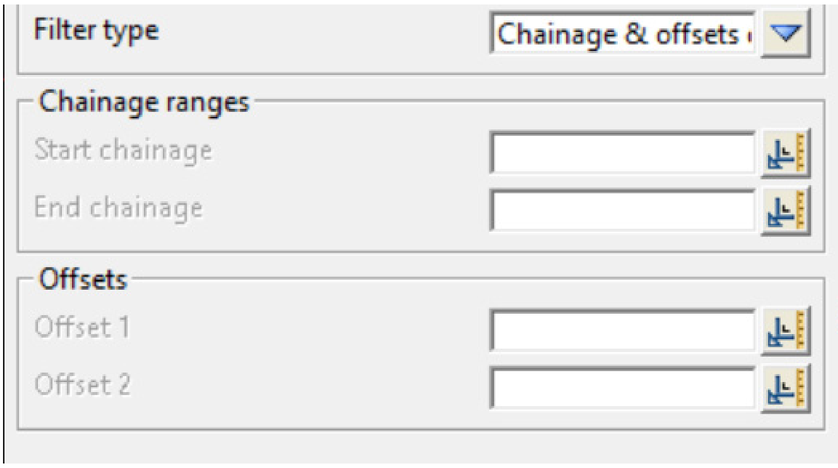
Field Description	Type	Defaults	Pop-Up
Inputs			
Data to filer Model	source box	model	
Strings with vertices to filter.			
Selected data source	input	Model	
Source of data to process.			
Reference string	select box		
Reference string to be used for chainage and offset used to filer vertices of strings in the data source.			
Filter type	choice box		Chainage & offsets only Increment Between strings Increment between strings
Filters for the vertices. *For information on filter types see* Filter types.			
Outputs			
Output name pre*postfix	text box		
Clean output models	tick box		
*if **ticked**, the output models are cleaned before any data is added to them.* *If **not ticked**, the output models are not cleaned.*			
Target output model	target box	Move to model	Move to model Move to model prefix Copy to model Copy to model prefix
*If **Move to model**, remove vertices from input strings and place them in the output model.* *if **Move to model prefix**, remove vertices from input strings and place in many output models.* *if **Copy to model**, copy vertices from input strings and place in output model.* *if **Copy to model prefix**, copy vertices from input strings and place in many output models.* *Find more info 2.23.4 Data Target*			

Filter types



Chainage & offsets only
Increment: (Includes optional chainages and offsets)
Between strings: (Includes optional chainages)
Increment between strings: (Includes optional chainages)

Chainage & offsets only



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Start chainage	real box	Start chainage of Reference String	

*If **not blank**, select the vertices of strings whose chainage when dropped onto the reference string are greater than **Start chainage**.*

*If **blank**, select the vertices of string whose chainage when dropped onto the reference string are greater than the start chainage of the reference string.*

End chainage	real box	End chainage of Reference String	

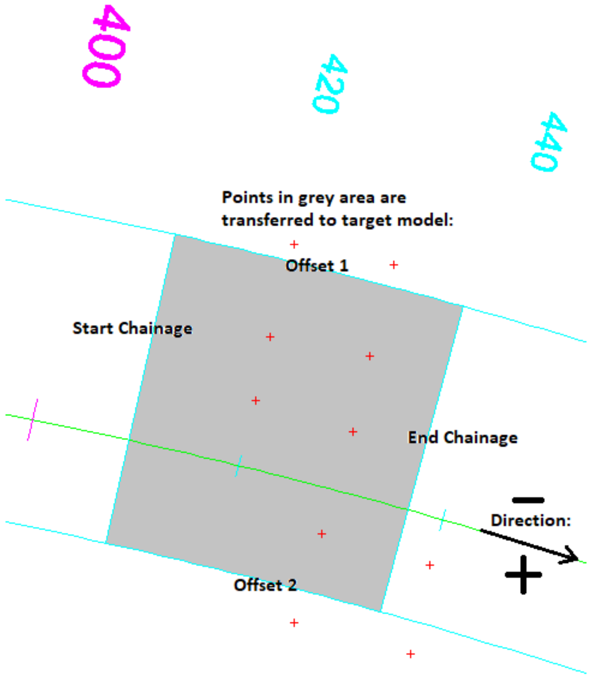
*If **not blank**, select the vertices of strings whose chainage when dropped onto the reference string are less than **End chainage**.*

*If **blank**, select the vertices of string whose chainage when dropped onto the reference string are less than the end chainage of the reference string.*

Offset 1 & 2	real box	0	

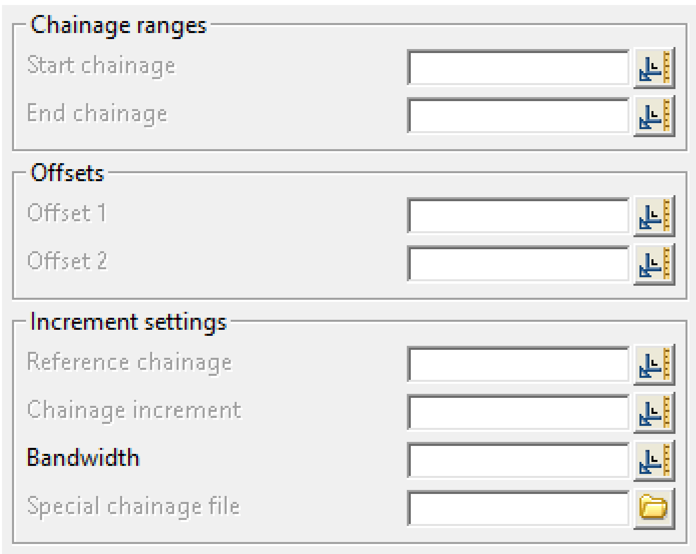
*Select the vertices of strings whose offset from the reference string is between **Offset 1** and **Offset 2**.*

***Note:** when going in the chainage direction of the reference string, left of the reference string is negative and right of the reference string is positive.*



Increment: (Includes optional chainages and offsets)

See **Chainage & offsets only** for information on the ***Chainage Ranges*** and ***Offsets*** part of the panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Reference chainage	real box		

*If **not blank**, used if start chainage box is left default to set start chainage of the increment filter.*

Chainage increment (opt)	real box		

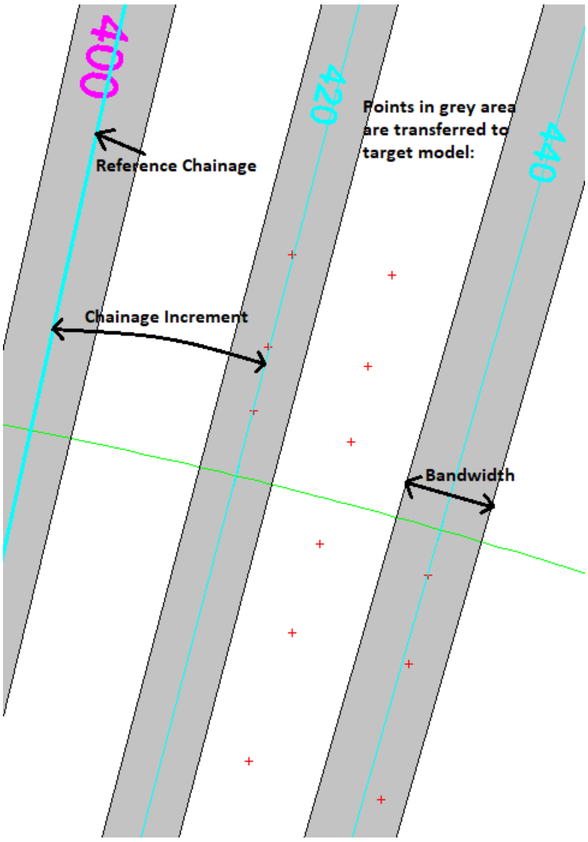
Distance between each chainage the bandwidth is applied to filter points.

Bandwidth real box

Points bandwidth/2 on the left and right of the chainages are filtered.

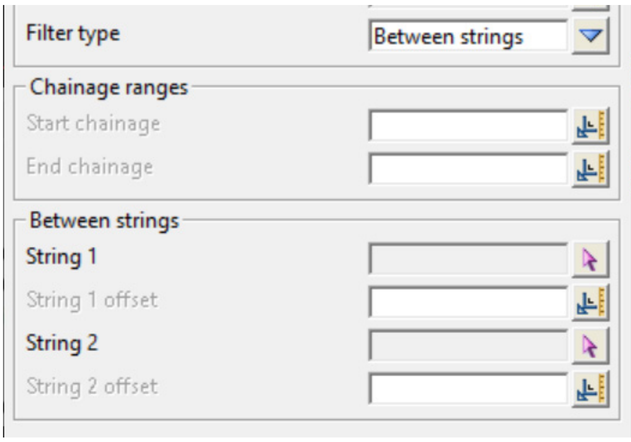
Special chainage file (opt) file box *spf File directory

File that contains chainages that can be have the bandwidth applied to filter points.



Between strings: (Includes optional chainages)

See **Chainage & offsets only** for information on the Chainage Ranges part of the panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
String 1, String 2	select box		

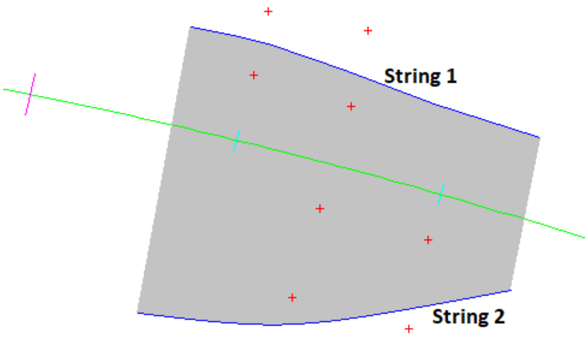
Strings to filter between.

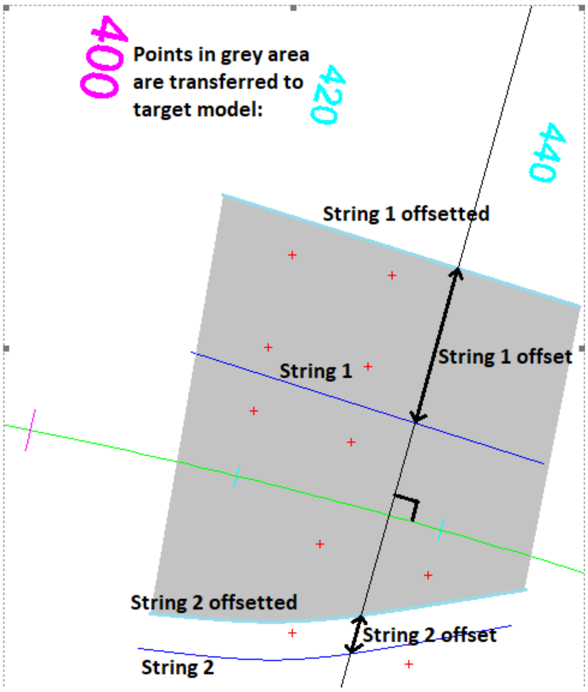
String 1 & String 2 offset real box

Offsets of the strings.

Direction of the Offsets are also determined by direction of the Reference string.

***Left** of the reference string is **negative**, **right** of the reference string is **positive**.*



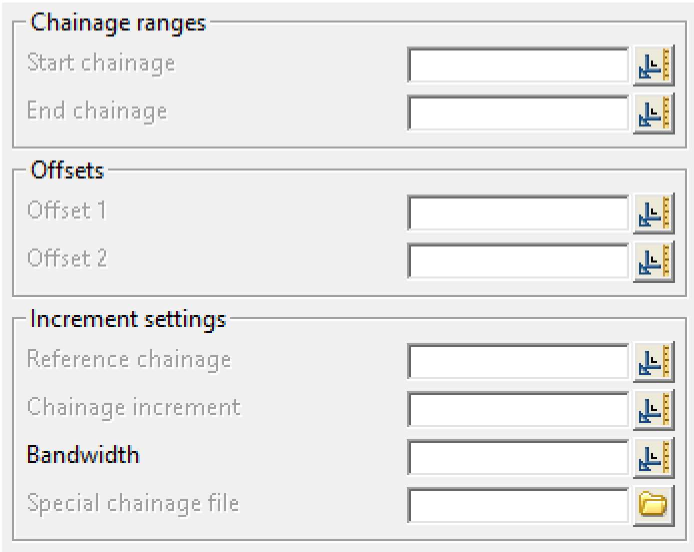


Increment between strings: (Includes optional chainages)

See **Chainage & offsets only** for information on the Chainage ranges part of the panel.

See **Increment** for information on the Increment settings part of the panel.

See **Between strings** for information on the Between strings part of the panel.



Buttons at Bottom

Process button

Run the option.

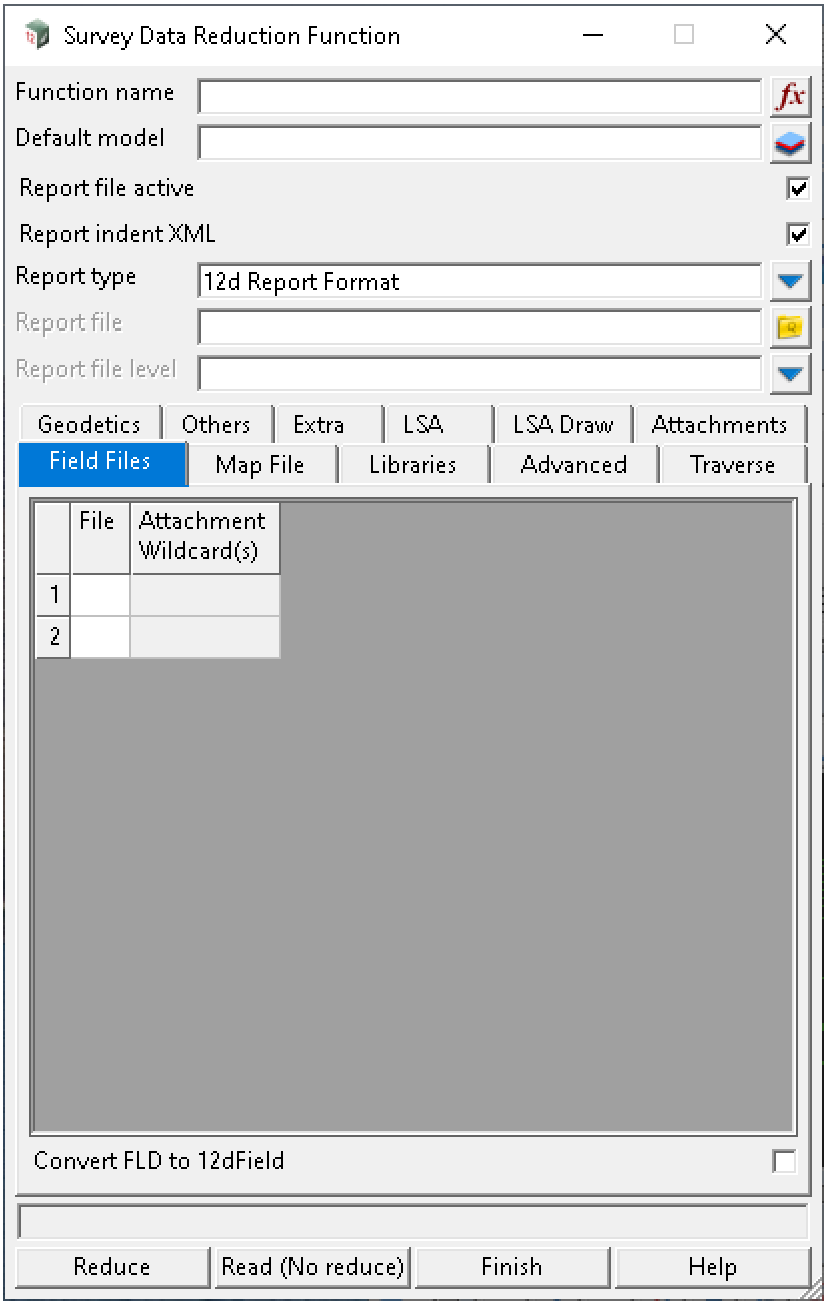
Continue to 14.6 Create SDR Function from a 12d Field File or return to 14 Survey.

14.6 Create SDR Function from a 12d Field File

Position on menu: **Survey =>Create =>Field file**

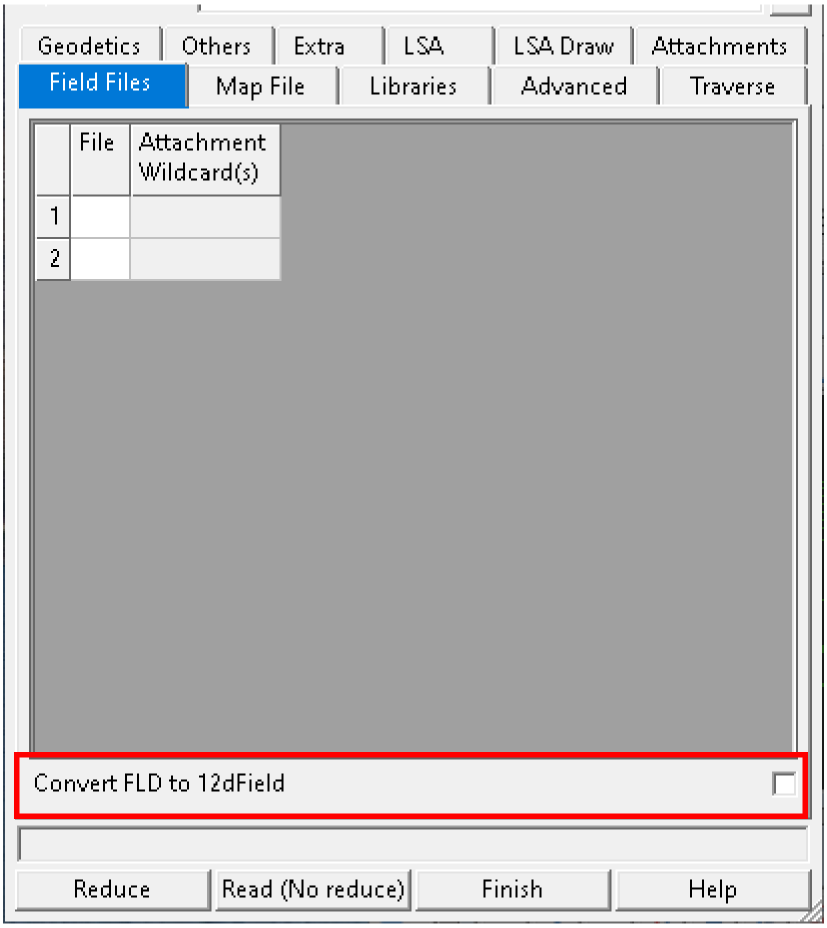
The panel field **Convert FLD to 12dField** has been added to the **Field Files** tab on the **Survey Data Reduction Function** panel**.**

Selecting **Field file** brings up the **Survey Data Reduction Function** panel:



Field Files tab

List of field files to read in.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Convert FLD to 12dField	tick box	ticked	

The SDR function is converted from FLD (flat) to 12dField (tree) format.

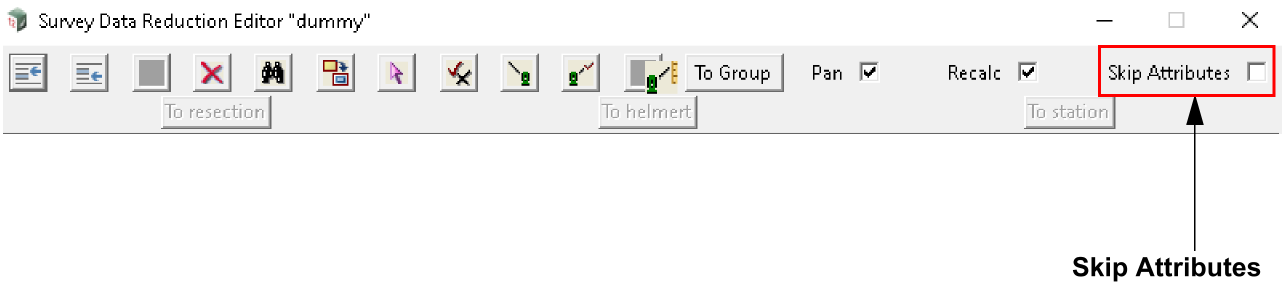
For all .FLD files, equivalent .12dField files are created.

If any .12dField files already exist, the convert fails.

Continue to 14.7 Survey Data Reduction Editor or return to 14 Survey.

14.7 Survey Data Reduction Editor

The tick box **Skip Attributes** has been added to the Survey Data Reduction Editor.



***Ticked on** - when a command in the **SDR Editor** is modified or added, all measurement child attributes are processed.*

***Ticked off** - when a command in the **SDR Editor** is modified or added, all measurement child attributes are skipped.*

Notes:

When there are millions of measurement child attributes, it takes time to process, and applied to strings.

Having the ability to skip these attributes, can make any edit many times faster.

*When exiting the **SDR Editor**, a full recalc will be performed if the tick was on.*

Continue to 14.7.2 Selecting a line with the mouse or return to 14.7 Survey Data Reduction Editor or 14 Survey.

14.7.1 Terminology

Node

Parent

Child

Continue to 14.7.2 Selecting a line with the mouse or return to 14.7 Survey Data Reduction Editor or 14 Survey.

14.7.2 Selecting a line with the mouse

Single clicking a line with the LMB makes that line the current selection.

When selecting a coordinate, you will see a full view cross.

When selecting a measurement which is a child of a backsight, you will see a line drawn from the measurement coordinate to it's associated station coordinate.

Continue to 14.7.3 Navigating with cursor keys or return to 14.7 Survey Data Reduction Editor or 14 Survey.

14.7.3 Navigating with cursor keys

Navigating is achieved by using the 4 arrow keys, **up**, **down**, **left** and **right**.

The **down** arrow key will move to the next visible line. This means if you have various nodes expanded, the you are navigating the current expanded tree.

The **up** arrow key will move to the previous visible line. This means if you have various nodes expanded, the you are navigating the current expanded tree.

The **right** arrow key does one of two things. When the current line is a node which is not expanded, right arrow expands the node.

When the current node is expanded or does not contain children, right arrow moves down to the next node containing children.

The **left** arrow key does one of two things. When the current line is a node which is expanded, left arrow collapses the node.

When the current node is collapsed or does not contain children, left arrow moves up to the parent.

15 12d Field

See

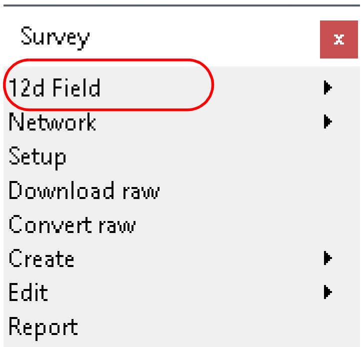
15.1 Overview of 12d Field

15.2 12d Field Menu

15.1 Overview of 12d Field

Position of menu: **Survey =>12d Field=>12d Field**

.



The ***12d Field*** module is designed for surveyors, engineers and others to be able to create and/or work with ***12d Model*** projects out on site and perform real time tasks with those project on site.

12d Field consists of two sub parts:

(a) ***12d Field Pickup*** (***12d Pickup***) for collecting data in the field such as for detailed pickups.

(a) ***12d Field Setout*** (***12d Setout***) for using the ***12d Model*** project for setting out for construction or collecting data for as-exists or as-constructed purposes.

12d Field is an attribute rich system using string, vertex and segment attributes. All relevant information in collecting data or setting out is stored as attributes which means every ***12d Field*** point in a model has the full details of its creation. All references to the original data used to setout are stored as attributes with measured 12d Field points. This means where the user has project specific needs to store extra information with the standard 12d Field attributes various post processing methods such as custom macros can be run to meet the requirements.

To perform these tasks, ***12d Field*** connects to either a **Total Station** (**TPS**), the modern electronic/ robotic theodolite, or to high accuracy **Global Navigation Satellite System** units (**GNSS**). See 15.1.1 TPS Instruments and 15.1.2 GNSS Instruments .

12d Field can also connect to a primary TPS instrument and a secondary GNSS instrument concurrently. This is primarily used in TPS robotic surveying modes.

Notes:

1. **GNSS** instruments are often referred to (sometimes even in this manual and in ***12d Model***) as GPS instruments but GPS is actually the name of the original USA system and modern instruments can use satellites from multiple constellations other than the original GPS system.

That is, modern instruments use many Global Navigation Satellite Systems (GNSS).

2. Prior to ***12d Model 14***, ***12d Field Setout*** and ***12d Field Pickup*** were separate options but from ***12d Model 14*** onwards, the two were unified into the one ***12d Field*** option.

15.1.1 TPS Instruments

Modern Total Stations can measure to either tradition prisms, tape targets or to any surface without a prism.

12d Field connects to multiple manufacturers of Total Stations and provides a comprehensive range of functionality for controlling these units for the vast array of tasks the modern instrument can perform.

For some background information about TPS, see 26.1.1.1 Total Stations - TPS.

Please note that specific details on connections to TPS instruments are outside the scope of this manual and are supplied separately.

See

15.1.1.1 Leica Instruments
15.1.1.2 Trimble Instruments
15.1.1.3 Topcon Instruments
15.1.1.6 TPS Simulator

15.1.1.1 Leica Instruments

Connection to a Leica TPS is completely controlled by ***12d Field***.

12d Field manages the communication and sends/receives commands via the Leica Geocom language.

From version V15C1g ***12d Field*** also has support for the Leica **AP20** smart pole.

15.1.1.2 Trimble Instruments

Connection to a Trimble instrument is done via the Trimble supplied Trimble Precision SDK (TPSDK).

12d Field sends requests to the SDK which manages all communication with the instrument, all aspects of controlling the instrument including reduction of measurement data back to basic angles and distances.

15.1.1.3 Topcon Instruments

For V15 there are now 2 types of Topcon instruments:

15.1.1.4 Topcon Instruments

15.1.1.5 Topcon Generic Instruments

15.1.1.4 Topcon Instruments

Connection to a Topcon TPS instrument is completely controlled by ***12d Field***.

12d Field manages the communication and sends/receives commands via the Topcon AP-L1A language.

15.1.1.5 Topcon Generic Instruments

From V15 a new method of connection is available for Topcon instrumenting negating the need to run the external link program, instruments since ~2016 such as the GT series can use this option.

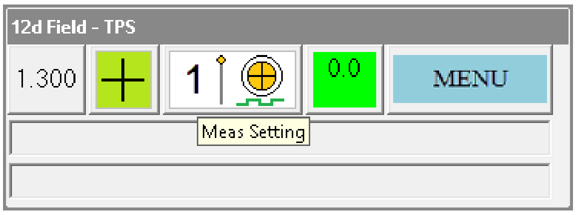
Connection to a Topcon Generic TPS instrument is completely controlled by ***12d Field***.

12d Field manages the communication and sends/receives commands via a proprietary Topcon command language.

15.1.1.6 TPS Simulator

For training and demonstration purposes, a TPS simulator is provided as one of the supported instruments.

Upon selecting the TPS simulator the user is presented with an identical TPS control bar as if they have selected a real instrument.



For details on how to control measurements taken by the TPS simulator please go to 15.4.1.2 12d Field - TPS Settings.

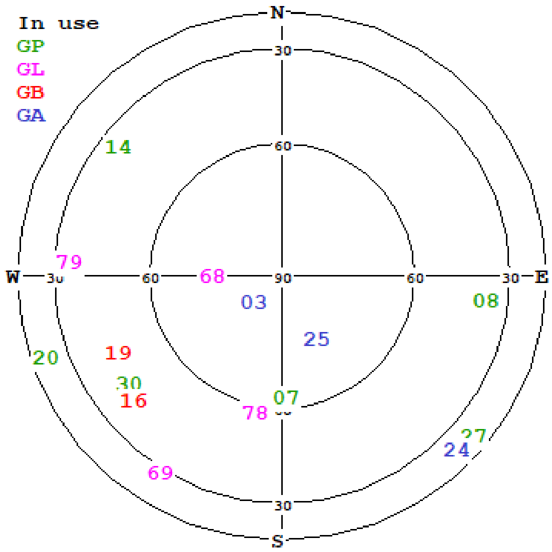
Continue to 15.1.2 GNSS Instruments or go back to 15.1.1 TPS Instruments .

15.1.2 GNSS Instruments

Unlike TPS instruments, ***12d Field*** simply receives and processes industry standard and some propriety NMEA strings from GNSS instruments.

For all instruments it recommended to broadcast **GGA** and **GST** sentences at the highest frequency possible, typically 5 or 10Hz, these sentences have the basic information for position and position quality. Originally these sentences used to be prefixed with **GP**, e.g. **GPGGA** but with multiple constellations now readily available most receivers broadcast the global prefix **GN**, e.g. **GNGGA**, **GNGST**.

It is also recommended to broadcast the **GSA**, **GSV** sentences at a much slower frequency, say 10s. These sentences contain the satellites type and in use information and can be viewed in the **GNSS Status** panel. The following image is from a receiver close to the south side of a building hence the lack of satellites to the north.



See

- 15.1.2.1 Generic GNSS Instrument
- 15.1.2.2 Script File GNSS Instrument
- 15.1.2.3 Bince GNSS Instrument
- 15.1.2.4 CHC GNSS Instrument
- 15.1.2.5 Emlid GNSS Instrument
- 15.1.2.6 Hemisphere GNSS Instrument
- 15.1.2.7 Tersus GNSS Instrument
- 15.1.2.8 Leica GNSS Instrument
- 15.1.2.9 ComNav GNSS Instrument
- 15.1.2.10 GNSS Simulator

15.1.2.1 Generic GNSS Instrument

Prior to V15C1p this was the most common choice of connecting ***12d Field*** to a GNSS instrument. With the advent of tilt pole support in V15C1p this option will only be used for GNSS instruments that ***12d Field*** does not need to do calculations on the received NMEA sentences to determine positions. Examples of this are non tilt pole instruments and GNSS instruments where the tilt corrections are done completely on board and the corrected tip position is broadcast as a standard NMEA string.

Continue to 15.1.2.10 GNSS Simulator or go back to 15.1.2 GNSS Instruments

15.1.2.2 Script File GNSS Instrument

It is expected this is largely a legacy instrument, identical to the **Generic GNSS** instrument except it allows a script to be uploaded to the instrument on starting ***12d Field***.

15.1.2.3 Bince GNSS Instrument

Use this option if using a Bince tilt capable GNSS instrument. In addition to the recommended **GNSS** sentences the Bince instrument must be set to broadcast the **GEINS** sentence at the same rate as the standard **GGA** and **GST** sentences. The pole height and phase centre are set in ***12d Field*** and tilt calculations done by ***12d Field***.

15.1.2.4 CHC GNSS Instrument

Use this option if using a CHC tilt capable GNSS instrument. In addition to the recommended **GNGST** sentence the CHC instrument must be set to broadcast the **GNPOS** and **GNGGA** sentences at the same rate as the standard **GST** sentence. The pole height and phase centre are set in ***12d Field*** and tilt calculations done by ***12d Field***.

15.1.2.5 Emlid GNSS Instrument

Use this option if using a Emlid tilt capable GNSS instrument. In addition to the recommended **GNGST** sentence the Emlid instrument must be set to broadcast the **GNETC** and **GNGGA** sentences at the same rate as the standard **GST** sentence. The pole height and phase centre are set in ***12d Field*** and tilt calculations done by ***12d Field***.

15.1.2.6 Hemisphere GNSS Instrument

Use this option if using a Hemisphere tilt capable GNSS instrument. In addition to the recommended GNSS sentences the Hemisphere instrument must be set to broadcast the **GEINS** sentence at the same rate as the standard **GGA** and **GST** sentences. The pole height and phase centre are set in ***12d Field*** and tilt calculations done by ***12d Field***.

15.1.2.7 Tersus GNSS Instrument

Use this option if using a Tersus tilt capable GNSS instrument. In addition to the recommended **GNGST** sentence the Tersus instrument must be set to broadcast the **tiltdata** and **GNGGA** sentences at the same rate as the standard **GST** sentence. The pole height and phase centre are set in ***12d Field*** and tilt calculations done by ***12d Field***.

15.1.2.8 Leica GNSS Instrument

Use this option to connect to a Leica GNSS instrument via an OWI interface. This option is different to other instruments where ***12d Field*** interprets standard NMEA strings broadcast by the receiver and set via the user via an external interface.

With this option ***12d Field*** does not use the standard NMEA strings broadcast by the receiver and automatically broadcasts the necessary data via the OWI port. The antenna height is set on the receiver via ***12d Field*** and tilt can be turned on or off via ***12d Field***. The tip position and quality data calculated in the receiver are broadcast to ***12d Field***.

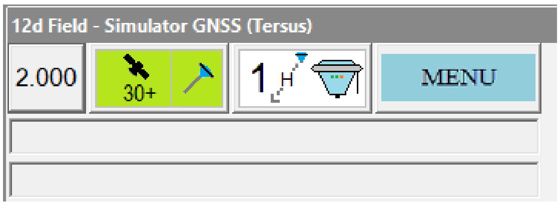
15.1.2.9 ComNav GNSS Instrument

Use this option if using a ComNav tilt capable GNSS instrument. In addition to the recommended GNGST sentence the ComNav instrument must be set to broadcast the GNETC and GNGGA sentences at the same rate as the standard GST sentence. The pole height and phase centre are set in 12d Field and tilt calculations done by ***12d Field***.

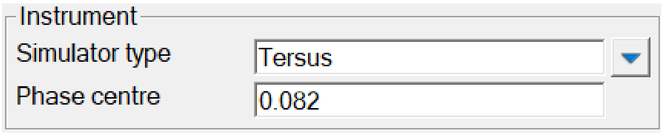
15.1.2.10 GNSS Simulator

For training and demonstration purposes, a GNSS simulator is provided as one of the supported instruments.

Upon selecting the Instrument as **GNSS - Simulator**, the user is presented with an identical GNSS control bar as if they have selected a real GNSS instrument.



Important, when entering ***12d Field*** as a GNSS simulator it is essential to select the **Simulator type** to match the sentences in the replay file used.



Continue to 15.1.3 General Information on 12d Field or go back to 15.1.2 GNSS Instruments .

15.1.3 General Information on 12d Field

See

15.1.3.1 12d Field Attributes

12d Field has approximately 1400 unique attribute names that describe everything from the instrument station setup details to the configuration of, and text used in, panels, and panel field values.

These values are written as vertex attributes on points stored in a model, or to a variety of text configuration files that ensure each ***12d Field*** session starts exactly where it left off in the previous session.

Continue to 15.1.3.2 Panel Field Behaviour or go back to 15.1.3 General Information on 12d Field.

15.1.3.2 Panel Field Behaviour

The behaviour of ***12d Field*** panels and the individual panel fields has changed slightly from V15C1k onwards.

Prior to V15C1k, unlike most ***12d Model*** panels ***12d Field*** boxes, (**12dF Real** boxes for example), did not need a "**Set**" button and were updated as soon as the focus left the box. For example, when selecting another field via the mouse.

When this happened the attribute for the appropriate field was updated. If this attribute could do calculations such as a setout chainage this would happen and if this attribute was present in another panel then the box in the other panel would also be automatically updated.

From V15C1k this is slightly different, the pre V15C1k behaviour is maintained if the user presses **Enter** after entering a value in the box. If **Enter** is not pressed the value is then validated only when the user presses for example the **Meas** button on a setout dialog. All boxes on the panel will then be validated and only if all validate successfully will progress continue.

Continue to 15.1.3.3 Primary Setout Panel and Hot Keys or go back to 15.1.3 General Information on 12d Field.

15.1.3.3 Primary Setout Panel and Hot Keys

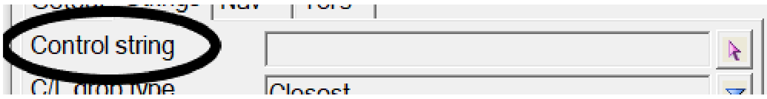
In general ***12d Field*** can have any number of ***Setout*** panels open which all can process measurements and display results but the first panel opened is the ***primary*** panel.

Only the ***primary*** panel will have the **Measurement** buttons active and be able to react to hot key presses. If this panel is closed then the next panel opened will become the primary panel and have its buttons activated.

Continue to 15.1.3.4 Customising Panel Field Descriptions or go back to 15.1.3 General Information on 12d Field.

15.1.3.4 Customising Panel Field Descriptions

All ***12d Field*** panels allow customising of the field descriptions on the panels to match regional naming conventions.



For more details see 15.8.4.10 12dF_USER_TEXT_BOX_INFO.4D file format .

Continue to 15.1.3.5 Top most buttons or go back to 15.1.3 General Information on 12d Field .

15.1.3.5 Top most buttons

Many tablets have no hard keys available but keys such as <ESC>, LMB etc are essential for using ***12d Model**.* So to replace these keys, ***Top Most Buttons*** are available.

For more details see 6.10.19 Toggle Topmost Buttons .

Continue to 15.1.3.6 On screen keyboard or go back to 15.1.3 General Information on 12d Field .

15.1.3.6 On screen keyboard

For use on a tablet ***12d Model**.* provides an internal on-screen keyboard specifically designed to work with ***12d Model***.data fields.

For more details see 6.8.2.8 On-Screen Keyboard Settings .

Continue to 15.1.3.7 Hotkeys and Toolbars or go back to 15.1.3 General Information on 12d Field .

15.1.3.7 Hotkeys and Toolbars

12d Field has its own specialist keyboard shortcuts and 4 user definable hotkey bars.

For more details on the 4 user definable 12dField toolbars see 15.8.5.5 12dF_HOTKEY_BARS.4D file format .

For more details on 12d Field keyboard shortcuts see 15.8.5.3 12dF_USER_KEYS.4D file format .

For more details on how to use user_toolbars.4d with 12d Field see 15.8.5.4 12d Field and User_Toolbars.4d .

Continue to 15.1.3.8 General Font and Icon Scaling for 12d Model or go back to 15.1.3 General Information on 12d Field .

15.1.3.8 General Font and Icon Scaling for 12d Model

When using ***12d Model*** on a tablet it may be desirable to adjust menu, toolbar, view icon scaling and more. For more details refer to the GUI section of 6.10.2 Create/Edit env.4d .

General ***12d Field*** font size can be adjusted on the fly from ***12d Field*** itself. For more details please go to GUI >Gen tab .

Continue to 15.1.3.9 12d Field Panels or go back to 15.1.3 General Information on 12d Field .

15.1.3.9 12d Field Panels

12d Field panels do not use the standard panel layout files of slx or ddx.

For each panel opened inside the working directory, a file 12dF_XXXX_CONFIG.4D will be created when the panel is closed (XXXX being the internal name of the panel).

The ***12d Field*** attributes in the config file are identical for all panels with the values written varying on the needs of the parent panel.

For details of all ***12d Field*** panel configurations please go to 15.8.4 Panel Configuration .

As per slx/ddx style panel layouts, ***12d Field*** can save and restore favourites for all Setout/Pickup panels.

Continue to 15.1.3.10 Logging or go back to 15.1.3 General Information on 12d Field .

15.1.3.10 Logging

12d Field creates two log files while running:

(a) a text file for the user showing important details of the ***12d Model*** session, see 15.7.4.1 User Logging .

(b) (b) a binary file for 12d internal use in analysing problems, see 15.7.4.2 General Logging .

Continue to 15.1.3.11 Attributes or return to 15 12d Field .

15.1.3.11 Attributes

12d Field uses 1000's of unique attributes for its internal configuration and publishing of surveyed results as vertex attributes.

For V15 attribute names underwent a major breaking revision, since it's conception in 2007 the functionality available in ***12d Field*** has vastly expanded, this meant a complete revision of attribute names was necessary for logical groupings and clarity heading into the future.

All ***12d Field*** attribute names are unique, they will appear at the end of an attribute x-path as vertex attributes. For example the measured easting, **12dField/Measurement/pu_mp_x**, but any reference to use this attribute to configure a panel or display information by the user will simply be accessed as **pu_mp_x**.

For full details see 15.7.3 12d Field Attributes .

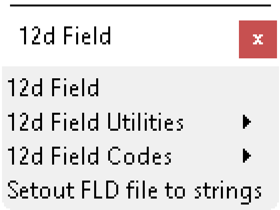
Continue to 15.2 12d Field Menu or return to 15 12d Field .

15.2 12d Field Menu

Position of menu: **Survey =>12d Field**

For an overview of ***12d Field***, see 15.1 Overview of 12d Field .

The **12d Field** walk-right menu is:
.



See
15.3 Starting and Configuring 12d Field
15.9 12d Field Utilities
15.10 12d Field Codes
15.11 12dField Setout FLD File To Strings

15.3 Starting and Configuring 12d Field

Position of menu: **Survey =>12d Field =>12d Field**

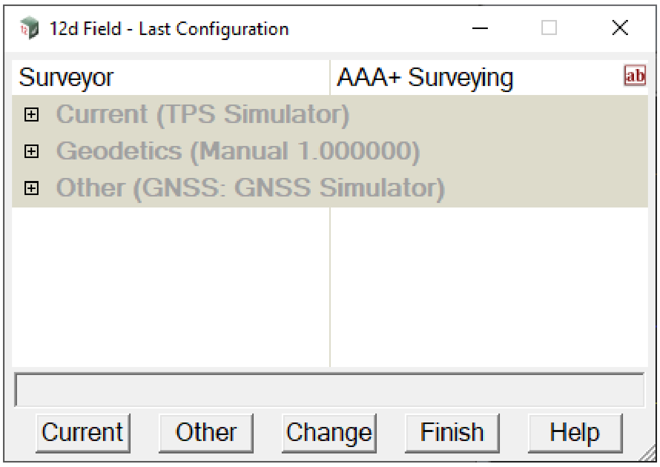
Important

12d Field uses many text files to store its configurations and allow easy customisation.

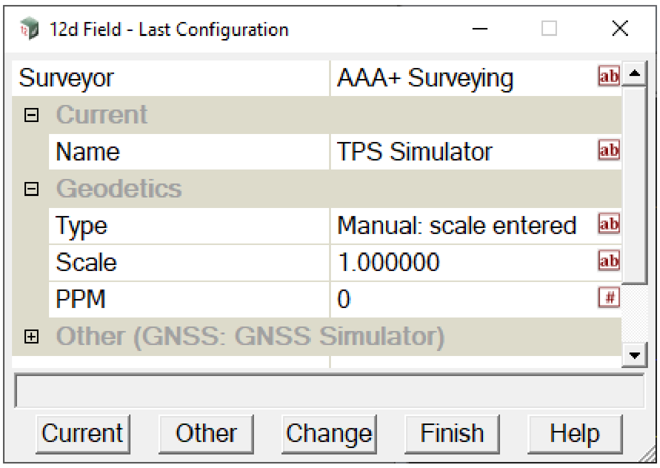
Generally, but not always these files start with the prefix **12dF_** and have the extension**.4D**, by default these files are stored in the **USER** area so that they are common to all projects. Note, from **V15C1r** if the directory **12dF_Current_Settings** is present in the **USER** area these files will be stored here instead of **USER**. A user can then copy individual files in the **CUSTOMER_USER** or **working directory** to allow extra flexibility where needed. Please refer 32.2.5 Searching Order for Setup Files for full details.

When **12d Field** is selected from the **12d Field** menu, the **12d File - Last Configuration** panel is brought up. From V15C1k the last configuration panel is available in a compact format as well as the traditional panel and allows one button switching between TPS and GNSS instruments.

Compact style



Traditional style



and

(a) if ***12d Field*** has been used before then the **12d File - Last Configuration** panel displays the settings for the last configuration used.

or

(b) if ***12d Field*** has **NOT** been used before then the **12d File - Last Configuration** panel displays default configuration settings.

The user can then either click on **Current** to start using ***12d Field*** with the displayed configuration, **Other** to start using ***12d Field*** with either the previously used **TPS** or **GNSS** instrument, **Change** to change the instrument configuration then run ***12d Field*** or click on **Finish** to stop using ***12d Field***.

So in all cases, the **12d File - Last Configuration** panel is the first panel the user sees when starting ***12d Field.*** See 15.3.1 12d Field - Last Configuration

Note

This manual only covers in detail the **TPS** and **GNSS simulators**. For connection details for actual instruments, please refer to the separate ***12d Field*** documents for each instrument type.

Continue to 15.3.1 12d Field - Last Configuration or return to 15 12d Field .

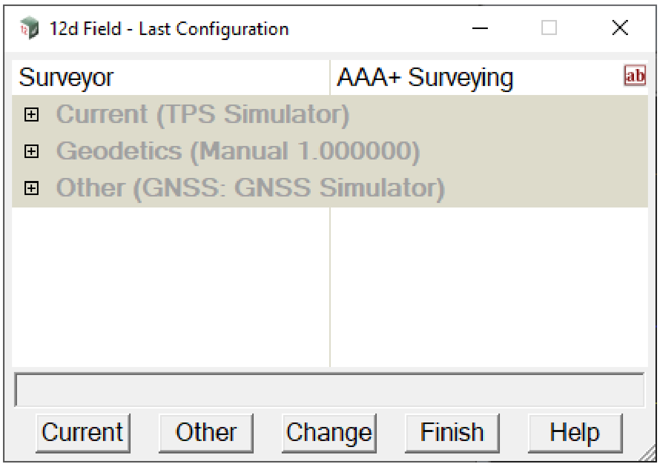
15.3.1 12d Field - Last Configuration

Position of option on menu: **Survey =>12d Field=>12d Field**

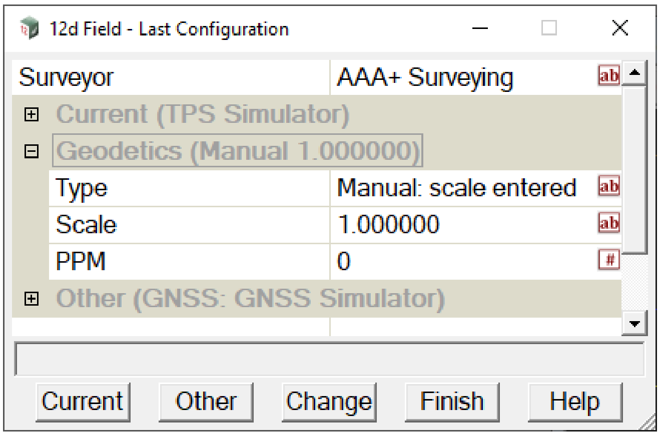
Clicking on the ***12d Field*** options displays the **12d File - Last Configuration** panel.

This panel is displayed if ***12d Field*** is being used for the first time, or had previously been used (see 15.3 Starting and Configuring 12d Field).

The image shown is the compact form of the **Last Configuration** panel, see 15.6.8 General Settings - TPS Panels >Config 1 tab on how to configure the **Last Configuration** panel.



Note full configurations details can be viewed by expanding the appropriate nodes.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

The contents of this panel will vary depending on the instrument type and connection to the instrument.

Buttons at bottom

Current button

*Start **12d Field** using the current instrument and settings.*

Other button

*Start **12d Field** using the other TPS or GNSS instrument and its settings.*

Change button

*Clicking on Change closes this panel and opens the **12d Field Instrument Selection** panel (see 15.3.1.1 12d Field - Instrument Selection).*

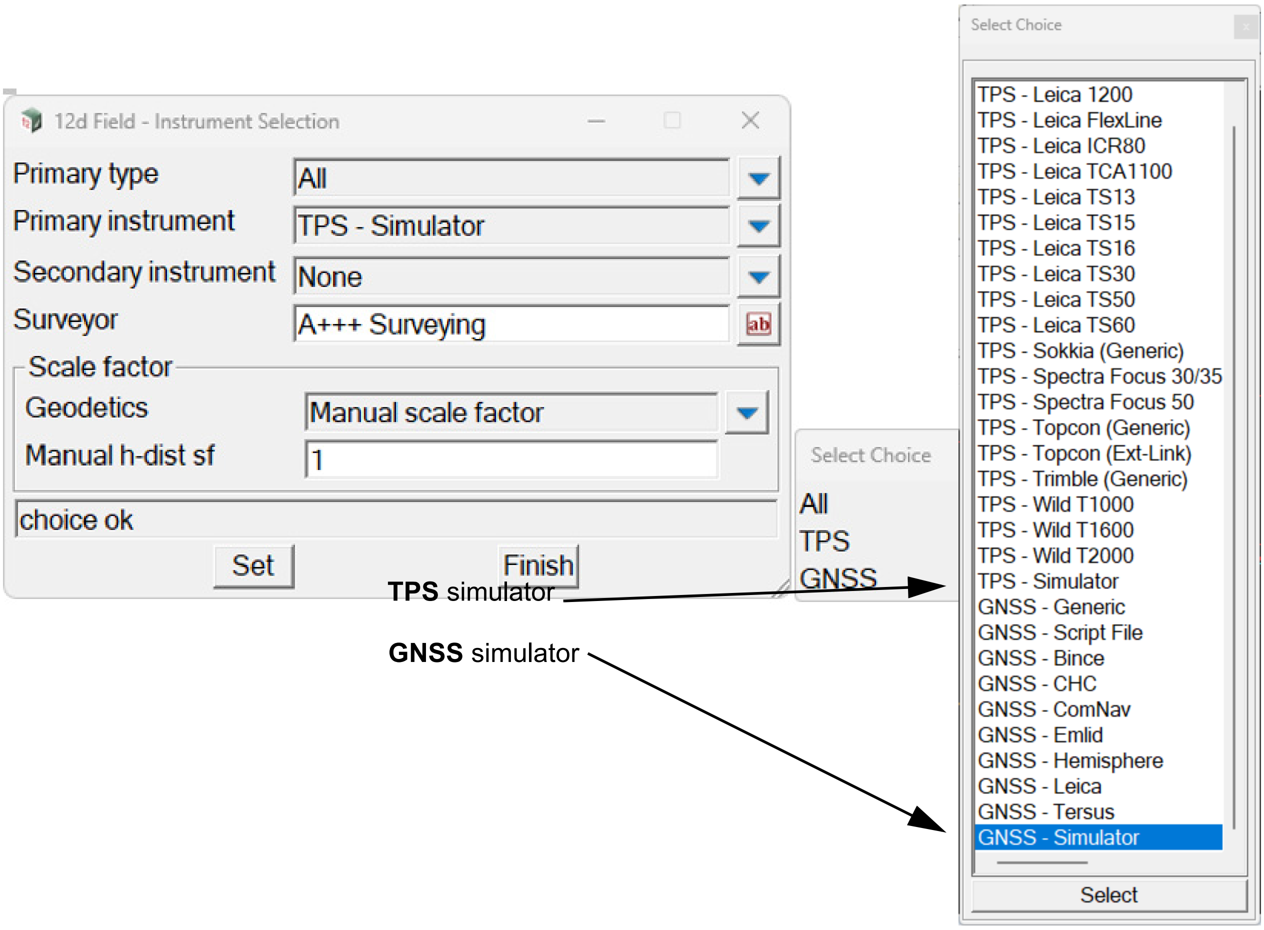
If there are no configuration changes to be made and there are no configuration or connections errors, either the 15.4.1 12d Field TPS Control Bar or the 15.4.2 12d Field GNSS Control Bar is brought up.

Continue to 15.3.1.1 12d Field - Instrument Selection or go back to 15 12d Field .

15.3.1.1 12d Field - Instrument Selection

The **12d Field - Instrument Selection** panel is used to select the type of instrument to connect to and then the connection method for the selected instrument.

This manual only covers in detail the **TPS** and **GNSS simulators**. For connection details for actual instruments, please refer to the separate ***12d Field*** documentation for each instrument type.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Primary type	choice box		All, TPS, GNSS

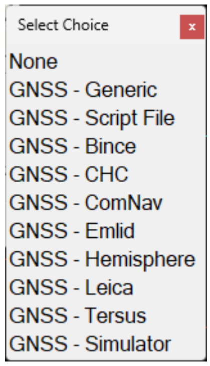
The user can restrict the instruments shown in the Primary instrument choice box to either TPS or GNSS instruments if desired.

Field Description	Type	Defaults	Pop-Up
Primary instrument	choice box		defined instruments

List of possible instruments to connect to.

The list is comprehensive and can be filtered to only the instruments actually used- for more details please see 15.6.2.1 Instruments in use .

Field Description	Type	Defaults	Pop-Up
Secondary instrument	choice box		None, All supported GNSS instruments, GNSS - Simulator



The primary use of the secondary instrument was intended to be when using a TPS in robotic mode with a GNSS equipped tablet that the position of the tablet can be used to guide the TPS to it reestablish lost lock, as such only the first 2 choices are described.

***None**, do not use a secondary instrument.*

***GNSS - Generic**, the instrument connected to, tablet or real GNSS unit will be used as the secondary instrument.*

Surveyor input box

Company/surveyor name to be written to all stored attributes.

Scale factor group

For TPS instruments, comprehensive geodetic adjustments to measured distances are available.

Geodetics choice box Manual scale factor, Point scale factor
Height scale factor, Combined scale factor

Scale factor to use.

*If **Manual scale factor**, a* **Manual h-dist sf** *field is displayed and the appropriate value entered.*
*If **Point scale factor**, a* **Projection** *field is displayed and the appropriate projection selected.*
*If **Height scale factor**, a* **Projection** *field is displayed and the appropriate projection selected.*
*If **Combined scale factor**, a* **Projection** *field and a **N Value** field is displayed and the appropriate projection and N value file are selected.*

For details see Geodetics.

Buttons at bottom

Set button

*If **Instrument** is **TPS - Simulator,** no further panels are necessary and the **12d Field** simulator begins.*
*If **Instrument** is the **GNSS - Simulator,** the **Configure GNSS Simulator** panel is brought up. See* 15.3.1.1.1 Configure GNSS Simulator .
*For all other **Instrument** types, further configuration panels appropriate to the selected instrument are brought up. These are outside the scope of this manual.*

Finish button

*Do not start recording shots and exit **12d Field**.*

Continue to 15.3.1.1.1 Configure GNSS Simulator or go back to 15.3.1 12d Field - Last Configuration .

15.3.1.1.1 Configure GNSS Simulator

When ***GNSS- Simulator*** has been selected as the ***instrument*** two extra panels are needed to configure the instrument:

1. The ***Configure GNSS Simulator (Step 1)*** panel

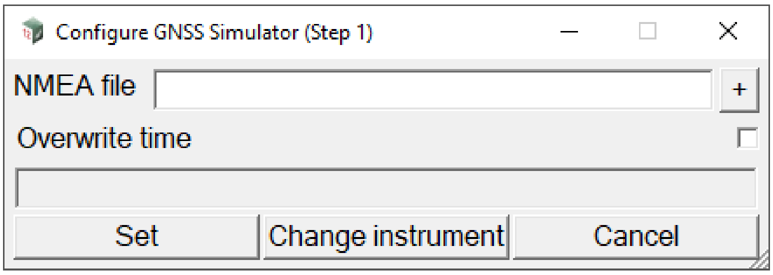
   This panel selects the NMEA file, See 15.3.1.1.1.1 Configure GNSS Simulator (Step 1)

2. The ***Configure GNSS Simulator (Step 2)***

   This panel is for providing information about the GNSS equipment, the projection used and a possible 2D Helmert. See 15.3.1.1.1.2 Configure GNSS Simulator (Step 2)

3. For an actual GNSS Device, there is a third configuration panel. See 15.3.1.1.1.3 Configure GNSS Device (Step 3) Panel .

15.3.1.1.1.1 Configure GNSS Simulator (Step 1)



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
NMEA file	folder		*.nmea

The GNSS simulator needs a NMEA file to run.

*The GNSS file can be a file recorded from an actual instrument or constructed from within 12d **Field** itself by 'driving' along an existing string. For more details see* 15.6.16.4 Create NMEA String .

A default file "Default_LLQ.NMEA" is created automatically for first up usage.

Overwrite time tick box

*If **not ticked**, the time in the NMEA string is used.*

*If **ticked**, the time in the NMEA string is ignored and the current computer time is used instead.*

Buttons at bottom

Set button

After selecting **Set***, the panel* **Configure GNSS Device (Step 2)** *is displayed. See* 15.3.1.1.1.2 Configure GNSS Simulator (Step 2) .

Change instrument button

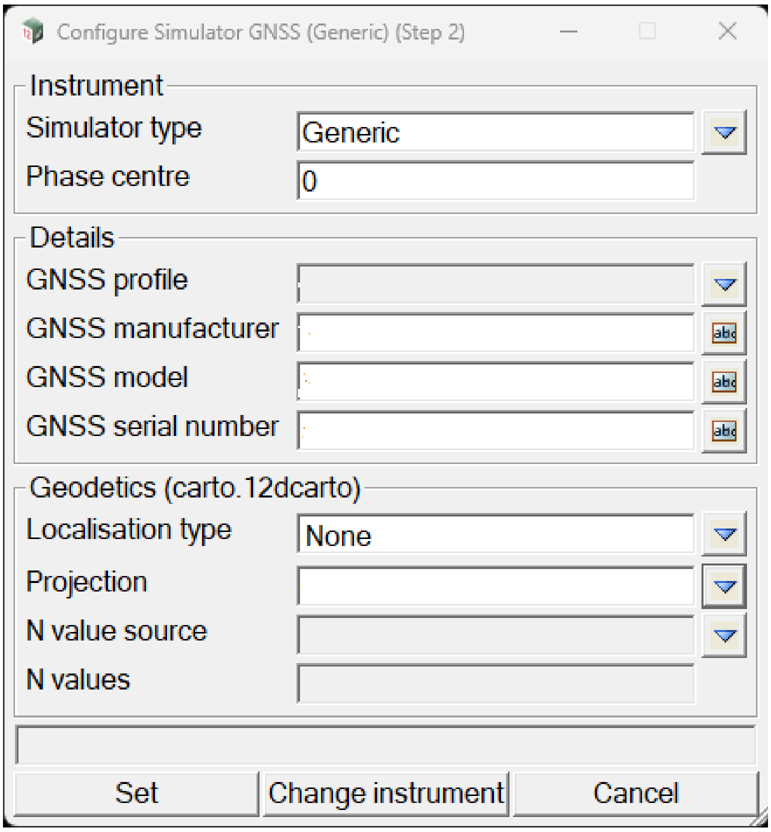
*Return to the **12d Field - Instrument Selection** panel. See* 15.3.1.1 12d Field - Instrument Selection .

Cancel button

*Exit 12d **Field**.*

Continue to 15.3.1.1.1.2 Configure GNSS Simulator (Step 2) or go back to 15.1.3 General Information on 12d Field .

15.3.1.1.1.2 Configure GNSS Simulator (Step 2)



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Instrument			
Simulator type	choice box		Generic, Emlid, Bince, Hemisphere, CHC, Tersus

With the addition of tilt GNSS support in V15C1p it is necessary to select the type of instrument to match the NMEA replay chosen.

Phase centre

A manufacturer supplied offset, typically from the bottom of the antenna mount to the true 'receiving centre' of the unit. Note, from V15C1k the phase centre is only able to be set in this panel. It is still shown in the "Target heights" panel but not editable there.

Details

GNSS Profile choice box

For users transferring between multiple GNSS instruments, the individual details for populating the following fields can be stored in a configuration file, select the GNSS unit to be used.

For more details see GNSS Profiles Configuration, 15.8.3.2 12dF_GPS_PROFILES.4D file format.

GNSS Manufacturer input box

Name of the manufacturer.

GNSS Model input box

Model of the instrument.

GNSS serial number input box

Alphanumeric serial number of the instrument.

Geodetics (carto.12dcarto)

The following section expects the user has n values and projections already defined. Please refer to 15.5.1.2 Quick guide to setting up n-values and projections for 12d Field *if unsure of the requirements in V15 for doing this.*

Localisation type choice box None, Full

***12d Field** allows the user to simply select a projection and n-value source or to use a full localisation. Typically the 1st time on a site the user will select the **None** option and choose the appropriate projection and n-value source. They will then survey control points and then use the GNSS localisation panel to create the full localisation for the site. Subsequently on entering **12d Field** the **Full** option will be selected and the full localisation used, here the projection and n-value are contained in the localisation and are displayed for informational purposes only.*

*If **None**, a **Projection** field and a N **Value source** field are displayed:*

Projection projection box

*Select the projection defined in the **carto.12dcarto** file.*

Note the projection may or may not have a n-value defined. How the projection in the 12dcarto file needs to be configured is dependent on the N value source choice selection.

N value source choice box None, Receiver, 12d

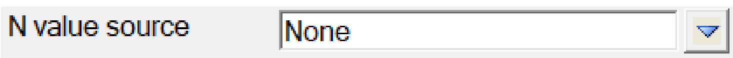
***Very important note**, **12d Field** uses NMEA format strings from the GNSS receiver to establish position and height, a NMEA sentence is meant to contain the orthometric height and geoid separation (n value) and these 2 when added together give the ellipsoid height. The following sentence has a true orthometric height with the receiver's geoid value published.*

*$GPGGA,053348.00,4245.63312634,S,14713.99830715,E,4,36,0.4,**47.715**,M,**-8.221**,M,1.0,0116*7A*

Many GNSS receivers do not honour this standard and often write the ellipsoid height as the orthometric height and the geoid value set to 0.0 rather than left blank as per the following sentence.

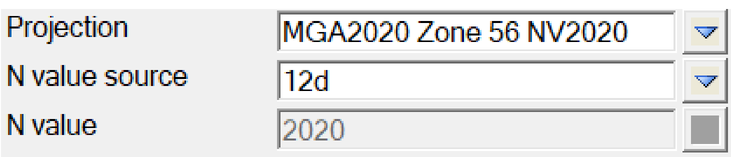
*$GPGGA,041441.00,4245.63312941,S,14713.9983121,E,4,25,0.5,**39.5271**,M,**0.0000**,M,1.0,0116*67*

*The user must choose the **N value source** carefully when using mixed GNSS receivers.*

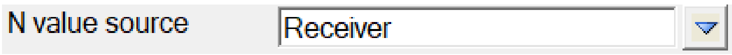


*If **None**, the orthometric height and geoid separation, (n value) fields from the NMEA sentence are added together to form the ellipsoidal height, this mode will rely on the z translate value in the full localisation to produce orthometric heights. This method is suitable for usage where different GNSS receivers write differing NMEA strings or that it is known that the ellipsoidal height will be wrong due to an incorrect base station setup*

*If **12d**, an **N Value** field is displayed:*



*If **12d**, the orthometric height and geoid separation, (n value) fields from the NMEA sentence are added together to form the ellipsoidal height, the n-value stored with the projection in* *__carto.12dcarto__ is then subtracted from the ellipsoidal height to produce the orthometric heights. This method is suitable for usage where different GNSS receivers write differing NMEA strings. Like the __None__ method, in conjunction with using a full localisation it is suitable to use if it is known that the ellipsoidal height will be wrong due to an incorrect base station setup. Here, the localisation z translate will translate the incorrect but n-value adjusted orthometric heights to their true values.*



If __Receiver__, the orthometric height and n value from the NMEA sentence are used for all

calculations.This method honours the orthometric height from the receiver, __do not use this source unless all receivers used write the orthometric heights correctly in the NMEA sentence and have identical n-value calculations.__

If __Full,__ a **Localisation parameters** *field is displayed and the appropriate 2D Helmert parameters selected.*

Localisation parameters folder box *.TDF_HEL files

*Select the *.TDF_HEL file containing the transformation details to apply. This file is created with the* **GNSS Localisation** *panel in the __12d Field__ Toolbar menu.*

Buttons at Bottom

Set button

For the GNSS Simulator, __Set__ start __12d Field__ running and bring up the 1__2d Field GNSS Control bar__ with the instrument type __GNSS - Simulator__. See 15.4.2 12d Field GNSS Control Bar.

For an actual GNSS device, brings up the **Configure GNSS Device (Step 3)** *panel. See* 15.3.1.1.1.3 Configure GNSS Device (Step 3) Panel.

Change instrument button

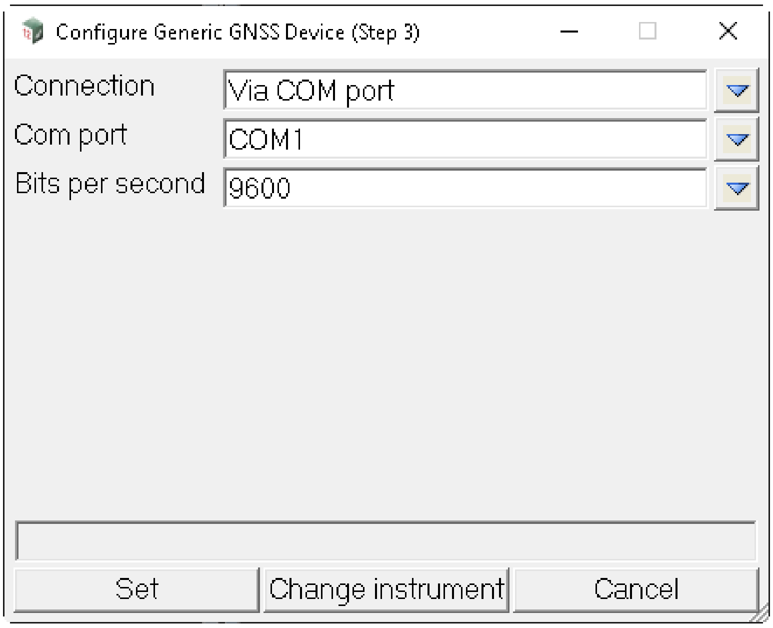
Return to the __12d Field - Instrument Selection__ panel. See 15.3.1.1 12d Field - Instrument Selection

Cancel button

Exit __12d Field__.

Continue to 15.3.1.1.1.3 Configure GNSS Device (Step 3) Panel or return to 15.3.1 12d Field - Last Configuration .

15.3.1.1.1.3 Configure GNSS Device (Step 3) Panel



Field Description	Type	Defaults	Pop-Up
Connection	choice box		Via COM port, Via Network, Via Bluetooth

*If **Via COM Port**, the* **Com port** *and* **Bits per second** *fields are displayed*

Com port choice box

Select the serial communication port to use.

Bits per second choice box

Select the data rate to match the settings on the GNSS unit.

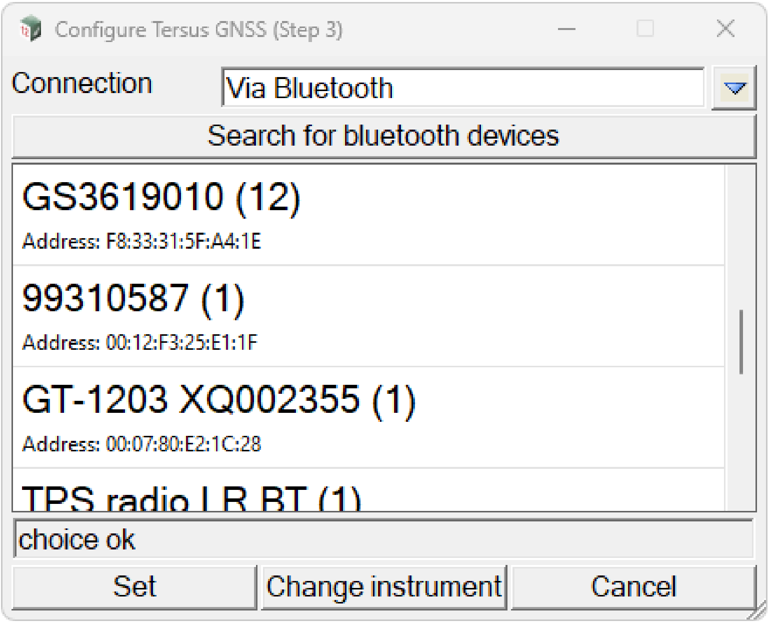
*If **Via Bluetooth COM Port**, the* **Com port** *field is displayed - this is deprecated*

Com port choice box

Select the serial communication port to use.

***Important note:** this is deprecated and is only need for older versions of Windows and will not appear on the menu with newer Windows installations.*

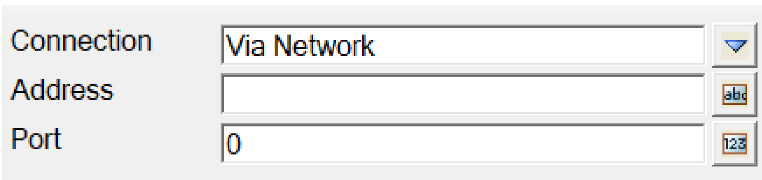
*If **Via Bluetooth**, the **Search for bluetooth device**s button is displayed and a list of previously discovered devices shown.*



If your device is not listed, clicking on the ***Search for bluetooth devices*** *button lists the available bluetooth devices to select from. Existing devices will not be removed from the list if they are not available when the search is done.*

Warning *- in the Windows 11* ***Bluetooth & Devices*** *panel the following must be set to advanced or the computer will likely not detect surveying instruments.*

If ***Via Network*** *the* ***Address*** *and* ***Port*** *fields are displayed. The method of establishing the connection to the instrument is outside the scope of this manual, please refer to the documentation provided by the manufacturer for full details.*



Address input box

Enter the IP address the manufacturer provided by the manufacturer.

Port input box

Enter the port number provided by the manufacturer.

Buttons at Bottom

Set button

Brings up the 12d Field GNSS toolbar. See 15.4.2 12d Field GNSS Control Bar.

Change instrument button

Return to the **12d Field - Instrument Selection panel**. *See* 15.3 Starting and Configuring 12d Field

Cancel button

Exit 12d ***Field***.

Continue to 15.4.1 12d Field TPS Control Bar or return to 15.3.1 12d Field - Last Configuration .

15.4 12d Field Control Bar

For information on ***12d Field*** TPS control bar see 15.4.1 12d Field TPS Control Bar.

For information on ***12d Field*** GNSS control bar see 15.4.2 12d Field GNSS Control Bar.

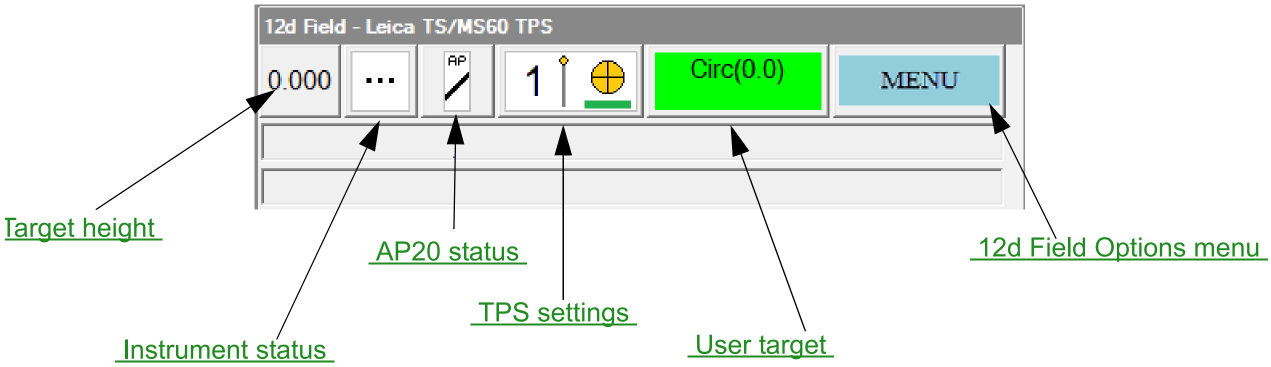
15.4.1 12d Field TPS Control Bar

Once a TPS instrument has been selected and ***12d Field*** has successfully connected to the instrument, the **TPS control bar** will appear.

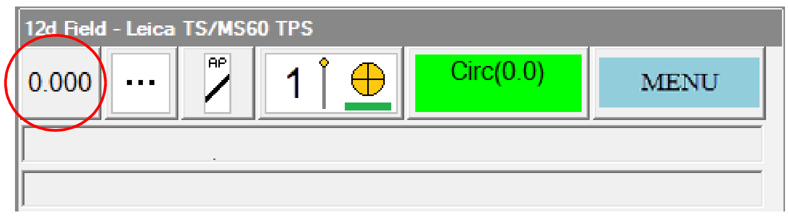
The **TPS control bar** is identical in functionality and layout for all TPS except for Leica instruments using an AP20 auto pole where an extra button is shown displaying the status of the AP20.

The **TPS control bar** has all the options for working with TPS for both ***Pickup*** and ***Setout***.

12d Field TPS Control Bar

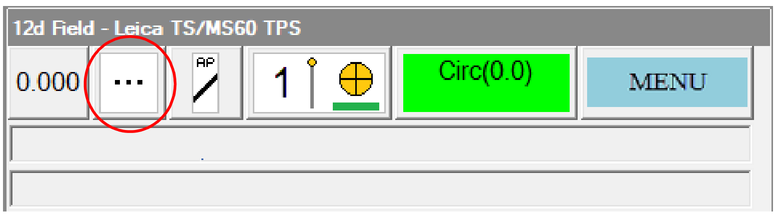


Target height



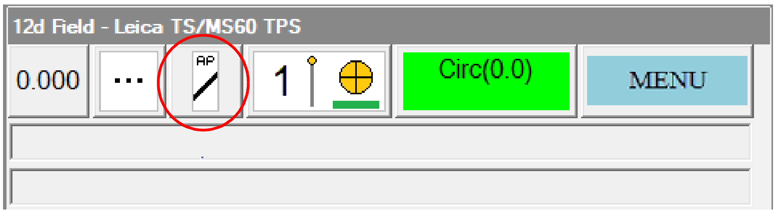
The button displays the current overall target height in use, if the target height is suffixed by an asterisk. For example **1.850*** this indicates the extra target field is being used. Pressing the button brings up the **12d Field - Target Heights** panel. See 15.4.1.1 12d Field - TPS Target Heights for full details on setting and using TPS target heights.

Instrument status



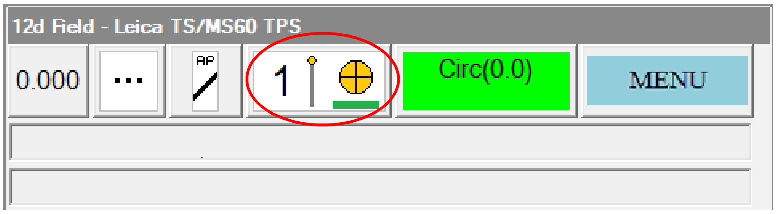
The button displays the current operational status of the TPS instrument. For example whether it is idle, measuring a distance, rotating, locked onto and tracking a prism or lost lock and awaiting search instructions. Pressing the instrument status button does not bring up a panel but dependent on the TPS instrument type and its current status will commence some instrument action such as initiating a target search. For full details see 15.5.2.4 Lock Status Bitmaps .

AP20 status



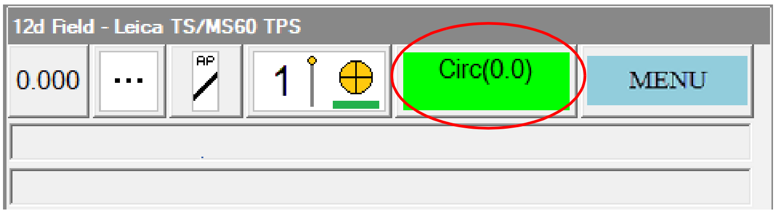
The button displays the current status of the IMU on the AP20 autopole. Pressing the button does nothing. For full details see 15.5.2.6 12dField and the Leica AP20 .

TPS settings



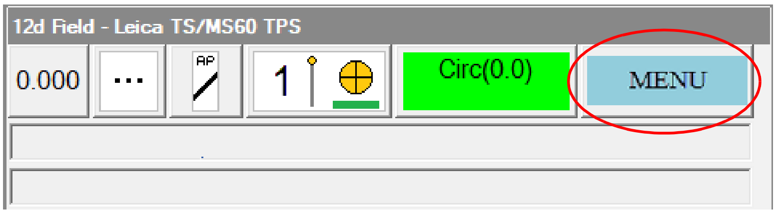
The button displays the combined ***12d Field*** and TPS instrument measurement settings. The left hand side of the icon indicates the ***12d Field*** measurement style, single, continuous, etc, the middle the target pole type if applicable and the right hand side the TPS target acquisition and measurement programs. Pressing the button will bring up the **12d Field - TPS Setting** panel, see 15.4.1.2 12d Field - TPS Settings for full details.

User target



The button displays user definable information indicating what sort of target is currently in use. For full details on configuring targets for use with ***12d Field*** see 115.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format file format. Pressing the button will also bring up the **12d Field - TPS Setting** panel as the target to be used is selected in this panel, see 15.4.1.2 12d Field - TPS Settings .

12d Field Options menu



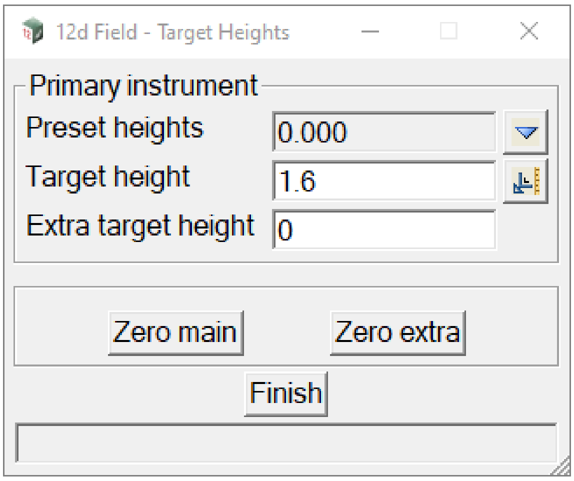
See
15.6.8 General Settings - TPS
15.6.2 Configurations
15.6.3 Station Setup - TPS
15.6.4 Checks - TPS
15.6.5 Setout
15.6.6 Pickup
15.6.10 Store Point Setup
15.6.11 Store Point Names
15.6.7 TPS Functions
15.6.12 Log Comment
15.6.9 Reconnect
15.6.13 12d Field Shutdown

This button brings up the 12d Field Options menu, access to all of the available panels and functionality for the TPS instrument being used. All panels can also be accessed directly via user definable hotkeys and toolbars, see 15.1.3.7 Hotkeys and Toolbars for full details.

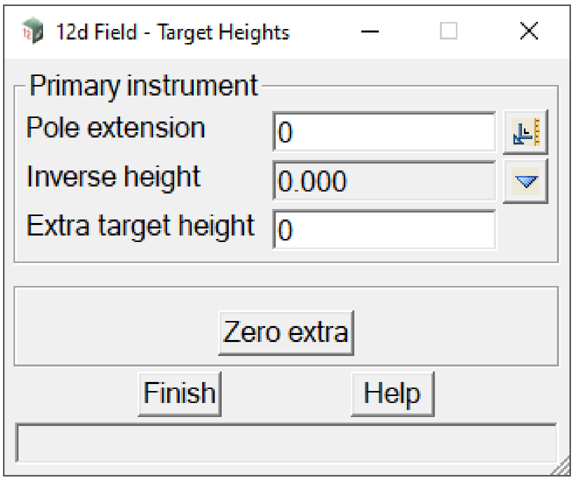
Continue to next section 15.4.1.1 12d Field - TPS Target Heights or return to 15.4 12d Field Control Bar .

15.4.1.1 12d Field - TPS Target Heights

The **12d Field - TPS Target Heights** panel display, and sets, the state of the target heights for the **TPS** instrument.



If a TPS supports automatic pole heights such as the Leica AP20 and the TPS is in an auto-height mode the following panel variation is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Preset heights	choice box		pre-set target heights

List of preset target heights to select from.
When a value is selected it will be copied into the **Target height** *field.*

Target height	real box		

Target height.

Pole extension	real box		

A value to be added to the target height returned by the instrument, this can be used to compensate for tip wear to the pole, (typically a small negative number) or to support pole extensions and the like.

Inverse height choice box

An inverse target height is the height from the prism centre to the top of a pole attached to the top of the prism.

If an auto target height mode is in use the user can select a non zero choice here which will convert the measured position from the tip of the main pole to the top of the prism mounted pole.

*For example, if the user has an autopole set at **1.5**m and selects an inverse height of **0.4**m the control bar will display a target height of **-1.900**.*

*The **pole extension** value is not used when an inverse height is used.*

To set the inverse height see TPS >Inverse Target Heights tab .

Extra target height real box

*The **extra target height** allows the user to increase the **target height** with a measured value, e.g. the depth of a pit. When **non zero** the **extra target height** is added to the **target height** when reducing the TPS measurement. When the **extra target height** is **non zero** the user is presented the target heights panel every measurement.*

Zero main button

When pressed, the **Target height** *is set to zero (0).*

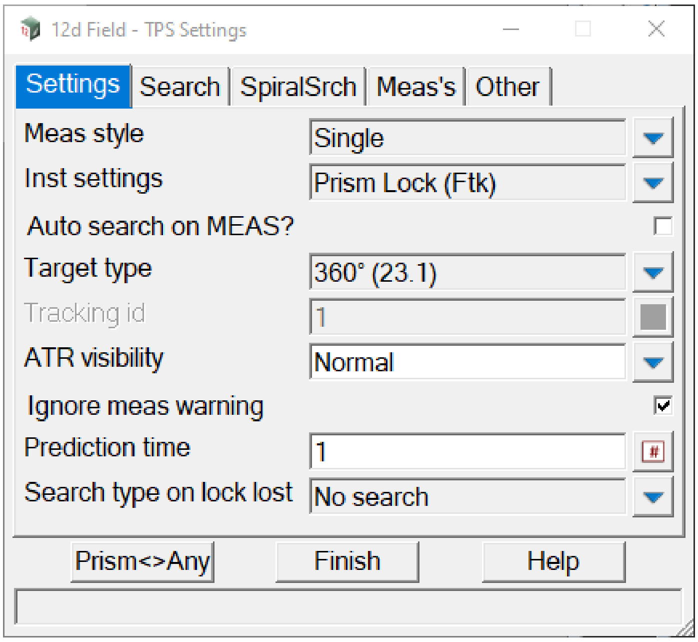
Zero extra button

When pressed, the **Extra tar height** *is set to zero (0).*

Continue to next section 15.4.1.2 12d Field - TPS Settings or return to 15.4 12d Field Control Bar .

15.4.1.2 12d Field - TPS Settings

The **12d Field - TPS** Settings panel defines the internal ***12d Field*** measurement style, the measurement and tracking setting on the TPS instrument itself, the search parameters when the prism is lost in robotic modes and accuracy tolerances to be achieved amongst other minor settings. The panel is different for all TPS instruments.



Settings tab
Search tab
SpiralSrch tab
Meas's tab
Other tab

The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

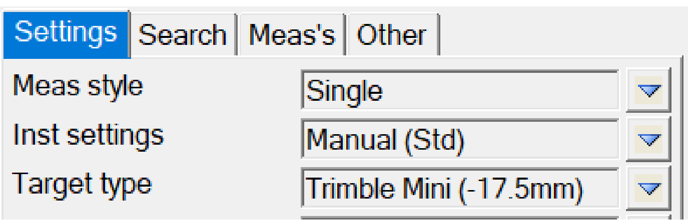
Buttons at Bottom

Prism<>Any   button

Where an instrument can switch between measurement to a target and measurement to any surface this button will switch to the last combination of settings used for either type of measurement.

Settings tab

Setting tab common fields



Settings tab
Search tab
SpiralSrch tab
Meas's tab
Other tab

For the 3 fields described next, the choices available for them vary greatly across TPS manufacturers and their individual TPS models. As such the following descriptions are brief with links to the full details.

Meas style choice box Single Single Meas, Averaging Continuous, Hidden Pt

*Select the **12d Field** measurement style, the selected style will repopulate subsequent choices available in the panel dependent on capabilities of the TPS instrument in use.*

For more information on Meas style see 15.5.1.1 Measurement styles.

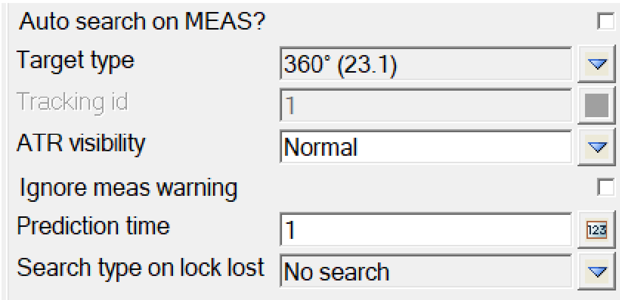
Inst settings choice box choice list is dependent on TPS instrument in use

*The **Inst settings** box presents the user with a list of EDM and motorisation modes available for each TPS, it is populated dependent on the choice in the Meas style box. For information on the choices presented for the TPS instrument in use see* 15.5.2 TPS Instruments Only.

Target type choice box choice list is dependent on TPS instrument in use

*List of targets, (prism, tape or none) available for the current Inst setting, populated 1st from the inbuilt **12d Field** targets list then the user defined targets. For a full description of target and pole types see* 15.5.2.1 Target and Pole Types. *For a full description of defining and customising **12d Field** targets see* 15.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format.

Leica settings extras



Auto search on MEAS? tick box ticked

*If **ticked**, when in a robotic mode and the prism target is not in the field of view a search will be started.*

*If **not ticked**, when in a robotic mode and the prism target is not in the field of view the measurement will fail.*

ATR visibility choice box

For pre Captivate instruments this controls ATR settings on the instrument, refer to the instrument manual for details.

Ignore meas warning tick box not ticked

There are some warnings returned by the instrument, 1283 & 1284 that angular accuracy might be compromised.

*If **ticked**, the measurement will be accepted and processed.*

*If **not ticked**, the measurement is not accepted and fails.*

Prediction time integer box

Enter a value between 0 and 10 which is the number of seconds the instrument will keep turning in the direction it was travelling when lock with the prism was lost.

This is only available for firmware versions of 7 or greater, prior to these it must be set directly on the instrument.

Search type on lock lost choice box

What sort of search the instrument will do when lock has been lost and the prediction time has expired.

This is only available for firmware versions of 7 or greater, prior to these it must be set directly on the instrument.

Important note, these newly available options conflict to some extent with the lock and auto-lock instrument settings available in the current choice lists, it was not possible for V15C1h to resolve these issues in the time frame available. The behaviour of instrument with the ***Dynamic Lock*** *license active is also different to those without and beyond the scope of this manual to explain.*

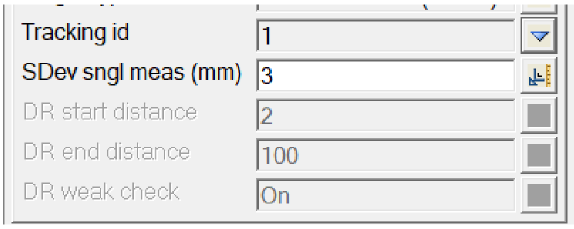
No search *the instrument will do no automatic search, it will wait for the user to send commands to position it and reacquire lock.*

Do ATR search *the instrument will do an ATR search, if this fails to relocate the prism it will then wait for the user to send commands to position it and reacquire lock.*

Do cube search *the instrument will do an cube power search, if this fails to relocate the prism it will then wait for the user to send commands to position it and reacquire lock.*

Wait and lock *the instrument will not search, it will wait for the target to come back into its field of view and then automatically reacquire lock, if this also fails it will then wait for the user to send commands to position it and reacquire lock.*

Trimble settings extras



Tracking id choice box 1 1 to 8

If an active tracking mode is selected select the tracking id of the active target.

SDev sngl meas (mm) real box 3

For standard measurement programs enter the desired standard deviation for the slope distance.

DR start distance

For direct reflex/any surface measurement programs enter the minimum distance that can be measured.

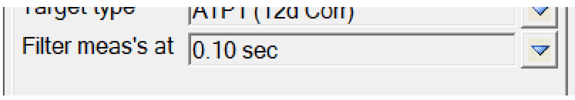
DR end distance

For direct reflex/any surface measurement programs enter the maximum distance that can be measured.

DR weak check choice box On, Off

To accept measurements at a lower accuracy (that is, below the normal instrument specification), disable Weak check.

Topcon generic settings extras



Filter mea's at choice box 0.10 sec 0.01, 0.25, 0.33, 0.5 and 1.0 sec

The Topcon generic instrument transmits measurements at a very high rate, over 10Hz, set the filtering rate here to suit.

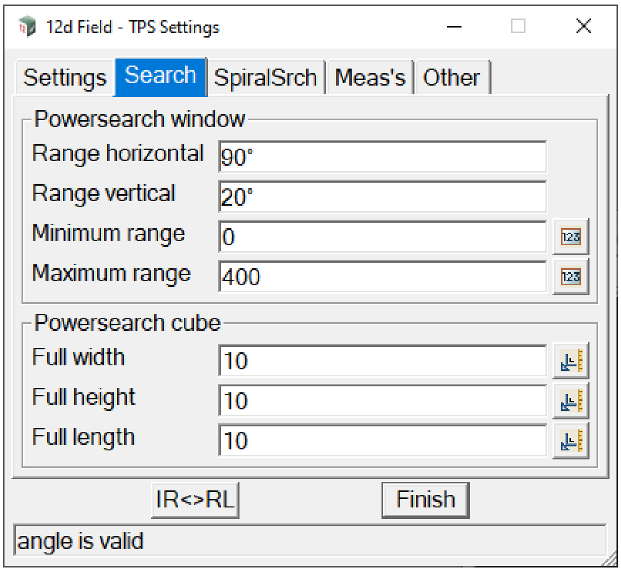
Search tab

For information on Leica search tab see Leica search tab .

For information on Trimble search tab see Trimble search tab .

For information on Topcon, Topcon 9000, Topcon generic search tab see The Topcon, Topcon 9000, Topcon generic search tab .

Leica search tab



Settings tab
Search tab
SpiralSrch tab
Meas's tab
Other tab

Powersearch window

The settings for a window powersearch relative to the current pointing of the instrument when the search is activated.

Range horizontal

The search window will be half of this value left and right of the current pointing.

Range vertical

The search window will be half of this value up and down of the current pointing.

Minimum range

Any target found less than this distance away will be ignored.

Maximum range

Any target found more than this distance away will be ignored.

Powersearch cube

The settings for a cube powersearch relative to the current pointing of the instrument when the search is activated and the last measured distance.

Full width

The search width will be half of this distance left and right of the current pointing.

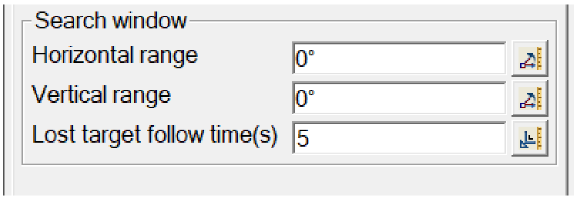
Full height

The search height will be half of this distance up and down of the current pointing.

Full length

The search depth will be half of this distance to and from the last measured distance.

Trimble search tab



Search window

The settings for a window powersearch relative to the current pointing of the instrument when the search is activated.

Horizontal range **angle box**

The search window will be half of this value left and right of the current pointing.

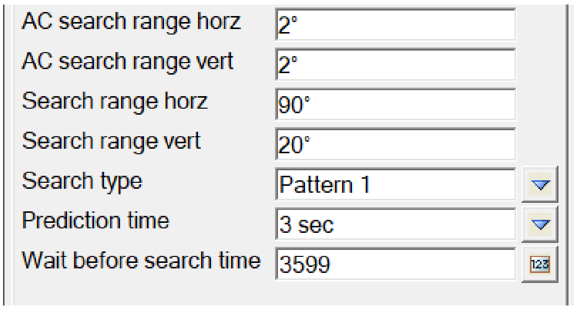
Vertical range **angle box**

The search window will be half of this value up and down of the current pointing.

Lost target follow time(s) **real box**

Time in seconds the instrument will follow the trajectory at the point of time the prism was lost.

The Topcon, Topcon 9000, Topcon generic search tab



AC search range horz

The auto-collimate search window will be half of this value left and right of the current pointing.

AC search range vert

The auto-collimate search window will be half of this value up and down of the current pointing.

Search range horz

The standard search window will be half of this value left and right of the current pointing.

Search range vert

The standard search window will be half of this value up and down of the current pointing.

Search type choice box Pattern 1 Pattern 1, Pattern 2

Select the predefined search pattern on the instrument.

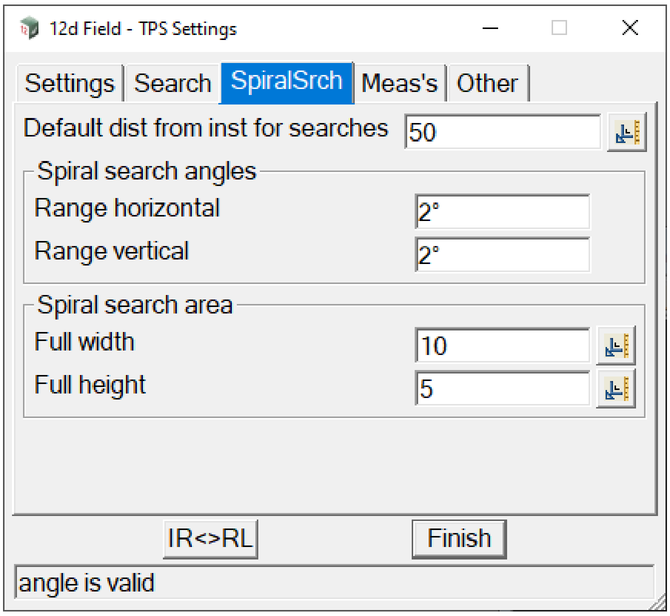
Prediction time choice box 3 sec 0.5, 1, 2, 3, 4, 5 seconds

Time in seconds the instrument will follow the trajectory at the point of time the prism was lost.

Wait before search time

Time in seconds after the prism is lost and the prediction time is finished before the instrument will perform an automatic search for the target. Leave at the maximum value of 3599 to disable this feature.

SpiralSrch tab



Settings tab
Search tab
SpiralSrch tab
Meas's tab
Other tab

Default dist from inst for searches real box 50

When there is no current distance measurement available this value will be used to calculate the angular range of cube searches.

Spiral search angles

Range horizontal

The search window will be half of this value left and right of the current pointing.

Range vertical

The search window will be half of this value up and down of the current pointing.

Spiral search area

Full width

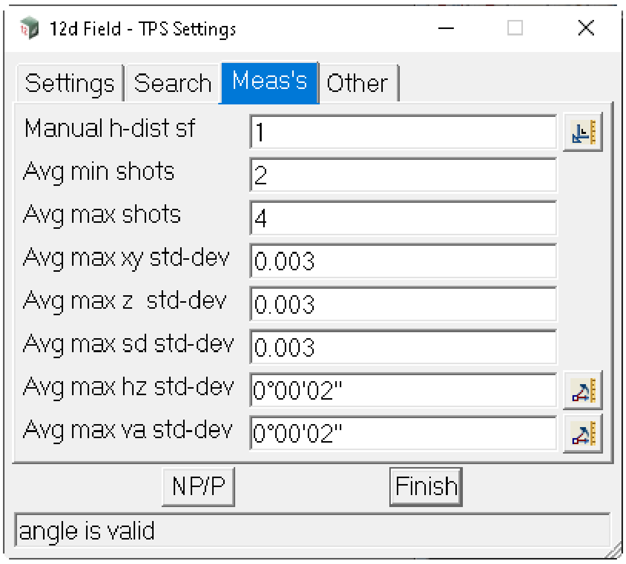
The search width will be half of this distance left and right of the current pointing.

Full height

The search height will be half of this distance up and down of the current pointing.

Meas’s tab

The Meas's tab is common for all instruments.



Settings tab
Search tab
SpiralSrch tab
Meas’s tab
Other tab

Manual h-dist sf real box

When geodetics are set to manually entered scale factor the value can be changed here.

Avg min shots integer box

For multiface type measurements the minimum number of faces to be measured.

Avg max shots integer box

For multiface type measurements the maximum number of faces to be measured, if tolerances have not been met at this point the measurement will fail.

Avg max xy std-dev real box

For multiface type measurements if the minimum faces have been completed and the standard deviation of the xy position is under this value then the measurement can proceed if all other tolerances have been met.

Avg max z std-dev real box

For multiface type measurements if the minimum faces have been completed and the standard deviation of the z/height is under this value then the measurement can proceed if all other tolerances have been met.

Avg max sd std-dev real box

For multiface type measurements if the minimum faces have been completed and the standard deviation of the slope distance is under this value then the measurement can proceed if all other tolerances have been met.

Avg max hz std-dev real box

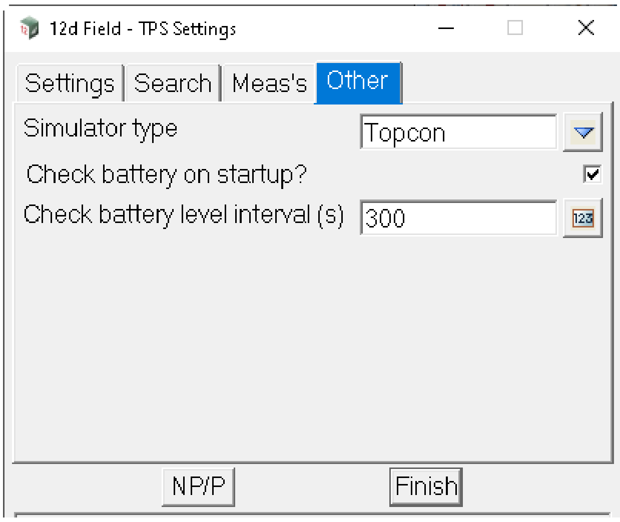
For multiface type measurements if the minimum faces have been completed and the standard deviation of the horizontal angle is under this value then the measurement can proceed if all other tolerances have been met.

Avg max va std-dev real box

For multiface type measurements if the minimum faces have been completed and the standard deviation of the vertical angle is under this value then the measurement can proceed if all other tolerances have been met.

Other tab

Common settings for other tab



[Settings tab](#)
[Search tab](#)
[SpiralSrch tab](#)
[Meas's tab](#)
[Other tab](#)

Simulator type choice box Leica, Trimble
Topcon 9000, Topcon
Topcon generic

Choose which instrument type the simulator will mimic. The simulator will never be fully identical to the real TPS due to subtle variations on what functionality is actually available so generally the simulator will mimic a fully featured instrument.

Check battery on startup? tick box

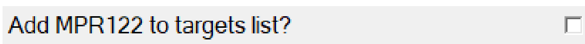
*If **ticked**, a message panel will show the battery level when **12d Field** is started.*

*If **not ticked**, the battery level is not checked when **12d Field** is started.*

Check battery level interval (s) integer box

*Interval in seconds that **12d Field** polls the instrument for the battery level, if the level is different to the last level defined in 12dF_Battery_Levels.4D a message panel will show the new level.*

Leica other tab extras



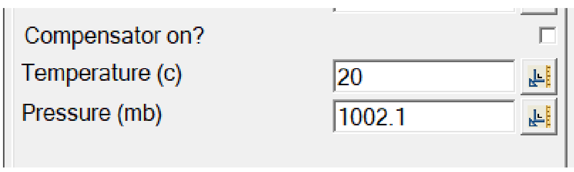
Add MPR122 to targets list? tick box ticked

***12d Field** cannot detect whether some Leica instruments support a MPR122 prism or not. If it is chosen as a target on an instrument that does not support it the user will receive messages about target mismatches.*

*If **ticked**, the MPR122 will be added to the target choice list.*

*If **not ticked** the MPR122 will not be added to the target choice list.*

Trimble other tab extras



Compensator on?	tick box	not ticked

*If **ticked**, the instruments compensator is enabled.*

*If **not ticked**, the instruments compensator is disabled, this should only ever be unticked when absolutely necessary.*

Temperature (c)	real box

Temperature in Celsius to be used for measurement calculations.

Pressure (mb)	real box

Pressure in millibars to be used for measurement calculations.

Continue to 15.4.2 12d Field GNSS Control Bar or return to 15.4 12d Field Control Bar .

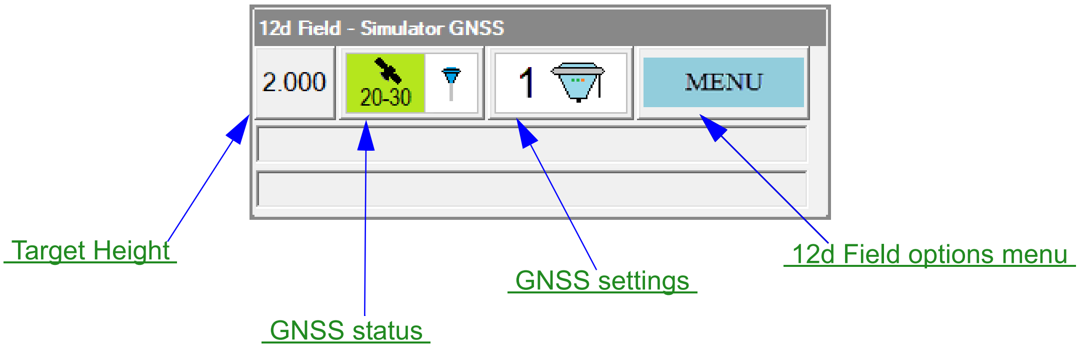
15.4.2 12d Field GNSS Control Bar

Once a GNSS instrument has been selected and ***12d Field*** has successfully connected to the instrument, the **GNSS control bar** will appear.

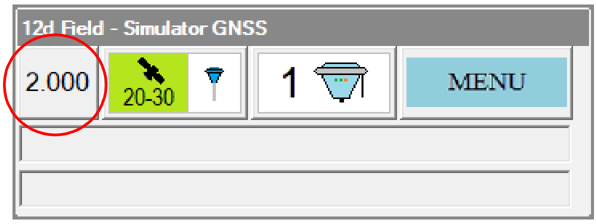
The **GNSS control bar** is identical in functionality and layout for all GNSS instruments but individual icons may vary from instrument type to instrument type.

The **GNSS control bar** has all the options for working with GNSS for both ***Pickup*** and ***Setout***.

12d Field GNSS Toolbar

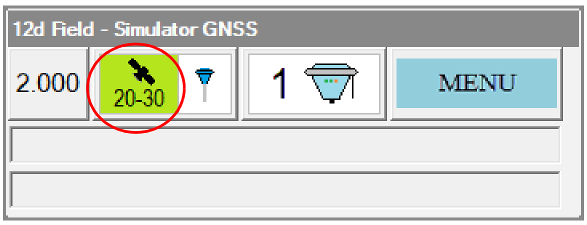


Target Height



The button displays the current overall target height in use, if the target height is suffixed by an asterisk. For example **1.850*** this indicates the extra target field is being used. Pressing the button brings up the **12d Field - Target Heights** panel. See 15.4.2.1 12d Field - GNSS Target Heights for full details on setting and using GNSS target heights.

GNSS status



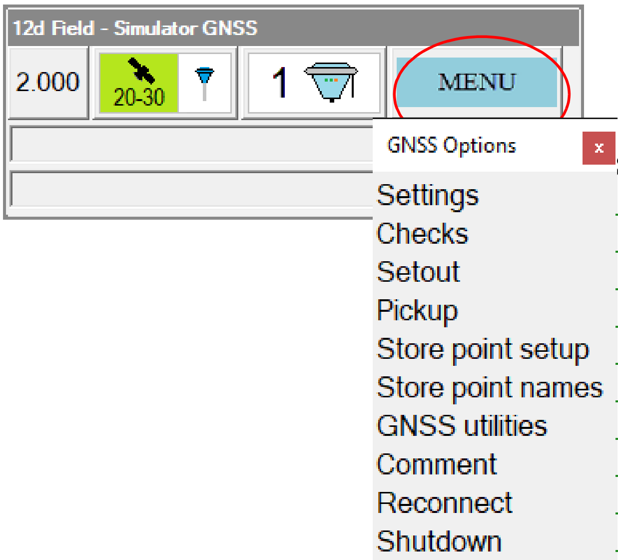
The button displays an indication of the status of the GNSS instrument, this comprises the satellite and tilt pole status for tilt capable receivers. For example, here the left side of the button is indicating the RTK status of the receiver is considered good via the green colouring and that there are 20 to 30 satellites being used to calculate the position. The right side of the button is white with a vertical pole which indicates the instrument is not in tilt mode.

For full information on interpreting the GNSS status see 15.5.3.1 GNSS Status Button Bitmaps. Pressing the button brings up the **12d Field - GNSS Status** panel, see 15.4.2.2 12d Field - GNSS Status.

GNSS settings

The button displays the combined ***12d Field*** and GNSS instrument measurement settings. The left hand side of the icon indicates the ***12d Field*** measurement style, single, continuous, etc, the right hand side currently simply displays an image depicting a GNSS receiver, this could change for future versions if more sophisticated information is available from various receivers. Pressing the button will bring up the **12d Field - GNSS Setting** panel, see 15.4.2.3 12d Field - GNSS Setting for full details.

12d Field options menu



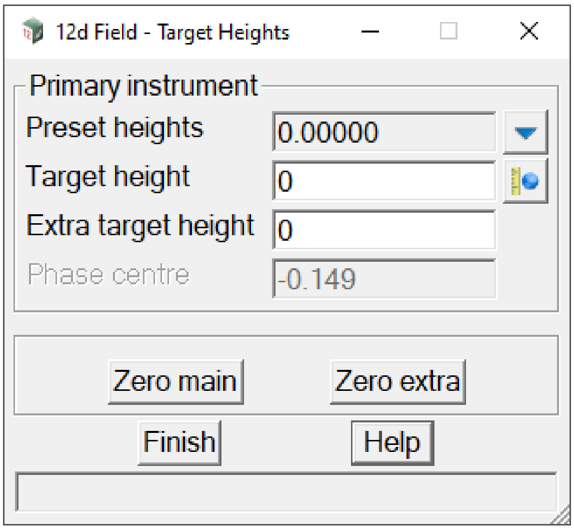
See
15.6.14 General Settings - GNSS
15.6.15 Checks - GNSS
15.6.5 Setout
15.6.6 Pickup
15.6.10 Store Point Setup
15.6.11 Store Point Names
15.6.16 GNSS Utilities
15.6.12 Log Comment
15.6.9 Reconnect
15.6.13 12d Field Shutdown

This button brings up the 12d Field Options menu, access to all of the available panels and functionality for the GNSS instrument being used. All panels can also be accessed directly via user definable hotkeys and toolbars, see 15.1.3.7 Hotkeys and Toolbars for full details.

Continue to 15.4.2.1 12d Field - GNSS Target Heights or return to 15.4 12d Field Control Bar .

15.4.2.1 12d Field - GNSS Target Heights

The **12d Field - GNSS Target Heights** panel display, and sets, the state of the target heights for the **GNSS** instrument.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Preset heights	choice box		preset heights

List of preset target heights to select from.
When a value is selected it will be copied into the **Target height f***ield.*

Target height real box

For GNSS instruments the target height and phase centre added to form the full target height. It is the users preference on how to use the combination of these 2.

Extra tar height real box

The ***extra target height*** *allows the user to increase the* ***target height*** *with a measured value, e.g. the depth of a pit. When* ***non zero*** *the* ***extra target height*** *is added to the* ***target height*** *and* ***phase centre*** *when reducing the GNSS measurement. When the* ***extra target height*** *is* ***non zero*** *the user is presented the target heights panel every measurement.*

Phase centre

A manufacturer supplied offset, typically from the bottom of the antenna mount to the true 'receiving centre' of the unit. This value is set when initially configuring the GNSS receiver and is not editable in this panel.

Zero main button

When pressed, the **Target height** *is set to zero (0).*

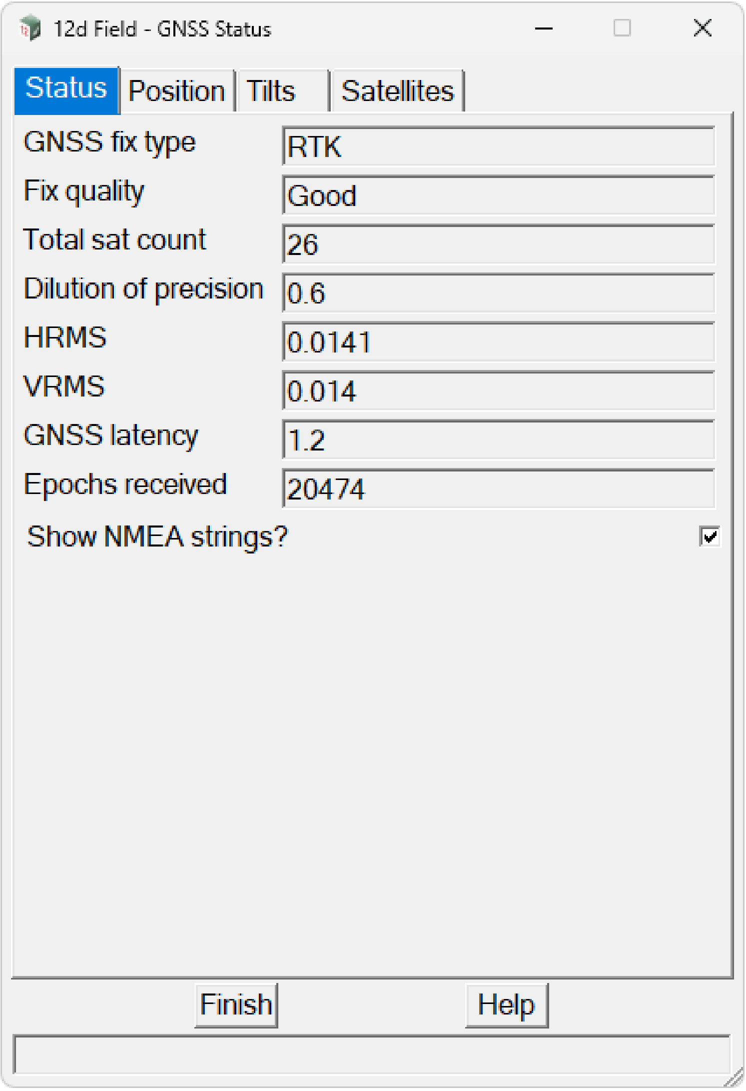
Zero extra button

When pressed, the **Extra tar height** *is set to zero (0).*

Continue to 15.4.2.2 12d Field - GNSS Status or return to 15.4 12d Field Control Bar .

15.4.2.2 12d Field - GNSS Status

The **12d Field - GNSS Status** panel provides information about the current state of the **GNSS** instrument such as fix quality and number of satellites used.



Status tab
Position tab
Tilts tab
Satellites tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Status tab

Note, prior to V15C1p this tab used to display the traditional GPS and Glonass information. With the advent of new constellations, especially BeiDou, most receivers now broadcast the global talker id, ***GN****, this panel has been updated to reflect that.*

GNSS fix type text box

Current fix type of the GNSS satellites, e.g RTK.

Fix quality text box

Quality of the GNSS, Good, Average, Poor no RTK.

Tot sat count integer box

Number of GNSS satellites (GPS, BeiDou, Glonass etc).

Dilution of precision real box

Current dilution of precision.

Coordinate quality real box

Leica specific coordinate quality.

HRMS real box

Horizontal Root Mean Square value.

VRMS real box

Vertical Root Mean Square value.

GNSS latency real box

Latency of the measurements from all the GNSS satellite constellations.

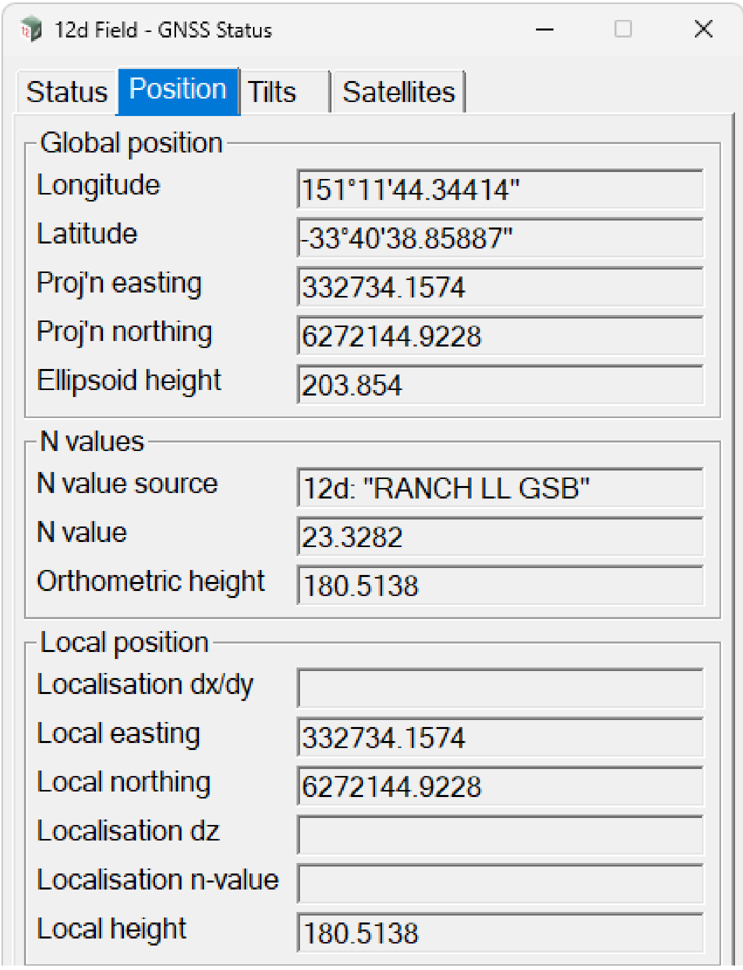
Received sentences integer box

*Number of NMEA sentence bundles received in the current **12d Field** session.*

Show NMEA strings tick box

*If **ticked**, the received NMEA sentence bundles are written to the output window.*
*If **not ticked,** the received NMEA sentence bundles are not shown.*

Position tab



Status tab
Position tab
Tilts tab
Satellites tab

Global position

Longitude angle box

Longitude of the running measurement.

Latitude angle box

Latitude of the running measurement.

Proj'n easting real box

Current easting of the GNSS.

Proj'n northing real box

Current northing of the GNSS.

Ellipsoid height real box

Current ellipsoid height of the GNSS.

N values

N value source text box

Source of the N values - Receiver or 12d.

N value real box

Current N value.

Orthometric height real box

Current orthometric height of the GNSS.

Local position

Localisation dx/dy real box

Adjustment applied to the raw GNSS coordinate to bring it into the local system.

Local easting real box

Local easting of the running measurement.

Local northing real box

Local northing of the running measurement.

Localisation dz real box

Height adjustment applied to the raw GNSS height to bring it into the local system.

Localisation n-value real box

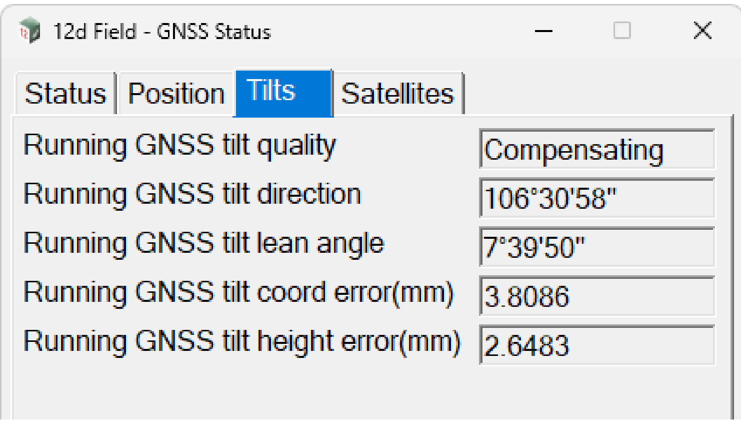
Current n-value

Local height real box

Local height of the running measurement.

Tilts tab

The ***Tilt*** *tab shows the status of GNSS tilt poles when active. All of the units vary greatly in how they transmit the tilt data to* ***12d Field****, especially their errors messages so the documentation here is minimal as this is still work in progress, especially with regular firmware upgrades with many of the instruments happening.*



Status tab
Position tab
Tilts tab
Satellites tab

Running GNSS tilt quality input box

If the tilt quality is ***good*** *this box will display* ***Compensating****.*

If the tilt quality is ***not good*** *then dependent on the manufacturer/firmware provider the appropriate error/ warning message will be displayed.*

Running GNSS tilt direction angle box

The direction/bearing of the tilt of the pole.

Running GNSS tilt lean angle angle box

The angle of tilt from vertical of the pole.

Running GNSS tilt coord error (mm) real box

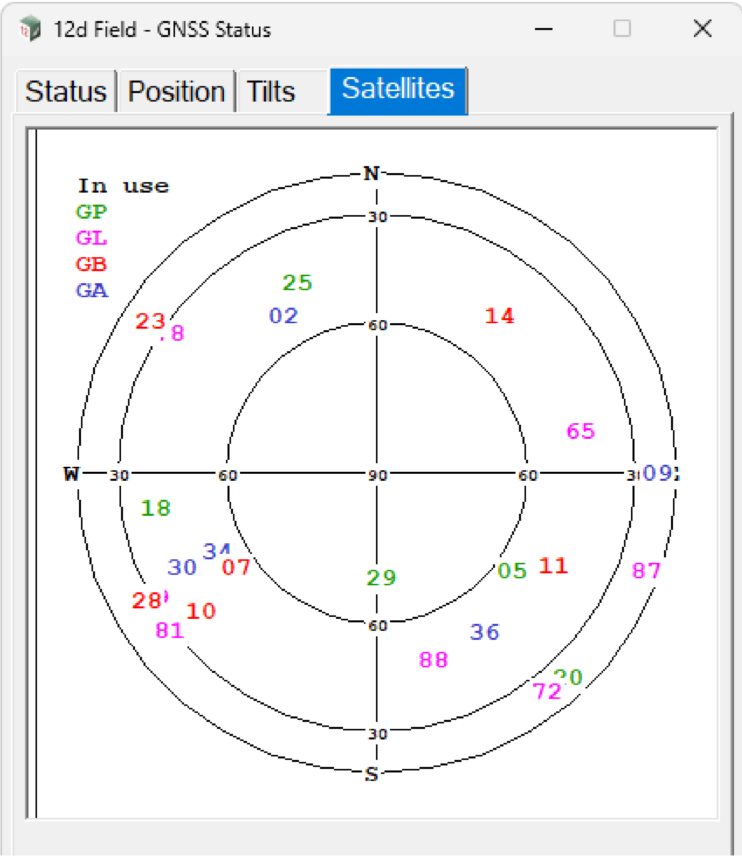
An estimate of the xy error at the corrected pole tip position.

Running GNSS tilt height error (mm) real box

An estimate of the z error at the corrected pole tip position.

Satellites tab

*If the user is broadcasting the **GSA** and **GSV** NMEA sentences then the **Satellites** tab will be shown and dependent on the sentence contents the satellites "In use" or "In view" shown in this simple diagram.*

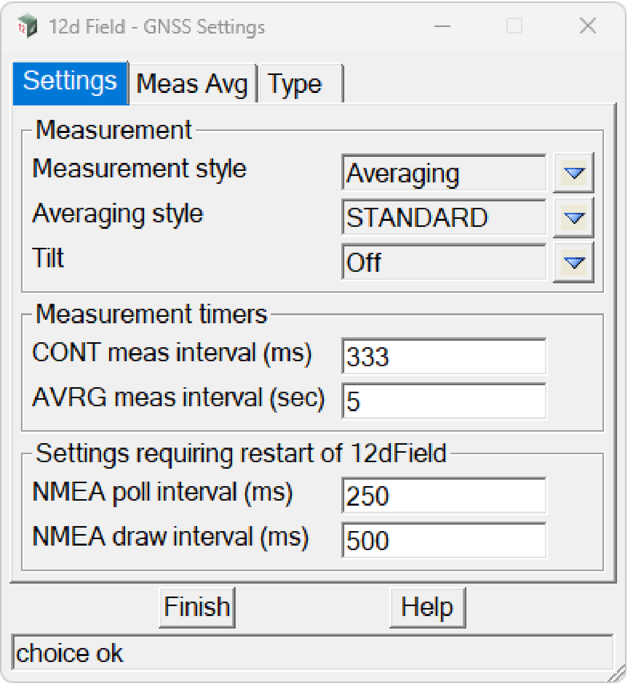


Status tab
Position tab
Tilts tab
Satellites tab

Continue to 15.4.2.3 12d Field - GNSS Setting or return to 15.4 12d Field Control Bar .

15.4.2.3 12d Field - GNSS Setting

The **12d Field - GNSS Settings** panel defines the settings to control the collection of **GNSS** shots.



Settings tab
Meas Avg tab
Type tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Settings tab

Measurement

Measurement style	choice box		Single Meas, Averaging, Continuous, Hidden Pt

For information on GNSS Measurements see 15.5.1.1 Measurement styles

Averaging style	choice box		

When the measurement style is set to averaging select the averaging style you wish to use here.

Averaging styles are defined in 15.8.3.1 12dF_GPS_MEAS_AVERAGE_SETTINGS.4D .

Tilt	choice box		On, Off

If the instrument is tilt capable this choice box will be active allowing the user to toggle tilt usage on and off. If the instrument is not tilt capable the box is not active and set to ***Off***.

On*, start using tilt corrections, 12d will display a single warning box if the NMEA sentences being broadcast are not the necessary sentences needed to do the tilt calculations.*

Off*,* ***12d Field*** *will accept the phase centre reading for the GNSS as is ignoring all tilt sentences being broadcast.*

Measurement timers

CONT meas interval (ms)	integer box		

Interval when in continuous measurement style 12dField looks to process downloaded NMEA sentence bundles, the NMEA poll interval should be set to faster than this.

AVRG meas interval (sec integer box

When in the averaging measurement mode the time interval in seconds before processing the next NMEA sentence bundle.

Setting requiring restart of 12dField

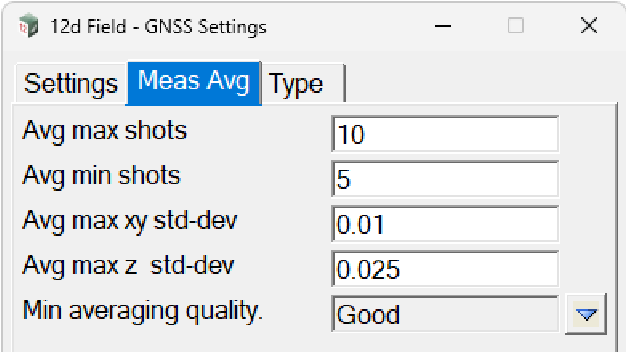
NMEA poll interval (ms) integer box

Interval 12d Field polls the communications port for NMEA sentence bundles, set this time faster than the equivalent time on the GNSS receiver.

NMEA draw interval (ms) interval box

Interval the current GNSS position is drawn on the 12dField views.

Meas Avg tab



Settings tab
Meas Avg tab
Type tab

Avg max shots integer box

When averaging the maximum number of readings to be taken, if tolerances have not been met at this point the measurement will fail.

Avg min shots integer box

When averaging the minimum number of readings to be taken.

Avg max xy std-dev real box

For averaging type measurements if the minimum number of readings have been completed and the standard deviation of the xy position is under this value then the measurement can proceed if the z tolerance has been met as well.

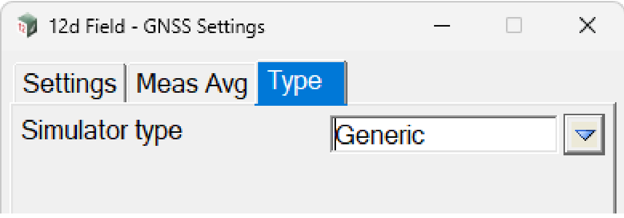
Avg min xy std-dev real box

For averaging type measurements if the minimum number of readings have been completed and the standard deviation of the z/height is under this value then the measurement can proceed if the xy tolerance has been met as well.

Min averaging quality choice box Good Quality, Average Quality, Poor Quality, No RTK

Minimum quality level allowable for GPS averaging, levels less than this quality will be ignored.

Type tab



Settings tab
Meas Avg tab
Type tab

Simulator type	choice box	available GNSS instrument types

Although the simulator type can be changed here it is recommended this is done when starting up ***12d Field****. Some things might not work as expected if the type is changed here after the initial startup process.*

Continue to 15.5 12d Field Instruments in Detail or return to 15.4 12d Field Control Bar .

15.5 12d Field Instruments in Detail

See 15.5.1 TPS and GNSS Instruments Common
See 15.5.2 TPS Instruments Only
See 15.5.3 GNSS Instruments Only

15.5.1 TPS and GNSS Instruments Common

15.5.1.1 Measurement styles

12d Field has a large range of measurement options, especially with TPS instruments.

It is important that the user carefully reads what each mode does, and is clear with the terminology, and understands which of the modes best suits the task they are performing.

All the modes are there because they have been needed for users to undertake various jobs - they are not there because ***12d Solutions*** has a perverse sense of humour.

12d Field TPS Measurement Styles available with TPS and GNSS instruments

Important note - these modes are how the ***12d Field*** panel asks for and processes data from the instrument, not about settings/modes on the instrument itself hence identical for all instrument makes.

Single (TPS/GNSS)

The instrument takes a single measurement and the panel processes the measurement and updates results.

Single Remote (Leica TPS Only)

Leica only, the same as single except that the measurement is started from the TPS keyboard rather than the tablet.

Multiface (TPS)

The instrument takes multiple measurements on different faces until a minimum number of readings and a defined accuracy is met, the panel then processes the combined measurement and updates results.

Averaging (GNSS)

The instrument takes multiple measurements until a minimum number of readings and a defined accuracy is met, the panel then processes the combined measurement and updates results.

Continuous (TPS/GNSS)

The instrument takes a single measurement and the panel processes the measurement and updates results, the process is then repeated, hence, the panel data is continuously updated until the user presses stop. The instrument in this mode will typically be set to a fast measurement program and be in a prism tracking mode.

Hidden Pt (TPS/GNSS)

The user enters 2 offsets from a hidden point, the instrument takes a measurement at each of these points and the panel processes the measurement and updates results. This mode can handle either horizontally or vertically hidden points.

Continue to 15.5.1.2 Quick guide to setting up n-values and projections for 12d Field or go back to 15.5.1 TPS and GNSS Instruments Common .

15.5.1.2 Quick guide to setting up n-values and projections for 12d Field

The following documentation is not comprehensive. It will run through what is necessary to use an n value with projection inside ***12d Field***, as such it will document the most common combination typical used, a **GSB** file used with an **MGA** projection.

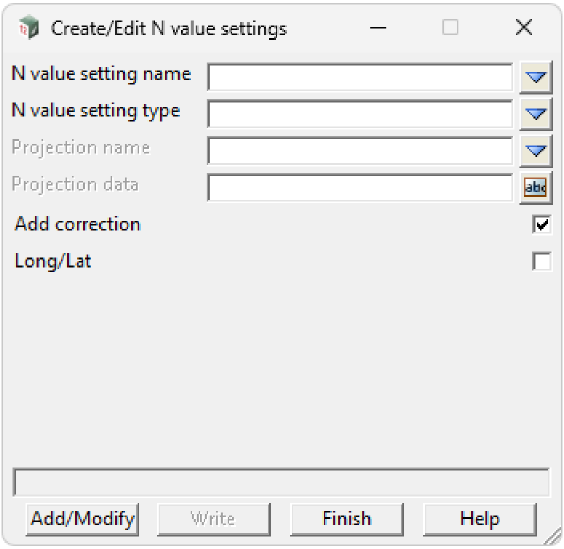
See 15.5.1.2.1 Setting up an n value for 12d Field

See 15.5.1.2.2 Setting up a projection for 12d Field

See 15.5.1.2.3 Selecting the n value in 12d Field

15.5.1.2.1 Setting up an n value for 12d Field

Open **Project-> Management-> N values-> Create/Edit**



N value setting name, in this box type is the name you want use for the n value.

N value setting type, for this exercise we will select **GSB.**

Projection name, ***please note, this is not optional for use with 12d Field.*** Select the projection to use, in this case we will use **MGA2020 Zone 56.**

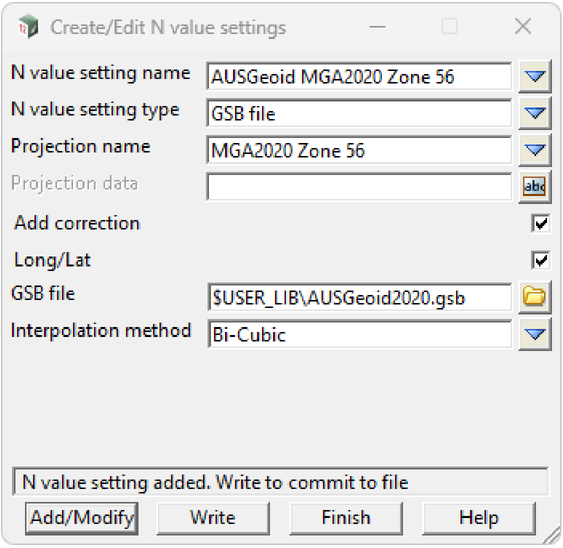
Add correction, this will typically be ticked **on**.

Long/Lat, this will typically need to be ticked on as for this case.

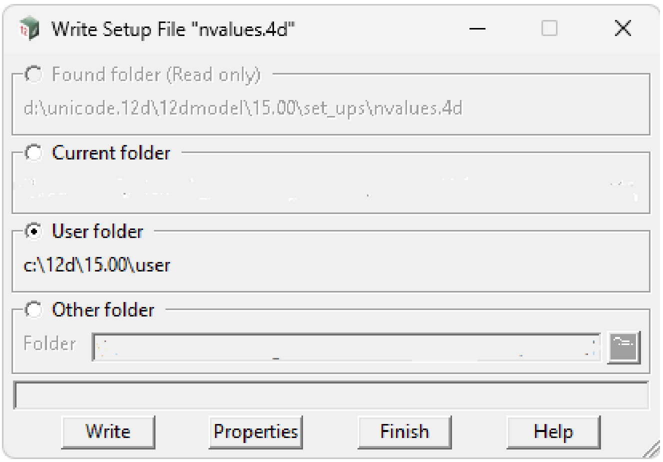
GSB file, browse to the GSB file to use, typically in user lib.

Interpolation method, select the interpolation method to use.

When all data is entered press **Add/Modify.** If all data is correct you can then press **Write** to create the n value file.



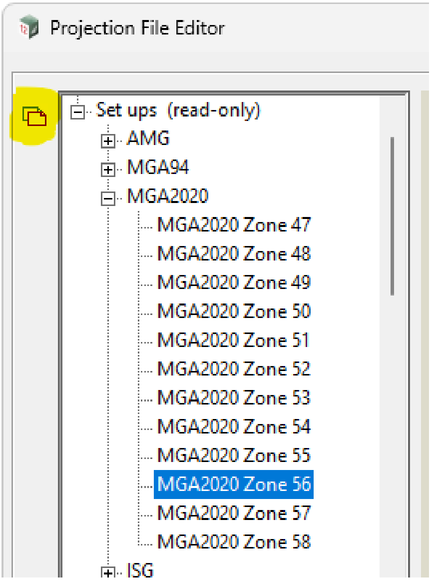
Typically you would choose to save this in the user folder.



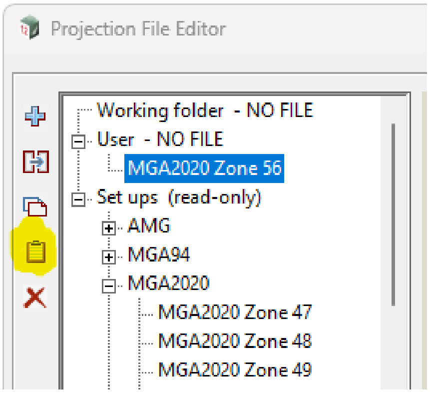
15.5.1.2.2 Setting up a projection for 12d Field

Open **Project-> Management-> Projections-> Projections editor**

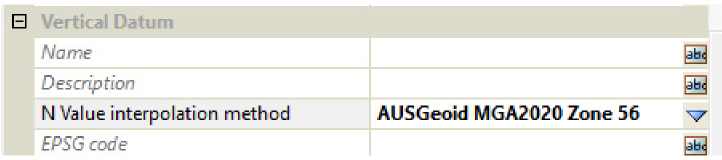
Select the projection to use and press the copy button in the top left corner.



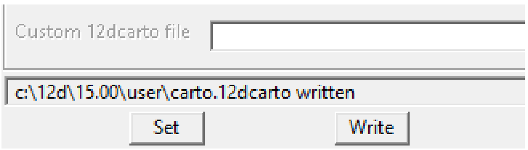
Paste this into the **User** area.



Scroll to the **Vertical Datum** area and select the newly defined n value.

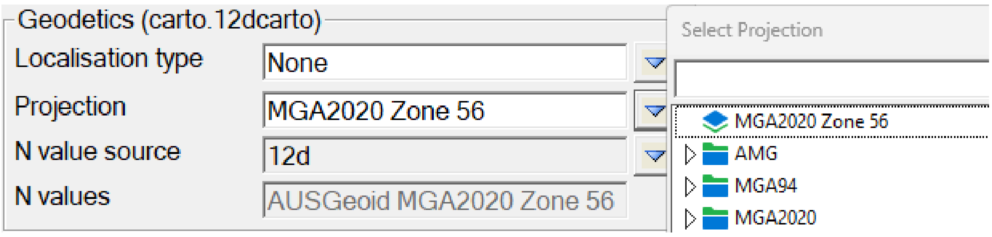


Then press **Set** then **Write** and the n value and projection are ready to use.

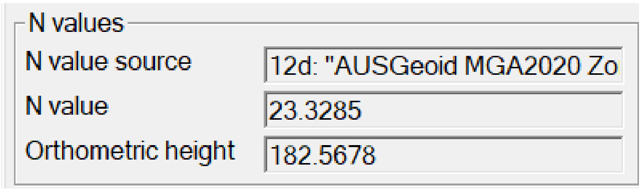


15.5.1.2.3 Selecting the n value in 12d Field

Please note when starting ***12d Field*** you need to select the projection from list the first time for the value to populate correctly.



And the n values are now used inside ***12d Field***.



Continue to 15.5.2.1 Target and Pole Types or go back to 15.5.1.2 Quick guide to setting up n-values and projections for 12d Field .

15.5.2 TPS Instruments Only

A TPS Setting comprises of 3 fundamental elements.

1. What sort of target and pole combination is being used.
2. How the TPS points at and optionally locks to the target.
3. What measurement program is used to measure a distance to the target.

From V15C1g all of the TPS instruments use the same terminology rather than historical terminology associated with each of the individual manufacturers.

In this section we will first describe each TPS Settings and the associated control bar bitmaps for those settings.

See 15.5.2.1 Target and Pole Types .

See 15.5.2.2 Target Pointing and Following Modes

See 15.5.2.3 Measurement Programs

See 15.5.2.4 Lock Status Bitmaps

See 15.5.2.5 TPS Settings Bitmaps

See 15.5.2.6 12dField and the Leica AP20

See 15.5.2.7 12dField and Trimble TPS Instruments

See 15.5.2.8 TPS Prism Searches

15.5.2.1 Target and Pole Types

For modern TPS and GPS instruments the target and pole selection have become intertwined with the advent of tilt poles combined with the existing id target technology and its newer variations.

12d Field 'supports' 4 basic target types.

Any - no target, measure to any surface, previously referred to as RL, NP DR dependent on manufacturer.

Tape - or sheet, a measurement to generally a square reflective 'tape' surface.

Prism - This refers to the typical circular prism, a prism that must be specifically pointed at the TPS.

360 Prism - A prism that does not need orientating towards the TPS.

Then there are the extra capabilities available with the particular target or pole type.

Id - the target has an electronic Id which prevents the TPS from locking onto another/incorrect target. This Id can be native to the target or be part of a device on the pole.

Height - the pole has auto sensing of the height, when ***12d Field*** takes a reading the height is sourced from the pole and not manually entered.

Tilt - the pole has a tilt capability, can correct itself to give the correct tip position no matter the direction or inclination it is leaning. These need the pole height to be manually set.

Tilt with height - a tilt pole with auto sensors for the height.

Standard Target types

For each TPS instrument there are a number of inbuilt targets. For these targets the user selects the target type and the rest is handled internally by ***12d Field*** or natively on the TPS instrument itself. From V15C1g the user has the ability to customise the text displayed for these targets on the control bar. See 15.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format .

User Defined Targets

12d Field supports up to twenty (20) user defined targets.

These can be **tape**, **prism** or **360 prism** targets, it is up to the user to understand, configure correctly and test these targets for the instrument being used. See 15.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format .

Continue to 15.5.2.2 Target Pointing and Following Modes or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.2 Target Pointing and Following Modes

The following 4 modes are available, (dependent on instrument hardware) for pointing and following the instrument, the 3 letter abbreviation is used throughout the manual to describe the pointing mode.

MNL - manual pointing, the user must manually fine point to the target prior to measuring, the TPS will not lock to and follow the target.

ATR - automatic target recognition, the user must approximately point to the target prior to measuring, the TPS will automatically do the fine pointing on measure, the TPS will not lock to and follow the target.

LCK - manual lock to target, the user must approximately point at the target and then initiate the lock to target, after that fine pointing is automatic and the TPS will follow the target.

ALK - automatic locking to target, the user needs only to approximately point at the target, the TPS will then automatically lock to the target, after that fine pointing is automatic and the TPS will follow the target.

Continue to 15.5.2.3 Measurement Programs or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.3 Measurement Programs

Across the instrument manufacturers there are a plethora of measurement modes to targets/any surfaces available, it is very difficult without rigorous testing in the user's specific environment to truly say what the accuracy of these modes are.

12d Field offers 4 styles of measurement, the 3 letter abbreviation is used throughout the manual to describe the program.

STD - single standard, a measurement to full accuracy, for each of the manufacturers there is a distinct measurement program that measures to the full capability of the instrument, this is the slowest of the measurement modes. The screen position of the target in ***12d Field*** is only updated after a measurement is completed.

PRC - single precise, for some high end Leica instruments a precise measurement is offered, this is nominally better than a standard measurement, it is only offered in single and multiface modes.

FST - single fast, a measurement with possibly reduced accuracy, (this is often the same internal measurement as used for the STD mode but just done once rather than the average of several readings.) There can be little time difference between this and the **STD** mode. The screen position of the target in ***12d Field*** is only updated after a measurement is completed.

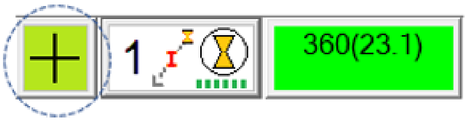
STK, standard tracking measurement, continuous distance measurement to a higher accuracy, (not recommended nor offered on all instruments), the screen position of the target in ***12d Field*** is continuously updated.

FTK - fast tracking measurement, for each of the manufacturers there is a distinct measurement program that measures as rapidly as possible with a nominal loss of accuracy, the screen position of the target in ***12d Field*** is continuously updated.

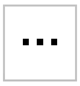
It should also be noted horizontal and vertical angle measurements are independent of distance measurements so it is up to the user to determine the right combination for the job at hand. For example, minor variations in distances in most cases will make no difference to calculated heights so a fast measurement program could be more suited to such jobs. If a user wants a precise distance but still wants the TPS to follow the target then **STD** would be an appropriate program as the target is steady when the measurement is called.

Continue to 15.5.2.4 Lock Status Bitmaps or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

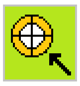
15.5.2.4 Lock Status Bitmaps



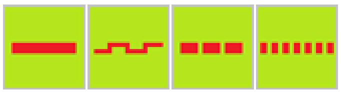
The instrument status button serves two purposes, it shows the current activity of the instrument and also serves to start searches or temporarily interrupt lock modes.



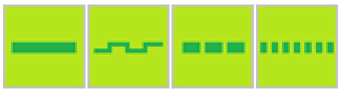
The instrument is idle, note this will be improved post V15C1g to indicate what search or other functionality will occur on pressing the button.



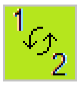
The instrument is in ATR mode and focusing.



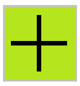
The instrument is taking an any surface measurement.



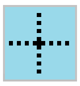
The instrument is taking a prism/tape measurement.



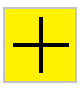
The instrument is changing face.



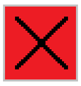
The instrument is locked onto and following the target, if the user presses the button the instrument will manually unlock from the target.



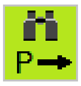
The instrument is manually unlocked by the user, press to search and lock on again.



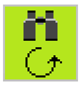
The instrument has lost lock and is in prediction mode.



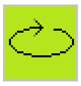
The instrument has lost lock.



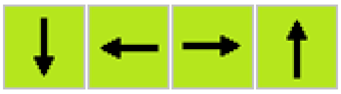
The instrument is power searching.



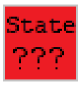
The instrument is spiral searching.



The instrument is rotating/moving to a new position.



The instrument is rotating in these directions.



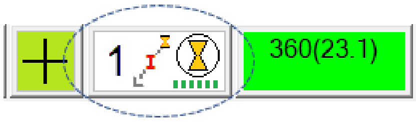
This should never happen, an unhandled state.

Continue to 15.5.2.5 TPS Settings Bitmaps or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.5 TPS Settings Bitmaps

From **V15C1g** the bitmaps on the control bar are uniform for all of the instruments and they follow a strict naming standard to allow simple customisation if desired.

Take the following bitmap.



This represents a ***12d Field*** single measurement mode using a 360 prism with id and full tilt pole, the TPS is in a manual lock mode and using fast tracking measurement. The bitmap name for this bitmap is: **TDF_TPS_SNGL_PIHT_LCK_FTK.bmp**

The naming format is strict and can be interpreted as follows.

The first **3** characters are fixed:

TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

Characters **5-7** are the instrument type, **TPS** or **GPS**

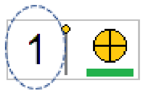
TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

Characters **9-12** are the ***12d Field* measurement style**

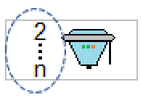
TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

For TPS there are **SNGL**, **MULT**, **CONT**, **HPSP** or **RSNG** corresponding to single, multiface, continuous, hidden point and remote single respectively. GPS has **AVRG**, averaging.

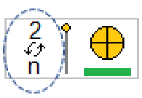
SNGL - Single



AVRG - Averaging

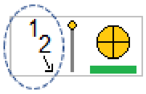


MULT - Multi-face

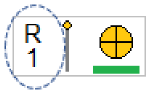


CONT - Continuous

HPSP - Hidden point



RSNG - Remote single



Character **14** indicates the target type.

TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

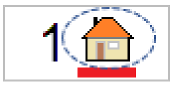
N - any surface for **TPS**, always **N** for **GPS**

C - a circular prism

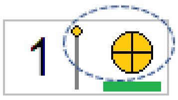
P - a 360 prism

S - a tape/sheet target

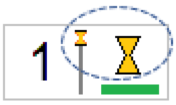
Any surface



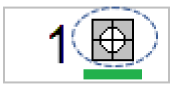
A circular prism



A 360 prism



A tape/sheet target



Characters **15-17** are about extra target and pole functionality.

TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

___ - a standard target

I__ - the target is an Id/active target.

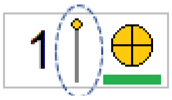
T__ - the pole has tilt capability but the height must be set manually.

H__ - the target has an auto-height pole.

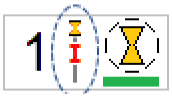
HT_ - the target has a tilt pole with auto-height.

IHT - the target is an Id/active target and has a tilt pole with auto-height.

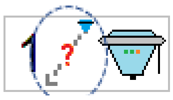
Standard target and pole



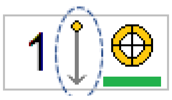
Id target



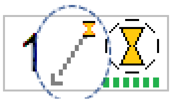
Tilt without automatic height



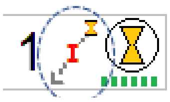
Auto height



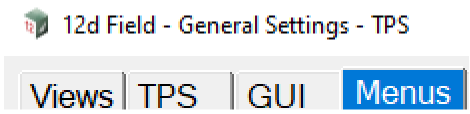
Tilt and auto height



Id, tilt and auto height



Tape or **any surface** targets do not display any information.



Characters **19-21** are the target pointing and locking modes

TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

XXX - GPS only, not applicable

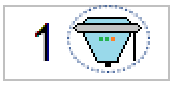
MNL - the user must manually fine point to the target prior to measuring, the TPS will not lock to and follow the target.

ATR - the user must approximately point to the target prior to measuring, the TPS will automatically do the fine pointing on measure, the TPS will not lock to and follow the target.

LCK - the user must approximately point to the target and then initiate the lock to target, after that fine pointing is automatic and the TPS will follow the target.

ALK - the user needs only to approximately point to the target, the TPS will then automatically lock to the target, after that fine pointing is automatic and the TPS will follow the target.

GPS is a simple icon of a GPS receiver.



MNL, a simple circular prism, 360 prism or house is shown.

ATR, a circular prism, 360 prism or tape target is shown with a clear circle in the middle.

LCK, a circular prism or 360 prism is shown with a solid circle on the outside.

ALK, a circular prism or 360 prism is shown with a broken circle on the outside.

Characters **23-25** are the TPS measurement program.

TDF_TPS_SNGL_PIHT_LCK_FTK.bmp

XXX - GPS only, not applicable

STD - single standard, a measurement to full accuracy, the screen position of the

target in ***12d Field*** is only updated after a measurement is completed.

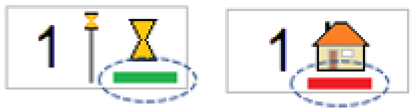
PRC - single precise, (some Leica instruments only), a measurement to precise accuracy, the screen position of the target in 12d Field is only updated after a measurement is completed.

FST - single fast, a measurement with possibly reduced accuracy, the screen position of the target in ***12d Field*** is only updated after a measurement is completed.

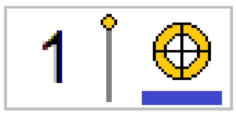
STK, standard tracking measurement, continuous distance measurement to a higher accuracy, (not recommended), the screen position of the target in ***12d Field*** is continuously updated.

FTK - fast tracking measurement, continuous fastest distance measurement nominally with reduced accuracy, the screen position of the target in ***12d Field*** is continuously updated.

STD - a thick line, green for prism, red for any surface.

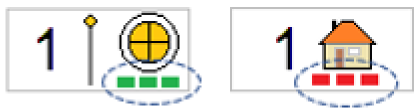


PRC - a thick line, blue for prism, not available for any surface.

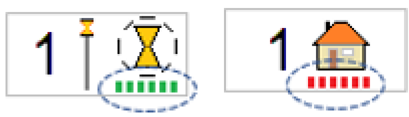


FST - a thin wavy line, green for prism, red for any surface.

STK - a dashed solid line, green for prism, red for any surface.



FTK - a dash-dot line, green for prism, red for any surface.



Continue to 15.5.2.6 12dField and the Leica AP20 or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.6 12dField and the Leica AP20

From V15C1g support has been added for the Leica AP20 smart pole, the basics of operating the AP20 with ***12d Field*** are covered here.

Basics

The Leica TPS must have the appropriate GeoCOM licences to operate with ***12d Field***.

The AP20 autopole must be turned on and connected to the total station prior to 12d Field being started, ***12d Field*** only looks for the presence of the AP20 on start-up, if the AP20 is turned on after 12d Field is running options for it will not be shown in the various menus.

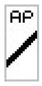
Starting a AP20 session

It takes the AP20 a relatively short time for the IMU to activate but substantially longer for it to be able to be held stationary for a longer period of time. When using the AP20 with ***12d Field*** first open the appropriate panels and enter the data necessary for the job at hand prior to moving the pole to activate the IMU, if you 1st activate the IMU and then pause to open panels and enter data you will find the IMU will 'drop out' and need reactivating.

Use of the ID pole

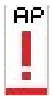
The user must be aware use of the ID feature of the AP20 means in case of losing lock a spiral search must take place as opposed to the much faster "lock on the fly" style reacquisition, the user needs to judge depending on the environment whether to use the ID feature of the autopole or not.

IMU Status Bitmaps



The AP20 is not in use.

TDF_TPS_AP20_OFF.bmp



The AP20 is not initialised, or the quality is bad, > 3°

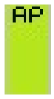
TDF_TPS_AP20_BAD.bmp

The AP20 quality is low, between 2 and 3°

TDF_TPS_AP20_LOW.bmp

The AP20 quality is medium, between 1 and 2°

TDF_TPS_AP20_MED.bmp

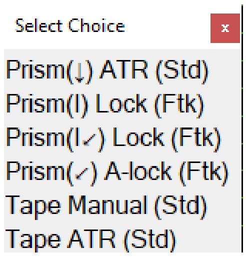


The AP20 quality is good, better than 1°

TDF_TPS_AP20_HGH.bmp

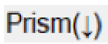
Modes supported

When the autopole is active and depending on which features are present on the pole the specific autopole instrument settings are added to the top of the instrument settings choices.



Height only

Prism(?)



The target height is taken from the autopole every time a measurement is taken. Note, the TPS control bar target height is not updated as soon as the user changes the pole height, only when the user activates a measurement is the pole queried and the control bar updated if necessary.

Id only

Prism (I)

The total station will only lock onto a target with the correct ID, again, note using the ID feature means lock on the fly is not available hence reacquiring the target is slower.

Height/tilt

Prism(?)

The AP20 is in its conventional tilt mode, this means the pole can even be held sideways or upside down when the IMU is active, ***12d Field*** does not support the "reversed" tilt mode.

In this mode target reacquisition is by auto-lock/lock on the fly.

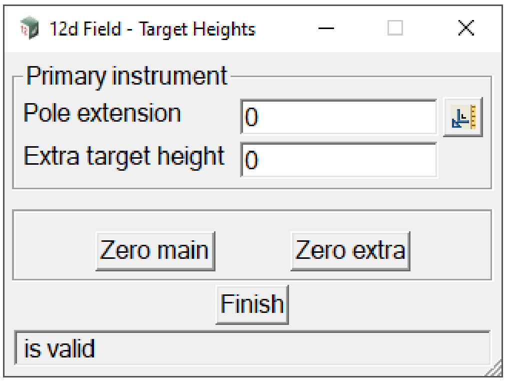
Height/tilt and ID

Prism (I?)

The same as height/tilt except in this mode target reacquisition is by a spiral search to ascertain the ID of the AP20 hence a little slower than the auto-lock mode.

Target Heights panel and the AP20

When the AP20 auto height or height/tilt is used the Target Heights panel changes to the following.



Pole extension

This value is added to the target height returned form the AP20 to become the overall target height, tilt measurements are adjusted using this value.

This is intended to be used in 2 ways, the first being to counter tip wear on the pole, e.g., if the pole has worn down by 5mm the user would enter -0.005 in this field, this adjustment to the target height is used both vertically and in tilt modes.

The second use is for different or extended poles, enter the value here to suit the AP20/pole combination.

Extra target height

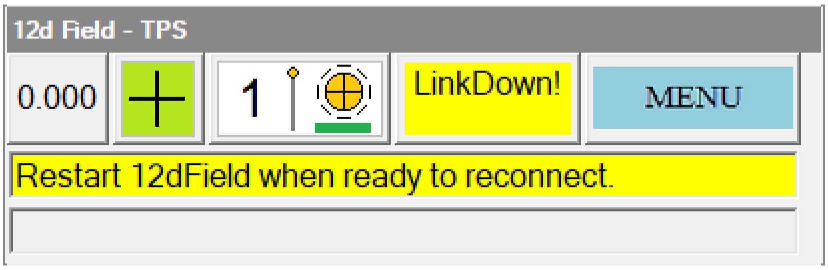
Unlike **Pole extension** this value is applied vertically from the calculated pole tip position, i.e. this value is subtracted from the pole tip RL to give the final measured RL. See 15.6.4.3 Check Target Height Calibrate - TPS for how to accurately determine pole heights.

Continue to 15.5.2.7 12dField and Trimble TPS Instruments or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.7 12dField and Trimble TPS Instruments

15.5.2.7.1 Loss of Radio Link

From V15C1k when the Trimble SDK loses connection with the TPS instrument the 12dField control bar will look as follows.



Typically there will be up to a 30 second period between when the SDK has initially lost connection until ***12d Field*** receives this message.

Once this has occurred ***12d Field*** must be exited and restarted when the connection issue has been addressed, e.g., too far from instrument, it cannot reestablish the connection 'on the fly'.

Continue to 15.5.2.8 TPS Prism Searches or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail .

15.5.2.8 TPS Prism Searches

15.5.2.8.1 Leica Prism Searches

15.5.2.8.1.1 Leica Prism Spiral Searches

15.5.2.8.1.2 Leica Prism Power Searches

15.5.2.8.2 Topcon Prism Searches

15.5.2.8.3 Trimble Prism Searches

Continue to 15.5.3 GNSS Instruments Only or return to 15.5.2 TPS Instruments Only or 15.5 12d Field Instruments in Detail

15.5.3 GNSS Instruments Only

See 15.5.3.1 GNSS Status Button Bitmaps
See 15.5.3.2 Change of base station warning

15.5.3.1 GNSS Status Button Bitmaps

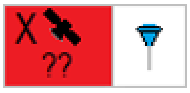
The GNSS status button shows the user the current satellite and RTK status on the left hand side of the button and the tilt status on the right hand side.

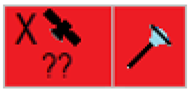
There many individual bitmaps because of the combinations of satellite numbers, RTK and tilt status so this section is a simple overview of the basics.

See 15.5.3.1.1 Initial bitmaps on starting up
See 15.5.3.1.2 RTK status
See 15.5.3.1.3 Satellite in use
See 15.5.3.1.4 Tilt pole status

15.5.3.1.1 Initial bitmaps on starting up

The user might see some of these bitmaps on originally starting ***12d Field*** with a GNSS instrument. It is expected they should be replaced very quickly with status derived from the incoming NMEA sentences.


No satellite status received, no tilt pole used.

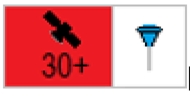

No satellite status received, tilt pole is not calibrated.

If these bitmaps remain it is an indication no NMEA strings are being received.

15.5.3.1.2 RTK status

The RTK status is shown by the colour of the LHS of the bitmaps.

In a non RTK state, e.g. autonomous mode.



RTK is poor quality.

RTK is average quality.

RTK is good quality.

15.5.3.1.3 Satellite in use

The satellites in use is indicative only, they are shown as numbers on the lower LHS of the bitmaps.

There are 0 to 10 satellites in use.

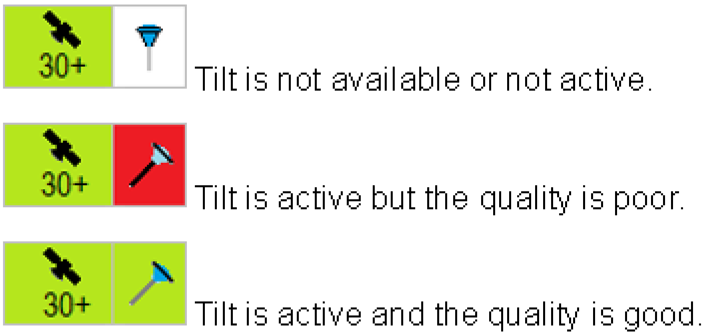
There are 10 to 20 satellites in use.

There are 20 to 30 satellites in use.

There are over 30 satellites in use.

15.5.3.1.4 Tilt pole status

Tilt status is shown as a combination of colour and pole images on the RHS of the bitmaps.

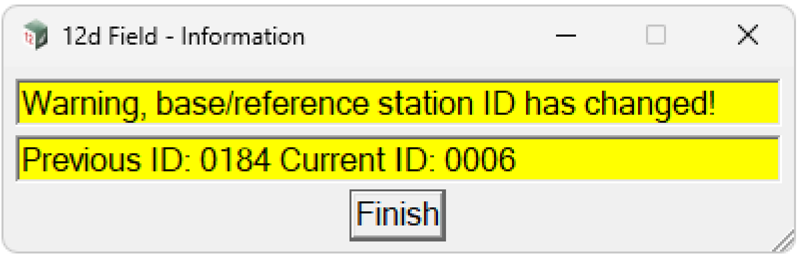


Continue to 15.5.3.2 Change of base station warning or return to 15.5.3 GNSS Instruments Only or 15.5 12d Field Instruments in Detail

15.5.3.2 Change of base station warning

The NMEA **GNGNS**, **GNGGA** and **GNPOS** sentences broadcast the base station ID. A change of base station can often result in considerably different coordinates to previously readings in the same area when corrections came from another base station.

If the base station is being broadcast on processing a GNSS measurement 12dField will warn if the base station ID has changed since the previous measurement. It is up to the user to then check for possible errors introduced by the change.



The user should ensure their GNSS receiver is broadcasting at least one of the **GNGNS**, **GNGGA** or **GNPOS** sentences for protection against base station changes.

Continue to 15.6 12d Field Options or return to 15.5.3 GNSS Instruments Only or 15.5 12d Field Instruments in Detail

15.6 12d Field Options

12d Field TPS Options

TPS Options	See
Settings	15.6.8 General Settings - TPS
Configs	15.6.2 Configurations
Station	15.6.3 Station Setup - TPS
Checks	15.6.4 Checks - TPS
Setout	15.6.5 Setout
Pickup	15.6.6 Pickup
Store point setup	15.6.10 Store Point Setup
Store point names	15.6.11 Store Point Names
TPS	15.6.7 TPS Functions
Comment	15.6.12 Log Comment
Reconnect	15.6.9 Reconnect
Shutdown	15.6.13 12d Field Shutdown

12d Field GNSS Options

GNSS Options	See
Settings	15.6.14 General Settings - GNSS
Checks	15.6.15 Checks - GNSS
Setout	15.6.5 Setout
Pickup	15.6.6 Pickup
Store point setup	15.6.10 Store Point Setup
Store point names	15.6.11 Store Point Names
GNSS utilities	15.6.16 GNSS Utilities
Comment	15.6.12 Log Comment
Reconnect	15.6.9 Reconnect
Shutdown	15.6.13 12d Field Shutdown

Continue to 15.6.1 Common Buttons, Panel Tabs and Fields .

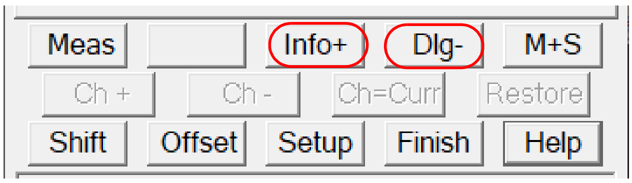
15.6.1 Common Buttons, Panel Tabs and Fields

See

- 15.6.1.1 Info and Dlg Buttons
- 15.6.1.2 Meas, Store and MS+ST Buttons
- 15.6.1.3 Ch+, Ch-, Ch=Curr and Restore Buttons
- 15.6.1.4 Shift, Offset and Setup Buttons
- 15.6.1.5 Point Id Increment/Decrement Buttons
- 15.6.1.6 Navigation Tab
- 15.6.1.7 Tolerances Tab
- 15.6.1.8 Common Panel Fields

15.6.1.1 Info and Dlg Buttons

These buttons do not change in behaviour between all of the different measure modes.



Info+

Displays the information panel.

This panel contains extra information about the current setout that is not displayed in the standard panel. The contents of this information panel is user configurable via the text file ***12dF_INFO_PAGE_CONFIG.4D***. *See* 15.8.4.3 12dF_INFO_PAGE_CONFIG.4D file format .

When the information panel is active, the button changes to ***Info-***.

Info-

Closes the extra the information panel.

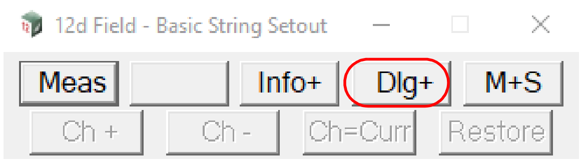
When the information panel closed, the button changes to ***Info****+.*

Dlg-

When pressed the panel changes so that only the button area is displayed and the button changes to ***Dlg+.***

Dlg+

When pressed the panel changes from just showing the button to full size and the button changes to ***Dlg-.***



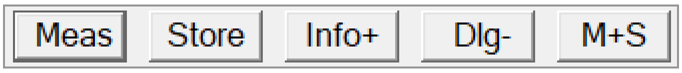
15.6.1.2 Meas, Store and MS+ST Buttons

See

[15.6.1.2.0.1 Single (GNSS/TPS) and Multiface (TPS only) Measurement Modes](#)
[15.6.1.2.0.2 Continuous (GNSS/TPS) Measurement Mode](#)
[15.6.1.2.0.3 Averaging measurement mode (GNSS only)](#)

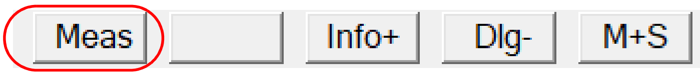
15.6.1.2.0.1 Single (GNSS/TPS) and Multiface (TPS only) Measurement Modes

In **Single** and **Multiface** modes, the **Meas, Store and MS_ST** buttons can be used.



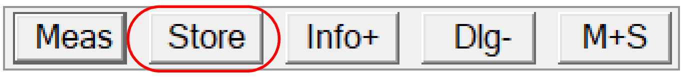
However, the **Store** button is disable until a measurement is made.

Meas



*Starts the measurement and on completion of the measurement, the **Store** button appears:*

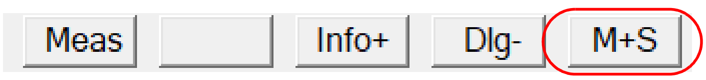
Store



Stores the point as per the settings in the 15.6.10 Store Point Setup *panel.*
*Once stored, the **Store** button is blanked out until a new measurement is taken.*

***Note**: storing the first point automatically brings up the* **Store Point Setup** *panel to define the settings.*

MS+ST - Measure and Store

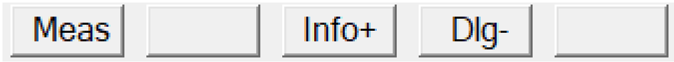


Starts a measurement and stores the point as per the settings in the 15.6.10 Store Point Setup *panel.*
*The **Store** button remains disabled.*

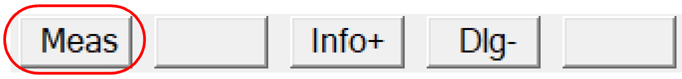
Continue to 15.6.1.2.0.2 Continuous (GNSS/TPS) Measurement Mode or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.2.0.2 Continuous (GNSS/TPS) Measurement Mode

In **Continuous** mode, the **MS+ST** button is disabled.



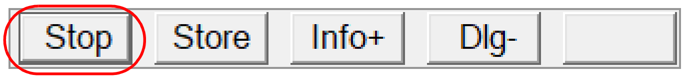
Meas - Continuous



Start continuous measurement.

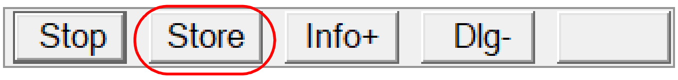
*The **Stop** button then replaces the **Meas** button and the **Store** button is enabled.*

Stop



Stop the continuous measurement.

Store



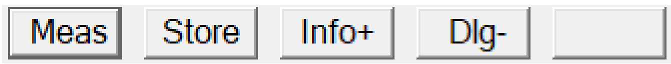
Store the point as per the settings in the 15.6.10 Store Point Setup *panel.*

*The button state does not change meaning the user can continue to store points at a single press of the **Store** button.*

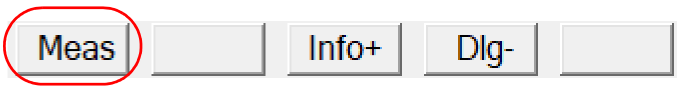
Continue to 15.6.1.2.0.3 Averaging measurement mode (GNSS only) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.2.0.3 Averaging measurement mode (GNSS only)

In Averaging mode the **MS+ST** button is disabled.



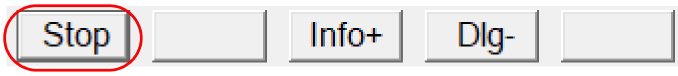
Meas



Start an averaging measurement.

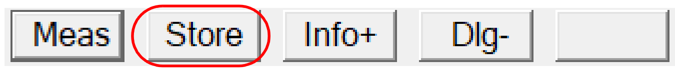
*The details of the averaging, standard deviations in x, y, and z are displayed in the third message line of the panel. The **Stop** button then replaces the **Meas** button.*

Stop



Stop the averaging measurement.

Store

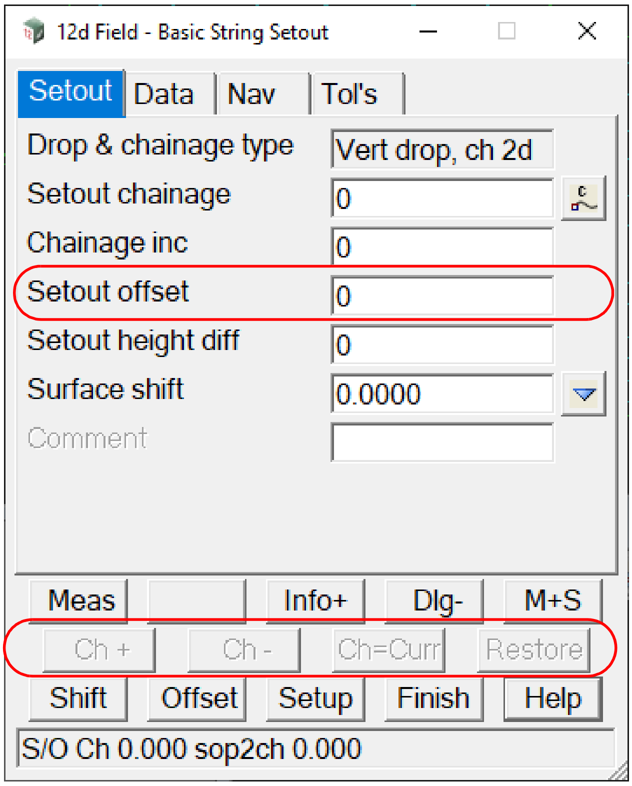


Store the point as per the settings in the 15.6.10 Store Point Setup *panel.*

Continue to 15.6.1.3 Ch+, Ch-, Ch=Curr and Restore Buttons or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

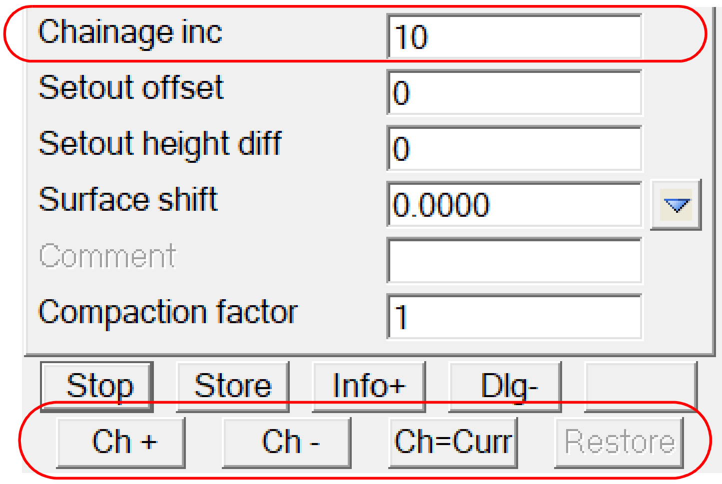
15.6.1.3 Ch+, Ch-, Ch=Curr and Restore Buttons

The chainage buttons commonly appear as the middle row of buttons in a **12d Field Setout** panel.



The **Ch+** and **Ch-** buttons are used to quickly increment to the next chainage to be setout.

The buttons are activated when the **Chainage Increment** field in the panel has a value other than zero (0).



Ch+

*When pressed the value in the **Chainage Increment** field is added to the current setout chainage. The value in **Chainage Increment** field can be positive or negative.*

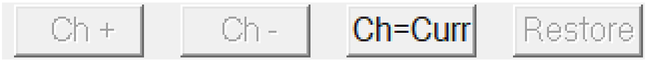
Ch-

*When pressed the value in the **Chainage Increment** field is subtracted from the current setout chainage.*

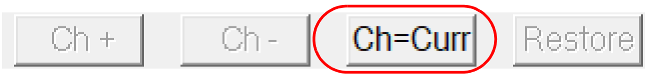
*The value in **Chainage Increment** field can be positive or negative.*

***Note** - the chainages generated by Ch+/Ch- are not restricted to the simple interval from the current setout chainage, other significant points on the control string such as horizontal tangent points can be included as well. Link to Settings->Survey->Spec Ch's.*

The **Ch=Curr** and **Restore** buttons are used when the user has a need to temporarily use the current chainage for setout purposes.



Ch=Curr



The button is activated when a measurement has been taken.

When pressed, the setout chainage is set to the current chainage.

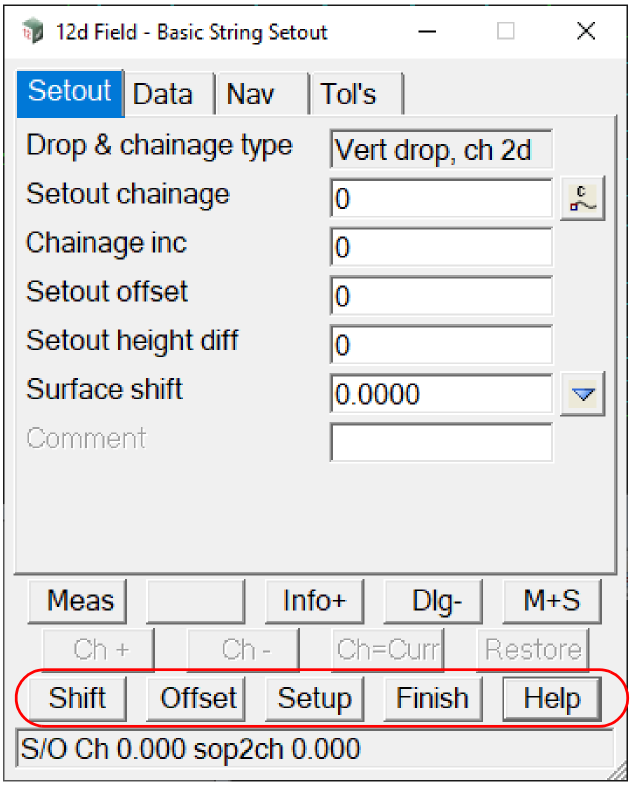
The **Restore** *button is then activated and the* **Ch+** and **Ch-** *buttons disabled.*

Restore

*When pressed, the setout chainage is set back to the chainage when **Ch=Curr** was pressed and the **Ch+ Ch-** buttons enabled.*

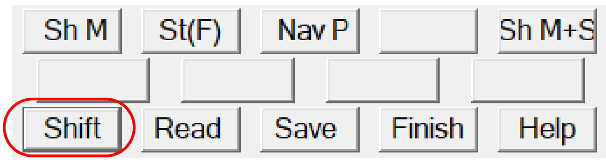
Continue to 15.6.1.4 Shift, Offset and Setup Buttons or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.4 Shift, Offset and Setup Buttons



Shift

Display extra functionality available for each panel button.



Offset

Open the Offset Measurement panel. See 15.6.7.6 TPS Offset Measurement.

Setup

Open the Store Point Setup panel. See 15.6.10 Store Point Setup.

Setup >

Sh M

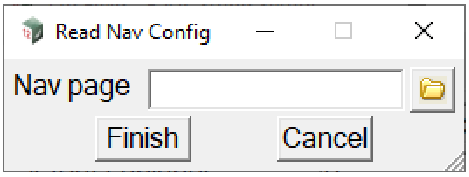
Prepares the tablet to take a measurement by a touch anywhere on the screen.

Sh M+S

Prepares the tablet to take a measurement and store the point by a touch anywhere on the screen.

Nav P

*Brings up the **Read Nav Config** panel.*



The standard navigation page configuration is store in the file "12dF_NAV_PAGE_CONFIG.4D", alternative configurations can be dynamically loaded using this panel, these files are identical format to the standard file but with the extension "NAV_PAGE_CONFIG_4D".

Finish button

Read the selected file, the next measurement will populate the navigation screen using the new configuration.

Cancel button

Exit without changing the configuration.

St(F)

*Force store, this button allows a measurement to be stored a second time. For example the **Store Point Setup** panel could be opened, settings changed and the point stored again.*

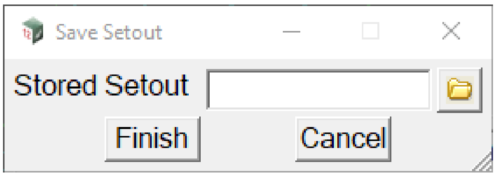
Save and Read

*Like all of **12d Model** it can be advantageous to store frequently used settings and load them on demand.*

***12d Field** predates the SLX & DDX formats and as such uses custom files to save and populate its panels. The standard config files are named dependent on the setout panel. For example the **Crossfall Setout** panel configuration is stored in **12dF_CROSSFALL_CONFIG.4D.** Any number of configurations for each panel can be stored in a favourites file with an extension based on the panel, e.g.**12dF_PANEL_FAV_CROSSFALL_SETOUT_4D**.*

Save

*Brings up the **Save Setout** panel.*



Stored Setout file box

Enter or select the favourites file to store the panel contents, the extension is dependent on the setout panel.

Finish button

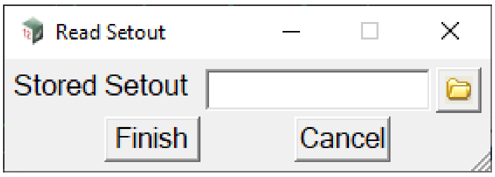
Save the contents of the current panel for future use.

Cancel button

Exit without saving.

Read

*Brings up the **Read Setout** panel.*



Stored Setout file box

The favourites file to use to populate the panel.

Read a stored favourite and populate the panel from it.

Finish button

***Save** the contents of the current panel for future use.*

Cancel button

Exit without saving.

Continue to 15.6.1.6 Navigation Tab or return to 15.6.1 Common Buttons, Panel Tabs and Fields

15.6.1.5 Point Id Increment/Decrement Buttons

In panels which allow the user to select points in a super string by the point id the following buttons are used.

Inc Id

Increment the point id and update finding a point matching the new point id on the super string. This is an alpha numeric increment, it will not change the length of the point id, it updates only numbers or letters walking backwards from the last character.

E.g 1->2, 9->0, A->B, Z->A, PM02->PM03, PM99->PM00

Dec Id

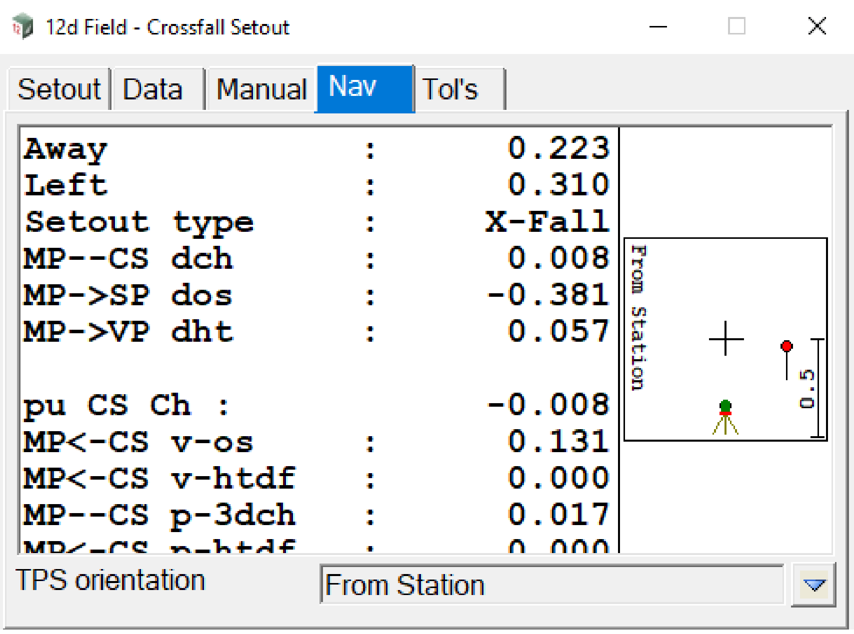
Decrement the point id and update finding a point matching the new point id on the super string. This is an alpha numeric increment, it will not change the length of the point id, it updates only numbers or letters walking backwards from the last character.

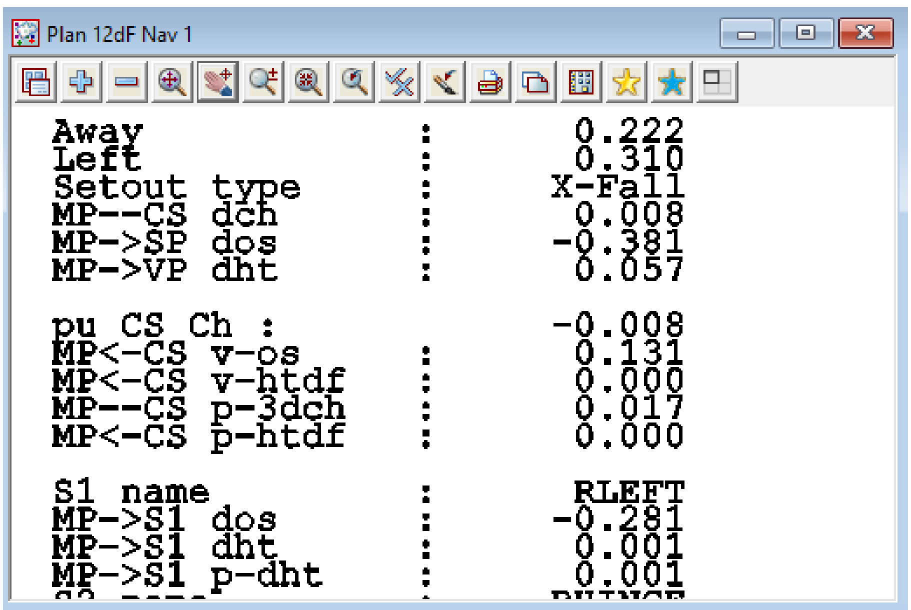
E.g 2->1, 0->9, B->A, A->Z, PM03->PM02, PM00->PM99

15.6.1.6 Navigation Tab

The Navigation Tab and the 2 related navigation plan views are configurable by the user to display desired attributes for each setout panel.

Normally only a panel navigation tab or a navigation plan view would be used but they can all be used simultaneously.





For details on settings for the navigation tab see Panels >Nav Page .

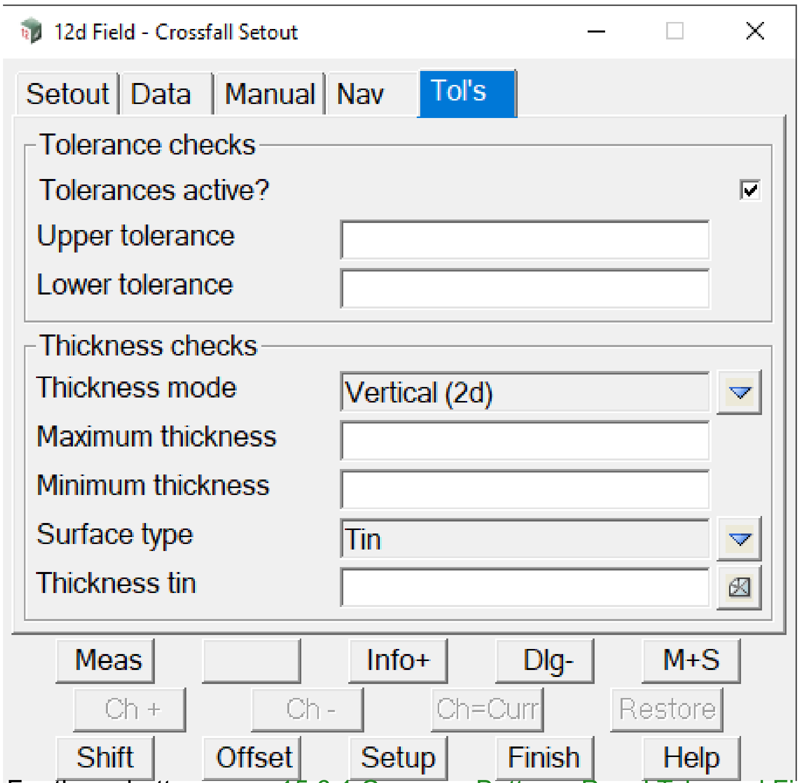
For details on settings for the navigation plan views see Views >Nav Plan tab .

For details on configuring the attributes displayed see 15.8.4.4 12dF_NAV_PAGE_CONFIG.4D file format .

Continue to 15.6.1.7 Tolerances Tab or return to 15.6.1 Common Buttons, Panel Tabs and Fields

15.6.1.7 Tolerances Tab

The **tolerances tab** enables the user to run dynamic checks of differences of heights from design and differences in thickness from previous layers. These values can be added to the message line in the setout panels and can be flagged as warning when out of tolerance.



For these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Tolerance checks

Tolerances active? tick box not ticked

*If **ticked**, then differences to design will be checked against these tolerances and warnings displayed, the tolerances and differences to them will also be written to the 12dField vertex attributes.*

Attribute "st_tol_pav_active".

Upper tolerance 12dF real box

The upper tolerance from design at which a warning is triggered, +ve = above design level.

Attribute "st_tol_pav_upper_tol".

Lower tolerance 12dF real box

The lower tolerance from design at which a warning is triggered, -ve = below design level.

Attribute "st_tol_pav_lower_tol".

Thickness checks

Thickness mode choice box None, Vertical(2d), Perpendicular (3d)

None - no thickness checks are done.

Vertical(2d) - a thickness check is done dropping the measured point vertically to the nominated surface.

Perpendicular (3d) - a thickness check is done dropping the measured point perpendicularly to the nominated surface.

Attribute "st_tol_pav_thickness_mode", -1 = None, 0 = Vertical(2d), 1 = Perpendicular (3d)

Maximum thickness 12dF real box

Maximum thickness for a thickness check.

Attribute " st_tol_pav_max_thickness".

Minimum thickness 12dF real box

Minimum thickness for a thickness check.

Attribute " st_tol_pav_min_thickness".

Surface type choice box Tin, Trimesh

*Select whether a **tin** or **trimesh** will be used for thickness checks.*

Attribute "st_tol_pav_thickness_is_tin"

Thickness tin 12dF tin box

Tin to be used for thickness checks.

Attribute " st_tol_pav_thickness_tinr".

Thickness mesh select box

*Trimesh to be used for thickness checks. **Important** - for thickness checks with trimeshes only the highest or closest drop is used, the trimesh is assumed to be 'tin like'.*

Attribute " st_tol_pav_thickness_trmr".

Attributes generated by the tolerance and thickness settings.

If tolerances are active the following attributes are available.

st_tol_pav_in_tol_value - if in tolerance this value is valid and the height difference from design.

st_tol_pav_above_tol_value - if above tolerance this value is valid and the value above tolerance.

st_tol_pav_below_tol_value - if below tolerance this value is valid and the value below tolerance.

st_tol_pav_out_of_tol_value - if above or below tolerance this value is valid and the above or below value.

If thicknesses are active the following attributes are available:

st_tol_pav_actual_thickness - if in tolerance this value is valid and the actual thickness.

st_tol_pav_above_max_thickness_value - if over thickness this value is value and the amount over thickness.

st_tol_pav_below_min_thickness_value - if under thickness this value is value and the amount under thickness.

st_tol_pav_out_of_thickness_value - if over or under thickness this value is valid and the amount over or under thickness.

The user is able to configure these attributes for use in the message area of the setout panels, see 15.8.4.6 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D file format and 15.8.4.8 12dF_USER_TEXT_PICKUP_MESSAGE.4D file format for full details.

Continue to 15.6.1.8 Common Panel Fields or return to 15.6.1 Common Buttons, Panel Tabs and

Fields .

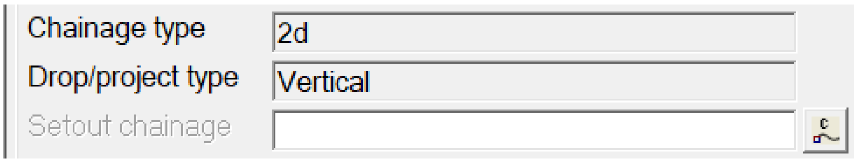
15.6.1.8 Common Panel Fields

See

[15.6.1.8.1 Setout Chainage (so_cs_ch)](#)
[15.6.1.8.2 Chainage inc (so_cs_ch_inc)](#)
[15.6.1.8.3 Setout offset (so_sp_ss_os)](#)
[15.6.1.8.4 Surface shift (so_spl_dpl_htdf)](#)
[15.6.1.8.5 Setout height diff (so_vpl_spl_htdf)](#)
[15.6.1.8.6 Comment (st_gui_display_pu_comment_line)](#)
[15.6.1.8.7 Compaction factor (so_compaction_factor)](#)

15.6.1.8.1 Setout Chainage (so_cs_ch)

Fundamental to many 12d Field setout panels is the setout chainage.



The setout chainage can be one of the 4 available chainage types, [19.5 Different Types of Chainage Drop Point](#), the type of chainage is always shown, read only when fixed, changeable when the setout panel supports use of multiple chainage types.

Note, the attribute **so_cs_ch** accesses one of the 4 the underlying ch/drop values dependent on the current settings, the raw types are:

so_vcut_cs_ch2d, the standard vertical drop 2D chainage.

so_pcut_cs_ch2d, the perpendicular drop 2D chainage.

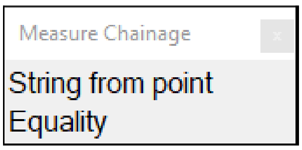
so_pcut_cs_ch3d, the perpendicular drop 3dDchainage.

so_vcut_cs_ch3d, the rare, for completeness only vertical drop 3D chainage.

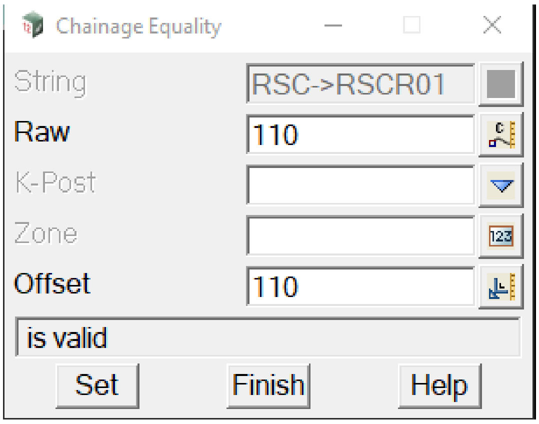
Chainage equalities are only supported for the typical Vertical/2d chainage type.

The chainage shown is always the 'raw chainage', the distance along the control string plus the start chainage.

If the control string is a super-alignment ***with equalities*** then clicking the **chainage** icon brings up the **Measure Chainage** menu with **Equality** on it.



Clicking **Equality** brings up the **Chainage Equality** panel.



Continue to 15.6.1.8.2 Chainage inc (so_cs_ch_inc) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.2 Chainage inc (so_cs_ch_inc)

Value that the setout chainage will be changed by when chainage increment/decrement is called.

If special chainages are specified in the Settings Panel such as horizontal TP's then these will affect the increment, for more details please go to Spec Ch's.

Continue to 15.6.1.8.3 Setout offset (so_sp_ss_os) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.3 Setout offset (so_sp_ss_os)

The offset from the setout string to setout, +ve is to the right of the string, -ve left. Note the offset is from the setout string, not the control string, the setout string is cut perpendicular to the control string at the setout chainage and the offset applied from there.

Continue to 15.6.1.8.4 Surface shift (so_spl_dpl_htdf) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.4 Surface shift (so_spl_dpl_htdf)

A road design might only be delivered as the final surface, the surface shift can be used to define the various sub layers, the entered values can be stored in the file 12dF_SURFACE_SHIFTS.4D for reuse.

The shift is added to the design plane to give the shifted plane.

Continue to 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.5 Setout height diff (so_vpl_spl_htdf)

There is often the need to mark a set height above the shifted surface.

The height diff is added to the shifted plane to give the virtual plane.

Note the **surface shift** and **height diff** are provided for clarity but not necessary. For example, to mark out a point 0.500 above a surface-0.362 below the design plane.

A **surface shift -0.362** & **height diff 0.5** is the same as a **surface shift 0.000** & **height diff 0.138**.

Continue to 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.6 Comment (st_gui_display_pu_comment_line)

If this attribute is true then a user defined comment box is added to various panels enabling the user to enter user comments. The text of the comment is stored in the attribute

" **pu_panel_comment_line**"

Continue to 15.6.1.8.7 Compaction factor (so_compaction_factor) or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.1.8.7 Compaction factor (so_compaction_factor)

A compaction factor applied to the delta heights. For example if a material is going to compact by 23% enter this value as 1.23, this means the delta height displayed on the screen will be inflated by 23% to account for subsequent compaction. (Note this widget is optional and only appears if activated in the Settings panel). For more details please go to Settings->Panels->General->Use compaction factors.

Continue to 15.6.2 Configurations or return to 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.2 Configurations

Clicking on the **Configs** menu option brings up the **Configurations** menu.

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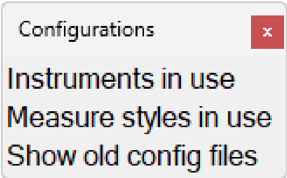


See
15.6.2.1 Instruments in use
15.6.2.2 Measure styles in use
15.6.2.3 Show old config files

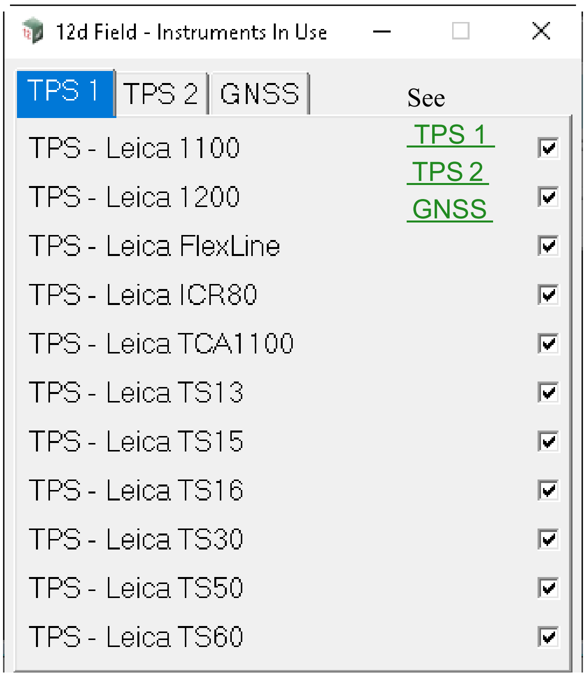
15.6.2.1 Instruments in use

The **Instruments In Use** panel enables the user to easily customize the list of instruments choices to those they actually use. This panel is in place from **V15C1q** and replaces the old manual configuration file **12dF_INSTRUMENT_SELECTION.4D**, this file can be removed from the user's configuration.

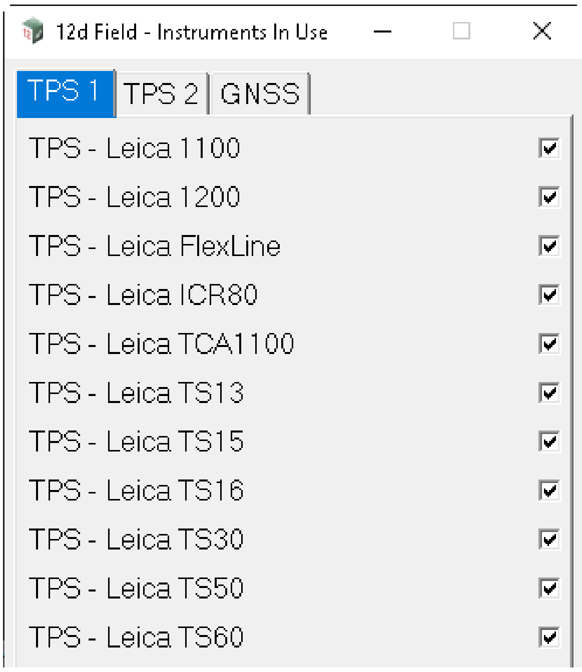
The documentation for this panel is minimal as the fields are self explanatory, upon first use of this panel all instruments are selected, untick all instruments not in use. On restarting **12d Field** only the selected instruments will be shown.

There are 2 **TPS** tabs and 1 **GNSS** tab in the panel, the instruments are listed primarily in alphabetical order.

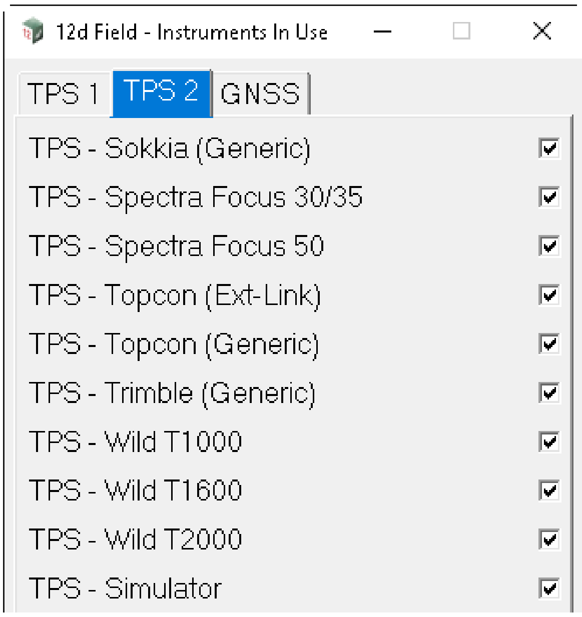
Clicking on the **Instruments in use** menu option brings up the **12d Field - Instruments In Use** panel.



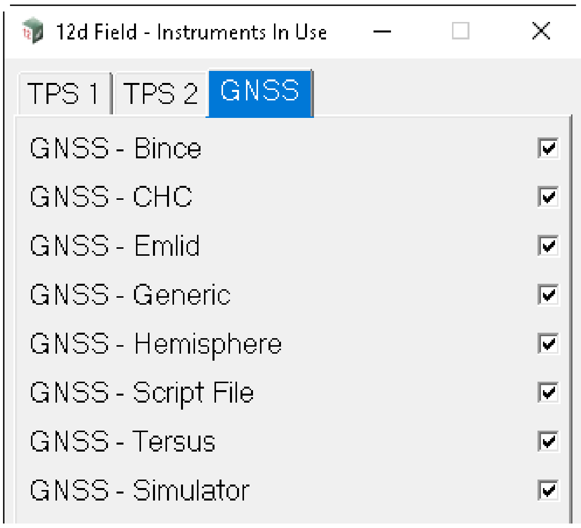
TPS 1


12d Field - Instruments In Use
TPS 1
TPS 2
GNSS
TPS - Leica 1100
TPS - Leica 1200
TPS - Leica FlexLine
TPS - Leica ICR80
TPS - Leica TCA1100
TPS - Leica TS13
TPS - Leica TS15
TPS - Leica TS16
TPS - Leica TS30
TPS - Leica TS50
TPS - Leica TS60

TPS 2


12d Field - Instruments In Use
TPS 1
TPS 2
GNSS
TPS - Sokkia (Generic)
TPS - Spectra Focus 30/35
TPS - Spectra Focus 50
TPS - Topcon (Ext-Link)
TPS - Topcon (Generic)
TPS - Trimble (Generic)
TPS - Wild T1000
TPS - Wild T1600
TPS - Wild T2000
TPS - Simulator

GNSS



For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

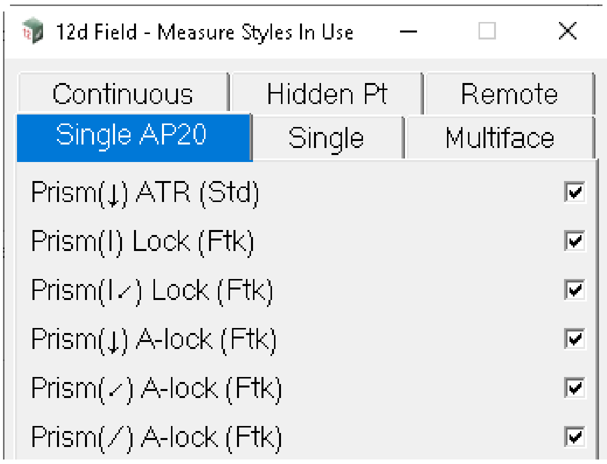
Continue to 15.6.2 Configurations or return to 15.6.2 Configurations .

15.6.2.2 Measure styles in use

The **Measure styles in use** panel is for Leica instruments only and enables the user to easily customize the list of measurement style choices to those they actually use, with the advent of lock on the fly and AP20 options the list had grown unwieldy.

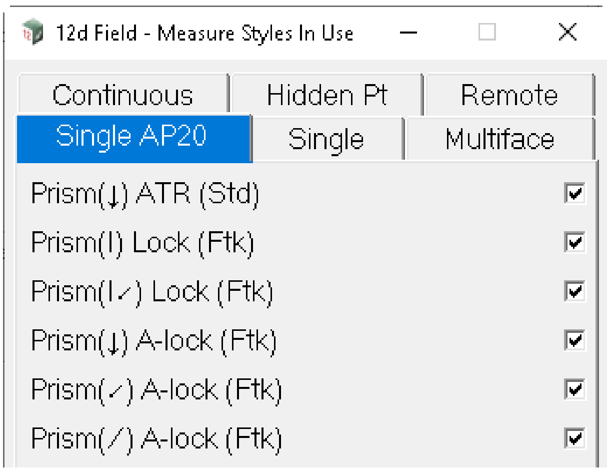
The documentation for this panel is minimal as the fields are self explanatory, upon first use of this panel all styles are selected, untick all styles not in use.

Clicking on the **Measure styles in use** menu option brings up the **12d Field - Measure Styles In Use** panel.



See
Single AP20 Single
Multiface Continuous
Hidden Pt Remote

Single AP20



Select the styles for use with an AP20 in single shot mode.

The attributes in order are

st_ins_use_meas_tps_sngl_h___atr_std

st_ins_use_meas_tps_sngl_i___lck_ftk

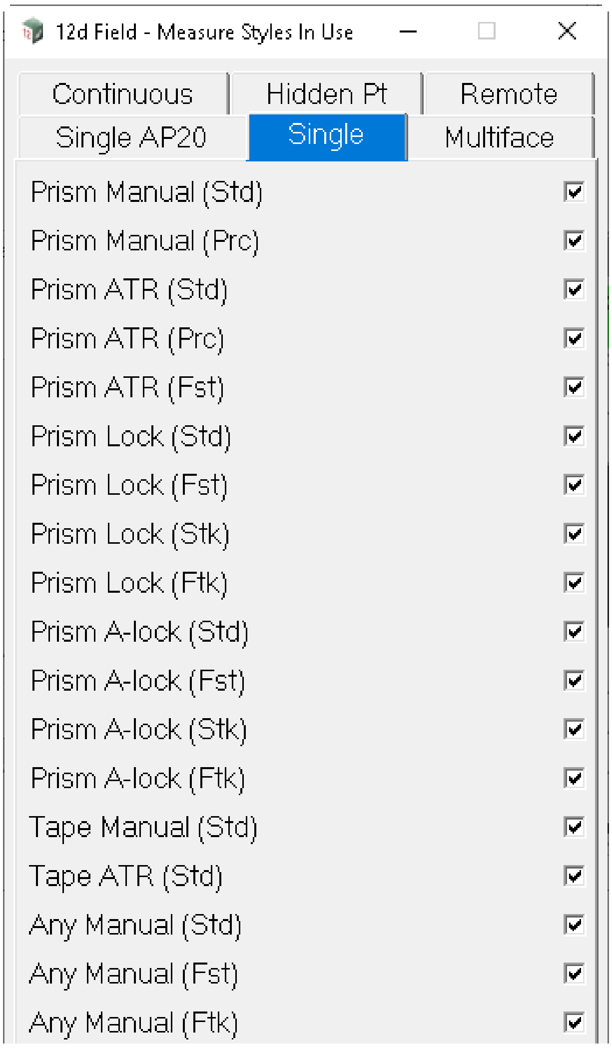
st_ins_use_meas_tps_sngl_iht_lck_ftk

st_ins_use_meas_tps_sngl_h___alk_ftk

st_ins_use_meas_tps_sngl_ht__alk_ftk

st_ins_use_meas_tps_sngl_t___alk_ftk

Single



Select the styles for use for non AP20 single shot modes.

The attributes in order are

st_ins_use_meas_tps_sngl_p___mnl_std

st_ins_use_meas_tps_sngl_p___mnl_prc

st_ins_use_meas_tps_sngl_p___atr_std

st_ins_use_meas_tps_sngl_p___atr_prc

st_ins_use_meas_tps_sngl_p___atr_fst

st_ins_use_meas_tps_sngl_p___lck_std

st_ins_use_meas_tps_sngl_p___lck_fst

st_ins_use_meas_tps_sngl_p___lck_stk

st_ins_use_meas_tps_sngl_p___lck_ftk

st_ins_use_meas_tps_sngl_p___alk_std

st_ins_use_meas_tps_sngl_p___alk_fst

st_ins_use_meas_tps_sngl_p___alk_stk

st_ins_use_meas_tps_sngl_p___alk_ftk

st_ins_use_meas_tps_sngl_s___mnl_std

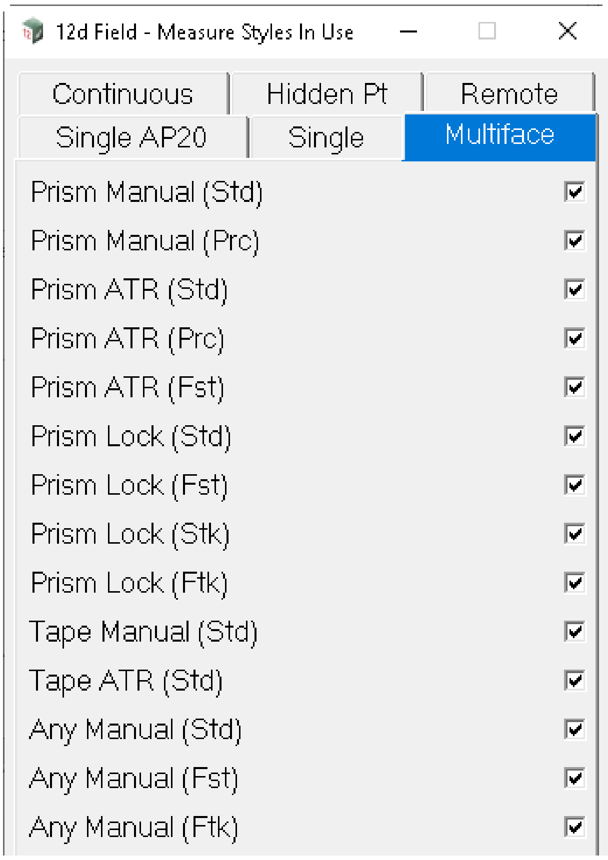
st_ins_use_meas_tps_sngl_s___atr_std

st_ins_use_meas_tps_sngl_n___mnl_std

st_ins_use_meas_tps_sngl_n___mnl_fst

st_ins_use_meas_tps_sngl_n___mnl_ftk

Multiface



Select the styles for use for multiface modes.

The attributes in order are

st_ins_use_meas_tps_mult_p___mnl_std

st_ins_use_meas_tps_mult_p___mnl_prc

st_ins_use_meas_tps_mult_p___atr_std

st_ins_use_meas_tps_mult_p___atr_prc

st_ins_use_meas_tps_mult_p___atr_fst

st_ins_use_meas_tps_mult_p___lck_std

st_ins_use_meas_tps_mult_p___lck_fst

st_ins_use_meas_tps_mult_p___lck_stk

st_ins_use_meas_tps_mult_p___lck_ftk

st_ins_use_meas_tps_mult_s___mnl_std

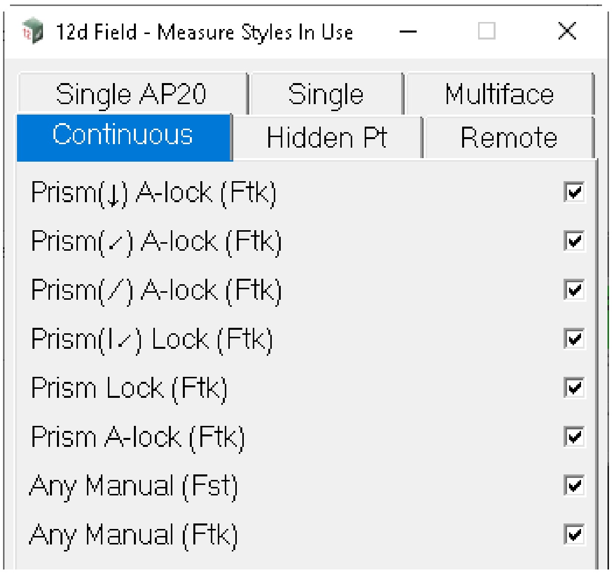
st_ins_use_meas_tps_mult_s___atr_std

st_ins_use_meas_tps_mult_n___mnl_std

st_ins_use_meas_tps_mult_n___mnl_fst

st_ins_use_meas_tps_mult_n___mnl_ftk

Continuous



Select the styles for use for continuous modes.

The attributes in order are

st_ins_use_meas_tps_cont_h___alk_ftk

st_ins_use_meas_tps_cont_ht__alk_ftk

st_ins_use_meas_tps_cont_t___alk_ftk

st_ins_use_meas_tps_cont_iht_lck_ftk

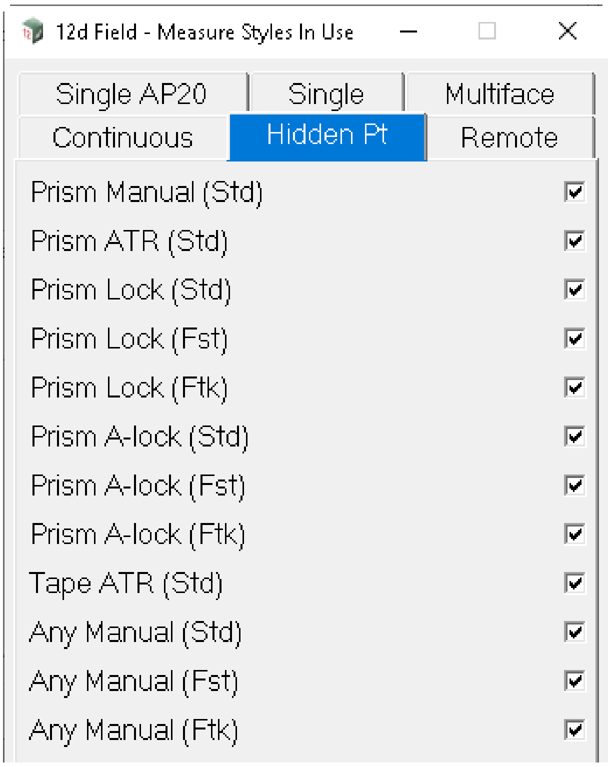
st_ins_use_meas_tps_cont_p___lck_ftk

st_ins_use_meas_tps_cont_p___alk_ftk

st_ins_use_meas_tps_cont_n___mnl_fst

st_ins_use_meas_tps_cont_n___mnl_ftk

Hidden Pt



Select the styles for use for hidden point modes.

The attributes in order are

st_ins_use_meas_tps_hpsp_p___mnl_std

st_ins_use_meas_tps_hpsp_p___atr_std

st_ins_use_meas_tps_hpsp_p___lck_std

st_ins_use_meas_tps_hpsp_p___lck_fst

st_ins_use_meas_tps_hpsp_p___lck_ftk

st_ins_use_meas_tps_hpsp_p___alk_std

st_ins_use_meas_tps_hpsp_p___alk_fst

st_ins_use_meas_tps_hpsp_p___alk_ftk

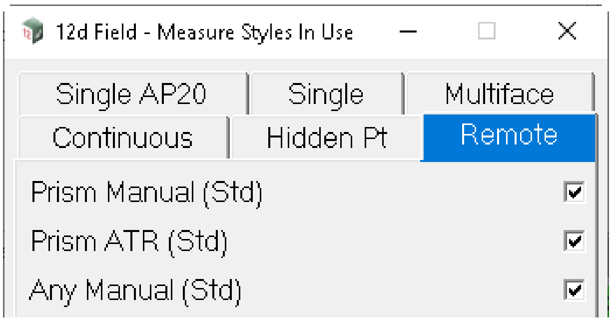
st_ins_use_meas_tps_hpsp_s___atr_std

st_ins_use_meas_tps_hpsp_n___mnl_std

st_ins_use_meas_tps_hpsp_n___mnl_fst

st_ins_use_meas_tps_hpsp_n___mnl_ftk

Remote



Remote

Select the styles for use for remote single modes.

The attributes in order are

st_ins_use_meas_tps_rsng_p___mnl_std

st_ins_use_meas_tps_rsng_p___atr_std

st_ins_use_meas_tps_rsng_n___mnl_std

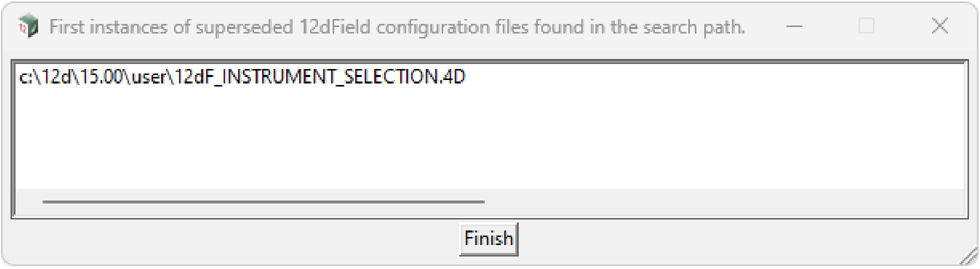
Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Continue to 15.6.2.3 Show old config files or return to 15.6.2 Configurations .

15.6.2.3 Show old config files

This option simply shows the user of a list of superseded configuration files present in their search paths.



These files are not removed automatically, it is up to the user to manually remove them.

Continue to 15.6.3 Station Setup - TPS or return to 15.6.2 Configurations .

15.6.3 Station Setup - TPS

Clicking on the **Station Setup** menu option brings up the **Station Setup** menu.

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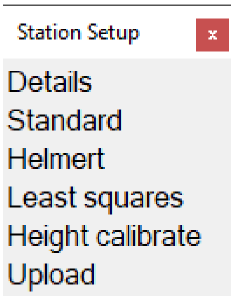


See
15.6.3.1 Station Details - TPS
15.6.3.2 Station Standard - TPS
15.6.3.3 Station Helmert - TPS
15.6.3.4 Station Least Squares Resection - TPS
15.6.3.5 Instrument Station Height Calculation - TPS
15.6.3.6 Station Upload - TPS

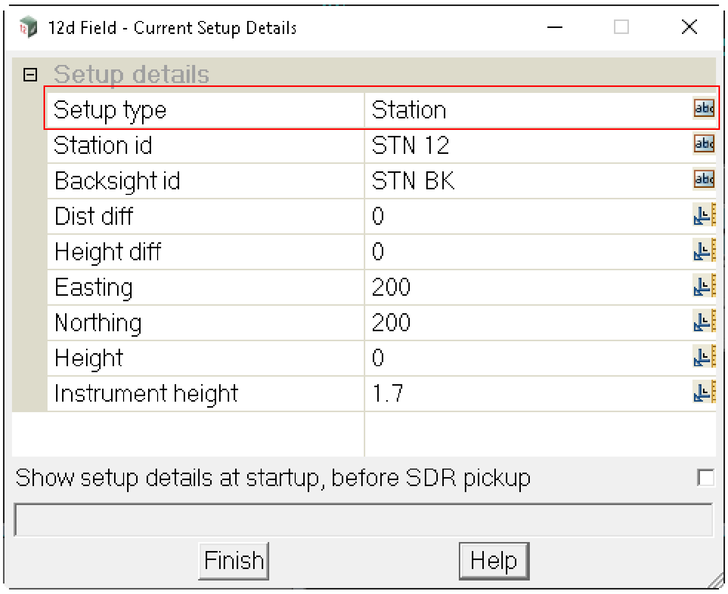
15.6.3.1 Station Details - TPS

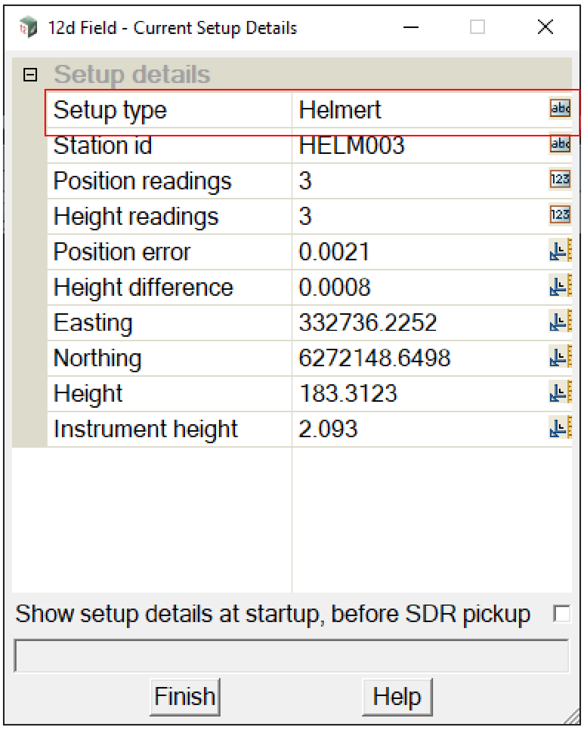
There are 3 basic TPS setup types available in ***12d Field,*** **standard**, **helmert** and **least squares**.

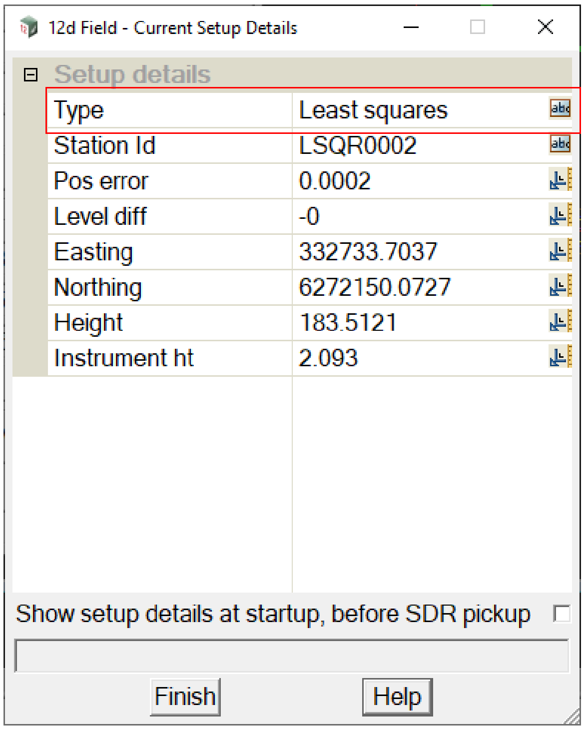
It is possible to also do a height calibration to alter the height of the current setup

Clicking on **Station Details** brings up the **12d Field - Current Setup Details** panel.

.







The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Type output

Station

Setup over a known point and sight to a backsight.

Station (Hgt Cal)

Same as station but height has been recalibrated to one or more points.

Helmert

A linearised resection with distance measurements to all points

Helmert (Hgt Cal)

*Same as **helmert** but height has been recalibrated to one or more points.*

Least squares

A resection allowing a combination of distance and angle only measurements.

Least squares (Hgt Cal)

*Same as **least squares** but height has been recalibrated to one or more points.*

Station id output

Name of the point that the TPS is set up on or the name of the newly resected point.

Backsight id output

***Station only**, the name of the point that the backsight was made to.*

Position readings output

***Resections only**, number of readings used to determine the xy position of the calculated point.*

Height readings output

***Resections only**, number of readings used to determine the position of the calculated point.*

Dist diff output

***Station only**, difference in distance measured to the backsight and the distance calculated from the coordinates of the instrument and the backsight.*

Position error output

***Resections only**, estimated positional error of the calculated point.*

Level diff output

***Station**: Difference in z-value measured to the backsight.*

***Resections**: maximum difference between all calculated z values.*

Easting, Northing, Height output

X/Y/Z coordinate of the instrument set up point.

Instrument height output

Height of the TPS at the instrument set up point.

Show setup details at start up, before SDR pickup tick box

*If **ticked**, the set up details are show at start up and when starting up SDR Pickup.*
*If **not ticked**, the set up details are NOT show at start up and when starting up SDR Pickup.*

Continue to 15.6.3.2 Station Standard - TPS or return to 15.6.3 Station Setup - TPS .

15.6.3.2 Station Standard - TPS

The **Station Standard** option is for setting up the instrument over a known point and for then doing a backsight measurement.

Clicking on **Station Standard** brings up the **12d Field - Point & Backsight Setup** panel.

.

Station tab
Backsight tab
Traverse tab
Meas tab
Params tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Station tab

Select pt	string select box		

Select a point to setup the TPS over.

After the point is selected, the Station id, Model for the selected point will be displayed in the **Station id** *and* **Model** *fields.*

Station id	text box		

Point id of the point to setup the TPS over.

Model	model box		available models

Model of the point to setup the TPS over.

Instrument ht	real box		

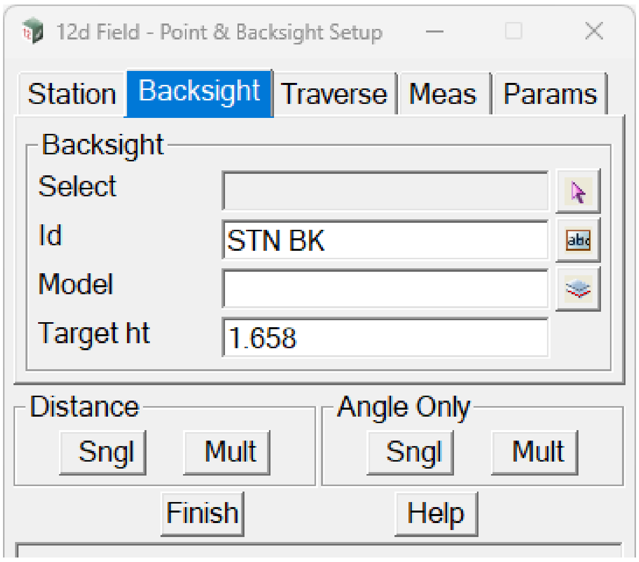
Height of the instrument. See 26.1.1.1 Total Stations - TPS.

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Backsight tab

.



[Station tab](#)
[Backsight tab](#)
[Traverse tab](#)
[Meas tab](#)
[Params tab](#)

Backsight

Select string select box

Select a point to measure to and uses as a ***Backsight****. See* Backsight - Bearing Datum Difference *.*

After the point is selected, the Station id and Model for the selected backsight point will be displayed in the **Station id** *and* **Model** *fields.*

Id text box

Point id of the backsight point.

Model model box available models

Model of the backsight point.

Target height real box

Note, when using an auto-height pole such as the Leica AP20 this value will be set to the current pole height on entering this panel and on taking a measurement.

Height of the target. See 26.1.1.1 Total Stations - TPS *.*

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields *.*

Traverse tab

This tab is used in conjunction with **SDR pickup** if the user is traversing while conducting the survey. The backsight is flagged as the next traverse point.

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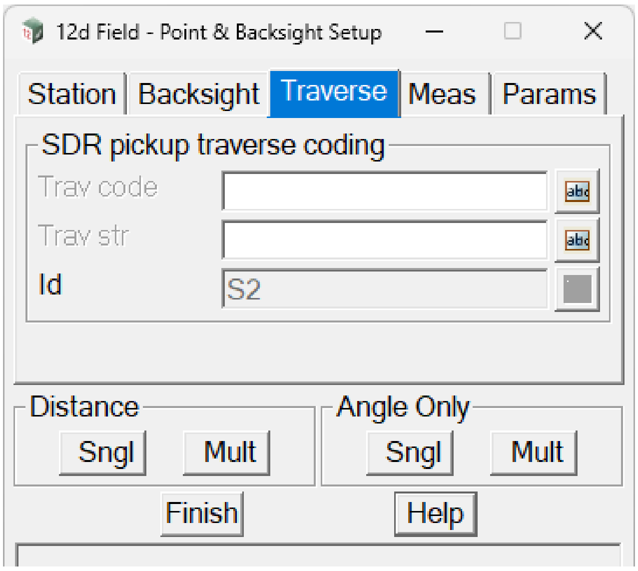


Station tab
Backsight tab
Traverse tab
Meas tab
Params tab

SDR pickup traverse coding

Trav code text box

This should match the code nominated in the SDR function as the traversing code.

Trav str text box

String name matching the current traverse leg.

Id text box

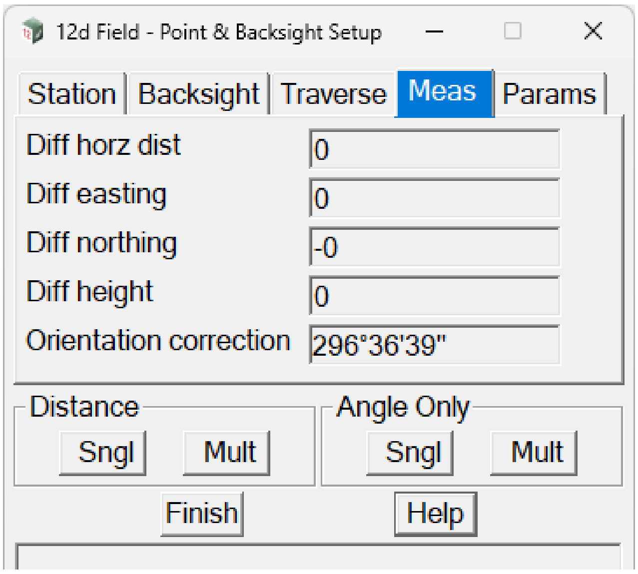
Informational only, this is the selected backsight id.

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Meas tab

.



[Station tab](#)
[Backsight tab](#)
[Traverse tab](#)
[Meas tab](#)
[Params tab](#)

Diff horz dist real box

Measured - calculated horizontal distance.

Diff easting real box

Measured - backsight easting.

Diff northing real box

Measured - backsight northing.

Diff height real box

Measured - backsight height.

Orientation correction real box

Information, no horizontal angle is uploaded to the instrument so a correction is necessary to correct the random pointing of the TPS into the true system. Note internally ***12d Field*** *works in angles, anticlockwise from east, not survey bearings.*

Measured - calculated horizontal angle.

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Params tab

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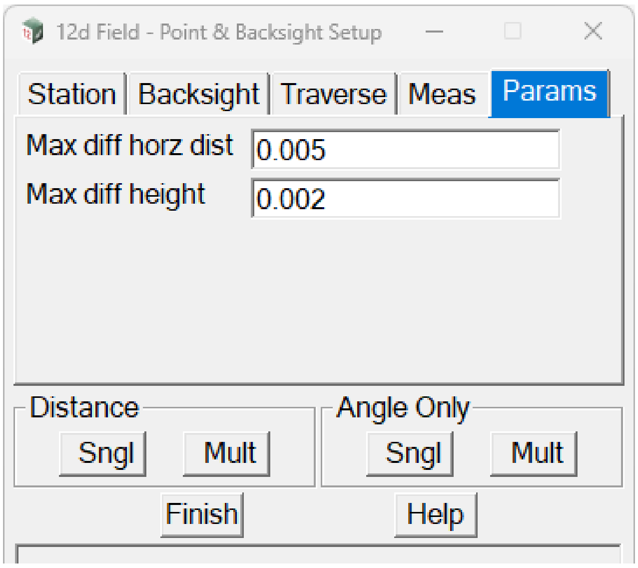

Station tab
Backsight tab
Traverse tab
Meas tab
Params tab

Max diff horz dist output

If the ***Diff horz dist*** *exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.*

Max diff height output

If the ***Diff height*** *exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.*

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Continue to 15.6.3.3 Station Helmert - TPS or return to 15.6.3 Station Setup - TPS .

15.6.3.3 Station Helmert - TPS

The **12d Field - Helmert Resection** panel can be used to establish a station setup by taking readings to up to 6 known points.

The horizontal position is obtained by a Helmert transformation; translation, rotation and uniform scaling of the readings.

The vertical position is obtained by meaning the z values of the readings, the z value is not weighted on distance measured.

Readings can be used for either horizontal position, vertical position or both.

Clicking **Station Helmert** brings up the **12d Field - Helmert Resection** panel.

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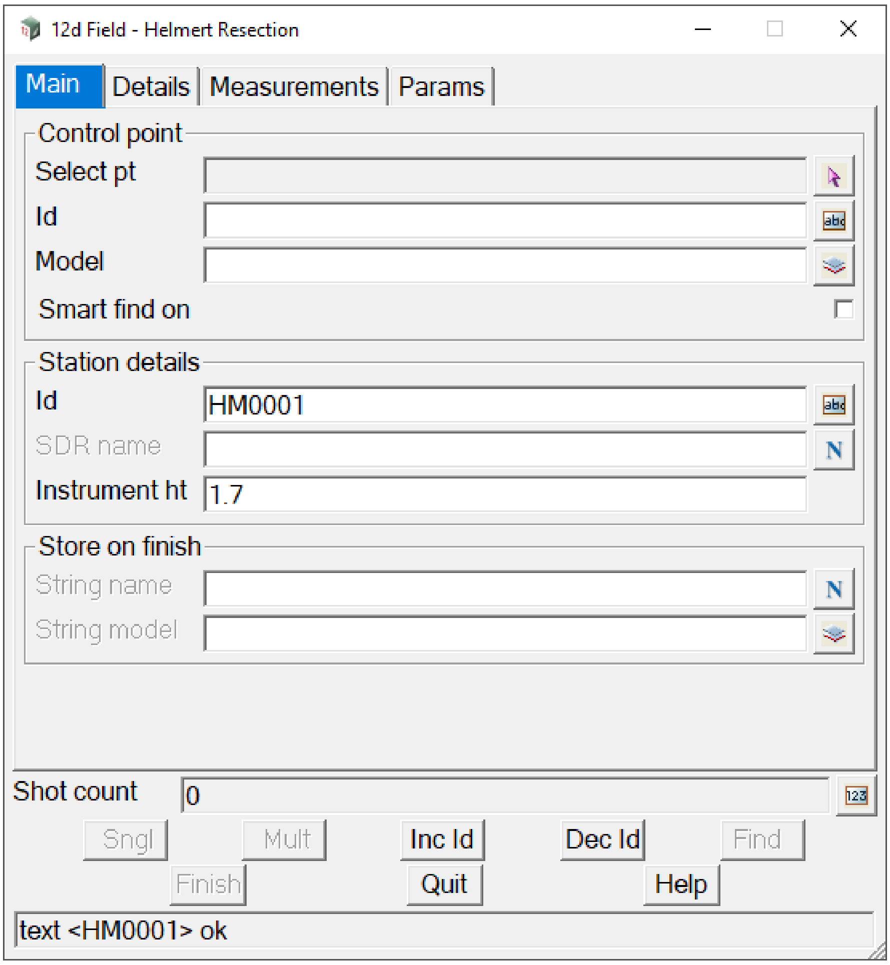

Main tab
Details tab
Measurements tab
Params tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Main tab

A point for use in the resection can either be picked from the screen or manually entered.

If picked from the screen the Id and Model boxes will be filled automatically.

If entered manually the Id must be unique in the point model.

*Note in 12d **Field** the Id always refers to the Vertex Id.*

Control point

Select pt string select box

Select a Control point for the resection.

After the point is selected, the Id and Model for the selected control point is displayed in the **Id** *and* **Model** *fields.*

Id text box

Point id of the control point.

***Warning**, for usage with typical **12dField Setout** options it is not necessary for the points to have ids. However, if the user selects a point without an id they will be given a once off warning the setup cannot be used with **SDR Pickup** which requires a unique id for each point in the control model.*

Model model box available models

Model of the control point.

Smart find on tick box not ticked

***Smart find** can automatically work out which control point is associated with each measurement without the user selecting a point or manually entering the id. This is particularly useful in difficult environments where the target is visible but difficult or physically impossible to identify. When smart find is activated only the **Model** field is active, all smart points must be in this one model. The helmert resection needs no initial reading before using smart find.*

***Warning**, smart find will not work with points without an id.*

Station details

*For typical engineering use the resected station is never stored as a physical point nor does it really need an **id** but this is enforced so when the resection is used inside SDR pickup it follows normal convention.*

Id text box

*Id to be used for the new resected point. This **id** is automatically incremented for the next resection setup.*

SDR name name box

The SDR name/feature code for a control point, this is only necessary when the resected point is used subsequently in a SDR reduction as a control point.

Instrument ht

Height difference of the TPS from the ground point.

Store on finish

*The **Store on finish** fields are for optional direct storage of the resected point as a vertex on a super string in a model, they are completely unrelated to use of the resected point consequently in SDR reductions.*

String name name box

Name of the super string the point is to be stored as a vertex on.

String model model box available models

Model for the resected point super string.

*If either the **String name** or **String model** field is blank a point will not be created.*

*If both the **String name** and **String model** fields are valid the resected point will be stored as a point on the super string with the vertex id of **Id**.*

Details tab

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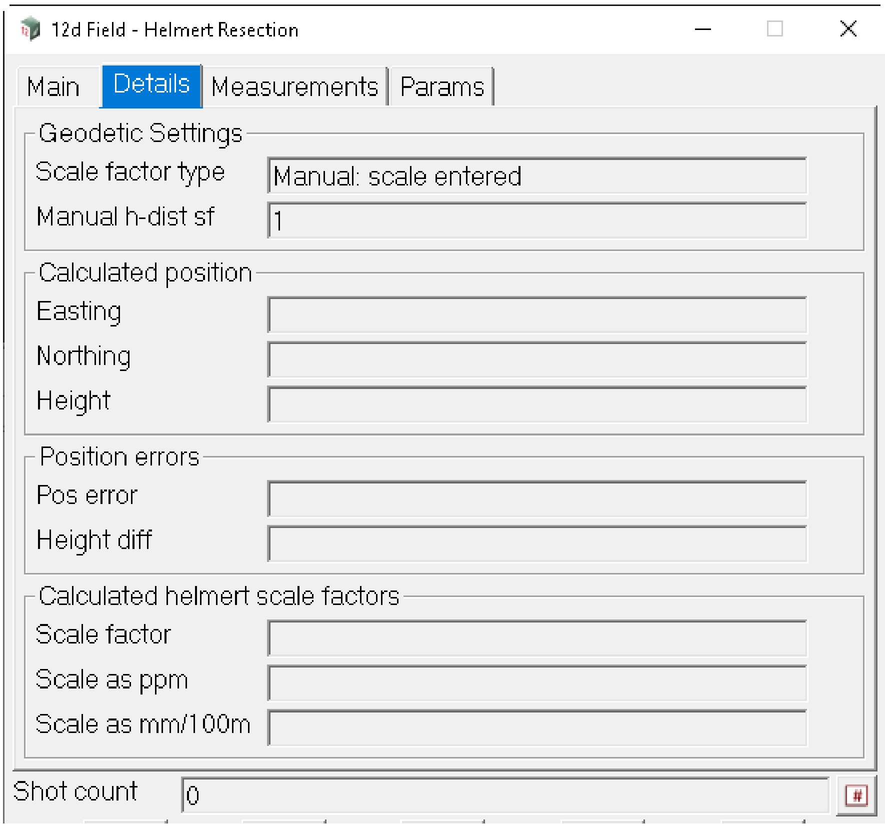

[Main tab](#)
[Details tab](#)
[Measurements tab](#)
[Params tab](#)

Geodetic Settings

Informational only, the geodetics in use for the current ***12d Field*** *sessions.*

Calculated position

Easting real box

Calculated easting of the resected point.

Northing real box

Calculated northing of the resected point.

Height real box

Calculated height of the resected point.

Position errors

Pos error

The position error is only available when 3+ measurements have been completed.
The estimated positional error of the resected point, the point should lie inside a circle of this diameter.

Height diff

The Height diff is only available when 2+ measurements have been completed.
Maximum difference between calculated heights of all measurements.

Calculated helmert scale factors

A helmert resection applies a uniform scaling to all measurement to get a best fit, the following field give the user an idea of the accuracy of the reading.

The geodetics scale factor has already been applied and is not reflected in this scale factor, this should be as close to ***1.0*** *as possible.*

Scale factor real box

Calculated scale factor applied to all reduced horizontal distances to get the best fit, e.g., 1.00011.

Scale as ppm integer box

Calculated scale factor expressed as ppm, e.g., 110.

Scale as mm/100m integer box

Calculated scale factor expressed as mm per 100m, e.g., 11.

Measurements tab

The measurements grid allows the user to view and manipulate the measurements so far taken for the resection.

A measurement can be completely removed from the resection by placing the focus in the row to be removed and clicking the delete icon, on the RHS.

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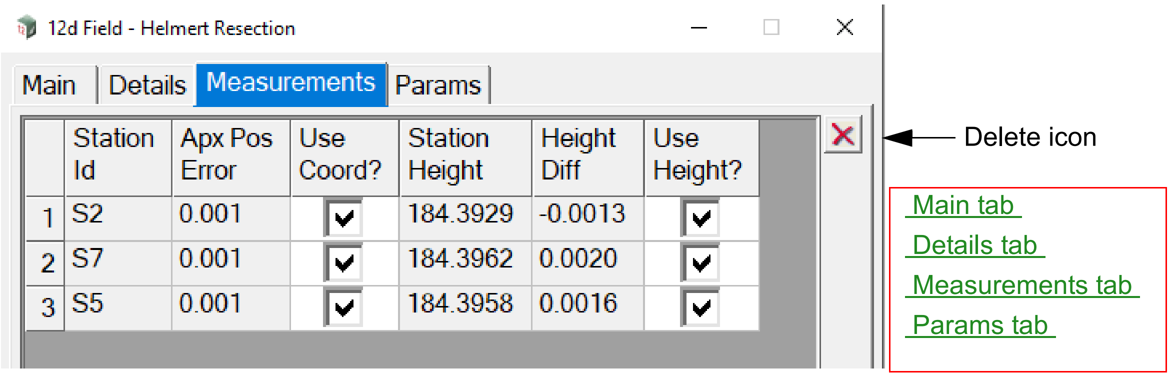


Grid

Station Id text column

Control point id of this measurement.

Apx Pos Error real column

Estimated error circle for this measurement, a larger error here generally, but not necessarily means this measurement has some sort of error.

Use Coord? tick column

The user can tick on or off the usage of this xy measurement in the resection, the resection will be recalculated and xy residuals updated on changing the tick status of this box.

Station Height real column

Calculated height from this control point.

Height Diff real column

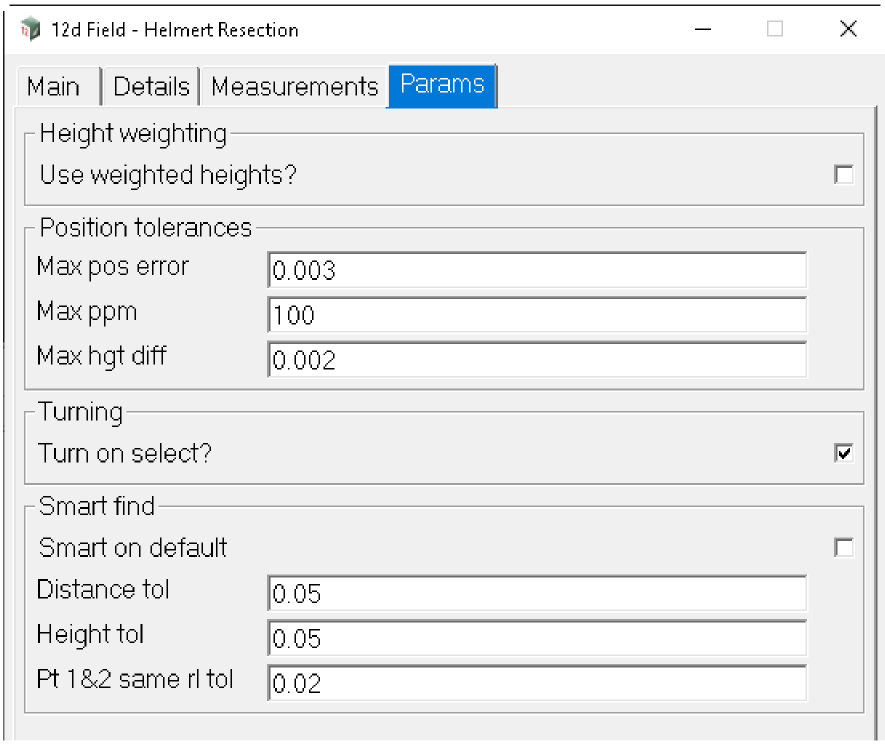
Height difference from the mean of all heights for this measurement, a larger difference here generally, but not necessarily means this measurement has some sort of height error.

Use Height? tick column

The user can tick on or off the usage of this height measurement in the resection, the resection will be recalculated and height residuals updated on changing the tick status of this box.

Params tab

.



Main tab
Details tab
Measurements tab
Params tab

Height weighting

Use weighted heights? tick box not ticked

*If **ticked**, the calculation of the mean height is biased towards the closest measurement. Height only measurements will be given the same bias as the closest measurement.*

*If **not ticked**, the mean height is not biased toward the closest measurements and simply the average of the calculated setup heights.*

Position tolerances

Max pos error real box

If the position error exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Max ppm real box

If the calculated helmert ppm exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Max hgt diff real box

If the maximum height difference exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Turning

Turn on select? tick box ticked

*If **ticked**, and a helmert position has been established, (2 or more measurements) then the TPS will automatically turn to the next selected control point.*
*If **not ticked**, the TPS will not automatically turn to the next selected control point.*

Smart find

*For **smart find** to work it needs tolerances as it tries to find matching points in the control model for the measurements taken. These tolerances should be as small as possible, especially for large control models as multiple pairs of points could match the current readings.*

If possible if the 1st reading in the resection is to a known control point then the chances of following smart find reading finding an incorrect match is greatly reduced.

Smart on default tick column

*If **ticked**, on opening the helmert panel **smart find** is active.*
*If **not ticked**, on opening the helmert panel **smart find** is inactive.*

Distance tol real box

For a control point to be accepted as a smart find candidate the distance and height difference to it from the estimated resection point must fall within both of these tolerances.

Height tol real box

Height difference tolerance for a smart find candidate.

Pt 1&2 same rl tol real box

When smart find is used to locate the 1st 2 control points in a resection there are always 2 solutions which can only be determined by the best height differences, if the height differences are less than this value a warning message will be displayed that the current solution might be 'flipped'.

Buttons at Bottom

SNGL button

Take a single distance measurement dependent on the current TPS measurement settings.

MULT button

Take a multiface distance measurement dependent on the current TPS measurement settings.

INC ID button

Increment the point ID E.g. BOLT30 -> BOLT31

DEC ID button

Decrement the point ID E.g. BOLT31 -> BOLT30

Find button

This button can be used to locate a control point by displaying a bearing and distance from the current target location to the newly selected control point. It will take a measurement using the last type used, SNGL or MULT and display the direction and distance in the panel message box.

Continue to 15.6.3.4 Station Least Squares Resection - TPS or return to 15.6.3 Station Setup - TPS
.

15.6.3.4 Station Least Squares Resection - TPS

The **12d Field - Least Squares Resection** panel can be used to establish a station setup by taking distance and angle only readings to up to 6 known points.

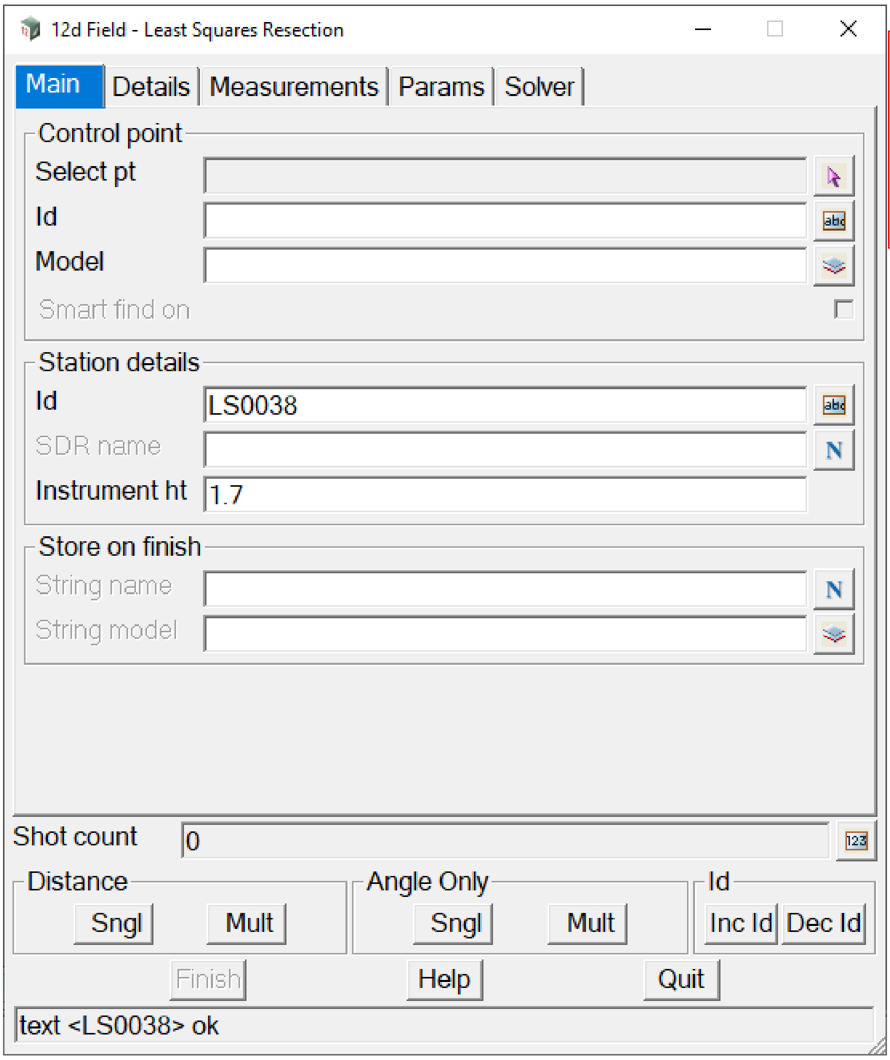
The horizontal position is obtained by a least squares calculation; the iterative calculation finds the best coordinate of the resection point to match the measurements. Least squares does not support the calculation of the orientation correction needed to swing unadjusted bearing from the TPS into the local system, this is a separate calculation.

The vertical position is obtained by meaning the z values of the readings, the z value is not weighted on distance measured.

Readings can be used for either horizontal position, vertical position or both.

Clicking **Station Least Squares** brings up the **12d Field - Least Squares Resection** panel.

.



Main tab
Details tab
Measurements tab
Params tab
Solver tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Main tab

Control point

Select pt string select box

Select a Control point for the resection.

After the point is selected, the Id and Model for the selected control point is displayed in the **Id** *and* **Model** *fields.*

Id text box

Point id of the control point.

***Warning**, for usage with typical **12dField Setout** options it is not necessary for the points to have ids. However, if the user selects a point without an id they will be given a once off warning the setup cannot be used with **SDR Pickup** which requires a unique id for each point in the control model.*

Model model box available models

Model of the control point.

Smart find on tick box not ticked

***Smart find** can automatically work out which control point is associated with each measurement without the user selecting a point or manually entering the id. This is particularly useful in difficult environments where the target is visible but difficult or physically impossible to identify. When smart find is activated only the **Model** field is active, all smart points must be in this one model. The least squares resection needs an initial reading to a known point before using smart find.*

***Warning**, smart find will not work with points without an id.*

Station details

*For typical engineering use the resected station is never stored as a physical point nor does it really need an **id** but this is enforced so when the resection is used inside SDR pickup it follows normal convention.*

Id text box

*Id to be used for the new resected point. This **id** is automatically incremented for the next resection setup.*

SDR name name box

The SDR name/feature code for a control point, this is only necessary when the resected point is used subsequently in a SDR reduction as a control point.

Instrument ht

Height difference of the TPS from the ground point.

Store on finish

*The **Store on finish** fields are for optional direct storage of the resected point as a vertex on a super string in a model, they are completely unrelated to use of the resected point consequently in SDR reductions.*

String name name box

Name of the super string the point is to be stored as a vertex on.

String model model box available models

Model for the resected point super string.

*If either the **String name** or **String model** field is blank a point will not be created.*

*If both the **String name** and **String model** fields are valid the resected point will be stored as a point on the super string with the vertex id of **Id**.*

Details tab

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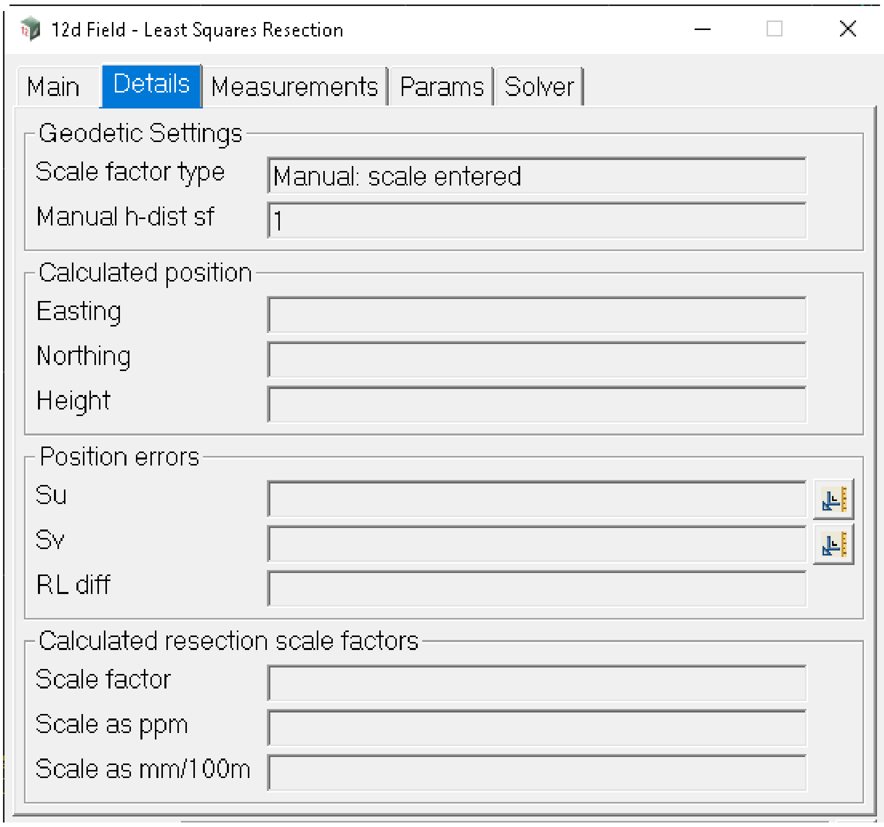


Main tab
Details tab
Measurements tab
Params tab
Solver tab

Geodetic Settings

Informational only, the geodetics in use for the current 12dField sessions.

Calculated position

Easting real box

Calculated easting of the resected point.

Northing real box

Calculated northing of the resected point.

Height real box

Calculated height of the resected point.

Position errors

The least squares resection will give an error ellipse as opposed to the circle of the helmert resection, the closer the ellipse is to a circle the better conditioned the least squares result.

Su

Major axis of the positional error of the resected point.

Sv

Major axis of the positional error of the resected point.

RL diff

Maximum difference between calculated heights of all measurements.

Calculated helmert scale factors

A least squares resection applies non uniform scaling to all measurements to get a best fit, the following *fields try give the user an idea of the accuracy of the readings.*

*The geodetics scale factor has already been applied and is not reflected in this scale factor, this should be as close to **1.0** as possible.*

Scale factor real box

Calculated meaned scale factor from all reduced horizontal distances to get the best fit, e.g., 1.00011.

Scale as ppm integer box

Calculated meaned scale factor expressed as ppm, e.g., 110.

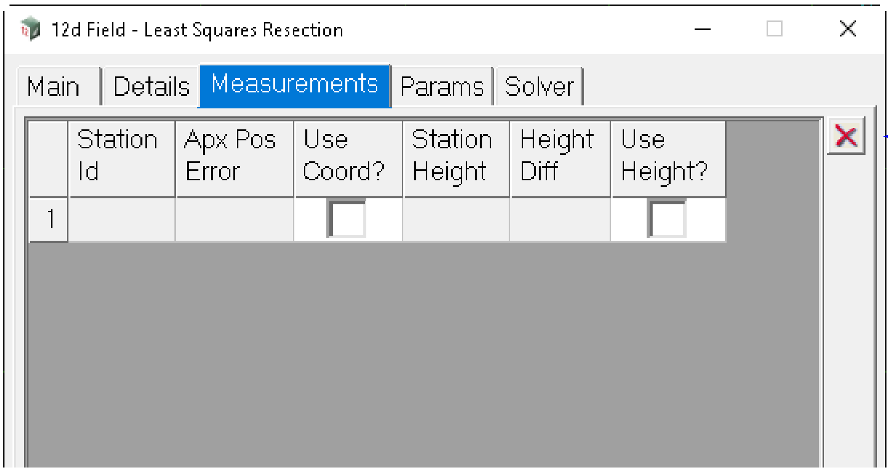
Scale as mm/100m integer box

Calculated meaned scale factor expressed as mm per 100m, e.g., 11.

Measurements tab

The measurements grid allows the user to view and manipulate the measurements so far taken for the resection.

A measurement can be completely removed from the resection by placing the focus in the row to be removed and clicking the delete icon, on the RHS.



Delete icon

Main tab
Details tab
Measurements tab
Params tab
Solver tab

Grid

Station Id text column

Control point id of this measurement.

Apx Pos Error real column

The estimated error circle for this measurement, a larger error here generally, but not necessarily means this measurement has some sort of error.

Use Coord? tick column

The user can tick on or off the usage of this xy measurement in the resection, the resection will be recalculated and xy residuals updated on changing the tick status of this box.

Station Height real column

Calculated height from this control point.

Height Diff real column

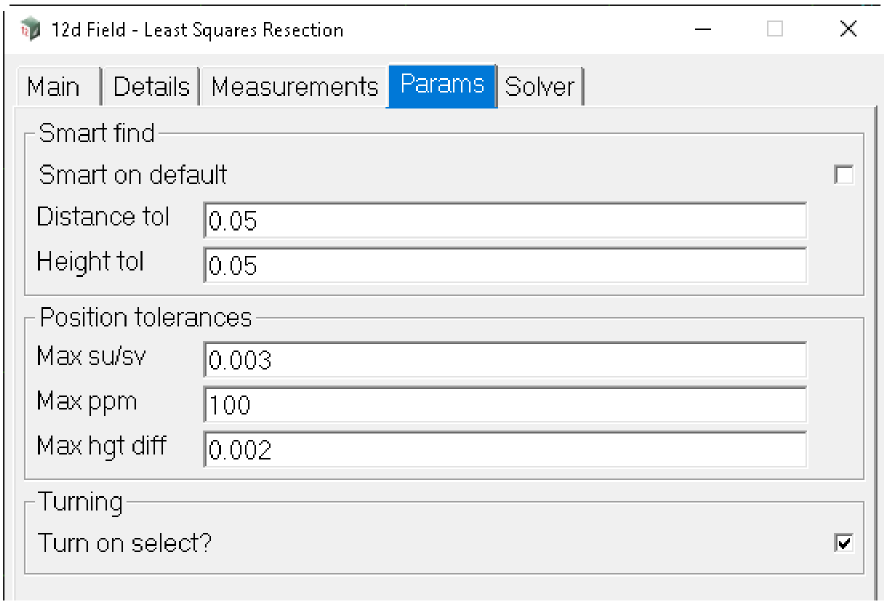
Height difference from the mean of all heights for this measurement, a larger difference here generally, but not necessarily means this measurement has some sort of height error.

Use Height? tick column

The user can tick on or off the usage of this height measurement in the resection, the resection will be recalculated and height residuals updated on changing the tick status of this box.

Params tab

.



[Main tab](#)
[Details tab](#)
[Measurements tab](#)
[Params tab](#)
[Solver tab](#)

Smart find tolerances

*For **smart find** to work it needs tolerances as it tries to find matching points in the control model for the measurements taken. These tolerances should be as small as possible, especially for large control models as multiple pairs of points could match the current readings.*

If possible if the 1st reading in the resection is to a known control point then the chances of following smart find reading finding an incorrect match is greatly reduced.

Smart on default? tick box

*If **ticked**, on opening the helmert panel **smart find** is active.*
*If **not ticked**, on opening the helmert panel **smart find** is inactive.*

Distance and Height tols

For a control point to be accepted as a smart find candidate the distance and height difference to it from the estimated resection point must fall within both of these tolerances.

Distance tol real box

Horizontal distance tolerance for a smart find candidate.

Height tol real box

Height difference tolerance for a smart find candidate.

Position tolerances

Max sj/sv real box

If the RMS of the su&sv errors exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Max ppm real box

If the calculated resection ppm exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Max hgt diff real box

If the maximum height difference exceeds this value on exiting the setup a warning message will be displayed the setup is out of tolerance.

Turning

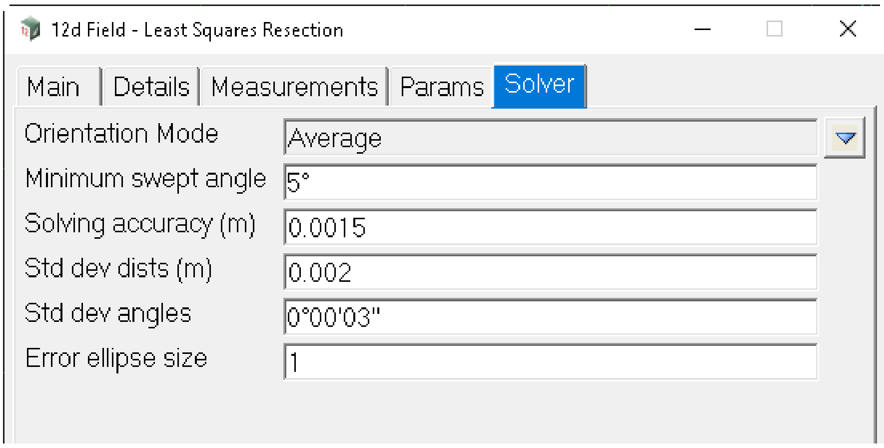
Turn on select? tick box

*If **ticked**, and a helmert position has been established, (2 or more measurements) then the TPS will automatically turn to the next selected control point.*

*If **not ticked**, the TPS will not automatically turn to the next selected control point.*

Solver tab

.



Main tab
Details tab
Measurements tab
Params tab
Solver tab

Orientation mode choice box Average, Longest

A least squares resection calculates the best position, unlike a helmert resection it has no concept of a general orientation correction to be applied to every TPS reading.

*If **Average**, Use the means of measurements to all control points for the orientation correction.*

*If **Longest**, Use the measurement to the furthest control point to calculate the orientation correction.*

Minimum swept angle real box

Least squares resections should not contain swept angles near to 0 or 180°, enter a value here to automatically values less than this from the calculations.

Solving accuracy (m) real box

Enter the accuracy desired for the calculations, once better than this value the calculations will stop, if this cannot be achieved an error is shown.

Std dev dists (m) real box

Enter the nominal standard deviation of the TPS distance in metres, e.g., 0.002.

Std dev angles real box

Enter the nominal standard deviation of the TPS angle measurements, e.g., 3".

Error ellipse size real box

Enter the size of the error ellipse to be display on screen.

Buttons at Bottom

SNGL button

Take a single distance measurement dependent on the current TPS measurement settings.

MULT button

Take a multiface distance measurement dependent on the current TPS measurement settings.

INC ID button

Increment the point ID E.g. BOLT30 -> BOLT31

DEC ID button

Decrement the point ID E.g. BOLT31 -> BOLT30

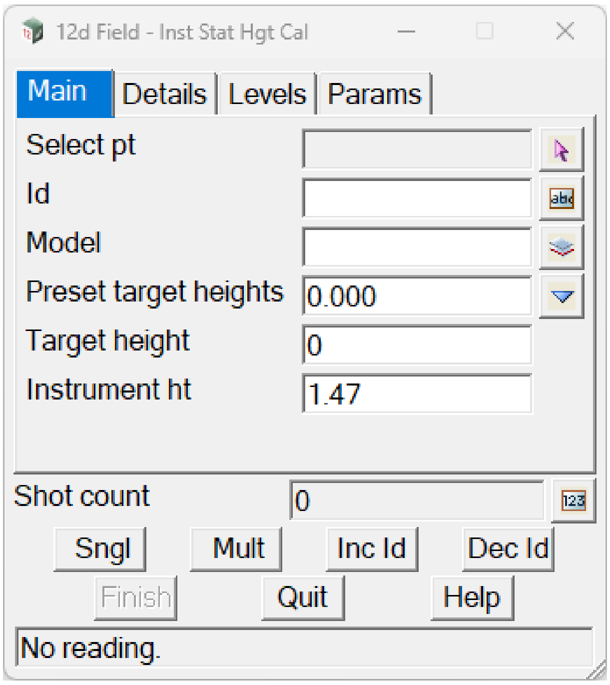
Continue to 15.6.3.5 Instrument Station Height Calculation - TPS or return to 15.6.3 Station Setup - TPS .

15.6.3.5 Instrument Station Height Calculation - TPS

The **Station Height Cal** option measures to one or more known points to refine the height of the current setup.This routine will replace the current instrument station height, attribute "su_is_z" with the one calculated here, the old instrument station height will be available via the attribute "su_is_z_orig".

Clicking **Station Height Cal** brings up the **12d Field - Inst Stat Hgt Cal** panel.

.



Main tab
Details tab
Levels tab
Params tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

Quit button

Exit the panel and do not update the station height.

For more information on the standard buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Main tab

Select pt string select box

*Select the point to calibrate the instrument height to, the **Id** and **Model** boxes will be populated from this select.*

Id text box

The point id of the calibration point.

Attribute "su_hm_id"

Model model box

The model of the calibration point.

Attribute "su_hm_pnt_eler"

Preset target heights choice box list of preset target

Select a target height from the pop-up list. The selected target height is piped into the Target height field.

Target height real box

Height of the target.

Attribute" st_is_th"

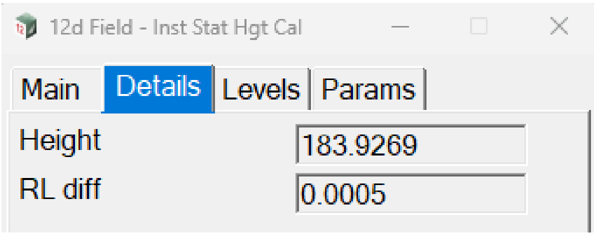
Instrument height real box

Height of the TPS at the setup point.

Attribute" st_is_hi"

Details tab

.



Main tab
Details tab
Levels tab
Params tab

Height real box

The meaned height of the instrument station from all reading.

Attribute "su_is_z"

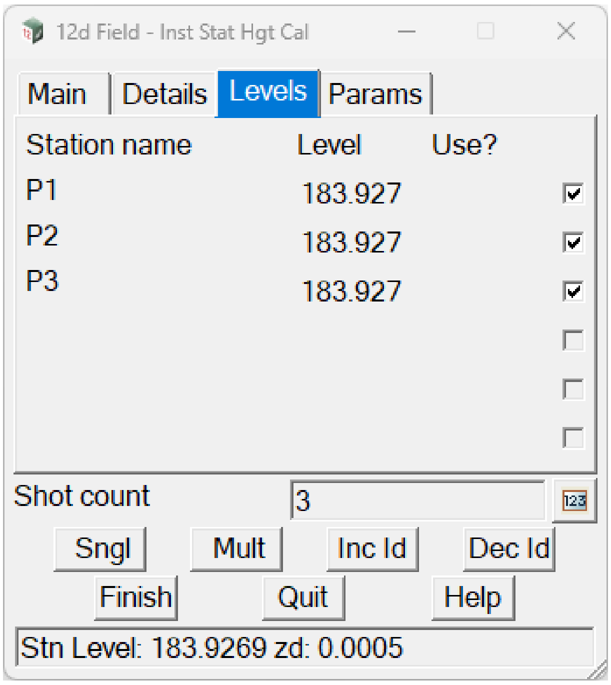
RL diff real box

The maximum difference in height of the instrument station from all reading.

Attribute "su_is_max_zdf"

Levels tab

.



Main tab
Details tab
Levels tab
Params tab

Station name text box

The column shows the point id of the individual calibration point.

Level real box

The column shows the calculated height of the instrument station from the individual calibration point.

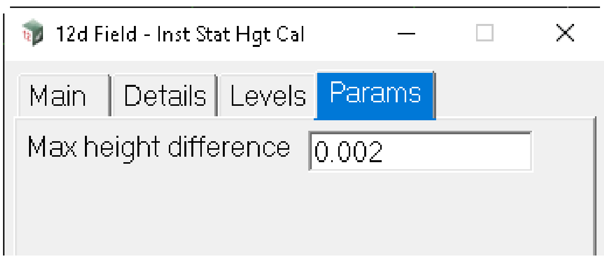
Use tick box

*If **ticked**, use this calibration point in the height calculation.*

*If **not ticked**, exclude this calibration point from the height calculation.*

Params tab

.



Main tab
Details tab
Levels tab
Params tab

Max height difference real box

*If the **RL Diff** exceeds this value when finishing the panel the user will be prompted to confirm to use the new station height.*

*If the **RL Diff** is less than this value the panel will close with no confirmation prompts.*

Attribute "su_is_max_zdf"

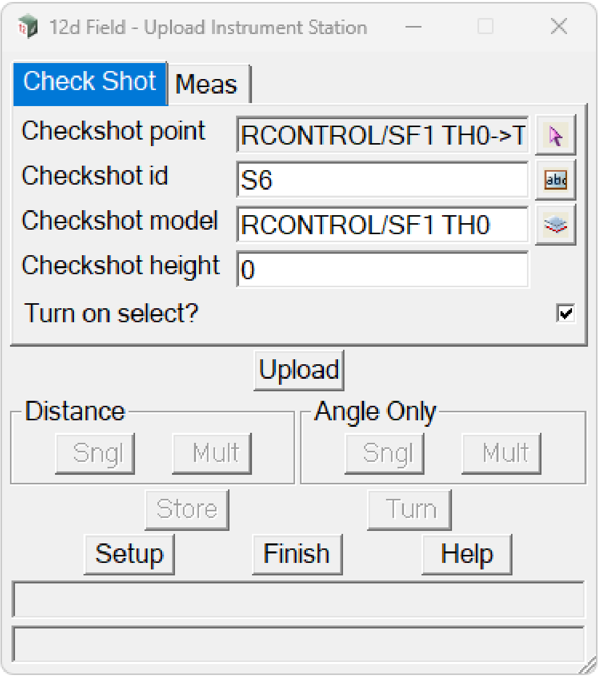
15.6.3.6 Station Upload - TPS

On instruments that support this type of upload the **Station Upload** panel uploads the easting, northing and level of the current ***12d Field*** instrument setup to the **TPS** and sets the orientation on the **TPS** so it is displaying true bearings. This is necessary for scanning and is done automatically in this case, this panel allows the user to manually perform this procedure.

Once a setup is uploaded to the **TPS** a checkshot can be taken from this panel.

Clicking **Station Upload** brings up the **12d Field -**panel.

.



Check shot tab
Meas tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Check shot tab

Checkshot point string select box

Select the point to take a checkshot to.

Checkshot id text box

Id of the checkshot point.

Checkshot model model box available models

Model of the checkshot point.

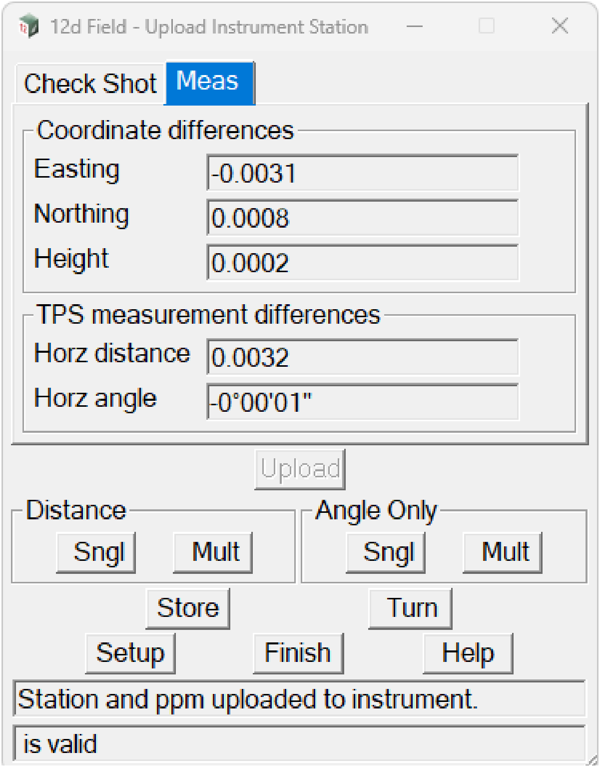
Checkshot height real box

Height of the checkshot point.

Turn on select? tick box ticked

*If **ticked**, and a valid Checkshot height is entered on selecting the checkshot point the instrument will turn* *both horizontally and vertically to the point.*

Meas tab



Check shot tab
Meas tab

Coordinate differences

Easting/Northing/Height real box

Difference between the easting/northing/height calculated from the measurement to the checkshot point and the actual easting/northing/height of the checkshot point.

TPS measurement differences

Horz distance real box

Difference in horizontal distance of the measurement to the checkshot point and the horizontal distance calculated from the coordinates of the instrument set up point to the checkshot point.

Horz angle real box

Difference in horizontal angle of the measurement to the checkshot point and the horizontal angle calculated from the coordinates of the instrument set up point to the checkshot point.

Buttons

Upload button

*Upload the current setup coordinates and orientation to the **TPS** instrument, once uploaded the button is disabled.*

Store button

*If **SDR Pickup** is **running** the appropriate checkshot opcodes are written to the SDR function.*

*For non **SDR Pickup** panels the checkshot is written directly as opcodes to the backup .FLD file and stored as vertex attributes under **12dField/Check Shot** for all subsequent measurements. For each instrument setup up to 6 check shots are remembered and stored as vertex attributes.*

Turn button

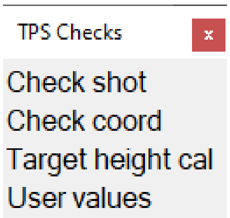
Turn the instrument both horizontally and vertically to the checkshot point.

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

15.6.4 Checks - TPS

Clicking on the **Checks** menu option brings up the **TPS Checks** menu.

.



See

15.6.4.1 Check Shot - TPS

15.6.4.2 Check Coord - TPS

15.6.4.3 Check Target Height Calibrate - TPS

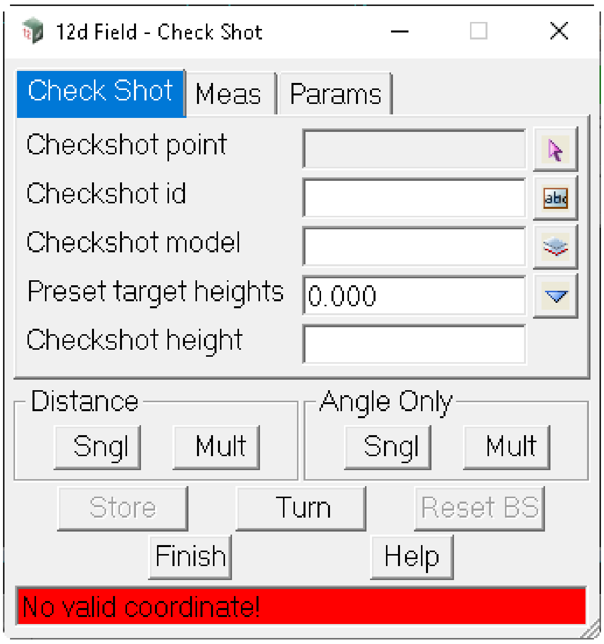
15.6.4.4 Check User Values - TPS

15.6.4.1 Check Shot - TPS

The **Check Shot** option performs a check measurement for delta angles and distances to a known point.

Clicking **Check Shot** brings up the **12d Field -**panel.

.



Check Shot tab
Meas tab
Params tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Check Shot tab

Checkshot point string select box

Select the point to take a checkshot to.

Checkshot id text box

Id of the selected checkshot point.

Checkshot model model box available models

Model of the selected checkshot point.

Preset target heights choice box list of preset target heights

Select a target height from the pop-up list. The selected target height is piped into the **Checkshot height** *field.*

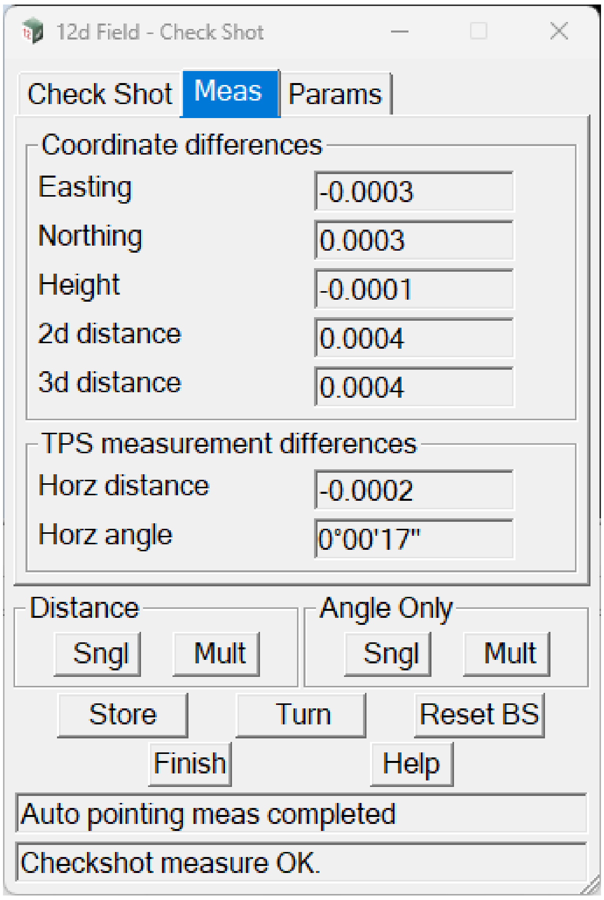
Checkshot height real box

Height of the target at the checkshot point.

Note, when using an auto-height pole such as the Leica AP20 this value will be set to the current pole height on entering this panel and on taking a measurement.

Meas tab

.



Check Shot tab
Meas tab
Params tab

Coordinate differences

Easting/Northing/Height real box

Difference between the easting/northing/height calculated from the measurement to the checkshot point and the actual easting/northing/height of the checkshot point.

2d distance real box

The horizontal distance from the coordinates of the checkshot measurement to the actual checkshot point.

3d distance real box

The 3D distance from the coordinates of the checkshot measurement to the actual checkshot point.

TPS measurement differences

Horz distance real box

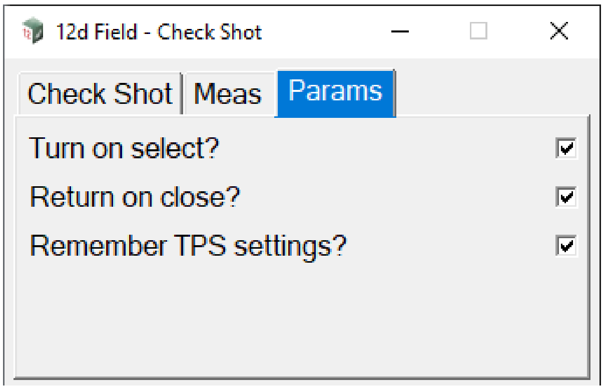
Difference in horizontal distance of the measurement to the checkshot point and the horizontal distance calculated from the coordinates of the instrument set up point to the checkshot point.

Horz angle real box

Difference in horizontal angle of the measurement to the checkshot point and the horizontal angle calculated from the coordinates of the instrument set up point to the checkshot point.

Params tab

.



Check Shot tab
Meas tab
Params tab

Turn on select? tick box

*If **ticked**, and a valid Checkshot height is entered on selecting the checkshot point the instrument will turn both horizontally and vertically to the point.*

Return on close? tick box

*If **ticked**, when the Check Shot panel is closed the instrument will return turn both horizontally and vertically to where it was pointed before the panel opened.*

Remember TPS settings? tick box

*If **ticked**, when the Check Shot panel is opened and the TPS measurement settings/style are subsequently changed from what they were before these new settings are remembered and used the next time the panel is opened. On closing the settings will also be changed back to be the settings before the panel was opened.*

This means if the survey is being conducted in a robotic mode but the checkshot is to a fixed target the user does not have to manually change settings again once the correct settings for the checkshot have been entered.

Buttons

STORE button

*If **SDR Pickup** is **running** the appropriate checkshot opcodes are written to the SDR function.*

*For non **SDR Pickup** panels the checkshot is written directly as opcodes to the backup .FLD file and stored as vertex attributes under **12dField/Check Shot** for all subsequent measurements. For each instrument setup up to 6 check shots are remembered and stored as vertex attributes.*

TURN button

Turn the instrument both horizontally and vertically to the checkshot point.

RESET BS button

*Internal angle swing attribute (su_is_ori_corr) is reset to match the reading to the backsight. If **SDR pickup** is running then all of the appropriate op-codes for backsight coords, id and height are written to the SDR function.*

Note this button can be used with all setup types, Standard, Helmert and Least Squares resections.

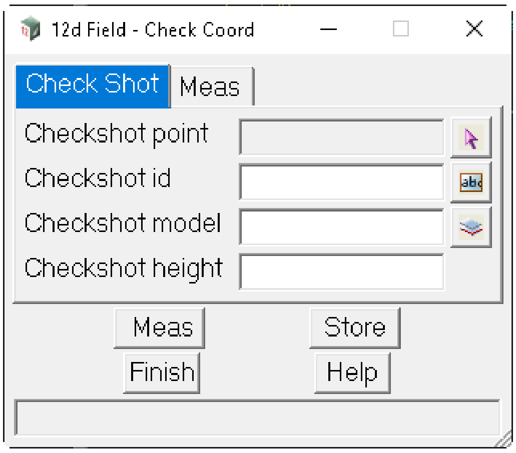
Continue to 15.6.4.2 Check Coord - TPS or go back to 15.6.4 Checks - TPS .

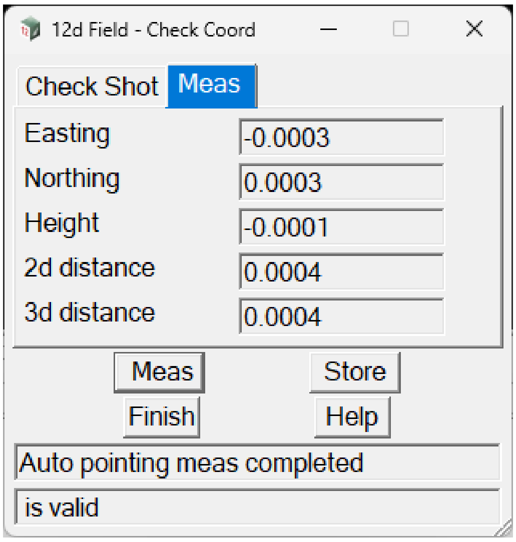
15.6.4.2 Check Coord - TPS

The **Check Coord** option performs a check measurement for delta coordinates to a known point, this is primarily intended as a GNSS option.

Clicking **Check Coord** brings up the **12d Field -**panel.

.





The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Check Shot tab

Checkshot point   string select box

Select the point to take a checkshot to.

Checkshot id   text box

Name of the checkshot point.

Checkshot model   model box   available models

Model of the checkshot point.

Checkshot height   real box

Height of the target at the checkshot point.

Note, when using an auto-height pole such as the Leica AP20 this value will be set to the current pole height on entering this panel and on taking a measurement.

Meas tab

Easting/Northing/Height   real box

Difference between the easting/northing/height calculated from the measurement to the checkshot point and the actual easting/northing/height of the checkshot point.

2d distance   real box

The horizontal distance from the coordinates of the checkshot measurement to the actual checkshot point.

3d distance   real box

The 3D distance from the coordinates of the checkshot measurement to the actual checkshot point.

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

STORE **button**

*If **SDR Pickup** is **running** all of the appropriate check coord opcodes are written to the SDR function.*

*If **SDR Pickup** is **not running** the similar check coord codes are written the 12dField backup.FLD file.*

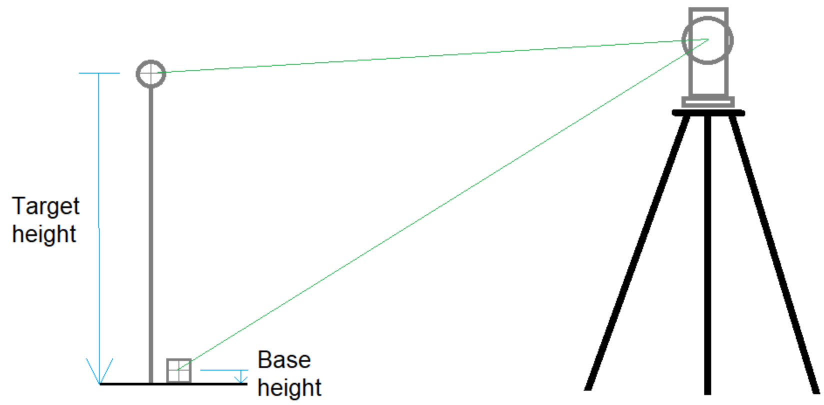
12dField setout stores up to 6 sets of vertex check coord attributes, i.e., each instance of a setout panel, (or Basic Pickup and any other non SDR panel) can open and use the check coord panel 6 times, this is an automatic process.

Continue to 15.6.4.3 Check Target Height Calibrate - TPS or go back to 15.6.4 Checks - TPS .

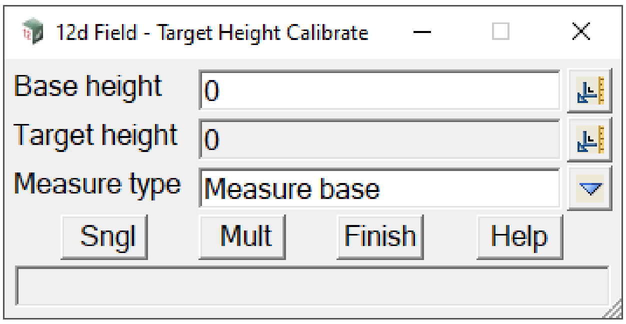
15.6.4.3 Check Target Height Calibrate - TPS

The **Check Target Height Cal** option is a routine to calibrate heights of target poles. All poles will suffer eventually from tip wear and tear, if mixing readings to fixed 0.0 height tape or any surface targets with reading to prisms on poles it is necessary to accurately calibrate the height of each pole.

This simple panel allows the user to measure an accurately defined base height. For example, this could be an any surface measurement to a flat smooth surface with a zero height or to a tape target glued to a block with a precise small target height. After that the user can measure to targets at the same point and be shown their precise actual height.



Clicking **Check Target Height Cal** brings up the **12d Field - Target Height Calibrate** panel.
.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Base height	measures box		

Enter the height of the target to be used as the base measurement.

Field Description	Type	Defaults	Pop-Up
Target height	measures box		

Calculated height of the current pole and prism.

Field Description	Type	Defaults	Pop-Up
Measure type	choice box		Measure base. Measure target

Measure base *- take a measurement to establish the basis height for the calibration.*

Measure target *- take a measurement to determine the height of a pole and prism combination after the base height has been established.*

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

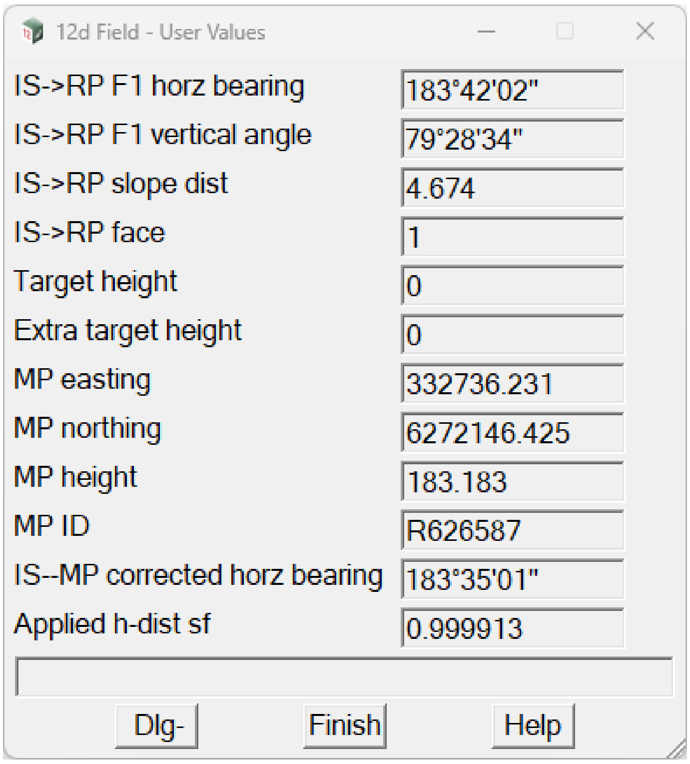
Continue to 15.6.4.4 Check User Values - TPS or go back to 15.6.4 Checks - TPS .

15.6.4.4 Check User Values - TPS

The **Check User Values** option is a user defined panel for displaying values of various attributes.

Clicking **Check User values** brings up the **12d Field - User Values** panel.

.

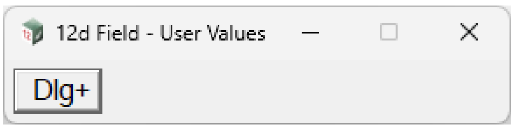


The contents of this panel are user configurable, only a typical TPS configuration is shown in the above image, for all of the available attributes that can be added to the panel see 15.8.4.2 12dF_USER_VALUES_PANEL_CONFIG.4D file format.

Button at bottom

Dig- button

Transforms the panel to a minimised state which can be restored to full size via the subsequent **Dlg+** *button.*



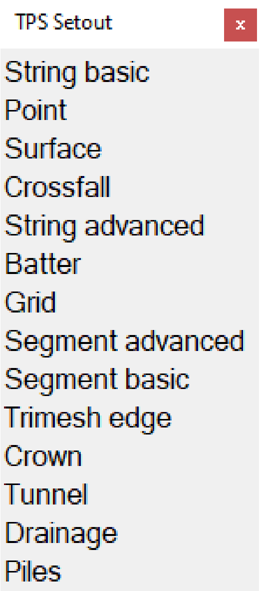
Continue to 15.6.5 Setout or go back to 15.6.4 Checks - TPS.

15.6.5 Setout

Clicking on the **Setout** menu option brings up the **Setout** menu.

.

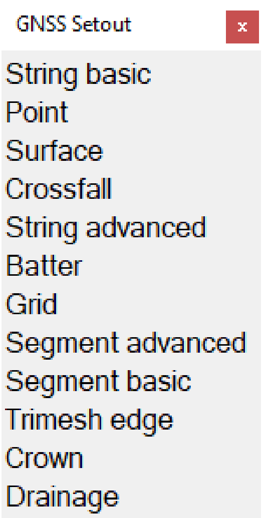
TPS Setout



See

15.6.5.1 Setout String Basic
15.6.5.2 Setout Point
15.6.5.3 Setout Surface
15.6.5.4 Setout Crossfall
15.6.5.5 Setout String Advanced
15.6.5.6 Setout Batter
15.6.5.7 Setout Grid
15.6.5.8 Setout Advanced Segment
15.6.5.9 Setout Basic Segment
15.6.5.10 Setout Trimesh Edge
15.6.5.11 Setout Crown
15.6.5.12 Setout Tunnel
15.6.5.13 Water Network Setout
15.6.5.14 Setout Piles

GNSS Setout



See

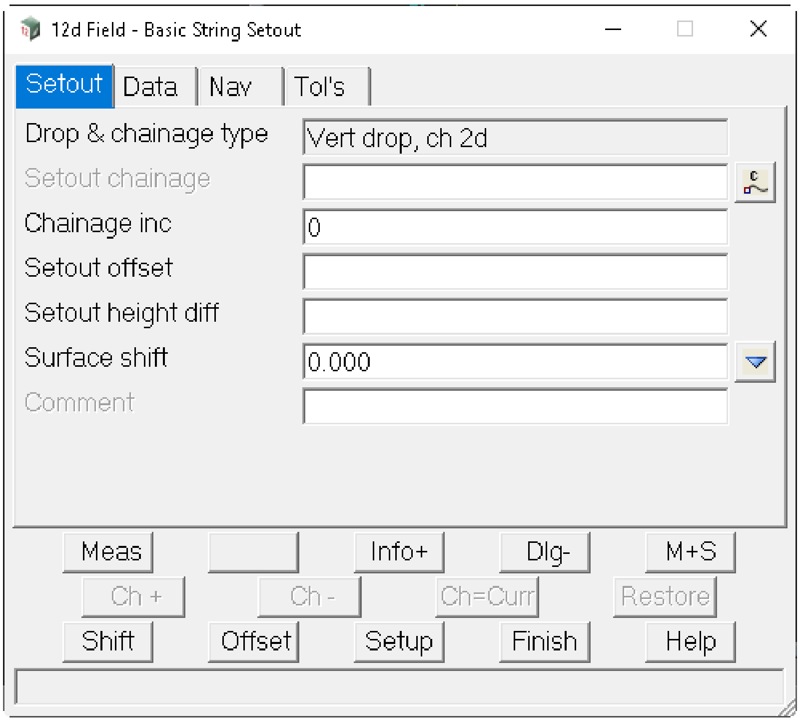
15.6.5.1 Setout String Basic
15.6.5.2 Setout Point
15.6.5.3 Setout Surface
15.6.5.4 Setout Crossfall
15.6.5.5 Setout String Advanced
15.6.5.6 Setout Batter
15.6.5.7 Setout Grid
15.6.5.8 Setout Advanced Segment
15.6.5.9 Setout Basic Segment
15.6.5.10 Setout Trimesh Edge
15.6.5.11 Setout Crown
15.6.5.13 Water Network Setout

15.6.5.1 Setout String Basic

Basic string setout allows the user to select a single string which is used for both horizontal and vertical positioning of a setout point. A control string can be used in conjunction with the setout string or the setout string can act as both.

For an indicative diagram of basic string setout and associated attributes see 15.7.3.2.5.1 Basic String Diagrams .

Clicking **String Basic** brings up the **12d Field - Basic String Setout** panel.



Setout tab
Data tab
Nav tab
Tol's tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout tab

Drop & chainage type Vert drop, ch 2d

The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point *for more information.*

Setout chainage

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

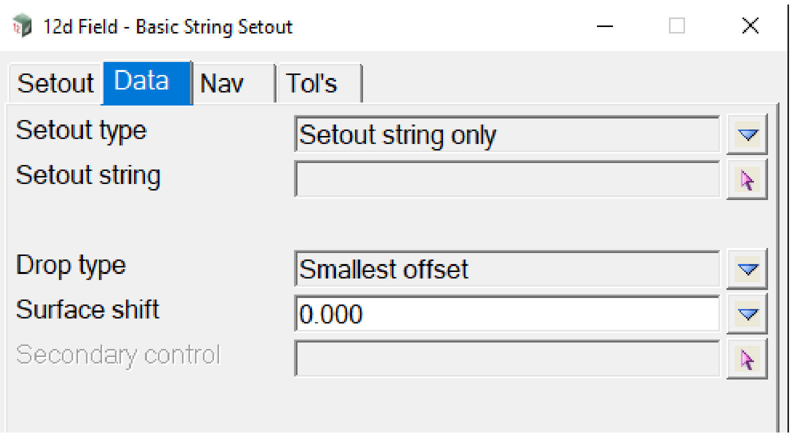
Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Compaction factor

If turned on a value to multiple delta heights by for certain construction situations, it would be set to 1.0 in most situations, for more information see 15.6.1.8.7 Compaction factor (so_compaction_factor) .

Data tab



Setout tab
Data tab
Nav tab
Tol's tab

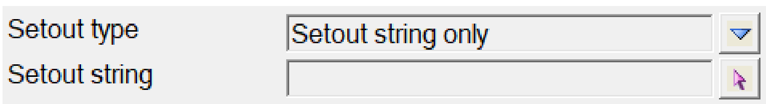
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data tab

Setout type	choice box	Setout string only	Setout string only String & control string

Setout string only

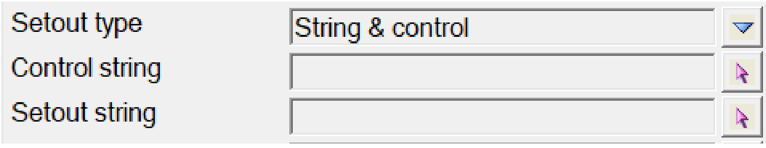


Setout string **string select**

The setout string is used both as the control string and setout string, points are dropped directly to it and projected perpendicular from it.

Attribute "so_ss_strr"

String & control



Control string string select

The setout string is cut normal to this string for calculations, for standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Setout string string select

The string that the ***Setout offset*** *and* ***Setout height diff*** *are applied to generate the setout point, the offsets are applied using the* ***control string*** *direction.*

Attribute "so_ss_strr"

Drop type choice box Closest Closest to control string
Closest to setout ch

Closest to control string*, where multiple drops are possible to the control string the drop with the smallest offset from the control string will be used.*

Closest to setout ch*, in situations like traffic islands sometimes the drop with the smallest offset is not the drop to the point attempting to be set out, this option will use the drop whose chainage is the closet to the* ***setout chainage****.*

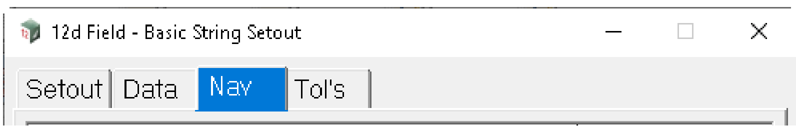
Surface shift choice box

*A vertical shift to be applied to the design level, +ve raises the level, can be manually entered or selected from the choice list, (defined in "****TDF_SURFACE_SHIFTS.4D****").*

Secondary control string select

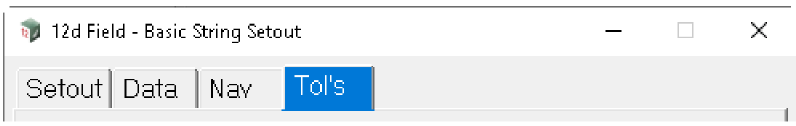
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Nav tab



For information on the ***Navigation tab*** *see* 15.6.1.6 Navigation Tab .

Tol's tab



Tol's tab

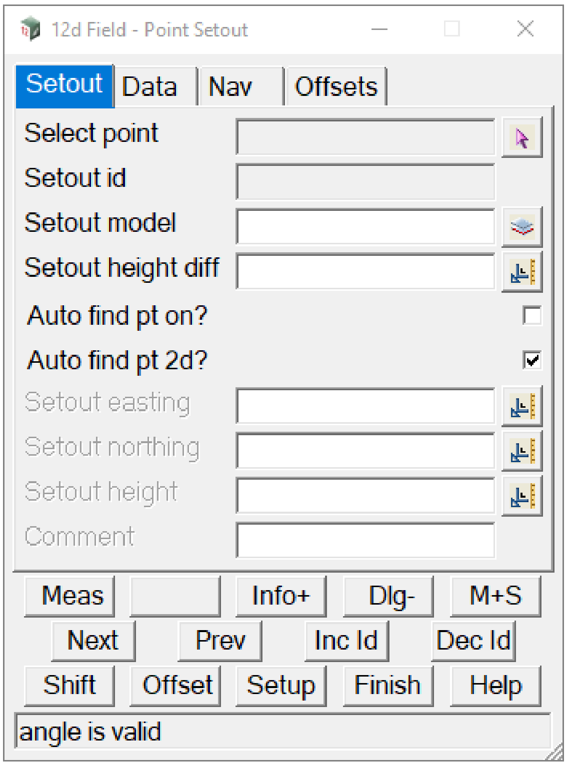
For information on the ***Tolerance tab*** *see* 15.6.1.7 Tolerances Tab .

Continue to 15.6.5.2 Setout Point or go back to 15.6.5 Setout .

15.6.5.2 Setout Point

The Point Setout panel allows the user to mark out and offset coordinates, they can be selected directly from super string or trimesh vertices, be automatically selected from super string or trimesh vertices closest to the measurement taken or manually entered.

Clicking **Point** brings up the **12d Field - Point Setout** panel.



Data Tab
Nav tab
Tol's tab
Offset Pt Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout tab

Select Pt string select

Select a super string or trimesh vertex as the point to setout. The ***Setout id****,* ***Setout model****,* ***Setout easting****,* ***Setout northing*** *and* ***Setout height*** *boxes will be updated from the selected vertex information.*

Note - the user can select a super string segment or trimesh edge rather than a vertex, in this case the ***Setout Id*** *is invalid.*

Setout id

Point id of the point to setout, this can be entered manually or changed via the ***Inc Id*** *and* ***Dec Id*** *buttons, if the id is valid and new vertex found the* ***Setout easting****,* ***Setout northing*** *and* ***Setout height*** *boxes will be updated.*

Attribute "so_sp_id"

Setout model model box

*Model containing the element of the setout point, this is informational only and will be populated via selecting a super string or trimesh with **Select point**.*

Setout height diff real box

This is added to the vertex height to produce the final setout height.

Attribute "so_vpl_spl_htdf".

Auto find pt on? tick box ticked

*If **ticked** after taking a measurement the setout point is updated to the closest vertex of the super string or trimesh.*

Attribute "so_panel_auto_find_point_on".

Auto find pt 2d? tick box not ticked

*If **ticked** the auto find uses the closest 2d distance, the z value of the points are not considered.*

*If **not ticked** the auto find uses the nearest 3D distance, the z values of the points are used.*

Attribute "so_panel_auto_find_point_2d".

Setout easting

Easting to setout.

Attribute "so_sp_x"

Setout northing

Northing to setout.

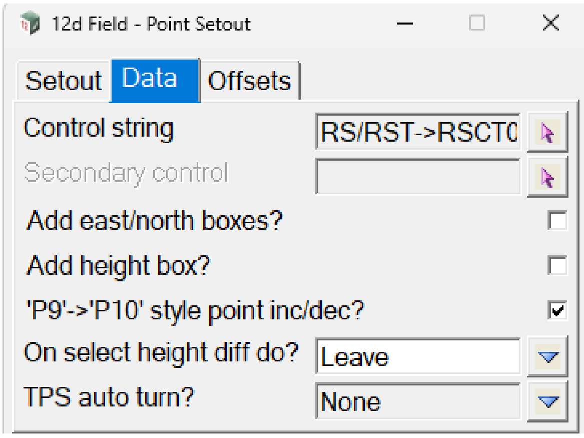
Attribute "so_sp_y"

Setout height

Height to setout.

Attribute "so_sp_z"

Data Tab



Data Tab
Nav tab
Tol's tab
Offset Pt Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Control string string select

*If **selected** the setout point will be dropped to this string and the default direction in the Offsets tab will be populated.*

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Secondary string string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Add east/north boxes? tick box not ticked

*If **ticked**, the setout easting and northing boxes will be added to the Setout tab allowing viewing or manual entry of the setout coordinates.*

*If **not ticked**, the boxes are not added to the Setout tab.*

Attribute "st_gui_point_setout_show_xy_boxes"

Add height box? tick box not ticked

*If **ticked**, the setout height box will be added to the Setout tab allowing viewing or manual entry of the setout height.*

*If **not ticked**, the box is not added to the Setout tab.*

Attribute "st_gui_point_setout_show_z_boxes"

P9->P10 style point inc/dec? tick box not ticked

*If **ticked**, the setout point id can vary in length, for example **P9** will be incremented to **P10**, **P10** decremented to **P9**.*

*If **not ticked**, the setout point id will not vary in length, for example **P99** will be incremented to **P00**, **P00** decremented to **P99**.*

Attribute "st_gui_point_setout_variable_length_id"

On select height diff do? choice box Leave Leave, Clear, Zero

*If **Leave**, on selection of a point the **Setout height diff** will be left as is.*

*If **Clear**, on selection of a point the **Setout height diff** will be set to blank.*

*If **Zero**, on selection of a point the **Setout height diff** will be set to 0.0.*

Attribute "st_gui_auto_zero_setout_heights_select_point"

On select height diff do? choice box None None, 2d, 3d

*This is a **TPS** option only.*

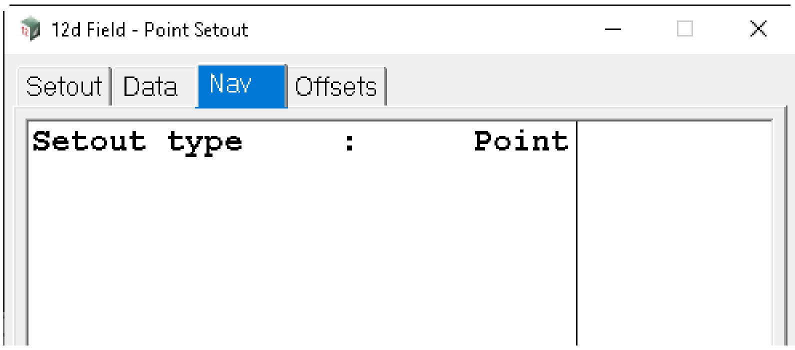
*If **None**, on updating the setout position the **TPS** will do nothing.*

*If **2d**, on updating the setout position the **TPS** will turn horizontally to the point.*

*If **3d**, on updating the setout position the **TPS** will turn horizontally and vertically to the point.*

Attribute "st_tps_auto_turn_setting"

Nav Tab



Data Tab
Nav tab
Tol's tab
Offset Pt Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

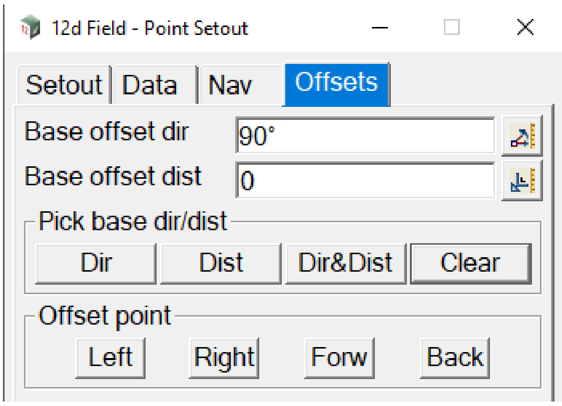
Navigation Box draw box

*The **12d Field** navigation box augments setout by displaying user definable information rows plus a bullseye as a visual aid.*

See 15.6.1.6 Navigation Tab .

Offset Pt Tab

It is common a point cannot be setout directly but via points at an offset from the true setout point. The offsets tab provides a variety of options to offset the setout point.



Data Tab
Nav tab
Tol's tab
Offset Pt Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Base offset dir	real box	90 degrees	

The base direction for offsetting the point. If a ***Control string*** *is selected then the direction by default will be the instantaneous direction of the point dropped to the* ***Control string.***

Attributes "so_offset_point_base_dir" "so_offset_point_base_dir_dms"

Base offset dist	real box	0	

The distance to offset the setout point.

Attribute "so_offset_point_base_dist"

Pick base dir/dist

Dir button

Select a point, the ***Offset direction*** *will be set to the bearing from the setout point to the selected point.*

Dist button

Select a point, the ***Offset distance*** *will be set to the distance from the setout point to the selected point.*

Dir&Dist button

Combine ***Dir*** *and* ***Dist*** *into the one select.*

Clear button

Reset the Offset direction to ***90*** *and the Offset distance to* ***0****.*

Offset point

Left button

Offset the setout point by the ***Offset distance*** *at 90 degrees to the left of the* ***Offset direction****.*

Right button

Offset the setout point by the ***Offset distance*** *at 90 degrees to the right of the* ***Offset direction****.*

When either the ***Left*** *or* ***Right*** *buttons are used the attributes for the actual direction of the offset point from the base point are "so_offset_point_base_dir" and "so_offset_point_base_dir_dms".*

Forw button

*Offset the setout point by the **Offset distance** in the **Offset direction**.*

Back button

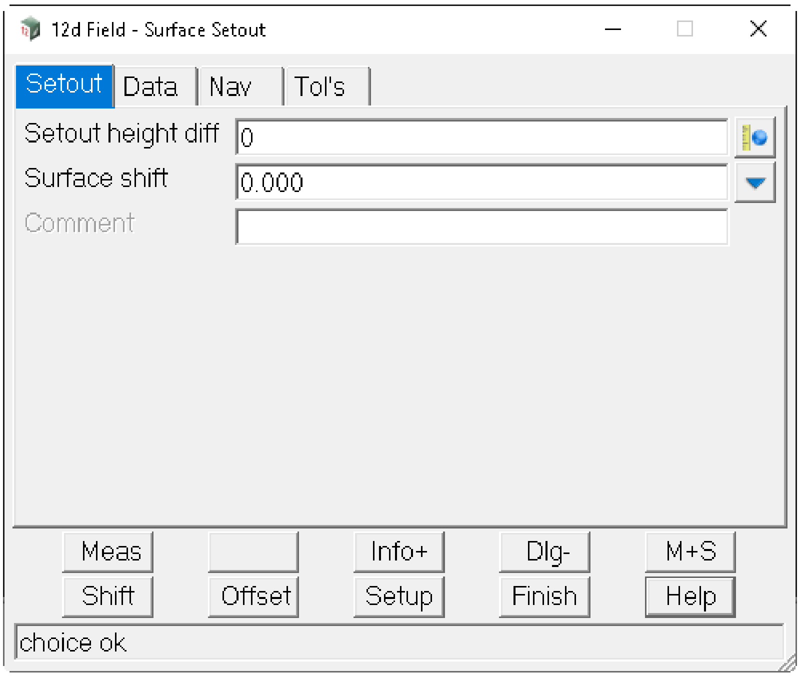
*Offset the setout point by the **Offset distance** in the reverse of the **Offset direction**.*

Continue to 15.6.5.3 Setout Surface or go back to 15.6.5 Setout .

15.6.5.3 Setout Surface

The setout surface panel enables the user to take measurements, primarily for height differences to a **tin** or **trimesh**.
Tins can typically be used for things such as design road pavements and as builts for previous pavement layers while **trimeshes** can be used for typical **tin** situations but also for fully 3D objects such as retaining wall faces.
The drop of the point can be **vertical**, where the xy of the measured point will match the xy of the point dropped on to the surface, just the z value will vary, this is not necessarily the closest point in true 3D to the surface from the measured point. The drop can also be **perpendicular** where the point is dropped 3d to a triangle/face on the surface, (the drop must be **perpendicular** to the face, not just the closest distance), here the xyz of the measured and dropped points are different.
There is only ever one possible drop to a **tin**, there can be multiple valid drops to a **trimesh** so the user must choose which drop they wish to use.

Clicking **Surface** brings up the **12d Field -Surface Setout** panel.



Setout tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout tab

Setout height diff real box

This is added to the height of the drop to the surface to produce the final setout height.

Attribute "so_vpl_spl_htdf".

Surface shift choice box 0.000

A vertical shift to be applied to the surface level, +ve raises the level, can be manually entered or selected *from the choice list, (defined in "TDF_SURFACE_SHIFTS.4D").*

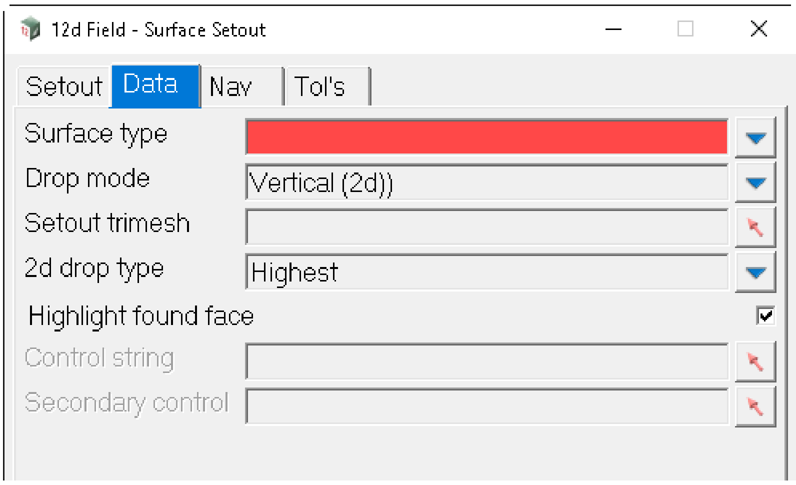
Attribute "so_spl_dpl_htdf".

Comment input box

Attribute " pu_panel_comment_line".

A user entered comment, see 17.6.1.8.6 Comment (st_gui_display_pu_comment_line).

Data Tab



Setout tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

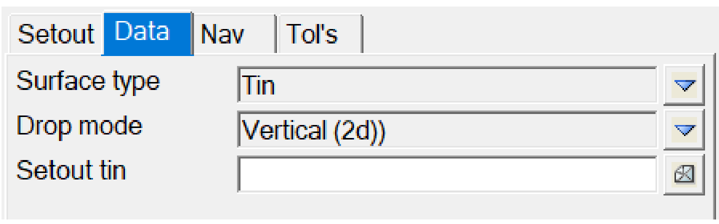
Field Description Type Defaults Pop-Up

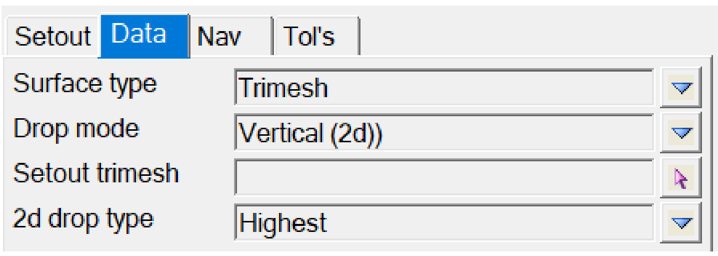
Data tab

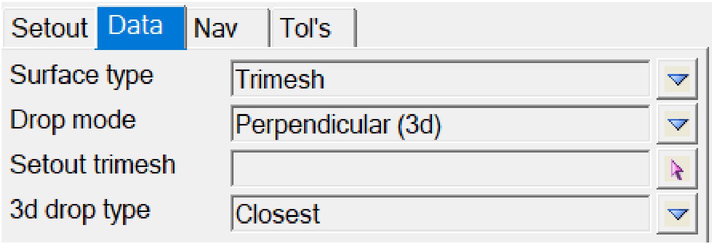
Surface type choice box Tin Tin, Trimesh

Choose the surface type to use, the subsequent choices vary dependent on whether ***Tin*** *or* ***Trimesh*** *is selected.*

Attribute "so_sf_setout_type".







Drop mode	choice box		Vertical (2d), Perpendicular (3d)

__Vertical (2d)__ the drop is the same xy on the surface as the measured point.

__Perpendicular (3d)__ the drop is perpendicular to a face/triangle on the surface, here is no relation to the xyz of the measured point.

Attribute "so_spl_dpl_htdf_mode".

Setout tin tin select

Select the tin to setout

Attribute "so_tn_eler".

Setout trimesh select box

Select the trimesh to setout

Attribute "so_tm_eler".

2d drop type	choice box	Highest	Highest, Closest, Lowest

Trimesh only, is the desired drop the highest, closest or lowest 2d drop to the trimesh.

Attribute " so_sf_2d_drop_type".

3d drop type	choice box	Closest	Closest, Furthest

Trimesh only, drops can be 'horizontal' as well as 'vertical' so is the desired drop the closest to or furthest from the measured point.

Attribute " so_sf_3d_drop_type".

Highlight found face	tick box	ticked	

If __ticked__, the face of the tin or trimesh the point was dropped to will be highlighted in the 12dF views.

Attribute "so_sf_draw_face".

Control string string select

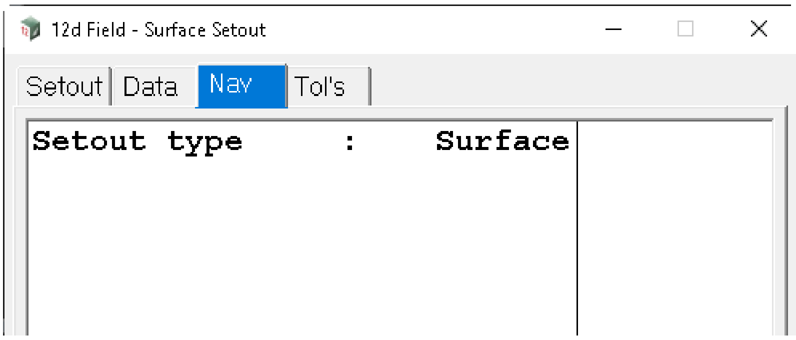
Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr).

Secondary control String select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr).

Nav Tab



Setout tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

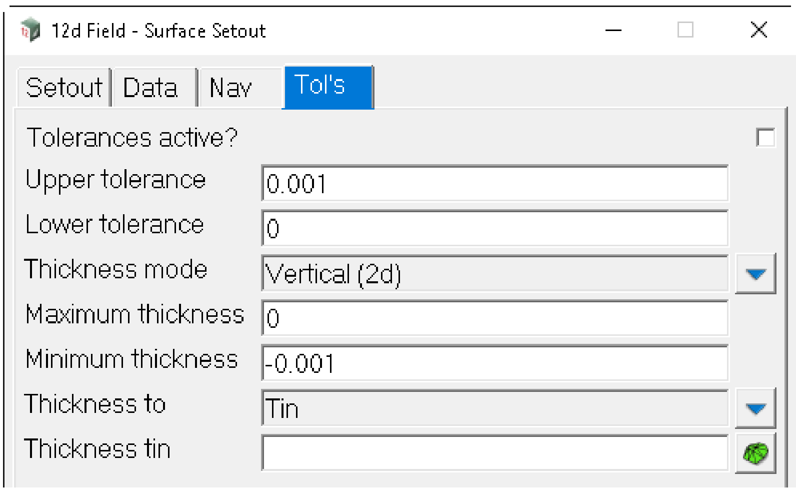
Nav tab

Navigation Box draw box

*The **12d Field** navigation box augments setout by displaying user definable information rows plus a bullseye as a visual aid.*

See 15.6.1.6 Navigation Tab .

Tol's Tab



Setout tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

*For information on the **Tolerance tab** see* 15.6.1.7 Tolerances Tab .

Continue to 15.6.5.4 Setout Crossfall or go back to 15.6.5 Setout .

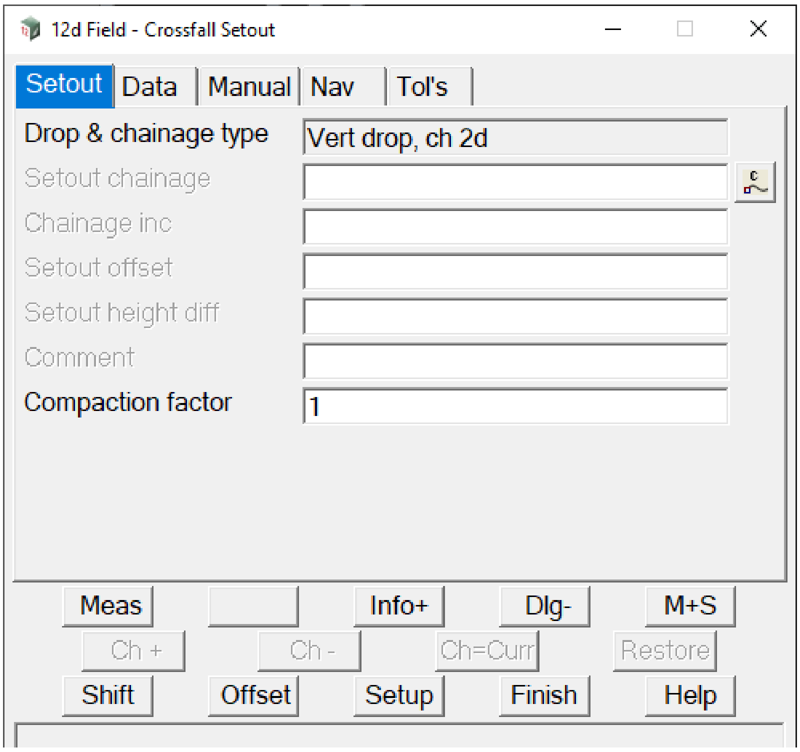
15.6.5.4 Setout Crossfall

The **12d Field - Crossfall Setout panel** is used when the user wants to generate their design height by cutting 2 strings and projecting the plane of the cuts to their position. The user is able to set a shift to move the design surface up or down once the strings are cut. There are manual modes available of setting the design crossfall when 2 strings are not able to be cut.

Crossfall Setout works by dropping a point to a nominated control string, then a setout string and the 2 strings used to determine the crossfall are cut normal to the dropped point on the control string. Note the control string, the setout string and 1 of the level strings could be the same string or all different, this dependant on the task being performed.

For an indicative diagram of crossfall setout and associated attributes see 15.7.3.2.5.2 Crossfall Diagrams .

Clicking **Crossfall** brings up the **12d Field - Crossfall Setout** panel.



Setout tab
Data Tab
Manual Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout tab

Drop & chainage type Vert drop, ch 2d

The type of drop of a point to the centreline and the type of chainage used. This panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point *for more information.*

Setout chainage

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1

Setout Chainage (so_cs_ch) .

Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

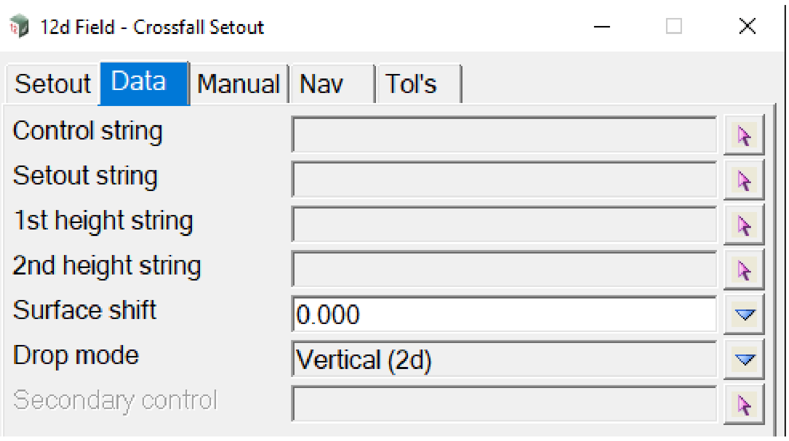
Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Compaction factor

If turned on a value to multiple delta heights by for certain construction situations, it would be set to 1.0 in most situations, for more information see 15.6.1.8.7 Compaction factor (so_compaction_factor) .

Data Tab



Setout tab
Data Tab
Manual Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Control string string select

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Setout string string select

The string that the ***setout offset*** *is applied to generate the setout point easting and northing, this string is not used for height calculations.*

Attribute "so_ss_strr"

1st height string string select

The 2 height strings are sectioned to produce the plane for the crossfall calculation, the order of the 2 strings is not important.

Attribute "so_s1_strr"

2nd height string string select

*See **1st height string** above for details.*

Attribute "so_s2_strr"

Surface shift choice box 0.000 0.000

A vertical shift applied to the plane generated by cutting the 2 height strings, intended to be used for pavement layers when only the design surface is available, for more information see 15.6.1.8.4 Surface shift (so_spl_dpl_htdf).

Drop mode choice box Vertical (2d) Vertical (2d), Perpendicular (3d)

Whether the height difference to the surface is vertical or perpendicular.

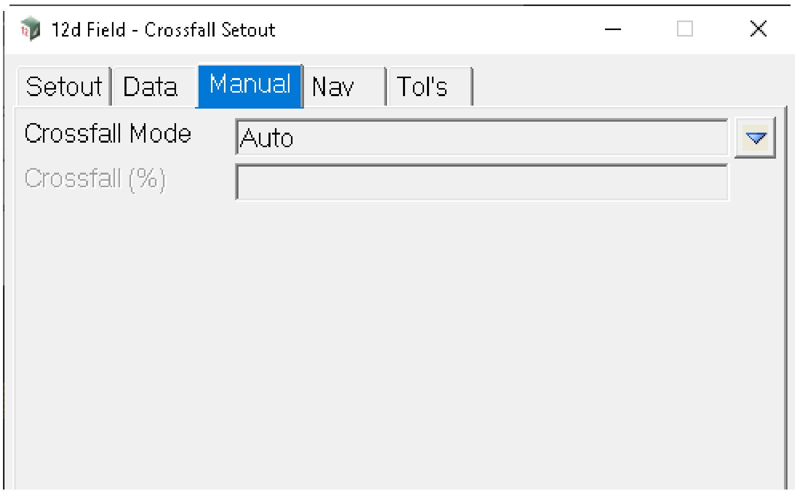
Vertical (2d): The height difference is applied vertically to the design surface.

Perpendicular (3d): The vertical height difference is adjusted as if it was applied perpendicular to the design surface, the calculated offset of the dropped point is the same as the vertical drop.

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr).

Manual Tab



Setout tab
Data Tab
Manual Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Crossfall Mode	choice box		Auto Centreline, string & x-fall Manual, use current x-fall

Method used to generate the design crossfall.

***Auto**: The crossfall is calculated by cutting the 1st and 2nd strings.*

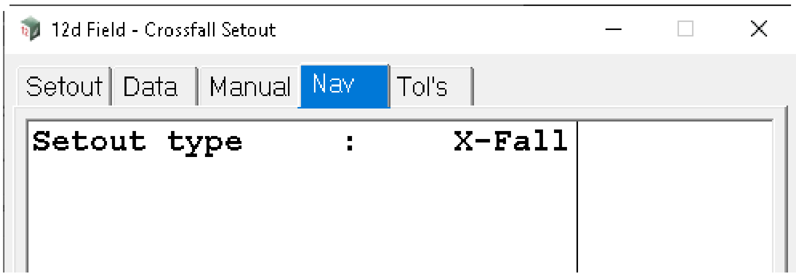
***Centreline, string & x-fall**: The crossfall is entered manually, only the 1st string is cut and the crossfall projected from this.*

***Manual, use current x-fall**: Identical to **Centreline, string & x-fall** except the crossfall is populated automatically with the last calculated value from the **Auto** mode.*

Crossfall (%)

*The manually entered crossfall when not in **Auto** mode.*

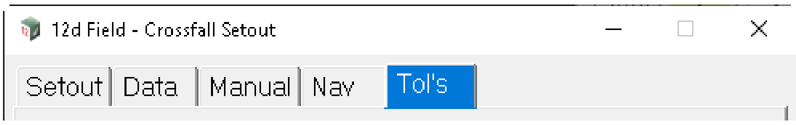
Nav Tab



Setout tab
Data Tab
Manual Tab
Nav Tab
Tol's Tab

For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Tol's Tab

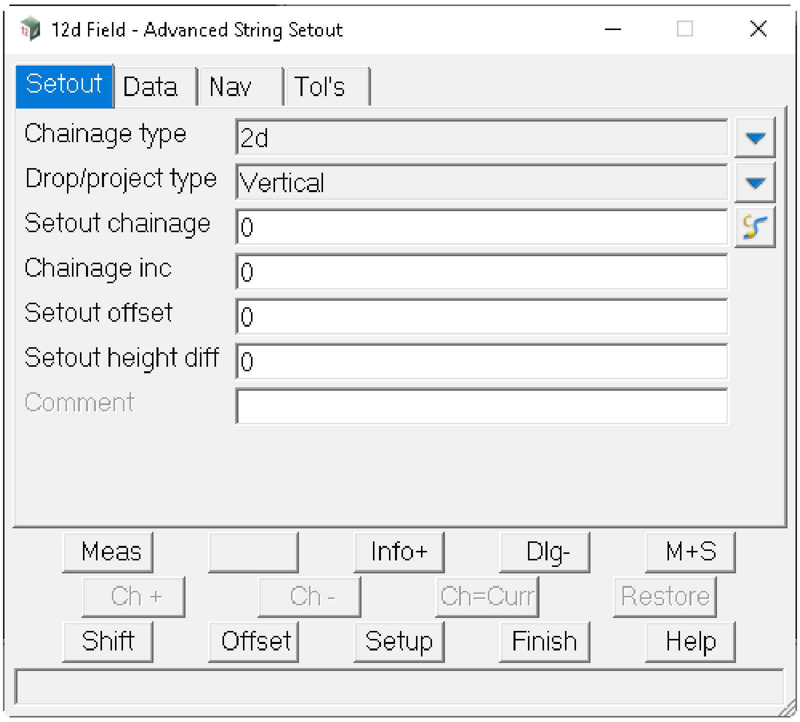


For details on using and populating the Tol's tab see 15.6.1.7 Tolerances Tab .

Continue to 15.6.5.5 Setout String Advanced or go back to 15.6.5 Setout .

15.6.5.5 Setout String Advanced

The Advanced String Setout panel allows the ability to use all 4 chainage and drop types as opposed to 15.6.5.1 Setout String Basic which only uses the convention 2d vertical drop chainage type.
Clicking **String Advanced** brings up the **12d Field - Advanced String Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Chainage type choice box 2d 2d, 3d

Whether the chainage is measured along the horizontal alignment, 2d or along the vertical alignment, 3d, see 19.5 Different Types of Chainage Drop Point *for more information.*

Attribute "so_cs_ch_type"

Drop/project type choice box Vertical Vertical, Perpendicular

Whether points are dropped to/projected from the control string vertically, Vertical or perpendicular to the vertical alignment, Perpendicular, see 19.5 Different Types of Chainage Drop Point *for more information.*

Attribute "so_cs_cut_type"

Setout chainage

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

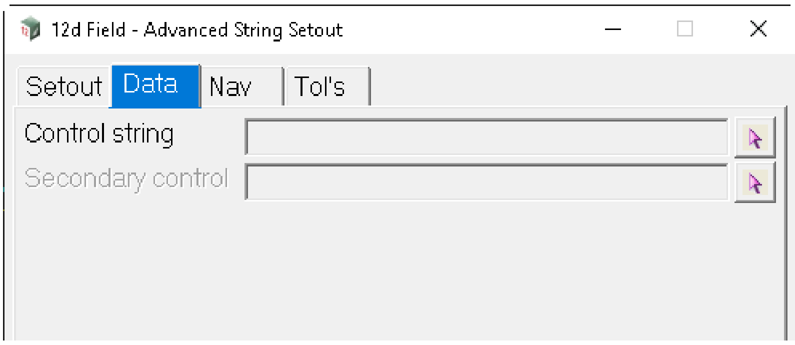
Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Data Tab



[Setout Tab](#)
[Data Tab](#)
[Nav Tab](#)
[Tol's Tab](#)

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Control string

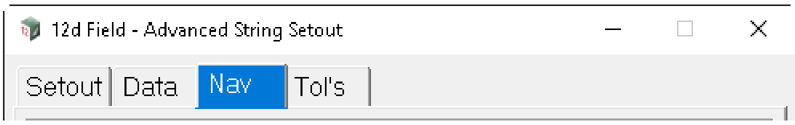
Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Secondary control

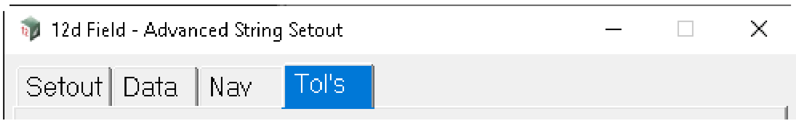
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Nav Tab



For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Tol’s Tab



For details on using and populating the Tol's tab see 15.6.1.7 Tolerances Tab.

Continue to 15.6.5.6 Setout Batter or go back to 15.6.5 Setout.

15.6.5.6 Setout Batter

The **12d - Field Batter Setout** panel is used to dynamically locate the intersection point of a slope defined by the cut of 2 strings and the natural surface at the users current position.

It is designed around the user wishing to place batter rails in place for guiding the cut/fill.

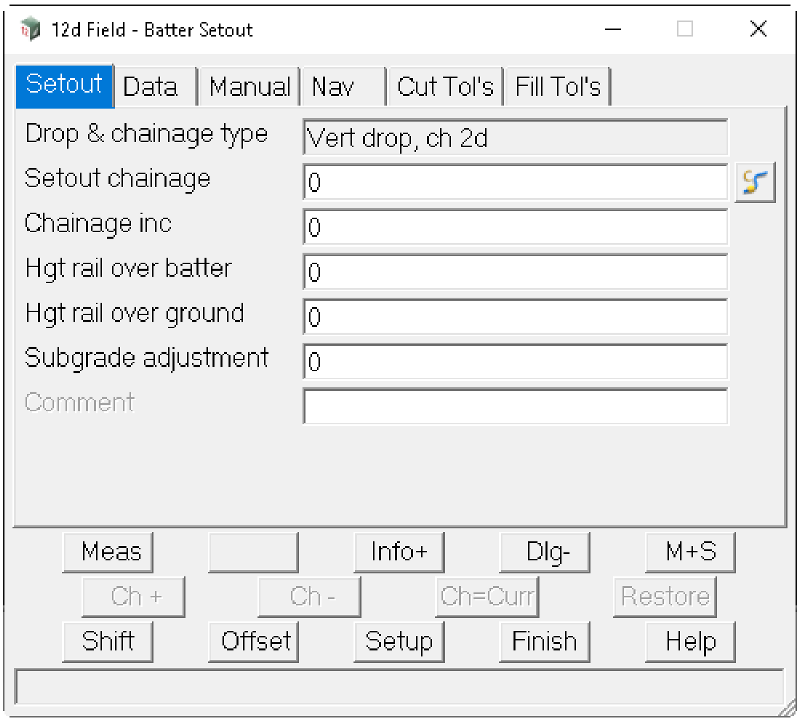
Note, unlike other string setout routines the batter setout does not have a setout string, just the control string and the 2 design strings.

The user is able to set a shift to move the design surface up or down once the strings are cut.

There are manual modes available for setting the design slope when 2 strings are not able to be cut.

Batter setout works by dropping a point to a nominated control string, the 2 strings used to determine the slope are cut normal to the dropped point on the control string, the delta offset for the pole is dependant on the users height rather than a setout string.

Clicking **Batter** brings up the **12d Field - Batter Setout** panel.



[Setout Tab](#)
[Data Tab](#)
[Manual Tab](#)
[Nav Tab](#)
[Cut Tol's Tab](#)
[Fill Tol's Tab](#)

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Setout Tab

Drop & chainage type Vert drop, ch 2d

The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point *for more information.*

Setout chainage chainage box

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch).

Chainage inc real box 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc).

Hgt rail over batter real box 0

Height of the batter rail above the design batter, say 0.1 for cut and 1.0 for fill.

Attribute "so_batter_rail_batter"

Hgt rail over ground real box 0

Height of the batter rail above the natural ground, typically as large as number as possible to get the rail away from the top/toe of the batter.

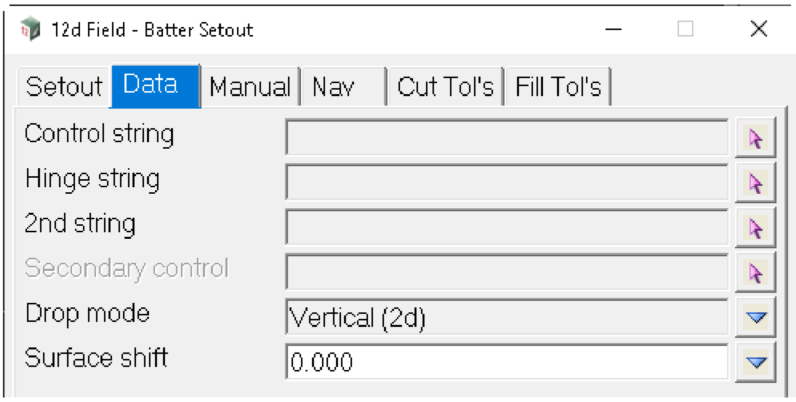
Attribute "so_batter_rail_ground"

Subgrade adjustment real box 0

The hinge string is often not at the full depth the batter needs to be cut to, enter the vertical height difference from the hinge to subgrade level here if needed, this value will be negative for cut batters.

Attribute "so_s1_sg_htdf"

Data Tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Control string string select

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr).

Hinge string string select

Hinge string is the string the batter is being cut or filled to. Slope distances etc. are given to this string.

Attribute "so_s1_strr"

2nd string string select

Other string along with the hinge string defining the batter slope.

Attribute "so_s1_strr"

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Drop mode choice box Vertical (2d) Vertical (2d), Perpendicular (3d)

Whether the offset to the surface is vertical or perpendicular.

Vertical (2d): The height offset is applied vertically to the design surface.

Perpendicular (3d): The height offset is applied perpendicular to the design surface.

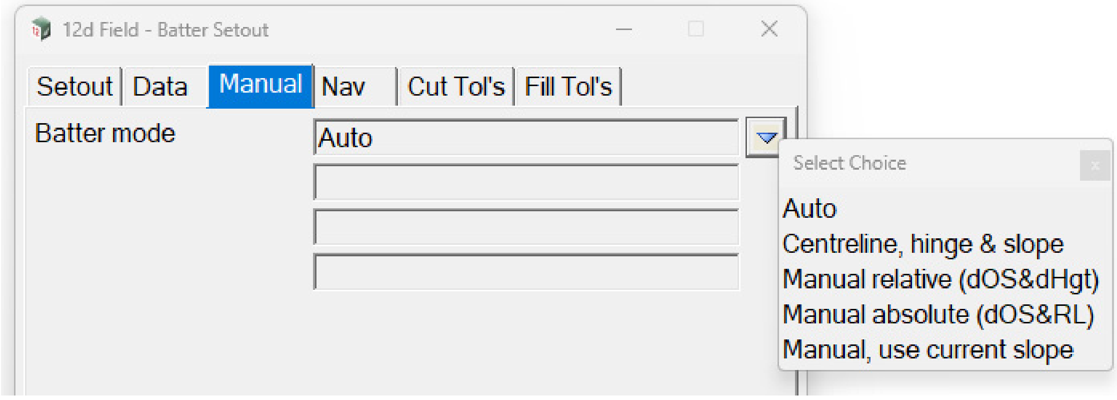
Attribute "so_spl_dpl_htdf_mode"

Surface shift choice box 0.000

A vertical shift applied to the plane generated by cutting the height string or strings, intended to be used for pavement layers when only the design surface is available, for more information see 15.6.1.8.4 Surface shift (so_spl_dpl_htdf) .

Manual Tab

The manual tab allows a varieties of manual entries for batter setout when the hinge and 2nd strings typically can not be cut by the centreline.

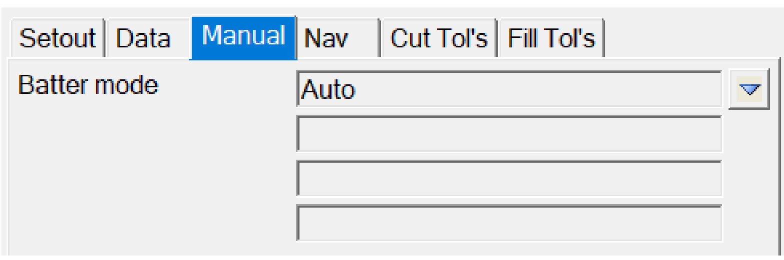


The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

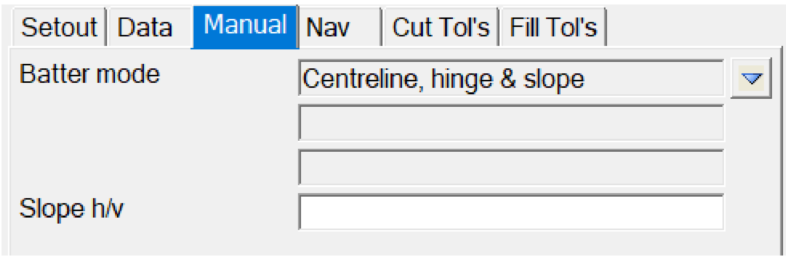
Auto

The hinge and 2nd string are used for the batter calculations.



Centreline, hinge & slope.

The centreline and hinge are used normally, the user enters a manually defined slope.



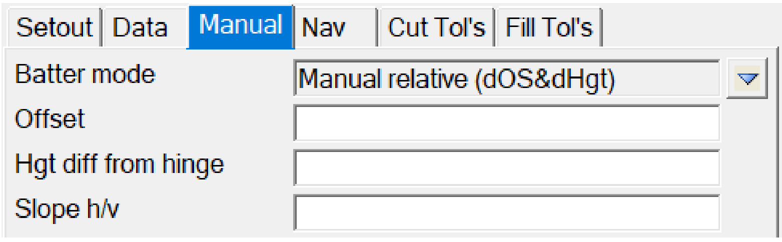
Slope h/v

Slope of the batter in horizontal/vertical from, e.g. 2:1

Attribute "so_batter_manual_slope"

Manual relative (dOS&dHgt)

The centreline and hinge are used conventionally, the user enters an offset and height difference from the hinge and a manual slope to do the batter calculations.



Offset real box

The offset for the new hinge.

Attribute "so_batter_offset"

Height diff from hinge real box

The height difference for the new hinge.

Attribute "so_batter_height_diff"

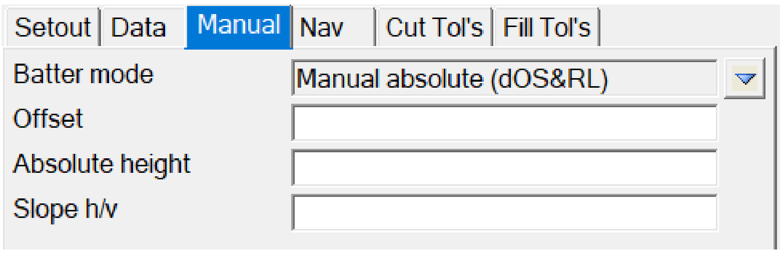
Slope h/v

Slope of the batter in horizontal/vertical from, e.g. 2:1

Attribute "so_batter_manual_slope"

Manual absolute (dOS&RL)

The hinge is defined as an offset from the centreline and an absolute height, combined with a manual slope to do the batter calculations.



Offset real box

The offset from the centreline for the new hinge.

Attribute "so_batter_offset"

Absolute height real box

The RL of the new hinge, this is not relative to the centreline.

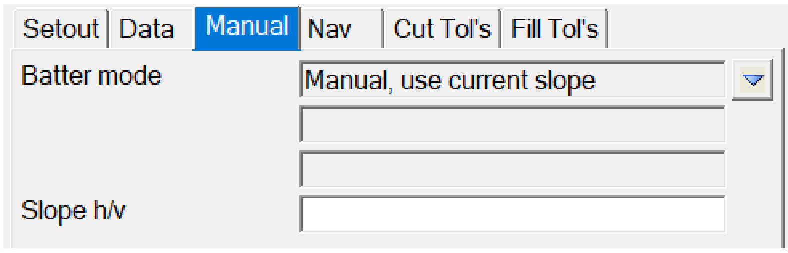
Attribute "so_batter_height_diff"

Slope h/v

Slope of the batter in horizontal/vertical from, e.g. 2:1

Attribute "so_batter_manual_slope"

Manual, use current slope

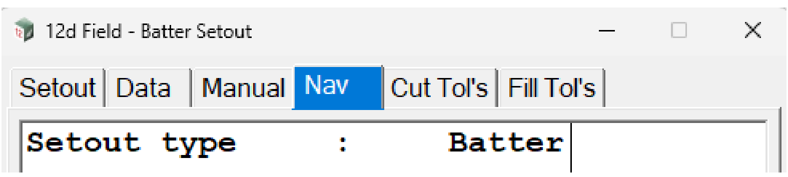


Slope h/v

Slope of the batter in horizontal/vertical from, e.g. 2:1, this is populated from the last automatically calculated batter slope.

Attribute "so_batter_manual_slope"

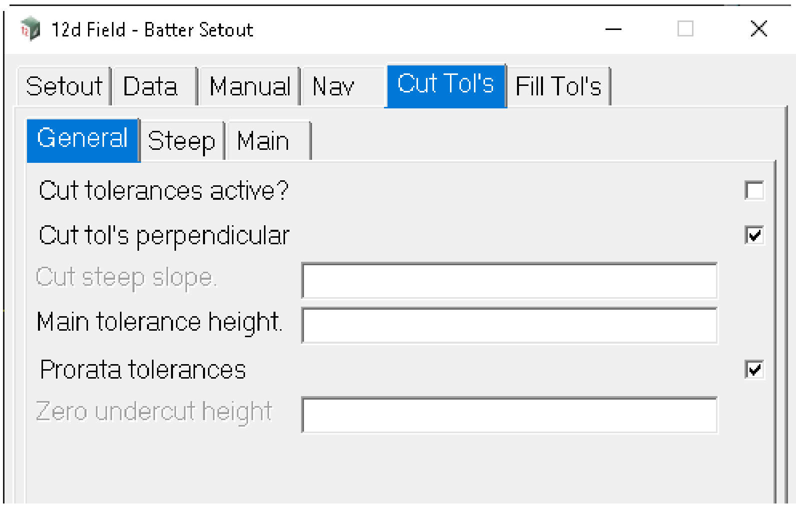
Nav Tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Cut Tol's Tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

General tab
Steep tab
Main tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

General tab

Cut tolerances active?	tick box	not ticked	

??

Cut tol's perpendicular	tick box	ticked	

??

Cut steep slope

??

Main tolerance height

??

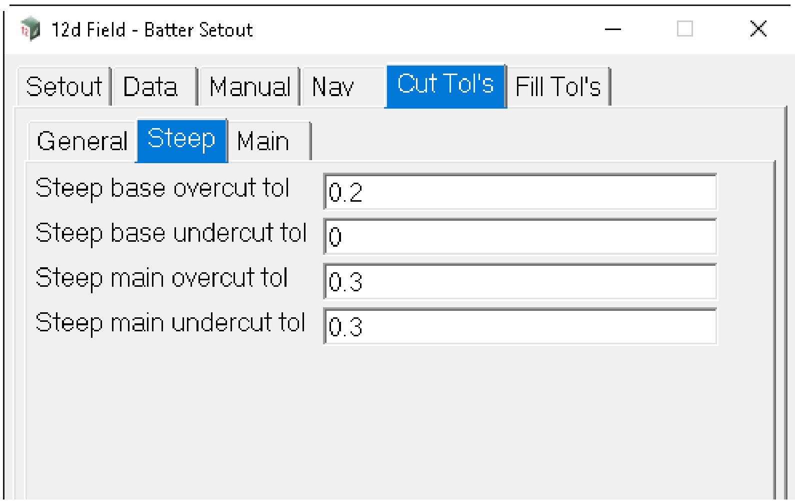
Prorata tolerance	tick box	ticked	

??

Zero undercut height

??

Steep tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

General tab
Steep tab
Main tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Steep base overcut tol

??

Steep base undercut tol

??

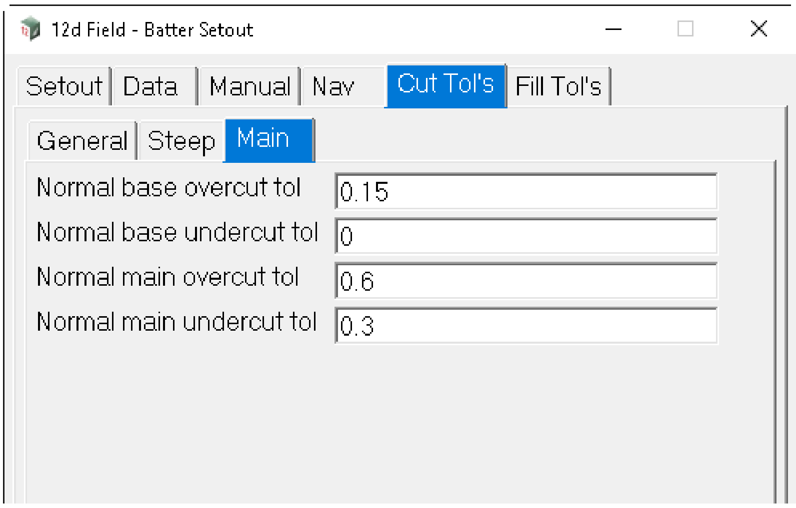
Steep main overcut tol

??

Steep main undercut tol

??

Main tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

General tab
Steep tab
Main tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Normal base overcut tol

??

Normal base undercut tol

??

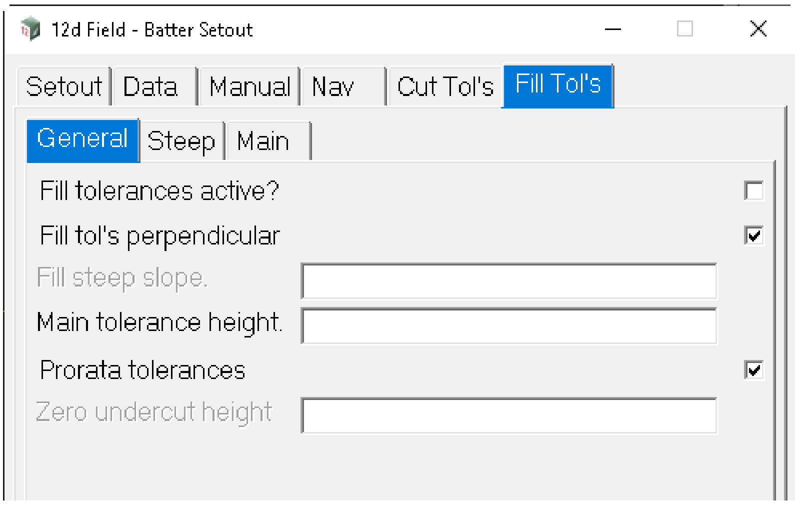
Normal main overcut tol

??

Normal main undercut tol

??

Fill Tol's Tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

General tab
Steep tab
Main tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

General tab

Fill tolerances active?	tick box	not ticked	

??

Fill tol's perpendicular	tick box	ticked	

??

Fill steep slope

??

Main tolerance height

??

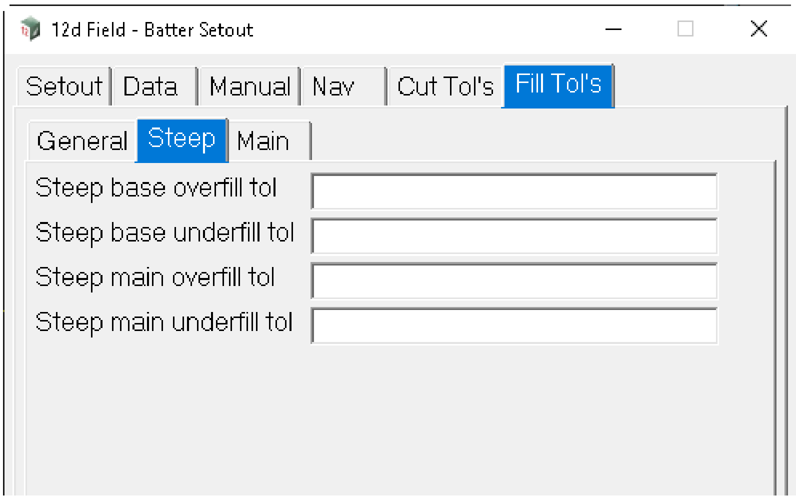
Prorata tolerance	tick box	ticked	

??

Zero undercut height

??

Steep tab



Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

General tab
Steep tab
Main tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Steep base overcut tol

??

Steep base undercut tol

??

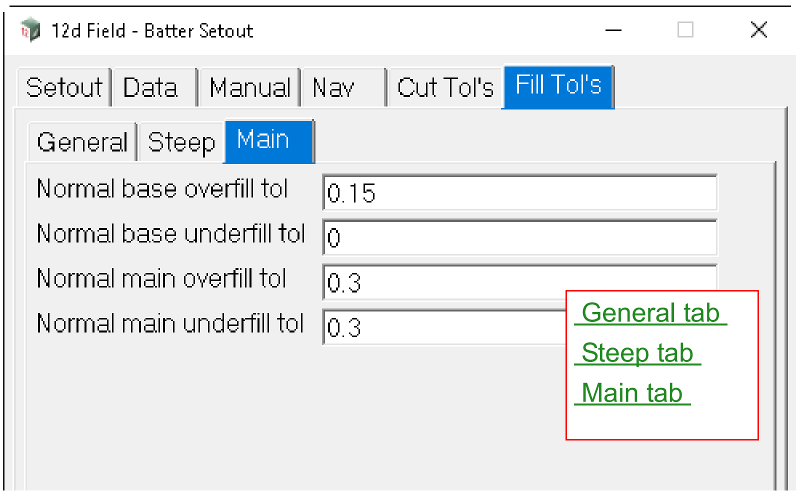
Steep main overcut tol

??

Steep main undercut tol

??

Main tab



General tab
Steep tab
Main tab

Setout Tab
Data Tab
Manual Tab
Nav Tab
Cut Tol's Tab
Fill Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Normal base overcut tol

??

Normal base undercut tol

??

Normal main overcut tol

??

Normal main undercut tol

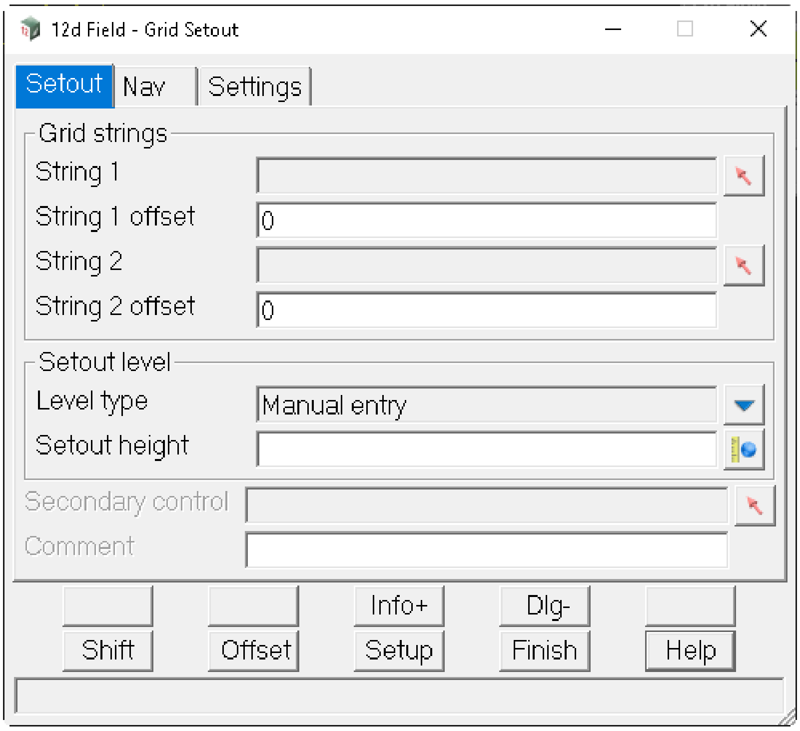
??

Continue to 15.6.5.7 Setout Grid or go back to 15.6.5 Setout .

15.6.5.7 Setout Grid

The Grid Setout panel allows the selection of 2 strings, entering an offset from each string and the setting out of points created at the intersection of the 2 strings at the entered offsets. The strings can be more complex than simple 2 point line strings and can contain both arcs and transitions.
Note, strings than have multiple intersections cannot be used with this panel and will result in error messages.

Clicking **Setout Grid** brings up the **12d Field - Grid Setout** panel.



Setout Tab
Nav Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Grid strings

String 1 string select

First string for grid setout.

Attribute "so_g1_strr"

String 1 offset 0

Setout offset from the first string.

Attribute "so_sp_g1_os"

String 2 string select

Second string for grid setout.

Attribute "so_g2_strr"

String 2 offset 0

Setout offset from the second string.

Attribute "so_sp_g2_os"

Setout level

Level type choice box Manual entry Manual entry
Drop to string 1
Drop to string 2

***Manual entry**, the **Setout height** box is editable and the height to setout is manually entered in it.*

***Drop to string 1**, the setout height is the height of **String 1** at the measured point, the **Setout height** box is not editable and is populated with this value.*

***Drop to string 2**, the setout height is the height of **String 2** at the measured point, the **Setout height** box is not editable and is populated with this value.*

Attribute "so_grid_level_style"

Setout height real box

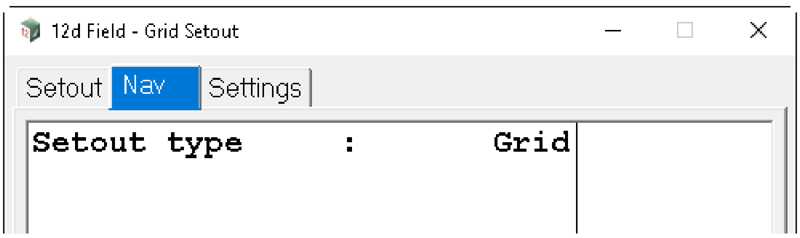
*The height to setout, see **Level type** above for a full description.*

Attribute "so_vcut_sp_z"

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr).

Nav Tab



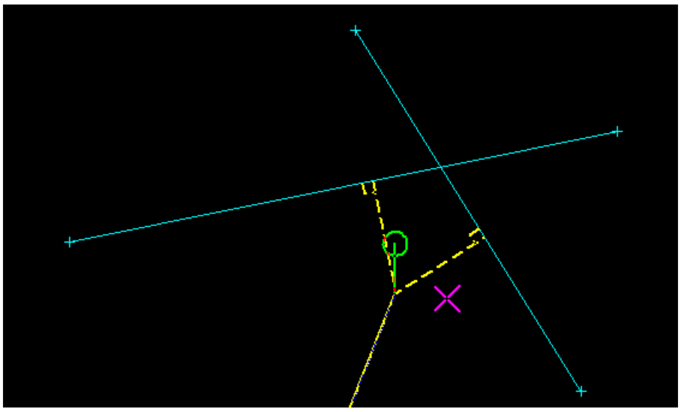
Setout Tab
Nav Tab
Settings Tab

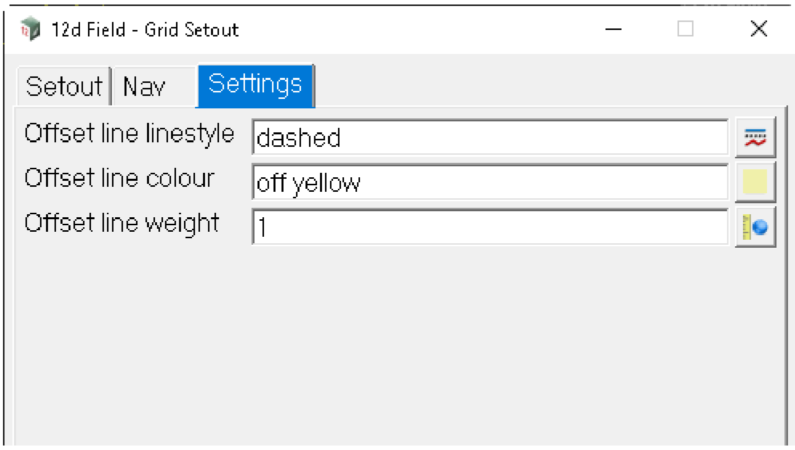
For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab.

Settings Tab

The settings for controlling the drawing of the drops from the measured point to the 2 grid strings.

The setting for controlling the drawing of the setout point is common to all panels, see Views >Plan 1 tab *for more information.*





Setout Tab
Nav Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Offset line linestyle			
Offset line colour	colour box	yellow	
Offset line weight	real box	1	

Offset line linestyle

The linestyle drawn from the measured point to the grid strings.

Offset line colour colour box yellow

The colour of the line drawn from the measured point to the grid strings.

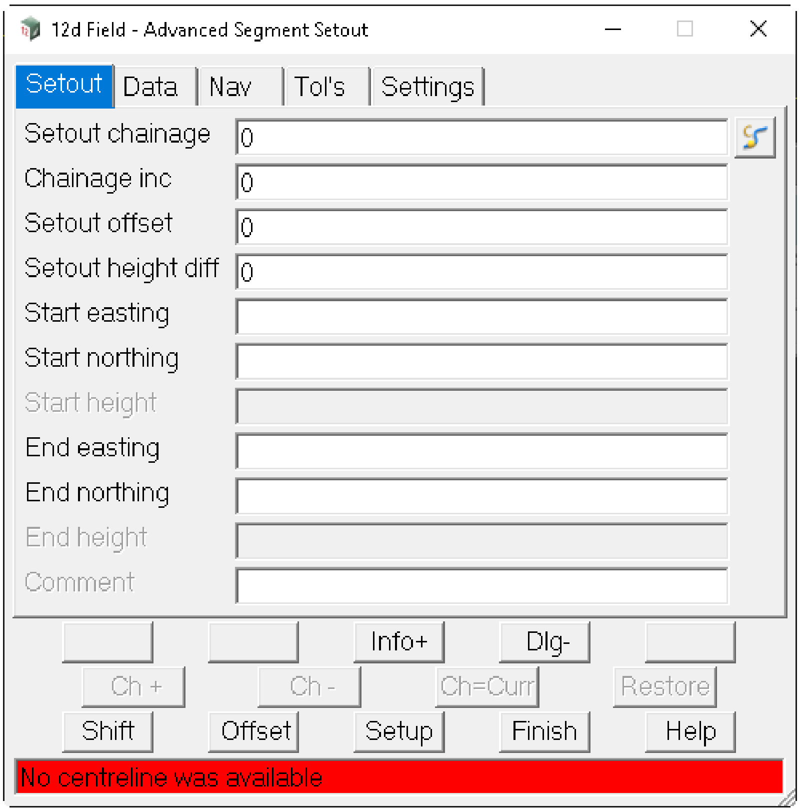
Offset line weight real box 1

The thickness of the line drawn from the measured point to the grid strings.

Continue to 15.6.5.8 Setout Advanced Segment or go back to 15.6.5 Setout .

15.6.5.8 Setout Advanced Segment

Clicking **Segment Advanced** brings up the **12d Field - Advanced Segment Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol’s Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Setout Tab

Setout chainage

The raw, no equalities setout chainage on the control string, start chainage plus distance along string.

Setout offset 0

Offset from the setout string to setout, +ve is to the right of the string, -ve left.

Chainage inc

Value that the setout chainage will be changed by when chainage increment/decrement is called.

Setout height diff 0

Height diff from the setout surface/string. +ve is above.

Start easting

??

Start northing

??

Start height

??

End easting

??

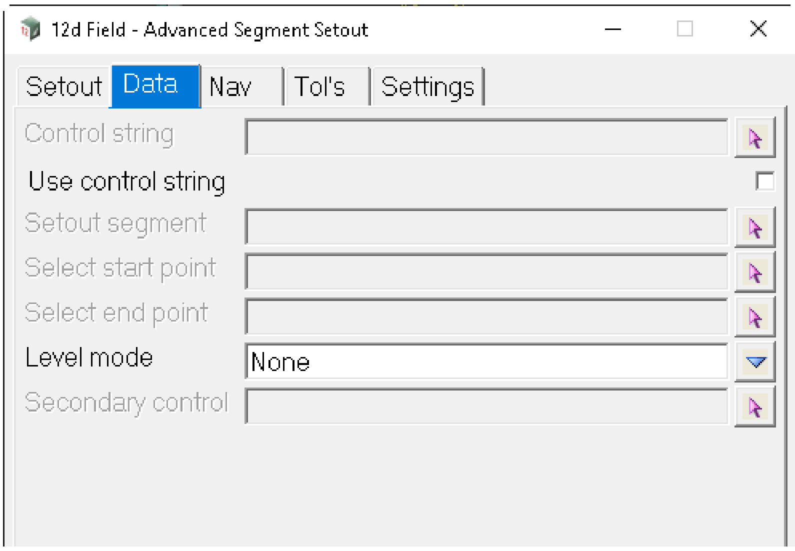
End northing

??

End height

??

Data Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Control string string select

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr).

Use control string tick box not ticked

??

S/O segment string select

??

Select start point string select

??

Select end point

??

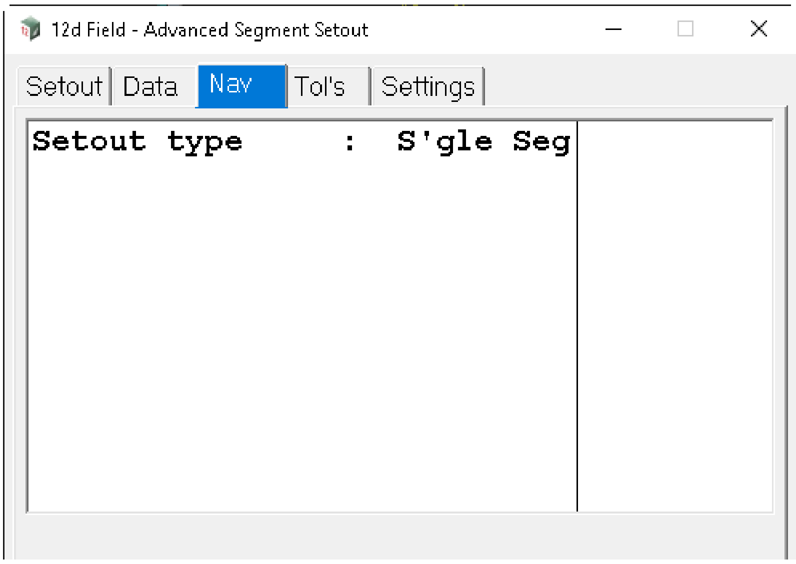
Level mode choice box

??

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr).

Nav Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab
Settings Tab

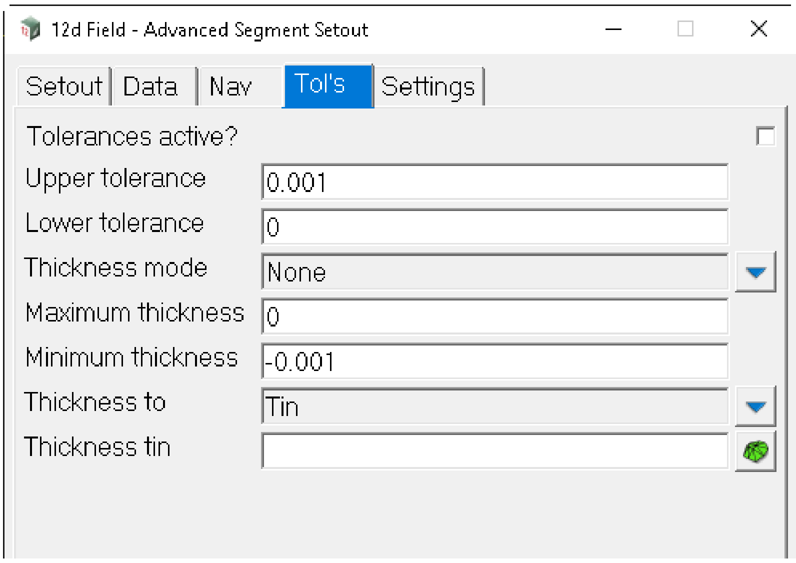
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Navigation Box		draw box	

The ***12d Field*** *navigation box augments setout by displaying user definable information rows plus a bullseye as a visual aid.*

See 15.6.1.6 Navigation Tab .

Tol’s Tab



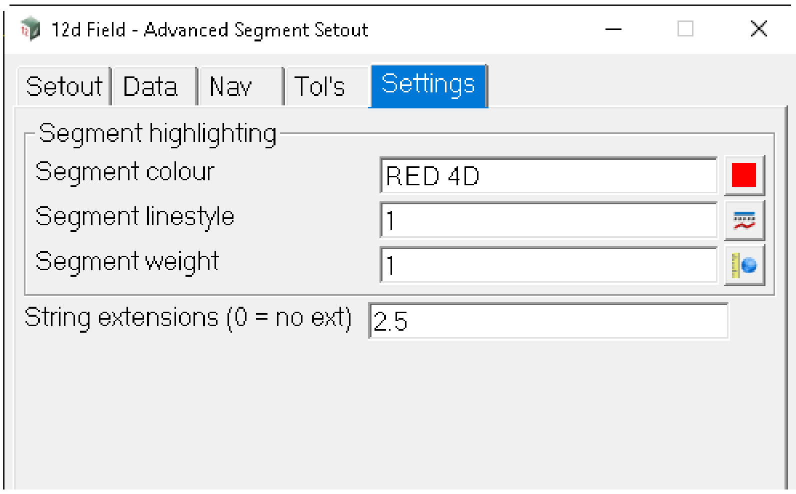
Setout Tab
Data Tab
Nav Tab
Tol’s Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

*For information on the **Tolerance tab** see* 15.6.1.7 Tolerances Tab.

Settings Tab



[Setout Tab](#)
[Data Tab](#)
[Nav Tab](#)
[Tol's Tab](#)
[Settings Tab](#)

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Segment highlighting			
Segment colour	colour box	red	available colours

??

Segment linestyle

??

Segment weight real box

??

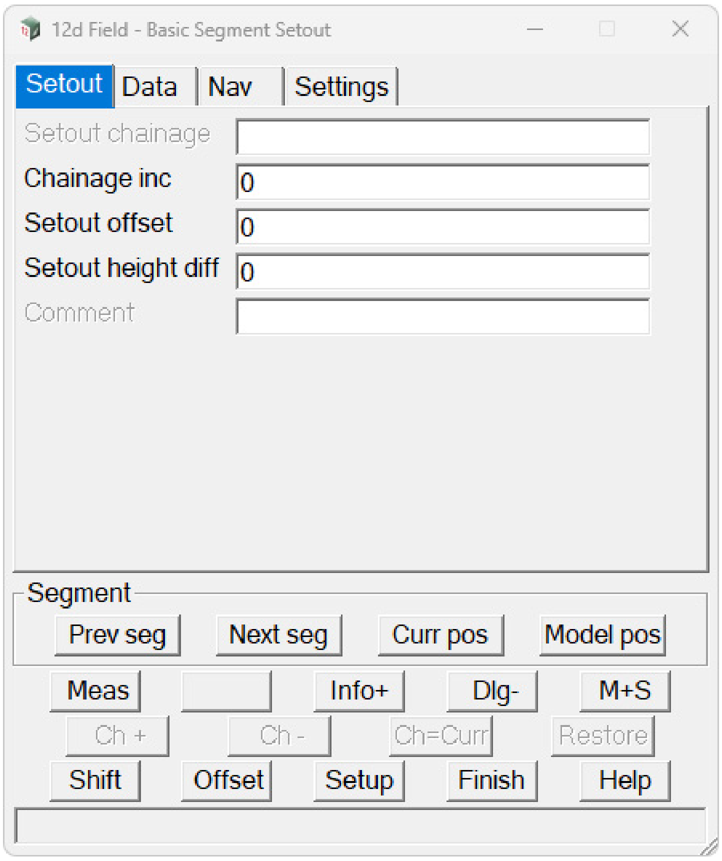
String extensions (o = no ext)

??

Continue to 15.6.5.9 Setout Basic Segment or go back to 15.6.5 Setout .

15.6.5.9 Setout Basic Segment

The Basic Segment Setout panel allows the user to select one segment of a super string and use this as if it was a 2 point line or arc string with extensions, transition segments are not permitted for use with this option.
Clicking **Segment Basic** brings up the **12d Field - Basic Segment Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol's Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Setout Tab

Setout chainage

The natural, no equalities setout chainages on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

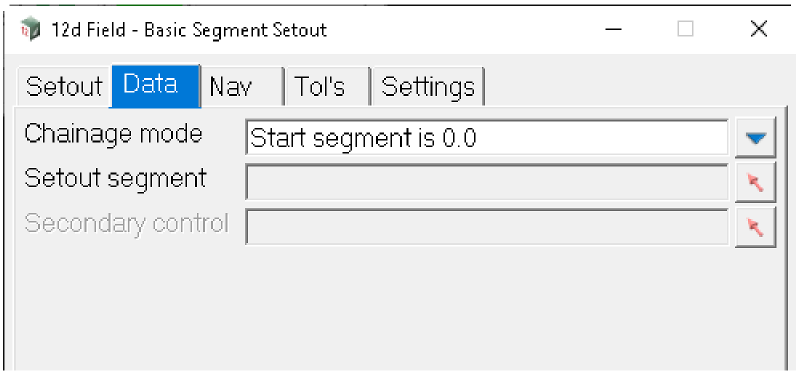
Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Data Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab
Settings Tab

Chainage mode	choice box	Start segment is 0.0 End segment is 0.0 String chainage

Start segment is 0.0: *the start chainage of the selected string segment is set to 0.0. If the user wants to setout a point a set distance before the start of the segment enter a negative chainage.*

End segment is 0.0*: the chainage at the end point of the selected string segment is set to 0.0, the start chainage of the segment is then -ve, 0.0 – the segment length. If the user wants to setout a point a set distance after the end of the segment enter a positive chainage.*

String chainage*: the start chainage of the selected string segment is set to the parent string chainage at that point.*

Important*: upon changing this choice the segment must be reselected for the chainage type to apply.*

Attribute "so_seg_ch_mode"

Setout segment

Select either a line or arc segment of a string to use.

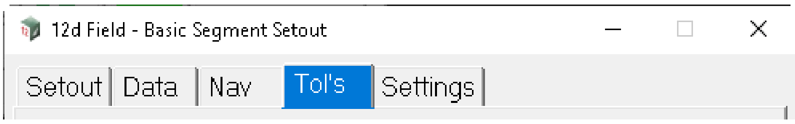
Secondary control

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Nav Tab

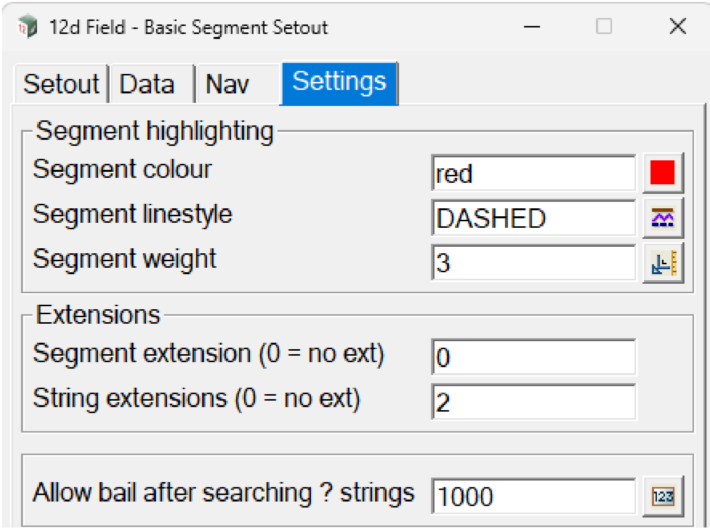
For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Tol’s Tab



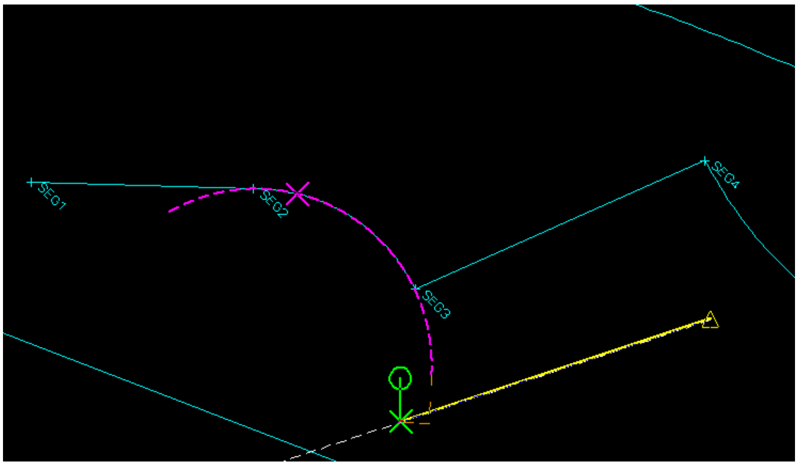
For details on using and populating the Nav tab see 15.6.1.7 Tolerances Tab.

Settings Tab



Setout Tab
Data Tab
Nav Tab
Tol’s Tab
Settings Tab

Note, all of the following settings are only applied when the temporary segment is created, the segment must be reselected or the Prev/Next/Curr buttons used after changing these values.



Segment highlighting

Segment colour colour box red available colours

Select the colour for the temporary segment.

Attribute "so_seg_lc"

Segment linestyle

Select the linestyle for the temporary segment.

Attribute "so_seg_ls"

Segment weight real box

Select the thickness of the temporary segment.

Attribute "so_seg_lw"

Extensions

Segment extensions (o = no ext)

Enter the value to extend the inbuilt horizontal geometry by to create the temporary string, as per the diagram above arcs are extended natively.

Global attribute "so_segment_extension_length"

String extensions (o = no ext)

Like the standard string extensions enter the maximum tangential horizontal and vertical extension value from the ends of the temporary string, if a measurement drops into this the area the panel message box will be coloured as a warning.

Global attribute "so_string_extension_length"

Allow bail after searching ? strings integer box 1000

This setting is protection against the user accidently searching through a huge model trying to find the closest segment, a search does not precheck the number of strings in the model but allows a bail out option if this number is exceeded. Enter a value between 10 and 10000.

Buttons at Bottom

Prev seg button

Create the temporary string from the next segment of the currently selected string. If the current segment is the last segment of the string it will advance to the first segment.

Next seg button

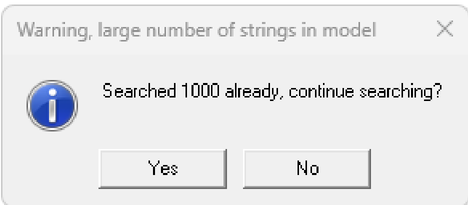
Create the temporary string from the previous segment of the currently selected string. If the current segment is the first segment of the string it will advance to the last segment.

Curr pos button

Create the temporary string from the segment closest in offset to the measured point.

Model pos button

*Similar to **Curr Pos** but this option will search all of the strings in the selected model, update the string and set the segment to the closest found segment. If the search exceeds the user defined bail out number the following message box is shown.*



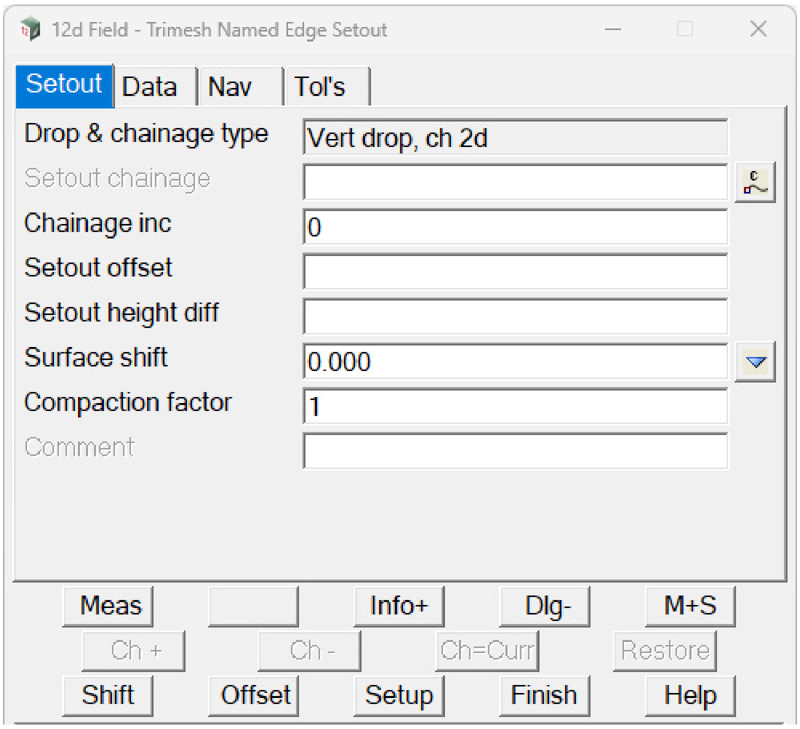
For more information on the standard buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Continue to 15.6.5.10 Setout Trimesh Edge or go back to 15.6.5 Setout .

15.6.5.10 Setout Trimesh Edge

The **Trimesh Named Edge Setout** is very similar in functionality to the 15.6.5.1 Setout String Basic panel, just instead of strings the user selects a named edge from the selected trimesh. This panel is ideal to use with Trimeshes produced from 12d itself such as via the **Apply MTF**.

Clicking **Trimesh Edge** brings up the **12d Field - Trimesh Named Edge Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Drop & chainage type Vert drop, ch 2d

The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point *for more information.*

Setout chainage

The natural, no equalities setout chainages on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

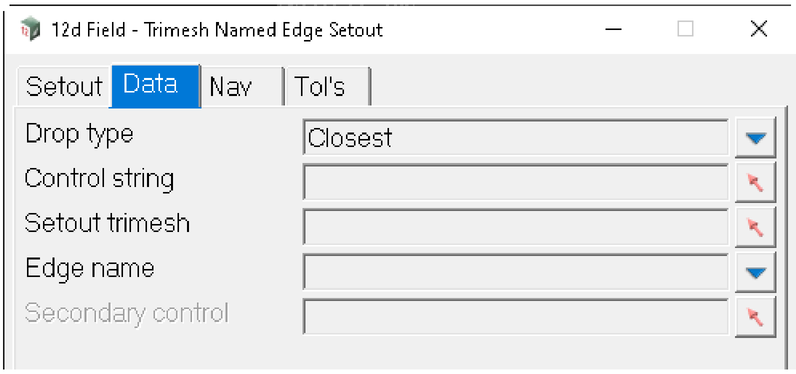
Compaction factor

If turned on a value to multiple delta heights by for certain construction situations, it would be set to 1.0 in most situations, for more information see 15.6.1.8.7 Compaction factor (so_compaction_factor) .

Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Data Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drop type	choice box	Closest	Closest to control string Closest to setout ch

Closest to control string*, where multiple drops are possible to the control string the drop with the smallest offset from the control string will be used.*

Closest to setout ch*, in situations like traffic islands sometimes the drop with the smallest offset is not the drop to the point attempting to be set out, this option will use the drop whose chainage is the closet to the setout chainage.*

Field Description	Type	Defaults	Pop-Up
Control string	string select		

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Field Description	Type	Defaults	Pop-Up
Setout trimesh	trimesh select		

Select the trimesh to use for named edge setout.

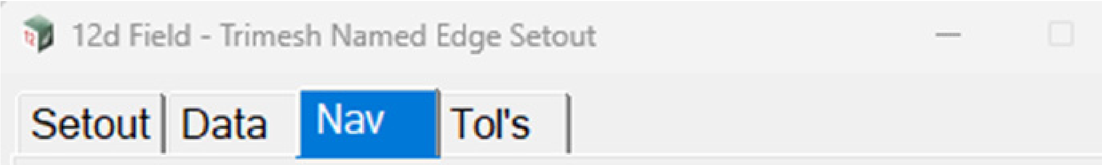
Field Description	Type	Defaults	Pop-Up
Edge name	choice box		

On selecting the trimesh the choice box will be populated with the available named edges to use, select the named edge to setout.

Field Description	Type	Defaults	Pop-Up
Secondary control	string select		

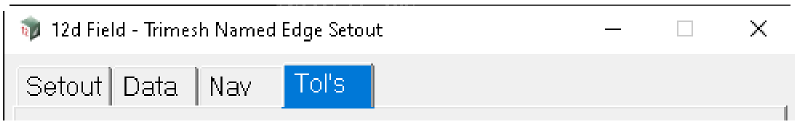
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Nav Tab



For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Tol’s Tab



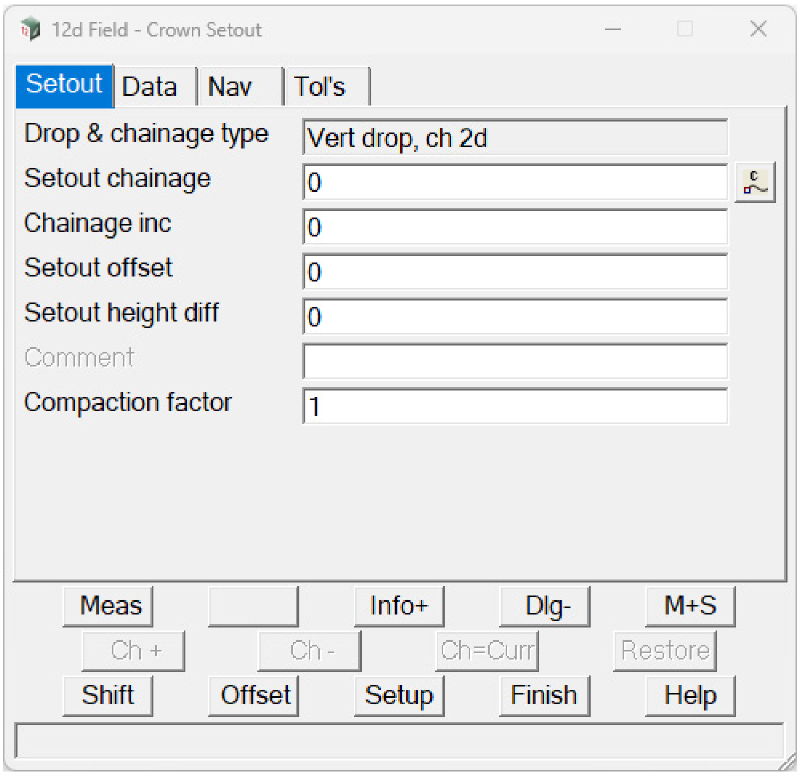
For details on using and populating the Tol's tab see 15.6.1.7 Tolerances Tab .

Continue to 15.6.5.11 Setout Crown or go back to 15.6.5 Setout .

15.6.5.11 Setout Crown

The **Crown Setout** panel is very similar to the **Crossfall Setout** panel except that the user selects 3 strings to produce 2 design planes as opposed to the 1 design plane in crossfall setout. Crown setout was typically used on rural roads where on straight sections the road has the high point, the crown, in the middle of the road and drains to both sides.
For an indicative diagram of crown setout and associated attributes see 15.7.3.2.5.3 Crown Diagrams .

Clicking **Crown** brings up the **12d Field - Crown Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol’s Tab

The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Drop & chainage type   Vert drop, ch 2d

The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point for more information.

Setout chainage

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Chainage inc   0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more *information see* 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Setout offset

The offset of the setout point from the setout string, +ve is to the right relative to the control string direction, for more information see 15.6.1.8.3 Setout offset (so_sp_ss_os) .

Setout height diff

The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

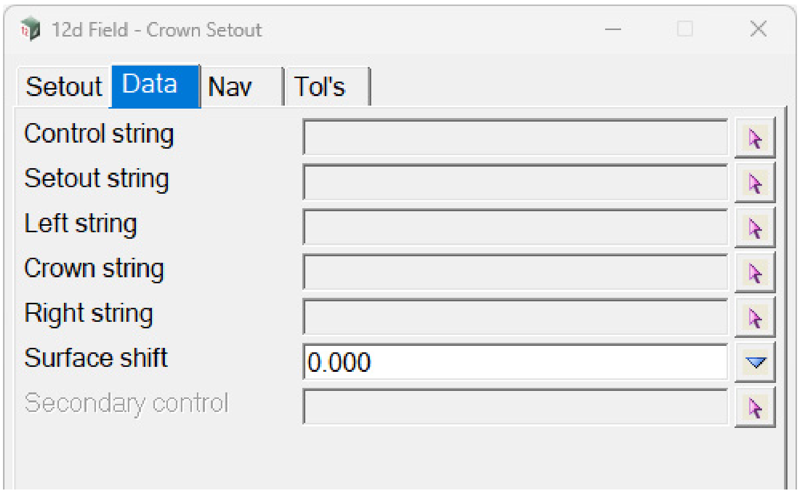
Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Compaction factor

If turned on a value to multiple delta heights by for certain construction situations, it would be set to 1.0 in most situations, for more information see 15.6.1.8.7 Compaction factor (so_compaction_factor) .

Data Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Control string string select

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Setout string string select

The string that the setout offset is applied to generate the setout point easting and northing, this string is not used for height calculations.

Left string string select

The outer height string on the left hand side of the road.

Crown string string select

The crown string, the central height string used by both side of the road.

Right string string select

The outer height string on the right hand side of the road.

Surface shift choice box 0.000

A vertical shift applied to the plane generated by cutting the height string or strings, intended to be used for pavement layers when only the design surface is available, for more information see 15.6.1.8.5 Setout height diff (so_vpl_spl_htdf) .

Secondary control string select

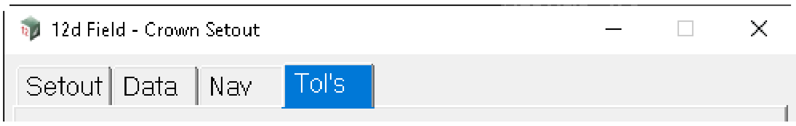
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Nav Tab

Setout Tab
Data Tab
Nav Tab
Tol's Tab

For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Tol’s Tab



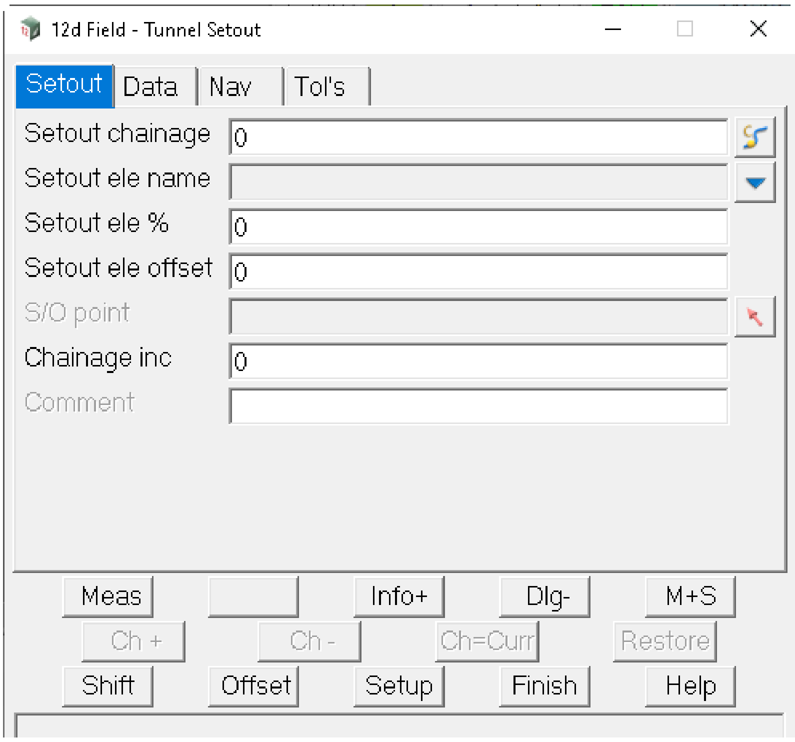
For details on using and populating the Tol's tab see 15.6.1.7 Tolerances Tab .

Continue to 15.6.5.12 Setout Tunnel or go back to 15.6.5 Setout .

15.6.5.12 Setout Tunnel

The **12d Field - Tunnel Setout** panel allows use of a standard 12d tunnel definition in the field to perform related tasks.
See 18.15 Tunnels and Structures for full information on tunnel definitions.

Clicking **Tunnel** brings up the **12d Field - Tunnel Setout** panel.



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Setout chainage

The natural, no equalities setout chainage on the control string, for more information see 15.6.1.8.1 Setout Chainage (so_cs_ch) .

Setout ele name choice box

On selecting the tunnel definition this choice box is populated with the available profile elements, select the element you want to work with.

Attribute "so_tun_ele_name"

Setout ele % 0

Percentage around the element to setout, 0% means the start of the element, 100% the end of the element.

Attribute "so_tun_ele_per"

*Note, there is a hotkey available, "**tunnel_so_seg_per_from_last_pt**", which will populate the **Setout ele name** and **Setout ele** % fields from the drop of the lase measured point to tunnel design.*

Setout ele offset 0

Offset from the element to setout, +ve is to the right of the element.

Attribute "so_tun_ele_os"

S/O point string select

Allows the selection of a point from a view which is then dropped to the tunnel profile to populate the ***Setout chainage****,* ***Setout ele name****,* ***Setout ele %*** *and* ***Setout ele offset*** *fields.*

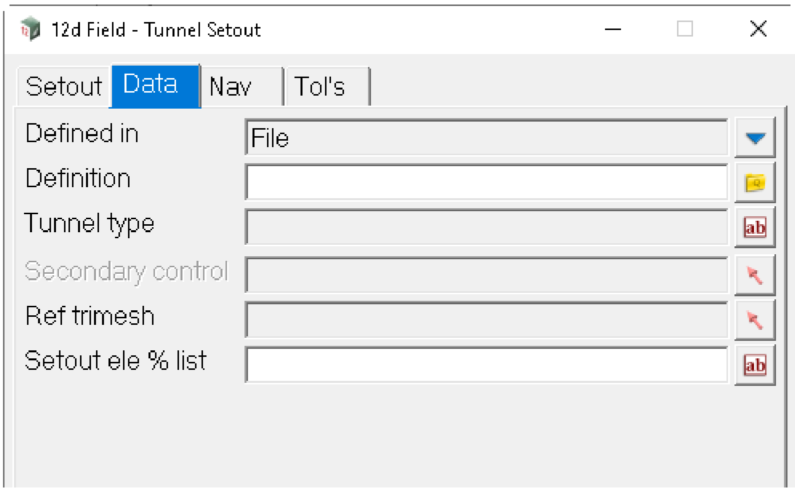
Chainage inc 0

Value that the setout chainage will be changed by when chainage increment/decrement is called, for more information see 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Data Tab



[Setout Tab](#)
[Data Tab](#)
[Nav Tab](#)
[Tol's Tab](#)

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Defined in	choice box	file	File, Centreline

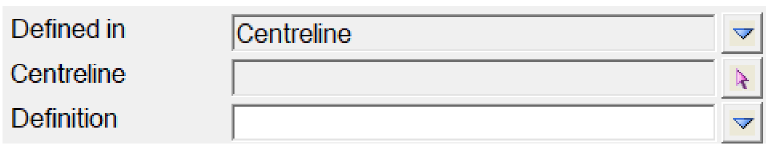
Tunnel definitions can either be stored in a text file or as control string attributes.

File

Definition file box

*Select the **12d_tunnel** text file defining the tunnel to be used.*

Centreline



Centreline string select

Select the centreline containing the tunnel definitions, the Definition choice box will be populated with the available tunnel definitions.

Definition choice box

Select the tunnel definition to use from the available choices.

Tunnel type text box

Information only, what sort of chainages and drop types this tunnel definition uses, see 18.15.2 Creating/ Editing a Tunnel Definition File *for more information.*

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Ref trimesh string select

If selected, when a measured point is dropped to the tunnel definition a ray perpendicular to the tunnel surface at the drop will be intersected with this trimesh and this distance available as the attribute pu_tun_mesh_drop_off_square_prf.

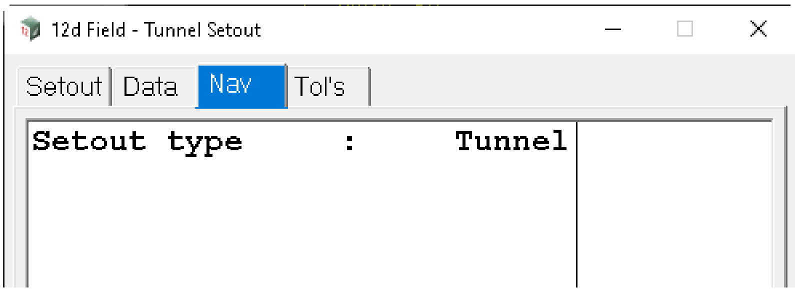
Attribute "so_tun_trimesh_eler"

Setout ele % list text box

*A manually entered, space separated list of percentages which is design to work with the 12d Field function keys "**next_tunnel_seg_per**" and "**prev_tunnel_seg_per**". For example, if the user enters **10 20 50 70** then they will see the **Setout ele %** cycle through these values, order dependent on which key is used.*

*Also note the function keys "**next_tunnel_seg**" and "**prev_tunnel_seg**" can be use to iterate through the **Setout ele name** choice list.*

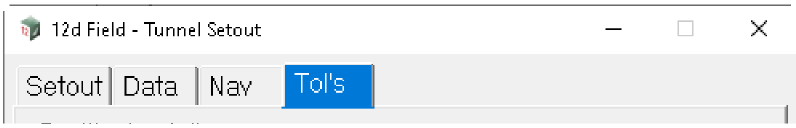
Nav Tab



Setout Tab
Data Tab
Nav Tab
Tol's Tab

For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab.

Tol’s Tab



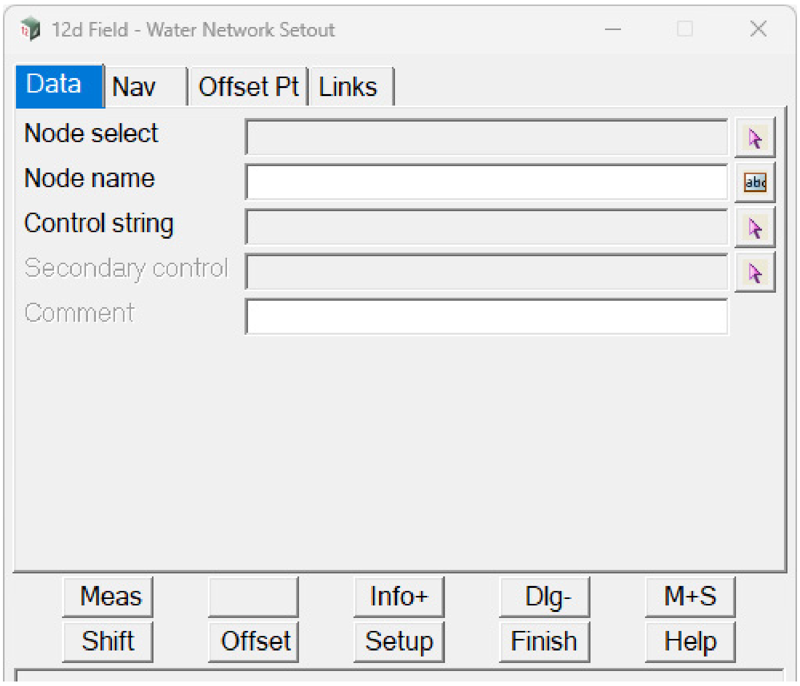
For details on using and populating the Tol’s tab see 15.6.1.7 Tolerances Tab.

Continue to 15.6.5.13 Water Network Setout or go back to 15.6.5 Setout.

15.6.5.13 Water Network Setout

The **12d Field - Water Network Setout** takes a ***12d Model*** water network model and uses it directly in the field for marking out water nodes and links.
This panel has been updated for V15 to use the modern terminology of **nodes** and **links** which correlate the stormwater terms **pits** and **pipes**.
The user simply selects the water node to setout, once a reading is taken they can then cycle through the upstream links to write up the relevant information to construct those.

Clicking **Drainage** brings up the **12d Field - Drainage Setout** panel.



Setout Tab
Nav Tab
Offset Pt Tab
Links Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Setout Tab

Node select string select

Select the water node to setout, the select does not have to be exact, the closest water node is used, it is an error if the selected item is not a Water String.

Node name text box

The name of the selected node.

Control string string select

Select a string for guidance in setting out the node, delta values are shown relative to this. For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

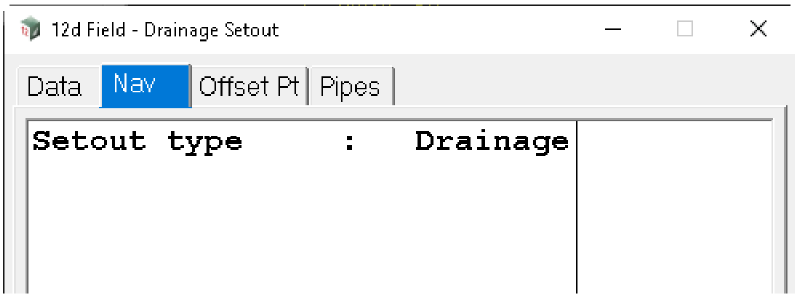
Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Comment

A user entered comment, for more information see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line) .

Nav Tab

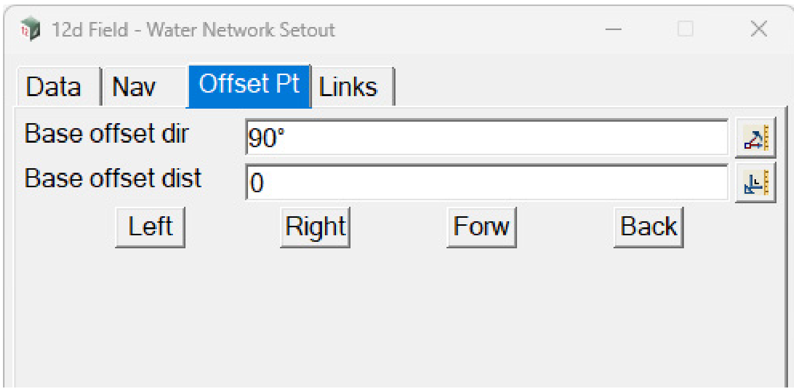


Setout Tab
Data Tab
Nav Tab
Tol's Tab

For details on using and populating the Nav tab see 15.6.1.6 Navigation Tab .

Offset Pt Tab

A common method of marking out node/pit locations is to place 2 pegs offset in a straight line from the centre of the node/pit, typically square to the pipe/link direction where possible. When the water node is selected it's centre coordinates are dropped to the control string and the base direction for offsets calculated.



Setout Tab
Data Tab
Nav Tab
Tol's Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Base offset dir	angle box	90 degrees	

The direction for offsetting points.

Base offset dis	real box	0	

The distance for offsetting points.

Left button

Create a setout point to the left of the base direction at the offset distance.

Right button

Create a setout point to the right of the base direction at the offset distance.

Forw button

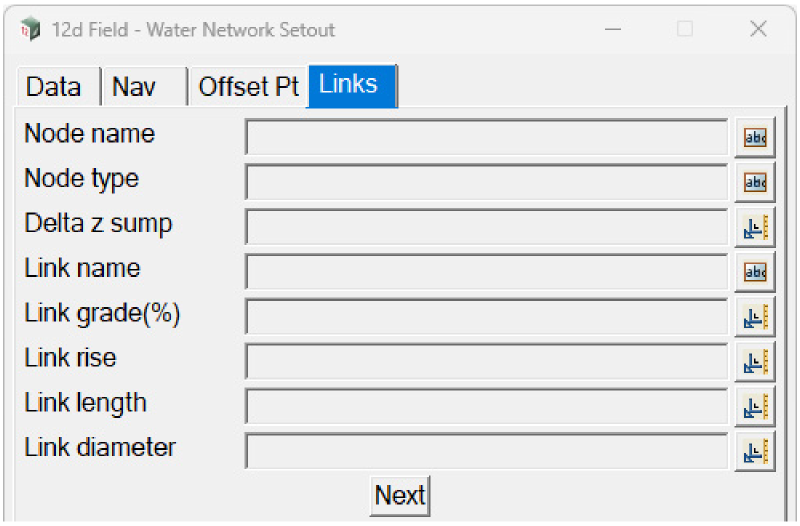
Create a setout point in the base direction at the offset distance.

Back button

Create a setout point reverse to the base direction at the offset distance.

Links Tab

This tab allows the user to cycle through the information relating to the individual upstream links, the 12d Field plan view also highlights the current upstream link.



[Setout Tab](#)
[Data Tab](#)
[Nav Tab](#)
[Tol's Tab](#)

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Node name	text box		

The name of the selected node.

Node type	text box		

The type of the selected node.

Delta Z sump	real box		

The delta height from the measured point to the sump level of the node/pit.

Link name	text box		

Displays the names of the 2 nodes of the upstream link/pipe.

Link grade (%)	real box		

The actual grade of the upstream link/pipe, this is not the centre to centre grade of the 2 nodes.

Link rise	real box		

The height difference from the sump level of the node/pit to the invert level of the upstream link/pipe.

Link length	real box		

The actual length of the upstream link/pipe, this is not the centre to centre length of the 2 nodes.

Link diameter real box

The nominal diameter of the upstream link/pipe.

Next button

*Update the **Links** tab with the information for the next upstream pipe.*

Continue to 15.6.5.14 Setout Piles or go back to 15.6.5 Setout .

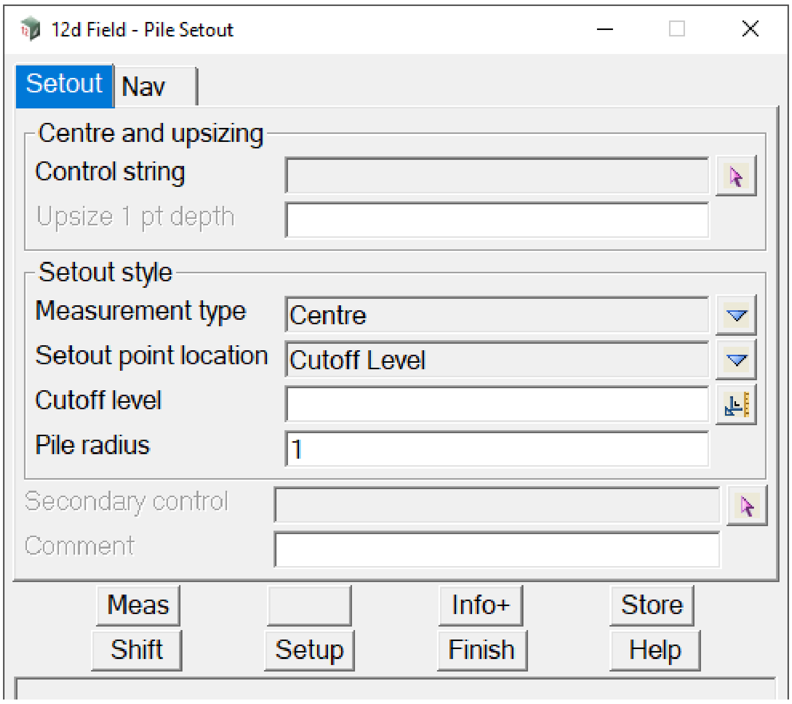
15.6.5.14 Setout Piles

The pile setout panel is designed to position primarily vertical circular piles, the centreline of the pile must be a 2 point string, if the user is supplied a series of single points for vertical piles they can be upsized to 2 points by this panel so they can be used.

Given the piles are primarily vertical the user needs to be aware the delta values attributes to correctly position the pile a quite different to 'flat' setout.

The attribute guiding the user to the correct height is the delta 3d chainage of the perpendicular drop to the string, **pu_pcut_mp_cs_dch3d**. The 3d versions of delta offset and height, **pu_pcut_mp_cs_dos** and **pu_pcut_mp_cs_dht** are not meaningful unless the pile is on a substantial rake, so most of the absolute 3D distance to the correct position, **pu_pcut_mp_cs_dist** is the most useful.

Clicking **Piles** brings up the **12d Field - Pile Setout** panel.



Setout Tab
Nav Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Setout Tab

Centre and upsizing

Control string string select

Attribute " so_cs_strr "

*The 2 point straight line string representing the centreline of the pile, this is extended infinitely by the internal calculations so its start and end points are not critical. If only a single point is available the user must fill in the **Upsize 1 pt depth** field to the string can be upsized for use.*

Upsize 1 pt depth real box

Attribute " so_cyl_pile_upsize"

The depth, the value that will be subtracted from the z value of a single point string for the new vertex to *make it a 2 point vertical string, e.g. (**x1, y1, z1**) & (**x2=x1, y2=y1, z2=z1-depth**).*

Setout style

Measurement type choice box Centre

The type of pile setout to use.

Attribute " so_cyl_pile_setout_style "

Measure the cutoff level

*Aim to a point on the pile and press **Meas**, the **Cutoff level** widget will be populated with the measured height value.*

Left/Right/Centre

*The user will point to the left or right hand side of the pile, press **Meas**, the button will change text to **Angle**, the user will then press the button again when pointed at the other side of the pile, the instrument will turn to the mean angle and take a distance measurement and calculate the result using the radius value from **Pile radius**.*

Centre, (manual aim)

*The user points manually to the centre of the pile, press **Meas**, a distance measurement is taken and results calculated using the radius value from **Pile radius**.*

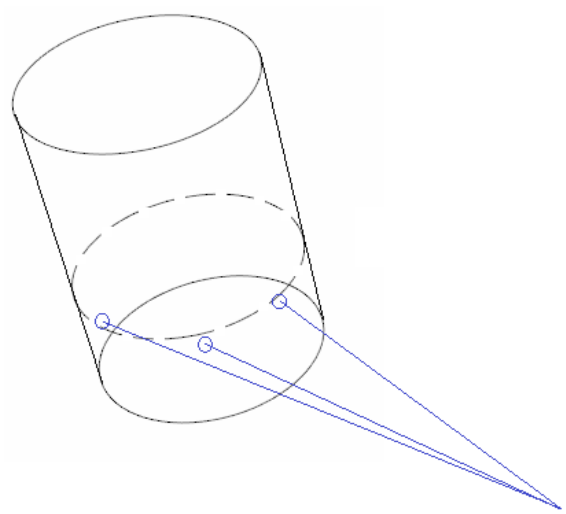
Fit 2 bands, known radius

Fit 3 bands, known radius

Fit 3 bands, find radius

For these modes either 2 or 3 bands of 3 points are taken, the best fit of the pile is then calculated either using a known radius or calculating the best fit radius.

As shown in the following diagram the band of three points should be measured as close as possible to an inclined circle representing a section through the pile. A unique 3D circle is fitted through the 3 points and the 2 or 3 formed circles used to calculated the current pile position.



The points do not need to be perfectly on the true section but the closer they are to it and the wider the spacing the more accurate the calculated position will be.

The user is prompted as the 6 or 9 readings are taken as to which point the next reading will be to.

Setout point location choice box

Attribute " so_cyl_pile_setout_point_location "

*The position the delta value attributes will be calculated to. The list is dynamically updated depending on the **Measurement type** choice.*

***Cutoff Level** to the manual cutoff level*

***Band 1** to the calculated centre of band 1*

***Band 2** to the calculated centre of band 2*

***Band 3** to the calculated centre of band 3*

Cutoff level real box

Attribute " so_cyl_pile_rl_t "

The nominal pile cutoff level, this can be manually entered or measured.

Pile radius real box

Attribute " so_cyl_pile_rl_t

The known external radius of the pile, the box is disabled if the radius is being calculated on the fly.

Secondary control string select

Attribute " so_sc_strr "

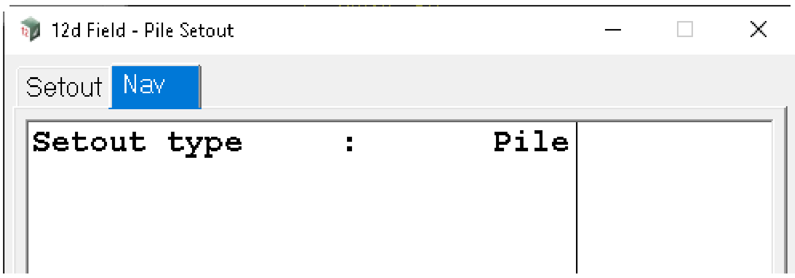
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr).

Comment input

Attribute " pu_panel_comment_line"

A user entered comment, see 15.6.1.8.6 Comment (st_gui_display_pu_comment_line).

Nav Tab



Setout Tab
Nav Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Navigation Box		draw box	

*The **12d Field** navigation box augments setout by displaying user definable information rows plus a bullseye as a visual aid.*

See 15.6.1.6 Navigation Tab.

*For information on **pile setout specific attributes** see* 15.7.3.2.7 Pile Setout Specific Attributes.

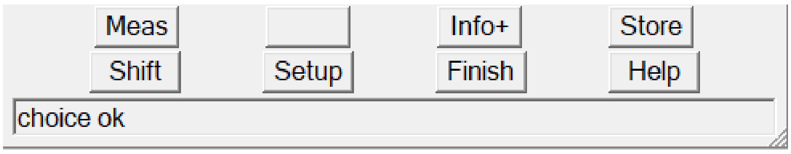
Buttons at Bottom

The buttons at the bottom vary dependent on the pile setout mode.

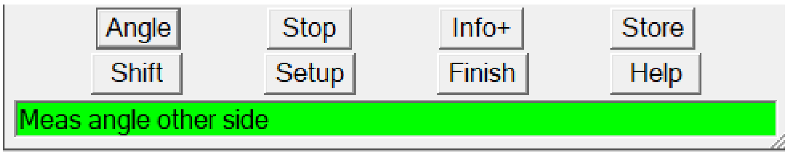
For information on the standard buttons see [15.6.1 Common Buttons, Panel Tabs and Fields](#).

The behaviour of the special Pile Setout buttons is as follows.

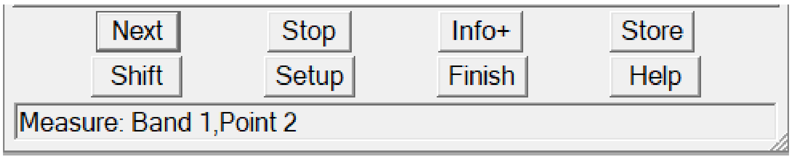
For setout types ***Measure the cutoff level*** *and* ***Centre, (manual aim)*** *the buttons look as such.*



For setout types **Left/Right/Centre** after **Meas** has been pressed the first time the buttons look as such, **Angle** to take the next reading or **Stop** to cancel the measurements.



For setout types ***Fit 2 bands, known radius, Fit 3 bands, known radius, Fit 3 bands, find radius*** *after* ***Meas*** *has been pressed the first time the buttons look as such, Next to take the next reading as prompted in the message box or* ***Stop*** *to cancel the measurements.*



Continue to 15.6.6 Pickup or go back to 15.6.5 Setout .

15.6.6 Pickup

Clicking on the **Pickup** menu option brings up the **Pickup** menu.

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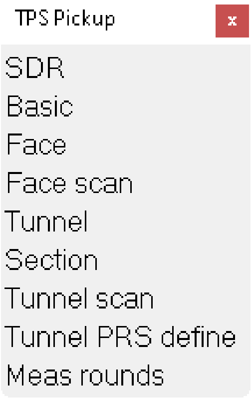
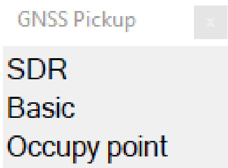
TPS Pickup



See
15.6.6.1 Pickup SDR
15.6.6.2 Pickup Basic
15.6.6.3 Pickup Face
15.6.6.4 Pickup Face Scan
15.6.6.5 Pickup Tunnel
15.6.6.6 Pickup Section
15.6.6.7 Pickup Tunnel Scan
15.6.6.8 Pickup Tunnel PRS Define
15.6.6.9 Pickup Measurement Rounds

GNSS Pickup



See
15.6.6.1 Pickup SDR
15.6.6.2 Pickup Basic
15.6.6.10 Pickup Occupy Point - GNSS

15.6.6.1 Pickup SDR

12d Field - SDR Pickup is a panel which populates an **SDR Function** directly in the field. Unlike 15.6.6.2 Pickup Basic , **SDR Pickup** is a complete record of the completed survey with full edit and recalculation abilities.

SDR Pickup and the format of panels it brings up can be configured for individual users needs by a user defined coding file, see 15.10 12d Field Codes for full details.

SDR pickup operates in conjunction with any number of standard 12d Field setout panels, when a measurement is taken in **SDR Pickup** all of the setout panels run their individual calculations and when a measurement is stored in the **SDR Function** all of the attributes from the open setout panels are stored as well.

Note, if a control model is nominated SDR pickup will not copy the coordinates of the current setup as opcode 2 to the function being created, just the measurements to the control points. If the user wants the function to be a complete snapshot of the survey at that point of time, e.g. control points are destroyed or their coordinates constantly adjusted then do not enter a control model. In this case the control points are copied to the SDR function as opcode 2 along with the measurements to the control points. The function will then be able to be recalculated in the future independent of changes to the original control model.

Clicking **SDR** first brings up the **12d Field - Current Setup Details** panel.

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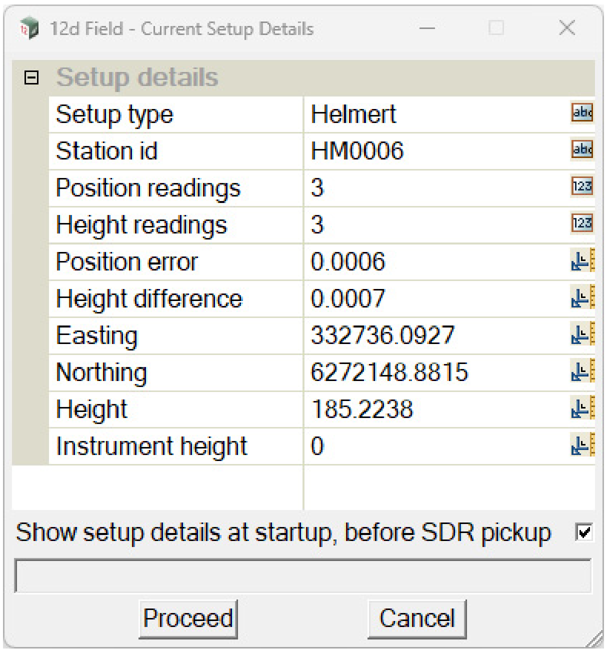


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Show setup details at startup, before SDR pickup	tick box	ticked	

*If **ticked**, the current setup details are displayed on starting 12dField and every time SDR Pickup is started.*

*If **not ticked**, this panel will not be displayed on entering SDR Pickup and the user will proceed straight to 16.6.5.1.2 SDR Function.*

Buttons at Bottom

Proceed	button

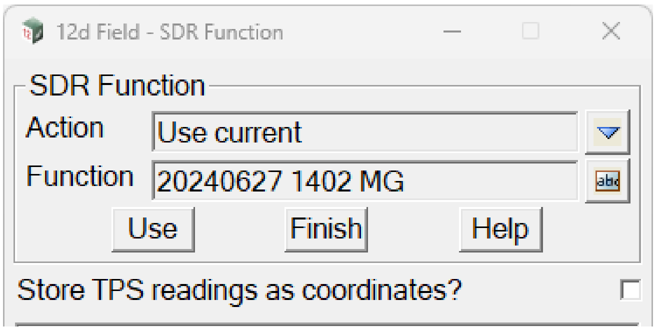
Proceed to 16.6.5.1.2 SDR Function.

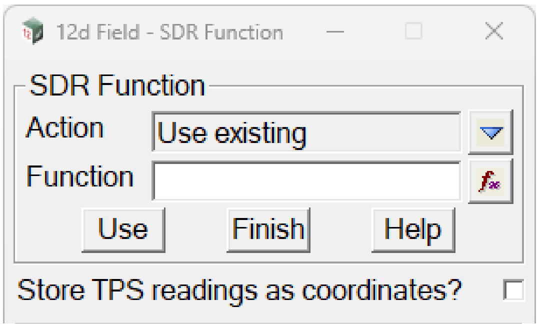
Cancel button

Exit SDR Pickup.

The fields is this panel have been documented in except there is now an addition **Proceed** button.

After clicking on **Proceed**, the **12d Field - SDR Function** panel appears:





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Store TPS reading as coordinates?	tick box	not ticked	

*If **ticked**, a TPS reading will be stored as **Opcode 2**, **coordinate**, the reading will never be recalculated. **Warning**, the raw TPS readings, ha, va and sd are still there as attributes but some options will expect them to be present as Opcode 7, the user must decide whether this option is suitable for their work flows.*

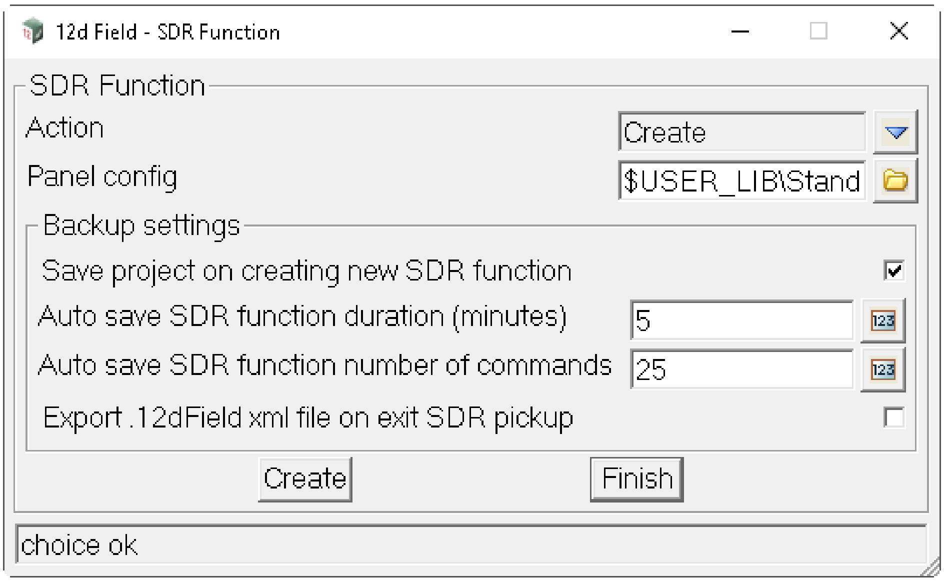
*If **not ticked**, TPS readings will be stored conventionally as **Opcode** 7, **edm_tachy_measurement**, the readings and subsequent coordinates are able to be recalculated.*

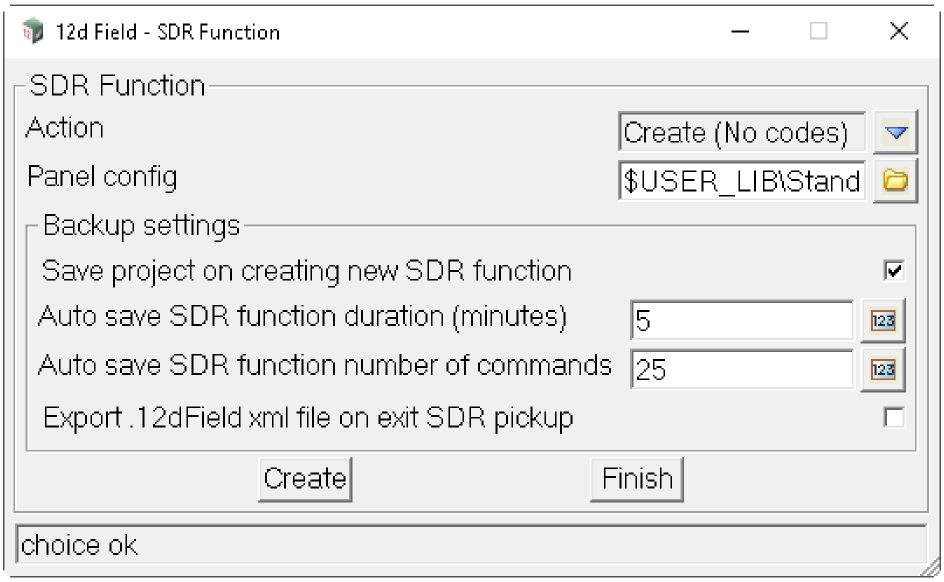
Action	choice box		Use current, Use existing Create, Create (no codes)

*If **Use current**, the SDR Function currently being used and is used when the* **Use** *button is pressed.*

*If **Use existing**, a different, but existing, SDR Function is selected in the* **Function** *field, and then used when the* **Use** *button is pressed.*

*If **Create** or **Create (No Codes)**, a new SDR Function is created and extra fields are added to the* **12d Field - SDR Function** *panel:*





The extra fields and buttons used in this panel have the following functions.

Panel config folder box *.12dfield_sdr_config files

*If **not blank**, the given **12dfield_sdr_config file** is used to tailor what tabs are visible on the created **12d Field - SDR Function.***

*If **blank**, the **12d Field - SDR Function** is created with all fields and tabs.*

Backup settings

Save project on creating new SDR function tick box

*If **ticked**, recommended, the project will be saved on creating the SDR function meaning the function is added to the project so if 12d terminates unexpectedly the function will still be visible in the project.*

*If **not ticked**, the project will have to be saved manually. If 12d terminates unexpectedly before a subsequent save of the project the function will still be there and valid but will have to be manually added to the project.*

Auto save SDR function duration (minutes) integer box

*If **not blank**, the **SDR Function** is saved after every given number of minutes.*

*If **blank**, the **SDR Function** is not automatically saved at any time interval.*

Auto save SDR function number of commands integer box

*If **not blank**, the **SDR Function** is saved after every given number of SDR commands.*

*If **blank**, the **SDR Function** is not automatically saved after any number of SDR commands.*

Export.12dField xml file on exit SDR pickup tick box

*If **ticked**, a 12d Field XML file is created when the SDR Function is exited.*

*If **not ticked**, no 12d Field XML file is created when the SDR Function is exited.*

Buttons at Bottom

Create button

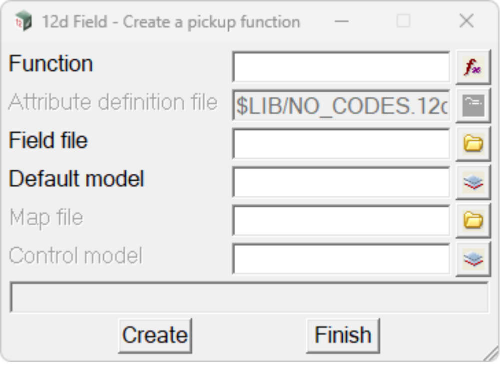
When pressed, the **12d Field - Create a Pickup Function** *panel is displayed.*

*What tabs are on the panel will depend on the **Panel config** file.*

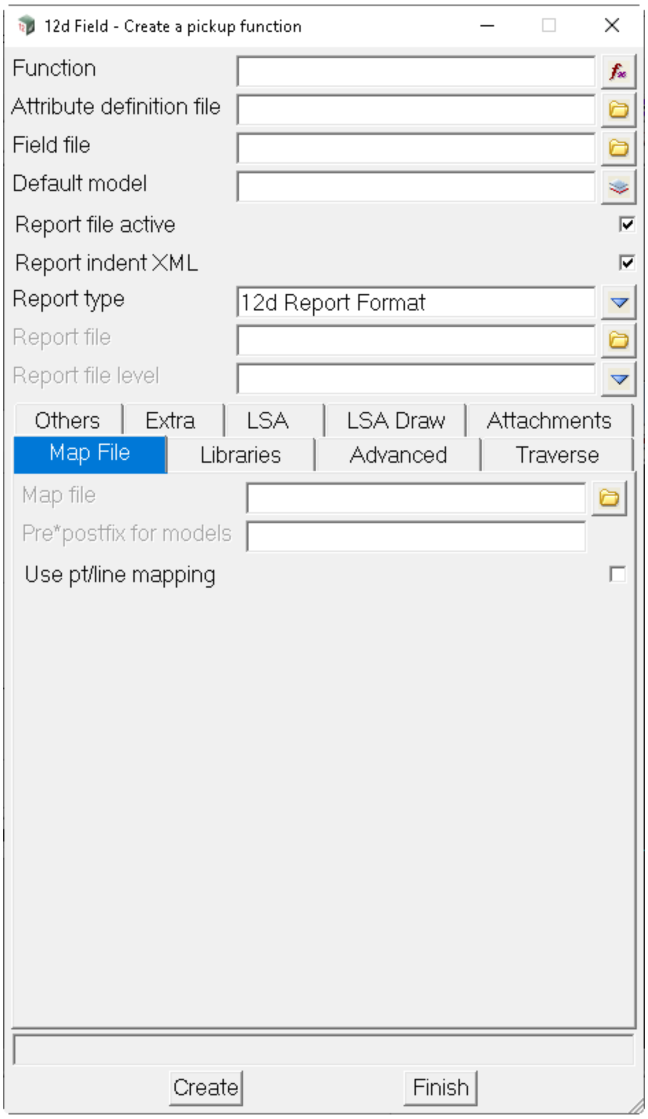
When **Create** (**No Codes**) is used a fixed config file **$LIB/NO_CODES.12dfield_sdr_coding**, shipped with **12d Model** is used, the **12d Field - Create a Pickup Function** panel is a simplified pane with fewer fields and tabs. The Attribute definition file box is also non editable and uses the fixed file **$LIB/NO_CODES.12dfieldcodes**. The **Create (No Codes)** option is intended for a simplified introduction to **SDR Pickup** where only manually entered codes are used and no pre-configuration is necessary.

When **Create** is used with the panel config **Standard.12dfield_sdr_coding**, the **12d Field - Create a Pickup Function** panel is the standard full panel with all field and tabs, this is the image shown, when a user uses a customised **.12dfield_sdr_coding** file the panel appearance will match this file.

Create (NO CODES) Used



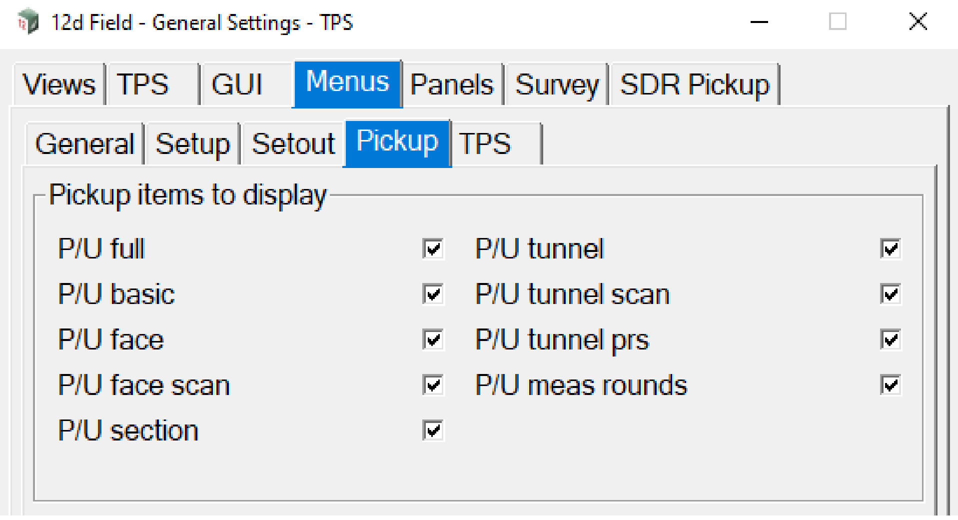
Create Used



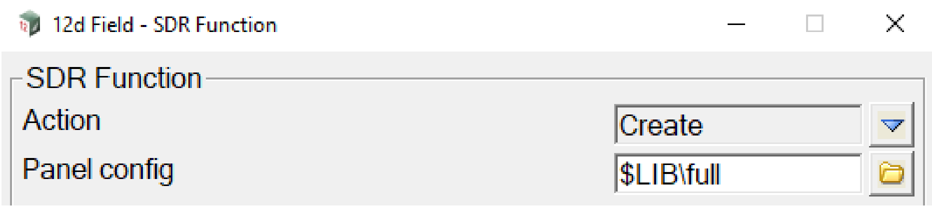
Continue to 15.6.6.1.1 Configuring the "12d Field - Create a pickup function" panel or go back to 15.6.6 Pickup .

15.6.6.1.1 Configuring the "12d Field - Create a pickup function" panel

A surveyor using ***12d Field*** can create and record to an SDR (Survey Data Reduction) function directly with either TPS or GNSS and see the fully reduced survey updated on the screen as they proceed. Like all SDR functions there are many tabs with multiple fields that are necessary to be filled in to fine tune the reduction to the individuals or organisation's needs.



The vast majority of settings for an individual or organisation are the same. To simplify the "**Create a pickup function**" showing only the fields the surveyor needs to enter while populating other values with defaults in the background the surveyor is offered the choice of a panel configuration file with the extension "**12dfield_sdr_config**".



A **12dfield_sdr_config** file is a text file. Sample files **full.12dfield_sdr_config** and **default.12dfield_sdr_config** are shipped in the standard installation.

Note, this section is simply explaining the usage of a **12dfield_sdr_config** file. The shipped **full.12dfield_sdr_config** contains all of the settings that are user modifiable, see 14.4.2 Creating a SDR Function from a 12d Field File for full details on each setting.

The basic structure of the file can be used to mirror the appearance of the standard SDR panel or create a very simple panel, a line in the file either contains settings for a field in the panel or an instruction to place the following settings under a new tab.

First the user defines all settings to be added to the main part of the panel and then optionally any number of tabs and the settings contained in them.

The line format for a new tab is: **1 TAB Sundries**

> Here the keyword **TAB**, only valid if **1** is set before it otherwise ignored signifies a new tab with the name **Sundries**, no quotes are necessary, all characters following TAB are the tab name. All setting following in the file will be placed under this tab until another tab directive is encountered.

Each line of setting contains 3 fields, whether to add a setting to the "**Create a pickup function**" panel, the name of the setting and a default value.

For example:

0 traverse_traverse_code TL

This line sets the default traverse code to **TL** but does not add it to the panel.

1 advanced_control_model TUNNEL CONTROL

This line sets the control model to "**TUNNEL CONTROL**" and adds it to the panel.

0 advanced_check_model

This line adds the check model to the panel but sets no defaults panel.

This section is deliberately minimal, it is expected the author of a **12dfield_sdr_config** file understands all of the necessary setting for their usage and will use the shipped full and default files as the basis and documentation for constructing their configurations.

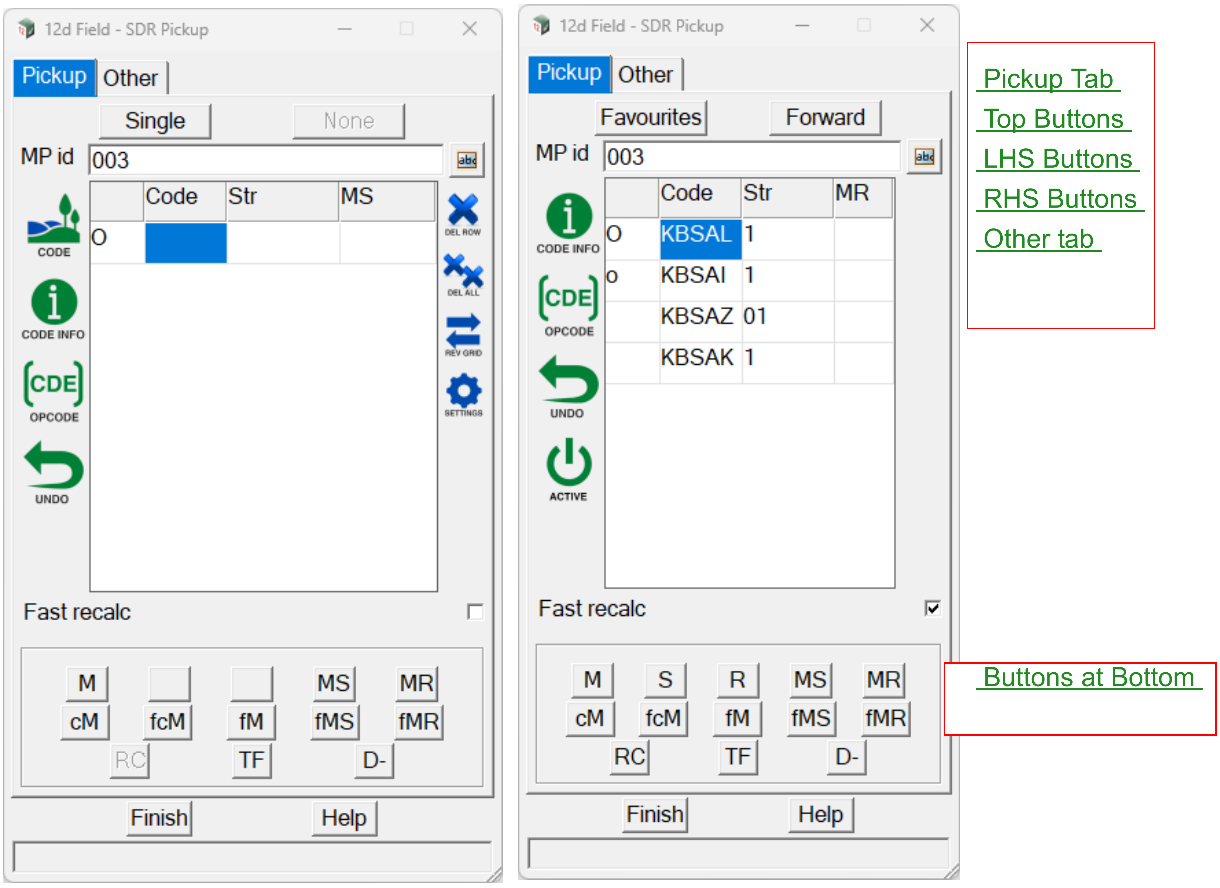
15.6.6.1.2 SDR Pickup Panel

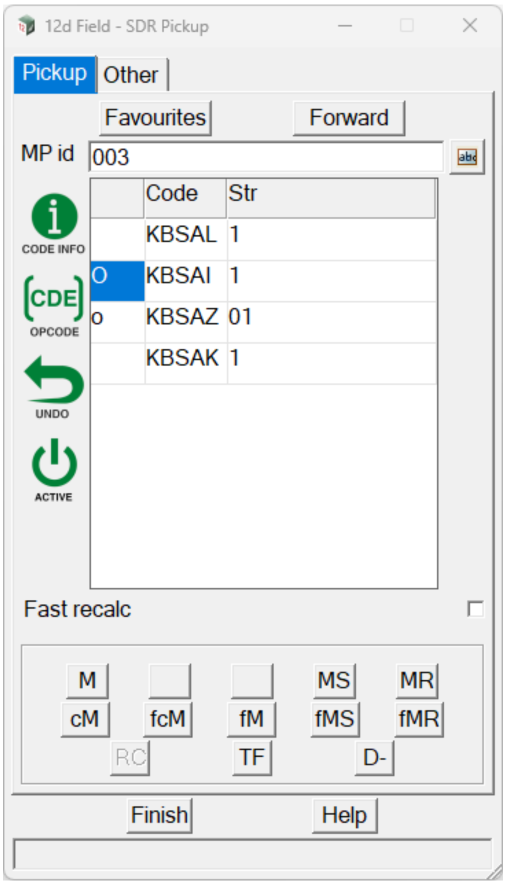
The **12d Field - SDR Pickup** panel is used to take and store measurements from TPS and GNSS instruments to the SDR Function, allow the user to select codes to use and enter the details necessary for each of them, control aspects of the SDR Function amongst many other things.

The following is a basic explanation of the workings of the **SDR Panel** and not how to use it or set it up for actual survey work. Dependent on what work the panel is used for, complex detail surveys with extensive code lists or relatively simple construction conformance surveys will determine how it us used.

Pickup Tab

The Pickup Tab has been designed in such a way the user is only presented with the functionality available dependent on the current modes selected or focus position in the main grid. The **top** and **RHS** buttons and their content change dependent on whether **Single** or **Favourites** mode is in use. The **LHS buttons** change in context of which column in the main grid has the focus and the 4th MS/MR column is a user setting.





The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

MP id

The vertex id that will be used for the next point stored.

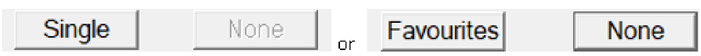
Fast recalc

*If **ticked**, the SDR function will not be fully recalculated every time a point is stored. This is the recommended setting to use and can be considerably faster for very large functions. Note, when ticked the **RC** button in the bottom buttons area is enabled allowing a full recalculation when needed.*

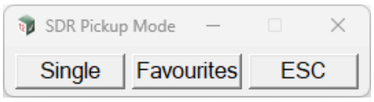
*If **not ticked**, the SDR function will be fully recalculated every time a point is stored. While this means what is displayed on screen is always the final result this is not the recommended setting to use as dependent on opcodes use this can be considerably slower, especially for large functions.*

Top Buttons

*These buttons toggle between **Single** and **Favourites** mode, the default mode is **Single**.*



*Pressing **Single** or **Favourites** dependent brings up the **SDR Pickup Mode** panel.*



Single button

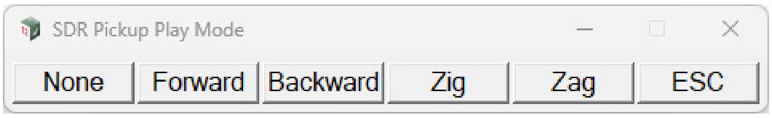
Use Single mode.

***Single** mode uses a code and string number chosen from the main grid, this is a completely manual mode.*

Favourites button

Use favourites mode.

***Favourites** load a list of prestored code names and string numbers from a 12dFieldFavourites file and populates the main grid with these, the right button, default **None** is active in favourites mode and opens the **SDR Pickup Play Mode** panel.*



*Unlike **Single** mode, **Favourites** allows the user to walk automatically through the code list with a defined action on taking and storing a reading.*

None button

Do not move in the code list on storing a point.

Forward button

Move down to the next code in the list on storing a point, if at the bottom of the list move to the top.

Backward button

Move up to the next code in the list on storing a point, if at the top of the list move to the bottom.

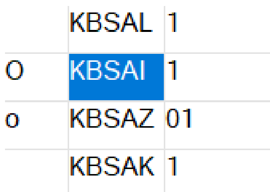
Zig button

*First move **Forward** in the code list, upon reaching the bottom repeat the reading to that code then move **Backward** up the code list.*

Zag button

*First move **Backward** in the code list, upon reaching the top repeat the reading to that code then move **Forward** down the code list.*

These modes use the indicator in the first column to show the current and next codes in us.

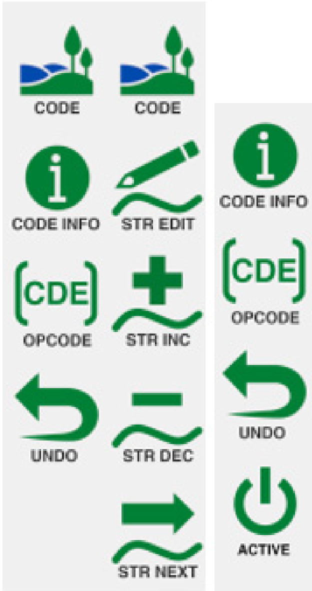


ESC button

Return to the current node.

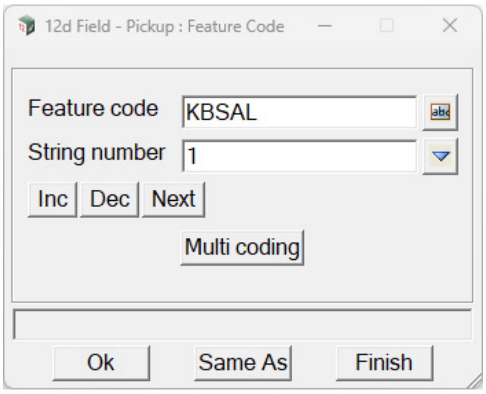
LHS Buttons

The LHS buttons change dependent on the current settings.



Code button

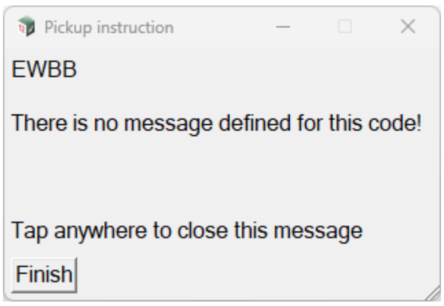
*Show the **12d Field - Pickup: Feature Code** panel.*



The user can manually enter new codes and string numbers or browse through loaded feature codes.

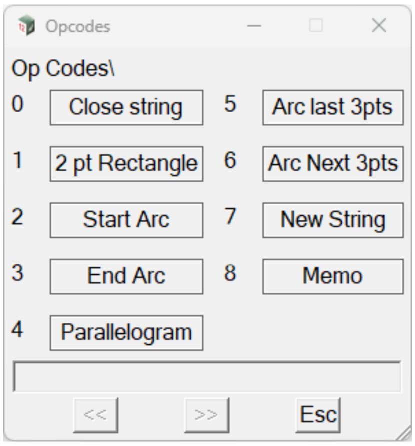
Code INFO button

A panel will pop up showing the code name and detailed information stored with it.



OPCODE button

A panel is displayed to select an opcode to be added to the SDR function.



The opcodes available are defined in the ***12dFieldCodes*** *file in use.*

See 15.6.8 General Settings - TPS *and select* SDR Pickup >GUI *for how to set the number of rows and columns in this panel.*

Undo button

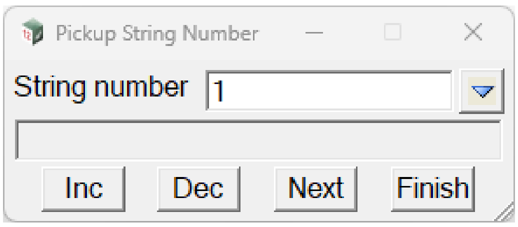
Undo the last reading only.

ACTIVE button

Will disable the code highlighted at the time of pressing, the code is shown as disabled with an x.

STR EDIT button

Will pop up the ***Pickup String Number*** *panel.*



STR INC button

Will create a new instance of the current code with an incremented string number and move it to the top of the list, if the string number already exists that instance will be moved to the top.

STR DEC button

Will create a new instance of the current code with a decremented string number and move it to the top of the list, if the string number already exists that instance will be moved to the top.

STR NEXT button

Will search through existing instances of that code stored and create a new instance of the code with an *unused incremented string number and move it to the top of the list.*

RHS Buttons

DEL ROW button

Delete the current row of the grid.

DEL ALL button

Delete all rows in the grid, a confirmation prompt is displayed.

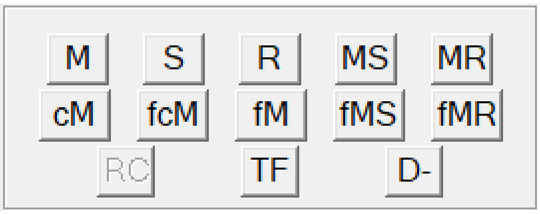
REV GRD button

Reverse the order of the grid.

SETTINGS button

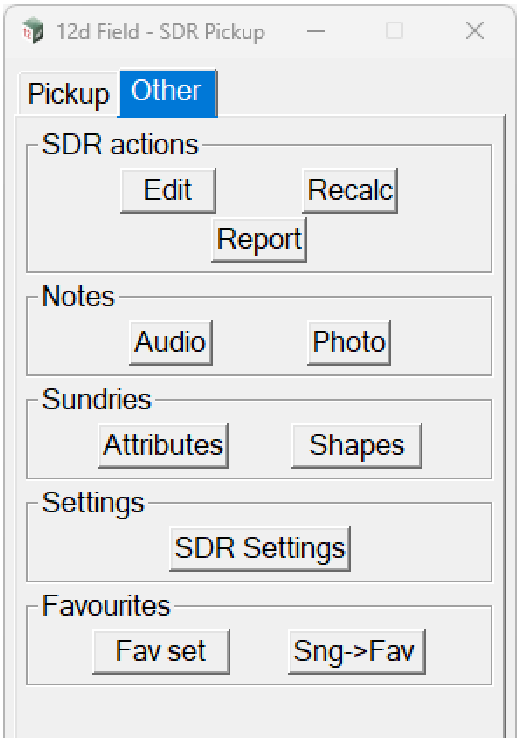
Open the ***SDR Pickup Settings*** *panel.*

Buttons at Bottom



See 15.8.4.11 12DF_SDR_PICKUP_PANEL_BUTTON_LAYOUT.4D file format *for a description of the individual button functionality and how to configure the button text and layout.*

Other tab

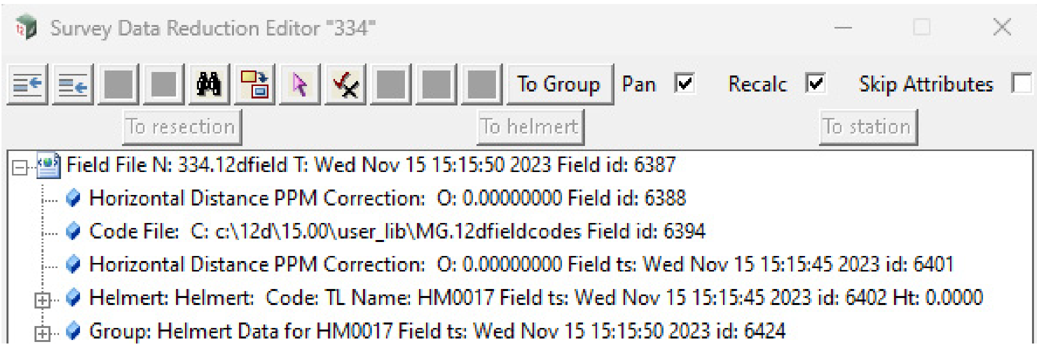


Pickup Tab
Other tab

SDR actions

Edit button

Open the Survey Data Reduction Editor panel for viewing the current function contents, it does not allowing editing the function.



Recalc button

Recalc the SDR function.

Report button

Create a XML report of the function, a warning will be displayed this could take a long time.

Notes

Audio button

*Open the **Record audio note** panel.*

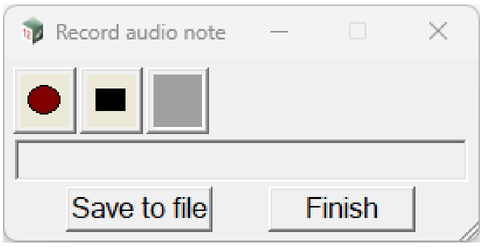


Photo button

Take a photo and store in the SDR function which references a BMP file in the working directory.

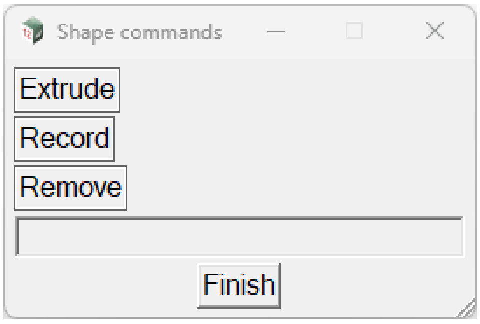
Sundries

Attributes button

??

Shapes button

Open the Shape commands panel.



Extrude button

??

Record button

??

Remove button

??

See 26.3.12 Shape Field Coding *for details.*

Settings

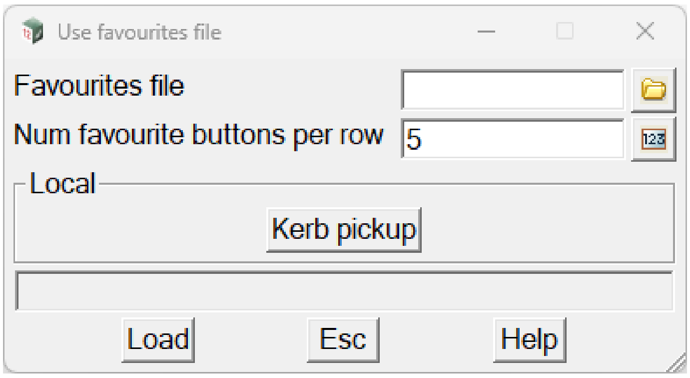
SDR Settings button

Opens up the ***SDR Pickup Settings*** *panel, see* 15.6.6.1.3 SDR Pickup Setting Panel *for full details.*

Favourites

Fav set button

Opens the ***Use favourites file*** *panel, this is used to populate the main grid when in favourites mode.*



Favourites file file box

Manually browse to the favourites file to be used.

Num favourite buttons per row integer box 5

*For fast selection of a favourites file all favourites files in the working directory are added to the group shown above **Local**. The example only has one file, when there are multiple files a new button row will be started when this number is exceeded. Pressing a button in this group will load the favourites and exit the panel.*

Buttons at Bottom

Load button

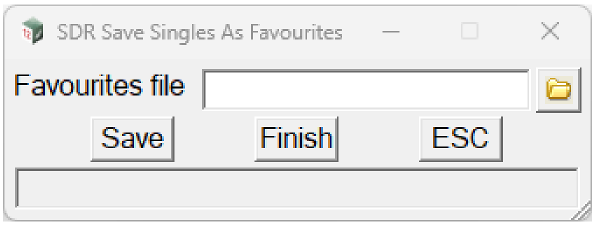
Load the selected favourites file and exit the panel.

Esc button

Exit the panel without loading a file.

Sng->Fav button

*Opens the **SDR Save Singles As Favourites** panel, this allows the saving of the current contents of the main grid as a favourites file, typically the list build up while in Single mode.*



Favourites file file box

Enter the favourites file to be saved.

Buttons at Bottom

Save button

Create the favourites file as specified in the Favourites file box.

Finish button

Exit the panel.

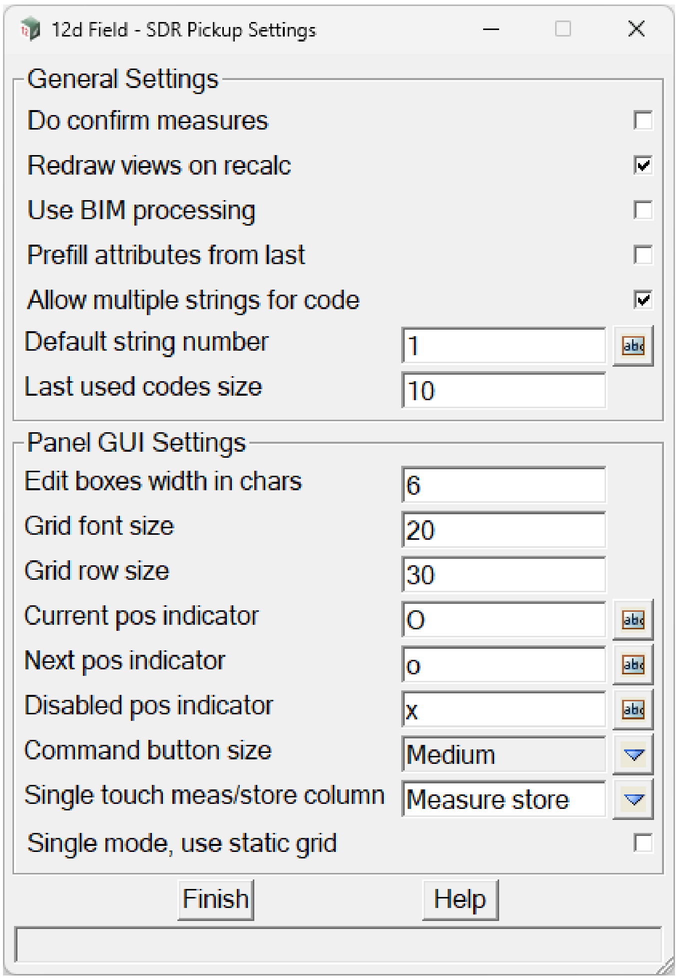
ESC button

Exit the panel without saving a file.

Continue to 15.6.6.1.3 SDR Pickup Setting Panel or go back to 15.6.6 Pickup .

15.6.6.1.3 SDR Pickup Setting Panel

The **SDR Pickup Settings** panel contains various settings for the GUI of the main SDR Pickup panel and its behaviour when taking readings.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

General Settings

Do confirm measures tick box not ticked

*If **ticked**, the **Confirm Measure** panel will be shown after every measurement.*

*If **not ticked**, the **Confirm Measure** panel will be not shown after a measurement.*

Redraw views on recalcs tick box not ticked

*If **ticked**, on a recalc the 12d **Field** views will be completely redrawn.*

*If **not ticked**, on a views will be not be redrawn.*

Use BIM processing tick box not ticked

*If **ticked**, the GIS.4do macro will be run on each measurement.*

*If **not ticked**, the GIS.4do macro will not be run.*

Prefill attributes from last tick box not ticked

*If **ticked**, a code panel will be automatically populated from the last instance of that panel.*

*If **not ticked**, a code panel will be empty when created requiring all fields to be filled in.*

Allow multiple string for code tick box ticked

*If **ticked**, a code will be searched for by code and string name.*

*If **not ticked**, a code will be searched for by matching the code only.*

Default string number input box 1

The default alpha numeric string for each code used.

Last used codes size input box 1

The maximum number of codes used to be remembered.

Panel GUI Settings

Edit boxes width in chars integer box 6

*This setting is used to alter the width of the **SDR Pickup** to the users liking. It is not precise but the larger the number the larger the panel will be.*

Grid font size input box 20

*The size of the font used in the **SDR Pickup** grid.*

Grid row size input box 30

*The depth in pixels of rows in the **SDR Pickup** grid.*

Current pos indicator input box '0'

In the first column of the grid shows the next code that will be used.

O	KINV	1

Next pos indicator input box '0

In the first column of the grid shows the next code that will be used after the current one.

	KLIP	1
O	KINV	1
o	KTOP	1
	KBCK	1

Disabled pos indicator input box 'x'

In the first column of the grid shows codes that have been disabled.

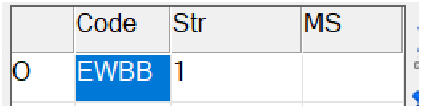
	KLIP	1
O	KINV	1
o	KTOP	1
x	KBCK	1

Command button size choice box Small, Medium, Large

Set the size of the icons used on the LHS and RHS of the grid, a restart of the panel is necessary if changed.

Single touch meas/store column choice box None, Measure store, Measure record

Sets the behaviour of a press in the option 4th MS column which can be used to activate a measurement.



Single mode, use static grid tick box not ticked

*If **ticked**, when in single mode selecting a code in the grid will not change its current position.*

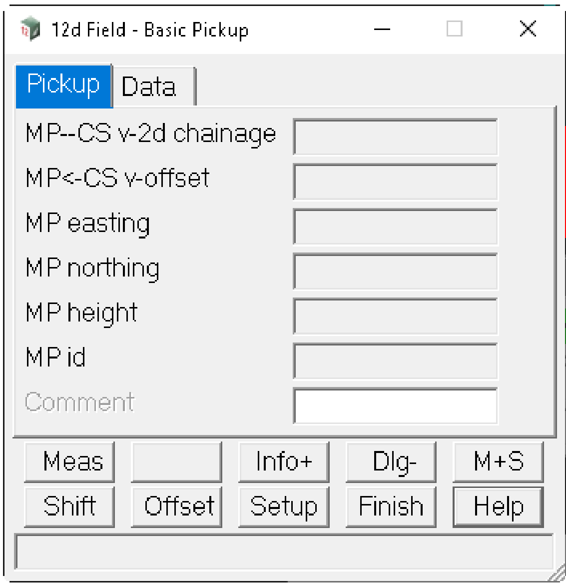
*If **not ticked**, when in single mode selecting a code on the grid will push it to the top of the grid.*

Continue to 15.6.6.2 Pickup Basic or go back to 15.6.6 Pickup .

15.6.6.2 Pickup Basic

The Basic Pickup panel as per its name is a simple panel to collect data as simple super strings, the data collected has no recalculation abilities. If the user needs recalculation abilities or must match more stringent quality assurance requirements then see 15.6.6.1 Pickup SDR.
The panel allows the selection of a control string for a reference chainage and offset if desired.

Clicking **Basic** brings up the **12d Field - Basic Pickup** panel.



Pickup Tab
Data Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Pickup Tab

MP--CS v-2d chainage

The natural, no equalities measured chainage on the control string, for more information on control string chainages see 15.6.1.8.1 Setout Chainage (so_cs_ch).

Attribute "pu_vcut_cs_ch2d"

MP<-CS v-offset

The offset of the measured point from the control string, +ve is to the right relative to the control string direction.

Attribute "pu_vcut_mp_cs_os"

MP easting

Measured easting.

Attribute "pu_mp_x"

MP northing

Measured northing.

Attribute "pu_mp_y"

MP height

Measured height.

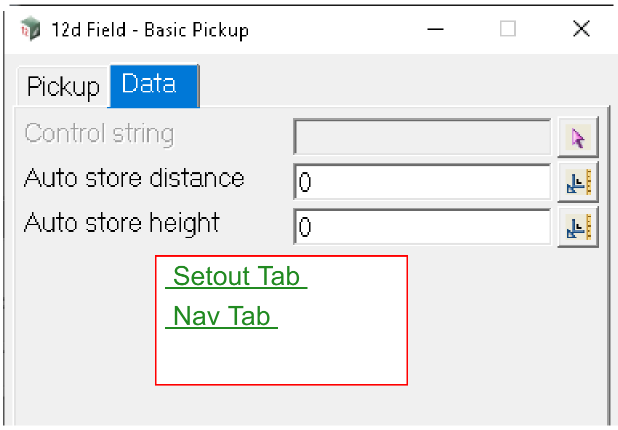
Attribute "pu_mp_z"

MP id 0001

Point id of the measured point.

*See **MP id** in the* Vertex point id style *section of the* 15.6.10 Store Point Setup *panel.*

Data Tab



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Control string	string select		

If selected the chainage and offset of the current point on this string will be displayed.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Auto store distance	real box	0	

If non zero, when the distance between the last stored point and the last measured point exceeds this value the point will be stored automatically, the measurement mode would normally be ***continuous*** *in conjunction with this setting.*

Attribute "so_panel_auto_store_dist"

Auto store height	real box	0	

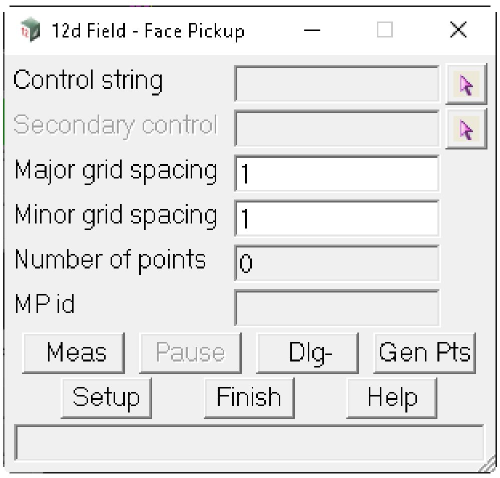
If non zero, when the height difference between the last stored point and the last measured point exceeds this value the point will be stored automatically, the measurement mode would normally be ***continuous*** *in conjunction with this setting.*

Attribute "so_panel_auto_store_height"

Continue to 15.6.6.3 Pickup Face or go back to 15.6.6 Pickup .

15.6.6.3 Pickup Face

The **Pickup Face** panel is designed as a simple panel for non scanning TPS instruments to measure points to a simple string forming a polygon, vertical or horizontal to user defined densities. The polygon should be rectangular in style and the points roughly colinear, the behaviour of the panel is undefined if this is not the case.
Clicking **Face** brings up the **12d Field - Face Pickup** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Control string string select

Select the string to be used to define the scanning polygon. The usage of the control string is different in this panel compared to most other panels.

Secondary control string select

For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Major grid spacing real box 1

The first 2 points of the scanning polygon are used to define the 3D direction of the major axis of the scan. Entered the desired distance along this axis for the scanned points.

Attribute "so_face_pu_maj_grid"

Minor grid spacing real box 1

The 3rd point of the scanning polygon is dropped to the 3D line between first 2 points to define the 3D direction of the minor axis of the scan. Entered the desired distance along this axis for the scanned points.

Attribute "so_face_pu_min_grid"

Number of points integer box 0

The number of points generated to scan from the axis settings.

Attribute "so_face_pu_num_pts"

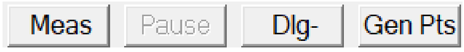
MP id 0001

Point id of the measured point.

*See **MP id** in the* Vertex point id style *section of the* 15.6.10 Store Point Setup *panel.*

Buttons at Bottom

The initial state of the buttons is as follows:



Meas button

Start the scan of the points.

Gen Pts button

Generate the scan points from the selected polygon, the number of points to be measured is displayed.

Once the scan has been started the buttons change behaviour as above.

Stop button

Stop/abandon the scan.

Pause button

Temporarily pause the scan.

If the scan has been paused the **Pause** button changes as above.

Resume button

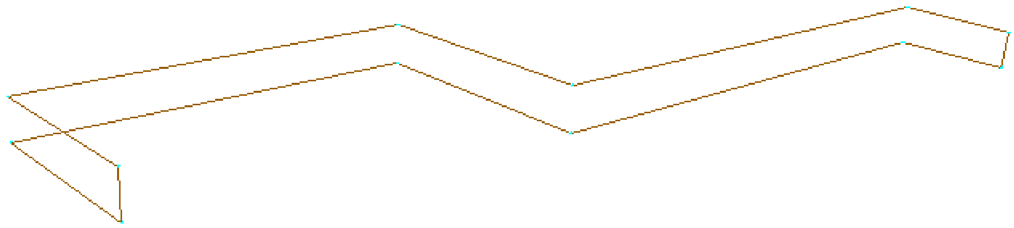
Continue the scan from the last unmeasured point.

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Continue to 15.6.6.4 Pickup Face Scan or go back to 15.6.6 Pickup .

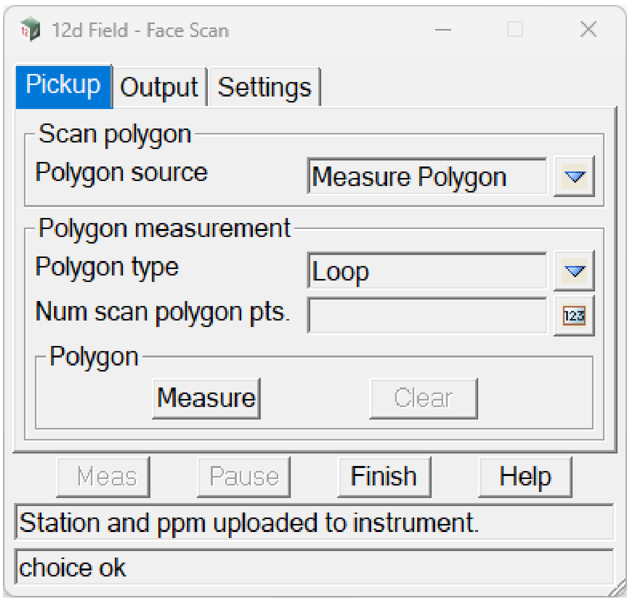
15.6.6.4 Pickup Face Scan

The **Pickup Face Scan** is only available to supported scanning TPS instruments such as the Leica MS60. The panel takes a user defined polygon, examines this and splits it into smaller area polygons if necessary so the completed scan will have a consistent point density.
The scanning polygon should be regular in shape, an even number of points, for example a polygon defining a wall scan.



The polygon should be in one of 2 formats. A **loop** format, e.g. for the polygon above the super string starts at the top most right position, loops around the top then back on the bottom to finish at the bottom right. A **paired** format, e.g. the above polygon is surveyed in matching pairs, say top and bottom of the scan area working lengthwise along the to be scanned area.
Any scan directly above the TPS will be split into 4 so no special licence is needed for overhead scans.
Upon entering the panel the current setup coordinates are uploaded to the instrument and true bearing set in it.

Clicking **Pickup Face Scan** brings up the **12d Field - Face Scan** panel.



Pickup Tab
Output Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

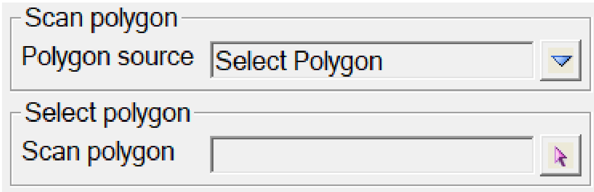
For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Pickup Tab

Scan polygon

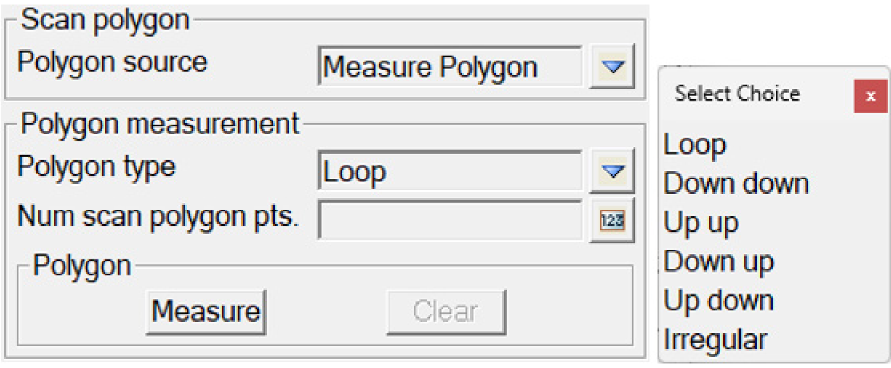
Polygon source	choice box	Measure Polygon	Select Polygon Measure Polygon

Choose whether to use an existing polygon or measure a polygon for the face scanning, the panel will change dependent on the choice.



Scan Polygon	select box

Select an existing super string to use as the scan polygon.



Polygon measurement

Note, the scanning can be any combination of vertical, horizontal and in between polygons, the description following is in the style of a vertical, e.g. wall scan. It is believed that most of the time only the Loop option would be used.

Polygon type	**choice box**	Irregular	Irregular, Loop, Down down, Up up, Down up, Up down

***Loop** - the polygon is surveyed in order around the scan boundary.*

***Down down** - the points are surveyed in pairs, top point first then the bottom point.*

***Up up** - the points are surveyed in pairs, bottom point first then the top point.*

***Down up** - the points are surveyed in pairs, alternating between top point first then the bottom and vice versa.*

***Up down** - the points are surveyed in pairs, alternating between bottom point first then the top and vice versa.*

***Irregular** - deprecated and should not be used.*

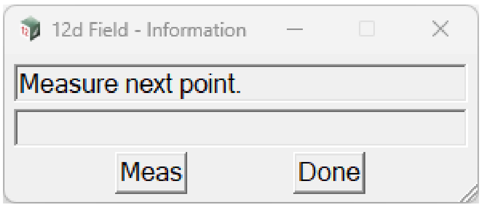
Num scan polygon pts	integer box

The number of points in the polygon to be scanned, information only.

Polygon

Measure button

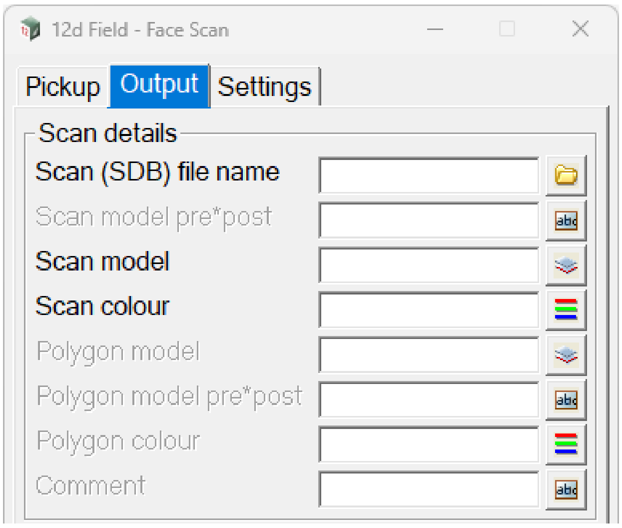
*Start the measurement of the scan points, when a new measurement is ready to be taken a prompt panel will appear. Press **Meas** when aimed at the next point or **Done** when all points are measured.*



Clear button

Clear the currently measured polygon.

Output Tab



Pickup Tab
Output Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Scan details

Scan (SDB) file name file box *.SDB files

*Enter the name of the SDB files for the scanning, this will be used as a prefix for the downloaded files, they are stored in the working folder in the **LEICA_SDB_SCANS** sub directory.*
Attribute "st_scan_sdb_file_name"

Scan model model box available models

The model for the scan to be stored in.
Attribute "st_scan_model"

Scan model pre*post text box

An optional pre/post that can be added to the scanning model name.
Attribute "st_scan_model_pre_post"

Scan colour colour box available colours

The colour of the scan points, (no colours are imported from the TPS)

Attribute "st_scan_colour"

Polygon model model box available models

The model for the scan polygon to be optionally stored in.
Attribute "st_scan_poly_model"

Polygon model pre*post text box

An optional pre/post that can be added to the polygons model name.
Attribute "st_scan_poly_model_pre_post"

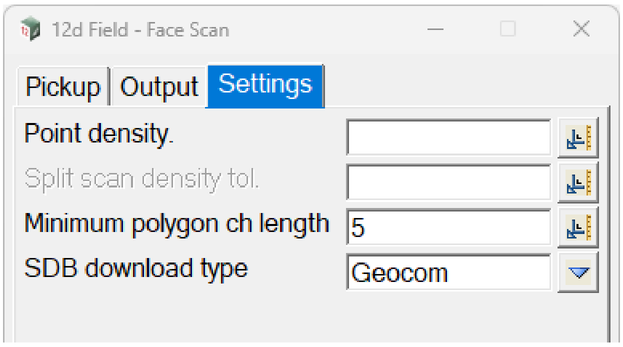
Polygon colour colour box available colours

The colour of the scan polygons to be optionally stored.
Attribute "st_scan_poly_colour"

Comment text box

And optional comment stored the 12d Field attributes.
Attribute "pu_panel_comment_line"

Settings Tab



Pickup Tab
Output Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Point density real box

Enter the nominal density for the scan, the overall polygon will be broken into smaller areas if necessary to maintain the density to the users tolerance.
Attribute "st_scan_tun_density"

Spit scan density tol real box

When a scan quadrangle, dependent on the horizontal and vertical angle from the TPS will result in points being created outside this tolerance from the nominal density the quadrangle will be split into 2.
Attribute "st_scan_tun_density_tol"

Minimum polygon ch length real box 5

A quadrangle will not be split to side lengths less than this value.
Attribute "st_scan_minimum_ch_length"

SDB download type choice box Geocom Geocom, USB

***Geocom** - each SDB file for the scan will be downloaded in small blocks via the normal commands used to communicate with the instrument. This style of download might not be suitable for larger scanning due to the speed of the download.*

***USB** - if the user has the appropriate cable and drivers the SDB files can be copied directly from the TPS,*

*this is considerably faster than the **Geocom** method.*
Attribute "st_tps_leica_sdb_download_type"

Buttons at bottom

Meas button

Start the scan using the defined polygon and settings. To keep the scan densities consistent it will be broken into quadrangles which are passed to the TPS. Once each quadrangle is completed the data is downloaded and the next quadrangle done. The progress is shown in the panel message boxes. When the scanning is completed the individual downloads are read into 12d and combined into the users nominated output model.

Stop button

Abandon the scanning.

Pause button

Temporarily pause the scanning.

Resume button

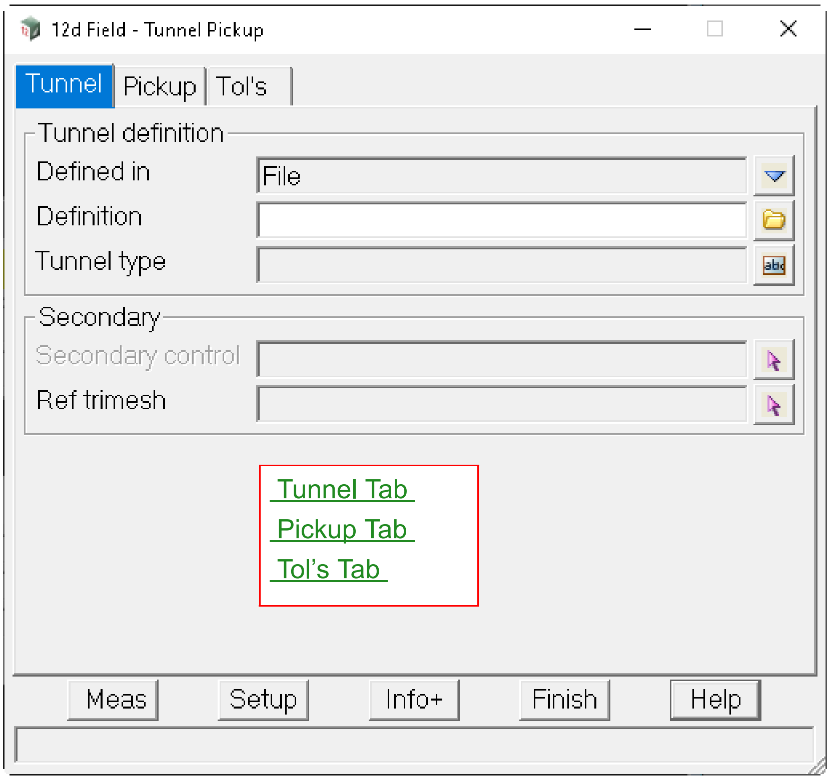
Recommence the scanning.

Continue to 15.6.6.5 Pickup Tunnel or go back to 15.6.6 Pickup .

15.6.6.5 Pickup Tunnel

The **Tunnel Pickup** panel enables the user to survey cross section of a tunnel by selecting a tunnel definition and entering the chainage and profile ranges to survey.

Clicking **Tunnel** brings up the **12d Field - Tunnel Pickup** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Tunnel Tab

Tunnel definition

Select the tunnel definition to use. It can either be a file or attributes on a control string definition.

For details of the fields see the Data Tab *of* 15.6.5.12 Setout Tunnel .

Secondary

Secondary control string select

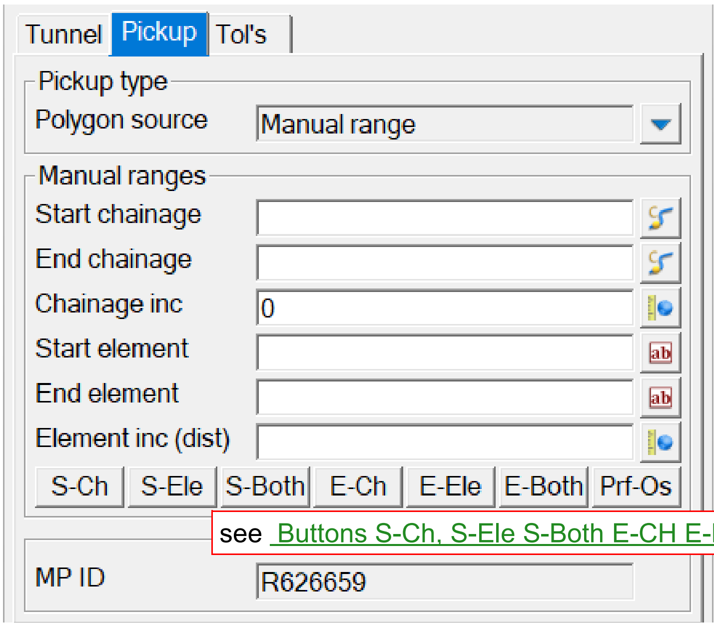
For standard secondary control string functionality see 15.7.2.2 The Secondary Control String (so_sc_strr) .

Ref trimesh string select

For reference readings to an existing trimesh select it here.

Attribute "st_scan_element_inc"

Pickup Tab



Tunnel Tab
Pickup Tab
Tol's Tab

see Buttons S-Ch, S-Ele S-Both E-CH E-Ele E-Both Prf-Os

The **Pickup** tab has the details defining the range of the survey.

There are 3 methods to define the survey.

Pickup type

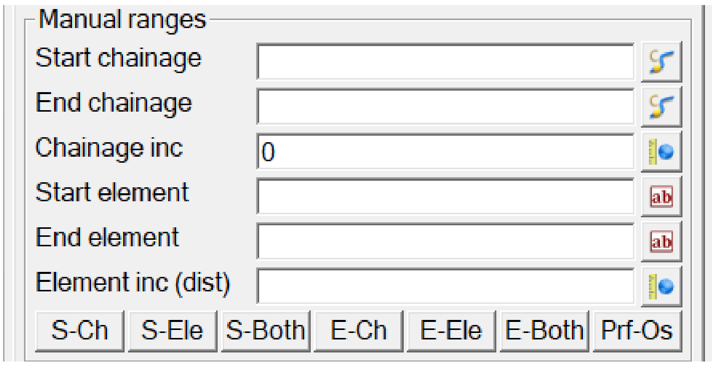
Polygon source choice box Manual range, PRS file, Previous Model

*If **Manual range**, the chainage and profile ranges of the survey are entered/entered manually.*

*If **PRS file**, the profile range are read from the PRS file and the chainage ranges entered manually.*

*If **Previous Model**, use points from a previous survey, here the previous model is selected and the start and end chainages defined.*

If Manual range



Start chainage real box

First chainage on the centreline to survey a tunnel section.

Attribute "pu_cs_sc"

End chainage real box

Last chainage on the centreline to survey a tunnel section.

Attribute "pu_cs_ec"

Chainage inc real box 0

The chainage interval for the survey. See [15.6.1.8.2 Chainage inc (so_cs_ch_inc)](#).

Start element text box

The element name followed by the % along that element for the start element of the pickup.

*For example, **"WallRight" 90.0***

Attribute "st_scan_start_element"

End element text box

The element name followed by the % along that element for the end element of the pickup.

*For example, **"WallLeft" 50.0***

Attribute "st_scan_end_element"

Element inc (dist) real box

Nominal 3d distance between surveyed points around the tunnel section.

Attribute "st_scan_element_inc

Buttons S-Ch, S-Ele S-Both E-CH E-Ele E-Both Pfr-Os

These buttons allow the measuring of start and end points of the tunnel section pickup.

S-Ch button

Measure a point and set the start chainage from it.

S-Ele button

Measure a point and set the start element and percentage from it.

S-Both button

Measure a point and set the start chainage, element and percentage from it.

E-Ch button

Measure a point and set the end chainage from it.

E-Ele button

Measure a point and set the end element and percentage from it.

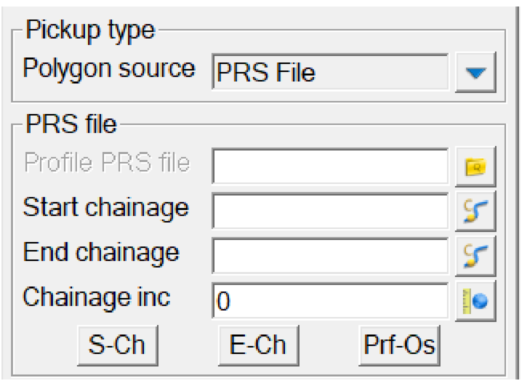
E-Both button

Measure a point and set the end chainage, element and percentage from it.

Prf-Os button

Measure a point which is a typical offset from the design profile so initial iterations are more accurate.

If PRS file



The user defines a **PRS file** and the start, end chainages and increment for the survey. Largely a deprecated option, see [15.6.6.8 Pickup Tunnel PRS Define](#) for details

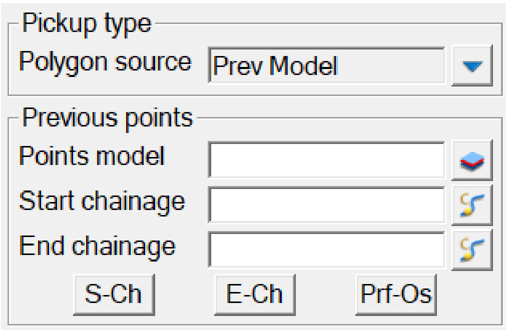
PRS file file box

Profile PRS file to use.

See [If Manual range]

See [Buttons S-Ch, S-Ele S-Both E-CH E-Ele E-Both Pfr-Os]

If Prev Model



Use points from a previous survey.

Points model model box

Model of previously surveyed points to use as the new survey's basis.

Attribute "so_tun_prev_model_name"

Start chainge, End chainage, Chainage Inc

See [If Manual range]

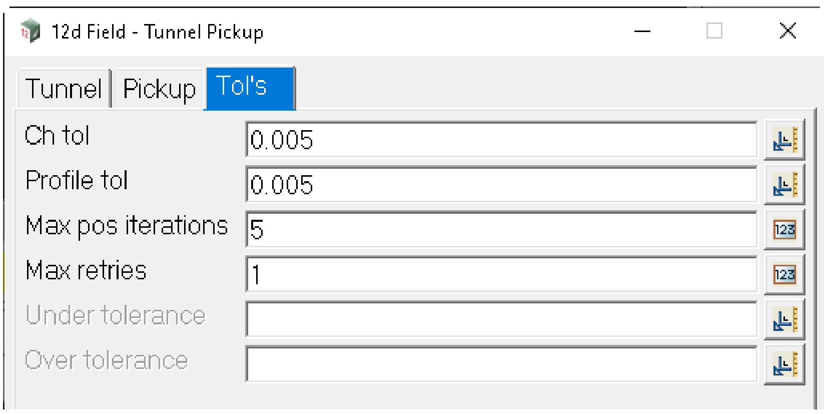
See [Buttons S-Ch, S-Ele S-Both E-CH E-Ele E-Both Pfr-Os]

MP id output

Point id of the measured point.

*See **MP id** in the* [Vertex point id style] *section of the* [15.6.10 Store Point Setup] *panel.*

Tol's Tab



[Tunnel Tab]
[Pickup Tab]
[Tol's Tab]

Ch tol real box 0.005

If the measured chainage is within this range of the nominal chainage the TPS will not reposition to the nominal chainage.

Attribute "st_tps_pos_ch_prf_ch_tol"

Profile tol real box 0.005

If the measured distance from the previous section point to the current point is within this range the TPS will not reposition to the nominal cross section distance.

Attribute "st_tps_pos_ch_prf_prf_tol"

Max pos iterations integer box 5

Number of times the TPS attempts to locate the next section point before failing and skipping that point.

Attribute "st_tps_pos_max_iterations"

Max retries integer box 1

Number of times once all other points have been surveyed the TPS attempts to redo missed points.

Attribute "st_tps_pos_max_retries"

Under tolerance real box

Enter the offset from design considered a point under tolerance.

Attribute "so_tun_under_tol"

Over tolerance real box

Enter the offset from design considered a point over tolerance.

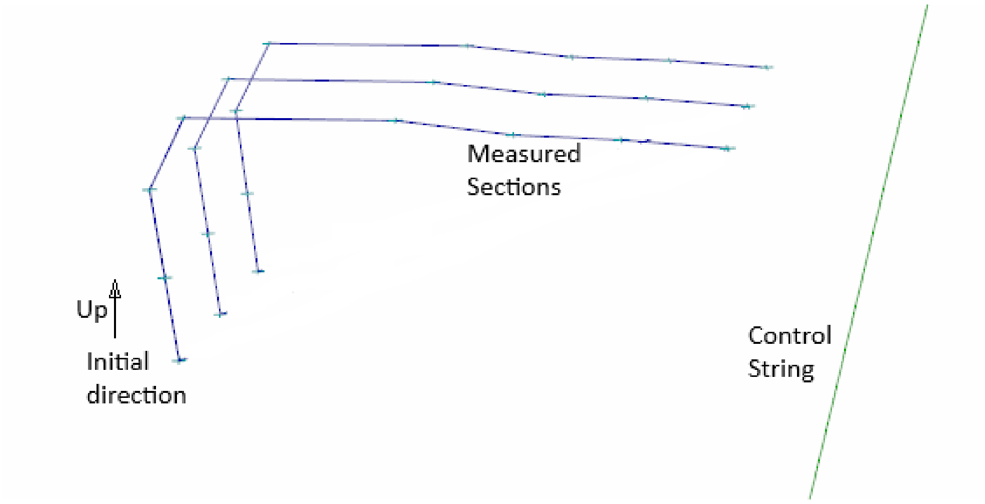
Attribute "so_tun_under_tol"

Continue to 15.6.6.6 Pickup Section or go back to 15.6.6 Pickup .

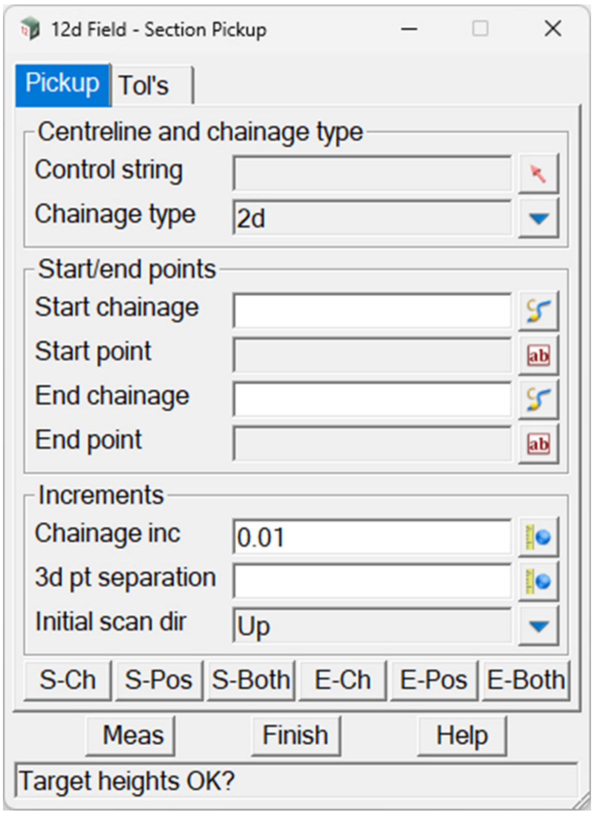
15.6.6.6 Pickup Section

The **Section Pickup** panel allows the user to automatically survey cross sections of an object using a control string running roughly parallel to the object.

The option does not need to know the shape of the section to be surveyed, just a hint on the initial direction the scan needs to head in from the initial point.



Clicking **Section** brings up the **12d Field - Section Pickup** panel.



Pickup Tab
Tol's Tab

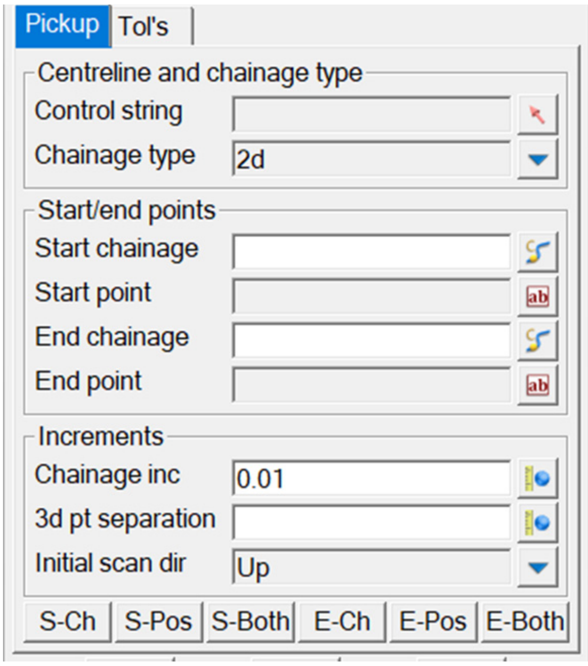
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Pickup Tab



Pickup Tab
Tol's Tab

Centreline and chainage type

Control string string select

Control string, the string to which the other strings are cut normal to for calculations.

For standard control string functionality see 15.7.2.1 The Control String (so_cs_strr) .

Chainage type choice box 2d

The type of drop of a point to the centreline and the type of chainage used.

This panel only uses the standard vertical drop and 2d chainage mode. See 19.5 Different Types of Chainage Drop Point *for more information.*

Start/end points

Start chainage real box

First chainage on the centreline to survey a cross section.

Attribute "pu_cs_sc"

Start point output box

Informational only: Shows the offset and height difference from the control string for the first point in a cross section

End chainage real box

Last chainage on the centreline to survey a cross section.

Attribute "pu_cs_ec"

End point **output box**

Informational only: Shows the offset and height difference from the control string for the last point in a cross section.

Increments

Chainage inc real box 0

Chainage interval for the survey. 15.6.1.8.2 Chainage inc (so_cs_ch_inc) .

3d pt separation real box

Nominal 3D distance between points in the cross section.
Attribute "st_scan_pt_diff"

Initial scan dir	choice box	Up	Up, Up right, Right, Down right Down, Down left, Left, Up left

Initial direction on the cross section for the TPS to point to for the next point to be measured.
After the initial readings the location of the next point will be calculated automatically.

Buttons S-CH, S-Pos, S-Both, E-Ch, E-Pos, E-Both

The buttons allow the measuring of start and end points of the section pickup.

S-Ch button

Measure a point and set the start chainage from it.

S-Pos button

Measure a point and set the start offset and height from it.

S-Both button

Measure a point and set the start chainage, offset and height from it.

E-Ch button

Measure a point and set the end chainage from it.

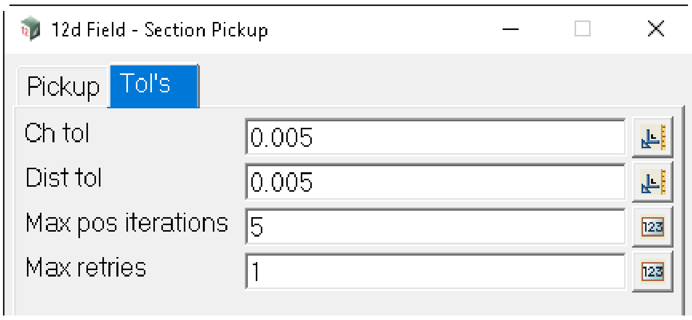
E-Pos button

Measure a point and set the end offset and height from it.

E-Both button

Measure a point and set the end chainage, offset and height from it.

Tol’s Tab



Pickup Tab
Tol’s Tab

Ch tol real box

If the measured chainage is within this range of the nominal chainage the TPS will not reposition to the nominal chainage.

Attribute “st_tps_pos_ch_prevpt_ch_tol”

Dist tol real box

If the measured distance from the previous section point to the current point is within this range the TPS will not reposition to the nominal cross section distance.

Attribute “st_tps_pos_ch_prevpt_di_tol”

Max pos iterations integer box

Number of times the TPS attempts to locate the next section point before failing and skipping that point.

Attribute “st_tps_pos_max_iterations”

Max retries integer box

The number of times once all other points have been surveyed the TPS attempts to redo missed points.

Not yet implemented in this panel.

Attribute “st_tps_pos_max_retries”

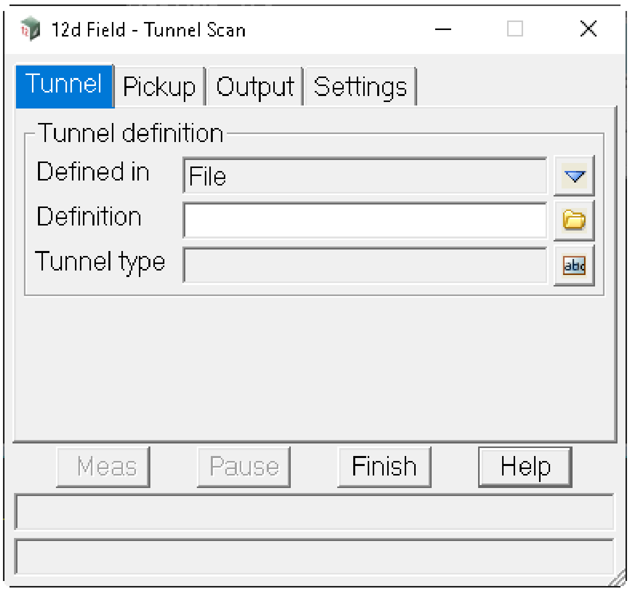
Continue to 15.6.6.7 Pickup Tunnel Scan or go back to 15.6.6 Pickup .

15.6.6.7 Pickup Tunnel Scan

The Tunnel Scan panel is essentially the same as 15.6.6.4 Pickup Face Scan except for how the basic scanning polygons are defined.

In the future these two panels will be merged into a single panel so the documentation here is minimal.

Clicking **Section** brings up the **12d Field - Tunnel Scan** panel.



Tunnel Tab
Pickup Tab
Output Tab
Settings Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at Bottom

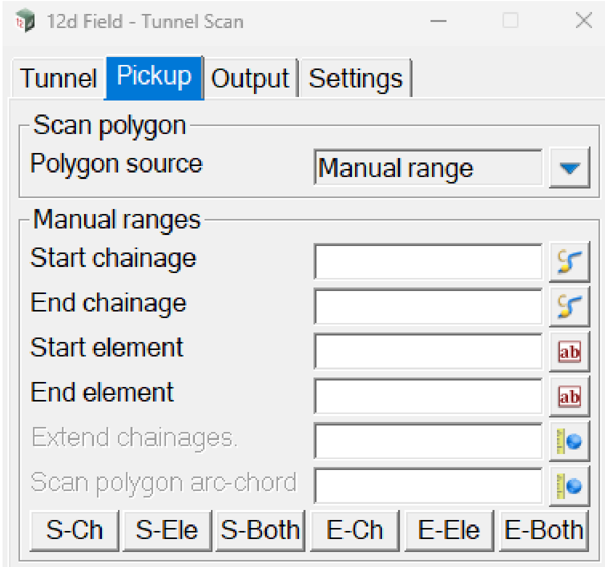
For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields .

Tunnel Tab

Tunnel definition

These fields are for selecting the tunnel definition and are documented the Data Tab of 15.6.5.12 Setout Tunnel .

Pickup Tab



[Tunnel Tab](#)
[Pickup Tab](#)
[Output Tab](#)
[Settings Tab](#)

This tab allows scan ranges by manual chainage and element entry or PRS files.

Scan polygon

Polygon source	choice box	Manual range, PRS File

Select the method defining the scanning polygon.

The following fields are unique to this panel.

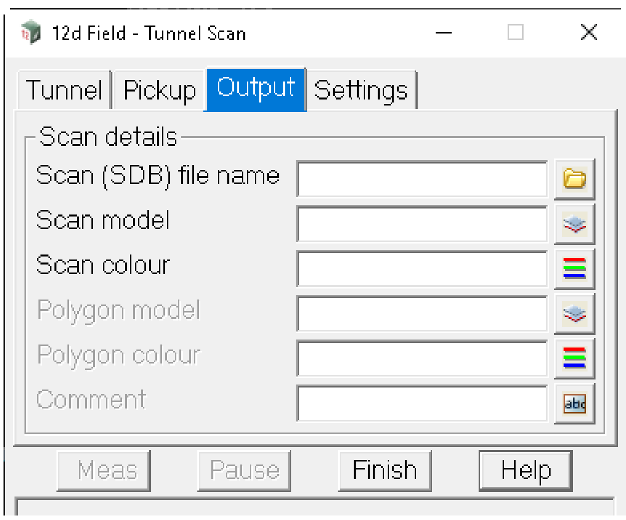
Extend chainages real box

A value that is subtracted from the start chainage and added to the end chainage.

Scan poygo arc-chord real box

Break circular profile sections into straight using this arc to chord tolerance.

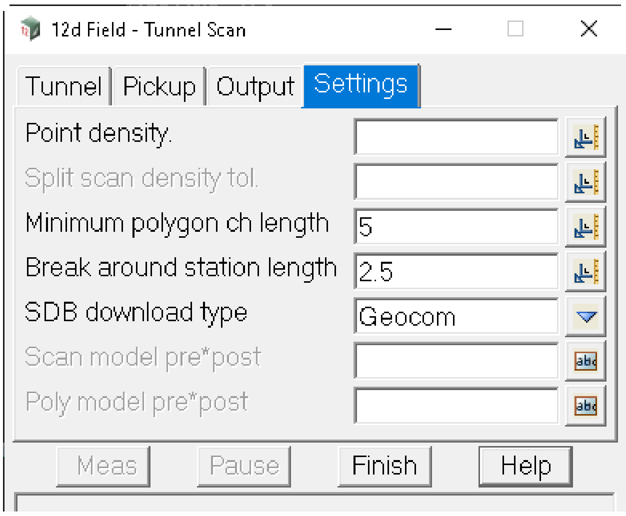
Output Tab



[Tunnel Tab](#)
[Pickup Tab](#)
[Output Tab](#)
[Settings Tab](#)

This tab is identical to the [Output Tab](#) on the [15.6.6.4 Pickup Face Scan](#).

Settings Tab



Tunnel Tab
Pickup Tab
Output Tab
Settings Tab

The fields on this tab are identical to the Settings Tab for 15.6.6.4 Pickup Face Scan except for:

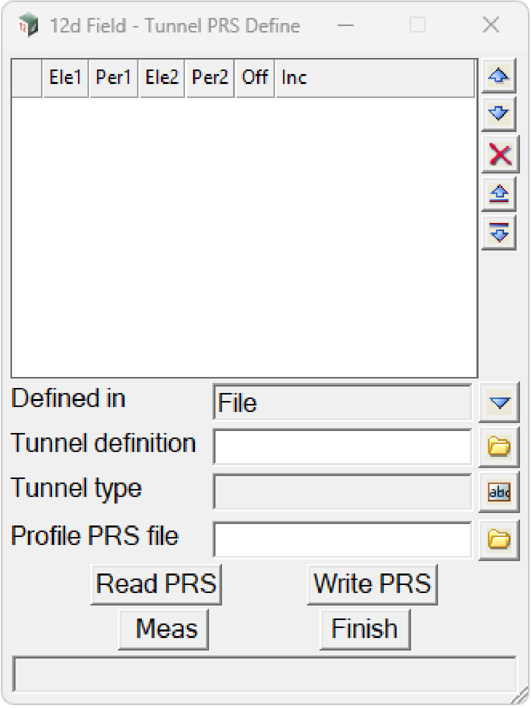
Break around station length real box 2.5

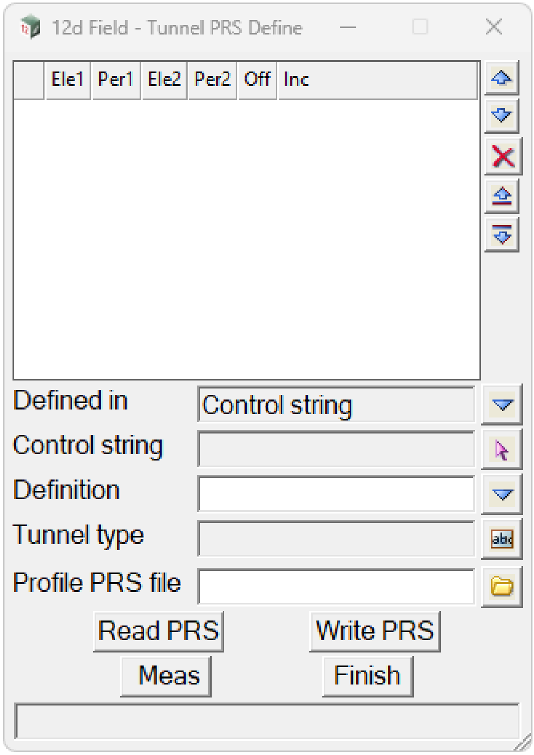
*If **non zero** the scan polygons will be split around the current TPS setup position, this value forward and back in chainage.*

Continue to 15.6.6.8 Pickup Tunnel PRS Define or go back to 15.6.6 Pickup.

15.6.6.8 Pickup Tunnel PRS Define

The **Pickup Tunnel PRS Define** panel is largely a legacy panel used to create a *.PRS text file which contains predefined tunnel element regions that can be used to populate the various tunnel pickup panels.
Clicking **Tunnel PRS define** brings up the **12d Field - Tunnel PRS Define** panel.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Defined in	choice box	File	File, Centreline
Control string	string select		
Tunnel definition	file box		*.12d_tunnel files
Tunnel type	text box		

These boxes are used for choosing the tunnel definition, see 15.6.5.12 Setout Tunnel *for full details.*

Profile PRS file	file box		*.PRS files

Enter/select the PRS file to edit or create.

Grid

Ele1 grid box

Enter the start element for the pickup.

Per1 grid box

Enter the percentage around the start element for the pickup.

Ele2 grid box

Enter the end element for the pickup.

Per2 grid box

Enter the percentage around the end element for the pickup.

Off grid box

Enter the offset from the design tunnel profile for the pickup.

Inc grid box

Enter the increment distance around the profiles for the pickup.

Buttons at Bottom

Read PRS button

Read in an existing PRS file and populate the grid.

Write PRS button

Validate the grid and write to the nominated PRS file.

For more information on these buttons, see 15.6.1 Common Buttons, Panel Tabs and Fields.

Continue to 15.6.6.9 Pickup Measurement Rounds or go back to 15.6.6 Pickup .

15.6.6.9 Pickup Measurement Rounds

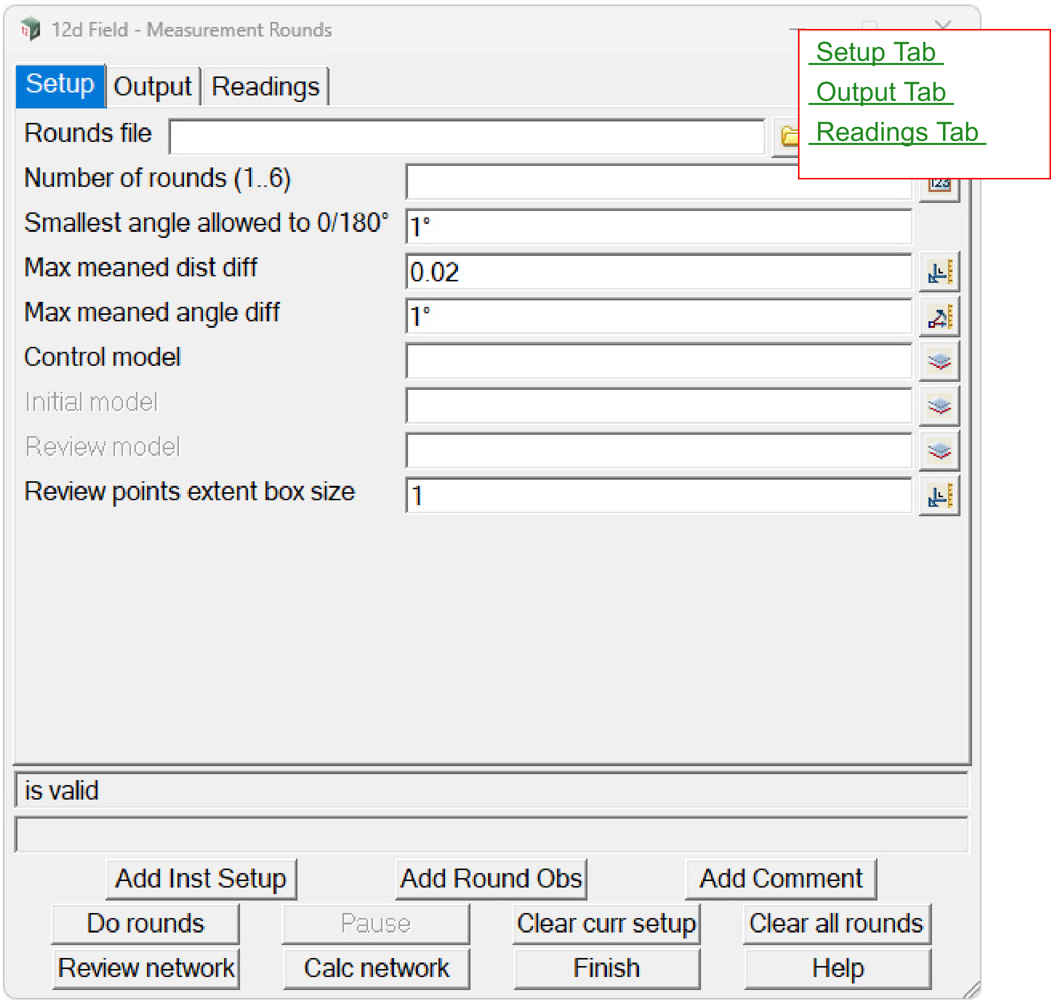
The **Measurement Rounds** panel is used to collect measurements from TPS instruments for control surveys to be passed into the least squares network adjustment routines, see 14.2.1.1 Edit Least-Square Network for full details.

The surveyor occupies a station, sets up the parameters for the readings to any numbers of observed stations and then starts the observations rounds.

The instrument cycles through the measurement until the parameters are met and is then ready to move to the next setup.

It is possible to partially reduce the currently completed observation sets to make sure there are no gross errors before proceeding to the next setup.

Clicking **Meas rounds** brings up the **12d Field - Measurement Rounds** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Setup Tab

Rounds file file box *.12dF_Meas_Rounds files

*The **12dF_Meas_Rounds** format file to store the measurement rounds reading in.*

Read button

*Read in an existing **12dF_Meas_Rounds** file and populate the panel.*

Write button

*Write the current setting and reading to a **12dF_Meas_Rounds** file.*

Number of rounds (1..6) integer box

How many times to repeat the readings from each setup point to the observed points, the readings to each setup point are done one by one then the round repeated again.

Smallest angle allowed to 0/180 10 degrees

*For least squares style adjustments swept angles close to **0** or **180** degrees could degrade the solution, any swept angle closer to **0** or **180** than this value will be not be included and a warning message box displayed on running.*

Max meaned dist diff real box 0.02

If the difference between all horizontal distances measured between 2 stations exceeds this value an error message will be shown and the network calculations will not proceed.

Max meaned angle diff angle box 1 degree

If the difference between all swept angles measured between 2 stations exceeds this value an error message will be shown and the network calculations will not proceed.

Control model model box available models

The model containing the fixed stations to be used in the network adjustment.

Initial model model box available models

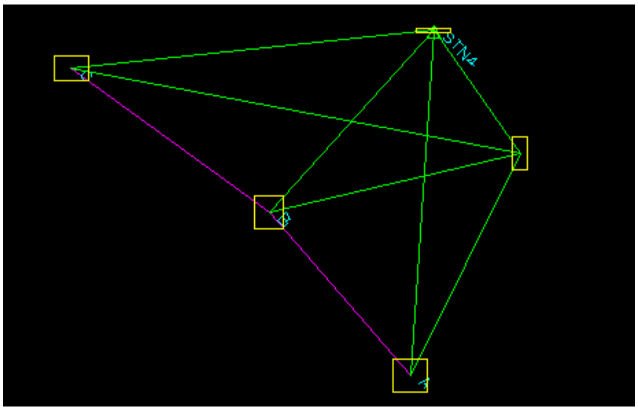
An optional model containing approximate coordinates for each of the new stations in the adjustment, this is only necessary when the network adjustment is unable to calculate an initial solution.

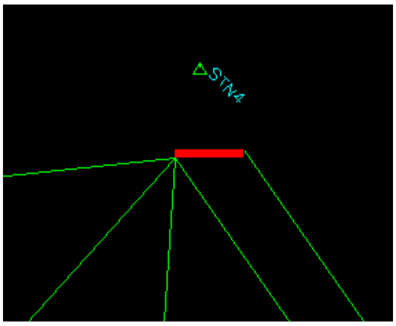
Review model model box available models

*The model populated when the user presses the **Review network** button.*

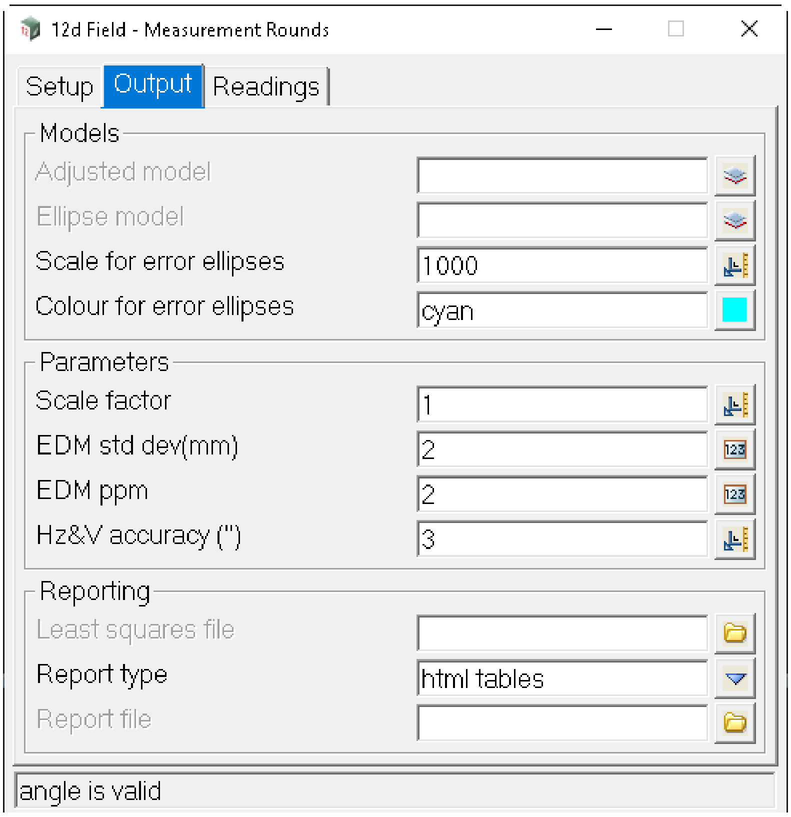
Review points extent box size real box 1.0

To make the results of the review process more obvious entering a non zero value here will result in the review model containing extra polygons mirroring the extents of the calculated coordinates of each point in the review model which can be very small. The longest side of the box matches the entered number and the other scaled down to reflect the actual extent shape.





Output Tab



[Setup Tab](#)
[Output Tab](#)
[Readings Tab](#)

Models

Adjusted model model box available models

The model for the position of the new stations after the adjustment is run.

Ellipse model model box available models

The model for the error ellipses showing the accuracy of the new stations after the adjustment is run.

Scale for errors ellipses real box 1000

The multiplication factor so the error ellipses are viewable on a plan view.

Colour for error ellipses colour box cyan available colours

The colour for the error ellipses.

Parameters

Scale factor real box 1

The scale factor used for the TPS distance measurements in the network survey, this is informational only and not used by the network adjustment.

EDM std dev(mm) integer box 2

The nominal edm standard deviation of distance measurements of the TPS used for the network survey, this is used by the least squares adjustment for weighting distance measurements.

EDM ppm integer box 2

The nominal ppm of distance measurements of the TPS used for the network survey, this is used by the least squares adjustment for weighting distance measurements.

Hz&V accuracy (") real box 3

The nominal angular accuracy of the TPS used for the network survey, this is used by the least squares adjustment for weighting angle measurements.

Reporting

Least squares file	file box		*.XML files

The raw XML that can be read by the survey network least squares if necessary.

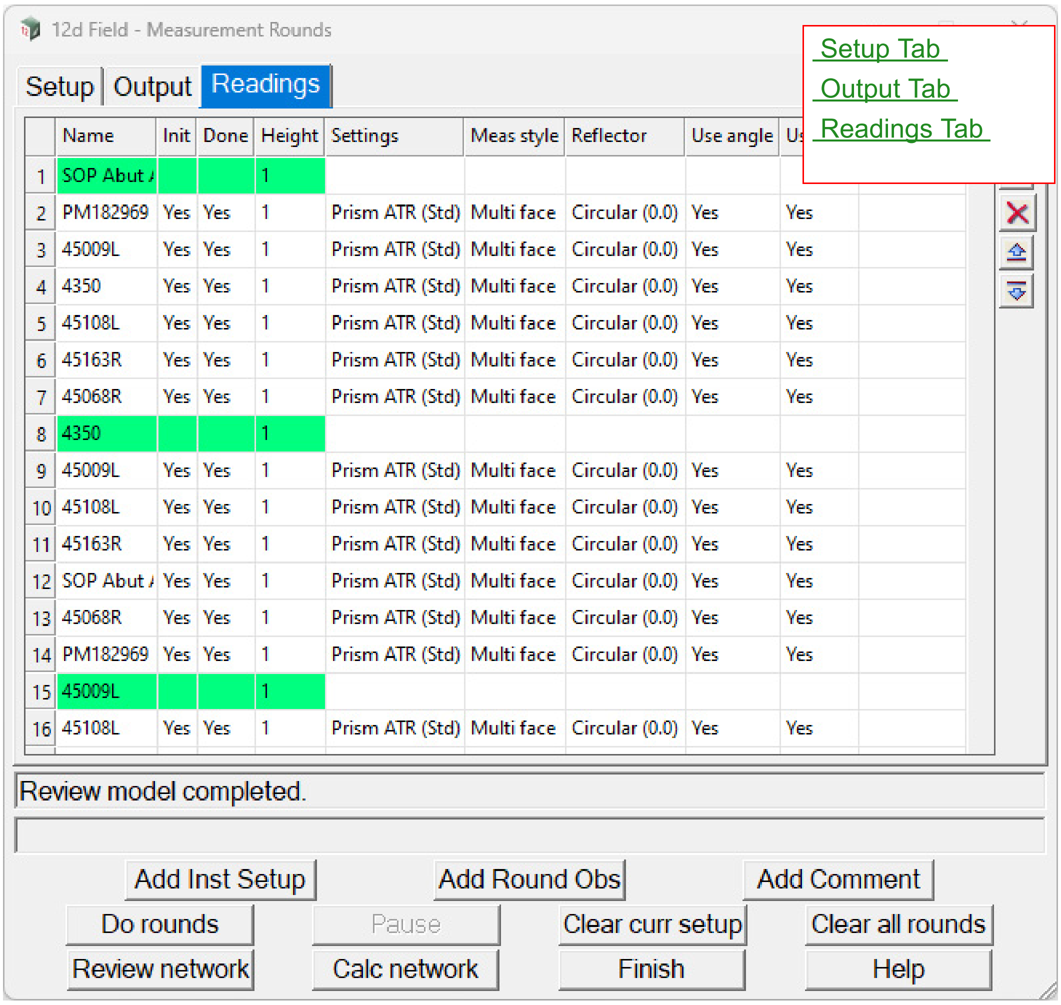
Report type	choice box	html tables	html tables, pdf tables original xml, plain text <Customize>

The report type for the output produced by the survey network least squares adjustment.

For more information and information on setting up custom reports from the generated XML file using xslts, see 3.38 Setting Up and Using XML Reports.

Readings Tab

The readings tab shows all of the current setups and observations.



Columns in grid

Name

The name of the control point and observed points.

Init

***Yes** or **No**, whether the initial horizontal and vertical reading to the observed point has been done.*

Done

***Yes** or **No**, whether all of the readings to the observed point have been completed.*

Height

The target height of the control or observed point.

Settings

The TPS settings used for the observed measurement.

Meas style

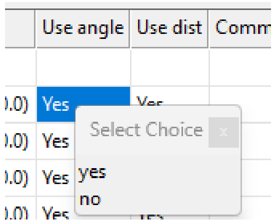
The 12dField measurement style used for the observed measurement.

Reflector

The type of prism used for the observed measurement.

Use angle

Yes or No, whether the angle measurement for this measurement was used, the user can right click on this column to toggle the value.



Use dist

Yes or No, whether the distance for this measurement was used, the user can right click on this column to toggle the value.

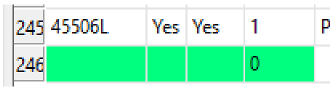
Comment

The user entered comment.

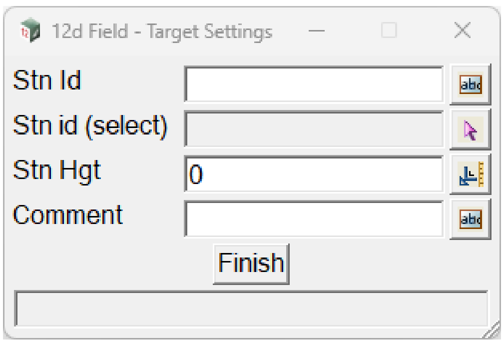
Buttons at Bottom

Add Inst Setup button

A empty setup line is added to the bottom of the grid.



The user must double click on this to bring up the settings panel to fill in the setup details.



Stn Id input box

Enter the Id of the point to setup over.

Stn Id (select) select

*If the user has the station in a model they can select it and the **Stn Id** box will be populated to save manual entry.*

Stn Hgt real box 0

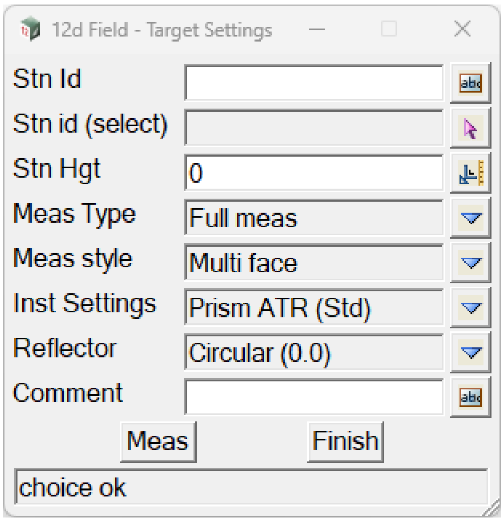
If the user is calculating heights in the network adjustment enter the instrument height here.

Comment input box

Enter an optional comment about the setup point.

Add Rounds Obs button

*Like the **Add Inst Setup** button a line is created at the bottom of the grid, the user must double click on this to enter details of the observed point.*



Stn Id input box

Enter the Id of the point to setup over.

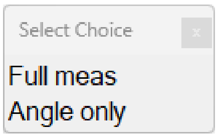
Stn Id (select) select

*If the user has the station in a model they can select it and the **Stn Id** box will be populated to save manual entry.*

Stn Hgt real box 0

If the user is calculating heights in the network adjustment enter the instrument height here.

Meas Type choice box



***Full meas**, both distance and angle measurements for this observation will be used.*

***Angle only**, only angle measurements to this observation will be used.*

Meas style, Inst Settings, Reflector

The settings for measurements to the observed point, see 15.5.2 TPS Instruments Only *for details.*

Meas button

The instrument must be pointed at the target so the approximate horizontal and vertical angles can be stored, this does not take a distance measurement but the pointing must be accurate enough to suit the measurement mode entered for this observation.

Finish button

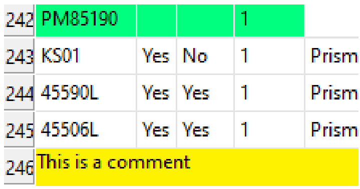
When the observed point is fully setup return to the main panel.

Comment input box

Enter an optional comment about the setup point.

Add Comment button

A comment line is added to the bottom of the grid, the user can then type a comment directly into this line.



Do rounds button

Commence the actual measurements for the current setup.

Pause button

An active round might become affected by one of the observation points becoming blocked amongst other things, when the ***Pause*** *button is pressed as soon as possible the user will be presented with a panel with 3 options,*

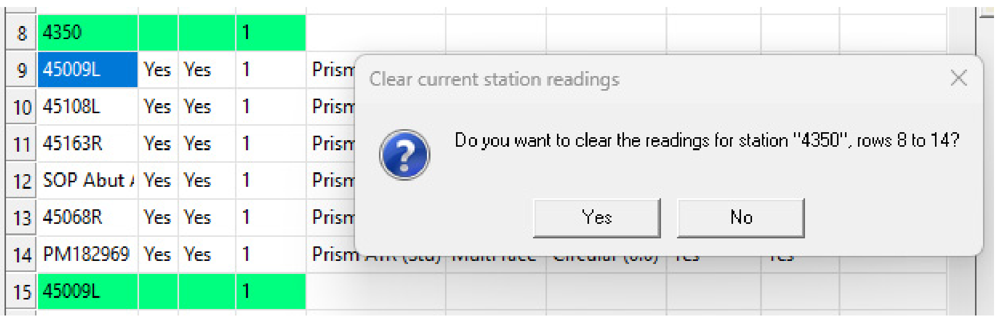
Skip next*, skip the next point and resume the measurement round.*

Continue*, resume the measurement round.*

Stop rounds*, abandon the current measurement round in progress.*

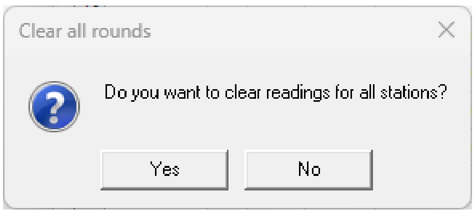
Clear curr setup button

If the focus is on the setup point or any observed points the user is offered to clear the readings for that group as being complete, no observations are deleted.



Clear all rounds button

The user is offered to clear all of the readings for all group as being complete, no observations are deleted.

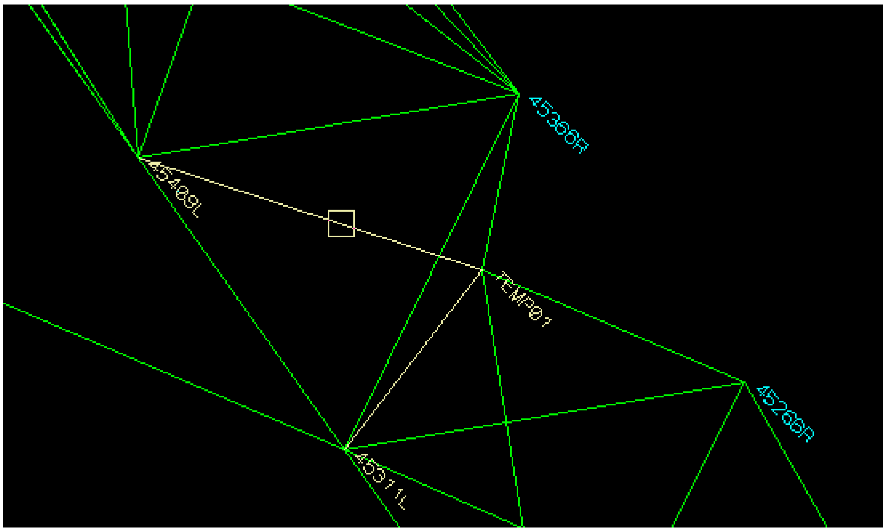


Review network button

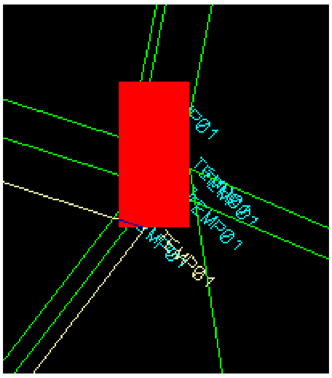
This allows the panel to examine the current readings, collate them into a diagram of what has been observed so far and write them to the review model. The network does not yet have to be fully *solvable, i.e., have readings to fixed control points, this feature is intended to show the integrity of the observations so far and display blunders.*

Important, there will always be a red "extent box" indicating the accuracy of the readings when there are multiple readings to a point, however, they can be tiny when the readings are high quality and not visible until zoomed in to the individual point in question. The ***Review points extent box size*** *setting helps give a quick indication of the existence of and quality of an extent box without needing to zoom in to the necessary level at each point.*

The following diagram shows a temporary point in a network and the observations to and from it.



At a much zoomed in scale around the temporary point in the review model it can be seen it is actually many calculated vertices and not just one.



If there is a gross error in the observations so far a red extents box of the observations to each point will be viewable at a normal scale. It is then up to the user to discover which observations are faulty.

The review process only works with swept angles with 2 distances, other readings are ignored. If there are not enough of these reading with common sides the review will fail.

Calc network button

The current readings are collated and passed to the survey least squares network adjustment and processed, the various models will be updated to show the results and report files displayed as per settings.

Finish button

*Exit **Measurement Rounds**, a warning will be displayed if the panel contents and observations have not been saved yet.*

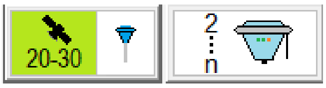
Continue to 15.6.7 TPS Functions or go back to 15.6.6 Pickup .

15.6.6.10 Pickup Occupy Point - GNSS

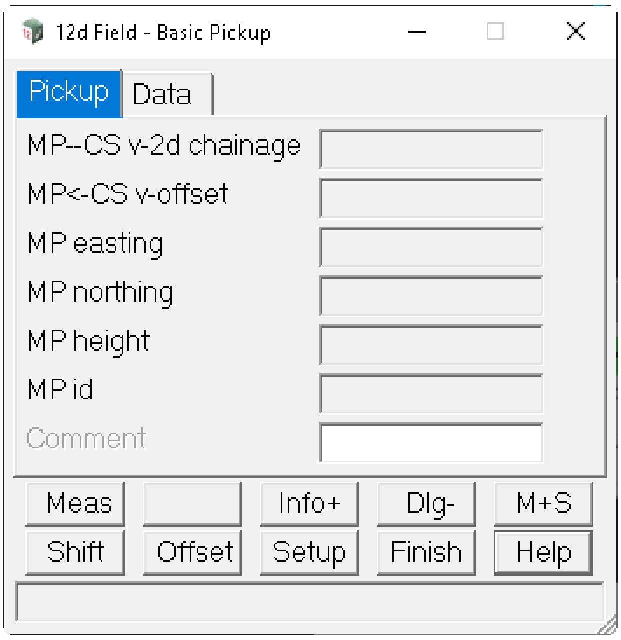
Position of option on menu: **Survey =>Field 12d=>Pickup =>Occupy point**

The **Occupy Point** option measure a point by taking reading over an extended time period.

The GNSS must be in the **averaging** measure mode to use this panel and would generally not have tilt active.



Selecting **Occupy Point** brings up the **12d Field - Occupy Point** panel:



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

MP id text box

The Point Id for the occupied point.

MP easting/northing/height output

Easting/northing/height for the occupied point.

Log interval (sec) real box

The current GNSS reading is added to the averaged data at this interval if the GNSS quality meets the users specifications.

Occupied time (sec) output

*Shows the time in seconds from when the **Meas** button was pressed.*

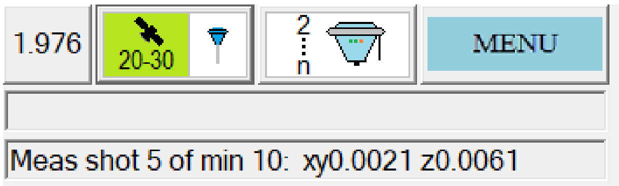
Occupied time output

*Shows the time in hours, minutes and seconds from when the **Meas** button was pressed.*

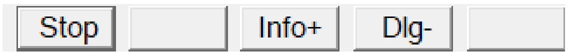
Buttons at bottom

Meas button

Start the occupation of the point, dependent on where the user has their information message boxes the averaging statistics are displayed.



*When **Meas** it changes to **Stop**.*



***Stop** - the averaging reading cycle is stopped, when storing the measurement. If the nominal minimum numbers of reading have not been met the user will be prompted if it is ok to store the point anyway.*

Continue to 15.6.7 TPS Functions or return to 15.6.6 Pickup .

15.6.7 TPS Functions

Clicking on the **TPS** menu option brings up the **TPS Functions** menu.

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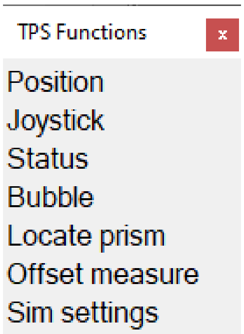


See
15.6.7.1 TPS Position
15.6.7.2 TPS Joystick
15.6.7.3 TPS Status
15.6.7.4 TPS Bubble
15.6.7.5 TPS Locate Prism
15.6.7.6 TPS Offset Measurement
15.6.7.7 TPS Simulator Settings

15.6.7.1 TPS Position

The **Position TPS** panel is used in conjunction with the primary setout panel to automatically position the TPS to match desired setout data entered on the setout panel.

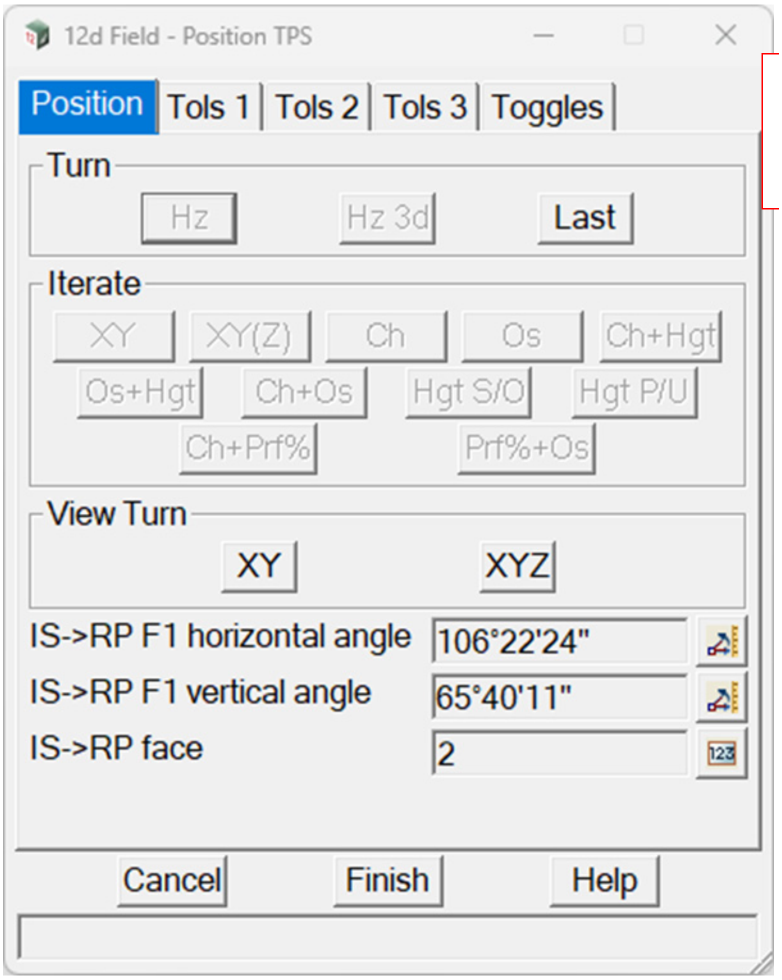
Sometimes it is a simple turn to a position, sometimes the instrument has to iterate to get to the correct position.

A typical example of this is positioning the TPS to the desired height above a design surface: here the TPS would be manually pointed by the surveyor to a location.

For example a peg in the ground, the iterate positioning is started where the TPS takes a reading, the height calculation is done, the TPS repositions vertically, remeasures, all is repeated until the height tolerance is met or the maximum specified iterations are exceeded.

This panel does not need to be present to do the positioning, there are matching function keys for all of the buttons described here.

Clicking on **TPS Position** brings up the **12d Field - Position TPS** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Position Tab

Turn

Hz	button		

Turn the TPS horizontally to the setout point.

Function key "tps_position_hz"

Hz 3d button

Turn the TPS horizontally and vertically to the setout point.

Function key "tps_position_hz_3d"

Last button

Turn the TPS horizontally to the last measured point.

Function key "tps_position_lastxy"

Iterate

*The following terms are used in the descriptions below, **slab**, a floor, a roughly horizontal plane, **wall**, a roughly vertical plane parallel to the control string and **face**, a roughly vertical plane but unlike a **wall** square to the control string.*

XY button

Measure and iterate from the current position to the setout (x,y) coordinates. The next iterate position is the setout (x,y) and the measured height.

Typical usage, marking setout points on a slab.

Function key "tps_position_xy"

XY(Z) button

*This is identical to **XY** except the TPS will position to the setout xyz first before commencing the iterate process.*

Function key "tps_position_xy_z1"

Ch button

Measure and iterate from the current position to the setout chainage, the next iterate position is the setout chainage and the measured offset.

Typical usage, marking points at a chainage on a slab.

Function key "tps_position_ch"

Os button

Measure and iterate from the current position to the setout offset, the next iterate position is the measured chainage and the setout offset.

Typical usage, marking points at an offset on a slab.

Function key "tps_position_os"

Ch+Hgt button

Measure and iterate from the current position to the setout chainage and setout height difference, the next iterate position is the setout chainage, the measured offset and the setout height difference.

Typical usage, marking points at a chainage and height on a wall.

Function key "tps_position_ch_z"

Os+Hgt button

Measure and iterate from the current position to the setout offset and setout height difference, the next iterate position is the measured chainage, the setout offset and the setout height difference.

Typical usage, marking points at a chainage and height on a face.

Function key "tps_position_os_z"

Ch+Os button

*Measure and iterate from the current position to the setout chainage and setout offset, the next iterate position is the setout chainage, the setout offset and the measured height/z. This is effectively the same as **XY**.*

Typical usage, marking setout points on a slab.

Function key "tps_position_ch_os"

Hgt S/O button

Measure and iterate from the current position to the setout z, the next iterate position is the measured x,y and the setout height/z.

Typical usage, would not typically be used.

Function key "tps_position_height_so"

Hgt P/U button

Measure and iterate from the current position to the design height at that point, the next iterate position is the measured x,y and the design height.

Typical usage, marking design heights on a peg, wall or face.

Function key "tps_position_height_pu"

Ch+Prf% button

Measure and iterate from the current position to the setout chainage and setout tunnel point, the next iterate position is the setout chainage and a setout tunnel point calculated at the measured offset from the tunnel profile.

Typical usage, marking points around an excavated tunnel surface.

Function key "tps_position_ch_ele_per"

Prf%+Os button

Measure and iterate from the current position to the setout tunnel profile point, the next iterate position is the measured chainage and the setout tunnel point.

Typical usage, marking points on a tunnel face, say under excavation.

Function key "tps_position_ele_per_os"

View Turn

XY button

Select a point from a view and turn the TPS horizontally to that position.

Function key "tps_position_screen_xy"

XYZ button

Select a point from a view and turn the TPS horizontally and vertically to that position.

Function key "tps_position_screen_xyz"

IS->RP F1 horizontal angle angle box

The current TPS horizontal angle.

IS->RP F1 vertical angle angle box

The current TPS vertical angle.

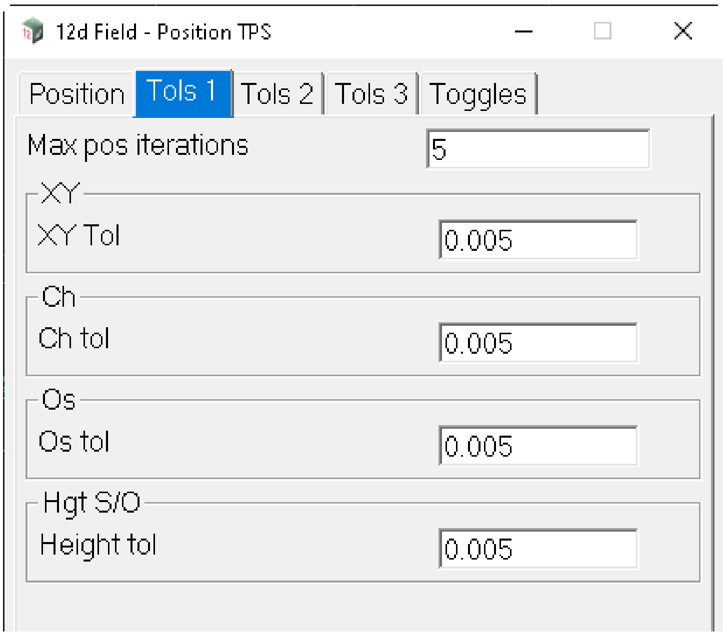
IS->RP face integer box

The current TPS face.

Tols 1, 2 and 3 Tabs

The 3 tolerances tabs have the tolerances for the positioning modes on the **Position Tab**, as such the description here is deliberately brief as the fields are self-explanatory and is simply to describe the underlying attribute for each tolerance.

Tols 1 Tab



Position Tab
Tols 1, 2 and 3 Tabs
Toggles Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Max pos iterations integer box

The maximum number of iteration attempts to achieve the desired position before failing.

Attribute "st_tps_pos_max_iterations"

XY

XY tol

Attribute "st_tps_pos_xy_xy_tol"

Ch

Ch tol

Attribute "st_tps_pos_ch_ch_tol"

Os

Os tol

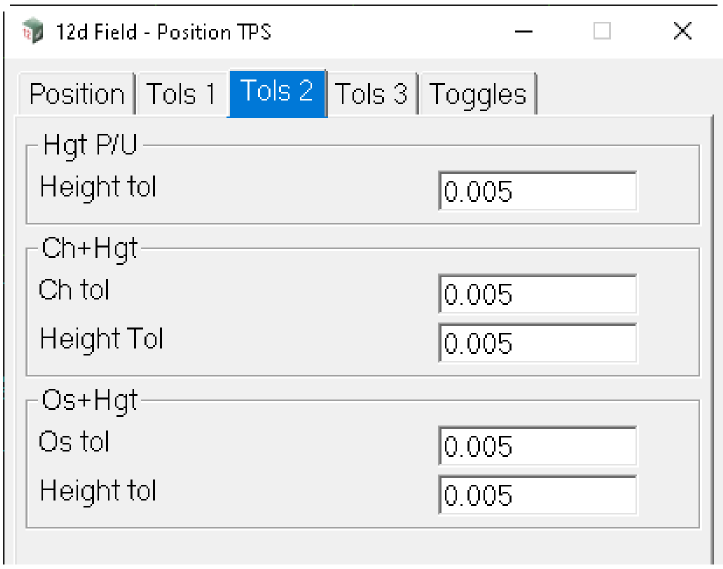
Attribute "st_tps_pos_os_os_tol"

Hgt S/O

Height tol

Attribute "st_tps_pos_soz_z_tol"

Tols 2 Tab



Position Tab
Tols 1, 2 and 3 Tabs
Toggles Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Hgt P/U

Height tol

Attribute "st_tps_pos_puz_z_tol"

Ch+Hgt

Ch tol

Attribute "st_tps_pos_ch_z_ch_tol"

Height tol

Attribute "st_tps_pos_ch_z_z_tol"

Os+Hgt

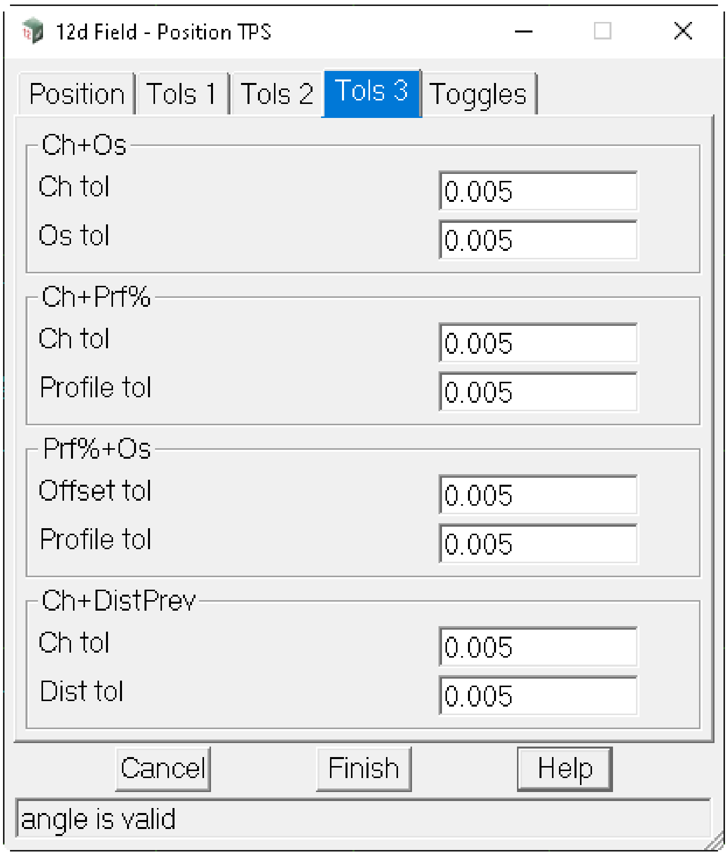
Os tol

Attribute "st_tps_pos_os_z_os_tol"

Height tol

Attribute "st_tps_pos_os_z_z_tol"

Tols 3 Tab



Position Tab
Tols 1, 2 and 3 Tabs
Toggles Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Ch+Os

Ch tol

Attribute "st_tps_pos_ch_os_ch_tol"

Os tol

Attribute "st_tps_pos_ch_os_os_tol"

Ch+Prf%

Ch tol

Attribute "st_tps_pos_ch_prf_ch_tol"

Profile tol

Attribute "st_tps_pos_ch_prf_prf_tol"

Prf%+Os

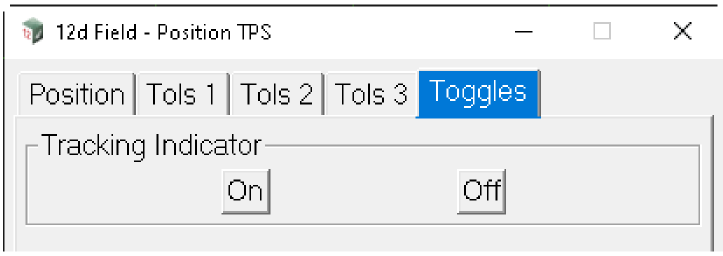
Offset tol

Attribute "st_tps_pos_prf_os_prf_tol"

Profile tol

Attribute "st_tps_pos_prf_os_os_tol"

Toggles Tab



Position Tab
Tols 1, 2 and 3 Tabs
Toggles Tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Laser pointer

Pointer on

Turn the TPS pointer on.

Pointer off

Turn the TPS pointer off.

Toggle Pointer

If the pointer is on turn it off and vice versa.

Guide lights

Note, this group will only be shown if the instrument supports guide lights and its contents instrument specific.

On, Low, Med, High

Turn the TPS guide lights on to either a default or user specified intensity.

Off

Turn the TPS guide lights off.

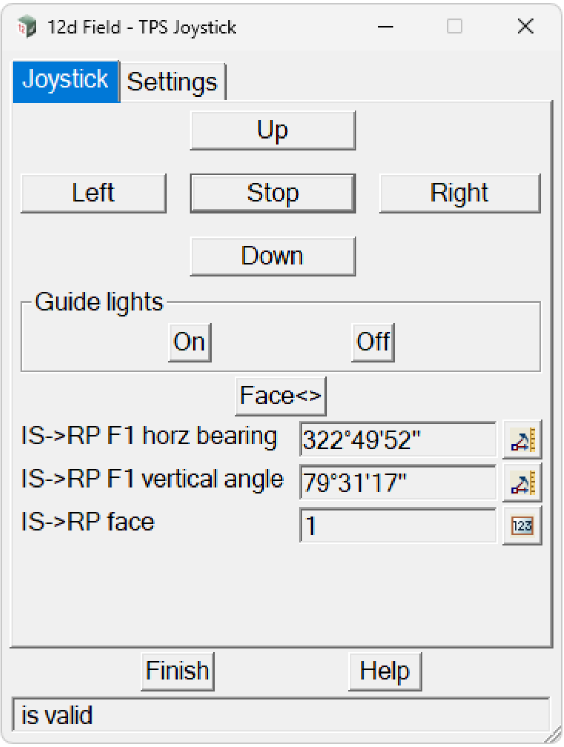
Continue to 15.6.7.2 TPS Joystick or go back to 15.6.7 TPS Functions .

15.6.7.2 TPS Joystick

The **TPS Joystick** panel will be primarily used for controlling the joystick settings to suit the TPS instrument in use. The actual joystick usage would normally be controlled by user defined hotkeys, see 15.1.3.7 Hotkeys and Toolbars for details on configuring hotkeys.

Clicking **TPS Joystick** brings up the **12d Field - TPS Joystick** panel.

.



Joystick tab
Settings tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Joystick tab

Up button

Dependent on the joystick settings rotate the TPS up.

Hotkeys

"joystick_up"

"joystick_up_ramp_up"

"joystick_up_ramp_up_down"

"joystick_up_stop_repress"

Left button

Dependent on the joystick settings rotate the TPS left as seen from the user looking at the TPS.

Hotkeys

"joystick_left"

"joystick_left_ramp_up"

"joystick_left_ramp_up_down"

"joystick_left_stop_repress"

Stop button

Stop the TPS rotating.

Hotkey

"joystick_stop"

Right button

Dependent on the joystick settings rotate the TPS right as seen from the user looking at the TPS.

Hotkeys

"joystick_right"

"joystick_right_ramp_up"

"joystick_right_ramp_up_down"

"joystick_right_stop_repress"

Down button

Dependent on the joystick settings rotate the TPS down.

Hotkeys

"joystick_down"

"joystick_down_ramp_up"

"joystick_down_ramp_up_down"

"joystick_down_stop_repress"

Guide lights

On, Off, High, Low, Medium

The guide light buttons vary dependent on the TPS instrument in use, they might not be available, simply turn the lights on or off or allow varying intensities.

Hotkeys, instrument dependent

"tps_egl_low"
"tps_egl_med"
"tps_egl_high"
"tps_egl_on"
"tps_egl_off"
"tps_egl_toggle"

Face<> button

Rotate the TPS to the opposite face.

IS->RP F1 horizontal angle angle box

The current TPS horizontal angle.

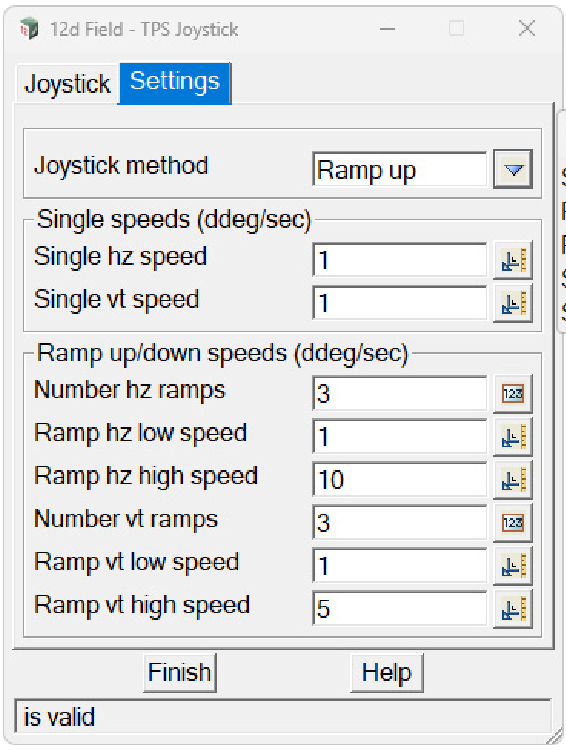
IS->RP F1 vertical angle angle box

The current TPS vertical angle.

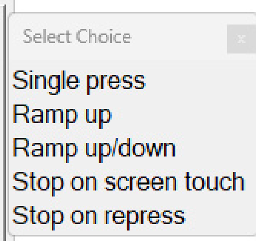
IS->RP face integer box

The current TPS face.

Settings tab



Joystick tab
Settings tab



Joystick method

***Single Press**, the TPS will rotate in the selected direction at the applicable **Single speeds** setting until **Stop** is pressed.*

***Ramp up**, the TPS will start rotating in the selected direction at the **Ramp low speed** setting until **Stop** is pressed. If the same direction key is pressed again the rotation speed increases according to the **Ramp high speed** and **Number ramps** setting.*

***Ramp up/down**, the TPS will start rotating in the selected direction at the **Ramp low speed** setting until **Stop** is pressed. If the same direction key is pressed again the rotation speed increases according to the **Ramp high speed** and **Number ramps** setting. When the TPS reaches the full rotation speed pressing the selected direction again will incrementally decrease the speed back to zero.*

***Stop on screen touch**, the TPS will rotate in the selected direction at the applicable **Single speeds** setting until the screen is tapped anywhere.*

***Stop on repress**, the TPS will rotate in the selected direction at the applicable **Single speeds** setting, rotation will stop when the same button or the Stop button is pressed.*

Attribute "st_tps_joystick_method"

Single speeds (ddeg/sec)

Single hz speed real box

The horizontal rotation speed in degrees per second for single press modes.

Attribute "st_tps_joystick_single_hz_speed"

Single vt speed real box

The vertical rotation speed in degrees per second for single press modes.

Attribute "st_tps_joystick_single_vt_speed"

Ramp up/down speeds (ddeg/sec)

Number hz ramps integer box

The number of presses in horizontal ramp modes to get from low to high rotation speeds.

Attribute "st_tps_joystick_ramp_hz_number_ramps"

Ramps hz low speed real box

The initial horizontal rotation speed in degrees per second for ramp modes.

Attribute "st_tps_joystick_ramp_hz_low_speed"

Ramps hz high speed real box

The final horizontal rotation speed in degrees per second for ramp modes.
Attribute "st_tps_joystick_ramp_hz_high_speed"

Number vt ramps integer box

The number of presses in vertical ramp modes to get from low to high rotation speeds.
Attribute "st_tps_joystick_ramp_vt_number_ramps"

Ramps vt low speed real box

The initial vertical rotation speed in degrees per second for ramp modes.
Attribute "st_tps_joystick_ramp_vt_low_speed"

Ramps vt high speed real box

The final vertical rotation speed in degrees per second for ramp modes.
Attribute "st_tps_joystick_ramp_vt_high_speed"

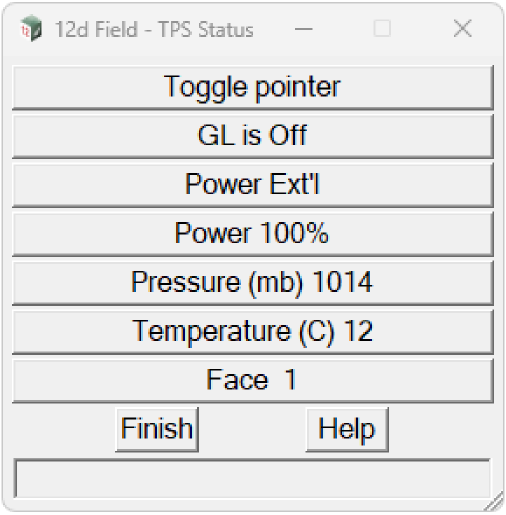
Continue to 15.6.7.3 TPS Status or go back to 15.6.7 TPS Functions .

15.6.7.3 TPS Status

The **TPS Status** panel is a simple panel that displays various information about the current status of the TPS instrument in use, its contents are instrument specific, the image shown is for a typical Leica TPS.

Clicking **TPS Status** brings up the **12d Field - TPS Status** panel.

.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Toggle pointer	button		

Press to toggle the laser pointer on/off, the button text does not change.

GL is * button

Shows the current guide light status, the possibilities are

__GL is Off__, the guide light is off
__GL is Low__, the guide light is low intensity
__GL is Medium__, the guide light is medium intensity
__GL is High__, the guide light is high intensity
__GL is Unknown__, the guide light status is unknown
Pressing the button does nothing.

Power * button

Shows the current power source, the possibilities are

__Power Src ?__, the power source is unknown
__Power Int'l__, the power source is an internal battery
__Power Ext'l__, the power source is external
Pressing will query the power level and refresh.

Power ??% button

Shows the current power level in %, the possibilities are

*__Power *%__, the power level in %*
__Power ??%__, the power level is unknown
Pressing will query the power level and refresh.

AP20 * button

If a Leica AP20 is in use its power level in %, the possibilities are

***AP20 Power *%**, the AP20 power level in %*
***AP20 Power ??%**, the AP20 power level is unknown*
Pressing will query the AP20 power level and refresh.

Pressure (mb) button

Shows the pressure set/measured on the TPS instrument.

Temperature (C) button

Shows the temperature set/measured on the TPS instrument.

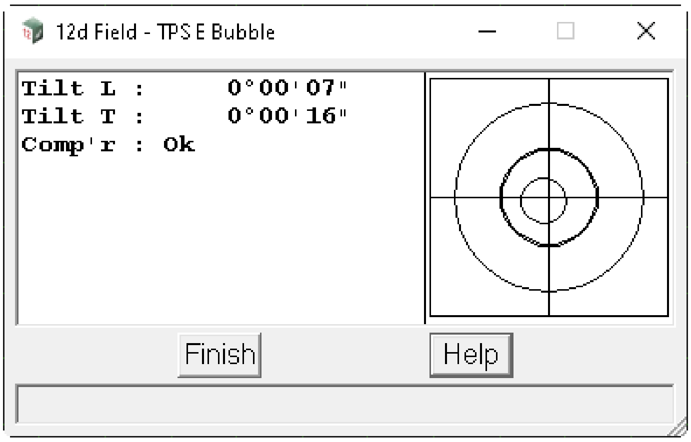
Face * button

Shows the current face of the TPS, pressing the button will make the TPS change face.

Continue to 15.6.7.4 TPS Bubble or go back to 15.6.7 TPS Functions .

15.6.7.4 TPS Bubble

Clicking **TPS Bubble** brings up the **12d Field - TPS Bubble** panel.
.



The diagram and information show the status of the bubble on the TPS.

When using ***12d Field*** you are usually not near the TPS Instrument itself so this option allows to monitor the bubble on the TPS in case it moves out of being set up on the vertical.

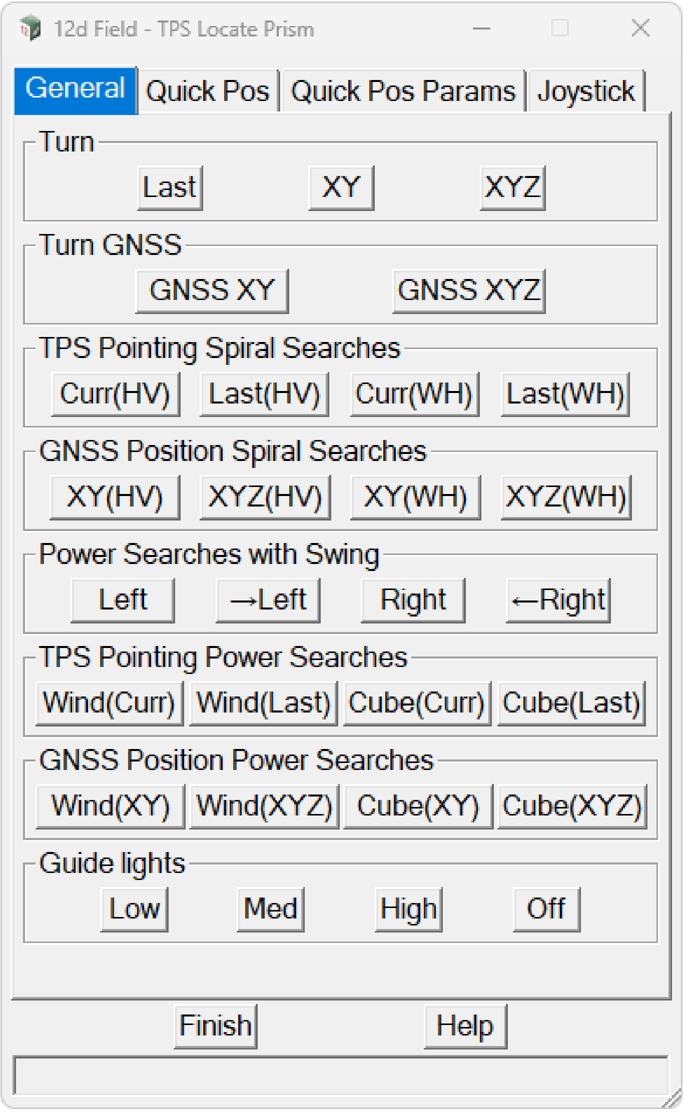
Please note for Leica Captivate instruments, the readings to ascertain the bubble status cannot be done while the instrument is locked on to a prism. When the panel is opened the instrument is unlocked and when the panel is closed a search is done to relock to the prism.

Continue to 15.6.7.5 TPS Locate Prism or go back to 15.6.7 TPS Functions .

15.6.7.5 TPS Locate Prism

The **TPS Locate Prism** panel is a collection of functions to manipulate a TPS instrument, the panel overlaps in functionality with many other panels and would generally not be used as the functionality is available as hotkeys.
The contents of this panel vary dependent on the TPS instrument in use, the images shown are for a typical Leica TPS with a GNSS secondary instrument.

Clicking **TPS Locate Prism** brings up the **12d Field - TPS Locate Prism** panel.
.



General tab
Quick Pos tab
Quick Pos Params tab
Joystick tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

General tab

Turn

Last button

Turn the TPS horizontal and vertically to the last measured point.

Hotkey "tps_position_lastxy"

XY button

Select a point from a view and turn the TPS horizontal to it.

Hotkey "tps_position_screen_xy"

XYZ button

Select a point from a view and turn the TPS horizontal and vertically to it.

Hotkey "tps_position_screen_xyz"

Turn GNSS (Only if secondary GNSS is active)

GNSS XY button

If a secondary GNSS instrument is active turn the TPS horizontal to it.

Hotkey "tps_pos_to_gps_xy"

GNSS XYZ button

If a secondary GNSS instrument is active turn the TPS horizontal and vertically to it.

Hotkey "tps_pos_to_gps_xyz"

TPS Pointing Spiral Searches

Curr (HV) button

Start a spiral search at the current instrument pointing.

Hotkey "leica_atr_search"

Last (HV) button

Turn to the last measured position and start a spiral search.

Hotkey "leica_atr_search_last"

Curr (WH) button

Start a spiral search at the current instrument pointing, the angular width and height of the search are calculated from the last measured distance.

Hotkey "leica_spiral_distance_search"

Last (WH) button

Turn and start a spiral search at the last measured point, the angular width and height of the search are calculated from the last measured distance.

Hotkey "leica_spiral_distance_search_last"

GNSS Position Spiral Searches (Only if secondary GNSS is active)

XY(HV) button

Turn horizontally to the GNSS position and start a spiral search.

Hotkey "leica_atr_search_gps_xy"

XYZ(HV) button

Turn horizontally and vertically to the GNSS position and start a spiral search.

Hotkey "leica_atr_search_gps_xyz"

XY(WH) button

Turn horizontally and start a spiral search at the current GNSS position, the angular width and height of the search are calculated from the GNSS distance from the instrument.

Hotkey "leica_spiral_search_gps_xy"

XYZ(WH) button

Turn horizontally and vertically and start a spiral search at the current GNSS position, the angular width *and height of the search are calculated from the GNSS distance from the instrument.*

Hotkey "leica_spiral_search_gps_xyz"

Power Searches with Swing

Left button

Power search to the left.

Hotkey "leica_next_left_powersearch"

-> Left button

Power search to the left starting with a small swing to the right.

Hotkey "leica_next_left_swing_powersearch"

Right button

Power search to the right.

Hotkey "leica_next_right_powersearch"

-> Right button

Power search to the right starting with a small swing to the left.

Hotkey "leica_next_right_swing_powersearch"

TPS Pointing Power Searches

Wind(Curr) button

Start a window, no distance restriction power search.

Hotkey "powersearch_window"

Wind(Last) button

Turn to the last measured position and start a window, no distance restriction power search.

Hotkey "powersearch_window_last"

Cube(Curr) button

Start a cube, distance restricted power search.
Hotkey "leica_cube_search"

Cube(Last) button

Turn to the last measured position and start a cube, distance restricted power search.
Hotkey "leica_cube_search_last"

GNSS Position Power Searches (Only if secondary GNSS is active)

Wind(XY) button

Turn to the current GNSS position horizontally and start a window, no distance restriction power search.
Hotkey "powersearch_window_gps_xy"

Wind(XYZ) button

Turn to the current GNSS position horizontally and vertically and start a window, no distance restriction power search.
Hotkey "powersearch_window_gps_xyz"

Cube(XY) button

Turn to the current GNSS position horizontally and start a cube, distance restricted power search.
Hotkey "leica_cube_search_gps_xy"

Cube(XYZ) button

Turn to the current GNSS position horizontally and vertically and start a cube, distance restricted power search.

Hotkey "leica_cube_search_gps_xyz"

Guide lights

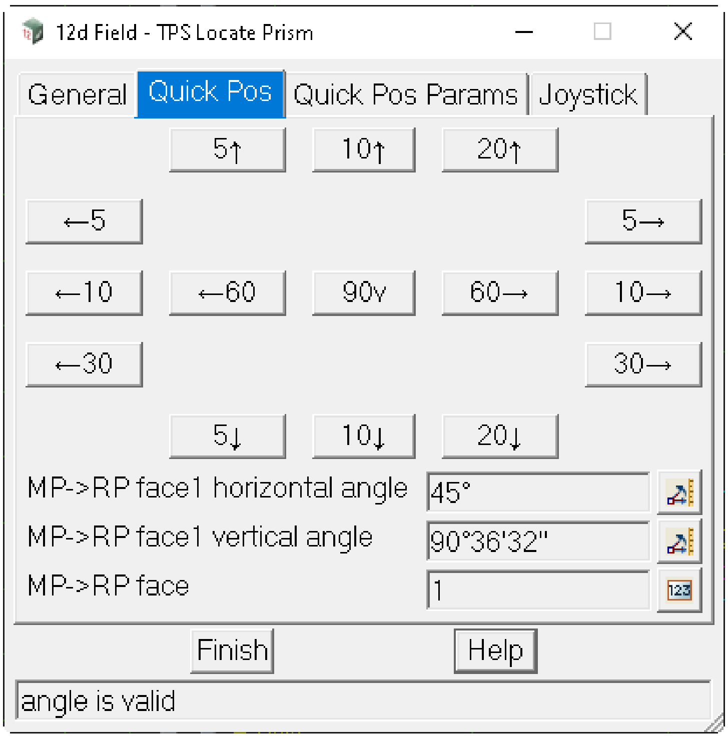
On, Off, High, Low, Medium button

The guide light buttons vary dependent on the TPS instrument in use, they might not be available, simply turn the lights on or off or allow varying intensities.

Hotkeys, instrument dependent

"tps_egl_low"
"tps_egl_med"
"tps_egl_high"
"tps_egl_on"
"tps_egl_off"
"tps_egl_toggle"

Quick Pos tab



General tab
Quick Pos tab
Quick Pos Params tab
Joystick tab

Buttons

90v button

This button is fixed in functionality, it positions the TPS vertically to 90°

The rest of the buttons are user configurable in value, see the Quick Pos Params tab *following for details. There are 4 horizontal turn buttons in either direction, left or right and 3 vertical turn buttons in either direction, up or down.*

Pressing one of these buttons will turn the TPS instrument in this direction for the specified number of degrees.

IS->RP F1 horizontal angle angle box

The current TPS horizontal angle.

Attribute "pu_tps_running_f1_hb"

IS->RP F1 vertical angle angle box

The current TPS vertical angle.

Attribute "pu_tps_running_f1_va"

IS->RP face integer box

The current TPS face.

Attribute "pu_tps_running_face"

Quick Pos Params tab

The fields in this tab are the settings for the turn buttons on the ***Quick Pos*** *tab.*

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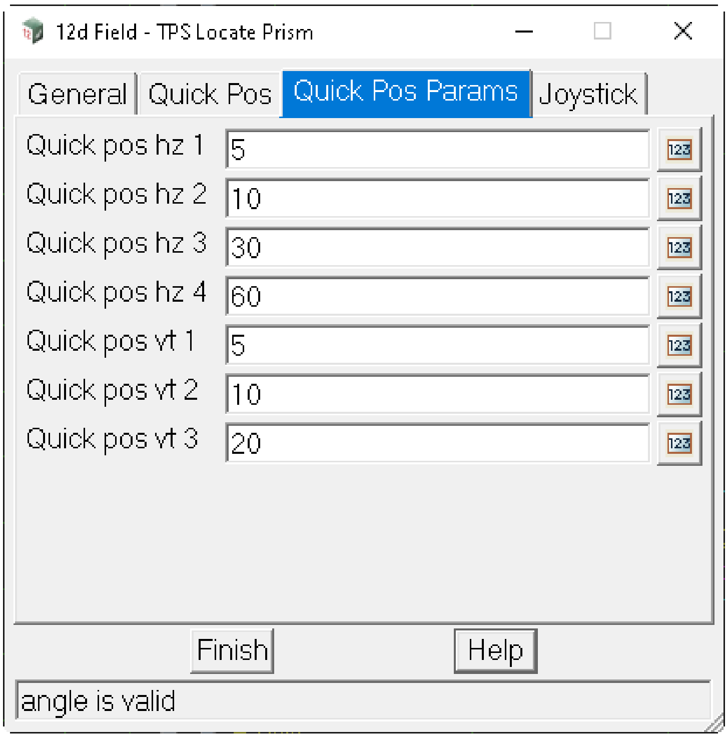


General tab
Quick Pos tab
Quick Pos Params tab
Joystick tab

Quick poz hz 1 integer box

The angle to turn for the top horizontal buttons.

Attribute "st_tps_quickpos_hz_1"

Quick poz hz 2 integer box

The angle to turn for the outer middle horizontal buttons.

Attribute "st_tps_quickpos_hz_2"

Quick poz hz 3 integer box

The angle to turn for the lower horizontal buttons.

Attribute "st_tps_quickpos_hz_3"

Quick poz hz 4 integer box

The angle to turn for the inner middle horizontal buttons.

Attribute "st_tps_quickpos_hz_4"

Quick poz vt 1 integer box

The angle to turn for the left side vertical buttons.

Attribute "st_tps_quickpos_vt_1"

Quick poz vt 2 integer box

The angle to turn for the middle vertical buttons.

Attribute "st_tps_quickpos_vt_2"

Quick poz vt 3 integer box

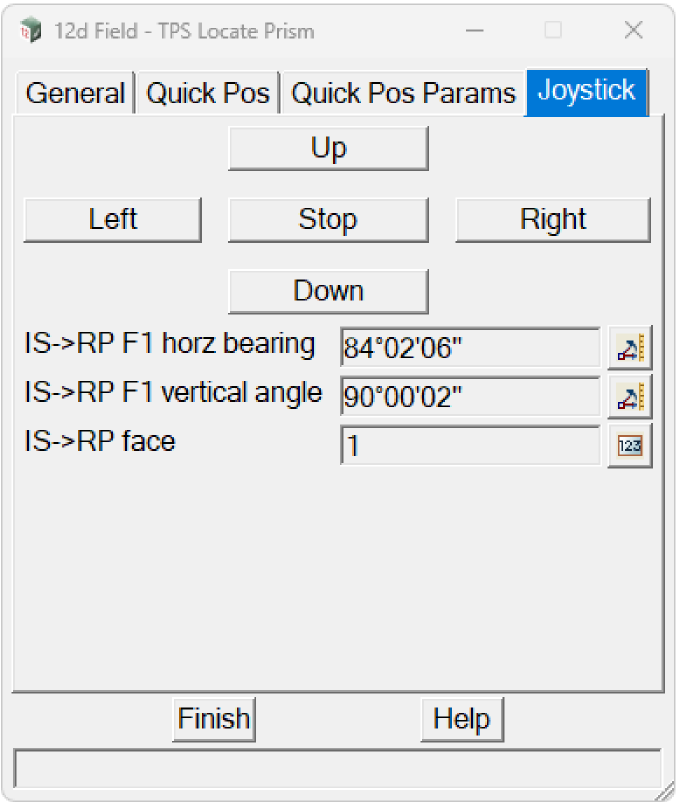
The angle to turn for the right side vertical buttons.

Attribute "st_tps_quickpos_vt_3"

Joystick tab

See 15.6.7.2 TPS Joystick *for joystick functionality.*

.



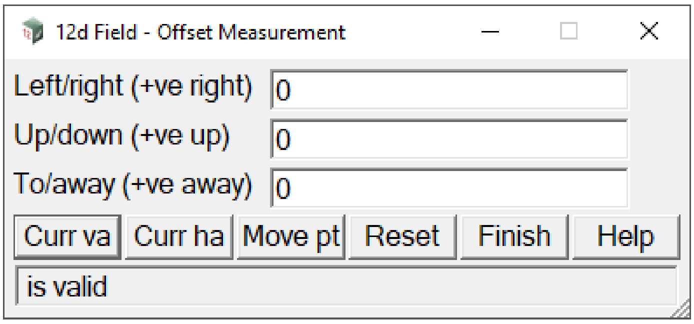
General tab
Quick Pos tab
Quick Pos Params tab
Joystick tab

Continue to 15.6.7.6 TPS Offset Measurement or go back to 15.6.7 TPS Functions.

15.6.7.6 TPS Offset Measurement

The **TPS Offset Measurement** panel is a panel for adjusting TPS measurements for **non SDR** style pickup, e.g. the setout panels. **Important**, this panel adjusts readings normal/square to the original measurement, it does not 'rotate' the original measurement.

Clicking **Offset Measurement** brings up the **12d Field - Offset Measurement** panel.
.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Left/right (+ve right)	real box		

The distance to move the measured point left/right of the original measured bearing.
Attribute "pu_mp_os_right_left"

Up/down (+ve up) real box

The value to move the original measured point up or down.
Attribute "pu_mp_os_up_down"

To/away (+ve away) real box

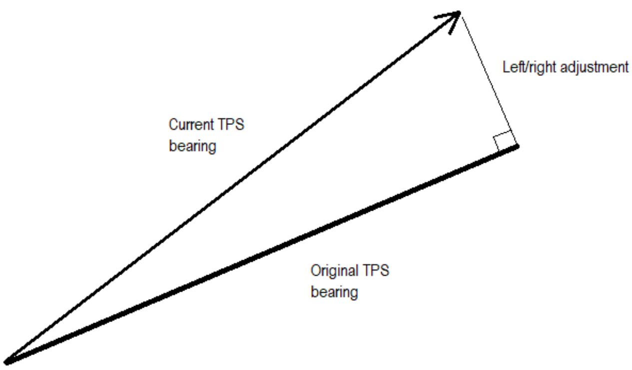
The distance to move the measured point to or away from the TPS in the direction of the original measured bearing.
Attribute "pu_mp_os_away_to"

Curr va button

*This calculates a new **Up/down** value using the current TPS vertical angle.*

Curr ha button

*This calculates a new **Left/right** value using the current TPS bearing, note the adjustment is normal/ square to the original measurement.*



Move pt button

Adjust the measured point to the current offset values.

Reset button

Reset the measurement point to the original TPS reading.

Continue to 15.6.7.7 TPS Simulator Settings or go back to 15.6.7 TPS Functions .

15.6.7.7 TPS Simulator Settings

The **TPS Sim Setting** panel is a simple panel used to control TPS measurements when ***12d Field*** is configured as a TPS simulator. The panel allows the user to either pick individual points to calculate the simulator readings or have the simulator drifting, continuously measuring and angles and distances.

Clicking **TPS Sim Settings** brings up the **12d Field - Sim Settings** panel.

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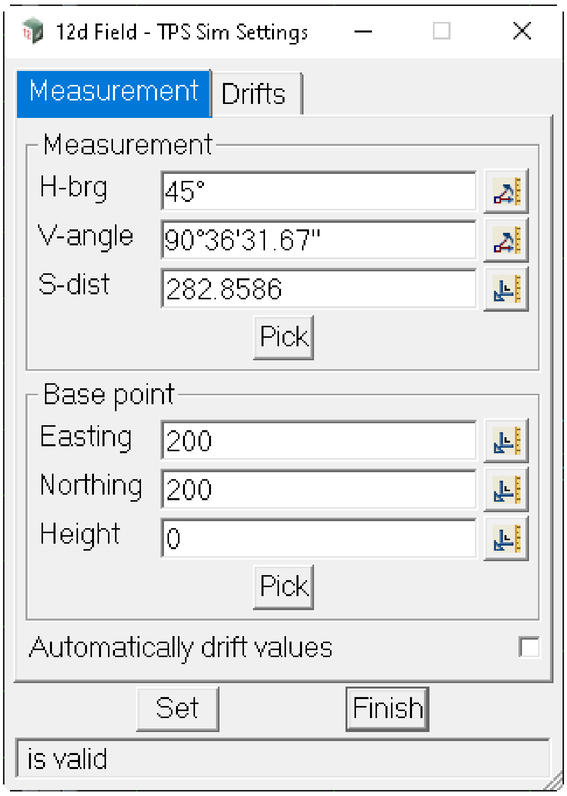
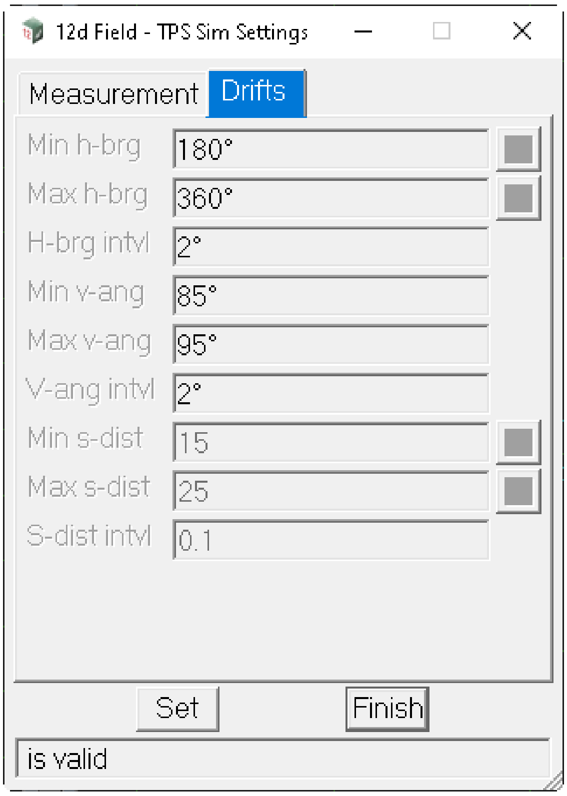




The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Measurement tab

Measurement

H-brg real box

The horizontal bearing to be used for the next measurement.

Attribute "st_tps_sim_ha"

V-angle real box

The vertical angle to be used for the next measurement.

Attribute "st_tps_sim_va"

S-dist real box

The slope distance to be used for the next measurement.

Attribute "st_tps_sim_sd"

Pick button

*Select a point to measure to, the **H-brg**, **V-angle** and **S-dist** fields will be calculated and updated using the base point coordinates.*

Base point

The point all readings are calculated from, this is set to the current instrument setup coordinates on opening the panel, the user would typically only change these coordinates when doing a new instrument setup.

Easting real box

The easting of the base point.

Northing real box

The northing of the base point.

Height real box

The height of the base point.

Automatically drift values tick box not ticked

*If **ticked**, the TPS simulator will rotate automatically according to the settings on the **Drifts** tab. When in the minimum or maximum drift values are reached the simulator will reverse direction for that value.*

Drifts tab

Min h-brg angle box

The start bearing for the horizontal drift.

Attribute "st_tps_sim_drift_ha_min"

Max h-brg angle box

The end bearing for the horizontal drift.

Attribute "st_tps_sim_drift_ha_max"

H-brg intvl angle box

The bearing increment for the horizontal drift.

Attribute "st_tps_sim_drift_ha_int"

Min v-ang angle box

The start angle for the vertical drift.

Attribute "st_tps_sim_drift_va_min"

Max v-ang angle box

The end angle for the vertical drift.

Attribute "st_tps_sim_drift_va_max"

V-ang intvl angle box

The angle increment for the vertical drift.

Attribute "st_tps_sim_drift_va_int"

Min s-dist real box

The start distance for the slope distance drift.

Attribute "st_tps_sim_drift_sd_min"

Max s-dist real box

The end distance for the slope distance drift.

Attribute "st_tps_sim_drift_sd_max"

S-dist intvl real box

The distance increment for the slope distance drift.

Attribute "st_tps_sim_drift_sd_int"

Buttons at Bottom

Set button

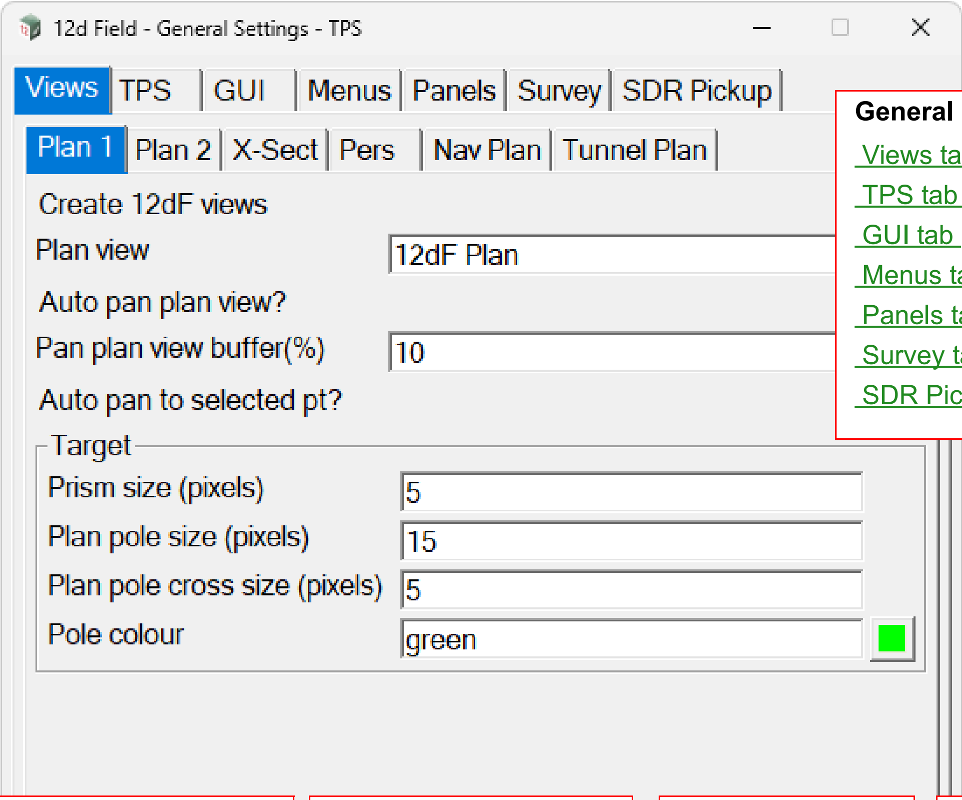
Validate and set the simulator settings for use, start or stop the simulator rotating according to the drift tick box.

Continue to 15.6.8 General Settings - TPS or go back to 15.6.7 TPS Functions .

15.6.8 General Settings - TPS

Clicking **Settings** brings up the **12d Field - Settings** panel for a TPS.

.



General Settings - TPS tabs

Views tab
TPS tab
GUI tab
Menus tab
Panels tab
Survey tab
SDR Pickup tab

Views tab

Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

TPS tab

TPS >Search tab
TPS >General tab
TPS >Target Heights tab
TPS >Inverse Target Heights tab

GUI tab

GUI >Gen tab
GUI >Sounds tab
GUI >Colours tab
GUI >Logging tab

Menus tab

Menus >General tab
Menus >Setup tab
Menus >Setout tab
Menus >Pickup
Menus >TPS

Panels tab

Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

Survey tab

Survey >General tab
Survey >Keys tab
Survey >Storage
Survey >Spec Ch's
Survey >Setup visualisation

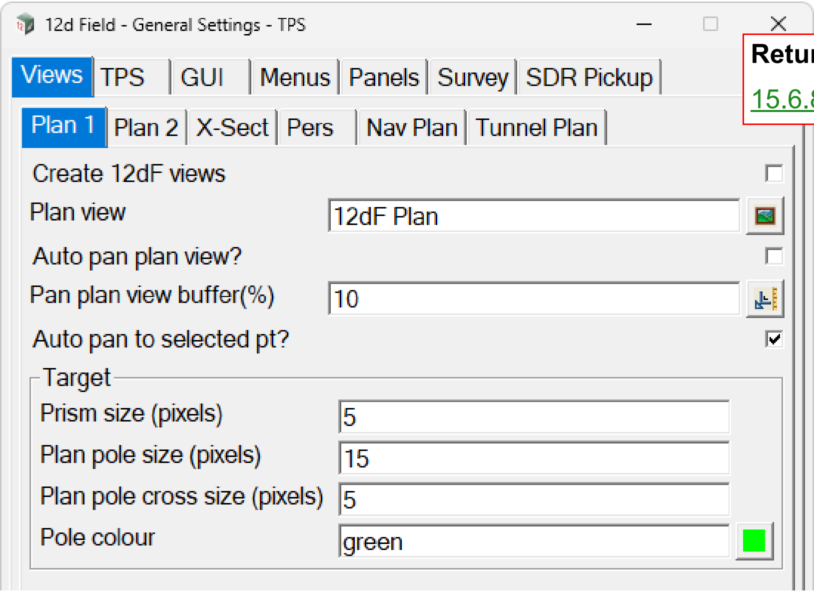
SDR Pickup tab

SDR Pickup >General tab 1
SDR Pickup >General tab 2
SDR Pickup >GUI

Continue to Views tab .

Views tab

Views >Plan 1 tab



Return to
15.6.8 General Settings - TPS

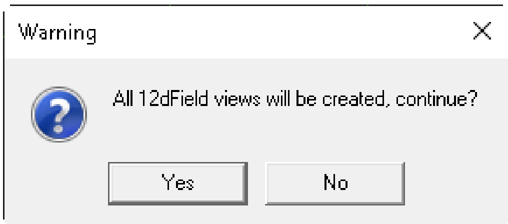
Views tab
Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

The fields and buttons used in this panel have the following functions.

Field Description　　Type　　Defaults　　Pop-Up

Create 12dF views　　tick box

*When **ticked**, a Warning message comes up and if **Yes** is selected and the standard **12d Field** views don't exist, the standard **12d Field** plan, section and perspective views are created and their names added to the appropriate fields in the view tabs. The tick is then turned off.*



Plan view　　view box　　available views

Plan view to display survey data. Note, the selected view cannot be an OpenGL Plan View. A warning message will be displayed if one is selected.

Auto pan Plan view?　　tick box

*If **ticked**, this Plan view automatically pans to a point highlighted by the **12d Field** options.*

*If **not ticked**, this Plan view does not automatically pan to a point highlighted by the **12d Field** options.*

Pan plan view buffer (%)　　real box　　measures

*When the point highlighted by **12d Field** comes within this % of the view border and auto pan is on the highlighted point will be panned to be centre of the view.*

Auto pan to selected pt?　　tick box

*If **ticked**, this Plan view automatically pans to selected points in the **12d Field** options.*

*If **not ticked**, this Plan view does not automatically pan to selected points in the **12d Field** options.*

Prism size (pixels) real box

Size in pixels to draw the symbol for the prism at its position in the plan view.

Plan pole size (pixels) real box

Size in pixels to draw the symbol for the pole at its position in the plan view.

Plan pole cross size (pixels) real box

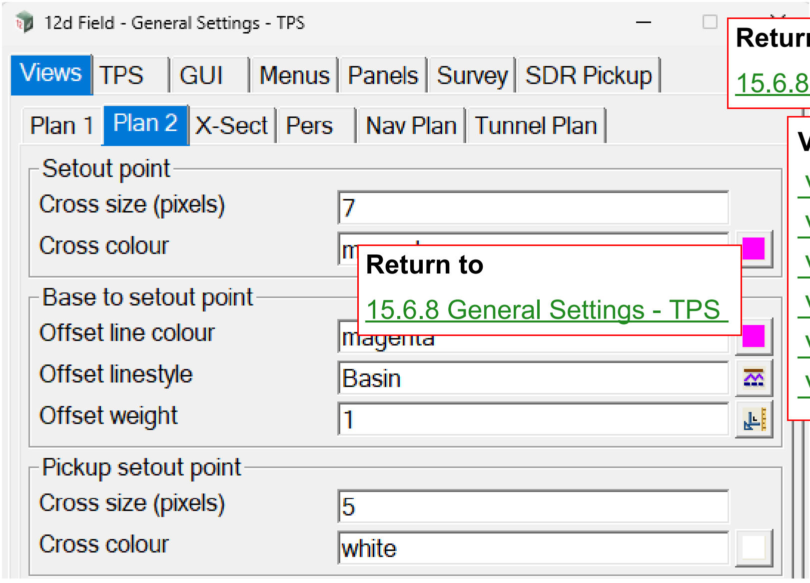
Size in pixels to draw a cross at the pole at its position in the plan view.

Pole colour colour box

Colour to draw the pole in the plan view.

Continue to Views >Plan 2 tab or return to Views tab or 15.6.8 General Settings - TPS .

Views >Plan 2 tab



Return to
15.6.8 General Settings - TPS

Views tab
Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

Return to
15.6.8 General Settings - TPS

Setout point

Cross size (pixels) real box

Size in pixels to draw a cross at the design setout point in the plan view.

Cross colour colour box orange available colours

Colour to draw a cross at the design setout point in the plan view.

Base to setout point

This setting is used in the Setout Point panel when offsetting from the base point, see 15.6.5.2 Setout Point .

Offset line colour colour box

The colour of the line drawn from the selected base point to offset point being setout.

Offset linestyle linestyle box

The linestyle of the line drawn from the selected base point to offset point being setout.

Offset weight real box

The weight of the line drawn from the selected base point to offset point being setout.

Pickup setout point

Cross size (pixels) real box

Size in pixels to draw a cross at the calculated setout point relative to the actual pole position in the plan view.

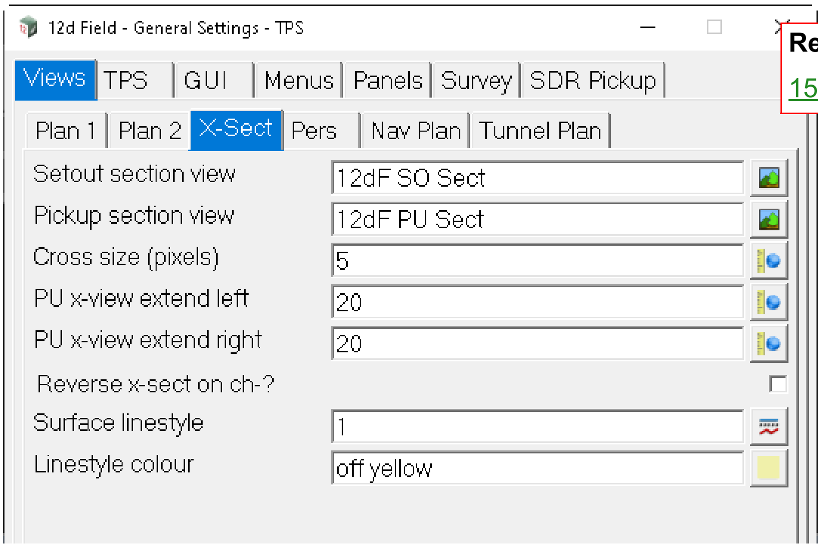
Cross colour colour box orange available colours

Colour to draw a cross at the calculated setout point relative to the actual pole position in the plan view.

Continue to Views >X-Sect tab or return to Views tab or 15.6.8 General Settings - TPS .

Views >X-Sect tab

.



Return to

15.6.8 General Settings - TPS

Views tab

Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

Setout section view view box available views

Section view to display a section at the current setout chainage.

Pickup section view view box available views

Section view to display a section at the current target position.

X-sect reprofile dist real box measures

The section is only redrawn when the chainage difference from previously drawn section is greater than this.

PU x-view extend left/right real box measures

Distance to extend the section view to the left/right (relative to the alignment).

Distance is in metres.

Reverse x-sect on ch- tick box

*If **ticked**, the section view is reversed when setting out in the opposite direction to the alignment.*

*If **not ticked**, the section view is NOT reversed when setting out in the opposite direction to the alignment.*

***Note**: Chainage increment must be set to negative to reverse the section view display.*

Surface linestyle linestyle box

Linestyle to use to display the profile through the surface.

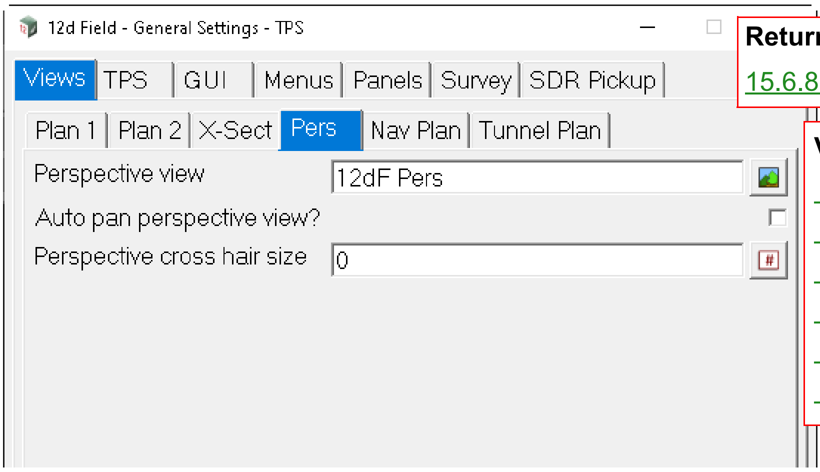
Linestyle colour) colour box

Colour of the linestyle.

Continue to Views >Pers tab or return to Views tab or 15.6.8 General Settings - TPS .

Views >Pers tab

.



Return to

15.6.8 General Settings - TPS

Views tab

Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

Perspective view view box available views

Perspective view to display measurements etc. Note, the selected view cannot be an OpenGL Perspective View. A warning message will be displayed if one is selected.

Auto pan Plan view? tick box

*If **ticked**, this Perspective view automatically pans to a point highlighted by the **12d Field** options.*

*If **not ticked**, this Perspective does not automatically pan to a point highlighted by the **12d Field** options.*

Perspective cross hair size real box measures

Size in metres of the cross hair in this perspective view.

Continue to Views >Nav Plan tab or return to Views tab or 15.6.8 General Settings - TPS .

Views >Nav Plan tab

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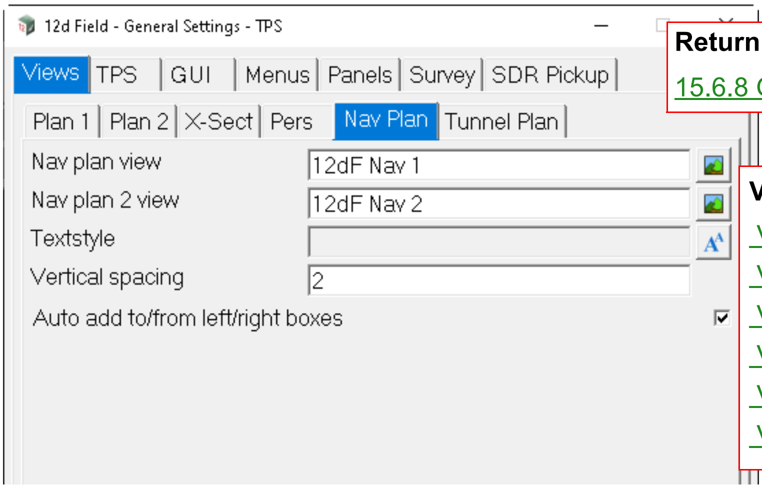


Return to

15.6.8 General Settings - TPS

Views tab

Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

Nav plan view view box available views

Plan view to use to display the Nav plan information.

Nav plan 2 view view box available views

Plan view to use to display the second setout panel information.

Textstyle textstyle data box

Textstyle data used to display the information in the Nav plan view and Nav plan 2 view.

***Note** - it is recommended to use a monospaced font such as Courier to prevent the misalignment of text as shown in following image.*

Vertical spacing real box measures

Spacing to use between the line of text when displaying the information.

Auto add to/from left/right boxes tick box not ticked

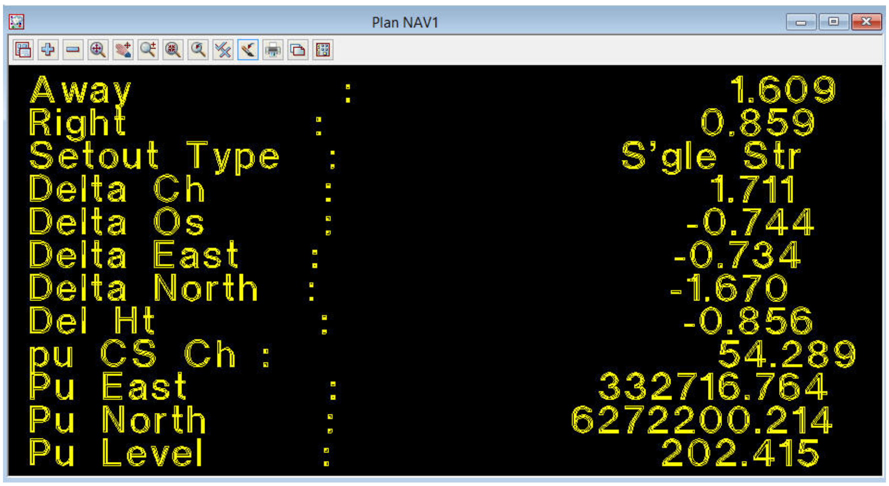
This tick box controls the placement of these 2 navigation attributes on the navigation and info pages.

```
Away     :     0.020
Right    :     0.137
```

*If **ticked**, these are automatically added to the top of the navigation and information pages.*

*If **not ticked**, the position of these is controlled only by the attributes **st_nav_box_ori_to_from** and **st_nav_box_ori_left_right** in the **12dF_NAV_PAGE_CONFIG.4D** and **12dF_INFO_PAGE_CONFIG.4D** files.*

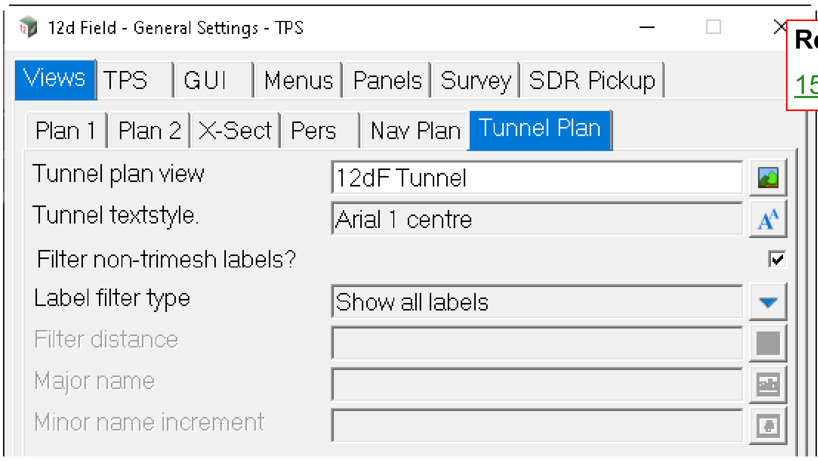
.



Continue to Views >Tunnel Plan tab or return to Views tab or 15.6.8 General Settings - TPS .

Views >Tunnel Plan tab

.



Return to
15.6.8 General Settings - TPS

Views tab
Views >Plan 1 tab
Views >Plan 2 tab
Views >X-Sect tab
Views >Pers tab
Views >Nav Plan tab
Views >Tunnel Plan tab

Tunnel plan view view box available views

Plan view to use to display the Tunnel plan information.

Tunnel Text textstyle data box

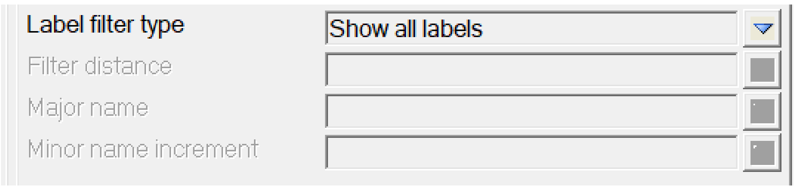
Textstyle data used to display the tunnel information in the Tunnel plan view.

Filter pro/pra labels? tick box

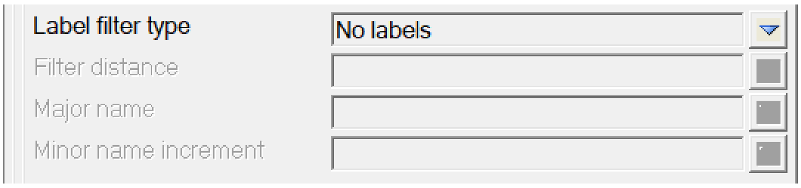
*If **ticked**, filtering is applied to traditional profiles defined by lines and arcs. These would normally not need filtering as points are not generated around arcs unlike trimesh definitions which always have label filtering.*

*If **not ticked**, traditional profiles labels are not filtered.*

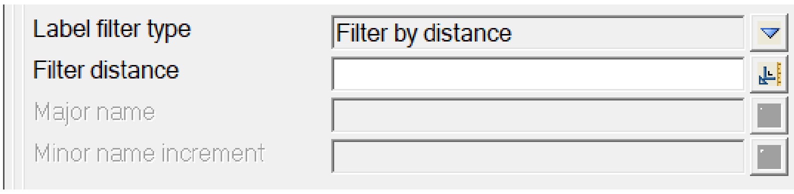
Label filter type choice box Show all labels
Show no labels
Show labels filtered by distance
Show labels filtered by name



No filtering takes place and all labels are shown.



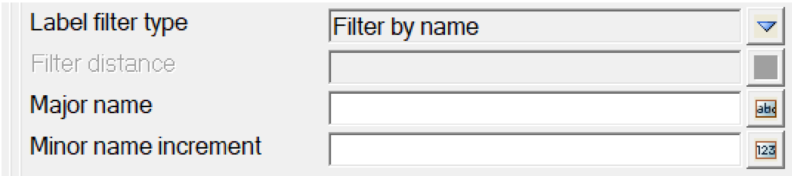
No labels are shown.



Labels are shown only when a certain distance around the profile from the previously displayed label.

Filter distance real box measures

Distance from the previous label before displaying the next.



For trimesh tunnels generated with a major text part, e.g. WALL, ROOF and minor numeric parts, WALL01, WALL02… ROOF20, ROOF21… the labelling can be filtered with this choice.

Major name text box

*A wildcarded match the major labelling, e.g. * to label all tunnel profile segments.*

Major name increment long box

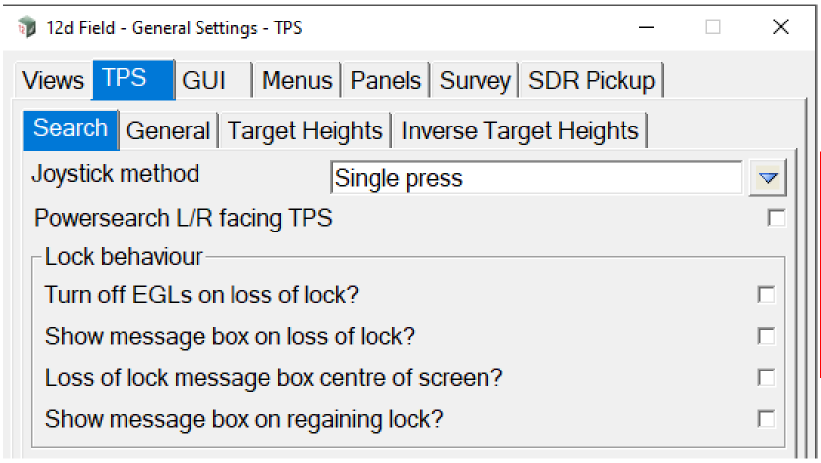
Display every n'th label, e.g. For RR0..RR8 a value of 3 will display RR0, RR3, RR6

Continue to TPS tab or return to Views tab or 15.6.8 General Settings - TPS .

TPS tab

TPS >Search tab

.



Return to
15.6.8 General Settings - TPS

TPS tab
TPS >Search tab
TPS >General tab
TPS >Target Heights tab
TPS >Inverse Target Heights tab

Stop joystick by screen tap? tick box not ticked

*If **ticked**, the joystick rotating is stopped by tapping on the screen.*

*If **not ticked**, the joystick rotating is NOT stopped by tapping on the screen.*

Joystick, use ramp up method? tick box not ticked

*If **ticked**, the joystick starts at the minimum speed and ramps up to maximum speed after 3 presses.*

*If **not ticked**, the joystick starts and stays at the minimum speed.*

Lock behaviour

Turn off EGLs on loss of lock? tick box not ticked

Guide lights are not permitted in many workplaces, if the TPS turns them on automatically on loss of lock use this setting.

*If **ticked**, then the EGL is turned off when lock is lost.*

*If **not ticked**, then the EGL status is not checked or changed when lock is lost.*

Show message box on loss of lock? tick box not ticked

*If **ticked** then a message box appears when lock is lost.*

*If **not ticked** then a message box does not appears when lock is lost.*

Loss of lock message box centre of screen? tick box not ticked

*If **ticked**, then the lost lock message box is always displayed centre of screen.*

*If **not ticked**, then the lost lock message box is displayed at the previous message box position*

Show message box centre on regaining lock? tick box not ticked

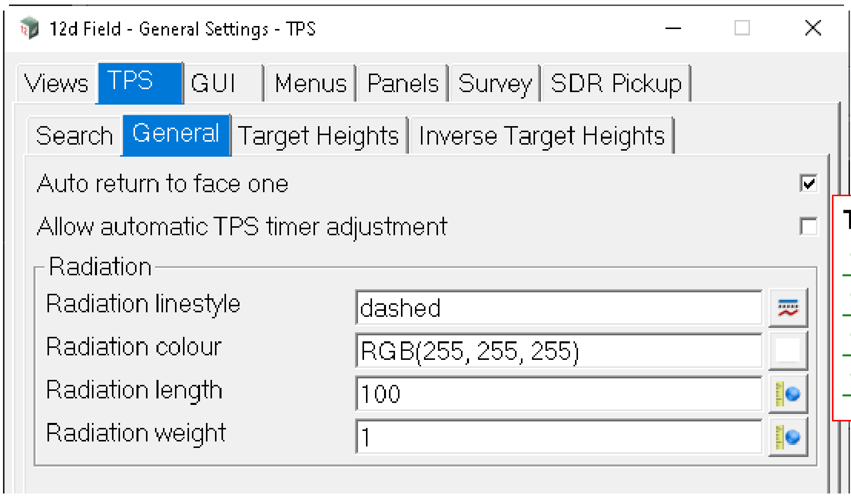
*If **ticked**, then a message box is displayed when lock is regained.*

*If **not ticked**, then a message box is not displayed when lock is regained*

Continue to TPS >General tab or return to TPS tab or 15.6.8 General Settings - TPS .

TPS >General tab

.



Return to
15.6.8 General Settings - TPS

TPS tab
TPS >Search tab
TPS >General tab
TPS >Target Heights tab
TPS >Inverse Target Heights tab

Auto return to face one tick box not ticked

For options, measurement styles that change the face of the instrument this setting attempts to return the instrument to face one on completion. This does not work in all situations.

*If **ticked**, the instrument returns to face one is possible.*

*If **not ticked**, the instrument does not return to face 1.*

Allow automatic TPS timer adjustment tick box not ticked

*The rate at which 12dField polls a TPS for angles and continuous measurements is controlled in the file **12dF_INSTRUMENT_SETTING_4D**. For each instrument in this 12da style file there is a line*

integer "tps_angle_poll_time" 500

*which sets the time in milliseconds the user wishes to poll the TPS. This is only editable via the file and with valid values of **250** to **1000ms**, i.e., a **¼ to 1s**.*

Dependent on hardware, the number of panels open and the complexity of computations a shorter poll time could lead the system to become less responsive.

*If **ticked**, 12dField will monitor the total processing time and on starting the next session of 12dField adjust the polling time to a more suitable value.*

*If **not ticked**, the polling time will remain constant at the setting in the file.*

Radiation

Radiation defines the drawing of the current TPS direction, e.g. from the setup point to the last known target position.

Radiation linestyle linestyle box

Linestyle used for drawing the radiation line.

Radiation colour colour box orange available colours

Colour used for drawing the radiation line.

Radiation length real box

Length of the radiation line to be drawn if the TPS is not in a mode actively tracking/measuring distances to the target.

Radiation weight real box

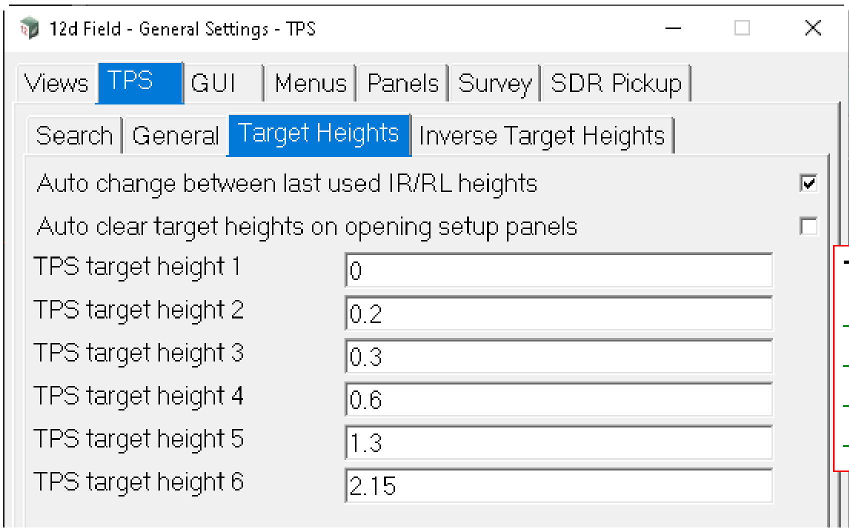
Weight used for drawing the radiation line.

Continue to TPS >Target Heights tab or return to TPS tab or 15.6.8 General Settings - TPS .

TPS >Target Heights tab

Up to six target heights can be stored. They are displayed in the pop-up list for **Preset heights** fields.

.



Return to

15.6.8 General Settings - TPS

TPS tab

TPS >Search tab

TPS >General tab

TPS >Target Heights tab

TPS >Inverse Target Heights tab

Auto change between last used IR/RL heights tick box ticked

*The is a button/hotkey available to toggle between measurement to a target and measurement to any surface, 12d **Field** remembers the last target height used in either of these modes.*

*If **ticked**, change the target height to the last used in that mode.*

*If **not ticked**, do not change the target height to the last used in that mode, use the current height.*

Auto clear target heights on opening setup panels tick box not ticked

*If **ticked**, the target height field will be blanked on starting the panel forcing the user to enter a new height.*

*If **not ticked**, the target height value is untouched when starting the panel.*

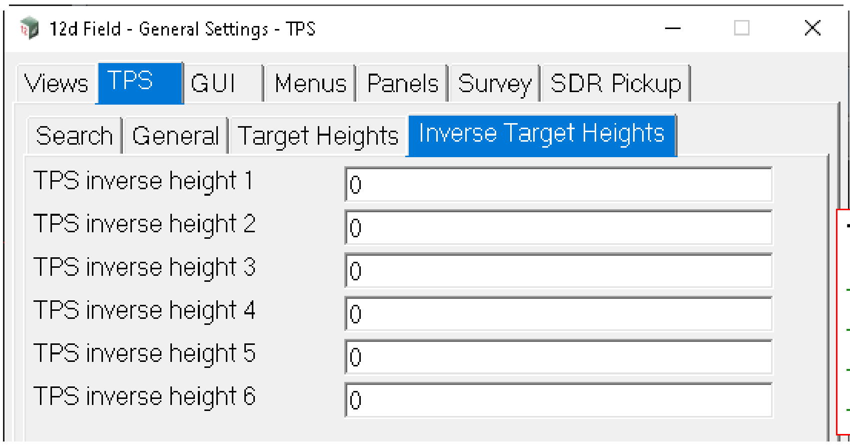
TPS target height 1-6 real box measures

Up to six target heights can be stored. They are displayed in the pop-up list for Preset heights fields.

Continue to TPS >Inverse Target Heights tab or return to TPS tab or 15.6.8 General Settings - TPS .

TPS >Inverse Target Heights tab

Up to 5 inverse target heights can be stored, the 1st height should be left as 0.000 as this signifies an inverse target height is not active, see 15.4.1.1 12d Field - TPS Target Heights for full details.



Return to

15.6.8 General Settings - TPS

TPS tab

TPS >Search tab

TPS >General tab

TPS >Target Heights tab

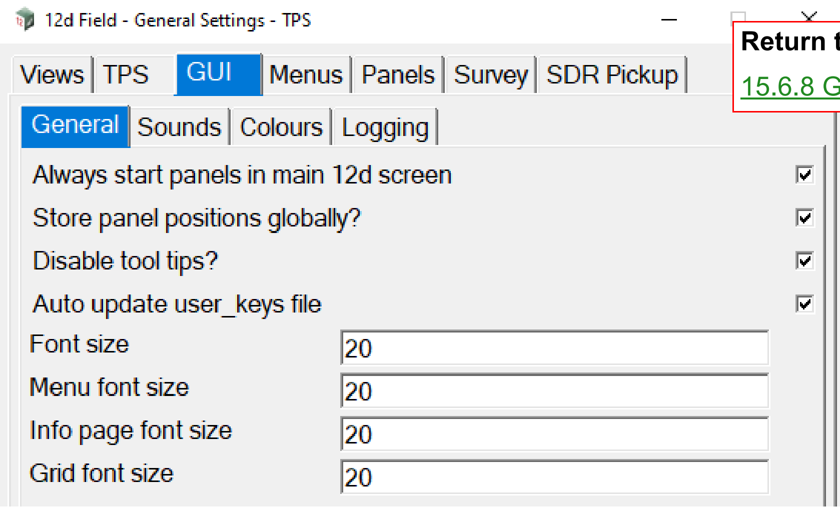
TPS >Inverse Target Heights tab

Continue to GUI tab or return to TPS tab or 15.6.8 General Settings - TPS .

GUI tab

GUI >Gen tab

.



Return to
15.6.8 General Settings - TPS

GUI tab
GUI >Gen tab
GUI >Sounds tab
GUI >Colours tab
GUI >Logging tab

Always start panels in main 12d screen tick box ticked

A panel is always checked on startup it falls inside the main 12d window, if it does not it is moved to the centre of the screen.

Store panel positions globally? tick box ticked

If ***ticked****, the position of the* ***12d Field*** *panels are stored in the global config file rather than the project config file.*

If ***not ticked****, the position of the* ***12d Field*** *panels are stored in the project config file.*

Disable tool tips? tick box ticked

If ***ticked****, the tool tip pop-up are disabled.*

If ***not ticked****, the tool tip pop-up are NOT disabled.*

Auto updateuser_keys file tick box ticked

If ***ticked****, the current contents of the user keys will be checked against the latest set available and missing keys appended to 12dF_USER_KEYS.4D after the comment line // auto appended hotkey.*

If ***not ticked****, then newer user keys are not checked for.*

Font size

Size of the font for ***12d Field*** *setout text.*

Menu font size

Size of the font for menus for ***12d Field*** *panels.*

Info page font size

Size of the font for the Info page.

Grid font size

Size of the font for the grid.

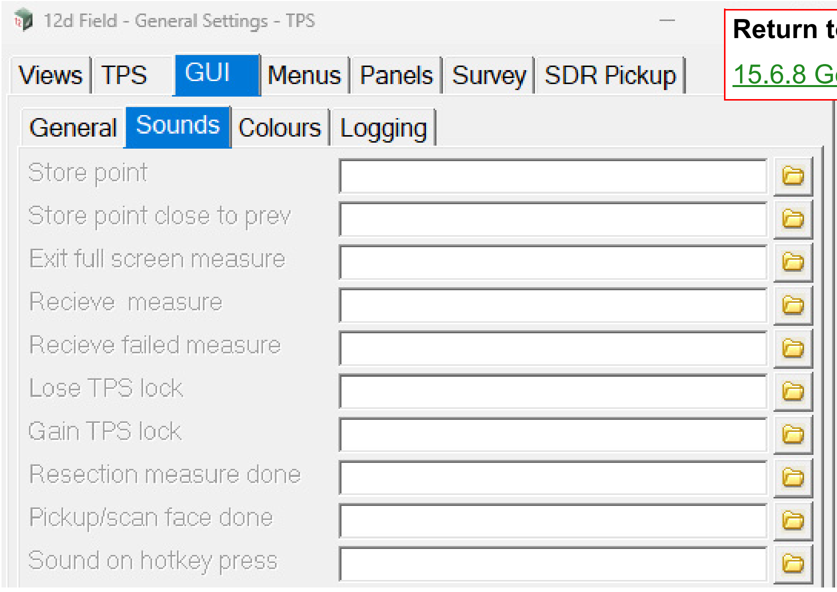
Continue to GUI >Sounds tab or return to GUI tab or 15.6.8 General Settings - TPS .

GUI >Sounds tab

This tab contains a number of events that the user can associate the playing of a sound with when they occur.

Note - when in continuous measurement modes the playing of some sounds is disabled as they take longer to play than the repeated measurements occur.

The user can add their own sound files or browse to the ones in the standard Windows installation.



Return to
15.6.8 General Settings - TPS

GUI tab
GUI >Gen tab
GUI >Sounds tab
GUI >Colours tab
GUI >Logging tab

Store point file box

Play a sound on the storing of a point.

Store point close to prev file box

Play a sound if the point to be stored is too close to the previously stored point.

Exit full screen measure file box

Play a sound when a full screen measure is completed. (Tapping the screen to start the measure.)

Receive measure file box

Play a sound on receiving a successful measurement.

Receive failed measure file box

Play a sound on receiving an unsuccessful measurement.

Lose TPS lock file box

Play a sound on the TPS losing lock.

Gain TPS lock file box

Play a sound on gaining TPS lock.

Resection measure done file box

Play a sound in any of the TPS station setup panels when a full measurement has been done.

Pickup/scan face done file box

Play a sound when a face or tunnel scan has been completed.

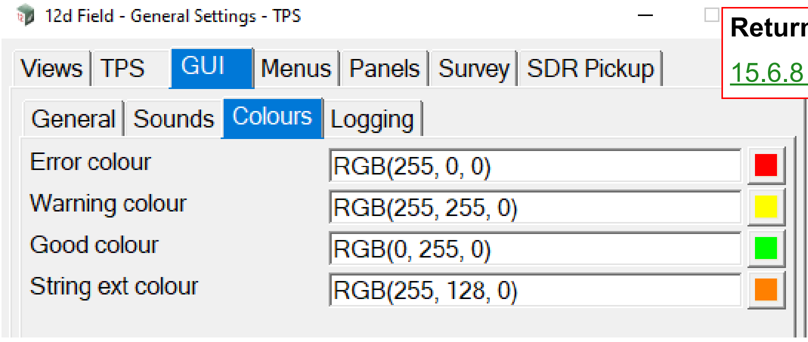
Sound on hotkey press file box

Play a sound on pressing a button on the hotkey bars.

Continue to GUI >Colours tab or return to GUI tab or 15.6.8 General Settings - TPS .

GUI >Colours tab

12d Field messages are generally a white background when informational but can have special colours set for various purposes.



Return to

15.6.8 General Settings - TPS

GUI tab

GUI >Gen tab
GUI >Sounds tab
GUI >Colours tab
GUI >Logging tab

Error colour colour box red

*Background colour to display in **12d Field** message boxes for errors.*

Warning colour colour box yellow

*Background colour to display in **12d Field** message boxes for warnings.*

Good colour colour box green

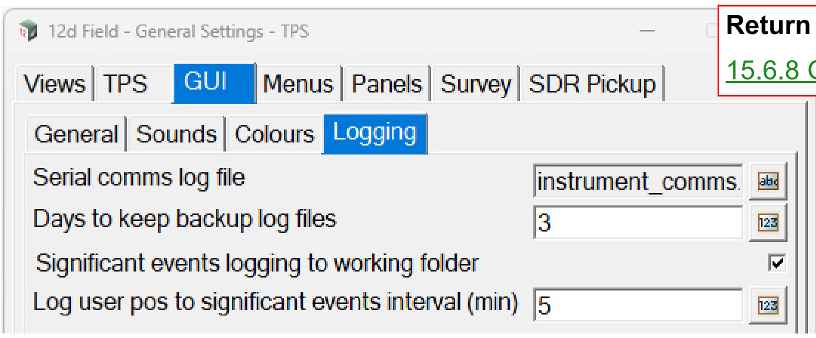
*Background colour to display in **12d Field** message boxes for to let the user know things have returned to a good state.*

String ext colour colour box orange

*Background colour to display in **12d Field** message boxes to show strings have been extended for calculations.*

Continue to GUI >Logging tab or return to GUI tab or 15.6.8 General Settings - TPS .

GUI >Logging tab



Return to

15.6.8 General Settings - TPS

GUI tab

GUI >Gen tab

GUI >Sounds tab

GUI >Colours tab

GUI >Logging tab

Serial comms log file input box read only

Informational only - logging from the TPS/GNSS instrument is written to the binary file instrument_comm.log. This file is necessary for support of complex communication and behavioural issues.

Days to keep backlog files integer box

*Logs for **12d Field** sessions are stored in the backups.4d folder in the working directory.*

*Enter the number of days before **12d Field** deletes these files automatically.*

Significant events logging to working folder tick box ticked

12DF_SIGNIFICANT_EVENTS_LOGGING.TXT is a plain text log file available to the user listing various aspects of the operation of 12dField.

*If **ticked**, 12DF_SIGNIFICANT_EVENTS_LOGGING.TXT is always created in the working directory.*

*If **not ticked**, 12DF_SIGNIFICANT_EVENTS_LOGGING.TXT is always created in accordance with the standard search paths.*

Log user pos to significant events interval (min) integer box 5

Set the interval in minutes to write the users current position to the 12DF_SIGNIFICANT_EVENTS_LOGGING.TXT file.

A duration of 0 will not log the users current position to the file.

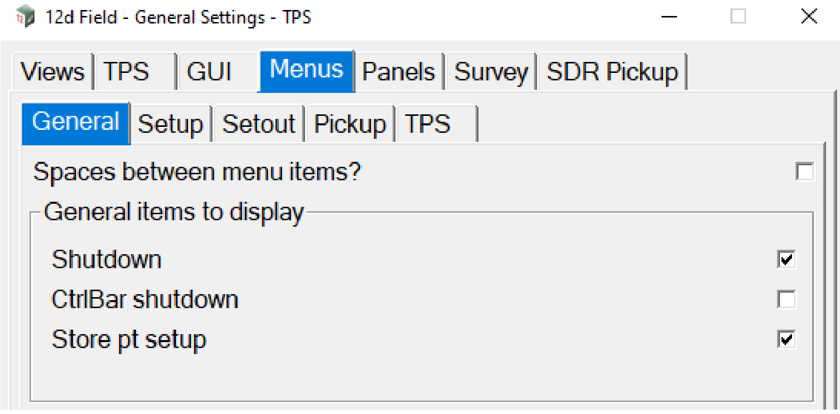
The position is written to log file as follows:

```
Last measured:   X:332732.5059 Y:6272148.8331 Z:183.4812
```

Continue to Menus tab or return to GUI tab or 15.6.8 General Settings - TPS .

Menus tab

Menus >General tab

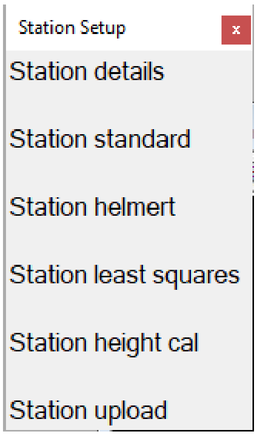


Return to
15.6.8 General Settings - TPS

Menus tab
Menus >General tab
Menus >Setup tab
Menus >Setout tab
Menus >Pickup
Menus >TPS

Spaces between menu items? tick box not ticked

*If **ticked**, add a space between all menu items.*

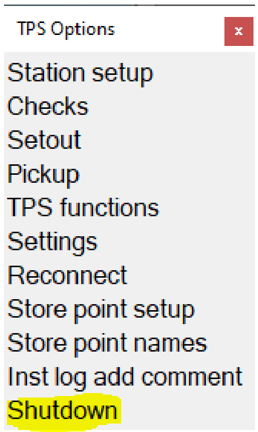


*If **not ticked**, menus do not add an extra space between menu items.*

General items to display

Shutdown tick box ticked

*If **ticked**, Shutdown is added to the end of the options menu.*



*If **not ticked**, Shutdown is added to the end of the options menu only if CtrlBar shutdown is also unticked.*

CtrlBar shutdown tick box not ticked

*If **ticked**, the shutdown button is added to the end of the control bar.*

*If **not ticked**, the shutdown button is not added to the end of the control bar and will be added to the options menu.*

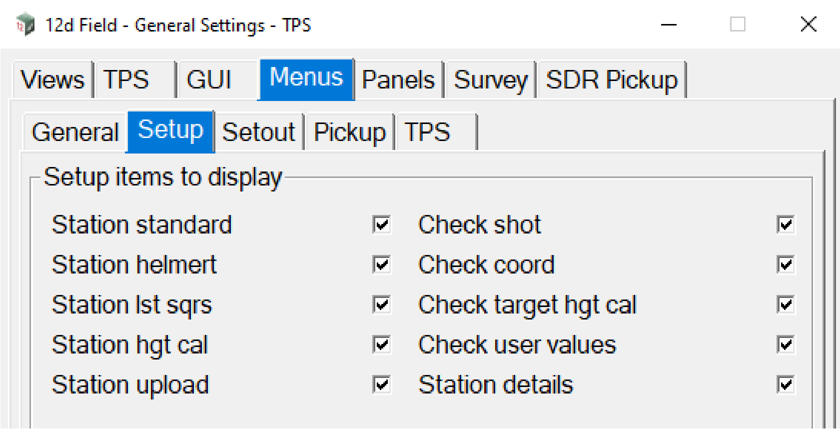
Store pt setup tick box ticked

*If **ticked**, Store point setup is added to the options menu.*

*If **not ticked**, Store point setup is not added to the options menu.*

Continue to Menus >Setup tab or return to Menus tab or 15.6.8 General Settings - TPS .

Menus >Setup tab



Return to
15.6.8 General Settings - TPS

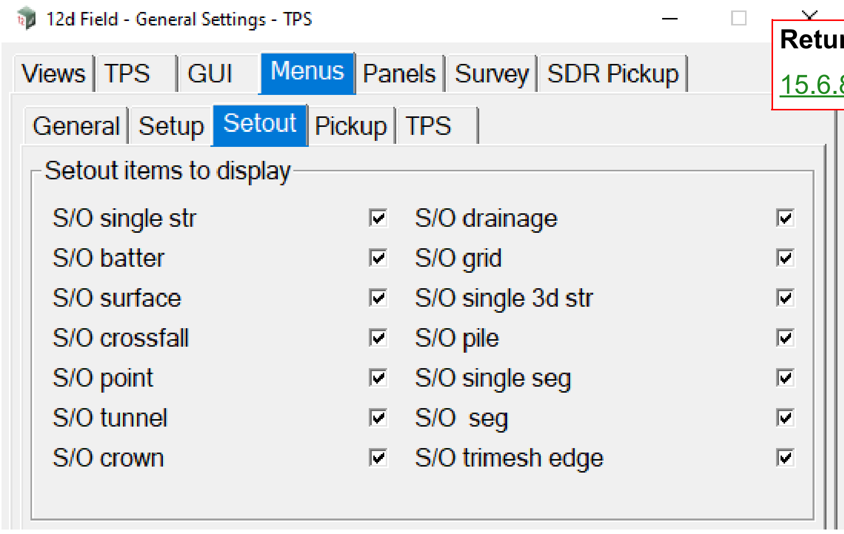
Menus tab
Menus >General tab
Menus >Setup tab
Menus >Setout tab
Menus >Pickup
Menus >TPS

Setup items to display

*Select the items to display on the **Station setup** and **Checks** menus.*

Continue to Menus >Setout tab or return to Menus tab or 15.6.8 General Settings - TPS .

Menus >Setout tab



Return to
15.6.8 General Settings - TPS

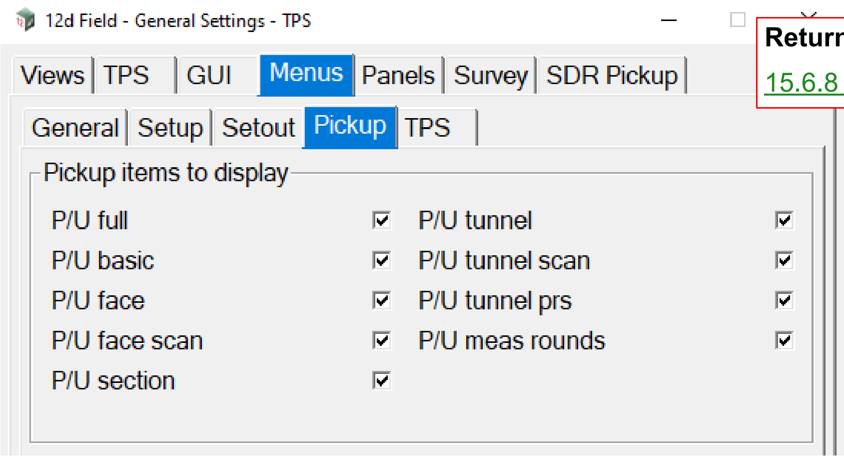
Menus tab
Menus >General tab
Menus >Setup tab
Menus >Setout tab
Menus >Pickup
Menus >TPS

Setout items to display

*Select the items to display on the **Setout** menu.*

Continue to Menus >Pickup or return to Menus tab or 15.6.8 General Settings - TPS .

Menus >Pickup



Return to
15.6.8 General Settings - TPS

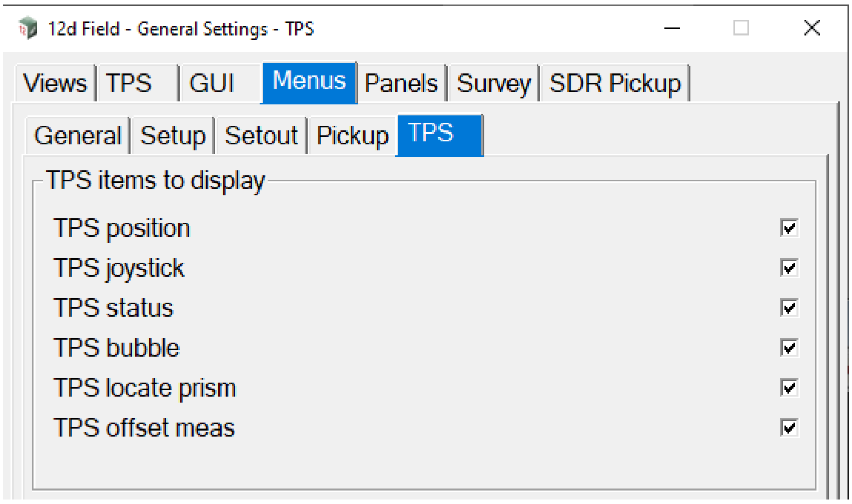
Menus tab
Menus >General tab
Menus >Setup tab
Menus >Setout tab
Menus >Pickup
Menus >TPS

Pickup items to display

*Select the items to display on the **Pickup** menu.*

Continue to Menus >TPS or return to Menus tab or 15.6.8 General Settings - TPS .

Menus >TPS



Return to

15.6.8 General Settings - TPS

Menus tab

Menus >General tab

Menus >Setup tab

Menus >Setout tab

Menus >Pickup

Menus >TPS

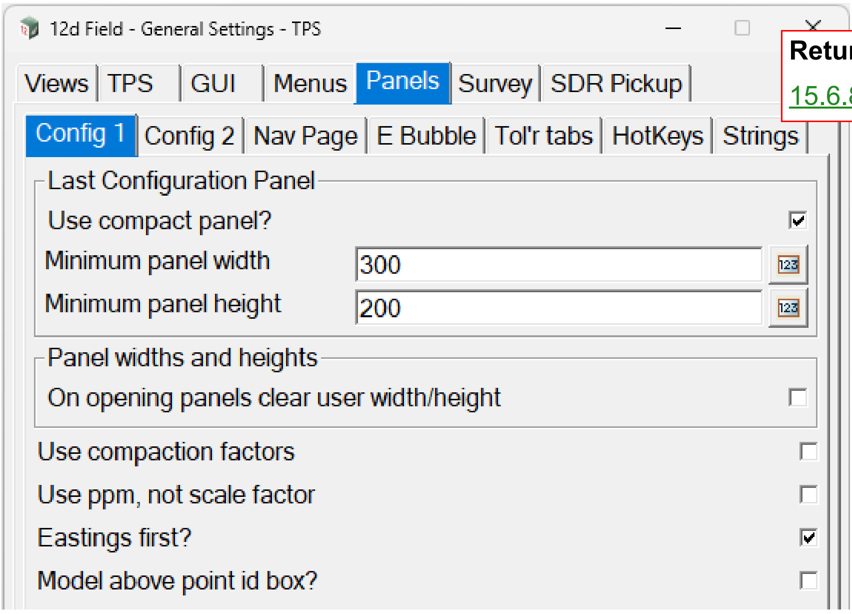
TPS items to display

Select the items to display on the ***TPS functions*** *menu.*

Continue to Panels tab or return to Menus tab or 15.6.8 General Settings - TPS .

Panels tab

Panels >Config 1 tab



Return to
15.6.8 General Settings - TPS

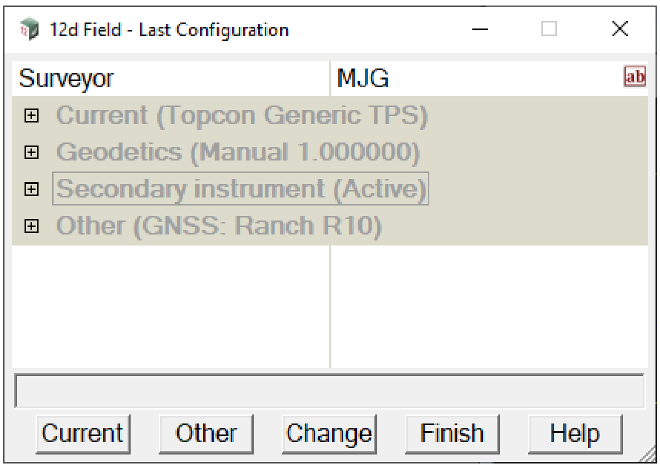
Panels tab
Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

Last Configuration Panel

*These settings control the style of the entry panel into **12d field**, the last configuration panel.*

Use compact panel? tick box ticked

*If **ticked**, then the last configuration panel will be compressed to the minimum number lines necessary to identify the operational instruments and its size restricted to the user entered values.*



*If **not ticked**, then the last configuration panel will show the full details of the instrument currently in use and upsize on startup so all information is shown in the panel.*

Minimum panel width integer box

The width of the last configuration panel when in compact mode.

Minimum panel height integer box

The height of the last configuration panel when in compact mode.

Panel widths and heights

On opening panels clear user width/height tick box not ticked

When a 12dField panel is open the user can upsize the panel manually, this size is remembered and the next time the panel is opened it will be the same size as previously. If for some reason the user cannot then readjust the sizing of the panel manually this option can be used to clear the internal attributes remembering the upsizing values.

These attributes are stored in the 12dF_GLOBAL_CONFIG.4D file in the fashion st_panel_XXXX_user_width and st_panel_XXXX_user_height with XXXX being the panel type in question.

*If **ticked**, when the user opens a 12dField panel the extra width and height settings are set to zero and the panel will open at its native size. When closing the panel the extra width and height settings are zeroed even if upsized after opening the panel.*

*If **not ticked**, when the user opens a 12dField panel the stored extra width and height settings are used to upsize the panel from its native size. When closing the panel the extra width and height settings over the native size of the panel are calculated and stored.*

Use compaction factors tick box ticked

*If **ticked**, the compaction factor widget will be added to the appropriate setout panels.*

*If **not ticked**, the compaction factor widget will not be added to the setout panels and the compaction factor will be set to 1.0. ?? LINK to comp factor explanation.*

Use ppm, not scale factor tick box not ticked

*If **ticked**, for geodetics the scale factor will be displayed as **ppm**, e.g **-40** rather than a scale factor **0.9996**.*

*If **not ticked**, for geodetics the scale factor will be displayed as **scale factor**, e.g **0.9996** rather than a ppm of **-40**.*

Easting first? tick box not ticked

*If **ticked**, an easting box will be added to a panel above a northing box.*

*If **not ticked**, a northing box will be added to a panel above an easting box.*

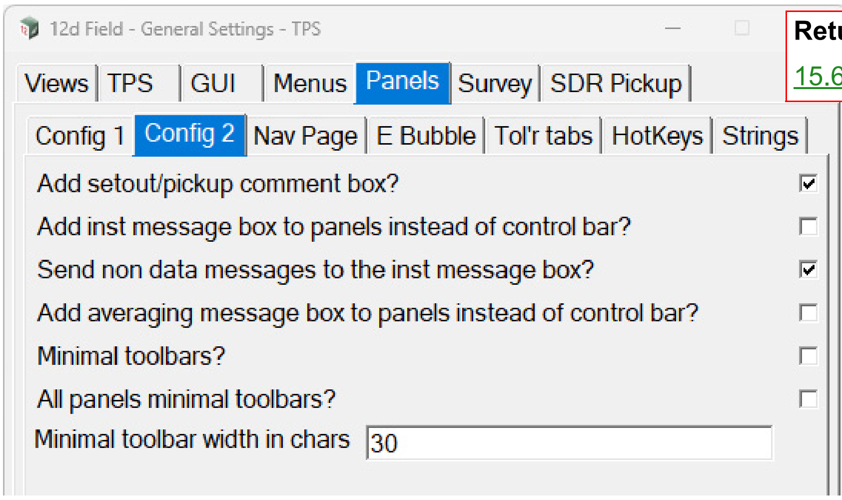
Model above point id box? tick box not ticked

*If **ticked**, in **point setout** the **model** box will be added before the **point id** box.*

*If **not ticked**, in **point setout** the **point id** box will be added before the **model** box.*

Continue to Panels >Config 2 tab or return to Panels tab or 15.6.8 General Settings - TPS .

Panels >Config 2 tab



Return to

15.6.8 General Settings - TPS

Panels tab

Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

Add setout/pickup comment box? tick box ticked

*If **ticked**, a user comment box is added to setout and pickup, not (SDR) panels.*

*If **not ticked**, a user comment box is not added to setout and pickup panels.*

Add inst message box to panels instead of control bar? tick box not ticked

*If **ticked**, the message box with information about the instrument and measurements is added to each panel rather than the control bar.*

*If **not ticked**, the message box with information about the instrument and measurements is added only to the control bar.*

Send non data messages to the inst measure box? tick box not ticked

*This tick box has been added for V15C1k, if the user has the **instrument message box** added to the control bar and this is ticked on then some select messages will be redirected here rather than being sent to the panel message box. An example of this is when storing a point the "Point stored" message can be redirected to **instrument message box** rather than override the delta values shown in the panel's message box.*

This feature is under development for V15C1k.

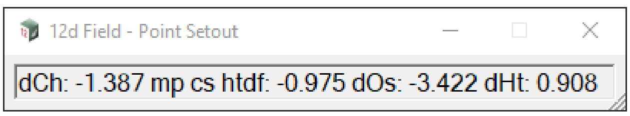
Add average message box to panels instead of control bar? tick box not ticked

*If **ticked**, the message box with progress information about multiface and averaging measurements is added to each panel rather than the control bar.*

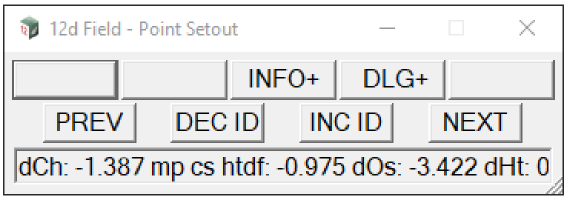
*If **not ticked**, the message box with information about multiface and averaging measurements is added only to the control bar.*

Minimal toolbars? tick box ticked

*If **ticked**, if the panel is not the primary setout panel when minimised only the message box with delta values is shown.*



*If **not ticked**, the minimised panel will show its buttons and the message box with delta values.*



All panels minimal toolbars? tick box not ticked

*If **ticked**, all panels, including the primary panel when minimised will only display the message box with delta values.*

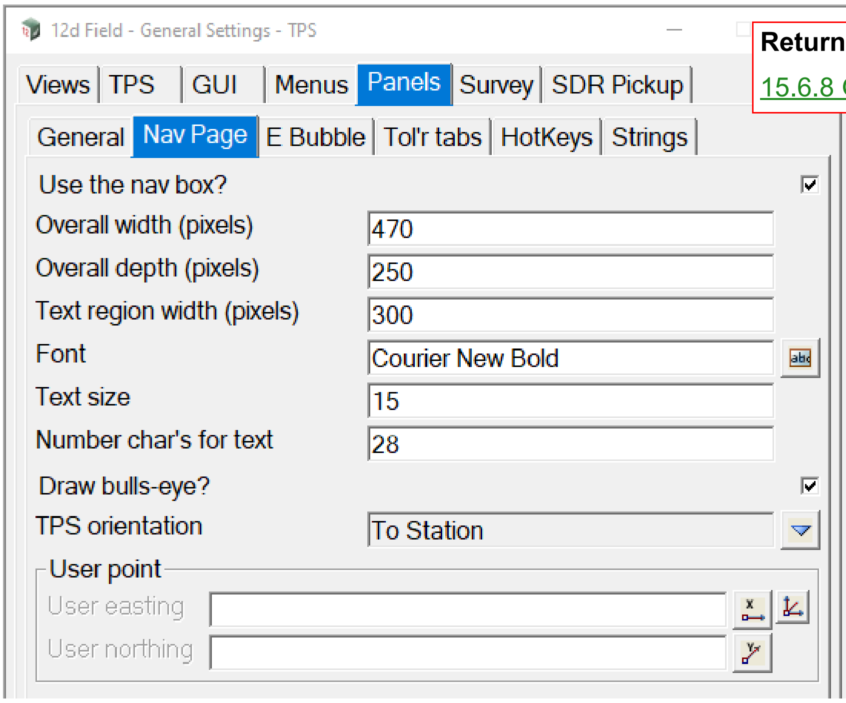
*If **not ticked**, the primary panel when minimised will display its button and the message box with delta values.*

Minimal toolbar width in chars

Width of the minimised toolbar in characters, this setting is deprecated and set for removal at a latter stage.

Continue to Panels >Nav Page or return to Panels tab or 15.6.8 General Settings - TPS .

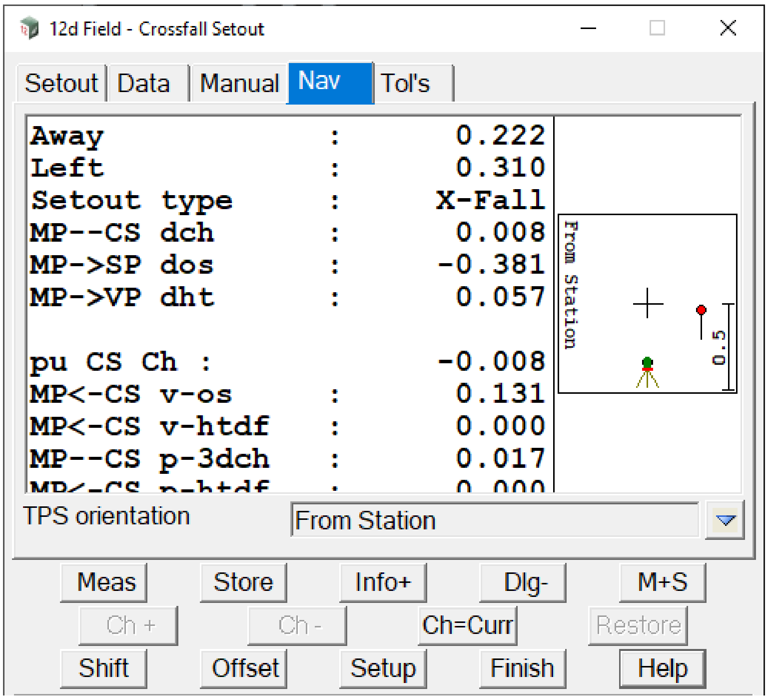
Panels >Nav Page



Return to
15.6.8 General Settings - TPS

Panels tab
Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

The ***12d Field*** navigation page is a 2 part page with a user definable information table and a bulls-eye as a visual aid.



Use the nav box? tick box ticked

*If **ticked**, the navigation page is added to supported setout panels.*

*If **not ticked**, the navigation page is not used.*

Overall width (pixels) integer box

Width in pixels of the entire draw box containing the information table and bulls-eye.

Overall depth (pixels) integer box

Depth in pixels of the entire draw box containing the information table and bulls-eye. Note the depth needs to be set to match the size necessary to display all of the information as no scrolling is available.

Text region width (pixels) integer box

Number of pixels on the left hand side of the draw box reserved for the information table.

Font font box

Font to use in the navigation page, it is recommended to use a monospaced font such as Courier New so text aligns neatly vertically.

Text size integer box

Text size.

Number char's for text integer box

This is a legacy setting that will be improved in the future, this number needs to be made large enough that it is greater than the combined prompt and value in the information tables. If it is not the value will be drawn as XX.XXXX.

Draw bulls-eye? tick box ticked

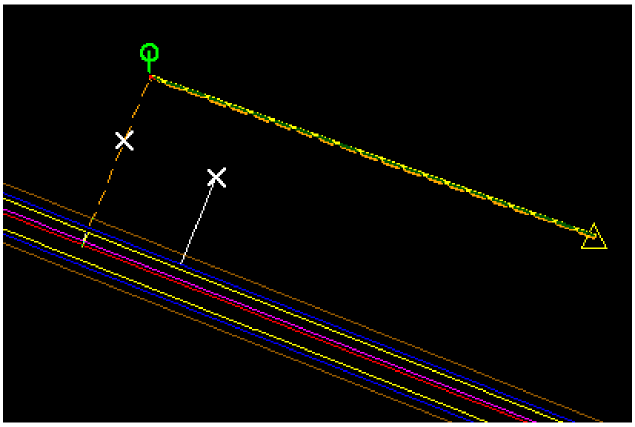
If ***ticked****, the bulls-eye is drawn.*

If ***not ticked****, the bulls-eye is not drawn but the space reserved for it remains untouched.*

TPS orientation choice box None, Centreline, From Station, To Station, To North, To User Point

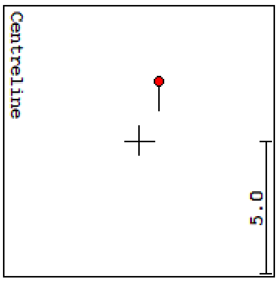
The bull-eye box shows the position of the target and setout point orientated in a certain direction to make it easier to move towards the setout point.

Take the following example, the centreline runs from the station to the measured point.

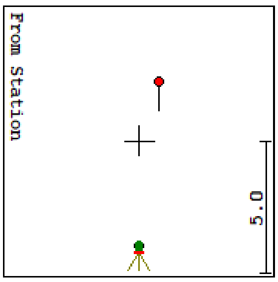


None *- nothing is drawn in the bull-eye box.*

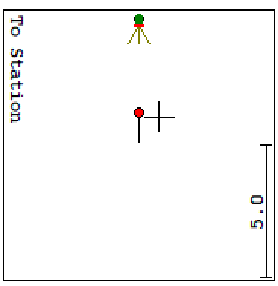
Centreline *- the box is orientated with the centreline direction as 'north'.*



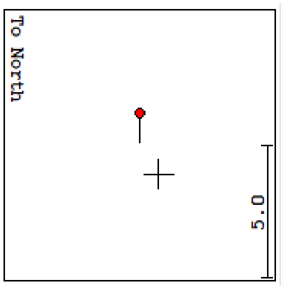
From Station



To Station

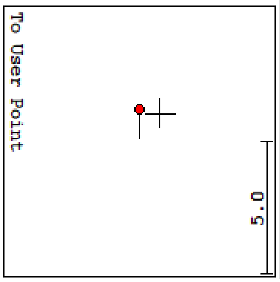


To North



To user point

In this case the user point has been set to the setup point.



User point

User easting

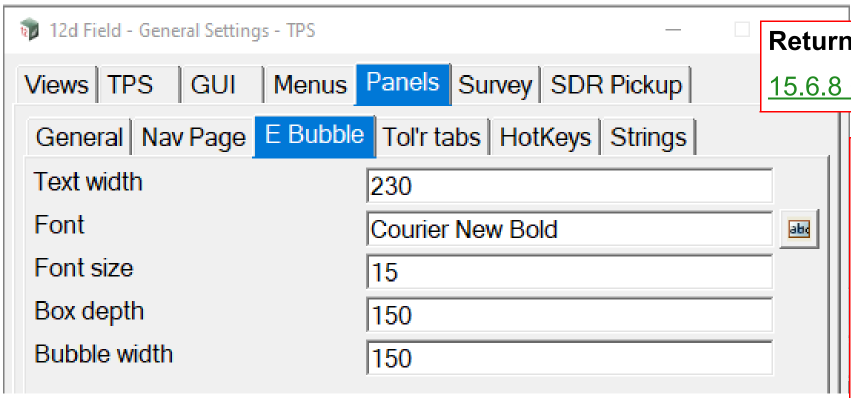
Easting of the user orientation point.

User northing

Northing of the user orientation point.

Continue to Panels >E Bubble or return to Panels tab or 15.6.8 General Settings - TPS .

Panels >E Bubble



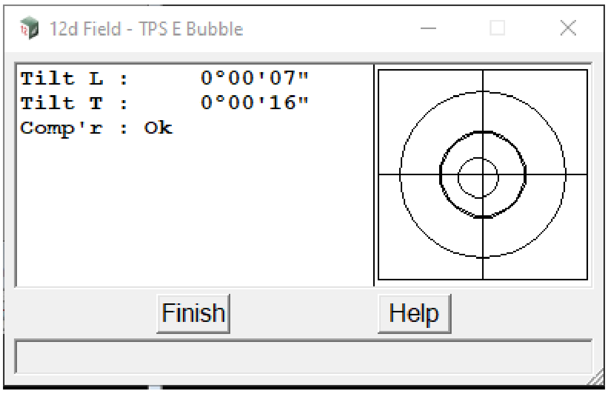
Return to

15.6.8 General Settings - TPS

Panels tab

Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

Control the settings for display of the TPS electronic bubble.



Text width integer box

Width in pixels of the text area.

Font font box

Font to use, it is recommended to use a monospaced font such as Courier so text aligns neatly vertically.

Box depth integer box

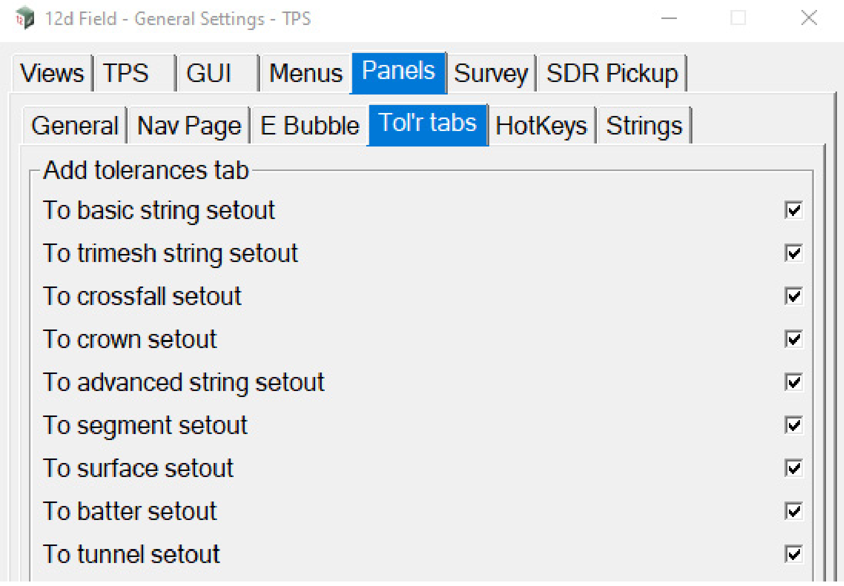
Depth of the bubble box.

Bubble width integer box

Width of the bubble box.

Continue to Panels >Tol'r tabs tab or return to Panels tab or 15.6.8 General Settings - TPS .

Panels >Tol'r tabs tab



Return to
15.6.8 General Settings - TPS

Panels tab
Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

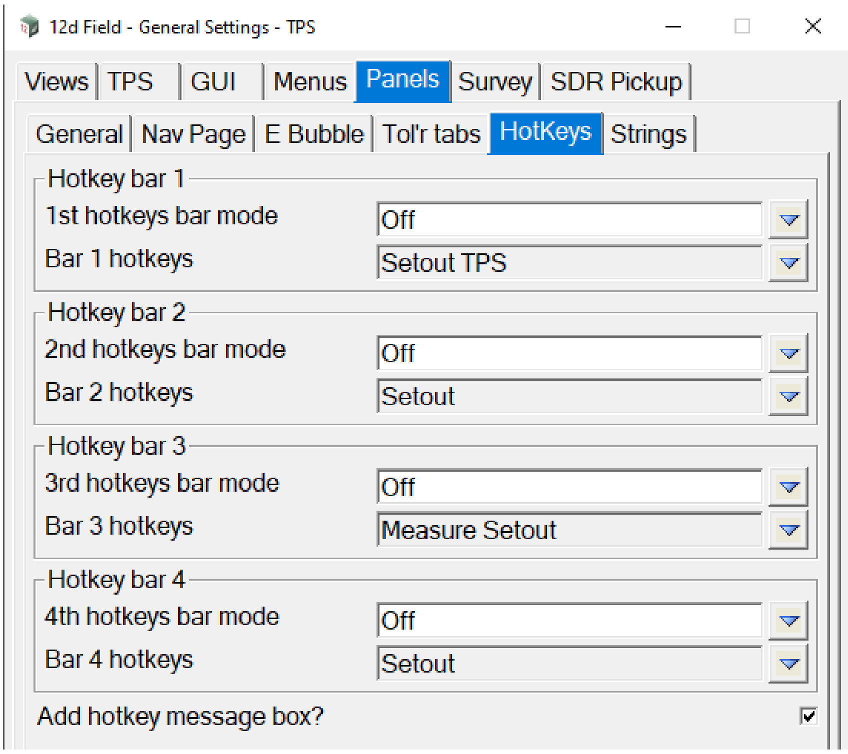
Add tolerances tab

*If **ticked**, the tolerances tab is added to the setout panel and tolerance checks are able to be performed.*

*If **not ticked**, the tolerances tab is not added to the setout panel and no tolerance checks are performed.*

Continue to Panels >HotKeys or return to Panels tab or 15.6.8 General Settings - TPS .

Panels >HotKeys



Return to

15.6.8 General Settings - TPS

Panels tab

Panels >Config 1 tab
Panels >Config 2 tab
Panels >Nav Page
Panels >E Bubble
Panels >Tol'r tabs tab
Panels >HotKeys
Panels >Strings

Hotkey bar 1 - 4

The behaviour of all 4 bars is identical.

1st, 2nd, 3rd, 4th hotkeys bar mode choice box Off Off, On -Vertical
On - Horizontal

Off *- the hotkey bar is not displayed.*

On - Vertical *- the hotkey bar is on and its item are arranged vertically.*

On - Horizontal *- the hotkey bar is on and its item are arranged horizontally.*

Bar 1,2,3,4 hotkeys choice box

*Select the contents of the hotkey bar, these are defined in the text file **12dF_HOTKEY_BARS.4D**.*

Add hotkey message box? tick box ticked

If using a keyboard for hotkeys it is essential that 12d has Windows focus, e.g. in a view or a widget.

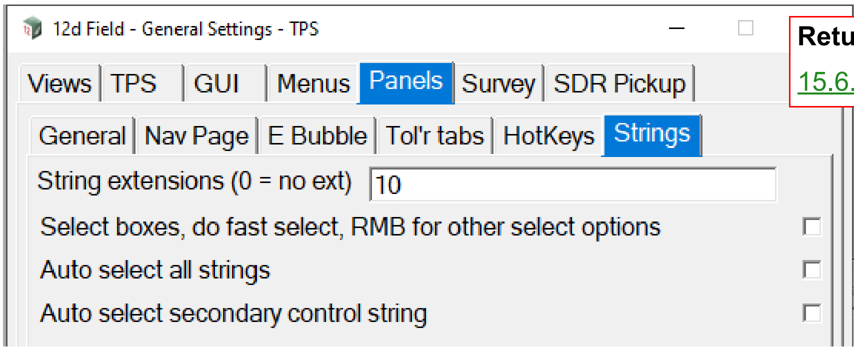
*If **ticked**, an extra message box is added to each panel add the focus shifted aggressively to this to ensure keyboard activated hotkeys will work.*

*If **not ticked**, the user must ensure the focus is on a view or widget to ensure keyboard activated hotkeys will work.*

Do not tick this box if you do not use keyboard hotkeys.

Continue to Panels >Strings or return to Panels tab or 15.6.8 General Settings - TPS .

Panels >Strings



Return to

15.6.8 General Settings - TPS

Panels tab

Panels >Config 1 tab

Panels >Config 2 tab

Panels >Nav Page

Panels >E Bubble

Panels >Tol'r tabs tab

Panels >HotKeys

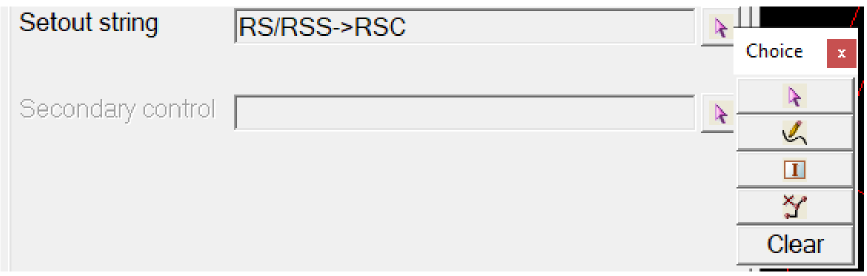
Panels >Strings

String extensions (0 = no ext) tick box not ticked

*If **non zero** then all strings used by **12d Field** will be extended tangentially, horizontally and vertically by this amount when dropping a point to or cutting them. If the drop or cut falls in this area then the results message box changes to a special warning colour, link to <GUI->Colours->String ext colour>*

Select boxes, do fast select, RMB for other select options tick box not ticked

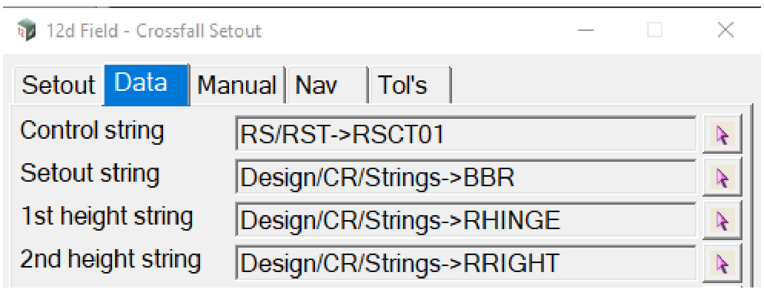
*If **ticked**, when clicking on the select widget the panel will minimise and restore when the element is selected. To access the options the user must right click on the select.*



*If **not ticked**, the options will be shown automatically, hence it will take 2 clicks to select a string but it also means on a tablet the RMB is not needed so access to other necessary options such as **Clear** can be simpler.*

Auto select all strings tick box not ticked

*If **ticked**, dependent on the setout panel a single select will auto prompt for the select of all following strings, using the crossfall setout panel as an example:*



*If the user chooses to select the **Setout string** then they will automatically be asked to select the **1st height string** and the **2nd height string**. The automatic selects can be cancelled with ESC.*

*If **not ticked**, all strings must be selected individually.*

Auto select secondary control string tick box not ticked

*If **ticked** and **Auto select all strings** is **ticked**, the secondary control string will be last in the automatic selection process.*

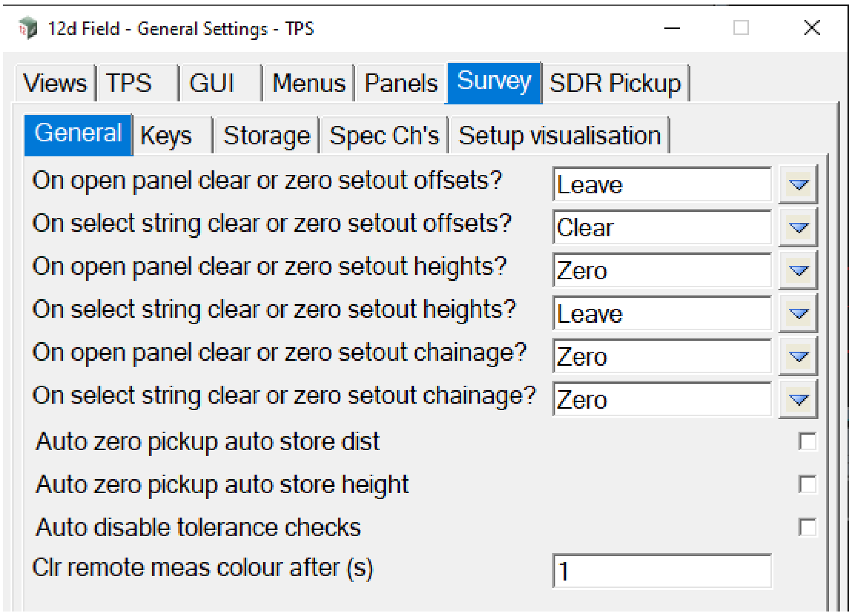
*If **not ticked**, the secondary control must be selected individually.*

Continue to Survey tab or return to Panels tab or 15.6.8 General Settings - TPS .

Survey tab

Survey >General tab

.



Return to
15.6.8 General Settings - TPS

Survey tab
Survey >General tab
Survey >Keys tab
Survey >Storage
Survey >Spec Ch's
Survey >Setup visualisation

On open panel clear or zero setout offsets> choice box Leave, Clear, Zero

*If **Leave**, the setout offset is left unchanged on starting a panel.*

*If **Clear**, the setout offset is cleared on starting a panel, the user will need to re-enter the value.*

*If **Zero**, the setout offset is set to 0.0 on starting a panel.*

On select string clear or zero setout offsets? choice box Leave, Clear, Zero

*If **Leave**, the setout offset is left unchanged on selecting a string.*

*If **Clear**, the setout offset is cleared on selecting a string, the user will need to re-enter the value.*

*If **Zero**, the setout offset is set to 0.0 on selecting a string.*

On open panel clear or zero setout heights? choice box Leave, Clear, Zero

*If **Leave**, the setout heights are left unchanged on starting a panel.*

*If **Clear**, the setout height difference, surface shift and batter rail heights are cleared on starting a panel, the user will need to re-enter these values.*

*If **Zero**, the setout height difference, surface shift and batter rail heights are set to 0.0 on starting a panel.*

On select string clear or zero setout heights? choice box Leave, Clear, Zero

*If **Leave**, the setout heights are left unchanged on selecting a string.*

*If **Clear**, the setout height difference, surface shift and batter rail heights are cleared on selecting a string, the user will need to re-enter these values.*

*If **Zero**, the setout height difference, surface shift and batter rail heights are set to 0.0 on selecting a String.*

On open panel clear or zero setout chainage? choice box Leave, Clear, Zero

*If **Leave**, the setout chainage is left unchanged on starting a panel.*

*If **Clear**, the setout chainage is cleared on starting a panel.*

*If **Zero**, the setout chainage is set to 0.0 on starting a panel.*

On select string clear or zero setout chainage? choice box Leave, Clear, Zero

*If **Leave**, the setout chainage is left unchanged on selecting a string.*

*If **Clear**, the setout chainage is cleared on selecting a string.*

*If **Zero**, the setout chainage is set to 0.0 on selecting a string.*

Auto zero pickup auto store dist tick box not ticked

*If **ticked**, on starting **Basic Pickup** the **Auto store distance** is set to 0.0.*

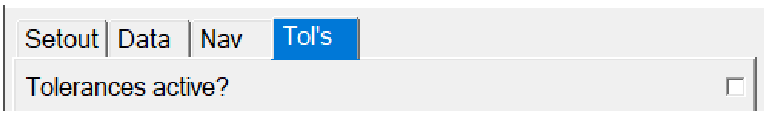
*If **not ticked**, on starting **Basic Pickup** the **Auto store distance** is left unchanged.*

Auto zero pickup auto store height tick box not ticked

*If **ticked**, on starting Basic Pickup the Auto store height is set to 0.0.*

*If **not ticked**, on starting Basic Pickup the Auto store height is left unchanged.*

Auto disable tolerance checks tick box not ticked



*If **ticked**, tolerance checks will be disabled when starting a panel.*

*If **not ticked**, the tolerance checks status will be left unchanged when starting a panel.*

Clr remote meas colour after (s) integer box

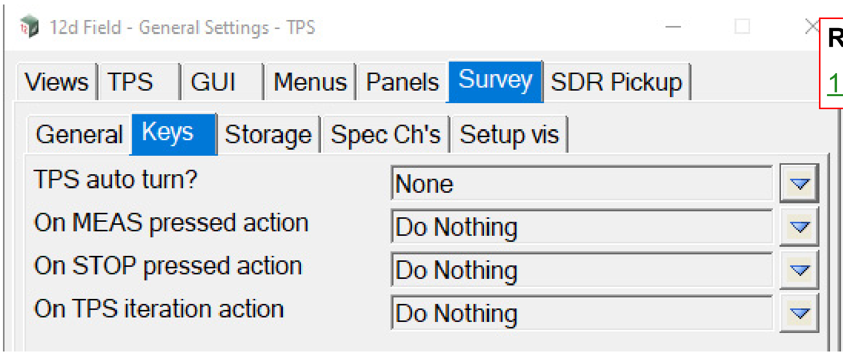
Deprecated, Leica TPS 1200 instrument only, if using remote measure, activating measurement for instrument keyboard via GSI.

After this amount of time has passed a warning this was a remote measure will be cleared.

Continue to Survey >Keys tab or return to Survey tab or 15.6.8 General Settings - TPS .

Survey >Keys tab

.



Return to

15.6.8 General Settings - TPS

Survey tab

Survey >General tab

Survey >Keys tab

Survey >Storage

Survey >Spec Ch's

Survey >Setup visualisation

TPS auto turn?	choice box	None, 2d and 3d

This is the action taken when a new setout coordinate is calculated, does the user want the instrument to automatically point there.

*If **None -** do nothing.*

*If **2d** - point horizontally to the setout point using current vertical angle.*

*If **3d -** point horizontally and vertically to the setout point.*

On MEAS pressed action	choice box	Do Nothing, Focus to Nav Page, DLG

*If **Do Nothing** - do nothing.*

*If **Focus To Nav Page** - change to the navigation page.*

*If **DLG** - minimise the panel.*

On STOP pressed action	choice box	Do Nothing, Startup Info Page, DLG+

*If **Do Nothing** - do nothing.*

*If **Startup Info Page** - startup the information page, (INFO+).*

*If **DLG+** - maximise the panel.*

On TPS iteration action	choice box	Do Nothing, Focus to Nav Page

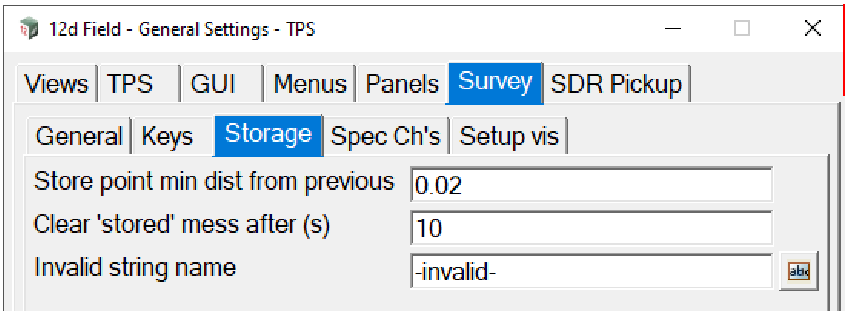
*If **Do Nothing** - do nothing.*

*If **Focus To Nav Page** - change to the navigation page.*

Continue to Survey >Storage or return to Survey tab or 15.6.8 General Settings - TPS .

Survey >Storage

.



Return to

15.6.8 General Settings - TPS

Survey tab

Survey >General tab

Survey >Keys tab

Survey >Storage

Survey >Spec Ch’s

Survey >Setup visualisation

Store point minimum dist from previous real box

If when attempting to store a point the new point is within this distance of the previously stored point a message box will be shown asking whether it is OK to continue.

Clear ’stored’ mess after (s) integer box

Time duration in seconds after which the 'Point stored' message will be cleared from the panel message box.

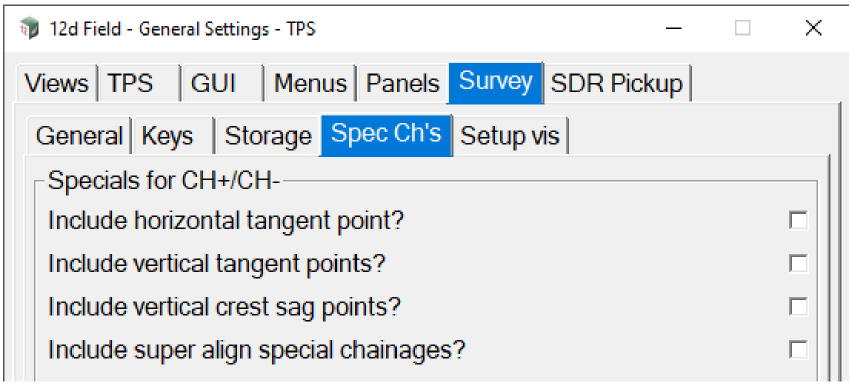
Invalid string name input box

For the setout panels and basic pickup this name will not validate and forces the user to enter a new string name. This was added primarily for administrators for various purposes when manipulating the ***12d Field*** *configuration files.*

Continue to Survey >Spec Ch’s or return to Survey tab or 15.6.8 General Settings - TPS .

Survey >Spec Ch’s

.



Return to

15.6.8 General Settings - TPS

Survey tab

Survey >General tab

Survey >Keys tab

Survey >Storage

Survey >Spec Ch’s

Survey >Setup visualisation

Specials for CH+/CH-

When the control string is a super alignment apart for the even chainage increments extra points can also be included.

Include horizontal tangent points? tick box not ticked

Includes all horizontal tangent chainages.

Include vertical tangent points? tick box not ticked

Includes all vertical tangent chainages.

Include vertical crest sag points? tick box not ticked

Includes all crest/high and sag/low vertical chainages.

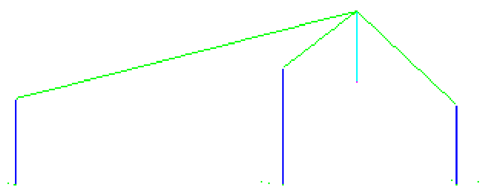
Include super alignment special chainages? tick box not ticked

Includes the list of super alignment special chainages.

Continue to Survey >Setup visualisation or return to Survey tab or 15.6.8 General Settings - TPS .

Survey >Setup visualisation

The settings on this tab allow the user to create a simple model for visualising the TPS setup, the following a helmert setup.



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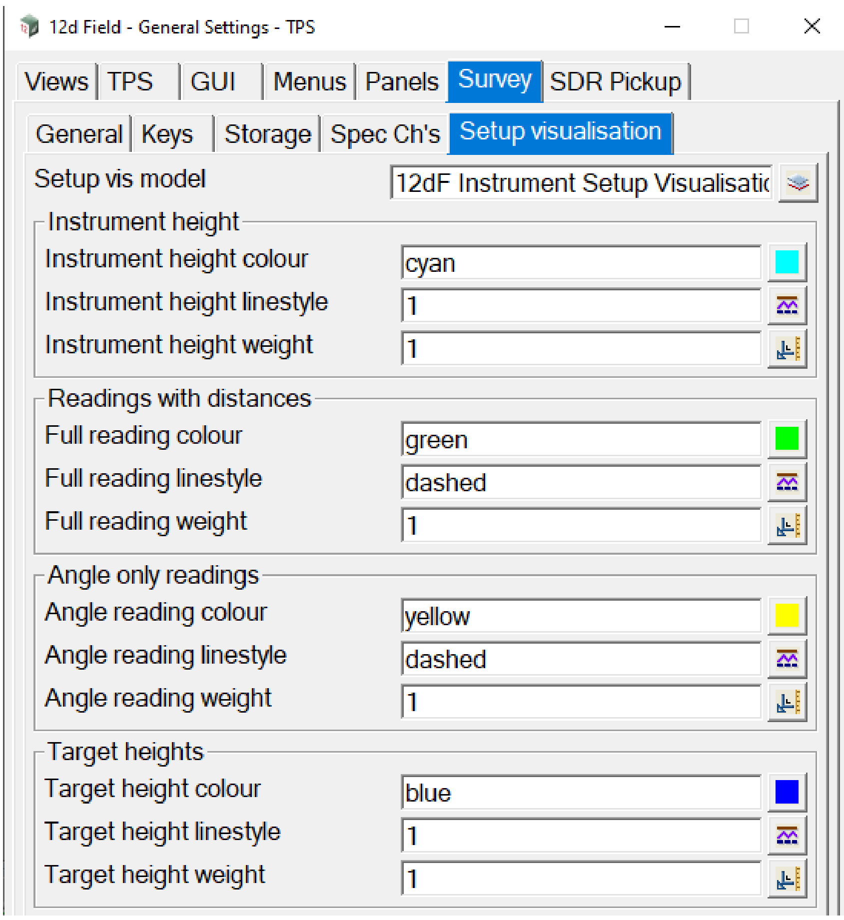


Return to

15.6.8 General Settings - TPS

Survey tab

Survey >General tab
Survey >Keys tab
Survey >Storage
Survey >Spec Ch's
Survey >Setup visualisation

Setup vis model model box Available models

Model to store the visualisation in.

Each of the following 4 groups prompt for the **colour***,* **linestyle** *and* **weight** *of the straight lines they draw, these are self explanatory,*

Instrument height

Colour, linestyle and weight of the line drawn from the centre of the TPS down to the entered instrument height. If the instrument height was zero no line will be drawn.

Reading with distances

Colour, linestyle and weight of measurements with distances, all measurements in a helmert resection will *be drawn with these settings.*

Angle only readings

Colour, linestyle and weight of measurements with angle measurements only, measurements in a least squares resection or standard setup could be drawn with these settings.

Target heights

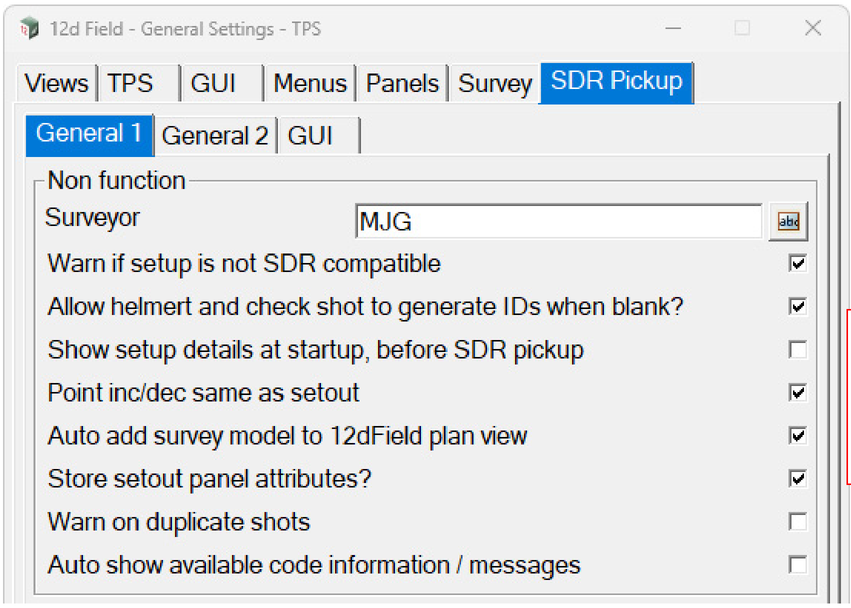
Colour, linestyle and weight of the line drawn from the control point up to the entered target height. If the target height was zero no line will be drawn.

Continue to SDR Pickup tab or return to Survey tab or 15.6.8 General Settings - TPS .

SDR Pickup tab

SDR Pickup >General tab 1

.



Return to
15.6.8 General Settings - TPS

SDR Pickup tab
SDR Pickup >General tab 1
SDR Pickup >General tab 2
SDR Pickup >GUI

Non function

Setting not related to the SDR function

Surveyor model box

Company/surveyor name to be written to all stored attributes.

Show setup.

Warn if setup is not SDR compatible tick box ticked

This is a TPS instrument only item.

*If **ticked**, if the user selects a point during the **helmert**, **least squares** or **standard** setup panels that has no id or multiple ids in the model a once off warning will be shown that the setup will not be able to be used with **SDR Pickup**.*

*If **not ticked**, the user will not be shown the warning, the setup will still not be able to be used with **SDR Pickup**.*

Allow helmert and check shot to generate IDs when blank? tick box ticked

*If it necessary for the user to use control points which have no IDs this option will allow the auto generation of a unique ID which for example will enable the setup to be used with SDR pickup. If ticked and the point has no ID an ID will be generated prefixed with **AUTOGEN** followed by a '-' delimited model name and GUID, string name and GUID and the vertex index.*

AUTOGEN-DSGN/EBOX/WEST-3863636-B03-3863782-7

Show setup details at startup, before SDR pickup tick box not ticked

*If **ticked**, the set up details are show when starting up SDR Pickup.*

*If **not ticked**, the set up details are NOT show when starting up SDR Pickup*

Point inc/dec same as setout tick box not ticked

*If **ticked**, the point increment/decrement operates as per **12d Field** setout. link to??*

*If **not ticked**, the point increment/decrement operates as per the origianl**12d Field** pickup, link to <??>*

Auto add survey model to 12dField plan view tick box ticked

*If **ticked**, the SDR survey is automatically added to the **12d Field** plan view.*

*If **not ticked**, the SDR survey is not added to the **12d Field** plan view.*

Store setout panel attributes? tick box ticked

*If **ticked**, any setout panel that is open in conjunction with SDR pickup will have its calculation attributes stored on the SDR point vertex as well.*

*If **not ticked**, any setout panel that is open in conjunction with SDR pickup is ignored.*

Warn on duplicate shots tick box ticked

This setting is obsolete and will be removed.

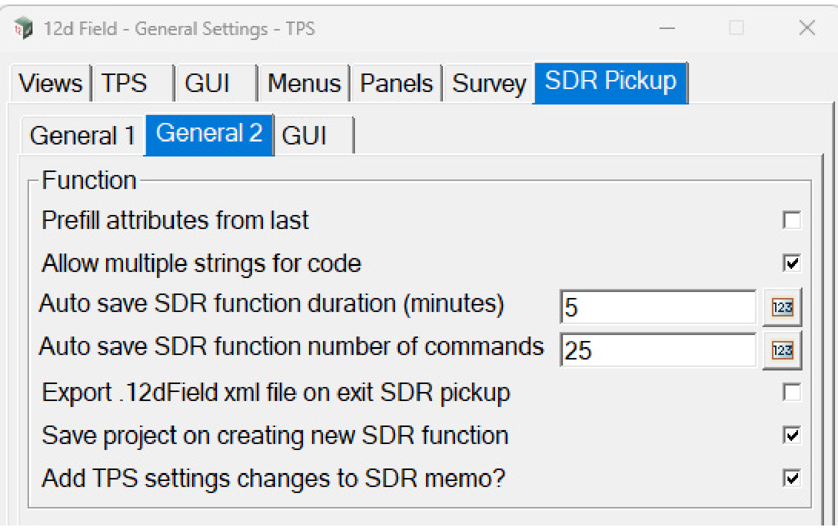
Auto show available code information/messages tick box not ticked

*If **ticked**, information available with an SDR code will be automatically shown when the code is selected for use.*

*If **not ticked**, information available with an SDR code will not be automatically shown when the code is selected for use.*

Continue to SDR Pickup >General tab 2 or return to SDR Pickup tab or 15.6.8 General Settings - TPS .

SDR Pickup >General tab 2



Return to

15.6.8 General Settings - TPS

SDR Pickup tab

SDR Pickup >General tab 1

SDR Pickup >General tab 2

SDR Pickup >GUI

Function

Setting associated directly with the SDR function

Prefill attributes from last tick box not ticked

*If **ticked**, a code panel will be automatically populated from the last instance of that panel.*

*If **not ticked**, a code panel will be empty when created requiring all fields to be filled in.*

Allow multiple string for code tick box ticked

*If **ticked**, a code will be searched for by code and string name.*

*If **not ticked**, a code will be searched for by matching the code only.*

Auto save SDR function number of commands integer box

Auto save the SDR function after this number of minutes, all of the SDR data is in the function so even if 12d terminates unexpectedly no data is lost before the last save of the function to disk.

Export .12dField XML file on exit SDR pickup tick box not ticked

*If **ticked**, not recommended, a **12d Field** XML will be written on closing SDR pickup. This is not recommended as all of the data is in the SDR function and the file serves no real purpose, informational only, it will also be very large and can take minutes to write dependent on hardware.*

*If **not ticked**, recommended, no file will be written on exiting SDR pickup.*

Save project on creating new SDR function tick box ticked

*If **ticked**, recommended, the project will be saved on creating the SDR function meaning the function is added to the project so if 12d terminates unexpectedly the function will still be visible in the project.*

*If **not ticked**, the project will have to be saved manually. If 12d terminates unexpectedly before a subsequent save of the project the function will still be there and valid but will have to be manually added to the project.*

Add TPS settings changes to SDR memo tick box ticked

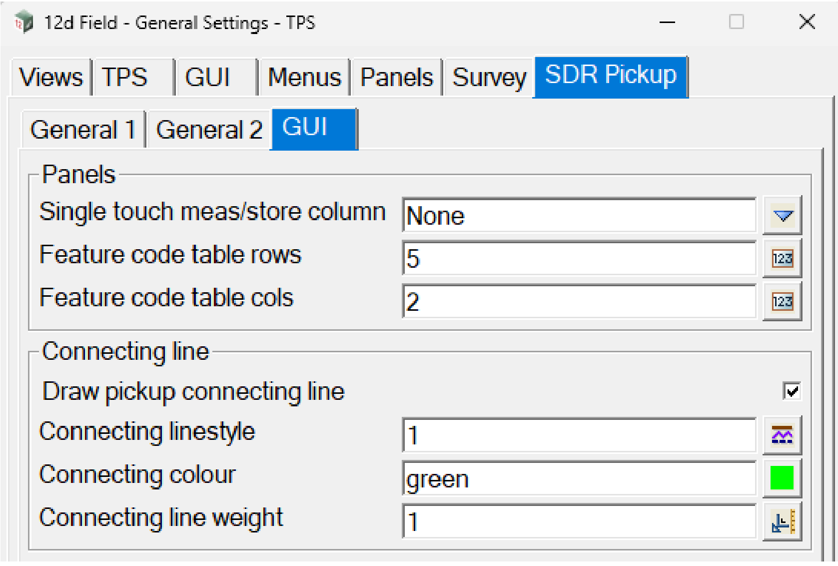
*If **ticked** when a setting on the TPS instrument has changed the following style of message will be added to the SDR notes model: **"Target=prism Pointing=autolock Measure=fast-track"***

*If **not ticked** nothing is written to the SDR notes model upon changing TPS settings, all TPS settings are always written to individual vertex attribute.*

Continue to SDR Pickup >GUI or return to SDR Pickup tab or 15.6.8 General Settings - TPS .

SDR Pickup >GUI

.



Return to
15.6.8 General Settings - TPS

SDR Pickup tab
SDR Pickup >General tab 1
SDR Pickup >General tab 2
SDR Pickup >GUI

Panels

Single touch meas/store column choice box None None, Measure store, Measure record

*If **None**, no extra column is added to the SDR pickup panel grid.*

*If **Measure store**, an extra column is added to the SDR pickup panel grid, a touch in this column will change to the code and string name in that row and activate measure & store.*

*If **Measure record**, an extra column is added to the SDR pickup panel grid, a touch in this column will change to the code and string name in that row and activate measure & record.*

Feature code table rows integer box

Number of rows of buttons in the feature code table.

Feature code table cols integer box

Number of columns of buttons in the feature code table.

Connecting line

Details of a line drawn for the last stored point to the current location.

Draw pickup connecting line tick box ticked

*If **ticked**, the connecting line is drawn.*

*If **not ticked**, the connecting line is not drawn.*

Connecting linestyle linestyle box

Linestyle of the connecting line.

Connecting colour colour box available colours

Colour of the connecting line.

Connecting line weight real box

Line weight of the connecting line.

Continue to 15.6.9 Reconnect or return to SDR Pickup tab or 15.6.8 General Settings - TPS .

15.6.9 Reconnect

Selecting **Reconnect** will attempt to disconnect from the current instrument and then reconnect.

This may be required when the instrument has been restarted.

Important Note: this option will not appear in the menu for some instruments.

Continue to 15.6.10 Store Point Setup or return to 15.6 12d Field Options .

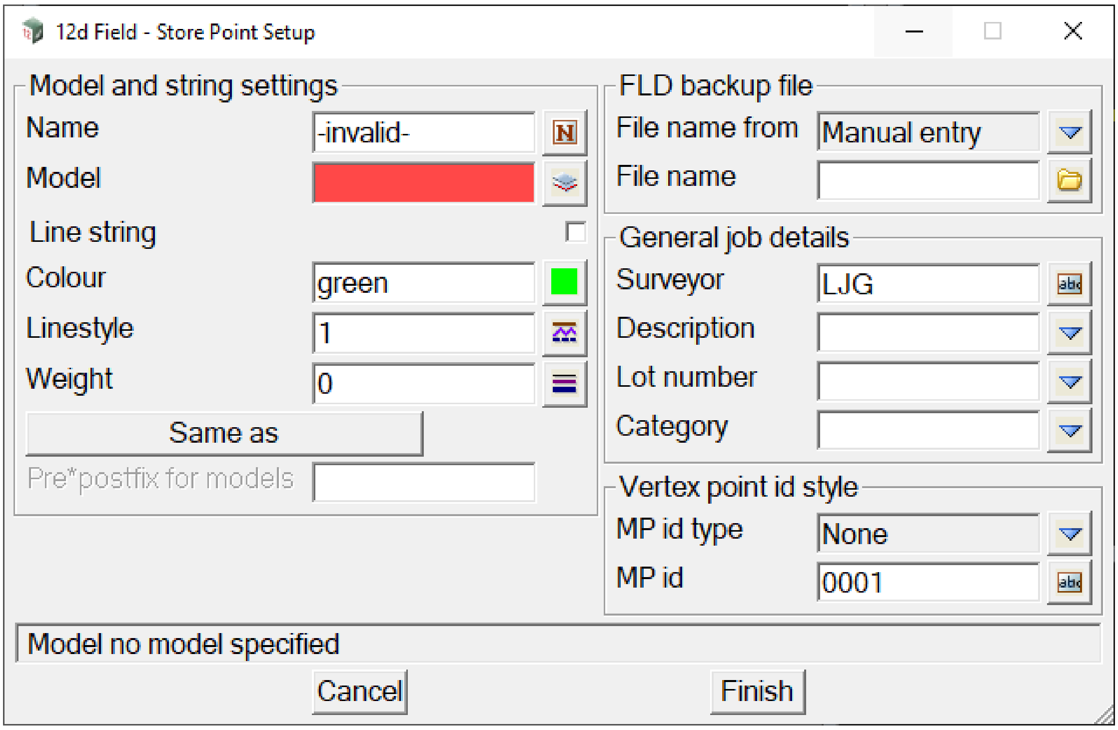
15.6.10 Store Point Setup

Clicking **Store Pt Setup** brings up the **12d Field - Store Point Setup** panel.

For setout and pickup panels other than SDR Pickup the **12d Field - Store Point Setup** panel is called up the first time a user attempts to store a point to a model or if the user presses the **Setup** button on the ***12d Field*** control bar.

This panel must be validly completed before a point can be stored.

The panel is grouped into four separate areas which will now be described.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Model and string settings

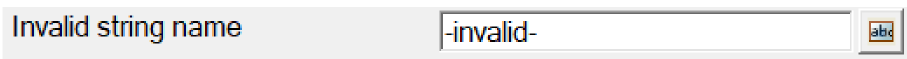
These settings work the same as your typical 12d settings work, they control the look of the stored string in the model.

Name name box

Enter the name of the string to be stored manually or from the pop up select a predefined name (from names.4d) which will also populate the other settings.

On initial use the name is set to that specified in the Settings panel.

General Settings - TPS/GNSS->Survey->Storage->Invalid string name



Name field will not validate until the user changes it from the above value.

Model model box available models

*Model to store the string in. (This model will automatically be added to your defined **12d Field** plan view)*

Line string tick not ticked

*If **ticked**, the string is a line string.*
*If **not ticked**, the string is a point string.*

Colour colour box green

Colour of the string.

Linestyle

Linestyle of the string.

Weight

Thickness of the string.

Same as button

Select an existing point/line and the fields will set to it's properties.

Pre*postfix for models

*If **not blank,** the pre-postfix will be applied to the nominal model when storing the point.*

FLD backup file

All 12dField points are stored to a FLD file as well as a model. This is done for backup reasons as every shot is stored to the FLD file on disk when a shot is taken ensuring no data should be lost in the event of an unexpected shutdown of 12d. The older .FLD format is used as it is a 'flat' format and each shot can be simply appended to the end of the file.

The 12dField .FLD files have sufficient attributes in them that they can be read directly back into 12d via a specialised panel, they cannot be reduced through the survey data reduction functions. 15.11 12dField Setout FLD File To Strings

File names from Manual Entry
Populate from model name
Populate from <pre> part of pre post
Populate from <post> part of pre-post

***Manual Entry** - enter the name of the file in the **File name** box.*
***Populate from model name** - the name of the model in the **model box** is used as the file name.*
***Populate from <pre> part of pre-post** - the name of the file is the pre part.*
***Populate from <post> part of pre-post** - the name of the file is the post part.*

*For example a surveyor might enter a model name of "Asphalt Conformance" in the **model box**.*
*They then for a pre fix enter the year month and day and their initials "20113006MG " and they select "**Populate from model name**" for the FLD file name.*
The model and field file written will be "20113006MG Asphalt Conformance".

***Note** - if the user is using 3.10 Object Tree names for models all forward slashes, (/), will be replaced by spaces for the FLD backup file name.*

General job details

Surveyor

Name of the surveyor.

Description

*A description of the survey (Populated from **12dF_JOB_DESCRIPTIONS.4D**).*

Lot number

*A lot number of the survey (Populated from **12dF_JOB_LOT_NUMBERS.4D**).*

Category

*Category of the survey (Populated from **12dF_JOB_CATEGORIES.4D**).*

Vertex point id style

This choice box controls the way the id of each vertex in the string is written.

MP id type None
Same each shot,
Inc on Rec, Dec on Rec
Chainage, Chainage &Offset.
Same as Setout Id

***None** - no vertex id is written.*
***Same each shot** - the value in the **Pickup Id** box will be used for all points stored.*
***Inc on Rec** - the value in the **Pickup Id** box will be used for the next point stored then incremented.*
***Dec on Rec** - the value in the **Pickup Id** box will be used for the next point stored then decremented.*
***Chainage** - the chainage of the point being stored will be used as it's vertex id.*
***Chainage&Offset** - the chainage and offset of the point being stored will be used as it's vertex id.*
***Same as Setout Id** - the vertex id of the point being setout will be used.*

Notes on the incrementing of the Id.
The id is alphanumeric and the number of characters does not change.The increment/decrement applies to the either the numeric or alpha ending of the id, not to a combination of both.

```
Increment examples 1->2, 9->0, A1>A2, A9->A0, AA->AB, AZ->BA,
S099->S100, S999->S000
Decrement examples 6->5, 0->9, A2>A1, A0->A9, AB->AA, AA->ZZ,
S100->S099, S000->S999
```

MP id

Id of the next vertex to be stored.

Button at Bottom

Cancel button

If cancel is pressed the panel will close but the next time a point is stored it will open again.

Finish button

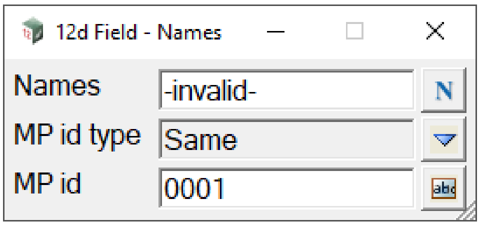
If the panel validates correctly it will close and the point will be stored. The panel will only open again if called manually from the control bar or a new setout is started.

Continue to 15.6.11 Store Point Names or return to 15.6 12d Field Options .

15.6.11 Store Point Names

The **Store Point Names** panel contains 3 of the common fields from the much larger 15.6.10 Store Point Setup panel. This panel is designed to stay up permanently for simple quick changes to points stored by the setout routines.

Clicking **Store Pt Names** brings up the **12d Field - Names** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Names	names box		

*See **Name** in the* Model and string settings *section of the* 15.6.10 Store Point Setup *panel.*

MP id type	choice box		

*See **MP id type** in the* Vertex point id style *section of the* 15.6.10 Store Point Setup *panel.*

MP id	text box		

*See **MP id** in the* Vertex point id style *section of the* 15.6.10 Store Point Setup *panel.*

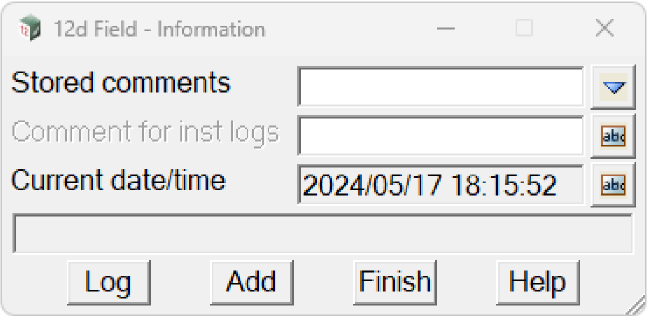
Continue to 15.6.12 Log Comment or return to 15.6 12d Field Options .

15.6.12 Log Comment

The Instrument **Log Comment** panel is for support purposes.

When an issue occurs the user can enter comments in this panel and the comments are written as part of the ***12d Field*** session time line to the logging files for later analysis.

Clicking **Inst log comment** brings up the **12d Field - Information** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Stored comments	choice box		

*The user has the ability to predefine comments, these are stored in file **12dF_USER_COMMENTS.4D**. When this panel is opened the file is read and each line added into this choice list.*

Comment for inst logs	text box		

*If **not blank,** the text is written to the instrument log file.*

Current date/time	text box		

Displays the continuously updated date and time, for support purposes if doing a screen captures having this panel present with the time/date in view helps to tie the events in with the log files.

Buttons at bottom

Log	button		

*The current comment and time are logged to the internal **instrument_comms.log** file and the user **12DF_SIGNIFICANT_EVENTS_LOGGING.TXT** file.*

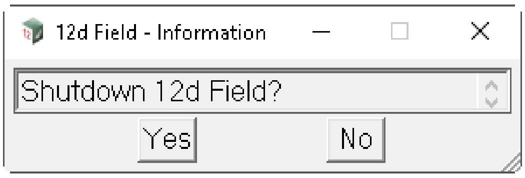
Add	button		

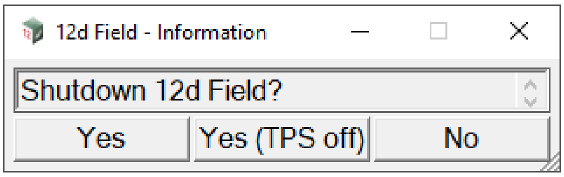
*The current comment is appended to the end of the **12dF_USER_COMMENTS.4D** file and can be subsequently used again without retyping.*

Continue to 15.6.13 12d Field Shutdown or return to 15.6 12d Field Options .

15.6.13 12d Field Shutdown

Clicking **Shutdown** brings up the **12d Field - Shutdown** panel.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Yes	button		

*If **pressed, 12d Field** is shutdown.*

Yes (TPS off)	button		

*If pressed, **12d Field** is shutdown and the TPS is powered off.*

***Note** this is only available on instruments that support this feature.*

No	button		

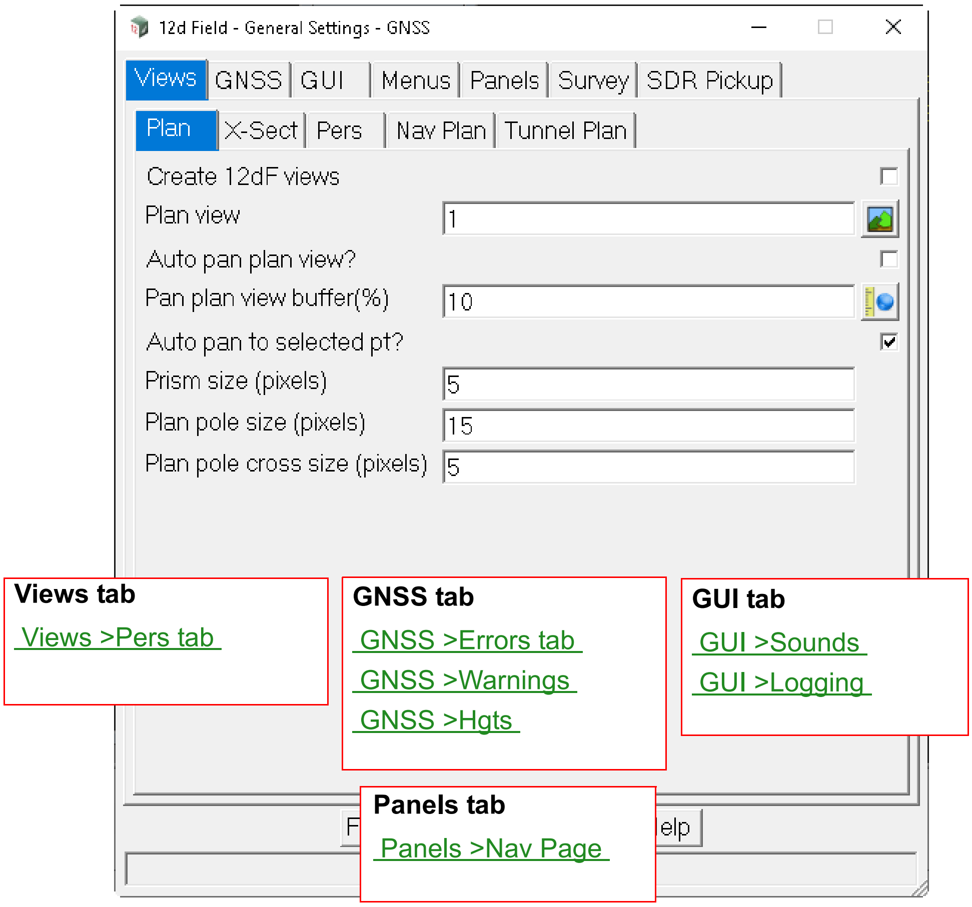
*If **pressed, 12d Field** is not shutdown.*

Continue to 15.6.14 General Settings - GNSS or return to 15.6 12d Field Options .

15.6.14 General Settings - GNSS

The GNSS version of this panel is largely identical to the TPS version, differences only are shown. For common fields see 15.6.8 General Settings - TPS .

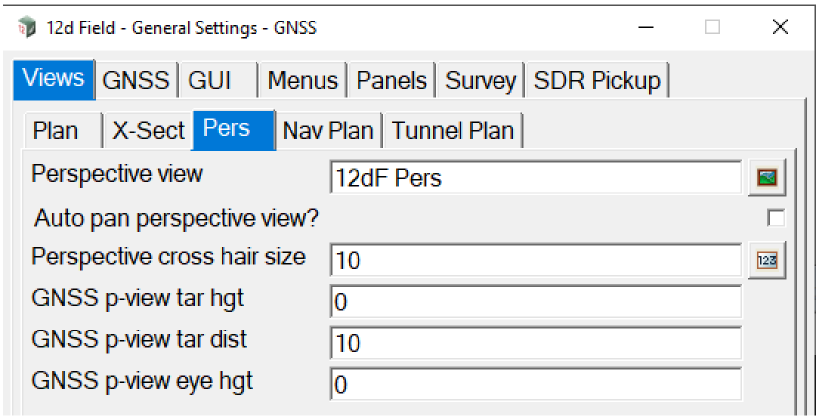
Clicking **Settings** brings up the **12d Field - Settings** panel for a GNSS.
.



Views >Pers tab

For common fields see the TPS panel, Views >Pers tab.

.



GNSS only items

When auto-panning the GNSS perspective view there are 3 fields to control the orientation of the view.

GNSS p-view tar dist real box

Target point is this distance from the current GNSS position in the direction from the previous GNSS position.

GNSS p-view tar hgt real box

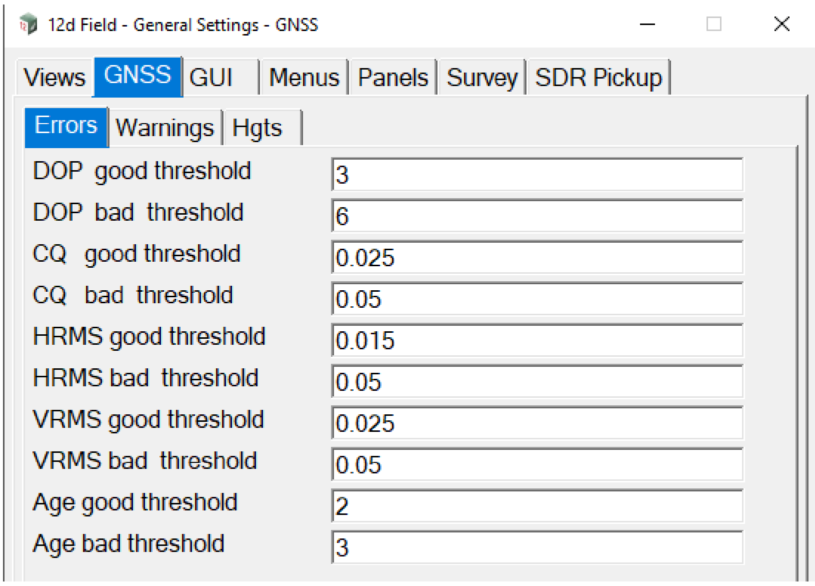
This height is added to the target point to give the final target position.

GNSS p-view eye hgt real box

Eye point of the view is the current GNSS position plus this height.

GNSS >Errors tab

.



The GPS errors define **good** and **bad** thresholds.

Any value less than the **good** threshold is considered **good**.

Any value greater than the **bad** threshold is considered **bad**.

Any value falling in between these 2 is considered **average**.

DOP, dilution of precision

CQ coordinate quality

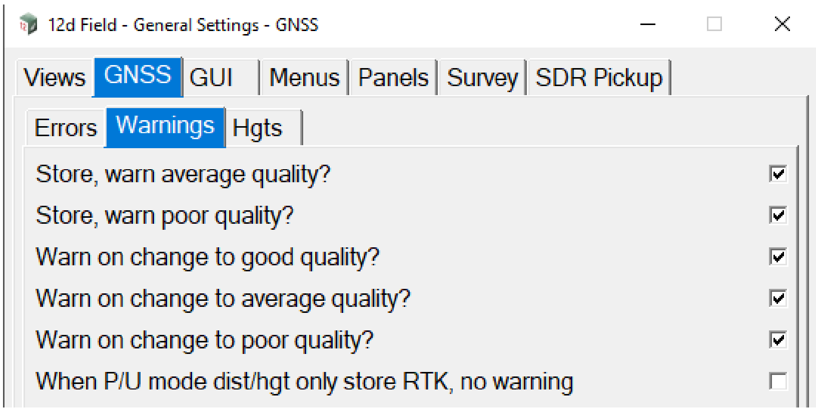
HRMS, horizontal root mean square

VRMS, vertical root mean square

Age, latency of measurements from GNSS satellites.

GNSS >Warnings

.



Store, warn average quality? tick box ticked

*If **ticked**, on storing a point and it is below **good** quality a message box will be shown prompting to continue.*

*If **not ticked**, on storing a point and it is **average** quality or better it will be stored without prompting.*

Store, warn poor quality? tick box ticked

*If **ticked**, on storing a point and it is below **average** quality a message box will be shown prompting to continue.*

*If **not ticked**, on storing a point and it is **poor** quality or better it will be stored without prompting.*

Store, warn on change to good quality? tick box ticked

*If **ticked**, and the GPS changes from poor or **average** to **good** quality a message box will be shown informing of this.*

*If **not ticked**, and the GPS changes from **poor** or **average** to good quality nothing will happen.*

Store, warn on change to average quality? tick box ticked

*If **ticked**, and the GPS changes from **poor** or **good** to average quality a message box will be shown informing of this.*

*If **not ticked**, and the GPS changes from **poor** or **good** to average quality nothing will happen.*

Store, warn on change to poor quality? tick box ticked

*If **ticked**, and the GPS changes from **good** or **average** to poor quality a message box will be shown informing of this.*

*If **not ticked**, and the GPS changes **good** or **average** to poor quality nothing will happen.*

When P/U mode dist/hgt only store RTK, no warning tick box not ticked

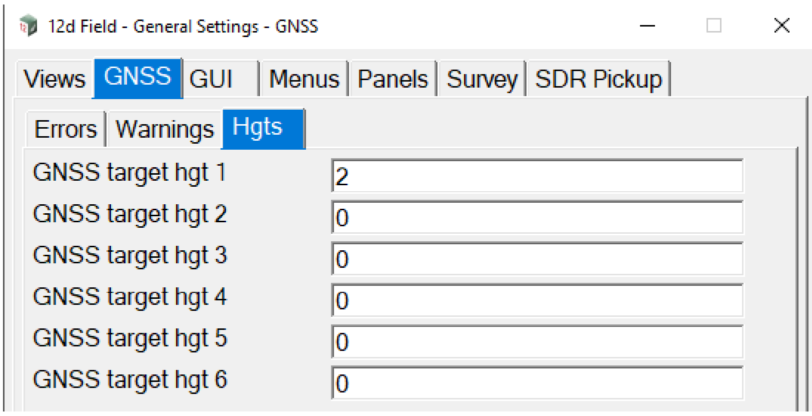
*This tick box applies when the user is in **Basic Pickup** automatically storing points when a certain distance or height difference from the previously stored point.*

*If **ticked**, a change from **good** quality to **poor** or **average** will not show a message box and points will be* *silently stored again once quality returns to **good**.*

*If **not ticked**, a change from **good** quality to **poor** or **average** will show a message box and storing of points will resume manually once quality has return to **good**.*

GNSS >Hgts

.



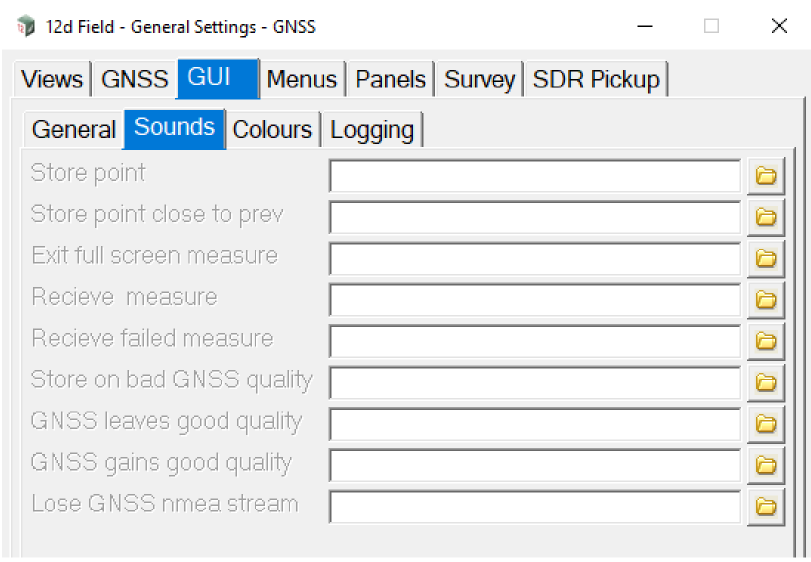
GNSS target hgt 1- 6 real box

Up to six target heights can be stored. They are displayed in the pop-up list for Preset heights fields.

GUI >Sounds

For common fields see the TPS panel, GUI >Sounds tab.

.



GNSS only options

Store on bad GNSS quality file box *.WAV files

*If **ticked**, play a sound on storing a point of **bad** quality.*

*If **not ticked**, do not play a sound on storing a point of **bad** quality.*

GNSS leaves good quality file box *.WAV files

*If **ticked**, play a sound when the quality changes from **good** to **bad** or **average**.*

*If **not ticked**, do not play a sound when the quality changes away from **good**.*

GNSS gains good quality file box *.WAV files

*If **ticked**, play a sound when the quality changes from **average** to **bad** or **good**.*

*If **not ticked**, do not play a sound when the quality changes back to **good**.*

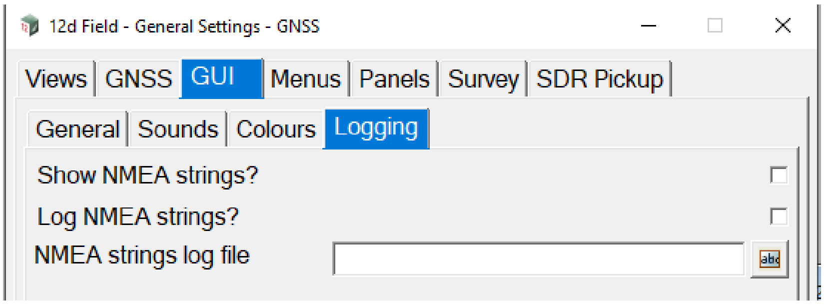
Lose GNSS nmea stream file box *.WAV files

*If **ticked**, play a sound when 12d **Field** detects the NMEA string has been lost.*

*If **not ticked**, do not play a sound when the NMEA string has been lost.*

GUI >Logging

.



Show NMEA strings? tick box not ticked

*If **ticked**, the received NMEA sentence bundles are written to the output window.*

*If **not ticked**, the received NMEA sentence bundles are not shown.*

Log NMEA strings tick box not ticked

*If **ticked**, the received NMEA sentence bundles are written to a text log file.*

*If **not ticked**, the received NMEA sentence bundles are not written to file.*

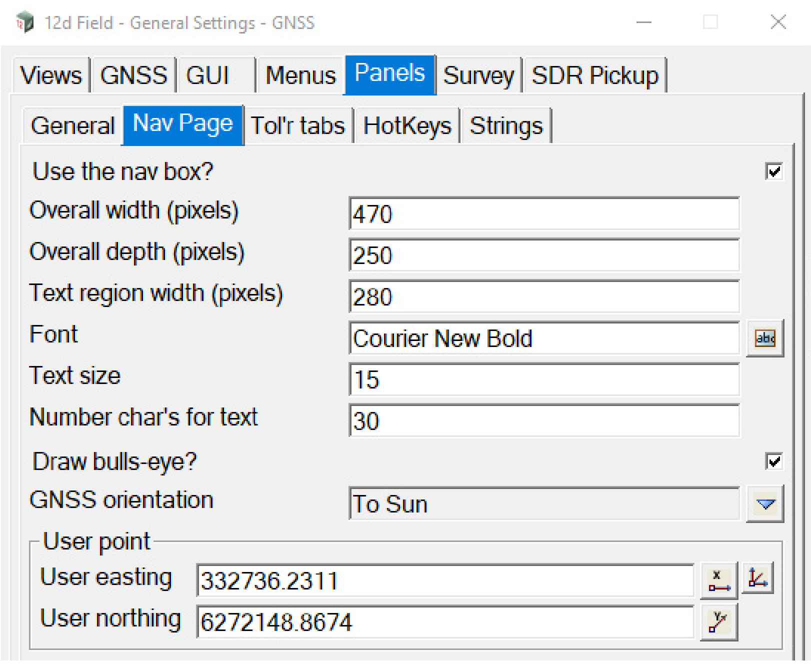
NMEA strings log file text box NMEA

Text file the NMEA sentence bundles will be written to.

Panels >Nav Page

For common fields see the TPS panel, Panels >Nav Page.

.

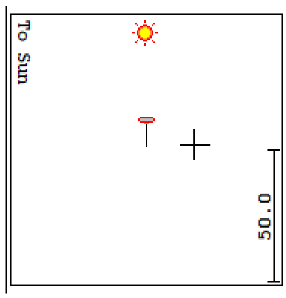


GNSS only options

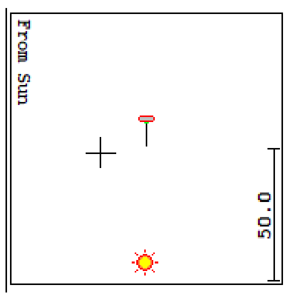
The GNS orientation is identical to TPS orientation except the options To Sun and From Sun are present.

GNS orientation	choice box	None, Centreline, From Station, To Station, To North, To Sun, From Sun, To User Point

To Sun



To From



Continue to 15.6.15 Checks - GNSS or go back to 15.6 12d Field Options .

15.6.15 Checks - GNSS

Clicking on the **Checks** menu option brings up the **GNSS Checks** menu.

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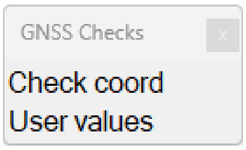


See
15.6.15.1 Check Coord - GNSS
15.6.15.2 User values - GNSS

15.6.15.1 Check Coord - GNSS

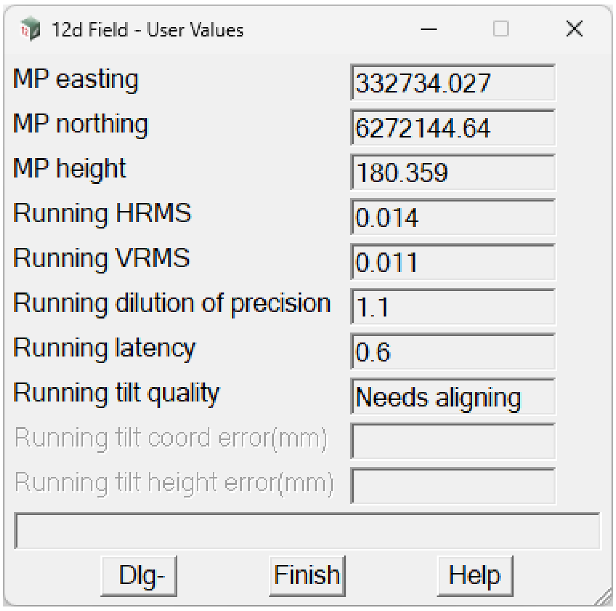
This panel is identical to the TPS version, see 15.6.4.2 Check Coord - TPS for a description of the panel functionality.

Continue to 15.6.15.2 User values - GNSS or go back to 15.6.15 Checks - GNSS .

15.6.15.2 User values - GNSS

This panel is identical in functionality to 15.6.4.4 Check User Values - TPS .

Clicking **User values** brings up the **12d Field -**panel:

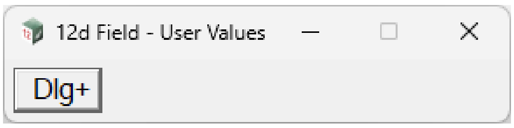


The contents of this panel are user configurable, only a typical GNSS configuration is shown in the above image, for all of the available attributes that can be added to the panel. See 15.8.4.2 12dF_USER_VALUES_PANEL_CONFIG.4D file format .

Button at bottom

Dig- button

Transforms the panel to a minimised state which can be restored to full size via the subsequent **Dlg+** *button.*

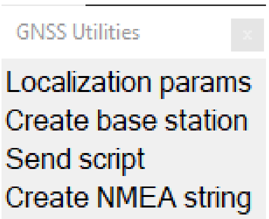


Continue to 15.6.16 GNSS Utilities or go back to 15.6.15 Checks - GNSS .

15.6.16 GNSS Utilities

Clicking on the **GNSS Utilities** menu option brings up the **GNSS Utilities** menu:

.



See
15.6.16.1 GNSS localisation Calculations
15.6.16.2 Create a Base Station
15.6.16.3 Send a Script
15.6.16.4 Create NMEA String

15.6.16.1 GNSS localisation Calculations

Position of option on menu: **Survey =>Field 12d =>GNSS utilities =>Localization params**

The panel is used to create the localisation parameters used inside ***12d Field*** for reducing GNSS observations to a local system.

Note - prior to V15 this panel was separate to ***12d Field*** with the advent of V15 the panel is now only available while ***12d Field*** is running. From V15 with the new 12dcarto format the surveyor configures the projection and n-value settings prior to entering ***12d Field***, these are informational only in this panel which is solely used to do the local horizontal and vertical transformations.

Points collected with ***12d Field*** as raw WGS84 cartesian coordinates can be matched with local control points to calculate the parameters to convert GNSS readings directly into the local system. **Important - the points must be surveyed using V15, using observed points prior to V15 will give an incorrect localisation.**

The ***12d Field*** localisation treats horizontal and vertical components separately.

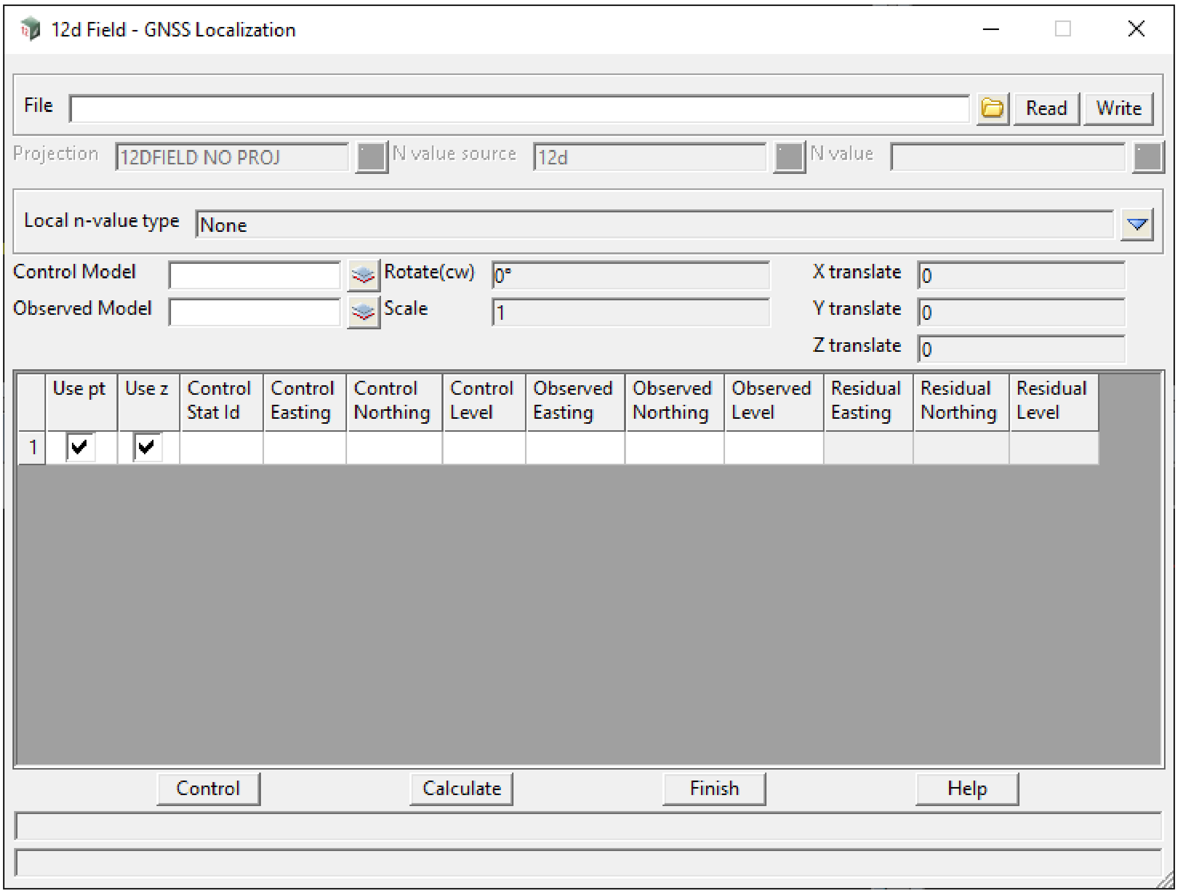
The horizontal transformation is a 2D Helmert with 2D translation, 2D rotation and uniform scaling of the x and y axes, the observed points are the raw WGS84 cartesian coordinates, reduced from long/lat via the current projection. The helmert transformation is used to fine tune the raw coordinates into the local variations always present with site control or to transform into a completely local system with no relation to the raw cartesian coordinates.

The vertical translation is then applied using the localized x,y coordinates, at this point the z value is the orthometric or geoid height, the ellipsoid less the n-value. Like the horizontal position the z value will often need fine tuning to match the local control, whether this be historical variations or substantial local variations in the n-values.

Note, prior to V15 the use of a local tin was available in this panel, this has been removed from V15 on as a local tin was not easily portable between projects.

The vertical translation can be a plane of best fit, a string, (ideal for long thin road corridors) or a trimesh. Note the plane, string and trimesh definitions are now written to the localisation file so the localisation is completely portable between projects. When you read an existing TDF_HEL file which has a string or trimesh it is added to a temporary model which can be copied, added to a view for visualisation and can also be edited if adjustments are needed. The model will have a GUID style name, "7825CF0A 2621 4943 A258 0057D3AD1867". When exiting the GNSS localisation panel the string/trimesh is saved to the TDF_HEL file and the temporary model deleted from the project.

Selecting **localisation params** brings up the **GNSS Localization** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

File *.tdf_hel

TDF_HEL file to be read in or written to. This is the file used by ***12d Field*** *to store the localisation parameters.*

Read button

Read in the TDF_HEL file.

Write button

Write out the TDF_HEL file.

Projection input box

Informational only, the projection used by ***12d Field*** *to calculate the WGS84 cartesian coordinates.*

N value source input box Receiver, 12d

Informational only.

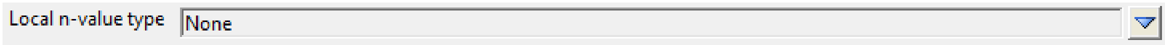
If ***None****, the ellipsoid and/or orthometric heights have probably been recognised as incorrect and need the GNSS Localization to calculate correctly.*

If ***Receiver****, the orthometric height has been calculated using the n-value in the NMEA sentence.*

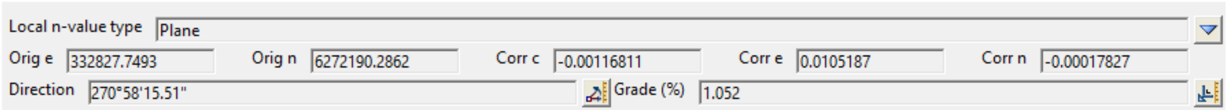
If ***12d****, the orthometric height has been calculated using the n-value from the 12dcarto file.*

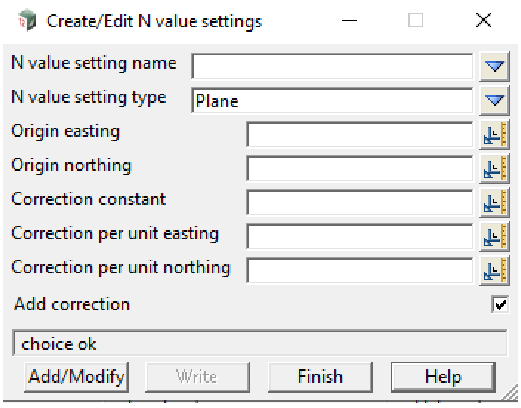
Local n-value type choice box None, Plane, String, Trimesh

*If **None**, the orthometric height of the observed point is used unadjusted.*



*If **Plane**, a plane of best fit is calculated from the observed points with valid z values, the plane coefficients are currently displayed and can be copied and pasted into the Create/Edit N value settings panel if necessary. The **Direction** and **Grade (%)** are informational only and are there to give the user a simple display of the orientation and grade of the plain.*

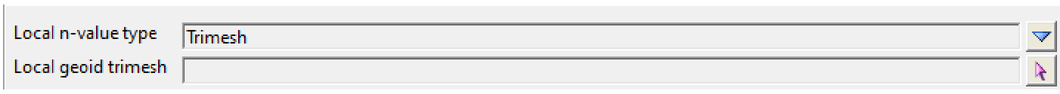




*If **String**, often, for long road corridors even with the most up to date n-value files there can be distinct variations between theoretical and actual values. Here, the user can create a string, typically a 3d like string with the vertex height the local n-value correction to apply, subsequently each point is dropped to this string and the interpolated z value used as the local n-value.*

***Note**, when using this option the string is written in a 12da format to the TDF_HEL file. It is therefore not necessary to copy the string between projects as an in memory copy of the string is created on reading the TDF_HEL file.*

*If **Trimesh**, the local xy are dropped vertically to a trimesh and the interpolated z added to the current height. For portability reasons a trimesh is used instead of a tin and like the **String** option the trimesh definition is written to the TDF_HEL and the trimesh does not need to be copied to all projects.*



*Note, for **String** and **Trimesh** types create the string or trimesh with the appropriate vertices set at 0.0 heights, when **Calculate** is pressed the Residual Level column will display the height differences to set to the string/trimesh.*

If local n value is a string or trimesh then it can be added to a model for editing or visualization if needed.

Control model model box available models

Model containing the control points, it is an error if the control point selected is not part of this model.

Observed model model box available models

Model containing the observed points, it is an error if the observed point selected is not part of this model.

***Note** - the **Control model** and **Observed model** boxes can be disabled by setting the environment variable **TDF_GPS_FORCE_CTRL_OBS_CHECK_4D** to **0**.*

Rotate (cw) angle box

Clockwise rotation parameter of the helmert transformation.

Scale real box

Scaling parameter of the helmert transformation.

X translate real box

X translation of the helmert transformation.

Y translate real box

Y translation of the helmert transformation.

Z translate measure box

*Z translation of the helmert transformation, (note this is 0.0 if any local n-value method is used other than **None**.*

***Important note**, internally, due to historical reasons the helmert transformation is stored as a 0.0, 0.0 based transformation rather than the origin being at the centroid of the control points. While this makes no difference at all to the end result the x, y translation values can look disconcertingly wrong to the user. As such the x&y translation values displayed are that as if the transformation was a centroid based origin.*

*The only time this is evident is when an existing TDF_HEL localisation is read in, the displayed x,y values are the 0 based values, pressing **Calculate** will show the 'true' centroid translations.*

The grid

Use pt tick box ticked

*If **ticked**, this point is used in the transformation xy calculations.*

Use z tick box ticked

*If **ticked**, this point is used to calculate the transformation height parameter. Note, if a **Local n-value type** of **Plane**, **String** or **Trimesh** has been selected **Use Pt** cannot be unticked and an error message will be displayed.*

*If **unticked**, this point is not used to calculate the transformation height parameter.*

Control Stat Id

Id of the control station, will normally match the observed Id.

Control Easting/Northing/Level

Coordinate of the control station.

Observed Easting/Northing/Level

Coordinate of the observed point.

Residual Easting/Northing/Level

Delta of the observed point with the control point after the transformation has been applied.

Buttons

Control button

Start the selection of the control/observed point pairs.

Note that he environment variable PICK_ORDER_OBSERVED_FIRST_4D can be set to make the selection order 'observed' then 'control'. For ease of use 2 plan views should be used, one with the observed points and one with the control points.

Calculate button

Calculate the transformation and update the residuals in the grid control.

Although never recommended a one point transformation is allowed, the scale factor will be set to 1.0, rotation to 0° and simple x, y& z translations set.

For more than 1 point the scale and rotation will be calculated.

Finish button

Exit the panel, a warning message will appear if the transformation parameters have not yet been written to file.

Continue to 15.6.16.2 Create a Base Station or return to 15.6.16 GNSS Utilities .

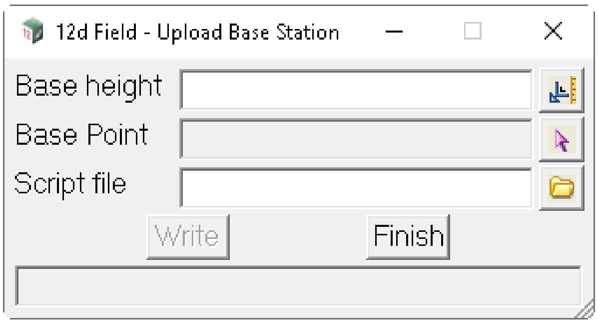
15.6.16.2 Create a Base Station

Position of option on menu: **Survey =>Field 12d=>GNSS Utilities =>Create Base Station**

This panel is deprecated and will be removed or updated in a future version.

When using a base and rover combination the panel allows the selection of the base point coordinates and a base height. This is converted to lat/lon/ele and written to a text file to be uploaded to the GNSS unit in a specific format supported by some GNSS units.

Selecting **Create Base Station** brings up the **12d Field - Upload Base Station** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Base height	measure box		

Height of the base station.

Base point	string select box		

The vertex to be the base station.

Script file	file box		

The file to write the base station script to.

Buttons at Bottom

Write	button		

Write out the script file.

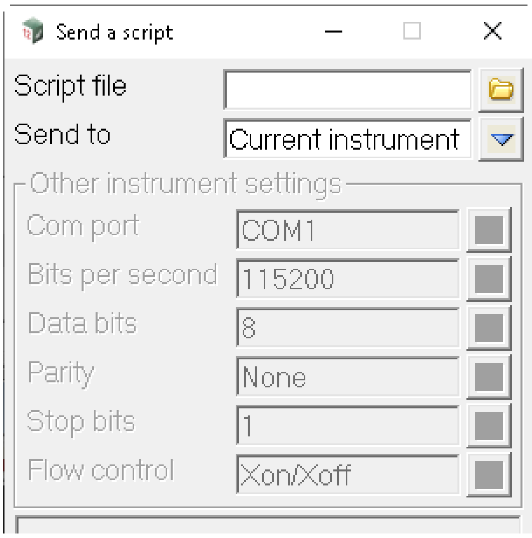
Continue to 15.6.16.3 Send a Script or go back to 15.6.16 GNSS Utilities .

15.6.16.3 Send a Script

Position of option on menu: **Survey =>Field 12d=>GNSS Utilities =>Send script**

This option uploads a script to a GNSS instrument.

Selecting **Send script** brings up the **Send a Script** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Script file	file box		

Height of the base station.

Send to	choice box		Current instrument Other instrument

*If **Current instrument** then the script file is uploaded to the current GNSS instrument.*

*If **Other instrument** then the script file is uploaded to the current GNSS instrument using the settings in the "Other Instrument settings" section of the panel.*

COM port	choice box		

Com port to write the data out to.

Bits per second	choice box		

Number of bits per second when sending the data.

Data bits	choice box		5, 6, 7, 8, Mark

Number of bits that make up a data word.

Parity	choice box		None, Odd, Even, Mark, Space

Parity for the data word.

Stop bits	choice box		1, 1.5, 2

Number of stop bits in the data word.

Flow control	choice box		Xon/Xoff, Hardware, None

Protocol to use to control the flow of data.

Send	button		

Transmit the script file.

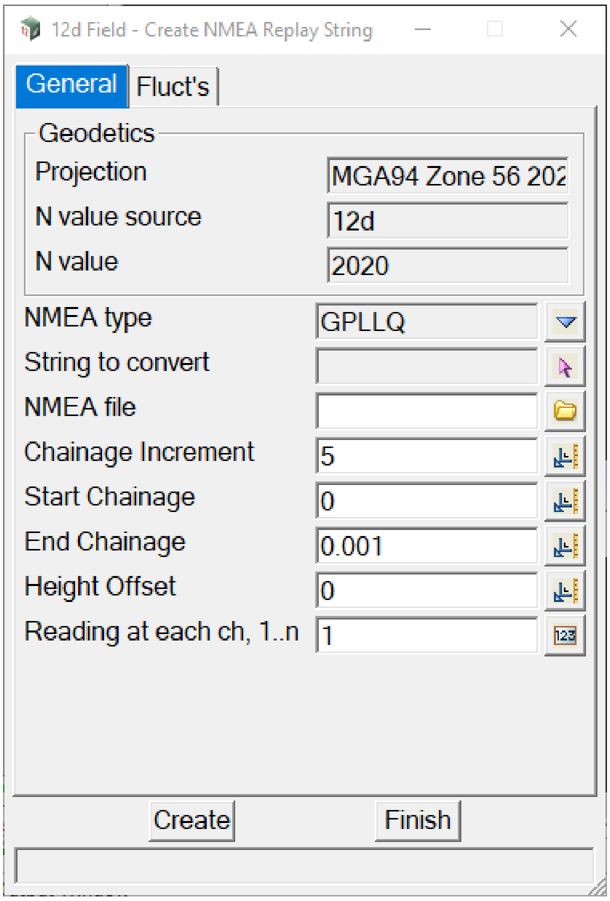
Continue to 15.6.16.4 Create NMEA String or go back to 15.6.16 GNSS Utilities .

15.6.16.4 Create NMEA String

Position of option on menu: **Survey =>Field 12d=>GNSS Utilities =>Create NMEA string**

This option creates a NMEA string from a super string to simulate a GNSS 'walking' around.

Selecting **Create NMEA string** brings up the **12d Field - Create NMEA Replay String** panel:



See
General tab
Fluct's tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Geodetics group

*Informational only, displays the current **Projection** and **N-value** details configured on starting **12d Field**.*

General tab

NMEA type choice box GNGGA & GNGST, GNLLQ

Standard for the NMEA string.

String to convert string select

String to create a NMEA file for.

NMEA file file box

Name for the created NMEA file.

Chainage increment measure box

Value that the setout chainage will be changed by when chainage increment/decrement is called.

Start chainage measure box

The chainage on the selected string to start generating the NMEA replay.

End chainage measure box

The chainage on the selected string to finish generating the NMEA replay.

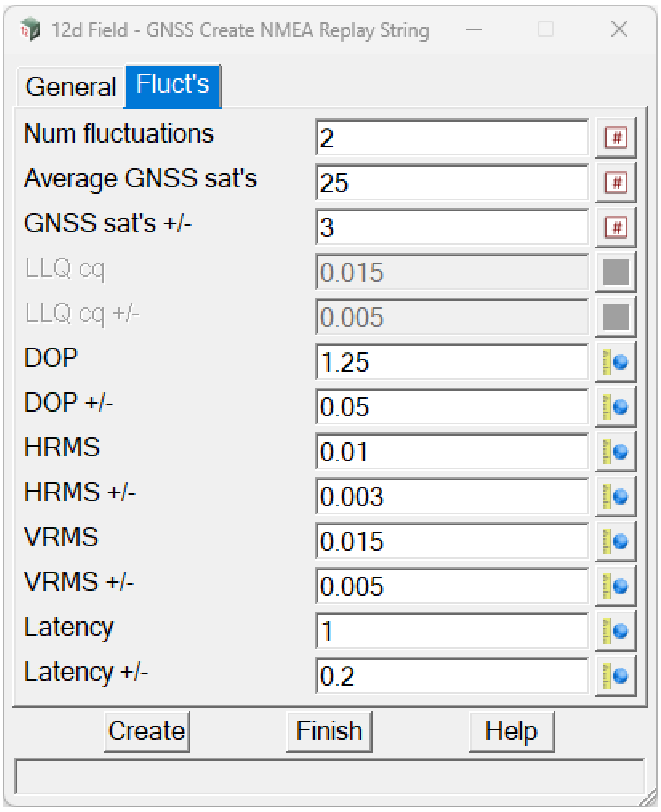
Height offset measure box

A height offset from the selected string for the NMEA replay.

Reading at each ch, 1... n integer box

Enter how many readings should be generated at each chainage before proceeding to the next.

Fluct's tab



See
General tab
Fluct's tab

Num fluctuations integer box

The number generated readings it takes for each field below to vary between the high and low values.

Average GNSS Sat's integer box

The average number of GNSS satellites.

GNSS sat's +/- integer box

The variation in GNSS satellites used.

LLQ cq real box

If LLQ strings are being produced the nominal coordinate quality.

LLQ cq +/- real box

If LLQ strings are being produced the variation in coordinate quality.

DOP real box

The nominal dilution of precision.

DOP +/- real box

The variation in dilution of precision.

HRMS real box

The nominal horizontal RMS value.

HMRS +/- real box

The variation in the horizontal RMS value.

VRMS real box

The nominal vertical RMS value.

VMRS +/- real box

The variation in the vertical RMS value.

Latency real box

The nominal latency value.

Latency +/- real box

The variation in latency value.

Button at Bottom

Create button

Create the NMEA file for the selected string.

Continue to 15.7 12d Field Implementation Details or go back to 15.6.16 GNSS Utilities .

15.7 12d Field Implementation Details

This section deals with the common methods used by all of the ***12d Field*** panels for string, tin, trimesh and tunnel calculations and the associated attributes.

The section is not in a completely sequential order as many of the topics are interrelated and can be separated out cleanly, the section is intended primarily as a reference on ***12d Field*** workings for an experienced user, not explanation of 1st principles.

See 15.7.1 Some Common Terms

See 15.7.2 Common 12d Field Calculation Strings

See 15.7.3 12d Field Attributes

See 15.7.4 Logging

15.7.1 Some Common Terms

Strings

Strings is used as a term here to describe primarily **Super Alignments** and **Super Strings**, ***12d Field*** does not allow the use of older string types and requires these to be separately converted prior to use.

Surfaces

Surfaces is used as a term here loosely describe **tins**, **trimeshes** and **tunnels**.

Perpendicular and Normal

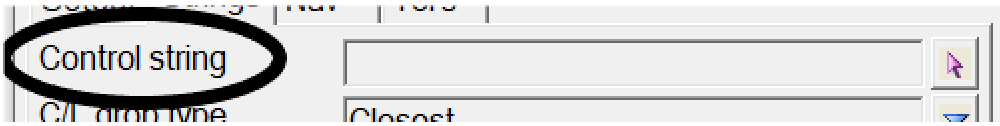
In this section the mathematical term **normal** will be used as well as **perpendicular** dependent on the context, **normal** tends to mean the physical object representing something **perpendicular** to an object.

15.7.2 Common 12d Field Calculation Strings

See 15.7.2.1 The Control String (so_cs_strr)

See 15.7.2.2 The Secondary Control String (so_sc_strr)

15.7.2.1 The Control String (so_cs_strr)



Many ***12d field*** panels ask for the user to select the **control string**, chainages are relative to this string, surveyed points are dropped to this string and all other strings and surfaces are cut perpendicular to this string for calculations.

There 3 important things to understand with the control string, the chainage type, how a point is dropped to the string and the cutting plane used to section other strings and surfaces.

Chainage types.

There are 4 different chainage types available for viewing and use depending on the ***12d Field*** panel in use, these will not be explained here, see 19.5 Different Types of Chainage Drop Point for a full explanation the chainage types.

For any point dropped to the **control string** attributes are available for all 4 chainage drops.

Important note*, in* ***12d Field*** *the term* ***vcut*** *or* ***pcut*** *is used in attributes as opposed to drop as all subsequent strings and surfaces are cut by the plane defined by the normal of the chainage drop. The term drop,* ***vdrp*** *or* ***pdrp*** *in* ***12d Field*** *attributes is used for indicating the drop type to a surface, vertical or perpendicular.*

1) Vertical Drop - Chainage 2d

This is by far the most commonly used chainage type and the only type available for entry on most panels.

The vertical drop is represented by vcut and the chainage type by **ch2d**. For example, **pu_vcut_cs_ch2d**, the vertical drop 2d chainage of the measured point.

This chainage type can also have equalities, these will not be explained here, for a full explanation of equalities see 3.42 Chainage Equalities .

The equality chainage is represented by **eq**. For example, **pu_vcut_cs_ch2d_eq**, the equality chainage of the measured point.

The k-post is represented by **kp**. For example, **pu_vcut_cs_ch2d_kp**, the chainage k-post of the measured point.

The zone by **zn**. For example, **pu_vcut_cs_ch2d_zn**, the chainage zone of the measured point.

2) Perpendicular Drop - Chainage 2d

The perpendicular drop is represented by pcut and the chainage type by **ch2d**. For example, **pu_pcut_cs_ch2d**, the perpendicular drop 2d chainage of the measured point.

3) Perpendicular Drop - Chainage 3d

The perpendicular drop is represented by pcut and the chainage type by **ch3d.** For example, **pu_pcut_cs_ch3d**, the perpendicular drop 3d chainage of the measured point.

4) Vertical Drop - Chainage 3d

The vertical drop is represented by vcut and the chainage type by **ch3d**. For example, **pu_vcut_cs_ch3d**, the vertical drop 3d chainage of the measured point.

Continue to 15.7.2.2 The Secondary Control String (so_sc_strr) or return to 15 12d Field .

15.7.2.2 The Secondary Control String (so_sc_strr)

The **secondary control string** is a string used for informational purposes only, the measured survey point is dropped to this string and the following attributes are populated and available, (this is a work in progress)

pu_vcut_sc_seg_htext

pu_vcut_sc_seg_vtext

so_vcut_sc_ch2d

so_vcut_sc_ch2d_eq

so_vcut_sc_ch2d_kp

so_vcut_sc_ch2d_zn

pu_sc_ch

pu_vcut_sc_ch2d

pu_vcut_sc_ch2d_eq

pu_vcut_sc_ch2d_kp

pu_vcut_sc_ch2d_zn

pu_vcut_sc_ha

pu_vcut_sc_grd_vh

pu_vcut_sc_radius

pu_vcut_sc_z

so_vcut_sc

pu_vcut_sc

so_vcut_sc_ha

so_vcut_sc_grd_vh

so_vcut_sc_radius

so_vcut_sc_z

Continue to 15.7.2.2 The Secondary Control String (so_sc_strr) or return to 15 12d Field .

15.7.3 12d Field Attributes

15.7.3.1 Panel Attributes

15.7.3.2 Setout Attributes

See 15.7.3.2.1 Overview of string and surface names .
See 15.7.3.2.2 Primary attribute prefixes .
See 15.7.3.2.3 Common attribute prefixes .
See 15.7.3.2.4 Common attribute suffixes .
See 15.7.3.2.5 Indicative Diagrams .
See 15.7.3.2.6 Measured point to setout point attributes pu_mp_sp_* .
See 15.7.3.2.7 Pile Setout Specific Attributes .

15.7.3.2.1 Overview of string and surface names

CS - **control string**, chainages are relative to this string, surveyed points are dropped to this string and all other cut perpendicular to this string for calculations.

SS - **setout string**, the string used for the horizontal location of the setout point.

S1, **S2**, **CR** - **string 1**, **string 2**, **crown**, strings used to define the plane of the setout surface dependent on the setout panel.

SG - **subgrade string**, the pseudo string used in **batter setout** to extend slopes to a subgrade depth.

SC - **secondary control**, not shown, a completely independent string the measure point is dropped to for a reference chainage and offset.

G1, **G2** - **grid1**, **grid2**, the strings used by the **grid setout** panel.

SP - **setout point**, the nominal point calculated from the setout chainage, offset and height difference.

MP - **measured point**, the surveyed TPS or GNSS point.

VP - **virtual point**, a point calculated at the measured point on the **virtual plane**, this is the point that defines the delta values to the setout point.

DPL - **design plane**, a plane through the nominal design strings.

SPL - **shifted plane**, a plane when necessary defining a surface that is a set value from the design surface. For example, top of a pavement sub layer.

VPL - **virtual plane**, a plane a nominal distance from the shifted plane, delta values are relative to this layer.

Continue to 15.7.3.2.2 Primary attribute prefixes or return to 15 12d Field .

15.7.3.2.2 Primary attribute prefixes

From V15 all attributes start with 2 characters signifying the broad category the attribute falls into.

st, setting, typically a user entered value.

iv, instrument value, typically a value that is read in from an instrument.

su attributes about the current instrument setup.

so, an attribute related to the setout point.

pu, an attribute related to the pickup/measured point.

Continue to 15.7.3.2.3 Common attribute prefixes or return to 15 12d Field .

15.7.3.2.3 Common attribute prefixes

Following the primary prefix the next group/s of characters further narrow the attribute categories, these are simply listed in alphabetical order. The list is an overview and does not try to identify every single group that is possible but to enable the user to quickly lookup the intention of the attributes in question.

bs, attributes for a backsight measurement. For example, **su_bs_id**, the backsight id.

cmp, computer or tablet. For example, **pu_cmp_local_time**, the time from the tablet.

cs, attributes for a checkshot measurement. For example, **su_cs_id**, the backsight id.

cyl, pile setout attributes. For example, **so_cyl_pile_radius**, the radius of the pile.

drn, drainage setout attributes. For example, **so_drn_pit_name**, the name of the pit to setout.

dwg, attributes controlling views and highlighting for ***12d field***. For example, st_drw_plan_view_name, the plan view ***12d Field*** draws in.

env, loosely settings that might have historically been environment variables. For example, **st_env_gps_show_nmea**, whether to display incoming NMEA strings in the output window.

gps, GNSS specific attributes. For example, **st_gps_phase_centre**, the phase centre offset for a GNSS receiver.

grd, grade, a value representing y/x. For example, **pu_vcut_sc_grd_vh**, the grade of the secondary control string.

hc, attributes for setup height calibrations. For example, **su_hc_id_1**, the id of the 1st point used in the height calibration.

hm, attributes specific to helmert resection data. For example, **su_hm_id_1_id**, the id of the 1st point used in the helmert resection.

hotkeys, attribute for the hotkey bars configurations. For example, **st_hotkeys_bar_1_x**, the x location the 1st hotkey bar is opened at.

hp, hidden point. For example, **pu_hp_1_sd**, the slope distance of the 1st hidden point measurement.

ins, instrument, information about the instrument, TPS or GNSS. For example, **st_ins_software_version** the software version of the instrument.

is, attributes about the current instrument setup. For example, **su_is_setup_type_text**, the current setup type as text.

ls, attributes specific to least squares resection data. For example, **su_ls_id_1_id**, the id of the 1st point used in the least squares resection.

menu, attributes about menu items. For example, **st_menu_show_pile_setout**, whether to show the **Pile Setout** panel.

mp, measured point. For example, **pu_mp_x**, the easting of the measured point.

nav, attributes defining the navigation box. For example, **st_nav_box_font**, the font to use inside the navigation box.

panel, attributes about ***12d Field*** panels. For example, **st_panel_basic_pickup_x_location**, the x location the Basic Pickup panel will be opened at.

pickup, attributes related to Basic Pickup, **pickup_bsc**, SDR Pickup, **pickup_sdr** or both, **pickup_cmn**. For example, **st_pickup_cmn_min_store_pt_separation**, the minimum distance between consecutive points at which a warning is shown.

scan, attributes related to TPS scanning. For example, **st_scan_poly_arc_ch**, the arc to chord tolerance for creating scan polygons. *See* 3.25.2 Chord-to-Arc Tolerance .

sound, attributes about sounds played for certain events. For example, **st_sound_on_store**, the sound to play on storing a point.

tol, attributes for tolerance checking. For example, **st_tol_pav_active**, whether tolerance setting are active for a setout panel.

tps, TPS specific attributes. For example, **st_tps_auto_change_ir_rl_th** a flag whether to automatically change target heights on switching EDM modes.

tun, tunnel specific attributes. For example, **so_tun_ele_name**, the name of the profile element to setout.

version, information about ***12d Model***. For example, st_ **version_12d_product**, the version of ***12d Model*** in use.

tps_pos, attributes relating to TPS positioning. For example, **st_tps_pos_max_iterations**, the number of iteration attempts allowed before the positioning fails.

Continue to 15.7.3.2.4 Common attribute suffixes or return to 15 12d Field .

15.7.3.2.4 Common attribute suffixes

The final characters tend to be the actual "unit", these are simply listed in alphabetical order. The list is an overview and does not try to identify every single group that is possible but to enable the user to quickly lookup the intention of the attributes in question.

asp, the aspect/direction of slope for a triangle in radian angles. For example, **so_sf_pdrp_asp**, the aspect of the triangle from a perpendicular drop to a surface.

corr_hb_dms, the corrected clockwise horizontal bearing in degrees, minutes & seconds. For example, **pu_tps_hb_dms**, the measured TPS bearing with orientation correction applied.

deg, an angle as decimal degrees. For example, **pu_tps_running_hb_deg**, the current TPS horizontal reading.

dist, a scalar, unsigned 2D or 3D distance. For example, **pu_vcut_mp_cs_dist**, the perpendicular distance between the measured point and the control string.

gon, an angle in gons, (400th of a circle). For example, **pu_tps_running_hb_gon**, the current TPS horizontal reading.

mil, an angle in mils, (3200th of a circle). For example, **pu_tps_running_hb_mil**, the current TPS horizontal reading.

ha, the anticlockwise horizontal angle in radians. For example, **su_cs_ha**, the measured angle to the checkshot.

hb, the clockwise horizontal bearing in radians. For example, **su_cs_hb**, the measured bearing to the checkshot.

hb_dms, the clockwise horizontal bearing in degrees, minutes & seconds. For example, **pu_tps_hb_dms**, the uncorrected measured TPS bearing.

hd, the horizontal distance. For example, **su_cs_hd**, the horizontal distance to the checkshot.

hb_dms, the clockwise horizontal bearing in degrees, minutes, seconds. For example,

su_hm_hb_dms_1, the measured bearing to the first helmert reading.

hv, percent, a ratio. For example, **so_sf_vdrp_slp_hv**, the triangle slope from a vertical drop to the surface as y/x.

id, an alphanumeric vertex id. For example, **su_cs_id**, the id of the checkshot point.

per, percent, a ratio *100.0. For example, **so_sf_vdrp_slp_per**, the triangle slope from a vertical drop to the surface in % y/x*100.0.

radius, the radius. For example, **pu_cs_radius**, the control string radius at the measured point.

sd, the slope distance. For example, **su_cs_sd**, the measured slope distance to the checkshot.

slp, slope, a ration expressed as y/x. For example, **so_sf_vdrp_slp_hv**, the triangle slope from a vertical drop to the surface.

th, target height. For example, **pu_hp_1_th**, the 1st hidden point target height.

va, the vertical angle from zenith in radians. For example, **su_cs_va**, the measured angle to the checkshot.

x y z, easting, northing, height. For example, **su_is_x**, the instrument setup easting.

xdf ydf zdf, easting, northing and height differences. For example, **su_cs_xdf**, the difference in easting of the checkshot measurement.

zen, zenith, 0.0 is vertically to the sky. For example, **pu_vcut_cs_zen_va_deg**, the centreline grade as degrees from vertical.

Continue to 15.7.3.2.5 Indicative Diagrams or return to 15 12d Field .

15.7.3.2.5 Indicative Diagrams

This section shows the typical attributes defining the attributes needed to calculate the setout point and the attributes used to show information about the measured/pickup point. The attributes shown are not comprehensive, just the critical attributes to clarify how each of the methods does its core calculations.

An attribute name in the diagram followed by **(_x..)**. For example, **so_sp(_x..)** indicates multiple attributes are available with various suffixes applied to the main attribute name. Hence for the setout point, **so_sp** the easting, northing and height are accessible via **so_sp_x, so_sp**_y & **so_sp_z** and its id **so_sp_id**.

See 15.7.3.2.5.1 Basic String Diagrams .

See 15.7.3.2.5.2 Crossfall Diagrams .

See 15.7.3.2.5.3 Crown Diagrams .

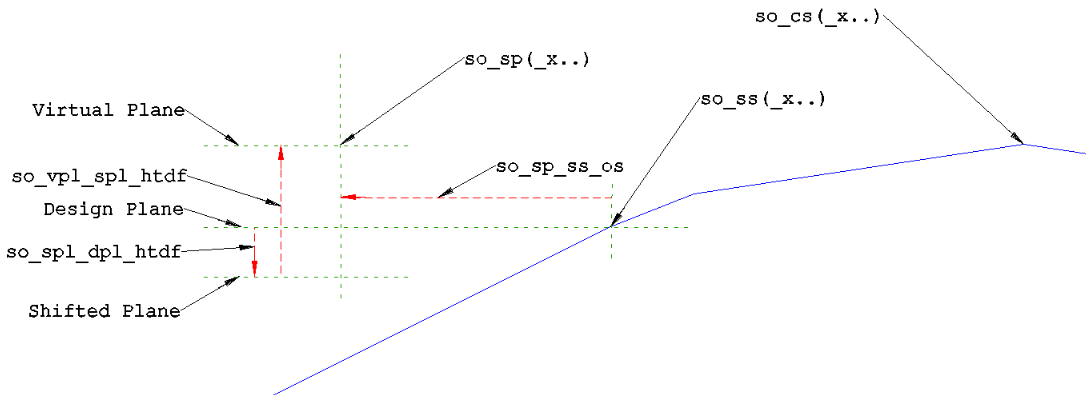
See 15.7.3.2.5.4 Batter Diagrams .

15.7.3.2.5.1 Basic String Diagrams

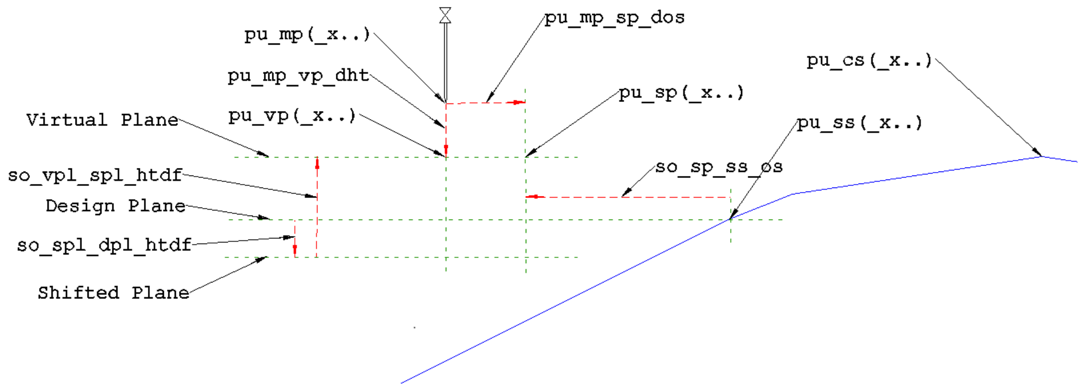
See 15.7.3.2.5.1.1 Single String .

See 15.7.3.2.5.1.2 Pickup Section .

15.7.3.2.5.1.1 Single String



15.7.3.2.5.1.2 Pickup Section



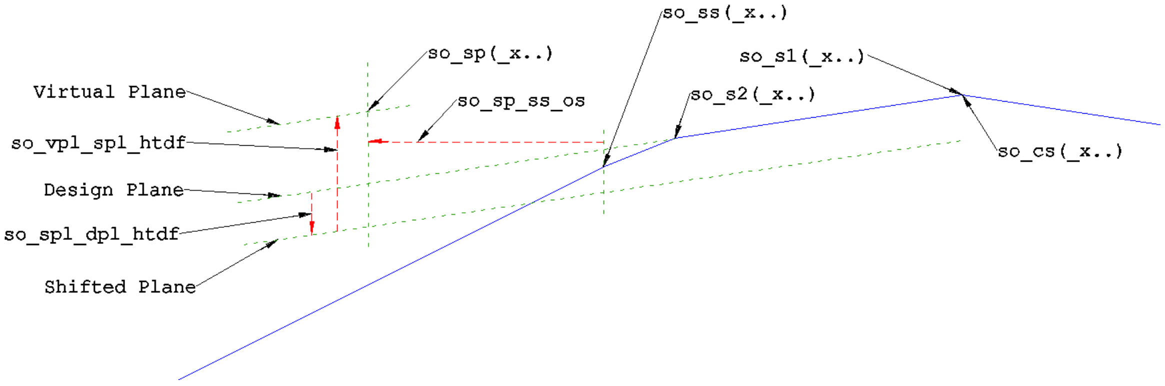
Continue to 15.7.3.2.5.2 Crossfall Diagrams or return to 15 12d Field .

15.7.3.2.5.2 Crossfall Diagrams

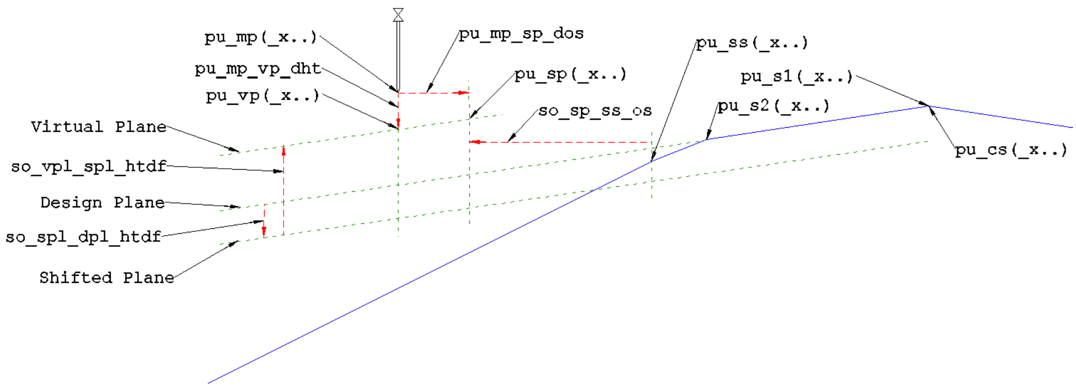
See 15.7.3.2.5.2.1 Setout Section .

See 15.7.3.2.5.2.2 Pickup Section .

15.7.3.2.5.2.1 Setout Section



15.7.3.2.5.2.2 Pickup Section

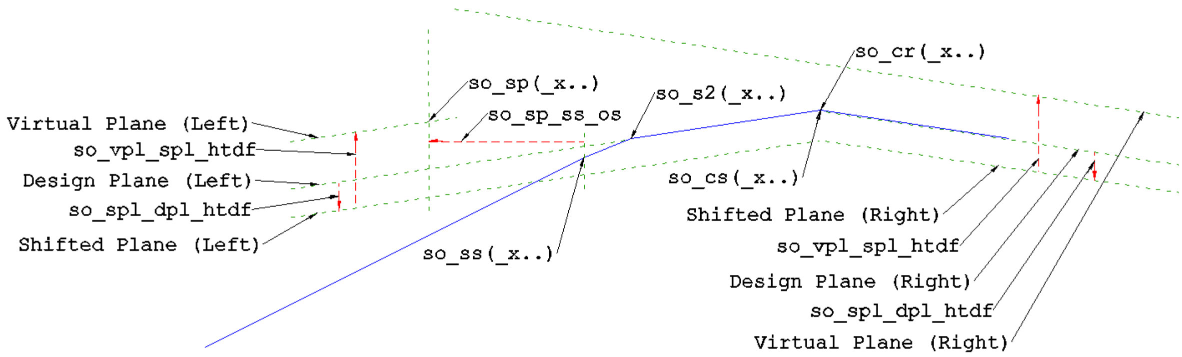


Continue to 15.7.3.2.5.3 Crown Diagrams or return to 15 12d Field .

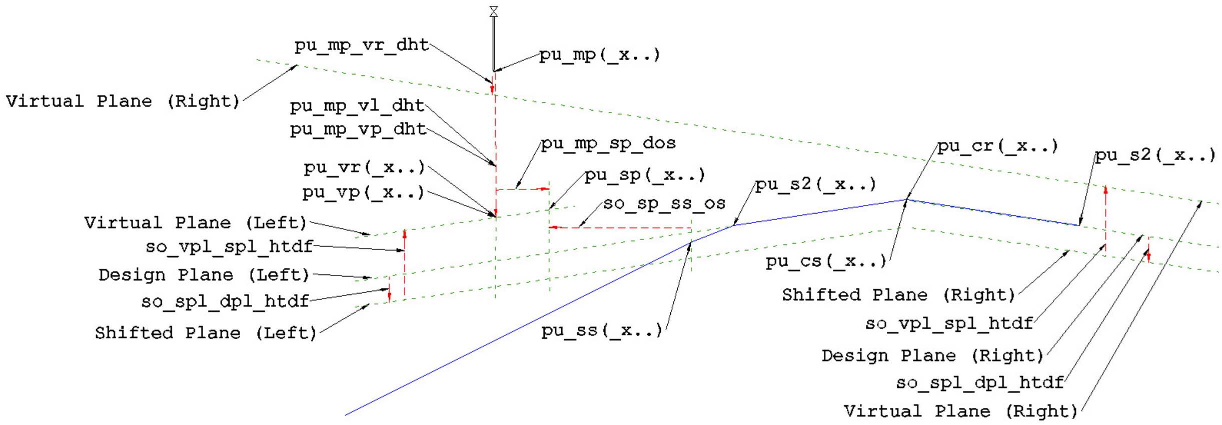
15.7.3.2.5.3 Crown Diagrams

See 15.7.3.2.5.3.1 Setout Section
See 15.7.3.2.5.3.2 Pickup Section

15.7.3.2.5.3.1 Setout Section



15.7.3.2.5.3.2 Pickup Section

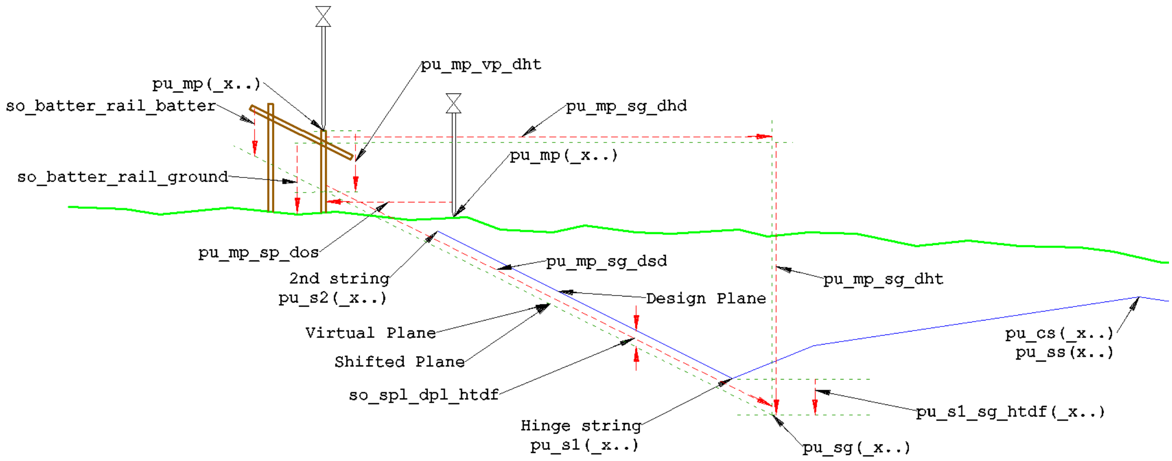


Continue to 15.7.3.2.5.4 Batter Diagrams or return to 15 12d Field .

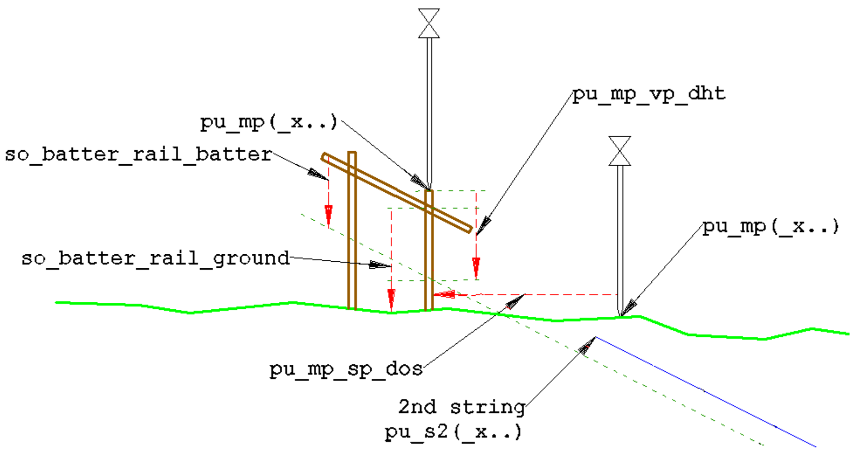
15.7.3.2.5.4 Batter Diagrams

Batter setout is a little different to the other string based setout routines such as **crossfall setout** in that there is no specific setout point. If placing batter rails the user takes measurements on the existing surface and the deltas guide them to where the ideal place to place the front peg supporting the rail will be.

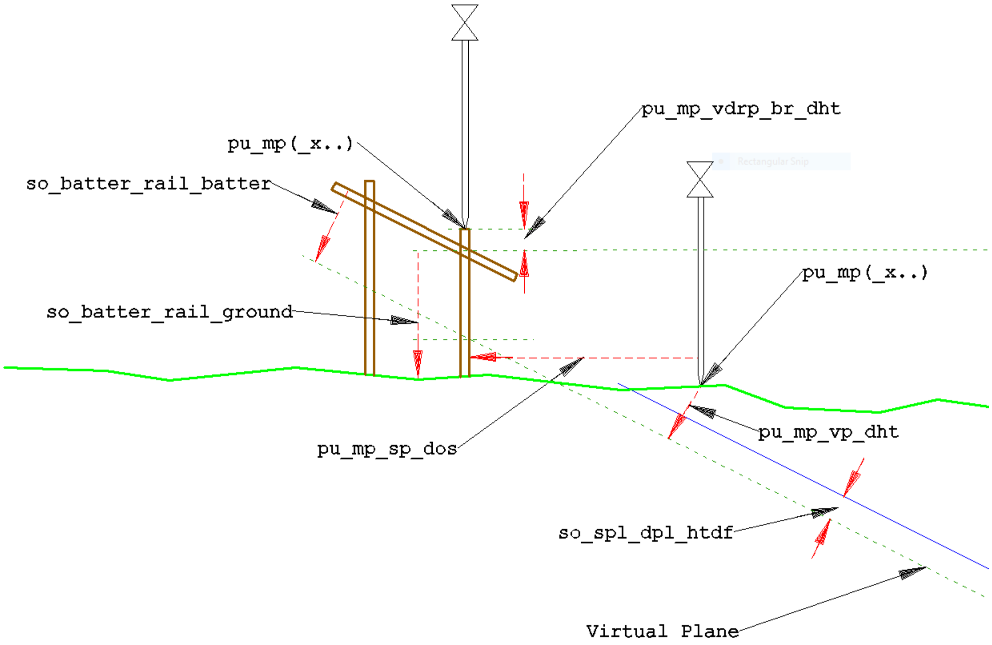
Pickup Attributes



The following diagram shows the typical batter attributes when the vertical setout mode is active.



The following diagram shows the typical batter attributes when the perpendicular setout mode is active, this is common say where a rock protection layer is present. Note the delta height from measured point to the desired batter plane, **pu_mp_vp_dht**, the height difference from design to the batter plane, **so_spl_dpl_htdf** and the offset of the rail from the batter, **so_batter_rail_batter** are now interpreted perpendicular to the batter plane. Also note the vertical height from the top of the peg to the batter rail is available from V15C1k, **pu_mp_vdrp_br_dht**, this is identical for the vertical setout mode.



Continue to 15.7.3.2.6 Measured point to setout point attributes pu_mp_sp_* or return to 15 12d Field .

15.7.3.2.6 Measured point to setout point attributes pu_mp_sp_*

These attributes contain calculated values from the coordinates of the **measured point** to the coordinates of the **setout point**. The **setout point** is calculated directly from the values entered on the setout panel. For example the chainage, offset and height differences on the string panels.

*Important note, these are different coordinates to the **virtual setout point** used for general delta values which are calculated using the chainage and offset of the **measured point**.*

pu_mp_sp_xdf, the difference in easting from the setout point to the measured point, (mp-sp).

pu_mp_sp_ydf, the difference in northing from the setout point to the measured point, (mp-sp).

pu_mp_sp_dx, the delta easting to get from the measured point to the setout point, (sp-mp).

pu_mp_sp_dy, the delta northing to get from the measured point to the setout point, (sp-mp).

pu_mp_sp_hd, the horizontal distance from the measured point to the setout point.

pu_mp_sp_sd, the slope distance from the measured point to the setout point.

pu_mp_sp_dht, the delta height to get from the measured point to the setout point, (sp-mp).

pu_mp_sp_htdf, the height difference from the measured point to the setout point, (mp-sp).

pu_mp_sp_hb, the raw tps horizontal bearing from the measured point to the setout point in radians.

pu_mp_sp_corr_hb, the horizontal bearing from the measured point to the setout point in radians adjusted for the setup datum swing.

pu_mp_sp_va, the zenith vertical angle in radians from the measured point to the setout point.

pu_mp_sp_va_deg, the zenith vertical angle in decimal degrees from the measured point to the setout point.

pu_mp_sp_va_dms, the zenith vertical angle from the measured point to the setout point in degrees/minutes/seconds.

pu_mp_sp_nad_va, the nadir vertical angle in radians from the measured point to the setout point.

pu_mp_sp_nad_va_deg, the nadir vertical angle from the measured point to the setout point in decimal degrees.

pu_mp_sp_nad_va_dms, the nadir vertical angle from the measured point to the setout point in degrees/minutes/seconds.

Continue to 15.7.3.2.7 Pile Setout Specific Attributes or return to 15 12d Field .

15.7.3.2.7 Pile Setout Specific Attributes

See 15.7.3.2.7.1 Some common 3d string drop attributes relevant to the pile setout panel. .

See 15.7.3.2.7.2 Attributes specific to the pile setout panel. .

15.7.3.2.7.1 Some common 3d string drop attributes relevant to the pile setout panel.

pu_pcut_mp_cs_dch3d - the delta 3d chainage of the perpendicular drop to the string, this is effectively the delta height to the pile setout point.

When the pile is raked the 3 following values are similar to their 2d cousins, the delta offset is identical to the 2d versions, the 3d delta height is always smaller or equal to the 2d version as it is the perpendicular drop to the 3d line.

pu_pcut_mp_cs_dos

pu_pcut_mp_cs_dht

pu_pcut_mp_cs_dist - the 3D distance from the measured point to the pile centreline, square_root(dos^2 + dht^2)

If the pile is vertical **dos** and **dht** are meaningless.

15.7.3.2.7.2 Attributes specific to the pile setout panel.

For all of the band reading the raw reading and coordinates are stored. For example band 1, reading 3

pu_cyl_band_1_pt3_x - the x coordinate of the reading

pu_cyl_band_1_pt3_y - the y coordinate of the reading

pu_cyl_band_1_pt3_z - the z coordinate of the reading

pu_cyl_band_1_pt3_ha - the uncorrected horizontal angle of the reading

pu_cyl_band_1_pt3_va - the vertical angle of the reading

pu_cyl_band_1_pt3_sd - the slope distance of the reading

The calculated centre and radius of each band. For example band 2

pu_cyl_band_2_ptc_x - the calculated x coordinate of the centre of band 2

pu_cyl_band_2_ptc_y - the calculated y coordinate of the centre of band 2

pu_cyl_band_2_ptc_z - the calculated z coordinate of the centre of band 2

pu_cyl_band_2_radius - the calculated radius of band 2

The residual of each measurement and the overall mean of the residuals.

pu_cyl_sum_residual_sqr - the overall mean of the residuals.

pu_cyl_band_3_pt1_residual - the residual of band 3 point 1

pu_cyl_band_3_pt2_residual - the residual of band 3 point 2

pu_cyl_band_3_pt3_residual - the residual of band 3 point 3

Continue to 15.7.4 Logging or return to 15 12d Field .

15.7.4 Logging

See 15.7.4.1 User Logging

See 15.7.4.1 User Logging

15.7.4.1 User Logging

When ***12d Field*** is running the text file ***12DF_SIGNIFICANT_EVENTS_LOGGING.TXT*** is continuously appended with information re usage of ***12d Field***. The file is there as extra information available to the user to use for whatever purpose it could prove useful.

The log lines start with the UTC and local time followed by an action and some extra information. Some typical examples follow.

```
2024/12/12 04:48:07.224 : 2024/12/12 15:48:07.224 :             Read global config:
"c:\12d\15.00\user\12dF_GLOBAL_CONFIG.4D" - 1571 items read.
2024/12/12 04:48:07.224 : 2024/12/12 15:48:07.224 :           Read customer config:
"C:\12d\15.00\Customer\12dF_CUSTOMER_CONFIG.4D" - 15 items read.
2024/12/12 04:48:07.224 : 2024/12/12 15:48:07.224 :            Read working config:
"12dF_WORKING_CONFIG.4D" - 11 items read.
2024/12/12 04:48:07.240 : 2024/12/12 15:48:07.240 :          Target height changed:
gps_target_height: 2.0000
2024/12/12 04:53:00.201 : 2024/12/12 15:53:00.201 :                    Log Comment:
User comment: Tilt off
2024/12/12 04:51:47.478 : 2024/12/12 15:51:47.478 :            Open 12dField Panel:
"12d Field - User Values"
```

The file is continually appended to 12dField across all sessions, it is up to the user to manage it

15.7.4.2 General Logging

When ***12d Field*** is running a binary file **instrument_comms.log** is created for that ***12d Field*** session. This file contains all details of the ***12d Field*** session including instrument communications, it is for ***12d*** internal use only and is necessary for support purposes in many situations.

The file can be quite large dependent on the length of the ***12d Field*** session, previous sessions are moved to the ***backups.4d*** folder and automatically deleted after 3 days.

15.8 12d Field Configuration

This section deals primarily with the back end files and rules for their usage that control the look and feel of the individual ***12d Field*** panels.

See 15.8.1 TPS/GNSS Configuration (new)

See 15.8.2 TPS Configuration

See 15.8.3 GNSS Configuration

See 15.8.4 Panel Configuration

See 15.8.5 General Configuration

15.8.1 TPS/GNSS Configuration (new)

See 15.8.1.1 12dF_BLUETOOTH_DEVICES.TXT file format

See 15.8.1.2 12dF_INSTRUMENT_SETTINGS.4D

15.8.1.1 12dF_BLUETOOTH_DEVICES.TXT file format

The ***12dF_BLUETOOTH_DEVICES.TXT*** file stores information about **Bluetooth** connections to **TPS**, **GNSS** and other devices such as radios.

The file consists of triplets of lines with the name, address and port of the device connection.

For example:

```
name=RanchRS3
addr=70:4A:0E:8F:21:AD
port=1

name=99310587
addr=00:12:F3:25:E1:1F
port=1

name=RB 000250
addr=00:80:E1:B0:ED:39
port=1

name=GT-1203 XQ002355
addr=00:07:80:E2:1C:28
port=1
```

New devices searched for and connected to are added to this file so they can be easily selected with subsequent usage.

Devices are not automatically removed from this file. When a device is redundant or no longer in use, simply delete the triplet of lines associated with it from the file.

Continue to 15.8.1.2 12dF_INSTRUMENT_SETTINGS.4D or return to 15 12d Field .

15.8.1.2 12dF_INSTRUMENT_SETTINGS.4D

The ***12dF_INSTRUMENT_SETTINGS.4D*** file stores information about each **TPS** and **GNSS** instrument in use. The user does not need to edit this file so it will not be documented.

15.8.2 TPS Configuration

See 15.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format
See 15.8.2.2 12dF_Battery_Levels.4D file format

15.8.2.1 12dF_TPS_INS_USER_TARGETS.4D file format

Before **V15C1g** ***12d Field*** allowed the definition of user targets for each of the major instrument manufacturers, these definitions were only for user defined targets and there was a separate file with a varying format for Leica, Trimble and Topcon.

From **V15C1g** all target definitions have been combined into a single file for all manufacturers and the format enhanced to allow more comprehensive user target definitions and overrides for the built-in target types.

12dF_TPS_INS_USER_TARGETS.4D is still a simple text file of similar format to the previous versions and loaded according to the standard ***12d Field*** file paths.

Each target definition line has 7 quoted and whites pace delimited fields. For example a user defining a Leica GPR1 circular prism for use with a Topcon instrument.

```
"TOPCON" "Leica GPR1 Circ" "-34.4" "50" "PRISM" "GPR1 -34.4" "Survey manager"
```

The format is as follows.

1st entry - manufacturer

"**LEICA**", "**TOPCON**" or "**TRIMBLE**"

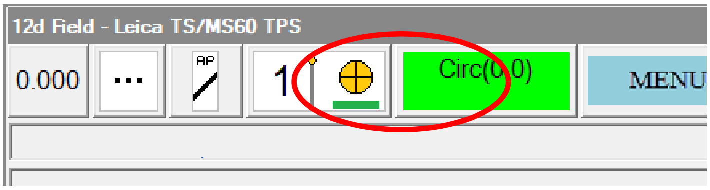
When the user starts 12dField only the target definitions related to the selected instrument will be loaded/shown.

2nd entry - target name

"**25mm sheet**"

This is the text shown in the drop down list when a user selects a target to use.

This entry can also be used to customize the text shown in the prism constant bitmap on the TPS Control Bar, prior to V15C1g only the target constant was displayed here.



The following fixed names indicate the user has custom text following for an inbuilt target to be displayed, these are not loaded as user targets.

Leica inbuilt prisms

"leica_circ_0" "leica_360_231" "leica_mini_360_300" "leica_mini_0" "leica_mini_175" "leica_tape_344" "leica_ma_mpr122" "leica_any"

Topcon inbuilt prisms

"topcon_generic_0" "topcon_generic_30" "topcon_360_ATP1_7_hc" "topcon_any"

Trimble inbuilt prisms

"trimble_360_id" "trimble_multitrack" " "trimble_activetrack_360" "trimble_mini_m17p5" "trimble_s_traverse_m35p0" "trimble_any"

3nd entry - target constant (mm.m)

"23.1"

The constant for the target to suit the manufacturer.

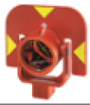
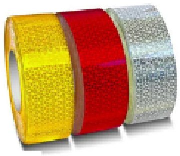
Inbuilt targets have fixed constants which cannot be overwritten, it is critical the user enters and tests for correct user constants.

The generic rule is a Topcon or Trimble constant is approximately equal to the Leica constant minus 34.4.

So, using the notation ~= means approximately equals

Topcon/Trimble ~= Leica - 34.4, hence Leica ~= Topcon/Trimble + 34.4

Note, the following diagram with some typical Leica prisms illustrates for a particular prism the +ve constant when used with a Leica will become negative for use with another instrument.

Prism Model	Leica Offset	Actual Offset	Diagram	Alternative Model
GPH1P	0.0	-34.4		GPH1P
GPR121 GPR111	0.0 0.0	-34.4 -34.4	 	LSP-LT
GMP101	+17.5	-16.9		LT101
GMP111 GMP111-0	+17.5 0.00	-16.9 -34.4		LT111
Reflective Tape	+34.4	0.0		REFLECTIVE TAPE
CPR105	+34.4	0.0		LT105
GRZ4	+23.1	-11.3		360P
GRZ122	+23.1	-11.3		GRZ122
GRZ101	+30.0	-4.4		360MINI

4th entry - target aperture/size (mm)

"38"

This field is highly recommended for Topcon instruments, it is the height of the glass part of the prism or the height of a tape/sheet target. If a user has multiple tape targets of different sizes it is recommended a user target with correct aperture to suit each one.

5th entry - target type

"ANY"

The instrument will be configured to measure to any surface, no defined target.

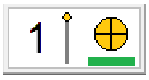
"TAPE"

The instrument will be configured to measure to a tape/sheet target, (Leica and Topcon only).

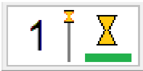
"PRISM", **"PRISM360"**

The instrument is configured to measure to a prism, the Topcon instruments distinguish between the circular and 360 types and use this settings internally, for all 3 manufacturers this setting is used to control the bitmap displayed in the control bar.

PRISM style bitmap:



PRISM360 style bitmap:



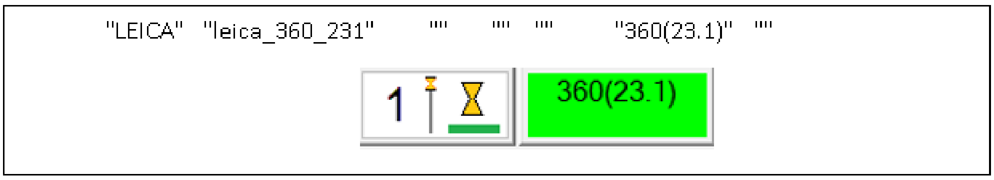
For information on TPS settings as Bitmaps see 15.5.2.5 TPS Settings Bitmaps.

6th entry - control bar text for target

"360(23.1)"

The text displayed in the target constant part of the control bar, a user description, maximum of 16 characters. When ***12d Field*** is started the longest user text will be used to size the control bar bitmap.

For example, a user overwrite of a Leica GRZ4 360 prism.



7th target - author

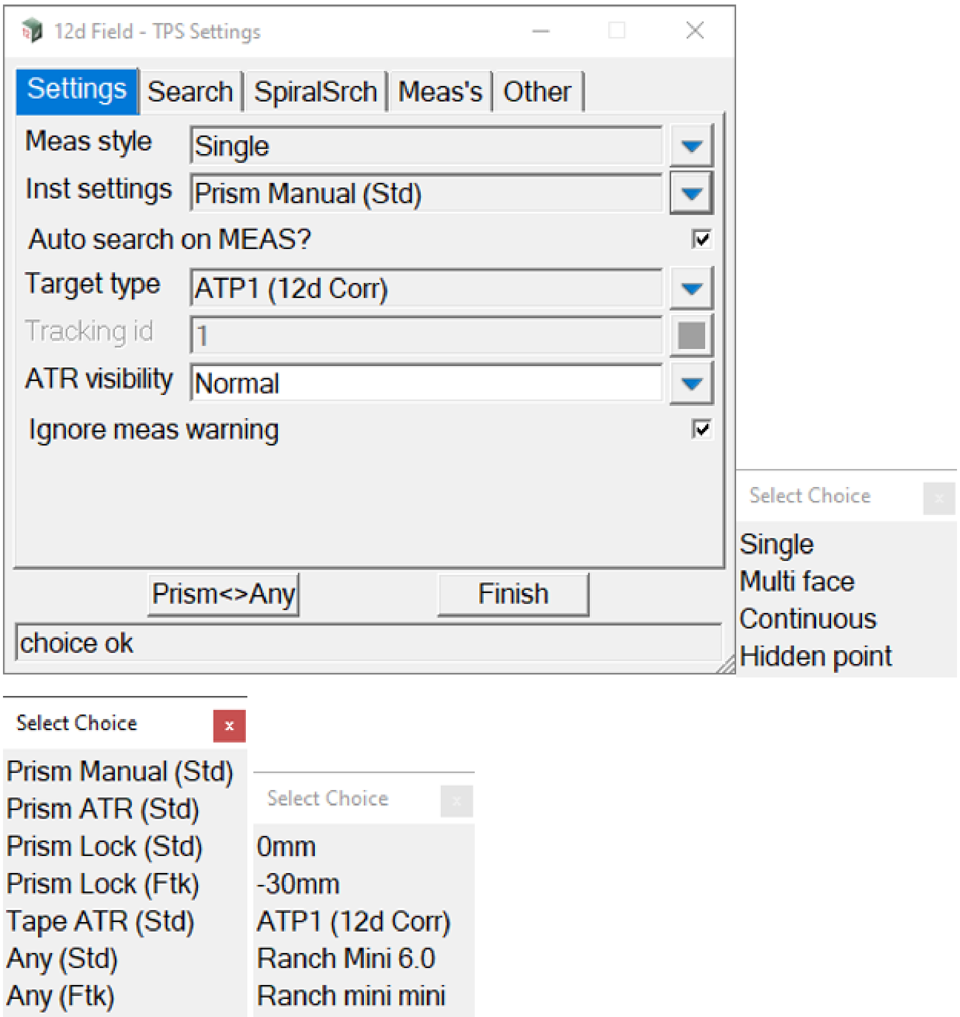
Informational only

An example of a combined file used with a Leica MS60, Trimble S8 and Topcon GT1200

```
"LEICA"   "leica_circ_0"          ""      ""    ""        "Circ(0.0)"   ""
"LEICA"   "leica_mini_360_300"    ""      ""    ""        "M360(30.0)"  ""
"LEICA"   "leica_360_231"         ""      ""    ""        "360(23.1)"   ""
"LEICA"   "leica_mini_0"          ""      ""    ""        "Mini(0.0)"   ""
"LEICA"   "leica_mini_175"        ""      ""    ""        "Mini(17.5)"  ""
"LEICA"   "leica_tape_344"        ""      ""    ""        "Tape(34.4)"  ""
"LEICA"   "leica_any"             ""      ""    ""        "Any(34.4)"   ""
"LEICA"   "Ranch Mini 6.0"        "6.0"   "24"  "PRISM"   "RM 6.0"      "Survey manager"
"LEICA"   "Ranch mini mini"       "28.0"  "12"  "PRISM"   "RMM 28.0"    "Survey manager"

"TOPCON"  "Ranch mini"            "-28.4" "24"  "PRISM"   "RM -28.4"    "Survey manager"
"TOPCON"  "Leica GPR1 Circ"       "-34.4" "50"  "PRISM"   "GPR1 -34.4"  "Survey manager"
"TOPCON"  "Leica GRZ4 360"        "-11.3" "47"  "PRISM360" "GRZ4 -11.3" "Survey manager"
"TOPCON"  "25mm sheet"            "0.0"   "25"  "TAPE"    "25.0 TAPE"   "Survey manager"
"TOPCON"  "topcon_360_ATP1_7_hc"  ""      ""    ""        "APT1 -7mm"   "Survey manager"

"TRIMBLE" "Ranch mini"            "-28.4" "24"  "PRISM"   "RM -28.4"    "Survey manager"
"TRIMBLE" "trimble_any"           "0.0"   ""    "ANY"     "Any(0.0)"    "Survey manager"
"TRIMBLE" "trimble_mini_ml7p5"    ""      ""    ""        "Mini 17.5"   ""
```

Continue to 15.8.2.1.1 TPS Settings as panel fields or return to 15.3 Starting and Configuring 12d Field .

15.8.2.1.1 TPS Settings as panel fields



Meas style	choice box	Single, Remote single, Multi face, Continuous, Hidden point

*Choose the 12d **Field** measurement style, see* 15.5.2.3 Measurement Programs .

Inst settings	choice box	dependent on instrument

Full list of instrument setting choices.

*Dependent on the **Meas style** selected and the instrument manufacturer and series many instrument setting combinations are offered.*

E.g.

Any Manual (Ftk)

Tape ATR (Std)

Prism Manual (Std)

Prism(I) A-lock (Ftk)

The prompt is comprised of

1. the prism and pole type

Any - *any surface.*

Tape - *to a reflective sheet.*

Prism - *to a standard circular or 360 prism.*

Prism(I) - *to a prism with id support.*

Prism(↓) - *to a prism with an automatic height pole.*

Prism(✓) - *to a prism with a tilt-height pole.*

Prism(I✓) - *to a prism with id support on a tilt-height pole.*

See 15.5.2.1 Target and Pole Types.

2. The point/follow mode, this can be Manual, ATR, Lock or A-lock, see 15.5.2.2 Target Pointing and Following Modes

3. The measurement program, this can be STD, FST, STK or FTK, see 15.5.2.3 Measurement Programs.

15.8.2.2 12dF_Battery_Levels.4D file format

The ***12dF_Battery_Levels.4D*** file allows the customization of user warnings about the battery level of the TPS instrument in use.

For each instrument a set of battery levels can be specified for internal and external batteries. The file is self-documenting and will not be documented here.

15.8.3 GNSS Configuration

See 15.8.3.1 12dF_GPS_MEAS_AVERAGE_SETTINGS.4D
See 15.8.3.2 12dF_GPS_PROFILES.4D file format

15.8.3.1 12dF_GPS_MEAS_AVERAGE_SETTINGS.4D

This file allows the user to define various GNSS averaging styles dependent on the style of survey being carried out. The file format is as follows, this is the default file created when ***12d Field*** starts for the 1st time. Note for the 2nd value, **minimum quality**, the text must match one of these 4 exactly.

```
// Predefined GNSS measure averaging settings
//
// 1st value name of style: "STANDARD"
// 2nd value minimum quality, choices: "GOOD" "AVRG" "POOR" "NORTK"
// 3rd value minimum number of readings: 5
// 4th value maximum number of readings: 10
// 5th value standard deviation xy : 0.015
// 6th value standard deviation  z : 0.025
//
//
"NONE" "NORTK" 0 1 1.0 1.0
"ROUGH" "NORTK" 2 4 1.0 1.0
"TOPO" "AVRG" 1 1 1.0 1.0
"STANDARD" "GOOD" 5 10 0.015 0.025
```

15.8.3.2 12dF_GPS_PROFILES.4D file format

This configuration file allows the storing of multiple GNSS instrument details. From V15C1k version 2 it also allows the optional storing of the phase centre value.

The file format is as follows:

```
version 2
// "Profile name" "Manufacturer" "Model" "Serial number" "Phase centre (optional)"
"GNSS Simulator" "12d" "Simulator" "SIM00001" // no phase centre
"12d Garmin GLO" "Garmin" "Unknown" "Unknown" // no phase centre
"12d R10" "Trimble" "R10" "5448485835"  0.149 // with phase centre.
```

15.8.4 Panel Configuration

See 15.8.4.1 12dF_AUTO_START_PANEL.4D file format
See 15.8.4.2 12dF_USER_VALUES_PANEL_CONFIG.4D file format
See 15.8.4.3 12dF_INFO_PAGE_CONFIG.4D file format
See 15.8.4.4 12dF_NAV_PAGE_CONFIG.4D file format
See 15.8.4.5 12dF_USER_TEXT_NAV.4D file format
See 15.8.4.6 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D file format
See 15.8.4.7 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D file format
See 15.8.4.8 12dF_USER_TEXT_PICKUP_MESSAGE.4D file format
See 15.8.4.9 12dF_USER_TEXT_SETOUT_MESSAGE.4D file format
See 15.8.4.10 12dF_USER_TEXT_BOX_INFO.4D file format
See 15.8.4.11 12DF_SDR_PICKUP_PANEL_BUTTON_LAYOUT.4D file format

15.8.4.1 12dF_AUTO_START_PANEL.4D file format

The ***12dF_AUTO_START_PANEL.4D*** file allows the user to have any number of panels appear on the screen when opening 12dField.

For example, a user for a TPS might always want the **Helmert Resection** to open automatically whenever starting ***12d Field*** with a TPS instrument.

The 1st line of the file start with **tps_panel**. The user simply pastes the panel names from the list commented out below in the file to this line for all panels to open when starting a **TPS** instrument.

Similarly, the 2nd line starts with **gps_panel** and contains the start up panels for **GNSS** instruments.

```
tps_panel inst_station_helmert_panel
gps_panel user_values_panel


// advanced_string_setout_panel
// basic_pickup_panel
// batter_setout_panel
// check_shot_panel
// check_coord_panel
// crossfall_setout_panel
// crown_setout_panel
// drainage_setout_panel
// face_pickup_panel
// grid_setout_panel
// gps_base_station_script_panel
// gps_create_nmea_pane
// gps_helmert_panel
// gps_occupy_point_panel
// gps_send_script_panel
// gps_settings_panel
// gps_status_panel
// inst_station_helmert_panel
// inst_station_lsa_panel
// inst_station_standard_panel
// inst_station_height_cal_panel
// leica_image_setup_panel
// measurement_offsets_panel
```

```
// measurement_rounds_panel
// names_panel
// pile_setout_panel
// point_setout_panel
// section_pickup_panel
// settings_panel
// sdr_pickup_panel
// single_segment_setout_panel
// basic_string_setout_panel
// trimesh_string_setout_panel
// soa_panel
// store_point_setup_panel
// target_height_panel
// surface_setout_panel
// tps_e_bubble_panel
// tps_joystick_panel
// tps_locate_prism_panel
// tps_position_panel
// tps_settings_panel
// tps_sim_settings_panel
// tps_status_panel
// tunnel_face_pickup_panel
// tunnel_face_scan_panel
// face_scan_panel
// tunnel_prs_define_panel
// tunnel_setout_panel
// user_values_panel
```

15.8.4.2 12dF_USER_VALUES_PANEL_CONFIG.4D file format

The content shown on the **TPS** and **GNSS User Values** panels are controlled by this file.

The file is a simple text format and all data after a pair of forward slashes "//" is considered a comment and removed on reading the file.

The file format is as follows.

st_version_conf 28

The first line is a configuration value, the file will be reset if this does not match the internal 12dfield configuration version number.

TPS

This line indicates the following attributes will be added in file order to the 15.6.4.4 Check User Values - TPS panel

GPS

This line indicates the following attributes will be added in file order to the 15.6.15.2 User values - GNSS panel

1 st_is_th // Target height

The attribute lines start with a **1** (on) or **0** (off) indicating whether an attribute is added, or not added, to the panel, and then the attribute name followed by a comment with the description of that attribute.

The following shows the default file created by ***12d Model*** which has all available attributes for **TPS** and **GNSS** instruments.

```
st_version_conf     28
```

```
TPS

0 su_is_setup_type_text            // Instrument setup type
0 su_is_id                         // alphanumeric id of the instrument setup point.
0 su_is_hi                         // height of the instrument above the setup point.
0 su_is_x                          // easting of the instrument station setup.
0 su_is_y                          // northing of the instrument station setup.
0 su_is_z                          // height of the instrument station setup point.
0 pu_tps_running_f1_ha             // face 1 horizontal mathematical angle to the
                                   //    current running point
1 pu_tps_running_f1_hb             // face 1 horizontal bearing to
                                   //   the current running point
1 pu_tps_running_f1_va             // face 1 vertical zenith angle to
                                   //   the current running point
1 pu_tps_running_sd                // TPS slope distance to the current running point
1 pu_tps_running_face              // TPS face to the current running point
1 st_is_th                         // Target height
1 st_is_extra_th                   // Extra target height, a temporary value added
                                   //   to the current target height.
1 pu_mp_x                          // easting of the last measured point
1 pu_mp_y                          // northing of the last measured point
1 pu_mp_z                          // elevation of the last measured point
1 pu_mp_id                         // ID given to the last measured point
1 pu_tps_corr_hb        // true/grid horizontal bearing in to the last measured point
0 pu_tps_corr_ha        // true/grid horizontal mathematical angle to
                        //   the last measured point.
0 pu_tps_ha                        // last measured horizontal mathematical angle.
0 pu_tps_hb                        // last measured horizontal bearing.
0 pu_tps_va                        // zenith vertical angle to the last measured point
0 pu_tps_sd                        // TPS slope distance to the last measured point
0 pu_tps_hd                        // horizontal distance with geodetics applied to
                                   //   the last measured point
0 pu_tps_vd                        // vertical distance to the last measured point
0 st_tps_scale_factor_type_text    // type of scale factor to
                                   //    apply to horizontal distances
1 pu_tps_applied_scale_factor      // Applied h-dist sf
0 st_tps_manual_scale_factor       // scale factor to be applied to
                                   //   measured horizontal distances.
0 pu_tps_point_scale_factor        // Grid scale factor
0 pu_tps_height_scale_factor       // Height scale factor
0 pu_tps_combined_scale_factor     // Combined scale factor
0 pu_tps_n_value                   // N-value

GNSS

1 pu_mp_x                          // easting of the last measured point
1 pu_mp_y                          // northing of the last measured point
1 pu_mp_z                          // elevation of the last measured point
0 pu_gps_hrms                      // horizontal root mean square value of
                                   //   the last measured point
0 pu_gps_vrms                      // vertical root mean square value of the
                                   //   last measured point
0 pu_gps_dilution_of_precision     // dilution of precision of the
                                   //   last measured point
0 pu_gps_gn_latency                // latency of the last measured point
0 pu_gps_latrms                    // latitude rms value of the last measured point
0 pu_gps_lonrms                    // longitude rms value of the last measured point
0 pu_gps_tilt_quality_text         // calculation state of the GNSS tilt pole to
                                   //   the last measured point
0 pu_gps_tilt_hb                   // horizontal bearing of the tilt of the
                                   //   GNSS tilt pole at the last measured point
0 pu_gps_tilt_va                   // angle of lean of the GNSS tilt pole at
                                   //   the last measured point
0 pu_gps_tilt_en_acc_mm            // estimated coordinate error accuracy in mm of a
                                   //    GNSS tilt pole at the last measured point
0 pu_gps_tilt_h_acc_mm             // estimated height error accuracy in mm of a
                                   //   GNSS tilt pole at the last measured point
1 pu_gps_running_hrms              // horizontal root mean square value of
                                   //   the current running point
```

```
1 pu_gps_running_vrms               // vertical root mean square value of
                                    //   the current running point
1 pu_gps_running_dilution_of_precision    // The dilution of precision at
                                          //   the current running point
1 pu_gps_running_gn_latency         // latency of the measurements at the
                                    //   current running point.
0 pu_gps_running_latrms             // latitude rms value of the current running point
0 pu_gps_running_lonrms             // longitude rms value of the current running point
1 pu_gps_running_tilt_quality_text  // calculation state of the tilt pole at
                                    //   the current running point
0 pu_gps_running_tilt_hb          // bearing of the tilt pole at the current running point
0 pu_gps_running_tilt_va    // angle of lean of the tilt pole at the current running point
1 pu_gps_running_tilt_en_acc_mm     // estimated coordinate error accuracy in mm of
                                    //   the tilt pole at the current running point.
1 pu_gps_running_tilt_h_acc_mm      // The estimated height error accuracy in mm of
                                    //   the tilt pole at the current running point
```

15.8.4.3 12dF_INFO_PAGE_CONFIG.4D file format

The configuration format of the navigation and information pages are identical, please see 15.8.4.4 12dF_NAV_PAGE_CONFIG.4D file format for details.

15.8.4.4 12dF_NAV_PAGE_CONFIG.4D file format

The contents of the navigation tab on supported panels and the navigation plan view are controlled in this file.

The file is a simple text format, all data after a pair of forward slashes // is considered a comment and removed on reading the file.

The file format is as follows, the first line a configuration value, the file will be reset if this does not match the internal 12dfield configuration version number.

st_version_conf 28

The start of the settings for a panel have the keyword **INFO** followed by the panel type, e.g.

INFO SINGLE_STRING

Note when you open a panel, default settings for that panel are added to the file if they don't exist.

Then a list of attributes to be added to the panel is terminated by the next panel type or the end of file. Attributes are prefixed by 0 or 1, if 0 the attribute is not used, if 1 added to the message line.

A very simple example for the string and point setout panels.

```
st_version_conf 28
INFO SINGLE_STRING
1 pu_mp_cs_dch
0 pu_mp_cs_htdf
1 pu_mp_sp_dos
1 pu_mp_vp_dht
INFO POINT
1 pu_mp_vp_dht
1 pu_mp_x
1 pu_mp_y
1 pu_mp_z
INFO SURFACE
```

Lines that do not have 2 words or contain an unknown attribute are ignored.

There is no definitive list available of attributes that can be added to the navigation tab/views at this point in time.

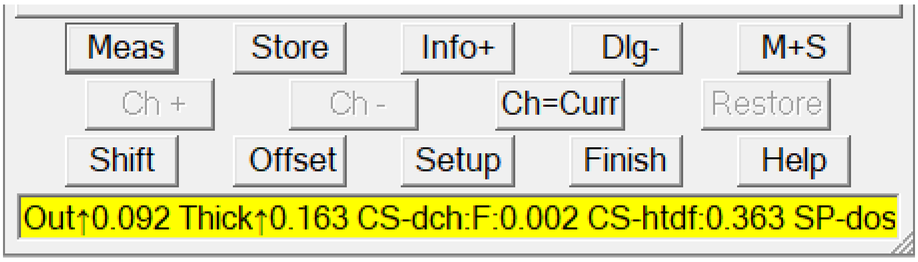
15.8.4.5 12dF_USER_TEXT_NAV.4D file format

The ***12dF_USER_TEXT_NAV.4D*** file allows the user to overwrite the text that appears on the navigation tab and navigation plan view. It is simply a list of attributes and the text overrides for those attributes.

```
// User definable nav page text.
// Space quote separated please.
// Format: Attribute_name "New nav page text"
//
// E.g. for the setout/pickup chainages on the control string
//
pu_vcut_cs_ch2d "pu CS Ch :"
so_vcut_cs_ch2d "so CS Ch :"
```

15.8.4.6 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D file format

The user is able to configure values to display in the message area of 12d Field panels after a reading is taken.



What is added to the panel message lines is controlled the file **12dF_PICKUP_MESSAGE_LINE_CONFIG.4D.**

The file format is as follows, the first line a configuration value, the file will be reset if this does not match the internal 12dfield configuration version number.

st_version_conf 28

The start of the settings for a panel have the key work **INFO** followed by the panel type, e.g.

INFO SINGLE_STRING

Note - when you open a panel default settings for that panel are added to the file if they don't exist.

Then a list of attributes to be added to the message line terminated by the next panel type or the end of file. Attributes are prefixed by 0 or 1, if 0 the attribute is not used, if 1 added to the message line.

An very simple example for the string and point setout panels.

```
st_version_conf 28
INFO SINGLE_STRING
1 pu_mp_cs_dch
0 pu_mp_cs_htdf
1 pu_mp_sp_dos
1 pu_mp_vp_dht
INFO POINT
1 pu_mp_vp_dht
1 pu_mp_x
1 pu_mp_y
1 pu_mp_z
INFO SURFACE
.
.
.
```

The navigation page attributes **st_nav_box_ori_left_right_text** and **st_nav_box_ori_to_from_text** can also be added to the message line. Dependent on the navigation setting, **Centreline**, **To Station** the to/from left/right numbers will change to suit.

This file only controls the adding of attributes to the message line, for extra functionality customizing the display of the attributes see 15.8.4.8 12dF_USER_TEXT_PICKUP_MESSAGE.4D file format.

For a list of attributes, in alphabetical order that are supported for use in the pickup message line config file, see 15.8.4.6.1 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D supported attributes.

15.8.4.6.1 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D supported attributes

The following list of attributes, in alphabetical order are supported for use in the pickup message line config file.

diff_z_norm

diff_z_vert

pu_cs_ch

pu_mp_cs_dch

pu_mp_cs_dht

pu_mp_cs_dos

pu_mp_cs_htdf

pu_mp_cs_os

pu_mp_id

pu_mp_pdrp_vp_dht

pu_mp_sc_dht

pu_mp_sc_dos

pu_mp_sc_os

pu_mp_sg_dhd

pu_mp_sg_dht

pu_mp_sg_dsd

pu_mp_sg_htdf

pu_mp_sp_dos

pu_mp_sp_dx

pu_mp_sp_dy

pu_mp_sp_hd

pu_mp_sp_sd

pu_mp_ss_htdf

pu_mp_ss_os

pu_mp_vdrp_br_dht

pu_mp_vdrp_vp_dht

pu_mp_vl_dht

pu_mp_vp_dht

pu_mp_vp_htdf

pu_mp_vr_dht

pu_mp_x

pu_mp_y

pu_mp_z

pu_pcut_cs_ch2d

pu_pcut_cs_ch3d

pu_pcut_mp_cs_dch2d

pu_pcut_mp_cs_dch3d

pu_pcut_mp_cs_dht

pu_pcut_mp_cs_dist

pu_pcut_mp_cs_dos

pu_pcut_mp_cs_htdf

pu_pcut_mp_cs_os

pu_pcut_mp_pdrp_vp_dht

pu_pcut_mp_sp_dos

pu_sf_p_slp_vh

pu_sf_slp_vh

pu_sf_v_slp_vh

pu_tps_hd

pu_tps_sd

pu_tps_vd

pu_tun_del_ele_os

pu_tun_del_prf_ch

pu_tun_diff_ele_os

pu_tun_diff_prf_ch

pu_vcut_cs_ch2d

pu_vcut_cs_ch3d

pu_vcut_mp_cs_dch2d

pu_vcut_mp_cs_dch3d

pu_vcut_mp_cs_dht

pu_vcut_mp_cs_dos

pu_vcut_mp_cs_os

pu_vcut_mp_pdrp_vp_dht

pu_vcut_mp_sc_os

pu_vcut_mp_sp_dos

pu_vcut_mp_vdrp_vp_dht

pu_vcut_mp_vl_dht

pu_vcut_mp_vr_dht

pu_vcut_s1_cs_os

pu_vcut_s2_cs_os

pu_vcut_sc_ch2d

pu_vcut_vp_slp_hv

pu_vcut_vp_slp_vh_per

pu_vcut_vp_slp_vh

pu_vp_slp_hv

pu_vp_slp_vh_per

so_cyl_pile_rl_b

so_cyl_pile_rl_t

so_offset_point_base_dir

so_offset_point_base_dist

so_ps_id

so_sp_id

st_gui_text_away

st_gui_text_left

st_gui_text_right

st_gui_text_to

st_nav_box_ori_left_right_text

st_nav_box_ori_to_from_text

st_tol_pav_above_max_thickness_value

st_tol_pav_above_tol_value

st_tol_pav_actual_thickness

st_tol_pav_below_min_thickness_value

st_tol_pav_below_tol_value

st_tol_pav_diff_z_vert

st_tol_pav_in_tol_value

st_tol_pav_out_of_thickness_value

st_tol_pav_out_of_tol_value

st_tps_target_internal_name

15.8.4.6.2 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D fallback attributes

Some attributes are configured to fall back to another attribute if invalid. For example, if a **setout chainage** is not entered then there is no **delta chainage**, in this case the raw **chainage** is displayed if valid.

The fallback attribute pairs are

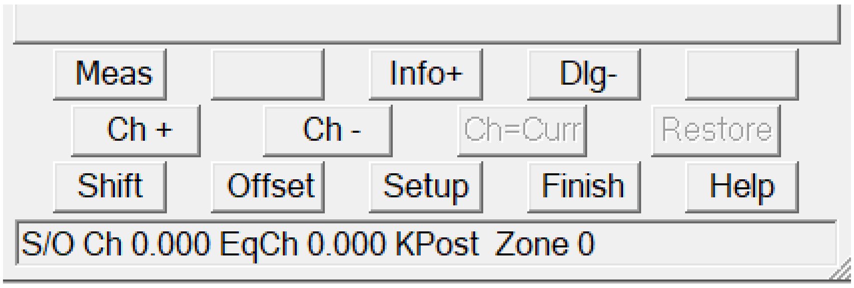
delta chainage to actual chainage: **pu_mp_cs_dch >> pu_cs_ch**

delta offset to offset from setout string: **pu_mp_sp_dos >> pu_mp_ss_os**

delta height to height diff from virtual point: **pu_mp_vp_dht >> pu_mp_vp_htdf**

15.8.4.7 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D file format

The user is able to configure values to display in the message area of ***12d Field*** panels after a setout value is entered.



What is added to the panel message lines is controlled the file

12dF_SETOUT_MESSAGE_LINE_CONFIG.4D.

The file format is as follows, the first line a configuration value, the file will be reset if this does not match the internal 12d field configuration version number.

st_version_conf 28

The start of the settings for a panel have the key work **INFO** followed by the panel type, e.g.

INFO SINGLE_STRING

Note - when you open a panel, default settings for that panel are added to the file if they don't exist.

Then a list of attributes to be added to the message line terminated by the next panel type or the end of file. Attributes are prefixed by 0 or 1, if 0 the attribute is not used, if 1 added to the message line.

A very simple example for the string setout panel.

```
st_version_conf 28
INFO SINGLE_STRING
1 st_cs_special_ch_text
1 so_vcut_cs_ch2d
1 so_vcut_cs_ch2d_eq
0 so_pcut_cs_ch2d
INFO POINT
.
.
.
```

For a list of attributes, in alphabetical order that are supported for use in the setout message line config file, see 15.8.4.7.1 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D supported attributes .

15.8.4.7.1 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D supported attributes

The following list of attributes, in alphabetical order are supported for use in the setout message line config file.

pu_mp_id

so_cyl_pile_radius

so_pcut_cs_ch2d

so_pcut_cs_ch3d

so_ps_id

so_sp_id

so_sp_ss_os

so_vcut_cs_ch2d_eq

so_vcut_cs_ch2d_kp

so_vcut_cs_ch2d

so_vcut_cs_ch2d_zn

so_vcut_cs_ch3d

st_cs_special_ch_text

15.8.4.8 12dF_USER_TEXT_PICKUP_MESSAGE.4D file format

The **12dF_USER_TEXT_PICKUP_MESSAGE.4D** file allows user customisation of attributes added to panel message lines. See 15.8.4.6 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D file format for the basics of adding pickup attributes to panel message lines and for supported attributes see 15.8.4.6.1 12dF_PICKUP_MESSAGE_LINE_CONFIG.4D supported attributes.

The default file has the details for configuring attributes.

```
// User definable pickup message text, this is the message
// displayed in the 2nd message box after pressing measure.
//
// Note from version 12 you can overwrite the +/- sign with user text,
// these are the optional 3rd and 4th parameters.
//
// Also note the user should provide white spacing or other after the user // text otherwise the value will be immediately after the user text.
//
// Format: Attribute_name "User text" "+ overwrite" "- overwrite"
//
// E.g. for the delta chainage
//
// pu_mp_cs_dch "dCh: " "Fwd: " "Bck: "
//
```

The text used for the navigation page attributes added to the message line, **st_nav_box_ori_left_right_text** and **st_nav_box_ori_to_from_text** can also be controlled in this file.

To customize the **standard to/from**, **left/right** text for all navigation settings other than **Centreline** use the following attributes as follows noting the +/- overwrite are left blank as ignored for these special settings.

st_gui_text_away “Away” “” “”

st_gui_text_to “To” “” “”

st_gui_text_left “Left” “” “”

st_gui_text_right “Right” “” “”

For the **Centreline** setting the text can be overwritten as such

st_gui_text_away_cl “Forward” “” “”

st_gui_text_to_cl “Back” “” “”

st_gui_text_left_cl “Left” “” “”

st_gui_text_right_cl “Right” “” “”

15.8.4.9 12dF_USER_TEXT_SETOUT_MESSAGE.4D file format

The **12dF_USER_TEXT_SETOUT_MESSAGE.4D** file allows user customisation of setout attributes added to panel message lines. See 15.8.4.7 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D file format for the basics of adding setout attributes to panel message lines and for supported attributes see 15.8.4.7.1 12dF_SETOUT_MESSAGE_LINE_CONFIG.4D supported attributes

The default file has the details for configuring attributes.

```
// User definable setout message text, this is the message displayed in the 2nd message box.
// in the dialog upon pressing CH+,CH- etc.
// Space quote separated please.
// Format: Attribute_name "New setout message"
//
// E.g. for the setout chainage on the control string
//
so_vcut_cs_ch2d "S/O Ch"
//
```

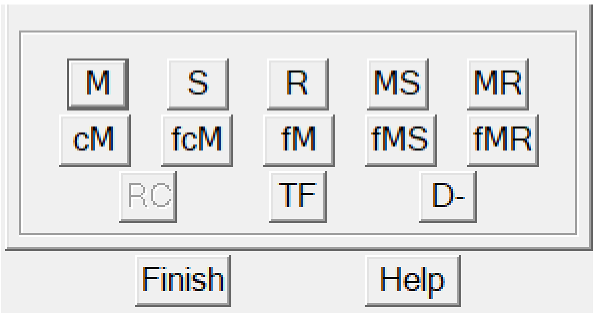
15.8.4.10 12dF_USER_TEXT_BOX_INFO.4D file format

The 12dF_USER_TEXT_BOX_INFO.4D file allows the user to overwrite the text that appears on the 12dField panels and Info panels. It is simply a list of attributes and the text overrides for those attributes.

```
// User definable box/info page text.
// Space quote separated please.
// Format: Attribute_name "New dialog/info page text"
//
// E.g. for the pickup chainages on the control string
//
pu_vcut_cs_ch2d "MP--CS vdrop 2d ch"
```

15.8.4.11 12DF_SDR_PICKUP_PANEL_BUTTON_LAYOUT.4D file format

This file allows customizing the measurement keys on the **SDR Pickup** panel, the default arrangement for the panel and the minimised panel is as follows:



From V15C1k the default configuration file is written out is as follows, any customisations in a previous file will be lost. Note the default configuration file is self explanatory so details in this section are deliberately minimal. From version 3, V15C1k the user can customize the button text in the **alias** section of the file, customise the buttons used and their positions in the **panel** section, and similarly for the minimised panel in the **toolbar** section.

```
version 3

// SDR panel/toolbar button config
//
// Configure the layout of the SDR Pickup Panel/Toolbar buttons
// There can be up to 4 rows of buttons, any more than that will be ignored.
//
// M   : Measure only.
// S   : Store prompting for attributes.
// R   : Record, stores using prefilled attributes.
// MS  : Measure & store prompting for attributes
// MR  : Measure & store using prefilled attributes
// cM  : Confirm measure, can store/record from the confirm panel.
// fcM : Delayed, full screen tap confirm measure, can store/record from the confirm panel.
// fM  : Delayed, full screen tap measure.
// fMS : Delayed, full screen tap measure & store prompting for attributes
// fMR : Delayed, full screen tap measure & store using prefilled attributes
//
// RC  : Recalc function
// TF  : Traverse foresight, (TPS only)
// D-  : Minimise the SDR panel
// D+  : Restore the SDR panel
// ST  : Stop a measurement, this is a text override of the M button only.

alias

// In this section override the button text by filling in the second field,
// leave blank for standard.
// E.g. for the measure button
```

```
// M "Meas"

M ""
S ""
R ""
MS ""
MR ""
cM ""
fcM ""
fM ""
fMS ""
fMR ""
RC ""
TF ""
D- ""
D+ "
"ST ""

panel

// In this section organise the buttons as needed on the panel
// 4 lines maximum, anymore will be ignored.
M S R MS MR
cM fcM fM fMS fMR
RC TF D-

toolbar

// In this section organise the buttons as needed on the toolbar, 4 lines maximum, anymore
will be ignored.

M S R MS MR
cM fcM fM fMS fMR
RC TF D+
```

15.8.5 General Configuration

See

15.8.5.1 Search paths in 12d Field

All of 12d Field configuration files are text files, all settings for instruments, panels and general settings are completely customised via these files.

How 12d Field configuration files are set up is very dependent on the user's needs. It would often be close to the sharing/Synergy configurations in use but allows its own tweaks to the overall environment.

See 15.8.5.1.1 Existing Files .

See 15.8.5.1.2 New Files .

See 15.8.5.1.3 12dF_Global_Config.4D .

15.8.5.1.1 Existing Files

When searching for an existing file ***12d Field*** will search via the standard paths with one exception. If the directory **12dF_Current_Settings** exists in the working directory ***12d Field*** will search here first before then using the standard search path. **12dF_Current_Settings** is new for V15.

Continue to 15.8.5.1.2 New Files or return to 15 12d Field .

15.8.5.1.2 New Files

If a 12d Field configuration file is not found ***12d Field*** will create a new file and populate it with default values. By default all 12d Field config files are created in the USER area however if the environment variable **TDF_CONFIGS_IN_USER_DIR_4D** is found and value set to 0 the new files will be created in the working directory.

Continue to 15.8.5.1.3 12dF_Global_Config.4D or return to 15 12d Field .

15.8.5.1.3 12dF_Global_Config.4D

12dF_Global_Config.4d stores many of the settings that are in theory global across all of a user's 12dField projects. While this might be the case for a majority of the attributes the user has the ability to split where it's attributes are sourced from and saved to over the **USER**, **CUSTOMER_USER** and working directories.

Important, the user must set the path to **CUSTOMER_USER** via the **CUSTOMER_USER_4D** environment variable to be able to use that directory.

12d Field looks for 3 separate files when reading its global attributes, **12dF_GLOBAL_CONFIG.4D**, **12dF_CUSTOMER_CONFIG.4D** and **12dF_WORKING_CONFIG.4D**, these are searched for via the standard paths. Note by default these files are created in the standard areas so if a user wishes to make use of **12dF_CUSTOMER_CONFIG.4D** in the **CUSTOMER_USER** directory the file must be manually moved there.

Firstly, the attribute will be searched for in **12dF_GLOBAL_CONFIG.4D**, this means if the user does not want to source an attribute from this file they must comment out or remove the line from this file and add it to the file they wish it to be sourced from.

Secondly, the attribute will be searched for in 1**2dF_CUSTOMER_CONFIG.4D**, the attribute will have needed to have been removed from the global file and pasted here.

If still not found the attribute will then be searched for in **12dF_WORKING_CONFIG.4D**.

For example, each surveyor in an organization might have their own preference for hotkey bars layout and content, here it is desirable to store these in the **CUSTOMER_USER** area as this can be unique to each user.

In the **12dF_GLOBAL_CONFIG.4D** these lines will need to be commented out as such with the // characters or removed completely. If commented out they will not be written to file the next time the file is saved.

```
//st_hotkeys_bar_1 1 0
//st_hotkeys_bar_1_x 1 1842
//st_hotkeys_bar_1_y 1 258
//st_hotkeys_bar_1_tps_keys 1 XYZ STD TPS BAR
//st_hotkeys_bar_1_gps_keys 0
```

And added to **12dF_CUSTOMER_CONFIG.4D** without the comments.

```
st_hotkeys_bar_1 1 0
st_hotkeys_bar_1_x 1 1842
st_hotkeys_bar_1_y 1 258
st_hotkeys_bar_1_tps_keys 1 FREDS TPS BAR
st_hotkeys_bar_1_gps_keys 0
```

Continue to 15.8.5.2 12dF_EXCLUDED_ATTRIBUTES.4D file format or return to 15 12d Field .

15.8.5.2 12dF_EXCLUDED_ATTRIBUTES.4D file format

The ***12dF_EXCLUDED_ATTRIBUTES.4D*** file is simply a list of attributes the user does not want added to the vertex attributes of a stored surveyed point. It is up to the user to build the list of attributes they do not want stored, simply one per line of this file.

```
//
cv_tps_unwanted_attr_1
cv_tps_unwanted_attr_2
```

Continue to 15.8.5.3 12dF_USER_KEYS.4D file format or return to 15.8.5 General Configuration or 15 12d Field .

15.8.5.3 12dF_USER_KEYS.4D file format

12d Field can be largely operated via user definable keys that can do things like open panels, toggle instrument settings and simulate button presses on panels.

The user keys can be operated via the keyboard, toolbars or special hotkey bars.

The ***12dF_USER_KEYS.4D*** file itself is large and contains the documentation on usage and so will not be shown here.

Continue to 15.8.5.4 12d Field and User_Toolbars.4d or return to 15.8.5 General Configuration or 15 12d Field .

15.8.5.4 12d Field and User_Toolbars.4d

This section describes adding ***12d Field*** commands to the ***User_toolbars.4d*** file. See 34.1 User Defined Function Keys for more information on User toolbars.

A sample custom toolbar in the ***user_toolbars.4d*** file for ***12d Field*** is:

```
Toolbar "12dField Setout" {

  Button "Joystick Left" {
    Command "12dfield joystick_left_new"
    Icon    "TDF_User_Joystick_Left.bmp"
  }

  Button "Joystick Stop" {
    Command "12dfield joystick_stop"
    Icon    "TDF_User_Joystick_Stop.bmp"
  }
}
```

Note each command starts with **12dfield** followed by the user key.

Commands can also have multiple parameters.

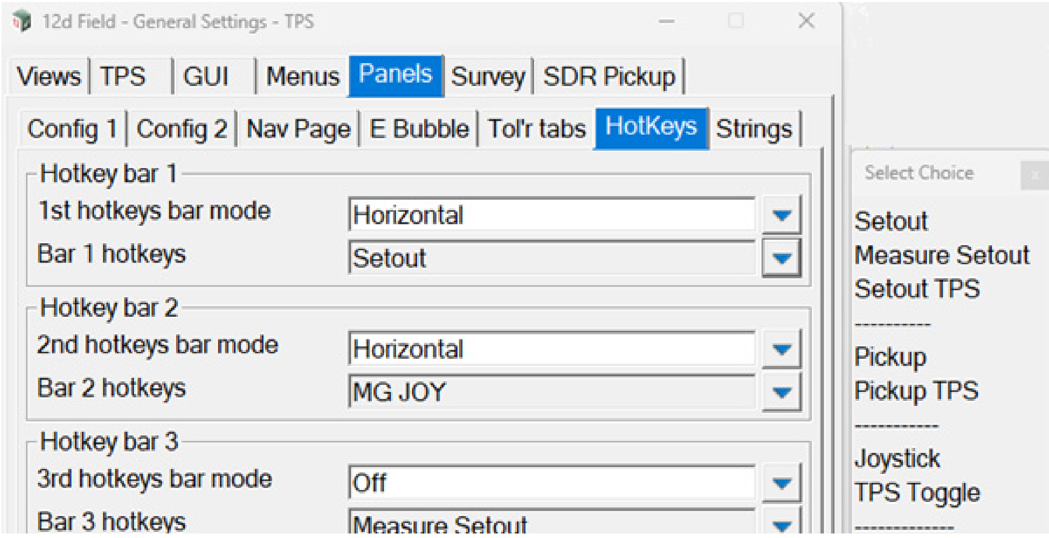
For example, the command to set a Leica TPS to manual pointing at a tape target is:

```
"12dfield inst_toggle_measure_mode tps_sngl_ppr_mnl_std leica_tape"
```

Continue to 15.8.5.5 12dF_HOTKEY_BARS.4D file format or return to 15.8.5 General Configuration or 15 12d Field.

15.8.5.5 12dF_HOTKEY_BARS.4D file format

The ***12dF_HOTKEY_BARS.4D*** file defines the choices available for the 4 hotkey bars.



The file consists of groups of user keys to be added to the hotkey bars.

The start of the group is the name of the group enclosed in square brackets [] (e.g. [Setout]) followed by lines with 3 words: a user key, a name for the user key and bitmap to use for the hotkey bar,.

For example

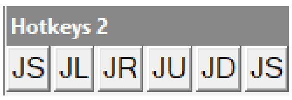
"point_setout_panel"   "Point SO"   "TDF_HOTKEY_Point_Setout.bmp"

If the **bitmap** is left blank then the text is used in the hotkey bar.

For example, the file

```
[JOY]

"joystick_stop"                 "JS" ""
"joystick_left"                 "JL" ""
"joystick_right"                "JR" ""
"joystick_up"                   "JU" ""
"joystick_down"                 "JD" ""
"joystick_stop"                 "JS" ""
```

will create



A typical file configuration follows.

```
[Setout]
"point_setout_panel"         "Point SO"      "TDF_HOTKEY_Point_Setout.bmp"
"basic_string_setout_panel"  "Single Str SO" "TDF_HOTKEY_String_Setout.bmp"
"surface_setout_panel"       "Surface SO"    "TDF_HOTKEY_Tin_Setout_1.bmp"
"basic_pickup_panel"         "Basic Pickup"  "TDF_HOTKEY_Basic_Pickup.bmp"
"batter_setout_panel"        "Batter SO"     "TDF_HOTKEY_Batter_Setout.bmp"
```

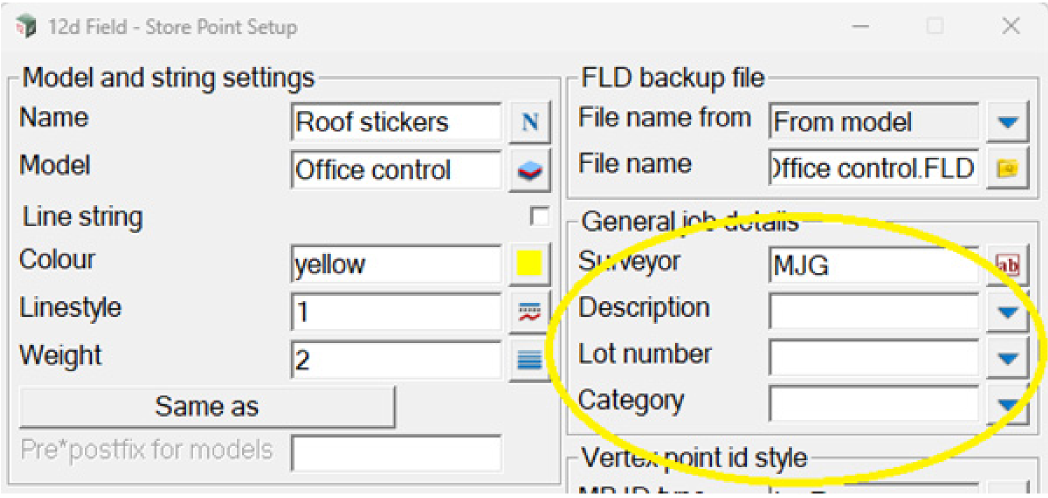
```
"pile_setout_panel"          "Pile SO"       "TDF_HOTKEY_Pile_Setout.bmp"
"crossfall_setout_panel"     "X Fall SO"     "TDF_HOTKEY_Crossfall_Setout.bmp"
"crown_setout_panel"         "Crown SO"      "TDF_HOTKEY_Crown_Setout.bmp"
"settings_panel"             "Settings"      "TDF_HOTKEY_settings.bmp"

[Measure Setout]
"measure"       "Meas"      "TDF_HOTKEY_Measure.bmp"
"measure_store" "MeasStore" "TDF_HOTKEY_Measure_STORE.bmp"
"store"         "Store"     "TDF_STORE.bmp"
"inc_chainage"  "ChInc"     "TDF_HOTKEY_Inc_Chainage.bmp"
"dec_chainage"  "ChDec"     "TDF_HOTKEY_Dec_Chainage.bmp"
```

For available user keys see 15.8.5.3 12dF_USER_KEYS.4D file format .

Continue to 15.8.5.6 12dF_JOB_CATEGORIES.4D file format or return to 15.8.5 General Configuration or 15 12d Field .

15.8.5.6 12dF_JOB_CATEGORIES.4D file format

The ***12dF_JOB_CATEGORIES.4D*** file and the related ***12dF_JOB_DESCRIPTIONS.4D*** and ***12dF_JOB_LOT_NUMBERS.4D*** files are used to populate the highlighted fields on the **Store Point Setup** panel.



Usage of the files is optional and they all are simple lines of text.

```
//Example job categories for 12d field
//
Subgrade Pickup
Bottom Select Pickup
Tunnel conformance
Service Pickup
```

Continue to 15.8.5.7 12dF_JOB_DESCRIPTIONS.4D file format or return to 15.8.5 General Configuration or 15 12d Field.

15.8.5.7 12dF_JOB_DESCRIPTIONS.4D file format

See 15.8.5.6 12dF_JOB_CATEGORIES.4D file format for details.

Continue to 15.8.5.8 12dF_JOB_LOT_NUMBERS.4D file format or return to 15.8.5 General Configuration or 15 12d Field.

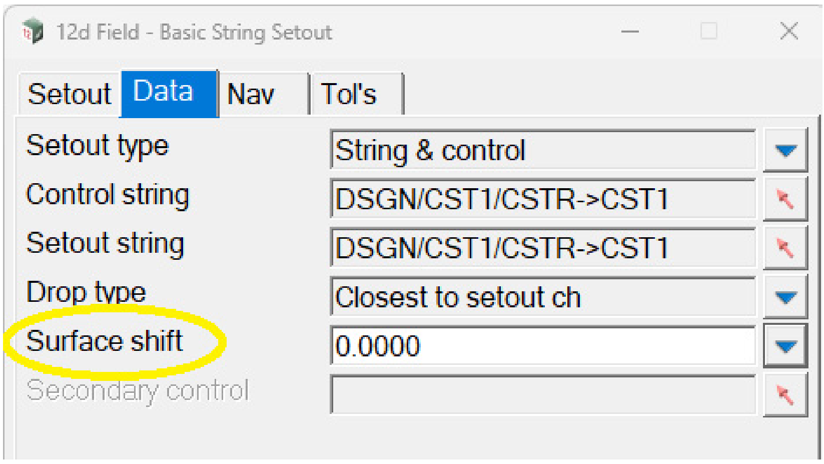
15.8.5.8 12dF_JOB_LOT_NUMBERS.4D file format

See 15.8.5.6 12dF_JOB_CATEGORIES.4D file format for details.

Continue to 15.8.5.9 12dF_SURFACE_SHIFTS.4D file format or return to 15.8.5 General Configuration or 15 12d Field.

15.8.5.9 12dF_SURFACE_SHIFTS.4D file format

The ***12dF_SURFACE_SHIFTS.4D*** file can be used to populate the **Surface shift** field on the **Setout** panels.



The file is a simple list of numbers.

```
0.0000
-0.237
-0.362
-0.662
```

The Setout panels will prompt to add a number to this file if a number entered in the panel field is not in the file.

Continue to 15.8.5.10 12dF_VIEWS.4D file format or return to 15.8.5 General Configuration or 15 12d Field .

15.8.5.10 12dF_VIEWS.4D file format

The 12dF_VIEWS.4D file contains a list customisable names for the standard 12dField views. When 12dField starts this file is read and if a view with this name does not exist it will be created.

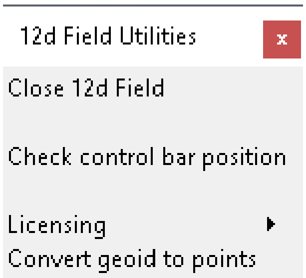
```
plan_view_name              "12dF Plan"
pickup_section_view_name "12dF PU Sect"
setout_section_view_name "12dF SO Sect"
nav_box_plan_view_1_name "12dF Nav 1"
nav_box_plan_view_2_name "12dF Nav 2"
perspective_view_name     "12dF Pers"
tun_plan_view_name        "12dF Tunnel"
```

Continue to 15.9 12d Field Utilities or return to 15.8.5 General Configuration or 15 12d Field .

15.9 12d Field Utilities

Position of menu: **Survey =>12d Field =>12d Field Utilities**

The **12d Field Utilities** walk right menu is:



See

15.9.1 Close 12d Field

15.9.2 Check Control Bar Position

15.9.3 Licensing

15.9.4 Convert Geoid to Points

15.9.1 Close 12d Field

Position of option on menu: **Survey =>12d Field =>12d Field Utilities => Close 12d field**

If pressed and ***12d Field*** is not running then an error is displayed.

If pressed and ***12d Field*** is running then the standard ***12d Field*** shutdown panel is displayed.

Continue to next section 15.9.2 Check Control Bar Position or return to 15.3 Starting and Configuring 12d Field .

15.9.2 Check Control Bar Position

Position of option on menu: **Survey =>12d Field =>12d Field Utilities =>Check control bar position**

If pressed and ***12d Field*** is not running an error is displayed.

If pressed and ***12d Field*** is running then two things happen:

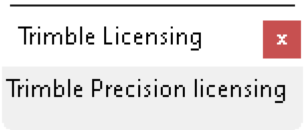
1. The position of the control bar is checked and if fully or partially outside the ***12d Model*** screen the control bar will be moved to the centre of the ***12d Model*** screen.
2. Then, moved or unmoved, the ***12d Field*** control bar will be refreshed and brought to the front of the ***12d Model*** screen.

Continue to next section 15.10 12d Field Codes or return to 15.3 Starting and Configuring 12d Field .

15.9.3 Licensing

Position of menu: **Survey =>12d Field =>12d Field Utilities =>Licensing**

The **Licensing** walk right menu is:



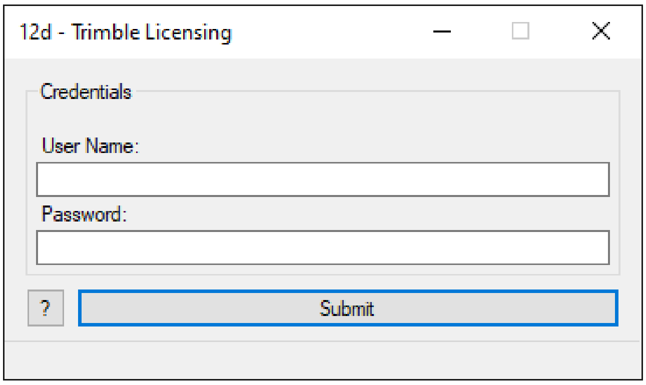
See
15.9.3.1 Trimble Precision Licensing

15.9.3.1 Trimble Precision Licensing

Position of menu: **Survey =>12d Field =>Utilities =>Trimble Precision licensing**

To connect to a Trimble or Spectra instrument the user must first licence their computer/tablet for use with the Trimble libraries. To use this option the user must have a valid Trimble login and administrative rights for the computer.

Clicking on **Trimble Precision licensing** runs the Trimble program ***TrimbleLicense.exe***.



On successful submission the computer/tablet will be able to connect to the Trimble/Spectra instrument with 12dField straight away.

Continue to next section 15.9.4 Convert Geoid to Points or return to 15.3 Starting and Configuring 12d Field .

15.9.4 Convert Geoid to Points

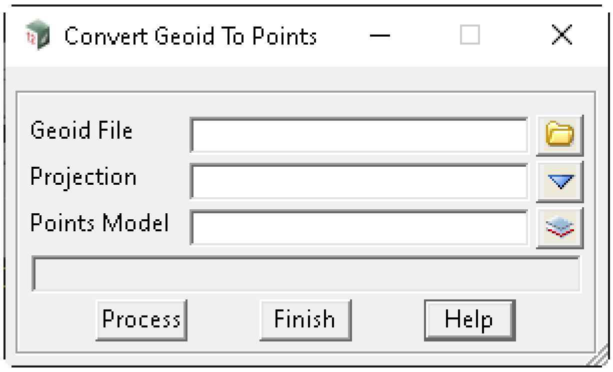
Position of option on menu: **Survey =>Field 12d=>12d Field Utilities =>GNSS Localisation =>Convert geoid to points**

Purpose

1.Convert *.dat files from (fttps://ftp.ga.gov.au/geodesy-outgoing/gravity/ausgeoid) to a 12d Model of points as preparation for creating a Geoid tin

2.Applies a defined projection

3.Allows the user to combine multiple *.dat files into one Model



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Geoid File	file box		*.dat

Select downloaded files from ftp site ftp://ftp.ga.gov.au/geodesy-outgoing/gravity/ausgeoid.

Projection	projection box	current projection	available projections

*If **not blank**, the projection of the data to be reduced.*

If a valid projection is specified, the reduction will be done taking into account the projection scale factors.

If this method is used it is paramount that the known coordinates(e.g station setups) are in terms of the projection coordinates and are not truncated (i.e. full coordinate values).

These coordinates will allow the calculation of the relative longitude and latitude values which are used to compute coordinates from observations from the setup points. For more information about how to setup different projections see 6.6.7 Cartographic Projections.

Points Model	input box		available models

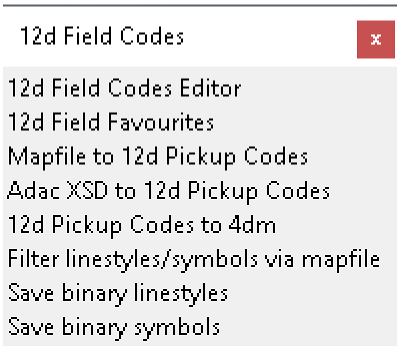
Name of the model that data is placed in. The model will be created if it does not already exist. This field must be filled in.

Continue to next section 15.10 12d Field Codes or return to 15.3 Starting and Configuring 12d Field
.

15.10 12d Field Codes

Position on menu: **Survey =>12d Field => 12d Field codes**

The **12d codes** walk right menu is



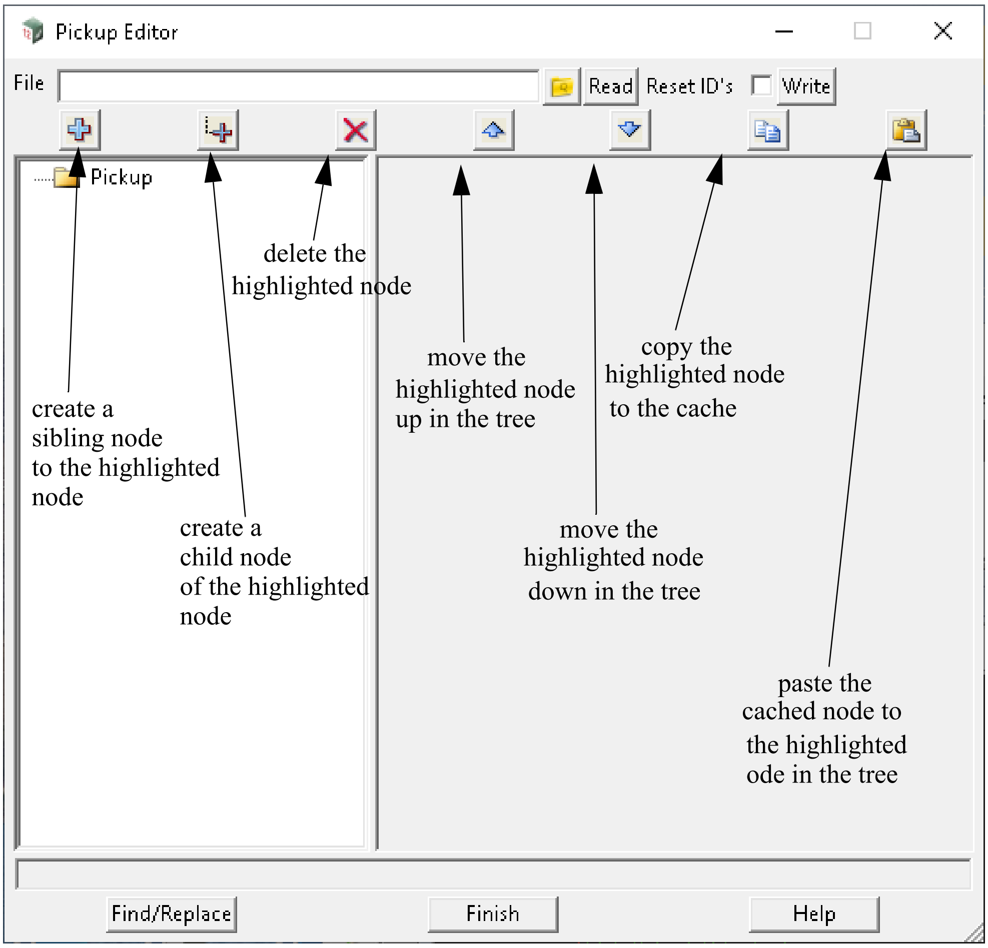
See
15.10.1 12d Field Codes Editor
15.10.2 12d Field Favourites
15.10.3 Mapfile to 12d Pickup Codes
15.10.4 ADAC XSD to 12d Pickup Codes
15.10.5 12d Pickup Codes to Macro
15.10.6 Filter Linestyles/Symbols via Mapfile
15.10.7 Save Binary Linestyles
15.10.8 Save Binary Symbols

15.10.1 12d Field Codes Editor

Position on menu: Survey =>12d Field =>12d Field Codes =>12d Field Codes Editor

The **Pickup Editor** panel allows you to define and edit feature codes to be used in **12d Field Pickup**.

Selecting **12d Pickup Codes Editor** brings up the **Pickup Editor** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

File

12d Field pickup codes file to edit or create.

Read

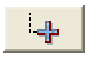
Reads the pickup codes file.

Write

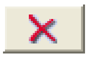
Writes the pickup codes file.

Icons

*Add a new node at the current level of the highlighted node in the tree - a sibling node. You can't add a sibling node to the top level **Pickup** node.*



Add a child to the current highlighted node in the tree.



Delete the current highlighted node in the tree.

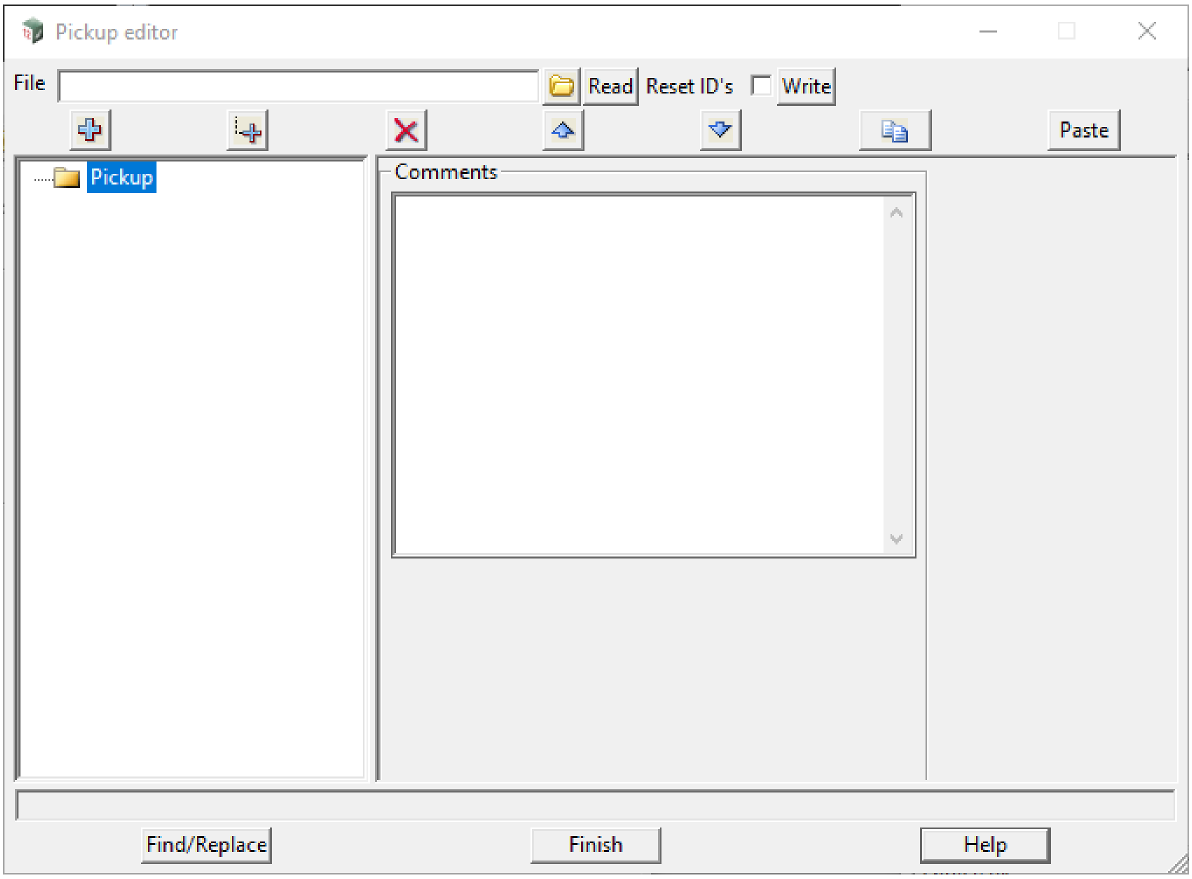
Moves the current highlighted node in the tree up.

Moves the current highlighted node down in the tree.

Copies to the cache the current highlighted node in the tree.

Paste *Pastes the cached node to the current node in the tree (if it is allowed).*

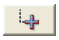
When you click on and highlight the **Pickup** node, a ***Comments*** text area is displayed on the right hand side of the panel.

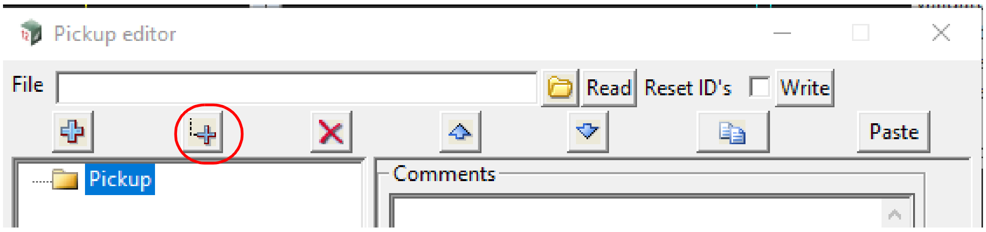


Text can be entered into the ***Comments*** area and it will be saved with the **Pickup Codes File.**

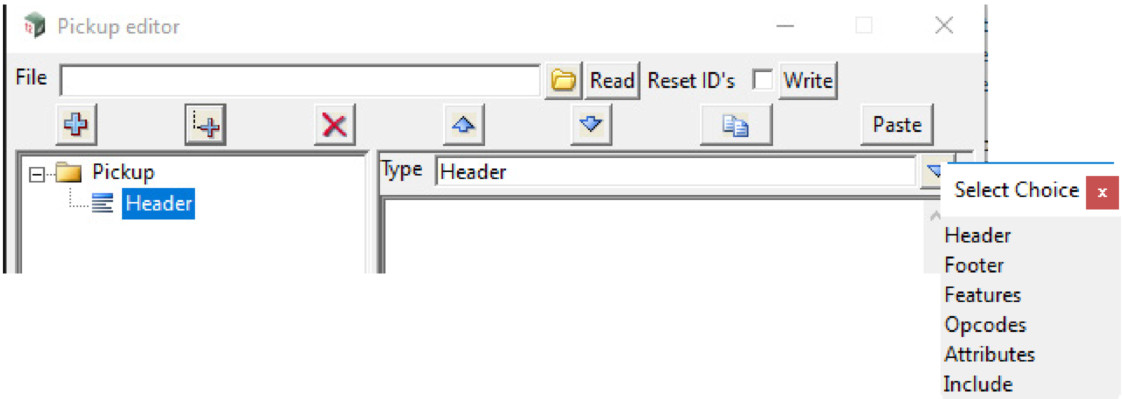
For information on using the panel, continue to next section 15.10.1.1 Defining Pickup Codes or return to 15.3 Starting and Configuring 12d Field .

15.10.1.1 Defining Pickup Codes

At the first level under **Pickup**, there are a number of different **Types of nodes** that can be added to the ***Pickup Codes File*** by first clicking on and highlighting the **Pickup** node, and then clicking on the **Add a Child** icon .

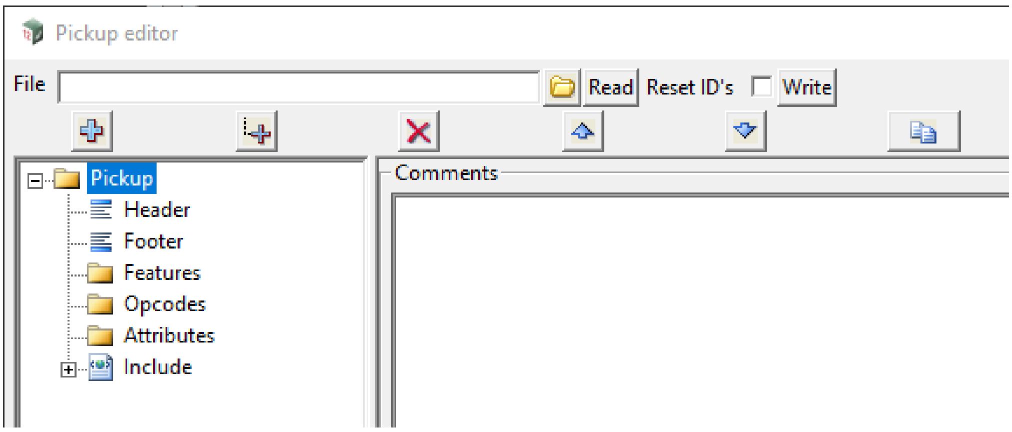


By default a **Header Type** is created but this can then be changed by clicking on the choice icon for the **Type** field and selecting from the pop-up list.



For example, selecting **Features** adds a **Prompt** field which is displayed as the **Features** name in ***12d Field Pickup***.and also replaces the node name **Header**.

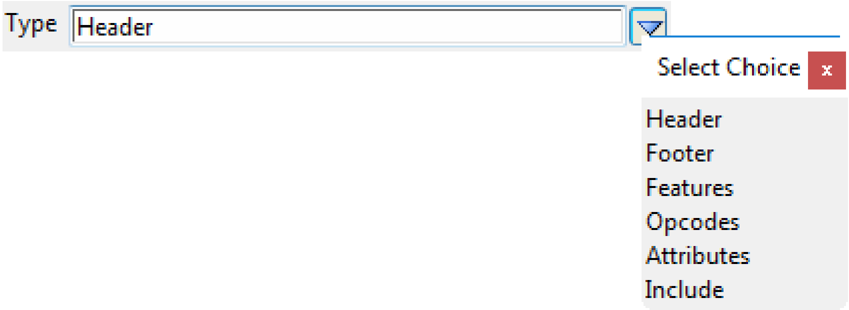
Or an example with one of each Type with the type of Type as the Prompt:



Important Note

To see the change of node name (e.g. **Header** to **Road**) in the **Pickup Editor**, you may have to click onto another node in the tree and then click back onto the current node.

For information on each of the **Types,** see:



See

15.10.1.1.1 Header

15.10.1.2 Footer

15.10.1.2.2 Features

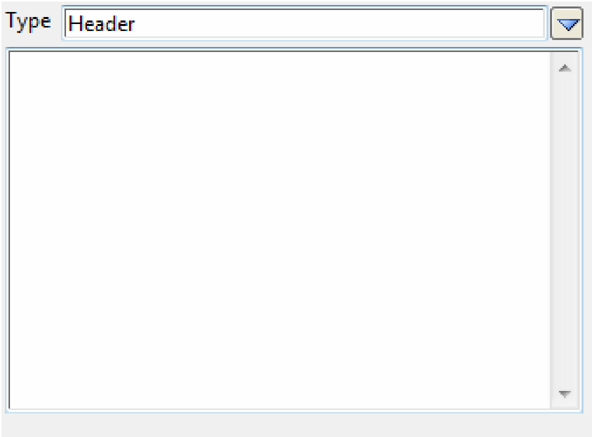
15.10.1.2.3 Opcodes

15.10.1.2.4 Attributes

15.10.1.2.1 Include

15.10.1.1.1 Header

A **Header Type** is for typing in data that will be included at the top of any generated macro code.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Text field

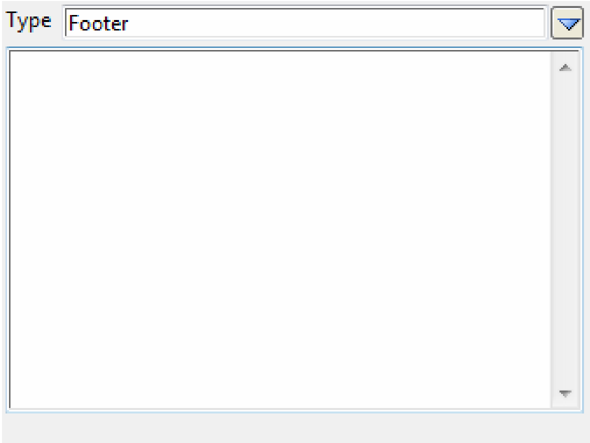
Macro code to include in the header of the macro.

There are **no** Children for **Header**.

Continue to next section 15.10.1.2 Footer or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2 Footer

A **Footer Type** is for typing in data that will be included at the bottom of any generated macro code.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Text field

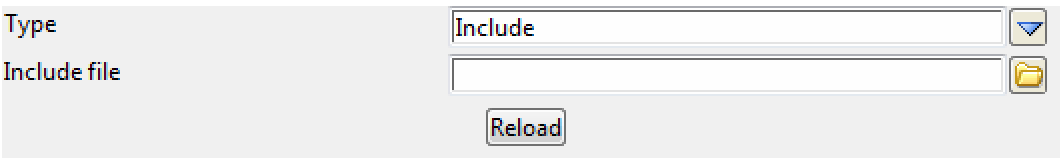
Macro code to include in the footer of the macro.

There are **no** Children for **Footer**.

Continue to next section 15.10.1.2.1 Include or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.1 Include

An **Include Type** is used for including another **Field Code File** at the place where the **Insert** occurs in the current **Field Code File**.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Include file file

Field code file to be included.

Reload button

Reloads the include file.

Note that **Include files** can be edited inline, within one editor.

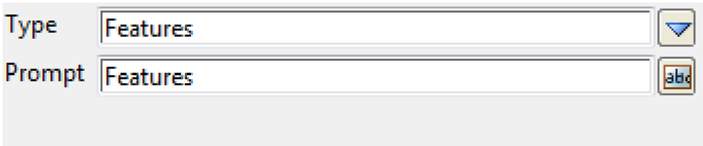
There are **no** Children for **Include**.

Continue to next section 15.10.1.2.2 Features or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2 Features

The **Features Type** can contain one or more Children of type **Feature**, **Features Group** or **Include** items.

Given that a **Features** can contain a ***Features Group*** which can contain a ***Features Group*** then a tree structure can be defined under any **Features.**



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

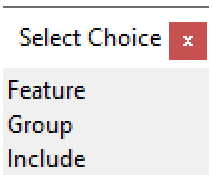
Prompt name of the Features that becomes the node name and will appear in 12d Field Pickup.

For example, for a **Features** called **Road**:

Important Note

The see the change of node name (e.g. **Road**) in the **Pickup Editor**, you may have to click onto another node in the tree and then click back onto the current node.

Allowed Children of a Features

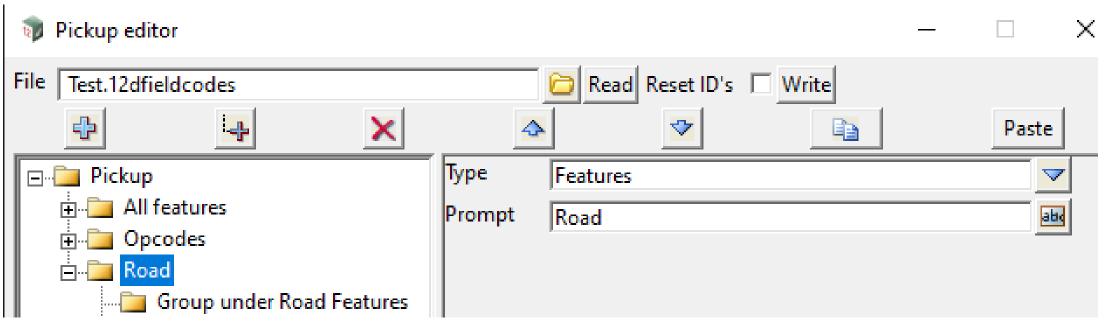


See
15.10.1.2.2.1.1 Feature
15.10.1.2.2.1 Features Group
15.10.1.2.1 Include

15.10.1.2.2.1 Features Group

Defines a **Features Group** that can contain one or more of children of type ***Features Group, Feature*** or ***Include***.

Given that a **Features Group** can contain a ***Features Group*** which can contain a ***Features Group*** then a tree structure can be defined under any **Features**.

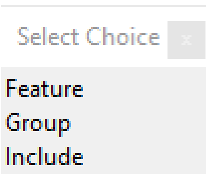


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name for the Features Group.

Allowed Children of a Features Group



See
15.10.1.2.2.1.1 Feature
15.10.1.2.2.1 Features Group
15.10.1.2.1 Include

Continue to next section 15.10.1.2.2.1.1 Feature or return to 15.3 Starting and Configuring 12d Field .

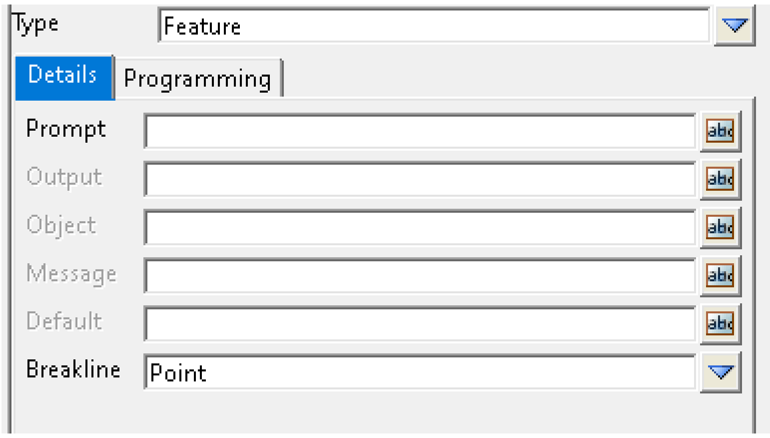
15.10.1.2.2.1.1 Feature

The **Feature** type defines the feature string that is now being picked up in the field. For example **EB** for Edge of Bitumen. The following measurement will then define the vertices that make up the feature string.

A **Feature** can contain one or more of children of type ***Feature Group***, ***Choice group***, ***Opcode***, ***Feature***, ***Real*** attribute, ***Text*** attribute, ***Integer*** attribute, ***Measure***, ***Choice*** or ***Include***.

Given that a **Feature** can contain a ***Feature Group*** which can contain a ***Feature Group*** then a tree structure can be defined under any **Feature**.

Important Note: Unlike **Feature**, a **Feature Group** can **not** contain an **Opcode** as a Child and so there is ***only one*** **Opcode** in the tree structure under a **Feature**.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt text box

Name to be displayed when this Feature is used during 12d Field Pickup. For example, Edge of Bitumen or EB.

Output text box

*If **not blank**, the value to output to the 12d Field Pickup file. e.g. EB.*

*If **blank** it uses the value in **Prompt**.*

Object text box

*If **not blank**, the value to be used to define a set of attributes.*

*If **blank** it uses the value in **Output**.*

Message text box

A message to display when picking up the feature.

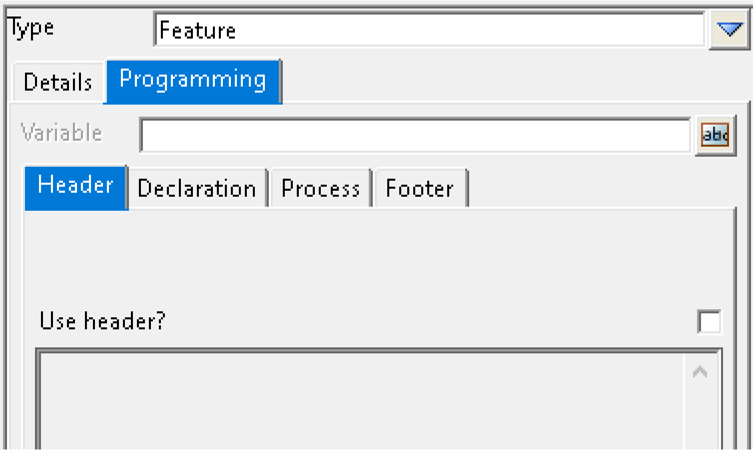
Default text box

Default value.

Breakline choice box — Pop-Up: Both, Point, Line

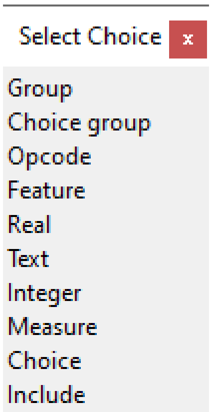
Breakline type for the created feature string.

Programming tab



See 15.10.1.2.5 Programming .

Allowed Children of a Feature



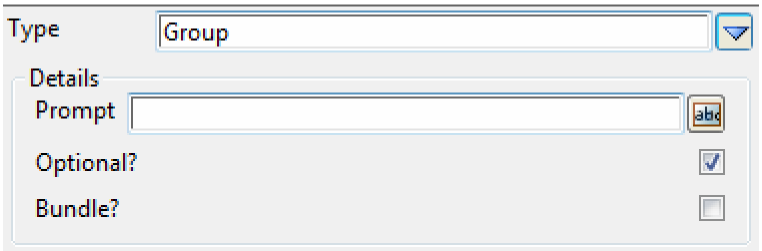
See
15.10.1.2.2.1.2 Feature Group
15.10.1.2.2.1.3 Choice Group Attribute
15.10.1.2.2.1.6 Opcode
15.10.1.2.2.1.7 Feature Attribute
15.10.1.2.2.1.8 Real Attribute
15.10.1.2.2.1.9 Text Attribute
15.10.1.2.2.1.10 Integer Attribute
15.10.1.2.2.1.11 Measure Attribute
??
15.10.1.2.1 Include

15.10.1.2.2.1.2 Feature Group

Defines a **Feature Group** that can contain one or more of children of type ***Feature Group***, ***Choice group***, ***Feature***, ***Real*** attribute, ***Text*** attribute, ***Integer*** attribute, ***Measure***, ***Choice*** or ***Include***.

Given that a **Feature Group** can contain a ***Feature Group*** which can contain a ***Feature Group*** then a tree structure can be defined under any ***Feature Group***.

Note: unlike **Feature**, a **Feature Group** can not contain an **Opcode** as a Child and so there is only one **Opcode** in the tree under a **Feature**.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name for the group.

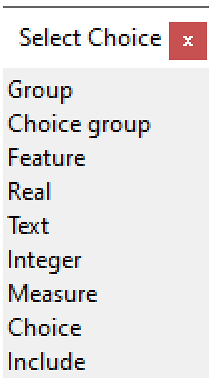
Optional?	tick box		

*If **ticked**, filling out the group is optional.*
*If **not ticked,** at least one field in the group must be filled out.*

Bundle?	tick box		

*If **ticked**, this feature group is treated as a bundle.*
*If **not ticked**, this group is treated as a normal group.*

Allowed Children under a Feature Group



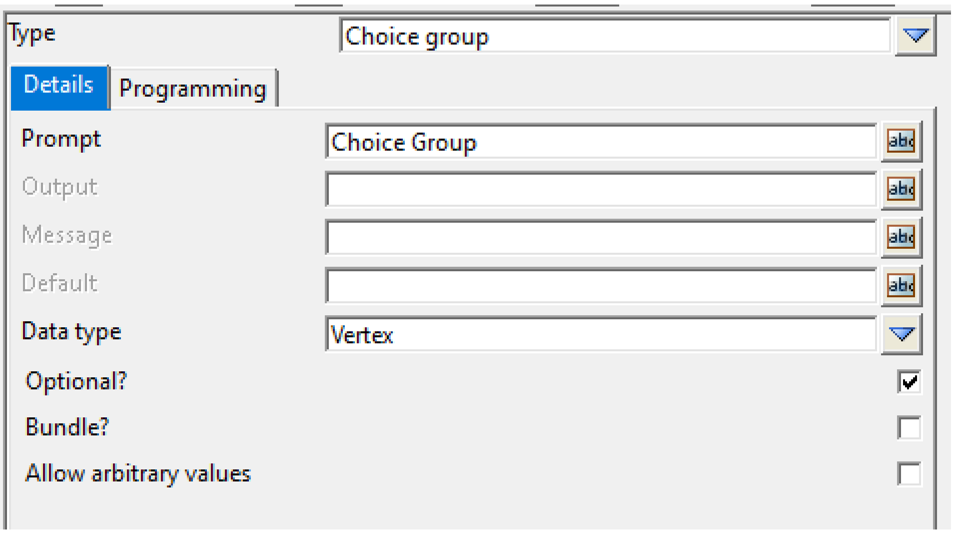
See
15.10.1.2.2.1.2 Feature Group
15.10.1.2.2.1.3 Choice Group Attribute
15.10.1.2.2.1.7 Feature Attribute
15.10.1.2.2.1.8 Real Attribute
15.10.1.2.2.1.9 Text Attribute
15.10.1.2.2.1.10 Integer Attribute
15.10.1.2.2.1.11 Measure Attribute
??
15.10.1.2.1 Include

15.10.1.2.2.1.3 Choice Group Attribute

This allows the definition of an attribute defined by a set of choices, defined into groups, to attach to a feature.

A **Choice Group Attribute** can contain one or more of children of type ***Choice group***, ***Choice data*** or ***Include***.

Given that a **Choice Group Attribute** can contain a ***Choice group*** which can contain a ***Choice group*** then a tree structure can be defined under any ***Choice Group Attribute***.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt input

Cosmetic name to be displayed during 12d field pickup

Output input

Optional value to output to the pickup file - uses prompt if undefined

Message input

A message to display when displaying the choice group

Default input

Default value

Data type choice box — Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached

Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

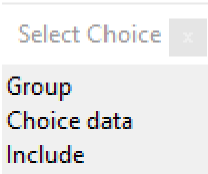
Allow arbitrary values tick box

*If **ticked**,??*
*If **not ticked**,??*

Programming tab

See 15.10.1.2.5 Programming .

Allowed Children Under a Choice Group Attribute



See
15.10.1.2.2.1.4 Choice Group
15.10.1.2.2.1.5 Choice Data
15.10.1.2.1 Include

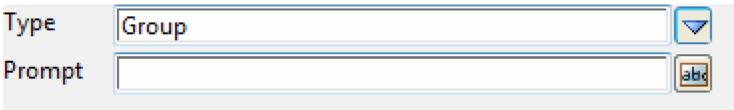
Continue to next section 15.10.1.2.2.1.4 Choice Group or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.4 Choice Group

Allows a group of choice group attribute related data to be defined

A **Choice Group** can contain one or more of children of type ***Choice group***, ***Choice data*** or ***Include***.

Given that a **Choice group** can contain a ***Choice group*** which can contain a ***Choice group*** then a tree structure can be defined under any ***Choice Group***.

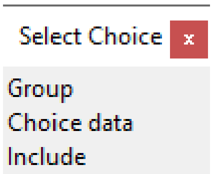


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name of the group to display.

Allowed Children under a Choice Group

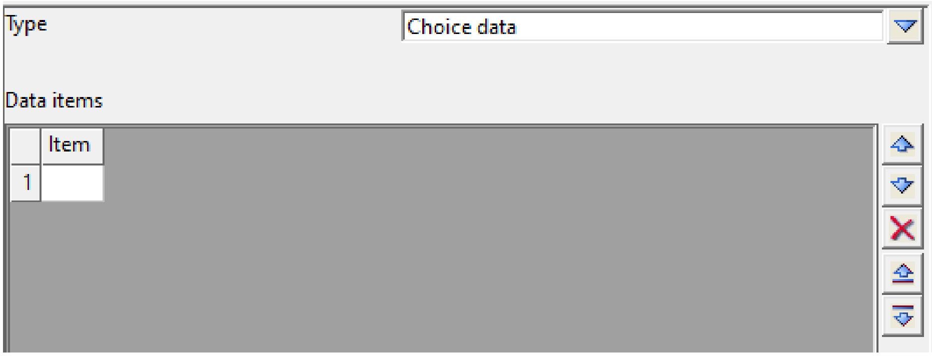


See
15.10.1.2.2.1.4 Choice Group
15.10.1.2.2.1.5 Choice Data
15.10.1.2.1 Include

Continue to next section 15.10.1.2.2.1.5 Choice Data or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.5 Choice Data

The choices to display for a Choice attribute.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

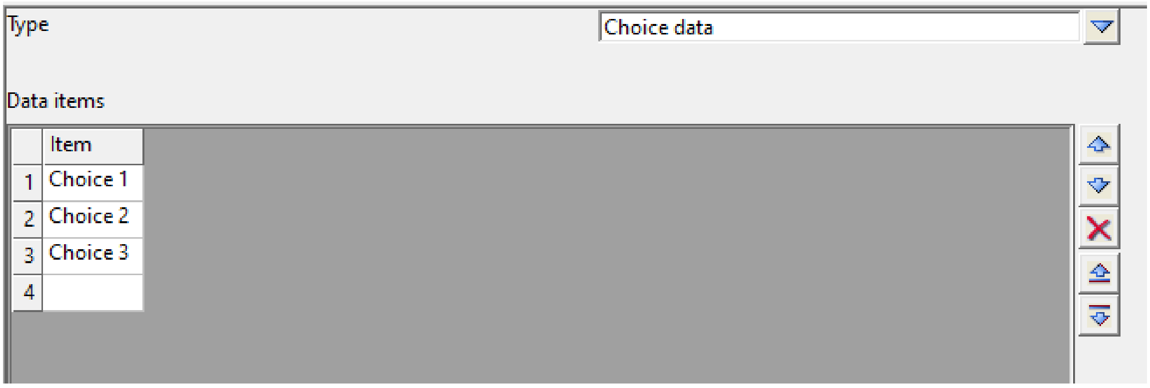
Data Items

Grid.

Item column of texts

Values for a Choice.

For example:

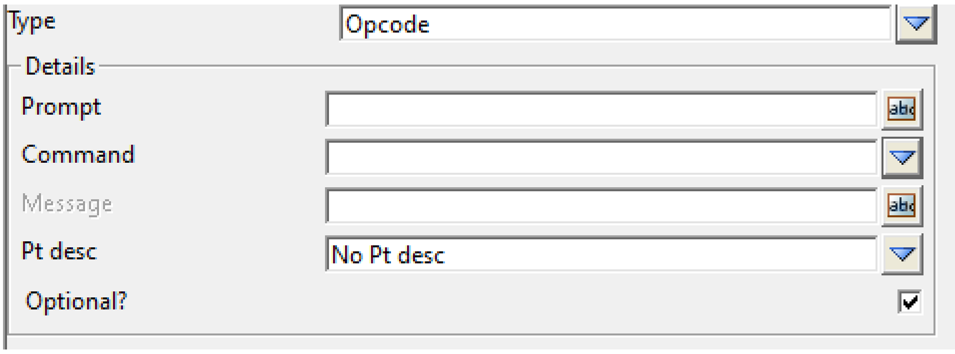


There are no Children under a Choice Data

Continue to next section 15.10.1.2.2.1.6 Opcode or return to 15.3 Starting and Configuring 12d Field

15.10.1.2.2.1.6 Opcode

This defines an attribute attached to a **Feature** that requires the entry of an ***12d Field*** **Opcode**.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	text box		

Cosmetic name for the opcode.

Command	opcode box		

Opcode to be recorded in the attribute. For the choice of Opcodes, see 28.9 12d Survey Opcode Summary .

Message	input		

An optional message to display when entering the opcode.

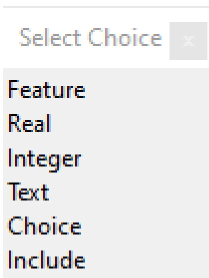
Pt desc	choice box		No pt desc, Pt desc, Null pt desc

Specifies if there is a point description or not.

Optional	tick box		

*If **ticked**, this opcode attribute is optional.*
*If **not ticked,** this opcode attribute must be entered in the field.*

Allowed Children under an Opcode

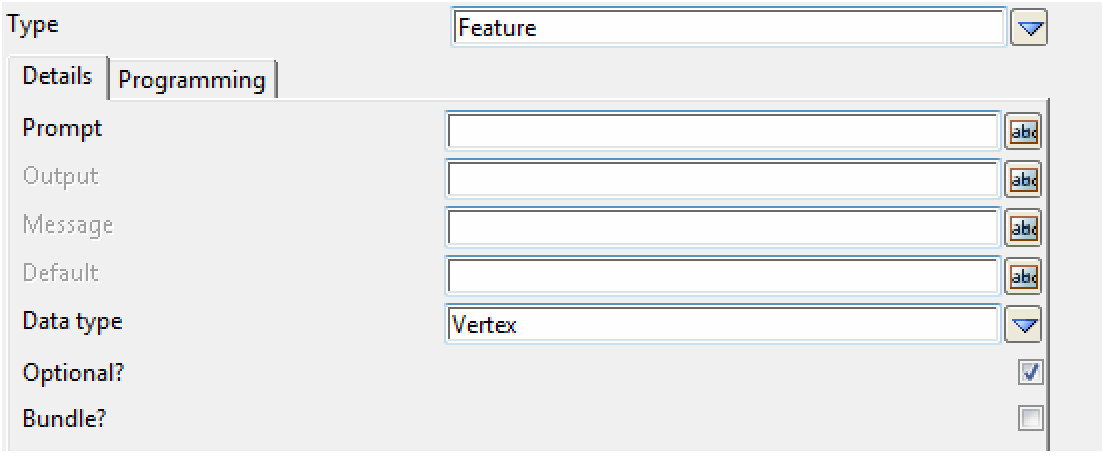


See
15.10.1.2.2.1.7 Feature Attribute
15.10.1.2.2.1.8 Real Attribute
15.10.1.2.2.1.10 Integer Attribute
15.10.1.2.2.1.9 Text Attribute
15.10.1.2.2.1.12 Choice Attribute
15.10.1.2.1 Include

Continue to next section 15.10.1.2.2.1.7 Feature Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.7 Feature Attribute

This defines an attribute attached to a feature, which requires the entry of another feature.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Output input

Optional value to output to the pickup file - uses prompt if undefined.

Message input

A message to display when picking up the code.

Default input

Default value.

Data type choice box — Pop-Up: Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

Programming tab

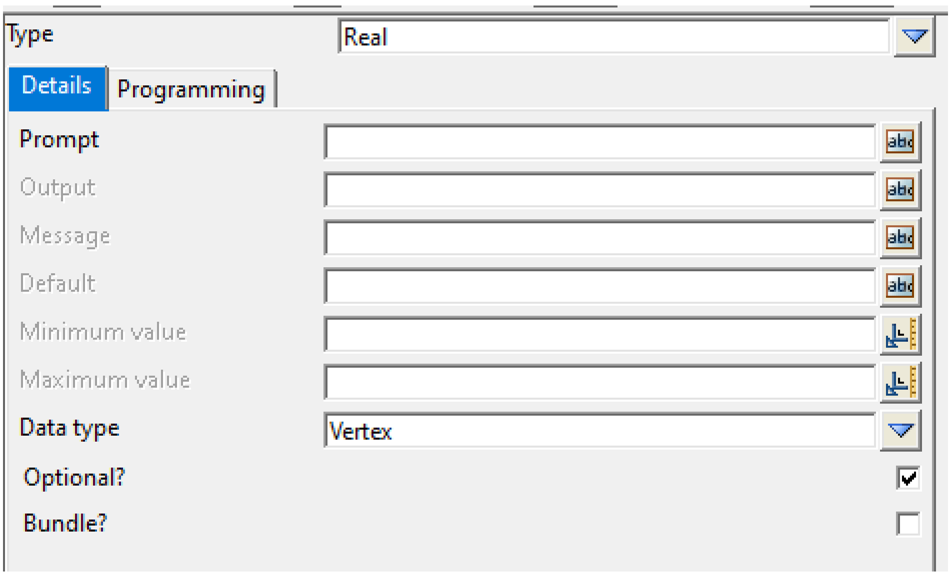
See 15.10.1.2.5 Programming .

There are no Children under a Feature Attribute

Continue to next section 15.10.1.2.2.1.8 Real Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.8 Real Attribute

This defines an attribute attached to a Feature, which requires the entry of a real value.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt	text box		

Cosmetic name to be displayed during 12d field pickup.

Output	text box		

Optional value to output to the pickup file - uses prompt if undefined.

Message	text box		

A message to display when picking up the code.

Default	text box		

Default value.

Minimum value	real box		

*If **not blank,** the entered value must be greater than or equal to this value.*
*If **blank** then there is no minimum value restriction.*

Maximum value	real box		

*If **not blank**, the entered value must be less than or equal to this value.*
*If **blank** then there is no maximum value restriction.*

Data type	choice box		Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional?	tick box		

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

Programming tab

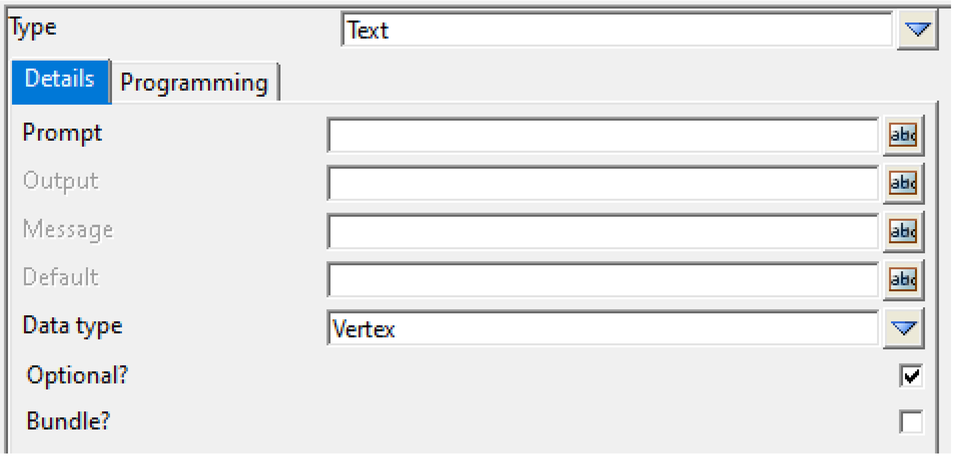
See 15.10.1.2.5 Programming .

There are no Children under a Real Attribute.

Continue to next section 15.10.1.2.2.1.9 Text Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.9 Text Attribute

This defines an attribute attached to a feature, which requires the entry of a text value.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt text box

Cosmetic name to be displayed during 12d field pickup.

Output text box

Optional value to output to the pickup file - uses prompt if undefined.

Message text box

A message to display when picking up the code.

Default text box

Default value.

Data type choice box — Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute*

Programming tab

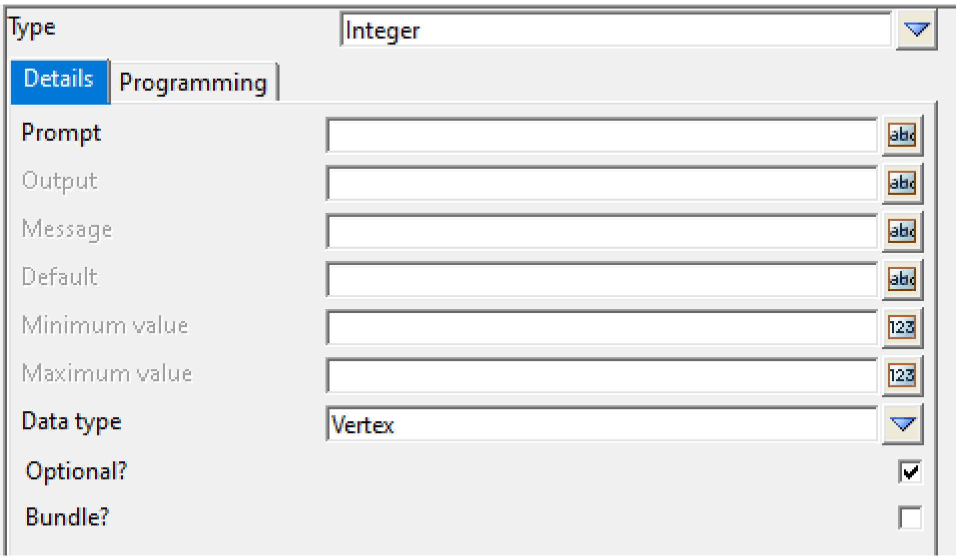
See 15.10.1.2.5 Programming .

There are no Children under a Text Attribute.

Continue to next section 15.10.1.2.2.1.10 Integer Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.10 Integer Attribute

This defines an attribute attached to a feature, which requires the entry of an integer value.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Details tab

Prompt text box

Cosmetic name to be displayed during 12d field pickup.

Output text box

Optional value to output to the pickup file - uses prompt if undefined.

Message text box

A message to display when picking up the code.

Minimum value integer box

*If **not blank,** the entered value must be greater than or equal to this value.*
*If **blank** then there is no minimum value restriction.*

Maximum value integer box

*If **not blank**, the entered value must be less than or equal to this value.*
*If **blank** then there is no maximum value restriction.*

Default text box

Default value.

Data type choice box — Pop-Up: Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

Programming tab

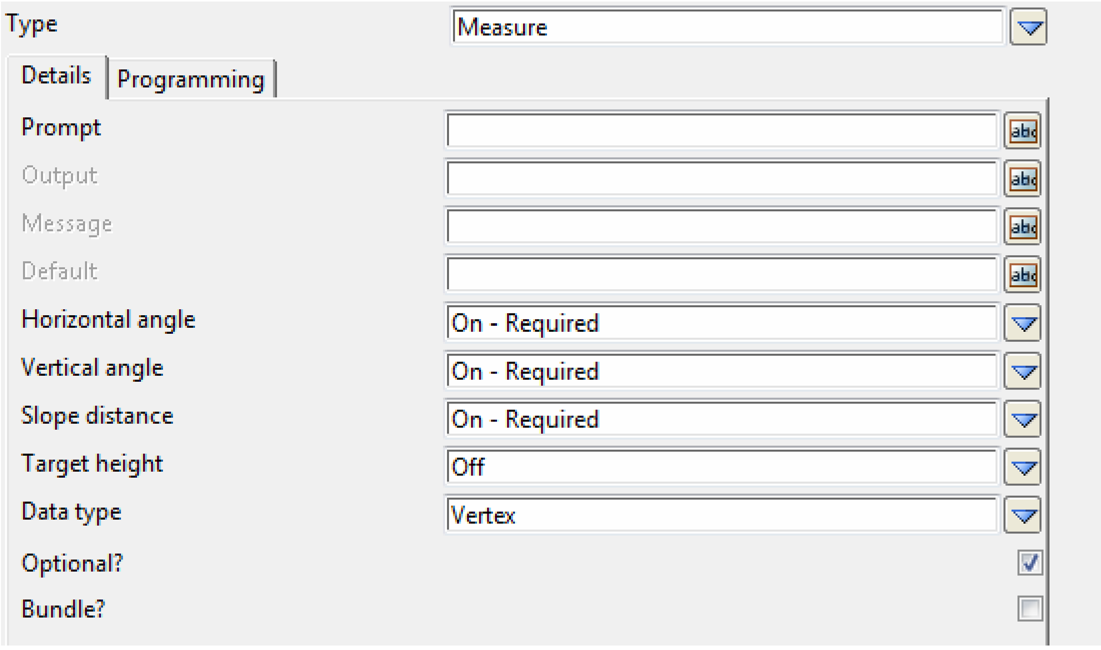
See 15.10.1.2.5 Programming .

There are no Children under an Integer Attribute.

Continue to next section 15.10.1.2.2.1.11 Measure Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.11 Measure Attribute

This defines an attribute attached to a feature, which requires a physical measurement.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Details tab

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Output input

Optional value to output to the pickup file - uses prompt if undefined.

Message input

A message to display when picking up the code.

Default input

Default value.

Horizontal angle choice box Off, On - Required, On - Optional

If the horizontal angle is to be captured.

Vertical angle choice box Off, On - Required, On -Optional

If the vertical angle is to be captured.

Slope distance choice box Off, On - Required, On -Optional

If the slope distance is to be captured.

Target height choice box Off, On - Required, On - Optional

If the target height is required.

Data type	choice box	Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional?	tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle?	tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

Programming tab

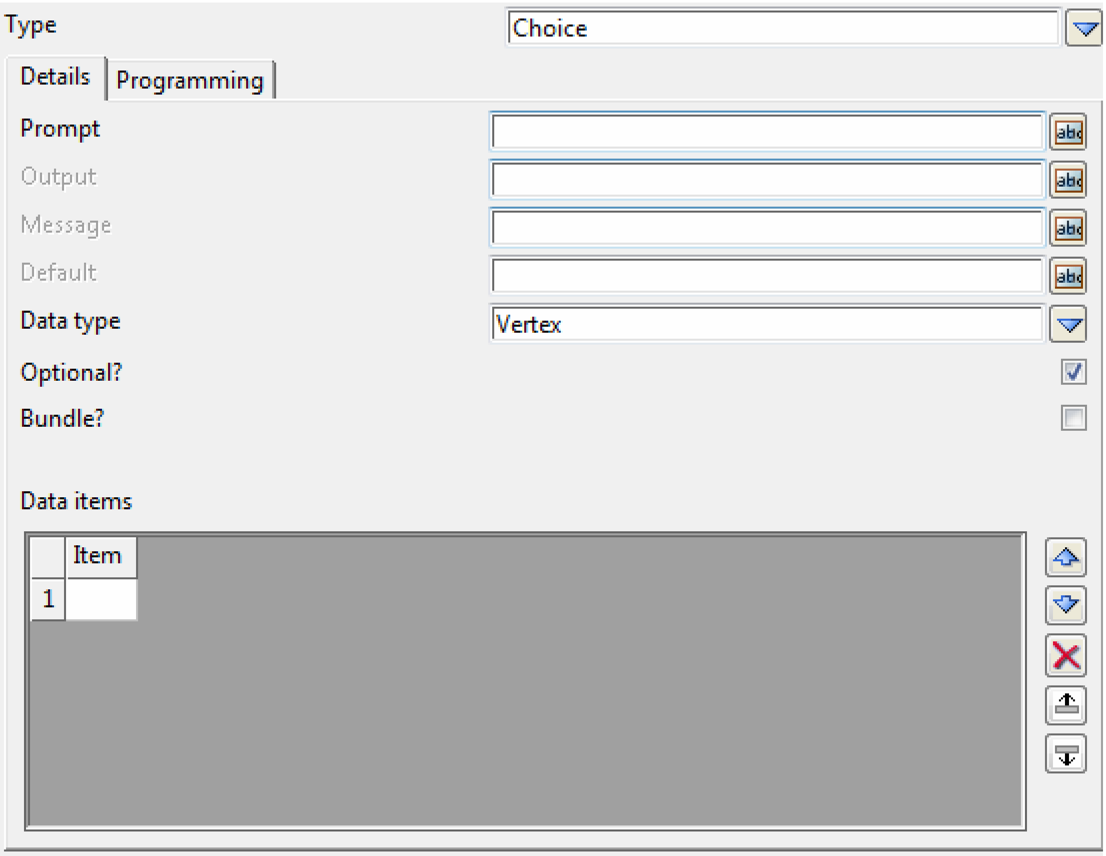
See 15.10.1.2.5 Programming .

There are no Children under a Measure Attribute.

Continue to next section 15.10.1.2.2.1.12 Choice Attribute or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.2.1.12 Choice Attribute

This defines an attribute attached to a feature, which requires a value to be selected from a list of choices.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Details tab

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Output input

Optional value to output to the pickup file - uses prompt if undefined.

Message input

A message to display when picking up the code.

Default input

Default value.

Data type choice box Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

How the attribute should be attached.

Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, this attribute must be filled out.*

Bundle? tick box

*If **ticked**, this attribute is treated as a bundle.*
*If **not ticked**, this attribute is treated as a normal attribute.*

Data Items grid

Grid.

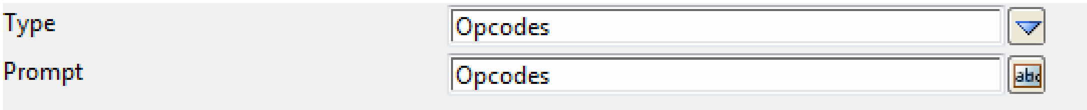
Item grid

A choice item to display.

Continue to next section 15.10.1.2.3 Opcodes or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3 Opcodes

This **Type** defines a group of opcodes.

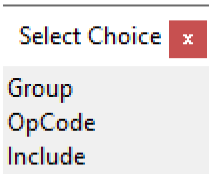


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name of the opcodes group.

Allowed Children under an Opcodes

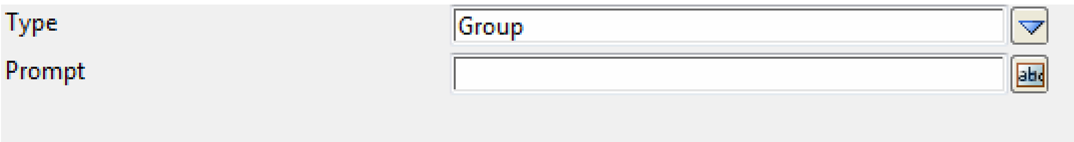


See
15.10.1.2.3.1 Opcodes Group
15.10.1.2.3.2 OpCode
15.10.1.2.1 Include

Continue to next section 15.10.1.2.3.1 Opcodes Group or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.1 Opcodes Group

This code defines a group of opcodes

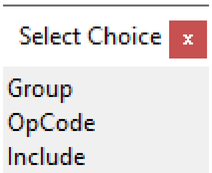


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name of the group of opcodes.

Available children types

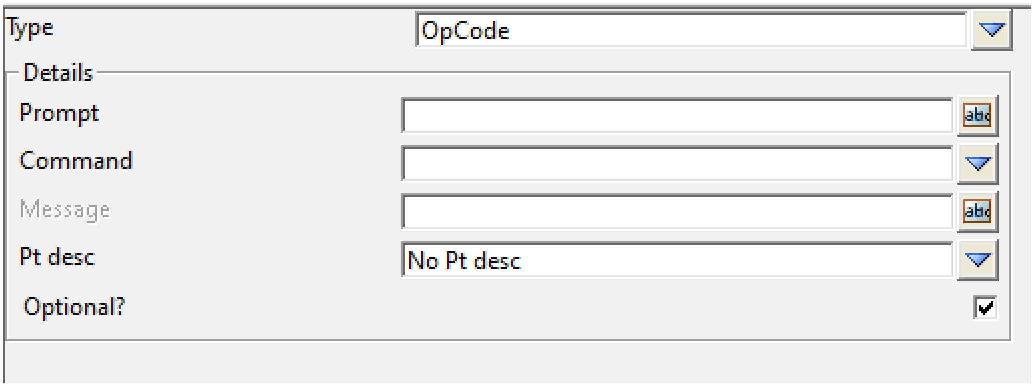


See
15.10.1.2.3.1 Opcodes Group
15.10.1.2.3.2 OpCode
15.10.1.2.1 Include

Continue to next section 15.10.1.2.3.2 OpCode or return to 15.3 Starting and Configuring 12d Field
.

15.10.1.2.3.2 OpCode

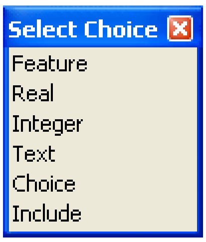
This defines a custom opcode that can be attached to the running pickup function or a picked up Feature.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		
Cosmetic name to be displayed during 12d field pickup.			
Output	input		
Optional value to output to the pickup file - uses prompt if undefined.			
Message	input		
A message to display when entering the opcode.			
Pt desc	choice box		No pt desc, Pt desc, Null pt desc
Point description.			
Optional?	tick box		
*If **ticked**, this opcode is treated as optional.* *If **not ticked**, it is required.*			

Available children types

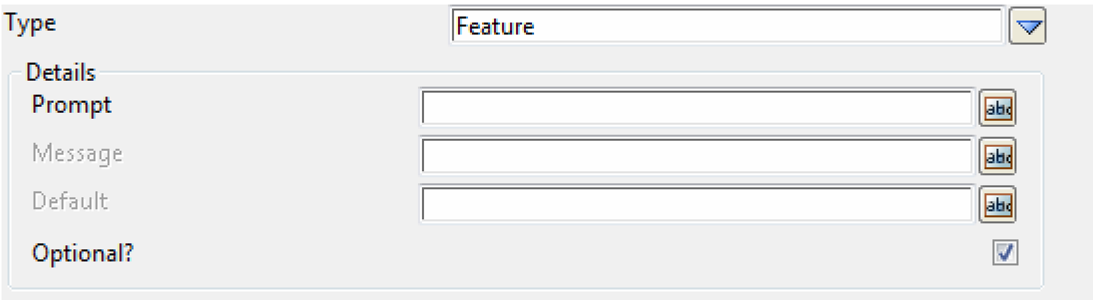


See
15.10.1.2.3.3 Feature Attribute (OpCode)
15.10.1.2.3.4 Real Attribute (OpCode)
15.10.1.2.3.5 Integer Attribute (OpCode)
15.10.1.2.3.6 Text Attribute (OpCode)
15.10.1.2.3.7 Choice Attribute (OpCode)
15.10.1.2.1 Include

Continue to next section 15.10.1.2.3.3 Feature Attribute (OpCode) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.3 Feature Attribute (OpCode)

This defines an attribute attached to an opcode, which requires the entry of a feature.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name to be displayed during 12d field pickup.

Message	input		

A message to display when entering the opcode attribute.

Default	input		

Default value for the attribute.

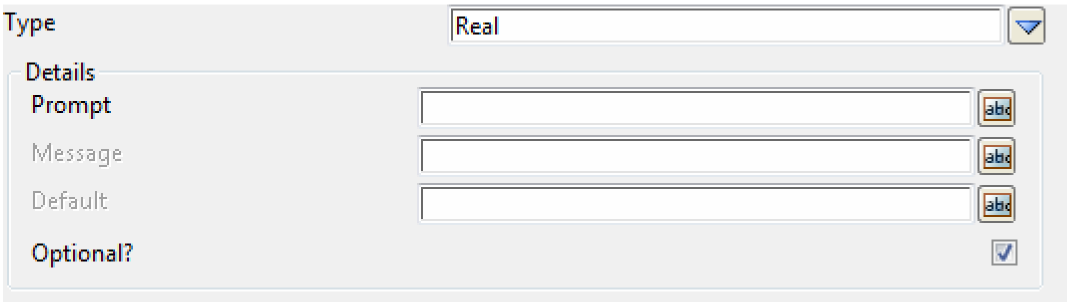
Optional?	tick box		

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, it is required.*

Continue to next section 15.10.1.2.3.4 Real Attribute (OpCode) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.4 Real Attribute (OpCode)

This defines an attribute attached to an opcode, which requires the entry of a real value.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Message input

A message to display when entering the opcode attribute.

Default input

Default value for the attribute.

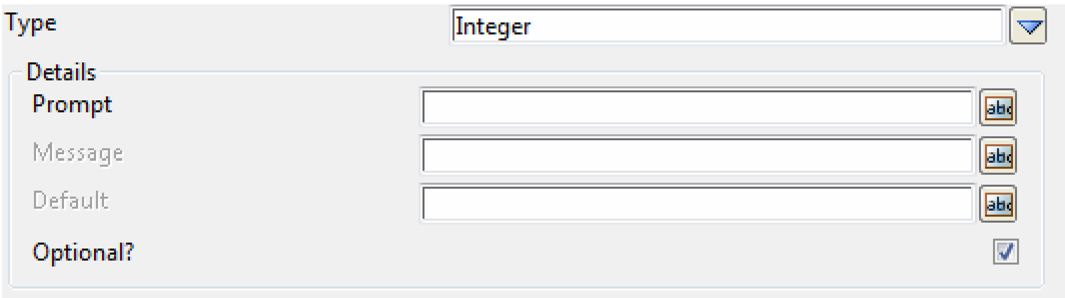
Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, it is required.*

Continue to next section 15.10.1.2.3.5 Integer Attribute (OpCode) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.5 Integer Attribute (OpCode)

This defines an attribute attached to an opcode, which requires the entry of an integer value.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name to be displayed during 12d field pickup.

Message	input		

A message to display when entering the opcode attribute.

Default	input		

Default value for the attribute.

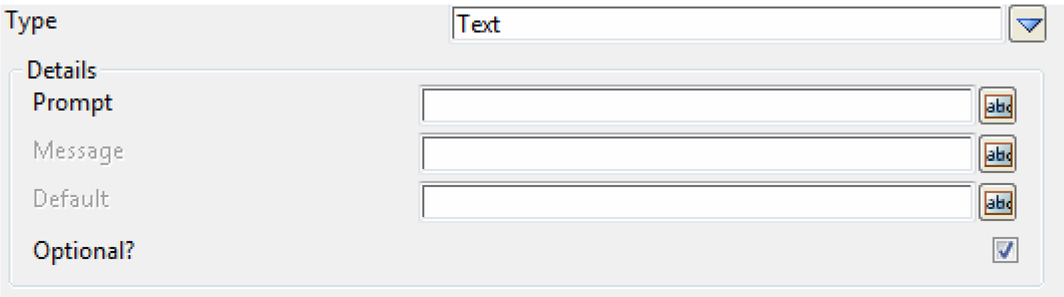
Optional?	tick box		

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, it is required.*

Continue to next section 15.10.1.2.3.6 Text Attribute (OpCode) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.6 Text Attribute (OpCode)

This defines an attribute attached to an opcode, which requires the entry of a text value.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name to be displayed during 12d field pickup.

Message	input		

A message to display when entering the opcode attribute.

Default	input		

Default value for the attribute.

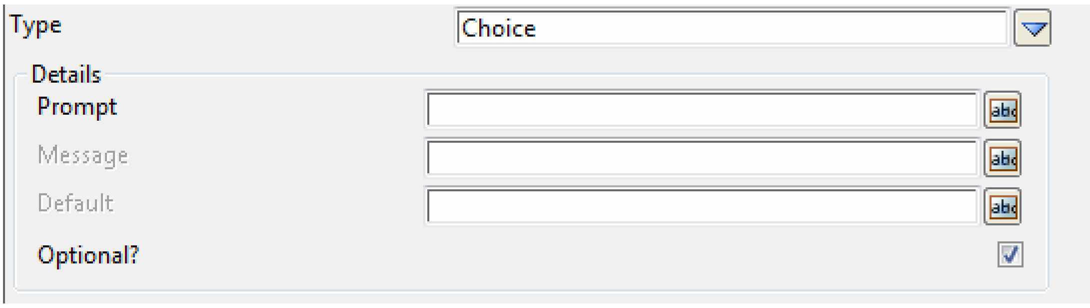
Optional?	tick box		

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, it is required.*

Continue to next section 15.10.1.2.3.7 Choice Attribute (OpCode) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.3.7 Choice Attribute (OpCode)

This defines an attribute attached to an opcode, which requires the entry of a value selected from a choice.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Message input

A message to display when entering the opcode attribute.

Default input

Default value for the attribute.

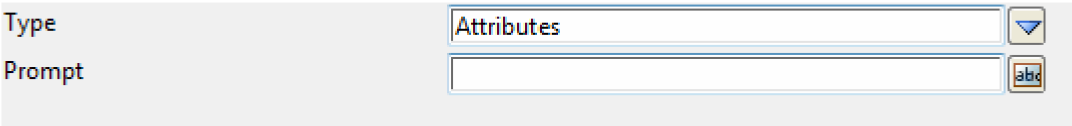
Optional? tick box

*If **ticked**, this attribute is treated as optional.*
*If **not ticked**, it is required.*

Continue to next section 15.10.1.2.4 Attributes or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.4 Attributes

This defines a top level group of attributes.

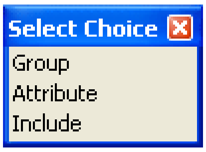


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name for the group of attributes.

Available children types

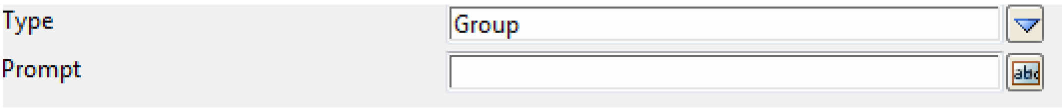


See
15.10.1.2.4.1 Group (Attributes)
15.10.1.2.4.2 Attribute
15.10.1.2.1 Include

Continue to next section 15.10.1.2.4.1 Group (Attributes) or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.4.1 Group (Attributes)

This defines a group of attributes or other groups.

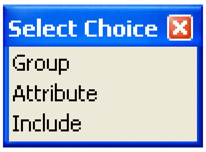


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Prompt	input		

Cosmetic name for the group that will be displayed.

Available children types

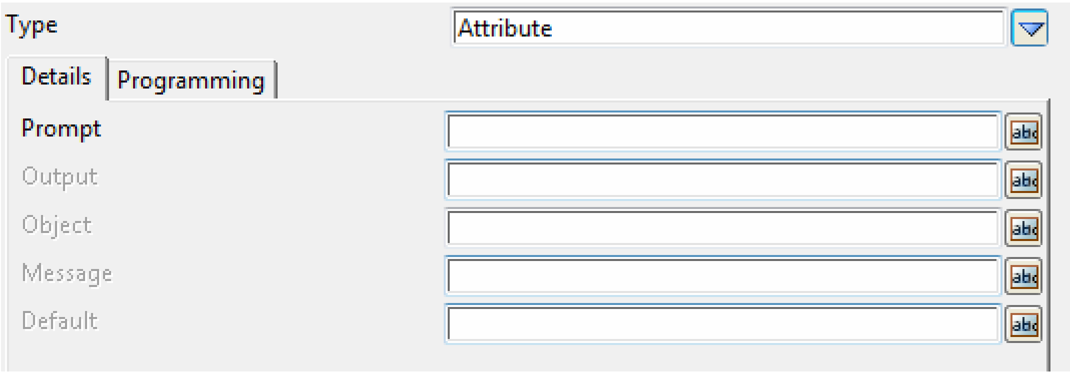


See
15.10.1.2.4.1 Group (Attributes)
15.10.1.2.4.2 Attribute
15.10.1.2.1 Include

Continue to next section 15.10.1.2.4.2 Attribute or return to 15.3 Starting and Configuring 12d Field
.

15.10.1.2.4.2 Attribute

This defines an attribute that may be attached to a picked up point or string during pickup.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Details tab

Prompt input

Cosmetic name to be displayed during 12d field pickup.

Output input

Optional value to output to the pickup file - uses prompt if undefined.

Object input

Optional value to be used to define a set of attributes - uses output if undefined.

Message input

A message to display when picking up the code.

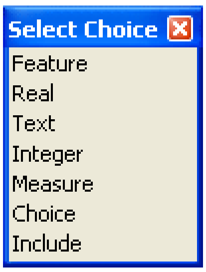
Default input

Default value.

Programming tab

See 15.10.1.2.5 Programming

Available children types



See
15.10.1.2.2.1.7 Feature Attribute
15.10.1.2.2.1.8 Real Attribute
15.10.1.2.2.1.9 Text Attribute
15.10.1.2.2.1.10 Integer Attribute
15.10.1.2.2.1.11 Measure Attribute
15.10.1.2.2.1.12 Choice Attribute
15.10.1.2.1 Include

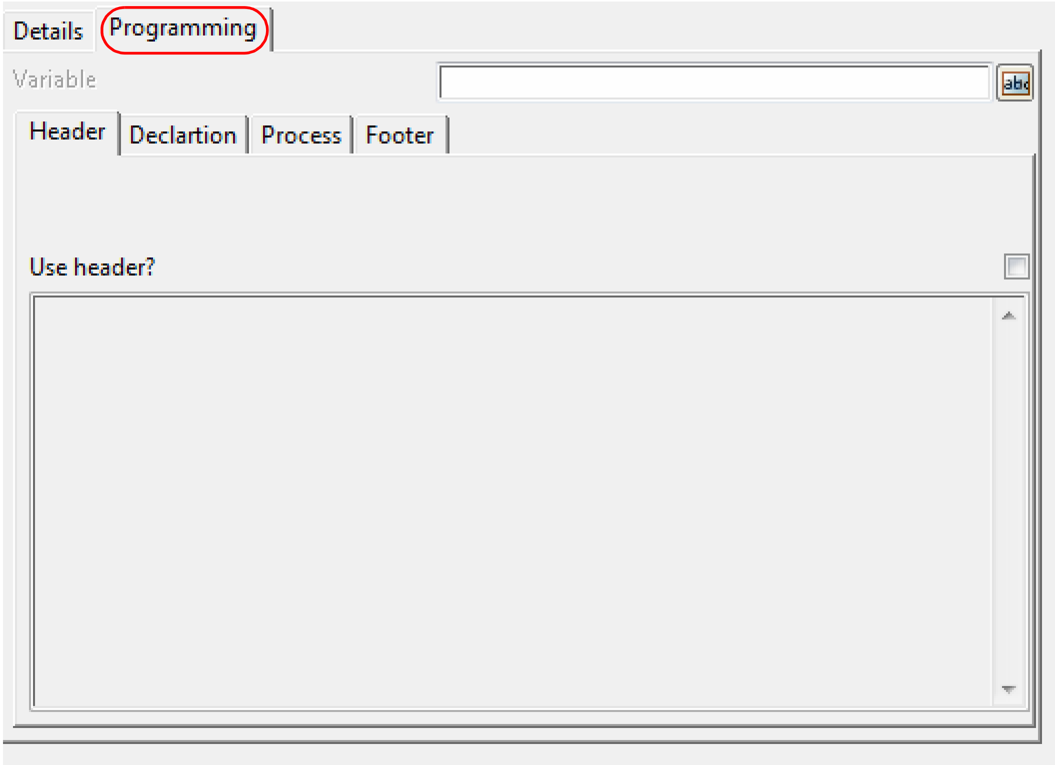
Continue to next section 15.10.1.2.5 Programming or return to 15.3 Starting and Configuring 12d Field .

15.10.1.2.5 Programming

It is possible to generate macro code for GIS post processing, for any feature or attribute. The **Programming tab** is used to assist you in doing so.

See 15.10.5 12d Pickup Codes to Macro for more information on how to generate a GIS post processing 4dm file.

To assist you, this is broken into sections: Header tab , Declaration tab , Process tab , Footer tab .



The fields and buttons used in this panel have the following functions.

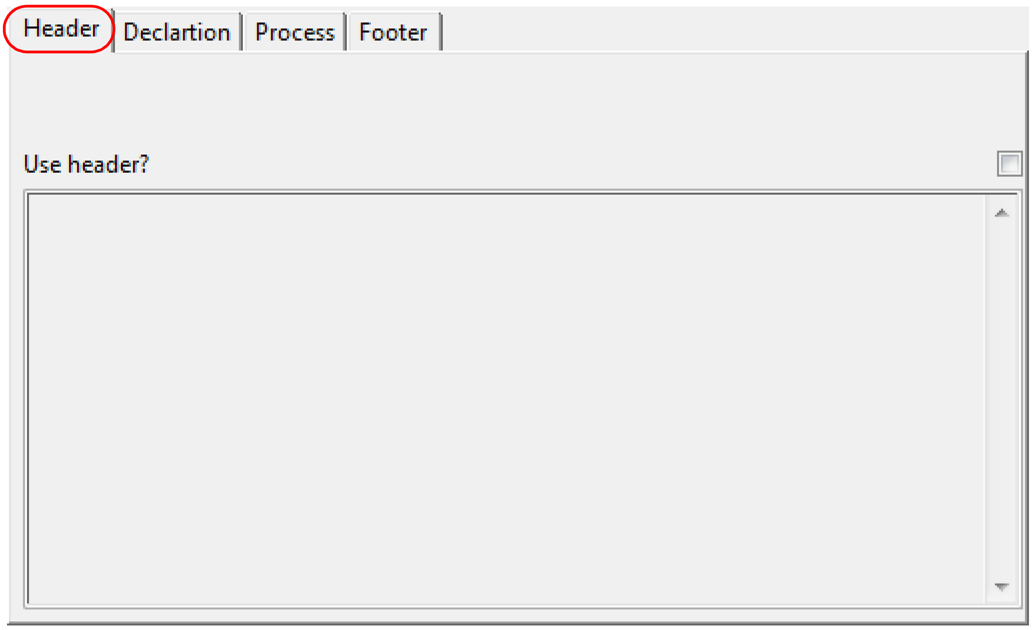
Field Description	Type	Defaults	Pop-Up
Variable	input		

For use with attributes or opcodes, defines the variable that the data should be stored in for use later.

See Header tab , Declaration tab , Process tab , Footer tab .

Header tab

The **Header tab** defines any header that should be output into the macro file for the current item.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Use header?	tick box		

*If **ticked**, the header will output to the generated file.*
*If **not ticked**, no header will be used.*

Text field

Macro code to output into the GIS post processing file.

Declaration tab

The **Declaration tab** defines the 'declaration' to be output into the macro, which can be used for defining variables.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Use declaration?	tick box		

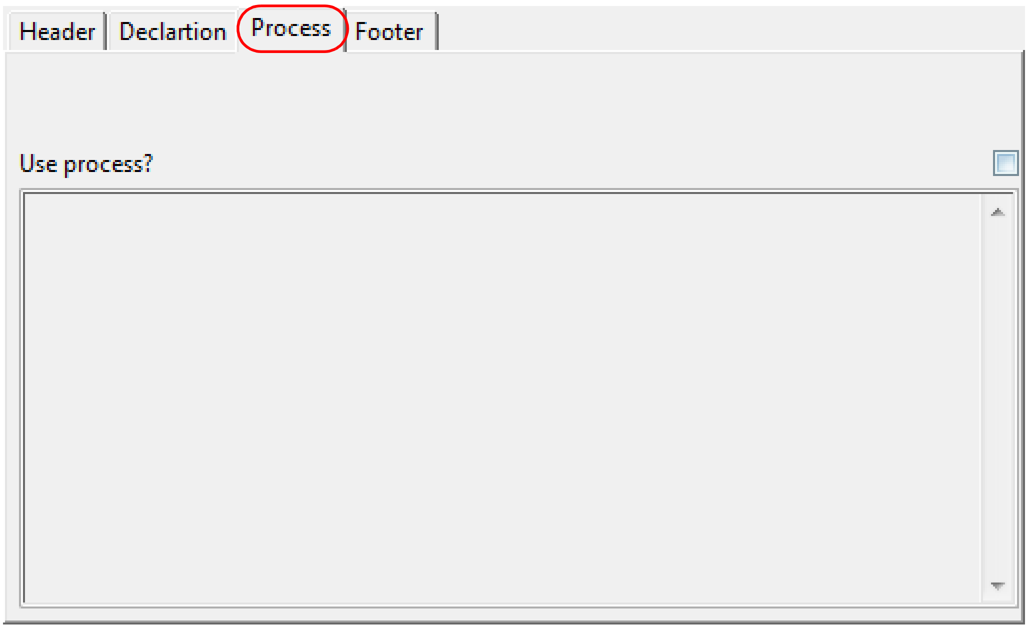
*If **ticked**, a declaration will be output to the generated file.*
*If **not ticked**, no declaration will be output.*

Text field

Macro code to output into the GIS post processing file.

Process tab

The **Process tab** defines the main processing part of the macro code, which could be used to process a selected feature code and associated attributes, or other items such as opcodes.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Use process?	tick box		

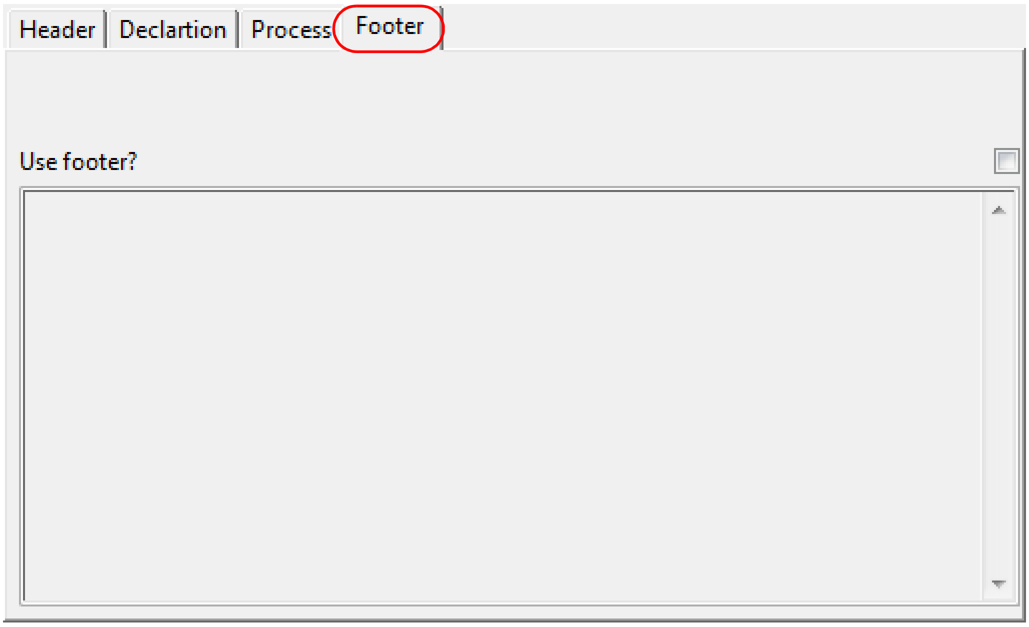
*If **ticked**, the process data will be output into the generated file.*
*If **not ticked**, no process data will be output.*

Text field

Macro code to output into the GIS post processing file.

Footer tab

The **Footer tab** defines any footer that should be output into the macro file for the current item.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Use footer?	tick box		

If ***ticked****, the footer will output to the generated file.*
If ***not ticked,*** *no footer will be output.*

Text field

Macro code to output into the GIS post processing file.

Continue to next section 15.10.2 12d Field Favourites or return to 15.3 Starting and Configuring 12d Field .

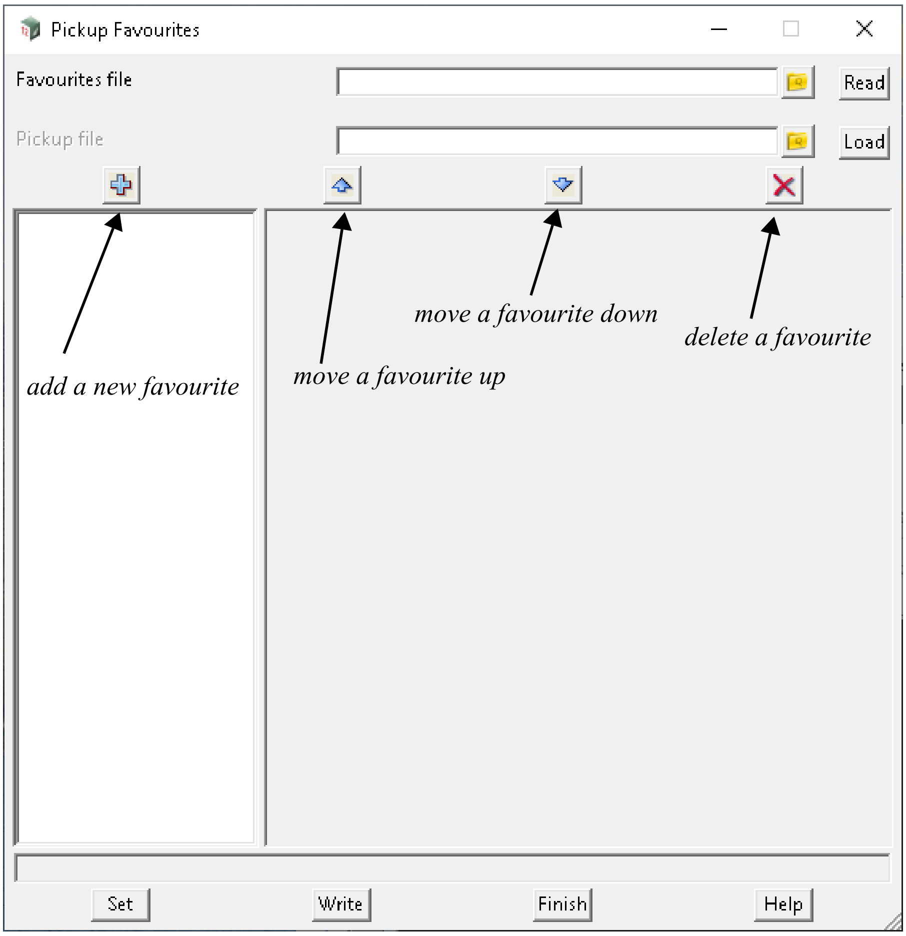
15.10.2 12d Field Favourites

Position of option on menu: Survey =>12d Field =>12d Field Codes => 12d Field Favourites

This panel is used to create and edit ***12d Field Pickup Favourites*** files.

The files contain a list of feature codes and associated information for use with picking up within ***12d Field***.

Selecting **12d Field Favourites** brings up the **Pickup Favourites** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Favourites file	file		*.12dfieldfavourites

Favourites file to create or edit.

Read	button		

Reads the favourites file, if it exists.

Pickup file	file		*.12dfieldcodes

Optional 12d field pickup codes file to use as the source of feature codes available as favourites.

Load	button		

Loads the optional 12d field pickup codes file for use.

Buttons at Bottom

Set button

??

Write button

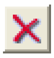
Writes the Pickup favourites to the specified file.

Icons

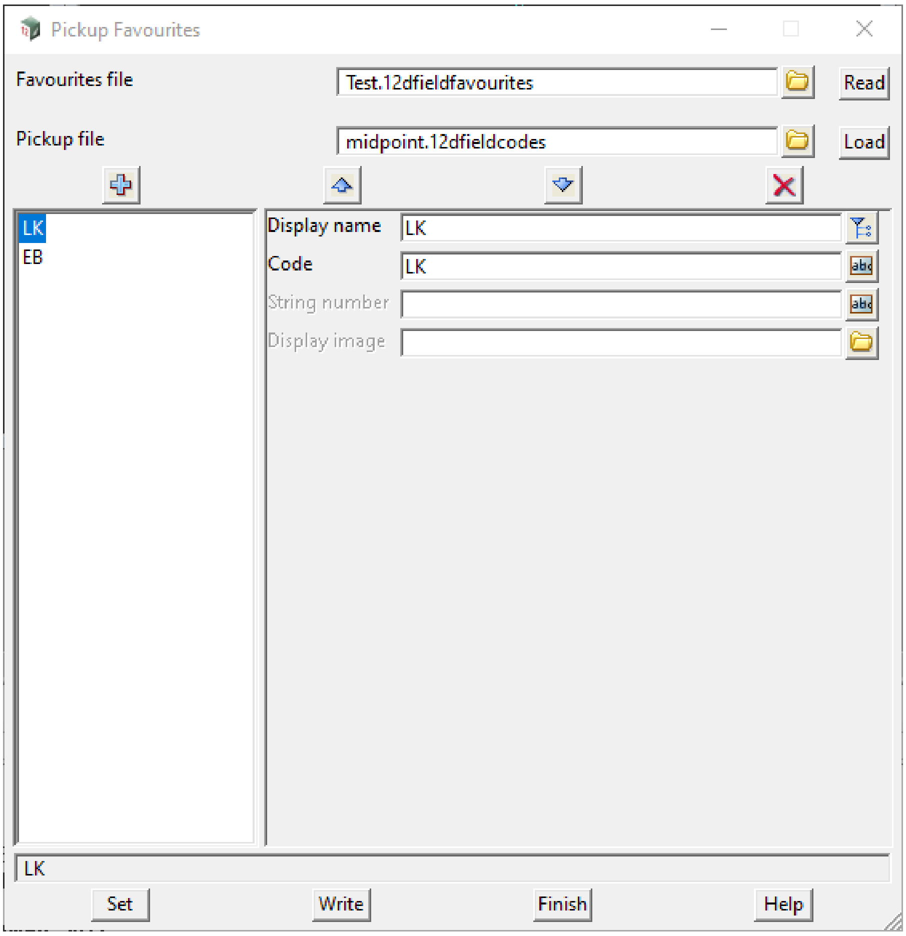

add a new favourite


move a favourite up


move a favourite down


delete a favourite

*Clicking on **Add a New Favourite** adds a new Favourite to the tree and fields to the right hand side.*



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Display name	input		Loaded Field Codes

Cosmetic name of the favourite to display
If not specified, the favourite will display using the code name.

If a Pickup Codes File has been loaded, the list of codes in the Pickup Codes File will be available as a choice in the browse box.
If no Pickup Codes File has been loaded, nothing will appear in the browse box.

Code

Name of the favourite.
String number *input*

Optional string number for the favourite.

Display image file

Optional cosmetic image of the favourite to display.
If not specified, no image will be displayed.

Continue to next section 15.10.3 Mapfile to 12d Pickup Codes or return to 15.3 Starting and Configuring 12d Field .

15.10.3 Mapfile to 12d Pickup Codes

Position of option on menu: Survey =>12d Field =>12d Field Codes => Mapfile to 12d Pickup Codes

This option is used to create a ***12d Field Pickup Coding*** file from an existing map file.

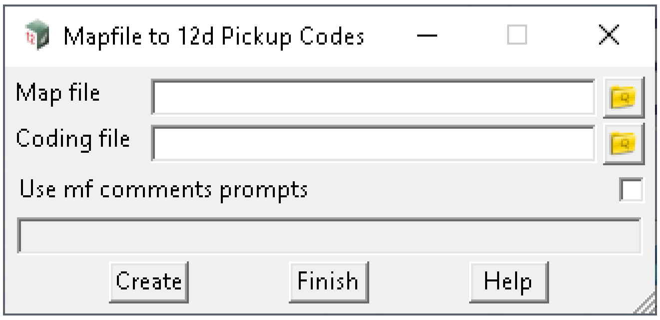
Only the following information from the **Basic** section of the mapfile is used

Key

Model

Comment

Selecting **Mapfile to 12d Pickup Codes** brings up the **Mapfile to 12d Pickup Codes** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Mapfile	file		*.mapfile *.mf

Name of the 12d mapfile to convert from.

Coding file	file		*.12dfieldcodes

Name of the coding file to convert to.

Use mf comments prompts tick box

*If **ticked**, the **Comment** field is used as the display prompt that the user sees when selecting the current feature code.*
*If **not ticked**, the **Key** field is used as the display prompt.*

Buttons at Bottom

Create button

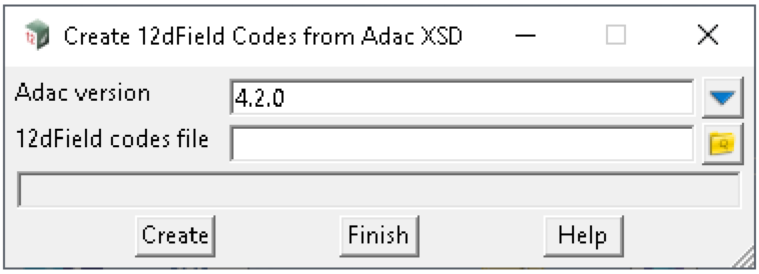
Convert the file.

Continue to next section 15.10.4 ADAC XSD to 12d Pickup Codes or return to 15.3 Starting and Configuring 12d Field .

15.10.4 ADAC XSD to 12d Pickup Codes

Position of option on menu: **Survey =>12d Field =>12d Field Codes => ADAC XSD to 12d Pickup Codes**

Selecting **ADAC XSD to 12d Pickup Codes** brings up the **Create 12d Field Codes from ADAC XSD** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
ADAC Version	choice box		

The version of ADAC being used.

12dField codes file	file box		*.12dfieldcodes

??

Buttons at Bottom

Create	button

Convert the file.

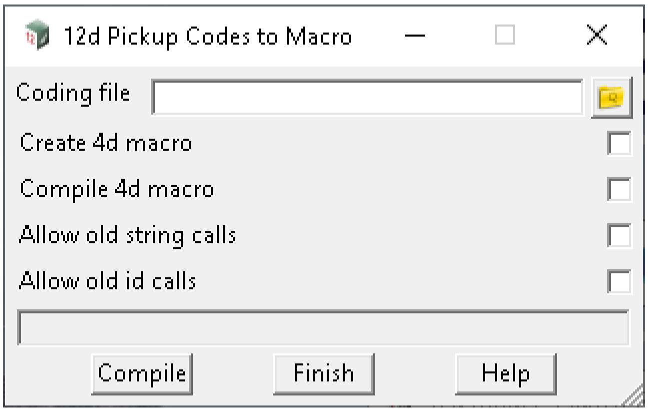
Continue to next section 15.10.5 12d Pickup Codes to Macro or return to 15.3 Starting and Configuring 12d Field .

15.10.5 12d Pickup Codes to Macro

Position of option on menu: **Survey =>12d Field =>12d Field Codes => 12d Pickup Codes to 4dm**

This panel generates a macro based on any programming defined in a ***12d Field Pickup Codes*** file. It will create a new file of the same name as the 12d Field pickup codes file, with the extension 4dm

Selecting **12d Pickup Codes to 4dm** brings up the **12d Pickup Codes to Macro** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Coding file	file		*.12dfieldcodes

12d Field Pickup codes file to read.

Create 4d macro tick box

*If **ticked**, it creates the 4dm file from the 12d Field Pickup codes file programming.*

Compile 4d macro tick box

*If **ticked**, the created 4dm file will be compiled into a 4do file.*
*If **not ticked**, no compilation will take place.*

Allow old string calls tick box

*If **ticked**, old string calls will be allowed by the compiler.*
*If **not ticked**, old string calls will not be allowed by the compiler.*

Allow old id calls tick box

*If **ticked**, old id calls will be allowed by the compiler.*
*If **not ticked**, old id calls will not be allowed by the compiler.*

Buttons at Bottom

Compile button

Creates and/or compiles the 12d Field Pickup codes file into a macro.

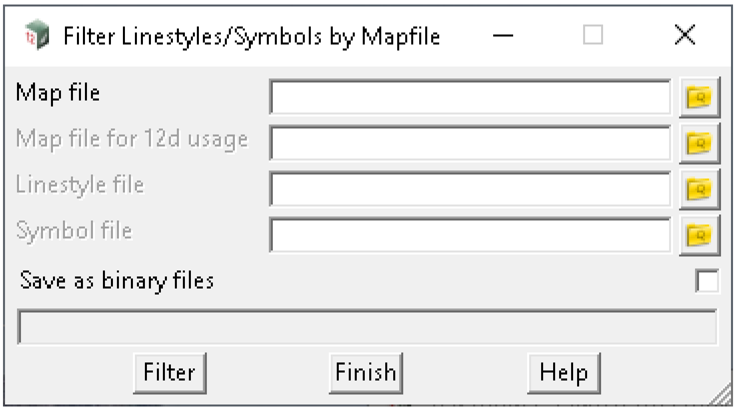
Continue to 15.10.6 Filter Linestyles/Symbols via Mapfile or return to 15.3 Starting and Configuring 12d Field .

15.10.6 Filter Linestyles/Symbols via Mapfile

Position of option on menu: **Survey =>12d Field =>12d Field Codes => Filter linestyles/symbols via mapfile**

This section of documentation is a work in progress and will be updated in subsequent releases??

Selecting **Filter linestyles/symbols via mapfile** brings up the **Filter Linestyles/Symbols by Mapfile** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Map file	file box		available map files
??			
Map file for 12d usage	file box		available map files
??			
Linestyle file	file box		
??			
Symbol file	file box		
??			
Save as binary files	tick box	not ticked	
??			

Buttons at Bottom

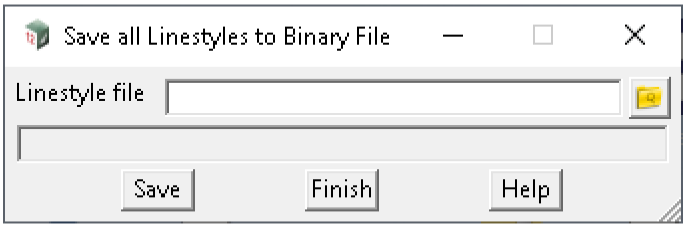
Filter	button
??	

Continue to next section 15.10.7 Save Binary Linestyles or return to 15.3 Starting and Configuring 12d Field .

15.10.7 Save Binary Linestyles

Position of option on menu: **Survey =>12d Field =>12d Field Codes => Save binary linestyles**

Selecting **Save binary linestyles** brings up the **Save all Linestyles to Binary File** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Linestyle file	file box		available *.4d files

Name of the binary form of the linestyle file.

Save	button		

Buttons at Bottom

Saves the linestyle data as a binary file.

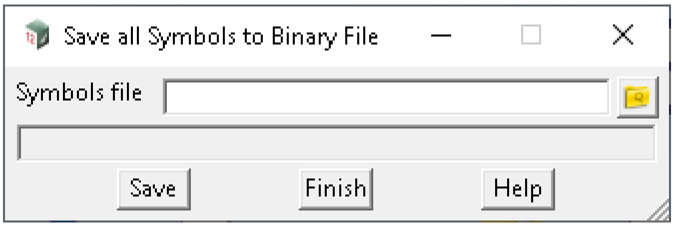
Continue to next section 15.10.8 Save Binary Symbols or return to 15.3 Starting and Configuring 12d Field .

15.10.8 Save Binary Symbols

Position of option on menu: **Survey =>12d Field =>12d Field Pickup Codes => Save binary symbols**

This section of documentation is a work in progress and will be updated in subsequent releases??

Selecting **Save binary symbols** brings up the **Save all Symbols to Binary File** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Symbols file	file box		available *.4d files

??

Buttons at Bottom

Save	button		

Saves file.

Continue to next section 15.11 12dField Setout FLD File To Strings or return to 15 12d Field .

15.11 12dField Setout FLD File To Strings

Position of option on menu: **Survey =>12d Field =>Setout FLD file to strings**

Note, this option does not apply to SDR pickup but to the setout dialogs which store points directly to a model without any re-reduction capabilities.

12d Field Setout is used to setout data directly from a ***12d Model*** project but during that process ***12d Field Setout*** also can produce points that are stored in the ***12d Model*** project.

As a backup to the storing of points, ***12d Field Setout*** also creates a modified ***fld*** file. The **FLD** file is appended to every time a point is stored, in case of an unexpected shutdown where the project had not been saved the data can be recovered from the **FLD** file.

Although this modified ***fld*** file created by ***12d Field Setout*** can't be used with ***SDR Function Reduction***, the ***fld*** file is attributed in such a way it can be read directly into ***12d Model*** **without** going through a ***SDR Function*** by using the ***Setout FLD file to string*** option.

The string data will be read in with the original name, model, colour, linestyle and weight.

fld files created by ***12d Field Setout*** from version **V9C1e** can be read in with the ***Setout FLD file to string*** option.

It might be necessary to manually edit the **FLD** file prior to reading in case of a catastrophic failure to make it readable, the basic format of the setout **FLD** file is a follows:

Each point starts with an op-code 7 which has the horizontal angle, vertical angle and slope distance to the point.

7 280.29517808 90.19002974 68.78440184

Note this is cosmetic only, it is not used in restoring the data. This is followed by the complete set of 12dField attributes for the point, opcode 124 signifies the start of an attribute group and 125 the end.

124 12dField

.

.

125 12dField

There are multiple attribute groups embedded in the overall group, the actual attributes used to restore the position of the point are in the "Measurement" attribute sub-group.

124	**Measurement**	
72	**pu_mp_x**	**332733.7501842570491135**
72	**pu_mp_y**	**6272150.0985664268955588**
72	**pu_mp_z**	**183.9431435443221119**
73	**pu_mp_id**	**786**
125	**Measurement**	

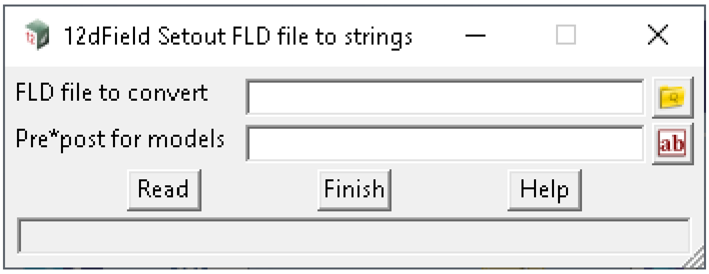
And the string details in the **Original String Details** group

124	**Original String Details**
73	**st_pickup_bsc_pt_modelTest 22**
73	**st_pickup_bsc_pt_string_nameDESK-TB**
73	**st_pickup_bsc_pt_colourred**
73	**st_pickup_bsc_pt_linestyle1**
72	**st_pickup_bsc_pt_weight0.0000000000000000**
71	**st_pickup_bsc_pt_point_line1**

125 **Original String Details**

All op-code **124**s must be matched by a closing **125**, the reader will warn in most case if the file is corrupted or only partially written.

Selecting **Setout FLD file to strings** displays the**12dField Setout FLD File To Strings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
FLD file to convert	file		

__fld__ file produced by 12d Field Setout that is to be read in.

Pre*post for models

For more information please go to the section 3.26.2 Pre*Postfix in Panel Fields

Buttons at Bottom

Read	button

The __fld__ file will be read in.

If a point in the __.fld__ file is not correctly attributed, a message will be displayed in the output window and no point will be created.

Return to 15 12d Field .

16 Design

There has been changes to the **Design** chapter in the ***12d Model Reference manual***.

See 16.1 Quick Start

See 16.2 Design Quick Tools

See 16.3 Boxing - Named Grade

See 16.4 MTF Links and Layers File Format

See 16.6 Apply MTF Manager - Create/Update

See 16.5 Fixed link - Remove by Pattern

See 16.6 Apply MTF Manager - Create/Update

See 16.7 MTF Snippets

See 16.8 Snippet Placed to Model of Strings

See 16.9 Create Shapes

See 16.10 Pavement Manager

See 16.11 TRI_PAVEMENT_NEW_FROM_ATTRS.mtfsnippet

See 16.12 TRI_PAVEMENT_NEW_KERB_FROM_ATTRS.mtfsnippet

See 16.13 TRI_PAVEMENT_NEW_TO_TIN_FROM_ATTRS.mtfsnippet

See 16.14 INSERT_PAVEMENT_TYPE_LOCATION.MTFSNIPPET.mtfsnippet

See 16.15 Important note for using parameters in _PROJECT_ATTRIBUTE and _MODEL_ATTRIBUTE

See 16.16 Copy MTF to seed

See 16.17 Apply MTF - Recreate String Sort

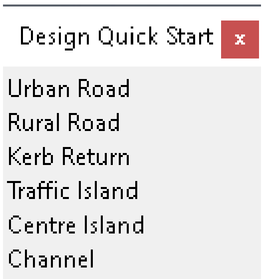
See 16.18 Apply MTF - Recreate

See 16.19 Debugging Snippets
See 16.20 Road Widening - with Snippet
See 16.21 Create Ramps and Driveways
See 16.23 Track
See 16.24 Fixed Link - To String
See 16.25 Create Polygon
See 16.26 Fixed Decisions - String Exists
See 16.27 MTF Modifiers File Format

16.1 Quick Start

Position of menu: **Design =>Quick start**

The **Quick start** walk- right menu is



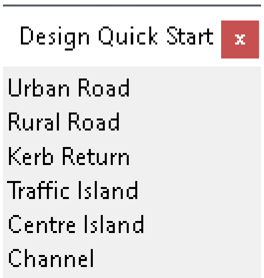
16.1.2 Urban Road
16.1.3 Rural Road
16.1.4 Kerb Return
16.1.5 Traffic Island
16.1.6 Centre Island
16.1.7 Channel

Also see

16.1.1 Information on the Design Quick Start MTF Seed Files
16.2.5 Design Quick Start Toolbar Commands.

16.1.1 Information on the Design Quick Start MTF Seed Files

Each of the options on the **Design Quick Start** menu work in a similar manner.



16.1.2 Urban Road
16.1.3 Rural Road
16.1.4 Kerb Return
16.1.5 Traffic Island
16.1.6 Centre Island
16.1.7 Channel

Each option uses a special ***MTF Seed File*** (that is installed with ***12d Model***) to automatically create an ***Apply MTF*** function.

The seed files are:

Urban road	uses *DQ_Road_Urban.mtf_seed*
Rural road	uses *DQ_Road_Rural.mtf_seed*
Kerb return	uses *DQ_Kerb_Return.mtf_seed*
Traffic island	uses *DQ_Island.mtf_seed*
Centre island	uses *DQ_Centre_Island.mtf_seed*
Channel	uses *DQ_Channel_Flat_bottom.mtf_seed*

Each ***MTF Seed File*** consists of:

1. **start up snippets** for the placement of the design road surface (not in ***Channel***)
2. various **regions** defining example modifiers.

   Some regions are example modifiers and currently set to **inactive**. They are there for use at a later stage.
3. Finally, a region for applying the **Pavement Manager New** attribute snippets.

Certain key lines are needed in the Left Hand Side (LHS) and/or Right Hand Side (RHS) modifiers to enable the ***MTF Seed File*** to automatically create an ***Apply Many***.

These special key lines are made up of

(a) ***Comments***

(b) ***Chainage Aliases***

and

(c) ***Special Region titles***.

Their position in the ***MTF Seed File*** is essential for the **Design Quick Tools** to work.

For more information, see 16.1.1.1 Data in the Left Hand Side (LHS) of the Seed File, 16.1.1.2 Data in the Right Hand Side (RHS) of the Seed File: and 16.1.1.3 Why the Above Restrictions in the Seed Files?.

16.1.1.1 Data in the Left Hand Side (LHS) of the Seed File

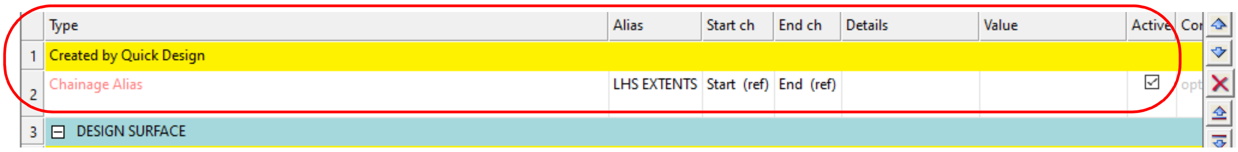
The first two lines of the seed file **must be**:

First line:

a Comment line with the text: **Created by Quick Design**

Second line

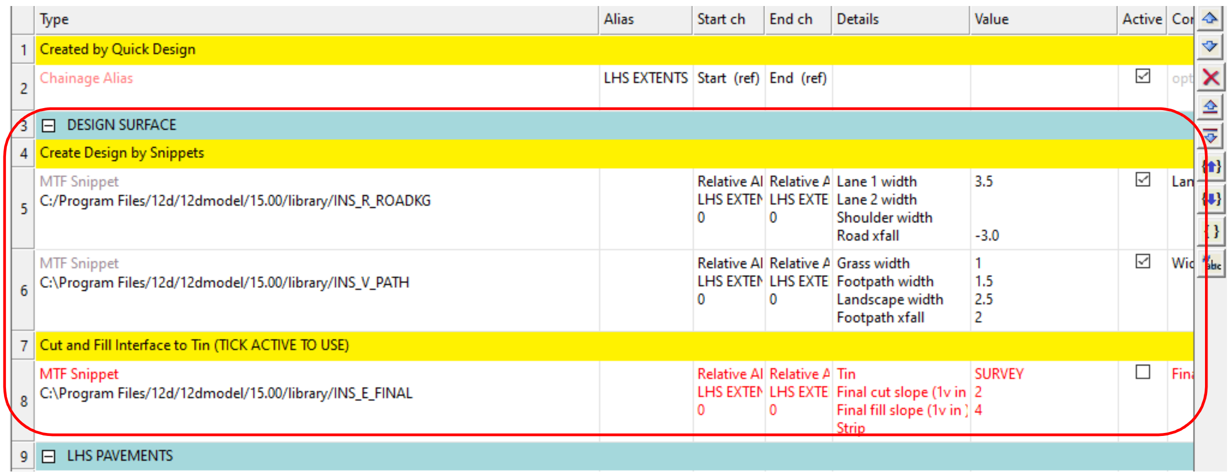
a Chainage Alias called **LHS EXTENTS** with Start chainage ***Start (ref)*** and End chainage ***End (ref)***



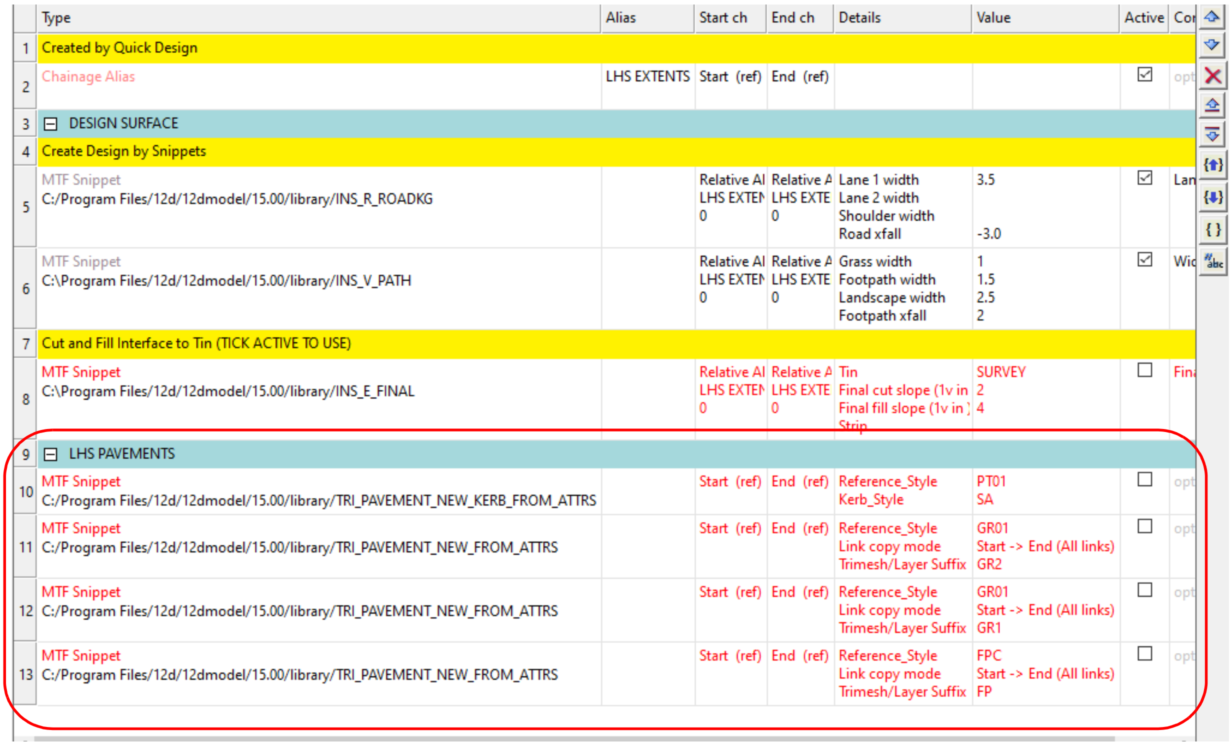
This is followed by the **DESIGN SURFACE** Region:

The **DESIGN SURFACE** region is made up of a few snippets to define the road surface.

DESIGN SURFACE region is **not mandatory** but is a good idea.



This is followed by the **LHS PAVEMENTS** region which consists of ***Pavement modifiers***, which are snippets that have been set to inactive.



	Type	Alias	Start ch	End ch	Details	Value	Active	Co
1	Created by Quick Design							
2	Chainage Alias	LHS EXTENTS	Start (ref)	End (ref)			☑	opt
3	⊟ DESIGN SURFACE							
4	Create Design by Snippets							
5	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_R_ROADKG		Relative Al LHS EXTEN 0	Relative A LHS EXTE 0	Lane 1 width Lane 2 width Shoulder width Road xfall	3.5 -3.0	☑	Lan
6	MTF Snippet C:\Program Files/12d/12dmodel/15.00/library/INS_V_PATH		Relative Al LHS EXTEN 0	Relative A LHS EXTE 0	Grass width Footpath width Landscape width Footpath xfall	1 1.5 2.5 2	☑	Wic
7	Cut and Fill Interface to Tin (TICK ACTIVE TO USE)							
8	MTF Snippet C:\Program Files/12d/12dmodel/15.00/library/INS_E_FINAL		Relative Al LHS EXTEN 0	Relative A LHS EXTE 0	Tin Final cut slope (1v in Final fill slope (1v in) Strip	SURVEY 2 4	☐	Fin
9	⊟ LHS PAVEMENTS							
10	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_KERB_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Kerb_Style	PT01 SA	☐	opt
11	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	GR01 Start -> End (All links) GR2	☐	opt
12	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	GR01 Start -> End (All links) GR1	☐	opt
13	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	FPC Start -> End (All links) FP	☐	opt

The **LHS PAVEMENTS** region is **mandatory**.

16.1.1.2 Data in the Right Hand Side (RHS) of the Seed File:

The first two lines of the RHS seed file **must** be:

First line:

a Comment line with the text: **Created by Quick Design**

Second line

a Chainage Alias called **RHS EXTENTS** with Start chainage ***Start (ref)*** and End chainage ***End (ref)***

	Type	Alias	Start ch	End ch	Details	Value	Active
1	Created by Quick Design						
2	Chainage Alias	RHS EXTENTS	Start (ref)	End (ref)			☑
3	⊟ DESIGN SURFACE						

This is followed by the **DESIGN SURFACE** Region:

The **DESIGN SURFACE** region is made up of a few snippets to define the road surface.

The **DESIGN SURFACE** region is **mandatory**.

	Type	Alias	Start ch	End ch	Details	Value	Active
1	Created by Quick Design						
2	Chainage Alias	RHS EXTENTS	Start (ref)	End (ref)			☑
3	⊟ DESIGN SURFACE						
4	Create Design by Snippets (Recommended)						
5	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_R_ROADKG		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Lane 1 width Lane 2 width Shoulder width Road xfall	3.5 -3.0	☑
6	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_V_PATH		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Grass width Footpath width Landscape width Footpath xfall	1 1.5 2.5 2	☑
7	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_E_FINAL		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Tin Final cut slope (1v in) Final fill slope (1v in) Strip	SURVEY 2 4	☐
8	⊟ RHS PAVEMENTS						

This is followed by the **RHS PAVEMENTS** region which consists of ***Pavement modifiers***, which are snippets that have been set to **inactive**.

	Type	Alias	Start ch	End ch	Details	Value	Active
1	Created by Quick Design						
2	Chainage Alias	RHS EXTENTS	Start (ref)	End (ref)			☑
3	⊟ DESIGN SURFACE						
4	Create Design by Snippets (Recommended)						
5	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_R_ROADKG		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Lane 1 width Lane 2 width Shoulder width Road xfall	3.5 -3.0	☑
6	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_V_PATH		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Grass width Footpath width Landscape width Footpath xfall	1 1.5 2.5 2	☑
7	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_E_FINAL		Relative Alias Start RHS EXTENTS 0	Relative Alias End RHS EXTENTS 0	Tin Final cut slope (1v in) Final fill slope (1v in) Strip	SURVEY 2 4	☐
8	⊟ RHS PAVEMENTS						
9	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_KERB_FROM_		Start (ref)	End (ref)	Reference_Style Kerb_Style	PT01 SA	☐
10	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	GR01 Start -> End (All links) GR2	☐
11	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	GR01 Start -> End (All links) GR1	☐
12	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_FROM_ATTRS		Start (ref)	End (ref)	Reference_Style Link copy mode Trimesh/Layer Suffix	FPC Start -> End (All links) FP	☐

The **RHS PAVEMENTS** region is also **mandatory**.

16.1.1.3 Why the Above Restrictions in the Seed Files?

After a ***Design Quick Start*** option is used to create an ***MTF***, the ***Design Quick Tools*** can be used to make modifications to the MTF, and hence the design produced by the applying the MTF. For example, pavement generation can be turned on and off or sections of the MTF stopped to allow for say a bridge.

In order to activate the edit options, the ***Design Quick Tools*** require the user to select strings created from the ***Apply MTF*** function using the MTF created by the **Design Quick Start** option

The MTF is read and the first line checked that it is a comment with the text "Quick Design".

If this is found then the ***Design Quick Start*** tool can proceed otherwise it will flag that an error has occurred.

If it proceeds then the rest of the ***MTF*** is read and modifiers edited, and/ or inserted, to reflect the ***Design Quick Tool*** used.

The ***MTF*** is then **UPDATED**, run and **SAVED**.

Return to 16.1 Quick Start

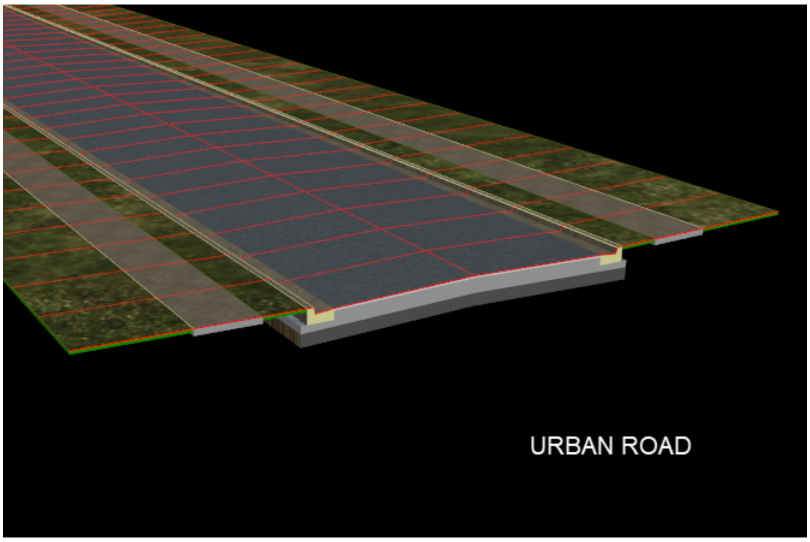
16.1.2 Urban Road

Position of menu: **Design =>Quick start =>Urban road**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Road_Urban.mtf_seed

The *MTF Seed File* ***DQ_Road_Urban.mtf_seed*** is installed with ***12d Model***.



As long as the file name above remains the same, it can be placed in your working folder, in customer_user, or user'

This will enable you to customise the seed file. If the file is not found in this search path, then the setups install version will be used.

For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

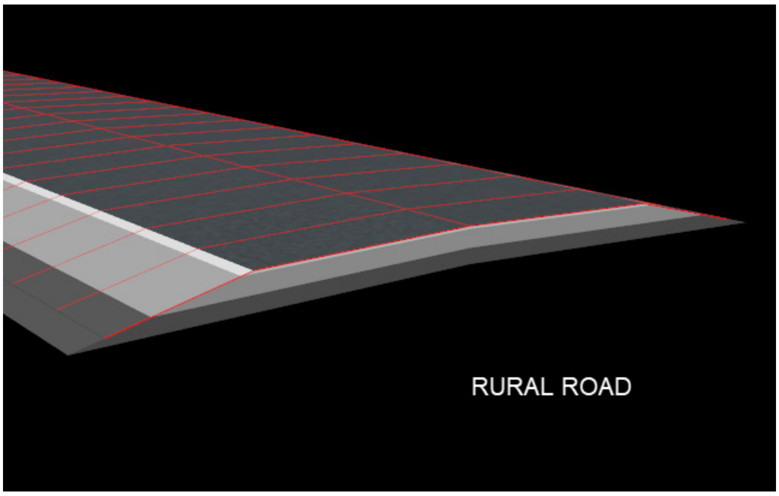
16.1.3 Rural Road

Position of menu: **Design =>Quick start =>Rural road**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Road_Rural.mtf_seed

The *MTF Seed File* ***DQ_Road_Rural.mtf_seed*** is installed with ***12d Model***.



As long as the file name above remains the same, it can be placed in your working folder, in customer_user, or user.

This will enable you to customise the seed file. If the file is not found in this search path, then the setups install version will be used.

For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

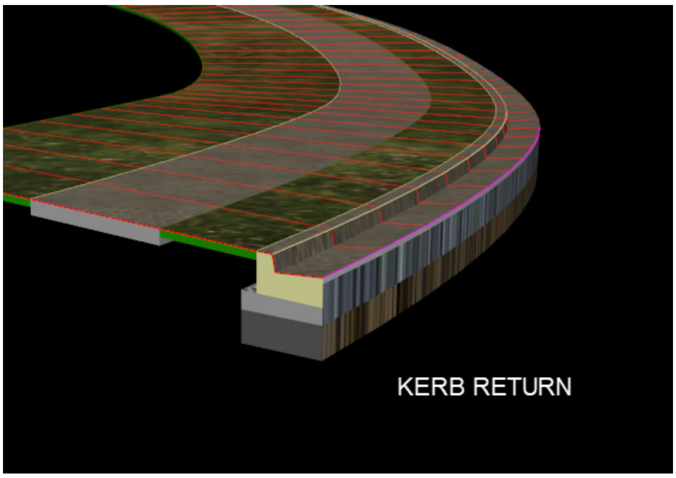
16.1.4 Kerb Return

Position of menu: **Design =>Quick start =>Kerb return**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Kerb_Return.mtf_seed

The *MTF Seed File* ***DQ_Kerb_Return.mtf_seed*** is installed with ***12d Model***.



As long as the file name above remains the same, it can be placed in your working folder, in customer_user, or user.

This will enable you to customise the seed file. If the file is not found in this search path, then the setups install version will be used.

For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

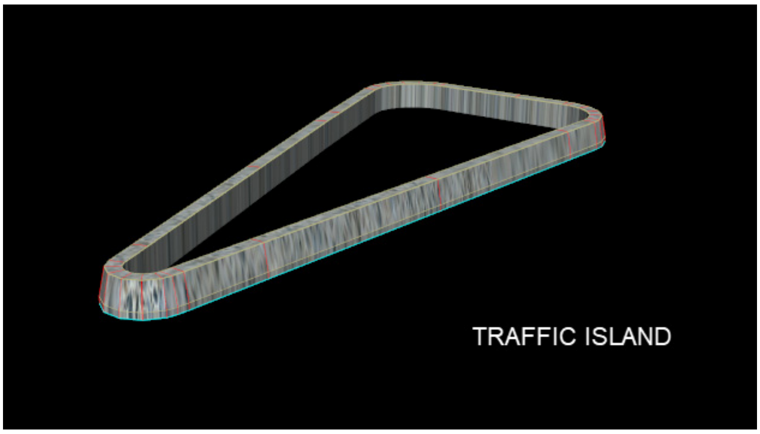
16.1.5 Traffic Island

Position of menu: **Design =>Quick start =>Traffic island**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Island.mtf_seed

The *MTF Seed File* ***DQ_Island.mtf_seed*** is installed with ***12d Model***.



As long as the file name above remains the same, it can be placed in your working folder, in customer_user, or user.

This will enable you to customise the seed file. If the file is not found in this search path, then the setups install version will be used.

For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

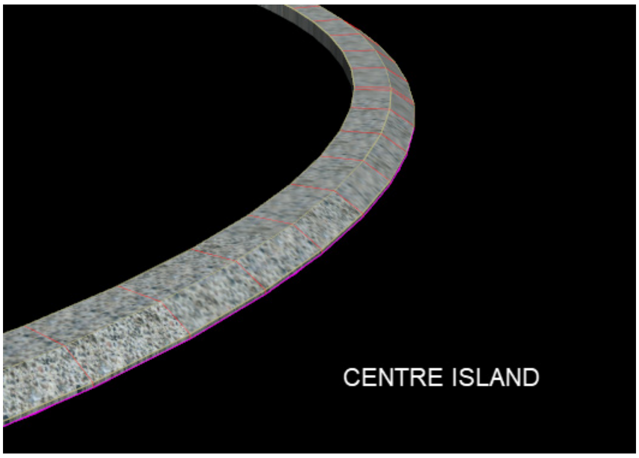
16.1.6 Centre Island

Position of menu: **Design =>Quick start =>Centre island**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Centre_Island.mtf_seed

The *MTF Seed File* ***DQ_Centre_Island.mtf_seed*** is installed with ***12d Model***.



As long as the file name above remains the same, it can be placed in your working folder, in customer_user, or user.

This will enable you to customise the seed file. If the file is not found in this search path, then the setups install version will be used.

NOTE: The seed files above are also installed in the library, so they can be accessed when using the Apply Many Manager.

For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

16.1.7 Channel

Position of menu: **Design =>Quick start =>Channel**

This option uses the following ***MTF Seed File*** to automatically create an ***Apply MTF*** function:

DQ_Channel_Flat_Bottom.mtf_seed

The *MTF Seed File* ***DQ_Channel_Flat_Bottom.mtf_seed*** is installed with ***12d Model***.

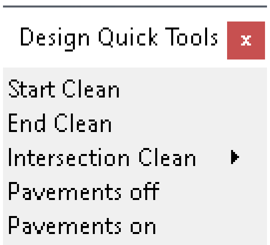
For more information on the structure of the *Design Quick Start MTF Seed File*, see 16.1.1 Information on the Design Quick Start MTF Seed Files.

Continue to 16.2 Design Quick Tools or go back to 16.1 Quick Start.

16.2 Design Quick Tools

Position of menu: **Design =>Quick tools**

The **Quick tools** walk- right menu is



See
16.2.1 Start Clean
16.2.2 End Clean
16.2.3 Intersection Clean
16.2.4 Pavement On/Off
16.2.4 Pavement On/Off

For information on toolbar commands see 16.2.5 Design Quick Start Toolbar Commands.

16.2.1 Start Clean

Position of menu: **Design =>Quick tools =>Start clean**

This option is used to redefine the LHS and/or RHS of the design road, by selecting any strings created by the ***Apply MTF*** function created by a ***Design Quick Start*** option, followed by a string end point.

Typically, the end point of an intersection kerb return

Depending on which side is selected…

If the kerb return is a **Super Alignment**, a smart chainage is used that references the end of the kerb return.

A test is done to check whether or not that kerb return is unique. If not, an **evaluated chainage** is calculated and a **typed** chainage entry is used.

If the external string selected is **not** a super alignment, **or** the end of the kerb return is **not** selected (rather a point along the string e.g.) …

An **evaluated chainage** is calculated and a **typed** chainage entry is use.

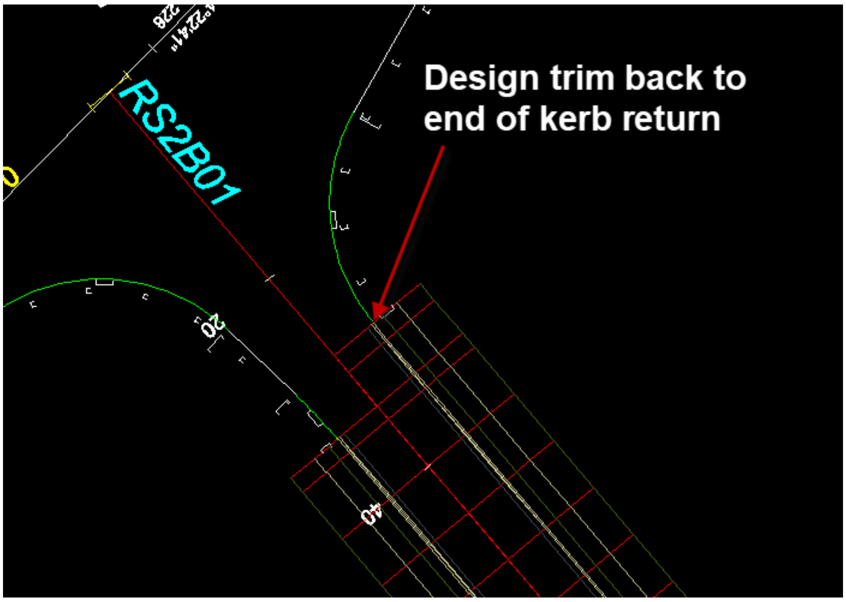
Continue to 16.2.2 End Clean or go back to 16.2 Design Quick Tools.

16.2.2 End Clean

Position of menu: **Design =>Quick tools =>End clean**

This option is similar to the start tool above but the end of the road design is selected

The LHS EXTENTS alias, and RHS EXTENTS alias is again updated.



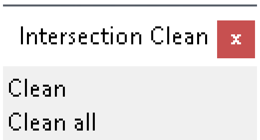
The ***Apply MTF*** function is then recalced.

Continue to 16.2.3 Intersection Clean or go back to 16.2 Design Quick Tools.

16.2.3 Intersection Clean

Position of menu: **Design =>Quick tools =>Intersection clean**

The **Intersection clean** walk- right menu is



See
16.2.3.1 Clean
16.2.3.2 Clean All

16.2.3.1 Clean

Position of menu: **Design =>Quick tools =>Intersection clean =>Clean**

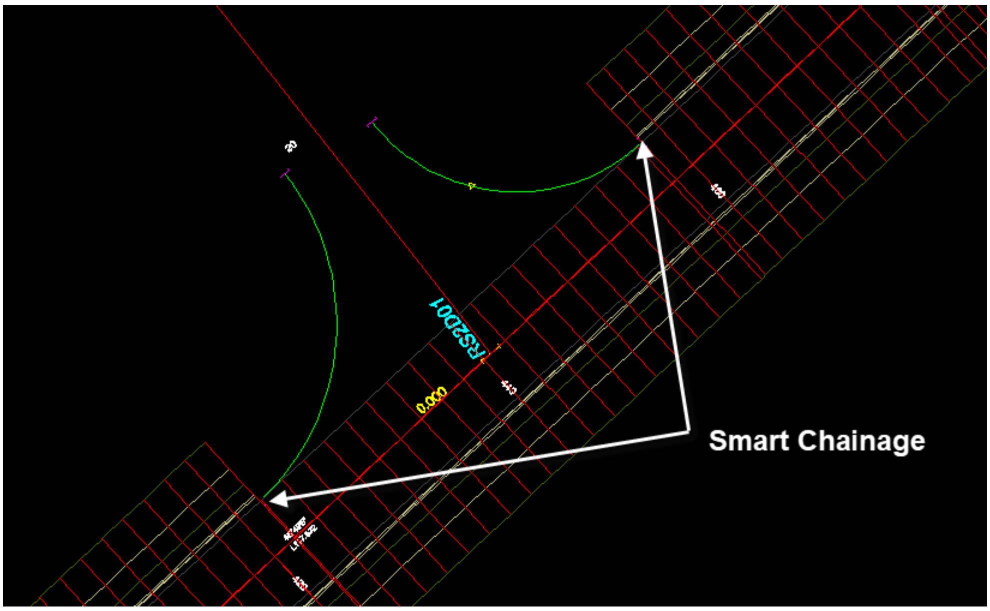
This option is used to remove parts of your design from the first link outwards (Lip of Kerb e.g.).

Once one of the design **AM strings** is selected, you will be prompted for the selection of **two** end point strings. Typically, the end points of intersection kerb returns.

Depending on which side is selected.

As per the start and end clean up checks are done on the strings selected, to determine if the end of a **unique** kerb return has been selected or not.

A smart chainage is used or a typed evaluated chainage.

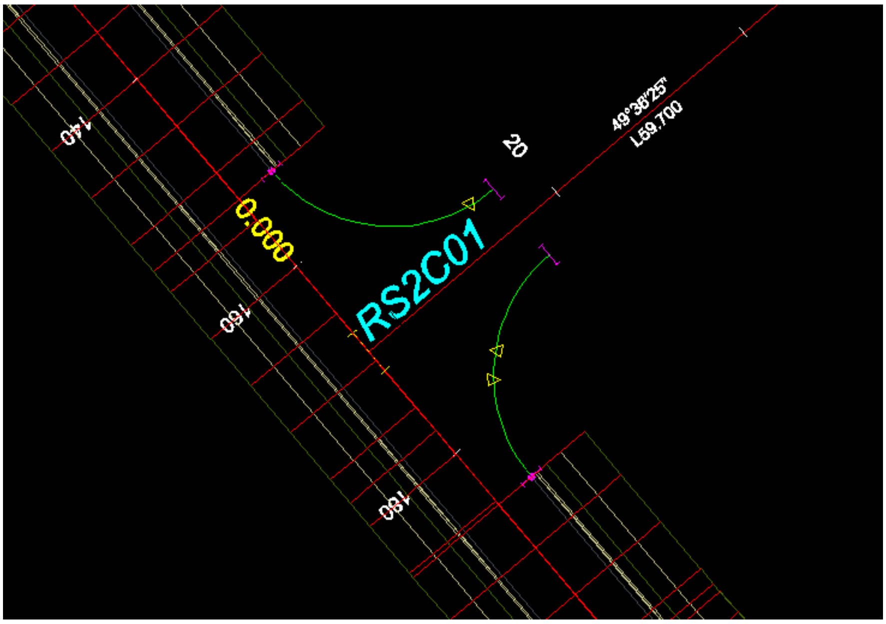


Continue to 16.2.3.2 Clean All or go back to 16.2.3 Intersection Clean.

16.2.3.2 Clean All

Position of menu: **Design =>Quick tools =>Intersection clean =>Clean all**

This option is similar to the previous, except that it removes **ALL** the design strings through the intersection.



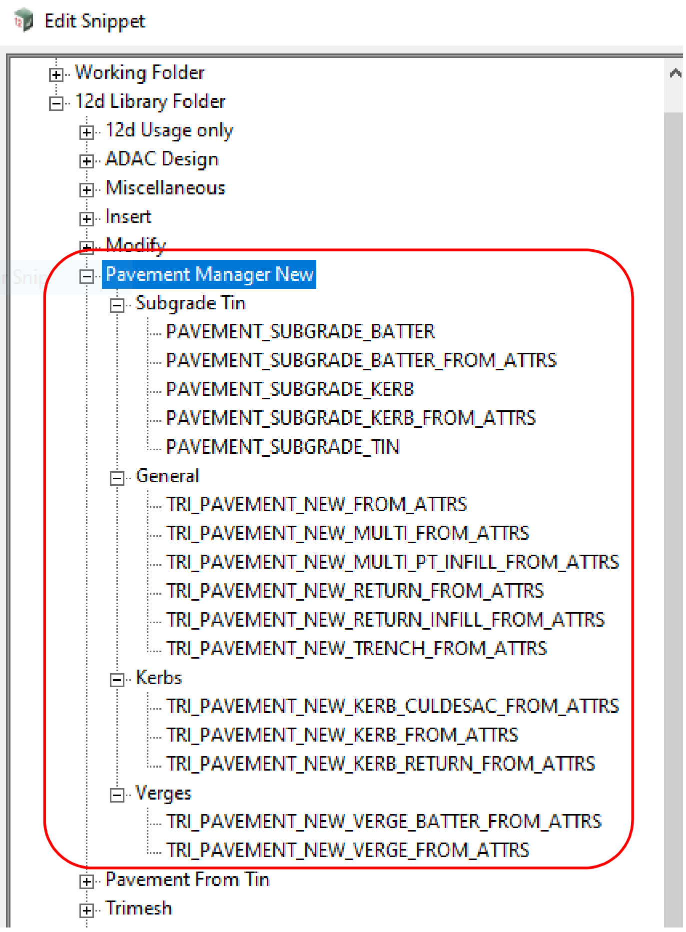
Continue to 16.2.4 Pavement On/Off or go back to 16.2.3 Intersection Clean.

16.2.4 Pavement On/Off

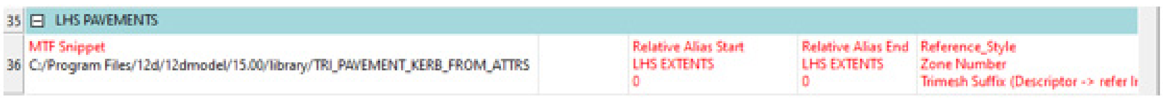
Position of menu: **Design =>Quick tools =>Pavement on**

Position of menu: **Design =>Quick tools =>Pavement off**

These options will search through the MTF on both sides, for any standard **12d Pavement Manager New** snippets using **Attributes** e.g.



Once found, the modifier is either made **active** or **inactive**.



Note: These options can be used on any MTF, even if it was not initially created, using the **Design Quick** seed files.

THE MTF IS UPDATED AND SAVED.

Continue to 16.2.5 Design Quick Start Toolbar Commands or go back to 16.2 Design Quick

Tools.

16.2.5 Design Quick Start Toolbar Commands

Even though the ***Design Quick*** menu and toolbar uses seed files shipped with ***12d Model***, a user cannot **defined their own seeds** and add them to a ***User Defined Toolbar*** in

user_toolbars.4d.

Extract from **12d toolbars.4d**

Toolbar "Design Quick Start" {

Button "Urban Road" {

Command "macro -no_console -close_on_exit $LIB_4D/AM_Seed_Drop.4do $LIB_4D/ DQ_Road_Urban.mtf_seed

"**Icon** "Urban.bmp"

}

}

Continue to 16.3 Boxing - Named Grade or go back to 16.2 Design Quick Tools.

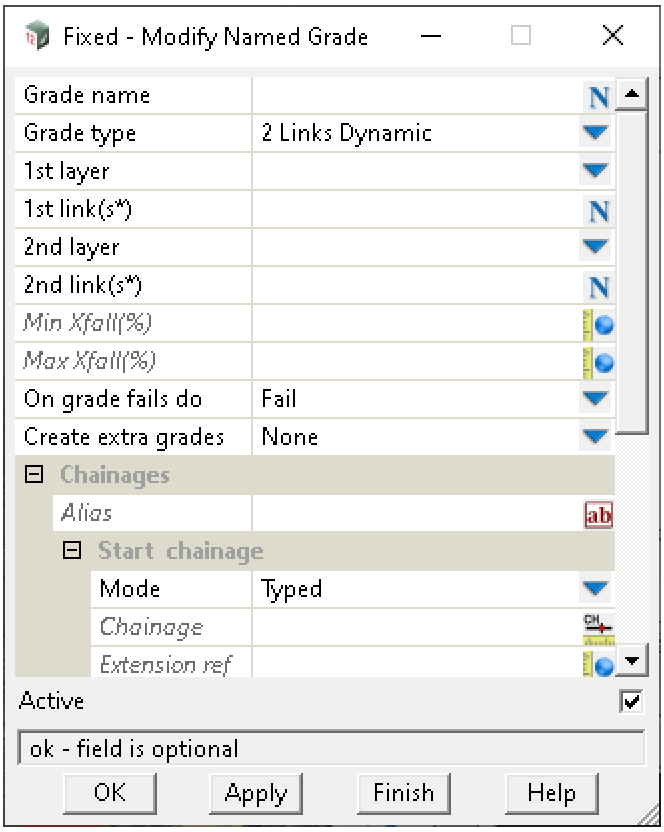
16.3 Boxing - Named Grade

Selecting **Named grade** brings up the panel **Fixed - Modify Named Grade**

A named grade is a compact way of defining a grade/Xfall/slope that can constantly be reused in an apply, this is especially important for subgrade layers where paralleling the finished surface is critical.

For example, rather constantly entering the layer and link for 2 points on a surface defining the Xfall, (4 boxes on the panel) this is compacted into a single named grade box.

Named grades are typically defined for pavements and batter slopes which have to be constantly paralleled and intersected to produce subgrade layers.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Default	Pop-Up
Grade Name	name box		available names

Name of the grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

Grade Type	choice box	2 links layers	2 Links Dynamic, 2 Links, Horizontal, Vertical, Xfall(%), Slope(h/v), Link & Tin, Link & Tin Dynamic, Link & Side

Method used to define the named grade.
For more information on the choices, see 16.3.0.1 Choices for Grade Type.

On grade fails do	choice box		Fail, Horizontal, Vertical X-Fall(%), Slope(h/v)

If the name grade fails, for example a link is missing at a chainage then one of the fixed named grades, those that do not require links or tins can be called instead.

If ***On Grade Fails do*** *is* ***Horizontal****, see*16.3.0.1.3 Grade type is Horizontal.
If ***On Grade Fails do*** *is* ***Vertical****, see*16.3.0.1.4 Grade type is Vertical.
If ***On Grade Fails do*** *is* ***X-Fall(%)****, see*16.3.0.1.5 Grade type is Xfall(%).
If ***On Grade Fails do*** *is* ***Slope(h/v)****, see*16.3.0.1.6 Grade type is Slope (h/v).

Alias, **Start Chainage**, **End Chainage**, **Interval**

Defines the start and end chainages that the modifier exists between.

For information on these panel fields, see 20.2.2.1.1 Common Fields and Buttons on MTF Modifier Panels.

Comment, **Extra start**, **Extra End, Active, OK, Apply**

For information on these panel fields, see 20.2.2.1.1 Common Fields and Buttons on MTF Modifier Panels.

16.3.0.1 Choices for Grade Type

See 16.3.0.1.1 Grade Type 2 Links Dynamic

See 16.3.0.1.2 Grade Type is 2 Links (deprecated)

See 16.3.0.1.3 Grade type is Horizontal

See 16.3.0.1.4 Grade type is Vertical

See 16.3.0.1.5 Grade type is Xfall(%)

See 16.3.0.1.6 Grade type is Slope (h/v)

See 16.3.0.1.7 Grade Type Link & Tin (deprecated

See 16.3.0.1.8 Grade Type Link & Tin Dynamic

See 16.3.0.1.9 Grade Type Link & Side

16.3.0.1.1 Grade Type 2 Links Dynamic

Grade between 2 links is evaluated at all chainages along the apply, dynamically updating the grade at each chainage.

It is an error if the 2 links have the same height and offset.

Grade name	
Grade type	2 Links Dynamic
1st layer	Design
1st link	
2nd layer	Design
2nd link	
Min Xfall(%)	
Max Xfall(%)	
On grade fails do	Fail
Create extra grades	None

1st Layer layer box Design available layers, External String

Name of the layer that the 1st link to evaluate is in.

1st Link input box

Name of the 1st link to evaluate.

2nd Layer layer box Design available layers, External String

Name of the layer that the 2nd link to evaluate is in.

2nd Link input box

Name of the 2nd link to evaluate.

Min Xfall(%) real box

Minimum Xfall(%) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

Max Xfall(%) real box

Maximum Xfall(%) where if the evaluated Xfall is greater than this value then the Xfall is set to this *value.*

On grade fails do	choice box	Fail	Fail, Horizontal, Vertical, Xfall(%), Slope(h/v)

When grade cannot be evaluated at a chainage, either fail or fall back to a named grade type that will always produce a grade.

For more information on the choices, see 16.3.0.2 Choices for On Grade Fails Do.

Create extra grades	choice box	None	None, Mirror, Normal, Mirror & Normal

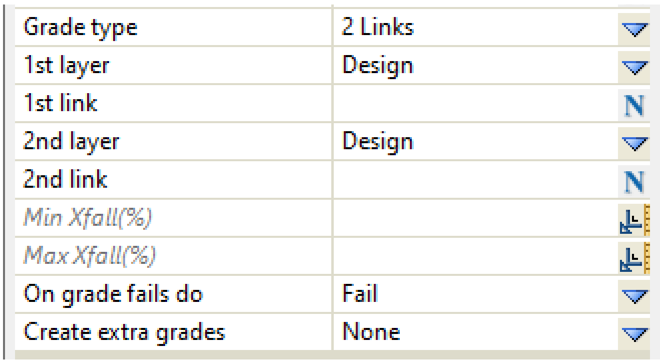
Define more named grade(s) relative to the named grade being defined in this panel.

For more information on the choices, see 16.3.0.3 Choices for Create Extra Grades.

16.3.0.1.2 Grade Type is 2 Links (deprecated)

Deprecated, same as 16.3.0.1.1 Grade Type 2 Links Dynamic *except the named grade is only evaluated once and will not dynamically update the grade if the 2 nominated links are modified after the declaration of this named grade in the MTF.*

It is an error if the 2 links have the same height and offset.

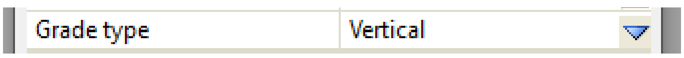


16.3.0.1.3 Grade type is Horizontal

Grade will be a Xfall(%) of 0%.

16.3.0.1.4 Grade type is Vertical

Grade will be a Xfall(%) of -100,000,000% on the LHS and 100,000,000% on the RHS.



16.3.0.1.5 Grade type is Xfall(%)

Grade is defined as a fixed Xfall(%).

Grade type	Xfall(%)
Xfall(%)	
Create extra grades	None

Xfall(%) real box

Grade in Xfall(%) to use.

Create extra grades choice box None None, Mirror, Normal, Mirror & Normal

Define more named grade(s) relative to the named grade being defined in this panel.
For more information on the choices, see 16.3.0.3 Choices for Create Extra Grades.

16.3.0.1.6 Grade type is Slope (h/v)

Grade is defined as a fixed slope(horizontal/vertical).

Grade type	Slope(h/v)
Slope(h/v)	
Create extra grades	None

Slope(h/v) real box

Grade in Slope(h/v) to use.

Create extra grades choice box None None, Mirror, Normal, Mirror & Normal

Define more named grade(s) relative to the named grade being defined in this panel.
For more information on the choices, see 16.3.0.3 Choices for Create Extra Grades.

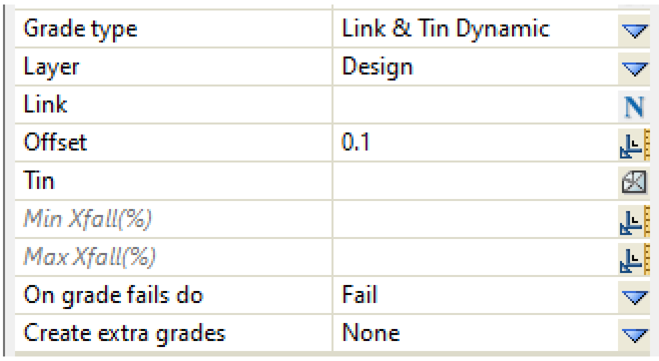
16.3.0.1.7 Grade Type Link & Tin (deprecated

Deprecated, same as 16.3.0.1.8 Grade Type Link & Tin Dynamic *except the named grade is only evaluated once and will not dynamically update the grade if the nominated link is modified after the declaration of this named grade in the MTF.*

Grade type	Link & Tin
Layer	Design
Link	
Offset	0.1
Tin	
Min Xfall(%)	
Max Xfall(%)	
On grade fails do	Fail
Create extra grades	None

16.3.0.1.8 Grade Type Link & Tin Dynamic

Grade is evaluated at all chainages along the apply, defined by the grade between a link dropped to a tin and an offset from the link also dropped to the tin.



Layer layer box Design available layers, External String

Name of the layer containing the link to drop to the tin.

Link input box

Name of the link to drop to the tin.

Offset real box 0.1 available tins

Offset from the link for the second drop to the tin.

Tin tin box

Tin to drop the link position and link offset position to define the grade at a chainage.

Min Xfall(%) real box

Minimum Xfall(%) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

Max Xfall(%) real box

Maximum Xfall(%) where if the evaluated Xfall is greater than this value then the Xfall is set to this value.

On grade fails do choice box Fail Fail, Horizontal, Vertical, Xfall(%), Slope(h/v)

When grade cannot be evaluated at a chainage, either fail or fall back to a named grade type that will always produce a grade.

For more information on the choices, see 16.3.0.2 Choices for On Grade Fails Do.

Create extra grades choice box None None, Mirror, Normal, Mirror & Normal

Define more named grade(s) relative to the named grade being defined in this panel.

For more information on the choices, see 16.3.0.3 Choices for Create Extra Grades.

16.3.0.1.9 Grade Type Link & Side

Defined by the grade between a nominated link and the next/previous existing link in the layer at a given chainage along the apply. Note that the Hinge string can be nominated with this grade type.

It is an error if the 2 links have the same offset.

Grade type	Link & Side
Layer	Design
Link	
2nd link	Next
Min Xfall(%)	
Max Xfall(%)	
On grade fails do	Fail
Create extra grades	None

Layer layer box Design available layers

Name of the layer containing the links to evaluate.

Link input box

Name of the 1st link to evaluate.

*The Hinge string can be entered by name here if the 2nd link choice is set to **Next**.*

2nd link choice box Next Next, Previous

The position of 2nd link to evaluate relative to the 1st link.

*It is an error if **Next** is selected and **Link** is the last link in the layer.*

*It is an error if **Next** is selected, **Link** is set to Hinge and the first link in the layer and has the same offset as the **Hinge**.*

*If **Previous** is selected and **Link** is the first link in the layer the **Hinge** will be used as the 2nd link.*

*It is an error if **Previous** is selected and **Link** is the first link in the layer and has the same offset as the **Hinge**.*

Min Xfall(%) real box

Minimum Xfall(%) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

Max Xfall(%) real box

Maximum Xfall(%) where if the evaluated Xfall is greater than this value then the Xfall is set to this value.

On grade fails do choice box Fail Fail, Horizontal, Vertical, Xfall(%), Slope(h/v)

When grade cannot be evaluated at a chainage, either fail or fall back to a named grade type that will always produce a grade.

For more information on the choices, see 16.3.0.2 Choices for On Grade Fails Do.

Create extra grades choice box None None, Mirror, Normal, Mirror & Normal

Define more named grade(s) relative to the named grade being defined in this panel.

For more information on the choices, see 16.3.0.3 Choices for Create Extra Grades.

16.3.0.2 Choices for On Grade Fails Do

see 16.3.0.2.1 On Grade Fails Do Fail
see 16.3.0.2.2 On Grade Fails Do Horizontal.
see 16.3.0.2.3 On Grade Fails Do Vertical.
see 16.3.0.2.4 On Grade Fails Do Xfall(%).
see 16.3.0.2.5 On Grade Fails Do Slope(h/v).

16.3.0.2.1 On Grade Fails Do Fail

When named grade fails to evaluate at a given chainage, print an error message to the output window with details on what caused the failure. An error message will also be printed for each modifier that attempts to reference a named grade at a chainage that has failed to evaluate.

16.3.0.2.2 On Grade Fails Do Horizontal

When named grade fails to evaluate at a given chainage, substitute failed grade with a horizontal grade.

For more information, see 16.3.0.1.3 Grade type is Horizontal.

16.3.0.2.3 On Grade Fails Do Vertical

When named grade fails to evaluate at a given chainage, substitute failed grade with a vertical grade.

For more information, see 16.3.0.1.4 Grade type is Vertical.

16.3.0.2.4 On Grade Fails Do Xfall(%)

When named grade fails to evaluate at a given chainage, substitute failed grade with a user defined Xfall(%).

For more information, see 16.3.0.1.5 Grade type is Xfall(%).

16.3.0.2.5 On Grade Fails Do Slope(h/v)

When named grade fails to evaluate at a given chainage, substitute failed grade with a user defined slope(h/v).

For more information, see 16.3.0.1.6 Grade type is Slope (h/v).

16.3.0.3 Choices for Create Extra Grades

see 16.3.0.3.1 Extra Grades None.

see 16.3.0.3.2 Extra Grades Mirror.

see 16.3.0.3.3 Extra Grades Normal.

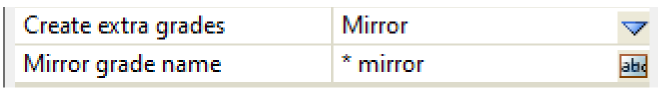
16.3.0.3.1 Extra Grades None

Create no extra named grade(s) relative to the named grade being defined in this panel.

16.3.0.3.2 Extra Grades Mirror

Create an additional named grade as the Xfall of the opposite sign to the Xfall of named grade being defined in this panel.

E.g. Mirror Grade as Xfall = -(Named Grade as Xfall)



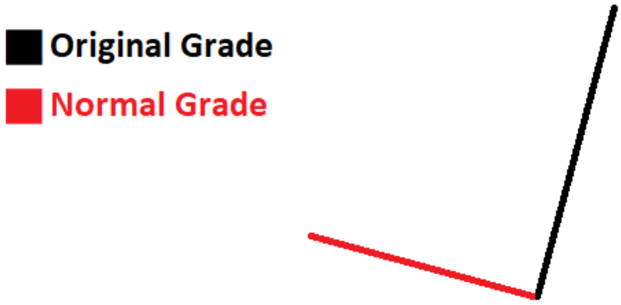
Mirror grade name input box * mirror

Name of the mirror grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

If a wildcard(*) is used, it will substituted with the original grade name.

16.3.0.3.3 Extra Grades Normal

Create an additional named grade as the grade normal/perpendicular to the named grade being defined in this panel.



Create extra grades	Normal
Normal grade name	* normal

Normal grade name input box * normal

Name of the normal grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

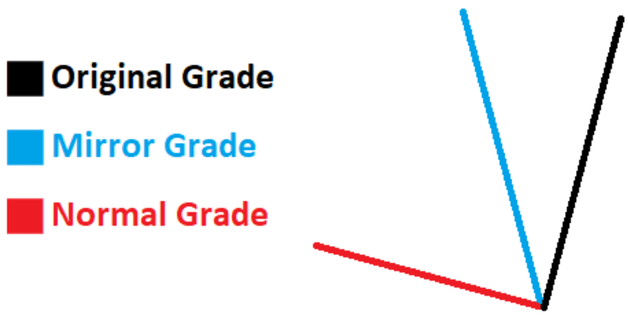
If a wildcard(*) is used, it will substituted with the original grade name.

16.3.0.3.4 Extra Grades Mirror & Normal

Create a mirror grade and normal grade relative to the named grade being defined in this panel.

For more information on mirror grades, see 16.3.0.3.2 Extra Grades Mirror.

For more information on normal grades, see 16.3.0.3.3 Extra Grades Normal.



Create extra grades	Mirror & Normal
Mirror grade name	* mirror
Normal grade name	* normal

Mirror grade name input box * mirror

Name of the mirror grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

If a wildcard(*) is used, it will substituted with the original grade name.

Normal grade name input box * normal

Name of the normal grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

If a wildcard(*) is used, it will substituted with the original grade name.

Continue to 16.4 MTF Links and Layers File Format or go back to 16.3 Boxing - Named Grade.

16.4 MTF Links and Layers File Format

In a MTF file the first keyword on a line indicates the type of modifier and is generally followed by the link(s) description, we will use this format here to describe the various forms the link(s) description can take in an MTF or MTFSNIPPET file.

The link description(s) is always quoted, e.g., "**EPRL**".

See 16.4.1 Link names prior to the introduction of multiple layers.

See 16.4.2 Link names with the introduction of multiple layers and snippets.

See 16.4.3 Syntax for compacting multiple link names.

See 16.4.4 Syntax for auto generating incrementing/decrementing link names.

See 16.4.5 Final notes.

16.4.1 Link names prior to the introduction of multiple layers

Links and their associated Layers can be represented in many ways in the MTF and MTFSNIPPET files, prior to the introduction of multiple layers in the MTF just the link name was necessary.

A single link being insert in the design layer

insert "**EPRL**" "green" …….

Multiple links being removed from the design layer

remove "**EPRL**" "**L1RL**" "**L2CL**" 1000.0 …

This format is still valid, any link without a layer name will be inserted in the "**Design**" layer.

Continue to 16.4.2 Link names with the introduction of multiple layers and snippets.

16.4.2 Link names with the introduction of multiple layers and snippets

With the introduction of multiple layers and snippets the traditional layer was given the default name "**Design**" with the following layers user defined.

So, in the MTF file the new syntax had to contain both the layer and link names, then, especially with use in snippets it was necessary to introduce notation to indicate the side, left, right or unresolved the link was being placed on.

A single link being inserted on the left hand side of the design layer, this is signified by the << separating the layer and link.

insert "**Design**<<**EPRL**" "green" …

A single link being inserted on the right hand side of the design layer, this is signified by the >>

separating the layer and link.

insert "**Design**>>**EPRR**" "green" …

A single link defined in a snippet, in this case when the snippet is used it could be inserted on either the left or right hand side of a layer, in this case we use => to denote the side is unresolved until the MTF is run.

insert "**Design**=>**EPRR**" "green"

Multiple links being removed from the LHS of layer "FSL"

remove "**FSL**<<**EPRL**" "**FSL**<<**L1RL**" "**FSL**<<**L2CL**" 1000.0 …

Note, for more advanced use a left hand modifier can contain a reference to a right hand side link by using the >> notation and vice-versa.

A link entered into the left or right hand sides of the MTF can also use the => notation, the 1st time the apply is run this will be converted to either << or >> to suit.

Continue to 16.4.3 Syntax for compacting multiple link names.

16.4.3 Syntax for compacting multiple link names

With the introduction of snippets which require the manual editing of the raw modifier commands and modifiers than contained many link names it was desirable to introduce syntax to compact multiple link names into something more manageable.

Concatenating multiple link names with a semicolon ";".

Multiple links in the same layer can be compacted via the following syntax "**Layer**=>**Link1;Link2;Link3**", the layer name and side syntax is unchanged followed by unlimited multiple link names separated with a ;

Take the example

remove "**FSL**<<**EPRL**" "**FSL**<<**L1RL**" "**FSL**<<**L2CL**" 1000.0 …

This can be compacted to

remove "**FSL**<<**EPRL**;**L1RL**;**L2CL**" 1000.0 …

This syntax can freely be used in the traditional multi link name format

remove "**FSL**<<**EPRL**;**L1RL**;**L2CL**" "**SGL**<<**EFLL**" 1000.0 …

Important, any white space will be honoured.

Continue to 16.4.4 Syntax for auto generating incrementing/decrementing link names.

16.4.4 Syntax for auto generating incrementing/decrementing link names

Some modifiers, such as **Fixed - Insert Arc** Links generate many links which would typically have an "incrementing" name

insert_arc_links "**FINAL**<<**W01**;**W02**;**W03**;**W04**;**W05**" "red"…

For these cases to avoid the labourious entry of all of the individual link names the user can use the colon : operator to generate consecutive link names.

insert_arc_links "**FINAL**<<**W01**:**W05**" "red"…

The 2 links must be the same number of characters, the incrementable/decrementable characters are auto detected and can be letters or numbers, an error will be displayed if the pattern cannot be determined.

Multiple uses are permitted separated by a semicolon:

insert_arc_links "**FINAL**<<**W01**:**W05**;**WLE**:**WLA**" "red"…

Continue to 16.4.5 Final notes.

16.4.5 Final notes

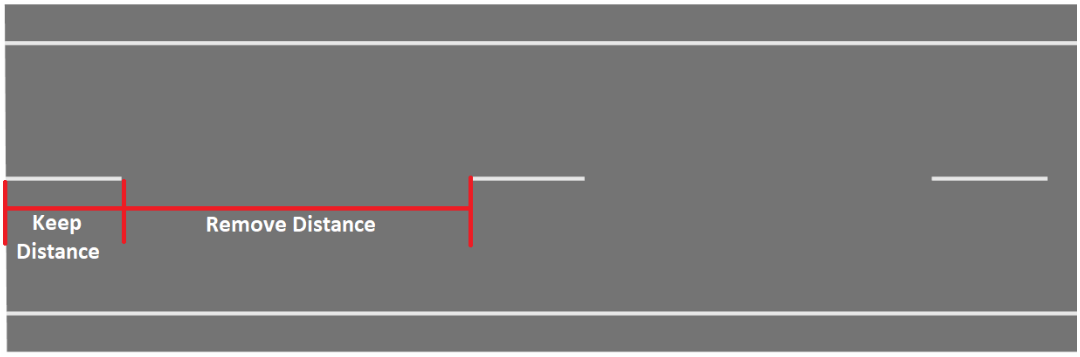
The semicolon operator is used in both the normal MTF editor panels and snippets. The user will see the semicolon compacted link name list in the main MTF Modifiers panel, when the individual modifier panel is opened the links will appear individually, quoted and separated by spaces. When the modifier panel is closed they will automatically be compacted again.

The colon operator is intended for use in snippets only, it can be manually entered into the MTF file but when the individual modifier panel is opened the link names will be expanded and upon closing written in the semicolon format.

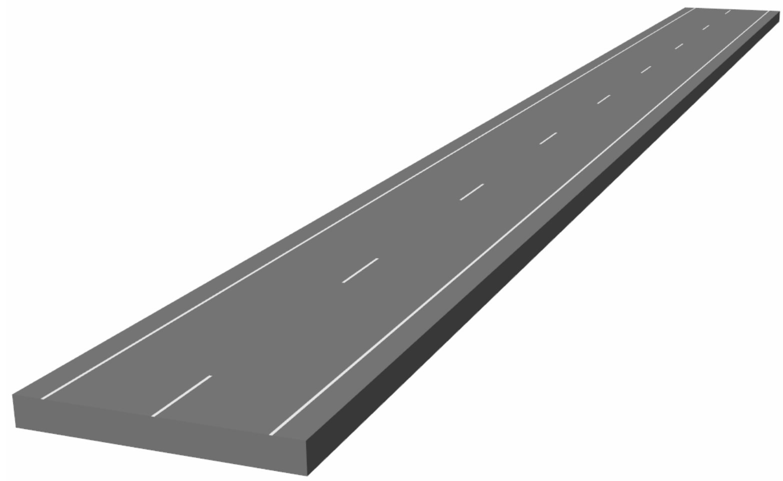
Continue to 16.5 Fixed link - Remove by Pattern or go back to 16.4 MTF Links and Layers File Format.

16.5 Fixed link - Remove by Pattern

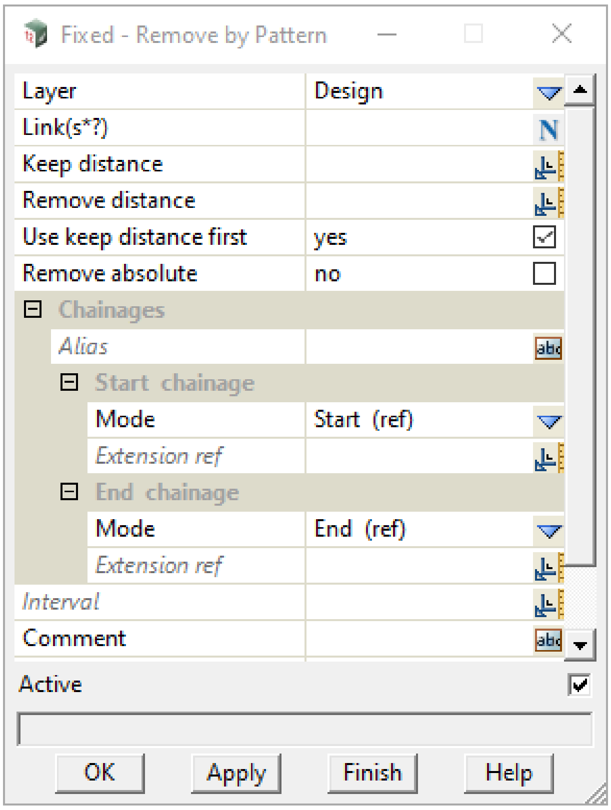
The **Remove by Pattern** option deletes links between given chainages at an interval. Because the link is no longer there, any following links will then be relative to the link before the deleted link. To remove by pattern a **Keep Distance** and **Remove Distance** must be specified.



fifAn example for the use of the **Remove by Pattern** option is to create road line markings as shown in the diagram below:



Selecting **Remove by Pattern** brings up the **Fixed - Remove by Pattern** panel.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Layer | layer box | | available Layers

Layer to remove the link. For information on Layers, see 20.1.1.2 MTF Links and Layers.

Link(s) | name box | select name | menu

Name of the links to remove. See 20.2.2.1.2 Link, Link(s) or Link(s).*

Keep distance | double box

The length of the distance that is not removed in the pattern.

Remove distance | double box

The length of the distance that is removed in the pattern.

Use keep distance first | tick box | not ticked

*If **ticked**, then the pattern begins with the keep distance.*

*If **not ticked**, then the pattern begins with the remove distance.*

Alias, **Start Chainage**, **End Chainage**, **Interval**

Defines the start/end chainages for removing the given fixed links.

For information on these panel fields, see 20.2.2.1.1 Common Fields and Buttons on MTF Modifier Panels.

Comment, **Extra start**, **Extra End, Active, OK, Apply**

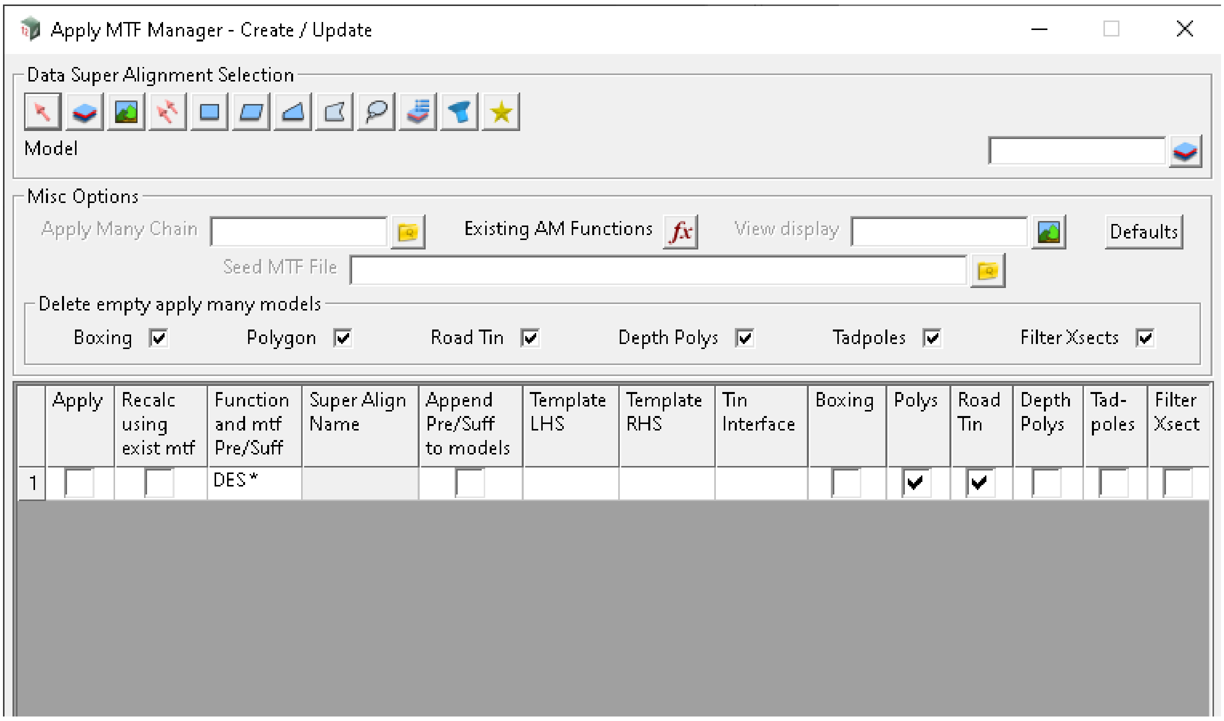
For information on these panel fields, see 20.2.2.1.1 Common Fields and Buttons on MTF Modifier Panels.

Continue to 16.6 Apply MTF Manager - Create/Update or go back to 16.5 Fixed link - Remove by Pattern.

16.6 Apply MTF Manager - Create/Update

Position of option on menu: **Design =>Apply =>Apply MTF manager**

Selecting the **Apply MTF manager** option displays the **Apply MTF Manager - Create / Update** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Data Super Alignment Selection data source

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source input Model

Source of data to be processed.

Populate Grid below from selection above button

Needs to be selected, to validate the data source and hence populate the grid with Super Alignments.

Misc Options

Apply Many Chain file box available *.chain files

*If **not blank**, entry used as chain file of all the Apply MTF Functions that are created at the time of process...optional.*

Existing AM functions list function box available functions

This option will give you a list of all the existing AM Functions in the project, as a quick reference when creating new ones.

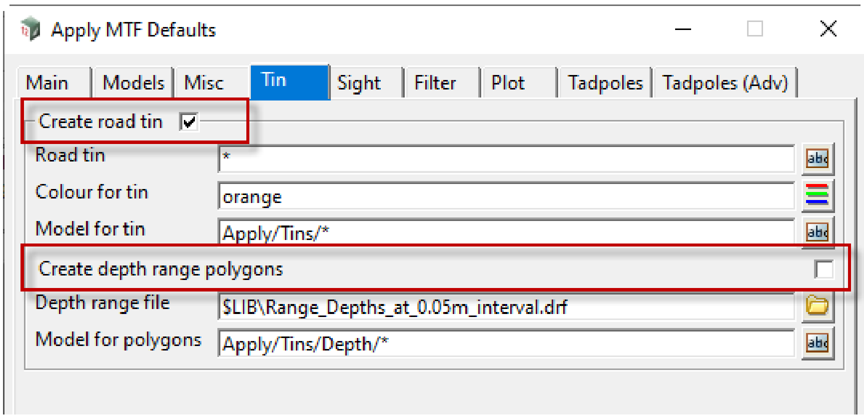
View Display view box available views

*If **not blank**, entry used as view onto which design strings and sections models will be automatically added, for ease of viewing...optional.*

Defaults button

If selected, the Apply MTF defaults panel will be activated. This allows you change the defaults before continuing with creating or editing any Apply MTF functions.

It is a good idea to complete the defaults for all tabs, which allows you to control their use by the tick box (refer Tin tab below).



Grid

Apply tick box not ticked

Set to ticked once a SA selection string is accepted.

*If ticked and the **<Create/Update>** is selected, then the Apply MTF will be created or an existing one recalced.*

*If **ticked** and the **<Del AMM>** button is also selected, then the Apply MTF Manager reference to that alignment will be deleted.*

*If **not ticked** and the **<Create/Update>** is selected, then the Apply MTF will NOT be created or an existing one recalced.*

Note: It is up to the user to delete the actual Apply MTF Function and all associated data including the mtf.

Recalc using exist mtf tick box

This tick box is an automatic indication of whether or not a Reference Super Alignment has an Apply MTF Function already linked to it.

There is no need for the user to use this box when creating or updating an Apply MTF Function.

It will be unticked if the reference has no Apply MTF Function attached.

In this case templates are required for Left, Right or both.

It will be ticked if the reference does have one or more Apply MTF Functions attached.

In this case the existing AM will be updated using the existing MTF and reflect any changes in regards to models required.

Function & mtf Pre/Suff input DES*

*If **not blank**, entry used as a prefix or suffix in conjunction with the Apply MTF Reference Super Alignment Name.*

Example:

Reference SA name:	MC00
Pre/Suff:	DES*
Apply MTF Function Name:	DES MC00
Reference SA name:	MC00
Pre/Suff:	* DES
Apply MTF Function Name:	MC00 DES

If blank, the Apply MTF Reference Super Alignment Name is used only

Apply MTF Function Name:	MC00

"Apply/Roads/* as the prefix will invoke object tree for the function name

Reference SA name	MC00
Pre/Suff	Apply/Roads/*
Apply MTF Function Name	Apply/Roads/MC00

*If **blank**, the Apply MTF Reference Super Alignment Name is used only*

Super Align Name input

Automatically populated, after the SA reference is selected.

The Super Alignment Name entry cannot be changed as it comprises part of the Apply MTF Function name....refer above.

Append Pre/Suff to models tick box not ticked

*If **ticked**, then the prefix or suffix will be combined with the SA name (refer above) and passed down to any default extensions from the Apply MTF Defaults.*

*refer **Design=>Apply=>Apply MTF Defaults***

Model Format for Apply MTF Defaults:

Road Surface Strings *e.g.*

"DESIGN *" used in conjunction with a Pre/Suff of DES * and a SA name MC00, would result in a strings model called "DES DESIGN MC00"

"* DESIGN" used in conjunction with a Pre/Suff of DES * and a SA name MC00, would result in a strings model called "DES MC00 DESIGN"

Template LHS input

Name of the template to be applied to the left side of the reference SA.

Template RHS input

Name of the template to be applied to the right side of the reference SA.

Tin interface input

*If **not blank**, the name of the tin to calculate the cut/fill interfaces against at the end of the fixed part of the templates given in the left and right template fields.*

*If **blank**, then only the fixed part of the templates is used unless a tin is specified in the decisions section of the templates.*

Seed MTF file box *.mtf_seed files

*If **not blank**, entry will be used to create the MTF for that row in the grid. In this case the Template LHS* *and RHS are not required.*

Turn off Design Tin file box

*If **ticked**, then the design tin will not be created, even if it has been set in the AM defaults.*

This is the only override available.

Extra model suffix: input optional

e.g. /Roads/

This text is added to the default models taken from the Apply MTF defaults, as a suffix

Apply MTF default:	***Apply/Design/Strings/****
With added suffix:	***Apply/Design/Strings/Roads/****

*Reference string may have the name **RS01***

Once the function is created then the strings model will be as below

Apply/Design/Strings/Roads/RS01

Buttons at Bottom

Create/Update button

A validation on the panel is carried out along with a check if an Apply MTF Function being created, exists or not.

Appropriate warning messages in the output window will be displayed.

The Apply MTF Function is created or an existing one is updated.

If a new Apply MTF is being created, then the grid on the AMM panel is refreshed and the tick box <Recalc using exist mtf> is set to ticked.

***Note**:*

If <Recalc using exist mtf> is displayed, then a normal recalc is done on the existing AM.

All settings will be set from the current AM defaults.

If the existing function is recalced outside of the AMM panel, then the AM defaults are not used.

Clear Grid button

Clears the selection lines in the grid.

Sort Grid button

Sorts the grid lines by placing lines where the <Recalc using exist mtf> box is ticked on, at the top of the grid.

Add AMM button

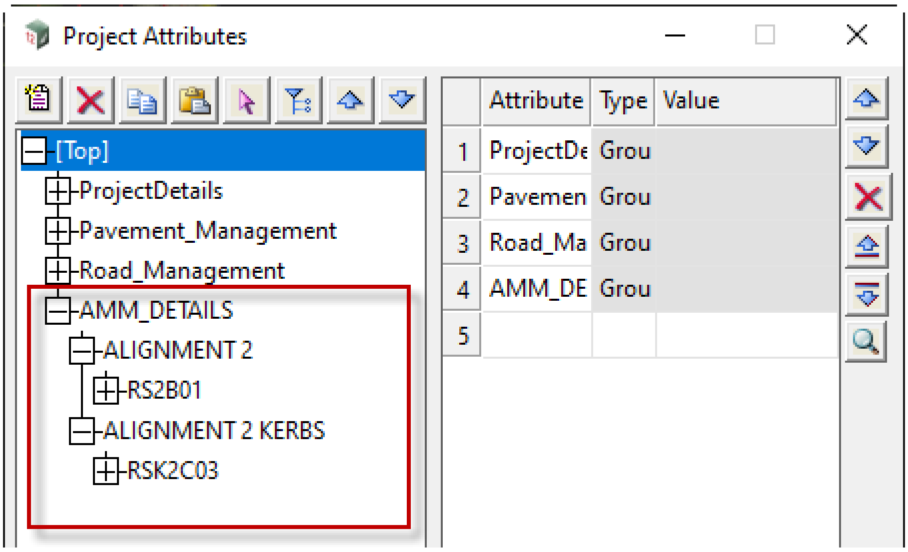
For clarity...clear the grid first and then select the Super Alignment you wish to add another Apply MTF Function to.

Del AMM button

In order to delete (or remove) from the Apply MTF Manager any connection to a Super Alignment, then first clear the grid, select the Super alignment and UNTICK the <Apply> box.

*The information on the **AMM**, and any association of a Function with a Super alignment, is available under menu:*

Project->Utilities->Attributes



Continue to 16.7 MTF Snippets or go back to 16.6 Apply MTF Manager - Create/Update.

16.7 MTF Snippets

There have been numerous additions to Snippets.

See

16.7.1 Common Definitions for Snippet Parameters

16.7.2 Snippet Parameters and Commands

16.7.3 Automatic Parameters in Snippets

16.7.4 Snippet Directives

16.7.1 Common Definitions for Snippet Parameters

param_desc param_default

param_desc

From V15C1g, the **description** can contain a **tooltip**.

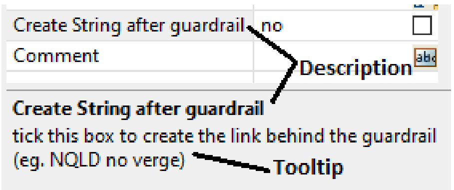
The general syntax for **param_desc** is:

"**description**<~~> **tooltip**"

The delimiter "<~~>" and **tooltip** are **optional**.

Where the double quotes (") are only required if there is a space within **param_desc**.

A **description** of "Create String after guardrail" and a **tooltip** of "tick this box to create the link behind the guardrail (eg. NQLD no verge)" for **param_desc** will produce the following parts of the **MTF Snippet** panel:



Multiline Snippet Parameter

Multiline snippet parameters allow values to be entered on a new line after a double forward slash (//) and at least one space.

The general syntax for a multiline snippet parameter is:

// START_PARAMETER param_name param_type param_desc param_default other_values

// END_PARAMETER

where

// START_PARAMETER

This signifies that it is a multiline parameter definition. Note that there must be at least one space after the forward slash (//) and before the word START_PARAMETER.

// END_PARAMETER

This signifies the termination of the multiline parameter definition. Note that there must be at least one space after the forward slash (//) and before the word END_PARAMETER.

Single-line parameter example:

// PARAMETER COLOUR_TYPE CHOICE2 "Enter colour" "COLOUR" "RED" "Red" "GREEN" …

Multiline parameter example:

// START_PARAMETER

// COLOUR_TYPE CHOICE2 "Enter colour" "COLOUR"

// "RED" "Red"

// "GREEN" "Green"

// "BLUE" "Blue"

// END_PARAMETER

Continue to 16.7.2 Snippet Parameters and Commands or go back to 16.7 MTF Snippets.

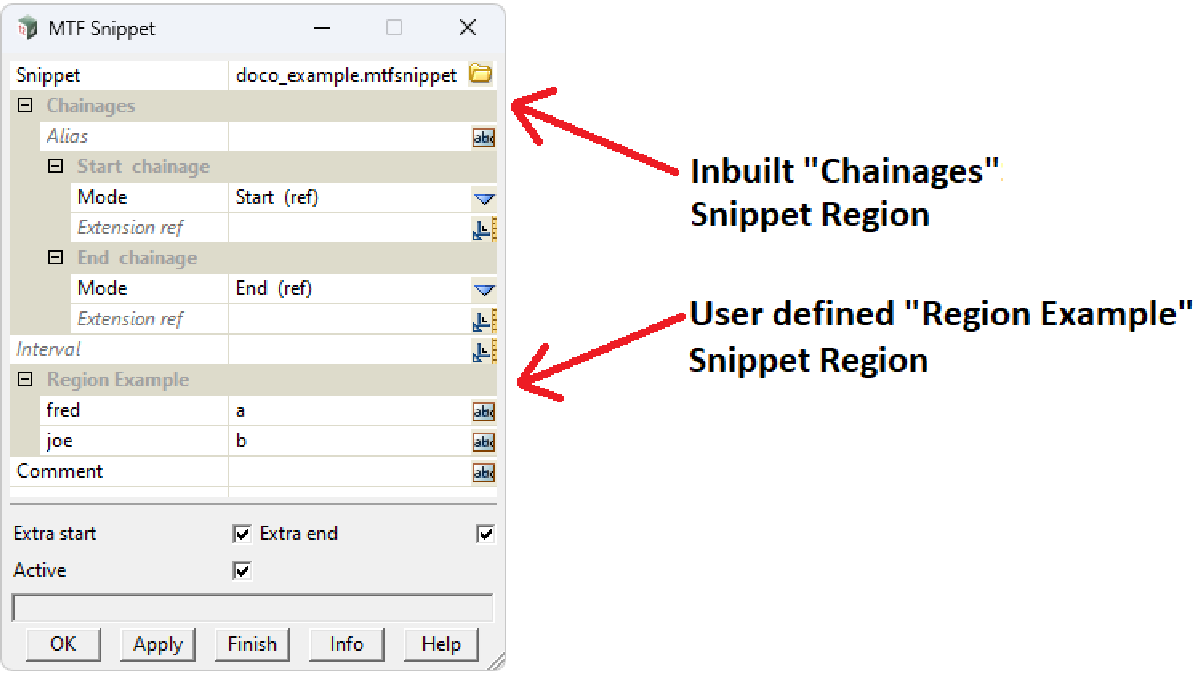
16.7.2 Snippet Parameters and Commands

See 16.7.2.1 Snippet Parameter Region
See 16.7.2.2 Snippet Command NO_REPEAT_DIRECTIVES

16.7.2.1 Snippet Parameter Region

A snippet parameter region allows the snippet writer to assemble snippet parameter widgets into collapsable groups. This is used to organise snippet parameters into logical groups that can be either closed or open in order to reduce the vertical size of the snippet panel.

Note: A snippet region cannot be nested within another snippet region.



The general syntax for a snippet parameter region is:

// START_PARAMETER_REGION   region_name   region_open

// PARAMETER …

// …

// END_PARAMETER_REGION   region_name

where

// START_PARAMETER_REGION   region_name   region_open

This signifies the start of a parameter region. Note that there must be at least one space after the forward slash (//) and before the word START_PARAMETER_REGION.

region_name

The title that will appear on the snippet region on the snippet panel. This must be enclosed in double quotes (").

region_open (OPEN/CLOSED)

This determines whether the snippet region is open or closed by default when opening the snippet panel. This value can only be OPEN or CLOSED, do NOT enclose in double quotes (").

// PARAMETER …

This signifies that any type or number of snippet parameters can be inserted between the START_PARAMETER_REGION and END_PARAMETER_REGION lines.

See 16.7.1 Common Definitions for Snippet Parameters.

// END_PARAMETER_REGION   region_name

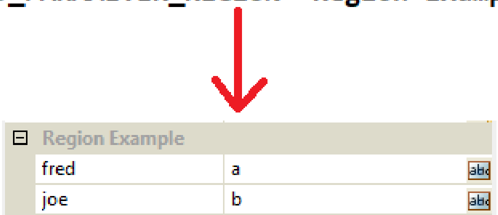
This signifies the end of a parameter region. Note that there must be at least one space after the forward slash (//) and before the word END_PARAMETER_REGION.

region_name

The title that must match the region_name that follows START_PARAMETER_REGION. This must be enclosed in double quotes (").

Snippet Parameter Region Example:

```
// START_PARAMETER_REGION "Region Example" OPEN
// PARAMETER test_param1 TEXT "fred" "a"
// PARAMETER test_param2 TEXT "joe" "b"
// END_PARAMETER_REGION "Region Example"
```



Continue to 16.7.2.2 Snippet Command NO_REPEAT_DIRECTIVES or go back to 16.7 MTF Snippets.

16.7.2.2 Snippet Command NO_REPEAT_DIRECTIVES

If the snippet does not use repeat directives, then including this snippet command will have a small performance gain the 1st time the snippet is run dependent on the size of the snippet.

It must be in a comment line and be the only text on the line.

```
// NO_REPEAT_DIRECTIVES
```

If this is not present the 1st time the snippet is run it will look for repeat directives, after that it will not search for them if not present in the initial search.

This snippet command will only have a noticeable effect on very large snippets, 1000's of lines.

Continue to 16.7.3 Automatic Parameters in Snippets or go back to 16.7.2 Snippet Parameters and Commands or 16.7 MTF Snippets.

16.7.3 Automatic Parameters in Snippets

16.7.3.1 _APPLY_FUNC_NAME

This will insert the name of the Apply MTF function.

16.7.3.2 _MODIFY_EXTRAS

This will insert **absolute extra_start extra_end**.

16.7.3.3 _ABS_ES_EE

This will insert **absolute extra_start extra_end**.

16.7.3.4 _ASE

This will insert **absolute extra_start extra_end**.

16.7.3.5 _ABS

This will insert **absolute.**

16.7.3.6 _ABS_ES

This will insert **absolute extra_start.**

16.7.3.7 _ABS_EE

This will insert **absolute extra_end.**

16.7.3.8 _CL_REF_MODEL

This will insert the entire name of the model of the Reference string from the Apply many function.

For example, if the reference string model name is **Alignments**, $(_CL_REF_MODEL) will insert **Alignments**.

16.7.3.9 _ES

This will insert **extra_start.**

16.7.3.10 _ES_EE

This will insert **extra_start extra_end.**

16.7.3.11 _EE

This will insert **extra_end.**

16.7.3.12 _MODEL_ATTRIBUTE

This will insert a **model attribute** from the current ***12d Model*** project.

The particular attribute to be inserted is specified between square brackets [ ] and follows the standard convention of attribute paths in ***12d Model***.

Model attributes are similar to **project attributes** just needing an extra field for the model to use.

The basic format is

_MODEL_ATTRIBUTE[the model name,the attribute]

The model name and attribute are separated by a comma should not be quoted.

```
$(_MODEL_ATTRIBUTE[MTF attrs source,MTF/General/Colours/ESL/value])
```

Model attributes can contain parameters:

```
$(_MODEL_ATTRIBUTE[$(SOURCE_MODEL),MTF/General/Colours/ESL/value])
$(_MODEL_ATTRIBUTE[$(SOURCE_MODEL),$(VALUE)])
```

Note that the standard convention of attribute paths in ***12d Model*** supports duplicate attribute paths accessible via the [instance] syntax. In the sample above to use the 2nd instance of **Value** it would look as such:

$(_MODEL_ATTRIBUTE[$(SOURCE_MODEL),MTF/General/Colours/ESL/value[2]])

This can also use a parameter.

$(_MODEL_ATTRIBUTE[$(SOURCE_MODEL),MTF/General/Colours/ESL/value[$(VAL_INST)]])

16.7.3.13 _ROW

$(_ROW) will insert the row position of this snippet in the MTF. If this snippet is called from another snippet $(_ROW) will insert the position of this snippet in the parent snippet.

Continue to 16.7.4 Snippet Directives or go back to 16.7.3 Automatic Parameters in Snippets or 16.7 MTF Snippets.

16.7.4 Snippet Directives

See

16.7.4.1 Tokens Arithmetic
16.7.4.2 Miscellaneous

16.7.4.1 Tokens Arithmetic

See

16.7.4.1.1 tok_divide_dbl_tok
16.7.4.1.2 tok_eval_as_int

16.7.4.1.1 tok_divide_dbl_tok

The **tok_divide_dbl_tok** directive divides and sets the value of a token by the value of another token.

The syntax is:

```
@ tok_divide_dbl_tok <token1> <token2>
```

<token1> - the name of the token to apply the arithmetic to.

<token2> - the name of the token to divide the 1st token by.

It is an error if either token cannot be evaluated as a valid real number.

It is an error if the value of the second token is zero.

```
@ def_tok TOK_VAL_1 10.0
@ def_tok TOK_VAL_2 5.0
@ tok_divide_dbl_tok TOK_VAL_1 TOK_VAL_2

@ if_tok_neq_dbl TOK_VAL_1 2.0
  @ echo "Eek, that should have equalled 2.0"
@ end_if
```

16.7.4.1.2 tok_eval_as_int

The **tok_eval_as_int** directive evaluates and truncates the real value of a token to an integer.

The syntax is:

```
@ tok_eval_as_int <token1>
```

<token1> - the name of the token to convert to an integer.

It is an error if the token cannot be evaluated as a valid real number.

3.14 will be truncated to 3

0.71 will be truncated to 0

-0.71 will be truncated to 0

-3.14 will be truncated to -3

```
@ def_tok NUM "(-2 - 0.5)"
@ tok_eval_as_int NUM

@ if_tok_eq_int NUM -2
@ else
  @ echo "Eek, that should have equalled -2"
@ end_if
```

Continue to 16.7.4.2 Miscellaneous or go back to 16.7.4 Snippet Directives or 16.7 MTF Snippets.

16.7.4.2 Miscellaneous

See

16.7.4.2.1 X remove_project_attribute
16.7.4.2.2 set_model_attribute
16.7.4.2.3 remove_model_attribute

16.7.4.2.1 X remove_project_attribute

The **remove_project_attribute** directive allows the removal of a project attribute, typically used to remove an attribute that has been used to transfer information between snippets once the apply has run.

```
@ remove_project_attribute <attribute path>
```

<**attribute path**> the path of the project attribute to remove.

16.7.4.2.2 set_model_attribute

The call **set_model_attribute** is identical in functionality to **set_project_attribute** just requiring an extra parameter for the model name.

The **set_model_attribute** directive allows the setting of a model text attribute.

```
@ set_model_attribute <model name> <attribute path> <value>
```

<model name> the name of the model to set the attribute to.

<attribute path> the path of the model attribute.

<value> the text attribute.

```
// simple define of a model attribute
@ set_model_attribute "ATTRS_MODEL" "APPLY/STR NUM" 9
// define of a model attribute using another token
@ def_tok INIT_VAL 9
@ set_model_attribute attribute "ATTRS_MODEL" "APPLY/STR NUM2" $(INIT_VAL)
```

16.7.4.2.3 remove_model_attribute

The **remove_model_attribute** directive allows the removal of a model attribute.

```
@ remove_model_attribute <model name> <attribute path>
```

<model name> the name of the model to set the attribute to.

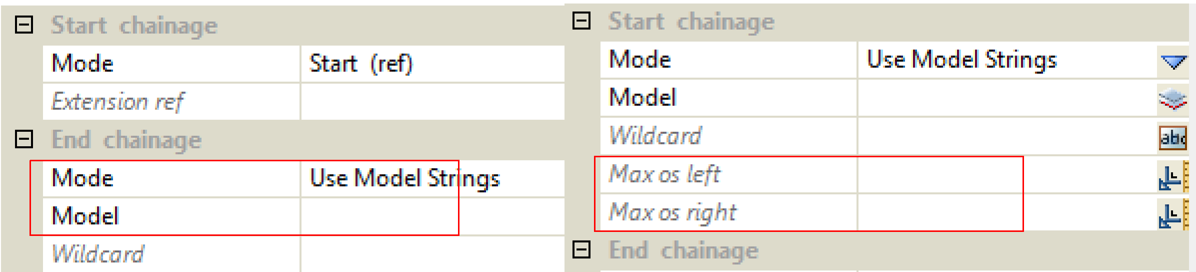
<attribute path> the path of the model attribute.

Continue to 16.8 Snippet Placed to Model of Strings or go back to 16.7.4 Snippet Directives or 16.7 MTF Snippets.

16.8 Snippet Placed to Model of Strings

The options **Max os left** and **Max os right** has been added to the panel.

Selecting **Snippet cut ref with model of string** adds the **Model**, **Wildcard** and **Extension other** fields.



Max os left real box

*If **not blank**, the maximum offset left of the control before the string is rejected for use as a smart chainage. If either the start or end point is further left than this value the string will not be used.*

*If **blank**, no string is rejected for use as a smart chainage on the LHS of the control string.*

***Note** - as per normal modifier behaviour the left offset should be entered as positive unless wishing to only use strings completely to the RHS of the control string.*

Max os right real box

*If **not blank**, the maximum offset right of the control before the string is rejected for use as a smart chainage. If either the start or end point is further right than this value the string will not be used.*

*If **blank**, no string is rejected for use as a smart chainage on the RHS of the control string.*

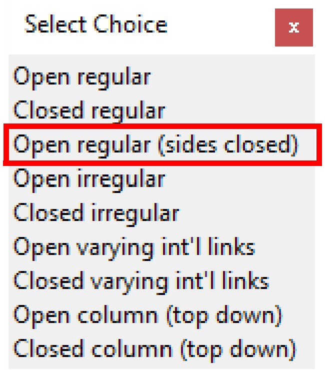
***Note** - as per normal modifier behaviour the right offset should be entered as positive unless wishing to only use strings completely to the LHS of the control string.*

Continue to 16.9 Create Shapes or go back to 16.8 Snippet Placed to Model of Strings.

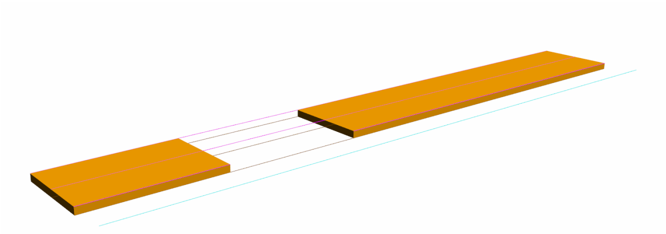
16.9 Create Shapes

The option ***Open regular (sides closed)*** has been added to **Shape type**.

Shape type choice box



*If **Open regular (sides closed)**, the shape will only be formed when all of the nominated strings exist. E.g. it will form multiple shapes if strings come and go along the length of the apply. No end caps will be formed, **open sides will be closed** and the trimesh will have no volume.*



Continue to 16.10 Pavement Manager or go back to 16.9 Create Shapes.

16.10 Pavement Manager

Position of option on menu: **Design =>Pavement =>Pavement Manager**

This option activates a menu to create pavement styles for use in the **MTF** and the **Trimesh** pavement options.

This option is **new**, but you will find the old option for creating pavement styles under the adjacent menu:

Design->Pavement->Design Pavement Old->Pavement Manager

Pavement Manager Features

Unlimited layers

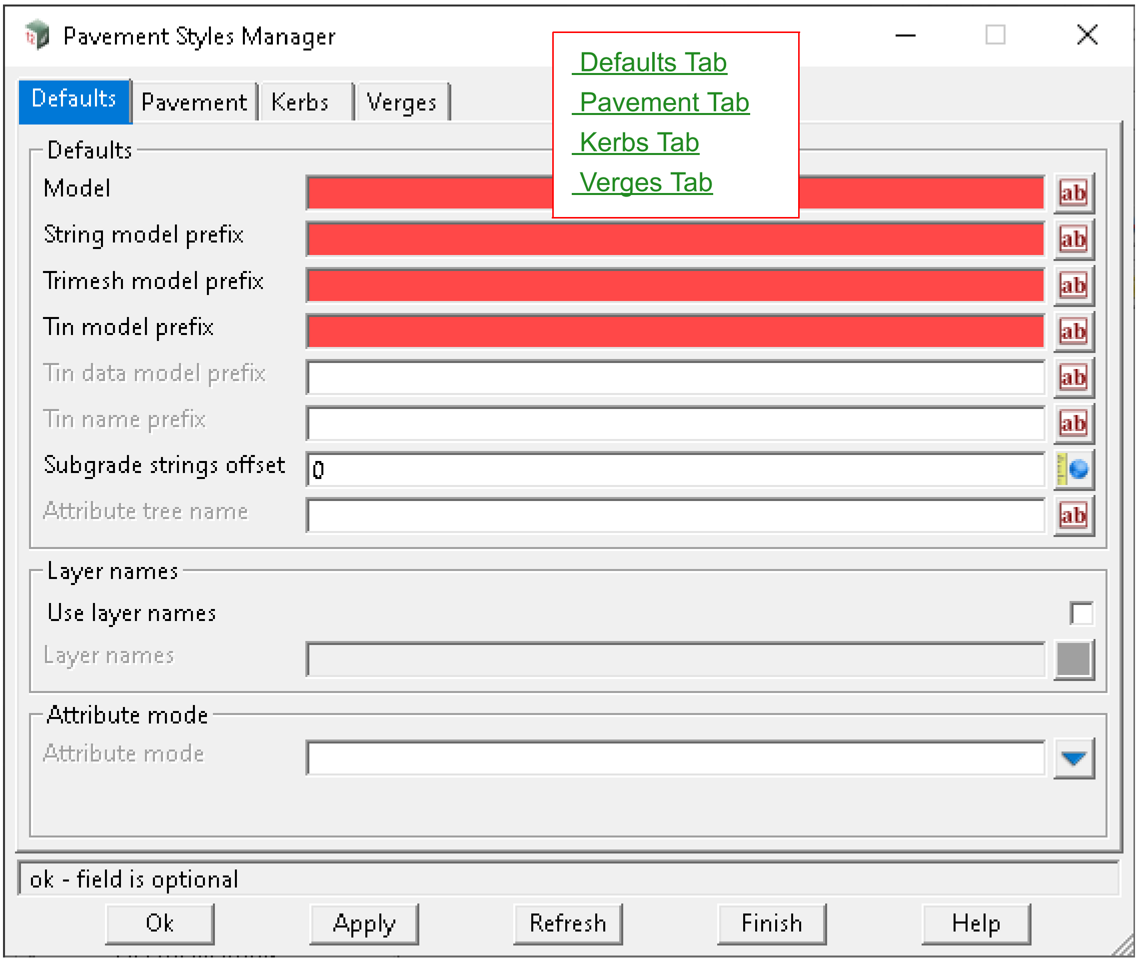
Duplication or copy and paste (in a grid system)

Start/end offsets and slope for every layer

Attribute selection for each layer

Layer Names file to set default layer names and descriptions

Selecting **Pavement manager** brings up the **Pavement manager** panel.



Buttons at Bottom

Ok button

Saves and exits the option.

Apply button

Saves.

Updates button

Refreshes the panel.

For information on each **Pavement Manager** tab go to

See Defaults Tab

See Pavement Tab

See Kerbs Tab

See Verges Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Defaults Tab

Defaults

The fields underneath the Defaults heading form part of the model naming convention when using the trimesh snippets e.g.

*Trimesh model: **MESH PAVEMENT** (Plus other settings from the snippet)*

*Trimesh strings model: **MESH STRS PAVEMENT** (Plus other settings from the snippet)*

Field	Type	Defaults
Model	text box	
String model prefix	text box	
Trimesh model prefix	text box	
Subgrade strings model prefix	text box	
Subgrade strings offset	input box	0.001
Attribute tree name	text box	

Layer names

Field	Type	Defaults
Use layer names	tick box	ticked
Layer names	file box	

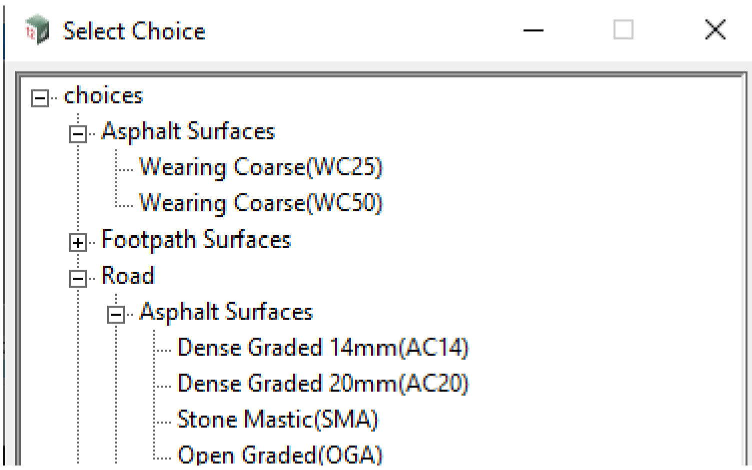
*Layer names and descriptions can be set as a **choice list** for Pavement, Kerbs and Verges.*

*There is a library example called **layer_names.12dpln***

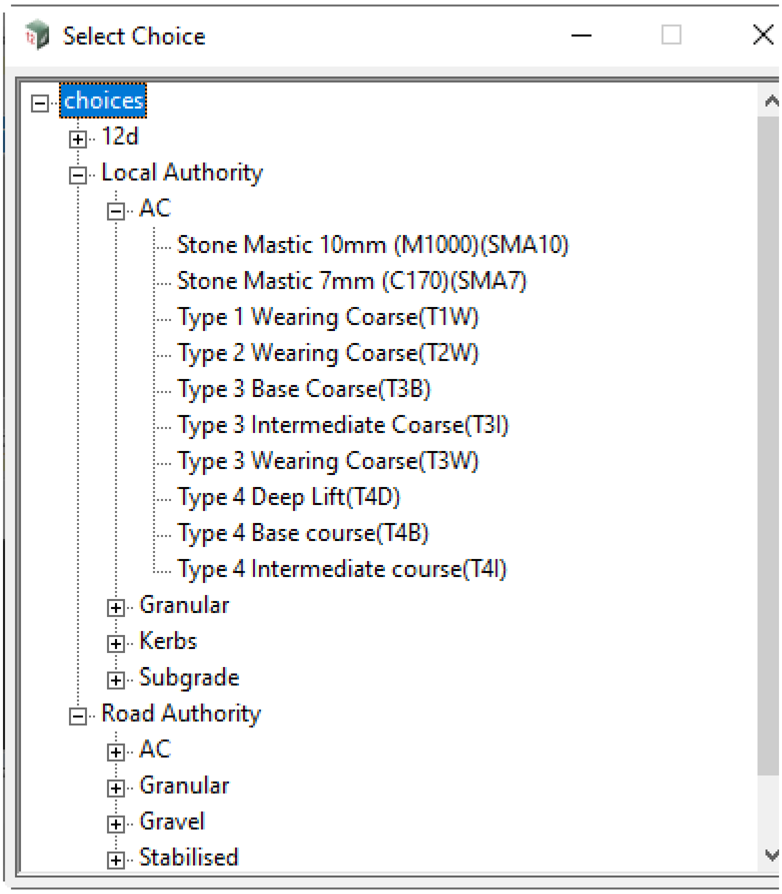
File Extract:

Name	***Description***	***Choice list headings***
WC25	*Wearing Coarse*	*Asphalt Surfaces*
WC50	*Wearing Coarse*	*Asphalt Surfaces*
FPPAV	*Paved Footpath*	*Footpath Surfaces*

FPCONC	*Concrete Footpath*	*Footpath Surfaces*
AC14	*Dense Graded 14mm*	*Road/Asphalt Surfaces*
AC20	*Dense Graded 20mm*	*Road/Asphalt Surfaces*
SMA	*Stone Mastic*	*Road/Asphalt Surfaces*
OGA	*Open Graded*	*Road/Asphalt Surfaces*
PCP	*Plain*	*Road/Concrete Pavements*
CRCP	*Continuously Reinforced*	*Road/Concrete Pavements*
JRCP	*Jointed Reinforced*	*Road/Concrete Pavements*
SFCP	*Steel Fibre Reinforced*	*Road/Concrete Pavements*



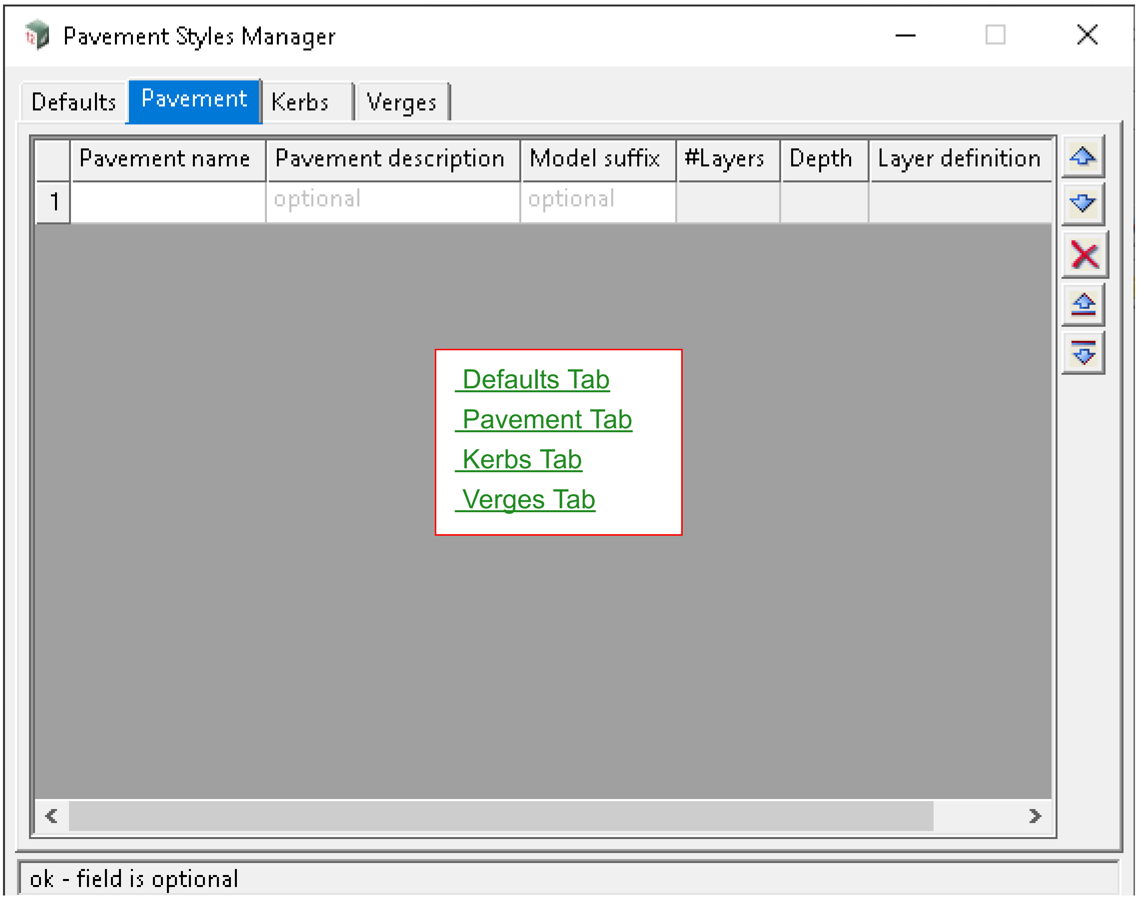
*A second example file called **Pavement_layer_names.12dpln** is also available:*



Attribute mode	choice box	Default, Custom, Metaconnex, Grid

The choice of attribute mode affects what type of options are displayed, when creating pavements, kerbs and or verges.

Pavement Tab



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Name	input		

Pavement type name.

Description	input		

Pavement type description.

#Layers	info only		

Number of layers in pavement type.

Depth	info only		

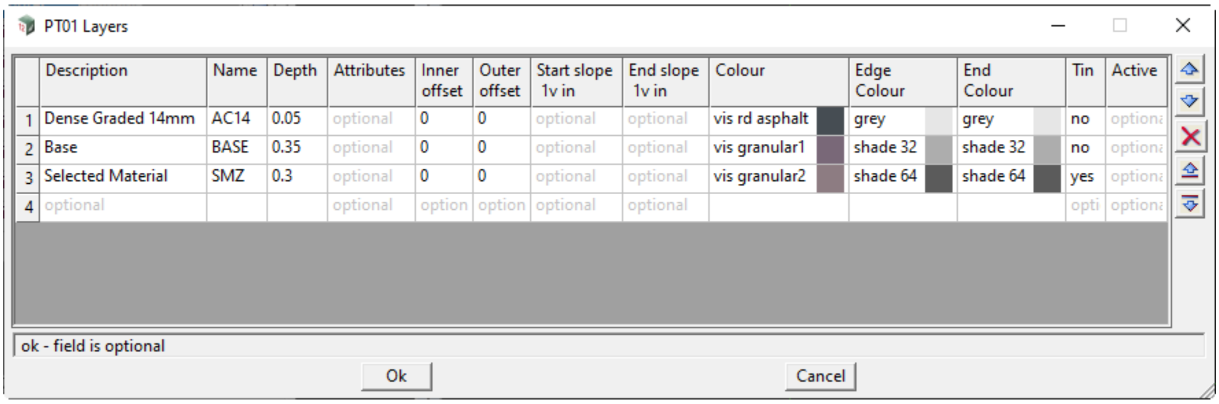
Total depth of layers in pavement type (m).

Layer definition	LMB		

LMB to activate layer creation panel.

Layer Definition

]



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Description LMB

If layer names file is used, LMB will activate choice list for layer description and name.

Name input

Pavement layer name.

Attributes LMB

Attribute choice activated.

Inner offset real

Layer offset from 1st link in snippet.

(+ve to the outside of link and -ve to the inside)

Outer offset real

Layer offset from 2nd link in snippet.

(+ve to the outside of link and -ve to the inside)

Start slope 1v in real

Layer start slope from 1st link in snippet.

(+ve to the outside of link and -ve to the inside)

End slope 1v in real

Layer start slope from end link in snippet.

(+ve to the outside of link and -ve to the inside)

Colour input

Trimesh colour (vis colours will display a texture with visualisation module).

Edge Colour input

Trimesh edge colour.

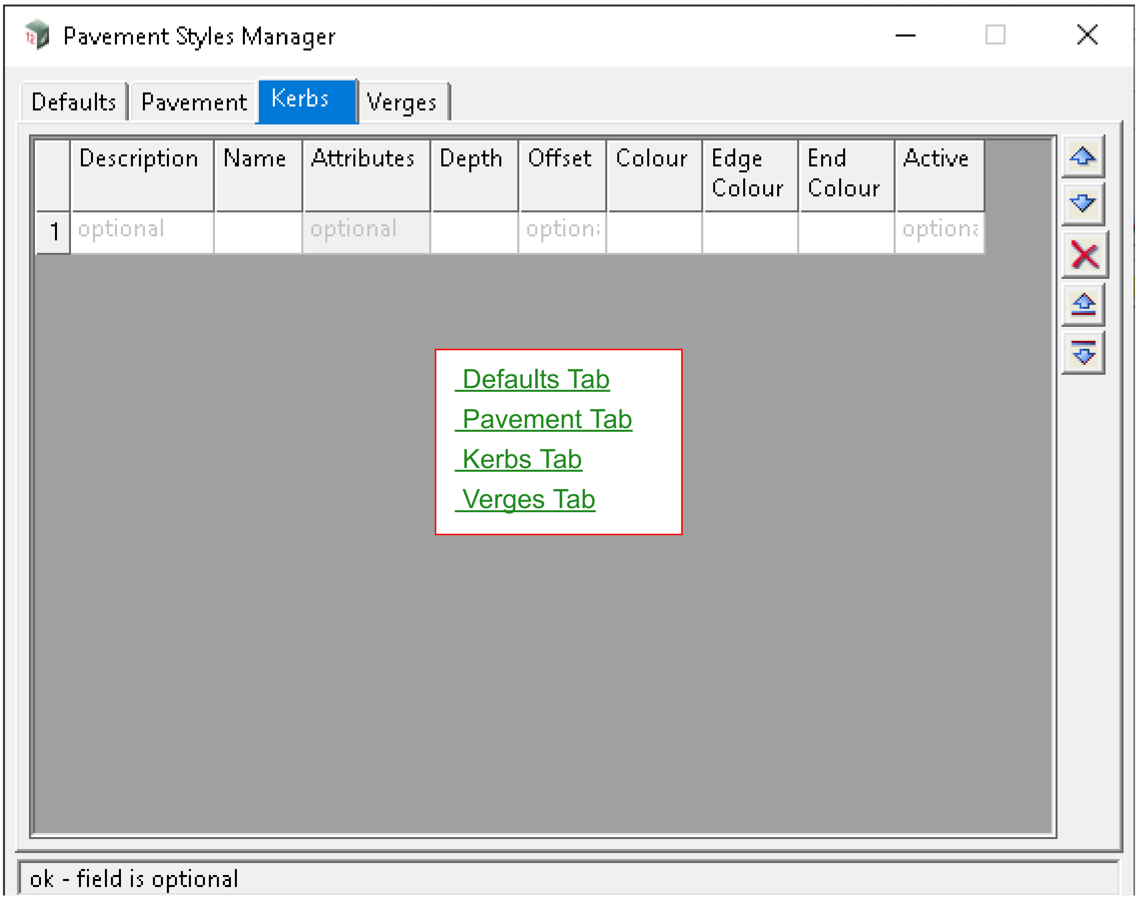
End Colour input

Trimesh end colour.

Tin input

Create a bottom tin of the layer.

Kerbs Tab



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description LMB

If layer names file is used, LMB will activate choice list for the kerb layer description and name.

Name input

Kerb layer name.

Attributes LMB

Attribute choice activated.

Depth real

Depth at kerb lip (typically) in metres.

Offset real

Offset behind back of kerb (typically) in metres.

Colour input

Trimesh colour (vis colours will display a texture with visualisation module).

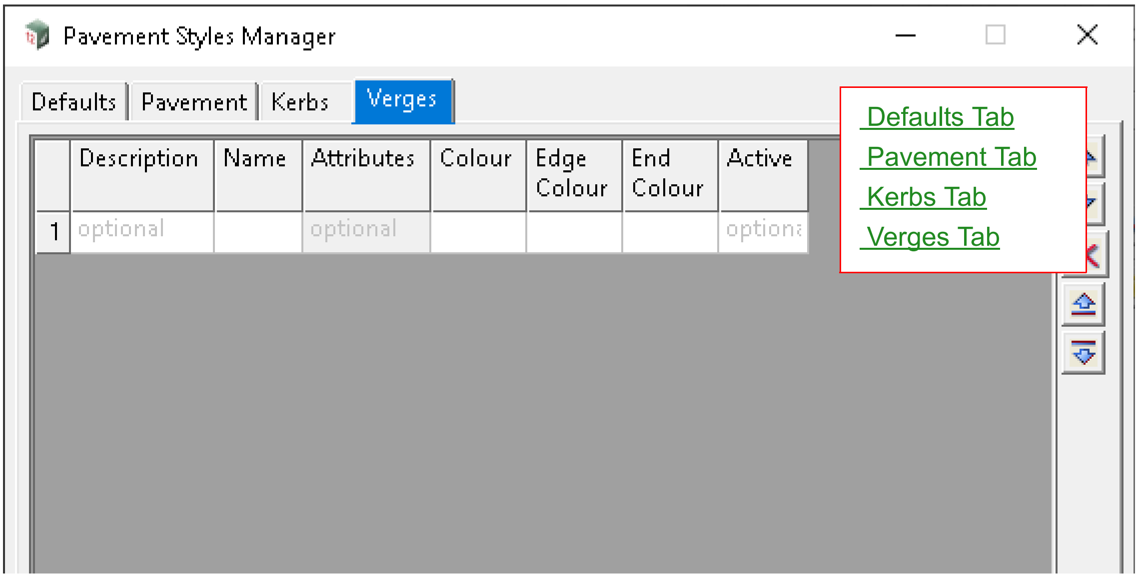
Edge Colour input

Trimesh edge colour.

End Colour input

Trimesh end colour.

Verges Tab



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description LMB

If layer names file is used, LMB will activate choice list for the verge layer description and name.

Name input

Verges layer name.

Attributes LMB

Attribute choice activated.

Colour input

Trimesh colour (vis colours will display a texture with visualisation module).

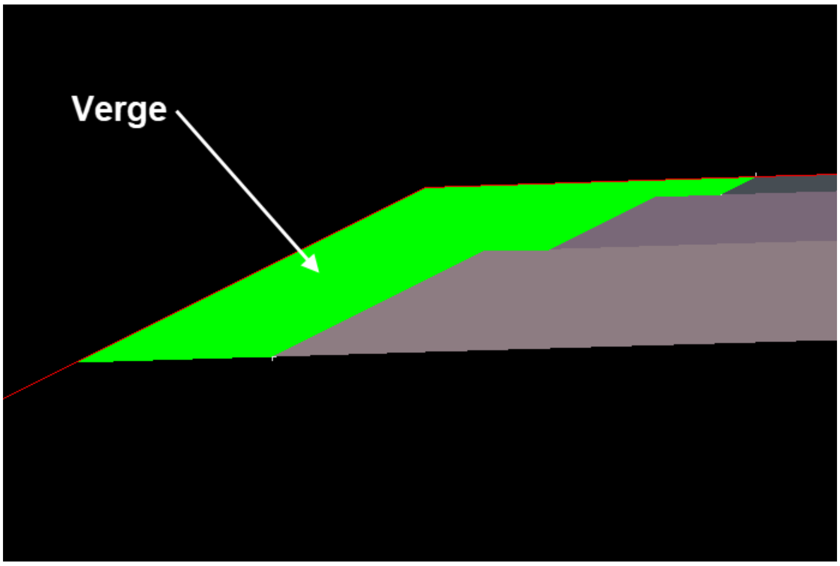
Edge Colour input

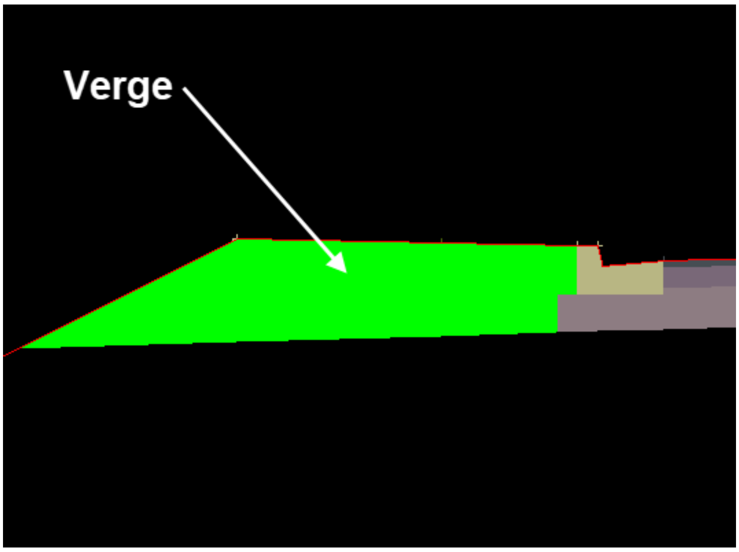
Trimesh edge colour.

End Colour input

Trimesh end colour.

Active choice





Continue to 16.11 TRI_PAVEMENT_NEW_FROM_ATTRS.mtfsnippet or go back to 16.10 Pavement Manager.

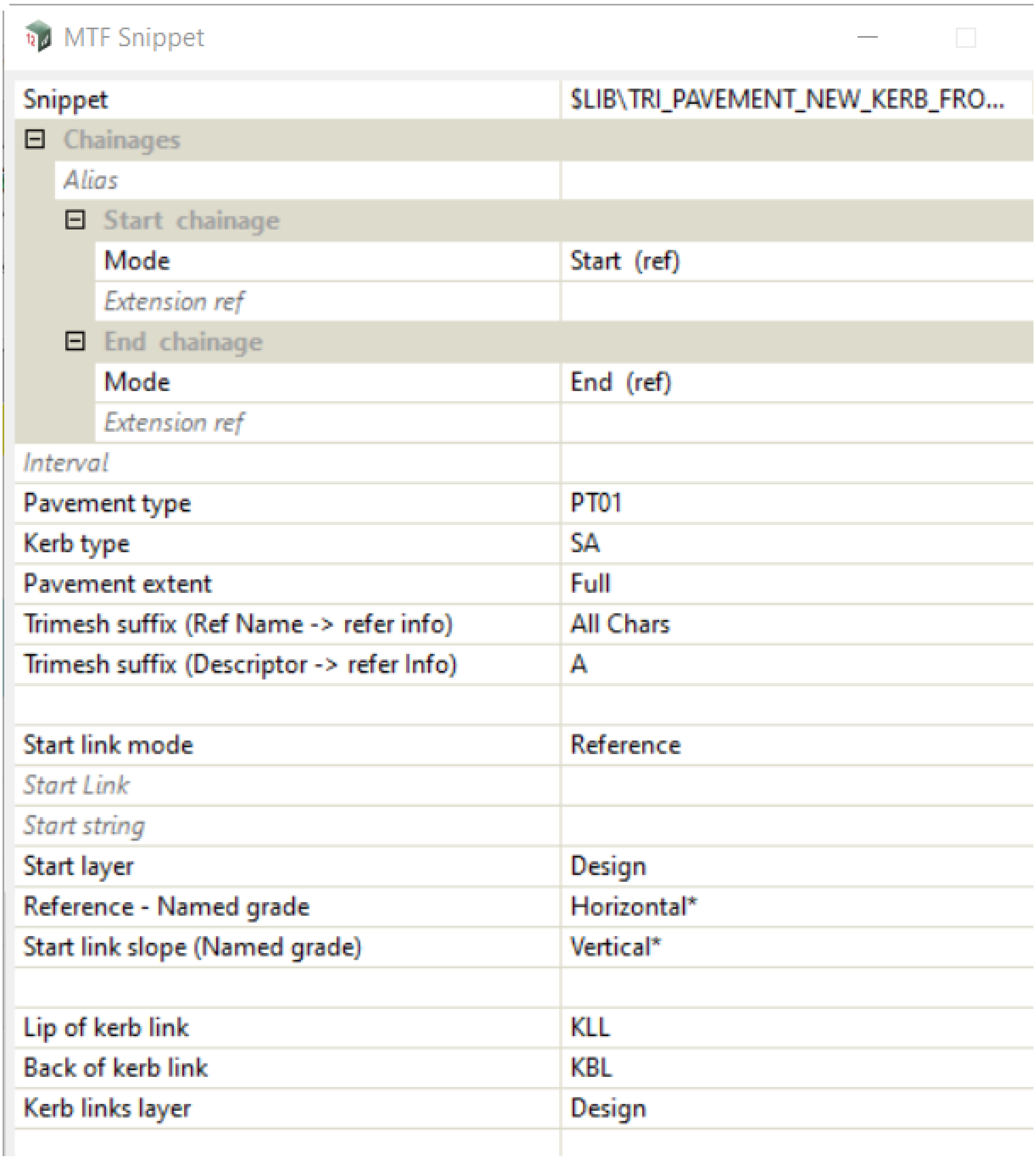
16.11 TRI_PAVEMENT_NEW_FROM_ATTRS .mtfsnippet

This snippet is used in conjunction with the **new** Pavement Manager

Details such as layer name, colour, depth etc have been defined separately in the manager.

The snippet is used to place the pavement by selection of design links.

The MTF modifier called "Snippet" is used.



MTF Snippet

Snippet	$LIB\TRI_PAVEMENT_NEW_KERB_FRO...
⊟ Chainages	
Alias	
⊟ Start chainage	
Mode	Start (ref)
Extension ref	
⊟ End chainage	
Mode	End (ref)
Extension ref	
Interval	
Pavement type	PT01
Kerb type	SA
Pavement extent	Full
Trimesh suffix (Ref Name -> refer info)	All Chars
Trimesh suffix (Descriptor -> refer Info)	A
Start link mode	Reference
Start Link	
Start string	
Start layer	Design
Reference - Named grade	Horizontal*
Start link slope (Named grade)	Vertical*
Lip of kerb link	KLL
Back of kerb link	KBL
Kerb links layer	Design

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Reference_type choice box

A range from pavement manager.

Kerb_type choice box

A range from pavement manager.

Trimesh Ref Name Suffix choice box All Chars

This option will add the Reference Alignment name to the names of all pavement elements created, including model names.

Ref name RS01, then RS01 is added.

*Models created:MESH PAVEMENT **RS01**MESH PAVEMENT STRS **RS01***

***Note**: MESH PAVEMENT & MESH PAVEMENT STRS are taken from the Pavement Manager, under the **Defaults tab**.*

Trimesh Suffix input

*This suffix is used to make up the **unique name** of the trimesh and strings **NOT** the model names.*

e.g. Suffix = A and snippet used on LHS

*Mesh name = AC14-L-A- **RS01** (Layer name-side-suffix-ref)*

Mesh strings name:

*AC14-L1-Z-L-A- **RS01** (Layer name-layer number-str-side-suffix-ref)*

Start link mode choice box Reference

***Reference** refers to the AM selected reference string.*

***3d Cut of Link** (maybe a lane line e.g.).*

***2d Cut of Link, Height from Named Grade** refers to a link on another layer from which a height is derived from the Reference at the named grade.*

***3d Cut of String** refers to an external string from which a height is derived from the Reference.*

***2d Cut of String, Height from Named Grade** refers to an external string from which a height is derived from the Reference at the named grade.*

Start Link, Start String, Start Layer and Named Grade

Fill in only what is required, depending on what is chosen as Start Link Mode.

Start link slope (name grade) choice box Vertical

This grade is used on each layer if there is no "Start slope" defined in the pavement style.

End link slope choice box

***3d Cut of Link** (maybe edge of shoulder e.g.).*

***2d Cut of Link, Height from Named Grade** refers to a link on another layer from which a height is derived from the Reference at the named grade.*

***3d Cut of String** refers to an external string from which a height is derived from the Reference.*

***2d Cut of String, Height from Named Grade** refers to an external string from which a height is derived from the Reference at the named grade.*

End Link, End String, End Layer and Named Grade

Fill in only what is required, depending on what is chosen as End Link Mode.

End link slope (named grade) choice box Vertical

This grade is used on each layer if there is no "End slope" defined in the pavement style.

Depth Type choice box Vertical

The depth is measured vertical or normal to the surface created by the start and end links or named grade.

Bottom surface mode choice box Use Road Surface

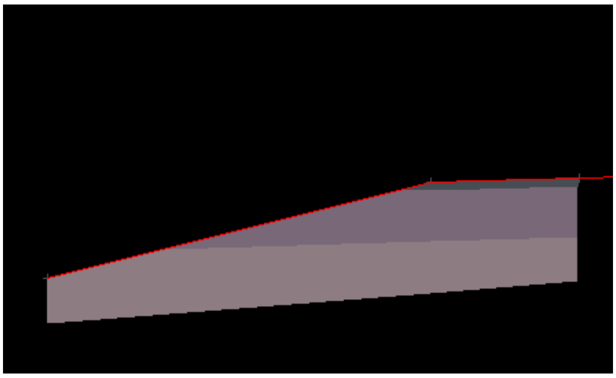
This option refers to pavement that extends past the end link.

***Use Road Surface** pertains to the start link and the end link.*

Bottom surface named grade input Horizontal

This option is for when the slope defined by the start and end points selected is different than the slope required for the bottom of the last pavement layer.

e.g. Start & end links may be varied, and you wish to project the bottom of the last layer at a constant grade to assist in draining the adjacent pavement.

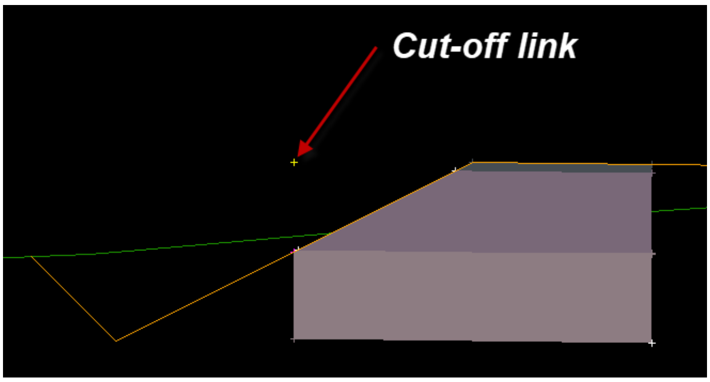


Pavement cut-off Link input

A valid link on any layer that can be used to control the extents of the pavement that gets extended out to the batter slope.

Cut-off link layer name input

A valid layer for the link above.



Comment

Information entered here will show up in the MTF modifier, and can be read without opening up the entire snippet panel.

Buttons at Bottom

Ok button

Will apply any changes and close the panel.

Apply button

Will apply any changes and if the Auto recalc is set on the main MTF.

***Note**: Panel size and position are saved in the working folder:*

mtf_panel_sizes.4d

***This file can be moved to your $user for all subsequent projects**.*

Continue to 16.12 TRI_PAVEMENT_NEW_KERB_FROM_ATTRS.mtfsnippet or go back to 16.11 TRI_PAVEMENT_NEW_FROM_ATTRS.mtfsnippet.

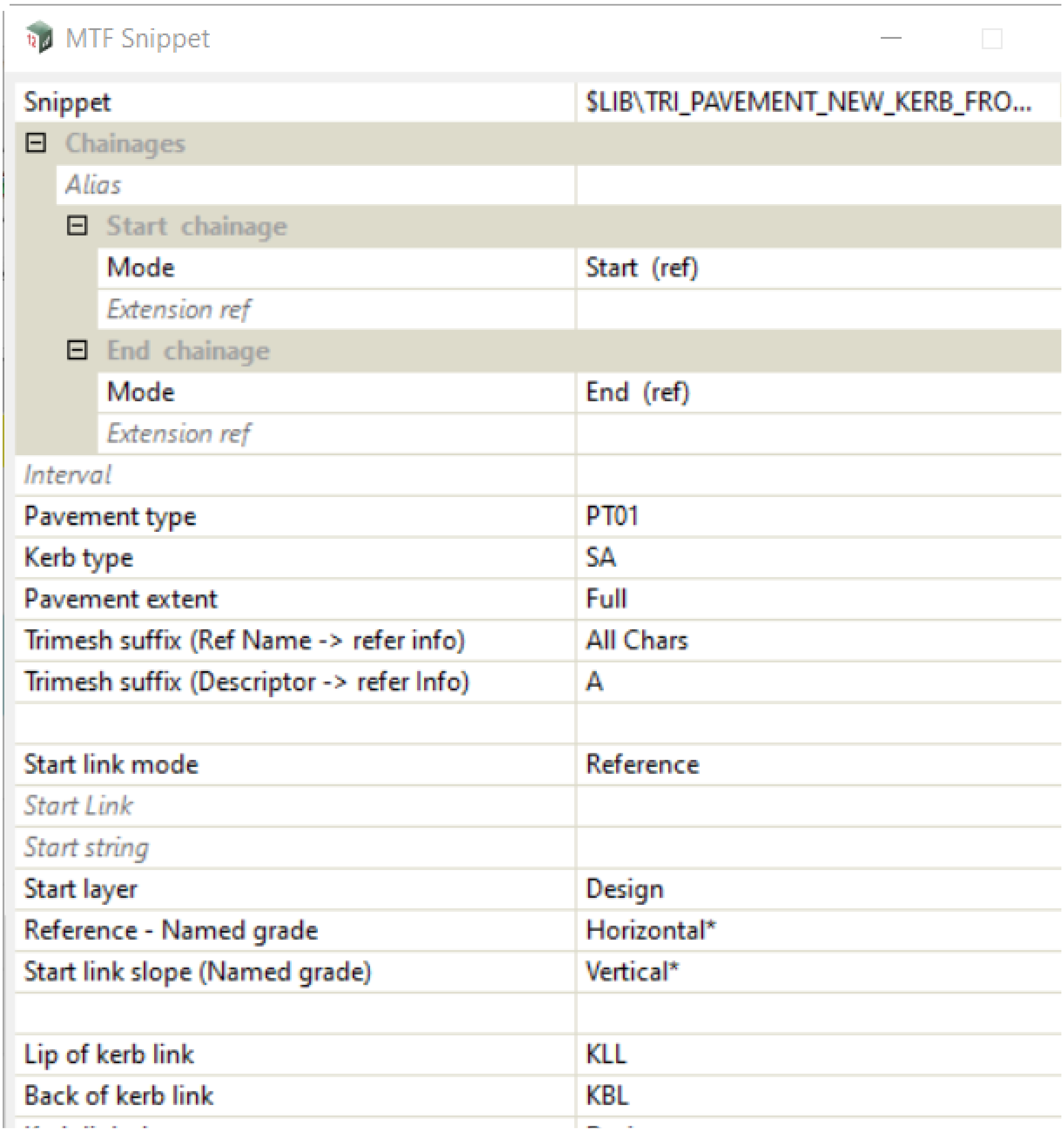
16.12 TRI_PAVEMENT_NEW_KERB_FROM_ATTRS.mtfsnippet

This snippet is used in conjunction with the **new** Pavement Manager

Details such as layer name, colour, depth etc have been defined separately in the manager.

The snippet is used to place the pavement by selection of design links.

The MTF modifier called "Snippet" is used.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Pavement type choice box

A range from pavement manager.

Kerb_type choice box

A range from pavement manager.

Trimesh Ref Name Suffix choice box All Chars

This option will add the Reference Alignment name to the names of all pavement elements created, including model names.

Ref name RS01, then RS01 is added.

*Models created:MESH PAVEMENT **RS01** MESH PAVEMENT STRS **RS01***

***Note**: MESH PAVEMENT & MESH PAVEMENT STRS are taken from the Pavement Manager, under the **Defaults tab**.*

Trimesh Suffix input

*This suffix is used to make up the **unique name** of the trimesh and strings*

***NOT** the model names*

e.g. Suffix = A and snippet used on LHS

*Mesh name = AC14-L-A- **RS01** (Layer name-side-suffix-ref)*

Mesh strings name:

*AC14-L1-Z-L-A- **RS01** (Layer name-layer number-str-side-suffix-ref)*

Start link mode choice box Reference

***Reference** refers to the AM selected reference string.*

***3d Cut of Link** refers to a Design Link (maybe a lane line e.g.).*

***2d Cut of String, Height from Design** refers to an external string, like a survey edge of bitumen, from which a height is derived from the design surface above.*

Start Link, Start String and Start Link Layer Name

Fill in only what is required, depending on what is chosen as Start Link Mode.

Start link slope (name grade) choice box Vertical

This grade is used on each layer if there is no "Start slope" defined in the pavement style.

Up of kerb link name box

A valid design layer link name (e.g. KLL).

Back of kerb link name box

A valid design layer link name (e.g. KIL).

Kerb links layer input Design

Generally, the layer is design.

Pavement slope (behind kerb) choice box Vertical*

This grade is used on each layer if there is no "End slope" defined in the pavement style.

Named grade kerb base choice box Horizontal*

this option refers to the base of the kerb. It can use the road surface, but that surface needs to defined as a named grade prior.

Pavement mode (below kerb) choice box Use Road Surface

This option refers to pavement that extends under the kerb.

Use Road Surface *pertains to the start link and the lip of kerb.*

The second choice is ***Named grade*** *which needs to be defined prior.*

Named grade below kerb choice box Horizontal*

This option is only used if the above pavement mode has been set to ***Named grade****.*

Pavement extent choice box Full

If set to ***Full****, then the kerb and the entire pavement from the start link, is created.*

If set to ***Kerb only****, then only the kerb and the pavement under the kerb, is created.*

Comment

Information entered here will show up in the MTF modifier, and can be read without opening up the entire snippet panel.

Buttons at Bottom

Ok button

Will apply any changes and close the panel.

Apply button

Will apply any changes and if the Auto recalc is set on the main MTF.

Note*: Panel size and position are saved in the working folder:*

mtf_panel_sizes.4d

This file can be moved to your $user for all subsequent projects*.*

Continue to 16.13 TRI_PAVEMENT_NEW_TO_TIN_FROM_ATTRS.mtfsnippet or go back to 16.12 TRI_PAVEMENT_NEW_KERB_FROM_ATTRS.mtfsnippet.

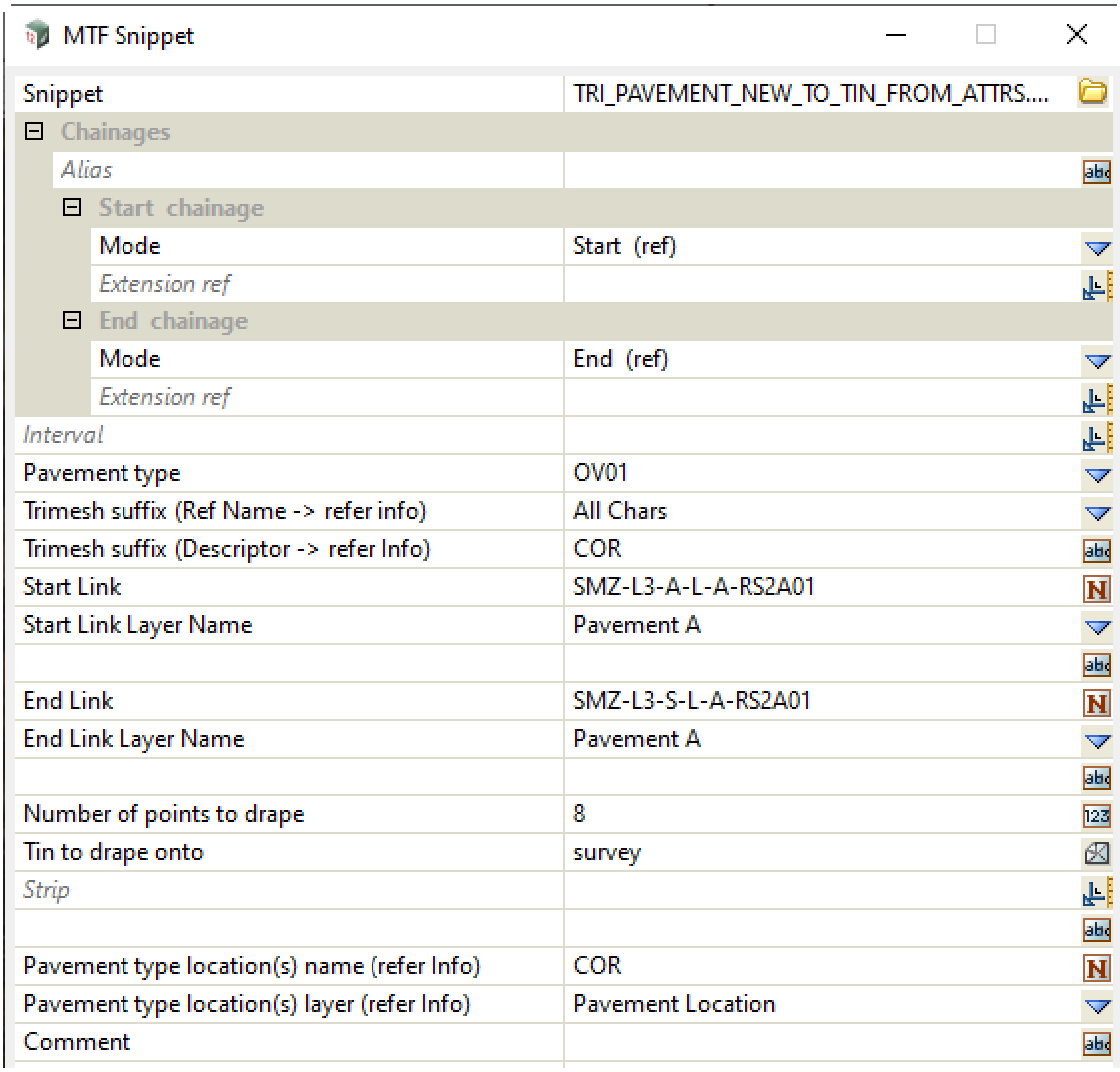
16.13 TRI_PAVEMENT_NEW_TO_TIN_FROM_ATTRS.mtfsnippet

This snippet is used in conjunction with the **new** Pavement Manager

Details such as layer name, colour, depth etc have been defined separately in the manager.

The snippet is generally is used to place corrector material under a pavement. A tin is specified to extend down to.

The MTF modifier called "Snippet" is used.



Field Description	Type	Defaults	Pop-Up
Pavement_type	choice box		

A range from pavement manager.

Note*: Only the first layer will be used for the trimesh created.*

Trimesh Ref Name Suffix	choice box	All Chars	

This option will add the Reference Alignment name to the names of all pavement elements created, *including model names.*

Ref name RS01, then RS01 is added

*Models created: MESH PAVEMENT **RS01** MESH PAVEMENT STRS **RS01***

***Note**: MESH PAVEMENT & MESH PAVEMENT STRS are taken from the Pavement Manager, under the **Defaults tab**.*

Trimesh Suffix input

*This suffix is used to make up the **unique name** of the trimesh and strings **NOT** the model names.*

e.g. Suffix = A and snippet used on LHS

*Mesh name = AC14-L-A- **RS01** (Layer name-side-suffix-ref)*

Mesh strings name:

*AC14-L1-Z-L-A- **RS01** (Layer name-layer number-str-side-suffix-ref)*

Start link choice box

***Reference** can be accessed by using "HINGE".*

Start link layer name choice box Design

Layer choice (could be layer from previous pavement snippet).

End link choice box

End link layer name choice box Design

Layer choice (could be layer from previous pavement snippet).

Number of points to drape integer

The number of points to drape onto tin to form the base of the trimesh.

Tin to drape onto choice box

Tin must exist.

Strip real box optional

Distance strip off the tin surface (+ ve value).

The two options below can be used to position the snippet instead of the start and end chainages at the top of the snippet.

The name and layer can be defined by using the snippet below (beforehand)

INSERT_PAVEMENT_TYPE_LOCATION.MTFSNIPPET

Pavement type location(s) name input optional

Location name (e.g. PT01).

Pavement type location(s) layer input optional

Location layer (e.g. Pavement location).

Comment

Information entered here will show up in the MTF modifier, and can be read without opening up the entire snippet panel.

Buttons at Bottom

Ok button

Will apply any changes and close the panel.

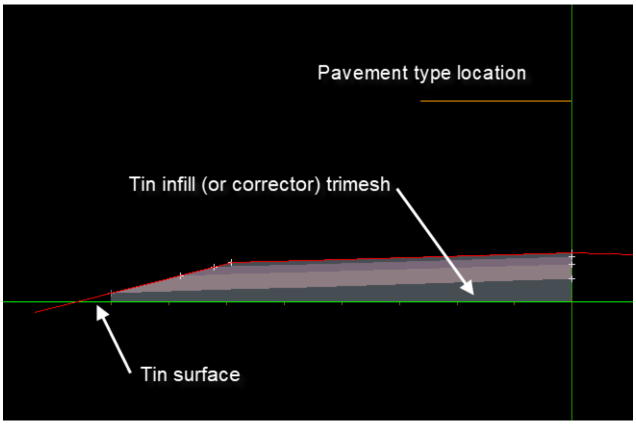
Apply button

Will apply any changes and if the Auto recalc is set on the main MTF.

Note*: Panel size and position are saved in the working folder:*

mtf_panel_sizes.4d

This file can be moved to your $user for all subsequent projects*.*



Continue to 16.14 INSERT_PAVEMENT_TYPE_LOCATION.MTFSNIPPET.mtfsnippet or go back to 16.13 TRI_PAVEMENT_NEW_TO_TIN_FROM_ATTRS.mtfsnippet.

16.14 INSERT_PAVEMENT_TYPE_LOCATION.MTFSNIPPET.mtfsnippet

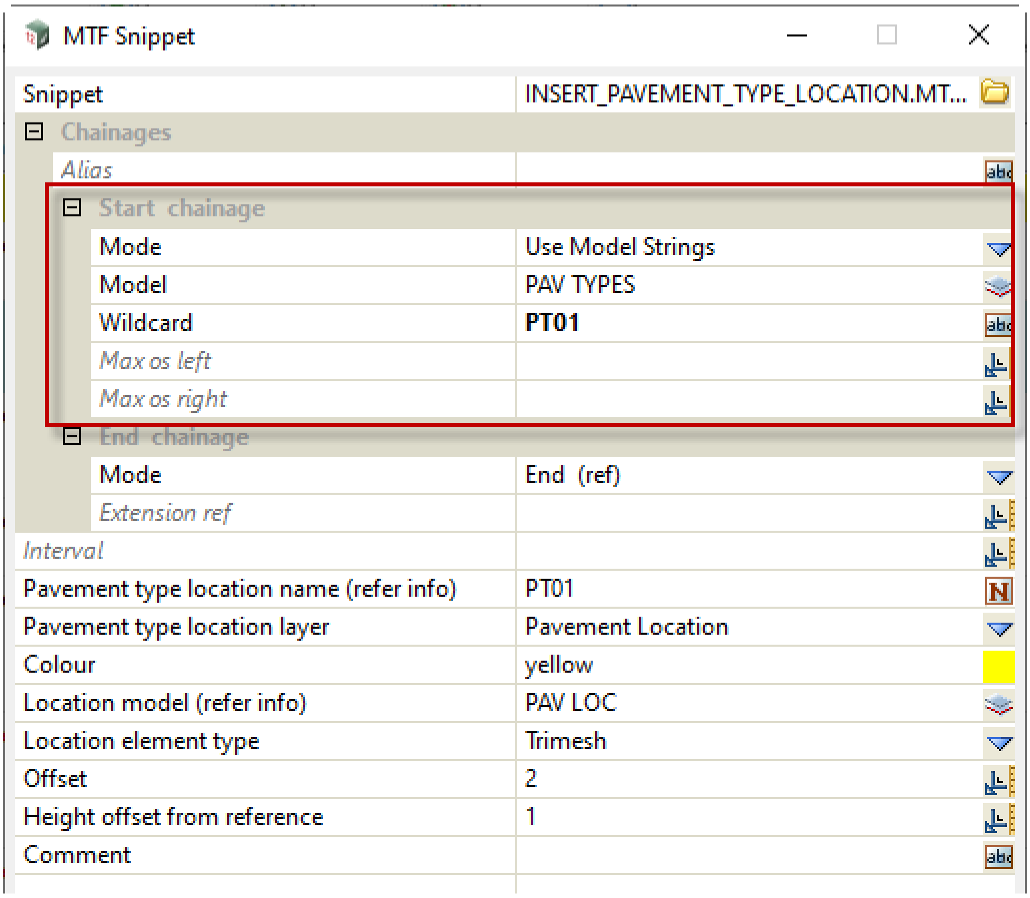
This snippet is used in conjunction with the **new** Pavement Manager

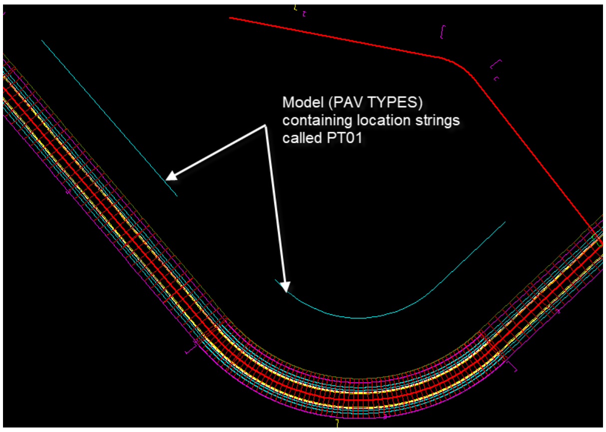
And any relevant NEW pavement snippets that use it

The snippet can create links on a user specified layer, that can then be used in other pavement snippets.

This process is used instead of the start/end chainages at the top of that snippet panel.

The MTF modifier called "Snippet" is used.





NOTE: The snippet is placed using the mode "Use model strings"

This enables the user to simply draw strings to define pavement locations

Field Description Type Defaults Pop-Up

Pavement type location name (refer info) input box

Link name that refers to the pavement type.

Pavement type location layer (refer info) layer box

Layer for the links.

Colour colour box red available colours

Colour of polygon and or trimesh chosen below.

Location model (refer info) model box available models

Model for polygon and or trimesh chosen below. It is optional so if not used, then no polygon or trimesh will be created.

Location element type colour box Polygon

The 3d Polygon and/or a Trimesh is mainly used for a visual location of the pavement type (add to perspective and section view e.g.).

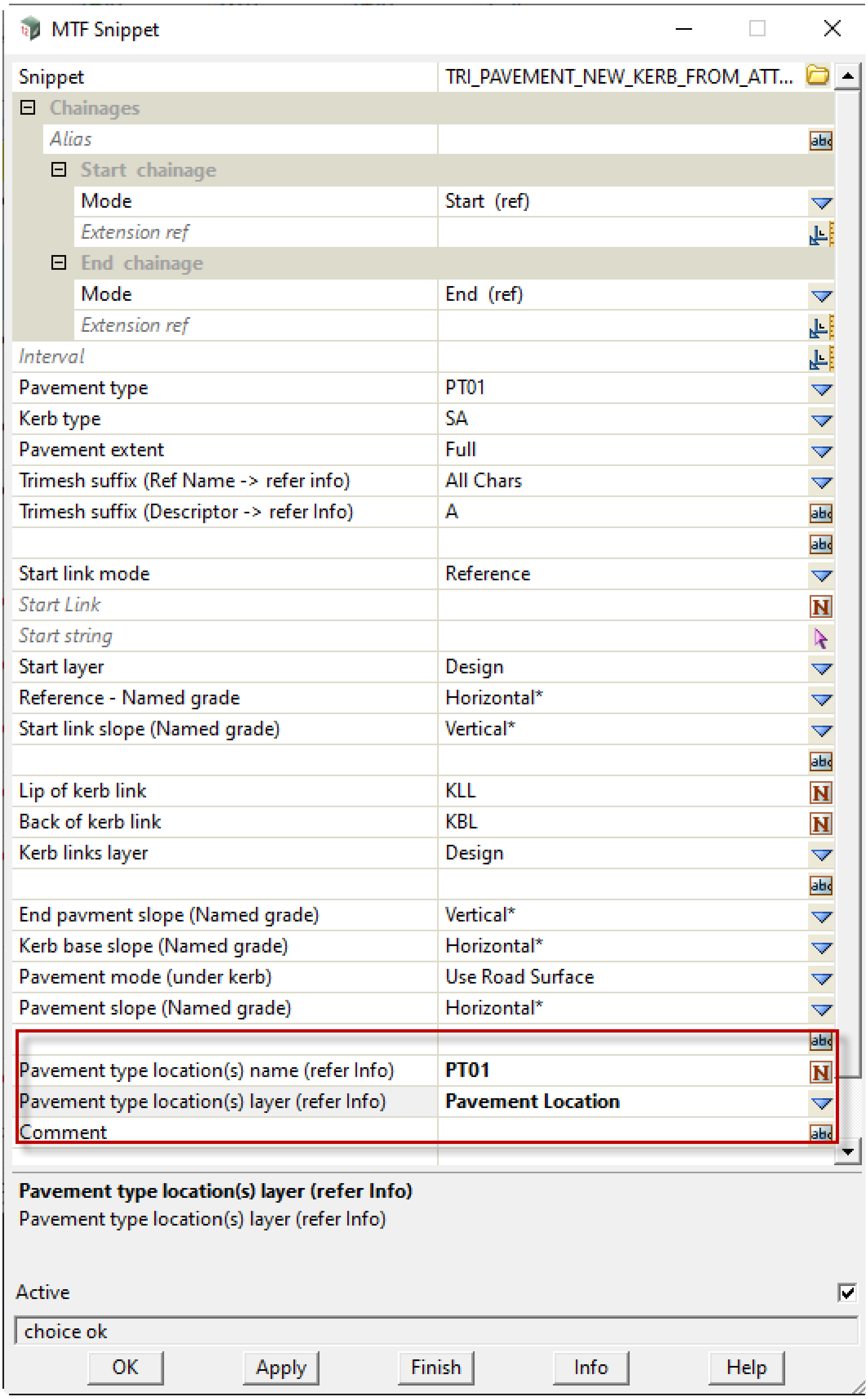
Offset real box 2

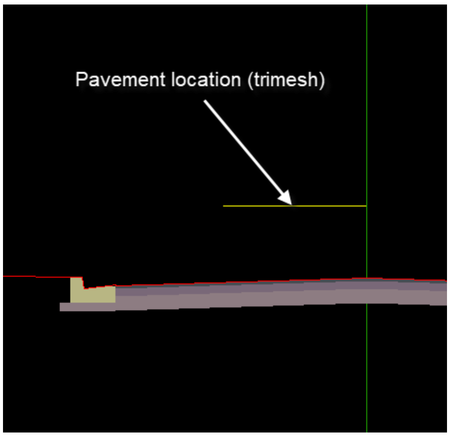
Will be used for the polygon width (measured from the reference).

Height offset from reference real box 1

Position height above the reference string.

The Pavement type location(s) are then used in most of the "NEW" supplied snippets e.g. TRI_PAVEMENT_NEW_FROM_ATTRS.MTFSNIPPET.


MTF Snippet
Snippet
TRI_PAVEMENT_NEW_KERB_FROM_ATT...
Chainages
Alias
Start chainage
Mode
Start (ref)
Extension ref
End chainage
Mode
End (ref)
Extension ref
Interval
Pavement type
PT01
Kerb type
SA
Pavement extent
Full
Trimesh suffix (Ref Name -> refer info)
All Chars
Trimesh suffix (Descriptor -> refer Info)
A
Start link mode
Reference
Start Link
Start string
Start layer
Design
Reference - Named grade
Horizontal*
Start link slope (Named grade)
Vertical*
Lip of kerb link
KLL
Back of kerb link
KBL
Kerb links layer
Design
End pavment slope (Named grade)
Vertical*
Kerb base slope (Named grade)
Horizontal*
Pavement mode (under kerb)
Use Road Surface
Pavement slope (Named grade)
Horizontal*
Pavement type location(s) name (refer Info)
PT01
Pavement type location(s) layer (refer Info)
Pavement Location
Comment
Pavement type location(s) layer (refer Info)
Pavement type location(s) layer (refer Info)
Active
choice ok
OK
Apply
Finish
Info
Help



Continue to 16.15 Important note for using parameters in _PROJECT_ATTRIBUTE and _MODEL_ATTRIBUTE or go back to 16.14 INSERT_PAVEMENT_TYPE_LOCATION.MTFSNIPPET.mtfsnippet.

16.15 Important note for using parameters in _PROJECT_ATTRIBUTE and _MODEL_ATTRIBUTE

While project and model attributes can use snippet parameters they must first be declared as tokens prior to being used in **_PROJECT_ATTRIBUTE** and **_MODEL_ATTRIBUTE**. This is necessary due to the order of snippet pre-processing, failure to do so will result in unresolved parameters.

```
// Declare parameters for the model to get an attribute from
// and the attribute itself


// PARAMETER MetaModel MODEL_MUST_EXIST "Metadata Model" "Metadata"
// PARAMETER Style     CHOICE          "Style Number"   "01" "02"


// Now declare tokens for both of these attributes.

@ def_tok MM $(MetaModel)
@ def_tok ST $(Style)


// Then we can access the model attribute

@ def_tok NAME $(_MODEL_ATTRIBUTE[$(MM),$(ST)/Attribute])


// and print in the output window to confirm

user_message_print_eval_tok "Name = $(NAME)" $(_SCH) 0 $(_SCH) 0.0001
```

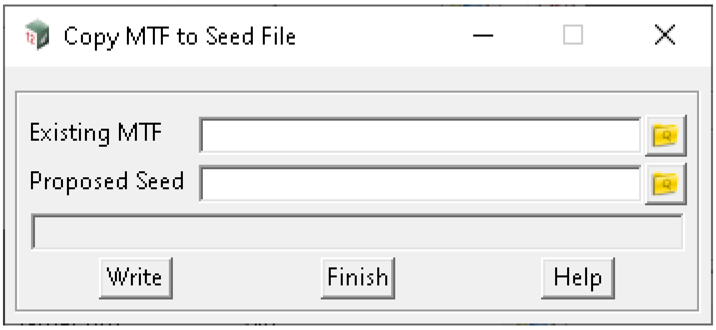
Continue to 16.16 Copy MTF to seed or go back to 16.15 Important note for using parameters in _PROJECT_ATTRIBUTE and _MODEL_ATTRIBUTE or 16 Design.

16.16 Copy MTF to seed

Position of option on menu: **Design =>MTF =>Copy MTF to seed**

This option allows you to copy an existing MTF to a seed file (mtf_seed).

Selecting **Copy MTF to seed** brings up the **Copy MTF to Seed File** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Existing MTF	file box		*.mtf files
The existing MTF file.			
Proposed Seed	file box		*.mtf_seed files
New name for the seed file.			

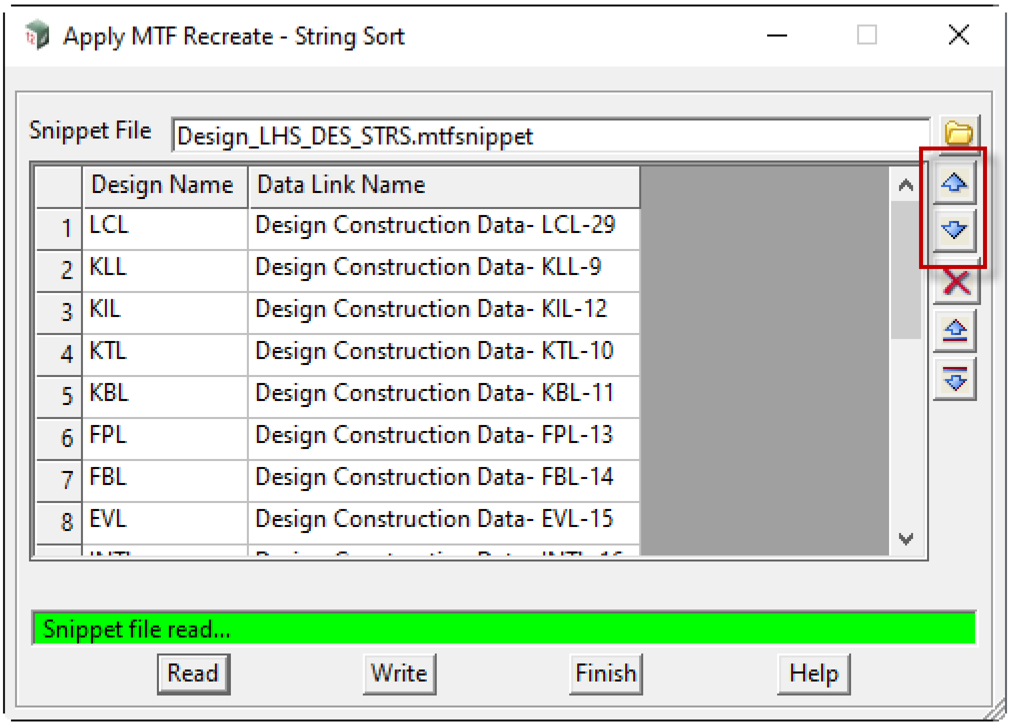
Buttons at Bottom

Write	button		
Write file (copies existing mtf to an mtf_seed file).			

Continue to 16.17 Apply MTF - Recreate String Sort or go back to 16.16 Copy MTF to seed or 16 Design.

16.17 Apply MTF - Recreate String Sort

Position of option on menu: **Design =>Apply =>Apply MTF recreate string sort**



In the above panel a snippet for the LHS of the recreate has been selected. All the strings that are created, via an "insert_absolute" command, are displayed in the grid.

The final design link name and the corresponding unique string in the construction data model are displayed.

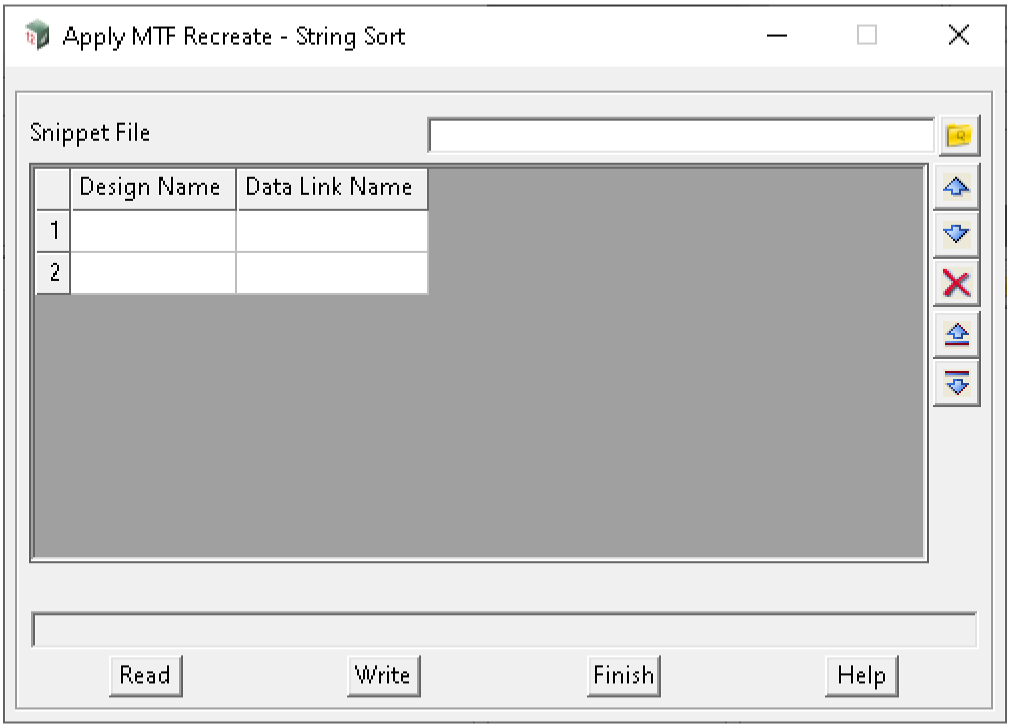
An effort is made to sort the strings into their position relative to the reference alignment. In some circumstances this automated process may fall short.

This "recreate sort", allows you to move any string up or down in the grid and write out the new ordered snippet.

In this example the design string "LCL" was in position 7 in the grid, but had to go ahead of the "KLL" string.

Note: The design strings may look correct, but their position in the data base, when created, may affect some modifiers.

Selecting **Apply MTF recreate string sort** displays the **Apply MTF Recreate - String Sort** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Snippet file	file box		*.mtfsnippet

Snippet file created using the Apply MTF Recreate.

Grid	selections		

Lines read from the file, which can be moved up or down via the arrows highlighted.

Buttons at Bottom

Read button

Read the file and fills out the grid.

Write button

Write the file (overwrites the existing file).

Continue to 16.18 Apply MTF - Recreate or go back to 16.17 Apply MTF - Recreate String Sort or 16 Design.

16.18 Apply MTF - Recreate

Position of option on menu: **Design =>Apply =>Apply MTF recreate**

This option is used to re-create an MTF and Apply MTF function from a model of strings which could even be from an external data source.

Whether the data is being used for Design or Construction, there may need to be some editing of the strings before running this option.

For example:

Check the consistency of the string names.

Join strings that define the same feature but have different names e.g. Kerb strings.

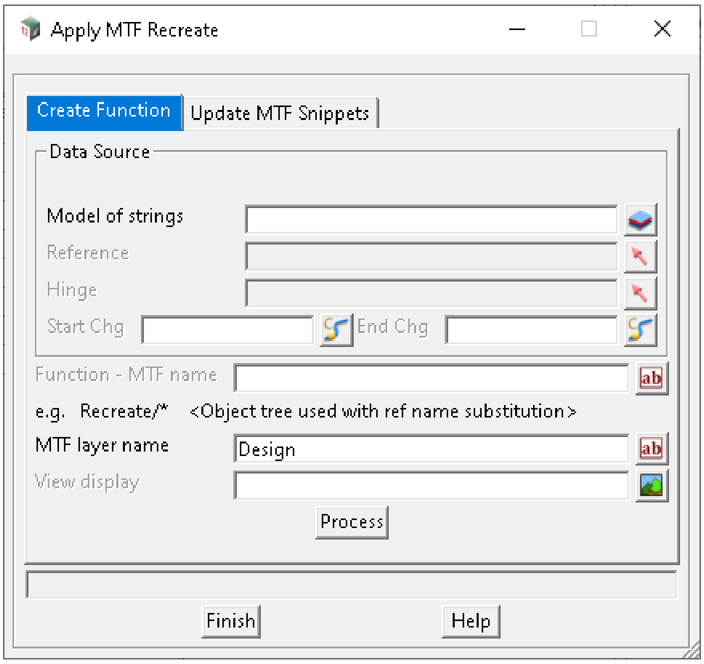
Note: Remove any data from the Model of strings that does not run longitudinally along the reference string (road centreline).

Strings cannot "go back on themselves"

Strings can be shared in via Model share. It is these strings that are used in the MTF when recreating the design.

The "insert at string" modifier is used along with the string exists decision modifier, to ensure that numerous output window warnings do not show.

Selecting **Apply MTF - recreate** displays the **Apply MTF Recreate** panel.



Create Function tab
Update MTF Snippets tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Create Function tab

Model of strings	model box		available models

Refer to information above on the string data.

Reference select box

Road centreline required (Super Alignment).

Hinge select box

Additional road centreline (Super Alignment).

Start chg chainage box

*If **not blank**, used as the **Start chainage** in the Apply MTF function.*
This can be used to restrict the area to work on.

For more information on Start Chainage Mode, see 19.3 Smart Chainages.

End chg chainage box

*If **not blank**, used as the **End chainage** in the Apply MTF function.*
This can be used to restrict the area to work on.

For more information on End Chainage Mode, see 19.3 Smart Chainages.

Function /MTF name text box

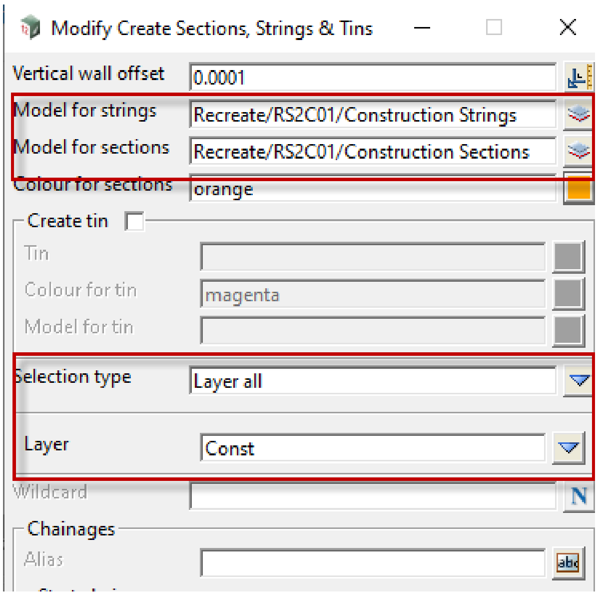
The name of the Reference string is automatically used as the Function and MTF name e.g.
Reference string: Alignment -> RS01
***Note:** to activate Object tree, the syntax below could be used e.g.*
Recreate/*
AM Function will be Recreate/RS01
MTF will be Recreate RS01.mtf (a space is used instead of the forward slash)
A user defined name can be used that does not include the * reference name substitution.
e.g. <Re design stage 1>
A check is done at "Process" time to ensure that a function of this name does not already exist.
*If it does exist then the above **Function / MTF name** will be used instead e.g.*
***Reference string:** Alignment -> RS01*
***Function / MTF name** RS01 DESIGN*
AM Function will be RS01 DESIGN
MTF will be RS01 DESIGN.mtf

MTF layer name input box Design

The layer name in the snippets created above (Generally Design).

View display view box optional available views

Strings and section model will be automatically added to this view
***Note**:*
Two models are created via this option:
Recreate/RS01 Construction Strings
Recreate/RS01 Construction Strings
***NOTE**: If something other than Design is used (**Const** e.g.), the models above will be empty.*
The models will be automatically set using the following mtf modifier.
Modifier left->Create->Sects, strs & tins
e.g.



This layer would also have to selected rather than <Design>, when using any pavement snippets.

Process button

Run the option.

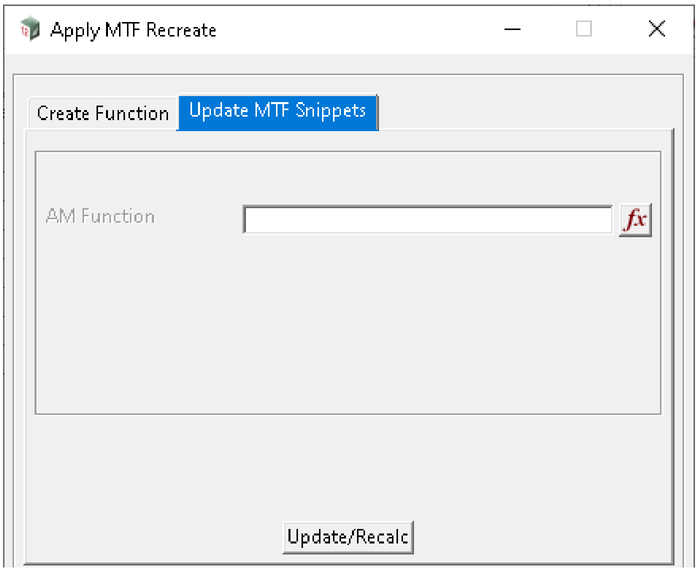
The design data modifiers used are wrapped up in two snippets (one for each side of the reference string)

RS01_LHS_DES_STRS.mtfsnippet
RS01_RHS_DES_STRS.mtfsnippet

Several models are created by this option:

RS01 Construction Data (a copy of the original model of strings)
RS01 Construction Strings
RS01 Construction Sections
RS01 Construction Filter sections

Update MTF Snippets tab



Create Function tab
Update MTF Snippets tab

This option can be used to re-write or update the snippet used by the original MTF and AM function.

The design data modifiers used are wrapped up in two snippets (one for each side of the reference string).

RS01_LHS_DES_STRS.mtfsnippet

RS01_RHS_DES_STRS.mtfsnippet

***Note**: Change or edit strings in the original **Model of strings** used.*

AM Function function box

When a valid function is selected, information on the data used will displayed below on the panel.

Update/Recalc button

*The snippets are updated **ONLY**, and then the AM function is recalced.*

Selecting the function box will display what was used to create the function.

Continue to 16.19 Debugging Snippets or go back to 16.18 Apply MTF - Recreate or 16 Design.

16.19 Debugging Snippets

See 16.19.1 Print Messages and Log Lines to the Output Window

16.19.1 Print Messages and Log Lines to the Output Window

(d) user_message_log_eval_token, user_message_print_eval_token

user_message_log_eval_token "text_msg" st_ch extra_st end_ch extra_end

user_message_print_eval_token "text_msg" st_ch extra_st end_ch extra_end

"text_msg" user defined text which has a token embedded in it, these 2 snippet commands simply indicate to the snippet processor there is a token embedded in the message that needs evaluating, it is not an error is the message has no token, it will printed/logged as is.

st_ch extra_st end_ch extra_end - optional

st_ch is a chainage

extra_st is added to st_ch to give the **start chainage**

end_ch is a chainage

extra_end is added to end_ch to give the **end chainage**

Print to or create a log line in the Output Window of the text **text_msg** with all embedded tokens evaluated.

The log lines are produced for every section in the chainage range given by the start chainage and the end chainage.

If the start and end chainage modes are omitted, they are taken to be from the start to the end of the reference string.

user_message_print_eval_tok "The road is $(RWIDTH)m wide!" $(SCH) 0 $(ECH) 0

user_message_log_eval_tok "The road is $(RWIDTH)m wide!" $(SCH) 0 $(ECH) 0

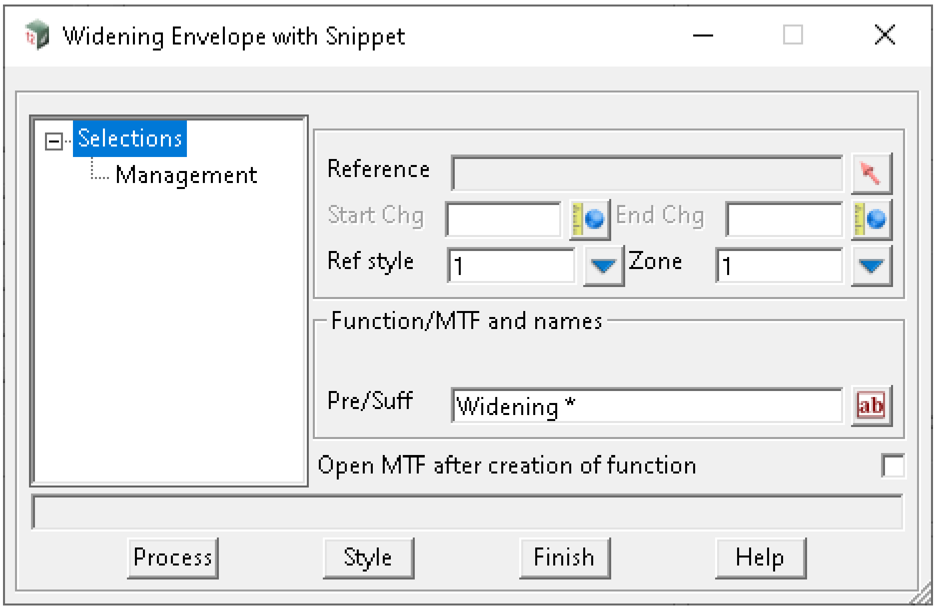
For every section between the start and the end chainage, this will evaluate $(RWIDTH) then print or log the text to the Output Window, "The road is 11.7m wide!"

Continue to 16.20 Road Widening - with Snippet or go back to 16.19 Debugging Snippets or 16 Design.

16.20 Road Widening - with Snippet

Position of option on menu: **Design =>Roads =>More =>Road widening (with snippet)**

Selecting **Road widening (with snippet)** brings up the **Widening Envelope with Snippet** panel.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Reference	string select		

Select super alignment.

Start Chg	real box		

Optional start chainage.

End Chg	real box		

Optional end chainage.

Ref style	choice box	1	1-10

*Reference styles can be created and set under "**Style**".*

Zone	choice box	1	1-10

Zones are part of the Ref style

***Note**: Refer toolbar menu, see 9.2.28 Road Toolbar.*

Pre/Suff	input box	Widening *	

Function/MTF uses this name plus the name of the reference alignment.

Open MTF after creation of function tick box not ticked

*If **ticked**, an edit panel for the MTF is displayed.*

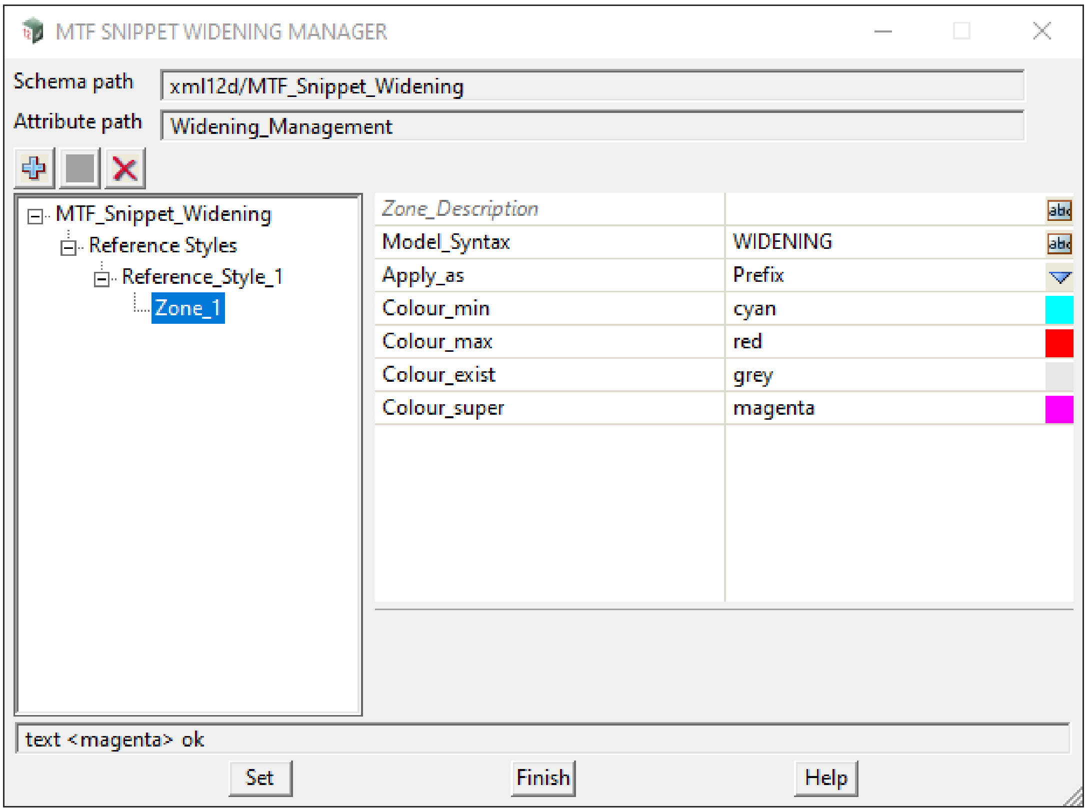
Buttons at Bottom

Process button

Process data selected with values entered.

Style button

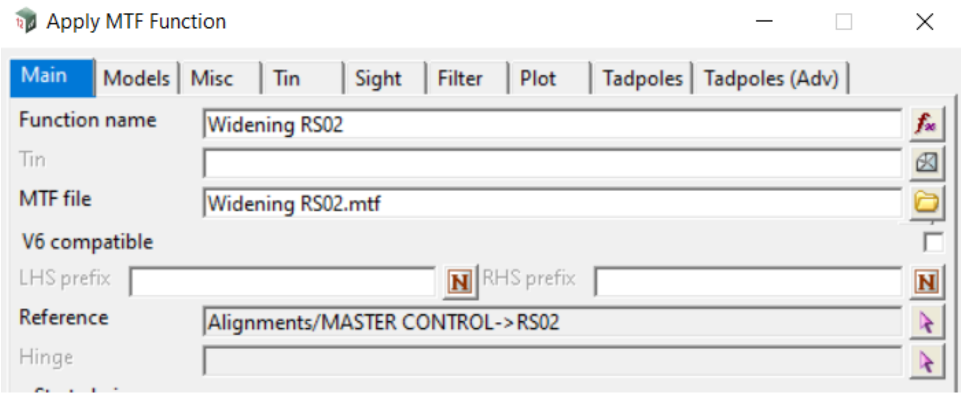
Displays the panel below where you can create other styles.

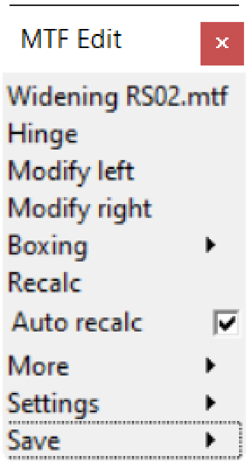


 *Selecting the add button above allows you to add other Reference styles and Zones. (10 maximum for each).*

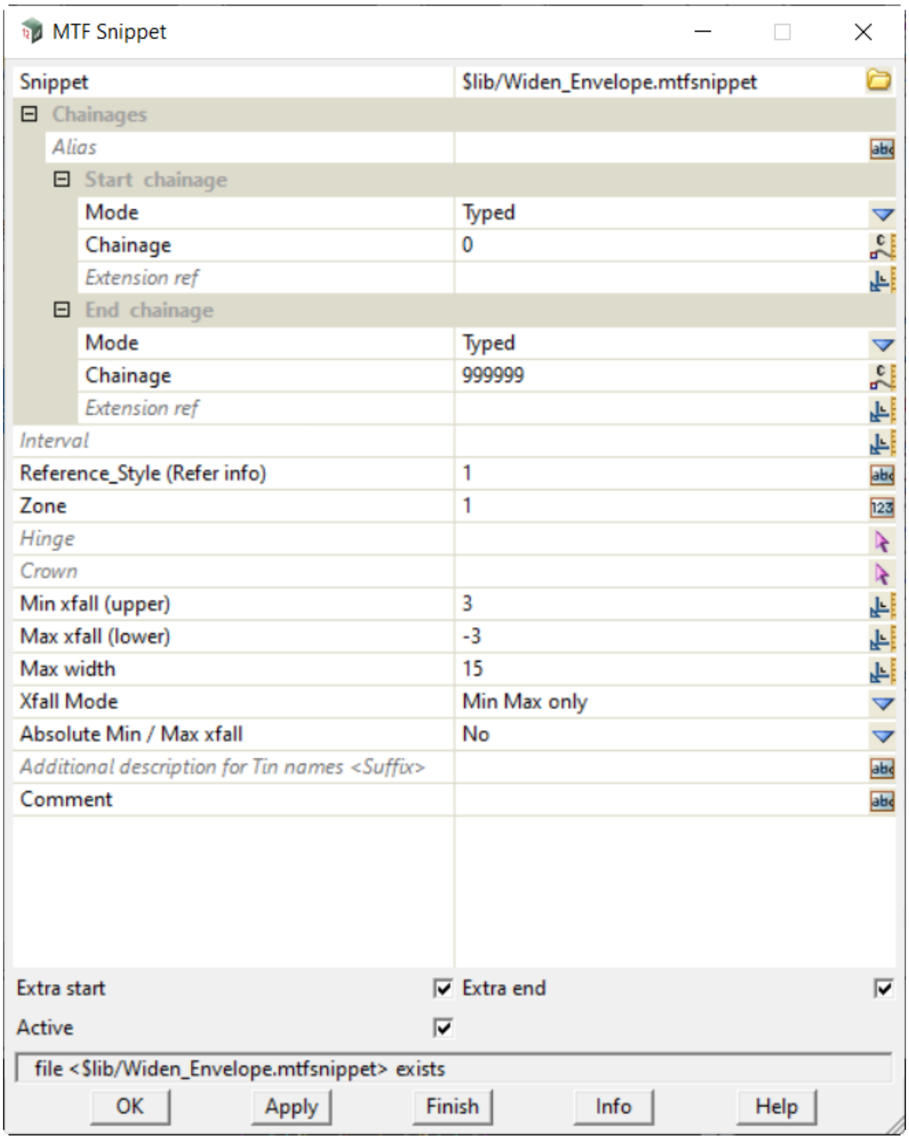
For more information see 19.11.12.5.1. Road Widening Manager.

Xfall envelope selections





The snippet below comes from the "**Modify left**" in the MTF created.

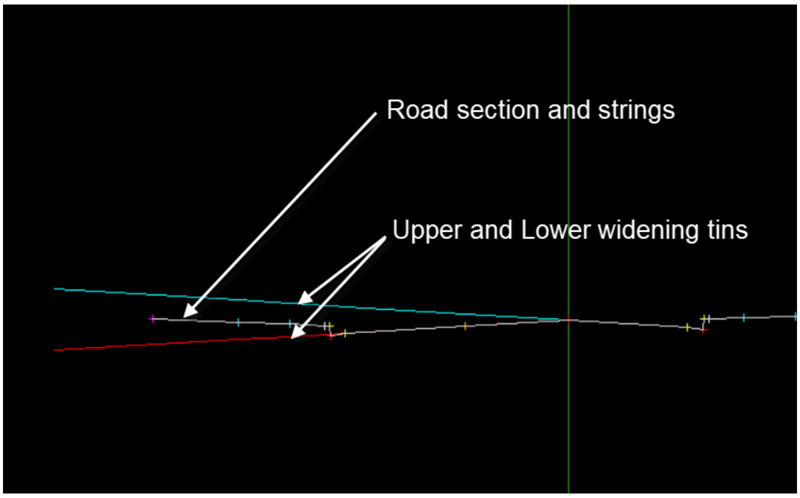


The snippet below comes from the first run when the function/MTF is created.

It uses the Upper and Lower xfalls, positioned at the reference string.

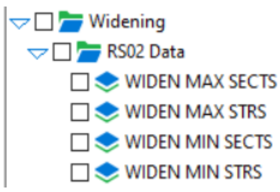
Xfall mode (Min Max only)

*Refer section view **below**, showing the profiled design road section and the two widening tins.*



Default model for tins as per below:

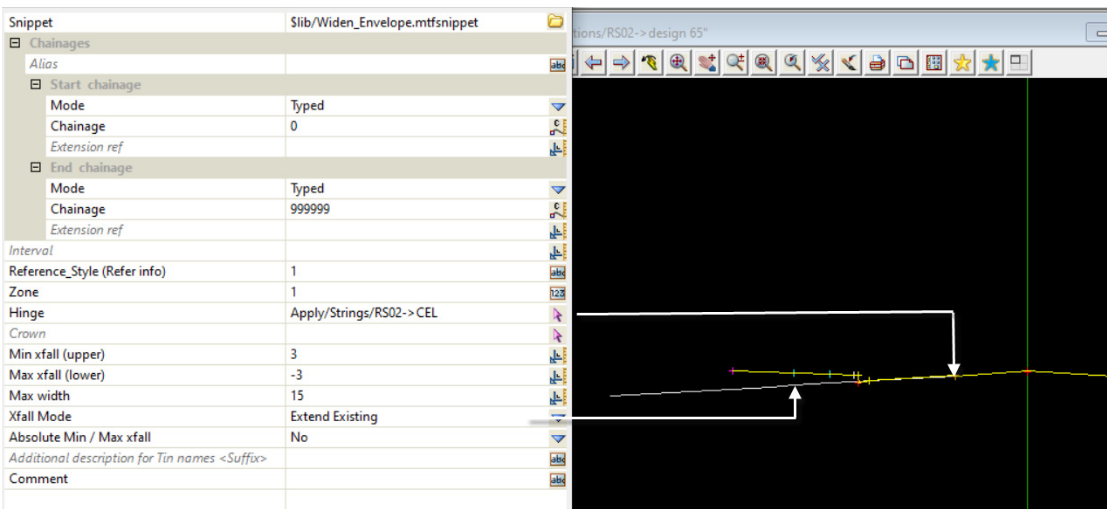
Extra default models for widening strings and sections, as per below:



Xfall mode (Extend existing)

It uses the reference string, and a hinge selection to define and extend the existing xfall.

*Refer section view **below**, showing the profiled design road section and the widening tin.*

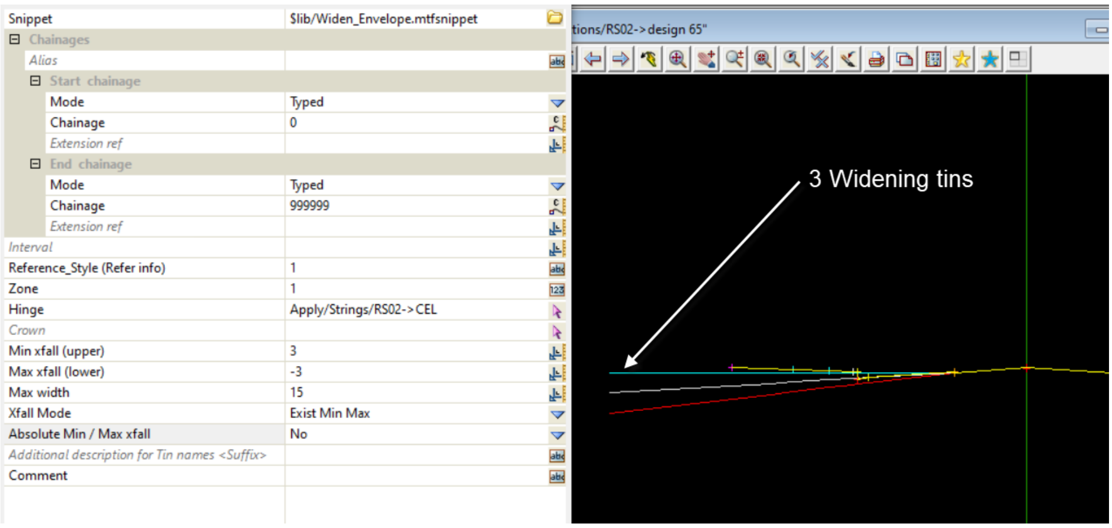


Xfall mode (Exist Min Max)

It uses the reference string, and a hinge selection to define and extend the existing xfall. The upper and lower xfalls are relative to the existing.

(Absolute Min / Max xfall is set to "No")

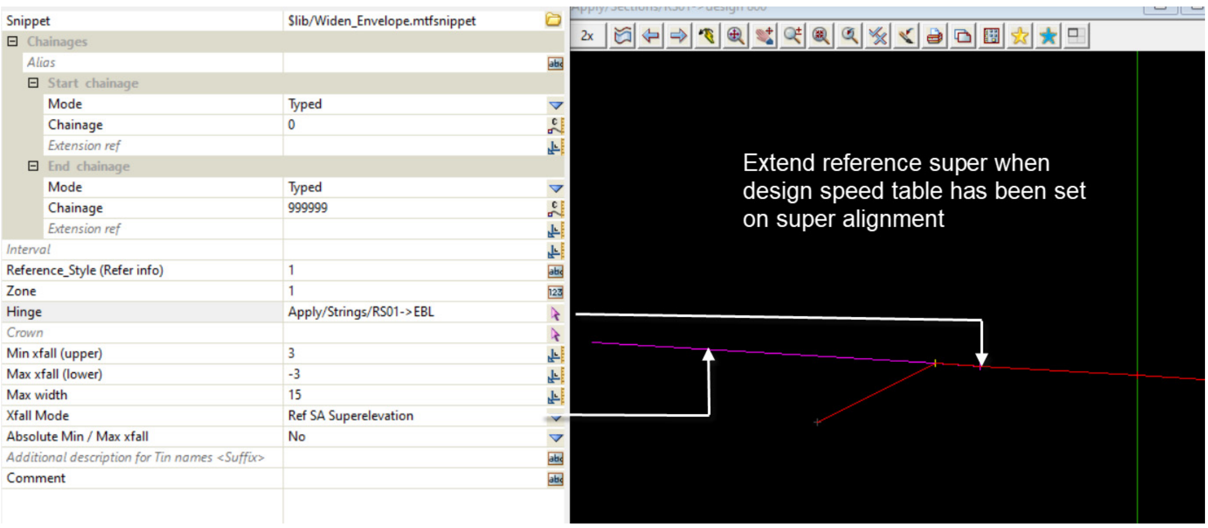
*Refer section view **below**, showing the profiled design road section and the 3 widening tins.*



Xfall mode (Ref SA Superelevation)

It uses the reference string, and a hinge selection to define and extend a xfall that matches the superelevation on the reference alignment.

*Refer section view **below**, showing the profiled design road section and the widening tin.*



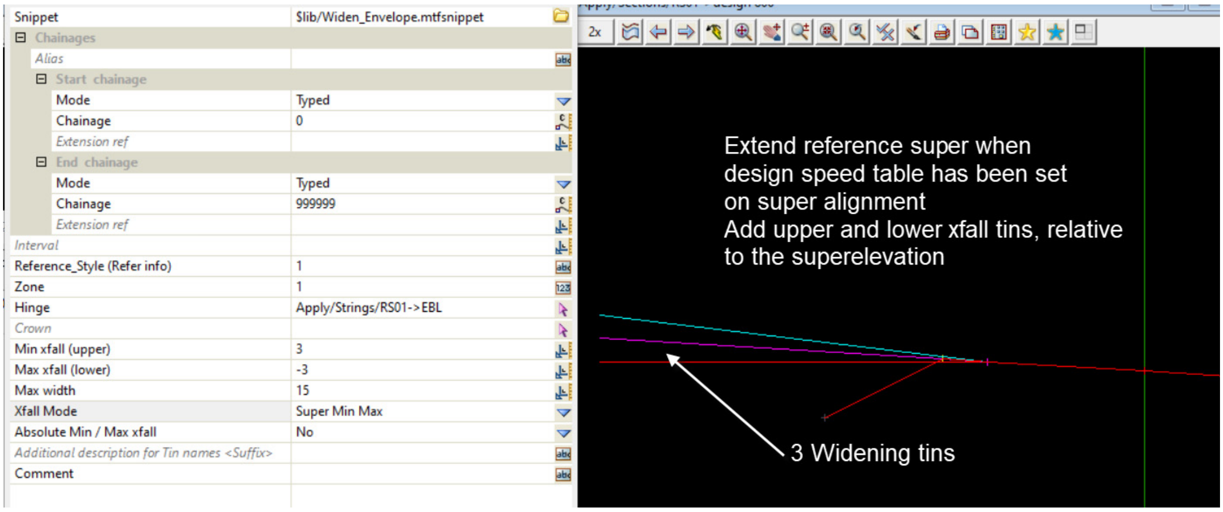
Xfall mode (Super Min Max)

It uses the reference string, and a hinge selection to define and extend a xfall that matches the superelevation on the reference alignment.

The upper and lower xfalls are relative to the superelevation.

(Absolute Min / Max xfall is set to "No")

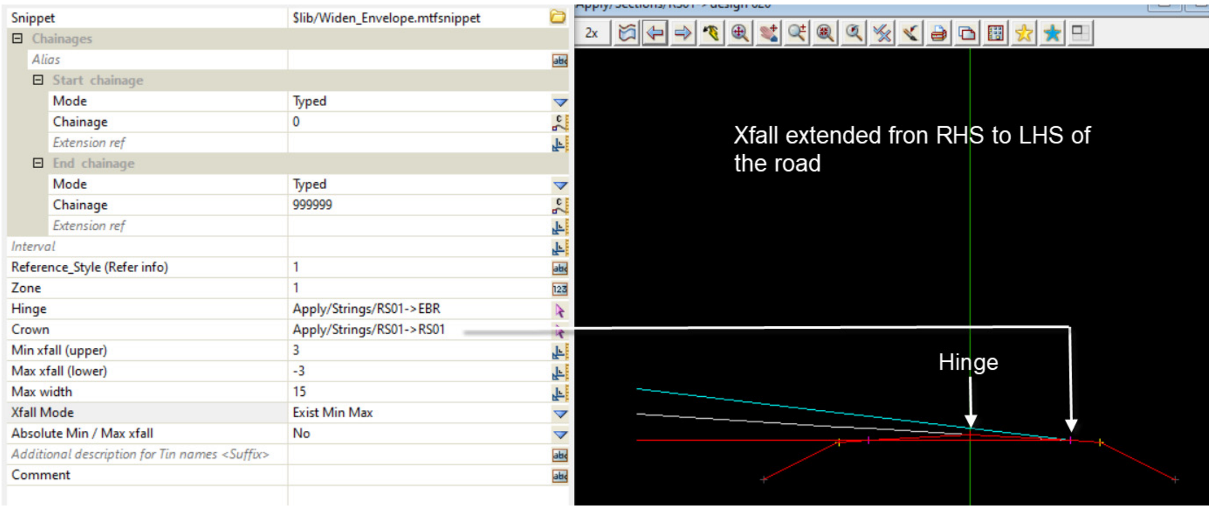
*Refer section view **below**, showing the profiled design road section and the widening tins.*



Crown and Hinge selection

The two strings can be used to extend the xfall between the two strings.

***Note**: As the widening snippet uses external strings to generate the tins, selection can be from any side of the reference string.*



Continue to 16.20.1 Road Widening Manager or go back to 16.20 Road Widening - with Snippet or 16 Design.

16.20.1 Road Widening Manager

This option creates widening styles for use in the **MTF** file. Setting project attributes which are then used within the "WIDENING_ENVELOPE_FROM_ATTRS.mtfsnippet"

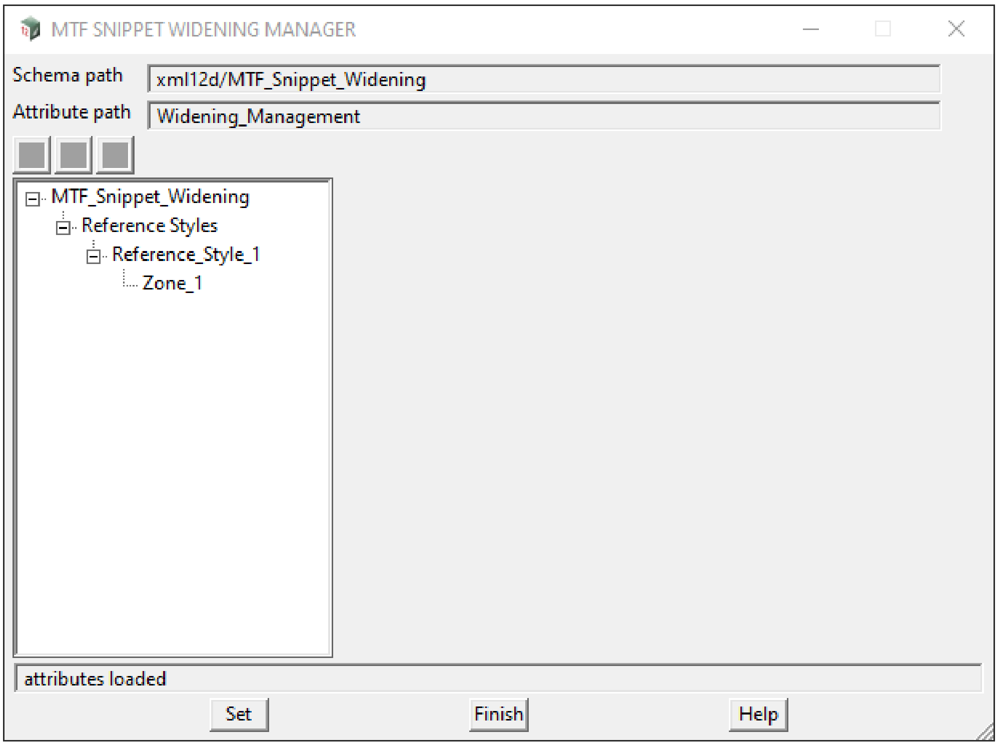
There are up to ten reference styles and each style consists of a possible further ten zones.

For example, when the Snippet Widening Manager is first activated, a default widening management style is created, called **Reference_Style_1**.

Under "Reference_Style_1" a default **Zone_1** is created with the defined attributes required for the snippet.

The widening management style information is stored as Project attributes under the tree **Widening Management**. The defined styles are only available within the current project.

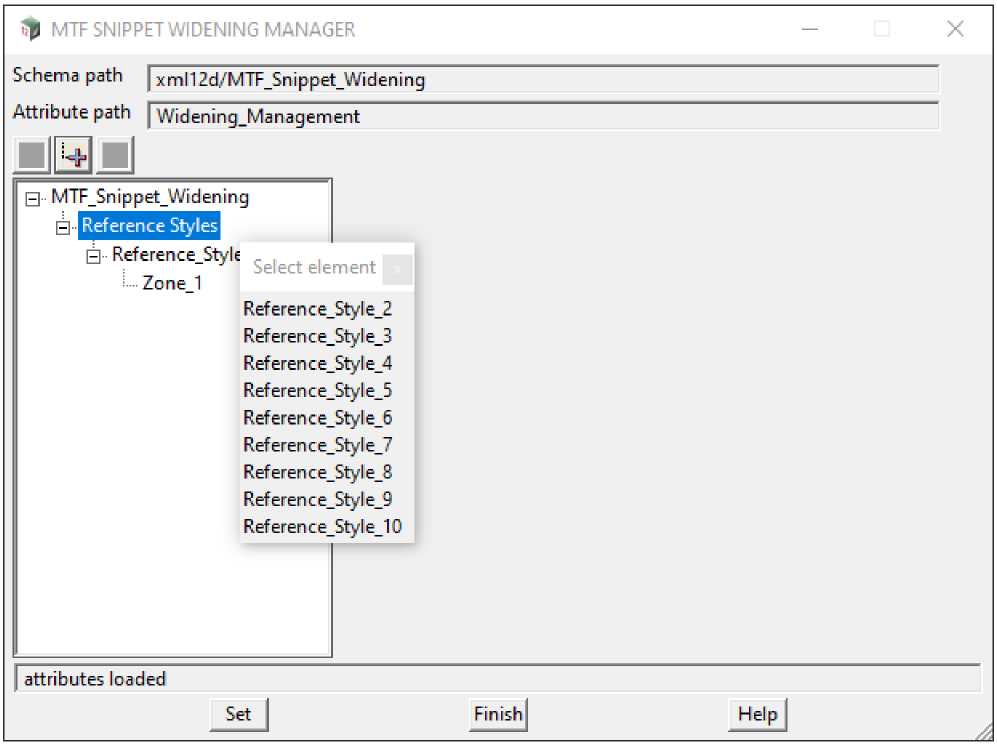
Selecting **Widening manager** brings up the **MTF Snippet Widening Manager** panel.



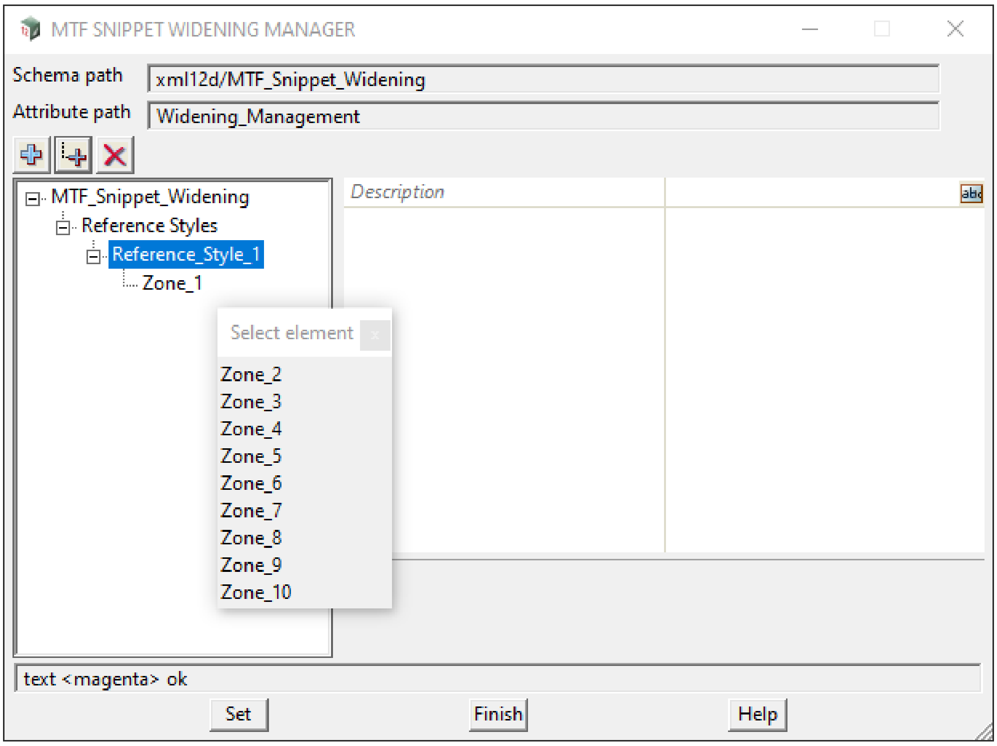
The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Reference Styles	file box		*.12dpm files

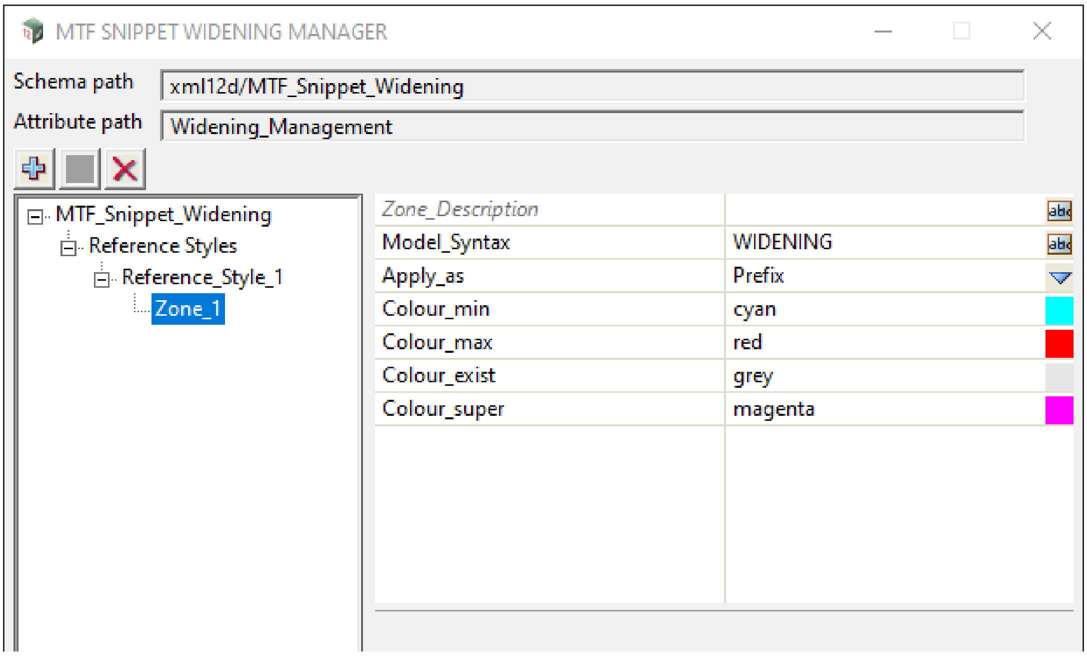
*When **Reference Styles** is highlighted, the **Add child** icon + appears and clicking on the + activates a drop down menu with up to nine new styles: Selecting a new **Reference_Style_n** will add it to the current lists of **Reference Styles**.*



*When the new **Reference_Style_n** is highlighted, the Add child icon + appears and clicking on the + activates a drop down menu with the new Zone number to be added.*



*Selecting a **Zone** will add it as a child of the highlighted **Reference Style**.*



Snippet attribute parameters

For each Zone created a number of individual parameters can be set for use within the MTF snippet. They include.

Zone_Description text box

This is an optional field to help differentiate between many Zones if used.

Model_Syntax text box WIDENING

Forms part of the final TIN model name used in the snippet eg. Model_synax + SA Name + Snippet Suffix.

Apply_as text box Prefix

Choice of Prefix or Suffix for the application of the model syntax.

Colour_min colour box cyan available colours

Colour used for the production of the minimum xfall tin.

Colour_max colour box red available colours

Colour used for the production of the maximum xfall tin.

Colour_exist colour box grey available colours

Colour used for the production of the existing xfall tin.

Colour_super colour box magenta available colours

Colour used for the production of the SA Superelevation xfall tin.

Buttons at Bottom

Set button

*Saves the information about the Widening Styles as Project attributes in the tree **Widening Management**.*

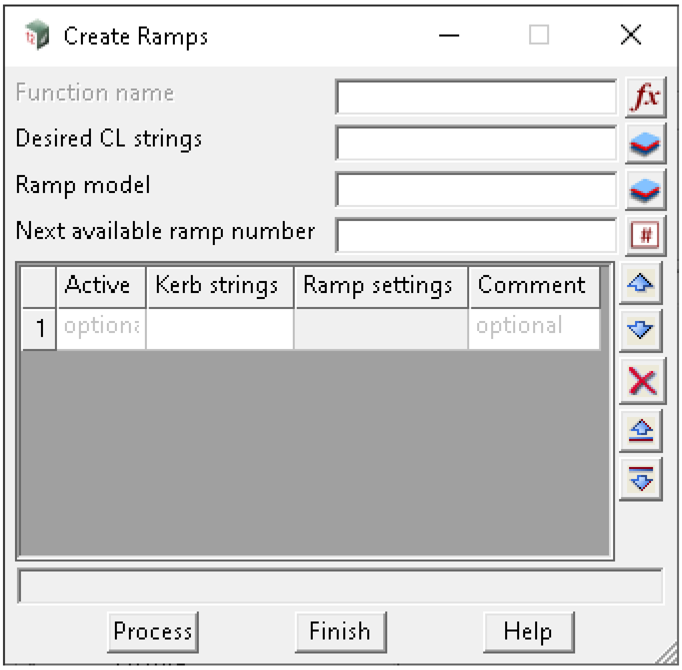
Continue to 16.21 Create Ramps and Driveways or go back to 16.20 Road Widening - with Snippet or 16 Design.

16.21 Create Ramps and Driveways

Position of option on menu: **Design =>Roads =>Create ramps/driveways**

This option has been developed to create one or more pram ramps or driveway locations that can be square or skew (angled) as often found from the kerb return geometry provided.

Selecting **Create ramps/driveways** brings up the **Create Ramps** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function name	function box		available create ramps functions

*Name of the function to define the **calculation** for reprocessing. If the function already exists and is picked from the list provided, the information from the existing function will be placed in the appropriate panel fields.*

Desired CL Strings	model box		available models

This model contains the locations and directions from which to calculate the directions from the centre of the new ramps. It is suggested the model contains construction strings (uniquely named) and these strings need to cross the SA Kerb Return strings provided in the grid below.

Ramp Model	model box		available models

Model name required into which the newly created ramp strings will be produced.

Start ramp number	text box		

The starting number for the ramp strings produced into the ramp model.

Grid area options by column

Active	optional	choice	

Selection of the cell for each row listed under active, users can choose (via RMB) "yes or no" to calculate the ramp information for that location.

Kerb Strings model box available model

This model selection contains the kerb return profile strings from which you intend to apply the modified invert, back and top of kerb strings to form the pram location.

Ramp Settings

Calculation settings per ramp location to be produced. These settings are stored as attributed for the calculation and can be modified or copied of required for additional ramps.For more information on the Ramp Settings Panel see 16.21.1 Ramp Settings Panel.

Buttons at bottom

Process button

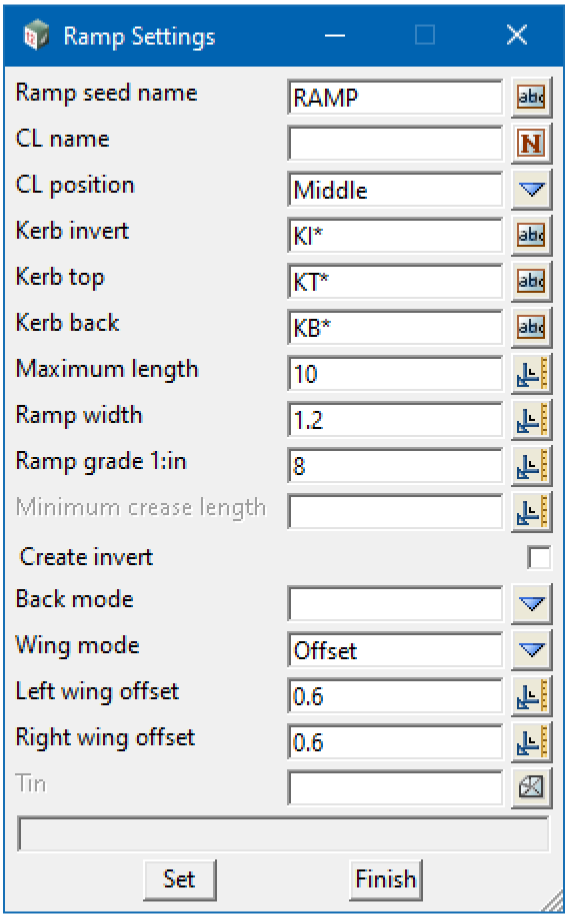
Once selected, the values provided above in the panel are calculated and any new ramp strings are generated into the "Ramp model".

Finish button

If selected the "Create ramp" panel will close and not undertake any calculations.

Continue to 16.21.1 Ramp Settings Panel or go back to 16.21 Create Ramps and Driveways or 16 Design.

16.21.1 Ramp Settings Panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Ramp seed name	text box	RAMP	

The seed name (defaulted to RAMP) is produced at the pre string name and is added before the "start ramp number" provided above. Hence each ramp string produced for the function has a unique name. eg RAMP01, RAMP02 etc.*

CL name	name box		

The string name selected to build the ramp from. This string is uniquely named within the "Desired CL strings" model provided above.

CL position	choice box	Middle	Left, Middle, Right

Given the "CL name" string provided above, the position of the new ramp and geometry/offsets regarding the placing of calculated strings.

Kerb invert	text box	KI*	

String name to be placed on the created ramp string at the time of processing.

Kerb top	text box	KT*	

String name to be placed on the created ramp string at the time of processing.

Kerb back	text box	KB*	

String name to be placed on the created ramp string at the time of processing.

Maximum length real box 10

Given the length and grade of ramp information provided below this is the maximum length over which to form the strings.

Ramp width real box 1.2

Width of the new ramp to be calculated from the CL name string based on the position selected above.

Ramp grade 1:in real box 8

Grade of the new ramp strings calculated from the height of the "Kerb Strings" height where the intersection of the "CL name" string intersects. Note: The "Kerb String" intersected much have valid heights for the ramp to be calculated.

Minimum crease length real box

*If **not blank**, the value entered will be the minimum length for a crease at the base of the ramp.*

If a crease is not required enter a large value so the minimum will not be met.

Create invert tick box not ticked

*If **not ticked**, no kerb invert string is produced in the final process.*

*If **ticked**, a kerb invert string is produced over the width of the ramp based off the geometry provided above, given the width and position of the ramp set.*

Back mode choice box Perpendicular to CL
Parallel to invert

Given the "CL name" string provided above, the position of the new ramp and geometry/offsets regarding the placing of calculated strings.

Wing mode choice box Offset Offset, Angle

??.

Left wing offset real box 0.6

??.

Right wing offset real box 0.6

??.

Tin tin box available tins

*If **blank**, then calculation of the ramp grade is used to determine the length of the ramp produced.*

*If **not blank**, the name of the tin to calculate the length of the ramp, given the desired grade and height of CL name string at the position of the invert.*

Comment text box

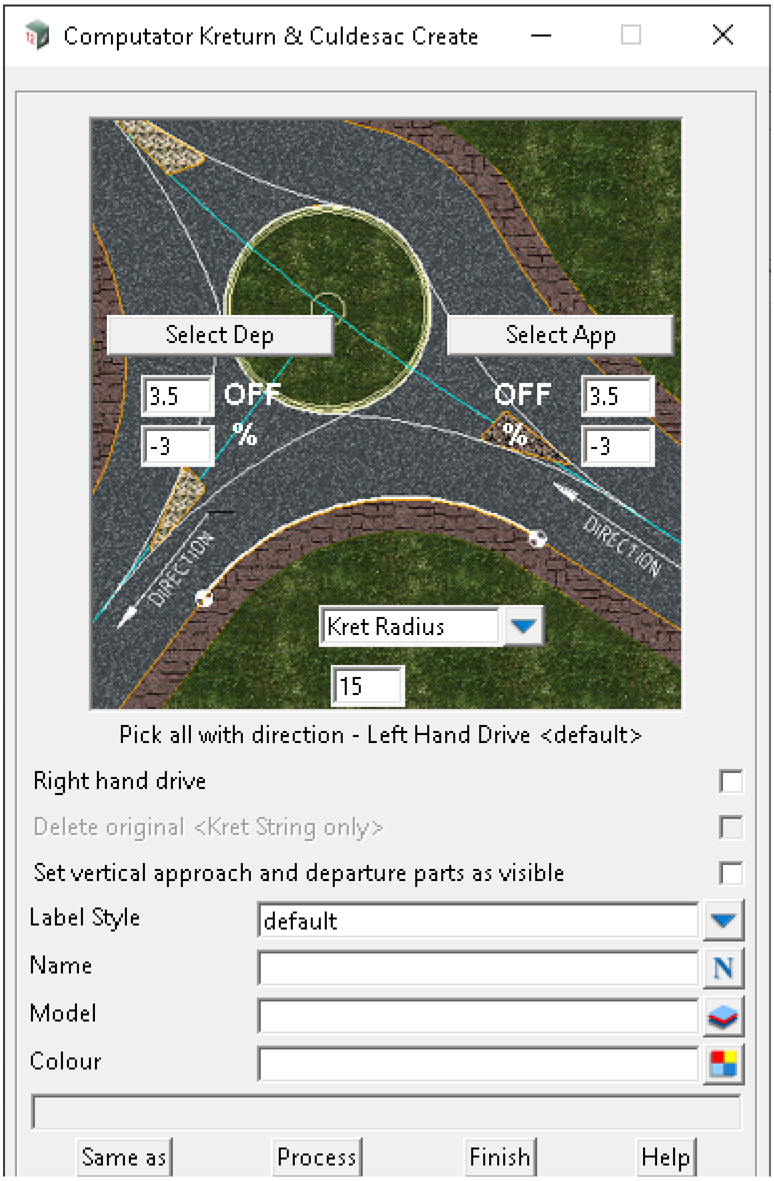
Optional note/comment for each row of the grid selection to allow users to document some feature for help in location of the ramp produced.

Continue to 16.22 Kret Convert to Computators or go back to 16.21 Create Ramps and Driveways or 16 Design.

16.22 Kret Convert to Computators

Position of option on menu: **Design =>Roads =>More =>Kret convert to computators**

Selecting **Kret convert to computators**, displays the **Computator Kreturn & Culdesac Create** panel on the screen



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Select App	button		

Selection must be a Super Alignment, picked with the direction of travel as if approaching the intersection. The offset and % values are for the constructed tangent point of the new kerb return arc and set the distance (offset) and vertical grade (crossfall %) the new arc should adopt to be positioned correctly both horizontally and vertically from the approaching SA string.

OFF	real box	3.5	

%	real box	-3	
Select Dep	button		

Selection must be a Super Alignment, picked with the direction of travel as if departing the intersection. The offset and % values are for the constructed tangent point of the new kerb return arc and set the distance (offset) and vertical grade (crossfall %) the new arc should adopt to be positioned correctly both horizontally and vertically from the departing SA string.

OFF	real box	3.5	
%	real box	-3	
Kret Radius	choice box	Kret Radius	Kret Radius, Kret String, Culdesac

Radius of new super alignment to be created for the kerb return (enter value below choice field).

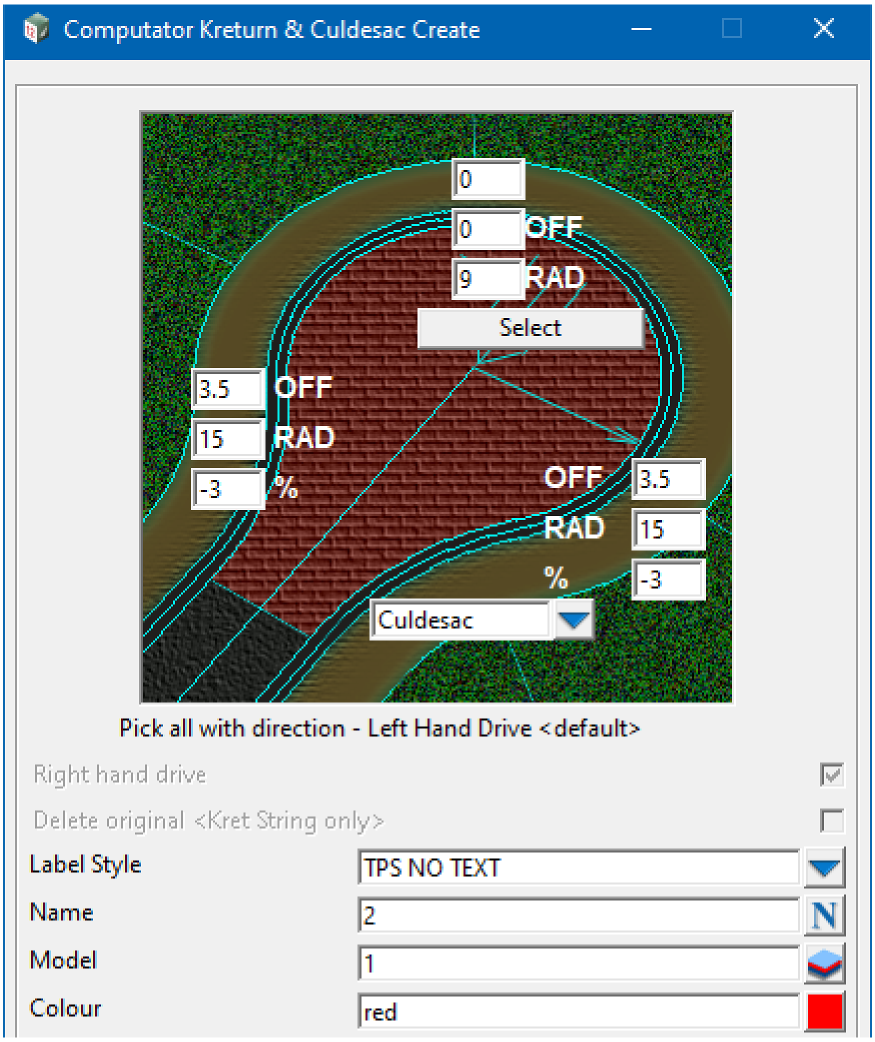
***Note**: The radius value should be a positive value for either a new left or right kerb return arc being designed.*

Kret String choice box

Requires an existing string to be selected, from which the radius value is obtained.

Example: Layout strings are super strings only from a cad process with the correct radius you require for your new kerb return alignment.

Culdesac choice box



Select button

Selection must be a Super Alignment, picked with the direction of travel as if approaching the cul-de-sac end of road.

Top box real box 0

Centre projection along road alignment. This value can move the centre co-ordinate of the culdesac bulb along the selected alignment to have a set chainage from the end of the selected alignment.

OFF real box 0

Offset of bulb centre from road alignment.

RAD real box 9

Radius of culdesac bulb.

Left and Right side parameters

OFF real box 3.5

Offset for the position of the tangent point from the selected centreline both left and right at the intersection.

RAD real box 15

Radius to use to be tangential to the radius of the cul-de-sac bulb.

% real box -3

Road xfall value to use for the vertical geometry of the new kerb return string.

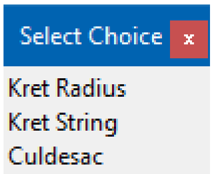
Right hand drive tick box not ticked

Method of driving affecting the approach and departure selections.

*(not used for **Culdesac** alignment creation)*

Delete original <Kret string only> tick box not ticked

*This option can only be used if the "Kret String" option is selected (not **Kret Radius** or **Culdesac**). If ticked the user can then have the construction cad string deleted automatically when the new kerb return super alignment is created.*



Label Style choice box

Super alignment styles available.

Name name box

Must be entered (a check is done, to see if a string of that name already exists).

Model model box available models

Must be entered (it is used in the check process above).

Colour colour box cyan available colours

*If **blank**, a default colour of cyan is used for the new kerb return super alignment.*

Buttons at Bottom

Same as button

Select another string for name, model and colour.

Process button

Process data selected with values entered (and any checks done).

***Note**: To create a design along an alignment see 19.5.4 Apply MTF MAnager - Create/Update.*

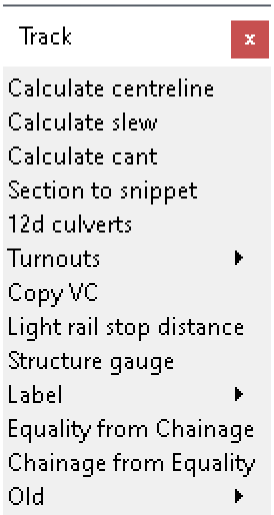
Continue to 16.23 Track or go back to 16.22 Kret Convert to Computators or 16 Design.

16.23 Track

Position of menu: **Design =>Track**

The Track options are for working on rail design.

The **Track** walk-right menu is



See
16.23.1 Calculate Centreline
16.23.2 Calculate Slew
16.23.3 Calculate Cant
16.23.4 Section to Snippet
16.23.5 12d Culverts
16.23.6 Track Turnouts
16.23.7 Copy VC

16.23.8 Structure Gauge Panel
16.23.9 Track Label

16.23.1 Calculate Centreline

Position of menu: **Design =>Track =>Calculate centreline**

The **Calculate centreline panel** generates a centreline between two strings. A centreline element is used by the 16.23.2 Calculate Slew panel to generate offset calculations between a design alignment and the generated centreline.

The Calculate centreline panel can generate the following types of elements: lowest string height (used for rail centrelines), average string height, highest string height, left string height, right string height, existing radius, existing cant or difference z, width2D, width3D, xfall grade %, slope 1v in h, regression tolerance and regression spiral.

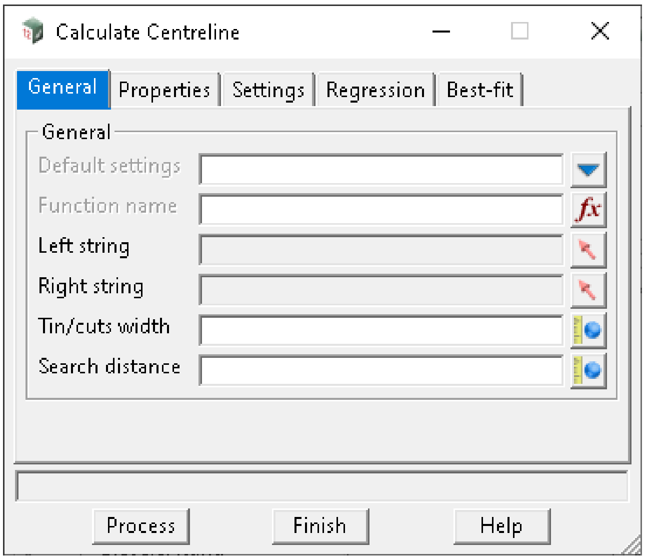
These elements can each generate a centreline with text at each vertex, a tin, a trimesh or cut strings.

The cut strings generated can be used as 23.7.4.25 Cuts - Long Section cut strings inside the 23.7.4 Long Section Plot PPF Editor to tabulate the values on a long section plot at survey points. Alternately generated centrelines can be used as offset strings 23.7.4.8.8 Boxes - Offset String Titles/Heights/Depths and tins 23.7.4.8.7 Boxes - Tin Titles/Heights/Depths can also be used in a long section plot.

The Calculate centreline panel can generate a best-fit super alignment. The performance of the super alignment element produced can be influenced by various factors, such as the complexity of the geometry and the quality of the input data. While the panel provides a time-saving tool for generating a best-fit alignment, manual adjustments may be required in certain situations to achieve the desired outcomes.

String attributes and vertex attributes are generated for centreline elements.

Selecting **Calculate centreline** displays the **Calculate Centreline** panel.



General tab
Properties tab
Settings tab
Regression tab
Best-fit tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

Process button

Runs the function.

General tab

Default settings choice box Rail, Road

When rail or road choice is selected, various fields will be populated with either rail or road defaults. This field is optional.

Function name function box

Name of the function. This field is optional.

Left string string select

Left string to calculate the centreline from.

Right string string select

Right string to calculate the centreline to.

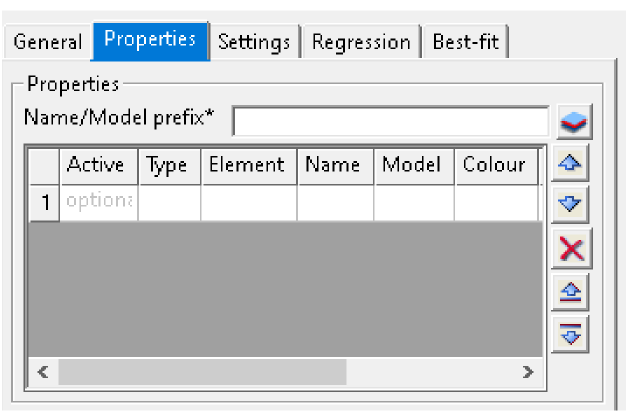
Tins/cuts width real box

Width of generated tin, trimesh and cut strings elements.

Search distance real box

The search distance considered for a point to be created between the left and right string survey pickups. A value larger than the distance between a point on the left string and the closest point on the right string should be entered.

Properties tab



General tab
Properties tab
Settings tab
Regression tab
Best-fit tab

Properties

Name/Model/prefix * model box survey/Railway/Rail available models

*A prefix/suffix that can be used in the **Name** and **Model** fields in the properties tab where the asterisk * character is substituted with the text entered in **Name/Model prefix ***.*

Active choice box

If no is selected, then the row will not be calculated. This is optional.

Type choice box

Type of element to be generated. There are the following options: Lowest string, average height, highest string, left string, right string, radius, cant/difference z, width2D, width3D, Xfall grade %, Slope 1v in h, Regression and Regression spiral.

__Lowest string__: An element with the lowest string height applied to the z-coordinate.

__Average height__: An element with the average height of both strings applied to the z-coordinate.

***Highest string**: An element with the highest string height applied to the z-coordinate.*

***Left string**: An element with the left string height applied to the z-coordinate.*

***Right string**: An element with the right string height applied to the z-coordinate.*

***Radius**: An element with a 3-point radius applied to the z-coordinate. This value is affected by settings in the **Cant/Radius** tab.*

***Cant/Difference Z**: An element with the cant or difference in left and right z values applied to the z-coordinate. This value is affected by settings in the **Cant/Radius** tab.*

***Width2D**: An element with the 2D distance between the left and right string points applied to the z-coordinate.*

***Width3D**: An element with the 3D distance between the left and right string points applied to the z-coordinate.*

***Xfall grade %**: The xfall or grade measured in % between the left and right string.*

***Slope 1v in h**: The slope or gradient measured in 1v in h between the left and right string.*

***Regression**: An element used to depict the segment types. Tangent or straight segments are horizontal sections located at z-level 0, transitions or spiral segments are increasing or decreasing sections, and curve segments are horizontal sections not situated at z-level 0.*

***Regression spiral**: An element used to depict the transition or spiral segment type. Values at z-level 0 are tangent or straight sections, values with z-levels close to 0 are curves, and any other z-levels are transition or spiral segments. Elements can be used to determine **Spiral tolerance**.*

Element choice box

Element to be generated. There are the following options: Centreline, Tin, Trimesh, and Cut strings. A centreline has the calculation displayed as text at each vertex and can be viewed in a plan or section view. A Tin selection has been designed to efficiently draw within a section view. Cut strings can be added to the long plot ppf cuts labelling.

Name custom name box available names

*Name of the generated tin or the name applied to a centreline, trimesh or cut strings element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Model custom model box available models

*Model name of the generated element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Colour colour box available colours

Colour to be applied to the generated element.

Linestyle linestyle box

Linestyle to be applied to the generated element.

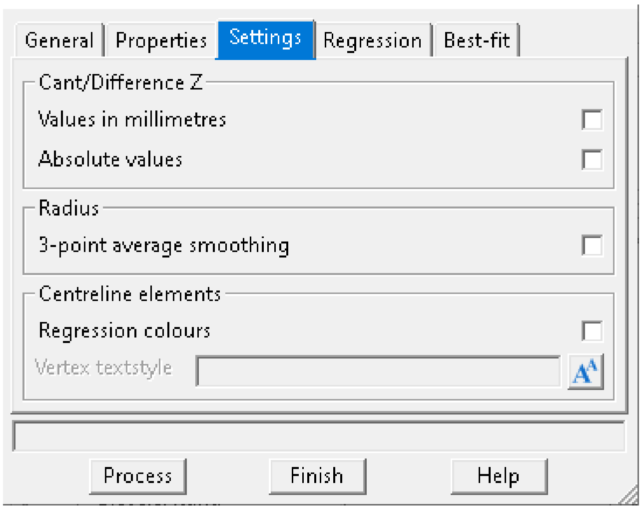
View view box available views

View for the generated element to be added to. If the view does not exist, a view will be created.

Vertex text choice box

*A choice to add vertex text at each vertex for centreline elements. If **Indices** is selected, the vertex number is added to the centreline element. If **Z-value** is selected, the z-level of the selected **Type** is applied to the centreline element.*

Settings tab



General tab
Properties tab
Settings tab
Regression tab
Best-fit tab

Cant/difference Z

Values in millimetres tick box not ticked

*If **ticked**, elements generated with the **Cant/Difference Z** type are in millimetres.*

*If **not ticked**, elements generated with the **Cant/Difference Z** type are in metres.*

Absolute values tick box not ticked

*If **ticked**, elements generated with the **Cant/Difference Z** type are all positive (absolute) values.*

*If **not ticked**, elements generated with the **Cant/Difference Z** type are positive values when the right string is higher than the left string, and negative values when the left string is higher than the right string.*

Radius

3-point average smoothing tick box not ticked

*If **ticked**, all elements generated with the **Radius** type are 3-point averaged to achieve closer consistency of radius values.*

*If **not ticked**, elements generated with the **Radius** type are calculated by every 3-points with no averaging applied.*

Centreline elements

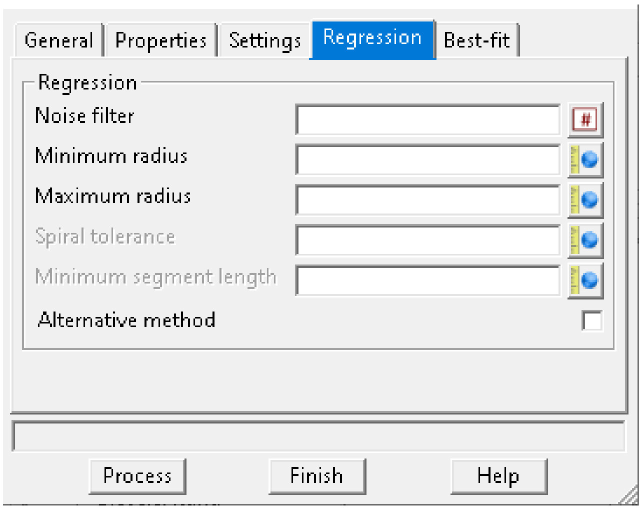
Regression colours tick box not ticked

*If **ticked**, all **Centreline** elements generated have regression colours applied. Green for arcs or curves, cyan for transitions or spirals, and red for tangents or straight segments.*

Vertex textstyle textstyle box

*The vertex textstyle applied to vertex text generated for **Centreline** elements.*

Regression tab



General tab
Properties tab
Settings tab
Regression tab
Best-fit tab

Regression

Noise filter integer box

*The number of vertices skipped between each vertex which results in a smoother **regression**, **regression spirals** and **radius** element. For perfect geometry, a value of 1 should be used; for non-perfect geometry such as surveyed rails, a higher value should be used.*

Minimum radius real box

Radius values below the minimum radius value are removed.

Maximum radius real box

Radius values above the maximum radius value are removed.

Spiral tolerance real box

*If specified, this tolerance value is used to determine transition or spiral segments. A **Regression spiral** element can be used to determine the tolerance value. If unspecified, transitions or spirals are not considered in regression calculations. This field is optional.*

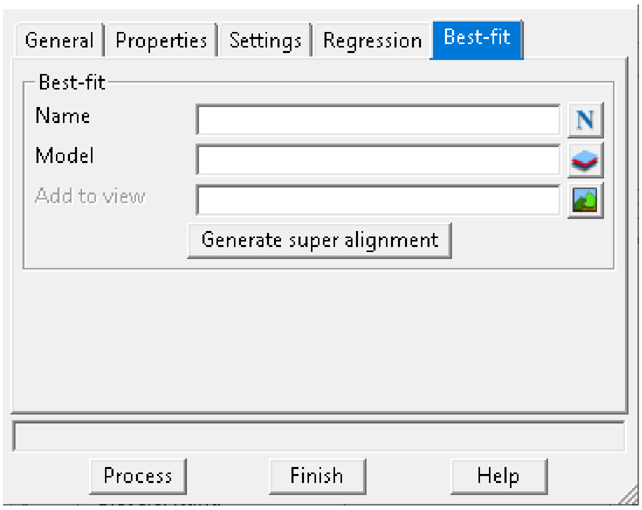
Minimum segment length real box

If specified, identified segments are removed if their length is less than the minimum segment length. This field is optional.

Alternate method tick box not ticked

*If **ticked**, this uses a different method to determine tangents, transitions and curves. This may result in a higher accuracy for extents.*

Best-fit tab



[General tab](#)
[Properties tab](#)
[Settings tab](#)
[Regression tab](#)
[Best-fit tab](#)

Best-fit

Name name box available names

Name of the best-fit super alignment to be generated.

Model model box available models

Model name of the best-fit super alignment to be generated.

Add to view view box

View to add the best-fit super alignment. This is optional.

Generate super alignment button

Generates a best-fit super alignment.

Continue to 16.23.2 Calculate Slew or return to 16.23 Track.

16.23.2 Calculate Slew

Position of menu: **Design => Track =>Calculate slew**

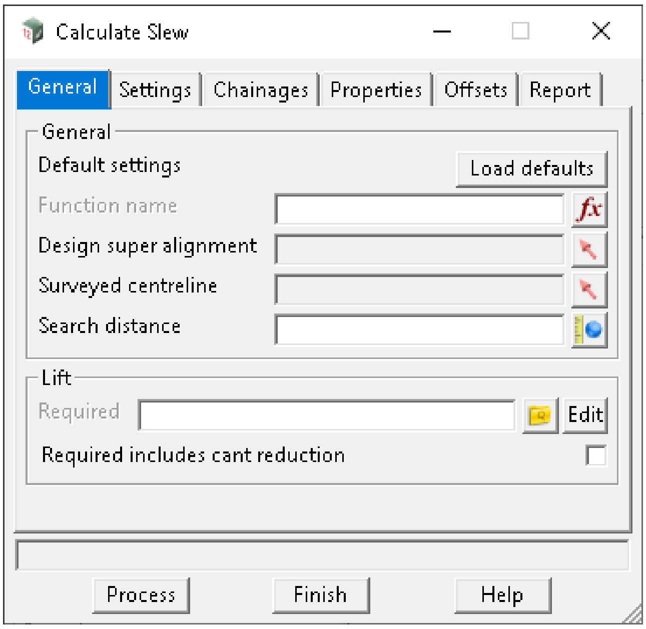
The **Calculate slew** panel calculates measurements of horizontal slew offset, lifting/lowering vertical offsets, lift required, and level required. A centreline, tin, trimesh, and cut strings can be generated for each element type. The rail slew calculations are made between a **Surveyed centreline** (which can be generated in 16.23.1 Calculate Centreline) to a **Design super alignment**.

In the offset tab, various calculations can be made between the Design super alignment and a specified source model. Options available for calculation include horizontal offset, vertical offset, vertex attributes, source x, y, z, 3D distance, crossfall grade, or slope. These offset types can be selected to generate elements or include them in a report.

A report can be generated as a Comma-Separated-Values (CSV), Hypertext Markup Language (HTML) or Extensible Markup Language (XML) file.

String and vertex attributes are generated for centreline elements.

Selecting **Calculate slew** displays the **Calculate Slew** panel.



General tab
Settings tab
Chainage tab
Properties tab
Offsets tab
Report tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

Process button

Runs the function.

General tab

General

Load defaults button

Various fields will be populated with default values. Affected fields include ***Textstyle****,* ***Centreline horizontal factor****,* ***Tin/cuts width****,* ***Search distance****,* ***Name/Model prefix ****, the Properties grid,* ***Slew colour****,* ***Lift colour****,* ***Required****, the Offsets grid,* ***Report type*** *and* ***Stylesheet****.*

Function name function box available functions

Name of the Calculate slew function.

Design super alignment string select

String for the design alignment.

Surveyed centreline string select

String for the surveyed centreline. This should be generated by the 16.23.1 Calculate Centreline *panel for full functionality.*

Search distance real box

Horizontal search distance considered for a measurement to be calculated between the design super alignment and the surveyed centreline or offset model.

Slew

Right slew is a negative value tick box not ticked

If ***ticked****, a slew towards the: left-hand side will be a positive value; right-hand side will be a negative value.*

If ***not ticked****, a slew towards the: left-hand side will be a negative value; right-hand side will be a positive value.*

Slew in millimetres tick box not ticked

If ***ticked****, slew values will be in millimetres.*

If ***not ticked****, slew values will be in metres.*

Lift

Required file box all *.12dslr files

File to calculate the lift required, based on the amount of slew calculated. This is optional.

Edit button

Opens the lift required panel. For more information see 16.23.2.1 Lift Required.

Lift in millimetres tick box not ticked

If ***ticked****, lift values will be in millimetres.*

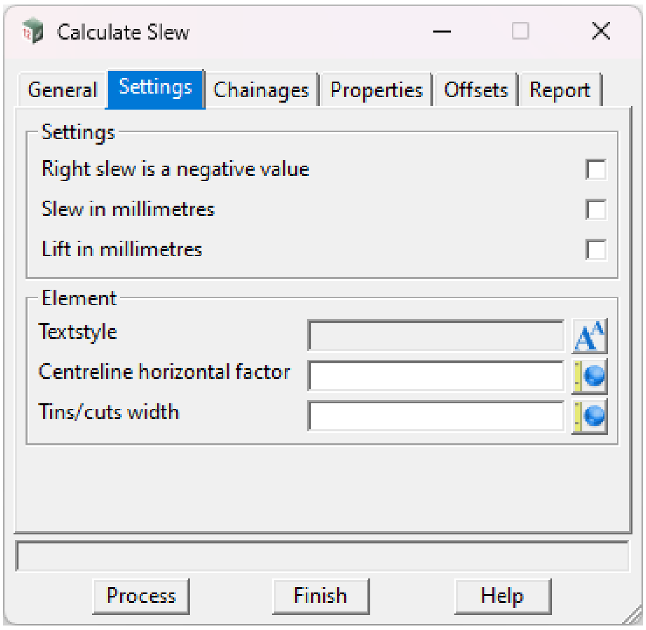
If ***not ticked****, lift values will be in metres.*

Required includes cant reduction tick box not ticked

If ***ticked*** *and cant applied to the design super alignment is less than the applied existing cant, this amount of cant reduction will be added to the lift required.*

If ***not ticked****, cant reduction will not be added to the lift required.*

Settings tab



General tab
Settings tab
Chainage tab
Properties tab
Offsets tab
Report tab

Settings

Right slew is a negative value tick box not ticked

*If **ticked**, a slew towards the: left-hand side will be a positive value; right-hand side will be a negative value.*

*If **not ticked**, a slew towards the: left-hand side will be a negative value; right-hand side will be a positive value.*

Slew in millimetres tick box not ticked

*If **ticked**, slew values will be in millimetres.*

*If **not ticked**, slew values will be in metres.*

Lift in millimetres tick box not ticked

*If **ticked**, lift values will be in millimetres.*

*If **not ticked**, lift values will be in metres.*

Element

Textstyle textstyle box select Textdata

Text style applied to vertex text on generated centreline elements.

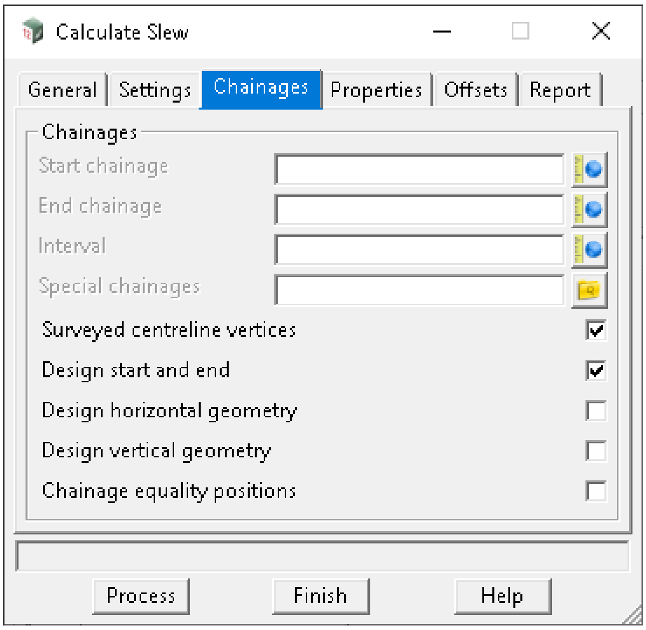
Centreline horizontal factor real box

Horizontal factor applied to the generated centreline elements.

Tins/cuts width real box

TWidth of generated tins, trimeshes and cuts elements.

Chainage tab



General tab
Settings tab
Chainage tab
Properties tab
Offsets tab
Report tab

Chainages

Start chainage real box

Design super alignment chainage for rail slew measurements to be calculated from. This is optional.

End chainage real box

Design super alignment chainage for rail slew measurements to be calculated to. This is optional.

Interval real box

Distance between rail slew measurements. This is optional.

Special chainages file box *.spc files

List of design super alignment chainages is included in the rail slew measurements.

Survey centreline vertices tick box ticked

*If **ticked**, includes chainages based on vertices of the **Surveyed centreline**.*

Design start and end tick box ticked

*If **ticked**, includes the start and end chainages of the **Design super alignment**.*

Design horizontal geometry tick box not ticked

*If **ticked**, includes horizontal geometry chainages of the **Design super alignment**.*

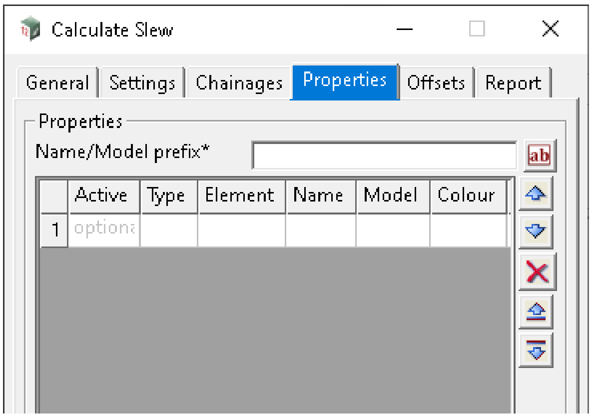
Design vertical geometry tick box not ticked

*If **ticked**, includes vertical geometry chainages of the **Design super alignment**.*

Chainage equality positions tick box not ticked

*If **ticked**, includes chainage equality positions of the **Design super alignment**.*

Properties tab



[General tab](#)
[Settings tab](#)
[Chainage tab](#)
[Properties tab](#)
[Offsets tab](#)
[Report tab](#)

Name/Model prefix* model box available models

*Name entered will be exchanged with any asterisk located in the **Name** or **Model** fields of the properties GridCtrl box. The default is a prefix for the model names and tins.*

Active choice box

*If **no** then the row will not be calculated.*

*If **yes** then the row is calculated.*

Type choice box

*Type of element to be generated. There are the following options: **Slew**, **Lift/Lower**, **Lift required**, **Level required**.*

> ***Slew**: An element with the horizontal offset distance between the **Surveyed centreline** and **Design super alignment** applied to the z-coordinate. This is affected by settings in the **Slew/Lift** tab.*
>
> ***Lift/Lower**: An element with the vertical offset distance between the **Surveyed centreline** and **Design super alignment** applied to the z-coordinate. This is affected by settings in the **Slew/Lift** tab.*
>
> ***Level required**: An element with the height that is required for the **Design super alignment** applied to the z-coordinate. This calculation is based on the slew amount and corresponding lift required specified in the CSV file referenced in the **Required** field in the **Slew/Lift** tab.*
>
> ***Lift required**: An element with the vertical offset distance that is required between the **Surveyed centreline** and **Design super alignment** applied to the z-coordinate. This calculation is based on the slew amount and corresponding lift required specified in the CSV file referenced in the **Required** field in the **Slew/Lift** tab.*
>
> ***Lift above required**: An element with the distance above the level required applied to the z-coordinate.*

Element choice box

Element to be generated. There are the following options: Centreline, Tin, Trimesh, and Cut strings. A centreline has the calculation displayed as text at each vertex and can be viewed in a plan or section view. A Tin selection has been designed to efficiently draw within a section view. Cut strings can be added to the long plot ppf cuts labelling.

Name custom name box available names

*Name of the generated tin or the name applied to a centreline, trimesh or cut strings element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Model custom model box available models

*Model of the generated element. An asterisk can be used to exchange the text entered in the **Name/***

Model prefix * *field.*

Colour colour box available colours

Colour to be applied to the generated element.

Colour drf file box available drf files

A 7.11.5 Depth Range File *to change the colour of each line segment and vertex text of centreline elements. The depth range file is in the format: from value, to value, colour name. This is optional.*

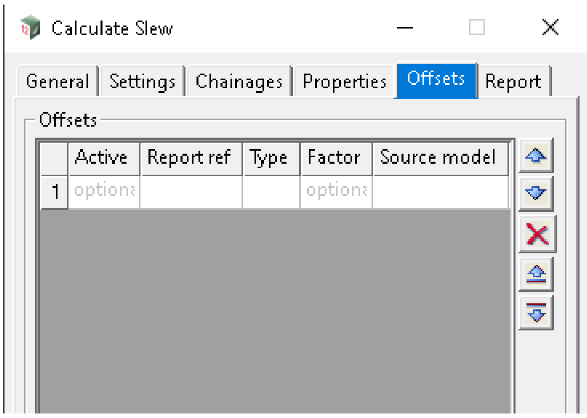
Linestyle linestyle box available linestyles

Linestyle to be applied to the generated element.

View view box available views

View for the generated element to be added to. If the view does not exist, a view will be created.

Offsets tab



General tab
Settings tab
Chainage tab
Properties tab
Offsets tab
Report tab

Active choice box

*If **no** the row will not be calculated.*

*If **yes** the row is calculated.*

Report ref input box

*Name of the xml node to be generated containing offset calculations that are referenced in the **Stylesheet** xslt file located in the **Report** tab. An identical name in the **Report** ref and **Stylesheet** is required so that these offsets calculations can be included in the report. For vertex attributes the report ref is used followed by an underscore and the name of the vertex attribute e.g. reportref_attributename. An underscore must be used rather than a space for the name.*

Type choice box

Type of offset calculation. There are the following options:

__Horizontal__: A horizontal distance between the __Design super alignment__ and the source model.

__Vertical__: A vertical distance between the __Design super alignment__ and the source model.

__Vertex attributes__: Vertex attributes contained in the source model are exported to the report. Attributes need to be added as fields in the __Stylesheet__ and are in the format __Report ref__, underscore followed by vertex attribute name e.g. reportref_attributename.

__Source x__: The easting of the source model.

__Source y__: The northing of the source model.

__Source z__: The elevation of the source model.

__Distance3D__: 3D distance between the __Design super alignment__ and the source model.

__Xfall grade %__: A cross-fall or grade measured in % between the __Design super alignment__ and the source model.

__Slope 1v in h__: A slope or gradient measured in 1v in h between the __Design super alignment__ and the source model.

Factor choice box

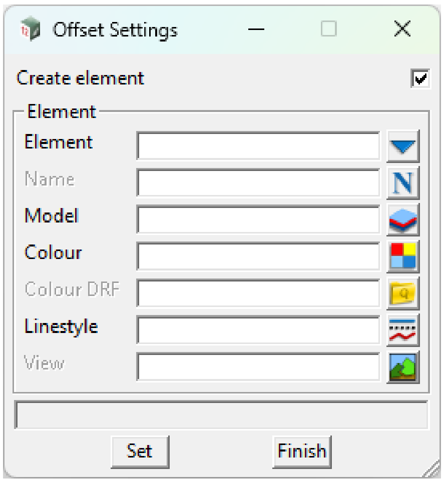
If Negation is selected, then offset values will be multiplied by negative 1. This is optional.

Source name name box

Source name to filter elements within the source model. This is optional.

Offset properties attributes box

If selected, this will open an offset settings panel. This is optional.



Create element tick box

*If **ticked**, an element will be generated.*

Element choice box

Element to be generated. There are the following options: Centreline, Tin, Trimesh, and Cut strings. A centreline has the calculation displayed as text at each vertex and can be viewed in a plan or section view. A Tin selection has been designed to efficiently draw within a section view. Cut strings can be added to the long plot ppf cuts labelling.

Name name box available names

*Name of the generated tin or the name applied to a centreline, trimesh or cut strings element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field located in the **Properties** tab.*

Model model box available models

*Model name of the generated element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Colour colour box available colours

Colour to be applied to the generated element.

Colour DRF file box available drf files

A 7.11.5 Depth Range File *to change the colour of each line segment and vertex text of centreline elements. The depth range file is in the format: from value, to value, colour name. This is optional.*

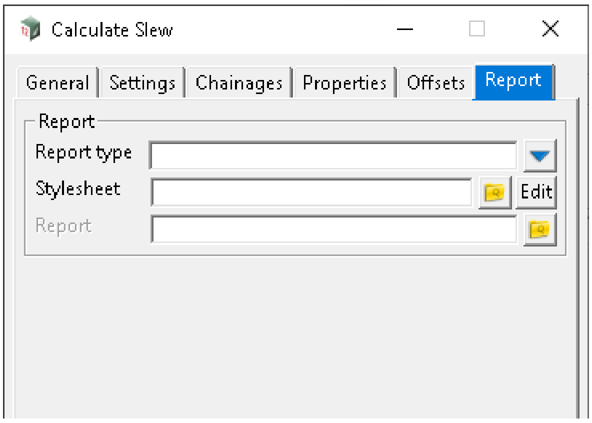
Linestyle linestyle box available linestyles

Linestyle to be applied to the generated element.

View view box available views

View for the generated element to be added to. If the view does not exist, a view will be created.

Report tab



General tab
Settings tab
Chainage tab
Properties tab
Offsets tab
Report tab

Report type choice box csv/html/xml

Type of report to be generated. A choice of csv, html or xml can be selected for the report type.

Stylesheet file box

Stylesheet to convert the xml output into a html or csv file.

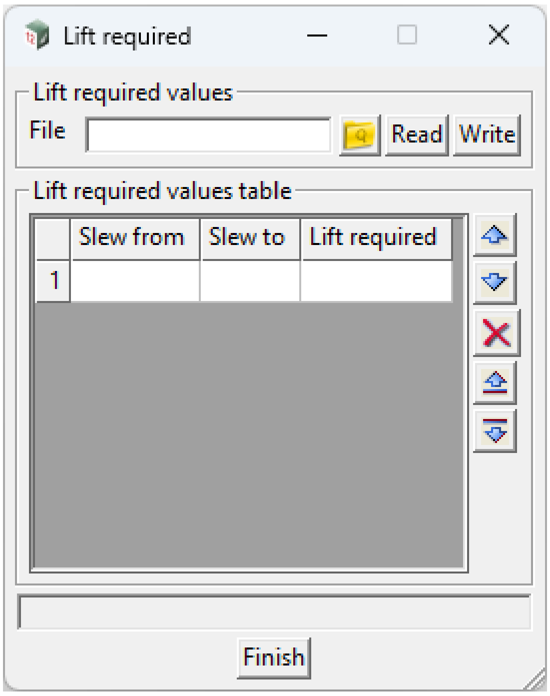
This file can be customized to include/exclude columns and apply various other adjustments to the output of the report. Variables can be changed at the top of this report and instructions have been commented inline to guide the user to customise the report. See 16.23.2.2 Calculate Slew Stylesheet.

Report file box *.html files

Filename of the report to be generated.

Continue to 16.23.2.1 Lift Required or return to 16.23 Track.

16.23.2.1 Lift Required



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
File	file box		all *.12dslr files

File to calculate the lift required, based on the amount of slew calculated.

Read	button		

Reads the lift required file and populates the lift required values table.

Write	button		

Writes the lift required file.

Slew from	real box		

Amount of slew value from that the lift required value will be applied.

Slew to	real box		

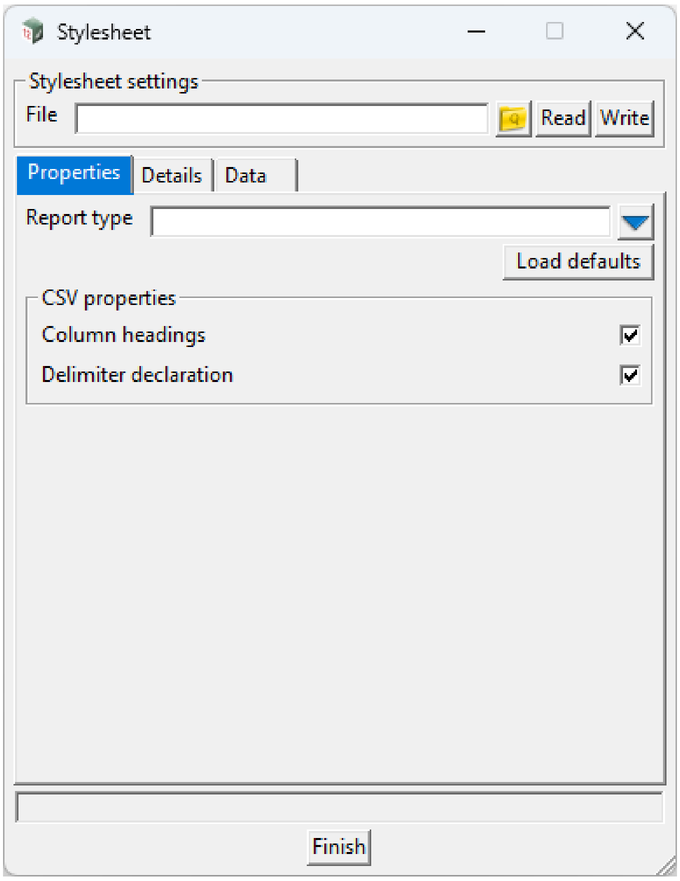
Amount of slew value to that the lift required value will be applied.

Lift required	real box		

Amount of lift required that is applied within the slew from and slew to.

Continue to 16.23.2.2 Calculate Slew Stylesheet or return to 16.23 Track.

16.23.2.2 Calculate Slew Stylesheet



Properties tab
Details tab
Data tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Properties tab

Stylesheet settings

File file box all *.xslt files

Filename to save the generated stylesheet.

Read button

Reads the stylesheet and populates the panel.

Write button

Writes the stylesheet file.

Report type choice box csv, html, pdf

Type of report to be generated. The options are comma-separated values (CSV), Hypertext Markup Language (HTML), and Portable Document Format (PDF).

CSV properties

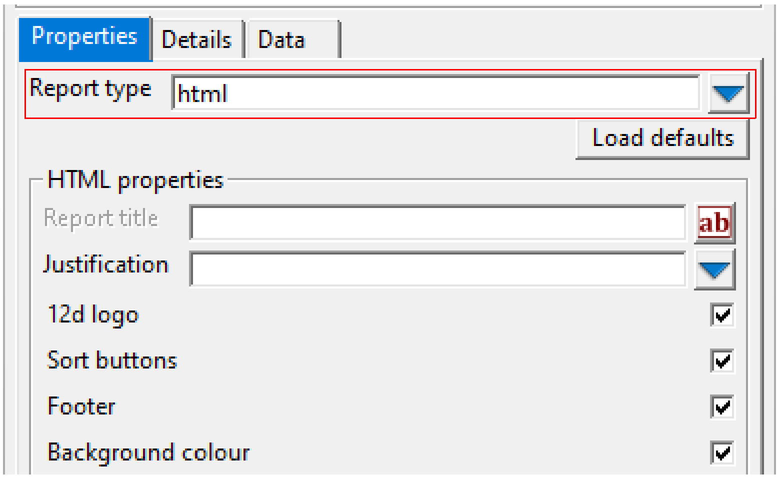
Column headings tick box ticked

*If **ticked**, the column headings will be exported in the report. The column headings are customised in the Data tab in the heading column.*

Delimiter declaration tick box ticked

*If **ticked**, the output file will include metadata that identifies the column delimiter, allowing other software to automatically convert the CSV data into columns.*

HTML properties



Report title input box

Text that will feature at the top of the document.

Justification choice box left, centre, right

Justification of all text values contained in the table of the document.

12d logo tick box ticked

*If **ticked**, the 12d logo will be added at the top of the document.*

Sort buttons tick box ticked

*If **ticked**, sort buttons will be added between the table headings and data. When the buttons are selected in the document, this will sort all column values.*

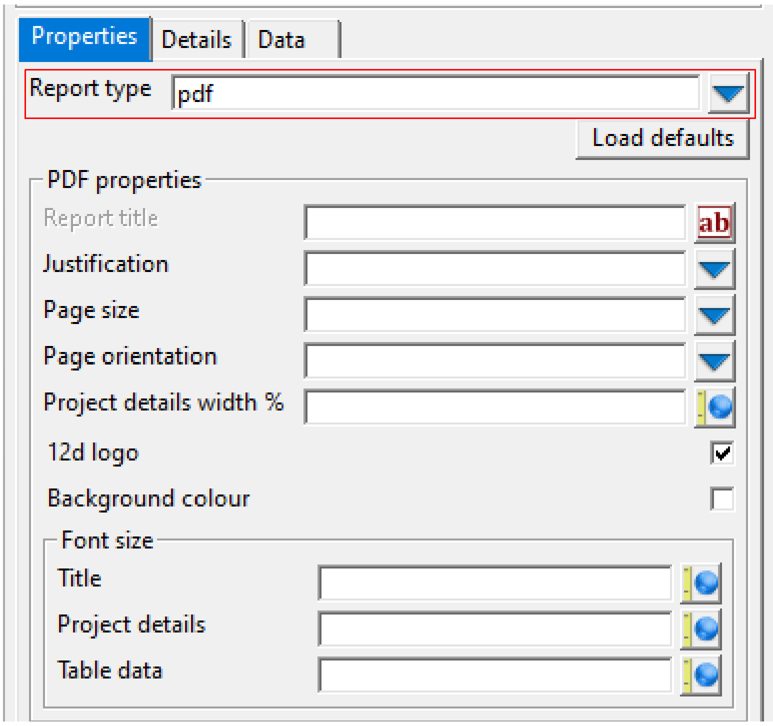
Footer tick box ticked

*If **ticked**, a footer containing the text "Generated by 12d Model at date time" will be added to the bottom of the document.*

Background colour tick box ticked

*If **ticked**, background colours will be applied to table cells.*

PDF properties



PDF Properties

Report title input box

Text that will feature at the top of the document.

Justification choice box left, centre, right

Justification of all text values contained in the table of the document.

Page size choice box A1, A3, A4

Sheet size of the document.

Page orientation choice box Landscape, Portrait

Orientation of the document.

Project details width % real box

Specify the width as a percentage of the overall sheet width for the project details headings.

12d logo tick box ticked

*If **ticked**, the 12d logo will be added at the top of the document.*

Background colour tick box not ticked

*If **ticked**, grey colours will be applied to the background in the table of the document.*

Font size

Title real box

Font size of the title text located at the top of the document.

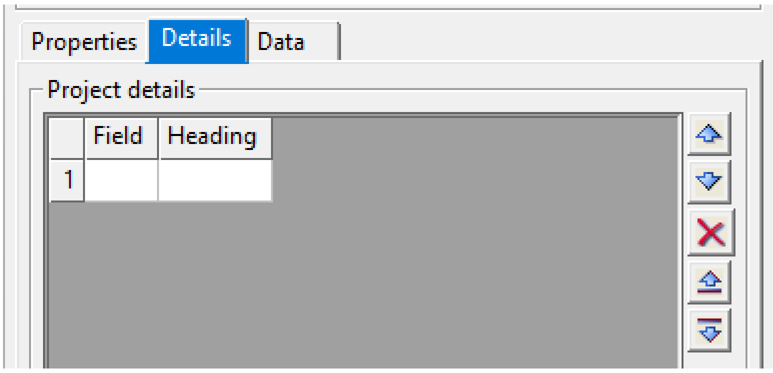
Project details real box

Font size of the project details text located above the table in the document.

Table data real box

Font size of the text inside the table in the document.

Details tab



Properties tab
Details tab
Data tab

Project details

Field choice box

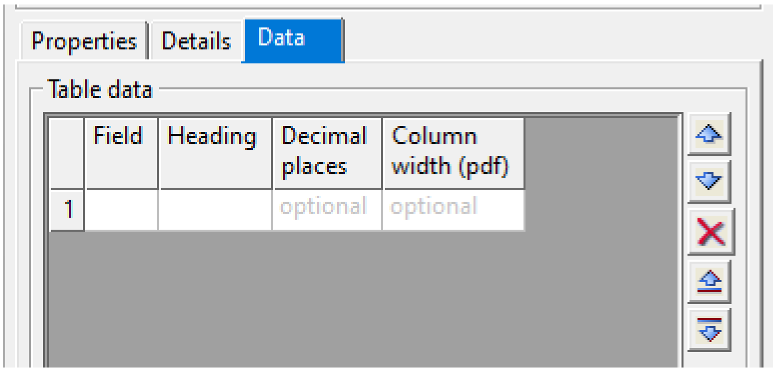
Field that will be included in the project details.

The choices include: project_name, project_folder, user, export_time_date, function_name, surveyed_centreline, design_alignment, lift_required, stylesheet, report_filename, right_slew, slew_units, and lift_units.

Heading text box

Heading for each project detail, which is shown at the left side of each value in bold font type.

Data tab



[Properties tab](#)
[Details tab](#)
[Data tab](#)

Table data

Field custom box

Name of the xml node to add as a column in the report.

For values in the ***Offsets tab*** *either the* ***Report ref****, can be manually typed, or Offset_Row followed by the row number can be used. Offset rows up to row 5 can be selected with right mouse button, otherwise any other row number can be manually typed in. For vertex attributes the report ref is used followed by an underscore and the name of the vertex attribute e.g. reportref_attributename.*

When right mouse button is selected the following options are displayed: No, Chainage, Equality_Value, Equality_Chainage, Equality_Name, Equality_Zone, Survey_Easting, Survey_Northing, Survey_RL, Design_Easting, Design_Northing, Design_RL, Slew_Offset, Lift_Lower, Lift_Required, Lift_Above_Required, Level_Required, Existing_Radius, Design_Radius, Existing_Cant, Design_Cant, Offset_Row1, Offset_Row2, Offset_Row3, Offset_Row4, and Offset_Row5.

Heading input box

Heading text shown for each column.

Decimal places choice box 0, 1, 2, 3, 4, 8

Number of decimal places for each value in the table.

Column width (pdf) input box

An override to the width of each column. Values can be absolute or relative units and should be suffixed with one of the following abbreviations: cm: centimetres; mm: millimetres; in: inches; pt: points; pc: picas; px: pixels; %: percentage relative to the table width; em: relative to the font size; ex: relative to the height of the current font. For example 10% or 20mm.

Continue to 16.23.3 Calculate Cant or return to 16.23 Track.

16.23.3 Calculate Cant

Position of option on menu: **Design =>Track =>Calculate cant**

The **Calculate Cant** panel is used to calculate rail cant (also known as superelevation) along a **Design super alignment**.

The **Network specifications** file encompasses constants employed in cant and curve compensation calculations, and also provides the ability to incorporate multiple vehicles with individual rail gauges and default speed settings.

An optional **Posted speed limits** file can be utilised to integrate individual speed limits for each vehicle within a specified chainage range.

To identify design compliance issues, an optional **Design Requirements** file can be employed to automatically highlight any values that exceed desirable or absolute minimum or maximum thresholds in the **Cant Editor** and **Vertical Compliance** panels.

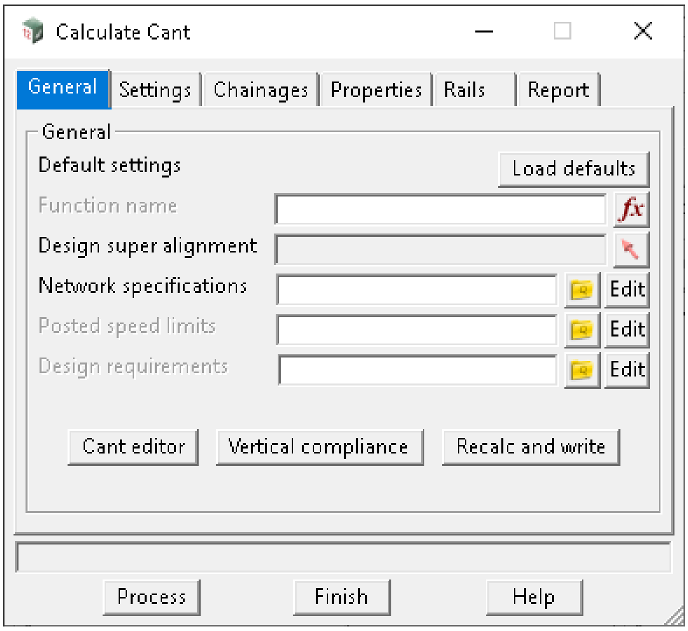
The **Properties** tab offers a range of output types and elements suitable for visualization in both plan and section views, as well as for plotting purposes. These outputs include centrelines, tins, trimeshes, and cut strings for each type.

The **Rails** tab has the option to create the top of rail strings with an optional custom gauge file and offset and height override.

A report can be generated as a Comma-Separated-Values (CSV), Hypertext Markup Language (HTML) or Portable Document Format (PDF) or Extensible Markup Language (XML).

String attributes are generated for the **Design super alignment** when **Recalc and Write** or **Write** is selected.

Selecting **Calculate cant** displays the **Calculate Cant** panel.



General tab
Settings tab
Chainages tab
Properties tab
Rails tab
Report tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

General tab

General

Load defaults button

Various fields will be populated with default values.

Function name function box all functions

Name of the Calculate cant function.

Design super alignment string select

String for the design centreline.

Network specifications file box available files

A network specifications file. This file is created within the calculate cant panel. See 16.23.3.1 Network Specifications.

Edit button

Opens the network specifications editor.

Posted speed limits file box available files

A posted speed limits file. This file is created within the calculate cant panel. See 16.23.3.2 Posted Speed Limits.

Edit button

Opens the speed limits editor.

Design requirements file box available files

A design requirements file. This file is created within the calculate cant panel. See 16.23.3.3 Design Requirements.

Edit button

Opens the design requirements editor.

Cant editor button

Opens the cant editor panel. See 16.23.3.4 Cant Editor.

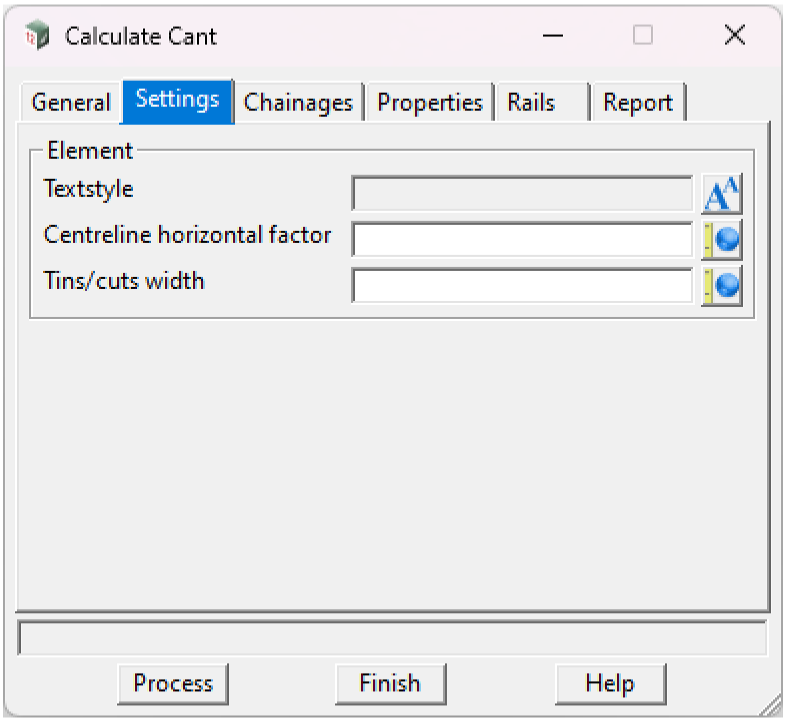
Vertical compliance button

Opens the vertical compliance panel.

Recalculate all button

*Runs cant, and horizontal and vertical geometry calculations and writes the values to string attributes on the **Design super alignment**. This button exhibits identical functionality to the **Recalculate all** button within the **Cant editor**.*

Settings tab



General tab
Settings tab
Chainages tab
Properties tab
Rails tab
Report tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Element

Textstyle text_style box Select Textdata

Text style applied to vertex text on generated centreline elements.

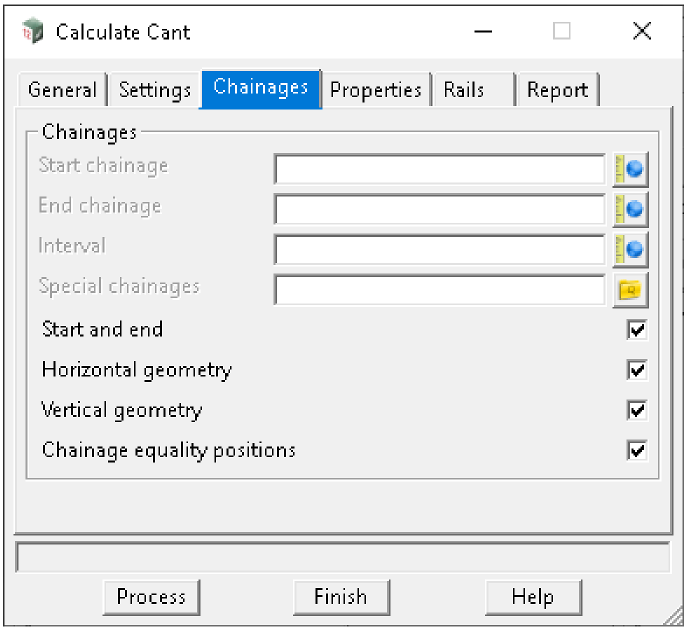
Centreline horizontal factor real box

Horizontal factor applied to the generated centreline elements.

Tins/cuts width real box

Width of generated tins, trimeshes and cuts elements.

Chainages tab



General tab
Settings tab
Chainages tab
Properties tab
Rails tab
Report tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Chainages

Start chainage real box

__Design super alignment__ chainage for elements and report values to be calculated from. This is optional.

End chainage real box

__Design super alignment__ chainage for elements and report values to be calculated to. This is optional.

Interval real box

If specified, the distance between chainages for elements and report values. This is optional.

Special chainages file box all *.spc files

A list of __Design super alignment__ chainages located in a text file that is included for elements and report values.

Start and end tick box ticked

Start and end chainages of the __Design super alignment__ are included for elements and report values.

Horizontal geometry tick box ticked

__Design super alignment__ horizontal geometry chainages are included for elements and report values.

Vertical geometry tick box ticked

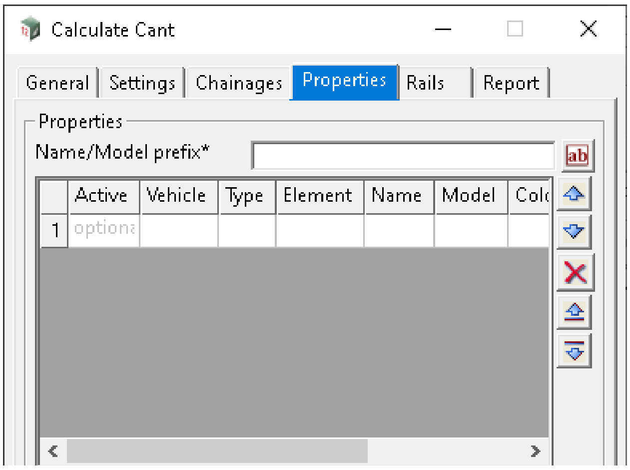
__Design super alignment__ vertical geometry chainages are included for elements and report values.

Chainage equality positions tick box ticked

__Design super alignment__ chainage equality positions chainages are included for elements and report values.

Properties tab

*The **Properties** tab offers a range of output types and elements suitable for visualization in both plan and section views, as well as for plotting purposes.*



[General tab](#)
[Settings tab](#)
[Chainages tab](#)
[Properties tab](#)
[Rails tab](#)
[Report tab](#)

Properties

Name/Model/prefix* model box available models

*Name entered will be exchanged with any asterisk located in the **Name** or **Model** fields of the properties GridCtrl box. The default is a prefix for the model names and tins.*

Active choice box

*If **no** then the row will not be processed. This is optional.*

Vehicle custom panel

*Name of the vehicle on which the element is to be based. The list of vehicles is configured in the **Network specifications** file.*

Type choice box

List of available types. The types are categorised under the headings of cant, horizontal, speed, and vertical.

Element choice box

*Element to be generated. There are the following options: **Centreline**, **Tin**, **Trimesh**, and **Cut strings**. A **Centreline** has the calculation displayed as text at each vertex and can be viewed in a plan or section view. A **Tin** selection has been designed to efficiently draw within a section view. **Cut strings** can be added to the long plot ppf cuts labelling.*

Name custom name box available names

*Name of the generated tin or the name applied to a centreline, trimesh or cut strings element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Model custom model box available models

*Model name of the generated element. An asterisk can be used to exchange the text entered in the **Name/Model prefix *** field.*

Colour colour box available colours

Colour to be applied to the generated element.

HRF file box available hrf files

A [7.11.7 Height Range File](#) *to change the colour of each line segment and vertex text of centreline* *elements. The height range file is in the format: from value, to value, colour name. This is optional.*

Linestyle linestyle box available linestyles

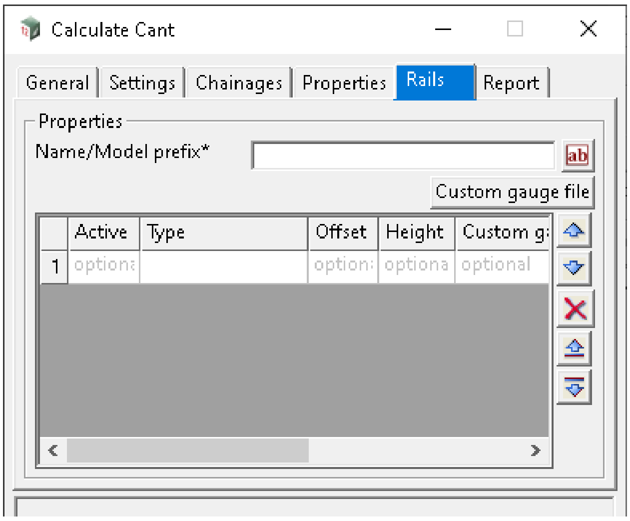
Linestyle to be applied to the generated element.

View view box available views

View for the generated element to be added to. If the view does not exist, a view will be created.

Rails tab

*The **Rails** tab has the option to create the top of rail strings with an optional offset and height override.*



[General tab](#)
[Settings tab](#)
[Chainages tab](#)
[Properties tab](#)
[Rails tab](#)
[Report tab](#)

Properties

Name/Model/prefix* model box available models

*Name entered will be exchanged with any asterisk located in the **Name** or **Model** fields of the rails GridCtrl box. The default is a prefix for the model names and tins.*

Active choice box

*If **no** then the row will not be processed. This is optional.*

Custom gauge file button

Opens a custom gauge panel to set gauge widening through curves. See [16.23.3.6 Custom Gauge](#).

Type choice box primary/secondary

*If **Primary gauge** is selected, the rails will be offset by the **Primary rail gauge** specified in the **Network specifications** file.*

*If **Secondary gauge** is selected, the rails will be offset by the **Secondary rail gauge** specified in the **Network specifications** file. The secondary gauge will also include a centreline offset based on the **Common rail location** specified in the **Network specifications** file.*

Offset real box

*An optional offset override to generate elements that are on the same vertical cant plane but are offset horizontally at a specified **Offset** distance, rather than based on the **Type**.*

Height real box

*An optional height override to generate elements that are on the same vertical cant plane but are offset vertically at a specified **Height** distance.*

Custom gauge file box available *.12dccg files

Custom gauge file to enable gauge widening through curves.

Name custom name box available names

Name of the generated rail strings element. An asterisk can be used to exchange the text entered in the ***Name/Model prefix ** *field.*

Model custom model box available models

Model name of the generated rail strings element. An asterisk can be used to exchange the text entered in the ***Name/Model prefix ** *field.*

Colour colour box available colours

Colour to be applied to the generated element.

Linestyle linestyle box available linestyles

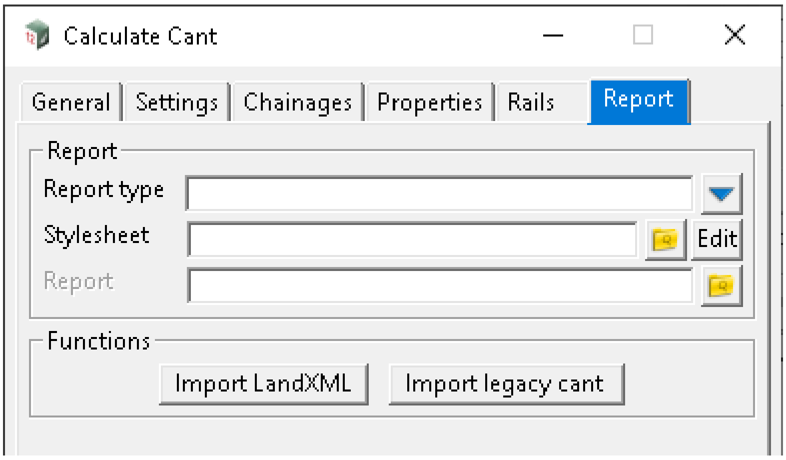
Linestyle to be applied to the generated element.

View view box available views

View for the generated element to be added to. If the view does not exist, a view will be created.

Report tab

A report can be generated as a Comma-Separated-Values (CSV), Portable Document Format (PDF), Hypertext Markup Language (HTML) or Extensible Markup Language (XML).



General tab
Settings tab
Chainages tab
Properties tab
Rails tab
Report tab

Report

Report type choice box csv/html

Tpe of report to be generated. A choice of csv, html or xml can be selected for the report type.

Stylesheet file box

Stylesheet to convert the xml output into a html or csv file. This file can be customized to include/ exclude columns and apply various other adjustments to the output of the report. Variables can be changed at the top of this report and instructions have been commented inline to guide the user to customise the report. See 16.23.3.7 Cant Stylesheet.

Edit button

Opens the stylesheet editor.

Report file box available *.html files

Filename of the report to be generated.

Import LandXML button

*Imports chainages, **Applied cant** and **Design speed** values from an alignment that has previously been read using* 7.4.16.1 Read LandXML*. Identical to the **Import LandXML** button located in the **Cant Editor**.*

Import legacy cant button

*Imports chainages, **Applied cant** and **Design speed** values from a **Design super alignment** that had cant values previously calculated using the older **Cant panel**. Identical to the **Import legacy cant** button located in the **Cant Editor**.*

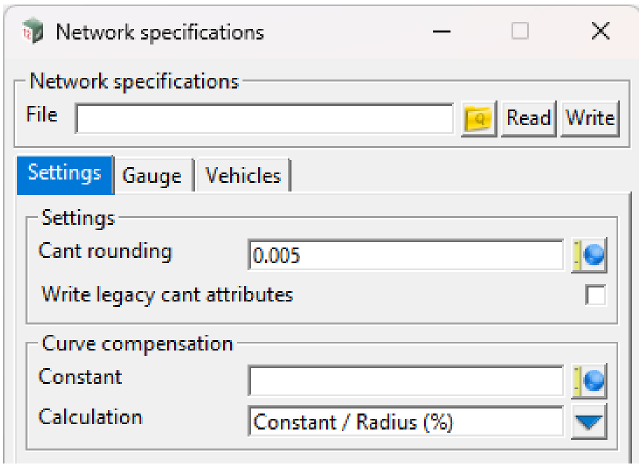
Continue to 16.23.3.1 Network Specifications *or return to* 16.23 Track.

16.23.3.1 Network Specifications

The Network Specifications panel encompasses both settings and vehicle data. The settings influence the calculations in the cant editor and vertical compliance panels and comprise of constants for cant rounding and curve compensation.

The vehicle data section is configured to calculate equilibrium and applied cant values, based on rail gauge and constants. It provides the capability to add multiple vehicles, which can be employed to assess various speeds and gauges against design requirements.

In single or dual-gauge track configurations, the primary rail gauge governs the applied cant. For dual gauge tracks, the equivalent applied cant is calculated for vehicles utilising the secondary rail gauge.



Settings tab
Gauge tab
Vehicles tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Settings tab

Network specifications

File	file box		available files

Filename for the network specifications.

Read	button		

*Reads the network specifications **File** and populates the network specifications panel.*

Write	button		

*Writes the values in the network specifications panel to the network specifications **File**.*

Settings

Cant rounding	real box	0.005	

Rounding value applied to cant calculations (the value is in metres).

Write legacy cant attributes	tick box	not ticked	

*If **ticked**, legacy RAIL_Classes cant attributes equivalent to the older cant panel are additionally applied to the **Design super alignment** for legacy purposes.*

Curve compensation

Constant	real box		

Constant value applied to curve compensation calculations.

*Curve compensated grade (1v:h) = Constant * Radius*

Curve compensated grade (%) = Actual gradient+Constant/Radius %

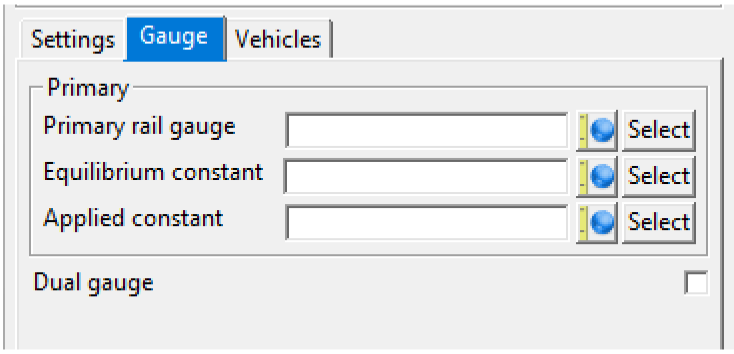
Calculation choice box Constant / Radius (%)

Calculation used to apply curve compensation.

Curve compensated grade (%) = Actual gradient+Constant/Radius %

*Curve compensated grade (1v:h) = Constant * Radius*

Gauge tab



Settings tab
Gauge tab
Vehicles tab

Primary

Primary rail gauge real box

Rail gauge of the primary vehicle.

Select button

Opens a list of common rail gauges.

Equilibrium constant real box

Equilibrium constant applied to the primary vehicle.

Select button

Opens a panel containing the equilibrium constant and applied constant calculations.

Applied constant button

Applied constant applied to the primary vehicle.

Select button

Opens a panel containing the equilibrium constant and applied constant calculations.

Dual gauge tick box not ticked

*If **ticked**, the secondary rail gauge values are displayed and can be populated.*

Secondary rail gauge real box

Rail gauge of the secondary vehicle.

Select button

Opens a list of common rail gauges.

Equilibrium constant real box

Equilibrium constant applied to the secondary vehicle.

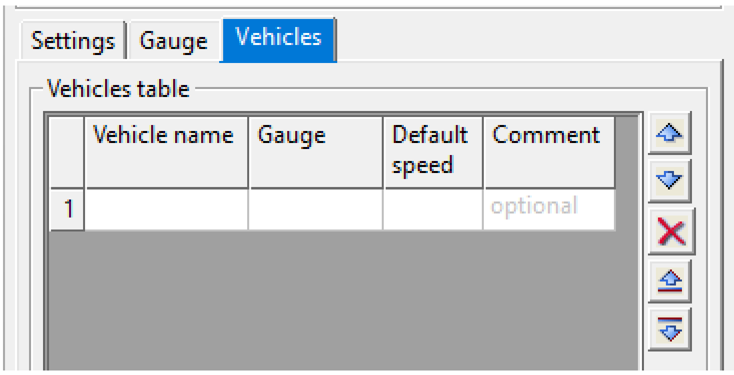
Applied constant button

Applied constant applied to the secondary vehicle.

Common rail location choice box Left Left, Right

Location of the common rail in dual-gauge track.

Vehicles tab



[Settings tab](#)
[Gauge tab](#)
[Vehicles tab](#)

Vehicles table

Vehicle name input box

Name of the vehicle.

Gauge choice box Primary, Secondary

Gauge of the vehicle. The two options are primary and secondary. These options relate to the primary or secondary rail gauge values that have been set in the ***Gauge*** *tab.*

Default speed real box

Default speed applied to the vehicle if a posted speed limits value does not exist at any chainage along the ***Design super alignment****.*

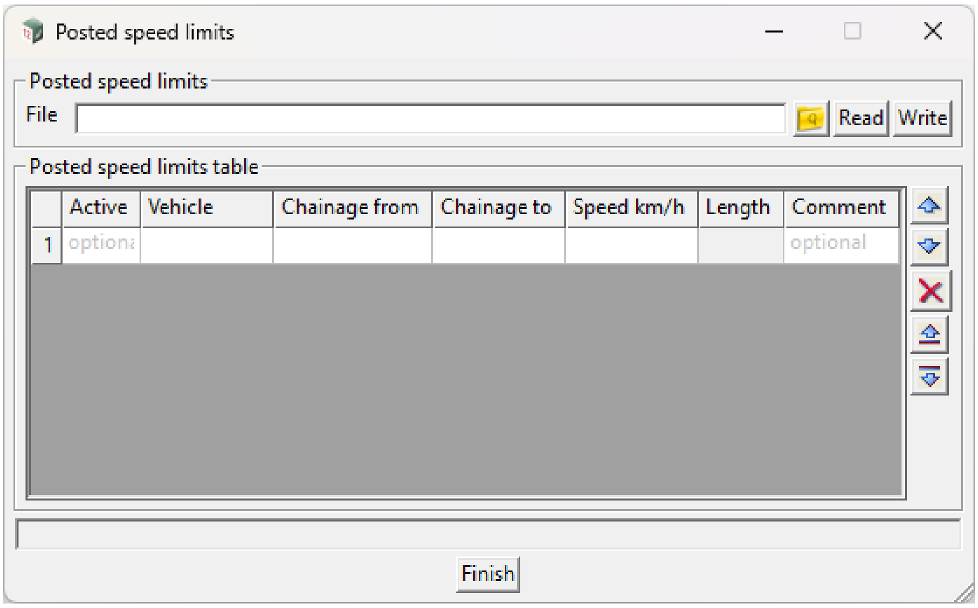
Comment text box

An optional comment for the vehicle.

Continue to 16.23.3.2 Posted Speed Limits *or return to* 16.23 Track.

16.23.3.2 Posted Speed Limits

The posted speed limits panel provides the ability to apply individual speed settings for each vehicle within a designated chainage range. These configured speeds are featured as minimum and maximum posted speed limit values for each segment, displayed in the cant editor and vertical compliance panels. In cases where a posted speed limit is not specified, the default speed outlined in the **Network specifications** panel is applied.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Posted speed limits			
File	file box		available files

Filename for the posted speed limits.

Read	button		

*Reads the posted speed limits **File** and populates the posted speed limits panel.*

Write	button		

*Writes the values in the posted speed limits panel to the posted speed limits **File**.*

Posted speed limits table			
Active	choice box		Yes, No

*If **no** then the row will not be included. This is optional.*

Vehicle	choice box		available vehicles

*Choice of vehicles specified in the **Network Specifications** file. The **All** option can be chosen to apply a speed limit universally to all available vehicles.*

Chainage from	real box		

***Design super alignment** chainage for the speed limit to be applied from.*

Chainage to	real box		

Design super alignment chainage *for the speed limit to be applied to.*

Speed km/h real box

Posted speed limit to be applied.

Length real box

Length of the speed limit section. This is for information and is read-only.

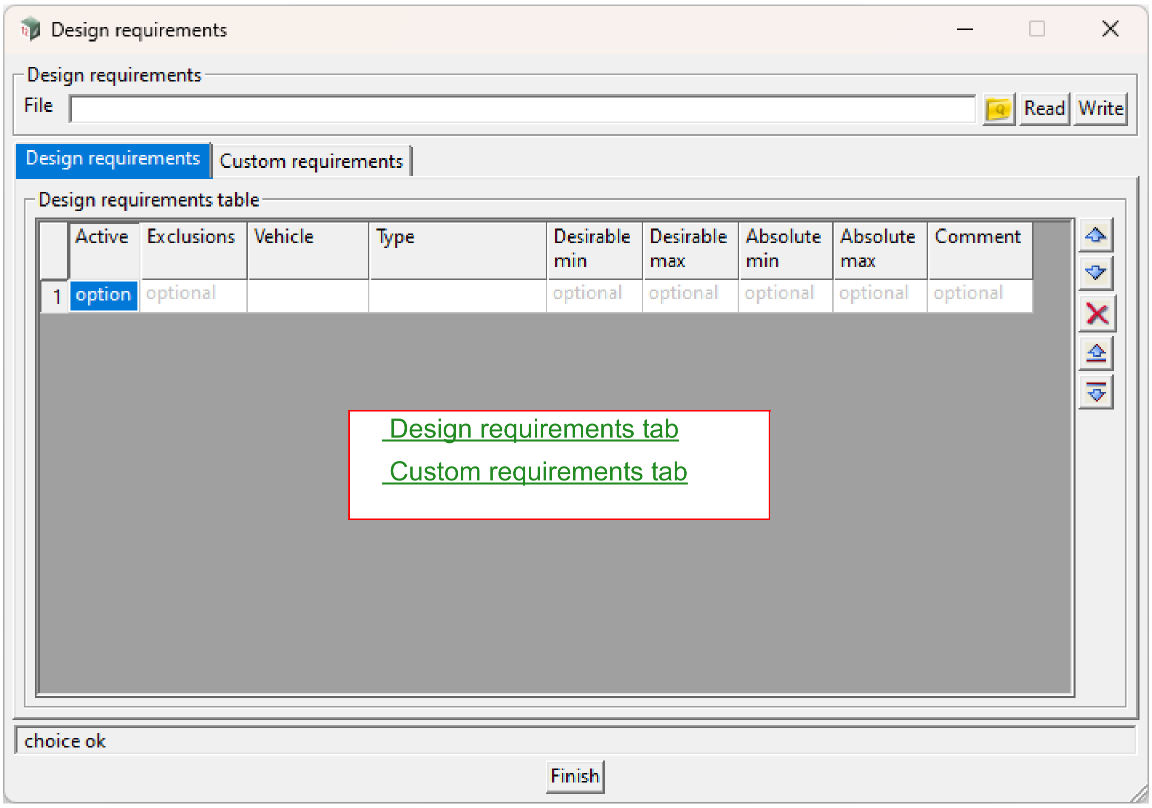
Comment text box

An optional comment.

Continue to 16.23.3.3 Design Requirements *or return to* 16.23 Track.

16.23.3.3 Design Requirements

To identify design compliance issues a **Design Requirements file** can be configured to automatically highlight any values that exceed desirable or absolute minimum or maximum thresholds in the **Cant Editor** and **Vertical Compliance** panels. A range of requirement types related to cant calculations, horizontal geometry, or vertical geometry are available for selection. These requirements can be individually applied to each vehicle as required.



Design requirements tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
File	file box		available files

Filename for the design requirements.

Read	button		

*Reads the design requirements **File** and populates the posted speed limits panel.*

Write	button		

*Writes the values in the design requirements panel to the design requirements **File**.*

Design requirements table

Active	choice box		Yes, No

*If **no** then the row will not be included. This is optional.*

Exclusions	choice box		Positive, Negative, zero

An optional field.

*If **Positive** only is selected, negative values will be excluded from highlighting.*

*If **Negative** only is selected, positive values will be excluded from highlighting.*

*If Exclude **zero** is selected, zero values will be excluded from highlighting.*

*If **nothing** is selected, all values will be highlighted if any value exceeds either the desirable or absolute minimum or maximum.*

Vehicle choice box

*Name of the vehicle for which the design requirements are to be applied. The list of vehicles is configured in the **Network specifications** file. Additionally, there is an option to select **All** to apply the design requirements universally.*

Type custom box

A list of available design requirement types. The requirements are categorised under the headings of cant, horizontal, and vertical.

Desirable min real box

*Minimum desirable threshold value for the designated design requirement type to be applied from. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in orange. This is optional.*

Desirable max real box

*Maximum desirable threshold value for the designated design requirement type to be applied to. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in orange. This is optional.*

Absolute min real box

*Minimum absolute threshold value for the designated design requirement type to be applied from. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in red. This is optional.*

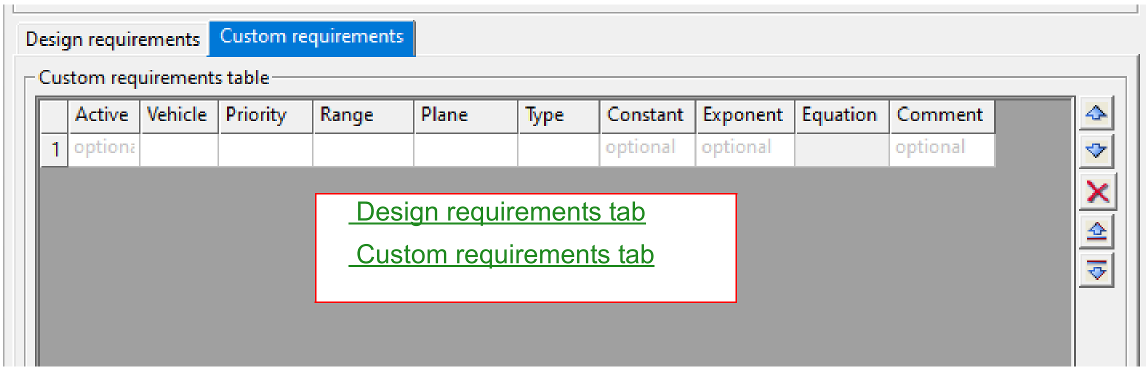
Absolute max real box

*Maximum absolute threshold value for the designated design requirement type to be applied to. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in red. This is optional.*

Comment text box

An optional comment.

Custom requirements tab



Custom requirements table

Active choice box yes, no

Indicates whether the row is active. If no is selected, the row will not be included (optional).

Vehicle choice box

*Name of the vehicle for which design requirements are applied. The list of vehicles is configured in the **Network specifications** file. Selecting All applies custom requirements universally.*

Priority choice box Desirable, Absolute

If a value exceeds the calculated threshold, it is highlighted in orange ('Desirable') or red ('Absolute').

Range choice box Minimum, Maximum

Specifies whether a value exceeding (maximum) or falling below (minimum) the calculated threshold is considered.

Plane choice box Horizontal, Vertical

Determines whether the value to check is on the horizontal or vertical plane.

Type choice box

Select the type from the list of options (tangent length, curve length, curve radius, transition length).

Constant real box

Constant multiplied by the speed (V). This is optional.

Exponent input box

Exponent of the speed (V). This is optional.

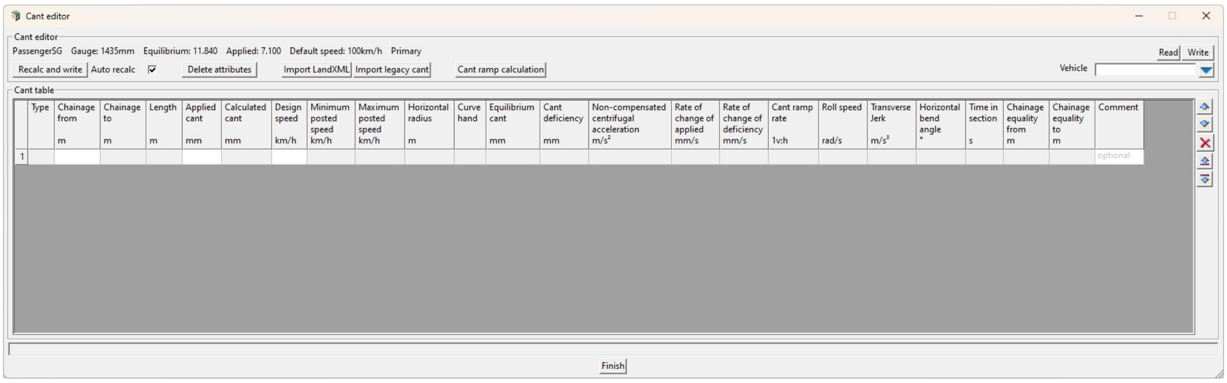
Comment text box

An optional comment.

Continue to 16.23.3.4 Cant Editor *or return to* 16.23 Track.

16.23.3.4 Cant Editor

The cant editor displays horizontal segment geometry and cant calculations. If a design requirements file has been selected then any values that exceed these thresholds will be highlighted. After selecting the **Recalc and write** button the **Cant editor** divides the **Design super alignment** horizontal segments into rows and applies various calculations for each row. If necessary, rows can be manually edited, added or deleted as required. Any manual updates made will not be saved until the **Write** button has been selected.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Recalc and write button

*Runs cant, and horizontal and vertical geometry calculations and writes the values to string attributes on the **Design super alignment**. This button exhibits identical functionality to the **Recalc** and **write** button within the **General** tab of the **Calculate Cant** panel.*

Auto recalc tick box ticked

*Calculations are run every time a field is updated. This will not write attributes to the **Design super alignment**.*

Delete attributes button

*Deletes all Cant attributes saved in the **Design super alignment**.*

Import LandXML button

*Imports chainages, **Applied cant** and **Design speed** values from an alignment that has previously been read using* 7.4.16.1 Read LandXML.

Import legacy cant button

*Imports chainages, **Applied cant** and **Design speed** values from a **Design super alignment** that had cant values previously calculated using the older **Cant panel**.*

Cant ramp calculation button

*Opens a panel that calculates cant **Ramp length**, **Previous chainage** and **Next chainage** based on a **Cant ramp 1v:h**, **Applied cant** and **Chainage value**.*

Read button

*Reads the cant attributes from the **Design super alignment** and populates the **Cant editor** panel.*

Write button

*Writes the values from the **Cant editor** panel to string attributes on the **Design super alignment**.*

Vehicle choice box

*The calculations for the currently selected vehicle will be displayed in the cant editor. The list of vehicles is configured in the **Network specifications** file.*

Cant table grid ctrl box

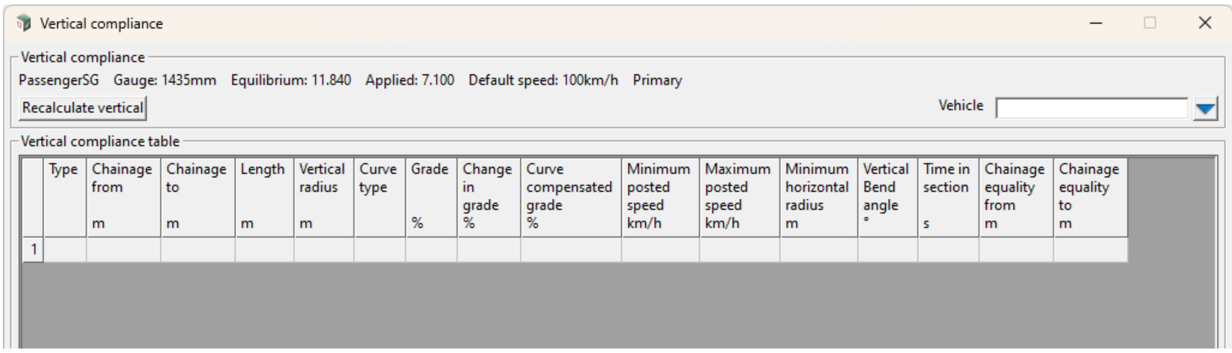
Type:	*Specifies the horizontal segment type - either Tangent (straight), Transition (spiral), or Curve (arc).*
Chainage from and to:	*Defines the chainage range for the horizontal segment. The Chainage From value is editable.*
Length:	*Indicates the length of the horizontal segment.*
Applied cant:	*The Calculated cant value is rounded by the cant rounding value specified in the Network specifications. Applied cant is measured from the lowest rail. The Applied cant value is always positive unless negative superelevation is desired. The Applied cant value is editable.*
Calculated cant:	*The cant value is calculated from the Design speed, Horizontal radius and Applied constant value specified in the Network specifications.*
Design speed, Minimum posted speed, & Maximum posted speed:	*The speed for the horizontal segment. This is calculated on a Posted speed limit if it exists, otherwise, it will use the Default speed value specified in the Network specifications. The Design speed value is editable.*
Horizontal radius:	*A positive value for right-hand curves and a negative radius value for left-hand curves.*
Curve hand	*Specifies whether the curve is right-hand or left-hand.*
Equilibrium cant:	*The equilibrium cant value is calculated from the Design speed, Horizontal radius and Equilibrium constant value specified in the Network specifications.*
Cant deficiency:	*The difference between the Applied cant and the Equilibrium cant. Cant excess is represented as a negative Cant deficiency value.*
Non-compensated centrifugal acceleration:	*A calculation representing the non-compensated centrifugal acceleration based on the gravity constant, Equilibrium constant, Design speed, Applied cant, Horizontal radius, and Rail gauge specified in the Network specifications.*
Rate of change of applied:	*The rate of change of applied cant over time, based on the Applied cant, Design speed and transition Length.*
Rate of change of deficiency:	*The rate of change of cant deficiency over time based on the Cant deficiency, Design speed and transition Length.*
Cant ramp rate:	*The cant gradient, based on the Applied cant, and transition Length.*
Roll speed:	*A calculation based on the Applied cant, transition Length, Design speed, and Rail gauge specified in the Network specifications.*
Transverse jerk:	*A calculation based on Non-compensated centrifugal acceleration, transition Length, and Design speed.*
Horizontal bend angle:	*The angle of deflection between consecutive Tangent segments.*
Time in section:	*The duration of time within the section, which is determined by the Length and Design speed.*

Chainage equality from and to:	*The equivalent chainage equality if chainage equalities have been enabled and are set up in the 11.3.11.4.4 SA - Chainage Equalities Editor. Chainage equality names should use the equivalent numerical chainage value without alphabetic prefixes or suffixes as this is used in the chainage equality calculation.*
Comment:	*An optional comment. The Comment is editable.*

Continue to 16.23.3.5 Vertical Compliance or return to 16.23 Track.

16.23.3.5 Vertical Compliance

The vertical compliance panel displays vertical segment geometry and associated calculations.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Recalculate vertical button

*Calculates vertical segment geometry values and writes these updated values as string attributes to the **Design super alignment**. The Recalc and write button on the **General** tab of the **Calculate Cant** panel and the **Cant editor** performs updates to both the **Cant editor** and the **Vertical compliance** panel. Therefore this option can be used if vertical geometry has been altered and you would like to retain existing **Cant editor** values.*

Vehicle choice box

*The calculations for the currently selected vehicle will be displayed in the **Vertical compliance panel**. The list of vehicles is configured in the **Network specifications** file.*

Vertical compliance table grid ctrl box

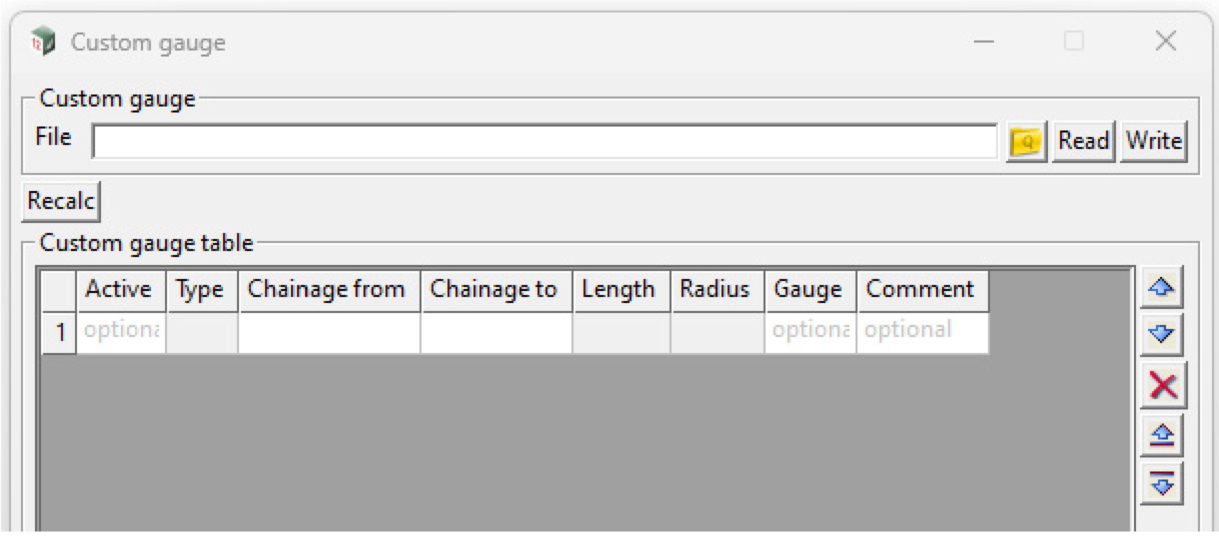
Type:	*The vertical segment type. Tangent (straight), and Curve (arc).*
Chainage from and to:	*The chainage range for the vertical segment.*
Length:	*The length of the vertical segment.*
Vertical radius:	*The radius of the vertical curve segment.*
Grade:	*The grade of the vertical tangent segment.*
Curve compensated grade:	*Curve compensation for the vertical tangent segment. This compensated grade is derived from the Grade, plus a calculation involving the Minimum horizontal radius, curve compensation Constant, and Calculation specified in the Network specifications file.*
Change in grade:	*The change in grade between the Grade between entering or exiting a vertical curve, or between consecutive tangents.*
Minimum and Maximum posted speed:	*The speed for the vertical segment. This will be calculated on a Posted speed limit if it exists, otherwise, it will use the Default speed value specified in the Network specifications.*

Minimum horizontal radius:	*The minimum horizontal radius through the vertical segment.*
Vertical bend angle :	*The angle of deflection between consecutive Tangent segments.*
Time in section :	*The duration of time within the section, determined by the Length and Maximum posted speed.*
Chainage equality from and to :	*The equivalent chainage equality if chainage equalities have been enabled and are set up in the 11.3.11.4.4 SA - Chainage Equalities Editor. Chainage equality names should use the equivalent numerical chainage value without alphabetic prefixes or suffixes as this is used in the chainage equality calculation.*

Continue to 16.23.3.6 Custom Gauge or return to 16.23 Track.

16.23.3.6 Custom Gauge

Widening through curves can be added in the custom gauge panel, opened through the **custom gauge file** button located in the **Rails** tab.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Custom gauge

File | file box | | available files

Specifies the custom gauge file.

Read | button

Reads the custom gauge file and updates the custom gauge table grid.

Write | button

Writes the custom gauge file.

Recalc | button

*Populates the Type, Chainage from, Chainage to, Length and Radius fields within the custom gauge table with the **Design super alignment** geometry.*

Custom gauge table

Active | choice box

*If **no** then the row will not be processed. This is optional.*

Type | input box

Type (Tangent, Transition, or Curve) of section. This is read-only.

Chainage from | real box

Starting chainage for the section.

Chainage to | real box

Ending chainage for the section.

Length | real box

Length of the section. This is read-only.

Radius real box

Radius of the section. This is read-only.

Gauge real box

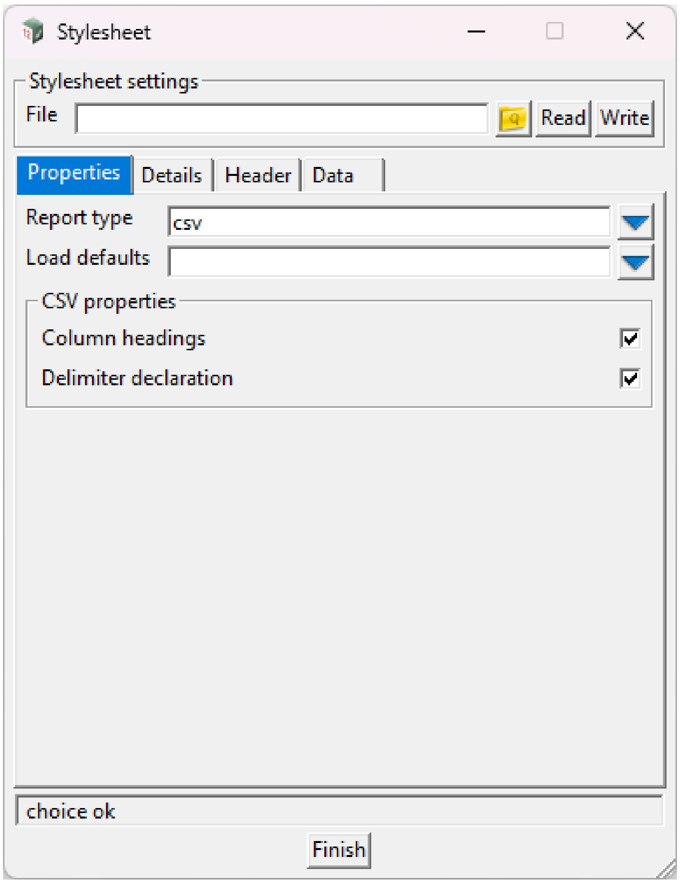
*Custom rail gauge to be applied between **From m** and **To m**.*

Comment text box

An optional comment.

Continue to 16.23.3.7 Cant Stylesheet or return to 16.23 Track.

16.23.3.7 Cant Stylesheet



Properties tab
Details tab
Header tab
Data tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Properties tab

Stylesheet settings

File file box all *.xslt files

Filename to save the generated stylesheet to.

Read button

Reads the stylesheet and populates the panel.

Write button

Writes the stylesheet file.

Report type choice box csv, html, pdf

Type of report to be generated.

*If **csv** (comma-separated values) see* CSV properties.
*If **html** (Hypertext Markup Language) see* HTML properties.
*If **pdf** (Portable Document Format) see* PDF Properties.

Load defaults choice box

Type of data to be presented in the report. The options are interval, rails, cant editor, speed, and vertical compliance.

CSV properties

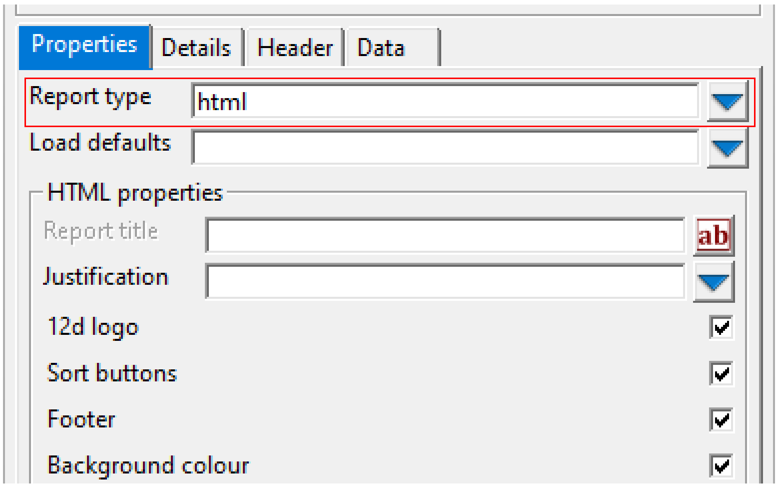
Column headings tick box ticked

*If **ticked**, the column headings will be exported in the report. The column headings are customised in the Data tab in the heading column.*

Delimiter declaration tick box ticked

*If **ticked**, the output file will include metadata that identifies the column delimiter, allowing other software to automatically convert the CSV data into columns.*

HTML properties



Report title input box

Text that will feature at the top of the document.

Justification choice box left, centre, right

Justification of all text values contained in the table of the document.

12d logo tick box ticked

*If **ticked**, the 12d logo will be added at the top of the document.*

Sort buttons tick box ticked

*If **ticked**, sort buttons will be added between the table headings and data. When the buttons are selected in the document, this will sort all column values.*

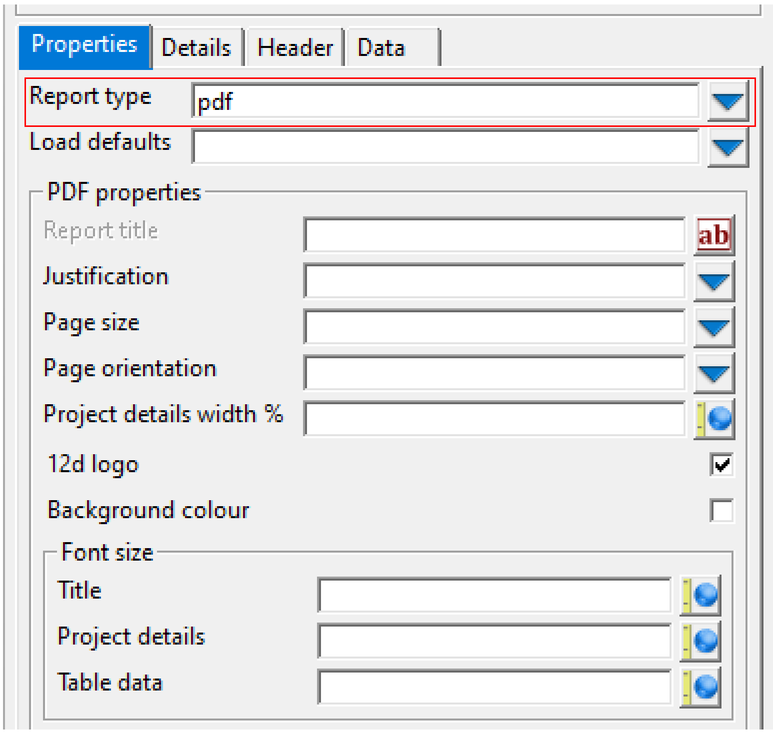
Footer tick box ticked

*If **ticked**, a footer containing the text "Generated by 12d Model at date time" will be added to the bottom of the document.*

Background colour tick box ticked

*If **ticked**, background colours will be applied to table cells.*

PDF Properties



Report title input box

Text that will feature at the top of the document.

Justification choice box left, centre, right

Justification of all text values contained in the table of the document.

Page size choice box A1, A3, A4

Sheet size of the document.

Page orientation choice box Landscape, Portrait

Orientation of the document.

Project details width % real box

Specify the width as a percentage of the overall sheet width for the project details headings.

12d logo tick box ticked

If ***ticked****, the 12d logo will be added at the top of the document.*

Background colour tick box not ticked

If ***ticked****, grey colours will be applied to the background in the table of the document.*

Font size

Title real box

Font size of the title text located at the top of the document.

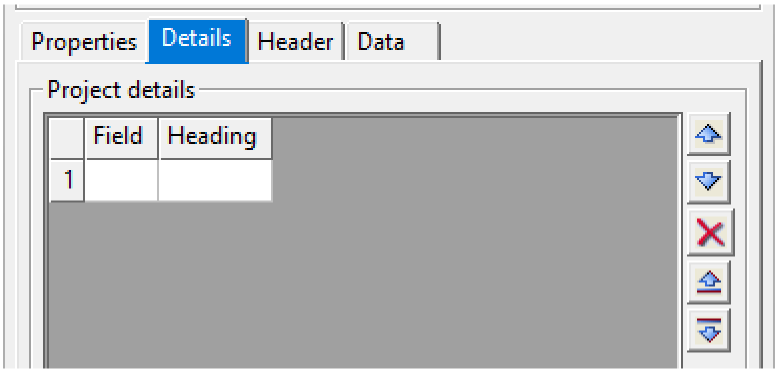
Project details real box

Font size of the project details text located above the table in the document.

Table data real box

Font size of the text inside the table in the document.

Details tab



[Properties tab](#)
[Details tab](#)
[Header tab](#)
[Data tab](#)

Project details

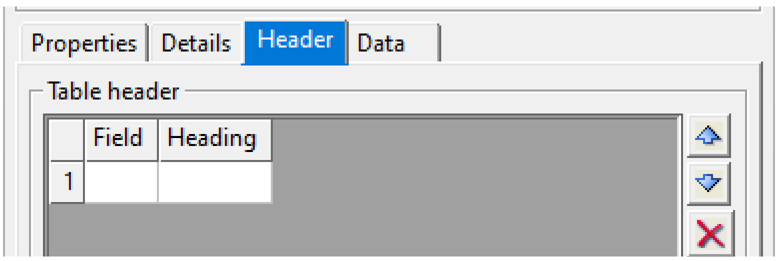
Field choice box

Field that will be included in the project details. The choices include: project_name, project_folder, user, export_time_date, function_name, design_alignment, stylesheet, report_filename, network_specifications, posted_speed_limits, and design_requirements.

Heading text box

Heading for each project detail, which is shown at the left side of each value in bold font type.

Header tab



[Properties tab](#)
[Details tab](#)
[Header tab](#)
[Data tab](#)

Table header

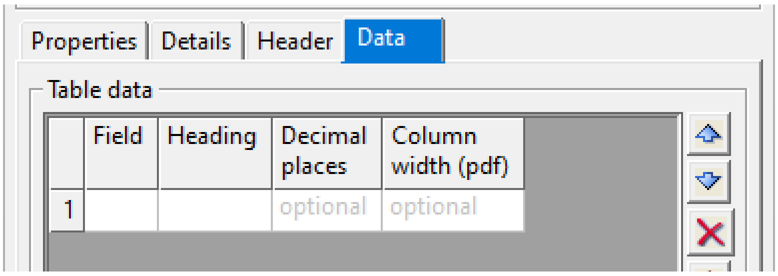
Field choice box

Field that will be included in the header above every table. The choices for Vehicles include: number, name, gaugeType, gauge, equilibriumConstant, appliedCantConstant and comment. The choices for Rails include: customGauge, type, offsetOverride, heightOverride.

Heading text box

Heading for each table header, which is shown at the left side of each value in bold font type.

Data tab



Properties tab
Details tab
Header tab
Data tab

Table data

Field custom box

Name of the xml node to add as a column in the report.

For a cant report the options are: number, type, station, stationTo, length, radius, curvature, directions, bearing, bearingDMS, xValue, yValue, zValue, stationEqFrom, stationEqTo, comment, speed, minSpeed, maxSpeed, appliedCant, calculatedCant, equilibriumCant, cantDeficiency, cantExcess, nonCompCentriAccel, bendAngle, timeInSection, rateOfChangeOfAppliedCantOverTime, rateOfChangeOfAppliedCantOverLength, rateOfChangeOfCantDeficiencyOverTime, cantGradient, rollSpeed, transverseJerk, and adverse.

For an interval report the options are: number, type, chainage, curveHand, easting, northing, level, bearing, bearingDMS, chainageEqualities, VerticalType, equalityValue, equalityValueEquation, equalityName, equalityZone, equalityChainage, equalityChainageEquation, HorizontalcalculatedCant, HorizontalcantExcess, HorizontalrateOfChangeOfAppliedCantOverLength, HorizontalappliedCant, HorizontalequilibriumCant, HorizontalcantDeficiency, HorizontalnonCompCentriAccel, HorizontalrateOfChangeOfAppliedCantOverTime, HorizontalrateOfChangeOfCantDeficiencyOverTime, HorizontalcantGradient, HorizontalrollSpeed, HorizontaltransverseJerk, Horizontallength, Horizontalradius, HorizontalbendAngle, HorizontaltimeInSection, Speedspeed, Horizontalspeed, Verticallength, Verticalradius, Verticalgrade, VerticalcompensatedGrade, VerticalchangeOfGrade, VerticalbendAngle, and VerticaltimeInSection.

For a rails report the options are: chainage, gauge, left_x, left_y, left_z, left_radius, right_x, right_y, right_z, and right_radius.

For a speed report the options are: station and speed.

For a vertical compliance report the options are: number, type, station, stationTo, length, grade, changeOfGrade, radius, curvature, xValue, yValue, zValue, stationEqFrom, stationEqTo, minHRadius, bendAngle, minSpeed, maxSpeed, timeInSection, and compensatedGrade.

Heading input box

Heading text shown for each column.

Decimal places choice box 0, 1, 2, 3, 4, 8

Number of decimal places for each value in the table.

Column width (pdf) input box

An override to the width of each column. Values can be absolute or relative units and should be suffixed with one of the following abbreviations: cm: centimetres; mm: millimetres; in: inches; pt: points; pc: picas; px: pixels; %: percentage relative to the table width; em: relative to the font size; ex: relative to the height of the current font. For example 10% or 20mm.

Buttons at Bottom

Process button

Runs the function.

Continue to 16.23.3.8 Cant Definitions or return to 16.23.3 Calculate Cant or 16.23 Track.

16.23.3.8 Cant Definitions

The 16.23.3 Calculate Cant panel is used to calculate cant along a design **Design super alignment**.

Some of the definitions used are:

Abbreviations used

Ca: Applied cant in mm

Cd/**Def**: Cant deficiency in mm

Ce: Equilibrium cant in mm

Lateral Accel/ACC: Lateral acceleration in m/s²

R: Radius of the curve in m

ROCC: Rate of change of cant in mm/s or 1v in ?h

ROCD: Rate of change of cant deficiency in mm/s or 1v in ?h

T: Time in element in s

V: Vehicle speed in km/h

Continue to 16.23.4 Section to Snippet or return to 16.23 Track.

16.23.4 Section to Snippet

Position of option on menu: **Design =>Track =>Section to snippet**

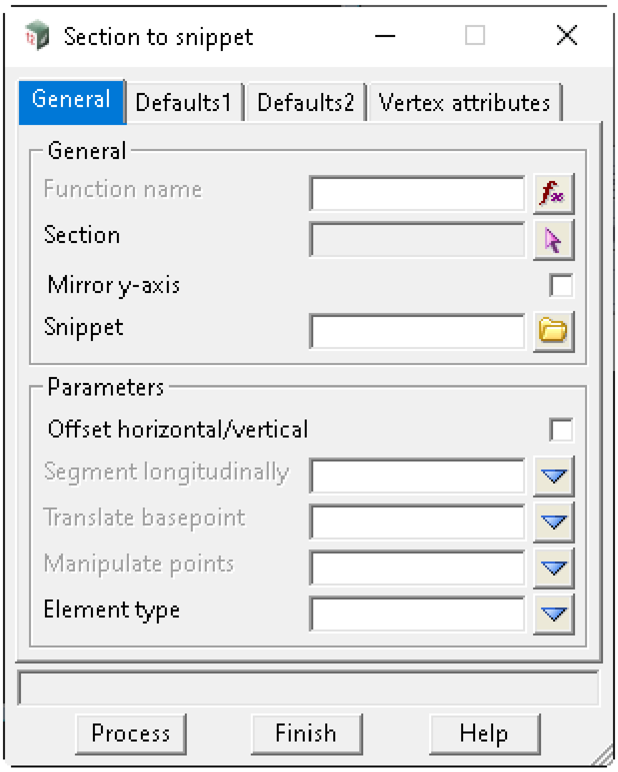
The **Section to snippet** panel generates a snippet based on a super string element in a section.

The panel can generate rails, sleepers, and ballast from a section and can also extend to anything else to be extruded along a design alignment including overhead structures, wayside structures, and in some cases sub-layers.

Various parameters can be added to the snippet file which appear as fields in the MTF Snippet panel so that a user can modify an instance of each snippet added.

For rails, sleepers, and ballast, the rail strings generated in the 16.23.3 Calculate Cant panel should be selected for the ***left grade*** and ***right grade*** strings.

Selecting **section to snippet** displays the **Section to Snippet** panel.



General tab
Defaults1 tab
Defaults2 tab
Vertex attributes tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

General tab

General

Function name function box all functions

Name of the function. This is optional.

Section select box

String for the section to generate the data for the snippet.

Minor y-axis tick box not ticked

Mirrors the section about the y-axis. This should be ticked for sections drawn on the left side.

Snippet	file box	all *.mtfsnippet files

Name of the snippet to be generated.

Parameters

Offset horizontal/vertical	tick box	not ticked

*Adds an **offset horizontal** and **offset vertical** parameter into the snippet file.*

Segment longitudinally	choice box	None, One, Many

Segments an extrusion into one or many elements. This is optional.

*If **One**, a segment length parameter is added to the snippet which specifies the length of extrusion to be applied. Only the start chainage is used. The end chainage is not used.*

*If **Many**, a segment length and a segment distance between parameter is added to the snippet. Segment length specifies the length of extrusion to be applied. Segment distance between specifies the distance between each element placed.*

Translate basepoint	choice box	None, Grade, Tin

Translates the basepoint (the 0 0 coordinate of the section) to either a named grade or tin. This is optional.

*If **Grade**, the basepoint is translated to the height of the named grade produced from the left grade and right grade strings. Suggested usage: rails, sleepers, and ballast as the alignment level is designed at the lowest rail level.*

*If **Tin**, the basepoint is draped to the tin specified in the Interface tin snippet parameter.*

Manipulate points	choice box	None, All points on grade, Vertex attributes

Manipulates all points to grade, or each point is manipulated individually through vertex attributes. This is optional.

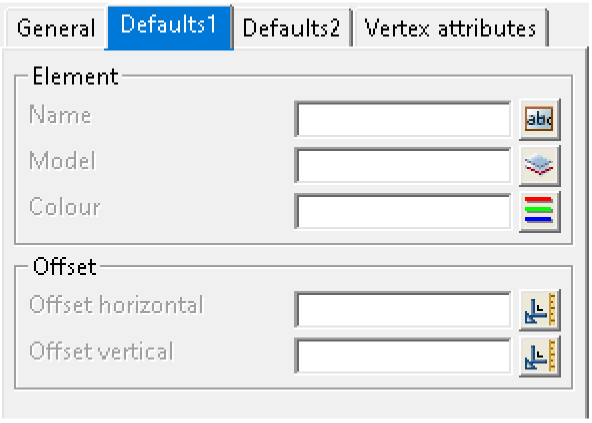
*If **All points on grade**, the Section is rotated to align with the named grade produced from the left grade and right grade strings. Suggested usage: rails and sleepers.*

*If **Vertex attributes**, each Section vertex has vertex attributes applied which individually control each vertex. Vertex attributes can be generated with the Generate vertex attributes button in the Vertex attributes tab. Suggested usage: ballast.*

Element type	choice box	Strings, Tin, Trimesh

Type of element to be generated. Choices include strings, tin or trimesh.

Defaults1 tab



[General tab](#)
[Defaults1 tab](#)
[Defaults2 tab](#)
[Vertex attributes tab](#)

Element

Name input box

*Parameter function: A **name** of the element to be generated.*

*If specified, this overrides the **name** parameter. If not specified, the name of the **Section** will be used. This is optional.*

Model model box available models

Parameter function: The name of the model for the elements to be generated.

*If specified, this overrides the **Trimesh/Strings/Tin model** parameter. If not specified, a **model** parameter will be generated based on the **Name** or name of the **Section**. This is optional.*

Colour colour box available colours

Parameter function: The colour of the element to be generated.

*If specified, this overrides the **Colour** parameter. If not specified, the colour of the **Section** element will be used. This is optional.*

Offset

Offset horizontal real box

Parameter function: Offsets the element generated horizontally.

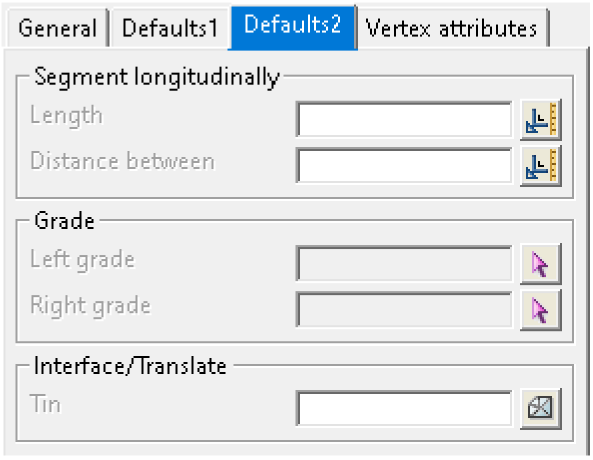
*If specified, this overrides the **Offset horizontal** parameter. If not specified, the **Offset horizontal** parameter will be optional. This is optional.*

Offset vertical real box

Parameter function: Offsets the element generated vertically.

*If specified, this overrides the **Offset vertical** parameter. If not specified, the **Offset vertical** parameter will be optional. This is optional.*

Defaults2 tab



General tab
Defaults1 tab
Defaults2 tab
Vertex attributes tab

Segment longitudinally

Length real box

Parameter function: The length of each extruded element.

If specified, this overrides the ***Segment length*** *parameter. If not specified, the* ***Segment length*** *parameter will be blank. This is optional.*

Distance between real box

Parameter function: The distance between each extruded element.

If specified, this overrides the ***Segment distance between*** *parameter. If not specified, the* ***Segment distance between*** *parameter will be blank. This is optional.*

Grade

Left grade select box

Parameter function: The left string used in the creation of a named grade when ***Translate basepoint: Grade, Manipulate points: All points on grade*** *or* ***Manipulate points: Vertex attributes*** *are selected.*

If specified, this overrides the ***Left grade*** *parameter. If not specified, the* ***Left grade*** *parameter will be blank. This is optional.*

Right grade select box

Parameter function: The right string used in the creation of a named grade when ***Translate basepoint: Grade, Manipulate points: All points on grade*** *or* ***Manipulate points: Vertex attributes*** *are selected.*

If specified, this overrides the ***Right grade*** *parameter. If not specified, the* ***Right grade*** *parameter will be blank. This is optional.*

Interface/Translate

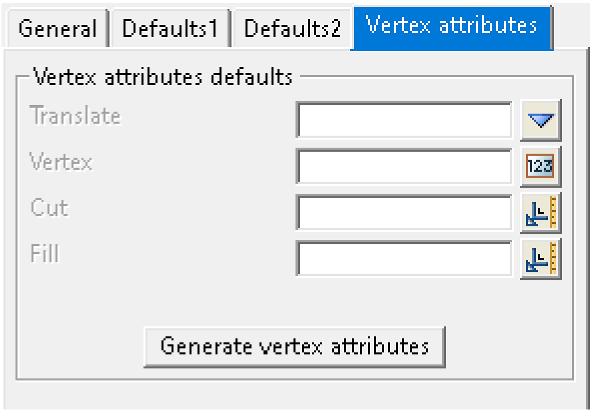
Tin select box

Parameter function: The tin used for translating or interfacing a point onto when ***Translate basepoint: Tin*** *or* ***Manipulate points: Vertex attributes*** *are selected.*

If specified, this overrides the ***Interface tin*** *parameter. If not specified, the* ***Interface tin*** *parameter will be blank. This is optional.*

Vertex attributes tab

*If **Vertex attributes** has been selected in the **Manipulate points** field of the **General tab** then vertex attributes of each vertex will be read to individually apply program logic to each vertex. Defaults can be initially applied to each vertex and then these vertex attributes can be manually edited to perform specific functions at each vertex.*



General tab
Defaults1 tab
Defaults2 tab
Vertex attributes tab

Vertex attributes defaults

Translate choice box None, Tin, Grade, Grade tin

The point is manipulated by one of the following criteria. This is optional.

*If **None**, the vertex will be at the original position in the Section. Same functionality as if the field remains blank.*

*If **Tin**, the vertex is draped or interfaced to the tin specified in the Interface tin snippet parameter. Suggested usage: ballast toe.*

*If **Grade**, the vertex is rotated about the basepoint based on the named grade generated by the left grade and right grade strings. Suggested usage: top of ballast point and the ballast shoulder.*

*If **Grade Tin**, the vertex is both on grade and draped or interfaced to a tin. Suggested usage: bottom of ballast point.*

Vertex integer box

The vertex index specified will copy the coordinates of another vertex. Usually required when an interface at cut/fill slope needs to be taken from another vertex which is on grade. Suggested usage: ballast toe (the vertex will be the ballast shoulder vertex index). This is optional.

Cut real box

*If the field is blank or null, then there is no cut interface and the vertex will be at the original position in the **Section**. If 0 is specified, the point will be translated up to the **interface tin**. If any other number is entered, the 1v in cut slope to interface the **interface tin**. This is optional.*

Fill real box

*If the field is blank or null, then there is no fill interface and the vertex will be at the original position in the **Section**. If 0 is specified, the point will be draped onto the **interface tin**. If any other number is entered, the 1v in fill slope to interface the **interface tin**. This is optional.*

Generate vertex attributes real box

*Generates translate, vertex, cut and fill vertex attributes for all vertices of the selected **Section** with default values specified in the above fields.*

Continue to 16.23.5 12d Culverts or return to 16.23 Track.

16.23.5 12d Culverts

Position of option on menu: **Design =>Track =>12d culverts**

The **12d culverts** panel can generate culvert centrelines, pipe and box culverts, rock protection, and labels.

Culverts and rock protection can be generated as super strings or trimesh.

Design requirements can be populated to highlight non-compliant design criteria in the culvert editor.

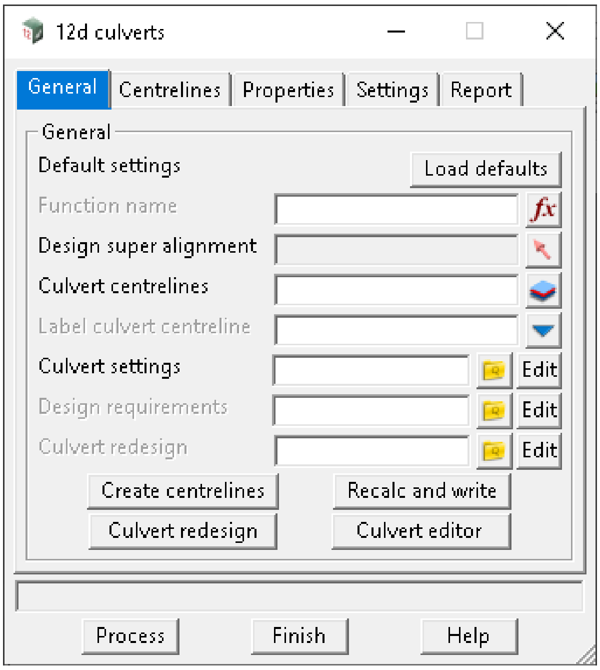
A culvert redesign function allows various updates to all culverts or all culverts of a certain type.

String attributes are generated for centrelines, culverts and rock protection.

An earthworks formation can be locally steepened at each culvert bank via a snippet generated inside the 12d culverts panel.

A report can be generated in csv, html, pdf, or xml.

Selecting **12d culverts** displays the **12d culverts** panel.



General tab
Centrelines tab
Properties tab
Settings tab
Report tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Buttons at Bottom

Process button

Runs the function.

General tab

General

Load defaults button

Various fields will be populated with default values.

*Affected fields include **Culvert centrelines**, **Label culvert centreline**, **Settings**, **Design requirements**, **Culvert redesign**, **Z-levels derived from**, **Model prefix***, **Side**, **Textstyle**, **Rock pattern**, **Rock pattern***

size, ***Report type***, ***Stylesheet***, *and* ***Snippet settings***.

Function name function box available functions

Name of the function. This field is optional.

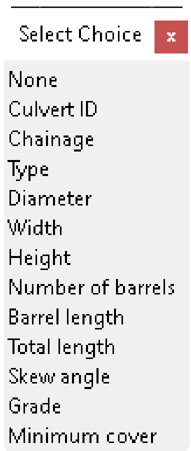
Design super alignment string select

String for the design alignment.

Culvert centrelines model box available models

A model containing centrelines of the culvert banks. These centrelines determine the geometry including length, grade, and location for where the culverts will be offset from. Culvert centrelines can be generated with the ***Create centrelines*** *button.*

Label culvert centrelines choice box



For ***Culvert centrelines*** *of the super string type, this will label the culvert centreline with an arrow symbol indicating the direction of flow, and a property of the culvert.*

This field is optional.

Culvert settings file box *.12drcrs

A file containing culvert settings that determine the culvert and rock protection types, defaults, and labelling format.

Edit *icon opens the* ***Settings*** *panel.See* 16.23.5.1 Culvert settings.

Design requirements file box *.12drcd

A file containing design requirements that highlight ***orange*** *or* ***red*** *if any values in the culvert editor exceed these tolerances.*
Edit *icon opens the* 16.23.5.2 Design Requirements *panel.*

Culvert redesign file box *.12drcr

A file containing redesign settings that can change properties or coordinates of a culvert type or all culverts.

Edit *icon opens the* 16.23.5.3 Culvert Redesign *panel.*

Create centrelines button

Generates culvert centrelines along stream centrelines which are cut at formation interfaces.

Recalc and write button

Processes culvert calculations and writes attributes to all Culvert centrelines.

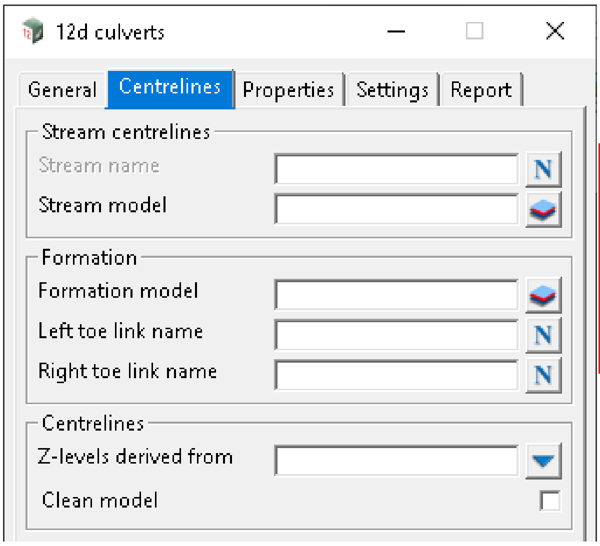
Culvert redesign button

*Runs the redesign function, changing properties or coordinates of a culvert type or all culverts based on settings in the **Culvert redesign** file.*

Culvert editor button

*Opens the **Culvert editor** panel. See* 16.23.5.4 Culvert Editor.

Centrelines tab



General tab
Centrelines tab
Properties tab
Settings tab
Report tab

Stream centrelines

Stream name name box all names

*A name filter which allows users to reduce the number of stream centrelines considered in the analysis. This filter includes only those centrelines whose names match the specified criteria in the **Name** field.*

This is optional.

Stream model model box all models

Model containing stream centrelines.

Formation

Formation model model box all models

Model containing formation strings.

Left toe link name name box all names

Name of the left toe interface string.

Right toe link name name box all names

Name of the right toe interface string.

Centrelines

Z-levels derived from choice box Formation, Streams

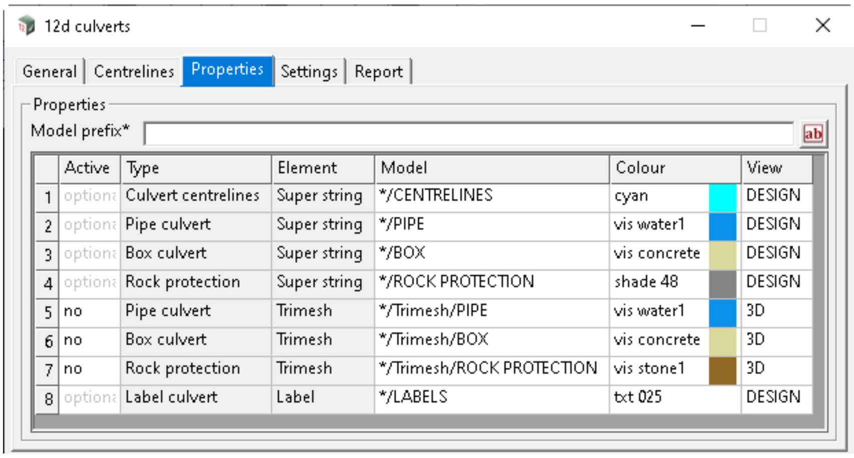
*If **Formation**, the z-levels or R.L.'s of the culvert centrelines are set by the height of the formation toe interface.*

*If **Streams**, the z-levels or R.L.'s of the culvert centrelines are set by the height of the f stream centreline.*

Clean model tick box not ticked

*If ticked, the **Culvert centrelines** model is cleaned before generating the culvert centrelines.*

Properties tab



General tab
Centrelines tab
Properties tab
Settings tab
Report tab

Properties

Model prefix * text box

Affects the model name of the generated elements. An asterisk in the **Model** *column can be used to exchange the text entered in the* **Model prefix *** *field.*

Active choice box yes, no

*If **yes** then the row will be processed.*

*If **no** then the row will **not** be processed.*

Type read-only

Type of the object generated. It will be Pipe culvert, Box culvert, Rock protection, and Label culvert.

Element read-only

Element of the object generated. It will include Super string, Trimesh and Label.

Model custom model box available models

Model name for the generated element. An asterisk can be used to exchange the text entered in the **Model prefix *** *field.*

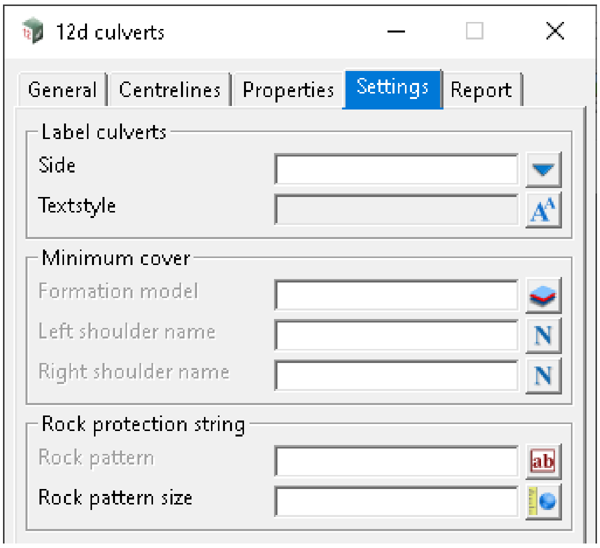
Colour colour box available colours

Colour to be applied to the generated element.

View view box available views

View to add the generated elements to. If the view does not exist, a view will be created.

Settings tab



General tab
Centrelines tab
Properties tab
Settings tab
Report tab

Label culverts

Side choice box Left, Right

*Sets the side of the super alignment for where the labels are generated. The options are left or right. Once set, this affects the **Textstyle**.*

Textstyle textstyle box

Sets the textstyle data to use for the labels.

Minimum cover

Formation model model box available models

A model containing the top of formation shoulder strings to calculate the minimum cover.

Left shoulder name name box available names

*Name of the **left shoulder** link that is located in the **Formation model** to calculate the minimum cover.*

Right shoulder name name box available names

*Name of the **right shoulder** link that is located in the **Formation model** to calculate the minimum cover.*

Rock protection string

Rock pattern text box

Name of the pattern to be applied to the rock protection super string element. This is optional.

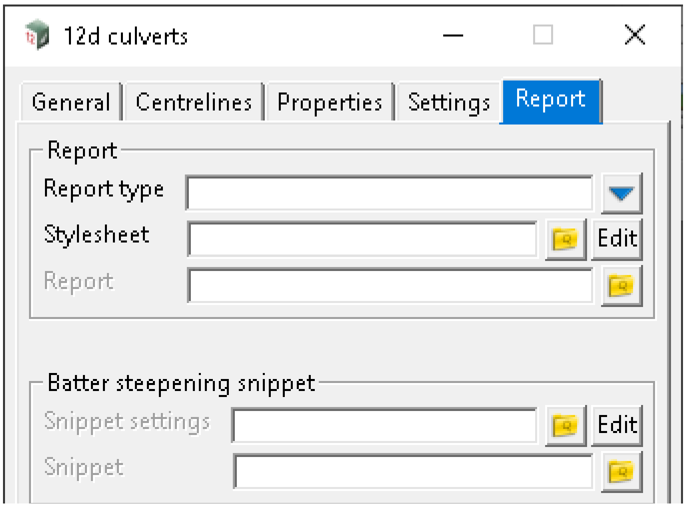
Rock pattern size real box

Size of the pattern to be applied to the rock protection super string element.

Report tab

A report can be generated as a Comma-Separated-Values (CSV), Hypertext Markup Language (HTML), Portable Document Format (PDF) or Extensible Markup Language (XML) file.

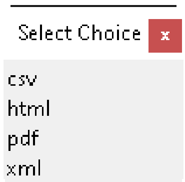
A snippet can be generated to steepen formation batters which should be added to the left and right modifiers of the design formation Apply MTF Function.



General tab
Centrelines tab
Properties tab
Settings tab
Report tab

Report

Report type choice box



Type of report to generate.

Stylesheet file box

The xslt stylesheet to convert the xml output into the required report type. a csv, html or pdf file.

This file can be customized to include/exclude columns and apply various other adjustments to the output of the report.

***Edit** icon opens the **Stylesheet editor**.*

Report file box available files

Filename of the generated report.

Snippet

Snippet settings file box *.12drcb

File containing the settings to be applied to the snippet.

***Edit** icon opens the **Snippet settings** panel.*

Edit button

Opens the Snippet settings panel.

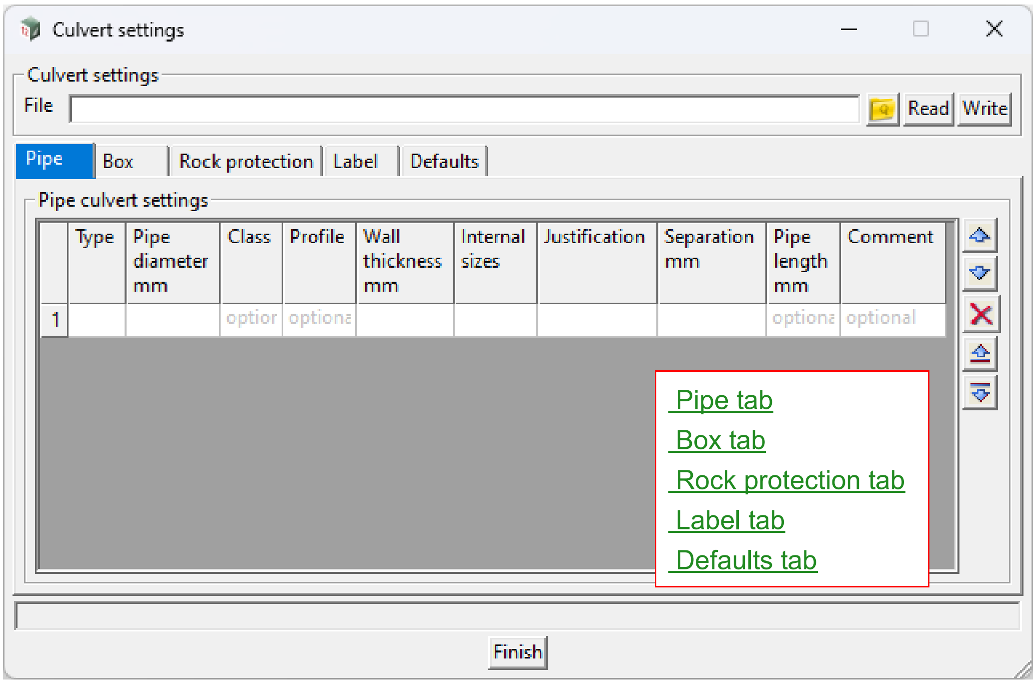
Steepen batters file box *.mtfsnippet

Filename of the snippet that is generated.

Continue to 16.23.5.1 Culvert settings or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.1 Culvert settings

A list of pipe culvert types can be populated which will appear as options in the culvert editor, auto redesign and design requirements panels.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Culvert settings

File	file box		*.rcs files

File to store the culvert settings.

Read	button		

Reads the culvert settings file.

Write	button		

Writes the culvert settings file.

Pipe tab

Pipe culvert settings

Type	input box		

A unique identifier of the type of pipe culvert. This is referred to in the culvert editor, report and optionally for labelling.

Pipe diameter mm	real box		measures

Diameter of the pipe, measured in millimetres.

Class	input box		

Pipe class. This is optional.

Profile	input box		

The pipe profile. This is optional.

Wall thickness mm real box measures

Wall thickness of the pipe, measured in millimetres.

Internal sizes choice box internal, external

*If **internal** the **Diameter** is the inside dimension of the pipe, excluding the pipe **Wall thickness**.*
*If **external** the **Diameter** is the outside dimension of the pipe, including the pipe **Wall thickness**.*

Justification choice box invert, centre, obvert

*If **invert**, the **Culvert centreline** is referenced from the invert or bottom interior of the pipe.*
*If **centre**, the **Culvert centreline** is referenced from the centreline or mid-point of the pipe.*
*If **obvert**, the **Culvert centreline** is referenced from the soffit, obvert or top interior of the pipe.*

Separation mm real box measures

Separation measured in millimetres between each culvert in a bank of culverts.

Pipe length mm real box measures

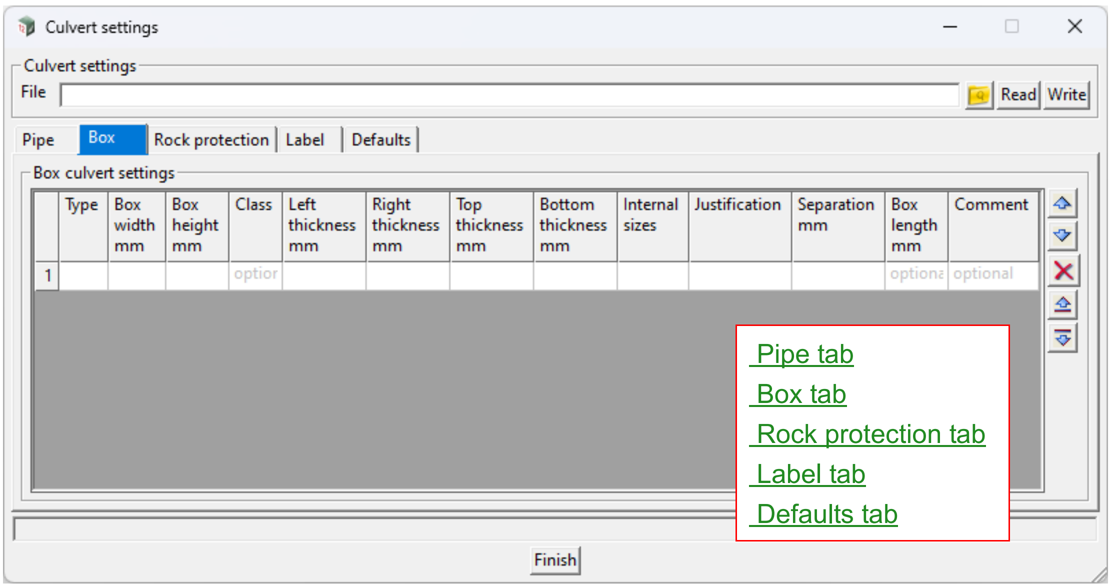
Length of each segment of pipe, measured in millimetres. This is optional.

Comment input box

A comment for the pipe culvert instance. This is optional.

Box tab

A list of box culvert types can be created which will appear as options in the culvert editor, auto redesign and design requirements panels.



Pipe tab
Box tab
Rock protection tab
Label tab
Defaults tab

Box culvert settings

Type input box

A unique identifier of the type of box culvert. This is referred to in the culvert editor, report and optionally for labelling.

Box width mm real box measures

Width of the box culvert, measured in millimetres.

Box height mm	real box	measures

Height of the box culvert, measured in millimetres.

Class	input box	

Pipe class. This is optional.

Left thickness mm	real box	measures

The thickness of the left side of the box culvert, measured in millimetres.

Right thickness mm	real box	measures

Thickness of the right side of the box culvert, measured in millimetres.

Top thickness mm	real box	measures

Thickness of the top side of the box culvert, measured in millimetres.

Bottom thickness mm	real box	measures

Thickness of the bottom side of the box culvert, measured in millimetres.

Internal sizes	choice box	internal, external

*If **internal**, the **Box width/height** is the inside dimension of the culvert, excluding the box **Left/Right/Top/Bottom thickness**.*

*If **external**, the **Box width/height** is the outside dimension of the culvert, including the box **Left/Right/Top/Bottom thickness**.*

Justification	choice box	invert, centre, obvert

*If **invert**, the **Culvert centreline** is referenced from the invert or bottom interior of the culvert.*

*If **centre**, the **Culvert centreline** is referenced from the centreline or mid-point of the culvert.*

*If **obvert** the **Culvert centreline** is referenced from the soffit, obvert or top interior of the culvert.*

Separation mm	real box	measures

Separation measured in millimetres between each culvert in a bank of culverts.

Box length mm	real box	measures

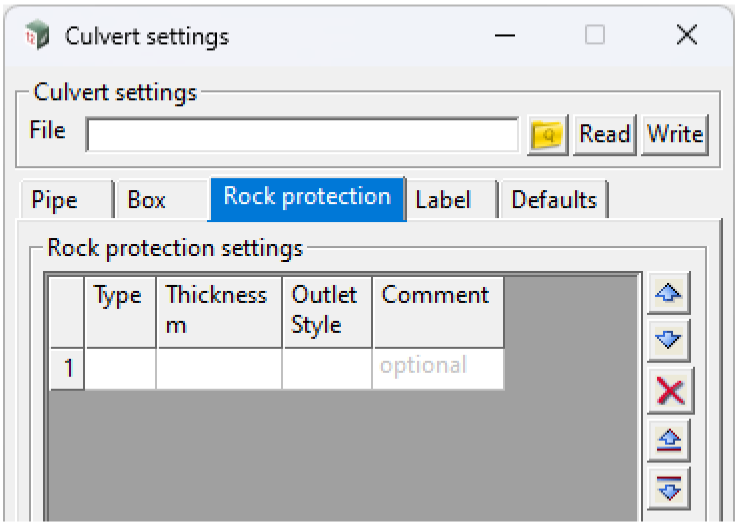
Culvert length of each segment, measured in millimetres. This is optional.

Comment	input box	

A comment for the box culvert instance. This is optional.

Rock protection tab

A list of rock protection types can be created which appear as options in the culvert editor, auto redesign and design requirements panels.



[Pipe tab](#)
[Box tab](#)
[Rock protection tab](#)
[Label tab](#)
[Defaults tab](#)

Rock protection settings

Type input box

A unique identifier of the type of rock protection. This is referred to in the culvert editor and report.

Thickness m real box measures

Thickness of the rock protection, measured in metres.

Outlet style choice box 4-sided, 6-sided

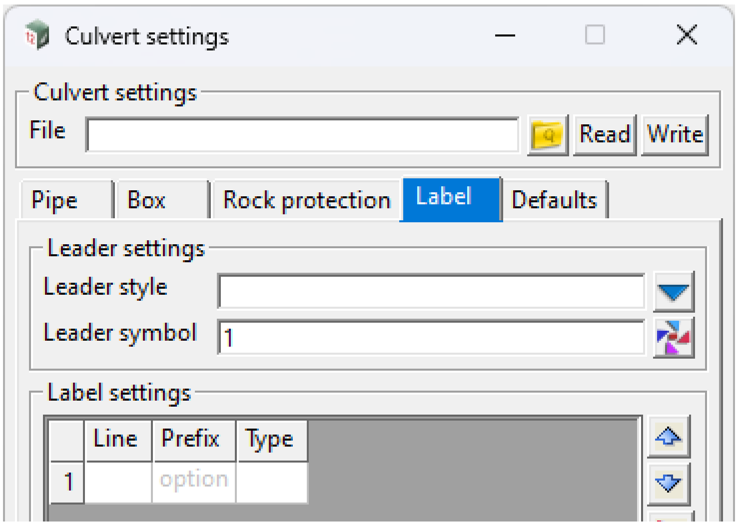
Number of sides in plan view of the rock protection.

Comment input box

A comment for the rock protection instance. This is optional.

Label tab

*The label text can be displayed on two lines with a leader from the centre of the **Culvert centreline** to the centre of the extent of the label text. The label text for each line can be built from multiple rows consisting of an optional prefix and a label type.*



[Pipe tab](#)
[Box tab](#)
[Rock protection tab](#)
[Label tab](#)
[Defaults tab](#)

Leader settings

Leader style choice box Line, Symbol

*If **line**, a super string is created as the leader for the labels.*

*If **symbol**, a paper type symbol is created as the leader for the labels. This type of leader can be affected by the plotting scale if the symbol type is set as paper.*

Leader symbol symbol box1 all symbols

Symbol to be applied, if the **Leader style** *is set as **Symbol**.*

Label settings

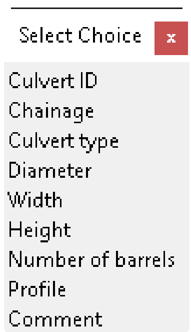
Line choice box Line 1, Line 2

Specifies which line the label **Prefix** *and* **Type** *instance will be placed on. The choices include Line1 and Line2.*

Prefix input box

A prefix to be added before each label **Type**. *The underscore _ can be used to enforce whitespace around a value. For example, using "_x_" ensures that the prefix value will be labelled as " x ". This is optional.*

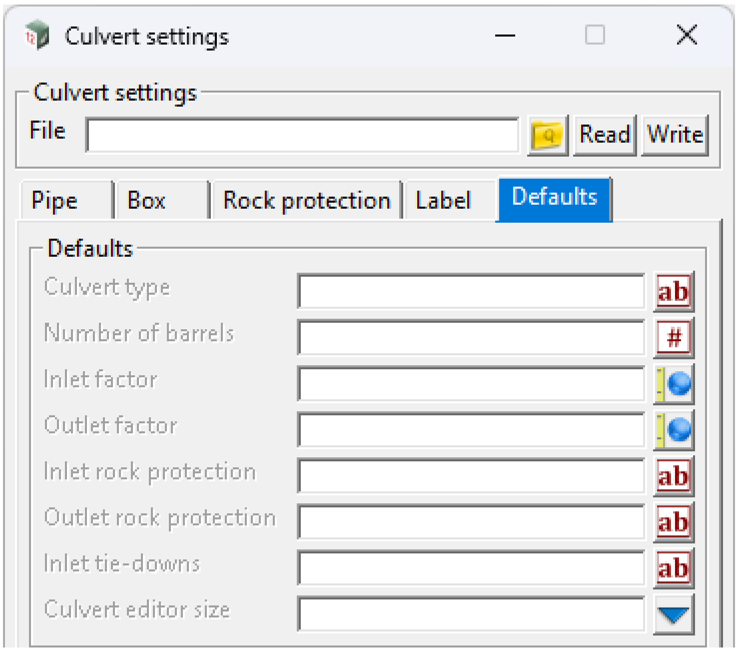
Type choice box



Type of label to be placed.

Defaults tab

*When **Recalc and write** is selected in the **Culvert editor** for the first time, the default values listed in the defaults tab will be populated for each **Culvert centreline**.*



[Pipe tab]
[Box tab]
[Rock protection tab]
[Label tab]
[Defaults tab]

Defaults

Culvert type text box

*Default culvert type. The type could either be a pipe **Type** listed in the **Pipe tab**, or a box **Type** listed in the **Box tab**. This is optional.*

Number of barrels integer box

Default number of barrels to be populated in the culvert editor. This is optional.

Inlet factor real box measures

*Factor applied to the rock protection inlet, which is multiplied by either the **Height** or the **Diameter** of the culvert. If not specified, an inlet factor of 1.0 will be used. This is optional.*

Outlet factor real box measures

*Factor applied to the rock protection outlet, which is multiplied by either the **Height** or the **Diameter** of the culvert. If not specified, an outlet factor of 3.0 will be used. This is optional.*

Inlet rock protection input box

*Default inlet rock protection type. The type is one of the rock protection **Types** listed in the **Rock protection tab**. This is optional.*

Outlet rock protection input box

*Default outlet rock protection type. The type is one of the rock protection **Types** listed in the **Rock protection tab**. This is optional.*

Inlet tie-downs input box

Default Inlet tie-downs value to be applied in the Culvert editor. This is optional.

Culvert editor size choice box Half, Full

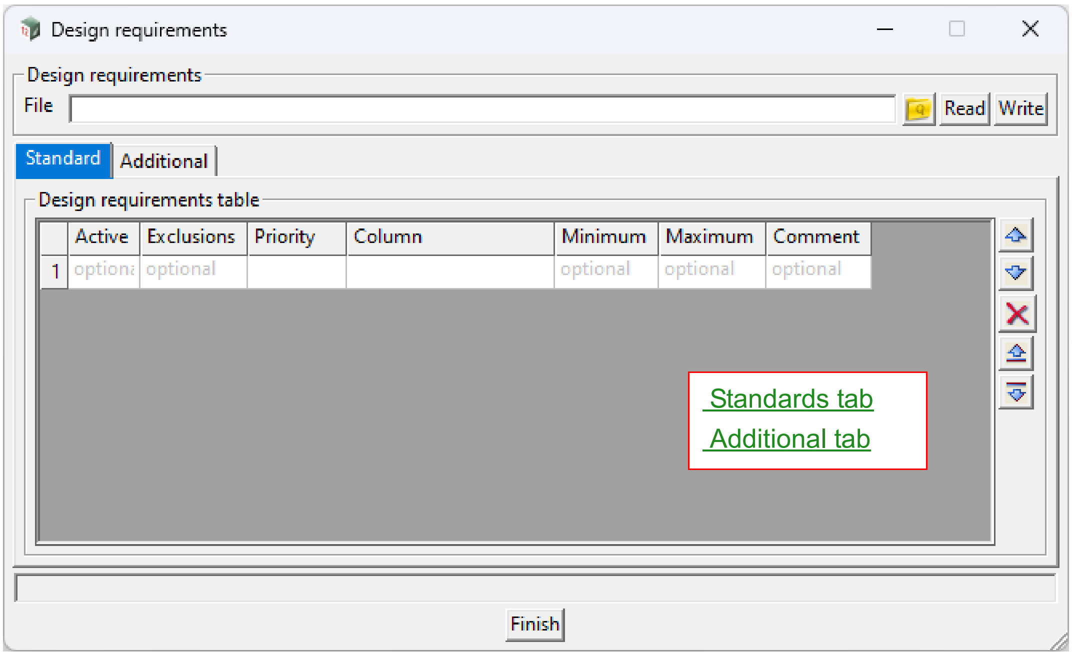
The culvert editor panel default width. The options are half-size or full-size. This is optional.

Continue to 16.23.5.2 Design Requirements or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.2 Design Requirements

A list of design requirements can be created.

Any values that exceed these thresholds will be highlighted orange if set as **Priority Desirable** or highlighted **red** if set as **Priority Absolute**.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Design requirements

File file box *.12drcd files

File to store the design requirements.

Read button

Reads a design requirements file.

Write button

Writes a design requirements file to the filename **File**.

Standards tab

Design requirements table

Active choice box yes, no

If ***no*** *then the row will be excluded from the design requirements validation.*
If ***yes*** *then the row will be included in the design requirements validation.*

Exclusions choice box Positive only, Negative only, Exclude zero

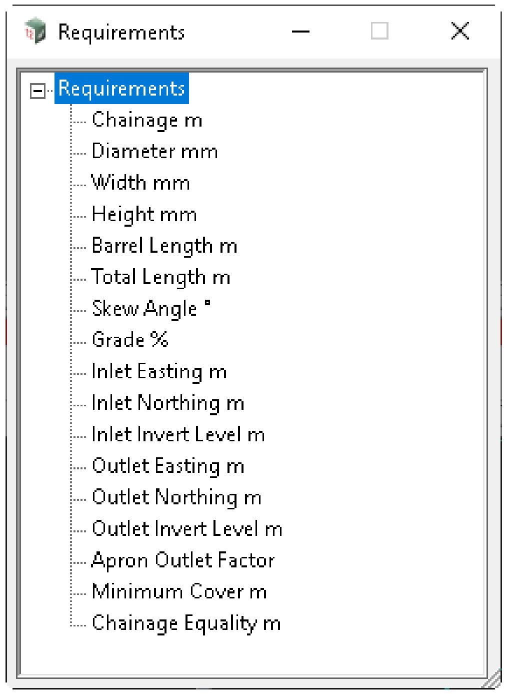
Excludes certain values based on a criteria.
If ***Positive only****, negative values are excluded from highlighting.*
If ***Negative only****, positive values are excluded from highlighting.*
If ***Exclude zero****, zero values are excluded from highlighting.*

Priority choice box Absolute, Desirable

*If **Absolute**, values meeting the criteria will be highlighted **red**.*

*If **Desirable**, values meeting the criteria will be highlighted **orange**.*

Column choice box



List of available design requirement types corresponding to columns in the culvert editor.

Minimum real box

*Minimum threshold value for the designated design requirement type to be applied from. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in the **Cant editor**. This is optional.*

Maximum real box

*Maximum threshold value for the designated design requirement type to be applied to. The value specified will be in the same units as the value specified in **Type**. If a value exceeds this threshold, it will be highlighted in the **Cant editor**. This is optional.*

Comment text box

An optional comment.

Additional tab

Active choice box yes, no

*If **no** then the row will be excluded from the design requirements validation.*

*If **yes** then the row will be included in the design requirements validation.*

Type choice box all culvert types

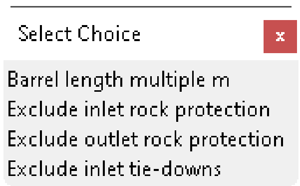
Type of culvert the design requirements are applied to. The Type list will be populated with all pipe and box culvert types configured in the 16.23.5.1 Culvert settings *panel.*

Priority choice box Absolute, Desirable

*If **Absolute**, values meeting the criteria will be highlighted **red**.*

*If **Desirable**, values meeting the criteria will be highlighted **orange**.*

Requirement choice box



A list of available design requirement types.

Value input box

Value to be tested.

For **Requirement** *of type **Barrel length multiple m**, this will test that the **Value** specified can be divided evenly into the barrel length of the culvert.*

For all other **Requirement***, this will test that a specific value does not feature for that specific culvert **Type**.*

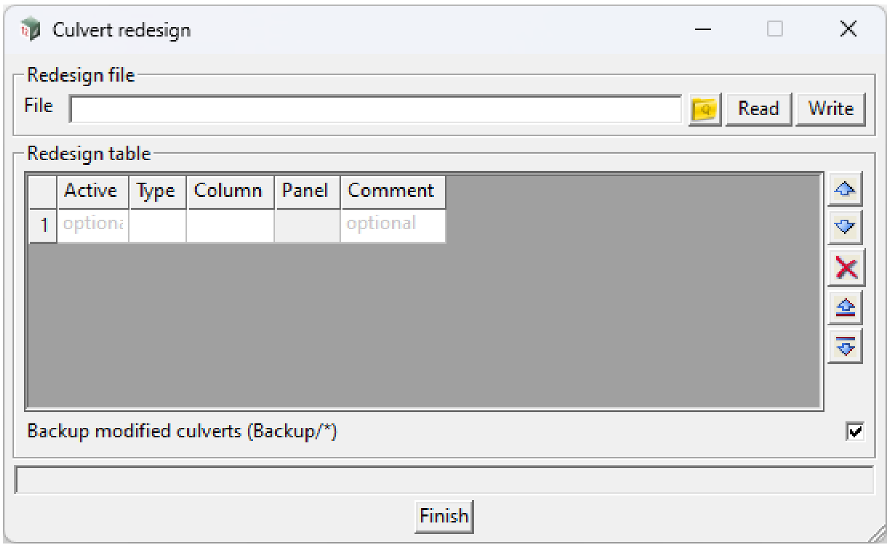
Comment text box

An optional comment.

Continue to 16.23.5.3 Culvert Redesign or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.3 Culvert Redesign

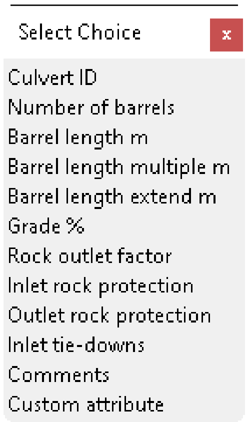
The culvert editor panel allows the user to set culvert ID, culvert type, number of barrels, rock protection details, tie-downs, comments and custom attributes for each culvert bank.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Redesign file			
File	file box		*.12drcr files
File to store the auto redesign settings.			
Read	button		
Reads a auto redesign file.			
Write	button		
Writes a auto redesign file to the filename **File**.			
Redesign table			
Active	choice box		yes, no
*If **no** then the row is excluded from the auto redesign process.* *If **yes** then the row is included in the auto redesign process.*			
Type	choice box		all culvert types
*The type of culvert that is specified as a pipe or box culvert **Type** in the* 16.23.5.1 Culvert settings *panel.*			

Column choice box



A list of available auto redesign types corresponding to columns in the culvert editor.

Panel attributes box

If a **Type** *and* **Column** *has been selected, then selecting this field will open a custom panel depending on the selection of* **Column**.

Column

Culvert ID ***Prefix*** *A prefix that is concatenated to the* ***Type****.*

Type ***Chainage:*** *The centreline chainage will be used.*

Incremental: *Numbers culvert ID incrementally from 001.*

Number of barrels ***Set number*** *Sets all barrels to a specified value.*

Barrel length m ***From*** *For barrel lengths from a specified value.*

To *For barrel lengths from a specified value.*

Set barrel length m to *Sets the barrel length in metres to a specified value*

Redesign from ***Start****: The start of the culvert remains at its original coordinate and updates to the length are made to the end.*

Centre*: The centre of the culvert remains at its original*

coordinate

and updates to the length are made to the start and end.

End*: The end of the culvert remains at its original coordinate*

and

updates to the length are made to the end.

Barrel length multiple m ***Set length multiple m*** *Sets the barrel length multiple to a specified value.*

Redesign from ***Start****: The start of the culvert remains at its original coordinate and updates to the length are made to the end.*

Centre*: The centre of the culvert remains at its original*

coordinate

and updates to the length are made to the start and end.

End*: The end of the culvert remains at its original coordinate*

and

updates to the length are made to the end.

Rounding ***Floor*** *Round down to the nearest integer.*

	Round	*Round to the nearest integer.*
	Ceiling	*Round up to the nearest integer.*
Barrel length extend m	***Extend***	*Length to extend the culvert type selected.*
	Extend from	***Start****: The start of the culvert remains at its original coordinate and updates to the length are made to the end.*
		Centre*: The centre of the culvert remains at its original*
coordinate		
		and updates to the length are made to the start and end.
		End*: The end of the culvert remains at its original coordinate*
and		
		updates to the length are made to the end.
Grade %	***From***	*For grades from a specified value.*
	To	*For grades to a specified value.*
	Set grade to	*Sets the grade in % to a specified value.*
	Redesign from	***Start****: The start of the culvert remains at its original coordinate and updates to the grade are made to the end..* ***Centre****: The end of the culvert remains at its original*
coordinate		
		and updates to the grade are made to the end
		End*: The end of the culvert remains at its original coordinate*
and		
		updates to the grades are made to the end.
Rock outlet factor	***Set to***	*Sets the rock outlet factor to a specified value.*
Inlet rock protection	***Set to***	*Sets the inlet rock protection to a specified value.*
Outlet rock protection	***Set to***	*Sets the outlet rock protection to a specified value.*
Inlet tie-down	***Set to***	*Sets the inlet tie-downs to a specified value.*
Comments	***Set to***	*Sets the comment to a specified value.*
Custom attribute	***Attribute***	*Name of the attribute.*
	Type	*The type of attribute. The choices are Integer, Real or Text*
	Set Value	*Value of the attribute.*

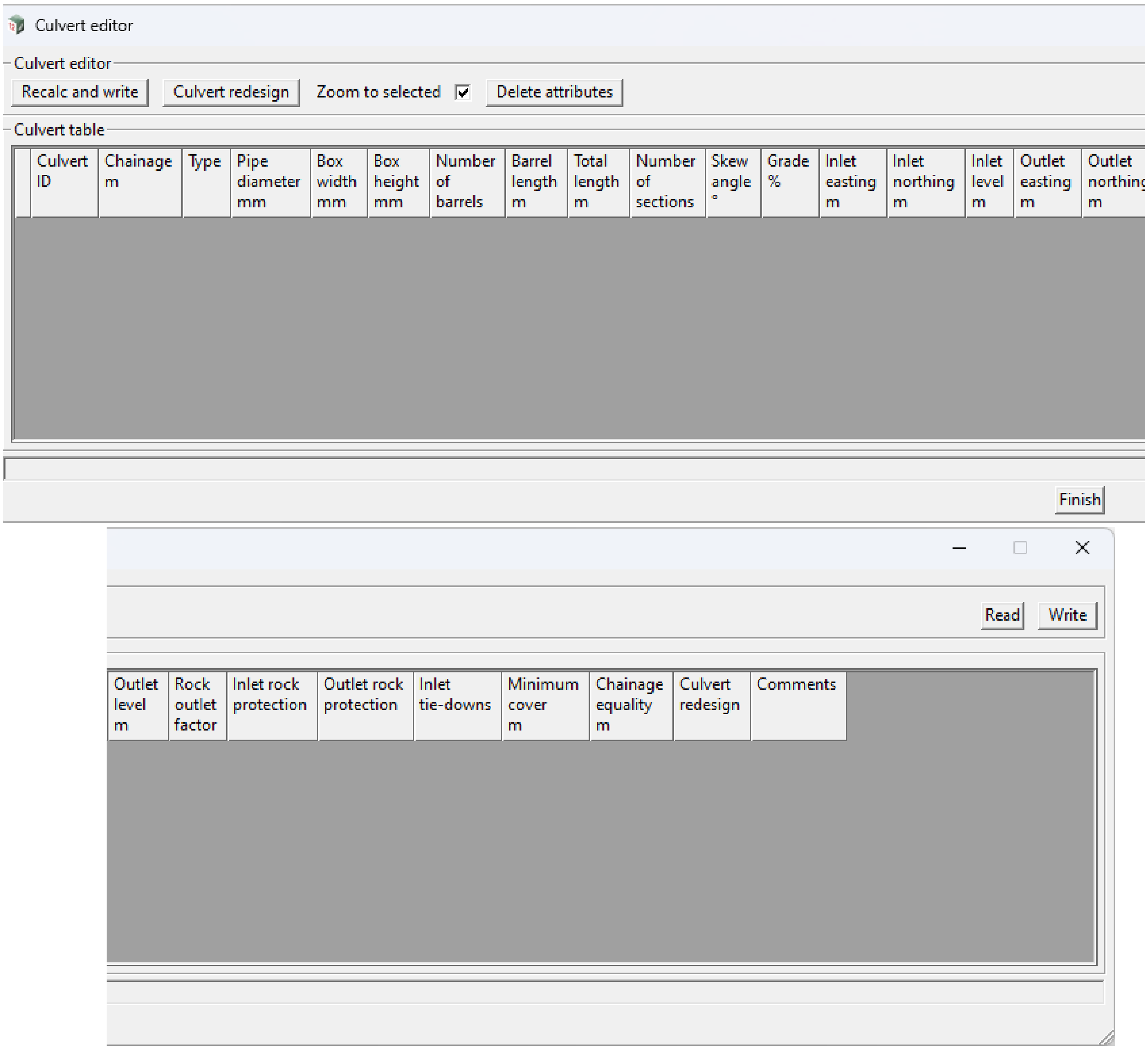
Comment text box

An optional comment.

Continue to 16.23.5.4 Culvert Editor or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.4 Culvert Editor

The culvert editor panel allows the user to set culvert ID, culvert type, number of barrels, rock protection details, tie-downs, and comments for each culvert bank.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Culvert editor

Recalc and write button

*Populates the read-only fields in the table with details from the Culvert centrelines and writes Culvert attributes to all **Culvert centrelines**. If the culverts have not been processed before, or if culvert attributes have been deleted using the **Delete attributes** button, then the Recalc and write button will populate editable fields with the default values specified in the **Settings** panel.*

Culvert redesign button

*Runs the redesign function, changing properties or coordinates of a culvert type or all culverts based on settings in the **Culvert redesign** file.*

Zoom to selected tick box ticked

*When culverts are selected in the **Culvert editor**, the **Culvert centreline** will be highlighted yellow and if a plan view was last selected, then the view will pan to the location of the selected culvert.*

Delete attributes button

*Deletes the Culvert attribute and all of its children for all **Culvert centreline** elements.*

Read button

*Reads Culvert attributes from **Culvert centrelines** and populates the culvert editor table with these values.*

Write button

*Writes Culvert attributes on all **Culvert centrelines** from values listed in the culvert editor table.*

Culvert table

Culvert ID text box

Unique identifier for each culvert bank.

Chainage m real box

*Chainage along the **Design super alignment** where the **Culvert centreline** element is located.*

Type choice box all culvert types

*Type of culvert that is specified as a pipe or box culvert **Type** in the **Settings** panel.*

Pipe diameter mm real box

*For pipe culverts, the diameter of the culvert in millimetres, which is defined in the **Settings** panel.*

Box width mm real box

*For box culverts, the width of the culvert in millimetres, which is defined in the **Settings** panel.*

Box height mm real box

*For box culverts, the height of the culvert in millimetres, which is defined in the **Settings** panel.*

Number of barrels integer box

Number of barrels for each culvert bank.

Barrel length m real box

Length of each culvert for each culvert bank in metres.

Total length m real box

Combined length of all culverts for each culvert bank in metres.

Number of sections real box

*Total number of individual culverts required for the culvert bank if the **Pipe length mm** or **Box length mm** has been defined in the **Settings** panel.*

Skew angle ° real box

*Angle of skew between the direction of the **Design super alignment** and the **Culvert centreline** in degrees.*

Grade % real box

Vertical grade of the culverts in %.

Inlet easting m real box

*x-coordinate of the **Culvert centreline** inlet in metres.*

Inlet northing m real box

*y-coordinate of the **Culvert centreline** inlet in metres.*

Inlet level m real box

*z-coordinate of the **Culvert centreline** inlet in metres.*

Outlet easting m real box

*x-coordinate of the **Culvert centreline** outlet in metres.*

Outlet northing m real box

*y-coordinate of the **Culvert centreline** outlet in metres.*

Outlet level m real box

*z-coordinate of the **Culvert centreline** outlet in metres.*

Rock outlet factor real box

*Factor applied to the rock protection outlet, which is multiplied by either the **Height** or the **Diameter** of the culvert.*

Inlet rock protection choice box all rock protection types

*Type of rock protection applied to the inlet which is defined in the **Settings** panel.*

Outlet rock protection choice box all rock protection types

*Type of rock protection applied to the outlet which is defined in the **Settings** panel.*

Inlet tie-downs input box

Optional field to specify details for inlet tie-downs.

Minimum cover m real box

*Minimum height above each culvert to each formation string if the **Minimum cover** fields **Formation model, Left shoulder name** and **Right shoulder name** have been populated.*

Chainage equality m real box

Equivalent chainage equality if chainage equalities have been enabled and are set up in the 11.3.11.4.4 SA - Chainage Equalities Editor. Chainage equality names should use the equivalent numerical chainage value without alphabetic prefixes or suffixes as this is used in the chainage equality calculation.

Auto redesign choice box include, exclude

*If **exclude** is selected, then this row will be excluded from updates when **Process** is selected in the **Auto redesign** panel.*

*If **include** is selected, then this row will be included in updates when **Process** is selected in the **Auto redesign** panel.*

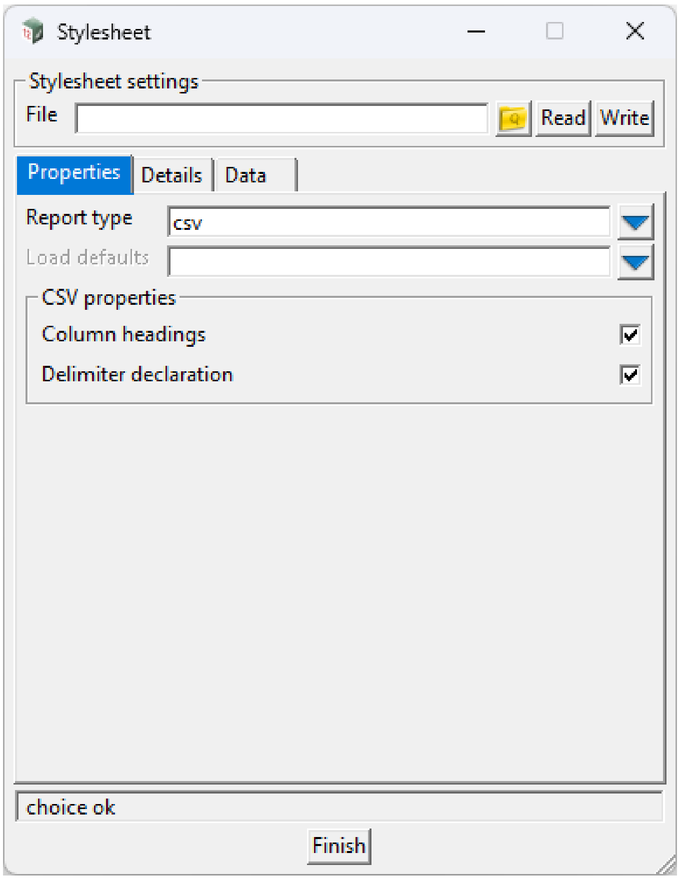
Comment input box

An optional comment.

Continue to 16.23.5.5 12d Culvert Stylesheet or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.5 12d Culvert Stylesheet

Defining the setup for stylesheets used by ***12d Culvert***.



Properties tab
Details tab
Data tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Stylesheet settings			
File	file box		all *.xslt files

Filename to save the generated stylesheet to.

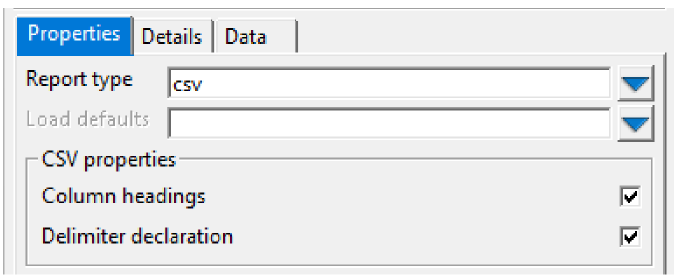
Read	button		

Reads the stylesheet and populates the panel.

Write	button		

Writes the stylesheet file

Properties tab



Report type choice box csv, html, pdf

Type of report to be generated.

*If **csv** (comma-separated values), go to* CSV properties.
*If **html** (Hypertext Markup Language), go to* CSV properties.
*If **pdf** (Portable Document Format), go to* PDF Properties.

Load defaults choice box

??

CSV properties

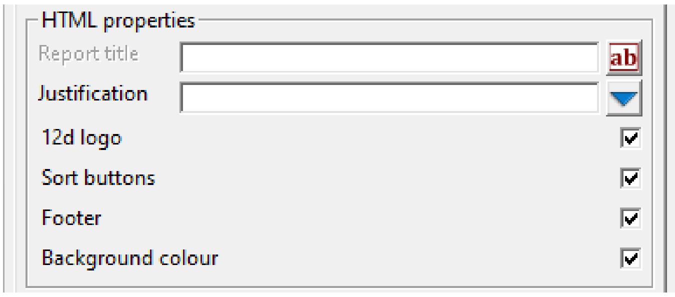
Column headings tick box ticked

If ticked, the column headings will be exported in the report. The column headings are customised in the Data tab in the heading column.

Delimiter declaration tick box ticked

*If **ticked**, the output file will include metadata that identifies the column delimiter, allowing other software to automatically convert the CSV data into columns.*

HTML properties



Report title input box

Text that will feature at the top of the document.

Justification choice box left, center, right

Justification of all text values contained in the table of the document.

12d logo tick box ticked

*If **ticked**, the 12d logo will be added at the top of the document.*

Sort buttons tick box ticked

*If **ticked**, sort buttons will be added between the table headings and data. When the buttons are selected in the document, this will sort all column values.*

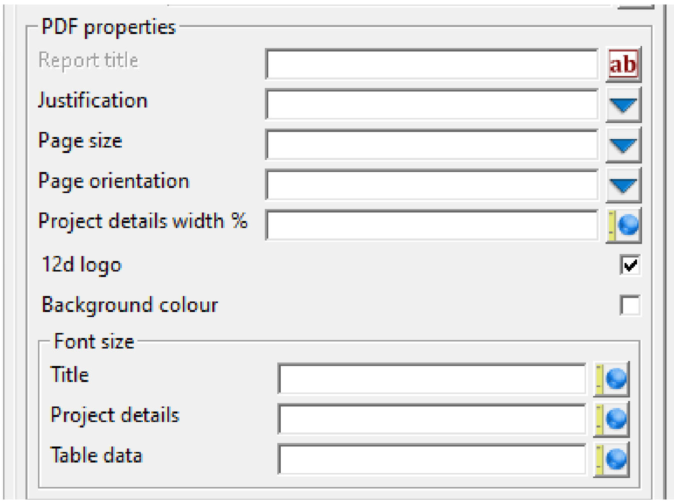
Footer tick box ticked

*If **ticked**, a footer containing the text "Generated by 12d Model at date time" will be added to the bottom of the document.*

Background colour tick box ticked

*If **ticked**, background colours will be applied to table cells.*

PDF properties



Report title nput box

Text that will feature at the top of the document.

Justification choice box left, center, right

Justification of all text values contained in the table of the document.

Page size choice box A1, A3, A4

Sheet size of the document.

Page orientation choice box Landscape, Portrait

Orientation of the document.

Project details width % real box

Width as a percentage of the overall sheet width for the project details headings.

12d logo tick box ticked

*If **ticked**, the 12d logo will be added at the top of the document.*

Background colour tick box not ticked

*If **ticked**, grey colours will be applied to the background in the table of the document.*

Font size

Title real box

Font size of the title text located at the top of the document.

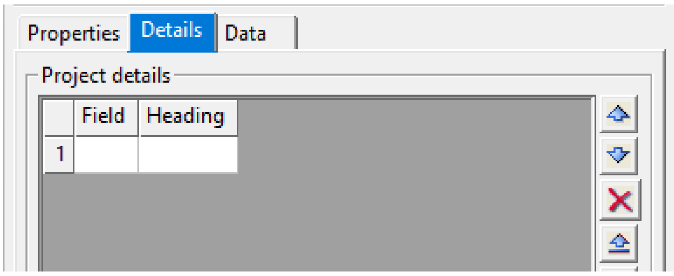
Project details real box

Font size of the project details text located above the table in the document.

Table data real box

Font size of the text inside the table in the document.

Details tab



Properties tab
Details tab
Data tab

Project details

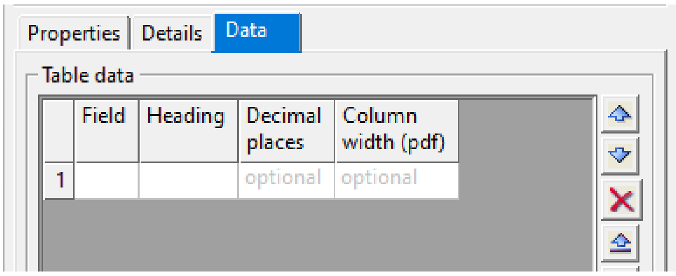
Field choice box

This field that will be included in the project details.
The choices include: project_name, project_folder, user, export_time_date, function_name, design_alignment, model_culvert_cl, settings, minimum_cover_model, stylesheet, and report_filename.

Heading text box

Heading for each project detail, which is shown at the left side of each value in bold font type.

Data tab



Properties tab
Details tab
Data tab

Table data

Field custom box

Name of the xml node to add as a column in the report.
When right mouse button is selected the following options are displayed: culvert_ID, chainage, ch_equality, culvert_type, diameter, class, profile, wall_thickness, width, height, num_barrels, barrel_length, total_length, num_sections, skew_angle, grade, inlet_easting, inlet_northing, inlet_level, outlet_easting, outlet_northing, outlet_level, rock_inlet_protect, rock_inlet_length, rock_inlet_width, rock_inlet_area, rock_inlet_volume, rock_outlet_protect, rock_outlet_length, rock_outlet_width, rock_outlet_area, rock_outlet_volume, inlet_tie_downs, min_cover, sa_easting, sa_northing, sa_level, section_length, separation, left_thickness, right_thickness, top_thickness, bottom_thickness, inlet_top, inlet_soffit, inlet_invert, inlet_bottom, outlet_top, outlet_soffit, outlet_invert, outlet_bottom, rock_inlet_factor, rock_outlet_factor, comment.

Heading text box

Heading text shown for each column.

Decimal places choice box 0, 1, 2, 3, 4, 8

Number of decimal places for each value in the table.

Column width (pdf) text box

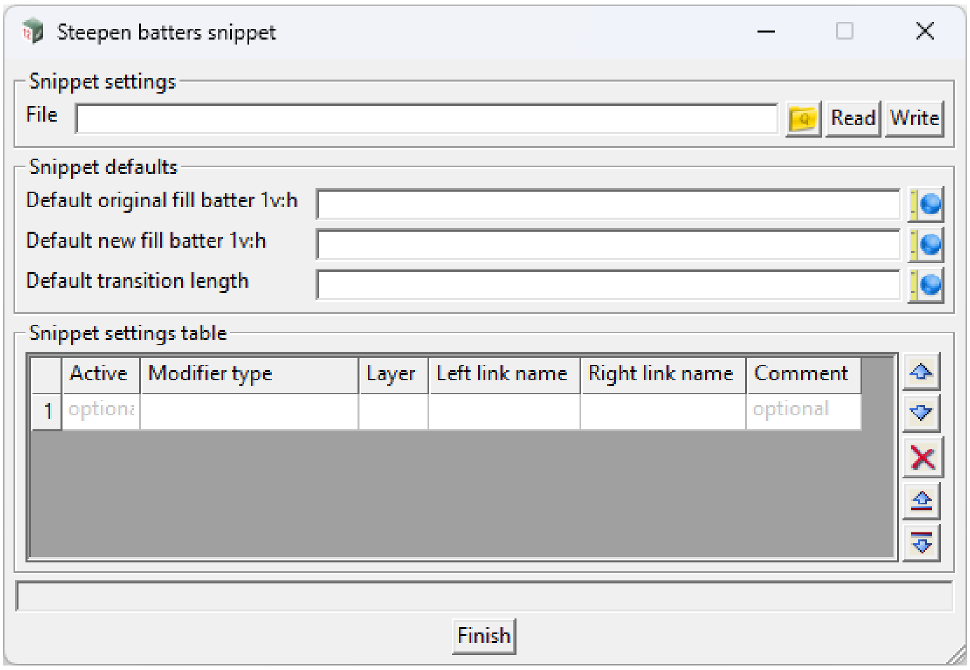
An override to the width of each column.
Values can be absolute or relative units and should be suffixed with one of the following abbreviations:

cm: centimetres; mm: millimetres; in: inches; pt: points; pc: picas; px: pixels; %: percentage relative to the table width; em: relative to the font size; ex: relative to the height of the current font. For example 10% or 20mm.

Continue to 16.23.5.5 12d Culvert Stylesheet or return to 16.23.5 12d Culverts or 16.23 Track.

16.23.5.6 12d Culvert Steepen Batter Snippet

The **Steepen Batters Snippet** panel contains settings used to build a snippet file to steepen formation batters.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Snippet settings

File file box *.12drcb files

File to store the steepen batters settings.

Read button

Reads the steepen batters settings file.

Write button

Writes the steepen batters settings file.

Snippet defaults

Default original fill batter 1v:h real box

*Original fill batter applied to the formation batters where culverts are not placed. Used exclusively when **Modifier type** Template/Final/Fill slope is used.*

Default new fill batter 1v:h real box

New fill batter applied to the formation batters where culverts are placed.

Default transition length real box

Transition length from the original fill batter to the new fill batter.

Snippet settings table

Active choice box yes, no

*If **no** then the row is excluded from the steepen batter settings validation.*
*If **yes** then the row is included in the steepen batter settings validation.*

Modifier type input box

The type of MTF modifier type for the desired link to change the slope or xfall at each culvert.

Fixed	***Modify Xfall Hold Height***	*Link to be modified is a fixed insert link with height and xfall specified.*
	Modify Xfall Hold Width	*Link to be modified is a fixed insert link with width and xfall specified.*
	Interface to tin	*Link to be modified is a fixed interface to tin.*
Template/Final	***Fill slope***	*Link to be modified is a final fill slope.*

Layer text box

Layer name that the link to modify was created. For example, the default design layer is named ***Design****.*

Left link name name box available names

Link name to modify for the left side of the MTF.

Right link name name box available names

Link name to modify for the right side of the MTF.

Comment text box

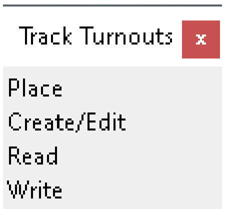
An optional comment.

Continue to 16.23.6 Track Turnouts or return to 16.23 Track.

16.23.6 Track Turnouts

Position of menu: **Design =>Track =>Turnouts**

The **Track Turnouts** walk-right menu is



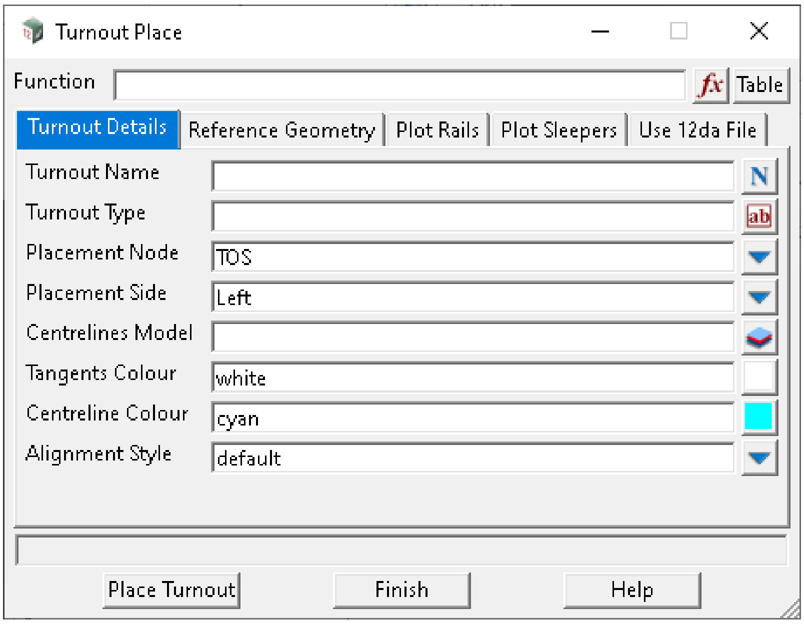
See
16.23.6.1 Turnout Place
16.23.6.2 Turnouts Create/ Edit
16.23.6.3 Read Turnouts
16.23.6.4 Write Turnouts File

16.23.6.1 Turnout Place

Position of option on menu: **Design =>Track =>Turnouts => Place**

The ***Turnout Place*** panel can generate rails, sleepers, and centrelines, and place elements from a 12da file of a turnout with a variety of placement modes.

Selecting **Place** displays the **Turnout Place** panel.



Turnout Details Tab
Reference Geometry Tab
Plots Rail Tab
Plots Sleepers Tab
Use 12da File Tab

The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Function | function box | | all function

Name of the function.

Table | button

*The table displays a panel containing a grid box of all **Turnout Place** functions where a function can be selected and loaded.*

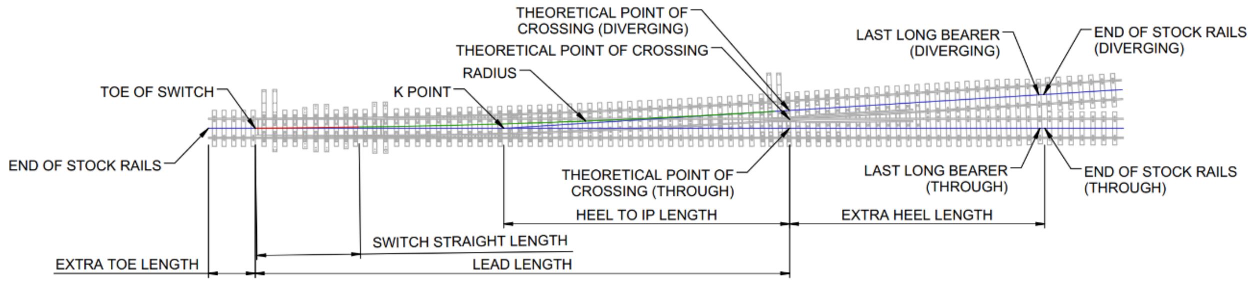
Turnout Details Tab

Turnout Name | name box | | available names

Name of the turnout to be placed.

Turnout Type | custom box | | all turnouts

Selecting the Turnout Type button opens a panel and a list of turnout types that have either been imported by 16.23.6.3 Read Turnouts *or created in* 16.23.6.2 Turnouts Create/ Edit.



Placement Node	choice box	TOS	Front End, TOS, TPC Main, TPC Loop, K Main, K Loop, Back Main, Back Loop

*If **Front End** is selected, the turnout will be placed from the end of stock rails on the facing direction side of the turnout.*

*If **TOS** is selected, the turnout will be placed from the Toe of Switch (TOS).*

*If **TPC Main** is selected, the turnout will be placed from the Theoretical Point of Crossing (TPC) on the through track.*

*If **TPC Loop** is selected, the turnout will be placed from the Theoretical Point of Crossing (TPC) on the diverging track. Note: If **Reference Type Fx line point & direction** is selected in the **Reference Geometry** tab, then the **Bearing** value will be set for the diverging track.*

*If **K Main** is selected, the turnout will be placed from the K Point, which is the intersection point of the through and diverging track. Note: If **Reference Type Fx line point & direction** is selected in the **Reference Geometry** tab, then the **Bearing** value will be set for the through track.*

*If **K Loop** is selected, the turnout will be placed from the K Point, which is the intersection point of the through and diverging track. Note: If **Reference Type Fx line point & direction** is selected in the **Reference Geometry** tab, then the **Bearing** value will be set for the diverging track.*

*If **Back Main** is selected, the turnout will be placed from the end of stock rails on the through track.*

*If **Back Loop** is selected, the turnout will be placed from the end of stock rails on the diverging track.*

Centrelines Model	model box		available models

Model that the centrelines will be generated onto.

Tangents Colour	colour box	white	available colours

Colour that the tangents elements will be coloured.

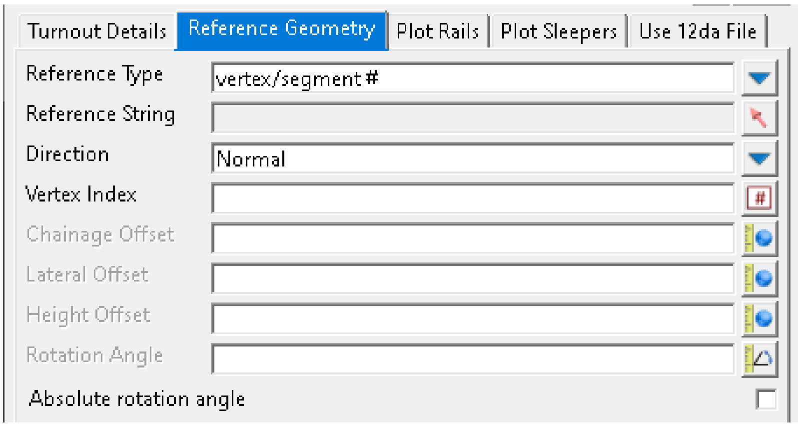
Centreline Colour	colour box	cyan	available colours

Colour that the centreline elements will be coloured.

Alignment Style	style box	default	alignment styles

Alignment style applied to the super alignment that is generated for the diverging track.

Reference Geometry Tab



Turnout Details Tab
Reference Geometry Tab
Plots Rail Tab
Plots Sleepers Tab
Use 12da File Tab

Reference Type choice box unknown turnout types

*Specifies which method for placement of the turnout. The options are **Fx line point & direction**, **tag origin**, **vertex/segment #**, **at chainage**, **dropped point**, and **dropped tag**.*

Reference String select box

String that the turnout will be placed along.

Direction choice box Normal Normal, Reverse

The direction that the turnout will be placed.

*If **Normal** is selected then the turnout will be placed in the direction of increasing chainage of the Reference String.*

*If **Reverse** is selected then the turnout will be placed in the direction of decreasing chainage of the Reference String.*

Point xyz box

*Field displayed when **Fx line point & direction** is selected as the **Reference Type**.*
The coordinate at which the turnout is to be placed.

Bearing angle box

*Field displayed when **Fx line point & direction** is selected as the **Reference Type**.*
The horizontal bearing at which the turnout is to be angled.

Grade real box

*Field displayed when **Fx line point & direction** is selected as the **Reference Type**.*
*The absolute vertical grade of the turnout strings that are generated. The grade is calculated from the **Placement Node** in the Turnout Details tab.*

Tag Name tag box all tags

*Field displayed when **tag origin** is selected as the **Reference Type**.*
*The tag name to retrieve the origin point at which the turnout is to be positioned. **Note: This feature has not been implemented yet.***

Vertex Index integer box

*Field displayed when **vertex/segment** # is selected as the **Reference Type**.*
*The vertex number of the **Reference String** at which the turnout is to be positioned.*

Chainage real box

*Field displayed when **at chainage** is selected as the **Reference Type**.*

*The chainage of the **Reference String** at which the turnout is to be positioned.*

Drop Point xyz box

*Field displayed when **dropped point** is selected as the **Reference Type**.*

The location on the Reference String perpendicular to the drop point coordinate at which the turnout is to be positioned.

Tag Name tag box all tags

*Field displayed when **dropped tag** is selected as the **Reference Type**.*

*The tag name to retrieve the tag location at which the turnout is to be positioned. **Note: This feature has not been implemented yet.***

Chainage Offset real box

*For the final turnout placement location, the value of **Chainage Offset** is added to the chainage of the turnout placement point along the **Reference String**.*

Lateral Offset real box

*The horizontal offset distance away from the **Reference String** at which the turnout is to be positioned.*

Height Offset real box

*The vertical offset distance away from the **Reference String** at which the turnout is to be positioned.*

Rotation Angle real box

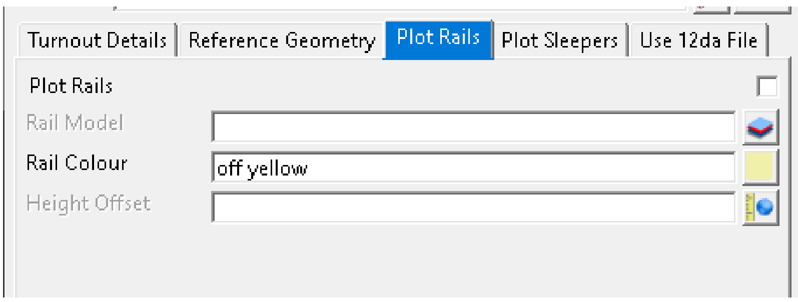
*For the final turnout rotation angle, the value of **Rotation Angle** is added to the rotation of the turnout of the **Reference String**.*

Absolute rotation angle tick box not ticked

*If **ticked**, the turnout rotation angle will be set by the **Rotation Angle**.*

*If **not ticked**, the Rotation Angle value will be added relative to the **Reference String** angle.*

Plots Rail Tab



Turnout Details Tab
Reference Geometry Tab
Plots Rail Tab
Plots Sleepers Tab
Use 12da File Tab

Plot Rails tick box not ticked

*If **ticked**, rails will be generated for the turnout.*

Rail Model model box available models

Name of the model that the rails will be generated onto.

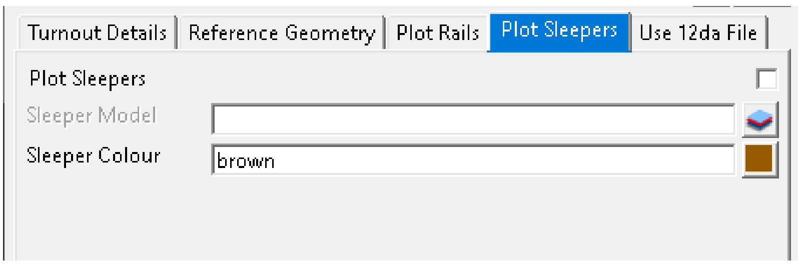
Rail Colour colour box off yellow available colours

Colour that the rails will be coloured.

Height Offset real box

The vertical offset distance that the rails will be generated.

Plots Sleepers Tab



Turnout Details Tab
Reference Geometry Tab
Plots Rail Tab
Plots Sleepers Tab
Use 12da File Tab

Plot Sleepers tick box not ticked

*If **ticked**, sleepers will be generated for the turnout.*

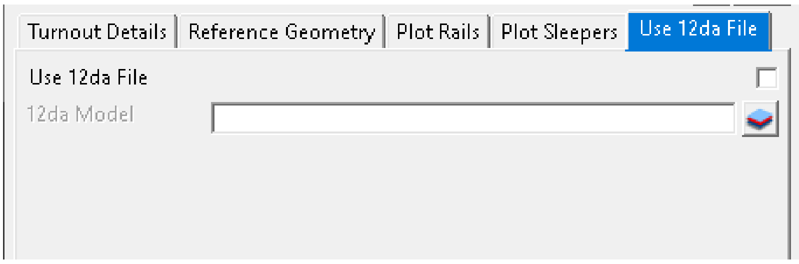
Sleeper Model model box available models

Name of the model that the sleepers will be generated onto.

Sleeper Colour colour box brown available colours

Colour that the sleepers will be coloured.

Use 12da File Tab



[Turnout Details Tab]
[Reference Geometry Tab]
[Plots Rail Tab]
[Plots Sleepers Tab]
[Use 12da File Tab]

Use 12da File tick box not ticked

*If **ticked**, elements in the 12da file will be used to generate additional elements for the turnout. **Note: This feature has not been implemented yet.***

12da Model model box available models

*Model that the 12da elements will be generated onto. **Note: This feature has not been implemented yet.***

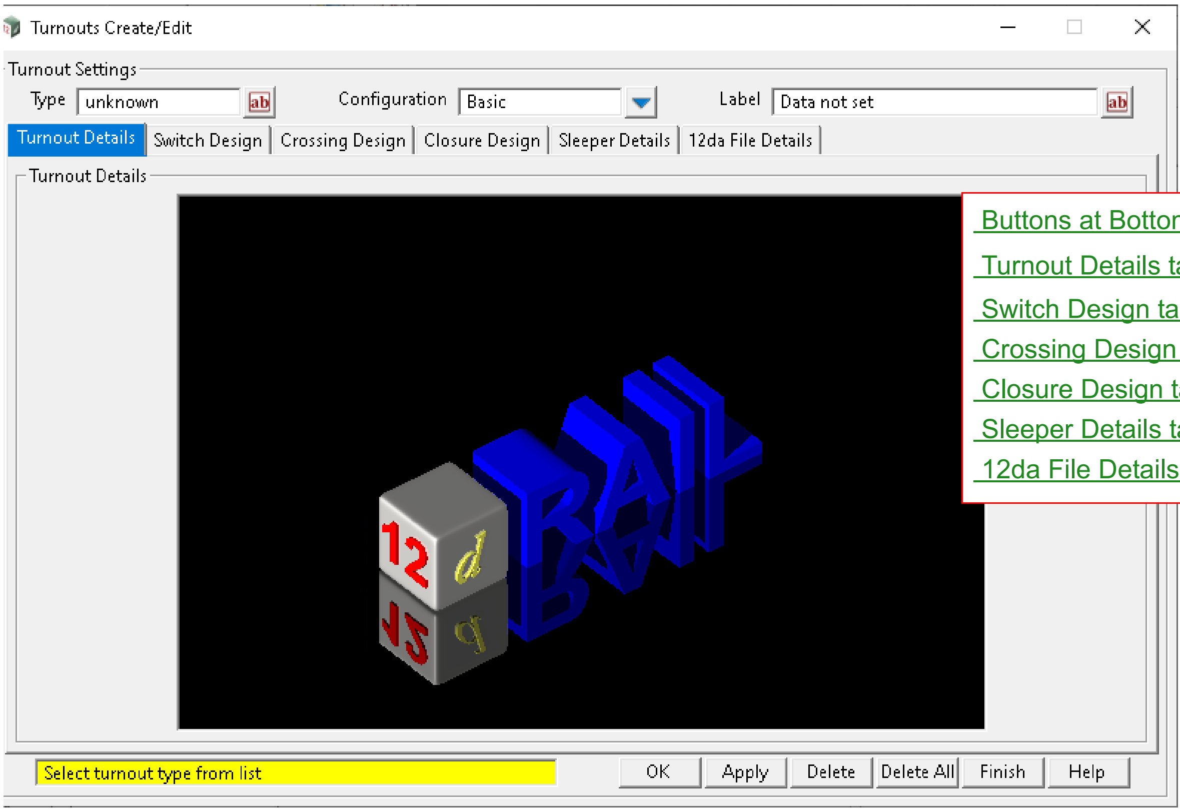
Continue to 16.23.6.2 Turnouts Create/ Edit or return to 16.23 Track.

16.23.6.2 Turnouts Create/ Edit

Position of option on menu: **Design =>Track =>Turnouts =>Create/Edit**

The **Turnout Create/Edit** panel enables the creation or modification of turnout types that can be generated onto a location with 16.23.6.1 Turnout Place.

Selecting Create/Edit displays the **Turnout Create/Edit** panel.



Buttons at Bottom
Turnout Details tab
Switch Design tab
Crossing Design tab
Closure Design tab
Sleeper Details tab
12da File Details tab

Buttons at Bottom

Ok button

*Saves the turnout parameters into the currently selected turnout **Type** and closes the panel.*

Apply button

*Saves the turnout parameters into the currently selected turnout **Type**.*

Delete button

*Deletes the currently selected turnout **Type**.*

Delete All button

Deletes all turnout types that are in the current 12d project.

Turnout Details tab

Turnout details

Type custom box all turnout types

Selecting the Type field opens a panel where the following functions are available:

***Select** button: Selecting a turnout type and then clicking the Select button loads that turnout type.*

***Sameas** button: Selecting an element of a turnout that has previously been placed with 16.23.6.1*

Turnout Place *loads that turnout type.*

New *button: A new turnout type can be created.*

Configuration choice box basic all configuration types

Turnout configuration consists of the following choices: ***Basic***, ***Catchpoint***, ***Tangential***, *various Dual Gauge configurations and* ***from library file***.

Basic*: A basic turnout is generated using the switch angle and simple lengths along the tangents.*

Catchpoint*: A catchpoint is generated using simple lengths along the* ***Reference String***.

Tangential*: A tangential turnout is generated using the switch angle and simple lengths along the tangents. The turnout radius is tangential to the* ***Reference String***.

Dual Gauge*: A Dual Gauge turnout is generated using the switch angle and simple lengths along the tangents.*

From library file*: Note: This feature has not been implemented yet.*

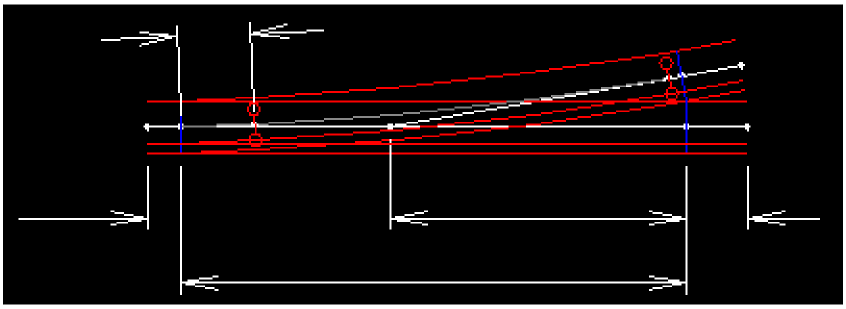
Label custom box

A label that is displayed as the turnout heading at the top of the Turnout Details window.

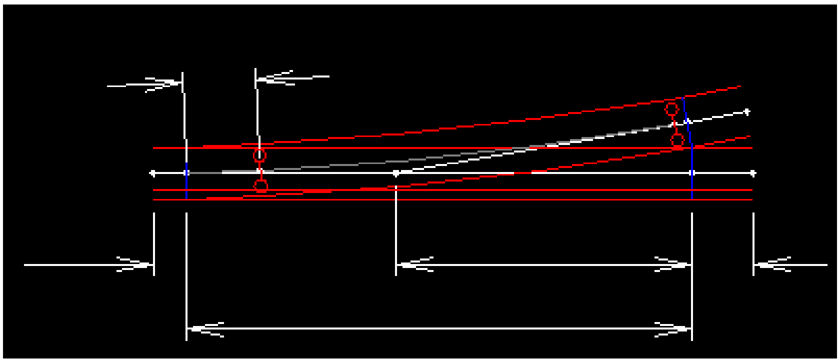
Types of Dual Gauge Configurations

Configuration	Common rail side	Through track	Diverging track
Dual_Gauge_A	Diverging	Dual gauge	Dual gauge
Dual_Gauge_B	Diverging	Dual gauge	Wider
Dual_Gauge_C	Diverging	Wider	Dual gauge
Dual_Gauge_D	Diverging	Dual gauge	Narrower
Dual_Gauge_E	Diverging	Narrower	Dual gauge
Dual_Gauge_F	Diverging	Wider	Narrower
Dual_Gauge_G	Diverging	Narrower	Wider
Dual_Gauge_H	Through	Dual gauge	Dual gauge
Dual_Gauge_I	Through	Dual gauge	Wider
Dual_Gauge_J	Through	Wider	Dual gauge
Dual_Gauge_K	Through	Dual gauge	Narrower
Dual_Gauge_L	Through	Narrower	Dual gauge
Dual_Gauge_M	Through	Wider	Narrower
Dual_Gauge_N	Through	Narrower	Wider

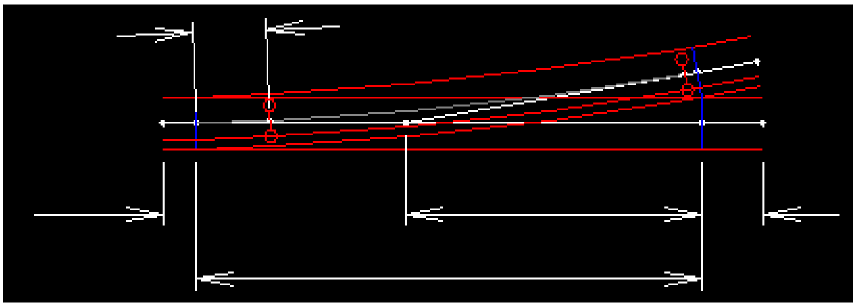
Dual_Gauge_A: *Common rail on the diverging side. Both tracks are dual gauge.*



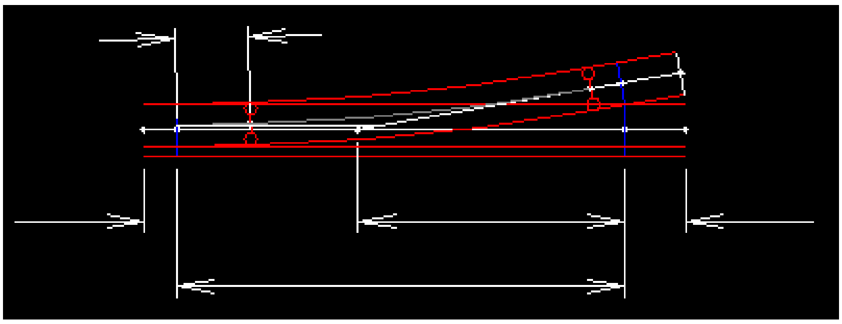
Dual_Gauge_B: *Common rail on the diverging side. Through track is dual gauge. Diverging track is wider gauge.*



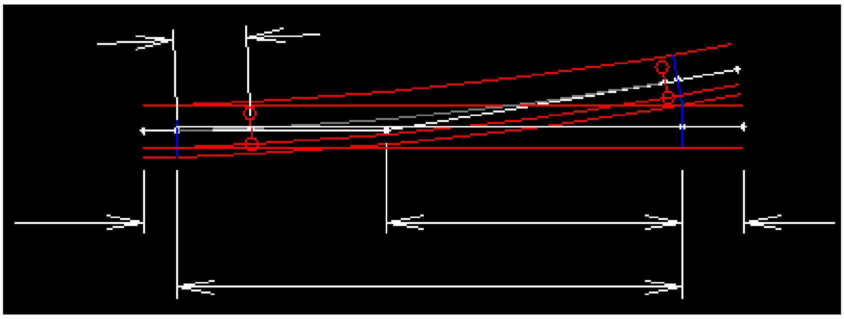
Dual_Gauge_C: *Common rail on the diverging side. Through track is wider gauge. Diverging track is dual gauge.*



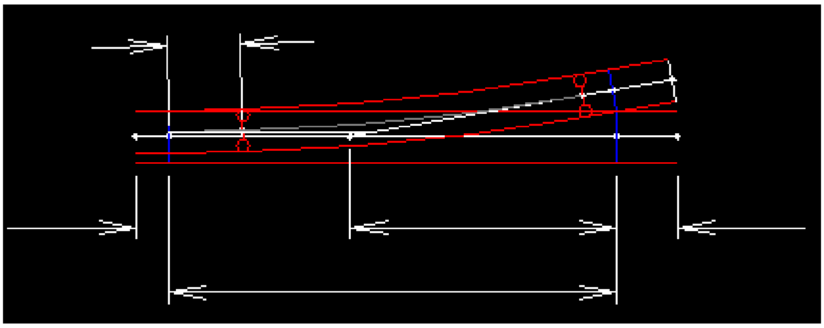
Dual_Gauge_D: *Common rail on the diverging side. Through track is dual gauge. Diverging track is narrower gauge.*



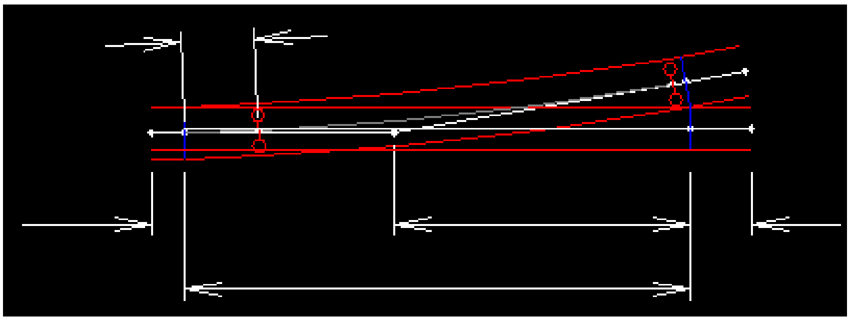
Dual_Gauge_E: *Common rail on the diverging side. Through track is narrower gauge. Diverging track is dual gauge.*



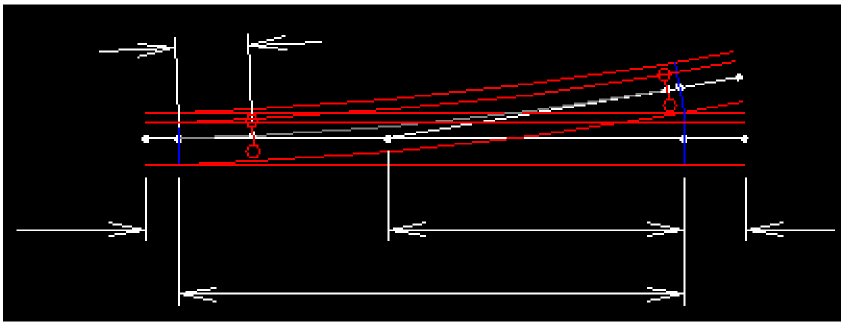
Dual_Gauge_F: *Common rail on the diverging side. Through track is wider gauge. Diverging track is narrower gauge.*



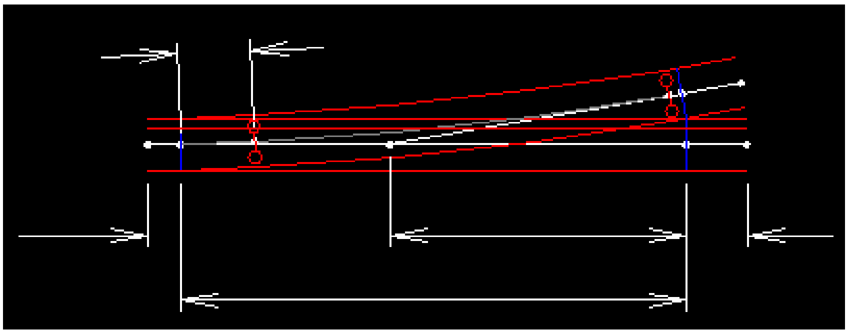
Dual_Gauge_G: *Common rail on the diverging side. Through track is narrower gauge. Diverging track is wider gauge.*



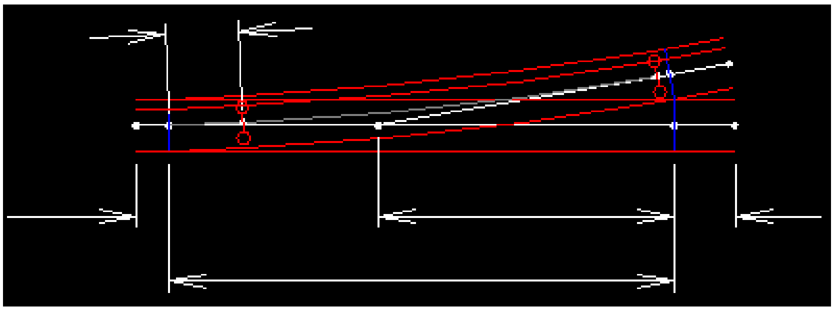
Dual_Gauge_H: *Common rail on the through side. Both tracks are dual gauge.*



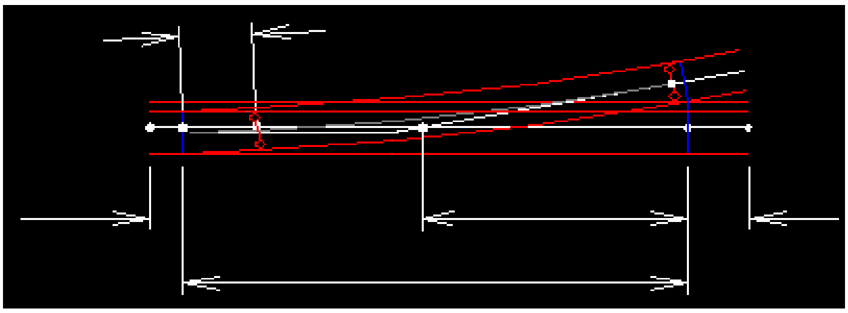
Dual_Gauge_I: *Common rail on the through side. Through track is dual gauge. Diverging track is wider gauge.*



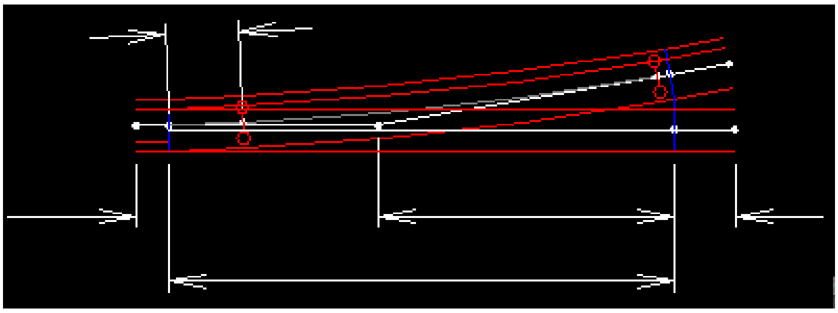
Dual_Gauge_J: *Common rail on the through side. Through track is wider gauge. Diverging track is dual gauge.*



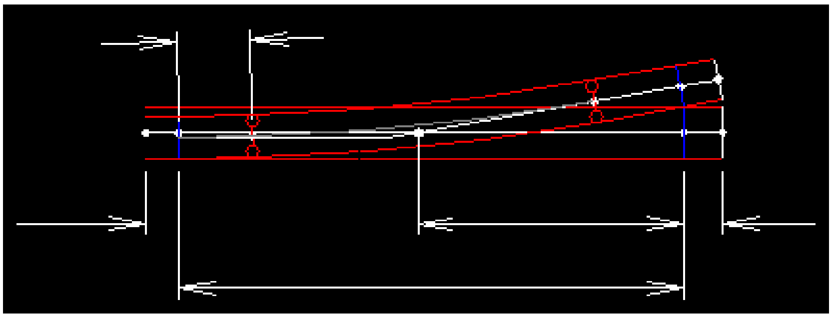
Dual_Gauge_K: *Common rail on the through side. Through track is dual gauge. Diverging track is narrower gauge.*



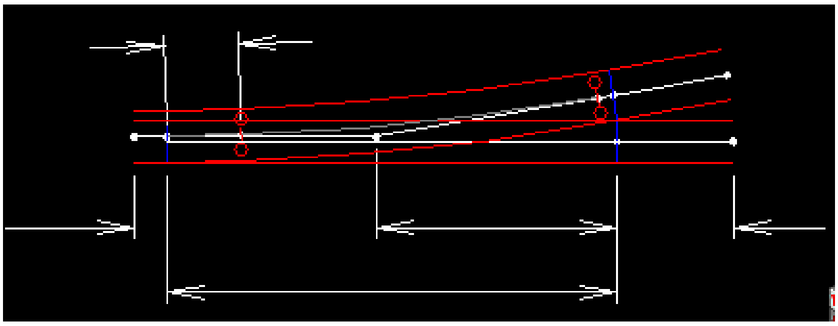
Dual_Gauge_L: *Common rail on the through side. Through track is narrower gauge. Diverging track* *is dual gauge.*



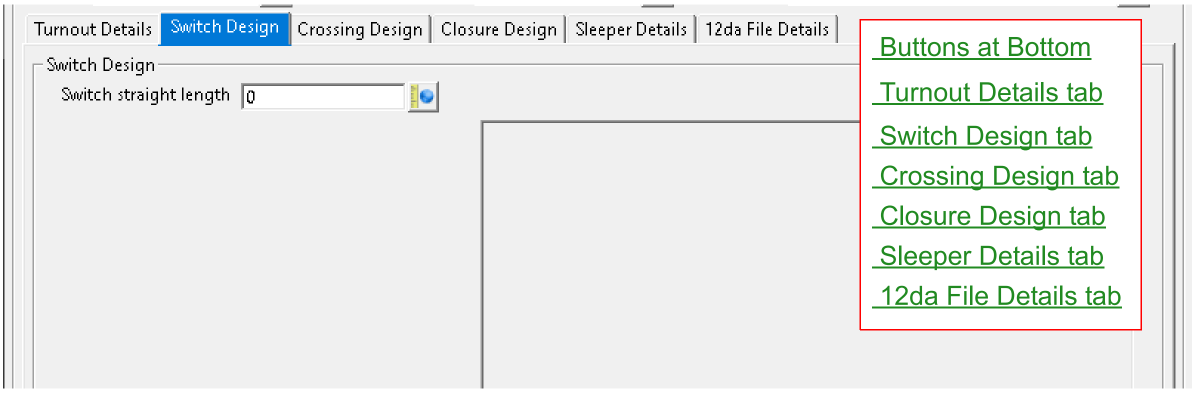
Dual_Gauge_M*: Common rail on the through side. Through track is wider gauge. Diverging track is narrower gauge.*



Dual_Gauge_N*: Common rail on the through side. Through track is narrower gauge. Diverging track is wider gauge.*



Switch Design tab

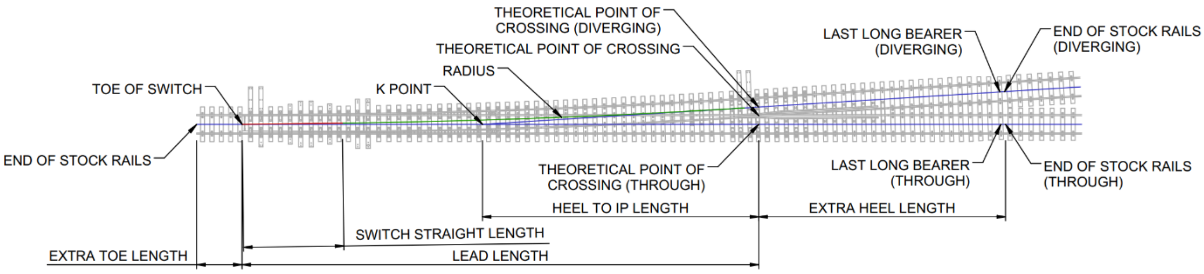


Buttons at Bottom
Turnout Details tab
Switch Design tab
Crossing Design tab
Closure Design tab
Sleeper Details tab
12da File Details tab

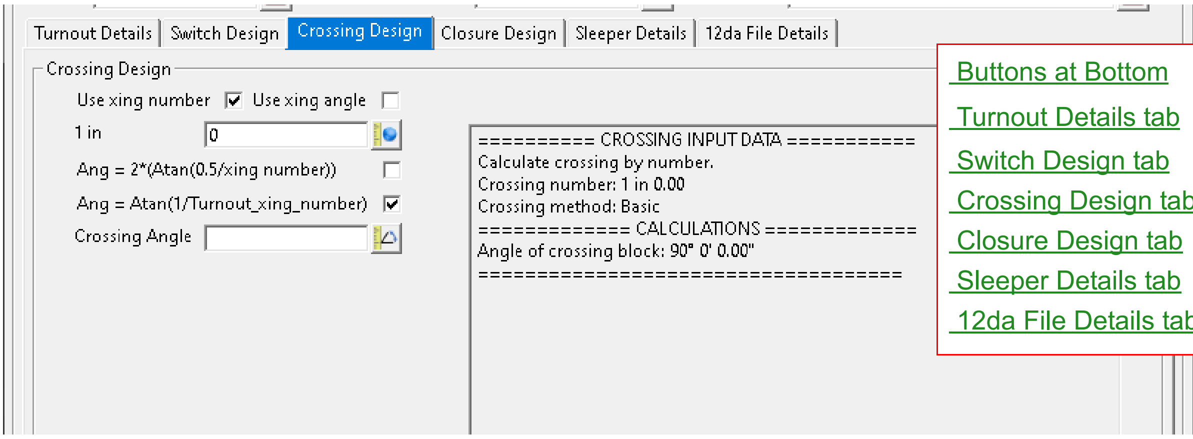
Switch straight length real box 0

*If **Configuration** field is set to **Catchpoint**: The length of the straight part of the switch rail.*

*If **Configuration** field is set to any other configuration: The length of the straight part of the turnout centreline. This straight floats off the end of the **Reference String** at the toe of switch and the angle is adjusted until a free arc of the turnout radius is tangential with the loop tangent.*



Crossing Design tab



Buttons at Bottom
Turnout Details tab
Switch Design tab
Crossing Design tab
Closure Design tab
Sleeper Details tab
12da File Details tab

Use xing number tick box ticked

Specify the turnout crossing angle as a ratio 1 in x.

Use xing angle tick box not ticked

Specify the turnout crossing angle in degrees.

1 in real box 0

Value of the turnout crossing angle as a ratio 1 in x.

Ang = 2*(Atan(0.5/xing number) tick box not ticked

Standard method for calculating the crossing angle in degrees from a ratio.

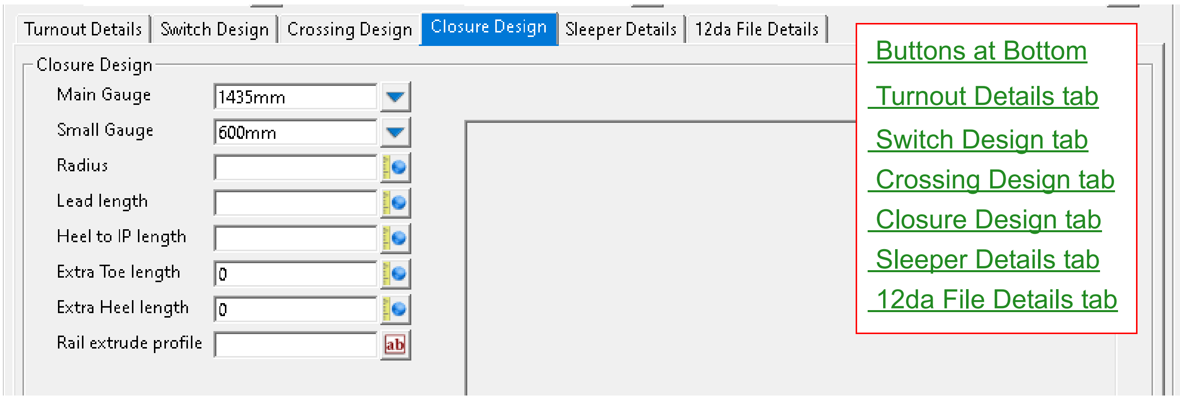
Ang = Atan(1/Turnout_xing number) tick box ticked

Modified method for calculating the crossing angle in degrees from a ratio.

Crossing Angle angle box

Value of the turnout crossing angle in degrees. The Angular system is controlled by the Project Settings. Refer to 6.8.2.4 System Settings *to change to another angular system.*

Closure Design tab



Buttons at Bottom
Turnout Details tab
Switch Design tab
Crossing Design tab
Closure Design tab
Sleeper Details tab
12da File Details tab

Main Gauge choice box 1435mm all gauges

Railway track gauge which is the minimum distance between two rails.

Small Gauge choice box 600mm all gauges

For dual gauge turnouts the smaller railway track gauge.

Radius real box

Radius of the centreline of the turnout leg.

Lead length real box

Length from the Toe of the Switch to the Theoretical Point of Crossing.

Heel to IP length real box

Non-editable, information field for the distance between the heel and the intersection point, or the distance between K point and the theoretical point of crossing.

Extra Toe length real box 0

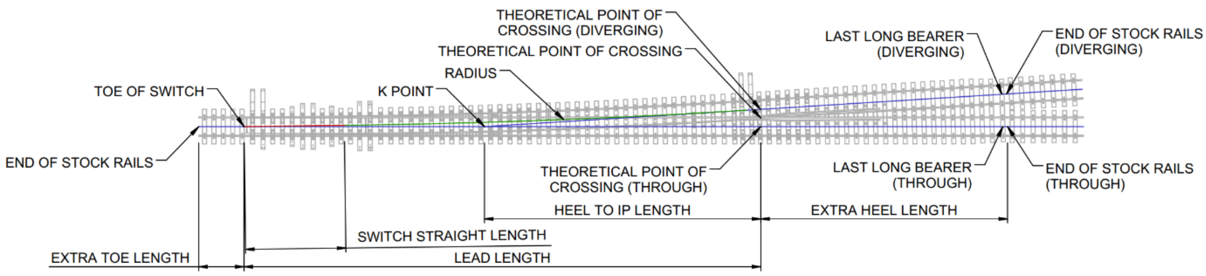
Distance from the Toe of the Switch to front end of the rails at the toe of the turnout. This is also the distance between the Front End and the TOS nodes.

Extra Heel length real box 0

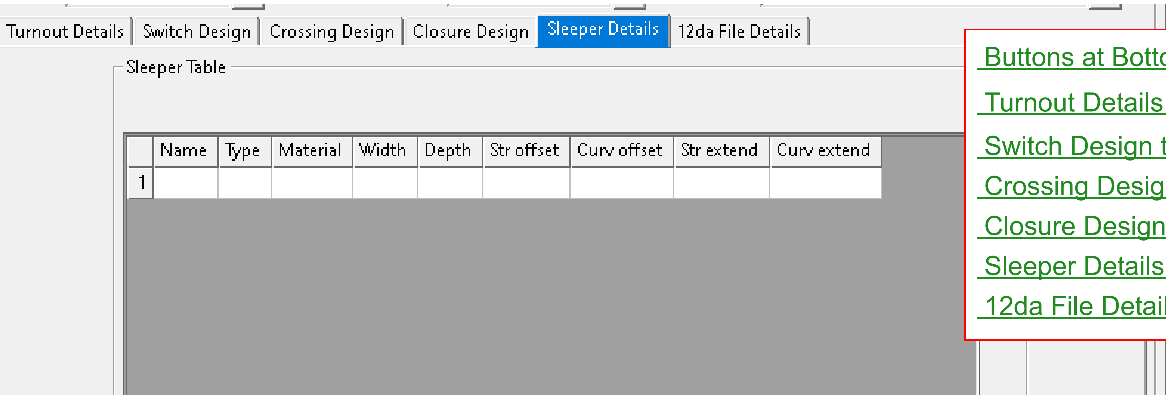
Distance from the Theoretical Point of Crossing to the back end of the turnout rails.

Rail extrude profile custom box all profiles

A rail profile can be selected to generate three-dimensional rails that can be displayed in perspective views.



Sleeper Details tab



Buttons at Bottom
Turnout Details tab
Switch Design tab
Crossing Design tab
Closure Design tab
Sleeper Details tab
12da File Details tab

Name name box available names

Name for the sleeper element.

Type text box

Type of sleeper.

Material choice box

The sleeper material. The material field contains the following choices: Timber, Concrete and Steel.

Width real box

Width of the sleeper.

Depth real box

Depth of the sleeper.

Str offset real box

Longitudinal distance between the Toe of Switch (TOS) and the centre of the sleeper on the through side.

Curv offset real box

Longitudinal distance between the Toe of Switch (TOS) and the centre of the sleeper on the diverging side.

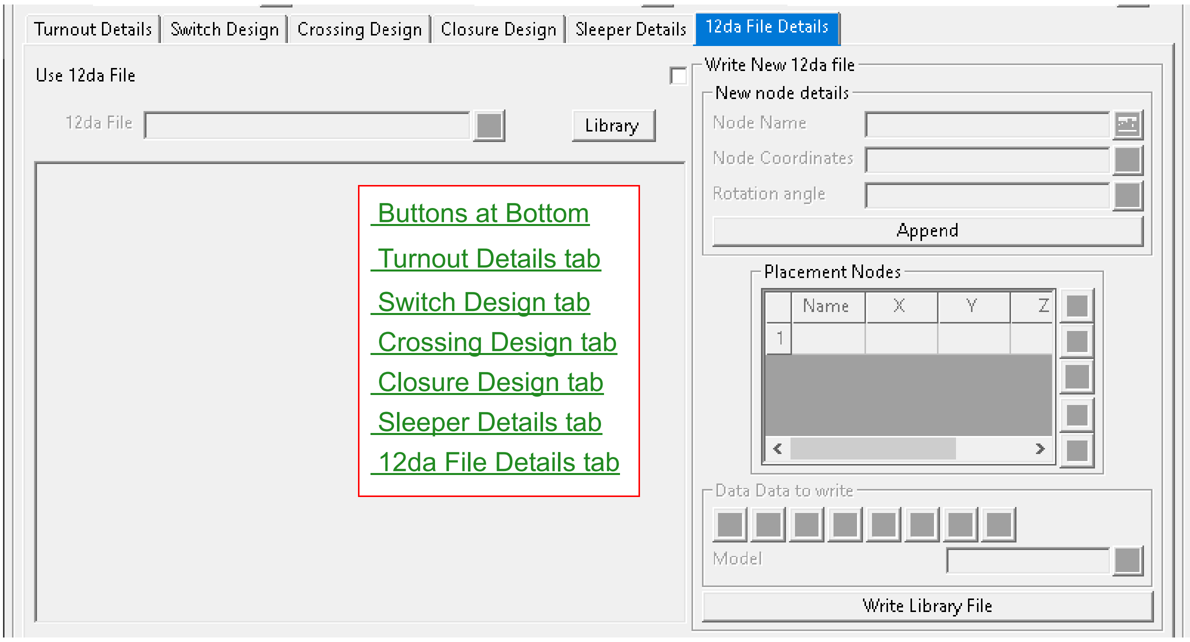
Str extend real box

Offset distance from the running rail to the end of sleeper on the through side.

Curv extend real box

Offset distance from the running rail to the end of sleeper on the diverging side.

12da File Details tab



Use 12da File tick box not ticked

*If **ticked**, a 12da file is used. **Note: This feature has not been implemented yet.***

12da File file box *.12da files

Filename of the 12da file to import.

Library button

*Opens a panel containing 12da files that can be previewed and selected. **Note: This feature has not been implemented yet.***

New node details

Node Name button

Placement node name.

Node Coordinates xyz box

Location of the placement node.

Rotation angle angle box

Angle of the placement node.

Append angle box

*Adds the fields from the **New node details** to the **Placement Nodes** table.*

Data to write source box

Data selection type - for a full description go to 3.26.3 Data Source.

Write Library File button

*Writes a 12da file with the elements selected in the **Data to write** field and information in the Placement Nodes table. **Note: This feature has not been implemented yet.***

Continue to 16.23.6.3 Read Turnouts or return to 16.23 Track.

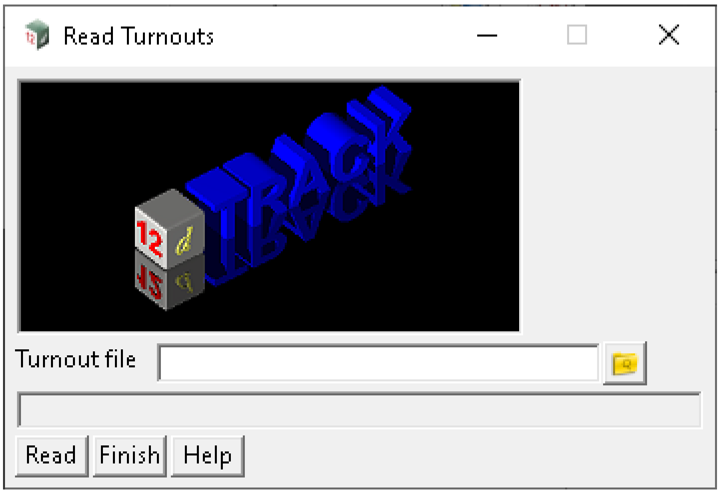
16.23.6.3 Read Turnouts

Position of option on menu: **Design =>Track =>Turnouts =>Read**

The **Read Turnouts** panel reads a *.turnouts file which imports **Turnout Types**. These turnouts can be edited in 16.23.6.2 Turnouts Create/ Edit, can be placed with16.23.6.1 Turnout Place and turnouts exported to a file with 16.23.6.4 Write Turnouts File.

Selecting Read displays the Read Turnout panel.

.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Turnout file	file box		*.turnouts

*Name of the file to read in the **Turnout Types**.*

Buttons at Bottom

Read	button		

*Reads the *.turnouts file and imports the Turnout Types.*

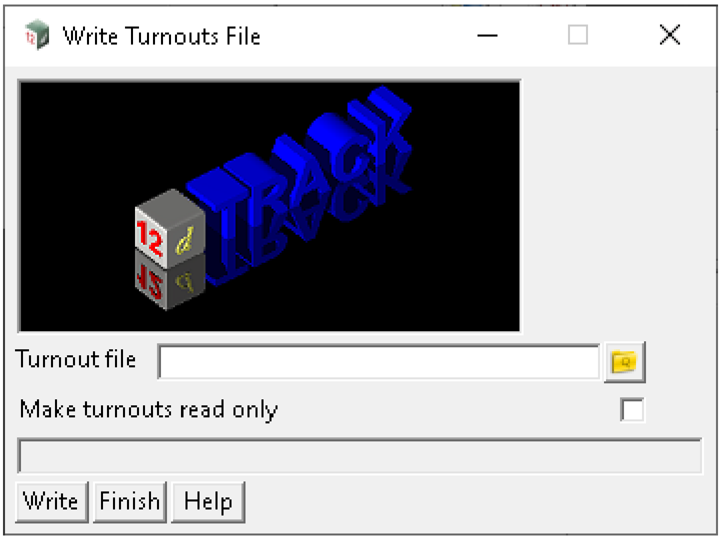
Continue to 16.23.6.4 Write Turnouts File or return to 16.23 Track.

16.23.6.4 Write Turnouts File

Position of option on menu: **Design =>Track =>Turnouts =>Write**

The **Write Turnouts** panel writes a *.turnouts file which exports **Turnout Types**.

Selecting **Write** displays the Write Turnouts File panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Turnout file	file box		*.turnouts

*Name of the file to write out the **Turnout Types**.*

Make turnouts read only	tick box	not ticked	

*If **ticked**, adds a read-only attribute to the entry in the **Turnouts file** which restricts modification when that **Turnout Type** has been imported.*

Buttons at Bottom

Write	button

*Writes the *.turnouts file.*

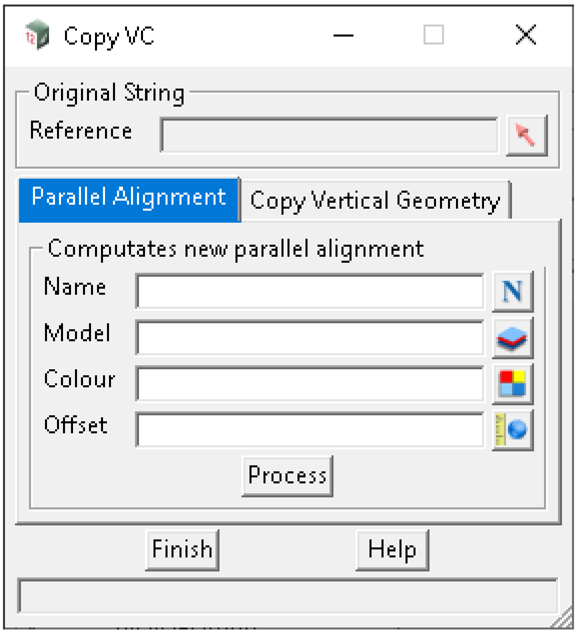
Continue to 16.23.7 Copy VC or return to 16.23 Track.

16.23.7 Copy VC

Position of menu: **Design => Track => Copy VC**

The **Copy VC** panel has two functions. Parallel alignment computes a new alignment with an offset from the **Reference** string. Copy Vertical Geometry copies the vertical geometry from an original string **Reference** 10.2 Super Alignments to a **New String** 10.2 Super Alignments.

Selecting **Copy VC** displays the **Copy VC** panel.



Parallel Alignment Tab
Copy Vertical Geometry Tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Original String

Reference	string select		

*If **Parallel Alignment**, reference string for a new alignment to be computed from.*
*If **Copy Vertical Geometry**, reference string for the vertical geometry to be copied from.*

Parallel Alignment Tab

Computes new parallel alignment

Name	name box		available names

Name of the new alignment.

Model	model box		available models

Model of the new alignment.

Colour	colour box	white	available colour

Colour of the new alignment.

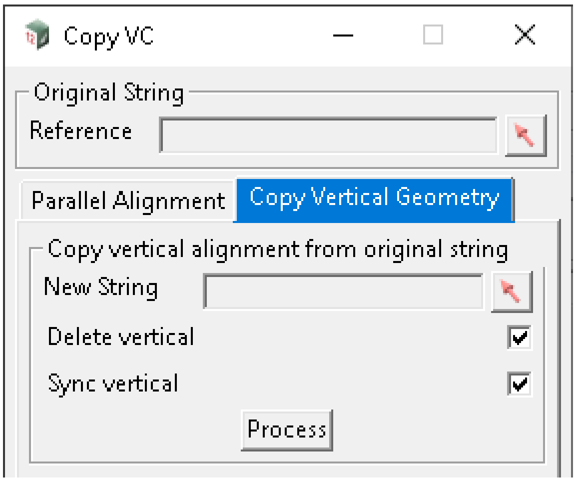
Offset	real box		

*Offset distance that the new string will be paralleled from the **Reference** string.*

Process	button		

Runs the function.

Copy Vertical Geometry Tab



Parallel Alignment Tab
Copy Vertical Geometry Tab

Copy vertical alignment from original string

New String string select

String that the reference string's vertical geometry will be copied onto.

Delete vertical tick box ticked

*If **ticked**, the vertical geometry will be deleted before the vertical geometry is copied.*

Sync vertical tick box ticked

*If **ticked**, the **Vertical Sync** property of the **New String** Super Alignment property will be set.*

Process button

Runs the function.

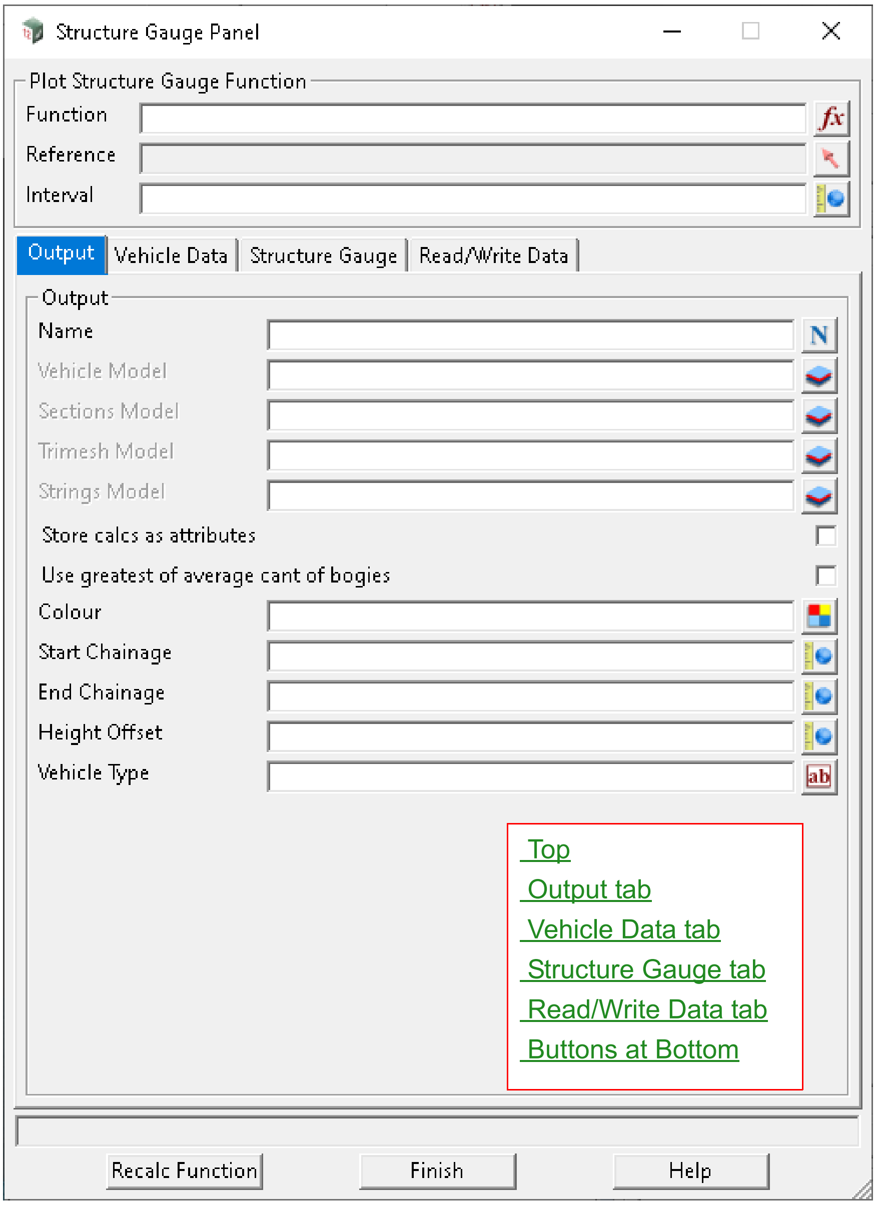
Continue to 16.23.8 Structure Gauge Panel or return to 16.23 Track.

16.23.8 Structure Gauge Panel

Position of option on menu: **Design =>Track =>Structure Gauge**

The **Structure Gauge** panel creates a structure clearance envelope along a **Reference** string. The prerequisites to running **Structure Gauge** are applying the cant in the 16.23.2 Calculate Slew panel to the **Reference** string. A structure gauge profile should be defined first in the Structure Gauge tab, then a vehicle should be defined using a structure gauge profile. Both the structure gauge and vehicle details can be imported and exported to file. Strings, sections, trimesh and front/ centre/end throw centrelines can be generated.

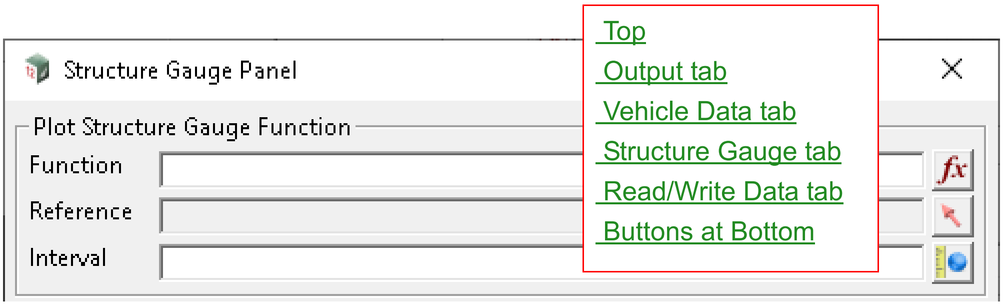
Selecting **Structure Gauge** displays the **Structure Gauge** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Top



Plot Structure Gauge Function

Function function box available functions

Name of the function.

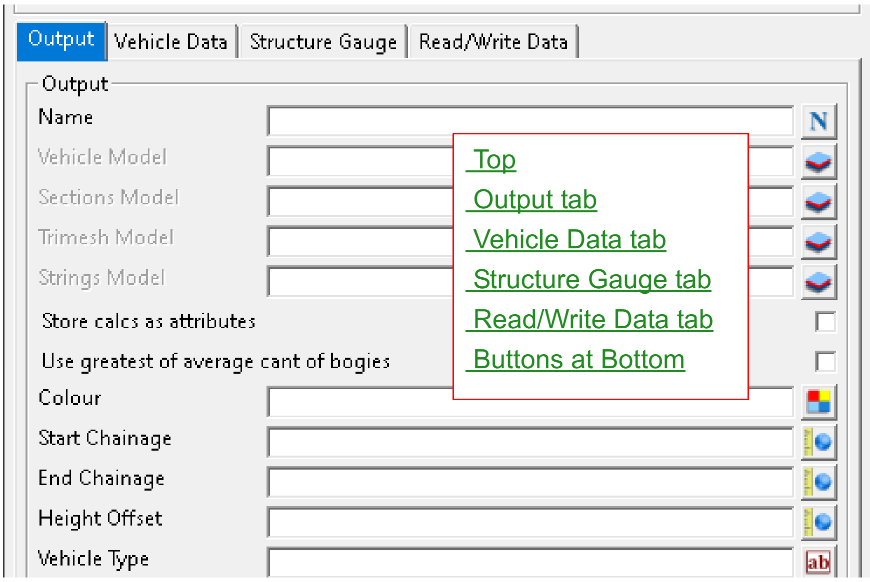
Reference string select available functions

Reference *string that structure gauge elements generated are based on. The* ***Reference*** *string would typically be the design alignment centreline. Cant values defined in* 16.23.3.8 Cant Definitions *must be applied to the* ***Reference*** *string before running the plot structure gauge panel*

Interval real box

Chainage increment between sections and vertices on strings.

Output tab



Top
Output tab
Vehicle Data tab
Structure Gauge tab
Read/Write Data tab
Buttons at Bottom

Name name box available names

Name stem for the structure gauge generated strings.

Vehicle Model model box available models

*Model for the vehicle strings to be generated onto. The model generated contains the front throw, centre throw and end throw centrelines which are the length of the **Vehicle Length** and are generated at every **Interval**. This is optional.*

Sections Model model box available models

*Model for the structure gauge sections to be generated onto. The sections are cut at a chainage increment specified in the **Interval** field. Note: sections will only display correctly in a perspective view. The **Trimesh Model** should be added to section views. This is optional.*

Trimesh Model model box available models

*Model for the structure gauge trimesh to be generated onto. The **Trimesh Model** is the best model to display the structure gauge in section and perspective views. This is optional.*

Strings Model model box available models

Model for the structure gauge strings to be generated onto. The vertices along the strings are generated at the chainage increment specified in the Interval field. This is optional.

Store Calcs as attributes tick box not ticked

*If **ticked**, attributes are generated on the **Vehicle Model** and **Sections Model**. The attributes include front/back bogie chainages, front/back bogie cant, vehicle cant and front/centre/end throw values.*

Use greatest of average cant of bogies tick box not ticked

*If **ticked**, the greatest average cant of bogies is used.*

Colour colour box available colours

*Colour for the strings/trimesh generated on the **Sections Model**, **Trimesh Model** and **Strings Model**.*

Start Chainage real box

*The **Reference** string start chainage for generating the structure gauge from. This is automatically populated with the **Reference** string start chainage when selected. Note: The structure gauge cannot be generated for one vehicle length from the start of the **Reference** string.*

For more information on Start Chainage Mode, see 19.3 Smart Chainages.

End Chainage real box

*The **Reference** string end chainage for generating the structure gauge up to. This is automatically populated with the **Reference** string end chainage when selected. Note: The structure gauge cannot be generated for one vehicle length from the end of the **Reference** string.*

For more information on Start Chainage Mode, see 19.3 Smart Chainages.

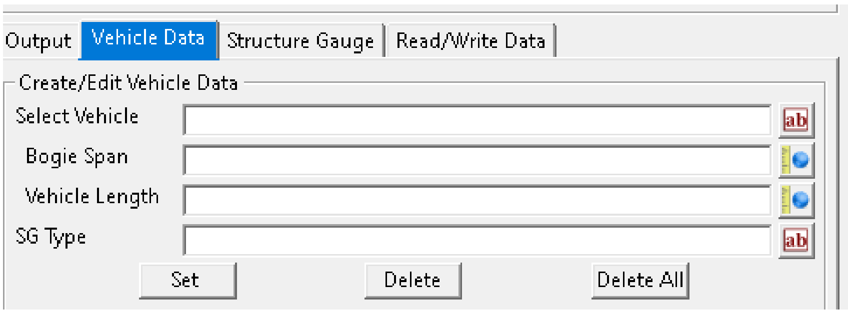
Height Offset real box

Vertical distance above/below the reference string to generate the structure gauge.

Vehicle Type custom box available vehicles

*Name of the vehicle that the structure gauge shall be based on. The vehicle is configured in the **Vehicle Data** tab under the **Select Vehicle** field.*

Vehicle Data tab



Top
Output tab
Vehicle Data tab
Structure Gauge tab
Read/Write Data tab
Buttons at Bottom

Create/Edit Vehicle Data

Select Vehicle custom box available vehicles

Name of the vehicle.

Bogie Span real box

The distance between the centre of the bogies of the vehicle.

Vehicle Length real box

Body length of the vehicle.

SG Type custom box available SG's

*Name of the associated structure gauge profile. This is configured in the **Structure Gauge** tab under the **Select SG** field.*

Set button

*Creates/updates vehicle specified in the **Select Vehicle** field.*

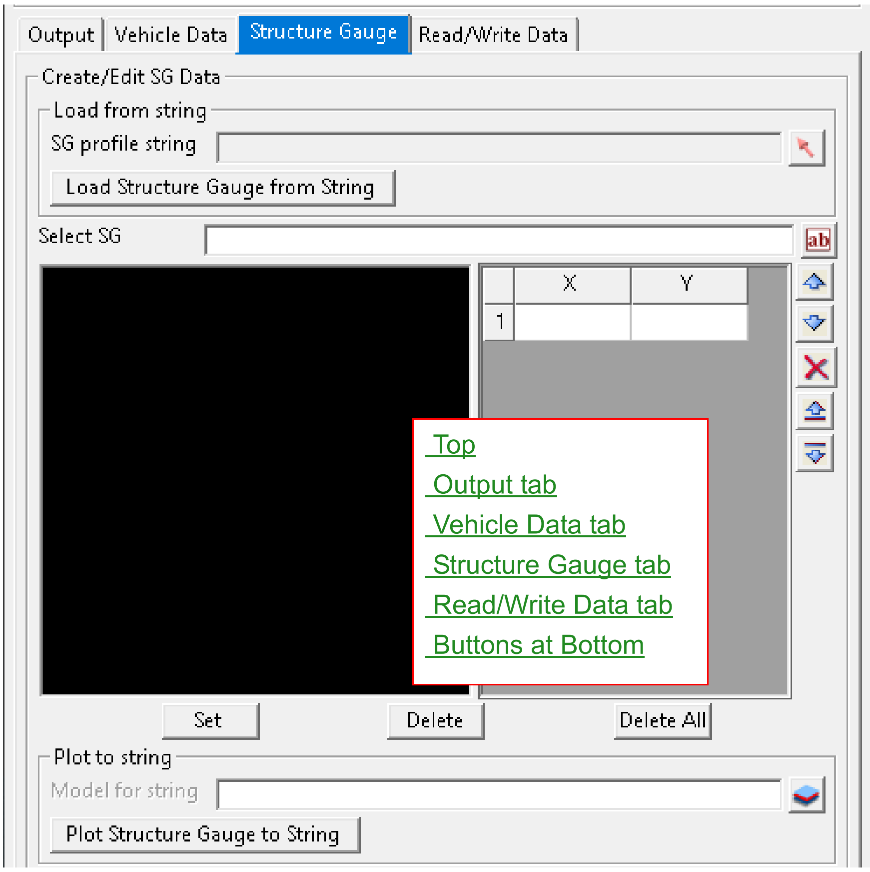
Delete button

*Deletes the vehicle specified in the **Select Vehicle** field.*

Delete All button

Deletes all vehicles stored in the vehicle library.

Structure Gauge tab



Top
Output tab
Vehicle Data tab
Structure Gauge tab
Read/Write Data tab
Buttons at Bottom

Create/Edit SG Data

Load from string

SG profile string string select

String selection to choose an element to create a structure gauge profile.

Load Structure Gauge from String button

Once a string has been selected in the ***SG profile string*** *field, clicking on this button will populate* ***Select SG****, graph and XY table.*

Select SG custom box available SG's

Name for the structure gauge profile.

Pick button

This option sets the graph box to pick mode. When in this mode the message area will display the X and Y coordinates as the mouse hovers over a location in the graph.

Fit button

This option sets the graph box to fit mode. This option will calculate the extent of the items plotted in the graph box and zoom out to show them. After the fit is complete the graph will return to pick mode.

Pan button

This option sets the graph box to panning mode. Click once to commence panning, then move the mouse and click a second time to stop panning.

Zoom button

This option sets the graph box to zoom mode. Click once to commence zooming, then move the mouse *and click a second time to stop zooming. Moving the mouse left and right will reduce and increase the scale factor.*

Window button

This option sets the graph box to window mode. Click once to select the first corner of a window and click a second time to select the second corner. After the window is complete the graph will return to pick mode.

X real box

X coordinates for the structure gauge vertices.

Y real box

Y coordinates for the structure gauge vertices.

Set button

Creates/updates the structure gauge profile stored with the name specified in ***Select SG****.*

Delete button

Deletes the structure gauge profile stored with the name specified in ***Select SG****.*

Delete All button

Deletes all structure gauge profiles.

Plot to string

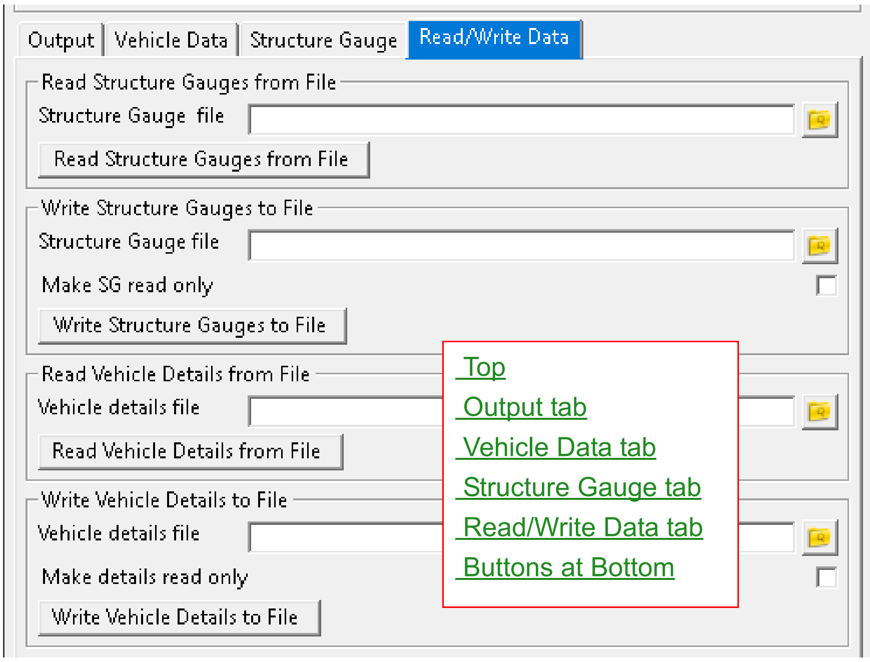
Model for string model box available models

Model for the structure gauge profile to be generated onto.

Plot Structure Gauge to String button

Generates the structure gauge profile onto the model specified in ***Model for string*** *based on the values entered in the X and Y table.*

Read/Write Data tab



Read Structure Gauges from File

Structure Gauge file file box available *.profiles

Name of the file for structure gauge profiles to be imported from.

Read Structure Gauges from File button

*Imports structure gauge profiles from the *.profiles file specified in the **Structure Gauge file** field. These structure gauge profiles are added to the **Select** SG **list** in the **Structure Gauge** tab.*

Write Structure Gauges to File

Structure Gauge file file box available *.profiles

Name of the file for structure gauge profiles to be exported to.

Write Structure Gauges to File button

*Exports structure gauge profiles to the *.profiles file specified in the **Structure Gauge file** field. These structure gauge profiles are entries stored in the **Select SG** list in the **Structure Gauge** tab.*

Make SG read only tick box not ticked

*Adds a read-only attribute to the entry in the **Structure Gauge file** which restricts modification of structure gauge profiles that have been imported.*

Read Vehicle Details from File

Vehicle details file file box available *.profiles

Name of the file for vehicle details to be imported from.

Read Vehicle Details from File button

*Imports vehicle details from the *.profiles file specified in the **Vehicle details file** field. These vehicle details are added to the **Select Vehicle** list in the **Vehicle Data** tab.*

Write Vehicle Details to File

Vehicle details file **file box** available *.profiles

Name of the file for vehicle details to be exported to.

Write Vehicle Details to File button

*Exports vehicle details to the *.profiles file specified in the **Vehicle details file** field. These vehicle details are entries stored in the **Select Vehicle** list in the Vehicle **Data** tab.*

Make details read only tick box not ticked

*Adds a read-only attribute to the entry in the **Vehicle details file** which restricts modification of vehicle details that have been imported.*

Buttons at Bottom

Recalc Function button

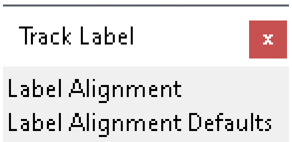
*Creates/updates the **Function** and generates the elements for the models defined in the **Output** tab.*

Continue to 16.23.9 Track Label or return to 16.23 Track.

16.23.9 Track Label

Position of menu: **Design =>Track =>Label**

The **Track Label** walk-right menu is

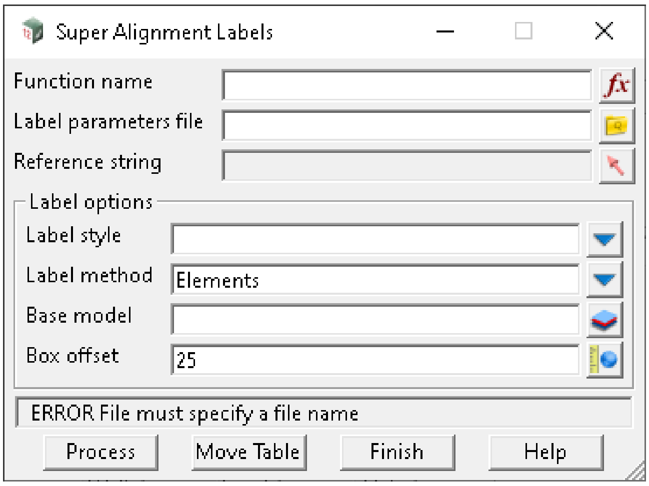


See
16.23.9.1 Label Alignment
16.23.9.2 Label Alignment Defaults

16.23.9.1 Label Alignment

Position of option on menu: **Design =>Track =>Label=>Label Alignment**

The **Label Alignment** panel generates either IPs and Tangent labels or horizontal segment labels called Elements labels along the design alignment.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function name	function box		available functions

Name of the function to store the panel settings.

Label parameters file	file box		all *.lpf files

Name of the label parameters file that Label styles are stored in. This is a file created in the 16.23.9.2 Label Alignment Defaults *panel.*

Reference string	string select		

Reference string for the labels to be created. This is typically the design alignment centreline.

Label Options

Label Stye	choice box		label styles

*Choice of labelling style. Multiple styles can be created within one **Label parameters file**. Labelling styles can be created in the* 16.23.9.2 Label Alignment Defaults *panel.*

Label Method	choice box	Elements	label methods

Choice of labelling method between the labelling of Elements or IPs and Tangents.

Base Mode	model box		available models

*If **Label Style - Use model suffix** in* 16.23.9.2 Label Alignment Defaults *has been **ticked**, then **Model** is a model name stem to generate text and table elements onto. The models are created based on the suffixes specified in the Label Style section of the* 16.23.9.2 Label Alignment Defaults*. These are **Elements Model Suffix**, **Stationing Model Suffix** and **Tables Model Suffix**.*

*If **Label Style** - Use model suffix in* 16.23.9.2 Label Alignment Defaults *has been unticked then all elements are generated onto the **Model**.*

Box offset	real box	25	

*Horizontal offset distance for tables and text elements to be located away from the **Reference String**.*

Buttons at Bottom

Process button

*Creates/updates the label **Function** and generates the elements for the models prefixed with the **Base Model** name stem.*

Move Table button

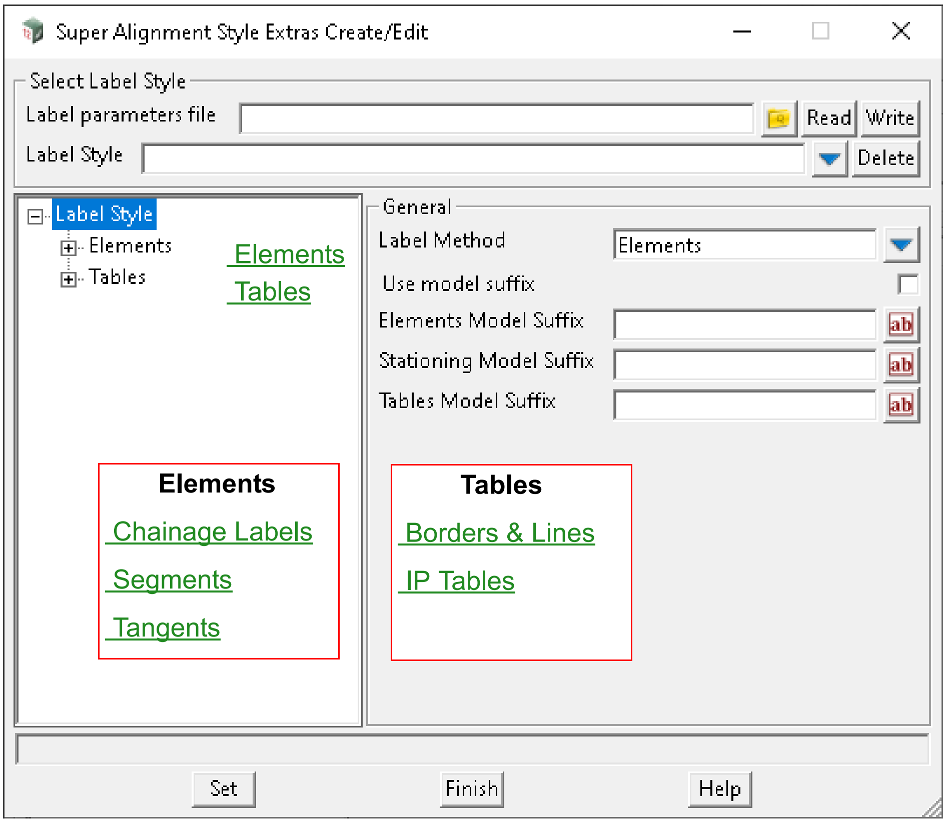
*Once tables have been generated, clicking on the **Move Table** button and then clicking on an element from one of these tables allows that table to be moved to another location. The **Maintain Existing Table Position** tick box is automatically ticked when a table has been moved to ensure that it doesn't revert to the default location when the **Process** button has been clicked.*

Continue to 16.23.9.2 Label Alignment Defaults or return to 16.23.6 Track Turnouts or 16.23 Track.

16.23.9.2 Label Alignment Defaults

Position of option on menu: **Design =>Track =>Label=>Label Alignment Defaults**

Label Styles in the 16.23.9.1 Label Alignment panel are saved in a **Label parameters file** (*.lpf) and are created, modified or deleted in the Label Alignment Defaults panel. The **Label Style** controls how the labelling information is presented.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Select Label Style

Label parameters file	file box		all *.lpf files

*Name of the parameter file that will store the **Label Style** definitions.*

Read button

When selected, the panel will be populated with values contained in the Label parameters file.

Write button

*Writes the *.lpf to file. The Set button must be clicked before the Write button to export the panel data. Data needs to be written to file before the Process button is clicked in the* 16.23.9.1 Label Alignment *panel for label style changes to take effect.*

Label Style	choice box	DEFAULT	all label styles

*List of **Label Styles**. A **Label Style** can be selected or [new] can be selected which will open a panel to create a new **Label Style**.*

Delete button

*Deletes the currently selected **Label Style**.*

Label Style node

Label Method choice box all label methods

*Intended **Label Method** of 16.23.9.1 Label Alignment for the current **Label Style**. 'IPs, Tangents' or 'Elements' are the two options that can be selected.*

Use model suffix tick box ticked

*If **ticked**, separates the generated elements into Elements Model Suffix, Stationing Model Suffix and Tables Model Suffix.*

*If **unticked**, puts all generated elements on **Base Model** specified in 16.23.9.1 Label Alignment.*

Elements Model Suffix custom box labels

*When Elements has been selected in the **Label Method** field specified in 16.23.9.1 Label Alignment, elements are generated on a model prefixed with the **Base Model** field from 16.23.9.1 Label Alignment and suffixed with **Elements Model suffix**.*

Stationing Model Suffix custom box stationing

*When Elements has been selected in the **Label Method** field specified in 16.23.9.1 Label Alignment, elements are generated on a model prefixed with the **Base Model** field from 16.23.9.1 Label Alignment and suffixed with **Stationing Model suffix**.*

***Note: This feature has not been implemented yet**.*

Tables Model Suffix custom box tables

*When IPs, Tangents has been selected in the **Label Method** field specified in 16.23.9.1 Label Alignment, elements are generated on a model prefixed with the Base Model field from 16.23.9.1 Label Alignment and suffixed with Tables Model suffix.*

Buttons at Bottom

Set button

Sets all values ready to be written to file. This is required to be clicked before the Write button is clicked.

Elements

See Chainage Labels

See Segments

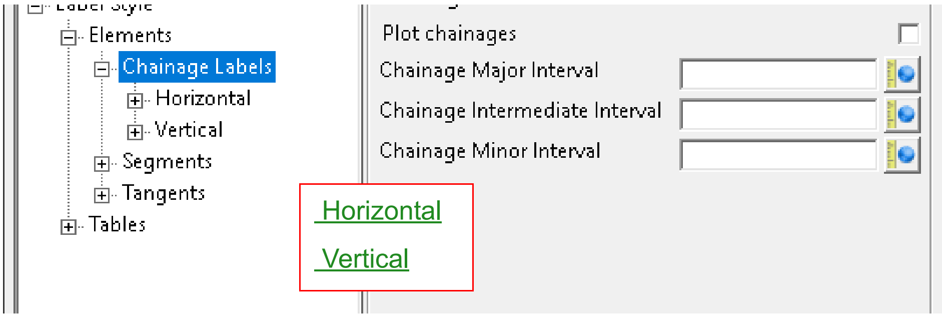
See Tangents

Tables

See Borders & Lines

See IP Tables

Chainage Labels



Chainage Labels

Plot chainages	tick box	not ticked

*If **ticked**, chainage labels are created.*

Chainage Major Interval	real box	1000

*Chainage increment for major chainages to be generated along the **Reference String**.*

Chainage Intermediate Interval	real box	100

*Chainage increment for intermediate chainages to be generated along the **Reference String**.*

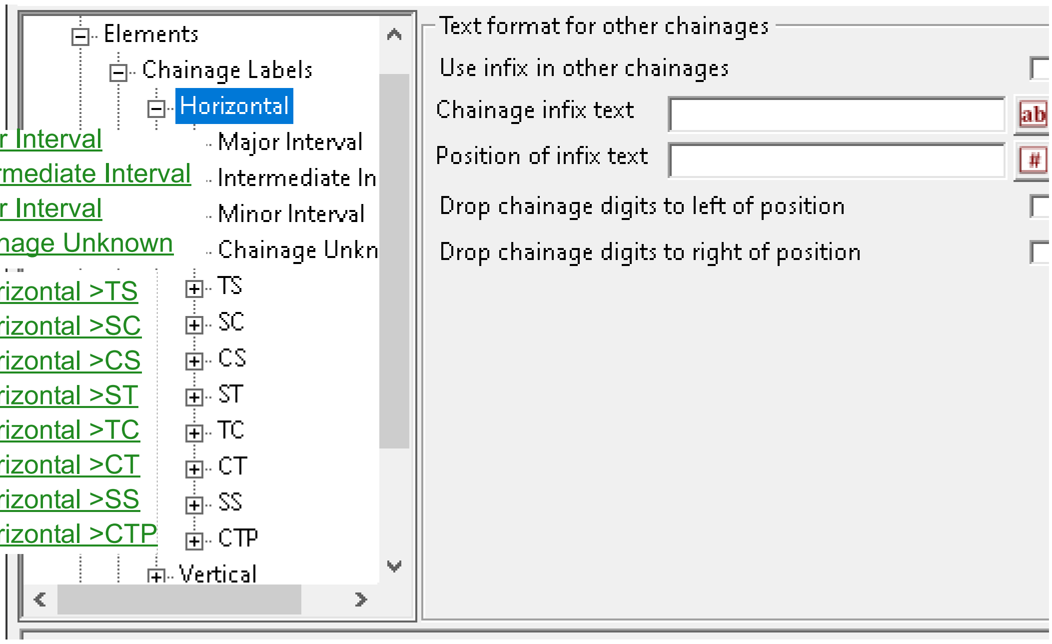
Chainage Minor Interval	real box	20

*Chainage increment for minor chainages to be generated along the **Reference String**.*

See Horizontal

See Vertical

Horizontal



Horizontal >Major Interval
Horizontal - Intermediate Interval
Horizontal >Minor Interval
Horizontal >Chainage Unknown
Horizontal >TS
Horizontal >SC
Horizontal >CS
Horizontal >ST
Horizontal >TC
Horizontal >CT
Horizontal >SS
Horizontal >CTP

Text format for other chainages

Use infix in other chainages tick box not ticked

*If **ticked**, **Other chainage infix text** is infixed to all other chainages.*

Chainage infix text custom box

Text to be infixed to all other chainage labels.

Position of infix text custom box

*If **Drop chainage digits to left of position** is **ticked**, the number of characters to retain at the end of the chainage value and to be prefixed by **Other chainage infix text**.*

*If **Drop chainage digits to right of position** is **ticked**, the number of characters to remove at the end of the chainage value and to be suffixed by **Other chainage infix text**.*

Drop chainage digits to left of position tick box not ticked

*Refer to **Position of infix text** above.*

Drop chainage digits to right of position tick box not ticked

*Refer to **Position of infix text** above.*

See

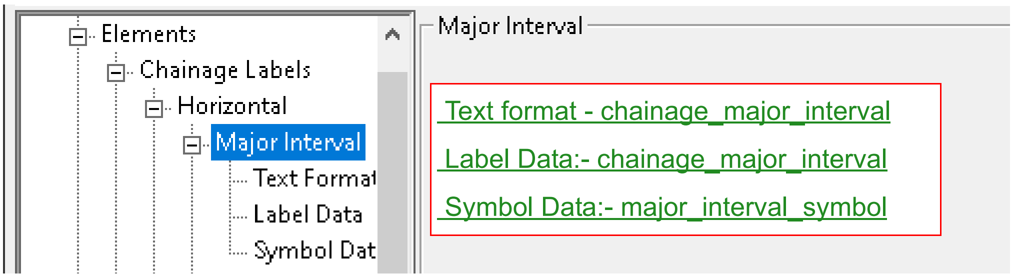
Horizontal >Major Interval Horizontal - Intermediate Interval Horizontal >Minor Interval

Horizontal >Chainage Unknown

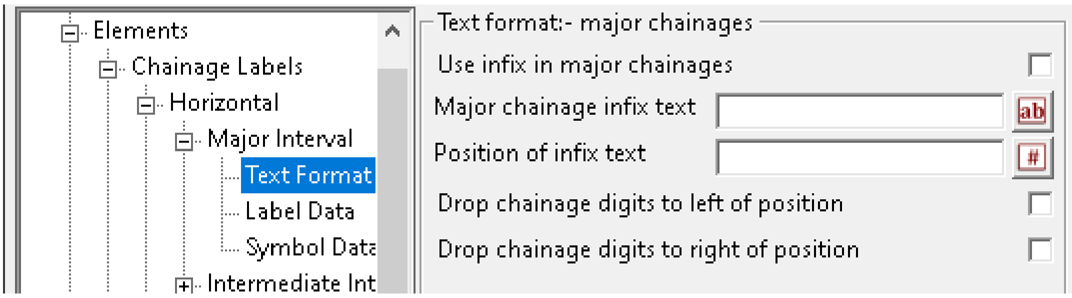
Horizontal >TS Horizontal >SC Horizontal >CS Horizontal >ST

Horizontal >TC Horizontal >CT Horizontal >SS Horizontal >CTP

Horizontal >Major Interval



Text format - chainage_major_interval

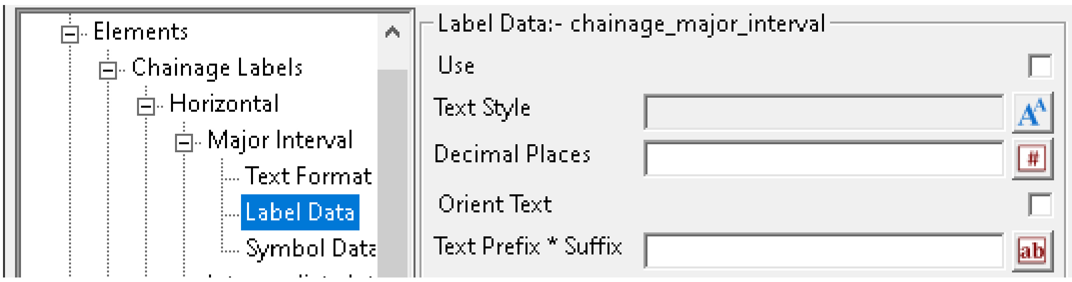


Use infix in major chainages tick box not ticked

*If **ticked**, **Major chainage infix text** is infixed to major chainages.*

Major chainage infix text, **Position of infix text**, **Drop chainage digits to left of position** and **Drop chainage digits to right of position**, see 16.23.9.2.1 Text Format Fields

Label Data:- chainage_major_interval

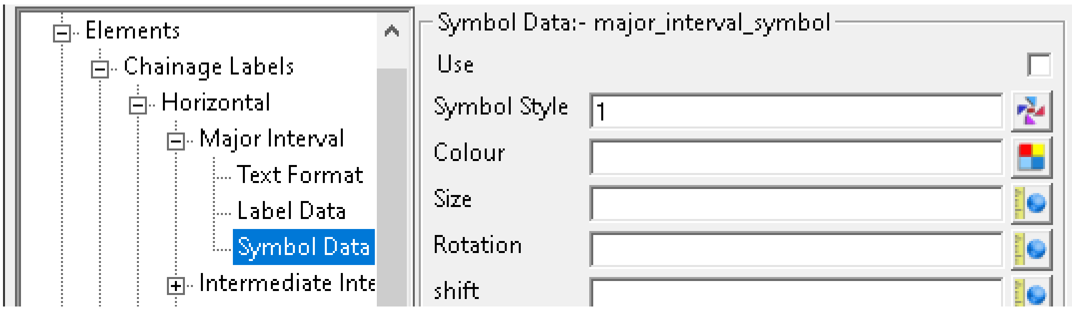


Use tick box ticked

*If **ticked**, major chainage labels will be displayed at the increment specified in **Chainage Labels**.*

Text style, **Decimal places**, **Orient Text** and **Text prefix*suffix**, see 16.23.9.2.2 Label Data Fields.

Symbol Data:- major_interval_symbol

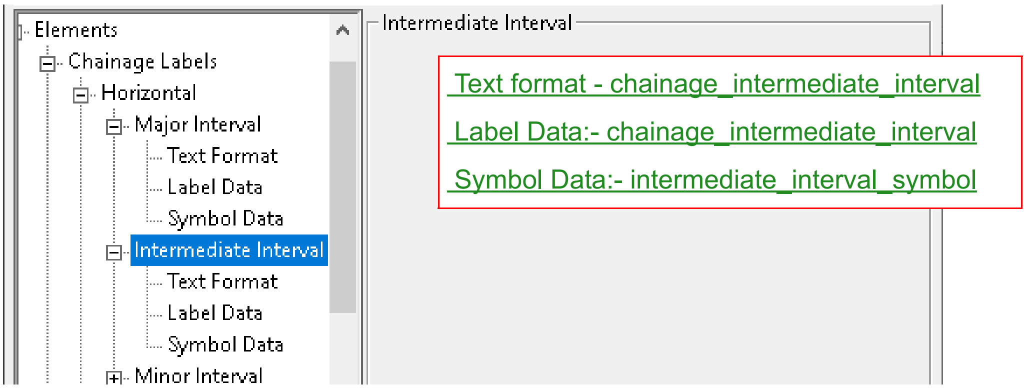


Use tick box not ticked

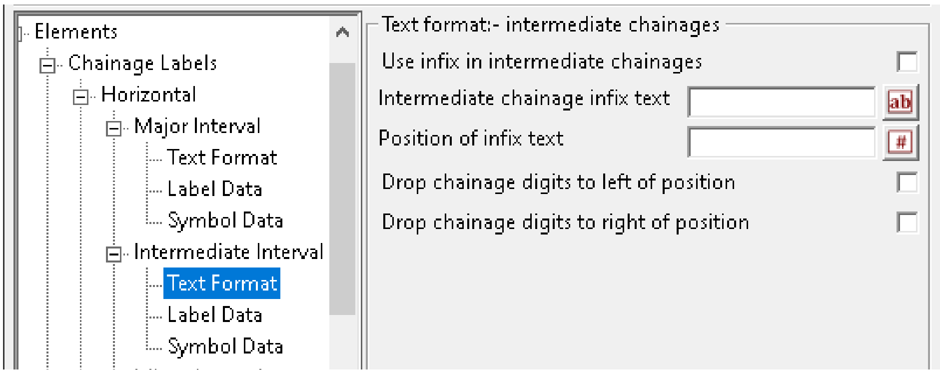
*If **ticked**, a symbol will be created at every major interval on the **Reference String**.*

Symbol style, **Colour**, **Size, Rotation, Shift** and **Raise,** see 16.23.9.2.3 Symbol Data Fields.

Horizontal - Intermediate Interval



Text format - chainage_intermediate_interval

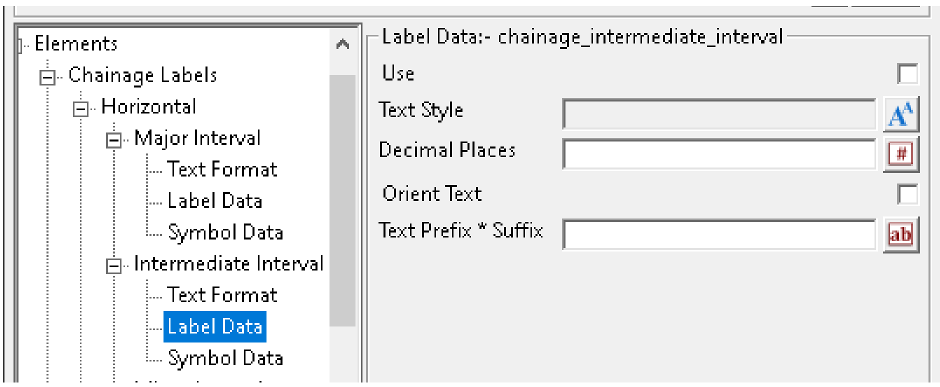


Use infix in intermediate chainages tick box not ticked

*If **ticked**, **Intermediate chainage infix text** is infixed to intermediate chainages.*

Intermediate chainage infix text, **Position of infix text**, **Drop chainage digits to left of position** and **Drop chainage digits to right of position**, see 16.23.9.2.1 Text Format Fields

Label Data:- chainage_intermediate_interval

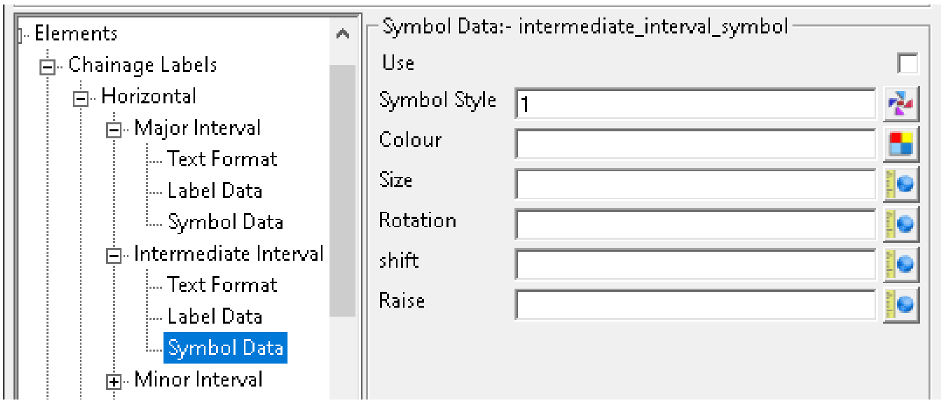


Use tick box ticked

*If **ticked**, intermediate chainage labels will be displayed at the increment specified in **Chainage Labels**.*

Text style, **Decimal places**, **Orient Text** and **Text prefix*suffix**, see 16.23.9.2.2 Label Data Fields.

Symbol Data:- intermediate_interval_symbol

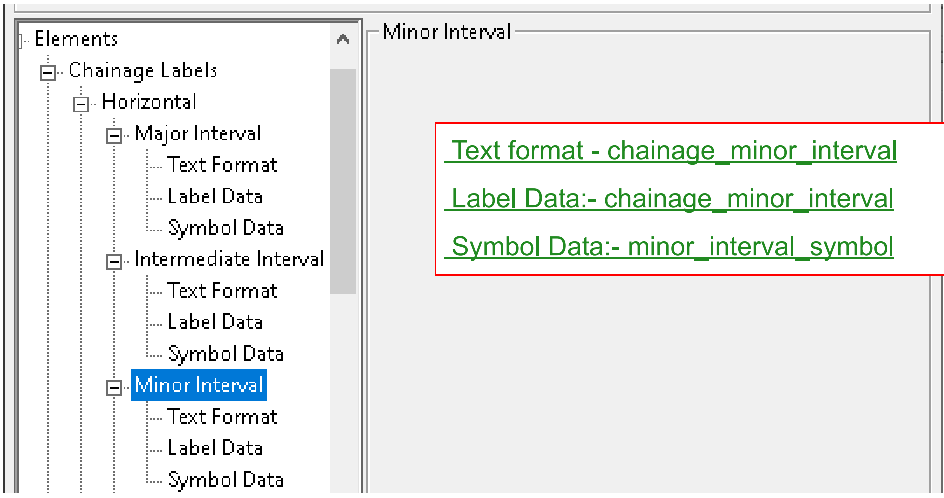


Use tick box not ticked

*If **ticked**, it will create a symbol at every intermediate interval on the **Reference String**.*

Symbol style, **Colour**, **Size, Rotation, Shift** and **Raise,** see 16.23.9.2.3 Symbol Data Fields.

Horizontal >Minor Interval

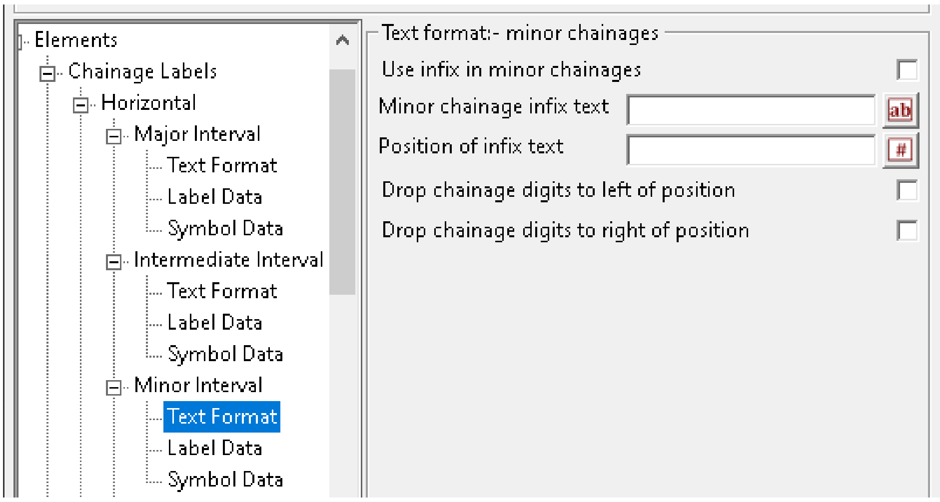


Text format - chainage_minor_interval

Label Data:- chainage_minor_interval

Symbol Data:- minor_interval_symbol

Text format - chainage_minor_interval

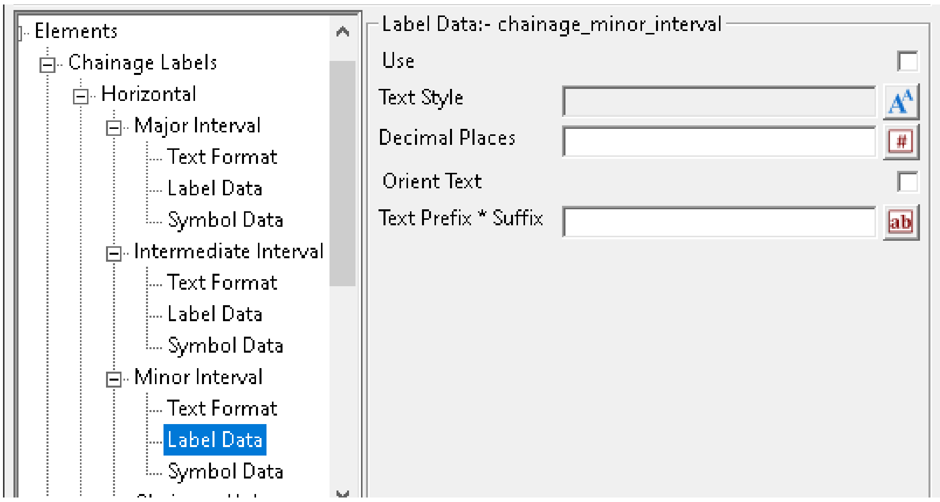


Use infix in minor chainages tick box not ticked

*If **ticked**, **Minor chainage infix text** is infixed to minor chainages.*

Minor chainage infix text, **Position of infix text**, **Drop chainage digits to left of position** and **Drop chainage digits to right of position**, see 16.23.9.2.1 Text Format Fields

Label Data:- chainage_minor_interval

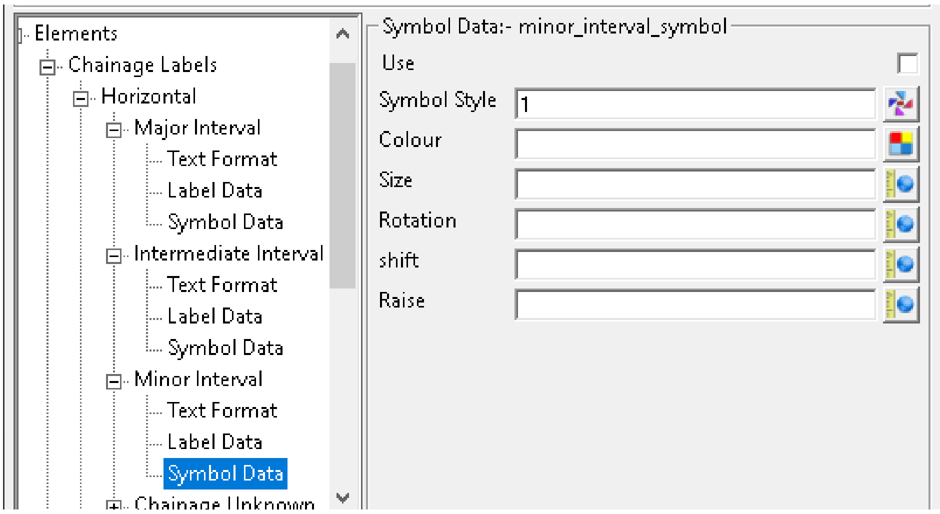


Use tick box ticked

*If **ticked**, minor chainage labels will be generated at the increment specified in **Chainage Labels**.*

Text style, **Decimal places**, **Orient Text** and **Text prefix*suffix**, see 16.23.9.2.2 Label Data Fields.

Symbol Data:- minor_interval_symbol

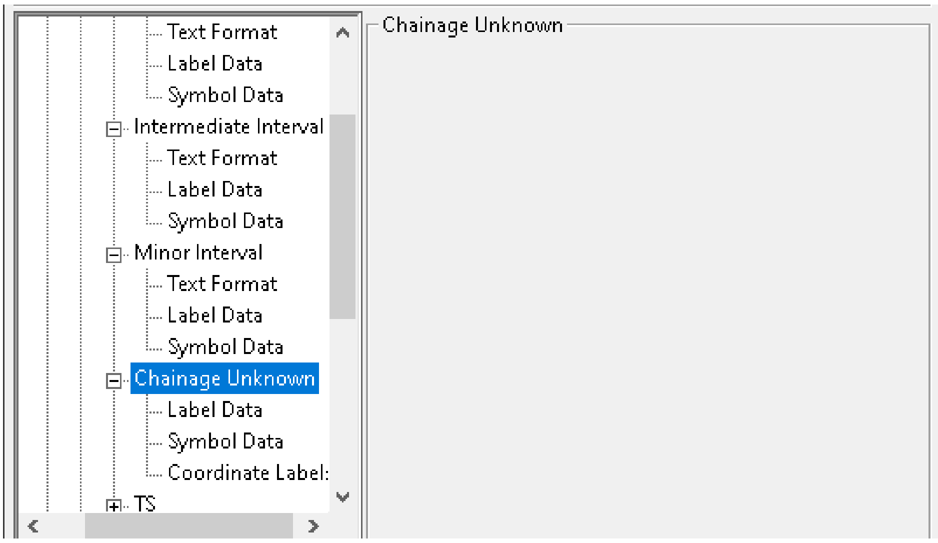


Use tick box not ticked

*If **ticked**, it will create a symbol at every minor interval on the **Reference String**.*

Symbol style, **Colour**, **Size, Rotation, Shift** and **Raise,** see 16.23.9.2.3 Symbol Data Fields.

Horizontal >Chainage Unknown



Label Data:- chainage_unknown

Use tick box ticked

*If **ticked**, chainage unknown labels will be generated.*

Text Style text style box all styles

Text style for the properties of the chainage unknown labels.

Decimal Places integer box 3

The number of decimal places for the chainage unknown chainage labels.

Orient Text tick box ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box CHG *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage unknown chainage value will be placed.*

Symbol Data:- tangent_unknown

Use tick box ticked

*If **ticked**, it will create a symbol at every chainage unknown chainage on the **Reference String**.*

Symbol Style symbol box PTLine

*Name of the symbol to place at every chainage unknown chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Coordinate_Labels:- coord_tangent_unknown

Use tick box ticked

If ***ticked****, coordinate labels of chainage unknown locations will be generated.* ***Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of chainage unknown locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of chainage unknown locations.

Orient Text tick box not ticked

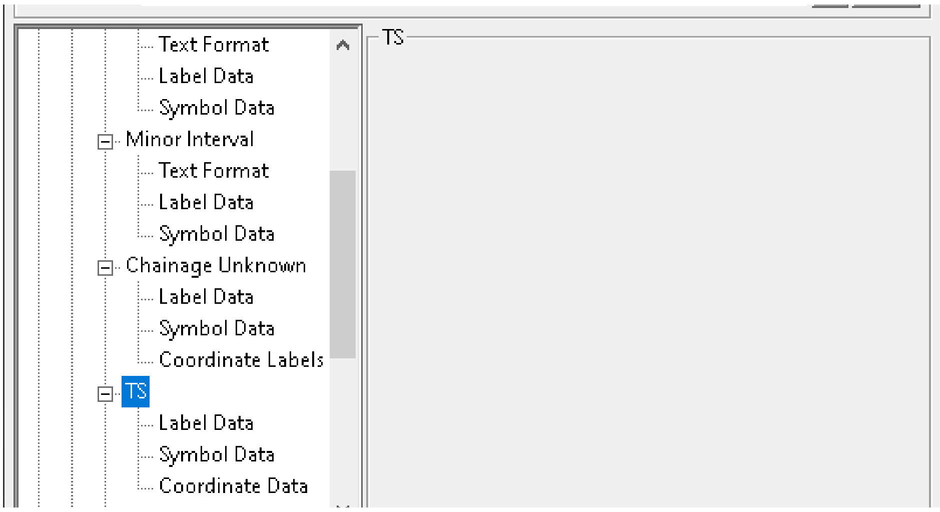
If ***ticked****, the* ***Text Style Angle*** *and symbol* ***Rotation*** *will be relative to the* ***Reference String****.*

If ***not ticked****, the* ***Text Style Angle*** *and symbol* ***Rotation*** *will be relative to the world.*

Text Prefix * Suffix text box CHG Int*

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of chainage unknown value will be placed.*

Horizontal >TS



TS

Label Data:- chainage_tangent_spiral

Use tick box ticked

*If **ticked**, tangent-spiral (TS) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box TS *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- tangent_spiral_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

Rotation of the symbol. The rotation angle is affected by ***Orient Text****.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Coordinate_Labels:- coord_tangent_spiral

Use tick box ticked

If ***ticked****, coordinate labels of the locations will be generated.* ***Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

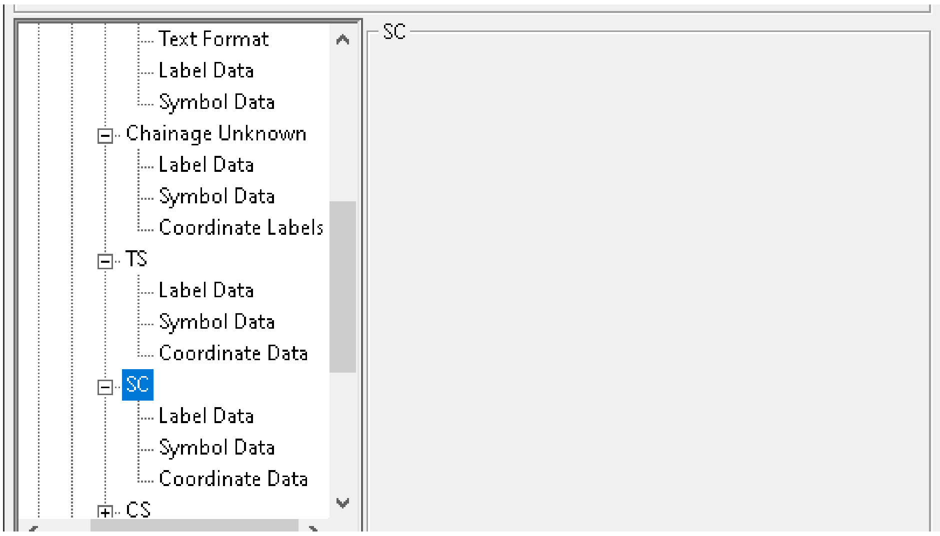
If ***ticked****, the* ***Text Style Angle*** *and symbol* ***Rotation*** *will be relative to the* ***Reference String****.*

If ***not ticked****, the* ***Text Style Angle*** *and symbol* ***Rotation*** *will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >SC



SC

Label Data:- chainage_spiral_curve

Use tick box ticked

*If **ticked**, spiral-curve (SC) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box SC *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- spiral_curve_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PButterfly

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_spiral_curve

Use tick box ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

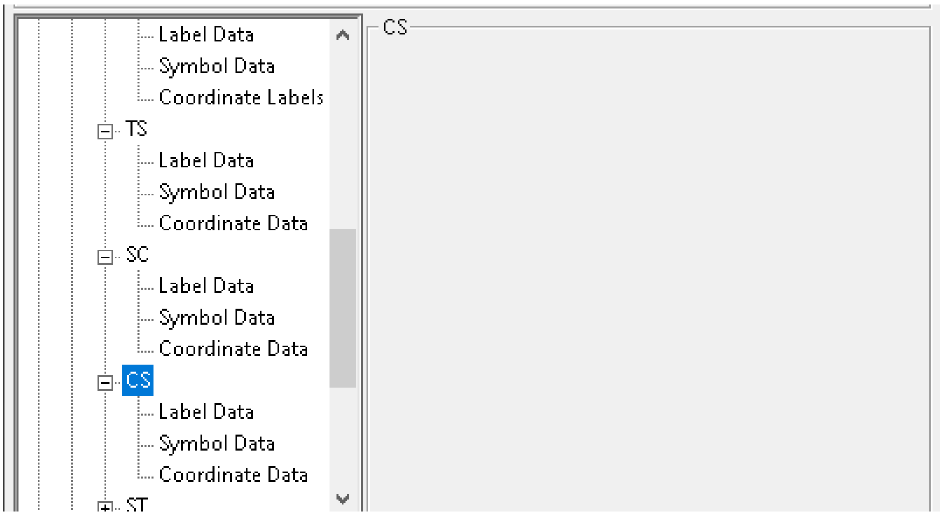
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >CS



CS

Label Data:- chainage_curve_spiral

Use tick box ticked

*If **ticked**, curve-spiral (CS) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box CS *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- curve_spiral_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PButterfly

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift	real box	0

Distance shifted to the left/right on the X plane.

Raise	real box	0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_curve_spiral

Use	tick box	ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style	text style box	all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places	integer box	3

The number of decimal places for the coordinate labels of the locations.

Orient Text	tick box	not ticked

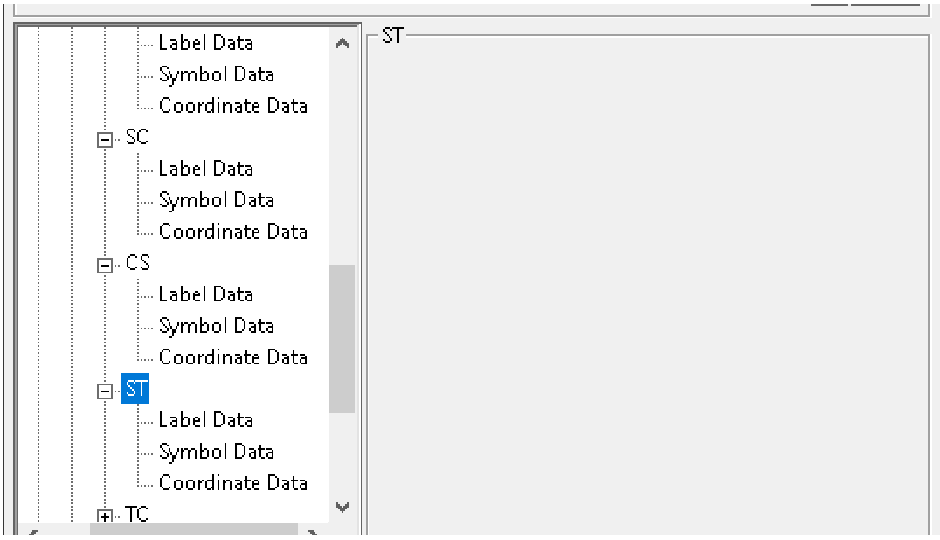
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix	text box	E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >ST



ST

Label Data:- chainage_spiral_tangent

Use tick box ticked

*If **ticked**, spiral-tangent (ST) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box ST *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- spiral_tangent_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PDumbell

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_spiral_tangent

Use tick box ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

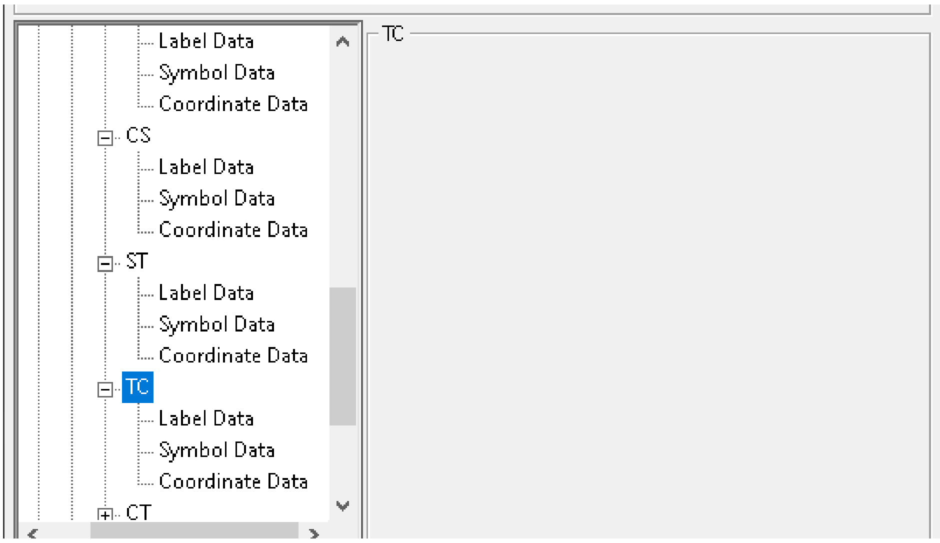
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >TC



TC

Label Data:- chainage_tangent_curve

Use tick box ticked

*If **ticked**, tangent-curve (TC) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box TC *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- tangent_curve_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.b***

Symbol Style symbol box PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_tangent_curve

Use tick box ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

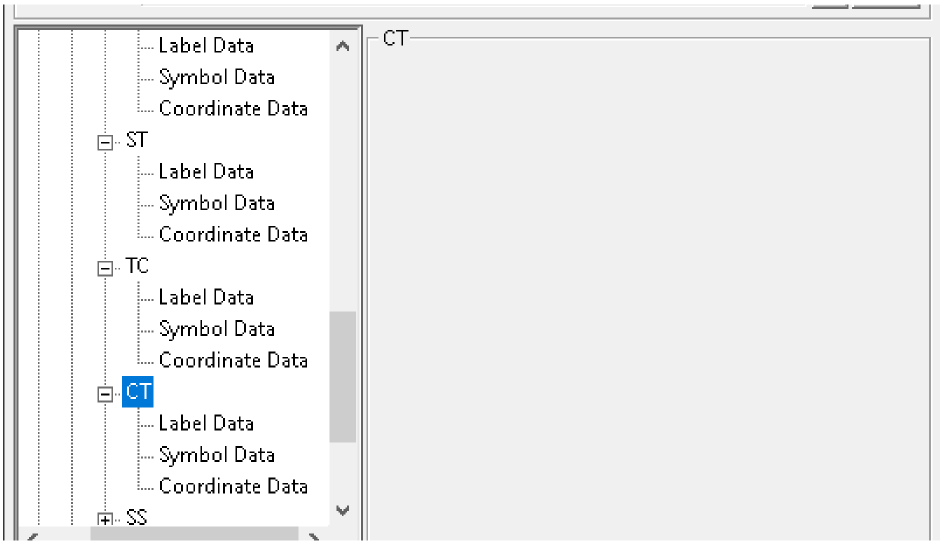
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >CT



CT

Label Data:- chainage_curve_tangent

Use tick box ticked

*If **ticked**, curve-tangent (CT) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box CT *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- curve_tangent_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_curve_tangent

Use tick box ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

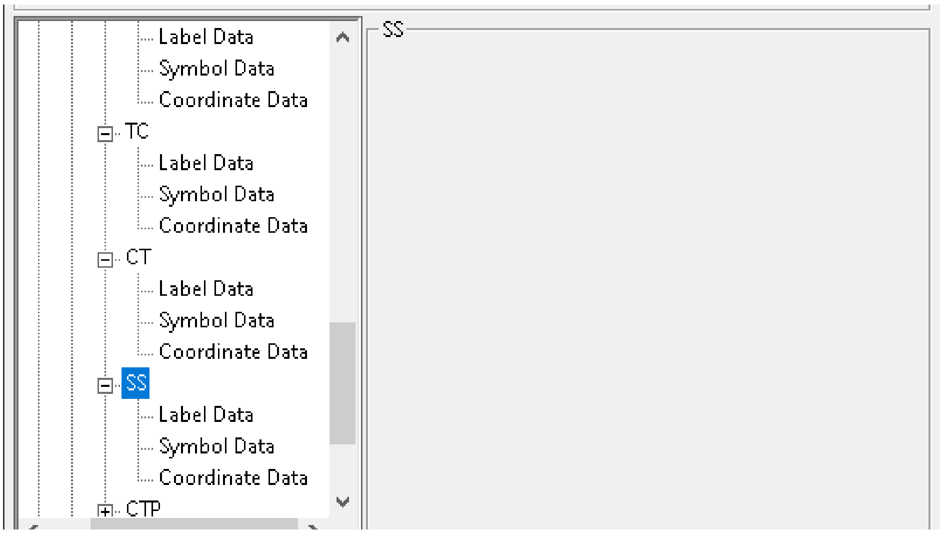
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >SS



SS

Label Data:- chainage_spiral_spiral

Use tick box ticked

*If **ticked**, spiral_spiral (SS) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box SS *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- spiral_spiral_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style symbol box PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour colour box red available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift real box 0

Distance shifted to the left/right on the X plane.

Raise real box 0

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_spiral_spiral

Use tick box not ticked

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places integer box 3

The number of decimal places for the coordinate labels of the locations.

Orient Text tick box not ticked

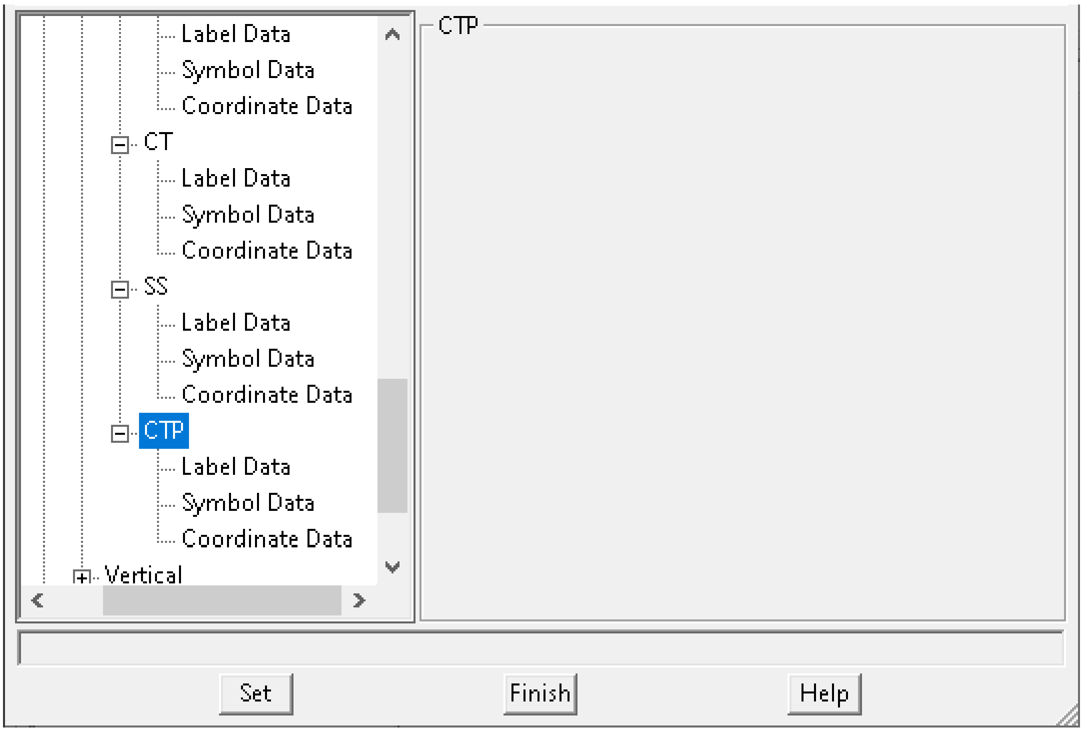
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box E *;N *

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Horizontal >CTP



CTP

Label Data:- chainage_common_tangent

Use tick box ticked

*If **ticked**, common tangent point (CTP) labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box CTP *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- common_tangent_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**. **Note: This feature has not been implemented yet.***

Symbol Style	symbol box	PDumbbell	

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	red	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

Distance raised/lowered on the Y plane.

Cooordinate_Labels:- coord_commom_tangent

Use	tick box	not ticked	

*If **ticked**, coordinate labels of the locations will be generated. **Note: This feature has not been implemented yet.***

Text Style	text style box		all styles

Text style for the properties of the coordinate labels of the locations.

Decimal Places	integer box	3	

The number of decimal places for the coordinate labels of the locations.

Orient Text	tick box	not ticked	

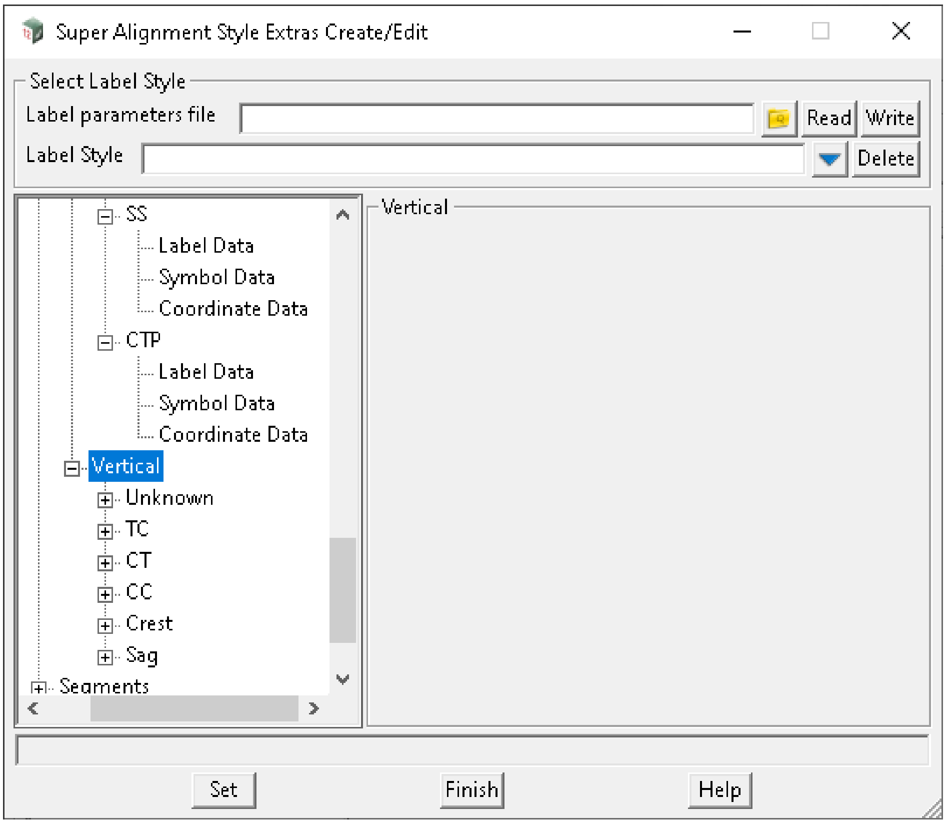
*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix	text box	E *;N *	

*Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.*

Vertical



See Vertical >Unknown

See Vertical >TC

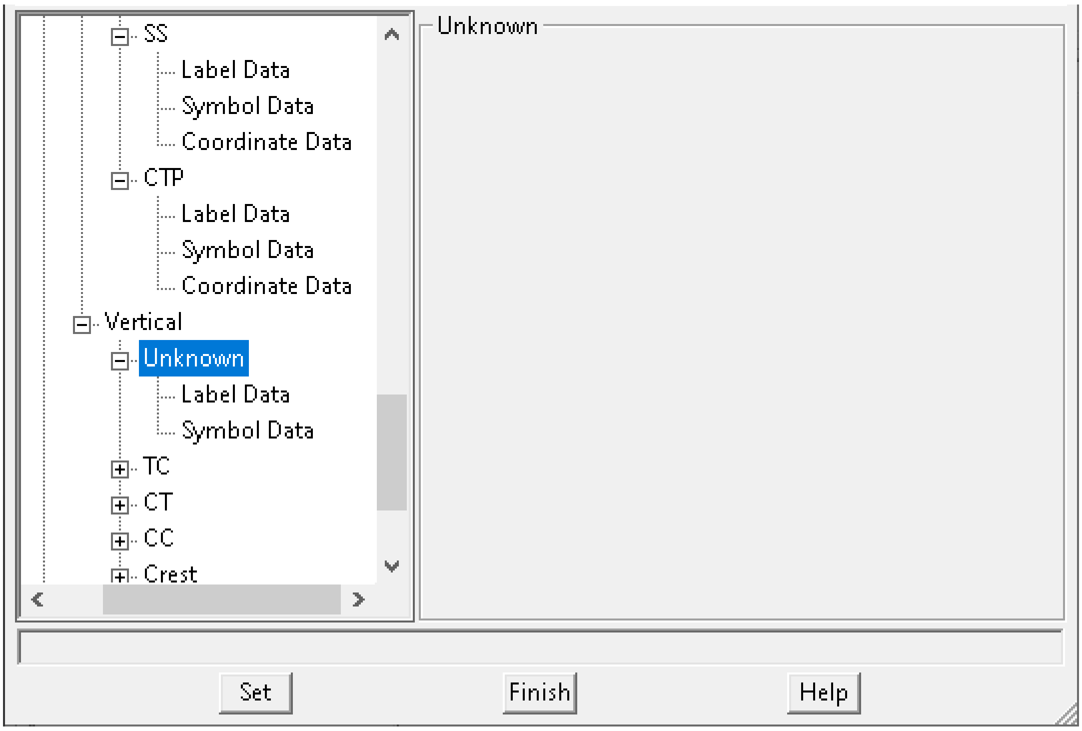
See Vertical >CT

See Vertical >CC

See Vertical >Crest

See Vertical >Sag

Vertical >Unknown



Unknown

Label Data:- chainage_vert_unknown

Use tick box ticked

*If **ticked**, unknown vertical point labels will be generated.*

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_unknown_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style symbol box CIRCLE

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1

Size of the symbol.

Rotation	real box	0

Rotation of the symbol. The rotation angle is affected by ***Orient Text****.*

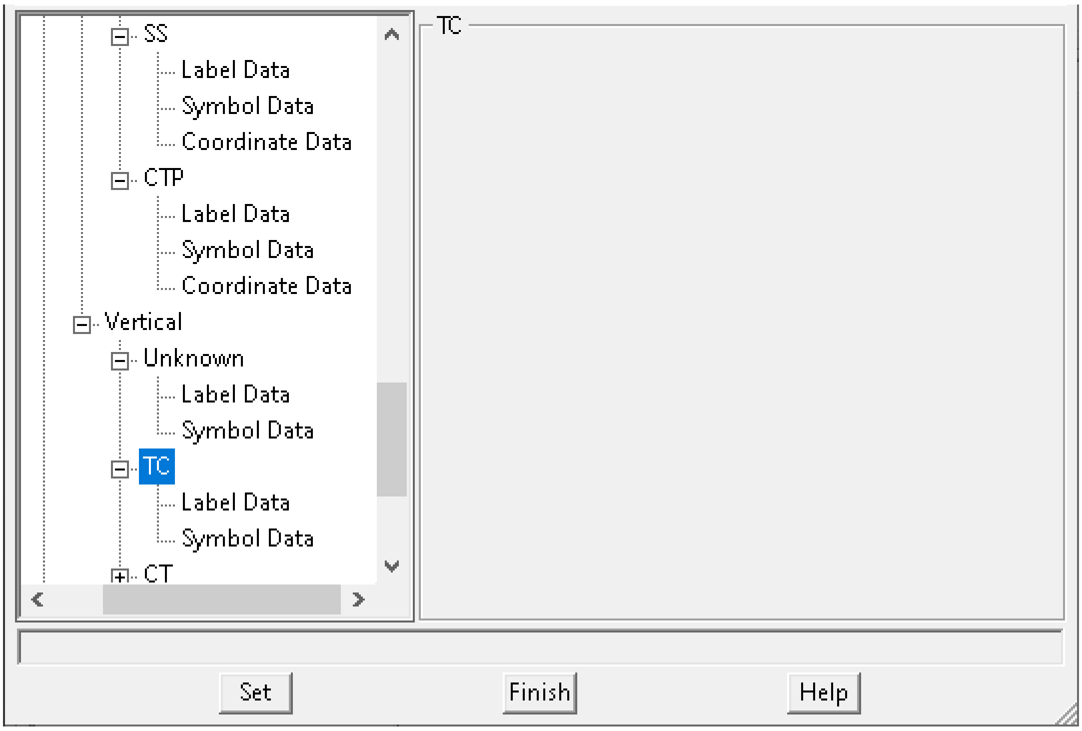
shift	real box	0

Distance shifted to the left/right on the X plane.

Raise	real box	0

Distance raised/lowered on the Y plane.

Vertical >TC



Unknown

Label Data:- chainage_vert_tc

Use tick box ticked

*If **ticked**, vertical tangent-curve labels will be generated.*

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_tc_symbol

Use	tick box	not ticked	

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style	symbol box	CIRCLE	

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

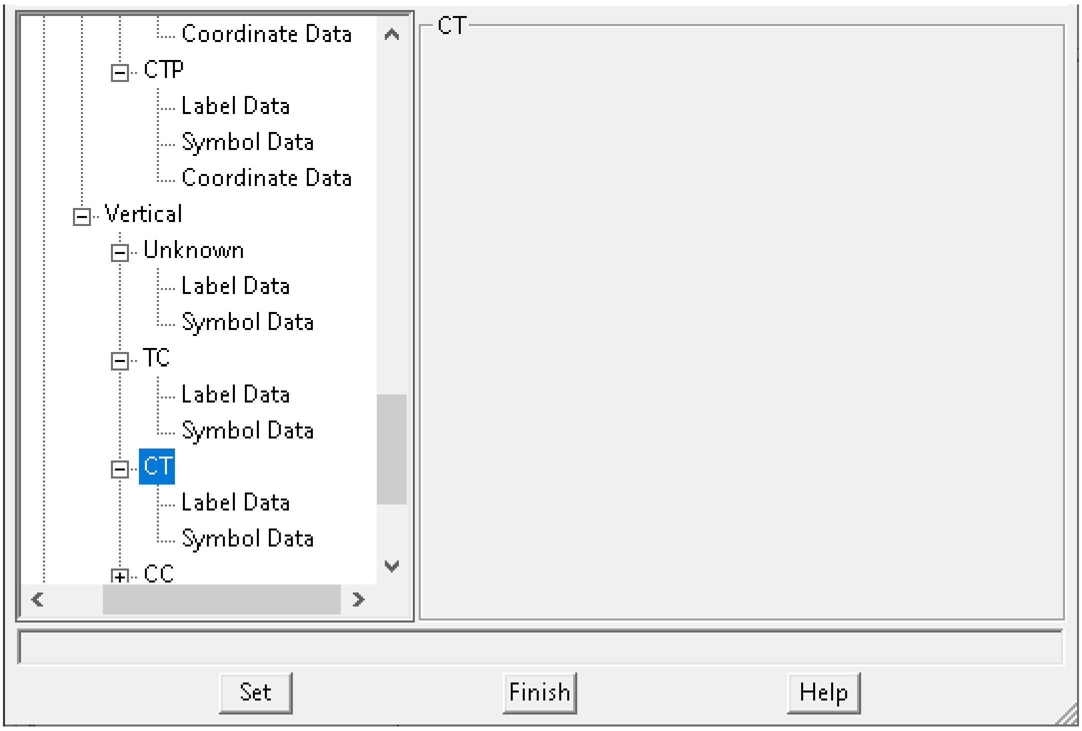
shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

Distance raised/lowered on the Y plane.

Vertical >CT



CT

Label Data:- chainage_vert_ct

Use tick box ticked

*If **ticked**, vertical curve-tangent labels will be generated.*

Text Style text style box all styles

Text style for the properties of the chainage labels.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_ct_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style	symbol box	CIRCLE	

Name of the symbol to place at every chainage on the ***Reference String****.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

Rotation of the symbol. The rotation angle is affected by ***Orient Text****.*

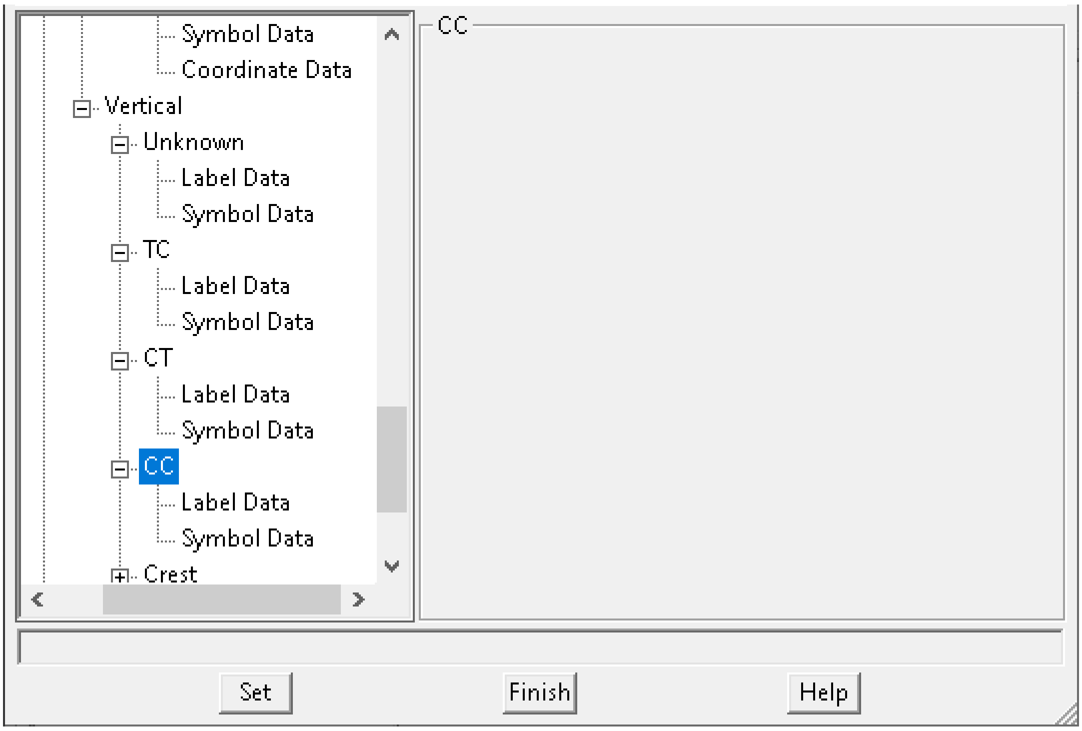
shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

Distance raised/lowered on the Y plane.

Vertical >CC



CC

Label Data:- chainage_vert_cc

Use tick box ticked

*If **ticked**, vertical curve-curve labels will be generated*

Text Style text style box all styles

Text style for the properties of the chainage labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_cc_symbol

Use	tick box	not ticked	

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style	symbol box	CIRCLE	

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

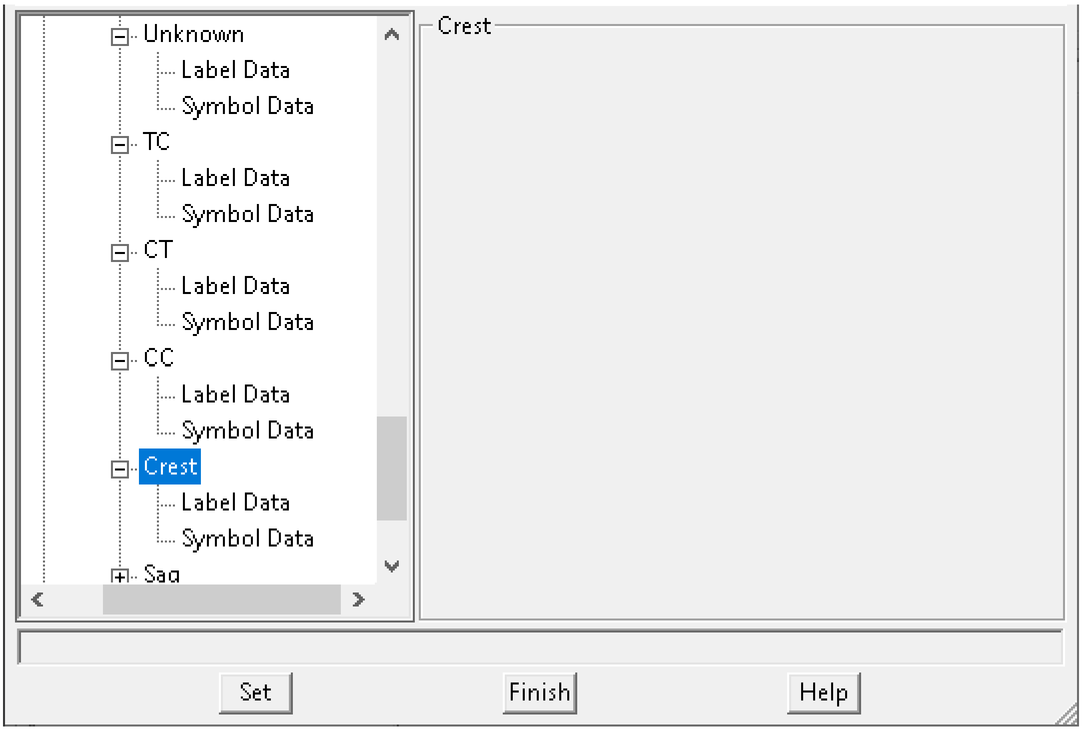
shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

Distance raised/lowered on the Y plane.

Vertical >Crest



Crest

Label Data:- chainage_vert_crest

Use tick box ticked

*If **ticked**, vertical curve crest labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_crest_symbol

Use tick box not ticked

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style symbol box CIRCLE

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1

Size of the symbol.

Rotation	real box	0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

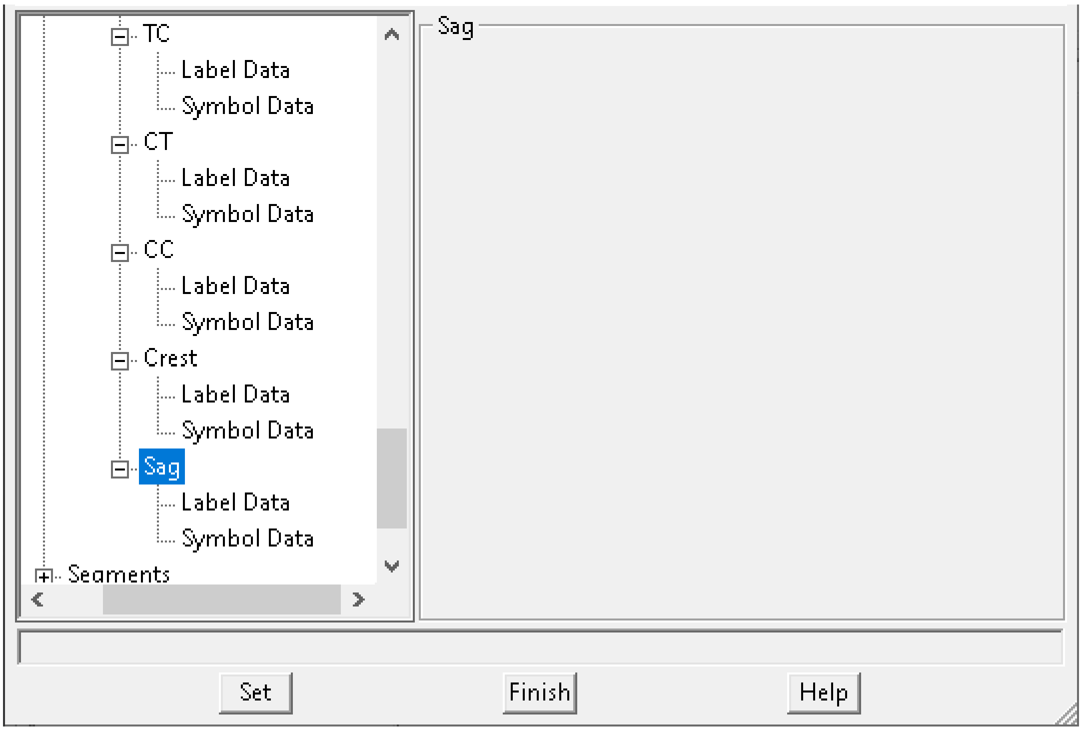
shift	real box	0

Distance shifted to the left/right on the X plane.

Raise	real box	0

Distance raised/lowered on the Y plane.

Vertical >Sag



Sag

Label Data:- chainage_vert_sag

Use tick box ticked

*If **ticked**, vertical curve crest labels will be generated. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the chainage labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places integer box 3

The number of decimal places for the chainage labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box Chd *

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Symbol Data:- vert_sag_symbol

Use	tick box	not ticked	

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol Style	symbol box	CIRCLE	

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

Distance raised/lowered on the Y plane.

Segments

See Straights >Short length

See Straights >Long length

See Straights >Bearing

See Straights >Short length

See Transitions >Type

See Transitions >Length

See Transitions >Grade

See Transitions >Cant ROCC

See Curves >Number

See Curves >Radius

See Curves >Length

See Curves >Speed

See Curves >Cant Eq

See Curves >Cant App

See Curves >Cant Def

Straights >Short length

Label Data:- straight_short_length

Use tick box ticked

*If **ticked**, straight short length labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box straight_short_length = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Straights >Long length

Label Data:- straight_long_length

Use tick box ticked

*If **ticked**, straight long length labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box straight_long_length = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Straights >Bearing

Label Data:- straight_bearing

Use tick box ticked

*If **ticked**, straight bearing labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

*The number of decimal places for the value labels. **Note: This feature has not been implemented yet.***

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box straight_bearing =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Transitions >Type

Label Data:- transition_type

Use tick box ticked

*If **ticked**, transition type labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box transition_type =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Transitions >Length

Label Data:- transition_length

Use tick box ticked

*If **ticked**, transition length labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box transition_length = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Transitions >Grade

Label Data:- transition_cant_grade

Use tick box ticked

*If **ticked**, transition grade labels will be generated*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box transition_cant_grade = 1 in *

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Transitions >Cant ROCC

Label Data:- transition_cant_ROCC

Use tick box ticked

*If **ticked**, transition rate of change of cant (ROCC) labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

If ***ticked****, the* ***Text Style Angle*** *will be relative to the* ***Reference String****.*

If ***not ticked****, the* ***Text Style Angle*** *will be relative to the world.*

Text Prefix * Suffix custom box transition_cant_ROCC = * mm/s

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Transitions >Cant ROCD

Label Data:- transition_cant_ROCD

Use tick box ticked

If ***ticked****, transition rate of change of cant deficiency (ROCD) labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

If ***ticked****, the* ***Text Style Angle*** *will be relative to the* ***Reference String****.*

If ***not ticked****, the* ***Text Style Angle*** *will be relative to the world.*

Text Prefix * Suffix custom box transition_cant_ROCD = * mm/s

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Number

Label Data:- curve_number

Use tick box ticked

*If **ticked**, curve number labels will be generated. Note: **Label Style - Elements - Tangents - IP - Use IP symbols** needs to be ticked to generate the curve number.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_number = *

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Radius

Label Data:- curve_radius

Use tick box ticked

*If **ticked**, curve radius labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_radius = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Length

Label Data:- curve_length

Use tick box ticked

*If **ticked**, curve length labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_length = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Speed

Label Data:- curve_speed

Use tick box ticked

*If **ticked**, curve speed labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

*The number of decimal places for the value labels. **Note: This feature has not been implemented yet.***

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_speed = * km/hr

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Cant Eq

Label Data:- curve_cant_eq

Use tick box ticked

*If **ticked**, equilibrium cant labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_cant_eq = * mm

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Cant App

Label Data:- curve_cant_app

Use tick box ticked

*If **ticked**, applied cant labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_cant_app = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Curves >Cant Def

Label Data:- curve_cant_def

Use tick box ticked

*If **ticked**, cant deficiency labels will be generated.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box curve_cant_def = * mm

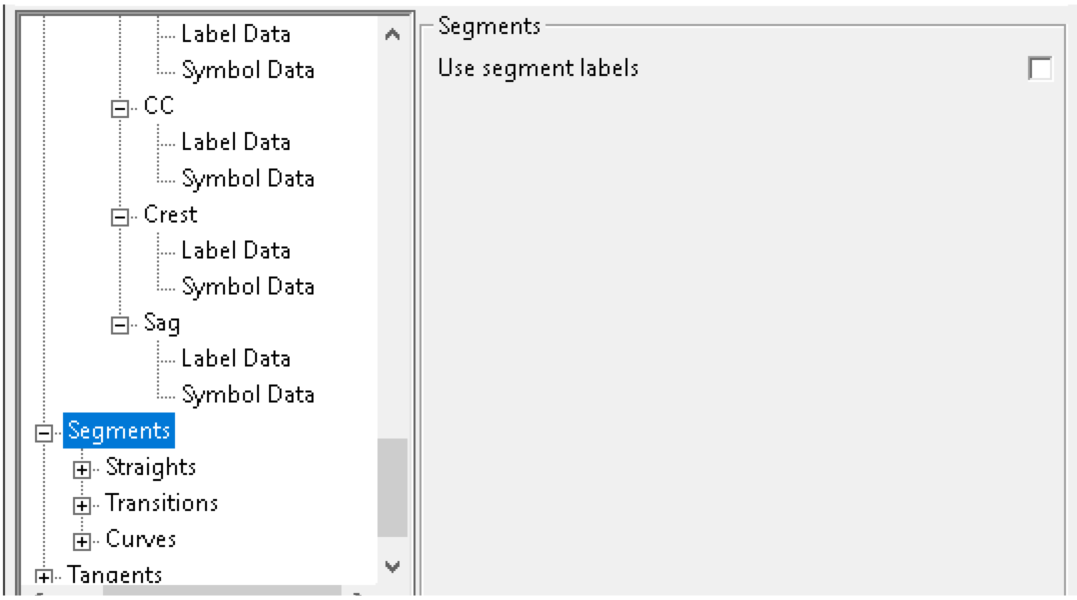
*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Tangents

See Tangent Lines >Text Format

See Tangent Lines >IP

Tangent Lines >Text Format



Label Data:- tangent_length

Use tick box ticked

*If **ticked**, tangent length label will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box tangent_length = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Label Data:- tangent_line

Use tick box ticked

*If **ticked**, tangent length label will be created when **Label Method** has been set to IPs, Tangents.*

Linestyle linestyle box DASHED all styles

Line style for the tangent lines. For information on linestyles refer to 44.1 Line Styles.

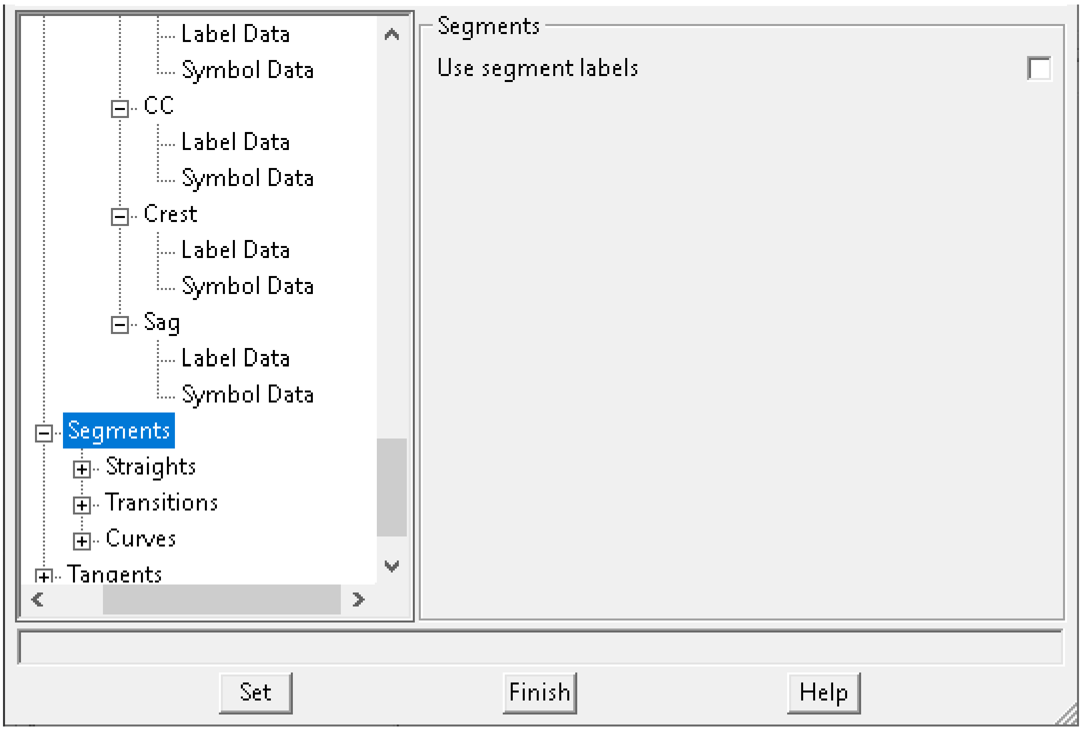
Colour colour box magenta available colours

Colour of the tangent lines.

Weight custom box 0

Line weight of the tangent lines.

Tangent Lines >IP



Use IP symbols tick box not ticked

*If **ticked**, IP symbol, IP coordinates and **Curves Number** will be created.*

Easting Label Data:- ip_easting

Use tick box ticked

*If **ticked**, IP eastings coordinates will be created.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box custom box ip_easting *

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Northing Label Data:- ip_northing

Use tick box ticked

*If **ticked**, IP northings coordinates will be created.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text	tick box	not ticked	

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix	custom box	custom box	ip_northing *

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Symbol Data:- ip_symbol

Use	tick box	not ticked	

*If **ticked**, it will create a symbol at every chainage on the **Reference String**.*

Symbol style	symbol box	CIRCLE	

*Name of the symbol to place at every chainage on the **Reference String**.*

Colour	colour box	white	available colours

Colour of the symbol.

Size	real box	1	

Size of the symbol.

Rotation	real box	0	

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

shift	real box	0	

Distance shifted to the left/right on the X plane.

Raise	real box	0	

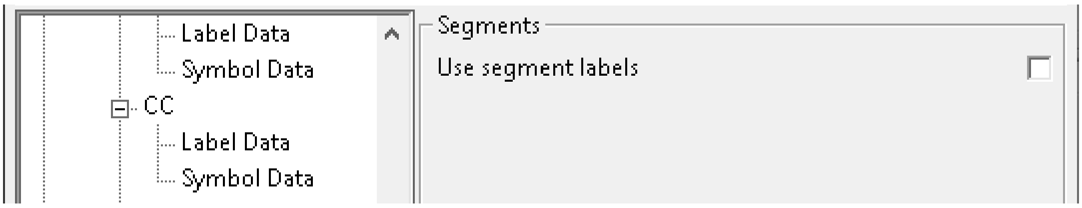
Distance raised/lowered on the Y plane.

Tables

See [Borders & Lines]

See [IP Tables]

Tables



Tables

Box offset real box 25

*The offset distance that the box will be placed away from the **Reference String**.*

Note: This feature has not been implemented yet.

Use table borders tick box not ticked

*If **ticked**, table borders will be used when **Label Method IPs**, **Tangents** has been selected.*

Note: This feature has not been implemented yet.

Rotate coordinates tick box not ticked

*If **ticked**, the boxes will be relative to the Reference String. **Note: This feature has not been implemented yet.***

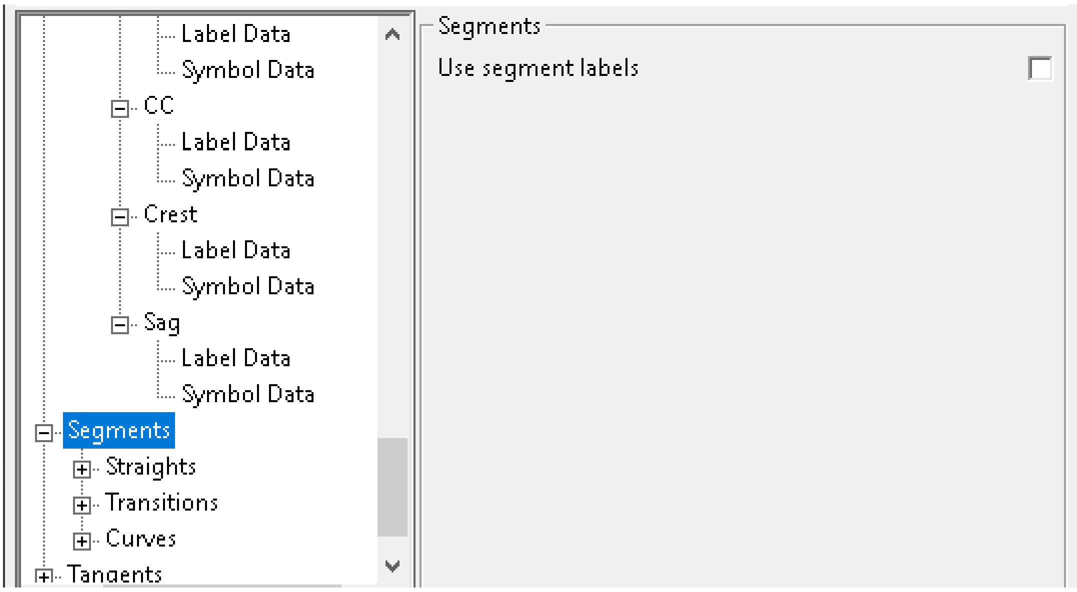
*If **not ticked**, the boxes will be relative to the world. **Note: This feature has not been implemented yet.***

Borders & Lines

See Tables >Borders

See Tables >Leaders

Tables >Borders



Borders

Linestyle:- ip_table_border

Use tick box not ticked

*If **ticked**, box borders will be generated for the **Label Method** Elements.*

Linestyle linestyle box 1 all styles

Name of the linestyle to be applied to the box border.

Colour colour box red all colours

Colour to be applied to the box border.

Weight custom box 2

Weight to be applied to the box border.

Linestyle:- ip_table_shadow

Use tick box not ticked

*If **ticked**, box border shadow will be generated for the **Label Method** Elements.*

Linestyle linestyle box 1 all styles

Name of the linestyle to be applied to the box border shadow.

Colour colour box red all colours

Colour to be applied to the box border shadow.

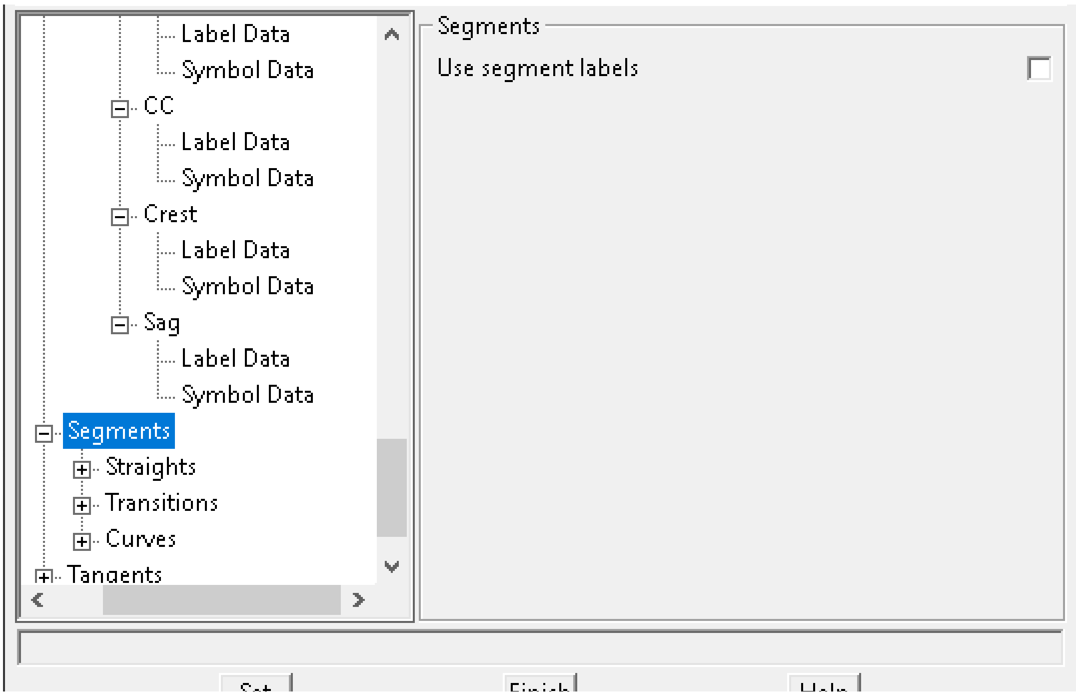
Weight custom box 2

Weight to be applied to the box border shadow.

Shadow width real box 0

Width of the box border shadow.

Tables >Leaders



Leaders

Linestyle:- ip_table_leader

Use tick box not ticked

*If **ticked**, leaders will be generated. **Note: This feature has not been implemented yet.***

Linestyle linestyle box 1 available styles

Name of the linestyle to be applied to the leaders.

Colour colour box red available colours

Colour to be applied to the leaders.

Weight custom box 2

Weight to be applied to the leaders.

Linestyle:- ip_table_leader_arrow

Use tick box not ticked

*If **ticked**, leader arrows will be generated. **Note: This feature has not been implemented yet.***

Symbol style symbol box CIRCLE

Name of the symbol to use as the leader arrow.

Colour colour box white available colours

Colour of the symbol.

Size real box 1

Size of the symbol.

Rotation real box 0

Rotation of the symbol.

Shift	real box	0

Distance shifted to the left/right on the X plane.

Raise	real box	0

Distance raised/lowered on the Y plane.

IP Tables

See IP Tables

See IP Tables >Number

See IP Tables >Radius

See IP Tables >Curve Length

See IP Tables >Easting

See IP Tables >Northing

See IP Tables >Deflection

See IP Tables >Tangent

See IP Tables >Tangent 1

See IP Tables >Tangent 2

See IP Tables >Short Tangent 1

See IP Tables >Short Tangent 2

See IP Tables >Shift 1

See IP Tables >Shift 2

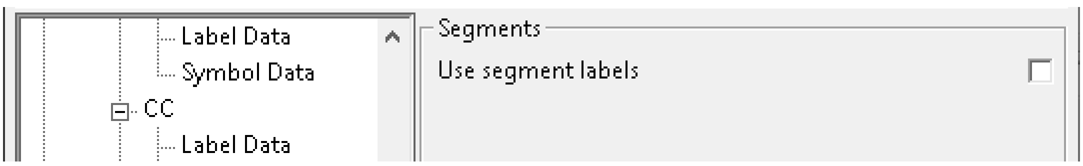
See IP Tables >Speed

See IP Tables >Cant Eq

See IP Tables >Cant App

See IP Tables >Cant Def

IP Tables



Text format for table chainages

Box Offset	real box	

??.

Rotate IP tables	tick box	not ticked

??.

IP Tables >Number

Linestyle:- ip_table_curve_number

Use tick box ticked

*If **ticked**, curve number labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box custom box ip_table_curve_number = *

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 1

Position in the table where the value will be ordered.

IP Tables >Radius

Label Data:- ip_table_curve_radius

Use tick box ticked

*If **ticked**, curve radius labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 0

Position in the table where the value will be ordered.

IP Tables >Curve Length

Label Data:- ip_table_curve_length

Use tick box ticked

*If **ticked**, curve length labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 0

Position in the table where the value will be ordered.

IP Tables >Easting

Label Data:- ip_table_curve_easting

Use tick box ticked

If ticked, curve intersection point easting coordinate labels will be created when Label Method has been set to IPs, Tangents.

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_easting * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 2

Position in the table where the value will be ordered.

IP Tables >Northing

Label Data:- ip_table_curve_northing

Use tick box ticked

*If **ticked**, curve intersection point northing coordinate labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_northing * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 3

Position in the table where the value will be ordered.

IP Tables >Deflection

Label Data:- ip_table_curve_deflection

Use tick box ticked

*If **ticked**, deflection angle labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

*The number of decimal places for the value labels. **Note: This feature has not been implemented yet.***

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_deflection < =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 4

Position in the table where the value will be ordered.

IP Tables >Tangent

Label Data:- ip_table_curve_tangent

Use tick box ticked

*If **ticked**, tangent length labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

*The number of decimal places for the value labels. **Note: This feature has not been implemented yet.***

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_tangent = * m

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 6

Position in the table where the value will be ordered.

IP Tables >Tangent 1

Label Data:- ip_table_curve_tangent1

Use tick box ticked

*If **ticked**, tangent 1 labels will be created when **Label Method** has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_tangent1 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 5

Position in the table where the value will be ordered.

IP Tables >Tangent 2

Label Data:- ip_table_curve_tangent2

Use tick box ticked

*If **ticked**, tangent 2 labels will be created when **Label Method** has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_tangent2 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 5

Position in the table where the value will be ordered.

IP Tables >Short Tangent 1

Label Data:- ip_table_curve_short_tangent1

Use tick box ticked

*If **ticked**, short tangent 1 labels will be created when Label Method has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_short_tangent1 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 7

Position in the table where the value will be ordered.

IP Tables >Short Tangent 2

Label Data:- ip_table_curve_short_tangent2

Use tick box ticked

*If **ticked**, short tangent 2 labels will be created when Label Method has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_short_tangent2 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 8

Position in the table where the value will be ordered.

IP Tables >Shift 1

Label Data:- ip_table_curve_shift1

Use tick box ticked

*If **ticked**, shift 1 labels will be created when Label Method has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_shift1 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 9

Position in the table where the value will be ordered.

IP Tables >Shift 2

Label Data:- ip_table_curve_shift2

Use tick box ticked

*If **ticked**, shift 2 labels will be created when Label Method has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_shift2 =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 10

Position in the table where the value will be ordered.

IP Tables >Speed

Label Data:- ip_table_curve_shift2

Use tick box ticked

*If **ticked**, speed labels will be created when Label Method has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box ip_table_curve_speed =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 11

Position in the table where the value will be ordered.

IP Tables >Cant Eq

Label Data:- ip_table_curve_cant_eq

Use tick box ticked

*If **ticked**, cant equilibrium labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 12

Position in the table where the value will be ordered.

IP Tables >Cant App

Label Data:- ip_table_curve_cant_app

Use tick box ticked

*If **ticked**, applied cant labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places custom box 3

The number of decimal places for the value labels.

Orient Text tick box not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix custom box

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position custom box 13

Position in the table where the value will be ordered.

IP Tables >Cant Def

Label Data:- ip_table_curve_cant_def

Use tick box ticked

*If **ticked**, cant deficiency labels will be created when **Label Method** has been set to IPs, Tangents.*

Text Style text style box all styles

Text style for the properties of the value labels. For information on textstyles refer to 3.13.3 Textstyle.

Decimal Places	custom box	3

The number of decimal places for the value labels.

Orient Text	tick box	not ticked

*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*If **not ticked**, the **Text Style Angle** will be relative to the world.*

Text Prefix * Suffix	custom box	ip_table_curve_cant_def =

*Text to add to the prefix or suffix of the value. The asterisk * denotes where the value will be placed.*

Table Position	custom box	14

Position in the table where the value will be ordered.

Continue to 16.23.9.2.1 Text Format Fields or return to 16.23.6 Track Turnouts or 16.23 Track.

16.23.9.2.1 Text Format Fields

XX chainage infix text text box

Text to be infixed to the labels at the specified chainages.

Position of infix text integer box

*If **Drop chainage digits to left of position** is **ticked**, the number of characters to retain at the end of the chainage value and to be prefixed by **Major chainage infix text**.*

*If **Drop chainage digits to right of position** is **ticked**, the number of characters to remove at the end of the chainage value and to be suffixed by **Major chainage infix text**.*

Drop chainage digits to left of position tick box not ticked

*Refer to **Position of infix text** above.*

Drop chainage digits to right of position tick box not ticked

*Refer to **Position of infix text** above.*

Continue to 16.23.9.2.2 Label Data Fields or return to 16.23.6 Track Turnouts or 16.23 Track.

16.23.9.2.2 Label Data Fields

Text Style text style box all styles

Text style for the properties of the labels at the specified chainages.

Decimal Places integer box 0

Number of decimal places for the chainage labels.

Orient Text tick box ticked

*If **ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*
*If **not ticked**, the **Text Style Angle** and symbol **Rotation** will be relative to the world.*

Text Prefix * Suffix text box MAJ*

*Text to add to the prefix or suffix of the chainage value. The asterisk * denotes where the chainage value will be placed.*

Continue to 16.23.9.2.3 Symbol Data Fields or return to 16.23.6 Track Turnouts or 16.23 Track.

16.23.9.2.3 Symbol Data Fields

Symbol Style symbol box CIRCLE

*Name of the symbol to place at the specified chainages on the **Reference String**.*

Colour colour box orange

Colour of the symbol.

Size real box 5

Size of the symbol.

Rotation real box 0

*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

Shift real box 0

Distance shifted to the left/right on the X plane.

Raise	real box	0

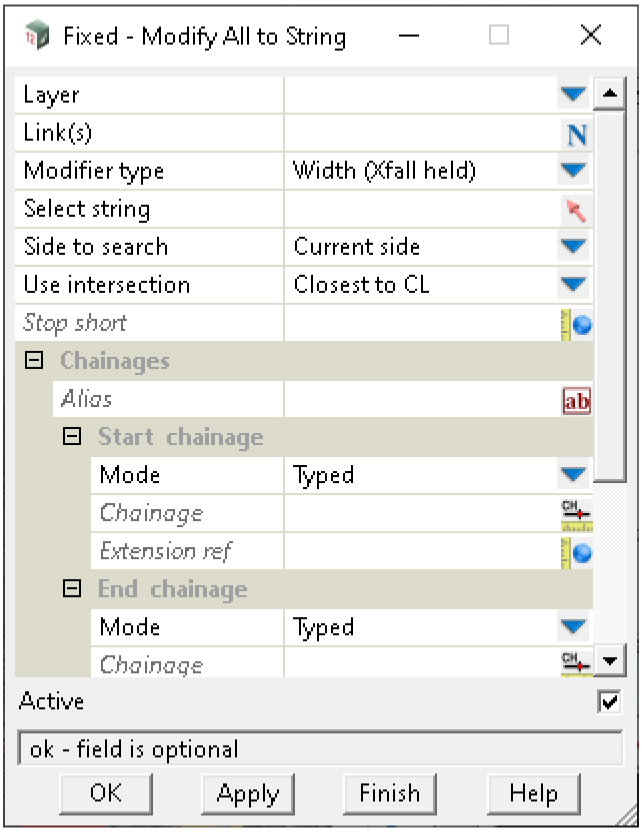
Distance raised/lowered on the Y plane.

Continue to 16.24 Fixed Link - To String or go back to 16.23.9 Track Label or 16.23 Track.

16.24 Fixed Link - To String

The choice **current side** has been added to the **Side to search** option on the **Fixed - Modify All to String panel.**

Selecting the **To string** brings up the **Fixed - Modify All to String** panel.



Side to search	choice box	left side	left side, right side, both sides, current side

Side of the hinge string to start searching to find the string to define width/height/xfall.
*If **current side**, the search side is **left** for left side modifiers and **right** for right side modifiers.*

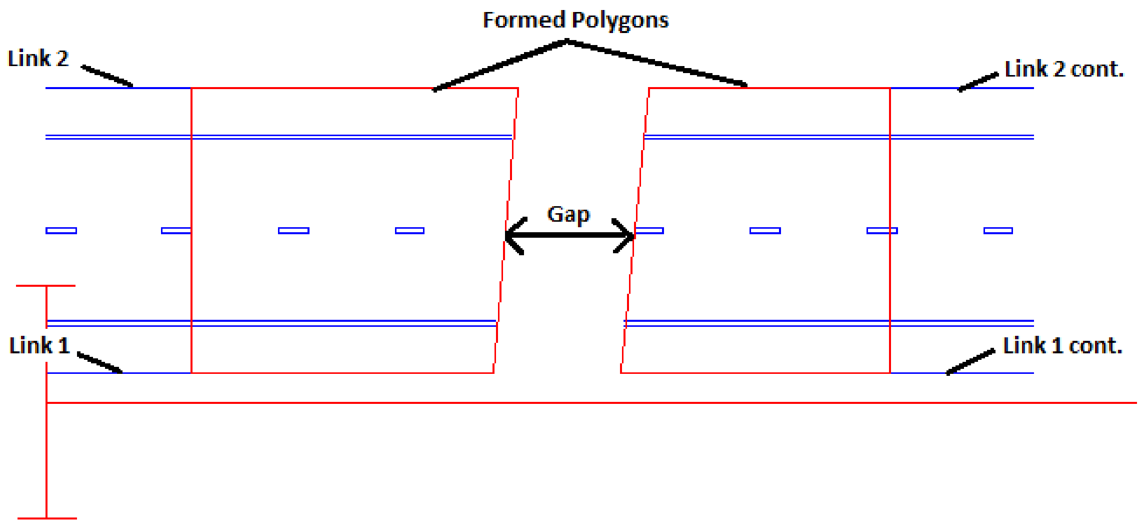
Continue to 16.25 Create Polygon or go back to 16.24 Fixed Link - To String.

16.25 Create Polygon

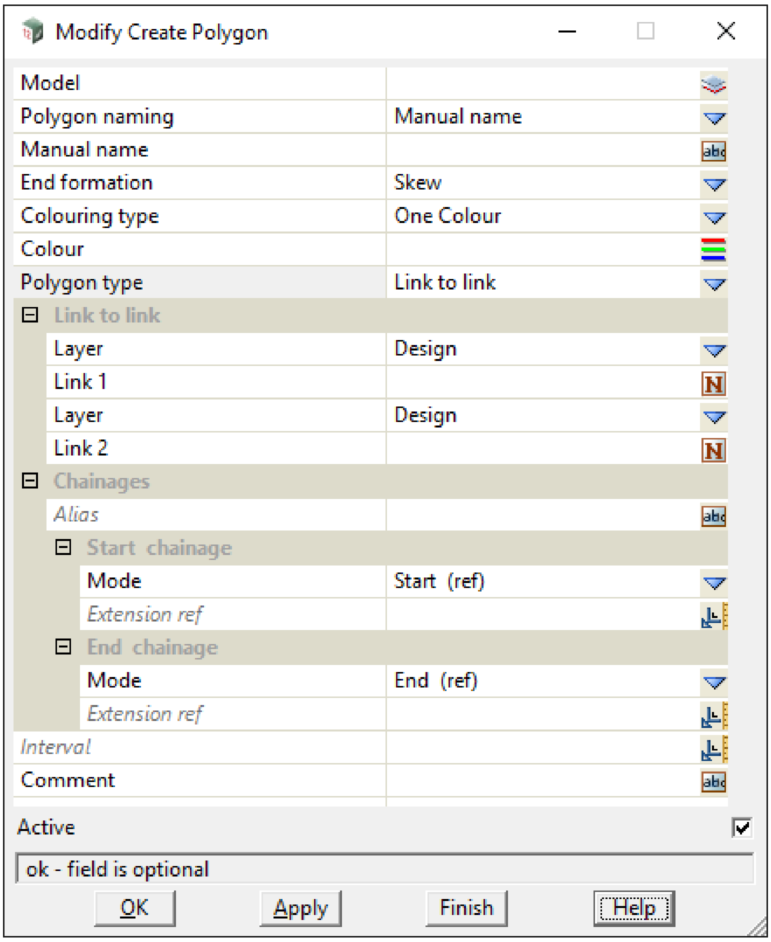
The **Polygon** option creates one or more closed strings between two given links. This option also provides the ability to customise the polygon naming, colouring and end formation type.

Note: Strings and sections are automatically created for all the MTF points in the default Layer **Design**.

For information on MTF Points, Strings, Shapes and Trimeshes, see 20.1.1 MTF Links, Points, Sections, Strings and Trimeshes.



Selecting **Polygon** brings up the panel **Modify Create Polygon**



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model	model box		available models

The model for the polygon/s that are created by this modifier.

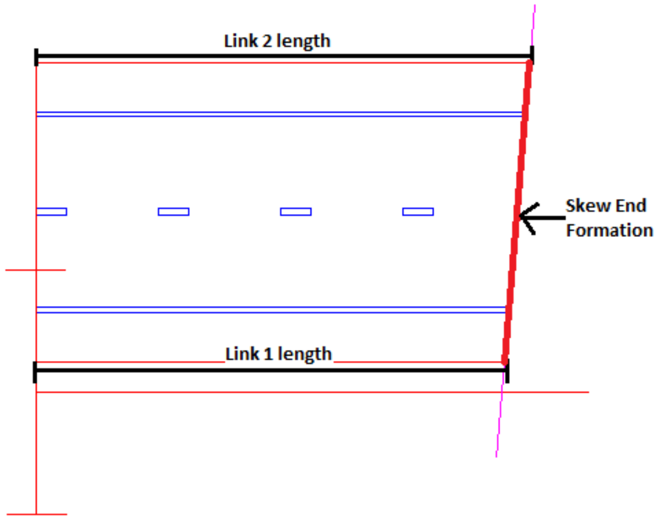
Polygon naming	choice box	Manual name	Manual name InnerLink-UserText-OuterLink OuterLink-UserText-InnerLink

The naming convention for the polygon/s that are created by this modifier.

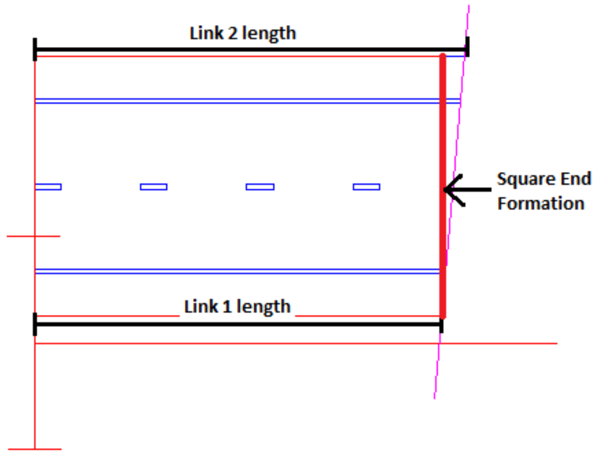
For more information, see 16.25.1 Polygon Naming.

End formation	choice box	Skew	Skew, Square

*If **Skew**, the ends of the polygon can be formed at any angle except parallel to the reference string in some cases.*



*If **Square**, the ends of the polygon will be perpendicular to the reference string where a common chainage exists for both links.*



Colouring type	choice box	One Colour	One Colour Inner Link Colour Outer Link Colour

The colouring convention for the polygon/s that are created by this modifier.

For more information, see 16.25.2 Colouring Type.

Polygon type	choice box	Link to link	Link to link All links between 2 links

*If **Link to link**, a polygon will be created spanning between 2 selected links from the same or different layers.*

*If **All links between 2 links**, a polygon will be created for each pair of adjacent links between and including 2 selected links all from the same layer.*

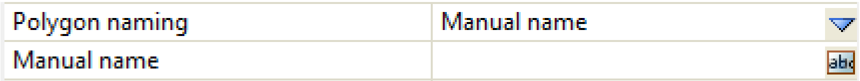
For more information, see 16.25.3 Polygon Type.

Continue to 16.25.1 Polygon Naming.

16.25.1 Polygon Naming

Manual name

This choice allows a uniform name for all created polygons.

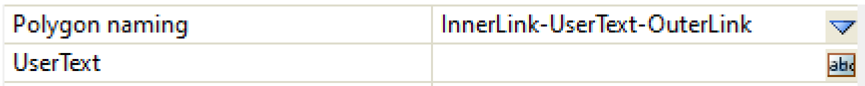


Manual name text box

The name that will be assigned to all the created polygon closed string elements.

InnerLink-UserText-OuterLink

This choice allows for each polygon name to take the form of: "Inner link name" + "User text" + "Outer link name". Note the inner link and outer links are determined by their offset distance to the reference string.

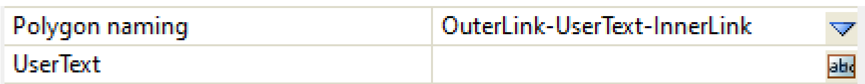


UserText text box

The text that will be inserted between the inner and outer link names to form a name for a given polygon.

OuterLink_UserText_InnerLink

This choice allows for each polygon name to take the form of: "Outer link name" + "User text" + "Inner link name". Note the outer link and inner links are determined by their offset distance to the reference string.



UserText text box

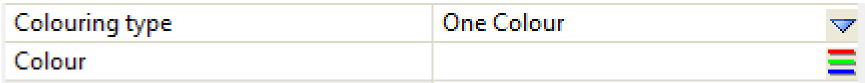
The text that will be inserted between the outer and inner link names to form a name for a given polygon.

Continue to 16.25.2 Colouring Type.

16.25.2 Colouring Type

One Colour

This choice allows a uniform colour for all created polygons.



Colour colour box

The colour that will be assigned to all the created polygon closed string elements.

Inner Link Colour

This choice allows for the created polygon colour to be determined by the link with the least offset distance from the reference string.

Outer Link Colour

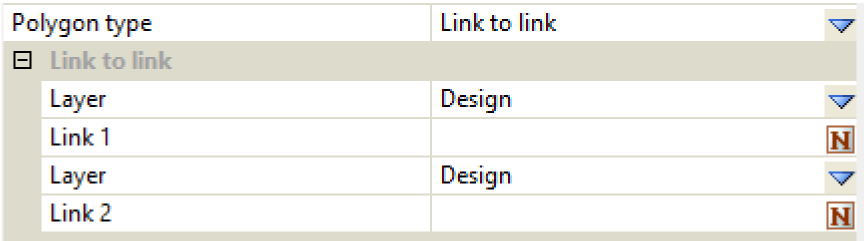
This choice allows for the created polygon colour to be determined by the link with the greatest offset distance from the reference string.

Continue to 16.25.3 Polygon Type.

16.25.3 Polygon Type

Link to link

This choice allows a polygon to be created spanning between 2 selected links from the same or different layers.



Layer choice box available Layers

*The layer containing **Link 1**. For information on Layers, see 20.1.1.2 MTF Links and Layers.*

Link 1 text box

The name of the link that will be used to form the one of the edges of the polygon.

Layer choice box available Layers

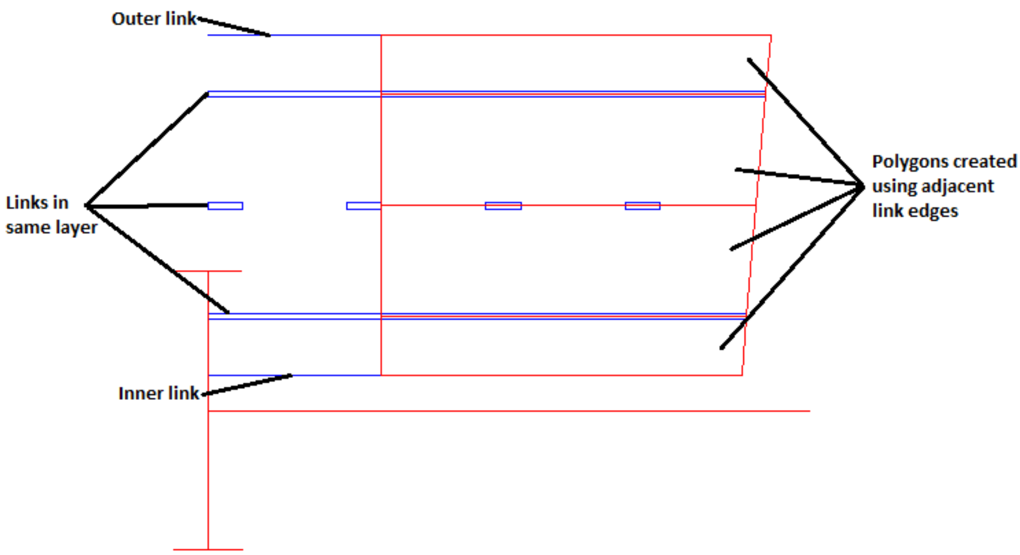
*The layer containing **Link 2**. For information on Layers, see 20.1.1.2 MTF Links and Layers.*

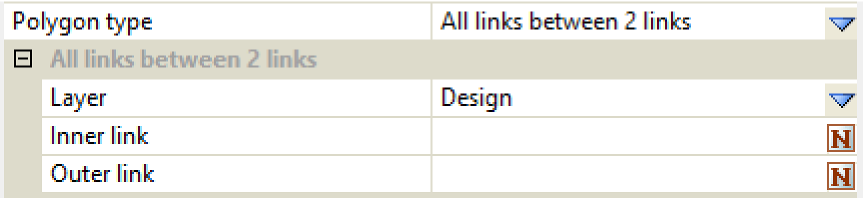
Link 2 text box

The name of the link that will be used to form the one of the edges of the polygon.

All links between 2 links

This choice allows a polygon to be created for each pair of adjacent links between and including 2 selected links all from the same layer.





Layer choice box available Layers

*The layer containing the **Inner link**, **Outer link** and all links in between. For information on Layers, see 20.1.1.2 MTF Links and Layers.*

Inner link text box

The name of the link that will be used to form the one of the edges of the polygon.

Outer link text box

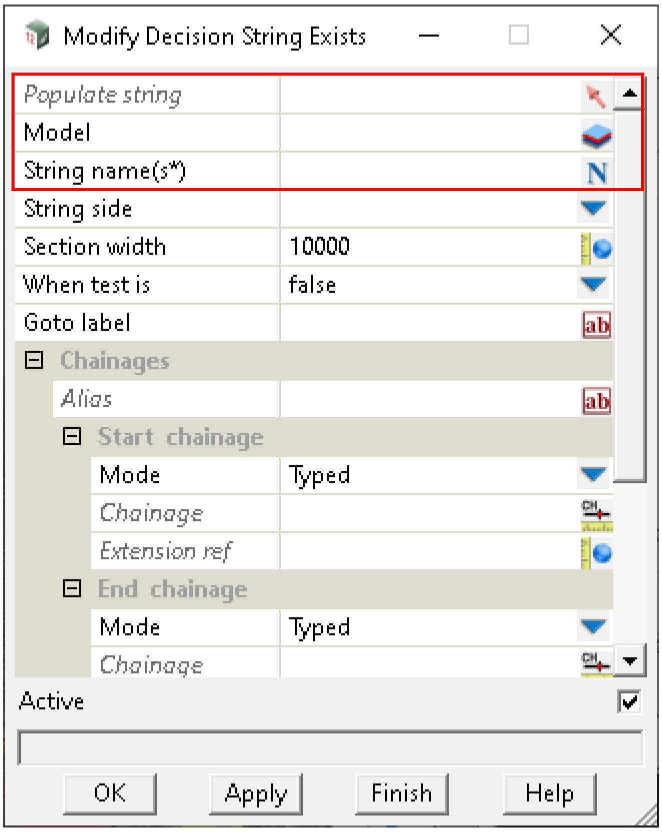
The name of the link that will be used to form the one of the edges of the polygon.

Continue to 16.26 Fixed Decisions - String Exists or go back to 16.25 Create Polygon.

16.26 Fixed Decisions - String Exists

The option "**String**" has been removed from the panel.

The options "**Populate string**", "**Model**" and "**String name(s)**" has been added to the panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Default	Pop-Up
Populate string	string select		

Allows user to manually select a string such that this string's model name will populate the "Model" widget and the string's name will populate the "String name(s)" widget.

Model	model box		available models

Model of the string(s) to be tested.

String name (s)	input box		

String(s) to be tested.

Wild cards "?" and "" are accepted.*

Continue to 16.27 MTF Modifiers File Format or go back to 16.26 Fixed Decisions - String Exists.

16.27 MTF Modifiers File Format

16.27.1 Common token types

< >

Denotes optional token.

" "

Denotes a string token.

value

A real numeric value, **45.678**

value/$null

A real numeric value, **45.678**

or no value, **$null**

value/unknown

A real numeric value, **45.678**

or no value, **unknown**

integer_value

An integer value, **2**

"model_string"

A reference to a string in a model in the format "model of string->string name", where quotes are necessary, "**Existing road->kerb return 1**".

"model_name"

Name of the model to use, this is a simple name, the quotes are necessary, "**Existing Road**". For more information see 3.5 Models.

"element_name"

For more information 4.7.1.1.1.Name and Model.

start_chainage

See 20.10.1.7 Start and End Chainages in the Modifier File Format for more information.

final_chainage

See 20.10.1.7 Start and End Chainages in the Modifier File Format for more information.

"colour"

Name of a ***12d Model*** colour.

See 4.29 Colours for more information.+

"named_grade"

See 20.2.2.2.6.2 Boxing - Named Grade for more information.

boolean

An integer_value of 1 or 0.

"layer name"

Name of an MTF layer.

See 20.1.1.2 MTF Links and Layers for more information.

"link_name"

Description of a single link.

See 20.10.1.6 MTF Links and Layers File Format for more information.

"link_names"

Description of multiple links.

20.2.2.1.2 Link, Link(s) or Link(s*)

See 20.10.1.6 MTF Links and Layers File Format for more information.

"template_name"

Name of a template.

name_list

A variadic number of "link_name" arguments delimited by spaces.

colour_list

The token **link_colour** followed by a variadic number of "colour" arguments delimited by spaces.

For example: **link_colour** "cyan:4" "no_colour" "red"

"boolean"

(1)"false" / (2)"true" / (3)"error"

(1) Text representing the boolean value of false.

(2) Text representing the boolean value of true.

(3) Text representing an invalid boolean value.

string_side_ex_type

(1)Left / (2)Both / (3)Right / (4)Inside / (5)Outside / (6)Current

(1) Left = -1

(2) Both = 0

(3) Right = 1

(4) Inside = 2

(5) Outside = 3

(6) Current = 4

string_side_type

(1)Left / (2)Both / (3)Right

(1) Left = -1

(2) Both = 0

(3) Right = 1

"string_side_type"

(1)"left" / (2)"Both" / (3)"Right"

(1) Left side of string.

(2) Both sides of string.

(3) Right side of string.

"link_type"

(1)"eek" / (2)"height_slope" / (3)"width_slope" / (4)"width_height"

(1) Error when defining link.

(2) Define a link by height and slope.

(3) Define a link by width and slope.

(4) Define a link by width and height.

16.27.2 Fixed Link Modifiers

16.27.2.1 Fixed - Insert

16.27.2.1.1 Common types

insert_modifier_link

(1)variable/value/unknown (2)variable/value/unknown (3)variable/value/unknown

(1) Width of the link.

(2) Height of the link.

(3) Slope of the link.

modifier_extras

<(1)**interval** (2)value> (3)<**absolute**> (4)<**cubic**> (5)<**rotate**> (6)<**extra_start**> (7)<**extra_end**> (8)<**inactive**> (9)<**suppress_msgs**> <(10)**modifier_alias** (11)"text">

(1) Token indicating a change in interval over the chainage range.

(2) The interval value, distance between sections.

(3) Token indicating insertion of link(s) is not relative.

(4) Token deprecated.

(5) Token deprecated.

(6) Token when defined adds extra section 0.1mm before start chainage.

(7) Token when defined adds extra section 0.1mm before end chainage.

(8) Token indicating current modifier will not be processed.

(9) Token to hide error messages generated by current modifier.

(10) Token to declare an alias.

(11) Name of alias to be referenced by modifiers and smart chainages.

16.27.2.1.2 Insert a Fixed Link

insert

(1)**insert** (2)"link_name" (3)"colour" (4)insert_modifier_link (5)start_chainage (6)final_chainage (7)"<link_name>" (8)"<link_name>" (9)<modifier_extras>

(1) Token that indicates a link is to be inserted.

(2) Name of this link.

(3) Colour of this link.

(4) See insert_modifier_link for more information.

(5) See start_chainage for more information.

(6) See final_chainage for more information.

(7) Base link to insert this new link before.

(8) Base link to insert this new link after.

(9) See modifier_extras for more information.

See 20.2.2.2.1.1 Insert a Fixed Link for more information.

16.27.2.1.3 Insert a Fixed Link Absolute

insert_absolute

(1)**insert_absolute** (2)"link_name" (3)"colour" (4)insert_modifier_link (5)start_chainage (6)final_chainage (7)"<link_name>" (8)"<link_name>" (9)"<named_grade>" (10)boolean (11)<modifier_extras>

(1) Token that indicates an absolute link is to be inserted.

(2) Name of link to be inserted.

(3) Colour of this link.

(4) See insert_modifier_link for more information.

(5) See start_chainage for more information.

(6) See final_chainage for more information.

(7) The base link.

(8) The grade link.

(9) The named grade.

(10) Whether the link dynamic updates or not.

(11) See modifier_extras for more information.

See 20.2.2.2.1.2 Insert a Fixed Link Absolute for more information.

16.27.2.1.4 Insert a Fixed Link at a String

insert_at_string

(1)insert_at_string (2)"link_name" (3)"colour" (4)start_chainage (5)final_chainage (6)"model_string" (7)"link_type" (8)string_side (9)variable/value/$null (10)variable/value/$null (11)"integer_value" (12)<modifier_extras>

(1) Token that indicates a link is to be inserted at a string.

(2) Name of link to be inserted.

(3) Colour of this link.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) String to insert new link relative to.

(7) Currently unused.

(8) Side of centreline to search for string.

(9) Strip depth of link.

(10) Stop short distance of link.

(11) Intersection number to use with string.

(12) See modifier_extras for more information.

See 20.2.2.2.1.3 Insert a Fixed Link at a String for more information.

16.27.2.1.4.0.1 Insert Intersect

"height_difference_type"

(1)"vert" / (2)"norm"

(1) Measure the height difference vertically/2d.

(2) Measure the height difference perpendicularly/3d.

"intersection_type"

(1)"extend" / (2)"int_or_stop"

(1) See 20.2.2.2.1.4.1 Intersection type - Extend for more information.

(2) See 20.2.2.2.1.4.2 Intersection type - Int or stop for more information.

insert_intersect

(1)**insert_intersect** (2)"link_name" (3)"colour" (4)start_chainage (5)final_chainage (6)"link_name" (7)"named_grade" (8)variable/value/$null (9)"height_difference_type" (10)"link_name" (11)"named_grade" (12)variable/value/$null (13)"height_difference_type" (14)"intersection_type" (15)"<link_name>" (16)"<link_name>" (17)<modifier_extras>

(1) Token that indicates the beginning of this insert modifier.

(2) Name of link to be inserted.

(3) Colour of this link.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) The name of the first link.

(7) Named grade to use for the first link.

(8) Height difference of the first link.

(9) Type of height difference for the first link.

See "height_difference_type" for more information.

(10) The name of the second link.

(11) Named grade to use for the second link.

(12) Height difference of the second link.

(13) Type of height difference for the second link.

See "height_difference_type" for more information.

(14) Intersection type of the two links.

See "intersection_type" for more information.

(15) The name of the link to stop at when intersection type(14) is "int_or_stop".

(16) The name of the extra link generated when intersection type(14) is "int_or_stop".

(17) See modifier_extras for more information.

See 20.2.2.2.1.4 Insert Intersect for more information.

16.27.2.1.5 Insert Xfall Point

"offset_distance_type"

(1)"hor_off_ver_dst" / (2)"hor_off_per_dst" / (3)"slp_off_per_dst" (4)"slp_off_ver_dst"

(1) Use a horizontal offset and vertical distance.

(2) Use a horizontal offset and perpendicular distance.

(3) Use a sloped offset and perpendicular distance.

(4) Use a sloped offset and vertical distance.

insert_xfall_point

(1)**insert_xfall_point** (2)"link_name" (3)"colour" (4)start_chainage (5)final_chainage
(6)"link_name" (7)"named_grade" (8)variable/value (9)variable/value
(10)"offset_distance_type" (11)<modifier_extras>

(1) Token that indicates the beginning of this insert modifier.

(2) Name of link to be inserted.

(3) Colour of this link.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) The name of the base link.

(7) Named grade for the Xfall.

(8) The offset from the base link.

(9) The distance from the base link.

(10) How the offset(8) and distance(9) are applied relative to the base link(6) and named grade(7).

See "offset_distance_type" for more information.

(11) See modifier_extras for more information.

See 20.2.2.2.1.5 Insert Xfall Pt for more information.

16.27.2.1.6 Insert Around Arc

insert_arc_links

(1)**insert_arc_links** (2)"link_names" (3)"colour" (4)variable/value (5)variable/value (6)variable/value/$null (7)start_chainage (8)final_chainage (9)<modifier_extras>

(1) Token that indicates the beginning of this insert modifier.

(2) Ordered names of links to be inserted for the arc.

(3) Colour of the links being inserted.

(4) Width of arc.

(5) Height of arc.

(6) Signed radius of arc.

(7) See start_chainage for more information.

(8) See final_chainage for more information.

(9) See modifier_extras for more information.

See 20.2.2.2.1.6 Insert Around Arc for more information.

16.27.2.1.7 Fixed Link - Insert Xfall Intersect

"xfall_intersect_type"

(1)"same_xfall_normal_hinge" / (2)"same_xfall_normal_both"

/ (3)"diff_xfall_normal_hinge" / (4)"diff_xfall_normal_both"

(1) See 20.2.2.2.1.7.1.1 Same Xfall and Normal to Reference String for more information.

(2) See 20.2.2.2.1.7.1.2 Same Xfall and Normal to Reference String and to Other String for more information.

(3) See 20.2.2.2.1.7.1.3 Two Xfalls and Normal to Reference String for more information.

(4) See 20.2.2.2.1.7.1.4 Two Xfalls and Normal to Reference String and to Other String for more information.

insert_xfall_intersect

Note: Prior to V15C1i this modifier was referred to as: **table_drain**

(1)**insert_xfall_intersect** (2)"link_name" (3)start_chainage (4)final_chainage (5)"colour" (6)"xfall_intersect_type" (7)variable/value/$null/null (8)variable/value/$null/null (9)$null/null (10)"model_string" (11)"" (12)<modifier_extras>

(1) Token that indicates the beginning of this insert modifier.

(2) Names of link to be inserted.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Colour of the link being inserted.

(6) The type of way to calculate intersections to create new link.

(7) First Xfall parameter.

(8) Second Xfall parameter.

(9) Spare parameter.

(10) Name of the "Other string" to be used in calculations.

(11) Spare parameter.

(12) See modifier_extras for more information.

See 20.2.2.2.1.7 Fixed Link - Insert Xfall Intersect for more information.

16.27.2.1.8 Insert Fixed Links from a Template

insert_template

(1)**insert_template** (2)start_chainage (3)final_chainage (4)"template_name" (5)"<link_name>" (6)"<link_name>" (7)<modifier_extras>

(1) Token that indicates the beginning of an insertion of a template.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) Name of the template to be inserted.

(5) The link that the template can be inserted before.

(6) The link that the template can be inserted after.

(7) See modifier_extras for more information.

See 20.2.2.2.1.8 Insert Fixed Links from a Template for more information.

16.27.2.1.9 Insert Full Template

insert_full_template

(1)**insert_full_template** (2)start_chainage (3)final_chainage (4)"template_name" (5)"layer_name" (6)<modifier_extras>

(1) Token that indicates the beginning of an insertion of a template.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) Name of the template to be inserted.

(5) The layer for the new links.

(6) See modifier_extras for more information.

See 20.2.2.2.1.9 Insert Full Template for more information.

16.27.2.1.10 Insert Kerb Ramp

"kerb_ramp_back_align_type"

(1)"to_kerb_centreline" / (2)"to_ramp_centreline"

(1) The back of the ramp is created square to the lip of kerb.

(2) The back of the ramp is created square to the ramp centreline.

insert_kerb_ramp

(1)**insert_kerb_ramp** (2)start_chainage (3)final_chainage (4)"model_string" (5)"link_name" (6)"link_name" (7)"link_name" (8)"link_name" (9)"kerb_ramp_back_align_type" (10)"link_name" (11)"link_name" (12)"link_name"

(13)"link_name" (14)"link_name" (15)"colour" (16)variable/value/$null (17)variable/value/$null (18)variable/value/$null (19)variable/value/$null (20)**offset** (21)variable/value/$null (22)variable/value/$null (23)**offset** (24)variable/value/$null (25)variable/value/$null (26)<modifier_extras>

(1) Token that indicates the beginning of an insertion of a kerb ramp.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) The ramp centreline.

(5) The invert of kerb link.

(6) The top of kerb link.

(7) The back of kerb link.

(8) The footpath of kerb link.

(9) See "kerb_ramp_back_align_type" for more information.

(10) Name for the new link of the outer left wing of the ramp.

(11) Name for the new link of the inner left wing of the ramp.

(12) Name for the new link of the back of the ramp.

(13) Name for the new link of the outer right wing of the ramp.

(14) Name for the new link of the inner right wing of the ramp.

(15) Colour of the new kerb ramps links.

(16) The front left width of the kerb ramp.

(17) The front right width of the kerb ramp.

(18) The back left width of the kerb ramp.

(19) The back right width of the kerb ramp.

(20) Token that must always be placed at the 20th parameter.

(21) The ramp length of the kerb ramp.

(22) The ramp grade of the kerb ramp.

(23) Token that must always be placed at the 23th parameter.

(24) The left kerb taper length of the kerb ramp.

(25) The right kerb taper length of the kerb ramp.

(26) See modifier_extras for more information.

See 20.2.2.2.1.10 Insert Kerb Ramp for more information.

16.27.2.2 Fixed - Modify

See 16.27.2.2.1 Common types

See 16.27.2.2.2 Fixed - Modify Link

See 16.27.2.2.3 Fixed - Modify To

See 16.27.2.2.4 Fixed - Modify from

16.27.2.2.1 Common types

"modify_what_type"

(1)"mod_wdt_hgt_fix" / (2)"mod_wdt_xfl_fix" / (3)"mod_hgt_wdt_fix" / (4)"mod_hgt_xfl_fix" / (5)"mod_xfl_wdt_fix" / (6)"mod_xfl_hgt_fix" / (7)"mod_slp_wdt_fix" / (8)"mod_slp_hgt_fix" / (9)"mod_all"

(1) Modify width, hold height.

(2) Modify width, hold Xfall.

(3) Modify height, hold width.

(4) Modify height, hold Xfall.

(5) Modify Xfall, hold width.

(6) Modify Xfall, hold height.

(7) Modify slope, hold width.

(8) Modify slope, hold height.

(9) Modify width, height and slope.

"interpolate_type"

Note: Use of the word "value" is substituted for width, height, Xfall or slope dependent on what in the link is being modified.

(1)"val_constant" / (2)"val_val_lineal" / (3)"val_val_par_fwd" / (4)"val_val_arc_fwd" / (5)"val_val_par_bck" / (6)"val_val_arc_bck" / (7)"val_val_cubic" / (8)"val_val_bi_para" / (9)"val_val_rev_arc" / (10)"val_val_sinusoidal" / (11)"val_val_rot_slp_grd" / (12)"val_val_rot_slp_ang" / (13)"pos_pos_geom_lineal" / (14)"pos_nul_constant" / (15)"pos_val_lineal" / (16)"nul_pos_constant" / (17)"val_pos_lineal" / (18)"pos_pos_lineal" / (19)"val_val_rev_arc_len" / (20)"named_grade" / (21)"pos_pos_rev_arc"

(1) Modify link to be a constant user defined value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.1 Width for more information.

Height, see 20.2.2.2.2.2.1 Height for more information.

Xfall, see 20.2.2.2.2.3.1 Xfall for more information.

Slope, see 20.2.2.2.2.4.1 Slope for more information.

(2) Modify link to linearly interpolate between a user defined start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.2 Width -> Width for more information.

Height, see 20.2.2.2.2.2.2 Height -> Height for more information.

Xfall, see 20.2.2.2.2.3.2 Xfall -> Xfall for more information.

Slope, see 20.2.2.2.2.4.2 Slope -> Slope for more information.

(3) Modify link from the existing start value and then follow the shape of a parabola over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.8 Parabola-> for more information.

Height, see 20.2.2.2.2.2.8 Parabola-> for more information.

Xfall, see 20.2.2.2.2.3.8 Parabola-> for more information.

Slope, see 20.2.2.2.2.4.8 Parabola-> for more information.

(4) Modify link from the existing start value and then follow the shape of an arc over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.10 Circular -> for more information.

Height, see 20.2.2.2.2.2.10 Circular -> for more information.

Xfall, see 20.2.2.2.2.3.10 Circular -> for more information.

Slope, see 20.2.2.2.2.4.5 Circular -> for more information.

(5) Modify link from the existing end value and then follow the shape of a parabola over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.9 <- Parabola for more information.

Height, see 20.2.2.2.2.2.9 <- Parabola for more information.

Xfall, see 20.2.2.2.2.3.9 <- Parabola for more information.

Slope, see 20.2.2.2.2.4.9 <- Parabola for more information.

(6) Modify link from the existing end value and then following the shape of an arc over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.11 <-Circular for more information.

Height, see 20.2.2.2.2.2.11 <-Circular for more information.

Xfall, see 20.2.2.2.2.3.11 <-Circular for more information.

Slope, see 20.2.2.2.2.4.6 <-Circular for more information.

(7) Modify link to a cubic between a user defined start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.12 Cubic for more information.

Height, see 20.2.2.2.2.2.12 Cubicfor more information.

Xfall, see 20.2.2.2.2.3.12 Cubic for more information.

Slope, see 20.2.2.2.2.4.7 Cubic Cubic for more information.

(8) Modify link to compound parabolas between a user defined start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.13 Compound Parabolas for more information.

Height, see 20.2.2.2.2.2.13 Compound Parabolas for more information.

Xfall, see 20.2.2.2.2.3.13 Compound Parabolas for more information.

Slope, see 20.2.2.2.2.4.8 Compound Parabolas for more information.

(9) Modify link to a reverse curve between a user defined start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.14 Reverse Curves for more information.

Height, see 20.2.2.2.2.2.14 Reverse Curves for more information.

Xfall, see 20.2.2.2.2.3.14 Reverse Curves for more information.

Slope, see 20.2.2.2.2.4.9 Reverse Curves for more information.

(10) Modify link to a sinusoidal curve between a user defined start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.15 Sinusoidal for more information.

Height, see 20.2.2.2.2.2.15 Sinusoidal for more information.

Xfall, see 20.2.2.2.2.3.15 Sinusoidal for more information.

Slope, see 20.2.2.2.2.4.10 Sinusoidal for more information.

(11) Modify link slope to rotate as grade between a user defined start and end slope over the chainage range.

If the link is being modified by:

Width, N/A

Height, N/A

Xfall, N/A

Slope, see 20.2.2.2.2.4.11 Rotate Slope as Grade for more information.

(12) Modify link slope to rotate as angle between a user defined start and end slope over the chainage range.

If the link is being modified by:

Width, N/A

Height, N/A

Xfall, N/A

Slope, see 20.2.2.2.2.4.12 Rotate Slope as an Angle for more information.

(13) Modify link width such that a straight line in plan can be drawn between the existing start and end width.

If the link is being modified by:

Width, see 20.2.2.2.2.1.16 Pos ->Pos: Straight line for more information.

Height, N/A

Xfall, N/A

Slope, N/A

(14) Modify link value to be the existing start value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.5 Pos -> for more information.

Height, see 20.2.2.2.2.2.5 Pos -> for more information.

Xfall, see 20.2.2.2.2.3.5 Pos -> for more information.

Slope, N/A

(15) Modify link to linearly interpolate between the existing start value and a user defined end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.3 Pos -> Width for more information.

Height, see 20.2.2.2.2.2.3 Pos -> Height for more information.

Xfall, see 20.2.2.2.2.3.3 Pos -> Xfall for more information.

Slope, N/A

(16) Modify link value to be the existing end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.6 <-Pos for more information.

Height, see 20.2.2.2.2.2.6 <-Pos for more information.

Xfall, see 20.2.2.2.2.3.6 <-Pos for more information.

Slope, N/A

(17) Modify link to linearly interpolate between a user defined start value and the existing end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.4 Width ->Pos for more information.

Height, see 20.2.2.2.2.2.4 Height ->Pos for more information.

Xfall, see 20.2.2.2.2.3.4 Xfall ->Pos for more information.

Slope, N/A

(18) Modify link to linearly interpolate between the existing start and end value over the chainage range.

If the link is being modified by:

Width, see 20.2.2.2.2.1.7 Pos->Pos: for more information.

Height,see 20.2.2.2.2.2.7 Pos->Pos: for more information.

Xfall, see 20.2.2.2.2.3.7 Pos->Pos: for more information.

Slope, N/A

All,   see 20.2.2.2.2.5.1 Pos-> Pos for more information.

(19) Modify link Xfall to circular reverse curves between a user defined start and end Xfalls over the chainage range.

If the link is being modified by:

Width, N/A

Height, N/A

Xfall, see 20.2.2.2.2.3 Xfall CRC for more information.

Slope, N/A

(20) Modify link Xfall to a named grade between the existing start and end Xfalls over the chainage range.

If the link is being modified by:

Width, N/A

Height, N/A

Xfall, see 20.2.2.2.2.3.17 Named Grade for more information.

Slope, N/A

(21) Modify link width such that a reverse curve in plan can be drawn between the existing start and end width.

If the link is being modified by:

Width, see 20.2.2.2.2.1.17 Pos->Pos:Reverse Curve for more information.

Height, N/A

Xfall, N/A

Slope, N/A

16.27.2.2.2 Fixed - Modify Link

link_fixed

(1)**link_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"modify_what_type" (6)"interpolate_type" (7)variable/value/$null (8)variable/value/$null (9)"<named_grade>" (10)boolean <(11)**offset** (12)variable/value (13)variable/value> (14)<modifier_extras>

(1) Token that indicates existing link(s) are to be modified.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "modify_what_type" for more information.

(6) See "interpolate_type" for more information.

(7) Start value to modify with.

(8) Final value to modify with.

(9) Named grade to modify with, only used when modifying XFall using the "named_grade" interpolate type.

(10) If 1 (true) then adjust the following links.

(11) Token to indicate the usage of a start and end length, only used when modifying Xfall using the "val_val_rev_arc_len" interpolate type.

(12) Start length for modifying Xfall using the "val_val_rev_arc_len" interpolate type.

(13) End length for modifying Xfall using the "val_val_rev_arc_len" interpolate type.

(14) See modifier_extras for more information.

See 20.2.2.2.2 Fixeed - Modify Link for more information.

16.27.2.2.3 Fixed - Modify To

See 16.27.2.2.3.1 Fixed Link - To String

See 16.27.2.2.3.2 Fixed Link - To Tin

See 16.27.2.2.3.3 Fixed Link - To Trimesh

See 16.27.2.2.3.4 Fixed Link - To RL

See 16.27.2.2.3.5 Fixed - to 2 Heights

See 16.27.2.2.3.6 Fixed - to 2 Links

See 16.27.2.2.3.7 Fixed - to 2 Strings

16.27.2.2.3.1 Fixed Link - To String

all_to_string_fixed

(1)**all_to_string_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"model_string" (6)"modify_what_type" (7)string_side_type (8)integer_value (9)variable/value (10)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to a string.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of string to modify link(s) to.

(6) See "modify_what_type" for more information.

(7) Side of centreline to search for string.

(8) Intersection number to determine what intersection on the string to modify link(s) to.

(9) The horizontal pullback from the string.

(10) See modifier_extras for more information.

See 20.2.2.2.3.1 Fixed Link - To String for more information.

16.27.2.2.3.2 Fixed Link - To Tin

"tin_extension_type"

(1)"suppress_errors" / (2)"show_errors" / (3)"create_link" / (4)"stop_last_cut" / (5)"ext_horizontal" / (6)"ext_last_slope"

(1) No error message will be displayed in the output window and no link will be created.

(2) Error messages will be displayed in the output window and no link will be created.

(3) New link will be extended to the maximum slope width.

(4) New link will be extended to the width where the section last cut the tin.

(5) New link will be extended to where the batter intersects the horizontal projection of the last cut of the tin.

(6) New link will be extended to the projection of the last cut slope of the tin.

See 20.2.2.2.6.8.1 Tin Extension Types for more information.

tin_all_fixed

(1)**tin_all_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"model_tin" (6)value (7)"modify_what_type" (8)integer_value (9)"tin_extension_type" (10)value (11)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to a tin.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin to modify link(s) to.

(6) The strip(positive depth) below the tin.

(7) See "modify_what_type" for more information.

(8) Intersection number to determine what intersection on the tin to modify link(s) to.

(9) See "tin_extension_type" for more information

(10) Section width for the tin.

(11) See modifier_extras for more information.

See 20.2.2.2.3.2 Fixed Link - To Tin for more information.

16.27.2.2.3.3 Fixed Link - To Trimesh

trimesh_all_fixed

(1)**trimesh_all_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"element_name" (6)"modify_what_type" (7)integer_value (8)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to a trimesh.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of trimesh to modify link(s) to.

(6) See "modify_what_type" for more information.

(7) Intersection number to determine what intersection on the trimesh to modify link(s) to.

(8) See modifier_extras for more information.

See 20.2.2.2.3.3 Fixed Link - To Trimesh for more information.

16.27.2.2.3.4 Fixed Link - To RL

rl_all_fixed

(1)**rl_all_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)variable/value (6)"modify_what_type" (7)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to an RL.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) RL to modify link(s) to.

(6) See "modify_what_type" for more information.

(7) See modifier_extras for more information.

See 20.2.2.2.3.4 Fixed - To RL for more information.

16.27.2.2.3.5 Fixed - to 2 Heights

"2_heights_interpolate_type"

(1)"val_constant" / (2)"val_val_lineal" / (3)"val_grd_fwd" / (4)"grd_bck_val" / (5)"pos_nul_constant" / (6)"nul_pos_constant" / (7)"pos_pos_lineal" / (8)"pos_grd_fwd" / (9)"grd_bck_pos" / (10)"val_pos_lineal" / (11)"pos_val_lineal" / (12)"pos_pos_tang_bi_para" / (13)"pos_pos_tang_cubic"

(1) Modify height to a constant user defined height over the chainage range.

See 20.2.2.2.3.5.1.1 RL: stay at a given RL for more information.

(2) Modify height to linearly interpolate between a user defined start

and end height over the chainage range.

See 20.2.2.2.3.5.1.2 RL ->RL: interpolate between two given RL’s for more information.

(3) Modify height with a user defined start height and continue along

centreline at grade over the chainage range.

See 20.2.2.2.3.5.1.8 RL Grade ->: start with a given Start RL and continue on the line at grade Grade-> for more information.

(4) Modify height with a user defined end height and continue backwards

along centreline at grade over the chainage range.

See 20.2.2.2.3.5.1.9 <-RL Grade: all points are on a line with given grade and going through End RL for more information.

(5) Modify height to the existing start height over the chainage range.

See 20.2.2.2.3.5.1.3 Pos ->: all points have the same height as the start point for more information.

(6) Modify height to the existing end height over the chainage range.

See 20.2.2.2.3.5.1.4 <-Pos: all points have the same height as the end point for more information.

(7) Modify height to linearly interpolate between the existing start

and end height over the chainage range.

See20.2.2.2.3.5.1.5 Pos->Pos: interpolate between the calculated start and end heights for more information.

(8) Modify height with the existing start height and continue along

centreline at grade over the chainage range.

See 20.2.2.2.3.5.1.10 Pos Grade ->: start with the calculated height and continue at a given grade for more information.

(9) Modify height with the existing end height and continue backwards

along centreline at grade over the chainage range.

See 20.2.2.2.3.5.1.11 <-Pos Grade: all points are on aline of given grade and going through the end point for more information.

(10) Modify height to linearly interpolate between a user defined start

height and the existing end height over the chainage range.

See 20.2.2.2.3.5.1.6 RL->Pos: interpolate between a given start RL & the calculated end height for more information.

(11) Modify height to linearly interpolate between the existing start

height and a user defined end height over the chainage range.

See 20.2.2.2.3.5.1.7 Pos->RL: interpolate between the calculated start height and a given RL at the end for more information.

(12) Modify height to the curve of tangential compound parabolas fit to

the existing start and end height over the chainage range.

See 20.2.2.2.3.5.1.12 Pos->Pos: Tangential Compound Parabolas for more information.

(13) Modify height to the curve of a tangential cubic fit to the existing

start and end height over the chainage range.

See 20.2.2.2.3.5.1.13 Pos-> Pos: Tangential Cubic for more information.

See 20.2.2.2.3.5.1 Fixed - Calculating the Heights for each Type for more information.

grade_all_pt_pt

(1)**grade_all_pt_pt** (2)"link_names" (3)start_chainage (4)final_chainage (5)"modify_what_type" (6)"2_heights_interpolate_type" (7)variable/value/$null (8)variable/value/$null (9)boolean (10)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to 2 heights.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "modify_what_type" for more information.

(6) See "2_heights_interpolate_type" for more information.

(7) The user defined start height if the interpolate type requires it.

(8) The user defined end height if the interpolate type requires it.

(9) If 1 (true) then adjust the following links.

(10) See modifier_extras for more information.

See 20.2.2.2.3.5 Fixed - to 2 Heights for more information.

16.27.2.2.3.6 Fixed - to 2 Links

"links_usage_type"

(1)"value" / (2)"projection"

(1) Use the existing link values.

(2) Use the projected link values.

all_by_2_links_fixed

(1)**all_by_2_links_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"modify_what_type" (6)boolean (7)"links_usage_type" (8)"link_name" (9)"link_name" (10)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to 2 links.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "modify_what_type" for more information.

(6) If 1 (true) then adjust the following links.

(7) See "links_usage_type" for more information.

(8) Link 1 to modify link(s) to.

(9) Link 2 to modify link(s) to.

(10) See modifier_extras for more information.

See 20.2.2.2.3.6 Fixed - by 2 links for more information.

16.27.2.2.3.7 Fixed - to 2 Strings

all_to_2_strings_fixed

(1)**all_to_2_strings_fixed** (2) "link_names" (3)start_chainage (4)final_chainage (5)"modify_what_type" (6)"model_string" (7)string_side_type (8)"model_string" (9)string_side_type (10)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to 2 strings.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "modify_what_type" for more information.

(6) String 1 to modify link(s) to.

(7) Side of centreline to search for string 1.

(8) String 2 to modify link(s) to.

(9) Side of centreline to search for string 2.

(10) See modifier_extras for more information.

See 20.2.2.2.3.7 Fixed - by 2 strings for more information.

16.27.2.2.4 Fixed - Modify from

See 16.27.2.2.4.1 Fixed - Absolute to a Base Link

See 16.27.2.2.4.2 Fixed Link - From link

See 16.27.2.2.4.3 Fixed - Parallel Links to String

See 16.27.2.2.4.4 Fixed Link - Parallel Links to Link

See 16.27.2.2.4.5 Fixed - Modify From - Corner Link

16.27.2.2.4.1 Fixed - Absolute to a Base Link

all_absolute

(1)**all_absolute** (2)"link_names" (3)start_chainage (4)final_chainage (5)"link_name" (6)"modify_what_type" (7)"interpolate_type" (8)variable/value/$null (9)variable/value/$null (10)variable/value/$null (11)variable/value/$null (12)variable/value/$null (13)boolean (14)<modifier_extras>

(1) Token that indicates existing link(s) will be modified absolute from a base link.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of base link.

(6) See "modify_what_type" for more information.

(6) See "interpolate_type" for more information.

(8) The user defined start value if the interpolate type requires it.

(9) The user defined end value if the interpolate type requires it.

(10) The user defined start extension if the interpolate type allows it.

(11) The user defined end extension if the interpolate type allows it.

(12) A final offset value to adjust each point by.

(13) If 1 (true) then adjust the following links.

(14) See modifier_extras for more information.

See 20.2.2.2.4.1 Fixed Link - Absolute to a Base Link for more information.

16.27.2.2.4.2 Fixed Link - From link

"link_zone_type"

(1)"fixed" / (2)"cut" / (3)"fill"

(1) The template fixed zone.

(2) The template cut zone.

(3) The template fill zone.

copy_fixed

(1)**copy_fixed** (2)"link_names" (3)start_chainage (4)final_chainage (5)"modify_what_type" (6)"link_name" (7)"link_zone_type" (8)<modifier_extras>

(1) Token that indicates existing link(s) will be modified from a link.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "modify_what_type" for more information.

(6) Name of link to modify from.

(7) Zone of the link to modify from.

(8) See modifier_extras for more information.

See 20.2.2.2.4.2 Fixed Link - From link for more information.

16.27.2.2.4.3 Fixed - Parallel Links to String

fixed_parallel

(1)**fixed_parallel** (2)"link_name" (3)"link_name" (4)start_chainage (5)final_chainage (6)"model_string" (7)<modifier_extras>

(1) Token that indicates existing link(s) will be modified such that their widths, Xfalls and heights are measured perpendicular to a selected string rather than the reference string.

(2) Start link name of the inclusive range of links to be modified.

(3) End link name of the inclusive range of links to be modified.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Name of string to measure perpendicular to.

(7) See modifier_extras for more information.

See 20.2.2.2.4.3 Fixed Link - Parallel Links to String for more information.

16.27.2.2.4.4 Fixed Link - Parallel Links to Link

fixed_parallel_link

(1)**fixed_parallel_link** (2)"link_name" (3)"link_name" (4)start_chainage (5)final_chainage (6)"link_name" (7)<modifier_extras>

(1) Token that indicates existing link(s) will be modified such that their widths, Xfalls and heights are measured perpendicular to a base link rather than the reference string.

(2) Start link name of the inclusive range of links to be modified.

(3) End link name of the inclusive range of links to be modified.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Name of base link to measure perpendicular to.

(7) See modifier_extras for more information.

See 20.2.2.2.4.4 Fixed Link - Parallel Links to Link for more information.

16.27.2.2.4.5 Fixed - Modify From - Corner Link

corner_link

(1)**corner_link** (2)"link_names" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates existing link(s) will be modified to create corners on non-tangential points of the apply.

(2) Names of link(s) to be modified.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.4.5 Fixed - Modify From - Corner Link for more information.

16.27.2.3 Fixed - Decisions

See 16.27.2.3.1 Fixed Decisions - Switch Sides

See 16.27.2.3.2 Fixed Decisions - Goto

See 16.27.2.3.3 Fixed Decisions - Label

See 16.27.2.3.4 Fixed Decisions - Then

See 16.27.2.3.5 Fixed Decisions - End Then

See 16.27.2.3.6 Fixed Decisions - Batter

See 16.27.2.3.7 Fixed Decisions - Batter Test

See 16.27.2.3.8 Fixed Decisions - String Exists

See 16.27.2.3.9 Fixed Decisions - Above String Height

See 16.27.2.3.10 Fixed Decisions - Link Exists

See 16.27.2.3.11 Fixed Decisions - Above Link Height

See 16.27.2.3.12 Fixed Decisions - Tin

See 16.27.2.3.13 Fixed Decisions - RL

See 16.27.2.3.14 Fixed Decisions - Trimesh

See 16.27.2.3.15 Fixed Decisions - Polygon

16.27.2.3.1 Fixed Decisions - Switch Sides

switch_side

(1)**switch_side** (2)start_chainage (3)final_chainage (4)<modifier_extras>

(1) Token that indicates a decision command to switch sides will occur.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See modifier_extras for more information.

See 20.2.2.2.5.1 Fixed Decisions - Switch Sides for more information.

16.27.2.3.2 Fixed Decisions - Goto

decision_goto

(1)**decision_goto** (2)"<label_name>" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates a decision command to jump to a label will occur.

(2) Name of label to jump and transfer processing to.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.5.2 Fixed Decisions -Goto for more information.

16.27.2.3.3 Fixed Decisions - Label

decision_label

(1)**decision_label** (2)"<label_name>" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates a label for other decision commands to reference and possibly jump to.

(2) Name of label being created.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.5.3 Fixed Decisions - Label for more information.

16.27.2.3.4 Fixed Decisions - Then

decision_then

(1)**decision_then** (2)"<label_name>" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates the creation of a label for the "Then" part of a "Then-End Then" block.

(2) Name of label being created.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.5.4 Fixed Decisions - Then for more information.

16.27.2.3.5 Fixed Decisions - End Then

decision_end

(1)**decision_end** (2)"<label_name>" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates the creation of a label for the "Then-End" part of a "Then-End Then" block.

(2) Name of label being created.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.3.3.3.5.5 Fixed Secisions - End Then for more information.

16.27.2.3.6 Fixed Decisions - Batter

decision_batter

(1)**decision_batter** (2)"link_name" (3)start_chainage (4)final_chainage (5)"tin_name" (6)variable/value (7)variable/value (8)insert_modifier_link (9)"colour" (10)"label_name" (11)"boolean" (12)<modifier_extras>

(1) Token that indicates a test decision command that will conditionally

construct a batter link.

(2) Name of conditionally constructed batter link.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin to batter to.

(6) Strip distance below tin to stop at.

(7) Offset distance from the link to check strip depth.

(8) Width, Height & Slope of batter link, see insert_modifier_link for more information.

(9) Colour of batter link.

(10) Name of label to conditionally jump to.

(11) Jump to label(10) when test evaluates to this value.

(12) See modifier_extras for more information.

See 20.2.2.2.5.7 Fixed Decisions - Batter for more information.

16.27.2.3.7 Fixed Decisions - Batter Test

decision_batter_test

(1)**decision_batter_test** (2)"layer_name" (3)start_chainage (4)final_chainage (5)"tin_name" (6)variable/value (7)variable/value (8)insert_modifier_link (9)"label_name" (10)"boolean" (11)<modifier_extras>

(1) Token that indicates a test decision command.

(2) Name of layer to append the test link to.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin to test battering to.

(6) Strip distance below tin to stop at.

(7) Offset distance from the link to check strip depth.

(8) Width, Height & Slope of test link, see insert_modifier_link for more information.

(9) Name of label to conditionally jump to.

(10) Jump to label(9) when test evaluates to this value.

(11) See modifier_extras for more information.

See 20.2.2.2.5.8 Fixed Decisions - Batter Test for more information.

16.27.2.3.8 Fixed Decisions - String Exists

decision_string_exists

(1)**decision_string_exists** (2)"model_name" (3)"element_name?*" (4)start_chainage (5)final_chainage (6)"string_side_type" (7)"label_name" (8)"boolean" (9)"" (10)<modifier_extras>

(1) Token that indicates a test decision command on whether given string(s) exist on the left or right of the centreline.

(2) Name of the model that contains the strings to be tested.

(3) Name(s) of string(s) to be tested.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Side of centreline to search for string(s).

(7) Name of label to conditionally jump to.

(8) Jump to label(7) when test evaluates to this value.

(9) Spare parameter.

(10) See modifier_extras for more information.

See 20.2.2.2.5.9 Fixed Decisions - String Exists for more information.

16.27.2.3.9 Fixed Decisions - Above String Height

decision_string_height

(1)**decision_string_height** (2)"link_name" (3)start_chainage (4)final_chainage (5)"element_name" (6)"string_side_type" (7)variable/value/$null (8)variable/value/$null (9)variable/value/$null (10)variable/value/$null (11)variable/value/$null (12)"label_name" (13)"boolean" (14)<modifier_extras>

(1) Token that indicates a test decision command.

(2) Name of base link to test.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of string to test base link against.

(6) Side of centreline to search for string(5).

(7) Offset of the base link.

(8) Height difference of the base link.

(9) Grade of line that is tested whether it is above the string.

(10) Offset to adjust string for test.

(11) Height difference to adjust string for test.

(12) Name of label to conditionally jump to.

(13) Jump to label(12) when test evaluates to this value.

(14) See modifier_extras for more information.

See 20.2.2.2.5.10 Fixed Decisions - Above String Height for more information.

16.27.2.3.10 Fixed Decisions - Link Exists

"link_search_type"

(1)"inside" / (2)"outside" / (3)"both"

(1) Test is true if found link is closer to the hinge than the test link and the distance between those links is less than the offset.

(2) Test is true if found link is further to the hinge than the test link and the distance between those links is less than the offset.

(3) Test is true if the distance between the found link and the test link is less than the offset.

decision_link_exists

(1)**decision_link_exists** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"<link_name>" (6)"link_search_type" (7)**offset** (8)variable/value/$null (9)"label_name" (10)"boolean" (11)<modifier_extras>

(1) Token that indicates a test decision command on whether link(s*) exist and optionally whether they are within the range of a test link.

(2) Name of link(s*) to be tested on whether they exist.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the test link.

(6) See "link_search_type" for more information.

(7) Token that must be placed at the 7th parameter.

(8) The offset from the test link to find the link(s*)(2).

(9) Name of label to conditionally jump to.

(10) Jump to label(9) when test evaluates to this value.

(11) See modifier_extras for more information.

See 20.2.2.2.5.11 Fixed Decisions - Link Exists for more information.

16.27.2.3.11 Fixed Decisions - Above Link Height

decision_link_height

(1)**decision_link_height** (2)"link_name" (3)start_chainage (4)final_chainage (5)"link_name" (6)variable/value/$null (7)variable/value/$null (8)variable/value/$null (9)variable/value/$null (10)variable/value/$null (11)"label_name" (12)"boolean" (13)<modifier_extras>

(1) Token that indicates a test decision command.

(2) Name of base link to test.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of link to test base link against.

(6) Offset of the base link.

(7) Height difference of the base link.

(8) Grade of line that is tested whether it is above the link.

(9) Offset to adjust link for test.

(10) Height difference to adjust link for test.

(11) Name of label to conditionally jump to.

(12) Jump to label(11) when test evaluates to this value.

(13) See modifier_extras for more information.

See 20.2.2.2.5.12 Fixed Decisions - Above Link Height for more information.

16.27.2.3.12 Fixed Decisions - Tin

decision_tin

(1)**decision_tin** (2)"link_name" (3)start_chainage (4)final_chainage (5)"tin_name" (6)variable/value (7)variable/value (8)variable/value (9)variable/value (10)"label_name" (11)"boolean" (12)<modifier_extras>

(1) Token that indicates a test decision command against a tin.

(2) Name of link to test against tin.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin that link is tested against.

(6) Strip distance to drop tin before testing.

(7) Offset from previous link to test depth range.

(8) Minimum depth to test for tin.

(9) Maximum depth to test for tin.

(10) Name of label to conditionally jump to.

(11) Jump to label(10) when test evaluates to this value.

(12) See modifier_extras for more information.

See 20.2.2.2.5.13 Fixed Decisions - Tin for more information.

16.27.2.3.13 Fixed Decisions - RL

decision_rl

(1)**decision_rl** (2)"link_name" (3)start_chainage (4)final_chainage (5)variable/value (6)variable/value (7)variable/value (8)"label_name" (9)"boolean" (10)<modifier_extras>

(1) Token that indicates a test decision command against a RL.

(2) Name of link to test against RL.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) RL(Height) to calculate to test against depth range.

(6) Minimum depth to test for RL.

(7) Maximum depth to test for RL.

(8) Name of label to conditionally jump to.

(9) Jump to label(8) when test evaluates to this value.

(10) See modifier_extras for more information.

See 20.2.2.2.5.14 Fixed Decisions - RL for more information.

16.27.2.3.14 Fixed Decisions - Trimesh

decision_trimesh

(1)**decision_trimesh** (2)"link_name" (3)start_chainage (4)final_chainage (5)"element_name" (6)variable/value (7)variable/value (8)variable/value (9)variable/value (10)"label_name" (11)"boolean" (12)<modifier_extras>

(1) Token that indicates a test decision command against a trimesh.

(2) Name of link to test against trimesh.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of trimesh that link is tested against.

(6) Strip distance to drop trimesh before testing.

(7) Offset from previous link to test depth range.

(8) Minimum depth to test for trimesh.

(9) Maximum depth to test for trimesh.

(10) Name of label to conditionally jump to.

(11) Jump to label(10) when test evaluates to this value.

(12) See modifier_extras for more information.

See 20.2.2.2.5.15 Fixed Decisions - Trimesh for more information.

16.27.2.3.15 Fixed Decisions - Polygon

"polygon_mode_type"

(1)"select" / (2)"manual"

(1) Select existing polygon element.

(2) Manually select polygon with cursor.

"polygon_search_type"

(1)"inside" / (2)"outside"

(1) The test is true if the link coordinates are inside the polygon.

(2) The test is true if the link coordinates are outside the polygon.

decision_polygon

(1)**decision_polygon** (2)start_chainage (3)final_chainage (4)"polygon_mode_type" (5)"model_string*?" (6)"link_name" (7)"polygon_search_type" (8)"label_name" (9)"boolean" (10)<modifier_extras>

(1) Token that indicates a test decision command against a polygon.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See "polygon_mode_type" for more information.

(5) Name of polygon(s) to test link against.

(6) Name of link to test against polygon(s).

(7) See "polygon_search_type" for more information.

(8) Name of label to conditionally jump to.

(9) Jump to label(8) when test evaluates to this value.

(10) See modifier_extras for more information.

See 20.2.2.2.5.16 Fixed Decisions - Polygon for more information.

16.27.2.4 Fixed - Boxing

See 16.27.2.4.1 Boxing - Analyse Subgrade

See 16.27.2.4.2 Boxing - Named Grade

See 16.27.2.4.3 Boxing - Named Grade Triple

See 16.27.2.4.4 Boxing - Copy Layer

See 16.27.2.4.5 Boxing - Stretch Heights

See 16.27.2.4.6 Boxing - Tin extension

16.27.2.4.1 Boxing - Analyse Subgrade

analyse_subgrade

(1)**analyse_subgrade** (2)"link_name" (3)"link_name" (4)start_chainage (5)final_chainage (6)"tin_name" (7)value (8)value (9)value (10)value (11)value (12)value (13)value (14)value (15)value (16)value (17)"boolean" (18)"link_name" (19)"link_name" (20)"model_name" (21)"boolean" (22)"boolean" (23)<modifier_extras>

(1) Token that indicates beginning of the "Analyse Subgrade" modifier.

(2) Name of the 1st link defining the edge of the road.

(3) Name of the 2nd link defining the edge of the road.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Name of tin used for the natural surface.

(7) Strip depth to adjust the natural surface(6) tin by.

(8) Depth of the pavement layer.

(9) Depth of the SMZ layer.

(10) UZ cut depth to generate a CUT subgrade string.

(11) UZ cut/fill depth to generate a CFP string.

(12) UZ embankment/fill depth to generate a EMB subgrade string.

(13) UZ shallow embankment/fill to generate a SEM subgrade string.

(14) Minimum cut length, when cut zone is calculated to be shorter than this length it will be converted to a shallow embankment.

(15) Minimum length of an embankment zone, when an embankment zone is calculated to be shorter than this length it will be converted to a shallow embankment.

(16) UZ cut/fill length used to excavate into the cut zone.

(17) When true, if one side of the road is in shallow embankment then the other side will also be forced to shallow embankment.

(18) Name of the 1st link defining the subgrade edge of the road.

(19) Name of the 2st link defining the subgrade edge of the road.

(20) Name of Model for the subgrade strings.

(21) When true, the subgrade links(18)(19) will have their type appended to their string name.

(22) When true, existing model of subgrade strings will be cleaned before running this modifier.

(23) See modifier_extras for more information.

See 20.2.2.2.6.1 Boxing - Analyse Subgrade for more information.

16.27.2.4.2 Boxing - Named Grade

"named_grade_fail_type"

(1)"fail" / (2)"horizontal" / (3)"vertical" / (4)"xfall" / (5)"slope"

(1) On failure there will be no grade available.

See 16.3.0.2.1 On Grade Fails Do Fail for more information.

(2) On failure the grade will be at a Xfall(%) of 0%.

See 16.3.0.2.2 On Grade Fails Do Horizontal for more information.

(3) On failure the grade will be a Xfall(%) of -100,000,000% on the LHS and 100,000,000% on the RHS.

See 16.3.0.2.3 On Grade Fails Do Vertical for more information.

(4) On failure the grade will be a fixed Xfall(%).

See 16.3.0.2.4 On Grade Fails Do Xfall(%) for more information.

(5) On failure the grade will be a fixed slope(horizontal/vertical).

See 16.3.0.2.5 On Grade Fails Do Slope(h/v) for more information.

named_grade_links_dynamic

(1)**named_grade_links_dynamic** (2)"name" (3)start_chainage (4)final_chainage (5)"<link_name>" (6)"<link_name>" (7)variable/value/$null (8)variable/value/$null (9)"named_grade_fail_type" (10)variable/value/$null (11)"<name*>" (12)"<name*>" (13)<modifier_extras>

(1) Token that indicates that a named grade is being defined by the grade between 2 links within the chainage range.

(2) The name of the grade between 2 links.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the 1st link to evaluate.

(6) Name of the 2nd link to evaluate.

(7) Minimum Xfall(v/h) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

(8) Maximum Xfall(v/h) where if the evaluated Xfall is greater than this value then the Xfall is set to this value.

(9) See "named_grade_fail_type" for more information.

(10) When "named_grade_fail_type"(9) is:

"xfall" : On failure the grade is defined as a constant Xfall(%).

"slope" : On failure the grade is defined as a constant slope(h/v).

(11) Name of the mirror grade.

If parameter is empty("") then do not generate a mirror grade.

If parameter contains no wildcard(*) then generate a mirror grade where the name is the contents of this parameter.

If parameter contains a wildcard(*) then generate a mirror grade where the name is the contents of this parameter with the wildcard(*) being substituted with the grade name(2).

(12) Name of the normal grade.

If parameter is empty("") then do not generate a normal grade.

If parameter contains no wildcard(*) then generate a normal grade where the name is the contents of this parameter.

If parameter contains a wildcard(*) then generate a normal grade where the name is the contents of this parameter with the wildcard(*) being substituted with the grade name(2).

(13) See modifier_extras for more information.

See 16.3.0.1.1 Grade Type 2 Links Dynamic for more information.

named_grade_horizontal

(1)**named_grade_horizontal** (2)"name" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates that a named grade is being defined as a Xfall(%) of 0% within the chainage range.

(2) The name of the grade that is horizontal.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 16.3.0.1.3 Grade type is Horizontal for more information.

named_grade_vertical

(1)**named_grade_vertical** (2)"name" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates that a named grade is being defined as a Xfall(%) of -100,000,000% on the LHS and 100,000,000% on the RHS within the chainage range.

(2) The name of the grade that is vertical.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 16.3.0.1.4 Grade type is Vertical for more information.

named_grade_xfall

(1)**named_grade_xfall** (2)"name" (3)start_chainage (4)final_chainage (5)variable/value (6)"<name*>" (7)"<name*>" (8)<modifier_extras>

(1) Token that indicates that a named grade is being defined by a fixed
Xfall(%) within the chainage range.
(2) The name of the grade that is a Xfall(%).
(3) See start_chainage for more information.
(4) See final_chainage for more information.
(5) The grade in Xfall(%) to use.
(6) Name of the mirror grade.
If parameter is empty("") then do not generate a mirror grade.
If parameter contains no wildcard(*) then generate a mirror grade where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a mirror grade where the name is the contents of this parameter with the wildcard(*) being substituted with the grade name(2).
(7) Name of the normal grade.
If parameter is empty("") then do not generate a normal grade.
If parameter contains no wildcard(*) then generate a normal grade where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a normal grade where the name is the contents of this parameter with the wildcard(*) being substituted with the grade name(2).
(8) See modifier_extras for more information.

See 16.3.0.1.5 Grade type is Xfall(%) for more information.

named_grade_slope

(1)**named_grade_slope** (2)"name" (3)start_chainage (4)final_chainage (5)variable/value (6)"<name*>" (7)"<name*>" (8)<modifier_extras>

(1) Token that indicates that a named grade is being defined by a fixed
slope(horizontal/vertical) within the chainage range.
(2) The name of the grade that is a slope(h/v).
(3) See start_chainage for more information.
(4) See final_chainage for more information.
(5) The grade in slope(h/v) to use.
(6) Name of the mirror grade.
If parameter is empty("") then do not generate a mirror grade.
If parameter contains no wildcard(*) then generate a mirror grade where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a mirror grade where the name is the contents of this parameter with the wildcard(*) being substituted with the grade name(2).
(7) Name of the normal grade.
If parameter is empty("") then do not generate a normal grade.

If parameter contains no wildcard(*) then generate a normal grade
where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a normal grade
where the name is the contents of this parameter with the
wildcard(*) being substituted with the grade name(2).

(8) See modifier_extras for more information.

See 16.3.0.1.6 Grade type is Slope (h/v) for more information.

named_grade_links_tin_dynamic

(1)**named_grade_links_tin_dynamic** (2)"name" (3)start_chainage (4)final_chainage (5)"<link_names*>" (6)variable/value (7)"tin_name" (8)variable/value/$null (9)value/$null (10)"named_grade_fail_type" (11)variable/value/$null (12)"<name*>" (13)"<name*>" (14)<modifier_extras>

(1) Token that indicates that a named grade is being defined by the grade between a link position dropped to a tin and an offset from the link dropped to the tin within the chainage range.

(2) The name of the grade from link and offset dropped to tin.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of link to drop to tin.

(6) Offset from the link for the second drop to the tin.

(7) Name of tin to use.

(8) Minimum Xfall(v/h) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

(9) Maximum Xfall(v/h) where if the evaluated Xfall is greater than this value then the Xfall is set to this value.

(10) See "named_grade_fail_type" for more information.

(11) When "named_grade_fail_type"(9) is:
"xfall" : On failure the grade is defined as a constant Xfall(%).
"slope" : On failure the grade is defined as a constant slope(h/v).

(12) Name of the mirror grade.
If parameter is empty("") then do not generate a mirror grade.
If parameter contains no wildcard(*) then generate a mirror grade
where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a mirror grade
where the name is the contents of this parameter with the
wildcard(*) being substituted with the grade name(2).

(13) Name of the normal grade.
If parameter is empty("") then do not generate a normal grade.
If parameter contains no wildcard(*) then generate a normal grade
where the name is the contents of this parameter.

If parameter contains a wildcard(*) then generate a normal grade
where the name is the contents of this parameter with the
wildcard(*) being substituted with the grade name(2).

(14) See modifier_extras for more information.

See 16.3.0.1.8 Grade Type Link & Tin Dynamic for more information.

named_grade_link_and_side

(1)**named_grade_link_and_side** (2)"name" (3)start_chainage (4)final_chainage (5)"<link_names*>" (6)integer_value (7)variable/value/$null (8)variable/value/$null (9)"named_grade_fail_type" (10)variable/value/$null (11)"<name*>" (12)"<name*>" (13)<modifier_extras>

(1) Token that indicates that a named grade is being defined by the grade
between a nominated link and the next/previous existing link in the
layer within the chainage range.

(2) The name of the grade between the link and the next/previous link.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of nominated link to evaluate.

(6) If (-1) use previous existing link in layer.
If (1) use next existing link in layer.

(7) Minimum Xfall(v/h) where if the evaluated Xfall is less than
this value then the Xfall is set to this value.

(8) Maximum Xfall(v/h) where if the evaluated Xfall is greater than
this value then the Xfall is set to this value.

(9) See " "named_grade_fail_type" for more information.

(10) When "named_grade_fail_type"(9) is:
"xfall" : On failure the grade is defined as a constant Xfall(%).
"slope" : On failure the grade is defined as a constant slope(h/v).

(11) Name of the mirror grade.
If parameter is empty("") then do not generate a mirror grade.
If parameter contains no wildcard(*) then generate a mirror grade
where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a mirror grade
where the name is the contents of this parameter with the
wildcard(*) being substituted with the grade name(2).

(12) Name of the normal grade.
If parameter is empty("") then do not generate a normal grade.
If parameter contains no wildcard(*) then generate a normal grade
where the name is the contents of this parameter.
If parameter contains a wildcard(*) then generate a normal grade
where the name is the contents of this parameter with the
wildcard(*) being substituted with the grade name(2).

(13) See modifier_extras for more information.

See 16.3.0.1.9 Grade Type Link & Side for more information.

"named_grade_type"

(1)"links" / (2)"horizontal" / (3)"vertical" / (4)"xfall" / (5)"slope" / (6)"link_and_tin" / (7)"links_dynamic" / (8)"links_tin_dynamic" / (9)"link_and_side"

(1) (Deprecated) Use "links_dynamic"(7).

See 16.3.0.1.2 Grade Type is 2 Links (deprecated) for more information.

(2) Grade is a Xfall(%) of 0%.

See 16.3.0.1.3 Grade type is Horizontal for more information.

(3) Grade is a Xfall(%) of -100,000,000% on the LHS and 100,000,000% on the RHS.

See 16.3.0.1.4 Grade type is Vertical for more information.

(4) Grade is defined as a fixed Xfall(%).

See 16.3.0.1.5 Grade type is Xfall(%) for more information.

(5) Grade is defined as a fixed slope(horizontal/vertical).

See 16.3.0.1.6 Grade type is Slope (h/v) for more information.

(6) Use "links_tin_dynamic"(8).

See 16.3.0.1.7 Grade Type Link & Tin (deprecated for more information.

(7) Grade between 2 links is evaluated at all chainages along the apply,

dynamically updating the grade at each chainage.

See 16.3.0.1.1 Grade Type 2 Links Dynamic for more information.

(8) Grade is evaluated at all chainages along the apply, defined by the grade between a link dropped to a tin and an offset from the link also dropped to the tin.

See 16.3.0.1.8 Grade Type Link & Tin Dynamic for more information.

(9) Grade is evaluated at all chainages

along the apply, defined by the grade between a nominated link and the

next/previous existing link in the layer at a each chainage.

See 16.3.0.1.8 Grade Type Link & Tin Dynamic for more information.

named_grade

Note: From V15C1i this modifier grammar is supported but usage is

discouraged. For the latest named grade text file definitions:

See named_grade_links_dynamic for more information.

See named_grade_horizontal for more information.

See named_grade_vertical for more information.

See named_grade_xfall for more information.

See named_grade_slope for more information.

See named_grade_links_tin_dynamic for more information.

See named_grade_link_and_side for more information.

(1)**named_grade** (2)"name" (3)start_chainage (4)final_chainage (5)"named_grade_type" (6)"<link_name>" (7)"<link_name>" (8)value/$null (9)value/$null (10)value/$null

(11)integer_value/value/$null (12)"<tin_name>" (13)"named_grade_fail_type" (14)value/$null (15)<modifier_extras>

(1) Token that indicates that a named grade is being defined.

(2) The name of the named grade.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See "named_grade_type" for more information.

(6) When "named_grade_type" (5) is:

"links": Name of 1st link to evaluate.

"link_and_tin": Name of link to drop to tin.

"links_dynamic": Name of 1st link to evaluate.

"links_tin_dynamic": Name of link to drop to tin.

"link_and_side": Name of 1st link to evaluate.

(7) When "named_grade_type"(5) is:

"links": Name of 2nd link to evaluate.

"links_dynamic" : Name of 2nd link to evaluate.

(8) When "named_grade_type"(5) is "links" or "links_dynamic", set the minimum Xfall (v/h) where if the evaluated Xfall is less than this value then the Xfall is set to this value.

(9) When "named_grade_type"(5) is "links" or "links_dynamic", set the maximum Xfall where if the evaluated Xfall is greater than this value then the Xfall is set to this value.

(10) When "named_grade_type"(5) is:

"xfall" : The grade is defined as a fixed Xfall(%).

"slope" : The grade is defined as a fixed slope(h/v).

(11) When "named_grade_type"(5) is:

"link_and_tin" : Offset from given link for the drop to tin.

"links_tin_dynamic" : Offset from given link for the drop to tin.

"link_and_side": Use +1 for next link, -1 previous link.

(12) When "named_grade_type"(5) is:

"link_and_tin" : Name of tin to drop link to.

"links_tin_dynamic": Name of tin to drop link to.

(13) See "named_grade_fail_type" for more information.

(14) When "named_grade_fail_type"(13) is:

"xfall" : On failure the grade is defined as a fixed Xfall(%).

"slope" : On failure the grade is defined as a fixed slope(h/v).

(15) See modifier_extras for more information.

See 16.3 Boxing - Named Grade for more information.

16.27.2.4.3 Boxing - Named Grade Triple

named_grade_triple

(1)**named_grade_triple** (2)"name" (3)start_chainage (4)final_chainage (5)"link_name" (6)"link_name" (7)"link_name" (8)value/$null (9)"boolean" (10)value/$null (11)value/$null (12)<modifier_extras>

(1) Token that indicates that a named grade triple is being defined.

(2) The name of the named grade.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of link that is present through the whole named grade.

(6) Name of link that is used for grading outside the prorate area.

(7) Name of link that is used for grading inside the pro-rata area.

(8) The length of the area to pro-rata.

(9) When "true" pro-rata is at the start.

(10) When the evaluated Xfall is less than this value then the Xfall is set to this value.

(11) When the evaluated Xfall is greater than this value then the Xfall is set to this value.

(12) See modifier_extras for more information.

See 20.2.2.2.6.3 Boxing - Named Grade Triple for more information.

16.27.2.4.4 Boxing - Copy Layer

copy_layer

(1)**copy_layer** (2)"layer_name" (3)start_chainage (4)final_chainage (5)"link_name" (6)"link_name" (7)value/$null (8)"pre*post" (9)<modifier_extras>

(1) Token that indicates that part of a layer is to be copied.

(2) Name of the layer to copy link points to.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the first link to copy from.

(6) Name of the final link to copy from.

(7) Value to add to the height of the copied vertices of the links from the start link to the end link within the chainage range.

(8) Each copied link point is given a new name by applying the pre*posfix to the original vertex name.

(9) See modifier_extras for more information.

See 20.2.2.2.6.8 Boxing - Copy Layer for more information.

16.27.2.4.5 Boxing - Stretch Heights

stretch_link_height

(1)**stretch_link_height** (2)"link_names" (3)start_chainage (4)final_chainage

(5)<modifier_extras>

(1) Token that indicates a height adjustment will occur.

(2) Name(s) of link(s) to modify.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.6.7 Boxing - Stretch Heights for more information.

16.27.2.4.6 Boxing - Tin extension

tin_extension

(1)**tin_extension** (2)start_chainage (3)final_chainage (4)"name" (5)"text" (6)"tin_extension_type" (7)value (8)integer_value (9)value (10)<modifier_extras>

(1) Token that indicates a tin extension will be defined.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) Name of the new tin extension.

(5) Description of the new tin extension.

(6) See "tin_extension_type" for more information.

(7) The maximum width when "tin_extension_type"(6) is "ext_last_slope".

(8) Unknown parameter.

(9) The maximum slope when "tin_extension_type"(6) is "ext_horizontal" or "ext_last_slope".

(10) See modifier_extras for more information.

See 20.2.2.2.6.8 Boxing - Tin extension for more information.

16.27.2.4.7 Boxing - Capture Link Height

capture_link_height

(1)**capture_link_height** (2)"link_name" (3)start_chainage (4)"text" (5)value/$null (6)<modifier_extras>

1) Token that indicates that the height of a link is to be captured.

(2) Name of the link to capture the height of.

(3) See start_chainage for more information.

(4) Alias that mtf variables can use to access the captured height.

(5) Height difference to add to the raw captured height.

(6) See modifier_extras for more information.

See 20.2.2.2.6.8 Boxing - Capture Link Height for more information.

16.27.2.5 Fixed - Remove

See 16.27.2.5.1 Remove a Fixed link

See 16.27.2.5.2 Remove a Fixed link - Absolute

See 16.27.2.5.3 Fixed Link - Remove All But Fixed & Remove a Number of Fixed Links

See 16.27.2.5.4 Fixed Link - Remove All But Fixed & Remove Named Fixed Links

See 16.27.2.5.5 Fixed Link - Remove All But Fixed & Remove Fixed Links from a Named Link

See 16.27.2.5.6 Fixed Link - Remove Layers

See 16.27.2.5.7 Fixed link - Remove by Pattern

16.27.2.5.1 Remove a Fixed link

remove

(1)**remove** (2)"link_names" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates chosen links will be removed.

(2) Name(s) of link(s) to be removed.

(3) See start_chainage for more information.

(4) See final chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.7.1 Remove a Fixed link for more information.

16.27.2.5.2 Remove a Fixed link - Absolute

remove_abs

(1)**remove_abs** (2)"link_names" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates chosen links will be removed whilst leaving
the positions of the following links undisturbed.

(2) Name(s) of link(s) to be removed in an absolute manner.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.7.2 Remove a Fixed link - Absolute for more information.

16.27.2.5.3 Fixed Link - Remove All But Fixed & Remove a Number of Fixed Links

only_fixed

(1)**only_fixed** (2)"<link_name>" (3)start_chainage (4)final_chainage (5)integer_value (6)<modifier_extras>

(1) Token that indicates all cut, fill and final cut/fill links will be
removed and a used defined number of fixed links will be removed.

(2) Name of layer to remove links from.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Number of fixed links to remove.

(6) See modifier_extras for more information.

See 20.2.2.2.7.3 Fixed Link - Remove All But Fixed & Remove a Number of Fixed Links for more information.

16.27.2.5.4 Fixed Link - Remove All But Fixed & Remove Named Fixed Links

only_fixed_named

(1)**only_fixed_named** (2)"link_names" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates all cut, fill and final cut/fill links will be

removed and chosen named fixed links will be removed.

(2) Name(s) of fixed link(s) to remove.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.2.7.4 Fixed Link - Remove All But Fixed & Remove Named Fixed Links for more information.

16.27.2.5.5 Fixed Link - Remove All But Fixed & Remove Fixed Links from a Named Link

only_fixed_from_name

(1)**only_fixed_from_name** (2)"link_name" (3)"" (4)boolean (5)start_chainage (6)final_chainage (7)<modifier_extras>

(1) Token that indicates all cut, fill and final cut/fill links will be

removed and a range of fixed links will be removed.

(2) Name of the fixed link to start removing links from/to.

(3) Spare parameter.

(4) If 1(true) remove fixed links to outside.

(5) See start_chainage for more information.

(6) See final_chainage for more information.

(7) See modifier_extras for more information.

See 20.2.2.2.7.5 Fixed Link - Remove All But Fixed & Remove Fixed Links from a Named Link for more information.

16.27.2.5.6 Fixed Link - Remove Layers

remove_layer

(1)**remove_layer** (2)name_list (3)start_chainage (4)final_chainage (5)"link_names*" (6)<modifier_extras>

(1) Token that indicates links will be removed in the chosen layers.

(2) Name(s) of link(s) to remove from layer(s).

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Wild cards(*) that the link names are matched against.

(6) See modifier_extras for more information.

See 20.2.2.2.7.6 Fixed Link - Remove Layers for more information.

16.27.2.5.7 Fixed link - Remove by Pattern

"first_distance_type"

(1)"invalid" / (2)"keep_first" / (3)"remove_first"

(1) Incorrect first distance type.

(2) Pattern begins with the keep distance.

(3) Pattern begins with the remove distance.

remove_by_pattern

(1)**remove_by_pattern** (2)"link_names*" (3)start_chainage (4)final_chainage (5)value (6)value (7)"first_distance_type" (8)"" (9)<modifier_extras>

(1) Token that indicates links will be removed in the chosen layers.

(2) Name(s) of link(s) to remove by pattern.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Keep distance of the pattern.

(6) Remove distance of the pattern.

(7) See "first_distance_type" for more information.

(8) Spare parameter.

(9) See modifier_extras for more information.

See 20.2.2.2.7.7 Fixed link - Remove by Pattern for more information.

16.27.2.6 Fixed - Trim

See 16.27.2.6.1 Common Types

See 16.27.2.6.2 Trim Links to Trimesh

See 16.27.2.6.3 Trim Strings to String

See 16.27.2.6.4 Trim Sections to Tin

See 16.27.2.6.5 Trim Sections to String

See 16.27.2.6.6 Trim Overlapping Sections

16.27.2.6.1 Common Types

"trim_type"

(1)"backward" / (2)"both" / (3)"forward" / (4)"around"

(1) Trim links from start chainage to given element.

(2) Trim links between two given elements.

(3) Trim links from given element to end chainage.

(4) Trim links from start chainage to a first given element then trim same links from a second given element to the end chainage.

16.27.2.6.2 Trim Links to Trimesh

link_trim_trimesh

(1)**link_trim_trimesh** (2)"link_names*" (3)start_chainage (4)final_chainage
(5)"trimesh_name" (6)"<trimesh_name>" (7)"trim_type" (8)boolean (9)<modifier_extras>

(1) Token that indicates that link(s) will be trimmed by trimesh(es).

(2) Name(s) of link(s) to trimmed.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the trimesh to trim link(s).

(6) Name of second trimesh to trim link(s), this parameter is only used when trim type(7) is "both".

(7) See "trim_type" for more information.

(8) If 0(false) duplicate names of selected trimesh within the same model will raise an error.

(9) See modifier_extras for more information.

See 20.2.2.2.8.1 Trim Links to Trimesh for more information.

16.27.2.6.3 Trim Strings to String

link_trim_string

(1)**link_trim_string** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"model_string" (6)"trim_type" (7)<modifier_extras>

(1) Token that indicates that link(s) will be trimmed by a string.

(2) Name(s) of link(s) to trimmed.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the string to trim link(s).

(6) See "trim_type" for more information.

(7) See modifier_extras for more information.

link_trim_strings

(1)**link_trim_strings** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"model_string" (6)"model_string" (7)"trim_type" (8)<modifier_extras>

(1) Token that indicates that link(s) will be trimmed by strings.

(2) Name(s) of link(s) to trimmed.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the start string to trim link(s).

(6) Name of the end string to trim link(s).

(7) See "trim_type" for more information.

(8) See modifier_extras for more information.

See 20.2.2.2.8.2 Trim Strings to Sting for more information.

16.27.2.6.4 Trim Sections to Tin

"trim_from_type"

(1)"from_inside" / (2)"from_outside"

(1) Trim links from inside.

(2) Trim links from outside.

trim_links_tin

(1)**trim_links_tin** (2)"link_names" (3)start_chainage (4)final_chainage (5)"tin_name" (6)"trim_from_type" (7)integer_value (8)<modifier_extras>

(1) Token that indicates that link(s) will be trimmed by a tin.

(2) Name(s) of link(s) to trimmed.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the tin to trim link(s).

(6) See "trim_from_type" for more information.

(7) Intersection number of against tin to trim link(s).

(8) See modifier_extras for more information.

See 20.2.2.2.8.3 Trim Sections to Tin for more information.

16.27.2.6.5 Trim Sections to String

trim_sections_string

(1)**trim_sections_string** (2)"link_names" (3)start_chainage (4)final_chainage (5)"model_string" (6)"" (7)<modifier_extras>

(1) Token that indicates that link(s) and sections will be trimmed back by an existing trim string.

(2) Name(s) of link(s) to trim back.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of string to trim link(s) and sections back to.

(6) Spare parameter.

(7) See modifier_extras for more information.

See 20.2.2.2.8.4 Trim Sections to String for more information.

16.27.2.6.6 Trim Overlapping Sections

trim_overlapping_sections

(1)**trim_overlapping_sections** (2)"layer_name" (3)start_chainage (4)final_chainage (5)boolean (6)<modifier_extras>

(1) Token that indicates that overlapping sections will be modified such that they do not overlay each other.

(2) Name of layer to modify.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) If 1(true) then use bisectors in the calculation.

(6) See modifier_extras for more information.

See 20.2.2.2.8.5 Trim Overlapping Sections for more information.

16.27.2.7 Fixed - Miscellaneous

See 16.27.2.7.1 Fixed - Rename Link

See 16.27.2.7.2 Fixed - Named Grade

See 16.27.2.7.3 Fixed - Interface to Tin

See 16.27.2.7.4 Fixed - Reinterface Tin

16.27.2.7.1 Fixed - Rename Link

modify_rename

(1)**modify_rename** (2)"link_name" (3)start_chainage (4)final_chainage (5)"link_name" (6)"colour" (7)<modifier_extras>

(1) Token that indicates that a link will be renamed to the same side and layer over the given chainage range.

(2) Name of existing link.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name to rename the existing link(2).

(6) Colour of the renamed link.

(7) See modifier_extras for more information.

See 20.2.2.2.9 Fixed - Rename Link for more information.

16.27.2.7.2 Fixed - Named Grade

See 20.10.1.4.2.4.2 Boxing - Named Gade for more information.

16.27.2.7.3 Fixed - Interface to Tin

interface_tin

(1)**interface_tin** (2)"link_name" (3)start_chainage (4)final_chainage (5)"link_name" (6)"tin_name" (7)variable/value/$null (8)variable/value/$null (9)variable/value (10)variable/value (11)"colour" (12)"colour" (13)boolean (14)integer_value (15)boolean (16)"tin_extension_type" (17)<modifier_extras>

(1) Token that indicates that an interface link will be created from a base link and tin that is dropped by a strip depth.

(2) Name of the interface link.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the base link.

(6) Name of tin to batter to.

(7) Cut slope, when base link is below tin.

(8) Fill slope, when base link is above tin.

(9) Section width to limit distance of a cut along a tin section.

(10) Strip depth to vertically drop the tin before interfacing.

(11) Cut colour.

(12) Fill colour.

(13) If 1(true) then use an exact interface.

(14) Intersection number against the tin.

(15) If 1(true) then dynamically update.

(16) See "tin_extension_type" for more information.

(17) See modifier_extras for more information.

See 20.2.2.2.11 Fixed - Interface to Tin for more information.

16.27.2.7.4 Fixed - Reinterface Tin

"cut_fill_type"

(1)"Cut" / (2)"Fill"

(1) Reinterface in the fixed cut zone.

(2) Reinterface in the fixed fill zone.

reinterface_tin

(1)**reinterface_tin** (2)"link_name" (3)start_chainage (4)final_chainage (5)"tin_name" (6)"cut_fill_type" (7)"interpolate_type" (8)variable/value/$null (9)variable/value/$null (10)variable/value (11)integer_value (12)value/$null (13)"tin_extension_type" (14)<modifier_extras>

(1) Token that indicates that a link will be adjusted to interface to a tin but only in a cut or fill situation, not both.

(2) Name of the interface link.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin to batter to.

(6) See "cut_fill_type" for more information.

(7) See "interpolate_type" for more information.

(8) Start slope if required by the interpolate type(7).

(9) End slope if required by the interpolate type(7).

(10) Strip depth to vertically drop the tin before interfacing.

(11) Intersection number against the tin.

(12) Section width to limit distance of a cut along a tin section.

(13) See "tin_extension_type" for more information.

(14) See modifier_extras for more information.

See 20.2.2.2.12 Reinterface Tin for more information.

16.27.3 Interval

See 16.27.3.1 Chainage Alias
See 16.27.3.2 Change Interval
See 16.27.3.3 Change Interval Relative
See 16.27.3.4 Interval String Tangent Points
See 16.27.3.5 Chainages for Intersect with Tin
See 16.27.3.6 Chainages of Intersection of Links with String

16.27.3.1 Chainage Alias

chainage_alias

(1)**chainage_alias** (2)start_chainage (3)final_chainage (4)<modifier_extras>

(1) Token that indicates a chainage alias definition.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See modifier_extras for more information.

See 20.2.2.4.1Chainage Alias for more information.

16.27.3.2 Change Interval

change_interval

(1)**change_interval** (2)start_chainage (3)final_chainage (4)<modifier_extras>

(1) Token that indicates a change in interval within the chainage range.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See modifier_extras for more information.

See 20.2.2.4.2 Change Interval for more information.

16.27.3.3 Change Interval Relative

change_interval_abs

(1)**change_interval_abs** (2)start_chainage (3)final_chainage (4)<modifier_extras>

(1) Token that indicates a change in interval within the chainage range.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See modifier_extras for more information.

See 20.2.2.4.3 Change Interval Relative for more information.

16.27.3.4 Interval String Tangent Points

interval_string_tps

(1)**interval_string_tps** (2)"model_string" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates extra sections will be generated on chainages of dropped tangent points to a selected string.

(2) Name of string to drop tangent points onto reference string.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) See modifier_extras for more information.

See 20.2.2.4.4 Interval String Tangent Points for more information.

16.27.3.5 Chainages for Intersect with Tin

link_intersect_tin

(1)**link_intersect_tin** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"tin_name" (6)value/$null (7)value/$null (8)value/$null (9)value/$null (10)value/$null (11)value (12)<modifier_extras>

(1) Token that indicates that sections will be generated on chainages where links intersect a tin.

(2) Name(s) of link(s) to intersect with the stripped tin.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of tin to find intersections with provided link(s).

(6) Strip depth to adjust tin before calculating intersections.

(7) Section 1 distance to generate section.

(8) Section 2 distance to generate section.

(9) Section 3 distance to generate section.

(10) Section 4 distance to generate section.

(11) The vertical intersection tolerance.

(12) See modifier_extras for more information.

See 20.2.2.4.5 Chainages for intersect with Tin for more information.

16.27.3.6 Chainages of Intersection of Links with String

link_intersect_string

(1)**link_intersect_string** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"model_string" (6)value/$null (7)value/$null (8)value (9)<modifier_extras>

(1) Token that indicates that sections will be generated on chainages where links intersect a string.

(2) Name(s) of link(s) to intersect with a string.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of string to find intersections with provided link(s).

(6) Section 1 distance to generate section.

(7) Section 2 distance to generate section.

(8) The vertical intersection tolerance.

(9) See modifier_extras for more information.

See 20.2.2.4.6 Chainages of Intersection of Links with String for more information.

Continue to 16.27.4 MTF Create or go back to 16.27 MTF Modifiers File Format.

16.27.4 MTF Create

16.27.4.1 Common Types

"link_selection_type"

(1)"not_set" / (2)"layer_all" / (3)"layer_left" / (4)"layer_right" / (5)"selection"

(1) An invalid default value.

(2) Use all links in layer.

(3) Use all LHS links in layer.

(4) Use all RHS links in layer.

(5) Use many links from many layers.

16.27.4.2 Create Shapes

"shape_type"

(1)"open_regular" / (2)"closed_regular" / (3)"open_irregular" / (4)"closed_irregular" / (5)"open_varying" / (6)"closed_varying" / (7)"open_column" / (8)"closed_column" / (9)"extrude" / (10)"open_regular_sides_closed"

(1) See 20.2.2.5.1.1 Open regular for more information.

(2) See 20.2.2.5.1.2 Closed regular for more information.

(3) See 20.2.2.5.1.4 Open irregular for more information.

(4) See 20.2.2.5.1.5 Closed irregular for more information.

(5) See 20.2.2.5.1.6 Open varying int'l links for more information.

(6) See 20.2.2.5.1.7 Closed varying int'l links for more information.

(7) See 20.2.2.5.1.8 Open column (top down) for more information.

(8) See 20.2.2.5.1.9 Closed column (top down) for more information.

(9) Usage unknown.

(10) See 20.2.2.5.1.3 Open regular (sides closed) for more information.

shape

(1)**shape** (2)"name_list" <(3)**link_colour** (4)colour_list> <(5)**link_must_exist** (6)name_list> <(7)**link_must_not_exist** (8)name_list> <(9)**link_order** (10)name_list> (11)start_chainage (12)final_chainage (13)"trimesh_name" (14)"colour" (15)"<model_name>" (16)"<model_name>" (17)"<model_name>" (18)"shape_type" (19)"" (20)"colour" (21)<modifier_extras>

(1) Token that indicates a shape is to be formed.

(2) Names of links used to form the shape.

(3) Token that indicates the inclusion of the colour list.

(4) Colours of the faces that form the shape.

(5) Token that indicates the inclusion of the link name list where all links must exist at a chainage for the shape to form.

(6) Names of links that must exist.

(7) Token that indicates the inclusion of the link name list where all links must not exist at a chainage for the shape to form.

(8) Names of links that must not exist.

(9) Token that indicates the inclusion of the link name list where all links must exist at a chainage in exact forward or reverse order for the shape to form.

(10) Names of links that must exist in order.

(11) See start_chainage for more information.

(12) See final_chainage for more information.

(13) Name of the formed trimesh.

(14) Colour of the formed trimesh.

(15) Name of the model of formed sections.

(16) Name of the model of formed strings.

(17) Name of the model of formed trimesh.

(18) See "shape_type" for more information.

(19) Spare parameter.

(20) Colour of the end caps on the formed trimesh.

(21) See modifier_extras for more information.

See 20.2.2.5.1 Create Shapes for more information.

16.27.4.3 Create Shapes (Extrude)

shape_extrude

(1)**shape_extrude** (2)"<link_names>" (3)**link_colour** (4)colour_list (5)**inner_links** (6)"<link_names>" (7)**link_colour2** (8)colour_list (9)start_chainage (10)final_chainage (11)"trimesh_name" (12)"colour" (13)"colour" (14)"colour" (15)"<model_name>" (16)"<model_name>" (17)<modifier_extras>

(1) Token that indicates a genus 1 shape is to be formed.

(2) Names of links that form the outer faces of the shape.

(3) Token that indicates that a colour list parameter will follow.

(4) Colours of the outer faces of the shape.

(5) Token that indicates that the inner link names parameter will follow.

(6) Names of links that form the inner faces of the shape.

(7) Token that indicates that a colour list parameter will follow.

(8) Colours of the inner faces of the shape.

(9) See start_chainage for more information.

(10) See final_chainage for more information.

(11) Name of the formed trimesh.

(12) Default colour for the outer faces of the formed trimesh.

(13) Default colour for the inner faces of the formed trimesh.

(14) Colour of the formed trimesh end caps.

(15) Name of the model of formed strings.

(16) Name of the model of formed trimesh.

(17) See modifier_extras for more information.

See 20.2.2.5.2 Create Shapes (Extrude) for more information.

16.27.4.4 Create Shapes (2 layers)

shape_dynamic_2_layers

(1)**shape_dynamic_2_layers** (2)"link_name" (3)"link_name" (4)"link_name" (5)"link_name" (6)start_chainage (7)final_chainage (8)"trimesh_name" (9)"colour" (10)"colour" (11)"<model_name>" (12)"<model_name>" (13)"boolean" (14)<modifier_extras>

(1) Token that indicates a shape will be formed by 2 layers.

(2) Name of the 1st link from the 1st layer.

(3) Name of the 2nd link from the 1st layer.

(4) Name of the 1st link from the 2nd layer.

(5) Name of the 2nd link from the 2nd layer.

(6) See start_chainage for more information.

(7) See final_chainage for more information.

(8) Name of the formed trimesh.

(9) Colour of the formed trimesh.

(10) Colour of the formed trimesh end caps.

(11) Name of the model of formed strings.

(12) Name of the model of formed trimesh.

(13) When "true", close the open sides and form end caps.

(14) See modifier_extras for more information.

See 20.2.2.5.3 Create Shapes (2 layers) for more information.

16.27.4.5 Create Strings

create_strings

(1)**create_strings** (2)"link_selection_type" (3)"link_names*?" (4)start_chainage (5)final_chainage (6)"colour" (7)"<model_name>" (8)"<model_name>" (9)<modifier_extras>

(1) Token that indicates that strings will be formed.

(2) See "link_selection_type" for more information.

(3) Name(s) of links and/or layers to create strings from.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Colour of the formed strings.

(7) Name of the model of formed sections.

(8) Name of the model of formed strings.

(9) See modifier_extras for more information.

See 20.2.2.5.4 Create Strings for more information.

16.27.4.6 Create Tins

create_tin

(1)**create_tin** (2)"link_selection_type" (3)"link_names*?" (4)start_chainage (5)final_chainage (6)"colour" (7)"tin_name" (8)"<model_name>" (9)value/$null (10)value/$null (11)value/$null (12)value/$null (13)<modifier_extras>

(1) Token that indicates a tin will be formed.

(2) See "link_selection_type" for more information.

(3) Name(s) of links and/or layers to create tin from.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Colour of the formed tin.

(7) Name of the formed tin.

(8) Name of the model of the formed tin.

(9) Formed tin nulling angle.

(10) Formed tin nulling length.

(11) Formed tin nulling combined angle.

(12) Formed tin nulling combined length.

(13) See modifier_extras for more information.

See 20.2.2.5.5 Create Tins for more information.

16.27.4.7 Create Sections, Strings and Tins

create_offset_strs_tin

(1)**create_offset_strs_tin** (2)"link_selection_type" (3)"link_names*?" (4)start_chainage (5)final_chainage (6)value (7)"<model_name>" (8)"<model_name>" (9)"colour" (10)"colour" (11)"tin_name" (12)"<model_name>" (13)value/$null (14)value/$null (15)value/$null (16)value/$null (17)<modifier_extras>

(1) Token that indicates a sections, strings and a tin can be formed.

(2) See "link_selection_type" for more information.

(3) Name(s) of links and/or layers to create sections, strings and tin.

(4) See start_chainage for more information.

(5) See final_chainage for more information.

(6) Vertical wall offset for tin creation.

(7) Name of the model of formed strings.

(8) Name of the model of formed sections.

(9) Colour of the formed sections.

(10) Colour of the formed tin.

(11) Name of the formed tin.

(12) Name of the model of the formed tin.

(13) Formed tin nulling angle.

(14) Formed tin nulling length.

(15) Formed tin nulling combined angle.

(16) Formed tin nulling combined length.

(17) See modifier_extras for more information.

See 20.2.2.5.6 Create Sections, Strings and Tins for more information.

16.27.4.8 Create Polygon

"polygon_colouring_type"

(1)"invalid" / (2)"one_colour" / (3)"inner_link_colour" / (4)"outer_link_colour"

(1) Invalid parameter.

(2) Use one colour for all formed polygons.

(3) Formed polygon colour is inherited from the colour of the edge link closest to centreline.

(4) Formed polygon colour is inherited from the colour of the edge link furthest from centreline.

See 20.2.2.5.7.3 Colouring Type for more information.

"polygon_naming_type"

(1)"invalid" / (2)"name" / (3)"inner_text_outer" / (4)"outer_text_inner"

(1) Invalid parameter.

(2) Use one name for all formed polygons.

(3) Formed polygons are named by the concatenation of:
"inner link name" + "user defined text" + "outer link name".

(4) Formed polygons are named by the concatenation of:
"outer link name" + "user defined text" + "inner link name".

See 20.2.2.5.7.2 Polygon Naming for more information.

"polygon_end_formation_type"

(1)"invalid" / (2)"skew" / (3)"square"

(1) Invalid parameter.

(2) Form the ends of a given polygon at any angle.

(3) Form the ends of a given polygon normal to the centreline.

See 20.2.2.5.7.1 End Formation Types for more information.

"polygon_type"

(1)"invalid" / (2)"link_link_2_layers" / (3)"all_links_layer"

(1) Invalid parameter.

(2) Form a polygon between any 2 links in any layers.

(3) Form many polygons between 2 links in the same layer.

See 20.2.2.5.7.4 Polygon Type for more information.

create_polygon

(1)**create_polygon** (2)"link_names*?" (3)start_chainage (4)final_chainage (5)"string_name" (6)"model_name" (7)"polygon_colouring_type" (8)"colour" (9)"polygon_naming_type" (10)"polygon_end_formation_type" (11)"polygon_type" (12)<modifier_extras>

(1) Token that indicates that polygon(s) will be formed.

(2) Names of links to form polygons with.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name input to use with the polygon naming type(9).

(6) Name of the model of formed polygon(s).

(7) See "polygon_colouring_type" for more information.

(8) Colour of formed polygon(s) when polygon colouring type(7) is "one_colour".

(9) See "polygon_naming_type" for more information.

(10) See "polygon_end_formation_type" for more information.

(11) See "polygon_type" for more information.

(12) See modifier_extras for more information.

See 20.2.2.5.7 Create Polygon for more information.

16.27.4.9 String Properties

string_properties

(1)**string_properties** (2)"link_names*" (3)start_chainage (4)final_chainage (5)"colour" (6)"<text>" (7)value/$null (8)"vertex_tinable"/"vertex_nontinable" (9)"segment_tinable"/ "segment_nontinable" (10)"closed"/"unclosed" (11)"ignore_mapfile"/"use_mapfile" (12)"reverse_string"/"leave_string" (13)<modifier_extras>

(1) Token that indicates that newly formed string(s) will have their string properties set.

(2) Names of links whose formed strings will have their properties set.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Colour to set for given strings.

(6) Linestyle to set for given strings.

(7) Weight to set for given strings.

(8) Vertex tinability to set for given strings.

(9) Segment tinability to set for given strings.

(10) String closure to set for given strings.

(11) Whether to use apply map file for given strings.

(12) Whether to reverse given strings.

(13) See modifier_extras for more information.

See 20.2.2.5.8 String Properties for more information.

16.27.4.10 Attribute Links

"attribute_type"

(1)"attr_text" / (2)"attr_int" / (3)"attr_real" / (4)"attr_real_var" / (5)"attr_multi_real_var"

(1) Created string attribute will be of type "Text".

(2) Created string attribute will be of type "Integer".

(3) Created string attribute will be of type "Real".

(4) See 20.2.2.5.10.1 Use of Link/Shape attributing in snippets for more information.

(5) See 20.2.2.5.10.1 Use of Link/Shape attributing in snippets for more information.

attribute_link

(1)**attribute_link** (2)"link_names*" (3)start_chainage (4)"attribute_type" (5)"attribute_path" (6)"text"/"integer_value"/"value" (7)<modifier_extras>

(1) Token that indicates that newly formed string(s) will have string attributes added.

(2) Names of links whose formed strings will be attributed.

(3) See start_chainage for more information.

(4) See "attribute_type" for more information.

(5) Full path for the created string attribute.

(6) Value of the created string attribute.

(7) See modifier_extras for more information.

See 20.2.2.5.9 Attribute Links for more information.

16.27.4.11 Attribute Shapes

attribute_shape

(1)**attribute_shape** (2)"element_name*" (3)start_chainage (4)"attribute_type" (5)"attribute_path" (6)"text"/"integer_value"/"value" (7)<modifier_extras>

(1) Token that indicates that newly formed shape(s) will have string attributes added.

(2) Names of shapes that shall be attributed.

(3) See start_chainage for more information.

(4) See "attribute_type" for more information.

(5) Full path for the created string attribute.

(6) Value of the created string attribute.

(7) See modifier_extras for more information.

See 20.2.2.5.10 Attribute Shapes for more information.

Continue to 16.27.5 Miscellaneous or go back to 16.27 MTF Modifiers File Format.

16.27.5 Miscellaneous

See 16.27.5.1 Debug

See 16.27.5.2 Pause

See 16.27.5.3 Clear Output Window

See 16.27.5.4 Region

16.27.5.1 Debug

layers_debug

(1)**layers_debug** (2)"model_name" (3)start_chainage (4)final_chainage (5)<modifier_extras>

(1) Token that indicates that debug models and a report will be created.

(2) Prefix for the generated debug model names.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) See modifier_extras for more information.

See 20.2.2.6.1 Debug for more information.

16.27.5.2 Pause

toggle_process

(1)**toggle_process** (2)start_chainage (3)final_chainage (4)boolean (5)<modifier_extras>

(1) Token that indicates that processing of the MTF will be enabled/disabled within the provided chainage range.

(2) See start_chainage for more information.

(3) See final_chainage for more information.

(4) If 0 then start processing, if 1 then end processing.

(5) See modifier_extras for more information.

See 20.2.2.6.2 Pause for more information.

16.27.5.3 Clear Output Window

clear_output_window

(1)**clear_output_window** (2)<modifier_extras>

(1) Token that indicates that processing of the MTF will be enabled/disabled within the provided chainage range.

(2) See modifier_extras for more information.

See 20.2.2.6.3 Clear Output Window for more information.

16.27.5.4 Region

region

(1)**region** (2)"text" (3)"<text>" (4)boolean (5)<modifier_extras>

(1) Token that indicates that a region is to be inserted.

(2) Name/description of region.

(3) Bookmark name of region.

(4) If 1(true) then collapse region on the MTF Edit Panel.

(5) See modifier_extras for more information.

See 20.2.2.9 Region for more information.

Continue to 16.27.6 Snippet or go back to 16.27 MTF Modifiers File Format.

16.27.6 Snippet

See 16.27.6.1 Snippet

16.27.6.1 Snippet

snippet

(1)**snippet** (2)"file_path" (3)start_chainage (4)final_chainage (5)<"text_list"...>
(6)<modifier_extras>

(1) Token that indicates that a snippet is to be inserted.

(2) The full path name of the snippet to run.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) The required argument(s) to provide for the snippet.

(6) See modifier_extras for more information.

See 20.2.2.7 Snippet for more information.

Continue to 16.27.7 Text File Only Modifiers or go back to 16.27 MTF Modifiers File Format.

16.27.7 Text File Only Modifiers

See 16.27.7.1 Variable

See 16.27.7.2 Link Variable

16.27.7.1 Variable

variable

(1)**variable** (2)"name" (3)start_chainage (4)final_chainage (5)"expression" (6)<modifier_extras>

(1) Token that indicates that a variable is being defined.

(2) Name of variable.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) The value of the variable which is a mathematical expression that is evaluated a each chainage along the apply.

(6) See modifier_extras for more information.

See 20.6.14.2 Defining General Variables for more information.

16.27.7.2 Link Variable

link_variable

(1)**link_variable** (2)"link_name" (3)start_chainage (4)final_chainage (5)"name" (6)<modifier_extras>

(1) Token that indicates that a link variable is being defined.

(2) Name of link that is being referenced by the link variable.

(3) See start_chainage for more information.

(4) See final_chainage for more information.

(5) Name of the link variable.

(6) See modifier_extras for more information.

See 20.6.14.1 Defining Link Variables for more information.

17 Water

Position of menu: **Water**

In ***12d Model 15*** the **Water** menu has been totally rearranged.

The **Water** menu contains option to

(a) Create water strings to represent stormwater (drainage), foul water (sewer) and water supply networks. See 17.3 Water Network, 17.2.1 Concept Stormwater Design and 17.3.3 Quick Water Network (QWN).

(b) Perform Rational analysis for stormwater networks and display the results. See 17.3.4 Water Network Editor (WNE).

(c) Perform dynamic analysis for stormwater and foul water networks using the SWMM engines as the basis, and display the results. See 17.3.4 Water Network Editor (WNE)

(d) Perform dynamic analysis for water supply networks using the EPANET engine and display the results. See 17.7 Water Supply.

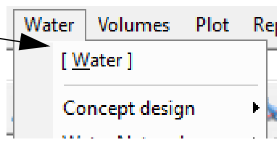
(e) Perform 2D Water analysis using the TUFLOW engine and interfacing with the ***12d Model*** dynamic analysis engine, and display the results. See 18 Water 2D

(f) Creating data ready for backwater curve analysis and then displaying the results. See 19 Rivers.

The **Water** menu is:

on Main menu

create floating **Water** menu



Main Water menu and floating Water menu

See
17.2 Water Concept Design
17.3 Water Network - for stormwater, foul water and water supply
17.4 Water Setup
17.5 Stormwater
17.6 Foul Water Tools
17.7 Water Supply
17.8 Water Quality
18 Water 2D TUFLOW interface
19 Rivers
22 Pipeline
Water User menu

17.1 Definitions for Water Strings and Networks

In ***12d Model***, a **water network** consists of one or more water strings in the *same* model. Consequently, all the water strings in the same model are considered to be part of the same water network. It is suggested that **all** water strings in a network be entered with the same flow direction.

See

17.1.1 Three Waters

17.1.2 Structure of the Water String

17.1.3 Water Networks and Junctions

17.1.4 Definitions for Nodes and Links

For information on ***Water Theory***, see 27 Water Theory.

17.1.1 Three Waters

In ***12d Model*** the term three waters is used to refer to:

(a) storm water (drainage)

(b) foul water (sewer)

(c) water supply

Because of the similarities in functionality, the ***12d Model*** string of type ***Water*** is used as the basis for each of the three waters.

What the water string can be used for depends on what modules the user has.

The basic water string and plot capabilities are available with the drainage, sewer and dynamic water supply Modules.

The sewer extensions (property control, house controls and Melbourne Water plots) are only available with the Sewer Module but for all users on Maintenance, this is included free of charge with the Drainage Module.

The water supply extensions are only available with the Dynamic Water Supply Module but for all users on Maintenance, this is included free of charge with the Dynamic Stormwater Analysis module.

17.1.2 Structure of the Water String

The **Water string** option creates a ***12d Model water string*** which is used to place stormwater (drainage), foul water (sewer) and water supply networks within a subdivision, along highways, and culverts for cross drainage. Pumps may also be included in the network when you have the **Dynamic Drainage Analysis** Module.

The network is placed in three dimensions including node (maintenance holes or pits), for sewer work lot controls and house connections can be defined, and for water supply valves and fittings.

If used in conjunction with the services on a section view, interference with neighbouring pipe strings can be taken into consideration when placing the network.

A **Water string** consists of a series of **nodes** (pits, maintenance holes etc) at user selected (x,y,z) positions and **links** joining the nodes but there is an underline polyline geometry and it is important to understand the relationship between the nodes and links, and the underlying polyline of vertices and segments.

The **Water string** is based on a **polyline** string so that **arcs** can exist between the polyline vertices. The **nodes** of a water string may be placed **anywhere along the polyline** but usually nodes are located at the polyline vertices. BUT except for a node on the first and last vertex of polyline, nodes don’t have to be on the string vertices. For example, in the diagram example, Pit 5 is not on a string vertex.

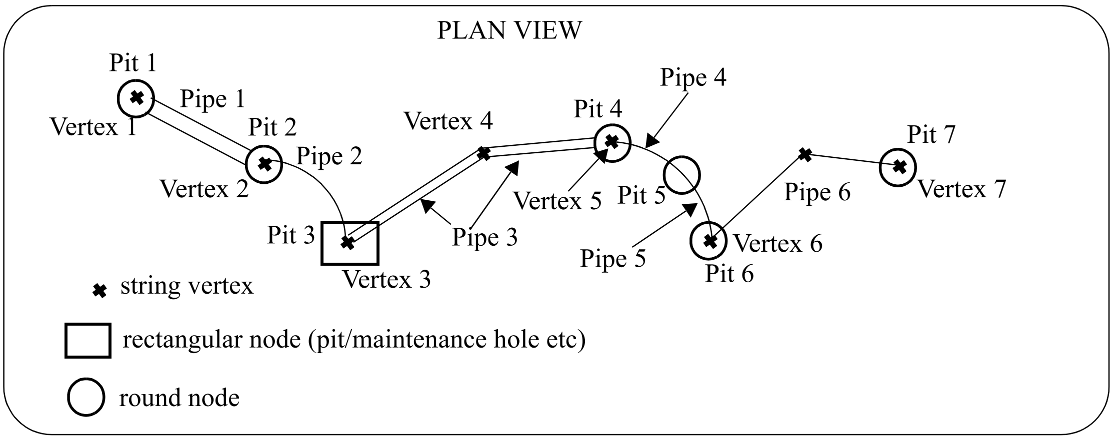
Nodes may be any type of drainage, sewer or water structure and are represented by circles, rectangles or capsules. Drainage inlets, pump wet wells, gross pollutant traps, soak away pit, open channel changes in direction are all examples of nodes. The nodes have cover, grate, sump and setout levels as well risers, wall and bottom thicknesses and trimeshes from detailed BIM modelling (visible in Opengl views only).

Junction Nodes are the first or last nodes of a water string (branch) that may be used to join into a node on another water string (trunk). The node on the trunk line must have a vertex. The vertex on the branch string must point snap onto the vertex of the trunk string.

Crossing strings are not considered as joining. A junction node will not exist.

Links are the conduits **connecting the nodes**. Round pipes, box culverts, trapezoidal channels, pump rising mains, basin links, weirs and orifices are all examples of links. The link may use a trimesh in opengl for detailed BIM modelling.

Because links go between nodes then links may or may not stop and start on vertices of the underlying polyline because nodes do not have to be on the polyline vertices. So links may include more than one string segment or only a part of some segments. For example, in the diagram example, Pipes 3 and 6 includes two string segments but Pipes 4 and 5 only include part of the one segment.



The use of the water string for stormwater (drainage) and water supply are only a subset of its use for foul water (sewer) so the steps for the sewer will be given since they cover drainage as well.

Like all ***12d Model*** strings, the water string has an implied direction, starting at the first node and going in the direction towards the next node in the water string. This order is normally determined by the creation order (or string order) of the nodes.

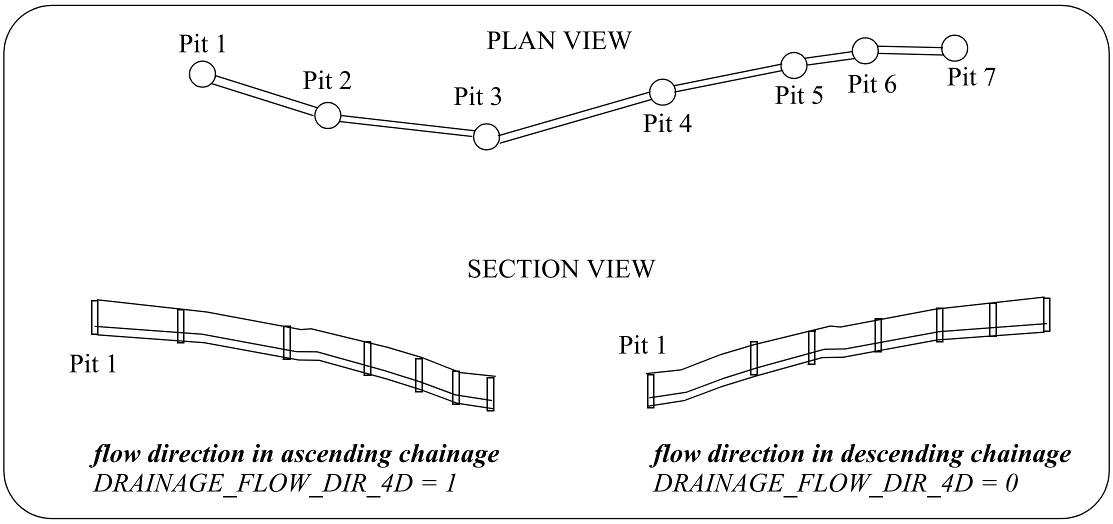
The chainage of the water string starts at the **first** node and then increases along the direction of the water string.

In ***12d Model***, water strings have a property indicating

(a) the most upstream node is entered as the first point of the string and hence the water flows in the direction of ascending string chainage. The flow direction is said to be in ***ascending chainage***.

or

(b) the most downstream node is entered as the first point of the string and hence the water flows in the direction of descending chainage. The flow direction is said to be in ***descending chainage***.



When a water string with flow direction in ascending order is profiled in a section view, the left hand side of a node is normally upstream and the right hand side of a node downstream.

It is recommended that water strings are entered with the flow direction in ascending chainage so that the minimum grade and cover can be satisfied as the water string is being placed.

That is, if the water string flow is in ascending chainage direction, then as nodes are appended, minimum *cover* and minimum *grade* can be automatically maintained. In all cases the invert levels can be recalculated using the 17.3.4 Water Network Editor (WNE).

For information on Creating and editing water strings, see 17.3.6.1 Create Water String and 17.3.6.2 Water String Edit.

Continue to 17.1.3 Water Networks and Junctions or return to 17.1.2 Structure of the Water String.

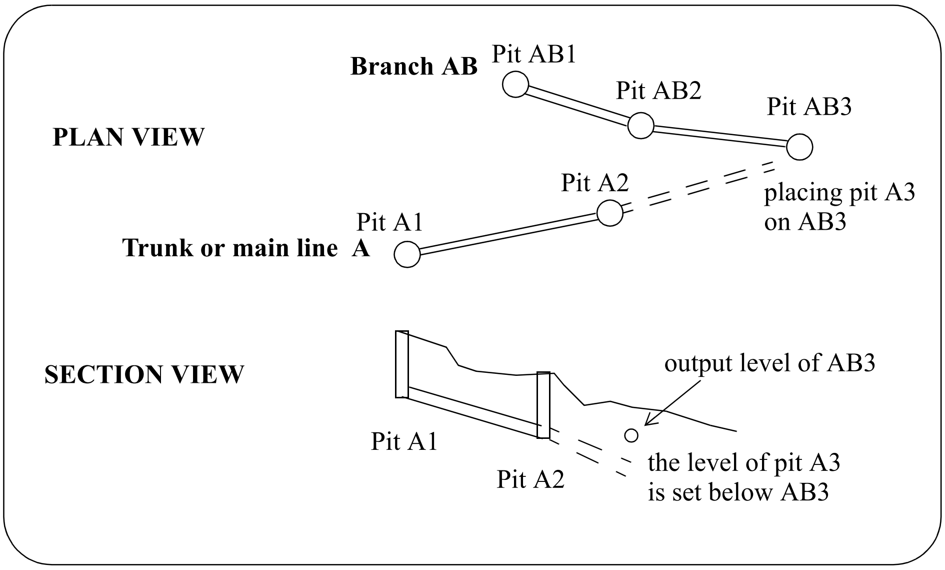
17.1.3 Water Networks and Junctions

In ***12d Model***, a **water network** consists of one or more water strings in the *same* model. Consequently, all the water strings in the same model are considered to be part of the same water network. It is suggested that **all** water strings in a network be entered with the same flow direction.

If two water strings from the same model have a node at exactly the same (x,y) location, then ***12d Model*** assumes that the coincident nodes **are** the same node and that the situation represents a **junction**. Most junction nodes are at the ends of the water strings. A junction may have a maximum of one node that is not at the end of the water string.

When water flows into a water string (from a branch water string) it is referred to as a trunk line. A trunk line may be a branch for another downstream trunk line.

Also for a network, if all the water strings are entered with the flow direction in ascending chainage, not only can minimum cover and minimum grade be maintained as nodes are appended, but if the branches are laid down before the trunk, then as you connect each branch to the trunk, the invert level for the trunk will be set to below the invert level of the branch line (less the default drop for the nodes). In all cases the invert levels for the entire network be recalculated using the 17.3.4 Water Network Editor (WNE).



Continue to 17.1.4.1 Nodes (Pits, Maintenance Holes) or return to 17.1.2 Structure of the Water String.

17.1.4 Definitions for Nodes and Links

See

17.1.4.1 Nodes (Pits, Maintenance Holes)
17.1.4.2 Links (Pipes)
17.1.4.4 Z Point Definitions for Nodes and Links
17.1.4.5 Definitions for Node RL Modes and Setout Modes
17.1.4.6 Setout of Nodes and Links
17.1.4.7 Bearing of the Node Base and Node Riser

17.1.4.1 Nodes (Pits, Maintenance Holes)

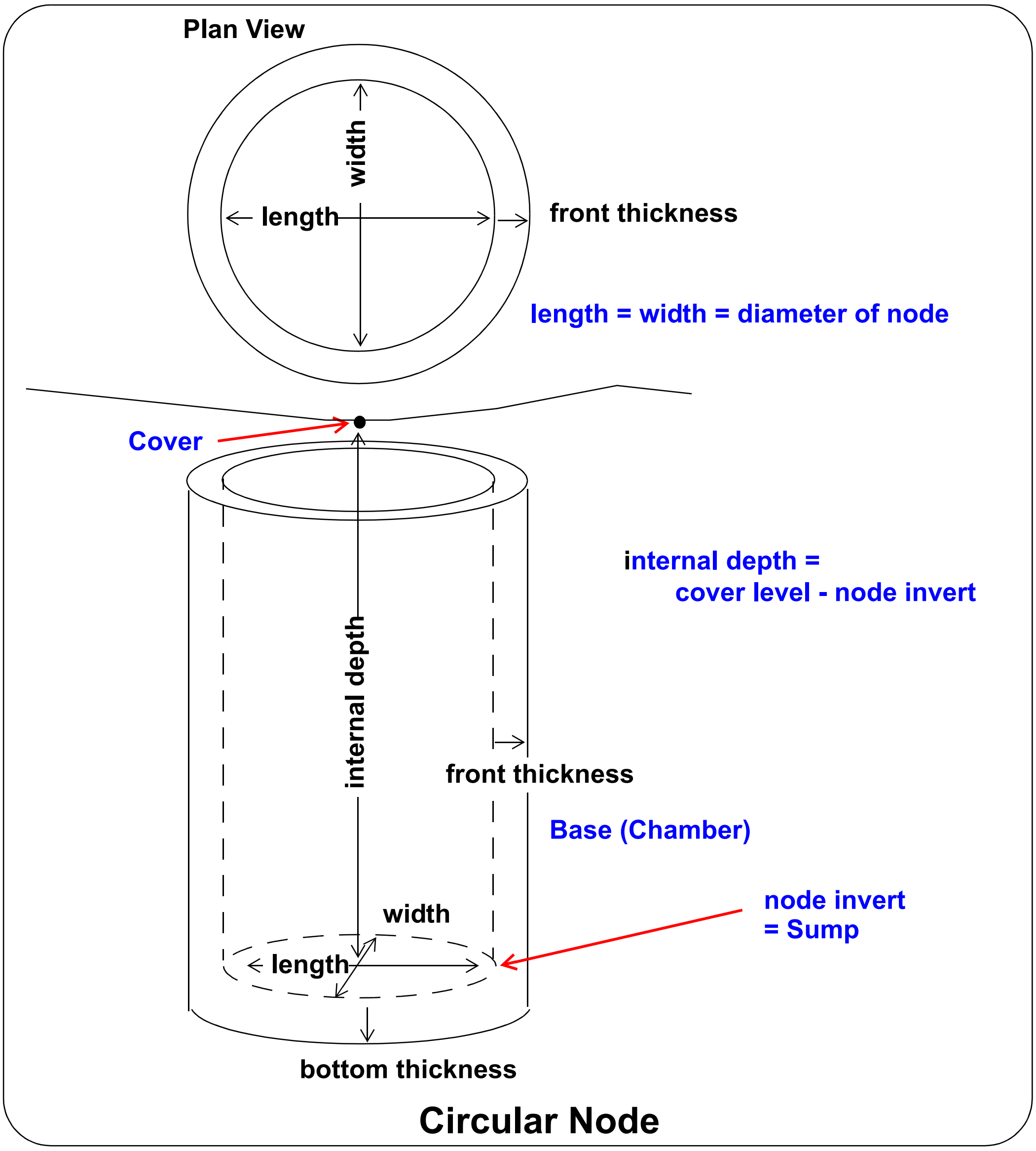
A node (pit, maintenance hole) is automatically created when appending or inserting nodes to a water string.

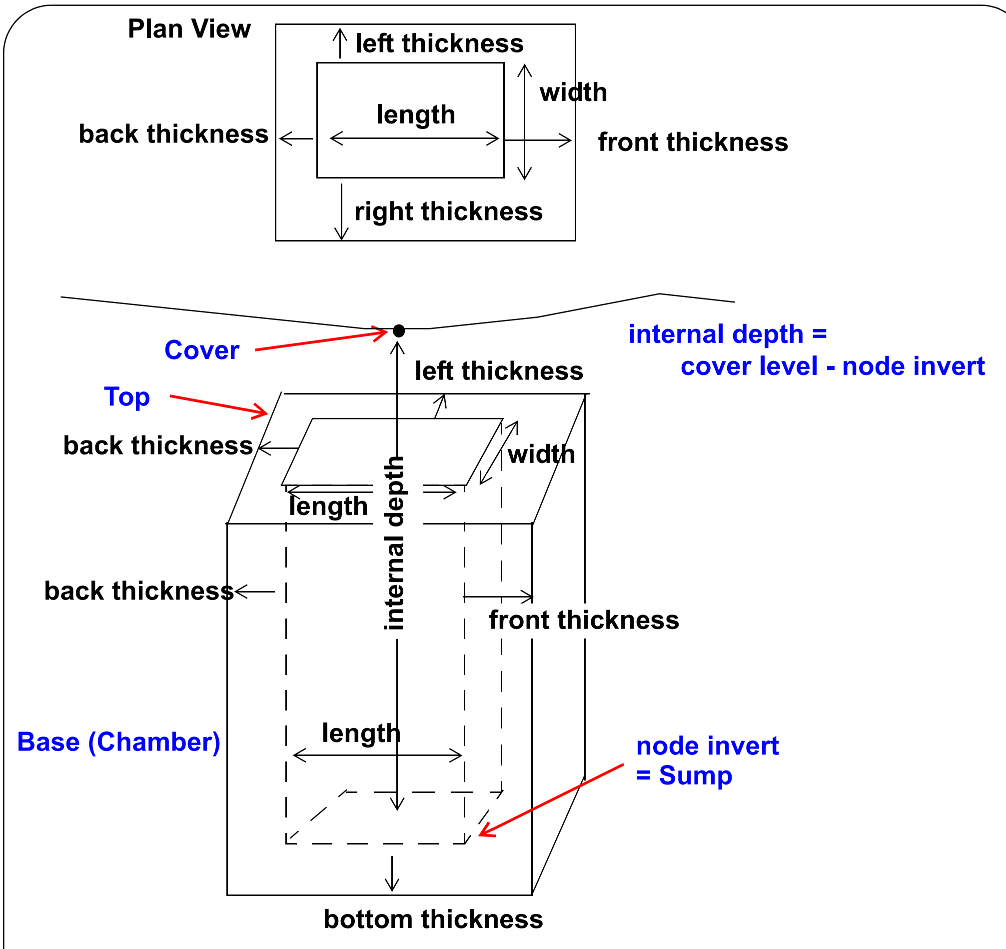
See

17.1.4.1.1 Node Shapes and Sizes with No Riser
17.1.4.1.2 Risers on Nodes
17.1.4.1.3 Node Symbol
17.1.4.1.4 Node and Riser Colours
17.1.4.1.5 Trimeshes on Nodes
17.1.4.1.6 Node Type

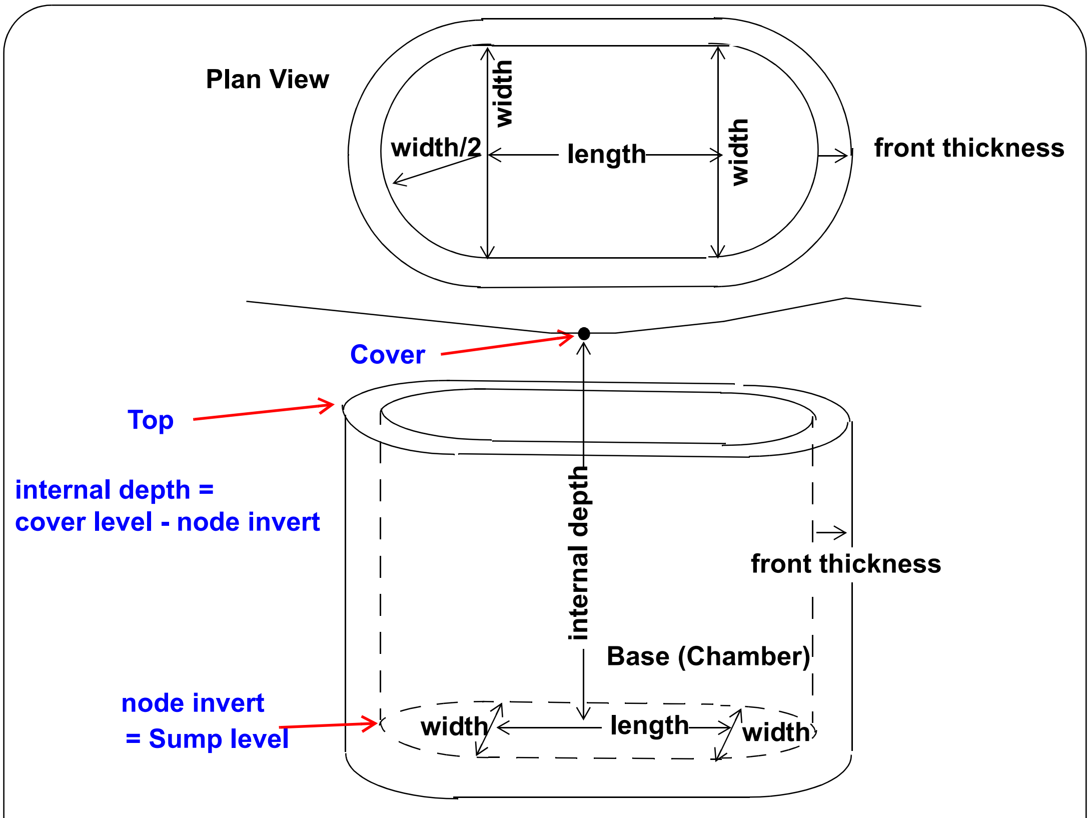
17.1.4.1.1 Node Shapes and Sizes with No Riser

Nodes without a riser of a Water string can be circular (round), rectangular or extended (capsule), and have thicknesses except there is no top thickness.





Rectangular Node



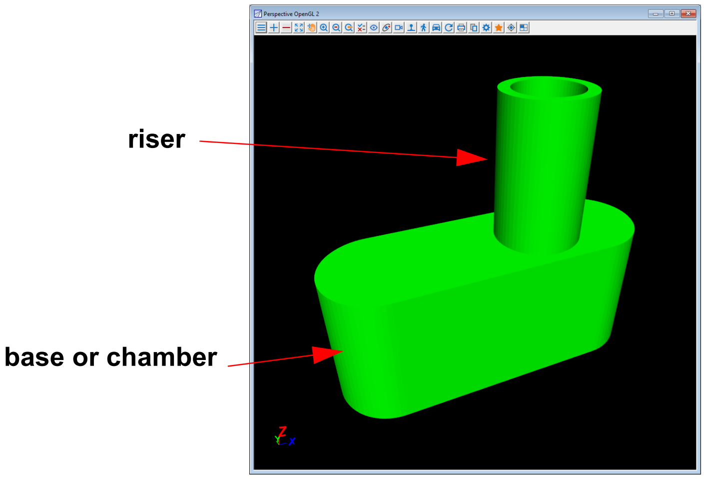
Node Extended in the Direction of Length

An **extended node** can be extended in either the direction of length or width.

When a node has no riser, the plan bearing of the node is the same as the bearing of the symbol. See 17.1.4.6.4 Setout Symbol Mode.

Continue to 17.1.4.1.2 Risers on Nodes or return to 17.1.2 Structure of the Water String.

17.1.4.1.2 Risers on Nodes



The **nodes** of a Water string can be circular, rectangular or extended and can also have **Risers**.

The part of the node under the Riser is referred to as the **Chamber**.

The **Riser** can be circular, rectangular or extended, and is independent of the type of the node. The centre of the riser can be offset from the centre of the node.

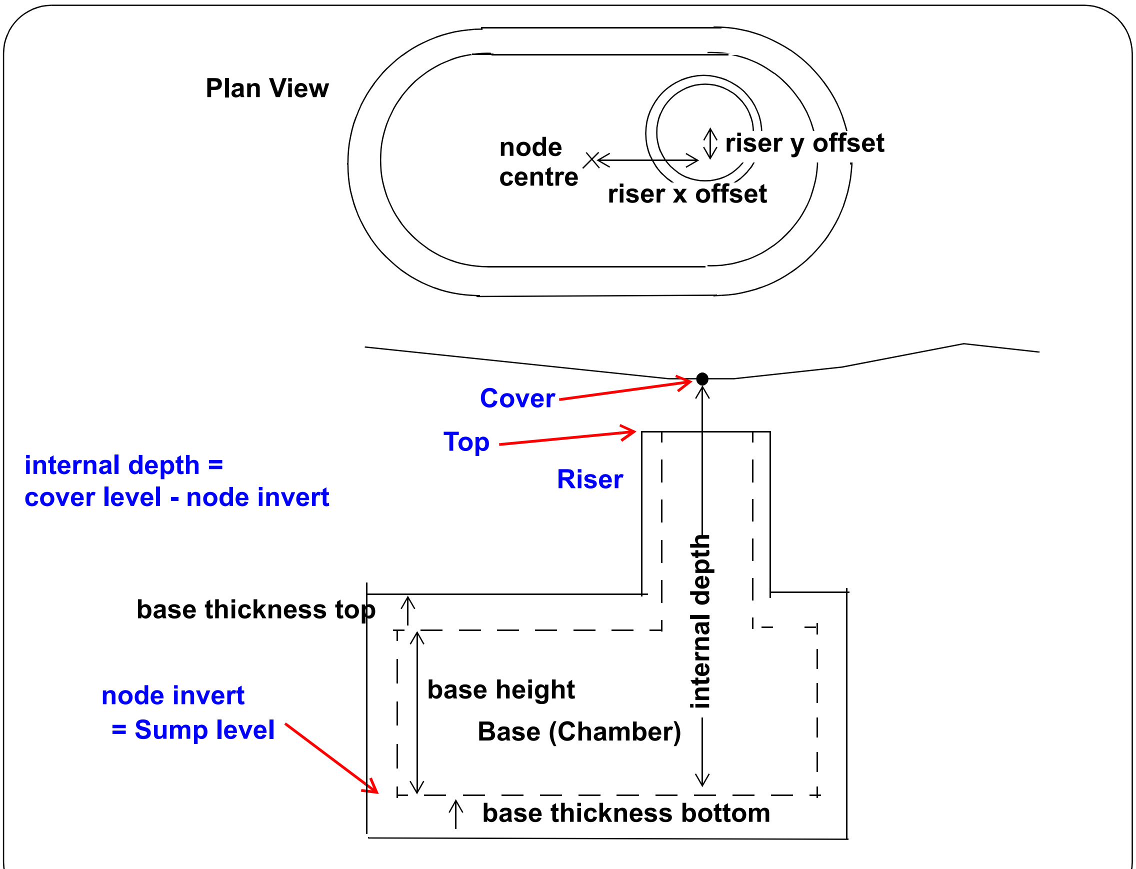
When there is a riser, there is also a **Base thickness top** field and it is used as the thickness of the top of the chamber below the riser. There is no base thickness top when there is no riser.

There is also a **Base height** field which is the **internal height** of the **Base**. Hence the **Base thickness top** in **not** included in the Base height just as the Base thickness bottom is not included in the Base height.

The **height** of the **base** is then **fixed** and it is the **height** of the **Riser** that **varies** depending on the cover level.

The other values for a **Riser** have the same definition as for a circular, rectangular or extended base.

Note: for water analysis, only the internal sizes are important for determining volumes of water.



Node with Riser

When a node has a **Riser**, the plan bearing of the Riser is given by the Symbol mode (17.1.4.7.2 Bearing of Rise and 17.1.4.6.4 Setout Symbol Mode) and there is then an optional **Base bearing** for specifying the plan bearing of the base (chamber) of the node (17.1.4.7.1 Bearing of Base (Chamber) with Riser).

Continue to 17.1.4.1.4 Node and Riser Colours or return to 17.1.2 Structure of the Water String.

17.1.4.1.3 Node Symbol

The "Symbol" for a node is used to indicate where things are placed.

For a **node with a riser,** the position of the symbol is in the centre of the riser.

For a **node without a riser,** the position of the symbol is in the centre of the chamber (base).

Continue to 17.1.4.1.4 Node and Riser Colours or return to 17.1.2 Structure of the Water String.

17.1.4.1.4 Node and Riser Colours

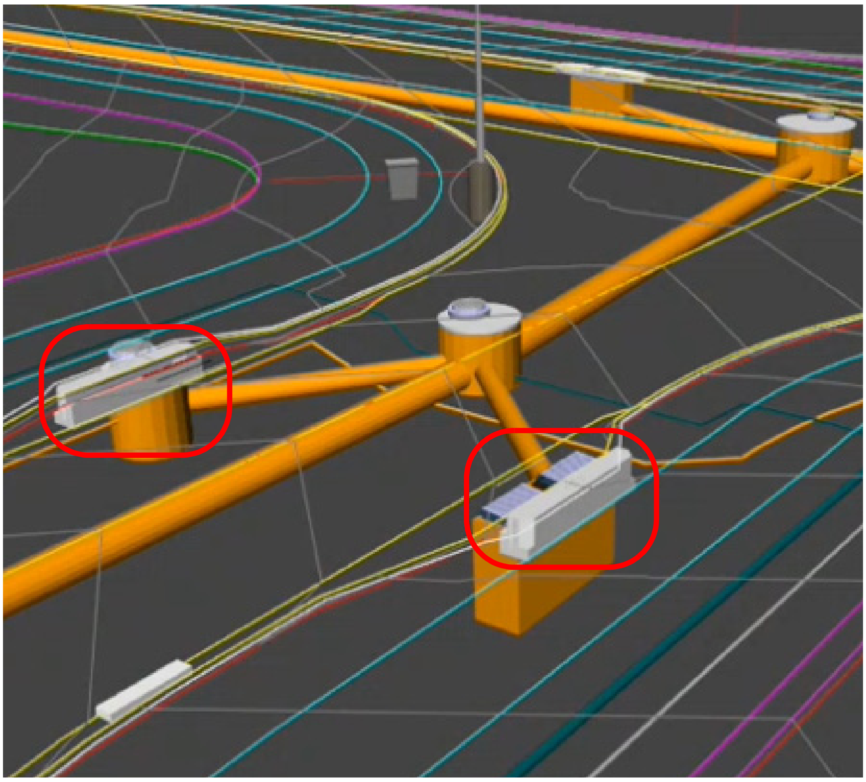
There is a colour for the overall water string but each node, node riser and link can have its own independent colour. See 17.3.6.2.1 Water Properties and 17.3.6.2.4.9 Change Node Colour.

Continue to 17.1.4.1.5 Trimeshes on Nodes or return to 17.1.2 Structure of the Water String.

17.1.4.1.5 Trimeshes on Nodes

Trimeshes (polymeshes) can be placed with a node for detailed BIM modelling.

For example, cover lids, grates, lintels and gross pollutant traps (gpt) are examples of polymeshes used at nodes.



There can be more than one trimesh (polymesh) placed at a node and all the trimeshes used for a particular node type are written to a 12da or 12daz file and the path to the file is stored with the node type. See 17.4.1.2.1.10 Note Type: Trimesh detail Tree Node.

See

17.1.4.1.5.1 Creating and Using Trimeshes at a Node
17.1.4.1.5.2 Rotating the Trimesh
17.1.4.1.5.3 Attributes Specifying the Rotating of the Trimesh
17.1.4.1.5.4 Placing the Rotated Trimesh at (x,y,z)
17.1.4.1.5.5 Attributes Specifying the (x,y,z) Placement of the Trimesh
17.1.4.1.5.6 Using a Node on the Left or the Right Side

17.1.4.1.5.1 Creating and Using Trimeshes at a Node

Each trimesh is created with the knowledge that (0,0,0) of the trimesh is used as the **trimesh reference point** for positioning the trimesh.

When a trimesh is used for a node, it will:

1. first have three rotations (given as a bearing, a grade and a crossfall) applied to the trimesh

   See 17.1.4.1.5.2 Rotating the Trimesh.

   The trimesh rotations (bearing, grade and crossfall) can be set manually or automatically (using road strings) via the 17.3.4 Water Network Editor (WNE). See 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout and 17.3.4.6.4.2 Node >Setout subtab.

2. then a translation in (x,y,z) is applied to the rotated trimesh.

   See 17.1.4.1.5.4 Placing the Rotated Trimesh at (x,y,z).

   The trimesh location (x,y,z) can be set manually or automatically (using road strings) via the 17.3.4 Water Network Editor (WNE). See 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout and 17.3.4.6.4.2 Node >Setout subtab.

Continue to 17.1.4.1.5.2 Rotating the Trimesh or return to 17.1.4.1.5 Trimeshes on Nodes or 17.1.4.1 Nodes (Pits, Maintenance Holes).

17.1.4.1.5.2 Rotating the Trimesh

The trimesh is defined at (0,0,0) with its X, Y and Z axes

The trimesh is rotated in 3D by the sequence:

1. Rotate the trimesh in the (X,Y) plane until the X axis is at a given bearing.
2. The (X,Y) plane of the trimesh is tilted with respect to the Z-axis until it has a given grade
3. The tilted (X,Y) plane of the trimesh is rotated around the tilted X-axis by a given xfall

The rotation of the trimesh is set via the following **node attributes**:

Attribute name	**type**	**Value**
bearing	real	pit symbol bearing (degrees)
grade (in bearing direction)	real	trimesh grade (%)
xfall (perpendicular to the bearing direction)	real	trimesh xfall (%)
Offsets added to the above grade and xfall (taken as 0.0 when not set)		
trimesh grade offset	real	(%)
trimesh xfall offset	real	(%)

These values can come from the ***drainage.4d*** file for the trimesh (see 17.4.1.2.1.10 Note Type: Trimesh detail Tree Node) or can be set in 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout or the 17.3.4.6.4.2 Node >Setout subtab of the 17.3.4 Water Network Editor (WNE), or set manually.

Continue to 17.1.4.1.5.3 Attributes Specifying the Rotating of the Trimesh or return to 17.1.4.1.5 Trimeshes on Nodes or 17.1.4.1 Nodes (Pits, Maintenance Holes).

17.1.4.1.5.3 Attributes Specifying the Rotating of the Trimesh

If **manual control** of the trimesh rotations is wanted, just set the following **node attributes** with the specified values:

Attribute name	**type**	**Value**
pit symbol angle mode	text	Manual
trimesh grade mode	text	Manual
trimesh xfall mode	text	Manual

Continue to 17.1.4.1.5.4 Placing the Rotated Trimesh at (x,y,z) or return to 17.1.4.1.5 Trimeshes on Nodes or 17.1.4.1 Nodes (Pits, Maintenance Holes).

17.1.4.1.5.4 Placing the Rotated Trimesh at (x,y,z)

When the trimesh is used, the trimesh reference point of the rotated trimesh is placed at (x,y,z) point where

(a) (x,y,z) is the **setout x, y and z.**

For example, depending on the modes, (x,y) could be the **centre of the node** and z the **Cover RL**

or

(b) setout x,y and z attributes are defined for the node and they are used for the (x,y,z).

Continue to 17.1.4.1.5.5 Attributes Specifying the (x,y,z) Placement of the Trimesh or return to 17.1.4.1.5 Trimeshes on Nodes or 17.1.4.1 Nodes (Pits, Maintenance Holes).

17.1.4.1.5.5 Attributes Specifying the (x,y,z) Placement of the Trimesh

If **manual control** of the trimesh location is wanted, set the following **node attributes** with the specified values:

Attribute name	type	Value	
setout xy mode	integer	2	// this says the x and y are supplied
setout z mode	integer	2	// // this says the z is supplied
setout x	real	required x	
setout y	real	required y	
setout z	real	required z	

Continue to 17.1.4.1.5.6 Using a Node on the Left or the Right Side or return to 17.1.4.1.5 Trimeshes on Nodes or 17.1.4.1 Nodes (Pits, Maintenance Holes).

17.1.4.1.5.6 Using a Node on the Left or the Right Side

Nodes, even of the same node type, can often be placed on the left or the right of a string.

So a node type requires different trimeshes (usually mirrored images of the trimesh) depending on when the node of that node type is placed on the left of a road string, or a node of that node type is placed on the right of a road string.

So for the one node type, there needs to be two versions of the trimeshes - one used when a node of that type is on the left and the other when a node of that type is used on the right.

Consequently for each node type defined in the ***drainage.4d*** file, there is a **Left name** list of trimeshes, and a **Right name** list of trimeshes. See 17.4.1.2.1.10 Note Type: Trimesh detail Tree Node.

For a particular node, the integer node attribute **mirror_pit** specifies if the left or right trimesh list is to be used.

***If* mirror_pit** = 0	or not defined	the node uses the **left trimesh** list.
= 1		the node uses the **right trimesh** list

Continue to 17.1.4.1.6 Node Type or return to 17.1.2 Structure of the Water String.

17.1.4.1.6 Node Type

Node types are defined and stored in a ***drainage.4d*** file and each node type has a unique name (RD PIT, SAG RD PIT, CHNL *etc.*) and other information useful for defining a node.

A **node type** may optionally include:

- *node wall thicknesses that vary with depth,*
- *node connection points (locations where the nodes join the pit),*
- *inlet capacities for sag and on grade inlet nodes.*
- *detailed node type descriptions to be inserted into your pit schedules*
- *trimeshes*
- *user defined attributes.*

For more information on node types, see 17.4.1.2 Nodes: node type.

When a ***node*** is created in a water string it can be given a ***node type*** (RD PIT, SAG RD PIT, CHNL *etc.*) and the information for the selected node type is used for the node.

This allows the user to **set** numerous **properties** for a **node** by **selecting** the ***node type***.

The ***node type*** parameters are used to control settings in the 17.3.4 Water Network Editor (WNE) including internal pit dimensions (diameter or length and width).

The 17.3.4 Water Network Editor (WNE) and the 17.3.6.2 Water String Edit can be used to change the ***node type*** for a node.

The 17.4.1 Drainage.4d File Editor is used to define and modify **node types**.

Continue to 17.1.4.2 Links (Pipes) or return to 17.1.2 Structure of the Water String.

17.1.4.2 Links (Pipes)

A link (pipe) is automatically created when a second or additional node is added to a water string.

For some the properties of a link, see

17.1.4.2.1 Link Shapes

17.1.4.2.2 Link Colour

17.1.4.2.3 Link Type

17.1.4.2.4 Link Inverts Levels

17.1.4.2.5 Link Minimum cover limit

Continue to 17.1.4.2.1.1 Standard Link Shapes and Sizes or return to 17.1.2 Structure of the Water String.

17.1.4.2.1 Link Shapes

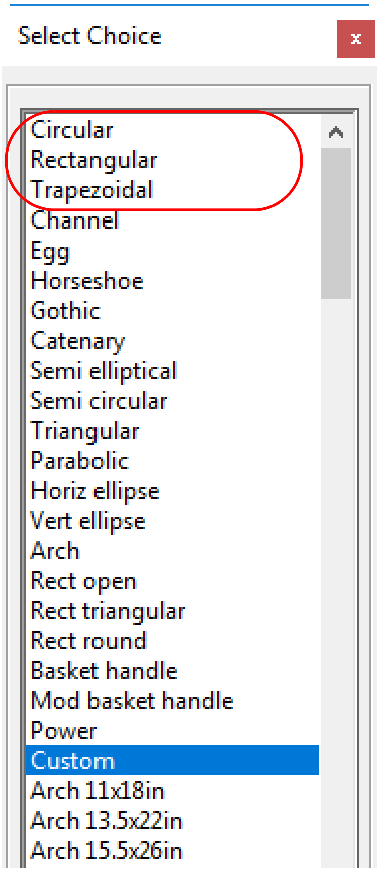
The link shape defines the cross section shape of the link.

There are a number of standard shapes (circular, rectangular and trapezoidal) that are fully defined with diameter, height, width and top width, and so are accurately drawn in 3D. See 17.1.4.2.1.1 Standard Link Shapes and Sizes. These can be defined in the 17.3.6.2 Water String Edit and the 17.3.4.6.5.1 Link >Main subtab of the 17.3.4.2 Network Editor.

However, there are also many other shapes in the **Shape** pop-up list in 17.3.4.6.5.1 Link >Main subtab that are not drawn in 3D but are used in water analysis.

Shape choice box

17.1.4.2.1.1 Standard Link Shapes and Sizes



If the link is **Circular** then Diam/Height is the diameter of the link.

If the link is **Rectangular** (box), **Diam/Height** is the height and width **Width** of the link.

If the link is **Trapezoidal**, **Diam/Height** is the height, width **Width** in the bottom width and **Top width/ extra** is the top of the link.

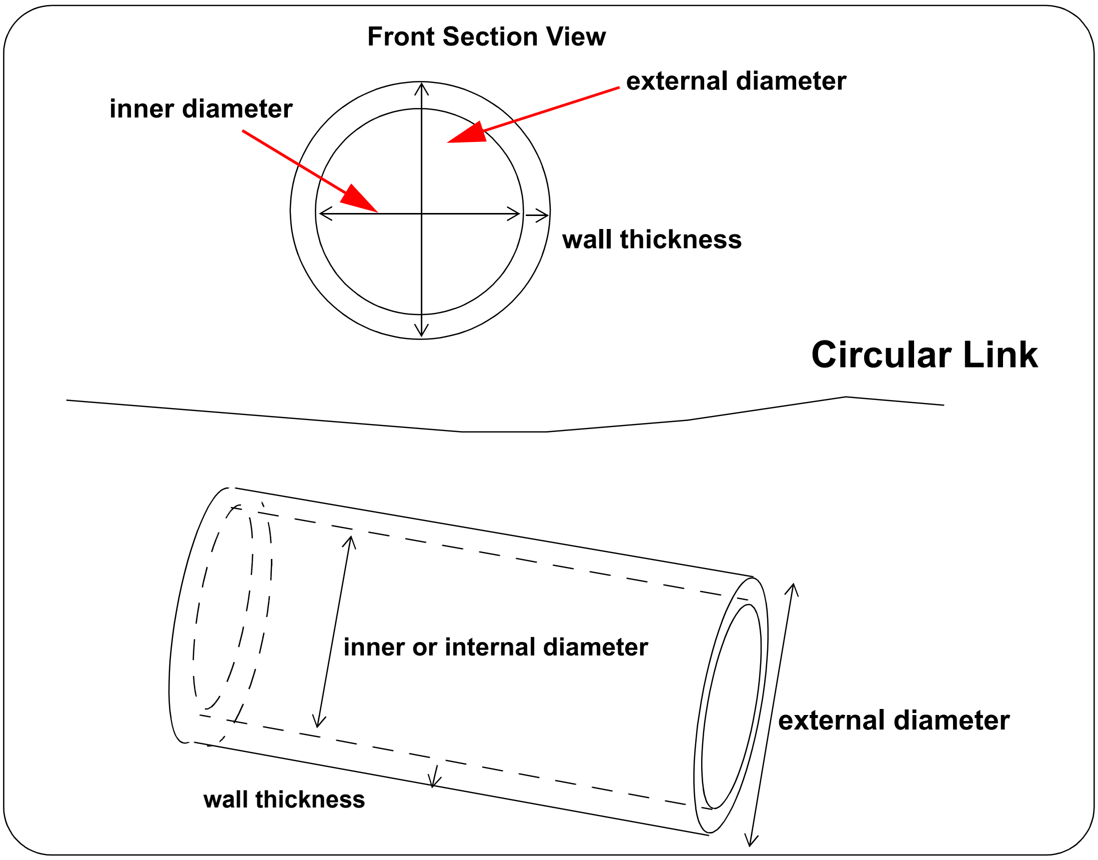
If **Custom** is selected, the height-width grid defining the **closed** cross section of the link is **typed in** on the 17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater.

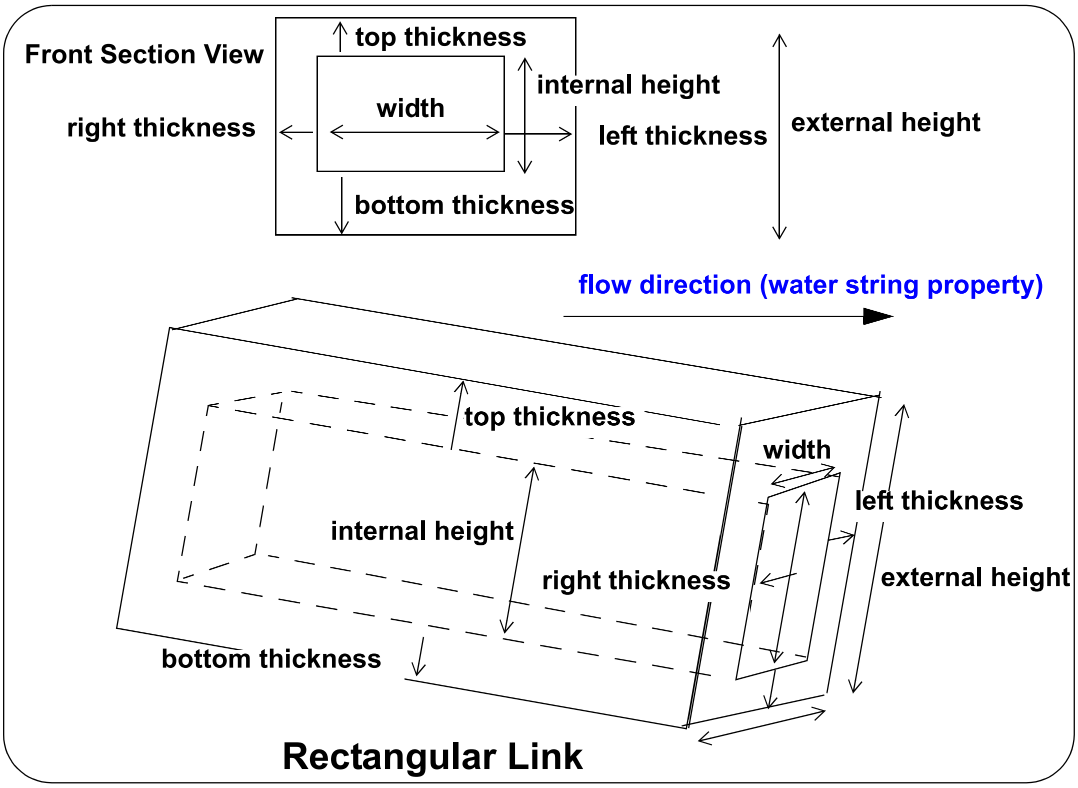
If **Channel** is selected, the link is an open channel and the shape of the channel is **typed in** on the 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater of the 17.3.4.2 Network Editor. This tab only appears when the Method is a Dynamic Stormwater method (see 17.3.4.4.1 Method field on the WNE)

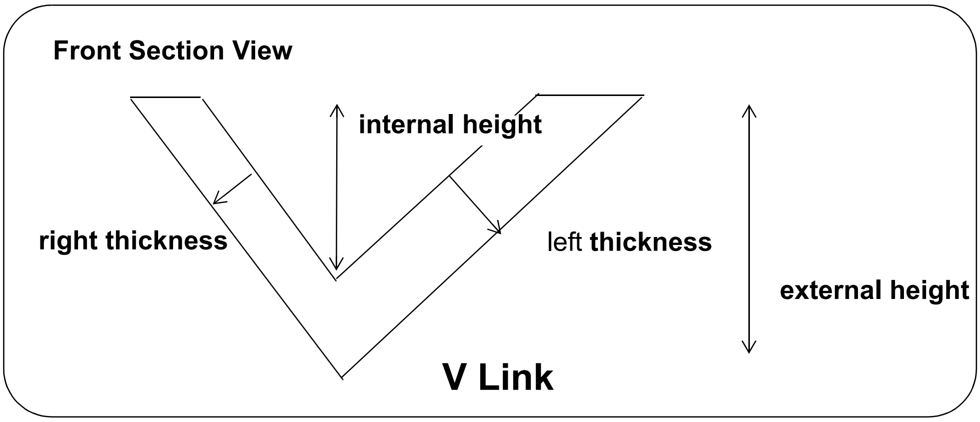
For the other choices, the selected shape is read in and displayed in the graph area on the 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater and the height-width information for the selected shape is loaded into the height-width grid on the 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater. They are closed shapes.

17.1.4.2.1.1 Standard Link Shapes and Sizes

Links of a Water string can be circular (round), rectangular, V, and have thicknesses.







Continue to 17.1.4.2.2 Link Colour or return to 17.1.2 Structure of the Water String.

17.1.4.2.2 Link Colour

There is a colour for the overall water string but each node and link can have its own independent colour. See 17.3.6.2.1 Water Properties and 17.3.6.2.5.6 Change Link Colour.

Continue to 17.1.4.2.3 Link Type or return to 17.1.2 Structure of the Water String.

17.1.4.2.3 Link Type

Link types are defined and stored in a ***drainage.4d*** file and each link type has a unique name (RCP, Class 2 *etc.*) and other information useful for defining a link.

A **link type** may optionally include:

- *link nominal/actual diameters/widths and thickness*
- *roughness method and value*
- *rational method design mode and design percent depth*
- *minimum link height for the rational design engine*
- *trimeshes*
- *user defined link attributes*

For more information on link types, see 17.4.1.3 Links: link type.

When a ***link*** is created in a water string it can be given a ***link type*** (RCP, Class 2 *etc.*) and the information from the selected link type is used for the link.

This allows the user to **set** numerous **properties** for a **link** by **selecting** the ***link type***.

The ***link type*** parameters are also used to control settings in the 17.3.4 Water Network Editor (WNE).

The 17.3.4 Water Network Editor (WNE) and the 17.3.6.2 Water String Edit can be used to change the ***link type*** for a node.

The 17.4.1 Drainage.4d File Editor is used to define and modify **link types**.

Continue to 17.1.4.2.4 Link Inverts Levels or return to 17.1.2 Structure of the Water String.

17.1.4.2.4 Link Inverts Levels

??

Continue to 17.1.4.2.5 Link Minimum cover limit or return to 17.1.2 Structure of the Water String.

17.1.4.2.5 Link Minimum cover limit

??

Continue to 17.1.4.2.6 Link Length or return to 17.1.2 Structure of the Water String.

17.1.4.2.6 Link Length

The default link length is set to node centre to node centre. This length is displayed in the 17.3.4 Water Network Editor (WNE) and on the section view (Toggle->Grades) when the water string is profiled. This is longer than the physical link as the link usually stops at the wall of the node.

The actual physical link length is calculated from the inside edge of the water node by ticking **Use link end to end length** in the 17.3.4 Water Network Editor (WNE) on the **GLOBAL >Main** subtab (see 17.3.4.6.1.1 GLOBAL > Main subtab.

Continue to 17.1.4.2.7 Link Grade or return to 17.1.2 Structure of the Water String.

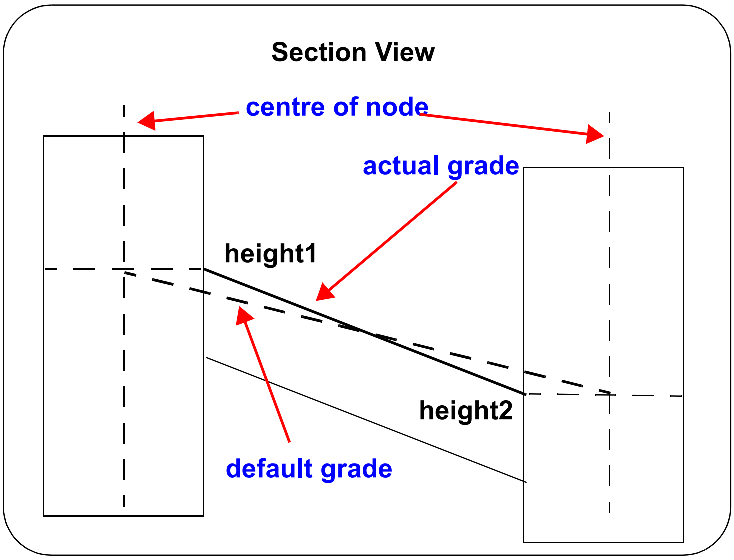
17.1.4.2.7 Link Grade

There are also two link grades.

The default link grade is calculated by taking the invert level of the link to be at the centre of the node. This grade is displayed on the section view (Toggle->Grades) when the water string is profiled. It is shown as % or 1 in via

Section View Menu ***View => Settings =>Grade annot***

The actual physical link grade is calculated by taking the invert level of the link to be at the edge of the node - where the link is. The actual physical grade is slightly steeper than the default grade.

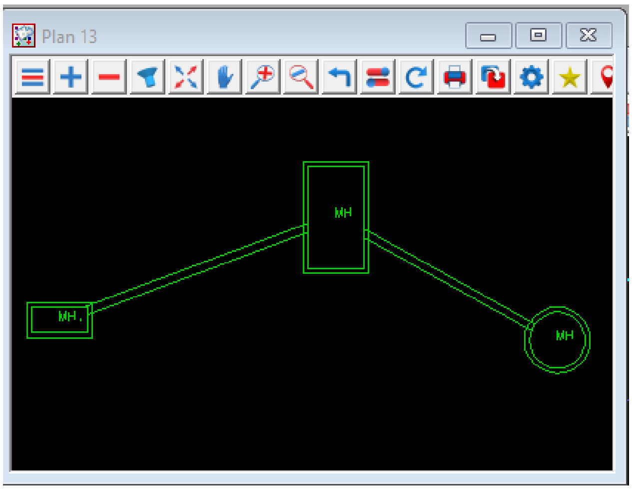


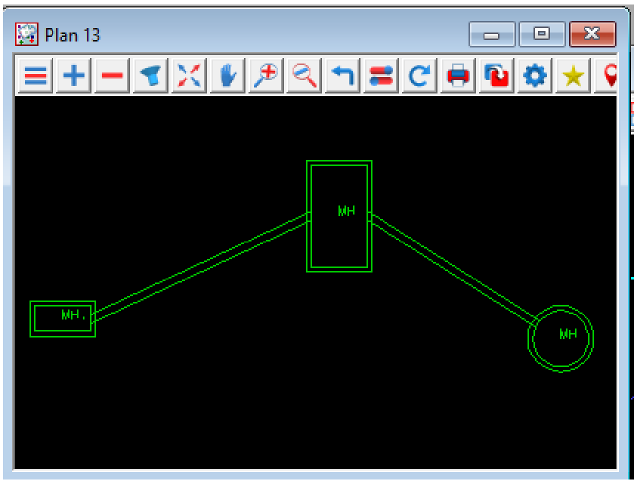
Continue to 17.1.4.3 Node Connection Points for Links or return to 17.1.2 Structure of the Water String.

17.1.4.3 Node Connection Points for Links

The default for a link connecting two nodes is for the link to go to the inner perimeter of the node walls on the line joining the centres of the two nodes.

Enabling **node Connection points** allows the links connected to the node to join at locations other than the line joining the centres of the nodes (the default).

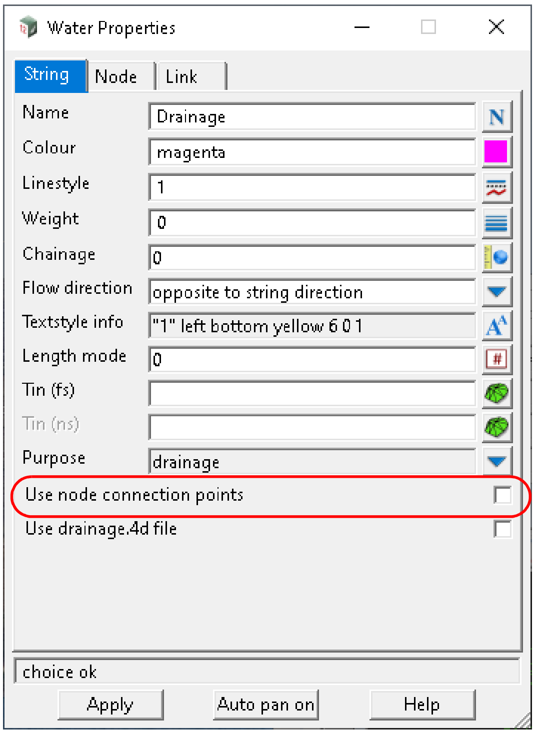


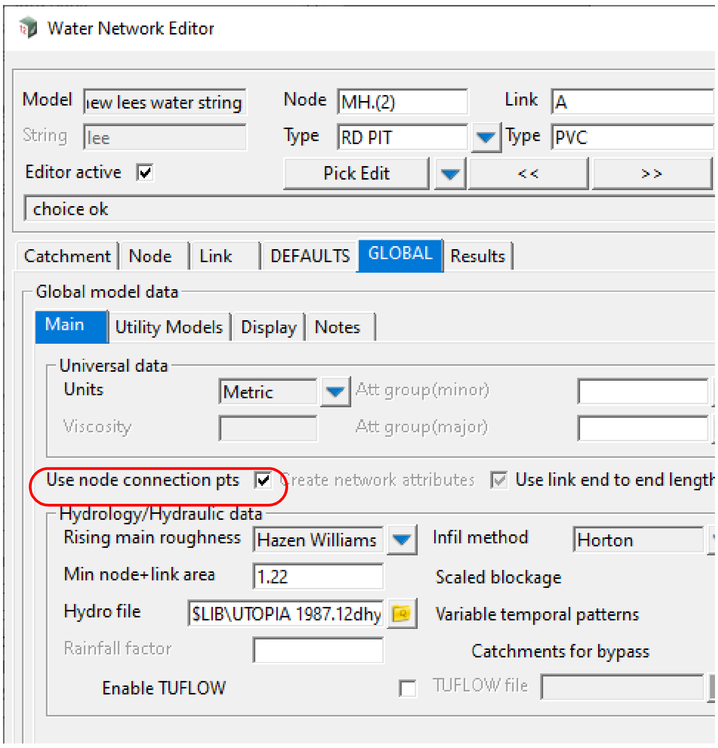


connection points - default: one or centre of node

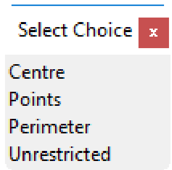
connection points: mid-point of side of rectangle nodes

Node connection points is enabled by **ticking on Use node connection points** in either the ***Water string*** editor 17.3.6.2.1 Water Properties or the 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section of the 17.3.4 Water Network Editor (WNE).





When **Use node connection points** is ticked**,** the choices for a **node connection point** are



Node Connection Mode choice box Centre, Points, Perimeter, Unrestricted

*Node connection points may be moved via **Strings->Points Edit->Move** (except for **Centre** mode described below). The other modes constrain the movement of the connection points. If a link is manually moved to a new connection point, it will be locked to the connection point and will not move if the node or neighbouring node is moved (see exceptions below).*

*If **Centre** (rectangle and circular)*

*This mode is the same as having the **Use connection points** turned off**.** The connection points will be located on the inside perimeter of the node wall with the centre line of the link intersecting the centre of the node. In this mode the connection points may not be adjusted.*

*If **Points** (rectangle)*

*A connection point is created at the mid point of each internal side of the node. This may be changed for a **Node type** by using the **con_points** command in the drainage.4d file. In this mode the link ends will snap to the connection points. It is possible to place more than one link on the same connection point (the elevation of the links is not checked for clashes).*

*If **Points** (circular)*

The connection point may be moved anywhere around the node internal wall as there are no connection points on circular nodes. Again, it is possible to place more than one link on the same connection location (the elevation of the links is not checked for clashes).
If the node centre is moved the connection point locks are removed.

*If **Perimeter** (rectangular and circular)*

*Same as **Points** (circular) above.*

*If **Unrestricted** (rectangular and circular)*

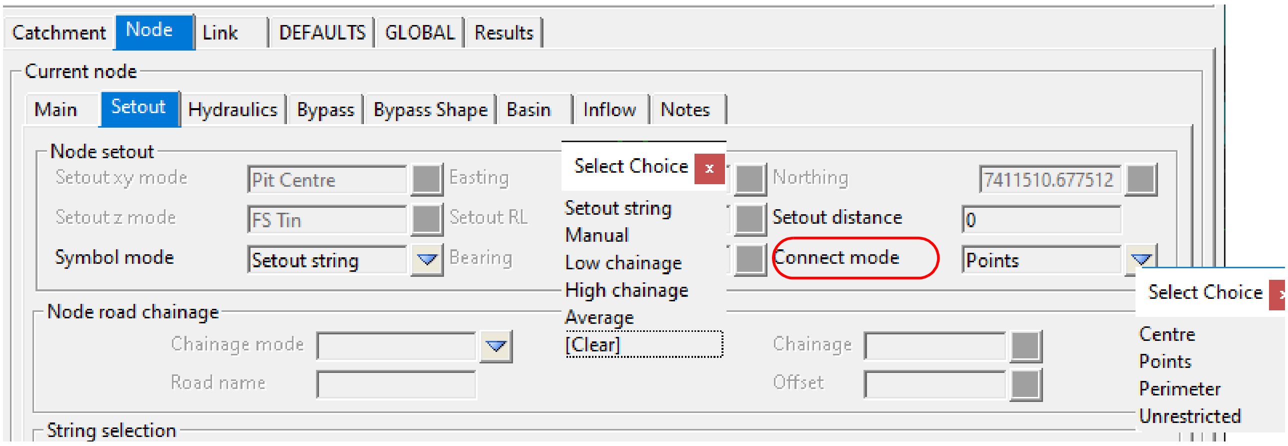
There are no constraints on the location of the node connection points.This mode is intended for irregular shapes such as GPT structures and storm water basins.

When **Use node connection points** is first ticked, all nodes have their connection point initially set to **Points**.

VERY IMPORTANT NOTE

Currently the ***Water string*** editor can only enable or disable the node connection points using **Use node connection points** and **cannot change the choice** of the node connection points for a node.

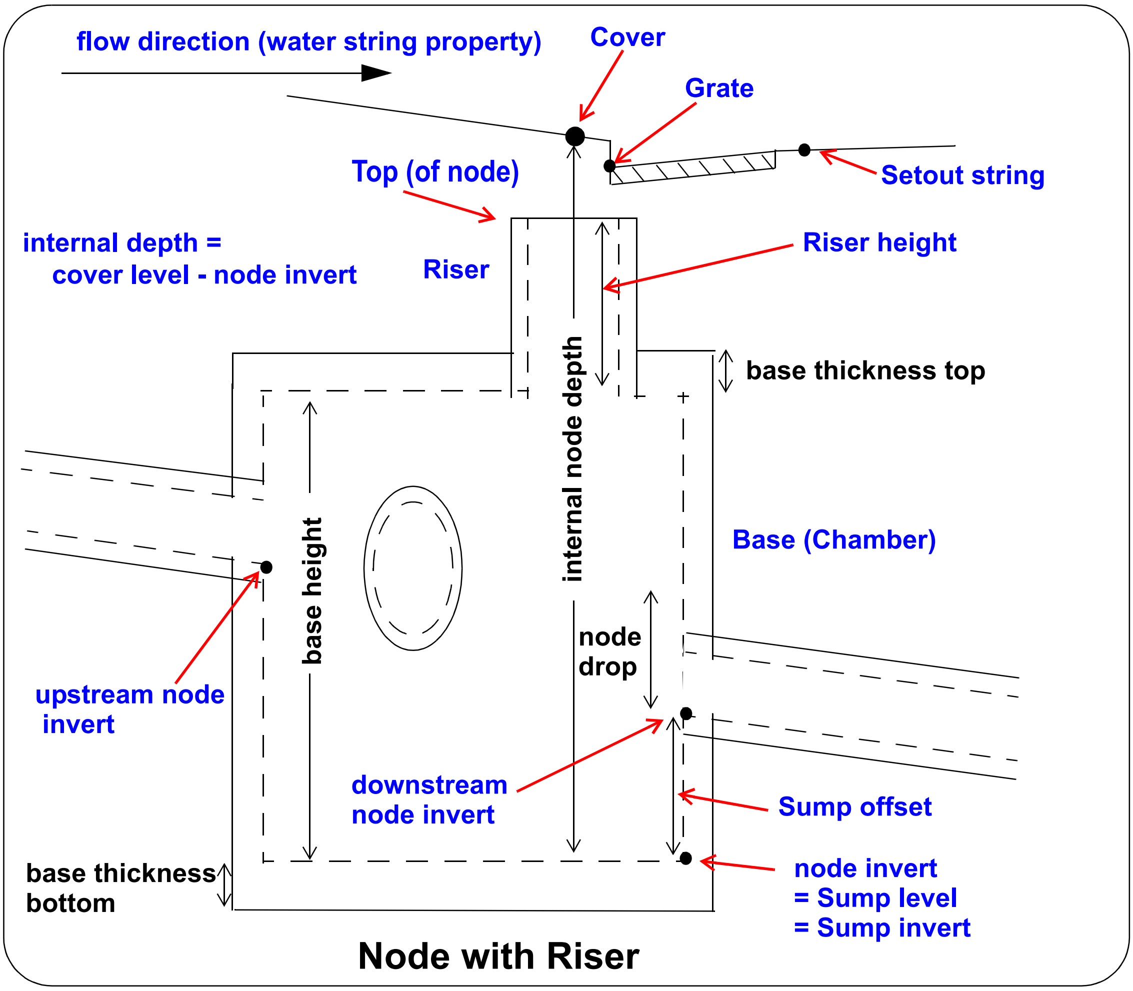
Only the 17.3.4 Water Network Editor (WNE) **can change to choice** of the node connection point for a node and this setting is the **Connect mode** found on the 17.3.4.6.4.2 Node >Setout subtab.



Continue to 17.1.4.4 Z Point Definitions for Nodes and Links or return to 17.1.2 Structure of the Water String.

17.1.4.4 Z Point Definitions for Nodes and Links

When discussing a **Node**, all the terms must be uniquely defined. The diagram below gives the terms and the position of the key points that go with them. These terms are used throughout ***12d Model***.



For a node to be positioned, it must be uniquely defined in size and in horizontal and vertical position.

Depending on the situation, different ways of specifying the positioning values are needed and these are referred to as node **RL modes** or **Z modes** (e.g. Cover RL mode, Top RL mode etc).

The description of the various RL's.in given in the next section 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

For information on the construction setout point and the chainage and offset to a road centreline, see 17.1.4.6 Setout of Nodes and Links.

17.1.4.5 Definitions for Node RL Modes and Setout Modes

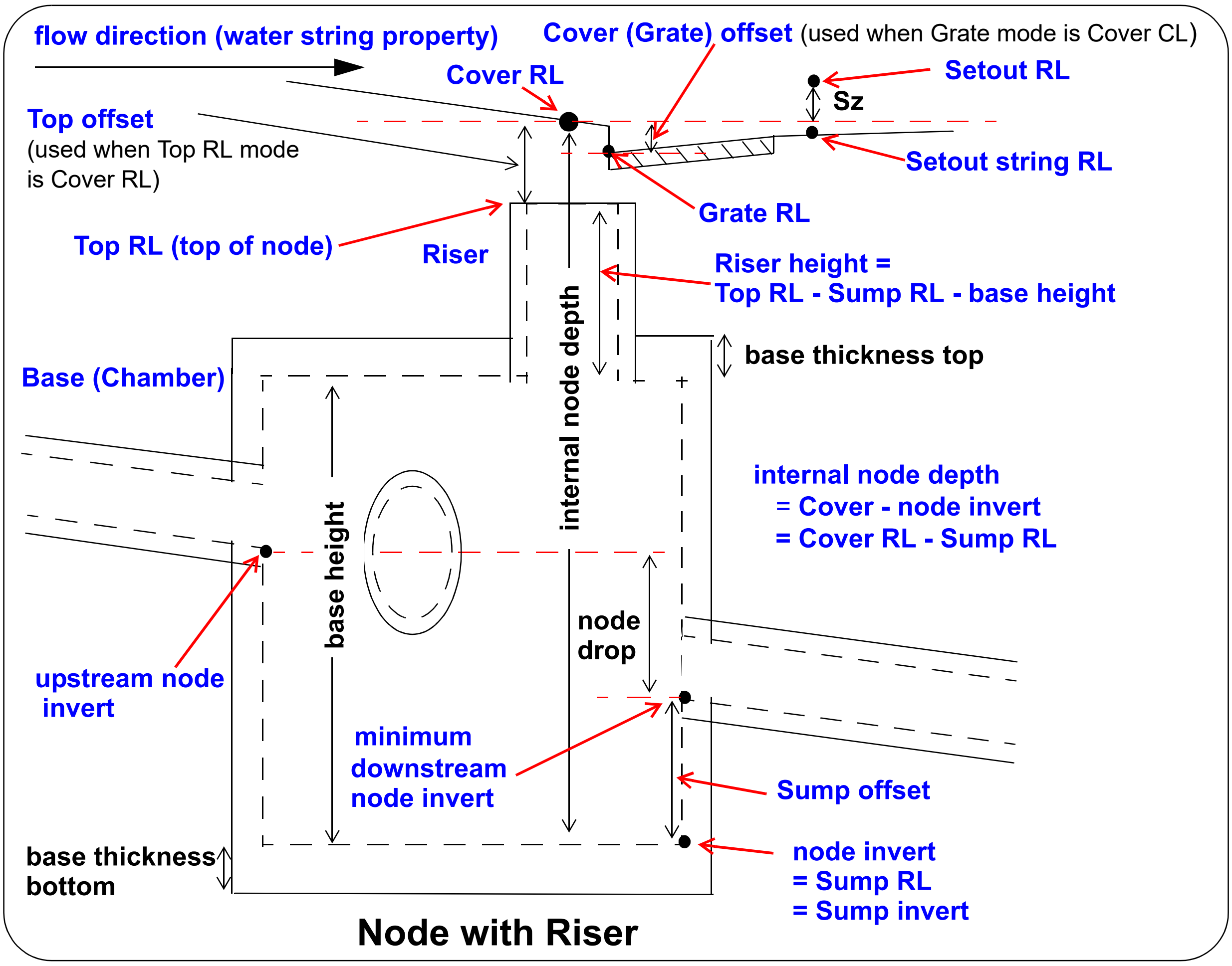
When a node is positioned, it must be **uniquely defined** in **size** and in **horizontal** and **vertical position**.

Depending on the situation, different ways of specifying the positioning values are needed and these are referred to as **RL modes** or **Z modes** (e.g. Cover RL mode, Top RL mode etc).

More often than not, it is the **internal node depth**, that needs to be calculated.

For construction it is also often beneficial to have a special **setout point**.

The diagram below shows the definition of the **RL** (**z values**) for Cover RL, Grate RL, Top RL and Sump RL for a node, plus a number of offset values., and the setout string RL, Sz and setout RL.



The **RL modes** are set in the 17.3.4 Water Network Editor (WNE) and pressing the 17.3.4.6.9 Set Node Details Button on the WNE will try to evaluate all the required information using the **RL modes**.

For the choices for each of the **Node RL Modes**, see

17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z)
17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z)
17.1.4.5.1.3 Top RL (z) Mode and Top RL (z)
17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z)

17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL

For the choices for each of the **Setout Modes**, see

17.1.4.6.1 Setout xy Mode and Setout xy

17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL

Continue to 17.1.4.5.1 Node RL Modes (Z Modes) or return to 17.1.2 Structure of the Water String.

17.1.4.5.1 Node RL Modes (Z Modes)

See

17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z)
17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z)
17.1.4.5.1.3 Top RL (z) Mode and Top RL (z)
17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z)
17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL

17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z)

Cover RL (z-value) is a z-value above the centre of the riser, or above the centre of the node if there is no riser.

When ***Cover RL*** is the mode for **Grate RL**, the field **Cover (Grate) offset** is subtracted from the ***Cover CL*** value to give the ***Grate RL*** value. See 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z).

When ***Cover RL*** is the mode for **Top RL**, the field **Top offset** is subtracted from the ***Cover CL*** value to give the ***Top RL*** value. See 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z).

The value for **Cover RL** (**Cover z**) can be defined in various ways and the method used is given by the **Cover RL mode** (**Cover z mode**).

Select Choice	**Cover RL Mode - it is the z-value:**
FS Tin	z on the Finished Surface tin.
NS Tin	z on the Natural Surface tin.
Setout String	from setout string by dropping the node centre x,y location perpendicularly onto the setout string and then moving the setout adjustment distance Sxy.
Sz + Setout String	as for the **Setout String** plus the z adjustment Sz.
Max Obvert	the maximum link obvert of all the links connecting to the node.
Manual	entered in the RL field to the right of the mode (field becomes active when this is selected)
[Clear]	clears the field - only on some pop-ups

If ***FS Tin*** then the Cover RL (z-value) is the z-value on the finished surface tin at the (x,y) of the centre of the riser, or above the centre of the node if there is no riser.

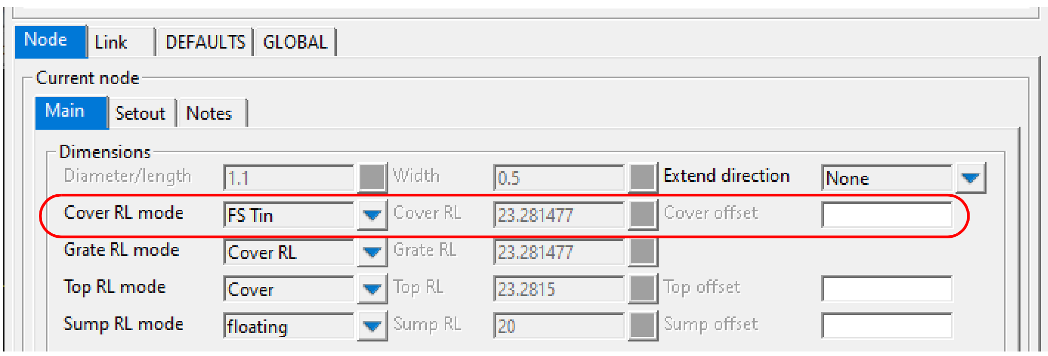
If ***NS Tin*** then the Cover RL (z-value) is the z-value on the natural surface tin at the (x,y) of the centre of the riser, or above the centre of the node if there is no riser.

If ***Max Obvert*** then Cover RL is the maximum link obvert of all the links connecting to the node.

If ***Manual*** then a z-value is **manually** set for the Cover RL (given in the **Cover RL** field on the **Node >Main** tab in the WNE - see the image below).

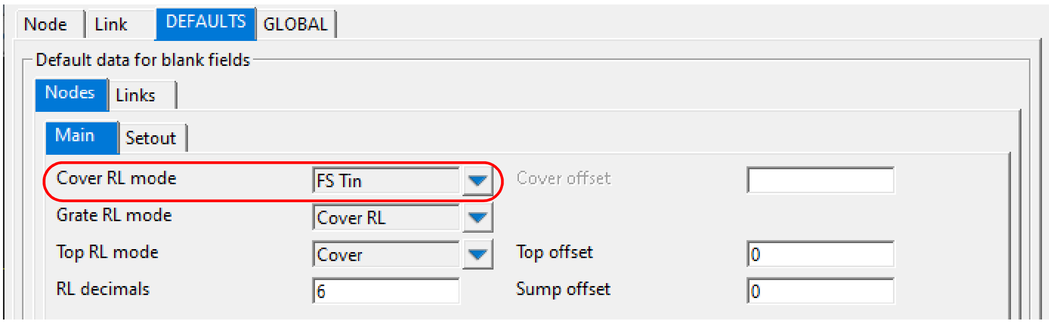
The **Cover RL mode** is given by the:

(a) **Cover RL mode** field on the ***Node >Main*** tab if it is not blank,



otherwise by the

(b) **Cover RL mode** field on the ***DEFAULTS >Nodes >Main*** tab



The **Cover RL** for each node is either set manually or is calculated using the **Cover RL mode** when the **Set Node Details** button is pressed.

For a diagram showing the definition of ***Cover RL***, see 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Continue to 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z) or return to 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z)

Grate RL (z-value) is the z-value of the grate.

When the **Grate RL** mode is ***Cover RL,*** the Grate RL is the Cover CL minus the **Cover (Grate) offset**.

The **Grate RL** is used by ***12d Model*** hydraulics when determining the freeboard level, bypass flows, inlet capacity values at sag inlets and depth of flooding at sag inlets.

The value for **Grate RL** (**Grate z**) can be defined in various ways and the actual one used is given by the **Grate RL mode** (**Grade Z mode**).

Select Choice	**Grate RL Mode - it is the z-value:**
Cover RL	Cover RL minus Cover (grate) offset
FS Tin	on the FS tin at the node centre x,y location.
NS Tin	on the NS tin at the node centre x,y location.
Setout String	from setout string by dropping the node centre x,y location perpendicularly onto the setout string and then moving the setout adjustment distance Sxy.
Sz + Setout String	as for the **Setout String** plus the z adjustment Sz.
Max Obvert	the maximum link obvert of all the links connecting to the node.
Manual	entered in the RL field to the right of the mode (field becomes active when this is selected).
[Clear]	clears the field - only on some pop-ups

If ***Cover*** then the Grate RL (z-value) is calculated and is the ***Cover RL*** minus the value in the **Cover offset** field**.** How the Cover RL is calculated is given by the Cover RL mode. See 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z).

If ***FS Tin*** then the Grate RL (z-value) is the z-value on the finished surface tin at the (x,y) of the centre of the node.

If ***NS Tin*** then the Grate RL (z-value) is the z-value on the natural surface tin at the (x,y) of the centre of the node.

If ***Setout string***: often the setout point for a node or catch basin is not the centre of the node but rather a point on the kerb or back on the foot path.

See If Setout string - for z

If ***Sz + Setout string***: it is the value for the choice **Setout String** plus **Sz**

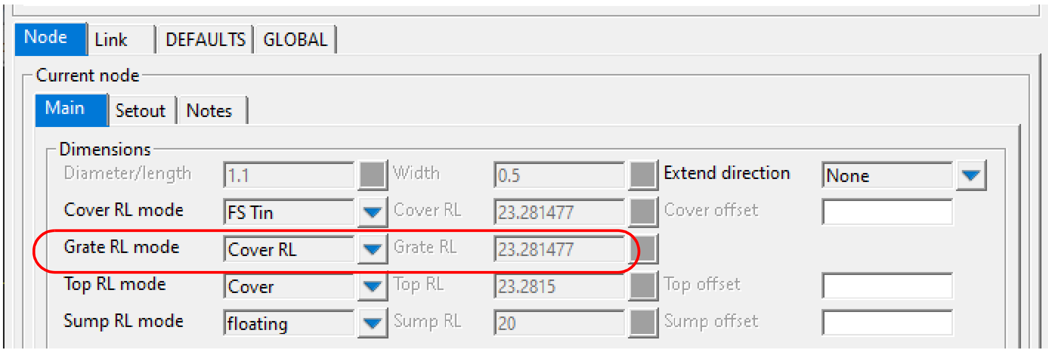
See If Sz + Setout string - z value

If ***Max Obvert*** then Grate RL is the maximum link obvert of all the links connecting to the node.

If ***Manual*** then a z-value is **manually** set for the Grate RL (given in the **Grate RL** field on the **Node >Main** tab in the WNE - see the image below).

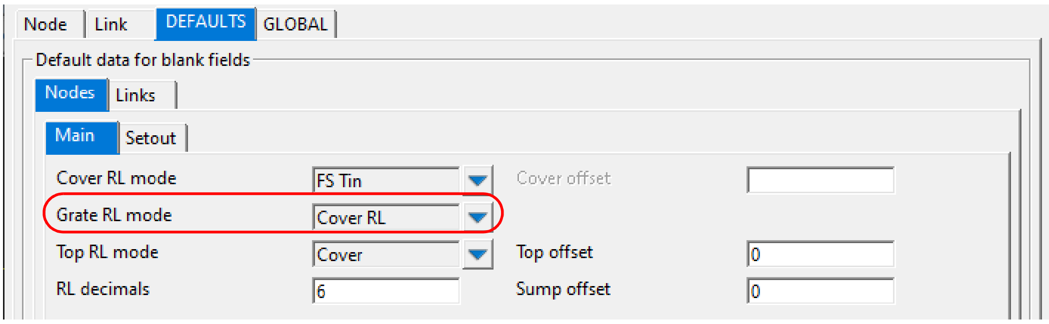
The **Grate RL mode** is given by the

(a) **Grate RL mode** field on the ***Node >Main*** tab if it is not blank,



otherwise by the

(b) **Grate RL mode** field on the ***DEFAULTS >Nodes >Main*** tab



The **Grate RL** for each node is either set manually or is calculated using the **Grate RL mode** when the **Set Node Details** button is pressed.

For a diagram showing the definition of ***Grate RL***, see 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

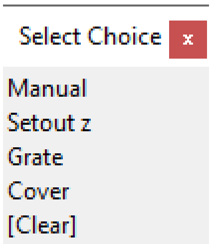
Continue to 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z) or return to 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

17.1.4.5.1.3 Top RL (z) Mode and Top RL (z)

Top RL is the z-value for the top of the Riser, or the top of the Chamber if there is no Riser.

When the **Top RL** mode is ***Cover RL,*** Top RL is the Cover CL minus the value in the **Top offset** field.

The value for **Top RL** (**Top z**) can be defined in various ways and the actual one used is given by the **Top RL mode** (**Top z mode**).



Top RL Mode - it is the z-value:
entered in the RL field to the right of the mode (field becomes active when this is selected).
use Setout z
use Grate RL
use Cover RL
clears the field - only on some pop-ups

If ***Manual*** then a z-value is **manually** given for the top of the node (given in the **Top RL** field on the **Node >Main** tab in the WNE - see the image below).

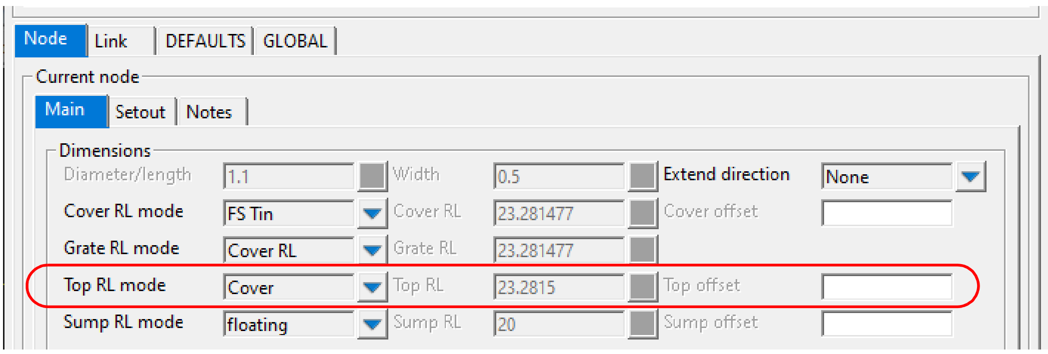
If ***Setout z*** then the Top RL (z-value) is calculated and is the ***Setout z.*** How Setout z is calculated is given by the Setout z mode. See 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

If ***Grate*** then the Top RL (z-value) is calculated and is the ***Grate RL***. How the Grate RL is calculated is given by the Grate RL mode. See 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z).

If ***Cover*** then the Top RL (z-value) is calculated and is the ***Cover RL*** minus the value in the **Top offset** field. How Cover RL is calculated is given by the Cover RL mode. See 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z).

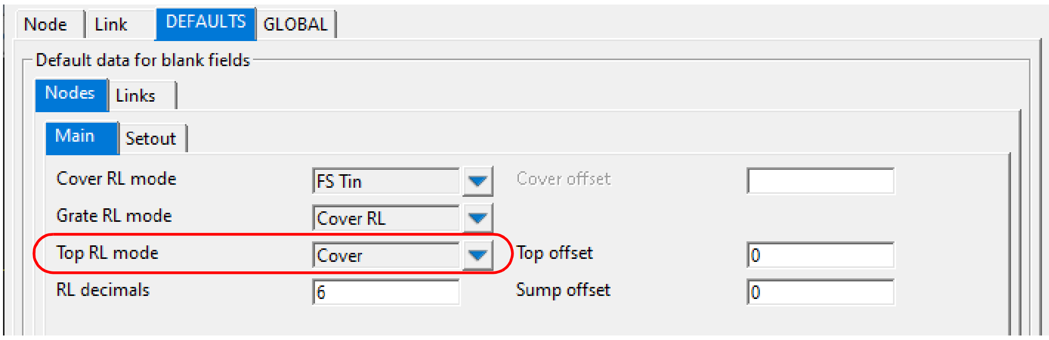
The **Top RL mode** is given by the

(a) **Top RL mode** field on the ***Node >Main*** tab if it is not blank,



otherwise by the

(b) **Top RL mode** field on the ***DEFAULTS >Nodes >Main*** tab



If the **Top RL mode** is **manual**, then the value can be typed into the **Top RL** field on the ***Node >Main*** tab.

The **Top RL** for each node is either set manually or is **calculated** using the **Top RL mode** when the **Set Node Details** button is pressed.

For a diagram showing the definition of ***Top RL***, see 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Continue to 17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z) or return to 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z)

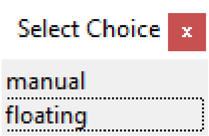
The **Sump RL** (**Sump z**) for each node is either

(a) set manually on the ***Node >Main*** tab

or

(b) calculated when the **Set Node Details** button is pressed by finding the minimum invert of all connecting links at the node and then subtracting the value in the ***Sump offset*** field on the ***Node >Main*** tab (or if that is blank, from the ***Sump offset*** field on the ***DEFAULTS >Nodes*** subtab).

The choice of either (a) or (b) is given by the **Sump RL mode** on the ***Node >Main*** tab.



Sump RL Mode - it is the z-value:
entered in the **Sump RL** field on the Node >Main subtab.
calculate the minimum link invert of all connecting links at the node minus the value in the ***Sump offset*** field

For a diagram showing the definition of ***Sump RL***, see 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Continue to 17.1.4.5.1.5 Summary of RL (z) Modes or return to 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

17.1.4.5.1.5 Summary of RL (z) Modes

There are several modes to calculate z values (RL's) for the nodes:

A description of each **mode** is:.

FS tin (x,y) is taken from the nodes centre and the z-value (level) is the z from the water finished surface tin at that (x,y)

NS tin (x,y) is taken from the nodes centre and the z-value (level) is the z from the water natural surface tin at that (x,y)

Setout string the node centre (x,y) on is dropped perpendicular onto the setout string. The x,y or z value is then obtained from this string. If this string is missing then the node x,y location or finished surface tin level is used instead.

Centre string the node centre x,y location is dropped perpendicular onto the road centre string and the chainage value is obtained. If this string is missing a problem message will be written to the output window.

Sz + Setout string the node centre (x,y) is dropped perpendicular onto the setout string. The Sz value for the node is then added to the z value obtained from this string. If this string is missing the Sz value is added to the finished surface tin level at the node centre (x,y).

Manual the x,y,z or chainage value is manually entered by the user.

Cover RL the z level is set to the Cover RL level (after it has been recalculated).

Max Obvert The maximum obvert level from off the conduits connected to this node is used.

Floating sump the node sump level is set to the lowest invert of all the conduits connected to this node + the sump offset

Clear clears the field. This is used on some pop-ups when having nothing in the field means that a default value is used.

Continue to 17.1.4.5.2 Using Road Design Centre line and Setout Strings or return to 17.1.4 Definitions for Nodes and Links.

17.1.4.5.2 Using Road Design Centre line and Setout Strings

Road design strings can be used to calculate many of the water string inputs. and this substantially reduces the setup and redesign time when **designs are modified**. A **setout string** is useful for construction purposes.

A node may have an associated **road centre line string** and **setout string**.

The road **centre line string** is used to:

1. Determine the node road chainage and offset for construction setout.
2. Together with the setout string, enable road cross fall measurements.
3. Define the left and right side of road plot symbols (looking down hill).

A **setout string** can be used to:

1. Set the symbol bearing of the inlet to align with the string and determine the downhill direction.
2. Set the construction setout x,y,z coordinates.
3. Set inlet grate levels (the most important level in 12d hydraulics).
4. Determine the locations to measure road grade and cross fall values for on-grade inlet capacity calculations.
5. Identify the approach flow bearing for hydraulic Ku calculations

A **trimesh** can be associated with a node and if so can be:

(a) manually rotated

or

(b) take its rotations from the grade and crossfall of a road string.

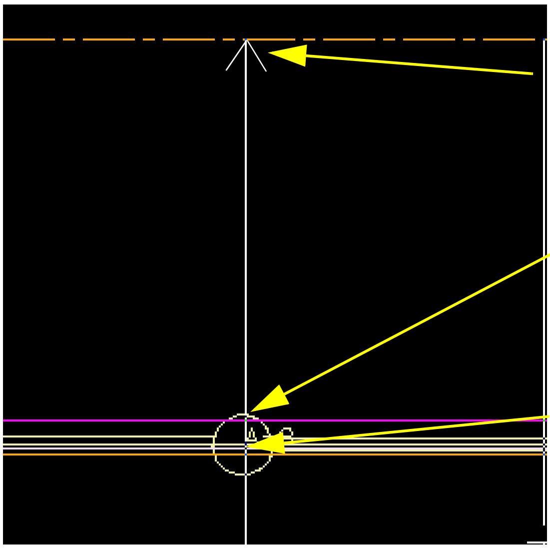
Continue to 17.1.4.6 Setout of Nodes and Links or return to 17.1.2 Structure of the Water String.

17.1.4.6 Setout of Nodes and Links

Nodes are setout on the construction site using a variety of techniques.

The 17.3.4 Water Network Editor (WNE) creates a construction **setout point (x,y)** a number of ways of being defined including being located at the node centre or the node centre can be dropped perpendicularly onto a string to get the xy location (called the **setout string**). See 17.1.4.6.1 Setout xy Mode and Setout xy

The chainage and offset of the centre of the node dropped onto a given **Road centreline string** can also be calculated. See 17.1.4.6.3 Node Road Chainage Mode.



Road Centreline
Get Road Chainage and Offset from dropping the centre of the Node onto the Road Centreline string

Setout String (magenta)

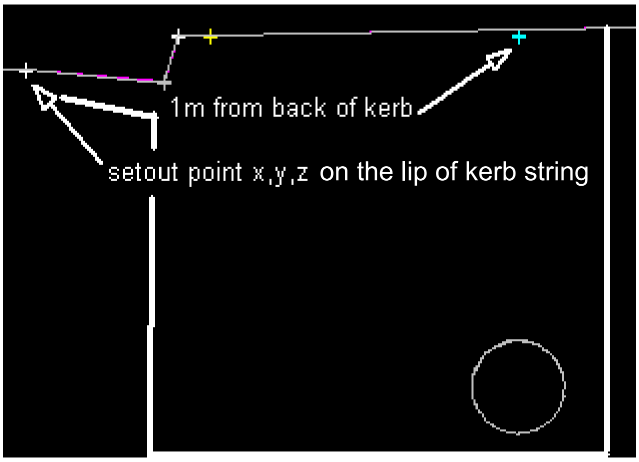
x y z from setout string

Node Centre

x y at node centre

The **z value for the setout point** also has a number of modes. See 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

In the section diagram below, the setout point is **lip of kerb**. The **setout x,y** location **level z** will be obtained from the **setout string** and the **link** will be shown at its proper position (one metre from the back of the kerb) so that the **link cover** is calculated correctly.



Link setout is along the **centre line of the Link,** using the 17.1.4.3 Node Connection Points for Links and the invert levels of the link.

Setout reports (Manhole/pit schedules or construction tables) can be created (see 17.3.11.5 Pit Schedules) and the ***Nodes >Setout*** tab on the ***Water Plan Plot*** generates strings for the surveyor to download to the instruments (see 23.7.8 Water Plan Plot PPF Editor).

The option ***Drainage Convert to Points and Lines*** will create super strings with the link attributes on them. See 17.3.7.2 Convert to Points and Lines.

Continue to 17.1.4.6.1 Setout xy Mode and Setout xy or return to 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

17.1.4.6.1 Setout xy Mode and Setout xy

The **Setout xy** is the (x,y) coordinate level used by **surveyors** to **setout** the **node**. They are also the coordinates printed in the pit setout tables and in the water plan plots.

The (x,y) coordinates for the **Setout xy** depends on the **Setout xy mode**.

Select Choice	**Setout xy Mode - it is the (x,y) coordinates:**
Pit Centre	centre of the node
Setout String	drop the centre point of the node onto the closest string in the **Road design** model list specified on the **GLOBAL >Utility models** tab.Could be a kerb string, or a foot path etc.
Manual	entered in the Easting and Northing fields to the right of the mode (fields active when elected)
[Clear]	clears the field - only on some pop-ups

If ***Pit centre***, the xy is the centre point of the node.

If ***Setout string*** - for (x,y)

Often the setout point for a node or catch basin is not the centre of the node but rather a point on the kerb or back on the foot path.

The choice **Setout string** will drop the centre point of the node perpendicularly onto the setout string and move a chainage distance **Sxy** along the selected string and use that xy. The setout string is selected in the **String setout** field in the 17.3.4.6.4.2 Node >Setout subtab.

Sxy is given by the **Sxy (+ve DS)** field in the 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout tab or the **Sxy (+ve DS)** in the **Setout adjustment section** of 17.3.4.6.4.2 Node >Setout subtab.

If ***Manual***, the xy location are typed in for **each node** into the **Easting** and **Northing** fields in the 17.3.4.6.4.2 Node >Setout subtab.

Notes on Usage

1. The **Setout xy mode** is given by the

(a) **Setout xy mode** field on the 17.3.4.6.4.2 Node >Setout subtab **if** it is **not blank**

otherwise by the

(b) **Setout xy mode** field on the 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout tab.

2. If the **Setout xy mode** is **manual**, then the values can be typed into the **Eastings** and **Northings** fields on the 17.3.4.6.4.2 Node >Setout subtab.
3. The **Setout Eastings** and **Northings** for each node are either set manually or are calculated using the **Setout xy mode** when the 17.3.4.6.9 Set Node Details Button is pressed on the 17.3.4 Water Network Editor (WNE).

Continue to 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL or return to 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL

The **Setout RL** is the level used by **surveyors** to setout the node (pit). It is also the level to be printed in the pit setout tables and in the water longsection plots.

For a diagram showing the definition of ***Setout string RL, Sz*** *and* ***Setout RL***, see 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

The value for **Setout RL** depends on the **Setout z mode**.

Select Choice	**Setout Z Mode - it is the z-value:**
Cover RL	use cover RL
FS Tin	on the FS tin at the node centre x,y location.
NS Tin	on the NS tin at the node centre x,y location.
Setout String	from setout string by dropping the node centre perpendicularly onto the setout string This is the **Setout string RL** (and if Sz = 0, the Setout RL)
Sz + Setout String	as for the **Setout String** plus the z adjustment **Sz**. This is the **Setout RL**.
Max Obvert	the maximum link obvert of all the links connecting to the node.
DS Invert	is the same as the link downstream invert
Sump Invert	is the same as the sump invert
Manual	entered in the RL field to the right of the mode (field becomes active when this is selected)
[Clear]	clears the field - only on some pop-ups

If ***Cover RL****,* the Setout z is the Cover RL value for the node.

If ***FS Tin***, the Setout z is the z-value on the FS (finished surface) Tin at the (x,y) of the centre of the node.

If ***NS Tin****,* the Setout z is the z-value on the NS (natural surface) Tin at the (x,y) of the centre of the node.

If ***Setout string*** - for z

Often the setout point for a node or catch basin is not the centre of the node but rather a point on the kerb or back on the foot path.

The choice **Setout string** will drop the centre point of the node **perpendicularly** onto the setout string and the z-value used. The setout string is selected in the **String setout** field in the 17.3.4.6.4.2 Node >Setout subtab of the 17.3.4 Water Network Editor (WNE).

If ***Sz + Setout string*** *- z value*

It is the value for the choice **Setout String** plus **Sz** which is given in the **Setout adjustment section** of 17.3.4.6.4.2 Node >Setout subtab or **Sz** on the 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout tab.

If ***Max Obvert***, the Setout z is the maximum overt of all the links connecting to the node**.**

If ***DS Invert***, the Setout z is the invert of the downstream link**.** See 17.1.4.5 Definitions for Node RL Modes and Setout Modes**.**

If ***Sump Invert****,* the Setout z is the sump invert**.** See 17.1.4.5 Definitions for Node RL Modes and Setout Modes**.**

If ***Manual***, the Setout z will be typed in for **each node** into the **Setout RL** field of the 17.3.4.6.4.2 Node >Setout subtab**.**

The ***Setout z mode*** is currently in the 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout and/or the 17.3.4.6.4.2 Node >Setout subtab of the 17.3.4 Water Network Editor (WNE).

Notes on Usage

1. The **Setout z mode** is given by the

(a) **Setout z mode** field on the 17.3.4.6.4.2 Node >Setout subtab **if** it is **not blank**,

otherwise by the

(b) **Setout z mode** field on the 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout tab.

2. If the **Setout z mode** is **manual**, then the value can be typed into the **Setout RL** field on the 17.3.4.6.4.2 Node >Setout subtab.
3. The **Setout RL** for each node is either set manually or is calculated using the **Setout z mode** when the **Set Node Details** button is pressed.

For information on **Setout xy**, return to 17.1.4.6.1 Setout xy Mode and Setout xy.

Continue to 17.1.4.6.3 Node Road Chainage Mode or return to 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

17.1.4.6.3 Node Road Chainage Mode

Select Choice	
No Road	no value is calculated
Centre String	the setout xy is found by dropped perpendicular onto the road centre line string which is selected in the **Centre string** field in the 17.3.4.6.4.2 Node >Setout subtab. Also see 17.1.4.5.2 Using Road Design Centre line and Setout Strings.
Manual	the chainage will be typed into the **Chainage**, **Road name** and **Offset fields** on the **Node >Setout** tab
[Clear]	clears the field - only on some pop-ups.

Road centre line chainage for pit setout schedules

*If **No road** - no value calculated*

*If **Centre String**, the setout xy is found by dropping the node centre point perpendicular onto the road centre line string which is selected in the* **Centre string** *field in the* 17.3.4.6.4.2 Node >Setout subtab. *This is used to measure the chainage and offset from. Also see* 17.1.4.5.2 Using Road Design Centre line and Setout Strings.

*If **Manual**, the chainage will be typed into the **Chainage**, **Road name** and **Offset fields** on the* 17.3.4.6.4.2 Node >Setout subtab.

If **Road chainage mode** is set to **Centre string**, then the **Centre String ID** in the **Road design file** is used to select the road string to measure the chainage and offset from.

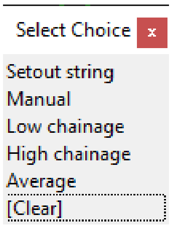
The values and settings for the road chainage and offset are found on the **Node >Setout** tab.

Continue to 17.1.4.6.4 Setout Symbol Mode or return to 17.1.2 Structure of the Water String.

17.1.4.6.4 Setout Symbol Mode

The ***Setout symbol mode*** is a method for calculating the bearing of the setout symbol for the node.

Symbol mode choice box



*If **Setout string:** the bearing of the length side of the node is obtained from setout and centre line strings (downhill bearing). If no setout string is found then no bearing is calculated.*

*If **Manual**: the bearing of the length side of the chamber is given for each node.*

*If **Low chainage**: the bearing of the length side of the chamber is the same as the bearing of the link on the low chainage side if the node.*

*The **first node** has no low chainage link so the bearing of the high chainage link is used*

*If **High chainage**: the bearing of the length side of the chamber is the same as the bearing of the link on the high chainage side if the node.*

*The **last node** has no high chainage link so the bearing of the low chainage link is used*

*If **Average**: the average of the bearings of the low and high chainage links.*

*If **Clear:** clears the field. Only on some pop-ups.*

*If **Manual:** bearing entered in the **Bearing** field on the **Node >Setout** tab.*

Bearing angle box measures

If **Symbol mode** *is **Manual**, then this is the **bearing** of the symbol on the node.*

Otherwise it is not used.

The see where the value is set in the two editors, see 17.1.4.6.4.1 Symbol mode for Water Network Editor *and* 17.1.4.7.1.3 Base bearing mode using Node Type in Drainage.4d File Editor.

17.1.4.6.4.1 Symbol mode for **Water Network Editor**

(a) the **Symbol mode** and **Bearing** fields are given for each node on the 17.3.4.6.4.1 Node >Main subtab.

17.1.4.6.4.2 Symbol mode for Node Type in Drainage.4d File Editor

For a ***Node type*** in the **Drainage.4d File Editor**:

(a) the **Symbol mode** is the field **symbol-surface bearing mode** on 17.4.1.2.1.3 Node Type: Pit details. The **Bearing** field is only used for the ***Manual*** mode and is given for each node in the WNE on the 17.3.4.6.4.1 Node >Main subtab.

Continue to 17.1.4.7 Bearing of the Node Base and Node Riser or return to 17.1.2 Structure of the Water String.

17.1.4.7 Bearing of the Node Base and Node Riser

When the **node** does **NOT** have a **riser**, the bearing of the node uses the **Symbol mode.** The **Symbol mode cannot** be set in the Water String Editor and must be set on the 17.3.4.6.4.2 Node >Setout subtab of the 17.3.4 Water Network Editor (WNE).

When the **node has a riser**, the bearing of the base (chamber) and the riser are set separately.

See

17.1.4.7.1 Bearing of Base (Chamber) with Riser
17.1.4.7.2 Bearing of Rise

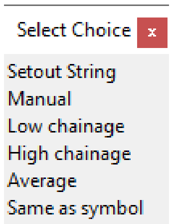
Continue to 17.1.4.7.1 Bearing of Base (Chamber) with Riser or return to 17.1.2 Structure of the Water String.

17.1.4.7.1 Bearing of Base (Chamber) with Riser

The ***Base bearing mode*** is a method for calculating the bearing of the length side of the chamber.

Note: This is only used when the node has a **riser**. When the node does not have a riser, the bearing of the node is the same as the setout symbol and is given by the 17.1.4.6.4 Setout Symbol Mode.

Base bearing mode choice box



*If **Setout string:** the bearing of the length side of the chamber is obtained from setout and centre line strings (downhill bearing). If no setout string is found then no bearing is calculated.*

*If **Manual**: the bearing of the length side of the chamber is given for each node.*

*If **Low chainage:** the bearing of the length side of the chamber is the same as the bearing of the link on the low chainage side if the node.*

*The **first node** has no low chainage link so the bearing of the high chainage link is used*

*If **High chainage:** the bearing of the length side of the chamber is the same as the bearing of the link on the high chainage side if the node.*

*The **last node** has no high chainage link so the bearing of the low chainage link is used*

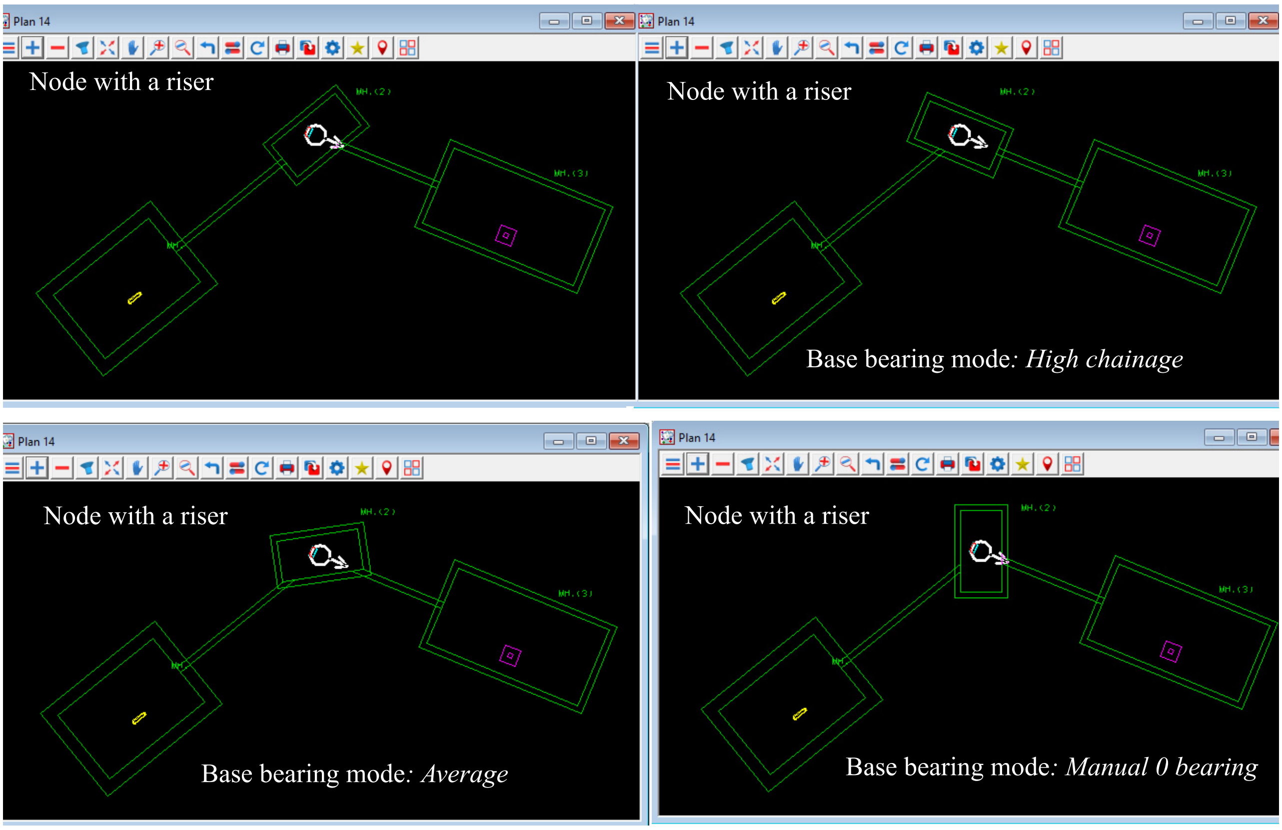
*If **Average**: the average of the bearings of the low and high chainage links.*

*If **Same as symbol:** use the value from the field* **Symbol mode** *which is in the*17.3.4.6.4.2 Node >Setout subtab *of the* 17.3.4 Water Network Editor (WNE) *and the filed* **Symbol-surface bearing mode** *in the **Pit details** section of the* 17.4.1.2.1.3 Node Type: Pit details *of* 17.4.1 Drainage.4d File Editor.

Base bearing angle box measures

If **Base bearing mode** *is **Manual**, then this is the **bearing** of the length direction of chamber of the node. Otherwise it is not used.t is not used.*

The see where the value is set in the three editors, see 17.1.4.7.1.1 Base bearing mode using Water String Editor, 17.1.4.7.1.2 Base bearing mode using Water Network Editor *and* 17.1.4.7.1.2 Base bearing mode using Water Network Editor.



17.1.4.7.1.1 Base bearing mode using Water String Editor

(a) When the nodes has a riser, the **Base bearing mode** and **Base bearing** field is given for each node on the Node tab of the Water Properties tab for the Water string editor.

(b) If the mode is **same as symbol,** use **Symbol mode** for the node on the 17.3.4.6.4.2 Node >Setout subtab of the WNE.

(c) If the node does not have a riser, then the **Base bearing mode** is **not used** and the bearing of the node uses the **Symbol mode** which **cannot** be set in the Water String Editor but is set on the 17.3.4.6.4.2 Node >Setout subtab.

17.1.4.7.1.2 Base bearing mode using Water Network Editor

(a) When the node as a riser, the **Base bearing mode** and **Base bearing** field is given for each node on the 17.3.4.6.4.1 Node >Main subtab.

(b) If the mode is **same as symbol,** use the **Symbol mode** on the 17.3.4.6.4.2 Node >Setout subtab.

(c) If the node does not have a riser, then the **Base bearing mode** is not used and the bearing of the node uses the **Symbol mode** on the 17.3.4.6.4.2 Node >Setout subtab.

17.1.4.7.1.3 Base bearing mode using Node Type in Drainage.4d File Editor

For a ***Node type*** in the **Drainage.4d File Editor**:

(a) When the node has a riser, the **Base bearing mode** is the field **Base bearing mode (used with riser)** on 17.4.1.2.1.3 Node Type: Pit details**.** The **Base bearing** is only used for the ***Manual*** mode and is given for each node in the WNE on the 17.3.4.6.4.1 Node >Main subtab.

(b) If the mode is **same as symbol,** use the mode for the field **symbol-surface bearing mode**.

Continue to 17.1.4.7.2 Bearing of Rise or return to 17.1.2 Structure of the Water String.

17.1.4.7.2 Bearing of Rise

When the **node has a riser**:

(c) the **bearing** of the **riser** is the **same** as the **bearing** of the **symbol**. See 17.1.4.6.4 Setout Symbol Mode.

(d) the bearing of the base (chamber) is given by the base bearing mode. See 17.1.4.7.1 Bearing of Base (Chamber) with Riser.

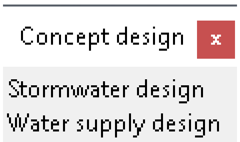
When the **node** does **NOT** have a **riser**, the node uses the **Symbol mode** which **cannot** be set in the Water String Editor but is set on the 17.3.4.6.4.2 Node >Setout subtab of the 17.3.4 Water Network Editor (WNE).

Continue to 17.2 Water Concept Design or return to 17.1.2 Structure of the Water String.

17.2 Water Concept Design

Position of menu: **Water =>Concept design**

The **Water Concept** walk-right menu is



17.2.1 Concept Stormwater Design
17.7.1 Concept Water Supply (CWS)

17.2.1 Concept Stormwater Design

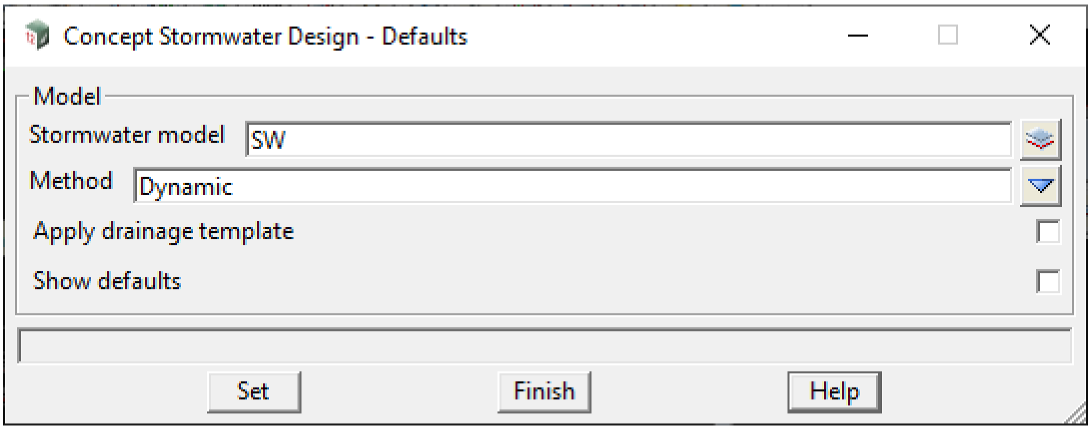
Position of menu: **Water =>Concept design =>Stormwater design**

This option provides a simplified interface for creation and editing of stormwater models for rational and dynamic analysis.

It is intended for faster network creation with less data demand and is suited to early design phases (i.e. concept or preliminary) when this data may not be available.

It does not allow for road design strings, trimeshes and node risers etc to be set, so the 17.3.4 Water Network Editor (WNE) is still required to add such items to the network.

Selecting **Stormwater design** displays the **Concept Stormwater Design - Defaults** panel.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Stormwater model	model box		available models

Stormwater model to create/edit.

Method	choice box		Rational, Dynamic

Stormwater analysis method - Rational or Dynamic.

Apply drainage template	tick box	not ticked	

*If **ticked**, a new file box* **Template file** *is displayed is displayed, and data can be loaded from an existing water model template :*

Template file	file box		*.12da files

Continue to 17.3.1 Create/Read Water Model Template

Show defaults	tick box	not ticked	

*If **ticked** the* General Tab, Catchment Tab, Node Tab, Link Tab *and* Colours Tab *are **displayed** on the panel. See* 17.2.1.1 Show Defaults Ticked.

Buttons at Bottom

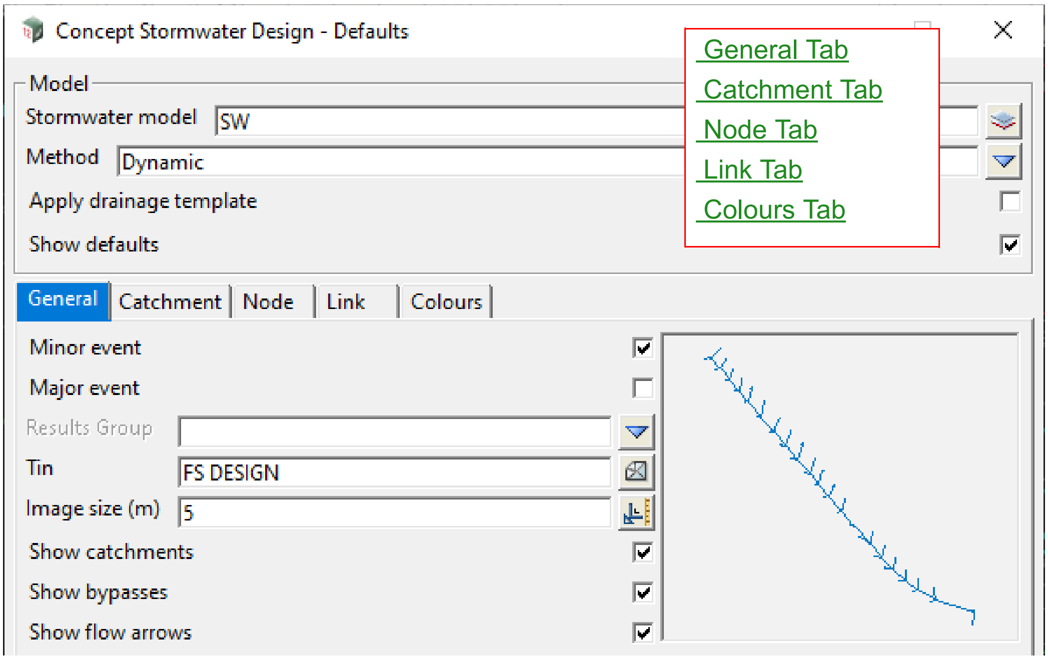
Set button

Sets the defaults and opens the CSD main panel.

Continue to 17.2.1.1 Show Defaults Ticked or return to 17.2.1 Concept Stormwater Design.

17.2.1.1 Show Defaults Ticked

The defaults panel allows the user to set default values for many of the model parameters, before starting to build the network. If an existing water model is selected then any default parameters already set for that model will be automatically loaded into the defaults panel. CSD can also work with either rational or dynamic method, and this will present different options for its various panels and toolbars. The user may also apply a drainage template file, and the widgets in the defaults panel will be set according to the parameters used in the template. By ticking **Show defaults***, the tabs General, Catchment, Node, Link and Colours will be seen.*



General Tab

Minor Event tick box not ticked

Defines the model to be set for a minor event.

Major Event tick box ticked

Defines whether the model is to be set for a major or minor event.'

Results Group choice box

Name of a group that results should be stored in. Existing groups will be populated in the list, and a new group may be created by typing the new name into the box.

Tin tin box

Tin for the specified model.

Image size (m) real box

CSD is a more visual way of viewing a drainage network. Nodes are shown as images representing their hydraulic function. The image size sets the size of node images.

Show catchments tick box ticked

Display catchment images for nodes.

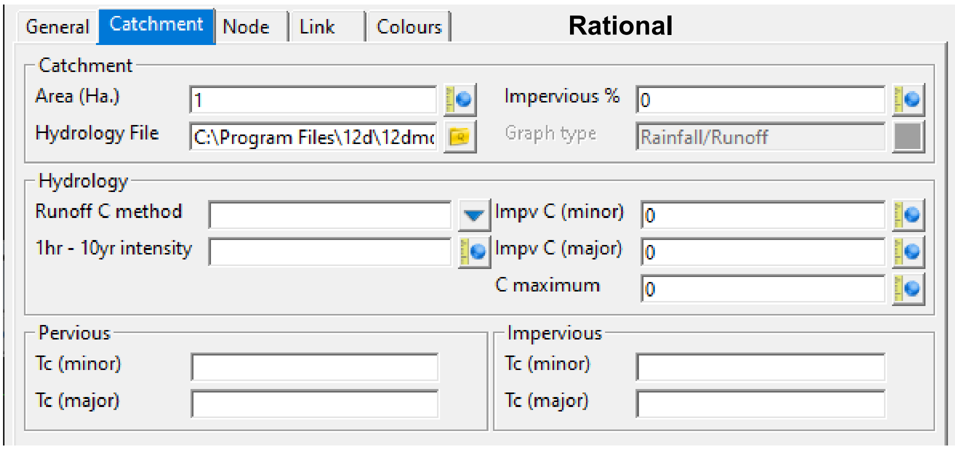
Show bypasses tick box ticked

Display bypass routes for the model.

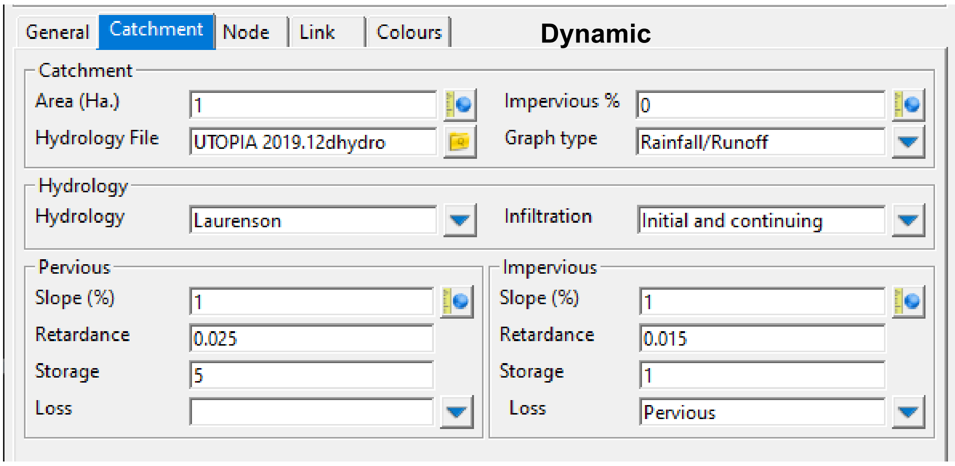
Show flow arrows tick box ticked

Display arrows indicating the fall of the links.

Catchment Tab



[General Tab](#)
[Catchment Tab](#)
[Node Tab](#)
[Link Tab](#)
[Colours Tab](#)



[General Tab](#)
[Catchment Tab](#)
[Node Tab](#)
[Link Tab](#)
[Colours Tab](#)

Catchment

For information on catchments, see [27.1.1 Water Catchments](#).

Area (Ha.) *real box* *1*

Default catchment area to be adopted for new catchments.

Impervious % real box 50

Impervious proportion of the total catchment area, as a percentage. See [27.1.1.1.2 Pervious and Impervious Sub Areas](#).

Hydrology File file box $LIB\UTOPIA 1987.12dhydro

Hydrology file to be used for the analysis. See [17.5.1 Hydro (Rainfall) File Editor](#).

Graph type choice box Rainfall/Runoff Rainfall/Runoff, Runoff, Rainfall, Losses, Excess Rainfall

Default graph type to use for catchment results display.

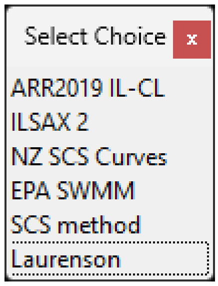
*Rational only allows **Rainfall/Runoff**.*

Hydrology

***Note**: Widgets in this group will change based on choices made in the Hydrology and Infiltration (loss) choice boxes.*

Hydrology choice box ILSAX 2

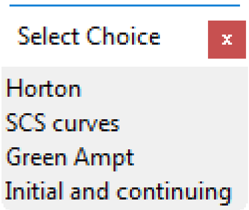
For a description of each dynamic hydrology, see 27.1.2.3 Dynamic Hydrology



*Hydrology method to be adopted for dynamic analysis (**dynamic only**).*

See 27.1.2.3 Dynamic Hydrology*,*

Infiltration choice box Horton



See
27.1.2.3.7.1 Horton Losses - *ILSAX 2, EPA SWMM*
27.1.2.3.7.2 SCS Curves *-EPASWMM, NZ SCSS and SCS*
27.1.2.3.7.3 Green Ampt - *EPA SWMM*
27.1.2.3.7.4 Initial and Continuing Losses - *ILSAX 2, Laurenson*

***Infiltration loss method** to be adopted for dynamic analysis (**dynamic only**). The available methods are dependent on the selected hydrology. Options are:*

> ***Horton**: Use by ILSAX 2, EPA SWMM. See* 27.1.2.3.7.1 Horton Losses.
> ***SCS Curves**: Used by EPA SWMM, NZ SCS Curves, SCS Method. See* 27.1.2.3.7.2 SCS Curves
> ***Green Ampt:** Used by EPA SWMM. See* 27.1.2.3.7.3 Green Ampt.
> ***Initial and continuing:** Used by ILSAX2, Laurenson. See* 27.1.2.3.7.4 Initial and Continuing Losses.

AMC (minor) real box 1

***Antecedent Moisture Condition** (AMC) to be used for minor event analysis (only available for dynamic **ILSAX2 Hydrology**)*

AMC (major) real box 3.5

***Antecedent Moisture Condition** (AMC) to be used for minor event analysis (only available for dynamic **ILSAX2 Hydrology**).*

Width real box 1000

*Catchment width in metres (only available for dynamic **EPA SWMM**).*

Slope (%) real box 1

*Catchment slope in % (only available for dynamic **EPA SWMM**).*

Pervious

***Note**: Fields in this group will change based on the selection made in the* **Hydrology** *choice box.*

Tc (minor) real box 10

*Time of concentration to be used for the **pervious** portion of the catchment in the minor event analysis (only available for ILSAX2, NZ SCS and SCS Method).*

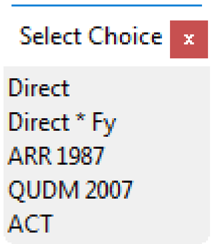
Tc (major) real box 10

*Time of concentration to be used for the **pervious** portion of the catchment in the major event analysis only available for ILSAX2, NZ SCS and SCS Method).*

Slope (%) real box 1

*Average slope of the **pervious** portion of the catchment (only available for Laurenson and EPA SWMM).*

Runoff C Method choice box



See
Direct
Direc*Fy
ARR 1987
QUDM 2007
ACT

*Runoff coefficient method for Rational analysis (**Rational only**).*

*For information about each **Runoff C method**, see* 27.1.2.2.2 Runoff Coefficient (C).

1hr-10yr intensity real box 10

*Rainfall intensity for the 10-year ARI (**rational only**).*

Impv C (minor) real box 0

*Impervious C for a minor event (**rational only**).*

Impv C (major) real box 0

*Impervious C for a major event (**rational only**).*

C maximum real box 0

*Maximum C value for rational analysis (**rational only**).*

Pervious

Tc (minor) real box 10

*Time of concentration to be used for the **pervious** portion of the catchment in the minor event analysis (only available for ILSAX2, NZ SCS and SCS Method)*

Tc (major) real box 10

*Time of concentration to be used for the **pervious** portion of the catchment in the major event analysis (only available for ILSAX2, NZ SCS and SCS Method)*

Slope (%) real box 1

*Average slope of the **pervious** portion of the catchment (only available for Laurenson and EPA SWMM).*

Retardance real box 0.025

*Resistance to runoff of the **pervious** portion of the catchment (only available for Laurenson and EPA SWMM).*

Storage real box 5

*Amount of catchment storage (ponding) to be applied to the **pervious** portion of the catchment following the start of runoff (dynamic only).*

Loss choice box

*Infiltration losses to be applied to the **pervious** portion of the catchment following the start of rainfall (dynamic only). Loss options are as defined in your hydro file for the Infiltration method selected.*

Impervious

Tc (minor) real box 5

*Time of concentration to be used for the **impervious** portion of the catchment in the minor event analysis (only available for Horton and SCS Curves).*

Tc (major) real box **5**

*Time of concentration to be used for the **impervious** portion of the catchment in the major event analysis (only available for Horton and SCS Curves).*

Slope (%) real box 1

*Average slope of the **impervious** portion of the catchment (only available for Laurenson and EPA SWMM).*

Retardance real box 0.025

*The resistance to runoff of the **impervious** portion of the catchment (only available for Laurenson and EPA SWMM).*

Storage real box 1

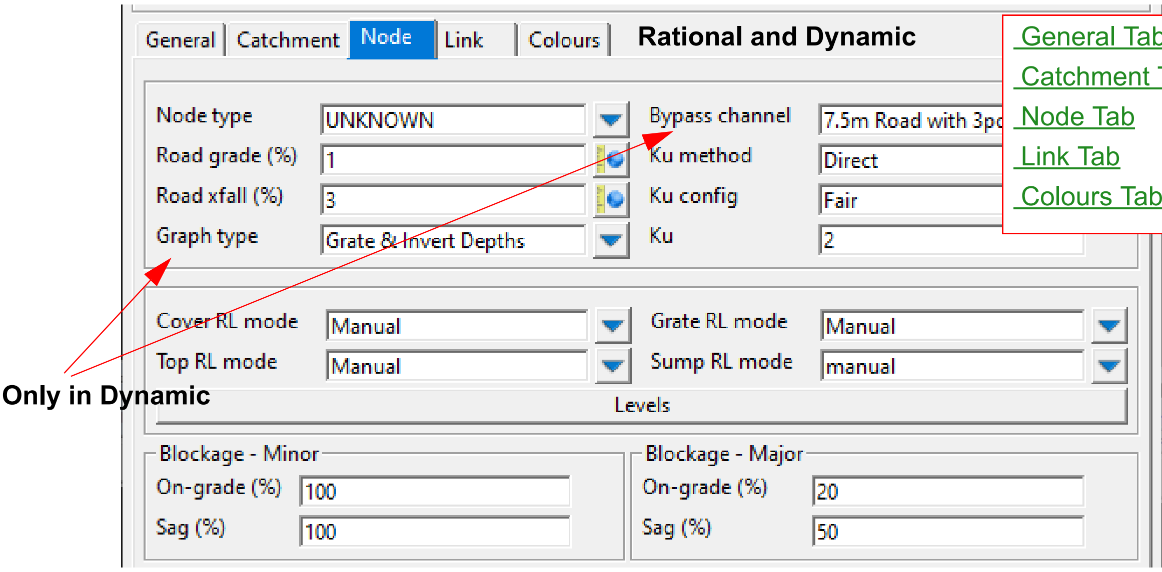
*Amount of catchment storage (ponding) to be applied to the **impervious** portion of the catchment following the start of runoff (dynamic only).*

Loss choice box

*The infiltration losses to be applied to the **impervious** portion of the catchment following the start of rainfall. Loss options are as defined in your hydro file for the Infiltration method selected. (Not used for ILSAX2. Dynamic only).*

Continue to Node Tab or return to 17.2.1 Concept Stormwater Design.

Node Tab



General Tab
Catchment Tab
Node Tab
Link Tab
Colours Tab

Node Type choice box

Default node type to be used for creation of new nodes. See 17.4.1.2 Nodes: node type *of the* 17.4.1 Drainage.4d File Editor *for information on defining Node types.*

Road Grade (%) real box 1

Default road grade to adopt for capture calculations at new nodes.

Road Xfall (%) real box 3

Default road crossfall to adopt for capture calculations at new nodes.

Graph type real box Grate & Invert Depths

Dynamic only: *Default graph type to use for node results display.*

Bypass Channel choice box
7.5m Road with 3pct xfall - Barrier Kerb
7.5m Road with 3pct xfall - Mountable Kerb
10m Road with 3pct xfall - Barrier Kerb
10m Road with 3pct xfall - Mountable Kerb
4m wide pathway

Dynamic Only: *Default channel shape to adopt for creation of new bypass channels.*

Ku Method choice box Direct

Default ***Ku Method*** *to adopt for creation of new nodes. See* 27.2.1.1 Ku and Kw *and* 27.2.1.1.3 Ku and Kw Calculations in 12d Model.

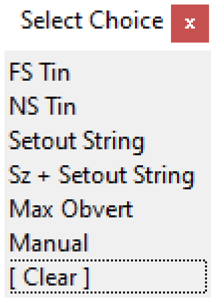
Ku Config choice box Good

Default ***Ku Configuration*** *to adopt for creation of new nodes. Only available for a Ku Method of Ku,Kw>0 - Missouri/Hare Charts. See* 27.2.1.1 Ku and Kw *and* 27.2.1.1.3 Ku and Kw Calculations in 12d Model.

Ku real box 2

Default ***Ku value*** *to adopt for creation of new nodes. Only available for a* ***Ku Method*** *of* ***Direct****.*

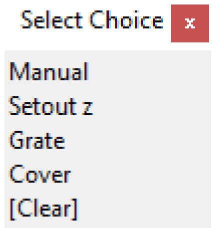
Cover RL mode choice box Manual



For the definition of each ***Cover RL mode,*** see
17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z)

*The **Cover RL** defines the top of the pit and is used to determine the pit depth.*
This is the default cover level to adopt for creation of new nodes.

Top RL mode choice box Manual



For the definition of each ***Top RL mode,*** see
17.1.4.5.1.3 Top RL (z) Mode and Top RL (z)

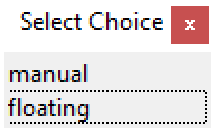
Default top level to adopt for creation of new nodes.

Grate RL mode choice box Manual

For the definition of each ***Grate RL mode,*** see
17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z)

Default grate level to adopt for creation of new nodes.

Sump RL mode choice box Manual



For the definition of each ***Sump RL mode,*** see
17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z)

Default sump level to adopt for creation of new nodes.

Blockage - Minor

On- grade (%) real box 100

Blockage to be applied to on-grade nodes in the minor event, as a percentage.

Sag (%) real box 100

Blockage to be applied to sag nodes in the minor event, as a percentage.

Blockage - Major

On- grade (%) real box 20

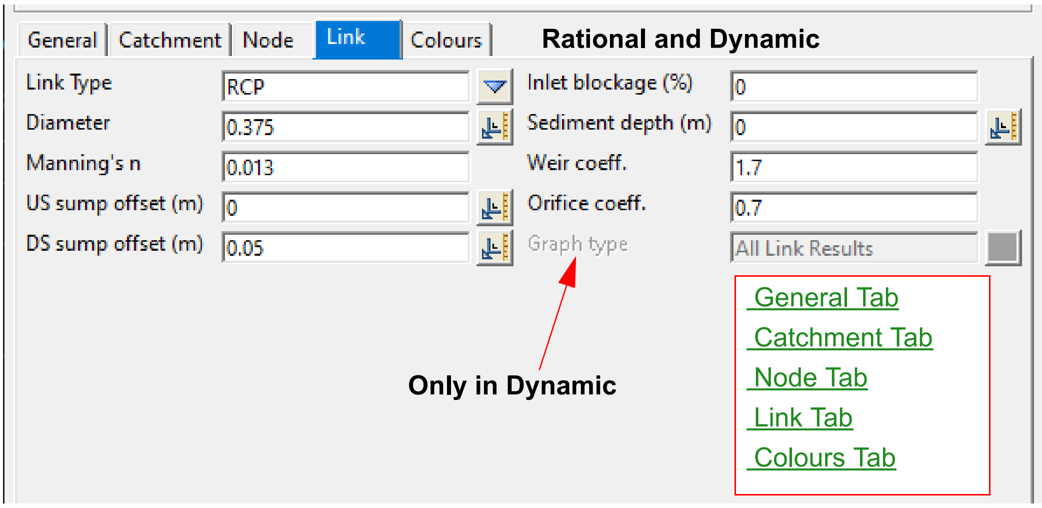
Blockage to be applied to on-grade nodes in the major event, as a percentage.

Sag (%) real box 50

Blockage to be applied to sag nodes in the major event, as a percentage.

Continue to Link Tab or return to 17.2.1 Concept Stormwater Design.

Link Tab



Link Type choice box RCP

Default link type to be used for creation of new links, See 17.4.1.3 Links: link type *of the* 17.4.1 Drainage.4d File Editor *for information on defining Link types.*

Diameter real box 0.375

Default diameter to be used for creation of new links.

Manning's n real box 0.013

Default roughness to be used for creation of new links.

US sump offset (m) real box 0

Default link upstream invert offset value from the node sump for creation of new links.

DS sump offset (m) real box 0.05

Default link downstream invert offset value from the node sump for creation of new links.

Inlet blockage (%) integer box 0

Default link blockage to be used for creation of new links. NOTE: This is NOT the same as node inlet blockage. Primarily used for structures such as culverts which can have blockage applied to the inlet, however it is not applied to the full link length and does not affect available link volume.

Sediment depth (m) real box 0

Default depth of sediment in the link.

***NOTE**: This is applied to the full link length, not just the inlet, and consequently affects available link volume.*

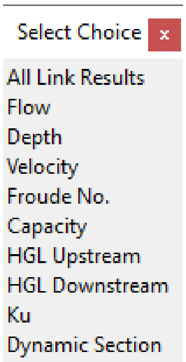
Weir coeff. real box 1.7

Default coefficient to be used for Weir links.

Orifice coeff. real box 0.7

Default coefficient to be used for Orifice links.

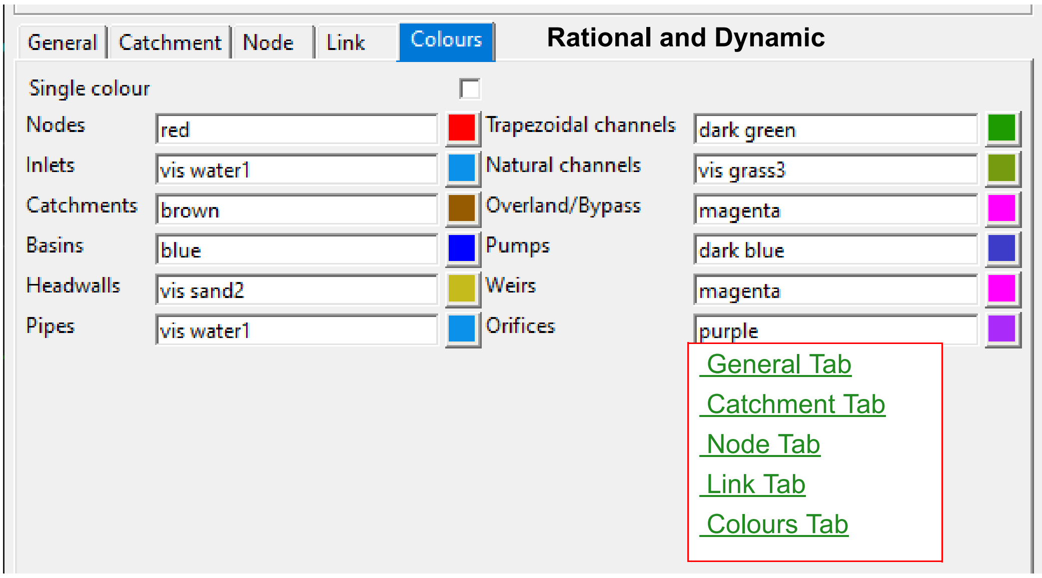
Graph type	choice box	All Link Results



Dynamic Only: *Default graph type to use for link results display.*

Continue to Colours Tab or return to 17.2.1 Concept Stormwater Design.

Colours Tab



Single colour tick box not ticked

*If **ticked**, there is a single colour to be used for the entire network. A field Colour is displayed and all the other fields in the panel are turned off.*

Colour colour box red

Default colour for all the items in the network.

Nodes colour box red

Default colour for nodes with no grate inflow.

Inlets colour box vis water1

Default colour for nodes with grate inflow.

Catchments colour box brown

Default colour for catchment type nodes (no grate capture and no outlet link).

Basins colour box blue

Default colour for basin type nodes (have a basin curve).

Headwalls colour box vis sand2

Default colour for headwall type nodes.

Pipes colour box vis water1

Default colour for pipe type links.

Trapezoidal channels colour box dark green

Default colour for trapezoidal channel type links.

Natural channels colour box vis grass3

Default colour for natural channel type links.

Overland/Bypass colour box magenta

Default colour for bypass channels / overland flow routes.

Pumps colour box dark blue

Default colour for pump type links (have a pump hydraulic function).

Weirs colour box magenta

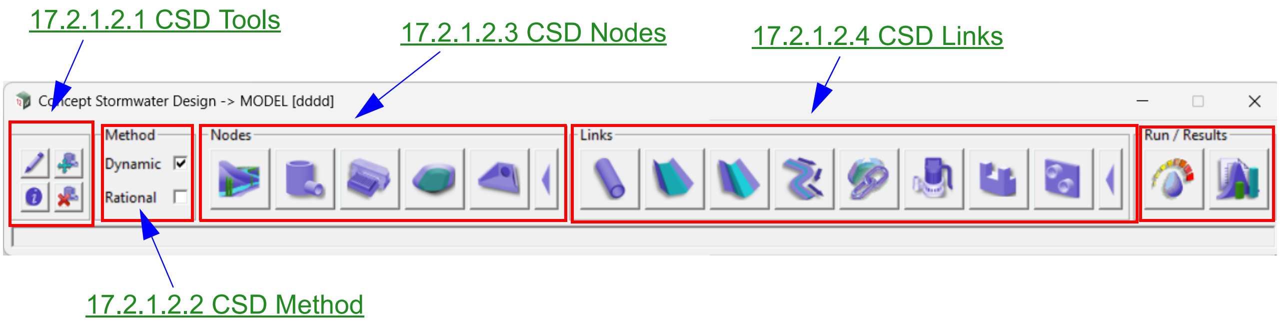
Default colour for weir type links (have a weir hydraulic function).

Orifices colour box purple

Default colour for orifice type links (have an orifice hydraulic function).

Continue to 17.2.1.2 CSD Main Panel or return to 17.2.1 Concept Stormwater Design.

17.2.1.2 CSD Main Panel

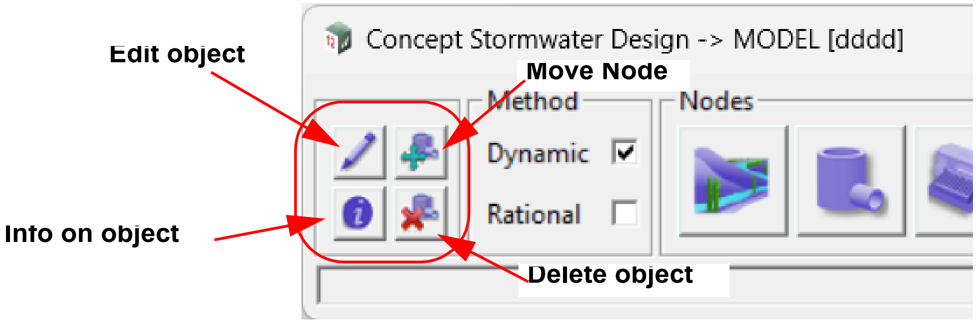


The main **CSD** panel is broken into five distinct areas:

1. Tools. See 17.2.1.2.1 CSD Tools
2. Method. See 17.2.1.2.2 CSD Method.
3. Nodes. To create and edit a Node, see 17.2.1.2.3 CSD Nodes.
4. Links. To create and edit a Node, see 17.2.1.2.4 CSD Links.
5. Run / Results

17.2.1.2.1 CSD Tools

One of **Dynamic** or **Rational** needs to be ticked.



Edit object

Message: **<Select object to edit> [Edit node] [Edit catchment] [Edit link]**
*Clicking with LB edits a **Node**.*
*Clicking with MB edits a **Catchment** node*
*Clicking with MB edits a **link**.*

Move Node

Message: **Move node**

Info on Object

Message: **<Info> [Object] [ ] [Defaults]**
*Clicking with LB give information on an **Object** (node or link).*
*Clicking with RB deletes a **Node** and the associated **Links**.*

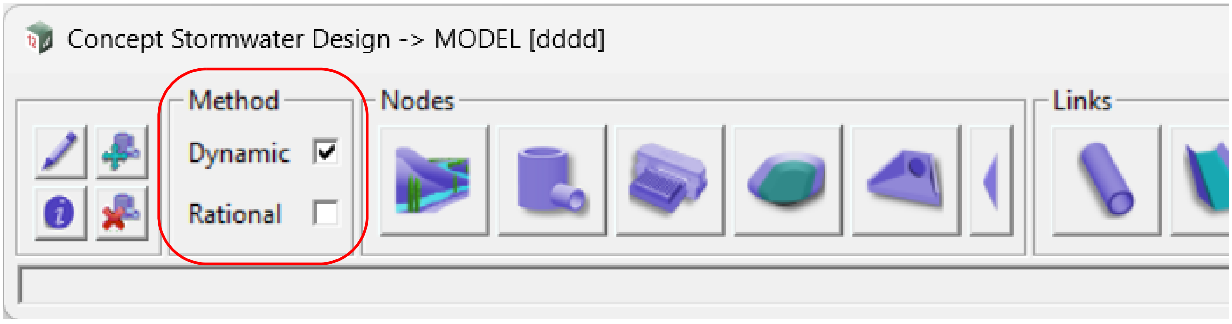
Delete object

Message: **<Select object to delete> [delete] [ ] [delete node + links]**
*Clicking with LB deletes an **Object** (node or link).*
*Clicking with RB deletes a **Node and** the associated **Links**.*

Continue to 17.2.1.2.3 CSD Nodes or return to 17.2.1.2 CSD Main Panel.

17.2.1.2.2 CSD Method

Dynamic or **Rational** needs to be ticked.



Dynamic tick box

*When **ticked**, if the analysis is **Dynamic**.*

*If the water network has already been set to **Dynamic** then this will already be ticked.*
This can be changed to Rational but only if none of the information in the water network is only applicable to Dynamic analysis.

Rational tick box

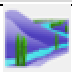
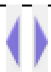
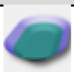
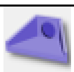
*When **ticked**, the analysis is using the **Rational Method**.*

*If the water network has already been set to **Ration** then this will already be ticked.*
This can be changed to Dynamic.

Continue to 17.2.1.2.3 CSD Nodes or return to 17.2.1.2 CSD Main Panel.

17.2.1.2.3 CSD Nodes

Each **Node** type has an associated icon so it is easy to tell them apart.

NODES				
	Create catchment node		Edit Catchment	
	Create node (no capture)		Edit Node	
	Create inlet node		Edit Node	
	See less/see more nodes			
NODES (expanded)				
	Create basin node		Edit Node	
	Create headwall node		Edit Node	

All the **Nodes** buttons have a left and right click functionality defined for them.

The **Nodes** area is enlarged/reduced in size by clicking the **See less/see more nodes** buttons.

Hovering over any of the **Nodes** button shows the button operations in the message box at the bottom of the panel in the format **[LB] [MB] [RB]** where LB refers to a left mouse button click, MB refers to a middle mouse button click and RB refers to a right mouse button click.

For example, hovering over the **Create inlet node** button will display:

<inlet> [create] [] [edit]

which indicates that:

(a) a **left mouse** click will **create** a new inlet node

The position of the new inlet is then picked on a view.

(b) **middle mouse** click will **do nothing**

and

(c) a **right mouse** click will allow **editing** of an existing Node.

The **Node** to edit is then picked and when accepted, the **Edit Node** panel for that Node appears.

Note: Editing a Catchment brings up the **Edit Catchment** panel.

Once a new **Node** is placed another **Node** of the same type can then be placed by picking another position on a view. This continues until <ESC> is pressed.

Editing a **Node** prompts for the object to be edited and once selected, either the **Edit Node**, **Edit Catchment** panel will be opened.

For information on editing a **Node** see 17.2.1.2.3.1 Editing a Node and for a catchment, see 17.2.1.2.3.2 Editing a Catchment Node.

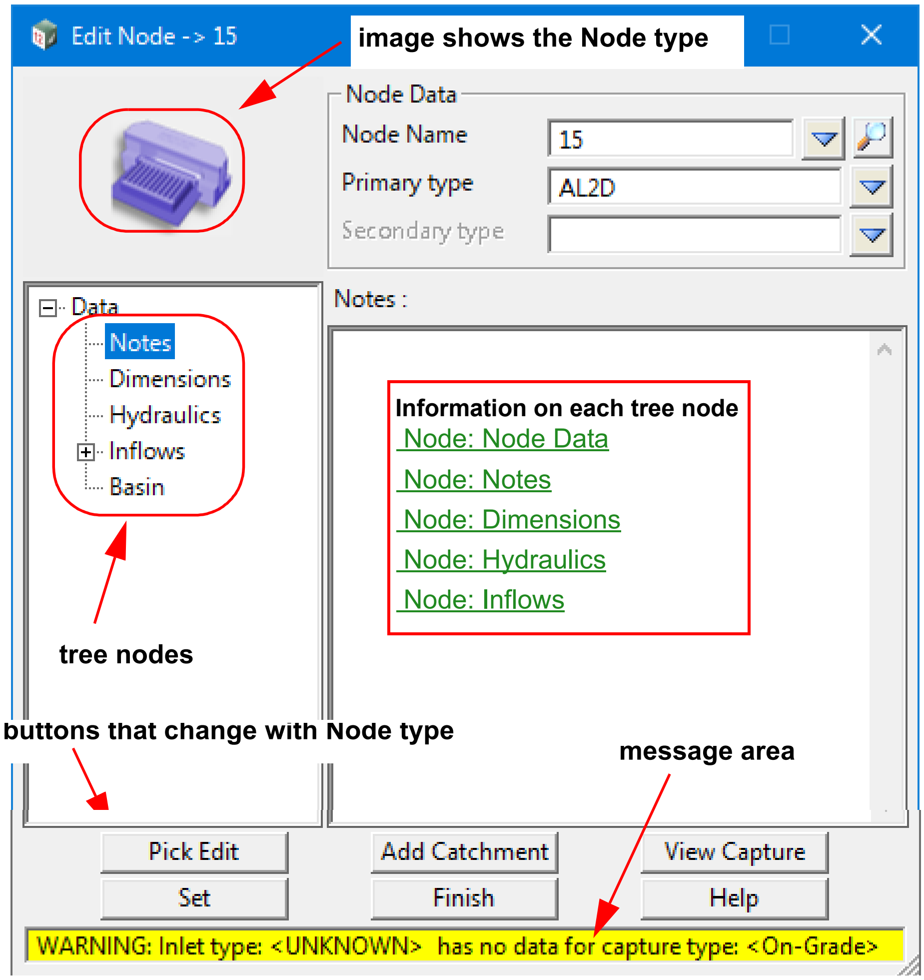
17.2.1.2.3.1 Editing a Node

After a **Node** is selected, the **Edit Node** panel comes up and the relevant data for the selected node is entered into the panel tree nodes and the associated fields.

The **Node Data** section at the top shows some information about the selected Node but also allows different Nodes to be selected. See Node: Node Data.

The tree on the left hand side is dependent on the **Node** selected, and clicking on each tree node displays the information to be entered on the right had side of the panel.

The buttons at the bottom change with the **Node** type and any messages are written to the message area at the bottom of the panel.



Buttons at Bottom

Pick Edit button

Allows selection of a node to edit.

Add Catchment button Edit Catchment panel

Allows adding a catchment to the currently selected node.

View Capture button Capture curve panel

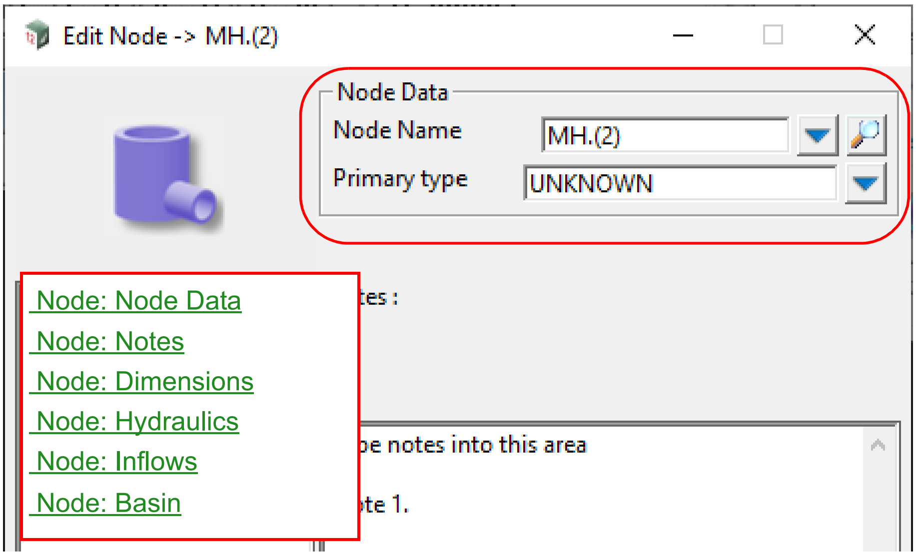
Display the capture curve (graph) that will be used for this node during analysis.

Set button

Sets the current parameters for the selected node.

Continue to Node: Node Data or return to 17.2.1.2.3 CSD Nodes.

Node: Node Data



Node Name choice box purple

Displays the name of the currently selected node.

 icon search for node

Allows for searching a node by name.

Primary type choice box

The primary node type (types defined in the drainage.4d).

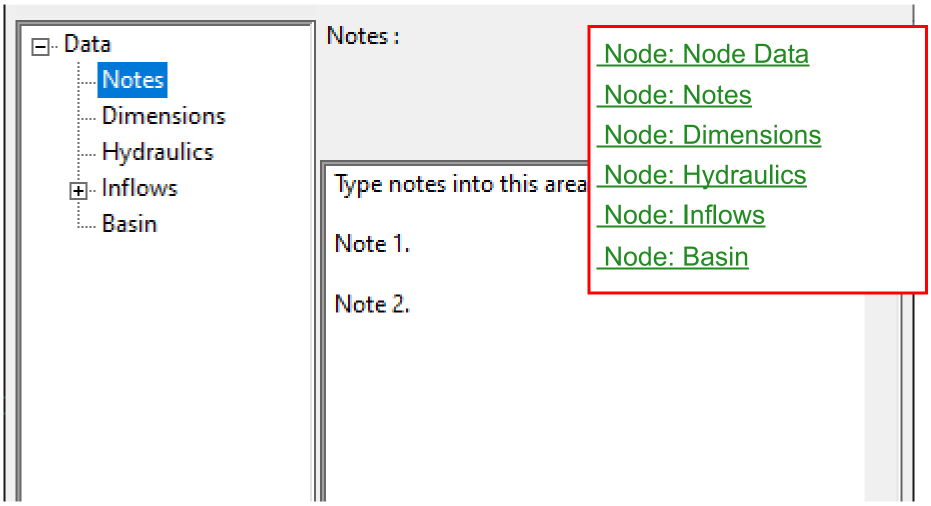
Secondary type choice box

The secondary node type (types defined in the drainage.4d). This allows nodes to switch between capture curve modes of on-grade and sag. The primary type will be used until the approach velocity reaches a point where it needs to switch to the secondary (i.e. approach flow velocity slows significantly and capture mode needs to change to sag).

Continue to Node: Notes or return to 17.2.1.2.3 CSD Nodes.

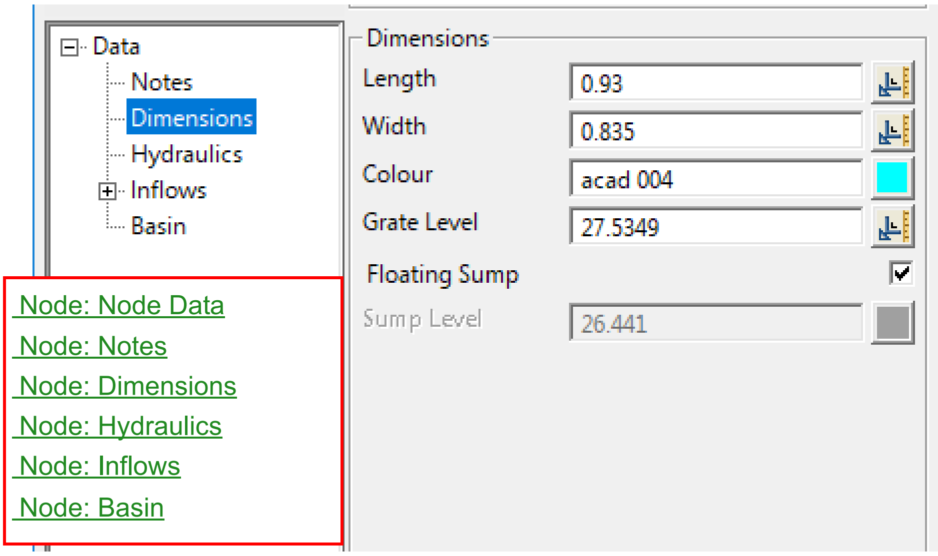
Node: Notes

Notes can be type into the right hand side.



Continue to Node: Dimensions or return to 17.2.1.2.3 CSD Nodes.

Node: Dimensions



Dimensions

Length real box

Length of the node in metres.

Width real box

Width of the node in metres.

Colour colour box

Node colour.

Grate Level real box

Grate level of the node.

Floating Sump tick box ticked

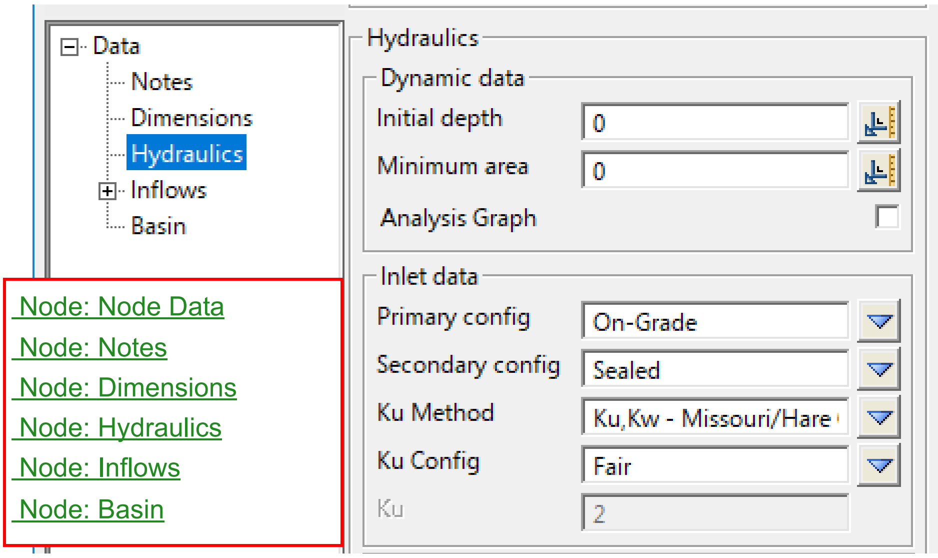
To enable a floating sump level, which results in the sump being calculated from the lowest level of all attached links. If unselected then the sump level is manually set.

Sump Level real box

Manually set sump level. Not active unless Floating Sump tick box is unselected.

Continue to Node: Hydraulics or return to 17.2.1.2.3 CSD Nodes.

Node: Hydraulics



Dynamic data

Initial depth real box 0

Initial depth allows setting an initial water depth in the node. It is NOT a static water level, and it is also not applied to links connected to the node. This is primarily intended for use with detention basins, and can result in a sudden spike in flow rates through attached links. Use with caution.

Minimum area real box 0

Sets a minimum cross-sectional area of the node. Useful for improving volumetric accuracy when the drainage.4d dimensions are incorrect but modifying the file isn't possible.

Analysis Graph tick box not ticked

Enable the graph for this node during analysis.

Inlet data

Primary config choice box On-Grade

Primary capture configuration for the node. This is the configuration most likely to occur (i.e. on-grade or sag).

Secondary config choice box Sealed

Secondary capture configuration for the node. This is the configuration less likely but may still occur (i.e. on-grade or sag).

Ku Method choice box

Method to use for ku determination. Refer to Section 27.2.1.2 Ku - Node Pressure Losses *for further details.*

Ku Config choice box

Configuration to adopt for Ku chart selection. Refer to Section 27.2.1.2 Ku - Node Pressure Losses *for further details.*

Ku real box

*Manually set ku value. Only available for a Ku Method of "**Direct**".*

Continue to Node: Inflows or return to 17.2.1.2.3 CSD Nodes.

Node: Inflows

Inflows to a node fall into two typical categories:

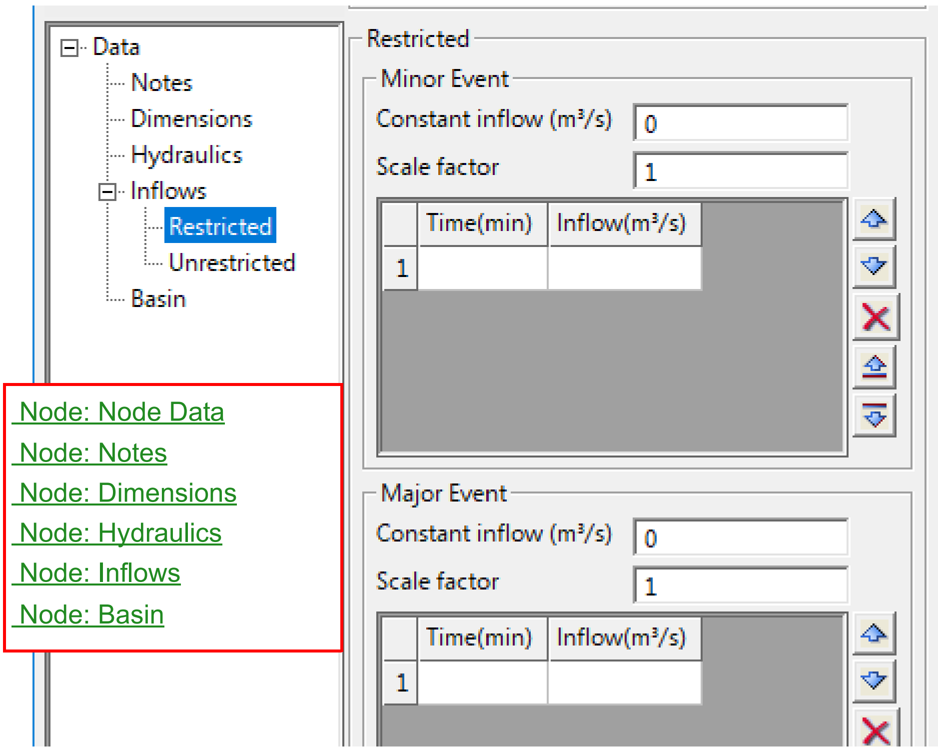
Restricted

Unrestricted

Regardless of which category the inflows fall under, they will often be different in the minor and major events. Inflows may also be static throughout the duration of the analysis, or they can vary (hydrograph). Any and all of the situations mentioned above can be catered for within the Inflows pages.

Restricted inflows represent those which will arrive at the grate of the node and be subsequently subject to the capture curve (if it exists).

Unrestricted inflows represent those which arrive directly inside the node (below the grate) and are subsequently NOT subject to any capture curve.



The widgets on the Restricted and Unrestricted pages are similar in function, and will be summarised below.

Constant inflow (m3/s) real box

Constant inflow. This will be included for every second of the model time.

Scale factor real box

Scale factor to be applied to the inflows (constant or varied).

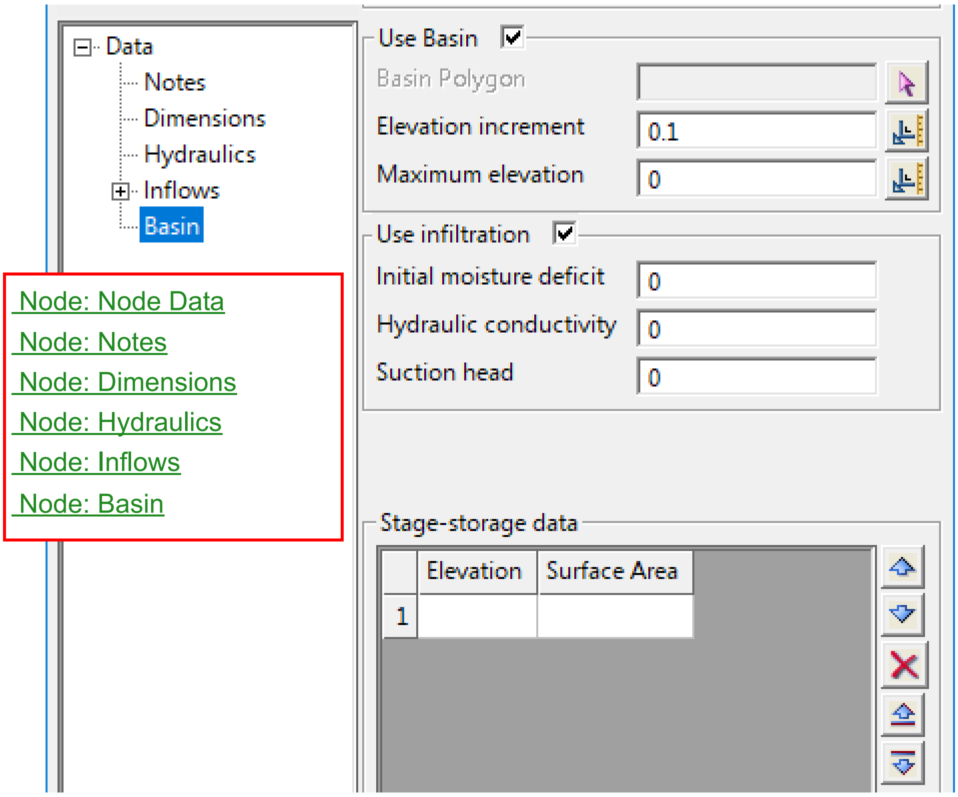
Time (min) / Inflow(m3/s) real box

Grid for input of an inflow hydrograph.

Continue to Node: Basin or return to 17.2.1.2.3 CSD Nodes.

Node: Basin

All nodes have storage, by way of their cross sectional area and the depth between the sump and HGL limit of the node. However additional storage may be defined for any node using a storage curve. The Basin tree node allows for the curve to be defined to override the node dimensions, for an elevation range as set by the user. Storage above or below the range of the basin curve will be based on the cross-sectional area of the node, as set on the Dimensions tree node.



Use Basin tick box ticked

Enables or disables using basin infiltration and a storage curve for the node. If Use Basin is disabled then any of the basin curve or infiltration data for the node will be ignored during analysis.

Basin Polygon select box

Not currently implemented - for future development. Allows selection of a polygon to use for creation of a depth-area curve for basin storage.

Elevation increment real box 0.1

Increment used for establishing the depth-area curve from a tin. Not used currently, but will show data set by the WNE.

Maximum elevation real box 0

Maximum elevation used for establishing the depth-area curve from a tin. Not used currently, but will show data set by the WNE.

Use infiltration tick box ticked

Enables or disables Green-Ampt infiltration data for the basin.

Initial moisture deficit real box

Fraction of the soil that is initially dry (i.e. difference between soil porosity and initial moisture content), as used in the Green-Ampt infiltration calculations.

Hydraulic conductivity real box

Saturated hydraulic conductivity, measured in mm per hour. Represents the ease that water can travel *through the soil whilst it is saturated. Tends to be high for sandy soils but low for compact clays. Used in the Green-Ampt infiltration calculations.*

Suction head real box

Suction head, in millimetres, is the average value of soil capillary suction along the wetting front. Tends to be large for fine grain soils (i.e. clays) and smaller for sandy soils. Used in the Green-Ampt infiltration calculations.

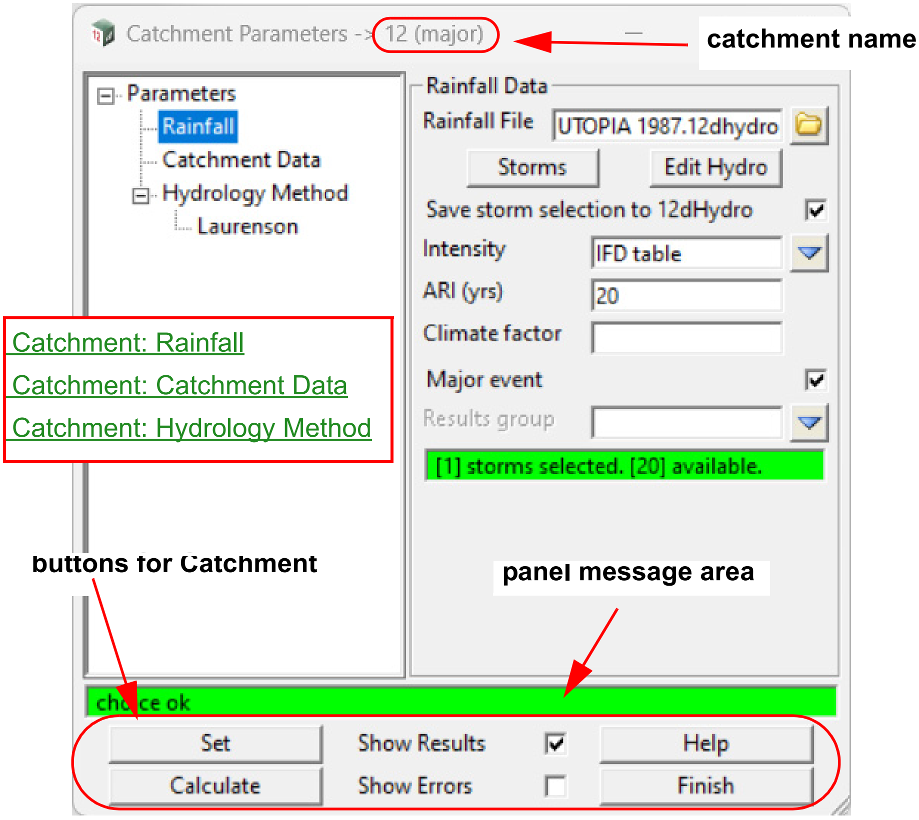
17.2.1.2.3.2 Editing a Catchment Node

After a **Catchment** is selected, the **Catchment Parameters** panel comes up and the relevant data for the selected catchment is entered into the panel tree nodes and the associated fields.

The **name** of the catchment is displayed in the panel title after **Catchment Parameters ->.**

The tree on the left hand side gives information about the selected catchment, and clicking on each tree node displays the information to be entered on the right had side of the panel.

The buttons at the bottom change with the **Node** type and any messages are written to the message area at the bottom of the panel.



Buttons at Bottom

Set button

Sets the data in the panel widgets to the network.

Calculate button

*Runs analysis for the currently **selected catchment only**. Useful for checking model sensitivity to catchment parameters. This is **NOT** a full model run.*

Show Results tick box ticked

*If **ticked**, results data will be displayed following analysis of the current catchment (after the Calculate button is pressed).*

*If **not ticked**, results data will not be displayed following analysis of the current catchment.*

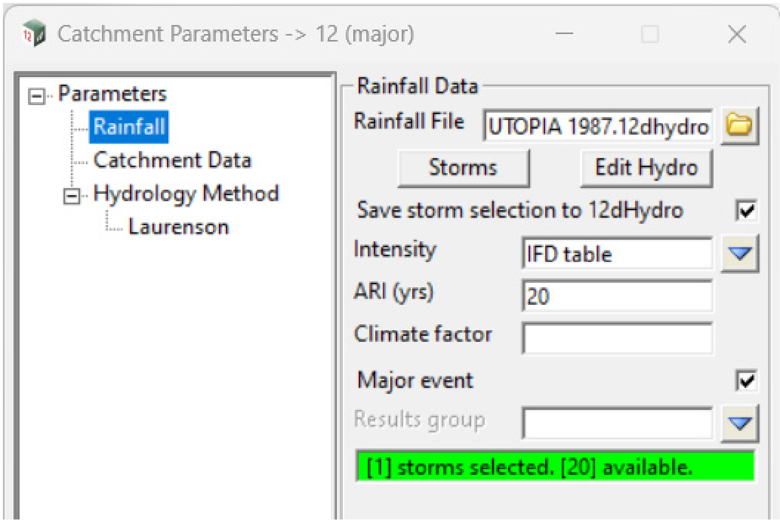
Show Errors tick box not ticked

*If **ticked**, the error log will be displayed following analysis of the current catchment (after the Calculate button is pressed).*

*If **not ticked**, the error log will not be displayed following analysis of the current catchment.*

Continue to Catchment: Rainfall or return to 17.2.1.2.3 CSD Nodes.

Catchment: Rainfall



Field Description	Type	Defaults	Pop-Up

Rainfall Data

Rainfall File File box UTOPIA 1987.12hydro

*Hydro file to use for analysis. See.*17.5.1 Hydro (Rainfall) File Editor.

Storms button Select Storms panel

Storm temporal patterns, found in the hydro file, can be selected for analysis.

Edit Hydro button Edit Hydro panel

*Edit the specified hydro file. See.*17.5.1 Hydro (Rainfall) File Editor.

Save storm selection to 12dHydro tick box ticked

Save the selected storm data to the specified hydro file.

Intensity choice box

Rainfall intensity method to be used for analysis. Possible options, dependent on data in the Hydro file, are:

IFD Table - See 27.1.4.1.1 IFD Tables.

ARR 1987

ARR 1977

ARI (yrs)/AEP (yrs) real box

Storm frequency to be used for analysis. This will switch between ARI and AEP, depending on what temporal pattern data exists in the hydro file. The message box will display how many storms are currently selected, and how many are available for the ARI/AEP chosen.

Climate factor real box

Coefficient of rainfall increase (as a percentage) to account for climate change.

Major event tick box ticked

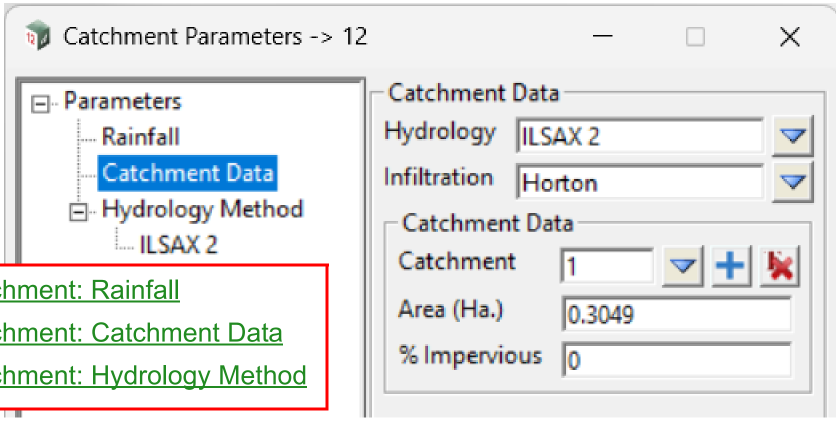
*If **ticked**, the Major event flag is set for analysis.*
*If **not ticked**, the Minor event flag is set for analysis.*

Results group choice box

Results data can be grouped for running multiple scenarios and simpler reference post-run. This is the same as Attribute Groups that can be set in the 17.3.4 Water Network Editor (WNE)*. Typing a new name into the choice box will create a new item in the list of available results groups.*

Continue to Catchment: Catchment Data or return to 17.2.1.2.3 CSD Nodes.

Catchment: Catchment Data



[Catchment: Rainfall](#)
[Catchment: Catchment Data](#)
[Catchment: Hydrology Method](#)

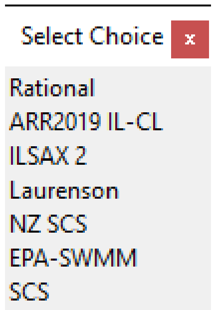
The fields on the right hand side when the tree node **Catchment Data** is clicked are described below.

Field Description	Type	Defaults	Pop-Up

Catchment Data

Hydrology choice box ILSAX2

[Hydrology Method: Rational](#)
[Hydrology Method: AR&R 2019 IL-CL](#)
[Hydrology Method: ILSAX 2](#)
[Hydrology Method: Laurenson](#)
[Hydrology Method: NZ SCS](#)
[Hydrology Method: EPA SWMM](#)



*Hydrology methods available in the hydro file. Possible methods available are as described in the **Catchment Tab - Hydrology Group** section of the Defaults Panel. See* [Catchment: Hydrology Method](#).

Also see [27.1.2 Hydrological Methods](#).

Infiltration choice box

*Infiltration methods available for the currently selected hydrology method. Possible methods available are as described in the **Catchment Tab - Hydrology Group** section of the Defaults Panel. See* [Catchment: Hydrology Method](#). *Also see* [27.1.2.3.7 Infiltration Losses](#).

Catchment choice box

Index of currently selected catchment. Other catchment indices can be selected from the drop down choice list.

 icon

Adds a catchment to the current node.

 icon

Deletes the currently selected catchment data from the current node.

Area (Ha.) real box

Catchment area in hectares.

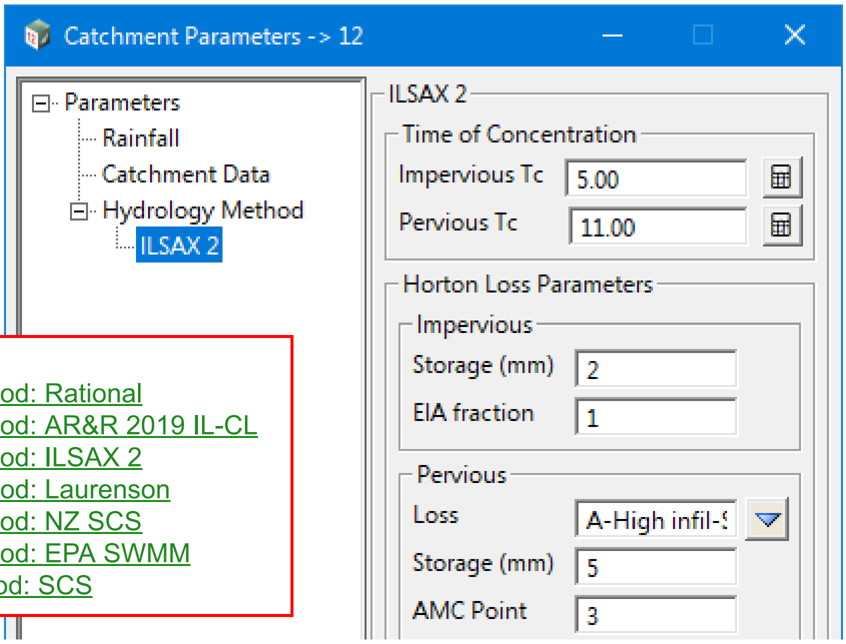
% Impervious real box

Percentage of the current catchment which is impervious.

Continue to [Catchment: Hydrology Method](#) or return to [17.2.1.2.3 CSD Nodes](#).

Catchment: Hydrology Method

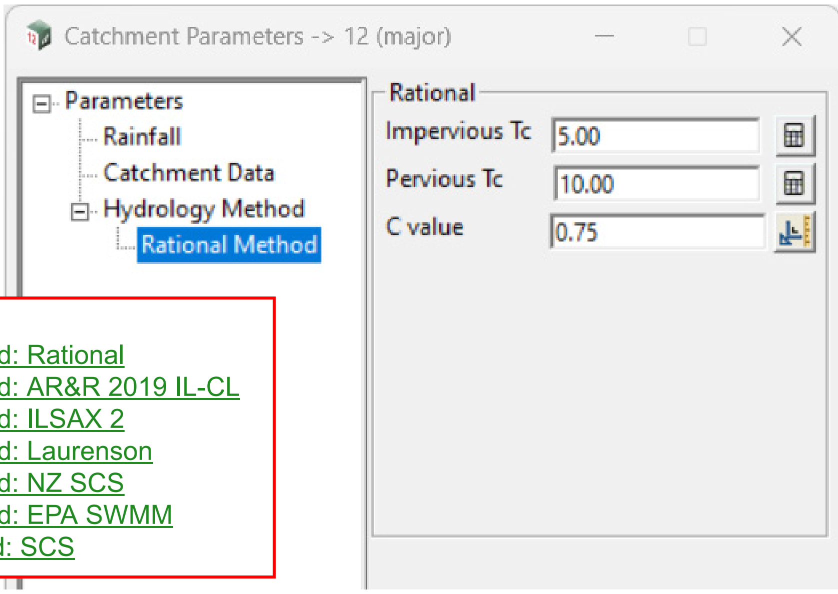
The fields on the right hand side for the subnodes of the **Hydrology Method** node depend on the hydrology method and Infiltration method selected on the Catchment: Catchment Data node.



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

Continue to Hydrology Method: Rational or return to Catchment: Hydrology Method.

Hydrology Method: Rational



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **Rational Method** are described below.

Impervious Tc real box 5.00

Impervious catchment time of concentration (minutes).

Pervious Tc real box 10.00

Pervious catchment time of concentration (minutes).

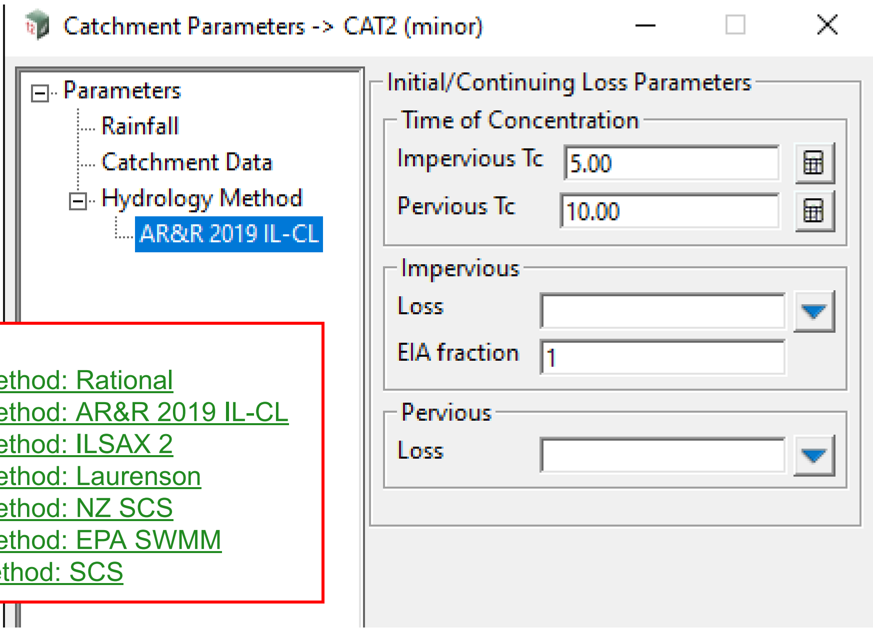
C value real box

The runoff coefficient.

For more information, see 27.1.2.2 Rational Method Hydrology.

Continue to Hydrology Method: AR&R 2019 IL-CL or return to 17.2.1.2.3 CSD Nodes.

Hydrology Method: AR&R 2019 IL-CL



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **AR&R 2019 IL-CL2** node which currently only allows Infiltration method **Initial and Continuing Loss**, are described below.

Time of Concentration

Impervious Tc real box 5.00

Impervious catchment time of concentration (minutes).

Pervious Tc real box 10.00

Pervious catchment time of concentration (minutes).

icon

Opens the Tc Calculator panel for calculation of Time of Concentration. See 17.5.12 Time of Concentration Builder.

Initial and Continuing Loss Parameters

Impervious Loss choice box

Soil type for the impervious catchment (Initial and Continuing infiltration loss) as defined in the 12dhydro file.

For information on defining the choices in 12dhydro file for the **Loss** *pop-up, see*17.5.1.7 Rainfall Editor - Initial and Continuing Losses.

Impervious EIA fraction real box 1.0

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious Loss choice box

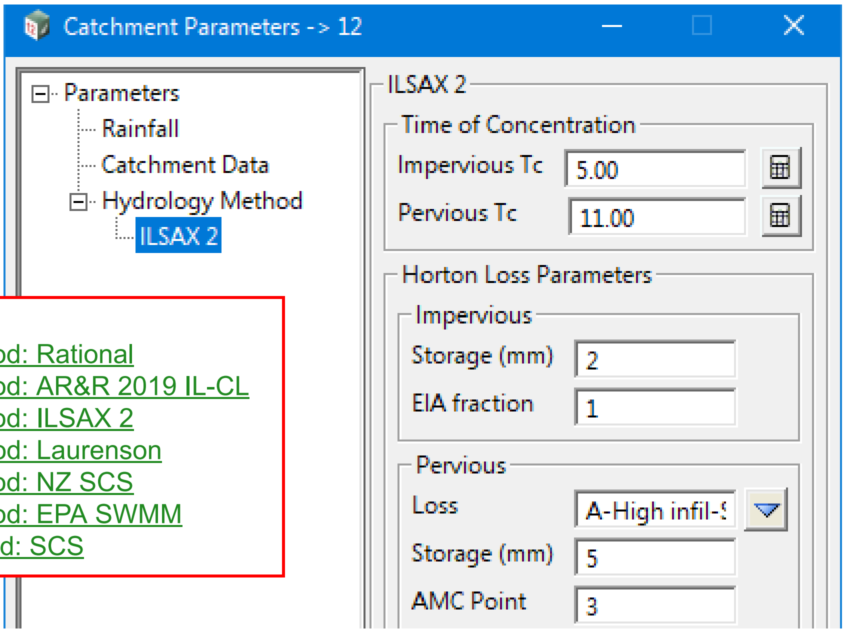
Soil type for the pervious catchment (Initial and Continuing infiltration loss) as defined in the 12dhydro file.

For information on defining the choices in 12dhydro file for the **Loss** *pop-up, see*17.5.1.7 Rainfall Editor - Initial and Continuing Losses.

For more information, see 27.1.2.3.1 ARR2019 IL-CL.

Continue to Hydrology Method: ILSAX 2 or return to 17.2.1.2.3 CSD Nodes.

Hydrology Method: ILSAX 2



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **ILSAX 2** node which currently only allows Infiltration method **Horton Loss**, are described below.

Time of Concentration

Impervious Tc real box 5.00

Impervious catchment time of concentration (minutes).

Pervious Tc real box 10.00

Pervious catchment time of concentration (minutes).

 icon

Opens the Tc Calculator panel for calculation of Time of Concentration. See 17.5.12 Time of Concentration Builder.

Horton Loss Parameters

Impervious Storage (mm) real box

Initial storage depth over the impervious catchment (mm of rainfall).

Impervious EIA fraction real box 1.0

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious Loss choice box

Soil type for the pervious catchment (Horton's infiltration loss) as defined in the 12dhydro file.

For more information on Horton's equation see 27.1.2.3.7.1 Horton Losses. *For information on defining the choices in 12dhydro file for the* **Loss** *pop-up, see*17.5.1.5 Rainfall Editor - Horton Losses.

Pervious Storage (mm) Real box

Initial storage depth over the pervious catchment (mm of rainfall).

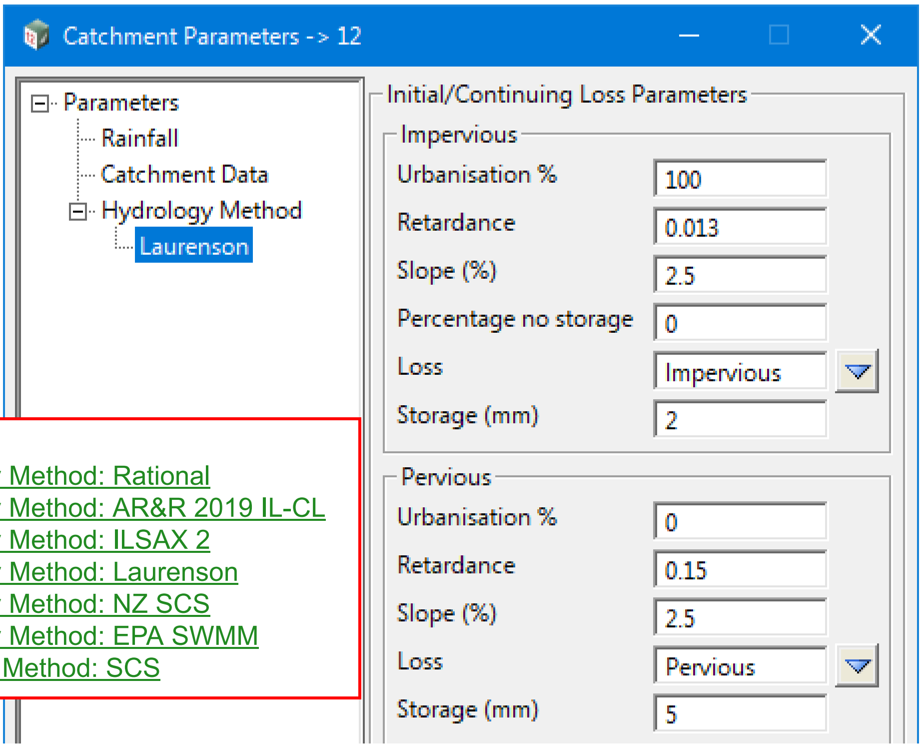
AMC Point Real box

Antecedent Moisture Condition for the catchment, prior to the storm burst. Defines the starting point on the Horton's curve.

For more information, see 27.1.2.3.2 ILSAX 2.

Continue to Hydrology Method: Laurenson or return to Catchment: Hydrology Method.

Hydrology Method: Laurenson



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **Laurenson** node which only allows Infiltration method **Initial/ Continual Losses**, are described below.

Impervious

Urbanisation % Real box 100

The percentage of the impervious catchment area that is urbanised. This is typically a model calibration parameter and does not need to match the catchment impervious percentage.

Retardance real box 0.013

Resistance to runoff for the impervious catchment area. Similar to Manning's roughness, valid within the range 0.01 to 0.10.

Slope (%) real box 2.5

Average slope of the impervious catchment, as a percentage.

Percentage no storage real box 0

Percentage of the impervious catchment which has no storage loss.

Loss real box

Initial/continuing losses for the impervious catchment, as defined in the 12dhydro file.

Storage (mm) real box

Initial storage depth over the impervious catchment (mm of rainfall). This is applied in addition to the initial rainfall losses.

Pervious

Urbanisation % real box 0

Percentage of the pervious catchment area that is urbanised. This is typically a model calibration parameter and does not need to match the catchment impervious percentage.

Retardance real box 0.10

Resistance to runoff for the pervious catchment area. Similar to Manning's roughness, valid within the range 0.01 to 0.10.

Slope (%) real box 2.5

Average slope of the pervious catchment, as a percentage.

Loss choice box

Initial/continuing losses for the pervious catchment, as defined in the 12dhydro file.

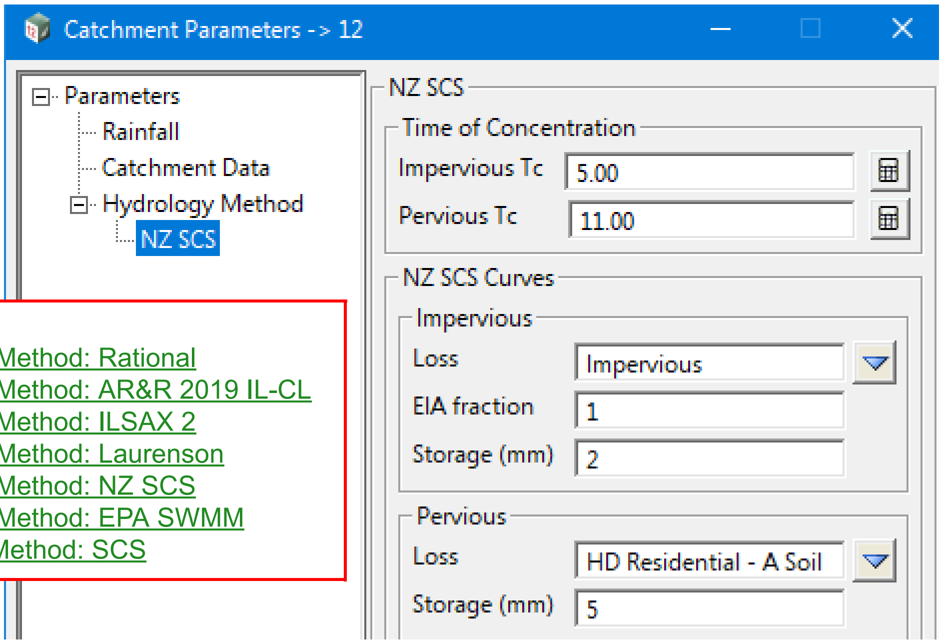
Storage (mm) real box

Initial storage depth over the pervious catchment (mm of rainfall). This is applied in addition to the initial rainfall losses.

For more information, see 27.1.2.3.6 Laurenson.

Continue to Hydrology Method: NZ SCS or return to Catchment: Hydrology Method.

Hydrology Method: NZ SCS



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side when the **NZ SCS** node is selected. For Infiltration, **NZ SCS** only uses the **SCS Curve Losses.** See 27.1.2.3.3 NZ SCS Curves.

Time of Concentration

Impervious Tc real box 5.00

Impervious catchment time of concentration (minutes).

Pervious Tc real box 10.00

Pervious catchment time of concentration (minutes).

icon

Opens the Tc Calculator panel for calculation of Time of Concentration. See 17.5.12 Time of Concentration Builder.

NZSCS Curves

Impervious

Loss choice box

Loss type for the impervious catchment (SCS Curve) as defined in the 12dhydro file.

EIA fraction real box 1.0

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Storage (mm) real box

Initial storage depth over the impervious catchment (mm of rainfall).

Pervious

Loss choice box

Loss type for the pervious catchment (SCS Curve) as defined in the 12dhydro file.

Storage (mm) real box

Initial storage depth over the pervious catchment (mm of rainfall).

For more information, see 27.1.2.3.3 NZ SCS Curves.

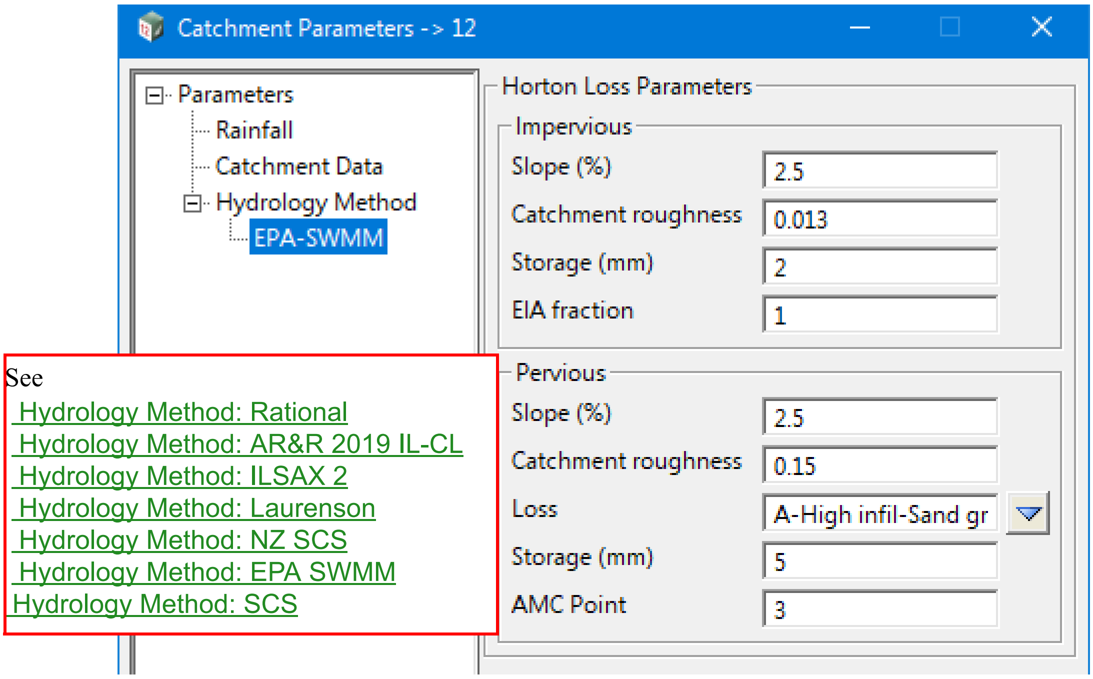
Continue to Hydrology Method: EPA SWMM or return to Catchment: Hydrology Method.

Hydrology Method: EPA SWMM

See

[Hydrology Method: EPA SWMM with Horton Infiltration]
[Hydrology Method: EPA SWMM with SCS Curves Infiltration]
[Hydrology Method: EPA SWMM with Green-Ampt Infiltration]

Hydrology Method: EPA SWMM with Horton Infiltration



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **EPA SWMM** node when the Infiltration method is set to **Horton Loss**, are described below.

Horton Loss Parameters

Impervious

Slope % real box 2.5

Impervious catchment slope (%).

Catchment roughness real box 0.013

Mannings roughness of the impervious catchment.

Storage (mm) real box 2

Initial storage depth over the impervious catchment (mm of rainfall).

EIA fraction real box 1.0

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious

Slope % real box 2.5

Pervious catchment slope (%).

Catchment roughness real box 0.01

Mannings roughness of the pervious catchment.

Loss choice box

***Soil type** for the pervious catchment as defined in the **Horton Losses** section of the **12dhydro file**.*

For more information on Horton's equation see 27.1.2.3.7.1 Horton Losses. *For information on defining the choices in 12dhydro file for the* **Loss** *pop-up, see*17.5.1.5 Rainfall Editor - Horton Losses**.**

Storage (mm) real box

Initial storage depth over the pervious catchment (mm of rainfall).

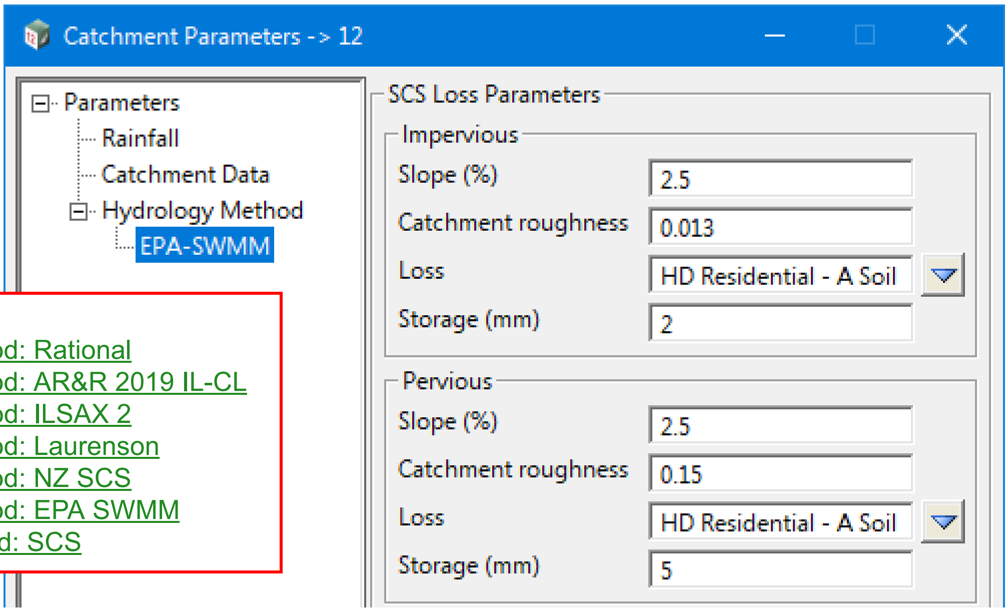
AMC Point real box

Antecedent Moisture Condition for the catchment, prior to the storm burst. Defines the starting point on the Horton's curve.

For more information, see 27.1.2.3.4 EPA SWMM.

Continue to Hydrology Method: EPA SWMM with SCS Curves Infiltration or return to Catchment: Hydrology Method.

Hydrology Method: EPA SWMM with SCS Curves Infiltration



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **EPA SWMM** node when the Infiltration method is set to **SCS Curves**, are described below.

SCS Loss Parameters

Impervious

Slope % real box 2.5

Impervious catchment slope (%).

Catchment roughness real box 0.013

Mannings roughness of the impervious catchment.

Loss choice box

Loss type for the impervious catchment (SCS Curve) as defined in the 12dhydro file.

Storage (mm) real box

Initial storage depth over the impervious catchment (mm of rainfall).

Pervious

Slope % real box 2.5

Pervious catchment slope (%).

Catchment roughness real box 0.01

Mannings roughness of the pervious catchment.

Loss choice box

Loss type for the impervious catchment (SCS Curve) as defined in the 12dhydro file.

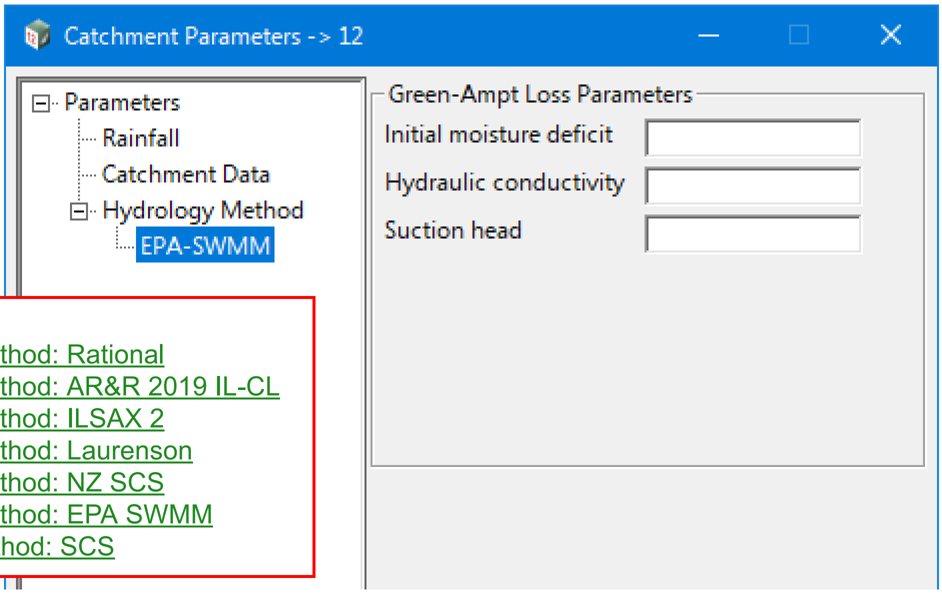
Storage (mm) real box

Initial storage depth over the pervious catchment (mm of rainfall).

For more information, see 27.1.2.3.5 SCS Curves.

Continue to Hydrology Method: EPA SWMM with Green-Ampt Infiltration or return to Catchment: Hydrology Method.

Hydrology Method: EPA SWMM with Green-Ampt Infiltration



See
 Hydrology Method: Rational
 Hydrology Method: AR&R 2019 IL-CL
 Hydrology Method: ILSAX 2
 Hydrology Method: Laurenson
 Hydrology Method: NZ SCS
 Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side of the **EPA SWMM** node when the Infiltration method is set to **Green Ampt Loss**, are described below.

Initial moisture deficit real box

Fraction of the soil that is initially dry (i.e. difference between soil porosity and initial moisture content), as used in the Green-Ampt infiltration calculations.

Hydraulic conductivity real box

Saturated hydraulic conductivity, measured in mm per hour. Represents the ease that water can travel through the soil whilst it is saturated. Tends to be high for sandy soils but low for compact clays. Used in the Green-Ampt infiltration calculations.

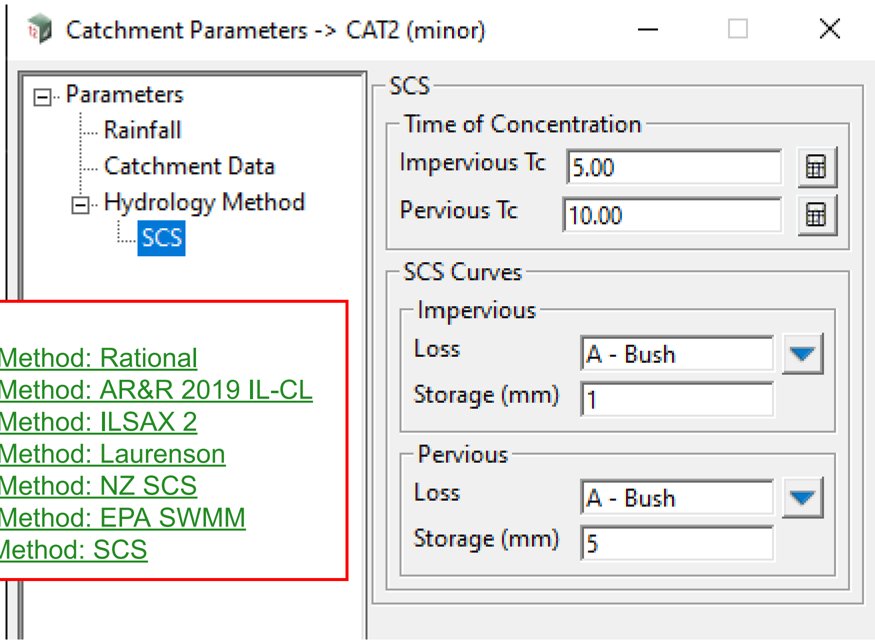
Suction head real box

Suction head, in millimeters, is the average value of soil capillary suction along the wetting front. Tends to be large for fine grain soils (i.e. clays) and smaller for sandy soils. Used in the Green-Ampt infiltration calculations.

For more information, see 27.1.2.3.4 EPA SWMM.

Continue to Hydrology Method: SCS or return to Catchment: Hydrology Method.

Hydrology Method: SCS



See
Hydrology Method: Rational
Hydrology Method: AR&R 2019 IL-CL
Hydrology Method: ILSAX 2
Hydrology Method: Laurenson
Hydrology Method: NZ SCS
Hydrology Method: EPA SWMM
Hydrology Method: SCS

The fields on the right hand side when the **SCS** node is selected. For Infiltration, **SCS** only uses the **SCS Curve Losses.** See 27.1.2.3.5 SCS Curves.

Time of Concentration

Impervious Tc real box 5.00

Impervious catchment time of concentration (minutes).

Pervious Tc real box 10.00

Pervious catchment time of concentration (minutes).

icon

Opens the Tc Calculator panel for calculation of Time of Concentration. See 17.5.12 Time of Concentration Builder.

SCS Curves

Impervious

Loss choice box

Loss type for the impervious catchment (SCS Curve) as defined in the 12dhydro file.

Storage (mm) real box

Initial storage depth over the impervious catchment (mm of rainfall).

Pervious

Loss choice box

Loss type for the pervious catchment (SCS Curve) as defined in the 12dhydro file.

Storage (mm) real box

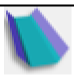
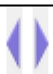
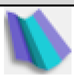
Initial storage depth over the pervious catchment (mm of rainfall).

For more information, see 27.1.2.3.5 SCS Curves.

Continue to 17.2.1.2.4 CSD Links or return to 17.2.1.2.3 CSD Nodes.

17.2.1.2.4 CSD Links

Each **Link** type has an associated icon so it is easy to tell them apart.

	LINKS			
	Create pipe link		Edit Link	
	Create trapezoidal channel link		Edit Link	
	See less/see more links			
	LINKS (expanded)			
	Create natural channel link		Edit Link	
	Create bypass channel link		Edit Link	
	Create pump link		Edit Link	

All the **Link** buttons have a left and right click functionality defined for them.

The **Links** area is enlarged/reduced in size by clicking the **See less/see more nodes** buttons.

Hovering over any of the **Link** button shows the button operations in the message box at the bottom of the panel in the format **[LB] [MB] [RB]** where LB refers to a left mouse button click, MB refers to a middle mouse button click and RB refers to a right mouse button click.

For example, hovering over the **Create pipe link** button will display:

<Pipe> [create single] [create multiple] [edit]

which indicates that:

(a) a **left mouse** click will a **create** a new **pipe** either:

- *between two existing nodes. Note: the existing nodes can't be headwall.*
- *from an existing node to a new position on a view. An Headwall node is automatically placed at the new position.*
- *From a new position on the screen to an existing node. An MH node is automatically placed at the new position. Note: the existing node can't be a headwall.*

Once the first pipe is place, the option repeats until <ESC> is pressed

(b) **middle mouse** click will create a line of Links and MH nodes.

- *from an existing node to a new position on a view and an MH node is automatically placed at the new position. Another new position is then selected and a MH node is automatically created at the new position and a pipe is created between the two nodes.*

Once the first pipe is place, the option to create a new MH node and link repeats until <ESC> is pressed

and

(c) a **right mouse** click will allow **editing** of any existing Link.

The **Link** to edit is then picked and when accepted, the **Edit Link** panel for that link appears.

For information on editing a **Link** see 17.2.1.2.4.1 Editing a Link.

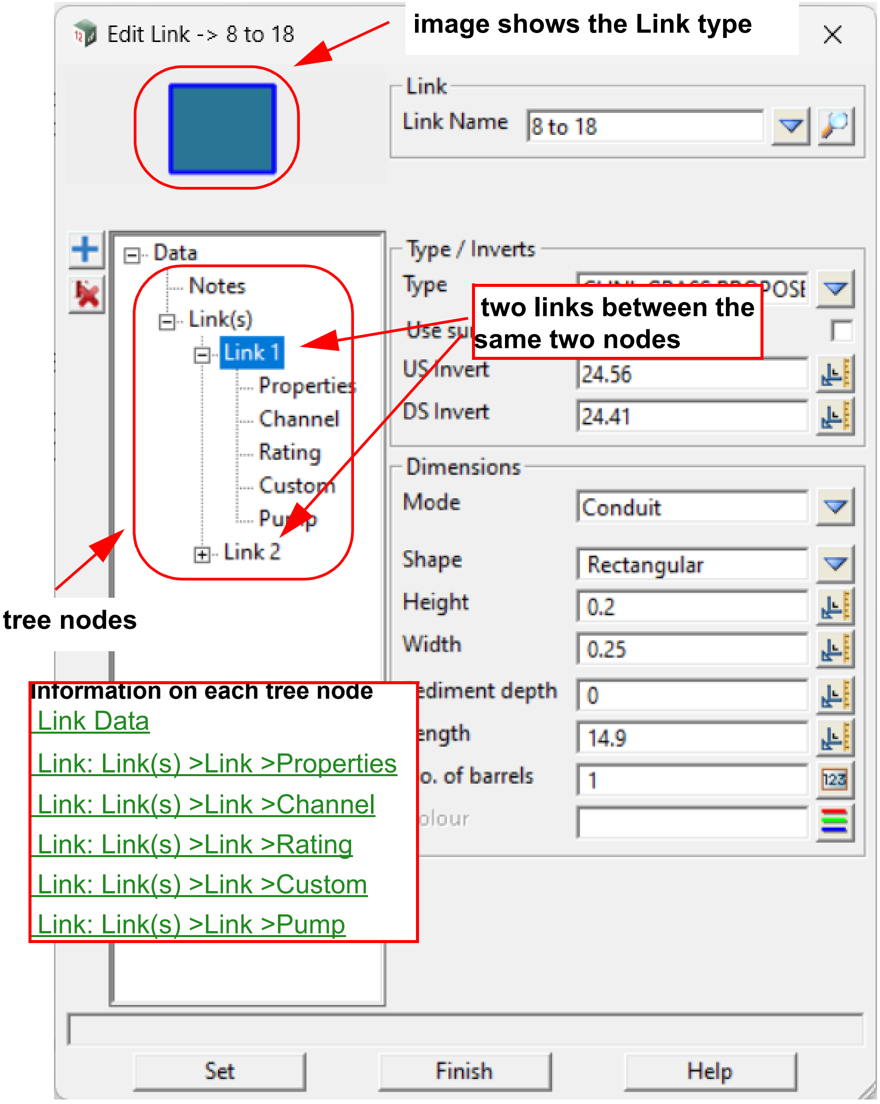
17.2.1.2.4.1 Editing a Link

After a **Link** is selected, the **Edit Link** panel comes up and the relevant data for the selected link is entered into the panel tree nodes and the associated fields.

The **Link Data** section at the top shows some information about the selected Link but also allows different Link to be selected. See Link Data.

The tree on the left hand side is dependent on the **Link** selected, and clicking on each tree node displays the information to be entered on the right had side of the panel.

The buttons at the bottom change with the **Link** type and any messages are written to the message area at the bottom of the panel.



Important Note: Dynamic analysis in ***12d Model*** allows multiple links to exist between any two **Nodes**. As can be seen in the image above, the links available between the **same two Nodes** are displayed in a tree structure with an index for each subsequent link found in the model (i.e. (1), (2) etc). Each link can have its own independent properties such as shape, invert levels and dimensions etc.

Icons on Left Side

 icon

Add another link between the upstream and downstream nodes.

 icon

Delete the currently selected link between the upstream and downstream nodes.

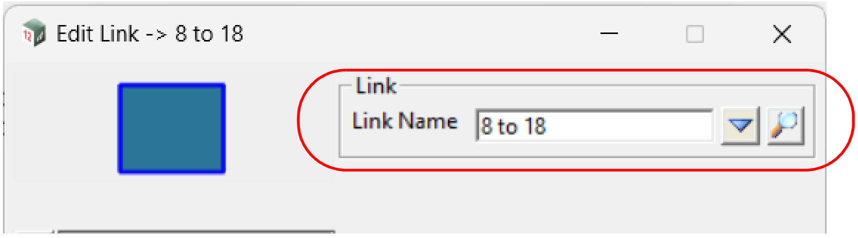
Button at Bottom

Set button

Sets the current parameters for the selected link.

Continue to Link Data or return to 17.2.1.2.4 CSD Links.

Link Data



Link Name	choice box	purple

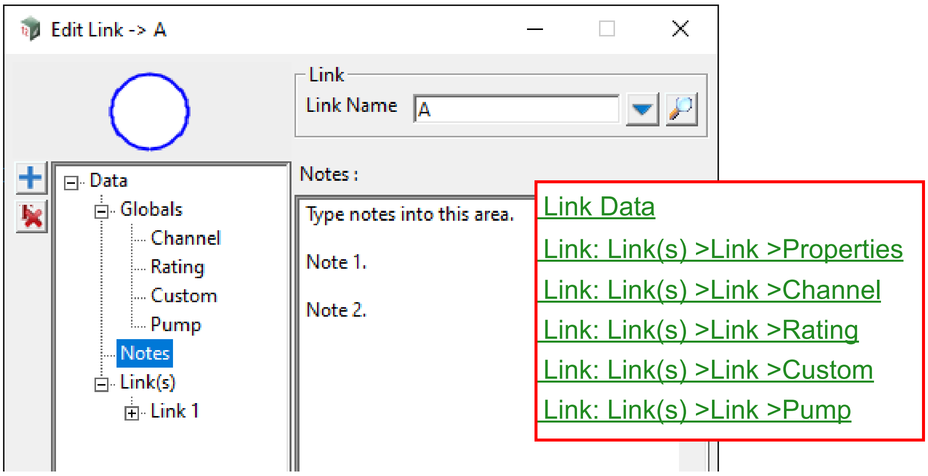
Allows selection of a link to edit.

🔍	icon	search for link

Allows for searching a link by name.

Continue to Link: Notes or return to 17.2.1.2.4 CSD Links.

Link: Notes



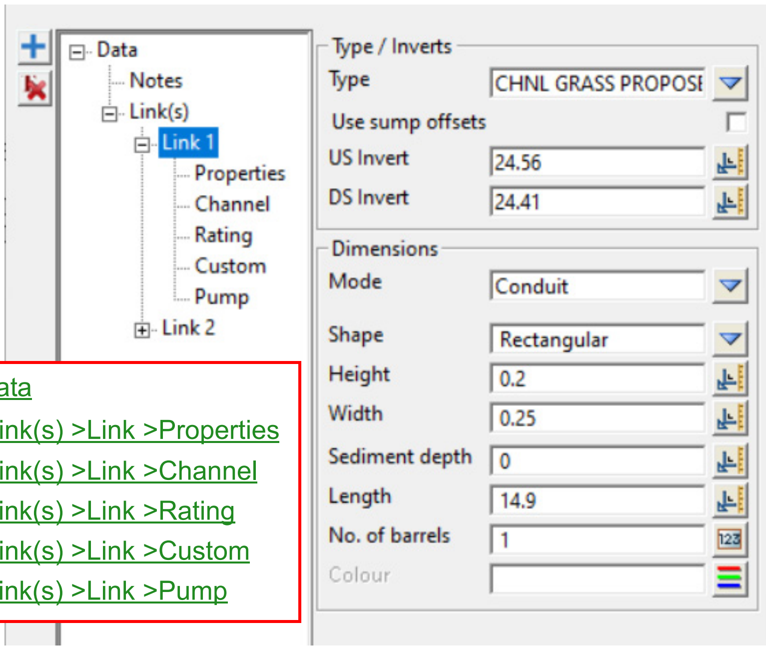
Notes can be type into the right hand side.

Continue to Link: Link(s) >Link or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link

Dynamic analysis in ***12d Model*** allows multiple links to exist between any two Nodes. As can be seen in the image below, the links available between the same **two Nodes** are displayed in a tree structure with an index for each the first link as **Link 1** and the second link as **Link 2**.

Each link can have its own independent properties such as shape, invert levels and dimensions etc.



Link Data
Link: Link(s) >Link >Properties
Link: Link(s) >Link >Channel
Link: Link(s) >Link >Rating
Link: Link(s) >Link >Custom
Link: Link(s) >Link >Pump

Type / Inverts

Type choice box

Link type (as defined in the drainage.4d) for the link.

Use sump offsets tick box not ticked

Switches between Invert levels and sump offsets. Sump offsets will allow your invert levels to be automatically set from the sump elevation at the upstream or downstream node. Otherwise, US and DS Invert elevations need to be explicitly set.

US Invert real box

*Upstream invert elevation to use for the link. Only available when **Use sump offsets** is **NOT** selected.*

DS Invert real box

*Downstream invert elevation to use for the link. Only available when **Use sump offsets** is **NOT** selected.*

US Offset real box

*Offset the link upstream invert elevation by the nominated value from the upstream node sump elevation. Only available when **Use sump offsets** is **selected**.*

DS Offset real box

*Offset the link downstream invert elevation by the nominated value from the downstream node sump elevation. Only available when **Use sump offsets** is **selected**.*

Dimensions

Mode choice box Conduit, Weir, Orifice, Basin link (non-hydraulic), Pump, Rating Curve

Hydraulic mode to use for the link.

Shape choice box

Shape to use for the link. Only available for a ***hydraulic*** *mode of "****Conduit****", "****Weir****" and "****Orifice****".*

Conduit *mode choices are:*

Circular	*Rectangular*	*Trapezoidal*
Channel	*Egg*	*Horseshoe*
Gothic	*Catenary*	*Semi circular*
Triangular	*Parabolic*	*Horiz ellipse*
Vert ellipse	*Arch*	*Rect open*
Rect triangular	*Rect round*	
Basket handle	*Mod basket handle*	
Power	*Custom*	

For information of what is needed for each ***Conduit*** *mode, see* Conduit Mode Fields.

Orifice *mode choices are:*

Circular *Rectangular*

For information of what is needed for each ***Orifice*** *mode, see* Other Mode Widgets.

Weir *mode choices are:*

Rectangular *Trapezoidal* *Triangular*

For information of what is needed for each ***Orifice*** *mode, see* Weir Mode Fields.

Also see 17.1.4.2.1 Link Shapes.

Height real box

Maximum vertical dimension (m or ft) of the **Shape** *defined above (or diameter for a circular conduit shape).*

Width real box

Maximum horizontal width (m or ft) of the **Shape** *defined above.*

Sediment depth real box 0

*Depth of sediment blockage to be used for the link during analysis, in metres. Only available for a hydraulic mode of "****Conduit****".*

Length real box

Conduit length, in metres.

No. of barrels integer box 1

Number of barrels to use for the link. This is for the selected link only, and is independent of duplicate links between the upstream and downstream nodes.

Colour colour box available colours

Colour to use for the link.

Note: There are many other Dimensions-related widgets which have their visibility changed by settings on the Mode and Shape widgets. The table below provides a summary of how the widgets are displayed for a Conduit mode relative to the Shape of the link.

Conduit Mode Fields

Note: All dimensions are in metres unless noted otherwise.

Shape	Widgets available	Description
Circular	**Diameter**	Link diameter
Rectangular	**Height** **Width**	Link height Link width
Trapezoidal	**Maximum height** **Base width** **Top width**	Maximum height of the trapezoidal link The bottom width of the trapezoidal link The top width of the trapezoidal link
Channel	**Maximum height** **Maximum width** **Top width** **Section shape**	Displays the height of the link set in the Channel tab Displays the maximum width of the link set in the Channel tab Displays the width at the top of the channel set in the Channel tab Allows the section shape to be chosen from a list of choices
Egg	**Maximum height**	Maximum height of the link
Horseshoe	**Maximum height**	Maximum height of the link
Gothic	**Maximum height**	Maximum height of the link
Catenary	**Maximum height**	Maximum height of the link
Semi elliptical	**Maximum height**	Maximum height of the link
Semi circular	**Maximum height**	Maximum height of the link
Triangular	**Maximum height** **Top width**	Maximum height of the link Width of the top of the triangle
Parabolic	**Maximum height** **Top width**	Maximum height of the link Width of the top of the parabola
Horiz ellipse	**Maximum height** **Maximum width**	Maximum height of the link Maximum width of the link
Vert ellipse	**Maximum height** **Maximum width**	Maximum height of the link Maximum width of the link
Arch	**Maximum height** **Maximum width**	Maximum height of the link Maximum width of the link
Rect open	**Maximum height** **Width**	Maximum height of the link Width of the link
Rect triangular	**Maximum height** **Triangle height** **Top width**	Overall height of the link. Should be greater than the triangle height. Height of the triangular bottom of the shape Width of the rectangular top of the shape
Rect round	**Maximum height** **Bottom radius** **Top width**	Overall height of the link. Should be greater than the bottom radius. Radius of the circular bottom of the shape Width of the rectangular top of the shape
Basket handle	**Maximum height**	Maximum height of the link
Mod basket handle	**Maximum height** **Top radius** **Bottom width**	Overall height of the link. Should be greater than the top radius. Radius of the circular top of the shape Width of the rectangular bottom of the shape
Power	**Maximum height** **Power** **Top width**	Overall height of the link Exponent of the curve Width of the top of the curve
Custom	Relies on the custom dimensions provided on the Custom tree page	

Weir Mode Fields

The table below shows how the fields change for **Weir mode**

Shape	Widgets available	Description
Rectangular	Maximum height Maximum width	Maximum height of the weir Maximum width of the weir
Trapezoidal	Maximum height Width Top width	Maximum height of the trapezoidal weir The bottom width of the trapezoidal weir The top width of the trapezoidal weir
Triangular	Maximum height Top width	Maximum height of the triangular weir Top width of the triangular weir

Other Mode Widgets

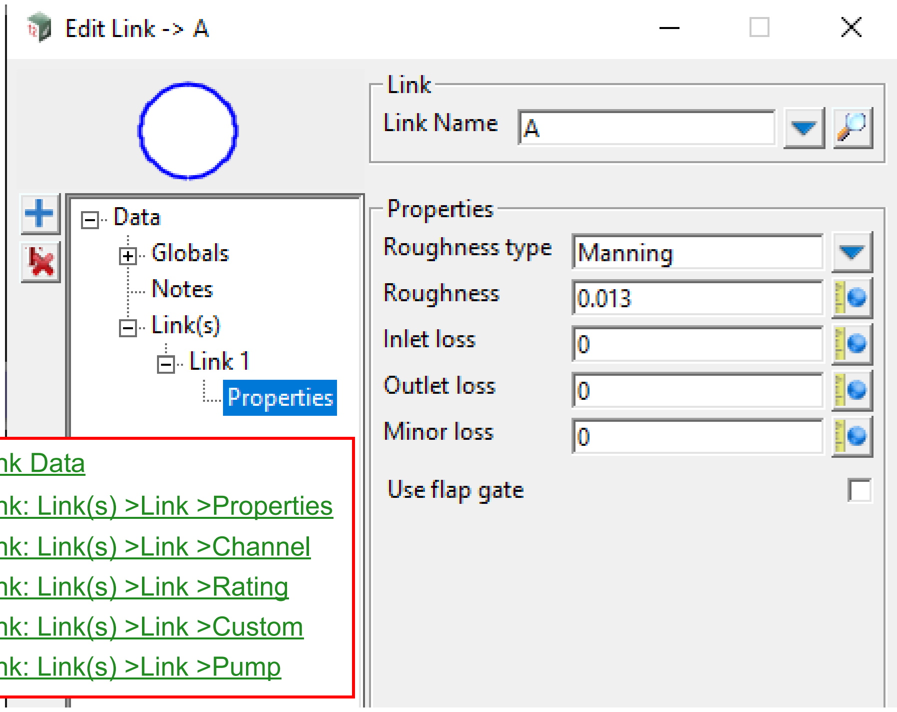
The table below shows how the fields change for other Link **hydraulic** modes

Note: The following are applicable for both Bottom outlet type orifice and Side outlet type orifice.

Mode	Shape/Type	Widgets available	Description
Orifice	Circular	Diameter	Orifice diameter
	Rectangular	Height Width	Orifice height Orifice width
Pump	All pump types	Rising main dia.	Diameter of attached rising main
		Relies on data input on the Pump tree page	
Rating Curve	Depth discharge	Relies on data input on the Rating tree page	
	Head discharge	Relies on data input on the Rating tree page	

Continue to Link: Link(s) >Link >Properties or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link >Properties



Link Data
Link: Link(s) >Link >Properties
Link: Link(s) >Link >Channel
Link: Link(s) >Link >Rating
Link: Link(s) >Link >Custom
Link: Link(s) >Link >Pump

The link properties tree node is dynamic. That is, what appears on the right hand side depend on the hydraulic mode selected on the main tree node of the selected Link.

In the example above, the link is **Circular**.

The table below summarises the displayed widgets for each mode.

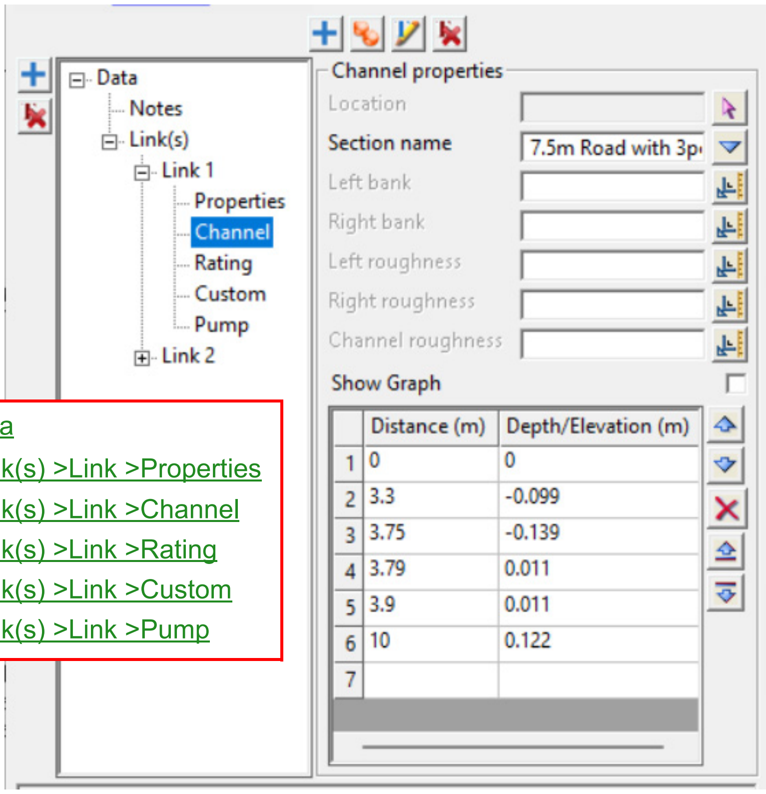
Mode	Widgets available	Description
Circular	Roughness type	Manning / Colebrook
	Roughness	Link roughness
	Inlet loss	Link inlet loss
	Outlet loss	Link outlet loss
	Minor loss	Minor losses through the link
	Use flap gate	Tick box – link will operate as a flap gate
Weir	Discharge coeff	Coefficient for the bottom of trapezoidal and for rectangular weirs
	Side coeff	Coefficient for the sides of trapezoidal or triangular weirs
	Use flap gate	Tick box – link will operate as a flap gate
Orifice	Coefficient	Orifice coefficient
	Use flap gate	Tick box – link will operate as a flap gate
Pump	Roughness type	Hazen-Williams / Darcy-Weisbach
	Roughness	Link roughness value

Continue to Link: Link(s) >Link >Channel or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link >Channel

When a link has been defined as a channel-shaped conduit, the shape of the channel needs to be described for the analysis. The Channel tree node is where the data is set for this.

The fields on the **Channel** tree node are described below.



Link Data
Link: Link(s) >Link >Properties
Link: Link(s) >Link >Channel
Link: Link(s) >Link >Rating
Link: Link(s) >Link >Custom
Link: Link(s) >Link >Pump

The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Channel properties

Location select box

Allows selection of a string z-values on it to be used as the channel profile.

Section name choice box

Allows a name to be set for the channel defined in the Grid Box at the bottom of the page. Typing a new name in the choice box will create a new standard section with the dimensions in the grid.

Left bank real box

Optional distance along the channel profile for the left over bank.

Right bank real box

Optional distance along the channel profile for the right over bank.

Left roughness real box

Optional roughness value for the left over bank.

Right roughness real box

Optional roughness value for the right over bank.

Channel roughness real box

An optional roughness for the channel.

Show Graph tick box not ticked

Show the channel profile in a separate window.

Distance/Depth/Elevation Grid box

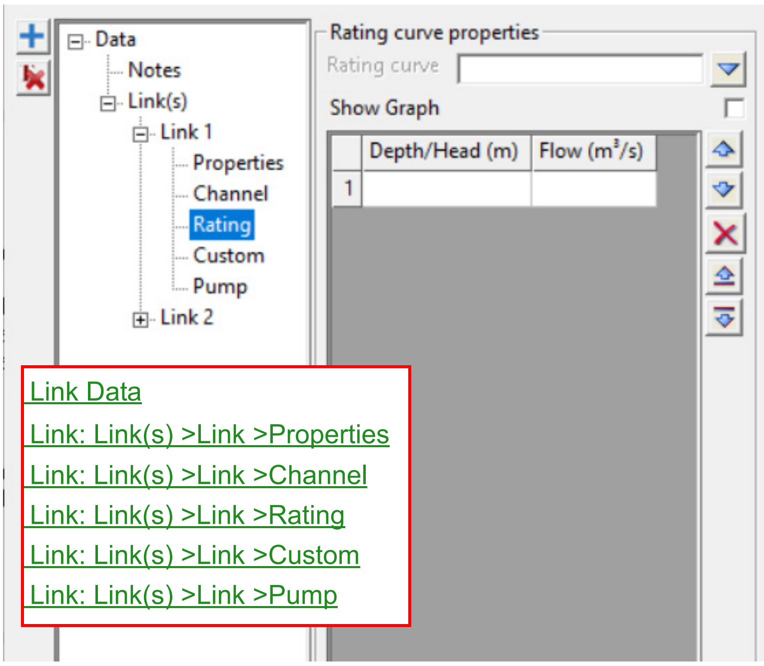
For defining the channel profile.

Continue to Link: Link(s) >Link >Channel or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link >Rating

When a link has a hydraulic mode of Rating Curve, the rating curve needs to be described for the analysis. The Rating tree page is where the data is set for this.

The widgets on the Rating page are described below.



Rating shape properties

Rating curve choice box

Rating curves can be saved with an optional name to allow use on other links, rather than defining it multiple times. Entering a name in the choice box will store the data in the grid box with that name.

Show Graph tick box not ticked

Show the rating curve in a separate window.

Depth/Head/Flow grid box

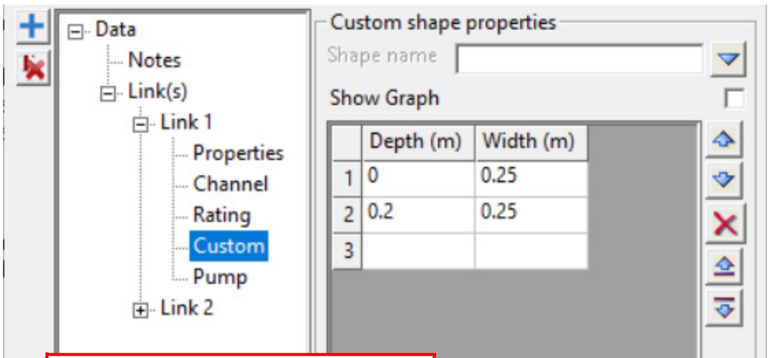
Data for the rating curve. As the data is updated a graph will show beside the panel with a graphical representation of the rating curve.

Continue to Link: Link(s) >Link >Custom or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link >Custom

When a link has been defined as a custom-shaped conduit, the custom shape needs to be described for the analysis. The Custom tree page is where the data is set for this.

The widgets on the Custom page are described below.



Link Data
Link: Link(s) >Link >Properties
Link: Link(s) >Link >Channel
Link: Link(s) >Link >Rating
Link: Link(s) >Link >Custom
Link: Link(s) >Link >Pump

Custom shape properties

Shape name choice box

Custom shapes can be saved with an optional name to allow use on other links, rather than defining it multiple times. Entering a name in the choice box will store the data in the grid box with that name.

Show Graph tick box not ticked

Shows the custom in a separate window.

Depth/Width grid box

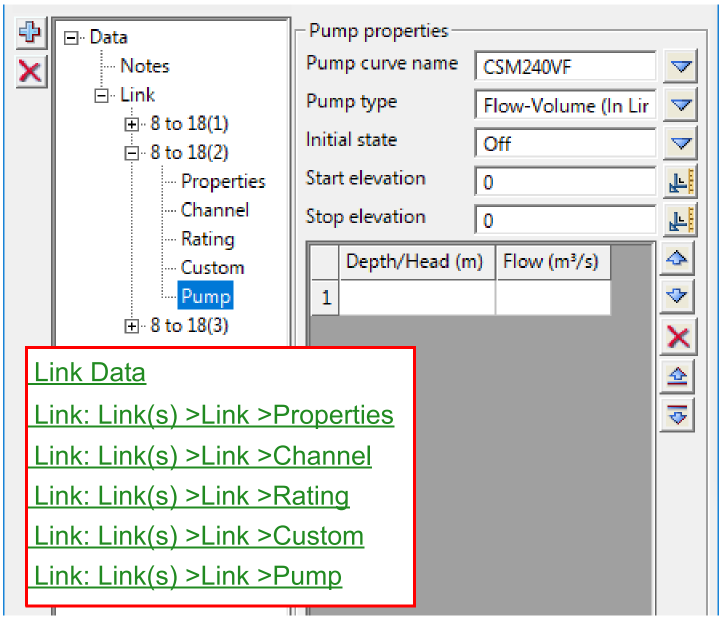
Data for the custom shape. Shapes are treated as symmetric, with only half of the shape (i.e. Left side) defined in the grid. As the data is updated a graph will show beside the panel with a graphical representation of the conduit shape.

Continue to Link: Link(s) >Link >Pump or return to 17.2.1.2.4 CSD Links.

Link: Link(s) >Link >Pump

Data for the rating curve. As the data is updated a graph will show beside the panel with a graphical representation of the rating curve.

The fields on the **Pump** tree node are described below.



Pump properties

Pump curve name choice box

Pump curves are typically stored in the 12dhydro file and the choice list is populated from there. Entering a new name in the choice box will store the data in the grid box to the 12dhydro file under that name.

Pump type choice box

Pump type for the link. Refer to the Pumps descriptions of Section 17.3.4.6.5.1 Link >Main subtab *for further details regarding pump types.*

Initial state choice box

*Controls the state of the pump at the start of simulation. Available values are **On** and **Off**.*

Start elevation real box

Water elevation that the pump is required to switch on at.

Stop elevation real box

Water elevation that the pump is required to shut off at.

Depth/Head/Flow grid box

Data for the pump curve. As the data is updated a graph will show beside the panel with a graphical representation of the pump curve.

Continue to 17.3 Water Network or return to 17.2 Water Concept Design.

17.3 Water Network

Position of menu: **Water =>Network**

The **Water string** is used to place drainage, sewer and water supply networks within a subdivision, along highways and culverts for cross drainage. Pumps may also be included in the network.

The network is placed in three dimensions including nodes (pits, maintenance holes etc), and for sewer work, lot controls and house connections can be defined. A ***12d Model*** water string is used for all of these options.

If used in conjunction with the services on a section view, interference with neighbouring pipe strings can be taken into consideration when placing the network.

Note that the water string and plots capabilities are only available with the drainage, sewer and water supply modules, and the sewer extensions (property control, house controls and Melbourne Water plots) are only available with the sewer module.

The use of the water string for drainage and water supply is only a subset of its use for sewer so the steps for the sewer will be given since they cover drainage as well.

The sewer process consists of a number of steps (the drainage and water supply process does not use steps 3 and 4):

1. creating the water strings in the water network. See 17.3.6 Water Create.
2. vertical alignment, pipe cover and utility clash checking using the 17.3.4 Water Network Editor (WNE),
3. checking that residential blocks are controlled by the sewer network
4. creating the house connections for the sewer
5. network design and analysis using custom routines, spread sheets or advanced network analysis packages via the 17.3.4 Water Network Editor (WNE)
6. producing 17.3.10 Water Network Plots (plan and long section) and 17.3.11 Water Reports (material quantity reports, excavation volumes and manhole construction reports)

These steps are described in the rest of this chapter.

The **Water Network** menu is:

Water Network	See
Water model template	17.3.1 Create/Read Water Model Template
Water string defaults	17.3.2 Water String Defaults
Quick water network	17.3.3 Quick Water Network (QWN)
Network editor	17.3.4 Water Network Editor (WNE)
String editor	17.3.5 String Editor
Delete	10.5.4 Delete
Create	17.3.6 Water Create
Convert	17.3.7 Convert Water Strings
Plan edits	17.3.8 Plan Edits
Tools	17.3.9 Water Network Tools
Plots	17.3.10 Water Network Plots
Reports	17.3.11 Water Reports
File I/O	17.3.12 Water String File I/O
Old	17.3.13 Water Network Old
User	Water String User menu

For a general description of the water string in ***12d Model***, see 17.1 Definitions for Water Strings and Networks and 17.1.2 Structure of the Water String.

For a definition of a water network and a junction in ***12d Model***, see 17.1.3 Water Networks and Junctions.

For a description of how to create and edit a water string, see 17.3.6.1 Create Water String and 17.3.6.2 Water String Edit.

17.3.1 Create/Read Water Model Template

Position of option on menu: **Water =>Water network =>Water model template**

Position of option on menu: **Water =>Setup =>Water model template**

A water model template is a 12da file that can be created or read into an existing network model.

The template file contains all the 17.3.4 Water Network Editor (WNE) attributes and information, including;

- **WNE** default values
- File associated with the defaults
- Models and file referenced as utility models.
- Hydrological and hydraulic settings

These settings are stored as model attributes.

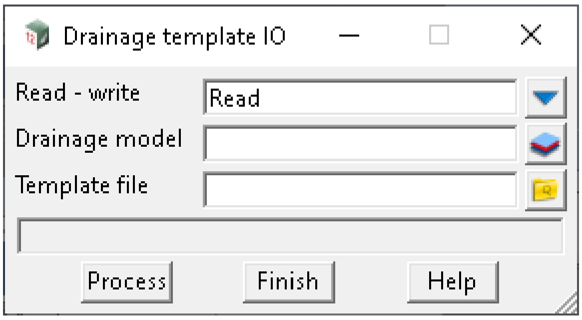
Once the template file has been created, it can be read into any water network model within any project, before or after the water strings have been created.

Reading a template file in will create a new empty model for the network if a model doesn't already exist.

A Water model template is the best way to ensure that your company standards are met, and that the correct settings will be used for the water analysis and design. The template contains information about the type of analysis you will be doing, where ***12d Model*** will find information about cover limits and drops through nodes, and much more.

Caution: Existing default and global setting may be overridden.

Selecting **Water model template** brings up the **Drainage Template I/O** panel:



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Read-write	choice box	Read	Read, Write

The read option will replace any settings in an existing drainage model. Reading a template file in will create a new empty model for the network if a model doesn't already exist.

With the write option you can write directly to the user library by prefixing the file name with $USER_LIB/

Drainage model	model box		

This model will be used as the source of the model attributes (write) or the destination (read).

Template file	file box		

File used as the source of the model attributes (read) or the destination (write).

Buttons at Bottom

Process button

*Read the template into the **Drainage model** or write a new drainage template.*

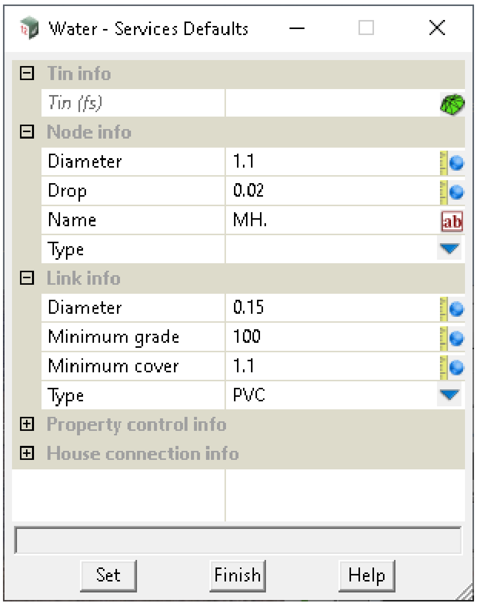
Continue to 17.3.2 Water String Defaults or return to 17.3 Water Network.

17.3.2 Water String Defaults

Position of option on menu: **Water =>Water network =>Water string defaults**

The **Water-Service Defaults** panel sets default tin, node (maintenance hole) information, drainage link information, property control (Sewer Module only) and house connection (Sewer Module only) defaults which are all used when defining water networks.

On selecting **Water string defaults**, the **Water - Services Defaults** panel is displayed.



Each of the infos are documented in individual sections

17.3.2.1 Tin Info

17.3.2.2 Node Info

17.3.2.3 Link Info

17.3.2.4 Property Control Info
17.3.2.5 House Connections Info

Button at bottom

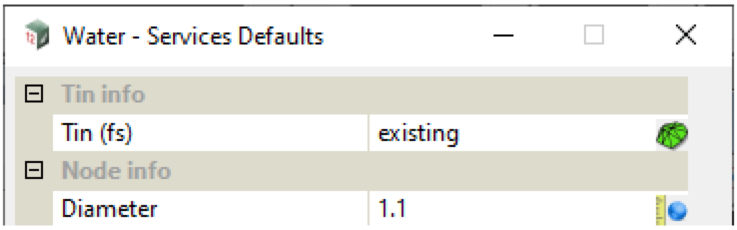
Set button

Sets the values in all the fields as the default values.

Continue to 17.3.2.1 Tin Info or return to 17.3 Water Network.

17.3.2.1 Tin Info

The field ***Tin (fs)*** is for setting the default finished surface tin in the **Create Water String** panel which is used for creating a new water string.



Field Description	Type	Defaults	Pop-Up
Tin (fs)	tin box		available tins

Tin to use as the default finished surface tin.

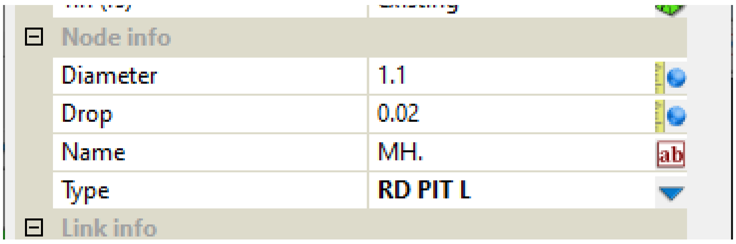
When doing house connections, the tin to automatically add to the section view used for drawing the profile along the house connection

For the water string, the finished surface tin is used as the surface that nodes automatically sit on when z float is set on, and for defining cover when placing controls and connections.

Continue to 17.3.2.2 Node Info or return to 17.3.2 Water String Defaults.

17.3.2.2 Node Info

This section is used as defaults when creating nodes (maintenance holes etc) in a water string.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Diameter	input	1.1	

Default diameter of a water node.

Field Description	Type	Defaults	Pop-Up
Drop	input	0.02	

Default Drop (invert level difference between incoming and outgoing links, in base units) across the node

Field Description	Type	Defaults	Pop-Up
Name	input	MH.	

Default name for the node.

Note that if a node name is EOL or eol, then the diameter of the node is forced to be zero.

Field Description	Type	Defaults	Pop-Up
Type	choice box	CONC COVER	CONC COVER, GATIC etc

Default Type of the node.

A node type is selected from the pop-up list defined by the drainage.4d file. If the node is to be all user *defined, select UNKNOWN from the node type pop-up. See* 17.1.4.1.6 Node Type.

If **Use drainage.4d file** *is* ***ticked*** *in the* **String tab**, *the information in the selected node type is used to fill in many of the fields in this* ***Node*** *tab. See* 17.4.1 Drainage.4d File Editor.

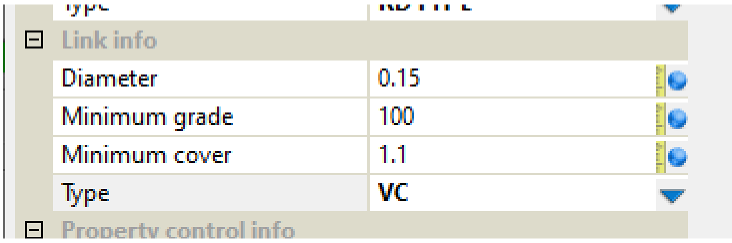
If **Use drainage.4d file** *is* ***not ticked*** *in the* **String tab**, *no information is taken from the selected node type.*

*(**??** Default cover or lid type of the nodes.* CONC COVERCONC COVER, GATIC etc
This was the doco but not what the pop-up now does.)

Continue to 17.3.2.3 Link Info or return to 17.3.2 Water String Defaults.

17.3.2.3 Link Info

This section is used for defaults when creating links (e.g.pipes) in a water string.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Diameter | real box | 0.1

Default diameter of the link.

Minimum grade | real box | 1.0

Minimum grade (measured as 1: value) used when laying down the link.

Minimum cover | real box | 1.0

Minimum cover, measured in world units from the surface to the top of the link (obvert); used when laying down the link.

Type | Link type box | PVC | Link types

Default Link type of the link. See 17.1.4.2.3 Link Type

IMPORTANT NOTE.

If the water string is laid down in the direction of flow (and hence the flow direction is in ascending chainage), then the minimum grade and minimum cover along the link are maintained as the water string is created. Otherwise the minimum grade and cover cannot be maintained.

Cover for the link segment can also be calculated and/or set afterwards by the **Link =>Cover** option in the water string editor. See 17.3.6.2.5.3 Change Cover.

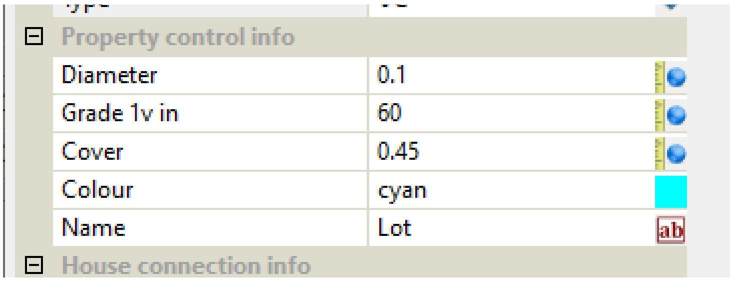
Minimum cover and minimum grade for the link segment to the end of the line can be set afterwards by the **Link =>Default grading** option in the water string editor. See 17.3.6.2.5.9 Default Grading

Continue to 17.3.2.4 Property Control Info or return to 17.3.2 Water String Defaults.

17.3.2.4 Property Control Info

On a section view, the ***Profile =>One substring*** and ***Profile =>Many substrings*** options will profile property controls. Note that the centre (axis) of the property control is drawn on the section view, not the invert (bottom) or the obvert (top).

This section is used for defaults when creating property controls in a water string.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Diameter	input	0.1	

Default diameter of the property control.

Grade 1v in	input	60	

Grade (units are "1v in" given value) to use for the property control.

Cover	input	1.0	

*Cover measured from the surface to the **top** of the property control (world units) to be maintained from the end of the property control in the house block to the drainage string.*

Colour	input	cyan	available colours

Colour to use to draw the property control.

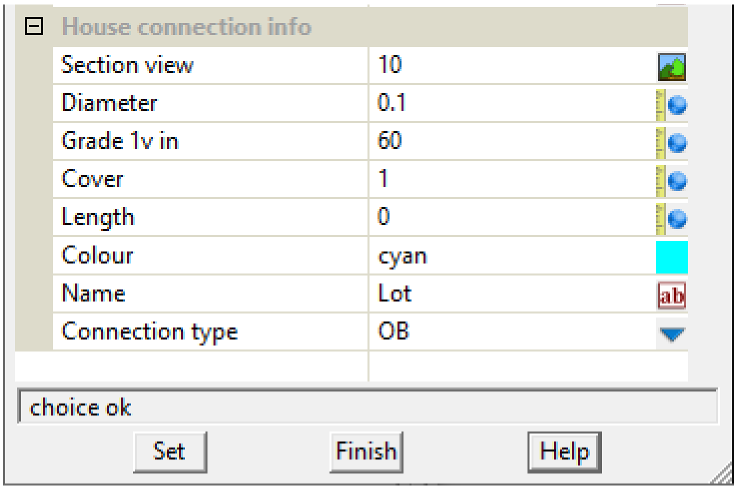
Name	input	Lot	

Name for the property control - usually the Lot number.

Continue to 17.3.2.5 House Connections Info or return to 17.3.2 Water String Defaults.

17.3.2.5 House Connections Info

This section is used for defaults when creating connections from the water link to the house blocks.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Note: the Tin (fs) (the finished surface tin) is automatically added to the section view used for drawing the profile along the house connection. See 17.3.2.1 Tin Info

Section view input

Section view used to profile along the house connections as the house connections are placed in plan view.

Diameter input 0.1

Default diameter of the house connection.

Grade 1v in input 60

Grade (units are "1v in") to use for the house connection.

Cover input 1.0

Cover (world units) to use for the house connection.

Length input 2.0

Length (metres) to use for some types of house connections.

Colour input cyan available colours

Default colour used for the house connection.

Name input Lot

Name for the house connection - usually the lot number.

Connection type input A special A, A special, B, C, OB, Special Jump Up

Default type of the house connection, Continue to the section 17.3.2.5.1 House Connection Types *for a description of each connection type.*

Button at bottom

Set button

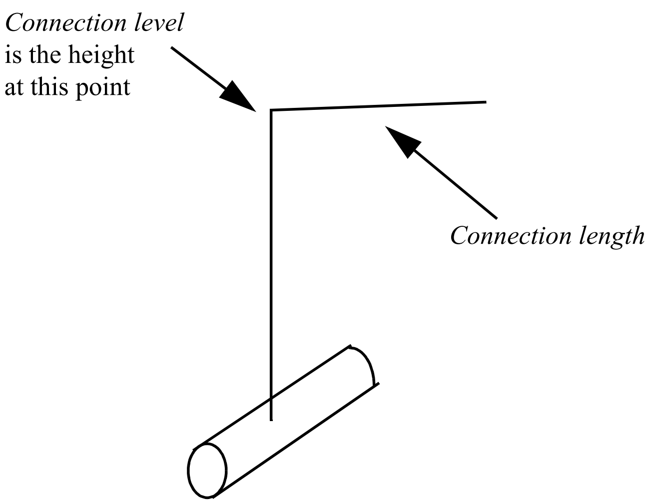
Sets the values in all the fields as the default values.

17.3.2.5.1 House Connection Types

All house connection calculations do not take into account any thickness of pipe, joint sizes or actual entry points into the sewer. Hence they are ***approximate only*** and should only ever be used as a guide. Any quantities calculations should allow for a suitable margin of error.

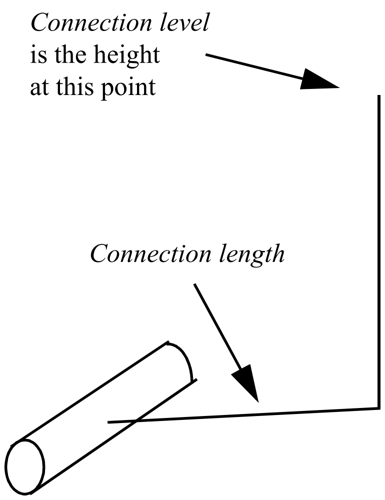
See 17.3.2.5.1.1 House Connection -Type A
See 17.3.2.5.1.2 House Connection - Type A Special
See 17.3.2.5.1.3 House Connection - Type B
See 17.3.2.5.1.4 House Connection - Type C
See 17.3.2.5.1.5 House Connection - Type Special Jump Up
See 17.3.2.5.1.6 House Connection - Type OB (Oblique)

17.3.2.5.1.1 House Connection -Type A



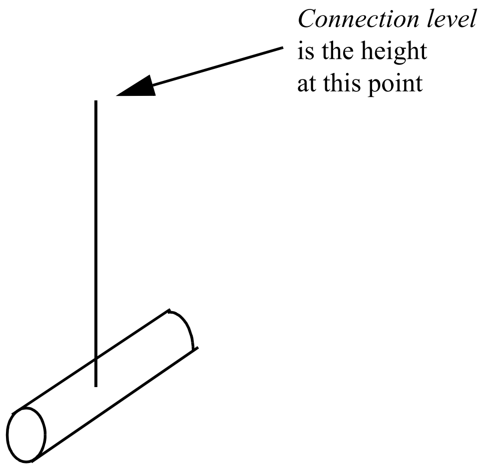
House Connection: Type A

17.3.2.5.1.2 House Connection - Type A Special



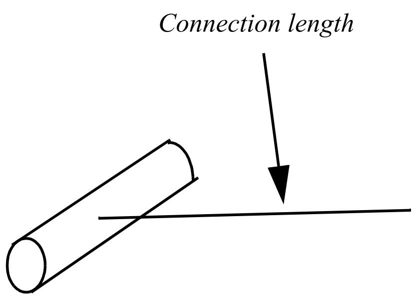
House Connection: Type A Special

17.3.2.5.1.3 House Connection - Type B



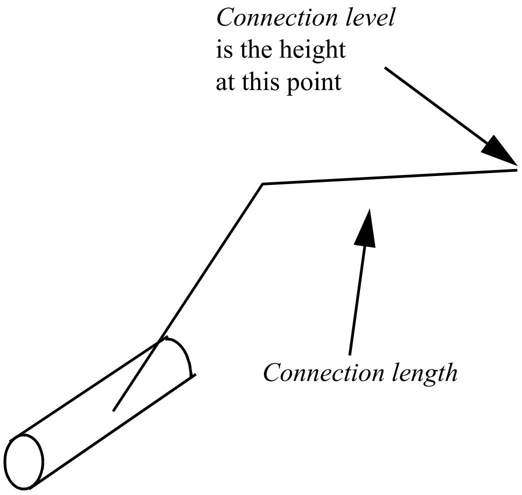
House Connection: Type B

17.3.2.5.1.4 House Connection - Type C



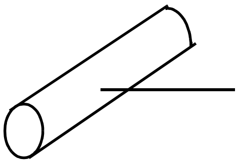
House Connection: Type C

17.3.2.5.1.5 House Connection - Type Special Jump Up



House Connection: Type Special Jump Up

17.3.2.5.1.6 House Connection - Type OB (Oblique)



House Connection: Type OB

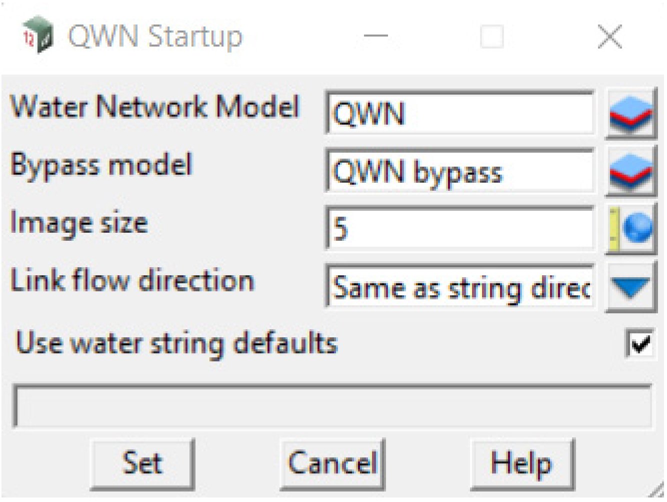
Continue to 17.3.3 Quick Water Network (QWN) or return to 17.3 Water Network.

17.3.3 Quick Water Network (QWN)

Position of menu: **Water =>Water network =>Quick water network**

Upon start-up, **QWN** will display a **defaults panel** that allows the user to specify the models and additional parameters that will be used when creating the water data and overlay.

Selecting **Quick water network** brings up the **QWN Startup** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Water Network Model	model box	CAD ControlBar Input	available models
Model used to draw all drainage data in QWN.			
Bypass model	model box	Auto populated	available models
The model used to draw all bypass strings.			
Image size	real box	5	
Set the size (m) of pit images in the overlay.			
Link flow direction	choice box	Same as string direction	opposite string direction same as string direction
Set the default flow direction for newly created drainage strings.			
Use water string defaults	tick box	not ticked	
Expands the panel to include options for specifying drainage defaults.			

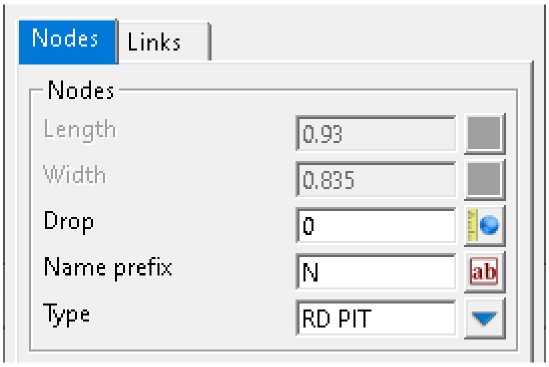
Unticking the **Use water string defaults** *tick box will expand the panel, presenting additional options.*

Nodes Tab

Note:

1. Depending on data stored within the drainage.4d for the selected node type, some boxes may be disabled.

2. 'Diameter' will automatically adjust to 'length' if a width value is specified.



Nodes Tab
Links Tab

Nodes

Diameter/length real box Drainage defaults OR drainage.4d over

Default pit diameter used when creating new nodes (depending on type, can be locked by drainage.4d) (will automatically update to 'length' if a width is specified).

Width real box Drainage defaults OR drainage.4d over

Default pit width used when creating new nodes (depending on type, can be locked by drainage.4d

Drop real box 0

Default node drop used when creating new nodes.

Name prefix input box Drainage defaults

Default name prefix assigned when creating new nodes (i.e. N1, N2…).

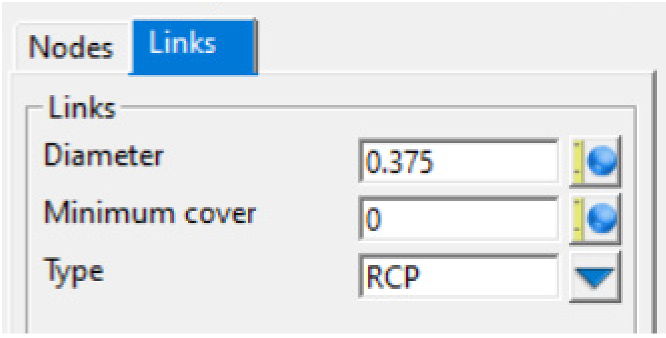
Type real box

Default node type used when creating new nodes (types list from drainage.4d). See 17.1.4.1.6 Node Type.

Links Tab

Note:

Unless a surface tin is specified, minimum cover will always default to null values.



Nodes Tab
Links Tab

Links

Diameter real box Drainage defaults

Default pipe diameter used when creating new links.

Minimum cover real box Drainage defaults

Default minimum cover used when creating new links.

Type choice box Drainage defaults

Default type used when creating new links. See 17.1.4.1.6 Node Type.

Buttons at Bottom

Set button

Accept the defaults and return to the main panel.

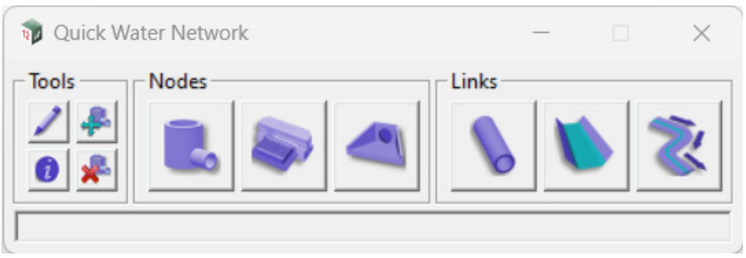
Cancel button

Close the panel and cancel the macro.

Help button 12d Reference Manual

Access this document in the reference manual.

QWN Main Panel



The main Quick Water Network panel contains 3 separate subsections:

1. Tools
2. Nodes
3. Links

Many of the buttons on this panel have additional functionality for left [LB] middle [MB] and right [RB] mouse button clicks. Hovering over any button on the panel will show the button operations in the message box at the bottom of the panel in the format [LB] [MB] [RB]. For example, hovering over the 'Node' button on the left side of the Nodes area will display:

<Node> [create] [] [edit]

which indicates that a left mouse click will create a new node, middle mouse click will do nothing, and a right mouse click will allow editing of an existing node. All buttons and their corresponding mouse click operations are described below:

Image	Left Button Click	Middle Button Click	Right Button Click	Pop-Up
	Edit Node	Defaults	Edit Link	
	No current functionality		Defaults	
	Move Node			
	Delete		Delete node + links	
NODES				
	Create node		Edit Node	
	Create inlet node		Edit Node	
	Create headwall node		Edit Node	
LINKS				
	Create single segment pipe	Create multiple segment pipe	Edit Link	
	Create single segment trapezoidal channel	Create multiple segment trapezoidal channel	Edit Link	
	Create bypass channel			

Creating any of the objects (nodes/links) enters a selection state, where a location must be specified for the new object to be placed. Note that in QWN, link vertices that are not placed on existing nodes will automatically generate a node at the selected location. Editing nodes or links will also prompt a selection, after which an edit node/edit link panel will be opened.

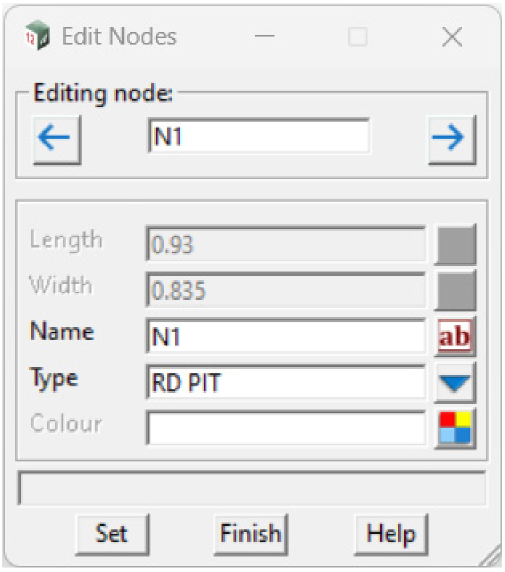
The Edit Node, Edit Link and Edit Catchment panels are described below.

Edit Node Panel
Edit Link Panel
Defaults Panel

Edit Node Panel

This panel is split into two sections - the first contains two buttons for cycling between nodes on the current model, as well as an input box that displays the name of the currently selected node. Note that selected nodes will be highlighted in green. This box may have text typed in to manually select a node by name.

The second section contains widgets that specify the water properties of the current node. Note that as in the **defaults panel**, some inputs may be locked by the drainage.4d depending on the node type selected. Diameter will also automatically update to 'length' if a width parameter is specified.



← button

Select the previous node vertex in the current water string.

→ button

Select the next node vertex in the current water string.

Editing Node: input box Selected node name

Select a node in the model by typing its name.

Diameter/Length real box Current node diameter

Set the diameter/length (whichever is relevant) of the currently selected node.

Width real box Current node width

Set the width of the currently selected node.

Name input box Current node name

Set the name of the currently selected node.

Type choice box Current node type

Set the type of the currently selected node.

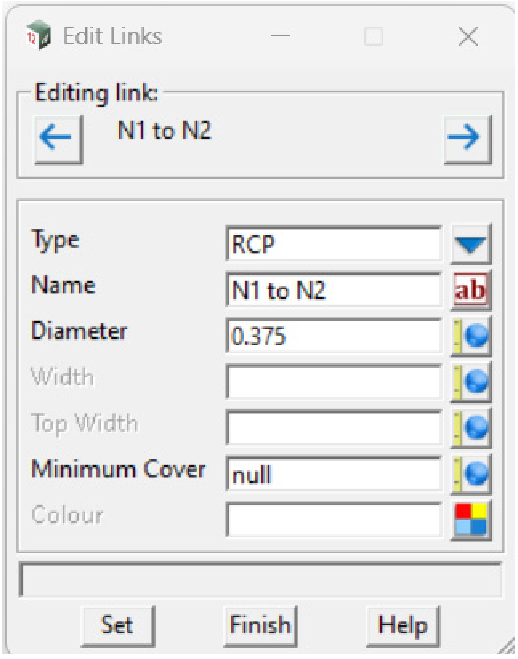
Colour colour box Current node colour available colours

Set the string colour of the currently selected node.

Edit Link Panel

This panel contains information relevant to the currently selected link. The border title on this panel will display the selected link, based on the nodes it connects. Like the edit node panel, the arrows can be used to cycle through links in the current model (current link is highlighted in green). The diameter, width, and top width boxes will automatically assign the pipe shape (either circular, rectangular or trapezoidal depending on inputs).

Note that at present, the drainage.4d overwrites do not affect the boxes in this panel but **will** affect what properties can ultimately be set (depending on pipe type selected). For a comprehensive list of predefined pipe dimensions and properties, please consult **Water -> Water Setup - > Edit drainage.4d**.



Type	choice box	Selected link type	

Set the type of the currently selected link.

Name	input box	Link name	

Set the name of the currently selected link.

Diameter/height	real box	Current link diameter	

Set the diameter of the currently selected link (used for height if a width/top width is specified).

Width	real box	Current link width	

Set the width of the currently selected link.

Top Width	real box	Current link top width	

Set the trapezoidal top width of the currently selected link.

Minimum cover	real box	Current link cover	

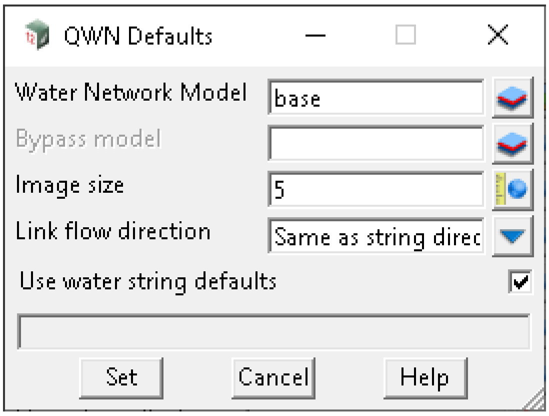
Set the cover of the currently selected link.

Colour	colour box	Current link colour	available colours

Set the string colour of the currently selected link.

Defaults Panel

Using the middle mouse button [MB] on the 'edit' button in **main panel** will open the **defaults panel**. While the water model box is disabled after start-up, all the other input fields may be changed to modify the project defaults for QWN. Note that changing defaults does **not** override the properties of any nodes/links that have already been created, but instead establishes the default properties for any future objects that are created.



Nodes tab
Links Tab

The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Water Network Model | model box | | available models

Model used to draw all data in QWN.

Bypass model | model box | Selected | available models

Defines the model to be set for a major event.

Image size | real box | 5

Set the size (m) of the node images in the overlay.

Tin | tin box

The tin for the specified model.

Image size (m) | tin box

CSD is a more visual way of viewing a drainage network. Nodes are shown as images representing their hydraulic function. The image size sets the size of node images.

Link flow direction | choice box | Same as string direction | opposite string direction
same as string direction

Display catchment images for nodes.

FS Tin | tin box

Select the finished surface tin for the drainage model.

Use water string defaults | tick box | ticked

Expands the panel to include options for specifying drainage defaults.

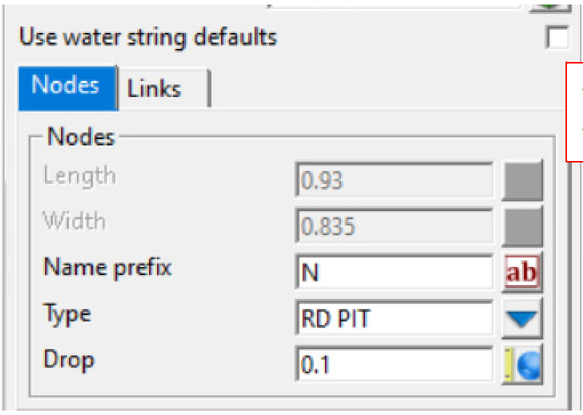
*Unticking the **Use water string defaults** tick box will expand the panel, presenting additional options. See* Nodes tab *and* Links Tab.

***Note**:*

1. Depending on data stored within the drainage.4d for the selected node type, some widgets may be disabled.

2. Diameter' will automatically adjust to 'length' if a width value is specified.

Nodes tab



Nodes tab
Links Tab

Nodes

Diameter/length real box Drainage defaults OR drainage.4d over

Default pit diameter used when creating new nodes (depending on type, can be locked by drainage.4d) (will automatically update to 'length' if a width is specified).

Width real box Drainage defaults OR drainage.4d over

Default pit width used when creating new nodes (depending on type, can be locked by drainage.4d

Name prefix input box Drainage defaults

Default name prefix assigned when creating new nodes (i.e. N1, N2…).

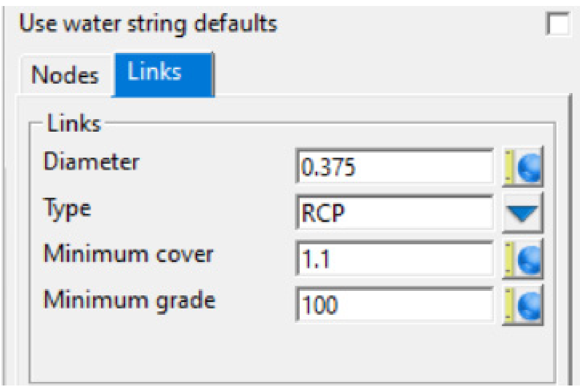
Type choice box Drainage defaults

Default node type used when creating new nodes (types list from drainage.4d). See 17.1.4.1.6 Node Type.

Drop real box Drainage defaults

Default maximum node drop between links - only available if a FS tin is selected.

Links Tab



Nodes tab
Links Tab

Links

Diameter	real box	Drainage defaults	

Default pipe diameter used when creating new links.

Type	choice box	Drainage defaults	

Default pipe type for new links.

Minimum cover	real box	Drainage defaults	

The minimum cover for new links - only available when a FS tin is selected.

Minimum grade	real box	Drainage defaults	

The minimum grade for new links - only available when a FS tin is selected.

Buttons at Bottom

Set	button		

Accept the defaults and return to the main panel.

Cancel	button		

Close the panel and cancel the macro.

Help	button		12d Reference Manual

Access this document in the reference manual.

Continue to 17.3.4 Water Network Editor (WNE) or return to 17.3 Water Network.

17.3.4 Water Network Editor (WNE)

17.3.4.1 Overview of Water Network Editor

A **Water network** consists of all the water strings in a given model (see 17.1.3 Water Networks and Junctions). Individual strings can be created using the ***Water String Editor*** and other methods (see 17.3.6 Water Create) but the **Water Network Editor** (**WNE**) works with all the water strings in the network.

The **Water Network Editor (WNE)** edits all of the water strings in a water network model and also:

(a) defines the names, types, shapes, sizes and orientations of all the nodes and links

(b) define wall thicknesses on nodes and links and define risers

(c) grade all links holistically in a network, to achieve minimum grade. cover and drop throughout

(d) establish links to design strings, catchment polygons, crossing service strings and overland flow paths

(e) create and report on setout points

(f) set up catchments and bypass flows

(g) runs rational stormwater analysis

(h) runs dynamic stormwater analysis

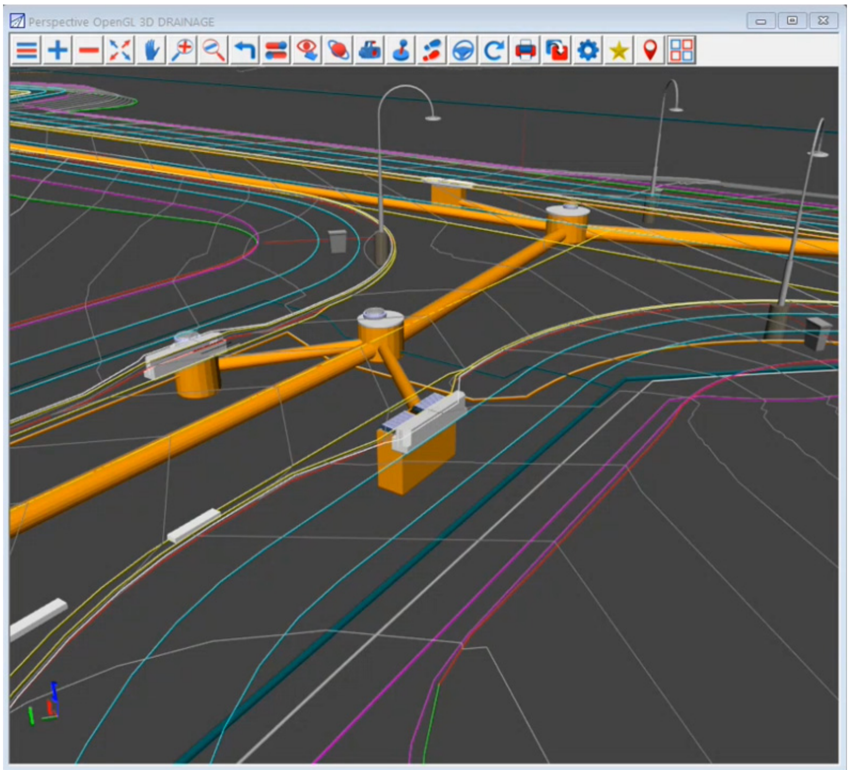
(i) runs dynamic water supply analysis

(j) produce graphs, plots and reports for the stormwater analysis

(k) produces long-section plots of water networks

(l) creates user defined attributes for nodes and links.

(m) create and synchronise attributes on all nodes and links, for 3D BIM, GIS, ADAC etc



Continue to 17.3.4.2 Network Editor.

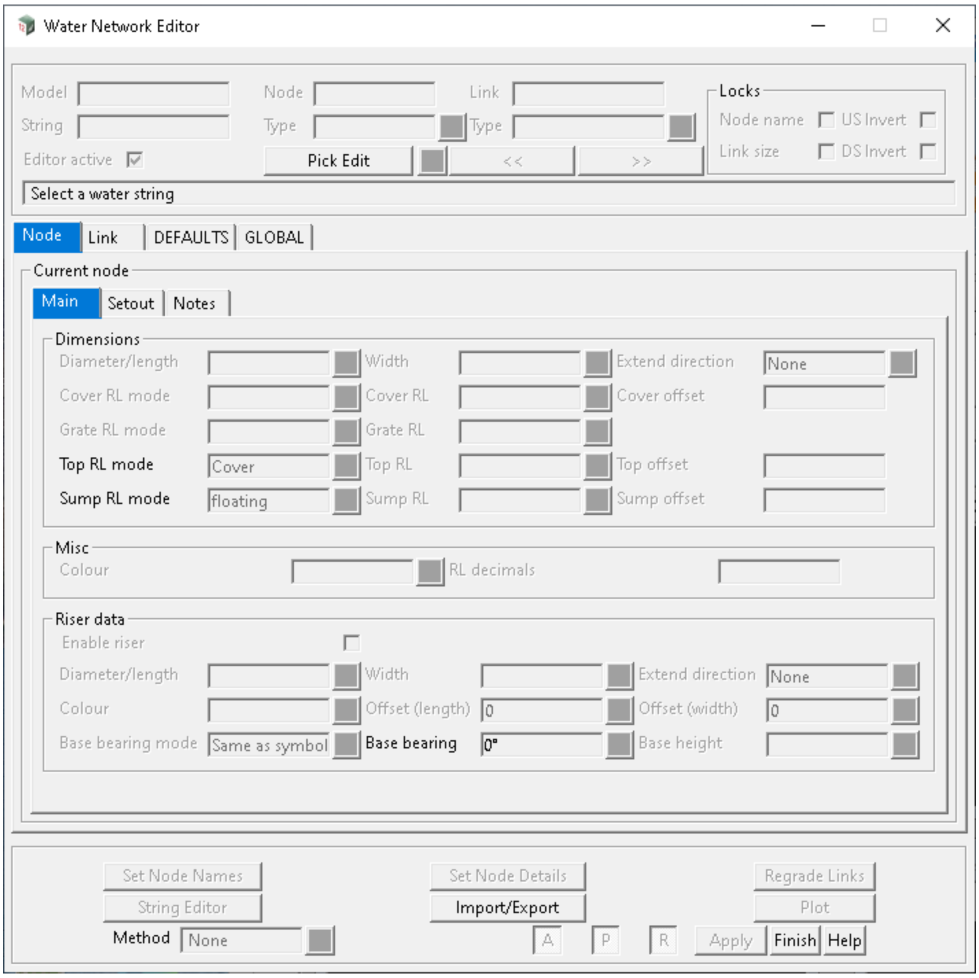
17.3.4.2 Network Editor

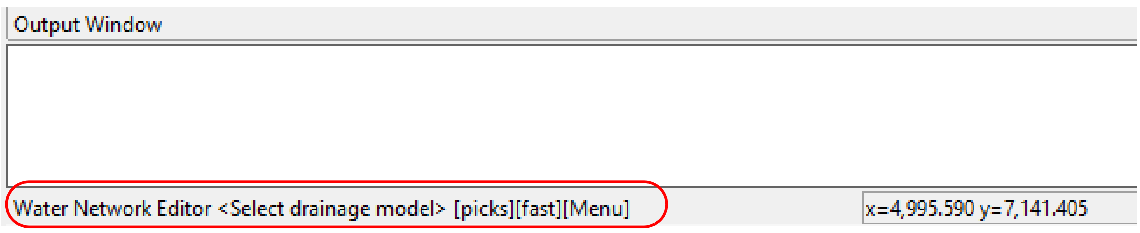
Position of option on menu: Water =>Water network =>Network editor

Position of option on menu: Water =>Foul Water =>Network editor

The 17.3.4 Water Network Editor (WNE) works with all the all the strings in the water network model (see 17.3.4.1 Overview of Water Network Editor).

Selecting **Network editor** brings up the **Water Network Editor** panel and starts the ***Select water network pick*** option:





Once a water string is selected the node closest to the selection point is highlighted with a circle and an arrow shows the direction of flow and the link being edited. See 17.3.4.3 Picking a Water Network from the WNE).

The data from the water network model containing the selected water string is loaded into the Water Network Editor ready for editing. See 17.3.4.4 The Water Network Model Loaded.

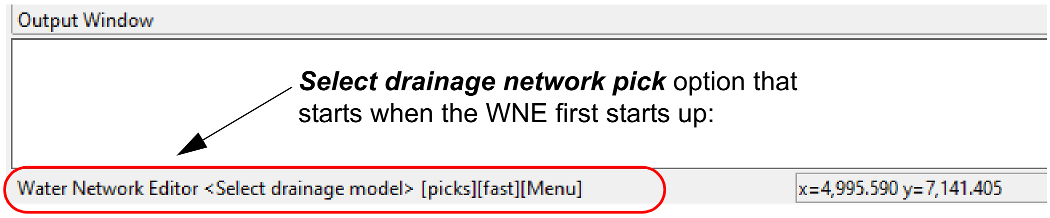
The **Water Network Editor** can have global and default settings and they may be stored and loaded via a water model template (see 17.3.1 Create/Read Water Model Template).

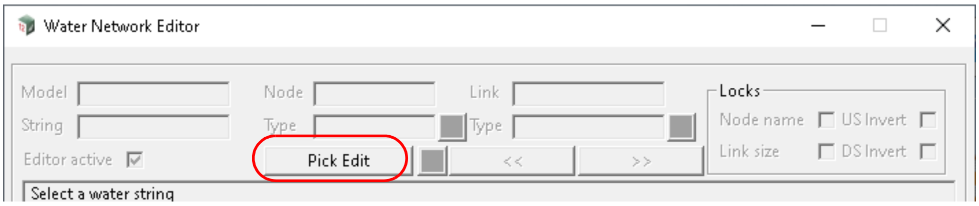
For information about the tabs and buttons on the WNE see 17.3.4.6 Tabs and Buttons on the WNE.

The ***12d Model*** output window contains significant amounts of information when using the WNE. This includes interactive Water Log Lines. See 17.3.4.7 Water Log Line (wll) Messages.

Continue to 17.3.4.3 Picking a Water Network from the WNE.

17.3.4.3 Picking a Water Network from the WNE



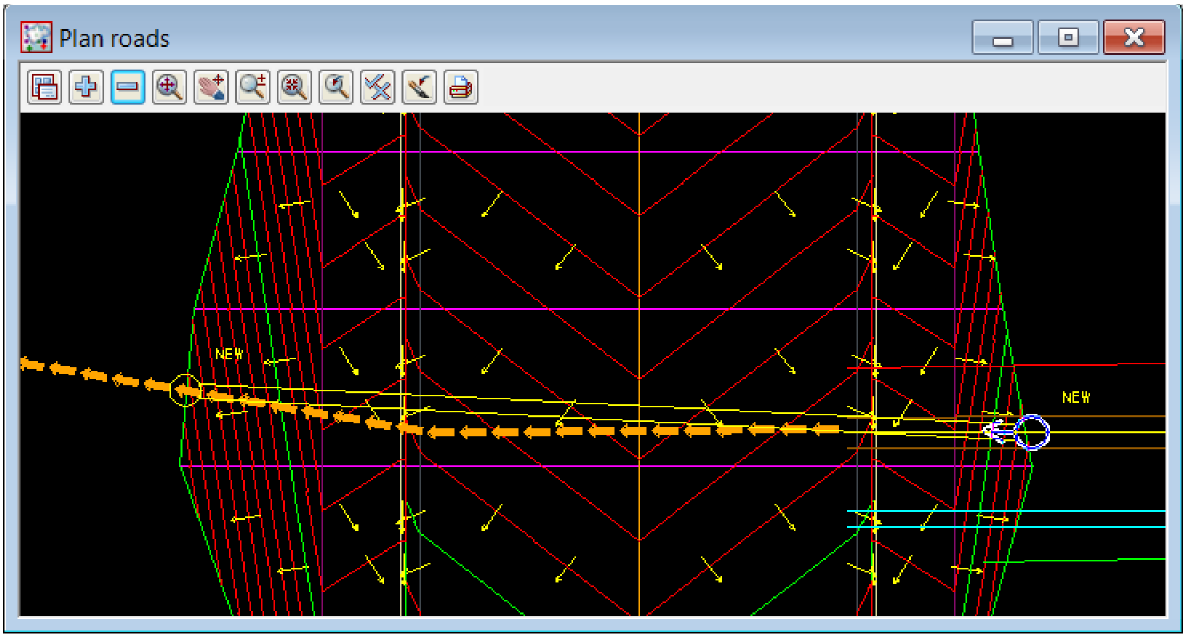


Most of the field in the **Water Network Editor** panel are not active until a water network is selected by picking a water string when the WNE is firsts started up, or later by using the **Pick Edit** button.

Pick Edit button

*Click on **Pick Edit** and then select a water string from the water network model that you want to work on and the model that contains the water string is loaded into the Water Network Editor. That model is then the Water Network being edited.*

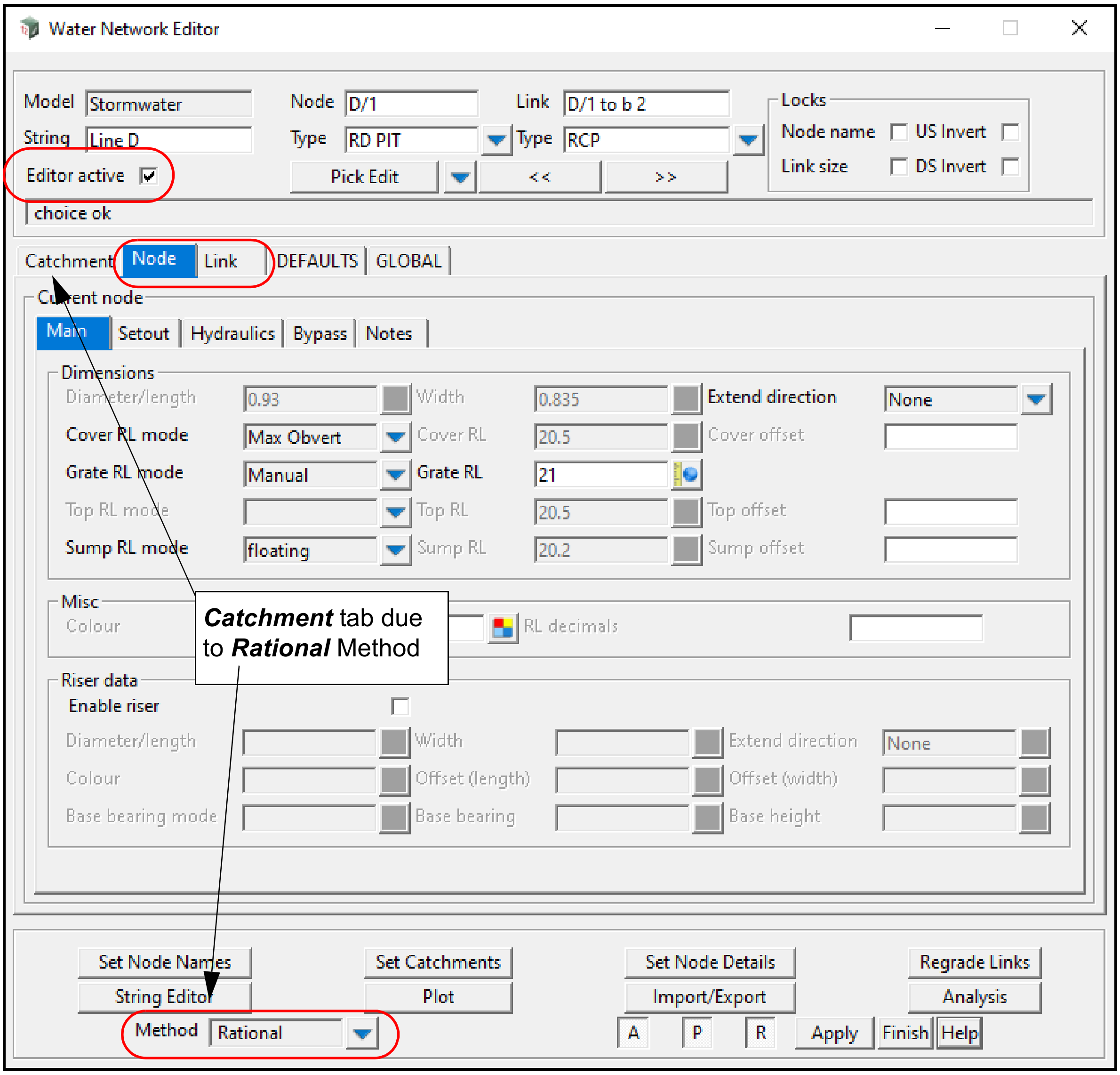
The node closest to the point selected is highlighted with a circle and an arrow shows the direction of flow and the link being edited. When an outlet is selected there is no arrow.



Continue to 17.3.4.4 The Water Network Model Loaded or return to 17.3.4 Water Network Editor (WNE).

17.3.4.4 The Water Network Model Loaded

After selecting a water string, the water network is loaded into the ***Water Network Editor*** (***WNE***) and information about the selected water string **node** and **link** is displayed in the top of the panel above the **Pick Edit** button, and in the **Node** and **Link** tabs in the WNE.



The **Editor Active** tick box is automatically ***ticked*** and the model and its strings will be **locked** so other options cannot change or delete these whilst the editor is active.

Unticking the **Editor Active** tick box will pause the WNE and release these locks so other ***12d Model*** operations can alter the model and strings. Ticking the **Editor Active** box again will resume the editing on the same node/link and lock the model and strings again.

Depending on the selection in the **Method** field at the bottom of the WNE, additional tabs and fields can appear in WNE. For example, when the **Method** is ***Rational***, there an extra **Catchment** tab and information on other tabs for defining the required hydrology and the hydraulics for the ***Rational*** method. See 17.3.4.4.1 Method field on the WNE.

See

17.3.4.5 Fields at the Top of the WNE

17.3.4.6 Tabs and Buttons on the WNE.

17.3.4.4.1 Method field on the WNE

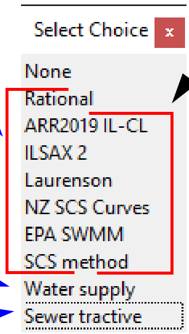
The **Method** field is very important because depending on the choice for **Method**, different WNE tabs and fields on the WNE tabs, will be added or removed. The method also determines the attribute groups where the results are stored. See Water Results Group.

Method choice box

Stormwater methods
Each method defines what is the required for the Hydrology and Hydraulics.

Water supply
Hydraulic and water quality behaviour in pressurised pipe networks

Sewer tractive
The tractive force sizing method for self cleansing sanitary system



Dynamic Stormwater methods
Each method defines what is the required for the Hydrology and Hydraulics, and also uses dynamic analysis rather than the Rational method

*If **None**:*

There is no hydrology or hydraulics calculations to be done and so there will be a minimum number of tabs and fields shown.

*If **Rational**:*

*The Hydrology is set to **12d Model**'s implementation of the rational method referencing the QUDM guidelines. See* 27.1.2.2 Rational Method Hydrology.

*If **ARR2019 IL-CL**:*

***ARR2019 IL-CL hydrology is used** See* 27.1.2.3.1 ARR2019 IL-CL. *Available loss methods are limited to Initial and Continuing Losses.*

*If **ILSAX 2**:*

***ILSAX 2 hydrology is used** (routing losses), implementing a time area method for hydrograph generation. See* 27.1.2.3.2 ILSAX 2. *Available loss methods are* 27.1.2.3.7.1 Horton Losses *and* 27.1.2.3.7.4 Initial and Continuing Losses.

*If **Laurenson:***

***The Laurenson hydrology method is used**. See* 27.1.2.3.6 Laurenson. *The only available infiltration loss method is* 27.1.2.3.7.4 Initial and Continuing Losses.

*If **NZ SCS Curves**:*

SCS hydrograph shapes with application of the SCS curve number infiltration method. Rainfall data is formatted differently for NZ than for the regular SCS Method. See 27.1.2.3.7.2 SCS Curves.

*If **EPA SWMM:***

***EPA SWMM hydrology method is used**. See* 27.1.2.3.4 EPA SWMM. *The available loss methods are* 27.1.2.3.7.1 Horton Losses *or* 27.1.2.3.7.3 Green Ampt *infiltration model.*

*If **SCS Method**:*

SCS hydrograph shapes with application of the SCS curve number infiltration method. See 27.1.2.3.7.2 SCS Curves.

*If **Water Supply:***

Allows simulation of hydraulic and water quality behaviour within pressurized pipe networks. See 17.7.2 Dynamic Water Supply**.**

*If **Sewer tractive**:*

The tractive force sizing method for self cleansing gravity sanitary systems is used. See 27.1.2.4 Sewer Tractive Force.

The term **Stormwater** methods is used for the **Rational**, **ILSAX2**, **Laurenson**, **NCS Curves**, **EPA SWMM** and **SCS** methods. These methods are for dealing with Stormwater and need Hydrology to be defined and hydraulic analysis is performed.

The **Rational Stormwater** method does not involve time. See 27.1.2.2 Rational Method Hydrology.

The term **Dynamic Stormwater** methods is used for the **ILSAX2**, **Laurenson**, **NCS Curves**, **EPA SWMM** and **SCS** methods. These methods are for dealing with Stormwater and need Hydrology to be defined but unlike the Rational method, the hydraulic analysis is a **dynamic** analysis (i.e. done over time). See 27.1.2.3 Dynamic Hydrology and 27.2.4 Dynamic Hydraulics.

Important Note:

Various WNE tabs and fields will be added or removed depending on the method selected in the **Method** field.

Water Results Group

The water results attribute group may be set via **Att group (minor or major)** on the Global-Main tab. The results below are stored in these groups (excluding DWS). The model text attribute "event type" is used to determine if the minor or major attribute group results were the last to be solved.

Rational method

Results are stored at the root level if **Att Group** is **blank**.

Dynamic Method

The water attribute results group is "dynamic" unless **Variable Temporal Patterns** is selected on the Global-Main tab. In this case the **Temporal Pattern** name is used for the results group.

Dynamic Water Supply (DWS)

The results attribute group is set via the **DWS prefix** box on the Global-Main tab.

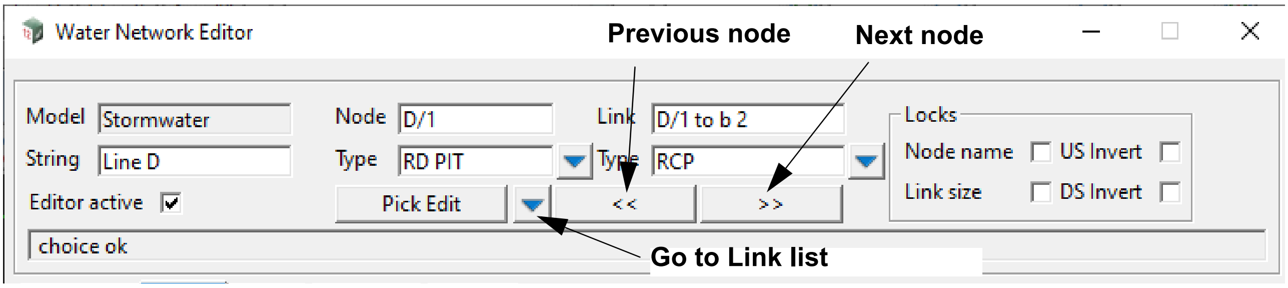
Continue to 17.3.4.5 Fields at the Top of the WNE or return to 17.3.4 Water Network Editor (WNE).

17.3.4.5 Fields at the Top of the WNE

Once a water network is picked and **Editor active** left ticked, the fields at the top of the WNE panel above the **Pick Edit** button will be filled in with information from the water network model, and the selected **node** and **link**.

The **next** (**>>**) and **previous** (**<<**) node buttons now work and take you to the next or previous node in the water string. If the editor finds an error on a node, the error must be corrected before moving to the next node.

The choice icon to the right of the **Pick Edit** button brings up a **list of links** in the network and selecting one will make it the current link in the top area and the rest of the WNE.



The fields and buttons in the top of the WNE have the following functions.

Field Description	Type	Defaults	Pop-Up
Pick Edit	button		

Used to pick a water string from any model and that model will be loaded into the WNE.
This can be used to pick water strings in the model currently being edited, or from a different model.

Model	text box	model of selected string

Name of the water network model being edited (the current model).

String	text box	name of the selected string

Name of the current water string being examined in the WNE.
The string can be renamed by typing in a new name into the field and pressing the **Set Node Details** *button.*

Node	text box

Name of the node of the current water string being examined in the WNE.

If the **Node name** ***Lock*** *is* ***not ticked,*** *then the current node can be renamed by typing a new name into the field and pressing the* **Set Node Details** *button.*

Link	text box

Name of the upstream link of the node of the selected water string.
The link can be renamed by typing in a new name into the field and pressing the **Set Node Details** *button.*

Type - under Node	node choice box

Type of the current node. See 17.1.4.1.6 Node Type.

The node type can be changed by typing/selecting a new node type into the field and pressing the **Set Node Details** *button.*

Type - under Link	link choice box

Type of the current link. See 17.1.4.2.3 Link Type.

The link type can be changed by typing/selecting a new link type into the field and pressing the **Set Node Details** *button.*

Locks

*Lock values refer to the **current node** and **link**.*

The **Link size**, **US invert** *and* **DS invert** *locks can be used to constrain the water network but that may mean that some resizing and analysis options can not solve.*

Node name tick box

*If **ticked**, the* **Set Node Names** *button can't change the node name for the current node.*

Unique pit names are important and can be set automatically using **Set Node Names.**

Link size tick box

*If **ticked**, the link size can't be changed for the current link.*

US invert tick box

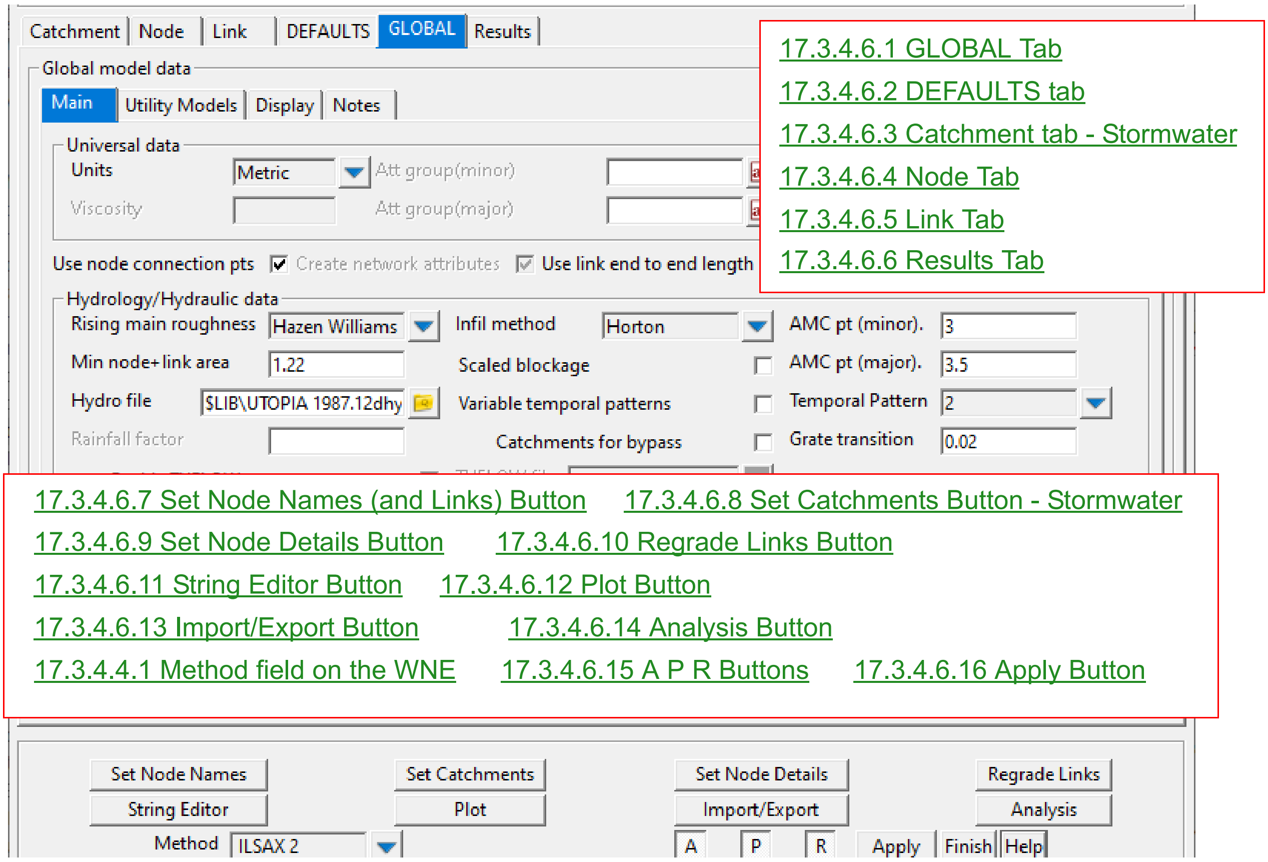
*If **ticked**, the upstream invert can't be changed for the current link.*

DS invert tick box

*If **ticked**, the downstream inverts can't be changed for the current link.*

Continue to 17.3.4.6 Tabs and Buttons on the WNE or return to 17.3.4 Water Network Editor (WNE).

17.3.4.6 Tabs and Buttons on the WNE



17.3.4.6.1 GLOBAL Tab
17.3.4.6.2 DEFAULTS tab
17.3.4.6.3 Catchment tab - Stormwater
17.3.4.6.4 Node Tab
17.3.4.6.5 Link Tab
17.3.4.6.6 Results Tab

17.3.4.6.7 Set Node Names (and Links) Button
17.3.4.6.8 Set Catchments Button - Stormwater
17.3.4.6.9 Set Node Details Button
17.3.4.6.10 Regrade Links Button
17.3.4.6.11 String Editor Button
17.3.4.6.12 Plot Button
17.3.4.6.13 Import/Export Button
17.3.4.6.14 Analysis Button
17.3.4.4.1 Method field on the WNE
17.3.4.6.15 A P R Buttons
17.3.4.6.16 Apply Button

17.3.4.6.1 GLOBAL Tab

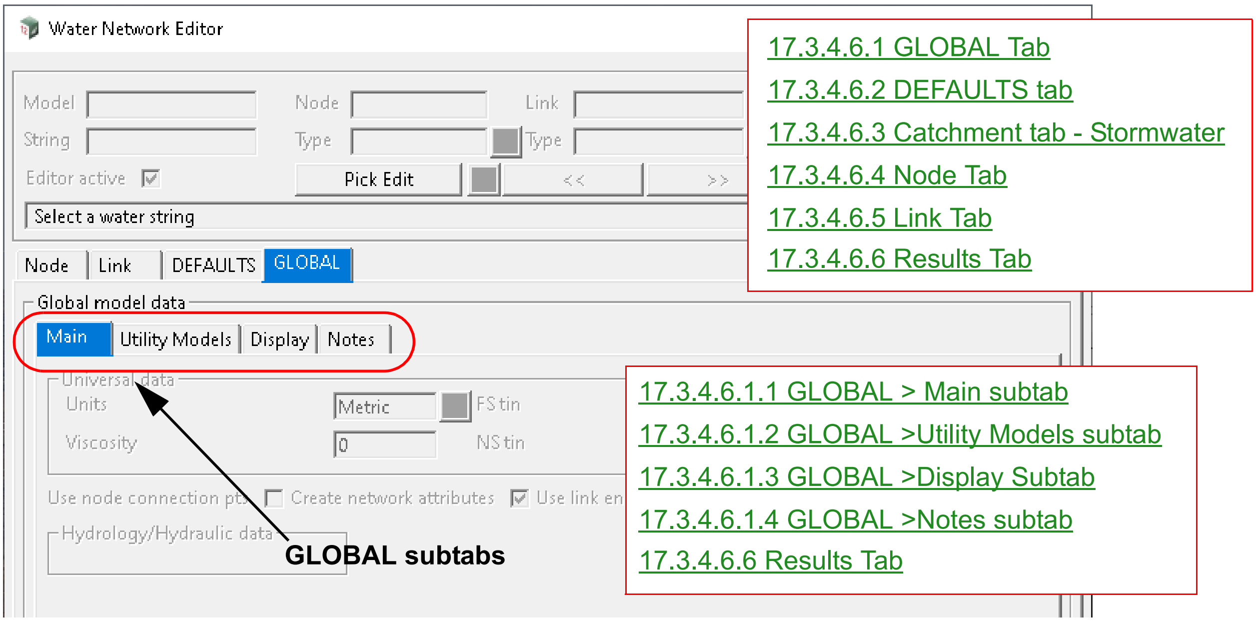
All values on this tab are set only once for the entire network (model). In contrast the values on the **Default** tab may be changed on any **node** or **link**.

The values for **GLOBAL** are either stored with the water network model or on every string in the model.

The values for **GLOBAL** may be read in or saved from user defined files before or after the string have been added to the model. See 17.3.1 Create/Read Water Model Template.

Special attention should be given to the **Method** selected in the **Method** field as changing the method option will enable/disable many of the fields on the WNE.

For example, selecting **Sewer tractive**, any of the dynamic analysis options (**ILSAX 2**, **Laurenson, NZ SCS curves, EPA SWMM**, **SCS method** or **Water Supply**) will result in additional tabs and fields been added to the WNE.



17.3.4.6.1.1 GLOBAL > Main subtab

Depending on the **Method** selected in the **Method** field, the fields on the **GLOBAL >Main** subtab will vary.

For all methods except **Water Supply**, the data described in 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section is identical.

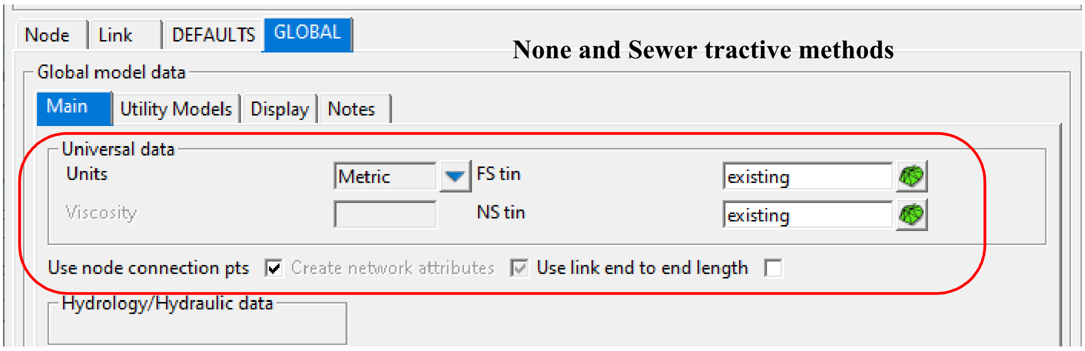
What other fields exist depends on the Method.

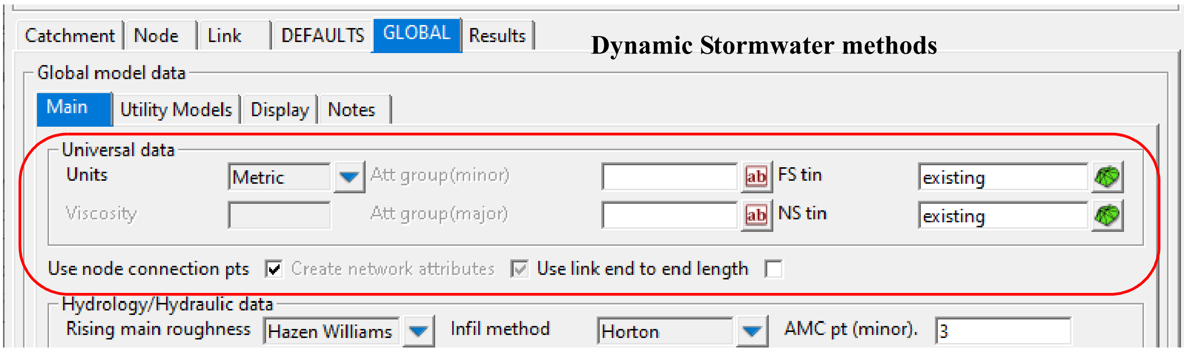
*For a description of the **GLOBAL >Main** subtab, see*

17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section
17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational
17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater
17.3.4.6.1.1.4 GLOBAL > Main subtab - Sewer tractive

For **Water Supply**, some of the fields are the same as for **None** but there are also some different fields. See 17.7.2.3.1.1 WS Global >Main

17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section





Universal data section

Units choice box

*If **Metric**, Catchment areas are in ha and rainfall-infiltration-storage is in mm*

*If **US**, Catchment areas in acres and rainfall-infiltration-storage in inches'*

Viscosity real box

Used with Colebrook-White energy loss calculations

Att group (minor) text box

Results from the storm analysis (minor event) may be contained within this node/link attribute group

Att group (major) text box

Results from the storm analysis (major event) may be contained within this node/link attribute group

FS tin tin box

Finished surface tin - used for determining link cover and surface levels for the nodes.

NS tin tin box

Natural surface tin - specified so that it can be included on the water longsection plots

Use node connection pts tick box

*If **ticked**, the links connect at the node connection points. See* 17.3.4.6.1.1.1.1 Node Connection Points *for more details.*

*If **not ticked**, links connect at the centre of the nodes.*

Create network attributes tick box

This tick box is for internal use and under almost all conditions if forced to be on.

*If **ticked** it creates a network attributes folder for every node and link in the network with data pertaining to link connectivity. This data is being gradually superseded as development continues on the dynamic drainage module and will eventually be completely removed.*

Use link end to end length tick box

*If **not ticked**, link lengths are calculated as the change in chainage (plan distance) between **node centres**.*

*If **ticked**, selected, link lengths are calculated as the change in chainage between the* 17.1.4.3 Node Connection Points for Links *(if used) or the intersection of the link with the inside edge of the node. This will result in a different link length (shorter) and link grade (flatter) than if not ticked.*

***Note:** Link grade has been traditionally measured based on the horizontal distance from **node centre to node centre.** However, this causes issues with surveyors when they use electronic models to set out the pipes as they required the actual length of the link and the actual grade of the link. For this case, **Use link end to end length** is ticked.*

For the extra fields for other Methods, see

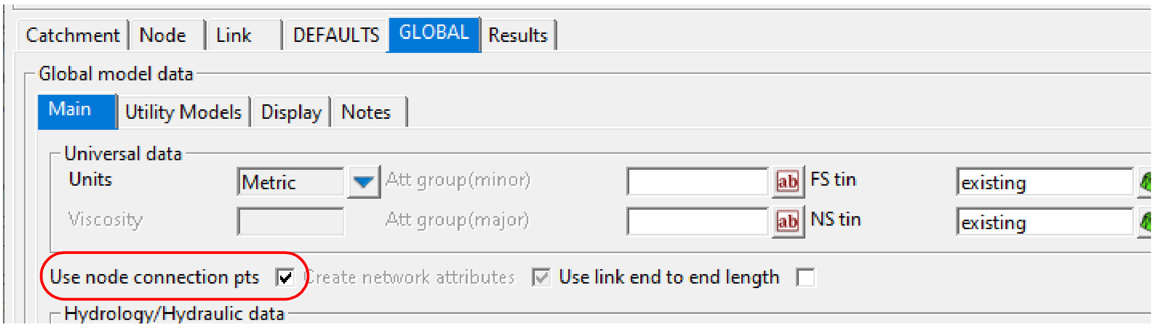
17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational

17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater

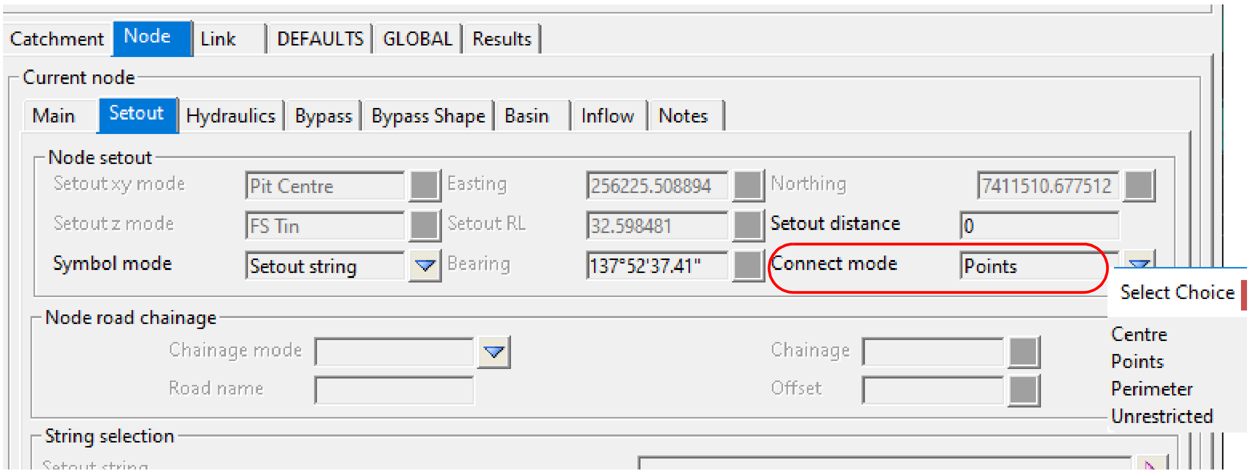
17.3.4.6.1.1.4 GLOBAL > Main subtab - Sewer tractive

17.3.4.6.1.1.1.1 Node Connection Points

Node Connection points allow the links connected to the node to join at locations other than the inside perimeter of the node wall. This feature is off by default and may be enabled on the 17.3.4.6.1.1 GLOBAL > Main subtab or in the Water string editor 17.3.6.2.1 Water Properties.



All nodes have their connection point initially set to **Points**. This setting is found on the 17.3.4.6.4.2 Node >Setout subtab.

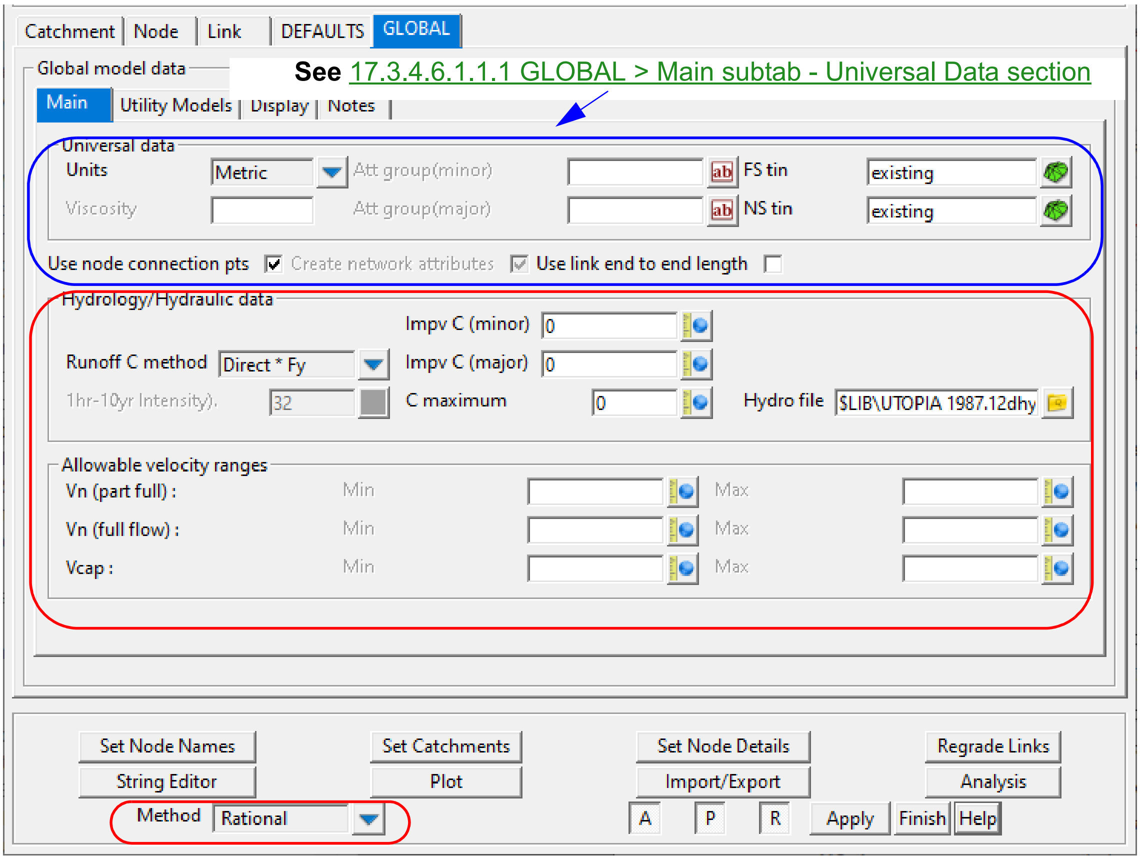


For the definition on the node connection point modes, see 17.1.4.3 Node Connection Points for Links.

Continue to 17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational or return to 17.3.4.6.1 GLOBAL Tab or 17.3.4 Water Network Editor (WNE).

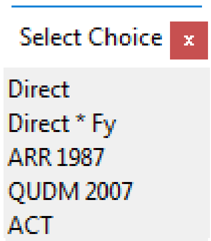
17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational

When the **Method** given in the **Method** field is ***Rational***, the fields n the ***GLOBAL >Main*** subtab consist of all those documented in 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section plus the additional ones documented in this section.



Hydrology data section

Runoff C Method choice box



See
Direct
Direc*Fy
ARR 1987
QUDM 2007
ACT

*This is used when the **Method** is **Rational**.*

*For information about each **Runoff C method**, see* 27.1.2.2.2 Runoff Coefficient (C).

1hr-10yr Intensity

*Used for **Runoff C Methods ARR 1987** and **QUDM 2007***

This intensity is used to calculate a composite C value together with the percent intensity. The QUDM 2007 method also uses the Veg/Soil catchment characteristic (see 17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational*).*

Impv C (minor) real box

*Used for **Runoff C Methods Direct** and **Direct * Fy**.*

This value will be used for all impervious sub catchment areas when minor storms are analysed.

***Note**: If you use a **single composite C** value for your catchments, enter a **%impervious C** of zero and ignore the impervious settings*

Impv C (major) real box

*Used for **Runoff C Methods Direct** and **Direct * Fy***

This value will be used for all impervious sub catchment areas when major storms are analysed.

C maximum real box

*Used for **Runoff C Methods Direct * Fy***

When a calculated C values will be restricted to this maximum.

Hydro file file box

*Also known as the **Rainfall File***

*For all Runoff C Methods except **None***

*This file contains the rainfall intensity data, patterns, soil infiltration, tailwater and pump data. The **Folder =>Open** button will launch an editor for this files (see* 17.5.1 Hydro (Rainfall) File Editor*). Samples of the file are contained in the 12d library.*

Allowable velocity ranges

The ranges for link peak velocities are used for checking purposes only. If the velocities are outside this range, warning messages will be given in the Output Window.

Vn (part full) Min/Max real box

Minimum/Maximum normal depth velocity (units per second) when Q < Qcap.

Vn (full flow full) Min/Max real box

Minimum/Maximum normal depth velocity (units per second) when Q >= Qcap.

Vncap Min/Max real box

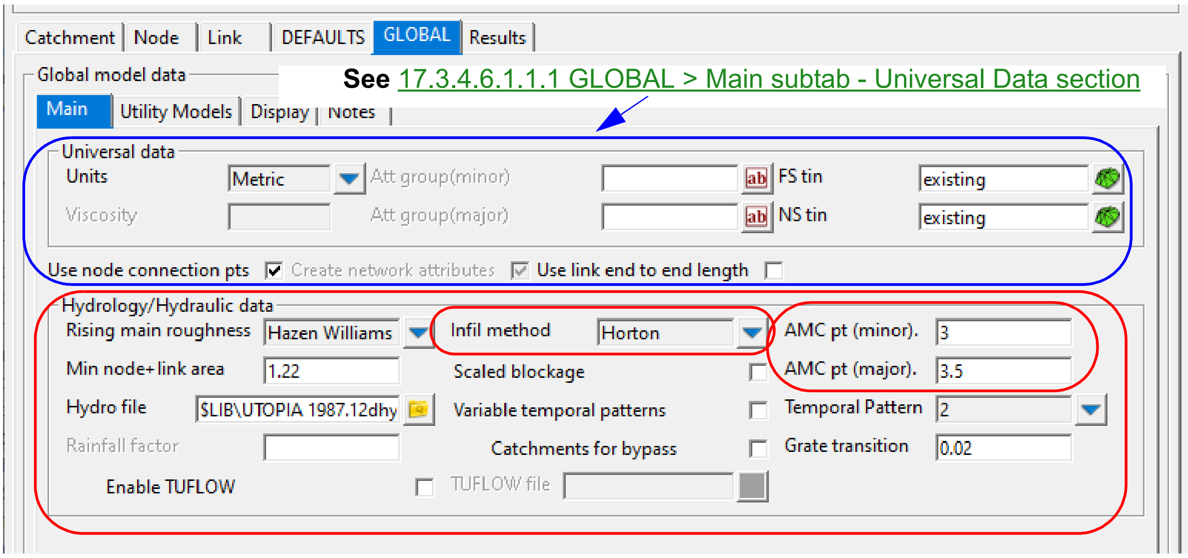
Minimum/Maximum capacity velocity (units per second).

For the extra fields for other Methods, see

17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section
17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater
17.3.4.6.1.1.4 GLOBAL > Main subtab - Sewer tractive

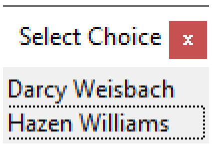
17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater

When the **Method** given in the **Method** field is ***a Dynamic Stormwater Method***, the fields n the ***GLOBAL >Main*** subtab consist of all those documented in 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section plus the additional ones documented in this section.



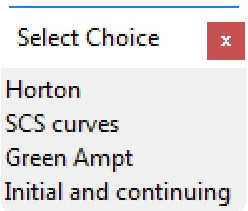
Hydrology/Hydraulic data section

Rising main roughness choice box



Roughness for rising mains only.

Infil method choice box



See
27.1.2.3.7.1 Horton Losses - *ILSAX 2, EPA SWMM*
27.1.2.3.7.2 SCS Curves -*EPASWMM, NZ SCSS and SCS*
27.1.2.3.7.3 Green Ampt - *EPA SWMM*
27.1.2.3.7.4 Initial and Continuing Losses - *ILSAX 2, Laurenson*

***Infiltration loss method** to be adopted for dynamic analysis (**dynamic only**). The available methods are dependent on the selected hydrology. Options are:*

Horton (ILSAX 2, EPA SWMM). See 27.1.2.3.7.1 Horton Losses.
SCS Curves (EPA SWMM, NZ SCS Curves, SCS Method). See 27.1.2.3.7.2 SCS Curves.
Green Ampt (EPA SWMM). See 27.1.2.3.7.3 Green Ampt.
Initial and continuing (ILSAX2, Laurenson). See 27.1.2.3.7.4 Initial and Continuing Losses.

AMC pt (minor)

Antecedent moisture condition point (1 to 4) for minor events.

(Use for Runoff Method ILSAX 2) 1 = dry catchment, 4 = saturated catchment for minor storm.

AMC pt (major)

Antecedent moisture condition point (1 to 4) for major events.

(Use for Runoff Method ILSAX 2) 1 = dry catchment, 4 = saturated catchment for major storm.

Min node+link area real box

Minimum are for node area.

Scaled blockage tick box

for Runoff C Methods = Hydrograph methods

*If **ticked**, scale both approach and inlet axis. of inlet curves*
*If **not ticked,** don't scale.*

Hydro file file box

*Also known as the **Rainfall File**.*

For all Runoff C Methods except None

*This file contains the rainfall intensity data, patterns, soil infiltration, tailwater and pump data. The **Folder =>Open** button will launch an editor for this files (see* 17.5.1 Hydro (Rainfall) File Editor*). Samples of the file are contained in the 12d library.*

Variable temporal patterns tick box

*If **ticked**, use variable temporal patterns from the Hydro file.*

*If **ticked**, all dynamic methods will run a single storm event from the Variable Pattern selected in the **Temporal Pattern** field. The Variable Patterns are in the **Hydro file** (Rainfall file). See* 17.5.1.4 Variable Temporal Patterns*).*

*If **not ticked**, the ILSAX 2 and EPA SWMM methods used the selected **fixed time interval patterns** in the Hydro file (Rainfall file). See* 17.5.1.3 Rainfall Temporal Patterns*. Multiple patterns may be run simultaneously.*

This selection also determines the water attribute result groups used to store the results. See Water Results Group.

Temporal Pattern choice box

Temporal pattern from the Hydro file.

For **Runoff C Methods** *= Hydrograph methods*

*When **Variable temporal patterns** is **ticked**, the choices are loaded from Variable Patterns in the Hydro file (Rainfall file). See* 17.5.1.4 Variable Temporal Patterns*). Only one variable pattern is analysed at run time.*

*When **Variable temporal patterns** is **not ticked,** the choices are loaded from fixed time interval patterns in the Hydro file (Rainfall file). See* 17.5.1.3 Rainfall Temporal Patterns*. Only select storms from this Zone will be analysed subject to the ARI range in the file.*

Rainfall factor real box

Rainfall data will be multiplied by this factor.

Catchments for bypass tick box

For **Runoff C Methods** *= Hydrograph methods*

*If **ticked**, the catchment flows are distributed to the upstream inlets (uncaptured flow) so that they may flow down the approaching bypass flow routes. See* 27.2.1.4 Catchments for Bypass.

*If **not ticked,** catchment flows are added at the grate of the inlet where the catchments are defined.*

Grate transition real box

Subsurface HGL will begin to recognise the surface GHL at this depth below the grade.

Enable TUFLOW tick box

For **Runoff C Methods** *= Hydrograph methods.*

*If **ticked**, the bypass routes within the TUFLOW grid extent will be removed and the TUFLOW 2d analysis engine will handle the surface flows.*

TUFLOW file file box

*When Enable TUFLOW is **ticked**: the TUFLOW tcf file.*

*With the **Dynamic Stormwater analysis** and **TUFLOW** modules, this specifies the TUFLOW tcf file to be used for the 2d storm analysis.*

*This TUFLOW tcf file must exist. If the required commands for the 12d drainage are not found in the file they will be added at run time. The 2D Quick Analysis option (*18.1 2D Quick Analysis*) is often used to create this tcf file.*

For the extra fields for other Methods, see

17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section

17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational

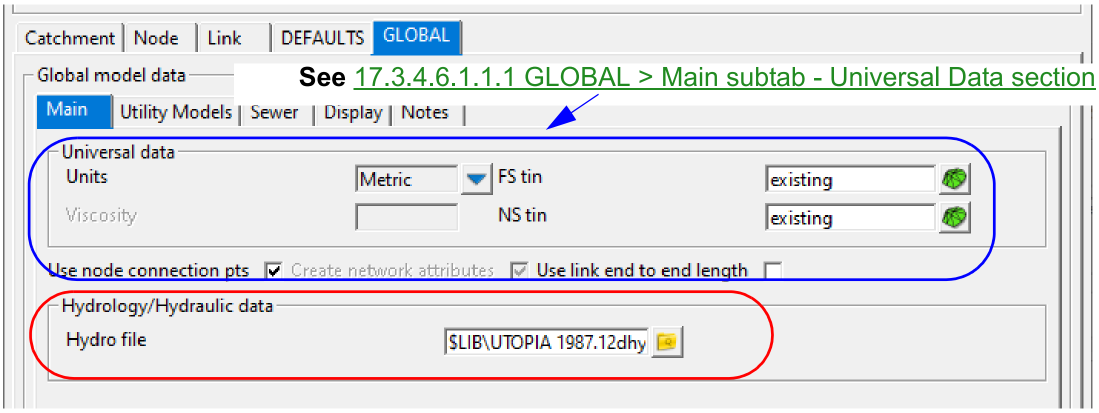
17.3.4.6.1.1.4 GLOBAL > Main subtab - Sewer tractive

NOT YET USED

Clear attributes - when selected all node/link attributes will be deleted before the Apply/Auto Apply saves the data currently in the panel.

17.3.4.6.1.1.4 GLOBAL > Main subtab - Sewer tractive

When the **Method** given in the **Method** field is ***Sewer tractive***, the fields n the ***GLOBAL >Main*** subtab consist of all those documented in 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section plus the additional ones documented in this section.



Hydrology data section

Hydro file file box

*Also known as the **Rainfall File**.*

For all Runoff C Methods except None.

*This file contains the rainfall intensity data, patterns, soil infiltration, tailwater and pump data. The **Folder =>Open** button will launch an editor for this files (see* 17.5.1 Hydro (Rainfall) File Editor*). Samples of the file are contained in the 12d library.*

For the extra fields for other Methods, see

17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section
17.3.4.6.1.1.2 GLOBAL > Main subtab - Rational
17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater

17.3.4.6.1.2 GLOBAL >Utility Models subtab

The water network model is completely integrated with the other design models in the project. This tab is used to link the water network model to the relevant design models in the project.

See

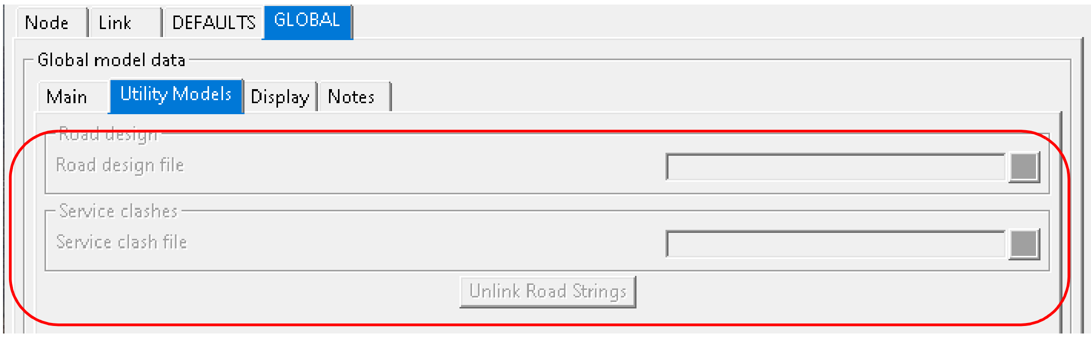
17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive

17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater

17.3.4.6.1.2.3 GLOBAL >Utility Models subtab - Drainage 2d

17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive

The fields with ***Method*** set to a ***None***, ***Water Supply*** and ***Sewer tractive*** are described below.



Road design section

Road design file file box *.road_des

The road design file contains the road string models for linking road setout and centre line strings.

For a description of the road design file and its editor, see 17.3.4.6.1.2.1.1 Road Design File Editor.

*To edit or create a clash file, click RB on the folder icon and select **Open** to bring up the Road Design File Editor.*

See 17.1.4.5.2 Using Road Design Centre line and Setout Strings.

Service clashes section

The WNE **Set Node Details** *and* **Regrade links** *buttons run the service clash check and any errors are be written to the Output window.*

Service clash file file box *.clash

The service clash file contains a list of models of super string services and the minimum allowable vertical clearances to the strings in that model.

For a description of the service clash file and its editor, see 17.3.4.6.1.2.1.2 Service Clash File.

*To edit or create a clash file, click RB on the folder icon and select **Open** to bring up the Service Clash File Editor.*

Unlink Road Strings button

*Selecting this button clears the **Setout string** and **Centre string** fields on the **Node >Setout** tab and deletes the **node Uid attributes** "design model id", "design string id", "centre model id" and "centre string id".*

For the extra fields for other Methods, see

17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater

17.3.4.6.1.2.3 GLOBAL >Utility Models subtab - Drainage 2d

17.3.4.6.1.2.1.1 Road Design File Editor

Each line is used to select a Road design model. The strings from the model are selected by using a name mask often using wild card * (*inv for example). The mask is entered in either the **Setout String ID** or **Centre String ID**) columns.

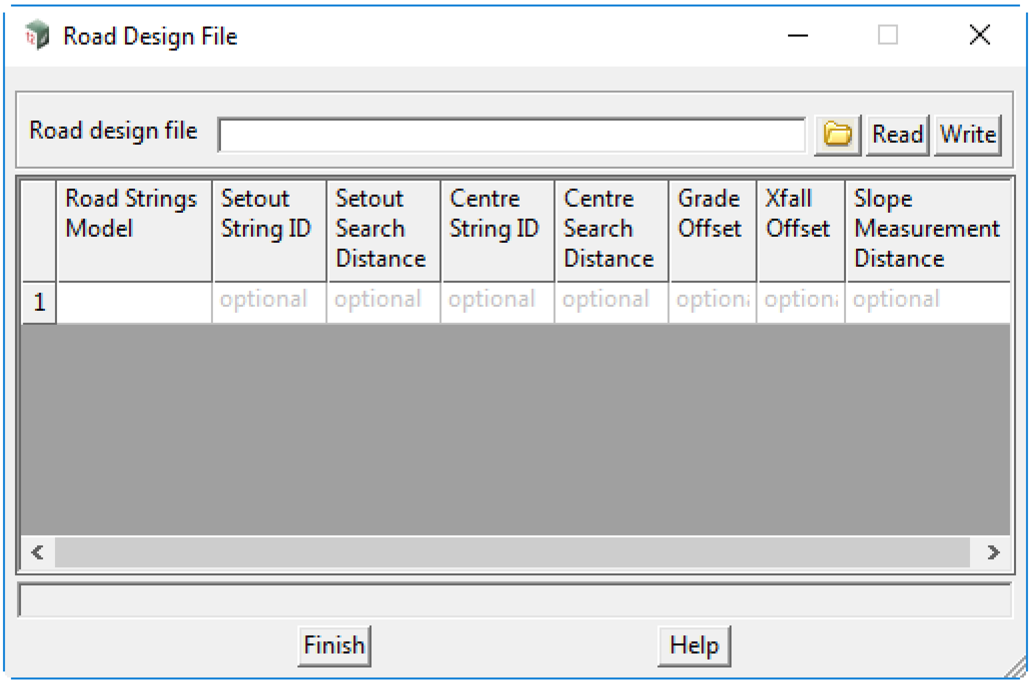
Select the **Set Node Details** button near the bottom of the WNE to connect nodes (currently without connections) to the eligible strings. The closest string from the model to the node centre that matches the name mask is selected if the perpendicular distance is less than or equal to the search distance.

Connections exist for the life of the connected string unless:

1. all connections are broken using the **Unlink Road Strings** button or
2. another string is manually selected via WNE ***String selection*** on the **Node >Setout** or
3. the link is manually cleared via WNE **Node >Setout *->String selection*** (RB Clear)

Once a string is connected, the **Set Node Details** button will not break the connection.

Recalculating the road string function deletes the selected strings and new ones are created. **Set Node Details** will need to be selected again.



Road design file file box *.road_des

File of road strings models etc.

Read button

*Data in the file given in the **Road design file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Road design file** field.*

Grid

Road strings model model column

Model to select strings from

*Click RB in the **Road Strings Model** column to get a list of project models to select from.*

Setout String ID text column

*Refers to the string name. To connect a node to this string a mask must be entered. Use * for all strings. See* 17.1.4.5.2 Using Road Design Centre line and Setout Strings *for uses of setout strings.*

Setout Search Distance real column

Strings with a perpendicular distance from the node centre less than or equal to this distance are eligible to be connected. The closest string will be chosen.

17.3.4.6.1.2.1.2 Service Clash File

The service clash file (default ending of ***.clash)*** contains a list of models of super string services and for each model, the minimum allowable vertical clearance of the links to the strings in that model.

Include an extra amount for the thickness of the water link. If the service model contains other water strings you must add the thickness of these links as well.

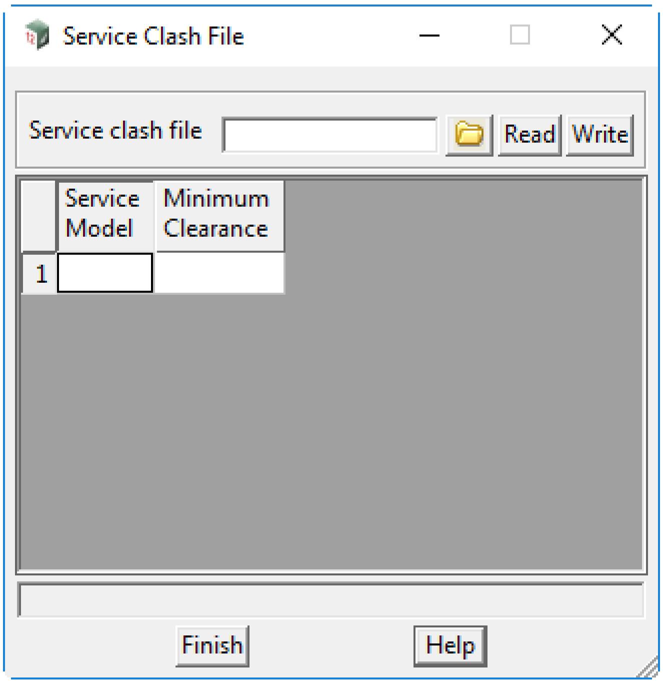
If different clearances are required for different services then place the services in different models. Warnings will be issued when you push the button to **Regrade Links, Set Node Details, Import** or **Storm Analysis**.

Cover levels or fixed inverts can be used to avoid the services.

Important Note

The clash detection performed with the clash file only checks for vertical clashes.

To check for horizontal and vertical, and node clash detection see 25.11.10.1 Clash Detection.



Service clash file file box *.clash

File of service models and minimum clearances.

Read button

*Data in the file given in the **Service clash file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Service clash file** field.*

Grid

Service model model column

This model contains super strings with the pipe or culvert dimension on them. To set these dimensions on the strings use **Utilities =>Super strings =>Pipe** *or great them using* **Strings =>Create =>Super**.

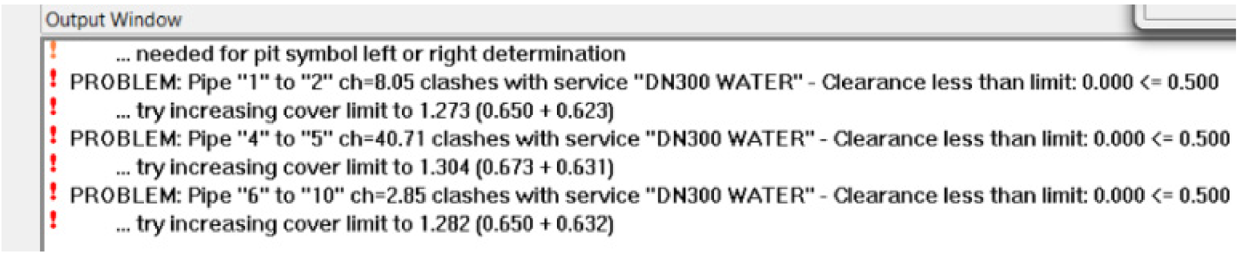
*Click RB in the **Service Model** column to get a list of project models to select from.*

Minimum Clearance real column

Minimum clearance for the services in this model.

If the vertical distance between the water string outside diameter (diameter + thickness) and the service is less than this value an error message and suggested design changes are printed in the output window.

Note: The WNE **Set Node Details** and **Regrade Links** option will run the service clash check and any errors will be written to the Output window.



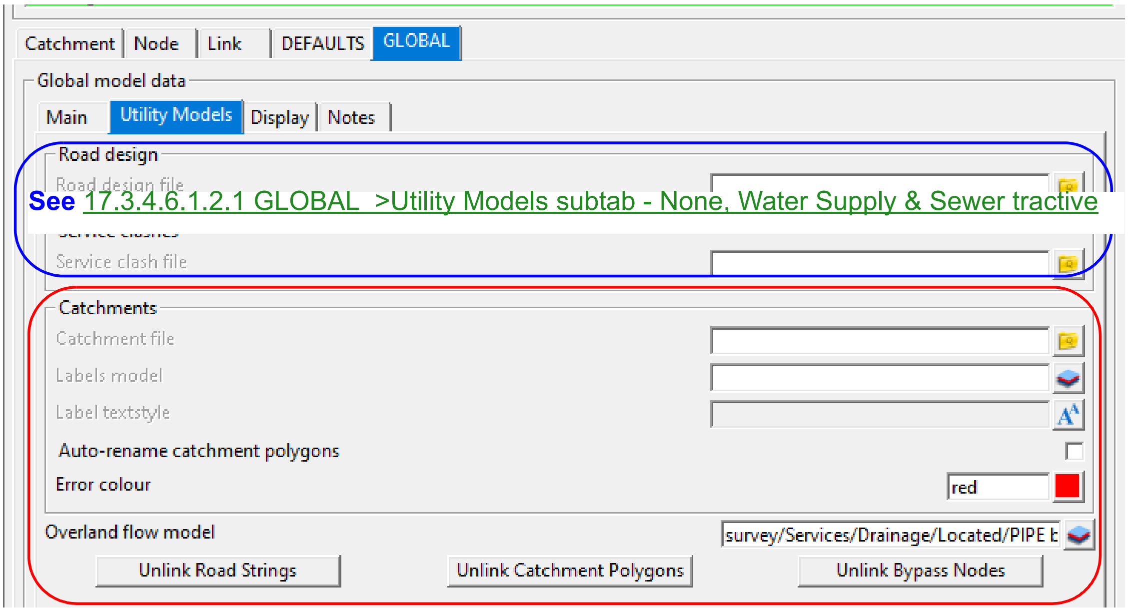
Note

The regrading of links can also be done by a separate option. See 17.5.5.11 Regrade Links,

17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater

The **Road design** section, **Service clashes** section and **Clear Road Links** button are documented in 17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive.

The extra fields with ***Method*** set to a ***Stormwater*** method are described below.



The ***WNE* Set Catchments** button connects the inlets to the catchment strings and creates the labels. For details see 17.3.4.6.8 Set Catchments Button - Stormwater.

Catchments section

Catchment file file box *.catchments

The catchment file contains a list of catchment string models, impervious Tc string models, pervious Tc strings models and the fill colours for those models. For more information on catchments, see 27.1.1 Water Catchments

For a description of the catchment file and its editor, see 17.3.4.6.1.2.2.1 Catchment File.

*To edit or create a catchment file, click RB on the folder icon and select **Open** to bring up the Catchment File Editor.*

Labels Model model box

Labels containing the inlet name (set number) and catchment area will be created in this model midway along the medial axis of the catchment area

Labels Textstyle textstyle box

Textstyle to use for the labels

Auto rename catchment polygons tick box

*If **ticked**, the name of the catchment string is to the inlet name connected to it. If it is not connected to any inlet, it will be named "not used". The option **Models =>String Info Table** can be used to locate these strings.*

Error colour colour box

Strings not connected to an inlet will be set to this colour.

Overland flow model model box

*If **not blank**, this model contains the strings indicating the direction of overland flow (strings drawn in the direction of flow). These strings are often created using the* 17.5.3 Downhill Strings. *See also* 17.3.4.6.1.2.2.2 Bypass Flow.

Unlink Road Strings button

*Selecting this button clears the **Setout string** and **Centre string** fields on the **Node >Setout** tab and deletes the **node Uid attributes** "design model id", "design string id", "centre model id" and "centre string id".*

Unlink Catchment Polygons button

*Selecting this button will delete all catchment connections and **Area** values. Catchments with Area values manually entered are also cleared.*

The node uid attributes "catchment string id" and "catchment model id" and real attribute "area" are deleted (including suffix 2 and 3). This includes inlets where a manual pick has been done.

Note that since the vertices are re-ordered by the 17.3.4.6.8 Set Catchments Button - Stormwater *then even after a **Unlink Catchment Polygons t**here is a significant probability that manual connections will be restored.*

Unlink Bypass Nodes button

*Selecting this button will clear all the **Bypass node** fields in the **Node >Bypass** tab for all inlets in the model. The node text attribute "bypass pit" is deleted. See* 17.3.4.6.4.4 Node >Bypass subtab - Stormwater.

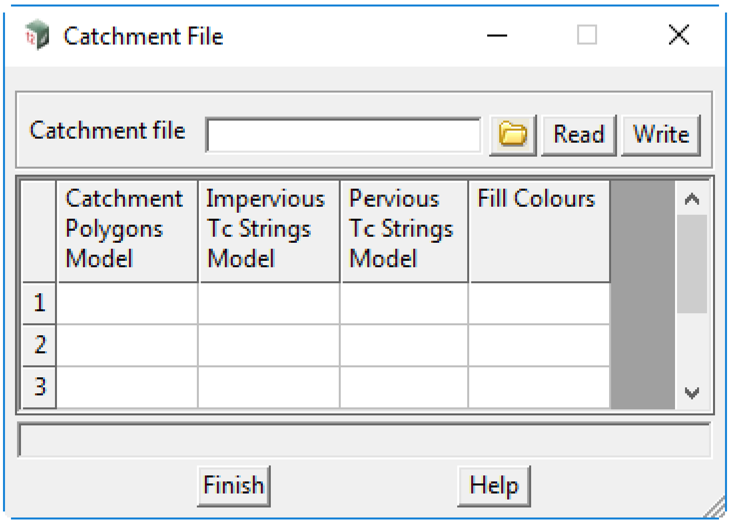
For the extra fields for other Methods, see

17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive
17.3.4.6.1.2.3 GLOBAL >Utility Models subtab - Drainage 2d

17.3.4.6.1.2.2.1 Catchment File

The catchment file (default ending of ***.catchments)*** contains for each catchment set, the model of catchment polygons, the model of impervious Tc strings and the model of pervious Tc strings.

There is a row in the grid for each of the five Catchment sets.



Catchment file file box *.catchments

File of catchment polygons models etc.

Read button

*Data in the file given in the **Catchments** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Catchments file** field.*

Grid

The five rows in the grid correspond to the five catchments available for each inlet (Set #1 to Set #5).

For each catchment set there is a model for impervious paths and a model for pervious paths so it is possible to have a maximum of ten Tc path models.

Catchment polygons model model column available models

This model contains closed super strings for catchments.

*Click RB in the **Catchment Polygons Model** column to get a list of project models to select from.*

Impervious Tc Strings Model model column available models

This model contains the impervious Tc path strings for the catchment corresponding to the row number. See 17.3.4.6.1.2.2.1.1 Tc Path Strings and Catchment Slope (equal area).

*Click RB in the **Impervious Tc Strings Model** column to get a list of project models to select from.*

Pervious Tc Strings Model model column available models

This model contains the pervious Tc path strings for the catchment corresponding to the row number.See 17.3.4.6.1.2.2.1.1 Tc Path Strings and Catchment Slope (equal area).

*Click RB in the **Pervious Tc Strings Model** column to get a list of project models to select from.*

Fill colours colour column

Colour to fill the catchment polygons for the catchment corresponding to the row number.

17.3.4.6.1.2.2.1.1 Tc Path Strings and Catchment Slope (equal area)

The **Tc Path Strings** are strings that are used to calculate the time of concentration for the **impervious** and **pervious** areas.

For each catchment set, they are drawn in two models; one for the **impervious paths** and one for **pervious paths**. The models are specified in the 17.3.4.6.1.2.2.1 Catchment File which is selected in **Catchment file** field on the 17.3.4.6.1.2 GLOBAL >Utility Models subtab.

The **length** of the **Tc** path string is used for the **length** parameter and the design tin is used with the string to calculate the **slope** using the **equal area method**.

The **equal area slope** is calculated when **Set Catchments** button is selected. See 17.3.4.6.8 Set Catchments Button - Stormwater.

Notes:

1. When creating a **Tc** path string, the end of the string should be near the inlet that it is to be connected to.
2. You must select a **Tc method** (explicit or implicit) via the 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater or the 17.3.4.6.3 Catchment tab - Stormwater. Just specifying the models is **NOT** enough!

17.3.4.6.1.2.2.2 Bypass Flow

The ***12d Model*** storm analysis allows for bypass flow.

Bypass flow involves the calculation of node inlet capacity for **on-grade** or **sag inlets**. These capacities are based on the node type and may use either ponding depths (sag inlets) or on the road grade and/or crossfall upstream of the inlet (on grade inlets). See 27.2.1.3 Node Inlet Configurations.

Bypass flow strings are used to trigger the bypass calculations in the network editor and are used as a centre line for flooded width calculations.

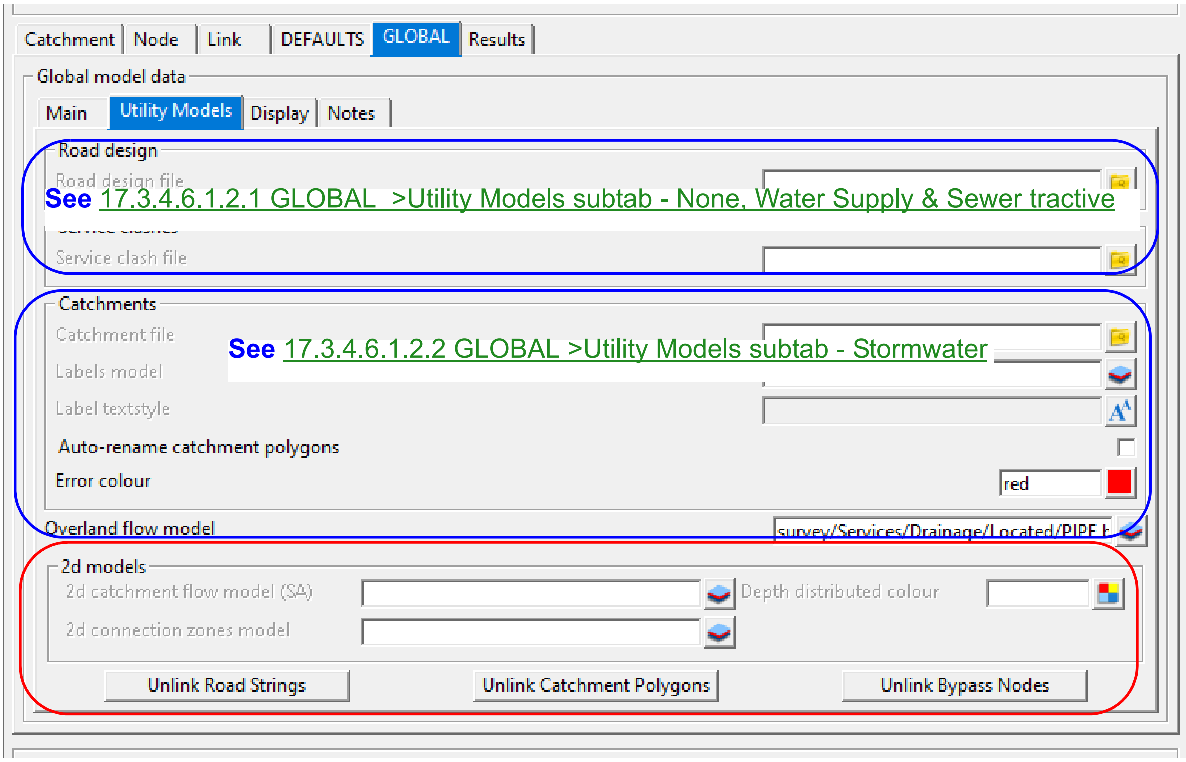
17.3.4.6.1.2.3 GLOBAL >Utility Models subtab - Drainage 2d

The following model boxes are displayed if the field ***GLOBAL >Main-Enable TUFLOW*** is ticked.

Note - this field will only appear for the Stormwater methods that use Dynamic Stormwater Analysis. It will **NOT** appear for the **Rational** Method.

The **Road design** section, **Service clashes** section, **Catchments** section, **Overland flow model** field and the **Clear Road Links** button, **Clear Catchment Links** button and **Clear Bypass Links** button are documented in 17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive and 17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater

The extra **2d models** section is described below.



2D models section

2D catchment flow model (SA)

The super strings in this model are the flow paths ending at the inlet. The catchment flows for this inlet will be evenly distribute along the cells on these flow paths and the inlet cell itself. SAG inlets often have more than 1 string. There must only be one of these strings in any 2d cell or an error will result. 12d Model exports a trimmed version of these strings so that they do not overlap with the inlet cells.

*Do not use **Catchments for bypass** with drainage 2d.*

*The **Set Catchments** button on this tab connects these strings to the inlets.*

Depth distributed colour colour box optional

Catchment flow lines with this colour will have their catchment, direct and hydrograph flows distributed across the string weighted by the cell depth. This mode is often used for applying flow hydrographs across a stream or channel.

Strings that do not match this colour will have the same flows equally distributed along the string. This mode is often used for applying flows to roadway gutter in the direction of flow so that the flow accumulates as it approached the node.

2D connection zone model

Without a connection zone string, a headwall, inlet or string outlet is connected to only one cell. Connection lines are drawn across additional cells and end at the 1d node. Flow is removed/added from these cells and conveyed through the 1d element. The cell centres and sides are also lowered to the grate level for inlets or the sump level for culverts and outlets.

Unlink Road String button

Selecting this button clears the ***Setout string*** *and* ***Centre string*** *fields on the* ***Node >Setout*** *tab and deletes the* ***node Uid attributes*** *"design model id", "design string id", "centre model id" and "centre string id".*

Unlink Catchment Polygons button

Selecting this button will delete all catchment connections and ***Area*** *values. Catchments with Area values manually entered are also cleared.*

The node uid attributes "catchment string id" and "catchment model id" and real attribute "area" are deleted (including suffix 2 and 3). This includes inlets where a manual pick has been done.

Note that since the vertices are re-ordered by the 17.3.4.6.8 Set Catchments Button - Stormwater *then even after a* ***Clear catchment links t****here is a significant probability that manual connections will be restored.*

Unlink Bypass nodes button

Selecting this button will clear all the ***Bypass node*** *fields in the* ***Node >Bypass*** *tab for all inlets in the model. The node text attribute "bypass pit" is deleted. See* 17.3.4.6.4.4 Node >Bypass subtab - Stormwater.

For the extra fields for other Methods, see

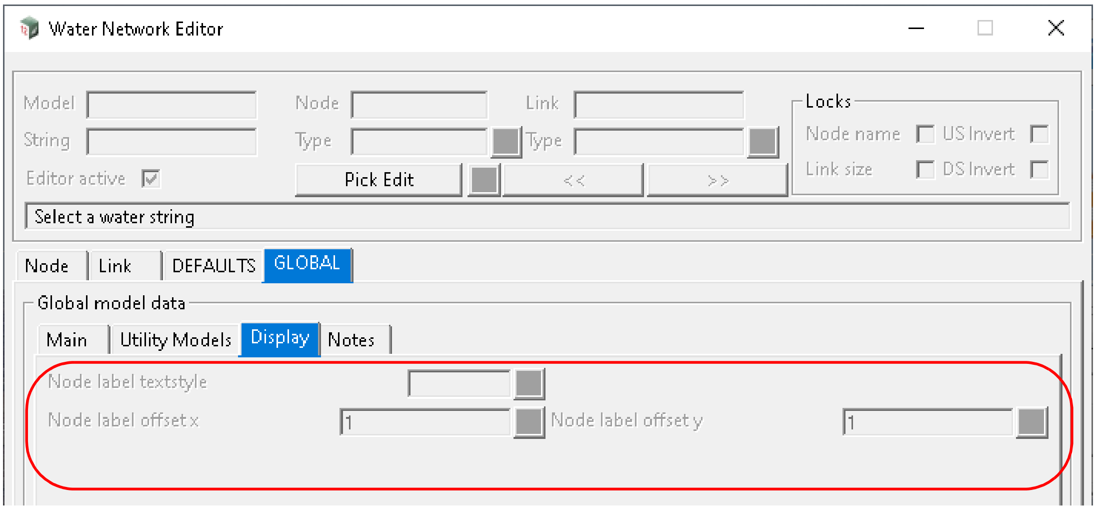
17.3.4.6.1.2.1 GLOBAL >Utility Models subtab - None, Water Supply & Sewer tractive
17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater

17.3.4.6.1.3 GLOBAL >Display Subtab

Select the Apply button on the WNE to immediately activate these settings.

The **Graph type**, **Graph width** and **Graph height** fields are disabled for **Methods** None, Rational and Sewer tractive.

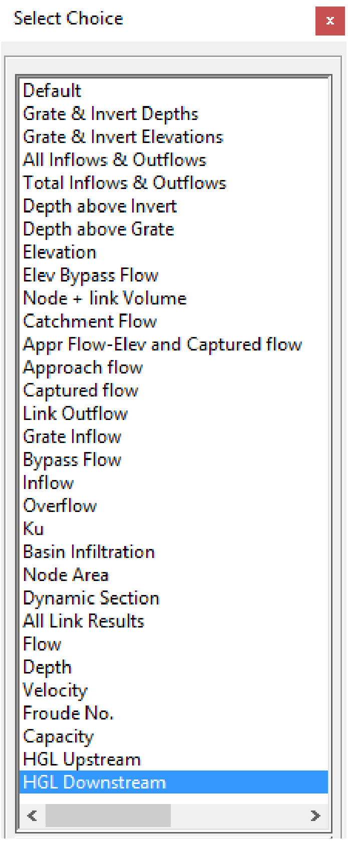
The **GLOBAL >Display** tab has the following fields:

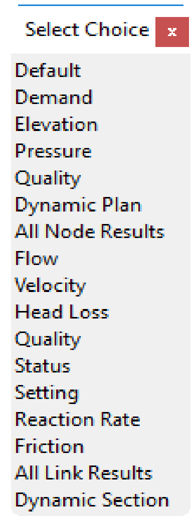


Graph Type choice box

*The choice list changes with the **Method** selected.*

ILSAX 2, Laurenson, NZ SCS Curves, EPA SWMM. SCS method Water Supply





This is default node type graph that is displayed.

Select the graph type to set the width and height. Selecting Default will display the graph width and height sizes in the fields below. The default sizes will be used for all graph types that do not have an explicit size set.

To explicitly set a size for a graph type, select the type, enter the width and height and then select the ***Apply*** *button.*

Graph width real box

Width in pixels of Graph type above when they are displayed.

Graph height real box

Height in pixels of Graph type above when they are displayed.

Plan Node Name Labels

Node label textstyle textstyle box

Node names will display (unless toggled off on the view) with this textstyle. Note that the height is in pixel. ***World text is not supported*** *at this time.*

Node label offset x real box

Offset from the node centre to the insertion point of the node label text. If the textstyle has an x offset, it will be measured from this offset x.

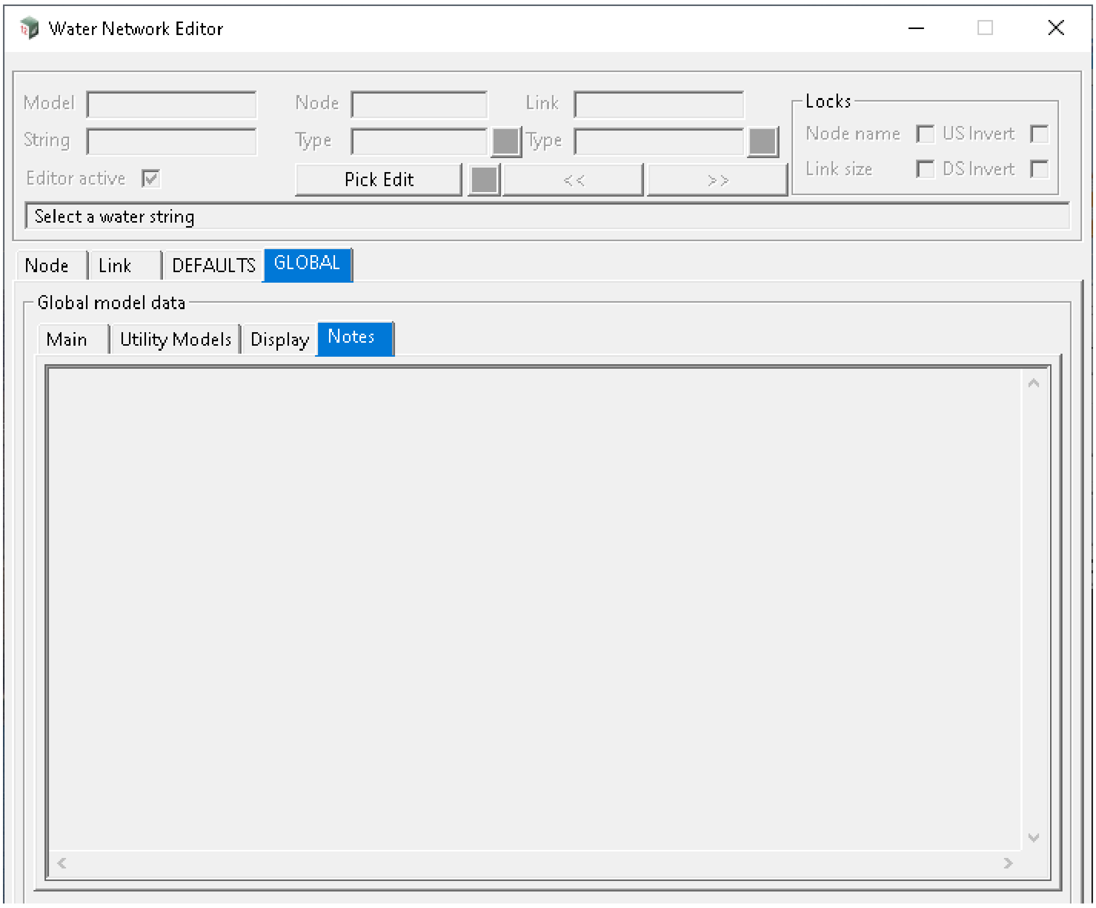
Node label offset y real box

Offset from the node centre to the insertion point of the node label text. If the textstyle has a y offset, it will be measured from this offset y.

17.3.4.6.1.4 GLOBAL >Notes subtab

Text entered on this tab will be stored as the model text attribute "remarks".

The **GLOBAL >Notes** tab has the following fields:



17.3.4.6.2 DEFAULTS tab

Node/Link/Catchment tabs Versus DEFAULTS Nodes/Links/Catchment tabs:

All of the fields (except file boxes) defined on the **DEFAULTS >Nodes, DEFAULTS >Links** and **DEFAULTS> Catchment** tabs also appear somewhere on the **Node, Link** and **Catchment** tabs (maybe not in exactly the same place).

The **DEFAULTS** tab values are used whenever the same field is blank on the **Node, Link** or **Catchment** tabs.

These default values apply only to strings in the **current** water network model. That is, in the water model being edited in the WNE.

This means than **many fields (except file boxes)** on the **DEFAULTS** tab **must be have valid entries** as the associated fields the **Node, Link** or **Catchment** tab may be blank.

Note

There are also the following water **project** defaults for **link grading**:
the invert drop across a manhole, the minimum link grade and the minimum cover.

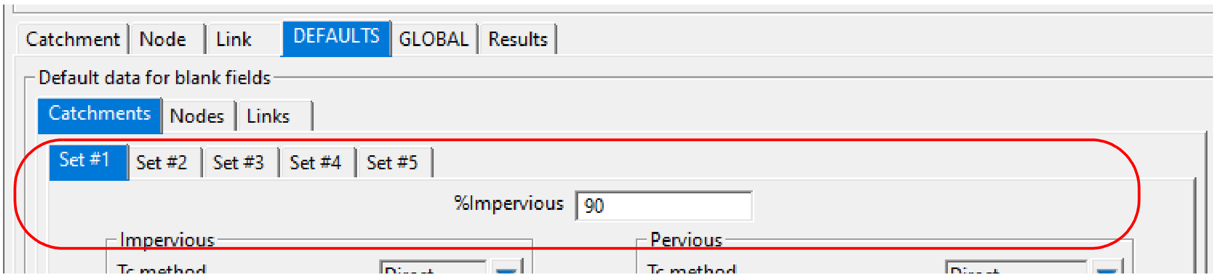
These project defaults are used when both the associated files fields are blank on the **DEFAULTS >Links** tab and associated field on the main **Link** tab.

For information on the **DEFAULTS** subtabs, see

17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational
17.3.4.6.2.2 DEFAULTS >Nodes subtab
17.3.4.6.2.3 DEFAULTS >Links subtab

17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater

The **DEFAULTS >Catchment** subtab is used to specify the default catchment data for up to five catchments:



Typically the user will use one set for different types of catchment areas. For example: Set 1 for the Road area, Set 2 for Lots, Set 3 for Parks.

The fields on **Set #1** to **Set #5** are identical and so will only be described the once.

The fields on **Set #1** is the **master default** for all catchment data and **all fields** must be specified for the **Set #1** tab.

If a field is left blank on the **Set #2** to **Set #5** tabs, the value from the **Set #1** tab is used. This allows the modeller to specify a minimum amount of data and focus on the differences between the catchment sets.

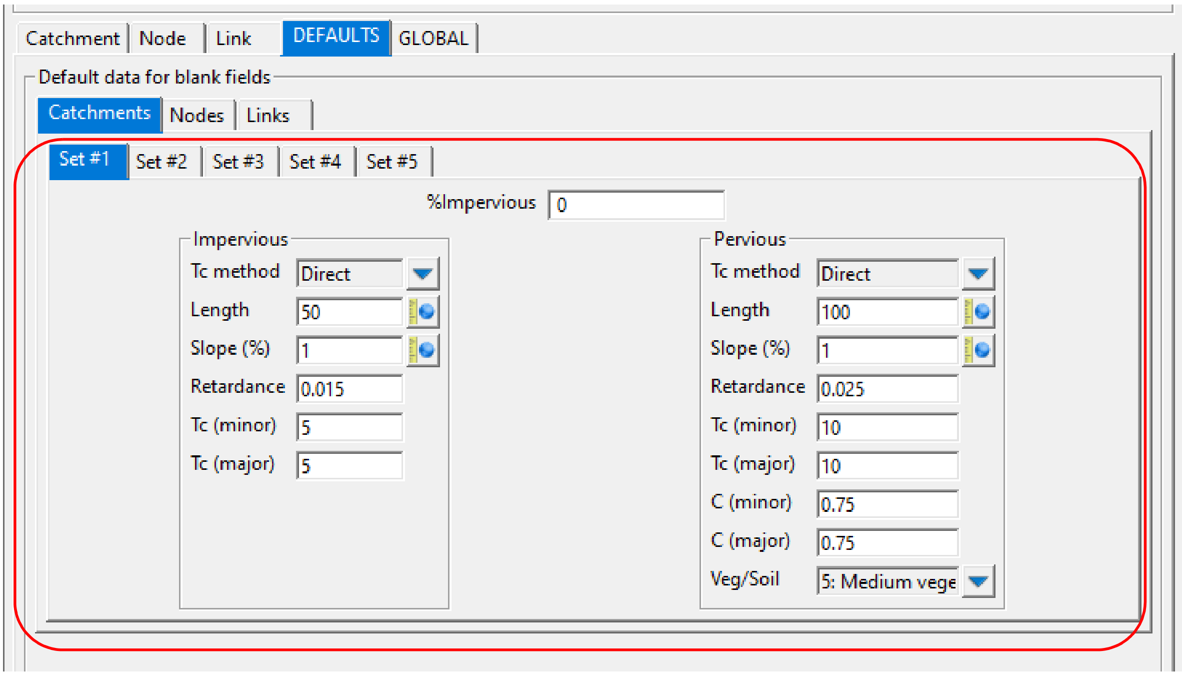
For the fields when the ***Rational*** method is selected, see 17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational.

For the fields when a ***Dynamic Stormwater*** method is selected, see 17.3.4.6.2.1.2 DEFAULTS >Catchment >Set #1 subtab - Dynamic Stormwater.

For more information on catchments, see 27.1.1 Water Catchments.

17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational

The **DEFAULTS >Catchment >Set #1** subtab is used to specify the following data for Set #1 when the Rational method is selected.:

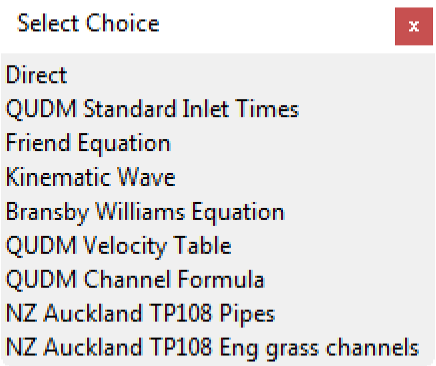


% impervious real box

The **% impervious** *(**percent impervious**) will split the catchment area into the pervious and impervious sub catchments. Separate C and Tc values are used for the pervious and impervious areas. See* 27.1.1.1.2 Pervious and Impervious Sub Areas.

Impervious and Pervious section

Tc method choice box



27.1.3.1 Direct
27.1.3.2 QUDM Standard Inlet Times
27.1.3.3 Friend Equation
27.1.3.4 Kinematic Wave Equation
27.1.3.5 Bransby Williams Equation
27.1.3.6 QUDM Velocity Table
27.1.3.7 QUDM Channel Formula
27.1.3.8 NZ Auckland TP108 Pipes
27.1.3.9 NZ Auckland TP108 Eng grass channels

There are several methods for entering times of concentration (Tc) for the catchment areas and the one to be used is selected from the choices. See 27.1.3 Time of Concentration.

Depending on the choice, different fields may be required.

***Direct method** requires **minor Tc** and **major Tc** values.*

***QUDM, Friend**, **Kinematic Wave** and **Bransby Williams** methods require the **Retardance**, **Length** and **Slope** of the catchments to be entered.*

***NZ Auckland TP108 Pipes method** uses the equation derived from a regression analysis of Auckland catchments (BCHF, 1999c).*

*Note that **Default values** must be entered for the **Length** and **Slope** but the optional explicit settings for*

__Length__ and __Slope__ can be entered on the [17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater] *or* [17.3.4.6.3 Catchment tab - Stormwater]*, or a catchment characteristic strings may be drawn (see* [17.3.4.6.1.2.2.1.1 Tc Path Strings and Catchment Slope (equal area)]*). When a string is used, the length of the string is used for the __Length__ parameter and the design tin is used with the string to calculate the __Slope__ using the equal area method.*

Since each catchment may use a different Tc method, **all** of the **Tc parameter fields** on the **DEFAULTS >Catchments** tab for **Set #1** are active and **are required**.

They must be filled in even if you do not plan on using that value.

Length real box

Length (m or ft) of the flow path from the most upstream point of the subcatchment to the subcatchment outlet.

Slope (%) real box

Average slope of the pervious/impervious portion of the catchment.

Retardance real box

Resistance to runoff of the pervious/impervious portion of the catchment.

Tc (minor) real box

Time of concentration to use for the pervious/impervious portion of the catchment for the minor storm.

Tc (major) real box

Time of concentration to use for the pervious/impervious portion of the catchment for the major storm.

Pervious section only - Rational

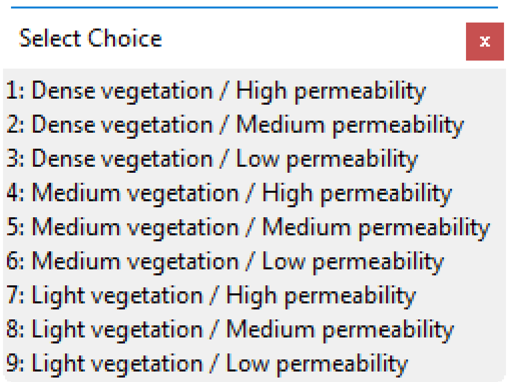
C (minor) real box

Pervious C for the minor storm.

C (major) real box

Pervious C for the major storm.

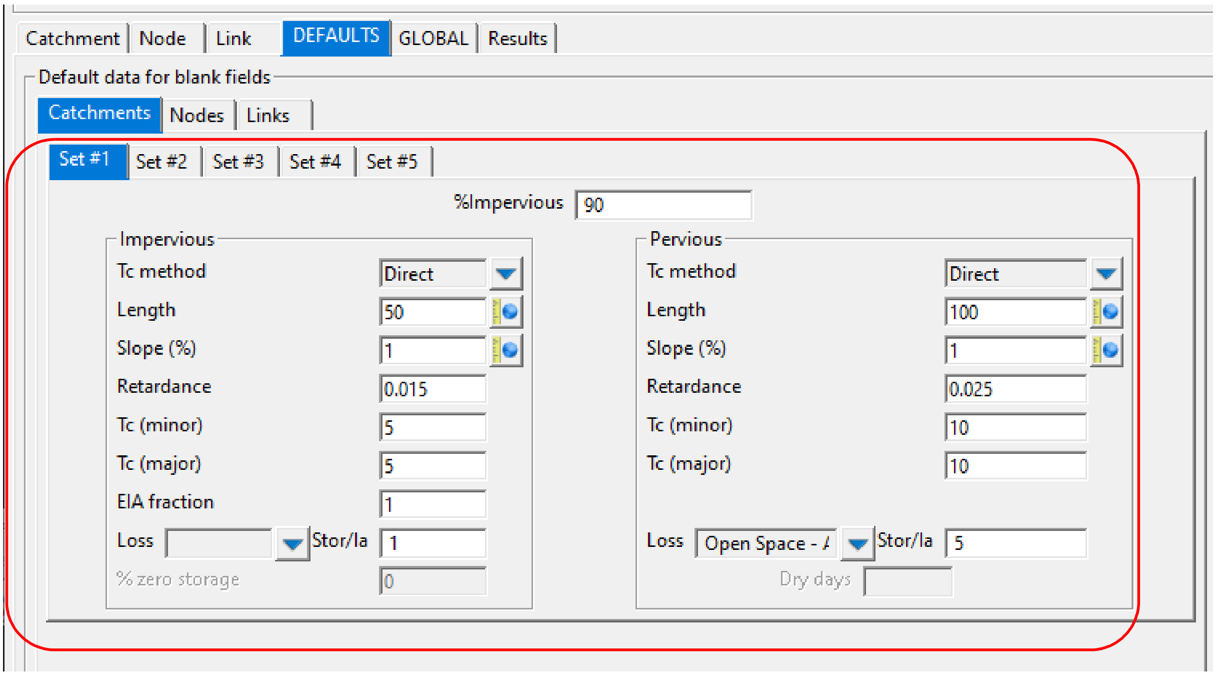
Veg/Soil choice box



The C value will be calculated in accordance with the procedure suggested in QUDM (2007) using the vegetation type selected from this choice box (and the rainfall intensity calculated at run-time).

17.3.4.6.2.1.2 DEFAULTS >Catchment >Set #1 subtab - Dynamic Stormwater

The **DEFAULTS >Catchment >Set #1** subtab is used to specify the following data for Set #1 when a ***Dynamic Stormwater*** method is selected.:

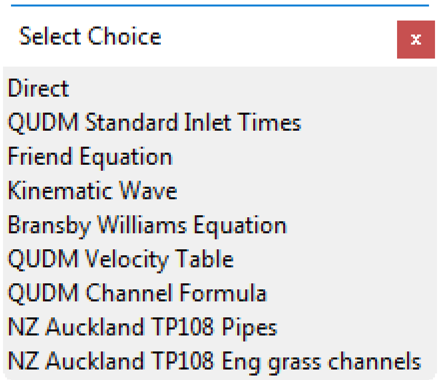


% impervious real box

The percent impervious will split the catchment area into the pervious and impervious sub catchments. Separate Tc and retardance values are used for the pervious and impervious areas.

Impervious and Pervious section - Dynamic

Tc method choice box



27.1.3.1 Direct
27.1.3.2 QUDM Standard Inlet Times
27.1.3.3 Friend Equation
27.1.3.4 Kinematic Wave Equation
27.1.3.5 Bransby Williams Equation
27.1.3.6 QUDM Velocity Table
27.1.3.7 QUDM Channel Formula
27.1.3.8 NZ Auckland TP108 Pipes
27.1.3.9 NZ Auckland TP108 Eng grass channels

There are several methods for entering times of concentration (Tc) for the catchment areas and one is to be selected from the choices.

For documentation on each of the choices, see 27.1.3 Time of Concentration*.*

Since each catchment may use a different Tc method, ***all*** *of the* ***Tc parameter fields*** *on the* ***DEFAULTS >Catchments*** *tab for* ***Set #1*** *are active and* ***are required****.*

They must be filled in even if you do not plan on using that value.

Length real box

Length (m or ft) of the flow path from the most upstream point of the subcatchment to the subcatchment outlet.

Slope (%) real box

Average slope of the pervious/impervious portion of the catchment.

Retardance real box

Resistance to runoff of the pervious/impervious portion of the catchment.

Tc (minor) real box

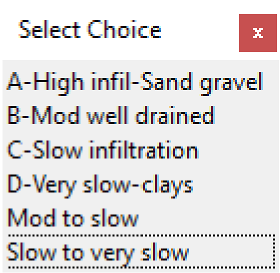
Time of concentration to use for the pervious/impervious portion of the catchment for the minor storm.

Tc (major) real box

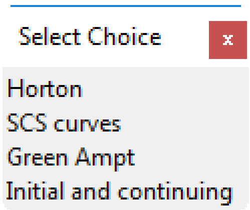
Time of concentration to use for the pervious/impervious portion of the catchment for the major storm.

Loss choice box

For Horton



The infiltration loss method. This choice box depends on the ***Method*** *being used.*



See
27.1.2.3.7.1 Horton Losses - *ILSAX 2, EPA SWMM*
27.1.2.3.7.2 SCS Curves -*EPASWMM, NZ SCSS and SCS*
27.1.2.3.7.3 Green Ampt - *EPA SWMM*
27.1.2.3.7.4 Initial and Continuing Losses - *ILSAX 2, Laurenson*

Stor/Ia real box

Initial abstraction.

Impervious section only - Dynamic

EIA fraction real box

Fraction of impervious area to be used in the calculations.

% zero storage real box

Percentage of impervious area with no storage.

Pervious section only - Dynamic

Max infil real box

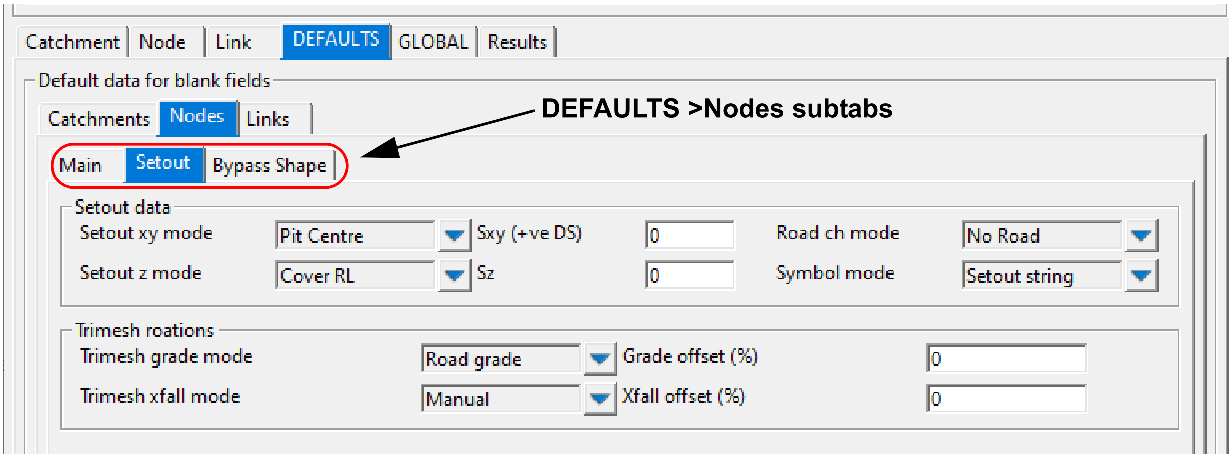
The cumulative limit of infiltration (mm or inched).
After this value is reached the soil is considered to be saturated and infiltration stops.

Dry days real box

Days for catchment to revert to starting infiltration (0 to disable)

17.3.4.6.2.2 DEFAULTS >Nodes subtab

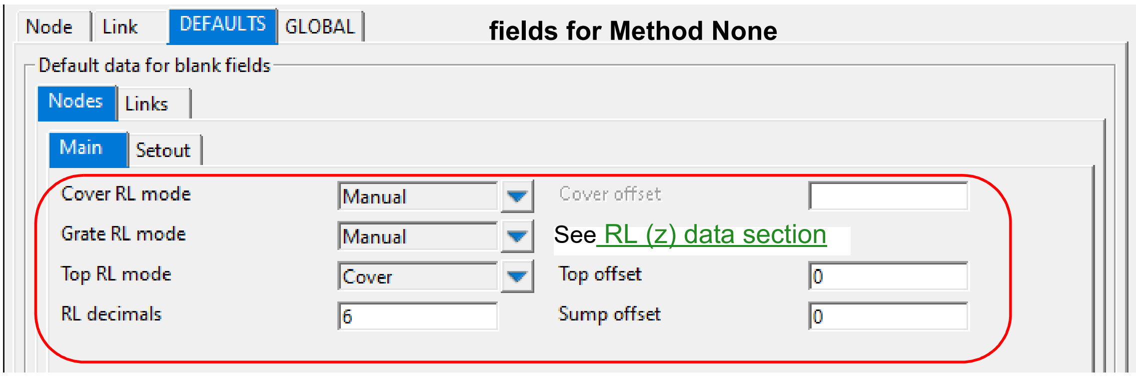
The **Defaults >Nodes** subtab has **Main** and **Setout** subtabs:

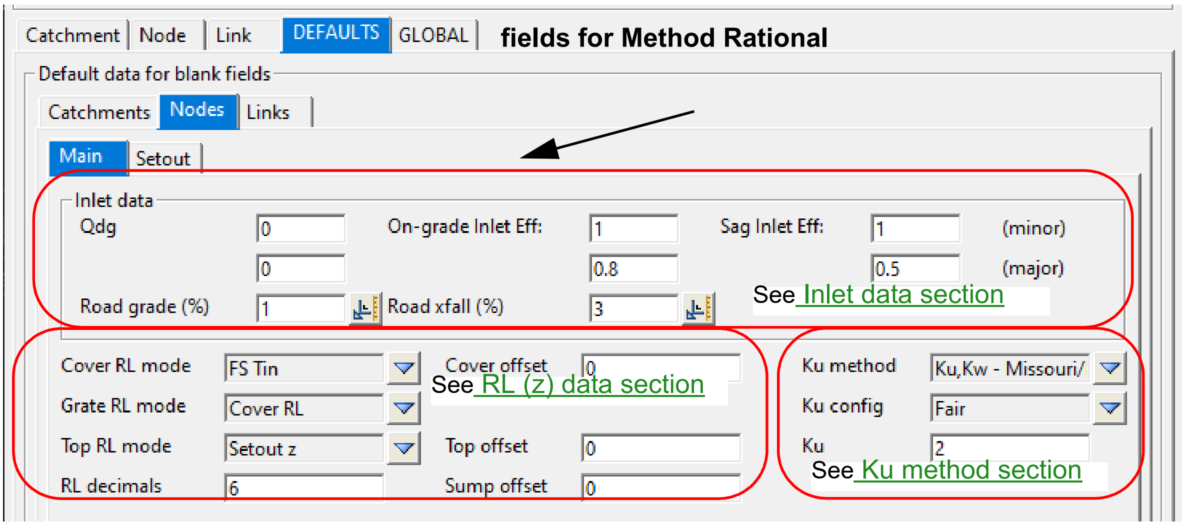


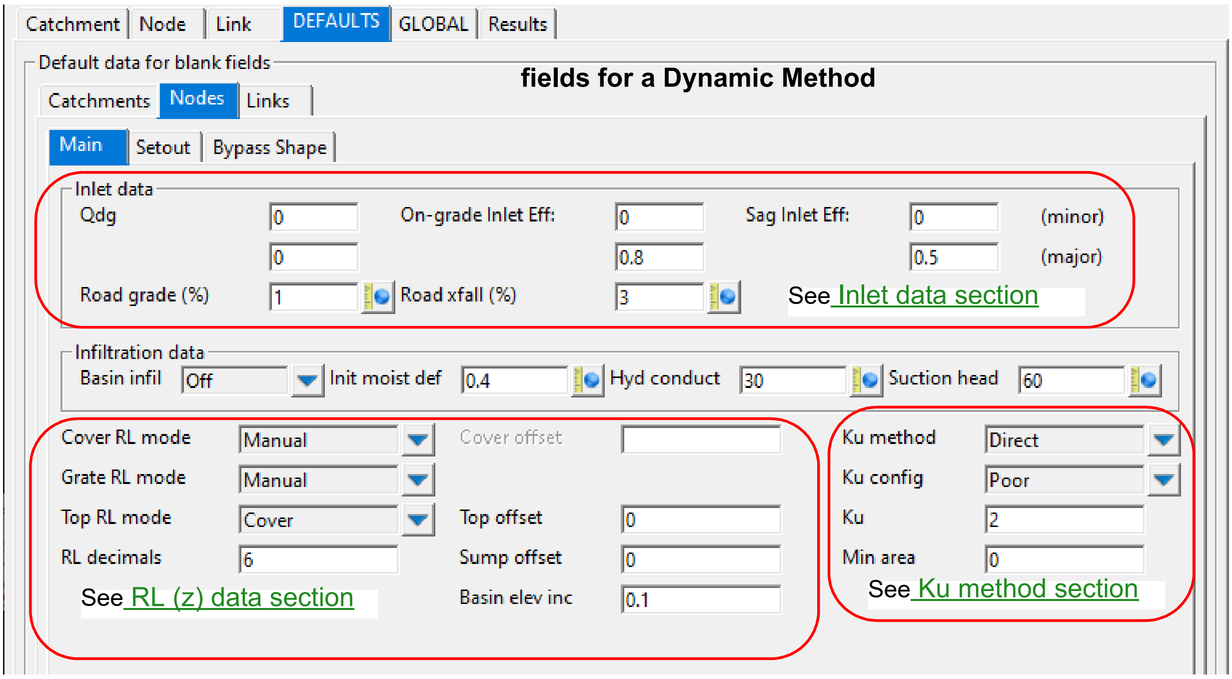
For information on the subtabs, see

17.3.4.6.2.2.1 DEFAULTS >Nodes >Main
17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout
17.3.4.6.2.2.3 DEFAULTS >Nodes > Bypass Shape - Dynamic Stormwater

17.3.4.6.2.2.1 DEFAULTS >Nodes >Main







Inlet data section

Qdg (minor)

Direct flow applied to node in minor storm analysis and subject to inlet capacity calculations (cubic units per second).

On-grade Inlet eff (minor) real box

Choke factor (0=blocked, 1=unblocked, >1 for multiple inlets) for On-grade pits in the minor storm event.

The captured flow axis of the inlet curve is multiplied by this factor during a minor storm analysis.

When the **Scaled blockage** *is ticked on the* ***Global*** **>** ***Main*** *tab (dynamic only) the approach flow axis of the inlet curve is also multiplied by this factor.*

Sag Inlet eff (minor) real box

Choke factor (0=blocked, 1=unblocked, >1 for multiple inlets) for Sag pits in the minor storm event.

The captured flow axis of the inlet curve is multiplied by this factor during a minor storm analysis.

Qdg (major)

Direct flow applied to node in major storm analysis and subject to inlet capacity calculations (cubic units per second).

On-grade Inlet eff (major) real box

Choke factor (0=blocked, 1=unblocked, >1 for multiple inlets) for On-grade pits in the major storm event.

The captured flow axis of the inlet curve is multiplied by this factor during a major storm analysis.

When the **Scaled blockage** *is ticked on the* ***Global >Main*** *tab (dynamic only) the approach flow axis of the inlet curve is also multiplied by this factor.*

Sag Inlet eff (major) real box

Choke factor (0=blocked, 1=unblocked, >1 for multiple inlets) for Sag pits in the major storm event.

The captured flow axis of the inlet curve is multiplied by this factor during a major storm analysis.

Road xfall (%) real box

The road xfall is used to rotate the node trimesh in the direction perpendicular to the symbol bearing and in the selection of on grade inlet capacity curves. When blank to default road xfall is used.

Road grade (%) - Manual tick box

If ***ticked****, the field for the* ***Road grade (%)*** *can have a value typed into it.*

Road grade (%) real box

The road grade is used to rotate the node trimesh in the direction of the symbol bearing and in the selection of on grade inlet capacity curves.

Road xfall (%) - Manual tick box

If ***ticked****, the field for the* ***Road xfall (%)*** *can have a value typed into it.*

Road xfall (%) real box

The road xfall is used to rotate the node trimesh in the direction perpendicular to the symbol bearing and in the selection of on grade inlet capacity curves.

Inlet data section

Qdg - minor

Direct flow applied to node in minor storm analysis and subject to inlet capacity calculations (cubic units per second).

On-grade inlet eff: - minor

On-grade inlet efficiency: the factor to reduce the on-grade inlet capacity defined in the drainage.4d file. See 27.2.1.3 Node Inlet Configurations *and* 27.2.1.3.1 Inlet Capacity Equation.

SAG Inlet eff: - minor

SAG inlet efficiency: the factor to reduce the sag inlet capacity defined in the drainage.4d file. See 27.2.1.3 Node Inlet Configurations *and* 27.2.1.3.1 Inlet Capacity Equation.

Qdg - major

Direct flow applied to node in major storm analysis and subject to inlet capacity calculations (cubic units per second).

On-grade inlet eff: - major

On-grade inlet efficiency: the factor to reduce the on-grade inlet capacity defined in the drainage.4d file. See 27.2.1.3 Node Inlet Configurations *and* 27.2.1.3.1 Inlet Capacity Equation.

SAG Inlet eff: - major

SAG inlet efficiency: the factor to reduce the sag inlet capacity defined in the drainage.4d file. See 27.2.1.3 Node Inlet Configurations *and* 27.2.1.3.1 Inlet Capacity Equation.

Infiltration data section

Basin Infil choice box Off, On

*If **On**, enable infiltration.*
*If **Off**, don't enable infiltration.*

Init moist def real box

Soils void ratio minus initial moisture (between 0 and voids ratio)

Hyd conduct real box

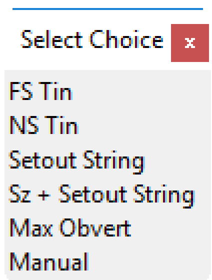
Soil hydraulic conductivity (mm/hr (in/hr))

Suction head real box

Soil capillary suction head (mm (in))

RL (z) data section

Cover RL mode choice box



*The **Cover RL** defines the top of the pit and is used to determine the pit depth*

*For **the Cover RL mode** definitions, see* 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z).

Cover offset

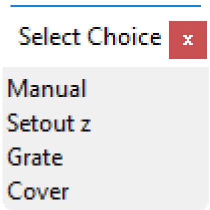
This value is added to the value given by the **Cover RL mode**.

Grate RL mode choice box

The ***Grate RL i****s the most important level in the 12d hydraulics.*

For the ***Grate RL mode*** *definitions, see* 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z).

Top RL mode choice box



The ***Top RL i****s the most important level in the 12d hydraulics.*

For the Top RL mode definitions, see 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z).

Top offset

This value is added to the value given by the **Top RL mode**.

RL decimals offset

A parameter used to imply accuracy in the calculation of slope, but that discounts the fact that the tolerance of invert elevations is +/- 5mm (at best, and normally +/- 20mm) and compaction +/-20mm.

Sump offset

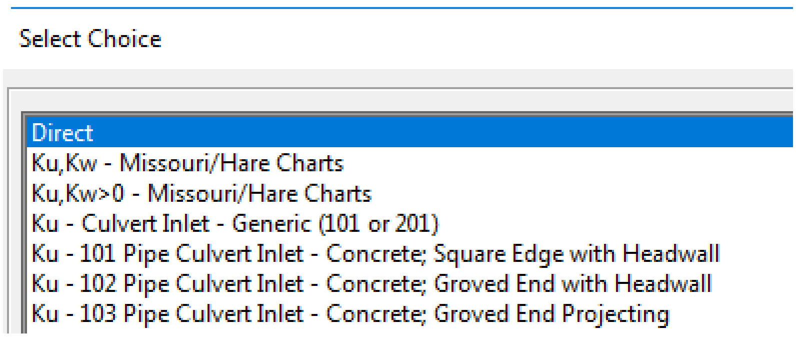
Distance from the minimum downstream node invert to the sump invert. See 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Basin elev inc

If a ***basin string*** *is defined (****Basin polygon*** *field on the* ***Node >Basin*** *tab), this is the default increment between elevations on the curve.*

Ku method section

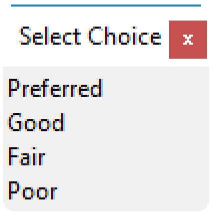
Ku method choice box



The Pit loss ***Ku*** *is used to model the energy losses through the pits and inlet control on culvert inlets.*

For more information on the Ku methods etc, see 27.2.1.2 Ku - Node Pressure Losses.

Ku config choice box



For the Ku config choices, see 27.2.1.2 Ku - Node Pressure Losses.

Ku

*Ku value when Ku method is **Direct**.*

Min area

Used when physical node area is less than this value.

Bypass data

Distance and lost grade are needed to determine the tail water conditions for the bypass channels going to the outlet LOST.

Distance

Default distance for a bypass channel going to the outlet LOST. This will affect the surface storage at the pit.

LOST grade

Default invert elevations of the bypass channel are set by the grate elevation of the upstream and downstream pits. However, when the bypass is to the outlet LOST, there is no downstream grate level so this grade is used.

Mannings n

*This Mannings n will be used for the entire channel if no left or right bank n values are defined on the **Bypass shape** tab.*

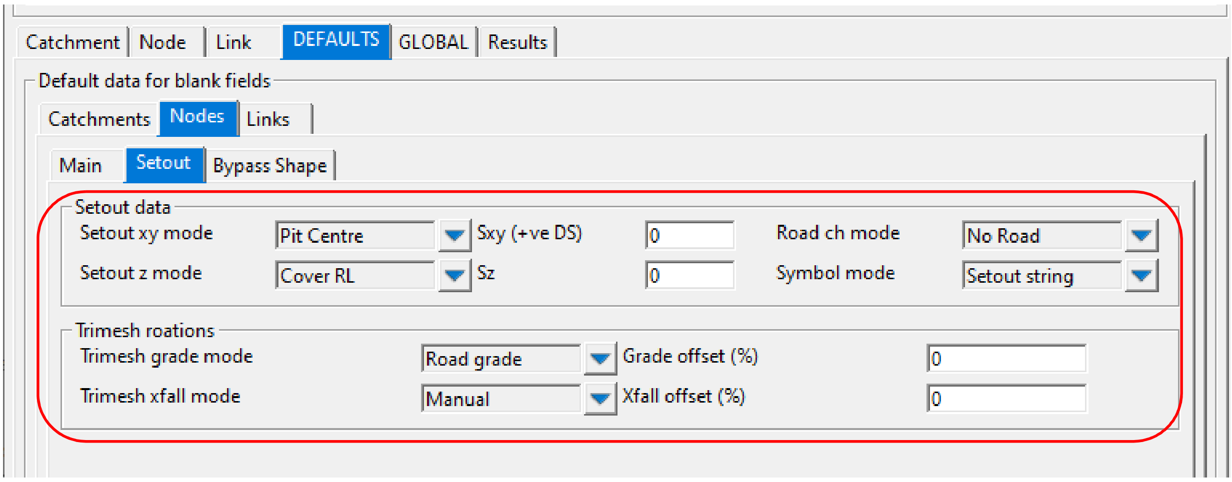
Continue to 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout or return to 17.3.4.6.2.2 DEFAULTS >Nodes subtab.

17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout

Road design strings may be used to calculate many of the water string inputs - this substantially reduces the setup and redesign time when designs are modified. A **setout string is** useful for construction purposes. See 17.1.4.5.2 Using Road Design Centre line and Setout Strings.

A node may have a **road centre line string** and a **setout string**.

A **trimesh** can also be associated with a node and if so can be manually rotated or take its rotations from the grade and crossfall of a road string.

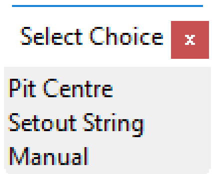


Setout data section

Nodes are setout on the construction site using a variety of techniques.

*WNE creates a **construction setout point (x,y,z)** that can either be located at the node centre or the node centre can be dropped perpendicularly onto a setout string for the xy location. The z value for the setout point has a number of modes as described below. Road centre line chainage may also be calculated. See* 17.1.4.6 Setout of Nodes and Links *and* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Setout xy mode choice box



*The **Setout xy mode** is given by the*
(a) Setout xy mode** field on the* 17.3.4.6.4.2 Node >Setout subtab ***if** it is **not blank
otherwise by the
***(b) Setout xy mode** field on the* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout *tab.*

*For the **Setout xy mode** definitions, see* 17.1.4.6.1 Setout xy Mode and Setout xy.

*If the **Setout xy mode** is **manual**, then the values can be typed into the **Eastings** and **Northings** fields on the* 17.3.4.6.4.2 Node >Setout subtab.

*The **Setout Eastings** and **Northings** for each node are either set manually or are calculated using the **Setout xy mode** when the* 17.3.4.6.9 Set Node Details Button *is pressed on the* 17.3.4 Water Network Editor (WNE).

Sxy (+ve DS) real box

*When **DEFAULTS >Nodes >Setout** tab is used and the* **Setout xy mode** *is **Setout string**,* **Sxy (+ve DS)** *is the chainage distance along the setout string from the setout string mode xy point to move to get the xy location. Positive is in the direction of the setout string.*

Setout z mode choice box

*The **Setout z mode** is given by the*
***(a) Setout z mode** field on the* 17.3.4.6.4.2 Node >Setout subtab ***if** it is **not blank**,*
otherwise by the
***(b) Setout z mode** field on the **DEFAULTS >Nodes >Setout** tab*

*For the **Setout z mode** definitions, see* 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

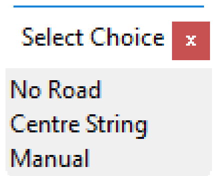
*If the **Setout z mode** is **manual**, then the value is not given here but can be typed into the **Setout RL** field on the* 17.3.4.6.4.2 Node >Setout subtab.

*The **Setout RL** for each node is either set manually or is calculated using the **Setout z mode** when the **Set Node Details** button is pressed.*

Sz real box

*When the **DEFAULTS >Nodes >Setout** tab is used,* **Sz** *is **added** to the level calculated for the* **Setout z mode** *above.*

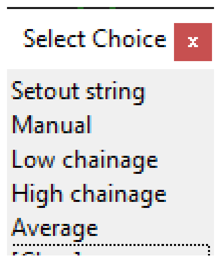
Road ch mode choice box



Road centre line chainage for pit setout schedules.

*For the **Road ch mode** definitions, see* 17.1.4.6.3 Node Road Chainage Mode.
*For more on **Road ch mode**, see* 17.1.4.6.3 Node Road Chainage Mode.

Symbol mode choice box



*Method for calculating the **bearing** of the node symbols*
For documentation on each **Symbol mode**, *see* 17.1.4.6.4 Setout Symbol Mode.

Trimesh rotations section

*If a **trimesh** is associated with a node then it can be manually rotated or take its rotation from the grade* *and crossfall from a road string.*

Trimesh grade mode choice box Manual, Road grade, Not set

The method of rotating the trimesh in the direction along the node.

*If **Manual**, the value is given for each node in the **Grade (%)** field in the **Node >Setout** subtab.*

*If **Road grade,** the value is taken as the grade of the road string.*

*If **Not set**, no value is given.*

Grade offset (%) real box

*This value is added to the value calculated by the **Trimesh grade mode**.*

Trimesh xfall mode choice box Manual, Road xfall, Not set

The method of rotating the trimesh in the direction perpendicular to the node.

*If **Manual,** the value is given for each node in the **Xfall (%)** field in the **Node >Setout** subtab*

*If **Road xfall,** the value is taken as the xfall of the.*

*If **Not set,** no value is given.*

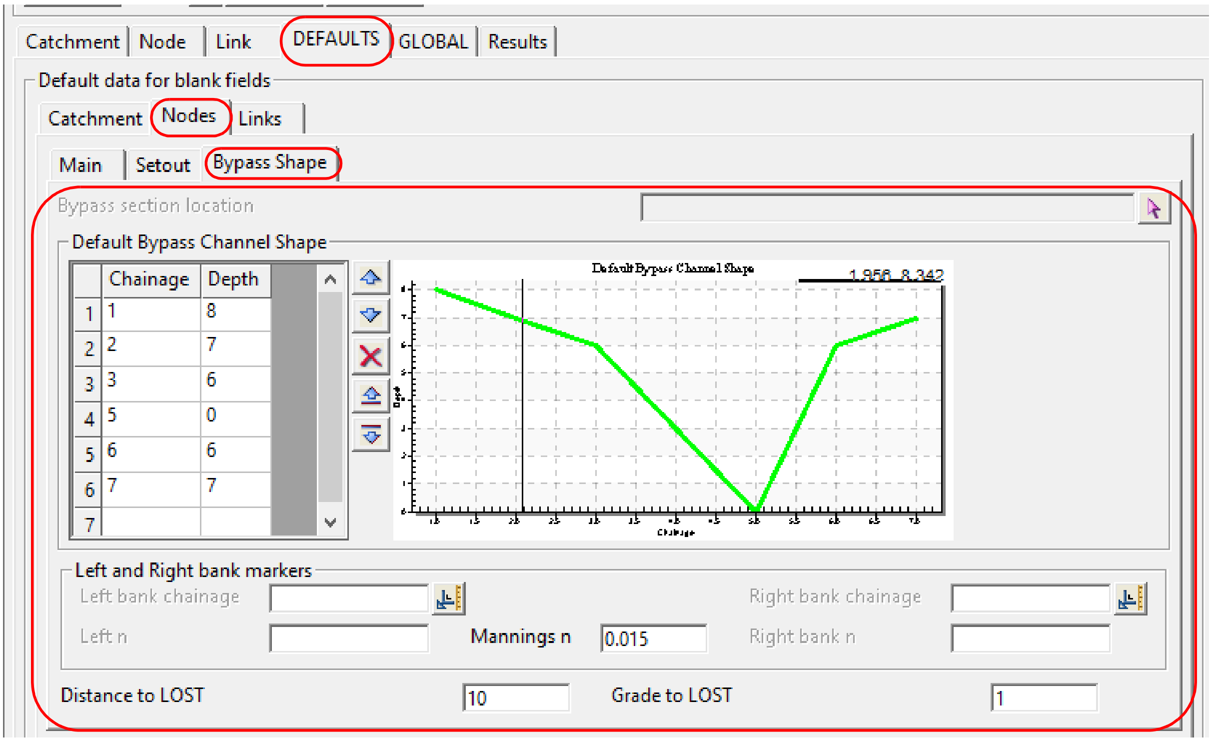
Xfall offset (%) real box

*This value is added to the value calculated by the **Trimesh xfall mode**.*

Continue to 17.3.4.6.2.2.3 DEFAULTS >Nodes > Bypass Shape - Dynamic Stormwater or return to 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

17.3.4.6.2.2.3 DEFAULTS >Nodes > Bypass Shape - Dynamic Stormwater

For information on the ***Bypass shape***, see 27.2.1.4.5 Bypass Shape.



Bypass section location string select box

If a string is selected, the string is draped onto the finished surface tin to obtain the section through the finished surface tin. The bypass shape is formed by finding the minimum z value of this section and then subtracting this minimum z value from the z-values for all the vertices in the section string.

The resulting string is drawn in the ***Default Bypass Channel Shape*** *graph area, and the (chainage, height) values of the resulting string are written to the (Chainage, Depth) grid.*

See 27.2.1.4.5 Bypass Shape.

Default Bypass Channel Shape section

Chainage, Depth grid grid

The (Chainage, Depth) values to define the cross section shape of the bypass channel.

This can be entered manually or comes from the processing of a string selected in the ***Bypass selection location*** *field.*

For more information on the processing after selecting a string, or manually entering in the data, see 27.2.1.4.5 Bypass Shape.

To enlarge the graph, right click on the graph and select ***Maximise****. Use* <ESC> *to un-maximise.*

Left and Right bank markers section

This data may be entered manually, or by adding labels string selected in the ***Bypass selection location*** *field using the* 17.5.4 Water Utility String Editor.

Left bank chainage real box

If ***not blank****, the section to the left of this chainage will have Manning's n defined by the* ***Left n****.*

If ***blank*** *then there is no left bank.*

Left n real box

If ***not blank****, the Manning's n value for the section to the left of the Left bank chainage.*

*If **blank** the value used is taken from the **Mannings n** field.*

Mannings n real box

***Manning's n v**alue for the centre section of the channel.*

This cannot be blank.

Right bank chainage

*If **not blank**, the section to the right of this chainage will have Manning's n defined by the **Right n**.*

*If **blank** then there is no right bank.*

Right n

*If **not blank,** the Manning's **n** value for the section to the right of the **Right bank chainage**.*

*If **blank** the value used is taken from the **Mannings n** field.*

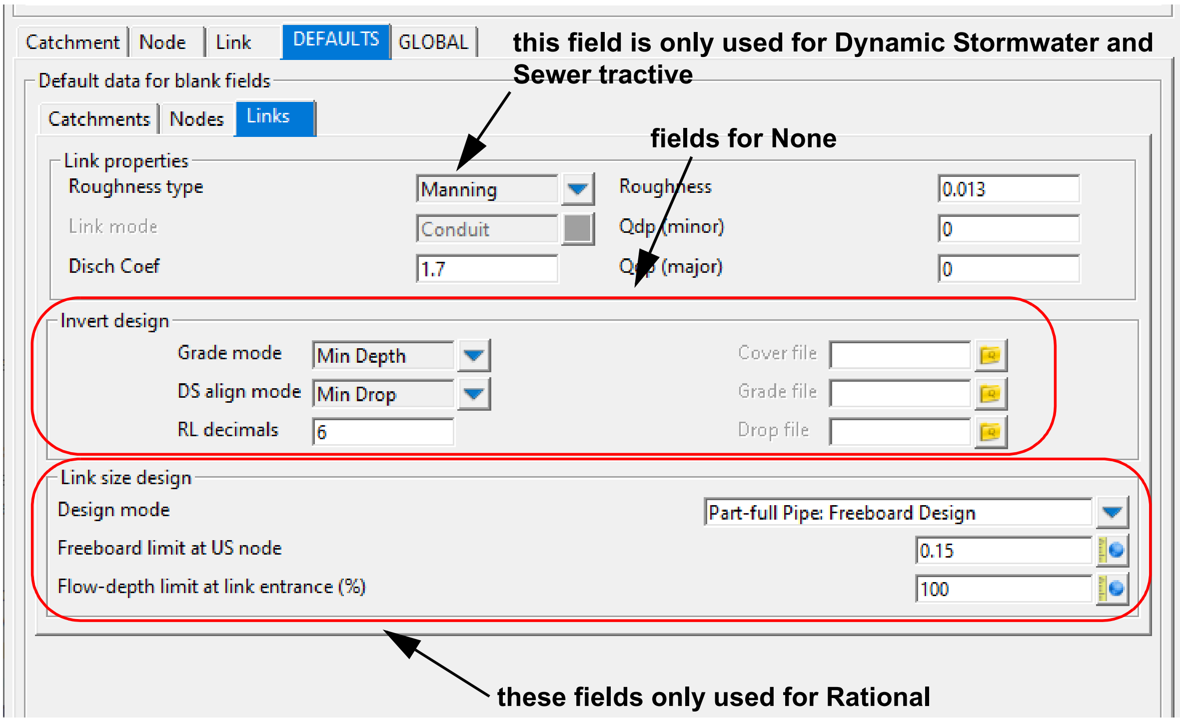
Distance to LOST

Distance to bypass node

Grade to LOST

Grade used for bypass to LOST node.

17.3.4.6.2.3 DEFAULTS >Links subtab



Link properties section

Roughness type choice box Manning, Colebrook

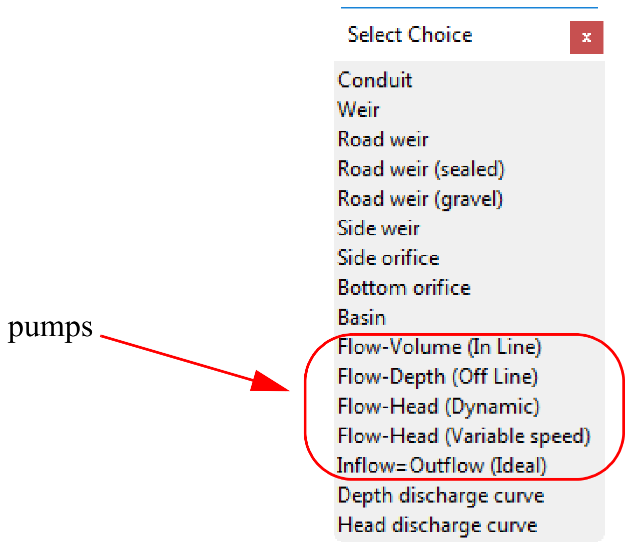
Default link roughness method

*If **Manning**, the* **Roughness** *field is Manning's **n** (based on metre-second units)*
*If **Colebrook**, the* **Roughness** *field is Colebrook's **k** (mm).*

Roughness real box

*The roughness value for the selected **Roughness type**.*

Link mode choice box



For a description of the **Link modes**, *see* 27.2.2.1 Link Modes.

Only for Dynamic Stormwater and Sewer tractive.

Qdp (minor) real box

__Direct pipe (link) flow__ for the minor storm (cubic units per storm).

__Direct link flow__ is flow at the upstream end of the link that is included in the link flow calculations but is not included in the upstream link losses nor restricted by the links inlet capacity.

Entrance blockage % (minor) real box

% blockage of the culvert entrance for the minor storm.

Qdp (major) real box

__Direct pipe (link) flow__ for the major storm.

__direct link flow__ is flow at the upstream end of the link that is included in the link flow calculations but is not included in the upstream link losses nor restricted by the links inlet capacity.

Entrance blockage % (major) real box

% blockage of the culvert entrance for the major storm.

Disch Coef real box

Weir or orifice discharge coefficient.

Invert design section

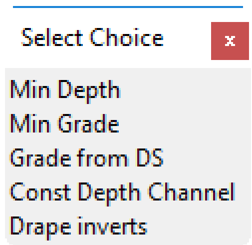
The invert levels may be set manually or calculated using the **Regrade Links** *button.*

The link invert levels during design are controlled by the link sizes, maxi link height, minimum link cover and invert alignment mode.

There are many controls to guide __12d Model__ in the setting of the pipe inverts and the user may over constrain the network so that no solution is possible. If the minimum cover, grade or drop criteria cannot meet the criteria you have set, a problem message will be in the Output Window.

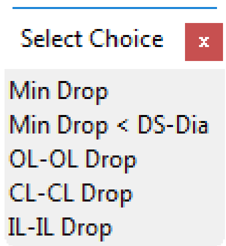
See 17.3.4.6.2.3.6 Link Invert Design.

Grade mode choice box



See 17.3.4.6.2.3.1 Link Grade Modes

DS align mode choice box



The amount of the drop is determined first from the Drop file and then if required from the node default settings for the project. How the drop value is applied is set via the __DS align mode__.

Inverts are moved down, if required, according to the setting in __DS align mode__.

See 17.3.4.6.2.3.4 Downstream Alignment Modes

RL decimals

Number of decimals for links.

Cover file) file box *.cover files

The minimum cover can be set via the link type and the pipe cover file (optional). See 17.3.4.6.2.3.2 Link Minimum Cover File. *To edit or create a pipe cover file, click RB on the folder icon and select* ***Open*** *to bring up the* ***Pipe Cover File*** *editor.*

If the link type is not found in the pipe cover file then the ***DEFAULTS >Links*** *Cover for the project is used??*

Grade file) file box *.grade files

The minimum and maximum grades can be set via the link type and the pipe grade file (optional). See 17.3.4.6.2.3.3 Link Grade File.

To edit or create a pipe grade file, click RB on the folder icon and select ***Open*** *to bring up the* ***Pipe Grade File*** *editor*

Drop file) file box *.drop files

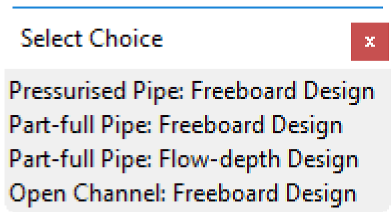
Deflection through a node and the pipe deflection drop file cover file (optional). See 17.3.4.6.2.3.5 Link Deflection Drop File.

To edit or create a pipe deflection drop file, click RB on the folder icon and select ***Open*** *to bring up the* ***Pipe Deflection Drop File*** *editor.*

Link size design section

This is only used for the ***Rational*** *method which can size links.*

Design mode choice box



If ***Pressurised Pipe: Freeboard Design*** *then it does not use partial depths in the pipes and pipe sizes are selected by checking the pit freeboard.*

If ***Part-full Pipe: Freeboard Design****: this is similar to* ***Pressurised Pipe: Freeboard Design*** *except gradual varied flow and hydraulic jumps are calculated in the pipes. Critical depth is the minimum depth at the upstream end of the pipe.*

If ***Part-full Pipe: Flow-depth Design****: this is the similar to* ***Part-full Pipe: Freeboard Design*** *except the pipe sizes are selected by checking the normal depth in the pipe against the* ***Flow-depth limit at US node****. Freeboard is also checked in this mode and if required the pipe will increase in size.*

If ***Open Channel: Freeboard Design****: this is similar to* ***Part-full Pipe: Freeboard Design*** *except depths at the upstream end of the pipe may be less than critical depth for steep pipes (supercritical flow at the entrance).*

Freeboard limit at US node real box

Freeboard limit at the upstream node.

The ***Freeboard limit*** *is used for all* ***Design modes****.*

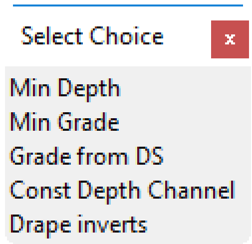
*The freeboard is measured down from the grate level (****Cover RL*** *plus* ***Grate offset****).*

Flow-depth limit at link entrance (%) real box

The ***Flow-depth limit at link entrance (%)*** *is used in* ***Design mode Part-full Pipe: Flow-depth Design****. If the flow depth in the link is greater than this value the link size is increased.*

17.3.4.6.2.3.1 Link Grade Modes

Grade mode choice box



*If **Minimum Depth**, the cover sets the inverts at each end of the link and then the downstream invert is lowered if the minimum grade is not achieved.*

*If **Minimum grade**, the link is set to the min grade and then lowered to meet the cover requirements.*

*If **Grade from DS -Warning! Minimum cover may not be maintained in this mode**.*

*Each link has its downstream (ds) invert level set via its **DS pipe alignment** mode.See* 17.3.4.6.2.3.4 Downstream Alignment Modes

If the downstream node is the outlet then the cover is used to set the invert level.

The upstream invert is set using the minimum grade.

*If **Const Depth Channel** - **Warning! Minimum cover, minimum grade and node alignments are not used in this mode.***

the obvert of the pipe is set to the finished tin level at the pit centre.

*If **Drape inverts**, ??*

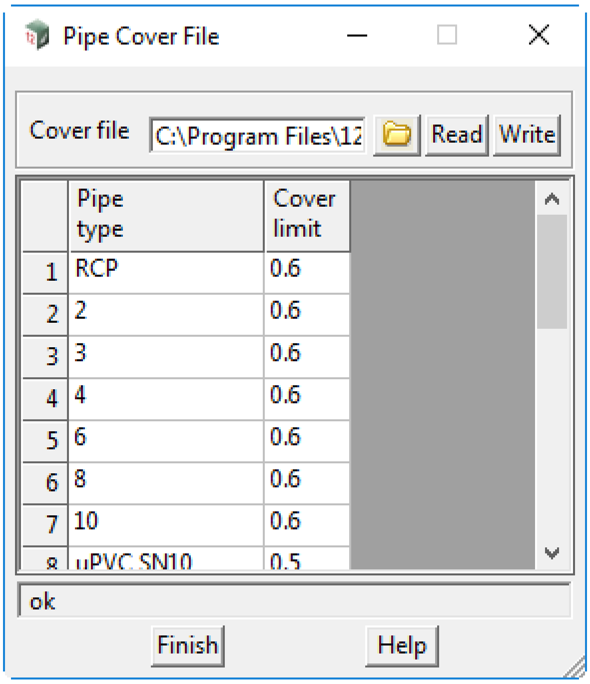
Note

Regrading of links can also be done by a separate option. See 17.5.5.11 Regrade Links,

17.3.4.6.2.3.2 Link Minimum Cover File

The minimum cover can be set via the **link type** and the l**ink cover file** (optional).

If the **link type** is not found in the **link cover file** then the ***DEFAULTS >Links*** Cover for the project is used (??).



Cover file file box *.cover

File of cover levels for link types.

Read button

*Data in the file given in the **Cover file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Cover file** field.*

Grid

Pipe type pipe type column

Link type that the cover is being defined for.

*Click RB in the **Pipe type** column to get a list of Pipe types to select from.*

Cover limit real column

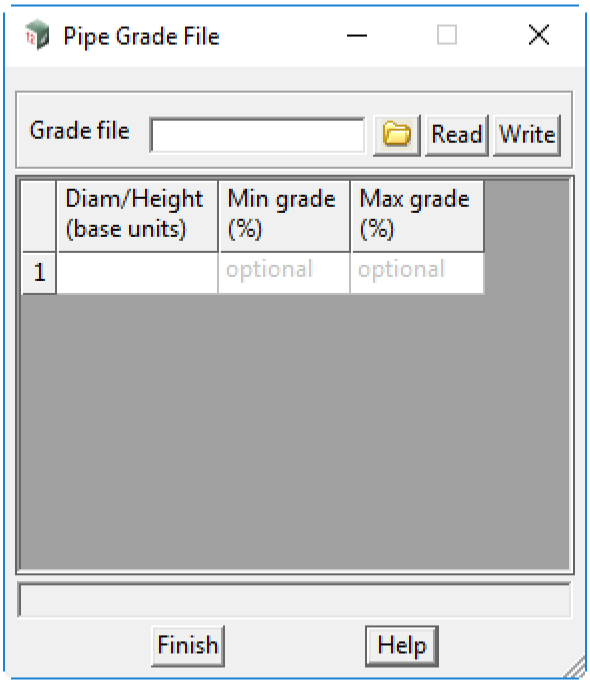
Minimum cover for the link type.

17.3.4.6.2.3.3 Link Grade File

The **minimum grade** can be set via the **link diamete**r and the **link grade file** (optional). The diameter is the maximum diameter that this grade will be used for.

If the diameter exceed the greatest diameter in the grid, the last grade will be used.

If the **link grade file** is not used then the grade from the ***DEFAULTS >Links*** Min grade for the project is used (??).



Grade file file box *.grade

File of cover levels for link types.

Read button

*Data in the file given in the **Grade file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Grade file** field.*

Grid

Diam/Height (base units) real column

Link type that the cover is being defined for.

*Click RB in the **Pipe type** column to get a list of Pipe types to select from.*

Min grade (%) real column

Minimum grade for the link type.

Max grade (%) real column

Maximum grade for the link type. An error message will be placed in the output window if the grade exceeds this value. The value has no effect on the regrading process.

Note on Link Grade

Link grade has been traditionally measured based on the horizontal distance from **node centre to node centre.** However, this causes issues with surveyors when they use electronic models to set out the water links as they require the actual length of the link and the actual grade of the link.

12d Model can calculate link length by the traditional method but can also calculate link lengths, and hence grades, from the horizontal distance between inside node edges (or node connection point for the unrestricted pit connection mode).

Which calculation is used depends on the tick box **Use link end to end lengths** on the ***WNE*** **GLOBAL >Main** tab**.** See 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section**.**

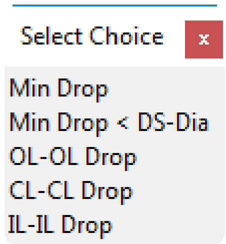
17.3.4.6.2.3.4 Downstream Alignment Modes

The amount of the drop is determined first from the **Drop file** (see 17.3.4.6.2.3.5 Link Deflection Drop File) and then if required, from the node default settings for the project.

How the drop value is applied is set via the **DS align mode**.

Inverts are moved down, if required, according to the setting in **DS align mode.**

DS align mode choice box



Min drop *ensures that the inverts drop a minimum of the drop but may be more.*

Min drop <DS-Dia *ensures that the inverts drop a minimum of the drop but may not be more than the downstream link diameter. This restricts the max drop so that the water jet will not completely impact the opposite wall of the node.*

OL-OL Drop *uses the drop value for the obverts. If the downstream link is smaller, then the drop will be applied to the inverts so that water will not be trapped in the node. If the downstream link is larger then the obverts will be aligned as long as the min drop is maintained on the inverts.*

CL-CL Drop *uses the*

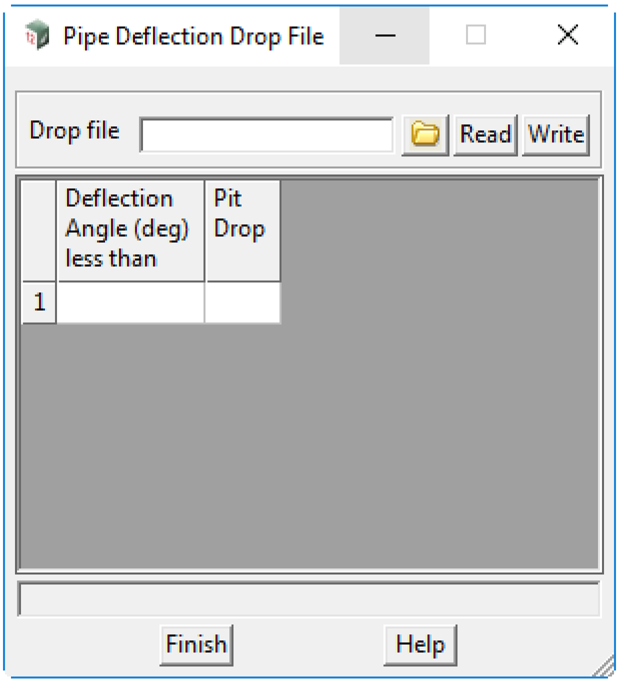
IL-IL Drop *uses the drop value for the inverts.*

17.3.4.6.2.3.5 Link Deflection Drop File

The **Link Deflection Drop file** contains the drop in the node from the incoming link to the outgoing link. The drop depends of the link deflection angle.

If only one drop value is to be used, set the deflection angle to 180 degrees.

The drop values are applied in conjunction with the ***DS Align mode*** in the 17.3.4 Water Network Editor (WNE). See 17.3.4.6.2.3.4 Downstream Alignment Modes.



Drop file file box *.cover

File of drops though a node.

Read button

*Data in the file given in the **Drop file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Drop file** field.*

Grid

Deflection angle (deg) less than pipe type column

Deflection angle of the incoming and outgoing links that the drop is being defined for. The angles entered are between 0 and 180 degrees.

If only one drop value is to be used, set the deflection angle to 180 degrees.

Pit drop real column

Amount to drop the outgoing link if the deflection angle is less than the value in the first column.

The drop is normally positive to indicate the outgoing invert is below the incoming link. Drops are rarely negative.

17.3.4.6.2.3.6 Link Invert Design

The link invert levels may be set manually or calculated using the WNE **Regrade Links** button (17.3.4.6.10 Regrade Links Button*)*.

When the link levels are calculated there are many controls to guide ***12d Model*** in the setting of the link inverts.

A number of these are specified in the ***Invert Design section*** of the ***DEFAULTS >Links*** subtab, or by any overrides given for individual links by the ***Node >Main subtab*** *(see* 17.3.4.6.4.1 Node >Main subtab*)*.

Link inverts can also be locked, even for the entire model. See 17.3.9.2 Set Water String Node and Link Locks*)*.

However the user may over constrain the network so that no solution is possible. If the minimum cover, grade or drop criteria cannot meet the criteria you have set, a problem message will be in the output window.

Important Node on Cover Calculations

17.3.4 Water Network Editor (WNE) calculates cover from the **top** of the **link** and **NOT the obvert** so cover may appear incorrect. Also for box culverts, cover is measured at the edges as well as the centre of the link.

Finally for multiple links, each link is checked for cover.

Note

Regrading of links can also be done by a separate option. See 17.5.5.11 Regrade Links,

17.3.4.6.3 Catchment tab - Stormwater

If the **current node** is an **Inlet** (on-grade or sag inlets - see 27.2.1.3 Node Inlet Configurations), the **Catchment** tab is used to specify the catchment and the catchment data **for the current node**.

Note: Nodes of Inlet configuration type Manhole will **not** connect to a catchment.

The defaults for many on the settings are given on the 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater subtab which can be overridden for any node.

The nodes are connected to the catchments by the 17.3.4.6.8 Set Catchments Button - Stormwater. *See* 17.3.4.6.3.1.1 Catchment String Connections.

For information on the Stormwater subtabs, see

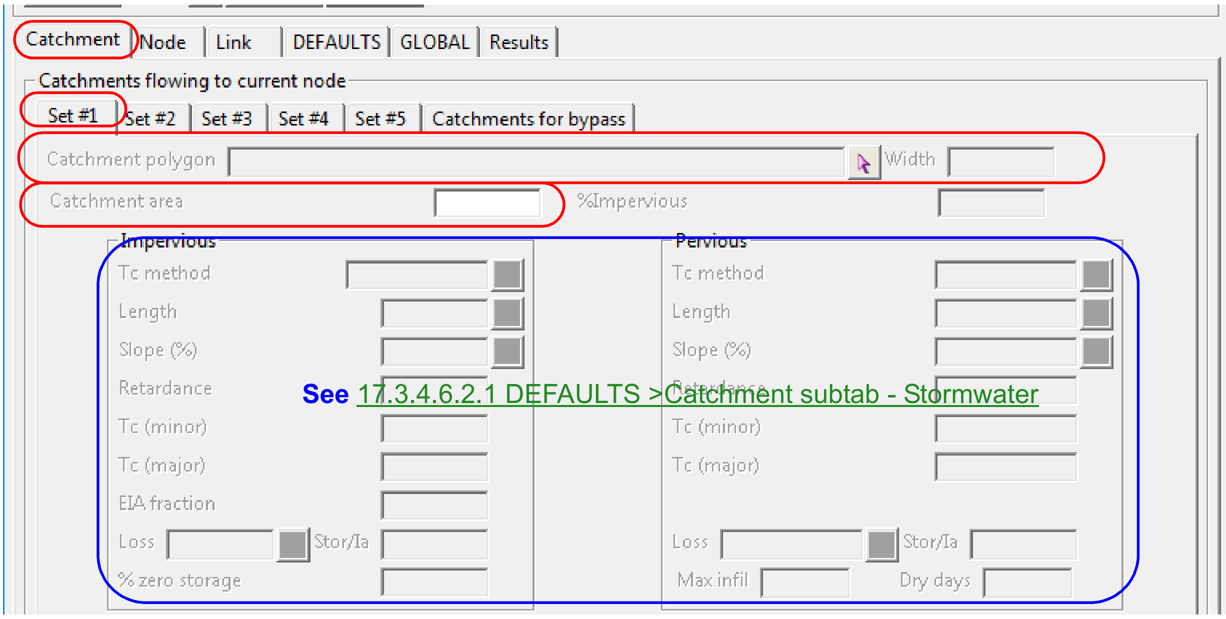
17.3.4.6.3.1 Catchment Sets #1 to #5 tabs

17.3.4.6.3.2 Catchments for Bypass tab

17.3.4.6.3.1 Catchment Sets #1 to #5 tabs

Each **Catchment Set** (#1 to #5) has **its own model of catchment strings** and if used, each **set is independently connected to the inlets**. This can be done automatically using the **Set Catchments** button or manually using the **Catchment polygon** field on this tab.

The default values for the fields circled in blue are entered in the ***DEFAULTS >Catchment*** tab and the only values that need to be entered for an individual node is when there is an **explicit value** to be set **for the current node**. Otherwise the fields are left blank and the default values are used. See Node/Link/Catchment tabs Versus DEFAULTS Nodes/Links/Catchment tabs: and DEFAULTS >Catchment > Set #1 subtab - Rational.



Catchment polygon string select

The **Catchment polygon** *select is used to* ***manually connect*** *a catchment string to the node for that Set. Any string from the catchment model for that Set may be selected. The area for the catchment is piped into the* **Catchment area** *field.*

If the selected string is already connected to another inlet, that previous connection will be broken and the previous **Area** *field cleared.*

Width real box

Width (m or ft) is the average catchment width and is used only by the EPA-SWMM hydrology method.

In loose terms, is the subcatchment short and wide or long and narrow?

It is a measure of how long it takes to saturate the catchment.

Area real box

There is no default catchment area to apply to all catchments. A value may typed in manually or the catchment area calculated from a selected string.

If a **Catchment polygon** *is selected its area is piped into the* **Area** *field.*

If a **Catchment polygon** *is* ***NOT*** *selected then an area can be manually entered into the* **Area** *field.*

For All the Other fields Circled in blue

See Node/Link/Catchment tabs Versus DEFAULTS Nodes/Links/Catchment tabs: and 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater.

17.3.4.6.3.1.1 Catchment String Connections

The 17.3.4.6.8 Set Catchments Button - Stormwater at the bottom of the WNE updates the catchment string connections, calculates the catchment areas and optionally creates catchment labels and optionally sets the fill colours for the catchment polygons.

Each **Catchment Set** (1, 2, 3, 4 and 5) has **its own model of catchment strings** and the **sets are connected to the inlets independently**.

Vertex number 1 on the catchment string determines which inlet the string will connect to. If vertex 1 of several catchment strings are closest to the same inlet, only the closest string will connect and the remaining will not be used for any other inlet.

Manholes (versus on-grade or sag inlets) will not connect to a catchment string (see 27.2.1.3 Node Inlet Configurations).

When the **Catchment polygon** select button is used to **manually connect** a catchment string, any string from the catchment model Set may be selected. If the selected string is already connected to another inlet, that previous connection will be broken and the **Area** field cleared.

The **Clear catchment connections** button on the 17.3.4.6.1.2.2 GLOBAL >Utility Models subtab - Stormwater-subtab will **delete** all catchment connections and Area values. Catchment with **Area** values manually entered are also cleared.

The node uid attributes "catchment string id" and "catchment model id" and real attribute "area" are deleted (including suffix 2 and 3). This includes inlets where a manual pick has been done.

Note that since the vertices are re-ordered by the 17.3.4.6.8 Set Catchments Button - Stormwater then even after a **Clear catchment connections** there is a significant probability that manual connections will be restored.

WHAT ARE

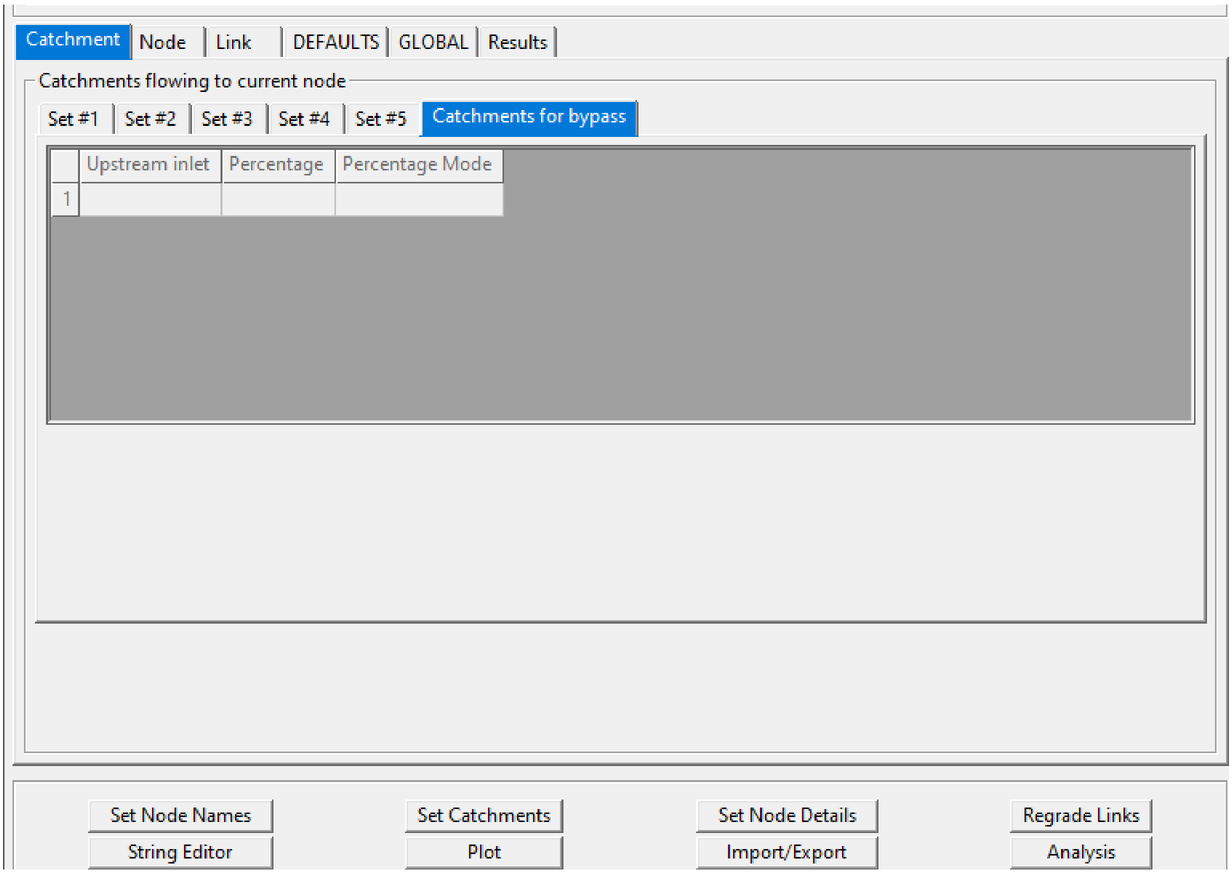
Catchment polygons, the catchment slope strings, catchment labelling data

Bypass flow strings

Road setout strings, road centre line strings and crossfall/grade offsets

Service/utility models and the allowable clearances

17.3.4.6.3.2 Catchments for Bypass tab



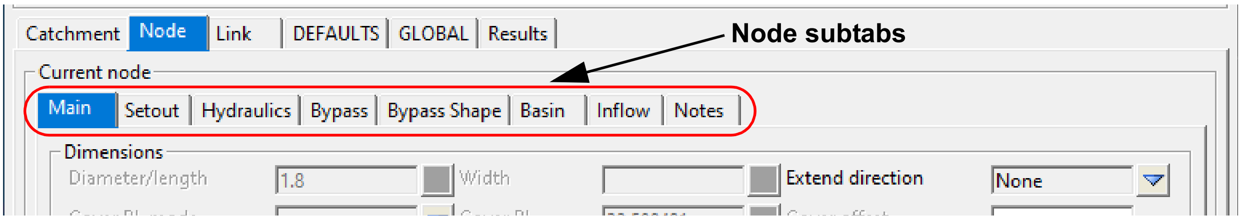
Select **Set Node Details** to calculate the percentage of flows that are allocated to each of the approaching bypass routes.

See 27.2.1.4.4 Catchments for Bypass Tab.

17.3.4.6.4 Node Tab

The **Node** tab is used to set data for the **currently selected node** in the WNE.

The fields in the subtabs of the **Node** tab can have the explicit values but when a **field** is **blank**, the value in the field of the same name in the same subtab of ***DEFAULTS > Nodes*** is **used**.

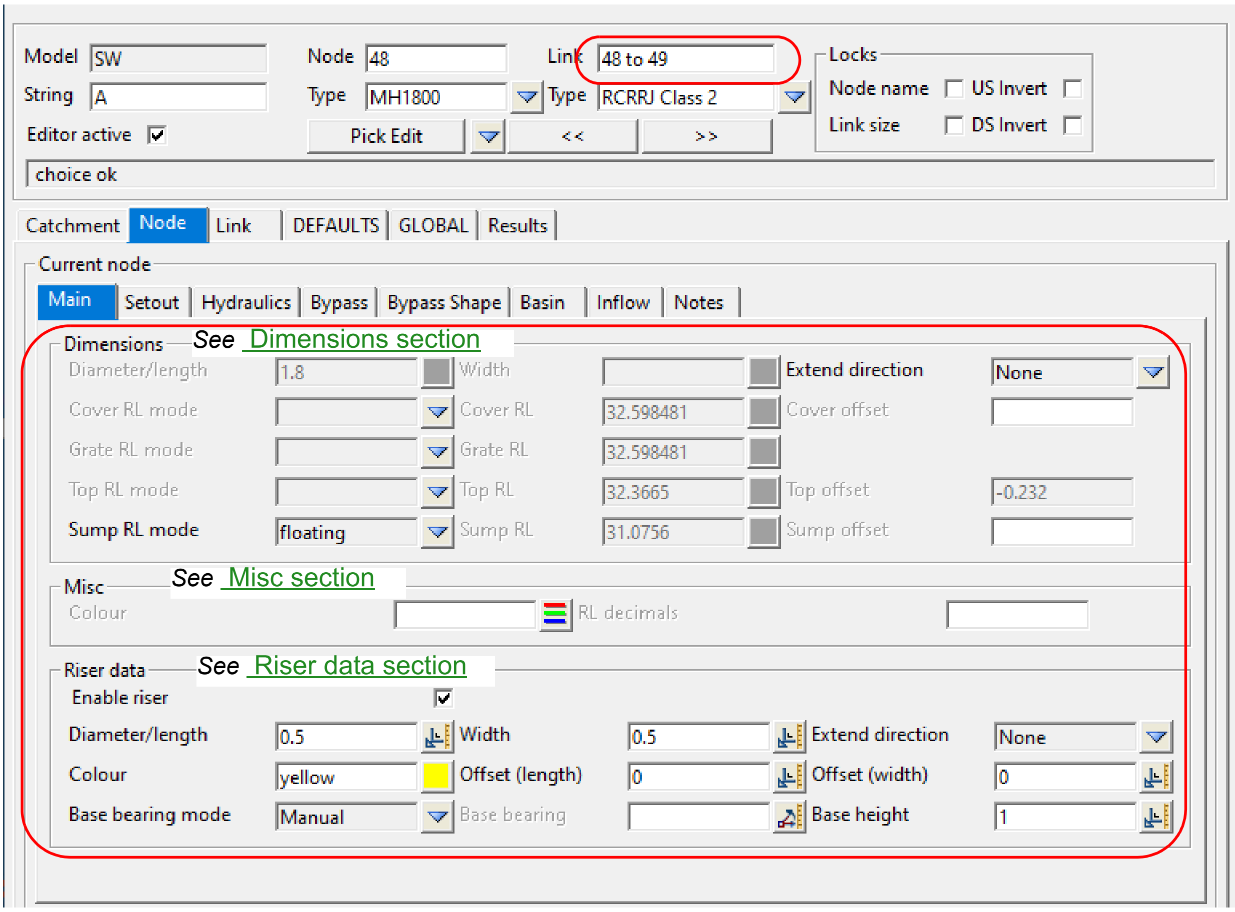


For information on the subtabs of **Node**, see

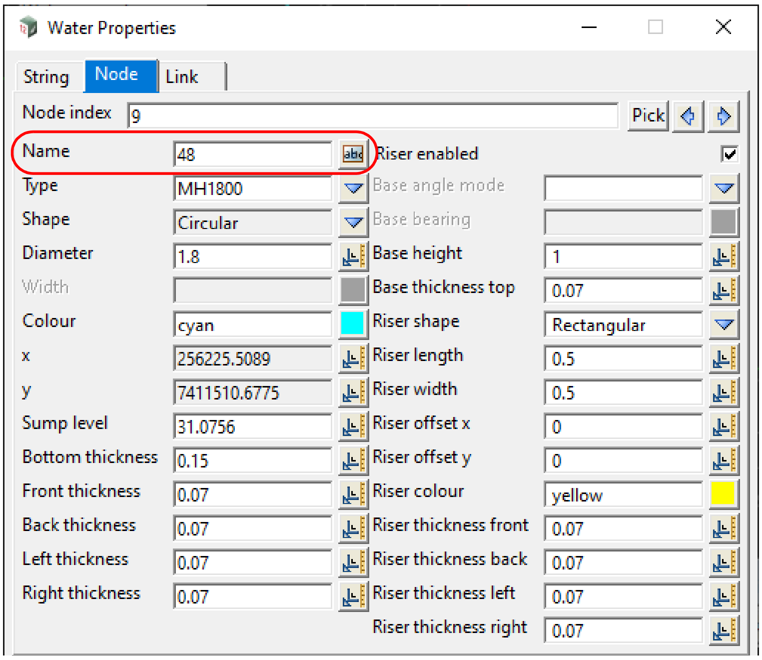
17.3.4.6.4.1 Node >Main subtab
17.3.4.6.4.2 Node >Setout subtab
17.3.4.6.4.3 Node > Hydraulics subtab
17.3.4.6.4.4 Node >Bypass subtab - Stormwater
17.3.4.6.4.5 Node >Bypass Shape subtab - Dynamic Stormwater
17.3.4.6.4.6 Node >Basin subtab -Dynamic Stormwater
17.3.4.6.4.7 Node >Inflow subtab - Dynamic Stormwater

17.3.4.6.4.1 Node >Main subtab

The fields in the **Node >Main** subtab are some of the values taken from the current node of the Water String being examined in the WNE.



For example, the **Water Properties** panel for the node index 4 in the ***Water String Editor*** is

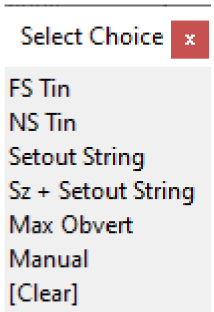


Dimensions section

Diameter/length, Width and **Extend direction**

These values cover the cases for **Shape**, **Length** *and* **Width** *on the* **Water Properties** *panel. See* 17.3.6.2.1 Water Properties.

Cover RL mode choice box



Cover RL *defines the surface z-value above the top of the node.*

The definition of the **Cover RL mode** *choices except* **[Clear]** *is given in* 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z).
If ***[Clear]***, **Cover RL mode** *is left blank.*

Note: *If* **Cover RL mode** *on the* ***Node >Main*** *tab is* ***blank*** *then* **Cover RL mode** *is defined by the* **Cover RL mode** *field on* 17.3.4.6.2.2.1 DEFAULTS >Nodes >Main

Cover RL real box

Value for the ***Cover RL*** *when* **Cover RL mode** *is* ***Manual***.

Cover offset

This value is added to the valued calculated using the **Cover RL mode**.

Grate RL mode choice box

Grate RL *defines the z-value for the top of the grate.* ***Grate RL*** *is the* ***most important level in the 12d hydraulics.***

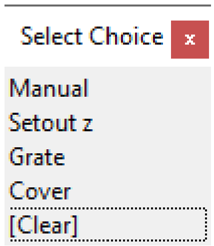
The definition of the **Grate RL mode** *choices except* **[Clear]** *is given in* 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z).
If ***[Clear]***, **Grate RL mode** *is left blank.*

Note: *If* **Grate RL mode** *on the* ***Node >Main*** *tab is* ***blank*** *then* **Grate RL mode** *is defined by the* **Grate RL mode** *field on* 17.3.4.6.2.2.1 DEFAULTS >Nodes >Main

Grate RL real box

Value for the ***Grate RL*** *when* **Grate RL mode** *is* ***Manual*** *or for other choices, the calculated value.*

Top RL mode choice box



__Top RL__ defines the z-value for the top of the node.

The definition of the **Top RL mode** *choices except* **[Clear]** *is given in* 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z).

*If **[Clear]**,* **Top RL mode** *is left blank.*

***Note:** If* **Top RL mode** *on the **Node >Main** tab is **blank** then* **Top RL mode** *is defined by the* **Top RL mode** *field on* 17.3.4.6.2.2.1 DEFAULTS >Nodes >Main

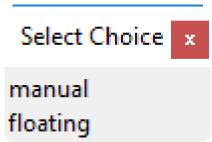
Top RL real box

*Value for the **Top RL** when **Top RL mode** is **Manual** or for other choices, the calculated value*

Top offset

*This value is added to the value calculated by the **Top RL mode**.*

Sump RL mode choice box



__Sump RL__ defines the z-value for the bottom of the inside of the node.

For the Sump RL mode definitions, see 17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z).

Sump RL real box

*Value for the **Sump RL** when **Sump RL mode** is **manual**.*

Sump offset real box

*This value is used when the **Sum RL mode** is **floating** and is subtracted from the minimum invert level of the joining links. See* 17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z)

Misc section

Colour colour box

Colour of the chamber of the node.

RL decimals real box

??

Riser data section

Enable riser tick box

*If **ticked** the node has a riser.*

Diameter/length, Width and **Extend direction**

These values cover the cases for **Riser Shape**, **Riser Length** *and* **Riser Width** *on the* **Water Properties** *panel. See* 17.3.6.2.1 Water Properties.

Colour colour box

Colour of the riser.

Offset (length) and **Offset Width**

These are the same as **Riser offset x** *and* **Riser offset y** *on the* **Water Properties** *panel. See* 17.3.6.2.1 Water Properties.

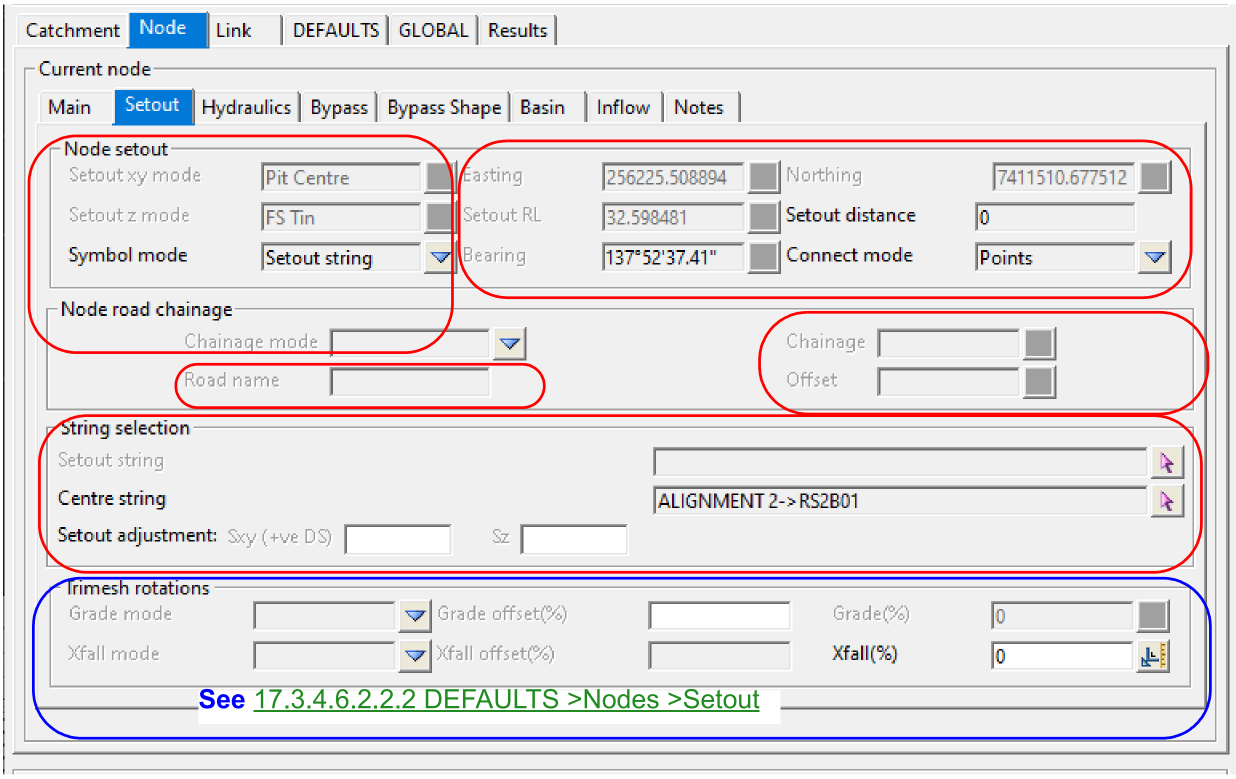
Base bearing mode, **Base bearing** and **Base height**

These are the same **Base angle mode***,* **Base bearing** *and* **Base height** *on the* **Water Properties** *panel. See* 17.3.6.2.1 Water Properties.

17.3.4.6.4.2 Node >Setout subtab

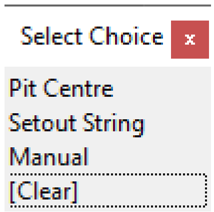
The fields in the **Node >Setout** subtab can have explicit values but when a field is blank, the value of the field of the same name in the ***DEFAULTS > Nodes >Setout*** subtab is used.

So many of the fields for the **Node >Setout** subtab have already been documented in the ***DEFAULTS > Nodes >Setout*** subtab and the ones that haven't been documented are circled below in red.



Node Setout section

Setout xy mode choice box



*If **Manual**, the x and y coordinates are given in the* **Easting** *and* **Northing** *fields.*

Easting output

Easting (x value) for the setout point.

Northing output

Northing (y value) for the setout point.

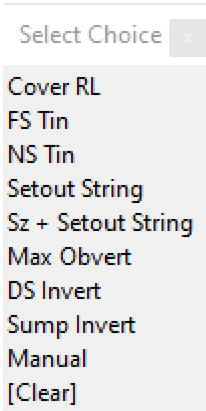
The definition of the choices except **[Clear]** *is given in* 17.1.4.6.1 Setout xy Mode and Setout xy.

*If **[Clear]**,* **Setout xy mode** *is left blank.*

***Note:** If* **Setout xy mode** *on the **Node >Setout** tab is **blank** then* **Setout xy mode** *is defined by the* **Setout xy mode** *field on* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

*The **Setout XY** for each node is either set manually or is calculated using the **Setout xy mode** when the **Set Node Details** button is pressed.*

Setout z mode choice box



*If **Manual**, the Setout RL and Setout distance are given in the* **Setout RL** *and* **Setout distance** *fields.*

Setout RL real box

Setout RL (z value) for the setout point.

Setout distance real box

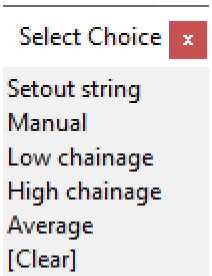
??

The definition of the choices except **[Clear]** *is given in* 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

*If **[Clear]**,* **Setout z mode** *is left blank.*

***Note:** If* **Setout z mode** *on the **Node >Setout** tab is **blank** then* **Setout z mode** *is defined by the* **Setout z mode** *field on* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.
*The **Setout RL** for each node is either set manually or is calculated using the **Setout z mode** when the **Set Node Details** button is pressed.*

Symbol mode choice box



*If **Manual**, the Symbol bearing is given in the* **Bearing** *field.*

Bearing real box

Bearing of the setout symbol.

The definition of the choices except **[Clear]** *is given in* 17.1.4.6.4 Setout Symbol Mode.

*If **[Clear]**,* **Symbol mode** *is left blank.*

***Note:** If* **Symbol mode** *on the **Node >Setout** tab is **blank** then* **Symbol mode** *is defined by the* **Symbol mode** *field on* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.
*The **Symbol mode** for each node is either set manually or is calculated using the **Setout mode** when the **Set Node Details** button is pressed.*

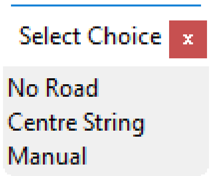
Connection mode choice box

Connection mode for the current node.

For information on Connection modes, see 17.3.4.6.1.1.1.1 Node Connection Points.

Node Road chainage section

Road ch mode choice box



Road centre line chainage, Road name and Offset for pit setout schedules

*If **No road** - no values calculated*

*If **Centre String**, the setout xy is found by dropped perpendicular onto the road centre line string which is selected in the **Centre** field in the* **Node >Setout** *tab. Also see* 17.1.4.5.2 Using Road Design Centre line and Setout Strings.

*If **Manual**, the values will be typed into the **Chainage**, **Road name** and **Offset fields**.*

*For more on **Road ch mode**, see* 17.1.4.6.3 Node Road Chainage Mode.

Road name text box or output

Name of the road.

Chainage real box or output

Road chainage of the node dropped onto the road string.

Offset real box or output

Offset to the road string of the node dropped onto the road string.

String selection section

For information on setout and centre strings, see 17.1.4.5.2 Using Road Design Centre line and Setout Strings.

Setout string string select

If selected, the string to use as the setout string.

Centre string string select

If selected, the string to use as the road string.

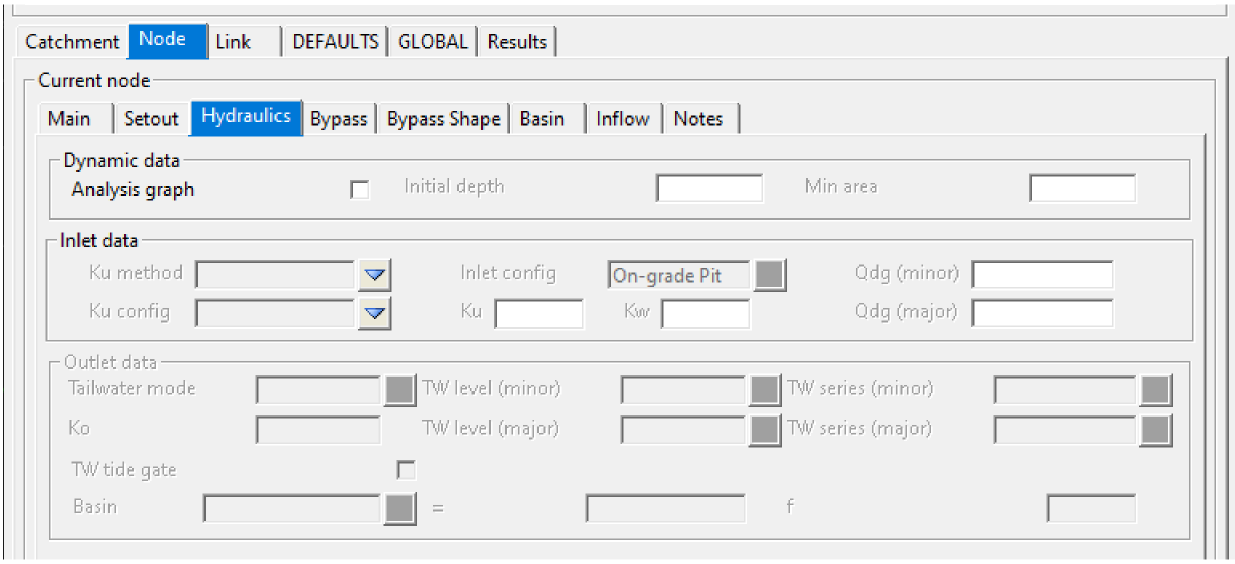
Setout adjustment: Sxy (+ve DS) real box

See 17.1.4.6.1 Setout xy Mode and Setout xy.

Setout adjustment: Sz real box

See 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

17.3.4.6.4.3 Node > Hydraulics subtab



Dynamic data section

Only displayed for a Dynamic Stormwater method.

Analysis graph tick box

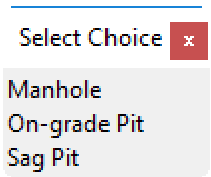
*If **ticked**, graphs of the analysis are created.*

Initial depth real box

Northing (y value) for the current node.

Inlet data section

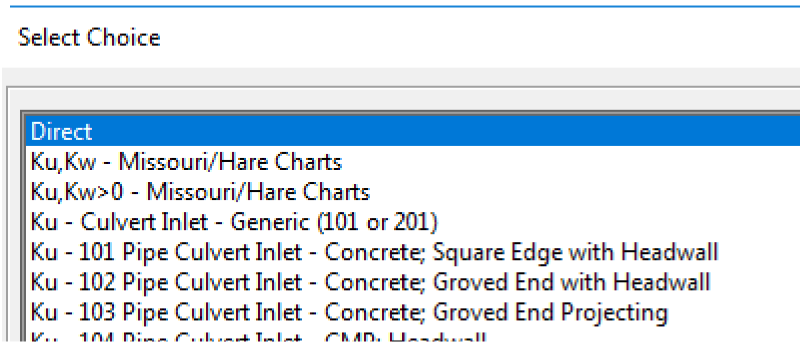
Inlet config choice box



*The inlet configuration specifies if the node wont let water in (**Manhole**), can capture water but lets it flow past as well (**On-grade Pit)**, or is where ponding can occur (**Sag Pit)**.*

The Inlet configuration is important because different information and calculations are needed for each case. See 27.2.1.3 Node Inlet Configurations.

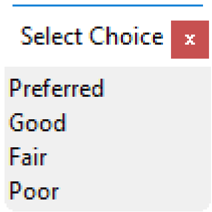
Ku method choice box



*The Pit loss **Ku** is used to model the energy losses through the pits and inlet control on culvert inlets.See*

27.2.1.2 Ku - Node Pressure Losses.

Ku config choice box



See 27.2.1.2 Ku - Node Pressure Losses.

Ku/Kw

Ku/Kw value when required by Ku method.

Qdg (minor)

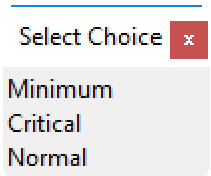
Direct flow applied to node in minor storm analysis and subject to inlet capacity calculations (cubic units per second).

Qdg (major)

Direct flow applied to node in major storm analysis and subject to inlet capacity calculations (cubic units per second).

Outlet data section

Tailwater mode choice box



TW level (minor)

The constant tailwater elevation at an outlet node for a minor event.

TW series (minor)

See 17.5.1.9 Outlet Tailwater Time Series

TW level (major)

The constant tailwater elevation at an outlet node for a major event.

TW series (major)

See 17.5.1.9 Outlet Tailwater Time Series

Ko

The head loss coefficient at the outlet of the network:

$Hl = Ko*v^2/2g$

e.g. Ko = 1 for a conduit discharging into still water.

TW tide gate tick box

*If **ticked**, reverse flow in the conduit upstream of this node is prevented.*

*If **not ticked**, reverse flow in the conduit upstream of this node is permitted and the network can be affected by flows coming from an outlet tailwater condition*

Basin choice box

This is a thumbnail-in-tar estimation of the affect a basin might have on the reduction of flow in the network when using the Rational method of analysis.

*Designers are strongly advised to use the **Dynamic Drainage** module if basins are present in the network.*

17.3.4.6.4.4 Node >Bypass subtab - Stormwater

The ***Bypass** subtab* is used when **overland flow** is to be **analysed**.

The **overland flow model** is specified on the **GLOBAL >Utility Models** subtab (17.3.4.6.1.2 GLOBAL >Utility Models subtab.

The calculations are enabled on the **Main** tab of the **Water Network Editor:Storm Analysis** panel, using the **Consider bypass flow** tick box (see 17.3.4.6.14.1 Analysis >Main tab). When this tick box is not selected, the inlets will have unrestricted inlet capacity.

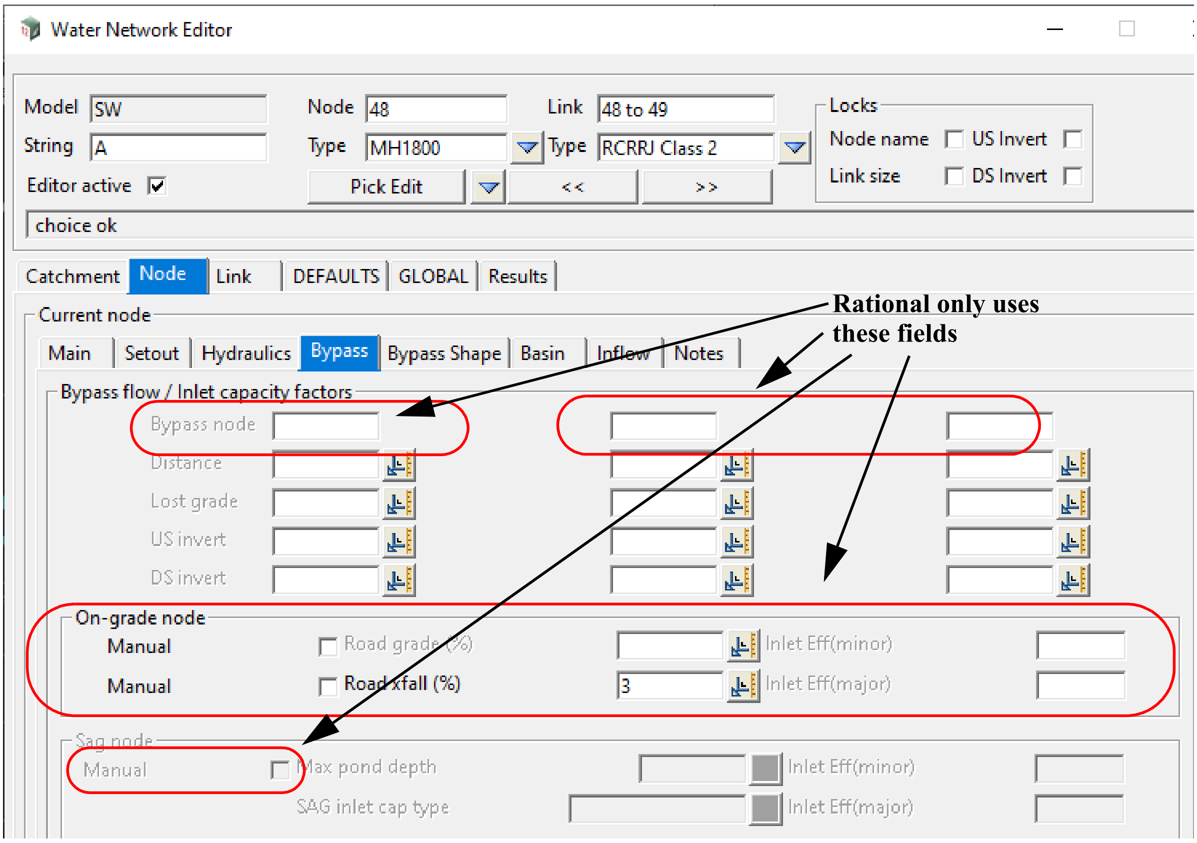
The **Inlet config** setting on the **Node >Hydraulics** subtab is the main control for inlet capacity calculations (see 17.3.4.6.4.3 Node > Hydraulics subtab).

> **Note:** A **manhole** is **NOT** an inlet. It has no inlet capacity, cannot be linked to catchment strings and cannot be used as a bypass inlet.See 27.2.1.3 Node Inlet Configurations.

SAG and **On-grade** inlets have unrestricted inlet capacity when there is no **Bypass node** value on this tab. Exception: The dynamic analysis will always calculate inlet capacity for basin nodes set as a sag inlet.

For **Drainage 2d** calculations, the inlets ***inside the 2d extent*** **DO NOT** use the **Bypass node**. Inlets connected via the sump connection have unrestricted inlet capacity and those connected via the grate will use inlet capacity calculations.

When **inlet capacity is not unrestricted**, the inlet capacity must be defined in the ***drainage.4d file*** and if it is not defined for the node type selected, the **inlet capacity** is **zero**.



Bypass flow / Inlet capacity factors

Bypass node

> *This is generally populated using the **overland flow model** specified on the **GLOBAL >Utility Models subtab** (17.3.4.6.1.2 GLOBAL >Utility Models subtab).*

*If the bypass string does not go to another inlet (the network outlet is never an inlet) then the **Bypass node** will be marked as **LOST.***

The following four fields are used only by **dynamic analysis**.

Distance real box

The bypass distance is determined from the length of the bypass flow string and the channel has a constant grade.

*If a **changing grade** or **channel shape** is required then a **Bypass node** should be **inserted** along the bypass string.*

Lost Grade real box

*Grade of the bypass channel when the bypass node is set to **LOST***

US invert real box

*If **not blank**, the upstream invert of the bypass channel.*

*If **blank**, the grate level is used.*

DS invert real box

*/if **not blank**, the downstream invert of the bypass channel.*

*If **blank**, the grate level of the bypass node is used.*

On-grade node section

This is used for an on-grade inlet.

Manual: Road grade (%) tick box

*If **ticked**, the field for the **Road grade (%)** can have a value typed into it.*

Road grade (%) real box

The road grade is used to rotate the node trimesh in the direction of the symbol bearing and in the selection of on grade inlet capacity curves.

*If **blank**, the default road grade is used.*

Manual: Road xfall (%) tick box

*If **ticked**, the field for the **Road xfall (%)** can have a value typed into it.*

Road xfall (%) real box

*If **blank**, the default road xfall is used*

*If **not blank**, the road xfall is used to rotate the node trimesh in the direction perpendicular to the symbol bearing and in the selection of on grade inlet capacity curves.*

Inlet eff (minor) real box

The captured flow axis of the inlet curve is multiplied by this factor during a minor storm analysis

*If **blank**, the default Inlet eff (minor) in used.*

*When the **Scaled blockage** is **ticked** on the **Global > Main** tab (**dynamic only**) the approach flow axis of the inlet curve is also multiplied by this factor.* 17.3.4.6.1.1 GLOBAL > Main subtab.

Inlet eff (major) real box

The captured flow axis of the inlet curve is multiplied by this factor during a major storm analysis.

*If **blank**, the default Inlet eff (major) in used.*

*When the **Scaled blockage** is **ticked** on the **Global> Main** tab (**dynamic only**) the approach flow axis of the inlet curve is also multiplied by this factor.* 17.3.4.6.1.1 GLOBAL > Main subtab

Sag node section

When the node is an sag inlet.

Manual tick box

*If **ticked**, the field for the **Max pond depth** can have a value typed into it.*

Max pond depth real box

Maximum pond depth

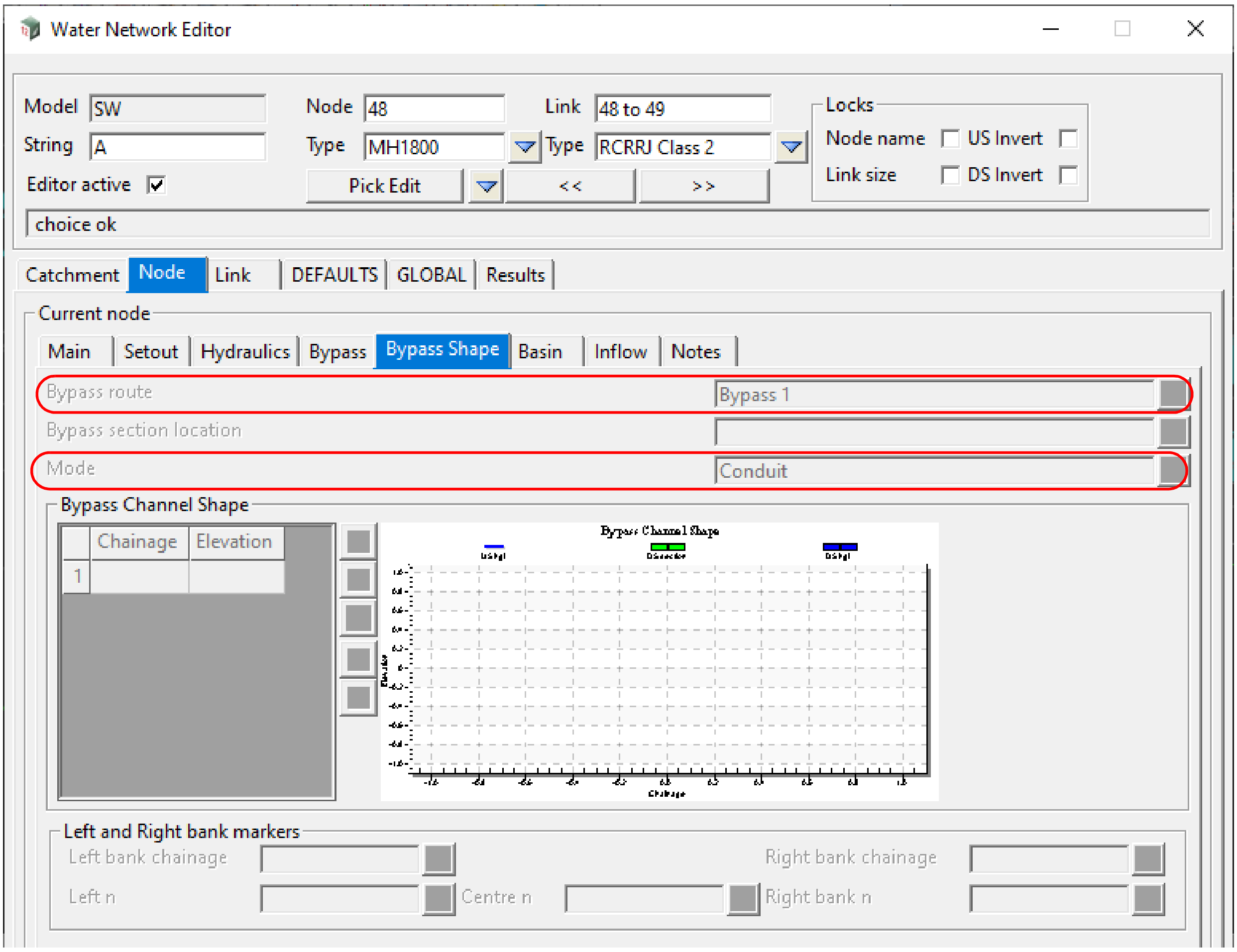
Inlet eff (minor) real box

*The captured flow axis of the inlet curve is multiplied by this factor during a minor storm analysis. If **blank**, the default* **Inlet eff (minor)** *in used.*

Inlet eff (major) real box

*The captured flow axis of the inlet curve is multiplied by this factor during a major storm analysis. If **blank**, the default* **Inlet eff (major)** *in used*

17.3.4.6.4.5 Node >Bypass Shape subtab - Dynamic Stormwater



The **Bypass shape** tab is used only by the **Dynamic Analysis**.

Bypass Route

Dynamic allows for 3 bypass routes.

***Bypass 1** used the bypass flow strings.*

***Bypass 2 and 3** require the bypass data to be entered on the **Bypass** tab.*

Bypass section location siring select

Pick the string to be draped onto the Water finished surface (FS) tin (the FS tin is set on 17.3.4.6.1.1 GLOBAL > Main subtab*).*

*The shape will be obtained from the tin and then adjusted vertically so that the lowest point on the draped string equals the grate levels on the upstream (current node) and bypass node. The resulting shape is entered into the grid and displayed in the **Bypass Channel Shape** graph area.*

*Pressing the **Set Node Details** button will recalc this data (*17.3.4.6.9 Set Node Details Button*).*

To raise or lower the upstream or downstream shape enter the new invert elevation on the **Bypass** tab.

Mode choice box

*If **Conduit,** this will use standard hydraulic conduit irregular shape calculations.*

*If **Road weir (sealed)** and **Road (weir gravel)**, these use the U.S. Department of Transportation, Federal*

*Highway Administration, HYDRAULIC DESIGN OF HIGHWAY CULVERTS, Third Edition (**3.1.5 Roadway Overtopping**). These calculations use the depth of flow and bypass path length to determine a weir discharge coefficient. Tailwater submergence is also considered.*

***Note:** that weir calculations have no link storage associated with them.*

Bypass Channel Shape section

*Data is obtained using the **Bypass section location** above or the shape can be manually entered. Elevations will always be adjusted as discussed in the **Bypass section location** field.*

***CAUTION**: If data from the tin is manually changed, **Set Node Details** will overwrite these changes unless the **Bypass section location** selection is cleared (right mouse click the select button and select clear).*

*To enlarge the graph, right click on the graph and select **Maximise**. Use* <ESC> *to un-maximise.*

After a dynamic run is complete the critical HGL (water level) results will be displayed from the last dynamic analysis. The HGL results are stored in the following node attributes in the water results groups (see Water Results Group*).*

"calculated pit max bypass HGL up stream"

" calculated pit max bypass HGL down stream"

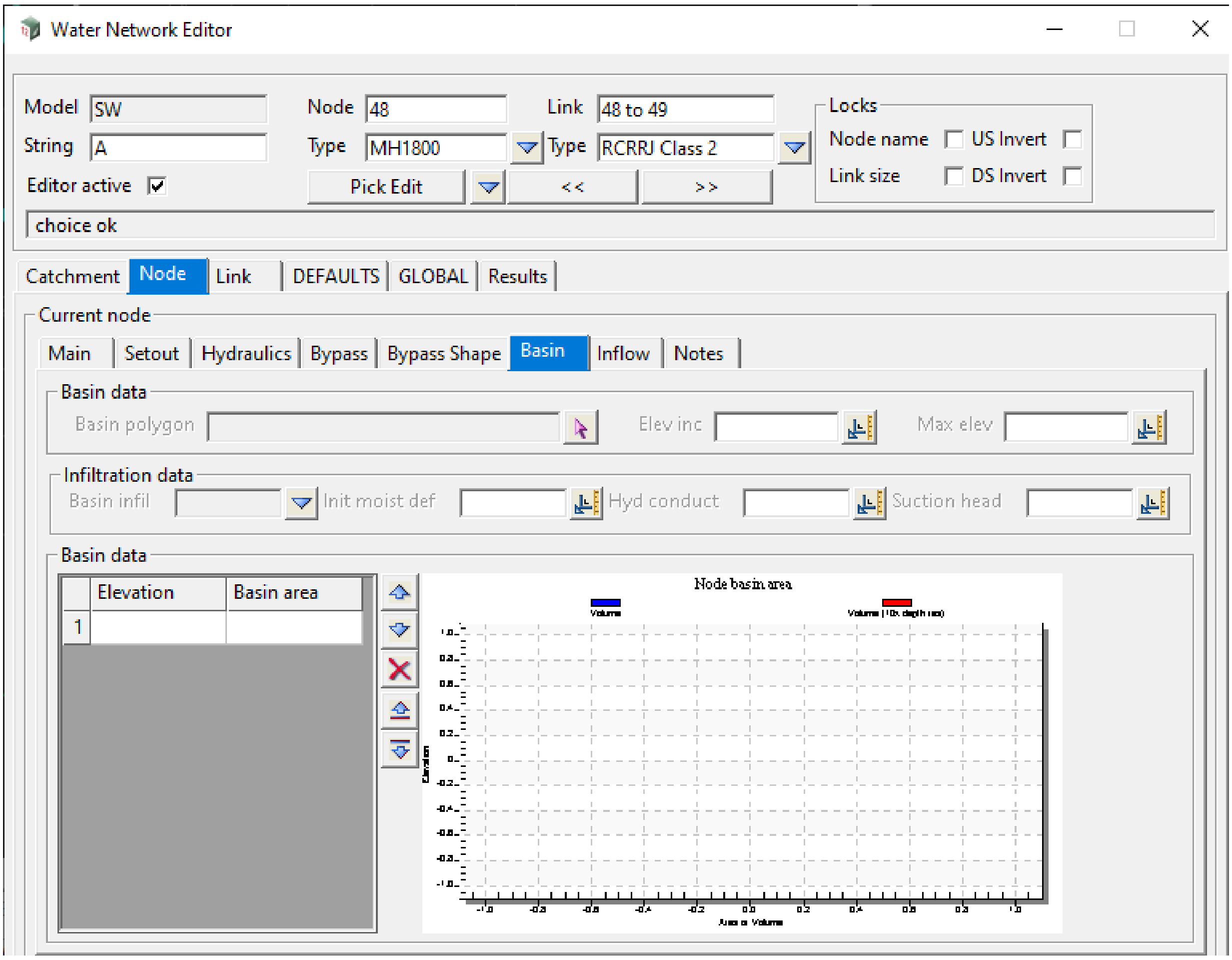
Left and Right Bank Markers section

*The **Bypass section location** selection will look for settings on the string to set the left and right bank n values (see Stormwater->Utility String Editor).*

If not using a string then you may manually enter the n values and chainage.

*When **Centre n** is blank the Manning's n value from Defaults->Nodes->Main Bypass data is used. When **Left n** or **Right n** are blank they use the value from **Centre n** (as discussed above).*

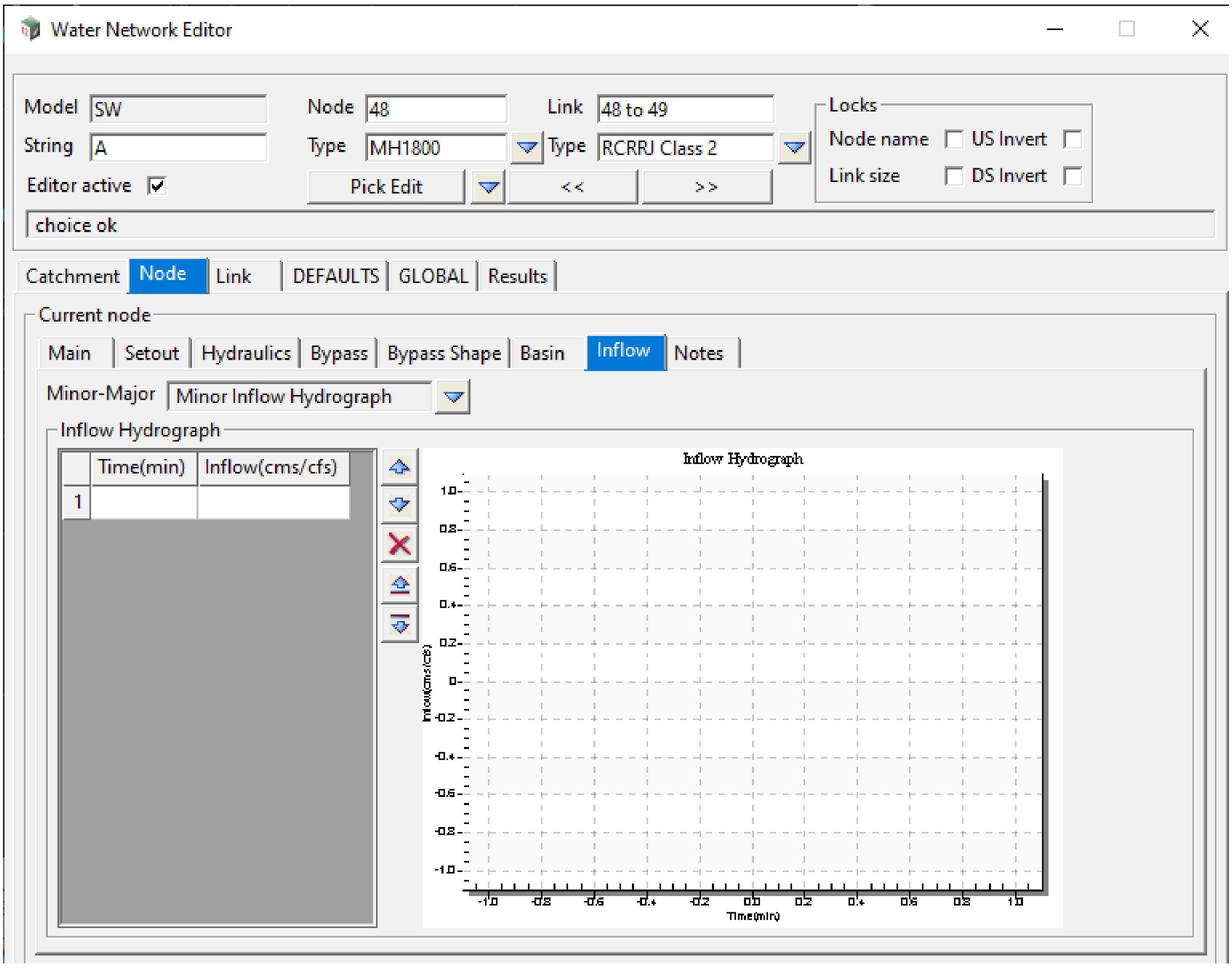
17.3.4.6.4.6 Node >Basin subtab -Dynamic Stormwater



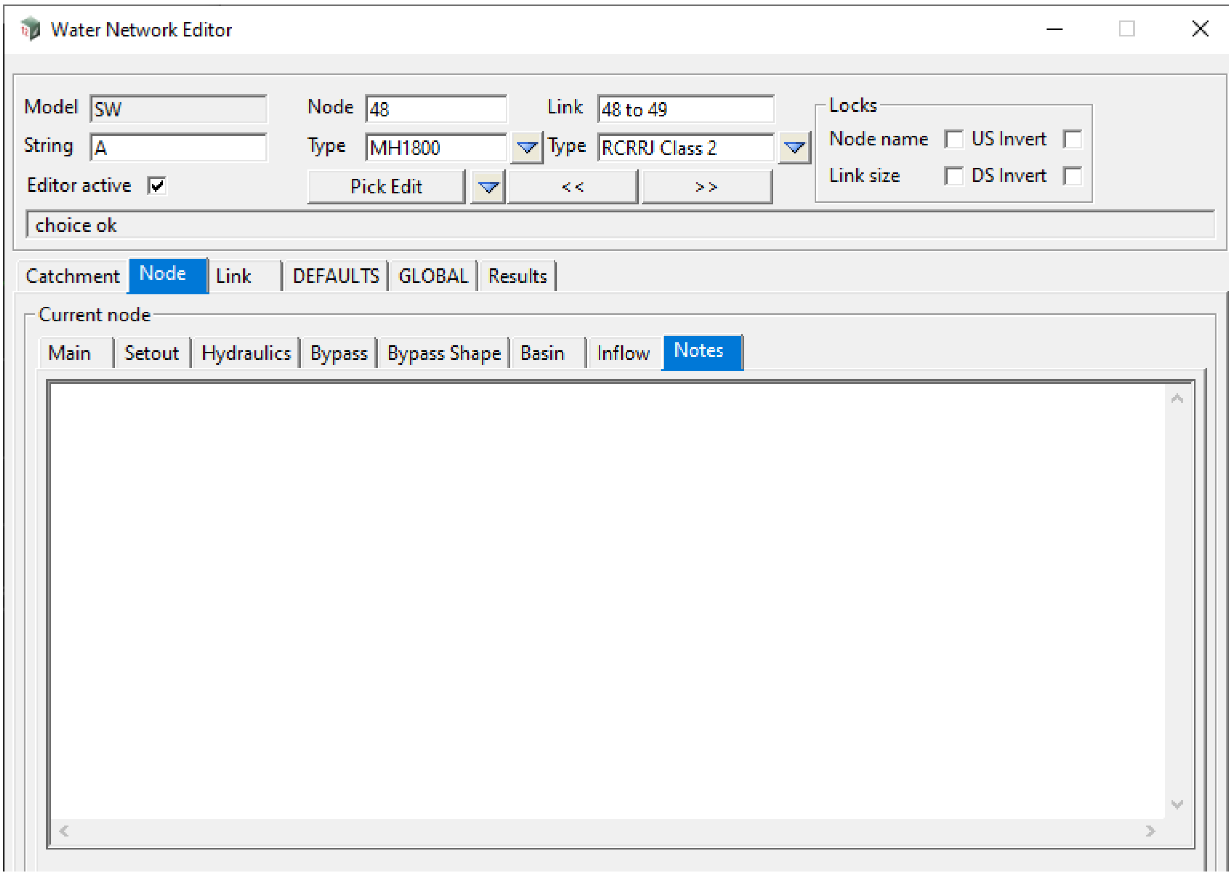
The ***Node >Basin*** tab is used only by the **dynamic analysis**.

When data is entered in the **Elevation**, **Basin area grid,** the node becomes a **Bypass** node and may have basin links connected to it. See the **Mode** setting on **Node >Main** tab for basin links??

17.3.4.6.4.7 Node >Inflow subtab - Dynamic Stormwater



17.3.4.6.4.8 Node >Notes subtab

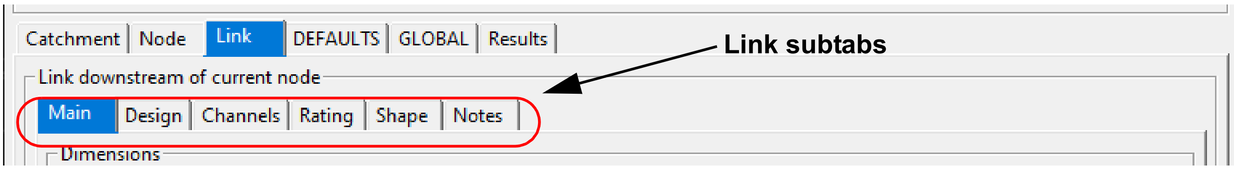


Text entered into the **Notes** area is saved as the node text attribute "**remarks"**.

17.3.4.6.5 Link Tab

The **Link** tab is used to set data for the **currently selected link** in the WNE.

The fields in the subtabs of the **Link** tab can have the explicit values but when a field is blank, the value in the field of the same name in the same subtab of ***DEFAULTS > Links*** is used.

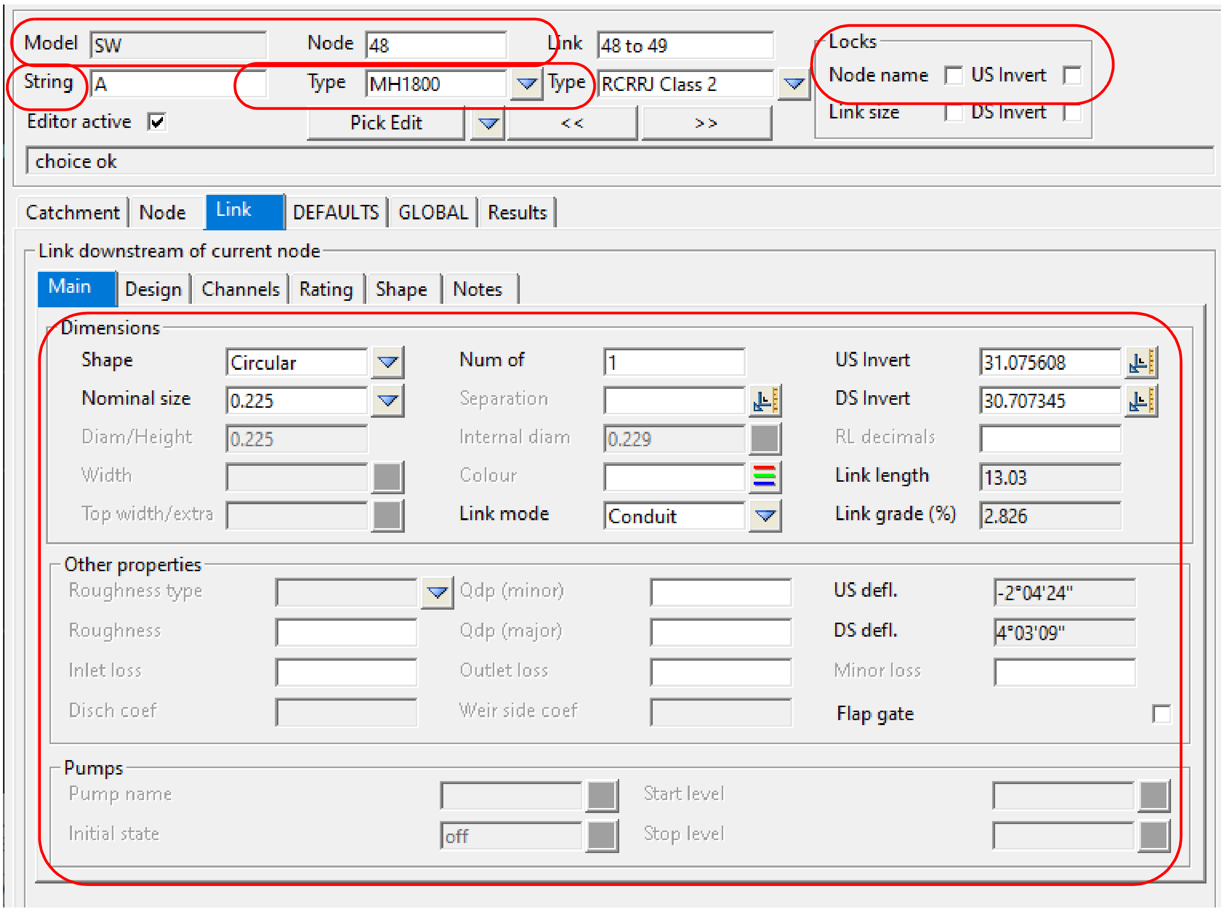


For information on the subtabs of **Link**, see

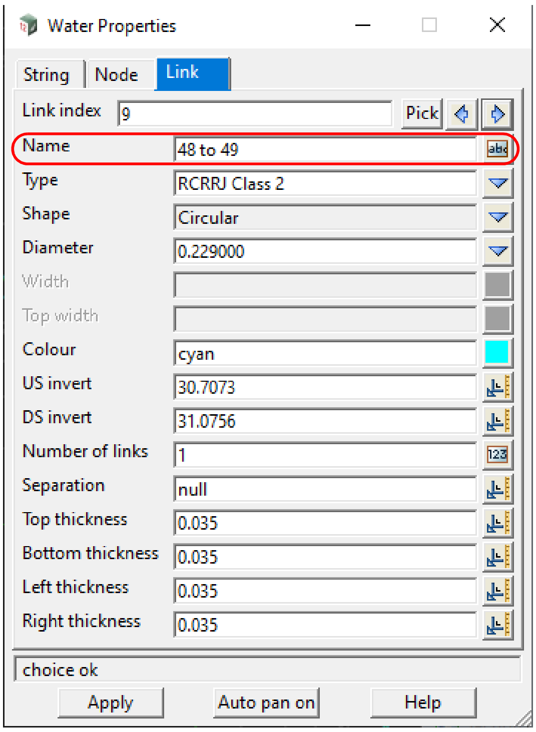
17.3.4.6.5.1 Link >Main subtab
17.3.4.6.5.2 Link >Design subtab
17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater
17.3.4.6.5.4 Link >Rating subtab
17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater
17.3.4.6.5.6 Link >Notes subtab

17.3.4.6.5.1 Link >Main subtab

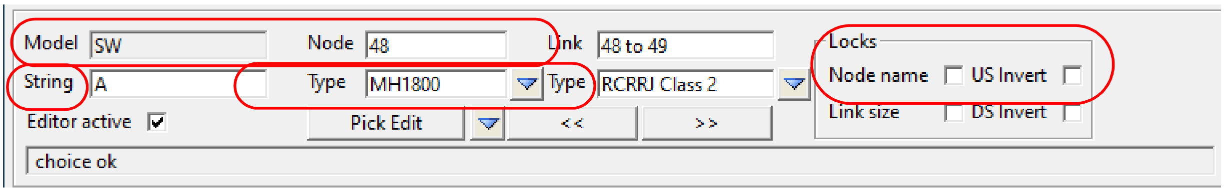
The fields in the **Link >Main** subtab are some of the values taken from the current link of the Water String being examined in the WNE.



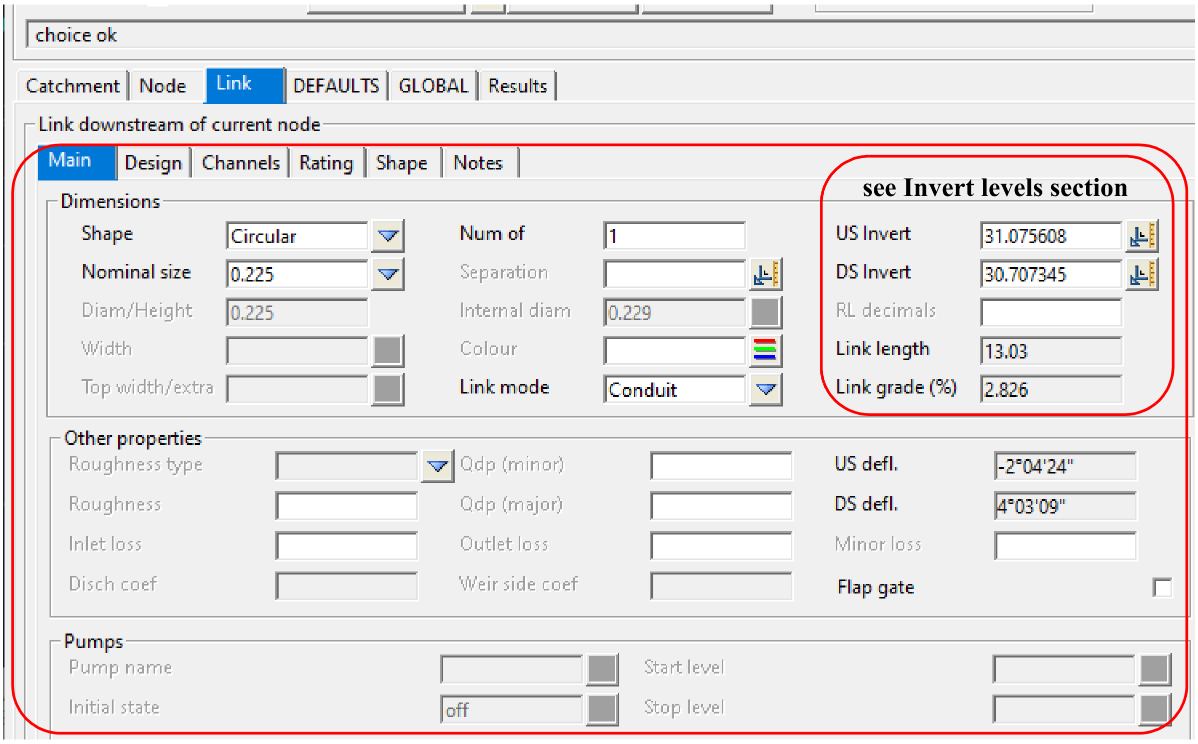
For example, the **Water Properties** panel for link index 3 in the ***Water String Editor*** is



The Top Fields are described in 17.3.4.5 Fields at the Top of the WNE.



The other fields are:



Invert levels

Warning

*Upstream and downstream refer to the **flow direction** in the water string. So it is possible for the upstream invert to be lower than the downstream invert.*

US Invert real box

The upstream invert level of the current link.

*If the **US lock** is **not ticked**, the value of the US Invert can be changed.*

DS Invert real box

Downstream invert level of the current link.

*If the **DS lock** is **not ticked**, the value of the DS Invert can be changed.*

RL decimals real box

Number of decimal places to use when labelling the US and DS inverts.

Link Length output only

Length of the link. How this is calculated depends on the tick box **Use link end to link end** *on* 17.3.4.6.1.1 GLOBAL > Main subtab.

Link Grade (%) output box

Grade of the link. How this is calculated depends on the tick box **Use link end to link end** *on* 17.3.4.6.1.1 GLOBAL > Main subtab

Dimensions section

Shape choice box

Defines the cross section shape of the link by selecting from the pop-up list.

If the link is ***Circular*** *then Diam/Height is the diameter of the link.*

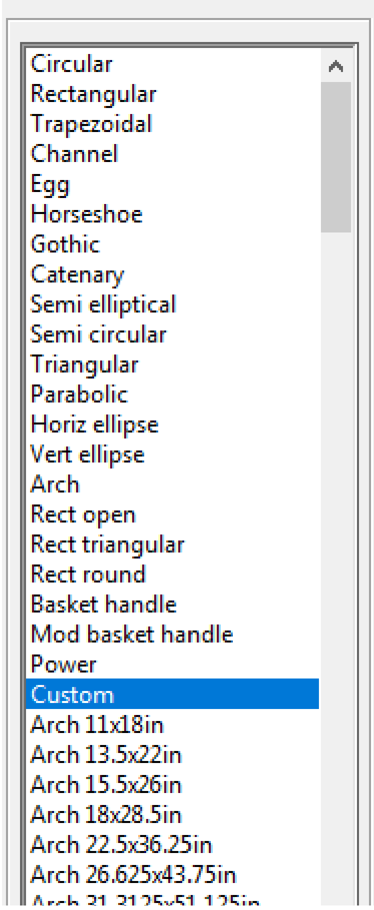
If the link is ***Rectangular*** *(box),* **Diam/Height** *is the height and width* **Width** *of the link.*

If the link is ***Trapezoidal***, **Diam/Height** *is the height, width* **Width** *in the bottom width and* **Top width/extra** *is the top of the link.*

If ***Custom*** *is selected, the height-width grid defining the closed cross section of the link is typed in on the* 17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater.

If ***Channel*** *is selected, the link is an open channel and the shape of the channel is defined in the* 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater.

Otherwise the selected shape is read in and displayed in the graph area on the 17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater *and the height-width information for the selected shape is loaded into the height-width grid on the* 17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater. *They are closed shapes.*



Defines the cross section shape of the link by selecting from the pop-up list. See 17.1.4.2.1 Link Shapes.

Nominal size choice box Nominal diameter list

Nominal diameter of the link - form pop-up list.

If the ***Link type*** *has a* **Thickness data** *tree node, then the pop-up list has the sizes listed in the Nominal diameter column from the grid. See* 17.4.1.3.1.6 Link Type: Thickness data Tree Node.

If there is no list then ***Variable***.

Diam/Height real box

If the link is ***Circular*** *then this is the diameter of the link.*

If the link is ***Rectangular*** *(box), this is the height of the link.*

Width real box

To specify a rectangular (box) section for the link, enter a ***non-zero width*** *value and this is the width of the link.*

For box culverts, when sizing a link, the design engine increases the widths and maintains the height through the available sizes. Once the maximum height has been reached, the next culvert height and minimum width is checked.

Top width/extra real box

Top width is used for ***Trapezoidal*** *channels.*

Note that if the HGL exceeds the top of the channel it will have friction on the soffit just as a box culvert.

Num of number box

Specifies the number of identical links. The link flow is divided by this value when calculating losses. If greater than 1, the link is made up of this number of ***identical*** *shapes.*

Separation real box

??

Internal diam real box

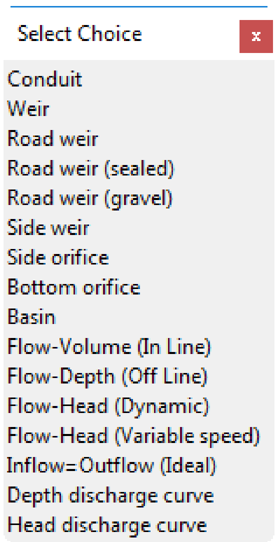
??

Colour colour box available colours

If ***not blank****, when* ***Set Node Details*** *is pressed, the link will be given this colour.*
If ***blank****, the link has the default colour of the water string.*

Note*: the water string has a default colour but individual links have different colours.*

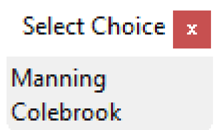
Link Mode choice box



For a description of the **Link modes***, see* 27.2.2.1 Link Modes.

Other properties section

Roughness type choice box



If ***Manning****, the* **Roughness** *field is Manning's* ***n*** *(based on metre-second units)*
If ***Colebrook****, the* **Roughness** *field is Colebrook's* ***k*** *(mm).*

Roughness real box

Roughness for the **Roughness type**.

Qdp (minor)

This constant flow is added (it can be negative) to the upstream end of the link when the ***Storm event type*** *is set to* ***minor*** *on the* ***Analysis*** *panel.*

In the case of dynamic analysis (ILSAX2, Laurenson, SCS, EPA SWMM) this is a constant inflow for the entire duration of the analysis, and is applied at the upstream node.

Use negative Qdp with extreme caution for dynamic analysis*. This flow is not subject to the node inlet capacity.*

Qdp (major)

This constant flow is added (it can be negative) to the upstream end of the link when the ***Storm event type*** *is set to* ***major*** *on the* ***Analysis*** *panel.*

In the case of dynamic analysis (ILSAX2, Laurenson, SCS, EPA SWMM) this is a constant inflow for the entire duration of the analysis, and is applied at the upstream node.

Use negative Qdp with extreme caution for dynamic analysis*. This flow is not subject to the node inlet capacity.*

US defl. output

Deflection angle (in degrees, minutes and seconds) through the upstream node.

DS defl. output

Deflection angle (in degrees, minutes and seconds) through the downstream node.

Inlet loss real box

Ke *value for dynamic analysis.*

The flow area at the upstream end of the link (relative to the string flow direction setting) is used in ***Ke***V^2*/2g.*

If ***blank****, the Ku method will determine the Ke value used. This also applies to culvert inlets under backwater control. This is only applicable for Conduits.*

Outlet loss real box

Ko *value for dynamic analysis.*

The flow area at the downstream end of the link (relative to the string flow direction setting) is used in ***Ko***V^2*/2g.*

If ***blank*** *zero is used.*

Minor loss real box

K_{minor} *value for dynamic analysis.*

The flow area at the mid chainage of the link is used in $K_{minor}V^2$*/2g. An example would be extra losses in a small radius link.*

If ***blank****, 0.0 is used.*

Disch coef real box

When the ***Link mode*** *is set to* ***Weir*** *or* ***Side Weir*** *this coefficient is used for the horizontal* ***width*** *portion of the view. It is not used for* ***FWHA Road weirs*** *(****Road weir (sealed)*** *or* ***Road weir (gravel)****).*

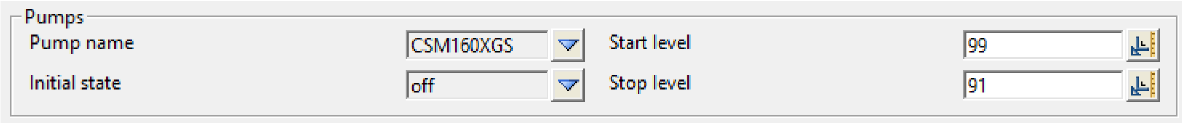
Weir side coef real box

When the ***Link mode*** *is set to* ***Weir*** *or* ***Side Weir*** *this coefficient is used for the sloped side portions of the weir (****top width – width)****. It is not used for* ***Road weirs.***

Flap gate tick box

If ***ticked****, flow reversal is prevented.*

Pumps



Pump name choice box

Pumps are links used to lift water to higher elevations.

The pump name is selected from a list of pumps previously defined in the Hydro file and the pump curve describes the relation between a pump's flow rate and conditions at its inlet and outlet nodes. See 17.5.1.10 Pumps and Valves.

Initial state choice box on, off

State of the pump at the beginning of the simulation.

*If **on**, the pump will run until the water level in the upstream node fall to the stop level.*

*If **off**, the pump will not start until the water level in the upstream node increases to the start level.*

Start level real box

Elevation (RL) at which the pump commences running.

Stop level real box

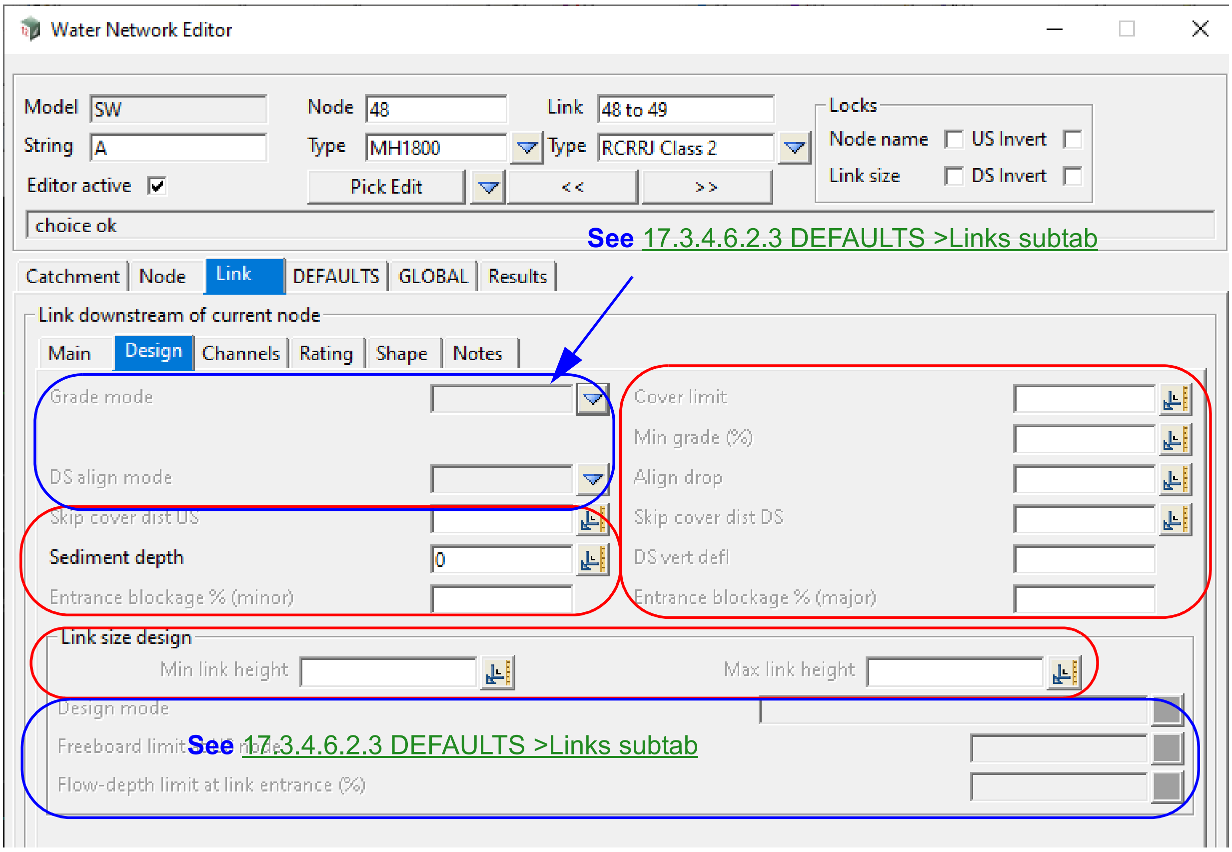
Elevation (RL) at which the pump shuts down.

For more formation on pumps, see 27.2.2.1.1 Pump Curve Types.

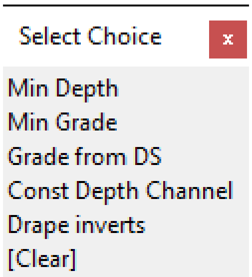
17.3.4.6.5.2 Link >Design subtab

The fields in the **Link >Design** subtab can have explicit values but when a field is blank, the value of the field of the same name in the ***DEFAULTS > Links*** subtab is used.

So many of the fields for the **Link >Design** subtab have already been documented in the ***DEFAULTS > Links*** subtab and the ones that haven't been documented are circled below.



Grade mode choice box



The definition of the choices except **[Clear]** *is given in* 17.3.4.6.2.3.1 Link Grade Modes.

*If **[Clear]**,* **Grade mode** *is left blank.*

Cover limit real box

*This minimum cover (vertical distance) is measured from the top of the pipe or culvert to the design tin (see Global->Main). The distance is measured at the centre line of circular pipes and at the centre line + outside edges for culverts. This value will override values the model defaults from the **Cover file** (see* 17.3.4.6.2.3 DEFAULTS >Links subtab *- minimum cover) or project defaults - **Minimum cover** (*17.3.2 Water String Defaults*).*

***Regrade links** will use this value, together with the **Grade mode**, to set link inverts levels. **Set Node** details will generate problem messages if the calculated cover is less than this value.*

Minimum Grade real box

*This value will override values the model defaults from the **Grade file** (17.3.4.6.2.3 DEFAULTS >Links subtabs) or project defaults - **minimum grade** (17.3.2 Water String Defaults).*

***Regrade links** will use this value, together with the **Grade mode**, to set link inverts levels. **Set Node** details will generate problem messages if the calculated grade is less than this value.*

Alignment drop real box

*This value will override values the model defaults from the **Drop file** (17.3.4.6.2.3 DEFAULTS >Links subtab) or project defaults - **Drop** (17.3.2 Water String Defaults).*

***Regrade links** will use this value, together with the **DS alignment mode**, to set link inverts levels. **Set** Node details will generate problem messages if the calculated drop does not meet the **DS alignment mode** criteria.*

Skip cover dist US real box

During Regrade link calculations and Set node details, the cover will not be checked for this distance from the upstream node. This is often used for culverts under roadway embankments.

Skip cover dist DS real box

During Regrade link calculations and Set node details, the cover will not be checked for this distance from the downstream node. This is often used for culverts under roadway embankments.

Sediment depth real box

For dynamic stormwater analysis, this bottom depth of the link cross section is not used for the conveyance properties of the link. Non zero values will reduce area, wetted perimeter and thus the conveyance of the link.

Entrance blockage %(minor) real box

*For dynamic stormwater analysis, this value reduces the cross sectional area at the upstream end of the link for minor event runs (see **Storm event type** on 17.3.4.6.14.1 Analysis >Main tab). A value of 100% is completely blocked.*

Entrance blockage %(major) real box

*For dynamic stormwater analysis, this value reduces the cross sectional area at the upstream end of the link for major event runs (see **Storm event type** on 17.3.4.6.14.1 Analysis >Main tab). A value of 100% is completely blocked.*

Link size design section

*If on the **Analysis >Main** tab, the **Modify pipe sizes** is **ticked**, the 12d Model design engine will select pipe sizes from the file specified in the **Preferred pipes file** field. See 17.3.4.6.14.1 Analysis >Main tab.*

However, the minimum link height, and the maximum link height allowed before multiple links are used, are set for each link. See below.

Min link height real box

*The **12d Model** design engine must select a size greater than this value for this link.*

***Note:** Specifying a minimum link height may speed up 12d design. The starting value for link sizing will not be less than this value. That includes all downstream links as well. So if you know that the link needs to be this size or bigger, enter it here.*

Max link height real box

*If the **12d Model** design engine requires a larger link than this value then multiple links will be selected.*

WHAT IS THIS ??

Analysis and Network Design factors section

Storm event type real box

*Many hydrology and hydraulic parameters in the WNE panel, and in this analysis panel, have a minor set of values and a major set of values. This selection determines which set is to be used in the analysis run. The **minor** and **major** run will need to be run at least once to run **Both** (the minor then the major will be run).*

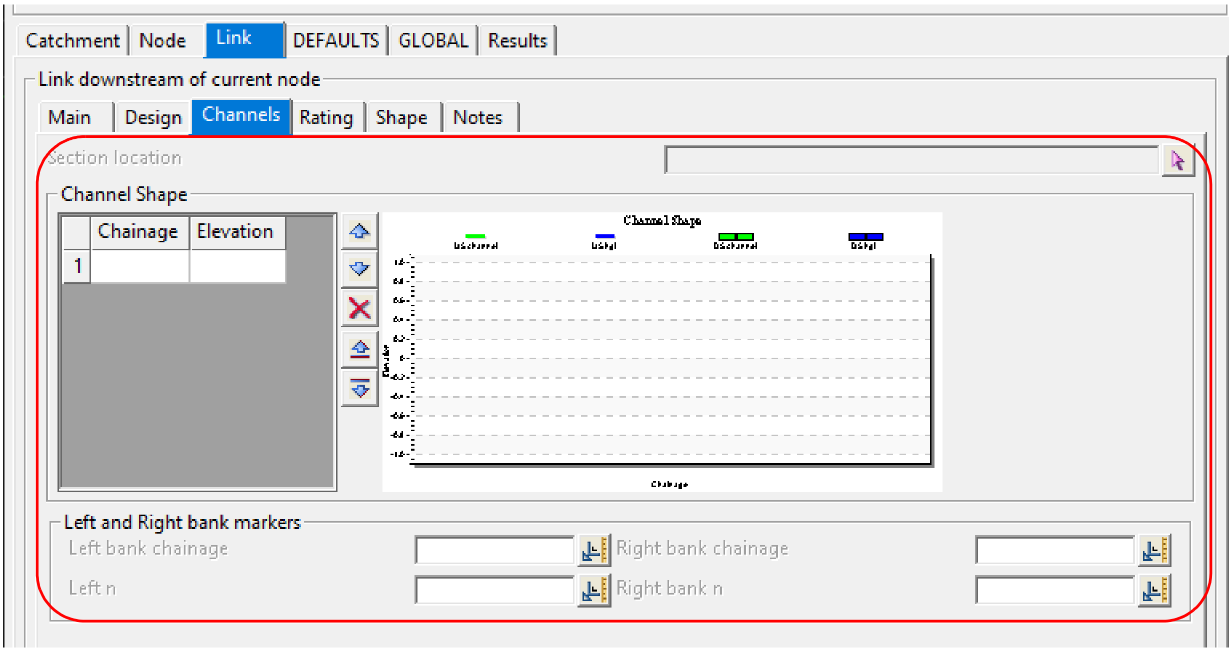
Frequency (Percent:yrs) real box

This value will be used to determine the rainfall intensities and temporal patterns used in the run. The hydro file data determines if the data in interpreted as Percent (AEP) or Years (yrs).

Pipe Friction Values and Freeboard Limit

17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater

The ***Link >Channels*** subtab only appears when the ***Method*** is a ***Dynamic Stormwater*** method (see 17.3.4.4.1 Method field on the WNE) and is for defining an open shape for the current ***Link*** when the choice for the **Shape** field for a link in the 17.3.4.6.5.1 Link >Main subtab is ***Channel***.



The channel shape can be:

(a) cut from the **FS tin** by drawing a string at the desired location. It is a standard convention to draw it from left to right looking in the direction of flow.

The selected string must be totally over a non-null section of the tin.

or

(b) the channel shape can be manually entered into the ***Chainage-Elevation*** grid.

Section location string select

Select the string to be cut through the FS tin.

If a string is selected then the profile against the FS tin will be piped into the Chainage-Elevation grid and the section drawn in the graph area.

Left and Right bank markers

Left/Right bank chainage real box

Chainage of the left/right bank,

Left/Right n real box

Left/Right bank n value.

*If **blank**, the link's n value will be use. See* 17.3.4.6.5.1 Link >Main subtab.

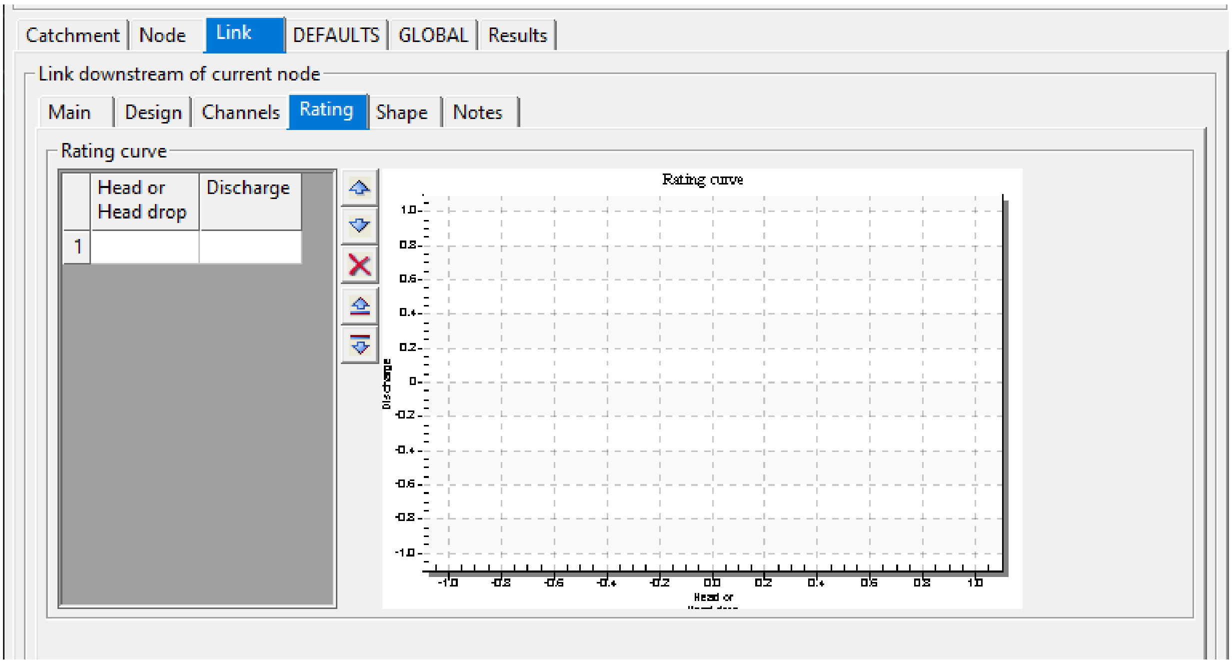
There are no default left and right bank n values.

Note:

A **Channel** is an **open** shape. If a closed shape is required then the shape choice is **NOT *Channel*** and the 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater is used.

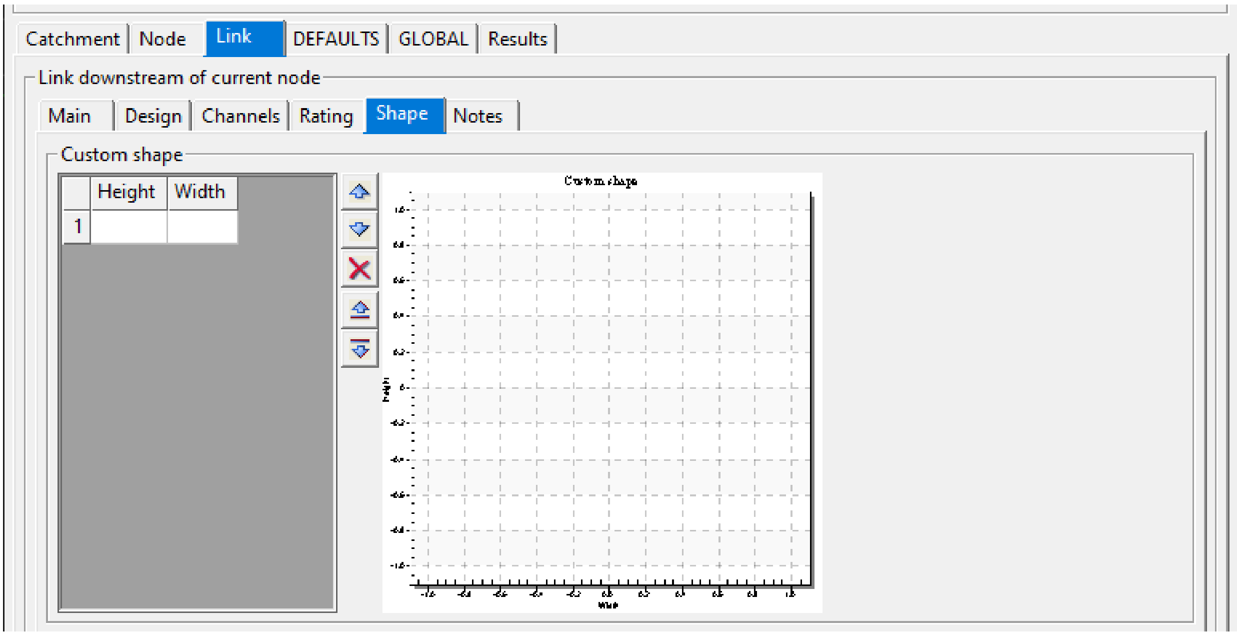
17.3.4.6.5.4 Link >Rating subtab

??



17.3.4.6.5.5 Link >Shape subtab - Dynamic Stormwater

The ***Link >Shape*** subtab only appears when the ***Method*** is a ***Dynamic Stormwater*** method (see 17.3.4.4.1 Method field on the WNE) and is for displaying or defining the shape of the current ***Link*** when the link shape selected in 17.3.4.6.5.1 Link >Main subtab is **closed**.



The actual shape is selected as a choice in the pop-up for the **Shape** field in the ***Dimensions section*** of the 17.3.4.6.5.1 Link >Main subtab. This is only for a closed shape.

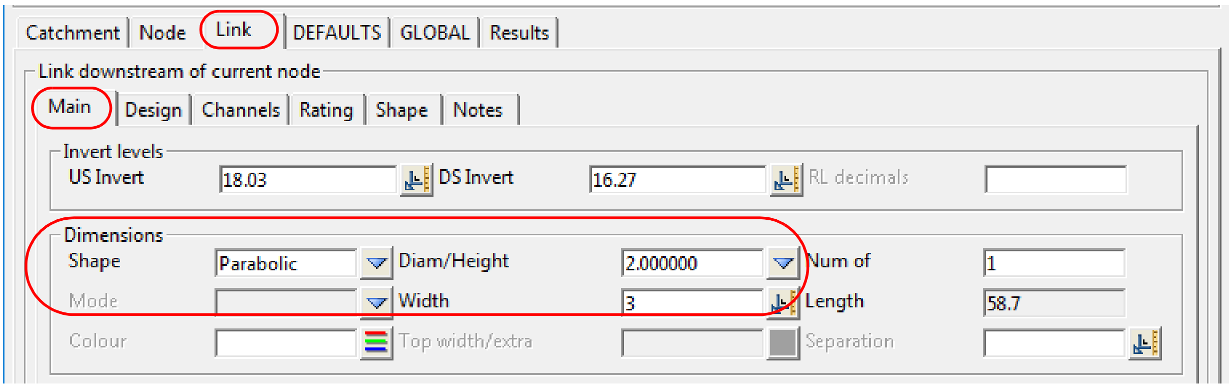
If the choice is ***Channel*** then it is to be an **open** shape and this subtab is **NOT used**. The channel shape is defined by 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater.

If the choice is ***Custom***, then the user types the height and width of the shape into the ***Height-Width*** grid.

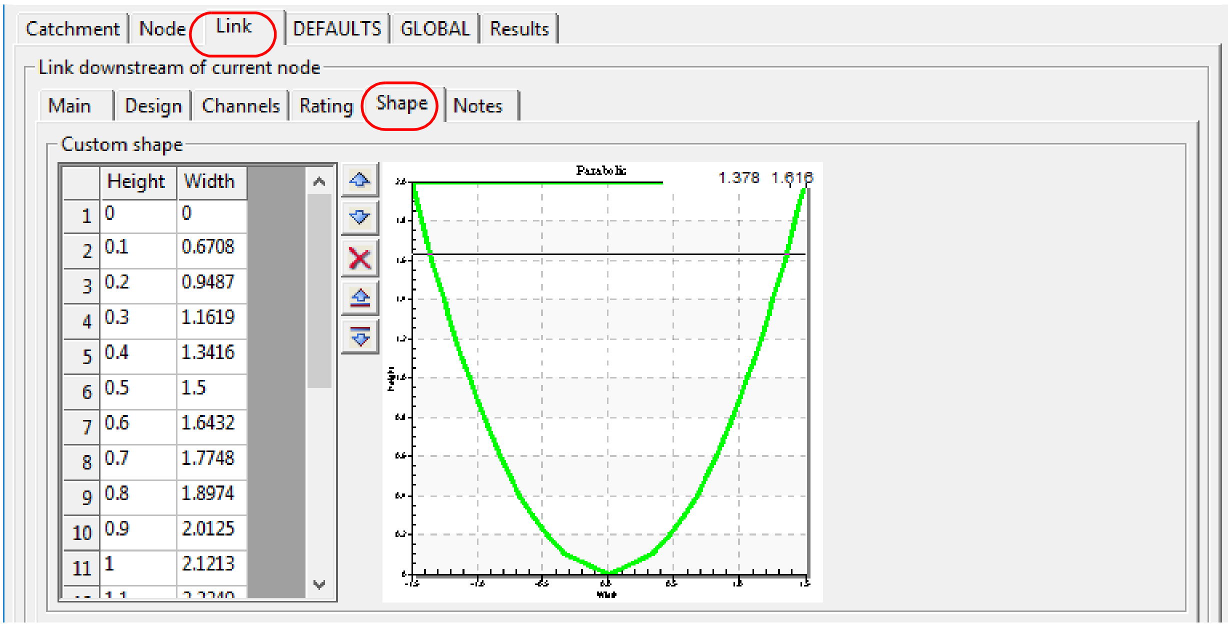
Warning - the ***Height-Width*** grid are not to be taken as coordinates in the (width, height) space. To see how the values are used to create a shape, see 17.3.4.6.5.5.1 How to Define a Shape Using Width and Height.

If any other choice is selected in the **Shape** field, the values required in the ***Height-Width*** grid to defined that shape are into the ***Height-Width*** grid and the shape drawn in the graph area on the right hand side of the panel.

For example, for a choice of ***Parabolic,*** and a ***Diam/Height*** of 2 and ***Width*** of 3,



the shape is



17.3.4.6.5.5.1 How to Define a Shape Using Width and Height

When defining a shape the **Width** and **Height** values in the Grid do **NOT represent coordinates** in a (Width, Height) grid.

How they the **Heights** and **Widths** are to be interpreted when defining a **Shape** is as follows:

(a) A **Shape** link must always be **closed**.

If you want an **open** Link then that referred to as a channel and is defined in the ***Link >Channels*** subtab. See 17.3.4.6.5.3 Link Channels subtab - Dynamic Stormwater.

(b) A **Shape** is **symmetric** about the **WIdth = 0 line**

(c) A value (Height, Width) from the grid is interpreted as:

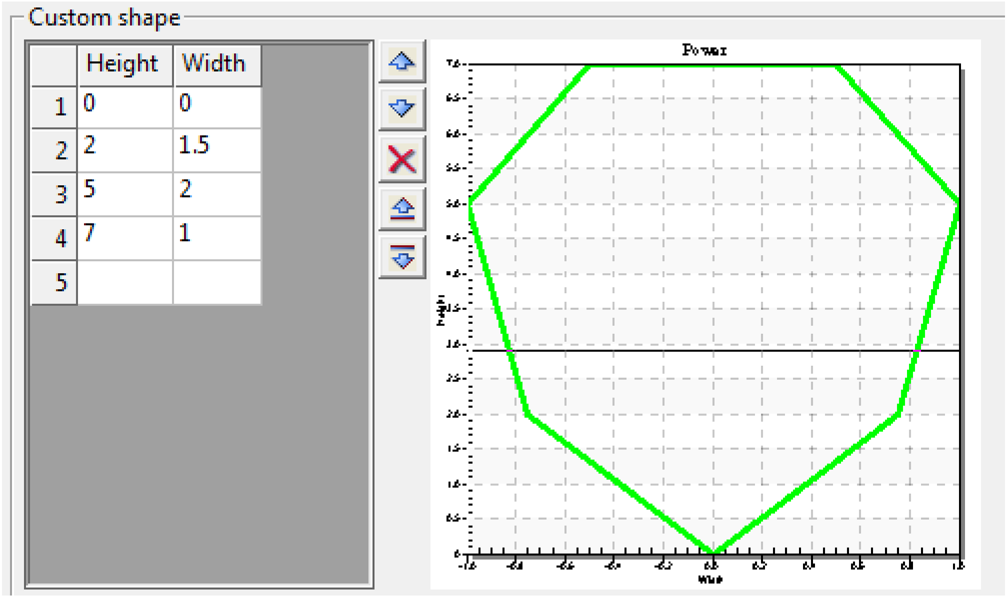
At a height of **Height**, two points are defined in the (width, height) plane

(WIdth, -0.5*Height) and (Width, 0,5*Height)

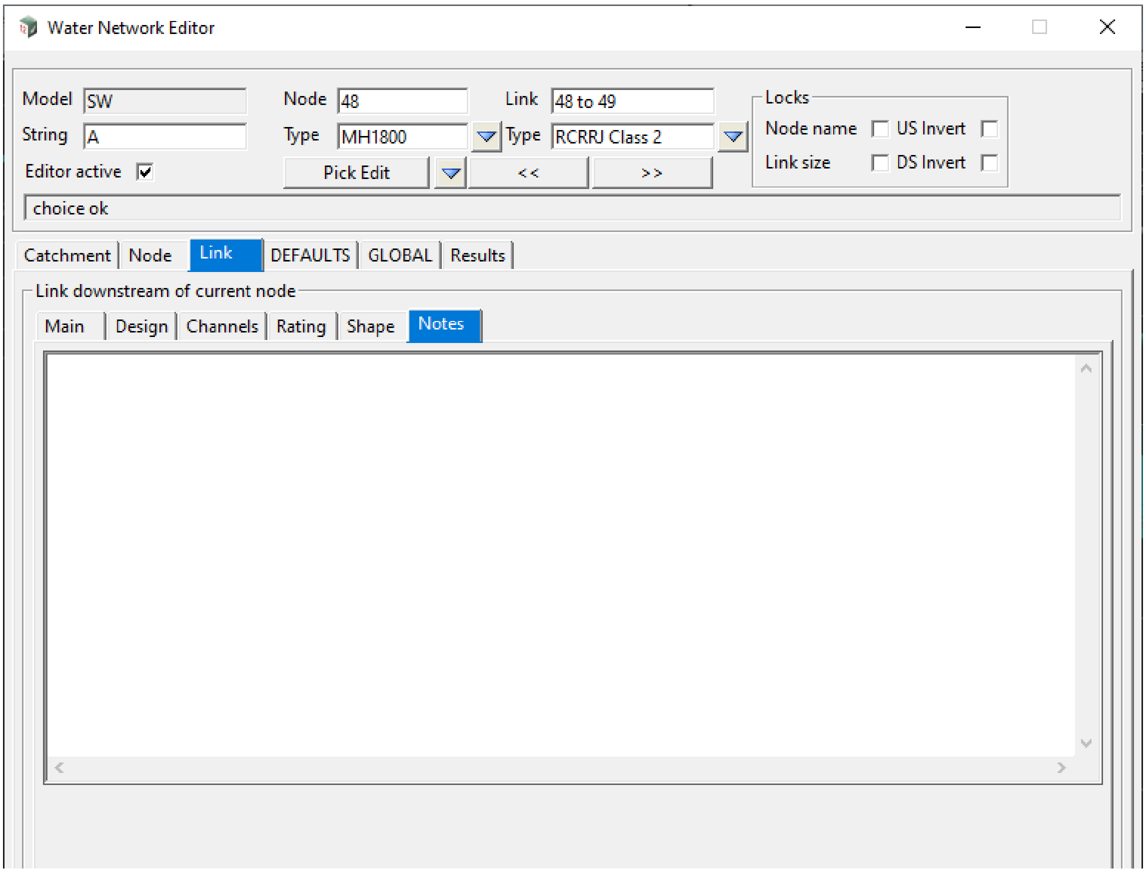
These two points are appended to the two previous points defined in the grid.

(d) A straight horizontal line is drawn between the two points created by the last entry in the grid.

(e) To be closed at the bottom, the first point needs to be Height = 0 and Width = 0.


Custom shape
Height
Width
1
0
0
2
2
1.5
3
5
2
4
7
1
5
Power

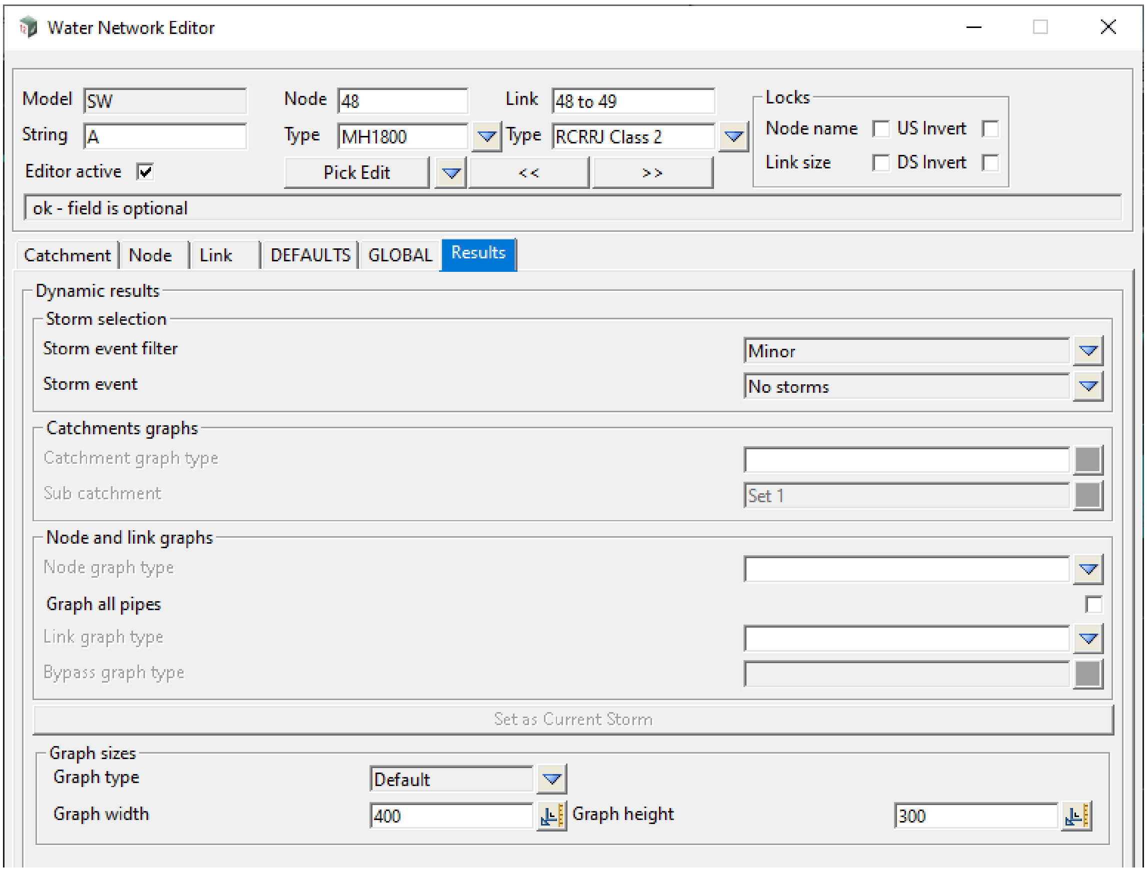
17.3.4.6.5.6 Link >Notes subtab



Text entered into the **Notes** area is saved as the link text attribute "**remarks**".

17.3.4.6.6 Results Tab

The results tab only appears when the ILSAX 2, SWMM, SCS or Water supply hydrology methods are selected.



Storm selection section

Storm Event Filter Choice box Minor, Major, Same duration

Dynamic results are stored with a tag for the minor/major setting that was used at analysis time. This is completely independent to the design frequency selected. Minor and Major could be considered as settings A and settings B.

*When the Att Group (minor) and major fields on the GLOBAL Main tab are blank, 12d only stores the results from the last analysis. Selecting Minor or the Major will have either **No storms** or a list of the storms from the last run.*

When Att Group (minor) has a value, selecting Minor will load all of the storms analysed using this att Group. Major works in a similar manor.

***Minor** - the **Storm event** box below will only display storms with the minor tag.*

***Major** - the **Storm event** box below will only display storms with the major tag.*

***Same duration** - the **Storm event** box below will show the durations analysed, not the individual storms. When a result graphs showing only 1 result type (elev, flow etc) is selected, all the storms for the selected duration will be displayed.*

Storm Event Choice box list of storm results

*With **Storm Event Filter** above set to **Minor** or **Major** all of the dynamic storms analysed with this tag are displayed in the choice box. With **Storm Event Filter** above set to **Same duration** the durations will be listed for all storms analysed.*

*These lists are generated by analysing the model attributes and searching for attribute groups named **dynamic** and checking the minor/major tag. An item is added to the list when the attribute group is found with valid results files.*

Catchment graphs section

Catchment Graph type	Choice box		Runoff, Rainfall. Loss, Rainfall/runoff,

This option is only available when catchment areas exist for this node.

Sub Catchment	Choice box		Set 1, Set 2, Set 3t

This option is only available when catchment areas exist for this node.

Node and link graphs section

Node Graph Type	Choice box		Depth above Grate Elevation Elev Bypass Flow Node + link Volume Catchment Flow Approach flow Captured flow Overflow Node Area
Graph all pipes	Tick box	Not ticked	

*When **ticked**, the selected graphs are displayed for all incoming and outgoing links.*

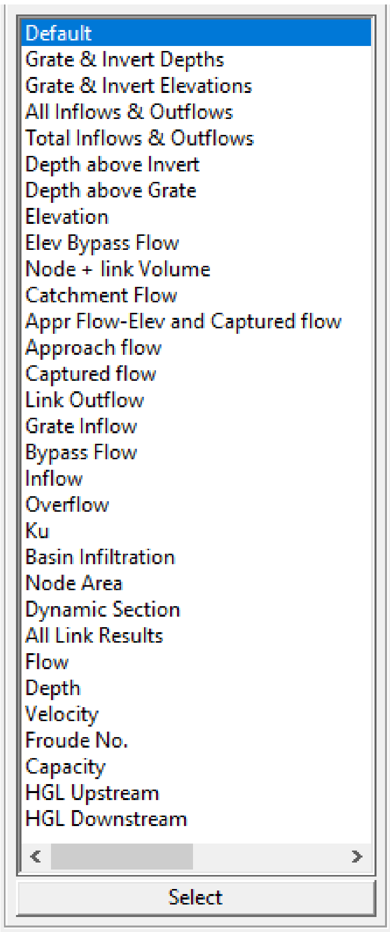
Link graph type	Choice box		Flow, Depth, Velocity Froude No., Capacity HGL upstream, HGL downstream
Bypass Graph Type	Choice box	Default	Flow, Depth, Velocity Froude No., Capacity HGL upstream HGL downstream

This option is only available if there is a bypass node specified.

Graph sizes

The dimensions below set the size of the graph area (including title and axis labels) for the dynamic result graphs.

Graph Type Choice box Default



***Default** - these dimensions will be used for all graphs unless the dimensions have been explicitly set for another graph type selected in this list.*

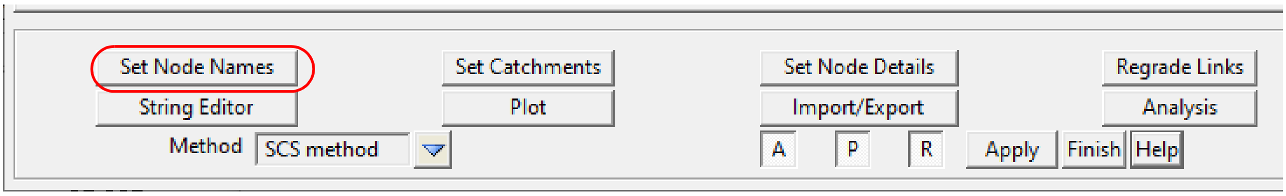
Graph width real box

Width of the graph area (including axis labels).

Graph height real box

Height of the graph area (including title and axis labels).

17.3.4.6.7 Set Node Names (and Links) Button



Node and link names are used to identify and label the nodes for easy access and for labelling.

The WNE **Goto** drop down and output window log lines which display warning/problem message, become much more meaningful with node names. **Storm analysis** requires that the nodes have **unique** names.

The WNE can be used to manually change single node names (in the **Node** field) but it is usually quicker to change all the names using the **Set Node Names** button.

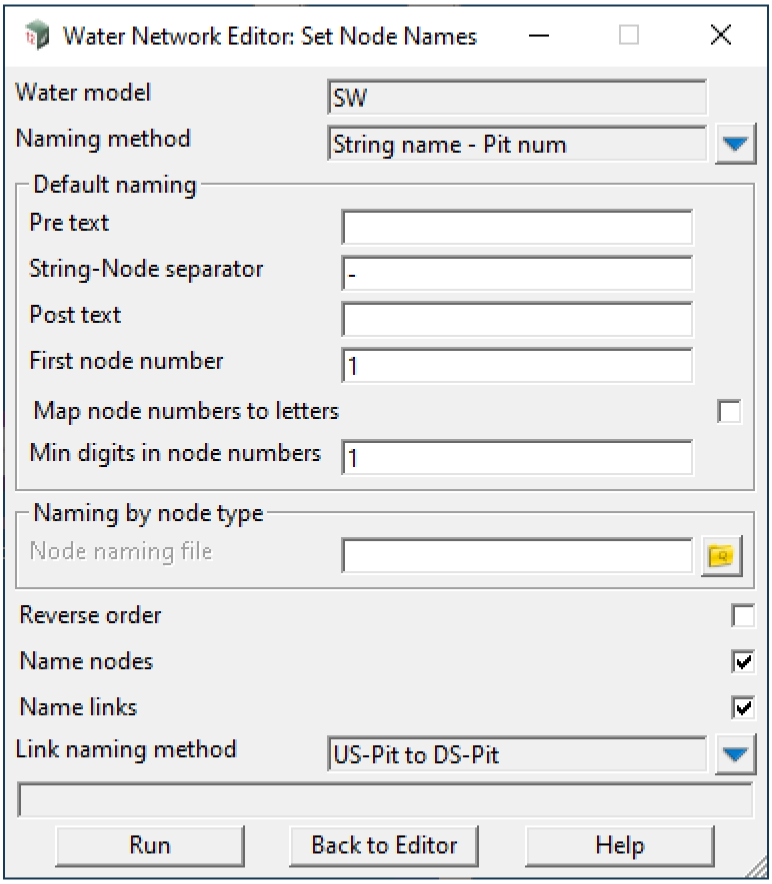
The **Set Node Names** button names the nodes and links for the water model (both nodes and links can be named). Three numbering schemes are available:

1. water string names are used as the prefix followed by the node number (ex A-1)
2. water strings names are used as the suffix followed by the node number (ex 1/A)
3. the nodes are sequentially numbered. (ex 1,2,3....)

The **Set Node Names** button requires unique string names.

The names can have pre-text added to the beginning of the node name and a separator between the string name and the node number (/- *etc*.) if desired.

Clicking on the **Set Node Names** button brings up the **Water Network Editor: Set Node Names** panel.

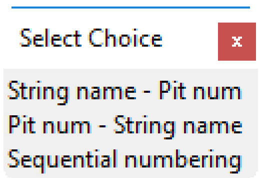


The fields and buttons used in this panels have the following functions.

Field Description	Type	Defaults	Pop-Up
Water model	output only	water model from main panel	

Name of the water network model that is being edited in the Water Network Editor.

Naming method choice box



The way to name the nodes and links

***String name - Pit num** for string A node 1 the name is A1*

***Pit num - String name** for string A node 1 the name is 1A*

Sequential numbering** the strings names are sorted alpha-numerically and the nodes are numbered starting at **First node number

Default naming section

*The fields in the Default naming section are used when the name of the node/link is not included in the **Node naming file***

Pre text text box

Text to put at the beginning of the node/link name. For example Pit A01

String node separator text box

The text that separates the string name from the Node number. For example if node names A/01, A/02 etc. where desired a **"/"** *would be entered. The separator can be left blank if none is desired.*

Post text text box

Text to put at the end of the node/link name

First node number integer box

Number to start using in the node/link name. The number will be incremented after each node/link is named.

For water strings with the flow direction set as descending chainage the first node is the junction node

Map node numbers to letters tick box

If ***ticked****, the number will be converted to the equivalent text and used in the node/link name. For example, the number 1 will become A.*

If ***not ticked****, the number will be used in the node/link name.*

Min digits in node numbers integer box

Minimum number of digits to use for the number in the node/link name. The numbers will be padded with leading zeros to make up the required number of digits. For example, if 2 is entered, node 1 is not A/1 but rather A/01).

Naming by node type section

Node naming file file box

The file with instructions on how to name the nodes and links

Reverse order tick box

If ***ticked****, the* ***First pit number*** *is the second node from the high chainage end of the line.*

If ***not ticked****, the* ***First node number*** *is at the low chainage end of the line.*

Name nodes tick box

If ***ticked****, the nodes will be assigned names.*

If ***not ticked****, nodes will NOT be named*

This allows the nodes and links to be named differently.

Name links tick box

If ***ticked****, the links will be assigned named.*

If ***not ticked****, links will NOT be named*

This allows the nodes and links to be named differently.

Run button

Name the nodes/links.

The node at the high chainage of the string is not labelled. The only time this node is to be named is when it is the outlet from the system.

Back to Editor button

Selecting this button removes the panel and brings back the Water Network Editor.

The textstyle and offset for the node/link names is set on the 17.3.4.6.1.3 GLOBAL >Display Subtab of the 17.3.4 Water Network Editor (WNE). The text is always shown as pixel text size and cannot be changed to world.

Notes when using other Design Programs

PCdrain users: Since catchments in PC Drain contain only 3 characters do not use separators. Using the letters A-Z for strings and numbers 1-99 will give you 26 strings and up to 99 pits on each string. Using the numbered stem works very well in PC Drain.

Micro Drainage users: Pits and pipes are numbered separately in Micro drainage. The pipes must use the numbered sequence with the most upstream pipes numbered with the smallest numbers. Number of digits must be set to 3.

ILSAX users: Alphabetic characters must be used for the string names and no more than 3 characters

See Also

Labelling a drainage network

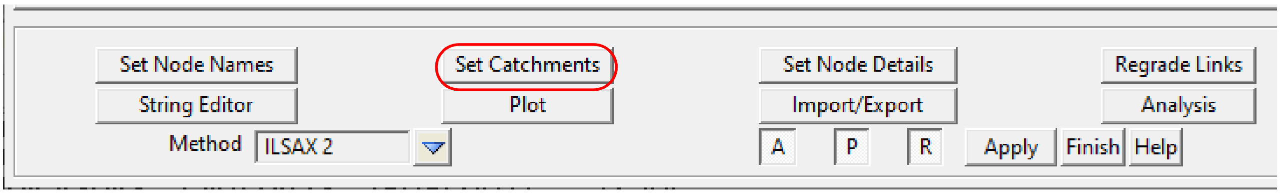
Displaying the Auto Pit Names

WHAT IS THIS ??

Tin for node cover level tin box

The new water node cover level will be set to the tin level at the node centre (optional).

17.3.4.6.8 Set Catchments Button - Stormwater



The **Set Catchments** button updates the catchment string connections to the inlet nodes (see 27.2.1.3 Node Inlet Configurations), calculates (recalculates) the catchment areas and optionally creates catchment labels and optionally sets the fill colours for the catchment polygons.

The option resets the catchment information by:

(a) **Catchment strings** that **are connected to inlets** will have their areas calculated and stored in the **Area** field.

(b) **Catchment strings** that are **not connected to an inlet** seek inlets that the catchment can be connected to using the vertex 1 rule.

Vertex number 1 on the catchment string determines which inlet the string will connect to. If vertex 1 of several catchment strings are closest to the same inlet, only the closest string will connect and the remaining catchment strings will not be used for any other inlet.

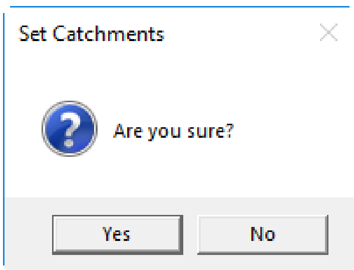
Catchment strings will not connect to inlets that already have a catchment string connected to them or have a value in the **Area** field.

Even if the inlet does not have a catchment string connected, a value in the **Area** field will stop a string from been connected to it. This preserves manually entered catchment areas.

After the catchment string connection is created, the **vertices of the catchment string are re arranged** so that **vertex 1 is closest to the inlet**.

(c) For **SAG** nodes, the catchments strings from all five catchment sets for the node are draped onto the design surface to locate the lowest overflow point. This level is used for the ponding depth. Information messages are written to the output window during this process.

After the **Set Catchments** button is pressed and the set catchment confirm request is ON, the user is asked to confirm that they wish to proceed.



If **Yes** is selected, the option proceeds, otherwise the option is not run.

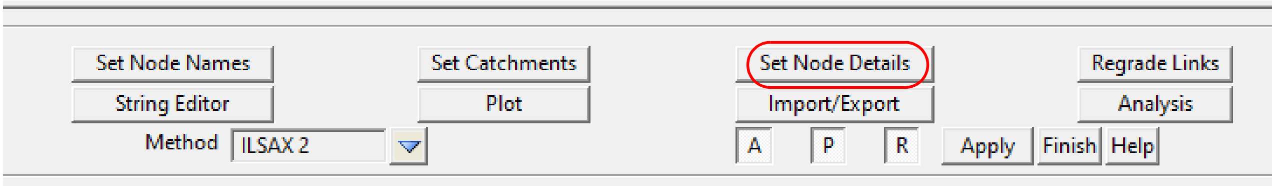
Important Note

Clicking RB on **Set Catchments** button toggles the set catchments confirm request off/on.

Also

To **clear all the Catchment connections**, use the Unlink Catchment Polygons button on the ***GLOBAL >Utility Models*** subtab (see 17.3.4.6.1.2 GLOBAL >Utility Models subtab)

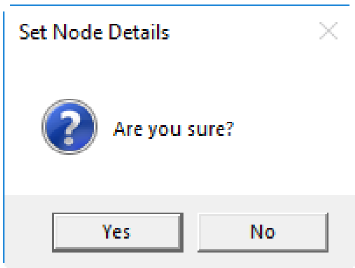
17.3.4.6.9 Set Node Details Button



Selecting **Set Node Details** will set the node levels (cover level) for all of the nodes in the water network using either the default settings for the model or the explicit settings for any node (if used).

If activated the following are also set: road design string, setout coordinates (x,y and z), road centre line chainage and offset, the node symbol rotation, the road grade and crossfall and the bypass node.

After the **Set Node Details** button is pressed and the set node details confirm request is ON, you are asked to confirm that you wish to proceed.



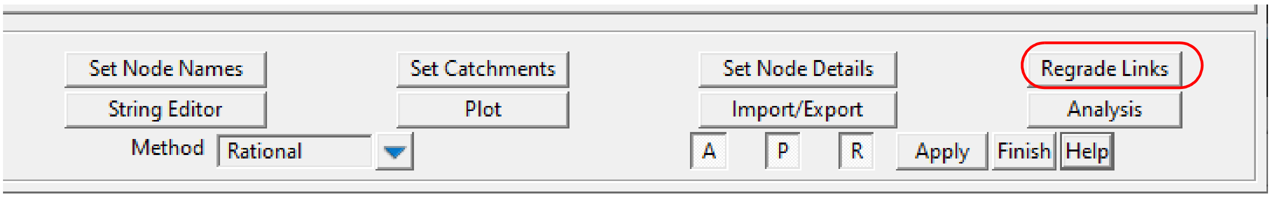
If **Yes** is selected, the option proceeds.

Important Note

Clicking RB on **Set Node Details** button toggles the set node details confirm request off/on.

17.3.4.6.10 Regrade Links Button

This option resets the link invert levels using the link design parameters link sizes, maximum link heights, minimum link cover and invert alignment mode.



Selecting the **Regrade Links** button sets the link inverts for all of the links in the network using either the default settings for the model or if used, the explicit settings for each link.

Minimum grade and ***cover*** are checked and trunk lines are lowered to accept incoming branch lines.

Grade is **calculated** using either the node centre to centre distance or the end of link to end of link distance (set by the tick box **Use end to end pipe length** on the ***GLOBAL >Main*** subtab 17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section).

Default link cover and **grade** are set on the ***DEFAULTS >Links*** tab and if not found there, the **minimum grade** and **minimum cover** for the water string are used (see 17.3.2 Water String Defaults).

Water - Service Defaults > Link settings are used. See see 17.3.2 Water String Defaults.

Invert alignment is based on the **link cover**, the **link minimum grade** and the **drop across the node** (see 17.3.4.6.2.3.1 Link Grade Modes). The finished surface tin specified in the **FS tin** field on the ***GLOBAL >Main*** subtab (17.3.4.6.1.1.1 GLOBAL > Main subtab - Universal Data section) is used for these calculations. Since every link that enters the node may have a different **drop mode**, the **drop mode** is set on the **downstream end of the link**, NOT the node.

If the inverts are **locked** on the **Node** tab then some the design criteria may not be able to be achieved. Messages in the output window will indicate these problems.

For **circular links,** the **cover** is checked along the **centre line of the link**.

For **box culverts**, the **cover** is also **measured along the sides**.

The wall thickness is set via the link type and diameter from the drainage.4d file.

Information, warning and problem messages will be displayed in the output window.

These messages will include link cover warnings, service crossing data and invert alignment messages.

The user may place too many restraints using the regrade options results in no feasible solutions to the grading. These messages will also be shown.

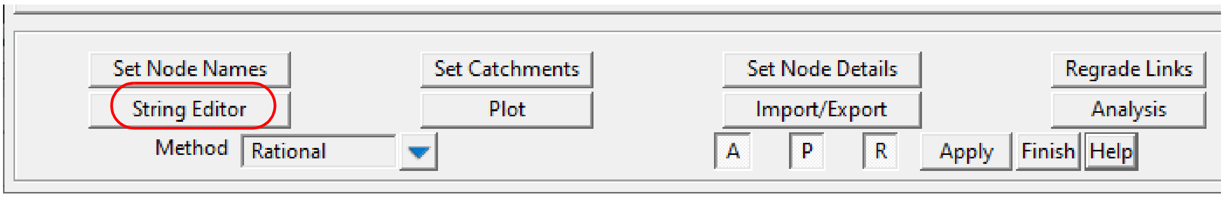
After the **Regrade Link** button is pressed and the **Regrade pipe confirm request** is **ON**, you are asked to confirm that you wish to proceed.

If **Yes** is selected, the option proceeds.

Important Note

Clicking RB on **Regrade Links** button toggles the regrade links confirm request off/on.

17.3.4.6.11 String Editor Button

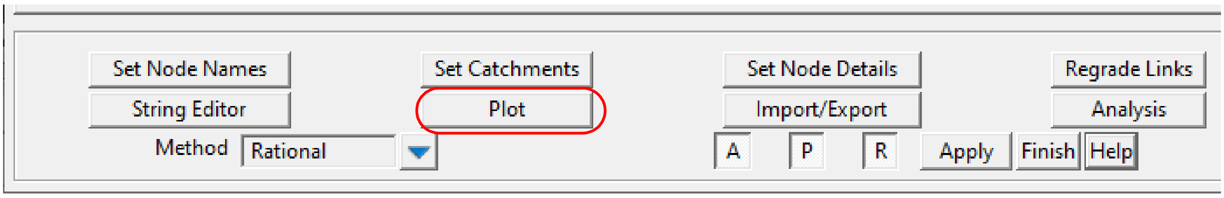


Pressing the **String Editor** button brings up the **Water Edit** option and it is editing the water string whose nodes and currently being displayed in the **Water Network Editor.**

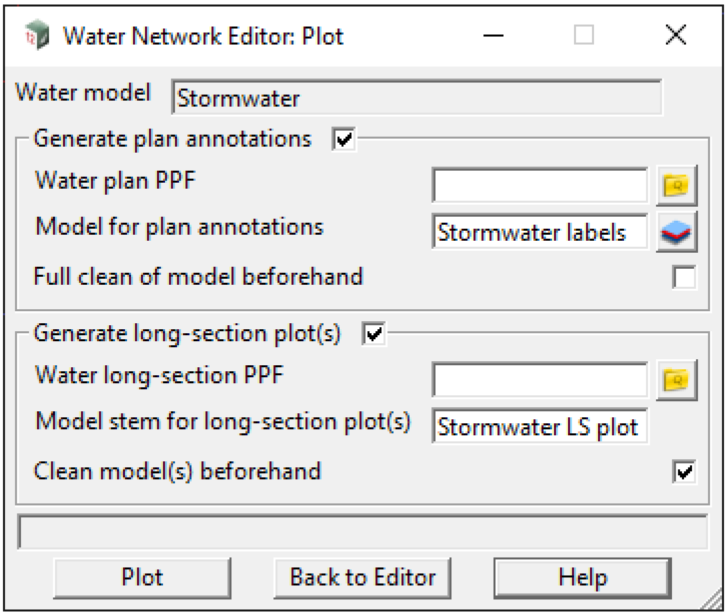
The **Water Network Editor** is also shut down as editing one of the water strings means the water network may no longer have the correct information in it after the selected water string is edited.

17.3.4.6.12 Plot Button

This plotting option will create a drainage plan and/or long section using the ppf files entered.

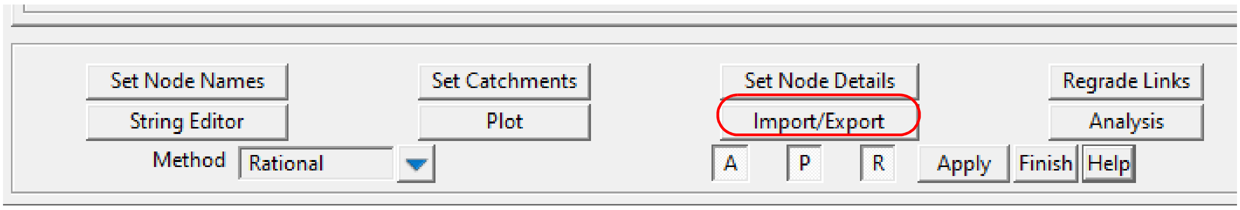


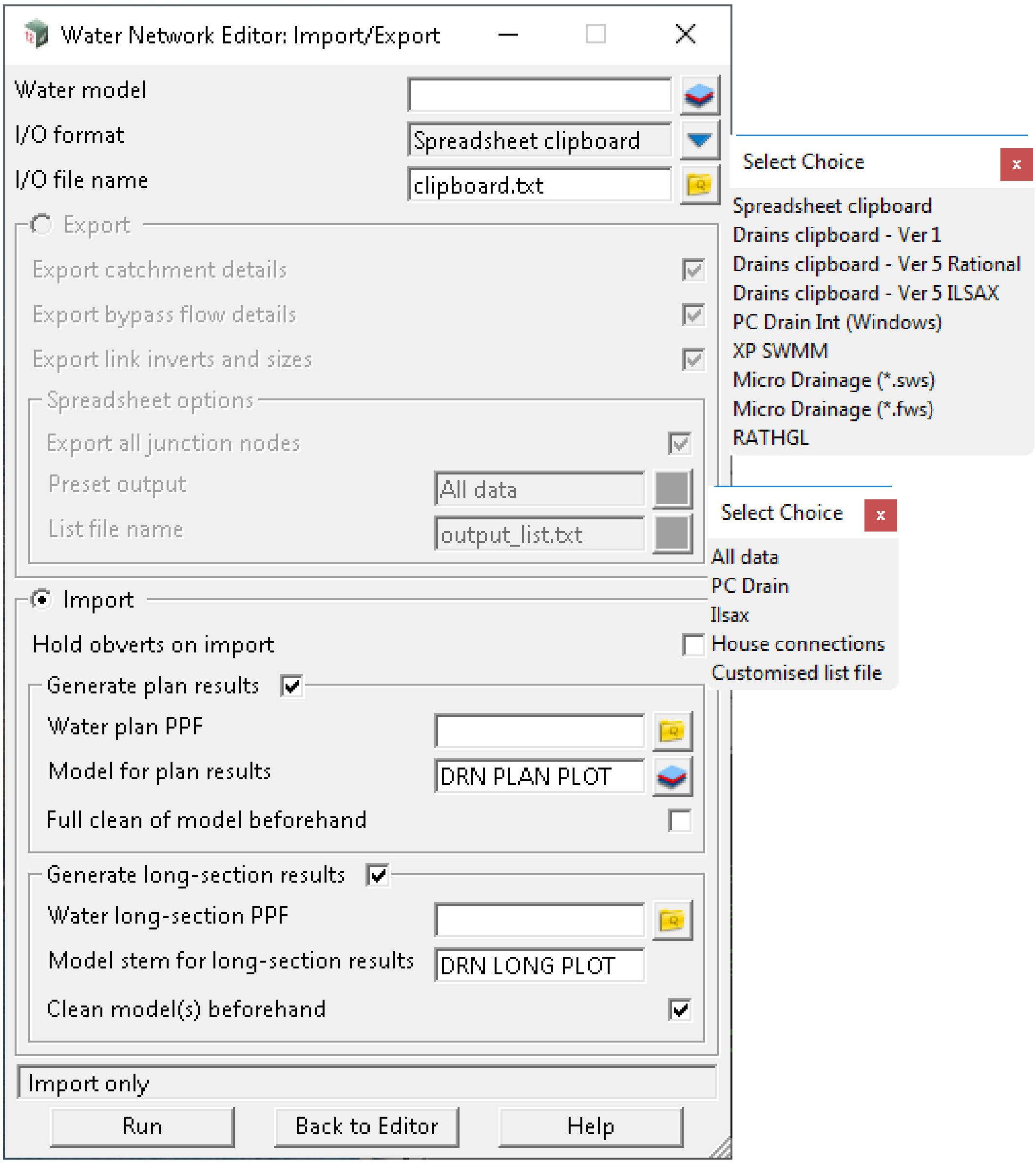
The ppf editors can be launched from this panel by selecting the More Information folder icon beside the ppf field.



See Using Drainage Network Plot Button

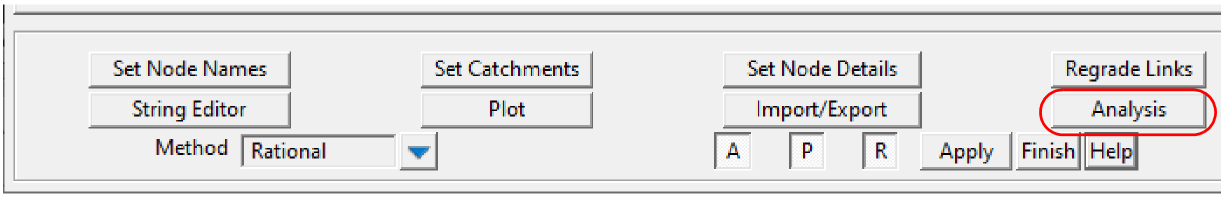
17.3.4.6.13 Import/Export Button





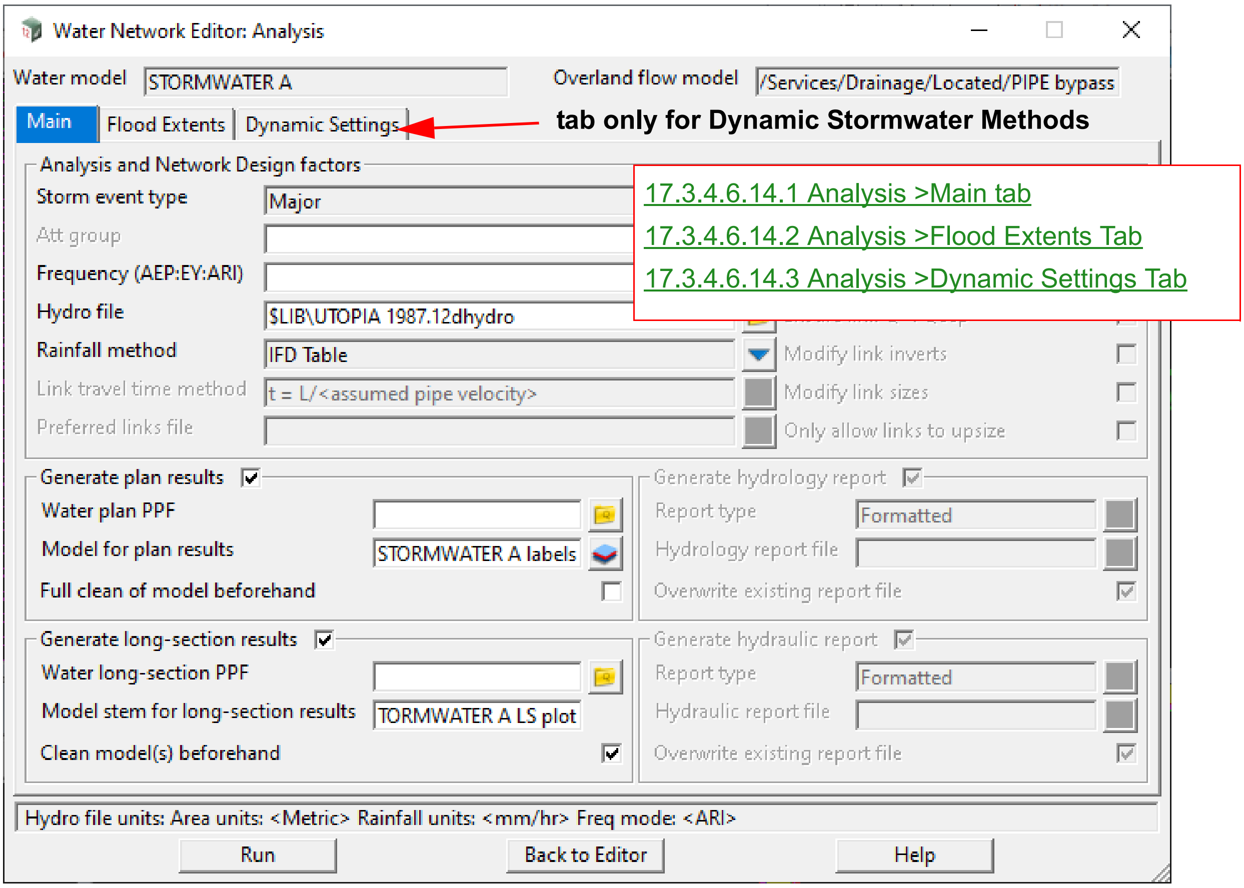
See Drainage Export and Import to Design Software

17.3.4.6.14 Analysis Button



For **Method** of ***Water Supply***, see 17.7.2.3.4 WS Analysis - Simulation Settings.

For the ***Stormwater*** methods, pressing on the **Analysis** button brings up the **Water Network Editor: Analysis** panel.



Field	Type	Defaults	Pop-Up

Fields on Top and Buttons at Bottom

Water model output

Model containing the water network currently being edited in the WNE.

Overland Flow model output

Model containing the overland flow strings.

Run button

Run 12d hydrology and hydraulic check routine

Back to Editor button

Return to the Water Network Editor

For information on the fields on the tabs, see

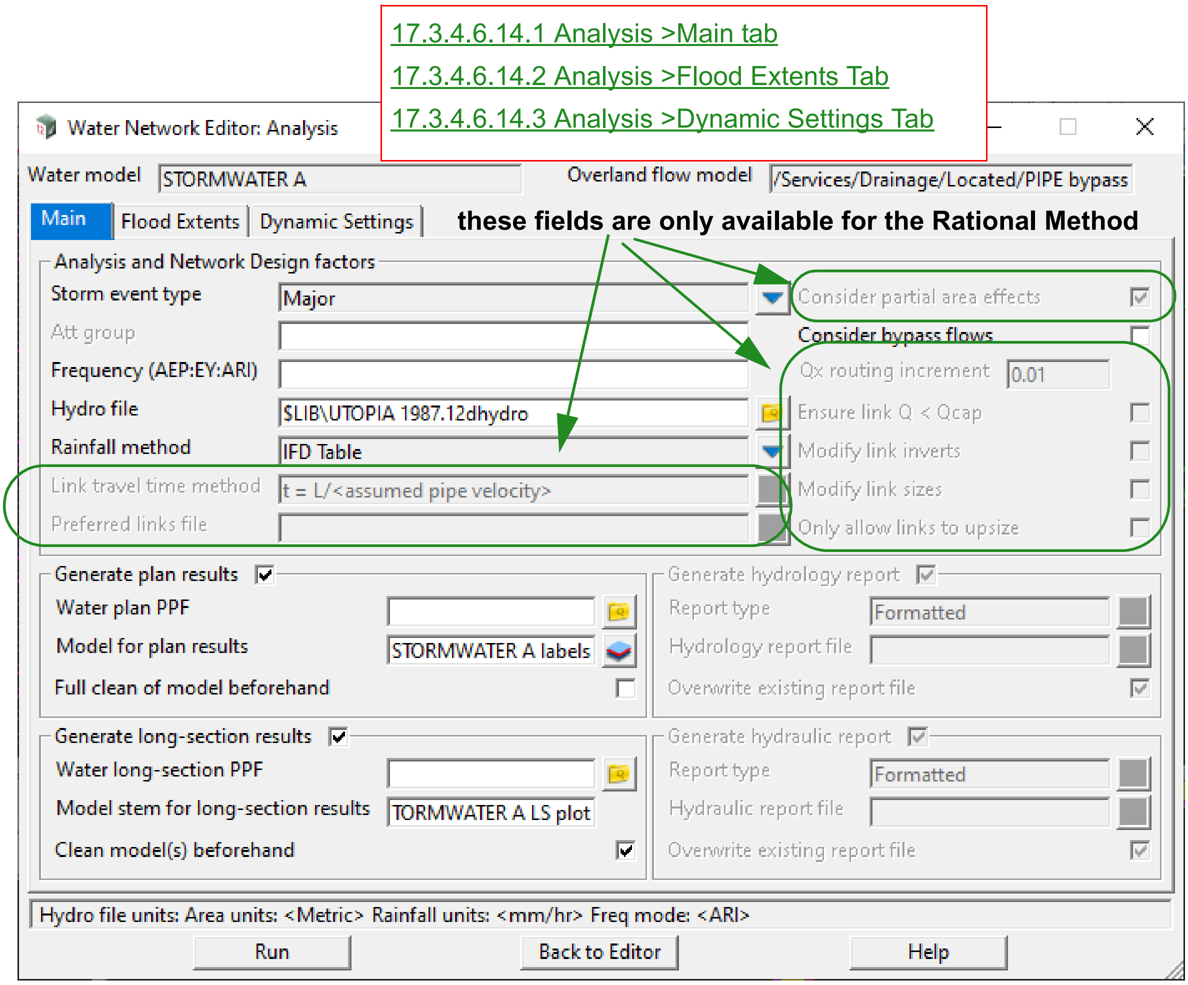
17.3.4.6.14.1 Analysis >Main tab

17.3.4.6.14.2 Analysis >Flood Extents Tab

17.3.4.6.14.3 Analysis >Dynamic Settings Tab **- for Dynamic Stormwater Method only**

17.3.4.6.14.1 Analysis >Main tab

Selecting the **Main** tab displays:



Field	Type	Defaults	Pop-Up

Analysis and Network Design factors section

Storm event type choice box Minor, Major, Both

*If **Minor**, do the analysis for the minor storm event.*
*If **Major**, do the analysis for the major storm event.*
*If **Both**, do the analysis for the minor and major storm event.*

Att group

*If **not blank**, the attributes will be placed under this attribute group.*

Frequency (Percent:yrs)

??

Hydro file file box

*Also known as the **Rainfall File.** For all Runoff C Methods except None*

*This file contains the rainfall intensity data, patterns, soil infiltration, tailwater and pump data. The **Folder =>Open** button will launch an editor for this files (see* 17.5.1 Hydro (Rainfall) File Editor*). Samples of the file are contained in the 12d library.*

Rainfall method choice box IFD table, ARR 1987

What is available will depend on the **Hydro file***.*

Consider bypass flows tick box

*If **ticked**, the analysis will consider bypass flows.*

*If **not ticked**, the inlets will have unrestricted inlet capacity.*

See 17.3.4.6.4.4 Node >Bypass subtab - Stormwater

Analysis and Network Design factors section - for Rational only

Consider partial area effects tick box

*If **ticked**, the Rational method will do partial area calculations.*

*If **not ticked**, the Rational method will NOT do partial area calculations.*

Qx routing increment real box

*If **Consider bypass flows** is **ticked**, a value can be entered.*

*The **Qx** value controls how excess flow is handled in the bypass flow calculations. If the HGL at the node reaches the grate level then no more water can enter the node even if there is inlet capacity. The flow that will not enter the node is considered excess flow. When a value greater than zero is entered here, the inlet will initially have its inlet capacity restricted by this value. Upstream inlets are done first as this may reduce the HGL in the downstream system. The system is automatically rerun adjusting the flows by this amount each time.*

If the inlet capacity is reduced to zero and the HGL is still above the pit then water is removed from the node and considered as Qs (surcharge flow). In the hydraulic reports this value is found as a negative Inlet Flow Qi.

Ensure pipe Q < Qcap tick box

*If **ticked**, the link size will be increased if this criteria is violated.*

Modify pipe inverts tick box

*If **ticked**, the **12d Model** design engine can shift the link inverts if required (usually link size changes).*

Modify link sizes tick box

*If **ticked**, the **12d Model** design engine will calculate the link sizes. A file of preferred sizes can then be selected in the **Preferred links file** field.*

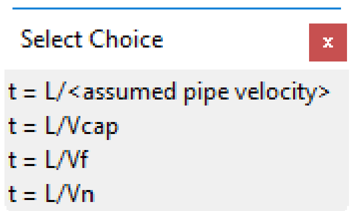
Only allow links to upsize tick box

*If **ticked**, the **12d Model** design engine will not reduce the size of links.*

*If **not ticked**, the **12d Model** design engine can reduce the size of links.*

***Note:** Regardless of this selection, the **12d Model** design engine will not allow a smaller link to be selected in the downstream direction.*

Pipe travel time method



Method of calculating the travel time in the link.

Preferred links file file box *.pip files

The file of preferred links sizes to use when sizing links. See 17.3.4.6.14.1.1 Preferred Links File.

*To edit or create a preferred pipes file, click RB on the folder icon and select **Open** to bring up the Preferred Pipes File editor.*

Plotting Section

Water Plan Plots

Generate plan results tick box

*If **ticked**, the Water plan plot is run using the PPF in the* **Drainage plan PPF** *field.*

Water plan PPF file box *.drainplanppf files

Water Plan PPF to use for generating the plot. See 23.7.8 Water Plan Plot PPF Editor*.*

Model for plan results model box

Model for the resulting plot.

Full clean of model beforehand tick box

*If **ticked**, the **Model for plan results** is cleaned before the new plot is run.*

Water Long Section Plots

Generate long section results tick box

*If **ticked**, the water long section plot is run using the PPF in the* **Water long section PPF** *field.*

Water long section PPF file box *.drainplanppf files

Water Long Section PPF to use for generating the plot. See 23.7.5 Water Long Section Plot PPF Editor*.*

Model stem for long section results text box

The stem of the model name for the resulting plot (there could be more than one page of plot).

Clean model(s) beforehand tick box

*If **ticked**, the **Model for long section results** is cleaned before the new plot is run.*

Reports Section

Hydrology report

Generate hydrology report tick box

*If **ticked**, a hydrology report is generated.*

Report type choice box

??

Hydrology report file file box

The file name for the report.

Overwrite existing report file tick box

*If **ticked** and a file already exist, the file is overwritten.*

Hydraulics report

Generate hydraulic report tick box

*If **ticked**, a hydraulic report is generated.*

Report type choice box

??

Hydraulic report file file box

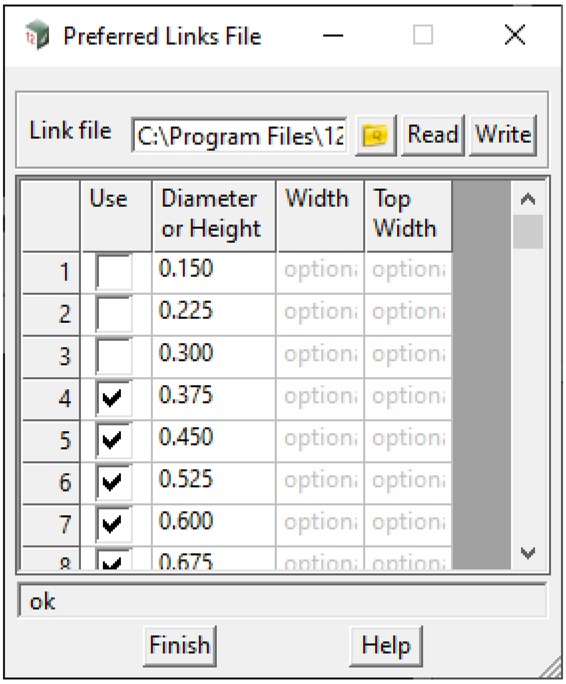
The file name for the report.

Overwrite existing report file tick box

*If **ticked** and a file already exist, the file is overwritten.*

17.3.4.6.14.1.1 Preferred Links File

When the ***12d Model*** design engine is sizing links, a file of preferred link sizes can be used.



Link file file box *.pip

File of preferred link sizes.

Read button

*Data in the file given in the **Link file** field is read into the grid.*

Write button

*Data in the grid is written to the file given in the **Link file** field.*

Grid

Use tick column

*If **ticked**, the link of this size is used.*
*If **not ticked**, the link of this size is **NOT** used.*

Diameter or Height real column

***Link diameter** for a **round** link or the **link height** for a **box** link (culvert) or **trapezoid** link.*

Width real column

***Link width** for a **box** link (culvert) or the bottom width for a trapezoid link.*

Top Width real column

*Top width for a **trapezoid** link.*

17.3.4.6.14.2 Analysis >Flood Extents Tab

The storm analysis engine will calculate

(a) flooded widths from normal depths along the flow path

and

(b) ponding extents at SAG inlets

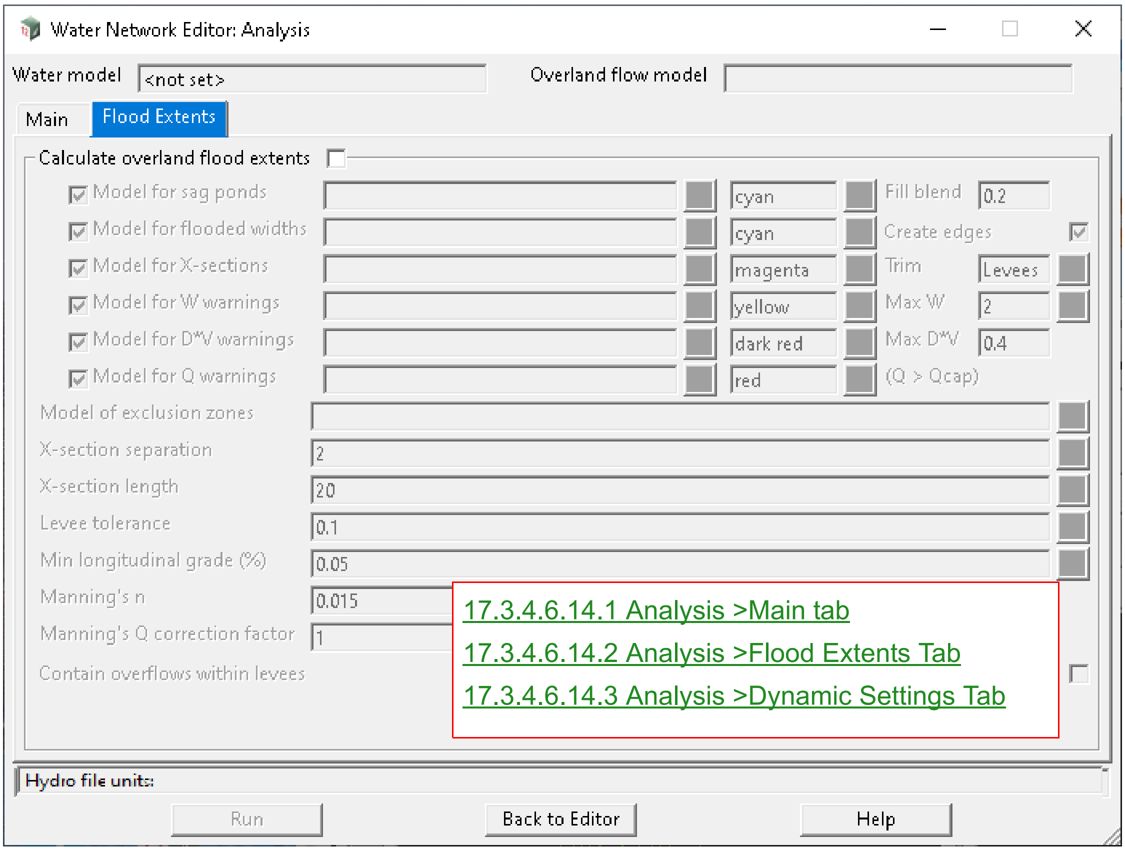
A bypass flow model (**Global-Utility Models** tab) is required for these calculations.

The 17.5.4 Water Utility String Editor should be used where bypass flow strings combine at a pit. Without using this editor it is assumed that 100% of the catchment flow flows down each bypass flow string thereby overestimating the flooded widths.

The 17.5.4 Water Utility String Editor could be used to change the Manning’s along the string (approach channels to culvert for example) or the maximum flooded width warning limit (before a pedestrian crossing or a highway off-ramp).

For the method of calculating flooded widths, see 17.3.4.6.14.2.1 Calculations of Flooded Width.

The **models** and the **default input data** for these calculations are entered on the **Flood Extents** tab.



Calculate overland flood extents tick box

*If **ticked**, overland flood extents are calculated and all the fields on the tab are enabled.*

*If **not ticked**, overland flood extents are **NOT** calculated and all the fields on the tab are disabled.*

Output models

Model for sag ponds model box available models

Is used to hold strings that indicate the extent of flooding at the nodes marked as SAG inlets. The total approach flow is used with the cap_curve_sag in the 27.2.1.3.1 Inlet Capacity Equation *to determine* *the depth of flooding above the grate level. A closed contour at this flood elevation is then selected near the centre of the inlet. A super string is then created at this level with the selected colour and* ***Fill blend*** *transparency selected (1.0 is solid).*

Colour (for sag ponds) colour box available colours

Colour for the flooded width for sag ponds.

Fill blend real box

If ***not blank****, the fill blend to use for the sag ponds.*

Model for flooded width model box available models

Holds the strings indicating the normal depth - flooded width calculation results. These strings are created with a fixed elevation of the flood level. The strings will have string attributes with all of the calculations details.

Colour (for flooded widths) colour box available colours

Colour for the flooded width strings.

Create edges tick box

If ***ticked****, strings are created by joining the edges of adjacent flooded width sections.*

Model for X sections model box available models

Holds the x-section strings that were used in calculating the flooded widths. See 17.3.4.6.14.2.1 Calculations of Flooded Width.

Colour (for X sections) colour box available colours

Colour for the X sections.

Trim choice box Nothing, Levees, Overflow

Trim settings used the trim the cut x-sections.

If ***Nothing****, no trimming is done.*
If ***Levees****,??*
If ***Overlow****,??*

Warning models

Max W real box - on right had side of panel

Maximum flooded width value before a warning is given.

Model for W warnings model box available models

Will contain copies of the flooded width strings with the selected colour if the flooded width is greater than the default ***Max W*** *value.*

Colour (for W warnings) colour box available colours

Colour for the flooded width warning strings.

Max D*W real box - on right had side of panel

*Maximum D*W value before a warning is given.*

Model for D*V warnings model box available models

*Will contain copies of the flooded width strings with the selected colour if the depth * velocity is greater than the* ***Max D*V*** *value.*

Colour (for D*V warnings) colour box available colours

*Colour for the D*V warnings.*

Model for Q warnings model box available models

*Will contain copies of the flooded width strings with the selected colour if the flow is greater than the capacity of the section. The capacity is the flow where the water over tops one of the sides of the section. That is, when **Q >Qcap**.*

Colour (for Q warnings) colour box available colours

Colour for the Q warnings.

Controls for Flooded Width Calculation

For the flooded width calculations that use the following fields, see 17.3.4.6.14.2.1 Calculations of Flooded Width.

Model of exclusion zones model box available models

*No calculations are done for parts of the bypass flow string within the polygons in the **Model of exclusion zones**.*

X-section separation real box

2D distance along the string that cross sections will be created

X-section length real box

2D length of the cross section

Levee tolerance real box

*The levees setting has the routine search for levee (high points) on either side of the low point near the bypass flow string. The levee points are found if sections drops more than the **Levee tolerance** value after the high point is found.*

Min longitudinal grade (%) real box

*The slope of the surface near the bypass flow line is measured for each section. If the slope is less than **Min longitudinal grade (%)** then this cross section is skipped in the calculations.*

Manning's n real box

Default roughness used in the calculations. This value may be changed at any vertex along the bypass flow string using the 17.5.4 Water Utility String Editor.

Manning's Q correction factor real box

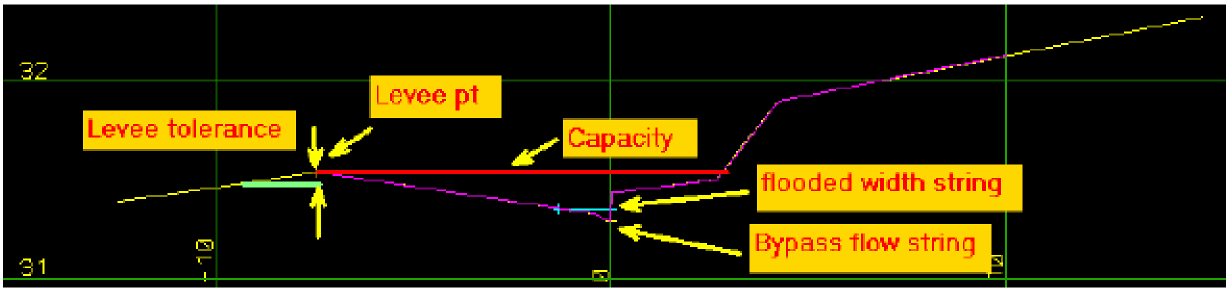
*The flow's calculated at the indicated level are multiplied by the **Manning's Q correction factor**.*

Contain overflow within levees tick box

*If **not ticked**, the maximum depth calculated will be at the point where water overflows the edges of the x-section (Road capacity).*

*If **ticked**, frictionless vertical walls are placed at the ends of the x-section so that higher water level may be calculated when the flow is greater that the road capacity.*

17.3.4.6.14.2.1 Calculations of Flooded Width



1. Cross sections are cut perpendicular to the overland flow string at the interval **X-section separation** with a length of **X-section length**. No calculations are done for sect of the bypass flow string with in **Model of exclusion zones** polygon.
2. The x-section string is then trimmed using the **Trim** settings.The section above had a x-section length of 20 and was trimmed at the levee. The **levees** setting has the routine search for levee (high points) on either side of the low point near the bypass flow string. The levee points are found if sections drops more than the **Levee tolerance** value after the high point is found.
3. The flow for the section is calculated using the bypass flow string chainage to interpolate between the upstream bypass flow and the downstream approach flow. The percentage of catchment flow used in the calculation of the approach flow for this bypass string may be changed using the 17.5.4 Water Utility String Editor.

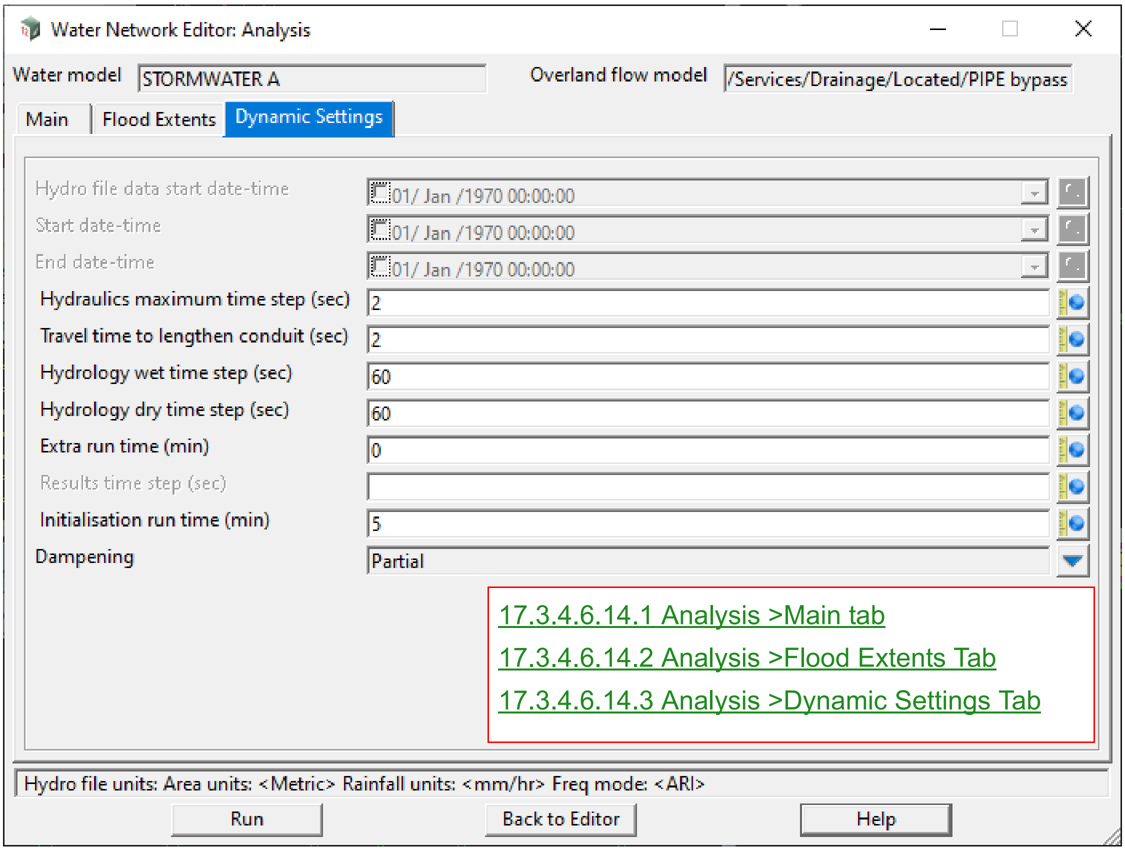
   Note: for the **Dynamic Analysis** the x-sections and discharges are sent to HEC-RAS for backwater analysis. The approach and bypass flows mentioned above are the maximum, duration critical flows found in the box plots.
4. For the **Rational method only**, the slope of the surface near the bypass flow line is measured for each section. If the slope is less than **Min longitudinal grade (%)** then this cross section is skipped in the calculations.
5. **Manning n** value is the default roughness used in the calculations. This value may be changed at any vertex along the bypass flow string using the 17.5.4 Water Utility String Editor.
6. For the rational method only, the flow's calculated at the indicated level are multiplied by the **Manning's Q correction factor**. A factor of 0.8 would cause the flooded widths to increase and the road capacity to decrease.
7. For the **Rational method only**, the maximum depth calculated will be at the point where water overflows the edges of the section (**Road capacity)** unless **Contain overflow within levees** is selected. This will cause frictionless vertical walls to be placed at the ends of the section so that higher water level may be calculated when the flow is greater that the road capacity.
8. For **Dynamic Analysis using HEC-RAS**, each bypass reach is analysed as a separate HEC-RAS run. The HEC-RAS files are saved in a sub folder, HEC-RAS, in the working folder. The HEC-RAS project name is from the bypass flow string name. When reaches have the same bypass string name, the HEC-RAS projects will overwrite the previous.

   HEC-RAS calculations are done in mixed mode with the upstream and downstream water levels taken from the node surface water levels (maximum, duration critical levels from the box plots).

   Note: HEC-RAS must be installed on your computer. HEC-RAS Versions currently supported are 6.4.1, 6.4, 6.3.1 and 5.0.7. When multiple versions are found on the computer, the most recent installed release from this list is used.

17.3.4.6.14.3 Analysis >Dynamic Settings Tab

Selecting the **Dynamic Setting** tab displays:



Hydro file data start date-time calendar

Used for variable temporal patterns (i.e. Historical Storms) to set the start time and date for the storm data supplied in the 12dhydro file.

Start date-time calendar

Used for variable temporal patterns to set the date/time in the 12dhydro data to begin the analysis. Allows a shorter subsection of the full storm to be run.

End date-time calendar

Used for variable temporal patterns to set the date/time in the 12dhydro data to end the analysis. Allows a shorter subsection of the full storm to be run.

Hydraulics maximum time step (sec) real box

Maximum allowable time step for hydraulic calculations. A variable time step is used, and this sets the upper limit.

Travel time to lengthen conduit (sec) real box

This is a time step, in seconds, used to artificially lengthen conduits so that they meet the Courant stability criterion under full-flow conditions (i.e., the travel time of a wave will not be smaller than the specified conduit lengthening time step). As this value is decreased, fewer conduits will require lengthening.

A value of 0 means that no conduits will be lengthened. The ratio of the artificial length to the original length for each conduit is listed in the Flow Classification table that appears in the analysis report.

Hydrology wet time step (sec) real box

Time step length used to compute runoff from subcatchments during periods of rainfall, or when ponded water still remains on the surface.

Hydrology dry time step (sec) real box

Time step length used for runoff computations during periods when there is no rainfall, and no ponded surface water.

Must be greater than or equal to the Hydrology wet time step.

Extra run time (min) real box

Default run time for storms is 4x duration for storm durations < 1080min and 2x duration for storm durations > 1080min.

This field allows for additional run time if required to reach the peak at some point in the network (typically required for short duration storms in large networks)

Results time step (sec) real box

Time steps at which results will be recorded for graphing. Default is 60 seconds. May require shorter time steps if the graph maximum value is less than the recorded attribute maximum value.

Must not be less than the Hydraulics maximum time step.

Initialisation time (min) real box 5 minutes

A pre-run of the network to avoid initial numerical instabilities that can occur under dynamic wave routing.

Allows conditions such as raised tailwater, initial water depths etc to propagate through the conduits prior to starting the rainfall event. Default 5min.

Longer durations may be required for long conduit reaches, large conduit volumes etc.

Dampening) choice box Partial, Full, None

*Indicates how the **inertial terms** in the St. Venant momentum equation will be handled. See* Dampening and the St Venant Dynamic 1D Equation *in* 27.2.4.1 Dynamic Hydraulic Equations.

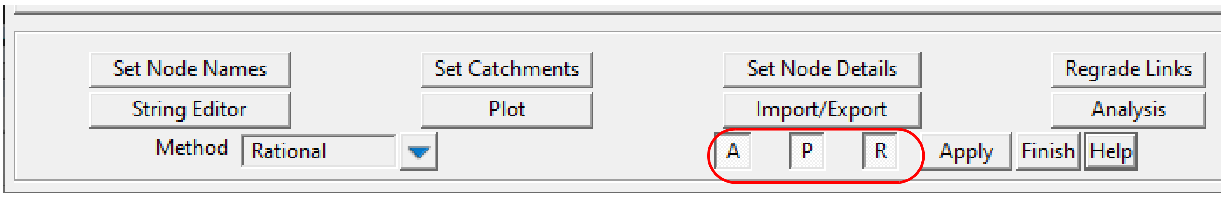
*If **Partial**, reduces the first two terms from the St. Venant momentum as the flow comes closer to being critical and ignores them when flow is supercritical. See* Dampening and the St Venant Dynamic 1D Equation.

*If **Full**, drops the first two terms altogether from the St. Venant momentum equation, producing what is essentially a Diffusion Wave solution. See* Dampening and the St Venant Dynamic 1D Equation

*If **None**, maintains the terms at their full value under all conditions. See* St Venant Dynamic 1D Equation.

Continue to 17.3.4.6.15 A P R Buttons or return to 17.3.4 Water Network Editor (WNE).

17.3.4.6.15 A P R Buttons



These button toggle of and off the Auto-Apply, Auto-Pan, Auto-Profile and Auto-Redraw

A - Auto-Apply

*With **Auto-Apply** (A) enabled, the **Apply** is automatically run and data updated in the water network when any of the lower buttons (***Set Node Names**, **Set Catchments** *etc) are pressed **except Finish** and **Help**.*

Important Note
The updated data will only be saved to disk when a Project save is done or the water network model is saved.

P - Auto-Profile

Auto-Pan is always active for plan views and on any plan view displaying the active water network selected, it will always auto pan if the selected node is not visible in the view.

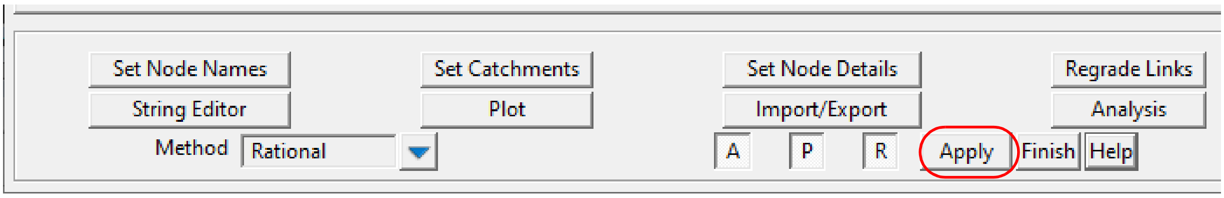
*With the **Auto-Profile** (**P**) enabled, the same will happen **for any section views** that the current water string is profiled on.*

R - Auto-Redraw - this is a Auto-Regen

*With **Auto-Redraw (R)** enabled, the editor will regenerate the section views that are profiling water strings from the current water network, when changes are made in the vertical. This saves selecting **Regen** on these section views.*

Continue to 17.3.4.6.16 Apply Button or return to 17.3.4 Water Network Editor (WNE).

17.3.4.6.16 Apply Button



To be documented.

Continue to 17.3.4.7 Water Log Line (wll) Messages or return to 17.3.4 Water Network Editor (WNE) or 17.3 Water Network.

17.3.4.7 Water Log Line (wll) Messages

Water log lines provide messages linked to the water model.

After expanding the log line, the nodes and links affected will be listed. A single click will pan views, with the water model added, to the selected node/link. A double click on the line, when the Water Network Editor (WNE) is open, will make this node/link active in the WNE.

Water log lines, that begin with [F1], have extra reference information. Selecting the line and pressing the F1 key will open the 12d reference model to the relevant section.

Important!

To jump to the relevant section, the ***12d Model*** reference manual must be closed before the F1 key is pressed.

See Regrade Links, Inverts locked

See Regrade Links, node invert alignment, min drop

See Regrade Links, node invert alignment, exact invert drop

See Regrade Links, node invert alignment, drop less than downstream pipe diameter

See Regrade Links, node obvert alignment, exact obvert drop

See Regrade Links, invert alignment, exact centreline drop

See Regrade Links, constant depth grading

See Regrade Links, grade from downstream

See Regrade Links, drape inverts

See Regrade Links, minimum depth before minimum grade

See Regrade Links, minimum grade before minimum depth

See Regrade links, skip cover distance error

See Regrade links, pipe inverts locked

See Regrade links and Set Node Details Error, grate level less than link the invert

See Regrade links, open channel

See Water Log line message not set

Regrade Links, Inverts locked

Regrade links will not alter inverts that are locked. The lock tick boxes are shown in the top right corner of the water network editor. This message indicates that either both, the upstream or the downstream invert level has been.

Regrade Links, node invert alignment, min drop

Regrade links will use first drop value found in the following drop search to set the invert drop between the incoming link and the main outgoing link. The upstream invert of the outgoing link will be lowered if the drop is less than this value.

Drop search:

1. the water network editor, link-design tab, Align drop
2. the water network editor, defaults-link tab, Drop file
3. the project Water services defaults, Drop value

Regrade Links, node invert alignment, exact invert drop

Regrade links will use first drop value found in the following drop search to set the invert drop between the incoming link and the main outgoing link. The inverts levels will be lowered if needed to obtain the drop.

Drop search:

1. the water network editor, link-design tab, Align drop
2. the water network editor, defaults-link tab, Drop file
3. the project Water services defaults, Drop value

Regrade Links, node invert alignment, drop less than downstream pipe diameter

This option is used to prevent the incoming water jet from impacting the node on the opposite wall.

Regrade links will use first drop value found in the following drop search to set the invert drop between the incoming link and the main outgoing link. The downstream invert levels of the incoming links will be lowered if they are above the upstream obvert of the outgoing link. The upstream invert of the main outgoing link may also be lowered if needed to obtain this drop.

Drop search:

1. the water network editor, link-design tab, Align drop
2. the water network editor, defaults-link tab, Drop file
3. the project Water services defaults, Drop value

Regrade Links, node obvert alignment, exact obvert drop

Regrade links will use first drop value found in the following drop search to set the obvert drop between the incoming link and the main outgoing link. The obverts levels will be lowered if needed to obtain the drop.

Drop search:

1. the water network editor, link-design tab, Align drop
2. the water network editor, defaults-link tab, Drop file
3. the project Water services defaults, Drop value

Regrade Links, invert alignment, exact centreline drop

Regrade links will use first drop value found in the following drop search to set the centre line (spring line) drop between the incoming link and the main outgoing link. The inverts levels will be lowered if needed to obtain the drop.

Drop search:

1. the water network editor, link-design tab, Align drop
2. the water network editor, defaults-link tab, Drop file
3. the project Water services defaults, Drop value

Regrade Links, constant depth grading

The option is used to grade the links to follow a defined depth below the Design surface tin (water network editor, Global tab). Minimum grade is ignored with this setting.

Regrade links will use the first depth value, found in the following depth search, to set the inverts levels depth below the design surface tin.

Cover limit, depth, search:

1. the water network editor, link-design tab, Cover limit
2. the water network editor, defaults-link tab, Cover file

3. the project Water services defaults, Minimum cover

Regrade Links, grade from downstream

The option is used to grade the links from the downstream end of the network. Minimum depth is ignored with this setting.

Regrade links will use the first grade value, found in the following grade search, to set the inverts levels from the outlet link proceeding in the upstream direction.

Grade search:

1. the water network editor, link-design tab, Min grade (%)
2. the water network editor, defaults-link tab, Grade file
3. the project Water services defaults, Minimum grade

Regrade Links, drape inverts

The option is used to grade the link inverts, usually open channels, to follow the Design tin. Minimum depth and minimum grade are ignored with this setting.

Regrade Links, minimum depth before minimum grade

The option is used to grade the links as close to the Design tin surface as possible. The invert levels are first set to the depth found in the search below and then the downstream invert is lowered, if needed, to obtain the minimum grade from the grade search below.

Cover limit, depth, search:

1. the water network editor, link-design tab, Cover limit
2. the water network editor, defaults-link tab, Cover file
3. the project Water services defaults, Minimum cover

Grade search:

1. the water network editor, link-design tab, Min grade (%)
2. the water network editor, defaults-link tab, Grade file
3. the project Water services defaults, Minimum grade

Regrade Links, minimum grade before minimum depth

The option is used to grade the links as close to the minimum grade as possible. The invert levels are first set to the grade found in the grade search below and then the link is lowered, maintaining the grade, to obtain the minimum cover from the cover search below.

Grade search:

1. the water network editor, link-design tab, Min grade (%)
2. the water network editor, defaults-link tab, Grade file
3. the project Water services defaults, Minimum grade

Cover limit, depth, search:

1. the water network editor, link-design tab, Cover limit
2. the water network editor, defaults-link tab, Cover file
3. the project Water services defaults, Minimum cover2

Regrade links, skip cover distance error

The sum of the upstream and downstream skip cover distances must be less than the end to end link length. Otherwise, there is link segment remaining to calculate the over.

Regrade links, pipe inverts locked

This is a confirmation message that the link inverts are locked.

Regrade links and Set Node Details Error, grate level less than link the invert

The grate level is essential in the hydraulic analysis and design of the water pipe system. The system cannot be analysed, or designed, with the grate level below the link invert.

Regrade links, open channel

When the grate level is less than link obvert, 12d refers to the link as an Open Channel.

Rational Analysis

Rational analysis uses the grate level as the maximum HGL level in the connected links. When the HGL cannot reach the obvert of the link, open channel flow must exist at that end of the link.

Dynamic analysis

Dynamic analysis, with bypass flow enabled, uses the grate level to divide the sub surface HGL from the surface HGL. With bypass flow enabled and a bypass node specified, this message is no expected.

Water Log line message not set

No additional reference information has been set for this water log line message.

Continue to 17.3.5 String Editor or return to 17.3.4 Water Network Editor (WNE) or 17.3 Water Network.

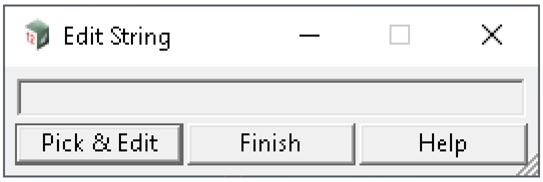
17.3.5 String Editor

Position of option on menu: **Water =>Water network =>String editor**

Position of option on menu: **String =>Editor**

This is the same option as **Editor** from the **Strings** walk-right menu on the ***12d Model*** menu. See 10.3 Editor.

The string editor is used to modify any ***12d Model*** strings. After selecting the **Editor** option, the **Edit String** panel is placed on the screen to record any error messages.



The option is already in the **Pick** mode (the **Pick & Edit** button only needs to be selected if the pick was cancelled) and the user simply picks and accepts the string to be edited.

From the picked string's type, the editor is able to determine the edits that apply to the string and list them in the string's **Edit** menu.

If a drainage string is selected, the **Drainage Edit** menu and **Drainage Edit** panel (as shown in the previous section) are placed on the screen.

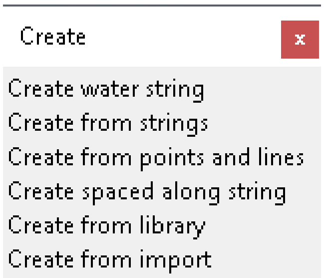
The individual edit operations for a drainage string will now be discussed in detail.

Continue to 17.3.6 Water Create or return to 17.3 Water Network.

17.3.6 Water Create

Position of menu: **Water =>Water network =>Create**

The **Create** walk-right menu is



See
17.3.6.1 Create Water String
17.3.6.3 Create from Strings
17.3.6.4 Create from Points and Lines
17.3.6.5 Create Water Spaced Along String
7.4.2.2 Insert from 12da Library
17.3.6.6 Create Network from Import - WinDes and XP SWMM

Also see 17.3.6.2 Water String Edit for the Water string editor.

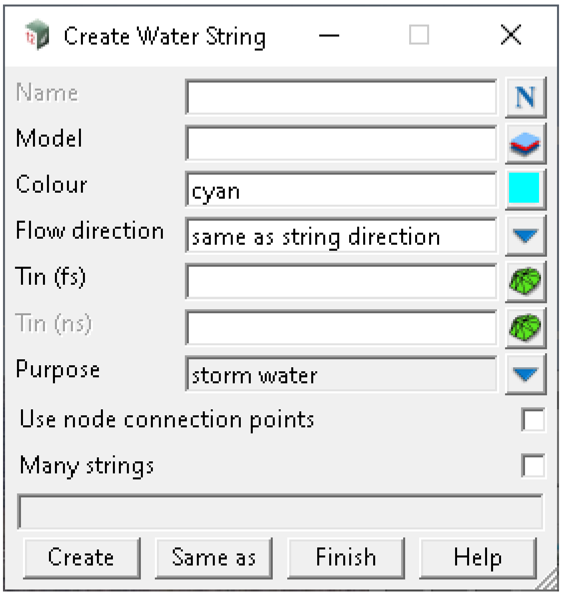
17.3.6.1 Create Water String

Position of option on menu: **Water =>Water network =>Create =>Create water string**

The **Create** option is used to produce **new** water strings and networks. If a water string already exists, the **Editor** option is used to modify it.

To create a new water string, the name, colour, model and style of the new string are entered into the appropriate fields, plus the finished surface triangulation that the nodes are normally flush with, the natural surface triangulation, and the **Create** button selected.

Selecting **Create** brings up the **Create Water String** panel.
n



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Name	name box		

Name for the new water string.

Model	model box		available models

Model for the new water string.

Colour	colour box	cyan	available colours

Colour of the new water string.

Flow direction	input	opposite to string direction	opposite to string direction same as string direction

If ascending chainage, then the flow direction is in ascending chainage (recommended)
if descending chainage, then the flow direction is in descending chainage.

Tin (fs)	input	water =>defaults =>tin	available tins

Finished surface tin. If nodes are "floating", the top of the node is automatically place on the tin surface ("floated" on the surface).

Tin (ns)	input		available tins

Natural surface tin used in longsection plots.

Purpose choice box storm water, foul water, water supply

Foul water strings utilise house connections and lot controls; storm water strings do not.

Use node connection points tick box not ticked

*If **ticked**, the ends of the links may snap to the centres of the sides, the perimeter or user defined points.*

*The type of connection points that are allowed for a particular node is given by the **Connection mode** set by the Water Network Editor. For more information see* 17.1.4.3 Node Connection Points for Links.

Many strings tick box not ticked

*If **ticked**, the panel will reappear after the Create process is completed ready to create another string.*

Buttons at Bottom

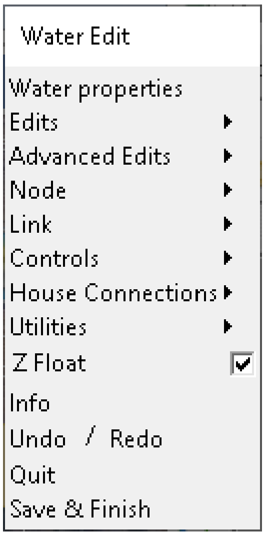
Create button

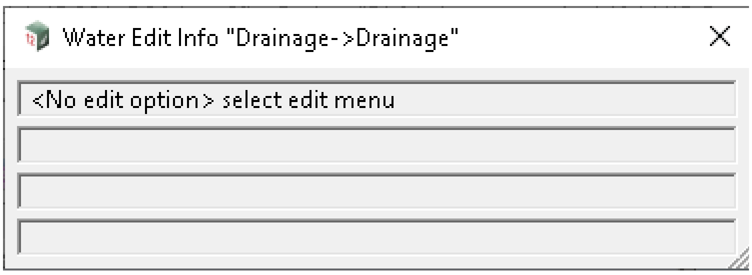
Starts the Create process. Edits =>Add/Append is usually the first command to be used from the menus.

The **Create Water String** panel is then removed and the **Water Edit** menu and **Water Edit Info** panel fired up.

As for a 3d string, to create a new water string with some of the **same** name, colour, model and style as an existing string (not necessarily a water string), the **Same as** button is chosen and the appropriate string selected.

The **Water Edit** menu contains all the available options for editing a water string and its associated block controls and house connections. The **Water Edit Info** panel contains information areas. The **Water Edit** menu and **Water Edit Info** panel are





To create a new water string, the user selects the **Append** option from the **Edits** walk right menu on the **Water Edit** menu.

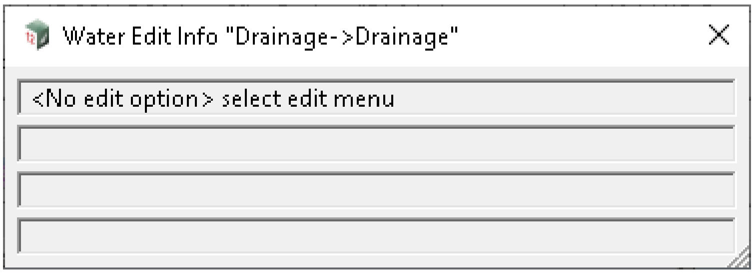
Since the **Water Edit** menu and **Water Edit Info** panel are the same as those used when editing a water string, the options will be discussed under the **Water Edit** option. See 17.3.6.2 Water String Edit

For water utilities and import/export see More Drainage

Continue to 17.3.6.2 Water String Edit or return to 17.3.6 Water Create.

17.3.6.2 Water String Edit

On picking a water string when in the string **Editor** option, or by selecting **Create** in the **Create Water String** panel, the **Water Edit** menu and panel are placed on the screen.



The edit is **cancelled** by selecting the **Quit**. No changes to the string are recorded and the **Water Edit** option terminates.

The edit is **finished** and the changes recorded when the **Finish** is chosen. The **Water Edit** option then terminates.

When either button is selected, a **Yes-No-Cancel** panel is displayed and the user must confirm the selection.

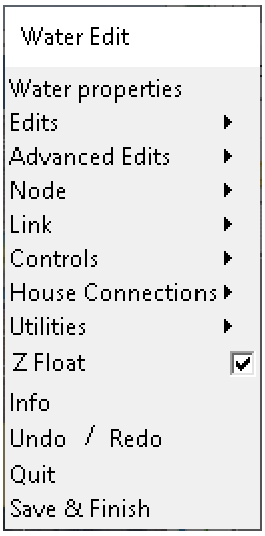
The **Water Edit Info** panel is principally used to display information and messages during the creation and editing of the water string. It is toggled on and off by **Info** on the **Water Edit** menu.

The main message area indicates the purpose of the mouse buttons at each step.

Message area 1 displays the current Water Edit option and message area 4 indicate the next step in the edit option.

Message areas 2 and 3 are used to display information about the string as the cursor is moved near the water string and the water nodes.

Each of the options in the **Water Edit** menu will now be described.

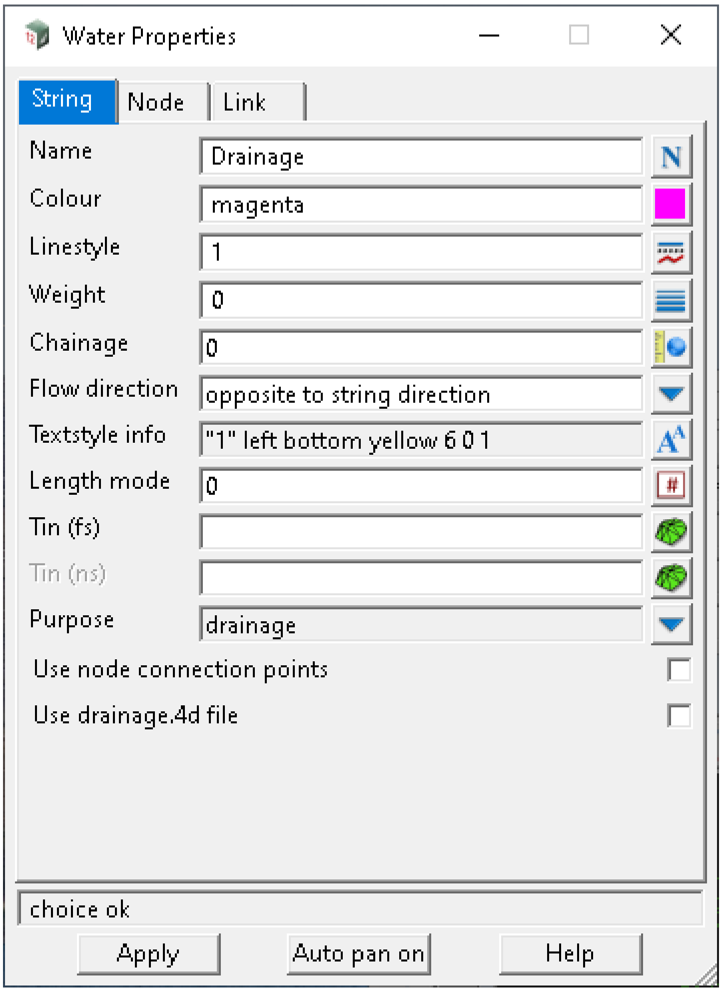


See
17.3.6.2.1 Water Properties
17.3.6.2.2 Edits
17.3.6.2.3 Advanced Edits
17.3.6.2.4 Node
17.3.6.2.5 Link
17.3.6.2.6 Property Controls
17.3.6.2.7 House Connections
17.3.6.2.8 Utilities
17.3.6.2.9 Z Float
17.3.6.2.10 Water Edit Info
Undo/Redo the last edits
Quit the editor without saving the changes
Save the changed and exist the editor

17.3.6.2.1 Water Properties

The Water Properties option allows the user to change string, node and link properties for a selected water string.

Selecting **Water properties** brings up the **Water Properties** panel



String tab
Node tab
Link tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

String tab

Fields on this tab are for displaying and changing the properties of the selected string.

Field	Type	Defaults	Pop-Up
Name	name box		Names pop-up

Name of the string.

Field	Type	Defaults	Pop-Up
Colour	colour box		

Colour of the string.

Field	Type	Defaults	Pop-Up
Linestyle	linestyle box		

Linestyle of the string.

Field	Type	Defaults	Pop-Up
Weight	weight box		

Weight of the string.

Chainage	real box		Measures pop-up

Start chainage of the string.

Flow direction	choice box	Opposite to string direction Same as string direction	

Flow direction in relation to the direction of the string.

Textstyle info	textstyle box		available textstyles

Flow direction in relation to the direction of the string.

Length mode	number box		

Tin (fs)	tin box		available tins

Finished surface tin.

Tin (ns)	tin box		available tins

Natural surface tin.

Purpose	choice box	drainage, sewer, water supply	

Type of water string.

If sewer, House connections and Property controls are available.

Use node connection pointstick box

*If **ticked**, the ends of the links may snap to the centres of the sides, the perimeter or user defined points.*

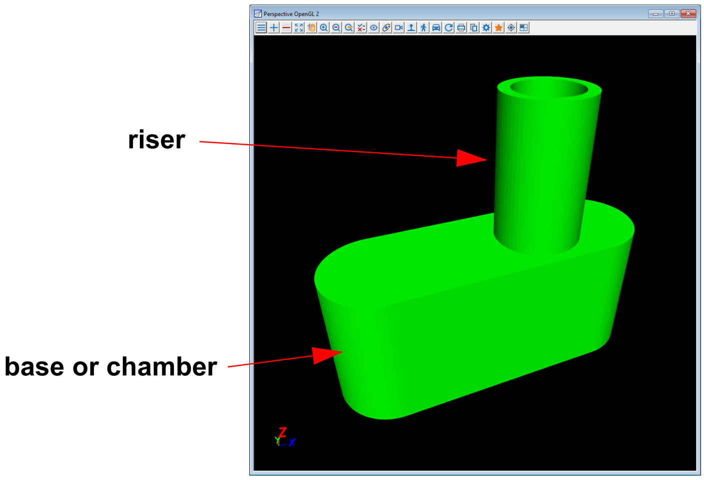
*The type of connection points that are allowed for a particular node is given by the **Connection mode** set by the Water Network Editor. For more information see* 17.1.4.3 Node Connection Points for Links.

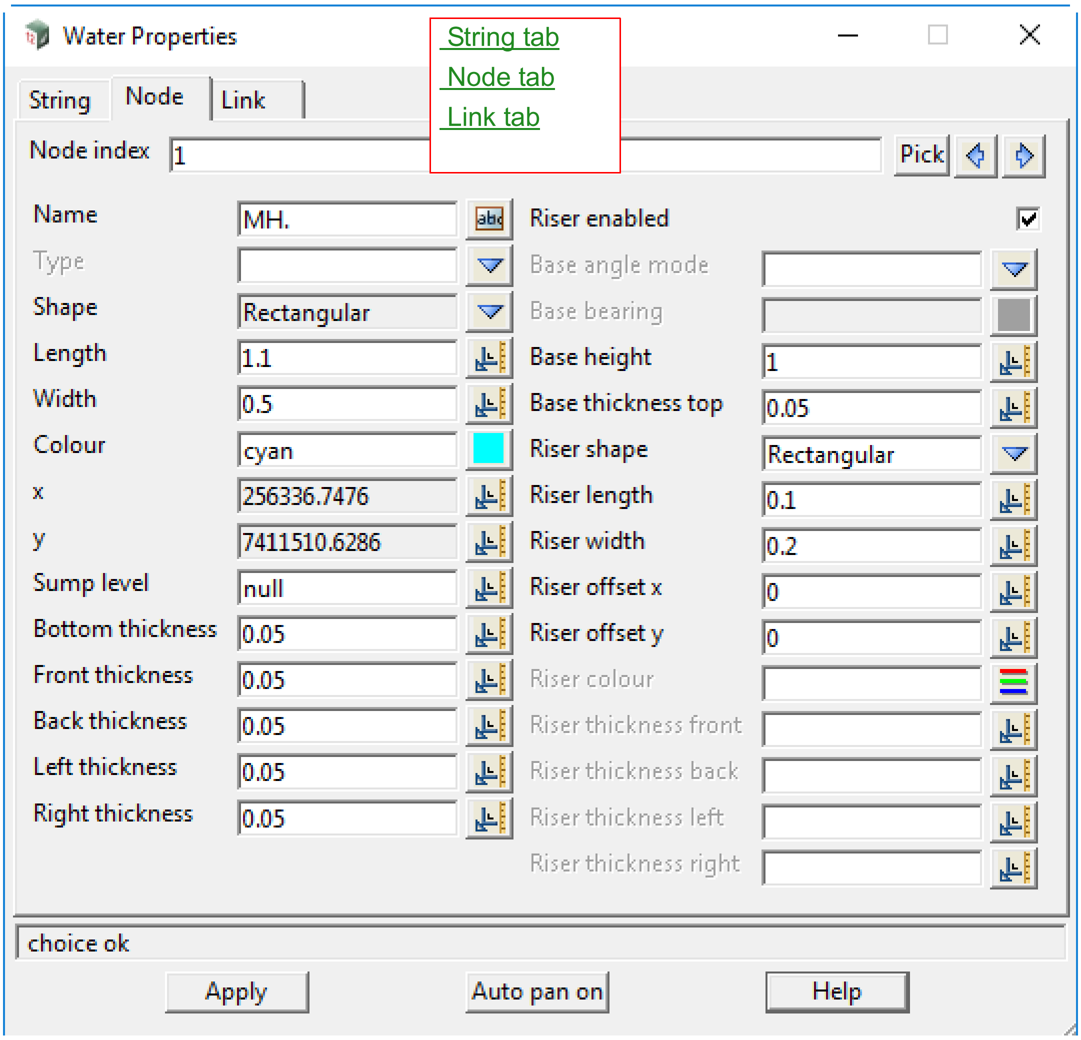
Use drainage.4d file tick box

*If **ticked**, the node, link and house control types selected from the drainage.4d file are used to define the fields for the select node type, link type and house connection type. See* 17.4.1 Drainage.4d File Editor.

Node tab

Fields on this tab are for displaying and changing the properties of the nodes on the string.





Node index integer box

Index of the current node in the string.

Pick string select button

*If **clicked**, a node from the string can be selected and its information will be displayed in the fields.*

<= previous button

*If **clicked**, the information for the **previous** node in the string is displayed in the fields.*

=> previous button

*If **clicked**, the information for the **next** node in the string is displayed in the fields.*

Name text box

Name of the current node.

Type choice box Node types

A node type is selected from the pop-up list defined by the drainage.4d file. If the node is to be all user defined, select UNKNOWN from the node type pop-up.

If **Use drainage.4d file** *is **ticked** in the* **String tab***, the information in the selected node type is used to fill in many of the fields in this **Node** tab. See* 17.4.1 Drainage.4d File Editor.

If **Use drainage.4d file** *is **not ticked** in the* **String tab***, no information is taken from the selected node type.*

Shape choice box Circular, Rectangular, Extended width, Extended length

Shape of the current chamber.

Diameter or **Length** and **Width** real boxes measures

*Depending on **Shape**, the diameter or the length, and if rectangular or extended, the width of the current node.*

Colour colour box available colours

Colour of the current chamber.

x/y measure box measures

(x,y) coordinates of the centre of the chamber of the current node.

Sump level real box measures

Sump level of the current chamber. See 17.1.4.4 Z Point Definitions for Nodes and Links.

Bottom/Front/Back/Left/ Right thickness real box measures

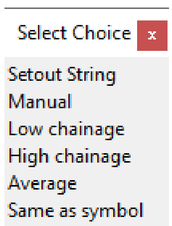
*If **not blank**, thickness of the chamber bottom/front/back/right/left.*

See 17.1.4.1 Nodes (Pits, Maintenance Holes).

Riser enabled tick box measures

*If **ticked**, the node has a riser.*
*If **not ticked**, the node does not has a riser.*

Base bearing mode choice box



For documentation on each **Base bearing mode***, see* 17.1.4.7.1 Bearing of Base (Chamber) with Riser.

*If **Manual**, the bearing of the length side of the chamber is the value in the* **Base bearing** *field.*

Base bearing angle box measures

If **Base bearing mode** *is **Manual**, then this is the bearing of the length direction of chamber of the node. Otherwise it is not used.t is not used.*

Base height real box measures

*Internal height of the **chamber**. See* 17.1.4.4 Z Point Definitions for Nodes and Links.

Base thickness top real box measures

*If **not blank**, thickness of the top of the **chamber**. See* 17.1.4.4 Z Point Definitions for Nodes and Links.

Riser shape choice box Circular, Rectangular, Extended width, Extended length

Shape of the current riser.

Riser Diameter or **Riser length** and **Riser width** real boxes measures

*Depending on **Shape**, the riser diameter or, the riser length and riser width, of the current riser.*

Riser offset x/y measure box measures

Offset of the centre of the current riser from the coordinates of the centre of the current chamber. X is and Y are measured in the direction of the coordinate system.

Riser colour colour box available colours

Colour of the current riser.

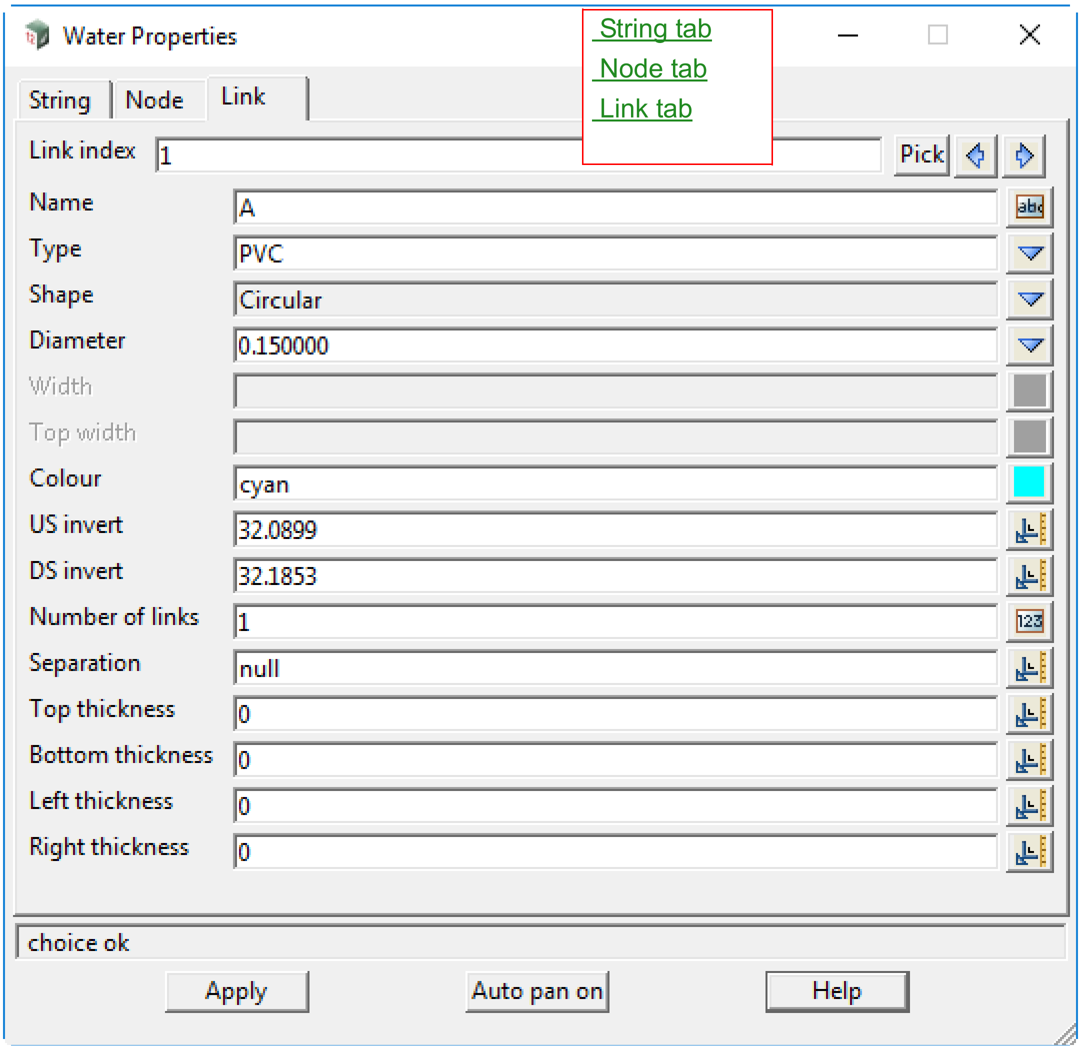
Riser thickness front/back/left/right real box measures

*If **not blank**, the thickness of the riser front/back/left/right.*

See 17.1.4.1.2 Risers on Nodes.

Link tab

Fields on this tab are for displaying and changing the properties of the pits on the string.



Link index integer box

Index of the current link in the string.

Pick string select button

*If **clicked**, a link from the string can be selected and its information will be displayed in the fields.*

<= previous button

*If **clicked**, the information for the **previous** link in the string is displayed in the fields.*

=> previous button

*If **clicked**, the information for the **next** link in the string is displayed in the fields.*

Name text box

Name of the current link.

Type choice box Link types

A link type is selected from the pop-up list defined by the drainage.4d file. If the link is to be all user defined, select UNKNOWN from the link type pop-up.

If **Use drainage.4d file** *is **ticked** in the* **String tab**, *the information in the selected link type is used to fill in many of the fields in this **Link** tab. See* 17.4.1 Drainage.4d File Editor.

If **Use drainage.4d file** *is **not ticked** in the* **String tab***, no information is taken from the selected link type.*

Shape choice box Circular, Box, Vee, Trapezoid

Shape of the current link.

Diameter or **Height** and **Width** or **Bottom width** and **Top width** real boxes

*Depending on **Shape**, the Diameter, or Height and Width etc, of the current link.*

Colour colour box available colours

Colour of the current link.

US invert real box measures

Invert level of the "upstream end" of the current link.

Which end this is depends on the flow direction of the string.

DS invert real box measures

Invert level of the "downstream end" of the current link.

Which end this is depends on the flow direction of the string.

Number of pipes integer box

If >1, the number of individual links that make up the current link.

Separation real box measures

*If **Number of pipes** >1 then this is the distance between each individual pipe that makes up the current link.*

Top/Bottom/Left/Right thickness real box measures

*If **not blank**, and depending on the* **Shape***, the thickness of the link top/bottom/left/right.*

Buttons at bottom

Apply button

*When **clicked**, values in the tabs are applied to the string.*

Auto pan on/off button

*When **clicked**, this changes between **Autopan on/off**. in the tabs are applied to the string.*

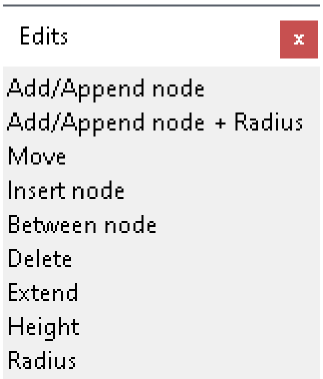
*When **Auto pan** on, as the next node or link is selected, if it is not displayed on the view then the view settings are changed so that the centre of the node, or end of the link, is displayed in the view.*

Continue to 17.3.6.2.2 Edits or return to 17.3.6.2 Water String Edit.

17.3.6.2.2 Edits

The options in the **Edits** menu are used for placing the initial nodes of a new water string, editing a new water string once the initial nodes are placed or editing an existing water string.

The **Edits** walk-right menu is



See
17.3.6.2.2.1 Append, Append+Radius
17.3.6.2.2.1 Append, Append+Radius
17.3.6.2.2.2 Move
17.3.6.2.2.3 Insert
17.3.6.2.2.4 Between
17.3.6.2.2.5 Delete
17.3.6.2.2.6 Extend
17.3.6.2.2.7 Height
17.3.6.2.2.8 Radius

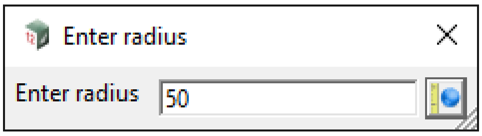
17.3.6.2.2.1 Append, Append+Radius

The **Append**, **Append+Radius** operations for a water string are similar to the **Append** options for a polyline string except that nodes are also automatically placed at each added vertex.

Important Note - a node can be removed from the vertex afterwards using the **Advanced edit** =>**Remove** option. The vertex will still be there but without a node on it. See 17.3.6.2.3.2 Remove Node (no vertex).

If the **Append** + **Radius** option selected, then before each vertex is appended, an enter radius typed-input box is placed on the screen.

The enter radius typed-input box looks like



The radius is entered into the typed-input box, terminated with <Enter>. The entered value is taken as the radius of the arc to the next water string vertex and the arc will be drawn correctly as the cursor is moved to the next vertex.

A **radius** value of **0** is taken to mean no arc.

If **z Float** is set to tick, then the top of the node is automatically placed on the terrain given in the **tin** field for the water string.

If height snap is toggled on in the **Snaps** menu, the height will be displayed an a new height entered but the new height will only be used if **z Float** is turned off for the node.

Each node in the string is connected by a water link. The diameter, type and cover at each end of the **water link** are taken from the **Water - Services Defaults** panel.

The **Append** options are terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.2 Move

If used in a plan view, the **Move** option is used to move the (x,y) position of a node.

If used in a section view, the **Move** option can be used to change the height of the top of any node or the height of either end of the water link connecting adjacent nodes in the water string.

After the **Move** option is chosen, the user selects either a node in a plan view or the top of a node or a link end in a section view.

If a node is selected from a plan view, then the plan position of the selected node will move with the cursor. The new position for the top of the node can be chosen by either cursor selection or typed input in exactly the same way as for moving a point on a 3d string.

If the top of a node or the end of a link connecting adjacent node is chosen in a section view, then only the height of the selected point can be modified. That is, if a point is selected in a section view, then it is constrained to move in the z-direction only.

The **Move** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.3 Insert

The **Insert** option is designed to place a new node between two adjacent nodes (note that the inserted node does not have to be on the line joining the two adjacent nodes).

To insert a new node, the two adjacent nodes are chosen by selecting the line connecting the two nodes. Once the **line** is selected, the new node is assumed to be at the current cursor position. As the cursor is moved, the water string is redrawn reflecting the changing position of the inserted node.

The **Insert** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.4 Between

The **Between** option is similar to the **Insert** option except that the inserted node **does** have to be on the line joining the two adjacent nodes. To accomplish this, the cursor position is projected onto the node-node line to give the new node position.

Important Note - once the node is placed, it is no longer constrained to be on the one straight or arc joining adjacent nodes. If the node is required to be constrained to be on the link, then the node is placed using the ***Advanced edits =>Insert node (no vertex)***. See 17.3.6.2.3.1 Insert Node (no vertex).

The **Between** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.5 Delete

The **Delete** option is used to delete nodes/and or points from the water string.

The node/point to be deleted is selected with the cursor and when the selection is accepted (MB), it is **deleted**.

Once a node/point has been deleted, the delete option is still current and can be repeated without re-selecting the **Delete** option.

The string, minus the deleted node/point, is redrawn after each deletion.

The **Delete** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.6 Extend

The **Extend** option is used to move a node/point along the line joining the node/point to one of its adjacent node/point.

That is, the bearing of the node/point-node/point line is kept constant and the node/point moved along that line either **towards** or **away** from its neighbouring node/point.

Extending, like moving a node/point, is a two step process.

Step (a) - selecting the node/point-node/point line and the node/point to be moved along that line

Step (b) - selecting the final position for the node

Both steps are identical to extending an point in a polyline string.

Once the extend is completed, the extend option is still current and can be repeated without re-selecting the extend option.

The **Extend** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

Note - Extend can be used on the end nodes of the water string.

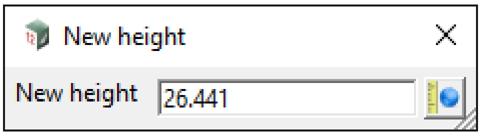
17.3.6.2.2.7 Height

The **Height** option is used to modify the height (z value) of the top of any node, or the height of the ends of the links connecting adjacent nodes in the water string.

The top of the node can be selected in either a plan or a section view. The link ends can only be selected in a section view.

After the **Height** option is chosen, the user must select the node top or link end that is going to have its height modified.

Once the node or link end has been selected, an **New height** typed-input box is displayed on the screen with the items current height (z value) in it.

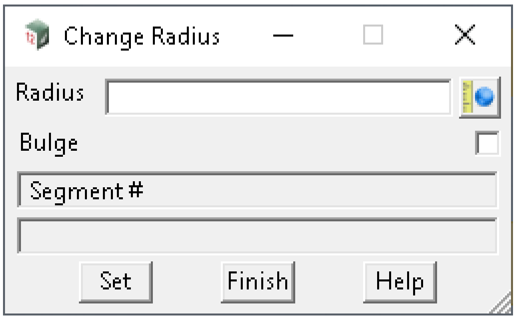


The required height is entered into the typed-input box, terminated with <enter>. The entered value is taken as the height of the node or link end and the string redrawn with the new height at that point. The typed-input box then disappears.

The **Height** option is terminated by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.2.8 Radius

Selecting **Radius** brings up the **Change Radius** panel which is used to modify the radius of any arc/ line joining adjacent node points.



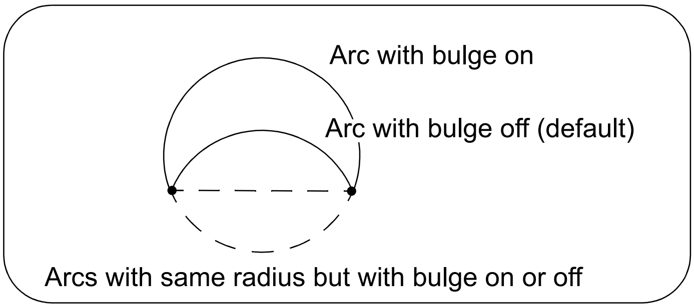
After selecting the **Radius** option, the user selects the arc/straight to be modified and the current arc radius and bulge setting will be displayed in the **Change Radius** panel.

New values can then be entered and the arc modified by selecting the **Set** button.

If the radius is positive, the arc is drawn from the start point to the next point on the polyline in a clockwise direction. If the radius is negative, the arc is drawn from the start point to the next point on the polyline in a counter-clockwise direction.

For a given radius (positive or negative), there are two possible cases for the arc- one where the arc is less than a semi-circle, the other when the arc is greater than a semi-circle.

If bulge is turned on, the larger arc is used. The default is bulge turned off.

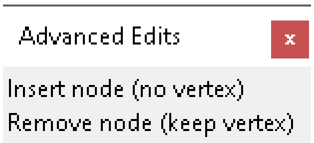


Continue to 17.3.6.2.3 Advanced Edits or return to 17.3.6.2 Water String Edit.

17.3.6.2.3 Advanced Edits

The options in the **Advanced Edits** menu are used for placing the adding nodes at locations other than a vertex and removing these nodes.

The **Advanced Edits** walk-right menu is



See
17.3.6.2.3.1 Insert Node (no vertex)
17.3.6.2.3.2 Remove Node (no vertex)

17.3.6.2.3.1 Insert Node (no vertex)

The **Insert node (no vertex)** operation for a water string adds a node onto the existing string. This node does not have to be at the vertex of the underlying polyline and no vertex is inserted with the node.

When either of the two adjacent nodes with a vertex are moved, this node will move as well so that the node stays on the link.

17.3.6.2.3.2 Remove Node (no vertex)

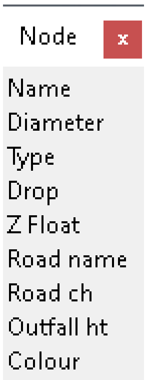
The **Remove node (no vertex)** operation for a water string removes a node on the existing string. If the node is on a vertex the vertex remains in the horizontal geometry but does not affect the vertical geometry.

Continue to 17.3.6.2.4 Node or return to 17.3.6.2 Water String Edit.

17.3.6.2.4 Node

.The options in the **Node** menu are used to modify information about individual nodes in the water string.

The **Node** walk-right menu is



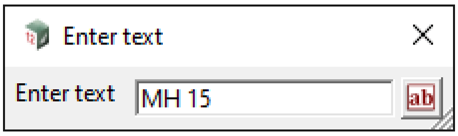
See
17.3.6.2.4.1 Change Node Name
17.3.6.2.4.2 Change Node Diameter
17.3.6.2.4.3 Change Node Type
17.3.6.2.4.4 Change Drop
17.3.6.2.4.5 Change Z Float
17.3.6.2.4.6 Change Road Name
17.3.6.2.4.7 Change Road Chainage
17.3.6.2.4.8 Change Outfall Height
17.3.6.2.4.9 Change Node Colour

17.3.6.2.4.1 Change Node Name

The **Name** option is used to change a node's label.

After selecting the option, the mouse is used to pick the node to have a name change.

Once a node has been selected, an Enter text typed-input box is displayed on the screen containing the selected node's name.



The new name is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

The **Name** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

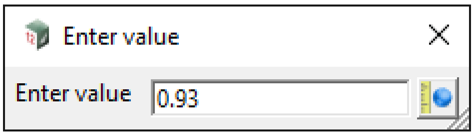
NOTE - if the name of the node is *EOL* or *eol* then the diameter of the node is forced to zero.

17.3.6.2.4.2 Change Node Diameter

The **Diameter** option is used to change a node's diameter.

After selecting the option, the mouse is used to pick the node to have its diameter modified.

Once a node has been selected, an **Enter value** typed-input box is placed on the screen displaying the selected node's current diameter.



The new diameter is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

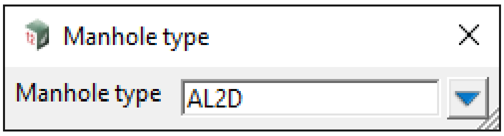
The **Diameter** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.4.3 Change Node Type

The **Type** option is used to change the type of the node (see 17.1.4.1.6 Node Type).

After selecting the option, the mouse is used to pick the node to have its type modified.

Once a node has been selected, a **Node type** typed-input box is displayed on the screen containing the selected node's type.



The list of common types for the node can be obtained by clicking the **[+]** in the **Node type** input box and getting a menu of valid node types. The pop-up list is taken from the 17.3.10 Water Network Plots file.

The new node type is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

The **Type** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

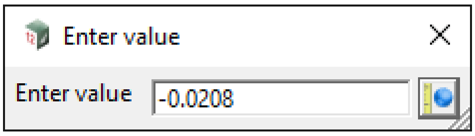
17.3.6.2.4.4 Change Drop

The **Drop** option is used to change the vertical distance between the bottom of the links on either side of a node, *i.e.*, the difference in the invert levels of the link.

Since the drop in simply the difference in vertical distance between two links on either side of a node, the actual value of the drop can be changed by moving either of the links up or down the node.

After selecting the option, the end of the link to be moved is selected with the mouse.

Once the link end been selected, an enter value typed-input box is displayed containing the drop across the node that the link end connects into.



The new drop type is entered into the typed-input box, terminated with <enter>.

If the end of the link was on the upstream side of the node (normally the right hand side of a node in a section view), the end of the link will be moved upward until the drop across the node equals the entered value.

If the end of the link was on the downstream side of the node (normally the left hand side of a node in a section view), the end of the link will be moved down until the drop across the node equals the entered value.

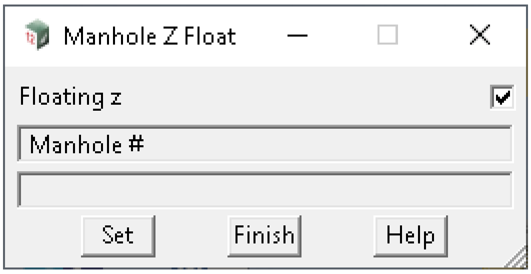
The typed-input box then disappears.

The **Drop** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.4.5 Change Z Float

A **floating node** takes the z-value for the top of the node from the tin selected for the water string. Hence as a floating node moves around in a plan view, the top of node will automatically change to suit the new z-value of the water string tin.

Selecting **Z float** brings up the **Node Z Float** panel which is used to change a node from floating to not floating and vice-versa.



After selecting the **Z Float** option, the user selects the node to be modified and the current **Floating z status** is displayed in the **Node Z Float** panel.

The tick box can then be changed and the node modified by then selecting the **Set** button.

17.3.6.2.4.6 Change Road Name

A **road name** can be set for a node of the line.

Selecting **Road name** brings up the **Node Road Name** panel which is used to give and change a road name for a node.

The option is running as soon as the panel is on the screen and the user is asked to selected a node.

<Select node> [picks][][Menu]

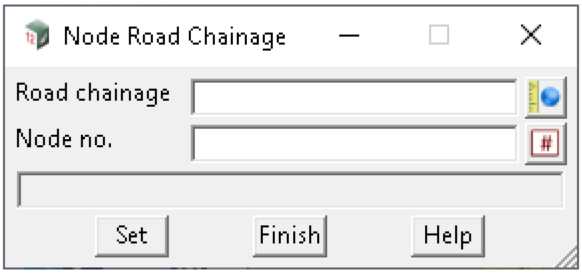
When the node is selected, any existing road name and the node number is placed in the **Road name** and **Node no**. fields respectively of the **Node Road Name** panel.

A new **road name** is then typed into the **Road name** panel field and the **Set** button selected to record the road name with the node.

17.3.6.2.4.7 Change Road Chainage

A **road chainage** can be set for a node of the line.

Selecting **Road ch** brings up the **Node Road Chainage** panel which is used to give and change a road chainage for a node.



The option is running as soon as the panel is on the screen and the user is asked to selected a node.

<Select node> [picks][][Menu]

When the node is selected, any existing road chainage and the node number is placed in the **Road chainage** and **Node no**. fields respectively of the **Node Road Chainage** panel.

A new **road chainage** is then typed into the **Road chainage** panel field and the **Set** button selected to record the road chainage with the node.

17.3.6.2.4.8 Change Outfall Height

When a water string is created, the furthest downstream is often an outfall and the height of the outfall known.

When the furthest downstream node is considered to be an outfall, the **Outfall ht** option is used to set and change the outfall height. Once set, the outfall height is taken to be the height at the *bottom* of the furthest downstream node.

If this option is not used, the outfall height is left undefined.

After selecting the option, an enter value typed-input box is displayed on the screen containing the existing outfall height or **null** if no outfall height has been set.

The new outfall height is entered into the typed-input box, terminated with <enter>.

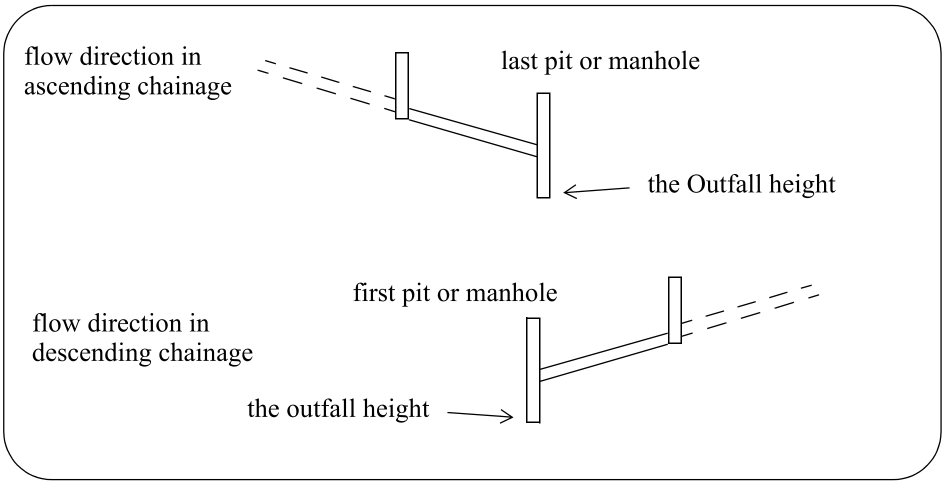
The height of the bottom of the furthest downstream node in the water string is then set to the given height and the typed-input box removed.

The **Outfall ht** option automatically terminates after use.

Note:

For a water string with flow direction in ascending chainage, the furthest downstream node is the *last* node.

For a water string with flow direction in descending chainage, the furthest downstream node is the *first* node.



17.3.6.2.4.9 Change Node Colour

The colour of a node can be changed.

Selecting **Colour** brings up the **Node Colour** panel which is used to change the colour of a pit to a colour different to the colour for the water string.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Colour	colour box		

Colour for the selected node

Link no.	number box		

Number of the Node to colour

Set	button		

When pressed, the Node number **Node no.** *is set to the colour* **Colour**.

The option is running as soon as the panel is on the screen and the user is asked to selected a node.

When the node is selected, any colour and the node number is placed in the **Colour** and **Node no.** fields respectively of the **Node Colour** panel.

A new **Colour** is then typed into the **Colour** panel field and the **Set** button selected to record the colour with the node.

Continue to 17.3.6.2.5 Link or return to 17.3.6.2 Water String Edit.

17.3.6.2.5 Link

The options in the **Link** menu are used to modify information about the links joining adjacent nodes in the water string.

The **Link** walk-right menu is

See
17.3.6.2.5.1 Link Move
17.3.6.2.5.2 Change Link Name
17.3.6.2.5.3 Change Cover
17.3.6.2.5.4 Change Link Diameter
17.3.6.2.5.5 Change Link Type
17.3.6.2.5.6 Change Link Colour
17.3.6.2.5.7 Change Grade
17.3.6.2.5.8 Grade to End
17.3.6.2.5.9 Default Grading

17.3.6.2.5.1 Link Move

The **Move** option is used to move a link connecting two nodes up and down whilst keeping the grade of the link constant.

After selecting the option, the mouse is used to pick the link to be moved.

Once a link has been selected, the link will be moved up or down so that the cursor remains on the link (or on the extension of the link if the cursor is on the other side of the nodes at either end of the link). The grade of the link is kept constant.

The nodes at either end of the link will also be extended if necessary so that the link still connects into the adjacent nodes.

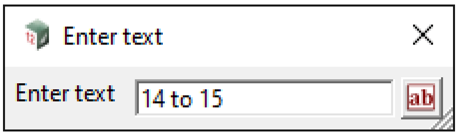
The **Move** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.2 Change Link Name

The **Name** option is used to change a link's label.

After selecting the option, the mouse is used to pick the link to have a name change.

Once a link has been selected, an Enter text typed-input box is displayed on the screen containing the selected link's name.



The new name is entered into the typed-input box, terminated with <Enter>. The typed-input box then disappears.

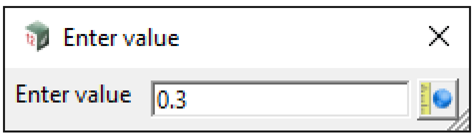
The **Name** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.3 Change Cover

The **Cover** option is used to place the selected link so that minimum cover is maintained along the top of the link (obvert) with respect to the finished surface tin (tin (fs)).

After selecting the option, the link to set the cover for is selected with the mouse.

Once a link has been selected, an Enter value typed-input box is displayed on the screen containing the existing cover.



The new cover is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears and the link is adjusted so that the specified cover is maintained for the full length of the link at the links existing grade.

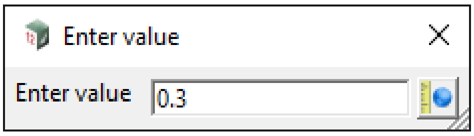
The **Cover** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.4 Change Link Diameter

The **Diameter** option is used to change a water link's diameter.

After selecting the option, the mouse is used to pick the link to be modified.

Once a water link has been selected, an Enter value typed-input box is placed on the screen displaying the selected link's current diameter.



The new diameter is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears

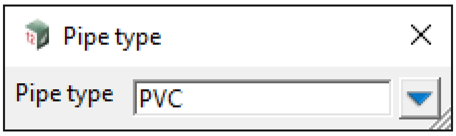
The **Diameter** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.5 Change Link Type

The **Type** option is used to change the type of material that the link is made of, plus other properties of the link. See 17.1.4.2.3 Link Type.

After selecting the option, the mouse is used to pick the link to have its material type modified.

Once a link has been selected, a Link type typed-input box is placed on the screen displaying the selected links material type.



The list of common materials for the link can be obtained by clicking RB in the type input box and getting a menu of valid link types. The pop-up list is taken from the 17.3.10 Water Network Plots file.

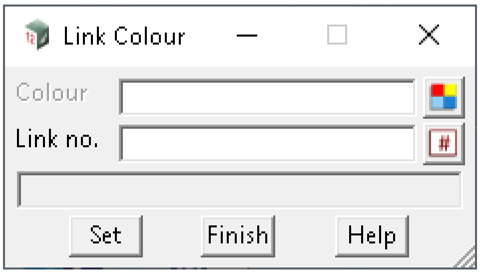
The new link type is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

The **Link Type** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.6 Change Link Colour

The **Colour** option is used to change the colour of a link.

After selecting the **Colour** option, the **Link Colour** panel is displayed on the screen.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Colour	colour box		
Colour for the selected link			
Link no.	number box		
Number of the Link to colour			
Set	button		
When pressed, the Link number **Link no.** *is set to the colour* **Colour**.			

The option is running as soon as the panel is on the screen and the user is asked to selected a link.

When the link is selected, any colour and the node number is placed in the **Colour** and **Link no.** fields respectively of the **Node Colour** panel.

A new **Colour** is then typed into the **Colour** panel field and the **Set** button selected to record the colour with the link.

17.3.6.2.5.7 Change Grade

The **Grade** option is used to specify an exact grade for a water link. The value for the grade is entered using typed input and is in the units "1v in".

In this option, the new grade is given to a link by keeping one end fixed and raising or lowering the other end by the amount required to give the link the new grade.

After the **Grade** option is selected, the link whose grade is to be modified is selected **at the end that is going to be moved**.

Once the link end has been selected, an enter value typed-input box is displayed on the screen containing the current grade of the link. The new grade is entered into the typed-input box, terminated with <enter>.

The selected end of the water link is then moved up or down so that the link has the new grade.

If necessary, the node at the moved end of the link will be lengthened so that the link still connects into the adjacent nodes.

The **Grade** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.8 Grade to End

The **Grade to end** option is used to specify a ***fixed*** grade for all the water links from a selected link to the **low chainage** end (beginning) of the line. That is, it grades from *right* to *left* on a long section of the water string.

The value for the grade is entered using typed input and is in the units "1v in".

This option was originally written for links with flow direction in descending chainage direction which is the reason why it works from the selected link back towards the beginning of the line.

Hence **Grade to end** should only be run on links with flow in descending chainage direction. If the flow is in ascending chainage direction, use the reverse string option (**String=> Strings Edit =>Reverse**) before using this option, and then reverse the string again after the option is run. Note that the **Default grading** option looks at maintaining minimum *grade* and minimum *cover* for flow in either ascending or descending chainage direction and supersedes **Grade to end.**

In this option, the new grade is given to a link by keeping the high chainage end of the selected link fixed and raising or lowering the low chainage end by the amount required to give the link the new grade. The minimum cover is over ridden during this process. If necessary, the bottom of the node will be lowered so that the link still connects into its adjacent nodes.

The next lower chainage link is then dropped through the default drop and given the new grade. The drop is measured from the lowest link invert of all links in the network entering the node.

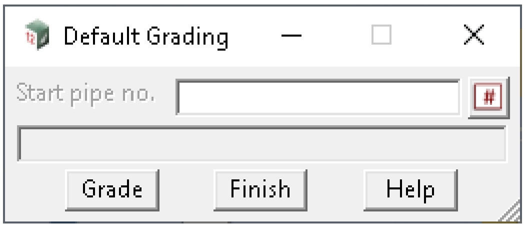
This process is repeated until the low chainage end (beginning) of the line is reached.

After the **Grade to end** option is selected, the first link whose grade is to be modified is selected.

Once the link end has been selected, an enter value typed-input box is displayed on the screen containing the current grade of the selected link. The new grade is entered into the typed-input box, terminated with <enter>. The option then does the grading.

The **Grade to end** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.5.9 Default Grading



The **Default grading** option starts at the given link and then works to the end of the line when the flow direction is in ascending chainage, or the beginning of the line when the flow direction is in descending chainage. The **Default grading** option maintains minimum grade and minimum cover.

Default grading is not designed to optimise the placement of the links but provides one solution preserving minimum grade and cover.

Continue to 17.3.6.2.6 Property Controls or return to 17.3.6.2 Water String Edit.

17.3.6.2.6 Property Controls

Property, block or lot **controls** are trial connections from a sewer line (water string) to a user specified plan point.

The property controls are used as checks that selected house blocks can be serviced by the sewer line. That is, they are used to test if the house block is under the control of the sewer line.

For the trial property connection, once the cover (measured from the finished surface to the top of the property connection line) that the property connection must maintain and the grade are specified, the position and depth that the trial property connection must have at the sewer line can be calculated, and where the height of the *centre line* of the property control when it reaches the sewer line is displayed in any section view containing a profile of the sewer line.

If the calculated depth of the trial property connection at the sewer line (water string) is below the sewer link, then no such connection would be feasible and the house block would not be totally controlled by the sewer line.

On a section view, the ***Profile =>One substring*** and ***Profile =>Many substrings*** options will profile the property control. Note that the *centre line* (axis) of the property control is drawn on the section view, not the invert (bottom) or the obvert (top).

NOTE - property controls are only accessible by the ***Sewer module.***

The options in the **Controls** menu are used to place and modify the trial connections. The **Controls** walk-right menu is

Controls x	See
Add	17.3.6.2.6.1 Add
Include	17.3.6.2.6.2 Include
Delete	17.3.6.2.6.3 Delete
Name	17.3.6.2.6.4 Name
Diameter	17.3.6.2.6.5 Diameter
Cover	17.3.6.2.6.6 Cover
Start level	17.3.6.2.6.7 Start Level
Grade	17.3.6.2.6.8 Grade
Boundary	17.3.6.2.6.9 Boundary
Calc all	17.3.6.2.6.10 Calc all
Delete all	17.3.6.2.6.11 Delete All

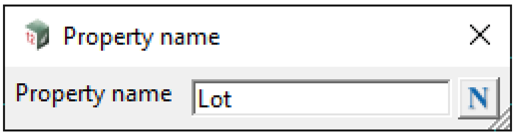
17.3.6.2.6.1 Add

The **Add** option is used to create a new trial control line going from a selected water link to a user specified plan position (the free end of the connection).

After selecting the option, the mouse is used to pick the plan position of the connection point of the property connection on the water link, and then the points defining the path to the plan position of the free end of the trial property connection.

After the free end has been selected, the property name typed-input box is displayed on the screen so that a label for the control can be entered (this usually consists of the lot number).

When the property name box is placed on the screen, it will already have some text in it. This text comes from the **name** field in the ***Property control info*** section of the **Water - Services Defaults** panel.



A z-value equal to the water tin value minus the default property control cover depth is automatically given to the free end of the property control. The default property control grade is then used to define z-values along the trial path (ensuring that the default property control cover depth is always observed) to give a z-value back at the water link (the connection height of the property control).

A cross at the calculated property connection height is displayed whenever the water string is profiled on a section view.

The colour for the new control is taken from the **Water - Services Default** panel.

The **Add** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.2 Include

The **Include** option is used to make a property control out of an existing polyline string.

The polyline string must start at the property control connection point on the water string and end at the free end (use ***Strings=>Strings Edit=>Reverse*** if the string's direction is incorrect).

After selecting the option, the mouse is used to pick the polyline string and its plan position is copied and used to define a new property control.

A z-value equal to the default water tin at that point, minus the default property control cover depth is automatically given to the free end of the new property control. The default property control grade is then used to define z-values along the trial path (ensuring that the default property control cover depth is always observed) to give a z-value back at the water link.

The **Include** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.3 Delete

The **Delete** option is used to delete a property control.

After selecting the option, the mouse is used to pick the block control to be deleted.

Once a block control has been selected, it will deleted and removed from the screen.

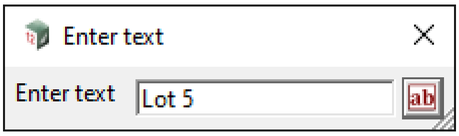
The **Delete** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.4 Name

The **Name** option is used to change the **Property name** of a property control.

After selecting the option, the mouse is used to pick the control that will have a name change.

Once a control has been selected, an enter text typed- input box is displayed on the screen containing the selected control's name.



The new name is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

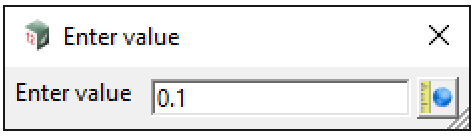
The **Name** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.5 Diameter

The **Diameter** option is used to change the diameter of a control.

After selecting the option, the mouse is used to pick the control that will have its diameter modified.

Once a control has been selected, an Enter value typed- input box is placed on the screen displaying the selected control's current diameter.



The new diameter is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

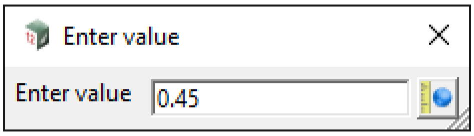
The **Diameter** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.6 Cover

The **Cover** option is used to change the distance that the control is below the tin (fs) for the water string.

After selecting the option, the cursor is used to pick the control whose cover will be modified.

Once a control has been selected, an Enter value typed- input box is placed on the screen displaying the selected block control's current cover.



The new cover is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears and the new connection height using the new cover calculated.

The **Cover** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.7 Start Level

??

17.3.6.2.6.8 Grade

The **Grade** option is used to change the grade of a control (units "1v in").

After selecting the option, the mouse is used to pick the control whose grade will be modified.

Once a control has been selected, an enter value typed- input box is placed on the screen displaying the selected control's grade.

The new grade is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears and the new connection height using the new grade calculated.

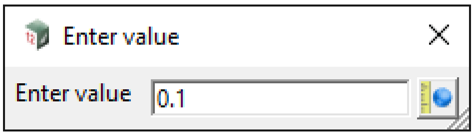
The **Grade** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.9 Boundary

The **Boundary** option is used to specify a boundary trap depth which is used as a final drop at the water link end of the control.

After selecting the option, the mouse is used to pick the control whose boundary depth will be modified.

Once a control has been selected, an Enter value typed- input box is placed on the screen displaying the selected boundary depth.



The new boundary trap depth is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears and the new connection height using the new boundary trap depth is calculated.

The **Boundary** option is terminated by selecting **Cancel** from the **Pick Ops** menu, or by selecting **Quit**, **Finish**, or a new option from the **Water Edit** menu.

17.3.6.2.6.10 Calc all

The **Calc all** option is used to re-calculate the connection heights for all controls of the water line.

The calculation uses the plan layout of the control, the control's cover, grade and boundary trap depth and the default tin for the water line.

The **Calcbc's** option automatically terminates after use.

17.3.6.2.6.11 Delete All

The **Delete all** option is used to remove all the controls defined for the water line being edited.

The **Delete all** option automatically terminates after use.

Continue to 17.3.6.2.7 House Connections or return to 17.3.6.2 Water String Edit.

17.3.6.2.7 House Connections

The **Connections** option is used to create the connections from the sewer line (water string) to the house blocks in a subdivision.

When placing a house connection, the user indicates the two corners of the frontage of the block to allow the cross-fall of the block to be calculated and allow the frontage to be used in positioning the house connection.

When placing house connections, a section view is used to automatically display the connection to facilitate checking the type of connection used and any obstructions that may need to be avoided.

NOTES

1. House connections are only accessible by the ***Sewer module.***
2. All house connection calculations do not take into account any thickness of link, joint sizes or actual entry points into the sewer. Hence they are ***approximate only*** and should only ever be used as a guide. Any quantities calculations should allow for a suitable margin of error.

The **Connections** walk-right menu is

See
17.3.6.2.7.1 Create from Controls
17.3.6.2.7.2 Create/Edit
17.3.6.2.7.3 Delete
17.3.6.2.7.4 Delete all

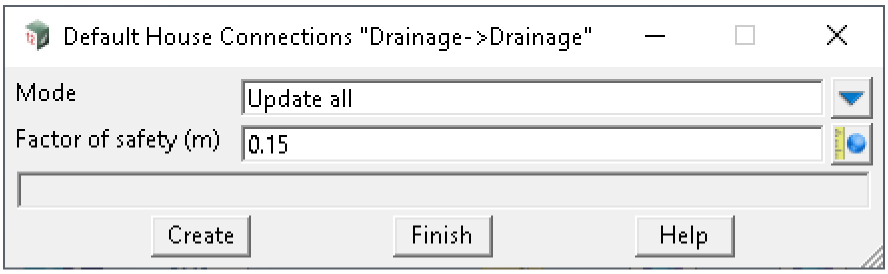
The process for creating a house connection will now be described in detail.

17.3.6.2.7.1 Create from Controls

The **Create from Controls** option is used to create a new house connection from existing controls.

or modify an existing house connection.

After selecting the **Create from Controls** option, the **Default House Connections** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Mode	input	update all	remove existing first, update new, update all

*If **remove existing first**, all the existing connections are deleted before new ones are created from the controls.*
*If **update new**, connections are only created from controls with names different from any existing connection.*
*If **update all**, connections are created from all controls.*

Factor of safety input 0.15

The connection height for the control is adjusted by this depth from the control connection depth.

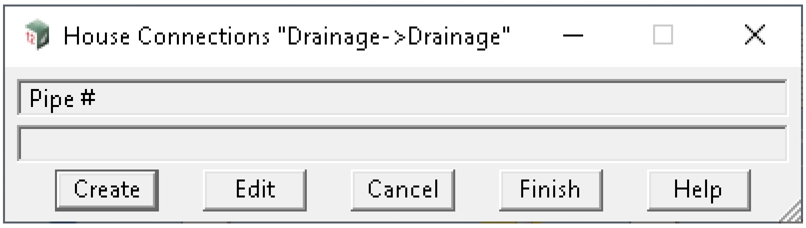
Create button

After selecting **Create***, the connections are created from the selected controls.*

17.3.6.2.7.2 Create/Edit

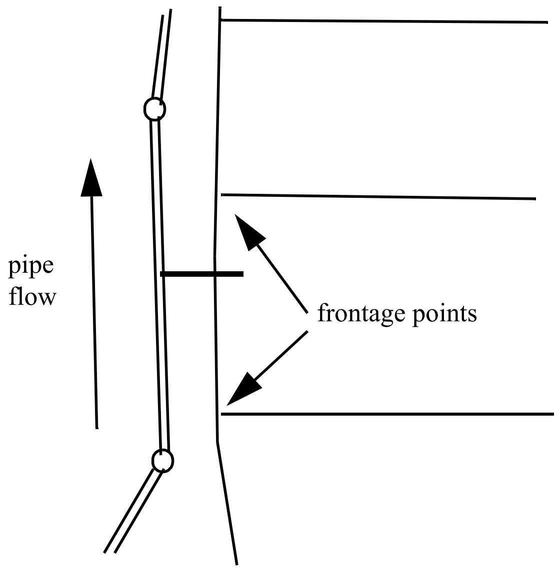
The **Create/edit** option is used to create a new house connection or modify an existing house connection.

After selecting the **Create/edit** option, the **House Connections** panel is displayed.



The process for creating a house connection will now be described in detail.

Creating A House Connection



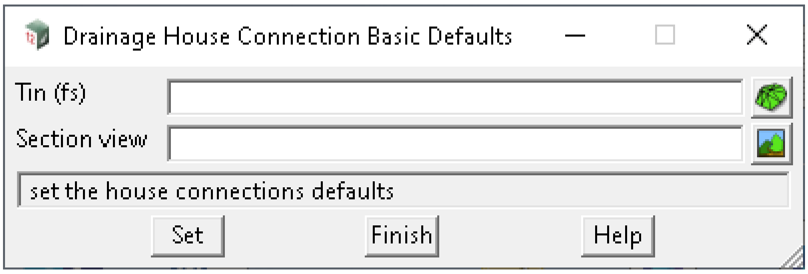
Step 1 Select *Create*

To create a new house connection, the **Create** button is selected from the **House Connections** menu.

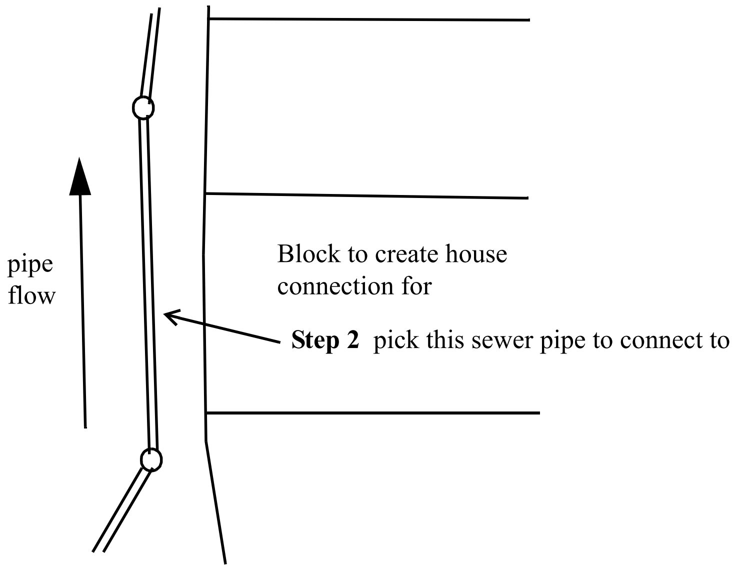
If either the default **water tin** or **section view** have not be defined, the **Water House Connection Basic Defaults** panel will be placed on the screen after the **Create** button is selected.

The missing values need to be filled in and the **Set** selected. This information is needed so that the house connections can be drawn up in a section view as soon as they are created.

Step 2 Selecting the Sewer (water) Link to Connect to

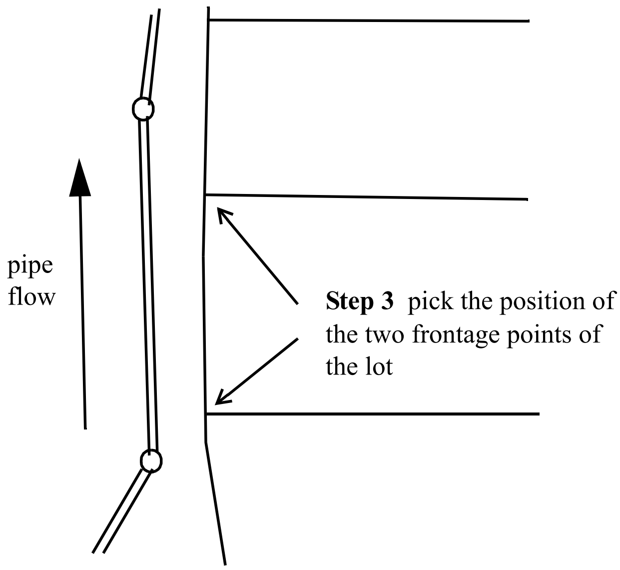


The user is then asked to select the sewer link to connect into.



Step 3 Selecting the House Lot Frontage

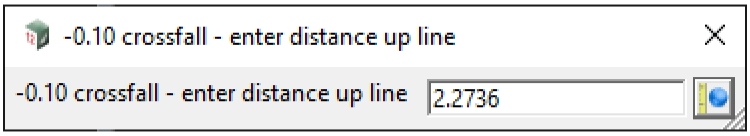
Next the user indicates the two frontage points for the house block.



Step 4 Positioning the House Connection on the Sewer Link

From the two frontage points and the default water tin, the program calculates the crossfall for the block frontage.

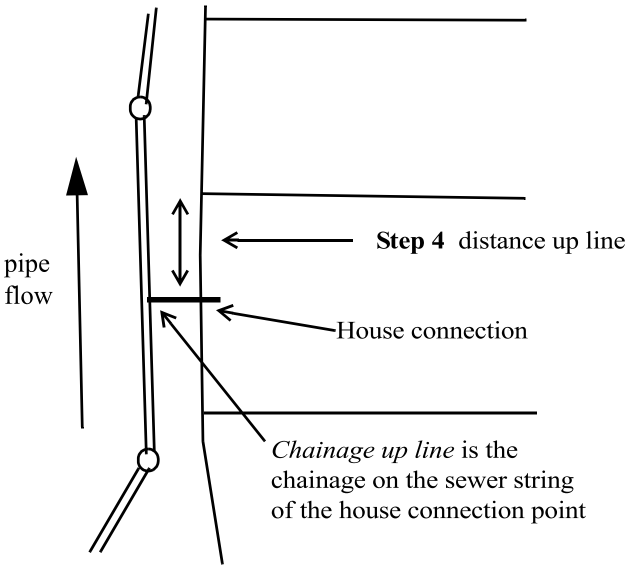
The crossfall is displayed in the name of the enter distance up line typed-input box which is now placed on the screen. The **distance up line** is the distance along the frontage that the house connection will be placed.



Depending on the crossfall, a default value for the distance up line is displayed. If the ground crossfall is greater than 1% the lot mid point is the suggested connection location. For crossfalls less than 1%, the connection is located 3m off the ***lowest*** lot boundary.

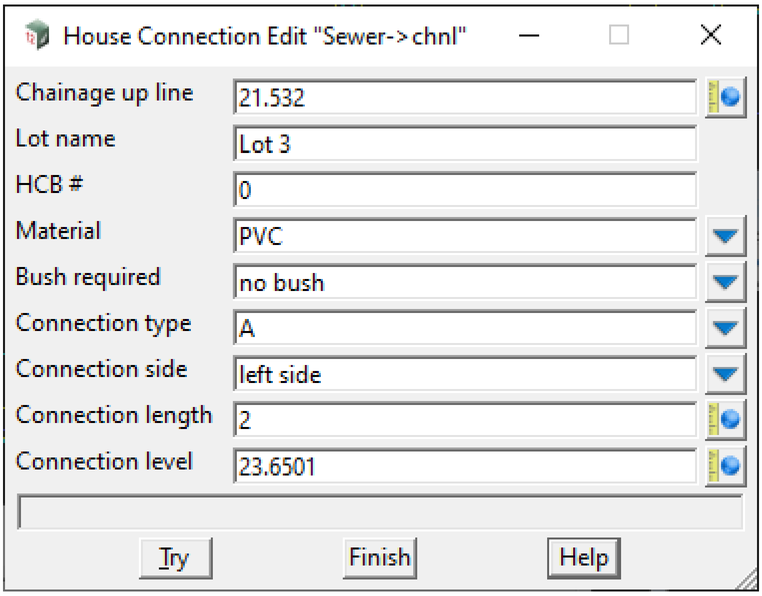
A pop-up also exists for placing the house connection point at the distance 2.0, 3.0, 5.0 along the frontage, the mid point of the frontage, and the distances 2.0, 3.0 and 5.0 from the other end of the frontage.

The **distance up line** value is entered into the typed-input box, terminated with <enter>. The typed-input box is then removed from the screen.



Step 5 Defining the House Connection Type

Next the **House Connection Edit** panel is placed on the screen.



Most of the values in the field come from the water house connection defaults.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Chainage up line	input/output	chainage of connection	

Chainage on the sewer string where the house connection is attached to the sewer line.

Lot name	input	from drainage defaults	

Name of the house block

HCB #	input		

User supplied house connection branch (HCB) number

Material	input	from drainage defaults	PVC, PVC X/HEAVY, VC

Material used for the house connection.

Bush required	input	no bush	no bush, PVC to VC

Type of bush used

Connection type	input	from drainage defaults	A, A Special, B, C, OB, Special jump up

House connect type to use. Type of connection used. Go to the section 17.3.2.5.1 House Connection Types *for a description of each connection type*

A house connection type is selected from the pop-up list defined by the drainage.4d file.

If **Use drainage.4d file** *is* ***ticked*** *in the* **String tab**, *the information in the selected house connection type is used for some information for the house connection. See* 17.4.1 Drainage.4d File Editor.

If **Use drainage.4d file** *is* ***not ticked*** *in the* **String tab**, *no information is taken from the select house connection type.*

Connection side input right side right side, left side

Side of the line to make the connection

Connection length input from drainage defaults

Length of pipe for the house connection

Connection level input calculated

Height of the house connection. When this is first displayed, it is calculated using the invert level of the sewer pipe where the house connection is attached, the house connection type and connection length (if required by the house connection type), the default house connection grade, the default house connection cover and the surface level at the end of the house connection.

Try button

Using the parameters in the panel fields, create the house connection. Also calculate a section along the house connection and draw it in the water default section view.

Finish button

End the option, remove the panel.

Step 5 Continued

After entering the appropriate values in the **House Connection Edit** panel and then selecting the **Try** button, the house connection will created.

To help check the house connection parameters, a section along the house connection will automatically be calculated and displayed in the section view given in the water defaults panel. Any tins or models on the section view will be included in the section.

Step 6 Modifying the Connection

If any of the fields in the **House Connection Edit** panel are changed, selecting the **Try** button will modify the house connection and redraw the section in the default water section view.

Editing A House Connection

To edit an existing house connection, the **Edit** button is selected from the **House Connections** menu and then the appropriate house connection selected.

The **House Connection Edit** panel will then be placed on the screen with the details of the selected house connection.

If any of the fields in the **House Connection Edit** panel are changed, the **Try** is used button to modify the house connection and redraw the section in the default water section view.

17.3.6.2.7.3 Delete

The **Delete** option is used to delete a connection.

After selecting the option, the mouse is used to pick the house connection to be deleted.

Once a house connection has been selected and accepted, it is deleted and removed from the screen.

The **Delete** option is terminated by selecting **Cancel** from the **Pick Ops** menu, by selecting a new option from the **Water Edit** menu.

17.3.6.2.7.4 Delete all

The **Delete all** option is used to delete all connections.

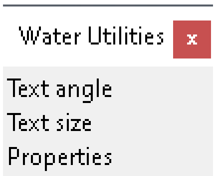
After selecting the option, all the connections are deleted and the option terminates.

Continue to 17.3.6.2.8 Utilities or return to 17.3.6.2 Water String Edit.

17.3.6.2.8 Utilities

The options in the **Utilities** menu are used to modify name, colour, style and start chainage of the water string, and the size, angle, and offsets used when displaying the text for the names of all the nodes.

The **Water Utilities** walk-right menu is



See
17.3.6.2.8.1 Text Angle
17.3.6.2.8.2 Text Size
17.3.6.2.8.3 Properties

17.3.6.2.8.1 Text Angle

The **Text angle** option changes the angle of the text for node labels.

After selecting the option, an enter angle typed-input box is displayed on the screen containing the current text angle.

The new angle is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

The **Angle** option then terminates.

17.3.6.2.8.2 Text Size

The **Text size** option is used to change the size of the text for node labels.

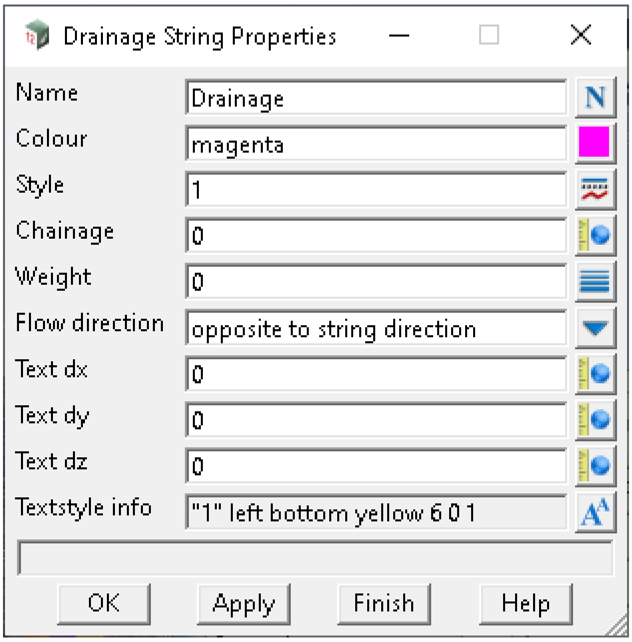
After selecting the option, an enter value typed-input box is displayed on the screen containing the current text size.

The new size is entered into the typed-input box, terminated with <enter>. The typed-input box then disappears.

The **Size** option then terminates.

17.3.6.2.8.3 Properties

The **Properties** option brings up the **Drainage String Properties** panel for the current water string.



Any of the data in the panel fields can be modified and then set for the drainage string by selecting the **OK** or **Apply** button.

Continue to 17.3.6.2.9 Z Float or return to 17.3.6.2 Water String Edit.

17.3.6.2.9 Z Float

The status of **Z Float** is used each time a new node is created.

If **Z Float** is set to tick, then the top of the node is set to z float which means that automatically sits on the default water tin.

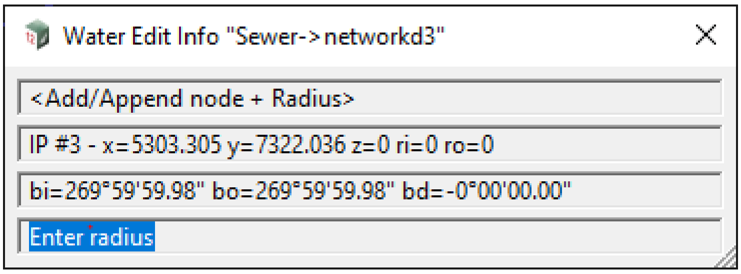
If **Z Float** is not set to tick, then the top of the node is given a set z value when it is created.

The z float status of the node can be changed after it has been created by using the **Water Edit =>Node =>Z Float** option.

Continue to 17.3.6.2.10 Water Edit Info or return to 17.3.6.2 Water String Edit.

17.3.6.2.10 Water Edit Info

As you move the cursor along the water string, the cursor position is dropped on the water string and information written to the Water Edit Info panel.



Continue to 17.3.6.3 Create from Strings or return to 17.3.6.2 Water String Edit.

17.3.6.3 Create from Strings

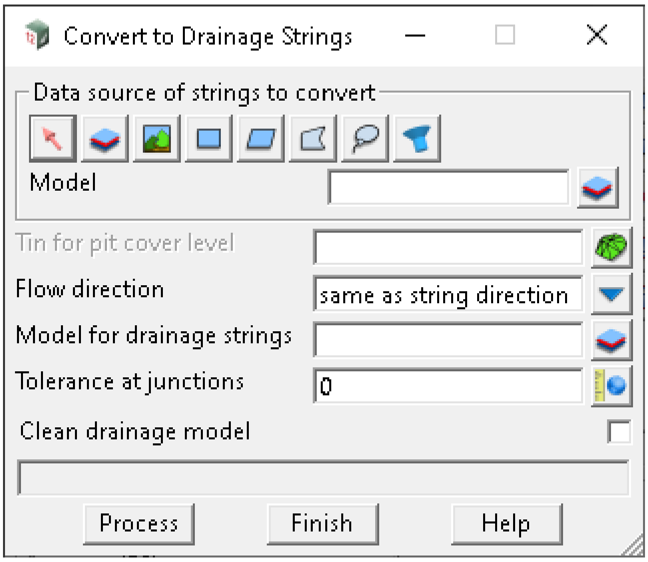
Position of option on menu: **Water =>Network =>Create =>Create from strings**

12d Model will convert the super strings into ***12d Model*** drainage strings. The default pipe, pit and tin data will be used to set the levels for the network. Do not use the other string convert commands found on the menu system.

See Also

Drainage overview

On selecting the **Create from strings** option, the **Convert to Drainage Strings** panel is displayed.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up

Data source of strings to convert data source

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source input Model

Data source for strings to be converted

Tin for pit cover level tin box

New drainage node cover level will be set to the tin level at the node centre (optional)

Flow direction choice box same as string direction

same as string direction *if the strings have been drawn in the direction of water flow*
opposite to string direction *if the strings are drawn opposite to the direction of flow.*

Model for drainage strings model box

New drainage strings will be added to this model. If it does not exist it will be created.

Tolerance at junctions measure box 0

*If specified **greater** than zero, then if the ends of branch lines are within the specified tolerance of trunk lines (even if there are no vertices on the trunk lines within tolerance), then an attempt is made to form a* *junction anyway.*

Note: *This enhancement was made when it became apparent that incoming cad models of water supply networks, were often not precise enough for this option, which previously required the vertices of all strings forming junctions, to be snapped to each other.*

Clean drainage model tick box

When selected, all strings in the model will be deleted before creating the new strings.

Process button

Converts the strings to the drainage strings.

Important notes:

The imported strings must all be drawn in the same direction. Either all in the direction the water flows or all opposite the direction of flow.

Pits are created at all vertices on the strings.

Trunk lines must have a vertex where the branch lines join.

String names can be used to control the order in when the drainage lines are numbered. These names will be transferred to the 12d drainage strings. Later, the string names can be changed in the 17.3.4 Water Network Editor (WNE).

Pits can always be renamed in 12d after the import is complete.

The drainage lines must have string names to use the Set Pit Names feature on the network editor.

Continue to the 17.3.6.4 Create from Points and Lines or return to 17.3.6 Water Create.

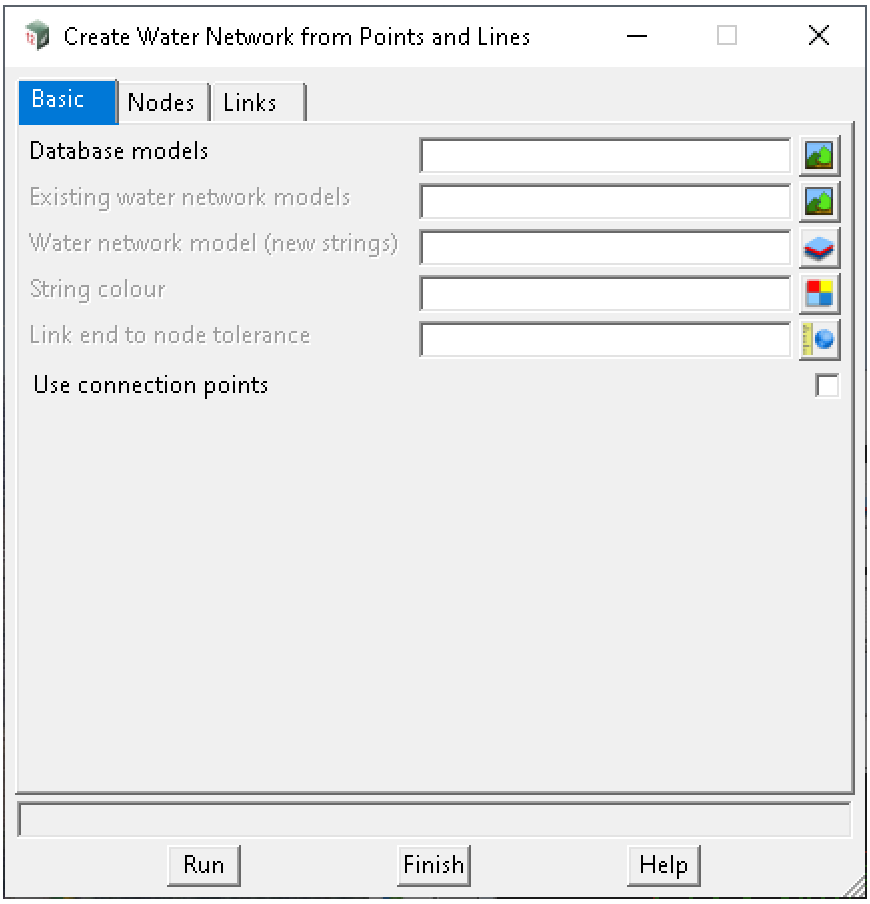
17.3.6.4 Create from Points and Lines

Position of option on menu: **Water =>Water network =>Create =>Create from pts and lines**

This option creates water strings using the x,y dimensions of 12d strings plus their string attributes.

Note: When a number is required from an attribute, a real attribute will be searched for. If not found, a text attribute will be searched for and an attempt will be made to convert it to a number.

On selecting the **Create from pts and lines** option, the **Drainage Create from Pts and Lines** panel is displayed.



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

See:

[Basic Tab](#)
[Nodes Tab](#)
[Pipe Tab](#)

Basic Tab

Database models view box

Strings on this view are sorted into node strings and link strings.

First, strings with only 1 vertex are used for nodes.

Next, strings with the breakline type set to point use only the first vertex for nodes.

All remaining strings are used to create links.

Attributes from these strings will be used to populate the choice boxes on the Manhole and Pipe tabs.

Existing water network models view box

Water strings from this view will be updated if their pipe names match the pipe name attribute on the pipe strings from the Database models above.

Water network model (new strings) model box available models

New water strings are appended to this model.

String colour colour box available colours

Colour for new water strings.

Link end to node tolerance measure box

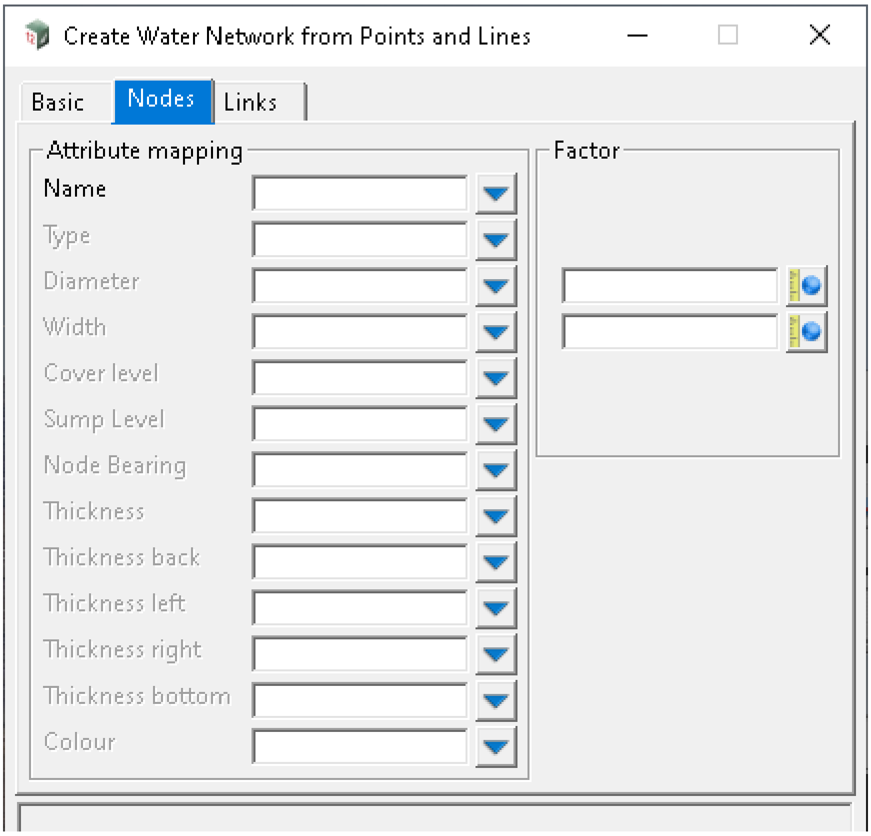
The node closest to the end of a link will be connected to the link as long as it is closer than this tolerance.

Use connection points tick box not ticked

When selected, the x,y location of the start and end of the link will be preserved using the water string node connection points.

When not selected the end of the link will be connected to the node centre.

Nodes Tab



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Name choice box

*Value from this text attribute will set the **node name**. If the attribute is not found the project default node name will be used.*

Type choice box

*Value from this text attribute will set the node **type**. If the attribute is **not found** the project default node type will be used.*

Diameter choice box

*Value from this attribute will set the node **diameter**. It will then be multiplied by the factor to the right. If the attribute is **not found** the project default node diameter will be used.*

Width choice box

*Value from this attribute will set the node **width**. It will then be multiplied by the factor to the right. If field is **blank** or the attribute is **not found**, the node will be circular.*

Cover level choice box

*Value from this attribute will set the node **cover and grate levels**. If these levels are less than the link obvert level they are raised to the link obvert level.*

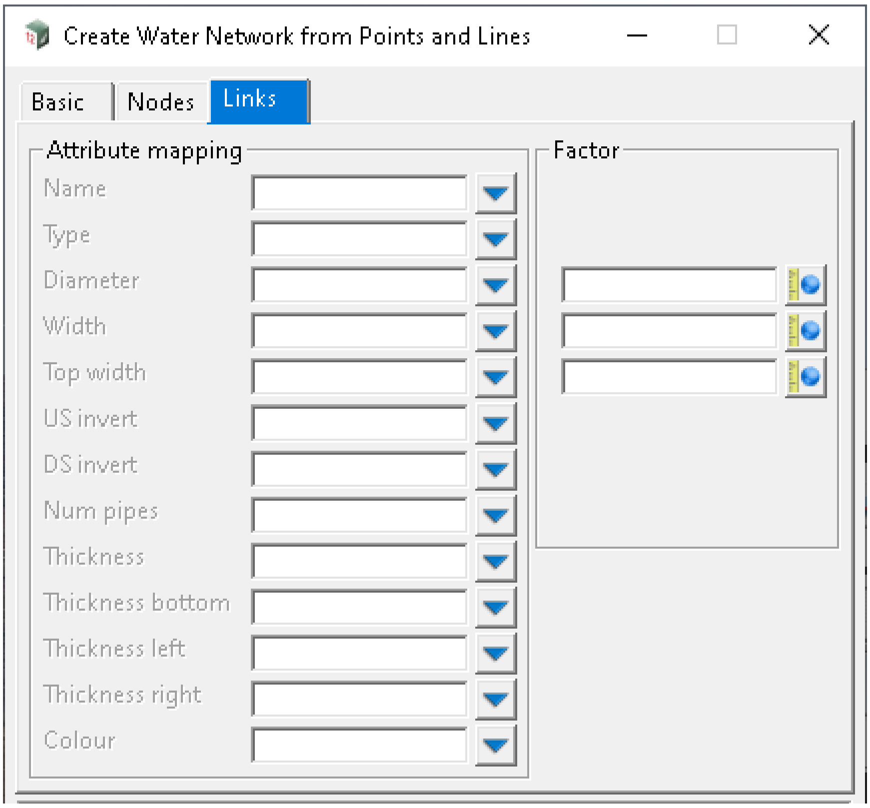
Sump level choice box

*Value from this attribute will set the node **sump level**.*

Factor measure boxes

These values for the attributes to the left will be multiplied by these factors.

Pipe Tab



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Name choice box

*Value from this text attribute will set the link name. The link name will also be used scan the **Existing drainage/sewer models**. When a match is found the link will be updated rather than a new link created. If the attribute is not found the project default link name will be used.*

Type choice box

*Value from this text attribute will set the link **type**. If the attribute is **not found**, the project default link type will be used.*

Diameter choice box

*Value from this attribute will set the link **diameter**. It will then be multiplied by the factor to the right. If the attribute is **not found**, the project default link diameter will be used.*

Width choice box

*Value from this attribute will set the link **width**. It will then be multiplied by the factor to the right. If field is **blank** or the attribute is **not found**, the link will be circular.*

Top width choice box

*Value from this attribute will set the link **top width**. It will then be multiplied by the factor to the right. If field is **blank** or the attribute is **not found**, no top width will be set.*

US invert choice box

*Value from this attribute will set the link **invert** at the l**ow chainage end of the string**.*

DS invert measure boxes

*Value from this attribute will set the link **invert** at the **high chainage end of the string**.*

Num pipes measure boxes

*Value from this attribute will set the number of identical **links**.*

Factor measure boxes

These values for the attributes to the left will be multiplied by these factors.

Buttons at Bottom

Run button

Runs the option.

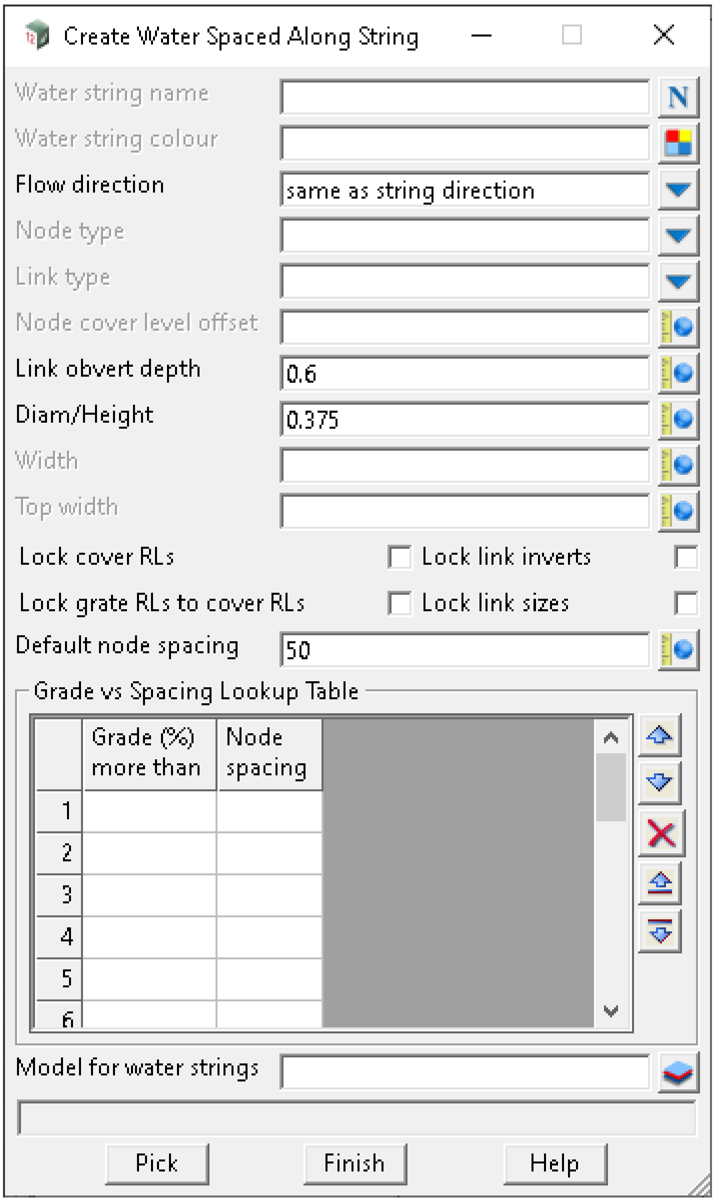
Continue to 17.3.6.5 Create Water Spaced Along String or return to 17.3.6 Water Create.

17.3.6.5 Create Water Spaced Along String

Position of option on menu: **Water =>Water network =>Create =>Create spaced along string**

This option creates **Water** strings with nodes variably spaced along selected design strings (which must have valid and variable z values). The user picks the design string at the downstream extent of the desired **Water** string, and the option works its way upstream (i.e. in increasing z direction) to a high point on the design string, at which point the full extent of the **Water** string is created automatically. The node spacing may be controlled by the grades measured from the design string at each node location, or from a default value. The node cover levels and link invert levels are set relative to the levels on the design string.

Selecting **Create spaced along string** brings up the **Create Water Spaced Along String** panel.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Water string name	text box		

*Name for created **Water** string. If unspecified, string will be created with no name.*

Water string colour colour box

Colour for created **water** *string. If unspecified, string will be created with a default colour.*

Flow direction choice box same as same as string direction,
opposite to string direction

Determines whether created **water** *string flows in, or opposite to, the direction of increasing chainage. Note that for water strings, the terms **upstream** and **downstream** refer to the flow direction, not the string direction. Also not that the downstream end of the created water string will always be at the point selected on the graded design string.*

Node type choice box available node types

*Node type to apply to every created Water node. If unspecified, the node type will be adopted from the project default value set via **Project Settings**.*

Link type choice box available link types

*Link type to apply to every created Water link. If unspecified, the link type will be adopted from the project default value set via **Project Settings**.*

Node cover level offset real box

Vertical distance of node cover levels from design string (positive up, zero if unspecified). For pipe links, this value should typically be zero. For channel links, if the picked design string represents the channel invert, this value should be set to the height of the channel; if the picked design string represents the channel obvert, this value should be zero.

Link obvert depth real box 0.6

Vertical distance of link obverts from node cover levels (positive down, zero if unspecified). For pipe links, this value should typically be set to the required pipe cover limit. For channel links, this value should typically be zero.

Diam/Height real box 0.375

Diameter of circular links or height of box/vee/trapezoid links (in base units).

Width real box

Width of box links or bottom width of trapezoid links (in base units). Leave blank for circular/vee links.

Top Width real box

Top width of vee/trapezoid links (in base units). Leave blank for circular/box links.

Lock cover RLs tick box not ticked

*If **ticked**, sets the explicit* **Cover RL** *mode to "Manual" on each node, for subsequent use in the* **Water Network Editor**.

Lock link inverts tick box not ticked

*If **ticked**, sets both the* **Lock US Invert** *and* **Lock DS Invert** *tick boxes to ticked, on each link, for subsequent use in the* **Water Network Editor**.

Lock grate RLs to cover RLs tick box not ticked

*If **ticked**, sets the explicit* **Grate RL** *mode to "Cover RL", on each node, for subsequent use in the* **Water Network Editor**.

Lock link sizes tick box not ticked

*If **ticked**, sets the* **Lock link size** *tick box to ticked, on each link, for subsequent use in the* **Water Network Editor**.

Default node spacing real box 50

Node spacing to apply between nodes if a value os not found in the **Grade vs Spacing Lookup Table**.

Grade (%) more than input real column

Column of grades in percent. If not already, the Grade vs Spacing Lookup Table will be sorted (internally) in ascending grade order. The grade is measured from the design string at each new node location, and the matching row is looked up in the table. If the design grade is greater than or equal to the row's grade, but less than the next row's grade, the matching row has been found.

Node spacing input real column

Column of node spacings. The node spacings to apply between each node and its next upstream node, corresponding to the grade specified in the **Grade vs Spacing Lookup Table**.

Model for water strings model box available models

Model in which to add the created **water** *string.*

Buttons at Bottom

Pick button

Starts a pick-process to select the design string, along which the **water** *string will be created. The coordinates of the selected point on the design string will be adopted as the downstream end of the created* **water** *string. Once the point on the design string is accepted, the panel is validated and the* **water** *string is created. The string-pick process is then re-started, allowing selection of another design string. Additional information is written to the* **Output Window**, *providing feedback to the user.*

Finish button

Removes the panel from the screen.

Help button

Launches the 12d help for the option.

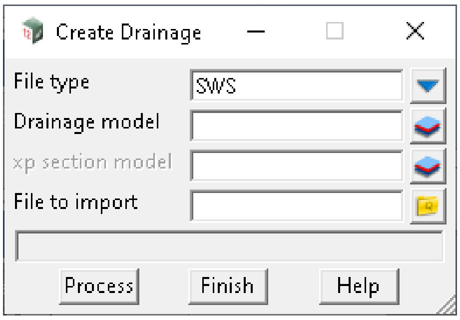
Continue to 17.3.6.6 Create Network from Import - WinDes and XP SWMM or return to 17.3.6 Water Create.

17.3.6.6 Create Network from Import - WinDes and XP SWMM

Position of option on menu: **Water =>Water network =>Create => Create from import**

This routine creates water strings and a network model from existing MicroDrainage WinDes (sws and fws) and XP Software xpswmm (xpx) files.

Selecting **Create from import** brings up the **Create Drainage** panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
File type	choice box	SWS	SWS, xpswmm, swmm5

SWS (or FWS) for WinDes files, xpstorm files are the xpsoftware xpx files.

Drainage model	model box		available models

Drainage strings created will be stored in this model.

xp section model	model box		available models

??

File to import	file box		

Select sws, fws or xpx file types.

Buttons at Bottom

Process	button		

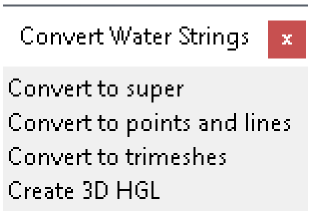
Create import file and create strings.

Continue to 17.5.15 Create/Change Culvert or return to 17.3.6 Water Create.

17.3.7 Convert Water Strings

Position of menu: **Water =>Water network =>Convert**

The **Convert** walk-right menu is



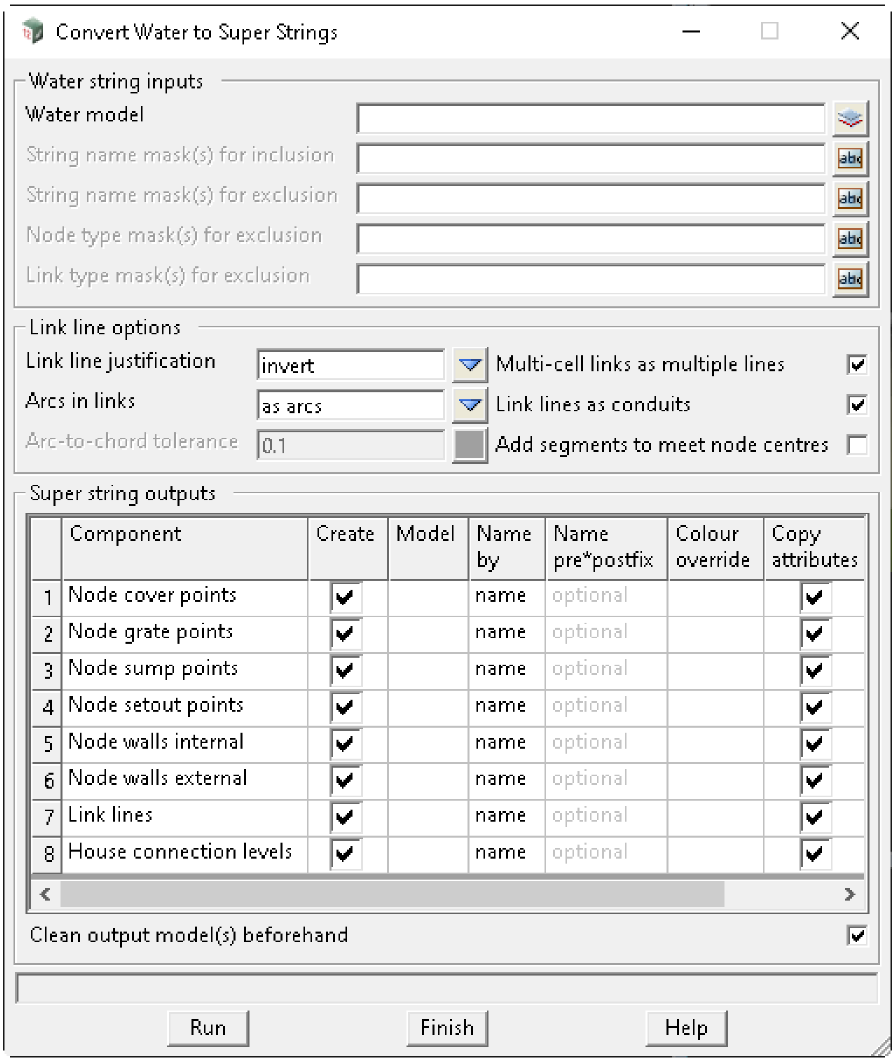
See
17.3.7.1 Convert Water to Super Strings
17.3.7.2 Convert to Points and Lines
17.3.7.3 Convert to Trimeshes
17.3.7.4 Create HGL in 3D

17.3.7.1 Convert Water to Super Strings

Position of option on menu: **Water =>Water network =>Convert =>Convert to super**

This option converts the **Water** strings selected from a model, into separate **Super** string components representing the nodes, links and house connections.

Selecting **Convert to super** brings up the **Convert Water to Super Strings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Water string inputs

Water model model box available models

Model containing the Water strings to convert. Entering or selecting a model will initially check that the model exists and contains Water strings. If so, a count of the Water strings, nodes, links and house connections is written to the status bar, and the Model column is populated in the Super string outputs grid, if not already.

String name mask(s) for inclusion text box

*Water string names to include. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

String name mask(s) for exclusion text box

*Water string names to exclude. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Node type mask(s) for exclusion text box

*Node types to exclude. Node types are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Link type mask(s) for exclusion text box

*Link types to exclude. Link types are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Link line options

Link line justification choice box invert obvert, centre, invert

Vertical justification of the link line Super string components.

Arc in links choice box as arcs as arcs, as straights, use arc-to-chord tolerance

If arcs exist in the Water string links, this setting controls how the arcs will be represented in the link line components.

Arc-to-chord tolerance real box 0.1

Only used when Arcs in links is set to "use arc-to-chord tolerance". Defines the maximum distance between the original arc and each chord. See 3.25.2 Chord-to-Arc Tolerance.

Multi-cell links as multiple lines tick box ticked

Whether to convert multi-cell links into multiple link line components.

Link lines as conduits tick box ticked

Whether to set matching conduit dimensions on the link line components. Circular and rectangular conduit shapes only.

Add segments to meet node centres tick box not ticked

Whether to add additional, horizontal segments to the end of each link line component, to meet its connecting node centres in plan.

Super string outputs

Components choice box all Node cover points, Node grate points Node sump points, Node setout points, Node walls internal, Node walls external, Link lines, House connection levels

*Defines the Super string output component for each row of the grid. Each of the component choices may be specified in the grid zero or more times. The Node * points choices create individual Super string points of each node's: cover, grate and sump level (at node centre), and setout level (at setout x,y). The Node walls * choices create closed Super string polygons of the internal and external walls of each node's chamber, at the sump and bottom levels respectively. The Link lines choice creates Super strings of each link. The House connection levels choice creates horizontal Super strings for each house connection, perpendicular to the Water string at the specified side and length, at the house connection level.*

Create tick box ticked

Whether to create each component.

Model model box column available models

Model for each component. If any of the model names in this column are blank, they can be automatically populated by entering or selecting a model in the Water model box, where the water model name is used as a prefix in the component model name. The models specified for each component are allowed to be the same as each other, but will be unique if they are all automatically populated.

Name by choice box name name, type, nothing

Defines the base name of each component to be the original node/link/connection name or type, or nothing.

Name pre*postfix choice box name, type, nothing

Optional prefix and/or postfix to apply to the base name (*) of each component.

Colour override colour box column available colours

Optional colour for each component. If unspecified, the component will adopt the colour of the original node/link/connection.

Copy attributes tick box ticked

Whether to copy the original node/link attributes to each node/link component. For house connections, whether to create a useful set of new string attributes on the component.

To attribute group text box column

Optional attribute group name to use for each component, when copying attributes.

Clean output models(s) beforehand tick box ticked

Whether to clean the output model(s) beforehand.

Buttons at Bottom

Run button

Runs the option.

Finish button

Removes the panel from the screen.

Help button

Launches the 12d help for the option.

Continue to 17.3.7.2 Convert to Points and Lines or return to Continue to 17.4 Water Setup or return to 17.3.13 Water Network Old..

17.3.7.2 Convert to Points and Lines

Position of option on menu: Water =>Water Network =>Convert =>Convert to pts and lines

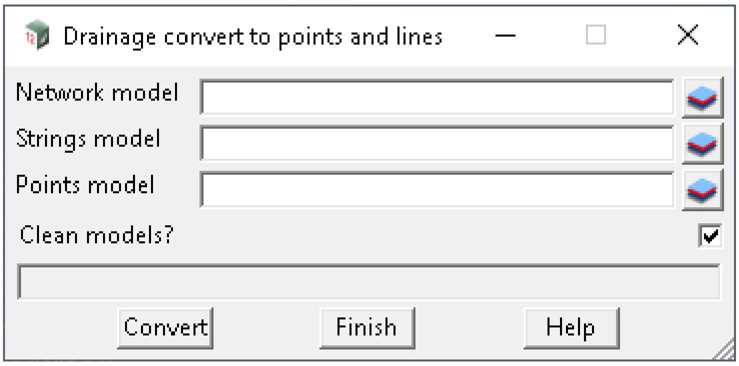
This option converts a drainage network into simple points and lines.

Pits will be created as single point super strings with the pit attributes set as string attributes.

Pipes will be created as single or multiple segment super strings with pipe attributes set as string attributes.

This may be useful for uploading to external GIS systems via the GIS module.

Selecting **Convert to pts and lines** brings up the **Drainage convert to points and lines** panel.



The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Network model   model box   available models

Source model of the drainage network.

Strings model   model box   available models

Model to output pipe strings to.

Points model   model box   available models

Model output pit point strings to.

Copy string attributes to pits and pipes?   tick box   not ticked

*If **ticked**, the string attributes for points are copied to pit attributes and string attributes for lines are copied to the pipe attributes.*

*If **not ticked**, no attributes are copied.*

Clean models?   tick box   ticked

Whether or not to clean the models first

Convert   button

Performs the conversion

Continue to 17.3.7.3 Convert to Trimeshes or return to Continue to 17.4 Water Setup or return to 17.3.13 Water Network Old..

17.3.7.3 Convert to Trimeshes

Position of option on menu: **BIM =>Trimesh =>Create =>Trimeshes from 12d objects**

Position of option on menu: **Water =>Water Network =>Convert =>Convert to trimeshes**

This is the same option as **BIM =>Trimesh =>Create =>Trimeshes from 12d objects** which brings up the panel **Generate Trimeshes from 12d Objects**.

See 11.5.2.1.1 Trimeshes from 12d Elements.

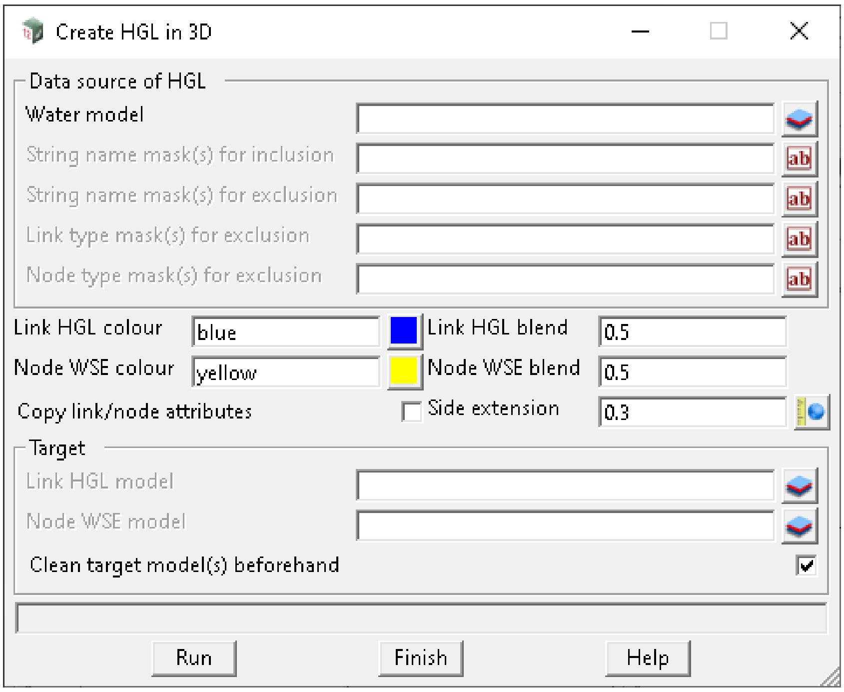
Continue to 17.3.7.4 Create HGL in 3D or return to Continue to 17.4 Water Setup or return to 17.3.13 Water Network Old..

17.3.7.4 Create HGL in 3D

Position of option on menu: **Water =>Water network =>Convert =>Convert to 3D HGL**

The **Create HGL in 3D** option creates 3D representations of the 1D HGL (pressure line) set along Water strings. The Hydraulic Grade Line set at each link and the Water Surface Elevation set at each node of the Water strings, are created as individual trimeshes.

Selecting **Create to 3D HLG** brings up the **Create HGL in 3D** panel.



Data source of HGL

Water model model box available models

Model containing the Water strings to convert. Entering or selecting a model will initially check that the model exists and contains Water strings. If so, a count of the Water strings, nodes, links and house connections is written to the status bar, and the Model column is populated in the Super string outputs grid, if not already.

String name mask(s) for inclusion text box

*Water string names to include. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask. Leaving this field blank is the same as specifying *.*

String name mask(s) for exclusion text box

*Water string names to exclude. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Node type mask(s) for exclusion text box

*Node types to exclude. Node types are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Link type mask(s) for exclusion text box

*Link types to exclude. Link types are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Link HGL colour colour box blue

Colour for the trimeshes of the link HGLs.

Link HGL blend real box 0.5

Opacity for the trimeshes of the link HGLs. A value between 0 and 1 will create translucent trimeshes. A value of 1 will create opaque trimeshes.

Node WSE colour colour box yellow

Colour for the trimeshes of the node WSEs.

Node WSE blend real box 0.5

Opacity for the trimeshes of the node WSEs. A value between 0 and 1 will create translucent trimeshes. A value of 1 will create opaque trimeshes.

Copy link/node attributes tick box not ticked

Whether to copy the node and link attributes from the Water strings, to element attributes of the trimeshes.

Side extension real box 0.3

Amount to extend the trimeshes laterally, beyond the external walls of the nodes and links. The side extension makes the trimeshes easier to see in 3D, in relation to the Water strings.

Target

Link HGL model model box available models

Model for the trimeshes of the link HGLs. In unspecified, they will not be created. May be specified the same as, or different from the Node WSE model.

Node WSE model model box available models

Model for the trimeshes of the node WSEs. In unspecified, they will not be created. May be specified the same as, or different.

Clean output models(s) beforehand tick box ticked

Whether to clean the output model(s) beforehand.

Buttons at Bottom

Run button

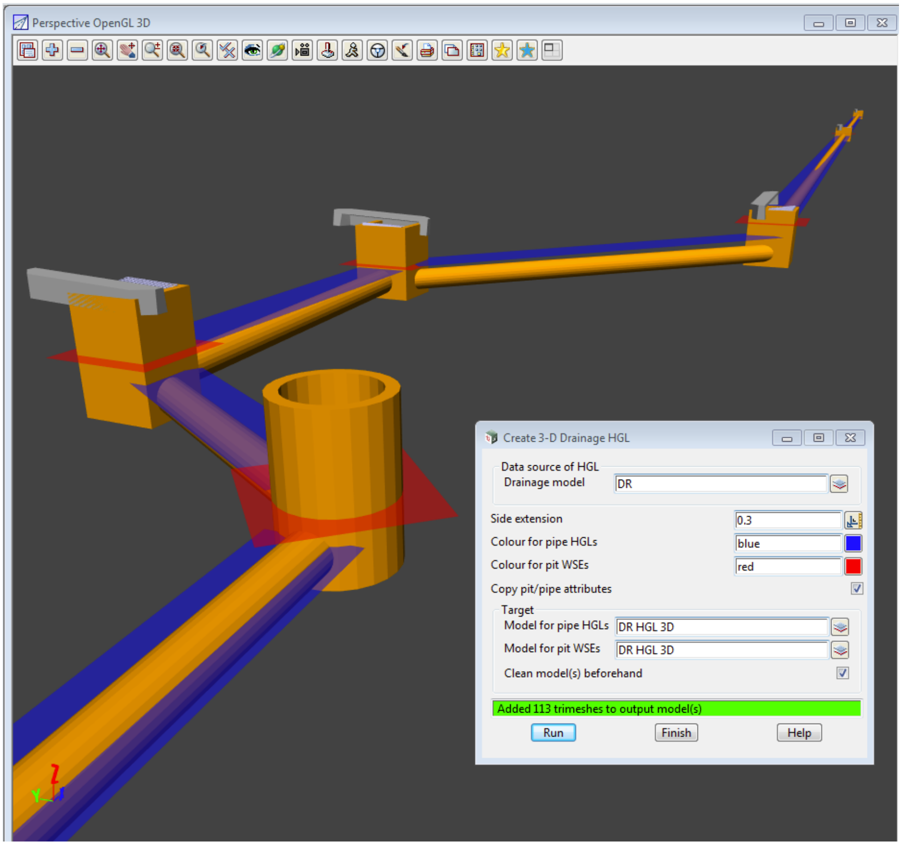
Run the option.

Finish button

Removes the panel from the screen.

Help button

Launches the 12d help for the option.

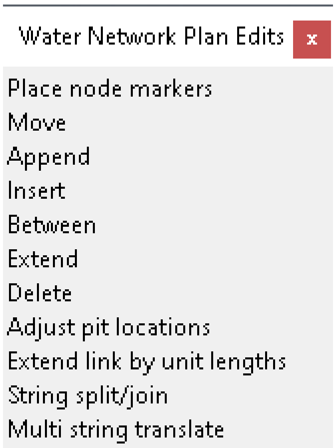


Continue to 17.3.8 Plan Edits or return to Continue to 17.4 Water Setup or return to 17.3.13 Water Network Old.

17.3.8 Plan Edits

Position of menu: **Water =>Water network =>Plan edits**

The **Create** walk-right menu is



See
17.3.8.1 Place Node Markers
10.4.8 Move Point
10.4.1 Append Point
10.4.7 Insert Point
10.4.2 Between Point
10.4.4 Extend Point
10.4.3 Delete Point
17.3.8.2 Adjust Node Locations
17.3.8.3 Extend Link by Length
17.3.8.4 String split/join
12.29.13 Multi-Strings Translate

17.3.8.1 Place Node Markers

Position of option on menu: **Water =>Water Network =>Plan edits =>Place node markers**

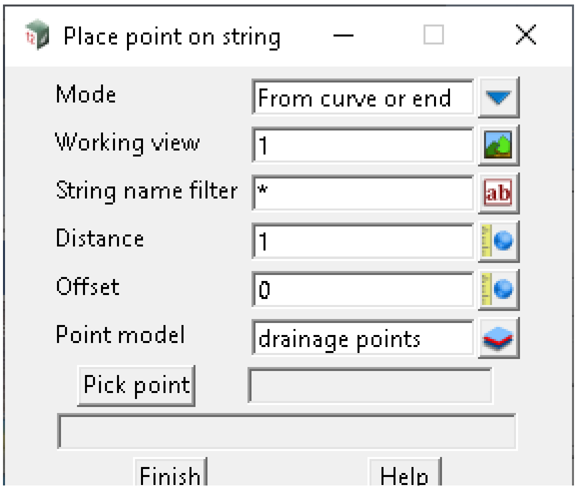
Position of option on menu: **Water =>Foul Water =>Plan edits =>Place node markers**

This routine creates points along a string so that water nodes can be placed at a fixed offset from an intersection. As this is a very common task it combines several standard 12d options into one step.

The user selects a point near where the node is to be located. The routine finds the closest string on the **working view** that matches the **String name filter** and creates a temporary point on the string.

The **Mode** determines a reference point located on the string and a marker of length, **distance**, is created from the reference point towards the temporary point.

Selecting **Place points** brings up the **Place Point on String** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Mode	choice box	From curve or end	From curve or end, From end, Nearest point

If **From curve or end**, the reference point is closest (by chainage) end of curve or end of string.
if **From end**, the reference point is the closest (by chainage) end of the string is located.
*if **Nearest point**,* the reference point is *the closest vertex to the temporary point is located.*

Working view	view box	1	

*Strings on this view will be searched using the **string name filter**. The **point model** will also be added to this view.*

String name filter	input	*	

*The closest string on the **working view** matching this filter will be selected.*

Distance	input	1	

Chainage distance from the reference point to the end of the marker (note that the marker is drawn as a straight line but the distance uses the chainage value).

Point Model	model box	drainage points	

*The marker points are placed in this model using the **FLOW LINE** linestyle.*

Pick point button

Select a point near where the point marker is to be created. Only the x,y value is used from the selected point.

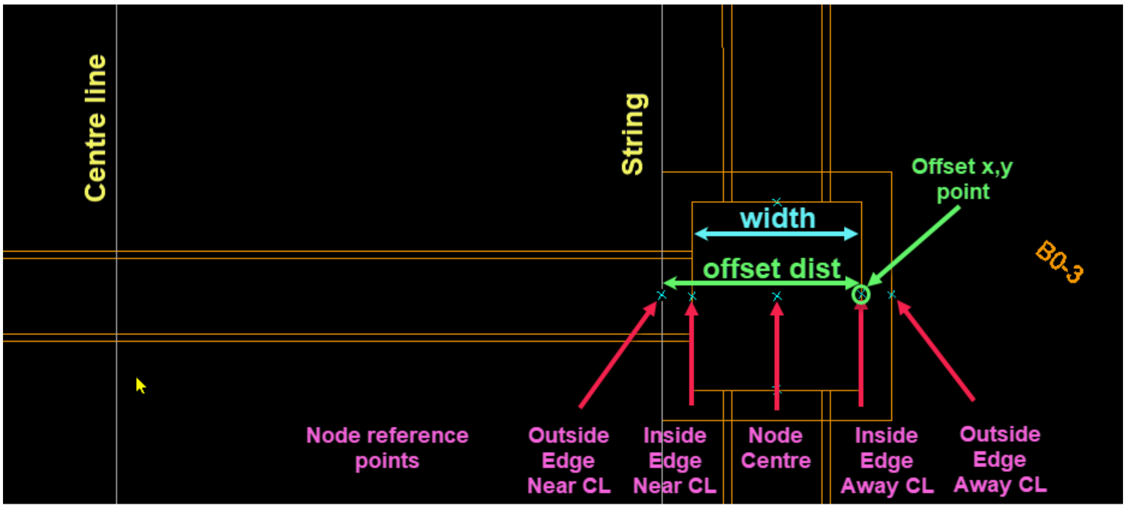
Continue to 17.3.8.2 Adjust Node Locations or return to 17.3.8 Plan Edits.

17.3.8.2 Adjust Node Locations

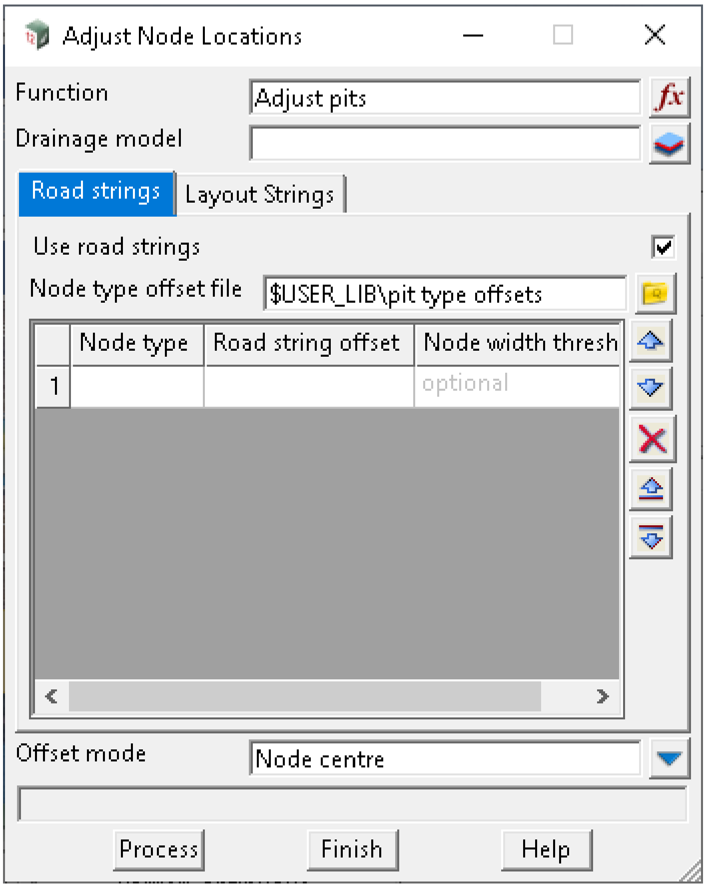
Position of option on menu: **Water =>Water Network =>Plan edits =>Adjust Pit Locations**

Key Points

1. This routine moves a **node reference point** to an **offset xy point** at an offset distance measured perpendicular to the **string**. Below the reference point, **Inside edge away from the centre line**, is moved onto the offset x,y point circled.



2. Nodes are moved perpendicular to the string.
3. With **Use road strings selected**, the WNE road string is used in preference to a layout string.
4. Road strings have a choice of 5 node reference points and use an offset distance.
5. Layout strings only use the Node Centre reference point and the offset is always 0.0
6. The node is not moved when no road or valid layout string is found.
7. The offset distance is set by the Node type and then optionally by the node width



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Function function

This function will re adjust the water nodes.

Water Network model model

Water network model to have the nodes moved.

Use road strings tick

*When selected, a WNE road string is checked for each node. When found, the node will be moved perpendicular to this string at the **Road string offset** distance. If the road string is not found, the layout string will be searched for using the **Max layout search distance**. If not selected then only the layout strings with an offset of zero will be used.*

Node type offset file file

*The grid data below is stored in this file when the **Process button** is selected.*

Node type input

*Only used when **Use road strings** is selected. Each node scans for its node type in the **Node type** column. When found, the Node is placed at the **Road string offset** distance from the road string.*

Road string offset input

*Only used when **Use road strings** is selected. The node is placed at the **Road string offset** distance from the road string. Positive is away from the road centreline and negative is towards the centreline. When no **Road string offset** is set via the **node type**, the offset value is zero.*

Node width threshold input

*This optional column allows the offset to change for a **Pit type** that with various node base widths. When used it is expected that there will be multiple rows with the same **Pit type**.*

Offset Mode input

This selection sets the Node reference point shown in the image above. This reference point is moved to the offset x,y point.

Layout Strings

*These strings are used when **Use road strings** is NOT selected or when no road string is found for the node. As road strings are often in several models, so the filter option is usually the best. Select a view with the road string models and then use the string info tab and name field (* wild card can be used) to select the strings to move to.*

Layout strings always use the Node centre as the reference point and the offset is always zero.

Data Source of Node Layout Strings data source

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source input Model

Source of data to be processed.

Max Layout Search Distancer real 1.0

Only used for layout strings. Road strings do not have a search distance. If the closest string in the node layout strings is farther than this distance the node will not be moved.

Buttons at Bottom

Run button

This moves the pits horizontally. Undo is available.

Finish button

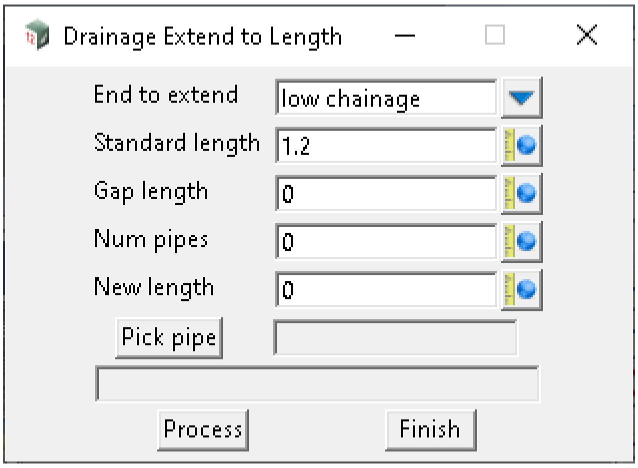
Removes the panel from the screen.

Continue to 17.3.8.3 Extend Link by Length or return to 17.3.8 Plan Edits.

17.3.8.3 Extend Link by Length

Position of option on menu: **Water =>Water network =>Plan edits =>Extend link by unit lengths**

On selecting the **Extend link by unit lengths** option, the **Drainage Extend to Length** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
End to extend	choice box	low chainage	low chainage, high chainage

Low chainage is the left side of a section, and high chainage is the right side of a section.

Standard length	measure box	1.2	At Point, Point to Point, String from Point, String to Point

Standard link construction length.

Gap length	measure box	0	At Point, Point to Point, String from Point, String to Point

Length of the gap that exists between the links.

Num pipes	measure box	0	At Point, Point to Point, String from Point, String to Point

Number of links to be used for the total length.

New length	measure box	0	At Point, Point to Point, String from Point, String to Point

*Number of links * length + (number of links -1) * gap length.*

Pick link	button		

Select the link to be altered.

Buttons at Bottom

Process	button		

Runs the option. Section views must be regenerated to see the changes.

Continue to 17.3.8.3 Extend Link by Length or return to 17.3.8 Plan Edits.

17.3.8.4 String split/join

Position of option on menu: **Water =>Water network =>Plan edits =>String split/join**

This option must be used on drainage strings instead of the standard split or join commands.

On selecting the **String split/join** option, the **String split/join** panel is displayed.

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Split options

US string name input

Upstream section of the split string is assigned this name.

DS string name input

Downstream section of the split string is assigned this name.

Buttons at Bottom

Split button

The split may only occur at a node. The upstream and downstream sections are renamed if names are provided above.

Join US to DS button

The upstream segment must be selected first and then the downstream. The properties from the upstream string are used for the new string created. If there is a gap in between the joined strings, a pipe will be inserted with the default pipe properties. The attributes of the upstream pit on the downstream string will be discarded.

Join DS to US button

The downstream segment must be selected first and then the upstream. The properties from the downstream string are used for the new string created. If there is a gap in between the joined strings, a pipe will be inserted with the default pipe properties. The attributes of the downstream pit on the upstream string will be discarded.

Finish button

Remove the panel from the screen.

Help button

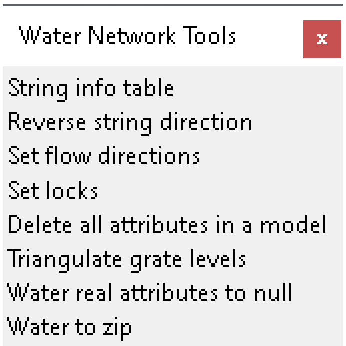
Display the help for this panel.

Continue to 17.3.9 Water Network Tools or return to 17.3.8 Plan Edits.

17.3.9 Water Network Tools

Position of menu: **Water =>Water network =>Tools**

The **Tools** walk-right menu is



See

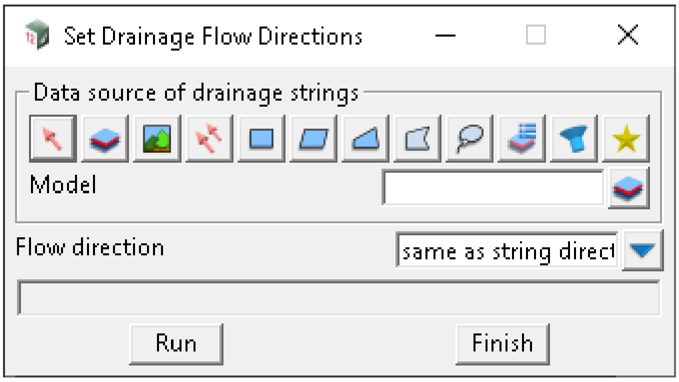
9.4 Strings in Model Information Table
25.12.10 Reverse Strings
17.3.9.1 Set Water String Flow Direction
17.3.9.2 Set Water String Node and Link Locks
17.3.9.4 Triangulate Grate Levels
17.3.9.3 Delete All Attributes in a Model
17.3.9.5 Water Real Attributes to Null
17.3.9.6 Water Network to Zip

17.3.9.1 Set Water String Flow Direction

Position of option on menu: **Water =>Water network =>Tools =>Set flow directions**

The routine changes the water strings flow direction to either **same as string direction** or **opposite to string direction.** This setting affects the node grading, network connectivity and hydraulic calculations.

On selecting the **Set flow directions** option, the **Set Drainage Flow Directions** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data source of drainage strings	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to be processed.

Flow direction	choice box	same as string direction	same as string direction, opposite to string direction

All water strings will have this flow direction set.

Buttons at Bottom

Run	button

Set flow directions.

Continue to 17.3.9.2 Set Water String Node and Link Locks or return to 17.3.9 Water Network Tools.

17.3.9.2 Set Water String Node and Link Locks

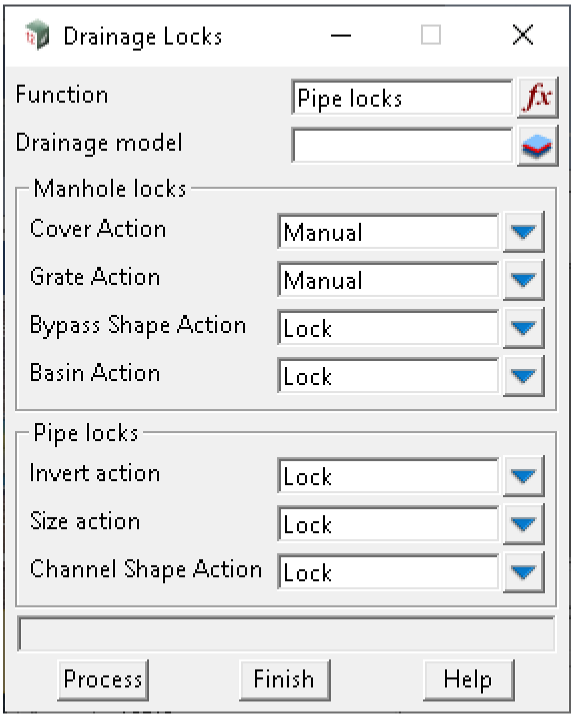
Position of option on menu: **Water =>Water network =>Tools =>Set locks**

The routine locks/unlocks (sets to manual) the node and link levels in a water network model.

A function is created so that the locks can easily be applied or removed.

This is often used for existing networks or by designers wishing to set all levels manually.

On selecting the **Pipe locks** option, the **Pit and pipe locks** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function	function box	Pipe locks	

A function can be created to lock and unlock the drainage string properties (via attributes).

Drainage model	model box		

Existing strings in this model are processed.

Manhole locks

Cover action	choice box	Manual	Manual, None, Default

Sets the mode for the cover levels (manual is the equivalent of locked)
*If **Manual**, the mode is set to manual.*
*If **None**, the mode if left unchanged.*
*If **Default**, the field is cleared and the default setting becomes active.*

Grate action	choice box	Manual	Manual, None, Default

Sets the mode for the grate levels (manual is the equivalent of locked)
*If **Manual**, the mode is set to manual.*
*If **None**, the mode if left unchanged.*
*If **Default**, the field is cleared and the default setting becomes active.*

Pipe locks

Invert action	choice box	Lock	Lock, Unlock, None, Default

Sets the pipe invert lock flags for the WNE
*If **Lock**, the flag is enabled.*
*If **Unlock**, the flags are cleared.*
*If **None**, the flags are left unchanged.*
*If **Default**, the flags are cleared (same as unlock).*

Size action	choice box	Lock	Lock, Unlock, None, Default

Sets the pipe diameter, width and top width lock flags for the WNE
*If **Lock**, the flag is enabled.*
*If **Unlock**, the flags are cleared.*
*If **None**, the flags are left unchanged.*
*If **Default**, the flags are cleared (same as unlock).*

Buttons at Bottom

Process	button

Applies and removes the locks as indicated.

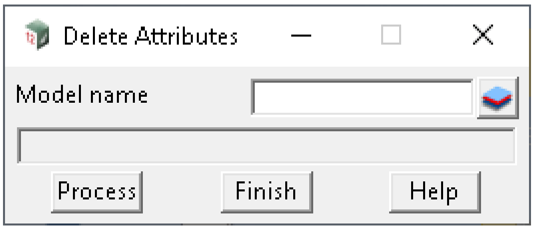
Continue to 17.3.9.3 Delete All Attributes in a Model or return to 17.3.9 Water Network Tools.

17.3.9.3 Delete All Attributes in a Model

Position of option on menu: **Water =>Water network =>Tools => Delete all attributes in a model**

This routine deletes all of the model, string, pit and pipe attributes in the selected model.

On selecting the **Delete All Attributes in a Model** option, the **Delete Attributes** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model name	model box		available models

Model to delete all the model attributes from, and all the string, pit and pipe attributes for the drainage strings in the model.

Buttons at Bottom

Process	button

Model, string, pit and pipe attributes will be deleted.

Notes **THERE IS NO UNDO!**

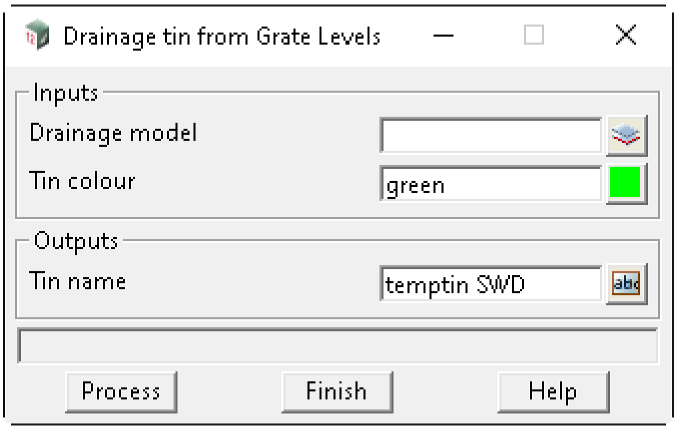
Continue to 17.3.9.4 Triangulate Grate Levels or return to 17.3.9 Water Network Tools.

17.3.9.4 Triangulate Grate Levels

Position of option on menu: **Water =>Water network =>Tools =>Triangulate grate levels**

This option allows the user to create a tin from the current grate levels on the drainage model. The option will also retain strings that can be used for retriangulation.

On selecting the **Triangulate grate levels** option, the Drainage tin from Grate Levels panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Inputs			
Drainage model	model box		available models
Drainage model to create a tin.			
Tin colour	colour box	green	available colours
Colour for the created tin.			
Outputs			
Tin name	text box	temp tin SWD	
Name for the created tin.			
Buttons at Bottom			
Process	button		
Creates the Tin.			

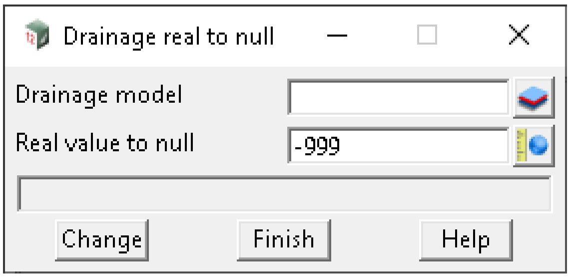
Continue to 17.3.9.5 Water Real Attributes to Null or return to 17.3.9 Water Network Tools.

17.3.9.5 Water Real Attributes to Null

Position of option on menu: **Water =>Water network =>Tools =>Water real attributes to null**

Used to convert real values that have been imported to ***12d Model*** (i.e. via 12da import) to a null value.

On selecting the **Water real attributes to null** option, the Drainage real to null panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		available models

The drainage model to check real attribute values for.

Field Description	Type	Defaults	Pop-Up
Real value to null	real box	-999	

Real value to substitute with Null, wherever it occurs (node / link / string attributes).

Continue to 17.3.9.6 Water Network to Zip or return to 17.3.9 Water Network Tools.

17.3.9.6 Water Network to Zip

Position of option on menu: **Water =>Water network =>Tools =>Water to zip**

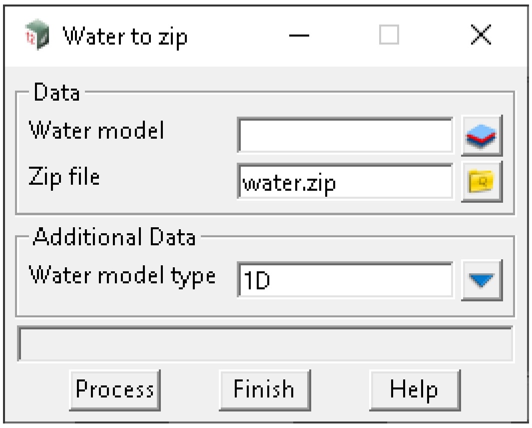
This zip routine is intended for Water support.

The option zips up project views and only the models and files related to the water model.

Water to zip supports 1D and 2D water models.

For 2D Data, users can specify whether their project has been created as 1D (default), or 2D through a variety of ***12d Model***'s existing tools. Selecting any of these choices will change the panel layout to collect extra information.

On selecting the Water **to zip** option, the **Water to Zip** panel is displayed.



The fields and buttons used in this panel have the following functions.

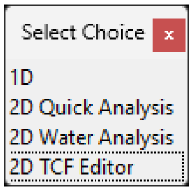
Field Description	Type	Defaults	Pop-Up
Water model	model box		available models

This model and the related models through the water network editor will be zipped into one file.

Field Description	Type	Defaults	Pop-Up
Zip file	file box	water.zip	*.zip files

This zip file is intended to be sent to support personnel.

Field Description	Type	Defaults	Pop-Up
Water model type	choice box	1D	



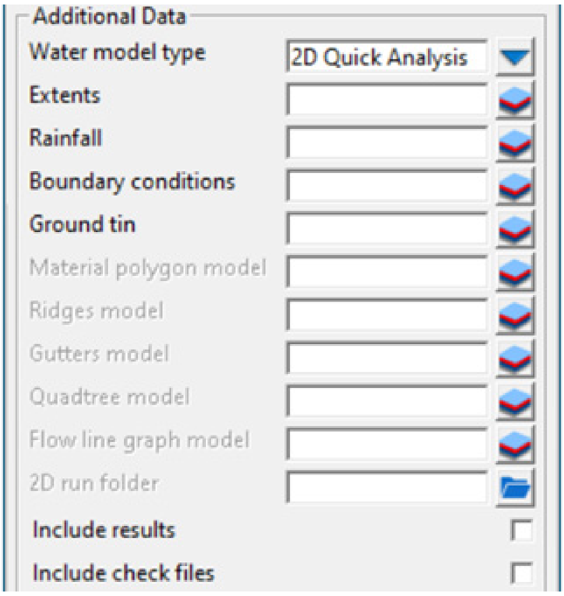
Specify the project type and the required fields for backup will be added to the panel.
*If **1D**, no more information is required because it is all obtained from the* **Water model**.

*If **2D Quick Analysis,** more information is required and extra fields are added to the panel. See* 2D Quick Analysis.

*If **2D Water Analysis** or **2D TCF Editor,** more information is required and extra fields are added to the panel. See* 2D Water Analysis or 2D TCF Editor.

2D Quick Analysis

Required for projects containing data created through the 12d option of the same name.



Extents model box

2D extents model.

Rainfall model box

2D rainfall area model.

Boundary conditions model box

2D boundary conditions model.

Ground tin model box

Model containing the surface tin.

Material polygon model model box

2D materials model.

Ridges model model box

2D ridges model.

Gutters model model box

2D gutters model.

Quadtree model model box

2D quadtree area model.

Flow line graph model model box

2D flow line graph model.

Include results tick box not ticked

*If **ticked** the results files are included in the zip.*

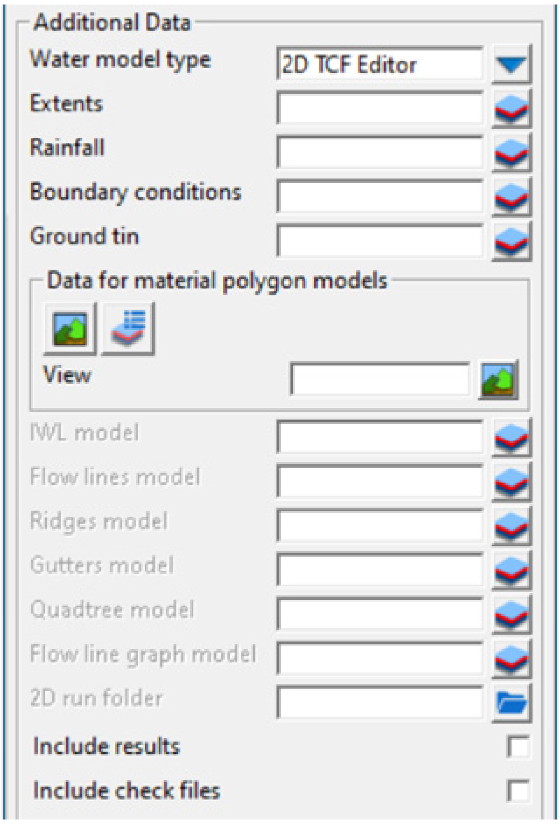
Include check files tick box not ticked

*If **ticked** the check files are included in the zip.*

Continue to 2D Water Analysis or 2D TCF Editor *or* Buttons at Bottom.

2D Water Analysis or 2D TCF Editor

Required for 2D projects using either the TCF Editor or 2D Water Analysis tools.



Material polygon models source box View or List of Models

TCF Editor and 2D Water analysis allow for selection of multiple material models.

IWL model model box

2D initial water level model.

Flow lines model Model box

2D flow lines model.

Ridges model model box

2D ridges model.

Gutters model model box

2D gutters model.

Quadtree model model box

2D quadtree area model.

Flow line graph model model box

2D flow line graph model.

Include results tick box not ticked

*If **ticked** the results files are included in the zip.*

Include check files tick box not ticked

*If **ticked** the check files are included in the zip.*

Continue to Buttons at Bottom.

Buttons at Bottom

Process button

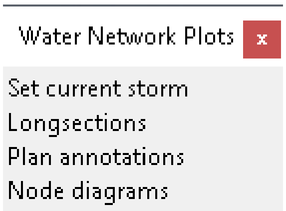
Saves the project and creates the zip file.

Continue to 17.3.10 Water Network Plots or return to 17.3.9.6 Water Network to Zip or 17.3.9 Water Network Tools or 17.3 Water Network.

17.3.10 Water Network Plots

Position of menu: **Water =>Water network =>Plots**

The **Plots** walk-right menu is



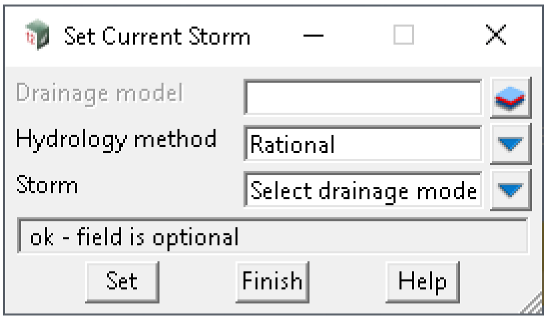
See
17.3.10.1 Set Current Storm
23.7.5 Water Long Section Plot PPF Editor
23.7.8 Water Plan Plot PPF Editor
23.7.12 Water Node Diagram PPF

17.3.10.1 Set Current Storm

Position of menu: **Water =>Water network =>Plots =>Set Current Storm**

??

Selecting **Set Current Storm** brings up the **Set Current Storm** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		available models

??

Hydrology method	choice box		

??

Storm	choice box		

??

Set	button		

??

Continue 17.3.10.2 Water Longsections or return to 17.3.10 Water Network Plots.

17.3.10.2 Water Longsections

Position of menu: **Water =>Water network =>Plots =>Longsections**

The **water long section** option is used to make special long section plots for individual water string, or for all the waters strings in a **water network**.

For full documentation, see 23.7.5 Water Long Section Plot PPF Editor.

Continue to 17.3.10.3 Plan Annotations or return to 17.3.10 Water Network Plots.

17.3.10.3 Plan Annotations

Position of menu: **Water =>Water network =>Plots =>Plan annotations**

The **Plan Annotation is** for creating stormwater and foul water plan plots.

For full documentation, see 23.7.8 Water Plan Plot PPF Editor.

Continue to 17.3.10.4 Node Diagrams or return to 17.3.10 Water Network Plots.

17.3.10.4 Node Diagrams

Position of menu: **Water =>Water network =>Plots =>Node diagrams**

The **Node diagrams** option is used to make special plan plots for the structures of the nodes of water strings.

For full documentation, see 23.7.12 Water Node Diagram PPF.

Continue to 17.3.11 Water Reports or return to 17.3.10 Water Network Plots.

17.3.11 Water Reports

Position of menu: **Water =>Water Network =>Reports**

The **Water Reports** menu contains an option to report on the property controls for the water strings, an option produce network quantities, pit schedules etc.

The **Reports** walk-right menu is

See
17.3.11.1 Water Network Quantities
17.3.11.2 Water Network Report
17.3.11.3 Property Controls
17.3.11.4 Excavation Quantities
17.3.11.5 Pit Schedules
17.3.11.6 Barwon Quantities
17.3.11.7 Barwon House Connections
17.3.11.8 Barwon Design Checks
17.3.11.9 Barwon Services Report
17.3.11.10 Water Dynamic Results Collator
17.3.11.11 Dynamic Reports

17.3.11.1 Water Network Quantities

Position of option on menu: **Water =>Water network =>Reports=> Network Quantities**

The **Network quantities** report contains information about the nodes and links that make up the selected water strings. Configuration files allow the user to specify the depth ranges and sizes of links to report on.

This option creates quantity tables for nodes, links and house connections.

The nodes/links/house connections are summarised by user defined depths and types.

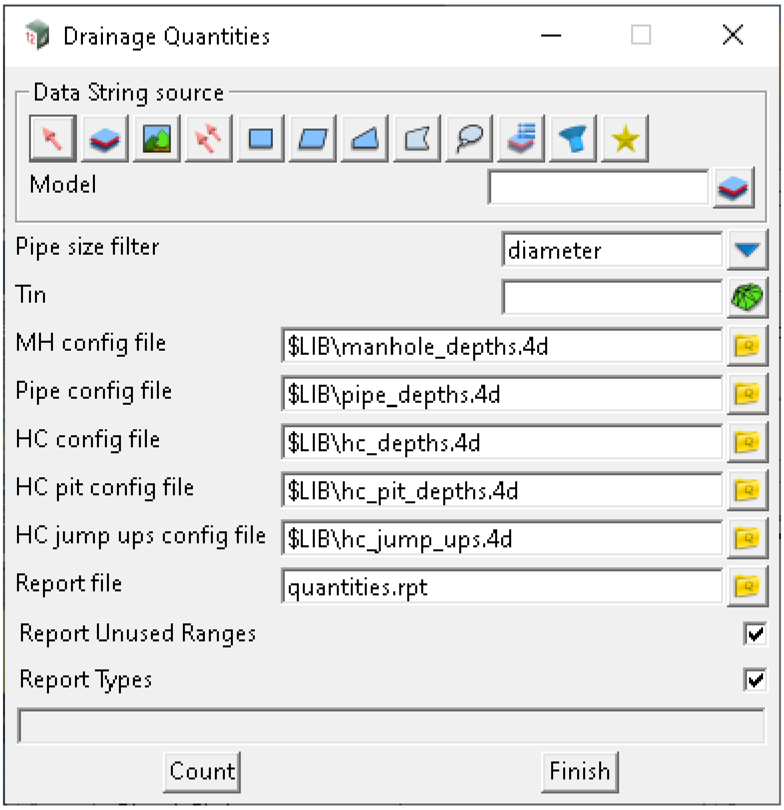
See Also

Drainage overview

Key points

1. Items are counted/totalled by depth and optionally type.
2. The routine will not "double count" items even if the ranges overlap.
3. Types are case sensitive, types with spaces in the name must be enclosed in quotes and the wild card * may be used.
4. Use vertically offset tins and "banded" depth ranges to get quantities under roads, foot paths, *etc.* This is discussed later in detail.
5. Erase count file fields if the items are not to be counted.

On selecting the **Network quantities** option, the **Drainage quantities** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data String Source data source

Usually the entire model is selected but view is also available for combining models. For a full description go to 3.26.3 Data Source.

Selected data source input Model

Source of data to be processed.

Pipe size filter Choice diameter or pipe size attribute

The second item in a count line is used to filter by ***diameter*** *(in meters/ft) or the* ***pipe size attribute****. The* ***diameter*** *can only be used when no box culverts or trapezoidal channels are used. The* ***pipe size attribute*** *is the label generally used in the plan plots. This is the pipe size in mm/inches (375), for box culverts width x height (750x375) and for trapezoidal channels TopwidthBottomwidthxHeight (T5000B1000x500).*

Tin tin box

Tin to use for the pipe and pit depths.

MH config file file box *.4d files

This file specifies the types and depth ranges for the pits. Details of this file are contained below.

Pipe config file file box *.4d files

This file specifies the types and depth ranges for the pipes. Details of this file are contained below.

HC config file file box *.4d files

This file specifies the types and depth ranges for the house connections. Details of this file are contained below.

HC pit config file file box *.4d files

This file specifies the types and depth ranges for the HC pits. Details of this file are contained below.

HC jump ups file file box *.4d files

This file specifies the types and depth ranges for the house connections jump ups. Details of this file are contained below.

Report file file box *.rpt files

A sample report file is given below.

Report unused ranges tick box ticked

*Depth ranges for the pit/pipe/house connections are defined in the *.4d files. Selecting this option will cause the depth ranges in the file to be printed even if there are no pit/pipe/house connections in these depth ranges (zero quantity values will be shown).*

Report types tick box ticked

*Selecting this option will cause the pit/pipe/house connection types used in the model types to be listed (even if quantities are not requested in the *.4d files). Since this is a complete of the type used in the model, the list informs the user what types have not been included in the quantity calculation.*

Buttons at Bottom

Count button

Executes the option.

Finish button

Removes the dialogue from the screen

The *.4d files listed above are contained in the 12d **library** directory. Each line is the file performs a count (count lines). No items are counted twice. Therefore, if an item is counted its type and then a count line is found the wild card is used for the type, the type already counted will not be included in the count.

The format for a count line is three or four values (space delimited) per line. Size is optional.

```
<type (from drainage.4d)>   <size>   <starting depth>   <ending depth>
```

Notes:

All **types** with spaces in the name must be enclosed in quotes The wild card * may be used.

The **size** is optional and if omitted the all sizes will be counted in this group (do not use the * for a wild card).

The **starting depth** and **ending depth** are required for all count lines.

Quantities Under Roads and Footpaths

By creating super tins with vertically offset sections, quantities under roads, footpaths, *etc.* can be determined. for example.

Offset your road design tin up by 1000m (**Tins->Utility->Translate/Copy)** and then use the depth range 1000-1999 for pipes under roads.

Create a tin from the footpaths only, null by angle length with a small length to remove the road and then offset it vertically by 2000m. the depth range 2000-2999 is not the quantities under the footpath.

Sample count lines

```
// sum concrete cover manholes is various ranges

"CONC COVER" 0.0 1.6
"CONC COVER" 1.5 3.0
"CONC COVER" 3.0 999.9  // this is expected to be zero
"CONC COVER" -999.0 0.0 // trap errors

// any that are not Concrete cover will be counted here

* 0.0 1.6
* 1.6 3.0
* 3.0 999.9
```

```
Manhole Quantities
====================================


CONC COVER          0.00    1.60    13      16.506
CONC COVER          1.60    3.00     1       1.510
CONC COVER          3.00   999.9     0       0.000
CONC COVER        -999.0     0.0     0       0.000

*                    0.00  1.60      0       0.000
*                    1.60  3.00      0       0.000
*                    3.00  999.9     0       0.000

  total length = 18.016


  Types Used
  ----------

  CONC COVER

  Diameters Used
  ----------

  1.100
```

Since the **Report unused ranges** tick box was selected, these lines were printed even though there were no pits in the data ranges.

This data results from selecting the **Report types** tick box.

Sample count lines for pipes follow.

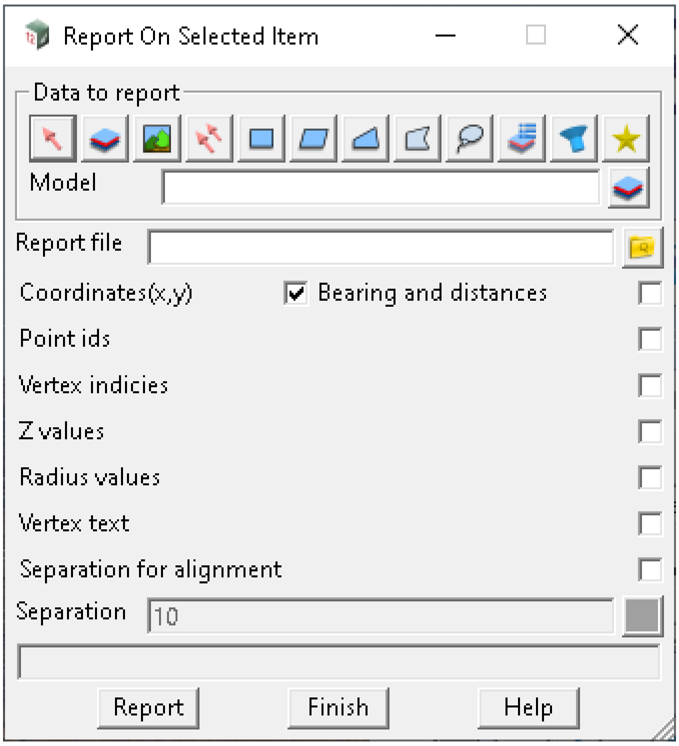
```
// sum class 2 pipes by diameter and for various ranges

// count 375

2 0.375 0.0 2.0
2 0.375 2.0 5.0
2 0.375 5.0 999.

// count 450

2 0.450 0.0 2.0
2 0.450 2.0 5.0
2 0.450 5.0 999.

// count 525

2 0.525 0.0 2.0
2 0.525 2.0 5.0
2 0.525 5.0 999.

// count pipe sizes that were missed

2 * 0.0 2.0
2 * 2.0 5.0
2 * 5.0 999.

// count all other missed pipes

* 0.0 999.
```

Continue to 17.3.11.2 Water Network Report or return to 17.3.11 Water Reports.

17.3.11.2 Water Network Report

Position of option on menu: **Water =>Water Network =>Reports =>Network report**

Selecting **Network report** brings up the **Report on Selected Items** panel.



This is the same as the option **Reports =>Strings =>Coord/ Brd-dst** on the main menu.

For the given model, it prints out the string information for each string in the model.

If a water network model is given, each water string in the network model is reported on.

For further information, go to 24.2.1 Coordinates or Bearing-Distance Report.

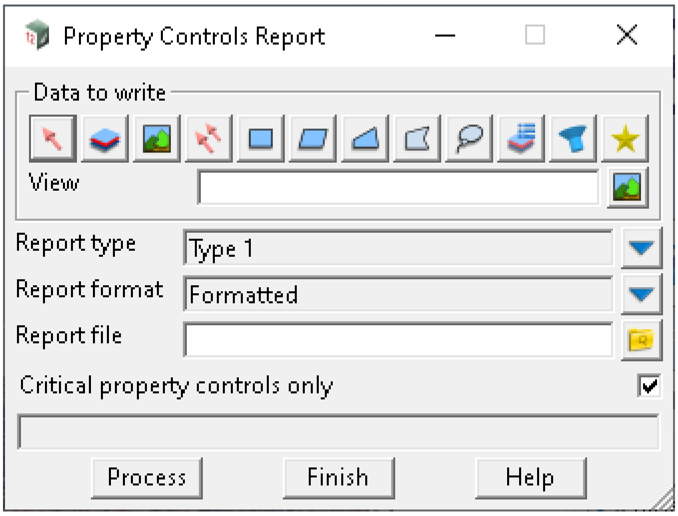
Continue to 17.3.11.3 Property Controls or return to 17.3.11 Water Reports.

17.3.11.3 Property Controls

Position of option on menu: **Water =>Water Network =>Reports =>Property Controls**

The property controls report contains information about all the property controls for the selected drainage strings, and if required, denote the critical property control for a lot.

On selecting **Property controls,** the **Property Controls Report** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to write	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Data source for the drainage strings to process.

Report type	choice box	Type 1	Type 1 or Type 2

??

Report format	choice box	Formatted	Formatted or Tab-delimited

Format for the property control report.

Report file	file box		*.rpt files

Name of the file for the report.

Critical property controls only	tick box	ticked	

*If **ticked**, only the critical property controls are reported.*

Buttons at Bottom

Process	button		

Run the option.

Continue to 17.3.11.4 Excavation Quantities or return to 17.3.11 Water Reports.

17.3.11.4 Excavation Quantities

Position of option on menu: **Water =>Water Network =>Reports =>=>Excavation quantities**

See Also

Drainage overview

This routine uses 12d templates to calculate the excavation volume for all of the drainage strings in a model. An option to create section for a tin on top of the pipe is also available so that the drainage long sections can include hatching between the obvert of the pipe and the design tin under roads.

Templates with names set to the pipe diameters (times 1000) are used for the calculations, thus trench shapes can be customised and over excavation for bedding materials can be included. Net area calculations to exclude pipe area are not supported.

Key points

1. One template for each pipe size (mm)
2. If obvert templates are used, add the prefix “obvert “to the pipe size
3. Carefully consider the tin selected.

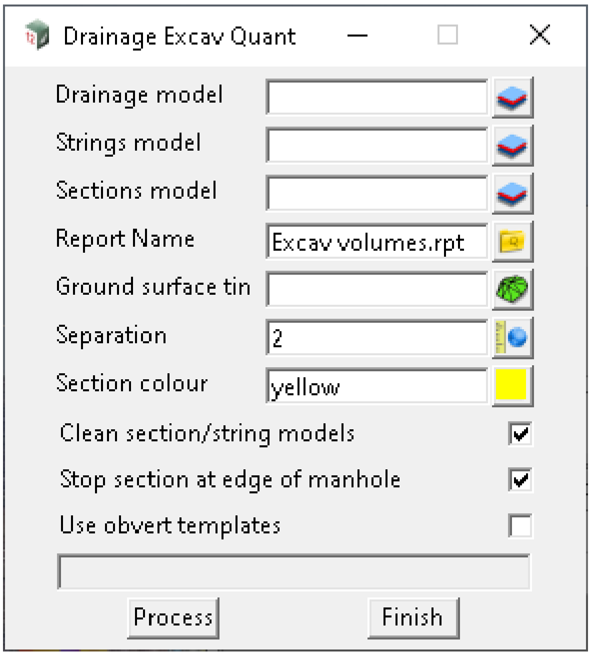
A template must exist for each pipe size in the model (pipe size x 1000). For example a 0.3m pipe will require a template to exist named 300. A 0.5ft pipe would require a template named 500. A sample template library is included in the 12d library in the file **pipe_template.tpl**.

The templates are run along the strings and the total volumes are reported. Volumes for each strings are given in the report file.

If a tin is created from these strings then volumes by depth can be determined using

Design =>Volumes =>Exact =>Tin to tin

On selecting the **Excavation quantities** option, the **Drainage Excavation Quantities** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		available models

Model to contain all of the pit and pipe network to be worked on.

Strings model model box available models

Strings generated from the templates will be stored in this model.

Sections model model box available models

Sections generated from the templates will be stored in this model.

Report name file box *.rpt files

Cut and fill volumes will be sent to this report.

Ground Surface Tin tin box

Tin from which the volumes will be calculated.

Separation real box 2

Distance between the sections.

Sections colour colour box yellow

Sections generated from the templates will be assigned this colour (strings colours are defined in the templates).

Clean section/strings model tick box ticked

Delete the strings in these models before processing.

Stop section at edge of pit tick box ticked

Template are run from pit centre to centre if this is not selected. The templates stop at the edge of the pit if selected. This is often selected with the following option ***Use obvert templates.***

Use obvert templates tick box not ticked

Templates must be named with the prefix "obvert". i.e. ***obvert 300.*** *The template is still run along the invert of the pipe but the user now has a section "set" of templates that can be used to create a tin on top of the pipe as well as below.*

An example report file follows.

```
----------------------------- BEGIN APPLY TEMPLATE REPORT ------------------------------

 apply template to string report -

   string         E
   tin            design
   separation         10.000
   left template  375
   right template 375
   cut volumes and areas are negative
   fill volumes and areas are positive


 chainage-  ------sectional   information------   ------intermediate   information----       ---------accumulative
information-------
          ---------- ---cut area --fill area ------------ ----cut vol ---fill vol    -cut volume-- -fill volume- -
--balance---


    0.000              -1.434      0.000                                           0.000        0.000        0.000
                                                              -0.771       0.000
    0.550              -1.367      0.000                                          -0.771        0.000       -0.771
                                                             -14.222       0.000
   10.000              -1.642      0.000                                         -14.992        0.000      -14.992
                                                             -15.293       0.000
   20.000              -1.416      0.000                                         -30.286        0.000      -30.286
                                                              -1.845       0.000
   21.313              -1.393      0.000                                         -32.130        0.000      -32.130
                                                              -0.794       0.000
   21.863              -1.493      0.000                                         -32.924        0.000      -32.924

 total cut                        -32.924
 total fill                         0.000
 balance                          -32.924
 ie excess of cut over fill        32.924
```

Buttons at Bottom

Process button

Process the option.

Continue to 17.3.11.5 Pit Schedules or return to 17.3.11 Water Reports.

17.3.11.5 Pit Schedules

Position of option on menu: **Water =>Water network =>Reports =>Pit schedule**

See Also

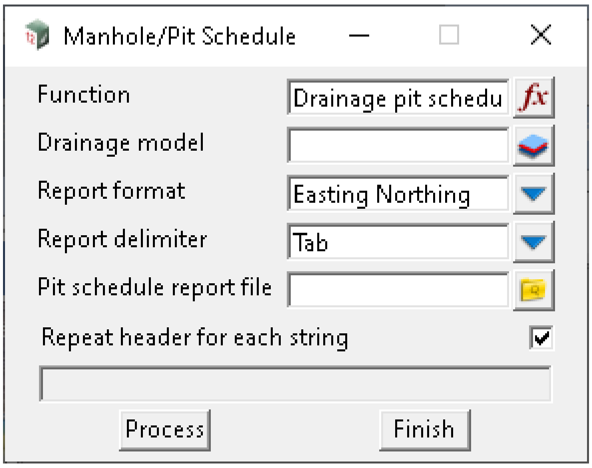
Selecting design string or tin?

Drainage overview

Usage

This routine prints the calculations from the last time **Set Node Details** was selected in the 17.3.4 Water Network Editor (WNE).

On selecting the **Pit schedule** option, the **Manhole/Pit Schedule** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function	function box		

??

Drainage model	model box		available models

Model containing the drainage strings.

Report Format	choice box	Road chainge.,Easting...	

File format.

Report delimiter	choice box	Tab, Space	

Tab delimiters are best for spreadsheets and space for some text editors.

Pit schedule file name	input box	pit report	

File to be created.

Repeat header for each string	tick box	selected	

When selected, the column headings will be printed each drainage string.

Buttons at Bottom

Process button

Create the pit report.

Finish button

Remove the panel from the screen.

Notes:

The columns of data may be separated by spaces or a tab. (tab is used for spreadsheet transfers). The internal width and length data are retrieved from the **drainage.4d** file for the pit type specified. If you want a longer description for the pit then the type used inside 12d this can also be entered in the drainage.4d file. The remarks for each pit are entered as user defined pit attribute named **remarks** and may be set using the attribute editor (on the drainage menu) or via a spreadsheet.

Easting Northing Sample

```
.PIT SCHEDULE
  Pit                            INTERNAL          INLET          OUTLET
PIT
  No    TYPE    EASTING NORTHING    WD       LEN     DIA   INV LEV   DIA   INV LEV  FIN RL
DEPTH          REMARKS
   B1   SA2    5302.458 7336.936  450.000  900.000                  375   28.210   29.387
1.177
   A2   SA2    5264.372 7322.036  450.000  900.000   375   27.470                  28.646
1.226
   C1   SA2    5224.155 7336.936  450.000  900.000                  375   26.690   27.863
1.173
   A3   SA2    5187.910 7322.036  450.000  900.000   375   25.930                  27.158
3.628
   A1   SA2    5309.458 7321.100  450.000  900.000                  225   28.550   29.577
1.027
    A2   SA2     5264.372 7322.036  450.000  900.000    225   27.470    375   27.420
28.646    1.226
    A3   SA2     5187.910 7322.036  450.000  900.000    375   25.930    375   23.530
27.158    3.628
  A4   SA2   5157.411 7321.332  450.000  900.000   375   23.090                   26.714
3.624 outlet to existing system
NOTE:
1. ALL SETOUT POINTS QUOTED TO CENTRE OF PIT
```

Road Chainage Offset Example

DRAINAGE LINE A

PIT	PIT LOCATION		LOCATION OFFSETS	
No.	EASTING	NORTHING	STATION	CTRLOFFSTYPEREMARKS
A/1	5354.629	7336.936	231.171	d002-7.450
A/2	5340.691	7320.911	217.233	d0028.575
A/3	5293.458	7320.886	170.000	d0028.600
A/4	5250.131	7320.886	126.673	d0028.600
A/5	5217.194	7322.036	93.736	d0027.450
A/6	5183.458	7322.036	60.000	d0027.450
A/7	5152.699	7322.036	29.241	d0027.450

Notes

The **Set node details** must be run at least once to before printing the report. If the pits are moved or the designed strings changed then this option must re rerun.

The easting northing data obtained for the **road design string** option is obtained by dropping the pit centre perpendicular onto the selected road design string. This data is stored as pit attributes **setout x** and **setout y**. It is calculated when the **Set Pit Detail** is selected in the 17.3.4 Water Network Editor (WNE).

Continue to 17.3.11.6 Barwon Quantities or return to 17.3.11 Water Reports.

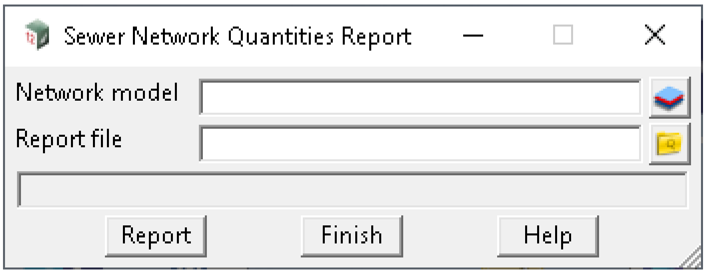
17.3.11.6 Barwon Quantities

Position of option on menu: **Water =>Water Network =>Reports =>Barwon quantities**

The report generated from this option includes

- the lengths of each pipe type for each line and the total length for each pipe type for all pipes in the network.
- the quantity of concrete used for the manholes in the network.
- the number and type of house connections in the network, including caps, bends and bushes.

After selecting the **Barwon quantities** option, the **Sewer Network Quantities Report** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Network model	model box		available models

Model containing the sewer strings.

Field Description	Type	Defaults	Pop-Up
Report file	file box		*.rpt files

Name of the file for the report.

Buttons at Bottom

Report button

Run the option.

Continue to 17.3.11.7 Barwon House Connections or return to 17.3.11 Water Reports.

17.3.11.7 Barwon House Connections

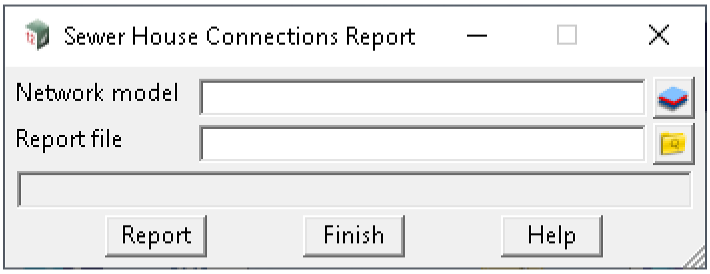
Position of menu: **Water =>Water Network =>Reports =>Baron HC's**

The house connections report contains information about all the house connections for the selected drainage (sewer) strings.

The house connection report includes for each house connection (branch) the

- name of the sewer line
- downstream manhole for the house connection
- lot name
- house connection number and type
- chainage of the house connection
- the invert level at the end of the house connection (IL branch)
- the invert level of the house connection at the sewer pipe (IL sewer)
- the drop over the house connection (branch depth)

On selecting **House connections**, the **Sewer House Connections Report** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Network model	model box		available models

Model containing the sewer strings.

Report file	file box		*rpt files

Name of the file for the report.

Buttons at Bottom

Report	button

Run the option.

Continue to 17.3.11.8 Barwon Design Checks or return to 17.3.11 Water Reports.

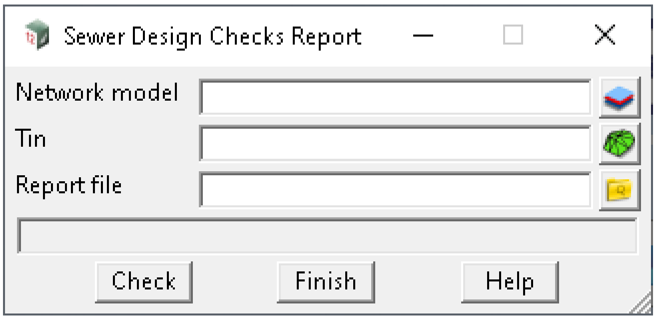
17.3.11.8 Barwon Design Checks

Position of option on menu: **Water =>Water Network =>Reports =>Barwon design checks**

The report generated from this option includes the design checks

- network validations (checks that there are strings, no closed loops)
- manholes don't have negative drops
- other sewer lines connecting in don't have negative drops
- sewers flows downhill with a minimum grade
- manholes are not too close together (*i.e.* on top of each other)
- a minimum cover for each sewer line
- block controls are above the pipe invert level

After selecting the **Design checks** option, the **Sewer Design Checks Report** panel is displayed



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Network model	model box		available models
Model containing the sewer strings.			
Tin	tin box		available tins
Tin used for checking minimum cover against.			
Report file	file box		*.rpt files
Name of the file for the report.			

Buttons at Bottom

Report	button		
Run the option.			

Continue to 17.3.11.9 Barwon Services Report or return to 17.3.11 Water Reports.

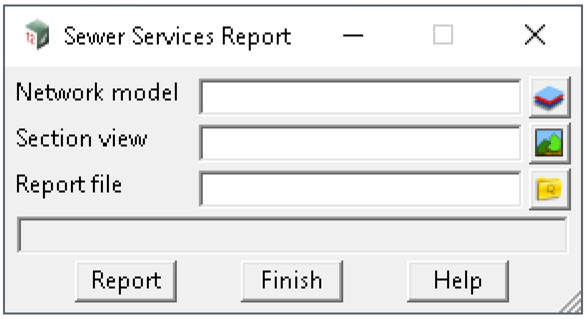
17.3.11.9 Barwon Services Report

Position of option on menu: **Water =>Water network =>Reports =>Barwon service reports**

For each sewer string in the network, this option generates a report which includes the

- section through any tins on the section view
- name and model of any services in the corridor defined by the section view
- coordinates and chainages of the parts of the service in the corridor, and the chainage and offset for each of the point of the parts projected onto the sewer centre-line.
- clearance at the point where any service goes under or over the sewer string.

After selecting the **Barwon service reports** option, the **Sewer Services Report** panel is displayed



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Network model	model box		available models
Model containing the sewer strings.			
Section view			available section views
Section view defining the corridor and service models.			
Report file	file box		*.rpt files
Name of the file for the report.			

Buttons at Bottom

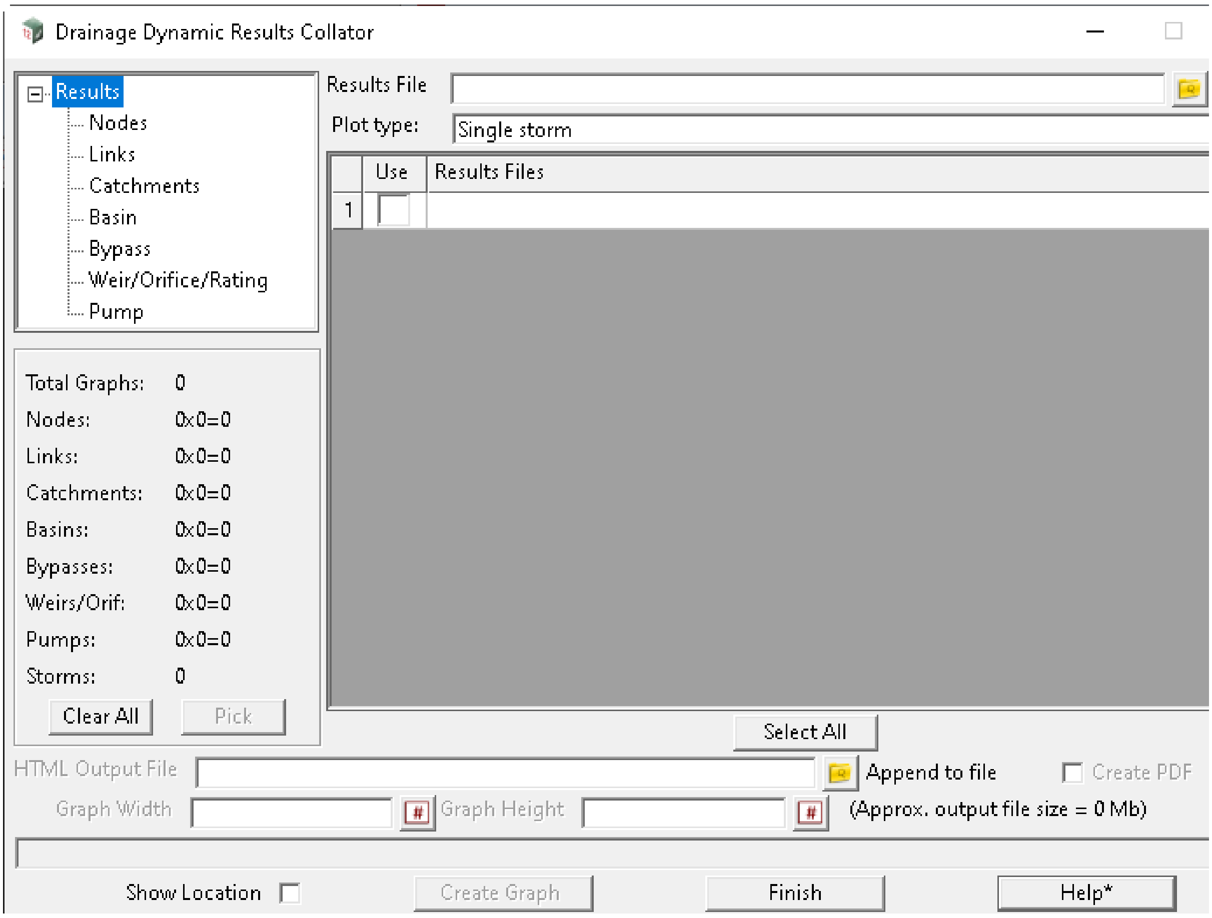
Report	button
Run the option.	

Continue to 17.3.11.10 Water Dynamic Results Collator or return to 17.3.11 Water Reports.

17.3.11.10 Water Dynamic Results Collator

Position of menu: **Water =>Water Network =>Reports =>Dynamic graphs**

Selecting **Dynamic graphs** brings up the **Water Dynamic Results Collator** panel.



Continue to 17.3.11.11 Dynamic Reports or return to 17.3.11 Water Reports.

17.3.11.11 Dynamic Reports

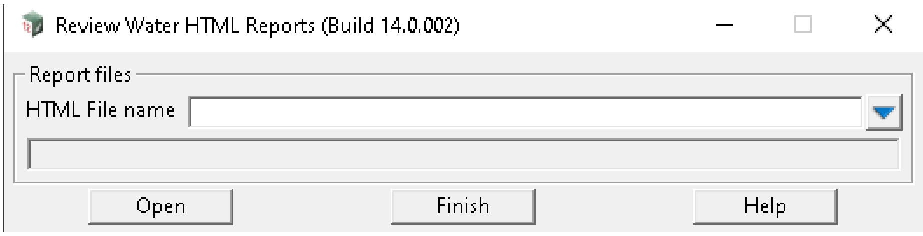
Position of menu: **Water =>Water network =>Reports =>Dynamic reports**

This option displays the 1D Dynamic Analysis Report.

This option is rarely if ever used in a stand-alone manner.

It is most commonly used at the end of an analysis run in which case the panel is not displayed, and the HTML file is **automatically created and opened**. See 17.5.5.6 Dynamic Drainage Error/ Warning Report.

Selecting **Dynamic reports** brings up the **Review html Reports** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
HTML file name	choice box		

The choice box shows a list of all results HTML files found in this project.
The HTML files are a "user-friendly" version of the text .rpt file created during the analysis run.

Open	button		

Opens the HTML given in **HTML file name**.

12d Model 1D Dynamic Drainage Analysis Report

Project: Stormwater Part 1
Directory: D:\12d\Training\Duplicate Pipes V15
User: geoff
Created: Tue Oct 24 08:55:39 2023

12d Dynamic Drainage Analysis V15 (Build 15.1.031)

12dModel 1D Dynamic Drainage Analysis 15.0C1r (Macro Version 224)

Storm Id: 3032 Duration: 25 mins AEP: 2 % (minor)

ID: 26N27LC21

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

CONTENTS

ANALYSIS OPTIONS

Parameters	
Flow Units	m^3/s
PROCESS MODELS:	
Rainfall/Runoff	YES
Snowmelt	NO
Groundwater	NO
Flow Routing	YES
Ponding Allowed	NO
Water Quality	NO
Hydrology Method	TIME-AREA (DRAINS)
Infiltration Method	HORTON (DRAINS)
Flow Routing Method	DYNWAVE
Starting Date	JAN-01-2008 00:00:00
Ending Date	JAN-01-2008 02:40:00
Antecedent Dry Days	0.0
Report Time Step	00:00:30
Wet Time Step	00:01:00
Dry Time Step	00:01:00

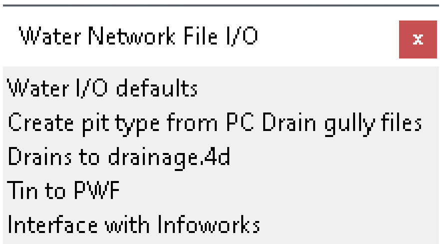
Continue to 17.3.12 Water String File I/O or return to 17.3.11 Water Reports.

17.3.12 Water String File I/O

Position of menu: **Water =>Water Network =>File I/O**

Position of menu: **Design =>Drainage-Sewer=>Reports**

The **File I/O** walk-right menu is



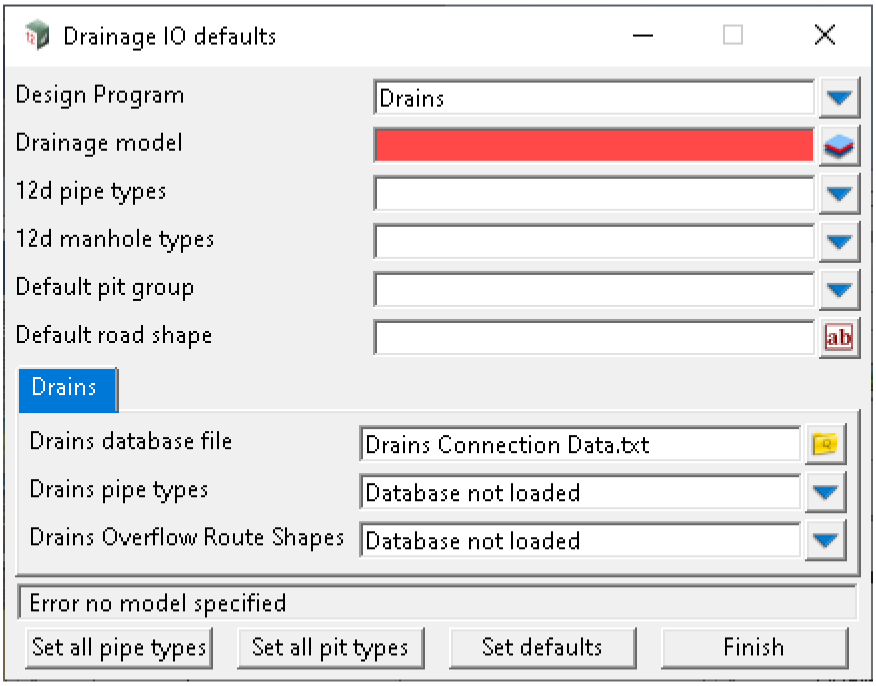
See
17.3.12.1 Water I/O Defaults
17.3.12.2 PCdrain to 12d pit converter
17.3.12.3 Creating drainage.4d file from Drains Database Dump
17.3.12.4 Tin to PWF
17.3.12.5 Interfacing with Infoworks

17.3.12.1 Water I/O Defaults

Position of option on menu: **Water =>Water network =>File I/O=> Water I/O defaults**

??

On selecting the **Water I/O defaults** option, the **Drainage IO defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Design Program	choice box	Drains	
??			
Drainage model	model box		
??			
12d pipe types	choice box	RCP	
??			
12d manhole types	choice box	RD PIT	
??			
Default pit group	choice box		
??			
Default road shape	input		
??			
Drains database file	file box		
??			
Drains pipe types	choice box		

??

Drains Overflow Route Shapes choice box

??

Set all pipe types button

??

Set all pit types button

??

Set defaults button

??

Continue to 17.3.12.2 PCdrain to 12d pit converter or return to 17.3.12 Water String File I/O.

17.3.12.2 PCdrain to 12d pit converter

Position of option on menu: **Water =>Water Network =>File I/O =>Create pit type from PC Drain gully files**

Create Pit type from PC Drain gully files

This option is used to read a PCdrain gully file and create the same pit type in the 12d drainage.4d file. The sag pits in the gully file have an "S" added as a suffix as they are imported.

Important: ***12d Model*** must be restarted to see the new pit types.

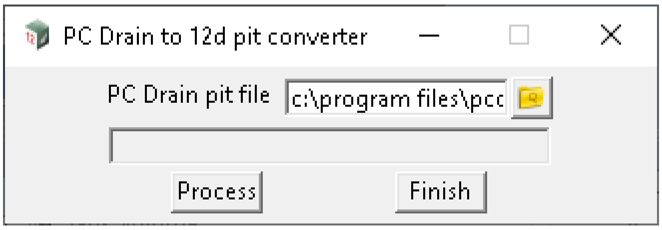
See Also

Drainage overview

Usage

This panel is accessed from the menu selection **Design => Drainage Sewer => More=>Create Pit type from PC Drain gully files.**

On selecting the **Create pit type from PC Drain gully files** option, the **PC Drain to 12d pit converter** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
PCdrain pit file	file box		

The PCdrain gully file to be imported into 12d.

Buttons at Bottom

Process	button

Import the data file.

Finish	button

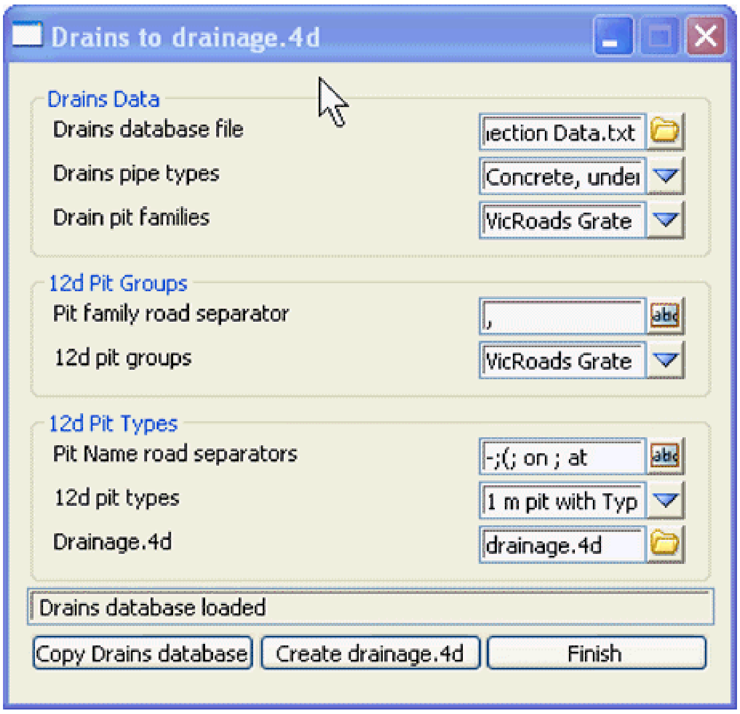
Removes the dialogue from the screen.

Continue to 17.3.12.3 Creating drainage.4d file from Drains Database Dump or return to 17.3.12 Water String File I/O.

17.3.12.3 Creating drainage.4d file from Drains Database Dump

Position of option on menu: **Water =>Water Network =>File I/O =>Drains to drainage.4d**

On selecting the **Drains to drainage.4d** option, the **Drains to drainage.4d** panel is displayed.



Key Points

When you are finished, open the drainage.4d file and check the road grade and crossfall values for the ongrade curves!

1. If Drains is used to selected the pit sizes
   then the 12d pit type must be the prefix of the Drains pit size (**Pit Name road separators** are used).

   If 12d is used to select the pit sizes to export to Drains, the Drains **Pit Size** and 12d **Pit types** have to match, exactly! The pit databases supplied by Drains often have road grade and/or crossfall attached to the end of the pit size. If pit sizes are to be sent from 12d, **this must be removed**! Find **Prepare the Drains Pit Database** for more details.
2. Select **Copy Drains database (12d will search the usual locations for the Drains database).**
3. Review the **Drains pipe types** and **Drains pit families** lists to ensure you have the correct database.
4. 12d pit groups are not used in Version 8.
5. **Pit Name road separators** can only be used if **Drains** is selecting the pit types. If 12d pit types are to be exported to Drains, this field should be left blank. If you change these entries you must press the enter key to update the **12d pit types** list below.
6. Check the **12d pit types** and if they are acceptable select **Create drainage.4d.**

The Details

YOU MUST RESTART 12D FOR THE NEW DRAINAGE.4D FILE TO BECOME ACTIVE!

Field Description Type Defaults Pop-Up

Drains database file file box Drains Connection Data.txt

You must update this file from Drains before each use of this panel. Inside Drains select Project =>Overflow Route database. Then select OK and then YES. This will cause Drains to export the database to the file "Drains Connection Data.txt".

*Selecting **Copy Drains database** will cause the panel to search for the database dump in the folders **C:\Program Files\Drains\Program** and **C:\Program Files\Drains\Demo\Program**. If the Drains program is installed in another folder then you must browse for the file. The file will be read and the panel updated with the other selection.*

Drainage.4d file box drainage.4d

Drainage.4d will be created in the 12d working folder unless otherwise specified. It will only be used for 12d projects in this folder.

Pit families choice box Drains pit families

*These are the Drains pit families that will be exported to the drainage.4d file. These will become the names ongrade inlet capacity curves for all the pit sizes that belong to the family. The pit family name will be searched for words like **grade**, **slope** etc to try to determine the values for road grade and crossfall for the 12d capacity curves.*

Pipe type choice box Drains pipe types

These are the Drains pipe types that will be exported to the drainage.4d file.

Pit group separatorinput box

*Pit groups are not used in Version 8. These characters will be used to remove the road grade crossfall data from the **Pit families** above. The data before this character will become the **12d pit groups.** Press **Enter** or select **Read Drains database** to create a new list of **12d pit groups.***

12d pit groups choice box 12d pit groups

*These are created from the Pit family list above by deleting all text after the **Pit group separator**.*

Create drainage.4dbutton

Create a drainage.4d file.

Continue to 17.3.12.4 Tin to PWF or return to 17.3.12 Water String File I/O.

17.3.12.4 Tin to PWF

Position of option on menu: **Water =>Water Network =>File I/O => Tin to PWF**

This option converts a 12d tin to a PWF file, for Micro Drainage WinDes.

On selecting the **Tin to PWF** option, the **TIN to PWF** panel is displayed.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin	tin box		

Tin to convert to a PWF file.

Field Description	Type	Defaults	Pop-Up
PWF file name	file box		

Name of the file to be created.

Buttons at Bottom

Field Description	Type	Defaults	Pop-Up
Run	button		

Runs the option.

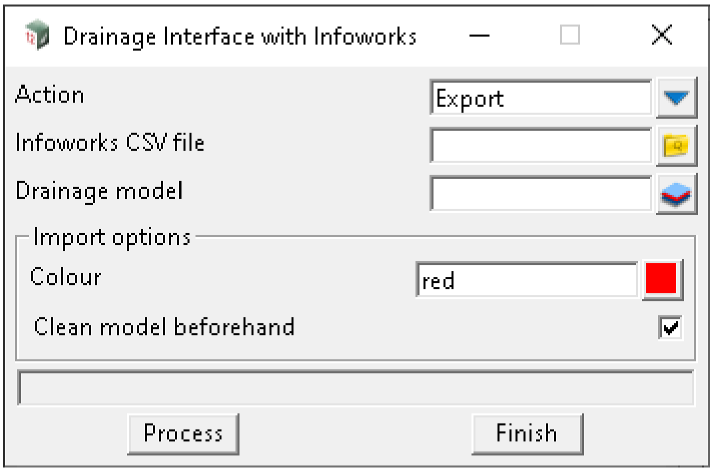
Continue to 17.3.12.5 Interfacing with Infoworks or return to 17.3.12 Water String File I/O.

17.3.12.5 Interfacing with Infoworks

Position of option on menu: **Water =>Water Network =>File I/O => Interface with Infoworks**

??

On selecting the **Interface with Infoworks** option, the **Drainage Interface with Infoworks** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Action	choice box	Export	Import, Export

??

Field Description	Type	Defaults	Pop-Up
Infoworks CSV file	file box		
Drainage model	model box		
Colour	colour box	red	
Clean model beforehand	tick box	ticked	

Deletes any existing data from the plot model.

Button at Bottom

Process button

Process the option.

Notes on this option

Code

// Description:

//

// Reads/Writes a CSV file containing the following 21 columns:

//

// us_node_id, SW 1.000,

// ds_node_id, SW 1.005,

// us_invert, 3.2,

```
// ds_invert,               3.14,
// conduit_length,          28.6,
// gradient,                0.0021,
// shape,                   CIRC,          (CIRC,RECT)
// conduit_width,           675,
// conduit_height,          675,
// bottom_roughness,        0.6,
// top_roughness,           0.6,
// us_node_x,               541147.4,
// us_node_y,               180379.3,
// us_node_ground_level,    5.2,
// us_node_chamber_area,    1.6,
// us_node_node_type,       Manhole,       (Manhole, Outfall, Storage, Break)
// ds_node_x,               541146.7,
// ds_node_y,               180407.9,
// ds_node_ground_level,    5.2,
// ds_node_chamber_area,    1.6,
// ds_node_node_type        Manhole,       (Manhole, Outfall, Storage, Break)
//
// Further Notes:
//
//1) Import: The macro will always create new drainage strings in 12d. It will
//not update existing strings (but there is an option to delete them beforehand).
//
//2) Import: Pit and Pipe types are not defined in the CSV data, so they are set
//based on the default settings under "Design=>Drainage-Sewer =>Defaults" menu.
//
//3) Import: Where downstream [or upstream] node (x,y) on a line in the CSV file, matches with
//the upstream [or downstream] node (x,y) on the next line, 12d will join the pipes together,
//to form longer drainage strings in 12d. As such, the imported result depends on
//the order of the lines in the CSV file.
//
//4) Export: Pipes (lines) are always exported to the CSV file, ordered by string,
//in an upstream to downstream fashion (regardless of whether the flow direction
//is same as or opposite to string direction).
//
//5) Import/Export: Infoworks values "us_node_node_type" & "ds_node_node_type"
//are not really required by 12d, as 12d can automatically detect outfalls (which
//may possibly have storage basins). On import, these Infoworks values are stored
//as pit attributes "infoworks node type". On export, all non-outfall nodes are
//exported as "Manhole" regardless of the attribute. And outfall nodes are
```

//exported as:

//a) Attribute "infoworks node type" (if found),

// otherwise as:

//b) "Storage" (if either attribute "basin discharge" or "basin volume" is found),

// otherwise as:

//c) "Outfall".

//

//6) Import: 12d does not support multiple pipes forming a junction at an

//outfall. If this is imported from Infoworks, the analysis part of the software

//may complain about duplicate pit names. Suggest creating a small "dummy" outlet

//pipe from the "real" outfall junction, to resolve this inconsistency.

//

//7) Import: 12d does not support bifurcating (diverging) flows. If a bifurcation

//is imported from Infoworks, it will be treated as a separate, unconnected pipe

//at the bifurcation, and the analysis part of the software may complain about

//duplicate pit names. Successful analysis of bifurcations in 12d, is a

//semi-manual process, and requires unique pit names.

//

//8) Import/Export: Infoworks chamber areas (A) are related to 12d pit diameters

//(D), via A = 0.25*pi*D^2.

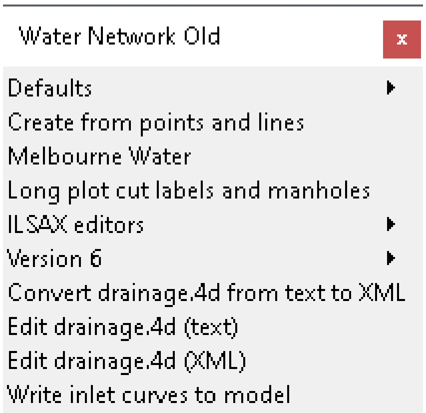
Continue to 17.3.13 Water Network Old or return to 17.3.12 Water String File I/O.

17.3.13 Water Network Old

Position of menu: **Water =>Water network =>Old**

The **Old** menu is for options before the change over to using ***Water***, ***Nodes*** and ***Links***.

The **Old** walk-right menu is



See

17.3.13.1 Defaults
17.3.6.4 Create from Points and Lines
17.3.13.2 Melbourne Water Longsections
17.3.13.3 Long Plot Cut Labels and Manholes
17.3.13.4 ILSAX Editors
17.3.13.5 Version 6
17.3.13.9 Convert to XML drainage.4d
17.3.13.10 Editing a Text drainage.4d file

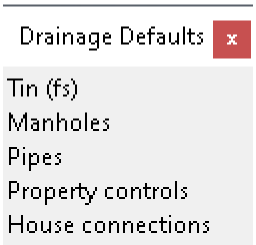
17.3.13.11 Write Inlet Curves to Model

17.3.13.1 Defaults

Position of menu: **Water =>Water string =>Old =>Defaults**

The **Defaults** menu sets default tin, node (maintenance hole) information, water link information, property control (sewer module only) and house connection (sewer module only) defaults which are all used when defining water networks.

The **Defaults** walk-right menu is



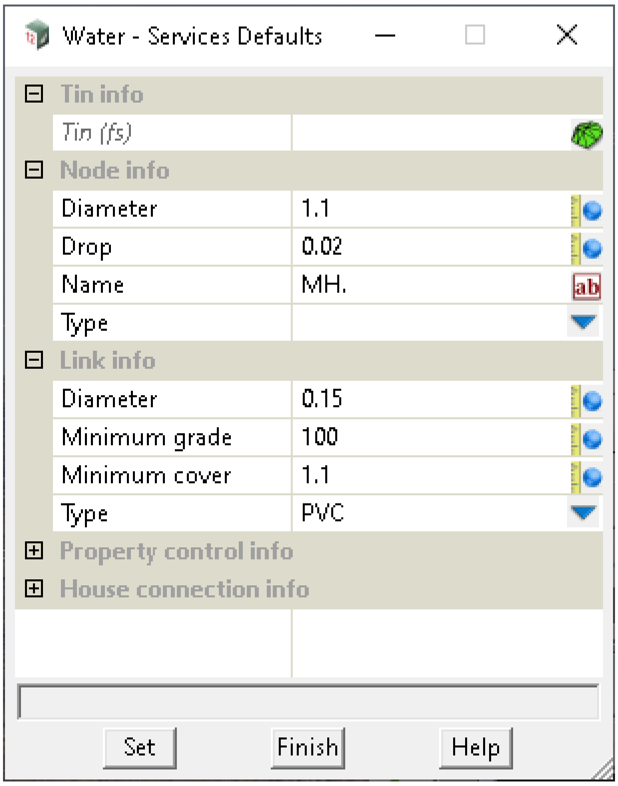
See
17.3.13.1.1 All Drainage Defaults
17.3.13.1.2 Tin (fs)
17.3.13.1.3 Links (Maintenance Holes)
17.3.13.1.4 Links
17.3.13.1.5 Property Controls
17.3.13.1.6 House Connections

17.3.13.1.1 All Drainage Defaults

Position of option on menu: **Water =>Network =>Water string defaults**

This panel is for setting all the defaults in the one panel rather that going to the individual menu items.

On selecting **All Drainage defaults**, the **All Drainage Defaults** panel is displayed.



Each of the fields are documented in the individual menus items.

For Tin (fs) see 17.3.13.1.2 Tin (fs)

For Node info, see 17.3.13.1.3 Links (Maintenance Holes)
For Link info, see 17.3.13.1.4 Links
For Property controls info, see 17.3.13.1.5 Property Controls
For House connection info, see 17.3.13.1.6 House Connections

Continue to 17.3.13.1.2 Tin (fs) or return to 17.3.13.1 Defaults.

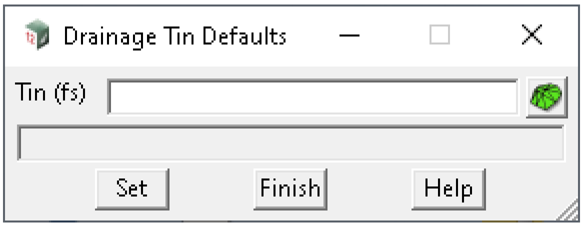
17.3.13.1.2 Tin (fs)

Position of option on menu: **Water =>Network =>Old =>Defaults =>Tin (fs)**

This panel is for setting the default finished surface tin in the **Create Drainage Strings** panel which is used for creating a new drainage string.

For the drainage string, the finished surface tin is used as the surface that manholes automatically sit on when z float is set on, and for defining cover when placing controls and connections.

On selecting the **Tin (fs)** option, the **Drainage Tin Defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin (fs)	tin box		available tins

Tin to use as the default finished surface tin.

Set	button		

Runs the option.

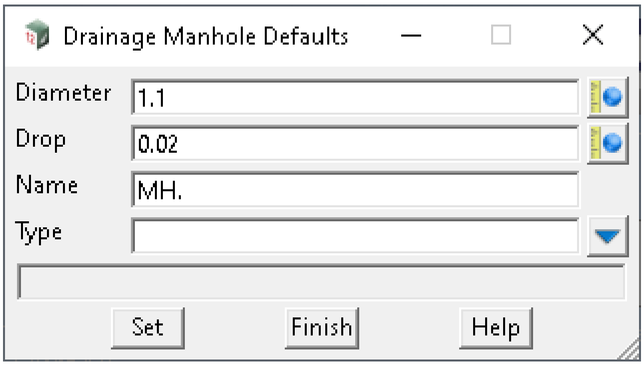
Continue to 17.3.13.1.3 Links (Maintenance Holes) or return to 17.3.13.1 Defaults.

17.3.13.1.3 Links (Maintenance Holes)

Position of option on menu: **Water =>Network =>Old =>Defaults =>Manholes**

These defaults are used when creating a link (maintenance hole) in a water string.

On selecting the **Manholes** option, the **Drainage Manhole Defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Diameter	input	1.1	
Default diameter of a drainage node.			
Drop	input	0.02	
Drop (metres) through the node.			
Name	input	MH.	
Default name for the node Note that if a node name is EOL or eol, then the diameter of the node is forced to be zero.			
Type	input	CONC COVER	CONC COVER, GATIC
Default cover or lid type of the node.			
Set	button		
Set the drainage node defaults to the values in the above fields.			

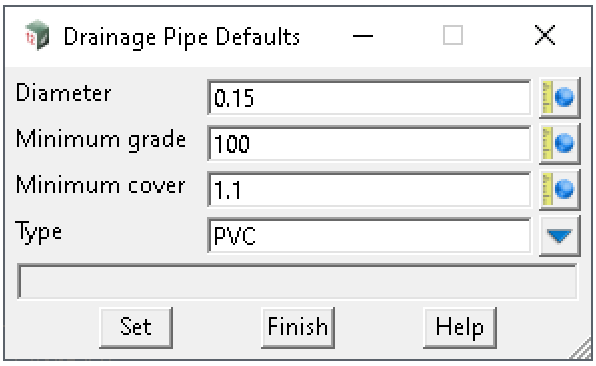
Continue to 17.3.13.1.4 Links or return to 17.3.13.1 Defaults.

17.3.13.1.4 Links

Position of option on menu: **Water =>Network =>Old =>Defaults =>Pipes**

This panel is for setting the default water link diameter, grade, cover and type. These defaults are used when creating a link in a water string.

On selecting the **Pipes** option, the **Drainage Pipes Defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Diameter	input	0.1	

Default diameter of the link.

Minimum grade	input	1.0	

Minimum grade (measured as 1: value) used when laying down the link.

Minimum cover	input	1.0	

Minimum cover, measured in world units from the surface to the top of the link (obvert); used when laying down the link.

Type	input	PVC	PVC, VC, PVC X/HEAVY

Default type of the link.

Set	button		

Set the water link defaults to the values in the above fields.

IMPORTANT NOTE.

If the water string is laid down in the direction of flow (and hence the flow direction is in ascending chainage), then the minimum grade and minimum cover along the link are maintained as the water string is created. Otherwise the minimum grade and cover cannot be maintained.

Cover for the link segment can also be calculated and/or set afterwards by the **pipe=>cover** option in the water string editor.

Minimum cover and minimum grade for the link segment to the end of the line can be set afterwards by the **pipe=>default grading** option in the water string editor.

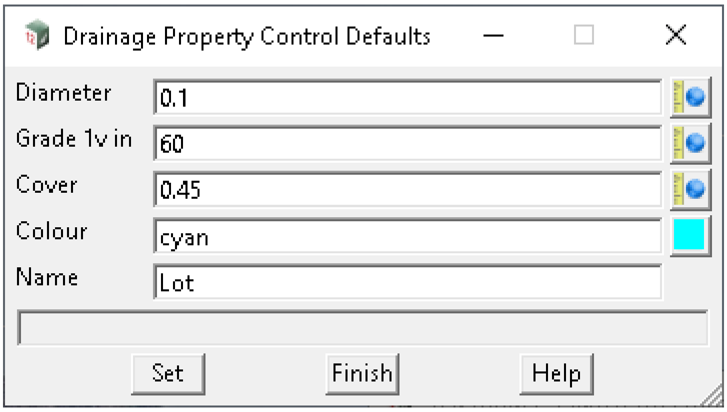
Continue to 17.3.13.1.5 Property Controls or return to 17.3.13.1 Defaults.

17.3.13.1.5 Property Controls

Position of option on menu: **Water =>Network =>Old =>Defaults =>Property Controls**

On a section view, the *Profile =>One substring* and *Profile =>Many substrings* options will profile the property control. Note that the centre (axis) of the property control is drawn on the section view, not the invert (bottom) or the obvert (top).

On selecting the **Property controls** option, the **Drainage Property Control Defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Diameter	input	0.1	
Default diameter of the property control.			
Grade 1v in	input	60	
Grade (units are "1v in" given value) to use for the property control.			
Cover	input	1.0	
*Cover measured from the surface to the **top** of the property control (world units) to be maintained from the end of the property control in the house block to the drainage string.*			
Colour	input	cyan	available colours
Colour to use to draw the property control.			
Name	input	Lot	
Name for the property control - usually the lot number.			
Set	button		
Set the property control defaults to the values in the above fields.			

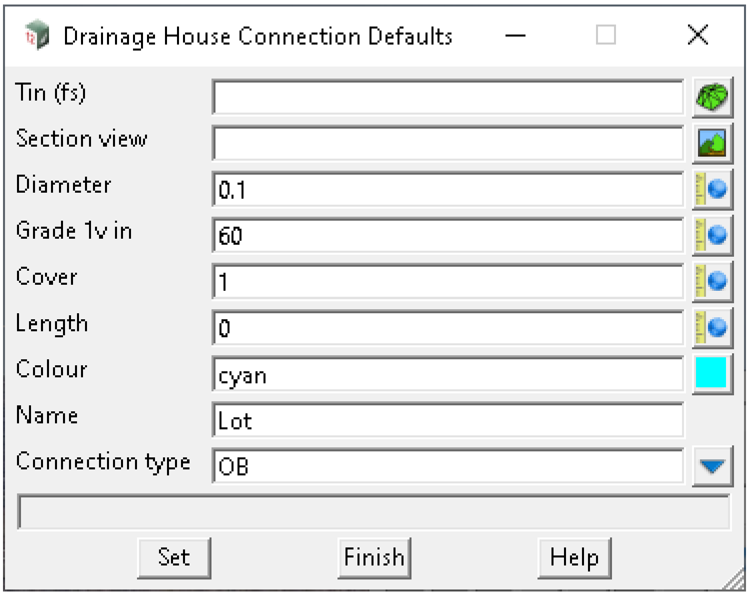
Continue to 17.3.13.1.6 House Connections or return to 17.3.13.1 Defaults.

17.3.13.1.6 House Connections

Position of option on menu: **Water =>Network =>Old =>Defaults =>House connections**

This panel is for setting the default information used for connections from the drainage pipe to the house blocks.

On selecting the **House connections** option, the **Drainage House Connection Defaults** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin (fs)	input	drainage tin	available tins

Name of the tin to automatically add to the section view used for drawing the profile along the house connection.

Section view	input		

The section view used to profile along the house connections as they are placed in plan view.

Diameter	input	0.1	

Default diameter of the house connection.

Grade 1v in	input	60	

Grade (units are "1v in") to use for the house connection.

Cover	input	1.0	

Cover (world units) to use for the house connection.

Length	input	2.0	

Length (metres) to use for some types of house connections.

Colour	input	cyan	available colours

Default colour used for the house connection.

Name	input	Lot	

Name for the house connection - usually the lot number.

Connection type	input	A special	A, A special, B, C, OB, Special Jump Up

Default type of house connection, Continue to the section 17.3.13.1.6.1 House Connection Types *for a description of each connection type.*

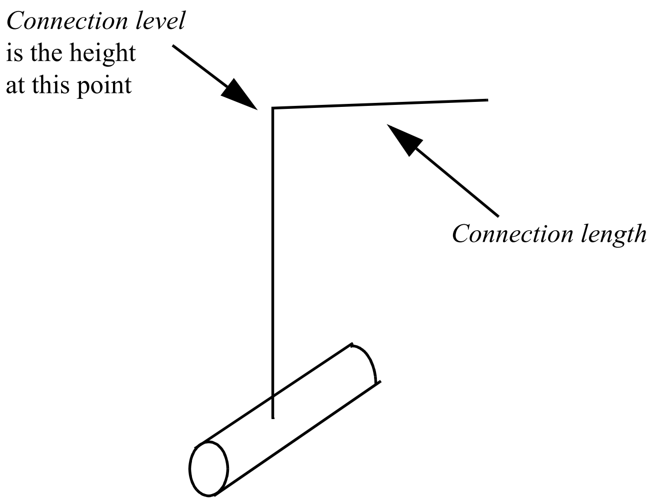
Set	button

Set the house connection defaults to the values in the above fields.

17.3.13.1.6.1 House Connection Types

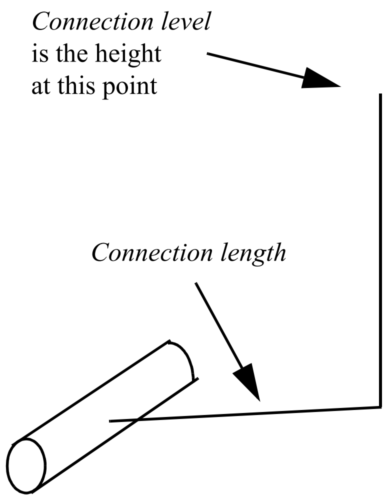
All house connection calculations do not take into account any thickness of pipe, joint sizes or actual entry points into the sewer. Hence they are ***approximate only*** and should only ever be used as a guide. Any quantities calculations should allow for a suitable margin of error.

17.3.13.1.6.1.1 House Connection -Type A



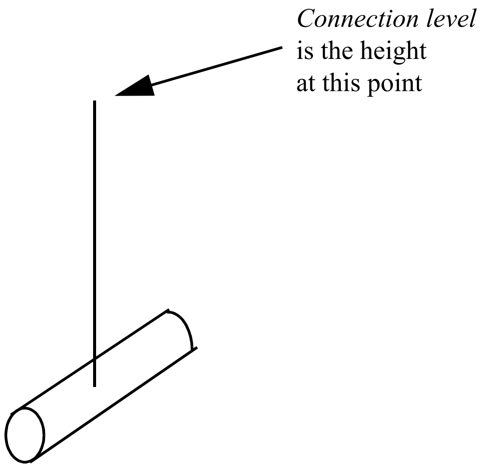
House Connection: Type A

17.3.13.1.6.1.2 House Connection - Type A Special



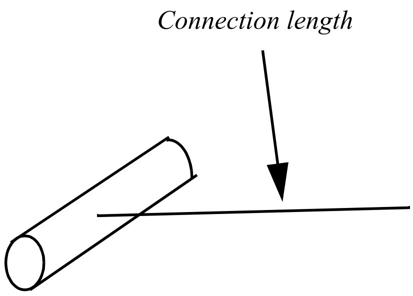
House Connection: Type A Special

17.3.13.1.6.1.3 House Connection - Type B



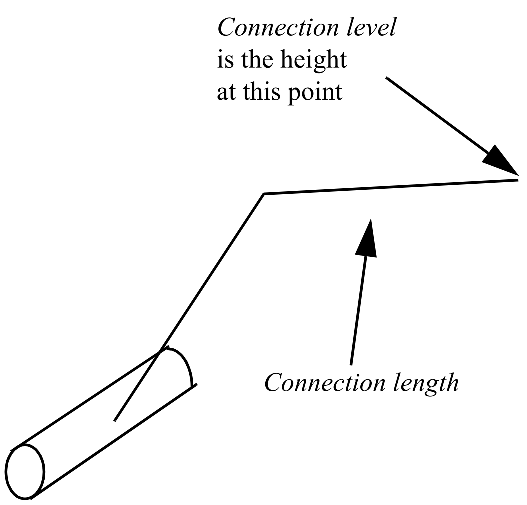
House Connection: Type B

17.3.13.1.6.1.4 House Connection - Type C



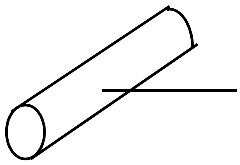
House Connection: Type C

17.3.13.1.6.1.5 House Connection - Type Special Jump Up



House Connection: Type Special Jump Up

17.3.13.1.6.1.6 House Connection - Type OB (Oblique)



House Connection: Type OB

Return to 17.3.13.1 Defaults.

17.3.13.2 Melbourne Water Longsections

Position of menu: **Plot =>Sections =>Melbourne Water**
Water =>Network =>Old =>Plots =>Melb Water

The **Melbourne Water long section** option is used to make special long section plots for individual drainage string, or for all the water strings in a **water network**.

For full documentation, see 23.7.5 Water Long Section Plot PPF Editor.

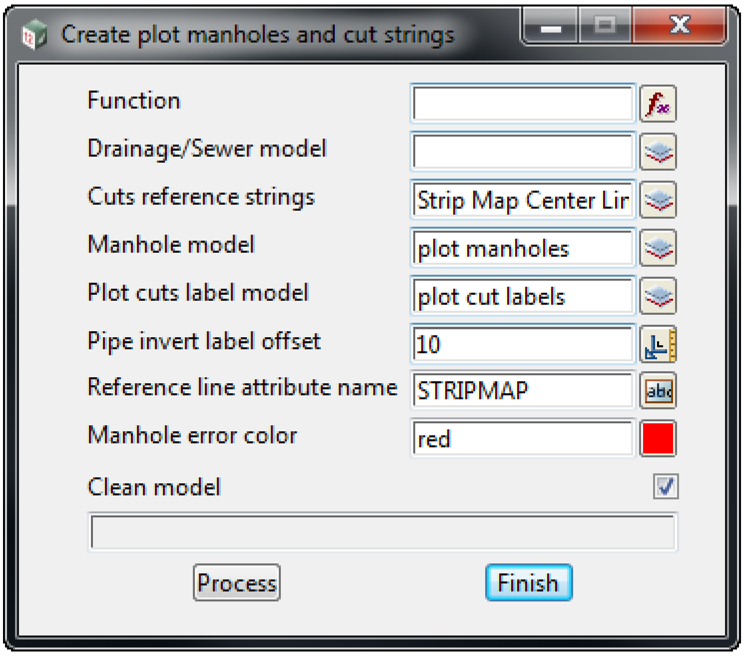
Continue to 17.3.13.3 Long Plot Cut Labels and Manholes or return to 17.3.10 Water Network Plots.

17.3.13.3 Long Plot Cut Labels and Manholes

Position of option in menu: **Water =>Network =>Old =>Long plot cut labels and manholes**

??

Selecting **Long plot cut labels and manholes** brings up the **Create plot manholes and cut strings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Function	function box		
??			
Drainage/Sewer model	model box		
??			
Cuts reference strings	model box		
??			
Manhole model	model box		
??			
Plot cuts label model	model box		
??			
Pipe invert label offset	measure box		
??			
Reference line attribute name	name box		
??			
Manhole error colour	colour box		
??			
Clean model	tick box		
??			

Process button

??

Continue to 17.3.13.4 ILSAX Editors or return to 17.3.13 Water Network Old.

17.3.13.4 ILSAX Editors

Position of menu: ***Design => Drainage => More => ILSAX Editors***

The **ILSAX editors** walk-right menu is

See ILSAX Pipe/Catchment Editor

See ILSAX Rainfall File Editor

17.3.13.4.1 ILSAX Pipe/Catchment Editor

Position of option on menu: **Design => Drainage => More=> ILSAX editor=>ILSAX pipe editor**

See Also

ILSAX Rainfall File Editor

Drainage overview

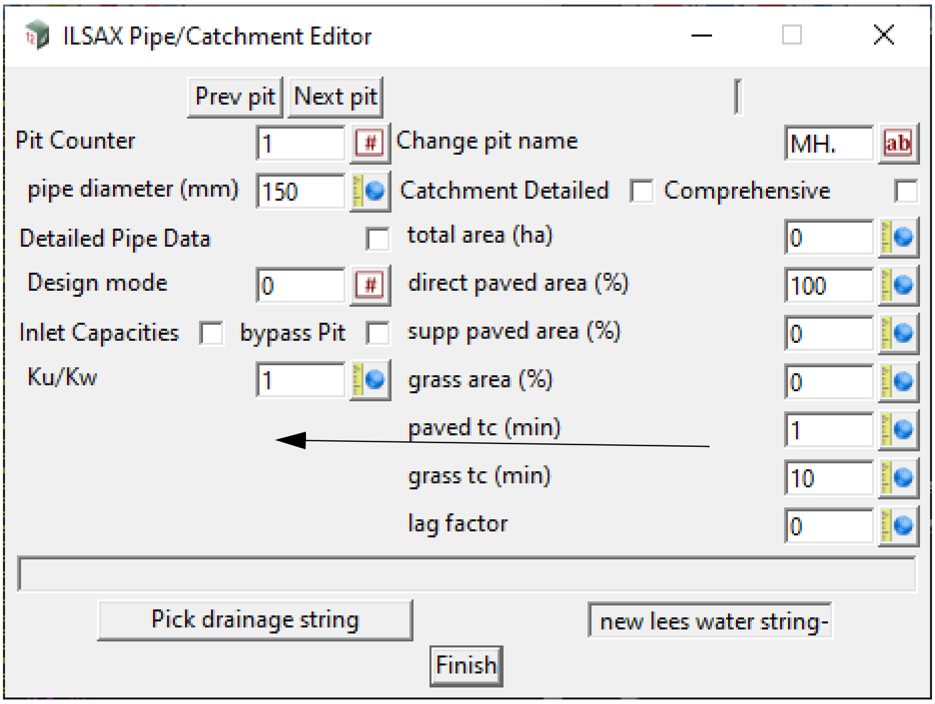
The ILSAX pipe data editor allows the user to edit pipe and catchment parameters. Most commonly used functions are supported but some of the less used functions are not included at this time. The same names have been used as those in the ILSAX drainage manual for easy reference.

Unlike the rainfall editor, all of the data in the pipe data editor is stored with the drainage string as user attributes. These user attributes can be changed using the editor (recommended for the novice user) or they may be output to a spreadsheet, changed and then read back into 12d.

CAUTION: If the drainage string is deleted then all of the attributes are deleted at the same time.

Usage

The ILSAX pipe data editor is accessed by selecting **Design=>Drainage-Sewer=>More=>ILSAX Editors=>ILSAX Pipe file editor**. The following dialogue will appear.



The panel to the left is only and example of what the editor panel may look like. This dialogue will change in size and complexity depending on the check boxes selected. The left side of the dialogue is reserved for pipe and pit data while the right side contains catchment data. The first step is to select the drainage string to be edited. Click on **Pick drainage string** and then select the drainage string from one of the views.

There are two ways to move between pits. The **Prev pit** and **Next pit** will move the user between the pits with the current pit name been shown in the **Change pit name** field. Do <u>**not**</u> use the **Change pit name** field to move between pits. It will not work! This field is used to manually change the pit name. Entering the **pit number** and pressing **Enter** is the second method for selecting pits. This is a good way to move between pits on long drainage lines (from pit 20 to pit 1 for example).

The **pipe diameter** will change the diameter of the pipe leaving the pit in the direction of increasing chainage. Note that the invert level of the pipe will remain fixed as the obvert level changes.

The most common **Design mode** is 1 for design. This ignores the present pipe size and resizes the pipe as required.

When the **Inlet capacity** and **Bypass pit** tick boxes are checked, additional fields are added to the dialogue. These will be discussed in the section 5.0 above

The **Catchment Detailed** and **Comprehensive** tic boxes also add additional fields to the dialogue. Again, the ILSAX drainage manual contains detailed descriptions of these parameters.

17.3.13.4.2 ILSAX Rainfall File Editor

Position of option on menu: **Design => Drainage => More => ILSAX Editor =>ILSAX rainfall file editor**

The ILSAX rainfall file editor assists in the creation and editing of the ILSAX rainfall files. It is truly a file editor and no data is stored inside the ***12d Model***. Most common features of the ILSAX rainfall file are included but some have been omitted as they have been rarely used. The files can be created using the editor and then manually edited using a word processor if required.

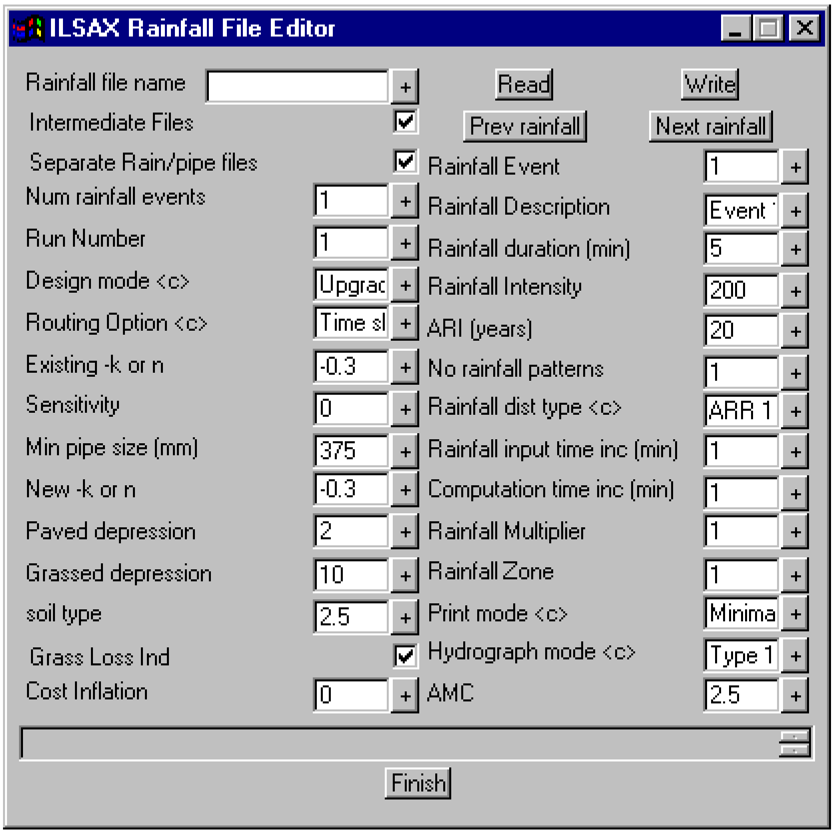
See Also

ILSAX pipe editor

Drainage overview

Usage

This panel is accessed from the menu selection **Design => Drainage => More=> ILSAX editors => Ilsax rainfall file editor**



The **Rainfall file name** must be specified before the **Read** or **Write** buttons will operate. If you want to create a file, fill in the **Rainfall file name** field and then **LB** select **Write** to save the data.

Intermediate Files and **Separate Rain/pipe files** must be ticked to have ILSAX run within 12d.

The minimum value for **Num Rainfall Events** is 1.

The remaining data in the left column is the data for the ILSAX R3 and R4 cards and the data in the right column is the data for the ILSAX R2,R6, R6B and R8 cards. Please refer to the ILSAX manual for a description of these values. The fields are not in the same order as the ILSAX files but instead the fields at the top of the column are those changed most frequently between rainfall events.

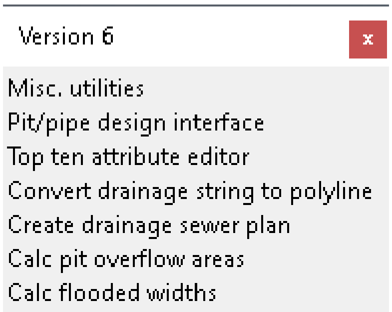
The **Prev Rainfall** and **Next Rainfall** buttons select the rainfall events up to the number specified in

Num rainfall events. If you wish to add or decrease the number of events analysed change the **Num rainfall events** value.

CAUTION: the **Finish** button does not perform a save so make sure you click **Write** before **Finish.**

The fields and buttons used in this panel are described in the ILSAX users manual.

17.3.13.5 Version 6



See
[17.3.13.5.1 Drainage Utility Program]
[17.3.13.5.2 Drainage Input/Output Interface]
[17.3.13.5.3 Top Ten Attribute Editor]
[17.3.13.5.4 Convert Drainage String to Polyline]
[23.7.8 Water Plan Plot PPF Editor]
[17.3.13.5.5 Calc Pit Overflow Areas]
[17.3.13.5.6 Flooded Width Flow Analysis]

17.3.13.5.1 Drainage Utility Program

Position of option on menu: **Water => Network => Old =>Version 6 =>Misc. utilities**

The Drainage utility program contains functions to significantly reduce the time required to perform drainage tasks. These tasks include

Assign Pit names

To use the export routines, every pit in 12d must have a pit name. This selection automatically creates the pit names for the entire model or selected strings. Examples of pit names are 1,2,3... A1,A2,A3....Pit 3-A, Pit 3-B.

Reset pit cover levels

This selection sets the cover levels for the manholes to the design tin or design strings. The user will be prompted for each manhole to select a tin level, a string level (if a design string model is supplied) or keep a manually set level. The tin/string/manual selection will be stored and the levels reset now and whenever the pit/pipe interfaces exports the data (unless this last option has been manually turned off).

Regrade pipe levels

The selection applies the default grading rules (cover level) to reset the pipe invert levels for the entire network. Manhole cover levels are not changed during this function

Label Catchments and Label drainage network

This selection quickly creates labels for a drainage and catchment plan. The pits are labelled with their name, the pipes with their diameters and the catchments with their area and the pit they drain to. These labels must be updated using this selection whenever the catchment or network is changed. To turn off the automatically drawn pit names in the current view select **Menu =>Settings =>Text =>Toggle** and select the drainage model.

Analyse Flooded Width

This is the only hydraulic calculation that takes place in 12d. The normal depth along the bypass flow paths is calculated using discharges imported from hydrology/hydraulic packages including spreadsheets. This flooded width is drawn to scale at intervals along the bypass flow path and colour coded (blue if less than a specified limit and red if greater than the limit).

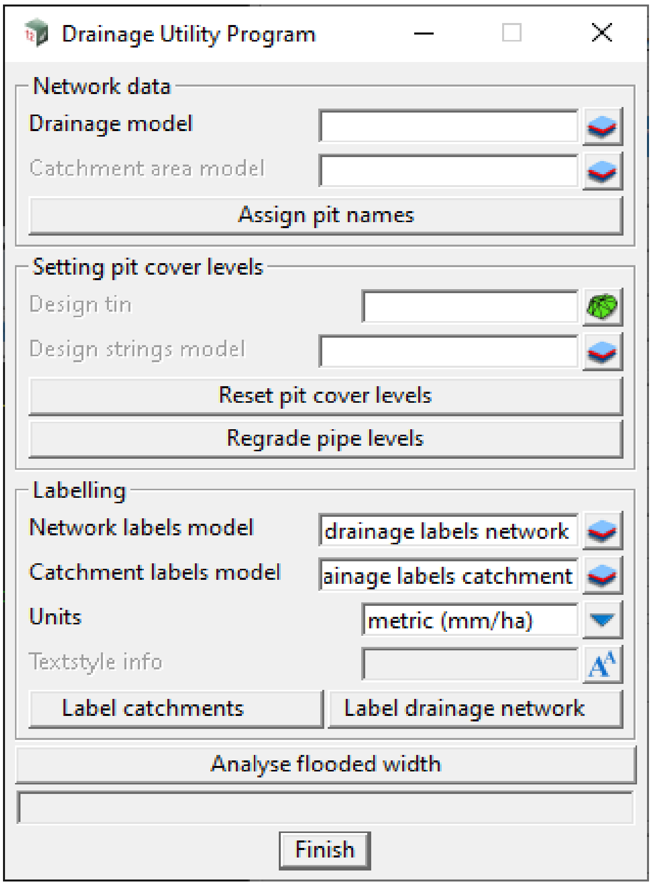
See Also

Drainage overview

Usage

This panel is accessed from the menu selection

Water => Network => Old =>Version 6 =>Misc. utilities



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Drainage model input box

Model to contain all of the pit and pipe network to be worked on.

Catchment area model input box

Model to contain the catchments strings for the ***Drainage Model*** *above*

Assign pit names button

This button launches a dialogue for setting the names for the pit and pipes in the network model.

Design tin tin box

This optional field allows the user to specify a new tin for the surface levels of the pits. If you are using road grade and cross fall for pit inlet capacity it is preferable leave this blank and to link the pits to a string using the ***design model*** *field below. If some or all of the pits are linked to strings in the design model below, they will still use the strings selected.* more about design strings

Design model model box

This model contains the strings for the pit cover levels (the string directions are also used for road grade and cross fall). If this model is changed you will be prompted to select new strings to link the pits to. more about design strings

Reset pit cover levels button

This button will reset the pit levels to the design strings in ***design model*** *or to the tin specified in* ***design tin*** *above. The first time this is selected you will be prompted to choose whether to set the pit cover level to the design tin or the a string in the design model.* more about design strings

Regrade pipe levels button

The selection applies the default grading rules (cover level) to reset the pipe invert levels.

Network labels model model box drainage labels network

*Model to contain the network labels for the **Drainage Model** above. This model is cleaned out each time **Label drainage network** is selected.*

Catchment labels model model box drainage labels catchment

*Model to contain the catchment labels for the **Catchment Area Model** above. This model is cleaned out each time **Label catchments** is selected*

Catchment units choice box ha, acres

Conversion factors of 10,000 will be used for ha and 43560 for acres.Not that not all design packages support both units.

Text parameters input box

*Select the + to access the text parameters (colour, size, alignment etc.) for the text created with **Label Catchment** or **Label drainage network***

label catchments button

This selection creates labels indicating the catchment name and area in the units specified above.

***CAUTION**: If you change you catchment strings or rename you pits you must run this routine to update the labels.*

label drainage network button

This selection creates labels indicating the pipe size and pit name for the network model.

***CAUTION**: If you change you change the pipe sizes or rename you pits you must run this routine to update the labels.*

analyse flooded width button

This selection launches the dialogue for analysing the flood along bypass flow paths. The bypass flows must be imported from your design package/spreadsheet before running this selection.

17.3.13.5.2 Drainage Input/Output Interface

Position of option on menu: Water => Water network => Old =>Version 6 =>Pit/pipe design interface

See Also

Drainage overview

Drainage Misc Utilities

Spreadsheet clipboard

Running Drains

Running PCdrain (Windows)

Running Micro Drainage - Win DES

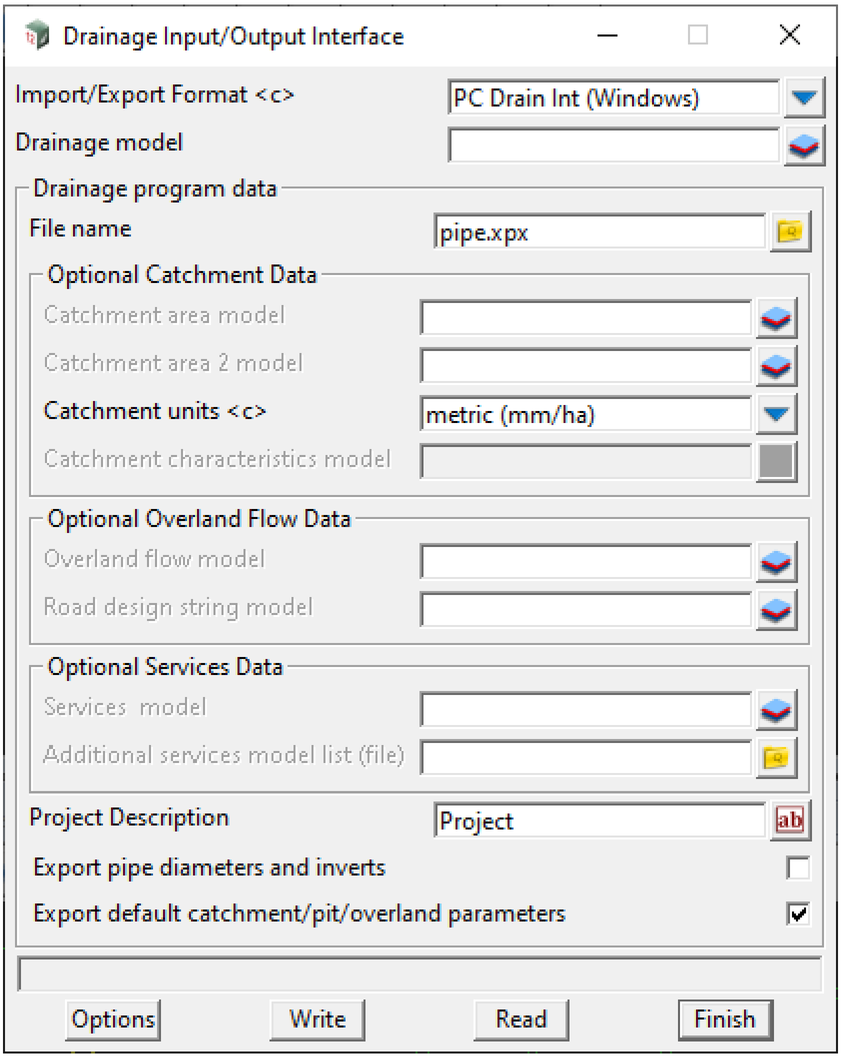
Running XPSWMM

Running RAT2000

Usage

This panel is accessed from the menu selection

Water => Water network => Old =>Version 6 =>Pit/pipe design interface



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Import/export format <c>	input box	XP SWMM	**Spreadsheet clipboard**, Drains clipboard, PCdrain Int (windows), RAT2000, XP SWMM, Micro Drainage, Drains, PC Drain (DOS), RAT HGL, ILSAX

Select the drainage design program to export/import to.

Drainage model input box

Required *Model to contain all of the pit and pipe network to be exported/imported. Also see* Drawing the Drainage Network.

File name input box

Required *file to be read or written to. If a clipboard format is chosen for* **import/export format** above then the data will also be written to this file on a **Copy** selection.

Catchment area model input box

Optional *model to contain the catchments strings for the* ***Drainage Model*** *above. Also see* Designating Catchment Areas.

Catchment units <c> input box ha, acres

Conversion factors of 10,000 will be used for ha and 43560 for acres.Not that not all design packages support both units.

Catchment characteristics modelinput box

Optional *strings in this model will be used to define the catchment slope and width (XP SWMM only).*

Bypass flow model input box

Optional *model to contain the bypass flow strings for the* ***Drainage Model*** *above. Also see* Creating Bypass Flow Strings.

Road design string model input box

Required *if* **bypass flow model** is specified above. Also see Pit Inlet Capacity, road grade/crossfall and Bypass routes.

Services model input box

Optional *if the strings in this model cross the drainage network the crossing data (drainage chainage, invert elevation and thickness) will be sent to the design package.*

Additional services model list (file) input box

Optional *if your services lie in more than one model then enter a text file name here and then select edit from the fields file icons. Type the names of all of the service models and then save the file.*

Project description input box

Optional *this description will be sent to the design program.*

Export pipe diameters and inverts tick box

Select this tick box to export the pipe diameters and inverts. see also Quick Check Lists for Drainage Design Software.

Export default catchment/pit parameters tick box tick

Selected all default catchment parameters are exported.
Not selected only catchment area is exported if **catchment area model** *is specified above. see also* Quick Check Lists for Drainage Design Software.

Options button

Several calculations are preformed before all exports. Advanced users may turn some off for large models (100's of pits). The option to re-link your pits to new design strings is also included here. More options

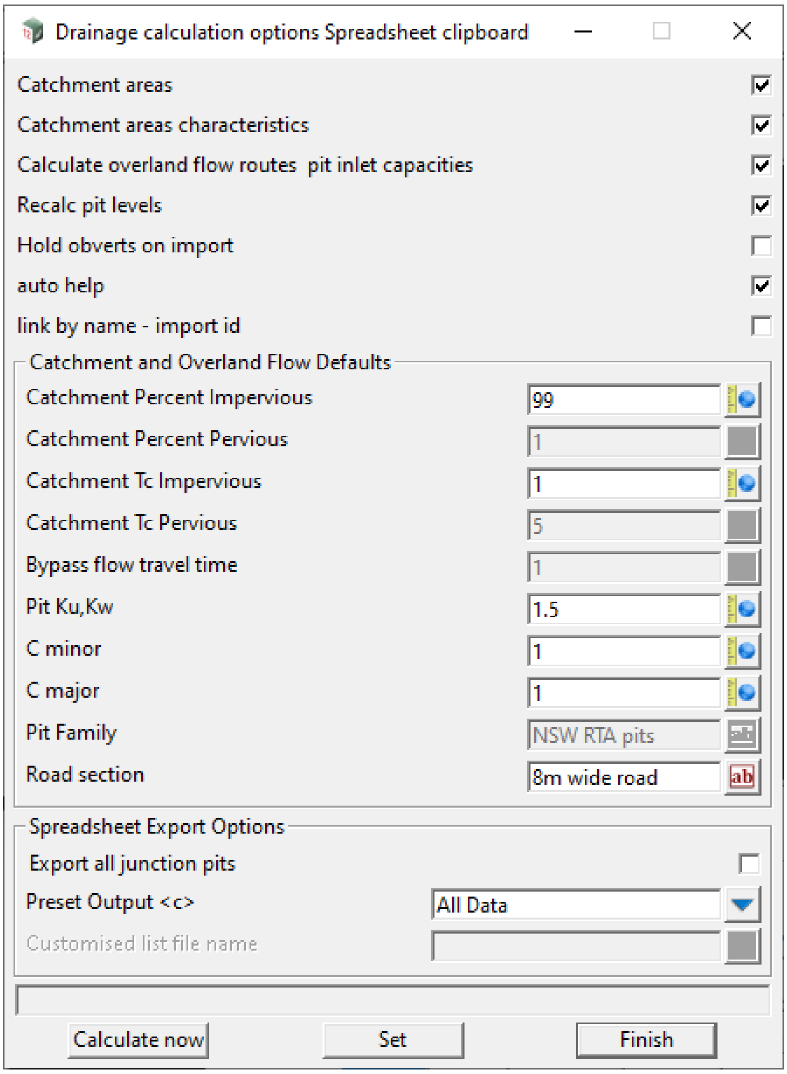
Write/Copy button

This will create/over write the file specified above in **file name**. *If* ***Copy*** *button is present the data will also be placed on the windows clipboard as Tab delimited text.*

Read/Paste button

Read *will read the file specified above in* **file name**. ***Paste*** *read the data from the windows clipboard. Both selections will update the drainage strings in the model specified above in* **drainage model**.*If the* ***Spreadsheet clipboard*** *import is selected and the strings are not present in the model they will be created.*

17.3.13.5.2.1 Options



Selecting the **Options** button brings up the dialogue to the left. Additional choices may be present at the bottom of the dialogue depending on the **Import/Export Format** that you selected on the main dialogue.:

Catchment areas when selected the catchment areas are linked to the drainage pits and the areas recalculated. See also Designating Catchment Areas

Re-link pits to road strings-tin when selected a dialogue for each pit will be presented asking which design string or tin to link the pit to. See also Selecting design string or tin

Calculate bypass flow routes when selected will calculate the downstream bypass pit, road grade and crossfall and inlet capacities. See also Pit Inlet Capacity, road grade/ crossfall and Bypass routes

Calculate now will calculate the selected option immediately and return the user to the main dialogue.

Set will set the options but no calculations will be performed until a **Write** or **Copy** is selected from the main dialogue.

Finish removes the panel from the screen.

17.3.13.5.3 Top Ten Attribute Editor

Position of option: **Water => Network => Old => Version 6 =>Top Ten attribute editor**

: **Strings => User =>Attribute editor**

This option displays ten (10) attributes of type string, vertex or segment for a selected string.

This option was written before the **Strings** =>**Properties** =>**Attributes** editor existed and is mainly used for editing drainage data.

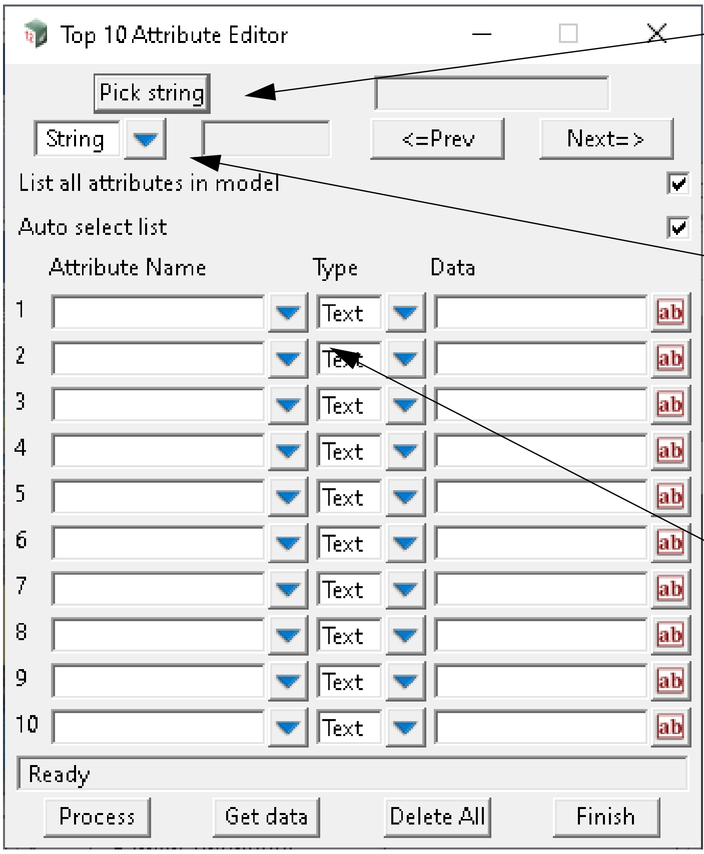
Most of the detailed catchment data is stored within ***12d Model*** as user defined attributes. These attributes are automatically created by ***12d Model*** when required but you are free to change them or add more as desired. The attributes may be exported to a spreadsheet and edited and then imported back into ***12d Model*** or edited inside ***12d Model*** using this panel.

See Also

Drainage overview

Usage

From the menu select **Design => Drainage => More => Version 6 =>Top ten attribute editor**



First Select **Pick** to select the string that contains the user attributes (the drainage string). All the drainage string in the model of the selected string strings will then be highlighted.

All catchment data is store with the pits in drainage strings. To access the pit attributes, select the drop down icon and then select **Pit**. A circle will be drawn around the pit selected. **Next** and **Prev** will now move you from pit to pit.

Select the drop down icon and then select the **Attribute Name** from the list of existing user defined attributes. These attributes include all of the attributes in the model that the string exists in.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pick string	button		

Used to pick the initial string in a model.

string-pit-pipe choice box **string,pit,pipe**

Select the type of attribute to be displayed. Pit and pipe attributes are only available for drainage strings.

Attribute name input box

*Three "top 10" attributes lists are maintained - one for pit attributes, one for pipe attributes and one for string attributes). The attributes that you can select from are all of the attributes that exist on all of the strings in the model. If the attribute does not exist for the string/pit/pipe that you are displaying the **data** field will display **Not found.***

Type choice box **Text, Real, Integer**

For existing attributes this will display Text, Real or Integer.
When defining a new attribute select the type of data to be stored in the attribute.

Data input box

Data stored in the attribute is displayed/edited/created in this field.

<= Prev button

Move to next string in the model
pit on the string
pipe on the string

Next => button

Move to next string in the model
pit on the string
pipe on the string

Process button

Updates the attributes displayed in the dialogue.

Notes:

First LB select Pick to select the string that contains the user attributes. All catchment data is stored with the pits in drainage strings. The strings will be highlighted in white when they are selected.

To access the pit attributes **LB** this field then select **Pit**. A circle will be drawn around the pit selected.

LB the **Attribute Name** field and then select from the list of existing user defined attributes. These attributes include all of the attributes in the model that the string exists in. They may not be defined for the string you are editing. If the string does not have that attribute defined **not found** will be displayed in the **Data** field.

To change the value for the attribute enter the new value in the **data** field. If the attribute does not exist, deleting the **not found** text and adding data will create it. The following message will be displayed whenever you are creating a new attribute.

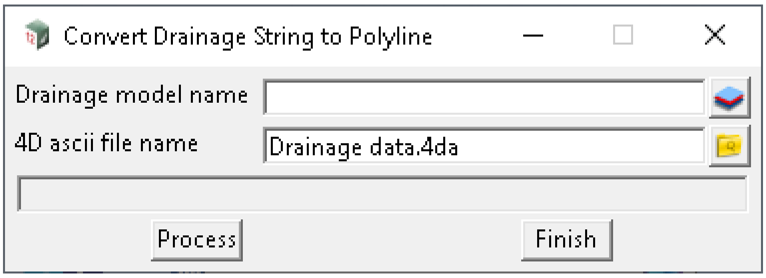
17.3.13.5.4 Convert Drainage String to Polyline

Position of option on menu: ***Water => Network => Old => Version 6 =>Convert drainage string to polyline***

See Also

Drainage overview

Usage



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drainage model name	input box		

Drainage model containing the drainage strings.

12da file name	input box	drainage data.4da	

File for the converted strings.

Process	button		

Converts the model to polylines and writes the polylines to a 12da file.

17.3.13.5.5 Calc Pit Overflow Areas

Position of option on menu: ***Water => Network => Old =>Version 6 =>Calc pit overflow areas***

This option is used to graphically display the overflow storage volume at a sag pit. The following pit attributes must exist for the flood extents to be calculated.

overflow volume	value greater than zero required.
sag pit	must be equal to 1.
catchment model id	set by labelling catchments
catchment string id	set by labelling catchments

The maximum storage volume is read from the drainage pit attribute "overflow volume". This may be entered manually using the **Attribute Editor** or it will be created when data is read from the drainage design programs Drains or XP SWMM design programs.

This routine locates the lowest point on the catchment string by draping the string on the tin specified and adds the overflow limit specified to this value. This becomes the **overflow limit.**

The volume at this level is calculated and the compared to the **overflow volume** read from the user defined attribute.If the overflow volume is less than the volume in the catchment then the routine iterates to find the flood level for the overflow volume.

If the overflow volume is greater than the volume in the catchment, the results depend on the **Use overflow limit** tick box.

If the box is selected, the **overflow limit** (calculated above) is reported at the flood level in the catchment.

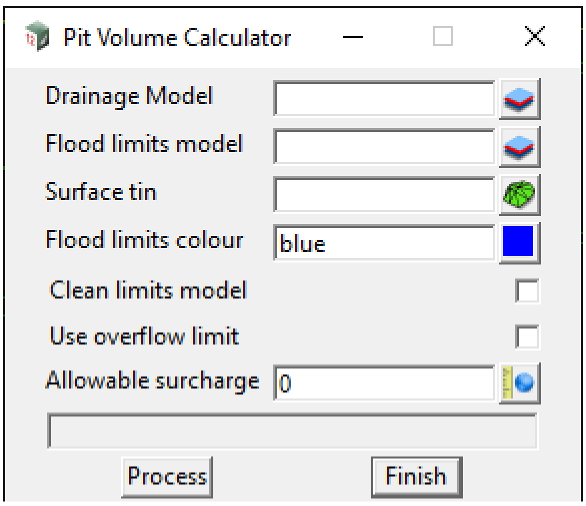
If the tick box is not selected the routine iterates to find the flood level where the storage equals the **overflow volume** read. This option allows the user to see the maximum flood level should the catchment low point become blocked.

See Also

Drainage overview

Usage

This panel is accessed from the menu selection **Water => Network => Old =Version 6 =>Calc pit overflow areas**



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Drainage model model box

All pits in this model that have a non zero "overflow volume" and "sag pit" set to 1 will be processed.

Flood limits model model box

Flood limits strings will be created in this model.

Surface Tin tin box

Ground surface tin used to calculate the volumes and flood limits.

Flood limits colour colour box

Flood limits strings will be created using this colour.

Clean limits model tick box

If selected all strings in the ***Flood limits model*** *will be deleted before the calculations commence.*

Use overflow limit tick box

If the elevation calculated from the storage volume is higher than the lowest point on the catchment string then the ***allowable surcharge*** *value below will be added to the lowest point on the catchment string and this elevation will be used to determine the flooding limits.*

Allowable surcharge real box

This value is used only if ***Use overflow limit*** *is ticked. Its purpose is described in the field above.*

Process button

Executes the option.

Finish button

Removes the dialogue from the screen.

17.3.13.5.6 Flooded Width Flow Analysis

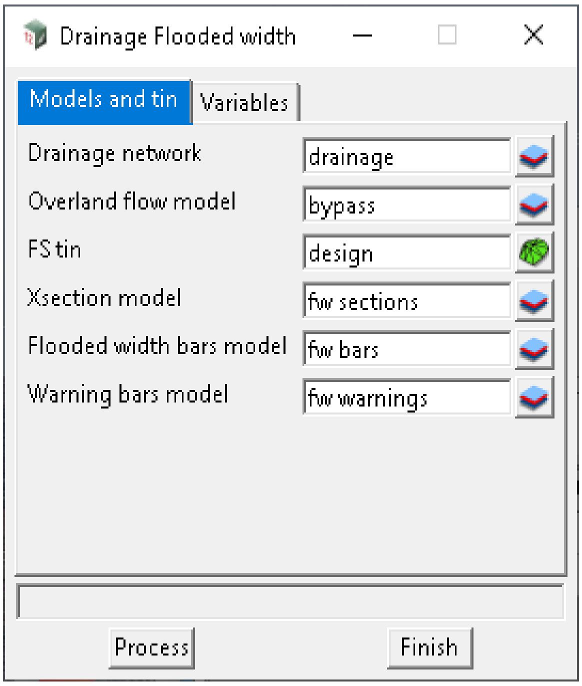
Position of option on menu: **Water =>Network =>Old =>Version 6 =>Calc flooded widths**

The Calculate Flooded width procedure creates cross sections along the **bypass flow** paths and then calculates the flooded width at each section using Manning's normal depth calculations. A HEC-RAS project (same name as the bypass flow string) is also created for each line. The flooded width is indicated on each section as a blue line if it is less than a user defined width and a red line if the flooded width exceeds the limit. Details of the calculations such as the velocity, depth, wetted perimeter and slope can be exported to a spreadsheet for further analyse (velocity times depth calculations for example). The discharges imports from the urban stormwater design packages are shown in the following table.

Design Program	Discharge Event
PCdrain	Minor ARI
Drains	Maximum flow event analysed
ILSAX	Maximum flow event analysed
RAT HGL	First return period analysed

The user defines the length of these sections and the interval at which they are to be spaced. 12d calculates the normal flow depth interpolating the pit approach and bypass flows from the hydrology models (ILSAX, Drains, PC Drains or RAT HGL). The cross sections are taken perpendicular to the flow line and the slope is for the normal depth calculations is determined using the distance along the flow line and the change in elevation between the two lowest points in the primary flow channel. The flow line need not intersect the low points on the section but the flow line does mark the primary flow channel. If the depth of the flow exceeds the banks of the primary channel, then all adjacent flow channels will be considered as active flow area.

On selecting the **Calc flooded widths**, the **Drainage flooded width** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Models and tin

Drainage network model box drainage

Existing drainage strings must have approach and bypass flow pit attributes. See doco below.

Overland flow model model box bypass

Cross sections are cut perpendicular to these existing strings.

FS tin tin box design

This tin is used to cut the cross sections and to determine the slope for normal depth calcs.

Xsection model model box fwsections

Model is cleaned before processing. Calculated values such as velocity and slope are stored with these strings.

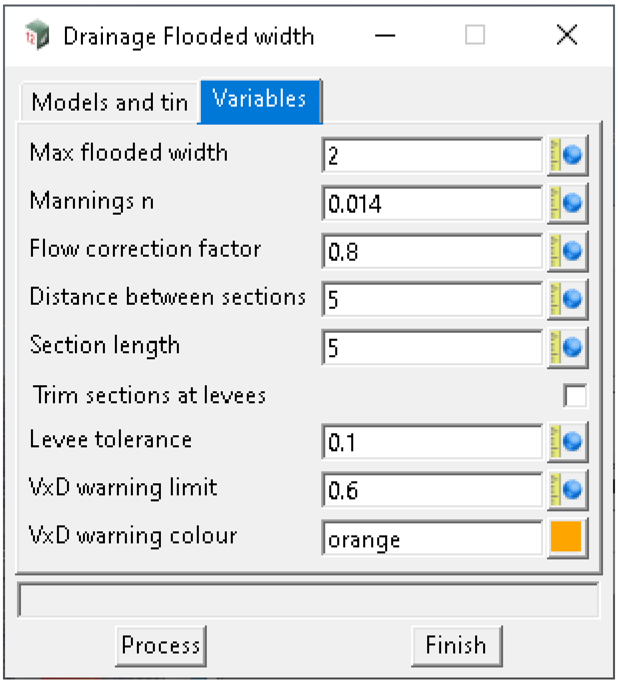
Flooded width bars model model box fw bars

Model is cleaned before processing. blue or yellow strings with levels indicate normal depth flooded widths.

Warning bars model model box fw warnings

Model is cleaned before processing. Strings created when vel x depth exceeds limit.

Variables



Max flooded width input 2

Limit where the blue flooded width bars turn red.

Manning's n input 0.014

N value to be used in the normal depth calculations.

Flow correction factor input 0.8

This is the factor described in ARR 1987 for calculating depths of flow in gutter channels.

Distance between sections input 5

Interval at which cross sections and therefore flooded width will be calculated along the flow path.

Section Length input 5

Length of each cross section. The cross section will be centred on the overland flow path.

Trim sections at levee tick box off

Trims the cross section at the crest on either side of the flow channel. A levee point is the crest in the cross section found as you move away from the flow line location.

Levee tolerance input 0.1

Amount the cross section needs to drop as you move away from the centre line in order to identify a levee.

VxD warning limit input 0.6

Velocity times depth limit that when exceeded will cause a flooded width bar to be generated in the warning bars model.

VxD warning colour colour box orange

Colour of the velocity x depth bars.

Process button

Clean output models, calculate flooded width and create HEC-RAS projects named from the string names.

Finish button

Remove the panel from the screen.

17.3.13.6 Limitations where overland flow lines join

Where overland flow lines converge at an inlet, 12d does not know the flow split between the 2 approaching paths. Therefore, 12d uses the total flow from all lines as the flow at the inlet for each line. This may overestimate the flooded width along the flow lines at these points.

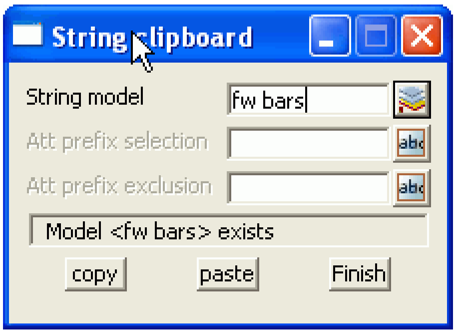
17.3.13.7 Limitations at SAG pits

The flow width are not shown adjacent the sag inlets. The depth of flow due to ponding and the approach flow coming from several directions may overestimated flooded width in these areas. Therefore not flood depths are calculated approaching SAG inlets.

Summary Tables

The hydraulic calculations and warning messages are stored as string attributes on the flooded width bars. If these attributes are exported to a spreadsheet via the clipboard a summary table my be created. To copy these attributes to the clipboard select

File IO->User->String attributes-properties to/from clipboard



The **string model** may be either the flooded width bars or the warning bars. Both models of strings contain attributes on the strings.

The prefix selection and prefix exclusion are filters for reducing the number attributes that are exported to the clipboard.

17.3.13.8 Cross Sections, Discharges and Warnings

The analyse flooded width will proceed along each flow path and identify every pit on the line. Cross sections will be constructed in the model with the length and interval entered in the input dialogue. These cross sections may be plotted using the main menu selection **Plot=>X plot =>X plot**. The **Sort Sections** must **not** be selected for these sections to be plotted.

Discharges will be determined for each cross section by linearly interpolating the discharge using distance between the pits. The bypass discharge (pit attribute - calculated bypass flow) will be taken from the upstream pit and the approach discharge (pit attribute - calculated approach flow) from the downstream pit.

The slope is calculated by subtracting the lowest points nearest to the centre line and dividing the cross section separation. The levee tolerance is NOT used for locating this point thus any rise in section moving away from the centre line marks the end of the low point search in that direction.

12d will give warning messages in the output window when it encounters the following conditions and these messages will be stored as string attributes on the flooded width strings. Descriptions of these messages follow.

Inverts do not go downhill

12d locates the lowest point (adjacent to the flow line without moving over a local crest) on each cross section to calculate the slope between the cross sections. This message indicates that the downstream minimum elevation is higher than the upstream minimum elevation.

Sometimes flow lines will go uphill. If you have specified an overflow from a SAG location then the flow line will go uphill until it crosses the overflow crest.

If the flow line is not supposed to be going uphill at this section, check to see where the flow line intersects the cross section located upstream of the one identified in the warning message. If it is in a local sag point that is not the lowest point on the section, move the flow line.

The program will use a slope of 0.5% to calculate a width at this location. This results in very wide flooded width sections to draw the user’s attention to the problem area.

Vertical Walls Assumed at the Ends of the Cross Sections

If the depth of flow exceeds the ground surface elevation at the ends of the cross section a warning message the warning message shown above is shown. The cross sections causing the warning follows.

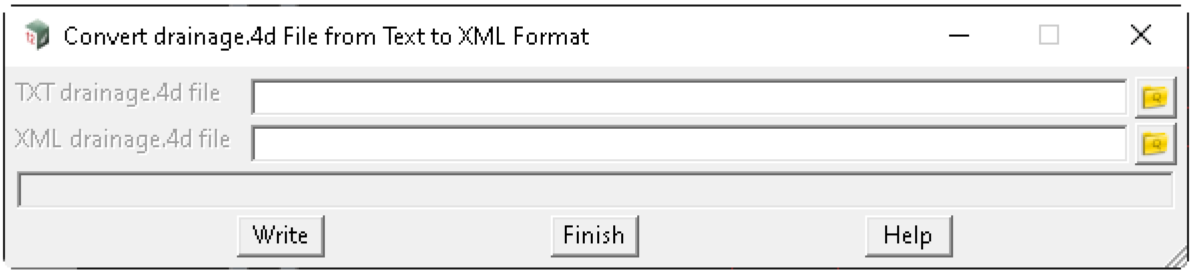
The vertical wall is placed at cross section chainage –20. Note that the flow line is always at chainage 0

Continue to 17.3.13.9 Convert to XML drainage.4d or return to 17.3.13 Water Network Old.

17.3.13.9 Convert to XML drainage.4d

Position of option on menu: **Water =>Network =>Old =>Convert drainage.4d from text to XML**

On selecting the **Convert drainage.4d from text to XML**, the **Convert drainage.4d File from Text to XML Format** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
TXT drainage.4d file	file box		all .*4d

An old existing drainage.4d file, so not any XML based file.

Field Description	Type	Defaults	Pop-Up
XML drainage.4d file	file box		all .*4d

A new drainage.4d file which will be in the XML format.

Note: these boxes should not be the same file.

Buttons at Bottom

Write button

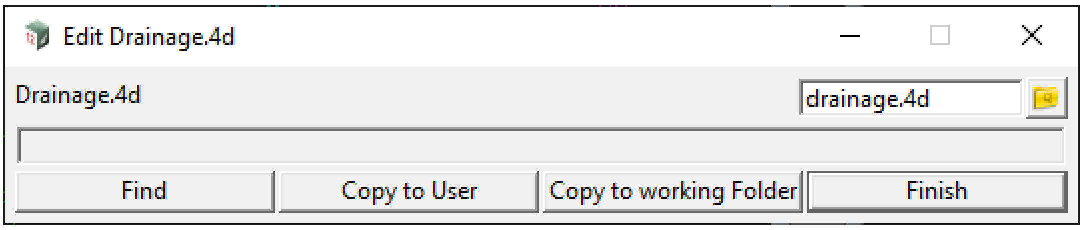
If clicked, writes out the drainage.4d file.

Continue to 17.3.13.10 Editing a Text drainage.4d file or return to 17.3.13 Water Network Old.

17.3.13.10 Editing a Text drainage.4d file

Position of option on menu: **Water =>Network =>Old =>Edit drainage.4d (text)**

On selecting the Edit drainage.4d option, the Edit drainage.4d panel is displayed.



Select the **Find** button to search the 12d path for the current **drainage.4d** file. The location of the file will be displayed in the panel message box.

Select the **More info** button and then **Edit** to edit the file.

Select the **Copy to User** to copy the file to the user folder.

Select the **Copy to working Folder** to copy the file to the current working folder.

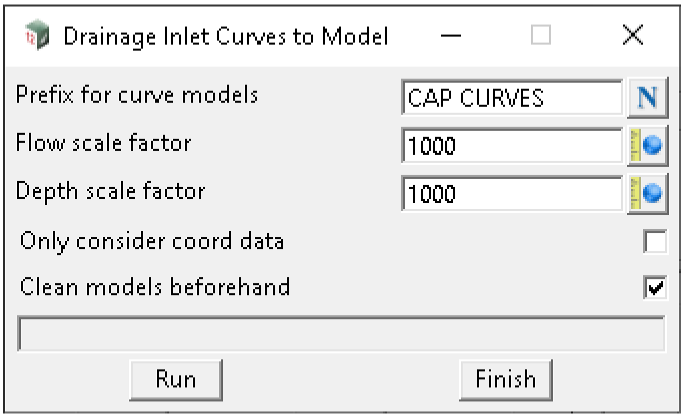
Continue to 17.3.13.11 Write Inlet Curves to Model or return to 17.3.13 Water Network Old.

17.3.13.11 Write Inlet Curves to Model

Position of option on menu: **Water =>Water network =>Old =>Write inlet curves to model**

This routines reads the inlet capacity curves from the drainage.4d file and creates plot strings. This tool is an efficient way to review the inlet capacity data in the file.

On selecting the **Write inlet curves to model**, the **Drainage Inlet Curves to Model** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Prefix for curves models | model box | CAP CURVES

All inlet curves for a node type will be placed in a model named with this prefix and the node type.

Flow scale factor | input | 1000

Inlet and bypass flow values will be multiplied by this value before creating the strings.

Depth scale factor | input | 1000

Depth values for sag curves will be multiplied by this value before creating the strings.

Only consider coord data | tick box | off

Inlet capacity curves may be expressed as formulas, curve coordinate or both. Selecting this box stops curves with only formulas from being plotted as strings.

Clean models before hand | tick box | ticked

The curve models are cleaned before the new strings are created.

Buttons at Bottom

Run | button

Models and strings are created from the drainage.4d file.

Continue to 17.3.13.12 Water Definitions File - Old Drainage.4d or return to 17.3.13 Water Network Old.

17.3.13.12 Water Definitions File - Old Drainage.4d

This File has now been replaced by a new XML version.

See 27.7 Water Definitions File - XML drainage.4d

A file of nodes and link definitions is used to create links and node with specified types to allow tailoring for a particular project. The node type and link type is one method to set many of the objects properties such as inlet capacity, thickness and roughness along with the objects user defined attributes.

When ***12d Model*** begins, it checks to see if an environment variable called DRAINAGE_4D exists and if it does, then the file it points to is used to provide the available types of nodes and links.

If the environment variable is not set, then***12d Model*** searches for a file called **drainage.4d** in the standard***12d Model*** search sequence for set up files.

Note: the name drainage.4d is from earlier versions of ***12d Model*** when the water string was known as the drainage string or drainage-sewer string.

The water definitions fie format is a text format and consists of one or more pipe and manhole definitions. Each definition in the file begins with the key word **Pipe** or **Manhole**, followed by the pipe or manhole type and then curly braces **{ }**. The order that the definitions appear in the file determines the order they appear in the drop down lists inside ***12d Model***.

If any syntax errors have been made editing the file, the line number will be displayed in the output window. The error generally slightly above this line. The most common errors are missing curly braces **{ }** and forgetting quotes around entries containing spaces

IMPORTANT: the file is only read when ***12d Model*** starts up. When the file is changed while, ***12d Model*** is running, you must restart ***12d Model*** for the changes to become active.

A minimal example of a drainage definitions file is:

```
// -------------------------------------------------------------
// drainage.4d1/6/96
// Used to define the types of Pipes and Manholes
// -------------------------------------------------------------
  Pipe   "PVC"   {
  }

  Pipe   "VC"   {
  }
  Pipe   "PVC Extra Heavy"   {
  }
  Pipe   "Plastic"  {
  }

  Manhole   "CONC COVER"  {
  }
  Manhole "Gatic"   {
  }
  Manhole   "Rubber"   {
  }
```

Notes

1. spaces in text - any text string that includes spaces or only numbers, must be enclosed in double quotes **"**.
2. comments - anything after // until the end of the line is ignored.
3. blank lines - blank lines are ignored
4. Duplicate definitions are not allowed.

Continue to 17.3.13.12.1 Water Definitions - Node Types - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.1 Water Definitions - Node Types - Old

Node types are used to set the following manhole properties via the 17.3.4 Water Network Editor (WNE)).

- manhole diameter, length/width and thickness
- manhole description, notes, group, ku/kw method, ku/kw values, rational engine design freeboard,
- manhole level modes for cover level, grate level, survey setout level and sump levels,
- survey setout xy modes and road chainage modes
- user defined manhole attributes

Each definition (manhole block) in the file begins with the key word **Manhole**, followed by the manhole type and then curly braces **{ }**. The order that the definitions appear in the file determines the order they appear in the drop down lists inside ***12d Model***.

The minimum requirement for a pit type definition is

```
Manhole “type name” {
}
```

The type name must be unique and the braces {} cannot be () or [].

Optional manhole commands may be placed inside the braces. These commands include may include 17.3.13.12.2 Node Editor Commands - Old, 17.3.13.12.4 Node Water Network Editor Commands - Old and Manhole Calculation Commands.

Continue to 17.3.13.12.2 Node Editor Commands - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.2 Node Editor Commands - Old

These optional commands change the properties of the manhole objects. Changes to these commands will used in creating new drainage strings and the 17.3.4 Water Network Editor (WNE) will prompt you to update the object if these settings are different to the strings current settings. A list of these commands follows

mhdiam x.x	set the manhole as circular (internal diameter in base units)
mhsize x.x y.y	set the manhole as rectangular (over rides mhdiam) length and width in base units

```
mhthickness    {
   diam_thickness   x.xxx a.aaa b.bbb c.ccc d.ddd
}
```

x.xxx	nominal diameter choices will appear in the WNE->Pipe->Diameter drop down
a.aaa	optional front thickness (base units) 0.000 if omitted
b.bbb	optional back thickness (base units), front thickness if omitted
c.ccc	opt left thickness in direction of chainage (base units), front thickness if omitted
d.ddd	opt right thickness in direction of chainage (base units), front thickness if omitted

Continue to 17.3.13.12.3 Node Level Modes - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.3 Node Level Modes - Old

There are several modes to calculate x, y and z values for the nodes.

A description of each follows.

FS tin	the node centre x,y location is used to obtain the level from the water finished surface tin
NS tin	the node centre x,y location is used to obtain the level from the water natural surface tin
Setout string	the node centre x,y location is dropped perpendicular onto the setout string. The x,y or z value is then obtained from this string. If this string is missing then the node x,y location or finished surface tin level is used instead.
Centre string	the node centre x,y location is dropped perpendicular onto the road centre string and the chainage value is obtained. If this string is missing an problem message will be created in the output window.
Sz + Setout string	the node centre x,y location is dropped perpendicular onto the setout string. The Sz value for the node is then added to the z value obtained from this string. If this string is missing the Sz value is added to the finished surface tin level at the node centre x,y location.
Manual	the x,y,z or chainage value is manually entered by the user.
Cover RL	the z level is set to the Cover RL level (after it has been recalculated).
Max Obvert	The maximum obvert level from off the conduits connected to this node is used.
Floating sump	the node sump level is set to the lowest invert of all the conduits connected to this node + the sump offset

Continue to 17.3.13.12.4 Node Water Network Editor Commands - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.4 Node Water Network Editor Commands - Old

These optional commands store user defined data on the nodes or change the calculation modes available in the 17.3.4 Water Network Editor (WNE).

The **Set Node Details** button in the WNE will **recalculate** these for all manholes in the network.

A list of these commands follows

mhdesc "description" creates a pit text attribute "pit type description" and is used in the drainage pit schedule report.

mhnotes "note" creates a pit text attribute "pit type remarks" and is used in the drainage pit schedule report.

mhgroup "group" routines that select manholes will select from a manhole belonging to the same group

attribute_integer "attribute name1" x x is an integer value (no decimal, stored exactly by computers

attribute_real "attribute name2" x.xxx x is a real value (used to store numbers with decimals or very large or very small numbers

attribute_text "attribute name3" "text" text is a series of words or numbers not intended for calculations

Note: If a non-special attribute name is set for some, but not all manhole types, that attribute will be deleted on all manholes with types where the attribute is not defined.

The following special attribute commands create/modify an attribute as described above but these attributes also control calculations performed by the **Set Node Details** button on the 17.3.4 Water Network Editor (WNE).

The WNE fields will be locked when these attributes are defined for the selected pit type. If these attribute are not defined for the selected pit type, the WNE field will not be locked and remain unchanged.

attribute_integer "cover rl mode" x WNE field ->Pit =>Main =>Cover RL mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Sz + setout string	8

attribute_integer "grate rl mode" x WNE field ->Pit =>Main =>Grate RL mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Cover RL	7
Sz + setout string	8

attribute_real "sump offset" x.xx WNE field ->Pit =>Main =>Sump offset
if sump RL mode is floating then this is the offset (negative down) from the lowest pipe invert <base units>

attribute_integer "ku method" WNE field is Pit =>Main =>Ku method

Mode	x	Description
Direct	0	user enters the ku value stored as pit real attribute "ku"
Ku,Kw - Missouri/Hare Charts		
	1	ku calculated during analysis
Ku,Kw>0 - Missouri/Hare Charts		
	2	ku calculated during analysis (ku < 0.0 changed to 0.0)
Ku - Culvert Inlet - Generic (101 or 201)		
	3	Culvert analysis using inlet control and backwater control (entrance and exit losses automatically set)
Remaining	xxx	Culvert analysis - use numbers from WNE drop down list

attribute_real "ku" x.xx WNE field is Pit =>Main =>Ku
x.xx is used to calculate pit upstream hgl when ku method is Direct

attribute_real "kw" x.xx WNE field is Pit =>Main =>Kw
x.xx is used to calculate pit hgl when ku method is Direct

attribute_integer "setout xy mode" x WNE field is Pit =>Setout =>Setout xy mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2

attribute_integer "setout z mode" x WNE field is Pit =>Setout =>Setout z mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Cover RL	7
Sz + setout string	8

attribute_integer "road chainage mode" WNE field is Pit =>Setout =>Chainage mode

Mode	**x**
No Road	0
Centre string	1
Manual	2

attribute_real "setout adjustment" WNE field is Pit =>Setout =>Sxy

attribute_real "setout adjustment z" WNE field is Pit =>Setout =>Sz

attribute_real "design freeboard" WNE field is Pipe =>Design =>Freeboard limit
at US pit

The following example of a channel ip point is given below. The setout modes are set, the cover and grate level modes are set and the ku (losses) are set. Finally, the inlet capacity is set to an on-grade pit with200% inlet capacity so that even in a major storm with a choke factor of 0.5 it will still have 100% inlet capacity.

```
Manhole "CHNL auto" {

  mhdesc  "channel hip-vip"
  attribute_text "lplot description1"  "OPEN CHANNEL"

  mhsize  0.0
  mhdiam  0.0
  attribute_integer "setout xy mode"        0 // centre of the channel
```

```
  attribute_integer "setout z mode"        6 // sump invert is the bottom of the channel
  attribute_integer "cover rl mode"        4 // max obvert - top of the channel
  attribute_integer "grate rl mode"        4 // max obvert - top of the channel
  attribute_integer "ku method"            0    // direct
  attribute_real    "ku"                   0.0  // zero unless interested in bend losses

  cap_config G

  cap_percent 200 // if a choke factor of 0.5 is applied then it will still have 100% inlet capacity
}

// attribute_real    "design freeboard"       Pipe =>Design =>Freeboard limit at US pit
```

Continue to 17.3.13.12.5 Node Drainage Analysis Inlet Capacity Commands - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.5 Node Drainage Analysis Inlet Capacity Commands - Old

Node inlet configuration and bypass pit entries determine if these inlet capacity commands are used. Both may be set in the 17.3.4 Water Network Editor (WNE).

17.3.13.12.5.1 cap_config

The inlet configuration may be set via the following command

cap_config x

Mode	x
Manhole	m
Ongrade	g
Sag	s

Inlet Configuration = manhole - no water will enter the pit through the grate. Commands not used.

Inlet configuration = on grade or sag

Bypass pit not set - 100% of the approach flow will enter the pit. Commands not used.
Bypass pit is entered. The following commands define the storm water inlet capacity characteristics.

Continue to 17.3.13.12.5.2 Inlet Capacity Equation in Old Drainage.4d or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.5.2 Inlet Capacity Equation in Old Drainage.4d

The inlet capacity equation is built up with optional components (**single polynomial** + **curve polynomial** + **curve coordinates**). Generally, only one of the components is used for each manhole type but they may all be used if desired.

inlet capacity = inlet efficiency * inlet multiplier *
[**single polynomial** + curve multiplier (**curve polynomial** + **curve coordinates**)]

An inlet efficiency (choke factor) is specified in the 17.3.4 Water Network Editor (WNE). An inlet efficiency (choke factor) of 0 would stop all water from entering the inlet.

The inlet multiplier is specified with a cap_multi parameter.

Multipliers

cap_multi   x.x   inside a cap_curve_grade block or cap_curve_sag block, the curve inlet capacity is multiplied by this value
outside a cap_curve_grade or cap_curve_sag, the total inlet capacity is multiplied by this value

Single Polynomial

The inlet capacity for an inlet may be specified by a single polynomial equation based on the approach flow. This is the most simplistic method and generally used for percentage capture or fixed capture rates.

inlet capacity = cap_fixed
+ cap_percent*0.01*Qa
+ cap_coeff*Qa^cap_power

Example
This example creates an inlet with a fixed inlet capacity of 0.010 (cms or cfs).

```
Manhole "fixed inlet capacity" {
        cap_fixed 0.010
}
```

Default values

cap_multi   = 1.0

cap_fixed   = 0.0

cap_percent = 0.0

cap_coeff   = 0.0

cap_power   = 1.0

Curve Polynomial

For on-grade inlets, the polynomial parameters may change with road grade and cross fall threshold values. The formula is the same for cap_fixed, cap_percent, cap_coeff and cap_power. Note that each curve may have its own curve multiplier specified with a cap_multi parameter (discussed below). Some hydraulic model tests have their on grade inlet results converted to polynomial equations.

Example
This example creates an inlet where the inlet capacity polynomials have been determined for 2 road grades (1% and 3%). Note that the road_grade 0.0 command is used for the 1% road grade. Since this is the flattest road grade curve we have calculated we will start using it at a road grade of 0%.

Note that the second curve "NJ G3" will be used when the road grade reaches 2.5. The threshold value where 12d should change to the next curve is generally slight less than the road grade from the source.

```
Manhole "On grade pit type NJ" {
        cap_config G

        cap_curve_grade    "NJ 1G" {
                road_grade  0
                cap_coeff  0.215
                cap_power  0.67
        }

        cap_curve_grade    "NJ 3G" {
                road_grade  2.5
                cap_coeff  0.24
                cap_power  0.673
        }
}
```

Curve Coordinates (On grade and SAG)

For on-grade and sag inlets, the inlet capacity may be determined by entering coordinates along the inlet capacity curve. These coordinates are usually obtained from hydraulic model studies or analytical methods such as HEC-22.

For on grade inlets, the coordinates are Qapproach and Qin, and the curves may change with road grade and cross fall threshold values. The inlet capacity curves are never extrapolated.

Example

```
Manhole "Ongrade coordinates" {
        cap_config G
        cap_curve_grade "0.5G" {
                road_grade  0
                coord 0.000 0.000
                coord 0.060 0.060
                coord 0.140 0.112
                coord 0.260 0.174
                coord 0.430 0.244
                coord 0.500 0.270
        }
        cap_curve_grade "1G" {
                road_grade  0.75
                coord 0.000 0.000
                coord 0.060 0.060
                coord 0.140 0.108
                coord 0.260 0.164
                coord 0.430 0.227
                coord 0.500 0.248
        }
}
```

For sag inlets, the coordinates are Depth (base units) and Qin, and there is only one curve. Each curve has a curve multiplier specified with a cap_multi parameter (discussed below).

Example

```
Manhole "SAG coordinates" {
        cap_config S
        cap_curve_sag "SAG" {
                coord 0.000 0.040
                coord 0.045 0.101
                coord 0.070 0.151
                coord 0.095 0.245
                coord 0.120 0.302
                coord 0.170 0.347
                coord 0.220 0.371
                coord 0.270 0.391
        }
}
```

Continue to 17.3.13.12.5.3 Polynomial Inlet Capacity Commands - old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.5.3 Polynomial Inlet Capacity Commands - old

The following commands are used to set the parameters in the following polynomial equation

inlet capacity = cap_fixed
+ cap_percent*0.01*Qa
+ cap_coeff*Qa^cap_power

cap_fixed	x.x	cms or cfs
cap_percent	x.x	percentage (0 to 100)
cap_coeff	x.x	multiplier
cap_power	x.x	exponent

Continue to 17.3.13.12.5.4 Inlet Curve Block Commands - old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.5.4 Inlet Curve Block Commands - old

Inlet curve blocks may be specified for both on-grade or sag inlets. Inside the curve block you may include the 17.3.13.12.5.3 Polynomial Inlet Capacity Commands - old and 17.3.13.12.5.5 Coordinate Inlet Capacity Commands - old.

cap_curve_grade "unique name for the pit type" {
road_grade x.xx
road_xfall x.xx
}

Inside the cap_curve_grade block the road grade and road crossfall threshold values (percent) may be set. The road grade and crossfall are calculated by the 17.3.4 Water Network Editor (WNE). When the 12d analysis engine selects the inlet curve, all curves with the same road_xfall are grouped together and then within the crossfall group the road_grade curves is selected.The inlet curve with the maximum grade threshold that is less than or equal to the road grade is selected.

Rules for 'cap_curve_grade' entries:

Only applicable to on-grade pits.
All cap_curve_grade names must be unique within a Manhole block
If both 'road_grade' and 'road_xfall' entries are omitted, only one cap_curve_grade entry is allowed within a pit.
The cap_curve_grade 'coord' entries (if used) must be in order of increasing Qa.

cap_curve_sag "unique name for the pit type" {

}

Rules for 'cap_curve_sag' entries:

Only applicable to sag pits.
Only one cap_curve_sag entry is allowed within a pit, and it must have a valid name.

Continue to 17.3.13.12.5.5 Coordinate Inlet Capacity Commands - old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.5.5 Coordinate Inlet Capacity Commands - old

The coord command must be used inside the cap_curve_grade or cap_curve_sag grouping

coord x.xx y.yy

x.xx must be in increasing order.

For cap_curve_grade group, the coord command has the parameters Qapproach and Qin

For cap_curve_sag group, the coord command has the parameters Depth and Qin

Continue to 17.3.13.12.6 Water Definitions -Link (Pipe) Types - Old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.6 Water Definitions -Link (Pipe) Types - Old

Link types are used to set the following link properties via the WNE.

- pipe nominal/actual diameters and thickness
- roughness method and value
- rational method design mode and design percent depth
- minimum pipe height for the rational design engine
- user defined pipe attributes

Each definition (pipe block) in the file begins with the key word **Pipe**, followed by the pipe type and then curly braces **{ }**. The order that the definitions appear in the file determines the order they appear in the drop down lists inside ***12d Model***.

The minimum requirement for a pipe type definition is

```
Pipe "name" {
}
```

The name must be unique and the braces {} cannot be () or [].

Example:

```
Pipe "CHNL GRASS PROPOSED" {    //Open Channel created below the tin.
                                // cover set in cover file to 0.0
  roughness_n 0.040
  attribute_integer "design size mode"    3  // open channel mode
}
```

Continue to 17.3.13.12.6.1 Link Water Network Editor Commands - old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.6.1 Link Water Network Editor Commands - old

17.3.13.12.6.1.1 Link Thickness - old

```
pipethickness   {
   diam_thickness   x.xxx y.yyy a.aaa b.bbb c.ccc d.ddd
}
```

x.xxx	nominal diameter choices will appear in the WNE->Pipe->Diameter drop down
y.yyy	internal diameter (base units) will be entered into the WNE->Pipe->Diameter field
a.aaa	optional top thickness (base units) 0.000 if omitted
b.bbb	optional bottom thickness (base units) top thickness if omitted
c.ccc	optional left thickness in direction of chainage (base units) top thickness if omitted
d.ddd	optional right thickness in direction of chainage (base units) top thickness if omitted

Continue to 17.3.13.12.6.1.2 Link Attributes - old or return to 17.3.13.12 Water Definitions File - Old Drainage.4d.

17.3.13.12.6.1.2 Link Attributes - old

attribute_integer	"attribute name1" x	x is an integer value (no decimal, stored exactly by computers
attribute_real	"attribute name2" x.xxx	x is a real value (used to store numbers with decimals or very large or very small numbers

attribute_text	"attribute name3" "text"	text is a series of words or numbers not intended for calculations

The following special attribute commands create/modify an attribute as described above but these attributes also control calculations performed by the **Set Node Details** button on the 17.3.4 Water Network Editor (WNE). The WNE fields will be locked when these attributes are defined for the selected pipe type. If these attribute are not defined for the selected pipe type the WNE field will not be locked and remain unchanged.

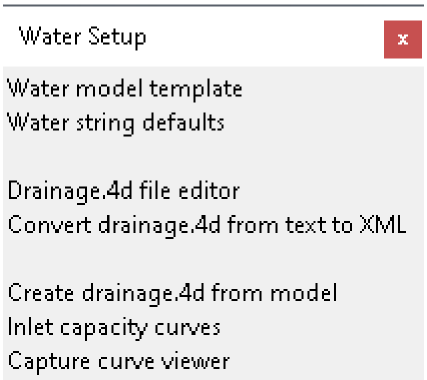
roughness_n	x.xx>	WNE field ->Pipe =>Main =>Roughness WNE field ->Pipe =>Main =>Roughness type (set to Manning)	
roughness_k	x.xx	WNE field ->Pipe =>Main =>Roughness	
	Colebrook k roughness value in millimetres	WNE field ->Pipe =>Main =>Roughness type (set to Colebrook)	
attribute_real	x.xx	WNE field ->Pipe =>Design =>Min pipe height	
	min height in base units		
attribute_integer	"design size mode"	x	WNE field ->Pipe =>Design =>Design mode
	Mode		**x**
	Pressurised Pipe: 7		0
	Part-full Pipe: Freeboard design		1
	Part-full Pipe: Flow depth design		2
	Open Channel: Freeboard design		3
attribute_real	"design percent depth"	x.xx	WNE field Pipe =>Design =>Flow-depth at pipe entrance

Continue to 17.4 Water Setup or return to 17.3.13 Water Network Old.

17.4 Water Setup

Position of menu: **Water =>Setup**

The **Water Setup** walk-right menu is



See
17.3.1 Create/Read Water Model Template
17.3.2 Water String Defaults

17.4.1 Drainage.4d File Editor
??

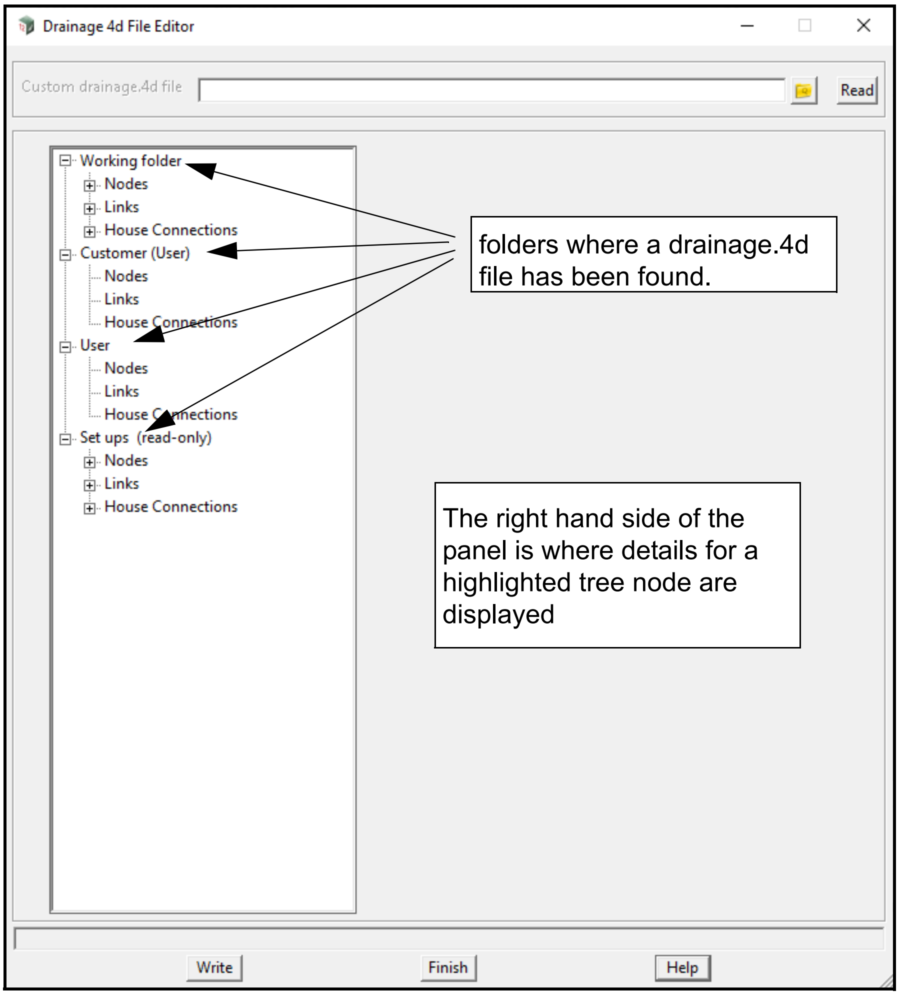
17.4.2 Create drainage.4d from Model
17.4.3 Stormwater Inlet Capacities
17.5.14 Capture Curve Viewer

17.4.1 Drainage.4d File Editor

Position of menu: Water =>Setup =>Edit drainage.4d

This option edits the XML version of drainage.4d.

Selecting **Edit drainage.4d** brings up the **Drainage.4d File Editor** panel.



The water definitions file **(drainage.4d**) contains information about **node types**, **link types** and **house connection types** that can be used in the node, link and house connection pop-ups.

The water definitions file that is used after ***12d Model*** starts up is not just one file but is accumulated from the **drainage.4d** files in **Working folder**, **Customer User folder** (if it exists), **User folder** and **set_ups folder**.

When the **Drainage.4d File Editor** starts, ***drainage.4d*** files from the current folder (working folder), customer, user and set_ups folders are loaded under the tree nodes ***Working folder***, ***Custom User*** and ***Set ups***.

On the right hand side of the panel, all the details of the current highlighted tree node are shown.

If in the various tree node **Nodes**, there is a **node type** of the same name, the one in **Working folder** takes priority over the one in **Customer User folder**, which takes priority over the one in **User folder,** which takes priority over the one in **Set_ups** folder.

If in the various tree node **Links**, there is a **link type** of the same name, the one in **Working folder** takes priority over the one in **Customer User folder**, which takes priority over the one in **User**

folder, which takes priority over the one in **Set_ups** folder.

If in the various tree node **House Connections**, there is a **house connection type** of the same name, the one in **Working folder** takes priority over the one in **Customer User folder**, which takes priority over the one in **User folder,** which takes priority over the one in **Set_ups** folder.

The **Set ups** node is marked as **read-only**" as the folder set_ups is in the administration folder ***Program Files.***

See

Buttons at bottom

Dynamic icons on the left hand side

Other Panel Fields and buttons

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Buttons at bottom

Write button

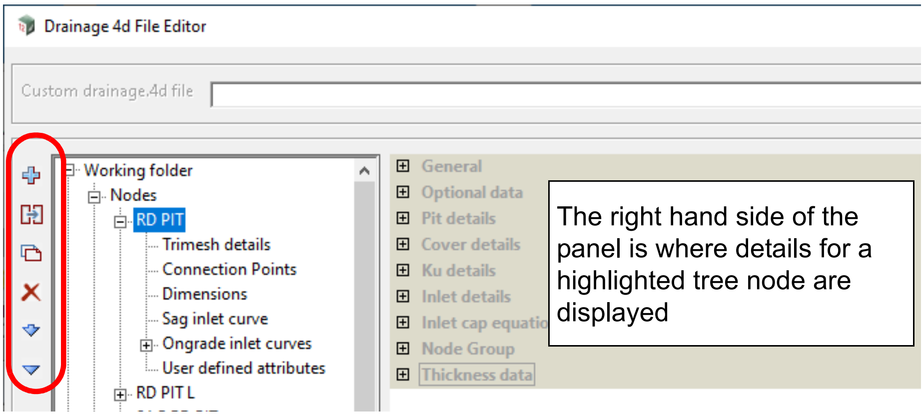
Clicking **Write** *save the current drainage.4d file being edited.*

Note: The drainage.4d file saved is the root node currently being edited.

Dynamic icons on the left hand side

When selecting a tree node or a sub node from the tree box, dynamic icons on the left hand side of the tree control will be displayed to indicate which actions can be performed on the highlighted (current) tree node.

command buttons (dynamic icons)



Add dynamic icon on left hand side

Add a new tree node.

Copy dynamic icon on left hand side

Copy the current tree node with all of its child nodes to the clipboard.

Paste dynamic icon on left hand side

Paste the data stored in the clipboard. The operation is allowed when clipboard data is compatible with the currently selected tree node.

Delete dynamic icon on left hand side

Delete the current tree node and all of its child nodes.

Move to top dynamic icon on left hand side

Move the current tree node to the top of the branch.

Move up dynamic icon on left hand side

Move the current tree node one place up.

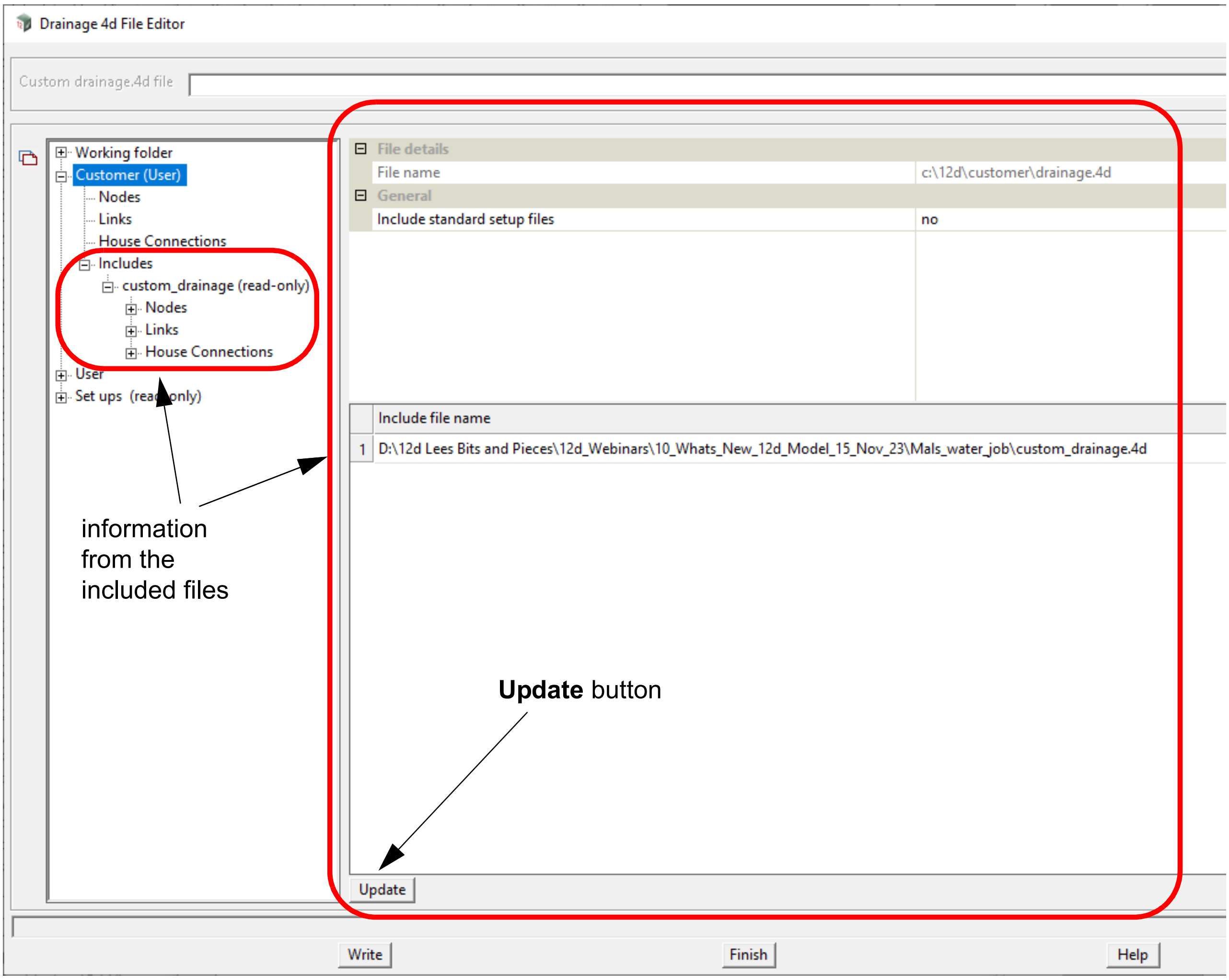
Move down dynamic icon on left hand side

Move the current tree node one place down.

Move to bottom dynamic icon on left hand side

Move the current tree node to the bottom of the branch.

Other Panel Fields and buttons



File name file box dialogue box

name of the rainge.4d file used for this tree node.

Include standard setup files tick/yes-no box not ticked

*If **ticked**, drainage.4d files from Customer, User and Setup folder will be included into the currently edited file.*

Update button

Add the files in the **Include file name** *column of the grid to the tree node.*

Grid

Include file name file box column

Name of a custom drainage file (which doesn't have to be named drainage.4d but should end in .4d) that is to be included.

Special usages

Including a custom drainage file

A custom drainage file (with more Nodes, Links and House Connection types) is used by adding it to the **Include file name** *column of the grid and pressing the* **Update** *button.*

Edit a custom drainage file

A custom drainage file is shown as ***"read-only"*** *in the tree.*

The custom drainage file can be edited by selecting it in the ***Custom drainage file*** *box on the top of the* **Drainage.4d File Editor** *and pressing* **Read.** *??*

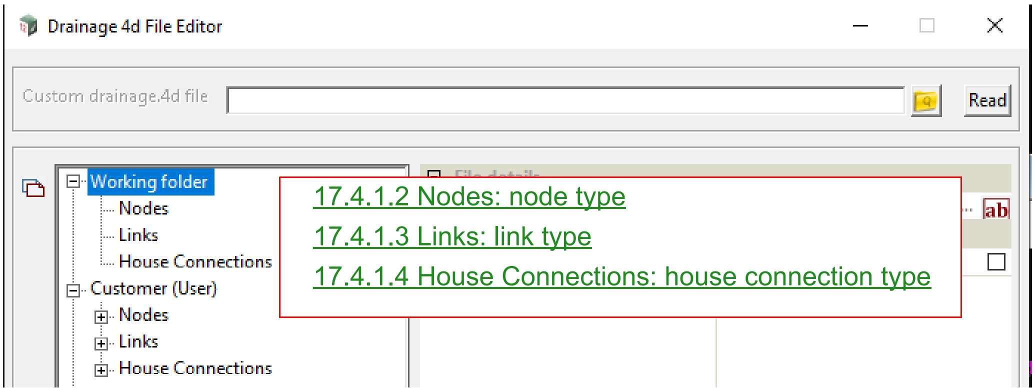
Make the changes to the custom drainage file and press **Write** *to save the custom drainage file.*

Continue to 17.4.1.1 Nodes, Links and House Connections Tree Nodes

17.4.1.1 Nodes, Links and House Connections Tree Nodes

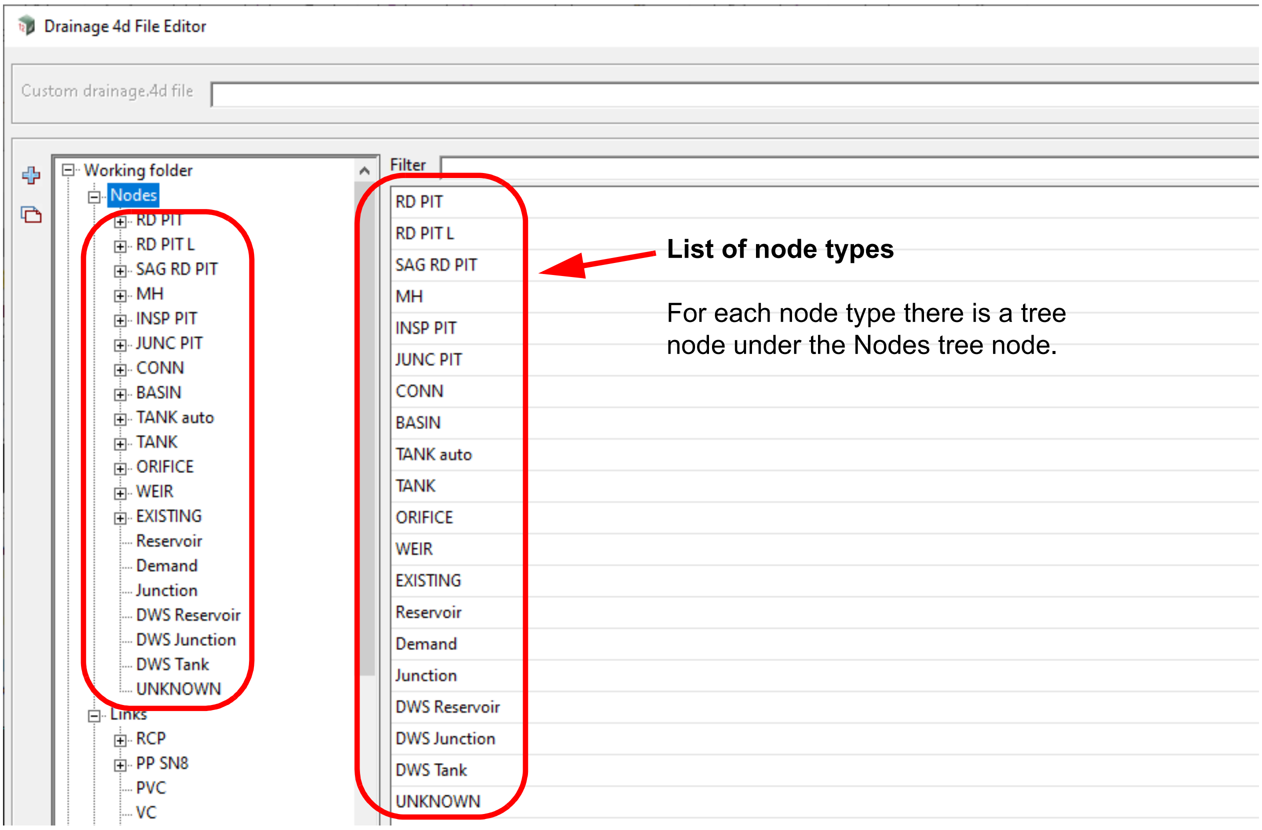
Each tree node ***Working folder***, ***Customer***, ***User*** and ***Set ups***, contains the information from a different drainage.4d file.

Each of these tree nodes has sub-nodes **Nodes**, **Links** and **House Connections** which contain the information on the **node types**, **link types** and **house connection types**.



17.4.1.2 Nodes: node type

Clicking on the **Nodes** node under Working folder, Custom, User or Set ups lists the names of the node types in that drainage.4d.



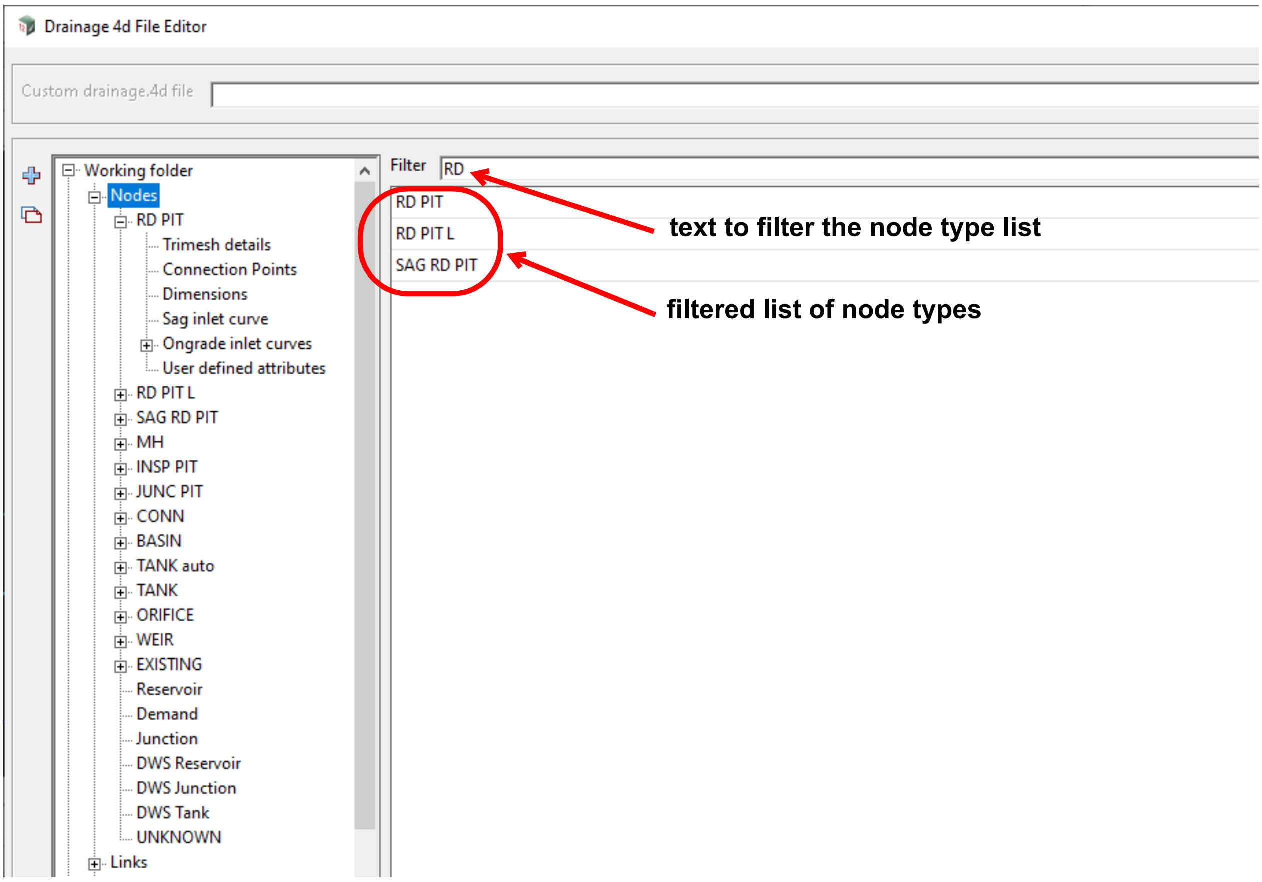
The **Filter** field is used to restrict which node types are used from the **Nodes** list

*If **not blank,** the text in the* **Filter** *field is made up of texts, separated by commas, and any node type name in the full list of names that includes part of any of the texts, are included in the final list of node types. For the Filter, the texts and node type names are case insensitive.*

For example:

Filter RD
includes RD PIT, RD PIT L and SAG RD PIT

Filter RD, j
includes RD PIT, RD PIT L, SAG RD PIT, JUNC PIT, Junction and DWS Junction.



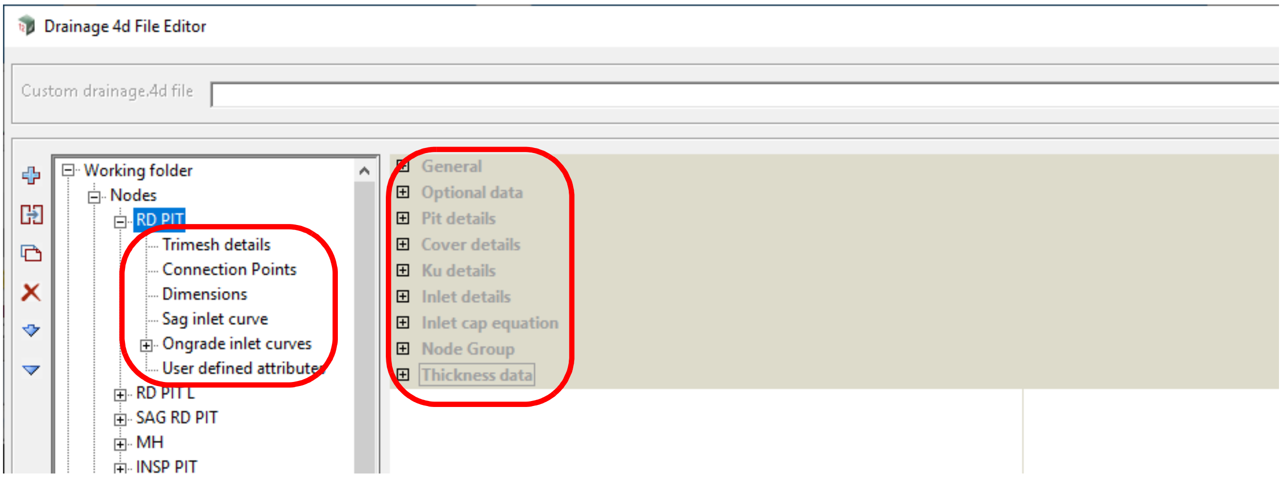
Continue to 17.4.1.2.1 Information About a Node Type or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1 Information About a Node Type

Each individual node type has much of the information required to define a node.

When clicking on the node type name, some of the information is displayed in sections on the right hand side of the panel.

The tree sub-nodes under the named node type appear when fields are ticked on in the **Optional data** section on the right.



For the information about each of the expanded sections on the left hand side, see

17.4.1.2.1.1 Node Type: General

17.4.1.2.1.2 Node Type: Optional data

17.4.1.2.1.3 Node Type: Pit details

17.4.1.2.1.4 Node Type: Cover details

17.4.1.2.1.5 Node Type: Ku details

17.4.1.2.1.6 Node Type: Inlet details

17.4.1.2.1.7 Node Type: Inlet cap equation

17.4.1.2.1.8 Node Type: Node Group

17.4.1.2.1.9 Node Type: Thickness data

For the information about each sub-nodes on the right hand side, see

17.4.1.2.1.10 Note Type: Trimesh detail Tree Node

17.4.1.2.1.11 Note Type: Connection Points Tree Node

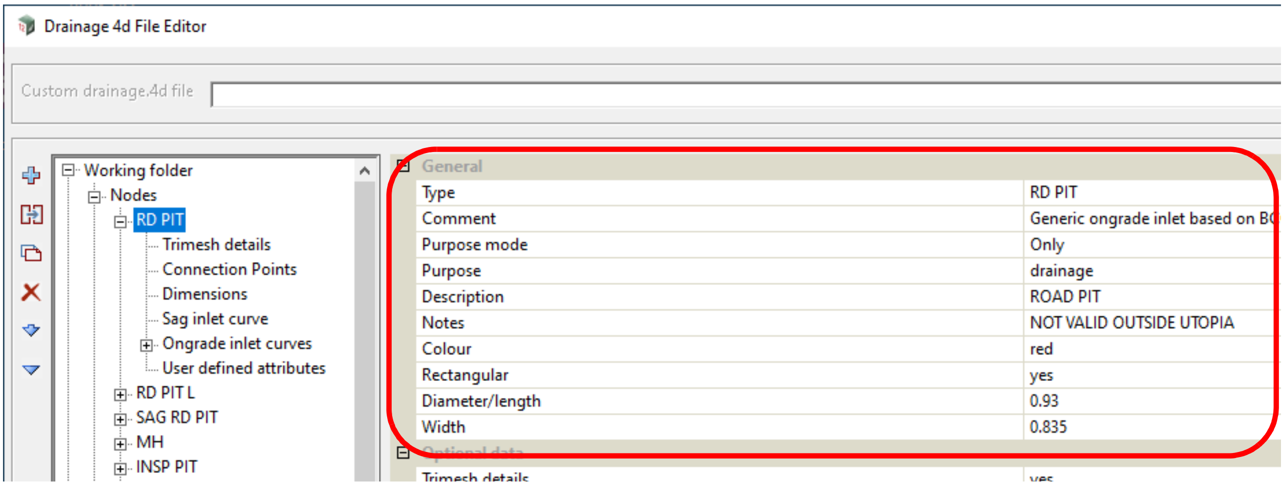
17.4.1.2.1.12 Note Type: Dimensions Tree Node

17.4.1.2.1.13 Note Type: Sag inlet curve Tree Node

17.4.1.2.1.14 Note Type: Ongrade inlet curves Tree Node

17.4.1.2.1.15 Note Type: User defined attributes Tree Node

17.4.1.2.1.1 Node Type: General



The fields and buttons used in this panel have the following functions.

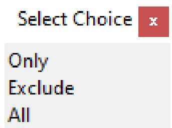
Field Description	Type	Defaults	Pop-Up
Type	text box		

Name to use as the water node "Type". This is the name that appears in a list of Node Types, and when selected, uses all the following node information for the selected node.

Comment	text box		

Comment about the node type.

Purpose mode	choice box	blank	or blank.



Determines how the purpose setting is to be used.

*If **blank** or **ALL**, the node types will be displayed for all water strings node type choices.*

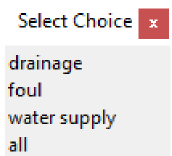
***Only**, the node type list will only be displayed for the node types specified by purpose*

***Exclude,** the node type will NOT be displayed for the type specified by purpose*

***All,** the node types will be displayed for all water strings node type choices. This is the same as leaving* **purpose** *blank.*

The purpose of a water string is controlled by the Method on the WNE-> GLOBAL->Main tab or the purpose on WSE.

Purpose	choice box	blank	or blank



Used with **Purpose mode** *to determines which type of water node is displayed/not displayed in Node type choice boxes. When left blank this type will be included for all water string type choice boxes.*

The purpose of a water string is controlled by the Method on the WNE-> GLOBAL->Main tab or the purpose on WSE.

Description	text box		

Description for the node type.

Notes	text box		

Note for the node type.

Colour	colour box	red	available colours

Colour for the node type.

Rectangular	tick/yes-no box		

If ***ticked****, the node type is rectangular with inside width* **Width** *and inside length* **Diameter/length**.
If ***not ticked****, the node type is round and its inside diameter is* **Diameter/length**.

See 17.1.4.1.1 Node Shapes and Sizes with No Riser.

Diameter/length	text box		

Diameter of a round node type, or length for a rectangular node type.

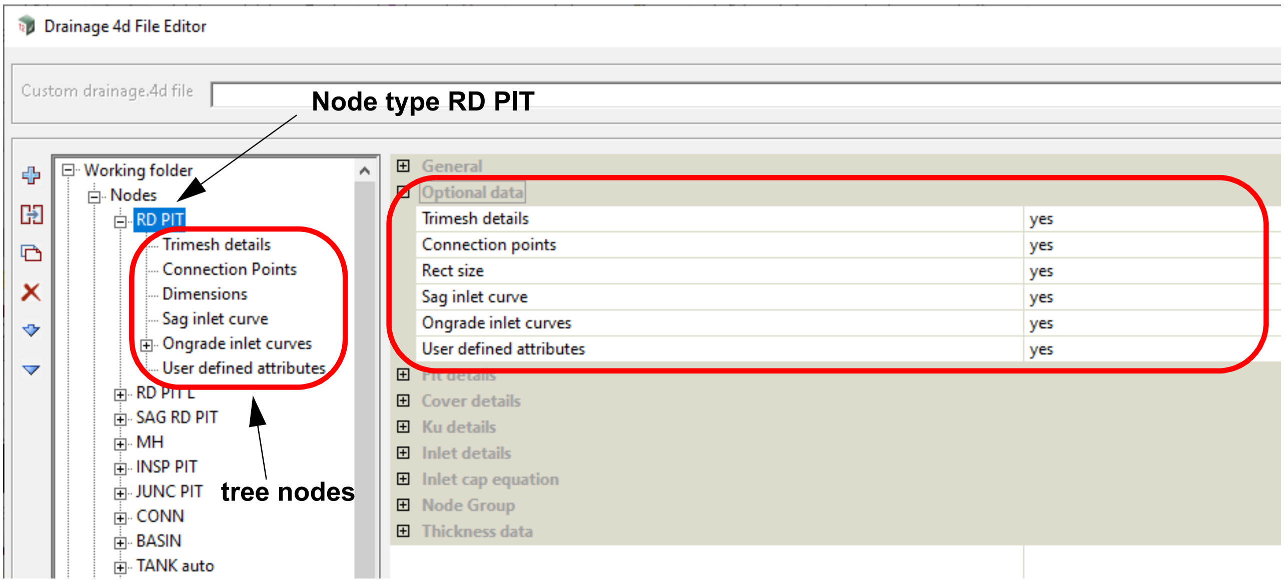
Width	text box		

Width of a rectangular node type.

Continue to 17.4.1.2.1.2 Node Type: Optional data or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.2 Node Type: Optional data

In the **Drainage.4d File Editor**, the **Optional data** section for a node type has the fields Trimesh details, Connection points, Rect size, Sag inlet curve, ongrade inlet curves and User defined attributes.



For ***Trimesh details:***

If ***yes*** is selected then a ***Trimesh details*** tree node is created to hold the trimesh information for drawing water nodes. See 17.4.1.2.1.10 Note Type: Trimesh detail Tree Node.

If ***no*** is selected then there is no ***Trimesh details*** tree node and nothing is written to the file. If a ***Trimesh details*** node already existed and then ***no*** is selected, the ***Trimesh details*** tree node is deleted and any data in it is lost.

For ***Connection points:***

If ***yes*** is selected then a ***Connection Points*** tree node is created to hold the user defined attributes for the node type. See 17.4.1.2.1.11 Note Type: Connection Points Tree Node.

If ***no*** is selected then there is no ***Connection Points*** tree node and nothing is written to the file. If a ***Connection Points*** tree node already existed and then ***no*** is selected, the ***Connection Points*** tree node is deleted and any data in it is lost.

For ***Rect size:***

If ***yes*** is selected then a ***Dimensions*** tree node is created to hold the user defined attributes for the node type. See 17.4.1.2.1.12 Note Type: Dimensions Tree Node.

If ***no*** is selected then there is no ***Dimensions*** tree node and nothing is written to the file. If a ***Dimensions*** tree node already existed and then ***no*** is selected, the ***Dimensions*** tree node is deleted and any data in it is lost.

For ***Sag inlet curve:***

If ***yes*** is selected then a ***Sag inlet curve*** tree node is created to hold the data to defined the sag inlet curve for the node type. See 17.4.1.2.1.13 Note Type: Sag inlet curve Tree Node.

If ***no*** is selected then there is no ***Sag inlet curve*** tree node and nothing is written to the file. If a ***Sag inlet curve*** tree node already existed and then ***no*** is selected, the ***Sag inlet curve*** tree node is deleted and any data in it is lost.

For ***Ongrade inlet curves:***

If ***yes*** is selected then a ***Ongrade inlet curves*** tree node is created to hold the data to defined the ongrade inlet curve for the node. type See 17.4.1.2.1.14 Note Type: Ongrade inlet curves Tree Node.

If ***no*** is selected then there is no ***Ongrade inlet curves*** tree node and nothing is written to the file. If a ***Ongrade inlet curves*** tree node already existed and then ***no*** is selected, the ***Ongrade inlet curves*** tree node is deleted and any data in it is lost.

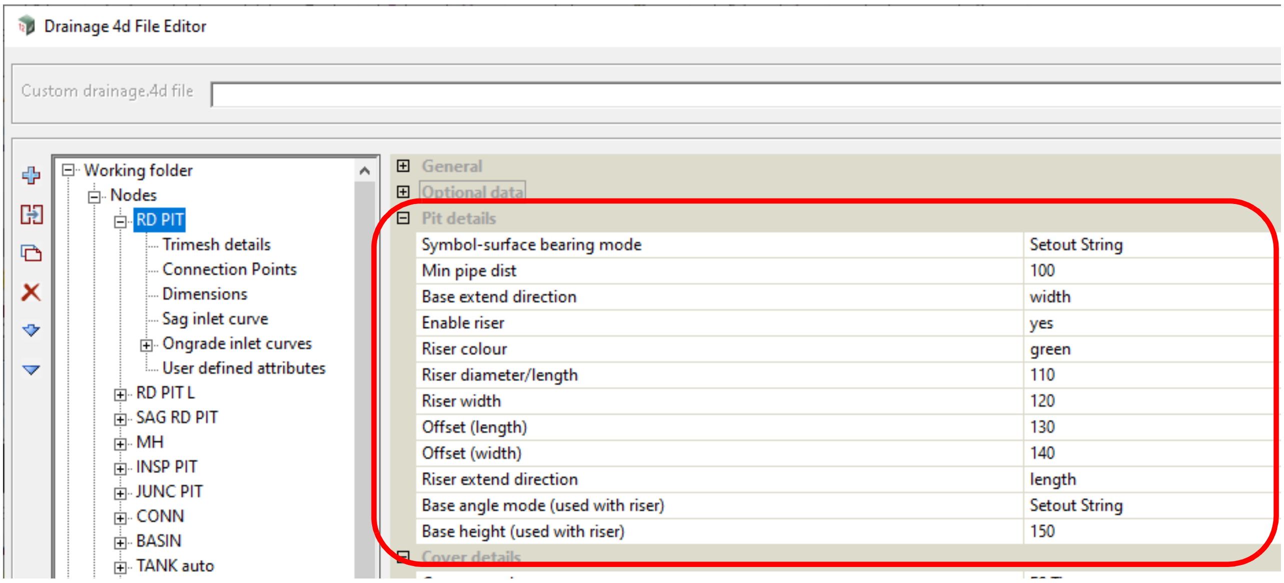
For ***User defined attributes:***

If ***yes*** is selected then a ***User defined attributes*** tree node is created to hold the user defined attributes for the node type. See 17.4.1.2.1.15 Note Type: User defined attributes Tree Node.

If ***no*** is selected then there is no ***User defined attributes*** tree node and nothing is written to the file. If a ***User defined attributes*** tree node already existed and then ***no*** is selected, the ***User defined attributes*** tree node is deleted and any data in it is lost.

Continue to 17.4.1.2.1.3 Node Type: Pit details or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

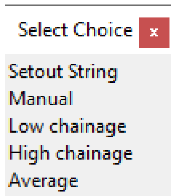
17.4.1.2.1.3 Node Type: Pit details



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Symbol-surface bearing mode choice box Setout string



*Method for calculating the **bearing** of symbols at a node. See* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

*If **Setout string** - the node bearing (direction of node length) obtained from setout and centre line strings (downhill bearing). If no setout string is found then no bearing is calculated.*

*If **Manual** - bearing entered in the **Bearing** field on the **Node >Setout** tab.*

*if **Low chainage** - the bearing of the link on the low chainage side of the node. The first node has no low chainage link so the high chainage link bearing is used.*

*If **High chainage** - the bearing of the link on the high chainage side of the node. The last node has no high chainage link so the low chainage link bearing is used.*

*If **Average** - the average of the low and high chainage link bearings.*

Min pipe distance real box

??

Base extend direction choice box none, width, length

*If **none**, the node type is not an extended node.*

***width**, the node type is an extended node and is extended in the width direction.*

***length**, the node type is an extended node and is extended in the length direction.*

See 17.1.4.1.1 Node Shapes and Sizes with No Riser.

Enable riser tick/yes-no box

*If **ticked**, the node type has a riser.*

*If **ticked**, the node type does not have a riser.*

See 17.1.4.1.2 Risers on Nodes.

Riser Colour colour box red available colours

Colour for the node type's riser.

See 17.1.4.1.1 Node Shapes and Sizes with No Riser.

Riser diameter/length real box

*If **Riser width** is **zero** or **blank** then the node type's riser is round and* **Riser diameter/length** *is the inside diameter of the node type's riser.*

*If **Riser width** is **non-zero** then the node type's riser is rectangular and* **Riser diameter/length** *is the inside length of the node type's riser.*

Riser width real box

*If **Riser width** is **non-zero** then the node type's riser is rectangular and* **Riser width** *is the inside width of the node type's riser.*
*If **Riser width** is **zero** or **blank** then the node type's riser is round.*

See 17.1.4.1.2 Risers on Nodes.

Offset (length) real box

The centre of the node type's riser is the distance **Offset (length)** *in the length direction from the centre of the node.*

Offset (width) real box

The centre of the node type's riser is the distance **Offset (width)** *in the width direction from the centre of the node.*

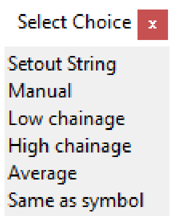
See 17.1.4.1.2 Risers on Nodes.

Riser extend direction choice box none, width, length

*If **none**, the node type's node is not an extended riser.*
***width**, the node type's riser is an extended riser and is extended in the width direction.*
***length**, the node type's riser is an extended riser and is extended in the length direction.*

See 17.1.4.1.1 Node Shapes and Sizes with No Riser.

Base bearing mode (used with riser) choice box Setout string



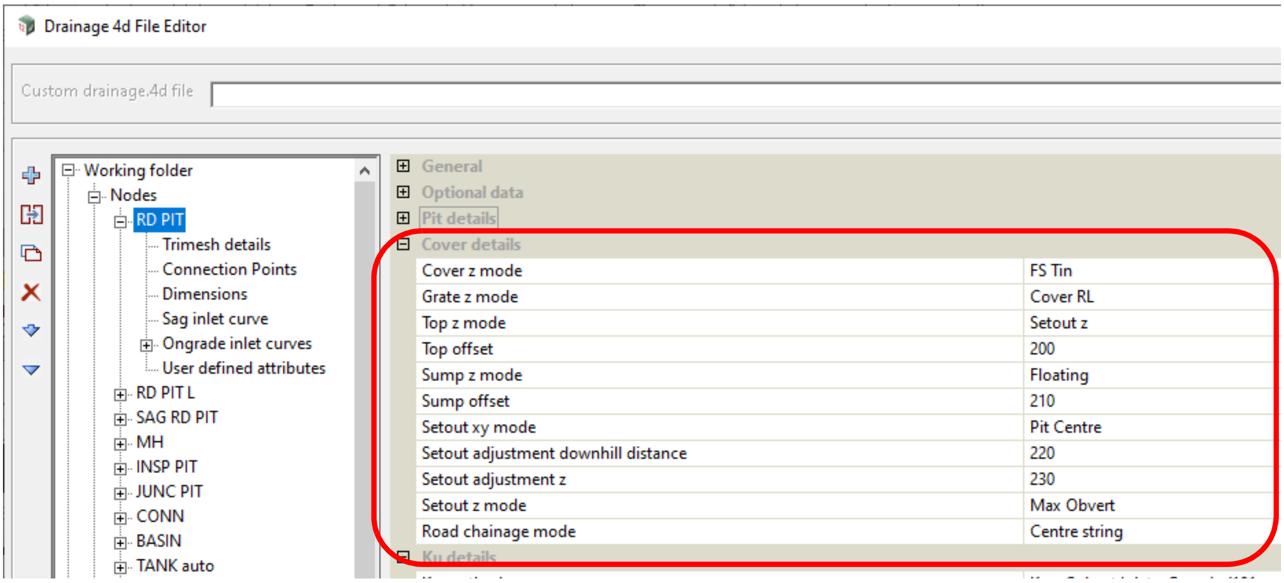
For documentation on each **Base bearing mode**, *see* 17.1.4.7.1 Bearing of Base (Chamber) with Riser.

Base height (use with riser) real box

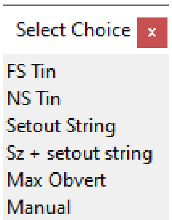
If the node type has a rise then **Base height (use with riser)** *is the inside base height of the node type's base. See* 17.1.4.4 Z Point Definitions for Nodes and Links.

Continue to 17.4.1.2.1.4 Node Type: Cover details or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.4 Node Type: Cover details

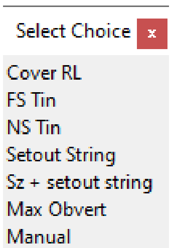


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Cover z mode	choice box		

This is also known as the Cover RL mode.

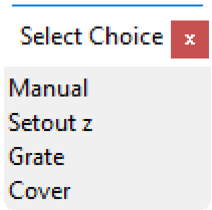
For the definition of these choices, see 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z) *and for a diagram showing the definition of* ***Cover RL****, see* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Field Description	Type	Defaults	Pop-Up
Grate z mode	choice box		

This is also known as the Grate RL mode.

For the definition of these choices, see 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z) *and for a diagram showing the definition of* ***Grate RL****, see* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Top z mode choice box



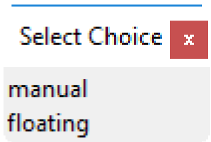
*This is also known as the **Top RL mode**.*

For the definition of these choices, see 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z) *and for a diagram showing the definition of **Top RL**, see* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Top offset real box

For the **Top z mode** *of **Cover**, **Top z** is given by the **Cover z** minus the* **Top offset.** *See* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Sump z mode choice box



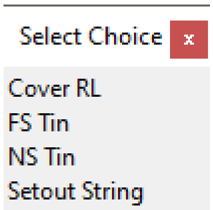
*This is also known as the **Sump RL mode**.*

For the definition of these choices, see 17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z) *and for a diagram showing the definition of **Sump RL**, see* 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

Sump offset real box

For the **Sump z mode** *of **floating**, **Sump z** is given by the **minimum downstream node invert** minus the* **Sump offset**.

Setout xy mode choice box



For the definition of these choices, see 17.1.4.6.1 Setout xy Mode and Setout xy *and* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

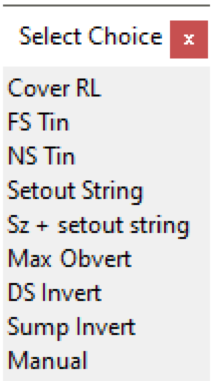
Setout adjustment downhill distance real box

??

Setout adjustment z real box

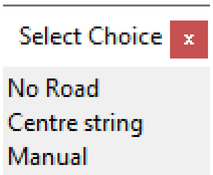
??

Setout z mode choice box



For the definition of these choices, see 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL *and* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

Road chainage mode choice box



For the definition of these choices, see 17.1.4.6.3 Node Road Chainage Mode.

Continue to 17.4.1.2.1.5 Node Type: Ku details or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

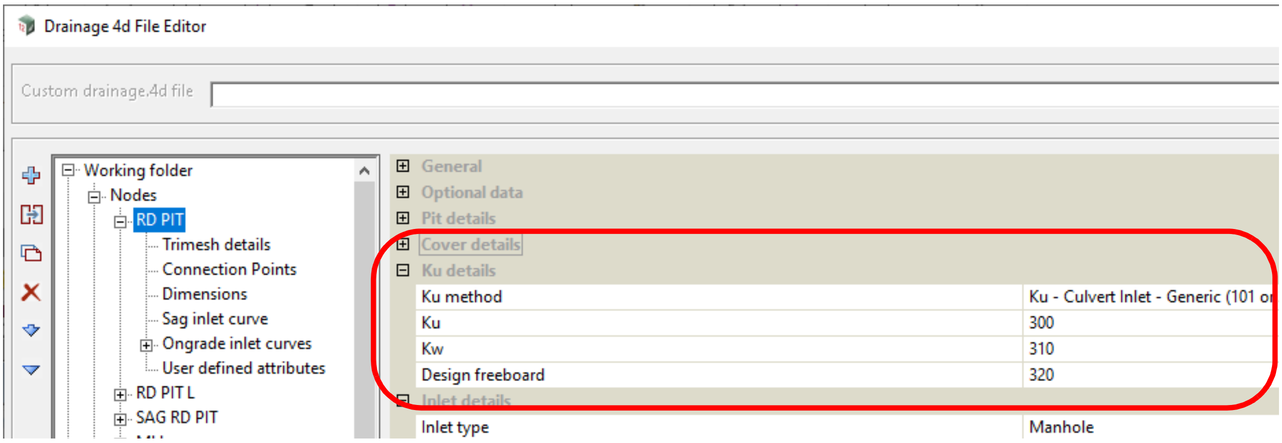
17.4.1.2.1.5 Node Type: Ku details

Head loss coefficients in conduits (Ku, Kw) are calculated using either the combination of "Missouri Charts" (Sangster et al, 1958) and "Hare Charts" (Hare, 1981) for typical pits and pipes found in subdivision-style applications, or the U.S. Department of Transportation publication “Hydraulic Design of Highway Culverts”

(Refer: https://www.12d.com/downloads/v9/12d_Drainage_Analysis_Ku_Kw.pdf)

(Refer: https://www.fhwa.dot.gov/engineering/hydraulics/pubs/12026/hif12026.pdf)

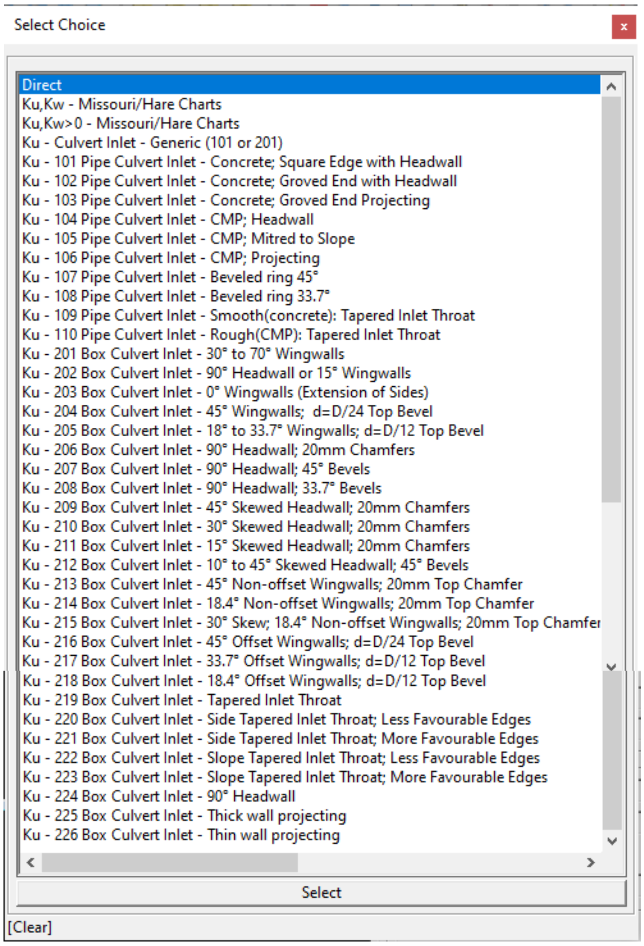
Note that these methods were developed for circular and rectangular conduits and should be used with caution for all other conduit types.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Ku method choice box



Ku real box

Pressure head change in a pipe related to the configuration of grated inlets and the number and direction of incoming pipes. See 27.2.1.1 Ku and Kw *and* 27.2.1.2 Ku - Node Pressure Losses.

Kw real box

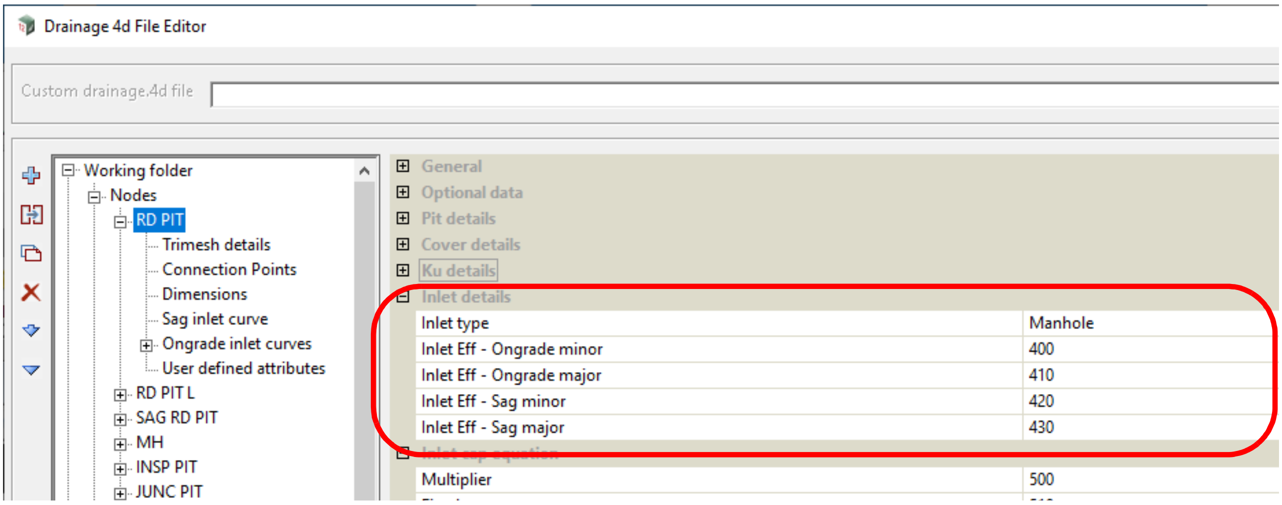
The Water surface elevation change at a node related to the configuration of grated inlets and the number and direction of incoming pipes. The water surface elevation change is an integral part of the St. Venant solution method used by the Dynamic Drainage Analysis module (DDA) and therefore Kw is only used in steady state Rational Formula design and analysis. See 27.2.1.1 Ku and Kw.

Design freeboard real box

The design freeboard is used by the rational method during the regrading and design of a pipe network.

Continue to 17.4.1.2.1.6 Node Type: Inlet details or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.6 Node Type: Inlet details

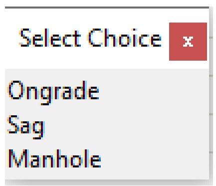


The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

This section defines the Inlet efficiency for the node. For information on inlet efficiency, see 27.2.1.3.1 Inlet Capacity Equation *and* 27.2.1.3.1.1 Inlet Efficiency.

Inlet type   choice box



*The node type is **one** of Ongrade, Sag and Manhole*
*If **Ongrade**, the captured flow is a function of the gutter flow approaching the node.*
*If **Sag**, the captured flow is a function of the depth of water at the node.*
*If **Manhole**, the node is sealed and no water goes into the node*

The following values apply for either ongrade or sag node types:

Inlet Eff - ongrade minor   real box

Inlet efficiency for an ongrade node for a minor storm.

Inlet Eff - ongrade major   real box

Inlet efficiency for an ongrade node for a major storm.

Inlet Eff - sag minor   real box

Inlet efficiency for a sag node for a minor storm.

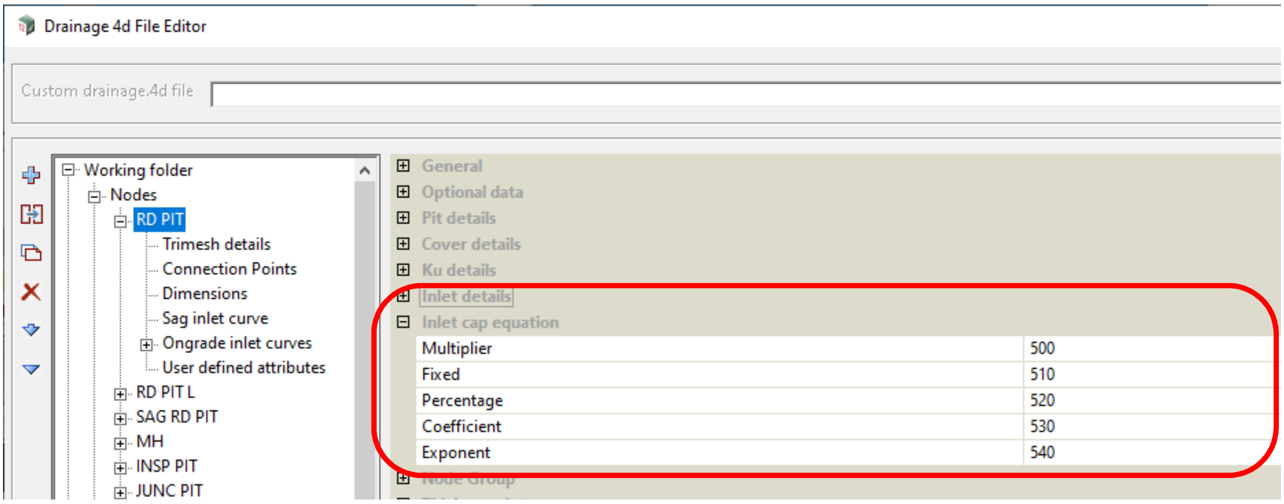
Inlet Eff - sag major   real box

Inlet efficiency for a sag node for a major storm.

For information on inlet efficiency, see 27.2.1.3.1 Inlet Capacity Equation and 27.2.1.3.1.1 Inlet Efficiency.

Continue to 17.4.1.2.1.7 Node Type: Inlet cap equation and or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.7 Node Type: Inlet cap equation



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

This section defines the Inlet multiplier and the defining values in the single polynomial, in the Inlet capacity equation. For information on the inlet capacity equation, see 27.2.1.3.1 Inlet Capacity Equation*,* 27.2.1.3.1.2 Inlet Multiplier *and* 27.2.1.3.1.3 Single Polynomial*.*

Multiplier real box

Inlet multiplier in the inlet capacity equation.

Fixed real box

Fixed term, ***cap_fixed****, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Percentage real box

Percentage term, ***cap_percent****, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Coefficient real box

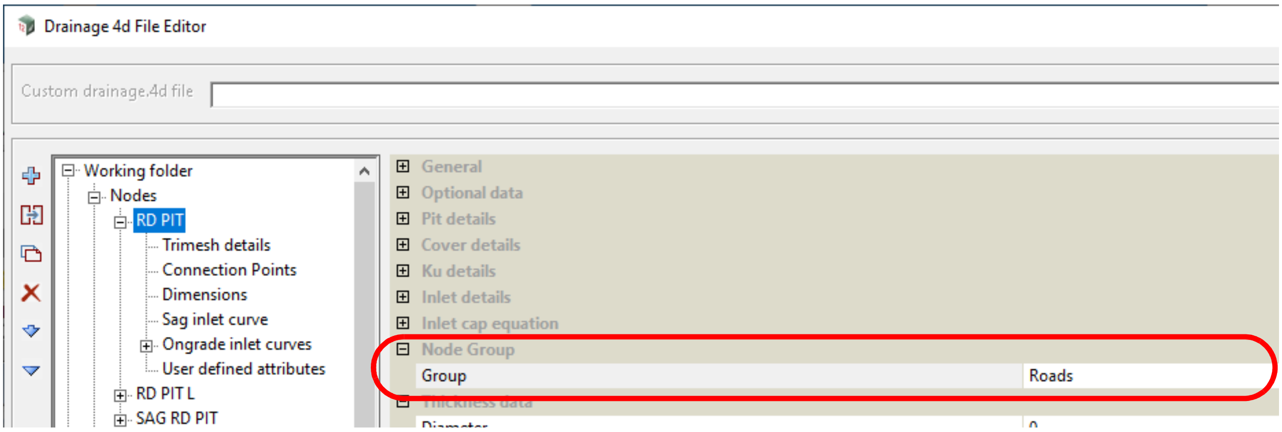
Coefficient term, ***cap_coeff****, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Exponent real box

Exponent term, ***cap_power****, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Continue to 17.4.1.2.1.8 Node Type: Node Group or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.8 Node Type: Node Group



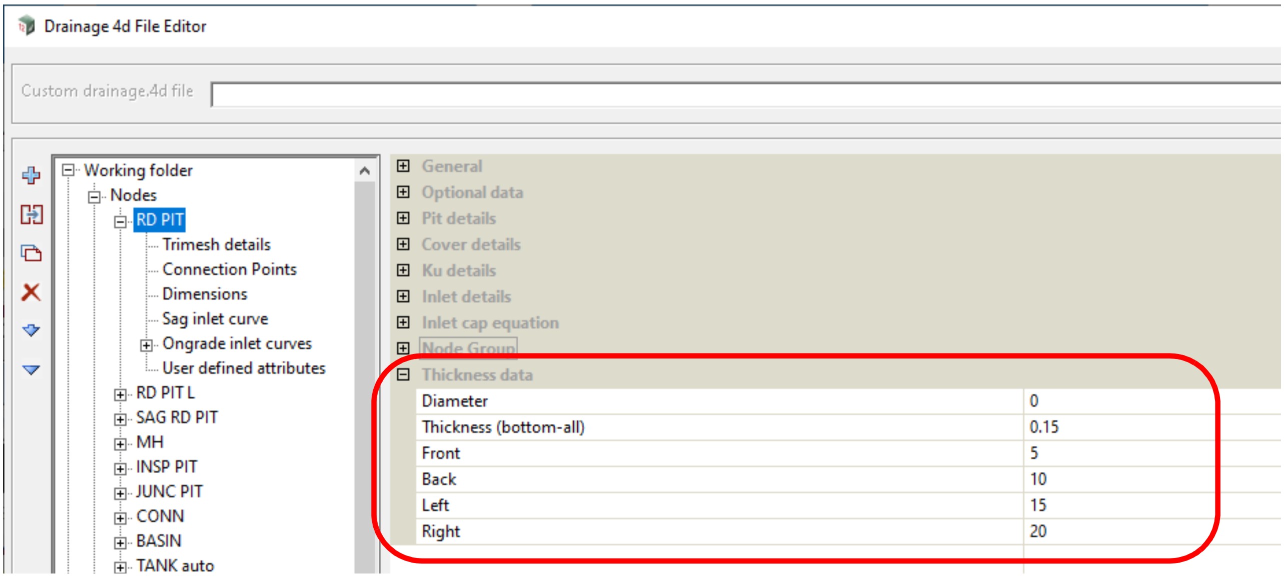
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Group	text box		

Name of the group that the name of the node type is in.

Continue to 17.4.1.2.1.9 Node Type: Thickness data or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.9 Node Type: Thickness data



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Diameter real box

*If **not zero,** the outside diameter if it is a round node type. See* 17.1.4.1.1 Node Shapes and Sizes with No Riser*??*

Thickness (bottom - all) real box

*If **not zero,** the thickness of the bottom. See* 17.1.4.1.1 Node Shapes and Sizes with No Riser*. ??*

Front/Back/Left/Right) real box

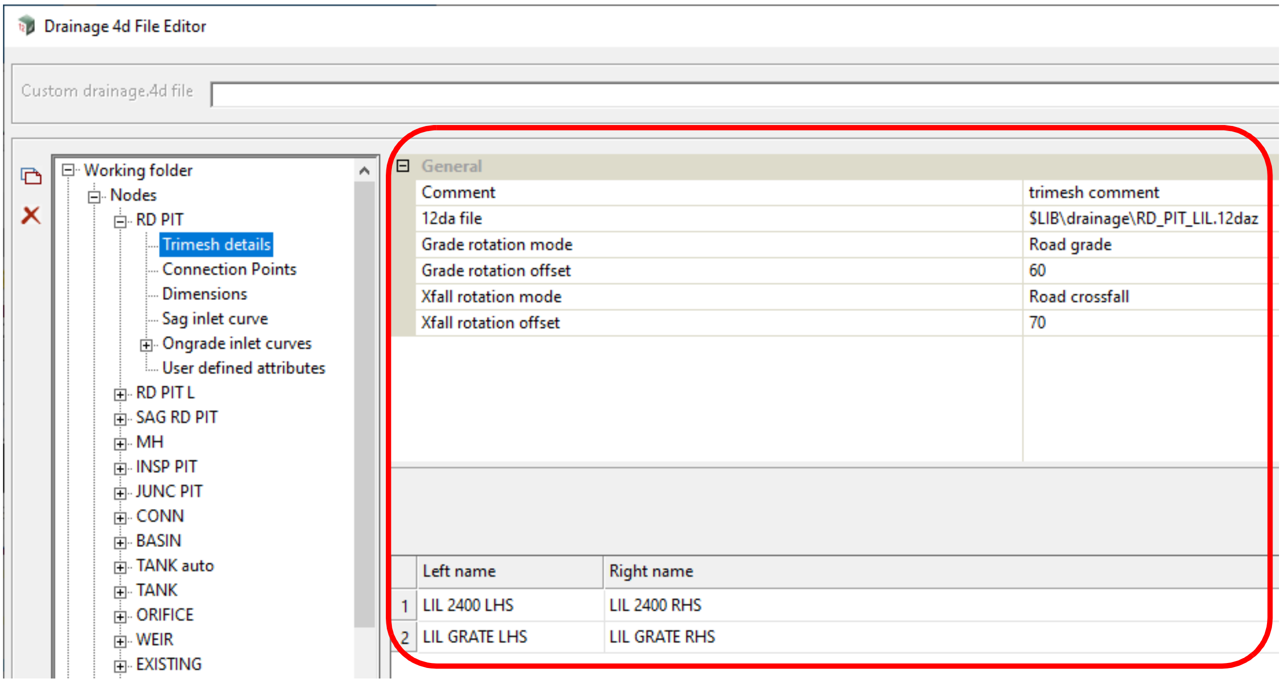
*If **not zero,** the front/back/left/right thickness. See* 17.1.4.1.1 Node Shapes and Sizes with No Riser.

Continue to 17.4.1.2.1.10 Note Type: Trimesh detail Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.10 Note Type: Trimesh detail Tree Node

*If a **trimesh** is associated with a node type then it can be manually rotated or take its rotation from the grade and crossfall from a road string.*

This section contains the contains the file containing the trimeshes for this node type. See [17.1.4.1.5 Trimeshes on Nodes](#) *for more details.*



The fields and buttons used in this panel have the following functions:

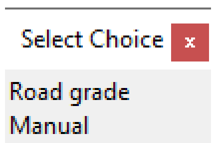
Field Description	Type	Defaults	Pop-Up
Comment	text box		

Comment.

12da file	file box		

*File to contain all of the trimeshes in the **Left name** and **Right name** columns below.*

Grade rotation mode	choice box		



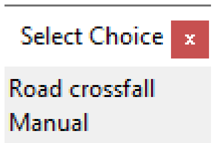
*The method of rotating the trimesh in the **direction along** the node.*

*If **Road grade,** the grade rotation is the grade of the road string (percentage).*
*   **Manual**, the grade rotation is the **Grade (%)** field in the **Node >Setout** subtab.*
*   **blank**, no value is used.*
*If **not blank**, this sets and locks the* **Grade rotation mode** *on the WNE >Node >Setout tab. See* [17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout](#).

Grade rotation offset	real box		

This value is added to the value calculated by the **Grade rotation mode**. *It is a percentage.*
*If **not blank,** this sets and locks the Grade rotation offset on the WNE >Node >Setout tab. See* [17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout](#).

Xfall rotation mode choice box



*The method of rotating the trimesh in the **direction perpendicular** to the node.*

*If **Road xfall,** the Xfall rotation is the xfall of the road (percentage).*
__Manual,__ the Xfall rotation is in the __Xfall (%)__ field in the __Node >Setout__ subtab
__blank,__ no value is used.

*If **not blank,** this sets and locks the Xfall rotation mode on the WNE >Node >Setout tab. See* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

Xfall rotation offset real box

This value is added to the value calculated by the **Xfall rotation mode**.

*If **not blank,** this sets and locks the Xfall rotation offset on the WNE >Node >Setout tab. See* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout

The grid

Left Name

Names of the trimeshes to be displayed when the node integer attribute "mirror pit" is set to 0 or not defined or the Right Name column is empty.??

Right Name

Names of the trimeshes to be displayed when the node integer attribute "mirror pit" is set to 1.??

Continue to 17.4.1.2.1.11 Note Type: Connection Points Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.11 Note Type: Connection Points Tree Node

??

Continue to 17.4.1.2.1.12 Note Type: Dimensions Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

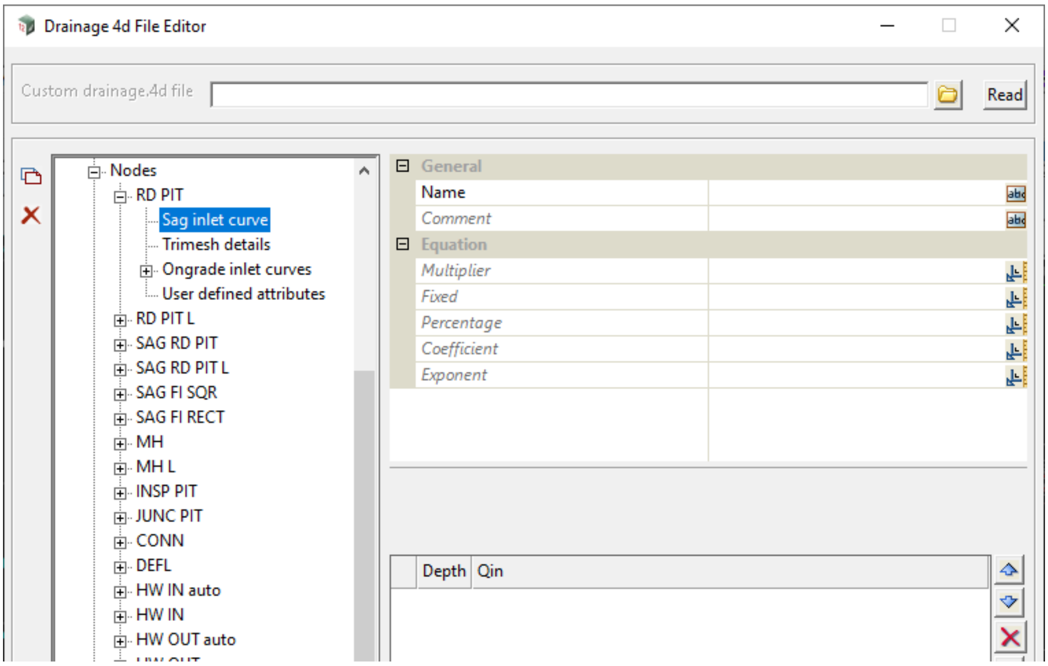
17.4.1.2.1.12 Note Type: Dimensions Tree Node

??

Continue to 17.4.1.2.1.13 Note Type: Sag inlet curve Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.13 Note Type: Sag inlet curve Tree Node

If in the **Optional data section**, the **Sag inlet curve** field is ticked on, then there is a **Sag inlet curve tree node**.



*This section defines the sag inlet polynomial parameters or the inlet capacity curve in **Depth** and **Qin**. For information on the inlet capacity equation, see* 27.2.1.3.1 Inlet Capacity Equation, 27.2.1.3.1.2 Inlet Multiplier *and* 27.2.1.3.1.3 Single Polynomial.

Name text box

Name

Comment real box

User comment about this sag inlet curve.

Multiplier real box

Inlet multiplier in the inlet capacity equation.

Fixed real box

*Fixed term, **cap_fixed**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Percentage real box

*Percentage term, **cap_percent**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Coefficient real box

*Coefficient term, **cap_coeff**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Exponent real box

*Exponent term, **cap_power**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Grid of Sag Inlet Curve Values

Grid of values defining the Depth-Qin curve used for a sag pit.

Depth real grid column

Depth coordinate for the capacity curve.

Qin real grid column

Qin coordinate for the given **Depth**.

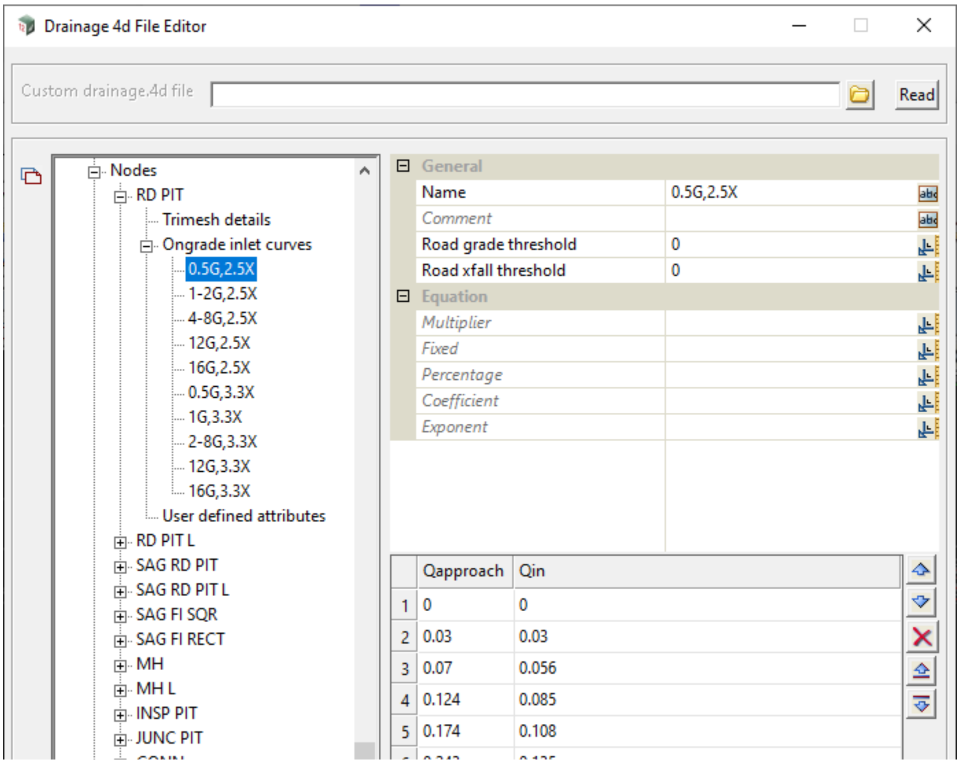
For an example, see 27.2.1.3.1.5.2 Curve Coordinates - Sag Inlets.

Continue to 17.4.1.2.1.14 Note Type: Ongrade inlet curves Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.14 Note Type: Ongrade inlet curves Tree Node

If in the **Optional data section**, the **Ongrade inlet curves** field is ticked on, then there is a **Ongrade inlet curves tree node**.

The node can have one or more named sets of inlet capacity information for different road grades and road x-falls



*This section defines the ongrade inlet polynomial parameters for given upper road grade and upper road cross fall thresholds, or the inlet capacity curves for given upper road grade and upper road cross xfall thresh hold in **Qapproach** and **Qin**.*

There will be a series of curves defined that are given in increasing upper road grad and upper road xfall, and the curved used is the one that fits into the upper road grade and upper road xfall. The ongrade inlet capacity curves are never extrapolated.

For information on the inlet capacity equation, see 27.2.1.3.1 Inlet Capacity Equation, 27.2.1.3.1.2 Inlet Multiplier *and* 27.2.1.3.1.3 Single Polynomial.

Name text box

Name of the ongrade inlet capacity information.

Comment real box

User comment about this set of inlet capacity information.

Road grade threshold real box

Upper road grade threshold for this information to apply.

Road xfall threshold real box

Upper road xfall threshold for this information to apply.

Multiplier real box

Inlet multiplier in the inlet capacity equation.

Fixed real box

*Fixed term, **cap_fixed**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Percentage real box

*Percentage term, **cap_percent**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Coefficient real box

*Coefficient term, **cap_coeff**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Exponent real box

*Exponent term, **cap_power**, in the* 27.2.1.3.1.3 Single Polynomial *for the inlet capacity equation.*

Grid of Ongrade Inlet Curve Values

Grid of values defining the Qapproach-Qin curve used for an online pit.

Qapproach real grid column

Qapproach coordinate for the inlet capacity curve.

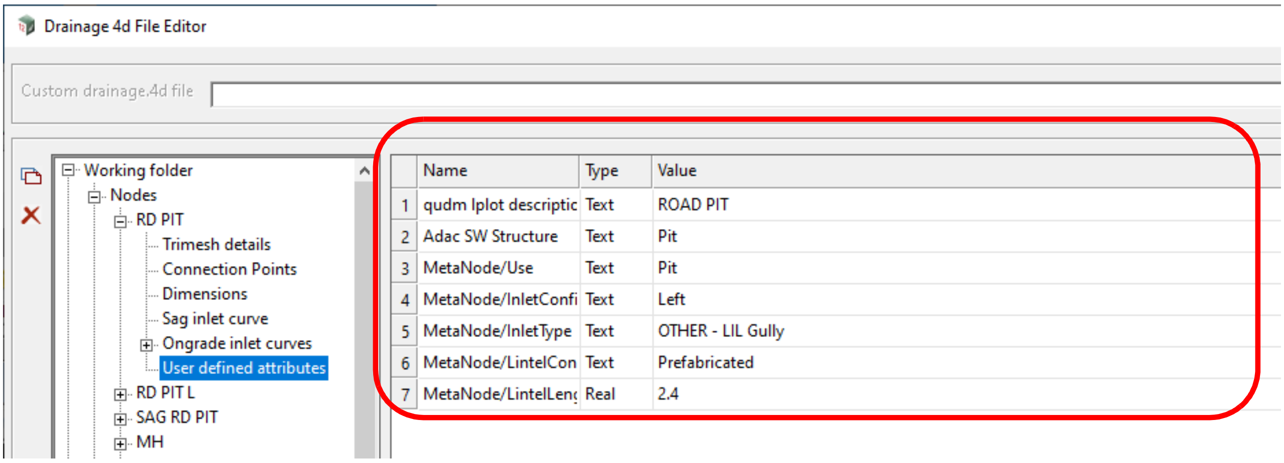
Qin real grid column

Qin coordinate for the given **Qapproach**.

For an example, see 27.2.1.3.1.5.1 Curve Coordinates - On Grade Inlets.

Continue to 17.4.1.2.1.15 Note Type: User defined attributes Tree Node or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.2.1.15 Note Type: User defined attributes Tree Node



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Grid:

Name text box column

Tree name of the attribute.

Type text box column

Type of the attribute.
The text should be one of Text, Real, Integer.

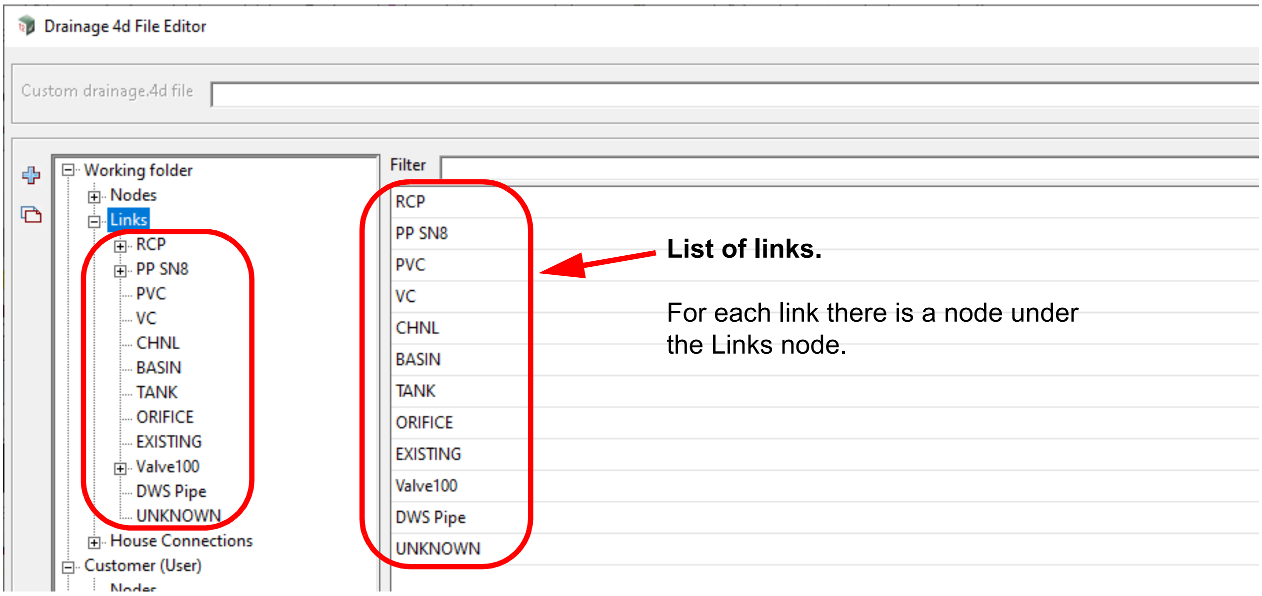
Value text box column

Value of the attribute (as text).

Continue to 17.4.1.3 Links: link type or return to 17.4.1.2 Nodes: node type or 17.4.1 Drainage.4d File Editor.

17.4.1.3 Links: link type

Clicking on the **Links** node under Working folder, Custom, User or Set ups lists the names of the link types in that drainage.4d.



The **Filter** field is used to restrict which link types are used from the **Links** list

*If **not blank,** the text in the* **Filter** *field is made up of texts, separated by commas, and any link type name in the full list of names that includes part of any of the texts, are included in the final list of link types. For the Filter, the texts and link type names are case insensitive.*

For example:

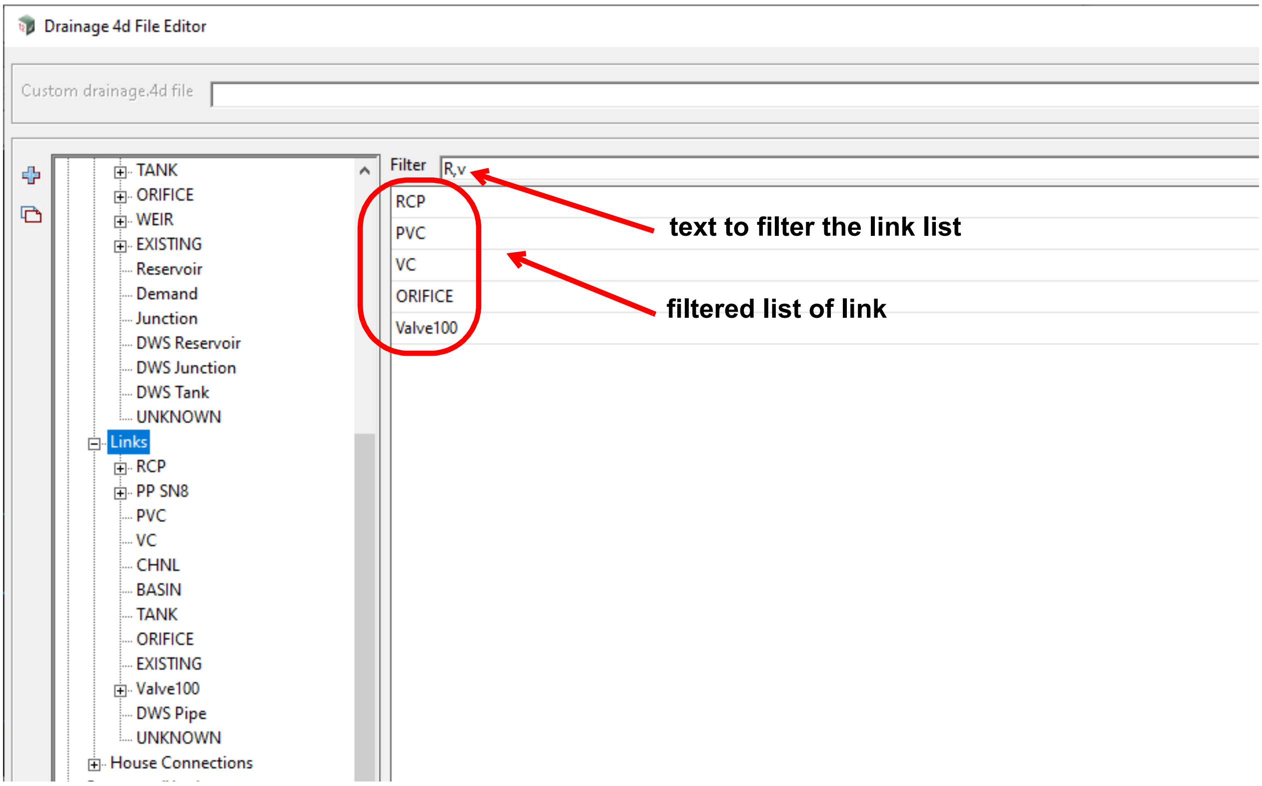
For example:

Filter R

includes RCP and ORIFICE

Filter R, v

includes RCP, PVC, VC, ORIFICE, Valve100.



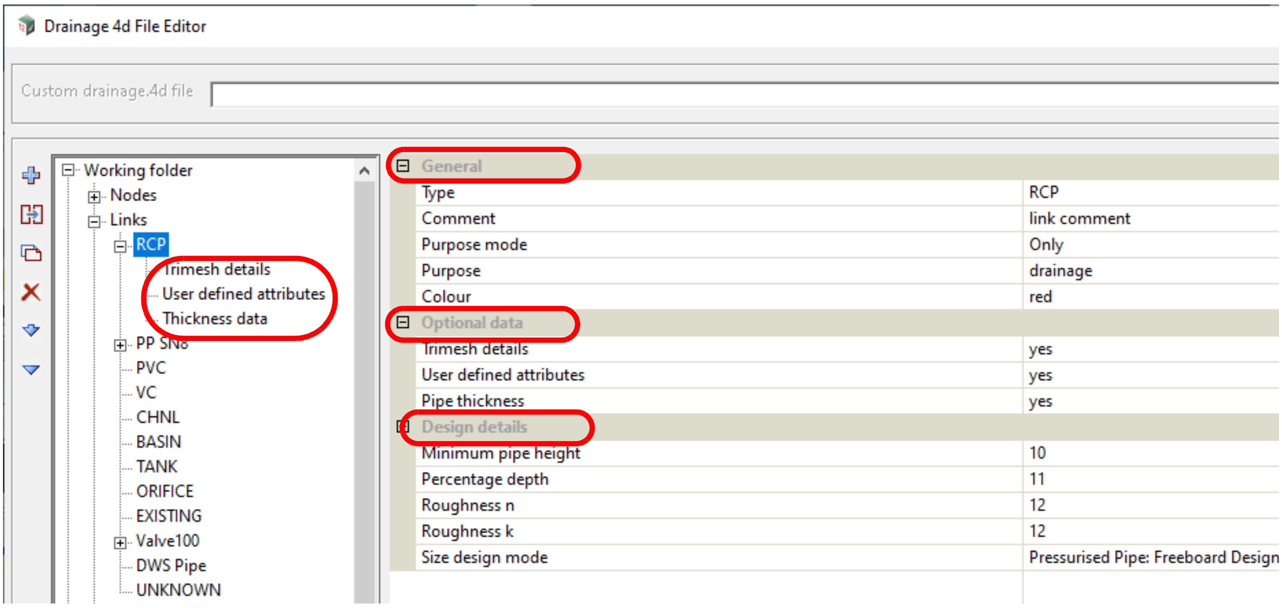
Continue to 17.4.1.3.1 Information About a Link Type or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1 Information About a Link Type

Each individual link type has much of the information required to define a link.

When clicking on the link type name, some of the information is displayed in sections on the right hand side of the panel.

The tree sub-nodes under the named link type appear when fields are ticked on in the **Optional data** section on the right.



For the information about each of the expanded sections on the left hand side, see

17.4.1.3.1.1 Link Type: General

17.4.1.3.1.2 Link Type: Optional data

17.4.1.3.1.3 Link Type: Design details

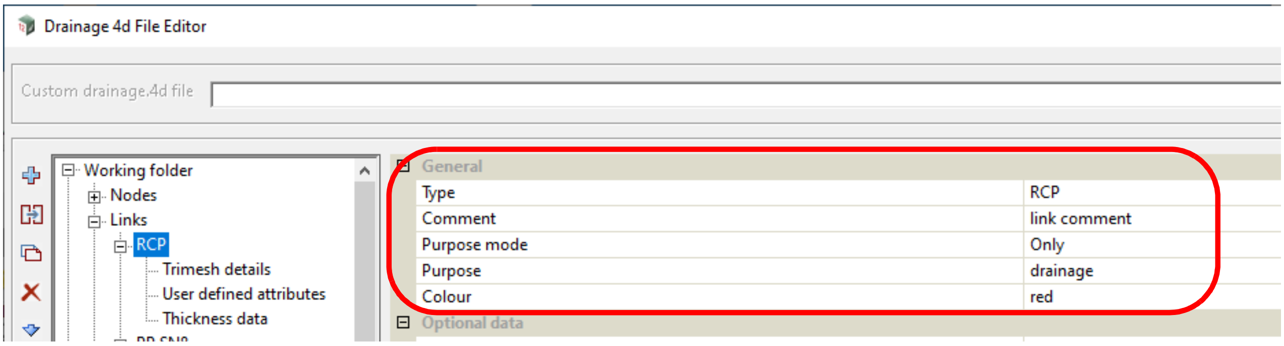
For the information about each sub-nodes on the right hand side, see

17.4.1.3.1.4 Link Type: Trimesh detail Tree Node

17.4.1.3.1.5 Link Type: User defined attributes Tree Node

17.4.1.3.1.6 Link Type: Thickness data Tree Node

17.4.1.3.1.1 Link Type: General



The fields and buttons used in this panel have the following functions.

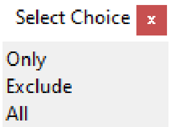
Field Description	Type	Defaults	Pop-Up
Type	text box		

Name to use as the water link "Type". This is the name that appears in a list of Link Types, and when selected, uses all the following node information for the selected node.

Comment	text box		

Comment about the link type.

Purpose mode	choice box	blank	or blank.



Determines how the purpose setting is to be used.

*If **blank** or **ALL**, the link types will be displayed for all water strings link type choices.*

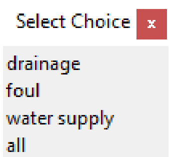
***Only**, the link type list will only be displayed for the link types specified by purpose*

***Exclude,** the link type will NOT be displayed for the type specified by purpose*

***All,** the link types will be displayed for all water strings link type choices. This is the same as leaving* **purpose** *blank.*

The purpose of a water string is controlled by the Method on the WNE-> GLOBAL->Main tab or the purpose on WSE.

Purpose	choice box	blank	or blank



Used with **Purpose mode** *to determines which type of water link is displayed/not displayed in Link type choice boxes. When left blank this type will be included for all water string type choice boxes.*

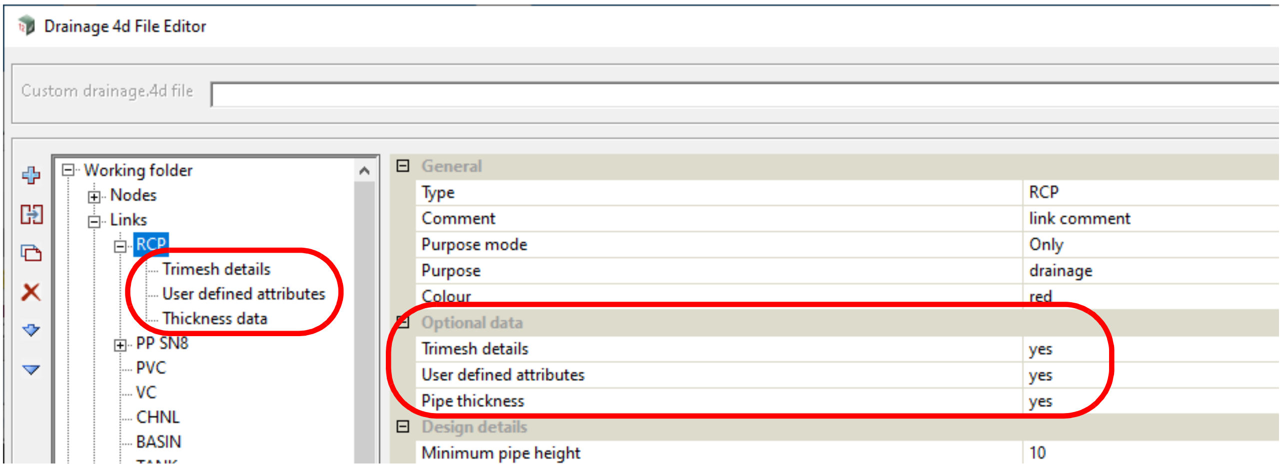
The purpose of a water string is controlled by the Method on the WNE-> GLOBAL->Main tab or the purpose on WSE.

Colour	colour box	red	available colours

Colour for the link type.

Continue to 17.4.1.3.1.2 Link Type: Optional data or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1.2 Link Type: Optional data



In the **Drainage.4d File Editor**, the **Optional data** section for a link has the three entries Trimesh details, User defined attributes and Pipe thickness.

For ***Trimesh details:***

If ***yes*** is selected then a ***Trimesh details*** node is created to hold the trimesh information for drawing links. See 17.4.1.3.1.4 Link Type: Trimesh detail Tree Node.

If ***no*** is selected then there is no ***Trimesh details*** node and nothing is written to the file. If a ***Trimesh details*** node already existed and then ***no*** is selected then the ***Trimesh details*** node is deleted and any data in it is lost.

For ***User defined attributes:***

If ***yes*** is selected then a ***User defined attributes*** node is created to hold the user defined attributes the link. See 17.4.1.3.1.5 Link Type: User defined attributes Tree Node.

If ***no*** is selected then there is no ***User defined attributes*** node and nothing is written to the file. If a ***User defined attributes*** node already existed and then ***no*** is selected then the ***User defined attributes*** node is deleted and any data in it is lost.

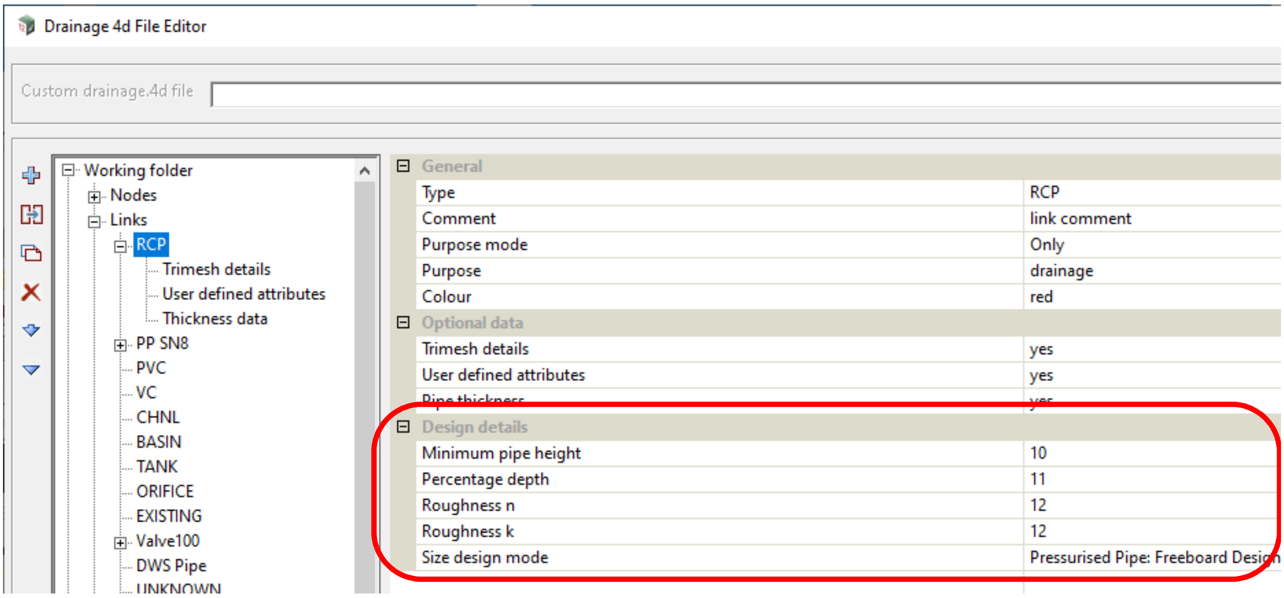
For ***Thickness data:***

If ***yes*** is selected then a ***Thickness data*** node is created to hold the user defined attributes the link. See 17.4.1.3.1.6 Link Type: Thickness data Tree Node.

If ***no*** is selected then there is no ***Thickness data*** node and nothing is written to the file. If a ***Thickness data*** node already existed and then ***no*** is selected then the ***Thickness data*** node is deleted and any data in it is lost.

Continue to 17.4.1.3.1.3 Link Type: Design details or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1.3 Link Type: Design details



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Min pipe height real box

Minimum height used during the rational method design process (diameter – circular, or depth – rectangular).

Percentage depth real box

Percentage of the conduit height (diameter or depth) used during the rational method design process.

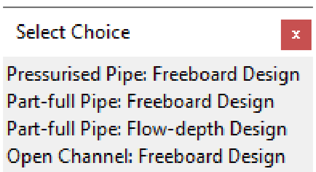
Roughness n real box

Default Manning's roughness

Roughness k real box

Default Colebrook White roughness.

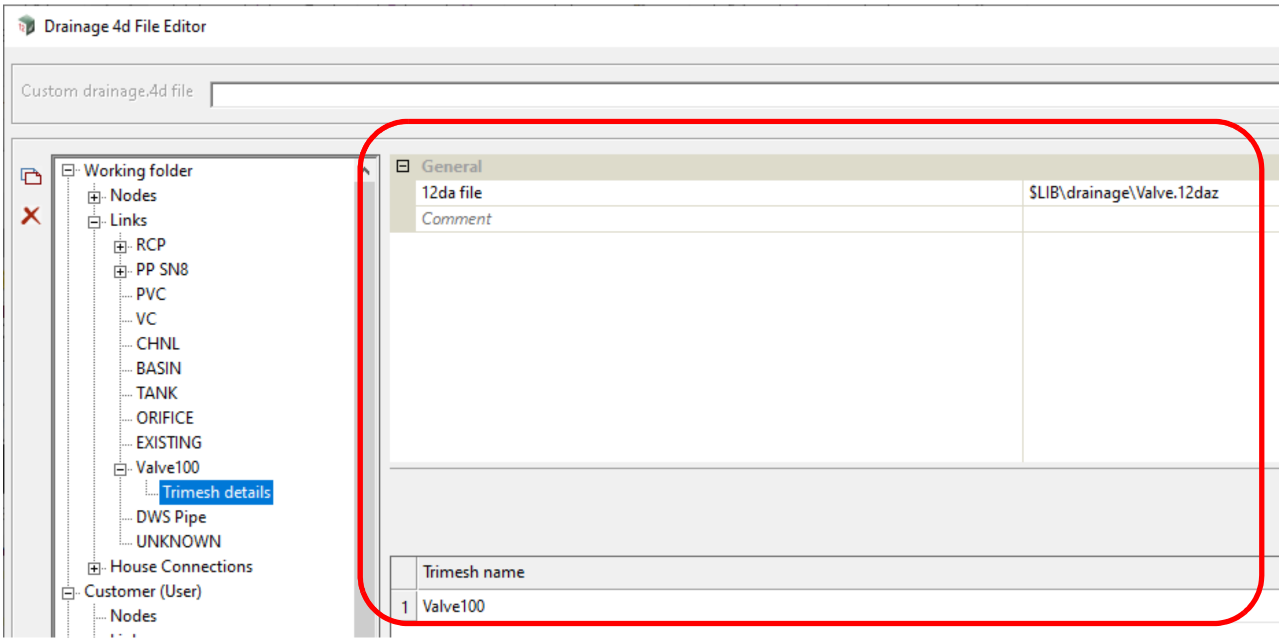
Size design mode choice box



For a desciption of each choice, see 17.3.4.6.2.3 DEFAULTS >Links subtab.

Continue to 17.4.1.3.1.4 Link Type: Trimesh detail Tree Node or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1.4 Link Type: Trimesh detail Tree Node



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
12da file	file box		

File to contain all of the trimeshes in the grid below.

Comment	text box		

Comment.

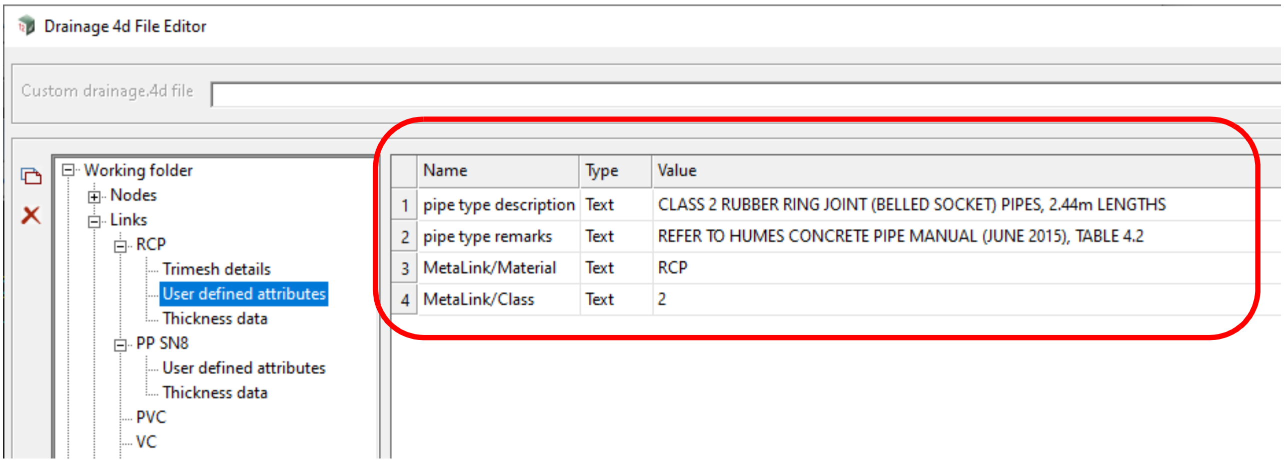
The grid

Trimesh Name	text box column		

Names of the trimeshes to be displayed??

Continue to 17.4.1.3.1.5 Link Type: User defined attributes Tree Node or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1.5 Link Type: User defined attributes Tree Node



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Grid:

Name text box column

Tree name of the attribute.

Type text box column

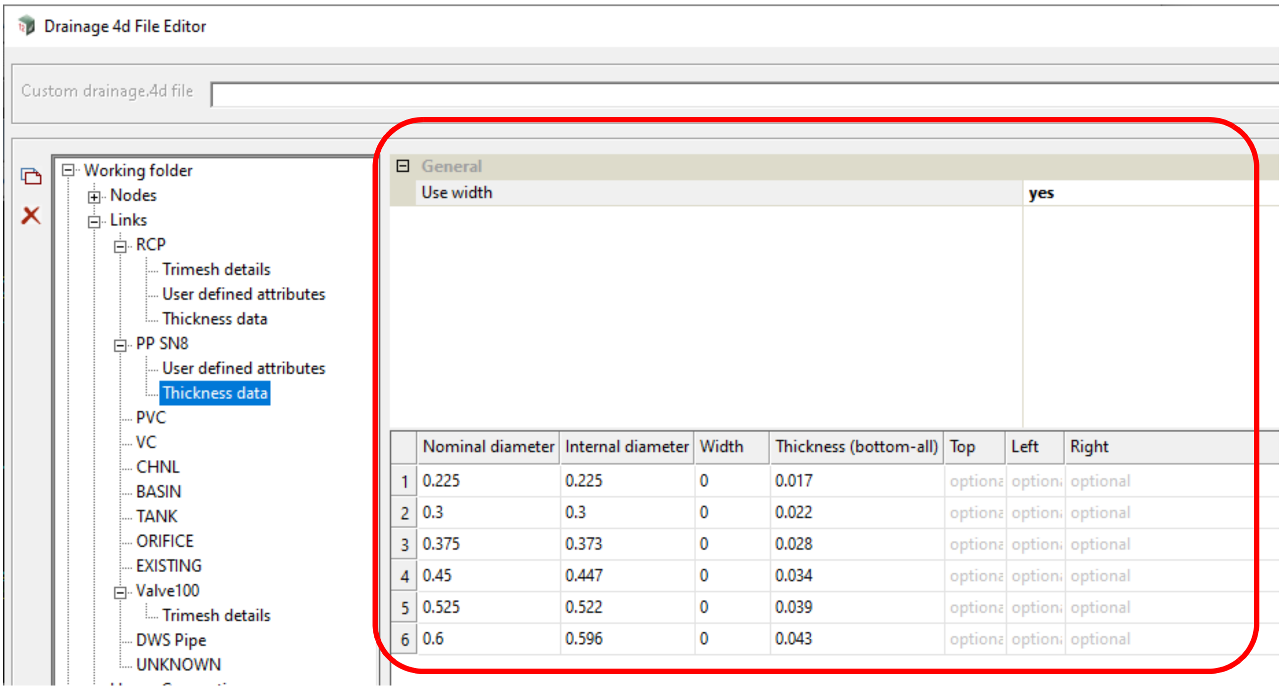
Type of the attribute.
The text should be one of Text, Real, Integer.

Value text box column

Value of the attribute (as text).

Continue to 17.4.1.3.1.6 Link Type: Thickness data Tree Node or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.3.1.6 Link Type: Thickness data Tree Node



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Use width tick/yes-no box

*If **ticked**, the* **Width** *column is displayed in the grid below.*
*If **not ticked**, the* **Width** *column is not displayed in the grid below.*

The grid

Nominal diameter text box column

Nominal diameter for the link.

Internal diameter text box column

Internal diameter for the link.

Width text box column

If **Use width** *is **yes**, width for the link.*

Thickness (bottom-all) text box column

Thickness of the bottom of the link.

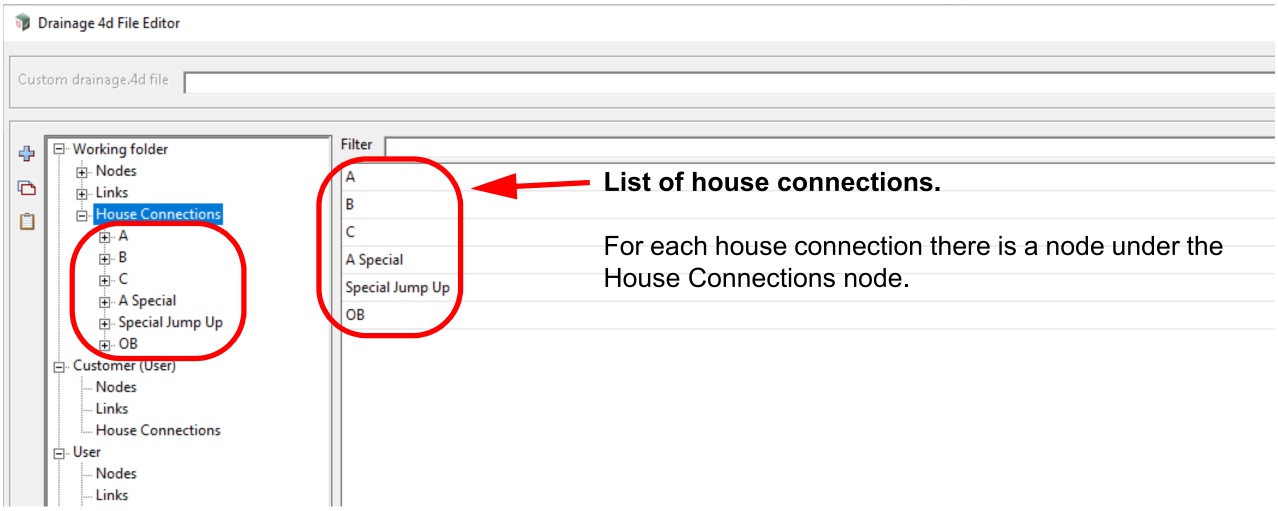
Top/Left/Right) text box column

Thickness of the top/left/right of the link.

Continue to 17.4.1.4 House Connections: house connection type or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.4 House Connections: house connection type

Clicking on the **House Connections** tree node under Working folder, Custom, User or Set ups lists the names of the house connection types in that drainage.4d.



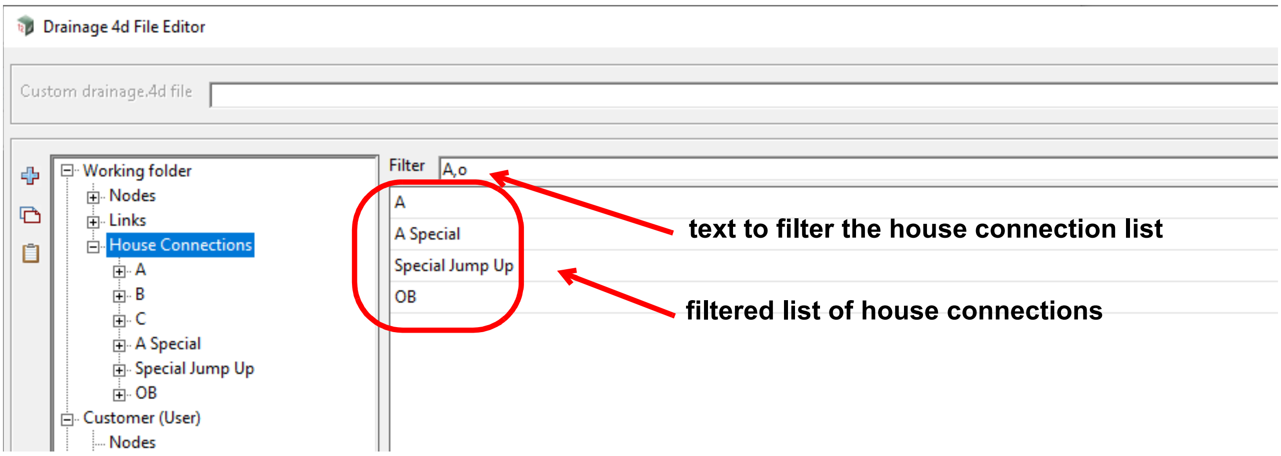
The **Filter** field is used to restrict which house connection types are used from the **House Connections** list

> *If **not blank,** the text in the* **Filter** *field is made up of texts, separated by commas, and any house connection type name in the full list of names that includes part of any of the texts, are included in the final list of house connection types. For the Filter, the texts and house connection type names are case insensitive.*

For example:

Filter A
   includes A, A Special, Special Jump Up

Filter A, o
   includes A, A Special, Special Jump Up, OB.



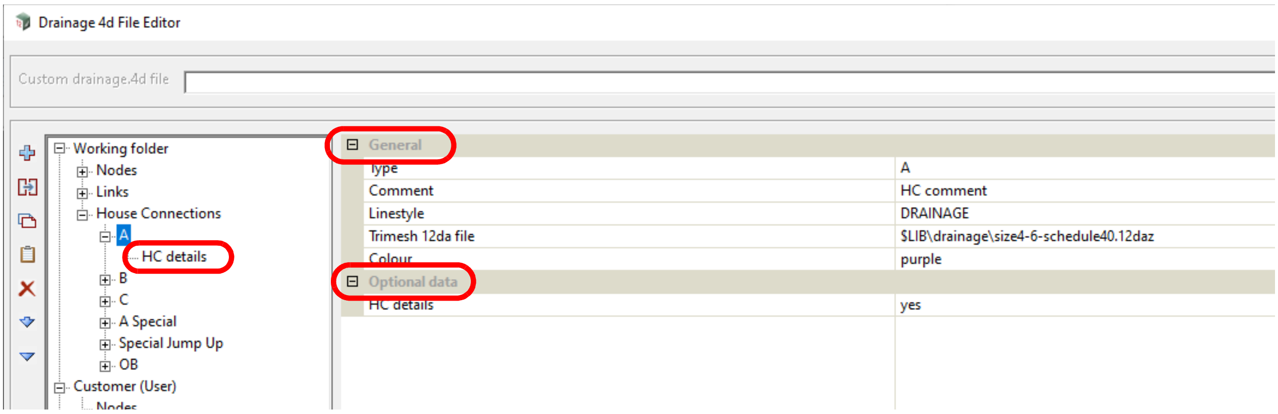
Continue to 17.4.1.3.1 Information About a Link Type or return to 17.4.1.3 Links: link type or 17.4.1 Drainage.4d File Editor.

17.4.1.4.1 Information About a House Connection Type

Each individual house connection type has much of the information required to define a house connection.

When clicking on the house connection type name, some of the information is displayed in sections on the right hand side of the panel.

The tree sub-nodes under the named house connection type appear when fields are ticked on in the **Optional data** section on the right.



For the information about each of the expanded sections on the left hand side, see

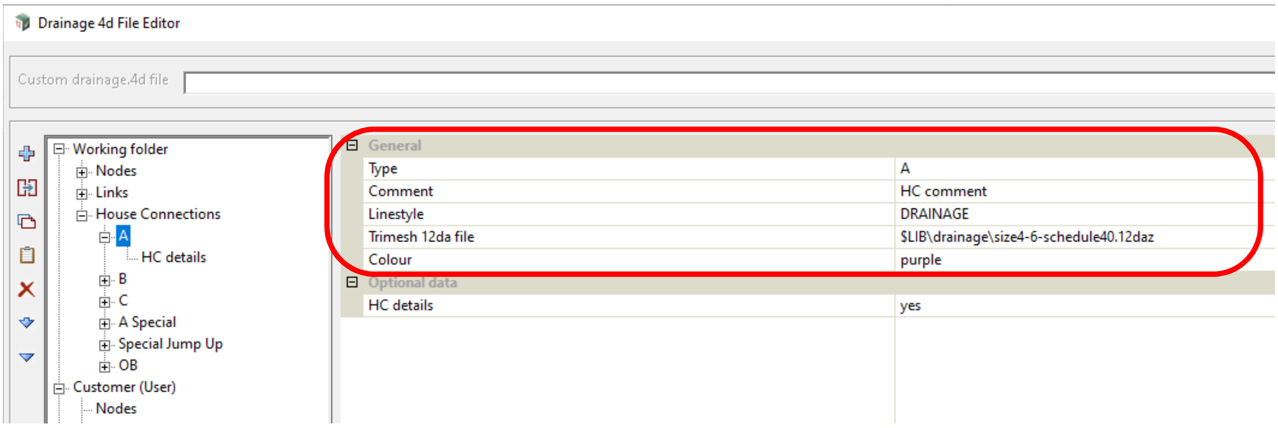
17.4.1.4.1.1 House Connection Type: General

17.4.1.4.1.2 House Connection Type: Optional data

For the information about each sub-nodes on the right hand side, see

17.4.1.4.1.3 House Connection Type: HC details Tree Node

17.4.1.4.1.1 House Connection Type: General



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Type	text box		
Comment	text box		
Linestyle	linestyle box		available linestyles
12da file	file box		
Colour	colour box	red	available colours

Type — text box

Name to use as the water house connection "Type". This is the name that appears in a list of House Connection Types, and when selected, uses all the following house connection information for the selected tree node.

Comment — text box

Comment about the house connection type.

Linestyle — linestyle box — available linestyles

Linestyle for the house connection type.

12da file — file box

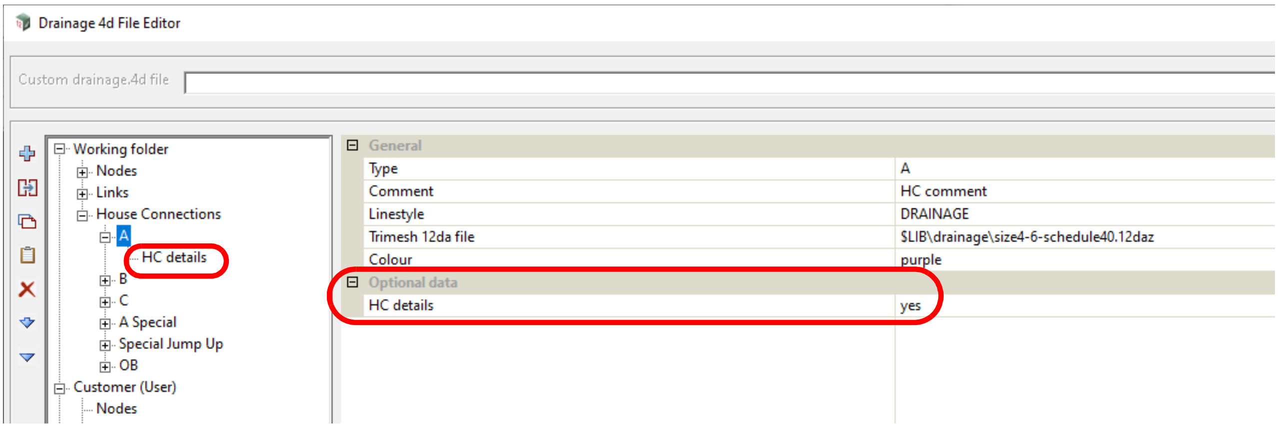
File to contain all of the trimeshes in the grid below.

Colour — colour box — red — available colours

Colour for the house connection type.

Continue to 17.4.1.4.1.2 House Connection Type: Optional data or return to 17.4.1.4 House Connections: house connection type or 17.4.1.1 Drainage.4d File Editor.

17.4.1.4.1.2 House Connection Type: Optional data



In the **Drainage.4d File Editor**, the **Optional data** section for a house connection just has the one entry ***HC details.***

For ***HC details:***

If ***yes*** is selected then a ***HC details*** node is created to hold the drawing information for the house connection. See 17.4.1.4.1.3 House Connection Type: HC details Tree Node.

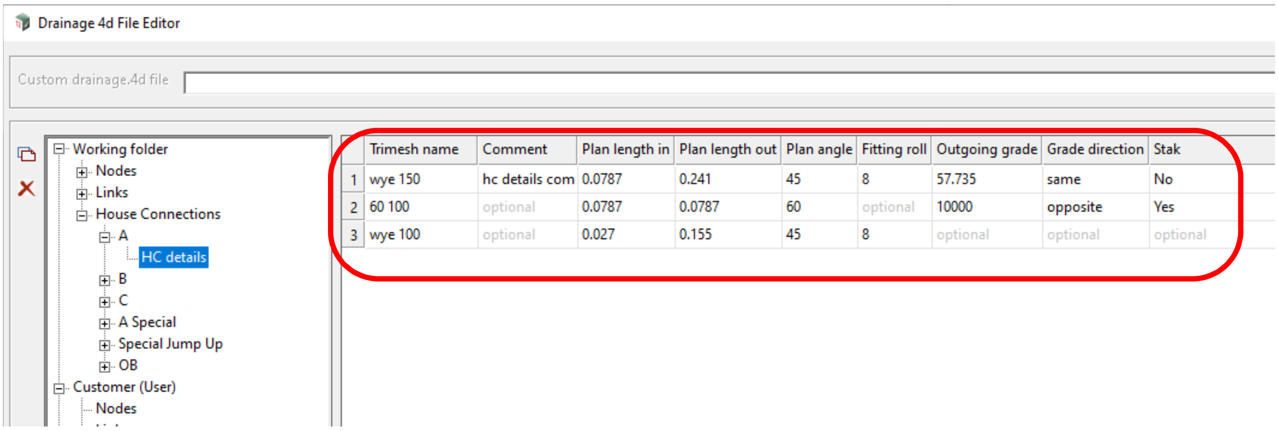
If ***no*** is selected then there is no ***HC details*** node and nothing is written to the file. If a ***HC details*** node already existed and then ***no*** is selected then the ***HC details*** node is deleted and any data in it is lost.

Continue to 17.4.1.4.1.3 House Connection Type: HC details Tree Node or return to 17.4.1.4 House Connections: house connection type or 17.4.1 Drainage.4d File Editor.

17.4.1.4.1.3 House Connection Type: HC details Tree Node

The 3D drawing details of the house connection is entered in the **Drainage.4d File Editor** as a grid of **house connection links going out from the water node**.

Each row of the grid describes the next link of the house connection:



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

The grid

Trimesh name text column

Trimesh used for the i-th house connection link.

Comment text column

Comment for the i-th house connection link.

Plan length in real column

Plan length in of the i-th house connection link.

Plan length out real column

Plan length out of the i-th house connection link.

Plan angle out real column

Plan angle out of the i-th house connection link.

Fitting roll real column

Fitting roll of the i-th house connection link.

Outgoing grade real column

Outgoing grade of the i-th house connection link.

Grade direction choice column some, opposite, blank

Grade direction choice of the i-th house connection link.

Stack choice column yes, no, blank

Stack choice of the i-th house connection link.

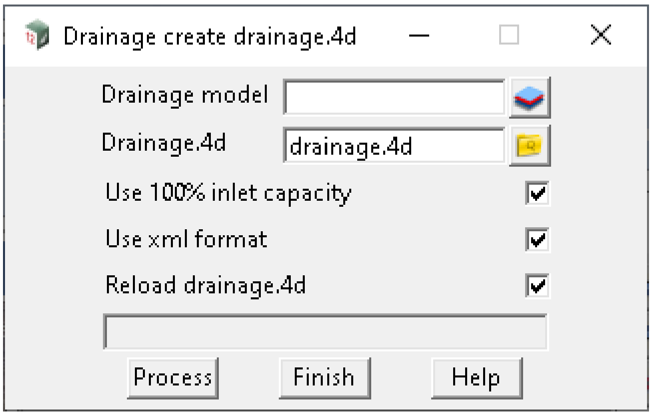
Continue to 17.4.2 Create drainage.4d from Model or return to 17.4.1.4 House Connections: house connection type or 17.4.1 Drainage.4d File Editor.

17.4.2 Create drainage.4d from Model

Position of option on menu: **Water =>Water setup =>Create drainage.4d from model**

This routine is used to create a drainage.4d file containing the pit and pipe types from existing drainage strings. For example, surveyors may receive drainage strings without the drainage.4d file used during design. ***12d Model*** must be restarted for the drainage.4d to be used.

On selecting the **Create drainage.4d from model** option, the **Drainage Create Drainage.4d** panel is displayed.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		

Drainage strings in this model are scanned for the pit and pipe types.

Drainage.4d	file box		*.4d

The pit and pipe types found in strings are created in this file.

Use 100% inlet capacity	tick box	ticked	

Cap_percent 100 is added to the manhole commands.

Buttons at Bottom

Process	button		

Creates or appends to the drainage.4d file.

Continue to 17.4.3 Stormwater Inlet Capacities or return to 17.4 Water Setup.

17.4.3 Stormwater Inlet Capacities

Position of option on menu: **Water => Stormwater =>Inlet capacity curves**
Water =>Setup =>Inlet capacity curves

Background: Stormwater Inlet Capacity - *12d Model* and HEC-22

A common question is "Where do I get stormwater inlet capacity curves for my roadway stormwater design?

Usually not on eBay. However, the University of South Australia has a full size road test rig to determine stormwater inlet capacities. If you are looking for a more theoretical approach, the U.S. Department of Transportation, **Urban Drainage Design Manual - HEC-22** has design procedures. ***12d Model V15*** has used these procedures as the basis for their inlet capacity routines for roadway on-grade and sag inlets.

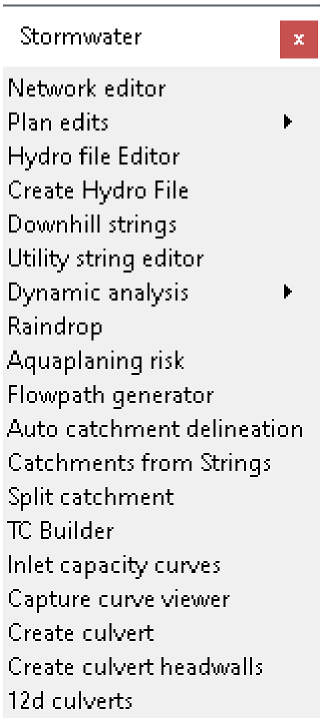
This is documented in 17.5.13 Stormwater Inlet Capacity Curves.

Continue to 17.5 Stormwater or return to 17.4 Water Setup.

17.5 Stormwater

Position of menu: **Water =>Stormwater**

The **Stormwater** walk-right menu is



See
17.3.4 Water Network Editor (WNE)
17.3.8 Plan Edits
17.5.1 Hydro (Rainfall) File Editor
17.5.2 Create Hydro File
17.5.3 Downhill Strings
17.5.4 Water Utility String Editor
17.5.5 Dynamic Analysis
17.5.6 Raindrop/Teardrop
17.5.7 Aquaplaning Risk Assessment
17.5.8 Flowpath Generator
17.5.9 Auto Catchment Delineation
17.5.10 Catchments from Strings
17.5.11 Split Catchment
17.5.12 Time of Concentration Builder
17.5.13 Stormwater Inlet Capacity Curves
17.5.14 Capture Curve Viewer
17.5.15 Create/Change Culvert
17.5.16 Create Culvert Headwalls
18.14.5 12d Culverts

17.5.1 Hydro (Rainfall) File Editor

Position of option on menu: **Water =>Stormwater =>Hydro file editor**

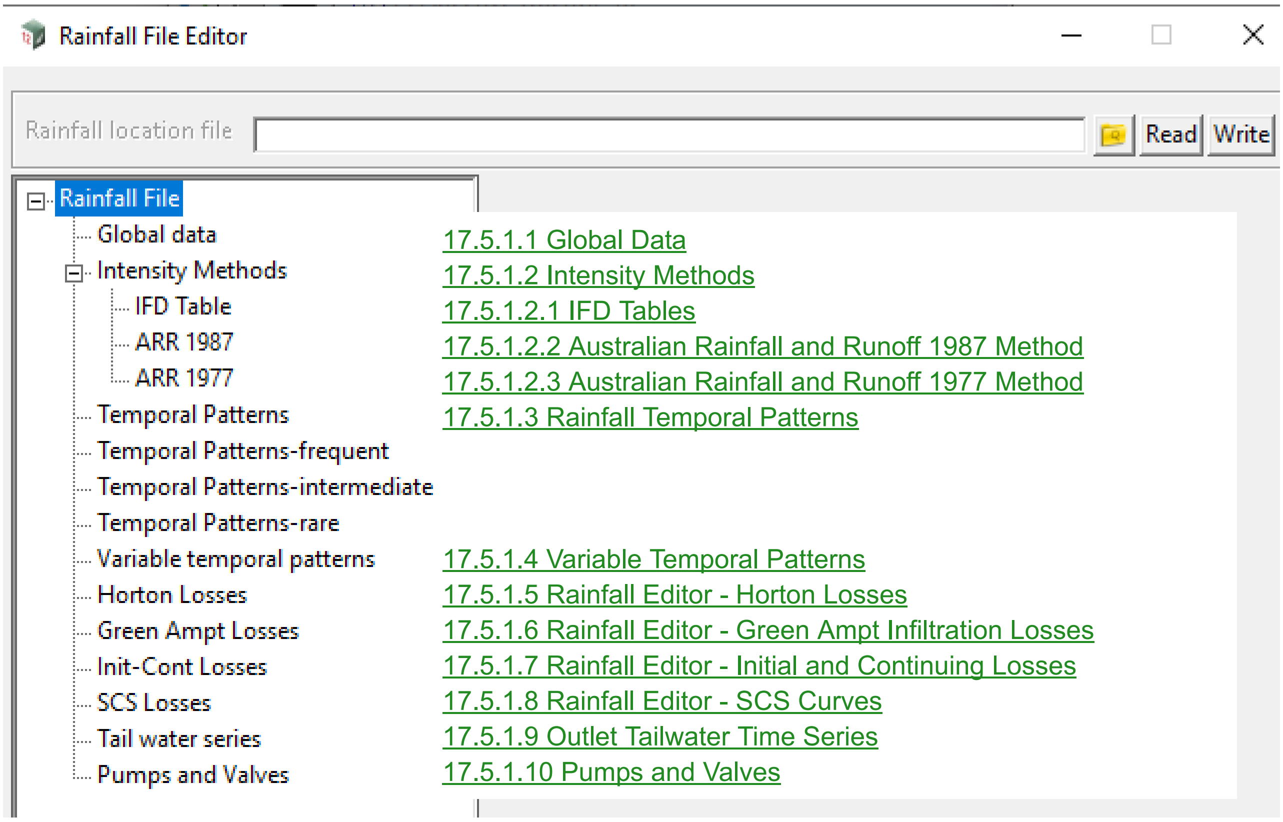
The **Hydro File Editor** (**Rainfall File Editor**) is used to define rainfall intensity data, several temporal pattern methods, infiltration loss methods, tail water series and pumps and valve curves.

The data is stored in hydro files (each file is for a specific location) that can be shared between ***12d Model*** projects.

A number of files are shipped with ***12d Model*** in the [Lib] area but users can create files and stored them in areas such as [User Lib], [12d Synergy], in a projects working folder or browse for a file.

The data is edited using an editor similar to those used for the plot parameter files (ppf).

Selecting **Hydro file editor** brings up the **Rainfall File Editor** panel:



To **Create** a **Hydro file**, data is entered into one or more of the tree nodes and then saved by typing the path name for the hydro file into the **Rainfall location file** field, and selecting **Write**.

To **Read** a **Hydro file**, click on the folder icon to easily search and select a hydro file ***locally***, from ***User_Lib*** , ***Lib***, ***12d Synergy*** or browse.

Once a hydro file is selected you **must** press the **Read** button to read in the file.

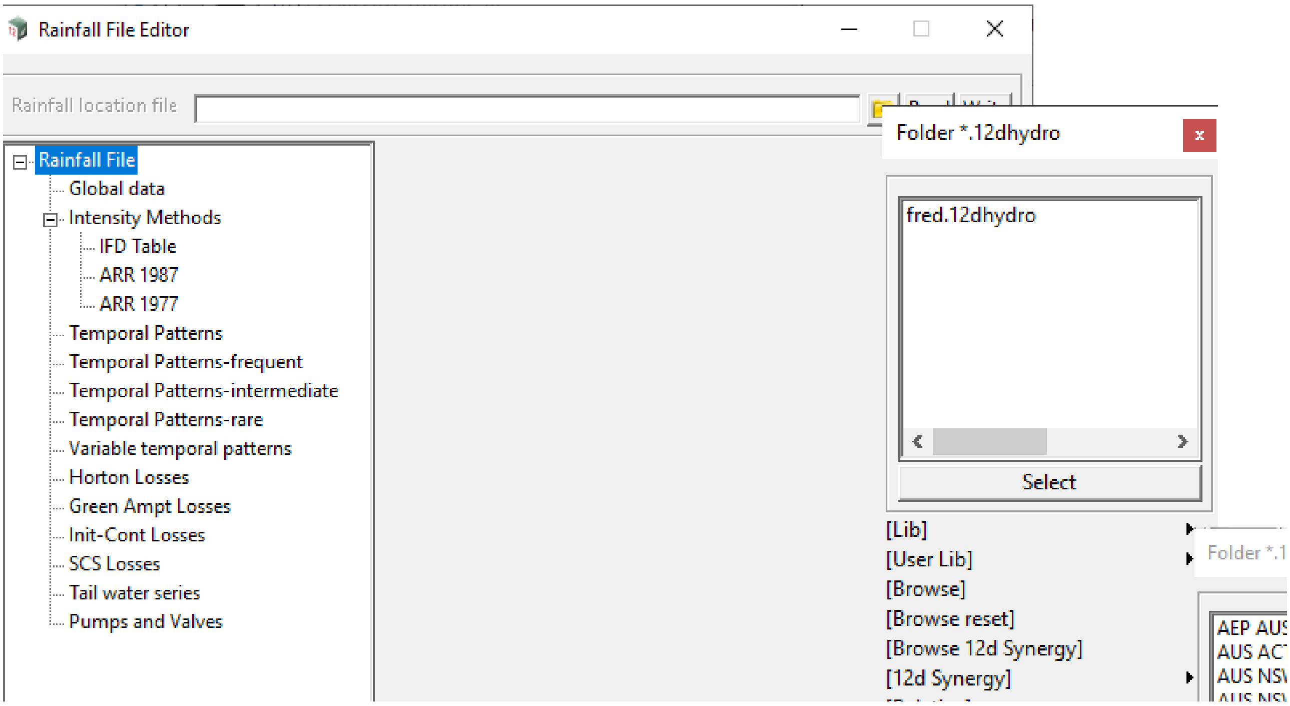
The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Rainfall location file	file box		*.12dhydro

File of rainfall intensity data, temporal pattern methods, infiltration loss methods, tailwater series and pump and valve curves.

Folder icon

*Clicking on the folder icon brings up the folder search panel for *.12dhydro files.*

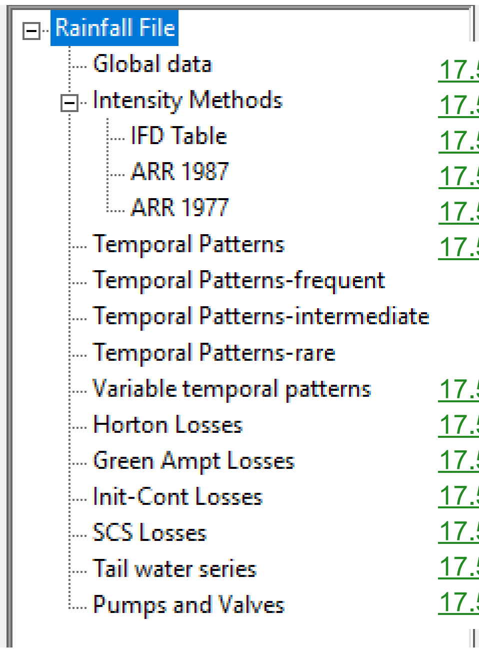


Read button

Clicking on **Read** *reads the data in the file given in the* **Rainfall location file** *into the grid.*

Write button

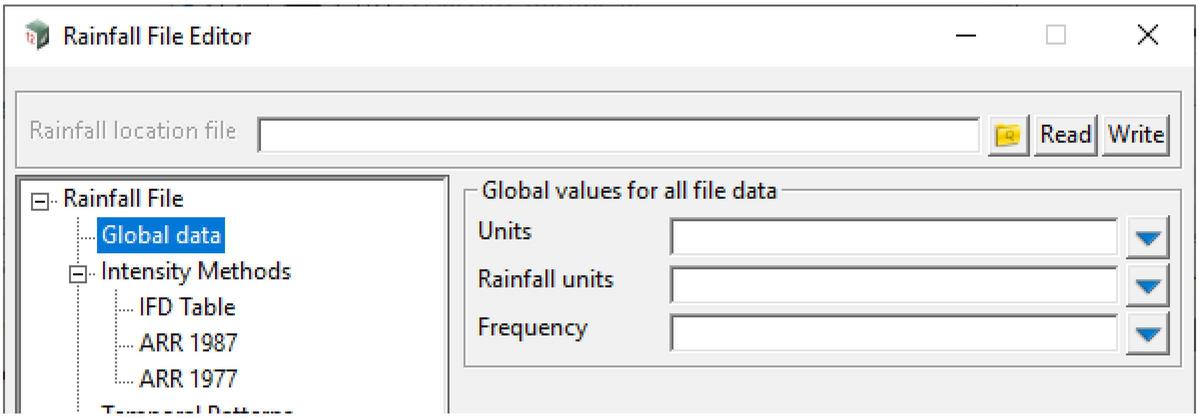
Clicking on **Write** *writes the data in the grids to the file given in the* **Rainfall location file** *field.*



17.5.1.1 Global Data
17.5.1.2 Intensity Methods
17.5.1.2.1 IFD Tables
17.5.1.2.2 Australian Rainfall and Runoff 1987 Method
17.5.1.2.3 Australian Rainfall and Runoff 1977 Method
17.5.1.3 Rainfall Temporal Patterns
17.5.1.4 Variable Temporal Patterns
17.5.1.5 Rainfall Editor - Horton Losses
17.5.1.6 Rainfall Editor - Green Ampt Infiltration Losses
17.5.1.7 Rainfall Editor - Initial and Continuing Losses
17.5.1.8 Rainfall Editor - SCS Curves
17.5.1.9 Outlet Tailwater Time Series
17.5.1.10 Pumps and Valves

Continue to 17.5.1.1 Global Data or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.1 Global Data



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Units	choice box		Metric, US

Select whether rainfall is in metric or US (aka Imperial) units.

Rainfall units	choice box		mm, mm/hr

*If **mm** and* **Units** *is Metric, the units for intensity is a depth in millimetres (mm).*
*If **mm/hr** and* **Units** *is Metric, the units for intensity is millimetres per hour (mm/hr).*

*If **in** and* **Units** *is US, the units for intensity is a depth in inches (in).*
*If **in/hr** and* **Units** *is US, the units for intensity is inches per hour (in/hr).*

Frequency	choice box		ARI, AEP

*If **ARI**, the unit for freqency in the IFD table is **average recurrence interval** (ARI).*
*If **AEP**, the unit for freqency in the IFD table is **exceedance probabliity** (AEP).*

Continue to 17.5.1.2 Intensity Methods or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.2 Intensity Methods

In order to compute design flows, a rainfall intensity and frequency and duration (IFD) relationship is required.

See

17.5.1.2.1 IFD Tables
17.5.1.2.2 Australian Rainfall and Runoff 1987 Method
17.5.1.2.3 Australian Rainfall and Runoff 1977 Method

Continue to 17.5.1.2.1 IFD Tables or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.2.1 IFD Tables

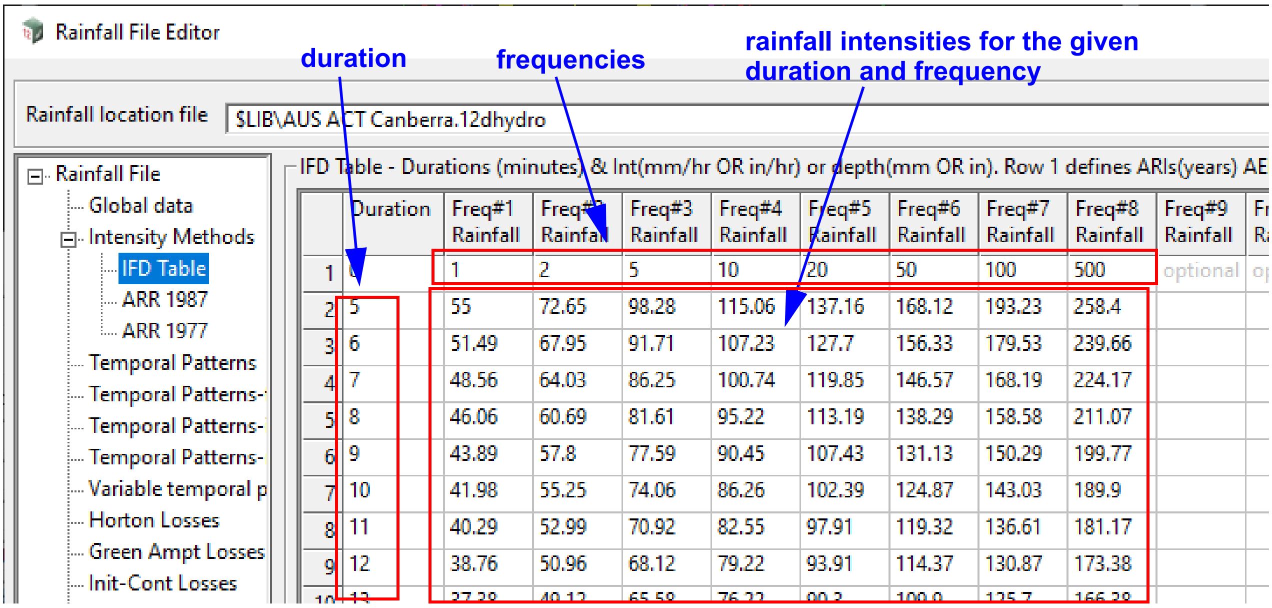
Intensity-Frequency-Duration (**IFD**) tables are often available from meteorological services.

The table input format is as follow:

The first row is used to define up to twenty **frequencies**.

The second and following rows list the rainfall **intensities** for the **duration** entered in the first column and the **frequency** (**return period**) in the second to twentieth columns.

Hint: to increase the size of the grid control select another method, ARR 1987 for example, and then select IFD table again.



	Duration	Freq#1 Rainfall	Freq#2 Rainfall	Freq#3 Rainfall	Freq#4 Rainfall	Freq#5 Rainfall	Freq#6 Rainfall	Freq#7 Rainfall	Freq#8 Rainfall	Freq#9 Rainfall
1	0	1	2	5	10	20	50	100	500	optional
2	5	55	72.65	98.28	115.06	137.16	168.12	193.23	258.4	
3	6	51.49	67.95	91.71	107.23	127.7	156.33	179.53	239.66	
4	7	48.56	64.03	86.25	100.74	119.85	146.57	168.19	224.17	
5	8	46.06	60.69	81.61	95.22	113.19	138.29	158.58	211.07	
6	9	43.89	57.8	77.59	90.45	107.43	131.13	150.29	199.77	
7	10	41.98	55.25	74.06	86.26	102.39	124.87	143.03	189.9	
8	11	40.29	52.99	70.92	82.55	97.91	119.32	136.61	181.17	
9	12	38.76	50.96	68.12	79.22	93.91	114.37	130.87	173.38	

The unit for **duration** is **minutes**.

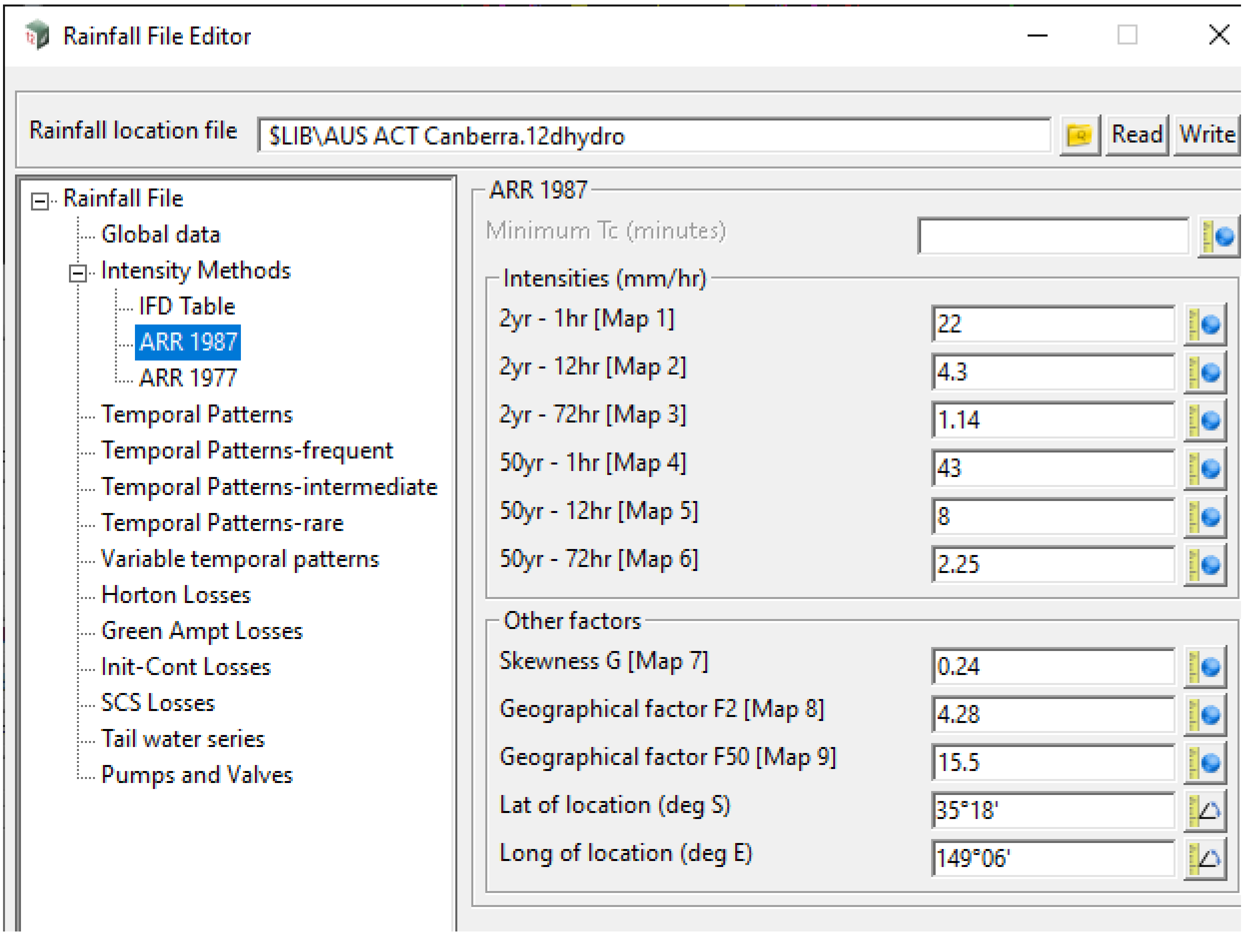
The unit for **frequency** is **average recurrence interval** (**ARI**) or **exceedance probabliity** (**AEP**) and as specified in **Frequency** field in the 17.5.1.1 Global Data node.

The unit for **intensities** is **millimetres per hour** or a **depth in millimetres** as specified in **Rainfall units** field in the 17.5.1.1 Global Data node.

Continue to 17.5.1.2.2 Australian Rainfall and Runoff 1987 Method or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.2.2 Australian Rainfall and Runoff 1987 Method

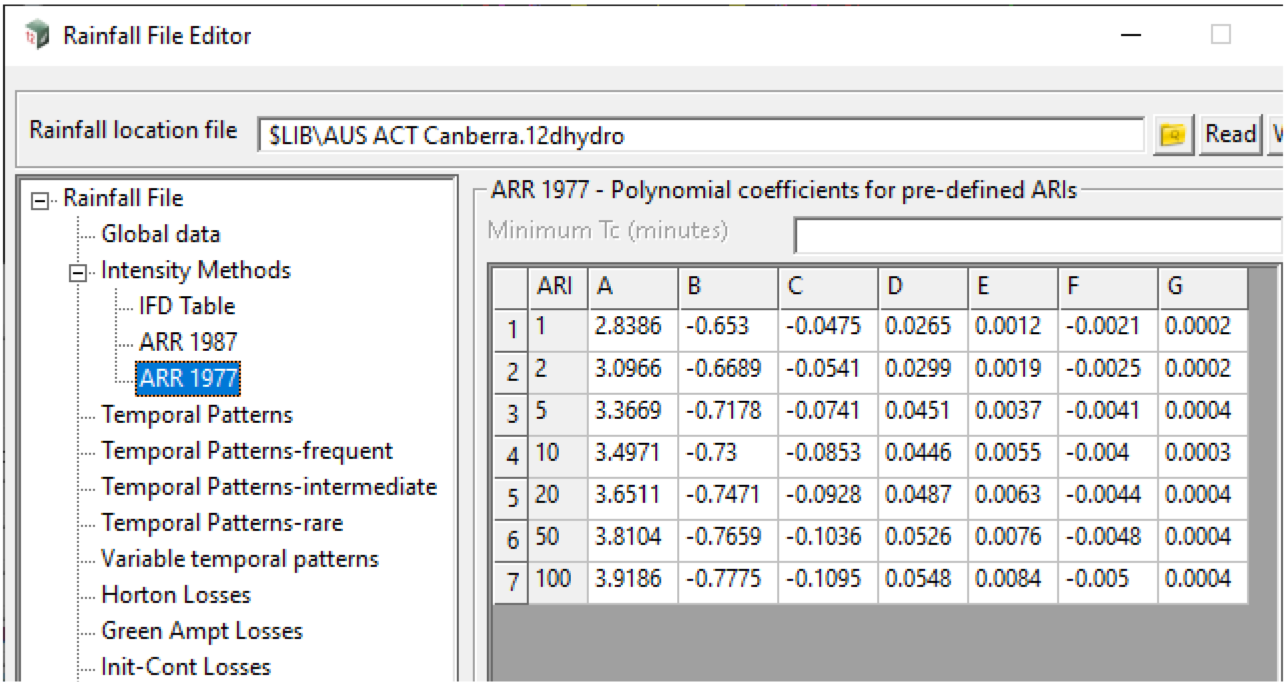
The rainfall intensities and other factors from Volume 2 of ARR 1987 are entered in this table.



Continue to 17.5.1.2.3 Australian Rainfall and Runoff 1977 Method or return to 17.5.1 Hydro (Rainfall) File Editor.

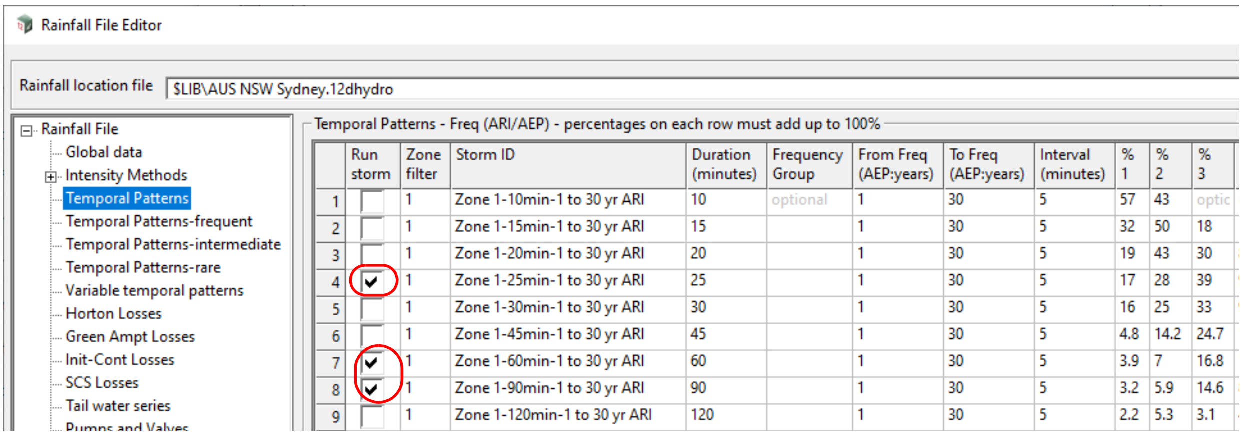
17.5.1.2.3 Australian Rainfall and Runoff 1977 Method

The seven coefficients for each return period from ARR 1977 are entered in this table.



Continue to 17.5.1.3 Rainfall Temporal Patterns or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.3 Rainfall Temporal Patterns



Patterns are referred to as **storms** in Dynamic Stormwater. Several example hydro files are included in the ***12d Model*** library.

These patterns have a **fixed time increment** and a maximum of 30 entries may be entered. The values entered are used differently for the various runoff methods.

Refer to the table below for the values to be entered. The method marked (using IFD) will use the ARI you specify at run time and the average rainfall intensity for the total storm duration of the data entered.

Runoff Method	**Fixed Time Increment Pattern**
ILSAX 2- EPA SWMM	Percentage (Design Storm - uses IFD)
	Total = 100
NZ SCS	Not available
SCS	fraction (Design Storm - uses IFD)
	Total = 1

Fixed Time Increment Pattern Examples

ILSAX 2 - EPA SWMM

For example a 100yr ARI storm with a total duration of 2hrs has an average rainfall intensity of 120mm/hr. 12 x 10 min percentages are entered which total 100. If one of the interval percentages was 5%

Rainfall for that 10min interval is calculated as

120mm/hr * 10/60 * 0.05 = 1 mm of rainfall in that period

SCS

For example a 100yr ARI storm with a total duration of 2hrs has an average rainfall intensity of 120mm/hr. 12 x 10 min percentages are entered which total 1. If one of the interval values was 0.05

Rainfall for that 10min interval is calculated as

120mm/hr * 2hr * 0.05 = 12 mm of rainfall in that period

The **Run storm**, **Zone filter, From ARI** and **To ARI** columns are used determine which storms are analysed (run). The **Run storm** column must be checked for that pattern to be analysed. Many storms may be selected.

The **Zone filter** is optional. Entering a value here will allow the selected storms to be further filtered. A **Zone filter** field (accepts wild card characters) is found on the WNE GLOBAL tab that is used to determine which of the selected storms (paragraph above) are analysed.

The **ARI** field on the Run panel is used with the **From ARI** and **To ARI** columns. The value on the run panel must be within the From-To range for the storm to be analysed.

The **Duration** column determines the total length of the storm. This value divided by the **Interval** must be a whole number and this number determines the number of**%** values to be entered to the right of the **Interval column.** The total of the percentage must equal 100.

Continue to 17.5.1.4 Variable Temporal Patterns or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.4 Variable Temporal Patterns

Variable Patterns are used by the dynamic engine and selected on the ***GLOBAL tab*** of the ***Water Network Editor***.

These variable patterns have a variable time increment and with a maximum of xxx entries may be entered.

The values entered are used differently for the various runoff methods.

Refer to the table below for the values to be entered. The method marked (using IFD) will use the ARI you specify at run time and the average rainfall intensity for the total storm duration of the data entered.

Runoff Method	Variable Patterns
ILSAX 2 - EPA SWMM	mm rainfall (Historical depth data - IFD not used) Total = storm rainfall depth
NZ SCS	I/I24 (Design Storm - uses IFD) Time weighted total = 24
SCS	fraction (Design Storm - uses IFD) Time weighted total = 1

Variable Pattern Examples

ILSAX 2 - EPA SWMM

The IFD data is not used. The values entered are the total rainfall in that increment.

NZ SCS

The values are the rainfall intensity in the interval divided by the 24 hr rainfall intensity. These values are multiplied by the 24hr rainfall intensity from the IFD table for the ARI specified at run time. Typically a 24hr storm is used. (I/I24).

For example a 100yr ARI storm with a total duration of 24hrs has an average rainfall intensity of 60mm/hr. If one of the interval values was 3.8 and the interval was 10min.

Rainfall depth for that 10min interval is calculated as

60mm/hr * 3.8 =   228mm/hr for 10min

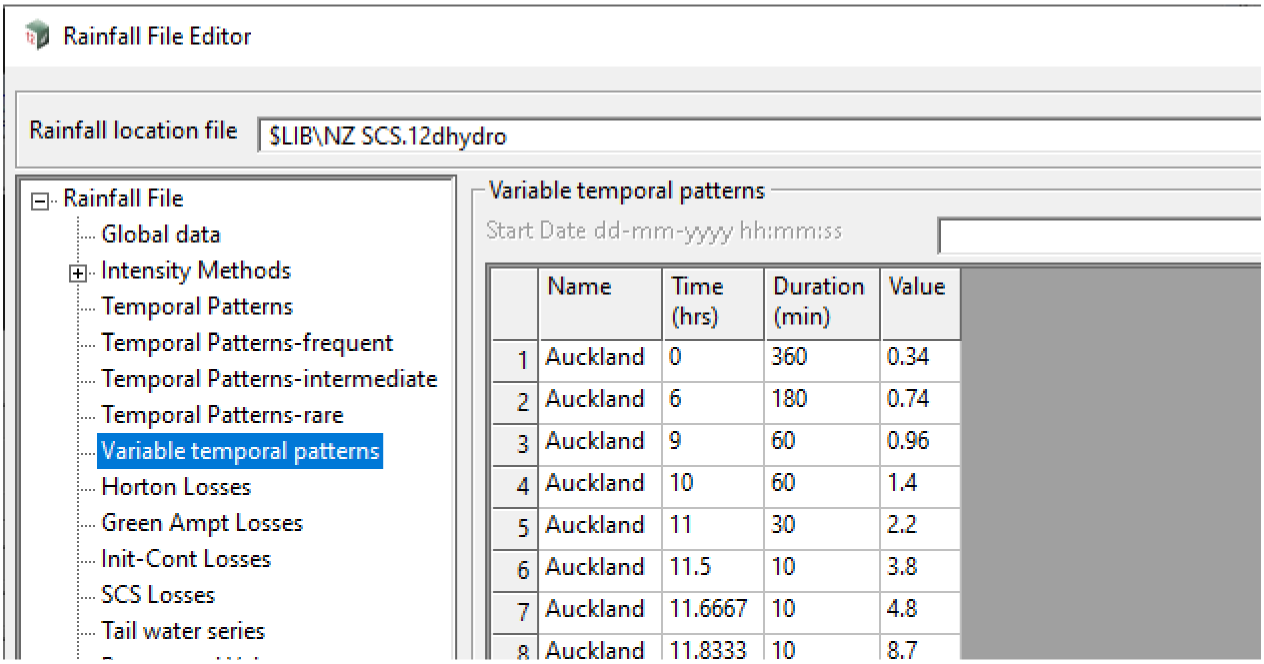
228 * 10/60 = 38 mm of rainfall in that period

SCS

For example a 100yr ARI storm with a total duration of 2hrs has an average rainfall intensity of 120mm/hr. If one of the interval values was 0.05 and the interval was 10min.

Rainfall depth for that 10min interval is calculated as

120mm/hr * 2hr * 0.05 = 12 mm of rainfall in that period



The fields and buttons used in this branch of the tree have the following functions

Field Description	Type	Defaults	Pop-Up

Start Date

Start date must be in the exact format indicated, for example:

25-12-2015 01:00:00 or 01-01-2015 00:00:00

Name

Every row with the same name is considered a separate rainfall event. All rows for the event must be grouped together with the increasing values for Time (hrs).

Time (hrs)

This is the start of the rainfall period. When this event has a previous period, the value must be greater than or equal to the previous Time(hrs)+Duration(min).

Value

The value entered for the time period has different meanings depending on the rainfall-runoff method selected by the water network editor.

Rainfall-runoff method *Value*

ILSAX 2 (variable patterns selected)rainfall intensity (mm/hr:in/hr)

NZ SCS Curves *I/I24hr (unitless)*

for an event the sum of

*value * time (min)/60/24*

must equal 1. These values will be multiplied by the average 24hr intensity from the IFD data for the return period specified at run time.

EPA SWMM *rainfall intensity (mm/hr:in/hr)*

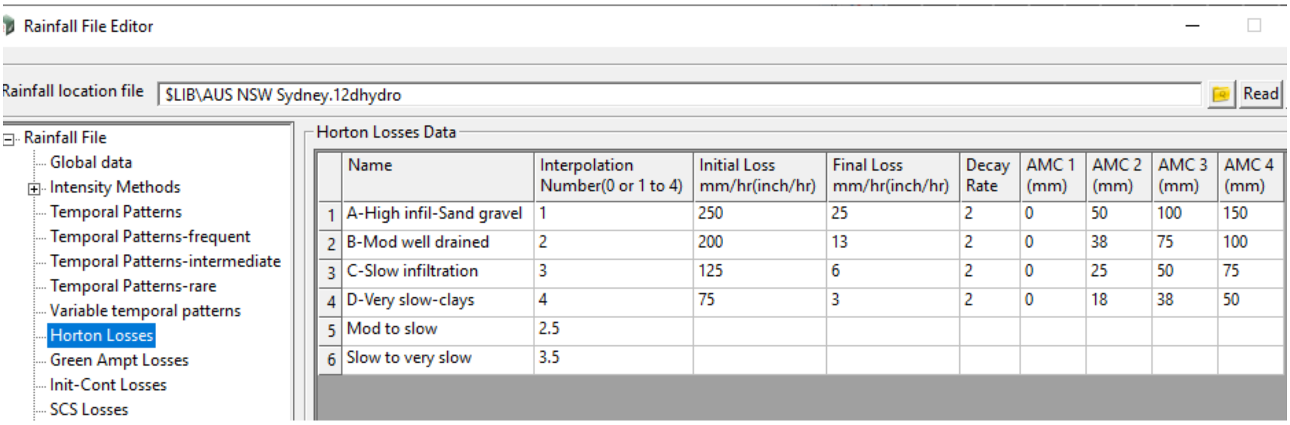
SCS method *the total rainfall depth for an event must equal 1.mm:inch*

Continue to 17.5.1.5 Rainfall Editor - Horton Losses or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.5 Rainfall Editor - Horton Losses

For information on the Horton equationand the parameters used in it, see 27.1.2.3.7.1 Horton Losses.

The name of the **Soil Types** and the values defined for them are entered into the **Rainfall File Editor** by clicking on the **Horton Losses** tree node in the **Rainfall File Editor.** The values for the loaded **Rainfall Location File** (**Hydro file**) are then displayed
:



	Name	Interpolation Number(0 or 1 to 4)	Initial Loss mm/hr(inch/hr)	Final Loss mm/hr(inch/hr)	Decay Rate	AMC 1 (mm)	AMC 2 (mm)	AMC 3 (mm)	AMC 4 (mm)
1	A-High infil-Sand gravel	1	250	25	2	0	50	100	150
2	B-Mod well drained	2	200	13	2	0	38	75	100
3	C-Slow infiltration	3	125	6	2	0	25	50	75
4	D-Very slow-clays	4	75	3	2	0	18	38	50
5	Mod to slow	2.5							
6	Slow to very slow	3.5							

The text in the **Name** column is the **Soil Type** that is displayed in the pop-up for a **Loss** field on a panel when **Horton** is the selected infiltration method.

These soil types use the classifications of Terstriep and Stall (1974), based on the system developed by the U.S. Department of Agriculture. The default values entered from the library represent the soil types of

1. **Type A** - low runoff potential, high infiltration rates (consists of sand and gravel
2. **Type B** - moderate infiltration rates and moderately well-drained
3. **Type C** - slow infiltration rates (may have layers that impede downward movement of water)
4. **Type D** - high runoff potential, very slow infiltration rates (consists of clays with a permanent high water table and a high swelling potential)

Also extra table entries with Interpolation numbers can be added to the list.

5. **Mod to slow** - Interpolation number of 2.5
6. **Slow to very slow** - Interpolation number of 3.5

Interpolation Numbers are assigned to each soil type to allow interpolation between the defined soil types. When interpolated values are used they must be included in the list (2.5 and 3.5 for example in the table above).

Interpolated values do not need loss data entered. **If loss data is entered** for the interpolated names then this data will be used rather than an interpolation occurring. If any loss data is entered then all of the values must be entered.

Antecedent moisture condition (AMC) points - only for ILSAX 2 Method

Four preset **antecedent moisture condition** (**AMC**) points are defined in the **rainfall file** to mark AMC conditions ranging from dry (AMC1) to saturated (AMC4). The required data for each line is the **Initial loss rate, Final loss rate, decay rate** and **4** antecedent moisture conditions **(AMCs).**

The AMC values are entered in **depth of rainfall (mm)** and represent the total rainfall prior to the start of the pattern.

For informationon how to set Horton losses in the 17.3.4 Water Network Editor (WNE), see 27.1.2.3.7.1.1 Using Horton Loses in the Water Network Editor.

Continue to 17.5.1.6 Rainfall Editor - Green Ampt Infiltration Losses or return to 17.5.1 Hydro (Rainfall) File Editor.

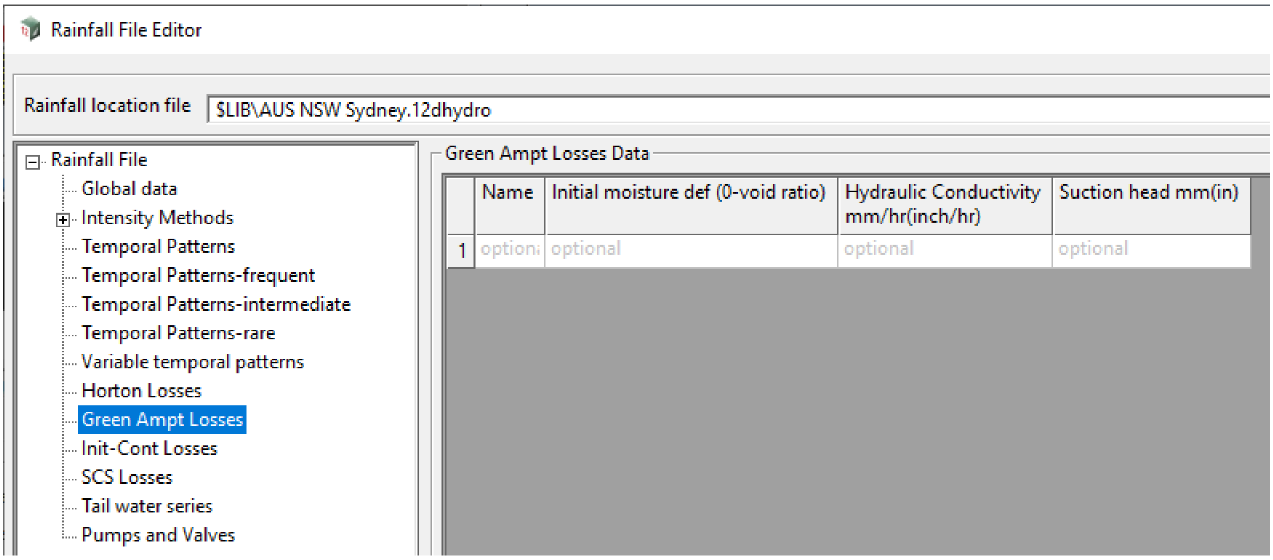
17.5.1.6 Rainfall Editor - Green Ampt Infiltration Losses

The parameters required for **Green Ampt** infiltration losses are the **Initial moisture deficit** (NOT moisture content), **Hydraulic Conductivity** and **Suction Head**. See 27.1.2.3.7.3 Green Ampt.

Many values are readily available online for various soil types, however for specific site data soil testing is generally simple to carry out and preferred.

The name of the **Soil Types** and the values defined for them are entered into the **Rainfall File Editor** by clicking on the **Green Ampt Losses** tree node in the **Rainfall File Editor.** The values for the loaded **Rainfall Location File** (**Hydro file**) are then displayed.

.



The text in the **Name** column is the **Soil Type** that is displayed in the pop-up for a **Loss** field on a panel when **Green Ampt** is the selected infiltration method.

Values for the **name**, **initial moisture deficit**, **hydraulic conductivity** and **suction head** are entered into the grid and the **Write** button is pressed to write the data in the grid to the **Rainfall location file.**

For information on how to set **Green Ampt** losses in the 17.3.4 Water Network Editor (WNE), see 27.1.2.3.7.3.1 Using Green Ampt Loses in the Water Network Editor.

Continue to 17.5.1.7 Rainfall Editor - Initial and Continuing Losses or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.7 Rainfall Editor - Initial and Continuing Losses

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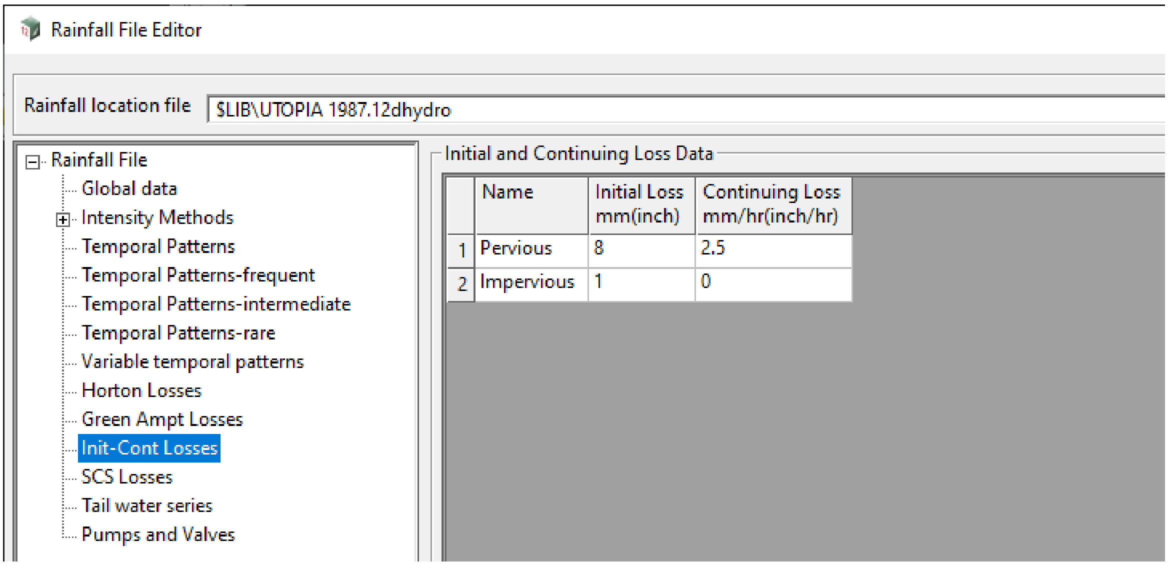
For **Initial and Continuing** infiltration losses, the **initial loss** and the **continuing loss** must be defined.

The pop-up of loss types for the **Loss** field is the list in the Name column defined in the tree node **Init-Cont Losses** in the **Rainfall File**.

Clicking on the **Init-Cont Losses** tree node in the **Rainfall File Editor** for the loaded **Rainfall Location File** (**Hydro file**) shows



For information on how to set **initial and Continuous** losses in the 17.3.4 Water Network Editor (WNE), see 27.1.2.3.7.4.1 Using Initial and Continuing Losses in the Water Network Editor.

Continue to 17.5.1.8 Rainfall Editor - SCS Curves or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.8 Rainfall Editor - SCS Curves

The infiltration method of **SCS Losses** uses and **Initial Abstraction** and **Curve Number**.

The **NZ SCS** and **SCS** loss methods use a **curve number** (**CN**) and an **Initial abstraction** (**Ia**) to determine the **losses** for the catchments.

A curve number of 0 results in zero runoff while a curve number of 100 results in 100% runoff. TP 108 recommends the selection of the curve number by identifying

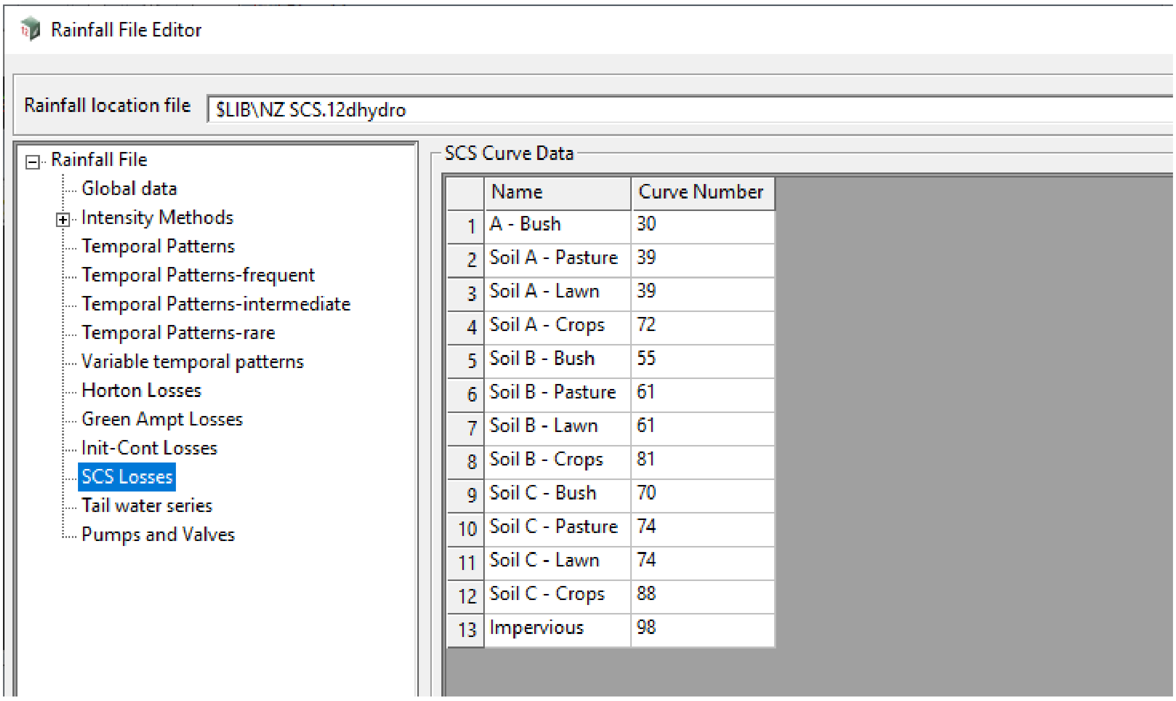
- *the **soil type***

and

- *the **land use**.*

A curve number of 98 and an Initial abstraction value of 0 are recommended for impervious areas.

Clicking on the **SCS Losses** tree node in the **Rainfall File Editor** for the loaded **Rainfall Location File** (**Hydro file**) shows the **Loss types**



Names are given to the **SCS curve numbers** in the rainfall file and the names are what is displayed in the pop-up list for the **Loss** field.

For information on how to set **Curve Numbers** and **Initial abstraction** in the 17.3.4 Water Network Editor (WNE), see 27.1.2.3.7.2.1 Using SCS Curve Losses in the Water Network Editor.

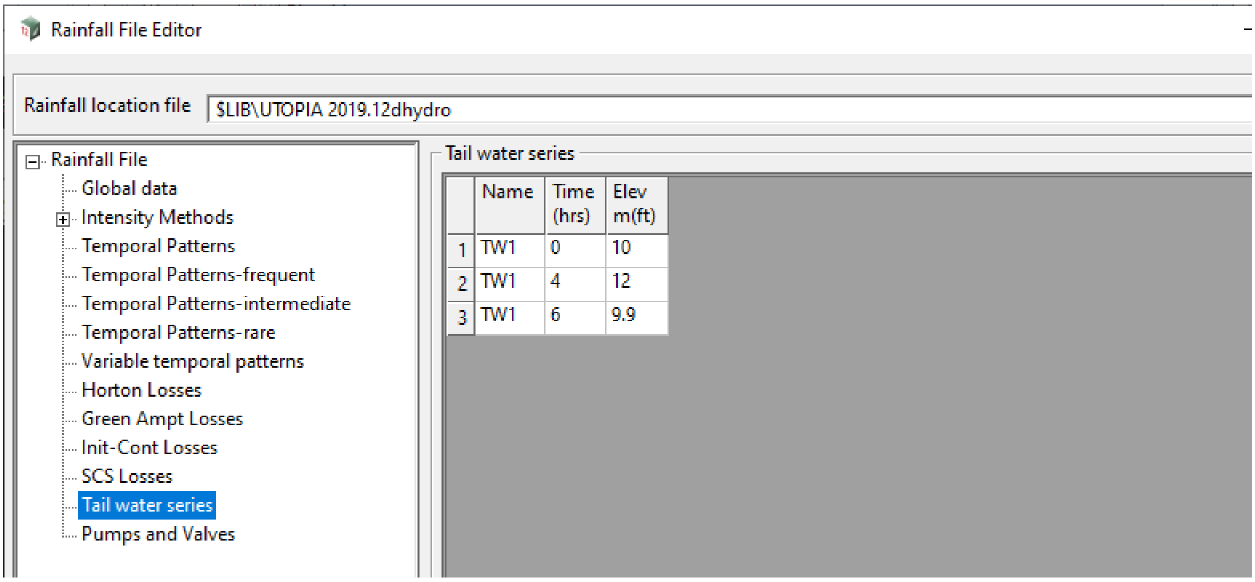
Continue to 17.5.1.9 Outlet Tailwater Time Series or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.9 Outlet Tailwater Time Series

When using ***Rational analysis***, only a a **single** tail water elevation can be specified at an outlet node location the for interaction when calculating the HGL during the analysis.

With ***Rational analysis***, a variable, or **series of tail water elevations** can be used during the hydraulic analysis of the network.

Clicking on the **Tail water series** tree node in the **Rainfall File Editor** for the loaded **Rainfall Location File** (**Hydro file**) shows the **Tail water series**



All the entries in the **Name** column with the **same name** define the one **series**.

Multiple series can be defined by using different names in the name column.

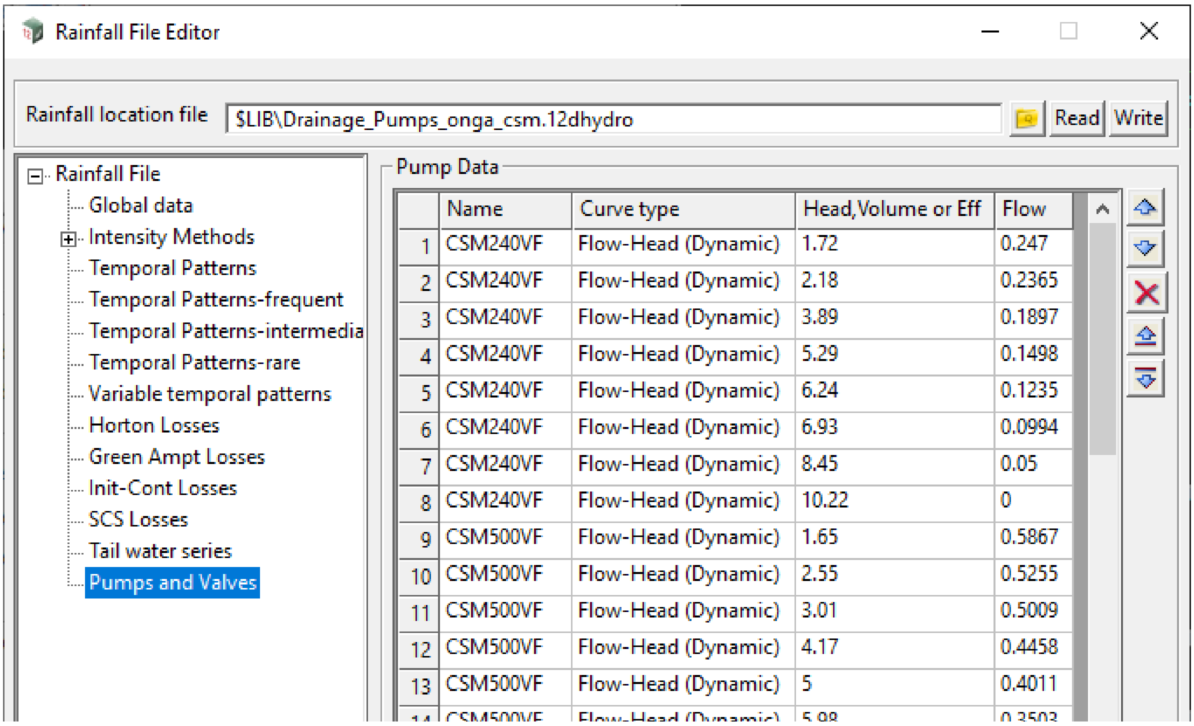
Continue to 17.5.1.10 Pumps and Valves or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.1.10 Pumps and Valves

Pumps are links used to lift water to higher elevations.

A pump curve describes the relation between a pump's flow rate and conditions at its inlet and outlet nodes. There are five different types of pump curves that are supported. See 27.2.2.1.1 Pump Curve Types

.



All the entries in the **Name** column with the **same name** define the one **pump curve**.

Multiple pumps can be defined by using different names in the name column.

For more information on pumps, see 27.2.2.1.1 Pump Curve Types.

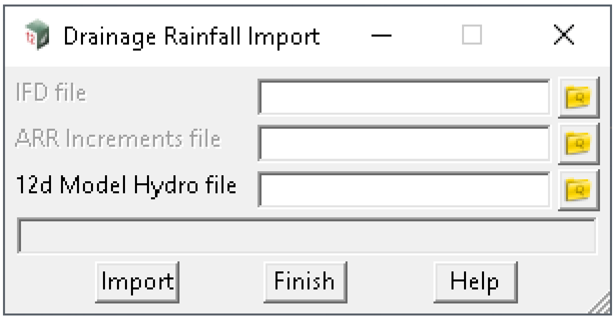
Continue to 17.5.2 Create Hydro File or return to 17.5.1 Hydro (Rainfall) File Editor.

17.5.2 Create Hydro File

Position of option on menu: **Water =>Stormwater => Create hydro file**

Water =>Water string =>Stormwater tools => Create rainfall file

Selecting **Create hydro file** option brings up the **Drainage Rainfall Import** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
IFD file	file box		

??

ARR Increment file	file box		

.

12d Model Hydro file	file box		

.

Import	button		

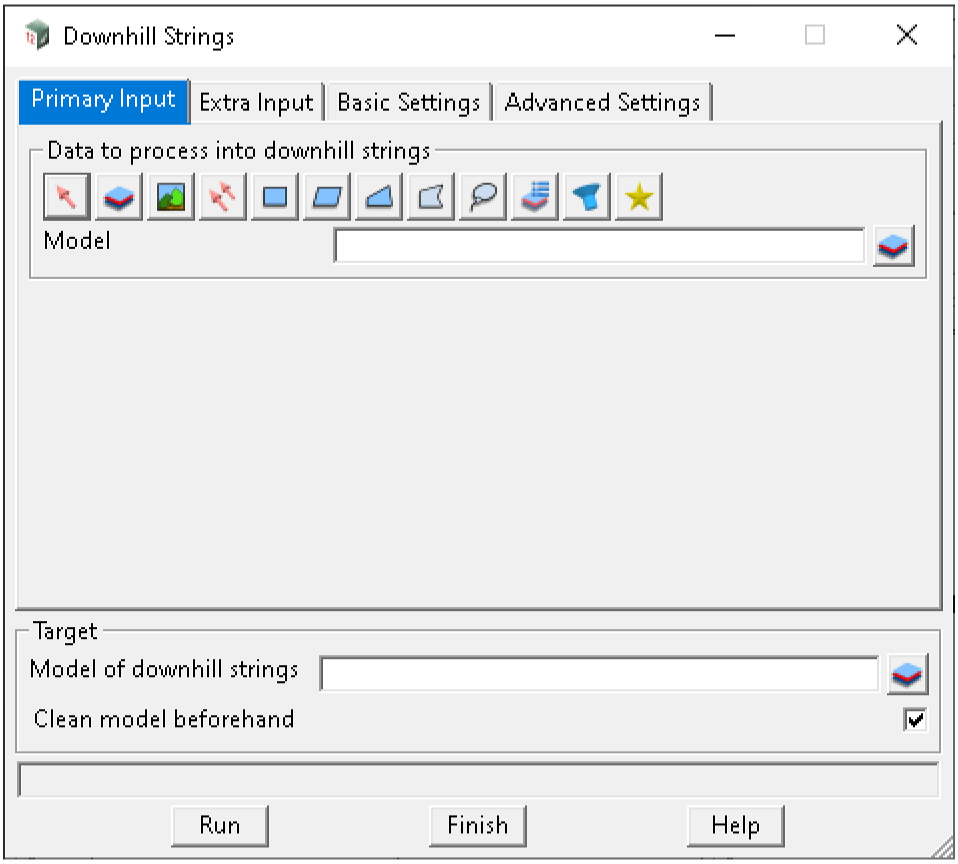
Continue to 17.5.3 Downhill Strings or return to 17.5 Stormwater.

17.5.3 Downhill Strings

Position of option on menu: **Water =>Stormwater =>Downhill strings**

This option copies selected Super strings to a target model, where the strings are split at their crests and sags, and set in the downhill direction, i.e. reversed where necessary. Selected Super strings with null, or constant z-values are also copied to the target model, but are never split, or reversed.

Selecting **Downhill strings** brings up the **Downhill Strings** panel.

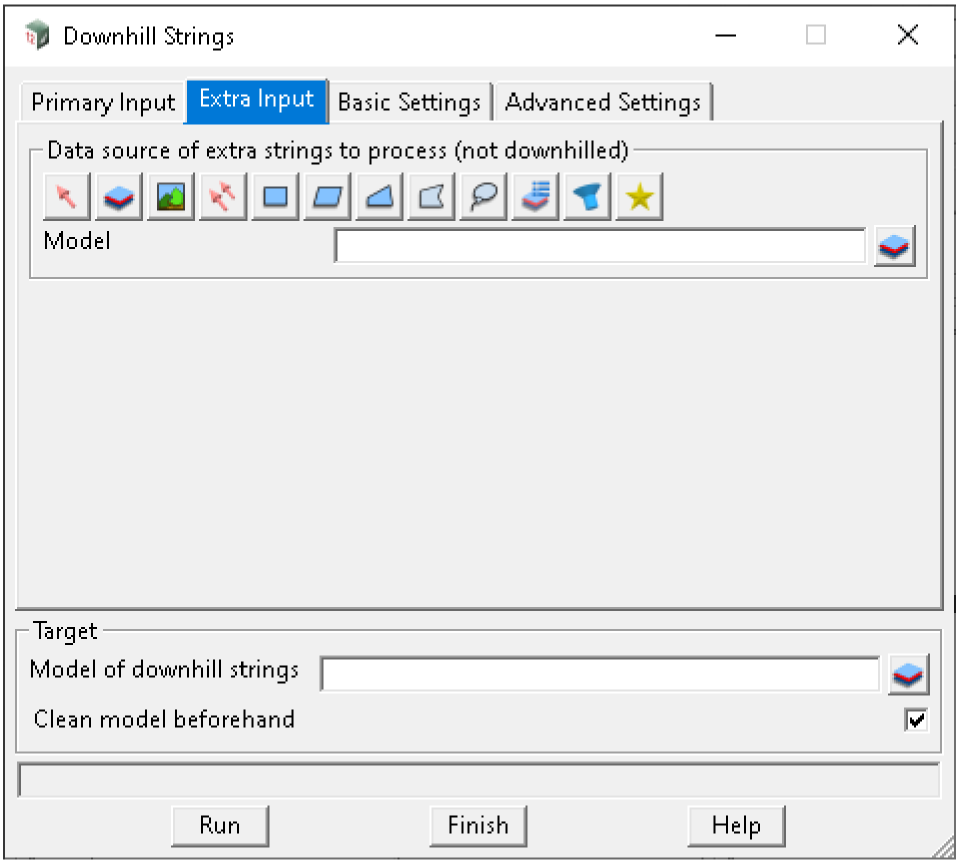


The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

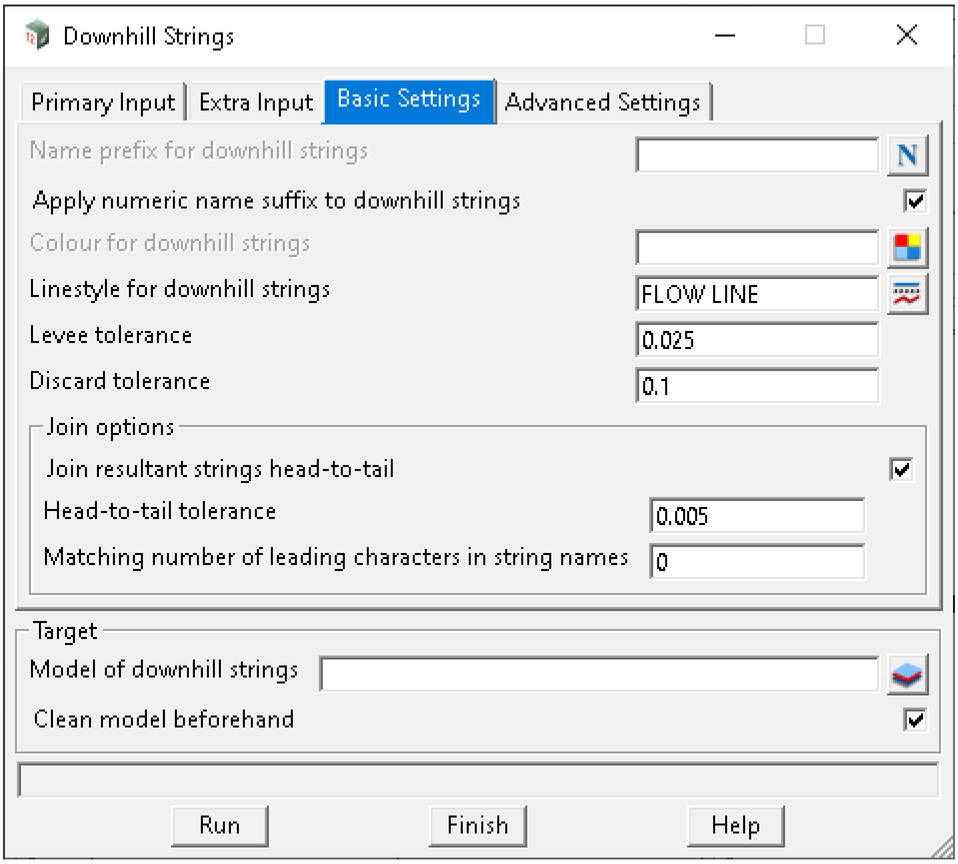
Data to process into downhill strings data source

Use the most appropriate ***12d Model*** *data selection method, to select the strings to be copied to the target model and processed into downhill strings.*



Data source of extra strings to process (not downhill) data source

Use the most appropriate ***12d Model*** *data selection method, to select the extra strings to be copied to the target model,* ***without*** *being processed into downhill strings. This source-box is optional. Its purpose is mainly for those using the* ***Downhill Strings*** *panel when creating an* ***Overland flow model*** *that links to a model of Water strings via the* ***Water Network Editor.*** *Manual modifications to the* ***Overland flow model*** *(typically near sags, headwalls and intersections) may be created in the data source of extra strings, and will simply be copied into the target model, each time the option is run. This avoids the need to re-create the manual modifications, each time the target model is cleaned and re-created.*



Name prefix for downhill strings name box available names

*If **non-blank**, resultant strings in the target model will be renamed with this prefix. If **blank**, the original string name is used as the prefix. In both cases, the resultant string names will be given a sequential numeric suffix, to ensure all strings in the target model have a unique name (as is ideal in an **Overland flow model**).*

Apply numeric name suffix to downhill strings tick box ticked

Whether to apply a sequential numeric name suffix to the resultant strings in the target model, to ensure all strings in the target model are named uniquely (as is ideal in an Overland flow model).

Colour for downhill strings colour box available colours

*If **non-blank,** resultant strings in the target model will be set to this colour, and any segment colours will be removed.*

Linestyle for downhill strings linestyle box "FLOW LINE" available linestyles

*If **non-blank**, resultant strings in the target model will be set to this linestyle, and any segment linestyles will be removed.*

Levee tolerance input real 0.025

Localised uphill portions will be allowed to rise up within this vertical tolerance, before descending. This allows small vertical "imperfections" in the strings to be ignored.

Discard tolerance input real 0.1

Resultant strings shorter than this tolerance will be discarded from the target model.

Join options

Join resultant strings head-to-tail tick box ticked

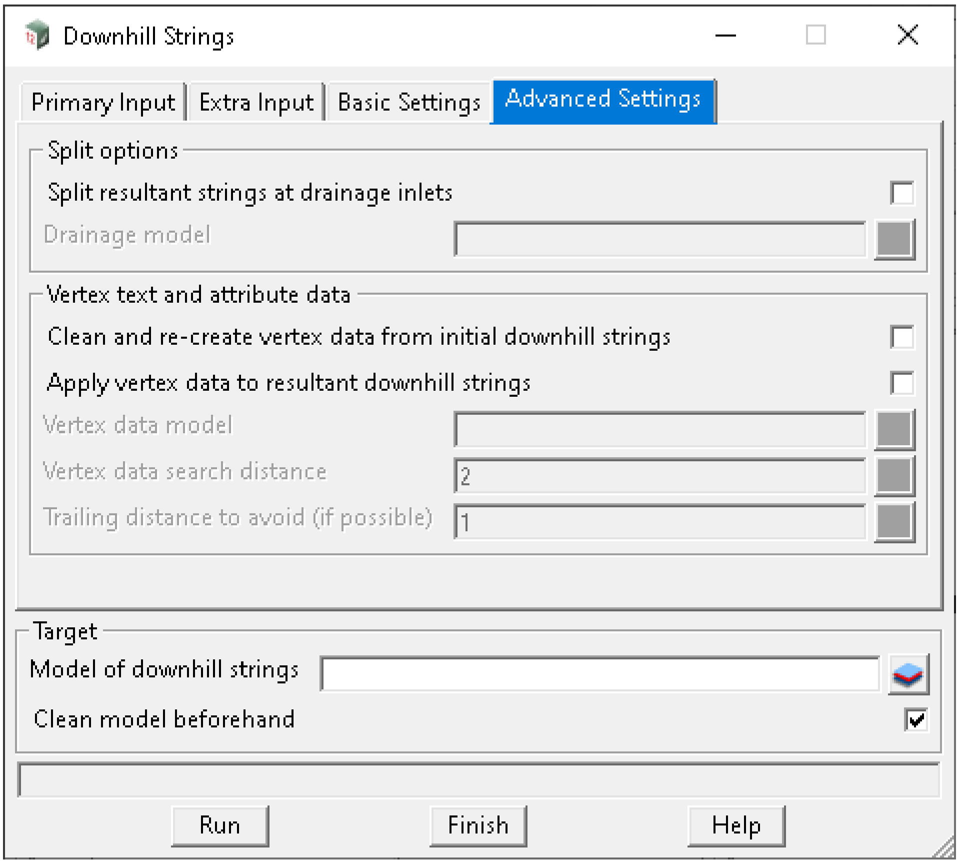
Whether to join strings in the target model in a head-to-tail fashion.

Head-to-tail tolerance input real 0.005

If joining strings head-to-tail, the head must be within this tolerance of the tail.

Matching number of leading characters in string names input integer 0

If joining strings head-to-tail, this number of leading characters in both string names must match.



Split options

Split resultant strings at drainage inlets tick box not ticked

Whether to split resultant strings in the target model, at nearby drainage inlets. If ***ticked****, the drainage model must be provided.*

Drainage model model box available models

If splitting strings at drainage inlets, strings will be split at all nearby drainage inlet nodes found in this model. Drainage inlets (on-grade and sag nodes only) must be within one node diameter (or at least 0.1 units) of the string, and may not be closer than the ***Discard tolerance*** *from either end of the string.*

Vertex text and attribute data

This section is mainly for those using the ***Downhill Strings*** *panel for Rational Method stormwater analysis. It allows the vertex text and attribute data that may already have been set on the* ***Overland flow model*** *(via the Drainage Utility String Editor panel) to be extracted from the* ***initial target model****, to the* ***Vertex data model****, and/or, to be applied from the* ***Vertex data model****, to the resultant target model. This can save significant re-work, whenever the target model needs to be cleaned and re-created.*

Clean and re-create vertex data from initial downhill strings tick box not ticked

*Whether to clean the **Vertex data model**, and then transfer the vertex text and attribute data to it, from the initial target model.*

Apply vertex data to resultant downhill strings tick box not ticked

*Whether to apply the data in the **Vertex data model** to the resultant target model.*

Vertex data model model box available models

Model of vertex text and attributes, for transfer from initial target model (and/or) to resultant target model. Only enabled when either (or both) of the above tick boxes is ticked.

Vertex data search distance input real 2

Vertex data must be within this distance to be applied to nearest resultant string in target model.

Trailing distance to avoid (if possible) input real 1

When applying vertex data to nearby strings in the resultant target model, give preference to points found more than this distance from end of string.

Target

Model of downhill strings model box available models

Target model. All matching source strings are copied to and processed in this model.

Clean model beforehand tick box ticked

Whether to clean the target model beforehand.

Run button

Runs the option.

Finish button

Removes the panel from the screen.

Help button

Launches the 12d help for the option.

Special Note:

This option is a macro. Previous versions of this macro supported argument inputs as an alternative to a panel interface. The option no longer supports argument inputs.

Continue to 17.5.4 Water Utility String Editor or return to 17.5 Stormwater.

17.5.4 Water Utility String Editor

Position of option on menu: **Water =>Stormwater =>Utility String Editor**

This editor is used to edit properties of the strings used by the 17.3.4 Water Network Editor (WNE). Properties always change at an existing vertex.

Cross Section Strings (Manning's n) - set the left and right bank n values. The centre n value is assigned by the WNE.

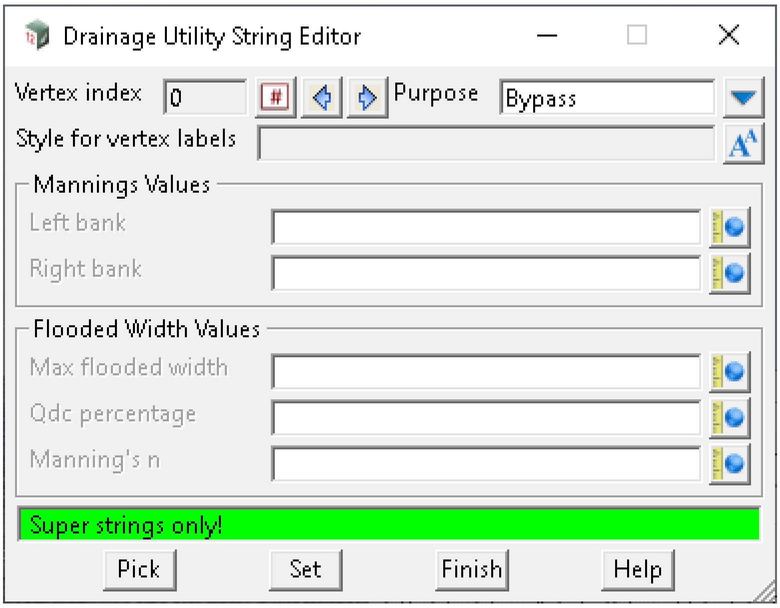
Flooded Width Values on Bypass Flow Strings - the default setting of the bypass flow strings when used to calculate flooded widths in the Stormwater Analysis.Changes are in effect until the end of the string or it has been re specified at vertex at a higher chainage.

Vertex labels are created whenever properties are set (Textstyle is required).

Usage

First the string is selected at the vertex where the values are to be assigned. Next select the purpose of the string (cross section or bypass) to unlock the appropriate fields. A textstyle favourite is required as the vertex is labelled with the assigned values. Enter the values into the fields and then select Set to set the values as vertex attributes and create the label as a vertex annotation.

Selecting the **Utility String Editor** brings up the **Drainage Utility String Editor** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Vertex index	vertex	selected vertex	

Once the string is selected use this to move between vertices

Style for Vertex Labels	textstyle favourite	textstyles	

A label is created on the vertex using this textstyle favourite

Left bank	real box		

Mannings n value, to delete clear and select set

Right bank	real box		

Mannings n value, to delete clear and select set

Max Flooded with real box

This changes the threshold were warning bars are created during flooded width calculations. It remains in effect till the next change or the end of the bypass flow string.

Qdc percentage real box

This changes the percentage of the Qdirect+Qcatchment that is used to interpolate the discharges during flooded width calculations. It is generally set on the first vertex past upstream pit and remains in effect till the next change or the end of the bypass flow string. The flow changes from the bypass flow at the upstream pit to this value/100(Qdirect+Qcatchment).*

Manning's n real box

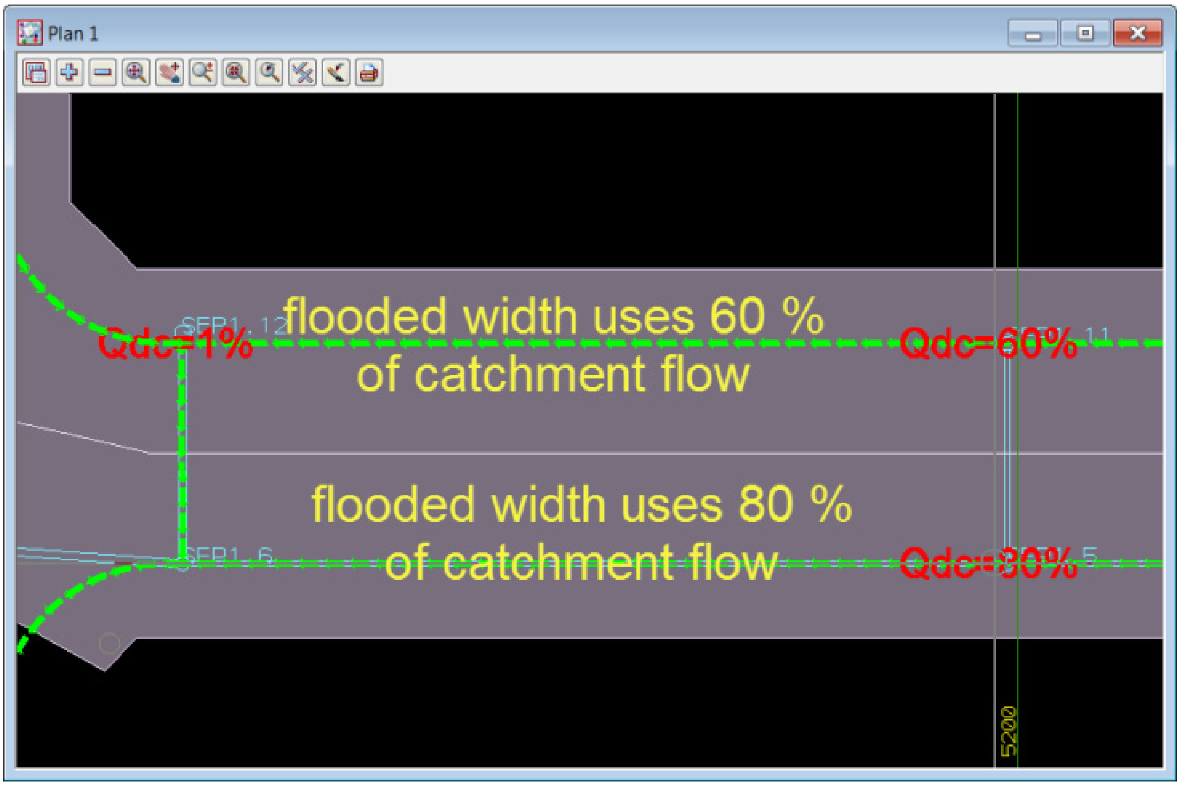
This changes the Manning's n value used for during flooded width calculations. It remains in effect till the next change or the end of the bypass flow string.

Pick button

Use this button to select the string. Select near the vertex you want assign the values to.

Set button

Creates the attributes and the label on the vertex.



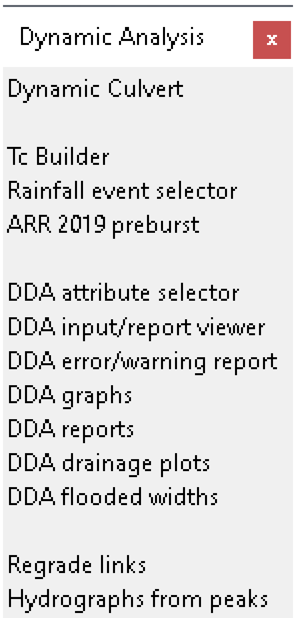
In the example above, The Qdc is set to 80% at the eastern end of the catchment. The Qdc is set to 2% for the water overtopping the road. The 18% of the area is not considered large enough to do the flooded width calculation for. If desired, another bypass flow string approaching from the east could be drawn but the final bypass string to the west (direction during bypass should remain).

Continue to 17.5.5 Dynamic Analysis or return to 17.5 Stormwater.

17.5.5 Dynamic Analysis

Position of menu: **Water =>Stormwater =>Dynamic analysis**

The **Dynamic Analysis** walk-right menu containing these options is:



See

17.5.5.1 Dynamic Culvert Design

17.5.12 Time of Concentration Builder
17.5.5.2 Rainfall Event Selector
17.5.5.3 AR&R Pre-Burst

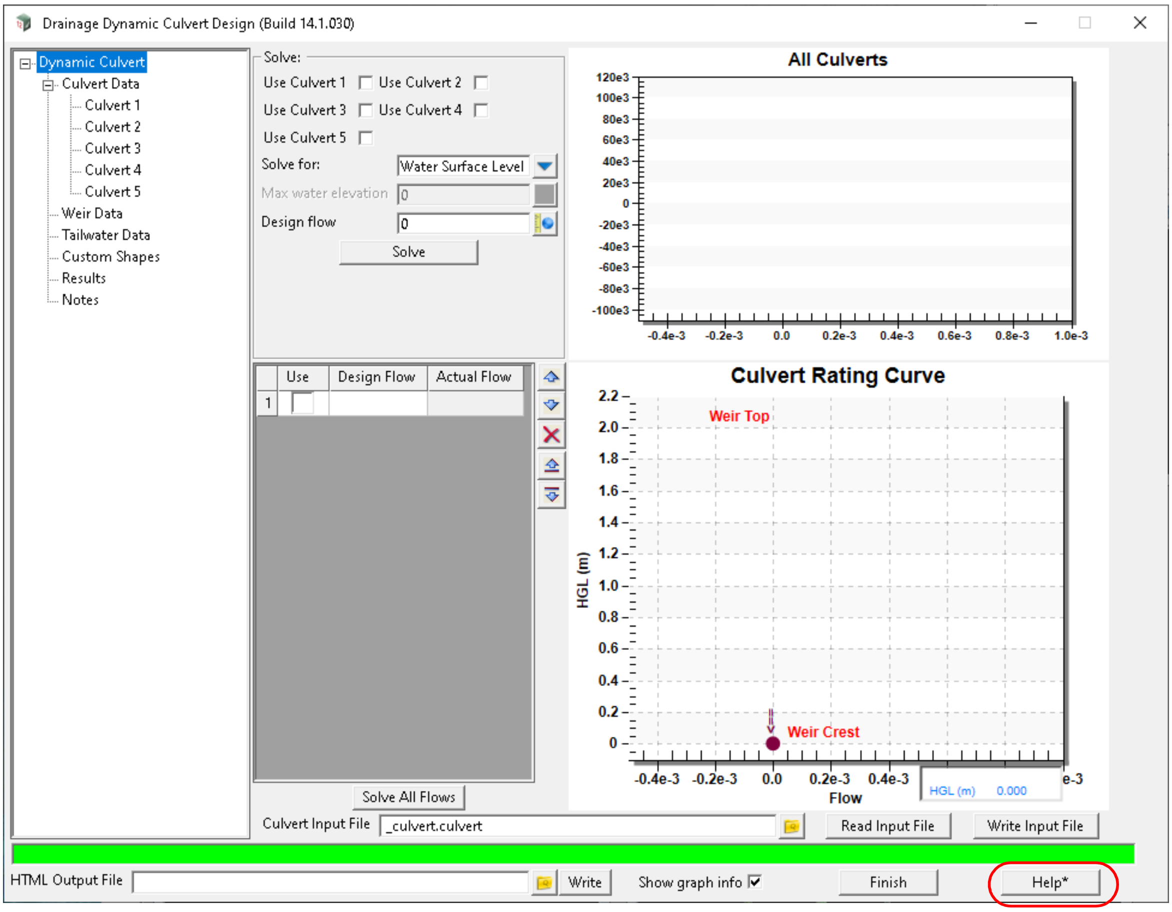
17.5.5.4 Dynamic Drainage Analysis Attributes
17.5.5.5 Dynamic Drainage Analysis Input/Report Files
17.5.5.6 Dynamic Drainage Error/Warning Report
17.5.5.7 Dynamic Graphs
17.5.5.8 Dynamic Reports
17.5.5.9 Dynamic Drainage Plots
17.5.5.10 DDA Flooded Widths

17.5.5.11 Regrade Links
17.5.5.12 Create Hydrographs from Peaks

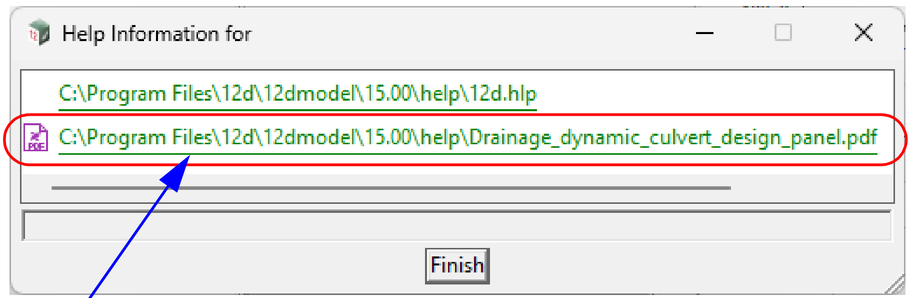
17.5.5.1 Dynamic Culvert Design

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Dynamic Culvert**

On selecting the **Dynamic Culvert** option, the **Drainage Dynamic Culvert Design** panel is displayed.



A separate PDF document describing this option is obtained by clicking on the **Help*** button on the bottom of the panel to bring up the **Help Information for** panel:



Clicking on the second line will bring up the required pdf file.

Continue to 17.5.5.2 Rainfall Event Selector or return to 17.5 Stormwater.

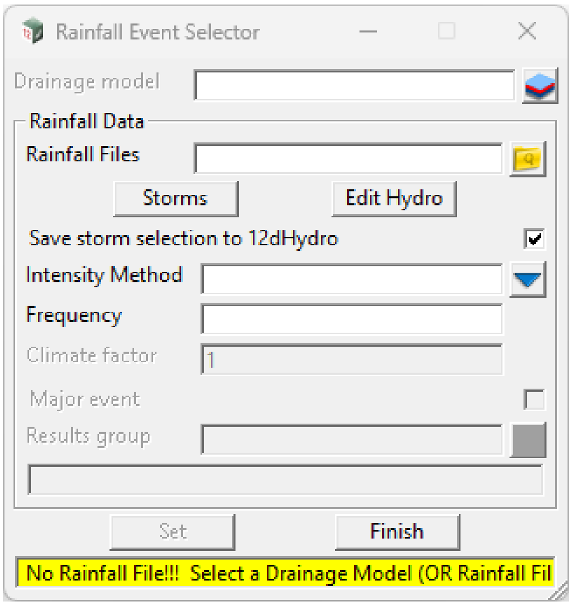
17.5.5.2 Rainfall Event Selector

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Rainfall event selector**

This utility is an alternative to using the **Rainfall File Editor** (17.5.1 Hydro (Rainfall) File Editor) to allow the fast selection of storm events to be used in a Dynamic Analysis run.

The run can be initiated from either the 17.3.4 Water Network Editor (WNE), or the 17.2.1 Concept Stormwater Design (**CSD**) panel.

Selecting **Rainfall event selector** brings up the **Rainfall Event Selector** panel:

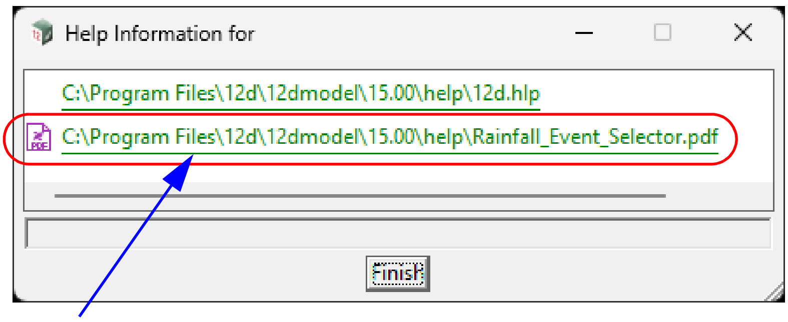


The use of a **Drainage model** is optional.

If the **Drainage model** is used, the Rainfall file name (the .12hydro file - see 17.5.1 Hydro (Rainfall) File Editor), Intensity method, Frequency (ARI or AEP), Climate factor, Event type (major or minor) and Results group are loaded from the drainage model.

If no **Drainage model** is defined, the Rainfall file name, along with the Intensity method, Frequency, Climate factor, Event type, and Results group all need to be defined by the user.

A separate PDF document describing this option in detail is obtained by pressing **F1** whilst over the panel to bring up the **Help Information for** panel:



Clicking on the second line will bring up the required pdf file.

Note:

The **Help** button will be added to the panel in a future release.

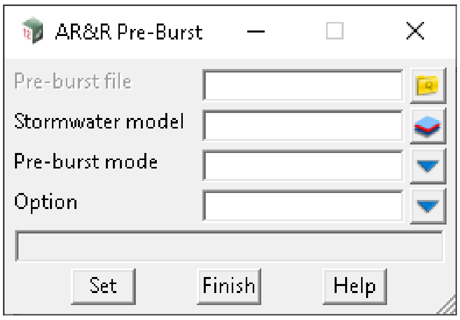
Continue to 17.5.5.3 AR&R Pre-Burst or return to 17.5 Stormwater.

17.5.5.3 AR&R Pre-Burst

Position of menu: **Water =>Stormwater =>Dynamic analysis =>ARR 2019 preburst**

Used to read in an ARR pre-burst file and set the data to a selected Drainage Model. Also allows the user to change the mode and option for the model without having to read the pre-burst file. Pre-burst is available for **ILSAX**, **Laurenson** and **ARR 2019 IL-CL** hydrology methods.

Selecting **ARR 2019 preburst** brings up the **AR&R Pre-Burst** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pre-burst file	file box		*.txt files

An AR&R pre-burst txt file downloaded from the AR&R Datahub https://data.arr-software.org/

Drainage model	model box		available models

The drainage model to set/modify pre-burst parameters for.

Pre-burst model	choice box		Median, 10%, 25%, 75%, 90% Transformational

Pre-burst modes available from either the file (if used) or Model (if previously set) will be listed here. If a model has no modes available, then it has never had a file read and set for it. Possible values are:

Where:

***Median** – Recommended by AR&R Guidelines for most Australian catchments, unless local authorities state otherwise.*

***10%** - 10th percentile pre-burst rainfall.*

***25%** - 25th percentile pre-burst rainfall.*

***75%** - 75th percentile pre-burst rainfall. Recommended by AR&R guidance for **Victorian catchments in loss region 3**. Refer to the Victoria-specific page of the AR&R Datahub for further information.*

***90%** - 90th percentile pre-burst rainfall.*

***Transformational** – Transformational pre-burst rainfall. Recommended by AR&R guidance for NSW catchments to calculate the Probability Neutral Burst Initial Losses. Refer to the NSW-specific page of the AR&R Datahub for further information.*

Other	choice box		None, Adjust losses, Prepend to rainfall

Pre-burst option for application. Possible values are:

Where:

***None** – turns off pre-burst for the model.*

__Adjust losses__ – will apply the pre-burst as a lumped rainfall depth and initial catchment conditions will be adjusted accordingly (initial loss, surface storage, time-area etc). The burst rainfall will then be run over the catchment.

__Prepend to rainfall__ – will add the pre-burst rainfall to the model rainfall prior to the burst rainfall to create a complete storm. This will result in longer model runtimes due to more time steps for the analysis.

Buttons at bottom

Set button

*Sets the data contained in the **pre-burst file** (if selected) to the **Model**. If no pre-burst file is selected then the **mode** and **choice** chosen will be set for the selected model.*

Finish button

Finishes the panel without applying any data to the model.

Help button

Opens the 12d reference manual.

Continue to 17.5.5.4 Dynamic Drainage Analysis Attributes or return to 17.5 Stormwater.

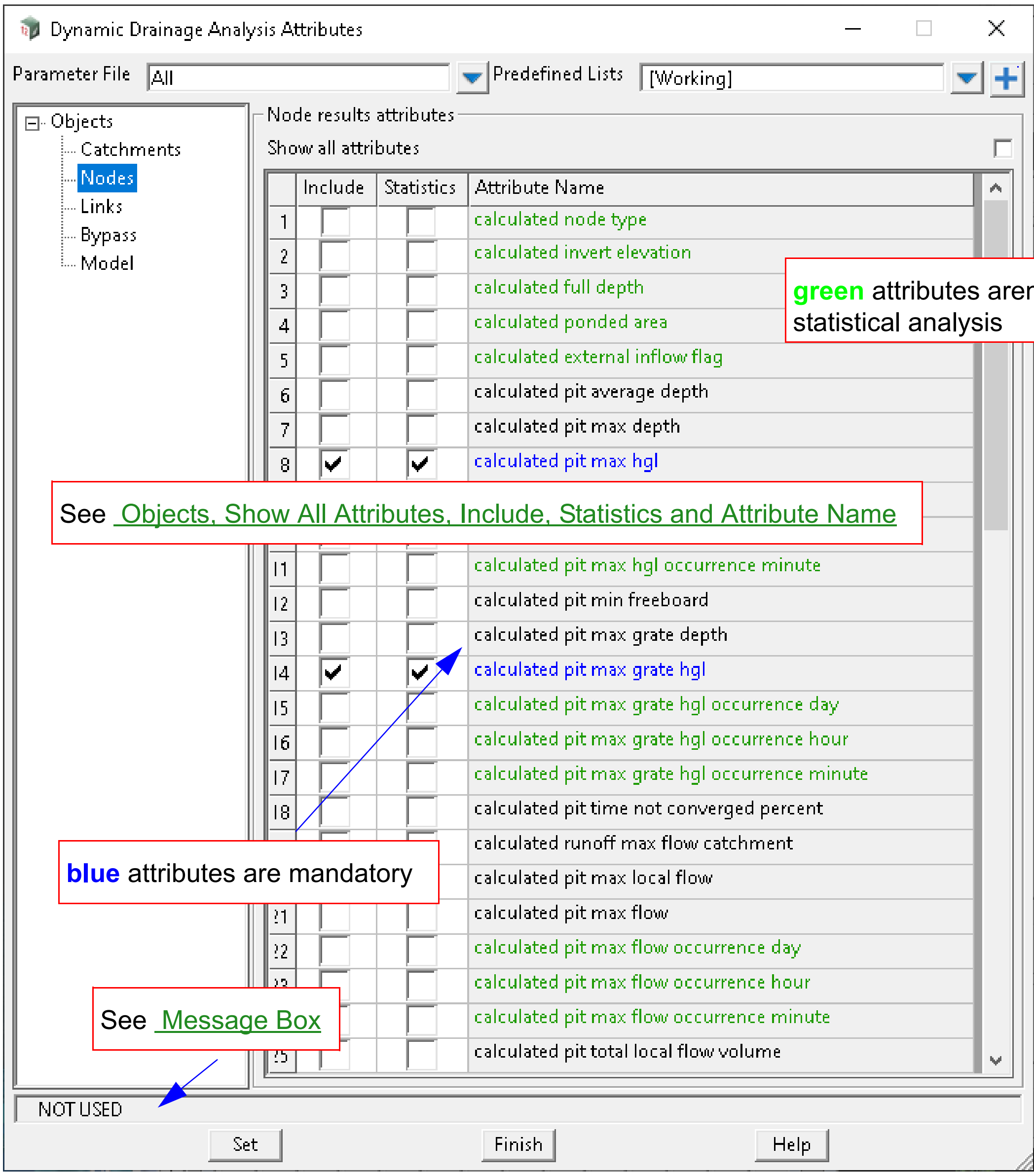
17.5.5.4 Dynamic Drainage Analysis Attributes

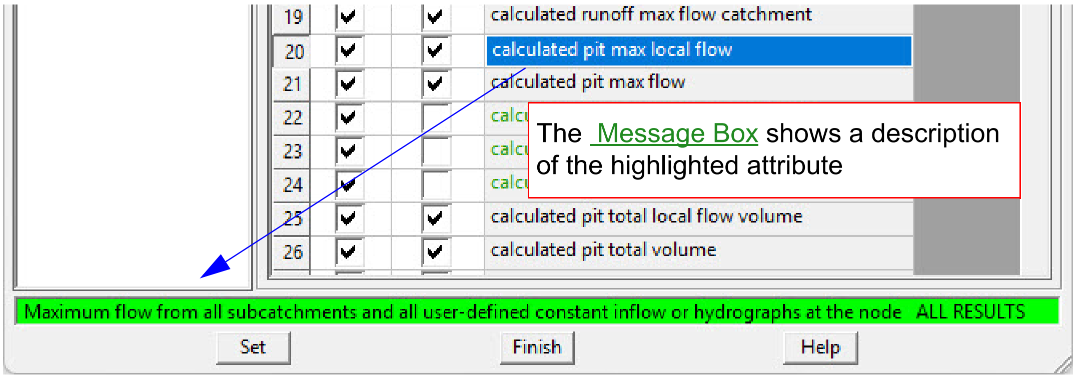
Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>DDA attribute selector**

This panel is used to display and select the model, catchment, node, link and bypass attributes generated when a model is saved.

Note that there are more than 230 individual attributes (plus 4 critical event attributes for each attribute with statistics plus 7 mean and median duration attributes for each attribute with statistics) that can be stored. Therefore, be conscious of how many results are being saved (for example a 100-node model running all the ARR 2019 events for 3 AEP/ARI events results in more than 10 million attributes being saved).

Selecting **DDA attribute selector** brings up the **Drainage Dynamic Drainage Analysis Attributes** panel:





The fields and buttons used in this panel have the following functions.

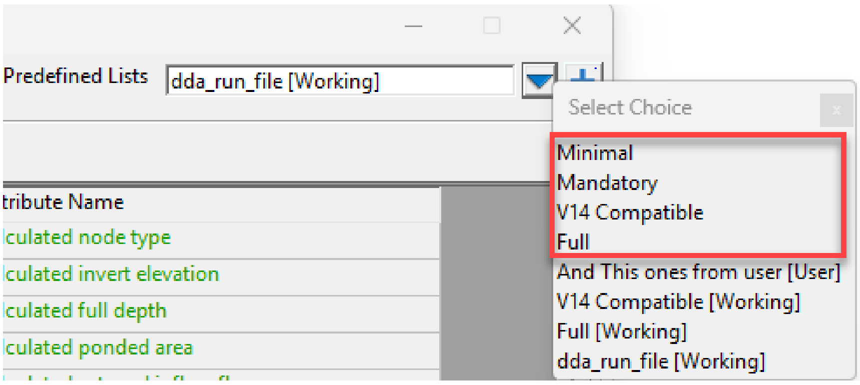
Field Description	Type	Defaults	Pop-Up
Parameter file	choice box		Working, User Lib, User, All

Allows the to display the dynamic drainage analysis (dda) attributes file (.ddaAtts) from the Working folder, the User Lib folder, the User older or All folders.*

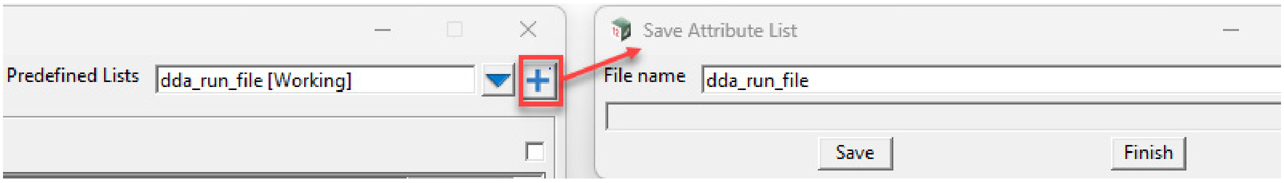
Predefined lists	choice box		

*Selection of the *.ddaAtts file to be used during the analysis run.*

There are 4 pre-defined groups (Minimal, Mandatory, V14 Compatible and Full) and any number of user-defined groups which are created by clicking the + *button adjacent to this widget:*



User-defined groups are created by clicking the + button adjacent to the predefined lists widget:



Objects, Show All Attributes, Include, Statistics and Attribute Name

Objects	tree box		

Selecting the appropriate page (node) in the tree box on the left will display the attributes selected for the Catchment, Node, Link, Bypass or Model highlighted.

Show all attributes	tick box		

*If ticked, **ALL** possible attributes are shown in the grid allowing for the selection of additional attributes* *that are not present in the current list.*

Include tick box

*If **ticked** this attribute is included in the **next analysis run**.*

Statistics tick box

*If **ticked**, mean and median statistics for each duration and critical ARI/AEP statistics will be calculated for this attribute during the **next analysis run**.*

***Note** that **statistics** are **only necessary** if using the **AR&R 2019** procedure.*

Attribute Name tick box

Name of the attribute.

*Attribute names shown in **blue** are mandatory and must be included in the run. Attribute names shown in **green** are meaningless for statistical analysis.*

Message Box

Message Box output

*The message box at the bottom the panel shows a description of the **highlighted** attribute.*

Continue to 17.5.5.5 Dynamic Drainage Analysis Input/Report Files or return to 17.5 Stormwater.

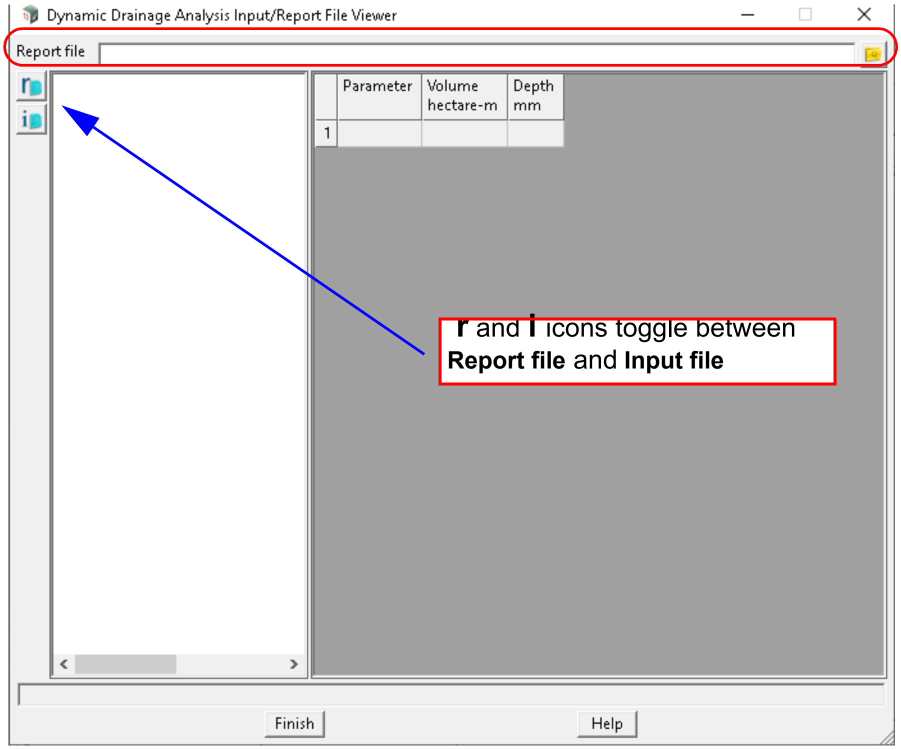
17.5.5.5 Dynamic Drainage Analysis Input/Report Files

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>DDA input/report viewer**

This options views the **report** and **input** tables generated by ***Dynamic Drainage Analysis***.

The displayed data is **Read-Only** and cannot be edited.

Selecting **DDA input/report viewer** brings up the **Drainage Dynamic Drainage Analysis Input/Report Files** panel:

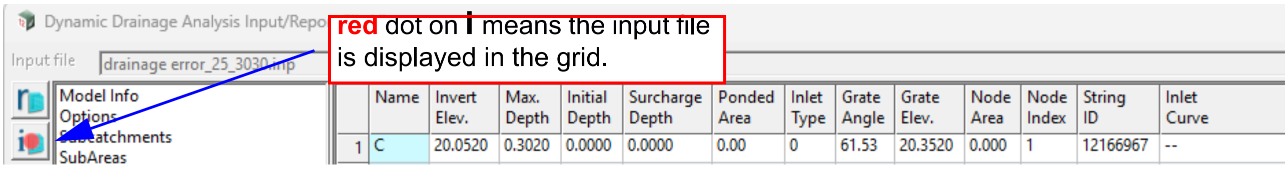


Report file/Input file file box *.rpt files

Either a report file (.rpt) or an Input file (*.inp) from a previous analysis run can be selected.*
The toggle between Report File and Input file selection is controlled by clicking the r (report file) or i (input file) icons on the left-hand side of the panel.
If found, the associated input file (.inp) or report file (*.rpt) will also be read in.*

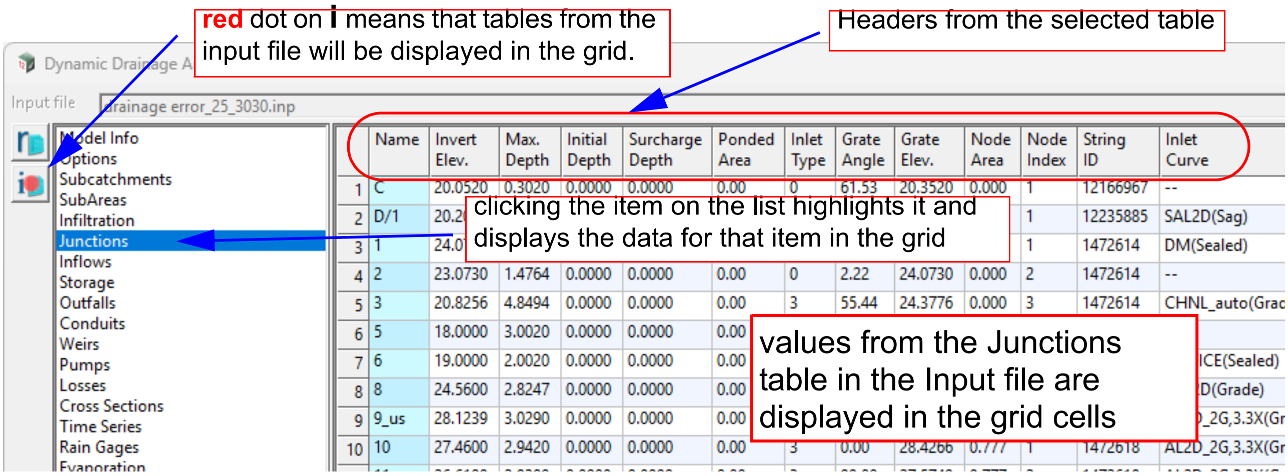
The empty left-hand field will be populated by the various table names associated with these files, and clicking these will populate the table data in the right-hand field. All data is read-only.

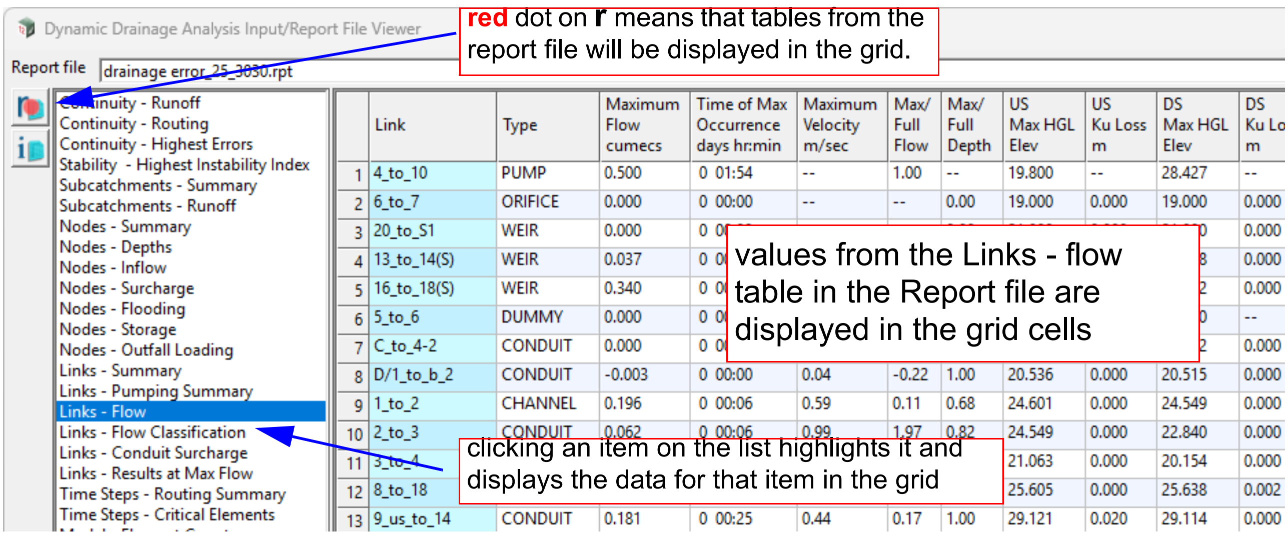
Which of the two files is to be viewed is selected by clicking the **r** (**report** file) or **i** (**input** file) icons on the left-hand side of the panel. A **red dot** on the icon indicates the which file is currently selected for viewing its data in the grid on the right had side of the panel.



As there are numerous tables available in the report file and the input file, the list of available tables in the selected file is displayed as a list on the left had side of the panel.

Clicking an item in the list highlights the item and shows the values for that table in the grid on the right hand side. The **Headings** for the selected table are show across the top of the grid and the values in each grid cell show the input data (.inp file) or results from the analysis run (.rpt file).





Continue to 17.5.5.6 Dynamic Drainage Error/Warning Report or return to 17.5 Stormwater.

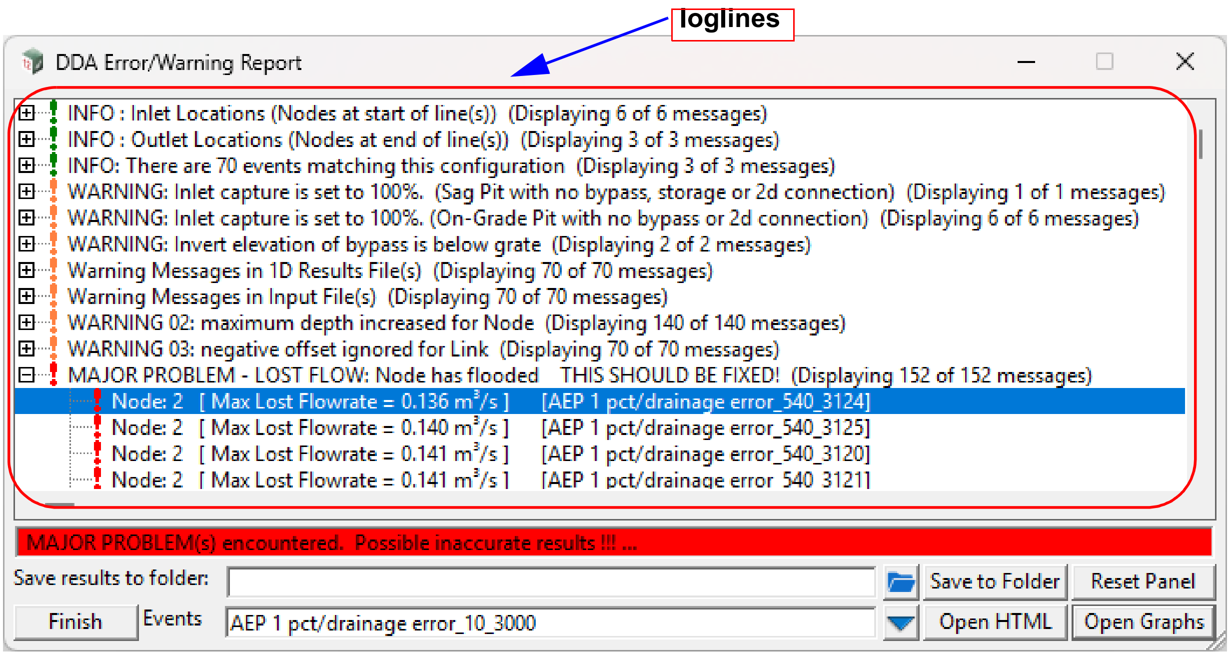
17.5.5.6 Dynamic Drainage Error/Warning Report

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>DDA error/warning report**

On completion of a dynamic analysis run a panel appears showing **Info**, **Warnings** and **Errors** encountered during the run.

This information is critical to ensuring confidence in the results of the analysis and should not be dismissed without review.

Selecting **DDA error/warning report** brings up results of the most recent analysis and displays them in the **DDA Error/Warning Report** panel:



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Loglines log box

The loglines contain all the information relating to the current (or most current) analysis run.

The information is loosely grouped into four categories:

INFO:** Contains general information about things like inlet and outlet locations (are there unintended disconnects in the network) and hydrology information. They start with a **green !

WARNINGS:** Information about the network that won't prevent the run but may be relevant (is the node inlet capture curve correct, are there surface bypasses connected below the grate elevation...). They start with an **orange !

MAJOR PROBLEMS**: Information about the network that may dramatically affect the results (flow disappearing from the network...). They start with a **red !

ERRORS:** Problems in the network that prevent the analysis from starting (or finishing). They start with a **red !

Clicking on the + for a logline expands it to provides additional details as to the problem and if the logline is clicked, the location of the relevant node or link is shown in the network view.

Save results to folder file box

Name of the folder where the simulation results are to be saved.

Save to Folder button

This button copies the .inp, .rpt and .out files to the folder defined in **Save results to folder**.

Reset Panel button

This button reduces the size of the panel to the smallest panel capable of containing all the widgets. The panel can be resized by dragging its bottom left corner to the size needed.

When the panel is closed by either the close box or the **Finish** *button the size and location of the panel is* ***saved*** *and used when the panel is re-opened.*

Events choice box

Contains a list of all the events in the current (or most recent) analysis run

Open HTML button

Opens the results file for the event selected above in the default HTML viewer. See 20.5.5.8 Dynamic Reports

Open HTML button

Opens the graph collator panel for the event selected above. See 20.5.5.7 Dynamic Graphs

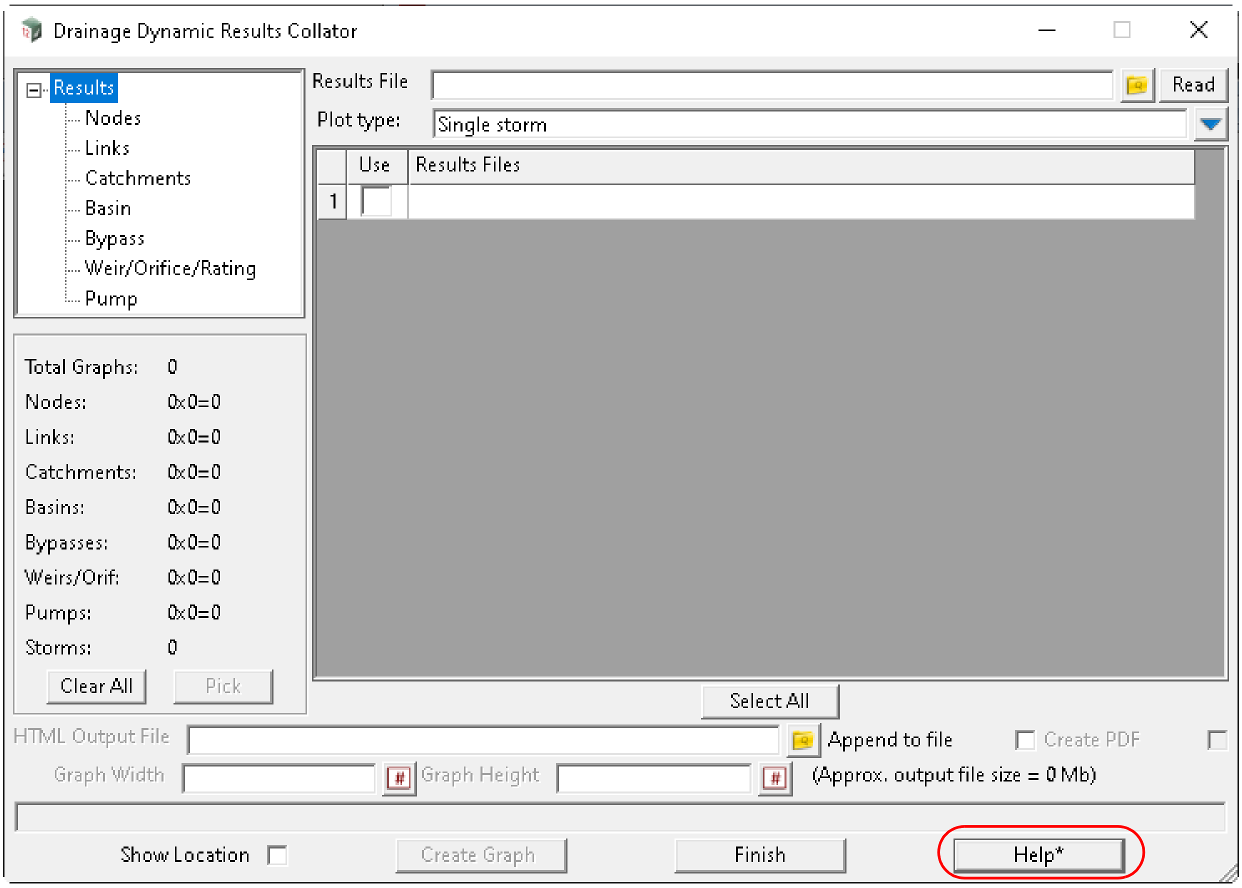
Continue to 17.5.5.7 Dynamic Graphs or return to 17.5 Stormwater.

17.5.5.7 Dynamic Graphs

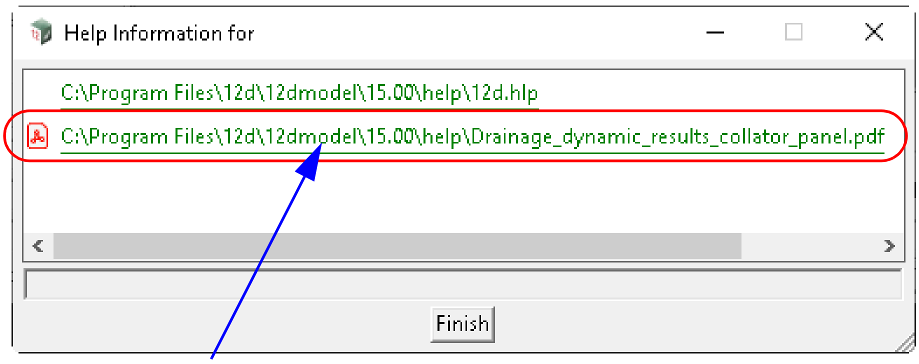
Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Dynamic graphs**

The **Dynamic Results Collator** panel is used to show time-series results from either a dynamic water supply (CWS or WNE) or from a Dynamic Drainage Analysis run (CSD or WNE).

Selecting **Dynamic graphs** brings up the **Dynamic Results Collator** panel:



A separate PDF document describing this option is obtained by clicking on the **Help*** button on the bottom of the panel to bring up the **Help Information for** panel:



Clicking on the second line will bring up the required pdf file.

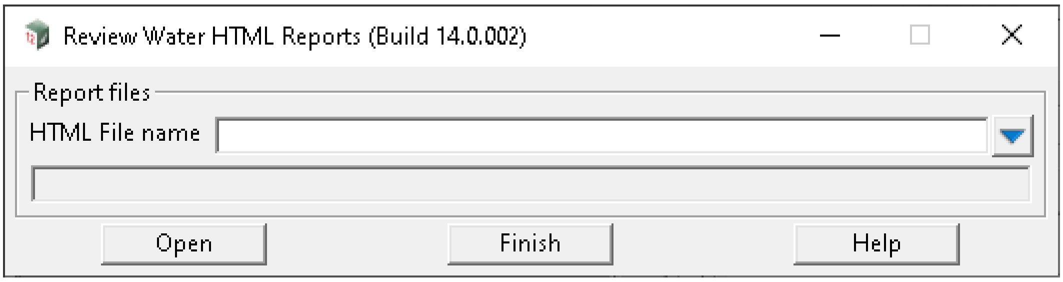
Continue to 17.5.5.8 Dynamic Reports or return to 17.5 Stormwater.

17.5.5.8 Dynamic Reports

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Dynamic reports**

??

Selecting **Dynamic reports** brings up the **Review Water HTML Reports** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
HTML file name	file box		

??

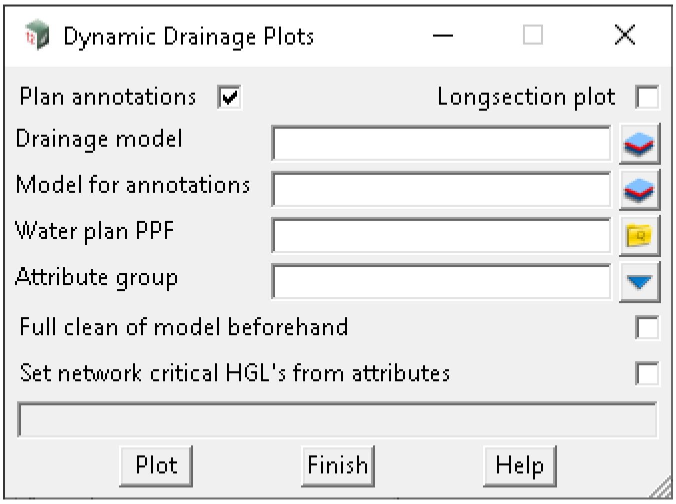
Continue to 17.5.5.9 Dynamic Drainage Plots or return to 17.5 Stormwater.

17.5.5.9 Dynamic Drainage Plots

Position of option on menu: Water => Stormwater =>Dynamic Analysis =>Dynamic drainage plots

Used to generate drainage plots (plan or long-section) for a dynamic drainage model. Allows selection of the analysis attribute group to reference for data, to work with shipped ppfs without modification.

Selecting **Dynamic drainage plots** brings up the **Dynamic Drainage Plots** panel:



The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Drainage model   model box   available models

Drainage model to reference for results data.

Water PPF   file box   Previous drainplanppf name used for the model (if any)

PPF file to use for the plots (drainplanppf or drainppf).

Model for annotations   model box   available models

Model to use for the drainplanppf outputs.

***Note:** only visible when a drainplanppf file has been chosen in **Water PPF**.*

Plot model stem   input box   Previous

The model stem to use for long-section plots.

***Note:** only visible when a drainppf file has been chosen in **Water PPF**.*

Attribute group   choice box

Allows selection of an analysis attribute group to use for the plots. This will override any analysis attribute path that exists in the currently selected ppf file to point at the attributes in the chosen group.

Full clean of model beforehand   tick box   not ticked

Allows for a full clean to be carried out when plotting. If not selected, a smart-clean will occur.

***Note**: Only visible when a drainplanppf has been selected in **Water PPF**.*

Clean model(s) beforehand   tick box   not ticked

Clean all of the models with the chosen plot model stem before plotting.

***Note**: Only visible when a drainppf has been selected in **Water PPF**.*

Set network critical HGL's from attributes   tick box   not ticked

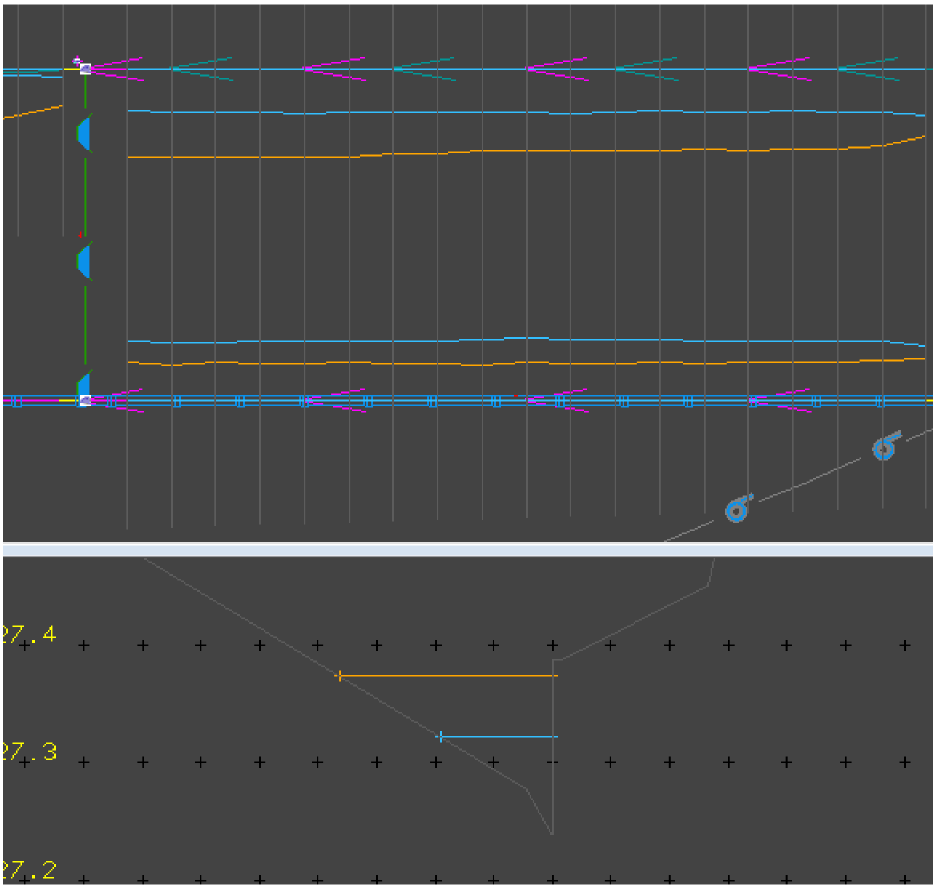
If selected then network properties will be updated to match the data in the selected attribute group (i.e. HGL's, velocities etc). If drainage lines are profiled in a Section view then the HGL's shown should match the data in the chosen Attribute group.

Continue to 17.5.5.10 DDA Flooded Widths or return to 17.5 Stormwater.

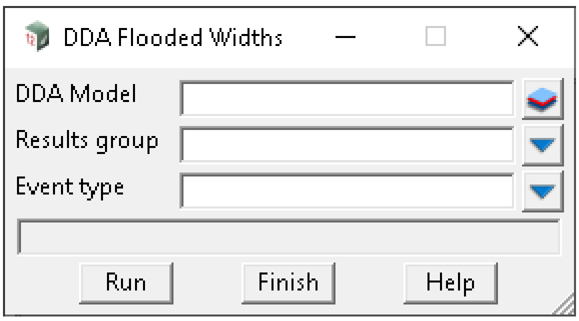
17.5.5.10 DDA Flooded Widths

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>DDA flooded widths**

This option is used to create plan and cross section views that show the extent of inundation of a dynamic drainage run. While it uses the results of the analysis run (there are no free lunches, the results of each event must exist) it is no longer necessary to re-run the analysis each time a new profile is needed.



Selecting **DDA flooded widths** brings up the **DDA Flooded Widths** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
DDA model	model box		

Name of the dynamic drainage model to use.

Results group	choice box		

Name of the event (storm) to use for the profile being created

Event type choice box Major/Minor

Select the type of event being used (Major or Minor).
What is available is loaded from the Model ->Result Group.

Parameters Button

Pressing the **Parameters** *button loads the following* **Settings** *panel. See* Main tab *and* Flood Extents tab.

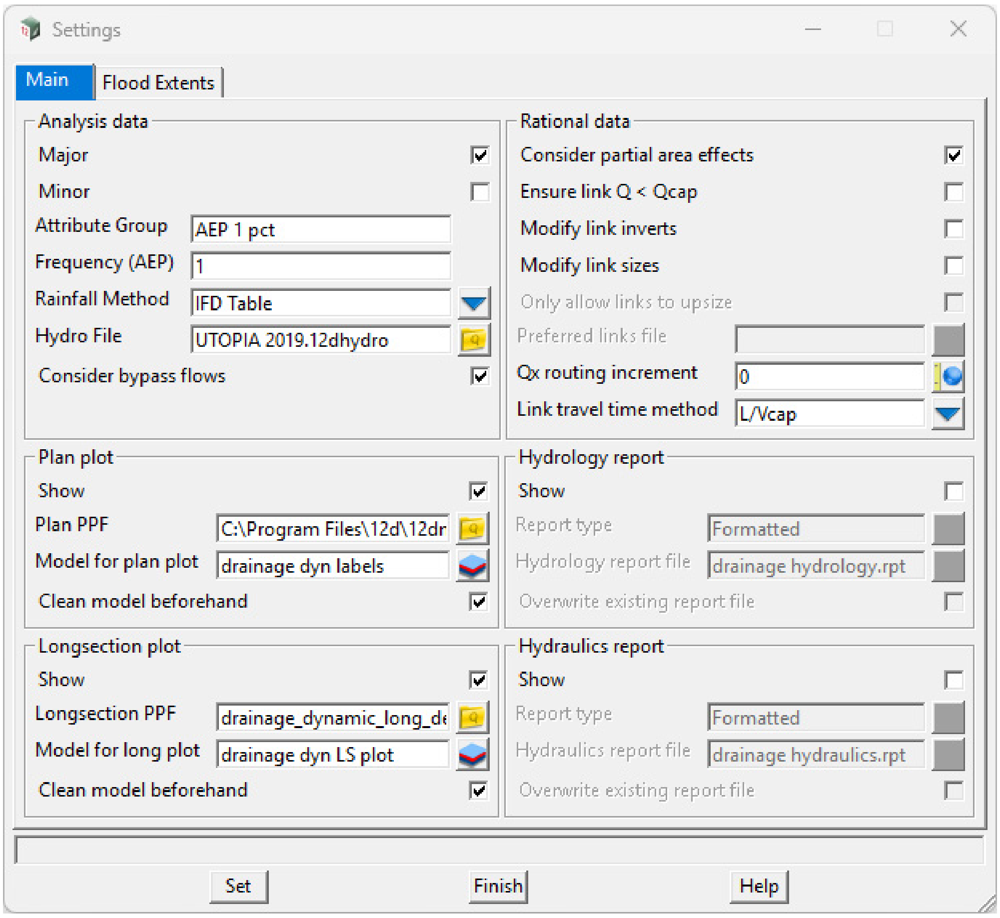
Run Button

Selecting the **Run** *button creates the flood inundation extents and depths using the currently selected* **Parameters**.

Main tab

The **Main tab** is used primarily for information purposes.

It contains information relating to the most recent dynamic analysis run for the currently selected model. However, this data is shared with the analysis panel so any changes made here will be reflected in that panel and will be used in the next analysis run.



For a detailed description of the field on this tab, see 17.3.4.6.14.1 Analysis >Main tab.of the 17.3.4.2 Network Editor

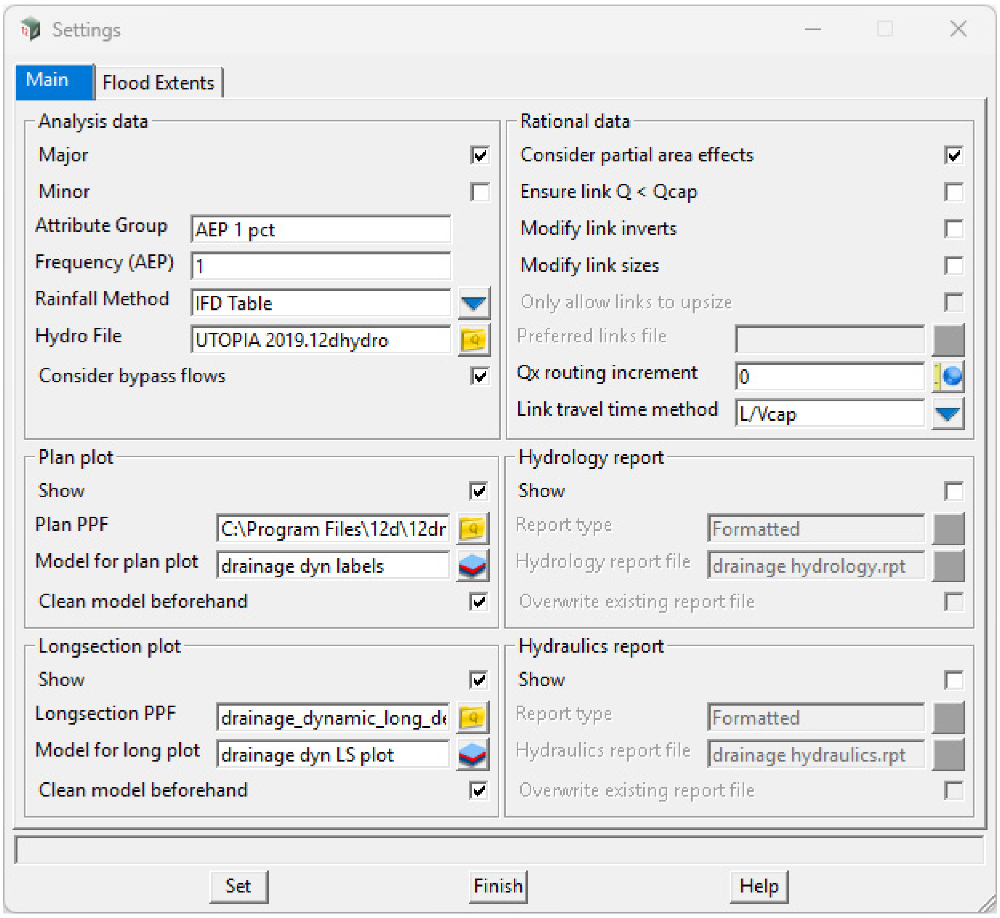
Button on Bottom

Set Button

Pressing ***Set*** *saves the currently selected* **Parameters** *to the currently selected* **DDA Model**.

Flood Extents tab

If creating multiple inundation profiles, the models used should be unique for each profile.



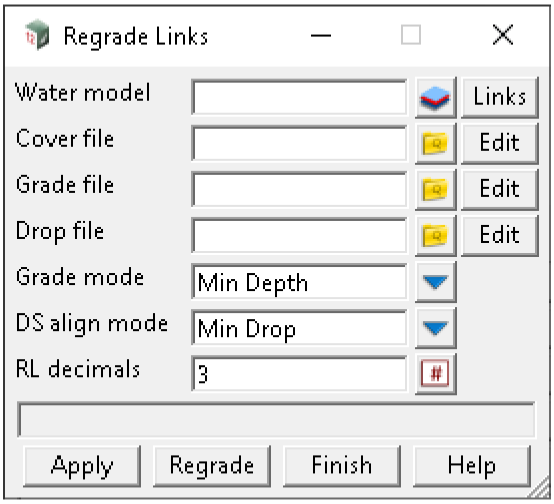
For a detailed description of the field on this tab, see 17.3.4.6.14.2 Analysis >Flood Extents Tab of the 17.3.4.2 Network Editor.

Continue to 17.5.5.11 Regrade Links or return to 17.5 Stormwater.

17.5.5.11 Regrade Links

Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Regrade links**

Selecting **Regrade links** brings up the **Regrade Links** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Water model	model box		

The water network model for regrading.

*The **Links** icon brings up the 17.5.5.11.1 Links Settings Table which displays the information for each link and allows information to be modified.*

Cover file	file box		*.cover files

*The cover file. The **Edit** icon edits the Cover file.*

For information, see 17.3.4.6.2.3.2 Link Minimum Cover File.

Grade file	file box		*.cover files

*The grade file. The **Edit** icon edits the Grade file.*

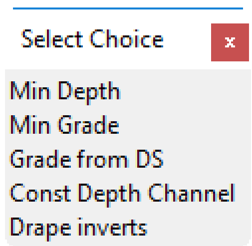
For information, see 17.3.4.6.2.3.3 Link Grade File.

Drop file	file box		*.cover files

*The drop file. The **Edit** icon edits the Drop file.*

For information, see 17.3.4.6.2.3.5 Link Deflection Drop File.

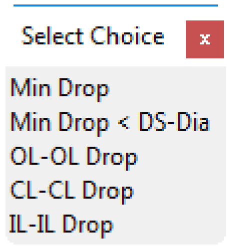
Grade mode	choice box		



The default grade mode for network grading.

For information on each choice, see 17.3.4.6.2.3.1 Link Grade Modes.

DS align mode choice box



Default downstream alignment mode.

For information on each choice, see 17.3.4.6.2.3.4 Downstream Alignment Modes.

RL decimals Integer box 3

Number of decimal places to display riser levels to.

Apply Button

Saves the fields to the network.

Regrade Button

Regrade the links in the selected model using the selected settings.

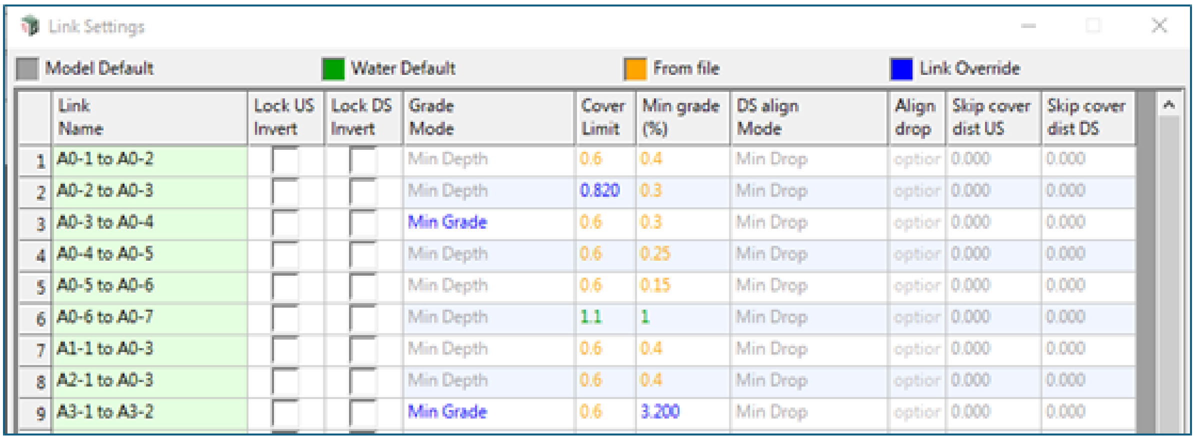
Continue to 17.5.5.11.1 Links Settings Table.

17.5.5.11.1 Links Settings Table

This grid displays all of the relevant information for all the links in the selected water model.

Data can be modified and the network regarded.

Text colours (key at the top of the panel) are used to communicate important information about the values in the different fields.



	Link Name	Lock US Invert	Lock DS Invert	Grade Mode	Cover Limit	Min grade (%)	DS align Mode	Align drop	Skip cover dist US	Skip cover dist DS
1	A0-1 to A0-2			Min Depth	0.6	0.4	Min Drop	optior	0.000	0.000
2	A0-2 to A0-3			Min Depth	0.820	0.3	Min Drop	optior	0.000	0.000
3	A0-3 to A0-4			Min Grade	0.6	0.3	Min Drop	optior	0.000	0.000
4	A0-4 to A0-5			Min Depth	0.6	0.25	Min Drop	optior	0.000	0.000
5	A0-5 to A0-6			Min Depth	0.6	0.15	Min Drop	optior	0.000	0.000
6	A0-6 to A0-7			Min Depth	1.1	1	Min Drop	optior	0.000	0.000
7	A1-1 to A0-3			Min Depth	0.6	0.4	Min Drop	optior	0.000	0.000
8	A2-1 to A0-3			Min Depth	0.6	0.4	Min Drop	optior	0.000	0.000
9	A3-1 to A3-2			Min Grade	0.6	3.200	Min Drop	optior	0.000	0.000

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Link Name	display only	current link name	

Each row displays the name of one of the links in the drainage model.

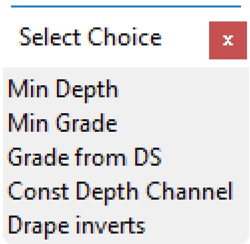
Lock US Invert	tick box	not ticked	

For each row, prevent link upstream invert from being changed when links are regraded.
See Regrade Links, Inverts locked

Lock DS Invert	tick box	not ticked	

For each row, prevent link's downstream invert from being changed when links are regraded
See Regrade Links, Inverts locked

Grade mode	choice box		



The grade mode for the current row's link.
For information on each choice, see 17.3.4.6.2.3.1 Link Grade Modes.

The grade mode for the current row's link.

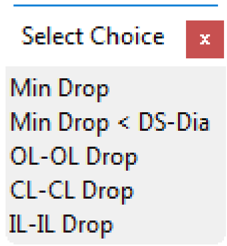
Cover Limit	real box	1.1	

The cover limit for the current row's link.

Min grade (%)	real box	1	

The minimum grade for the current row's link.

DS align mode choice box



The downstream alignment mode for the current row's link.

For information on each choice, see 17.3.4.6.2.3.4 Downstream Alignment Modes.

Align drop real box

The align drop value for the current row's link

Skip cover dist US real box 0.000

The skip cover distance upstream for the current row's link

Skip cover dist DS real box

The skip cover distance downstream for the current row's link

Continue to 17.5.5.12 Create Hydrographs from Peaks or return to 17.5.5.11 Regrade Links 17.5 Stormwater.

17.5.5.12 Create Hydrographs from Peaks

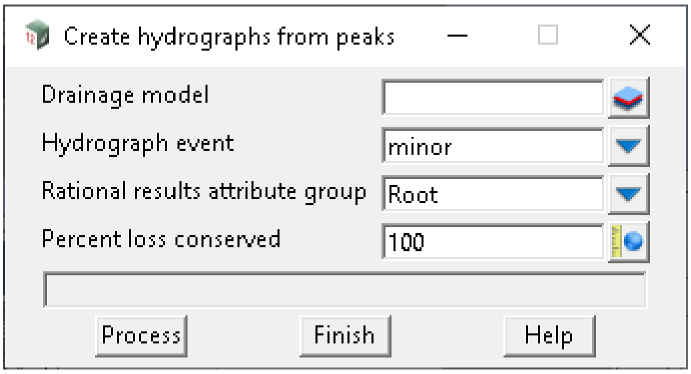
Position of option on menu: **Water =>Stormwater =>Dynamic analysis =>Hydrographs from peaks**

The intention of this routine is to investigate how the drainage network would respond hydraulically to the catchment rational flows (peaks) from multiple inlets. The peak rational flows could be applied to the network in a number of ways. Each inlet will likely have a different time of concentration and rainfall intensity so this must not be considered as analysing a single storm duration event. Note that the assumptions in this investigation into the network's response will likely not meet the design requirements of your certifying authority.

The hydraulic method used will be the solution of the dynamic terms of the St Venant equations and therefore storage is important. Thus a hydrograph will need to be created from the rational method peak flows. This requires a selection of a hydrograph shape.

This routine creates an inlet's single catchment hydrograph using from the 3 catchment sets. It uses the full Tc (max of Tc pervious and Tc impervious for all 3 sets) for the current catchment and the resulting full catchment flow (not partial area peak flow).

On selecting the **Create hydrographs from peaks** option, the **Create Hydrographs from Peaks** panel is displayed.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		

Drainage network that will be used.

Field Description	Type	Defaults	Pop-Up
Hydrograph event	choice box		minor, major, delete minor, delete major

*If **minor or major** - a hydrograph will be created and stored as the inlet's (minor or major) peak hydrograph using the current rational method full peak discharges and Tc.*

*If **delete minor** or **delete major** – the dynamic hydrograph will be deleted for the attribute group selected.*

Rational results attribute group choice box

Rational results may exist in attribute groups. If so, this choice box will be populated with the node attributes groups found to contain attribute results. The group selected will be used for the rational catchment peak flows.

Field Description	Type	Defaults	Pop-Up
Percent loss conserved	measure box		0-100

***Percent loss conserved = 0**, time to peak and recession time both equal the catchment Tc.*

***Percent loss conserved = 100**, time to peak equals the catchment Tc and the recession time is lengthened so that the volume of runoff equals the rainfall volume times the catchment C value. Examples are given below.*

Buttons at Bottom

Process button

0 will result in a hydrograph recession limb = Tc, 100 will result in a recession limb time such that the hydrograph volume is equal to the rainfall volume.

***Note**: any existing hydrographs will be replaced.*

Example

For a catchment area of 0.1ha, with the maximum Tc = 10min, a rainfall intensity of 148mm/hr (from a IFD table) and a Ceff (from all 3 sets, %impervious and pervious) = 0.83

Qp = CIA / 360 = 0.83 * 148 * 0.1 = =0.034cms

Percent loss conserved = 0

recession time = tp = 10min

With this assumption, the runoff volume will not equal the rainfall volume. Calculating the volumes.

Hydrograph volume = ½ (10 + 10) * 60 * 0.034= 20.4m3

Rainfall volume = rainfall intensity * duration * area

= 148mm/hr / 1000 * 10/60 * 0.1 * 10000 = 24.6m3

Note: Ceff 0.83 = runoff volume / rainfall volume = 20.4 / 24.6

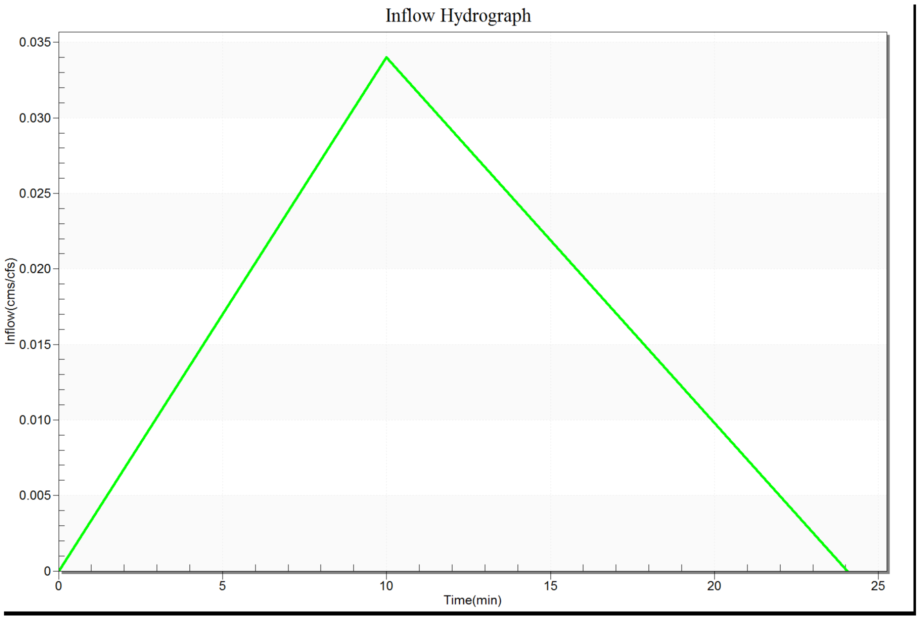
Percent loss conserved = 100

If we were to conserve the entire rainfall volume as runoff, the time base would need to be longer.

½ time base * peak flow = rainfall volume

½ time base * 0.034 = 24.6

time base = 1447. seconds or 24.1 minutes.

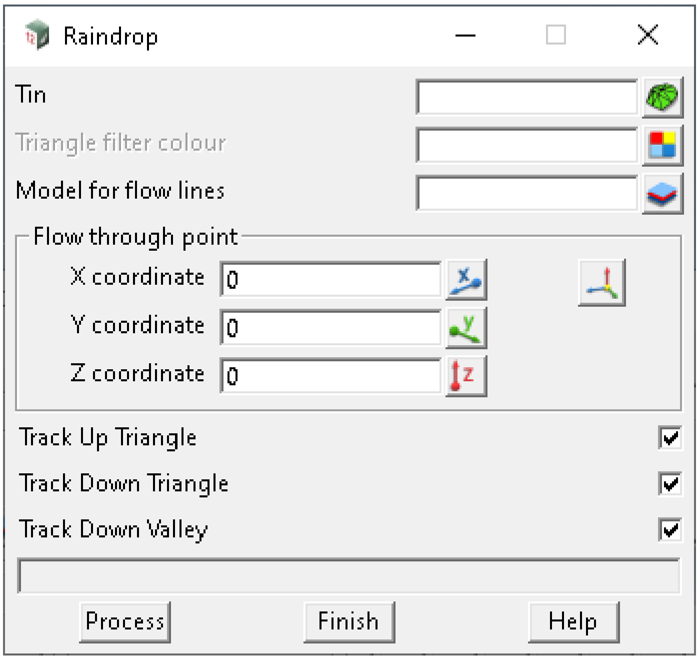


Continue to 17.5.6 Raindrop/Teardrop or return to 17.5 Stormwater.

17.5.6 Raindrop/Teardrop

Position of option on menu: **Water =>Stormwater =>Raindrop**

On selecting the **Raindrop** option, the **Teardrop Macro** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Tin	tin box	GROUND	available tins
Tin to use as surface for the water drops to run on.			
Triangle filter colour	colour box		available colours
*If **not blank**, only triangles from the tin of this colour will be used.*			
Model for flow lines	model box	FLOWMODEL	available models
Generated raindrop strings will be stored in this model.			
Flow through point			
Allows for selection of a position to track from/to with the raindrop strings.			
X/Y/Z coordinate	measure box	0	available measures
Allows manual selection of the x/y/z-value for the flow through point.			
Track Up Triangle	tick box	ticked	
*If **ticked**, consider flow upward across the triangle faces to find the highest point on the edges.*			
Track Down Triangle	tick box	ticked	
*If **ticked**, consider flow downwards across the triangle faces to find the lowest point on the edges*			
Track Down Valley	tick box	ticked	
*If **ticked,** then if a located point exists on a triangle edge which is found to be a valley, then flows will track along that triangle edge.*			

Process button

Begins processing for raindrop generation

Continue to 17.5.7 Aquaplaning Risk Assessment or return to 17.5 Stormwater.

17.5.7 Aquaplaning Risk Assessment

Position of option on menu: **Water => Stormwater =>Aquaplaning risk**

This option performs an aquaplaning risk assessment using either the Gallaway Equation (1979), or the equation developed by the Road Research Laboratory UK (1968).

The user need only supply flow path strings as 2d Super strings in the areas of concern on the road pavement tin (typically at the transitions in the road cross-fall).

The option then re-creates these flow path strings in 3D, with evenly spaced vertices, then applies the specified equation to determine a water film depth at each vertex (where all parameters considered are set as vertex attributes).

It then assesses the risk of aquaplaning at each vertex by associating a risk level and segment colour with the water film depth calculated at each vertex.

In addition, a report file is written to the *Windows* clipboard, and optionally to file.

The two different equations are defined as follows:

Gallaway Equation (1979)

$$d = \frac{0.103\,T^{0.11}\,L^{0.43}\,I^{0.59}}{S^{0.42}} - T$$

Road Research Laboratory UK (1968)

$$d = \frac{0.119\,L^{0.5}\,I^{0.5}}{S^{0.2}}$$

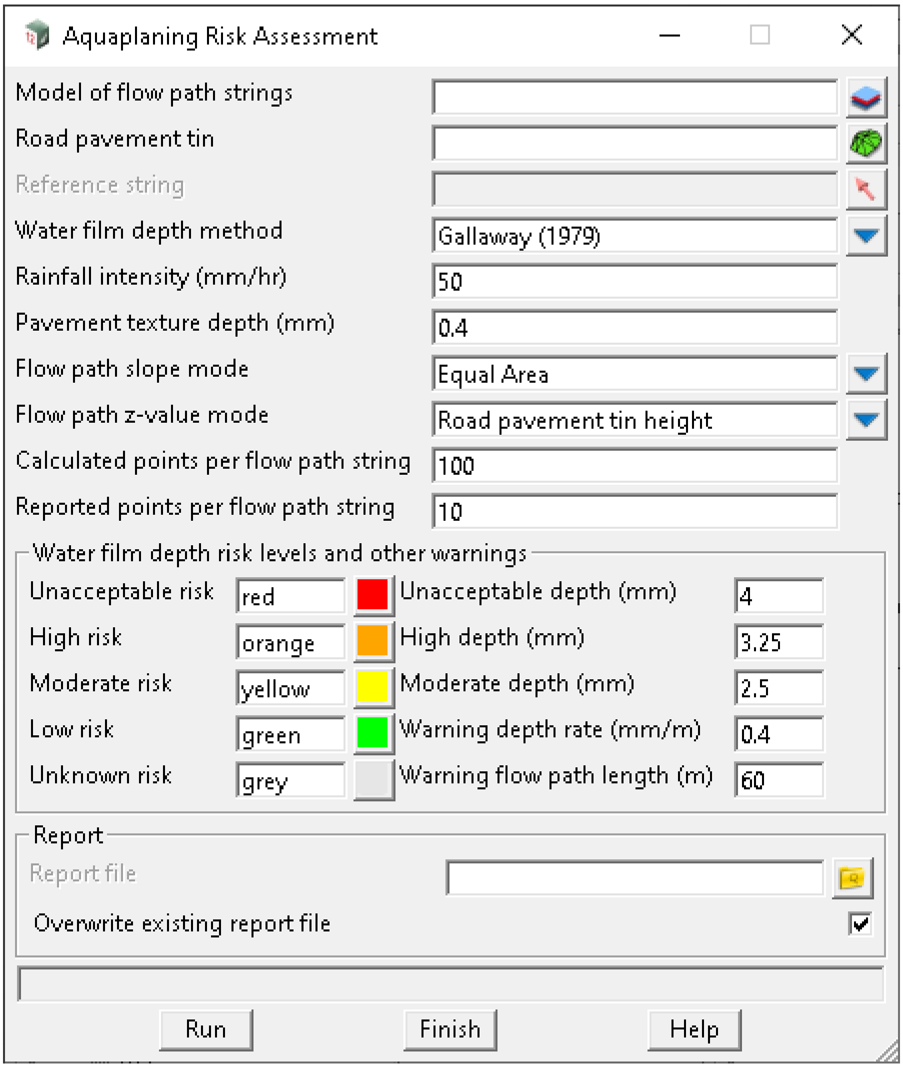
d = water film depth above top of pavement texture (mm)
L = length of flow path (m)
S = slope of the flow path (%)
T = average pavement texture depth (mm)
I = rainfall intensity (mm/hr)

Source:

Gallaway, B. M., et. al., "Pavement and Geometric Design Criteria for Minimizing Hydroplaning", Federal Highway Administration, Report No. FHWARD-79-31, (1979).

National Association of Australian State Road Authorities, "Drainage of Wide, Flat Pavements (pamphlet), Sydney, Australia, (1974).

On Selecting the **Aquaplaning risk** menu option, the **Aquaplaning Risk Assessment** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model of flow path strings	model box		available models

All Super strings in this model will be analysed and updated with results.

Road pavement tin	tin box		available tins

Used to define the vertical profile of each flow path string.

Reference string	string select		

Used to locate, identify, rename and sort the flow path strings (optional).

Water film depth method	choice box		Gallaway(1979)

Determines which equation to use to estimate the water film depths.

Rainfall intensity (mm/hr)	input	50	

For aquaplaning checks, typically 50 mm/hr, or the 5 minute intensity for the 1 or 2 year ARI.

Pavement texture depth (mm)	real box	0.4	

Average texture depths can range from about 0.2 to 4 mm for different pavement materials. Only considered in the Gallaway equation.

Flow path slope mode choice box Equal Area Equal Area, Average

Determines how the slope of the flow path string is calculated at each vertex. Available modes are "Equal Area" and "Average" slope, from the start of the string to each vertex.

Flow path z-value mode choice box Road pavement tin height Road pavement tin height, Water film depth (mm)

Determines what the z-values of the flow path strings will represent. Available modes are "Road pavement tin height" and "Water film depth (mm)".

Calculated points per flow path string integer box 100

Number of evenly spaced points along each flow path string at which to calculate water film depths.

Reported points per flow path string integer box 10

Number of evenly spaced points along each flow path string at which to report water film depths.

Water film depth risk levels and other warnings

Unacceptable risk colour box red available colours

Colour to associate with an unacceptable risk.

Unacceptable depth (mm) real box 4.0

Lowest water film depth associated with an unacceptable risk.

High risk colour box orange available colours

Colour to associate with a high (acceptable) risk.

High depth (mm) input 3.2

Lowest water film depth associated with a high (acceptable) risk.

Moderate risk colour box yellow available colours

Colour to associate with a moderate (acceptable) risk.

Moderate depth (mm) real box 2.5

Lowest water film depth associated with a moderate (acceptable) risk.

Low risk colour box green available colours

Colour to associate with a low (desirable) risk.

Unknown risk colour box grey available colours

Colour for strings that cannot be assessed for risk.

Warning depth rate (mm/m) real box 0.4

Warn if <water film depth>/<flow path length> is excessive (optional).

Warning flow path length (m) real box 60

Warn if flow path length is excessive (optional).

Report

Report file file box

Report will be written in tab-delimited format to the Windows clipboard, and optionally to this file.

Overwrite existing report file tick box ticked

Whether to overwrite or append to an existing report file.

Run button

Runs the option.

Finish button

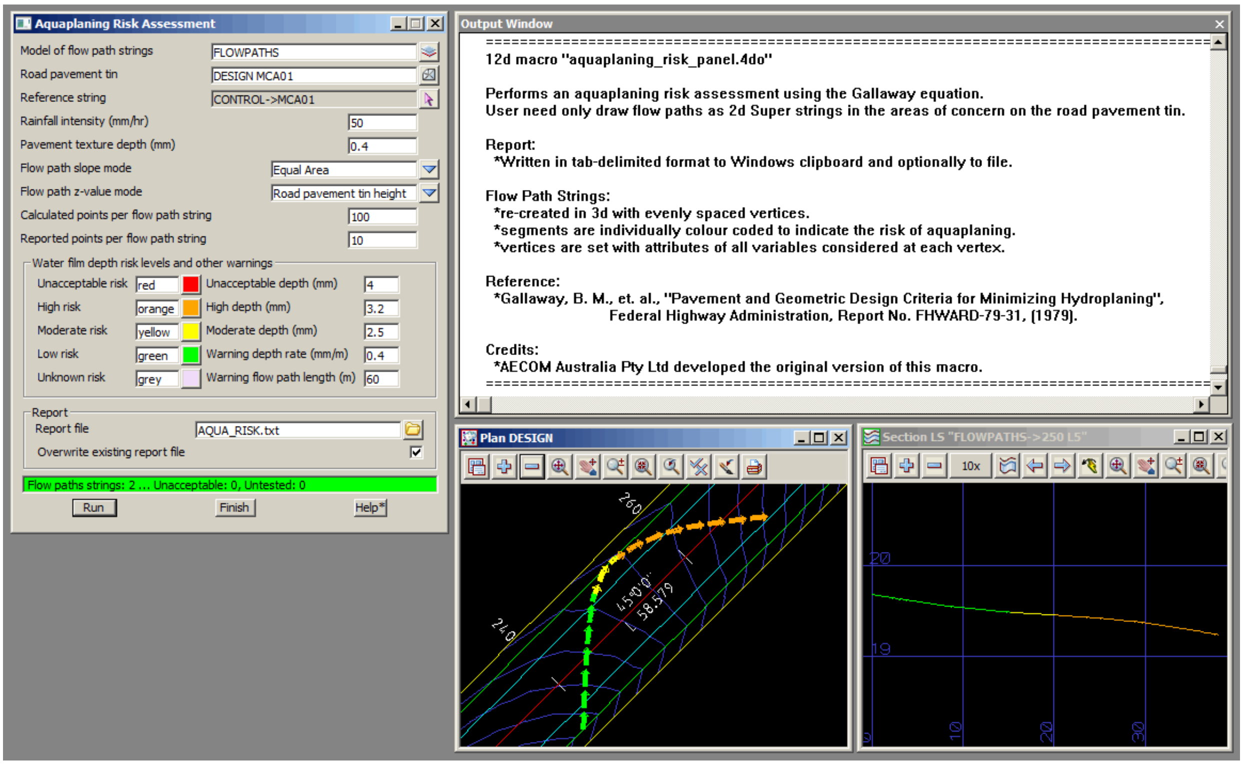
Removes the panel from the screen.

Help button

Launches the 12d help for the option.

Additional Notes:

1. The **Aquaplaning Risk Assessment** option is a macro, writes auxiliary help information to the *Output Window* every time the macro is run, *viz*:



2. The tab-delimited report is always written to the *Windows* clipboard, even if a report *file* is not specified. A pre-formatted *Excel* report template is installed and available in the library – **$LIB\aquaplaning_report_template.xlsx** – and after running the aquaplaning option, the contents of the clipboard may be pasted directly into a copy of this template file, as shown here:

12D AQUAPLANING RISK ASSESSMENT

12D MODEL VERSION 10.0 Beta 9

12D PROJECT:	AQUAPLANING
12D WORKING FOLDER:	C:\12d\10.00\Jobs\AQUAPLANING
DATE:	29-MAR-2012 16:57:38
ASSESSOR:	OWEN THORNTON
VERIFIER:	

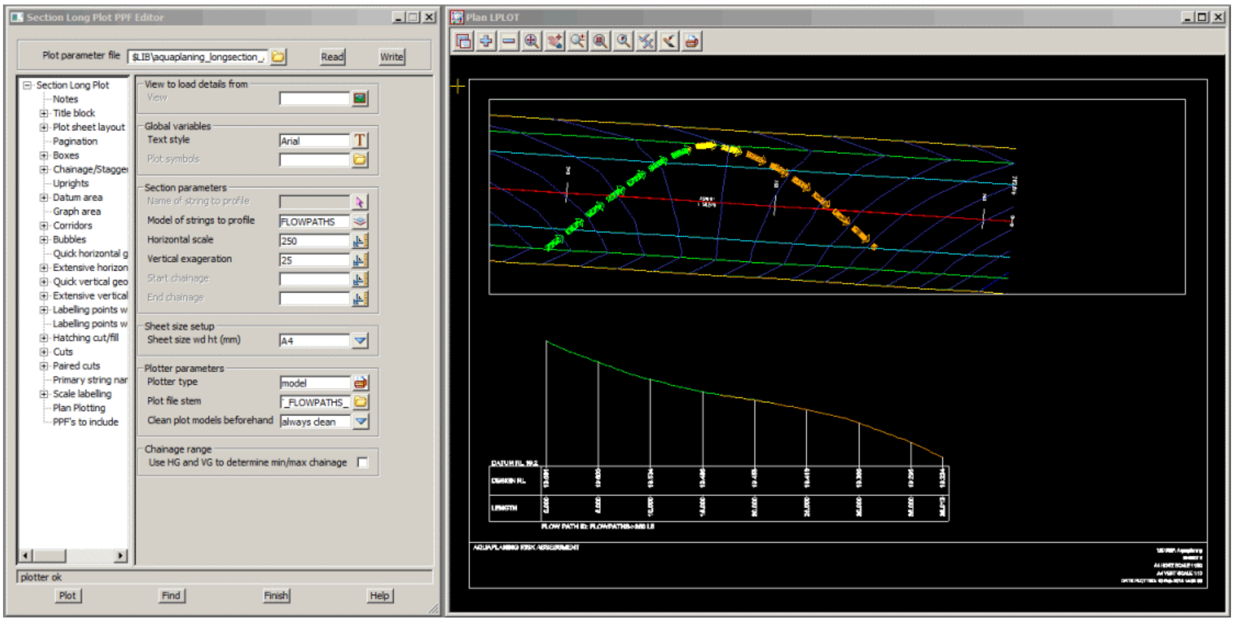
MODEL OF FLOW PATHS:	FLOWPATHS
ROAD PAVEMENT TIN:	DESIGN MCA01
REFERENCE STRING:	CONTROL->MCA01
RAINFALL INTENSITY (mm/hr):	50.0
PAVEMENT TEXTURE DEPTH (mm):	0.4
FLOW PATH SLOPE:	EQUAL-AREA SLOPE

WATER FILM DEPTH RISKS		
UNACCEPTABLE RISK >=	4.0	mm
HIGH (ACCEPTABLE) RISK >=	3.2	mm
MODERATE (ACCEPTABLE) RISK >=	2.5	mm
LOW (DESIRABLE) RISK: <	2.5	mm

WATER FILM DEPTH PREDICTION

FLOW PATH ID	POINT	LENGTH (m)	DESIGN RL (m)	SLOPE (%)	DEPTH (mm)	DEPTH RISK	DEPTH RATE (mm/m)	WARNING
250 L5	1	3.801	19.617	1.59	0.97	LOW	0.26	
250 L5	2	7.602	19.562	1.49	1.49	LOW	0.20	
250 L5	3	11.404	19.519	1.28	2.01	LOW	0.18	
250 L5	4	15.205	19.485	1.11	2.48	LOW	0.16	
250 L5	5	19.006	19.460	0.94	3.00	MODERATE	0.16	
250 L5	6	22.807	19.434	0.87	3.42	HIGH	0.15	
250 L5	7	26.608	19.404	0.85	3.71	HIGH	0.14	
250 L5	8	30.410	19.360	0.92	3.81	HIGH	0.13	
250 L5	9	34.211	19.305	1.03	3.82	HIGH	0.11	
250 L5	10	38.012	19.234	1.19	3.76	HIGH	0.10	

3. Combined plan and profile plots of the analysed flow path strings, for inclusion in reports, may be generated from the **Section Long Plot PPF Editor**. A PPF file set specifically for this purpose is installed and available in the library – **$LIB\aquaplaning_longsection_A4.lplotppf** – as shown here:



Continue to 17.5.8 Flowpath Generator or return to 17.5 Stormwater.

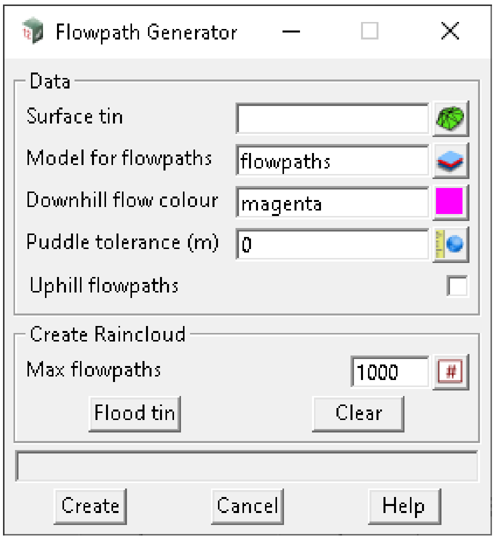
17.5.8 Flowpath Generator

Position of option on menu: Water =>Stormwater =>Flowpath generator

The **Flowpath Generator** allows users to quickly create flowpaths either up or downhill to simulate raindrops falling on the tin.

This tool can be used in conjunction with 17.5.9 Auto Catchment Delineation to help define catchment areas.

Selecting **Flowpath generator** displays the **Flowpath Generator** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data			
Surface tin	tin box		available tins
Surface tin. Shares data with the field of the same name in 17.5.9 Auto Catchment Delineation.			
Model for flowpaths	model box	flowpaths	
Model flowpaths will be drawn in.			
Downhill/Uphill flow colour	colour box	magenta/green	
Colour of the downhill/uphill flowpath strings respectively.			
Puddle tolerance (m)	real box	tin dependent	
Level of tin detail to consider when calculating raindrop paths. Shares data with the field of the same name in 17.5.9 Auto Catchment Delineation.			
Uphill flowpaths	tick box	not ticked	
*If **ticked**, run flowpaths toward lowest or highest elevation. Changes the state of the Downhill/Uphill flow colour widget.*			
Create Rain cloud			
Max flowpaths	integer box	1000	
Number of flowpaths to draw at once when **Flood tin** *is clicked.*			
Flood tin	button		
Creates a grid of flowpaths on the tin, with the number of paths equal to the value of **Max flowpaths**.			

Clear button

Clears the flowpath model, removing any elements.

Buttons at Bottom

Create button

Create a single raindrop at a user specified location.

Cancel button

Closes the panel.

Continue to 17.5.9 Auto Catchment Delineation or return to 17.5 Stormwater.

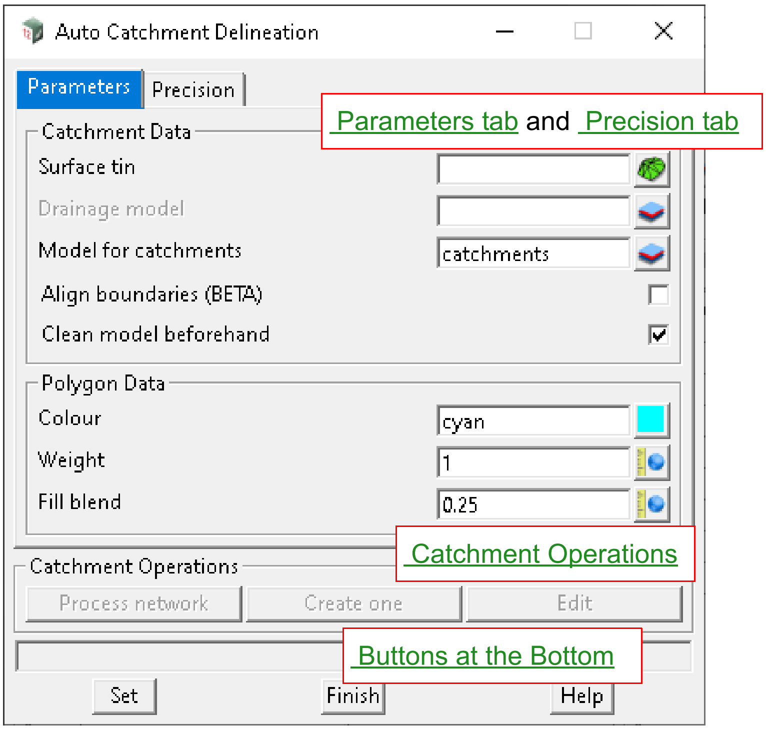
17.5.9 Auto Catchment Delineation

Position of option on menu: **Water =>Stormwater =>Auto catchment delineation**

Auto Catchment delineation allows users to quickly define catchment polygons on a specified tin surface.

This tool can be used in conjunction with Flowpath generator (17.5.8 Flowpath Generator) to help define catchment areas.

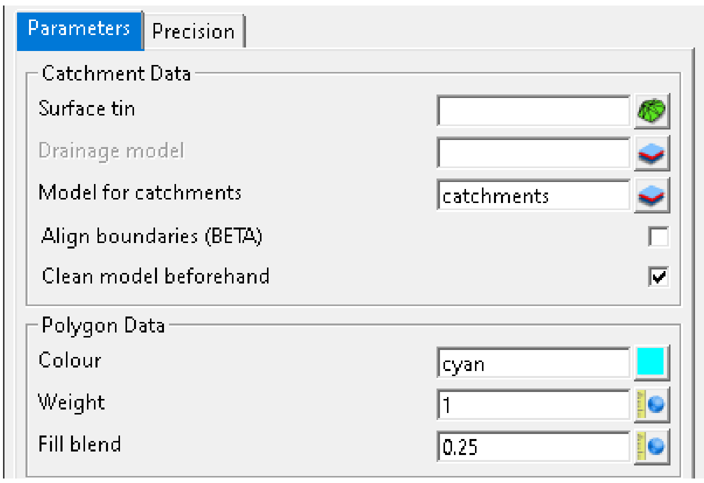
Selecting **Auto catchment delineation** displays the **Auto Catchment Delineation** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Parameters tab



Catchment Data

Surface tin tin box

Surface tin. Shares data with the field of the same name in the 17.5.8 Flowpath Generator.

Drainage model model box

Allows for specifying a drainage network. Enables the **Process network** *button.*

Model for catchments model box catchments

Model catchments will be drawn in.

Align boundaries (BETA) tick box not ticked

Allows catchments to align their boundaries with each other. Still in development.

Clean model beforehand tick box ticked

*If **ticked**, clean the catchments model before generating new catchments when* **Process network** *is clicked.*

Polygon Data

Colour colour box cyan

Colour of the catchment polygons.

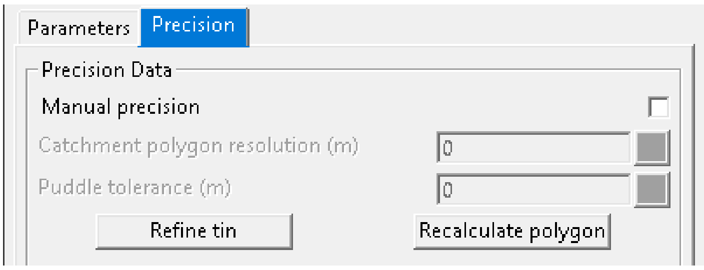
Weight real box 1

Line weight of the catchment polygons.

Fill blend real box 0.25

Fill blend opacity of the catchment polygon interiors.

Precision tab



Precision Data

This tab allows users to fine-tune catchment polygon generation. The values here are generated automatically when a tin is selected.

Manual precision tick box not ticked

Enables or disables the widgets on this screen.

Catchment polygon resolution (m) real box based on tin selection

The average length of polygon sides. Controls the level of detail catchments will show.

Puddle tolerance (m) real box based on tin selection

The level of tin detail to consider when calculating catchment area. Shares data with the field of the same name in the 17.5.8 Flowpath Generator.

Refine tin button

Increases the level of detail within the selected tin to reduce errors caused by low-detail areas. Consider using if catchments are very 'blocky' or are missing key terrain features.

Recalculate polygon button

Redraw a selected catchment using the current values for resolution and puddle tolerance.

Catchment Operations

Process network button

Scans the specified drainage model and creates a catchment at every inlet.

Create one button

Create a new catchment polygon at the user specified location.

Edit button Edit Catchments

Launches the 17.5.9.1 Edit Catchment *panel.*

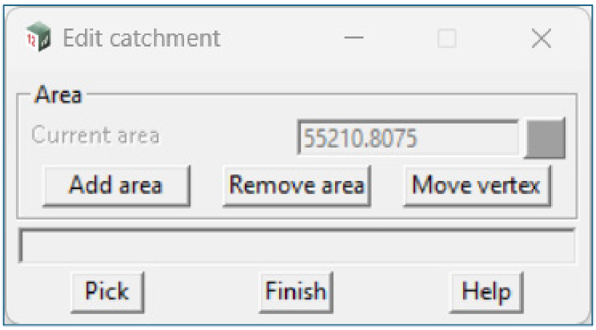
Buttons at the Bottom

Set button

Save the current panel layout. All input fields will be prepopulated with this data upon reload.

Continue to 17.5.9.1 Edit Catchment or return to 17.5.9 Auto Catchment Delineation or 17.5 Stormwater.

17.5.9.1 Edit Catchment



Field Description Type Defaults Pop-Up

Area

Current area real box selected polygon area

Displays the area of the currently selected catchment.

Add area button

Draw a lasso region to add to the currently selected catchment.

Remove area button

Draw a lasso region to remove from the currently selected catchment.

Move vertex button

Run the move point tool ??

Button at Bottom

Pick button

Select a catchment to edit.

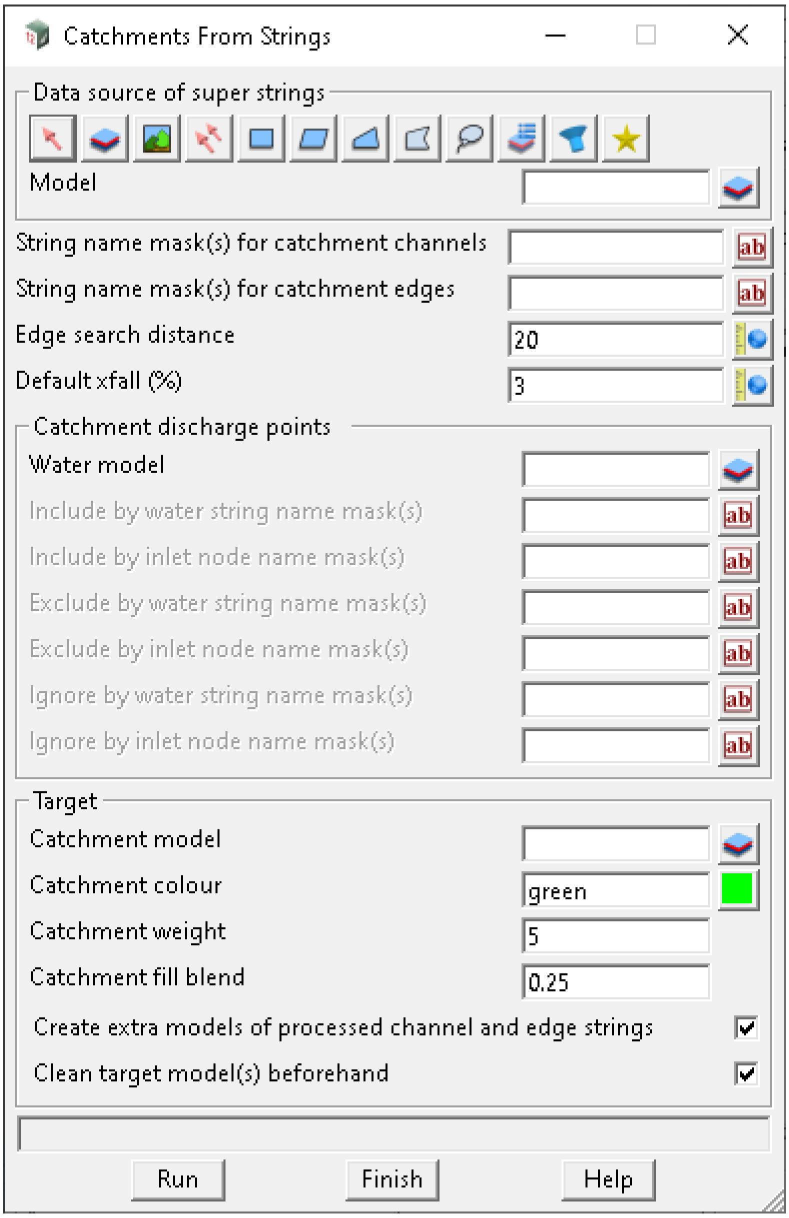
Continue to 17.5.10 Catchments from Strings or return to 17.5.9 Auto Catchment Delineation or 17.5 Stormwater.

17.5.10 Catchments from Strings

Position of option on menu: **Water =>Stormwater =>Catchments from Strings**

This option creates catchment polygons to suit the stormwater inlets of a water model, based on a selection of Super strings with z-values - typically road design strings - such as from ***Apply MTF*** functions.

On selecting **Catchment from strings** displays the **Catchment from Strings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data source of super strings data source

*Use the most appropriate **12d Model** data selection method, to select the Super strings to be considered as the basis for creating the catchment polygons. The strings should have z-values. For a full description go to* 3.26.3 Data Source.

String name mask(s) for catchments channels text box

*Super string names from the data source, to consider as catchment channels -- typically the channel invert strings. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

String name mask(s) for catchments edges text box

*Super string names from the data source, to consider as catchment edges -- typically the road crown and verge strings. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Edge search distance real box 20

Maximum distance to look for edge strings from channel strings.

Default xfall (%) real box 3

Optional xfall to adopt between channel and edge strings, when forming catchment polygons. If unspecified, the xfall measured between channel and edge will be adopted. The xfall is combined with the grade measured along the channel string, to define the angles of the catchment lines connecting the channels to the edges. Better looking results will typically be obtained within most road reserves, by setting this value to the predominant xfall of the road carriageways.

Catchment discharge points

Water model model box available model

Model containing the stormwater inlet nodes to consider as discharge points, defined on Water strings. Outlet and manhole nodes will be ignored. Only those inlet nodes found within one node diameter (or 0.1 units, whichever is larger) of a channel string, will be eligible for consideration as a catchment discharge point.

Include by water string name mask(s) text box

*Water string names to include. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask. Leaving this blank is the same as specifying *.*

Include by inlet node name mask(s) text box

*Inlet node names to include. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask. Leaving this blank is the same as specifying *.*

Exclude by water string name mask(s) text box

*Water string names to exclude. Excluded discharge points will not get catchments created, but may be used to define the upstream ends of other catchment channels. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Exclude by inlet node name mask(s) text box

*Inlet node names to exclude. Excluded discharge points will not get catchments created, but may be used to define the upstream ends of other catchment channels. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Ignore by water string name mask(s) text box

*Water string names to ignore. Ignored discharge points are treated as though they do not exist. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Ignore by inlet node name mask(s) text box

*Inlet node names to ignore. Ignored discharge points are treated as though they do not exist. Names are specified by mask, which may include wildcards * and ?. Multiple masks are separated by spaces. Use ? for a space within an individual mask.*

Target

Catchment method model box available models

Model in which to create catchment polygons.

Catchment colour colour box green available colours

Colour for catchment polygons.

Catchment weight real box 5

Line weight (pixels on screen, or mm on paper) for catchment polygons.

Catchment fill blend real box 0.25

Opacity for catchment polygons. A value of 0 will apply no fill. A value between 0 and 1 will create translucent polygons. A value of 1 will create opaque polygons. (The catchment colour is also used as the fill colour.)

Create extra models of processed channel and edge strings tick box ticked

Whether to create two additional output models, using the name of the catchment model as a prefix. If ***ticked****, processed channel strings are created in cyan, with a model name ending in " channel strings" and processed edge strings are created in magenta, with a model name ending in " edge strings". These extra models may be useful in more complex cases, where a catchment polygon cannot be created automatically. The channel and edge strings may be used to form these more complex catchment polygons, manually.*

Clean target model(s) beforehand tick box ticked

Whether to clean the target model(s) beforehand.

Buttons at Bottom

Run button

Runs the option.

Continue to 17.5.11 Split Catchment or return to 17.5 Stormwater.

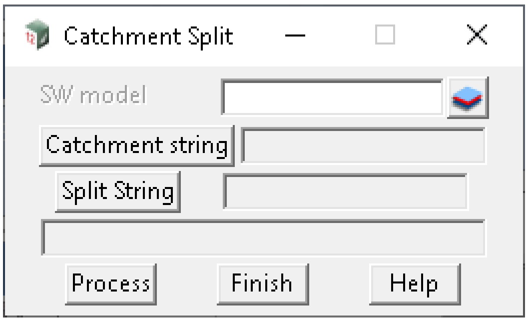
17.5.11 Split Catchment

Position of option on menu: **Water =>Stormwater =>Split catchment**

The split catchment option uses a super string to split a catchment into two separate catchments.

The two new catchments are linked to the same node that the original catchment was lined to, and the original catchments link removed.

Selecting **Split catchment** brings up the **Catchment Split** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
SW model	Model box		

Water network model that the water string that the catchment links to is in.

Catchment string	string select box		

Water catchment string to be split.

Split string	string select box		

String to be used to split the catchment string into two.

The string must only split the catchment into two parts.

Process	button		

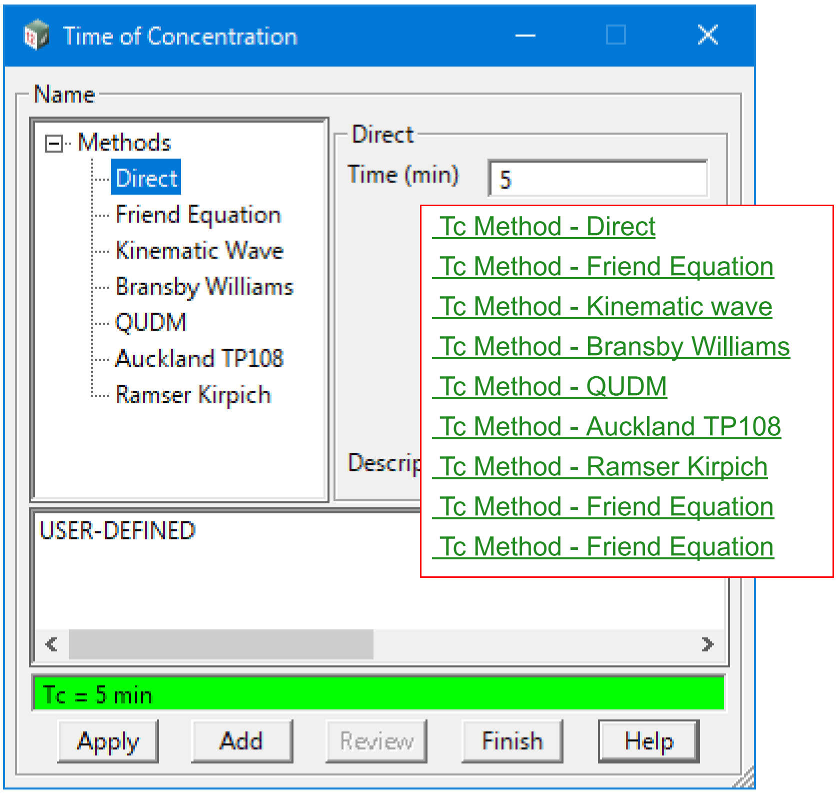
Runs the option.

Continue to 17.5.12 Time of Concentration Builder or return to 17.5 Stormwater.

17.5.12 Time of Concentration Builder

Position of menu: **Water =>Stormwater =>TC builder**
Water =>Stormwater =>Dynamic analysis =>Tc builder

There are times when one time of concentration method is not enough to cover the situation. In cases like this the **Tc** Builder can be used to 'add' different times of concentration, derived from different methods of calculation, together to provide a **lumped Tc**. The Time of Concentration builder panel is shown below. A discussion of the widgets on each tree page follows:



Field Description Type Defaults Pop-Up

Buttons at Bottom

Apply Button

Applies the total time of concentration to the catchment.

Add Button

Adds the current time of concentration to the total for the catchment.

Review Button

*Opens the **Review Tc Components** panel that shows all the times of concentration that have been added. See* 17.5.12.1 Review Tc Components.

Finish Button

Returns to the Catchment Parameters panel.

Help Button

Opens up the reference manual.

Time of Concentration Methods

Tc Method - Direct Tc Method - Friend Equation Tc Method - Kinematic wave

Tc Method - Bransby Williams Tc Method - QUDM
Tc Method - Auckland TP108 Tc Method - Ramser Kirpich

Tc Method - Direct

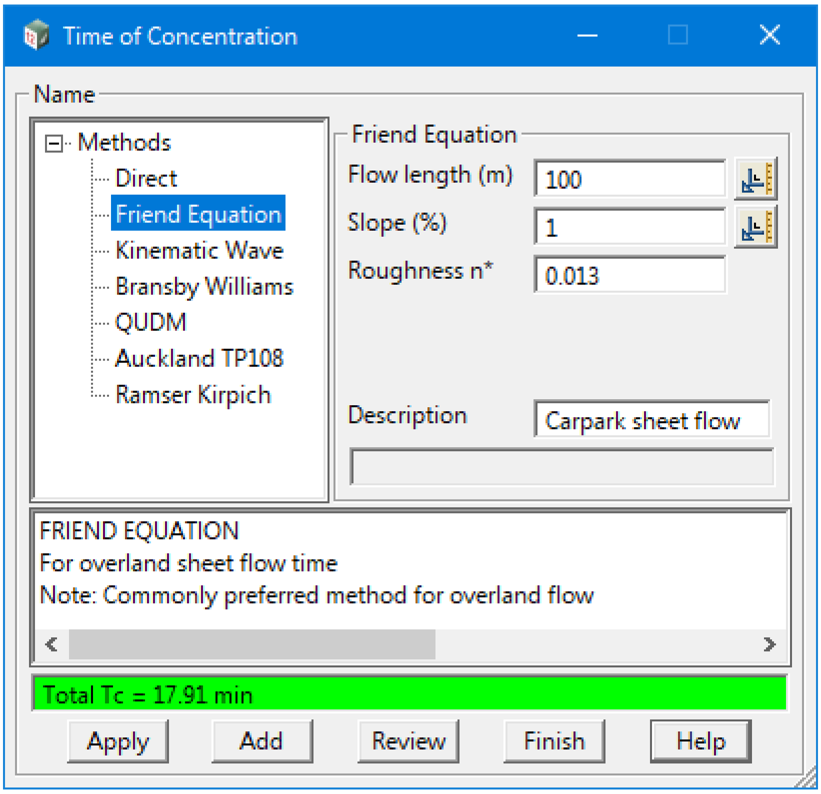
Time (min) real box

Direct time of concentration, in minutes.

Description input box

Optional description of what the direct time of concentration represents (i.e. Roof to road).

Tc Method - Friend Equation



Flow Length (m) real box

Length of the overland sheet flow path, in metres.

Slope % real box

Average slope of the flow path, in percent.

Roughness* real box

Horton's surface roughness factor.

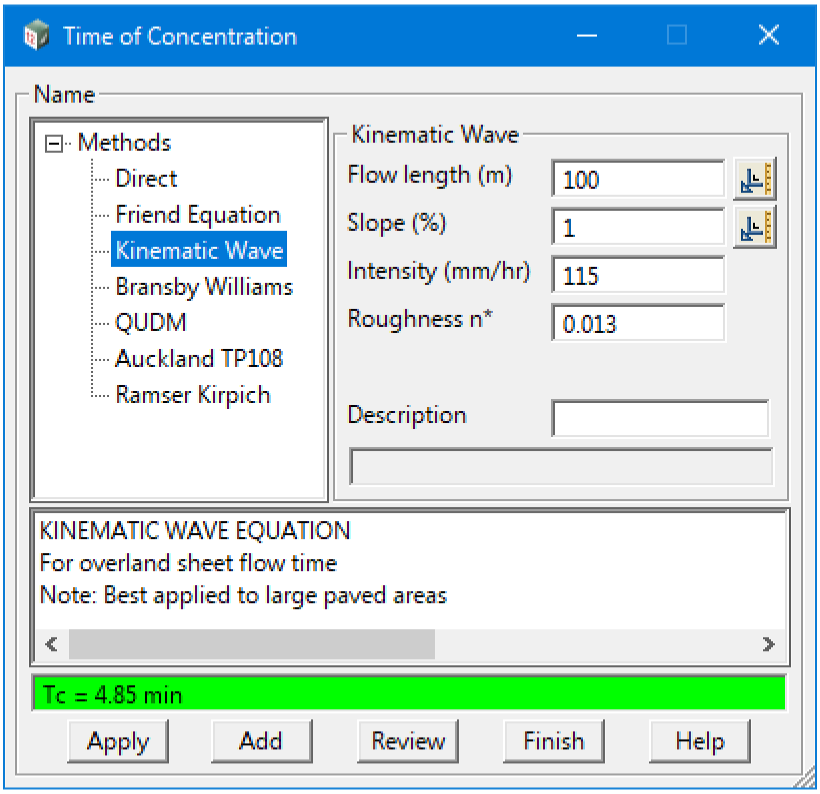
Description input box

Optional description of what the time of concentration component represents.

For more information on the equation, see 27.1.3.3 Friend Equation.

Continue to Tc Method - Kinematic wave or return to 17.2.1 Concept Stormwater Design.

Tc Method - Kinematic wave



Flow Length (m) real box

Length of the overland sheet flow path, in metres.

Slope % real box

Average slope of the flow path, in percent.

Intensity (mm/hr) real box

Rainfall intensity in mm/hr.

Roughness* real box

Surface roughness/retardance coefficient.

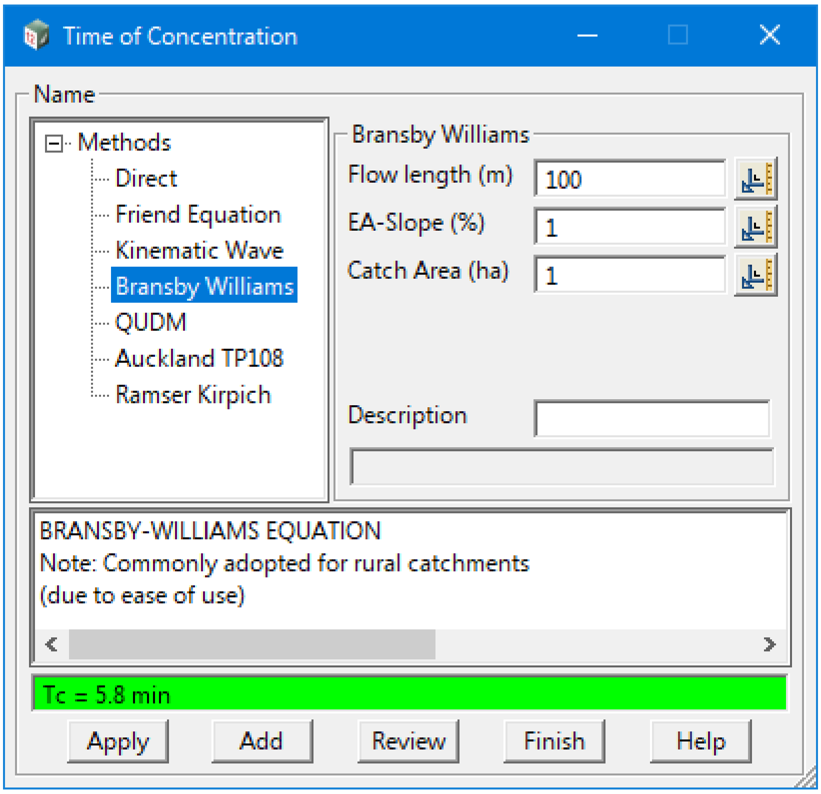
Description input box

Optional description of what the time of concentration component represents.

For information on the equation, see 27.1.3.4 Kinematic Wave Equation.

Continue to Tc Method - Bransby Williams or return to 17.2.1 Concept Stormwater Design.

Tc Method - Bransby Williams



Flow Length (m) real box

Length of the overland sheet flow path, in metres.

EA-Slope (%) real box

The equal area slope of the flow path, in percent.

Catch Area (ha) real box

Catchment area in hectares.

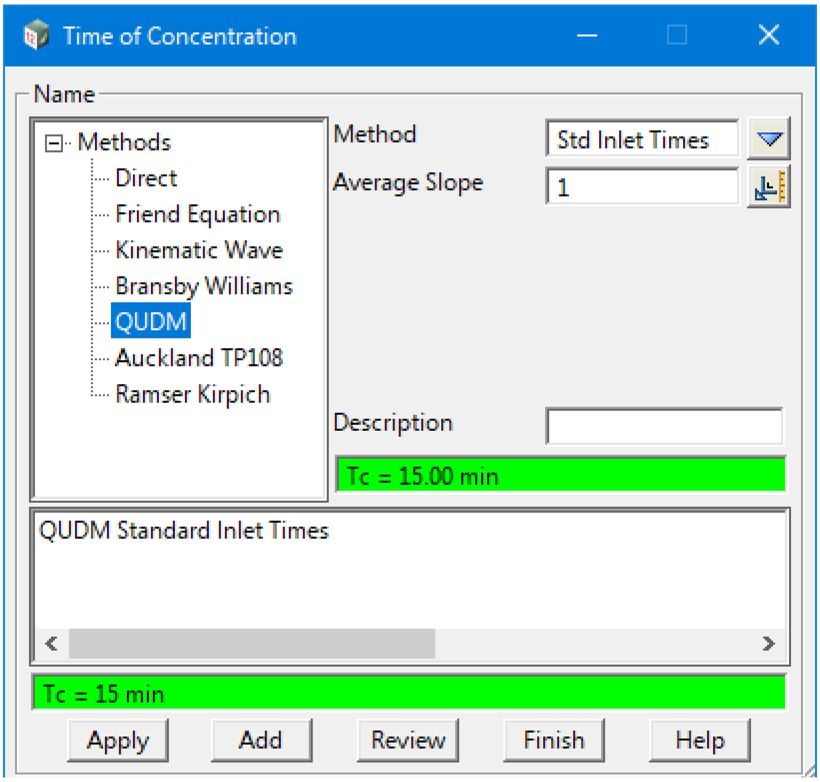
Description input box

Optional description of what the time of concentration component represents.

For information on the actual equation, see 27.1.3.5 Bransby Williams Equation.

Continue to Tc Method - QUDM or return to 17.2.1 Concept Stormwater Design.

Tc Method - QUDM



Method	choice box	Std Inlet Times Velocity Table Channel Formula

The QUDM method to be used.

Average Slope real box

Average slope of the catchment (only available for a Method of Std Inlet Times).

Catchment choice box

Type of catchment. Only available for a Method of ***Velocity Table****.*

Flat (0 to 1.5%)
Rolling (1.5 to 4%)
Hilly (4 to 8%) Significant storage
Hilly (4 to 8%) Limited storage
Hilly (4 to 8%) Minimal storage
Steep - Soil (7 to 15%)
Steep - Rocky (>10%)

Length (m) real box

Catchment length in metres. Only available for a Method of ***Velocity Table****.*

Channel Slope real box

Average slope of the channel (%). Only available for a Method of ***Channel Formula****.*

Channel Length real box

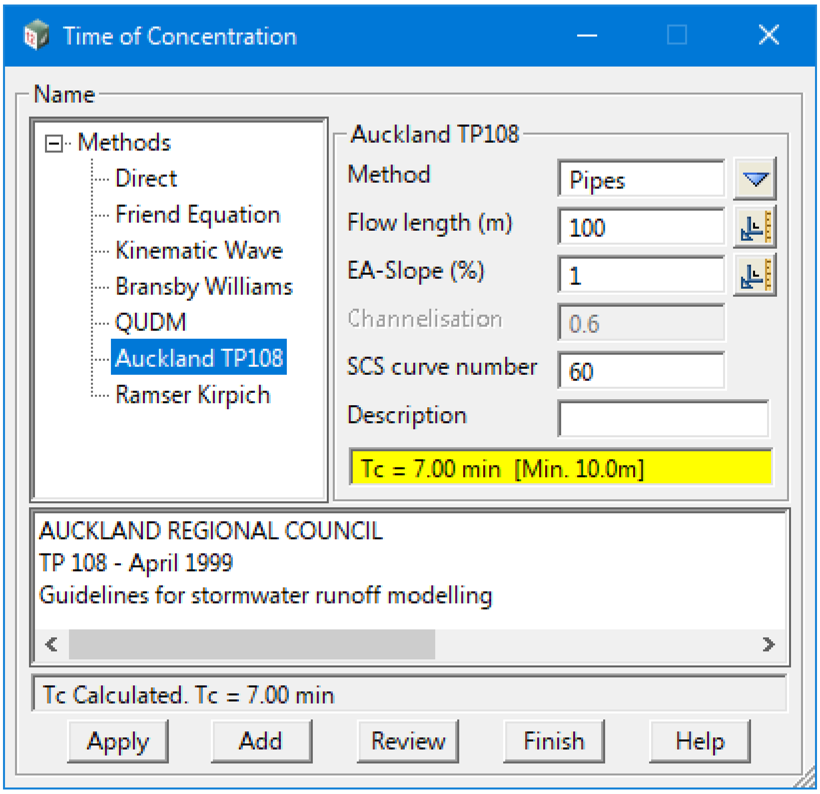
Length of the channel (m). Only available for a Method of ***Channel Formula****.*

Description input box

Optional description of what the time of concentration component represents.

Continue to Tc Method - Auckland TP108 or return to 17.2.1 Concept Stormwater Design.

Tc Method - Auckland TP108



Method choice box Pipes, Eng. Grass Channels

Calculation method to be used. Changes the channelisation factor.

Flow length (m) real box

Catchment flow length in metres.

EA-Slope % real box

The equal-area slope of the catchment, in percent.

SCS curve number real box

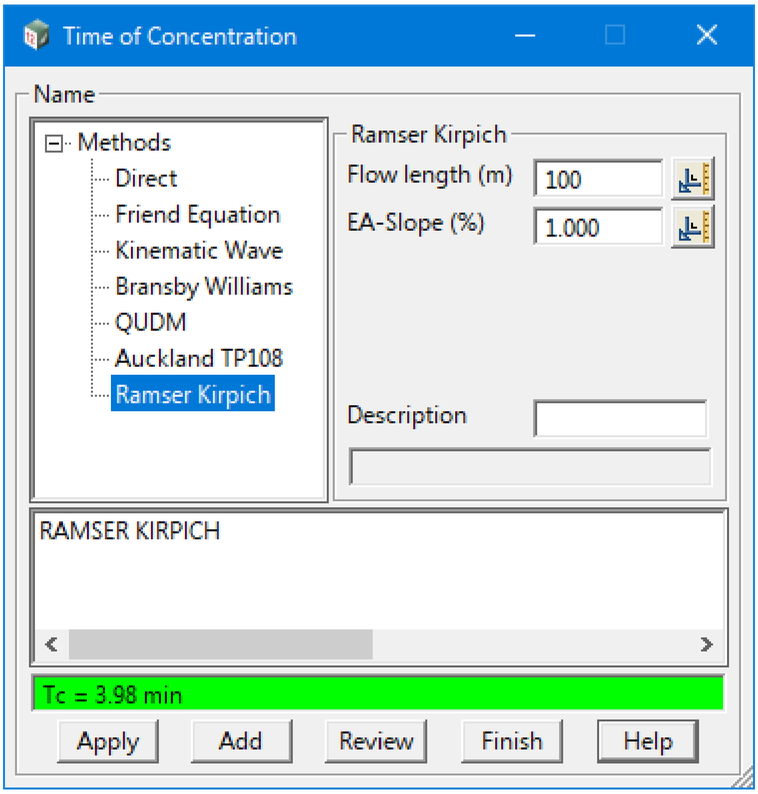
The SCS curve number to be used.

Description input box

Optional description of what the time of concentration component represents.

Continue to Tc Method - Ramser Kirpich or return to 17.2.1 Concept Stormwater Design.

Tc Method - Ramser Kirpich



Flow length (m) real box

Catchment flow length in metres.

EA-Slope % real box

Equal-area slope of the catchment, in percent.

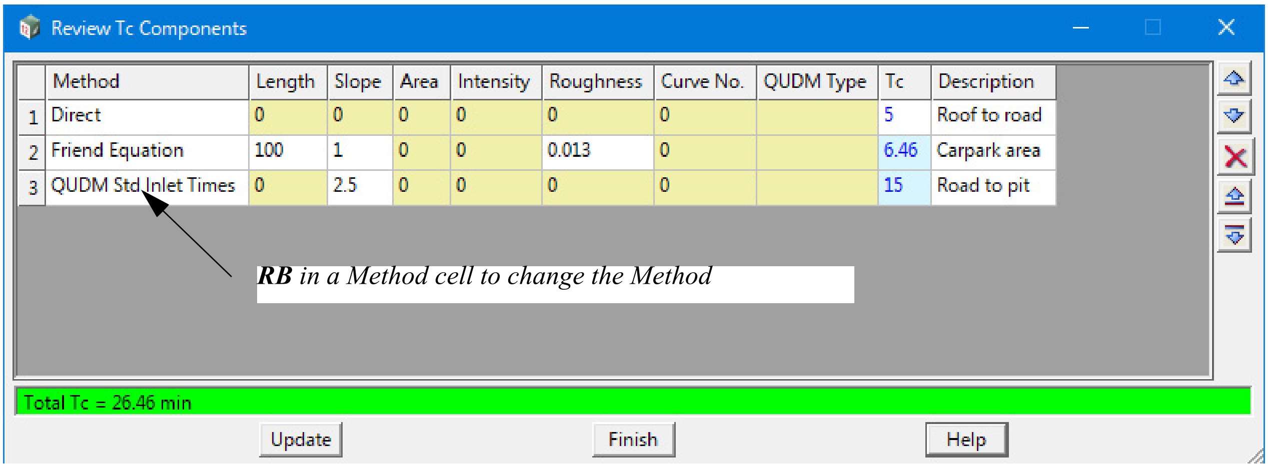
Description input box

Optional description of what the time of concentration component represents.

Continue to 17.5.12.1 Review Tc Components or return to 17.2.1 Concept Stormwater Design.

17.5.12.1 Review Tc Components

The Tc components that have been added in the 17.5.12 Time of Concentration Builder can be reviewed by pressing the **Review** button on the 17.5.12 Time of Concentration Builder.to bring up the **Review Tc Components** panel.



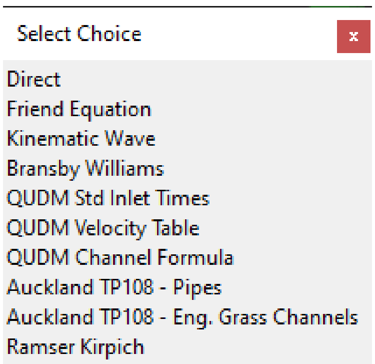
Cells with a **yellow** background colour are **not used** by the chosen method on that row, and are read-only.

Cells with a **blue** background are **calculated values** which will update automatically.

Cells with a **white** background are **editable** and any changes made will affect the yellow and blue cells accordingly.

Field Description Type Defaults Pop-Up

*It is possible to change the **Methods** on this panel by clicking RB on the method displayed in a row in the* **Method** *column to bring up the list of the supported methods for calculating a Tc.*



Changing a method will update the editable cells on that row to suit the newly chosen method and values can be manually input for those which have a zero value populated from the previously selected method.

For the various methods, see 17.5.12 Time of Concentration Builder.

Buttons at Bottom

Update button

Updates the model with the data populated in the grid.

Continue to 17.5.13 Stormwater Inlet Capacity Curves or return to 17.5 Stormwater.

17.5.13 Stormwater Inlet Capacity Curves

Position of option on menu: **Water => Stormwater =>Inlet capacity curves**
Water => Water setup =>Inlet capacity curves

Background: Stormwater Inlet Capacity - *12d Model* and HEC-22

A common question is "Where do I get stormwater inlet capacity curves for my roadway stormwater design?

Usually not on eBay.

However, the University of South Australia has a full size road test rig to determine stormwater inlet capacities. If you are looking for a more theoretical approach, the U.S. Department of Transportation, **Urban Drainage Design Manual - HEC-22** has design procedures. ***12d Model*** uses these procedures as the basis for their inlet capacity routines for roadway on-grade and sag inlets.

This option analyses a range of road depths, grades and cross falls, plots the inlet curves and inserts them directly into the ***12d Model*** drainage.4d file.

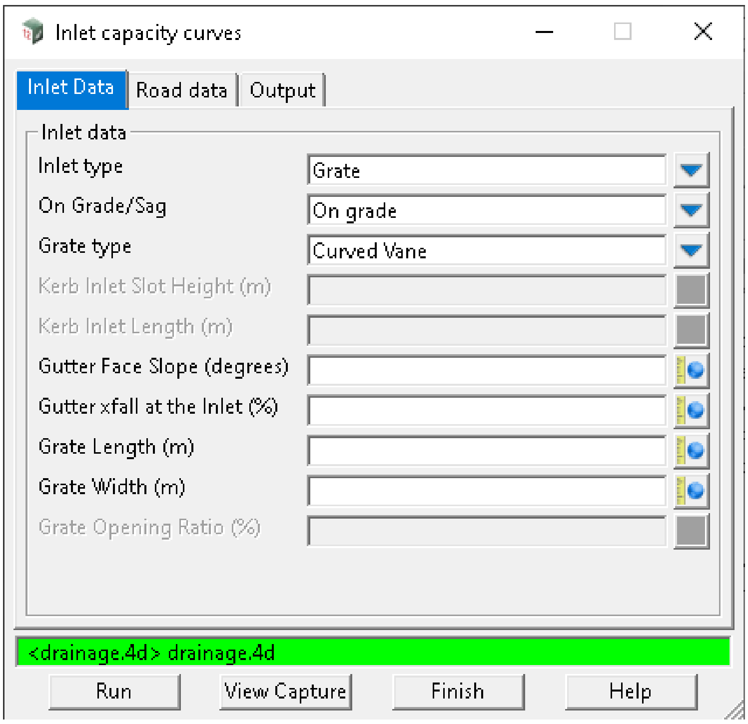
Inlet Capacity option

This routine calculates the inlet capacity for roadway kerb, grate and combination inlets based on principles from the U.S. Department of Transportation, Hydraulic Engineering Circular No. 22, Third Edition URBAN DRAINAGE DESIGN MANUAL. It is highly recommended that the user reads Section **4.4 Drainage Inlet Design** before using this option. https://www.fhwa.dot.gov/engineering/hydraulics/pubs/10009/10009.pdf

Inlet capacities calculations are very sensitive to input data. To assist in sensitivity, test these routine plot the curves to a model for checking and comparison. See 17.3.13.11 Write Inlet Curves to Model,

Fields in the panel will become disabled when they are not needed for the inlet calculations selected.

Selecting **Inlet capacity** brings up the **Inlet Capacity Curves** panel.



Inlet data tab
Road data tab
Output tab

The fields and buttons used in this panel have the following functions:

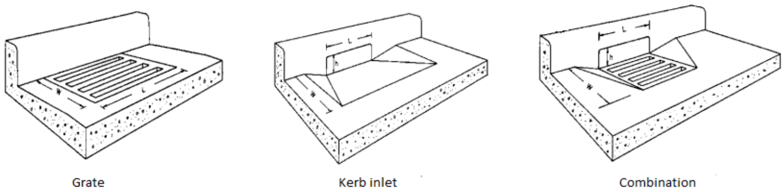
Field Description	Type	Defaults	Pop-Up

Inlet data tab

Inlet type choice box

Select Choice

Grate
Kerb inlet
Combination



Depending on the inlet type selected some boxes may be disabled.

On Grade/Sag choice box

Select Choice

On grade
Sag
On grade and sag

Depending on the On-grade or Sag type selected some boxes may be disabled.

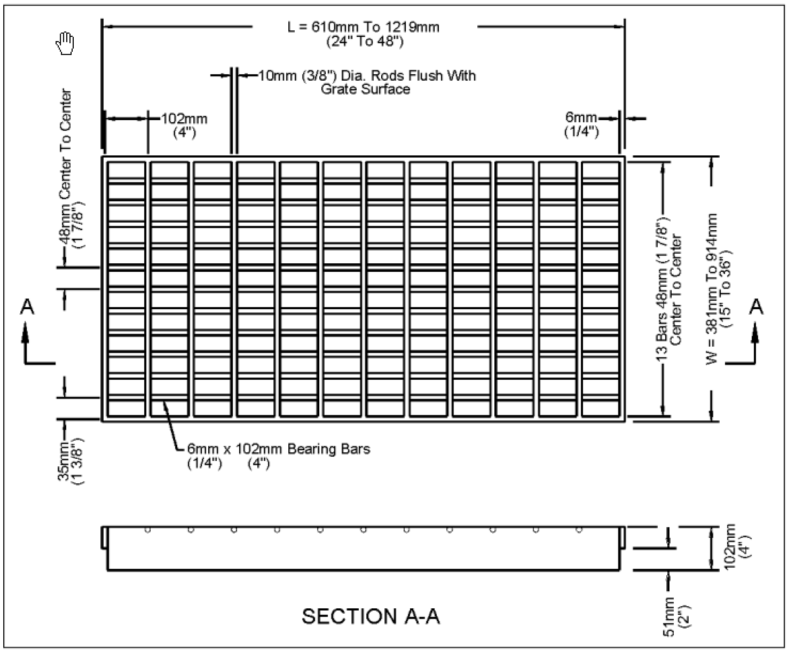
Grate type choice box

Select Choice

Bar P-1-7/8
Bar P-1-1/8
Vane Grate
45º Bar
Bar P-1-7/8-4
30º Bar
Reticuline

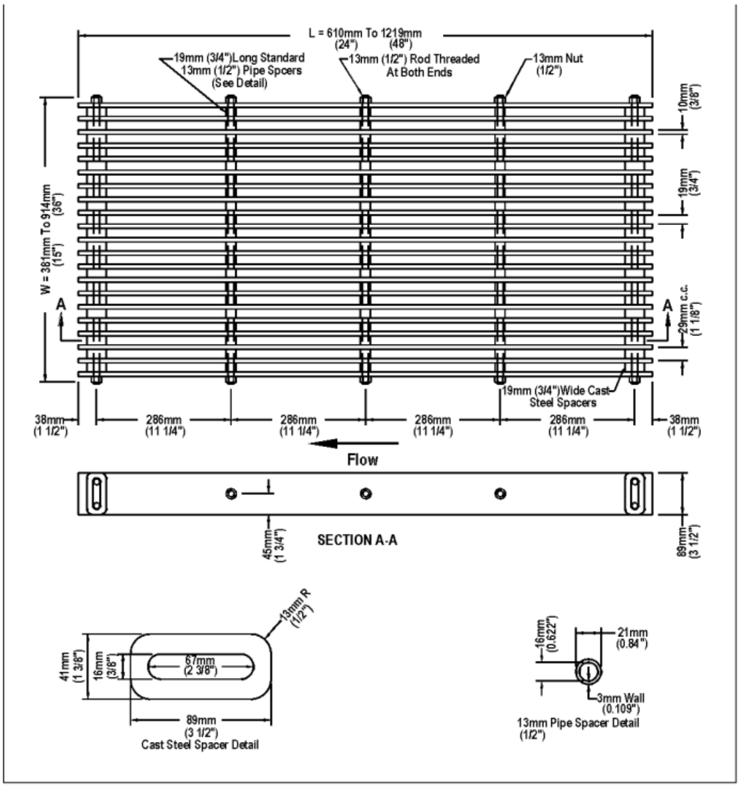
***Bar P50** - Parallel bar grate with bar spacing 48 mm (1-7/8 in) on centre (Original Imperial name was Bar P-1-7/8).*

***Bar P50 -100** - Parallel bar grate with bar spacing 48 mm (1-7/8 in) on centre and 10 mm (3/8 in) diameter lateral rods spaced at 102 mm (4 in) on centre (Original Imperial name was Bar P-1-7/8-4).*

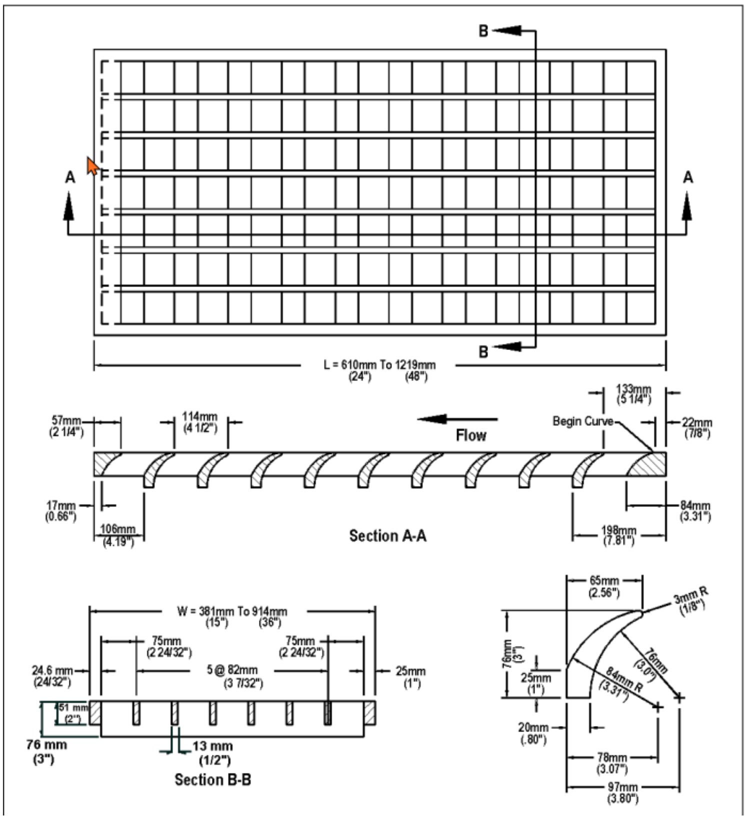


Bar P50 and Bar P50 - 100 grate (P50 is this grate without 10mm (3/8") transverse rods).

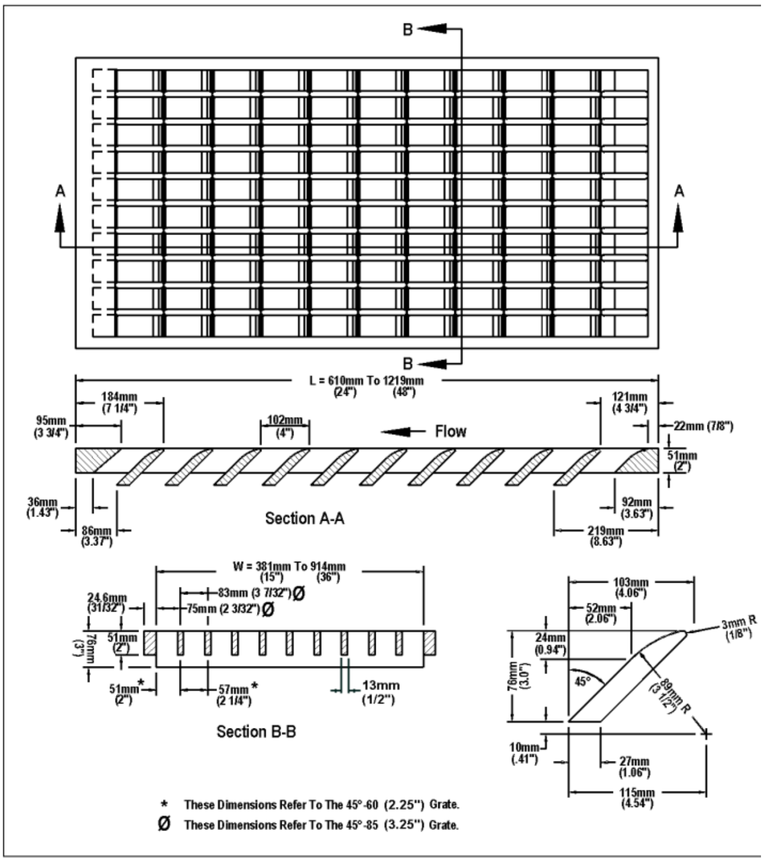
Bar P30 *- Parallel bar grate with 29 mm (1-1/8 in) on centre bar spacing (Original Imperial name was Bar P-1-1/8)*



Curved Vane *- Curved vane grate with 83 mm (3-1/4 in) longitudinal bar and 108 mm (4-1/4 in) transverse bar spacing on centre (Original Imperial name was Vane Grate).*

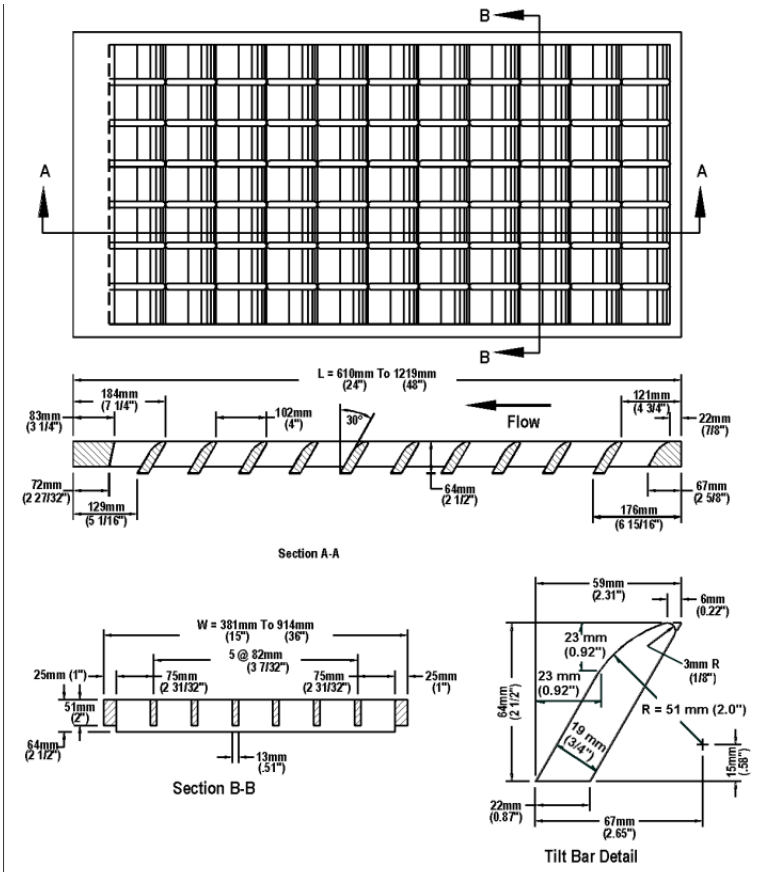


45°- 85 Tilt Bar *- 45° Tilt-bar grate with 83 mm (3-1/4 in) longitudinal bar and 102 mm (4 in) transverse bar spacing on centre (Original Imperial name was 45° Tilt-bar).*

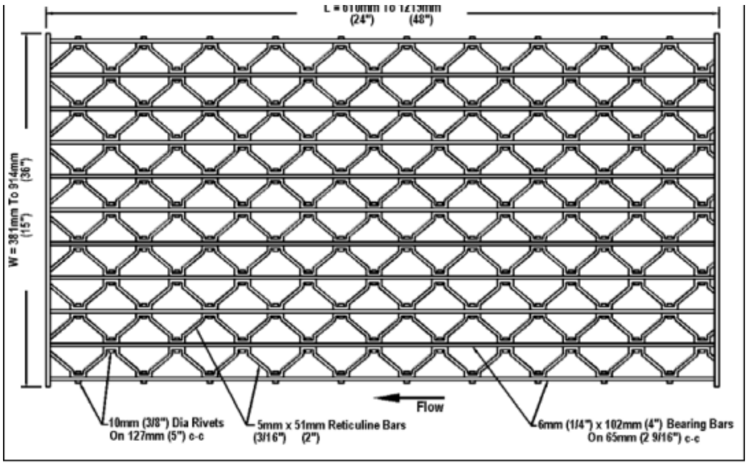


45°- 60 (2.25") and 45°- 85 (3.25") Tilt-bar grates (45°- 60 not supported).

30°- 85 Tilt Bar *- 30° Tilt-bar grate with 83 mm (3-1/4 in) longitudinal bar and 102 mm (4 in) transverse bar spacing on centre (Original Imperial name was 30° Tilt-bar).*



Reticuline *- "Honeycomb" pattern of lateral bars and longitudinal bearing bars (Original Imperial name was Reticuline).*



Kerb inlet slot height   real box

Kerb opening heights vary in dimension, however, a typical maximum height is approximately

0.1 to 0.15 m (4 to 6 in).

0.2

Kerb inlet length real box

Length of the kerb opening (m). The procedure used to calculate the length of kerb necessary to obtain complete capture described in Section 4.4.4 of the HEC-22 document referenced above.

Gutter xfall at the inlet (%) real box

Gutter crossfall at the inlet (%).

Grate length (m) real box

Length of the grate in parallel to the gutter (m).

Grate width (m) real box

Width of the grate in perpendicular to the gutter (m).

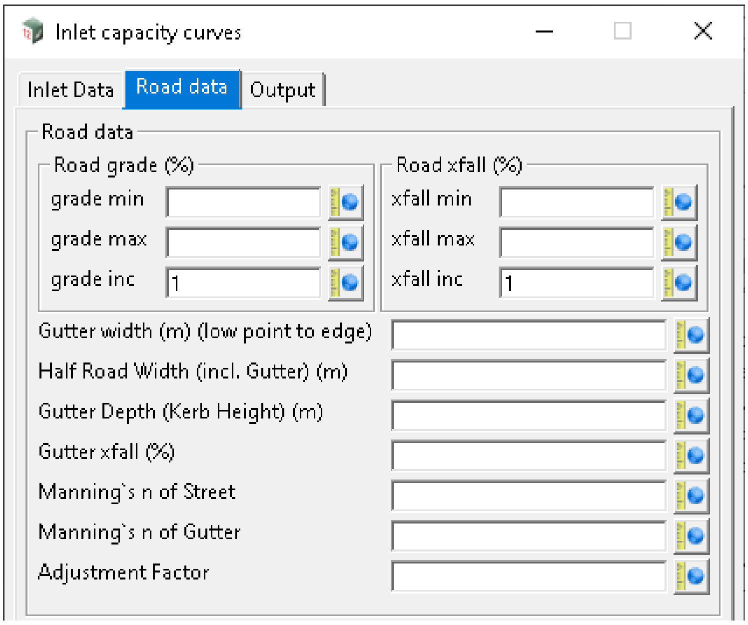
Grate opening ratio (%) real box

Ratio if grate area to grate opening (%). A grate inlet in a sag location operates as a weir to depths dependent on the size of the grate and as an orifice at greater depths. Grates of larger dimension will operate as weirs to greater depths than smaller grates. These inlet types require the clear area of opening of the grate.

Tests of three grates for the Federal Highway Administration showed that for flat bar grates, such as the P-50x100 and P-30 grates, the clear opening is equal to the total area of the grate less the area occupied by longitudinal and lateral bars.

Road data tab

Inlet capture curves can be created for a sag curve and/or a family of on-grade curve curves. For on-grade curves the parameters for road grade and crossfall are used to create a family of grade-crossfall curves.



Inlet data tab
Road data tab
Output tab

Road data

Road grade (%)

grade min real box

Flattest longitudinal grade for which a curve will be created.

grade max real box

Steepest longitudinal grade for which a curve will be created.

grade inc real box

Increment used in creation of the curves.

e.g., for a min grade of 1% and a max grade of 4% and an increment of 0.5% 7 curves will be created.

Road xfall (%)

xfall min real box

Flattest road crossfall for which a curve will be created.

xfall max real box

Steepest road crossfall for which a curve will be created.

xfall inc real box

Increment used in creation of the curves.

e.g., for a min crossfall of 1% and a max crossfall of 4% and an increment of 0.5% 7 curves will be created (or 49 curves if we use the 1% - 4% longitudinal grades).

Gutter depth (m) real box

Distance from the low point of the gutter to the top of the kerb.

Gutter xfall (%) real box

Grade of the gutter from the low point of the gutter to the gutter lip.

Gutter face slope (deg) real box

Vertical angle of the face of the kerb.

Manning's n of Street real box

Roughness of the roadway (excluding the gutter) expressed in terms of Manning's n.

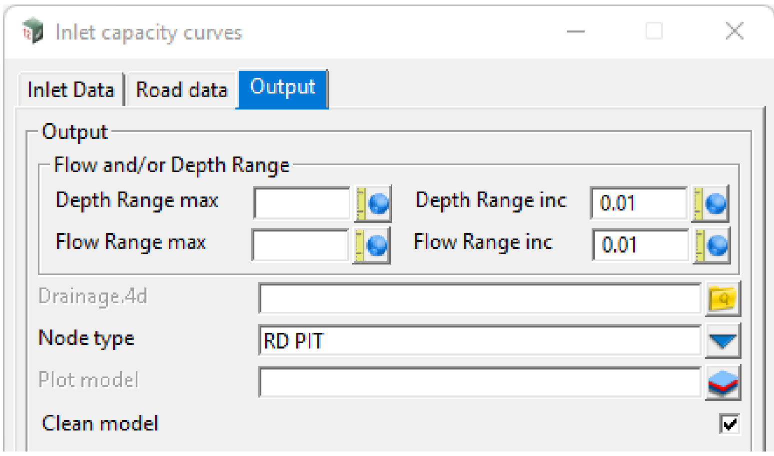
Manning's n of Gutter real box

Roughness of the kerb and gutter expressed in terms of Manning's n.

Adjustment Factor real box

Multiplier applied to the calculation of gutter flow using Izzards formula.

Output tab



Inlet data tab
Road data tab
Output tab

Output

Flow and/or Depth Range

Depth Range max real box

Maximum depth that will be used in the creation of a sag curve (curves always start at 0).

Depth Range inc real box .01

Depth increment used to determine the maximum number of points in the sag curve.

Flow Range max (m3/s) real box

Maximum flow that will be used in the creation of the on-grade curves (curves start at 0).

Flow Range inc. (m3/s) real box ,01

Flow increment that will be used in the creation of the on-grade curves.

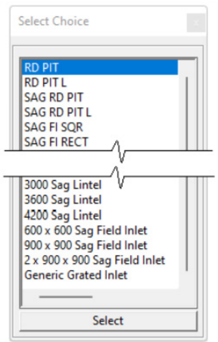
Drainage.4d file box

Name of the drainage.4d file (only available with XML format drainage.4d files).

If a file has been selected the capture curves created when ***Run*** *is clicked with be written to the* ***Node Type*** *selected below.*

To create a new drainage.4d file enter its name in this field.

Node type choice box



The choice box displays a list of all nodes in the currently selected drainage.4d file. If no file has been selected the list shows the node types in the default drainage.4d file.

To create a new node type simply enter a new name in this field and a new entry will be created. Note that this feature is not available in most choice boxes.

Plot model model box

*If a plot model is selected a plot of the inlet capacity curve(s) will be created and added to the Plot model. (This option has been largely superseded by the **Capture Curve Viewer** option selected via the **View Capture** button below).*

Clean model tick box

*If **ticked**, the model **Plot model** will be cleaned before the new plot is created.*

Buttons at Bottom

Run button

*Generate the family of Sag and/or On-grade curves with the results written to the drainage.4d files and/or the **Plot Model**.*

View Capture button

Opens the 17.5.14 Capture Curve Viewer panel and display the curves for any of the Node Types in the drainage.4d file. (This macro effectively deprecates the need for the Plot Model option).

Continue to 17.5.14 Capture Curve Viewer or return to 17.5 Stormwater.

17.5.14 Capture Curve Viewer

Position of option on menu: **Setup => Capture curve viewer (Water theme)**
Water => Stormwater =>Capture curve viewer
Water => Water setup =>Capture curve viewer

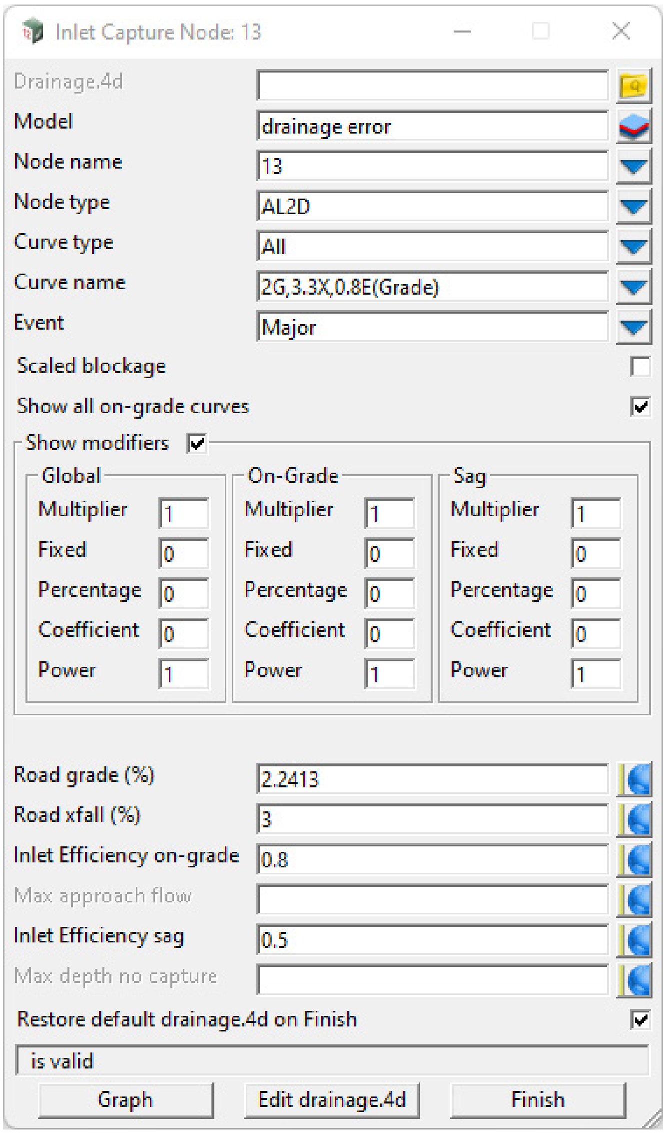
Background: Stormwater Inlet Capacity (pit capture) - 12d Model

The drainage.4d file is a behemoth. It is powerful but complex and not for the feint-hearted.

This option allows the user to test the sensitivity of captured flow to various drainage.4d parameters and give the modeller confidence in the selection of input data.

Where an individual node is selected the panel will show a combination of data from the drainage.4d file and the stormwater model (both model and string element data).

Selecting **Capture curve viewer** brings up the **Inlet Capture Node** panel.



The fields and buttons used in this panel have the following functions:

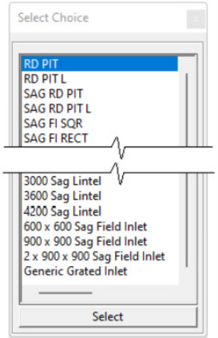
Field Description	Type	Defaults	Pop-Up
Drainage.4d	file box		*.4d files

Name of the drainage.4d file currently being interrogated. If blank the currently loaded drainage.4d file will be used.

Model model box available models

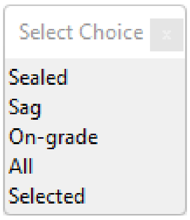
Name of the stormwater model. If blank the road grade, crossfall and efficiency will not be loaded from the stormwater model and used in the calculation of captured flow.

Node name choice box



The choice box displays a list of all nodes in the currently selected drainage.4d file. If no file has been selected the list shows the node types in the default drainage.4d file.

Curve type choice box



Select the type of curve to display in the graph for the selected ***Node Type****. If a stormwater model has been selected the value displayed will be that of the selected model, otherwise "All" will be the default.*

Sealed *- will display results only for sealed node types.*

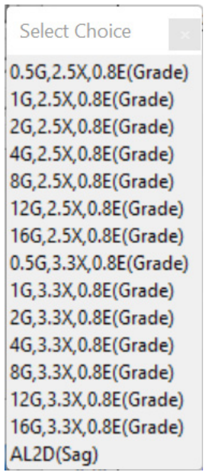
Sag *- will display results only for the sag curve.*

On-grade *- will display only results for the on-grade curves with the curve representing the road grade and crossfall shown with a bold line-style.*

All *- will display all the curves in the drainage.4d file. If a stormwater model has been selected the sag curve will be shown with a bold line-style, as will be the on-grade graph corresponding to the roadway grade and crossfall read from the stormwater model (this name will also be shown in the* ***Curve Name*** *choice box.*

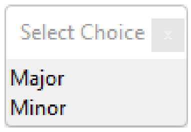
Selected *- will display results only for the curve shown in the* ***Curve Name*** *choice box.*

Curve name model box



*If the **Curve Type** option above is" Selected" then the curve name selected in this option will be shown in the graph. If there are on-grade curves available the default curve shown will be that matching the road grade and crossfall shown below.*

Event choice box



*The event type (major or minor) is used to decide which **Inlet Efficiency** value to load from the stormwater model.*

Scaled Blockage tick box not ticked

Adjust the approach flow according to the on-grade efficiency. Has no effect on Sag curves.

Show all on-grade curves tick box ticked

*If **ticked** the entire family of on-grade curves will be shown. If not, only the curve corresponding to the grade and crossfall below will be displayed.*

Show modifiers tick box ticked

Toggling this tick box will collapse and expand the curve modifiers shown below.

Global/On-grade/Sag modifiers

The drainage.4d file allows the inlet capture to be defined by an equation, a curve or a combination of both. The global modifiers are applied in addition to the on-grade or sag modifiers. The interaction of these modifiers can be quite complex so the modeller is encouraged to experiment with these parameters and use the graph to interpret the changes.

Multiplier real box

As the name suggests the multiplier adjusts the captured flow.

e.g., a multiplier of 2 will double the captured flow, 0.5 will halve it.

Fixed real box

A fixed captured flow is added to any existing capture curve.

Percentage real box

For on-grade inlets a percentage of the approach flow is added to any existing capture curve.

Coefficient real box

Coefficient used in a power equation for on-grade inlets.

Power real box

Exponent used in a power equation for on-grade inlets.

Road Grade (%) real box

Longitudinal grade at the selected node. The on-grade curve corresponding to this grade is shown with a bold line-type.

Road xfall (%) real box

Road crossfall at the selected node. The on-grade curve corresponding to this grade is shown with a bold line-type.

Inlet Efficiency on-grade real box

Efficiency of an on-grade inlet for the selected event type. This is the opposite of blockage. i.e., an inlet that is 20% blocked has an efficiency of 0.8.

Max approach flow real box

Restrict the inlet capture of an on-grade curve to the value captured at this approach flow.

Inlet Efficiency Sag real box

Efficiency of a sag inlet for the selected event type. This is the opposite of blockage. i.e., an inlet that is 20% blocked has an efficiency of 0.8.

Max depth no capture real box

Set the inlet capture of a sag curve to zero until this depth is exceeded, after which the original depth vs capture curve is applied.

Restore default drainage.4d on Finish tick box ticked

If a drainage.4d file name has been entered in this panel, the data from this file is loaded into memory and will be used after this panel is closed. Selecting this tick box will cause original drainage.4d file to be reloaded into memory.

Graph button

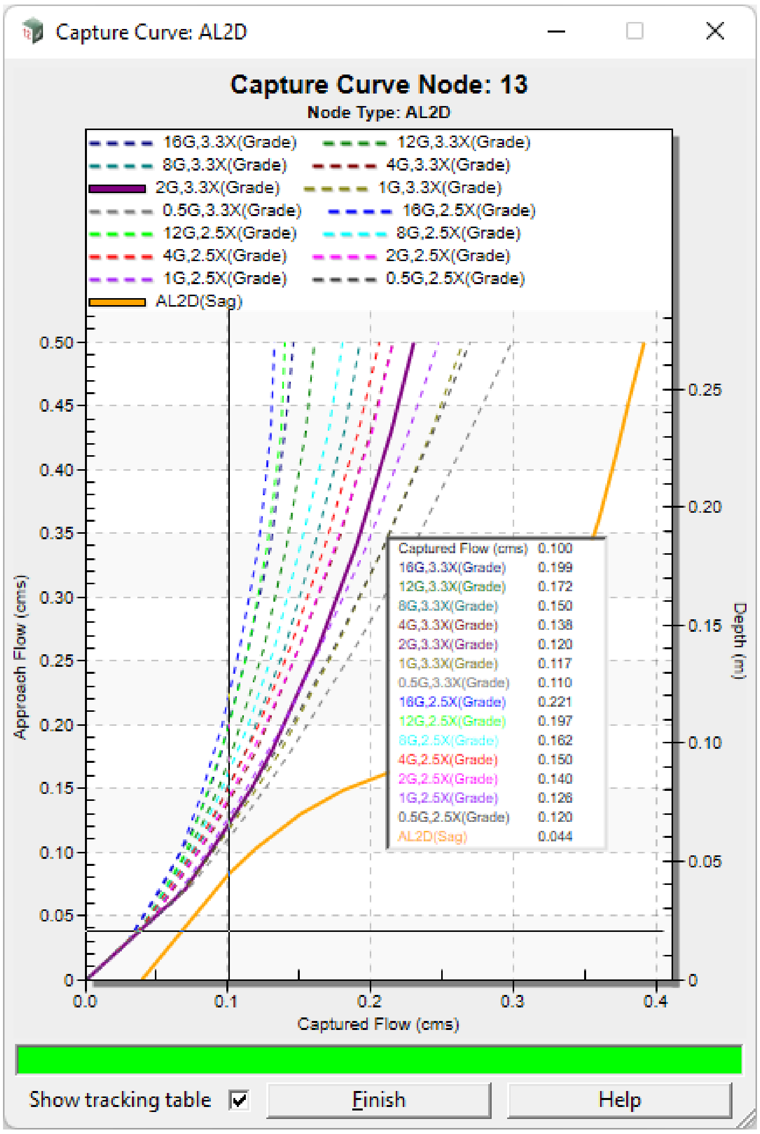
Open the Capture Curve graph. See 17.5.14.1 Graph Panel.

Edit drainage.4d button

Open the Drainage.4 File Editor.

Continue to 17.5.14.1 Graph Panel or return to 17.5 Stormwater.

17.5.14.1 Graph Panel



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Show tracking table	tick box	ticked	

The tracking table tracks the cursor as it moves about the screen displaying the captured flow and the equivalent captured flows for on-grade pits and depth for sag pits. Disabling this tick box removes the tracking table and changes the cursor style.

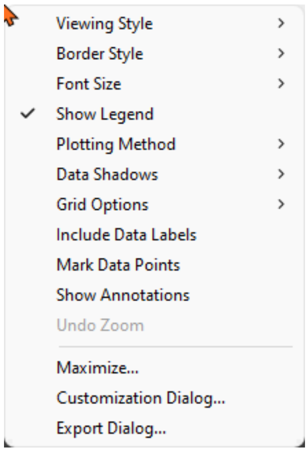
Finish button

Closes this panel. The panel can be re-opened by clicking the Graph button on the main panel.

Help button

Opens this help file.

RB Mouse



There are numerous display options available and the modeller is encouraged to experiment.

Continue to 17.5.15 Create/Change Culvert or return to 17.5 Stormwater.

17.5.15 Create/Change Culvert

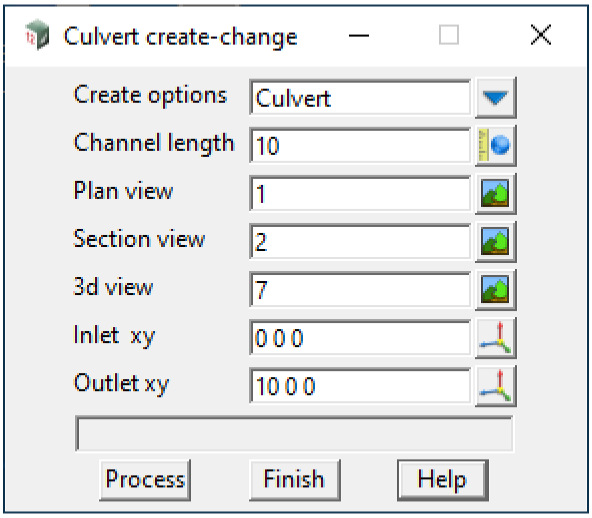
Position of option on menu: **Water =>Stormwater =>Create culvert**

This option quickly creates a water string for a culvert, or a culvert with exit channel, by importing a 12da file and then moving the vertices to the selected locations.

The 12da files read are from the standard library paths with the file names culvert.21da and culvert and channel.12da. The destination model in the supplied 12da files is culvert.

The string is added/profiled in the selected views.

On selecting the **Create culvert** option, the **Culvert Create-Change** panel is displayed.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Create options	choice box	Culvert	

__Culvert__ creates only the culvert while __Culvert and channel__ creates the culvert with a channel extended at the outlet.

Channel length	real box	10	

When the __Culvert and Channel__ option is selected above, a channel is extended from the outlet in the same direction as the channel.

Plan view	view box	1	

Model used in the 12da file (culvert as supplied) is added to this view.

Section view	view box	LS	

The culvert is profiled on this view.

3D view	view box	3D	

Model used in the 12da file (culvert as supplied) is added to this view.

Inlet xy	xy box	0 0 0	

This xy is the centre of the inlet headwall. The z is not used.

Outlet xy	xy box	10 0 0	

This xy is the centre of the outlet headwall. The z is not used.

Process button

The culvert is created in the model specified in the 12da files (culvert as shipped) and added/profiled in the selected views.

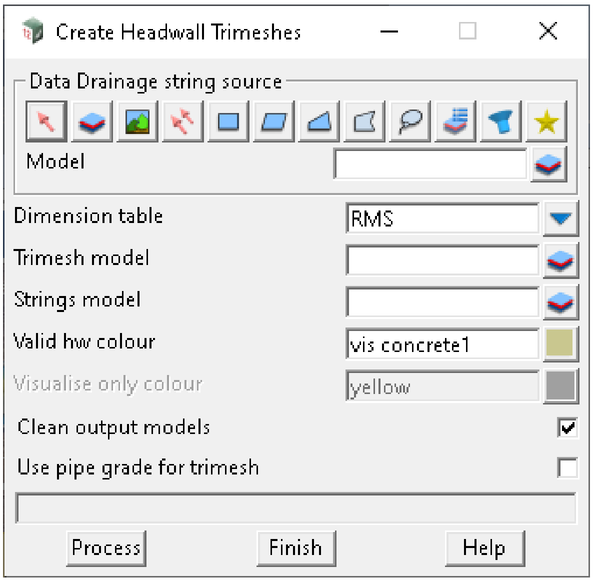
Continue to 17.5.16 Create Culvert Headwalls or return to 17.5 Stormwater.

17.5.16 Create Culvert Headwalls

Position of option on menu: **Water =>Stormwater =>Create culvert headwalls**

The **Create culvert headwalls** option creates trimeshes of culvert headwalls.

Selecting **Create culvert headwalls** brings up the **Create Culvert Headwalls** panel.

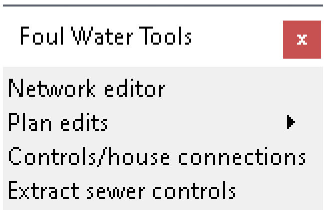


??

Continue to 17.6 Foul Water Tools or return to 17.5 Stormwater.

17.6 Foul Water Tools

Position of menu: **Water =>Foul water tools**



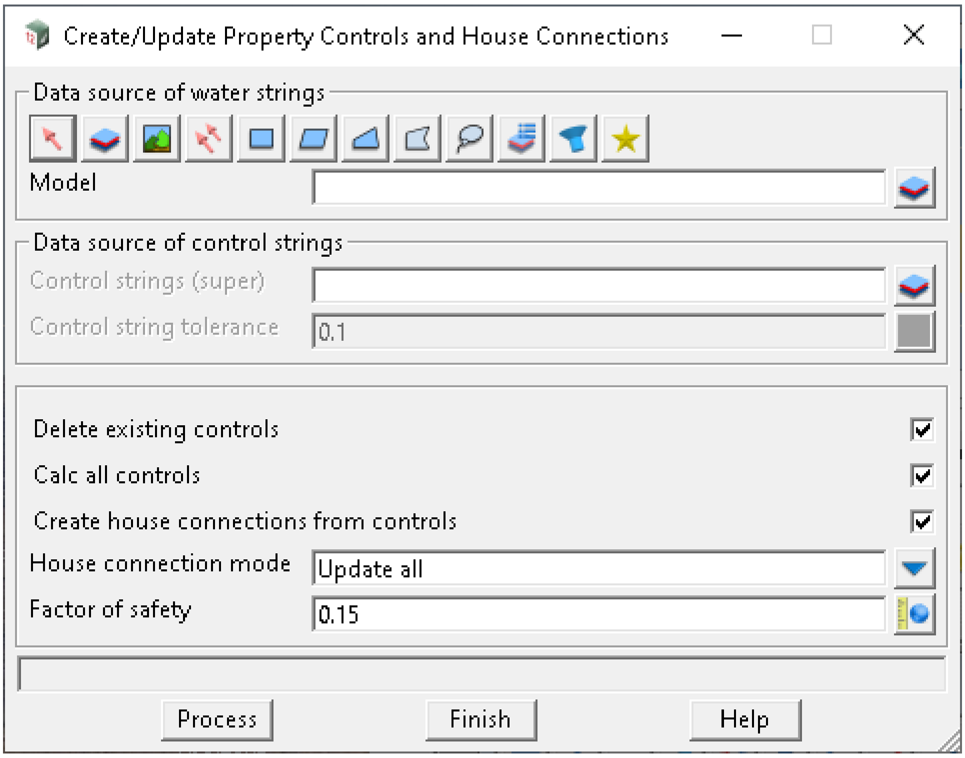
See
17.3.4 Water Network Editor (WNE)
17.3.8 Plan Edits
17.6.1 Controls/house Connections
17.6.2 Extract Sewer Property Controls

17.6.1 Controls/house Connections

Position of menu: **Water =>Foul water =>Controls/house connections**

The Property control and house connection option provides a quicker way to create and update property control and house connection. Originally you can only do it with only one pipeline at a time. This option allows multiple pipelines to be chosen and executed at the same time.

Selecting **Controls/house Connections** brings up the **Create/Update Property Controls and House Connections** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data source of water strings data source

Data selection type - for a full description go to 3.26.3 Data Source.

Control strings (super) model box

OPTIONAL -.The model including all controls to connect to water strings (must have type super).

Control string tolerance input number 0.1

OPTIONAL - The tolerant distance from controls to water string. This field is required if Lot control string is used.

Delete existing controls tick box ticked

*If **ticked**, existing controls beforehand is deleted.*

Calc all controls tick box ticked

*If **ticked**, property controls is created.*

Create house connection from controls tick box ticked

*If **ticked**, a house connection is created (connection from water string to property control).*

House connection mode	choice box	Update all	Removing existing first Update new Update all

*If **remove existing first**, all the existing connections are deleted before new ones are created from the controls.*

*If **update new**, connections are only created from controls with names different from any existing connection.*

*If **update all**, connections are created from all controls.*

Factor of safety	input number	0.15

The connection height for the control is adjusted by this depth from the control connection depth.

Buttons at Bottom

Process	button

Calculate controls and/or create house connections.

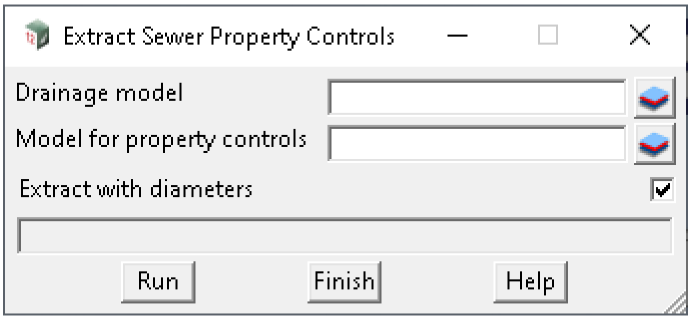
Continue to 17.6.2 Extract Sewer Property Controls or return to 17.6 Foul Water Tools.

17.6.2 Extract Sewer Property Controls

Position of option on menu: **Water =>Foul Water =>Extract sewer controls**

The sewer property control strings are a sub string of the drainage string and therefore may only be profiled using a right mouse click of the profile button. To include these control strings on plots, or export to other packages, they need to be converted to super strings.

On selecting the **Extract Sewer Controls** option, the **Extract Sewer Property Controls** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Drainage model	model box		available models

All drainage strings in this model will have their property controls strings duplicated as super strings.

Model for property controls	model box		available models

The super strings for the property controls are placed in this model.

Extract with diameters	tick box	ticked	

The super strings will have the constant pipe dimension set to the control diameter.

Buttons at Bottom

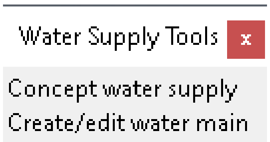
Run	button		

Create the super strings representing the property controls.

Continue to 17.7 Water Supply or return to 17.6 Foul Water Tools.

17.7 Water Supply

Position of menu: **Water =>Water supply**



17.7.1 Concept Water Supply (CWS)
17.7.3 Create/Edit Water Main

See also using the 17.3.4 Water Network Editor (WNE) for 17.7.2 Dynamic Water Supply

17.7.1 Concept Water Supply (CWS)

Position of option on menu: **Water =>Water supply =>Concept water supply**

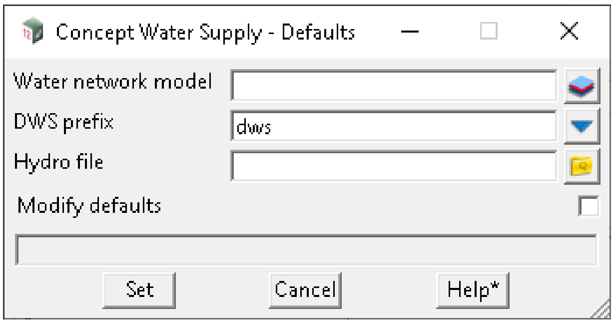
Water =>Concept design =>Water supply design

Note: this is not a comprehensive overview of 12d's Dynamic Water Supply module capabilities - for more information, please consult section 17.7.2 Dynamic Water Supply.

Concept Water Supply (CWS) presents a variety of options for controlling model, node and link parameters.

Upon startup, CWS will display a **defaults panel** that allows the user to specify the models and additional parameters that will be used when creating the drainage data and overlay.

Selecting **Concept water supply** brings up the **Concept Water Supply - Defaults** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Water Network Model	model box	Project settings	available models

Model used to draw all drainage data in CWS.

DWS prefix	text box		

Root folder path for Dynamic Water Supply attributes.

Hydro file	file box		*.12dhydro files

Project hydro file location.

Modify defaults	tick box	not ticked	

*If **ticked**, expands to reveal a Tree with all the settings in the tree.*

Buttons at Bottom

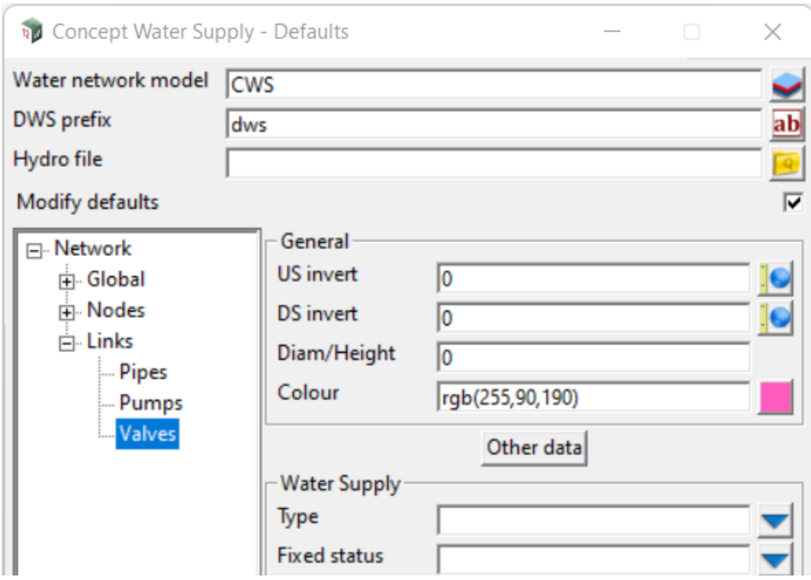
Set	button

Accept the defaults and return to the main panel.

Cancel	button

Close the panel and cancel the macro.

See
Global
Nodes
Links



Global

The **Rules page**, **Controls page, Patterns page, Curves page, Quality page, Display page** and **Valves Page** are described below.

See Rules page

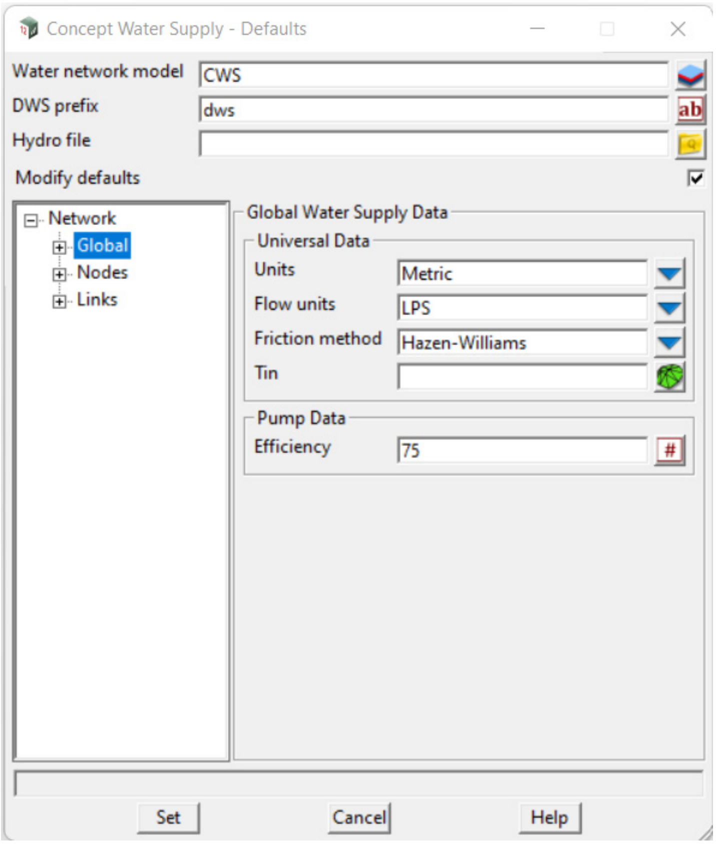
See Controls page

See Patterns page

See Curves page

See Quality page

See Display page



Global Water Supply Data

Universal Data

Units	choice box	Metric	Metric, US

Default measurement system for the project.

Flow units	choice box	LPS	LPS, LPM, MLD, CMH, CMD

Default flow rate system for the project.

Friction method	choice box	Hazen-Williams	Hazen-Williams, Darcy-Weisbach, Chezy-Manning

Default friction calculation method.

Tin	tin box		

Default tin for the project.

Hydrology data

Hydro file	file box	*.12dhydro files

The project hydro file location.

DWS prefix	input box

The root folder path for Dynamic Water Supply attributes.

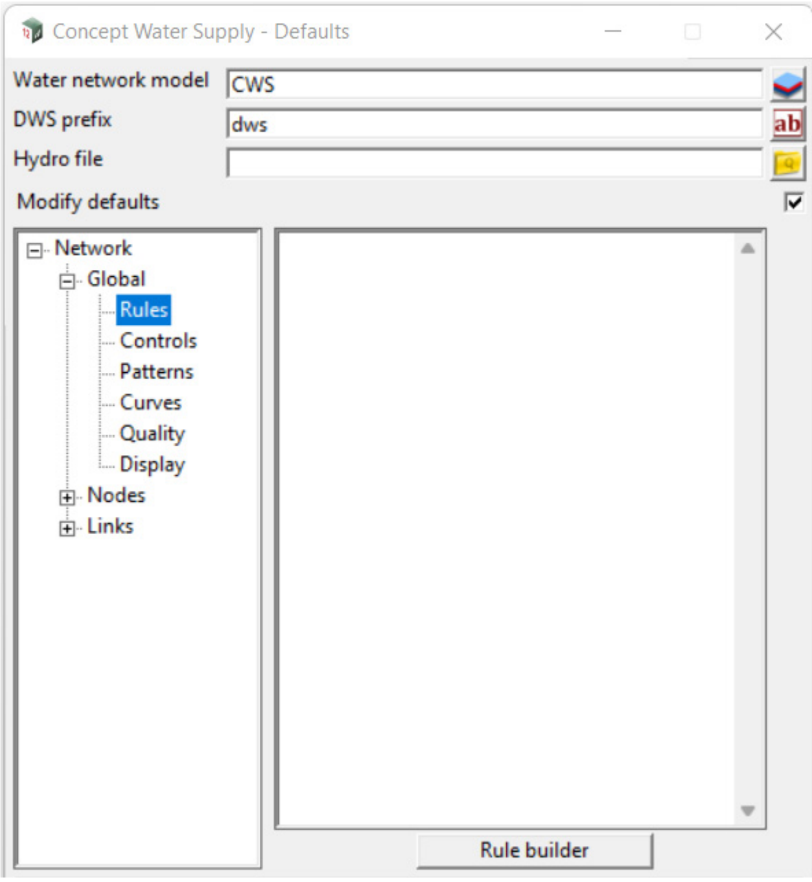
Pump data

Efficiency	integer box

Default pump efficiency.

Rules page

The rules page contains an input box that allows users to specify the status of selected links as a function of time, tank water levels, and pressures at select points within the network. This can be populated via the Rule Builder, accessed from the associated button.

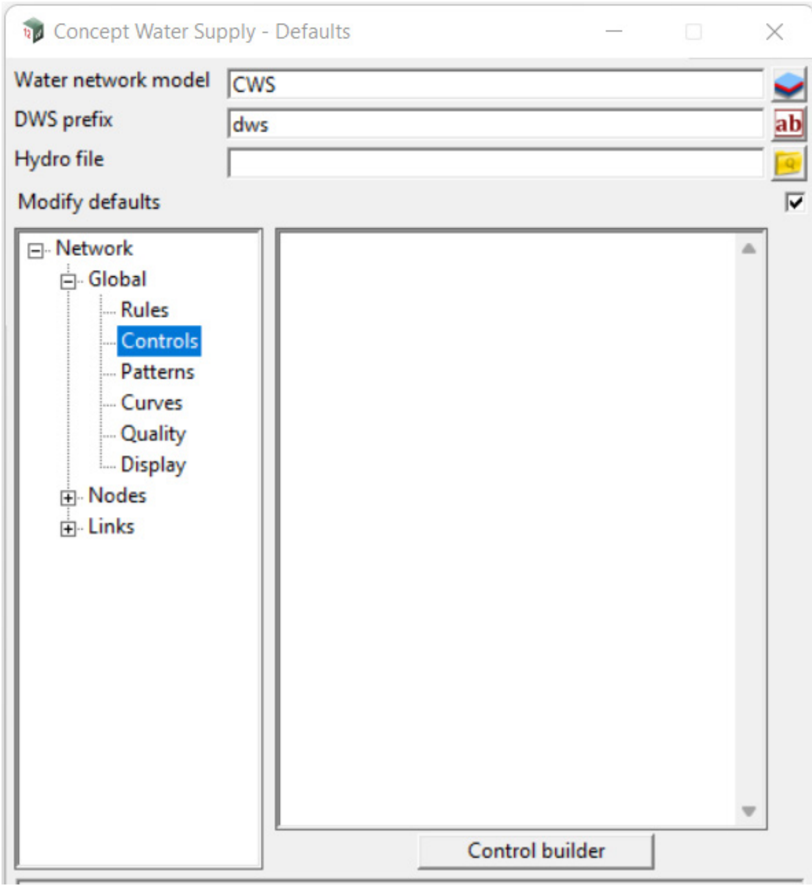


Rule builder button

Opens the DWS rule builder.

Controls page

The controls page contains an input box that allows users to modify links based on a single condition. This can be populated via the Control Builder, accessed from the associated button.

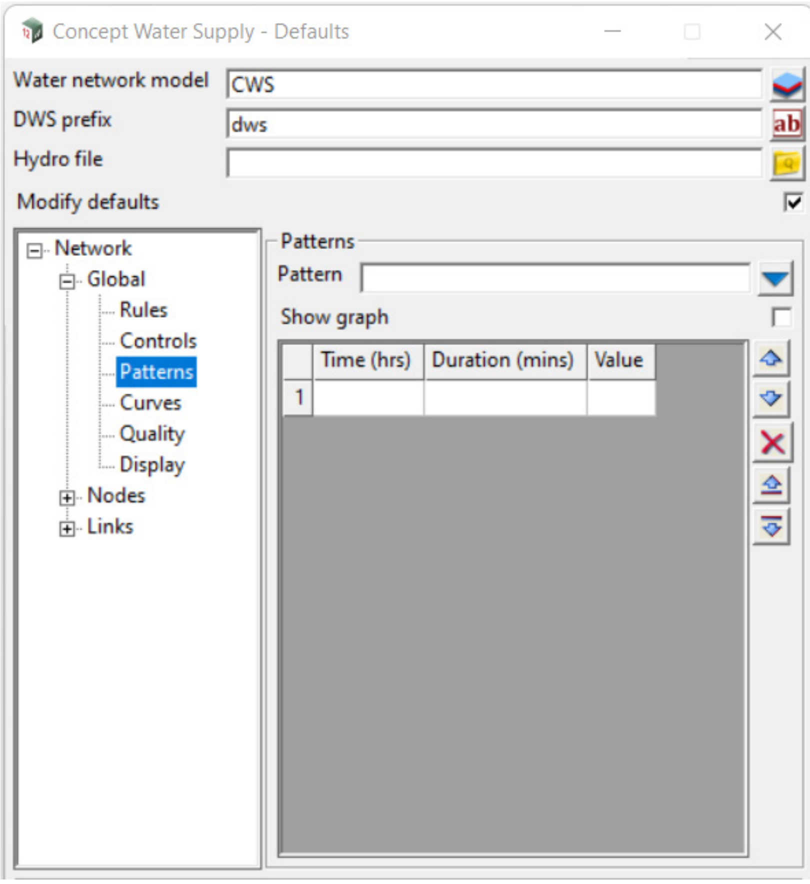


Control builder button

Opens the DWS control builder.

Patterns page

The patterns page allows users to view and graph various patterns associated with the selected hydro file (refer to Global).



Patterns

Pattern choice box

Select a pattern from the hydro file data.

Show graph tick box not ticked

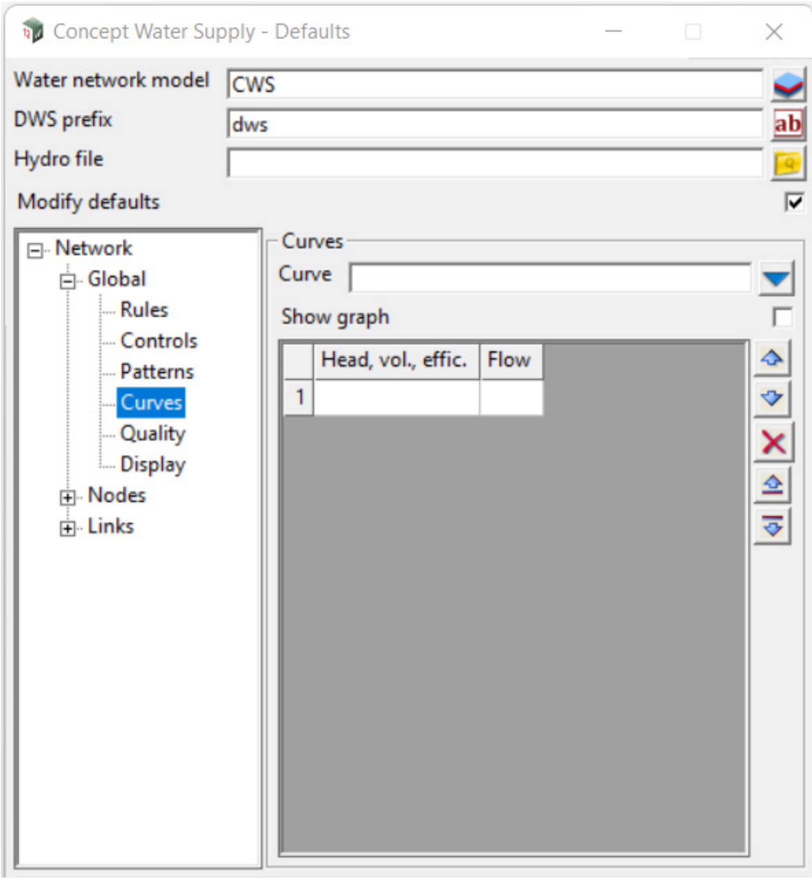
Display the graph associated with the selected pattern.

Grid box

Populated with data from the selected pattern in the "Pattern" choice box.

Curves page

The curves page allows users to view and graph various curves associated with the selected hydro file (refer to Global*).*



Curves

Curves choice box

Select a curve from the hydro file data.

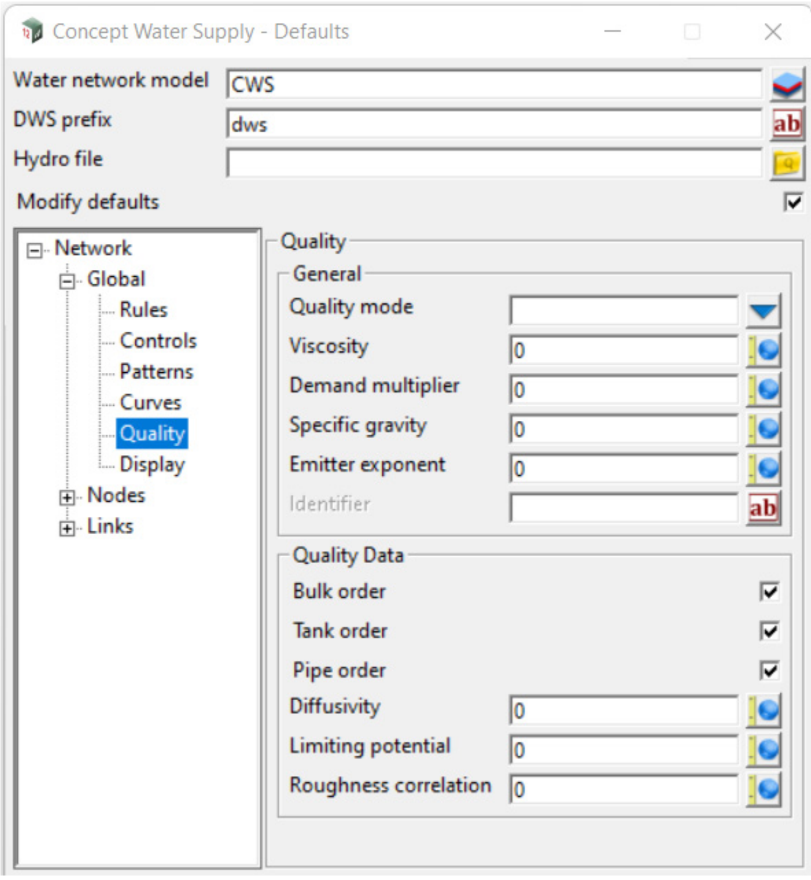
Show graph tick box not ticked

Display the graph associated with the selected curve.

Grid box

Populated with data from the selected pattern in the "Curve" choice box.

Quality page



Quality

General

Quality mode choice box None None, Chemical, Age, Trace

Default mode for modelling water quality.

Viscosity real box 0

Default kinematic viscosity.

Demand multiplier real box 0

Default multiplier for time-variant demand.

Specific Gravity real box 0

The ratio of fluid density to water at 4 degrees Celsius.

Emitter Exponent real box 0

The discharge pressure exponent.

Identifier Input box

The chemical or trace identifier.

Quality data

Bulk order tick box ticked

The kinetic reaction order in the bulk reaction equation.

Tank order tick box ticked

The kinetic reaction order in the tank reaction equation.

Pipe order	tick box	ticked

The kinetic reaction order in the pipe reaction equation.

Diffusivity	real box	0

The molecular diffusivity of the chemical being modelled.

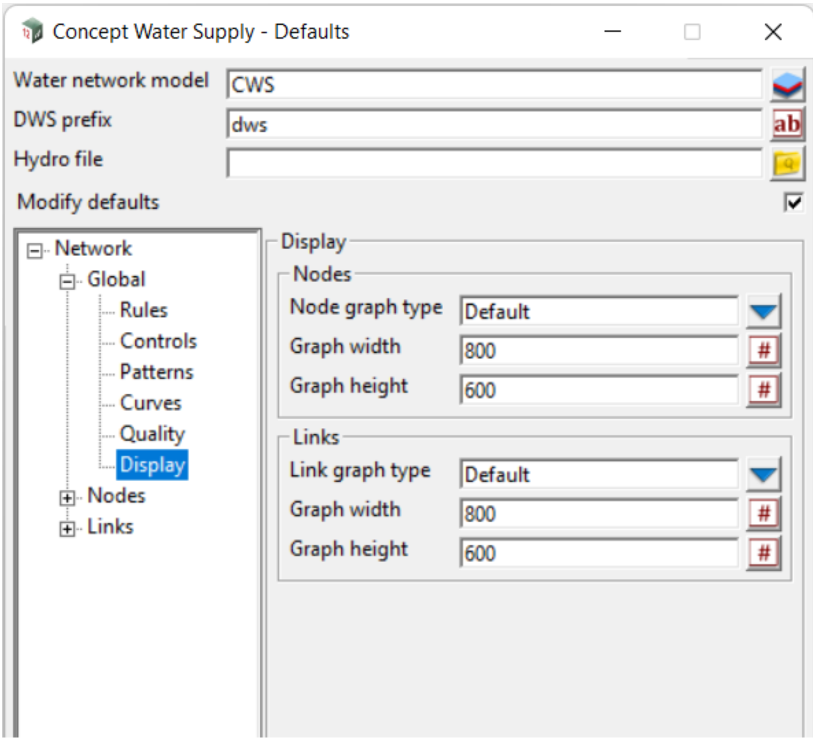
Limiting potential	real box	0

The limiting potential of reaction rates.

Roughness correlation	real box	0

The relation between reaction coefficients and specified Head loss equation.

Display page



Nodes

Node graph type	choice box	Default	Default, Demand, Elevation, Pressure, Quality, Dynamic Plan, All Node Results

Default graph type for nodes.

Graph width	integer box	800

Default node graph width.

Graph height	integer box	600

Default node graph height.

Links

Link graph type	choice box	Default

Default link graph type.

Graph width	integer box	800

Default link graph width.

Graph height	integer box	600

Default link graph height.

Nodes

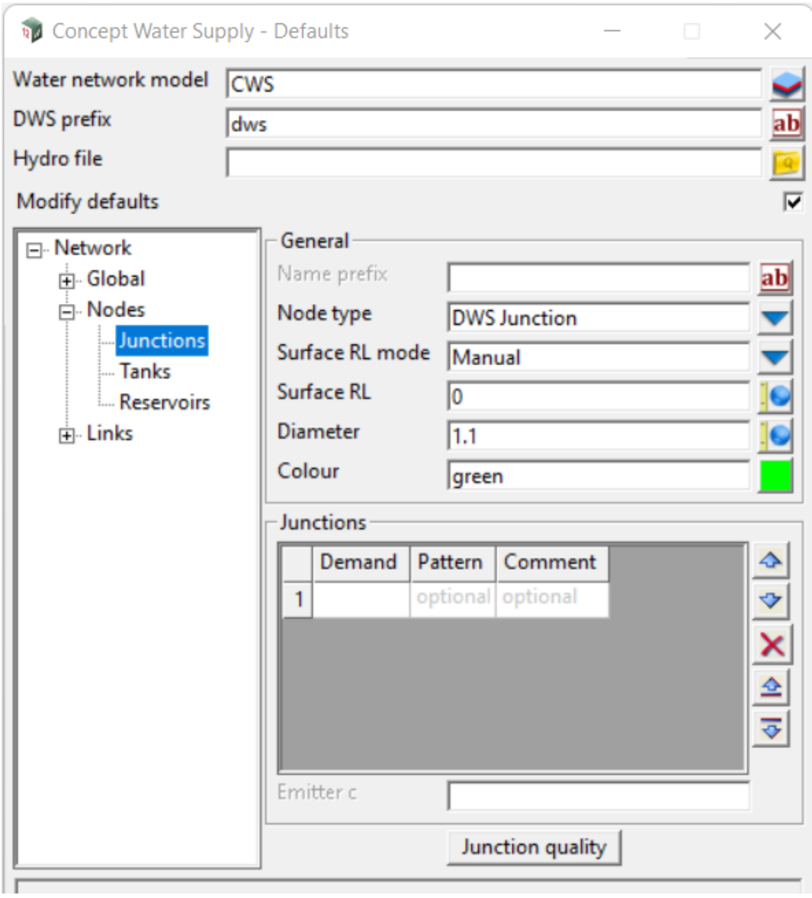
The **Junctions page**, **Tanks page** and **Reservoirs page** are described below.

See Junctions Page

See Tanks Page

See Reservoirs Page

Junctions Page



General

Name prefix input box

Default prefix for node naming (i.e. T1, T2…).

Node type choice box DWS Junction

Default drainage pit type for junction nodes.

Surface RL mode choice box Manual

Default mode for calculating surface reduced levels.

Surface RL real box 0

Default RL value (only valid if the mode is 'manual').

Diameter real box 1.1

Default junction diameter.

Colour colour box green available colours

Default junction diameter.

Junctions grid box

Default junction demand patterns.

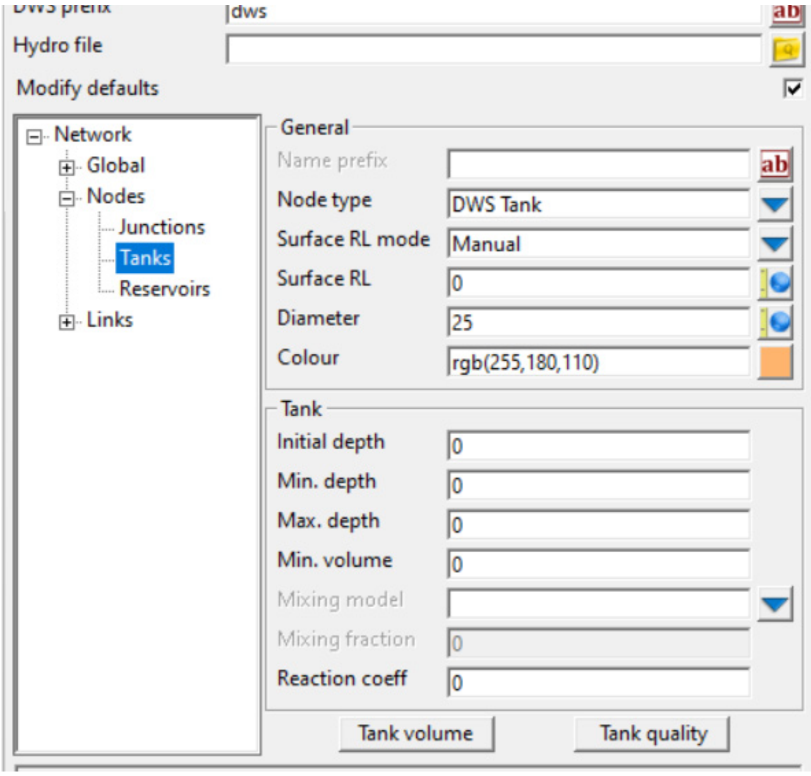
Emitter c real box

Default junction emitter coefficient.

Junctions quality button Quality panel

Opens the default quality panel for Junctions. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

Tanks Page



General

Name prefix input box

Default prefix for node naming (i.e. T1, T2…).

Node type choice box DWS Tank

Default drainage pit type for tank nodes.

Surface RL mode choice box Manual

Default mode for calculating surface reduced levels.

Surface RL real box 0

Default RL value (only valid if the mode is 'manual').

Diameter real box 25

Default tank diameter.

Colour colour box rgb(255,180,110) available colours

Default tank diameter.

Tank

Initial depth real box 0

Default tank initial depth.

Min. depth real box 0

Default tank minimum depth.

Max. depth real box 0

Default tank maximum depth.

Min. volume real box 0

Default tank minimum volume.

Mixing model choice box

Default tank mixing model.

Mixing fraction real box 0

Default tank mixing fraction.

Reaction Coeff real box 0

Default tank reaction coefficient.

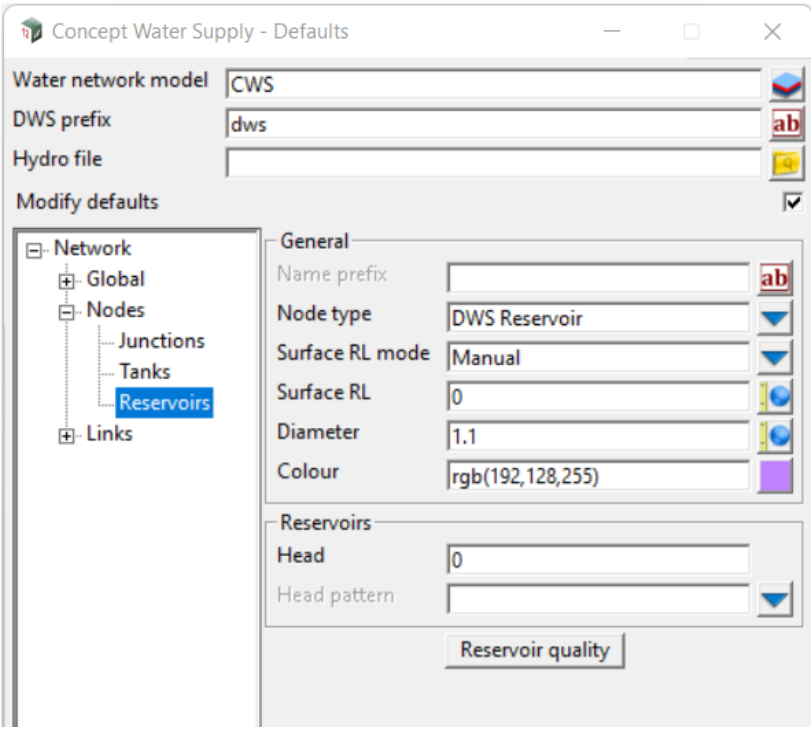
Tank volume button Tank Volume

Opens the tank volume panel. See 17.7.1.2 Tank Volume Panel.

Tank quality button Quality Panel

Opens the default quality panel for Tanks. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

Reservoirs Page



General

Name prefix input box

Default prefix for node naming (i.e. T1, T2…).

Node type choice box DWS Reservoir

Default drainage pit type for reservoirs nodes.

Surface RL mode choice box Manual

Default mode for calculating surface reduced levels.

Surface RL real box 0

Default RL value (only valid if the mode is 'manual').

Diameter real box 1.1

Default reservoir diameter.

Colour colour box rgb(192,128,255) available colours

Default reservoir diameter.

Reservoirs

Head real box

Default reservoir head flow.

Head pattern choice box

Default reservoir head pattern.

Reservoir quality button Quality panel

Opens the default quality panel for Reservoirs. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

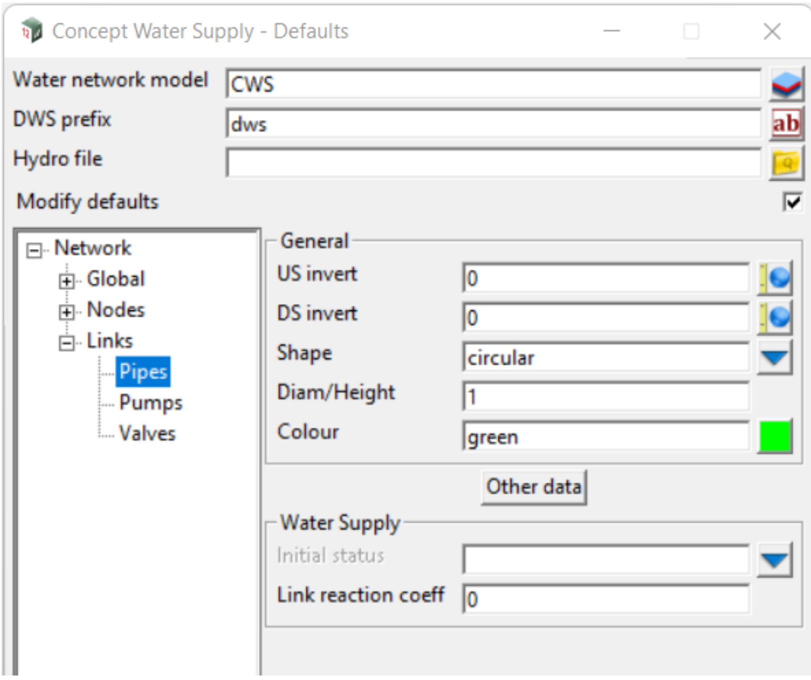
Links

The **Pipes page**, **Pumps page** and **Valves page** are described below.

See

[Pipes page](#)
[Pumps page](#)
[Valves page](#)

Pipes page



General

US invert real box 0

Default pipe upstream invert level.

DS invert real box 0

Default pipe downstream invert level.

Shape choice box Circular

Default pipe shape.

Diam/Height real box 1

Default pipe diameter.

Colour colour box green

Default pipe colour.

Other data button Link data

Opens additional link data defaults.

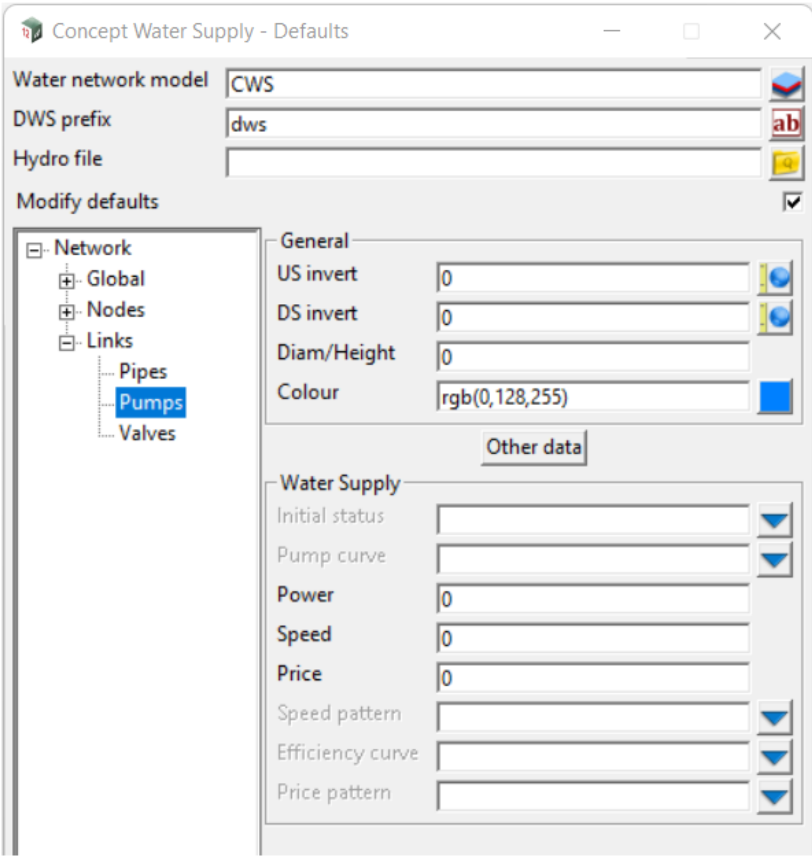
Initial status choice box

Default initial pipe status.

Link reaction coeff real box 0

Default link reaction coefficient.

Pumps page



General

US invert real box 0

Default pump upstream invert level.

DS invert real box 0

Default pump downstream invert level.

Diam/Height real box 1

Default pump diameter.

Colour colour box rgb(0,128,255)

Default pump colour.

Other data button Link data

Opens additional link data defaults.

Water supply

Initial status choice box

Default initial pump status.

Pump curve choice box

Default pump curve (populated by hydro file data).

Power real box 0

Default pump power.

Speed	real box	0

Default pump speed.

Price	real box	0

Default pump price.

Speed pattern choice box

Default pump speed pattern.

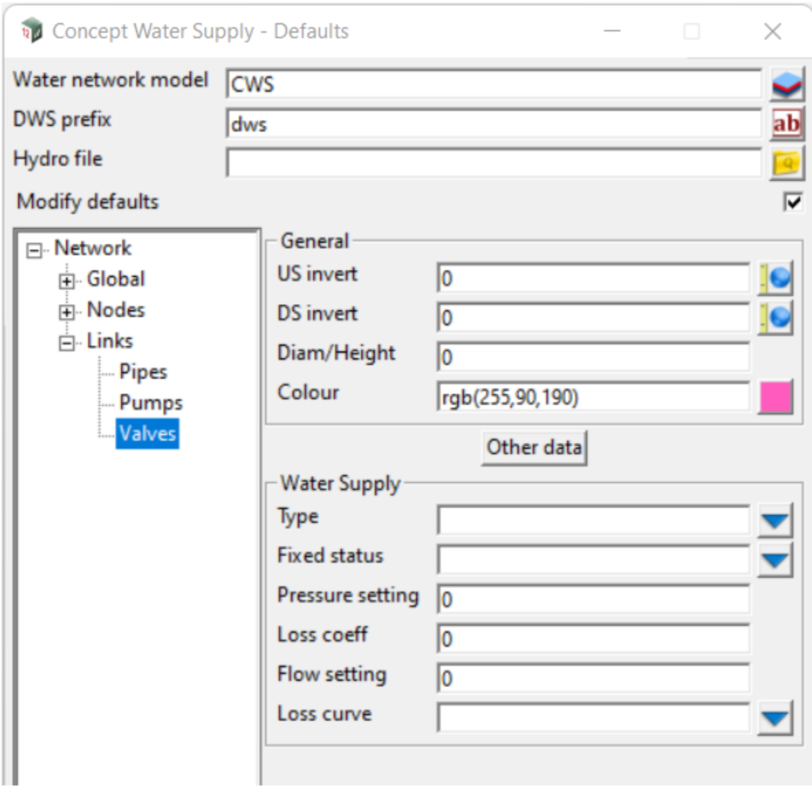
Efficiency curve choice box

Default pump efficiency curve.

Price pattern choice box

Default pump price pattern.

Valves page



General

US invert real box 0

Default valve upstream invert level.

DS invert real box 0

Default valve downstream invert level.

Diam/Height real box 1

Default valve diameter.

Colour colour box rgb(255,90,190)

Default valve colour.

Other data button Link data

Opens additional link data defaults.

Water supply

Type choice box Pressure breaker

Default water supply valve type.

Fixed status choice box Open

Default valve fixed status.

Pressure setting real box 0

Default pressure setting (only applicable for pressure valves).

Loss Coeff real box 0

Default loss coefficient (only applicable for throttle control valves).

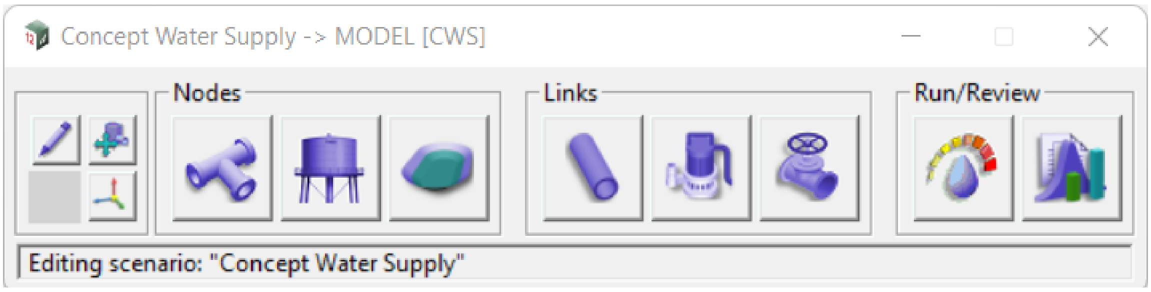
Flow setting real box 0

Default flow setting (only applicable for flow control valves).

Loss curve choice box

Default loss curve (only applicable for general purpose valves).

Main Panel



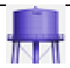
The main Concept Water Supply panel contains 4 separate subsections:

1. Tools
2. Nodes
3. Links
4. Run/Review

Many of the buttons on this panel have additional functionality for left [LB] middle [MB] and right [RB] mouse button clicks. Hovering over any button on the panel will show the button operations in the message box at the bottom of the panel in the format [LB] [MB] [RB]. For example, hovering over the 'Junction' button on the left side of the Nodes area will display:

<Junction> [create] [] [edit]

which indicates that a left mouse click will create a new junction node, middle mouse click will do nothing, and a right mouse click will allow editing of an existing node. All buttons and their corresponding mouse click operations are described below:

Image	Left Button Click	Middle Button Click	Right Button Click	Pop-Up
	Edit Node	Defaults Panel	Edit Link	
	Move Node			
	Grid Snapping	Snapping Options	Ortho snapping	
		NODES		
	Create junction node		Edit Node	
	Create tank node		Edit Node	
	Create reservoir node		Edit Node	
		LINKS		
	Create single segment pipe	Create multiple segment pipe	Edit Link	
	Create single segment pump	Create multiple segment pump	Edit Link	
	Create single segment valve	Create multiple segment valve	Edit Link	

Creating any of the objects (nodes/links) enters a selection state, where a location must be specified for the new object to be placed. Note that in CWS, link vertices that are not placed on existing nodes will automatically generate a node at the selected location. Editing nodes or links will also prompt a selection, after which an edit node/edit link panel will be opened.

The **Snapping Options Panel**, **Edit Junction Panel**, **Tank Page, Reservoirs Page, Pipes Page, Pumps Page** and **Valves Page** are described below.

See Snapping Options Panel

See Edit Junction Panel

See Tanks Page

See Reservoirs Page

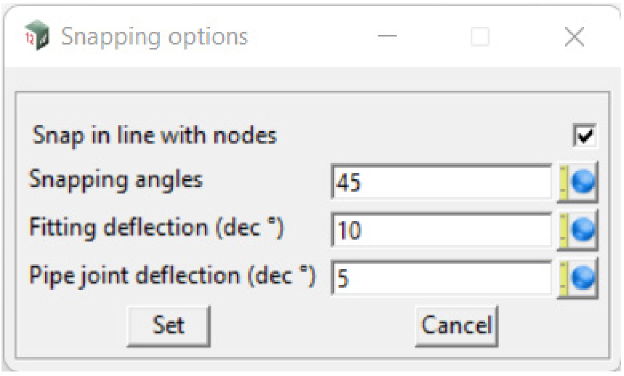
See Pipes Page

See Pumps Page

See Valves Page

Snapping Options Panel

Concept Water Supply provides a framework for automatically constraining link placements based on specified geometry or parameters.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Snap in line with nodes	tick box	ticked	

Based on the snapping type (grid/ortho), attempts to align node placement with existing node geometry. If snapping is set to grid, aligns along the x/y axes. If snapping is set to ortho, aligns along the angle made by the last created link.

Snapping angles	real box		

Only applies to the ***ortho snapping*** *mode. Attempts to align the next link created at specified degree increments from the previous link (i.e. every 45 degrees from the parallel).*

Fitting deflection	real box		

Only applies to the ***ortho snapping*** *mode. Allows a range of freedom (in degrees either side of the bend) when a snapping angle is set. Does not apply to pipes without any angle deflection.*

Pipe joint deflection	real box		

Only applies to the ***ortho snapping*** *mode. Allows a range of freedom (in degrees either side of the joint) for pipes travelling in a straight line. Only applies to pipes without any angle deflection.*

Buttons at Bottom

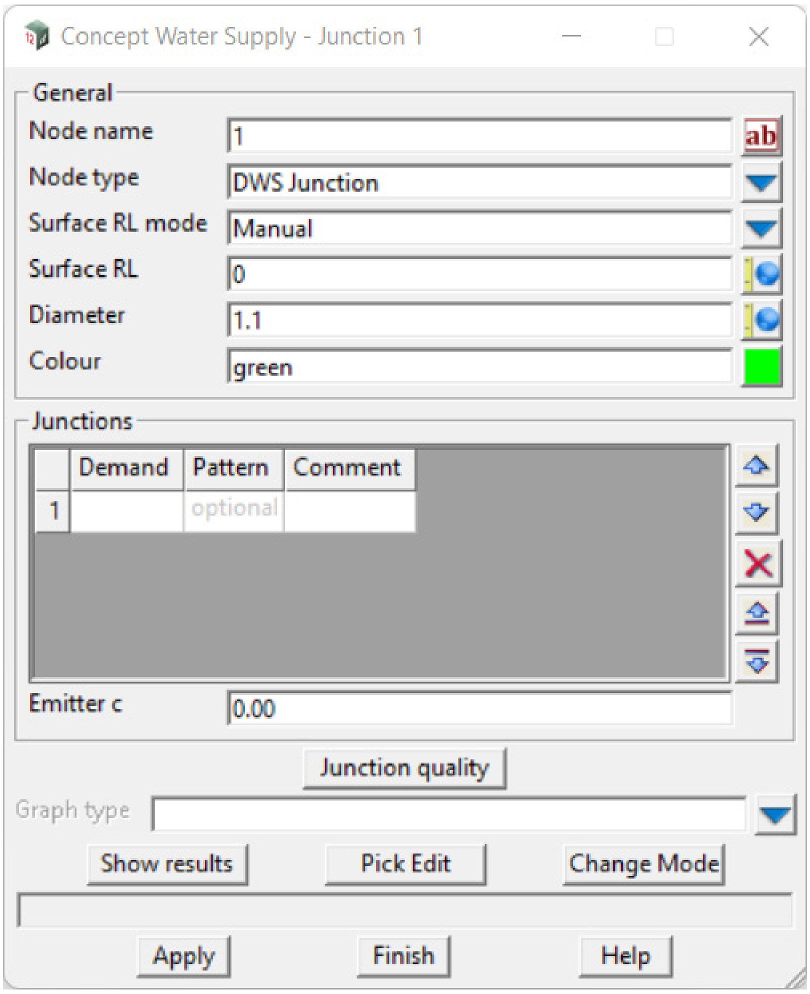
Set	button

Accept and return to the defaults panel.

Cancel	button

Closes the panel.

Edit Junction Panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Node name	input box		
The name of the currently selected node.			
Node type	choice box		
The type of the currently selected node.			
Surface RL mode	choice box		
The mode for calculating surface reduced levels.			
Surface RL	real box		
The RL value (only valid if the mode is 'manual').			
Diameter	real box		
The diameter of the currently selected node.			
Colour	colour box		available colours
The colour of the currently selected node.			

Junctions

Junctions grid box

The demand pattern for the currently selected node.

Emitter c real box

The emitter coefficient for the currently selected node.

Junctions quality button Quality panel

Opens the default quality panel for Junctions. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

Graph type choice box

Specifies the graph type for showing node results.

Show results button Node graph

Display the specified graph for the currently selected node.

Pick edit button

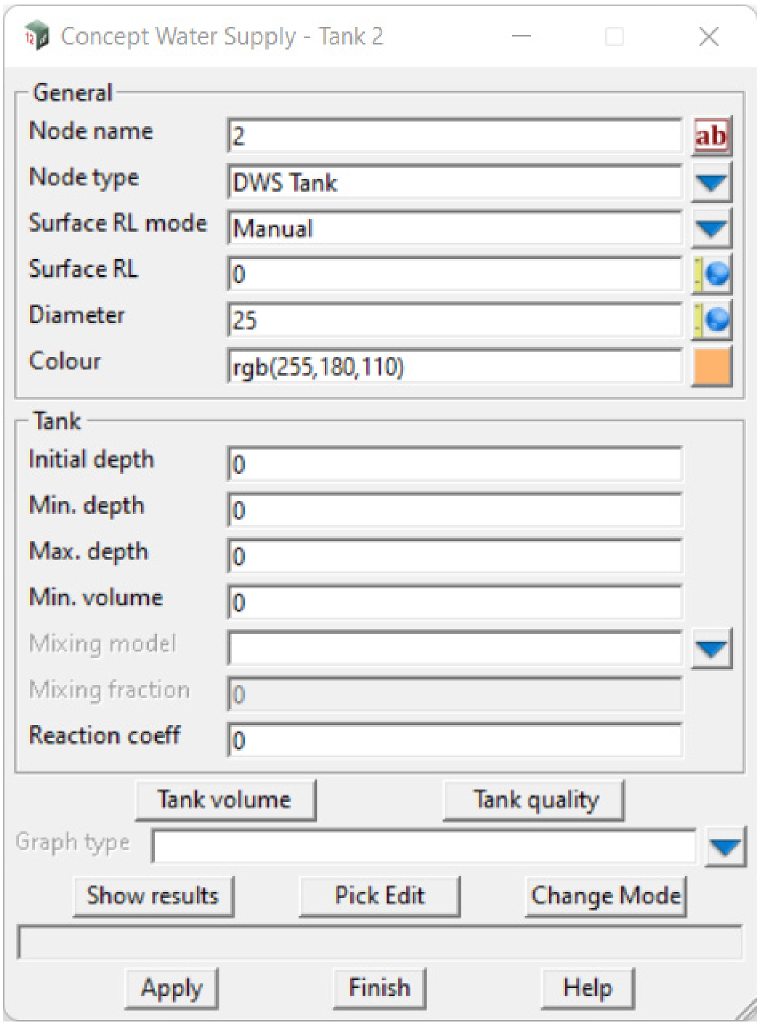
Select a different node.

Change mode button Change mode panel

Change the mode (junction/tank/reservoir) of the currently selected node. See 17.7.1.3 Change Mode: Nodes Panel.

See 17.7.2.3.3.1 Node Graph Type Results:.

Tanks Page



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

General

Name name	input box		

The name of the currently selected node.

Node type	choice box		

The type of the current tank.

Surface RL mode	choice box	Manual	

The mode for calculating surface reduced levels.

Surface RL	real box	0	

The RL value (only valid if the mode is 'manual').

Diameter	real box	25	

The diameter of the current tank.

Colour	colour box	rgb(225,180,110)	available colours

The colour of the current tank.

Tank

Initial depth	real box	0	

The initial depth of the current tank.

Min. depth	real box	0	

The minimum depth of the current tank.

Max. depth	real box	0	

The maximum depth of the current tank.

Min. volume	real box	0	

The minimum volume of the current tank.

Mixing model	choice box	2Comp	

The mixing model of the current tank.

Mixing fraction	real box	0	

The mixing fraction of the current tank.

Reaction Coeff	real box	0	

The reaction coefficient of the current tank.

Tank volume	button		Tank Volume

Opens the tank volume panel. See 17.7.1.2 Tank Volume Panel.

Tank quality	button		Quality Panel

Opens the quality panel for the currently selected tank. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

Graph type	choice box		

Specifies the graph type for showing node results.

Show results	button		Node graph

Display the specified graph for the currently selected node.

Pick edit	button		

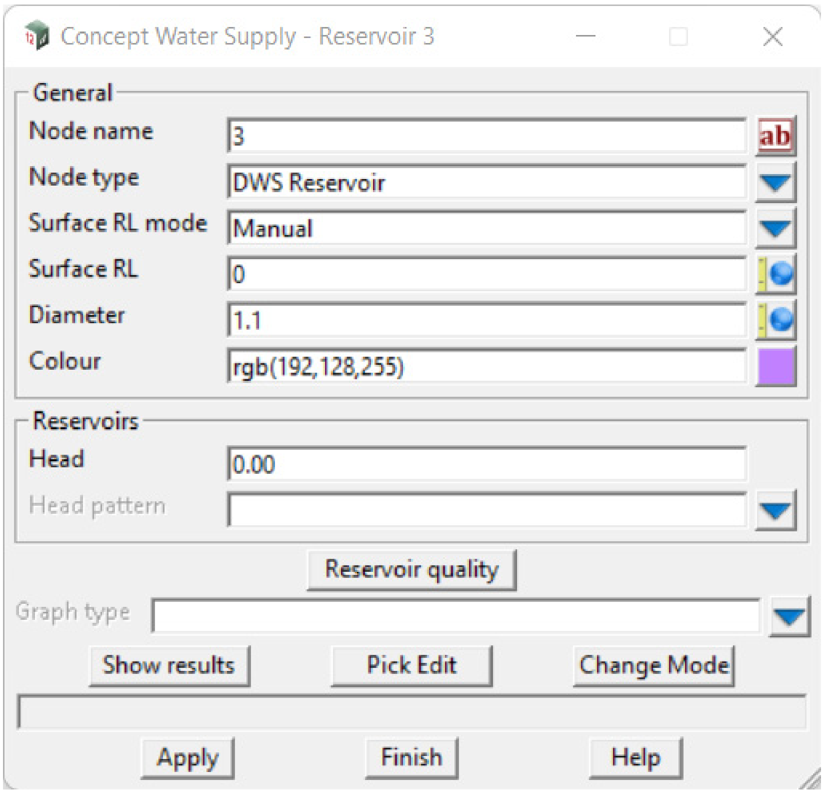
Select a different node.

Change mode	button		Change mode panel

Change the mode (junction/tank/reservoir) of the currently selected node. See 17.7.1.3 Change Mode: Nodes Panel.

See 17.7.2.3.3.1 Node Graph Type Results:.

Reservoirs Page



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
General			
Node name	input box		
The name of the current reservoir.			
Node type	choice box	DWS Reservoir	
The type of the current reservoir.			
Surface RL mode	choice box	Manual	
The mode for calculating surface reduced levels.			
Surface RL	real box	0	
The RL value (only valid if the mode is 'manual').			
Diameter	real box	1.1	
The diameter of the current reservoir.			
Colour	colour box	rgb(192,128,255)	available colours
The colour of the current reservoir.			
Reservoirs			
Head	real box		
The head flow of the current reservoir.			

Head pattern choice box

The head pattern of the current reservoir.

Reservoir quality button Quality panel

Opens the quality panel for the currently selected reservoir. See 17.7.1.1 Junction/Tank/Reservoir Quality Panel.

Graph type choice box

Specifies the graph type for showing node results.

Show results button Node graph

Display the specified graph for the currently selected node.

Pick edit button

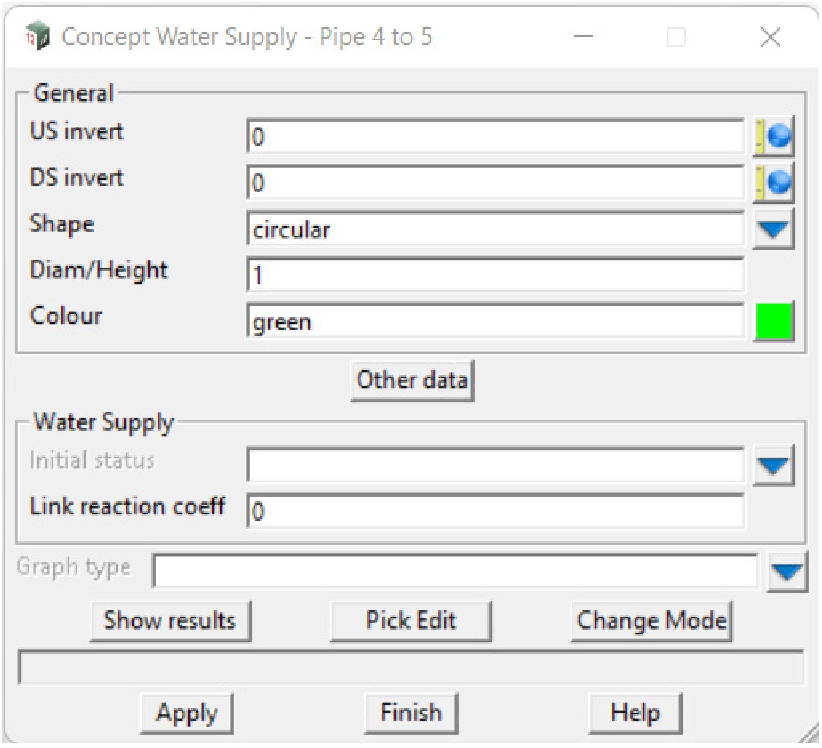
Select a different node.

Change mode button Change mode panel

Change the mode (junction/tank/reservoir) of the currently selected node. See 17.7.1.3 Change Mode: Nodes Panel.

See 17.7.2.3.3.1 Node Graph Type Results:.

Pipes Page



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
General			
US invert	real box	0	
The pipe upstream invert level.			
DS invert	real box	0	
The pipe downstream invert level.			
Shape	choice box	Circular	
The pipe shape.			
Diam/Height	real box	1	
The pipe diameter.			
Colour	colour box	green	
The pipe colour.			
Other data	button		Link data
Opens additional link data.			
Initial status	choice box		
The initial pipe status.			
Link reaction coeff	real box	0	
The pipe reaction coefficient.			

Graph type	choice box	

Specifies the graph type for showing link results.

Show results	button	Link graph

Display the specified graph for the currently selected link.

Pick edit	button	

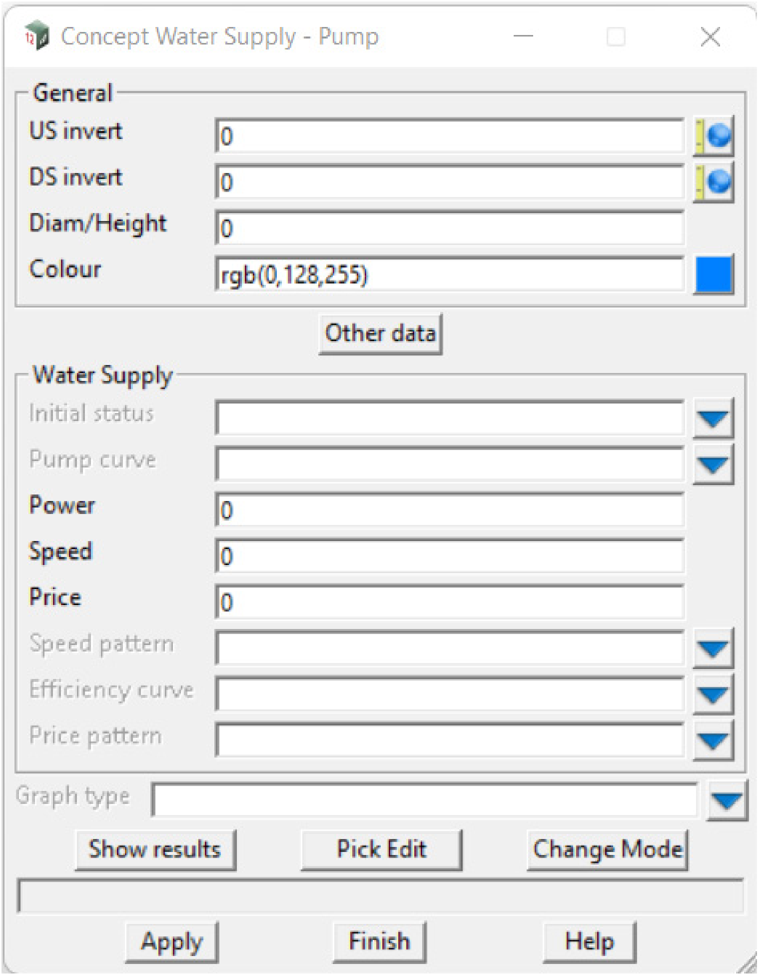
Select a different link.

Change mode	button	Change link panel

Change the mode (pipe/pump/valve) of the currently selected link. See 17.7.1.4 Change Mode: Links Panel.

See 17.7.2.3.3.2 Link Graph Type Results:.

Pumps Page



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
General			
US invert	real box	0	
The pump upstream invert level.			
DS invert	real box	0	
The pump downstream invert level.			
Diam/Height	real box	1	
The pump diameter.			
Colour	colour box	rgb(0,128,255)	
The pump colour.			
Other data	button		Link data
Opens additional link data.			
Water supply			
Initial status	choice box		

The initial pump status.

Pump curve	choice box		

The pump curve.

Power	real box	0	

The pump power.

Speed	real box	0	

The pump speed.

Price	real box	0	

The pump price.

Speed pattern	choice box		

The pump speed pattern.

Efficiency curve	choice box		

The pump efficiency curve.

Price pattern	choice box		

The pump price pattern.

Graph type	choice box		

Specifies the graph type for showing link results.

Show results	button		Link graph

Display the specified graph for the currently selected link.

Pick edit	button		

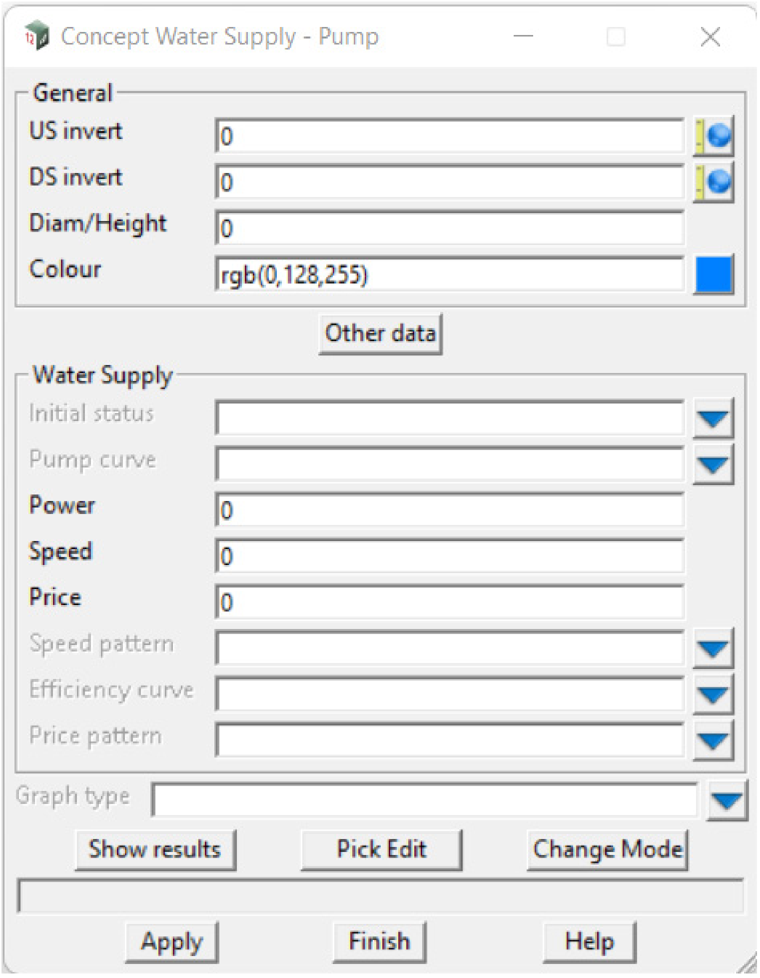
Select a different link.

Change mode	button		Change link panel

Change the mode (pipe/pump/valve) of the currently selected link. See 17.7.1.4 Change Mode: Links Panel.

See 17.7.2.3.3.2 Link Graph Type Results:.

Valves Page



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
General			
US invert	real box	0	
The valve upstream invert level.			
DS invert	real box	0	
The valve downstream invert level.			
Diam/Height	real box	1	
The valve diameter.			
Colour	colour box	rgb(255,90,190)	
The valve colour.			
Other data	button		Link data
Opens additional link data defaults.			
Water supply			

Type choice box Pressure breaker

Default water supply valve type.

Fixed status choice box Open

The valve fixed status.

Pressure setting real box 0

The pressure setting (only applicable for pressure valves).

Loss Coeff real box 0

The loss coefficient (only applicable for throttle control valves).

Flow setting real box 0

The flow setting (only applicable for flow control valves).

Loss curve choice box

The loss curve (only applicable for general purpose valves).

Graph type choice box

Specifies the graph type for showing link results.

Show results button Link graph

Display the specified graph for the currently selected link.

Pick edit button

Select a different link.

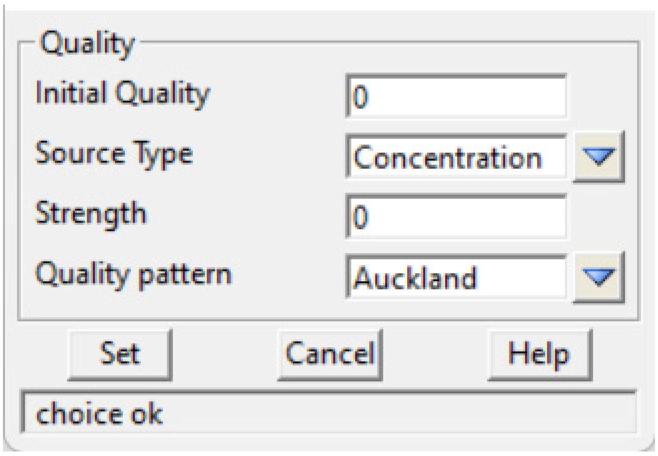
Change mode button Change link panel

Change the mode (pipe/pump/valve) of the currently selected link. See 17.7.1.4 Change Mode: Links Panel.

See 17.7.2.3.3.2 Link Graph Type Results:.

17.7.1.1 Junction/Tank/Reservoir Quality Panel

Note: This panel's layout is the same for **junctions**, **tanks**, and **reservoirs**. Despite this, the attributes associated with the fields in this panel are tracked separately across different pit types.



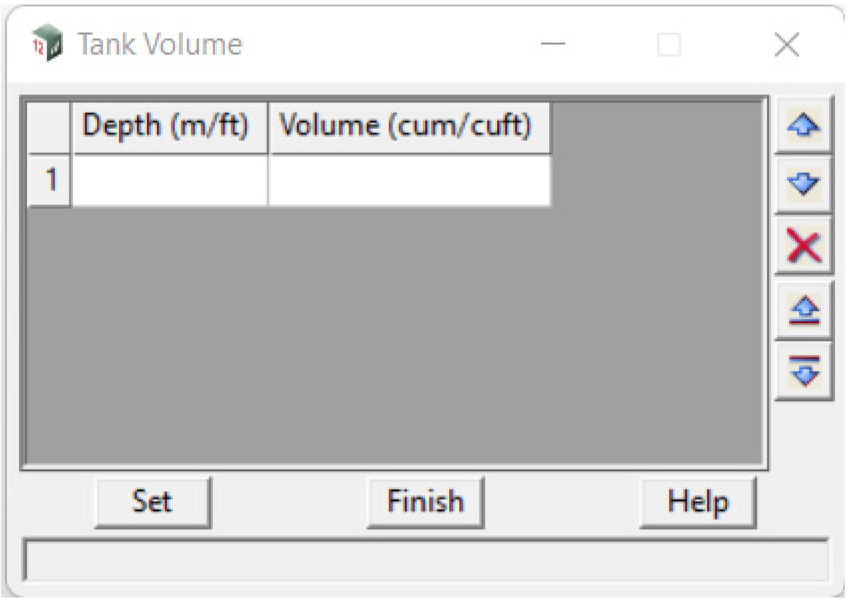
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Initial Quality	real box	0	
Default initial quality for selected pit type.			
Source type	choice box		
Default source type for selected pit type.			
Strength	real box	0	
Default source strength for selected pit type.			
Quality pattern	choice box		
Default source pattern for selected pit type.			

Buttons at Bottom

Set	button		
Accept and return to the defaults panel.			
Cancel	button		
Closes the panel.			
Help	button		12d reference manual
Access this document in the help manual.			

17.7.1.2 Tank Volume Panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Grid box	grid box		

Allows the user to specify tank volume parameters.

Buttons at Bottom

Set	button		

Accept and return to the defaults panel.

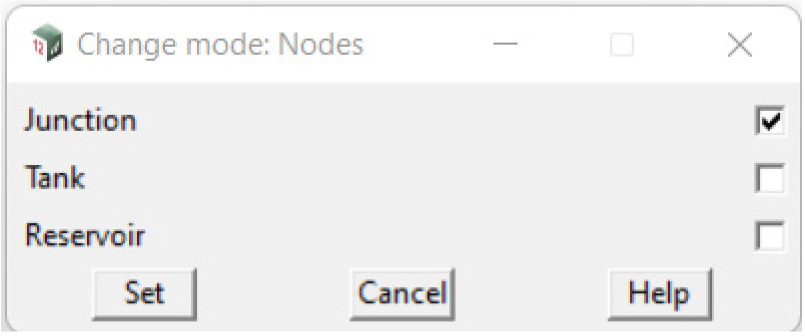
Cancel	button		

Closes the panel.

Help	button		12d reference manual

Access this document in the help manual.

17.7.1.3 Change Mode: Nodes Panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Junction	tick box		

Select junction as the new mode.

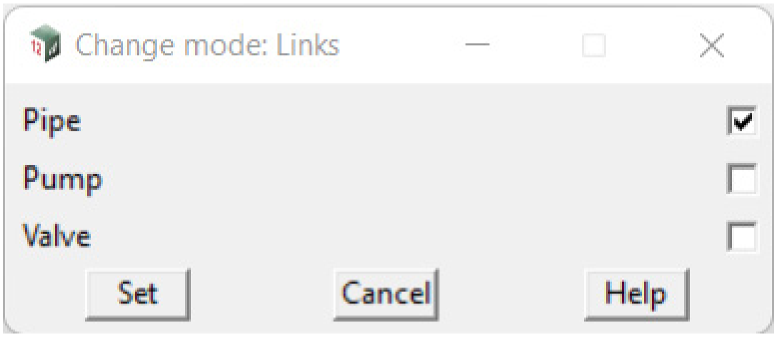
Tank	tick box		

Select tank as the new mode.

Reservoir	tick box		

Select reservoir as the new mode.

17.7.1.4 Change Mode: Links Panel



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Pipe	tick box		

Select pipe as the new mode.

Pump	tick box		

Select pump as the new mode.

Valve tick box

Select valve as the new mode.

17.7.1.5 Results Panel

See 17.7.2.3.3 DWS Results.

Continue to 17.7.2 Dynamic Water Supplyor 27 Water Theory or 18 Water 2D or return to 17.7 Water Supply or 17 Water.

17.7.2 Dynamic Water Supply

The ***Dynamic Water Supply*** (DWS) module is a ***12d Model*** option that performs extended period simulation of hydraulic and water quality behaviour within pressurized pipe networks.

A network consists of pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs. The flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network is computed during a simulation period comprised of 1 or more time steps. In addition to chemical species, water age and source tracing can also be simulated.

The module is designed to improve our understanding of the movement and fate of drinking water constituents within distribution systems. It can be used for many kinds of applications in distribution systems analysis. Sampling program design, hydraulic model calibration, chlorine residual analysis, and consumer exposure assessment are some examples. It can help assess alternative management strategies for improving water quality throughout a system.

These can include:

- *altering source utilization within multiple source systems,*
- *altering pumping and tank filling/emptying schedules,*
- *use of satellite treatment, such as re-chlorination at storage tanks*

and

- *targeted pipe cleaning and replacement.*

The ***Dynamic Water Supply*** module provides an integrated environment for editing network input data, running hydraulic and water quality simulations, and viewing the results in a variety of formats. These include colour-coded network maps, data tables, time series graphs, and contour plots.

17.7.2.1 Hydraulic Modelling Capabilities

Effective water reticulation modelling requires a full-featured and accurate hydraulic simulation package. The DWS module contains a state-of-the-art hydraulic analysis engine that includes the following capabilities:

- *places no practical limit on the size of the network that can be analysed*
- *computes friction headloss using the Hazen-Williams, Darcy-Weisbach, or Chezy-Manning formulas*
- *includes minor head losses for bends, fittings, etc.*
- *models constant or variable speed pumps*
- *computes pumping energy and cost*
- *models various types of valves including shutoff, check, pressure regulating, and flow control valves*
- *allows storage tanks to have any shape (i.e., diameter can vary with height)*
- *considers multiple demand categories at nodes, each with its own pattern of time variation*
- *models pressure-dependent flow issuing from emitters (sprinkler heads)*
- *can base system operation on both simple tank level or timer controls and on complex rule-based controls.*

17.7.2.2 Water Quality Modeling Capabilities

In addition to hydraulic modeling, the DWS module also provides the following water quality modelling capabilities:

- *models the movement of a non-reactive tracer material through the network over time*
- *models the movement and fate of a reactive material as it grows (e.g., a disinfection by-product) or decays (e.g., chlorine residual) with time*
- *models the age of water throughout a network*
- *racks the percent of flow from a given node reaching all other nodes over time*
- *models reactions both in the bulk flow and at the pipe wall*
- *uses nth order kinetics to model reactions in the bulk flow*
- *uses zero or first order kinetics to model reactions at the pipe wall*
- *accounts for mass transfer limitations when modeling pipe wall reactions*
- *allows growth or decay reactions to proceed up to a limiting concentration*
- *employs global reaction rate coefficients that can be modified on a pipe-by-pipe basis*
- *allows wall reaction rate coefficients to be correlated to pipe roughness*
- *allows for time-varying concentration or mass inputs at any location in the network*
- *models storage tanks as being either complete mix, plug flow, or two-compartment reactors.*

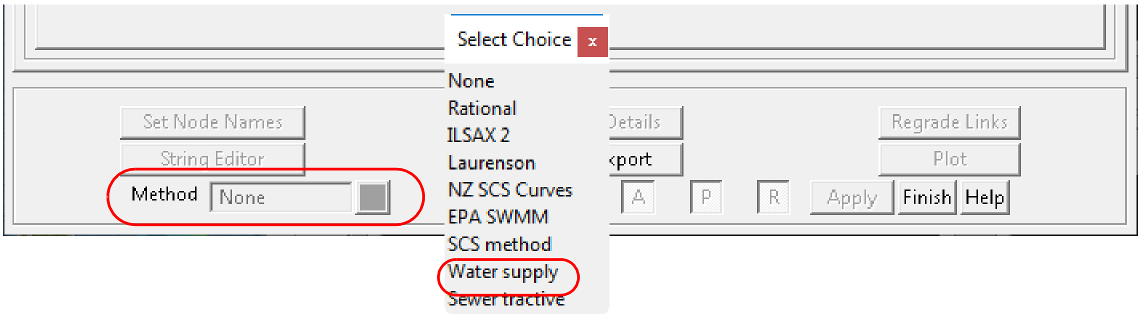
By employing these features, the designer can study such water quality phenomena as:

- *blending water from different sources*
- *age of water throughout a system*
- *loss of chlorine residuals*
- *growth of disinfection by-products*
- *tracking contaminant propagation events.*

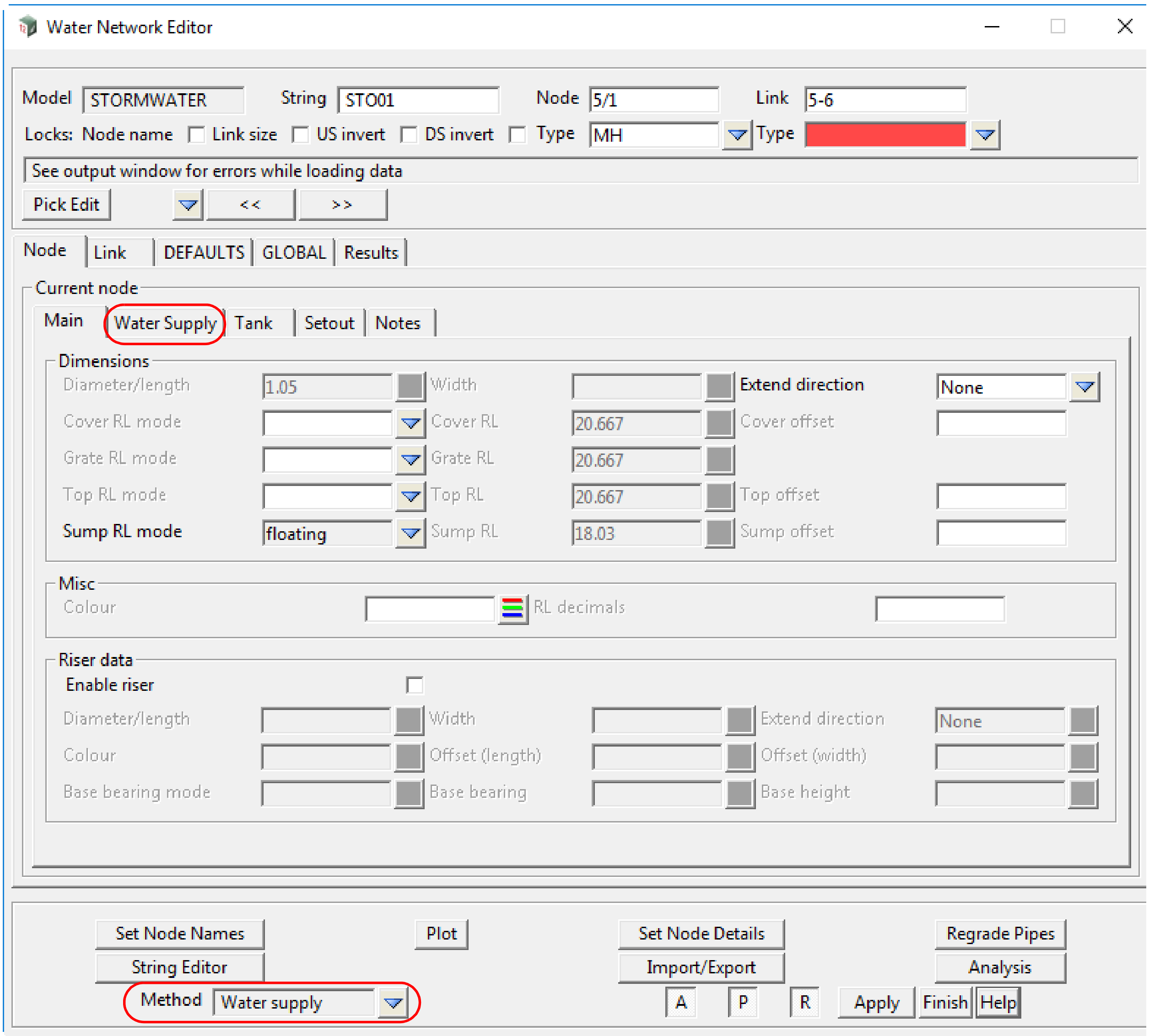
17.7.2.3 Water Network Editor for DWS

The ***Water Network Editor*** is used to create and modify data used by the Stormwater, Sanitary Sewer and Water Supply modules of ***12d Model***.

To create and analyse a Water Supply project, the water strings in the water model are all created with the **Purpose** field set to "Water Supply" and for the analysis, select **Water supply** from the **Method** choice box at the bottom of the WNE panel.



This will enable the **Water Supply** sections of the **Water Network Editor** and the tabs and fields will reflect what is required for **Dynamic Water Supply** analysis.



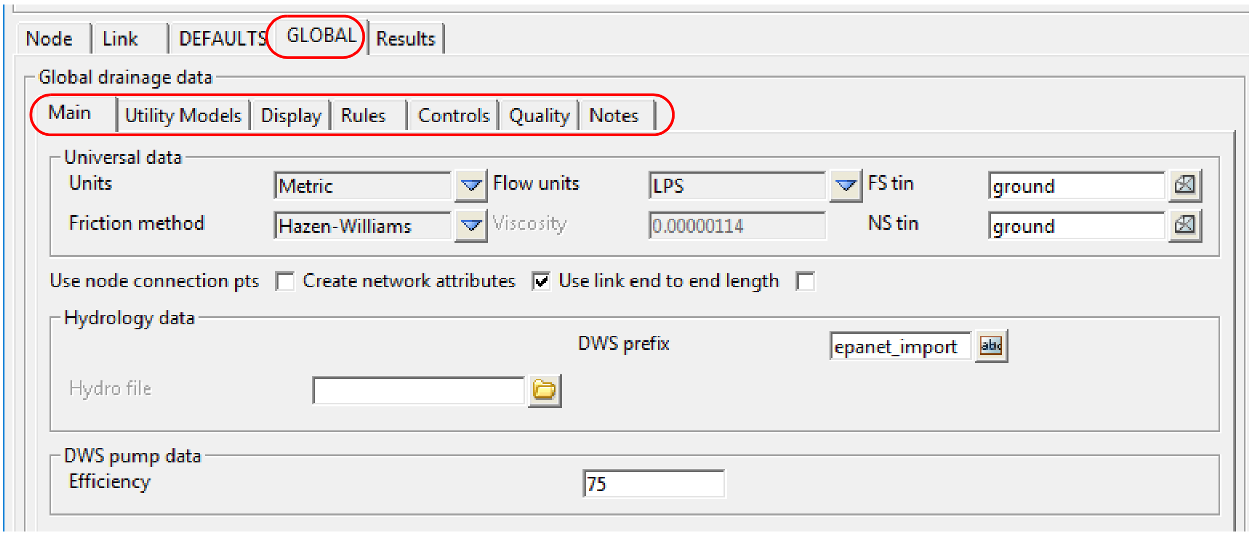
For information on the Water Supply tabs and fields, see

[17.7.2.3.1 WS Global Tab]

[17.7.2.3.2 Water Supply Network-specific Data - Nodes and Links]

17.7.2.3.1 WS Global Tab

When ***Water Supply*** is selected, the ***Global*** tab has a number of sub-tabs that allow various parameters to be set.

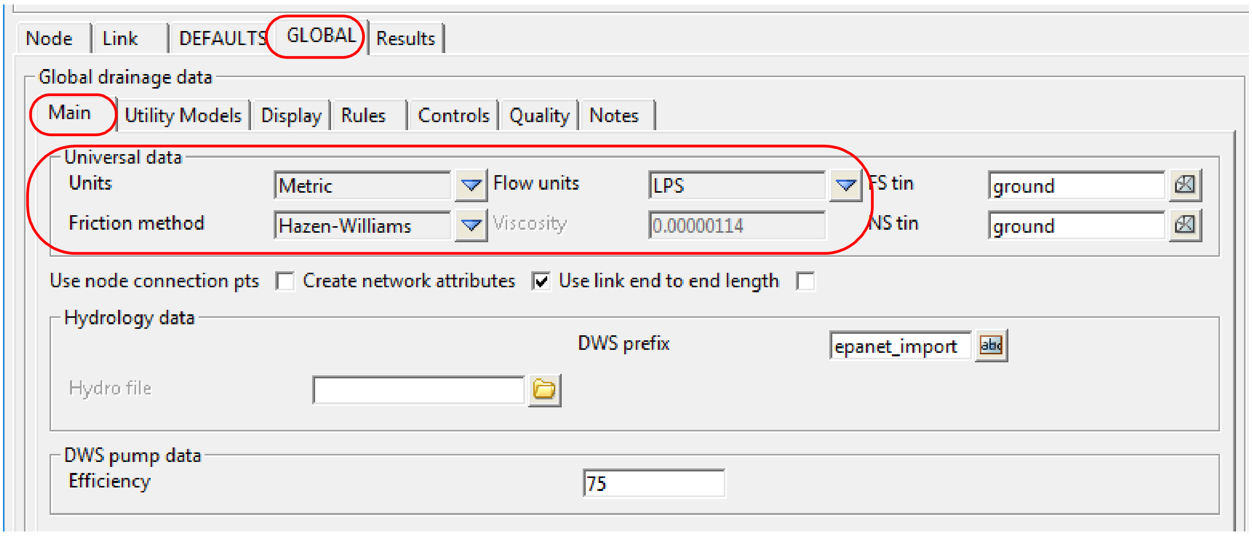


See

17.7.2.3.1.1 WS Global >Main
17.7.2.3.1.2 WS Global >Quality
17.7.2.3.1.3 WS Global >Rules
17.7.2.3.1.4 WS Global >Controls

17.7.2.3.1.1 WS Global >Main

When ***Water Supply*** is selected, the ***Global >Main*** tab allows various parameters to be set.



Units can be ***Metric*** or ***US***

Flow units can then be for ***Metric***:

LPS (litres / sec)
LPM (litres / min)
MLD (megalitres / day)
CMH (cubic meters / hr)
CMD (cubic meters / day)

or for ***US*** units,

CFS (cubic feet / sec)
GPM (gallons / min)
MGD (million gal / day)
IMGD (Imperial MGD)
AFD (acre-feet / day)

Friction method (Roughness) can be calculated using:

Hazen-Williams

the most commonly used method in water supply but is limited to water only

Darcy-Weisbach

the most academically correct method, which can also be used with fluids other than water (oil, LNG, milk, beer) but roughness coefficients not as readily available. This method is similar to Colebrook-White

Chezy-Manning

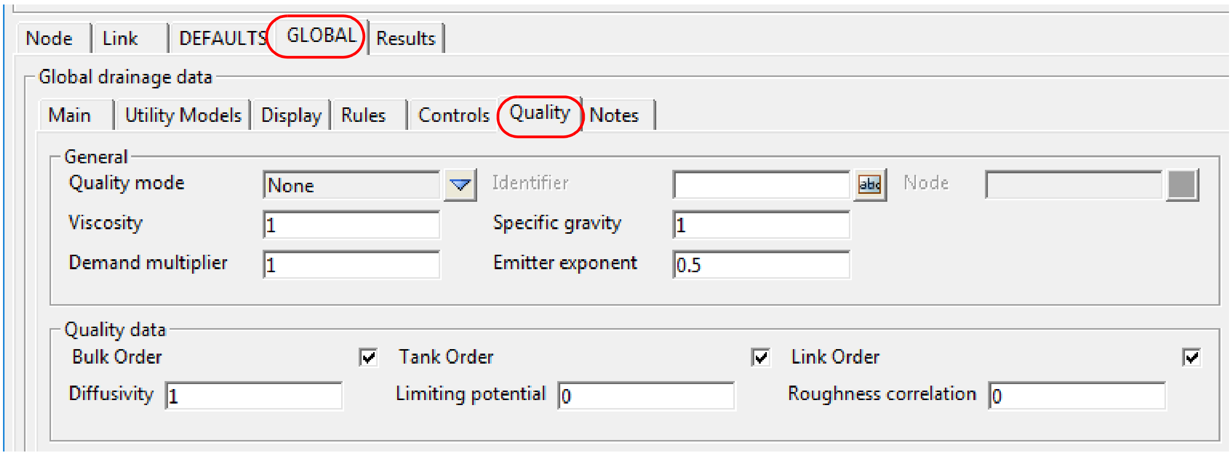
the most commonly used for open channel flow.

For more information on these method, see 17.7.2.3.2.2.1.3 Headloss Calculations for Pipes,

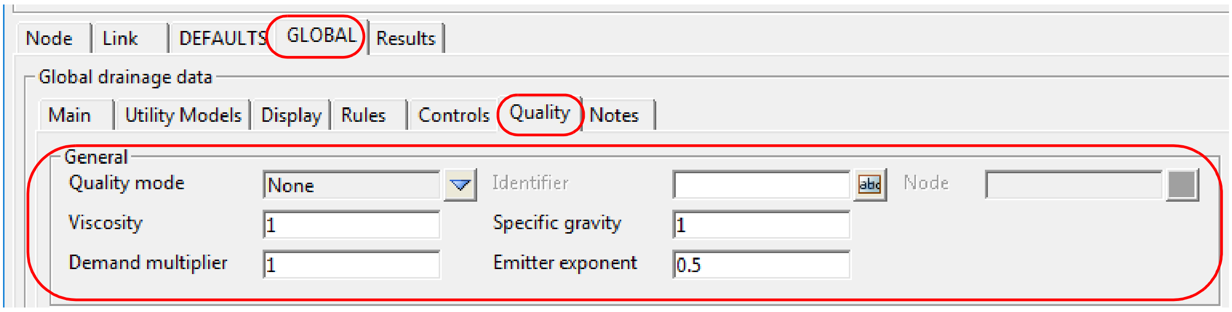
Continue to 17.7.2.3.1.2 WS Global >Quality

17.7.2.3.1.2 WS Global >Quality

When ***Water Supply*** is selected, the tab ***Global >Quality*** allows quality parameters to be set.



General section



Quality mode

The options available for modelling water quality are:

None - no water quality analysis is performed,

Chemical - the growth or decay of a substance can be tracked as it travels through a distribution system, For more information about ***Chemical***, see 17.7.2.3.1.2.1 More Information about Chemical.

Age - the time spent by a parcel of water in the network

In addition to chemical transport, the software can also model the changes in the age of water throughout a distribution system. Water age is the time spent by a parcel of water in the network. New water entering the network from reservoirs or source nodes enters with age of zero. Water age provides a simple, non-specific measure of the overall quality of delivered drinking water. Internally, the software treats age as a reactive constituent whose growth follows zero-order kinetics with a rate constant equal to 1 (i.e., each second the water becomes a second older).

Trace - tracks over time what percentage of water reaching any node in the network had its origin at a particular node. The source node is selected from the adjacent Node choice box.

The software can also perform source tracing. Source tracing tracks over time what percentage of water reaching any node in the network had its origin at a particular node. The source node can be any node in the network, including tanks or reservoirs. Internally, the software treats this node as a constant source of a non-reacting constituent that enters the network with a concentration of 100. Source tracing is a useful tool for analysing distribution systems drawing water from two or more different raw water supplies. It can show to what degree water from a given source blends with that from other sources, and how the spatial pattern of this blending changes over time.

The water distribution system is modelled as a collection of links connected to nodes. The links represent pipes, pumps, and control valves. The nodes represent junctions, tanks, and reservoirs.

If the **Quality mode** is ***Chemical*** or ***Trace*** a name (for example Chlorine for Chemical or Fluoride for Trace) can be entered in the adjacent **Identifier** box.

Viscosity is a ratio of the kinematic viscosity of fluid being modelled to that of water at 20 degrees Celsius (1.0 if you are modelling water)

Specific gravity is the ratio of the density of the fluid being modelled to that of water at 4 degrees Celsius (1.0 if you are modelling water)

Demand multiplier is used when the demand varies with time. The data entered is the name of the time pattern used to characterize time variation inflows (or outflows). The pattern provides multipliers that are applied to the base demand to determine actual demand in a given time period. The curve is defined in the Hydro file under Variable temporal patterns. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

Emitter Exponent is the discharge pressure exponent in the equation shown below.

Emitters are devices associated with junctions that model the flow through a nozzle or orifice that discharges to the atmosphere. The flow rate through the emitter varies as a function of the pressure available at the node:

$$q = Cp^{\gamma}$$

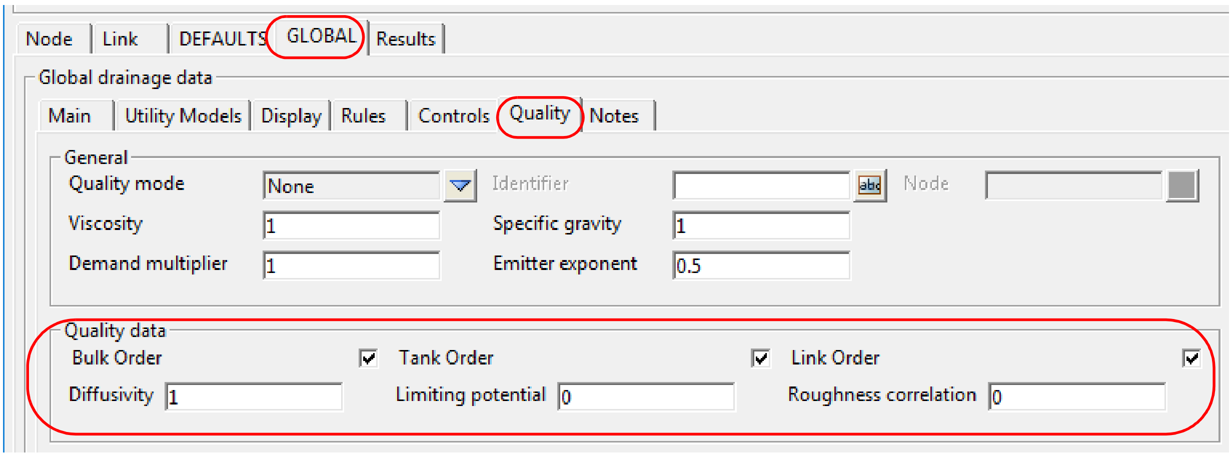
where
q = flow rate,
p = pressure,
C = discharge coefficient, and
γ = pressure exponent.

For nozzles and sprinkler heads γ equals 0.5 and the manufacturer usually provides the value of the discharge coefficient in units of $gpm/psi^{0.5}$ (stated as the flow through the device at a 1 psi pressure drop).

Emitters are used to model flow through sprinkler systems and irrigation networks. They can also be used to simulate leakage in a pipe connected to the junction (if a discharge coefficient and pressure exponent for the leaking crack or joint can be estimated) or compute a fire flow at the junction (the flow available at some minimum residual pressure). In the latter case one would use a very high value of the discharge coefficient (e.g., 100 times the maximum flow expected) and modify the junction's elevation to include the equivalent head of the pressure target

The discharge coefficient is entered at each node.

Quality data section



Bulk Order/Tank Order/Pipe Order is the kinetic reaction order in the respective Bulk, Pipe or Tank reaction equation (n = 0 or 1 depending on the status of the check box)

Diffusivity is the ratio of the molecular diffusivity of the chemical being modelled to that of chlorine at 20 degrees Celsius (0.00112 sq ft/day). Use 2 if the chemical diffuses twice as fast as chlorine, 0.5 if half as fast, etc. Applies only when modeling mass transfer for pipe wall reactions. Set to zero to ignore mass transfer effects.

Limiting potential specifies that reaction rates are proportional to the difference between the current concentration and some limiting potential value.

Roughness correlation will make all default pipe wall reaction coefficients be related to pipe roughness in the following manner

Head Loss Equation	***Roughness Correlation***
Hazen-Williams	$K_w = \frac{F}{C}$
Darcy-Weisbach	$K_w = \frac{-F}{log\left(\frac{e}{d}\right)}$
Chezy-Manning	$K_w = Fn$

where:

C = Hazen-Williams C-factor,

e = Darcy-Weisbach roughness,

d = pipe diameter,

n = Manning roughness coefficient, and

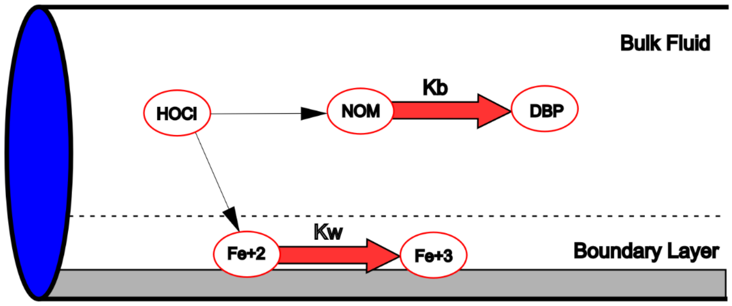
F = wall reaction - pipe roughness coefficient

The default value computed this way can be overridden for any pipe by supplying a specific value for the pipe.

Continue to 17.7.2.3.1.2.1 More Information about Chemical or 17.7.2.3.1.2 WS Global >Quality

17.7.2.3.1.2.1 More Information about Chemical

The DWS module can track the growth or decay of a substance as it travels through a distribution system. To do this, it needs to know the rate at which the substance reacts and how this rate might depend on its concentration. Reactions can occur both within the bulk flow and with material along the pipe wall as shown in the diagram,



In this example, free chlorine (HOCl) is shown reacting with natural organic matter (NOM) in the bulk phase and is also transported through a boundary layer at the pipe wall to oxidize iron (Fe) released from pipe wall corrosion. Bulk fluid reactions can also occur within tanks.

The software allows a modeller to treat these two reaction zones, Bulk and Wall, separately, the final result being the disinfection by-product (DPB).

Bulk Reactions

The software models reactions occurring in the bulk flow with n-th order kinetics, where the instantaneous rate of reaction (R in mass/volume/time) is assumed to be concentration-dependent according to:

$$R = K_b C^n$$

where:
K_b = a bulk reaction rate coefficient,
C = reactant concentration (mass/volume), and
n = a reaction order.

K_b has units of concentration raised to the (1-n) power divided by time. It is positive for growth reactions and negative for decay reactions.

The software can also consider reactions where a limiting concentration exists on the ultimate growth or loss of the substance. In this case the rate expression becomes

$$R = K_b(C_L - C)C^{(n-1)} \quad \text{for } n > 0,\ K_b > 0$$
$$R = K_b(C - C_L)C^{(n-1)} \quad \text{for } n > 0,\ K_b < 0$$

where:
C_L = the limiting concentration.

Thus, there are three parameters (K_b, C_L, and n) that are used to characterize bulk reaction rates. Some special cases of well-known kinetic models include the:

Model	***Parameters***	***Examples***
First-Order Decay	C_L = 0, K_b < 0, n = 1	Chlorine
First-Order Saturation Growth	C_L > 0, K_b > 0, n = 1	Trihalomethanes
Zero-Order Kinetics	C_L = 0, K_b <> 0, n = 0	Water Age
No Reaction	C_L = 0, K_b = 0	Fluoride Tracer

Wall Reactions

The rate of water quality reactions occurring at or near the pipe wall can be considered to be dependent on the concentration in the bulk flow by using an expression of the form:

$$R = \left(\frac{A}{V}\right) K_w C^n$$

where:

K_w = a wall reaction rate coefficient, and

$\left(\frac{A}{V}\right)$ = the surface area per unit volume within a pipe (equal to 4 divided by the pipe diameter).

The latter term converts the mass reacting per unit of wall area to a per unit volume basis. The software limits the choice of wall reaction order to either 0 or 1, so that the units of Kw are either mass/area/time or length/time, respectively.

As with Kb, Kw must be supplied by the modeller. First-order Kw values can range anywhere from 0 to as much as 5 ft/day.

Kw should be adjusted to account for any mass transfer limitations in moving reactants and products between the bulk flow and the wall. The software does this automatically, basing the adjustment on the molecular diffusivity of the substance being modelled and on the flow's Reynolds number. (Setting the molecular diffusivity to zero will cause mass transfer effects to be ignored.)

The wall reaction coefficient can depend on temperature and can also be correlated to pipe age and material. It is well known that as metal pipes age their roughness tends to increase due to encrustation and tuberculation of corrosion products on the pipe walls. This increase in roughness produces a lower Hazen-Williams C-factor or a higher Darcy-Weisbach roughness coefficient, resulting in greater frictional head loss in flow through the pipe.

There is some evidence to suggest that the same processes that increase a pipe's roughness with age also tend to increase the reactivity of its wall with some chemical species, particularly chlorine and other disinfectants. The software can make each pipe's Kw be a function of the coefficient used to describe its roughness. A different function applies depending on the formula used to compute head loss through the pipe:

Headloss Formula	***Wall Reaction Formula***
Hazen-Williams	$K_w = \frac{F}{C}$
Darcy-Weisbach	$K_w = \frac{-F}{log\left(\frac{e}{d}\right)}$
Chezy-Manning	$K_w = Fn$

where:

C = Hazen-Williams C-factor,

e = Darcy-Weisbach roughness,

d = pipe diameter,

n = Manning roughness coefficient, and

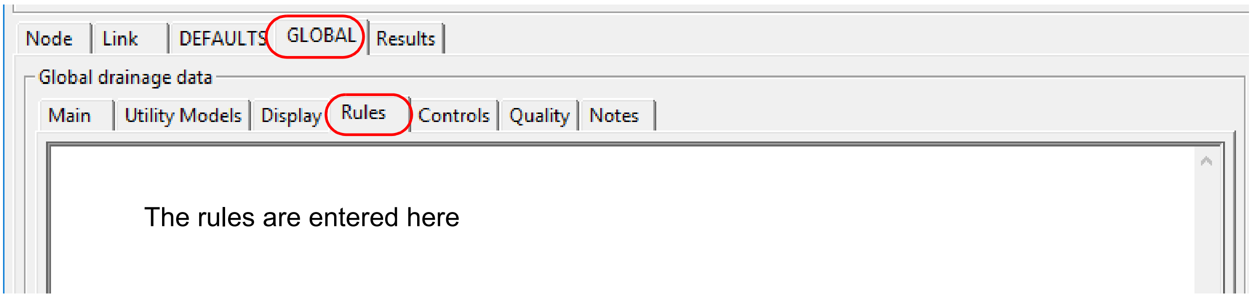
F = wall reaction - pipe roughness coefficient

The coefficient F must be developed from site-specific field measurements and will have a different meaning depending on which head loss equation is used. The advantage of using this approach is that it requires only a single parameter, F, to allow wall reaction coefficients to vary throughout the network in a physically meaningful way.

Continue to 17.7.2.3.1.3 WS Global >Rules or return to 17.7.2.3.1.2 WS Global >Quality

17.7.2.3.1.3 WS Global >Rules

Selecting the tab ***Global >Rules*** allows the typing in Rules for the network.



Rule-Based Controls allow link status and settings to be based on a combination of conditions that might exist in the network after an initial hydraulic state of the system is computed.

See 17.7.2.3.1.3.1 Rule Format for Dynamic Water Supply for information on the Rules and several examples.

See 17.7.2.3.1.3.2 Dynamic Water Supply - Rule Builder for information on the Rule Builder panel.

Continue to 17.7.2.3.1.3.1 Rule Format for Dynamic Water Supply or 17.7.2.3.1.4 WS Global >Controls

17.7.2.3.1.3.1 Rule Format for Dynamic Water Supply

Each rule is a series of statements of the form:

RULE ruleID
IF condition_1
AND condition_2
OR condition_3
AND condition_4
etc.
THEN action_1
AND action_2
etc.
ELSE action_3
AND action_4
etc.
PRIORITY value

where:

ruleID = an ID label assigned to the rule
condition_n = a condition clause
action_n = an action clause
Priority = a priority value (e.g., a number from 1 to 5)

Condition Clause Format:

A condition clause in a Rule-Based Control takes the form of:

object id attribute relation value

where
object = a category of network object
id = the object's ID label
attribute = an attribute or property of the object
relation = a relational operator
value = an attribute value

Some example conditional clauses are:

JUNCTION 23 PRESSURE > 20
TANK T200 FILLTIME BELOW 3.5
LINK 44 STATUS IS OPEN
SYSTEM DEMAND >= 1500
SYSTEM CLOCKTIME = 7:30 AM

The **object** keyword can be any of the following:

NODE
LINK
SYSTEM
JUNCTION
PIPE
RESERVOIR

PUMP
TANK
VALVE

When **SYSTEM** is used in a condition no ID is supplied.

The following **attributes** can be used with **Node-type objects**:

DEMAND
HEAD
PRESSURE

The following **attributes** can be used with **Tanks**:

LEVEL
FILLTIME (hours needed to fill a tank)
DRAINTIME (hours needed to empty a tank)

The following **attributes** can be used with **Link-Type objects**:

FLOW
STATUS (OPEN, CLOSED, or ACTIVE)
SETTING (pump speed or valve setting)

The following **attributes** can be used with **SYSTEM objects**:

DEMAND (total system demand)
TIME (hours from the start of the simulation expressed either as a decimal number or in hours:minutes format)
CLOCKTIME (24-hour clock time with AM or PM appended)

Relation operators consist of the following:

= IS
<> NOT
< BELOW
> ABOVE
<= >=

Action Clause Format:

An action clause in a Rule-Based Control takes the form of:

object_id STATUS/SETTING IS *value*

where

object = LINK, PIPE, PUMP, or VALVE keyword
id = the object's ID label
value = a status condition (OPEN or CLOSED), pump speed setting, or valve setting

Some example action clauses are:

LINK 23 STATUS IS CLOSED
PUMP P100 SETTING IS 1.5
VALVE 123 SETTING IS 90

Remarks:

(a) Only the RULE, IF and THEN portions of a rule are required; the other portions are optional.

(b) When mixing AND and OR clauses, the OR operator has higher precedence than AND, i.e., IF A or B and C is equivalent to IF (A or B) and C.

If the interpretation was meant to be

IF A or (B and C)

then this can be expressed using two rules as in

IF A THEN ...

IF B and C THEN ...

(c) The **PRIORITY** value is used to determine which rule applies when two or more rules require that conflicting actions be taken on a link. A rule without a priority value always has a lower priority than one with a value. For two rules with the same priority value, the rule that appears first is given the higher priority.

Example 1:

This set of rules shuts down a pump and opens a by-pass pipe when the level in a tank exceeds a certain value and does the opposite when the level is below another value.

```
RULE 1
IF   TANK   1 LEVEL ABOVE 19.1
THEN PUMP 335 STATUS IS CLOSED
AND  PIPE 330 STATUS IS OPEN

RULE 2
IF   TANK   1 LEVEL BELOW 17.1
THEN PUMP 335 STATUS IS OPEN
AND  PIPE 330 STATUS IS CLOSED
```

Example 2:

These rules change the tank level at which a pump turns on depending on the time of day.

```
RULE 3
IF   SYSTEM CLOCKTIME >= 8 AM
AND  SYSTEM CLOCKTIME < 6 PM
AND  TANK 1 LEVEL BELOW 12
THEN PUMP 335 STATUS IS OPEN
RULE 4
IF   SYSTEM CLOCKTIME >= 6 PM
OR   SYSTEM CLOCKTIME < 8 AM
AND  TANK 1 LEVEL BELOW 14
THEN PUMP 335 STATUS IS OPEN
```

Continue to 17.7.2.3.1.3.2 Dynamic Water Supply - Rule Builder or 17.7.2.3.1.4 WS Global >Controls.

17.7.2.3.1.3.2 Dynamic Water Supply - Rule Builder

This option allows for definition of rule-based controls that modify links based on a combination of conditions, during analysis.

Each rule is a series of statements of the general form:

RULE ruleID

IF condition_1

AND condition_2

OR condition_3

AND condition_4

etc.

THEN action_1

AND action_2

etc.

ELSE action_3

AND action_4

etc.

PRIORITY value

where

ruleID	=	an ID label assigned to the rule
condition_#	=	a condition clause
action_#	=	an action clause
Priority	=	a priority value (e.g. a number from 1 to 5)

The rule builder is intended to assist with achieving the correct rule syntax, without requiring an in-depth knowledge of the rule format.

Notes:

1.Only the **RULE**, **IF** and **THEN** portions of a rule are required; the other portions are optional.

2.When mixing **AND** and **OR** clauses, the **OR** operator has a higher precedence than **AND**, i.e.

IF A or B and C

Is equivalent to

IF (A or B) and C

If the interpretation was intended to be

IF A or (B and C) then this would need to be expressed using two rules as in

IF A THEN …

IF B and C THEN …

3.The PRIORITY value is used to determine which rule applies when two or more rules require that conflicting actions be taken on a link. A rule without a priority value always has a lower priority than one with a value. For two rules with the same priority value, the rule that appears first is given the higher priority.

Condition Clause Format:

A condition clause in a Rule-Based Control takes the form of:

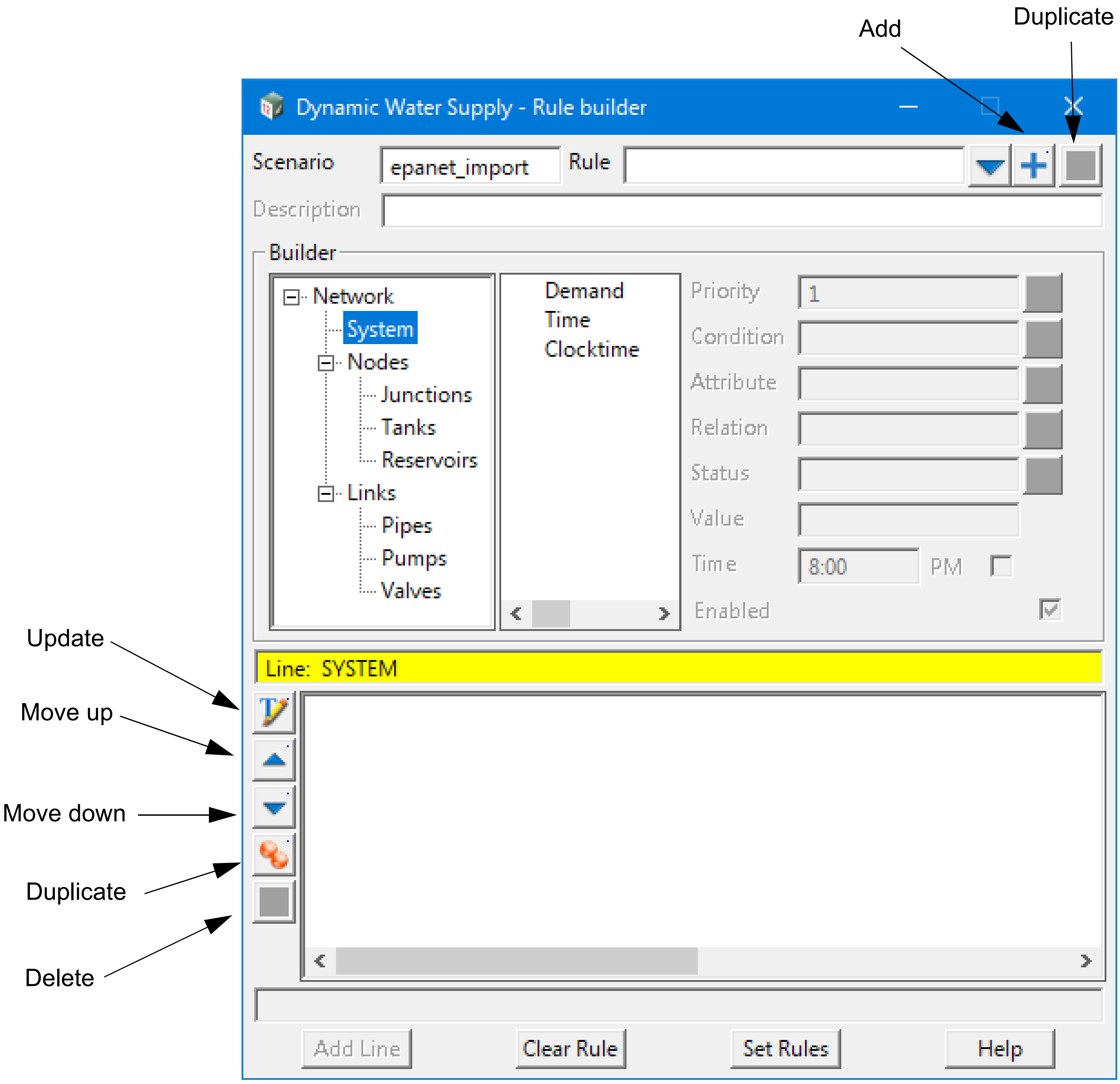
<object> <id> <attribute> <relation> <value>

where

object	=	a category of network object (i.e. NODE, JUNCTION, PUMP etc)

id	=	the object's ID label (not required for SYSTEM objects)
attribute	=	an attribute or property of the object
relation	=	a relational operator
value	=	an attribute value

After clicking the **Rule Builder** button on the Water Network Editor, the **Dynamic Water Supply - Rule Builder** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Scenario input box

The DWS prefix that was set in the WNE. Controls the attribute group that the rules and controls will be stored under for analysis. This is a read-only field.

Rule choice box

The rule name. A model can have as many rules as required to allow the analysis to operate in an effective and intended manner. Each.rule is required to have a unique ID. Rules already set can be selected via their ID here for review/editing.

Add Rule button

Prompts the user for a name and then creates a new rule with the name.

Duplicate Rule button

Prompts the user for a new name and then duplicates the currently selected rule with the new name.

Description input box

An optional description can be provided for the currently selected rule.

Priority choice box

<Not currently used - future development>

Condition choice box

Rule condition clause (Eg, IF, AND, OR, THEN, ELSE).

Attribute choice box

An attribute belonging to the condition clause. The attributes available depend on the object type related to the rule line that is being written.

For Node-type objects (Node, Junction, Reservoir) the following attributes can be used:

DEMAND

HEAD

PRESSURE

For Tanks the following attributes can be used:

LEVEL

FILLTIME (hours needed to fill a tank)

DRAINTIME (hours needed to empty a tank)

For Link-type objects (Pumps, Valves, Pipes) the following attributes can be used:

FLOW

STATUS

SETTING (pump speed or valve setting)

For a System object, the following attributes can be used:

DEMAND (total system demand)

TIME (hours from the start of simulation - decimal)

CLOCKTIME (12-hour clock time with AM or PM appended)

Relation choice box

The relation operator used for the condition clause. Relation operators consist of the following:

=

<>

<

>

<=

>=

IS

NOT

BELOW

ABOVE

Status choice box

Defines the status of selected links during the simulation. The status value can be OPEN or CLOSED. For control valves (i.e. PRVs, FCVs etc) this means that the valve is either fully opened or closed, not active at its control setting. The setting value can be a speed setting for pumps or a valve setting for valves. Check valves cannot have a preset status. Available choices are:

OPEN

CLOSED

SETTING

Value real box

Value to be used in the Condition clause (refer condition clause format at the top of this section).

Time input box

A time value, either the time since start of the simulation in decimal hours (i.e. 1.25) or the Clocktime in 12-hour format (i.e. 8:15).

PM tick box

Allows the user to choose AM or PM for a Clocktime object (not used for time since start of simulation).

Enabled tick box

Allows the user to disable a rule for analysis, without deleting the rule. Any disabled rules will not appear after returning to the WNE.

Update line button

Updates the currently selected line in the rule conditions list, with the values in the widgets on the panel.

Move up button

Moves the line currently selected in the rule conditions list, up one level.

Move down button

Moves the line currently selected in the rule conditions list, down one level.

Duplicate line button

Duplicates the line currently selected in the controls list box at the bottom of the list.

Delete line button

Deletes the line currently selected in the rule conditions list.

Buttons at Bottom

Add Line button

Adds the line being built, into the current rule. Not active until the line syntax has been correctly built.

Clear Rule button

Clears all lines from the current rule.

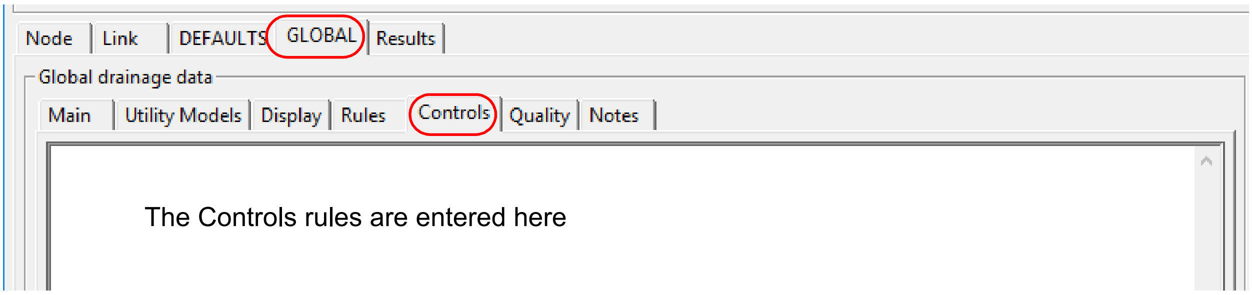
Set Rules button

Sets all of the rule data that has been modified in the panel and returns to the WNE for inclusion in the *model.*

Continue to 17.7.2.3.1.4 WS Global >Controls.

17.7.2.3.1.4 WS Global >Controls

Selecting the tab ***Global >Controls*** are rules that modify links based on a single condition.



Controls are rules that modify links based on a single condition. There is no limit on the number of simple control statements that can be used.

See 17.7.2.3.1.4.1 Controls Rule Format for Dynamic Water Supply for information on the Control Rules and several examples.

See 17.7.2.3.1.4.2 Dynamic Water Supply - Control Builder for information on the Control Builder panel.

Continue to 17.7.2.3.1.4.1 Controls Rule Format for Dynamic Water Supply.

17.7.2.3.1.4.1 Controls Rule Format for Dynamic Water Supply

Controls are rules that modify links based on a single condition. There is no limit on the number of simple control statements that can be used.

The format for the Controls rule are:

One line for each control which can be expressed in one of the following three forms:

LINK linkID status IF NODE nodeID ABOVE/BELOW value

LINK linkID status AT TIME time

LINK linkID status AT CLOCKTIME clocktime AM/PM

where:

linkID = a link ID label

status = OPEN or CLOSED, a pump speed setting, or a control valve setting

nodeID = a node ID label

value = a pressure for a junction or a water level for a tank

time = a time since the start of the simulation in decimal hours or in hours:minutes format

clocktime = a 24-hour clock time (hours:minutes)

Remarks:

(a) Simple controls are used to change link status or settings based on tank water level, junction pressure, time into the simulation or time of day.

(b) See the notes regarding status for conventions used in specifying link status and setting, particularly for control valves.

(c) Level controls are stated in terms of the height of water above the tank bottom, not the elevation (total head) of the water surface.

(d) Using a pair of pressure controls to open and close a link can cause the system to become unstable if the pressure settings are too close to one another. In this case using a pair of Rule-Based controls might provide more stability

Examples:

```
; Close Link 12 if the level in Tank 23 exceeds 20 ft.
LINK 12 CLOSED IF NODE 23 ABOVE 20

; Open Link 12 if pressure at Node 130 is under 30 psi
LINK 12 OPEN IF NODE 130 BELOW 30

; Pump PUMP02's speed is set to 1.5 at 16 hours into
; the simulation
LINK PUMP02 1.5 AT TIME 16

; Link 12 is closed at 10 am and opened at 8 pm
; throughout the simulation
LINK 12 CLOSED AT CLOCKTIME 10 AM
LINK 12 OPEN AT CLOCKTIME 8 PM
```

Continue to 17.7.2.3.1.4.2 Dynamic Water Supply - Control Builder or return to 17.7.2.3.1.4 WS Global >Controls

17.7.2.3.1.4.2 Dynamic Water Supply - Control Builder

This option allows for definition of controls that modify links based on a single condition, during analysis.

Each control is a single line statement of the general form:

LINK linkID status **IF NODE** nodeID **ABOVE/BELOW** value

LINK linkID status **AT TIME** time

LINK linkID status **AT CLOCKTIME** clocktime **AM/PM**

where

linkID	=	a link ID label
status	=	OPEN or CLOSED, a pump speed setting, or a control valve setting
nodeID	=	a node ID label
value	=	a pressure for a junction or a water level for a tank
time	=	a time since the start of the simulation in decimal hours
clocktime	=	a 12-hour clock time (hours:minutes)

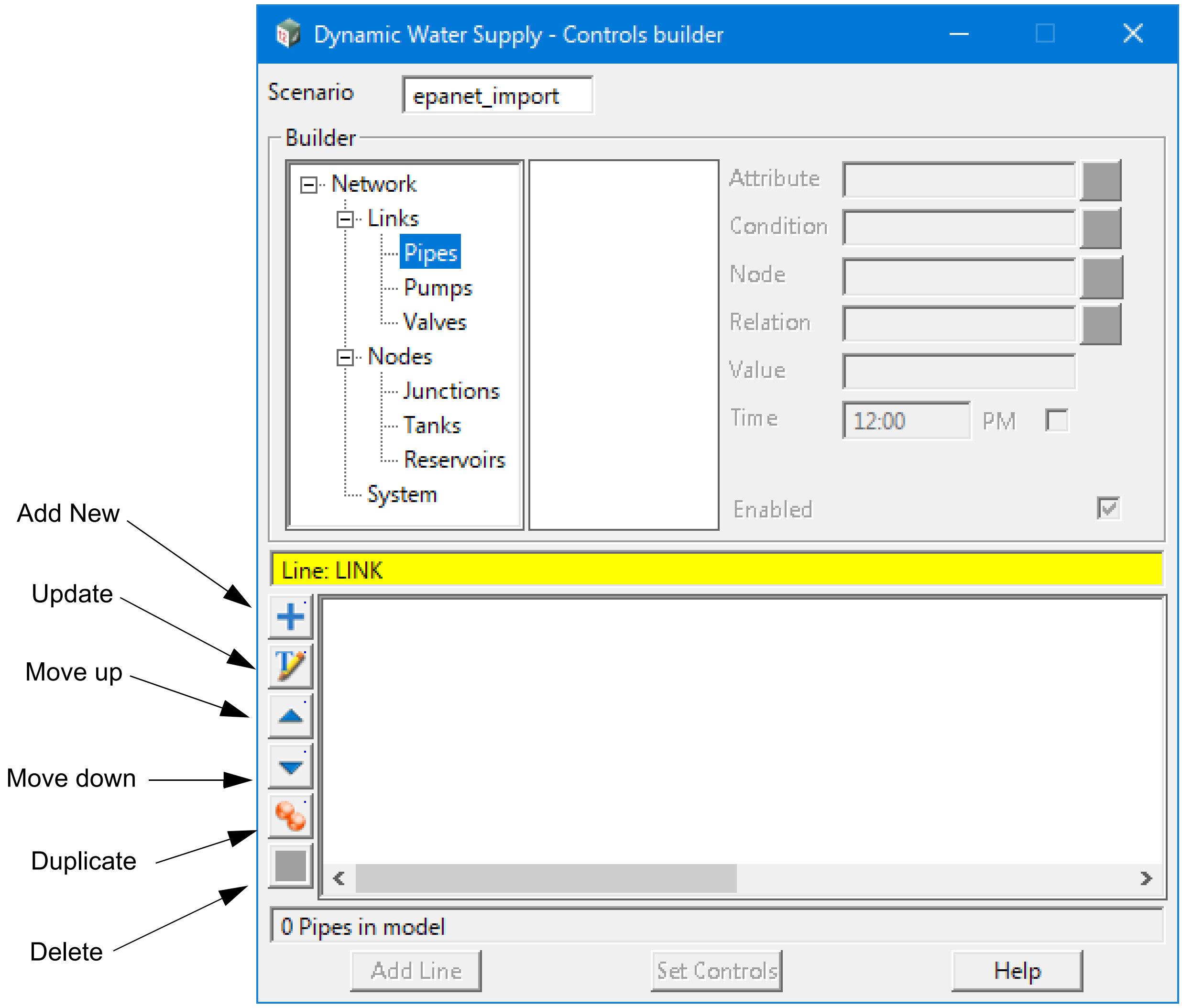
The rule builder is intended to assist with achieving the correct rule syntax, without requiring an in-depth knowledge of the rule format.

Notes:

1. Simple controls are used to change link status or settings based on tank water level, junction pressure, time into the simulation or time of day.

2. Refer to the section on Rule Builder in the subsection 'Status' for conventions used in specifying link status and setting, particularly for control valves.

After clicking the **Control Builder** button on the Water Network Editor, the **Dynamic Water Supply - Control Builder** panel.



he fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Scenario input box

The DWS prefix that was set in the WNE. Controls the attribute group that the rules and controls will be stored under for analysis. This is a read-only field.

Add Rule button

Prompts the user for a name and then creates a new rule with the name.

Attribute choice box

An attribute belonging to the condition clause. The attributes available depend on the object type related to the rule line that is being written.

For Node-type objects (Node, Junction, Reservoir) the following attributes can be used:

DEMAND

HEADPRESSURE

For Tanks the following attributes can be used:

LEVEL

FILLTIME (hours needed to fill a tank)

DRAINTIME (hours needed to empty a tank)

For Link-type objects (Pumps, Valves, Pipes) the following attributes can be used:

FLOW

STATUS

SETTING (pump speed or valve setting)

For a System object, the following attributes can be used:

DEMAND (total system demand)

TIME (hours from the start of simulation - decimal)

CLOCKTIME (12-hour clock time with AM or PM appended)

Condition choice box

Rule condition clause (IF or AT)

Node choice box

Allows the user to select the node that is to be used for evaluation of the control. Not required for TIME or CLOCKTIME controls.

Relation choice box

The relation operator used for the condition clause. Relation operators consist of the following:

ABOVE

BELOW

Not required for TIME or CLOCKTIME controls.

Value real box

Value to be used in the Condition clause (refer condition clause format at the top of this section). Not used for TIME or CLOCKTIME controls.

Time input box

A time value, either the time since start of the simulation in decimal hours (i.e. 1.25) or the Clocktime in 12-hour format (i.e. 8:15).

PM tick box

Allows the user to choose AM or PM for a Clocktime object (not used for time since start of simulation).

Enabled tick box

Allows the user to disable a control for analysis, without deleting the control. Any disabled controls will not appear after returning to the WNE.

after returning to the WNE.

Update line button

Updates the currently selected line (Control) in the controls list box with the values in the widgets on the panel.

Move up button

Moves the line currently selected in the controls list box, up one level.

Move down button

Moves the line currently selected in the controls list box, down one level.

Duplicate line button

Duplicates the line currently selected in the controls list box at the bottom of the list.

Delete line button

Deletes the line currently selected in the controls list box.

Buttons at Bottom

Add line button

Adds the line being built, into the current set of model controls. Not available until the line syntax has been correctly built.

Set Controls button

Sets all of the controls that have been modified in the panel and returns to the WNE for inclusion in the model.

Continue to 17.7.2.3.2 Water Supply Network-specific Data - Nodes and Links or return to 17.7.2.3.1.4 WS Global >Controls

17.7.2.3.2 Water Supply Network-specific Data - Nodes and Links

A ***Water Supply network*** consists of global data pertaining to the entire simulation area plus the physical data in the form of the pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs making up the model. The flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network is computed during a simulation.

See

17.7.2.3.2.1 WS Nodes
17.7.2.3.2.2 WS Links

17.7.2.3.2.1 WS Nodes

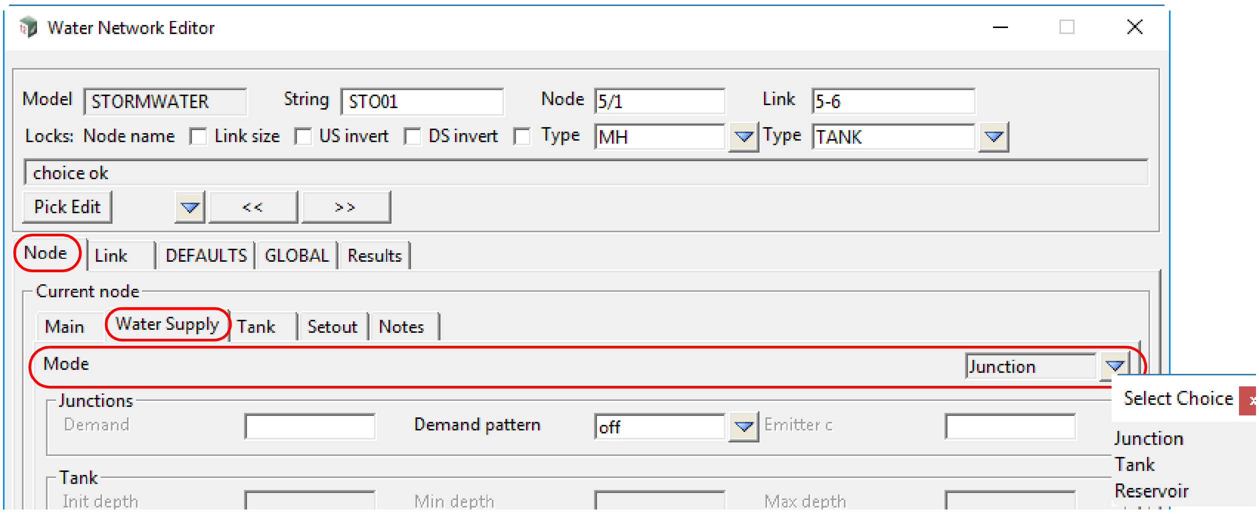
Nodes consist of:

Junctions which are points in the network where links join and where water enters or leaves the network,

Tanks which are nodes with storage capacity, where the volume of stored water can vary with time during a simulation, and

Reservoirs which are nodes that represent an infinite external source or sink of water.

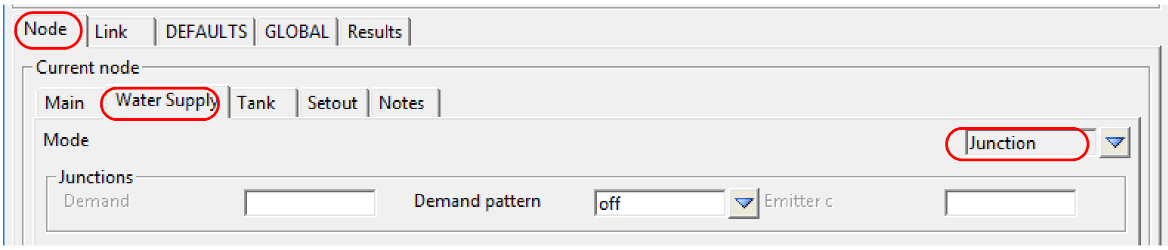
The ***Node type*** is chosen in the **Mode** choice box on the **Node >Water supply t**ab.



See

17.7.2.3.2.1.1 When Mode is Junction:
17.7.2.3.2.1.2 When Mode is Tank:
17.7.2.3.2.1.3 When Mode is Reservoir:

17.7.2.3.2.1.1 When Mode is Junction:



Junctions are points in the network where links join and where water enters or leaves the network. The basic input data required for junctions are:

elevation above some reference (usually mean sea level)

demand

demand pattern

emitters

initial quality

The **Output** results computed for junctions at all time periods of a simulation are:

Hydraulic head (internal energy per unit weight of fluid)

Pressure

Quality.

Defining a ***Junction*** uses information from a number of tabs:

See

17.7.2.3.2.1.1.1 Junction: Node >Water Supply

17.7.2.3.2.1.1.2 Junction: Node >Main

17.7.2.3.2.1.1.1 Junction: Node >Water Supply

The following values for a ***Junction*** are taken from the ***Node >Water Supply*** tab:

Demand

the base demand rate is the average or nominal demand for water by the main category of consumer at the junction, as measured in the current flow units. A negative value is used to indicate an external source of flow into the junction. (although the analysis engine supports any number of demands assigned to a junction, the DNE currently supports only one).

Demand pattern

Demand pattern is used to override the ***GLOBAL =>Quality =>Demand multiplier***.

The value entered is the name of the time pattern used to characterize time variation of inflows or outflows at this node. The pattern provides multipliers that are applied to the base demand to determine actual demand in a given time period. The curve is defined in the Hydro file under Variable temporal patterns. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

Emitter c

Emitters are devices associated with junctions that model the flow through a nozzle or orifice that discharges to the atmosphere. The flow rate through the emitter varies as a function of the pressure available at the node:

$$q = Cp^{\gamma}$$

where
q = flow rate,
p = pressure,
C = discharge coefficient, and
γ = pressure exponent.

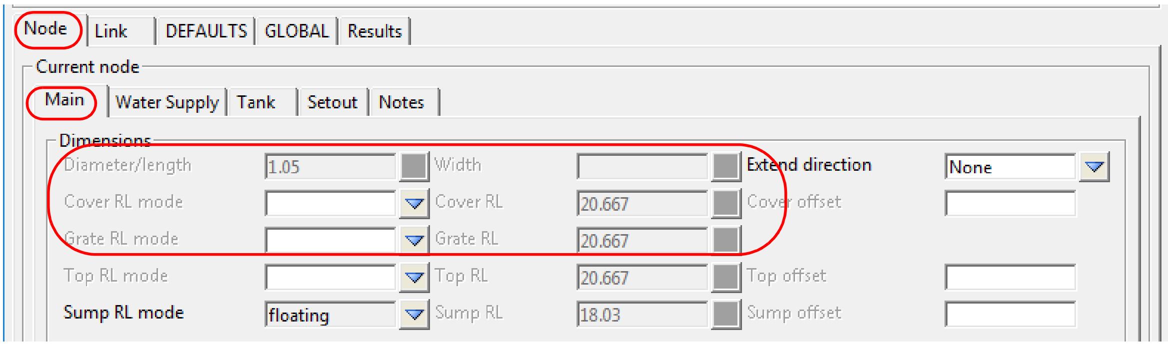
For nozzles and sprinkler heads γ equals 0.5 and the manufacturer usually provides the value of the discharge coefficient in units of $gpm/psi^{0.5}$ (stated as the flow through the device at a 1 psi pressure drop).

Emitters are used to model flow through sprinkler systems and irrigation networks. They can also be used to simulate leakage in a pipe connected to the junction (if a discharge coefficient and pressure exponent for the leaking crack or joint can be estimated) or compute a fire flow at the junction (the flow available at some minimum residual pressure). In the latter case one would use a very high value of the discharge coefficient (e.g., 100 times the maximum flow expected) and modify the junction's elevation to include the equivalent head of the pressure target

Continue to 17.7.2.3.2.1.1.2 Junction: Node >Main or return to 17.7.2.3.2.1.1 When Mode is Junction:

17.7.2.3.2.1.1.2 Junction: Node >Main

The following values for a ***Junction*** are taken from the ***Node >Main*** tab:



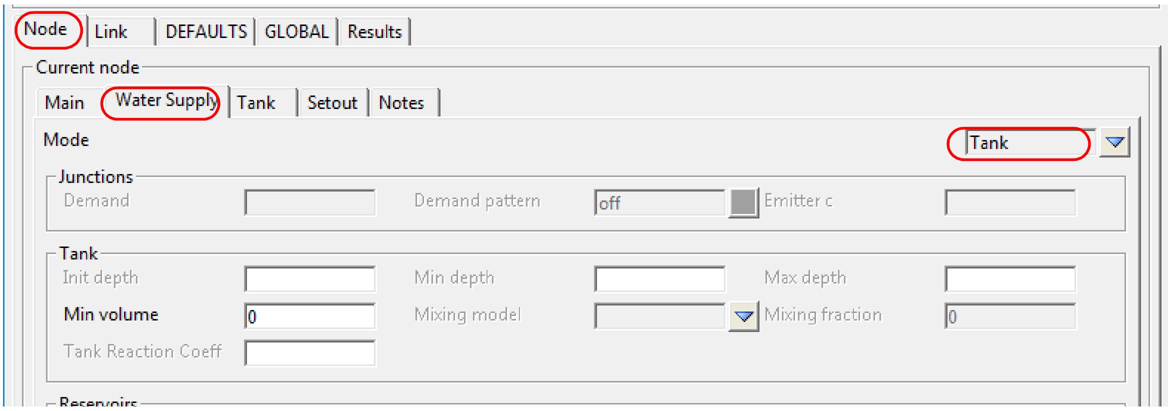
Grate RL is used to define the hydraulic junction elevation.

Cover RL - for a Junction this is only used for plotting purposes.

Diameter/Length - is used to describe the physical node size. For a Junction, it is only used for plotting.

Continue to 17.7.2.3.2.1.2 When Mode is Tank: or return to 17.7.2.3.2.1.1 When Mode is Junction:

17.7.2.3.2.1.2 When Mode is Tank:



Tanks are nodes with storage capacity, where the volume of stored water can vary with time during a simulation.

The primary input properties for tanks are:

bottom elevation (where water level is zero)

diameter (or shape if non-cylindrical)

initial, minimum and maximum water levels

initial water quality.

The principal **Outputs** computed over time fora at tank are:

Hydraulic head (water surface elevation)

Water quality.

Defining a **Tank** uses information from a number of tabs:

See

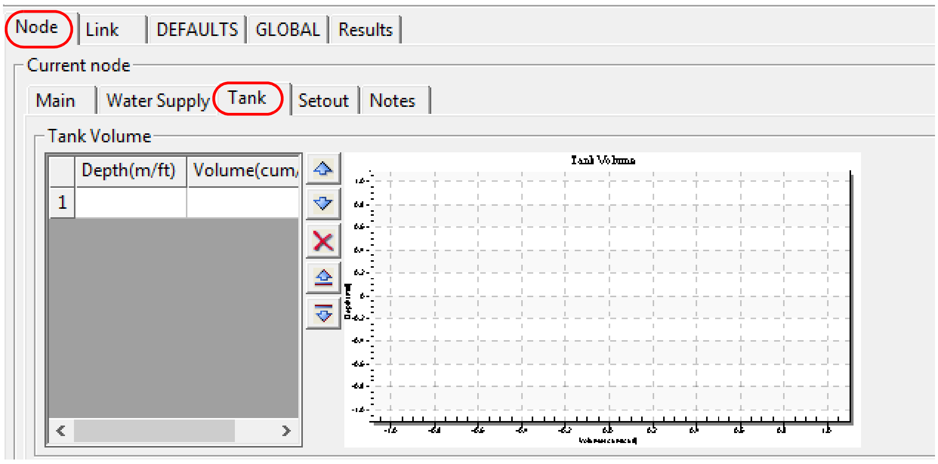
17.7.2.3.2.1.2.1 Tank: Node >Tank tab

17.7.2.3.2.1.2.2 Tank: Node >Water Supply tab

17.7.2.3.2.1.2.3 Tank: Node >Main

17.7.2.3.2.1.2.1 Tank: Node >Tank tab

The following values for a ***Tank*** are taken from the ***Node >Tank*** tab:

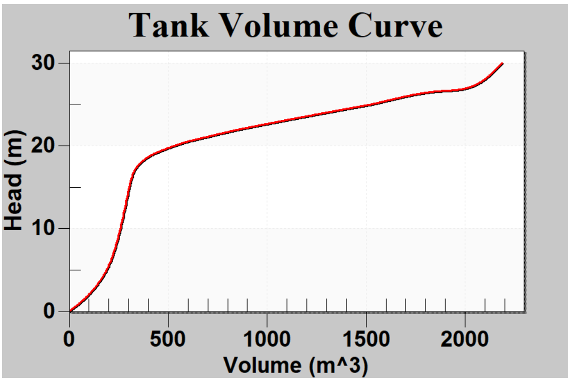


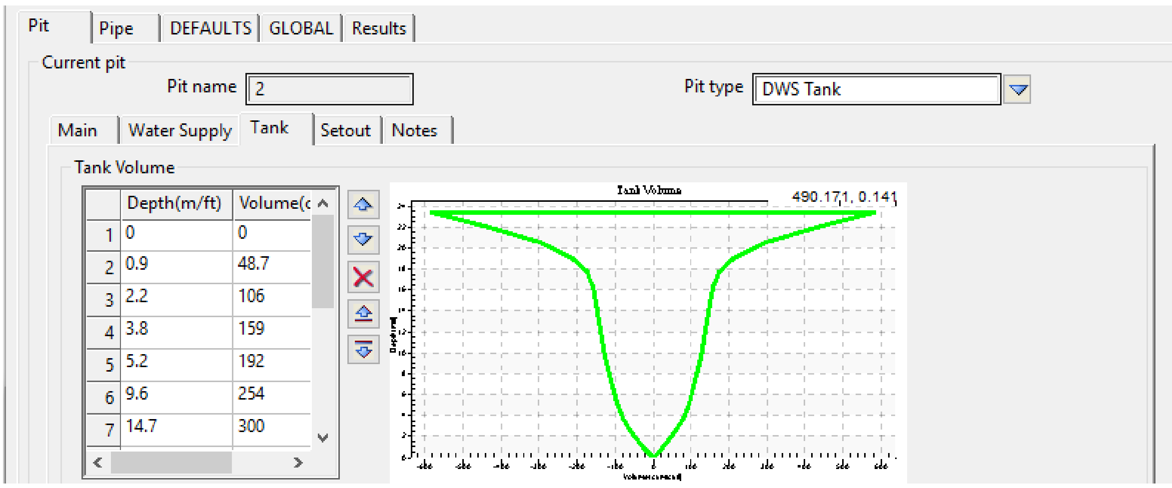
The **Tank** tab is for defining a Volume curve.

Values are entered in the **Depth (m or ft)** and **Volume (cum or cuft)** to define the Volume curve for the tank.

A **Volume curve** determines how storage tank volume (in cubic meters or cubic feet) varies as a function of water level (in meters or feet). It is used when it is necessary to accurately represent tanks whose cross-sectional area varies with height. The lower and upper water levels supplied for the curve must contain the lower and upper levels between which the tank operates.

An example of a tank volume curve is given below



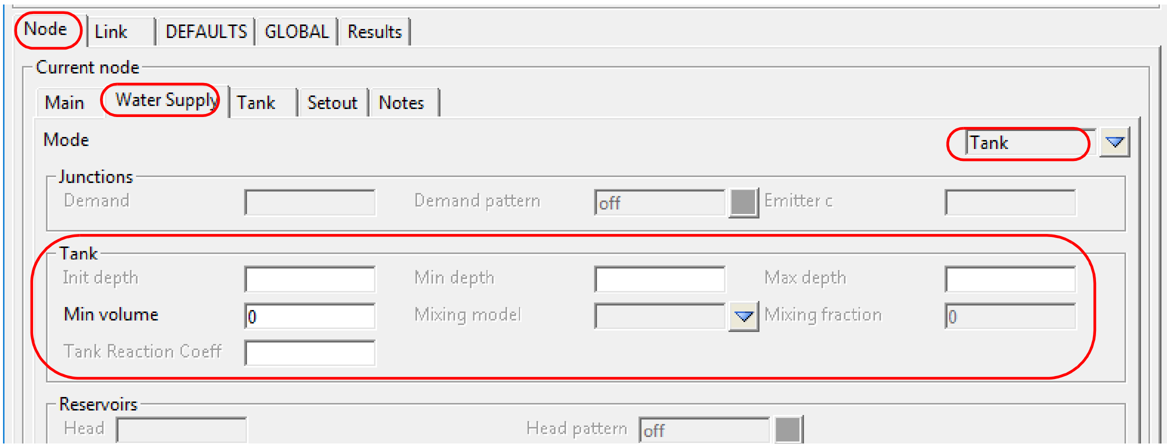


Continue to 17.7.2.3.2.1.2.2 Tank: Node >Water Supply tab or return to 17.7.2.3.2.1.2 When Mode

is Tank:

17.7.2.3.2.1.2.2 Tank: Node >Water Supply tab

The following values for a ***Tank*** are taken from the ***Node >Water Supply*** tab:



Initial depth - the starting water level in the tank. The initial water surface elevation equals Sump RL (bottom elevation) plus the initial depth.

Min depth/Max depth - the minimum and maximum allowable operational depths in the tank. Tanks are required to operate within their minimum and maximum levels. The simulation stops outflow if a tank is at its minimum level and stops inflow if it is at its maximum level.

Min Volume - the tank volume at minimum depth. It can be zero for a cylindrical tank or if a volume curve is supplied.

Mixing model can be one of four different types

Mixed (Complete Mixing),

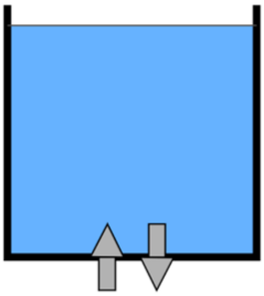
2Comp (Two-Compartment Mixing),

FIFO (First-In First-Out Plug Flow), and,

LIFO (Last-In First-Out Plug Flow)

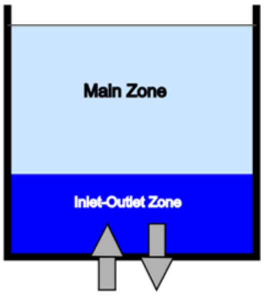
Different characterizations can be used with different tanks within a network

Mixed:
The **Complete Mixing** model assumes that all water that enters a tank is instantaneously and completely mixed with the water already in the tank. It is the simplest form of mixing behaviour to assume, requires no extra parameters to describe it, and seems to apply quite well to a large number of facilities that operate in fill-and-draw fashion.



Complete Mixing

2Comp:
The Two-Compartment Mixing model divides the available storage volume in a tank into two compartments, both of which are assumed completely mixed. The inlet/outlet pipes of the tank are assumed to be located in the first compartment. New water that enters the tank mixes with the water in the first compartment. If this compartment is full, then it sends its overflow to the second compartment where it completely mixes with the water already stored there.

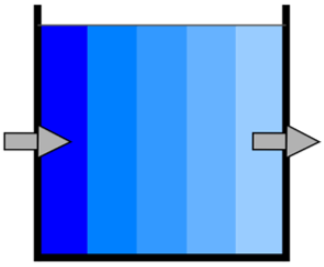


Two-Compartment Mixing

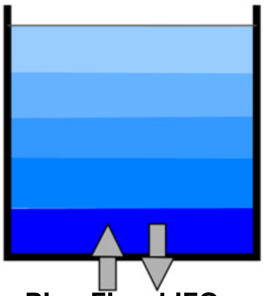
When water leaves the tank, it exits from the first compartment, which if full, receives an equivalent amount of water from the second compartment to make up the difference. The first compartment is capable of simulating short-circuiting between inflow and outflow while the second compartment can represent dead zones. The user must supply a single parameter, which is the fraction of the total tank volume devoted to the first compartment.

The **Mixed Fraction** field is also used with the **2Comp** choice

FIFO:
The First-In First-Out Plug Flow model assumes that there is no mixing of water at all during its residence time in a tank. Water parcels move through the tank in a segregated fashion where the first parcel to enter is also the first to leave. Physically speaking, this model is most appropriate for baffled tanks that operate with simultaneous inflow and outflow. There are no additional parameters needed to describe this mixing model.


Plug Flow FIFO

LIFO:
The Last-In First-Out Plug Flow model also assumes that there is no mixing between parcels of water that enter a tank. However, in contrast to FIFO Plug Flow, the water parcels stack up one on top of another, where water enters and leaves the tank on the bottom. This type of model might apply to a tall, narrow standpipe with an inlet/outlet pipe at the bottom and a low momentum inflow. It requires no additional parameters be provided.


Plug Flow LIFO

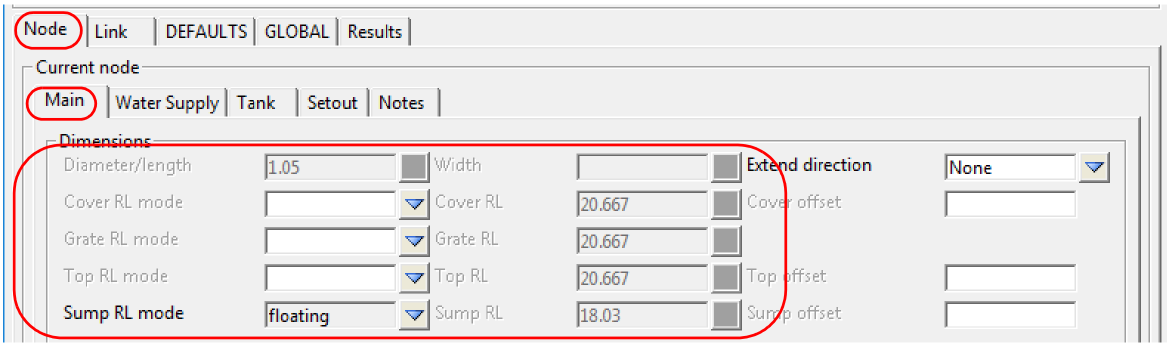
Mixing Fraction - only used for **2Comp** mixing and is the fraction of the total tank volume devoted to the first compartment (the Inlet-Outlet zone).

Tank Reaction Coeff - the water quality bulk reaction coefficient for the tank.

Continue to 17.7.2.3.2.1.2.3 Tank: Node >Main or return to 17.7.2.3.2.1.2 When Mode is Tank:

17.7.2.3.2.1.2.3 Tank: Node >Main

The following values for a ***Tank*** are taken from the ***Node >Main*** tab:



Grate RL - used to define the hydraulic junction (??) elevation.

Cover RL - for a Junction this is only used for plotting purposes.

Sump RL - the elevation of the base of the tank (where water level is zero).

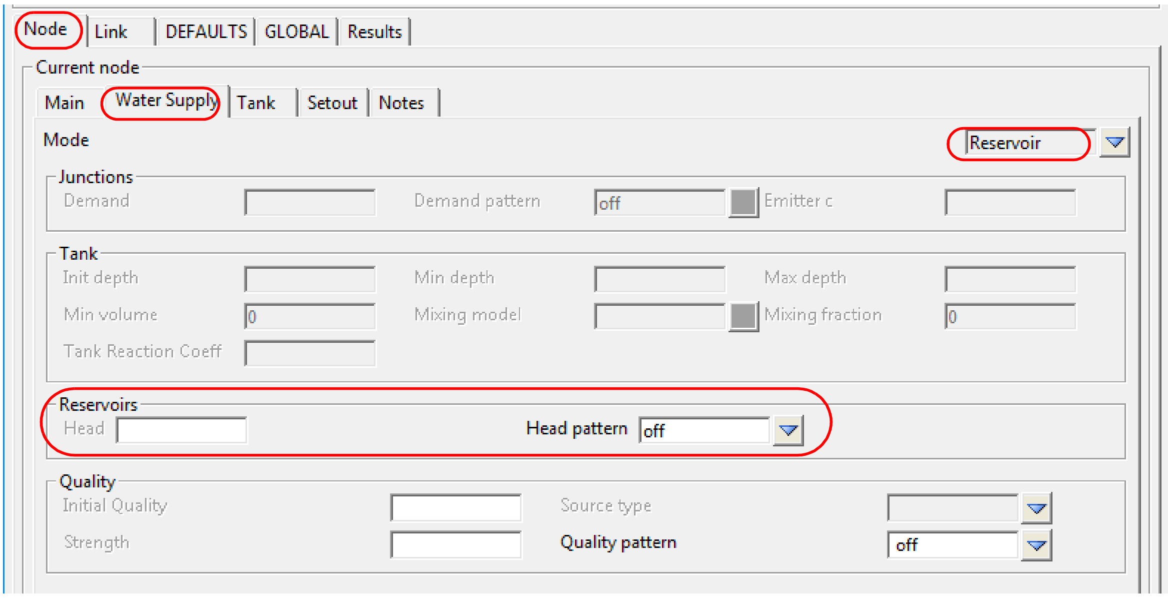
Diameter/Length - used to describe the physical node size. For a Junction, it is only used for plotting.

Diameter/Length - used to describe the physical node size. For Tanks, it is used to calculate the volume of a cylinder unless there is a **depth vs volume** curve defined on the ***Pit =>Tank*** tab.

Continue to 17.7.2.3.2.1.3 When Mode is Reservoir: or return to 17.7.2.3.2.1.2 When Mode is Tank:

17.7.2.3.2.1.3 When Mode is Reservoir:

The values for a ***Reservoir*** are taken from the ***Node >Water Supply*** tab:



Reservoirs are nodes that represent an **infinite** external **source** or **sink** of water to the network. They are used to model such things as lakes, rivers, groundwater aquifers, and tie-ins to other systems.

Generic Node parameters are entered on the on the ***Pit =>Main*** tab as for Junctions and tanks ??

The input properties for a Reservoir are taken from the ***Node >Water Supply*** tab:

Head - the hydraulic head (equal to the water surface elevation if the reservoir is not under pressure) and,

Head Pattern - the head can be made to vary with time by assigning it a time pattern. The pattern provides multipliers that are applied to the base head to determine actual elevations over a given time period. The curve is defined in the **Hydro file** under ***Variable temporal patterns***. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

Because a reservoir is a **boundary point** to a network, its head and water quality cannot be affected by what happens within the network. Therefore, it has no computed output properties.

Continue to 17.7.2.3.2.1.4 DWS Quality.

17.7.2.3.2.1.4 DWS Quality

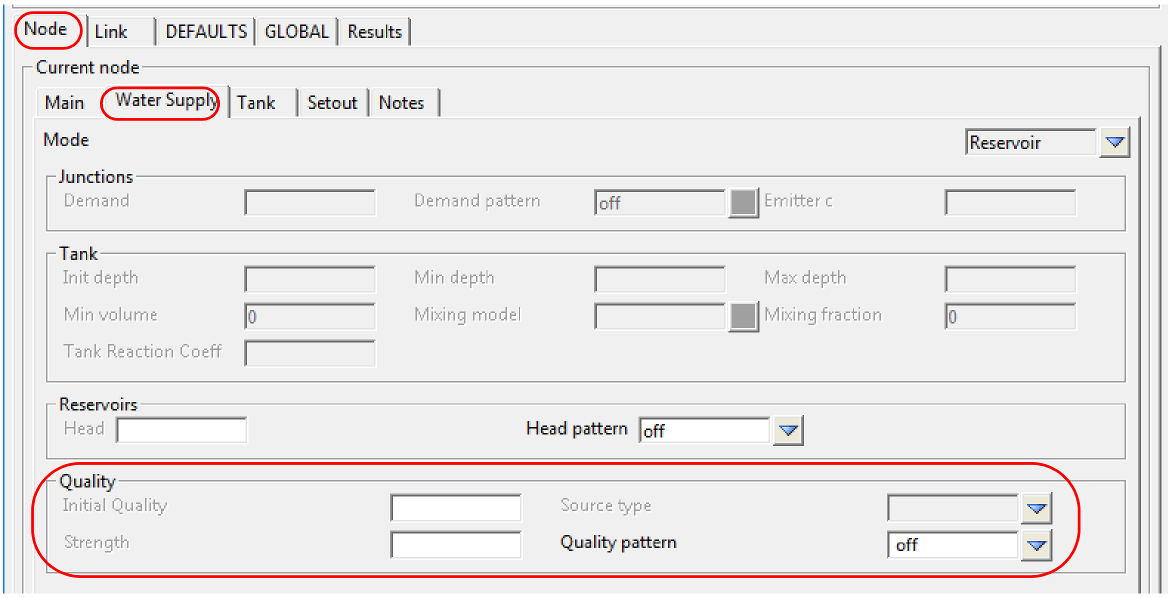
The **DWS water quality simulator** uses a Lagrangian time-based approach to track the fate of discrete parcels of water as they move along pipes and mix together at junction. These fixed-length water quality time steps are typically much shorter than the hydraulic time step (e.g., minutes rather than hours) to accommodate the short times of travel that can occur within pipes.

The method tracks the concentration and size of a series of non-overlapping segments of water that fills each link of the network. As time progresses, the size of the most upstream segment in a link increases as water enters the link while an equal loss in size of the most downstream segment occurs as water leaves the link. The size of the segments in between these remains unchanged.

For each water quality time step, the contents of each segment are subjected to reaction, a cumulative account is kept of the total mass and flow volume entering each node, and the positions of the segments are updated. New node concentrations are then calculated, which include the contributions from any external sources. Storage tank concentrations are updated depending on the type of mixing model that is used. Finally, a new segment is created at the end of each link that receives inflow from a node if the new node quality differs by a user-specified tolerance from that of the link's last segment.

Initially each pipe in the network consists of a single segment whose quality equals the initial quality assigned to the upstream node. Whenever there is a flow reversal in a pipe, the pipe's parcels are re-ordered from front to back.

Junctions, **tanks** and **reservoirs** can all serve as **water quality source points**.



Initial quality - represents the initial value of a quality constituent at this location at the start of the simulation. The value represents concentration for chemicals, hours for water age, or percent for source tracing.

Strength - the source quality of any water entering the network at this location.

Source type - a water quality source can be designated as a concentration or booster source.

The options available are:

Concentration - A concentration source fixes the concentration of any external inflow entering the network, such as flow from a reservoir or from a negative demand placed at a junction.

Mass - A mass booster source adds a fixed mass flow to that entering the node from other points in the network.

Flow paced - A flow paced booster source adds a fixed concentration to that resulting from the mixing of all inflow to the node from other points in the network.

Set point - A set-point booster source fixes the concentration of any flow leaving the node (as long as the concentration resulting from all inflow to the node is below the set point).

The concentration-type source is best used for nodes that represent source water supplies or treatment works (e.g., reservoirs or nodes assigned a negative demand). The booster-type source is best used to model direct injection of a tracer or additional disinfectant into the network or to model a contaminant intrusion.

Quality Pattern - the quality can be made to vary with time by assigning it a time pattern. The pattern provides multipliers that are applied to the base strength to determine actual values over a given time period. The curve is defined in the **Hydro file** under **Variable temporal patterns**. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

Continue to 17.7.2.3.2.2 WS Links.

17.7.2.3.2.2 WS Links

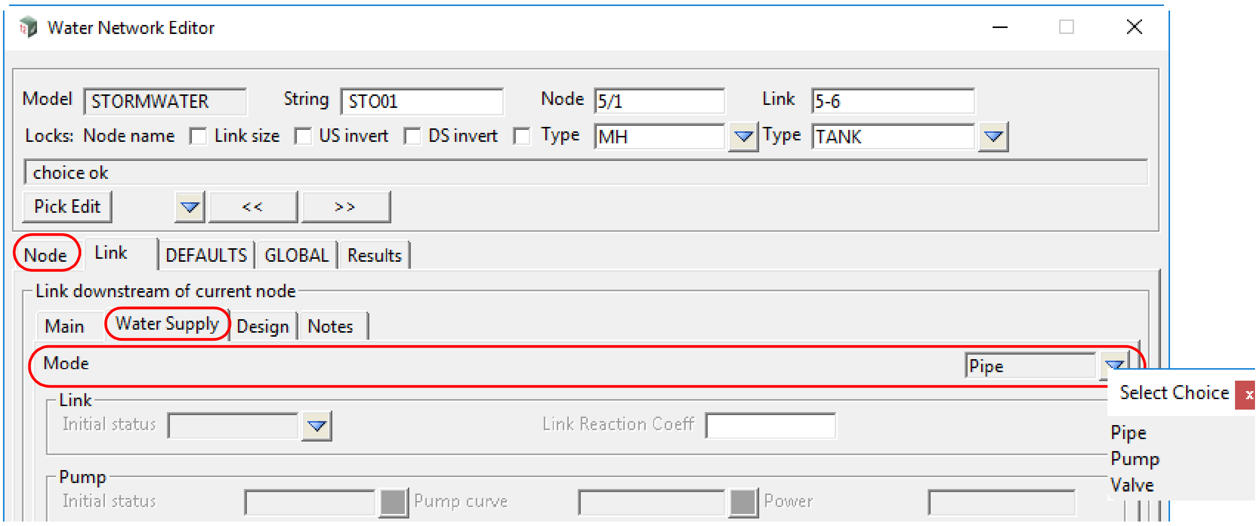
Links consist of:

Pipes which are links that convey water from one point in the network to another,

Pumps which are links that impart energy to a fluid thereby raising its hydraulic head, and

Valves which are links that limit the pressure or flow at a specific point in the network.

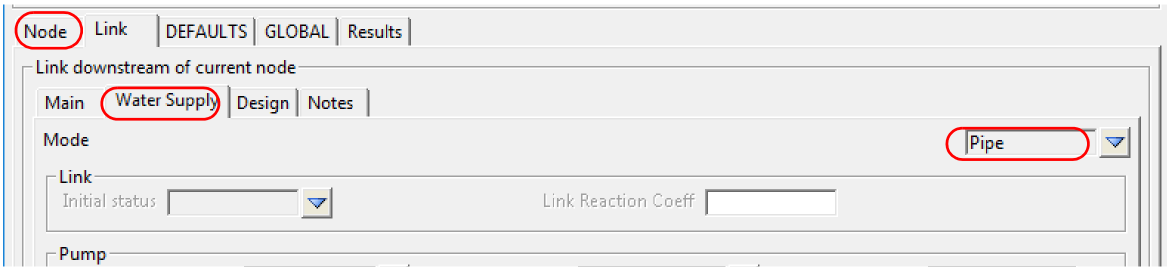
The ***Link type*** is chosen in the **Mode** choice box on the **Link >Water supply t**ab.



See

17.7.2.3.2.2.1 When Mode is Pipe:
17.7.2.3.2.2.2 When Mode is Pump:
17.7.2.3.2.2.3 When Mode is Valve:

17.7.2.3.2.2.1 When Mode is Pipe:



Pipes are links that convey water from one point in the network to another. It is assumed that **all pipes** are **full** at all times. Flow direction is from the end at higher hydraulic head (internal energy per weight of fluid) to that at lower head.

The principal hydraulic input parameters for pipes are:

start and end nodes
diameter
length
roughness coefficient (for determining headloss)
status (open, closed, or contains a check valve).

The status parameter allows pipes to implicitly contain shutoff (gate) valves and check (non-return) valves, which allow flow in only one direction.

The water quality **inputs** for pipes consist of:

bulk reaction coefficient
wall reaction coefficient.

Computed **Outputs** for pipes include:

flow rate
velocity
headloss
Darcy-Weisbach friction factor (if used)
average reaction rate (over the pipe length)
average water quality (over the pipe length).

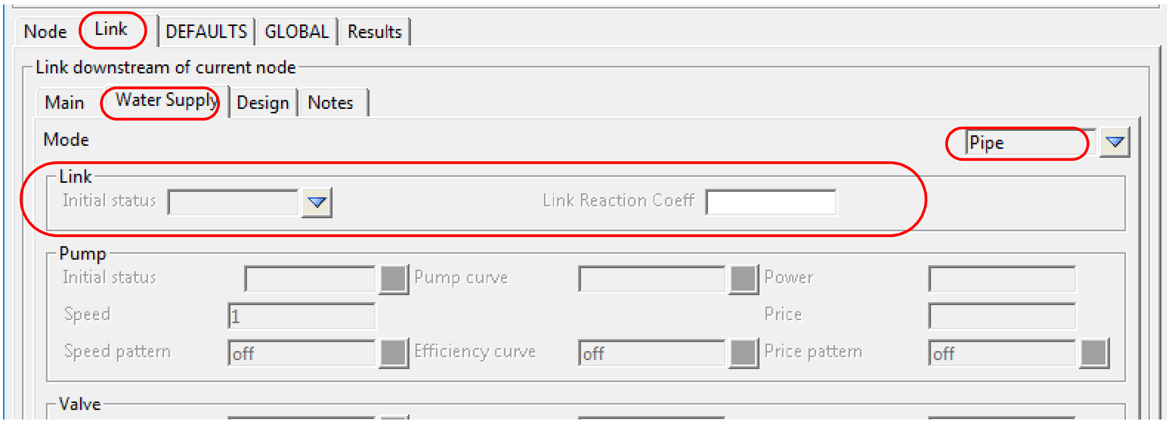
Defining a ***Pipe*** uses information from a number of tabs:

See

17.7.2.3.2.2.1.1 Pipe: Node >Water Supply
17.7.2.3.2.2.1.2 Pipe: Node >Main
17.7.2.3.2.2.1.3 Headloss Calculations for Pipes

17.7.2.3.2.2.1.1 Pipe: Node >Water Supply

The DWS-specific pipe data are entered on the ***Link >Water Supply*** tab.



Initial Status - defines whether the pipe is open, closed or contains a check valve when the simulation commences. The status of the pipe can be changed during an Extended Period Simulation (EPS) using **Rules** and **Controls**. The options available are:

Open - whereby flow is unrestricted,

Closed - where no flow is permitted, and

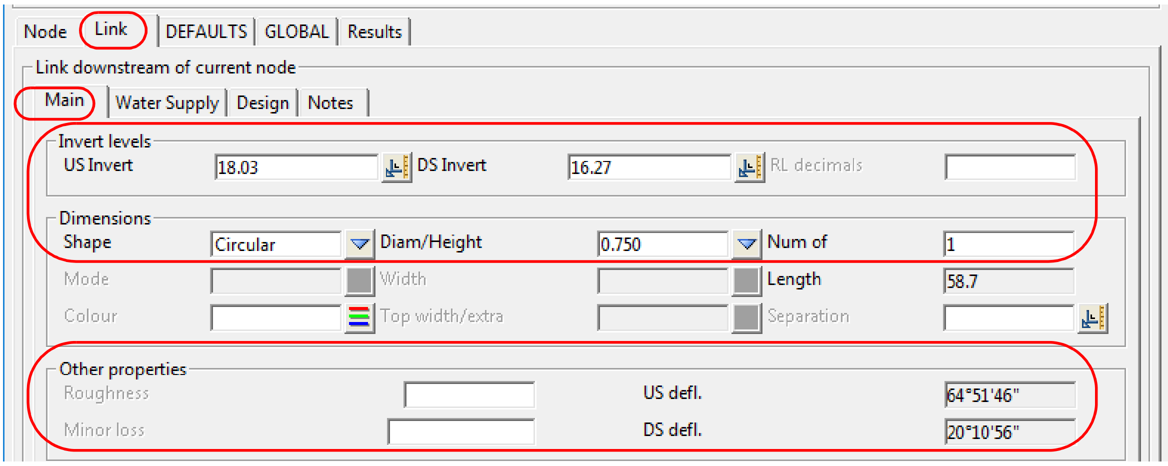
Check Valve - where reverse flow is not permitted.

Pipe Reaction Coefficient - is used to override the global pipe wall reaction coefficient when water quality is enabled.

Continue to 17.7.2.3.2.2.1.2 Pipe: Node >Main or return to 17.7.2.3.2.2.1 When Mode is Pipe:.

17.7.2.3.2.2.1.2 Pipe: Node >Main

General Link parameters are entered on the ***Link >Main*** tab.



US Invert/DS Invert - are the upstream and downstream link invert elevations.

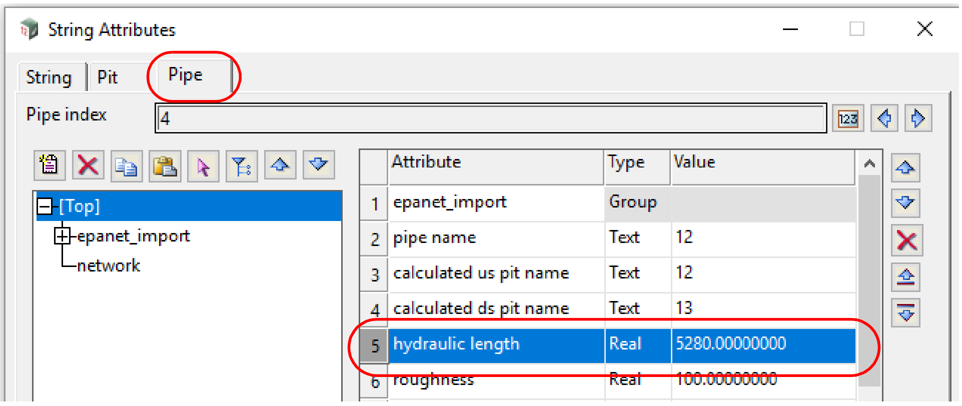
Shape - the cross-sectional shape of the link. Only **Circular** shape is supported.

Diam/Height - the internal diameter of the pipe (in metres or feet)

Num of - the number of identical parallel pipes. Only **one pipe** is allowed

Mode, **Width** and **Top Width** are not used by the DWS module

Length is the distance between the nodes and is **calculated from the network coordinates**. However, to allow for the importing of schematic networks and additional Pipe Attribute **hydraulic length** which, if present, will override the length calculated by 12d.



This attribute must be manually deleted by the user to return to the length calculated by 12d.

Roughness - describes the hydraulic head lost by water flowing in a pipe due to friction with the pipe walls. It is computed using one of three different formulas:

Hazen-Williams formula

The Hazen-Williams formula is the most commonly used headloss formula. It cannot be used for liquids other than water and was originally developed for turbulent flow only.

Darcy-Weisbach formula

The Darcy-Weisbach formula is the most theoretically correct. It applies over all flow regimes and to all liquids.

Chezy-Manning formula

The Chezy-Manning formula is more commonly used for open channel flow.

For headloss calculations, see 17.7.2.3.2.2.1.3 Headloss Calculations for Pipes.

Minor Losses - (also called local losses) are caused by the added turbulence that occurs at bends and fittings. The importance of including such losses depends on the layout of the network and the degree of accuracy required. They can be accounted for by assigning the pipe a minor loss coefficient. The minor headloss becomes the product of this coefficient and the velocity head of the pipe, i.e.,

$$h_L = K\left[\frac{v^2}{2g}\right]$$

Where:

K = minor loss coefficient,

v = flow velocity (Length/Time), and

g = acceleration of gravity (Length/Time^2).

Typical minor loss coefficients for several types of fittings are shown in the following table.

Minor Loss Coefficients for Selected Fittings

Fitting	*Loss Coefficient*
Globe valve, fully open	10.0
Angle valve, fully open	5.0
Swing check valve, fully open	2.5
Gate valve, fully open	0.2
Short-radius elbow	0.9
Medium-radius elbow	0.8
Long-radius elbow	0.6
45 degree elbow	0.4
Closed return bend	2.2
Standard tee - flow through run	0.6
Standard tee - flow through branch	1.8
Square entrance	0.5
Exit	1.0

Continue to 17.7.2.3.2.2.1.3 Headloss Calculations for Pipes or return to 17.7.2.3.2.2.1 When Mode is Pipe:.

17.7.2.3.2.2.1.3 Headloss Calculations for Pipes

The **Hazen-Williams** formula is the most commonly used headloss formula. It cannot be used for liquids other than water and was originally developed for turbulent flow only.

The **Darcy-Weisbach** formula is the most theoretically correct. It applies over all flow regimes and to all liquids.

The **Chezy-Manning** formula is more commonly used for open channel flow.

Each formula uses the following equation to compute headloss between the start and end node of the pipe:

$$h_L = Aq^B$$

where:

h_L = headloss (Length),

q = flow rate (Volume/Time),

A = resistance coefficient,

and B = flow exponent.

The Pipe Headloss table below lists expressions for the resistance coefficient and values for the flow exponent for each of the formulas. Each formula uses a different pipe roughness coefficient that must be determined empirically. The Roughness Coefficients table lists general ranges of these coefficients for different types of new pipe materials. Be aware that a pipe's roughness coefficient can change considerably with age.

With the Darcy-Weisbach formula different methods are used to compute the friction factor f depending on the flow regime:

The Hagen-Poiseuille formula is used for laminar flow (Re < 2,000).

The Swamee and Jain approximation to the Colebrook-White equation is used for fully turbulent flow (Re > 4,000).

A cubic interpolation from the Moody Diagram is used for transitional flow (2,000 < Re < 4,000)

Pipe Headloss Formulas for Full Flow (for headloss in feet and flow rate in cfs)

Formula	*Resistance Coefficient (A)*	*Flow Exponent (B)*
Hazen-Williams	$4.727\ C^{-1.852}\ d^{-4.871}\ L$	1.852
Darcy-Weisbach	$0.0252\ f(\varepsilon,d,q)d^{-5}L$	2
Chezy-Manning	$4.66\ n^2\ d^{-5.33}\ L$	2

Notes:
C = Hazen-Williams roughness coefficient
ε = Darcy-Weisbach roughness coefficient (ft)
f = friction factor (dependent on ε, d, and q)
n = Manning roughness coefficient d = pipe diameter (ft)
L = pipe length (ft)
q = flow rate (cfs)

Roughness Coefficients for New Pipe

Material	*Hazen-Williams C (unitless)*	*Darcy-Weisbach e (feet x 10^{-3}) (mm)*	*Manning's n (unitless)*
Cast Iron	130 – 140	0.85 (0.25)	0.012 - 0.015
Concrete or Concrete Lined	120 – 140	1.0 - 10 (0.3 - 3.0)	0.012 - 0.017
Galvanized Iron	120	0.5 (0.15)	0.015 - 0.017
Plastic	140 – 150	0.005(0.002)	0.011 - 0.015
Steel	140 – 150	0.15(0.05)	0.015 - 0.017
Vitrified Clay	110		0.013 - 0.015

Continue to 17.7.2.3.2.2.2 When Mode is Pump: or return to 17.7.2.3.2.2.1 When Mode is Pipe:.

17.7.2.3.2.2.2 When Mode is Pump:

Pumps are links that impart energy to a fluid thereby raising its hydraulic head. The principal input parameters for a pump are its start and end nodes and its pump curve (the combination of heads and flows that the pump can produce). In lieu of a pump curve, the pump could be represented as a constant energy device, one that supplies a constant amount of energy (horsepower or kilowatts) to the fluid for all combinations of flow and head.

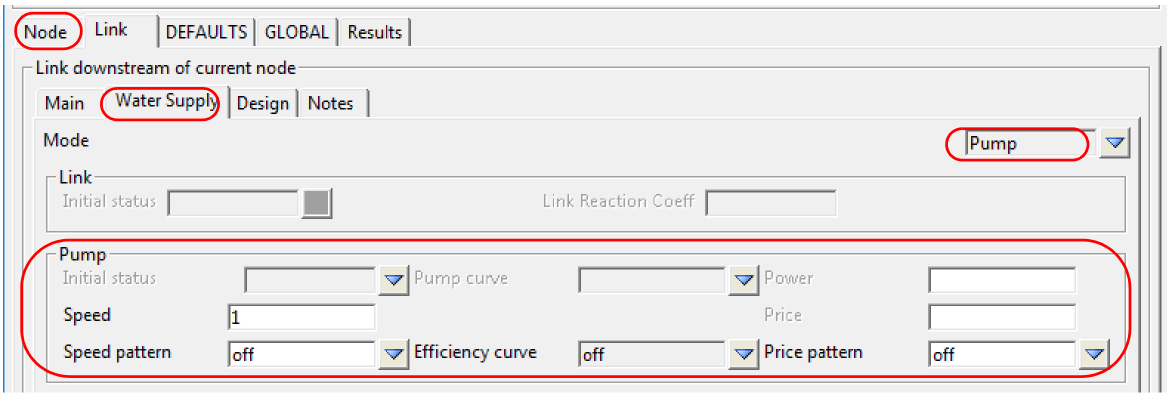
The principal output parameters are flow and head gain. Flow through a pump is unidirectional and the pump is not permitted to operate outside the range of its pump curve.

Variable speed pumps can also be considered by specifying that their speed setting be changed under these same types of conditions. By definition, the original pump curve supplied to the program has a relative speed setting of 1. If the pump speed doubles, then the relative setting would be 2; if run at half speed, the relative setting is 0.5 and so on. Changing the pump speed shifts the position and shape of the pump curve

As with pipes, pumps can be turned on and off at preset times or when certain conditions exist in the network. A pump's operation can also be described by assigning it a time pattern of relative speed settings. The energy consumption and cost of a pump can also be calculated. Each pump can be assigned an efficiency curve and schedule of energy prices. If these are not supplied, then a set of global energy options will be used.

Flow through a pump is unidirectional. If system conditions require more head than the pump can produce, the pump shuts off. If more than the maximum flow is required, the pump curve is extrapolated to the required flow, even if this produces a negative head. In both cases a warning message will be issued.

The values for a ***Pump*** are taken from the ***Node >Water Supply*** tab:



Initial Status

defines whether the pump is open or closed when the simulation commences. The status of the pump can be changed during an Extended Period Simulation (EPS) using Rules and Controls. The options available are:

Open (running) - whereby flow is permitted,

Closed (stopped) - where no flow is permitted

Pump Curve **see Hydro file**

A Pump Curve represents the relationship between the head and flow rate that a pump can deliver at its nominal speed setting. Head is the head gain imparted to the water by the pump and is plotted on the vertical (Y) axis of the curve in feet (meters). Flow rate is plotted on the horizontal (X) axis in flow units. A valid pump curve must have decreasing head with increasing flow.

Different shaped pump curves are used depending on the number of points supplied (see 17.7.2.3.2.2.2.1 Pump Curves).

The curve is defined in the **Hydro file** under **Pumps**.

Power

is the power supplied by the pump in horsepower (kw). It is assumed that the pump supplies the same amount of energy no matter what the flow is. Leave blank if a pump curve will be used instead. Use when pump curve information is not available.

Speed

a relative setting (normal speed is 1.0, 0 means pump is off).

Speed pattern

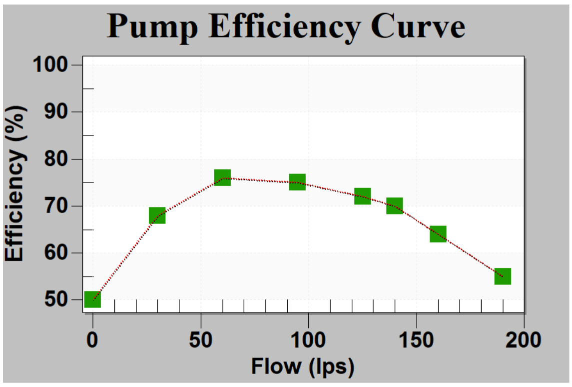
is the ID of a time pattern used to control the pump's operation. The multipliers of the pattern are equivalent to speed settings. A multiplier of zero implies that the pump will be shut off during the corresponding time period. Leave blank if not applicable. The curve is defined in the Hydro file under Variable temporal patterns. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

Efficiency

represents the wire-to-water effectiveness that takes into account mechanical losses in the pump itself as well as electrical losses in the pump's motor. It is used only for energy calculations.

Efficiency Curve

determines pump efficiency (in percent) as a function of pump flow rate (in flow units). An example efficiency curve is shown below. If not supplied for a specific pump, then a fixed global pump efficiency will be used. It is only used for energy calculations.



Price

is the average or nominal price of energy in monetary units per kw-hr. It is used only for computing the cost of energy usage. Leave blank if not applicable.

Price pattern

is the ID of a time pattern used to describe the variation in energy price throughout the day. Each multiplier in the pattern is applied to the pump's energy price to determine a time-of-day pricing for the corresponding period. Leave blank if not applicable. The curve is defined in the Hydro file under Variable temporal patterns. The interval between values is constant and equal to the simulation run time divided by the number of data points in the pattern.

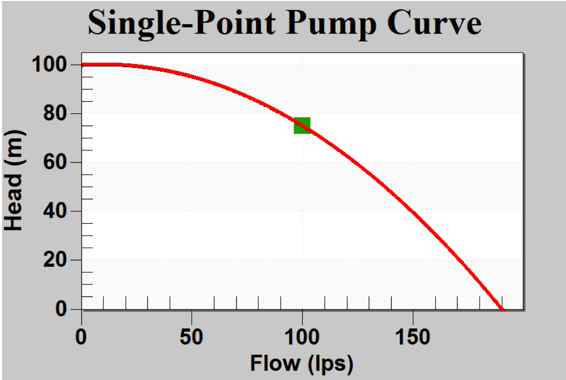
Continue to 17.7.2.3.2.2.2.1 Pump Curves or return to 17.7.2.3.2.2.2 When Mode is Pump:.

17.7.2.3.2.2.2.1 Pump Curves

Different shaped pump curves are used depending on the number of points supplied.

Single-Point Curve

A single-point pump curve is defined by a single head-flow combination that represents a pump's desired operating point. Two more points are then added to the curve by assuming a shutoff head at zero flow equal to 133% of the design head and a maximum flow at zero head equal to twice the design flow. It then fits a curve through these three points and treats the curve as a three-point curve.

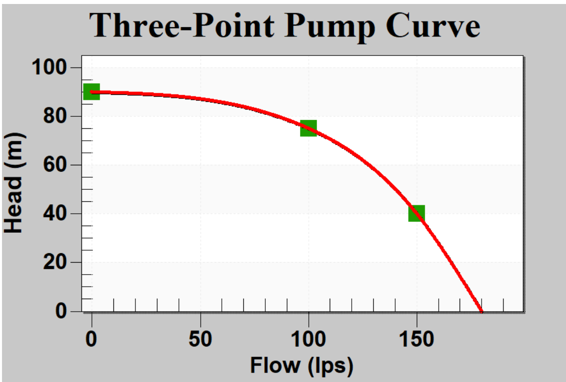


Three-Point Curve

A three-point pump curve is defined by three operating points: a Low Flow point (flow and head at low or zero flow condition), a Design Flow point (flow and head at desired operating point), and a Maximum Flow point (flow and head at maximum flow). A continuous function of the form:

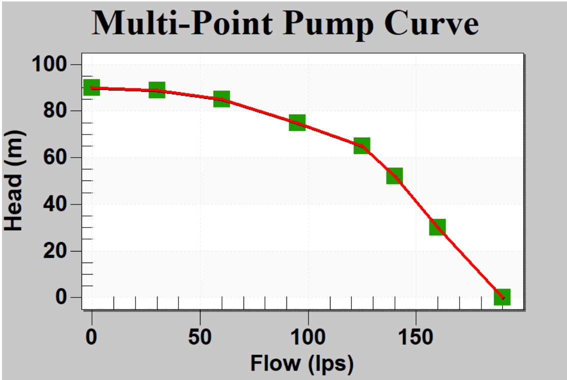
$$h_G = A - Bq^C$$

is fitted through the three points used to define the entire pump curve. In this function
h_G = head gain,
q = flow rate, and
A, B, and C are constants.



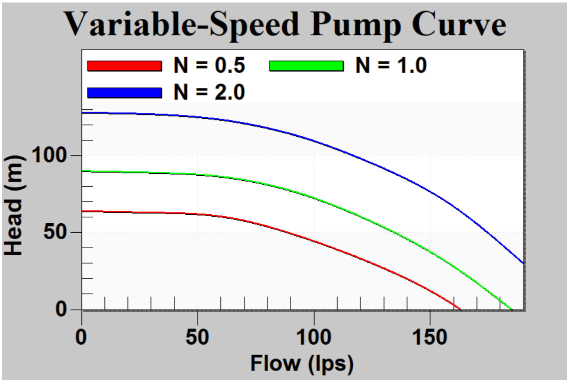
Multi-Point Curve

A multi-point pump curve is defined by providing either a pair of head-flow points or four or more such points. A complete curve is created by connecting the points with straight-line segments.



For **variable speed pumps**, the pump curve shifts as the speed changes. The relationships between flow (Q) and head (H) at speeds N1 and N2 are

$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} \qquad \frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$$

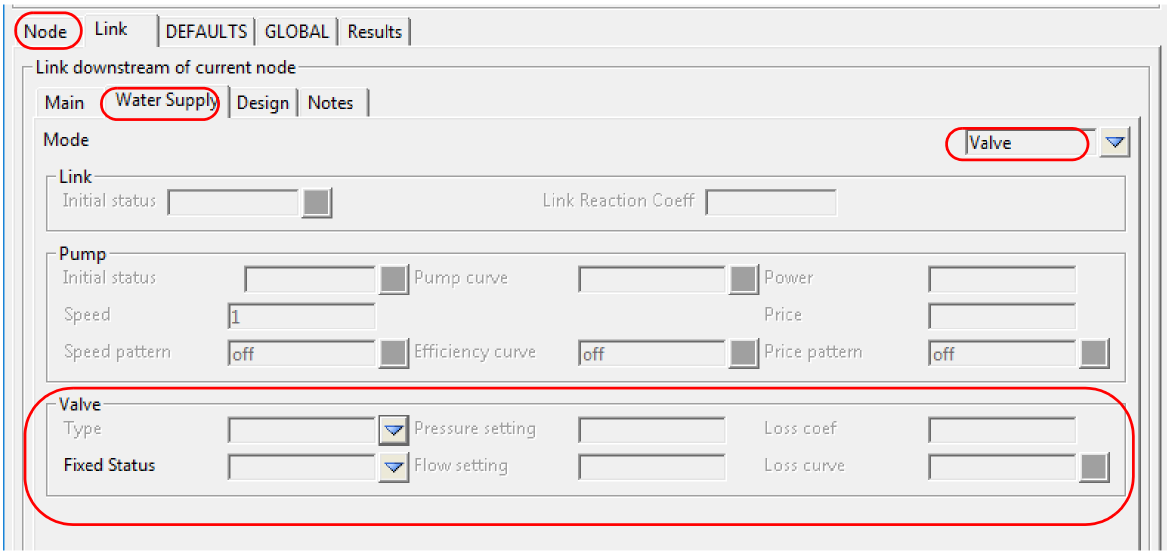


Continue to 17.7.2.3.2.2.3 When Mode is Valve: or return to 17.7.2.3.2.2.2 When Mode is Pump:.

17.7.2.3.2.2.3 When Mode is Valve:

Valves are links that limit the pressure or flow at a specific point in the network. The computed outputs for a valve are flow rate and head loss.

The values for a ***Valve*** are taken from the ***Node >Water Supply*** tab:



Type is used to select the valve type. The different types of valves are:

Pressure Reducing Valve (PRV)

PRVs limit the pressure at a point in the pipe network A PRV can be in one of three different states:

partially opened (i.e., active) to achieve its pressure setting on its downstream side when the upstream pressure is above the setting

fully open if the upstream pressure is below the setting

closed if the pressure on the downstream side exceeds that on the upstream side (i.e., reverse flow is not allowed).

Pressure Sustaining Valve (PSV)

PSVs maintain a set pressure at a specific point in the pipe network. A PSV can be in one of three different states:

partially opened (i.e., active) to maintain its pressure setting on its upstream side when the downstream pressure is below this value

fully open if the downstream pressure is above the setting

closed if the pressure on the downstream side exceeds that on the upstream side (i.e., reverse flow is not allowed).

Pressure Breaker Valve (PBV)

PBVs force a specified pressure loss to occur across the valve. Flow through the valve can be in either direction. PBVs are not true physical devices but can be used to model situations where a particular pressure drop is known to exist.

Flow Control Valve (FCV)

FCVs limit the flow to a specified amount. The program produces a warning message if this flow cannot be maintained without having to add additional head at the valve (i.e., the flow cannot be maintained even with the valve fully open

Throttle Control Valve (TCV)

TCVs simulate a partially closed valve by adjusting the minor head loss coefficient of the valve.   A relationship between the degree to which a valve is closed and the resulting head loss coefficient is usually available from the valve manufacturer.

General Purpose Valve (GPV)

GPVs are used to represent a link where the user supplies a special flow - head loss relationship instead of following one of the standard hydraulic formulas. They can be used to model turbines, well draw-down or reduced-flow backflow prevention valves.

Shutoff (gate) valves and **check (non-return) valves,** which completely open or close pipes, are not considered as separate valve links but are instead included as a property of the **pipe** in which they are placed.

Each type of valve has a different type of setting parameter that describes its operating point:

Pressure setting (in psi or m) for PRVs, PSVs, and PBVs;

Flow setting in flow units) for FCVs;

Loss coefficient

is a unitless minor loss coefficient used by TCVs that applies when the valve is completely opened. Assumed 0 if left blank.

Loss curve for GPVs

Headloss curve is used to described the headloss (in feet or meters) through a General-Purpose Valve (GPV) as a function of flow rate (in flow units). It provides the capability to model devices and situations with unique headloss-flow relationships, such as reduced flow - backflow prevention valves, turbines, and well draw-down behaviour. The curve is defined in the Hydro file under Pumps.

Fixed status

is the valve status at the start of the simulation. If set to OPEN or CLOSED then the control setting of the valve is ignored and the valve behaves as an open or closed link, respectively. If set to NONE, then the valve will behave as intended. A valve's fixed status and its setting can be made to vary throughout a simulation using control statements. If a valve's status was fixed to OPEN/CLOSED, then it can be made active again using a control that assigns a new numerical setting to it.

Valves can have their control status overridden by specifying they be either completely open or completely closed. A valve's status and its setting can be changed during the simulation by using control statements.

Because of the ways in which valves are modelled the following rules apply when adding valves to a network:

(a) a PRV, PSV or FCV cannot be directly connected to a reservoir or tank (use a length of pipe to separate the two)

(b) PRVs cannot share the same downstream node or be linked in series

(c) two PSVs cannot share the same upstream node or be linked in series

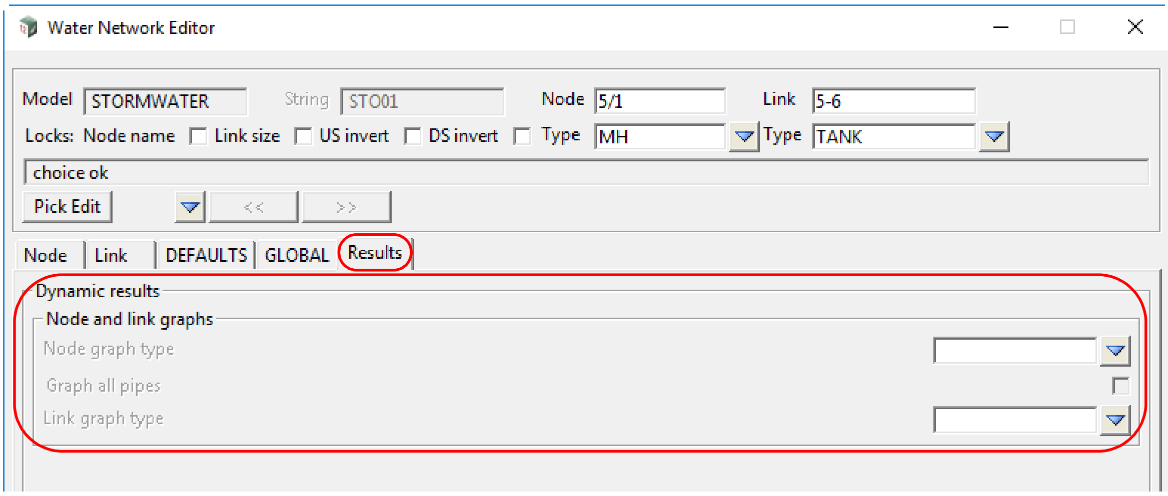
(d) a PSV cannot be connected to the downstream node of a PRV.

Continue to 17.7.2.3.3 DWS Results or return to 17.7.2.3.2.2 WS Links.

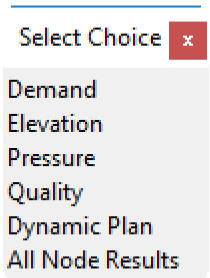
17.7.2.3.3 DWS Results

THIS SECTION IS STILL BEING COMPLETED

The **Time series results** that are generated when an extended period simulation (EPS) is run when the ***Analysis*** button is pressed are accessed via the ***Results*** tab of the WNE.



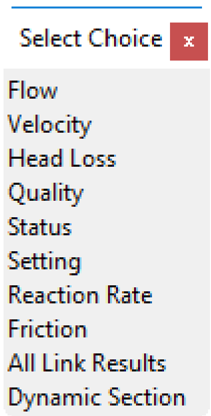
Node graph type choice box



See 17.7.2.3.3.1 Node Graph Type Results:

Graph all pipes tick box

Link graph type choice box



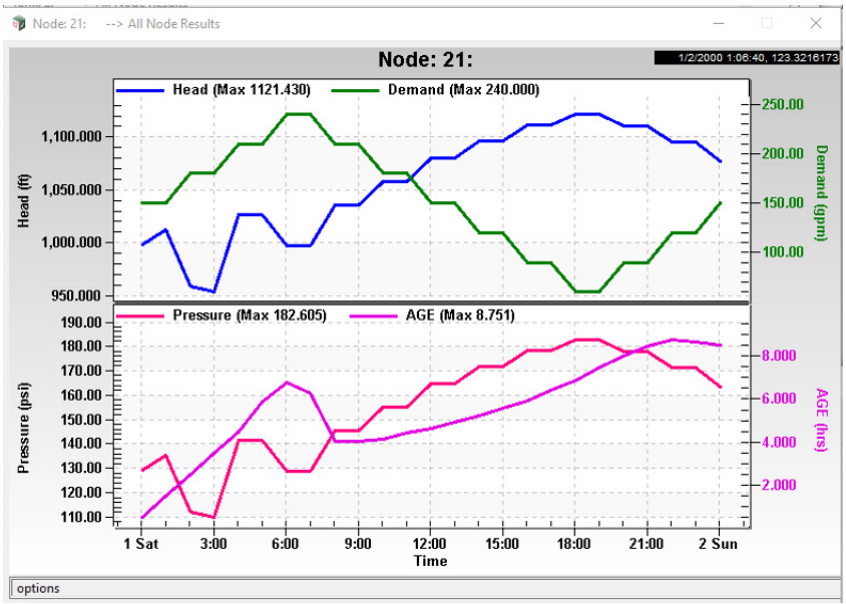
See 17.7.2.3.3.2 Link Graph Type Results:

17.7.2.3.3.1 Node Graph Type Results:

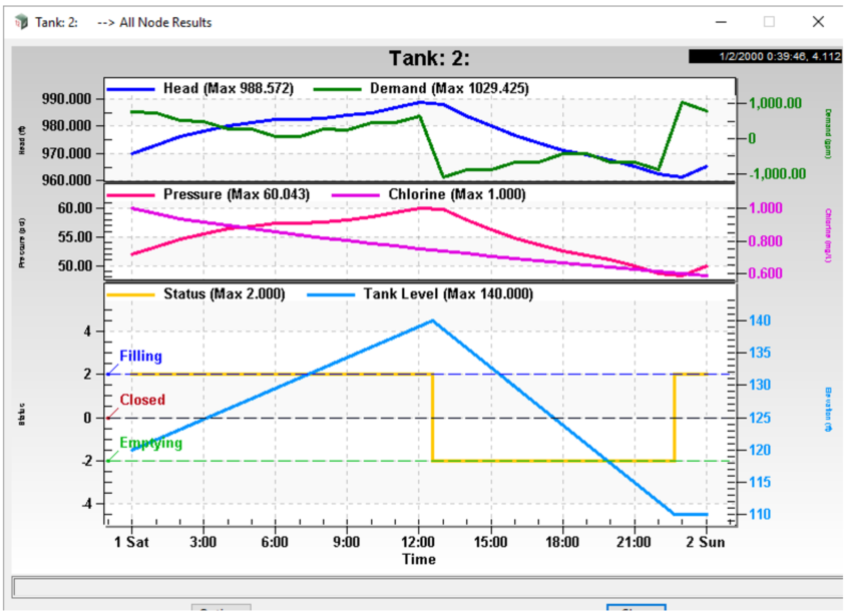
There are graphs for:

Select Choice

- Demand
- Elevation
- Pressure
- Quality
- Dynamic Plan
- All Node Results



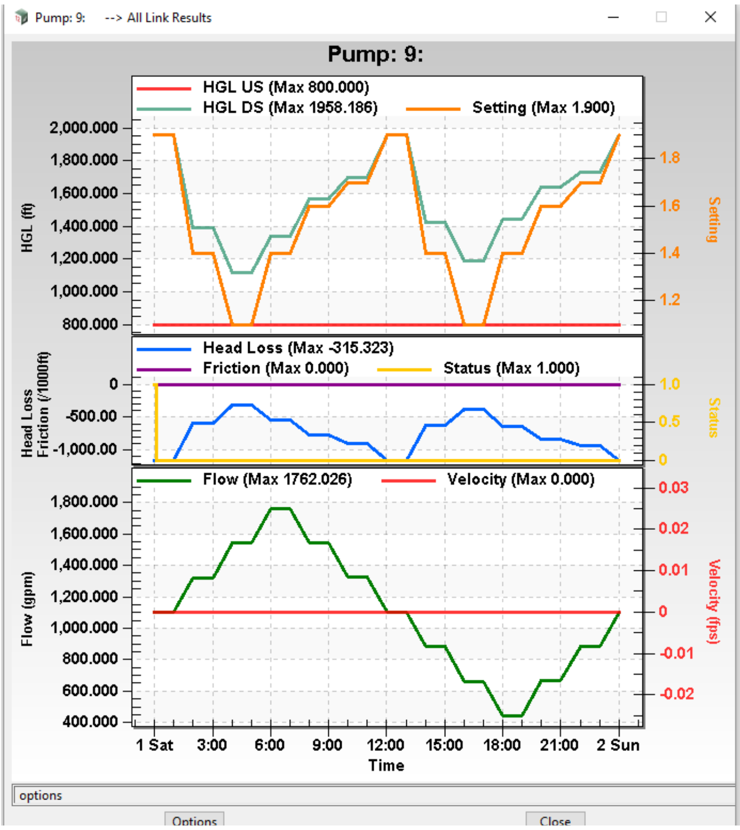
Tank results



Demand
Head
Pressure

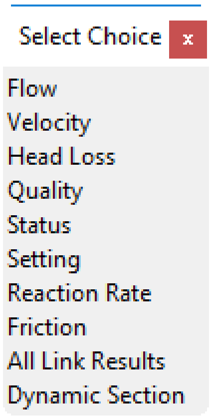
Water Quality
Status
Tank Level

Pump results



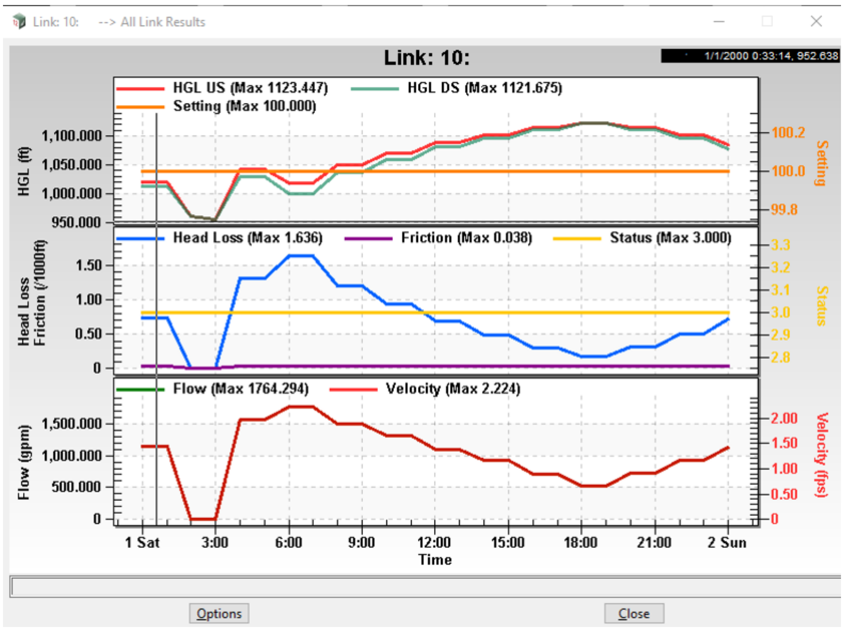
17.7.2.3.3.2 Link Graph Type Results:

There are graphs for:

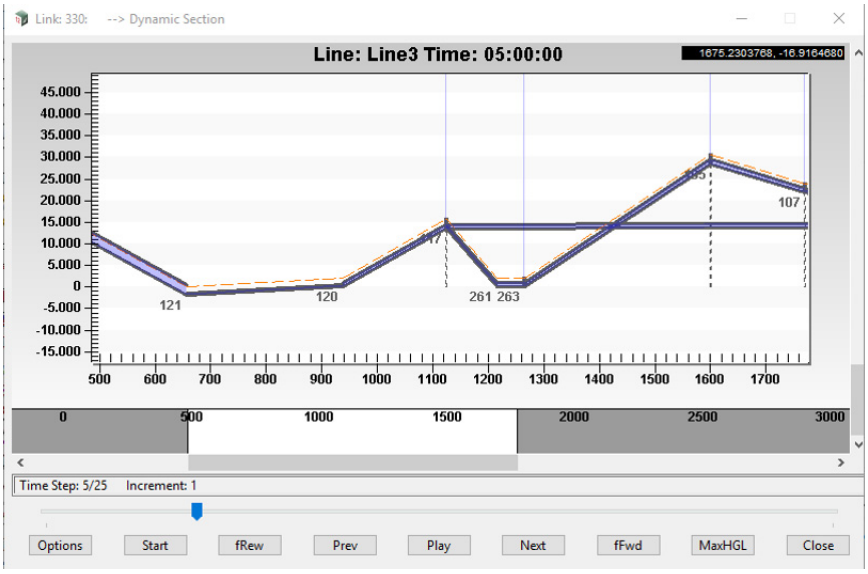


describe status and setting (different meanings for different object types)

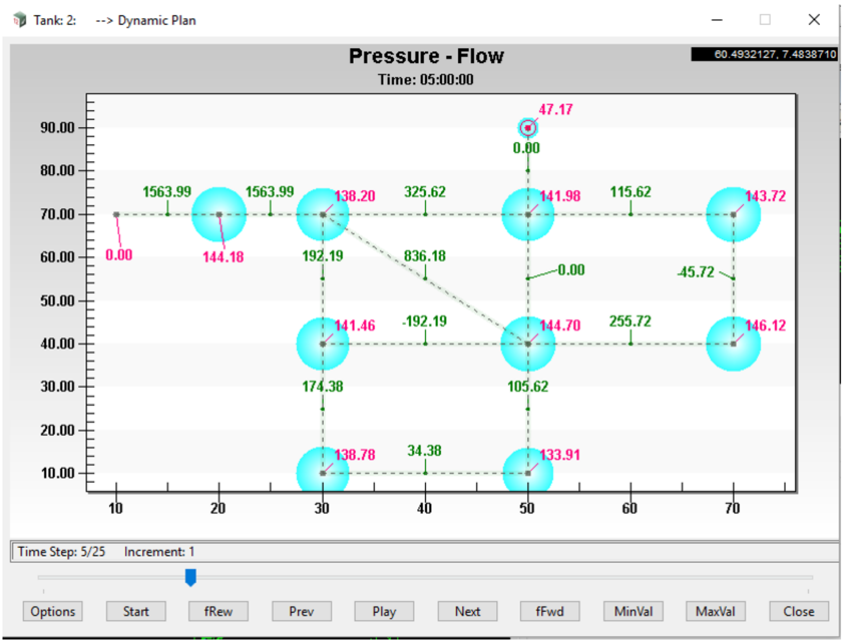
Link results



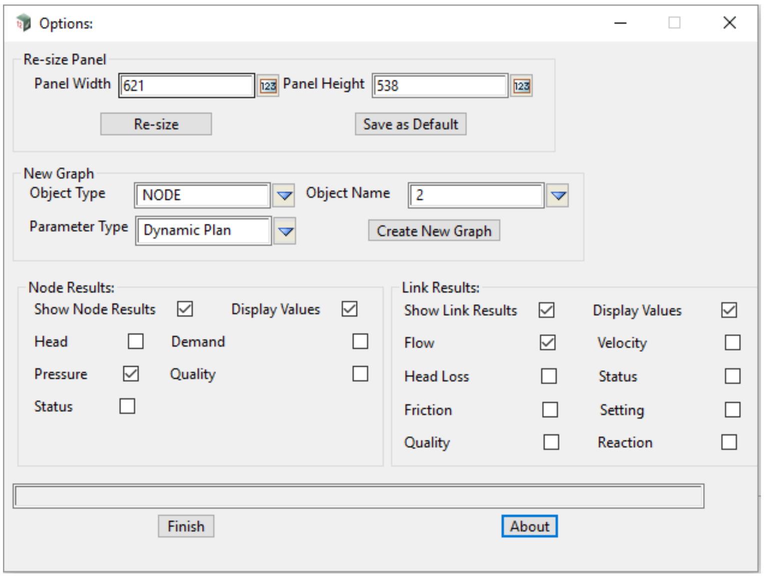
Link profile results



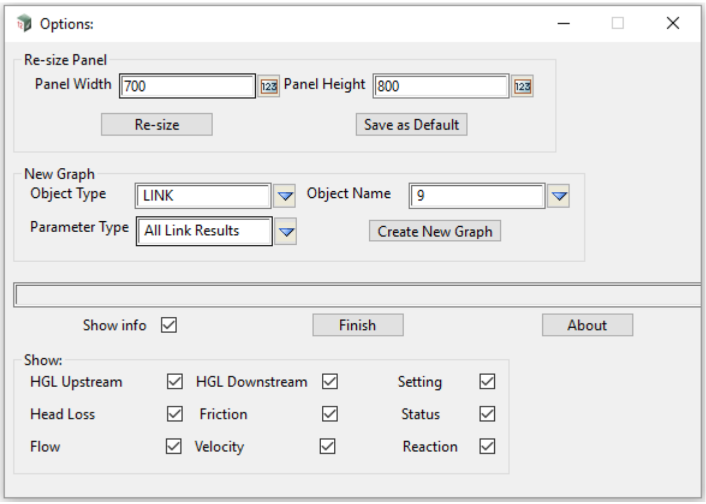
Plan results



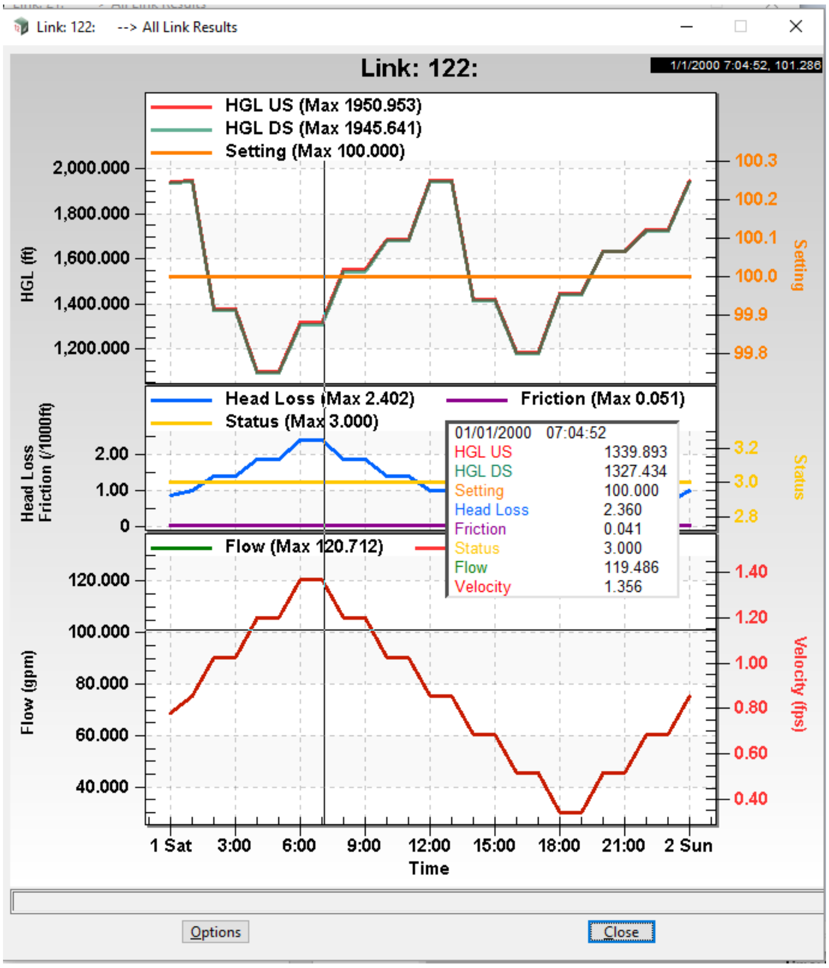
Graph options (dynamic plan)



Graph options (all link results)



Show info



Results attributes

Model attributes

- *reaction wall*
- *reaction bulk*
- *reaction tank*
- *reaction source*
- *pumps total cost*
- *pumps demand charge*

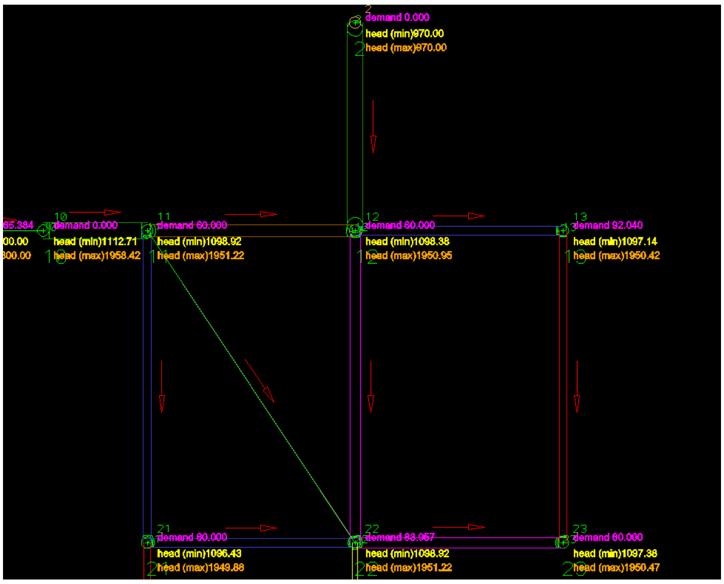
Link attributes

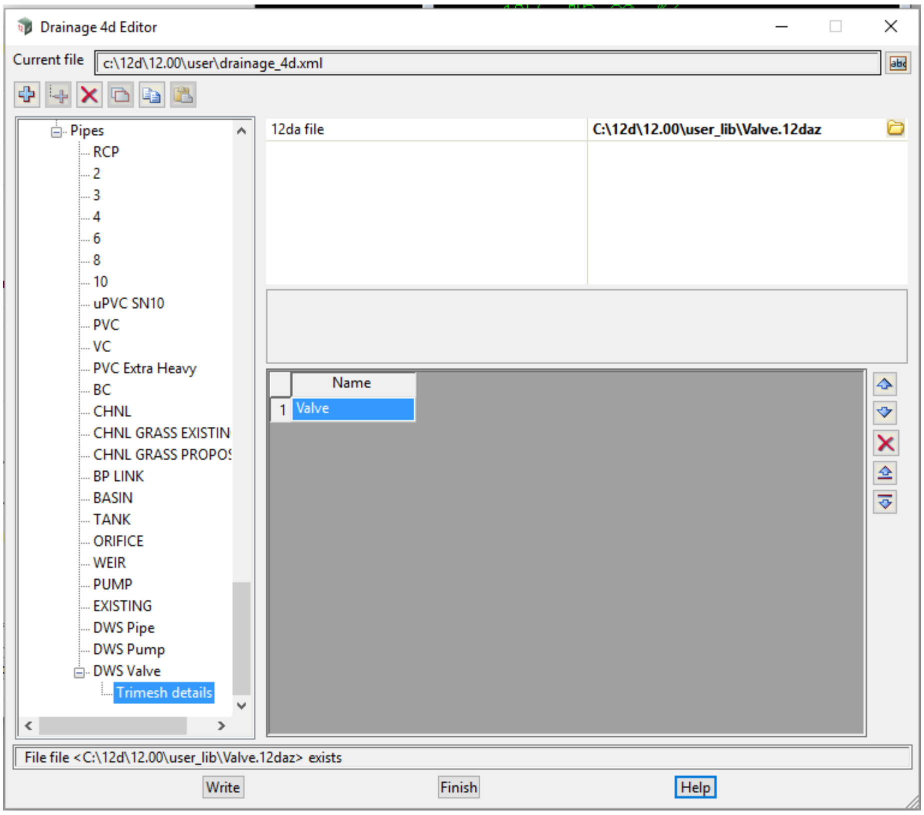
- *pump percent utilisation*
- *pump energy average efficiency*
- *pump energy usage rate*
- *pump energy usage average*
- *pump energy usage peak*
- *pump energy usage cost*

- *ink flow minimum*
- *link flow maximum*
- *link flow average*
- *link velocity minimum*
- *link velocity maximum*
- *link velocity average*
- *link unit headloss minimum*
- *link unit headloss maximum*
- *link unit headloss average*
- *link friction factor minimum*
- *link friction factor maximum*
- *link friction factor average*
- *link reaction rate minimum*
- *link reaction rate maximum*
- *link reaction rate average*
- *link quality minimum*
- *link quality maximum*
- *link quality average*
- *link status minimum*
- *link status maximum*
- *link status average*
- *link setting minimum*
- *link setting maximum*
- *link setting average*

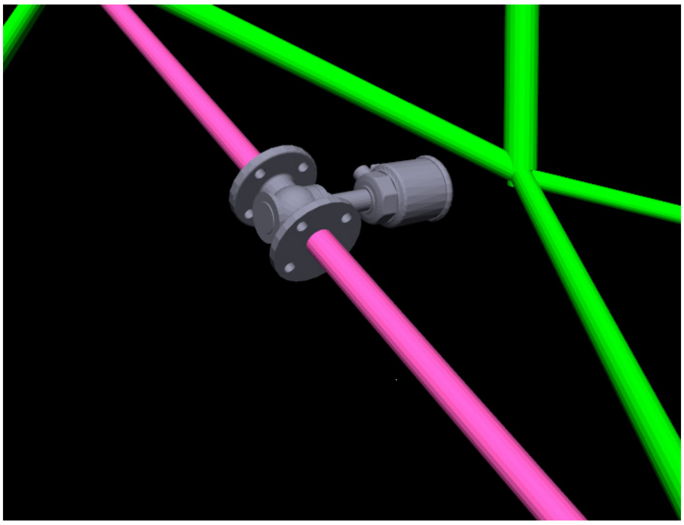
Node attributes

- *node demand minimum*
- *node demand maximum*
- *node demand average*
- *node head minimum*
- *node head maximum*
- *node head average*
- *node pressure minimum*
- *node pressure maximum*
- *node pressure average*
- *node quality minimum*
- *node quality maximum*
- *node quality average*




Drainage 4d Editor
Current file
c:\12d\12.00\user\drainage_4d.xml
Pipes
RCP
2
3
4
6
8
10
uPVC SN10
PVC
VC
PVC Extra Heavy
BC
CHNL
CHNL GRASS EXISTIN
CHNL GRASS PROPOS
BP LINK
BASIN
TANK
ORIFICE
WEIR
PUMP
EXISTING
DWS Pipe
DWS Pump
DWS Valve
Trimesh details
12da file
C:\12d\12.00\user_lib\Valve.12daz
Name
1
Valve
File file <C:\12d\12.00\user_lib\Valve.12daz> exists
Write
Finish
Help

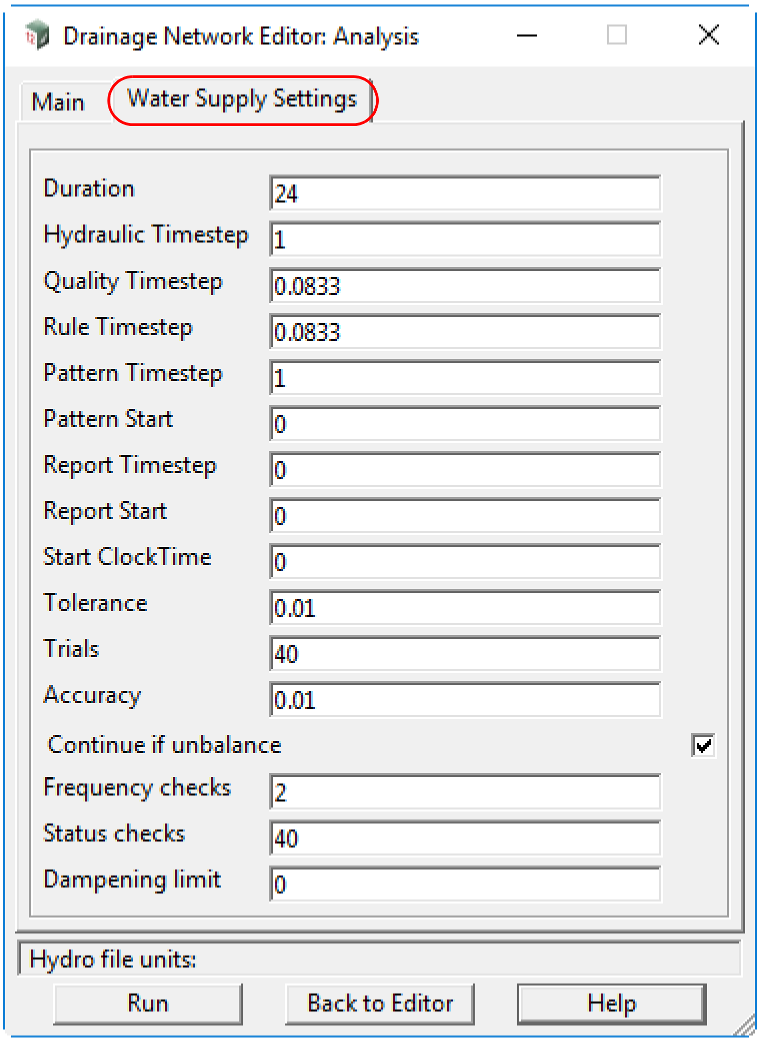
Visualisation



17.7.2.3.4 WS Analysis - Simulation Settings

When the **Analysis** button at the bottom of the WNE is pressed, the **Drainage Network Editor: Analysis** panel appears.

The **Water Supply Settings** tab has the values for run-time parameters that are used in the analysis run.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Duration real box

Total length of a simulation in hours.

Use 0 to run a single period (snapshot) hydraulic analysis.

Hydraulic timestep real box

Time interval between re-computation of system hydraulics. Normal default is 1 hour.

Quality timestep real box

Time interval between routing of water quality constituent. Normal default is 5 minutes (0:05 hours).

Rule timestep real box

Time interval between evaluating rules and controls. Normal default is 5 minutes (0:05 hours).

Pattern timestep real box

Time interval used with all time patterns. Normal default is 1 hour.

Pattern start real box

Time into all time patterns at which the simulation begins (e.g., a value of 2 means that the simulation begins with all time patterns starting at their second hour). Normal default is 0.

Reporting timestep real box

Time interval between periods at which computed results are reported. Normal default is 1 hour.

Report start real box

Time into simulation at which computed results begin to be reported. Normal default is 0 hours.

Start clocktime real box

Clock time (e.g., 7:30 am, 10:00 pm, 20:00) at which simulation begins. Default is 12:00 am (midnight).

Tolerance real box

Difference in water quality level below which one can say that one parcel of water is essentially the same as another. The default is 0.01 for all types of quality analyses (chemical, age (measured in hours), or source tracing (measured in percent)).

Trials real box

Maximum number of trials used to solve network hydraulics at each hydraulic timestep of a simulation. The default is 40.

Accuracy real box

Prescribes the convergence criterion that determines when a hydraulic solution has been reached. The trials end when the sum of all flow changes from the previous solution divided by the total flow in all links is less than this number. The default is 0.001.

Continue real box

If unbalanced determines what happens if a hydraulic solution cannot be reached within the prescribed number of Trials. If this checkbox is disabled, the simulation will halt the entire analysis at that point. If enabled the simulation will continue the analysis with a warning message issued.

Frequency checks real box

Number of solution trials before the status of pumps, check valves, flow control valves and pipes connected to tanks are once again updated. The default is 2.

Status checks real box

Number of solution trials after which status checks on pumps, check valves, flow control valves and pipes connected to tanks are discontinued. The default is 40.

Dampening limit real box

Accuracy value at which solution dampening and status checks on Pressure Reducing Valves and Pressure Sustaining Valves should begin. The default is zero.

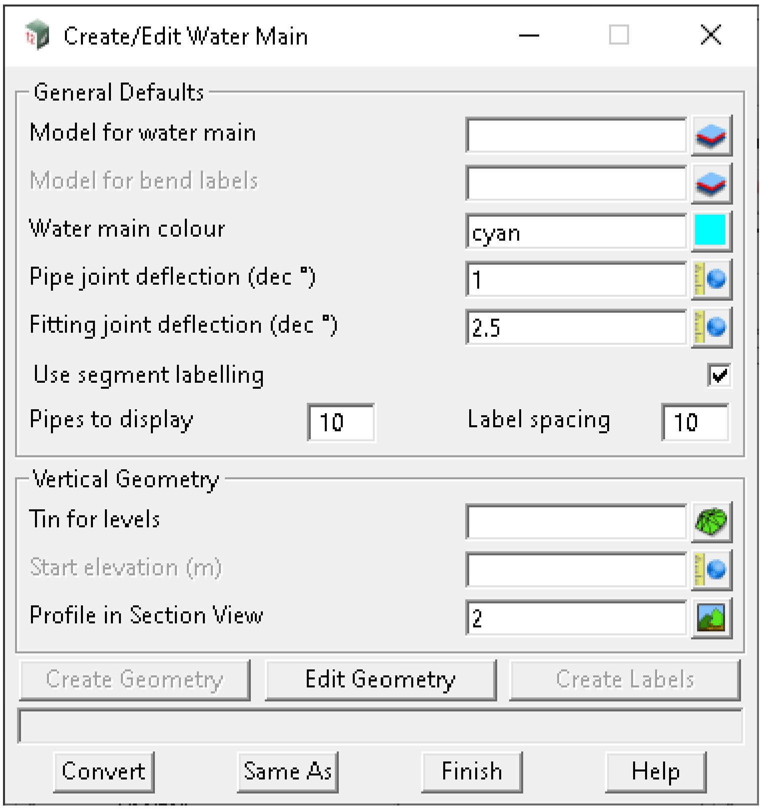
Continue to 17.7.3 Create/Edit Water Main or return to 17.7 Water Supply.

17.7.3 Create/Edit Water Main

Position of option on menu: **Water =>Water supply =>Create/edit water main**

Create/edit water main is used to generate a string which defines the horizontal and vertical geometry for a water main. Standard bend angles are able to be turned on/off for the string creation and a default pipe length is used to assist with bend positioning.

Selecting **Create/edit water main** brings up the **Create/Edit Water Main** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Defaults node

*The **Defaults node** has basic defaults for the creation of the water main. It allows for parameters such as the angle labels for geometry option strings to be used and the spacing of the labels to be controlled. The number of standard pipe lengths created for the geometry option strings is also controlled by the defaults. Note that larger numbers of pipe lengths will result in slower update of geometry options. The defaults can be dynamically updated during string creation.*

Model for water main model box

Model that the water main will be added to.

Model for bend labels model box available models

*If **not blank**, the model that bend labels will be added to.*

Water main colour colour box available colours

Colour the new water main will have.

Tin for levels tin box available tins

*Tin to use for vertical geometry calculations - **work in progress and not yet working??***

Profile in Section View view box available section views

*View the water main will be profiled in during geometry creation - **work in progress and not yet working??***

Pipe lengths to display integer box 20

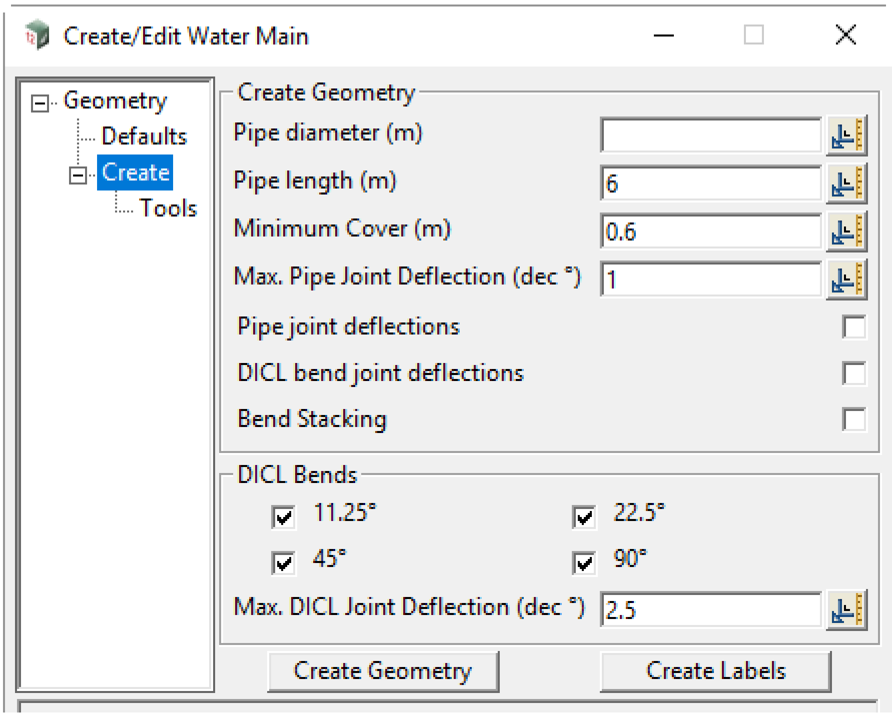
Number of standard pipe lengths to use for geometry options strings.

Use segment labelling tick box Selected

*If **ticked**, segment labelling is created for the geometry options strings.*

Segment label spacing integer box 10

Segment spacing is required for the geometry options string labels.



Create node

*The **Create node** contains fields related to creation of the water main geometry.*
The fields on this page can be dynamically changed during string creation.
Standard DICL bend sizes can be chosen, and pipe joint or DICL bend joint deflection angles can be set.
The nominal pipe length and minimum cover values are both set here.

Pipe diameter (m) real box

Required diameter of the water main.

Pipe length (m) real box 6

Nominal pipe segment length for the water main.

Minimum cover (m) real box 0.6

Minimum cover required for the water main.

Max. pipe joint deflection (°) real box 1

Maximum allowable deflection through pipe joints.

Pipe joint deflection tick box

*If **ticked**, use pipe joint deflections rather than standard DICL bends.*

DICL bend joint deflections tick box

*If **ticked**, use bend joint deflections with standard DICL bends.*

Bend Stacking tick box

*If **ticked**, allow stacking of standard DICL bends to achieve non-standard angles.*

DICL Bends tick boxes

***Tick** the Standard bend sizes to be used for geometry calculations.*

Max. DICL Joint Deflection (dec °) real box 2.5

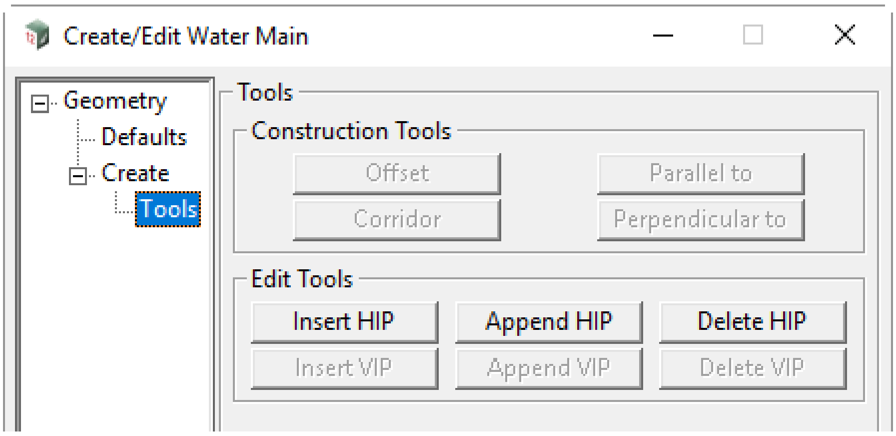
Maximum deflection allowed through DICL bend sockets. The units are decimal degrees.

Create Geometry button

Initiate the construction of the water main geometry.

Create Labels button

Create deflection labels along the water main for both horizontal and vertical deflections, in the model selected in defaults.



Create >Tools node

*The **Tools** node has tools to assist with creation and editing of the water main.*

This node is a work in progress and not all functionality is currently available??

Construction Tools

Offset button

*Create a geometry string at a fixed offset from a selected string. Geometry strings are temporary - **work in progress- not active at this time??***

Parallel to button

*Set the angle of your geometry options based on the bearing of another selected string - **work in progress??***

Corridor button

*Create geometry strings to define an offset corridor from a selected string. Geometry strings are temporary - **work in progress- not active at this time??***

Perpendicular to button

*Select a point perpendicular to a selected string - **work in progress- not active at this time??***

Edit Tools

Insert HIP button

Insert a new HIP at a selected location on the water main.

Append HIP button

Append a new HIP at the end of a water main.

Delete HIP button

Delete the selected HIP.

Insert VIP button

*Insert a new VIP at a selected location on the water main - **work in progress - not active at this time??***

Append VIP button

*Append a new VIP at the end of a water main - **work in progress - not active at this time??***

Delete VIP button

*Delete the selected VIP - **work in progress - not active at this time??***

Buttons at Bottom

Export to WNE button

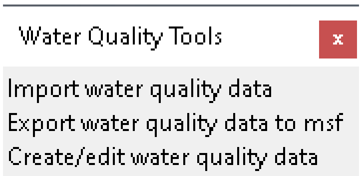
*Export the water main to the **Water Network Editor** in 12d for hydraulic analysis purposes - work in progress and not yet working??*

Same As button

Allows parameters on another string to be used for the water main. Relevant fields will be automatically populated based on the parameters available.

17.8 Water Quality

Position of menu: **Water =>Water quality**



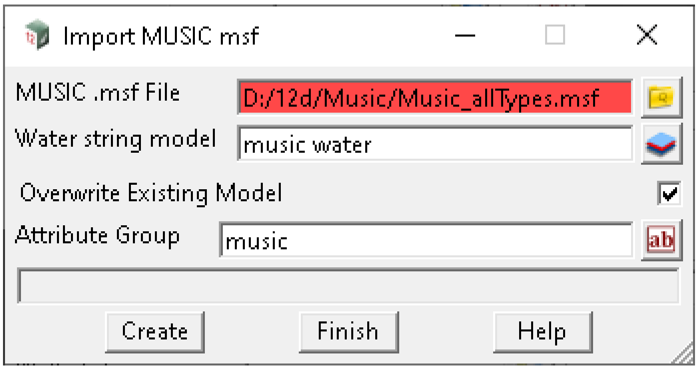
17.8.1 Import MUSIC msf File
17.8.2 Create MUSIC msf File
17.8.3 Water Quality Create/Edit

17.8.1 Import MUSIC msf File

Position of option on menu: Water =>Water quality =>Import water quality data

This option is under development.

Selecting **Import water quality data** brings up the **Import MUSIC msf** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
MUSIC msf file	file box		*.msf files

MUSIC msf file to read in.

Water string model	model box		available models

Model??

Overwrite exiting model	tick box	ticked	

*If **ticked**,??*

Attribute group	text box		

??

Buttons at Bottom

Create	button		

??

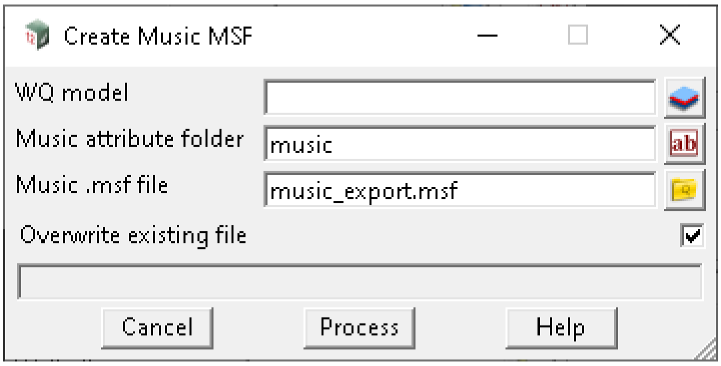
Continue to 17.8.2 Create MUSIC msf File or return to 17.8 Water Quality or 17 Water.

17.8.2 Create MUSIC msf File

Position of option on menu: **Water =>Water quality =>Export water quality data**

This option is under development.

Selecting **Export water quality data** brings up the **Create MUSIC msf File** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
WQ model	model box		available models
Water quality model to create the msf file from.			
MUSIC attribute folder	text box		
??			
MUSIC msf file	file box		*.msf files
MUSIC msf file to create.			
Overwrite exiting file	tick box	ticked	
*If **ticked**,??*			

Buttons at Bottom

Cancel	button		
??			
Process	button		
??			

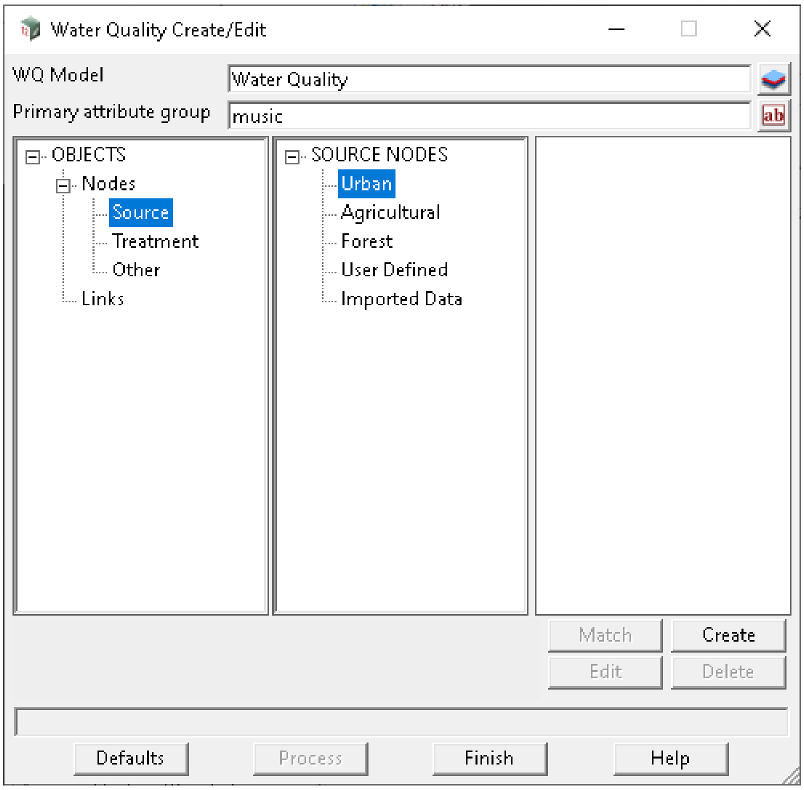
Continue to 17.8.3 Water Quality Create/Edit or return to 17.8 Water Quality or 17 Water.

17.8.3 Water Quality Create/Edit

Position of option on menu: Water =>Water quality =>Create/edit water quality data

This option is under development.

Selecting **Create/edit water quality data** brings up the **Water Quality Create/Edit** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
WQ model	model box		available models

Water quality model??

Buttons at Bottom

Defaults	button

??

Process	button

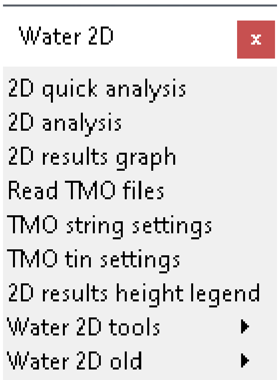
??

Continue to 18 Water 2D or return to 17.8 Water Quality or 17 Water.

18 Water 2D

Position of menu: **Water =>Water 2D**

The **Water 2D** walk-right menu is



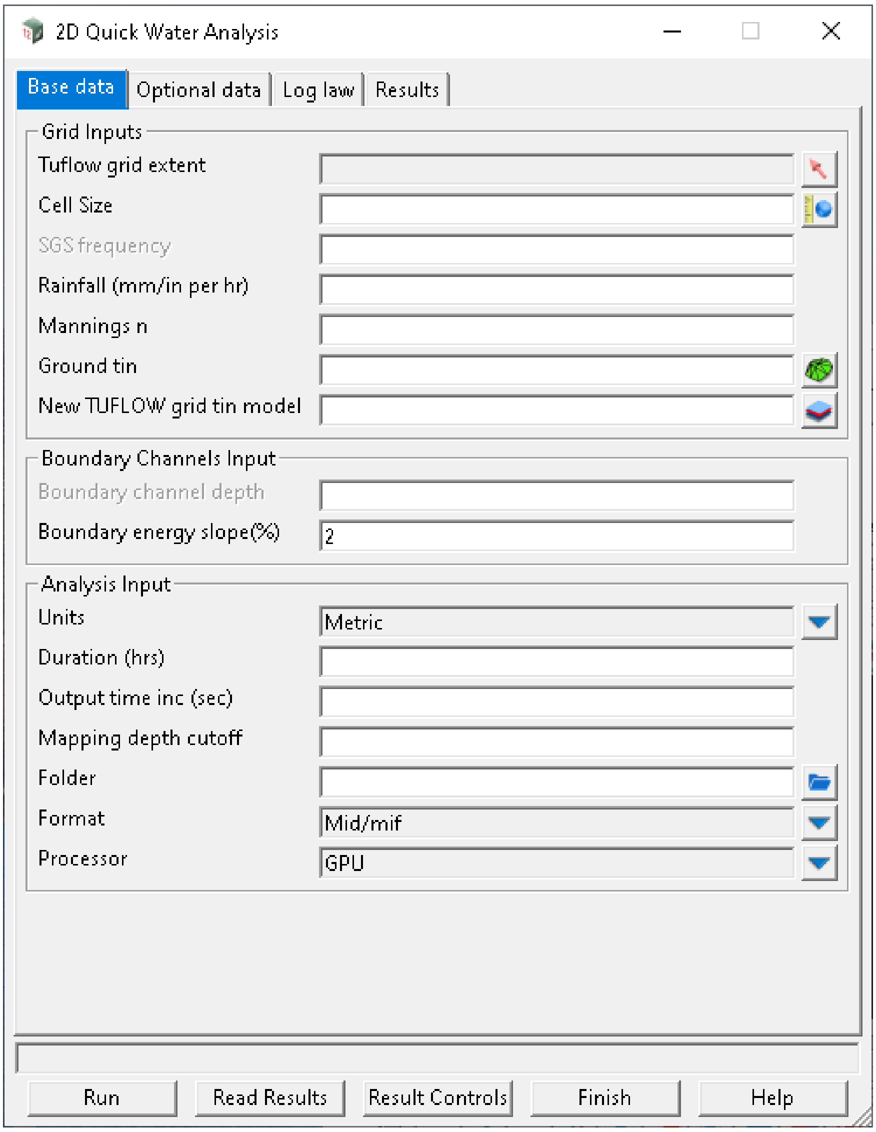
See
18.1 2D Quick Analysis
18.2 2D Water Analysis
18.3 TUFLOW Results Graph
18.4 Reading TUFLOW TMO/TGO Files
18.5 TMO String Results Settings
18.6 TMO Tin Results Settings
18.7 2D Results Height Legend
18.8 Water 2D Tools
18.9 Water 2D Old

18.1 2D Quick Analysis

Position of option on menu: **Water =>Water 2D =>2D quick analysis**

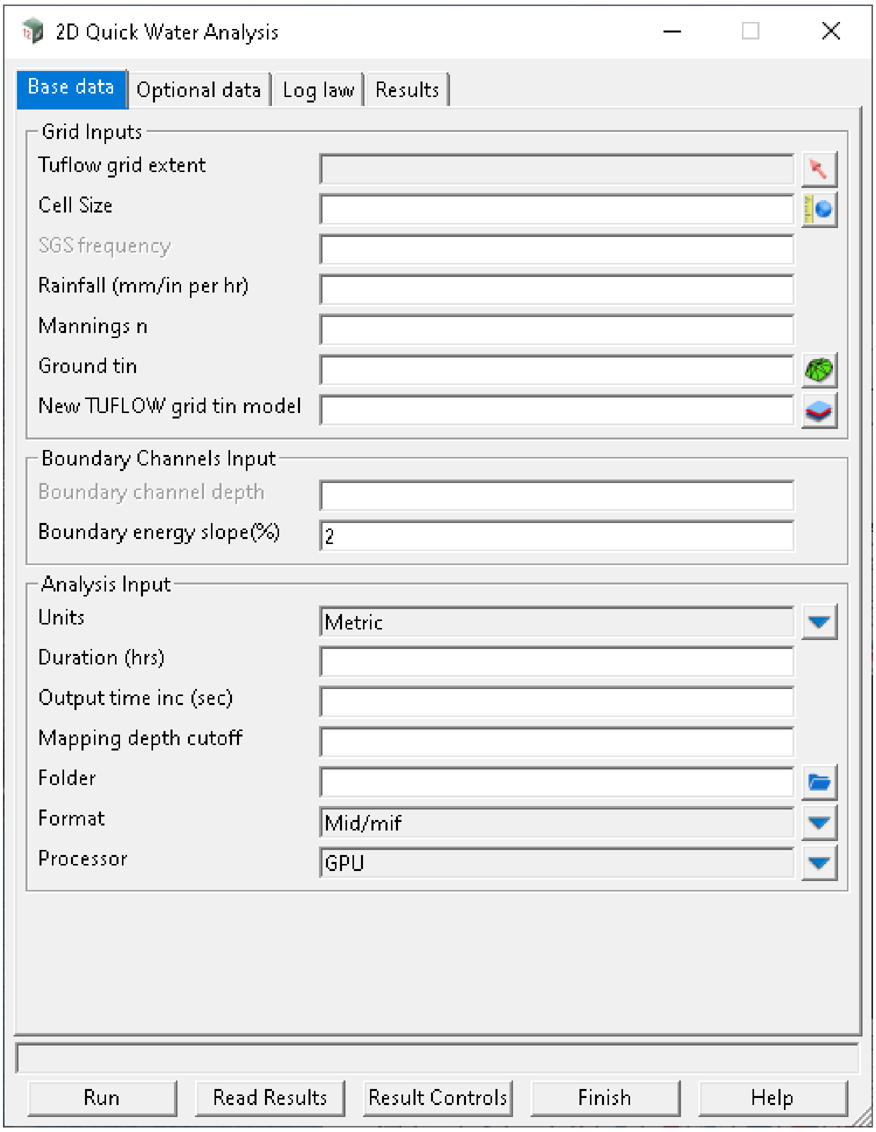
This option was previously known as **Roadflow** in Version 14.

Selecting the **2D quick analysis** displays the **2D Quick Analysis** panel.



See
Base data tab
Optional data tab
Log law tab
Results tab
Buttons at bottom

Base data tab



See
Base data tab
Optional data tab
Log law tab
Results tab
Buttons at bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Grid Inputs

TUFLOW grid Extent select box

The string must be a super string rectangle in a model by itself.

Cell Size real box

A number greater than zero must be entered. When enter is pressed the number of cells is calculated from the grid extent rectangle. When the cell count is less than 30,000, no Roadflow module is required.

SGS frequency

This value must be an odd number greater than 1. When not blank, TUFLOW flow calculations are improved by increasing the number of elevations points along a cell side (includes the corner points). The cell storage calculations are also improved using a grid of elevations for the bottom cell. The same frequency is used for Quadtree refined cell sizes. The extra z points are not shown in the zpt check file.

Note that there is still only one cell centre result for each cell. For partially wet cells, the water level may be below the cell centre ground elevation.

Rainfall (mm/in per hour) real box

A number greater than or equal to zero is entered here for a constant rainfall on grid.

Manning's n real box

*A number greater than zero must be entered. This roughness is used for all cells unless the **Material polygon model** is specified on the **Optional data** tab.*

Ground tin tin box

This tin must exist. The grid cell centre and side centre elevations are retrieved from this tin.

New TUFLOW grid tin model model box

*This model name will also be used for the grid tin name. If a tin with this name exists it will be replaced. Pressing enter will copy this text into the **Folder name** field.*

Boundary Channels Input

Boundary channel depth real box 0.1

This setting controls the number of stage discharge curves along the extent rectangle.

Stage discharge curves are created along the sides of the extent rectangle. A value of zero will result in each size having 1 boundary condition.

If a value greater than 0 is entered in this field, the boundary rectangle is draped onto the ground tin and the draped string split into separate channels. When a channel has a depth greater than this tolerance, the string is split at the crests. Should there be any tin errors found in this process the boundary conditions will revert to one boundary per edge. The boundary check file will provide verification of the boundaries used.

Boundary Energy Slope(%) real box 2

This energy slope will be used when creating the stage discharge curves described above.

Analysis inputs

Units choice box Metric Metric, US

*These units will be used by TUFLOW. If using the **Drainage model** on the **Optional data** tab, both units must be the same.*

Duration (hrs) real box

*The TUFLOW model end time is set by this value when no **Drainage model** specified on the **Option data** tab or when the **Drainage model** has no catchment areas. When the **Drainage model** specified has catchment areas, the duration is determined by the 1d model rainfall durations.*

Output time inc (sec) real box

A number greater than zero must be entered. Results will be saved at this time interval for tmo grid results and time graphs.

Mapping depth cutoff

Cell centre depth less than this value will be displayed as dry. The value has no effect on the wet dry depth used in the calculations. It is often set greater than zero for direct rainfall. Care should be taken when water is overtopping roads as this is often a shallow depth as well.

Folder file box

If this folder exists it will be cleaned. This text will also be used as a model prefix for the TUFLOW models been created and for the GIS file name prefixes.

Format	choice box	Mid/mif	Mid/mif, Shape

Controls the format of the GIS files written by RoadFlow.

Projection - (Mid/mif) the mid/mif projection is retrieved from the project text attribute "MapInfo_Projection". If this is not set (see Project->Utilities->Attributes) the value "0, 7" will be used to specify a Non-Earth (meters) projection.

Other MapInfo Projection strings may be found via Project->Management->Projections->Set Projection. Copy the MapInfo string from here into the project text attribute discussed above.

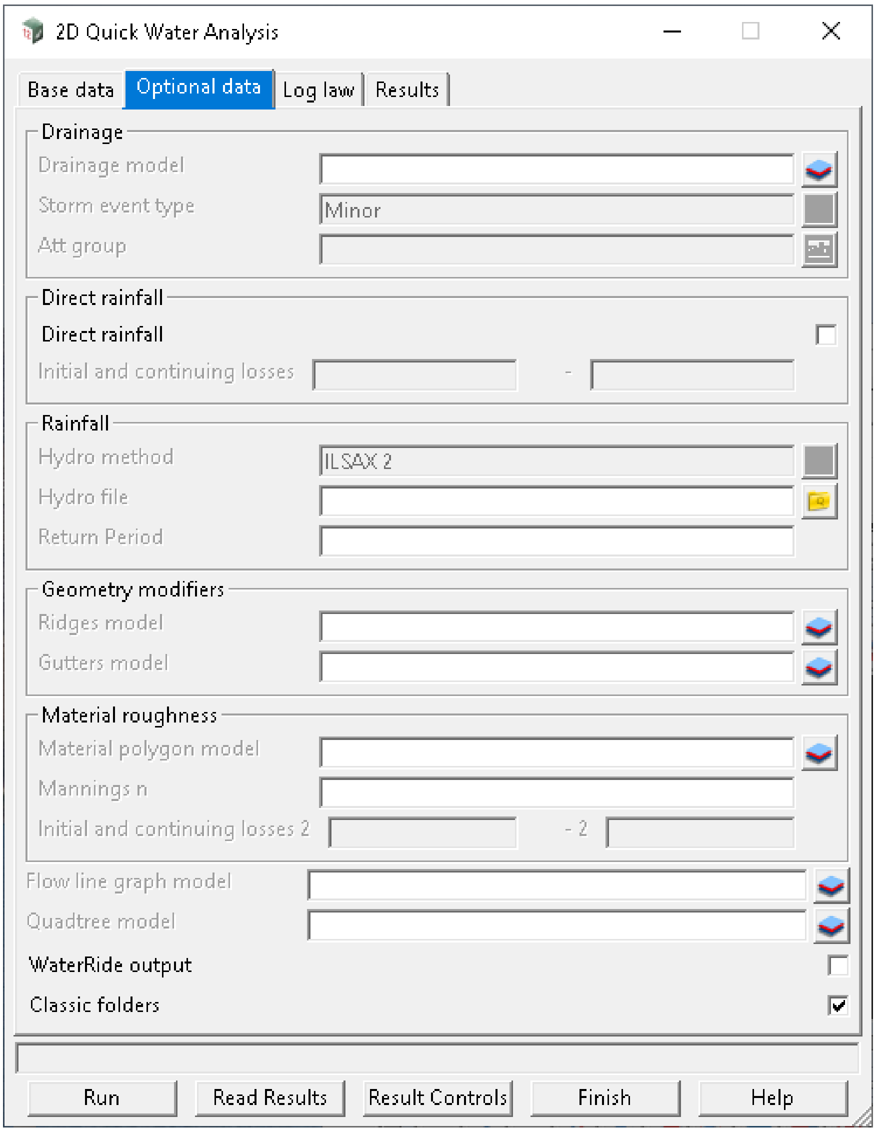
Processor	choice box	GPU	CPU, GPU

*CPU is available on all computers that run **12d Model** but GPU requires a TUFLOW compatible NVIDIA graphics card and an additional GPU module.*

Optional data tab

No fields on this tab are required.

The ***Geometry modifiers*** *may significantly improve the quality of the TUFLOW grid elevations.*



See
Base data tab
Optional data tab
Log law tab
Results tab
Buttons at bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Drainage

Drainage model	model box		available models

This model must contain drainage strings that can be solved using the dynamic drainage method. It is strongly recommended that you run this drainage model via the ***WNE*** *before using it in this panel. Inlets inside the grid extent will be linked to the 2d grid at the grate level and outlets at the sump level. Inlets with the Ku method set to a culvert will also be linked to the sump level. Bypass inlet inside the grid extent will be erased along with bypass across the edge boundaries.*

Inlets will accept water through the grate via inlet capacity curves (sag and on-grade) and will allow unrestricted surcharging.

Catchment flows will be directly applied to the 2d cell connected to the inlet unless a ***2d catchment flow model*** *is specified.*

Storm event type choice box

This box becomes active when a Drainage model is selected. The value displayed is from the last 1d dynamic run. Changes here will also be reflected in the WNE Analysis panel.

Att group text box

This box becomes active when a Drainage model is selected. The value displayed is from the last 1d dynamic run for the minor/major storm event specified above. Changes here will also be reflected in the WNE Analysis panel.

Direct Rainfall

Direct rainfall tick box not ticked

*When selected, rainfall temporal patterns selected in the **Hydro file** below will be used to create rainfall events for the entire extent. Rainfall intensity on the base data tab is generally set to zero as it will be added to the temporal pattern rainfall.*

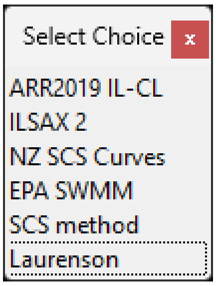
Initial and continuing losses real box

These boxes becomes active when Direct rainfall is selected. The initial loss (mm or inches) is entered in the first box and the continuing loss (mm/hr or inches/hr) in the second.

Rainfall

Hydro method choice box

For a description of each dynamic hydrology, see 27.1.2.3 Dynamic Hydrology



*This box is enabled when **Direct** rainfall is selected above. This selection determines how the rainfall temporal patterns in the **Hydro file** below are interpreted. When a **Drainage model** is selected above, this will be disabled the data displayed will be from the current drainage model setting.*

Hydro file file box *.12dhydro

*This box is enabled when **Direct** rainfall is selected above. Temporal patterns selected in this file, together with the **Return Period** below, determine the rainfall patterns created in the rainfall.csv file.*

Return Period

*This box is enabled when **Direct** rainfall or **Drainage model** are selected above. Fixed temporal patterns are selected from the **Hydro file**, using this value and it is used to obtain the rainfall depth or intensity from the **Hydro** file ifd data. Together they determine the rainfall patterns created in the rainfall.csv file.*

Geometry modifiers

Ridges model model box

The super strings in this model will be used to raise the cell sides crossing this string. This will ensure that the cell sides form a barrier to the flow near the string.

Gutters model model box

The super strings in this model will be used to lower the cell sides crossing this string. This will ensure that the cell sides form a flow path near the string.

Material roughness

Manning's n real box

*A number greater than zero maybe be entered here as an additional Manning's n for cells within the polygons specified in the **Material polygon model**.*

Material Polygon model model box

Super string polygons will be used to assigned the n value above the cells within the polygon.

Initial and continuing losses 2 model box available models

*These rainfall losses are used for all cells that are not selected by the **Material Polygons**.*

Flow line graph model model box available models

Flow across a line can be calculated by TUFLOW. These strings must be drawn from left to right looking in the positive direction of flow. The graph results are viewed using the Design->TUFLOW->TUFLOW results graph option.

Quadtree model model box available models

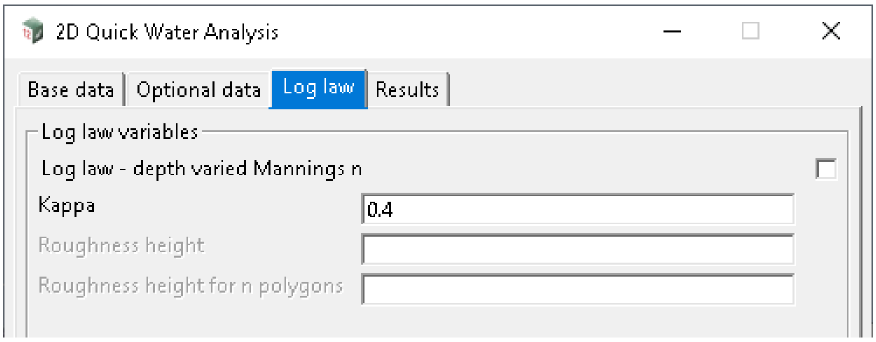
Closed polygons in the model specify areas to use a refined quadtree grid. By default, a level 2 refinement is used (1/2 the base cell size). Each base cell will now be divided into 4 cells with each cell having result values. In addition, results will be interpolated to the cell corners.

The Roadflow quadtree module will only allow a level 2. The Open Quadtree model will allow the level attribute on the polygons to be set between 2 and 9.

Classic folders tick box ticked

With classic folder selected, the TUFLOW data folders use the name convention used by most TUFLOW modellers.

Log law tab



See
Base data tab
Optional data tab
Log law tab
Results tab
Buttons at bottom

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Log law variables

Log law - depth varied Mannings n tick box not ticked

This option should not be used unless the user has read the documentation in the TUFLOW manual regarding depth varied Manning's n. See TUFLOW manual 2018 section 6.9.2 Log Law Depth Varying Bed Resistance. Consider creating graphs, as below, for several roughness heights.

Kappa

Kappa is typically in the range 0.38 to 0.42 (recommend 0.4)

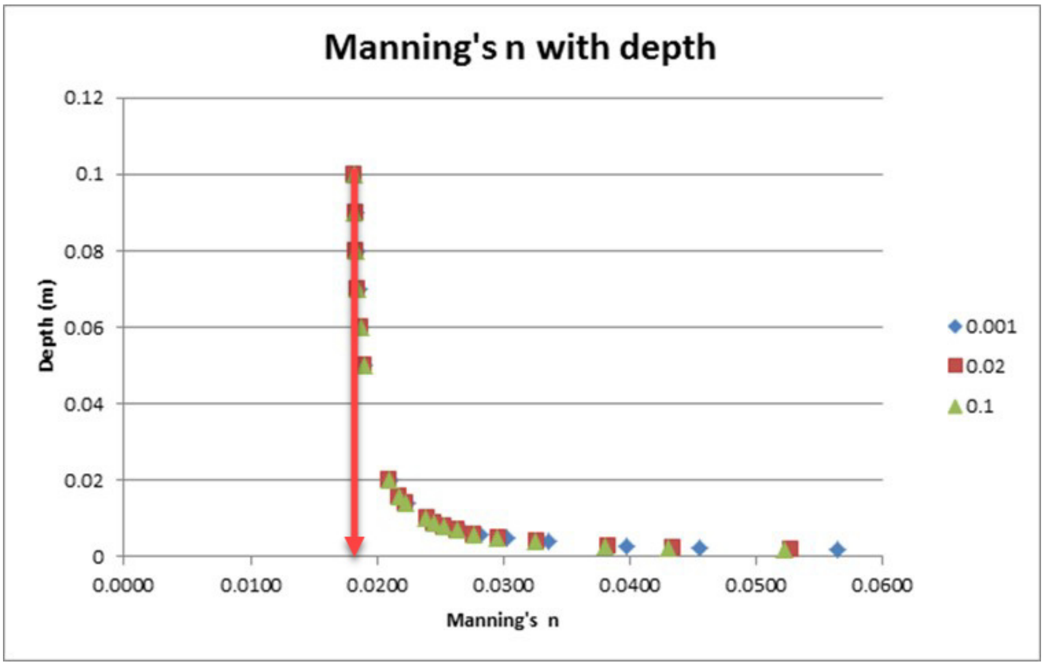
Source: TUFLOW 2018-03-AD manual

Roughness height

The roughness height in m will often range from 0.001 (smooth), 0.010 (a small pebble) to 0.1. The graph below is for a roughness height of 0.010. The y axis is the depth of flow. The 3 symbols are various water surface slopes (m/m).

The lower limit on the Manning's n value is approximately 0.018 in this case. At depths less than 0.010m, the slope of the water surface begins to have a more pronounced effect. The flat slope of 0.001 (blue diamond) produced the greatest n value while the steep slope 0.1 (green triangle) produced the smallest of the 3 n values.

Note that at depths greater than 0.020m the roughness height has little effect on the calculated Manning's n.

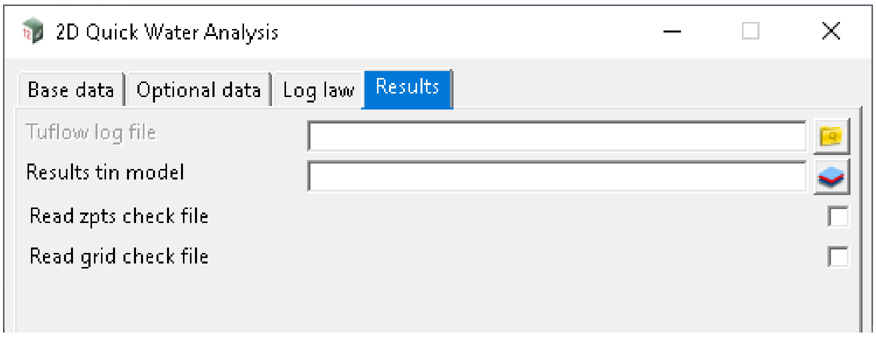


Source: TUFLOW 2018-03-AD manual (red arrow added).

Roughness height for n polygons

Roughness height for the Material roughness polygons.

Results tab



See
Base data tab
Optional data tab
Log law tab
Results tab
Buttons at bottom

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
TUFLOW log file	file box		*.tlf files

*The TUFLOW log file must be selected before the **Read Results** button may be used. This controls what results are read if multiple events are analysed. The log file contains details of the TUFLOW run and is helpful in processing runtime errors.*

Results tin model model box

This model will be used as a prefix for the 4 models and 4 grid tin. See 18.1.1 2D Grid Results *for more details.*

Read zpts check file tick box not ticked

The zpt check file will be used to create a check tin of the final z values used in the TUFLOW analysis.

Read grid check file tick box not ticked

*If **ticked**, the grid check file will be used to create a model of all the grid cells used in the TUFLOW analysis.*

Buttons at bottom

Run button

*The grid tin is recreated and all the required TUFLOW models are created. If they exist, they will be replaced. A TUFLOW analysis window will be displayed for the duration of the run. The results may be monitored during the calculations by starting another version of **12d Model**.*

Read Results button

Results grid tins will be created as discussed in the 18.1.1 2D Grid Results*. The results time step will be set to the run maximums if available. TUFLOW check files will also be imported to assist in analysis verification.*

Result Controls button

*The TUFLOW Tin Result setting panel will be displayed with the tin from the **Result tin model** field inserted. The current results settings are displayed. Please refer to the help for this panel for details.*

Continue to 18.1.1 2D Grid Results or return to 18 Water 2D.

18.1.1 2D Grid Results

4 models are created using the given model name as a prefix followed by either 3D, depth, velocity or hazard. Grid tins, by the same name, are created and added to these models. If the grid tins exist, they are deleted. The grid tins are linked to the result tmo files. You must keep the tmo files in the original folders to see the results.

The x,y of grid tins corners is the cell centre results. The z value for each grid is either elev (3D), depth, velocity or hazard.

2D grid results - shading and contour

The tins are usually shaded and contoured using the same result as the z value. The exception is the 3D tin which is shaded by depth. The max value used for the shading colours strip is determined by examining the maximum value for all cells at all time steps. This value is then rounded up to a reasonable value.

The default colour strip files used for depth, velocity and hazard or found in $LIB/drainage2d.

See 18.1.2 Shade and Vector Overrides to manually control the shading settings.

2D grid results - Vector Results

The 3D and velocity results tins also show velocity vectors (arrows). See 18.1.2 Shade and Vector Overrides to manually control the initial vector settings.

Continue to 18.1.2 Shade and Vector Overrides or return to 18 Water 2D.

18.1.2 Shade and Vector Overrides

When producing a large number of flood maps, it can be advantageous to have the shading and vector settings the same for all result grid tins. Enabling the defaults **before** reading in the results assists in this process.

After the first Read results is performed, the project attribute group, **tuflow results tin settings**, will exist. The attributes may be saved in a 12da file to be shared.

Shading Overrides

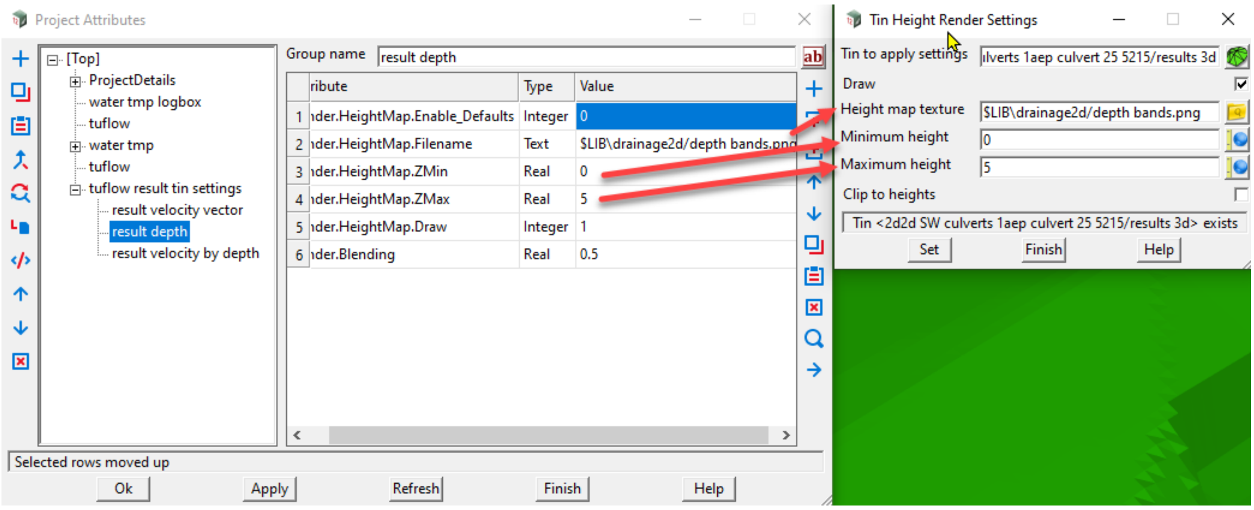
For each result type, (depth, velocity, etc) the default shading Min, Max and colour strip file name may be set. The attribute **Render.HeightMap.Enable_Defaults** must be set to 1 for the defaults to be used. The result grid tin current shading values are viewed and changed via these options.

Tin Height Render Settings,

Tin Render Height Legend.

The image below shows the shading attributes for Result_Depth shading.

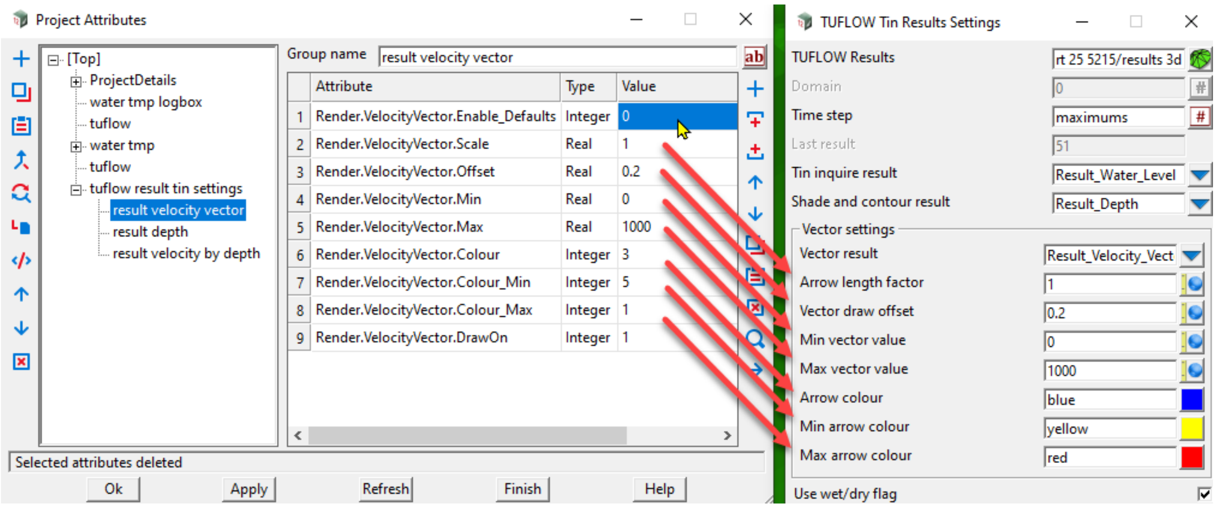
Note: the attribute group name, **result depth**, is the result, **Result_Depth**, changed to lower case and _ changed to space.



Vector Results Overrides

For each vector result type, (velocity) the default vector settings may be set. The attribute **Render.VelocityVector.Enable_Defaults** must be set to 1 for the defaults to be used.

Note: the attribute group name, **result velocity vector**, is the Vector results, **Result_Velocity_Vector**, changed to lower case and _ changed to space.



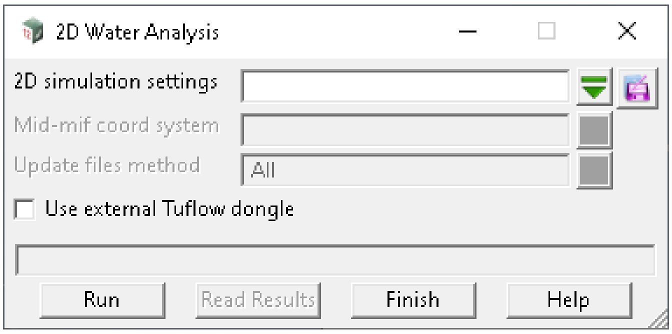
Continue to 18.2 2D Water Analysis or return to 18 Water 2D.

18.2 2D Water Analysis

Position of option on menu: **Water =>Water 2D =>2D analysis**

The first panel allows the user to type in a new names for the settings to be saved under or an existing one can be selected.

Selecting the **2D analysis** displays the **2D Water Analysis** panel.



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
2D simulation settings	type-choice box		sim files (*.12dsim)

A new name can be typed in for saving the panel options to and when <ENTER> is pressed, a new simulation setting file is created and the full panel appears. See After a Simulation Settings File is Loaded.

If an existing simulation settings file name is typed in and <ENTER> is pressed, the existing simulation setting file is loaded and the full panel appears with all the simulation settings read in. See After a Simulation Settings File is Loaded.

Save *icon*: *when pressed, the simulation settings file is updated with the current values in the* **2D Water Analysis** *panel.*

Mid-mif coordinate system

NOT CURRENTLY IMPLEMENTED

Update files method

NOT CURRENLY IMPLEMENTED

Use external Tuflow dongle tick box not ticked

If ***ticked*** *and the user has the BMT module, a TUFLOW licence is obtained from a TUFLOW Codemeter.*

If ***not ticked*** *or the user doesn't have the BMT module, a 12d Model 2D Analysis model is required to run the option.*

Buttons at bottom

Run button

When pressed, the option is run with the current simulation settings.

Read Results button

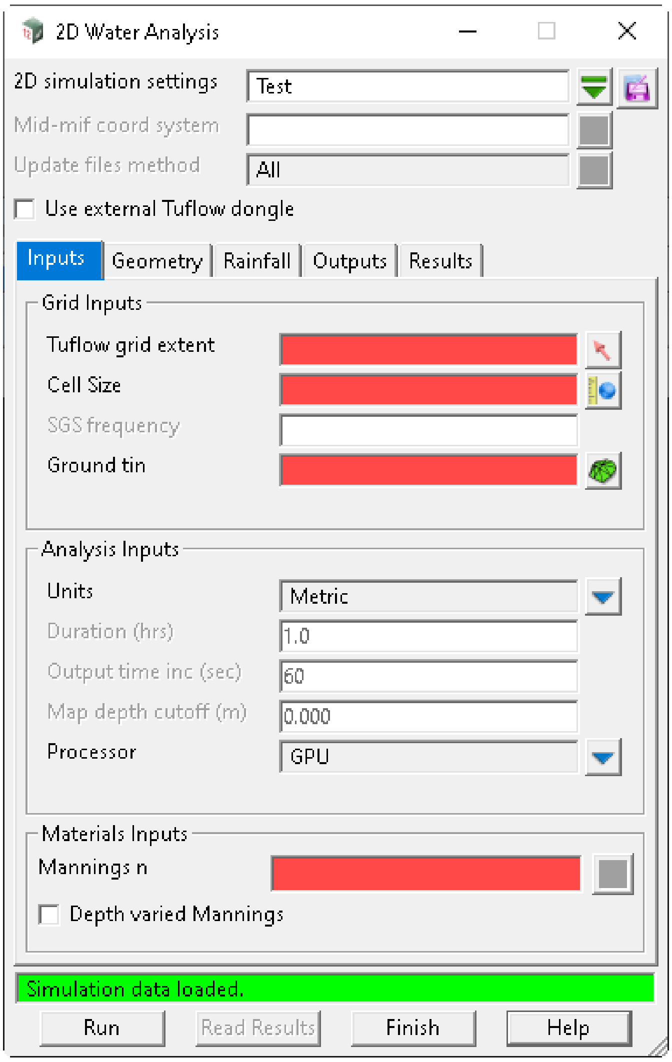
When pressed, the results from the 2D Analysis run are read in.

Results grid tins will be created as discussed in the 18.1.1 2D Grid Results. *The results time step will be* *set to the run maximums if available. TUFLOW check files will also be imported to assist in analysis verification.*

Continue to Inputs tab or return to.18.2 2D Water Analysis or 18 Water 2D.

After a Simulation Settings File is Loaded

Inputs tab



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Grid Inputs

TUFLOW grid extent select box

The string must be a super string rectangle in a model by itself.

Cell Size real box

A number greater than zero must be entered. When enter is pressed the number of cells is calculated from the grid extent rectangle. When the cell count is less than 30,000, no 2D Analysis module is required.

SGS frequency

This value must be an odd number greater than 1. When not blank, TUFLOW flow calculations are improved by increasing the number of elevations points along a cell side (includes the corner points). The cell storage calculations are also improved using a grid of elevations for the bottom cell. The same frequency is used for Quadtree refined cell sizes. The extra z points are not shown in the zpt check file.

Note that there is still only one cell centre result for each cell. For partially wet cells, the water level may *be below the cell centre ground elevation.*

Ground tin tin box

This tin must exist. The grid cell centre and side centre elevations are retrieved from this tin.

Analysis Inputs

Units choice box Metric Metric, US

These units will be used by TUFLOW. If using the ***Drainage model*** *on the* ***Optional data*** *tab, both units must be the same.*

Duration (hrs) real box

The TUFLOW model end time is set by this value when no ***Drainage model*** *specified on the* ***Option data*** *tab or when the* ***Drainage model*** *has no catchment areas. When the* ***Drainage model*** *specified has catchment areas, the duration is determined by the 1d model rainfall durations.*

Output time inc (sec) real box

A number greater than zero must be entered. Results will be saved at this time interval for tmo grid results and time graphs.

Mapping depth cutoff

Cell centre depth less than this value will be displayed as dry. The value has no effect on the wet dry depth used in the calculations. It is often set greater than zero for direct rainfall. Care should be taken when water is overtopping roads as this is often a shallow depth as well.

Processor choice box GPU CPU, GPU

CPU is available on all computers that run **12d Model** *but GPU requires a CUDA-enabled NVIDIA graphics card and an additional GPU module.*

Materials Inputs

Manning's n real box

A number greater than zero must be entered. This roughness is used for all cells unless the ***Material polygon model*** *is specified on the* ***Optional data*** *tab.*

Depth varied Manning's tick box

If ***ticked****, the extra fields Kappa and Roughness height (m) are displayed ready to be filled in:*

This option should not be used unless the user has read the documentation in the TUFLOW manual regarding depth varied Manning's n. See TUFLOW manual 2018 section 6.9.2 Log Law Depth Varying Bed Resistance. Consider creating graphs, as below, for several roughness heights.

Kappa real box

Kappa is typically in the range 0.38 to 0.42 (recommend 0.4)

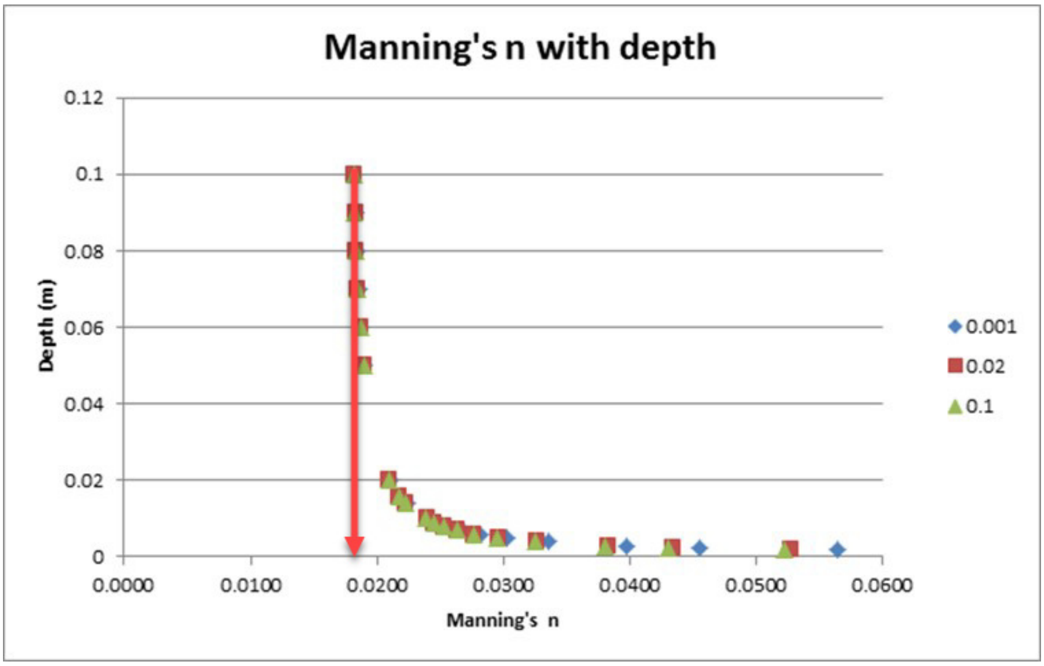
Source: TUFLOW 2018-03-AD manual

Roughness height (m) real box

The roughness height in m will often range from 0.001 (smooth), 0.010 (a small pebble) to 0.1. The graph below is for a roughness height of 0.010. The y axis is the depth of flow. The 3 symbols are various water surface slopes (m/m).

The lower limit on the Manning's n value is approximately 0.018 in this case. At depths less than 0.010m, the slope of the water surface begins to have a more pronounced effect. The flat slope of 0.001 (blue diamond) produced the greatest n value while the steep slope 0.1 (green triangle) produced the smallest of the 3 n values.

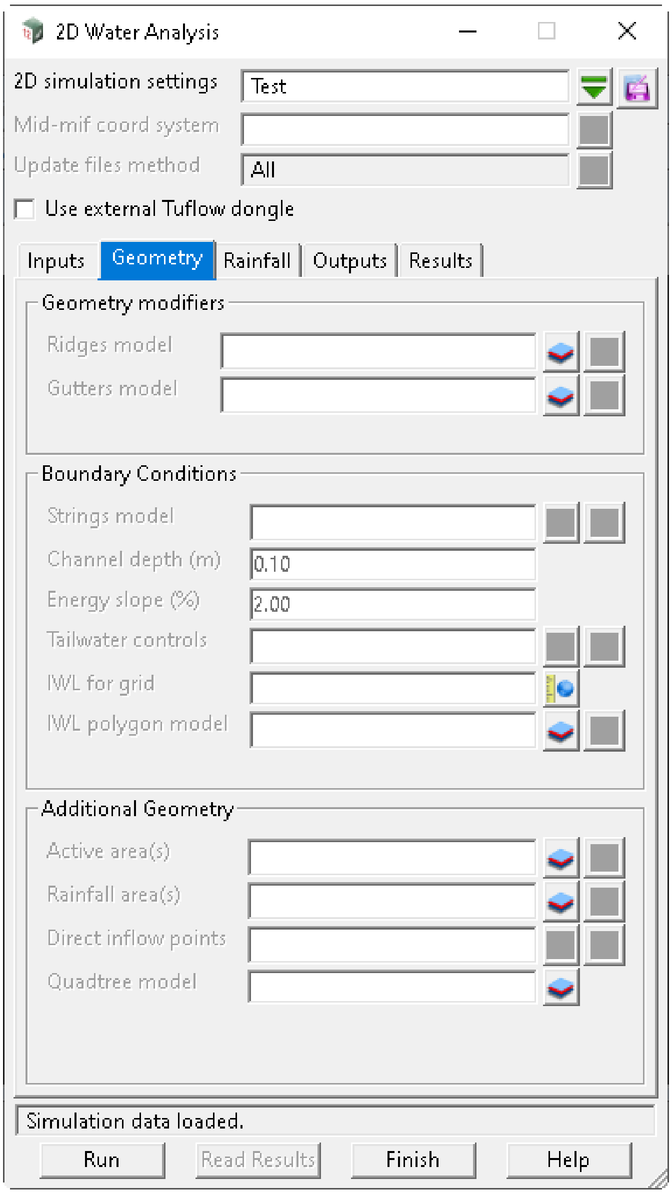
Note that at depths greater than 0.020m the roughness height has little effect on the calculated Manning's n.



Source: TUFLOW 2018-03-AD manual (red arrow added).

Continue to Geometry tab or return to.18.2 2D Water Analysis or 18 Water 2D.

Geometry tab



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Geometry modifiers

Ridges model model box

The super strings in this model will be used to raise the cell sides crossing this string. This will ensure that the cell sides form a barrier to the flow near the string.

Gutters model model box

The super strings in this model will be used to lower the cell sides crossing this string. This will ensure that the cell sides form a flow path near the string.

Boundary Conditions

Strings model model box

NOT YET IMPLEMENTED

Channel depth (m) real box 0.1

This setting controls the number of stage discharge curves along the extent rectangle.

Stage discharge curves are created along the sides of the active area polygons. A value of zero will result in each side having 1 boundary condition.

If a value greater than 0 is entered in this field, the boundary rectangle is draped onto the ground tin and the draped string split into separate channels. When a channel has a depth greater than this tolerance, the string is split at the crests. Should there be any tin errors found in this process the boundary conditions will revert to one boundary per edge. The boundary check file will provide verification of the boundaries used.

Energy Slope(%) real box 2

This energy slope will be used when creating the stage discharge curves described above.

Tailwater controls

NOT YET IMPLEMENTED

Initial water levels

NOT YET IMPLEMENTED

Additional Geometry

Active area(s) model box

Closed polygons in the model specify areas to be set as active or inactive. Polygons in the model may have their active states set individually. Default is ***Active****.*

Rainfall area(s) model box

Closed polygons in the model specify areas to be used for rainfall. Polygons in the model may have their rainfall factors set independently of one another.

Direct inflow points model box

NOT YET IMPLEMENTED

Quadtree model model box available models

Closed polygons in the model specify areas to use a refined quadtree grid. By default, a level 2 refinement is used (1/2 the base cell size). Each base cell will now be divided into 4 cells with each cell having result values. In addition, results will be interpolated to the cell corners.

The 2D Water Analysis module currently only allows a level 2 refinement, however further levels will be implemented at a later date.

Active area from choice box

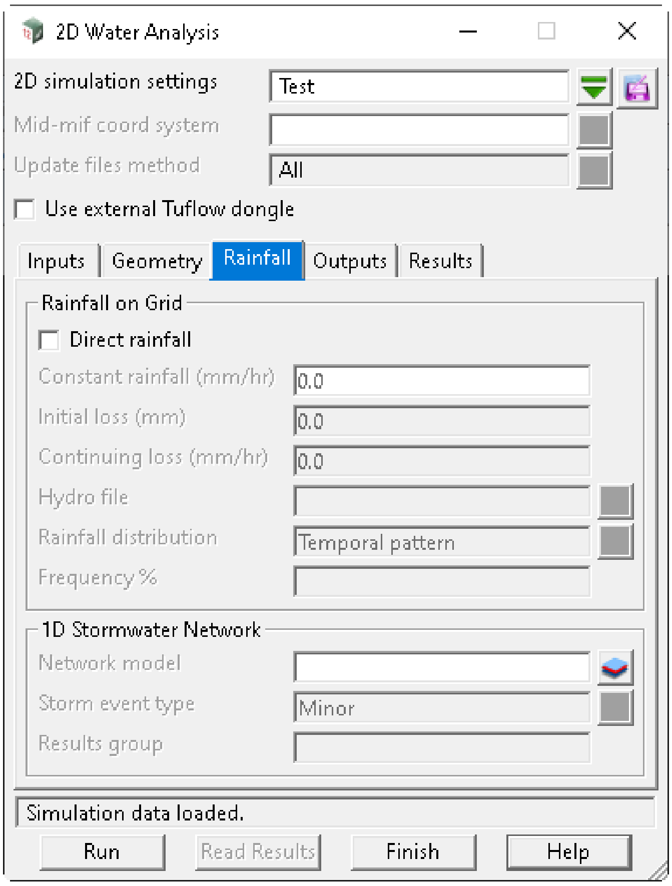
Only available when the Rainfall Area(s) model has been selected but an Active area(s) model is ***NOT*** *selected. Allows the user to choose how the active area polygons will be generated. Options are:*

1. Grid Extents - similar to what 2d Quick Analysis does; or

2. Rainfall polygons

Continue to Rainfall tab or return to.18.2 2D Water Analysis or 18 Water 2D.

Rainfall tab



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Rainfall on Grid

Direct rainfall tick box not ticked

*If **not ticked,** the only field to fill in is* **Constant rainfall (mm/hr).**

*If **ticked**, a rainfall temporal patterns selected in the **Hydro file** below will be used to create rainfall events for the entire extent. Rainfall intensity on the base data tab is generally set to zero as it will be added to the temporal pattern rainfall.*

Constant rainfall (mm/hr) real box

A number greater than or equal to zero is entered here for a constant rainfall on grid for the entire storm duration.

Initial loss (mm) real box

This field is active when **Direct rainfall** *is ticked.*

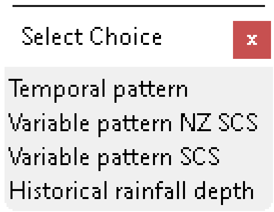
Values greater than zero will be removed as an initial loss value from the rainfall for cells in the first material region (or the entire grid if no materials polygons are used).

Continuing losses (mm/hr) real box

This field is active when **Direct rainfall** *is ticked.*

Values greater than zero will be removed from the rainfall for every hour of the storm following completion of initial loss, prorated to each time step in the in the first material region (or the entire grid if no materials polygons are used)

Rainfall distribution choice box



This field is active when **Direct rainfall** *is ticked.*

The **Rainfall distribution** *selected determines how the rainfall temporal patterns in the* **Hydro file** *field are interpreted.*

*When a **Network model** is selected below, this will be disabled the data displayed will be from the current drainage model setting.*

***Temporal pattern**- fixed temporal patterns (% rainfall depth)*

***Variable pattern NZ SCS** - variable temporal patterns (I/I24 data)*

***Variable pattern SCS** - variable temporal patterns (depth of rainfall in period)*

***Historical rainfall depth** - variable temporal patterns (fraction of rainfall depth)*

Hydro file file box *.12dhydro

This field is active when **Direct rainfall** *is ticked.*

Temporal patterns selected in this file, together with the **Return Period** *value, determine the rainfall patterns created in the rainfall.csv file.*

Frequency

This field is active when **Direct rainfall** *is ticked.*

Fixed temporal patterns are selected from the **Hydro file** *and this value obtains the rainfall depth or intensity from the **Hydro** file **ifd** data. Together they determine the rainfall patterns created in the rainfall.csv file.*

1D Stormwater Network

Network model model box available models

*This model must contain drainage strings that can be solved using the dynamic drainage method. It is strongly recommended that you run this drainage model via the **WNE** before using it in this panel. Inlets inside the grid extent will be linked to the 2d grid at the grate level and outlets at the sump level. Inlets with the Ku method set to a culvert will also be linked to the sump level. Bypass inlet inside the grid extent will be erased along with bypass across the edge boundaries.*

Inlets will accept water through the grate via inlet capacity curves (sag and on-grade) and will allow unrestricted surcharging.

*Catchment flows will be directly applied to the 2d cell connected to the inlet unless a **2d catchment flow model** is specified.*

Storm event type choice box Minor, Major

This field is active when **Direct rainfall** *is ticked.*

The value displayed is from the last 1D dynamic run. Changes here will also be reflected in the WNE Analysis panel.

Results group text box

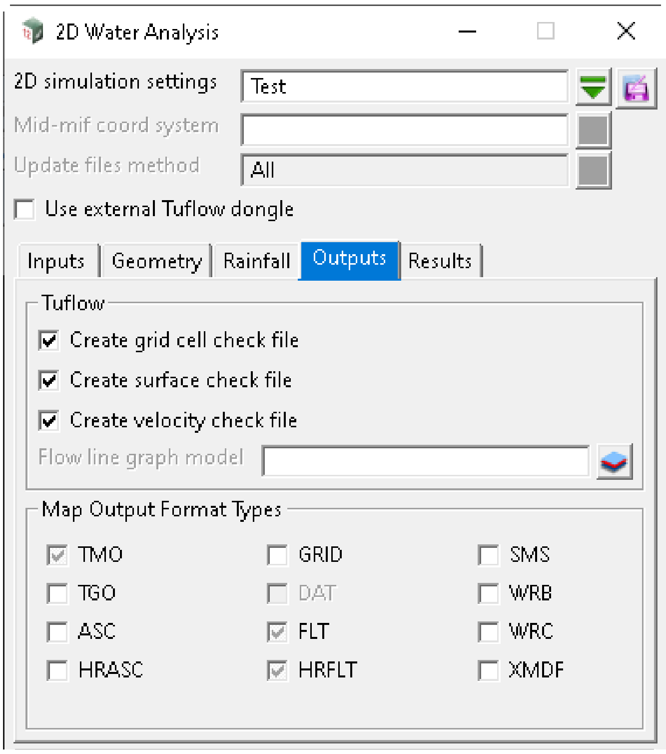
This field is active when **Direct rainfall** *is ticked.*

The value displayed is from the last 1D dynamic run for the minor/major storm event specified above.

Changes here will also be reflected in the WNE Analysis panel.

Continue to Outputs tab or return to.18.2 2D Water Analysis or 18 Water 2D.

Outputs tab



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Tuflow

Create grid cell check file tick box ticked

*If **ticked**, TUFLOW will create a check file for grid cells, showing the location and size of each cell in the grid.*

Create surface check file tick box ticked

*If **ticked**, TUFLOW will create a check file for the final surface z-elevations of the grid cells used for the analysis.*

Create velocity check file tick box ticked

*If **ticked**, TUFLOW will create a check file for the velocities calculated over the grid.*

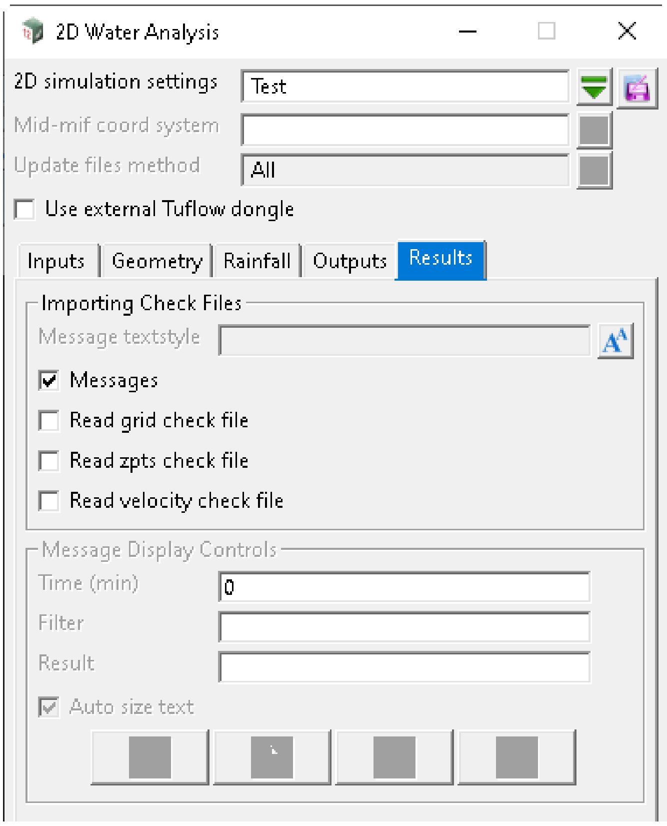
Flow line graph model model box available models

If not blank, flow across a line can be calculated by TUFLOW. These strings must be drawn from left to right looking in the positive direction of flow. The graph results are viewed using the 18.3 TUFLOW Results Graph *option.*

Map Output Format Types

Continue to Results tab or return to.18.2 2D Water Analysis or 18 Water 2D.

Results tab



See
Inputs tab
Geometry tab
Rainfall tab
Outputs tab
Results tab

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Importing Check Files

Message textstyle	textstyle box		available textstyle datas

Allows control of the textstyle to be used for messages read in from the messages check file.

Messages	tick box	ticked	

*If **ticked**, the messages check file will be used to create a model of all messages relating to the TUFLOW analysis.*

Read zpts check file	tick box	not ticked	

*If **ticked** the zpt check file will be used to create a check tin of the final z values used in the TUFLOW analysis.*

Read grid check file	tick box	not ticked	

*If **ticked**, the grid check file will be used to create a model of all the grid cells used in the TUFLOW analysis.*

Read velocity check file	tick box	not ticked	

*If **ticked**, the uvpt check file will be used to create a model of all the velocity points on cell sides from the TUFLOW analysis.*

Message Display Controls

Time (min)	real box		

NOT YET IMPLEMENTED

Filter) real box

NOT YET IMPLEMENTED

Result) real box

NOT YET IMPLEMENTED

Auto size text tick box ticked

NOT YET IMPLEMENTED

Continue to 18.3 TUFLOW Results Graph or return to 18.2 2D Water Analysis or 18 Water 2D.

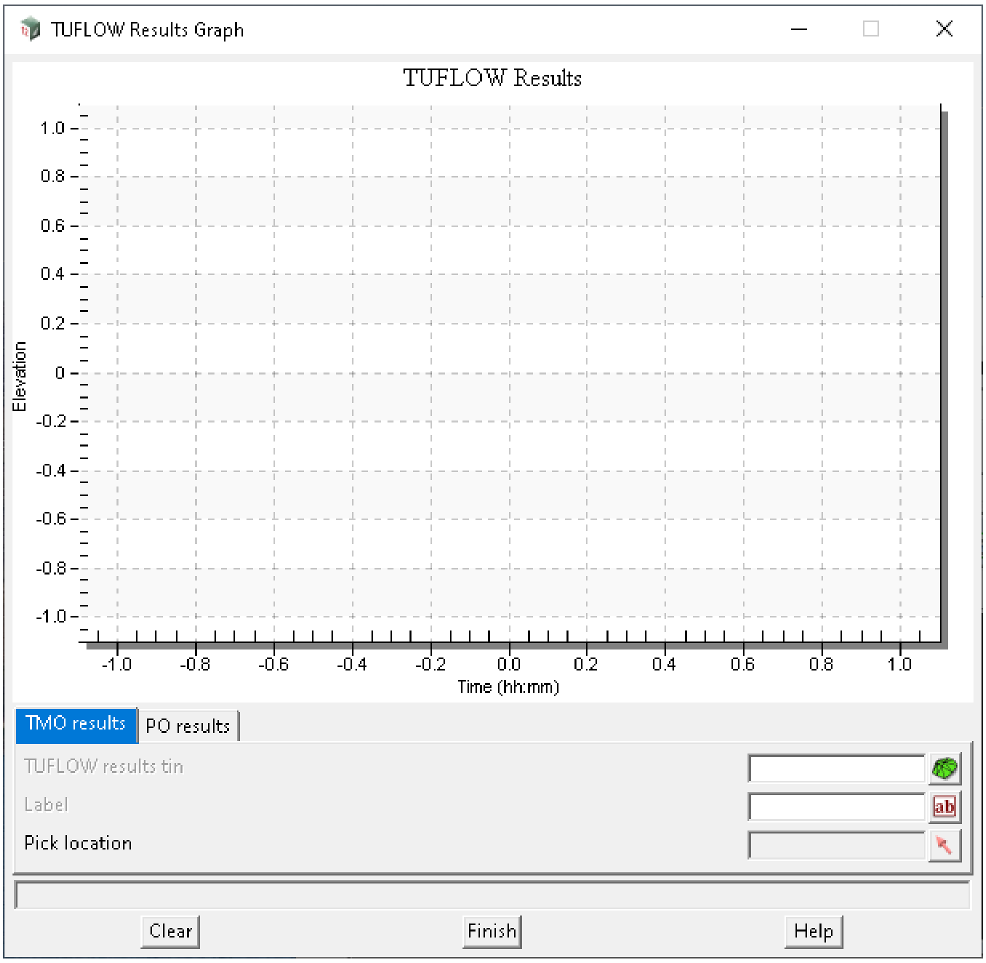
18.3 TUFLOW Results Graph

Position of option on menu: **Water =>Water 2D =>Tuflow results graph**

This option displays the TUFLOW results as graphs.

On selecting **Tuflow results graph** , the **TUFLOW Results Graph** panel is displayed.

TMO results tab



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
TUFLOW results tin	tin box		

Grid tin to display the result graph for.

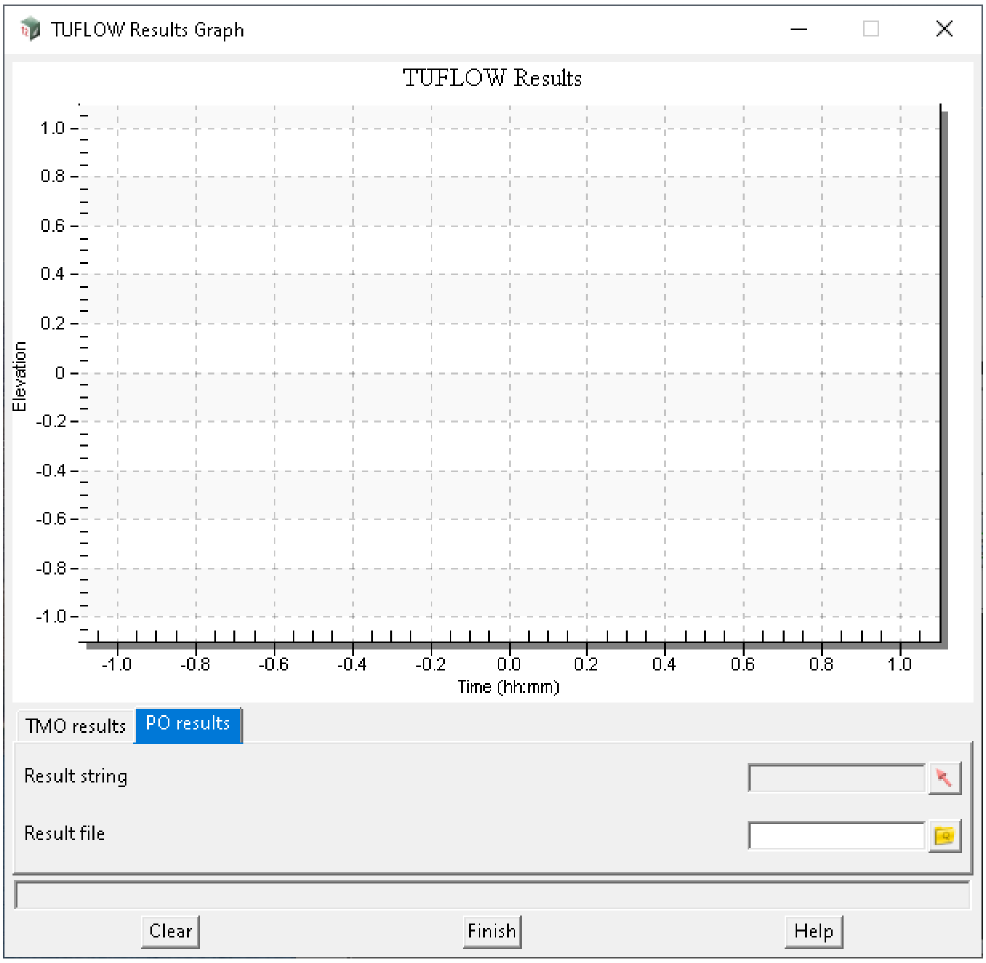
Label	text box		

Label to be used for the graph generated.

Pick location	string select		

Select a location inside the results grid tin to generate the graph for.

PO results tab



Result string string select

Select the Plot output string (PO string) to display a graph for.

The model the string exists in must have been selected prior to the TUFLOW analysis (either in 2D Quick Analysis, 2D Water Analysis or in the tcf Editor).

Result file file box

When TUFLOW has been run with a PO strings model, a csv file will be generated with the results data for each string included.

Selecting the csv file will allow the graph to be generated for the chosen string

Button at bottom

Clear button

Clear the graph.

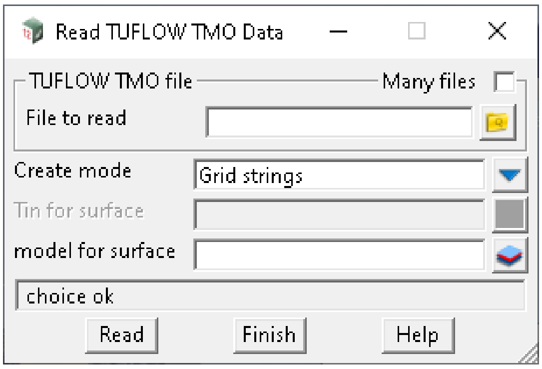
Continue to 18.4 Reading TUFLOW TMO/TGO Files or return to 18 Water 2D.

18.4 Reading TUFLOW TMO/TGO Files

Position of option on menu: **Water =>Water 2D =>Read TMO files**

This option reads both TMO and TGO files (results) and stores them in a grid object (grid tin or grid string). To change the result time step see 18.6 TMO Tin Results Settings or 18.5 TMO String Results Settings

Selecting **Read TMO files** displays the **Read TUFLOW TMO Data** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

File to read **file box**

The TMO/TGO file (results file) to read in and process.

Many files tick box

*When **ticked**, a grid is displayed and many tmo/tgo files can be entered for processing.*
When more than one tmo/tgo file is entered, all the TMO/TGO files (results files) are read into a single grid.

Create mode choice box Grid strings, Grid tins

*If **Grid strings**, grid strings are produced.*
*If **Grid tins**, a grid tin is produced.*

Tin for surface tin box

If **Create mode** *is **Grid tin**, then a grid tin is produced and given this name.*

Model for surface model box

The model for the Grid tin or Grid strings.

Button at bottom

Read button

When pressed, the TMO/TGO files (results files) are processed and the Grid tin or Grid strings created. The settings for displaying the results in tin inquire and tin display (contours and rendering) are set via 18.5 TMO String Results Settings *or* 18.6 TMO Tin Results Settings.

CAUTION!

*Do not read the *_times.tgo or tmo files in the same grid with other result files. The other results will only display a time step less than the number of items (time steps) in the times file. This is usually between 2 and 5.*

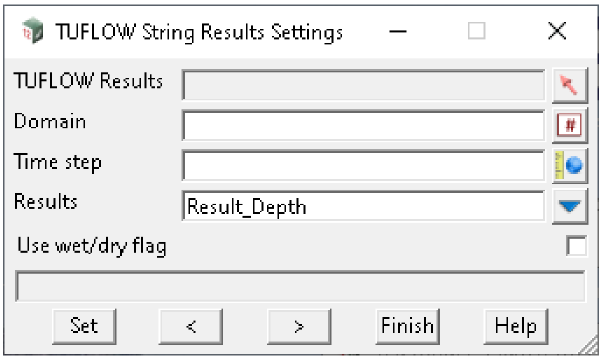
Continue to 18.5 TMO String Results Settings or return to 18 Water 2D.

18.5 TMO String Results Settings

Position of option on menu: **Water =>Water 2D =>TMO string settings**

This option allows control of the results display for Grid Strings imported to 12d Model from TUFLOW tmo results files (see 18.4 Reading TUFLOW TMO/TGO Files panel). Once the result type is set, the various time steps from the analysis can be stepped through to view the result for that time step.

Selecting **TMO string settings** displays the **TUFLOW Tin Results Settings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

TUFLOW Results string select box

Select a results grid string that has been created via the 18.4 Reading TUFLOW TMO/TGO Files panel.

Domain number box

*Currently **12d Model** only supports domain 0.*

Time step number box

*The index of the current time step displayed. A number equal to or greater than **Results available** will display maximum results for each cell.*

Results Choice box — available Result files

Select the result type to display data for.

***Note** that only result types that relate to the selected results string can be used to display data. i.e. Using Result_Velocity_Magnitude for a grid string which had Result_Depth data read in will mean nothing is displayed.*

Use wet/dry flag tick box — not ticked

*If **ticked**, the string vertices will draw as blue for wet cells and green dry cells.*

Buttons at Bottom

Set button

The above values are set for displaying the TUFLOW results.

Back < >Forward > buttons

***Back** reduces the Time step value by 1 to a minimum of zero (the start of the analysis).*

***Forward** increases the Time step value by 1 to a maximum of last result (the last results is often the* *maximum from all results).*

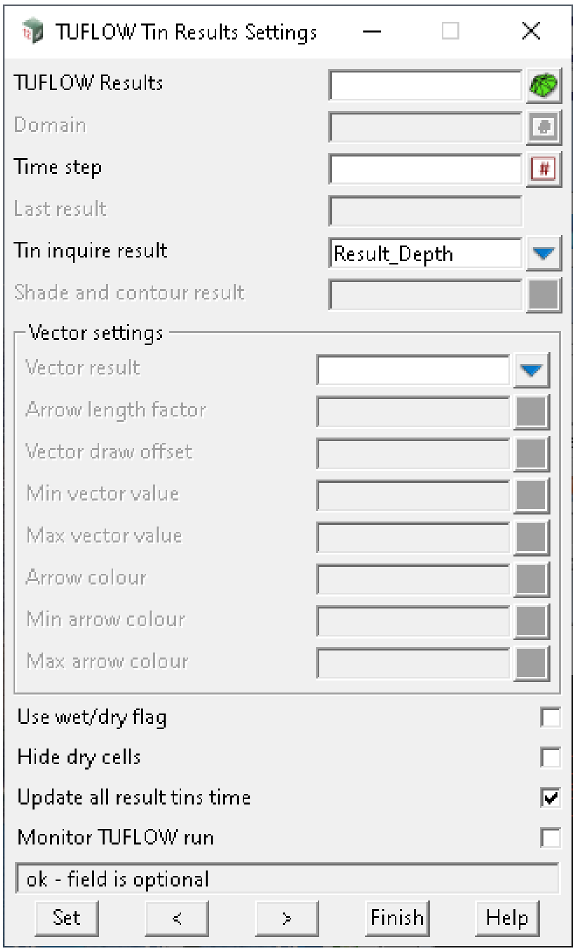
Continue to 18.6 TMO Tin Results Settings or return to 18 Water 2D.

18.6 TMO Tin Results Settings

Position of option on menu: **Water =>Water 2D =>TMO tin settings**

This option allows control of the results display for Grid Tins imported to 12d Model from TUFLOW tmo results files (see 18.4 Reading TUFLOW TMO/TGO Files panel). Once the result type is set, the various time steps from the analysis can be stepped through to view the result for that time step.

Selecting **TMO tin settings** displays the **TUFLOW Tin Results Settings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

TUFLOW Results tin box

A list of all grid tins in the project will be listed.

***Note**: In future releases only grid tins with TUFLOW results will be displayed.*

Domain number box

*Currently **12d Model** only supports domain 0.*

Time step number box

*The index of the current time step displayed. A number equal to or greater than **Results available** will display maximum results for each cell.*

Last result input

The number of time step results plus minimum and maximum values in the file.

Tin inquire result choice box

The result selected is used for the tins standard z levels. This includes tin inquire height, profile view z levels and levels shown in the OpenGL and perspective views. This type of tin is sometimes referred to a the functional tin.

Shade and contour result

The tin will use this result for shading the grid tin in Open GL views and creating contours.

See 18.1.2 Shade and Vector Overrides *to manually control the initial shading settings.*

Vector settings

Vector result choice box

TUFLOW has several results that have both a magnitude and direction. The most common is Result_Velocity_Vector.

See 18.1.2 Shade and Vector Overrides *to manually control the initial vector settings.*

Arrow length factor measure box

This value is the display length per velocity (m/s:ft/s). A value of 2 would draw a velocity of 0.5m/s as a 1m long arrow.

Vector draw offset

The centre of the velocity vector arrows are offset vertically by this amount from the Tin inquire result value.

Min vector value

Velocity magnitude values less than this value will be scaled up to this value and their colour changed to the ***Min arrow colour****.*

Max vector value

Velocity magnitude values greater than this value will be scaled down to this value and their colour changed to the ***Max arrow colour****.*

Arrow colour

Arrows are drawn with this colour unless changed by the Min or Max vector values.

Min arrow colour

Arrows are drawn in this colour when the vector magnitude is less than the ***Min vector value****.*

Max arrow colour

Arrows are drawn in this colour when the vector magnitude is greater than the ***Max vector value****.*

Use wet/dry flag tick box not ticked

The tin edges and the tin solid will draw the grid as blue for wet cells and green dry cells.

Hide dry cells tick box not ticked

When ***ticked****, the dry cells will not have their solid fill or edges shown.*

Update all results tin's timetick box ticked

12d Model *creates four tins when the user selects* ***Read results****: water level, depth, velocity and hazard. With this tick selected, the four tins time steps are set to the same value.*

Monitor TUFLOW run tick box not ticked

*When **ticked**, the tin results file will be monitored for changes in size. The **results available** will be updated when it changes.*

Buttons at Bottom

Set button

The values above are set for the TUFLOW results grid tin.

Back < >Forward > buttons

***Back** reduces the Time step value by 1 to a minimum of zero (the start of the analysis).*

***Forward** increases the Time step value by 1 to a maximum of last result (the last results is often the maximum from all results).*

Continue to 18.7 2D Results Height Legend or return to 18 Water 2D.

18.7 2D Results Height Legend

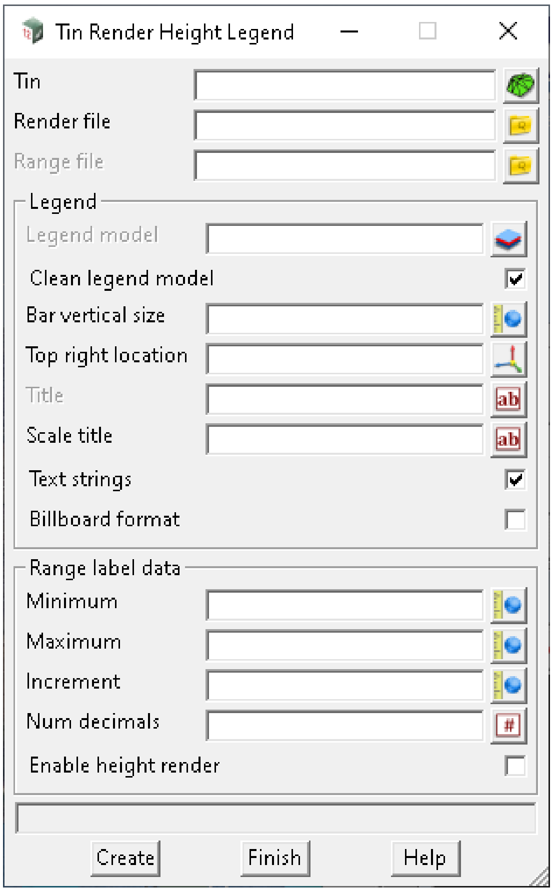
Position of option on menu: **Water =>Water 2D =>Tin height legend**

This option creates a legend of the Tin height colour rendering used on tins in the OpenGL views. It will apply existing colour strips or create new colour strips from ranger files.

The text style for the labels is controlled by the CAD text bar settings. The text height is auto scaled to fit.

Undo is available.

Selecting **2D result height legend** displays the **Tin Render Height Legend** panel.



The fields and buttons used in this panel have the following functions.

Field DescriptionType Defaults Pop-Up

Tin tin box

*When **selected**, the tin's current render range is loaded into the Range label data area at the bottom of the panel.*

Render file file box

Select on existing render file bit map or enter a name for a new bitmap strip to be created using the Range file below.

Range file file box Optional

*If **selected**, the Render file above will be created/overwritten using the colours in this file. The From/To* *settings in the file are not absolute. They determine the percentage of the bitmap strip to use the colour selected. Percentage of strip for colour = (To-From) / (Max To - Min From) * 100.*

Legend

All legend text will use the text style from the CAD toolbar.

Legend model model box

The legend is created in this model.

Clean legend model tick box ticked

The Legend model above is cleaned before the new legend is created.

Bar vertical size measure box

World unit Location range of the legend colour strip.

Top right location angle box

The x,y location of the top right corner of the scale bar.

Title text box

Text to appear at the top of the legend.

Scale title text box

Text to appear to the left of the legend range labels.

Text strings tick box ticked

*If **ticked**, the text labels will be created as Text strings for viewing in GDI and OpenGL views.*

*If **not ticked**, the text will be created as super strings.*

Billboard format tick box not ticked

Legend colour strip will be trice as wide and have labels on both sides.

Range label data

Minimum measure box

***Low** colour in the strip will be assigned this z.*

Maximum measure box

***High** colour in the strip will be assigned this z.*

Increment measure box

Label increment for the legend.

Num decimals integer box

Number of decimals for the legend range numbers.

Enable height render tick box not ticked

Turns on and off the OpenGL rendering of the tin above.

Buttons at bottom

Create button

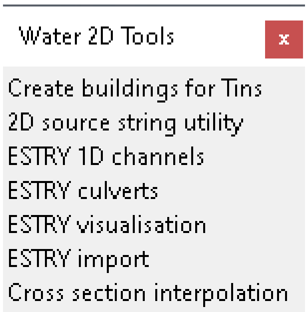
Creates the legend, sets the height colouring to the tin (if selected), and produces a solid colour strip when a range file is provided.

Continue to 18.8 Water 2D Tools or return to 18 Water 2D.

18.8 Water 2D Tools

Position of menu: **Water =>Water 2D tools**

The **Water 2D Tools** walk-right menu is:



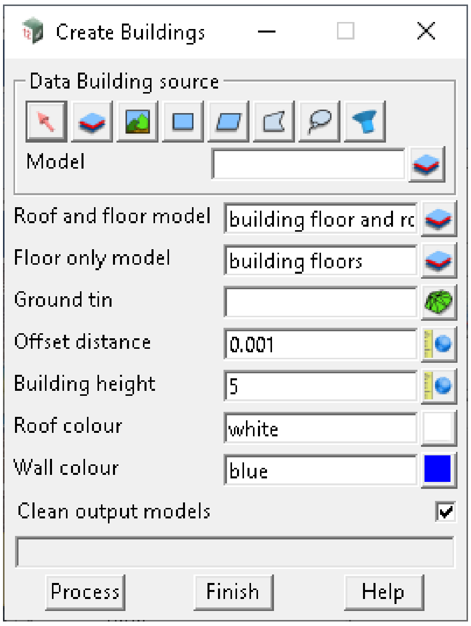
18.8.1 Create Buildings for Tins
18.8.2 TUFLOW Source String Utility
18.8.3 ESTRY 1D Channels
18.8.4 ESTRY Culverts
18.8.5 ESTRY Visualisation
18.8.6 ESTRY Import
18.8.7 Cross Section Interpolation

18.8.1 Create Buildings for Tins

Position of option on menu: **Water =>Water 2D =>Water 2D tools =>Create buildings for tins**

This option allows creation of roof and floor polygons for buildings based on 2d polygons of the building shape. These roof and floor polygons can then be tinned for addition to a Supertin.

It is very useful for TUFLOW modelling where structures can affect flow paths.



Data Building Source data source

Data selection type - for a full description go to 3.26.3 Data Source.

Depends on section default is Model

Data source for the 2D building polygons.

Roof and floor model model box

Model for the polygons generated for the floor and roof of the building

Floor only model model box

Model for the polygons generated for just the floor of the building.

Ground tin tin box

Ground tin to drape the floor polygons on.

Offset distance real box

Separation to use between floor and roof polygons so that a tin can be generated for the buildings.

Building height real box

This value will be added to the lowest z-value on the draped floor polygon to give the roof elevation for the building.

Roof colour colour box

Colour for the roof polygons.

Wall colour colour box

Colour to for the floor polygons

Clean output models tick box

*If **ticked**, the* **Roof and floor model** *and* **Floor only model** *will be cleaned prior to processing.*

Continue to 18.8.2 TUFLOW Source String Utility or return to 18.8 Water 2D Tools or 18 Water 2D.

18.8.2 TUFLOW Source String Utility

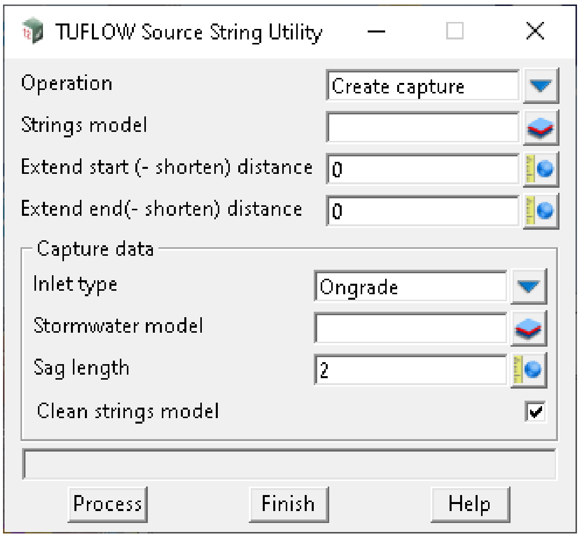
Position of option on menu: **Water =>Water 2D =>Water 2D tools => TUFLOW source string utility**

This panel creates or modifies strings that are used to select the 2d cells that:

Inlet hydrographs are applied to.

Inlet capture flow from.

Selecting **TUFLOW source string utility** displays the **TUFLOW Source String Utility** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Operation	choice box	Catchment	Create capture, Adjust catchments

*If **Create Capture**: Creates strings used in 2d connection zones model (WNE->Global->Utility models tab).*

*If **Adjust Catchments**: Modified strings used in 2d catchment flow model (WNE->Global->Utility models tab). These strings are typically created via the **Downhill strings** option using the **Split resultant strings at drainage inlets** (Advanced tab).*

Field Description	Type	Defaults	Pop-Up
Strings model	model box		available models

*Model for new strings for **Create Capture** and existing strings for **Adjust Catchments**.*

Extend start (- shorten) distance real box 0

New strings for Create Capture and existing strings for Adjust Catchments will have the start of the string extended or shortened by this distance.

Extend end (- shorten) distance real box 0

New strings for Create Capture and existing strings for Adjust Catchments will have the end of the string extended or shortened by this distance.

Capture data

*These fields are used only when **Create Capture** is selected above.*

Inlet type	choice box	Ongrade	Ongrade, Sag

*If **Ongrade**: For inlets in the Stormwater model below that are tagged as Ongrade (via the WNE), a capture line is created from the road centre line to the road setout string and then extended/shortened using the distances above. The road centre line and setout strings must be set via the WNE before running this option.*

*If **Sag**: For inlets in the Stormwater model below that are tagged as Sag (via the WNE), a capture line is created from along the road setout string using the Sag length below. The extend distances above are not used.*

Stormwater model	model box		available models

Ongrade and Sag inlets in this model are processed.

Sag length	real box

Capture strings of this length are created with 50% on each side of the inlet centre.

Clean strings model	tick box	ticked

*All strings in the **Strings mode**l above are deleted before the processing. If creating strings for both Sag and Ongrade this is usually on for the first and off for the second.*

Buttons at Bottom

Process	button

Process the option.

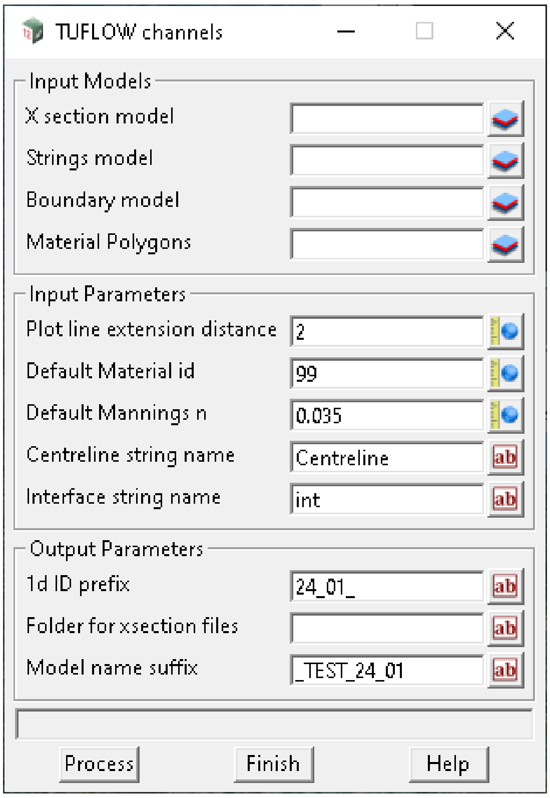
Continue to 18.8.3 ESTRY 1D Channels or return to 18.8 Water 2D Tools or 18 Water 2D.

18.8.3 ESTRY 1D Channels

Position of option on menu: **Water =>Water 2D =>Water 2D tools => ESTRY 1D channels**

This option allows for export of design channels to TUFLOW in an ESTRY format for analysis outside of 12d Model (i.e. batch file).

Selecting **ESTRY 1D channels** brings up the **TUFLOW Channels** panel.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Input Models

X section model | model box | | available models

Model containing channel design sections.

Strings model | model box | | available models

Model containing channel design strings

Boundary model | model box | | available models

Model containing the design boundary polygon for the channel.

Materials model | model box | | available models

Model containing materials polygons for materials regions to be used by the TUFLOW analysis

Input Parameters

Plot line extension distance | measure box

??

Default Material id | measure box

??

Default Mannings n measure box

??

Centreline string name text box

??

Interface string name text box

??

Output Parameters

C1d ID prefix text box

??

Folder for xsection files text box

??

Folder name suffix text box

??

Buttons at Bottom

Process button

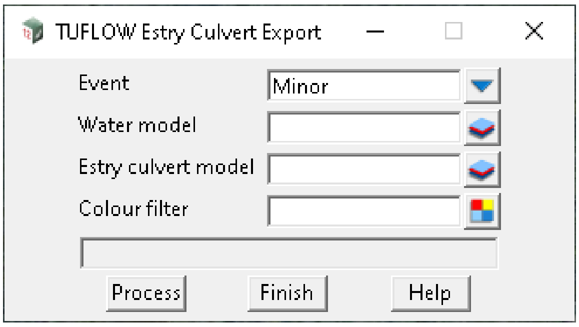
Process the option.

Continue to 18.8.4 ESTRY Culverts or return to 18.8 Water 2D Tools or 18 Water 2D.

18.8.4 ESTRY Culverts

Position of option on menu: **Water =>Water 2D =>Water 2D tools => ESTRY culverts**

Selecting **ESTRY culverts** brings up the **TUFLOW Estry Culvert Export** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Event	choice box	Minor	Minor, Major

Appended to attributes where indicated. For more information on ESTRY attributes see [ESTRY Attributes](#).

Water model	model box		available models

Source model for water strings.

Estry culvert model	model box		available models

Super strings with ESTRY attributes, elevations and pipe/culvert size will be created. The model is not cleaned first.

See ESTRY Attributes below for details of the attributes created. The size dimensions and elevations on the resulting super string are for visualisation only.

Colour filter	colour box		available colours

Only links matching this colour will be exported. String colour is checked when no link colour is specified.

Buttons at Bottom

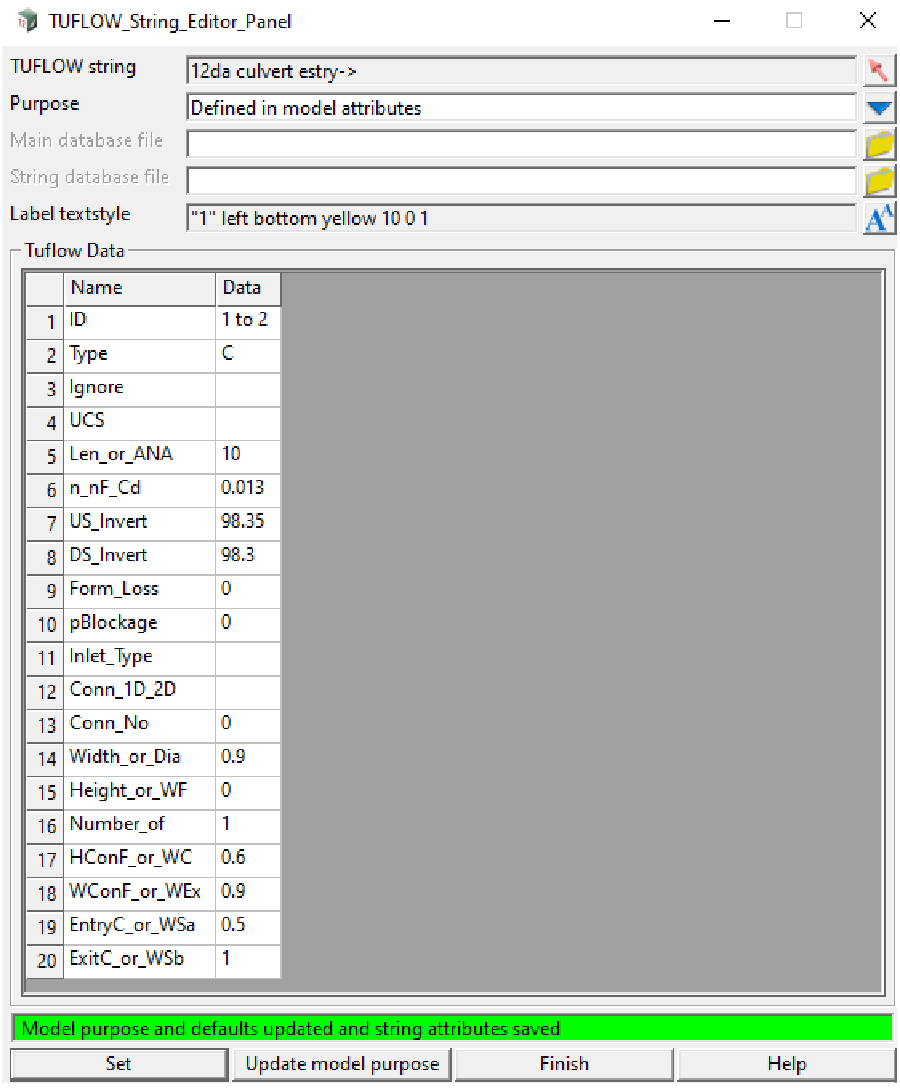
Process	button		

Process the option.

ESTRY Attributes

The **ESTRY attributes** are shown in the image below and are retrieved from the water link as follows.

Water String			Super string		
Property/attribute	Name	Default	ESTRY Attributes	Typical Vaue	Note
Property	Link Name		ID	1 to 2	
Property	width		Type	C	C if no width, R if width set
always blank			Ignore	always blank	
text attribute	use channel storage		UCS		
Property	length		Len_or_ANA	10	
real attribute	roughness n	0.013	n_nF_Cd	0.013	uses model default if avail
Property	us invert		US_Invert	98.35	
Property	ds invert		DS_Invert	98.3	
real attribute	dyn minor loss	0	Form_Loss	0	
real attribute	entrance blockage percent		pBlockage	0	appends suffix minor/major
always blank			Inlet_Type	always blank	
always blank			Conn_1D_2D	always blank	
		0	Conn_No	0	
Property	diameter/width		Width_or_Dia	0.9	circular pipe diameter, box width
Property	diameter/width		Height_or_WF	0	box height
Property	number of links		Number_of	1	
real attribute	height contraction coefficient	0.6	HConF_or_WC	0.6	
real attribute	width contraction coefficient	0.9	WConF_or_WEx	0.9	
real attribute	dyn inlet loss	0.5	EntryC_or_WSa	0.5	
real attribute	dyn outlet loss	1	ExitC_or_WSb	1	



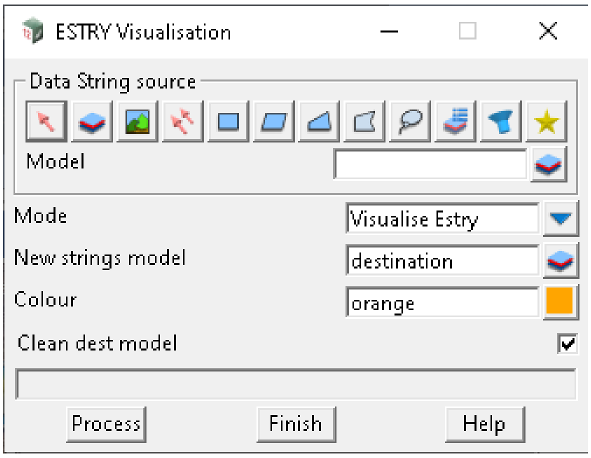
Continue to 18.8.5 ESTRY Visualisation or return to 18.8 Water 2D Tools or 18 Water 2D.

18.8.5 ESTRY Visualisation

Position of option on menu: **Water =>Water 2D =>Water 2D tools => ESTRY visualisation**

??

Selecting **ESTRY visualisation** brings up the **TUFLOW Visualisation** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data Building Source	data source		
Data selection type - for a full description go to 3.26.3 Data Source.			
Depends on section	default is Model		
Data source for the ??.			
New strings model	model box		available models
??			
Colour	colour box		available colours
??			
Clean dest model	text box		
??			

Buttons at Bottom

Process	button		
Process the option.			

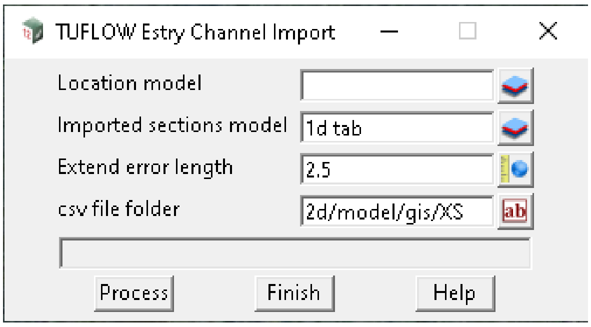
Continue to 18.8.6 ESTRY Import or return to 18.8 Water 2D Tools or 18 Water 2D.

18.8.6 ESTRY Import

Position of option on menu: **Water =>Water 2D =>Water 2D tools => ESTRY import**

??

Selecting **ESTRY import** brings up the **TUFLOW ESTRY Channel Import** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Location model	model box		available models

??

imported sections model	model box		available models

??

Extend error lengths	measure box		

??

csv file folder	text box		

??

Buttons at Bottom

Process	button		

Process the option.

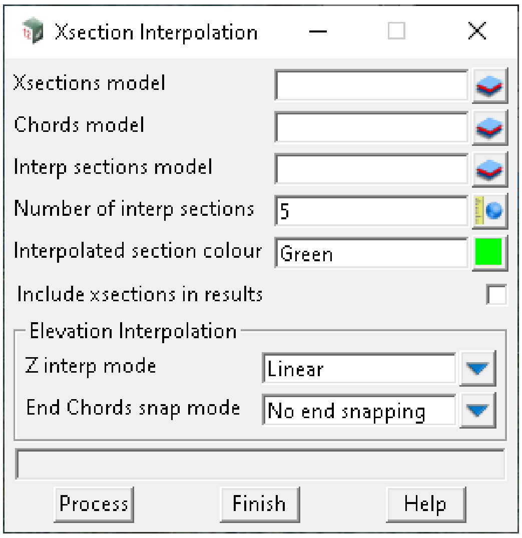
Continue to 18.8.7 Cross Section Interpolation or return to 18.8 Water 2D Tools.

18.8.7 Cross Section Interpolation

Position of option on menu: **Water =>Water 2D =>Water 2D tools =>Xsection interpolation**

The **Xsection Interpolation** panel performs a 3D interpolation of xsections using chords. Typically it is needed for bathymetry data being combined with Lidar scans.

Selecting **Cross section interpolation** displays the **Xsection Interpolation** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Xsections model	model box		available models

Existing super string cross sections with elevations.

The strings must start at the same chord (low chainage chord).

The strings must all end at the same chord (high chainage chord) that is different to the starting chord.

The xsections must not intersect.

Chords model	model box		available models

Existing super strings that intersect every xsection and never intersect each other.

The chord that intersects the start of the xsections in called the ***low chainage chord****.*

The chord that intersects the end of the xsections in called the ***high chainage chord****.*

All other chords are called internal chords.

The must be a low chainage chord and a high chainage chord. Internal chords are optional.

See Zinterp and snap modes below to check if elevations are required for the low and/or high chainage chords.

The chords must all start at the same xsection (starting xsection).

The chords must all end at the same xsection (ending xsection) that must be different than the starting xsection.

Interp sections model	model box		available models

This model is cleaned before each run. Interpolated xsections are placed in this mode optionally a copy of the source xsections (see Include xsections in results).

Number of interp sections real box 5

The number of xsection to be created between the strings in the Xsection model.

Interpolated section colour colour box Green available colours

New interpolated xsections will have this colour.

Include xsections in results tick box ticked

*When selected the strings in the **Xsection model** will be copied into the **Interpolated sections** model.*

Elevation Interpolation

Zinterp mode choice box Linear, Low chainage chord, High chainage chord Low, high average

Linear

The x,y,z locations of the interpolated cross sections are determined by assigning elevations to the chords from the intersection with the xsections. The chords between the sections are split into Number of section + 1 segments. The xsection is then created by joining the high chainage end of the segments.

Low chainage chord

The low chainage chord must have elevation for this mode.

Xsections are created as described in the linear mode above.

Xsection are translated vertically so that the low chainage xsection vertex elevation equals the low chainage chord elevation.

High chainage chord

The high chainage chord must have elevation for this mode.

Xsections are created as described in the linear mode above.

Xsection are translated vertically so that the high chainage xsection vertex elevation equals the high chainage chord elevation.

Low, high average

The low and high chainage chords must have elevations for this mode.

Xsections are created as described in the linear mode above.

Xsection are translated vertically using the average of the offsets used in the low and high chainage offsets described above.

End Chords snap mode choice box No end snapping, Snap low chainage end to chord, Snap high chainage end to chord, Snap both ends to chord

No end snapping

No vertical adjustments to the low and high chainage vertices on xsection.

Snap low chainage end to chord

The low chainage chord must have elevation for this mode.

The low chainage vertex on the xsection is adjusted to match the low chord elevation.

Snap high chainage end to chord

The high chainage chord must have elevation for this mode.

The high chainage vertex on the xsection is adjusted to match the high chord elevation.

Snap both ends to chord

The low and high chainage chords must have elevations for this mode.

The low and high chainage vertices on the xsection are adjusted to match the low and high chord elevations respectively.

Buttons at Bottom

Process button

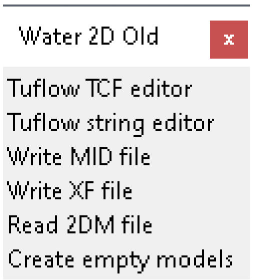
Process the option.

Continue to 18.9 Water 2D Old or return to 18.8 Water 2D Tools or 18 Water 2D.

18.9 Water 2D Old

Position of menu: **Water =>Water 2D tools**

The **Water 2D Old** walk-right menu is:



18.9.1 TUFLOW Project Editor
18.9.2 TUFLOW String Editor
18.9.3 Write TUFLOW MID File
18.9.4 Write TUFLOW XF File
18.9.5 Read TUFLOW 2DM Files
18.9.6 Create Empty Models

Continue to 18.9.1 TUFLOW Project Editor or return to 18.9 Water 2D Old or 18 Water 2D.

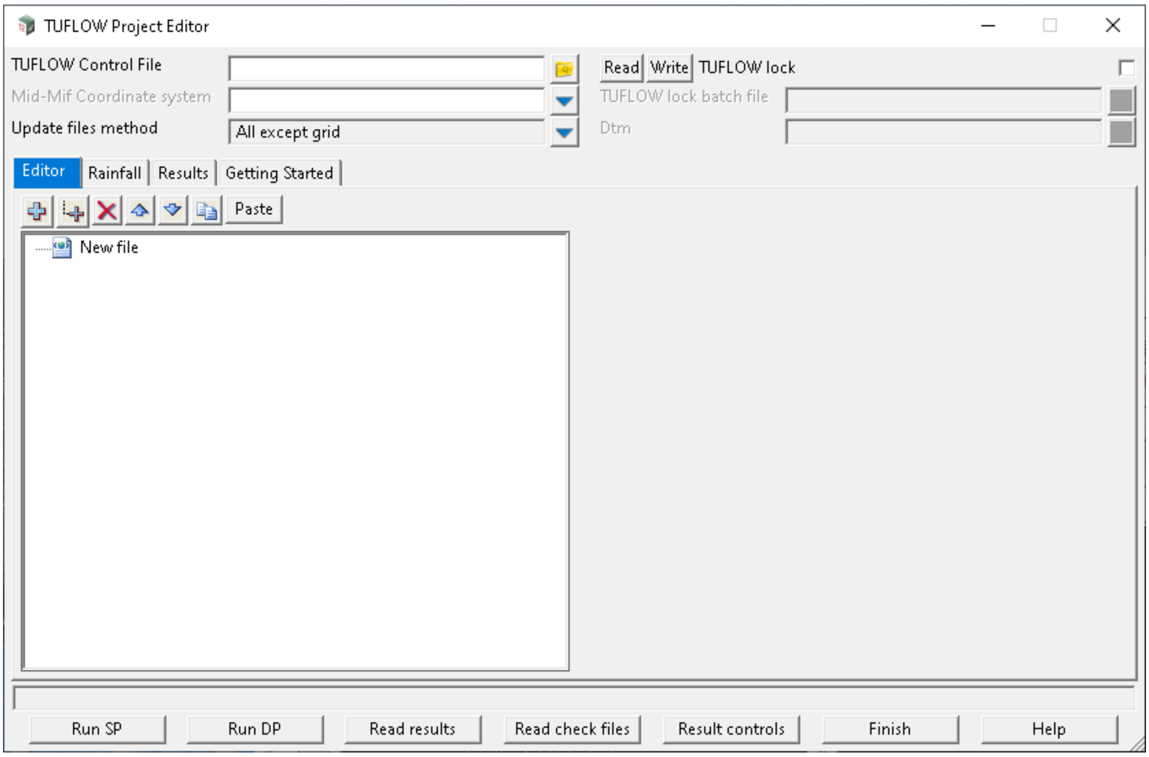
18.9.1 TUFLOW Project Editor

Position of option on menu: **Water =>Water 2D =>Water 2D old =>Tuflow TCF editor**

This option provides a way of viewing/editing the underlying text files involved in a TUFLOW analysis. By reading a TUFLOW control file (tcf) the panel will be populated to show the data associated with the analysis, including models. This is a fairly advanced means of running TUFLOW analysis inside 12d Model and it is recommended that users new to 2d Water in 12d Model use the 18.2 2D Water Analysis option in preference to the **TUFLOW Project Editor**.

This panel is largely undocumented as it requires an intimate knowledge of TUFLOW commands and operation.

On selecting the **Tuflow TCF editor** option, the **TUFLOW Project Editor** panel is displayed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Fields and Buttons at Top

TUFLOW Control File	file box		*.tcf files

??

Mid-Mif Coordinate system choice box

The choices here are set via the Project->Management->Projection Editor. The selected projection will update the project text attribute "MapInfo_Projection_Title". The MapInfo projection string from the projection editor will be stored as a text attribute "MapInfo_Projection" in both the project attributes and the model attributes of exported models.

Future Roadflow runs will also use the projection selected here.

Read button

??

Write button

??

TUFLOW lock tick box

??

TUFLOW lock batch file file box

??

Buttons at Bottom

Run SP button

This will launch the TUFLOW engine in single precision mode.

Run DP button

This will launch the TUFLOW engine in double precision mode. This will be disabled for HPC runs.

Read results button

*On selection, the **Log file** on the **Results tab** will populate the **TUFLOW tmo results file** and **Tuflow results tin** fields. **TUFLOW tmo results file** determines the set of result files read. **Tuflow results tin** field sets the prefix for the result model and tin names. Results grid tins will be created as discussed in the* 18.1.1 2D Grid Results.

The results time step will be set to the run maximums if available.

Read check files button

*TUFLOW check files will be imported to assist in analysis verification. See **Import check files** settings on the **Results tab**.*

Result control button

*The TUFLOW Tin Result setting panel will be displayed with the tin from the **Result tin model** field inserted. The current results settings are displayed. Please refer to the help for this panel for details.*

Finish button

Closes the panel.

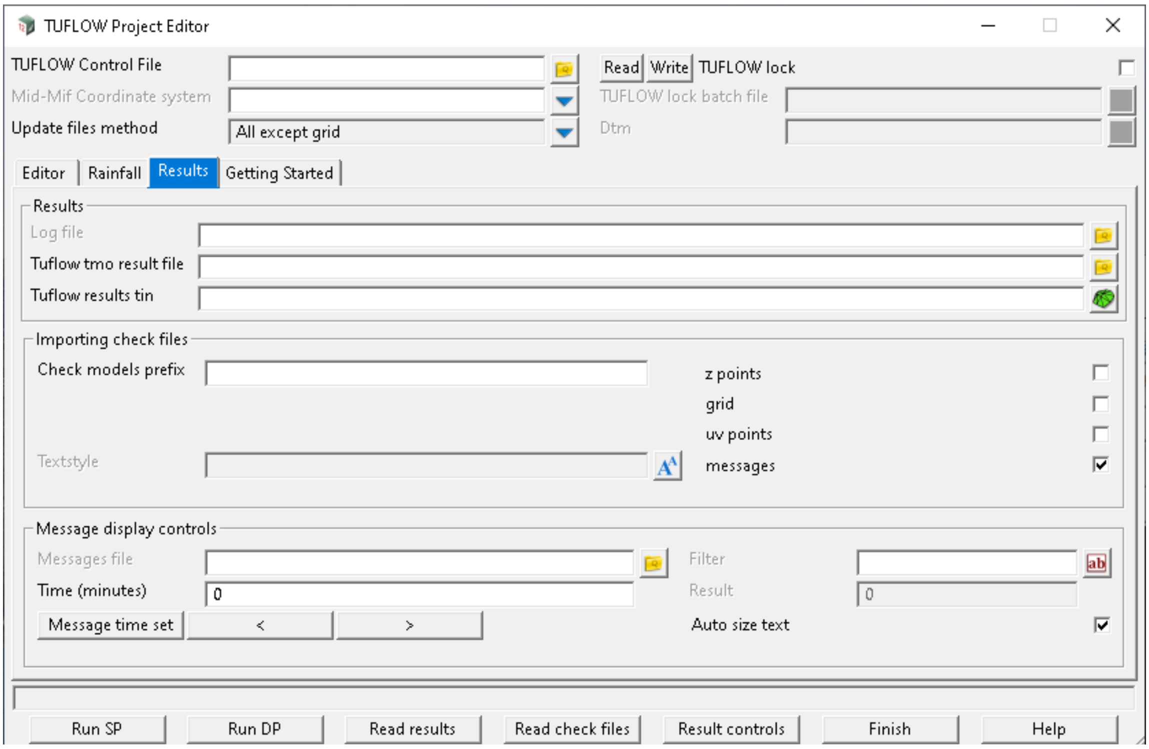
Help button

Opens the 12d reference manual.

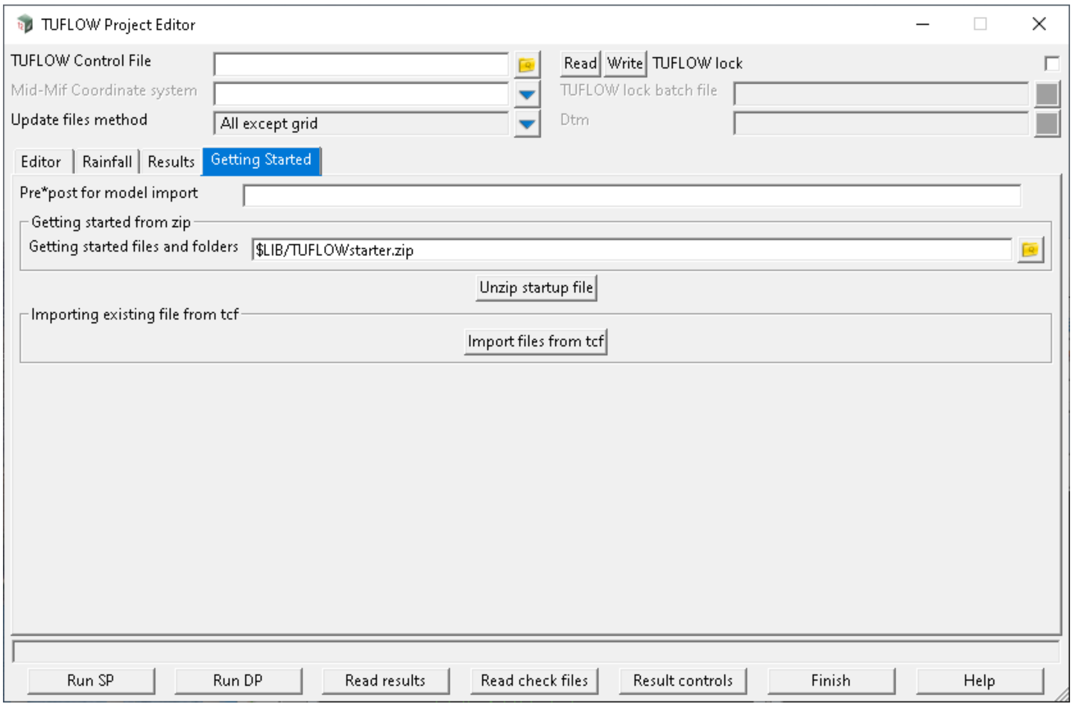
Editor tab ??

Rainfall tab ??

Results tab



Getting Started tab

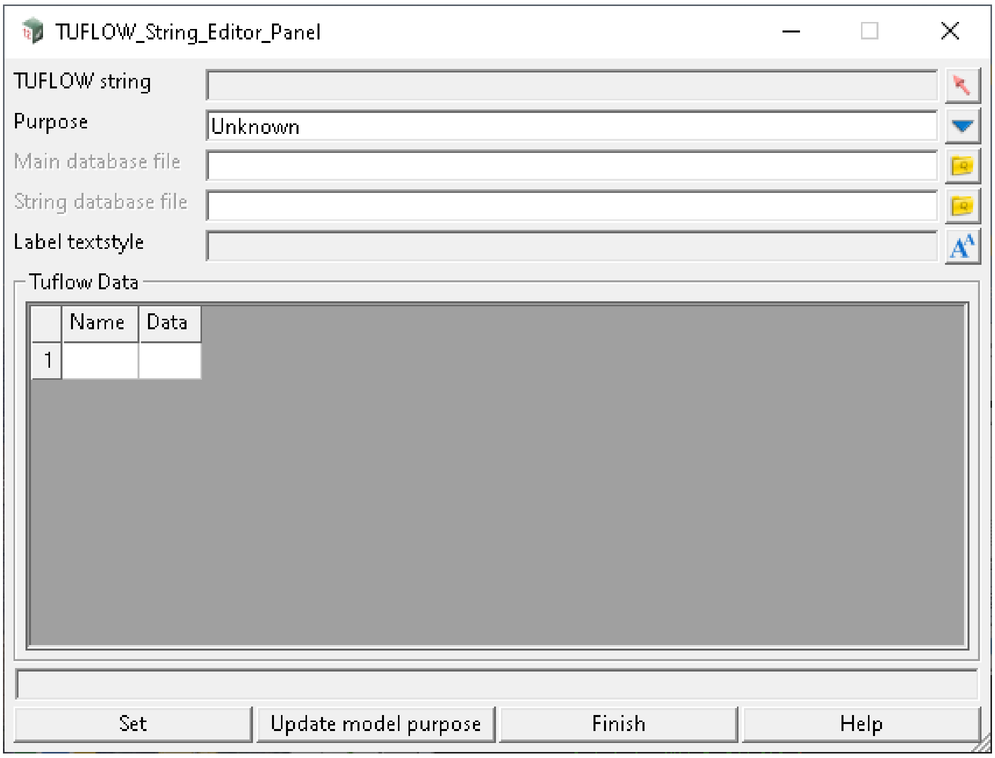


Continue to 18.9.2 TUFLOW String Editor or return to 18.9 Water 2D Old or18 Water 2D.

18.9.2 TUFLOW String Editor

Position of option on menu: **Water =>Water 2D =>Tuflow string editor**

On selecting the **Tuflow string editor** option, the **TUFLOW String Editor** panel is displayed.

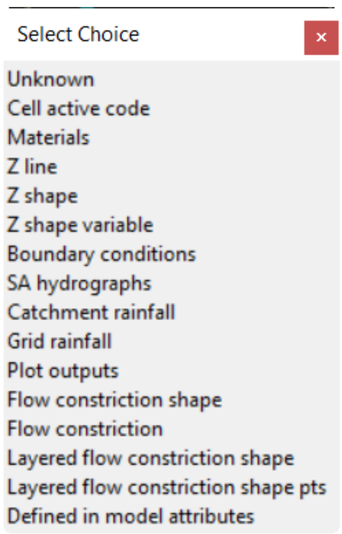


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
TUFLOW string	string select		

The TUFLOW attributes will be loaded from the accepted super string. The TUFLOW cells that are inside the closed polygon or along the open string will have affected. If the model purpose is found it will be displayed in the message box.

Purpose	choice box		



*The **Purpose** determines attributes displayed in the **TUFLOW data** grid below. The **Purpose** value will be loaded from the accepted string.*

***Unknown** - The model purpose has not been set and the attribute signature could not be identified for the accepted super string. Choose another option before selecting set.*

***Cell active code** - the cells will be set as active or inactive for the TUFLOW analysis.*

***Materials** - set the material code number that must be found in the materials database.*

***Z line** - set the elevation attributes for the Zline command.*

***Z shape** - set the elevation attributes for the Zshape command*

***Z variable shape** - set the elevations attributes for elevations that vary with time,*

***Boundary conditions** - set the boundary condition attributes.*

***SA hydrographs** - set the name of the hydrograph data to be found in the boundary condition database*

***Catchment rainfall** - set the name for the rainfall data to be found in the rainfall file.*

***Grid rainfall** - ??*

***Plot Outputs** - set the type of output desired along this string.*

Flow constriction shape

Flow constriction

Layered flow constriction shape

Layered flow constriction shape pts

***Defined in model** - the 12d Model, Create Empty Models function creates models with no strings but has model attributes to set the model purpose and thus the attribute signature. For more information see* 18.9.6 Create Empty Models.

Main database file file box *.csv, *.tmf files

The location of this file (the materials database file is an example) is stored as a model attribute on the string so it can be conveniently opened. All strings in the model share this file.

String database file file box *.csv files

The location of this file (flow or water level data file for example) is stored as an attribute on the string so it can be conveniently opened. Usually this database file related only to this string.

Label textstyle textstyle box

When Purpose choice box has Materials selected, this textstyle will be used to create a label at the centroid of the polygon indicating the Material type.

Tuflow Data grid

The attributes will be displayed in this grid. The user cannot change the attribute type. This is controlled by the model purpose. TUFLOW allows any name to be used. For some of the Purposes some validation with warning message is done.

Buttons at Bottom

Set button

*The attributes are set on the accepted string. If you change the **Model purpose** choice you will need to select **Update model purpose** before **Set** will be allowed.*

Update model purpose button

*The current names are values will saved as model attributes in the **tuflow template** group to be used as defaults for future strings with attributes. Attributes will not be added or removed from the **tuflow template** group.*

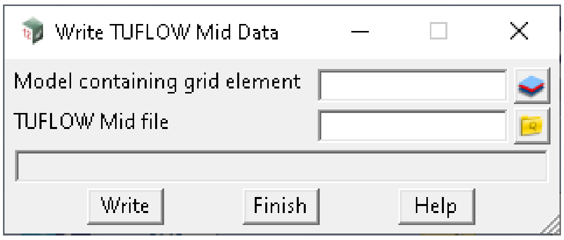
Continue to 18.9.3 Write TUFLOW MID File or return to 18.9 Water 2D Old or 18 Water 2D.

18.9.3 Write TUFLOW MID File

Position of option on menu: **Water =>Water 2D =>Write MID file**

This option writes out a grid element as a MapInfo MID file that TUFLOW can read.

Selecting **Write MID file** displays the **Write TUFLOW MID Data** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model containing grid element	model box		available models

Mode containing the grid element to write out to a file in MapInfo MID format that TUFLOW can read.

TUFLOW MID file	file box

Name of the file to write the grid element out to.

Button at bottom

Write	button

When pressed write out the grid element to the file.

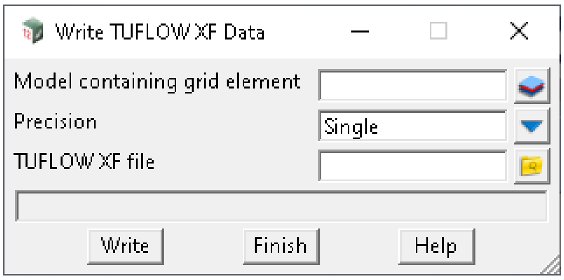
Continue to 18.9.4 Write TUFLOW XF File or return to 18.9 Water 2D Old or 18 Water 2D.

18.9.4 Write TUFLOW XF File

Position of option on menu: **Water =>Water 2D =>Write XF file**

This option writes out a grid element as a TUFLOW XF file.

Selecting **Write XF file** displays the **Write TUFLOW XF Data** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model containing grid element	model box		available models

Mode containing the grid element to write out to a TUFLOW XF file.

Precision	choice box		single, double

*If **Single**, write the file out with single precision for real numbers.*

*If **Double**, write the file out with double precision for real numbers.*

TUFLOW XF file	file box		

Name of the file to write the grid element out to.

Button at bottom

Write	button		

When pressed write out the grid element to the file.

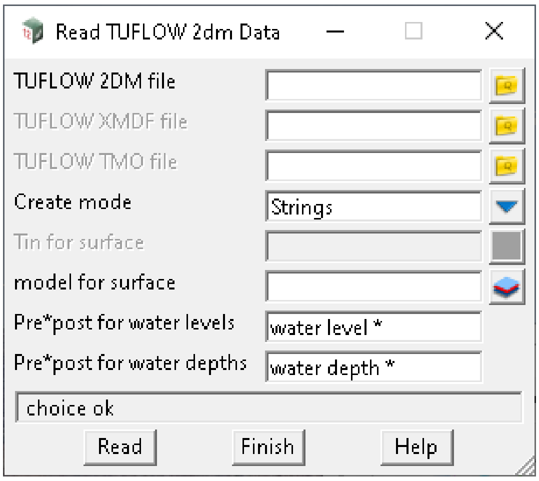
Continue to 18.9.5 Read TUFLOW 2DM Files or return to 18.9 Water 2D Old or 18 Water 2D.

18.9.5 Read TUFLOW 2DM Files

Position of option on menu: **Water =>Water 2D =>Read 2DM file**

This option reads in a TUFLOW 2DM file.

Selecting **Read 2DM files** displays the **Read TUFLOW 2DM Data** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
TUFLOW 2DM file	file box		

TUFLOW 2DM file to read in.

TUFLOW XMDF file	file box		

*If **not blank**, TUFLOW TMO file to read in. ??*

TUFLOW 2DM file	file box		

*If **not blank**, TUFLOW TMO file to read in. ??*

Create mode	choice box		Strings, Grid strings, Grid tin

*If **Strings**, string are produced.*
*If **Grid strings**, grid strings are produced.*
*If **Grid tin**, a grid tin is produced.*

Tin for surface	tin box		

If **Create mode** *is **Grid tin**, then a grid tin is produced and given this name.*

Model for surface	model box		

Model for the Strings, Grid tin or Grid strings.

Pre*post for water levels	text box		

??

Pre*post for water depths	text box		

??

Button at bottom

Read	button		

When pressed, the TUFLOW 2DM file is read in.

Continue to 18.9.6 Create Empty Models or return to 18.9 Water 2D Old or 18.8 Water 2D Tools.

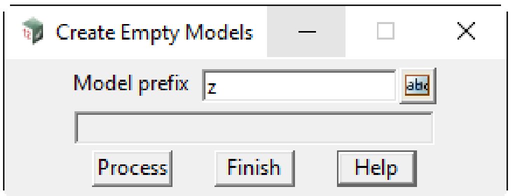
18.9.6 Create Empty Models

Position of option on menu: **Water =>Water 2D =>Water 2D old =>Create empty models**

This routine runs the TUFLOW program to create a set of empty GIS files that contain the required TUDFLOW attribute types and the required order (attribute signature). The files are read by 12d Model and the attribute signature is stored in a model attribute group named **tuflow**. These empty models are used to add super strings into and then alter their attributes using the **TUFLOW string editor (TSE)**.

The **tuflow** group has a text attribute named **purpose** containing the name of the tuflow file without the extension. It will also contain a sub group **tuflow template** that contains the required TUFLOW attribute types in the required order. The names of the attributes will be are suggested by TUFLOW but can be changed. These names will be used by the **TSE**. The values you set for the attributes are the default attribute values used by the **TSE** when no attributes are found on the string.

On selecting the **Create empty models** option, the **water blank mid to model** panel is displayed.

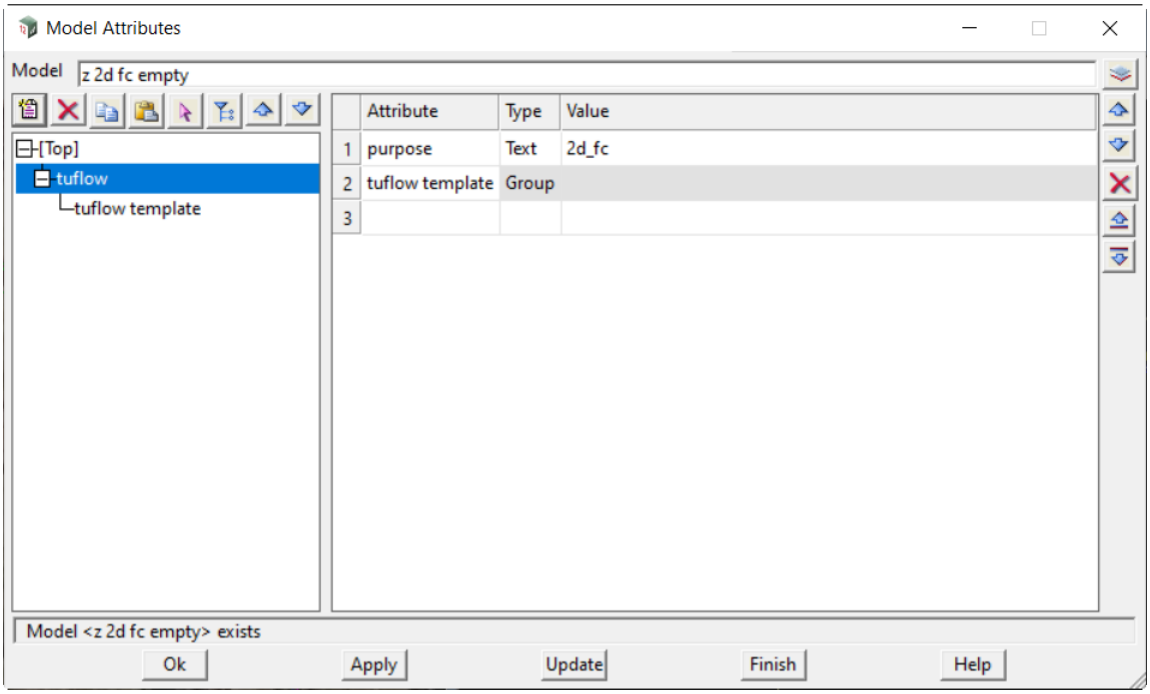


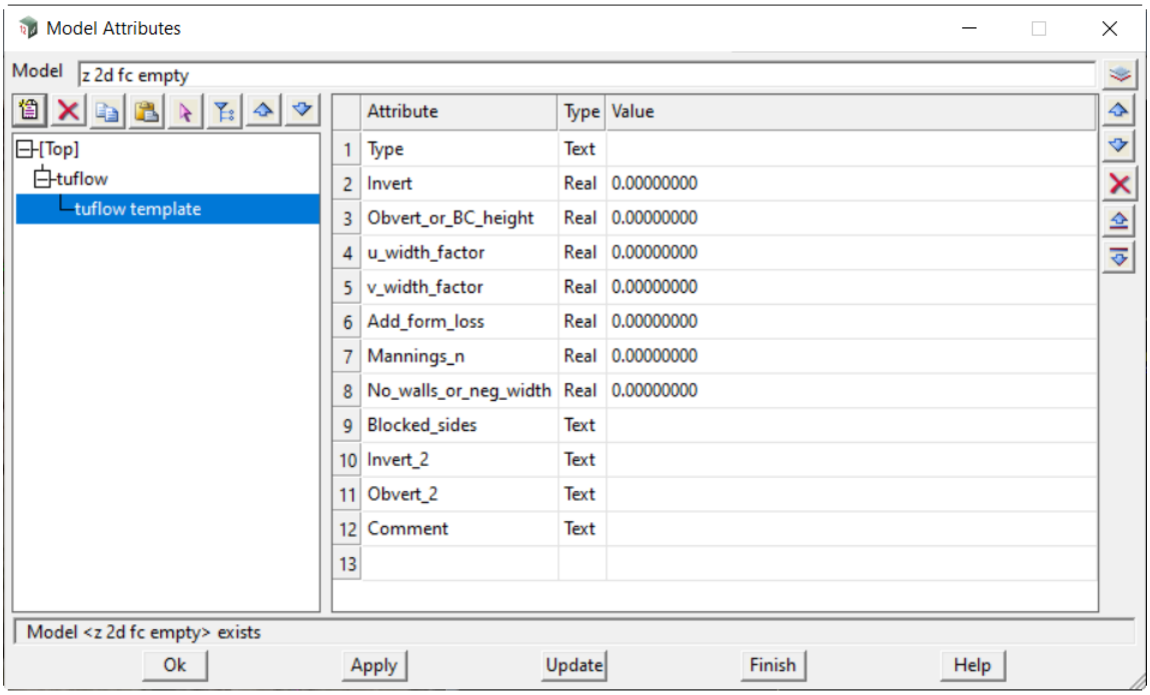
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model prefix	text box		

This prefix will be added to the file names created by TUFLOW. The model names will not contain the file extension.

Model ->Utilities->Attributes can be used to view and change the tuflow template attribute values. Following is an example of the attributes created from the flow constriction file.





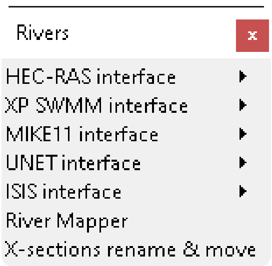
Continue to 19 Rivers or return to 18 Water 2D.

19 Rivers

Position of menu: **Water =>Rivers**

The **Rivers** option is used to prepare data for analysis packages and examine the results from the analysis.

The **Rivers** walk-right menu is:



19.3 HEC-RAS Interface
19.4 XP-SWMM Interface
19.5 MIKE11 Interface
19.7 UNET Interface
19.10.1 River Mapper
19.11 Rivers Rename and Move Cross Sections

See Also

Frequently Asked Questions (Rivers)

River Interface Models

HEC-RAS Interface

XP-SWMM Interface

XP SWMM Culverts

MIKE11 Interface

UNET Interface

ISIS Interface

River Mapper

Presenting Water Level Results

How to for Rivers

Rivers beta menu

19.1 River Interface Models

The River interface strings are split into different models depending on the strings function. Also the string names are used to define names of entities such as cross sections and reservoirs when they are exported. Following is a list of the river interface string types:

River strings

Source strings

Reservoir Strings

Spill Strings

19.1.1 River Strings

The river centre line and bank are defined by the strings in the **River strings** model.

The centre line string is used to

- measure the centre line distance between the sections,
- mark to zero chainage (or starting chainage) on the cross section, and
- if automatic source strings are created they will be perpendicular to this string
- **define culvert locations** and sizes (XP SWMM only)

The left and right bank strings are used to

- measure the bank distances between the sections and
- mark the cross section chainage where the conveyance (usually roughness) changes

The names of the strings must be **left bank, right bank** and **centre line** ***river name,reach name*** (centre may be spelled center).

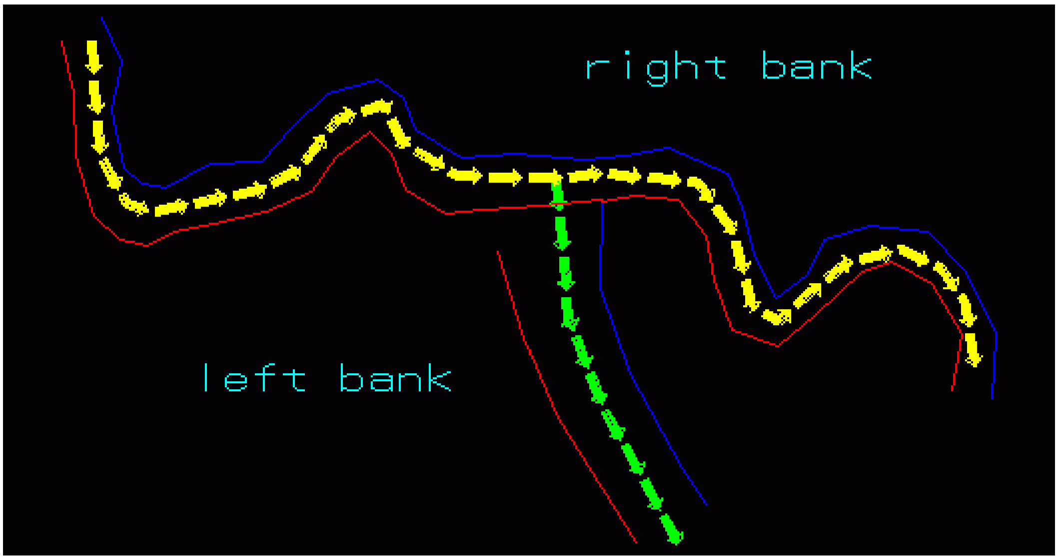
The left bank is on the left side of the river looking downstream and the right bank is on the right (looking down stream). These strings need not touch each other and may extend from one river reach to another.

HEC RAS and UNET

The centre line string must begin at the downstream end of the river. The modelling convention for these programs is to have the low chainage at the downstream end. You may use super, 2D,3D or alignment strings in this model. If you put other strings in this model you will receive warning messages saying that these strings will not be used.

Each reach of the river **MUST** have its own centre line string and they must "touch" each other to create a river confluence.

A sample of a river strings model for **HEC RAS** with one confluence is shown below. The line style for the centre line is not required. It is used only to show the direction of the centre line string.



Notes:

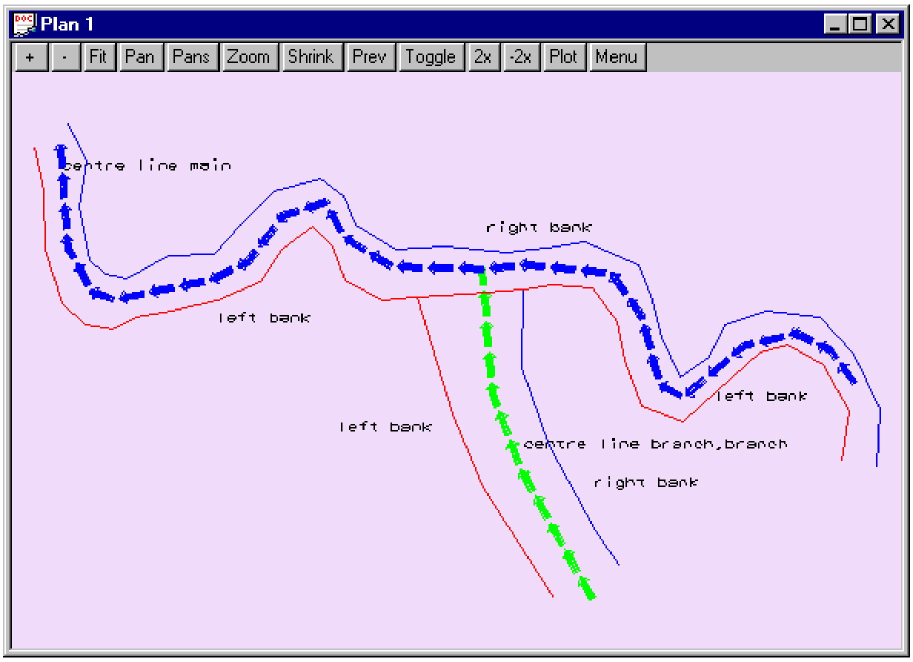
left bank strings are shown in red, right bank in blue and centre line strings in yellow and green. The line style for the centre line strings is *Drainage_4D->Flow line*. This is not required but shows the direction of the string. The string labels were created with Strings->Label->User->Label strings with names.

Centre line string direction is very important!

HEC RAS, UNET, XP SWMM	start at the **DOWN**stream end of the river
ISIS and Mike 11	start at the **UP**stream end of the river

ISIS and MIKE11

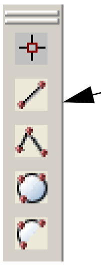
The centre line strings are drawn starting **upstream** for the ISIS and Mike 11 programs.



19.1.2 Source Strings

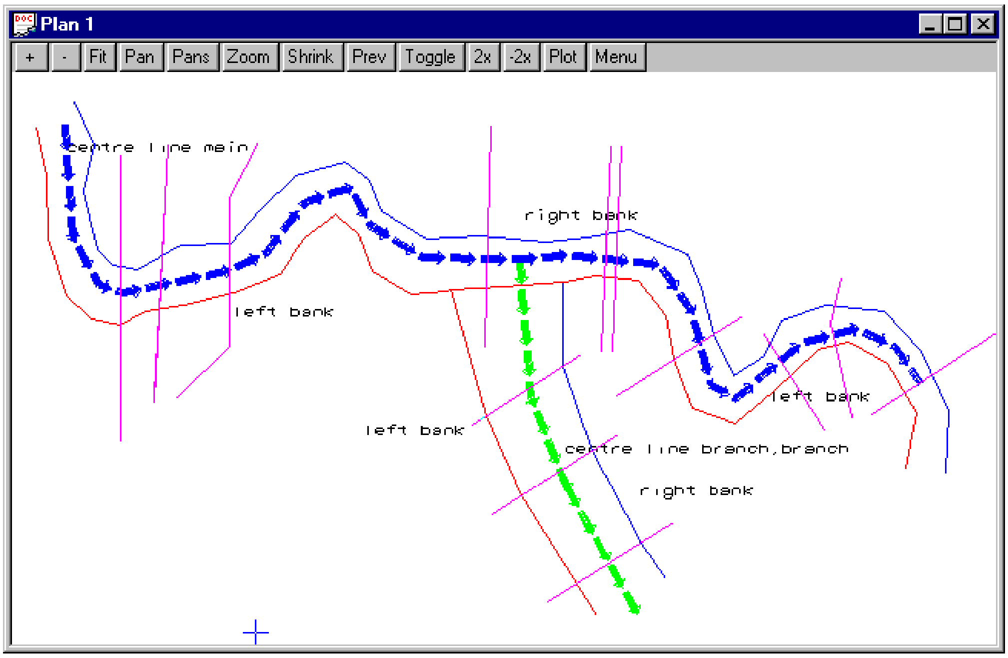
Cross sections are created at the location of the **source strings**. These source strings are initially created at a user defined spacing and section length using any one of the river interfaces writers. The user may alter these sections as desired. These may be shortened if they intersect at sharp bends in the river; they may be extended at extremely wide river sections or extra points may be added so that the section is no longer a straight line.

Source strings can be deleted and additional sections can be added by creating new source strings. The **Create source strings** tick box on the interface panel must **NOT** be selected to use the customised strings.



A quick way to manually create 2 point string is via the CAD tool bar.

A sample of source strings (shown in magenta) is presented below. The source strings may run in any direction except for Mike11. In Mike11, the cross sections will be created in the same direction as the source strings. For all other interfaces the low chainage will be used for the left bank (section viewed looking downstream).



19.1.3 Reservoir Strings

The **reservoir strings** may define inline reservoirs or offline storage. The elevation of the first point on the string sets the maximum level to be used in the stage storage curve. 12d will determine the minimum level inside the reservoir string and then calculate the volumes at a 1m (2 foot for imperial units) increment. The default increment may be changed by creating a string attribute "stage increment" (see **stage increment**).

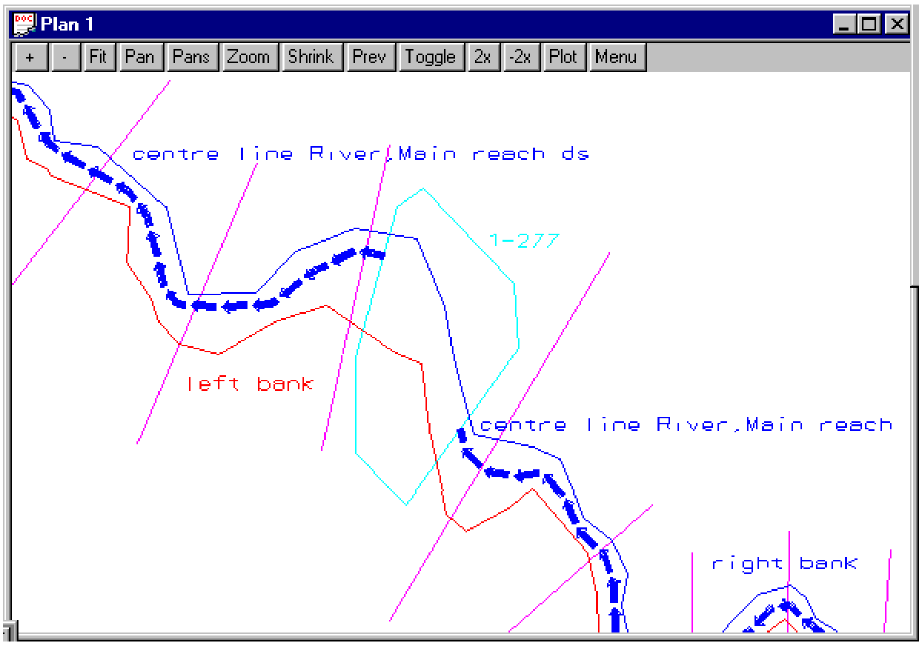
Inline reservoirs are "touched" by centre line strings both upstream and downstream. Offline storage areas are linked to the cross sections via **Spill strings.**

Other features of the reservoir strings are

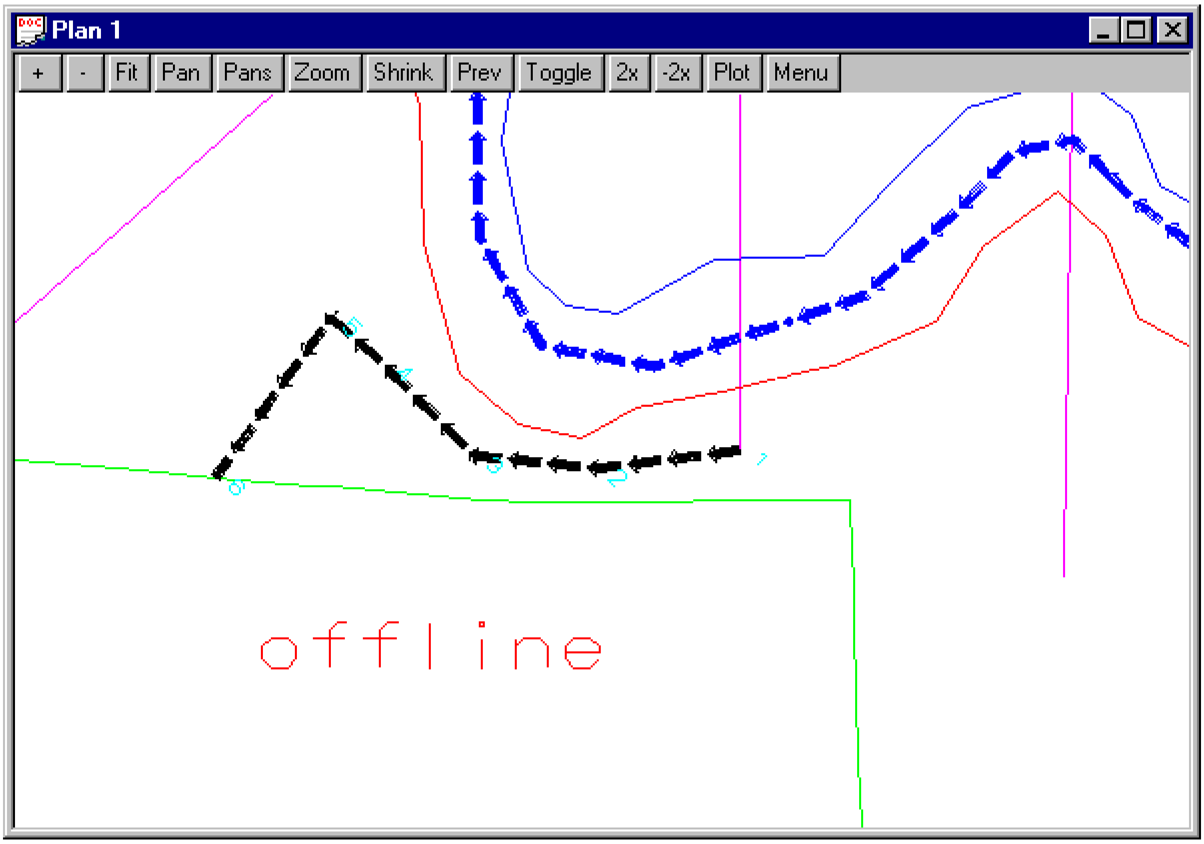
Auto height

XP SWMM catchment parameters

A sample drawing showing an inline reservoir in cyan (1-277) follows. Note that the river centre line touches the reservoir string both upstream and downstream. The left and right bank strings may continue straight through the reservoir.



A sample drawing of an offline reservoir follows (the reservoir string is shown in green). Note that the spill string (black) starts at the source string (point 1), then follows the section line to be cut and exported (points 2 to 5) and ends by touching the off line reservoir string at point 6. The rivers strings do not touch the offline storage strings.


Plan 1
+
-
Fit
Pan
Pans
Zoom
Shrink
Prev
Toggle
2x
-2x
Plot
Menu
offline

19.1.4 Spill strings

Spill strings are strings that link offline storage areas to a cross section (see drawing above). The string must begin by "touching" the source string and then proceed to the first point on the spill section. During the export the first point will NOT be exported as part of the spill section. After defining the end of the spill section the last point on the string must "touch" the reservoir string. Again this last point will NOT be exported as part of the spill section.

The default roughness for the spill section is the "left n" from the main export panel, the default slope is 0.5% and the default length is 100. See the manual setting table for **manual override settings**.

XPSWMM Only. 2 point culvert strings (6 max) may be draw across the spill string to create a multi conduit. The culvert strings should be drawn in the same direction as the spill string so that the upstream and downstream inverts follow in the same direction.

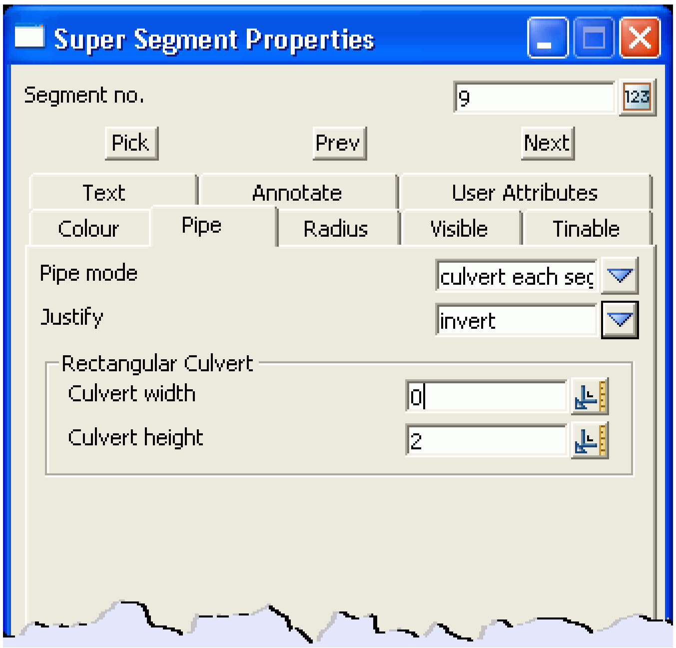
19.1.5 Define Culvert Locations

12d allows culverts to be included as a segment of a super string. The **XP SWMM** rivers interface allows culverts in 2 models. In the spill string model, multiple two point superstring mays cross a spill string to indicate a culvert through the embankment. In the river string model a segment of the river centre line may marked as a culvert. For parrallel culverts, segment attributes must be used.If a source string crosses the same segment than a mulit-link with both the culvert and the natural section will be exported.

Important note: Version 10.0 of xpswmm (at the time of writing) will only use inlet control curves on culverts with positive slopes.

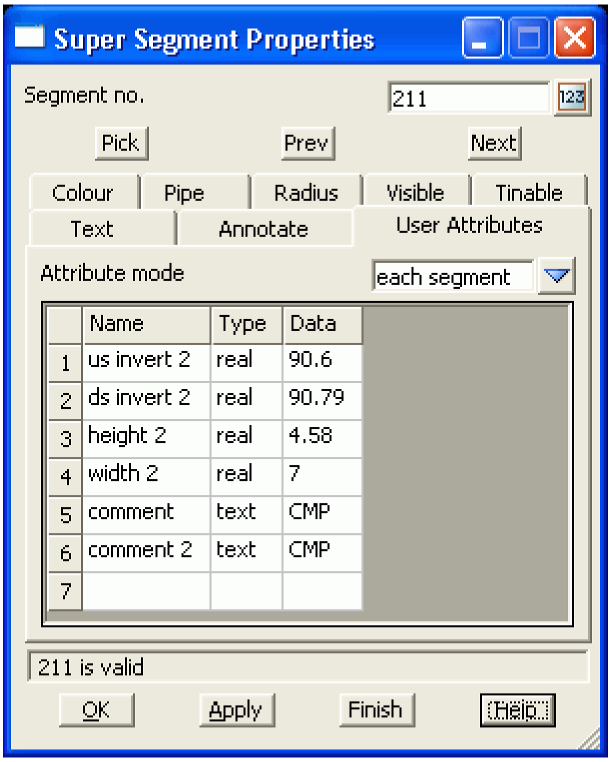
Adding a Culvert to a super string

1. **Super strings only!**
   Convert string to a super string (if required)
   Strings->Convert
2. **Mark the ends of the culvert.**
   Add a vertex at the upstream and downstream end of the culvert (Toggle vertices on if desired)
   String->Points Edit->Insert
3. **Mark the segemnt as a culvert or pipe**
   Use the super string segment editor to set the culvert data.
   Strings->Properties->Segments (all) and change Segment properties to use **culvert each segment** (box) or **pipe each segment** (round). Note that if there is one box culvert on the centre line then all must be box culverts. If you need pipes and box culverts combined, set the width to zero for pipes.
   Also set the Justify mode to indicate the type culvert levels you wish to specify.

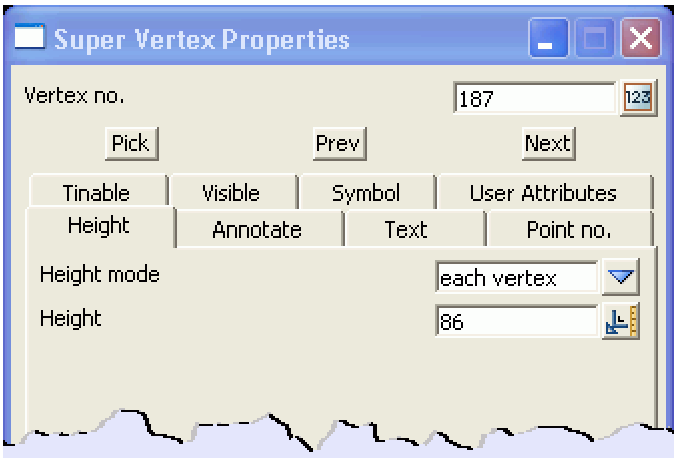


If there are two (max is 7) culverts at this location that have different inverts or sizes add the following user defined attributes to the segment. The comment attributes are printed by the Culvert Table routine and are used to label the culvert as well. If there are a number of identical culverts, the attributes "number of pipes" (integer) can be set to a value greater than 0. Additional attributes to customuse the culvert are listed at the end of this section. Default mannings n are 0.024 for pipes (corrigat metal) and 0.012 for box (concrete).

4. Conduit Factors are automatically set. Circular pipes are set to "Headwall (circular corrigated metal)" and box culverts are set to "45 deg Wingwall Flares (Rect, Conc)". Expansion and contraction energy loss coeficients have default values of 1.0 and 0.5 respectively but these may be changed using the attributes indicated below.



5. **Set the upstream and downstream levels**
Select a vertex at the end of segment, ensure the **height mode** is **each vertex** and set the height. Use the **Next** or **Prev button** to move to the other end of the culvert and set its height as well.



Additional Culvert Segment Attributes (Spill and River strings)

Purpose	Attribute Name	Type	Typical Data Value
Culvert entrance loss	entrance loss	Real	0.5
Culvert exit loss	exit loss	Real	1.0
Mannings n	roughness	Real	0.014
Multiple identical culverts	number of pipes	Integer	2

Centre Line Culvert Segment Attributes (River strings)

The attribute name has the culvert number as a suffix. i.e. (height 2)

Purpose	Attribute Name	Type	Typical Data Value
Diameter/height	height n	Real	0.5
Box culvert width	width n	Real	1.0
Upstream invert	us invert n	Real	20.2
Downstream invert	ds invert n	Real	20.1
Culvert length	length n	Real	10.2

19.2 Culvert Table

Position of option on menu: **Design=>Rivers=>XP SWMM interface=>Culvert table**

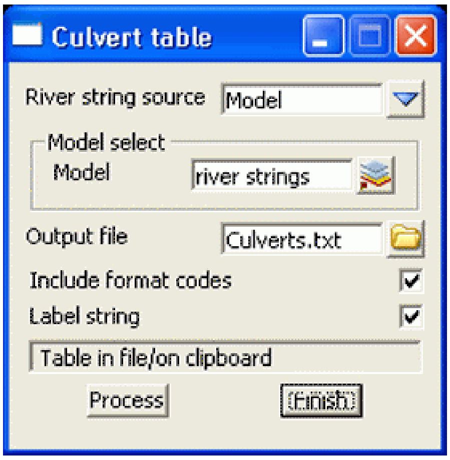
This option is used to create a table of the culverts created along the centre line of the river and to label the invert levels and comment for the first culvert on each segment (some segments may include attributes for more than on culvert). A sample is shown below.

Culvert Listing										
chainage	Number	US Inve	DS Inver	Height	Width	Quantity	X location	Y location	Comment	Segment
Centre lin	center line 1									
88444	1	125.28	124.95	11	7	1	683236	1389459		705
87269	1	127.58	127.24	6		1	683059	1390605	72/cmp	695
85983	1	123.13	123.72	6		1	682871	1391834	inv-72/cm	682
84317	1	124.15	123.47	6		1	681757	1392779		666
84317	2	124.59	125.15	6	0	1	681757	1392779	6ft cmp	666
83854	1	123.07	123.28	5		1	681319	1392820	60 inch cc	659
83854	2	123.54	123.42	5		1	681319	1392820	60 inch cc	659

See Also

Defining culvert locations

Usage



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
River string source	input	view	string,model,view

the imported cross section strings will be stored in this model

String,Model,View various

centre line string selection

Output file File box

text file to contain the table

Include format codes tick box

format codes are used to format tables in 12d...not desired for other programs

Label string tick box

The invert labels and the pipe size will be added as vertex and segement text

Process button

executes the option.

Finish button

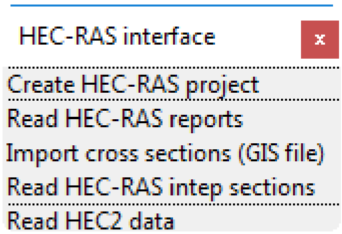
removes the dialogue from the screen

19.3 HEC-RAS Interface

Position of menu: Water =>Rivers =>HEC-RAS interface

The HEC-RAS interface creates the HEC-RAS project files ready to open and run. This includes the project, plan, flow and geometry files. Water levels are read back into ***12d Model*** where they may be viewed in a 3D perspective view to easily identify extents of flooding.

The HEC-RAS walk right menu is:



19.3.1 HEC-RAS Write Panel
19.3.1 HEC-RAS Write Panel
19.3.4 Read HEC-RAS interpolated sections
19.3.4 Read HEC-RAS interpolated sections
19.3.5 Read HEC2 Data

See also

River and Source Strings

Create HEC-RAS files

Read HEC-RAS results

Presenting Water Level Results

Import cross sections (GIS file)

Read HECRAS Interp sections

Read HEC2 Data

How to for Rivers

Frequently Asked Questions (Rivers)

Exporting to HEC-RAS

The HEC-RAS project is created from a surface tin (representing the river bed and overbanks) and a model containing strings identified by their names “left bank”, “right bank and the name prefix, “centre line”. Any additional strings in the specified model will be ignored (warning messages will be given when you run the macro that any additional strings are being ignored). The low chainage (often zero) of the centre line strings must be at the downstream end of the reaches.

Cross sections are created at the location of the **source strings**. These source strings are initially created using the HEC-RAS option at a user defined spacing and section length. The user may alter these sections as desired. These may be shortened if they intersect at sharp bends in the river; they may be extended at extremely wide river sections or extra points may be added so that the section is no longer a straight line.

Source strings can be deleted and additional sections can be added by creating new source strings. The **Create source strings** tick box on the interface panel must **NOT** be selected to use the customised strings.

Presenting HEC-RAS Results in 12d

After the HEC-RAS analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the HEC-RAS results. These strings are then triangulated to create a water surface tin from which the water level boundaries are determined. These results can then be shown in plan, long section, cross section and in 3D perspectives.

More details

19.3.1 HEC-RAS Write Panel

Position of option on menu: Water =>Rivers =>HEC-RAS interface =>Create HEC-RAS project

The HEC-RAS interface creates the HEC-RAS project files ready to open and run. This includes the project, plan, flow and geometry files. Water levels are read back into 12d where they may be viewed in a three dimension perspective view to easily identify extents of flooding.

See also

River and Source Strings

HEC-RAS Interface overview

Read HEC-RAS results

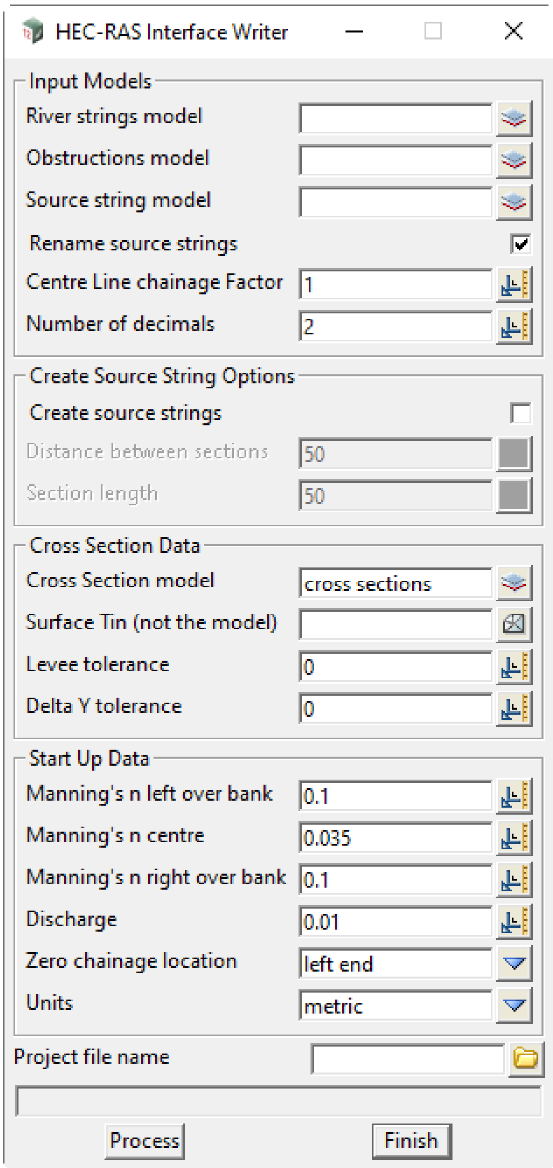
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The HEC-RAS panel for creating the HEC-RAS project follows.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up

Input models

River strings model Model box

Model containing the centre line, left bank and right bank strings. ***The centre line strings must begin downstream and proceed upstream.*** *The name of the river may follow the words "Centre line " (note the ending space). For example the centre line string may be named "Centre line Parramatta River, downstream reach". The comma separates the river name from the reach name. If no comma is included then the river name is repeated for the reach name.*

Confluences are modelled by a using a separate string for all reaches. Thus a system with a branch is modelled with three strings. The branch will be one string and the main reach will have a downstream string and an upstream string. The reaches must touch at the confluence.

The distance from the start of the upstream strings to the first cross section is used to model the confluence length.

The left and right bank strings need not be separate strings (see figure below).

Obstructions model Model box

??

Source string model Model box

*New source strings will be created in this model or existing source strings are contained in the model. See **Create source strings** tick box below.*

Rename Source Strings Tick box not ticked

*If selected the source strings will be a name using the chainage along the river centre line. The **number of decimals** and the **Centre line chainage factor** (ft to miles or m to km) are specified below.*

Centre Line Chainage Factor Real box

The cross section names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.

Number of decimals Real box

*When **Rename source strings** is selected, the source strings name will have the specified number of decimals.*

Create Source String Options

Create Source Strings Tick box not selected

*When selected existing source strings are deleted and new ones created perpendicular to the centre line at the specified spacing and length. Once you have created the sources strings they can be easily modified. On the **String =>Points Edit** menu you will find the selections **Move** (to move the end points), **Insert** (to insert additional points).*

Distance between sections Real box

The distance between the cross sections. At present no check is made for overlapping cross sections around river bends.

Section Length Real box

The length of the cross section with zero chainage at the mid point.

Cross Section Data

Cross section model Model box

The cross sections created and exported are stored in this model.

Surface Tin (not the model) Tin box

Tin or super tin to create the cross sections from (remember a tin is like a string. It is placed in a model.).

Levee Tolerance Real box

If the surface level drops more than this amount while moving away from the channel centre line then the crest is marked as a levee. A value of zero means that no levees are marked.

Delta Y tolerance Real box

*This value filters out points on the cross section. Imagine a tube of this diameter passing over the cross section. The tube is elongated until one point lies outside the tube. The tube is shortened to the previous point and then all points inside the tube are deleted from the cross section. The tube then moves on to the next point. The filtered (smoothed) and original sections are kept for comparison. **The final water tin is created from the ground tin and therefore the boundary string is located using the unfiltered section.***

Start Up Data

Manning's n Real box

Manning's n values for the left, right and centre channel sections.

Discharge Real box

This discharge is used at the upstream end of all reaches. If you have multiple river branches, you can set the flow for each branch inside HEC-RAS or inside 12d. This can be changed at each section See manual settings.

Zero chainage location Choice box left end, centre

??

Units Choice box metric, imperial

This selection will set the default units for the project being created.

Project file name Input box

The HEC-RAS project name. Remember HEC-RAS (2.0 or earlier) is limited to 8 characters only. If the total path name is too long HEC-RAS will not analyse the project.

Buttons at Bottom

Process button

Process the option.

Continue to the next subsection 19.3.2 HEC-RAS Read Panel or return to 19.3 HEC-RAS Interface.

19.3.2 HEC-RAS Read Panel

Position of option on menu: **Water =>Rivers =>HEC-RAS interface =>Read HEC-RAS reports**

After the HEC-RAS analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the HEC-RAS results. These strings are then triangulated to create a water surface tin.

See also

HEC-RAS Interface overview

Create HEC-RAS files

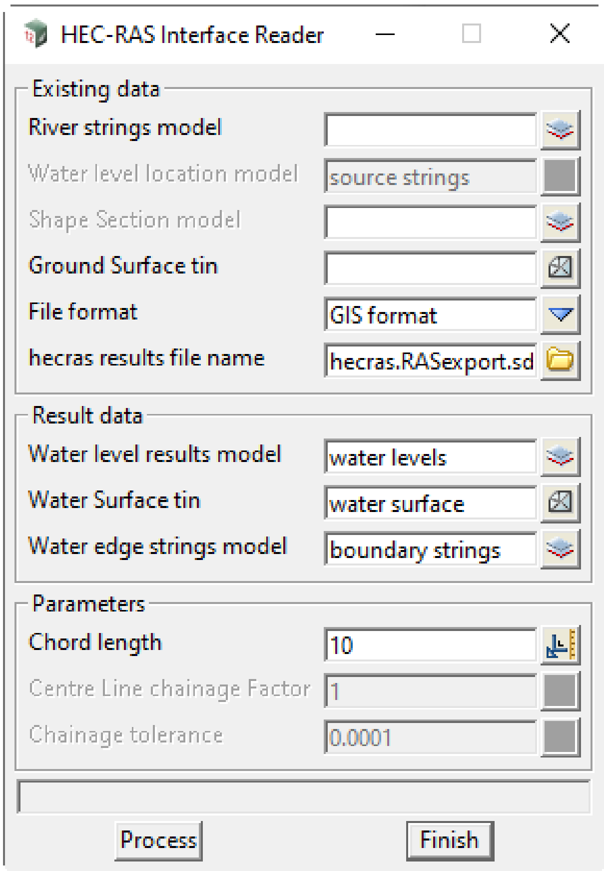
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The HEC-RAS read panel follows.



Existing Data

River strings model Model box

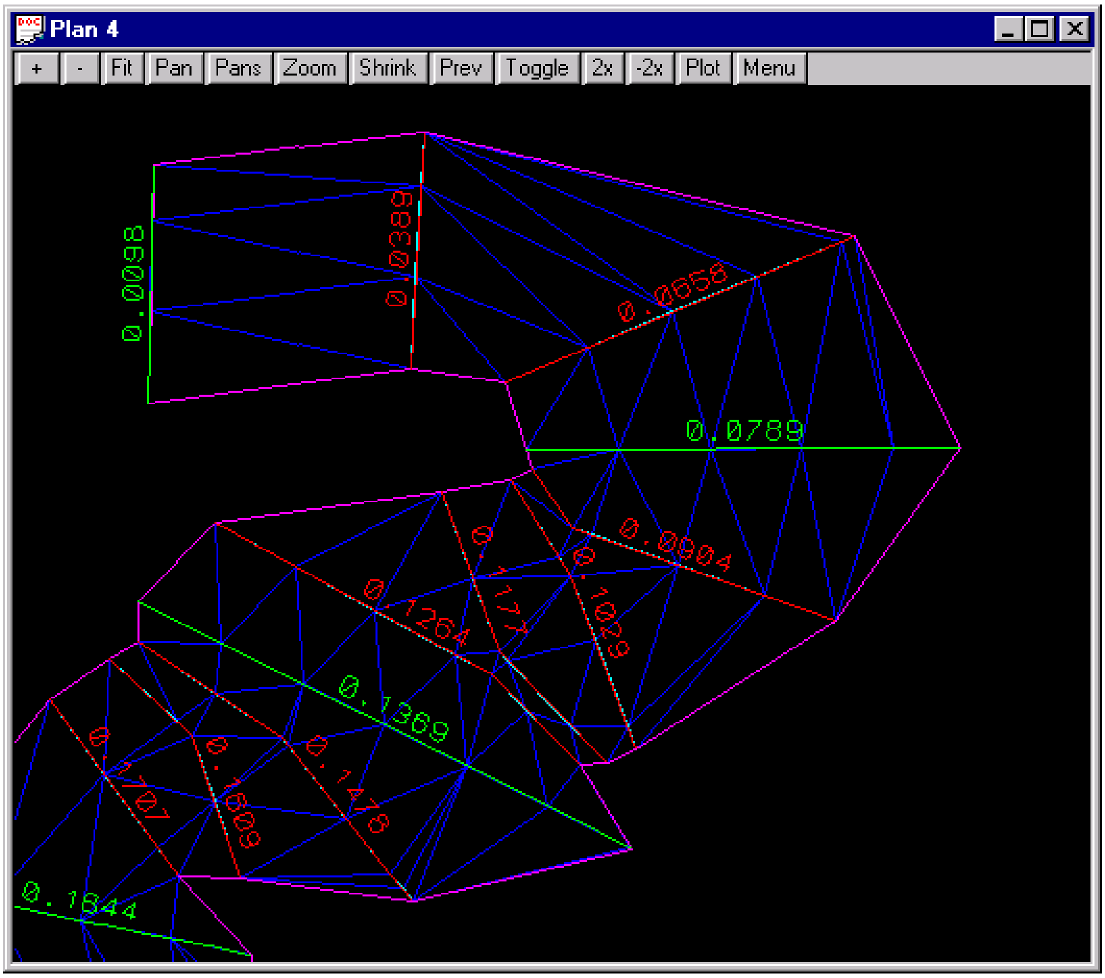
The river strings model specified in the write panel.

Water level location model Model box

??

Cross Section model Model box

*The cross section model specified in the write panel. This must be specified but is only used when reading the *.rep file types (see **File format** below). The interface will search the string names in this model for the cross sections specified in the HEC-RAS report. A match is successful if the HEC-RAS cross section chainage and the string name are within the tolerance specified below in **Chainage tolerance**.*



Shape string model Model box

For meandering rivers, the cross sections (shown in green above) may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings (shown in red above) can be created to create a water surface (shown in blue above) to follow the river. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach.

Ground surface tin Tin box

*If a **boundary string model** is specified below, the intersection of this ground surface and the water surface will be determined. The strings will be stored in the model from the **boundary string model** field.*

File format Choice box GIS format GIS format, REP format

The GIS format should be used in most cases. The rep format is used for reading the HECRAS report files with the "Standard Table 1" selected in HECRAS.

HEC-RAS report file name File box

The HEC-RAS report file (GIS format) is created using the HEC-RAS menu selection

File=>Export GIS data

The HEC-RAS report file (REP format) created using the HEC-RAS menu selection

File=>Generate Report

The report must include the Standard Table 1.

Result Data

Water level results model   Model box

The model where the water surface strings will be created at each cross section and shape string.

Water surface tin   Tin box

The name of the water surface tin to be created.

Water surface tin model   Model box

The model to contain the new water surface tin.

Boundary string model   Model box

*The model to contain the intersection strings between the water and ground surfaces specified above. If left **blank** no intersection strings will be calculated.*

Parameters

Chord Length   Model box

This value set the spacing for the points on the water level strings (both cross section and shape strings). It is recommended that you use a length of no more than half of your average cross section and shape string lengths. A large value in this field may result in unexpected water level profiles for meandering rivers.

Centre line chainage factor   Model box

*This data is only required if the **Shape string model** is used. The shape string names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.*

Chainage Tolerance   Real box

This is the tolerance used when the cross section chainage from the HEC-RAS report is compared with the cross section string names. A value of 0.00001 is excellent if you have not altered the cross section names in 12d or HEC-RAS.

However, if you have altered chainage names then you may have to increase the value of the tolerance. Suppose the tolerance is set to 0.001 and the water level for section 0.056 is read from the HEC-RAS report file. The interface will search for the first string with a name between 0.055 and 0.057. If you chose to great of a tolerance then more than one water level result will match a 12d cross section and a warning message will be given.

If you have one specific cross section that you would like to have a different tolerance set for (maybe only one section is giving you troubles), use the Attribute Editor

(String =>User =>Attribute Editor), select the cross section string and create a real type attribute named tolerance set to the tolerance desired.

Buttons at Bottom

Process   button

Process the option.

Continue to the next subsection 19.3.3 Import cross sections (GIS file) or return to 19.3 HEC-RAS Interface.

19.3.3 Import cross sections (GIS file)

Position of option on menu: **Water =>Rivers =>HEC-RAS interface =>Import cross sections (gis file)**

This option is used to import HEC RAS cross sections, interpolated cross sections, source strings (Cut lines), river centre lines and storage area boundaries into 12d. Note that the imported data will be given the X,Y coordinates used in the HECRAS project.

See Also

River and Source Strings

HEC-RAS Interface

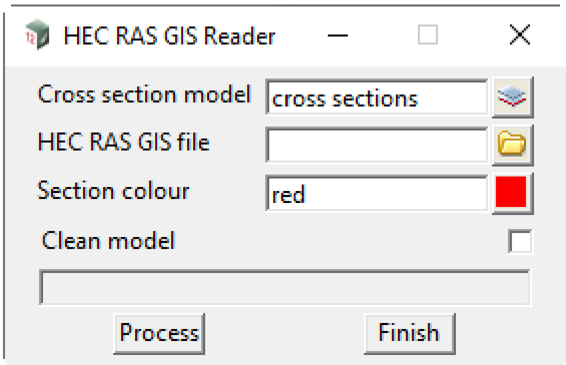
How to for Rivers

Frequently Asked Questions (Rivers)

Usage

This panel is accessed from the menu selection

Water => Rivers => HEC-RAS Interface=>Import cross sections (GIS file)



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
River strings model	model box		

The imported centre line strings will be stored in this model (REACH:CENTERLINE: data). If blank these string will not be imported.

Source string model	model box		

The imported source strings will be stored in this model (CROSS-SECTION:CUT LINE: data) If blank these string will not be imported.

Cross section model	model box		

The imported cross section strings will be stored in this model (CROSS-SECTION:SURFACE LINE: data). If blank these string will not be imported.

Storage area model	model box		

Storage area boundaries will be stored in this model (strings not supported in 12d V7 interface). If blank these string will not be imported.

HEC RAS GIS File	File box		

The GIS file generated from HEC RAS (.RASexport.sdf).*

Section colour colour box red

Cross sections will be created using this colour unless the section name contained illegal characters.

Clean model tick box

*If **selected**, all strings in the Cross section model will be deleted before the cross sections are imported.*

Buttons at Bottom

Process button

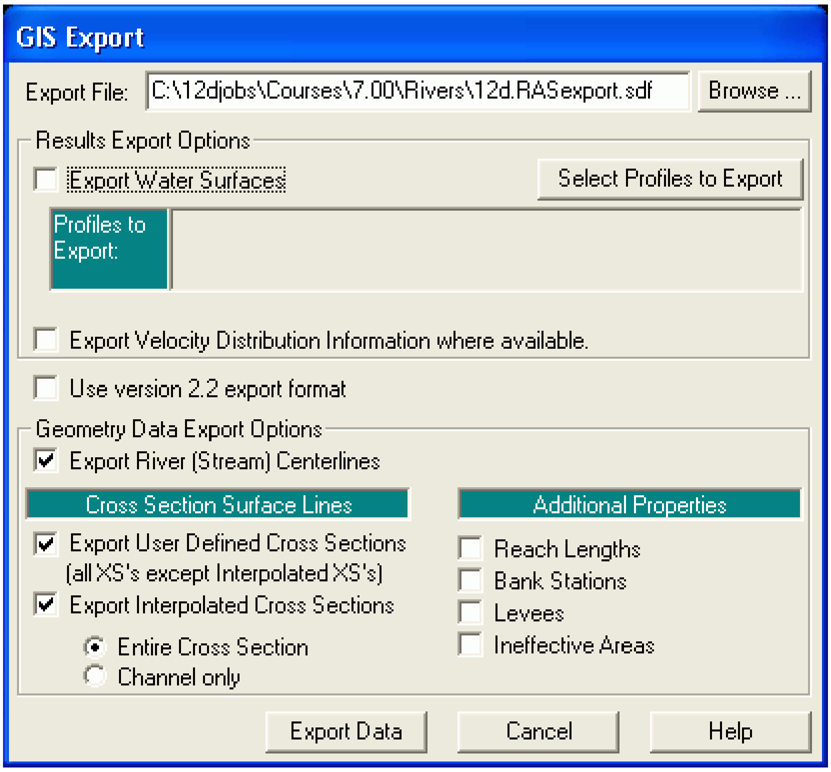
Executes the option and the number of string imported will be reported in the message area.

Finish button

Removes the dialogue from the screen.

Notes:

The RASexport.sdf file is create from HEC RAS using File->Export GIS Data. From this panel the desired data to be exported may be selected. In this example all three Geometry tick boxes have been selected.



Continue to the next subsection 19.3.4 Read HEC-RAS interpolated sections or return to 19.3 HEC-RAS Interface.

19.3.4 Read HEC-RAS interpolated sections

Position of option on menu: **Water =>Rivers =>HEC-RAS interface =>Read HEC-RAS interp section**

This option is used to import HEC RAS interpolated cross sections (names begin with *) based on their distance along the left and right bank strings.

The low chainage must be at the downstream end for both the "left bank" and "right bank" strings.

See Also

River and Source Strings

HEC-RAS Interface

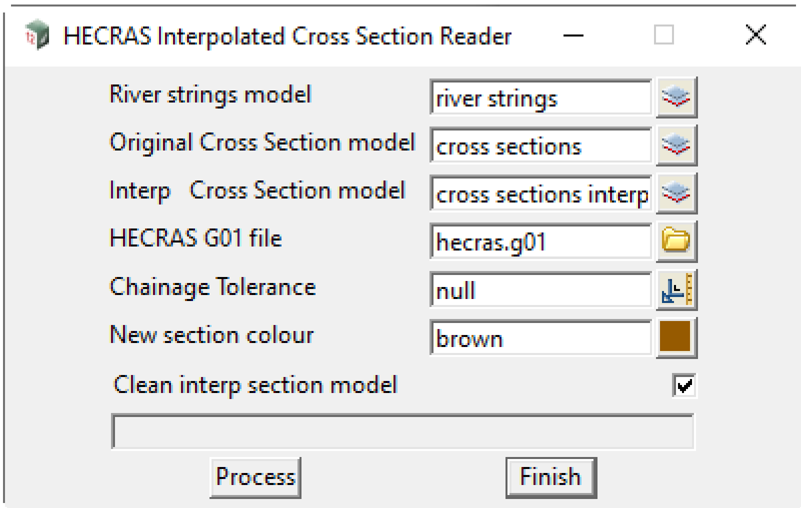
How to for Rivers

Frequently Asked Questions (Rivers)

Usage

This panel is accessed from the menu selection

Water => Rivers => HEC-RAS Interface=>Read HEC RAS Interp sections



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
River strings model	model box		

The centre line, left and right bank strings must exist in this model.

Original cross section model model box

The HEC RAS cross section names will be compared with the string names in this model

Interp cross section model model box

The imported cross section strings will be stored in this model.

HEC RAS G01 File File box

*The G01 (geometry) file used by HEC RAS to store the data in raw format. This is **not** the GIS format.*

Chainage tolerance Real box

Existing cross sections must be located in 12d model. This value is the tolerance used when the HEC RAS *cross section names are compared to the 12d string names.*

New section colour colour box

??

Clean interp section model tick box ticked

??

Buttons at Bottom

Process button

Executes the option.

Finish button

Removes the dialogue from the screen

Continue to the next subsection 19.3.5 Read HEC2 Data or return to 19.3 HEC-RAS Interface.

19.3.5 Read HEC2 Data

Position of option on menu: **Water =>Rivers =>HEC-RAS interface =>Read HEC2 data**

This option is used to import HEC2 cross sections into 12d. Since the file does not contain any easting and northing data, the cross sections will be lined up vertically and will have to be placed manually inside 12d.

See Also

River and Source Strings

HEC-RAS Interface

Moving Strings ragg

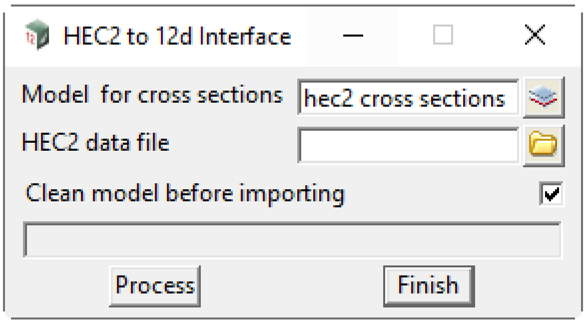
How to for Rivers

Frequently Asked Questions (Rivers)

Usage

This panel is accessed from the menu selection

Water => Rivers => HEC-RAS Interface=>Read HEC2 Data



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model for cross sections	model box		

The cross section created will be placed in this model.

HEC2 data file	File box		

The HEC2 cross section data file to be read.

Clean model before importing	Tick box	ticked	

??

Buttons at Bottom

Process	button

Read the data and create the cross sections.

Finish	button

Removes the dialogue from the screen.

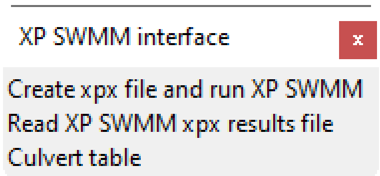
Continue to the next subsection 19.4 XP-SWMM Interface or return to 19.3 HEC-RAS Interface.

19.4 XP-SWMM Interface

Position of menu: **Water =>Rivers =>XP SWMM interface**

The XP-SWMM interface launches your XP-SWMM program and loads either a default xp file from the set_ups path (master_rivers.xp) or your existing project. The 12d data is automatically imported in the XP-SWMM project (via a *.xpx file) to either create a new river reach or update an existing reach. Water levels are read back into 12d where they may be viewed in a 3D perspective view to easily identify extents of flooding.

The XP-SWMM walk right menu is:



See also

River and Source Strings

Defining Centre Line Culverts

XP SWMM Culverts

Spill strings

Hydrology Data

Create XP-SWMM files

Read XP-SWMM results

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Exporting to XP-SWMM

The XP-SWMM project is created from a surface tin (representing the river bed and overbanks) and a model containing strings identified by their names “left bank”, “right bank and the name prefix, “centre line”. Any additional strings in the specified model will be ignored (warning messages will be given when you run the macro that any additional strings are being ignored). The low chainage (often zero) of the centre line strings must be at the downstream end of the reaches.

Cross sections are created at the location of the source strings. Source strings can be deleted and additional sections can be added by creating new source strings. The **Create source strings** tick box on the interface panel must **NOT** be selected to use the customised strings.

Presenting XP-SWMM Results in 12d

After the XP-SWMM analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the XP-SWMM results (xpx file). These strings are then triangulated to create a water surface tin from which the water level boundaries are determined. These results can then be shown in plan, long section, cross section and in 3D perspectives.

More details

19.4.1 XP-SWMM Write Panel

Position of option on menu: **Water =>Rivers =>XP SWMM interface =>Create xpx file and run XP SWMM**

The XP-SWMM interface creates the XP-SWMM project files ready to open and run. This includes the project, plan, flow and geometry files. Water levels are read back into 12d where they may be viewed in a three dimension perspective view to easily identify extents of flooding.

See also

River and Source Strings

Hydrology Data

XP-SWMM Interface overview

Read XP-SWMM results

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

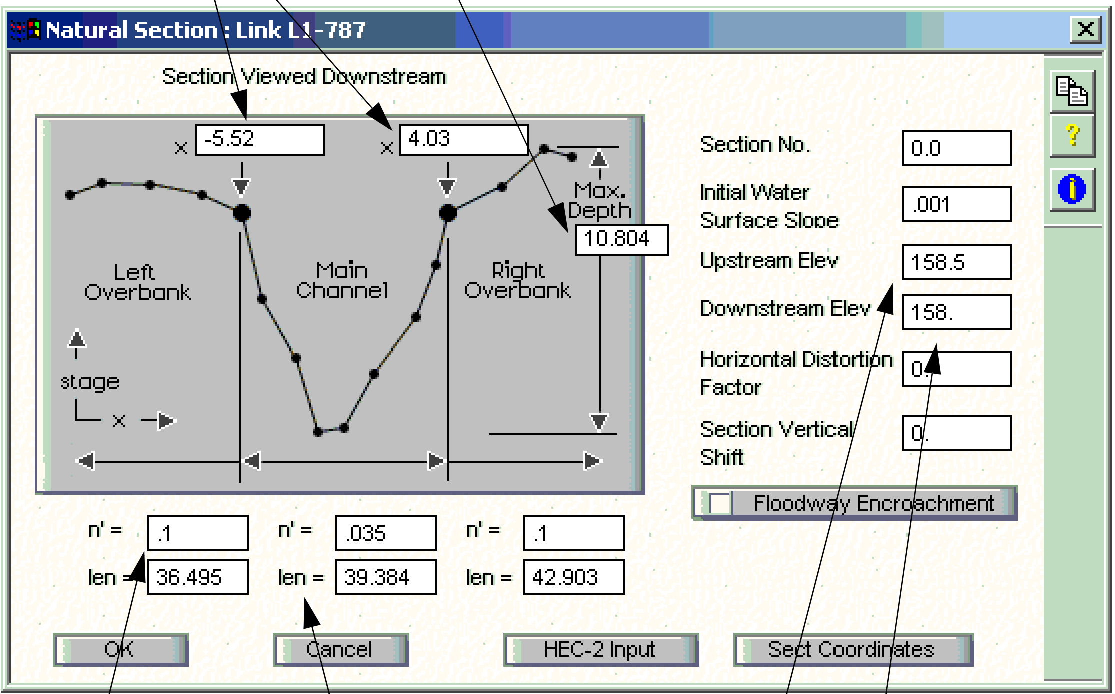
The source strings define the location where cross sections are cut from the ground surface TIN. A node is created in XP-SWMM at this location and the cross section shape is used to the next downstream node (no cross section is created at the most downstream source string).

The centre line and overbank channel lengths are measured in the downstream direction. XP SWMM link and node input panels are displayed below with the relationship to the ***12d Model*** described.

XP SWMM Link Data

cross section chainage at intersection of left and right bank strings

max elev - min elev at upstream cross section



n values from 12d panel

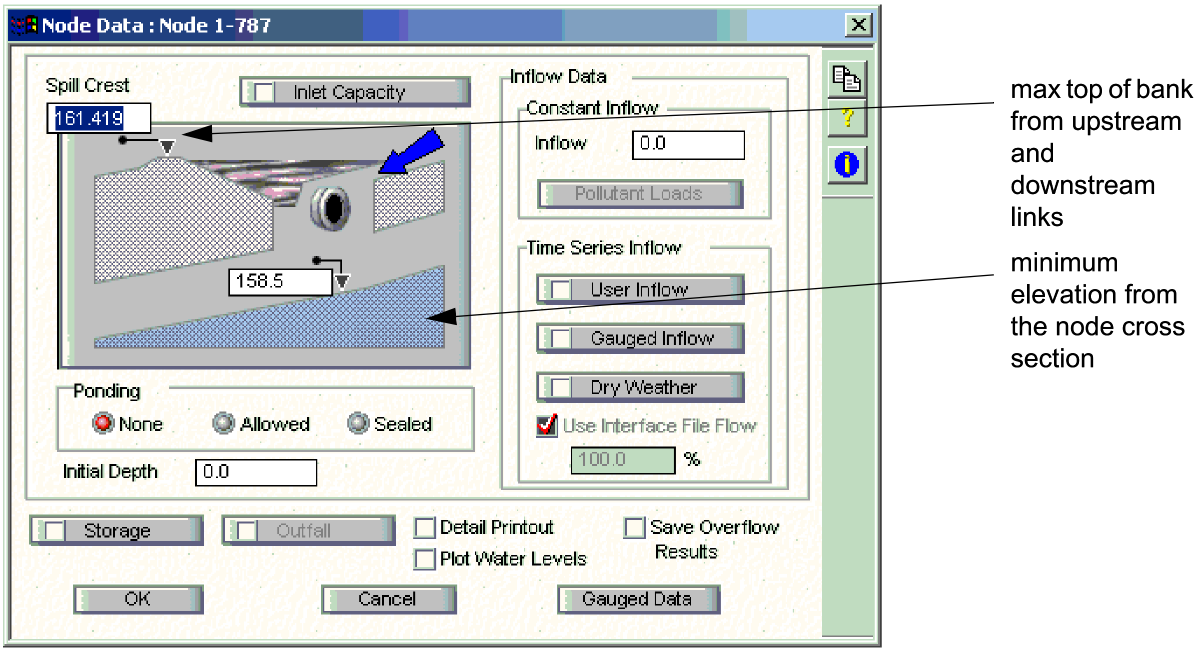
channel lengths measured along river strings

Minimum cross section elev from upstream node.

Minimum cross section elev from downstream node

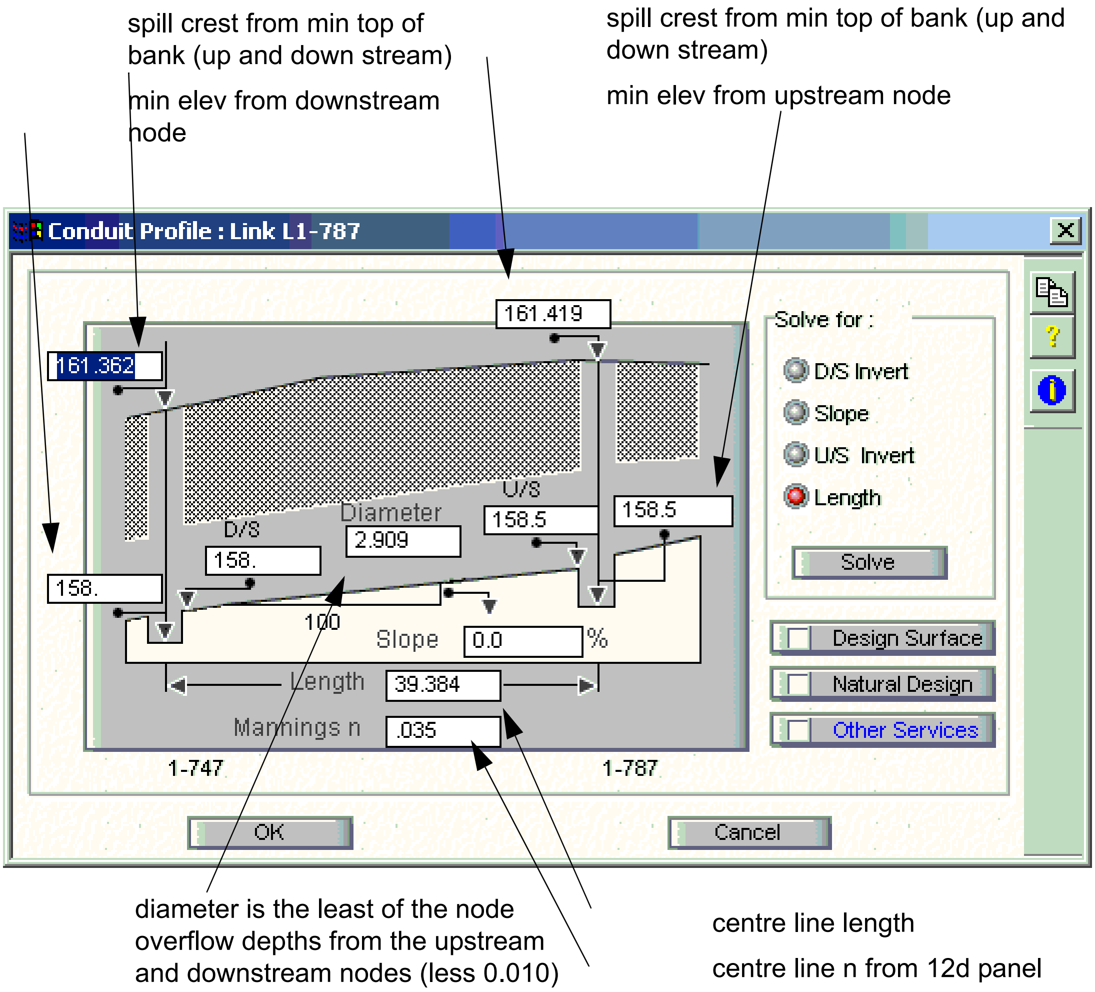
.

XP SWMM Node Data



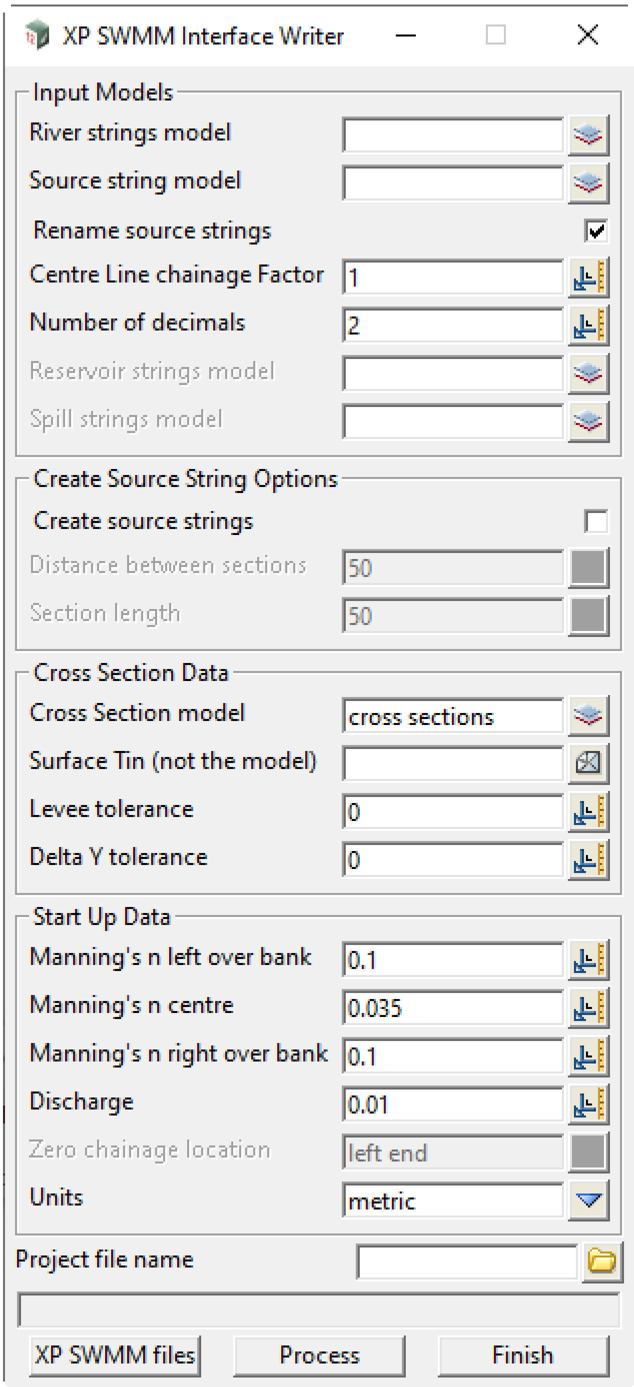
XP SWMM Conduit Data

The slope of the conduit/link is calculated by assuming that its invert matches vertically with the invert of the downstream link. The overflow levels at the nodes are calculated by determining the lowest of the bank levels for the upstream and downstream links. The least of the overflow depths at the nodes is then used as the link diameter.



Usage

The XP-SWMM panel for creating the XP-SWMM project follows.



The fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Input Models

River strings model Model box

Model containing the centre line, left bank and right bank strings. ***The centre line strings must begin downstream and proceed upstream.*** *The name of the river may follow the words "Centre line " (note the ending space). For example the centre line string may be named "Centre line Parramatta River, downstream reach". The comma separates the river name from the reach name. If no comma is included then the river name is repeated for the reach name.*

The left and right bank strings need not be separate strings (see figure below).

Source string model Model box

*New source strings will be created in this model or existing source strings are contained in the model. See **Create source strings** tick box below.*

Rename source strings Tick box ticked

??

Centre Line Chainage Factor Real box

The cross section names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.

Number of decimals Integer box

*The cross section names are created with this many decimals. CAUTION XP SWMM only allows 10 characters for the names and each link name begins with "**Lx-**" That leaves 7 characters for the chainages.*

Reservoir strings model Model box

??

Spill strings model Model box

??

Create Source String Options

Create Source Strings Tick box not selected

*When selected existing source strings are deleted and new ones created perpendicular to the centre line at the specified spacing and length. Once you have created the sources strings they can be easily modified. On the **String =>Points Edit** menu you will find the selections **Move** (to move the end points), **Insert** (to insert additional points).*

Distance between sections Real box

The distance between the cross sections. At present no check is made for overlapping cross sections around river bends.

Section Length Real box

The length of the cross section with zero chainage at the mid point.

Cross Section Data

Cross section model Model box

The cross sections created and exported are stored in this model.

Surface Tin (not the model) Tin box

Tin or super tin to create the cross sections from (remember a tin is like a string. It is placed in a model).

Levee Tolerance Real box

Not implemented in XP-SWMM.

Delta Y tolerance Real box

*This value filters out points on the cross section. Imagine a tube of this diameter passing over the cross section. The tube is elongated until one point lies outside the tube. The tube is shortened to the previous point and then all points inside the tube are deleted from the cross section. The tube then moves on to the next point. The filtered (smoothed) and original sections are kept for comparison. **The final water tin is***

created from the ground tin and therefore the boundary string is located using the unfiltered section.

Start Up Data

Manning's n Real box

Manning's n values for the left, right and centre channel sections.

Discharge Real box

This discharge is used at the upstream end of all reaches. If you have multiple river branches, you can set the flow for each branch inside XP-SWMM or inside 12d. This can be changed at each section See manual settings

Units Choice box metric, imperial

This selection will set the default units for the project being created.

Project file name Input box

*The XP-SWMM *.xp name to be created or updated. An xpx file will also be created using this name to transfer the data.*

After selecting the **Process** button the cross section strings will be created and exported to a xpx file (using the project file name as the stem. **Never included ".xpx" in the project file name**) The xpx file will be over written without any warning. This is only used as a temporary transfer file.

12d needs to know where XPSWMM program and the XP SWMM working directory are. The system file that contains these locations is called XPSWMM.4d. (See System file path for its location). The file contents are as follows:

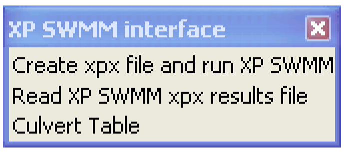
Line 1the XP SWMM working directory
Line 2the full path to the XP SWMM program
Line 3the destination of the hydro.ini file when it is created

IMPORTANT: include the final "\" on lines 1 and 3.

The **XPSWMM.4d** file as supplied follows;

c:\xps\xp-swmm\work\
c:\xps\xp-swmm\xpswmp32.exe
c:\xps\xp-swmm\

Next 12d will check for an XP project in your XP SWMM work directory (project file name + ".xp"). If it does not exist the file **Master_rivers.xp** will be copied from the System file path to your XP SWMM working directory. If a wp file already exists in your working directory you will see the following options dialogue.



The default is to update the wp file. Nodes and links in the file with the same names as in the export will be updated. If they do not exist they will be added. The import will NOT delete any nodes or links inside XP SWMM. This option is often used to merge rivers data with urban drainage data.

The over write option will copy the Master_river.xp file into the working directory and over write the existing file.

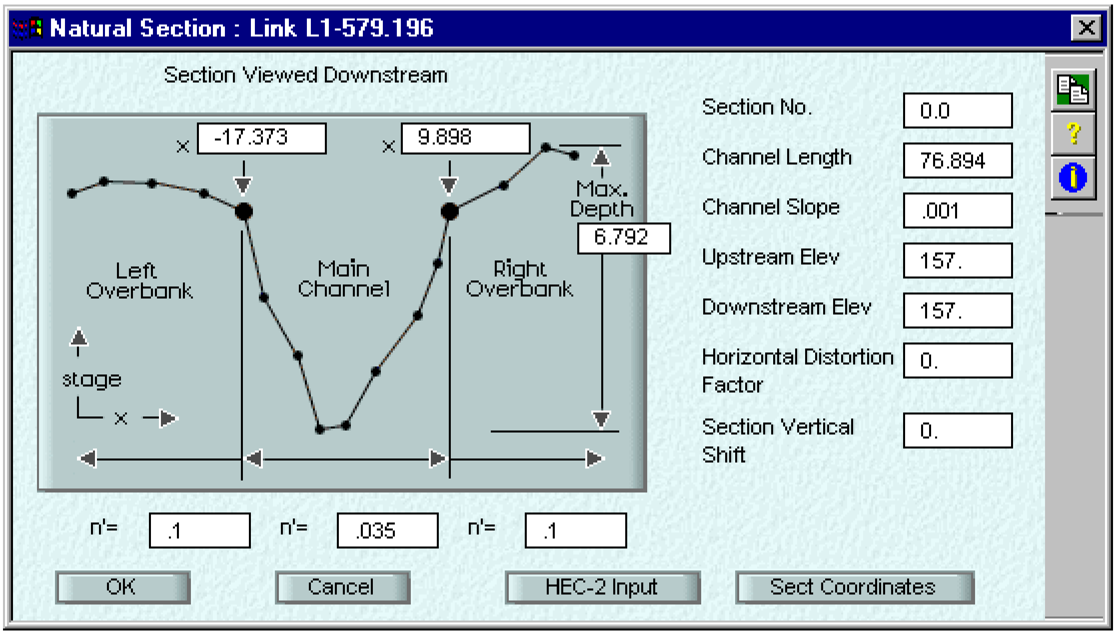
In either of the two cases the xpx file will be imported after XP SWMM has started. When you exit your XP SWMM session regardless of whether or not you save the XP file the XPX file will be exported over writing the original export file from 12d.

Your third option if not to run XP-SWMM at all and work with the XPX file as you see fit.

Continue to the next subsection 19.4.1.1 Export Details or return to 19.4 XP-SWMM Interface.

19.4.1.1 Export Details

The following diagram displays how the values from 12d are exported to XP-SWMM



At every source string location a node is created in XP-SWMM. The cross section geometry is then used for the downstream reach and is exported looking in the downstream direction.

The node name is set manually or calculated inside 12d by obtaining the centre line chainage at the intersection with section string. This value is divided by the **Centre line chainage factor** and rounded to the **Number of decimals** specified in the 12d export dialogue box. This value is then prefixed with the reach index followed by a dash. The downstream link name is set to the node name prefixed with "L". If you are planning to merge the river file with am XP SWMM drainage network then you will want to manually set the node names to the drainage pit names for the most upstream and most downstream source strings.

When selecting the **Number of decimals** in the 12d export dialogue, ensure that the total link name generated does not exceed the XP limit of 10 characters.

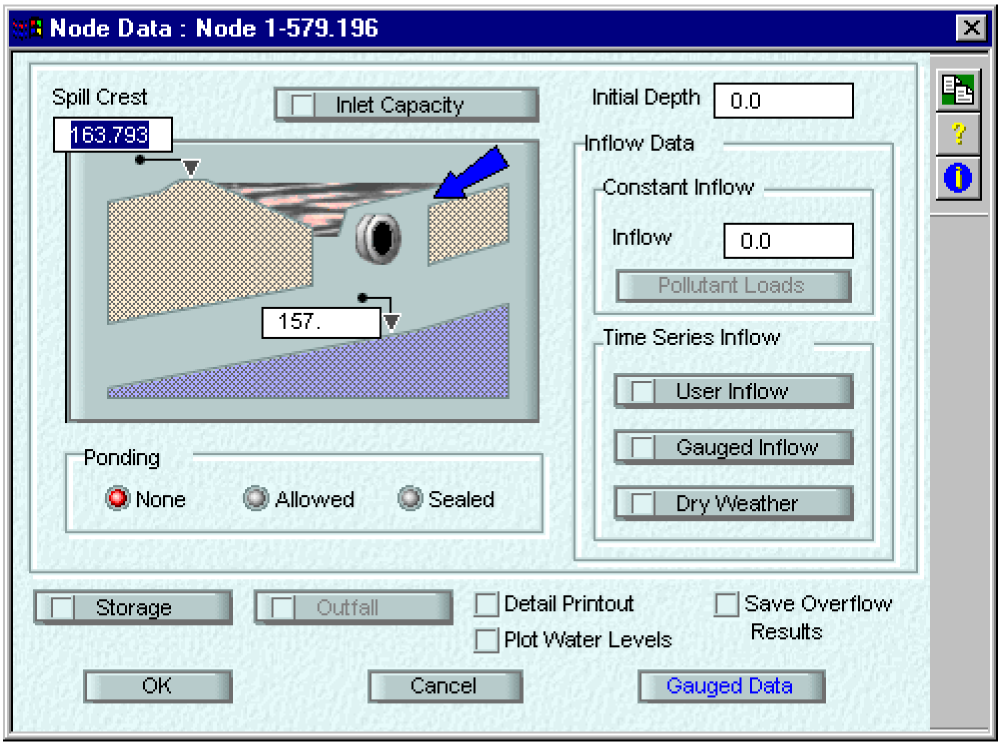
The section number variable is not exported to XP-SWMM.

Where the centre line cross the section in 12d is marked as zero chainage in XP-SWMM. The left overbank (-17.373) and the right overbank (9.898) are determined by the intersection of the left and right bank strings with the section. The n values are the values that are entered in the 12d export dialogue box. The maximum depth is calculated by subtracting the lowest elevation from the greatest elevation for both this cross section and the downstream cross section. The minimum of the two values is used.

The channel length is determined by subtracting the downstream section's centre line chainage from the current section centre line chainage. The **Centre line chainage factor** is **NOT** used in this calculation.

Upstream elevation is obtained by calculating the minimum elevation at the current section and the downstream elevation is the same value for the downstream cross section. The channel slope is calculated using these elevations and the channel length above.

The horizontal distortion factor and section vertical shift are set to zero. A section coordinate point in generated every time the source string crosses a 12d triangle edge, at the centre line and the left/ right bank locations.



The spill crest level at the node is set to the maximum level on the cross section. Constant inflow is zero unless the node is the most upstream section on the reach are the flow value for the source string has been set manually see manual settings.

Continue to the next subsection 19.4.1.2 Hydrology Data or return to 19.4 XP-SWMM Interface.

19.4.1.2 Hydrology Data

Hydrology data may be exported to the runoff layer of XP SWMM for both the reservoir strings and the source strings. There are 2 requirements to enable the hydrology.

19.4.1.2.1 Key Points

1. If you plan to use storage areas, you need to draw reservoir strings (all in one model) and each should have a name (to become the XP SWMM node name).
2. You must create a file named "hydrology.txt" and store it in the project working folder. This file will contain the default xpx variable names. These defaults may be over ridden using the same xpx variable name as a string attribute on the source/reservoir string (see format below).
3. The reservoir or source string must have an integer string attribute named "xpx r rfcmnt" with a value greater than 0 (max of 5). Use the String =>Properties =>Attributes or String =>User =>Attribute Editor to create/change this attribute.
4. Total area for the reservoir strings is calculated at each export time.

19.4.1.2.2 Hydology.txt file format

The file is tab delimited and each line consists of three pieces of data: the XPSWMM variable name, the default value, and the type of data (integer, real or text).

You enter the xpx variable name

Any of these default values may be specified using a string attribute on the reservoir or source string. The attribute name must be of the same type as defined in the hdrology.txt file. If data for a second XP SWMM catchment is desired add a " 2" to the end of the attribute name. Up to 5 catchments are allowed in XP SWMM.

A sample hydrology.txt file follows:

// SCS hydrology screen

R_CN	85	real
R_TC	60	real
R_SHF	256	integer
R_SHAPE	0	integer
R_IADEPTH	0.04	real
R_IAFRACT	0.2	real
R_IA	1	integer
CNTLS	5	integer
R_FSCS	1	integer

// sub catchment screen

R_RAINSEL	"SCS Type II FL Mod."	text
R_INFILSEL		""text
R_GWTAG	0	integer

// runoff node screen

R_WAREA	1.	real
R_WIMP	1.	real
R_WIDTH	1.	real
R_WSLOPE	1.	real

19.4.1.2.3 Attribute name format for string attributes.

The attribute name is the XP variable name prefixed by "xpx " with the underscore character in the xpx variable replaced by a space. For example the xpx variable "R_RAINSEL" would be set using the attribute name "xpx R RAINSEL".

Continue to the next subsection 19.4.1.3 Exporting River Junctions or return to 19.4 XP-SWMM Interface.

19.4.1.3 Exporting River Junctions

River junctions are defined by the intersection of the centre line strings in 12d. The cross section immediately downstream of the intersection becomes the junction node. It is used as the downstream cross section for all upstream branches. The channel length for the last link on the tributary is set to the distance the centre line string extends beyond the cross section. The distance downstream along the main branch is **NOT INCLUDED!**

Continue to 19.4.2 XP-SWMM Read Panel or return to 19.4 XP-SWMM Interface.

19.4.2 XP-SWMM Read Panel

Position of option on menu: Water =>Rivers =>XP SWMM interface =>Read XP SWMM xpx results file

After the XP-SWMM analysis is complete and the XP-SWMM program is closed the water level data is written to an xpx file that 12d will read. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the XP-SWMM results. These strings are then triangulated to create a water surface tin.

See also

XP-SWMM Interface overview

Create XP-SWMM files

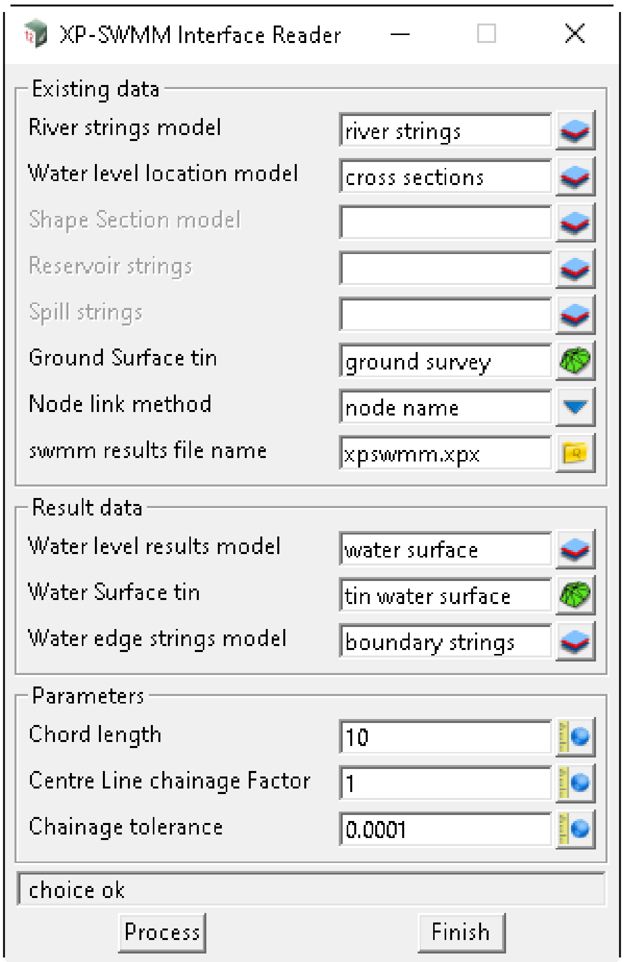
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The XP-SWMM read panel follows.



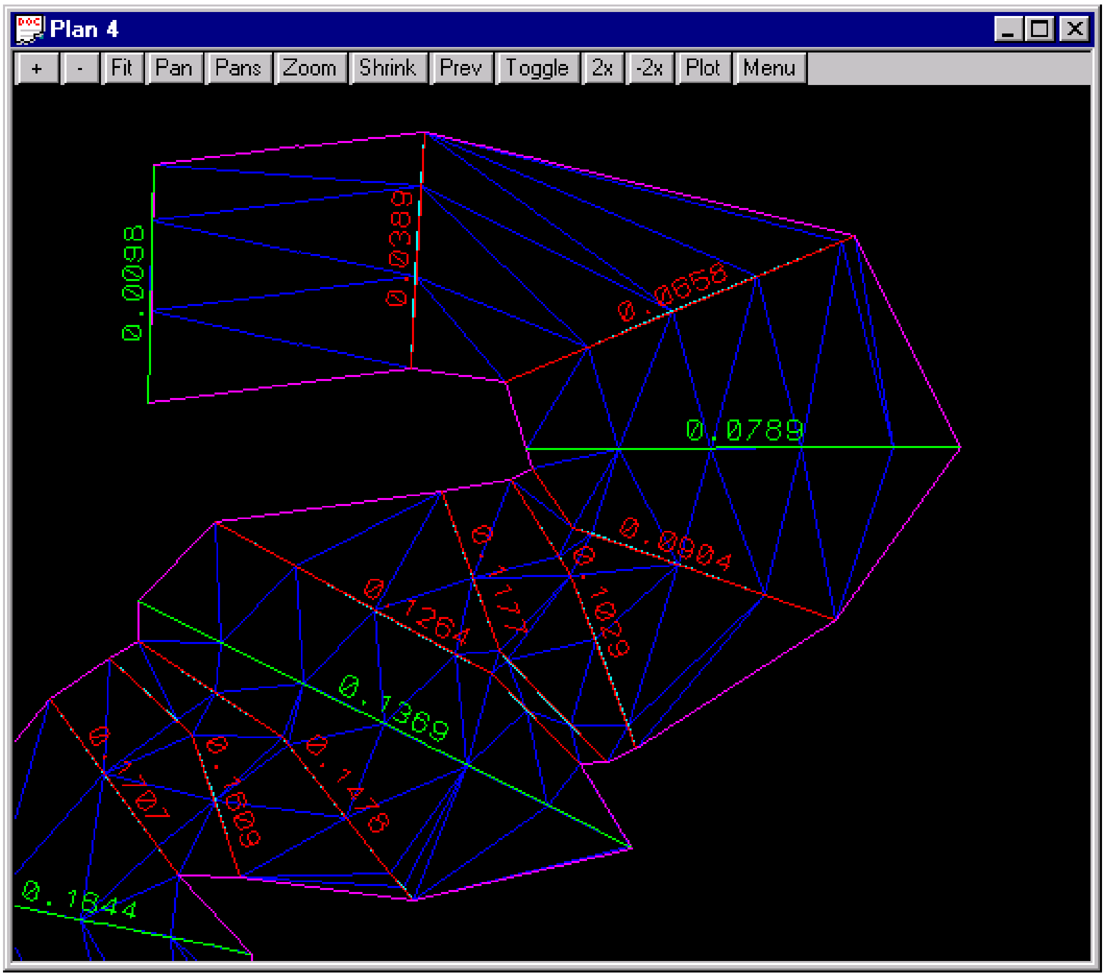
Existing data

River strings model Model box

The river strings model specified in the write panel.

Cross Section model Model box

*The cross section model specified in the write panel. The interface will search the string names in this model for the cross sections specified in the XP-SWMM report. A match is successful if the XP-SWMM cross section chainage and the string name are within the tolerance specified below in **Chainage tolerance**.*



Shape string model Model box

For meandering rivers, the cross sections (shown in green above) may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings (shown in red above) can be created to create a water surface (shown in blue above) to follow the river. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach.

Centre line chainage factor Model box

*This data is only required if the **Shape string model** is used. The shape string names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.*

Ground surface tin Tin box

*If a **boundary string model** is specified below, the intersection of this ground surface and the water surface will be determined. The strings will be stored in the model from the **boundary string model** field.*

XP-SWMM report file name File box

The XP-SWMM xpx file created automatically created when closing XP-SWMM or via the XP-SWMM menu selection

File =>Export Data

Result data

Water surface tin model Model box

The model to contain the new water surface tin.

Water surface tin Tin box

The name of the water surface tin to be created.

Water level results model Model box

The model where the water surface strings will be created at each cross section and shape string.

Boundary string model Model box

The model to contain the intersection strings between the water and ground surfaces specified above. If left blank no intersection strings will be calculated.

Parameters

Chord Length Model box

This value set the spacing for the points on the water level strings (both cross section and shape strings). It is recommended that you use a length of no more than half of your average cross section and shape string lengths. A large value in this field may result in unexpected water level profiles for meandering rivers.

Chainage Tolerance Real box

This is the tolerance used when the cross section chainage from the XP-SWMM report is compared with the cross section string names. A value of 0.00001 is excellent if you have not altered the cross section names in 12d or XP-SWMM.

However, if you have altered chainage names then you may have to increase the value of the tolerance. Suppose the tolerance is set to 0.001 and the water level for section 0.056 is read from the XP-SWMM report file. The interface will search for the first string with a name between 0.055 and 0.057. If you chose to great of a tolerance then more than one water level result will match a 12d cross section and a warning message will be given.

If you have one specific cross section that you would like to have a different tolerance set for (maybe only one section is giving you troubles), use the Attribute Editor

(String =>User=>Attribute Editor), select the cross section string and create a real type attribute named tolerance set to the tolerance desired.

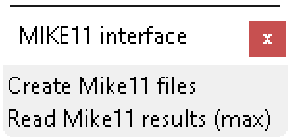
Continue to 19.5 MIKE11 Interface or return to 19.4 XP-SWMM Interface.

19.5 MIKE11 Interface

Position of menu: **Water =>Rivers =>Mike11 interface**

The MIKE 11 interface creates the MIKE 11 project files including *.bnd11, *.hd11, *.nwk11, sim11 and the cross section data text file (to be imported into *.xns11). Water levels are read back into 12d where they may be viewed in a 3D perspective view, on cross sections and on river profiles. Plan drawings easily identify extents of flooding and all data can be plotted onto engineering drawings.

The Mike11 walk right panel is



See also

River and Source Strings

MIKE11 Interface Overview

MIKE 11 Write Panel

MIKE 11 Read Panel

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Exporting to MIKE 11

The MIKE 11 project is created from a surface tin (representing the river bed and overbanks) and a model containing river centre line strings (identified by the name prefix, “centre line”). The low chainage (often zero) of the centre line strings must be at the upstream end of the reaches.

Cross sections are created at the location of the **source strings**. These source strings are initially created using the MIKE 11 option at a user defined spacing and section length, imported from drawing packages or manually created in 12d. The user may alter these sections as desired. They may be shortened if they intersect at sharp bends in the river; they may be extended at extremely wide river sections or extra points may be added so that the section is no longer a straight line.

Source strings can be deleted and additional sections can be added by creating new source strings. The Create source strings tick box on the interface panel must NOT be selected to use the customised strings.

Presenting MIKE 11 Results in 12d Model

After the MIKE 11 analysis is complete the maximum water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the MIKE 11 results. These strings are then triangulated to create a water surface tin.

How the water level boundaries are determined

19.5.1 MIKE 11 Write Panel

Position of option on menu: **Water =>Rivers =>Mike11 interface =>Create Mike11 files**

The MIKE 11 interface creates the MIKE 11 project files including *.bnd11, *.hd11, *.nwk11, *.sim11 and the cross section data text file (to be imported into *.xns11). Water levels are read back into 12d where they may be viewed in a 3D perspective view to easily identify extents of flooding.

See also

River and Source Strings

MIKE 11 Read Panel

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

12d creates most of the files necessary to run MIKE11. The exception to these are the time series files (both water level and discharge data). The simulation file created assumes that these files will have the same name as the centre line strings used in 12d. For example, if you name your centre line string *centre line Major River* then your time series files will be named *Major River-H.DFS0* for the tail water conditions and *Major River-q.dfs0* for your discharges.

The *.bnd11, *.hd11, *.nwk11 and *.sim11 files are created by appending 12d data to default data found in the following files.

cross_sections.4d

hd11-end.4d

hd11-header.4d

nwk11-header.4d

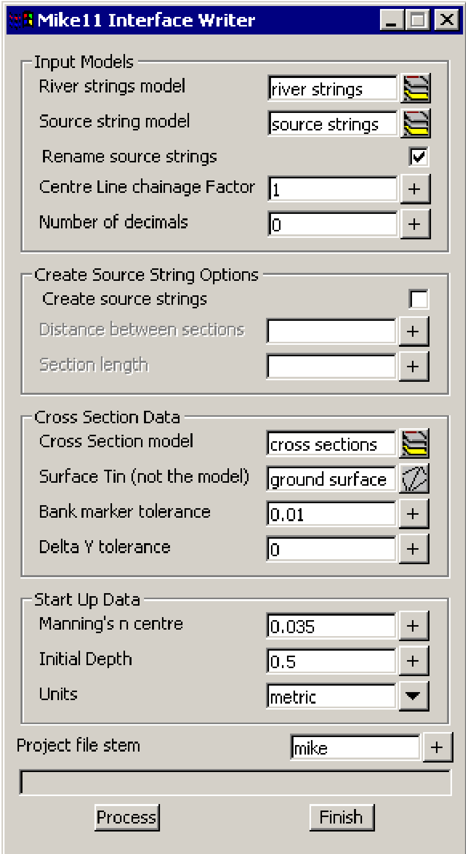
nwk11-options.4d

sim11-header.4d

sim11-period.4d

The user need not modify these files unless they would like to change the default values used when first creating the MIKE11 project. If you plan to modify these files, they are found in the 12d *setups* directory. Before modifying they should be copied to the 12d *user* directory (global defaults) or into the current project directory if they are project specific.

The MIKE 11 panel for creating the MIKE 11 project follows.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
River strings model	Model box		

Model containing the river centre line strings. ***The centre line strings must begin upstream and proceed downstream.*** *The name of the river must follow the words "centre line " (note the ending space). The name of the river may follow the words "Centre line " (note the ending space). For example the centre line string may be named "Centre line Parramatta River, downstream reach". The comma separates the river name from the reach name. If no comma is included then the river name is repeated for the reach name.*

Confluences are modelled by a using a separate string for all reaches. Thus a system with a branch is modelled with three strings. The branch will be one string and the main reach will have a downstream string and an upstream string. The reaches must touch at the confluence.

Source string model	Model box		

New source strings will be created in this model or existing source strings are contained in the model. See ***Create source strings*** *tick box below.*

Create Source Strings	Tick box	not selected	

When selected existing source strings are deleted and new ones created perpendicular to the centre line at the specified spacing and length. Once you have created the sources strings they can be easily modified. On the ***String =>Points edit*** *menu you will find the selections* ***Move*** *(to move the end points),* ***Insert*** *(to insert additional points).*

Distance between sections		Real box	

The distance between the cross sections. At present no check is made for overlapping cross sections around river bends.

Section Length Real box

The length of the cross section with zero chainage at the mid point.

Cross section model Model box

The cross sections created and exported are stored in this model.

Centre Line Chainage Factor Real box

The cross section names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.

Surface Tin (not the model) Tin box

Tin or super tin to create the cross sections from (remember a tin is like a string. It is placed in a model.).

Bank Marker Tolerance Real box

If the surface level drops more than this amount while moving away from the channel centre line then the crest is used as a Bank Marker. A value of zero means that no bank marks are created.

Delta Y tolerance Real box

This value filters out points on the cross section. Imagine a tube of this diameter passing over the cross section. The tube is elongated until one point lies outside the tube. The tube is shortened to the previous point and then all points inside the tube are deleted from the cross section. The tube then moves on to the next point. ***The final water tin is created from the ground tin and therefore the boundary string is located using the unfiltered section.***

Manning's n Real box

Manning's n values for the channel sections.

Initial depth Real box

This depth is added to the minimum elevation on the cross section and is used as the starting water level for the cross section.

Units Choice box

This selection will set the default units for the project being created.

Project file name Input box

The MIKE11 project name. All of the MIKE11 files will begin with this name and the appropriate extensions added.

Continue to 19.5.2 Running MIKE11 or return to 19.5 MIKE11 Interface.

19.5.2 Running MIKE11

Three steps are required to run MIKE11 with the files 12d creates.

1. Create you time series files.
2. Inside MIKE11, create a new cross sections file and import the cross sections.
3. Open the simulation file, and load the network file to have the grid points calculated.

Continue to 19.5.3 Creating Time Series Files or return to 19.5 MIKE11 Interface.

19.5.3 Creating Time Series Files

Your time series files must be named with the prefix of the river string name. For example if your centre line string in 12d was named *centre line Major* River your time series files need to named *Major River-H.DFS0* for the tail water conditions and *Major River-q.dfs0* for your discharges.

The standard time series dates are from 12:00 to 12:30 on 01 January 2000 with a one minute time step. If other periods are desired, you can either change the file *sim11-period.4d* in the 12d library before running the interface or change the dates inside MIKE11 after you read in the data. **DO NOT USE THE ORIGINAL FILES! Copy the file you are changing into the 12d user directory and modify it there. 12d will look for the file here first.**

Continue to 19.5.4 Importing Cross Sections or return to 19.5 MIKE11 Interface.

19.5.4 Importing Cross Sections

From the MIKE11 main menu select **File->new** and then under Mike11 select **cross sections** from the dialogue box.

From the main menu select **File->Import->Import Raw data & Recompute**. Select the *.txt file with the **Project file stem** you specified in the 12d-Mike11 Write Panel. Now save this file with the same **Project file stem** (MIKE11 adds the .xns11 extension).

Continue to 19.5.5 Calculating Grid Points or return to 19.5 MIKE11 Interface.

19.5.5 Calculating Grid Points

From the main menu select **File->Open** and select the *.sim11 file with the **Project file stem** you have specified in 12d. On the **Input** tab property sheet select **Edit** beside the **Network** file. Press **Ctrl+T** to take you into the table editing mode and then select the **Grid Points** tab property sheet. On the sheet select **Generate Grid Points** and then save the file.

You should now get the “Green lights” on the **Start** property sheet of the simulation file editor.

Continue to 19.5.6 MIKE 11 Read Panel or return to 19.5 MIKE11 Interface.

19.5.6 MIKE 11 Read Panel

Position of option on menu: Water =>Rivers =>Mike11 interface =>Read Mike11 results (max)
After the MIKE 11 analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the MIKE 11 results (maximum water level).

Water levels are interpolated to create water level strings at the shape string locations. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach. These strings are then triangulated to create a water surface tin.

The MIKE11 executable file, *res11read.exe* must be found in the directory *c:/mikezero/bin* so that 12d can read the Mike11 binary data files.

See also

MIKE11 Interface Overview

Presenting Water Level Results

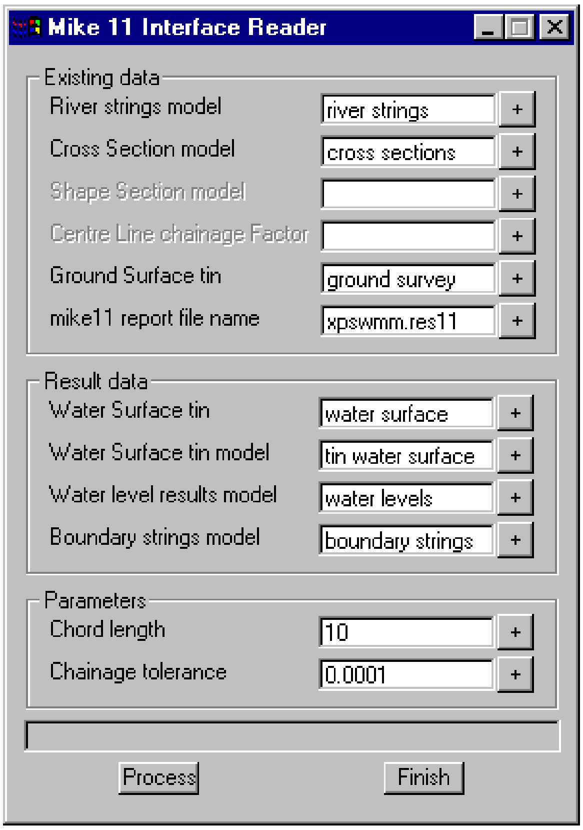
MIKE 11 Write Panel

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The MIKE 11 read panel follows.



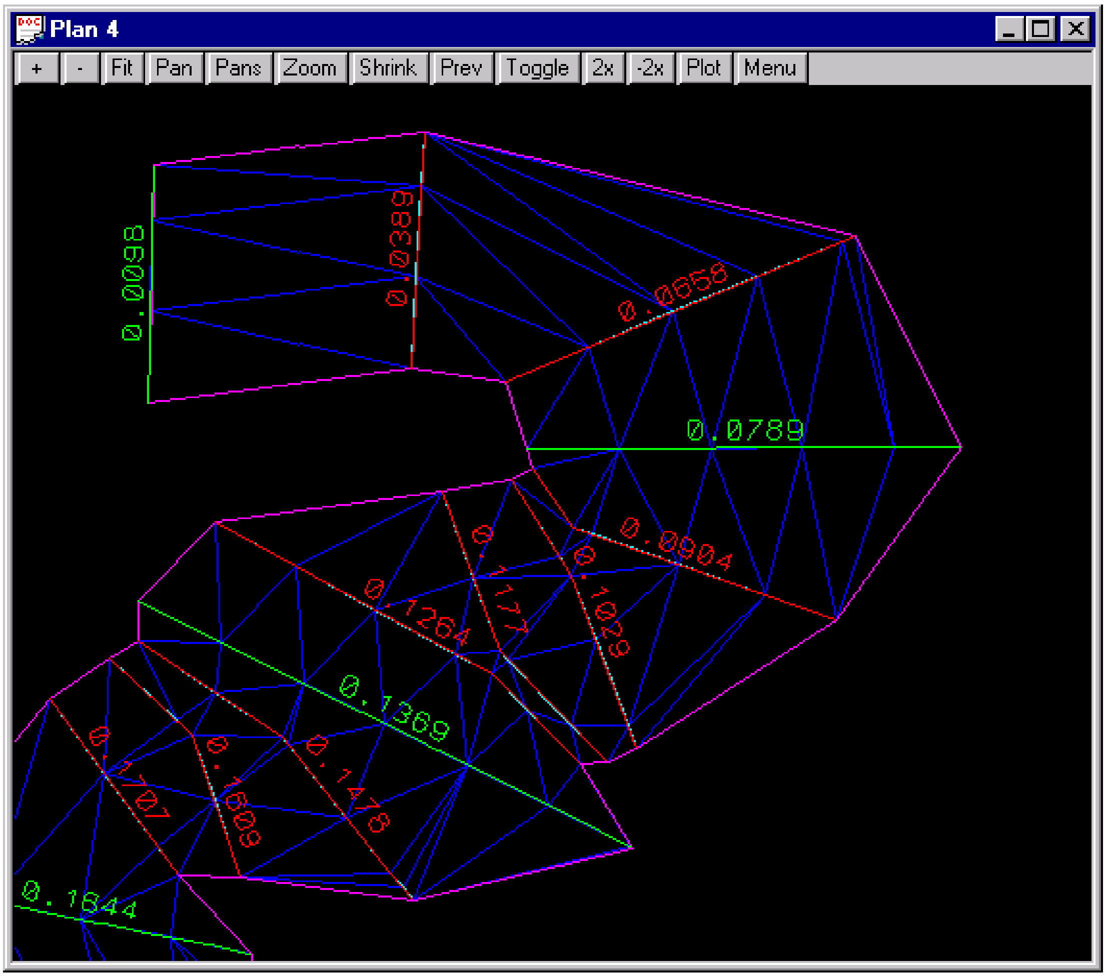
The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
River strings model	Model box		

The river strings model specified in the write panel.

Cross Section model Model box

The cross section model specified in the write panel. The interface will search the string names in this model for the cross sections specified in the MIKE 11 report. A match is successful if the MIKE 11 cross section chainage and the string name are within the tolerance specified below in ***Chainage tolerance****.*



Shape string model Model box

For meandering rivers, the cross sections (shown in green above) may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings (shown in red above) can be created to create a water surface (shown in blue above) to follow the river. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach.

Centre line chainage factor Model box

This data is only required if the ***Shape string model*** *is used. The shape string names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.*

Ground surface tin Tin box

If a ***boundary string model*** *is specified below, the intersection of this ground surface and the water surface will be determined. The strings will be stored in the model from the* ***boundary string model*** *field. Super tins cannot be used for this function. A composite tin is required for the tin-tin intersect.*

MIKE 11 report file name Input box

This is the binary data file that will converted to an ASCII text file and read by 12d. The maximum water levels at each cross section will be extracted from the file.

Water surface tin Tin box

The name of the water surface tin to be created.

Water surface tin model Model box

The model to contain the new water surface tin.

Water level results model Model box

The model where the water surface strings will be created at each cross section and shape string.

Boundary string model Model box

The model to contain the intersection strings between the water and ground surfaces specified above. If left blank no intersection strings will be calculated.

Chord Length Model box

This value set the spacing for the points on the water level strings (both cross section and shape strings). It is recommended that you use a length of no more than half of your average cross section and shape string lengths. A large value in this field may result in unexpected water level profiles for meandering rivers.

Centre Line Chainage Factor Real box

The cross section names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.

Chainage Tolerance Real box

*This is the tolerance used when the cross section chainage from the MIKE 11 results file is compared with the cross section string names. If a **Centre line chainage factor** of 1 is used a value of 0.1 is appropriate. If a **Centre line chainage factor** of 1000 or 5280 is used a **Chainage** tolerance of 0.00001 is more appropriate.*

However, if you have altered chainage names then you may have to increase the value of the tolerance. Suppose the tolerance is set to 0.001 and the water level for section 0.056 is read from the MIKE 11 report file. The interface will search for the first string with a name between 0.055 and 0.057. If you chose to great of a tolerance then more than one water level result will match a 12d cross section and a warning message will be given.

If you have one specific cross section that you would like to have a different tolerance set for (maybe only one section is giving you troubles), use the Attribute Editor (String =>User =>Attribute editor), select the cross section string and create a real type attribute named tolerance set to the tolerance desired.

Continue to 19.6 Presenting River Water Level Results or return to 19.5 MIKE11 Interface.

19.6 Presenting River Water Level Results

Topics

See also

River and Source Strings

XP-SWMM Interface

HEC-RAS Interface

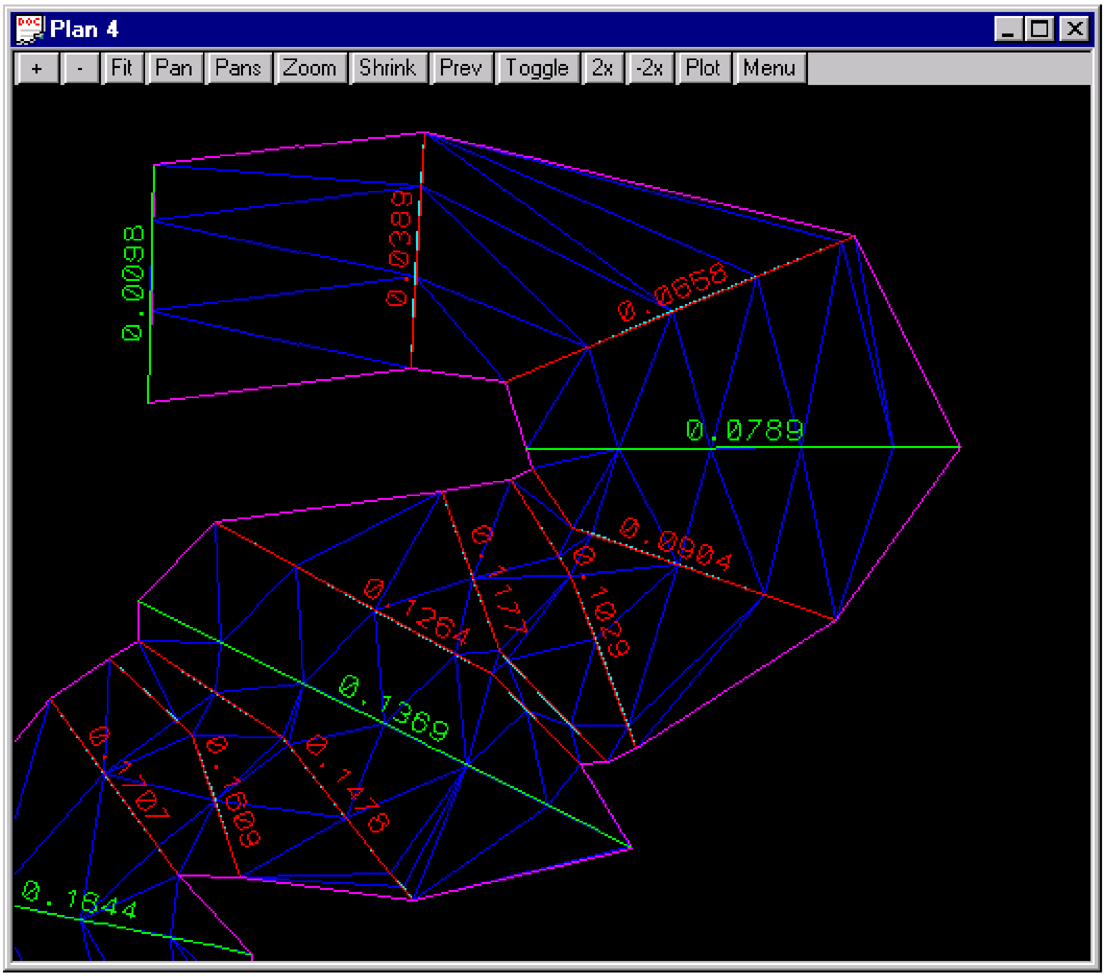
MIKE11 Interface

ISIS Interface

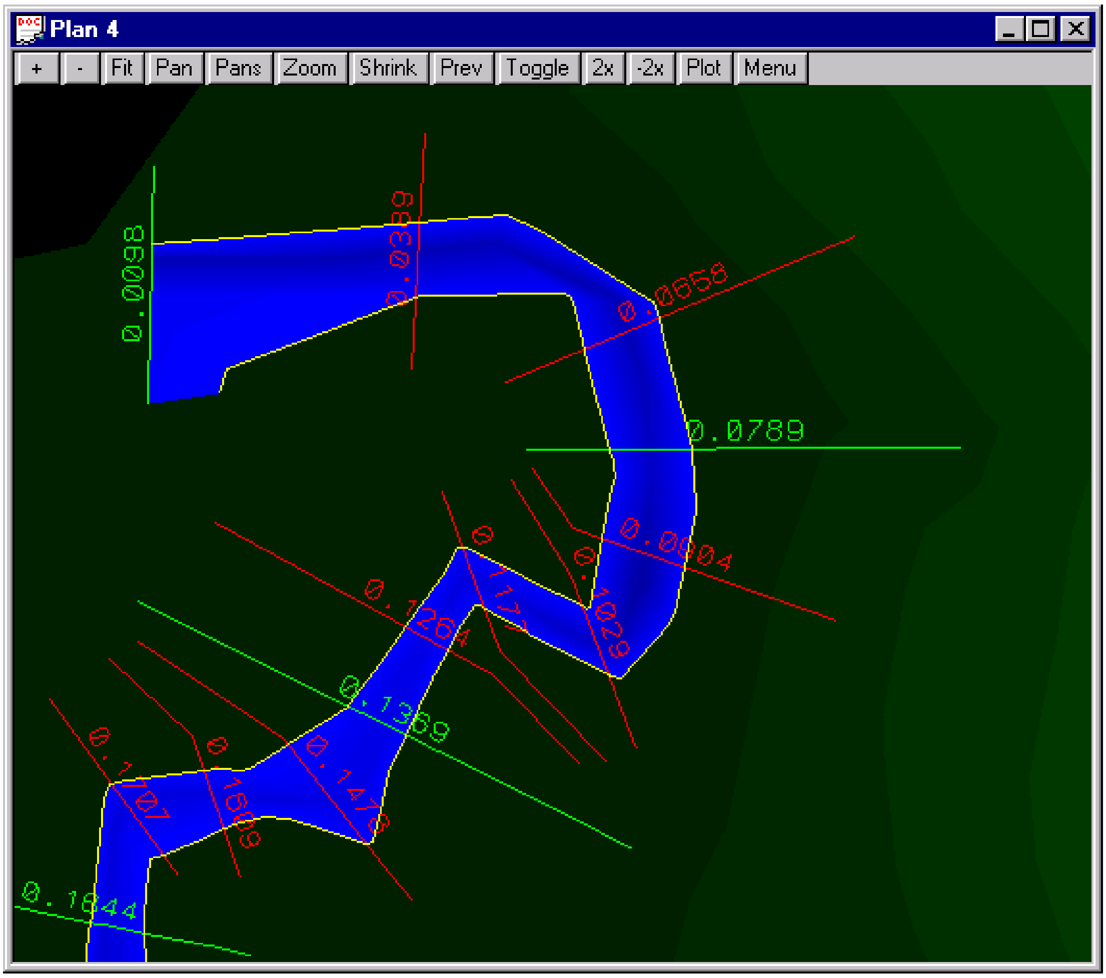
How to for Rivers

Frequently Asked Questions (Rivers)

19.6.1 How the water level boundaries are determined



For meandering rivers, the cross sections (shown in green above) may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings (shown in red above). Note that water levels are extended when the shape strings are in a junction area or past the end of a reach. can be created to create a water surface (shown in blue above) to follow the river.

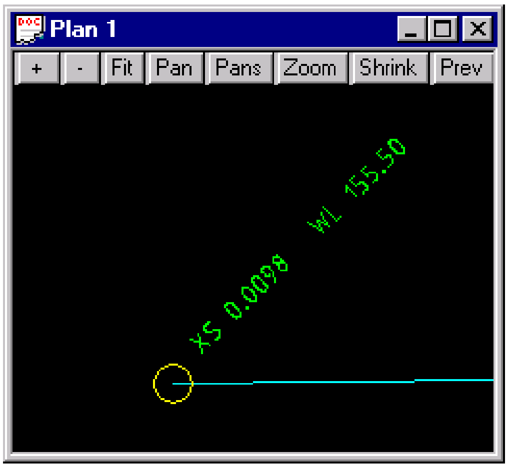


The water surface is draped over the ground surface and the boundary strings (strings defining the edges of the water surface – shown in yellow above) are created. They may be used to trim the water surface or shade your ground surface tin for flood inundation mapping. Boundary strings also include islands! Shading the river bed blue, in a 3D perspective view, is an effective way to show the water level extents and still view the shape of the river bottom (it has the effect of very clean water that you can see through!).

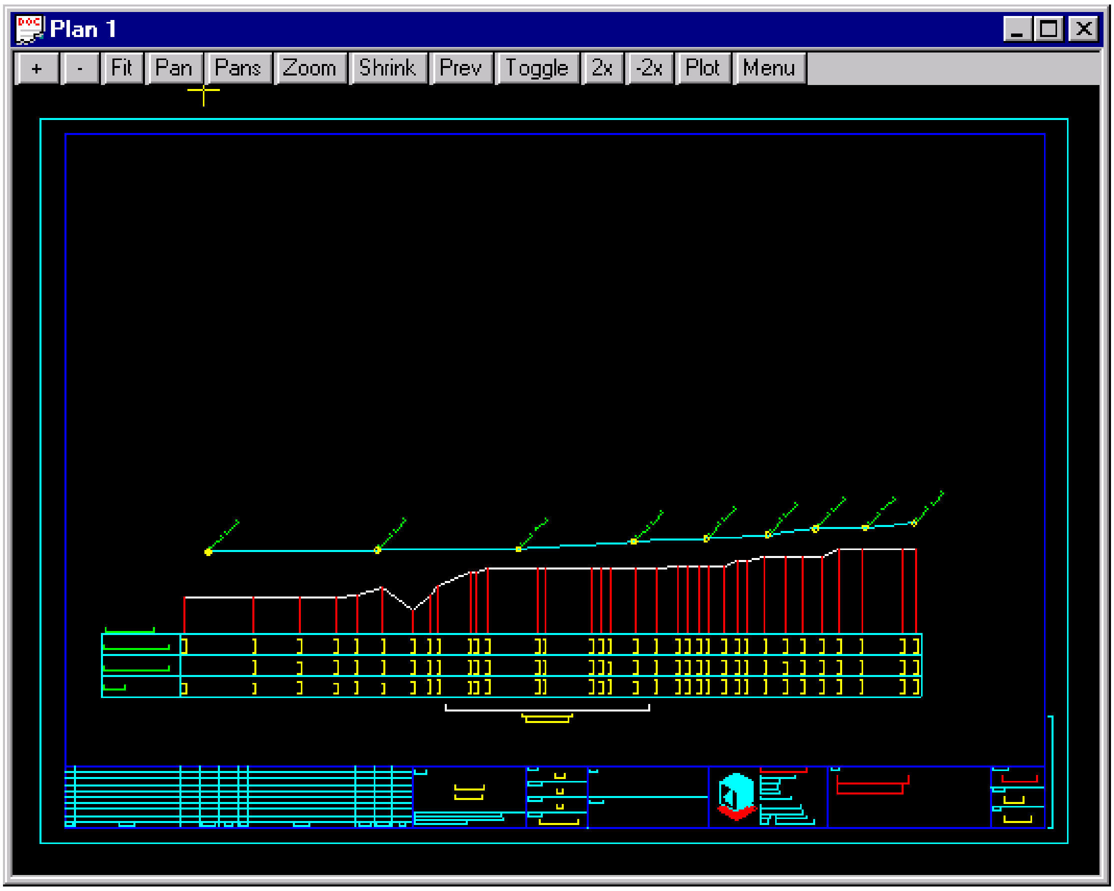
19.6.2 Sample Presentations and Drawings

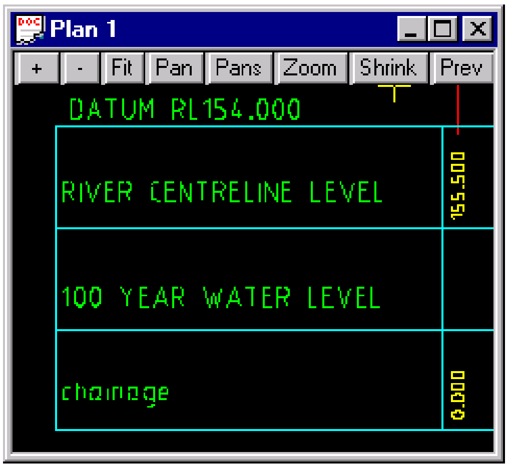
The water surface may be

- s •contoured (elevation),
- s • depth contours created,
- s • water surface coloured by depth (shown above),
- s • cross sections plotted
- s • and longitudinal profiles drawn (shown below).
- s •All of these results can be plotted complete with your customised drawing sheets.
- s •Finally, you may walk down the water course in the perspective view (and record this to an Windows AVI file).

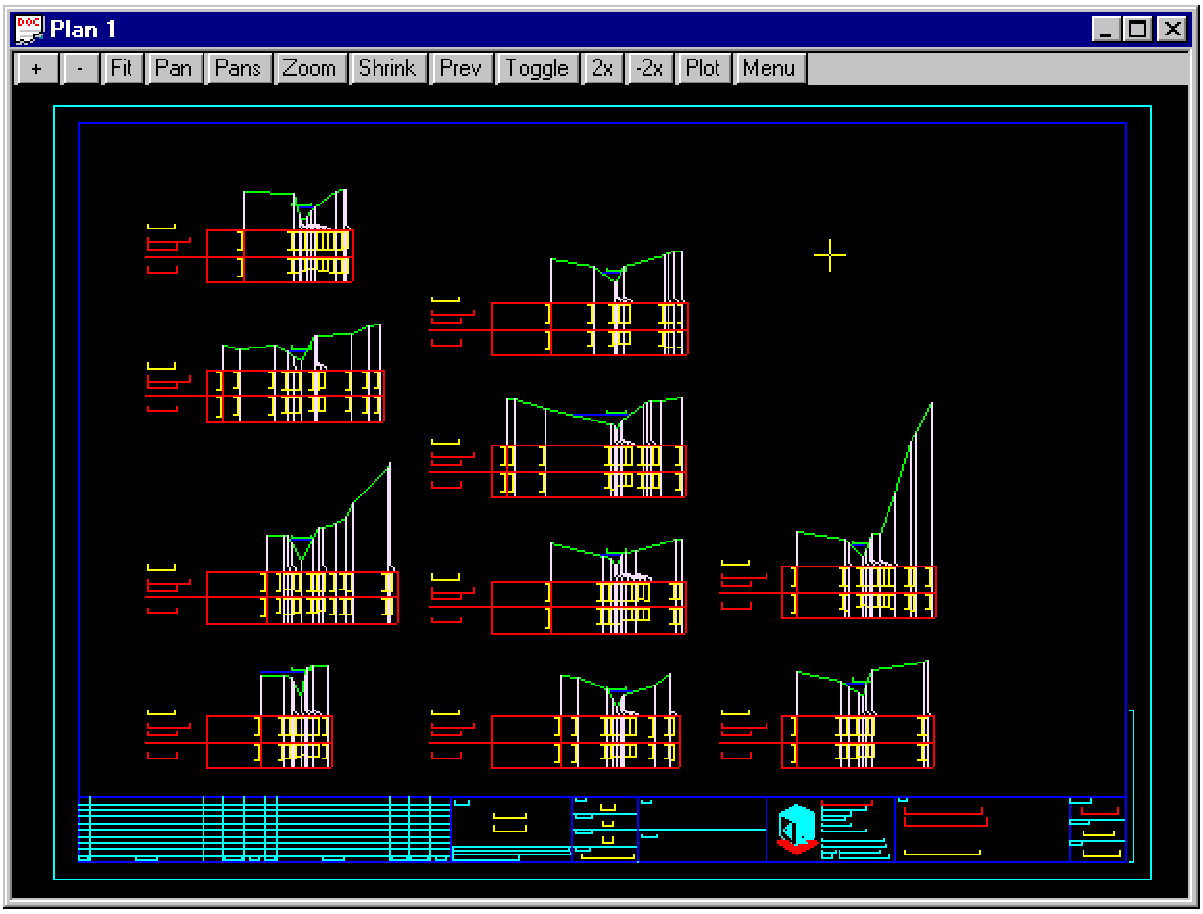


Close up view of cross section labels with water levels

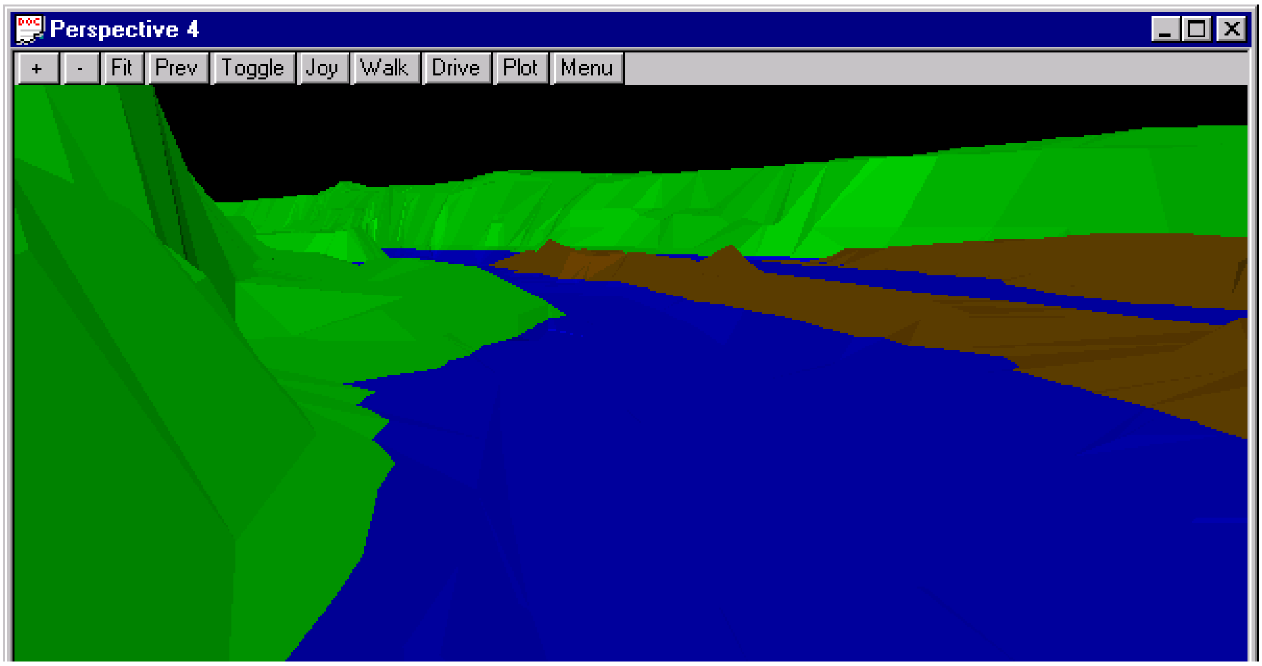

Plan 1
+
-
Fit
Pan
Pans
Zoom
Shrink
Prev
Toggle
2x
-2x
Plot
Menu


Plan 1
+
-
Fit
Pan
Pans
Zoom
Shrink
Prev
DATUM RL154.000
RIVER CENTRELINE LEVEL
155.500
100 YEAR WATER LEVEL
chainage
0.000

Close up of text (user chooses wording, size, colour, text style *etc.*)



The tin created can be viewed in a perspective view and sections taken where desired. A sample perspective view follows.



Example of cross sections long sections and depth colouring see the HEC-RAS Interface topic.

19.6.3 Defining the Water Surface Boundaries

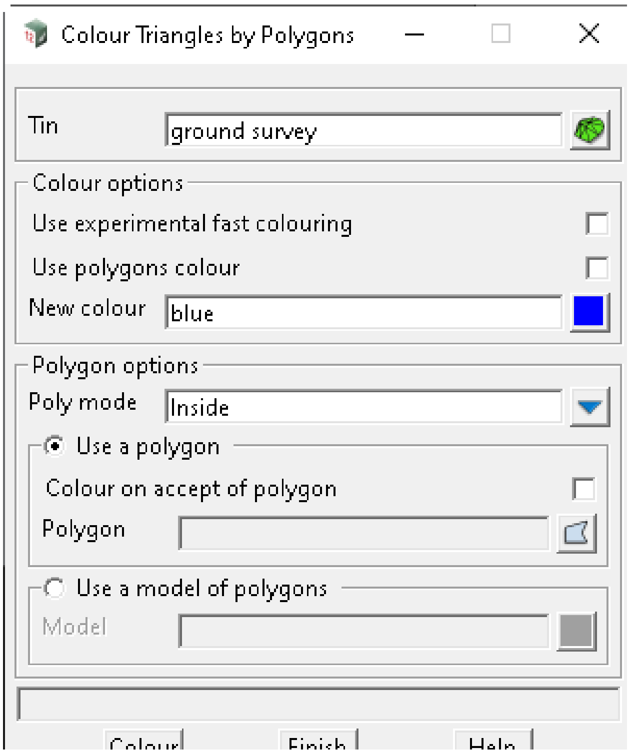
The water surface and its boundary is created by 12d. The first step is to trim the water surface back to the boundary strings. Since the water boundary does not generally form a closed polygon (the left and right river boundaries will need to be joined at one end of the river) use the **String =>Strings Edit =>Join** to connected strings.

If the water surface reached the edges of you cross sections then there will be numerous breaks in the boundary string. The best solution is to extend the cross sections and/or add additional shape strings. If it is not a major error in modelling then the break in the boundary can be joined using the **String =>Strings Edit =>Join.**

If boundary strings are created outside that water level boundaries they should not be used in this area. Boundary strings should only be used inside the area defined by your water level results.

19.6.4 Trimming the Water Surface Tin and Islands

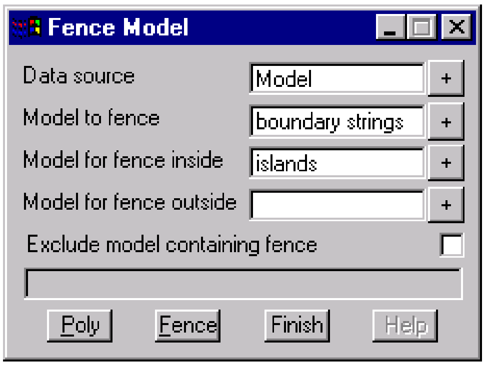
Use the **Tin =>Null =>by polygons** selection to null triangles inside the polygon you have created above.



Select your water surface tin and change the **Poly mode** to **Outside**. Now select the **Poly** button and pick the boundary string. The triangles outside the polygon will now be nulled.

If you have some islands in the model then change the **Poly mode** to **Inside** and select the islands.

If you have numerous islands, say more than 10 it may be easier to copy all of the islands into one model using the fence command (Utilities =>Fence =>Fence).

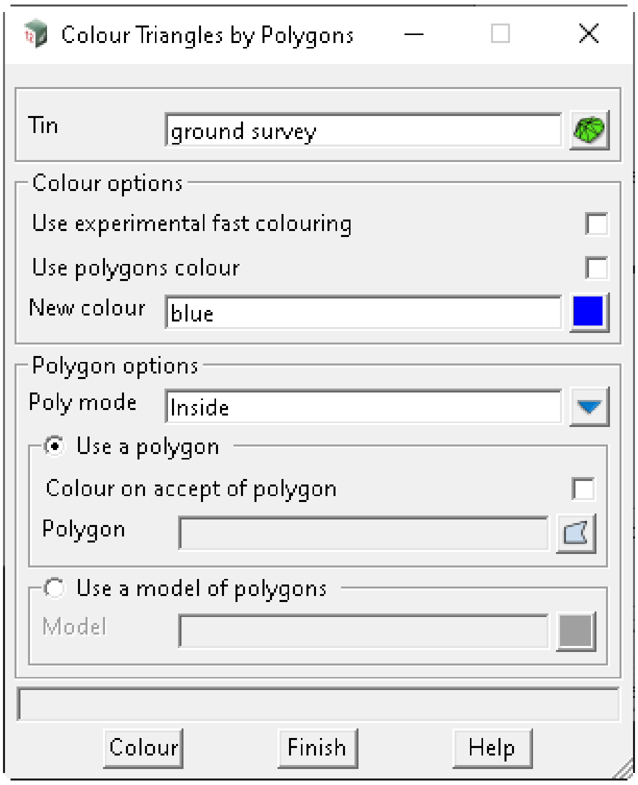


The **Model to fence** is the boundary strings model and the **Model for fence inside** is the new model to contain the islands. The **Exclude model containing fence** should not be ticked. Select **Poly** and then pick the boundary string. All of the islands inside the boundary string will not be copied to the islands model.

19.6.5 Colouring the Ground Surface with Flood Zones

The boundary strings can also be used to colour the ground surface. Colouring the river bed blue is an effective way to show the water level extents and still view the shape of the river bottom (the effect of very clean water that you can see through!).

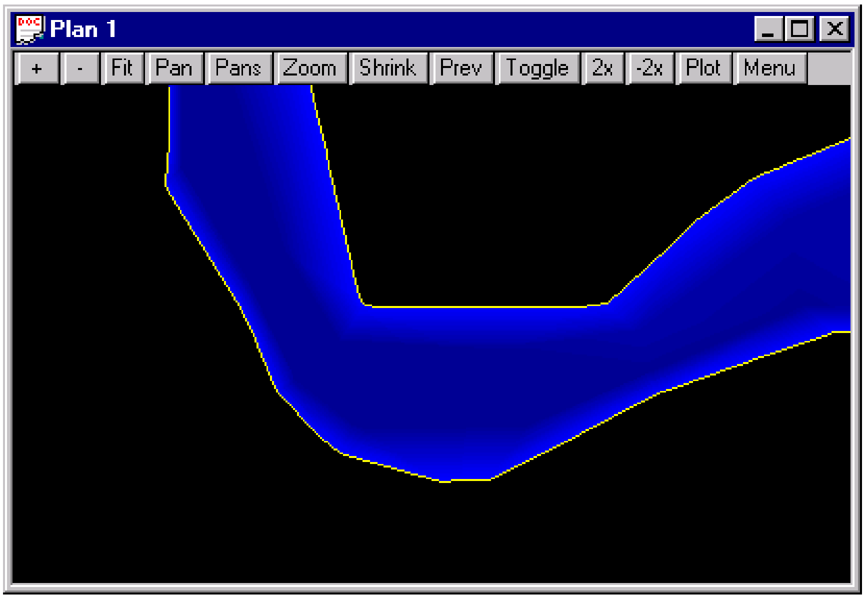
First, define the water surface boundaries (see above). Next re-triangulate the ground tin so that it includes the boundary string model (**Tin =>Edit =>Tin**). Next select **Tin =>Colour =>Colour within polygon**. The following panel will appear.



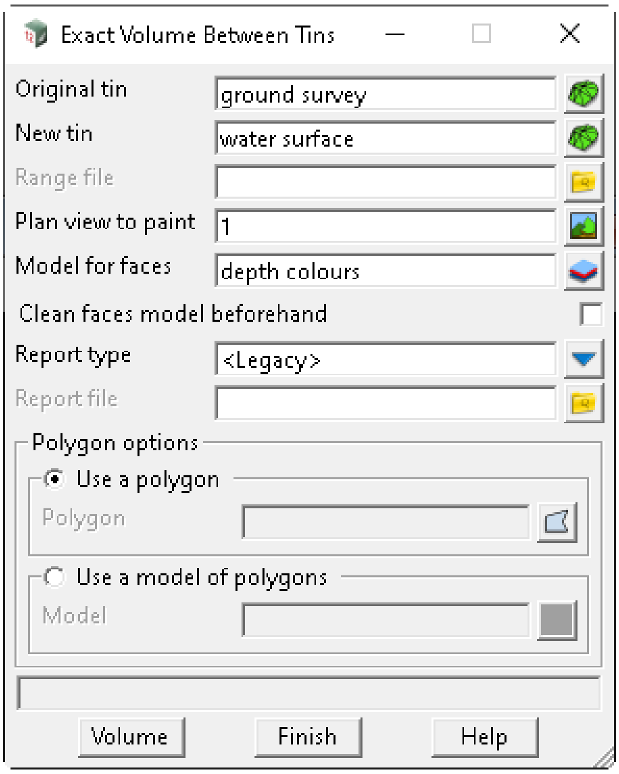
Select your ground tin and the desired colour. Next select the **Poly** button and pick the boundary string to be coloured inside. If islands exist change, change the colour (to a ground colour) and then select the island string.

19.6.6 Colour by Depth

The water surface can be coloured by depth. This function calculates the depth between the water surface and the ground surface and creates “faces” of different colours. The colours to be used are specified in a depth range file. This option requires the purchase of the Volumes Option.



From the main menu select Volumes =>Exact =>Tin to tin.



Original tin real box

This is your ground survey tin.

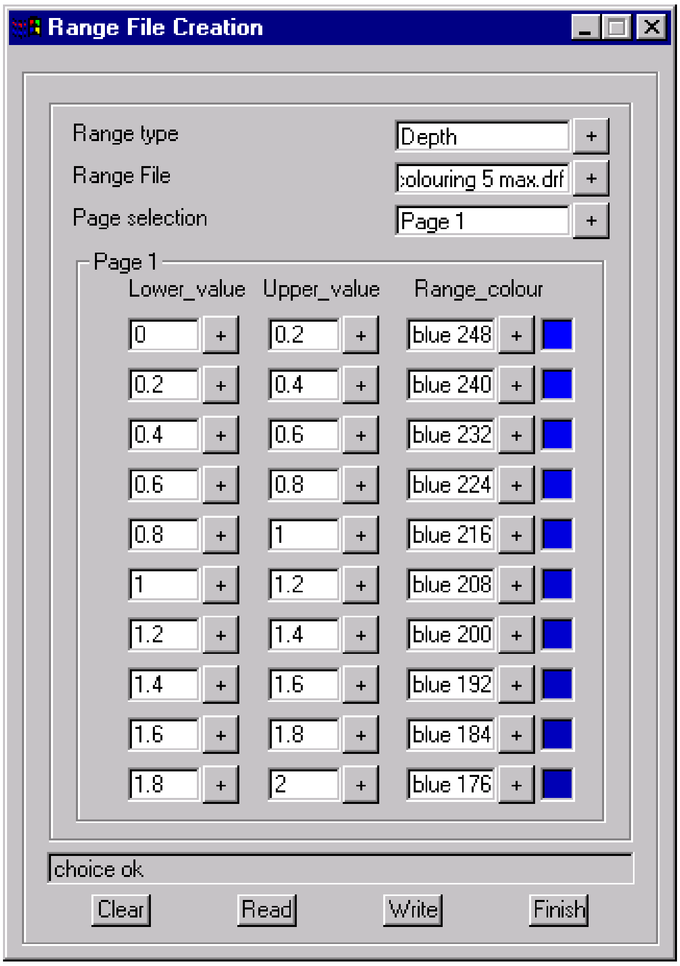
New tin real box

This is your water surface tin.

Range file real box

Two range files are supplied. One with a range from 0 to 5 and another from 0 to 50. The library contains a spreadsheet the can quickly create other range files or you may edit the using the built in range editor.

To use the built in range file editor select + beside you range file then edit.



*You may change the range value and the colours as desired. Be sure to select **Write** to save the changes before selecting **Finish.***

See also Range File Creation.

Plan View to paint real box

You can paint a current view without saving the face data. This is a good option if you wish to take a quick look at the depth colours in one area.

Model for faces real box

*The faces can be stored in a model. Note that faces consume a great deal of hard disk space. Therefore you may consider colouring one area at a time using the **Poly** option.*

Poly real box

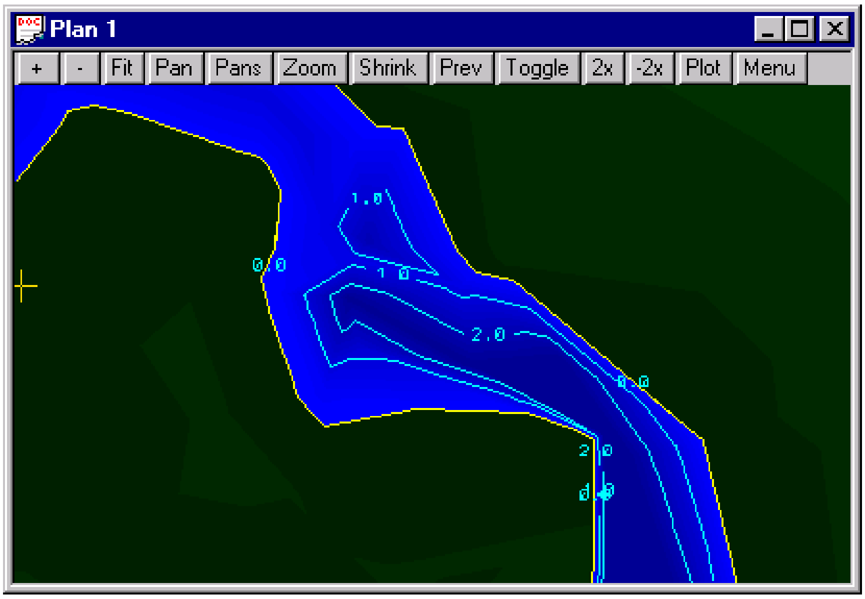
*If your water surface tin is very large than you may want to only colour a portion of the tin. You must create a polygon (String =>Create =>2d) and then pick this polygon. When your select **Volume** only the area inside the polygon will be coloured.*

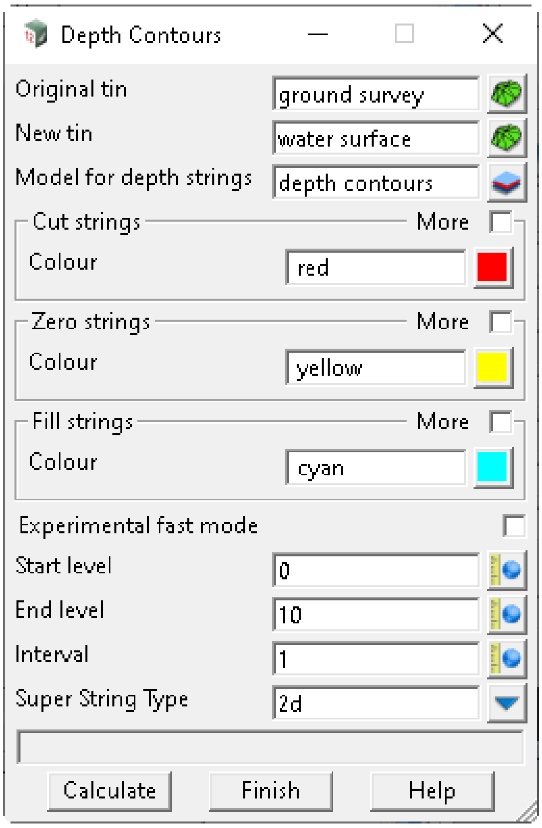
Volume real box

Select this button to colour the surface.

19.6.7 Depth Contours

Once you have the tin coloured by depth you might want to add depth contours. From the main menu select **Tin =>Contour =>Depth Contours**. This option requires the purchase of the tin Analysis module.





Original tin real box

This is your ground survey tin.

New tin real box

This is your water surface tin.

Model for depth strings real box

This is the model for your depth contours.

Colour for zero strings real box

The zero string will be the same as our boundary strings.

Colour for fill strings real box

This is the colour for the depth contours.

Start level real box

Enter a zero for this value.

End level real box

Enter a level grater than the greatest depth.

Interval real box

Enter the contour interval as desired.

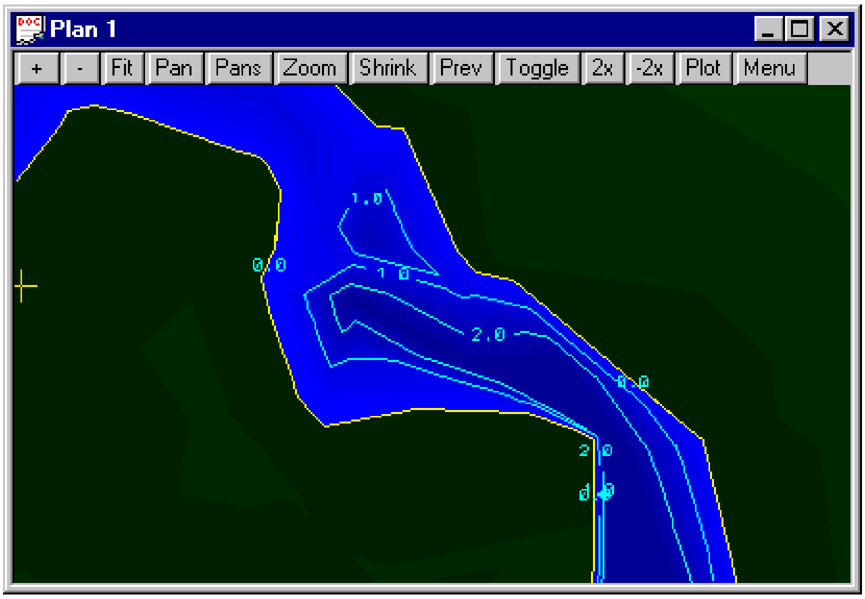
2d/3d strings real box

2d strings.

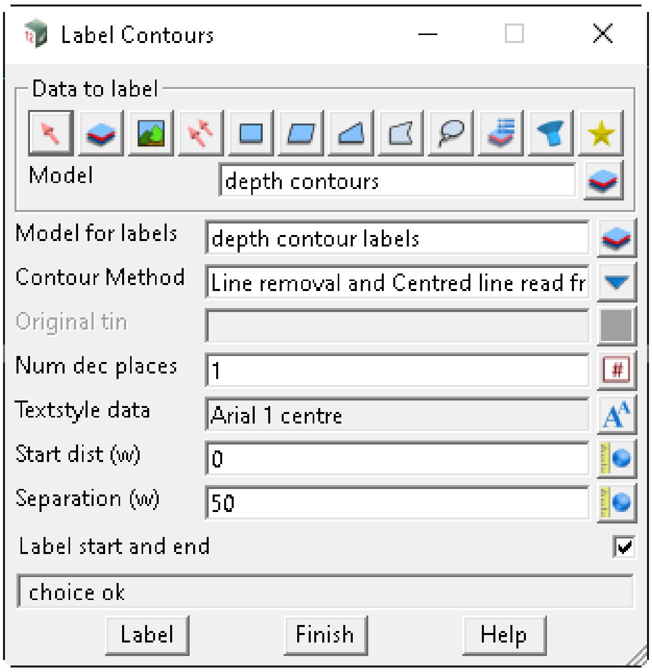
Calculate real box

This will create your contour strings.

Adding Values to the Contours



Since there are numerous ways to label the contours it is performed as a separate step. From the main menu select **Tin =>Label =>Contours.**



Contour method real box

The example above uses Line removal and Centred line read from below. This copies the contour lines themselves and inserts a break in the line.

Start distance real box

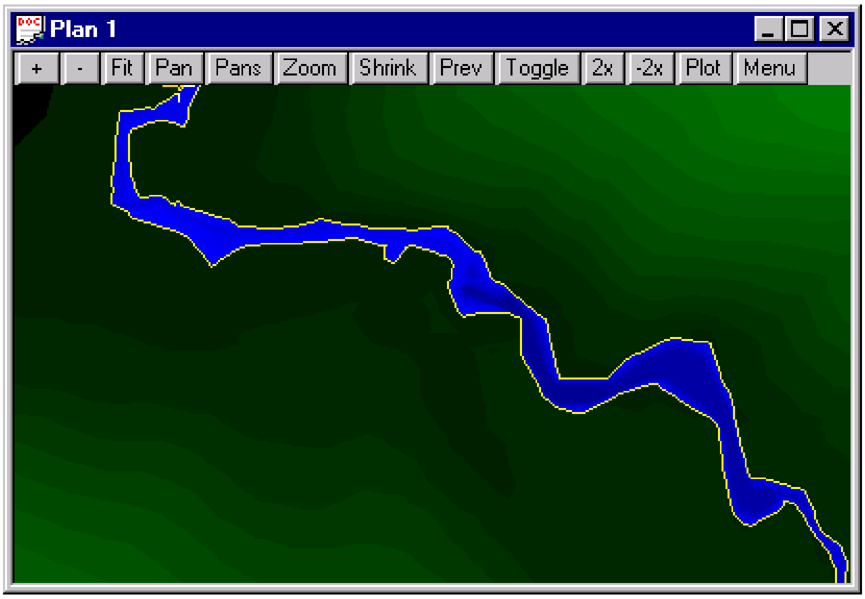
This is usually left as zero. It changes the start point for the first label on each contour.

Separation real box

This determines the spacing of the contour labels.

19.6.8 Colour the ground surface by elevation

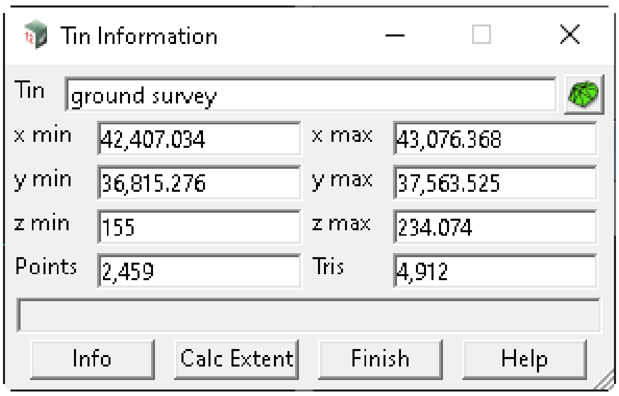
With the water surface coloured by depth, you may want to colour the ground surface by elevation.



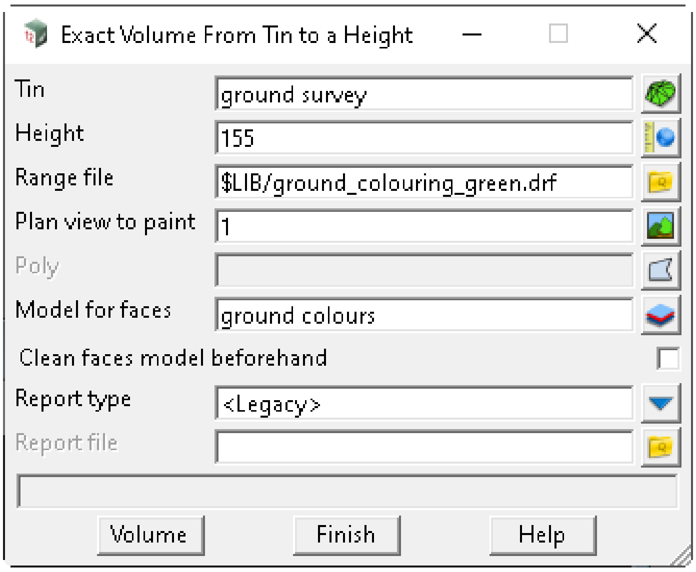
This colouring may be done from either From the main menu select **Volumes =>Exact =>Tin to height** or **Tin =>Colour =>Tin height colour.**

Volumes =>Exact =>Tin to height

Volumes =>Exact =>Tin to height requires the purchase of the Volumes module. First select **Tin =>Tin info** from the main menu and then select you ground surface tin. You will want to copy the minimum z level from this pane.



Now from the main menu select **Volumes =>Exact =>Tin to height**



Select your ground surface to colour and enter the minimum elevation (from above) into the **Height** field. The **Range file** "*$LIB/ground_colouring_green.drf*" is found in the library.

Plan view to paint real box

You can paint a current view without saving the face data. This is rarely used in this case.

Model for faces real box

*The faces can be stored in a model. Note that faces consume a great deal of hard disk space. Therefore you may consider colouring one area at a time using the **Poly** option.*

Poly real box

*If your ground surface tin is very large than you may want to only colour a portion of the tin. You must create a polygon (String =>Create =>2d) and then pick this polygon. When your select **Volume** only the area inside the polygon will be coloured.*

Volume real box

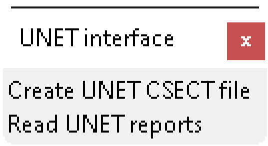
Select this button to colour the surface.

19.7 UNET Interface

Position of menu: **Water =>Rivers =>UNET interface**

The UNET interface creates the *.cs file. Water levels are read back into 12d where they may be viewed in a 3D perspective view to easily identify extents of flooding.

The UNET walk right menu is



See
19.7.1 UNET Write Panel
19.7.2 UNET Read Panel

See also

River and Source Strings

Reservoir Strings

Create UNET files

Read UNET results

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

19.7.1 UNET Write Panel

Position of option on menu: **Water =>Rivers =>UNET interface =>Create UNET CSECT file**

The UNET interface creates the UNET *.cs file. Water levels are read back into 12d where they may be viewed in a three dimension perspective view to easily identify extents of flooding.

See also

River and Source Strings

UNET Interface Overview

Read UNET results

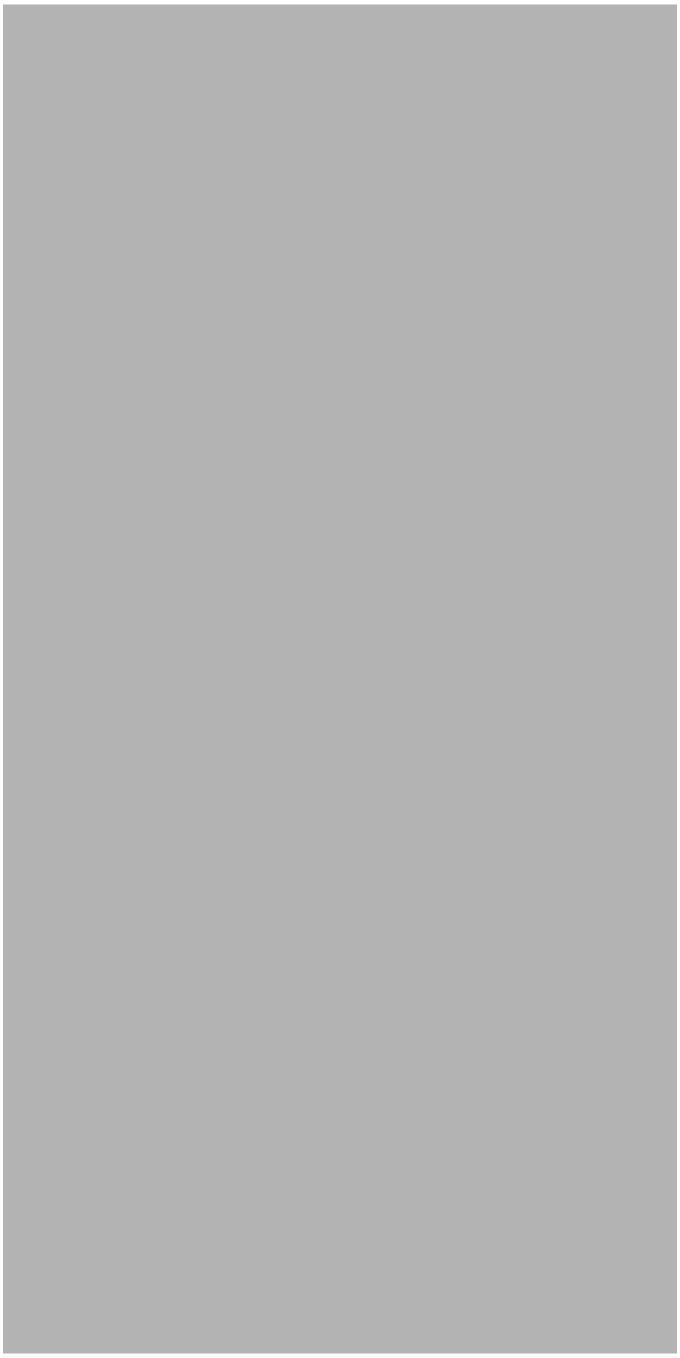
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The UNET panel for creating the UNET project follows.



Continue to 19.7.2 UNET Read Panel or return to 19.7 UNET Interface.

19.7.2 UNET Read Panel

Position of option on menu: **Design =>Rivers =>UNET interface =>Read UNET reports**

After the UNET analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the UNET results. These strings are then triangulated to create a water surface tin.

See also

UNET Interface Overview

Create UNET files

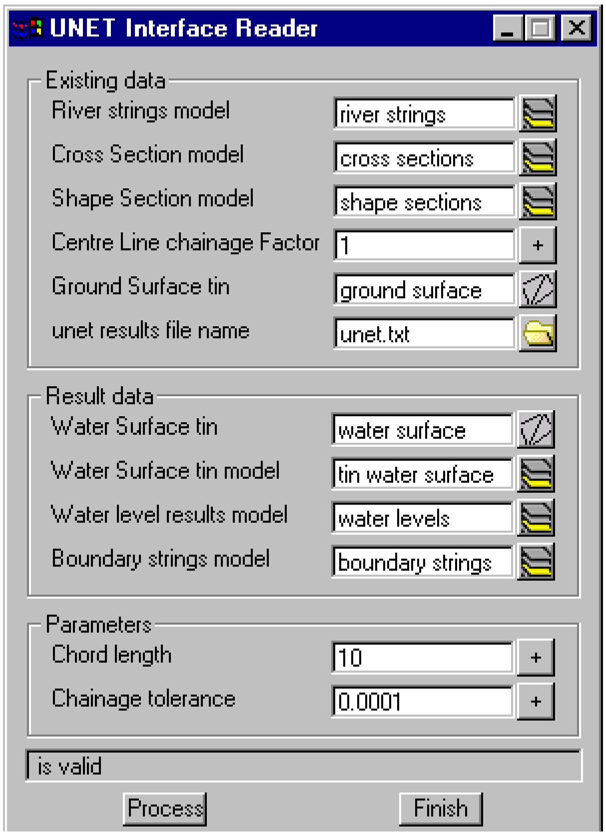
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The UNET read panel follows.



The UNET file format consists of a line number, section name and elevation separated by at least 1 space. An example follows:

1	0.25	118.24
2	0.50	118.25
3	0.75	118.30
4	1.00	118.40

Continue to 19.8 ISIS Interface or return to 19.7 UNET Interface.

19.8 ISIS Interface

Position of menu: **Water =>Rivers =>ISIS interface**

The ISIS interface creates *.dat input file. Water levels are read back into 12d where they may be viewed in a 3D perspective view to easily identify extents of flooding.

The ISIS walk right menu is:

See
19.8.1 ISIS Write Panel
19.8.2 ISIS Read Panel

See also

River and Source Strings

Reservoir Strings

Spill strings

Create ISIS files

Read ISIS results

Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Exporting to ISIS

The ISIS project is created from a surface tin (representing the river bed and overbanks) and a model containing river strings identified by their names “left bank”, “right bank and the name prefix, “centre line”. Any additional strings in the specified model will be ignored (warning messages will be given when you run the macro that any additional strings are being ignored). The low chainage (often zero) of the centre line strings must be at the upstream end of the reaches.

Cross sections are created at the location of the source strings. These source strings are initially created using the ISIS option at a user defined spacing and section length. The user may alter these sections as desired. These may be shortened if they intersect at sharp bends in the river; they may be extended at extremely wide river sections or extra points may be added so that the section is no longer a straight line.

Source strings can be deleted and additional sections can be added by creating new source strings. The **Create source strings** tick box on the interface panel must **NOT** be selected to use the customised strings.

Reservoir Strings are 2d strings that define the extents of the reservoir. The volume is calculated in increments of 1 or the value set in the attribute stage increment for this string. The volumes start from a level with zero volume to the level set for the 2d reservoir string.

The **reservoir strings** may define inline reservoirs or offside storage. Inline reservoirs are "touched" by centre line strings both upstream and downstream. Offline storage areas are linked to the cross sections via **spill strings.**

Spill strings are 2d strings that link offline storage areas to a cross section. The string must begin by "touching" the source string and then proceed to the first point on the spill section. During the export the first point will NOT be exported as part of the spill section. After defining the end of the spill section the last point on the string must "touch" the reservoir string. Again this last point will NOT be exported as part of the spill section.

Presenting ISIS Results in 12d

After the ISIS analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the ISIS *.zzr file. These strings are then triangulated to create a water surface tin from which the water level boundaries are determined. These results can then be shown in plan, long section, cross section and in 3D perspectives.

More details

19.8.1 ISIS Write Panel

Position of option on menu: **Water =>Rivers =>ISIS interface =>Create ISIS file**

The ISIS interface creates the ISIS project files ready to open and run. This includes the project, plan, flow and geometry files. Water levels are read back into 12d where they may be viewed in a three dimension perspective view to easily identify extents of flooding.

See also

River and Source Strings

ISIS Interface overview

Read ISIS results

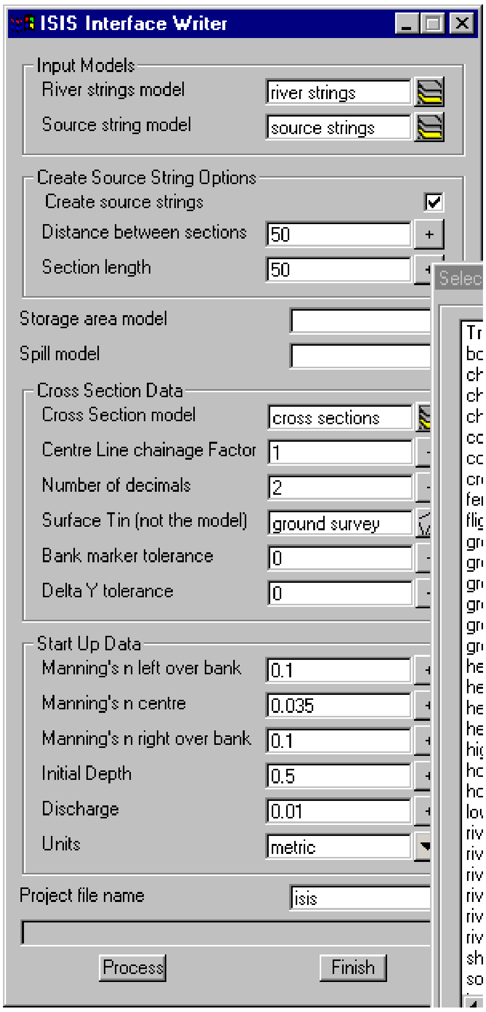
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The ISIS panel for creating the ISIS project follows.



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up

River strings model Model box

Model containing the centre line, left bank and right bank strings. ***The centre line strings must begin downstream and proceed upstream.*** *The name of the river may follow the words "Centre line " (note the ending space). For example the centre line string may be named "Centre line Parramatta River, downstream reach". The comma separates the river name from the reach name. If no comma is included then the river name is repeated for the reach name.*

Confluences are modelled by a using a separate string for all reaches. Thus a system with a branch is modelled with three strings. The branch will be one string and the main reach will have a downstream string and an upstream string. The reaches must touch at the confluence.

The distance from the start of the upstream strings to the first cross section is used to model the confluence length.

The left and right bank strings need not be separate strings (see figure below).

Source string model Model box

New source strings will be created in this model or existing source strings are contained in the model. See ***Create source strings*** *tick box below.*

Create Source Strings Tick box not selected

When selected existing source strings are deleted and new ones created perpendicular to the centre line at the specified spacing and length. Once you have created the sources strings they can be easily modified. On the ***Strings->Points Edit*** *menu you will find the selections* ***Move*** *(to move the end points),* ***Insert*** *(to insert additional points).*

Distance between sections Real box

The distance between the cross sections. At present no check is made for overlapping cross sections around river bends.

Section Length Real box

The length of the cross section with zero chainage at the mid point.

Storage strings Real box

These 2d strings define the extents of the storage area. For more details see Reservoir strings.

Spill strings Real box

These 2d strings define the location to cut the spill section and start end points define the cross section and reservoir, respectively. For more details see Spill strings

Cross section model Model box

The cross sections created and exported are stored in this model.

Centre Line Chainage Factor Real box

The cross section names are created by dividing the chainage on the centre line by this factor. Typically 1000 is used to convert metres to kilometres and 5280 to convert feet to miles.

Number of decimals Integer box

The cross section names are created with this many decimals. CAUTION XP SWMM only allows 10 characters for the names and each link name begins with ***"Lx-"*** *That leaves 7 characters for the chainages.*

Surface Tin (not the model) Tin box

Tin or super tin to create the cross sections from (remember a tin is like a string. It is placed in a model.).

Bank Marker Real box

Not currently implemented in ISIS

Delta Y tolerance Real box

This value filters out points on the cross section. Imagine a tube of this diameter passing over the cross section. The tube is elongated until one point lies outside the tube. The tube is shortened to the previous point and then all points inside the tube are deleted from the cross section. The tube then moves on to the next point. The filtered (smoothed) and original sections are kept for comparison. ***The final water tin is created from the ground tin and therefore the boundary string is located using the unfiltered section.***

Manning's n Real box

Manning's n values for the left, right and centre channel sections.

Initial depth Real box

Not currently implemented in ISIS.

Discharge Real box

This discharge is used at the upstream end of all reaches. If you have multiple river branches, you can set the flow for each branch inside ISIS or inside 12d. This can be changed at each section See manual settings

Units Choice box

This selection will set the default units for the project being created.

Project file name Input box

The ISIS project name. The extension ".dat" will automatically be added for you.

Continue to 19.8.2 ISIS Read Panel or return to 19.8 ISIS Interface.

19.8.2 ISIS Read Panel

Position of option on menu: **Water =>Rivers =>ISIS interface =>Read ISIS results**

After the ISIS analysis is complete the water level results are read back into 12d. Water level strings are created with the plan shape of the cross sections at the elevation retrieved from the ISIS results. These strings are then triangulated to create a water surface tin.

See also

ISIS Interface overview

Create ISIS files

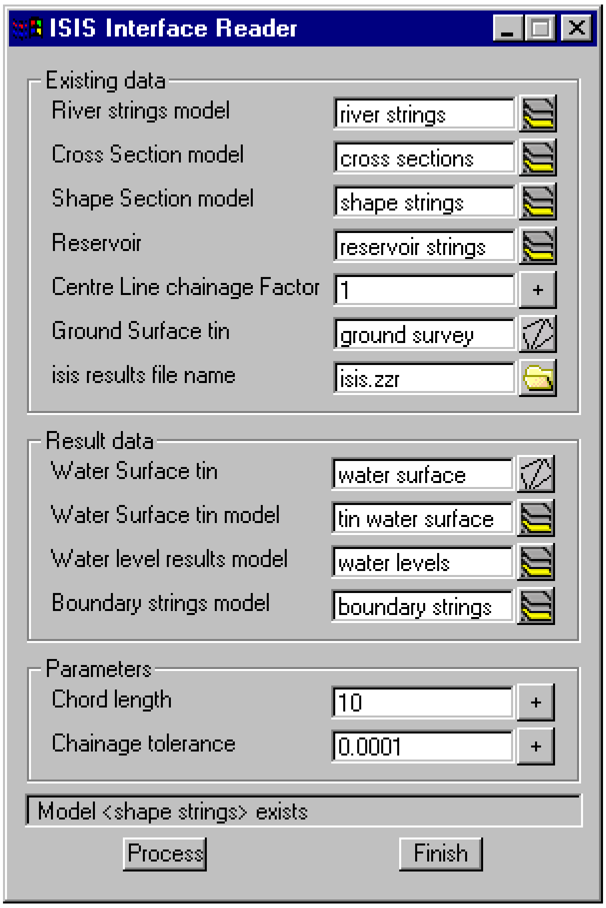
Presenting Water Level Results

How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The ISIS read panel follows.



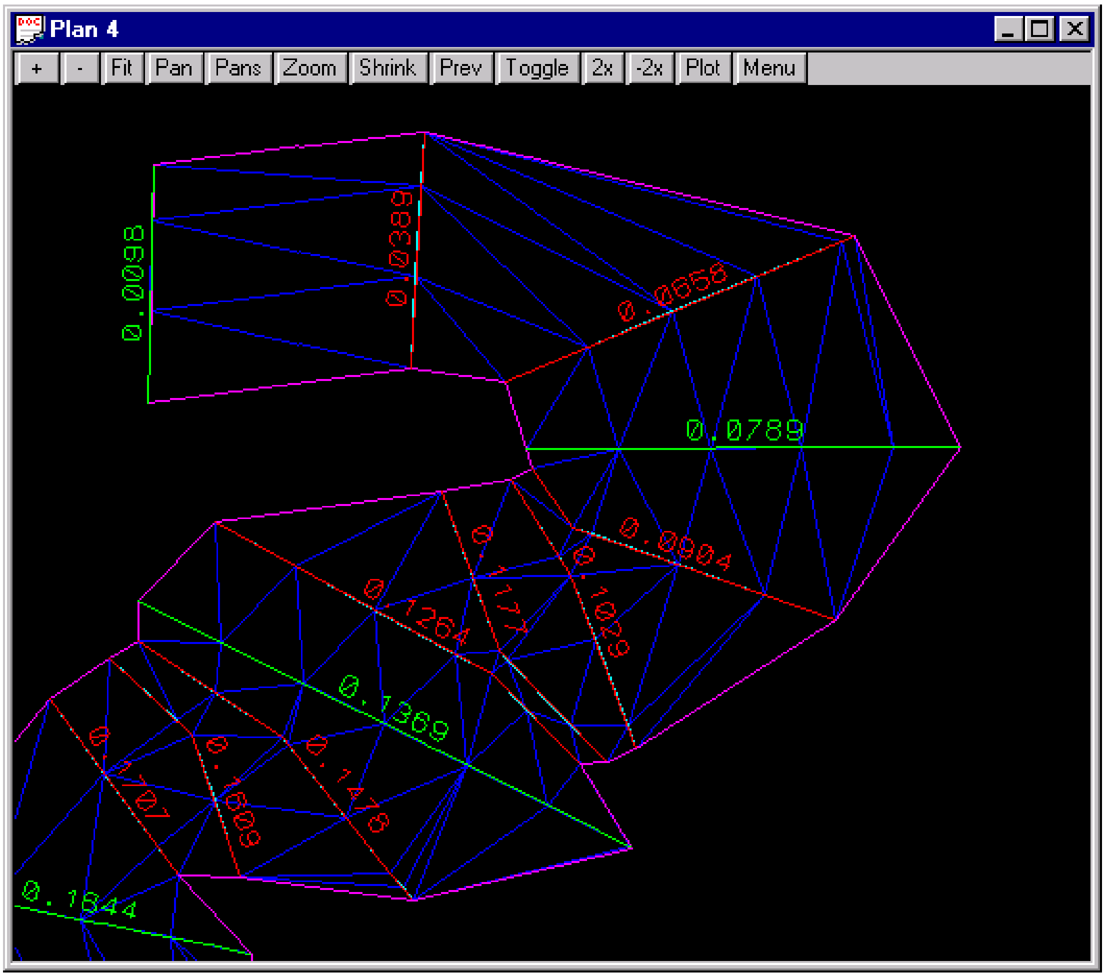
River strings model Model box

The same river strings model specified in the write panel. The river strings are used to sort the cross section and the shape strings. The left and right bank strings are used to check the direction of the strings.

Cross Section model Model box

The same cross section model specified in the write panel. The interface will match the ISIS label and the string name (without the "SECT "). If the ISIS labels were created by 12d then an exact match should result.

However, if the ISIS file was not created by 12d, the file can still be mapped by manually creating cross section strings (2d or 3d strings). See Mapping non 12d and historical water level data.



Shape string model Model box

For meandering rivers, the cross sections (shown in green above) may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings (shown in red above) can be created to create a water surface (shown in blue above) to follow the river. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach.

Reservoir Model box

Reservoir strings are assigned elevations from the ISIS zzr file. This model is the same as the ***storage area stings*** *specified in the write panel.*

Centre line chainage factor Model box

This data is only required if the Cross sections have been manually created and have no names yet. See Mapping non 12d and historical water level data.

ISIS results file name File box

The ISIS zzr file is automatically generated by ISIS.

Ground surface tin Tin box

If a ***boundary string model*** *is specified below, the intersection of this ground surface and the water surface will be determined. The strings will be stored in the model from the* ***boundary string model*** *field.*

Water surface tin model Model box

The model to contain the new water surface tin.

Water surface tin Tin box

The name of the water surface tin to be created.

Water level results model Model box

The model where the water surface strings will be created at each cross section and shape string.

Boundary string model Model box

The model to contain the intersection strings between the water and ground surfaces specified above. If left blank no intersection strings will be calculated.

Chord Length Model box

This value set the spacing for the points on the water level strings (both cross section and shape strings). It is recommended that you use a length of no more than half of your average cross section and shape string lengths. A large value in this field may result in unexpected water level profiles for meandering rivers.

Chainage Tolerance Real box

This tolerance is not used for the standard 12d cross section names. However, if the cross section names have been created manually and they can be converted to a real number then this is the tolerance used to match the cross section label from the ISIS report to the cross section string names. A value of 1.0 to 10. is common. See Mapping non 12d and historical water level data *for more details.*

A sample of the *.zzr file that is read by 12d follows.

A sample of the zzr file that is read follows.

Maxima and minima of all variables from

time 0.000 hours to time 30.000 hours

****

maxima of all variables

****

Label12		Flow	Stage	Froude no	Velocity	Umode	Ustate
WY201013	y	0.470	87.305	0.033	0.076	7.916	0.000
WY202013	y	0.470	87.288	0.162	0.297	2.335	0.000
WY203013	y	0.470	87.054	0.682	0.794	4.000	0.800
WY204013	y	0.470	86.804	0.671	1.002	0.562	0.000

Continue to 19.9 How to for Rivers or return to 19.8 ISIS Interface.

19.9 How to for Rivers

This section lists specific tasks for the rivers interface. Worked examples are contained in the courses directory of 12jobs and training manuals are found in the documentation directory on the ***12d Model*** distribution CD.

19.9.1 Manual Override settings

Many of the automatic settings can be overridden using string attributes via the String Attribute Editor. To use the editor

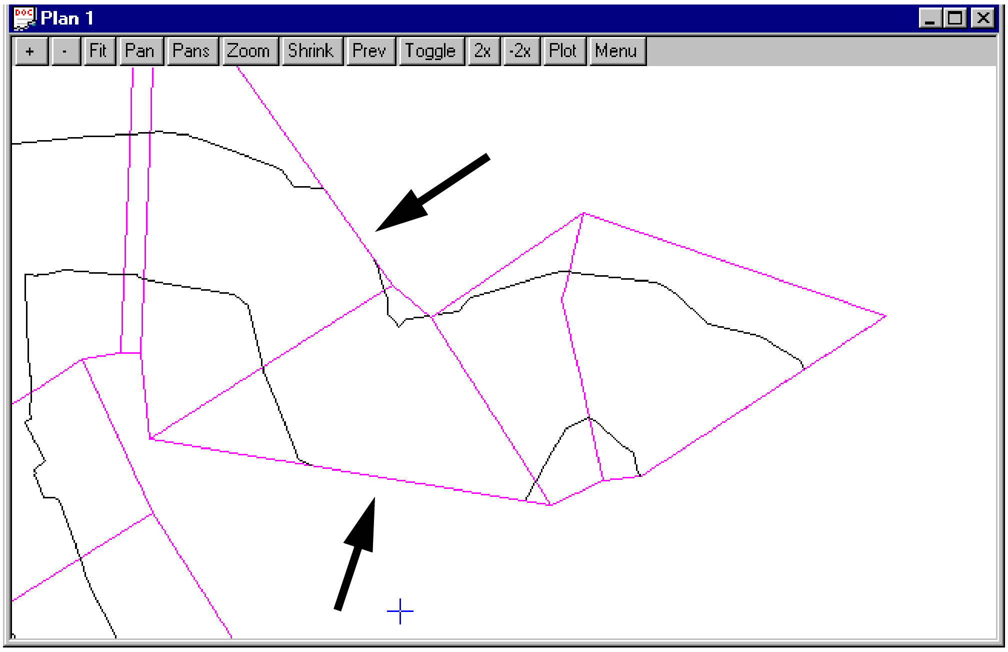
1. Select the river or source string to add/edit the attribute for
2. In the **Attribute Name** column use the selection list to find the attribute to change. If it is not listed then type the attribute name into on of the boxes.
3. Change the attribute **Type** to Integer/Real/Text as required
4. Type the attribute value into the **Data** field (erase the **not found** if required).
5. Select **Process, Next, Previous** or **Pick string.** Selecting **Finish** will NOT save the attribute.

You will be prompted that you will create a new attribute if you have typed in a new attribute for that string

Purpose	String Type	Attribute Name	Type	Typical Data Value
Node/cross section name	source strings	node name	Text	A1
Set a local inflow for this section	source string	flow	Real	10.2
Storage curve increment	storage area strings	stage increment	Real	1.0
Water level string tolerance when comparing numeric string names to data file names	cross sections before importing	tolerance	Real	0.01
Custom n values	source strings	left n, right n, centre n	Real	0.03
Culvert n value	centre line and culverts in spill	roughness	Real	.013
Culvert entrance loss	centre line and culverts in spill	entrance loss	Real	0.5
Culvert exit loss	centre line and culverts in spill	exit loss	Real	1.0
Culvert length	centre line and culverts in spill	length	Real	8.0
Multiple identical culverts	centre line and culverts in spill	number of pipes	Integer	2
Channel length of a spill string	spill strings	length	Real	30
Channel roughness	spill strings	roughness	Real	0.02
Channel slope %	spill strings	slope	Real	0.5

19.9.2 Boundary Strings are broken. How do I stop this?

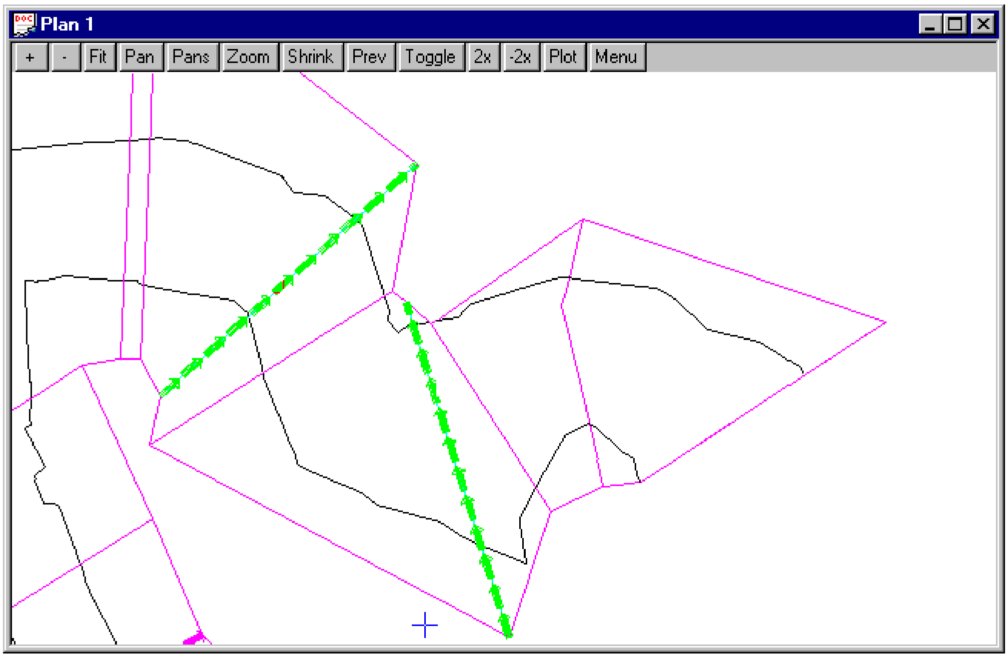
The boundary strings will be broken into sections when the boundary string goes outside the area defined by the cross sections. See below



In these two cases the water level has not exceeded the extents of the cross sections but the boundary strings (black) has gone outside the limits of the water level strings (magenta). **Shape strings** are used to expand the area of the water levels between the sections. The water level assigned to the shape string is a linear interpolation between the upstream and downstream cross section water levels. The interpolation is prorated using the distance along the centre line of the river.

Important! water levels are extended when the shape strings are in a junction area or past the end of a reach.

Shape strings are 2d strings. The direction is not important except for Mike11 models. For Mike11 they must be in the same direction as the cross section strings (usually left bank to right bank). The following drawing shows the boundary string when 2 shape strings have been added (green).


Plan 1
+
-
Fit
Pan
Pans
Zoom
Shrink
Prev
Toggle
2x
-2x
Plot
Menu

19.10 Mapping Non 12d & Historical Water Level Data

12d can map water levels from river engineering models that were not created by 12d. If the water level results are in the standard HECRAS GIS, HECRAS report, ISIS zzr, UNET, XP SWMM xpx or Mike11 binary file then the standard 12d readers can be used. If the data is historical or not in any of the standard format the **River Mapper** feature can be used.

19.10.1 River Mapper

Position of option on menu: **Water =>Rivers =>River Mapper**

River cross section water level data in an text file may be mapped and displayed using the 12d River Mapper interface. 2d strings are created by the user with the plan shape of the cross sections. 12d assigns water levels from a text file to these strings. These strings are then triangulated to create a water surface tin.

See also

Presenting Water Level Results

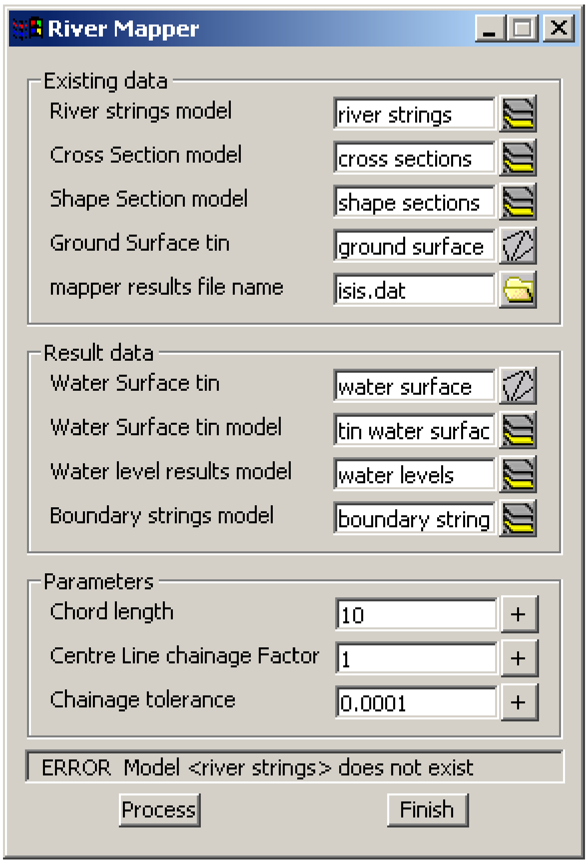
How to for Rivers

Frequently Asked Questions (Rivers)

Usage

The steps are as follows:

1. Create the river strings (centre line, left bank and right bank).
2. Create 2d source strings. Use your name for the cross section as the string name. 12d will match the water levels in the file to this string using the name as the key. If you do not assign a name the interface will assign names to strings according to the chainage along the centreline and the value of **Centre line chainage factor.**
3. From the **Water =>Rivers** menu select **River Mapper**.
4. Fill in the fields in the dialogue for the rivers strings (step 1 above) and the cross sections (step 2 above).



The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up

River strings model Model box

The river strings model specified in the write panel.

Cross Section model Model box

The cross section model specified in the write panel. The interface will search the string names in this model for the cross sections specified in the HEC-RAS report. A match is successful if the HEC-RAS cross section chainage and the string name are within the tolerance specified below in ***Chainage tolerance****.*

Shape string model Model box

For meandering rivers, the cross sections may not be at a close enough spacing to create a water surface that follows the river. 2D shape strings can be created (automatically or manually) to create a water surface to follow the river. Note that water levels are extended when the shape strings are in a junction area or past the end of a reach.

Centre line chainage factor Model box

If you assigned the source/cross section string a name in Step 2 this field is not used. Otherwise, the centre line chainage and the Centre line chainage factor are used to name your source string/cross sections in 12d. The cross sections will be named in the same units as the 12d data if a Centre line chainage factor of 1 is specified. If your existing data uses cross section names in your data file are in kilometres and your 12d data in meters, you will want to use a Centre line chainage factor of 1000. If your existing data cross section names are in miles and your 12d data is in feet then a Centre line chainage factor of 5280 would be used.

Mapper results file name File box

The report is a tab (or space) delimited text file (usually created by a text editor or spreadsheet). The format is

cross section name <tab> water level elevation

each section name with its water level must be on a separate line. For example.

Section A	*2.31*
Section B	*2.32*

If the names contain letters (abc..) then the section name must match the 12d string names exactly (case sensitive). If the names are real numbers than a tolerance for the matching (global and string specific) can be set (see parameters).

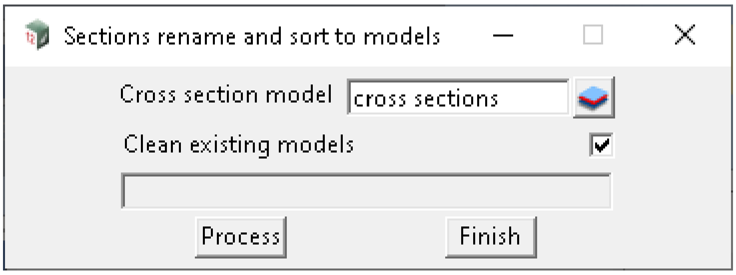
19.11 Rivers Rename and Move Cross Sections

Position of option on menu: **Water =>Rivers =>Xsections rename and move**

River cross section names begin with the river reach number followed by the cross section chainage. To plot these x sections they need to be renamed to the 12d chainage standard.

This routine gets the cross section model name moves the cross section to a model with the name as a prefix followed by the reach number. The reach number is removed from all of the cross section name.

On selecting the Xsections rename and move option, the panel is displayed.



These defaults are used when creating a manhole in a drainage string. The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Cross section model model box

This model holds the cross sections created by one of the river interface routines. The name of this model will used as the prefix for the new models to hold the renamed cross sections.

Clean existing models tick box

When selected the models that the cross sections are to be moved to will be cleaned before the supplied cross sections are moved into them.

Process button

Moves and renames the cross sections.

Finish button

Remove the panel.

19.12 12d System Path

When looking for system files 12d first checks your local project directory (the directory that hold the *.project folder), and then the system folders. Unless you have changed these folders in your env.4d file the path is first "program files\12d\12dmodel\5.00\user" and then "program files\12d\12dmodel\5.00\set_ups". In summary:

1. local project directory (the directory that hold the *.project folder
2. program files\12d\12dmodel\5.00\user
3. program files\12d\12dmodel\5.00\set_ups

Never modify the files in set_ups. Copy them to the user directory and make your changes there. Here they are safe from being changed during future 12d updates. The only time you will want files in the local project directory is when you have some project specific data. Master_drainage.xp and Master_rivers.xp are good examples of such cases.

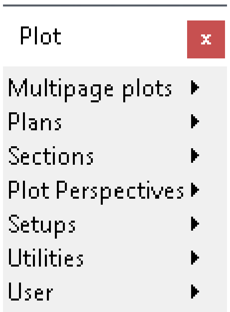
More on System files
Attribute Editor

19.12.1 FAQ Rivers

XP SWMM does not start or gives errors when starting from 12d

20 Plot

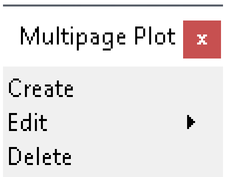
In **V14** the menu was called **Plots** and in **V15** this has been renamed **Plot** and has been totally rearranged.



See
20.1 Multipage Plots

20.1 Multipage Plots

Position of menu: **Plot =>Multipage plots**



20.1.1 Multipage Plot Create
20.1.2 Multipage Plot Edit
20.1.3 Multipage Plot Delete

20.1.1 Multipage Plot Create

Position of option on menu: **Plot =>Multipage plot =>Creates**

20.1.1.1 Icons and Fields for the Book

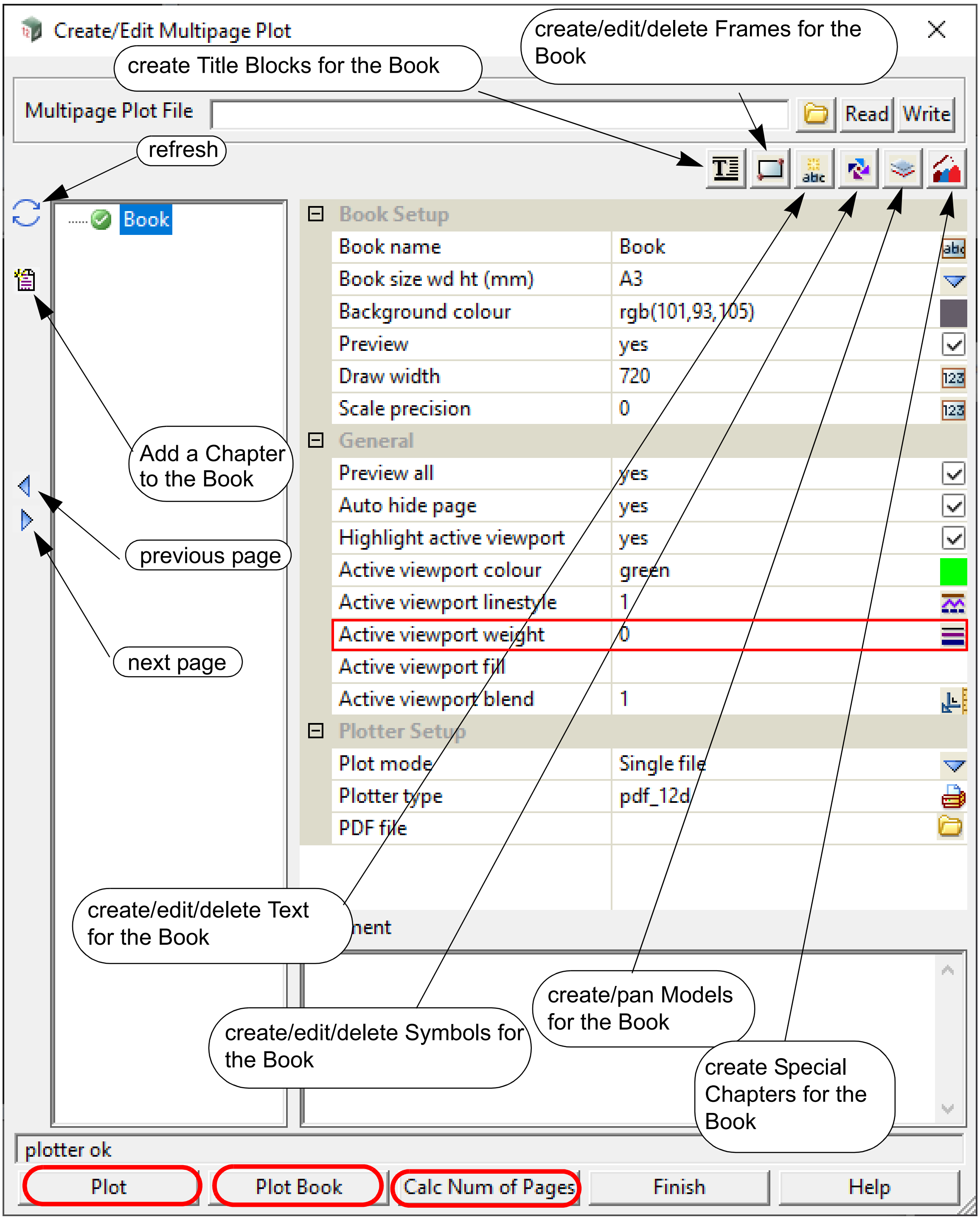
The option "Active" has been **deleted** from under the Book Setup tab on the *Create/Edit Multipage Plot* panel.

Active tick box ticked

*if **ticked**, the currently selected node is made active and will be used when plotting. The Node's active/ inactive icon will be set to active.*

*if **not ticked**, the currently selected node is made inactive and it (and all of its Subnodes) will be ignored when plotting. The Node's active/inactive icon will be set to inactive.*

***Note**: this tick box is linked to the Node's active/inactive icon. Changing one also changes the other.*



Active viewport weight has been **added** to the *Create/Edit Multipage Plot* panel.

Active viewport weight	weight box	0	available weights

the weight used for the border when highlighting the active viewport.

20.1.2 Multipage Plot Edit

Position of option on menu: **Plot =>Multipage plots =>Edit**

20.1.3 Multipage Plot Delete

Position on menu: **Plot =>Multipage plots =>Delete**

20.1.4 Create/Edit Multipage Plot

See

20.1.1.1 Icons and Fields for the Book
20.1.4.1 Node Diagram Frame
20.1.4.2 MPS Text $variables
20.1.4.3 Node Diagram Chapter
20.1.4.4 $variables

20.1.4.1 Node Diagram Frame

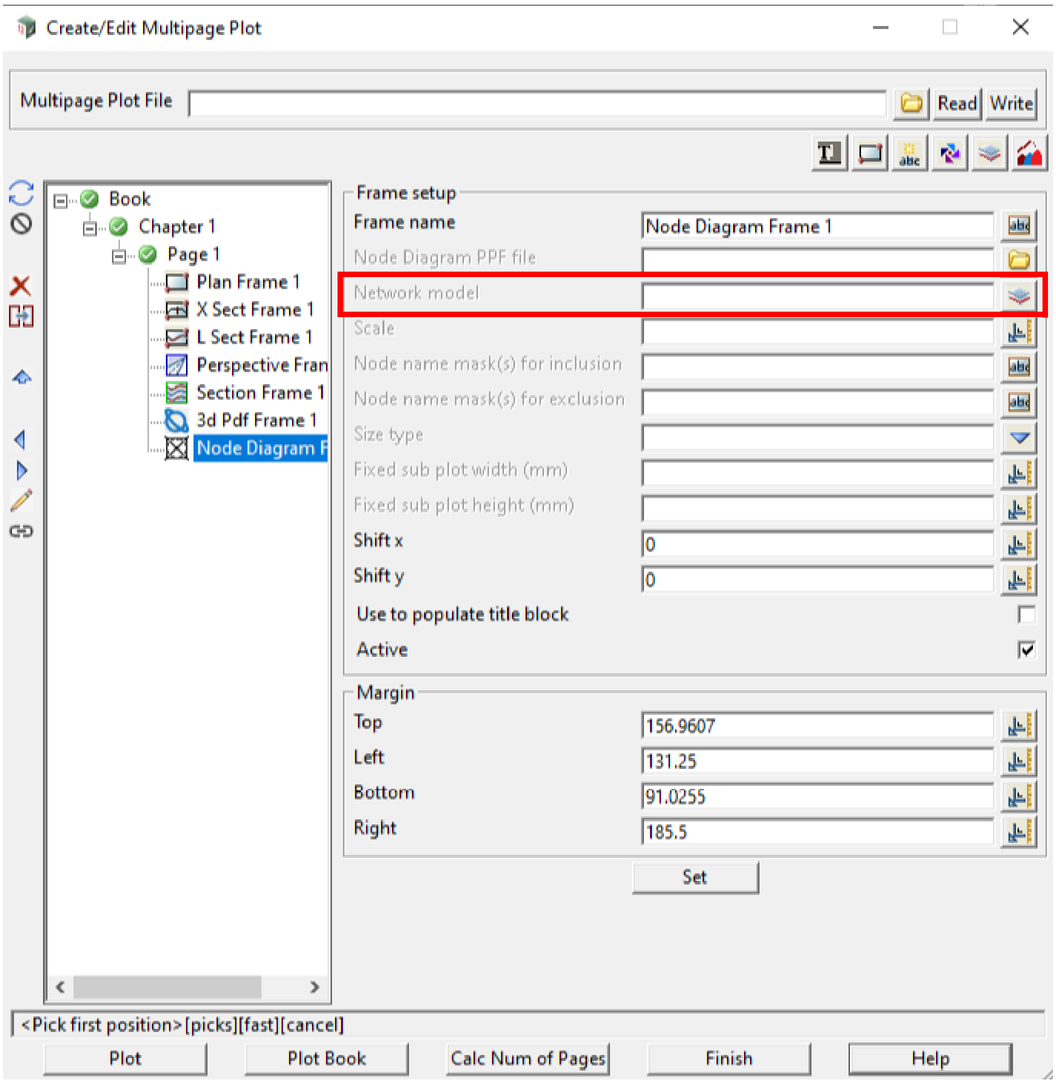
Netword Model has been added under Frame Setup menu on the **Create/Edit Multipage Plot** panel.

Network model Model box available models

the model containing the water string whose nodes are to be plotted.

if ***not blank****, this value will override the existing value of the* ***Network model*** *field in the* ***Node Diagram PPF file*** *when plotting.*

if ***blank****, no overriding will occur and the* ***Network model*** *field value specified in the* ***Node Diagram PPF file*** *will be used when plotting.*



20.1.4.2 MPS Text $variables

(h) **$folder** variable has been added to MPS text $variables.

(i) **$project** variable has been added to MPS text $variables.

$folder *which at plot time is replaced by the full path name of the working folder for the current project.*

$project *which at plot time is replaced the name of the current project.*

20.1.4.3 Node Diagram Chapter

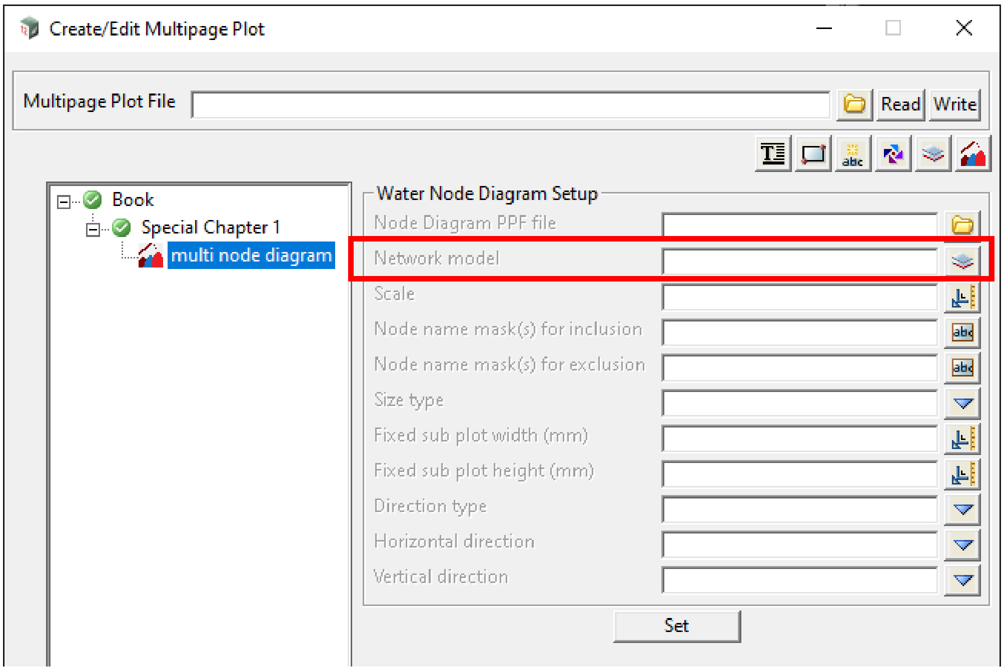
Netword Model has been added under Water Node Diagram Setup tab on the **Create/Edit Multipage Plot** panel.

Network model Model box available models

the model containing the water string whose nodes are to be plotted.

*if **not blank**, this value will override the existing value of the **Network model** field in the **Node Diagram PPF file** when plotting.*

*if **blank**, no overriding will occur and the **Network model** field value specified in the **Node Diagram PPF file** will be used when plotting.*



20.1.4.4 $variables

20.1.4.4.1 MPS Text and Text Frame $variables

Text can be inserted at the Book, Chapter and Page level or can be attached to a Frame (referred to as Text Frame).

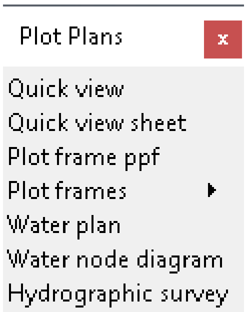
The $variables **$vertical_exaggeration**, **$scale** and **$frame** only make sense when they are used as a **Text Frame** and not just straight Text.

BAD	GOOD
NOT WORKING	WORKING
PARTIAL	NOT SUPPORTED
UNSURE	

$VARIABLE	Text and Text Frame $variables									
	Book	Chapter	Page	Plan	X Section	Long Section	Perspective	Section	3D PDF	Water Node
$vertical_exaggeration										
$scale										
$frame										
$total_pages										
$current_page										
$book										
$chapter										
$page										
$user										
$time										
$project_attribute										
$synergy_attribute										
$project_details										

20.2 Plans

Position of menu: **Plot =>Plans**

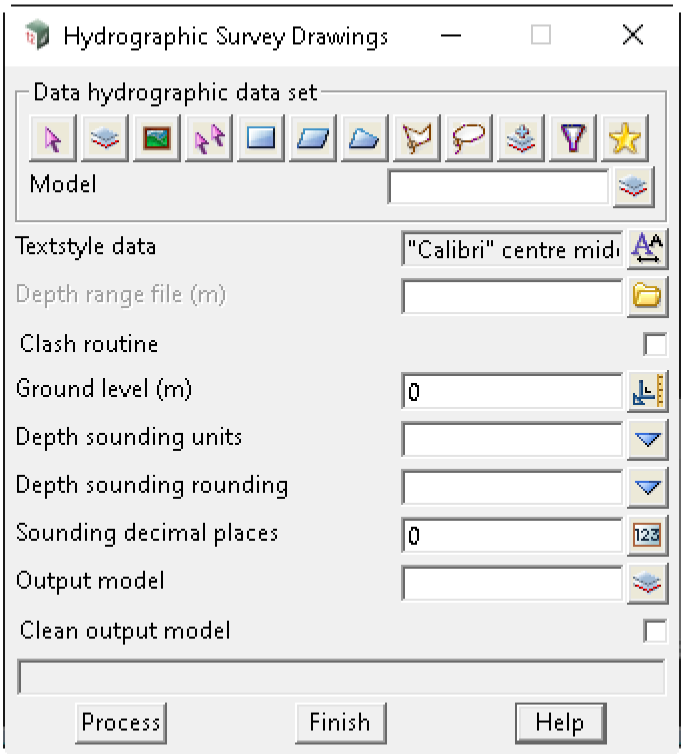


20.2.1 Hydrographic Survey Drawings

20.2.1 Hydrographic Survey Drawings

This panel takes an input dataset of points which will be converted to an output of depth soundings.

Selecting **Hydrographic survey** brings up the **Hydrographic survey drawings** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Hydrographic data set	source box	mode	

data set containing points to create depth soundings from. Find more info 3.26.3 Data Source.

Field Description	Type	Defaults	Pop-Up
Selected data source	input	Model	

source of data to process.

Field Description	Type	Defaults	Pop-Up
Textstyle data	textstyle data box	"Calibri" centre middle white 20 0.268 0.75	textstyle info panel

contains the parameters for defining the visual representation of the depth soundings.

Field Description	Type	Defaults	Pop-Up
Depth range file	file box	*drf	file directory

file containing specific colours for depth ranges, depth soundings with z values that lie within the depth ranges (m) will be assigned a given colour. Find more info 17.11.5 Depth Range File.

Field Description	Type	Defaults	Pop-Up
Clash routine	tick box	not ticked	

*if **ticked**, outputted depth soundings will not overlap each other.*

Field Description	Type	Defaults	Pop-Up
Ground level	real box	0	measures menu

determines the height in metres that the depth soundings are measure relative to.

Depth sounding units choice box Metres
Decimetres
Millimetres

determines whether the depth soundings are displaying the inputted heights in metres.

Depth sounding rounding choice box 0 Round
Round up

determines whether the displayed depth soundings are rounded normally or rounded up.

Sounding decimal places integer box 0

displayed depth soundings will be rounded to the given number of decimal places.

Output model model box select model panel

the chosen output model the depth soundings will be outputted to.

Clean output model tick box not ticked

*if **ticked**, the chosen output model will be cleaned before the depth soundings are added to the output model.*

Buttons at Bottom

Process button

run the option.

21 Plot

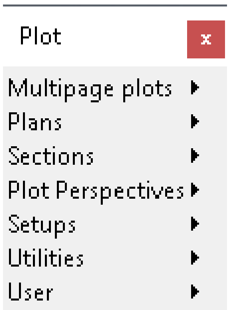
Position of menu: **It is on the main menu as Plot**

The **Plot** menu is

on Main menu

create floating **Plot** menu

Main Plot menu and floating Plot menu



See

21.1 Multipage Plots (MPS)

23.2 Plans

23.3 Sections

23.4 Plot Perspectives

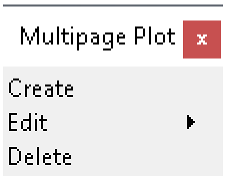
23.5 Plotting Setups

23.6 Plot Utilities

User Plot menu

21.1 Multipage Plots (MPS)

Position of option on menu: Plot =>Multipage plots



21.1.1 Multipage Plot Create
21.1.2 Multipage Plot Edit
21.1.3 Multipage Plot Delete

The **Multipage Plots** option, commonly referred to as **MPS**, is a heavily customisable option for producing multiple pages of technical drawings that are output as pdf files.

MPS has a tree-like structure that is made up of nodes. The top level Node is called the **Book** Node and there can only ever be one **Book** Node per **MPS**.

Each **Book** Node is made up of one or more **Chapter** Nodes, which in turn is made up of one or more **Page** Nodes. Each **Page** Node represents a single pdf page. There are also **Special Chapter** Nodes which are capable of producing multiple pdf pages.

The Node hierarchy of the tree structure allows other Node types (**Title Blocks**, **Frames**, **Text**, **Symbols** and **Models**) to be defined once at the **Book** or **Chapter** level and apply to all the **Page** Nodes beneath them in the tree.

For example, for **Text**:

Text can be defined at the **Book** level and will appear on all the **Pages** of all the **Chapters** of the **Book**.

If **Text** is defined at the **Chapter** level, it will appear on all the **Pages** of that **Chapter**.

If **Text** is defined at the **Page** level, it will appear on that **Page** only.

Text can also be defined for each individual **Frame** at any level of the tree.

Another benefit of the tree structure is that entire sections of the tree can be made inactive to stop them plotting. For example; individual **Page** Nodes or whole **Chapters** can be made inactive if the user desires.

Each **Page** of the **MPS** can be made up of any number of plotting areas (called **Frames**). These **Frames** can be of the type **Plan**, **X-Section**, **Long Section**, **Perspective**, **Section**, **3D PDF** and **Node Diagram**. The **Plan Frame** is for drawing part of a Plan View, the **X-Section Frame** draws a cross section at a selected chainage from a **X-Section PPF**, the **Long Section Frame** draws a chainage range from a **Long Section PPF**, the **Perspective Frame** is for drawing part of a Perspective View, the **Section Frame** is for drawing part of a Section View, the **3D PDF Frame** is for drawing part of a Perspective View as a 3D PDF and the **Node Diagram Frame** draws plan diagrams of the water nodes from a **Water Node Diagram PPF**.

The **Pages** can also have user defined Title Blocks.

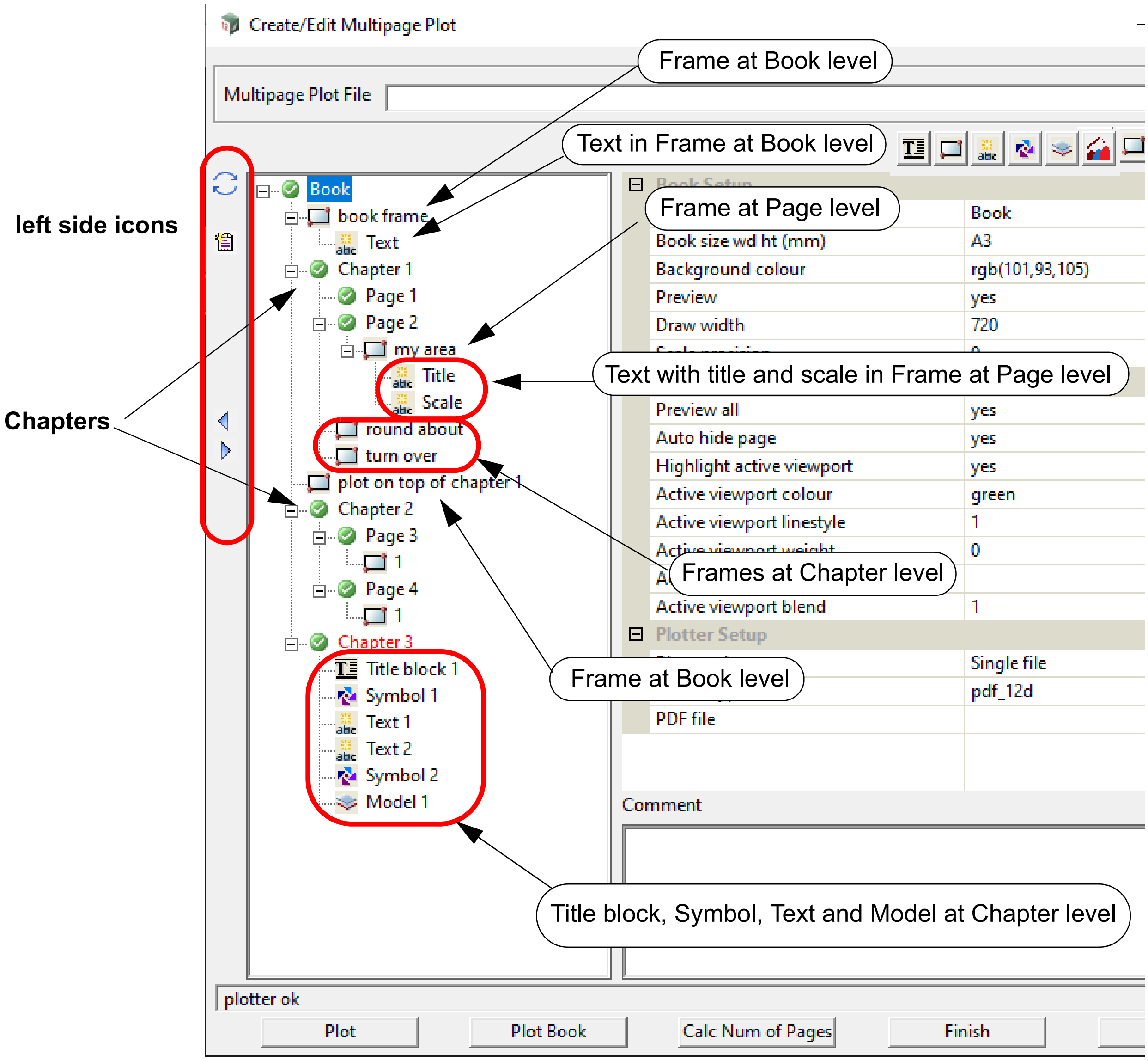
There are also **Special Chapters** that hold all the pages generated by a PPF file (e.g. **X-Section**, **Long Section**, **Water Long Section** and **Water Node Diagram** PPFs). **Plot Frames** also have a **Special Chapter** that operates without a PPF.

These Chapters cannot have any additional Pages added to them. For more information on these **Special Chapters**, see 21.1.4.11 Special Chapter.

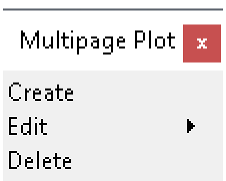
Finally all of the **Pages** in a **Book** can be plotted at once, or each **Chapter** plotted individually, or any selection of **Pages** plotted to a pdf.

Important Note

The order of the **Nodes** in the tree is important because that is the plotting order of the **Multipage Plots**.



The **Multipage Plot** menu is:



21.1.1 Multipage Plot Create
21.1.2 Multipage Plot Edit
21.1.3 Multipage Plot Delete

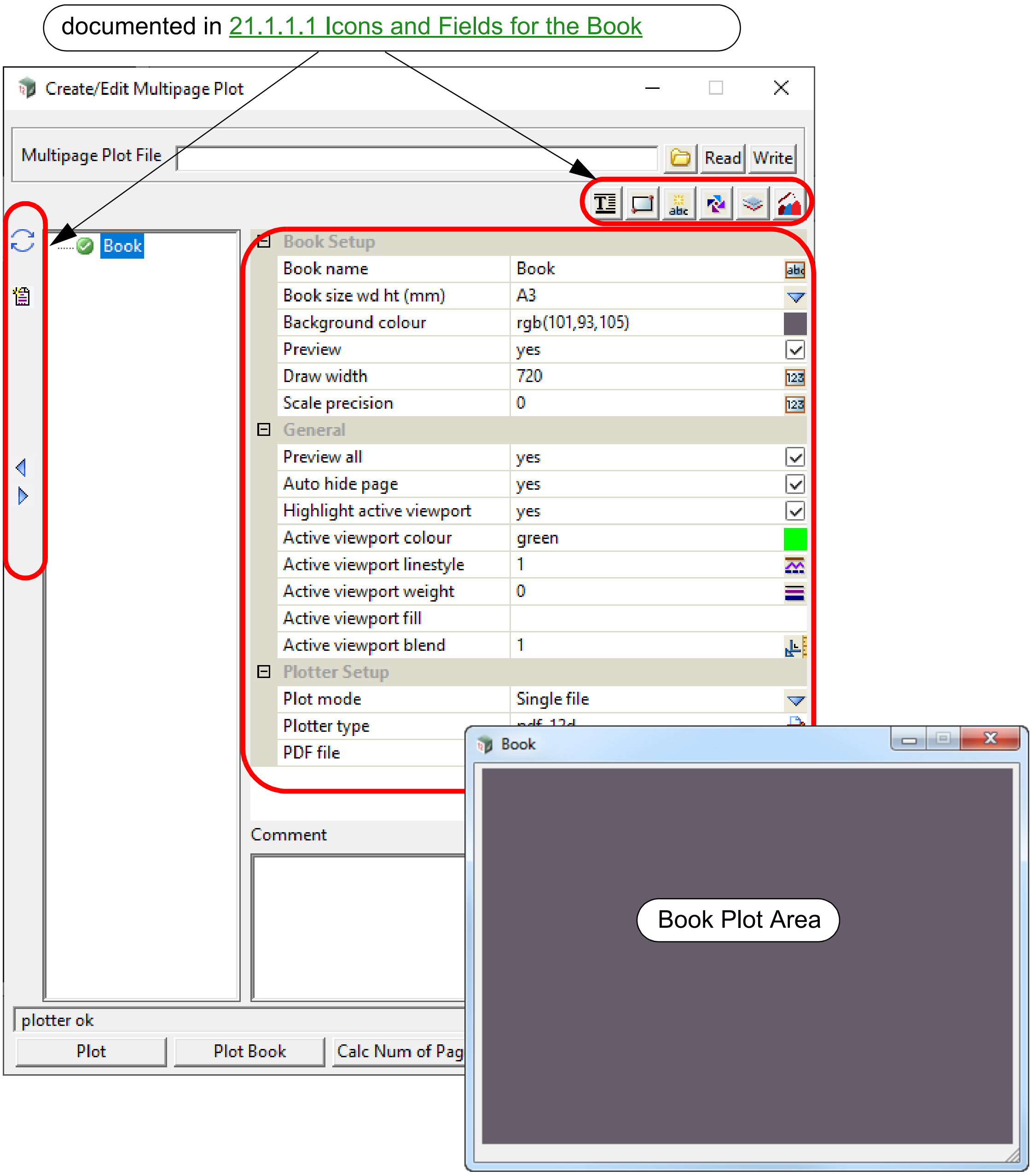
and the complete documentation is given in 21.1.4 Create/Edit Multipage Plot.

21.1.1 Multipage Plot Create

Position of option on menu: **Plot =>Multipage plots =>Create**

Multipage Plot Create is for creating a new Multipage Plot file (*.12dmpsf).

Selecting **Create** will bring up the ***Create/Edit Multipage Plot*** panel in its default state**.** The tree will only contain the Book Node.



The default name for the **Book node** is "Book" but that can be changed.

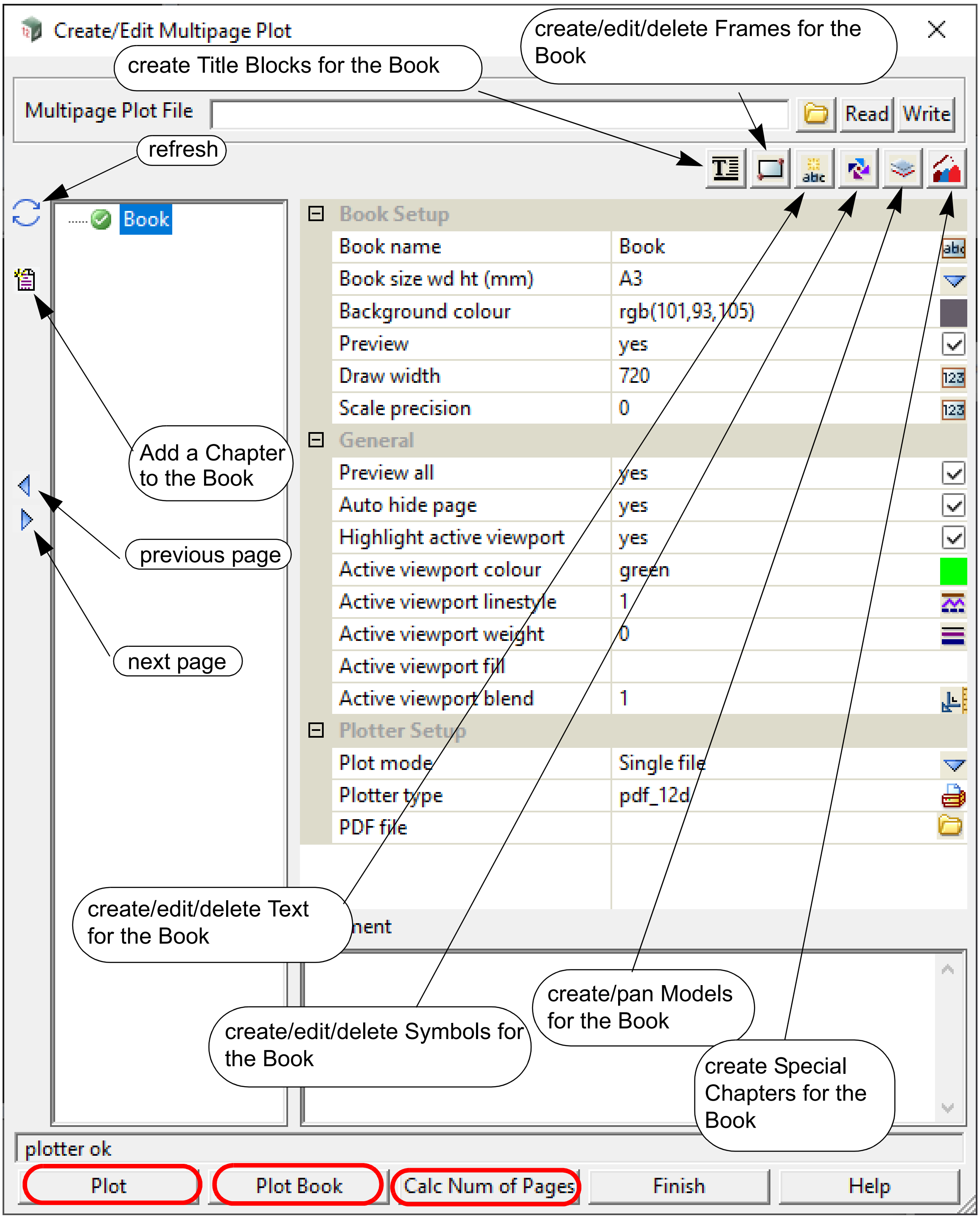
Books can contain **Chapters** which in turn contain the **Pages** that make up the Multipage plot.

Chapters and **Pages** are described in 21.1.4.1 Chapter. and 21.1.4.2 Page.

Books are also the only **Node** that can contain a **Special Chapter**, which is described in 21.1.4.11 Special Chapter.

All the icons and fields for the **Book** Node are documented in 21.1.1.1 Icons and Fields for the Book.

21.1.1.1 Icons and Fields for the Book



The icons, fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
Multipage Plot File	file box		*.12dmpsf, *.12dpsf

File that the MPS information will either be read in from or written out to.

Read	button		

*Read into the panel the MPS information contained within the file specified by the **Multipage Plot File*** *field.*

***Note**: Can also read in **V11 Plot Sheet Files** (*.12dpsf).*

Write button

*Write the MPS information contained within the panel out to the file specified by the **Multipage Plot File** field.*

Icons on the Left Side

The icons on the left side change depending on what is applicable for the currently selected node.

The icons common to most Nodes are described in 21.1.4.3 Icons on the Left Side.

The icon that is special for a Book is:

New Chapter icon

*Create a new **Chapter** Node for the **Book**. See* 21.1.4.1 Chapter

Icons on the Top Right

The icons are described in 21.1.4.4 Icons on the Top Right.

Book Setup

Book name text box Book

Name of the Book Node.

***Note**: the **Book name** can include **project attributes** as part of the name. For example:*

Book size wd ht (mm) sheet box A3 defined sheet sizes

Size of the page (in millimetres) for the Book.

*The **Book page size** is given as width followed by one or more spaces and the height. Or clicking on the choice icon brings up the defined **Page sizes** and one can be selected from the pop-up list. Once a size has been typed in, or selected from the pop up, the **Book Plot Area** panel is drawn with an aspect ratio to match the selected page size.*

*If there is a Page size in the selected user title block file, the Page size is automatically set to that size and the **Book Page size** does not need to be used.*

Background colour colour box rgb (101,93,105) available colours

Colour of the background for the Book Node.

Preview tick box ticked

*If **ticked**, the contents of the Frame and Title Block Nodes of the Book Node will be approximately drawn ("previewed") in the **Book Plot Area**.*

*If **not ticked**, the contents of the Frame and Title Block Nodes will not be drawn in the **Book Plot Area**.*

Draw width integer box 720

*Width in pixels of the **Book Plot Area** panel. This will change if the **Book Plot Area** is resized.*

*The height is then automatically determined by the aspect ratio of the Book Node (which is defined by **Book size wd ht (mm)**).*

Scale precision integer box 0

Number of decimal places used for a Text $variable at the Book level.

General

Preview all tick box ticked

*If **ticked**, then the **Preview** field of each Chapter, Special Chapter and Page Node in the tree will be set to* *ticked*.

*If **not ticked**, then the **Preview** field of each Chapter, Special Chapter and Page Node in the tree will be set to **not ticked**.*

***Note**: the **Preview** field value can be set individually on each Chapter, Special Chapter and Page Node in the tree; and those values will take precedence over this Book level setting.*

Auto hide page tick box ticked

*If **ticked**, then only the **Plot Area** of the selected Book, Chapter, Special Chapter or Page Node will be displayed. When a different Book, Chapter, Special Chapter or Page Node is selected then the **Plot Area** of the currently displayed Node is removed and the newly selected Nodes' is displayed.*

*If **not ticked**, then the **Plot Areas** of **all** the Book, Chapter, Special Chapter and Page Nodes in the tree will be displayed regardless of the currently selected node.*

Highlight active viewport tick box ticked

*If **ticked**, then the active viewport will be highlighted in the Key Plan (if one is present).*

*If **not ticked**, then the active viewport will NOT be highlighted.*

***Note:** See* 21.1.4.7.6.2 Creating a Key Plan for Plan Frames *for more information.*

Active viewport colour colour box green available colours

Colour for the active viewport.

Active viewport linestyle linestyle box 1 available linestyles

Linestyle for the active viewport.

Active viewport weight weight box 0 available weights

Weight used for the border when highlighting the active viewport.

Active viewport fill colour box 1 available colours

*If **not blank**, the active viewport will be filled with this colour.*

Active viewport blend measure box 1

Blend for the active viewport fill.

Plotter Setup

*If the **Plot** button is pressed then the following fields define how the plotting of the Book occurs.*

Plot mode choice box Single_file Single_file, Multiple_file, Chapter_file

*If **Single_file**, then the field **PDF file** is displayed and all the active Nodes in the tree are plotted to the pdf file whose name is given in the **PDF file** field.*

*If **Multiple_file**, then the field **Prefix** is displayed and each active Page Node in the tree is plotted to a different pdf file whose name will be the value of the **Prefix** field followed by the **Page name** of the Page Node.*

*If **Chapter_file**, then each active Chapter and Special Chapter Node in the tree is plotted to a different pdf file whose name will be the **Chapter name** or **Special Chapter name** of the Chapter or Special Chapter Node.*

Plotter type plotter box pdf_12d pdf plotters

***Plotter type** to use for the plotting. This can only ever be a pdf plotter.*

PDF file file box *.pdf files

*Name of the pdf file that will be produced when **Plot mode** is **Single file**.*

Prefix text box

***Prefix** that will be used to name the pdf files produced when **Plot mode** is **Multiple file**.*

Fields and Buttons at the Bottom

Comment text box

*User comments about the **Book**.*

Plot button

Plot from the currently selected node. Allows any Chapter, Special Chapter or Page Node to be plotted individually.

Plot Book button

*Plot the whole MPS tree from the **Book** Node down. Uses the **Plotter Setup** of the **Book** Node.*

Cal Num Pages button

Calculates the number of pages that will be produced by the entire MPS tree. Value is written out to the panel message area.

Create and **Edit** share the same options. To see the full documentation for the **Create** options see 21.1.4 Create/Edit Multipage Plot.

Continue to 21.1.2 Multipage Plot Edit or return to 21.1 Multipage Plots (MPS).

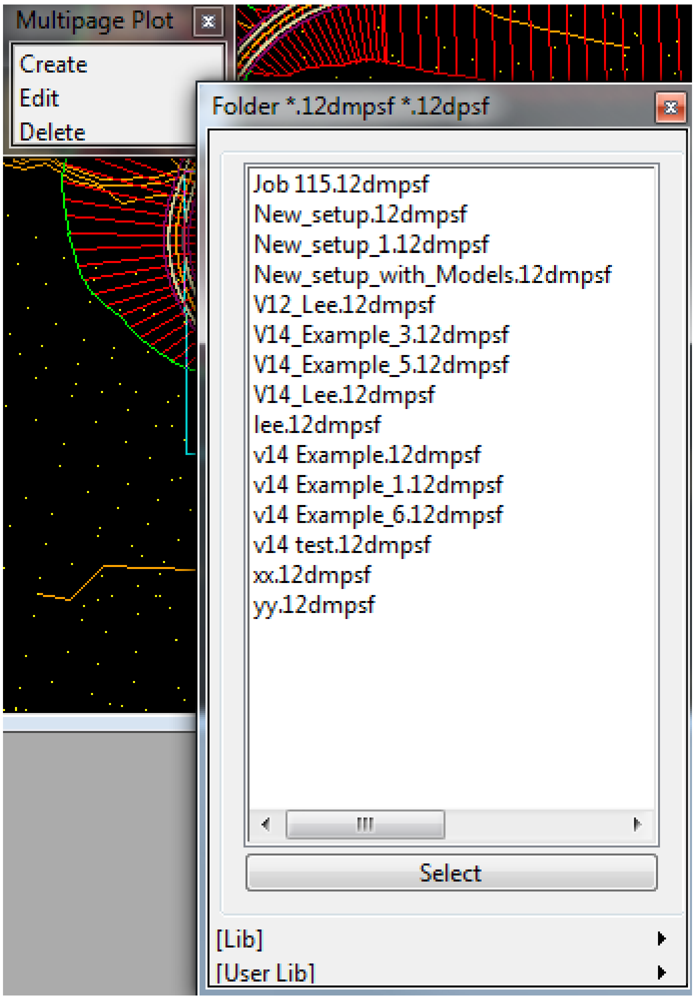
21.1.2 Multipage Plot Edit

Position of option on menu: **Plot =>Multipage plots =>Edit**

There are three different variations of the **Edit** option.

(1) Walking right on **Edit** when the **Multipage Plot** panel is pinned.

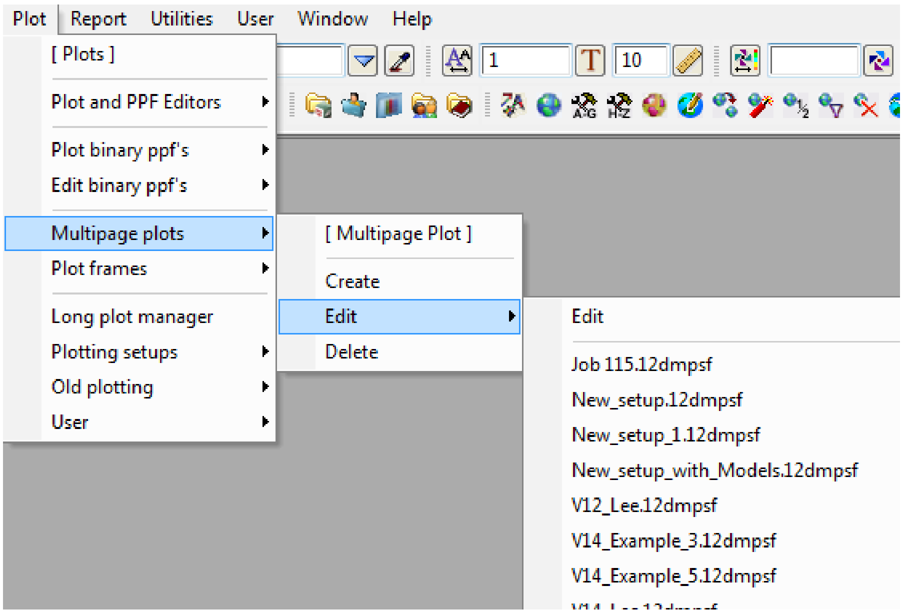
The list produced shows all the multipage plot sheet files (*.12dmpsf) in the **working folder**. It also has options to produce lists for the **[Lib]**, **[User Lib]** and any **[Customer Lib]** folders.



When an mpsf is selected the **Create/Edit Multipage Plot** panel will be brought up with the data from the selected mpsf already loaded in. See 21.1.4 Create/Edit Multipage Plot.

(2) Walking right on **Edit** when the **Multipage Plot** panel is NOT pinned.

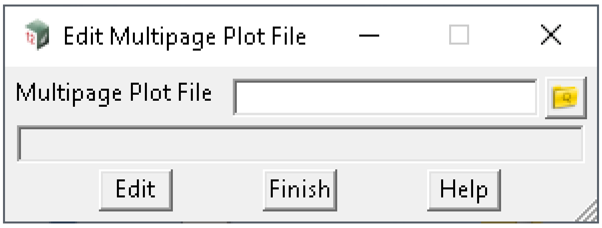
The walk right list produced shows all the multipage plot sheet files (*.12dmpsf) in the **working folder** only.



When an mpsf is selected the **Create/Edit Multipage** Plot panel will be brought up with the data from the selected mpsf already loaded in. See 21.1.4 Create/Edit Multipage Plot.

(3) Clicking directly on the **Edit**.

Clicking directly on **Edit** will bring up the **Edit Multipage Plot File** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Multipage Plot File	file box		*.12dmpsf files

Multipage plot sheet file to edit.

Edit	button		

*If the mpsf specified in the **Multipage Plot File** field exists, then the **Create/Edit Multipage Plot** panel will be brought up with the data from the selected mpsf already loaded in. See* 21.1.4 Create/Edit Multipage Plot.

Note: **Edit** can also read in **V11 Plot Sheet Files** (*.12dpsf).

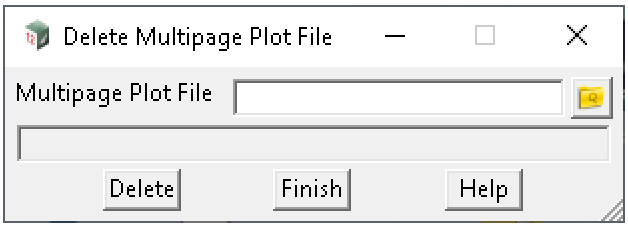
Continue to 21.1.3 Multipage Plot Delete or return to 21.1 Multipage Plots (MPS).

21.1.3 Multipage Plot Delete

Position on menu: **Plot =>Multipage plots =>Delete**

Multipage Plot Delete is for deleting an existing multipage plot file from disk.

Selecting **Delete** will bring up the **Delete Multipage Plot File** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Multipage Plot File	file box		*.12dmpsf files

Multipage plot sheet file to delete.

Delete	button		

*If the mpsf specified in the **Multipage Plot File** field exists, then it will be deleted.*

Continue to 21.1.4 Create/Edit Multipage Plot or return to 21.1 Multipage Plots (MPS).

21.1.4 Create/Edit Multipage Plot

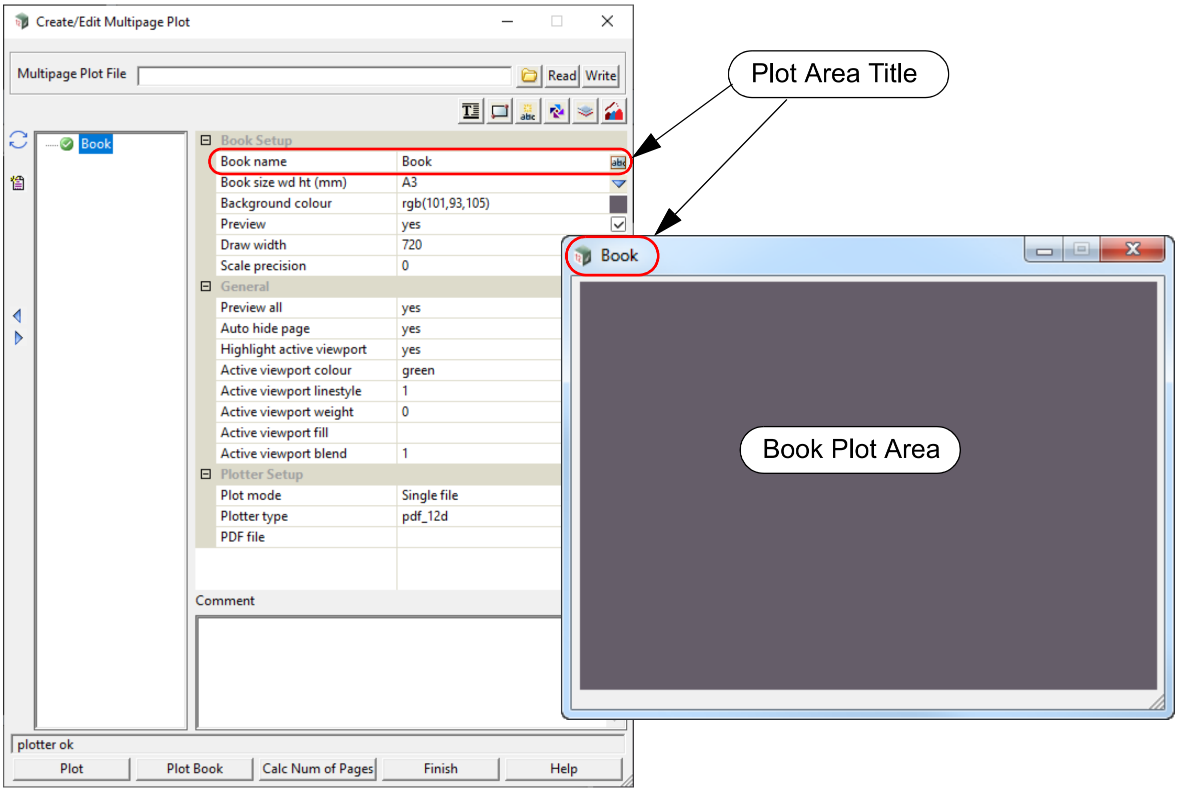
The **Create/Edit Multipage Plot** panel allows for the complete customisation of all the Nodes in the MPS tree and their Plot Areas. How the Nodes and Plot Areas are set up will determine everything about the produced pdf file.

The **Plot Area** represents the pdf page and shows the **relative location** and some values of many of the items that used in producing the plot for the selected Node. Many of the items can be edited from the **Plot Area**. For example, Frames can be resized and repositioned.

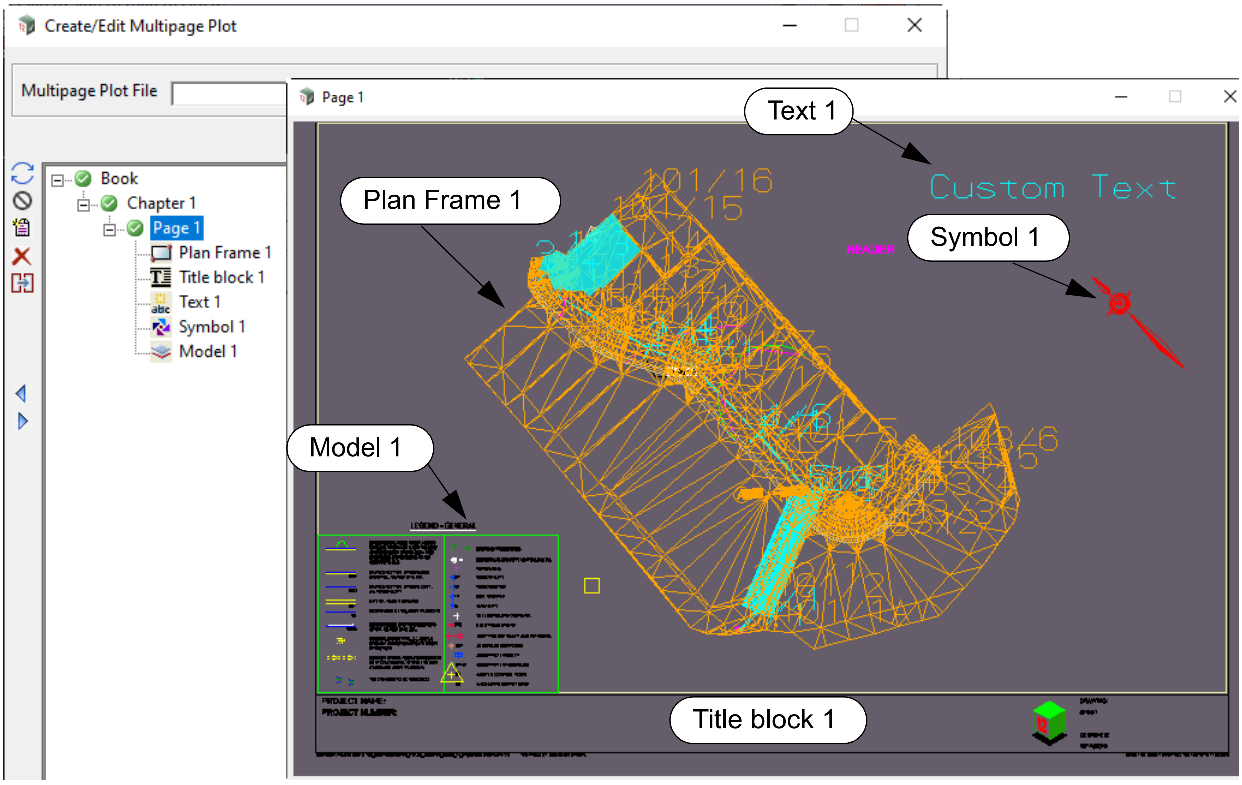
This is often referred to as the Preview window but beware, it is not intended to show exactly what the plotted page looks like. For that, press the **Plot** button.

The origin (0,0) of the **Plot Area** is the bottom left hand corner with the units in millimetres (mm). The aspect ratio of the **Plot Area** is declared in the **size wd ht (mm)** field of its respective Node (Book, Chapter, Special Chapter and Page).

The title that appears in title bar of the **Plot Area** window is set to the name of the currently selected Node (Book, Chapter, Special Chapter or Page).



When **Title Block**, **Frame**, **Text**, **Symbol** or **Model** Nodes are added to a Node, a representation will be displayed in the **Plot Area** of that Node. Having the representation of a Node appear in the **Plot Area** allows the user to easily see and manipulate the relative positions.



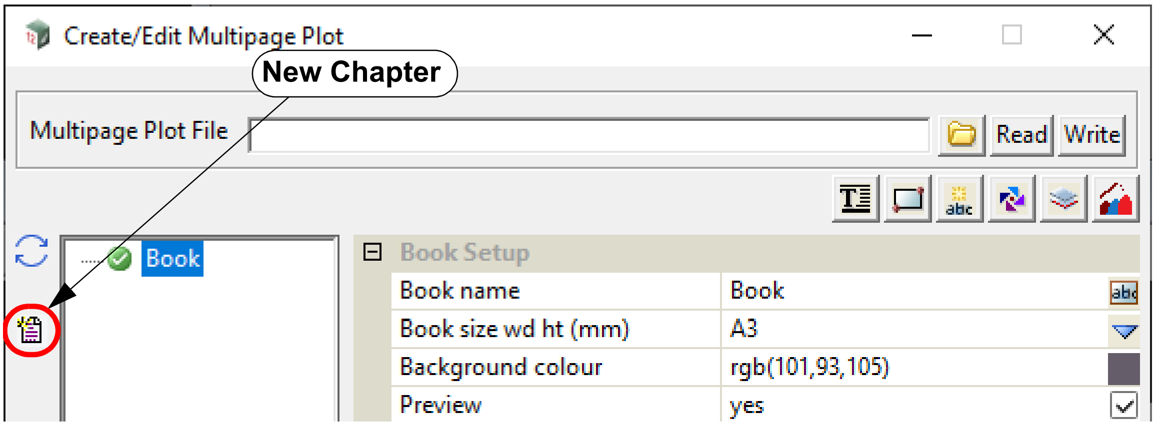
The complete documentation of the **Create/Edit Multipage Plot** panel now follows.

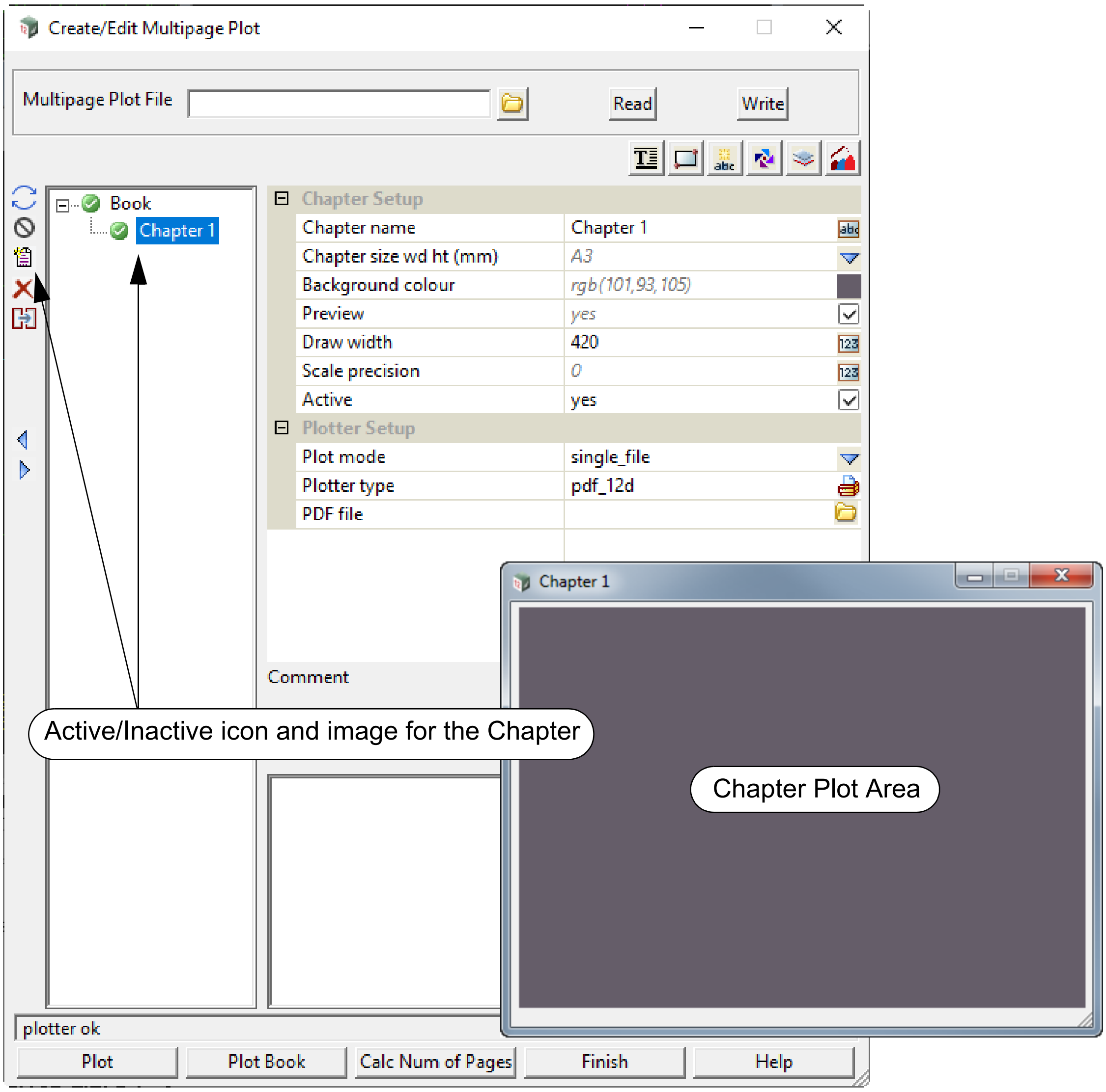
See

[21.1.4.1 Chapter]
[21.1.4.2 Page]
[21.1.4.3 Icons on the Left Side]
[21.1.4.6 Title Block]
[21.1.4.7 Frame]
[21.1.4.8 Text Icon for Use on a Book, Chapter, Page or Frame Node]
[21.1.4.9 Symbol Icon for Use on a Book, Chapter, Page or Frame Node]
[21.1.4.10 Model Icon for Use on a Book, Chapter or Page]
[21.1.4.11 Special Chapter]

21.1.4.1 Chapter

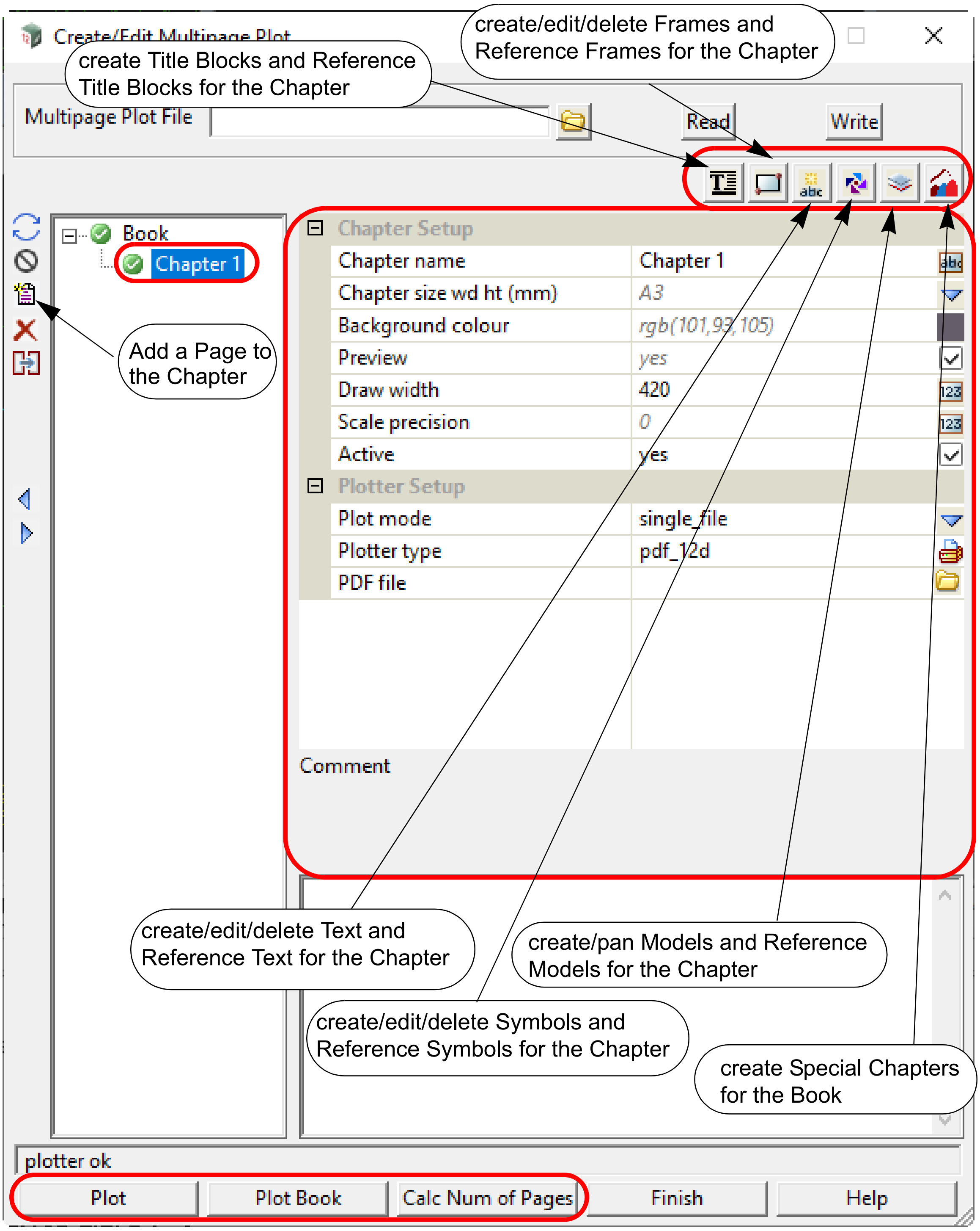
When the **Book** node is selected and the **New Chapter** is clicked, a new **Chapter** Node is created.





All the icons and fields for a **Chapter** Node are documented in 21.1.4.1.1 Icons and Fields for a Chapter.

21.1.4.1.1 Icons and Fields for a Chapter



The icons, fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Icons on the Left Side

The icons on the left side change depending on what is applicable for the currently selected node.

The icons common to most Nodes are described in 21.1.4.3 Icons on the Left Side

The icon that is special for a Chapter is:

New Page icon

*create a new **Page** Node for the **Chapter**. See 21.1.4.2 Page.*

Icons on the Top Right

The icons are described in 21.1.4.4 Icons on the Top Right.

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

*For more information on **Inherited Fields** see, 21.1.4.5 Inherited Fields *.*

Chapter Setup

Chapter name text box Chapter n

*Name of this Chapter Node. The default is **Chapter n** where **n** is the first number (integer from zero) to make the **Chapter name** unique amongst all Chapter Nodes in the tree.*

***Note**: the **Chapter name** can include **project attributes** as part of the name. For example:*

Chapter size wd ht (mm)* sheet box Book node value defined sheet sizes

*If **not blank**, the size of the page (in millimetres) for this Chapter.*

*If **blank**, the value from the equivalent **Book** Node field will be used.*

*The **Chapter page size** is given as **width** followed by one or more spaces and the height. Or clicking on the choice icon brings up the defined **Page Sizes** and one can be selected from the pop-up list.*

*Once a size has been typed in, or selected from the pop up, the **Chapter Plot Area** panel is drawn with an aspect ratio to match the selected page size.*

*If there is a Page size in the selected user title block file, the Page size is automatically set to that size and the **Chapter Page size** does not need to be used.*

Background colour* colour box Book node value available colours

*If **not blank**, the colour of the background for this Chapter.*

*If **blank**, the value from the equivalent **Book** Node field will be used.*

Preview* tick box Book node value

*If **ticked**, the contents of the Frame and Title Block Nodes of this Chapter Node will be approximately drawn ("previewed") in the **Chapter Plot Area**.*

*If **not ticked,** the contents of the Frame and Title Block Nodes will not be drawn in the **Chapter Plot Area**.*

***Note:** Re-establishing an inheritance link cannot be done for this field since it only has two states and cannot be left 'blank' in the same way as other fields.*

Draw width* integer box Book node value

*If **not blank**, the width in pixels of the Chapter Plot Area panel. This will change if the Chapter Plot Area is resized.*

*If **blank**, the value from the equivalent Book Node field will be used.*

*The height is then automatically determined by the aspect ratio of this Chapter Node (which is defined by **Chapter size wd ht (mm)**).*

Scale precision* integer box Book node value

*If **not blank**, the number of decimal places used for a Text $variable at the Chapter level.*

*If **blank**, the value from the equivalent **Book** Node field will be used.*

Active tick box ticked

*If **ticked**, the currently selected node is made active and will be used when plotting. The Node's active/ inactive icon will be set to active.*

*If **not ticked**, the currently selected node is made inactive and it (and all of its Subnodes) will be ignored when plotting. The Node's active/inactive icon will be set to inactive.*

***Note**: this tick box is linked to the Node's active/inactive icon. Changing one also changes the other.*

Plotter Setup

*If the **Plot** button is pressed then the following fields define how the plotting of this **Chapter** occurs.*

Plot mode choice box Single_file Single_file, Multiple_file

*If **Single_file**, then the field **PDF file** is displayed and all the active Nodes in the **Chapter** are plotted to the pdf file whose name is given in the **PDF file** field.*

*If **Multiple_file**, then the field **Prefix** is displayed and each active Page Node in the **Chapter** is plotted to a different pdf file whose name will be the value of the **Prefix** field followed by the **Page name** of the Page Node.*

Plotter type* plotter box Book node value pdf plotters

***Plotter type** to use for the plotting. This can only ever be a pdf plotter. This is an inherited field.*

*If **blank**, the value from the equivalent **Book** Node field will be used.*

PDF file file box *.pdf files

*Name of the pdf file that will be produced when **Plot mode** is **Single file**.*

Prefix text box

Prefix** that will be used to name the pdf files produced when **Plot mode** is **Multiple file.

Fields and Buttons at the Bottom

Comment text box

*User comments about this **Chapter**.*

Plot button

Plot from the currently selected node. Allows any Chapter, Special Chapter or Page Node to be plotted individually.

Plot Book button

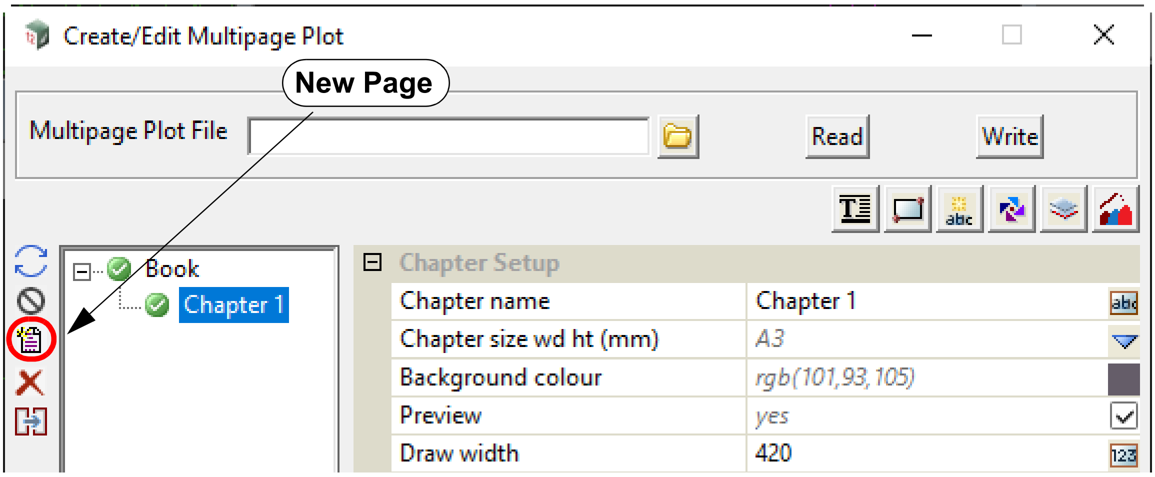
*Plot the whole MPS tree from the **Book** Node down. Uses the **Plotter Setup** of the **Book** Node.*

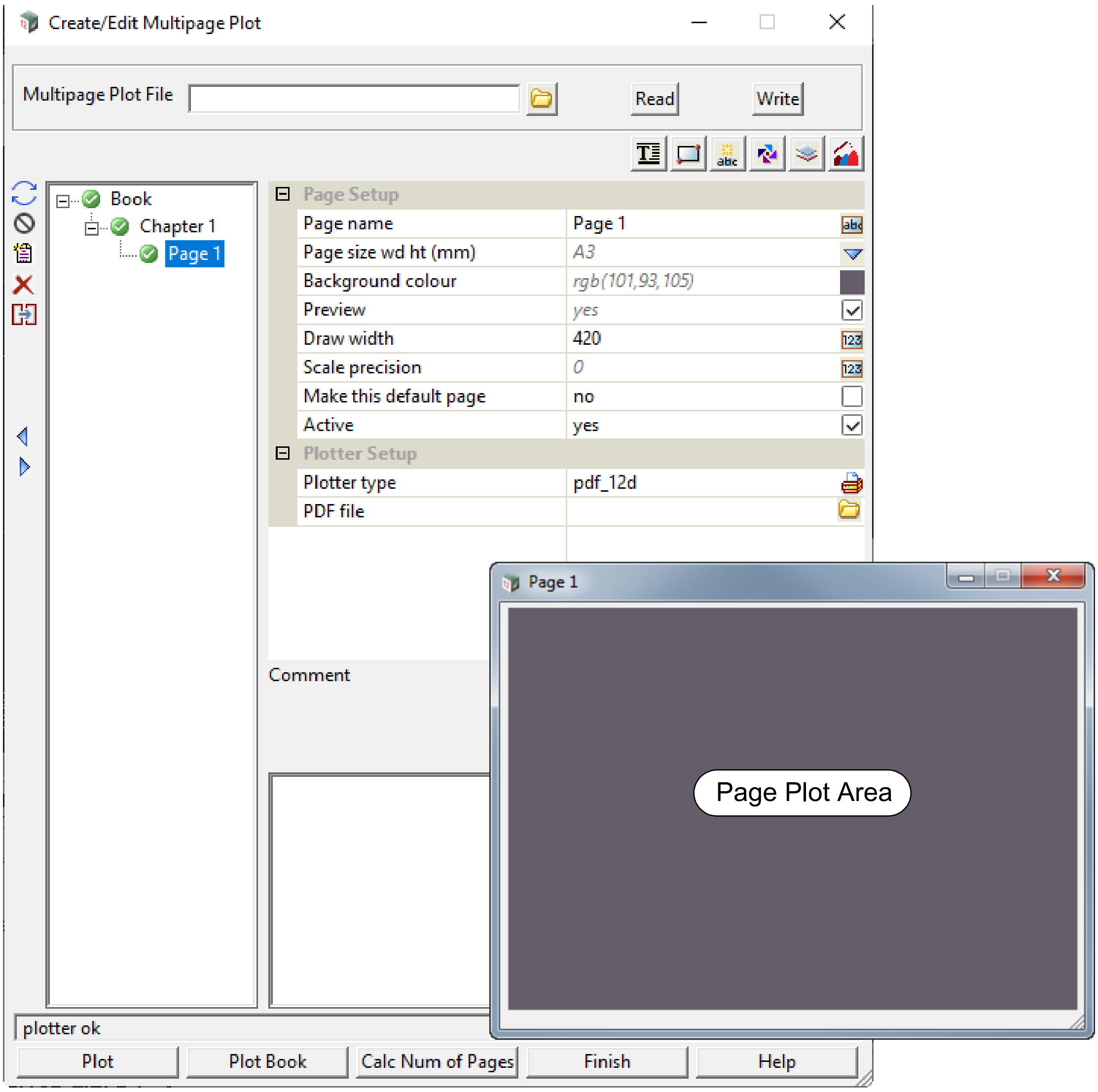
Important Note

If the **Chapter** is *inactive* then nothing in the Chapter will plot.

21.1.4.2 Page

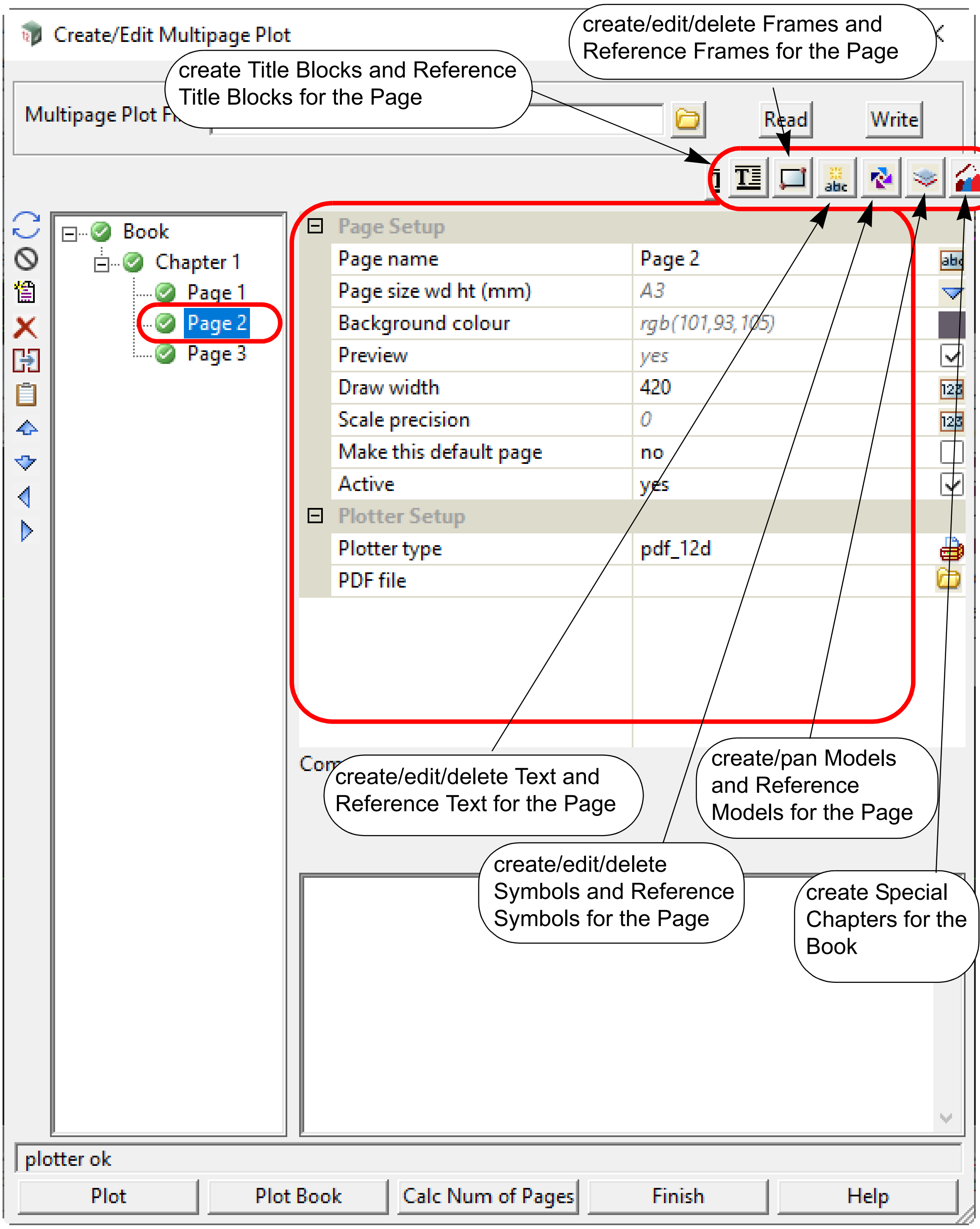
When a **Chapter** Node is selected and the **New Page** is clicked, a new **Page** Node is created.





All the icons and fields for a **Page** Node are documented in 21.1.4.2.1 Icons and Fields for a Page.

21.1.4.2.1 Icons and Fields for a Page



The icons, fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up

Icons on the Left Side

The icons on the left side change depending on what is applicable for the currently selected node.

The icons common to most Nodes are described in 21.1.4.3 Icons on the Left Side.

The icon that is special for a Page is:

New Page icon

*create a new **Page** Node for the **Chapter** that the currently selected **Page** Node is a Subnode of. See* 21.1.4.2 Page.

Icons on the Top Right

The icons are described in 21.1.4.4 Icons on the Top Right.

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Page Setup

Page name text box Page n

*Name of this Page Node. The default is **Page n** where **n** is the first number (integer from zero) to make the **Page name** unique amongst all Page Nodes in the tree.*

***Note**: the **Page name** can include **project attributes** as part of the name. For example:*

Page size wd ht (mm)* sheet box Chapter node value defined sheet sizes

*If **not blank**, the size of the page (in millimetres) for this Page.*
*If **blank**, the value from the equivalent Chapter Node field will be used.*

*The **Page size** is given as **width** followed by one or more spaces and the height. Or clicking on the choice icon brings up the defined **Page sizes** and one can be selected from the pop-up list.*

*Once a size has been typed in, or selected from the pop up, the **Page Plot Area** panel is drawn with an aspect ratio to match the selected page size.*

*If there is a Page size in the selected user title block file, the Page size is automatically set to that size and the **Page size** does not need to be used.*

Background colour* colour box Chapter node value available colours

*If **not blank**, the colour of the background for this Page.*

*If **blank**, the value from the equivalent **Chapter** Node field will be used.*

Preview* tick box Chapter node value

*If **ticked**, the contents of the Frame and Title Block Nodes of this Page Node will be approximately drawn ("previewed") in the **Page Plot Area**.*

*If **not ticked**, the contents of the Frame and Title Block Nodes will not be drawn in the **Page Plot Area**.*

***Note:** Re-establishing an inheritance link cannot be done for this field since it only has two states and cannot be left 'blank' in the same way as other fields.*

Draw width* integer box Chapter node value

*If **not blank**, the width in pixels of the Page Plot Area panel. This will change if the Page Plot Area is resized.*
*If **blank**, the value from the equivalent Chapter Node field will be used.*
*the height is then automatically determined by the aspect ratio of this Page Node (which is defined by **Page size wd ht (mm)**).*

Scale precision* integer box Chapter node value

*If **not blank**, the number of decimal places used for a Text $variable at the Page level.*

*If **blank**, the value from the equivalent Chapter Node field will be used.*

Make this default page tick box not ticked

*If **ticked**, then any new Page Nodes that are created will be duplicates of this **default page** (including any Subnodes).*

*If **not ticked**, then any new Page Nodes that are created will follow the standard inheritance rules and inherit the Setup values of their parents.*

***Note**: there can only be one Page Node with this field ticked at any one time. When this field is ticked on a second Page Node the field on the first Page Node will be un-ticked.*

Active tick box ticked

*If **ticked**, the currently selected node is made active and will be used when plotting. The Node's active/inactive icon will be set to active.*

*If **not ticked**, the currently selected node is made inactive and it (and all of its Subnodes) will be ignored when plotting. The Node's active/inactive icon will be set to inactive.*

Note: this tick box is linked to the Node's active/inactive icon. Changing one also changes the other.

Plotter Setup

*If the **Plot** button is pressed then the following fields define how the plotting of this **Page** occurs.*

Plotter type* plotter box Chapter node value pdf plotters

***Plotter type** to use for the plotting. This can only ever be a pdf plotter. This is an inherited field.*

*If **blank**, the value from the equivalent **Chapter** Node field will be used.*

PDF file file box *.pdf files

*Name of the pdf file that will be produced when plotting this **Page** individually.*

Fields and Buttons at the Bottom

Comment text box

*Users comments about this **Page**.*

Plot button

Plot from the currently selected node. Allows any Chapter, Special Chapter or Page Node to be plotted individually.

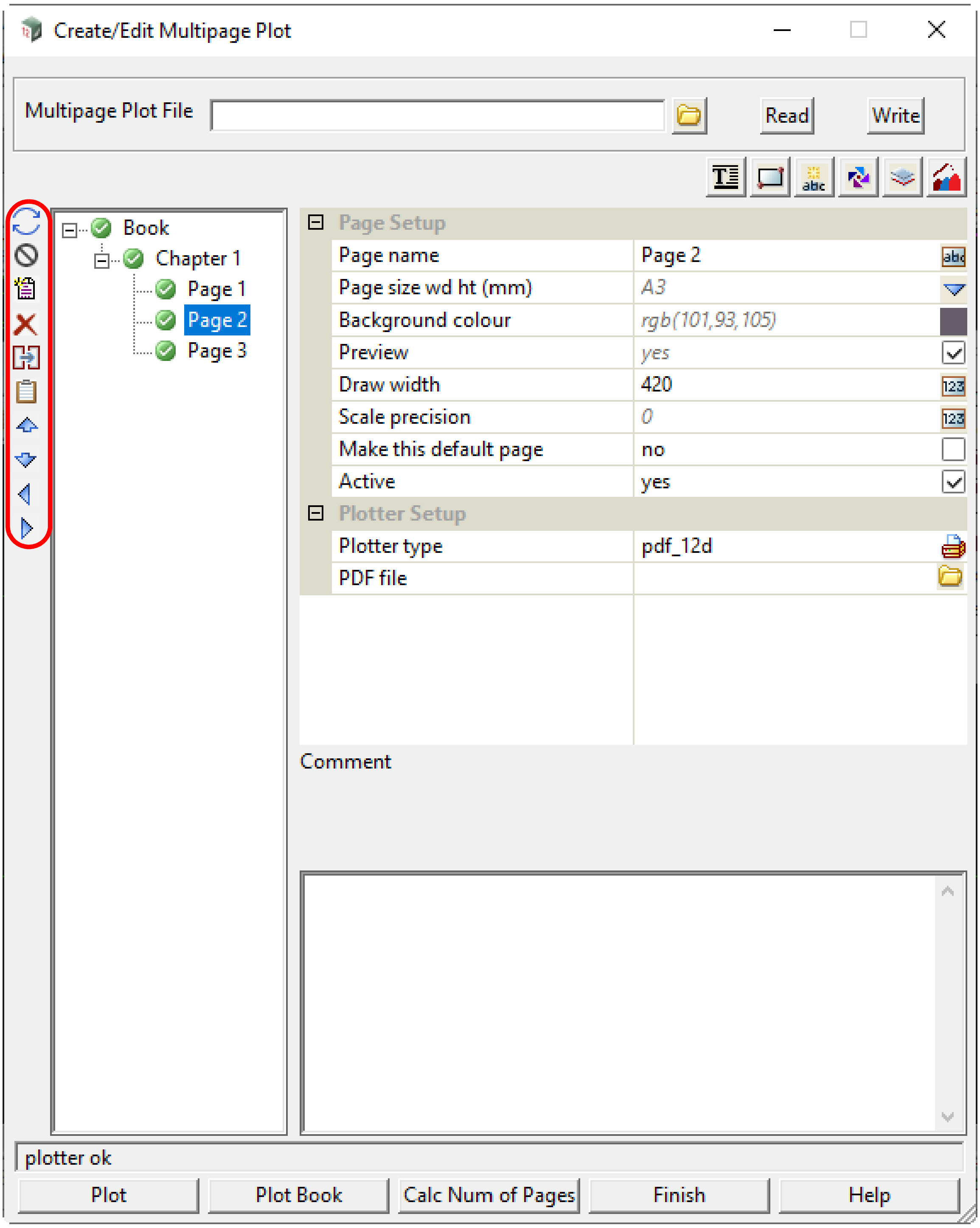
Plot Book button

*Plot the whole MPS tree from the **Book** Node down. Uses the **Plotter Setup** of the **Book** Node.*

Important Note

If the **Page** is *inactive* then nothing in the **Page** will plot.

21.1.4.3 Icons on the Left Side



The **icons on the left side** of the panel operate on the nodes of the tree.

Only the icons that are applicable for the currently selected node will appear.

Icons on the Left Side

 **Refresh** icon

refresh the field data in the tree and redraw the Plot Area drawings for the currently selected node and all its Subnodes.

*A typical use of **Refresh** is when data is added to, or removed from, a **model** and that **model** appears on a Node in the tree. A **Refresh** is needed to update the Plot Area of that Node to show the addition/removal.*

Activate icon

Make the currently selected node active.

***Note**: this icon is linked to the Node's active tick box. Changing one also changes the other.*

Deactivate icon

Make the currently selected node inactive.

***Note**: this icon is linked to the Node's active tick box. Changing one also changes the other.*

New Chapter or **New Page** icon

*If the **Book** Node is the currently selected node, then the icon will be **New Chapter** and will create a new **Chapter** Node for the **Book** when clicked.*

*If a **Special** Chapter Node is the currently selected node, then the icon will be **New Chapter** and will create a new **Chapter** Node for the **Book** when clicked.*

*If a **Chapter Node** is the currently selected node, then the icon will be **New Page** and will create a new **Page** Node for the **Chapter** when clicked.*

*If a **Page Node** is the currently selected node, then the icon will be **New Page** and will create a new **Page** Node for the **Chapter** that the currently selected **Page** Node is a Subnode of.*

Delete icon

Delete the currently selected node (and all its Subnodes) from the tree.

Copy icon

Copy the currently selected node (and all its Subnodes).

Paste icon

Paste the copied node into the tree after the currently selected node.

Move Up icon

*Move the currently selected node one position **up** the tree amongst its sibling nodes.*

***Note**: this icon only appears if the currently selected node has a sibling node above it in the tree.*

Move Down icon

*Move the currently selected node one position **down** the tree amongst its sibling nodes.*

***Note**: this icon only appears if the currently selected node has a sibling node below it in the tree.*

Previous Page icon

*Make the closest **Page** Node **up** the tree from the currently selected node the new currently selected node.*

***Note**: if there is no **Page** Node **up** the tree then this option will do nothing.*

Next Page icon

*Make the closest **Page** Node **down** the tree from the currently selected node the new currently selected node.*

***Note**: if there is no **Page** Node **down** the tree then this option will do nothing.*

Edit icon

Starts an edit on the currently selected node that allows its positioning to be adjusted via the Plot Area.

***Note**: this icon only appears if the currently selected node is a **Frame**, **Text** or **Symbol** Node.*

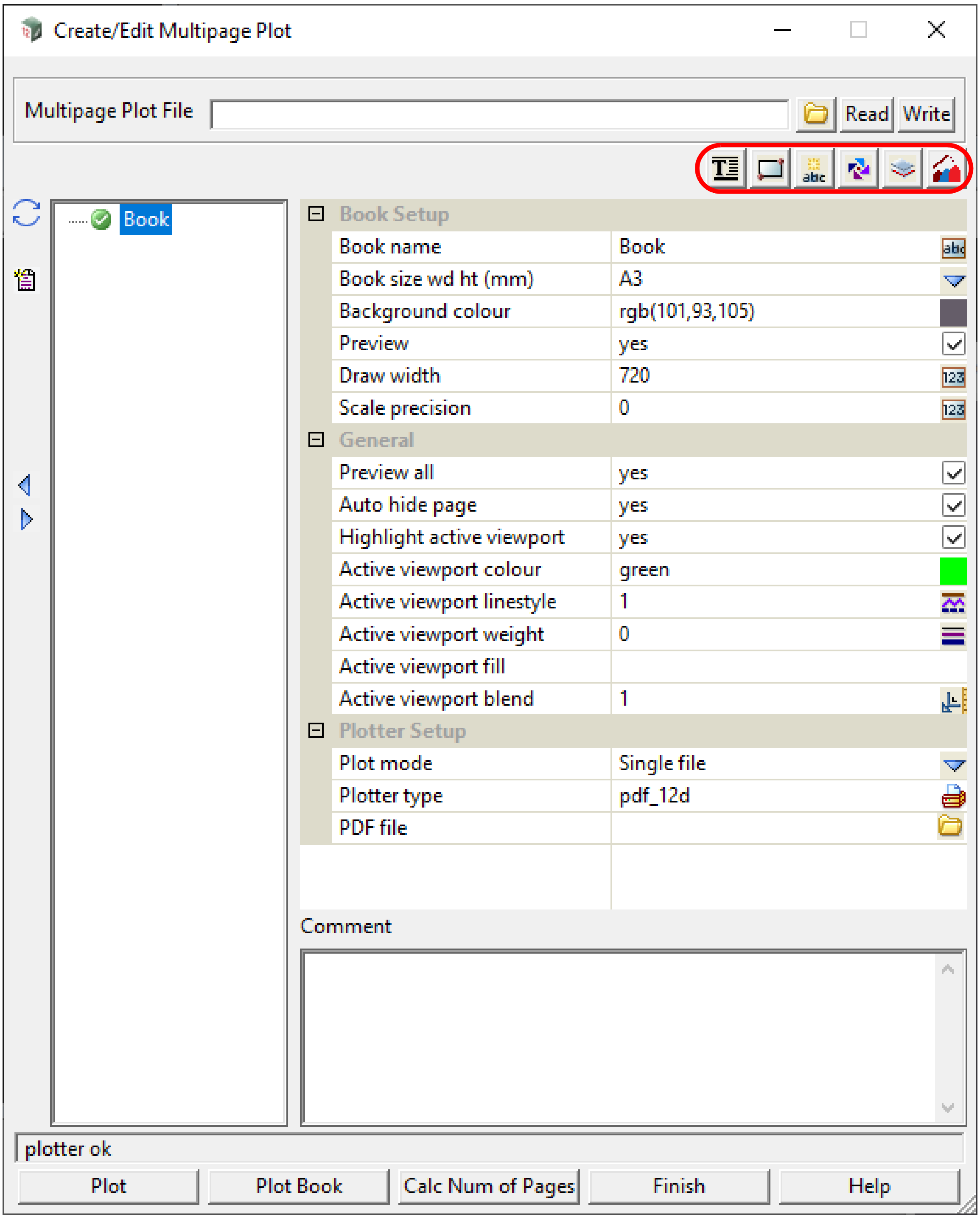
Pan icon

Starts a pan edit on the currently selected node that allows the data it displays to be panned via the Plot

Area.

***Note**: this icon only appears if the currently selected node is a **Frame** or **Model** Node.*

21.1.4.4 Icons on the Top Right



Icons on Top Right

The ***Title block****,* ***Frame****,* ***Text****,* ***Symbol*** *and* ***Model*** *icons can be used to create these items at the* ***Page*** *level.*

Title block icon

Create ***Title Blocks*** *and* ***Reference Title Blocks*** *for the currently selected node. For more detailed information, see* 21.1.4.6 Title Block.

Frame icon

Create/edit/delete ***Frames*** *and* ***Reference Frames*** *for the currently selected node. For more detailed* *information, see* 21.1.4.7 Frame.

Text icon

*Create/edit/delete **Text** and **Reference Text** for the currently selected node. For more detailed information, see* 21.1.4.8 Text Icon for Use on a Book, Chapter, Page or Frame Node

Symbol icon

*Create/edit/delete **Symbols** and **Reference Symbols** for the currently selected node. For more detailed information, see* 21.1.4.9 Symbol Icon for Use on a Book, Chapter, Page or Frame Node.

Model icon

*Create/pan **Models** and **Reference Models** for the currently selected node. For more detailed information, see* 21.1.4.10 Model Icon for Use on a Book, Chapter or Page.

Special Chapter icon

*Create **Special Chapters** for the Book. For more detailed information, see* 21.1.4.11 Special Chapter.

21.1.4.5 Inherited Fields *

There are a variety of cases where the value of a field is not explicitly set for the currently selected **Node** but is instead inherited from another Node above it in the MPS tree. These are called **Inherited Fields**. A field that is currently inheriting its value can be identified by the value appearing greyed out (grey scale font colour). Most of the fields for new **Chapter**, **Special Chapter**, **Page** and **Reference Nodes** are set to inherit by default for convenience.

Fields that support inheritance will be marked by a * symbol next to their **Field Description** in their **Node** types documentation.

While a field is inheriting it will reflect any changes made to the parent **Node's** value.

A field's inheritance can be severed at any time by manually entering a new value into it. This severance can be confirmed by the before greyed out value now appearing as fully opaque (black font colour).

A severed inheritance link can also be re-established at any time* by clearing out the value for a field. This will cause the field to repopulate from its parent **Node**. The value will appear greyed out once again to denote its inherited origin.

*inheritance links CANNOT currently be re-established for tick box type fields as there is no way to 'clear out' their value in the same way as other field types. So, show great care when severing tick box inheritance as it is permanent.

Options are being explored to rectify this hole in functionality.

Chapter/Special Chapter Nodes inherit values from the **Book Node**.

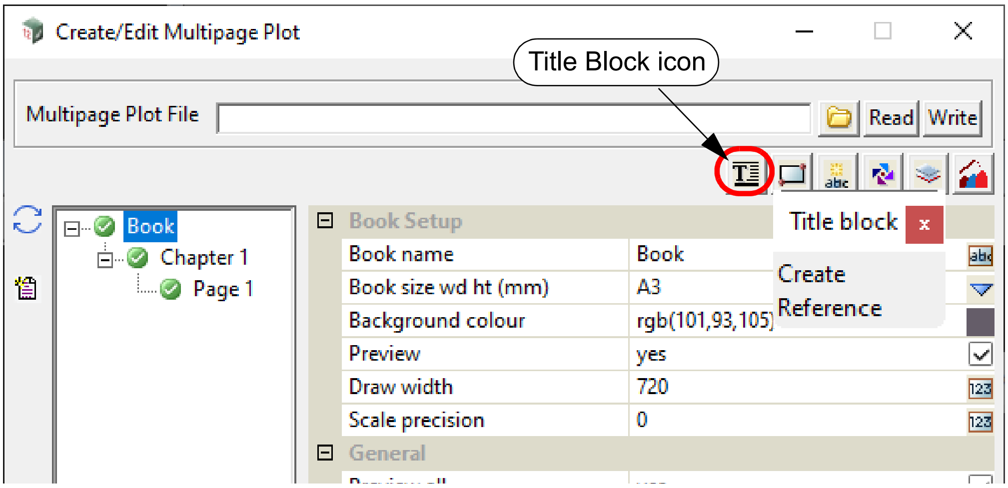
Page Nodes inherit values from their **Chapter Node**.

Reference Nodes inherit values from the **Node** that they reference.

21.1.4.6 Title Block

A **Title Block** Node can be inserted as a Subnode to any Book, Chapter, Special Chapter or Page Node in the tree by clicking the **Title Block** icon at the top right of the Editor panel.

If the currently selected node is a Book, Chapter, Special Chapter or Page Node then the **Title Block** will be inserted as a Subnode of the currently selected node.
If the currently selected node is any other kind of Node then the **Title Block** will be inserted as a Subnode of the Book, Chapter, Special Chapter or Page Node that the currently selected node is a Subnode of.



There are two options when adding a **Title Block** to a Node:

Title Block - Create

Create a new blank **Title Block** Node.

See 21.1.4.6.1.1 Creating a Title Block Node.

Title Block - Reference

Create a new **Reference Title Block** Node that will reference an existing **Title Block** Node to get its default field values. These values can then be freely modified by the user.

See 21.1.4.6.1.2 Creating a Reference Title Block Node.

Note: no **Reference** Nodes can be inserted at the **Book** level.

Important Note:

Title Block and **Reference Title Block** Nodes will be represented in the **Plot Area** if their parent node has the **Preview** field **ticked**.

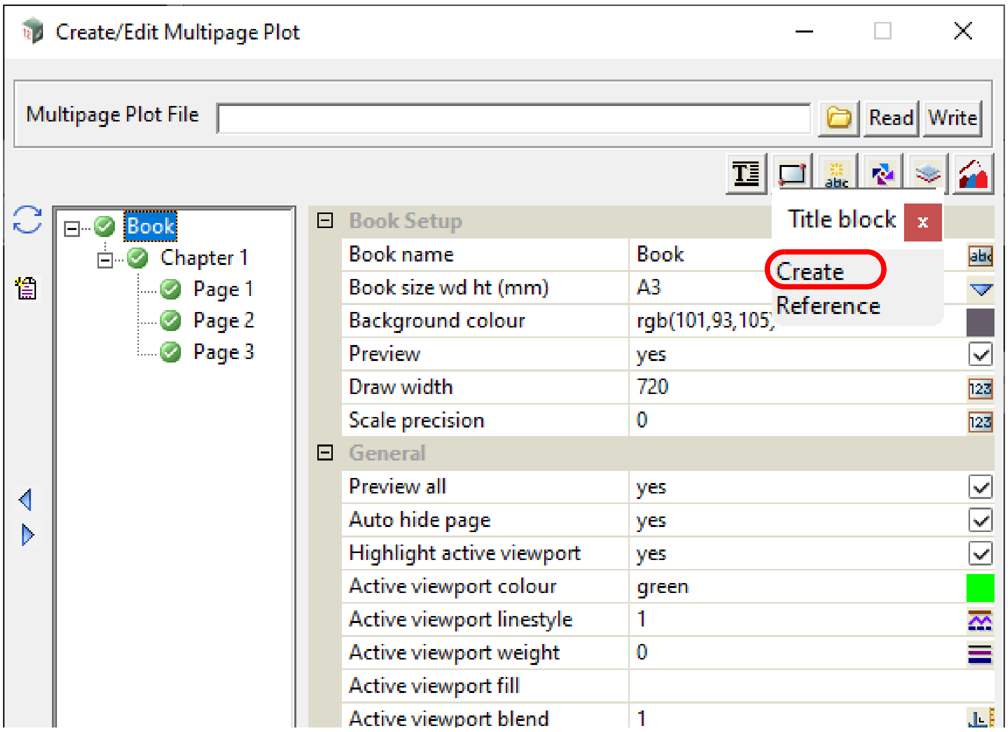
21.1.4.6.1 Creating Title Blocks

21.1.4.6.1.1 Creating a Title Block Node

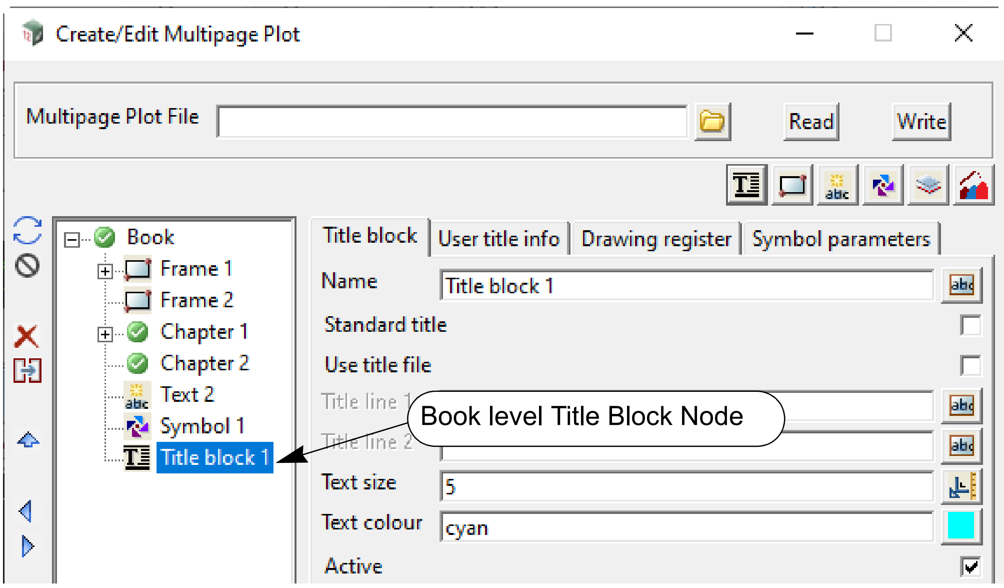
The process for creating a **Title Block** Node at the **Book** level will be described in detail here. The same process can also be used to create a **Title Block** Node at the Chapter, Special **Chapter** or **Page** level.

To create a **Title Block** Node at the **Book** level the currently selected node must be either the **Book** Node itself or an existing **Book** Subnode (excluding Chapter or Special Chapter Nodes).

Clicking the **Title Block** icon at the top right of the Editor panel will bring up the **Title Block** menu.



Selecting **Create** from the **Title Block** menu will result in the new **Title Block** Node being inserted at the **Book** level.

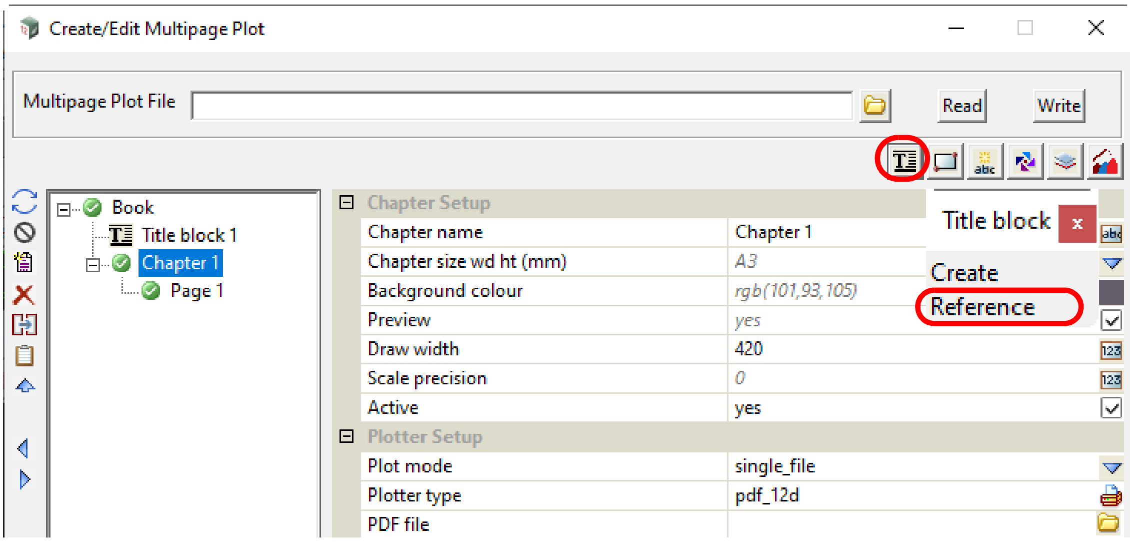


21.1.4.6.1.2 Creating a Reference Title Block Node

The process for creating a **Reference Title Block** Node at the **Chapter** level will be described in detail here. The same process can also be used to create a **Reference Title Block** Node at the **Special Chapter** or **Page** level.

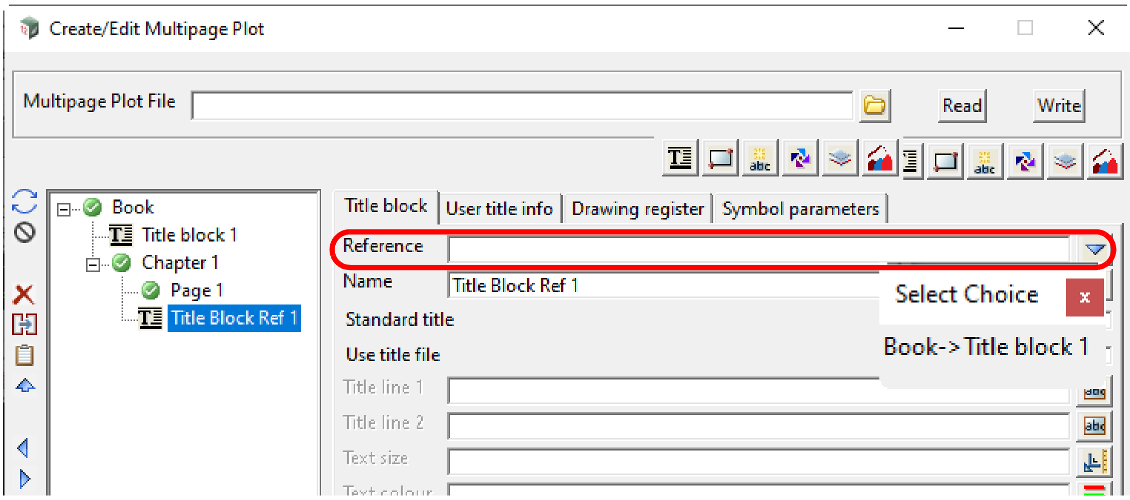
To create a **Reference Title Block** Node at the **Chapter** level the currently selected node must be either the **Chapter** Node itself or an existing **Chapter** Subnode (excluding Page Nodes).

Clicking the **Title Block** icon at the top right of the Editor panel will bring up the **Title Block** menu.



Selecting **Reference** from the **Title Block** menu will result in the new **Reference Title Block** Node being inserted at the **Chapter** level.

Note: no **Reference** Nodes can be inserted at the **Book** level.
The newly inserted **Reference Title Block** Node has a blank Reference field.

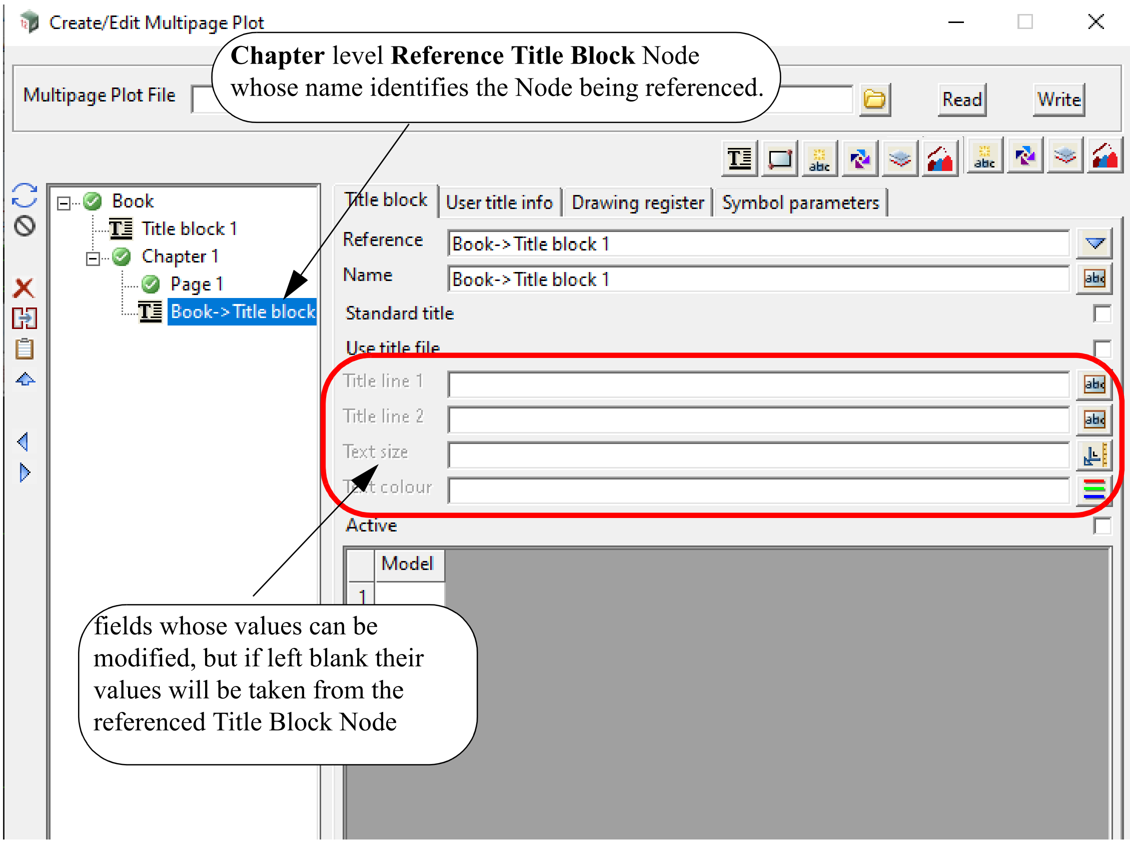


The drop-down list of the **Reference** field will show all of the existing **Title Block** Nodes that the **Reference Title Block** Node could reference. Only Nodes from higher levels of the tree can be referenced so in this **Chapter** case the list will only contain **Title Block** Nodes from **Book** level.

Once a **Title Block** Node to reference has been selected the name of the **Reference Title Block** Node will be changed to the full tree path of the referenced **Title Block** Node. The Node name can be freely modified by the user.

All of the fields of the **Reference Title Block** Node will appear blank to show that they are being referenced. All the referenced fields will use the values of the equivalent field of the referenced **Title**

Block Node. A referenced field can be overridden by entering a value into its blank field. This new field value will then be used when plotting the **Reference Title Block** Node.



Neat Tricks

If you don't want a **Book** level **Title Block** Node to plot for a particular **Chapter**, then create a **Reference Title Block** Node for the **Chapter** and have that Node reference the **Book** level **Title Block** Node that you don't want to plot and make the **Reference Title Block** Node inactive.

Conversely if there is an inactive **Book** level **Title Block** Node that you do want to plot for a particular **Chapter**, then create a **Reference Title Block** Node for the **Chapter** and have that Node reference the inactive **Book** level **Title Block** Node that you want to plot. As long as the **Reference Title Block** Node remains active it will plot.

These tricks can be applied to many other scenarios.

21.1.4.6.2 Icons and Fields for Title Block Nodes

The icons, fields and buttons used in this panel have the following functions:

Field Description Type Defaults Pop-Up

Icons on the Left Side

The icons on the left side change depending on what is applicable for the currently selected node.

The icons common to most Nodes are described in 21.1.4.3 Icons on the Left Side.

Icons on the Top Right

The icons are described in 21.1.4.4 Icons on the Top Right.

Buttons at the Bottom of each Tab

Set button

Must be pressed for any new field values in any of the tabs to take effect.

Title Block Tab

Reference choice box referenceable Title Block Nodes

Title Block Node that this Node is referencing.

When a Node is selected from the drop-down list the ***Name*** *field value will be changed to the full tree path of the referenced Title Block Node.*

Note*: this field only appears for Reference Title Block Nodes.*

Name text box Title Block n

Name of this Title Block Node. The default is ***Title Block n*** *where* ***n*** *is the first number (integer from zero) to make the* ***Name*** *unique amongst all Title Block Nodes in the tree.*

Standard title tick box not ticked

If ***ticked****, a standard 12d title block will be used.*

Use title file tick box not ticked

If ***ticked****, a user defined title file will be used.*

Title line 1 text box

If ***Standard title*** *is* ***ticked****, then* ***Title line 1*** *is the first line of title text.*

If ***Use title file*** *is* ***ticked****, then* ***Title line 1*** *is substituted for the Title Block variable $title_1.*

Title line 2 text box

If ***Standard title*** *is* ***ticked****, then* ***Title line 2*** *is the second line of title text.*

If ***Use title file*** *is* ***ticked****, then* ***Title line 2*** *is substituted for the Title Block variable $title_2.*

Text size measure box 5

If ***Standard title*** *is* ***ticked****, then this is the text size of title text.*

Text colour colour box cyan available colours

If ***Standard title*** *is* ***ticked****, then this is the colour of title text.*

Active tick box ticked

If ***ticked****, the currently selected node is made active and will be used when plotting. The Node's active/inactive icon will be set to active.*
If ***not ticked****, the currently selected node is made inactive and will be ignored when plotting. The Node's active/inactive icon will be set to inactive.*
Note*: this tick box is linked to the Node's active/inactive icon. Changing one also changes the other.*

Grid of models grid of model boxes available models

If ***not blank****, the models in the grid are plotted as part of the plot.*

For more information on plot data models, see 23.7.2.7.1.1.1 Plot Data Models.

User Title Info Tab

Title file file box available title files

*Name of the title block file (.tbf) to use. If a valid tbf exists, the **Name** fields of the grid will be populated using aliases of the title block variables $user_text_n that are specified in the tbf.*

Name output

Alias for the nth user text specified in the title block file.

Value text box

*Text to be substituted in for associated user text **Name**.*

Time format text box

Format to be used for the title block variable $time.

For more information on the available time formatting options, see 23.7.2.7.2.7 Specifying the Format for $time - Time Format.

Start page number integer box 1

Used as the starting value for the title block variable $page_number.

*If **blank**, then $page_number will start at 1.*

Start drawing number integer box 1

used as the starting value for the title block variable $drawing_number.

*If **blank**, then $drawing_number will start at 1.*

Drawing number prefix text box

Used as the value for the title block variable $drawing_number_prefix.

Drawing number postfix text box

Used as the value for the title block variable $drawing_number_postfix.

Drawing Register Tab

Enable drawing register tick box ticked

*If **ticked**, the drawing register fields are used.*

Register type choice box Excel
CSV

Type of file that is being used for the drawing register.

*if **EXCEL**, use an Excel file.*

*if **CSV**, use a CSV file.*

Register file file box available register files

Name of the drawing register file to use.

*if **Register type** is **EXCEL**, then will accept a .xlsx or .xls file.*

*if **Register type** is **CSV**, then will accept a .csv file.*

Worksheet text box

*If **not blank** and **Register type** is **EXCEL**, then the name of the worksheet to use in the **Register file**.*

Grid

Names and values in this grid are used to generate a search query that will identify the row to be used from the drawing register for each title block.

Name text grid cell

*Name of the column in the drawing register to search through for the associated **Value**.*

Value text grid cell

*Value to search for in the specified column (**Name**) of the drawing register.*

21.1.4.6.3 MPS Title Block $variables

Title Block $variables in MPS are populated from a Frame Node of the users choosing at the level where plotting is currently occurring.

The Frame Node to use is identified by the **Use to populate title block** field that is present on all Page level Frame Nodes. Only one Frame Node on each Page may have the field set at any given time, so there can only ever be one Frame Node linked to a Title Block Node.

For the $variables to populate correctly the specified Frame Node must appear before the Title Block Node in the plotting order.

If no Frame Node is specified for the population of the $variables or if the specified Frame Node appears after the Title Block Node in the plotting order, then the $variables will not be populated correctly. This will most likely result in the $variables having their default values, which is predominately blank/empty. Scale $variables are an exception and usually default to 1000.

The Title Block Node will only set the $variables that are associated with the Frame Node type that it populates from.

e.g.. If we are populating from a Long Section Frame, then the Plan Frame specific $variable $rotation will not be set.

For more information on plot specific $variables see 23.7.2.7.2.9 Plot Details.

Note: The Title Block behaviour described above was introduced in ***V14 C2g***. Before that the Title Block $variables were populated off of the last active Frame Node on each level. To guarantee upwards compatibility 12d model automatically sets the **Use to populate title block** field on Frame Nodes when reading a pre ***V14 C2g*** mpsf so that the old 'last frame' behaviour is preserved in newer versions where it is no longer standard.

For more information on the various Frame Nodes and their fields (including the **Use to populate title block** field) see:

21.1.4.7.6 Plan Frame

21.1.4.7.7 X Section Frame

21.1.4.7.8 Long Section Frame

21.1.4.7.9 Perspective Frame

21.1.4.7.10 Section Frame

21.1.4.7.11 3D PDF Frame

21.1.4.7.12 Node Diagram Frame

21.1.4.6.3.1 $plot_file

The plot file $variable is much more dynamic in MPS than standard plotting. It will change to match the name of the current Book, Chapter or Page Node that is being plotted.

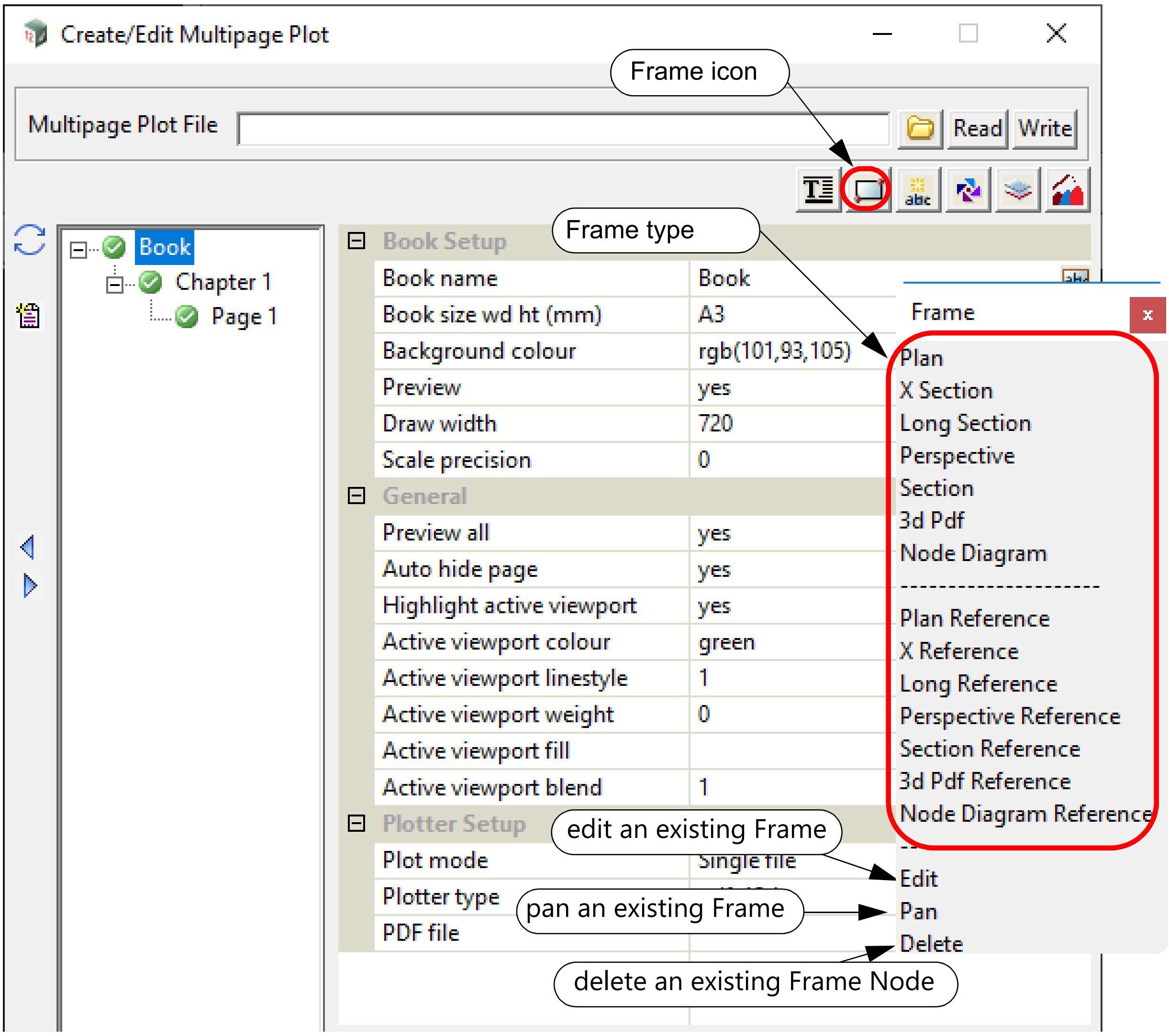
21.1.4.6.3.2 $scale/$horizontal_scale/$vertical_exaggeration

In the case where there are multiple Frame Nodes being plotted at the same level and you want to plot the $scale (or $horizontal_scale or $vertical_exaggeration) value for more than one of them you will not be able to do so using Title Blocks alone. It is recommended that you use Frame level Text Nodes (Frame Text) to accomplish this. Frame Text has been tailored to handle some $variables in a much more flexible way.

For more detailed information, see 21.1.4.8.2 Creating Frame Text and 21.1.4.8.6 MPS Text $variables.

21.1.4.7 Frame

A **Frame** Node can be inserted as a Subnode to any Book, Chapter, Special Chapter or Page Node in the tree by clicking the **Frame** icon at the top right of the Editor panel.



Frame - Create

21.1.4.7.1 Creating Frames for a Book
21.1.4.7.2 Creating Frames in a Chapter
21.1.4.7.3 Creating Frames on a Page

Frame - Edit

Used to move or modify the **Plot Area Frame** of a **Frame** Node. The **Frame** to edit is identified by pick from the **Plot Area**. A **Frame** can only be picked from the **Plot Area** it was created on. e.g.. A Book level **Frame** cannot be picked from a Page level **Plot Area**.

Note: a **Frame** can also be edited by selecting its **Frame** Node in the tree and clicking the **Edit** icon on the left hand side.

For further information see 21.1.4.7.13 Edit Frame.

Frame - Pan

Used to pan the drawing inside the **Plot Area Frame** of a **Frame** Node. The **Frame** to pan is identified by pick from the **Plot Area**. A **Frame** can only be picked from the **Plot Area** it was created on. e.g.. A Book level **Frame** cannot be picked from a Page level **Plot Area**.

Note: a **Frame** can also be panned by selecting its **Frame** Node in the tree and clicking the **Pan** icon on the left hand side.

Frame - Delete

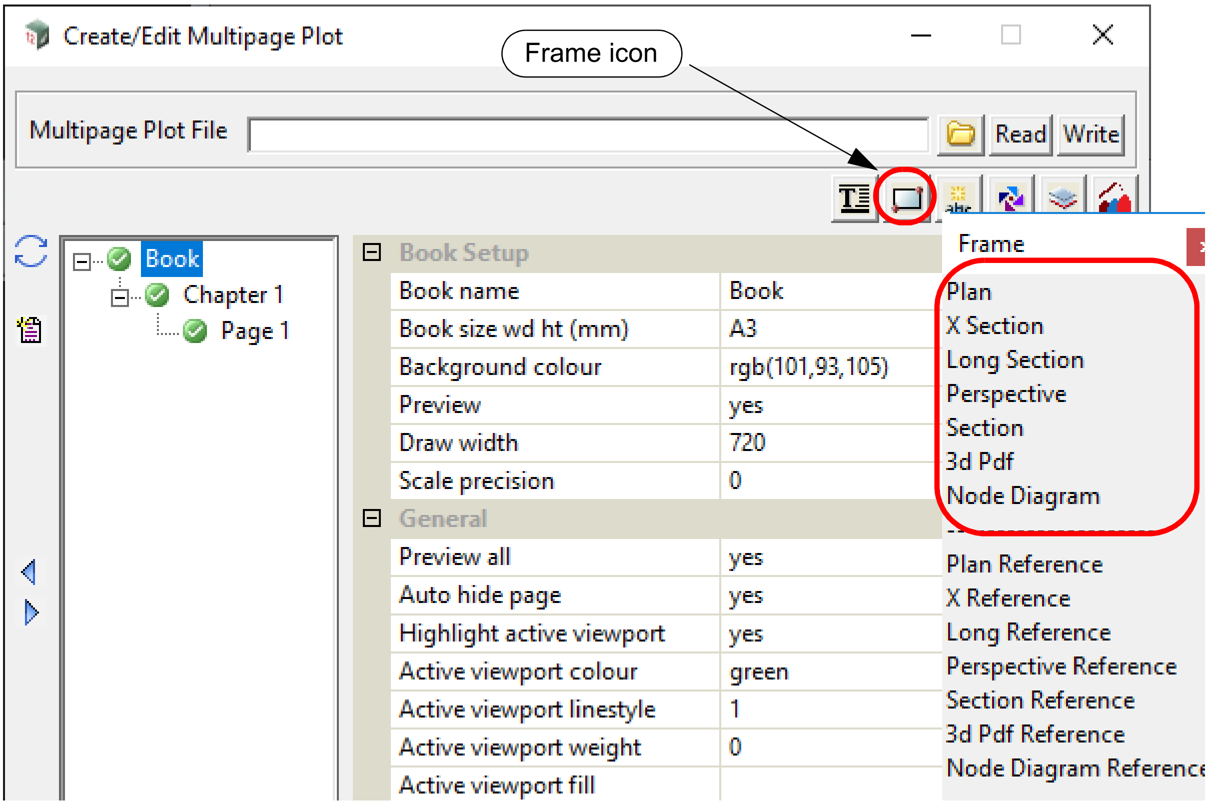
Used to delete a **Frame** Node from the tree. The **Frame** Node to delete is identified by picking its **Frame** from the **Plot Area**. A **Frame** can only be picked from the **Plot Area** it was created on. e.g.. A Book level **Frame** cannot be picked from a Page level **Plot Area**.

Note: a **Frame** Node can also be deleted by selecting it in the tree and clicking the **Delete** icon on the left hand side.

21.1.4.7.1 Creating Frames for a Book

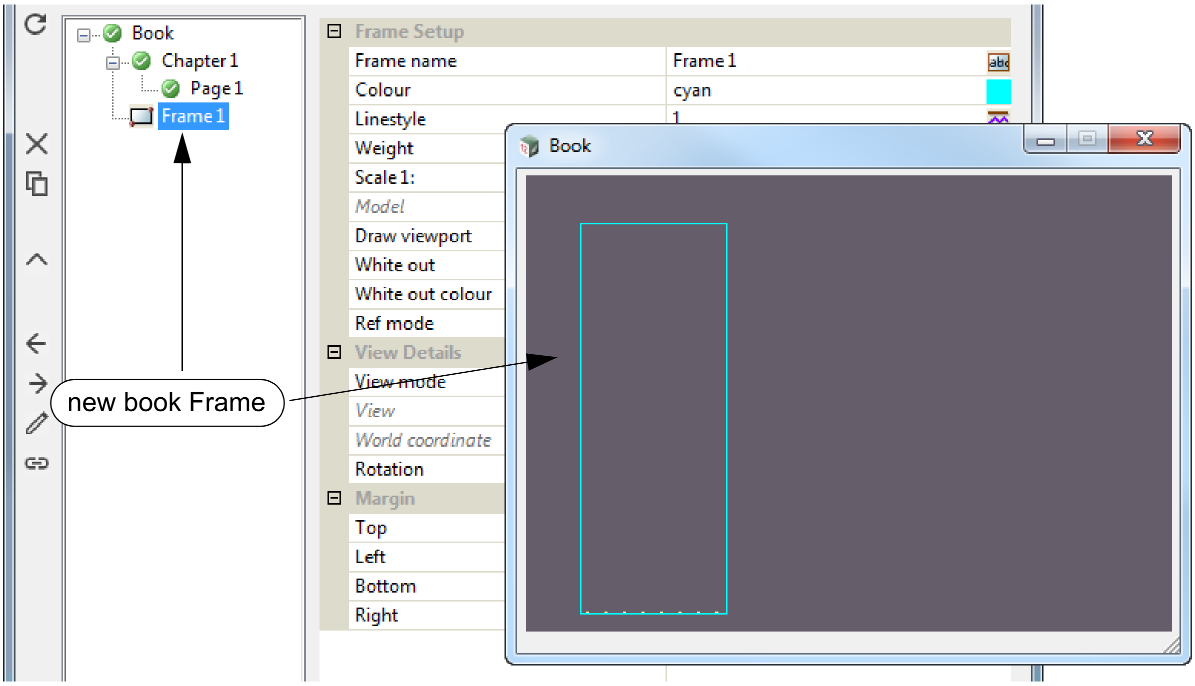
21.1.4.7.1.1 Frames for a Book

To create a **Frame** for the **Book**, click on **Book** to display the **Book Plot Area** and then click on the **Frame** icon and select either **Plan**, **X Section**, **Long Section**, **Perspective, Section** or **Pdf 3D**.

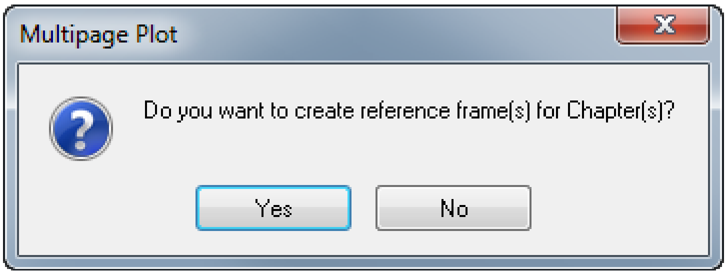


The user then creates a new **Book Frame** by drawing the rectangle representing the Frame in the **Book Plot Area**.

A **Book Frame** node is then automatically created at the bottom of the **Book** level with the name **Frame n** where **n** is the next integer that makes the name **Frame n** unique for the **Book Frames**.



The **Multipage Plot Yes-No** panel then comes up and asks if you want to create reference frames of the Frame for each **Chapter** in the Book.



(a) If **Yes** is selected, a **Book Frame** called "Frame n" is created and the field **Ref mode** for the **Book Frame** is set to ***Ref at Chapter***.

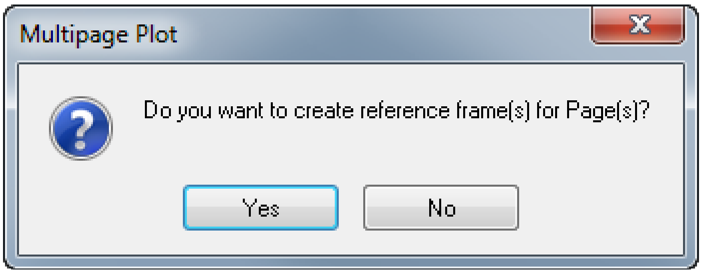
Then for each **Chapter** in the **Book**, a **Chapter Frame** is created and each **Chapter Frame** references back to the **Book Frame**.

The name of the **Reference Chapter Frame** in each Chapter will be "Book ->Frame n"

Note:
If the **Book Frame** is **Referenced** in a **Chapter**, then in that **Chapter** all the fields of the reference Book Frame initially have the values from the Book Frame but can then be optionally overridden at the Chapter level.

(b) If **No** is selected, then no **Chapter Frames** referencing back to the **Book Frame** are created.

The **Multipage Plot Yes-No** panel then comes up and asks if you want to create reference frames for each **Page** in the Book.



(a) If **Yes** is selected and **Yes** was **also** selected for the Chapter Reference question, a **Page Frame** is created for each **Page** in the **Book** and the created **Page Frame** references back to the **Chapter Frame** which in turn references back to the **Book Frame**.

The name of the **Reference Page Frame** will be "Chapter m ->Book ->Frame n" where "Chapter m" is the name of the Chapter.

The field **Ref mode** for the **Chapter Frame** is set to ***Ref at Page***.

Note:
If the **Book Frame** is **Referenced** in a **Chapter** and that **Chapter Frame** is **Referenced** in a **Page**, then for that **Page**, all the fields of the Reference Book-Chapter Frame initially have the values from the Book Frame but the values can be optionally overridden at the Chapter level, and/or overridden at the **Page** level. So what is used on the Page is determined by the values at the Book, Chapter and page level.

(b) If **Yes** is selected and **No** was selected for the Chapter Reference question, a **Book Frame** is created AND a **Page Frame** is created for each **Page** in the **Book** and the created **Page Frame** references back to the **Book Frame.** For more information see 21.1.4.7.14 Reference Frames.

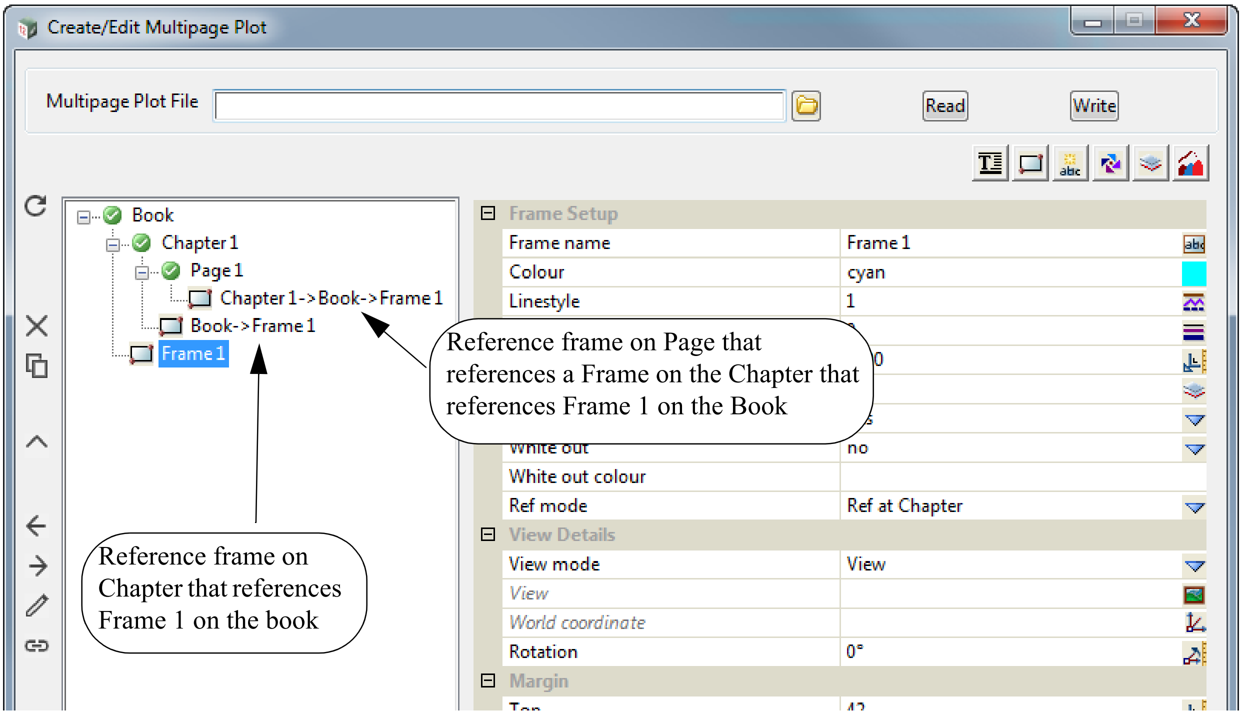
The name of the **Reference Page Frame** will be "Book ->Frame n" where "Frame n" is the name of the Book Frame.

The field **Ref mode** for the **Book Frame** is set to ***Ref at Page***.

Note:
If the **Book Frame** is **Referenced** in a **Page a**nd not to a Chapter Frame that then references to the Book Frame**,** then in that **Page** all the fields of the reference Book Frame initially have the values from the Book Frame but they can then be optionally overridden at the Page level.

(c) If **No** is selected, then no **Page Frames** referencing back to the **Book Frame** are created.

NOTE:
If the **Book Frame** is **NOT Referenced** in either a **Chapter** or a **Page**, the **Book Frame** and its contents are used without modification for all the **Pages** in the **Book.**



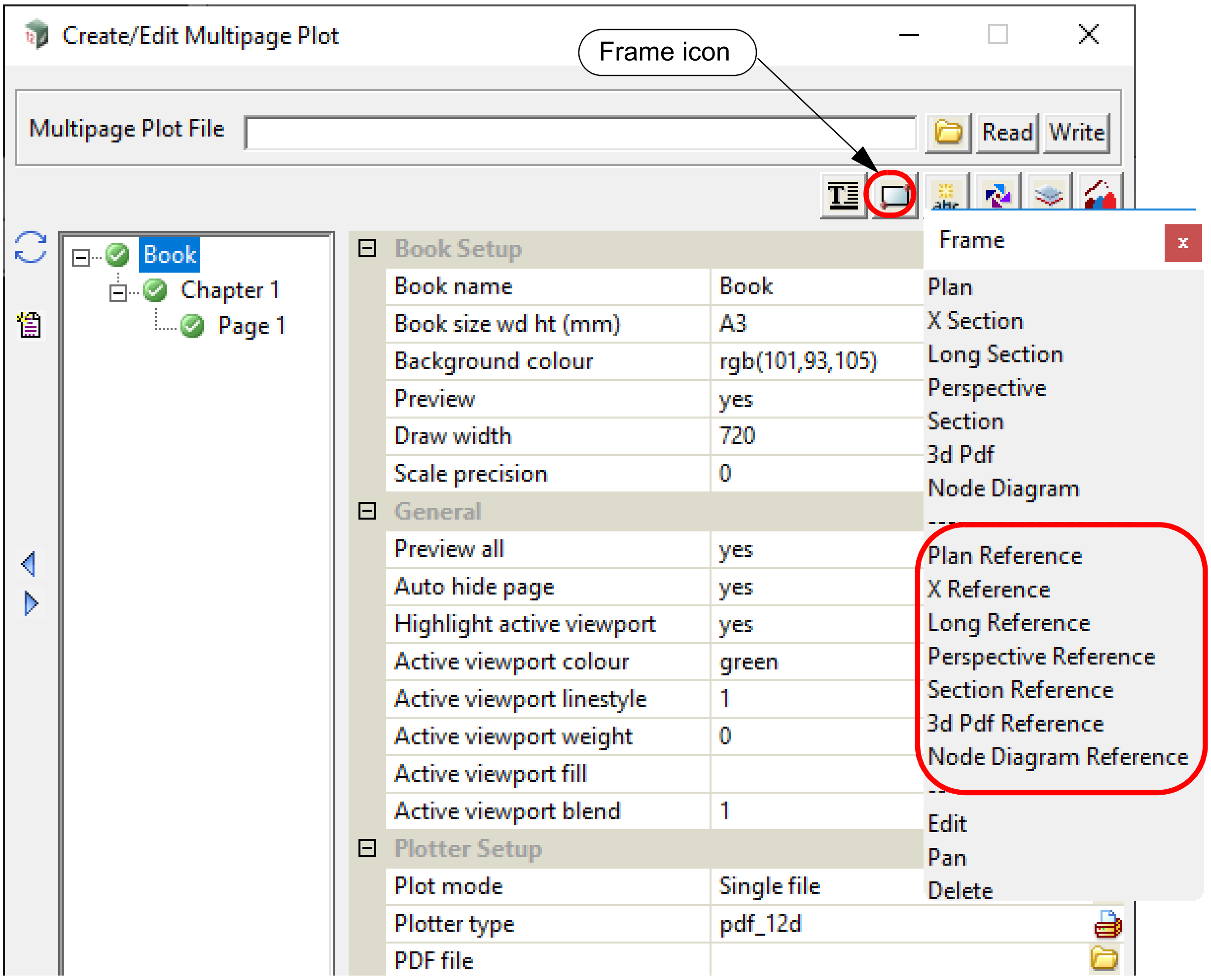
For the description on creating and editing Frames, see 21.1.4.7.5 Common Information About Frames.

Important Notes

1. The order of the items in the Tree is important as it is the drawing order. See 21.1.4.7.4 Plotting Order of Frame Nodes.
2. **Book Frame** names have to be unique within the **Book**.

21.1.4.7.1.2 No Reference Frames for a Book

The options **Plan Reference**, **X Reference**, **Long Reference, Perspective Reference, Section Reference** or **Pdf 3D Reference DO NOT** work for a **Book**.

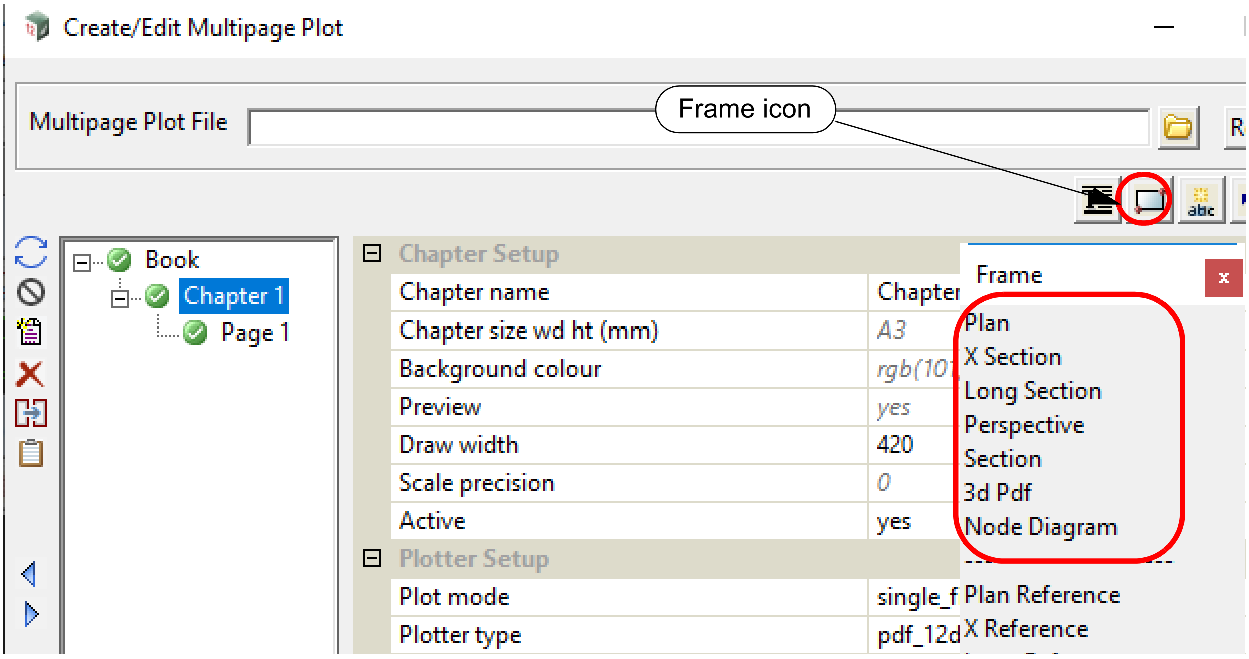


Selecting any of the menu items **Plan Reference**, **X Reference, Long Reference**, **Perspective Reference**, **Section Reference** or **Pdf 3D Reference** will do nothing.

21.1.4.7.2 Creating Frames in a Chapter

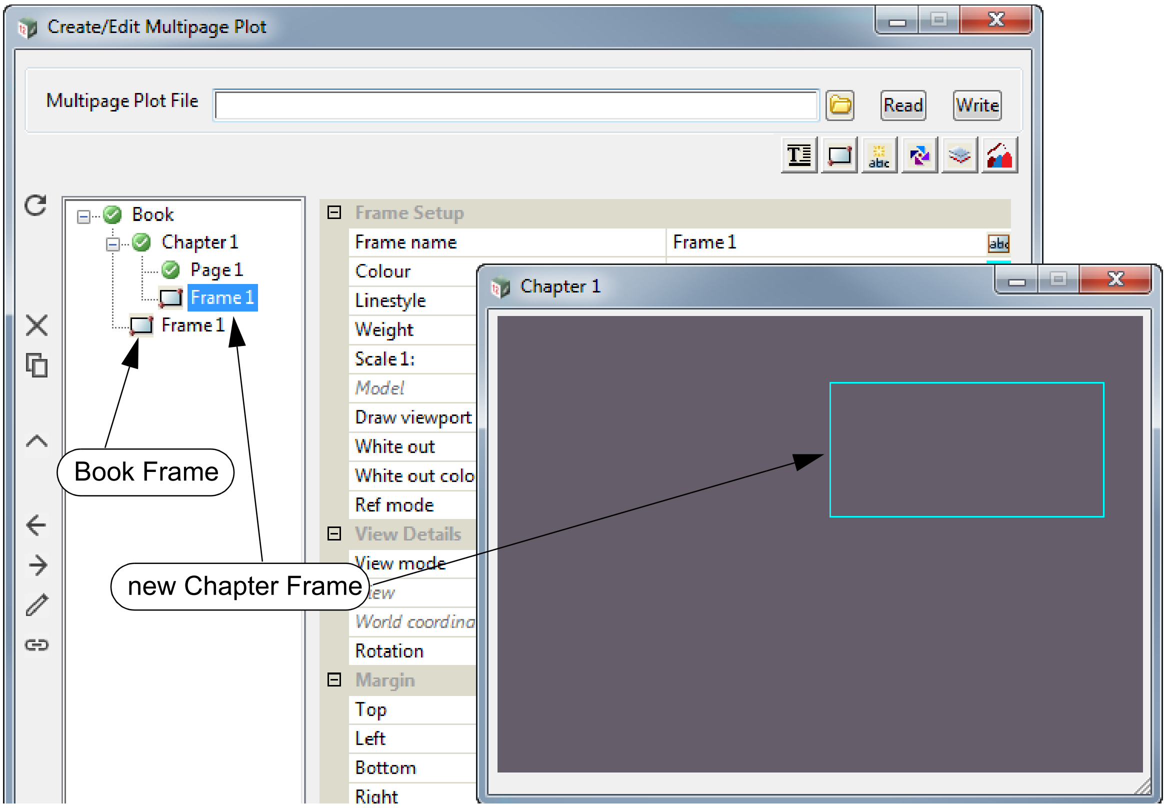
21.1.4.7.2.1 Frames for a Chapter

To create a **Frame** for a **Chapter**, click on the **Chapter** to display the **Chapter Plot Area** and then click on the **Frame** icon and select either **Plan**, **X Section**, **Long Section, Perspective, Section** or **Pdf 3D**.

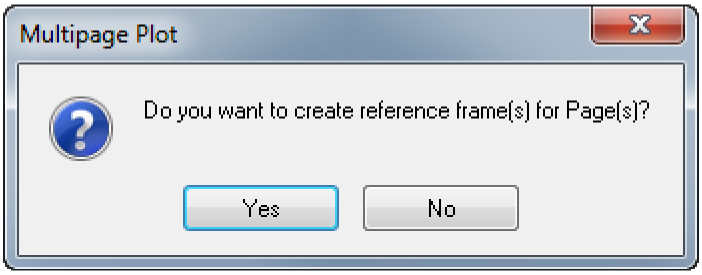


The user then creates a new **Chapter Frame** in the **Chapter Plot Area**.

A **Chapter Frame** node in the highlighted **Chapter** is then automatically created at the bottom of that **Chapter** with the name **Frame n** where **n** is the next integer that makes the name **Frame n** unique for the **Chapter Frames** for that highlighted *Chapter*.



The **Multipage Plot Yes-No** panel then comes up and asks if you want to create reference frames for each **Page** in the **Chapter**.



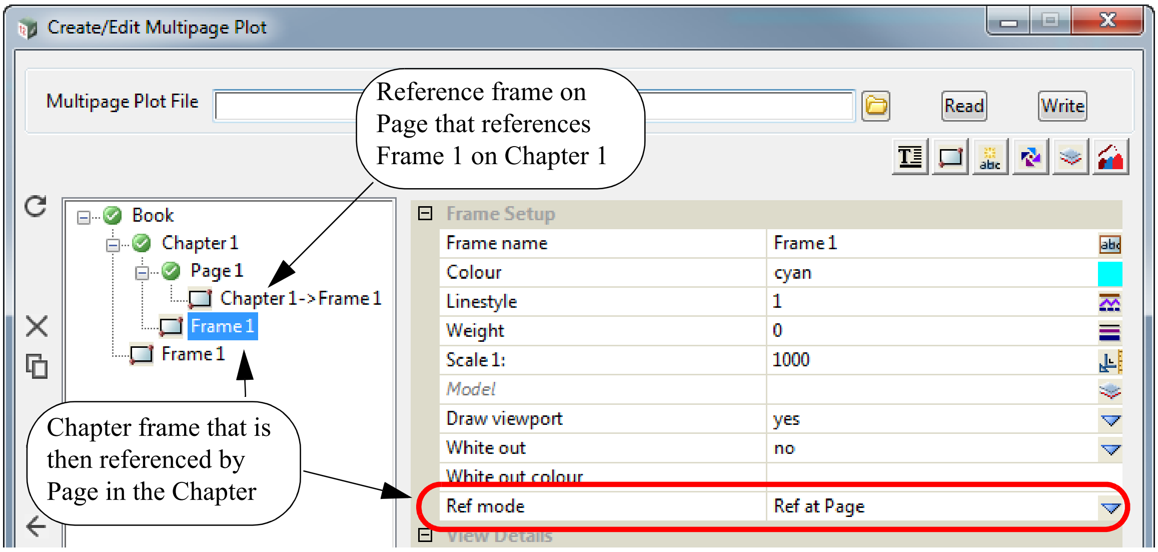
(a) If **Yes** is selected, a **Chapter Frame** called "Frame n" is created and the field **Ref mode** for the **Chapter Frame** is set to ***Ref at Page***.

Then for each **Page** in the **Chapter**, a **Page Frame** is created for each **Page** (a **Reference Page Frame**) and each **Page Frame** references back to the **Chapter Frame.**

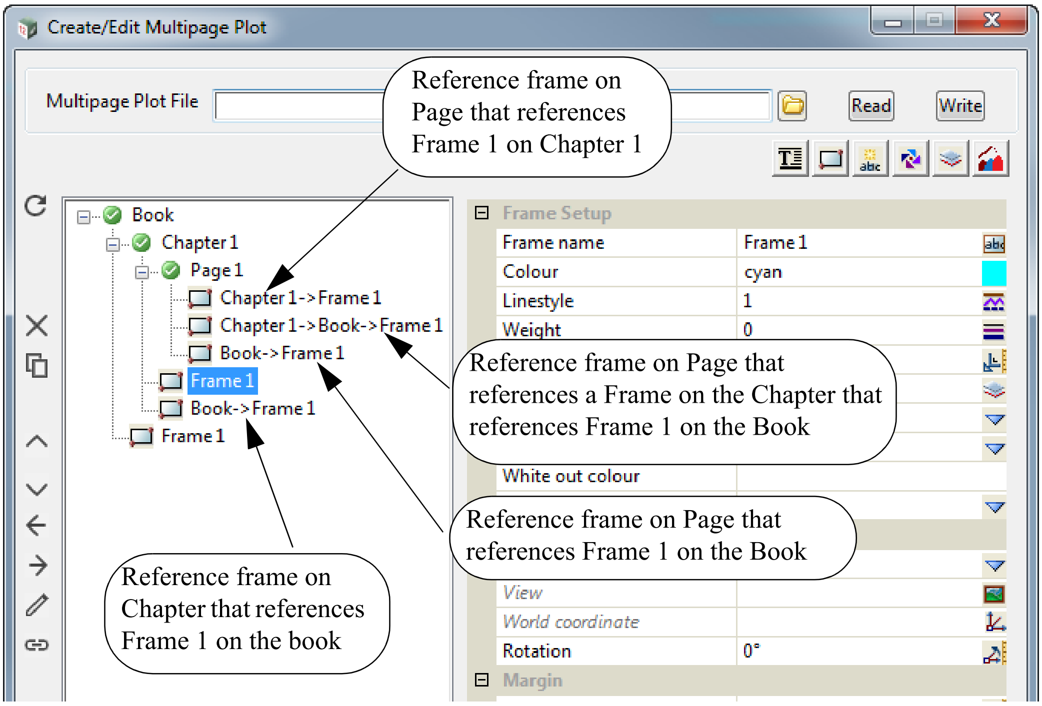
The name of the **Reference Page Frame** in each Page in the Chapter is "Chapter m ->Frame n" where "Chapter m" is the name of the **Chapter**.

(b) If **No** is selected, then no **Page Frames** referencing back to the **Chapter Frame** are created.

NOTE:
If the **Chapter Frame** is **NOT Referenced** in a **Page**, the **Chapter Frame** and its contents are used without modification for all the **Pages** in the **Chapter**.



Even though there are two Frames named "Frame 1", they are different because one is a Book Frame and the other is a Chapter Frame.



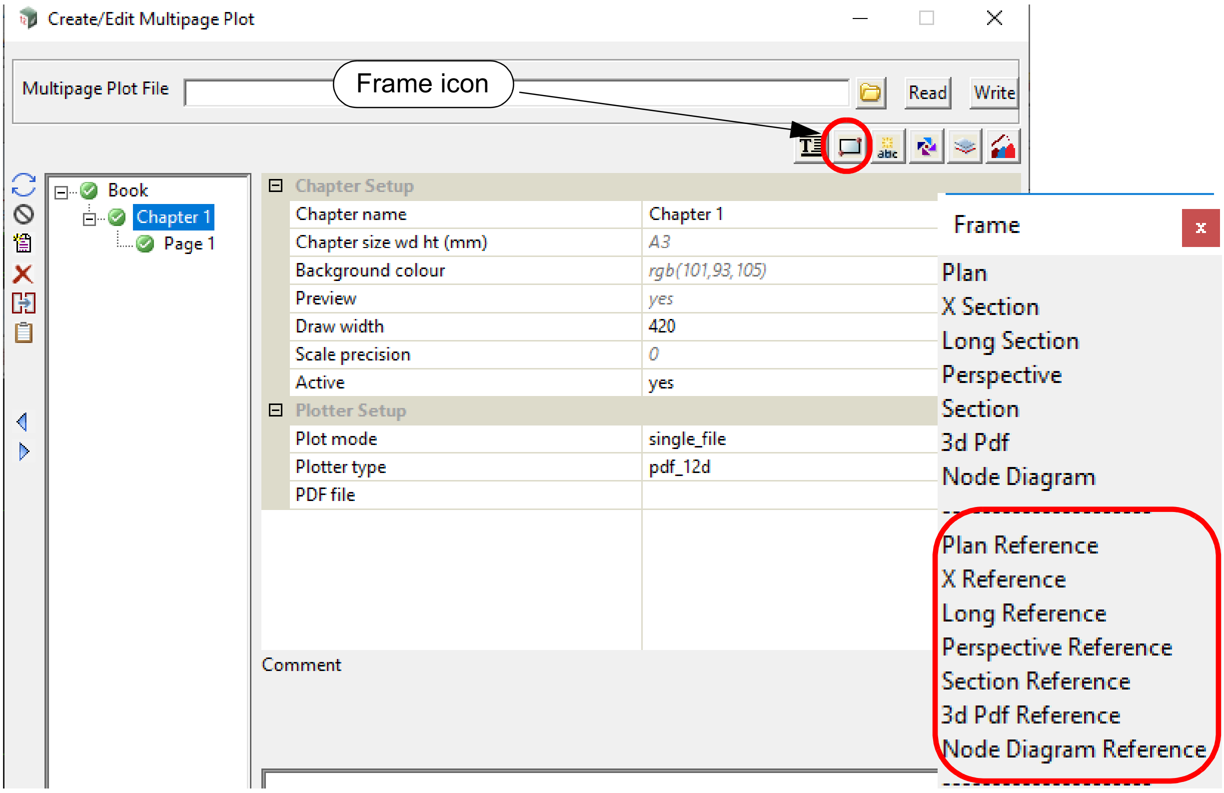
For the description on creating and editing Frames, see 21.1.4.7.5 Common Information About Frames

Important Notes

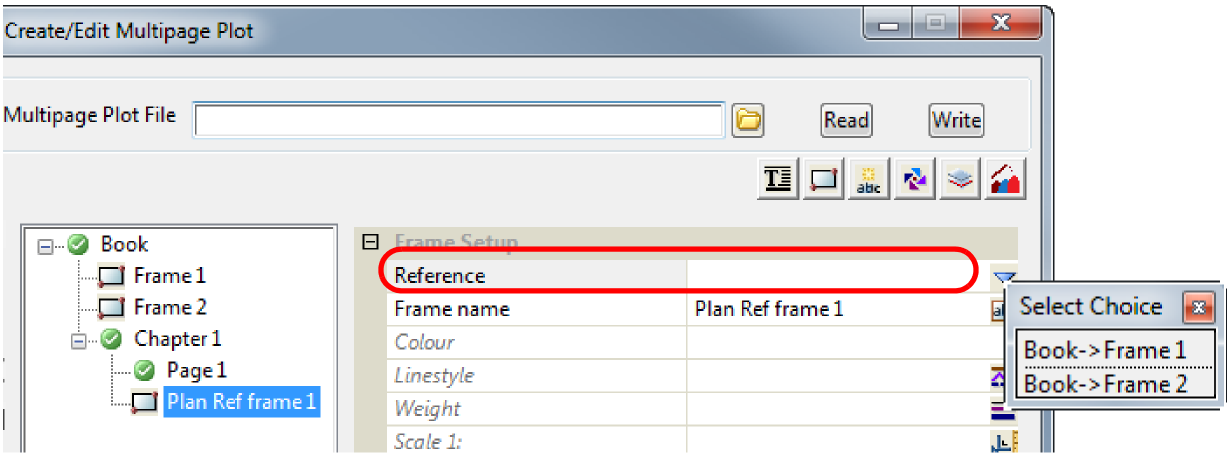
1. The order of the items in the Tree is important as it is the drawing order. See 21.1.4.7.4 Plotting Order of Frame Nodes.
2. **Chapter Frame** names have to be unique within a **Chapter**.

21.1.4.7.2.2 Reference Frames for a Chapter

The create a **Reference Frame** for the **Chapter**, click on **Chapter** to display the **Chapter Plot Area** and then click on the **Frame** icon and select either **Plan Reference**, **X Reference**, **Long Reference, Perspective Reference**, **Section Reference** or **Pdf 3D Reference**.



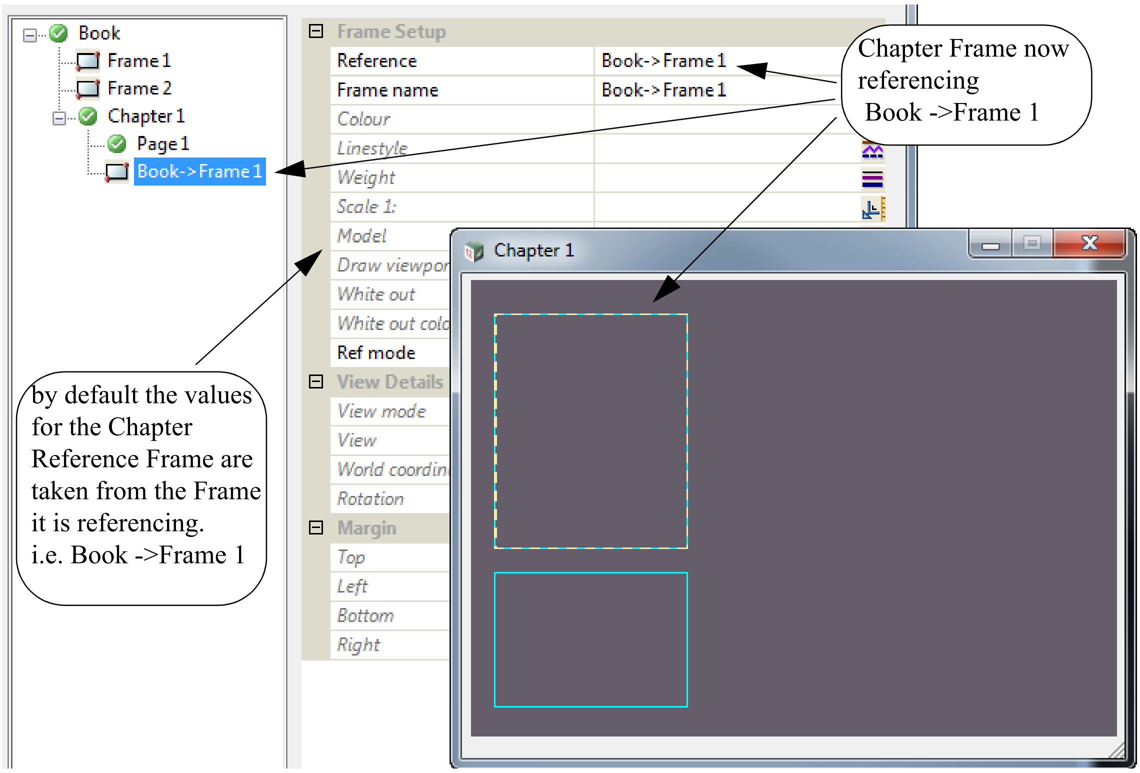
A new **Chapter Reference Frame** is created but it has a blank ***Reference field.***



The Choice pop-up for the ***Reference field*** lists the existing **Book Frames** that this **Frame** could reference.

Once a **Frame** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Frame** is changed to the full path name of the **Frame** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

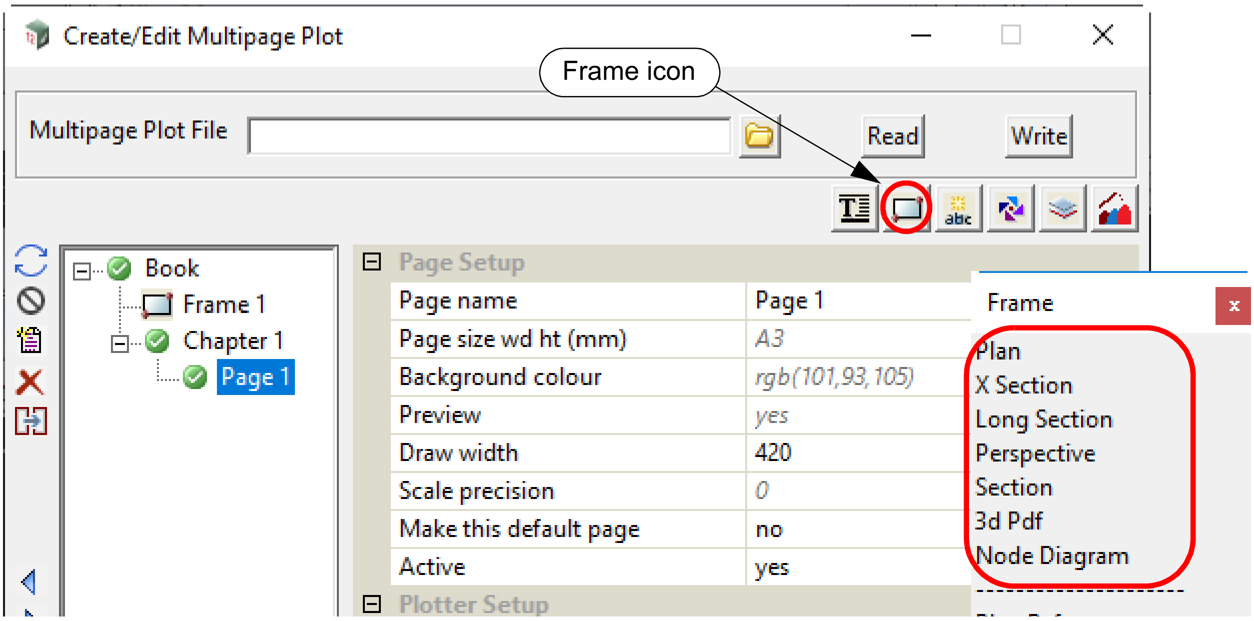
All the **Frame Setup** values are blank as their values are taken from the **Book Frame** being referenced but any of them can be changed and the changed values will be used for this **Chapter Reference Frame**.


Book
Frame 1
Frame 2
Chapter 1
Page 1
Book->Frame 1
Frame Setup
Reference
Book->Frame 1
Frame name
Book->Frame 1
Colour
Linestyle
Weight
Scale 1:
Model
Draw viewpor
White out
White out colo
Ref mode
View Details
View mode
View
World coordin
Rotation
Margin
Top
Left
Bottom
Right
Chapter 1
Chapter Frame now referencing Book ->Frame 1
by default the values for the Chapter Reference Frame are taken from the Frame it is referencing. i.e. Book ->Frame 1

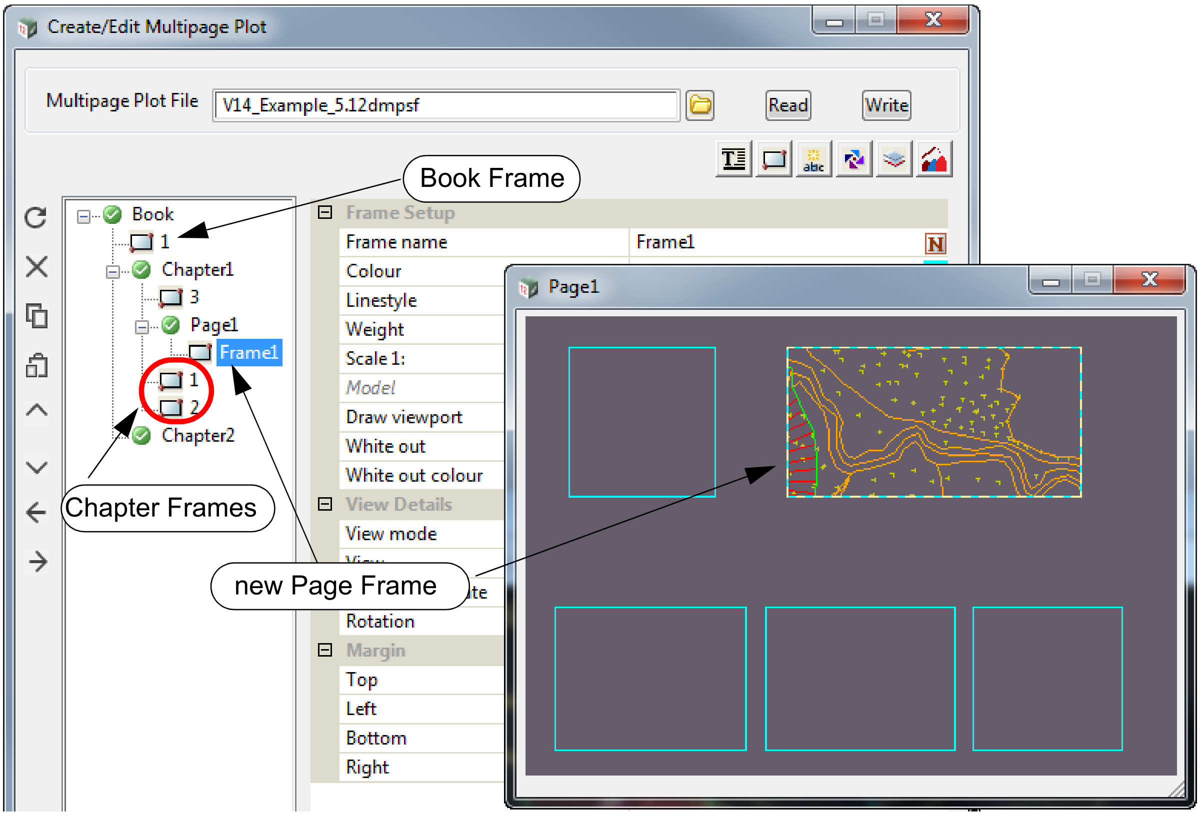
21.1.4.7.3 Creating Frames on a Page

21.1.4.7.3.1 Frames for a Page

To create a **Frame** for a **Page**, click on the **Page** to display the **Page Plot Area** and then click on the **Frame** icon and select either **Plan**, **X Section**, **Long Section**, **Perspective**, **Section**, **3D Pdf** or **Node Diagram**.



The user then creates a new **Page Frame** in the **Page Plot Area.**
A **Page Frame node** in for that **Page** is then automatically created at the bottom of that **Page** with the name **Frame n** where **n** is the next integer that makes the name **Frame n** unique for the **Page Frames** for that highlighted *Page*.



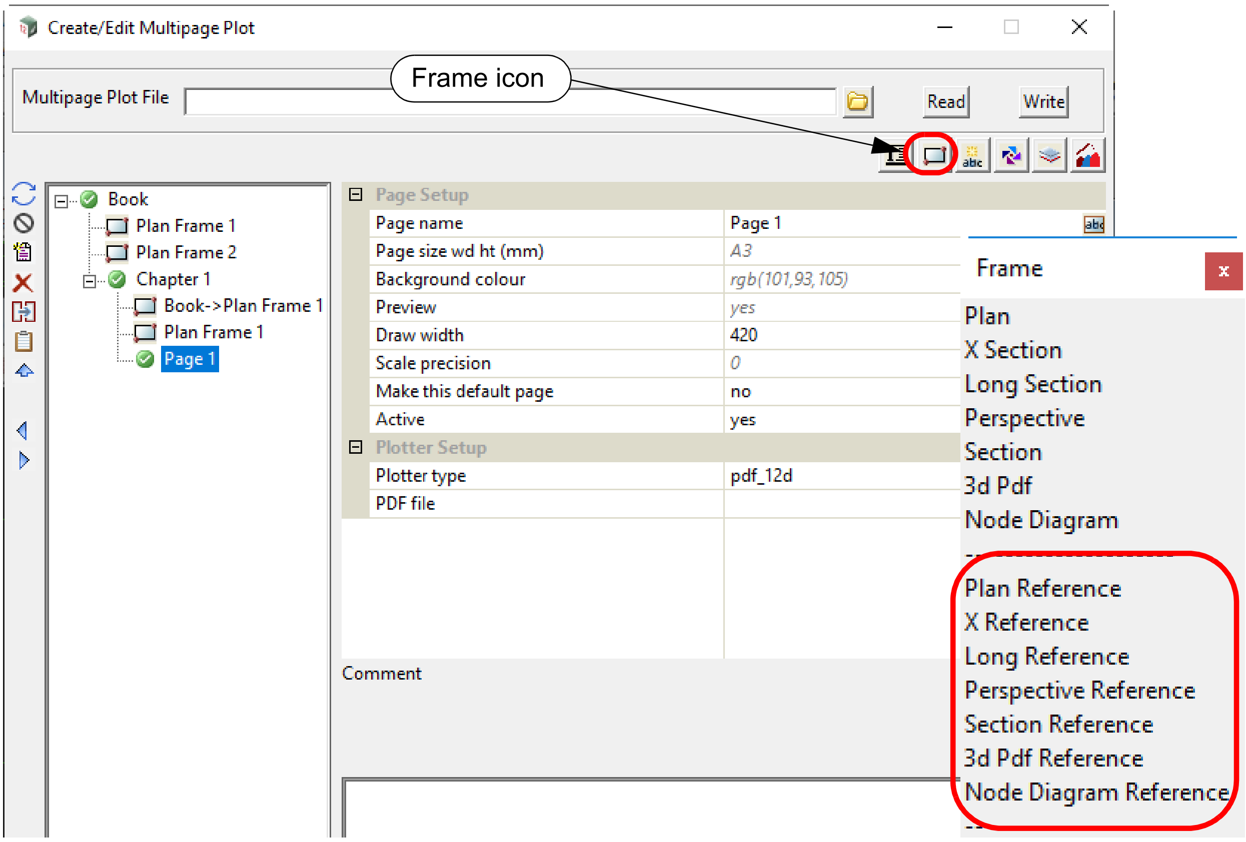
For the description on creating and editing Frames, see 21.1.4.7.5 Common Information About Frames.

Important Notes

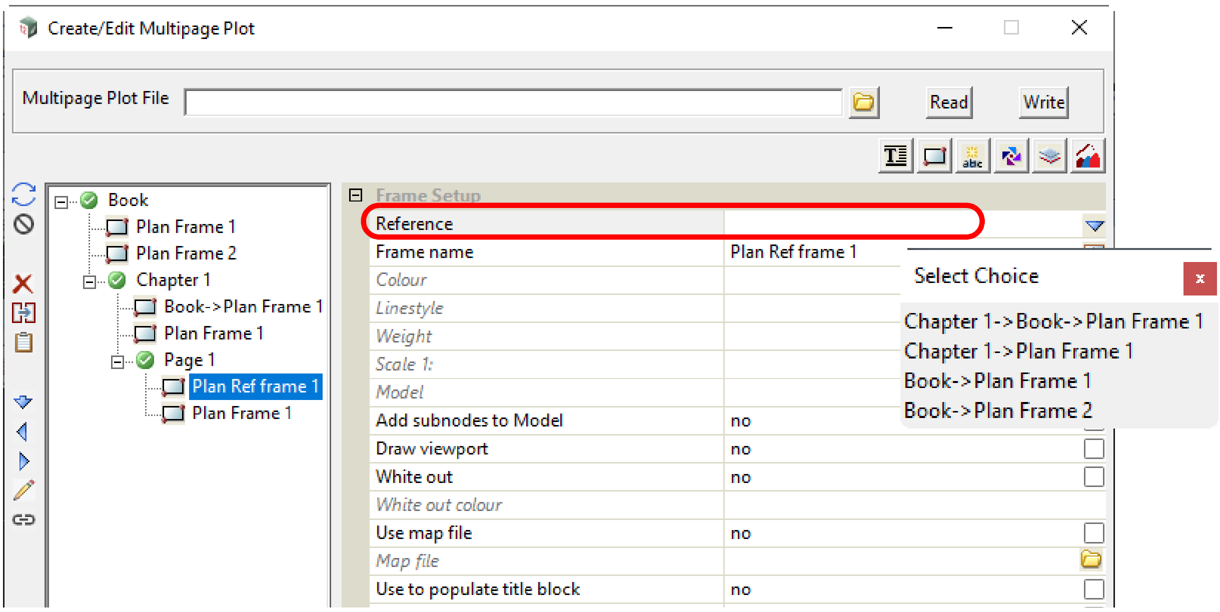
1. The order of the items in the Tree is important as it determines the drawing order in each page of the plot. See 21.1.4.7.4 Plotting Order of Frame Nodes.
2. **Page Frame** names have to be unique within the same **Page**.

21.1.4.7.3.2 Reference Frames for a Page

The create a **Reference Frame** for a **Page**, click on **Page** node to display the **Page Plot Area** and then click on the **Frame** icon and select either **Plan Reference**, **X Reference**, **Long Reference**, **Perspective Reference**, **Section Reference**, **3D Pdf Reference** or **Node Diagram Reference**.



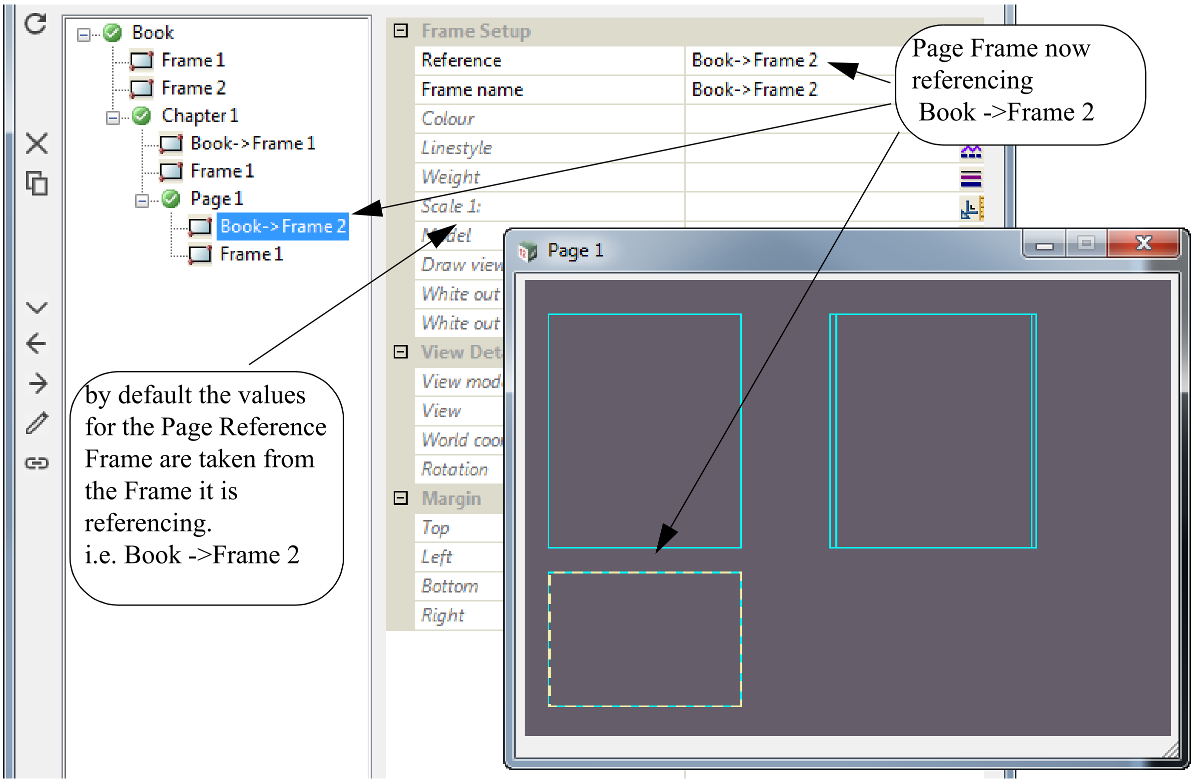
A new **Page Reference Frame** is created but it has a blank ***Reference field.***



The Choice pop-up for the ***Reference field*** lists the existing **Book Frames** and **Chapter Frames** that the **Page** is in, that this **Frame** could reference.

Once a **Frame** is selected, it is drawn in the **Page Plot Area** and the name of the Frame is changed to the full path name of the Frame that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

All the **Frame Setup** values are blank as their values are taken from the **Frame** being referenced but any of them can be changed and the changed values will be used for this **Page Reference Frame**.



21.1.4.7.4 Plotting Order of Frame Nodes

The order of the **Frame node** in the tree is important because it determines the plotting order of the **Frame**.

All the **Book Frame nodes** are plotted on each **Page**, but if the **Book Frame node** is in the tree before a **Page** then the **Book Frame** is plotted before the **Page** is plotted.

Similarly if the **Book Frame node** is in the tree after a **Page** then the **Book Frame** is plotted after the **Page** is plotted. See 21.1.4.10.5 Examples of Model Nodes.

All the **Chapter Frame nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Frame node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Frame** is plotted before that **Page** is plotted.

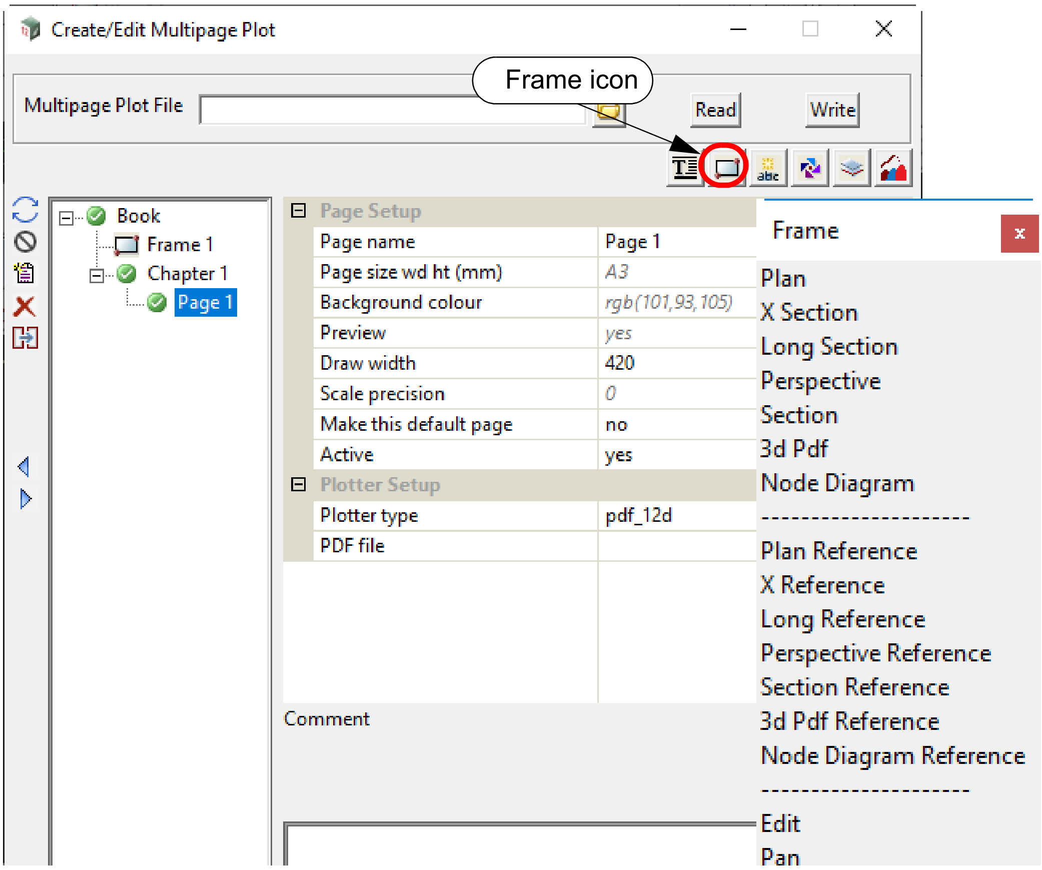
Similarly if the **Chapter Frame node** is in the tree after a **Page** in the **Chapter** then the **Chapter Frame** is plotted after the **Page** is plotted. See 21.1.4.10.5 Examples of Model Nodes.

Finally for a **Page node**, the order of the plotting is in the order of the items in the **Page** subtree.

21.1.4.7.5 Common Information About Frames

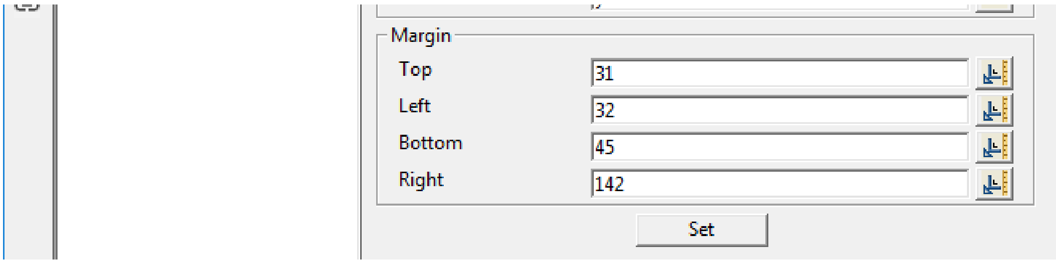
Clicking on the **Frame** icon brings up the **Frame** menu

.



There are three different Frames (plotting areas) that can be created on the Page: **Plan**, **X-Section** and **Long Section**, and each type is created by selecting the relevant option on the **Frame** menu.

The size of a Frame is usually initially set by drawing the frame on the relevant **Plot Area**. The position and size for the frame is then written to the **Top**, **Left**, **Bottom** and **Right** fields on the panel. The frame can be resized by typing values into these fields and then pressing **Set**.



Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Frame** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Margins

Top* real box

Distance in millimetres from the top of the frame to the top of the Plot Area.
*This value can be edited and the size of the Frame will adjust accordingly when the **Set** button is pressed.*

Left* real box

Distance in millimetres from the left side of the frame to the left side of the Plot Area.
This value can be edited and the size of the Frame will adjust accordingly when the ***Set*** *button is pressed.*

Bottom* real box

Distance in millimetres from the bottom of the frame to the bottom of the Plot Area.
This value can be edited and the size of the Frame will adjust accordingly when the ***Set*** *button is pressed.*

Right* real box

Distance in millimetres from the right side of the frame to the right side of the Plot Area.
This value can be edited and the size of the Frame will adjust accordingly when the ***Set*** *button is pressed.*

A **Reference frame** creates a Frame that references an existing Frame.

There are a number of different Reference Frame that can be created on the Page: **Plan Reference**, **X-Section Reference**, **Long Section Reference** and **Perspective Reference**, and each type is created by selecting the relevant option on the **Frame** menu. See 21.1.4.7.14 Reference Frames.

Edit is used to move/resize a Frame on the Book, Chapter or Page or display information about the Frame.

After selecting **Edit**, the Frame to edit is picked in the relevant Plot Area. See 21.1.4.7.13 Edit Frame.

Note that a Frame can also be Edited by highlighting the Frame's node in the tree and pressing the left hand side **Edit** icon.

Pan uses the mouse cursor inside a frame to pan the drawing inside the Frame.

After selecting **Pan**, the Frame to Pan is picked in the relevant Plot Area.

Note that a Frame can also be panned by highlighting the Frame's node in the tree and pressing the left hand side **Pan** icon.

Delete is used to delete a Frame.

After selecting **Delete**, the Frame to delete is picked in the relevant Plot Area.

Note that a Frame can also be deleted by highlighting the Frame's node in the tree and pressing the left hand side **Delete** icon.

The types of Frames are **Plan**, **X-Section**, **Long Section, Perspective, Section, 3D pdf** and **Node diagram**:

The **Plan frame** is for drawing part of a Plan View. The Plan Frame is displayed as line work on nominated views to indicate the region of the plan view that will be drawn on the plot. See 21.1.4.7.6 Plan Frame.

The **X-Section frame** allows you to select a **X-Section PPF**, and then a chainage from the model in the selected PPF. If it will fit, that x-section is drawn using the settings from the PPF. See 21.1.4.7.7 X Section Frame.

The **Long Section frame** allows you to select a **Long Section PPF** and then a chainage range. If it will fit, that chainage range for the long section is drawn using the settings from the PPF. See 21.1.4.7.8 Long Section Frame.

The **Perspective frame** is for drawing the image that is displayed on a Perspective View. See 21.1.4.7.9 Perspective Frame.

The **Section frame** is for drawing the image that is displayed on a Section View. See 21.1.4.7.10 Section Frame.

The **3D pdf frame** is for creating a 3D pdf of all the data in the models on a Perspective view and adding it as a 3D pdf to the plot. See 21.1.4.7.11 3D PDF Frame.

The **Node diagram** is for creating a structure node diagram for the node of a water string. See 21.1.4.7.12 Node Diagram Frame.

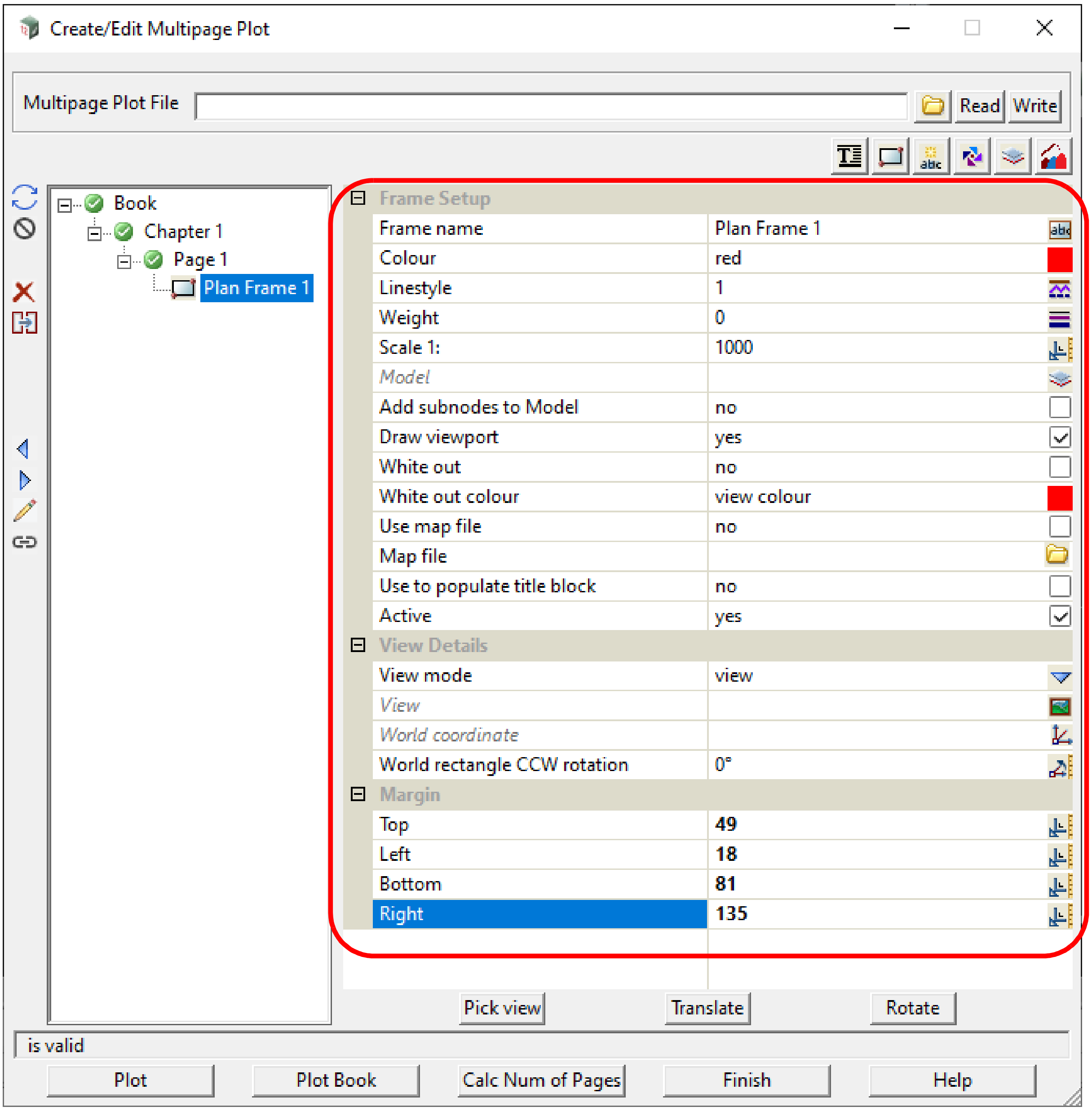
21.1.4.7.6 Plan Frame

After selecting **Plan** on the **Frame** menu, a rectangle for the Plan Frame is drawn on the Book, Chapter or Page Plot Area.

After each **Plan Frame** is drawn, a new subnode of the tree is created, and information such as Frame name, colour and scale for the new Plan Frame is displayed in the right had side of the **Create/Edit Multipage Plot** panel. These values can be changed. Settings such as name, colour and scale can be entered.

The position of the **Frame** on the page is given in **Margins** - **Top**, **Left**, **Bottom** and **Right**.

What is to be plotted in the **Frame** is defined by either a **Plan View** or a **Plan View Favourite** as selected in the ***View Details*** section.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

Note: Only ***Reference Frame*** *fields have inheritance support.*

For more information on ***Inherited Field****s see,* 21.1.4.5 Inherited Fields *.

Frame Setup

Frame name text box Plan Frame n

Name for this Plan frame. The default name is ***Plan Frame n*** *where* ***n*** *is the first number to make the name "Plan Frame n" unique for* ***this*** *node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

Colour* colour box red available colours

Colour for the border of the Plan Frame that is drawn when ***Draw viewport*** *is* ***ticked****.*

Linestyle* linestyle box 1 available linestyles

Linestyle for the border of the Plan Frame that is drawn when ***Draw viewport*** *is* ***ticked****.*

Weight* weight box 0

Weight for the border of the Plan Frame that is drawn when ***Draw viewport*** *is* ***ticked****.*

Scale 1:* measure box 1000

Scale of the drawing in the plan frame is 1:value.

The size of the ***Plan Frame*** *drawn on the Plot Area (which is in millimetres) and the* ***Scale 1:*** *value determines the width and height* ***in world units*** *of the World rectangle that is to be plotted to the plan frame.*

Model* model box

If ***not blank****, when this Multipage plot is being edited, a string of the World rectangle for the plan frame is added to this model.*

If ***blank****, no string of the World rectangle for the plan frame is created.*

Note: *the entered model and created string are locked for the duration of the Multipage plot edit. So any 12d option that requires a lock to be acquired on one of these elements will not be usable.*

Add subnodes to Model* tick box not ticked

If ***ticked****, then any Text or Symbol Subnodes that this Plan Frame has will also be added to the* ***Model*** *specified above.*

If ***not ticked****, then the Subnodes will not be added to the* ***Model****.*

Draw viewport* tick box ticked

If ***ticked****, the border of the Plan Frame is drawn on the plot.*

If ***not ticked****, the border of the Plan Frame is NOT drawn on the plot.*

White out* tick box not ticked

If ***ticked****, the Plan Frame is drawn on the plot and the frame area is first drawn in the* ***White out colour****.*

White out colour* colour box view colour available colours

Colour to be used for the white out if ***White out*** *is* ***ticked****.*

Use map file* tick box not ticked

If ***ticked****, the* ***Map file*** *given is applied to all the data to be drawn in the Plan Frame.*
If ***not ticked****, the* ***Map file*** *is not used.*

Map file* Map file box available Map files

Map file *to use if* **Use Map file** *is* ***ticked****.*

Note: Map file *does not support some of the more complex 12d objects (Rasters, Point Clouds, etc.) and* *may result in unexpected or incomplete output when used on these objects.*

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this Plan Frame Node.*
*If **not ticked**, then this Plan Frame Node will not be used for Title Block $variable population.*

*When created, if this Plan Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the Plan Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the Plan Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note**: This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

Margins

*The position of the **Frame** on the page is given in **Margins** - **Top**, **Left**, **Bottom** and **Right**.*

See Margins.

The size of the **Plan Frame** drawn on the Plot Area (which is in millimetres) and the **Scale 1:** value determines the width and height **in world units** of the world rectangle that is the area to be plotted. What is actually plotted inside the plan frame is given in the section **View Details**.

What is in **View Details** depend on the choice for **View mode.**

See

.21.1.4.7.6.1.1 Plan Frame - View Details - View mode - View
21.1.4.7.6.1.2 Plan Frame - - View Details - View mode - View Favourite

21.1.4.7.6.1 Plan Frame - View Details - View mode - View

View mode can be either **view** or **view_favourite.**

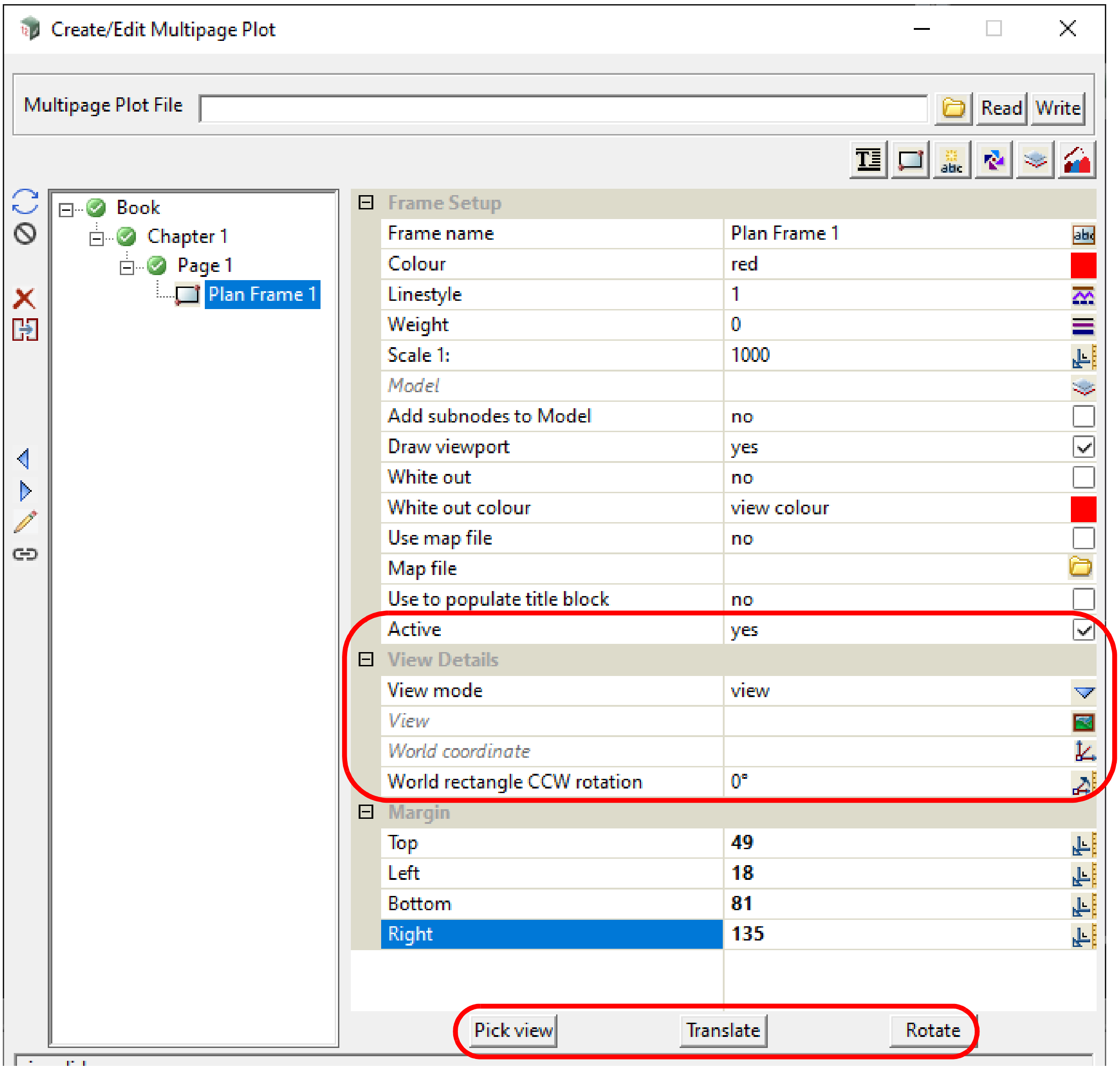
For **view**, the information for what is displayed in the Frame is taken from a View that the user selects. See 21.1.4.7.6.1.1 Plan Frame - View Details - View mode - View

For **view_favourite**, the information for what is displayed in the Frame is first taken from a selected **View Favourite** although some of the values can then be changed. See 21.1.4.7.6.1.2 Plan Frame - - View Details - View mode - View Favourite.

21.1.4.7.6.1.1 Plan Frame - View Details - View mode - View

If ***View mode*** is set to **view**, then a **plan view** is selected using the **Pick view** button and the selected *View* provides all the information about models and settings for the plot.

The position of the pick defines the world coordinate for the centre of a Word Rectangle that determines what is drawn in the Frame. The **Scale** together with the millimetre size of the Frame determines how large the World Rectangle is in world units.



Once a view is selected, the name of the plan view is written to the **View** field, the (x,y) coordinate of the centre of the view is written to the **World coordinate** field**.** The **World rectangle CCW Rotation** is initially set to **0**.

The **Pick view** option will repeat until <Esc> or another option is chosen.

A new view can be selected, or the fields in the View Details modified, to define the view information.

The fields and buttons used in this section of the panel when **View mode** is set to **View** have the following functions.

Field Description	Type	Defaults	Pop-Up

View Details

View mode*	choice box	View	View, View favourites

*When **View**.*

View*	view box		available views

*View that the World rectangle will take its information from to plot. An outline of the World rectangle is displayed on the View whilst the **Create/Edit Multipage Plot** panel is open.*

World coordinate*	xyz pick box	1	measures

World coordinate for the centre of the World rectangle.

*If a new **World coordinate** is entered or selected, that becomes the new centre of the World rectangle.*

World rectangle CCW Rotation*	angle box	0	angle measures

Angle of rotation of the World rectangle measured in the counter clockwise direction from the positive x-axis.

*If a new **Rotation** is entered, it becomes the rotation of the **World rectangle**.*

Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

Buttons

*The buttons **Translate** and **Rotate** are also for editing the position and rotation of the World rectangle on the Plan view.*

Pick view	buttons

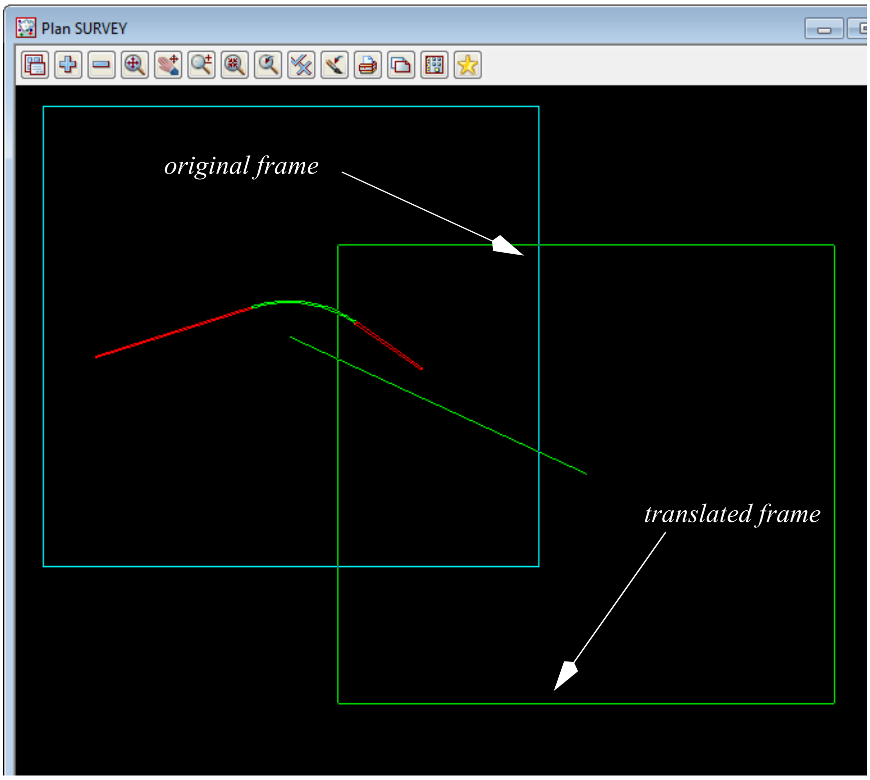
*After pressing the **Pick view**, when you select a position on a Plan View, the coordinate of the pick becomes the centre of the World rectangle for the Plan Frame and the World rectangle is drawn on the view. The name of the view is written to the **View** field and the pick coordinates are written to the **World Coordinate** field.*

*If there is a value in the **Rotation** field then it is maintained and used for the World rectangle.*

Translate	button

*After pressing the **Translate** button, when you move over a Plan View (even without the World rectangle for the Plan Frame on it), the centre of the World Rectangle will be tentatively moved to the position of the cursor on the Plan view. And when the position is accepted (MB), the new position is taken as the centre of the World rectangle. The coordinates of the new centre are written to the **World Coordinate** field*

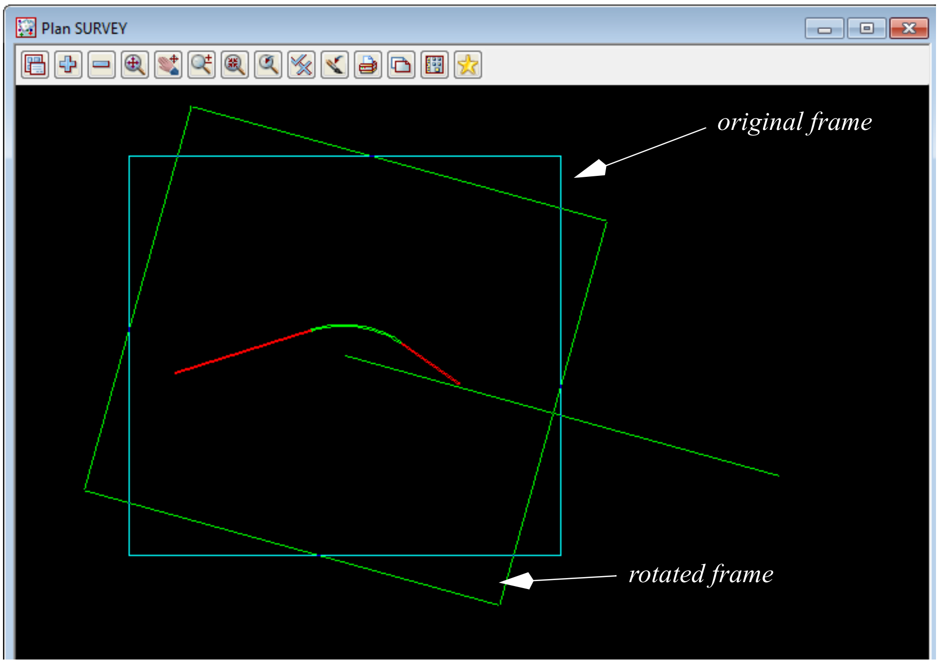
*Although the new centre can be selected on any Plan view, the World rectangle stays on the View given in the **View** field. The option will repeat until <Esc> or another option is chosen.*



Rotate button

*After pressing the **Rotate** button, when you move over a Plan View (even without the World rectangle for the Plan Frame on it), the World Rectangle will be tentatively rotated to the angle made from the centre of the rectangle to the cursor and this taken as the angle of the rectangle. And when the position is accepted (MB) the new angle is taken as the angle of the World rectangle. The new angle is written to the **Rotation** field.*

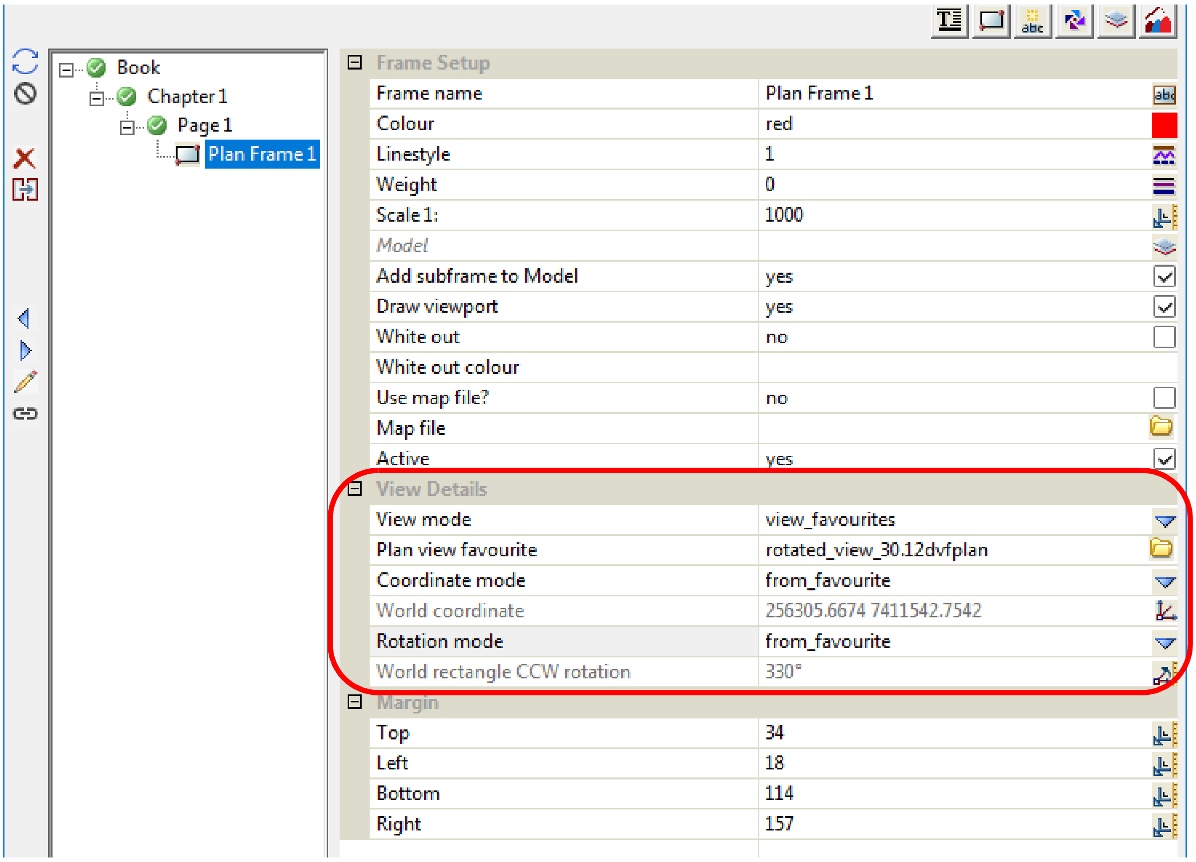
*Although the new angle can be selected on any Plan view, the World rectangle stays on the View given in the **View** field. The option will repeat until <Esc> or another option is chosen.*



21.1.4.7.6.1.2 Plan Frame - - View Details - View mode - View Favourite

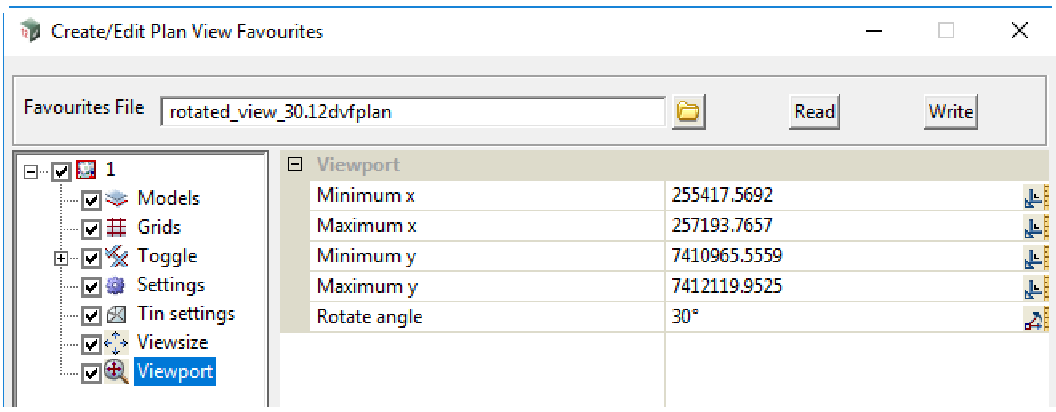
If **View mode** is set to **view_favourite**, then a **Plan view favourite** is selected in the **Plan view favourite** field and the selected **Plan Favourite** provides all the information about models and settings for the plot

.



Once a *Plan View favourite* is selected in the **Plan view favourite** field, the **Coordinate mode** is set to **from_favourite** and the **World coordinate** is set to the centre of the Minimum and Maximum x and y given in the **Viewport** section of the *Plan view favourite*.

The **Rotate mode** is set to **from_favourite** and the **World rectangle CCW rotation** is set as the **negative** of the **Rotate angle** given in the **Viewport** section of the *Plan view favourite* (and converted to an angle between 0 and 360 degrees).



If in **View Details**, the **Coordinate mode** is changed to **from_panel**, the **World coordinate** can be modified and the new coordinate becomes the centre of the World Rectangle.

If the **Rotation mode** is changed to **from_frame**, the **World rectangle CCW rotation** can be modified and the new value becomes the rotation of the World rectangle.

The fields and buttons used in this section of the panel when **View mode** is set to **View favourites** have the following functions.

Field Description	Type	Defaults	Pop-Up

View Details

View mode*	choice box	View	view, view_favourites

*Set to **view_favourites**.*

Plan view favourite*	plan view favourite box		

*View that the World rectangle will take its information from for the plot. An outline of the World rectangle is displayed on the View whilst the **Create/Edit Multipage Plot** panel is open.*

Coordinate mode*	choice box		from_favourite, from_frame

*If **from_favourite**, the world coordinate for the centre of the World rectangle is set as the centre of the Minimum and Maximum x and y given in the Viewport section of the Plan view favourite. This value is written to the **World coordinate** field. When **from_favourite,** the value in **World coordinate** can not be modified.*

*If **from_frame**, the world coordinate is taken from the **World coordinate** field. When **from_frame,** the value in **World coordinate CAN** be modified.*

World coordinate*	xyz pick box	1	measures

World coordinate for the centre of the World rectangle.

*If **Coordinate mode** is changed to **from_frame** and a new **World coordinate** is entered or selected, the new value becomes the new centre of the World rectangle.*

Rotation mode*	choice box		from_favourite, from_frame

*If **from_ favourite**, the **World rectangle CCW rotation** field is set as the negative of the **Rotate angle** given in the **Viewport** section of the Plan view favourite. This is necessary so that the plot is identical to that given by the Plan view favourite. When **from_favourite,** the value in **World rectangle CCW rotation** can not be modified.*

*If **from_frame**, the rotation angle is taken from the **World rectangle CCW rotation** field. When **from_frame,** the value in **World rectangle CCW rotation CAN** be modified.*

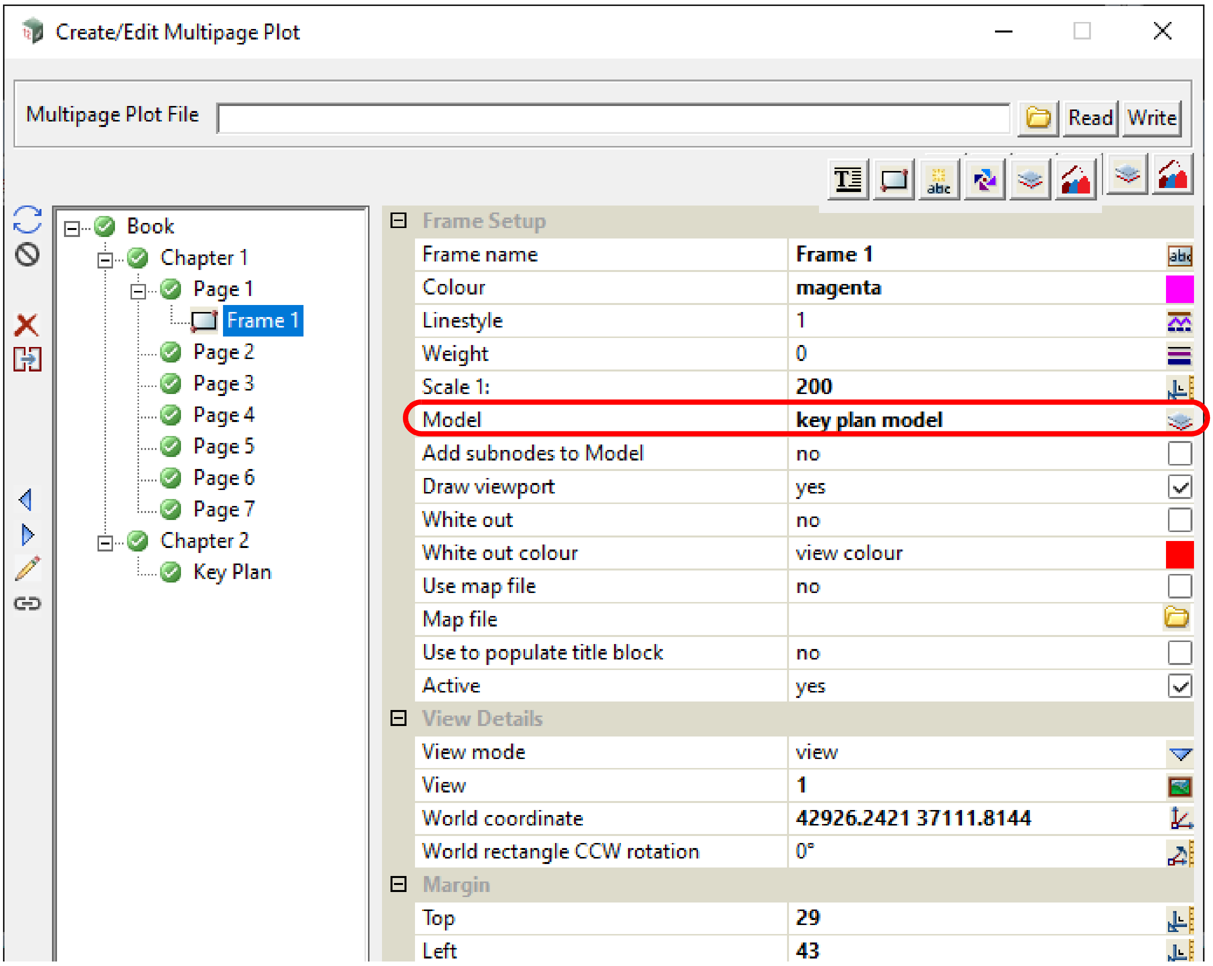
World rectangle CCW rotation*	angle box	0	angle measures

Angle of rotation of the World rectangle measured in the counter clockwise direction from the positive x-axis.

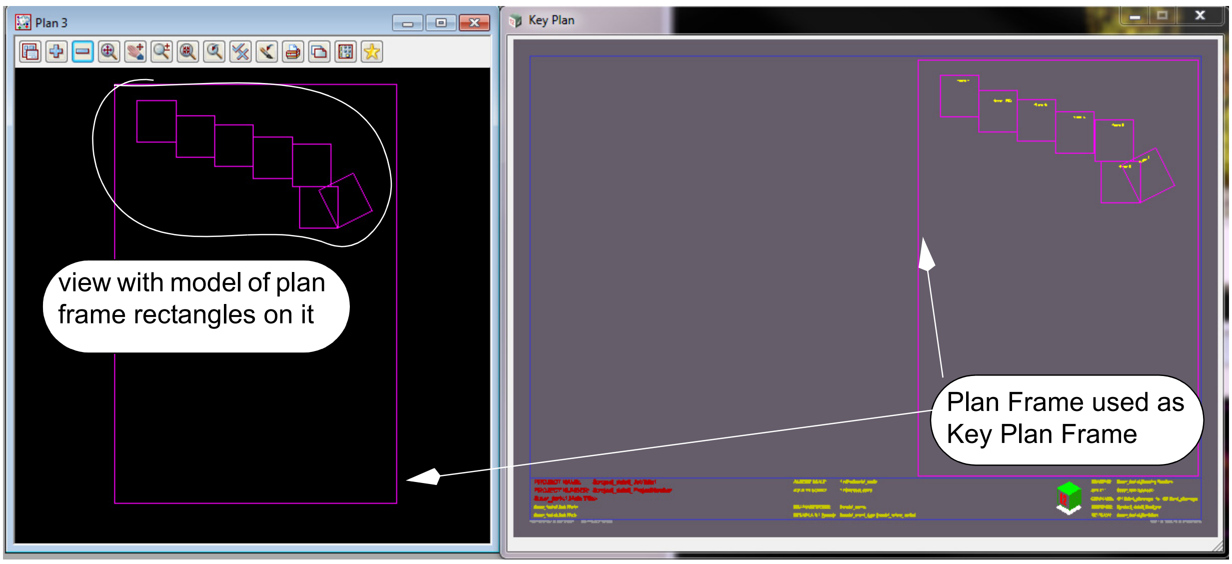
*If **Rotation mode** is changed to **from_frame** and a new **World rectangle CCW rotation** is entered, that new value becomes the rotation of the World rectangle.*

21.1.4.7.6.2 Creating a Key Plan for Plan Frames

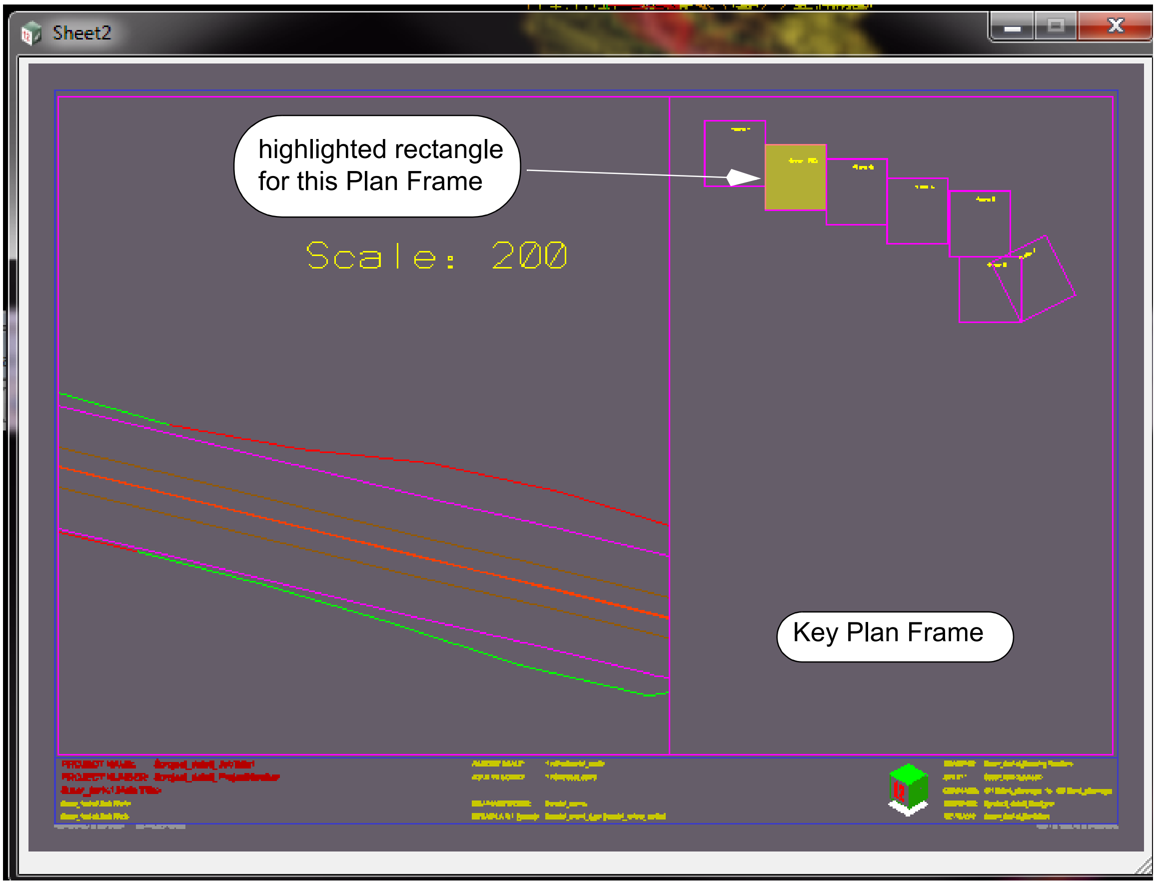
A Key Plan of selected Plan Frames can be easily created by first creating a model that rectangles of the required Plan Frames are added to (e.g. key plan model) and then selecting that model as the **Model** for each of the selected Plan Frames.



Then add the models containing the rectangles of the selected Plan Frames to a Plan view and create a Plan Frame on that view that contains the rectangles.

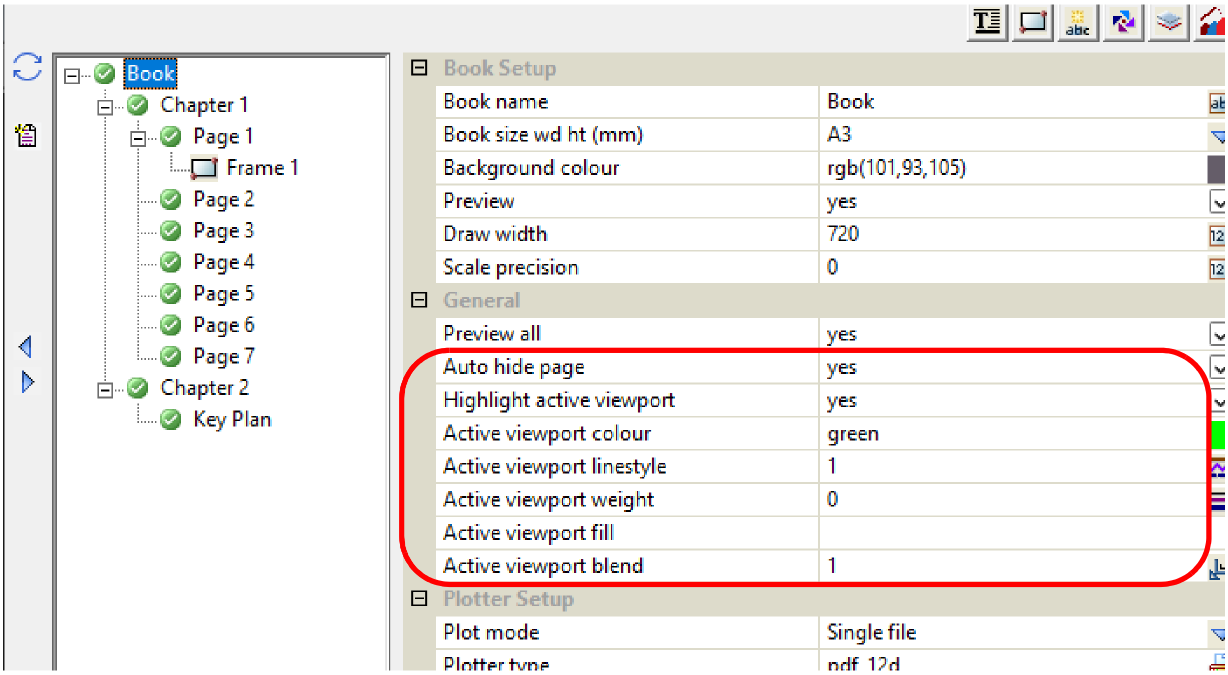


Now whenever a Plan Frame is placed on the same **Sheet** as a Key Plan Frame that contains the rectangle for that Plan Frame, the rectangle for the Plan Frame will be highlighted in the Key Plan if the **Highlight Active Viewport** is on in the **Sheets** node (this is the default setting).



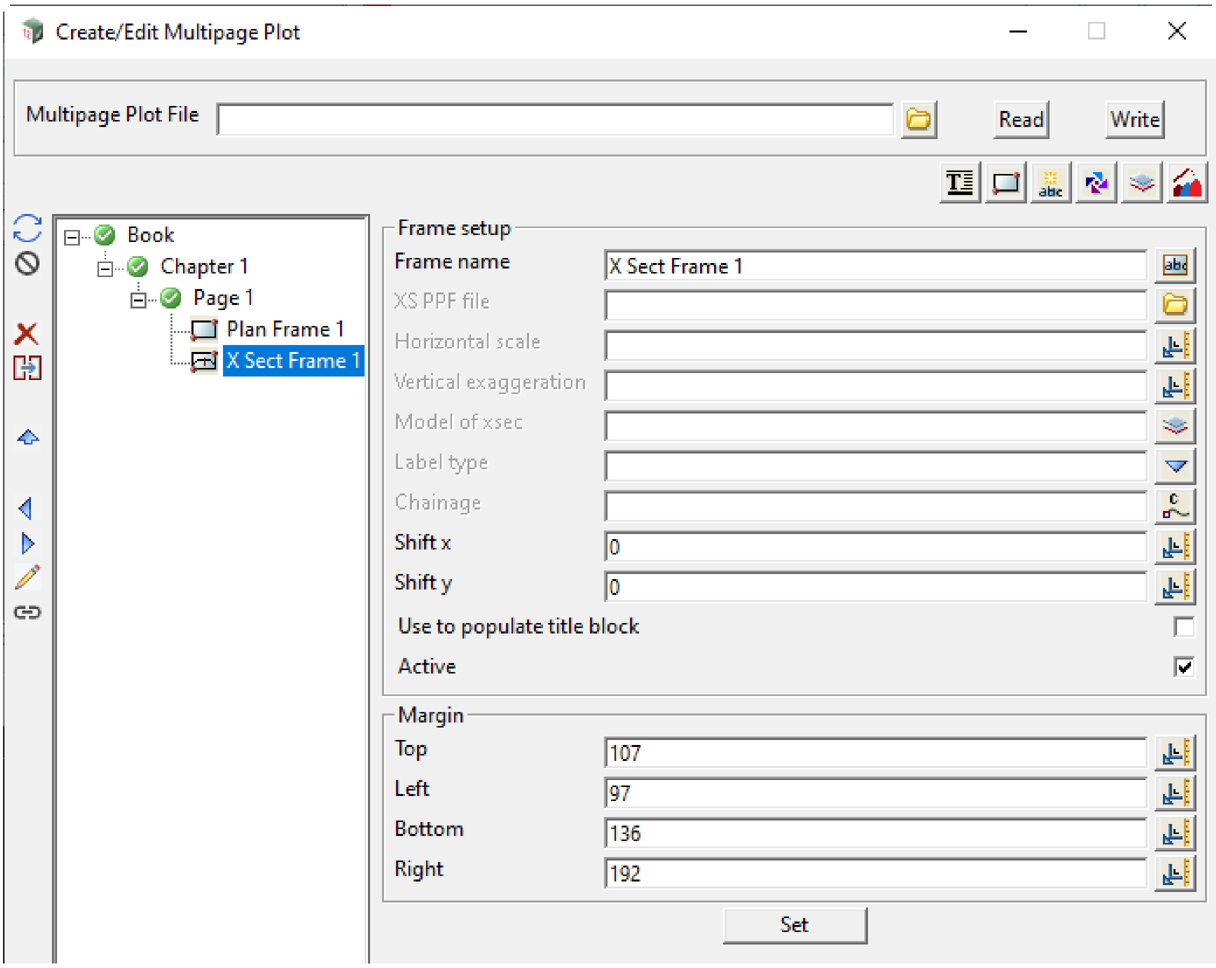
The settings for the Highlight such as **Active viewport fill** colour and **Active viewport blend** can be changed on the **Sheets** node.

Note that if an **Active viewport fill** is specified, **Active viewport colour** and **Active viewport linestyle** will be ignored.



21.1.4.7.7 X Section Frame

After selecting **X Section** in the **Frame** menu, a rectangle for the Cross Section Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.



Fields for the new X Section frame are displayed in the right had side of the **Create/Edit Multipage Plot** panel.

Information such as frame name, ppf file, chainage and x and y shifts can then be entered.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Frame Setup

Frame name	text box	X Sect Frame n	

*Name for this X Section Frame. The default is **X Sect Frame n** where **n** is the first number to make the name "X Sect Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

XS PPF file	x section ppf box		available x section ppfs

Selected PPF file that contains all the information for drawing a cross section plot.

Horizontal scale	real box		measures

*If **not blank**, the horizontal scale to use when plotting the cross section.*
*If **blank**, the horizontal scale from the **XS PPF file** is used.*

Vertical exaggeration	real box		measures

*If **not blank**, the vertical exaggeration to use when plotting the cross section.*
*If **blank**, the vertical exaggeration from the **XS PPF file** is used.*

Model of xsec model box available models

*If **not blank**, the model of x-sections to use when selecting the cross section.*
*If **blank**, the model of x-sections from the **XS PPF file** is used.*

Label type choice box centre line, boxes

*If **not blank**, the label type to use when plotting the cross section.*
*If **blank**, the label type from the **XS PPF file** is used.*

Chainage real box measures

*Chainage of the cross section from the **PPF file** to plot.*

Shift X real box 0 measures

Horizontal (x) shift to the drawing position of the x section that is drawn in the frame.

Shift Y real box 0 measures

Vertical (y) shift to the drawing position of the x section that is drawn in the frame.

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this X Section Frame Node.*
*If **not ticked**, then this X Section Frame Node will not be used for Title Block $variable population.*

*When created, if this X Section Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the X Section Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the X Section Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note**: This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

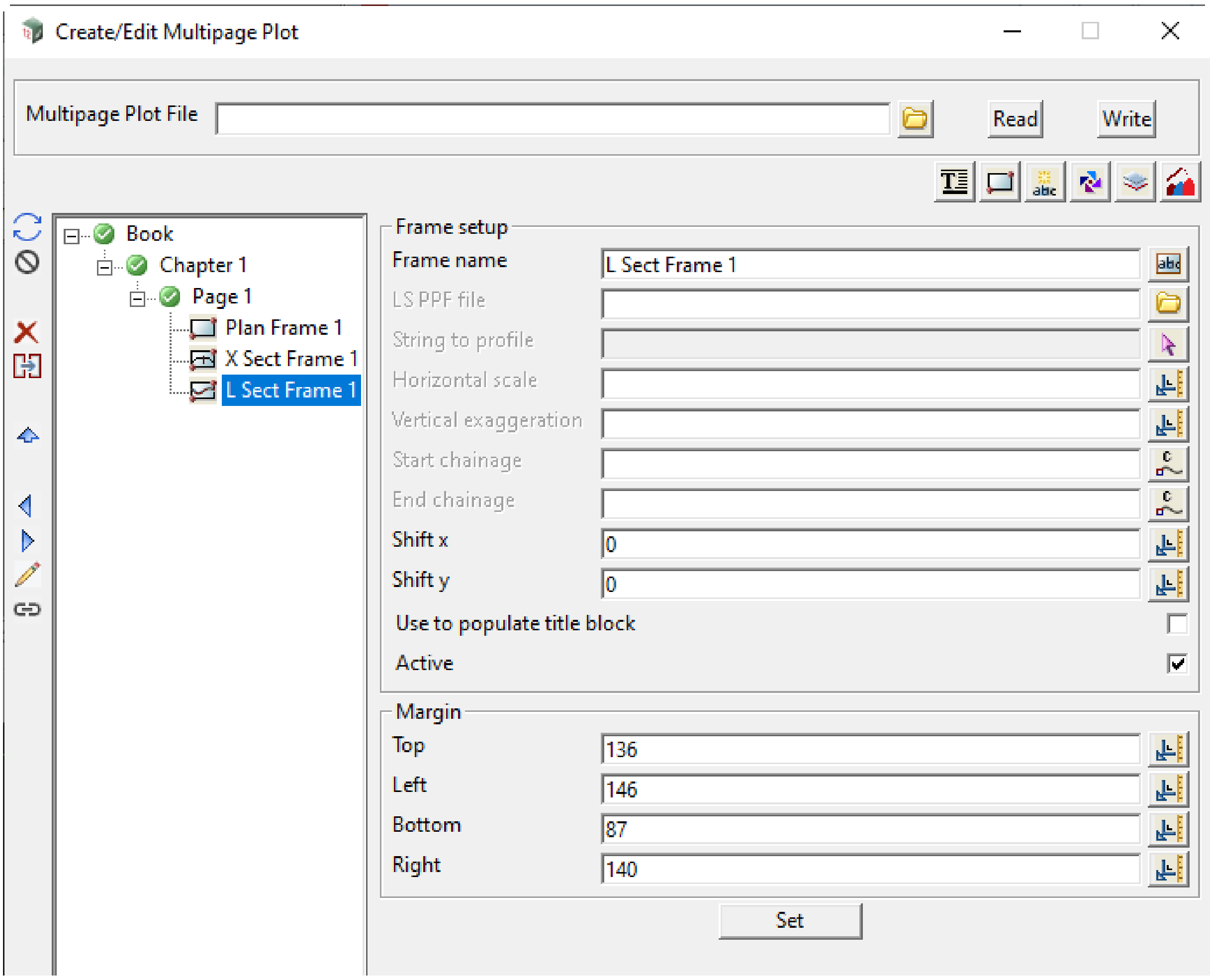
Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

After the **X- Section** Frame is created and the **XS PPF** and other information filled in, then **if** it will fit, the cross section at chainage **Chainage** is drawn in the x-section frame.

21.1.4.7.8 Long Section Frame

After selecting **Long Section** in the **Frame** menu, a rectangle for the Long Section Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.



Fields for the new Long-Section frame are displayed in the right had side of the **Create/Edit Multipage Plot Sheet** panel.

Information such as frame name, ppf file, start and end chainage, and x and y shifts can then be entered.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Frame Setup

Frame Name text box

*Name for this Long Section frame. The default **L Sect Frame n** where **n** is the initial position of the frame node in the tree for this Book, Chapter or Page. The name must be unique amongst all the frames on this node.*

LS PPF file long section ppf box available l sec ppfs

*Name for this Long Section Frame. The default is **L Sect Frame n** where **n** is the first number to make the name "L Section Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

String to profile string select box

*If **not blank**, the string to do the long section for is selected.*

*If **blank**, the string from the **LS PPF file** is used.*

Horizontal scale real box measures

*If **not blank**, the horizontal scale to use when plotting the long section.*
*If **blank**, the horizontal scale from the **LS PPF file** is used.*

Vertical exaggeration real box measures

*If **not blank**, the vertical exaggeration to use when plotting the long section.*
*If **blank**, the vertical exaggeration from the **LS PPF file** is used.*

Start/End chainage real box measures

Start and end chainage of the part of the long section to plot.

Shift X real box 0 measures

Horizontal (x) shift to the drawing position of the long section that is drawn in the frame.

Shift Y real box 0 measures

Vertical (y) shift to the drawing position of the long section that is drawn in the frame.

Use to populate title block tick box

this field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this Long Section Frame Node.*
*If **not ticked**, then this Long Section Frame Node will not be used for Title Block $variable population.*

*When created, if this Long Section Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active choice box Yes, No

*If **ticked**, the Long Section Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the Long Section Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note:** This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

Margins

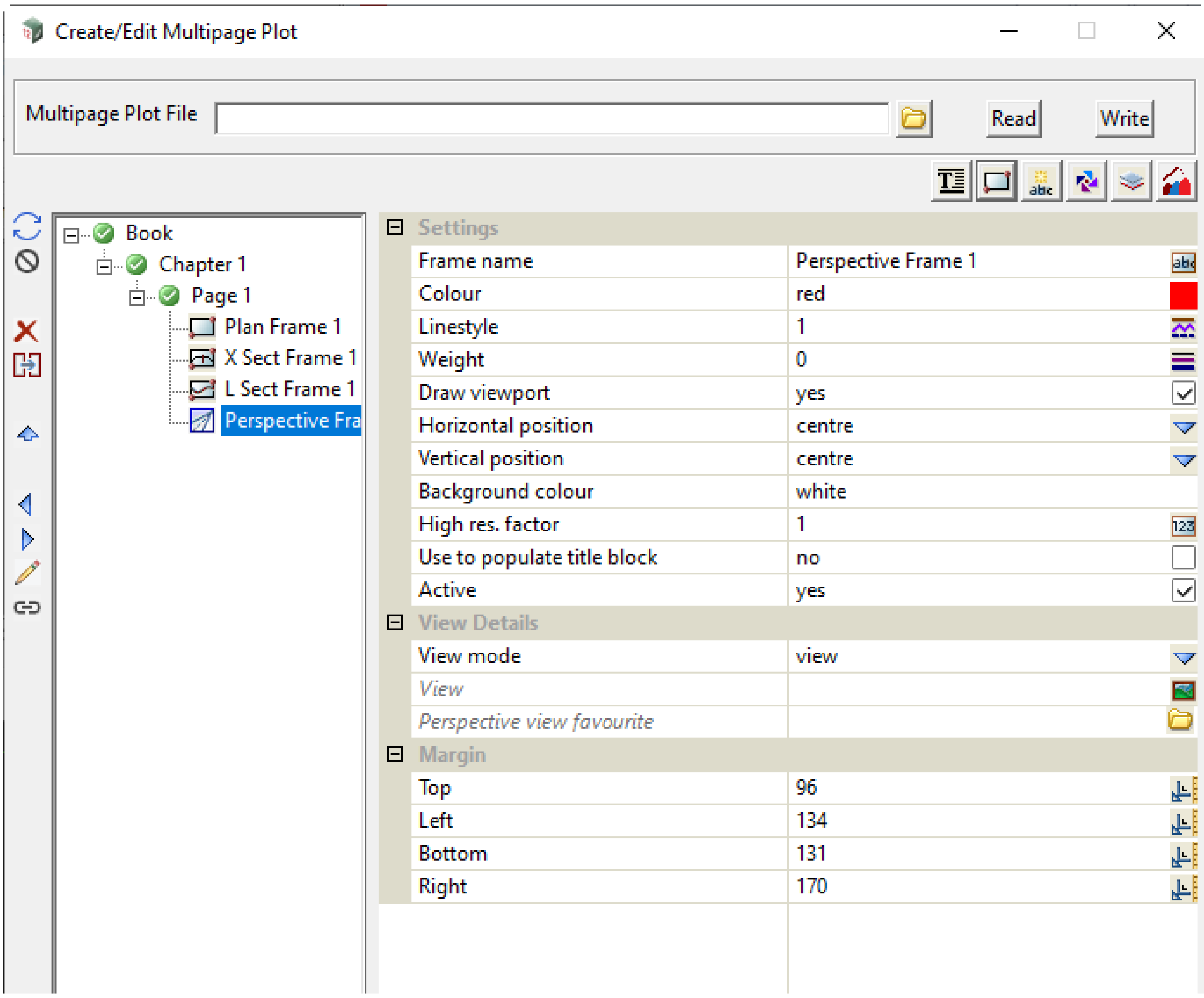
The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

After the Long-Section Frame is created and the **LS PPF** and other information filled in, then (if it will fit) the long section plot between the **Start chainage** and **End chainage** of the alignment in the long section ppf is drawn in the Long Section Frame.

21.1.4.7.9 Perspective Frame

After selecting **Perspective** in the **Frame** menu, a rectangle for the Perspective Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.

Note: Perspective Frames can not show anything inside the Frame displayed on the **Plot Area**. Plotting the node is the only way to view them.



Fields for the new Perspective frame are displayed in the right hand side of the **Create/Edit Multipage Plot Sheet** panel.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Fra0me** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Frame Setup

Frame name	text box	Perspective Frame n	

*Name for this Perspective Frame. The default is **Perspective Frame n** where **n** is the first number to make the name "Perspective Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

Colour* colour box red available colours

*Colour for the border of the Perspective Frame that is drawn when **Draw viewport** is **ticked**.*

Linestyle* linestyle box 1 available linestyles

*Linestyle for the border of the Perspective Frame that is drawn when **Draw viewport** is **ticked**.*

Weight* weight box 0

*Weight for the border of the Perspective Frame that is drawn when **Draw viewport** is **ticked**.*

Draw viewport* choice box Yes, No

*If **ticked**, the border around the Perspective Frame is drawn.*
*If **not ticked**, the border around the Perspective Frame is NOT drawn.*

Position of the view in the perspective Frame

The plot of the view is fitted as large as possible into the area defined by the Perspective Frame. Unless the aspect ration of the view is exactly the same as the aspect ration of the Perspective Frame, the plot will not totally fill the Perspective Frame The horizontal and vertical positions are then used to position the plot inside the Perspective Frame.

Horizontal position* choice box centre centre, left, right

*If **centre**, the centre of the plot is placed so that it is half way between the left margin and the right sides of the Perspective Frame.*

*If **left**, the left hand side of the plot is placed on the left side of the Perspective Frame*

*If **right**, the right hand side of the plot is placed on the right side of the Perspective Frame.*

Vertical position* choice box centre centre, bottom, top

*If **centre**, the centre of the plot is placed so that it is half way between the top and the bottom of the Perspective Frame.*

*If **bottom**, the bottom of the plot is placed on the bottom of the Perspective Frame.*

*If **top**, the top of the plot is placed on the top of the Perspective Frame.*

Background colour* colour box white available colours

Background colour to use for the plot.

*If **blank** it uses the Background from the used View or View favourite.*

High res. factor* integer box 1

*Number of pixels used in the plotting of the perspective view in the horizontal and vertical direction is multiplied by the integer **High res. factor**.*

*Hence the resultant plot will have **(High res. factor** x **High res. factor)** times as many pixels as there are pixels in the original view.*

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this Perspective Frame Node.*
*If **not ticked**, then this Perspective Frame Node will not be used for Title Block $variable population.*

*When created, if this Perspective Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the Perspective Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the Perspective Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note**: This tick box is linked to the node's active/inactive icon. Changing one also changes the other*

View Details

View mode*	choice box	View	view, view_favourites

*If **View mode** is **view**, the **View** field is used:*

View*	view box	available views

View that the Perspective Frame will take its information from to plot.

*if **View mode** is **view_favourites**, the **Perspective view favourite** field is used:*

Perspective view favourite* perspective view favourite box

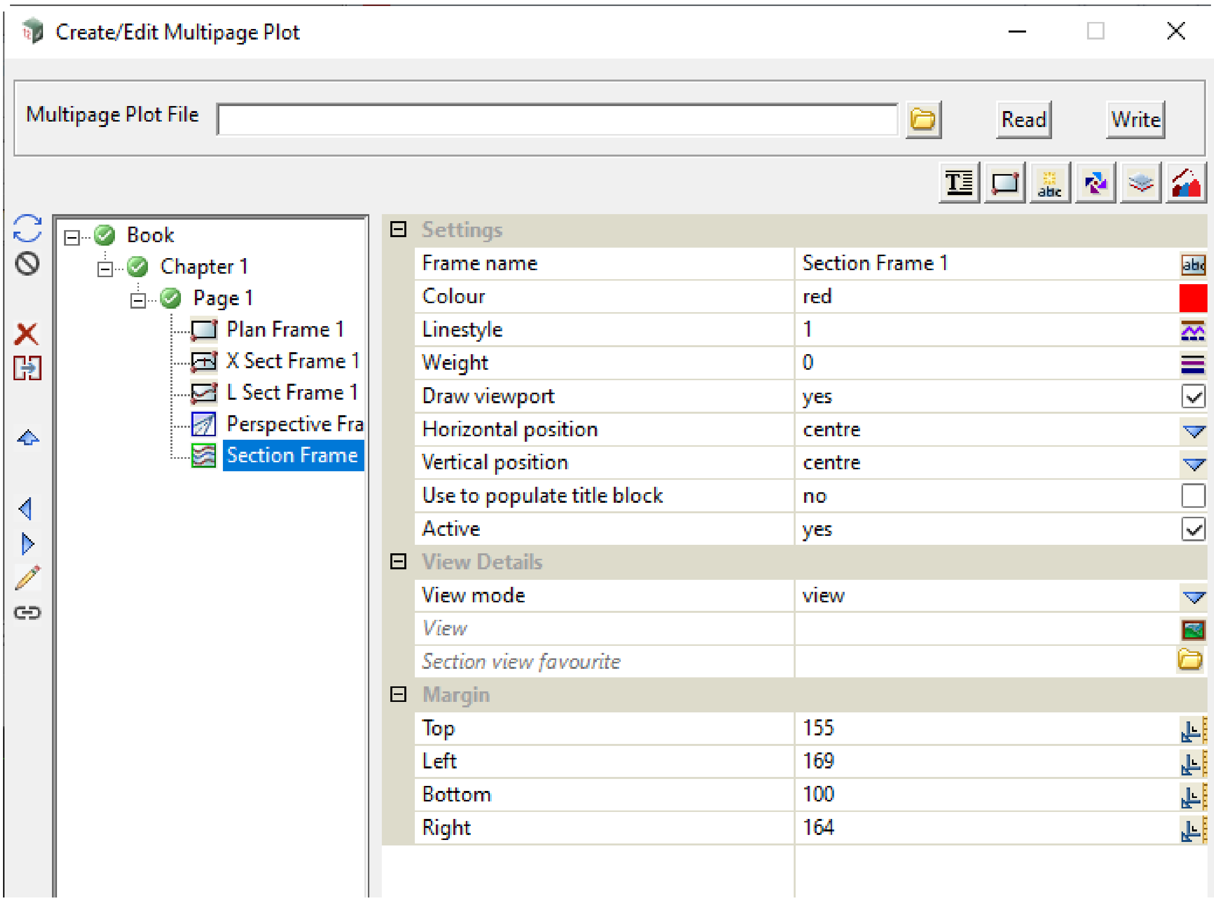
Perspective view favourite that is used to define all the information that will be displayed in the plot of the Perspective Frame.

Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

21.1.4.7.10 Section Frame

After selecting **Section** in the **Frame** menu, a rectangle for the Section Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.



Fields for the new Sections frame are displayed in the right hand side of the **Create/Edit Multipage Plot Sheet** panel.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Frame** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Frame Setup

Frame name	text box	Section Frame n	

*Name for this Section Frame. The default is **Section Frame n** where **n** is the first number to make the name "Section Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

Colour*	colour box	red	available colours

*Colour for the border of the Section Frame that is drawn when **Draw viewport** is **ticked**.*

Linestyle*	linestyle box	1	available linestyles

*Linestyle for the border of the Section Frame that is drawn when **Draw viewport** is **ticked**.*

Weight* weight box 0

*Weight for the border of the Section Frame that is drawn when **Draw viewport** is **ticked**.*

Draw viewport* tick box ticked

*If **ticked**, the border around the Section Frame is drawn.*
*If **not ticked**, the border around the Section Frame is NOT drawn.*

Position of the view in the perspective Frame

The plot of the view is fitted as large as possible into the area defined by the Section Frame. Unless the aspect ration of the view is exactly the same as the aspect ration of the Section Frame, the plot will not totally fill the Section Frame The horizontal and vertical positions are then used to position the plot inside the Section Frame.

Horizontal position* choice box centre centre, left, right

*If **centre**, the centre of the plot is placed so that it is half way between the left margin and the right sides of the Section Frame.*

*If **left**, the left hand side of the plot is placed on the left side of the Section Frame*

*If **right**, the right hand side of the plot is placed on the right side of the Section Frame.*

Vertical position* choice box centre centre, bottom, top

*If **centre**, the centre of the plot is placed so that it is half way between the top and the bottom of the Section Frame.*

*If **bottom**, the bottom of the plot is placed on the bottom of the Section Frame.*

*If **top**, the top of the plot is placed on the top of the Section Frame.*

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this Section Frame Node.*
*If **not ticked**, then this Section Frame Node will not be used for Title Block $variable population.*

*When created, if this Section Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the Section Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the Section Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note**: This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

View Details

View mode* choice box View view, view_favourites

*If **View mode** is **view**, the **View** field is used:*

View* view box available views

View that the Section Frame will take its information from to plot.

*If **View mode** is **view_favourites**, the **Section view favourite** field is used:*

Section view favourite* section view favourite box

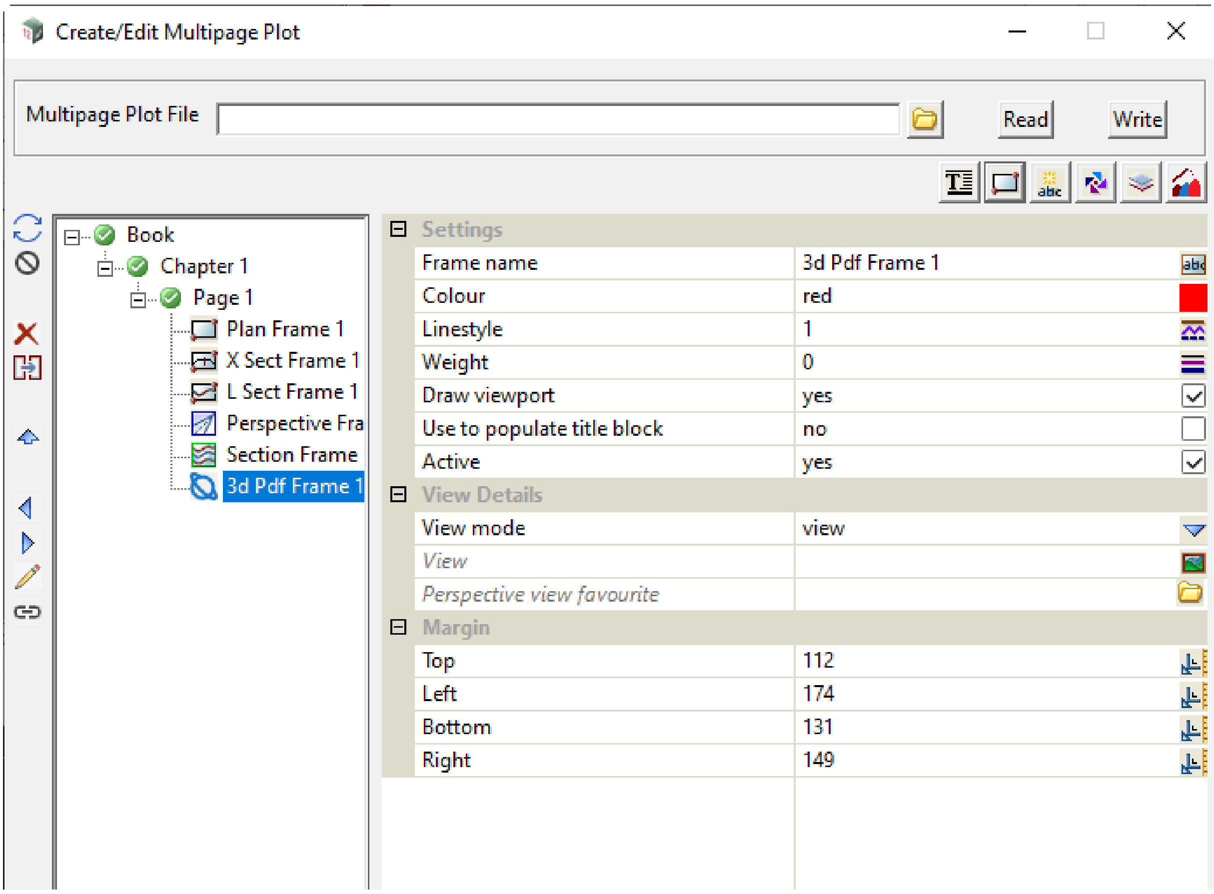
Section view favourite that is used to define all the information that will be displayed in the plot of the Section Frame.

Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

21.1.4.7.11 3D PDF Frame

After selecting **3D PDF** in the **Frame** menu, a rectangle for the 3D PDF Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.



Fields for the new 3D Pdf Frame are displayed in the right hand side of the **Create/Edit Multipage Plot Sheet** panel.

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Frame** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Frame Setup

Frame name text box 3d Pdf Frame n

*Name for this 3D Pdf. The default is **3D Pdf Frame n** where **n** is the first number to make the name "3D Pdf Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

Colour* colour box red available colours

*Colour for the border of the 3D Pdf that is drawn when **Draw viewport** is **ticked**.*

Linestyle* linestyle box 1 available linestyles

*Linestyle for the border of the 3D Pdf that is drawn when **Draw viewport** is **ticked**.*

Weight* weight box 0

*Weight for the border of the 3D Pdf that is drawn when **Draw viewport** is **ticked**.*

Draw viewport* choice box Yes, No

*If **ticked**, the border around the 3D Pdf is drawn.*
*If **not ticked**, the border around the 3D Pdf is NOT drawn.*

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this 3D Pdf Frame Node.*
*If **not ticked**, then this 3D Pdf Frame Node will not be used for Title Block $variable population.*

*When created, if this 3D Pdf Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*If otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the 3D Pdf Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the 3D Pdf Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*
***Note:** This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

View Details

View mode* choice box View view, view_favourites

*If **View mode** is **view**, the **View** field is used:*

View* view box available views

View that the Pdf 3D will take its information from to plot.

*If **View mode** set to **view_favourites**, the **Perspective view favourite field** is used:*

Perspective view favourite* perspective view favourite box

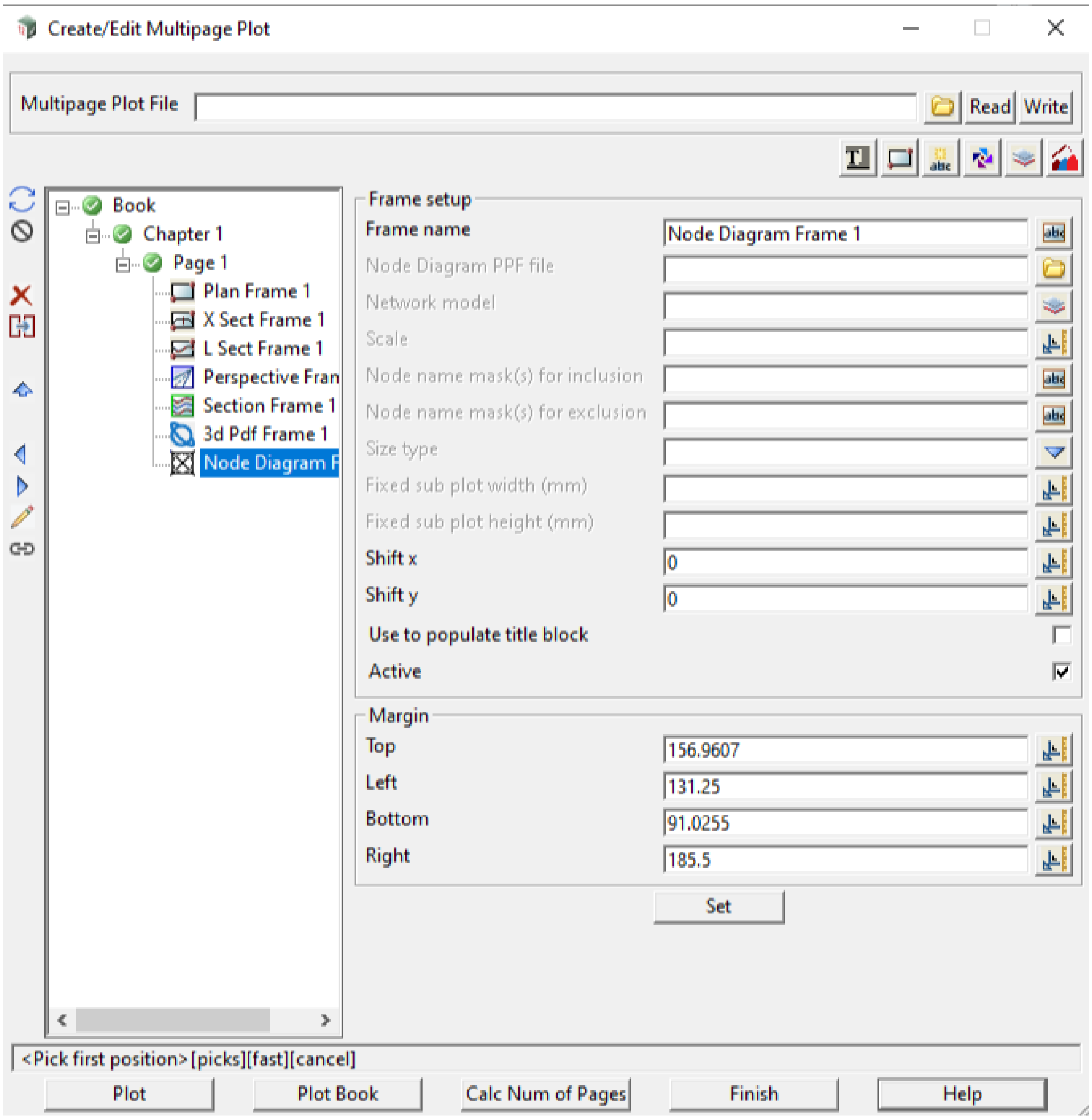
Perspective view favourite that is used to define all the information that will be displayed in the plot of the Pdf 3D Frame.

Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

21.1.4.7.12 Node Diagram Frame

After selecting **Node diagram** in the **Frame** menu, a rectangle for the Node diagram Frame is drawn on the Plot Area and a new subnode of the Book, Chapter or Page node is created.



Fields for the new Node Diagram Frame are displayed in the right hand side of the **Create/Edit Multipage Plot Sheet** panel.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Frame Setup

Frame name	text box	Node Diagram Frame n	

*Name for this Node Diagram Frame. The default is **Node Diagram Frame n** where **n** is the first number to make the name "Node Diagram Frame n" unique for this node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.*

Node diagram PPF file	node diagram ppf box		available node diagram ppfs

Selected PPF file that contains all the information for drawing a node diagram plot.

Network model	Model box		available models

Model containing the water string whose nodes are to be plotted.

*If **not blank**, this value will override the existing value of the **Network model** field in the **Node Diagram PPF file** when plotting.*

*If **blank**, no overriding will occur and the **Network model** field value specified in the **Node Diagram PPF file** will be used when plotting.*

Scale real box measures

Scale to plot the node diagrams.

Node name mask(s) for inclusion text box

*If **not blank** then only those nodes whose name matches one in the name mask are considered for plotting.*
*If **blank**, all nodes are considered for plotting. So blank acts like "*".*

See 23.7.2.1 Name Masks.

Node name mask(s) for exclusion text box

*If **not blank** then any node whose name matches one in the name mask is not plotted.*

*If **blank**, then no nodes are considered for excluding from plotting.*

See 23.7.2.1 Name Masks.

Set sub plot size to choice box fixed size, diagram size

*If **fixed size**, each node diagram is drawn in a rectangle defined by **Sub plot width in mm** and **Sub plot height in mm**.*

*If **diagram size**, each node diagram is drawn in a rectangle of a size calculated to fit that particular node. So the size will be different for each node.*

Fixed sub plot width in mm real box

Width of the imaginary box to draw each node diagram in.

Fixed sub plot height in mm real box

Height of the imaginary box to draw each node diagram in.

Shift X real box 0 measures

Horizontal (x) shift to the drawing position of the node diagram that is drawn in the frame.

Shift Y real box 0 measures

Vertical (y) shift to the drawing position of the node diagram that is drawn in the frame.

Use to populate title block tick box

This field only appears on Frame Nodes that exist at the Page level.

*If **ticked**, then any Title Block Nodes operating at this level will populate their $variables from this Node Diagram Frame Node.*
*If **not ticked**, then this Node Diagram Frame Node will not be used for Title Block $variable population.*

*When created, if this Node Diagram Frame Node is the first Frame Node on the Page AND there is a Title Block Node operating on this level, then this field will default to **ticked**.*
*if otherwise, then this field will default to **not ticked**.*

***Note:** this field is exclusive between all Frame Nodes on a Page. That is, only one Frame Node on each Page may have this field set to **ticked**. Ticking this field on a second Frame Node on a Page will results in the field being **un-ticked** on the first Frame Node of that Page.*

For more information, see 21.1.4.6.3 MPS Title Block $variables.

Active tick box ticked

*If **ticked**, the Node Diagram Frame node is made active and will be used when plotting. The node's active/inactive icon will be set to active.*
*If **not ticked**, the Node Diagram Frame node will be ignored when plotting. The node's active/inactive icon will be set to inactive.*

Note: *This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

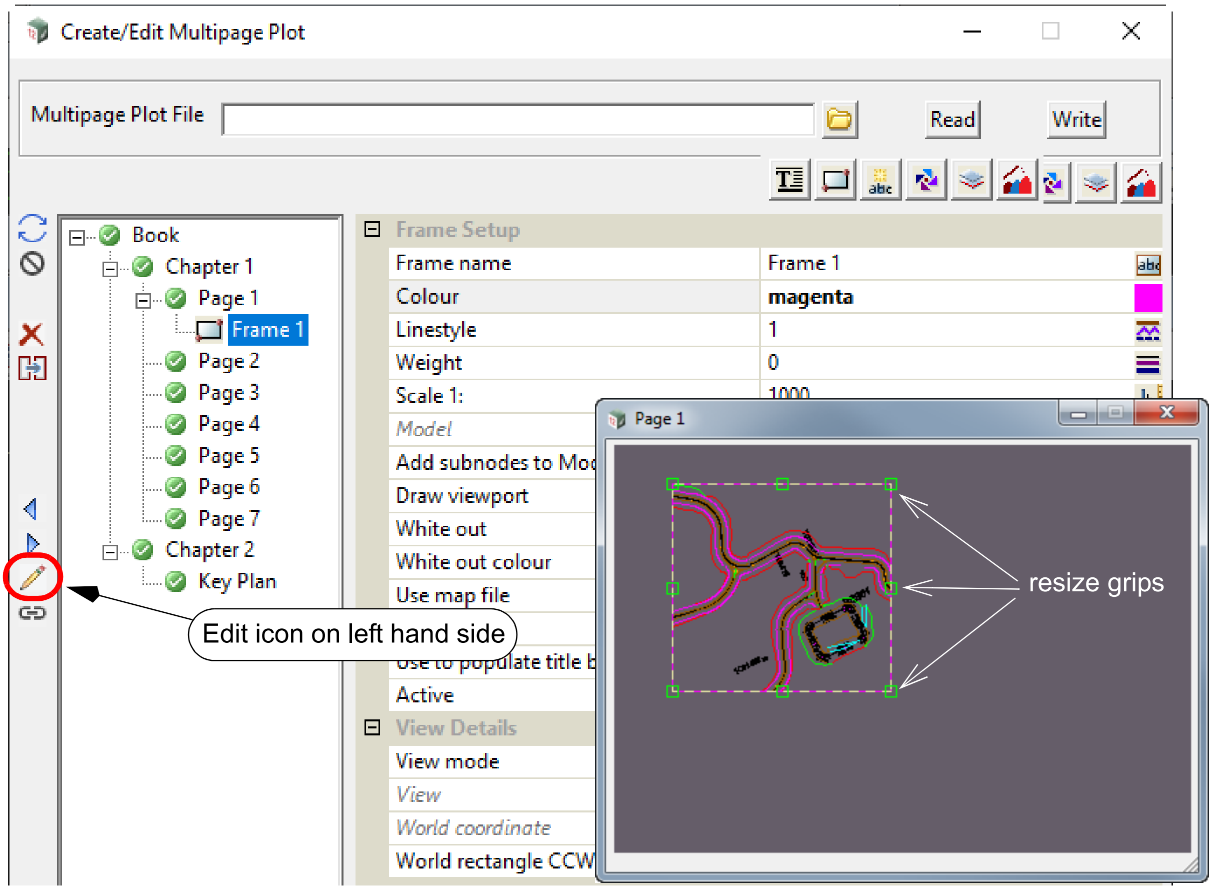
Margins

The margins give the size of the Frame in the Plot Area. See Margins *in* 21.1.4.7.5 Common Information About Frames.

21.1.4.7.13 Edit Frame

There are two ways of starting the Edit option for a Frame - one using the Frame node and the other by picking a Frame from a Plot Area.

(a) Clicking on and highlight the Frame node to be edited and then select the left had side **Edit** icon.

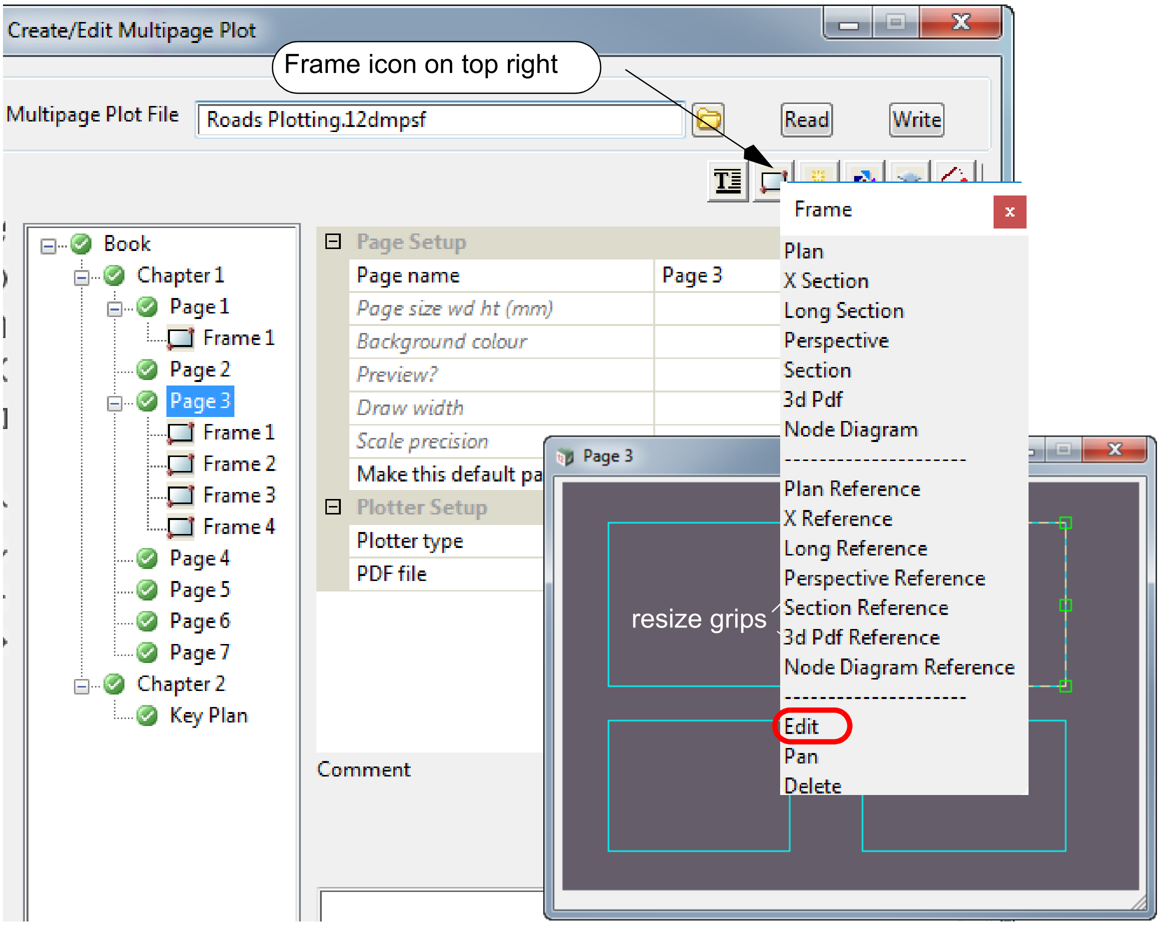


The frame is then highlighted in the Plot Area and resize grips displayed.

Plus when the cursor is inside a frame but not near the edge of a Frame, a **Move** grip is displayed. The **Move** grip is used to move the Frame around on the **Plot Area.**

(b) Click on the Book, Chapter or Page that the Frame is defined on, then click on the **Frame** icon on the top right and pick **Edit** from the **Frame** pop-up menu.

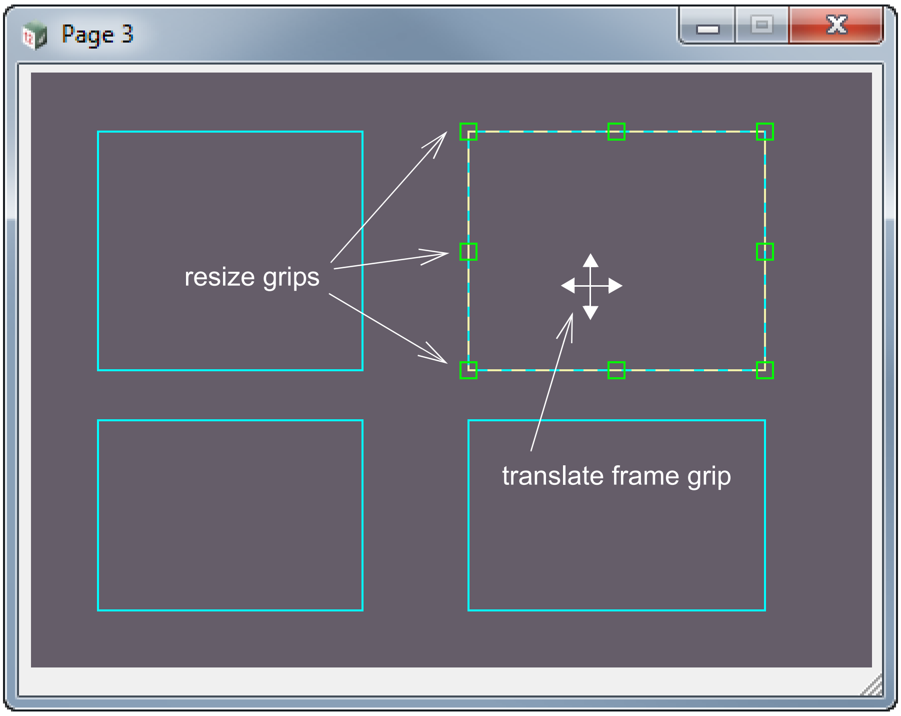
The Frame to Edit is then selected form the Plot Area by clicking LB **anywhere inside** the Frame **but don't accept it with MB**.



The Frame is then highlighted in the Plot Area and resize grips displayed.

For either (a) or (b), the Frame is highlighted, the **Resize** grips are displayed on the four corners and on the four sides of the Frame. These grips are used to resize the Frame, and hence the associated plotting area on the Plot Area.

When the cursor is inside a frame but not near the edge of a Frame, a **Translate** grip is displayed. The **Translate** grip is used to move the Frame around on the **Plot Area.**



For Case (b), if **MB** is clicked to accept the Frame, the information for the Frame is displayed in the right hand side of the **Create/Edit Multipage Plot** panel and the Frame node is highlighted in the tree.

For both cases, after the Resizing and Translating you can pick another Frame to resize or translate by simply clicking LB inside the new Frame.

21.1.4.7.14 Reference Frames

A Reference Frame is created in three ways:

(a) A **Chapter** or **Page node** is **highlighted** and either **Plan Reference**, **X Reference**, **Long Reference or Perspective Reference** is selected from the **Frame** menu.

A new **Frame** is created for the highlighted **Book**, **Chapter** or **Page** node.

This has been documented in 21.1.4.7.2.2 Reference Frames for a Chapter and 21.1.4.7.3.2 Reference Frames for a Page.

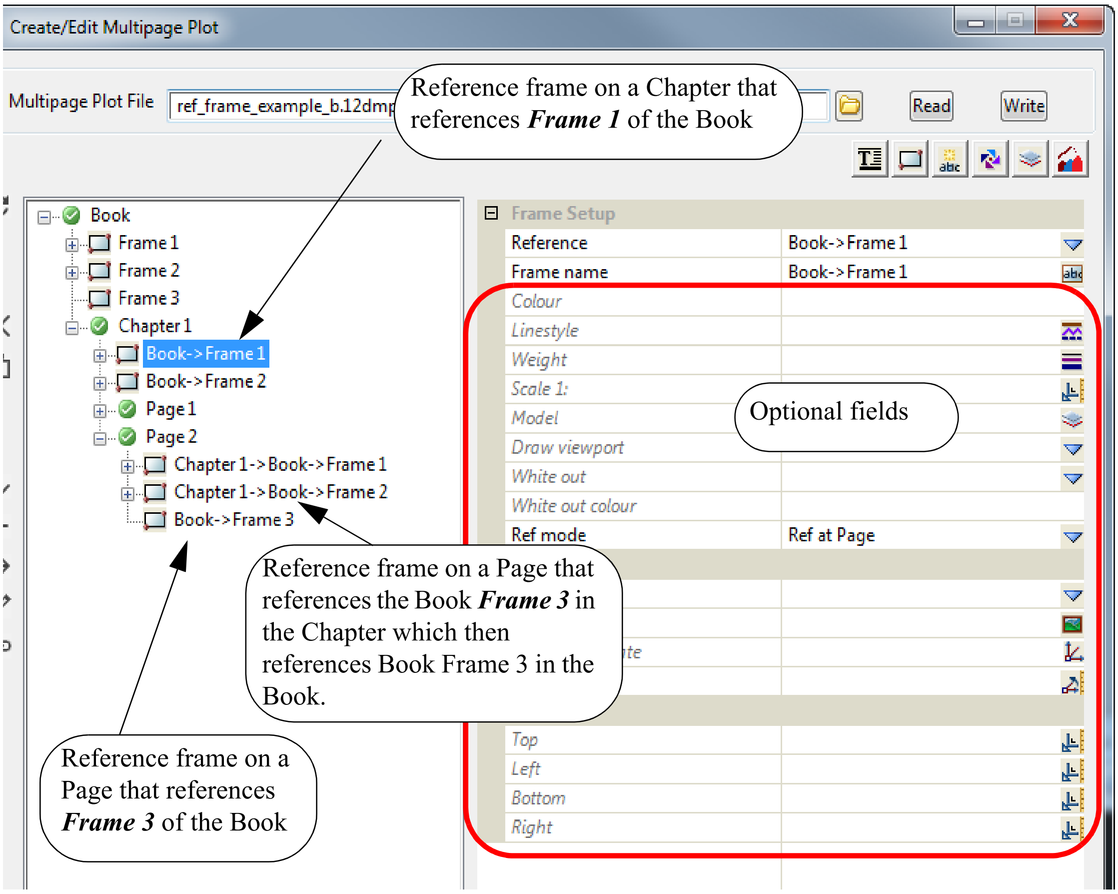
(b) When a **Frame** is created for a **Book**, you are asked "*Do you want to create reference frame(s) for Chapter(s)*? and "*Do you want to create reference frame(s) for Page(s)*?.

Depending on the answers, Reference Frames are created for all existing Chapters and/or Pages and new Reference Frames are created when new Chapters or Pages are added to the Book. For more information see 21.1.4.7.1.1 Frames for a Book.

(c) When a **Frame** is created for a **Chapter,** you are asked "*Do you want to create reference frame(s) for Page(s)*?.

If the answer is yes, Reference Frames are created for all existing Pages in the Chapter and new Reference Frames are created when Pages are added to the Chapter. For more information see 21.1.4.7.2.1 Frames for a Chapter.

.



The fields used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Reference	Frame box		non Reference Frames

Name of the Frame that this frame is derived from.
That is, all the information for this Frame is derived from the Frame listed here.

Frame name text box

Name for this frame. The default is the full name of the Frame it is referenced to.

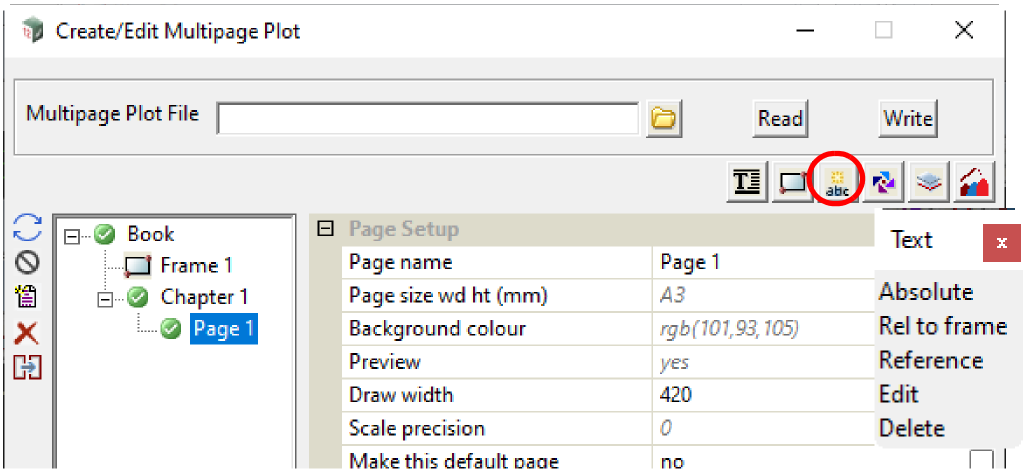
Optional Fields

the rest of the fields in the panel are optional and if blank, the values are taken from the referenced Frame.

See 21.1.5 Example Using Reference Frames.

21.1.4.8 Text Icon for Use on a Book, Chapter, Page or Frame Node

Text can be placed on a **Book**, **Chapter**, **Page** or **Frame** node using options on the **Text** menu which is brought up by clicking on the **Text** icon on the top right.



See

Text - Absolute and Rel to Frame
Text - Reference
Text - Edit
Text - Delete

Text - Edit

Edit: can be used to move or modify an existing Text on a **Plot Area** that the text was created on. For example, if the Text was created on a **Chapter Plot Area** then you need to highlight that **Chapter** and select the text on that **Chapter Plot Area** to edit it.

To **move** text after clicking on **Edit**, pick the text to move with LB **but don't accept it with MB.** The text can then be moved.

If **MB** is clicked to accept the text, the characters of the text is displayed in Text Area in the right hand side of the **Create/Edit Multipage Plot** panel. This can then be modified.

Note that a Text can also be edited by highlighting the Text node in the tree and pressing **Edit** on the left hand side.

Text - Delete

Delete: can be used to delete a **Text** by picking it on a **Plot Area.**

To **delete** a Text after clicking on **Delete**, pick and accept the Text on a **Plot Area** that the text was created on. For example, if the Text was created on a **Chapter Plot Area** then you need to highlight that **Chapter** and select the text on that **Chapter Plot Area** to delete it.

Note that a Text can also be deleted by highlighting the Text node in the tree and pressing **Delete** on the left hand side.

Text - Absolute and Rel to Frame

The options **Absolute** and **Rel to frame** are used when creating text on a plot.

For the **Book**, **Book Text** can be created by:

Highlighting the **Book** node, clicking on the **Text** icon and selecting **Absolute** from the **Text** menu.

This will create **Book Text**.

See 21.1.4.8.1 Creating Text at the Book, Chapter or Page Level.

For the **Book**, **Book Frame Text** can be created by either:

(a) highlighting a **Book Frame** node, clicking on the **Text** icon and selecting either **Absolute** or **Rel to frame** from the **Text** menu.

This will create **Book Frame Text** for the highlighted **Book Frame** node.

See21.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node.

(b) highlighting the **Book** node, clicking on the **Text** icon and selecting **Rel to frame** from the **Text** menu and then **picking** a **Book Frame** from the **Book Plot Area.**

This will create **Book Frame Text** for the **picked Book Frame**.

See21.1.4.8.2 Creating Frame Text.

For a **Chapter**, **Chapter Text** can be created by:

Highlighting the **Chapter** node, clicking on the **Text** icon and selecting **Absolute** from the **Text** menu.

This will create **Chapter Text**.

See 21.1.4.8.1 Creating Text at the Book, Chapter or Page Level.

For a **Chapter**, **Chapter Frame Text** can be created by either:

(a) highlighting a **Chapter Frame** node, clicking on the **Text** icon and selecting either **Absolute** or **Rel to frame** from the **Text** menu.

This will create **Chapter Frame Text** for the highlighted **Chapter Frame** node.

See21.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node.

(b) highlighting a **Chapter** node, clicking on the **Text** icon and selecting **Rel to frame** from the **Text** menu and then **picking** a **Chapter Frame** from the **Chapter Plot Area.**

This will create **Chapter Frame Text** for the **picked Chapter Frame**.

See21.1.4.8.2 Creating Frame Text

For a **Page**, **Page Text** can be created by:

Highlighting the **Page** node, clicking on the **Text** icon and selecting **Absolute** from the **Text** menu.

This will create **Page Text**.

See 21.1.4.8.1 Creating Text at the Book, Chapter or Page Level.

For a **Page**, **Page Frame Text** can be created by either:

(a) highlighting a **Page Frame** node, clicking on the **Text** icon and selecting either **Absolute** or **Rel to frame** from the **Text** menu.

This will create **Page Frame Text** for the highlighted **Page Frame** node.

See21.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node.

(b) highlighting a **Page** node, clicking on the **Text** icon and selecting **Rel to frame** from the **Text** menu and then **picking** a **Page Frame** from the **Page Plot Area.**

This will create **Page Frame Text** for the **picked Page Frame**.

See21.1.4.8.2 Creating Frame Text.

Text - Reference

The option **Reference** is not for creating new text but creates a **Text** node that **references** an existing **Text** node. This means that the **Reference Text** node has as default, all the values defined for the **Text** node that is being referenced BUT any of those values can be modified for the **Reference Text** node.

See 21.1.4.8.3 Reference Text.

Important Note:

The names of the **Book Text nodes** and **Book Frame Text nodes** must be unique amongst all the **Book Text nodes** AND the **Book Frame Text nodes.**

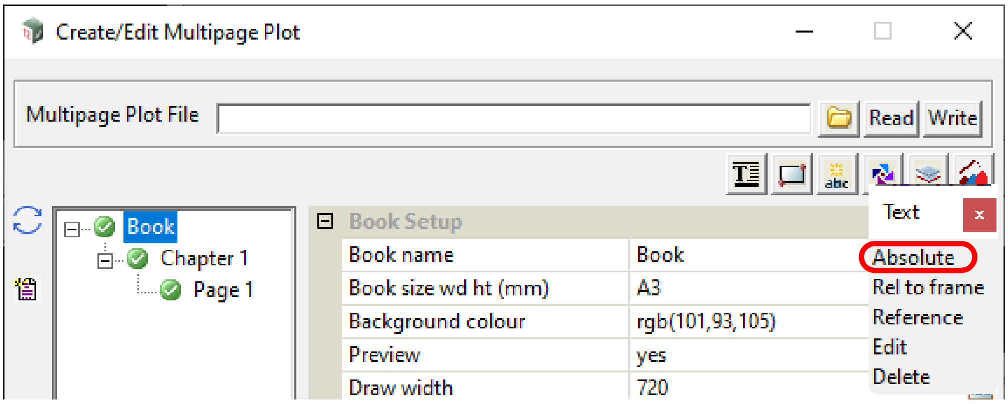
For a **Chapter**, the names of the **Chapter Text nodes** and the **Chapter Frame Text nodes** for **that Chapter** must be unique amongst all the **Chapter Text nodes** AND the **Chapter Frame Text nodes** for that **Chapter**.

Similarly for a **Page**, the names of the **Page Text nodes** and the **Page Frame Text nodes** for **that Page** must be unique amongst all the **Page Text nodes** AND the **Page Frame Text nodes** for that **Page**.

21.1.4.8.1 Creating Text at the Book, Chapter or Page Level

The process for creating **Book Text** will be described in detail but the steps are identical for **Chapter** and **Page** except that the word **Book** is replaced by **Chapter** or **Page** in the description.

Text is created at the **Book**, **Chapter** or **Page** level by first clicking on and highlighting either the **Book**, **Chapter** or **Page** node, then clicking on the **Text** icon on the top right to bring up the **Text** menu and finally selecting ***Absolute*** from the **Text** menu
.

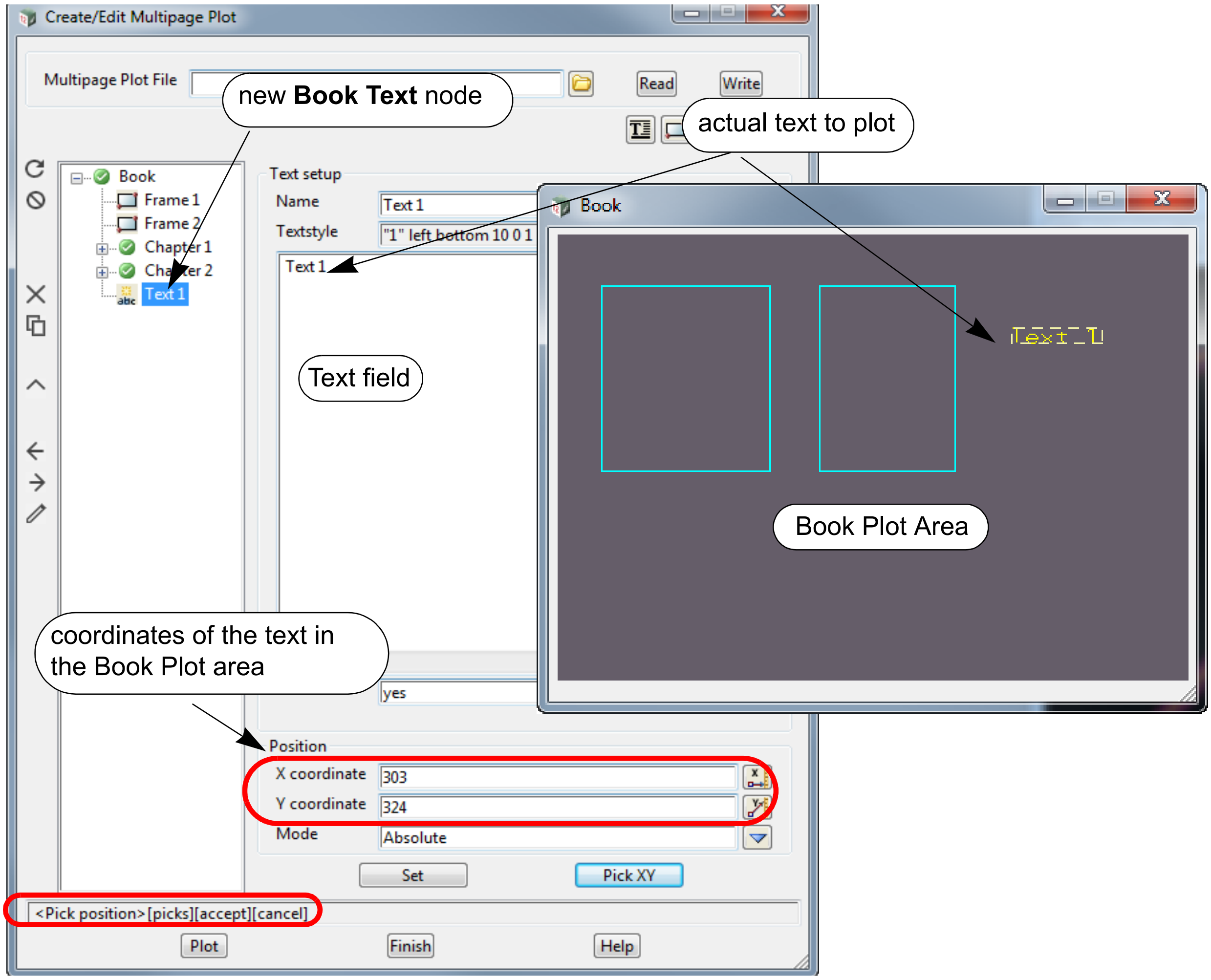


A position in the **Book Plot Area** for the text is then selected.

Once the text position is selected, a **Text** node is automatically added at the bottom of the **Book** with the default name **Text n** where **n** is the next integer that makes the **Text node** name unique amongst all the **Book Text nodes** AND the **Book Frame Text nodes.**

Similarly the name of a **Chapter Text node** must be unique amongst all the **Chapter Text nodes** AND the **Chapter Frame Text nodes** for that **Chapter**. And the name of a **Page Text node** must be unique amongst all the **Page Text nodes** AND the **Page Frame Text nodes** for that **Page**.

The default text "Text n" is added to the **Text** field and displayed in the **Book Plot Area**.



For documentation on the fields and icons used for **Book Text**, **Chapter Text** and **Page Text**, see 21.1.4.8.4 Icons and Fields for Text and Frame Text Nodes.

21.1.4.8.2 Creating Frame Text

Text can be **attached** to a **Frame** at either a **Book**, **Chapter** or **Page** level.

The main difference with **Frame Text** and **Book, Chapter** or **Page Text** is that **Frame Text** can be placed **Absolutely on the Page** or **Relative to the Frame.**

If the **Frame Text** is **Absolute**, then the **Text** is placed at a fixed position on the **Plot Area** that the **Frame** is on and if the **Frame** is moved, the **Text does not** move.

If the **Frame Text** is **Relative**, its position is **Relative to the Frame** the Text is on and if the Frame is **moved**, the **Frame Text moves with the Frame**.

There are two ways of selecting the **Frame** and then creating **Frame Text.**

1. Clicking on the **Frame node**.

   See 21.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node.

2. Picking a **Frame** from the **Plot Area**.

   See 21.1.4.8.2.2 Creating Frame Text by Picking a Frame from the Plot Area.

21.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node

The process for creating **Book Frame Text** will be described in detail but the steps are identical for **Chapter** and **Page** except that in the description, the word **Book** is replace by **Chapter** or **Page**.

To create **Frame Text** using the **Frame node**, click on and highlight the **Book Frame node**, **Chapter Frame node** or **Page Frame node** to add **Frame Text** to.

The **Plot Area** for the **Book**, **Chapter** or **Page** of the **Frame node** is then displayed and the **Frame** highlight on the **Plot Area**.

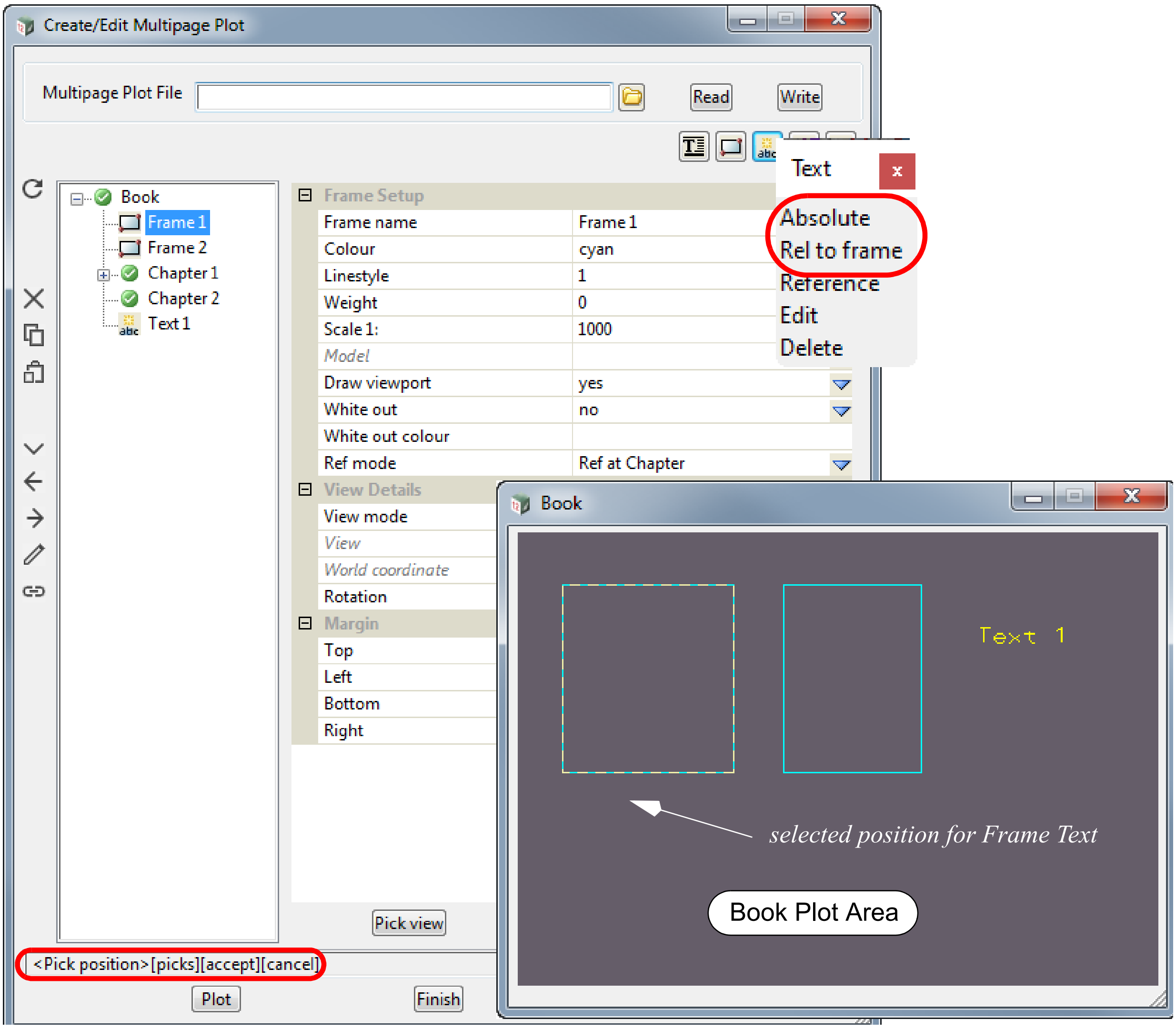
Next click on the **Text icon** at the top right to bring up the **Text** menu, and from the **Text** menu select:

(a) **Rel to frame** if you want the text in the Plot Area to move with the **Frame**

or

(b) **Absolute** if you want the text to have a fixed position on the **Plot Area**. The text does not move with the **Frame** but the Text will be deleted if the Frame is deleted.

After picking **Rel to Frame** or **Absolute**, the position for the **Fame Text** is selected in the **Plot Area**.

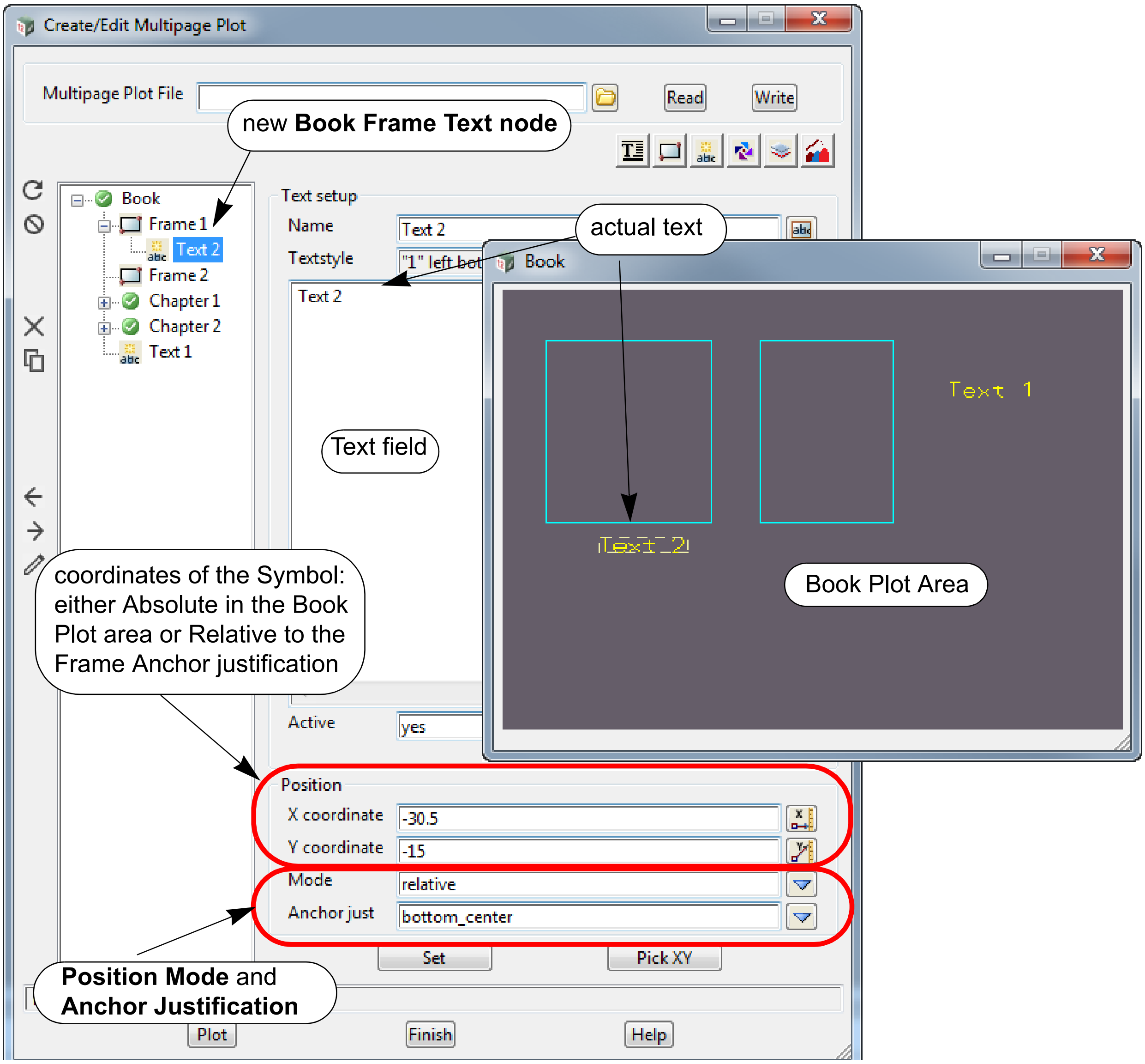


Once the text position is selected, a **Book Frame Text node** is automatically added at the bottom of the **Book Frame** with the default name **Text n** where **n** is the next integer that makes the **Book Frame Text node** name unique amongst all the **Book Text nodes** AND the **Book Frame Text nodes**.

Similarly the name of a **Chapter Frame Text node** must be unique amongst all the **Chapter Text nodes** AND the **Chapter Frame Text nodes** for that **Chapter**. And the name of a **Page Frame Text**

node must be unique amongst all the **Page Text nodes** AND the **Page Frame Text nodes** for that **Page**.

The default text "Text n" is added to the Text field and displayed in the **Book Plot Area**.



If ***Absolute*** was chosen from the **Text** menu:

> the **Position Mode** is set to ***Absolute*** and the values for **X coordinate** and **Y coordinate** are the position on the Book Plot area.

If ***Rel to Frame*** was chosen from the **Text** menu:

> the **Position Mode** is set to ***Relative***, and the **Anchor just** is set to the closest of the nine rustications positions for the Frame (bottom left, bottom centre, bottom right, middle left, middle centre, middle right, top left, top centre, top right). The values for **X coordinate** and **Y coordinate** are then relative to the Anchor justification point.

The values for **X coordinate, Y coordinate**, **Mode** and **Anchor just** can be changed at any time and the **Set** button pressed for them to take effect.

If **mode** is **Relative** and the Frame is moved, the Text also moves by the same amount.

If **mode** is **Relative** and the Frame is resized, the position of the Text relative to the **Anchor justification** is maintained.

For documentation on the fields and icons used for a **Frame Text**, see 21.1.4.8.4 Icons and Fields for Text and Frame Text Nodes.

21.1.4.8.2.2 Creating Frame Text by Picking a Frame from the Plot Area

Instead of having to click on a **Frame node** in the **Book** tree to create **Text**, a **Frame** can be **interactive selected** from either the **Book Plot Area**, **Chapter Plot Area** or **Page Plot Area**.

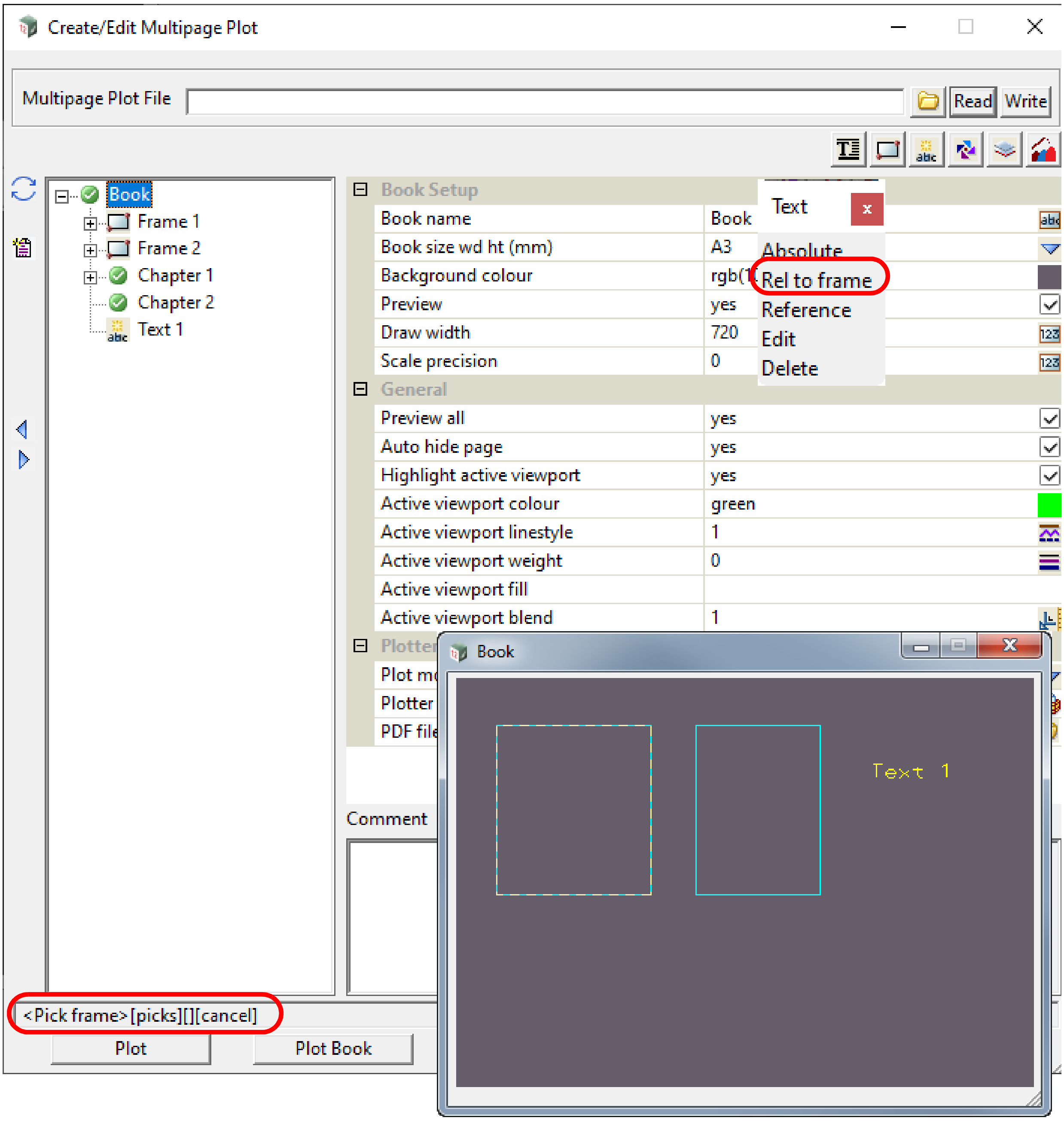
The process is similar to that for **Book**, **Chapter** or **Page Text** except **Rel to frame** must be selected from the **Text** menu.

(The steps are identical for a **Book**, **Chapter**, **Page** except that the word **Book** is replaced by **Chapter** or **Page** so the images will only show a **Book Frame**)

To create **Frame Text** by picking a **Frame** on the **Plot Area**, click on and highlight the **Book node**, **Chapter node** or **Page node** to display the **Plot Area**.

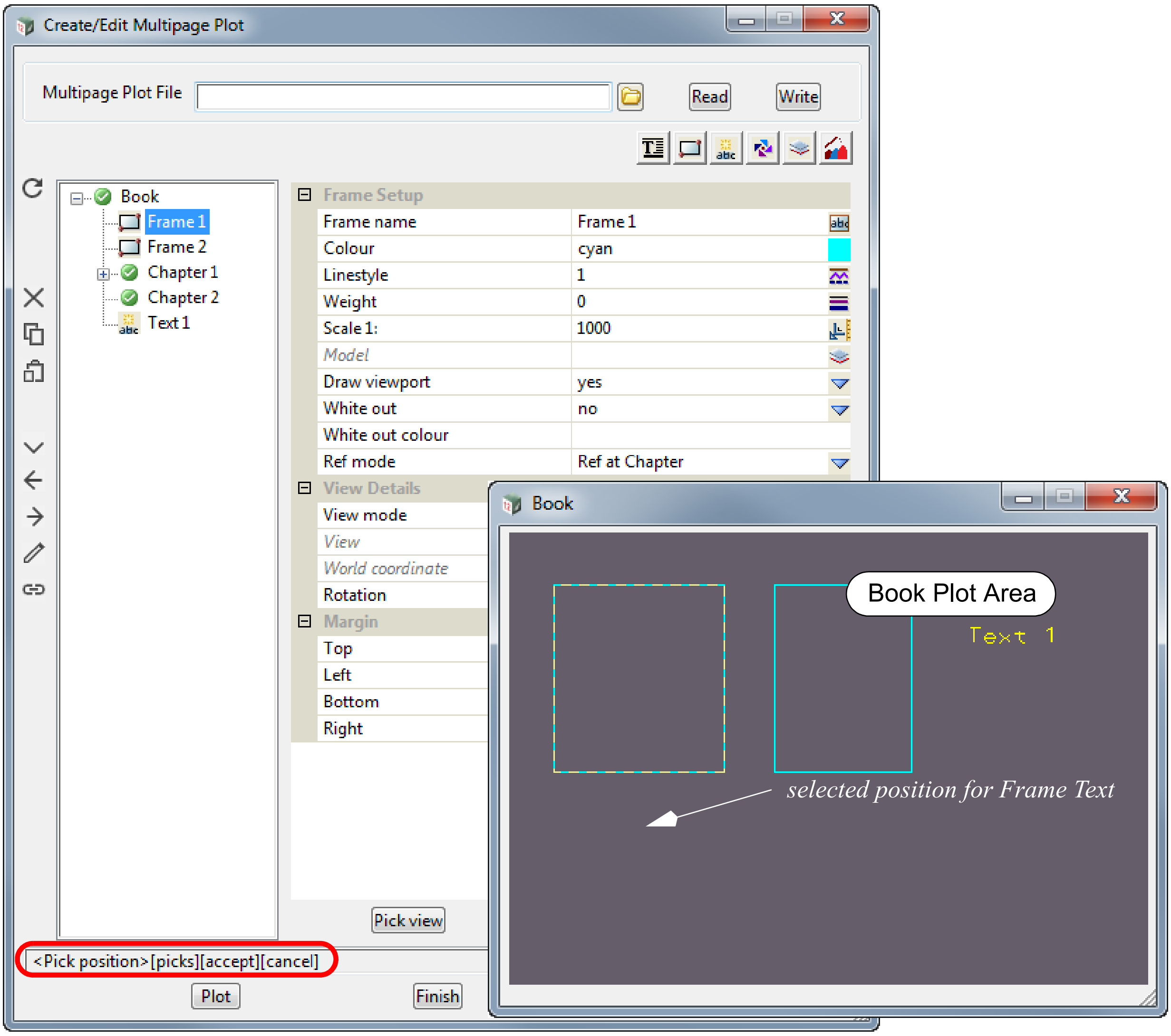
Next click on the **Text icon** at the top right to bring up the **Text** menu, and select ***Rel to frame*** from the **Text** menu.

The user is then asked to pick a **Frame** from the **Plot Area**.



When the **Frame** is **selected**, the **Frame** is highlighted in the **Plot Area** and the **Frame node** highlighted in the tree.

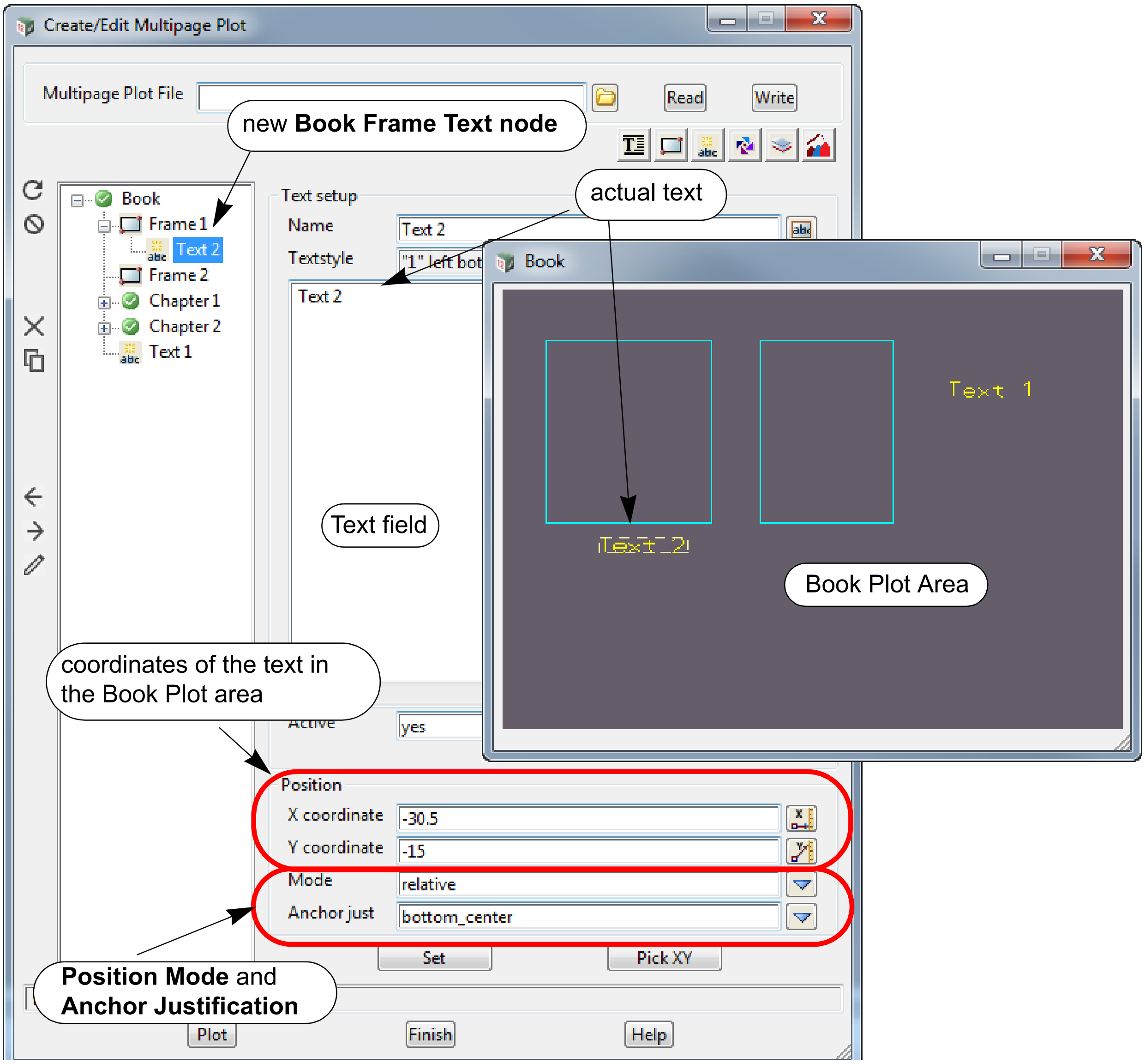
The position for the **Fame Text** is then selected in the **Plot Area**.



Once the text position is selected, a **Book Frame Text node** is automatically added at the bottom of the **Book Frame** with the default name **Text n** where **n** is the next integer that makes the **Book Frame Text node** name unique amongst all the **Book Text nodes** AND the **Book Frame Text nodes**.

Similarly the name of a **Chapter Frame Text node** must be unique amongst all the **Chapter Text nodes** AND the **Chapter Frame Text nodes** for that **Chapter**. And the name of a **Page Frame Text node** must be unique amongst all the **Page Text nodes** AND the **Page Frame Text nodes** for that **Page**.

The default text "Text n" is added to the Text field and displayed in the **Book Plot Area**.



If ***Absolute*** was chosen from the **Text** menu:

the **Position Mode** is set to ***Absolute*** and the values for **X coordinate** and **Y coordinate** are the position on the Book Plot area.

If ***Rel to Frame*** was chosen from the **Text** menu:

the **Position Mode** is set to ***Relative***, and the **Anchor just** is set to the closest of the nine justifications positions for the Frame (bottom left, bottom centre, bottom right, middle left, middle centre, middle right, top left, top centre, top right). The values for **X coordinate** and **Y coordinate** are then relative to the Anchor justification point.

The values for **X coordinate, Y coordinate**, **Mode** and **Anchor just** can be changed at any time and the **Set** button pressed for them to take effect.

If **mode** is **Relative** and the Frame is moved, the Text also moves by the same amount.

If **mode** is **Relative** and the Frame is resized, the position of the Text relative to the **Anchor justification** is maintained.

For documentation on the fields and icons used for **Frame Text**, see 21.1.4.8.4 Icons and Fields for Text and Frame Text Nodes.

21.1.4.8.3 Reference Text

Reference Text is not for creating a new **Text node** but creates a **Reference Text node** that **references** an existing **Text node** or **Reference Text node** at a higher level, and optionally replaces the values defining the new **Reference Text**.

That is, **Reference Text** at a **Chapter** level can only reference **Book Text** or **Book Frame Text**. And **Reference Text** at the **Page** level can only reference **Book Text**, **Book Frame Text, Chapter Text, Chapter Frame Text, Chapter Reference Text**, **Chapter Reference Frame Text** or **Chapter Reference Frame Reference Text.**

The **Reference Text** has as defaults all the values defined for the **Text** that is being referenced BUT any of those values can be modified for the **Reference Text**. In particular, the **Reference Text** can be made active/inactive independently of the original **Text**.

For example, if a **Book Text** was created then that text would by default be drawn exactly the same way on each **Page**. If a **Reference Text** was created on a **Page** and it referenced the **Book Text**, then the **Reference Text** would then specify how that **Book Text** was drawn on that **Page** and any of the Text values could be changed. For example, the actual text or its colour could be changed, or the **Reference Text** could be made inactive so that the **Text** is **no longer drawn** on that **Page**.

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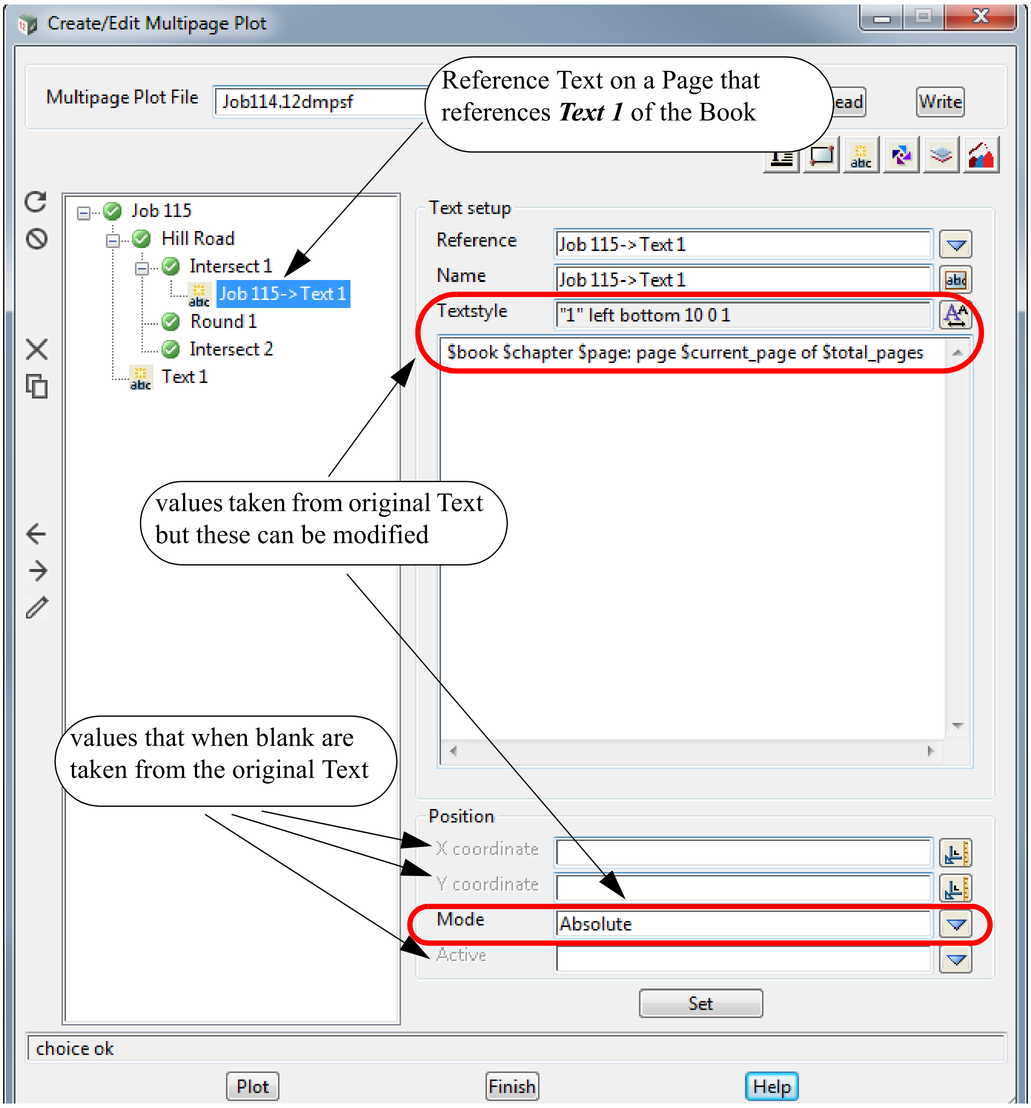


Reference Text can be created in six ways:

(a) **Chapter Reference Text.** *See* 21.1.4.8.3.1 Creating Chapter Reference Text

(b) **Chapter Frame Reference Text** *See* 21.1.4.8.3.2 Creating Chapter Frame Reference Text.

(c) **Chapter Reference Frame Reference Text** *See* 21.1.4.8.3.3 Creating Chapter Reference Frame Reference Text.

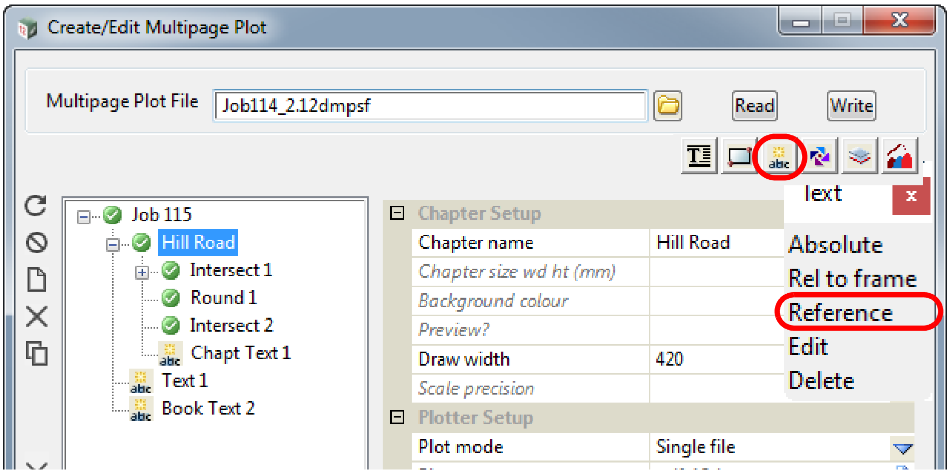
(d) **Page Reference Text.** *See* 21.1.4.8.3.4 Creating Page Reference Text.

(e) **Page Frame Reference Text.** *See* 21.1.4.8.3.5 Creating Page Frame Reference Text.

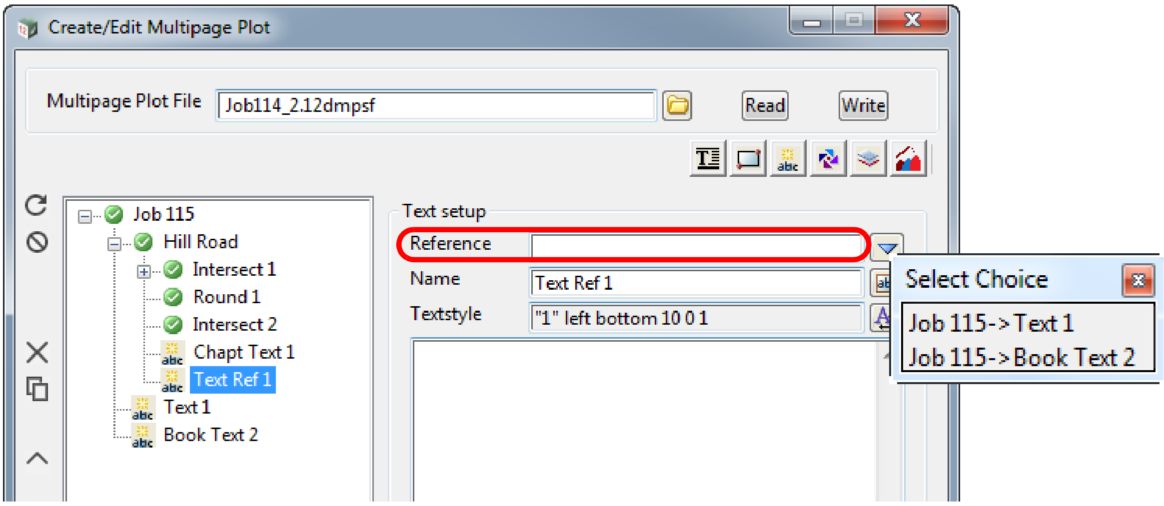
(f) **Page Reference Frame Reference Text.** *See* 21.1.4.8.3.6 Creating Page Reference Frame Reference Text.

21.1.4.8.3.1 Creating Chapter Reference Text

To create a **Chapter Reference Text** for a **Chapter**, click on the **Chapter node** and then click on the **Text** icon and select **Reference** from the **Text** menu.

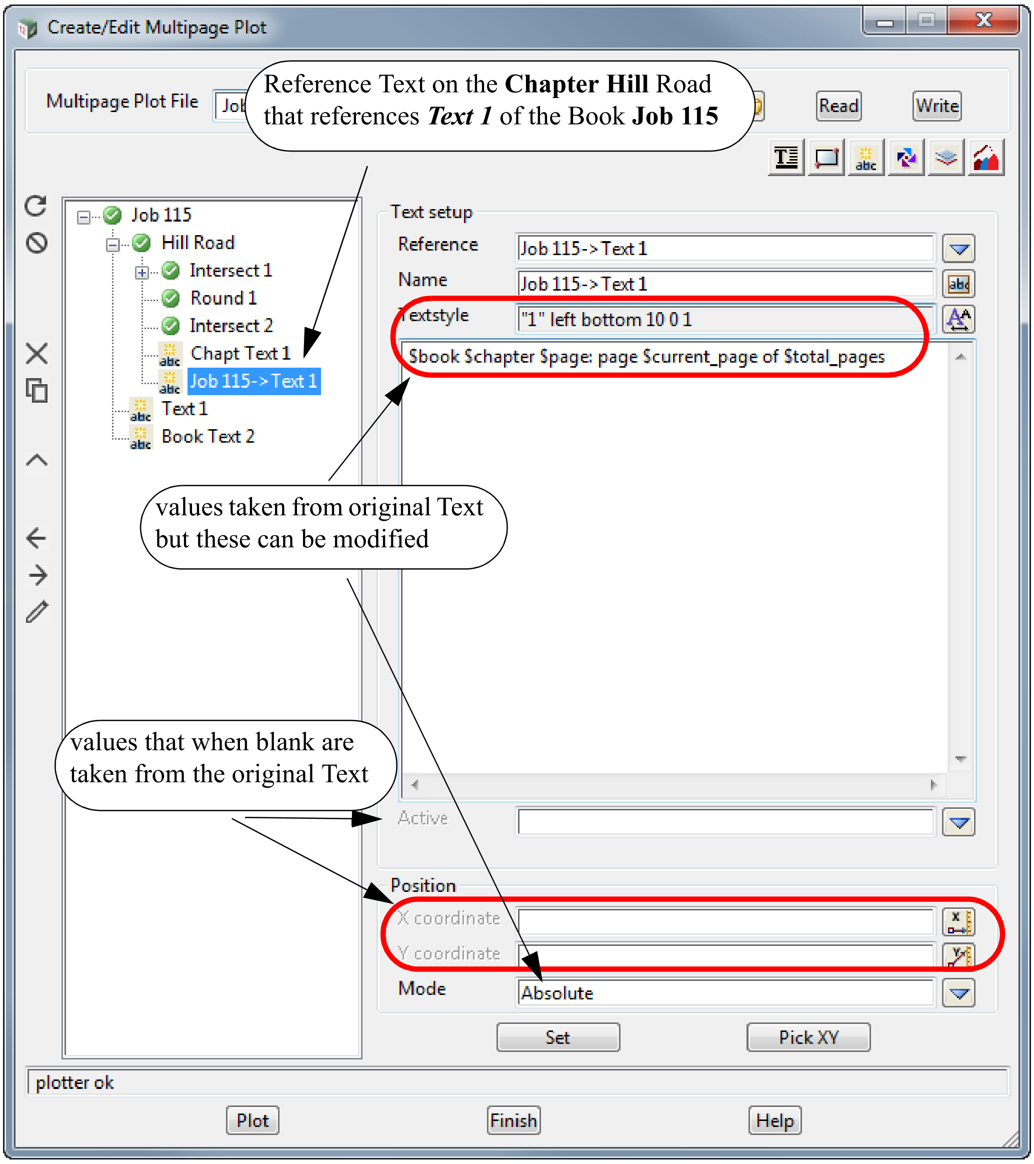


A new **Chapter Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts** and **Book Frame Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that it is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



Most of the **Text Setup** values are blank as their values are taken from the **Book Text** being referenced but any of them can be changed and the changed values will be used for this **Chapter Reference Text**.

Important Note

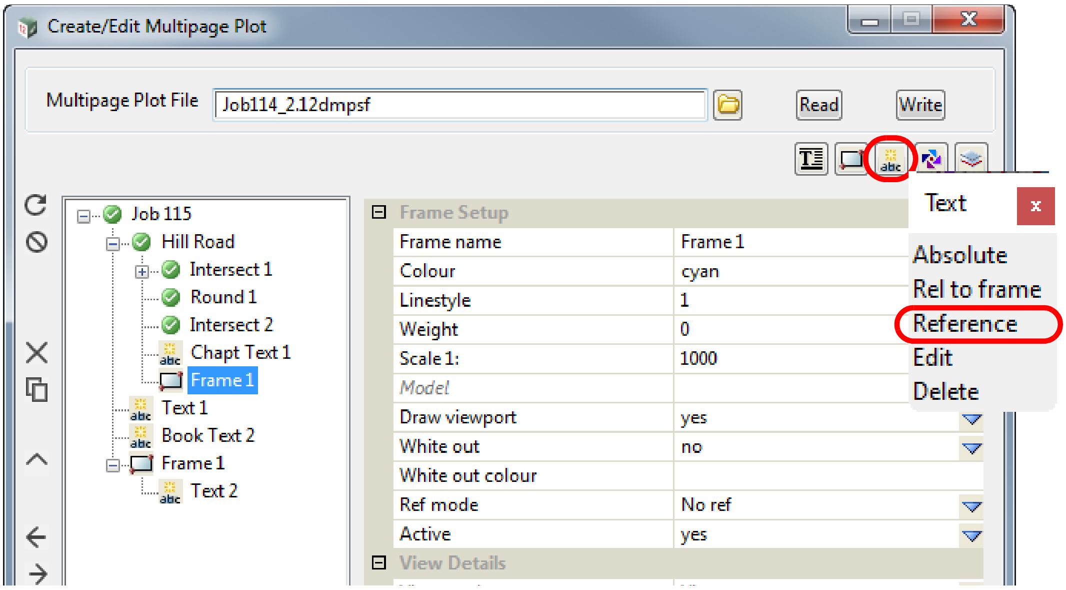
If you don't want to display **Book Text**, **Chapter Text** or **Chapter Reference Text** for a particular **Page**, then for that page, create a **Reference Text** that references the appropriate Book Text, Chapter Text or Chapter Reference Text, and set the ***Active*** field to **No**.

If you don't want to display **Book Text** for a particular chapter, then for that chapter, create a **Chapter Reference Text** which references the appropriate Book Text, and in the **Chapter Reference Text** fields, set the ***Active*** field to **No**.

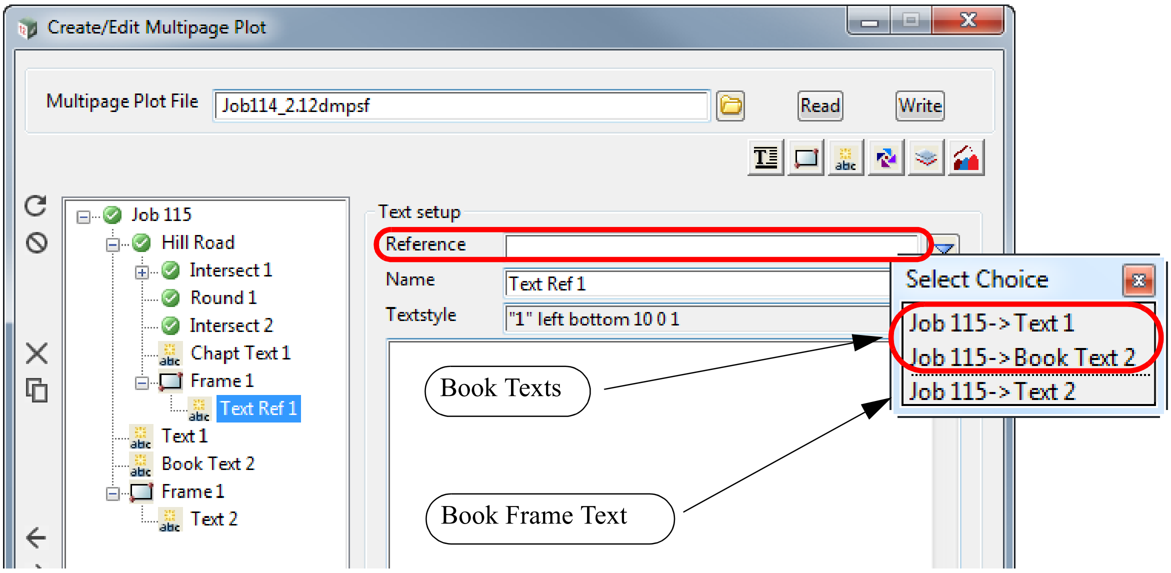
Similarly if a **Book Text** has been set to ***Inactive*** (i.e. OFF) then it can be displayed for a particular chapter by creating a **Chapter Reference Text** for that chapter and reference appropriate **Book Text**, and in the **Chapter Reference Text** fields, set the ***Active*** field to **Yes**.

21.1.4.8.3.2 Creating Chapter Frame Reference Text

To create a **Chapter Frame Reference Text** for a **Chapter Frame**, click on the **Chapter Frame node** and then click on the **Text** icon and select **Reference** from the **Text** menu.

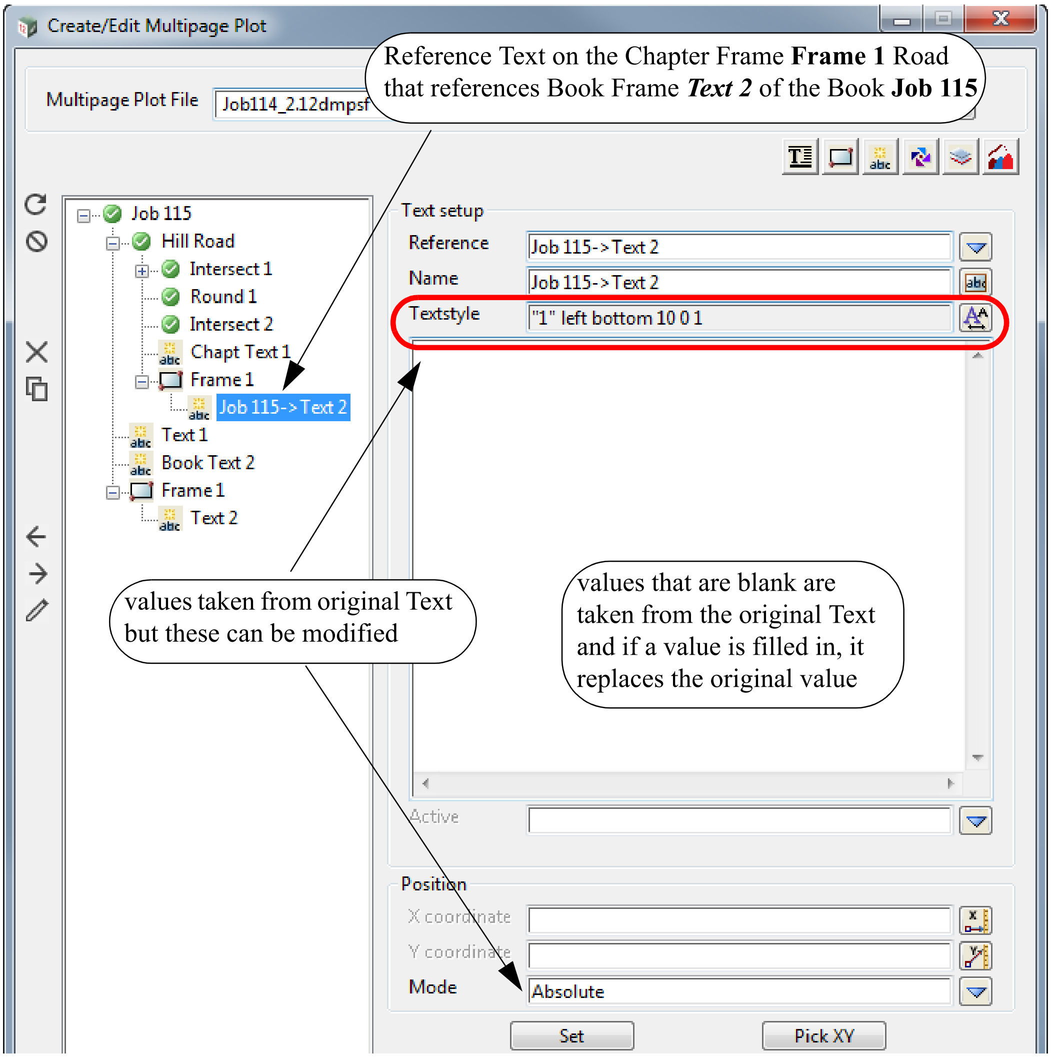


A new **Chapter Frame Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts** and **Book Frame Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Chapter Frame Reference Text** references a **Book Text** or **Book Frame Text,** any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Frame Reference Text**.

Important Notes

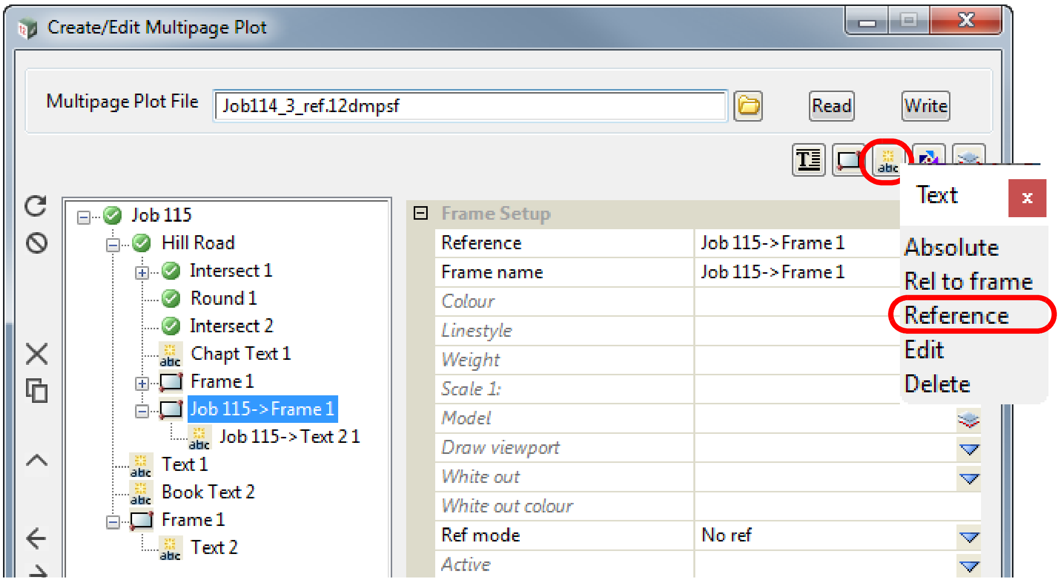
1. If you don't want to display **Book Text** for a particular chapter, then for that chapter, create a **Chapter Reference Text** which references the appropriate **Book Text**. And in the **Chapter Reference Text** fields, set the ***Active*** field to **No**.
2. If you don't want to display **Book Frame Text** for a particular chapter, then for that chapter, create a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Text**. This new **Chapter Reference Frame** will also include a **Chapter Reference Frame Reference Text** that references the appropriate **Book Frame Text**. And in the **Chapter Reference Frame Reference Text** fields, set the ***Active*** field to **No**.
3. If a **Book Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a **Chapter Reference Text** that references the appropriate **Book Text**. And in the **Chapter Reference Text** fields, set the ***Active*** field to **Yes**.
4. If a **Book Frame Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Text**. This new **Chapter Reference Frame** will also include a **Chapter Reference Frame Reference Text** that references the appropriate **Book Frame Text**. And in the **Chapter Reference Frame Reference Text** fields, set the ***Active*** field to **Yes**.

21.1.4.8.3.3 Creating Chapter Reference Frame Reference Text

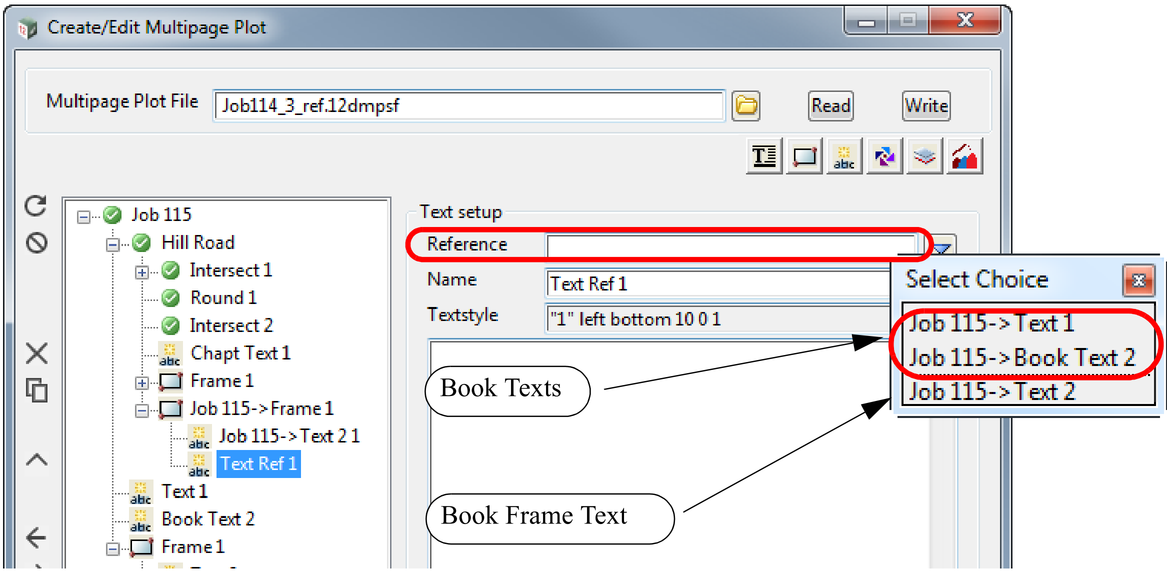
Important Note

Please note that the **Chapter Reference Frame Reference Text** and a **Chapter Frame Reference Text** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame**.

A **Chapter Reference Frame Reference Text** for a **Chapter Reference Frame** is created by clicking on the **Chapter Reference Frame node** and then clicking on the **Text** icon and selecting **Reference** from the **Text** menu.



A new **Chapter Reference Frame Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts** and **Book Frame Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

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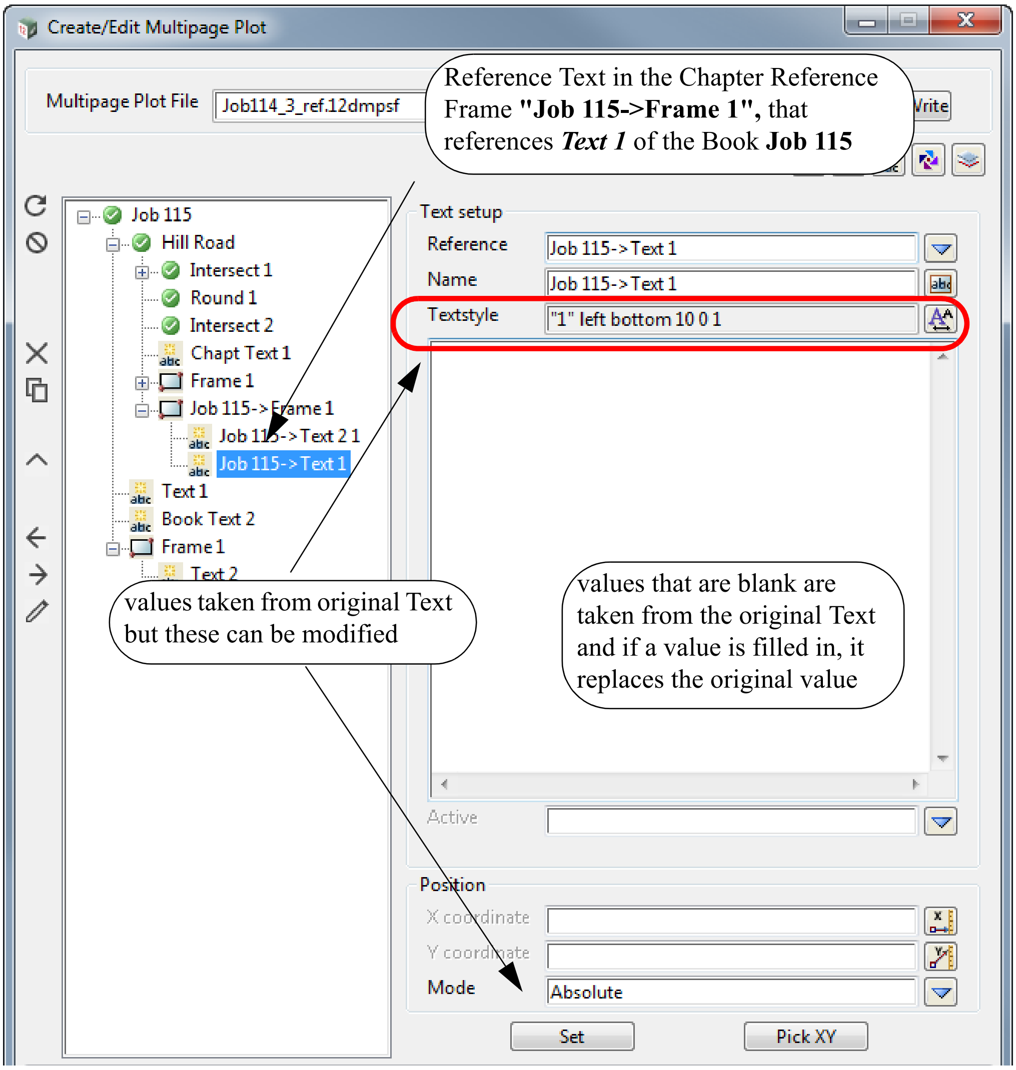


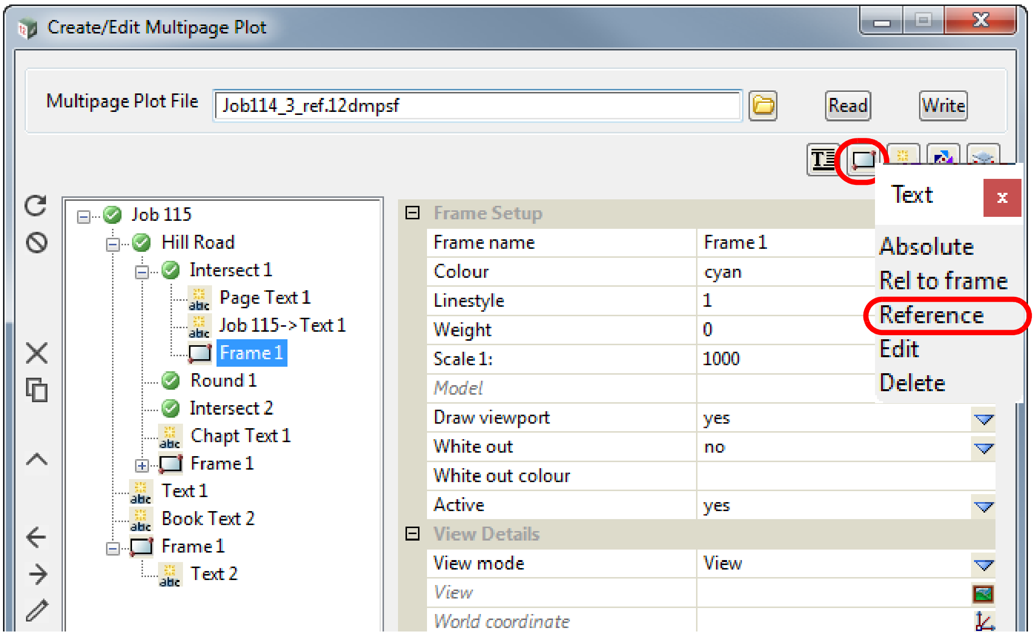
If the **Chapter Reference Frame Reference Text** references a **Book Text** or **Book Frame Text,** any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Reference Frame Reference Text**.

Important Notes

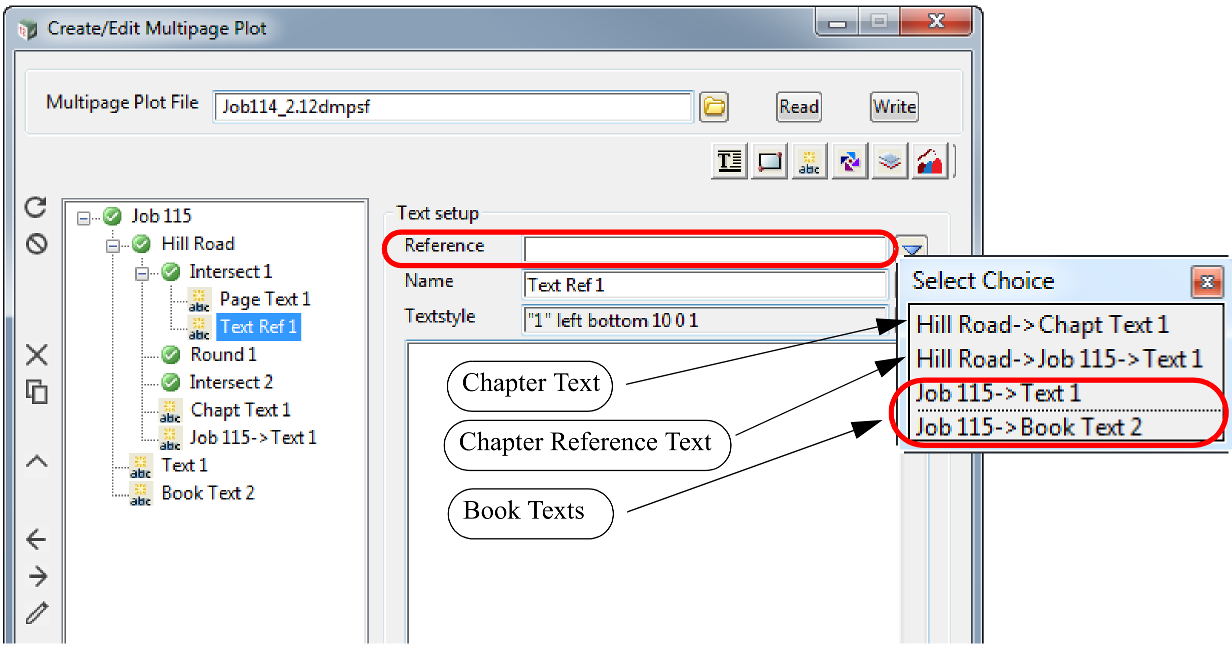
1. Please note that the **Chapter Reference Frame Reference Text** and the **Chapter Frame Reference Text** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame.**
2. The only way to tell if a **Text** references a **Book Text** or a **Book Frame Text** is that their names have to be unique at the **Book** level.

21.1.4.8.3.4 Creating Page Reference Text

To create a **Page Reference Text** for a **Page**, click on the **Page node** and then click on the **Text** icon and select **Reference** from the Text menu.

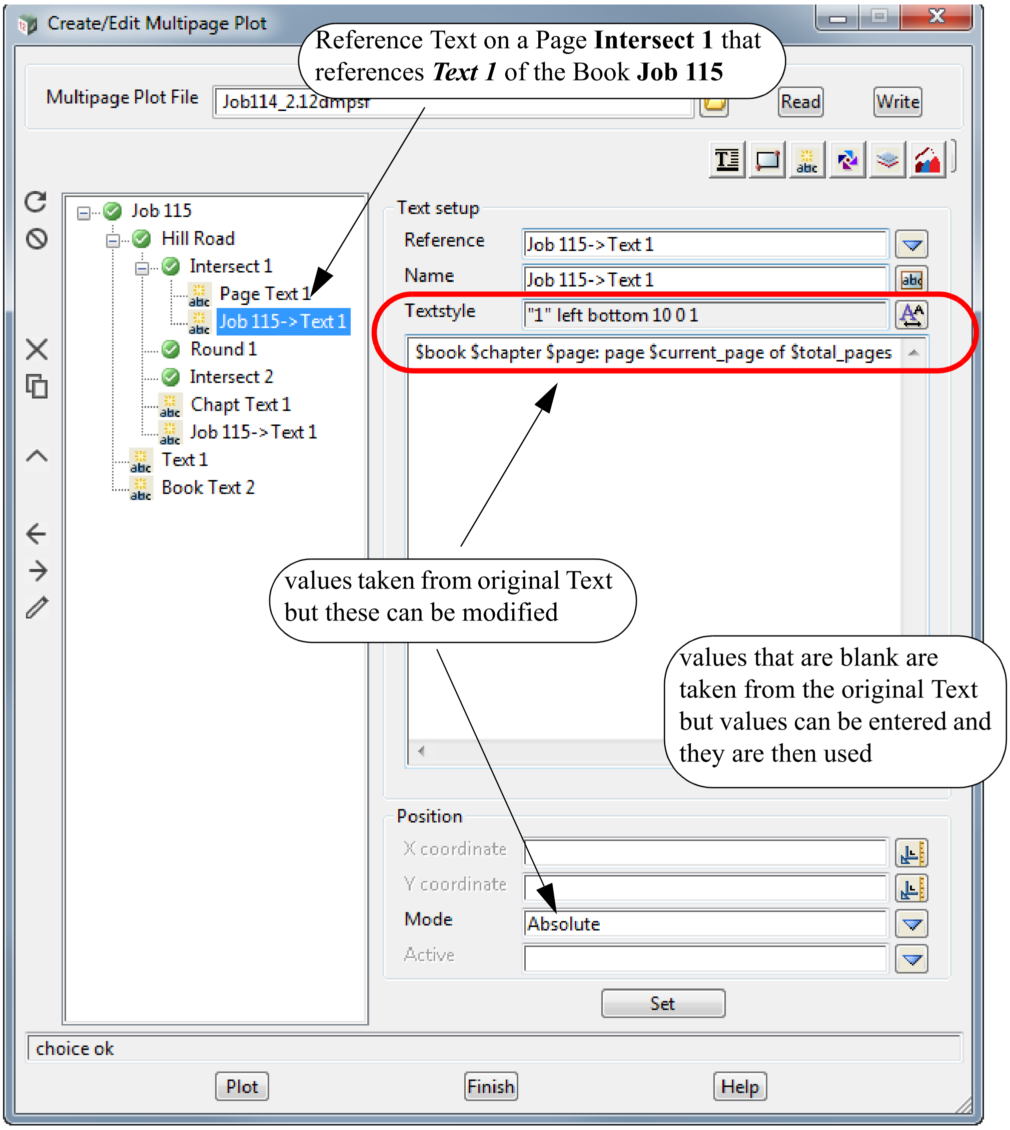


A new **Page Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts**, **Book Frame Texts**, **Chapter Texts**, **Chapter Reference Texts**, **Chapter Frame Texts, Chapter Frame Reference Texts**, **Chapter Reference Frame Texts** and **Chapter Reference Frame Reference Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Page Reference Text** references a **Book Text, Book Frame Text, Chapter Text** or **Chapter Frame Text**, any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Reference Text**.

If the **Page Reference Text** references a **Chapter Reference Text**, a **Chapter Frame Reference Text,** or a **Chapter Reference Frame Reference Text** then the fields in the **Page Reference Text** override the fields in the **Chapter Reference Text** which in turn overrides the fields in the original **Book Text**.

Important Notes

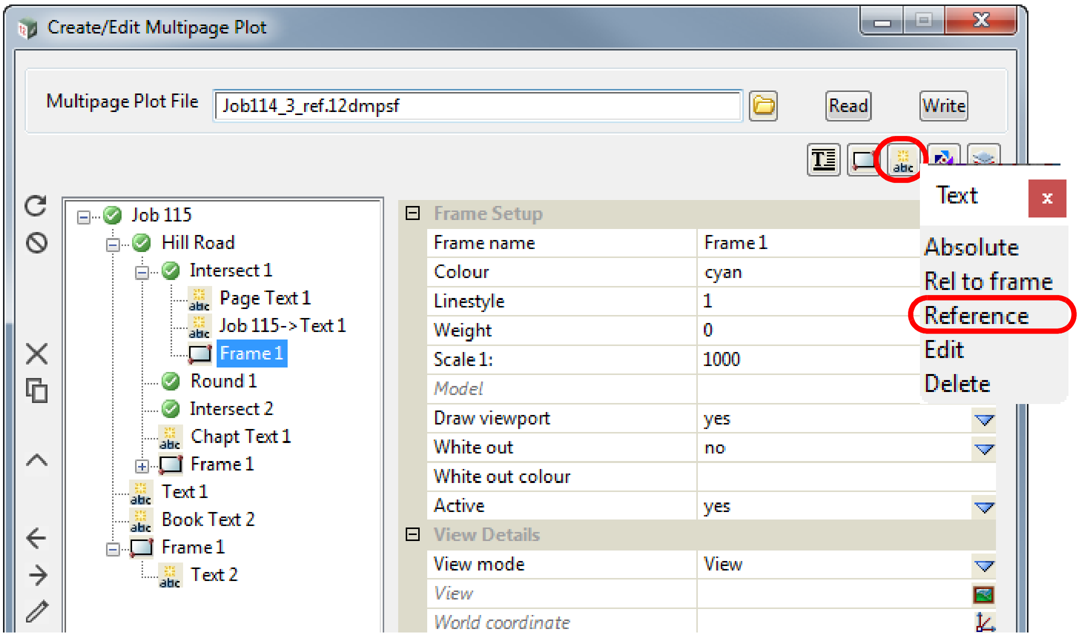
1. If you don't want to display **Book Text** for a particular page, then for that page, create a **Page Reference Text** which references the appropriate **Book Text**, and in the **Page Reference Text** fields, set the ***Active*** field to **No**.
2. If you don't want to display **Chapter Text** for a particular page, then for that page, create a **Page Reference Text** which references the appropriate **Chapter Text**, and in the **Page Reference Text** fields, set the ***Active*** field to **No**.
3. If you don't want to display **Chapter Reference Text** for a particular page, then for that page, create a **Page Reference Text** which references the appropriate **Chapter Reference Text**, and

in the **Page Reference Text** fields, set the ***Active*** field to **No**.

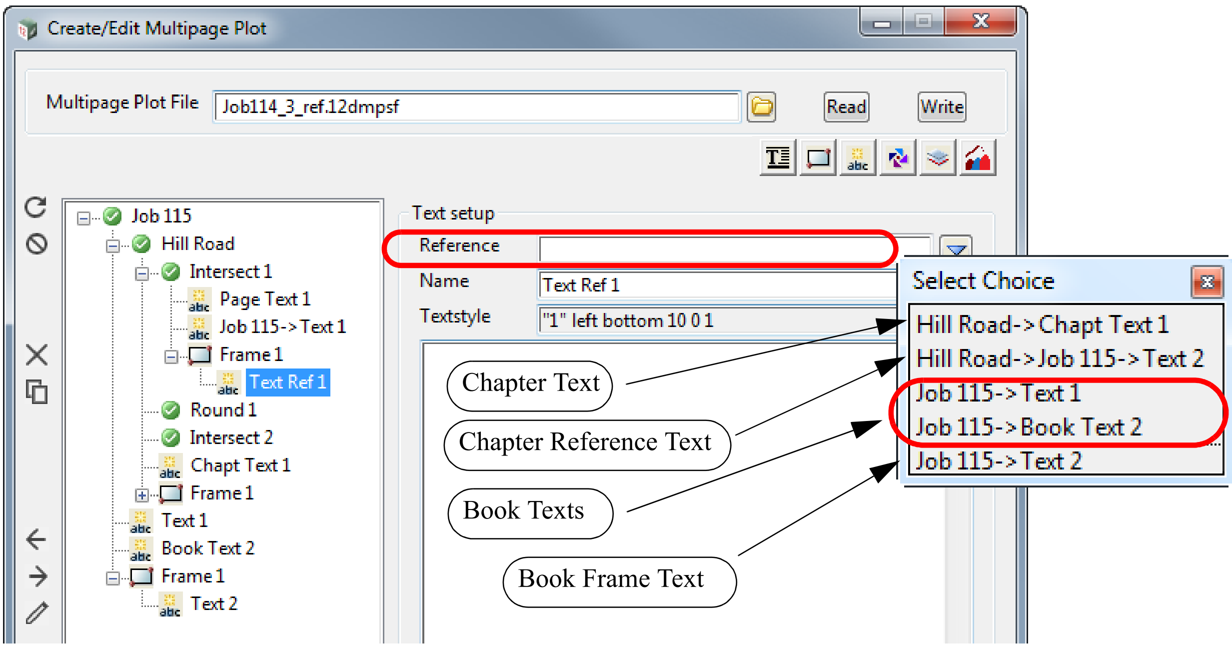
4. If a **Book Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Text** that references the appropriate **Book Text**. And in the **Page Reference Text** fields, set the ***Active*** field to **Yes**.
5. If a **Chapter Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Text** that references the appropriate **Chapter Text**. And in the **Page Reference Text** fields, set the ***Active*** field to **Yes**.
6. If a **Chapter Reference Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Text** that references the appropriate **Chapter Reference Text**. And in the **Page Reference Text** fields, set the ***Active*** field to **Yes**.

21.1.4.8.3.5 Creating Page Frame Reference Text

To create a **Page Frame Reference Text** for a **Page Frame**, click on the **Page Frame node** and then click on the **Text** icon and select **Reference** from the **Text** menu.

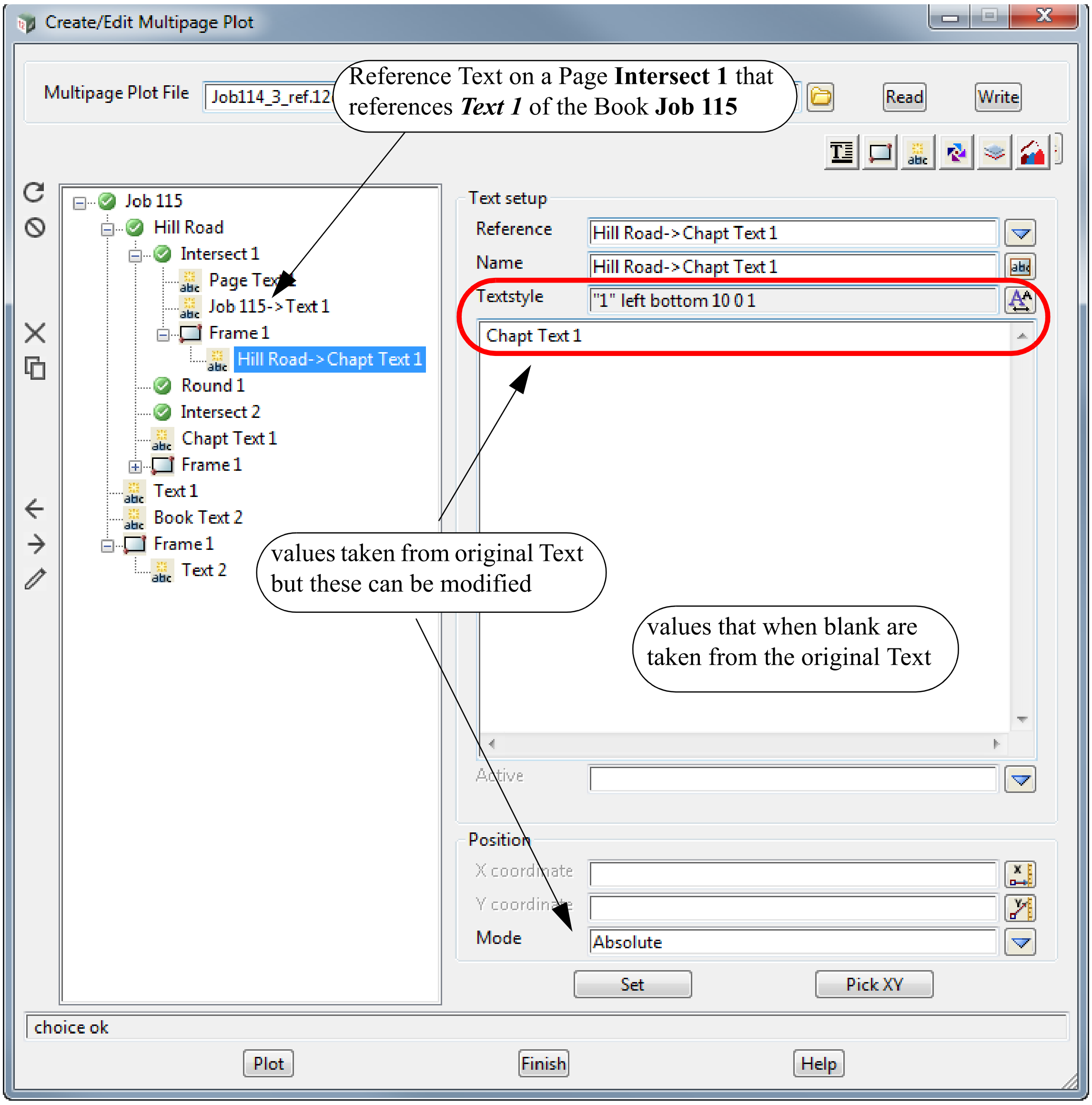


A new **Page Frame Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts**, **Book Frame Texts**, **Chapter Texts**, **Chapter Reference Texts**, **Chapter Frame Texts, Chapter Frame Reference Texts**, **Chapter Reference Frame Texts** and **Chapter Reference Frame Reference Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Page Frame Reference Text** references a **Book Text, Book Frame Text, Chapter Text** or **Chapter Frame Text**, any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Reference Text**.

If the **Page Reference Text** references a **Chapter Reference Text** then the fields in the **Page Reference Text** override the fields in the **Chapter Reference Text** which in turn overrides the fields in the original **Book Text**.

Important Notes

1. If you don’t want to display **Book Text** for a particular page, then for that page, create a **Page Reference Text** which references the appropriate **Book Text**, and in the **Page Reference Text** fields, set the ***Active*** field to **No**.
2. If you don’t want to display **Chapter Text** for a particular page, then for that page, create a **Page Reference Text** which references the appropriate **Chapter Text**, and in the **Page Reference Text** fields, set the ***Active*** field to **No**.
3. If you don’t want to display **Book Frame Text** for a particular page, then for that page, create a **Page Reference Frame** that references the **Book Frame** that contains the **Book Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** that references the appropriate **Book Frame Text**. And in the **Page Reference Frame**

Reference Text fields, set the ***Active*** field to **No**.

4. If you don't want to display **Chapter Frame Text** for a particular page, then for that page, create a **Page Reference Frame** that references the **Chapter Frame** that contains the **Chapter Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** that references the appropriate **Chapter Frame Text**. And in the **Page Reference Frame Reference Text** fields, set the ***Active*** field to **No**.

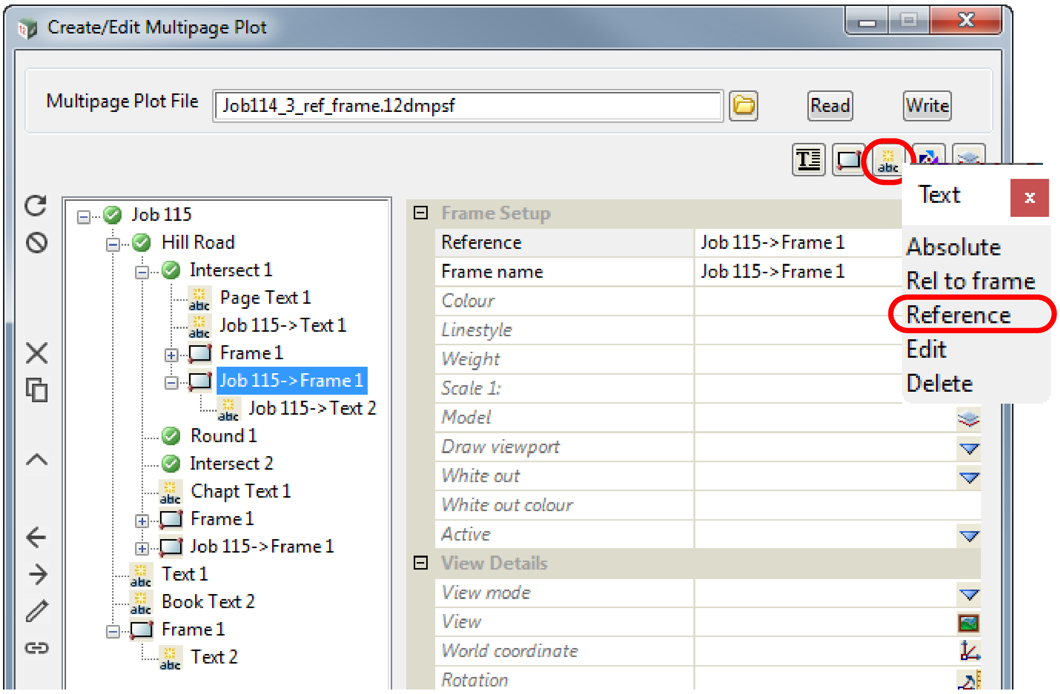
5. If a **Book Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Text** that references the appropriate **Book Text**. And in the **Page Reference Text** fields, set the ***Active*** field to **Yes**.
6. If a **Chapter Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Text** that references the appropriate **Chapter Text**. And in the **Page Reference Text** fields, set the ***Active*** field to **Yes**.
7. If a **Book Frame Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Book Frame** that contains the **Book Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** that references the appropriate **Book Frame Text**. And in the **Page Reference Frame Reference Text** fields, set the ***Active*** field to **Yes**.
8. If a **Chapter Frame Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Chapter Frame** that contains the **Chapter Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** that references the appropriate **Chapter Frame Text**. And in the **Page Reference Frame Reference Text** fields, set the ***Active*** field to **Yes**.
9. If a **Chapter Reference Frame Text** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Chapter Reference Frame** that contains the **Chapter Reference Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** that references the appropriate **Chapter Reference Frame Text**. And in the **Page Reference Frame Reference Text** fields, set the ***Active*** field to **Yes**.

21.1.4.8.3.6 Creating Page Reference Frame Reference Text

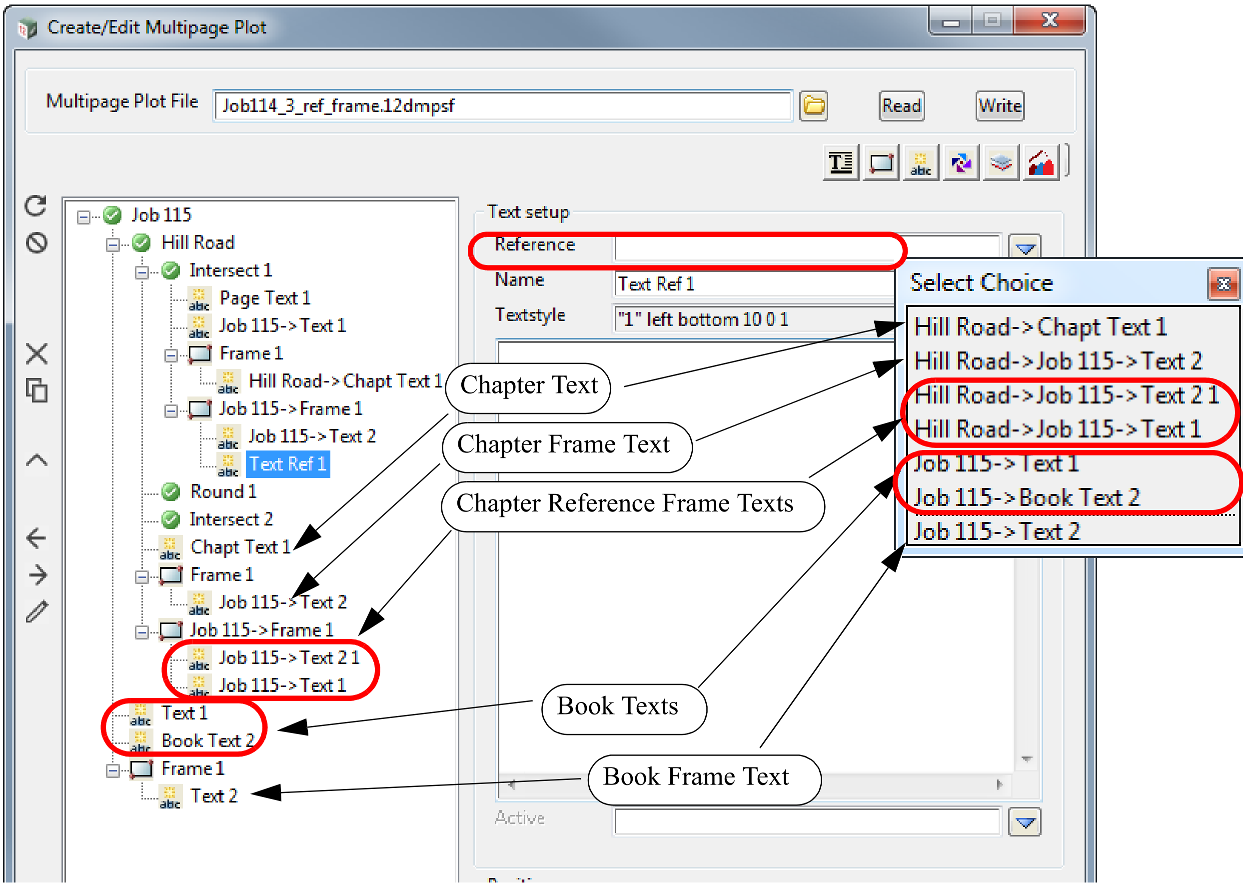
Important Note

Please note that the **Page Reference Frame Reference Text** and a **Page Frame Reference Text** are virtually identical and the only difference is that one is in a **Page Reference Frame** and the other in a **Page Frame**.

To create a **Page Reference Frame Reference Text** for a **Page Reference Frame**, click on the **Page Reference Frame node** and then click on the **Text** icon and select **Reference** from the **Text** menu.

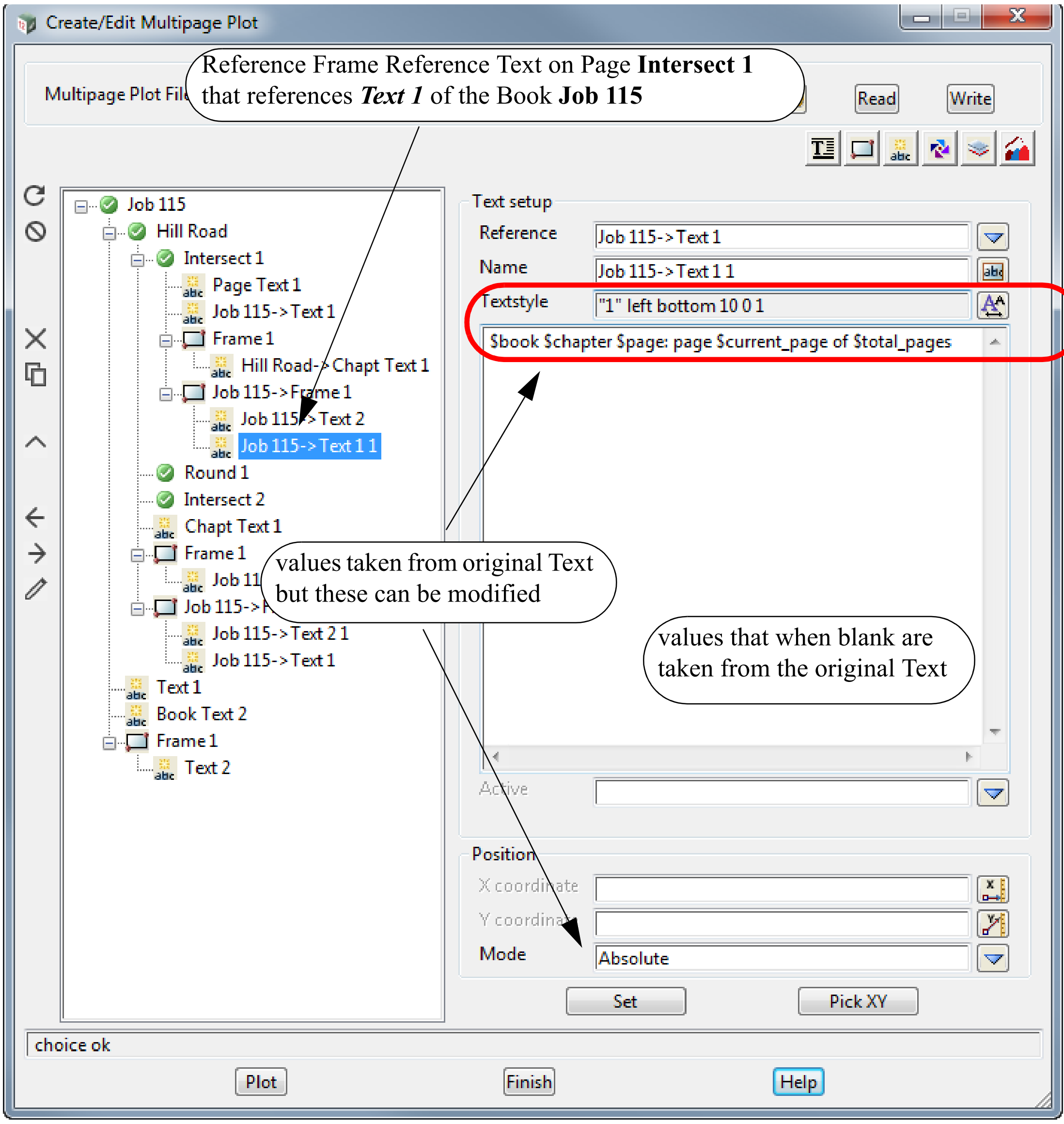


A new **Page Reference Frame Reference Text** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Texts**, **Book Frame Texts**, **Chapter Texts**, **Chapter Reference Texts**, **Chapter Frame Texts, Chapter Frame Reference Texts**, **Chapter Reference Frame Texts** and **Chapter Reference Frame Reference Texts** that this **Reference Text** could reference.

Once a **Text** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Text** is changed to the full path name of the **Text** that it is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Page Reference Frame Reference Text** references a **Book Text, Book Frame Text, Chapter Text** or **Chapter Frame Text**, any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Reference Frame Reference Text**.

If the **Page Reference Frame Reference Text** references a **Chapter Reference Text** /**Chapter Reference Frame Text** then the fields in the **Page Reference Frame Reference Text** override the fields in the **Chapter Reference Text/ Chapter Reference Frame Text** which in turn overrides the fields in the original **Book Text**.

Important Notes

1. Please note that the **Page Reference Frame Reference Text** and the **Page Frame Reference Text** are virtually identical and the only difference is that one is in a **Page Reference Frame** and the other in a **Page Frame**.
2. The only way to tell if a **Text** references a **Book Text** or a **Book Frame Text** is that their names have to be unique at the **Book** level.
3. The only way to tell if a **Text** references a **Chapter Text** or a **Chapter Frame Text** is that their names have to be unique at the **Chapter** level.

21.1.4.8.4 Icons and Fields for Text and Frame Text Nodes

The icons, fields and buttons used in the **Book Text, Chapter Text**, **Page Text, Book Frame Text, Chapter Frame Text** and **Page Frame Text** panels have the following functions.

Field Description	Type	Defaults	Pop-Up

Icons on Left Side

The icons on the left side change depending on what is applicable for the highlighted node.

The action of the icons are described in 21.1.4.3 Icons on the Left Side.

Text Setup

Text name text box

name of the Text node.

Textstyle textdata box available textdata

Textstyle data to use for the text.

Text Area text area

Area to type the required text into. The default value of Textn is entered so it is easy to see where the text is in the Plot Area. There are also special Text $variables that can be used in the Text Area (see 21.1.4.8.6 MPS Text $variables*).*

Note: if changes are made then the Set button must be pressed for the changes to take effect.

Active choice box Yes, No

*If **Yes**, the text is drawn.*
*If **No**, the text is not drawn.*
*For a Reference Text, the field can be left **blank** and then the value is taken from the referenced Text.*

Position

X/Y coordinate real box measures

X/Y coordinate (in millimetres) for the text.

*If **Mode** is **Absolute** then this is the position of the text in the Plot Area.*

*If **Mode** is **Relative** then this is the position of the text relative to the **Anchor justification** for the Frame.*

Mode choice box Absolute, Relative

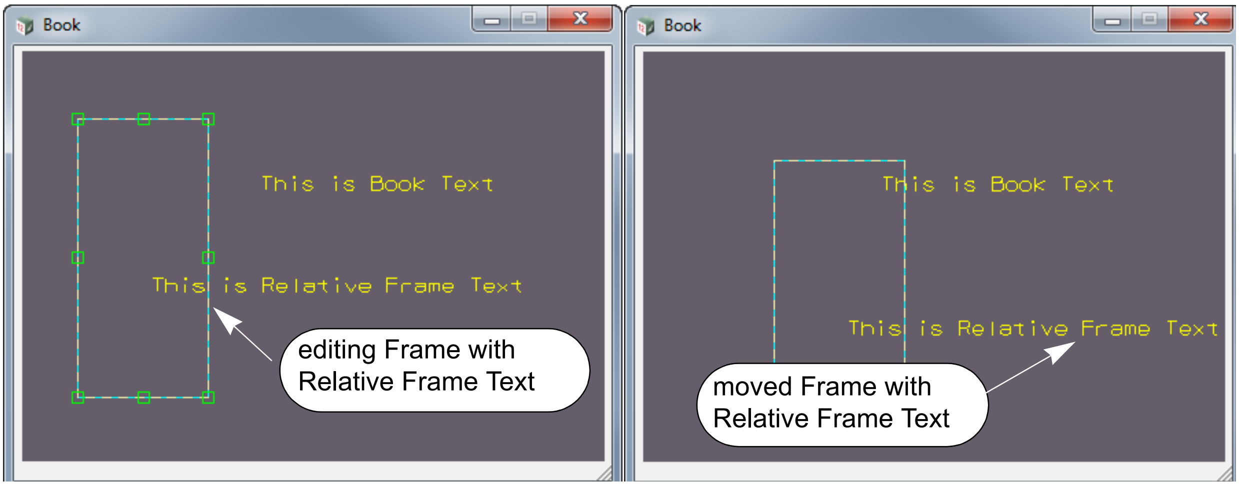
*If **Absolute**, the text is positioned in millimetre coordinates in the Plot Area.*

*If it is **Frame Text** and the Frame the Text is on is moved, the Text does not move with the Frame.*

*If **Relative**, the text is positioned in millimetre relative to the Frame **Anchor justification**.*

*If it is **Frame Text** and the Frame the Text is on is moved, the Text moves with the Frame.*

*If it is **Frame Text** and the Frame is resized, the position of the Text relative to the Frame **Anchor justification** is maintained.*



Note: For Book Text, Chapter Text and Page Text, Absolute and Relative are the same thing. ***Relative*** *is only different for* ***Frame Text.***

Anchor just	choice box	bottom left, bottom centre, bottom right middle left, middle centre, middle right top left, top centre, top right

If ***mode*** *is* ***Relative*** *then the text is positioned relative to the selected Frame* ***Anchor justification****.*

If ***mode*** *is* ***Absolute*** *then* ***Anchor justification*** *is ignored.*

Set	button

The **Set** *button must be pressed for any new values in the panel to take effect.*

Pick XY	button

the **Pick XY** *button is used to select a position in the Plot Area and the values are piped into the* **X coordinate** *and* **Y coordinate fields**.

21.1.4.8.5 Plotting Order of Text Nodes

The order of the **Text node** in the tree is important because it determines the drawing order of the **Text** on each page of a plot.

All the **Book Text nodes** are plotted on each **Page**, but if the **Book Text node** is in the tree before a **Page** then the **Book Text** is plotted before the **Page** is plotted.

Similarly if the **Book Text node** is in the tree after a **Page** then the **Book Text** is plotted after the **Page** is plotted.

All the **Chapter Text nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Text node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Text** is plotted before that **Page** is plotted.

Similarly if the **Chapter Text node** is in the tree after a **Page** in the **Chapter** then the **Chapter Text** is plotted after the **Page** is plotted.

Finally for a **Page node**, the order of the plotting is in the order of the items in the **Page** subtree.

21.1.4.8.6 MPS Text $variables

In the Text Area, there are special $variables that can be used.

(a) **$book** which at plot time is replaced by the **name** of the **Book**.

(b) **$chapter** which at plot time is replaced by the **name** of the **Chapter**.

(c) **$page** which at plot time is replaced by the **name** of the **Page**.

(d) **$frame** which at plot time is replaced by the **name** of the **Frame**.

(e) **$current_page** which at plot time is replaced by the **number** of the **Page**.

(f) **$total_pages** which at plot time is replaced by the **total number** of **pages** in the **Book**.

(g) **$chapter_current_page** which at plot time is replaced with the **number** of the **page** being plotted relative to its **Chapter**. Eg. if the **Chapter** has five pages in it and the page currently being plotted is the third page in that **Chapter** then the substituted value will be 3.

(h) **$chapter_total_pages** which at plot time is replaced by the **total number** of pages in the **Chapter** being plotted.

(i) **$chapter_start_page** which at plot time is replaced by the **number** of the **first page** of the **Chapter** being plotted.

(j) **$chapter_end_page** which at plot time is replaced by the **number** of the **last page** of the **Chapter** being plotted.

(k) **$if_next_page**<> which at plot time is replaced by the **value entered between the angled brackets**, if this page IS NOT the last page in the plot (i.e. There is a next page). If this IS the last page in the plot (i.e.. There isn't a next page), then the whole variable will be removed. If there is a syntax error, then the variable will remain but the '$' sign will be removed. Supports nesting. Example - $if_next_page<CONTINUES ON NEXT PAGE> will be replaced by "CONTINUES ON NEXT PAGE" on all pages but the last page of the plot.

(l) **$if_previous_page**<> which at plot time is replaced by the **value entered between the angled brackets**, if this page IS NOT the first page in the plot (i.e. There is a previous page). If this IS the first page in the plot (i.e. There isn't a previous page), then the whole variable will be removed. If there is a syntax error, then the variable will remain but the '$' sign will be removed. Supports nesting. Example - $if_previous_page<CONTINUES ON PREVIOUS PAGE> will be replaced by "CONTINUES ON PREVIOUS PAGE" on all pages but the first page of the plot.

(m) **$node_name<page_number>** which at plot time is replaced by the **name of the node that produces the page of the specified page_number**. Where page_number is an integer value. If the **page_number** is out of range, then the whole variable will be removed. If there is a syntax error, then the variable will remain but the '$' sign will be removed. Supports some nesting. Example - $node_name<2> will be replaced by the name of the node that produces the second page. Nesting Example - $node_name<$current_page> will be replaced by the name of the node that produces each page.

(n) **$user** which at plot time is replaced by the user's login name.

(o) **$folder** which at plot time is replaced by the full path name of the working folder for the current project.

(p) **$project** which at plot time is replaced the name of the current project.

(q) **$time**<> which at plot time is replaced by the current local date and time. (e.g.. Wed Jun 12 11:21:52 2019). **$time**<> has an optional parameter **time_format** (usage: **$time<time_format>**) that enables complete customisation of the output time's format. Details concerning all the available **<time_format>** options are given in 23.7.2.7.2.7 Specifying the Format for $time - Time Format.

(r) **$project_attribute<project_attribute_path>** which at plot time is replaced with the **project_attribute** specified by **project_attribute_path**. More information about the usage of **$project_attribute<project_attribute_path>** can be found at 23.7.2.7.2.1.3 Project Attributes.

(s) **$synergy_attribute<synergy_attribute_path>** which at plot time is replaced with the

synergy_attribute specified by **synergy_attribute_path**. For example - Text Frame Text - "Job name: $synergy_attribute<Job_Number>" will be written out as the text "Job name: " followed by the text in the 12d Synergy attribute Job_Number.

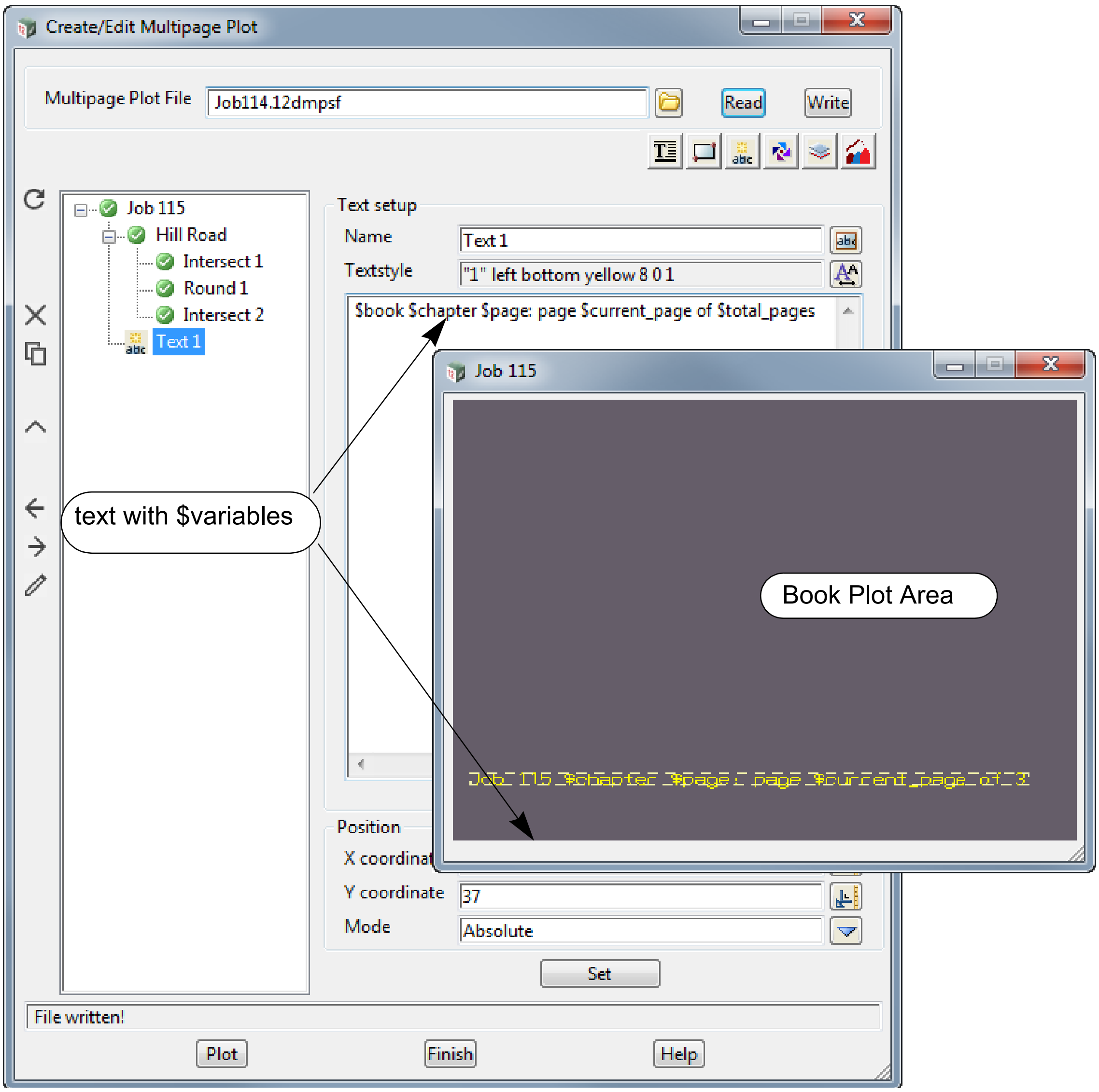
(t) **$project_details<project_details_path>** which at plot time is replaced with the **project_details_attribute** specified by **project_details_path**. The **project_details_path** can either be the name of the attribute group or a more specific path to a single attribute in a group. If the **project_details_path** is only to the group level, then the Value attribute in that group will be returned.For example - Text Frame Text - "Project Number: $project_details<ProjectNumber>" will be written out as the text "Project Number: " followed by the text from the ProjectDetails/ProjectNumber/Value attribute (if it exists).

And for **Frame Text** there are also some special $variables that at plot time, are substituted by values from the Frame. They are

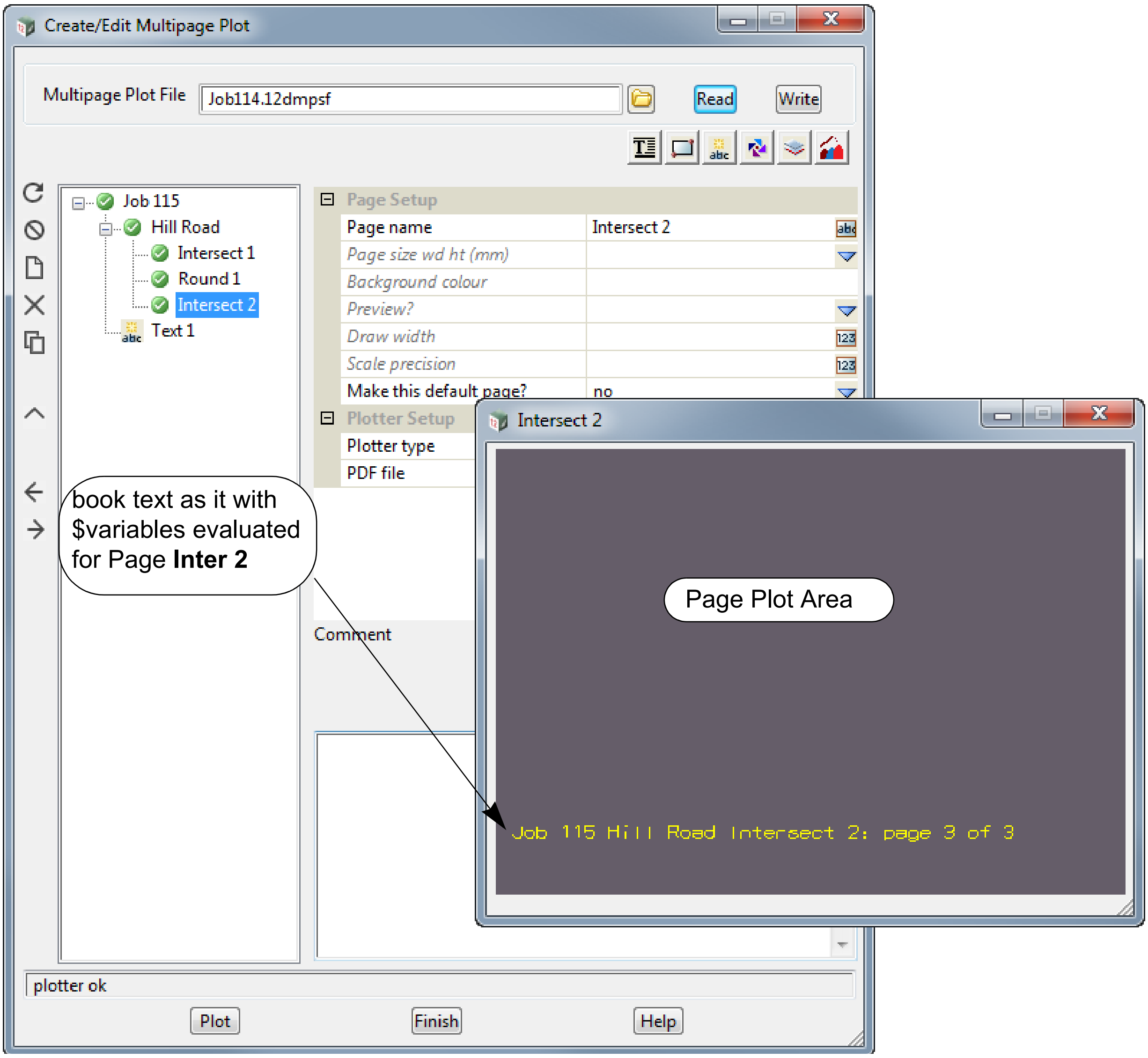
(u) **$scale** which at plot time is replaced by the **Horizontal scale** of the Frame.

(v) **$vertical_exaggeration** which at plot time is replaced by the vertical exaggeration of the Frame.

For Example, the **Book Text** with the text "$book $chapter $page: page $current_page of $total_pages".

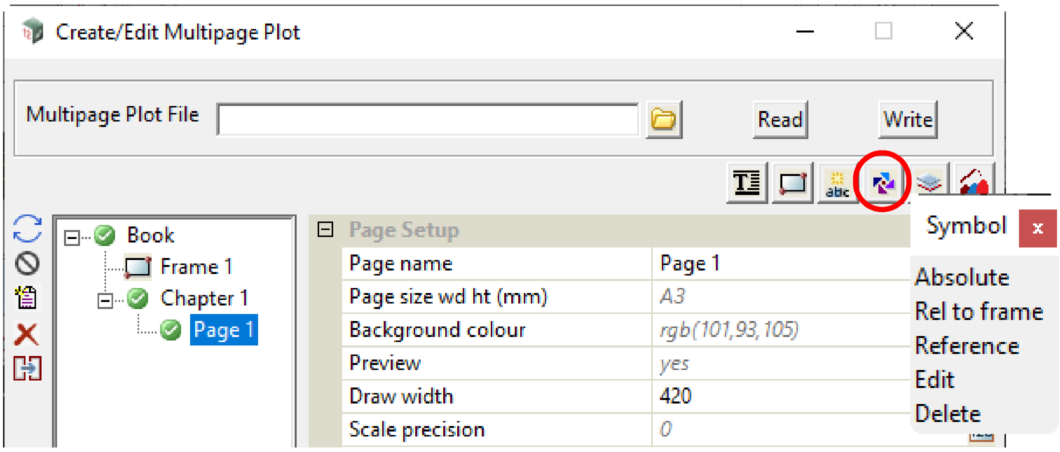


And on **Page** "Intersect 2", this would be evaluated as:


Create/Edit Multipage Plot
Multipage Plot File
Job114.12dmpsf
Read
Write
Job 115
Hill Road
Intersect 1
Round 1
Intersect 2
Text 1
Page Setup
Page name
Intersect 2
Page size wd ht (mm)
Background colour
Preview?
Draw width
Scale precision
Make this default page?
no
Plotter Setup
Plotter type
PDF file
Comment
book text as it with $variables evaluated for Page Inter 2
Intersect 2
Page Plot Area
Job 115 Hill Road Intersect 2: page 3 of 3
plotter ok
Plot
Finish
Help

21.1.4.9 Symbol Icon for Use on a Book, Chapter, Page or Frame Node

Symbols can be placed on a **Book**, **Chapter**, **Page** or **Frame** node using options on the **Symbol** menu which is brought up by clicking on the **Symbol** icon on the top right.



See

Symbol - Absolute and Rel to Frame
Symbol - Reference
Symbol - Edit
Symbol - Delete

Symbol - Edit

Edit: can be used to move or modify an existing Symbol on a **Plot Area** that the symbol was created on. For example, if the Symbol was created on a **Chapter Plot Area** then you need to highlight that **Chapter** and select the Symbol on that **Chapter Plot Area** to edit it.

To **move** a Symbol after clicking on **Edit**, pick the Symbol to move with LB **but don't accept it with MB.** The Symbol can then be moved.

If **MB** is clicked to accept the Symbol, the fields defining the Symbol are displayed in the right hand side of the **Create/Edit Multipage Plot** panel. These fields can then be modified.

Note that a Symbol can also be edited by highlighting the **Symbol node** in the tree and pressing **Edit** on the left hand side.

Symbol - Delete

Delete: can be used to delete a Symbol by picking it on a **Plot Area.**

To **delete** a Symbol after clicking on **Delete**, pick and accept the Symbol on a **Plot Area** that the Symbol was created on. For example, if the Symbol was created on a **Chapter Plot Area** then you need to highlight that **Chapter node** and select the Symbol on that **Chapter Plot Area** to delete it.

Note that a Symbol can also be deleted by highlighting the Symbol node in the tree and pressing **Delete** on the left hand side.

Symbol - Absolute and Rel to Frame

The options **Absolute** and **Rel to frame** are used when creating Symbols.

For the **Book**, **Book Symbol** can be created by:

Highlighting the **Book** node, clicking on the **Symbol** icon and selecting **Absolute** from the **Symbol** menu.

This will create a **Book Symbol**.

See 21.1.4.9.1 Creating a Symbol at the Book, Chapter or Page Level.

For the **Book**, a **Book Frame Symbol** can be created by either:

(a) highlighting a **Book Frame** node, clicking on the **Symbol** icon and selecting either **Absolute** or **Rel to frame** from the **Symbol** menu.

This will create a **Book Frame Symbol** for the highlighted **Book Frame** node.

See 21.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node.

(b) highlighting the **Book** node, clicking on the **Symbol** icon and selecting **Rel to frame** from the **Symbol** menu and then **picking** a **Book Frame** from the **Book Plot Area.**

This will create a **Book Frame Symbol** for the **picked Book Frame**.

See 21.1.4.9.2 Creating Frame Symbols.

For a **Chapter**, a **Chapter Symbol** can be created by:

Highlighting the **Chapter** node, clicking on the **Symbol** icon and selecting **Absolute** from the **Symbol** menu.

This will create a **Chapter Symbol**.

See 21.1.4.9.1 Creating a Symbol at the Book, Chapter or Page Level.

For a **Chapter**, a **Chapter Frame Symbol** can be created by either:

(a) highlighting a **Chapter Frame** node, clicking on the **Symbol** icon and selecting either **Absolute** or **Rel to frame** from the **Symbol** menu.

This will create a **Chapter Frame Symbol** for the highlighted **Chapter Frame** node.

See21.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node.

(b) highlighting a **Chapter** node, clicking on the **Symbol** icon and selecting **Rel to frame** from the **Symbol** menu and then **picking** a **Chapter Frame** from the **Chapter Plot Area.**

This will create a **Chapter Frame Symbol** for the **picked Chapter Frame**.

See 21.1.4.9.2 Creating Frame Symbols.

For a **Page**, a **Page Symbol** can be created by:

Highlighting the **Page** node, clicking on the **Symbol** icon and selecting **Absolute** from the **Symbol** menu.

This will create a **Page Symbol**.

See 21.1.4.9.1 Creating a Symbol at the Book, Chapter or Page Level.

For a **Page**, a **Page Frame Symbol** can be created by either:

(a) highlighting a **Page Frame** node, clicking on the **Symbol** icon and selecting either **Absolute** or **Rel to frame** from the **Symbol** menu.

This will create a **Page Frame Symbol** for the highlighted **Page Frame** node.

See 21.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node.

(b) highlighting a **Page** node, clicking on the **Symbol** icon and selecting **Rel to frame** from the **Symbol** menu and then **picking** a **Page Frame** from the **Page Plot Area.**

This will create a **Page Frame Symbol** for the **picked Page Frame**.

See 21.1.4.9.2 Creating Frame Symbols.

Symbol - Reference

The option **Reference** is not for creating a new symbol but creates a **Symbol** node that **references** an existing **Symbol** node. This means that the **Reference Symbol** node has as default, all the values defined for the **Symbol** node that is being referenced BUT any of those values can be modified for the **Reference Symbol** node.

See 21.1.4.10 Model Icon for Use on a Book, Chapter or Page.

Important Note:

The names of the **Book Symbol nodes** and **Book Frame Symbol nodes** must be unique amongst all the **Book Symbol nodes** AND the **Book Frame Symbol nodes.**

For a **Chapter**, the names of the **Chapter Symbol nodes** and the **Chapter Frame Symbol nodes** for **that Chapter** must be unique amongst all the **Chapter Symbol nodes** AND the **Chapter Frame Symbol nodes** for that **Chapter**.

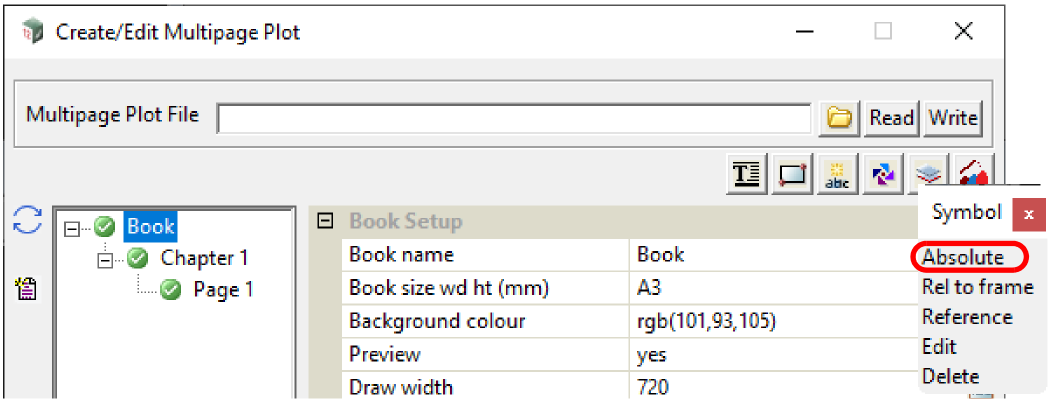
Similarly for a **Page**, the names of the **Page Symbol nodes** and the **Page Frame Symbol nodes** for **that Page** must be unique amongst all the **Page Symbol nodes** AND the **Page Frame Symbol nodes** for that **Page**.

21.1.4.9.1 Creating a Symbol at the Book, Chapter or Page Level

The process for creating **Book Symbol** will be described in detail but the steps are identical for **Chapter** and **Page** except that the word **Book** in the description is replace by **Chapter** or **Page**.

A Symbol is created at the **Book**, **Chapter** or **Page** level by first clicking on and highlighting either the **Book**, **Chapter** or **Page** node, then clicking on the **Symbol** icon on the top right to bring up the **Symbol** menu and finally selecting ***Absolute*** from the **Symbol** menu

.

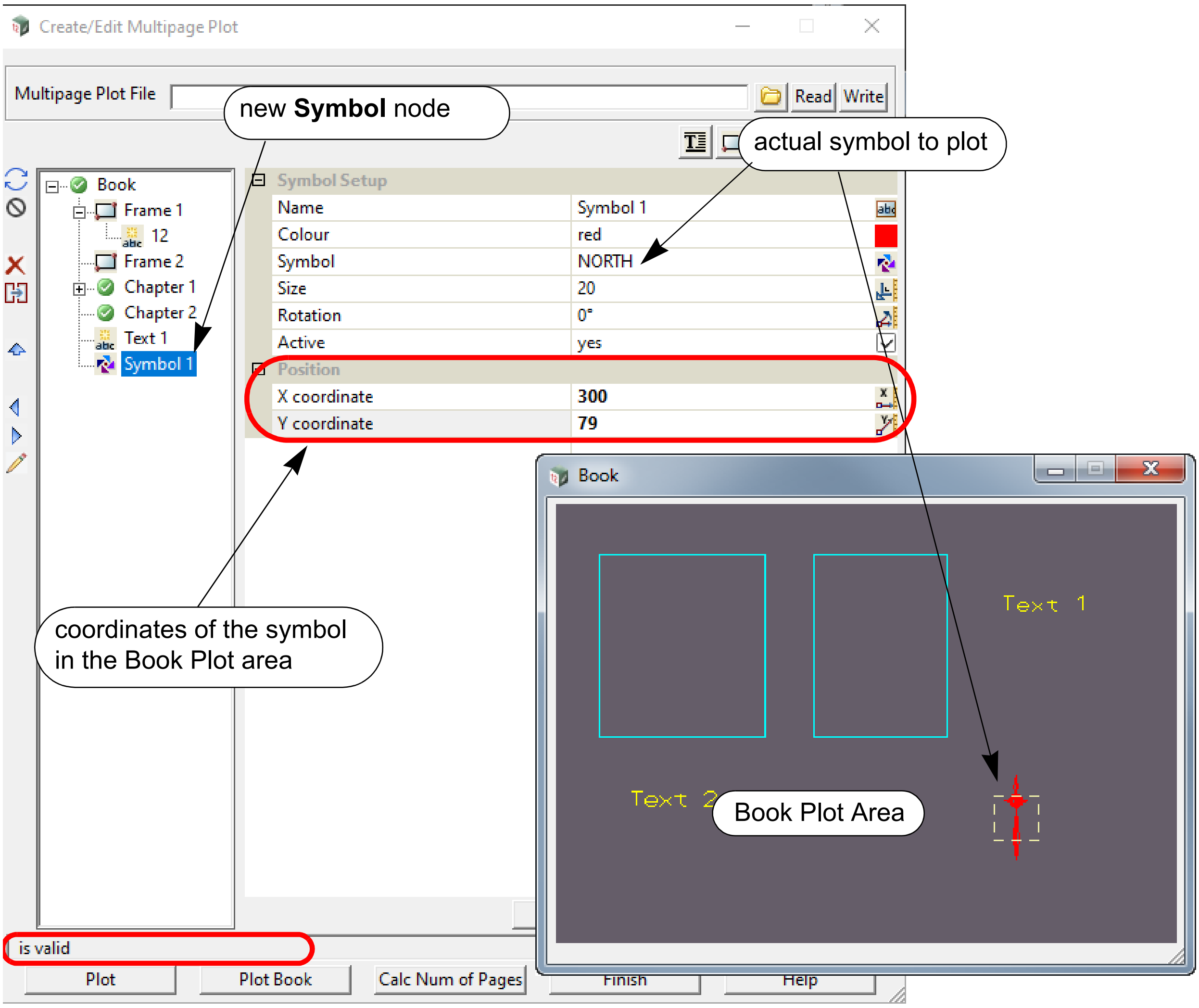


A position in the **Book Plot Area** for the symbol is then selected.

Once the Symbol position is selected, a **Book Symbol node** is automatically added at the bottom of the **Book** with the default name **Symbol n** where **n** is the next integer that makes the **Book Symbol node** name unique amongst all the **Book Symbol nodes** AND the **Book Frame Symbol nodes**.

Similarly the name of a **Chapter Symbol node** must be unique amongst all the **Chapter Symbol nodes** AND the **Chapter Frame Symbol nodes** for that **Chapter**. And the name of a **Page Symbol node** must be unique amongst all the **Page Symbol nodes** AND the **Page Frame Symbol nodes** for that **Page**.

The default Symbol "4dNorth" is added to the **Symbol** field and displayed in the **Book Plot Area**.



Notes

1. For **Book Symbol**, **Chapter Symbol** and **Page Symbol**, the values ***Relative*** and ***Absolute*** for **Rotation Mode** are both treated as an absolute rotation with respect to the **Book Plot Area**.
2. For **Book Symbol**, **Chapter Symbol** and **Page Symbol**, the values ***Relative*** and ***Absolute*** for **Position Mode** are both treated as an absolute position on the **Book Plot Area**.

For documentation on the fields and icons used for **Book Symbol**, **Chapter Symbol** and **Page Symbol**, see 21.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes.

21.1.4.9.2 Creating Frame Symbols

A **Symbol** can be **attached** to a **Frame** at either a **Book**, **Chapter** or **Page** level.

The main difference between a **Frame Symbol** and **a Book, Chapter** or **Page Symbol** is that a **Frame Symbol** can be placed **Absolutely on the Page Area** or **Relative to the Frame.**

If the **Frame Symbol** is **Absolute**, then the **Symbol** is placed at a fixed position on the **Plot Area** that the **Frame** is on and if the **Frame** is moved, the **Symbol does not** move.

If the **Frame Symbol** is **Relative**, its position is **Relative to the Frame** the Symbol is on, and if the Frame is **moved**, the **Frame Symbol moves with the Frame**.

There are two ways of selecting the **Frame** and then creating **Frame Symbol.**

1. Clicking on the **Frame node**.

   See 21.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node.

2. Picking a **Frame** from the **Plot Area**.

   See 21.1.4.9.2.2 Creating a Frame Symbol by Picking a Frame from a Plot Area.

21.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node

The process for creating **Book Frame Symbol** will be described in detail but the steps are identical for **Chapter** and **Page** except that in the description, the word **Book** is replace by **Chapter** or **Page**.

To create a **Frame Symbol** using the **Frame node**, click on and highlight the **Book Frame node**, **Chapter Frame node** or **Page Frame node** to add a **Frame Symbol** to.

The **Plot Area** for the **Book**, **Chapter** or **Page** of the **Frame node** is then displayed and the **Frame** highlighted on the **Plot Area**.

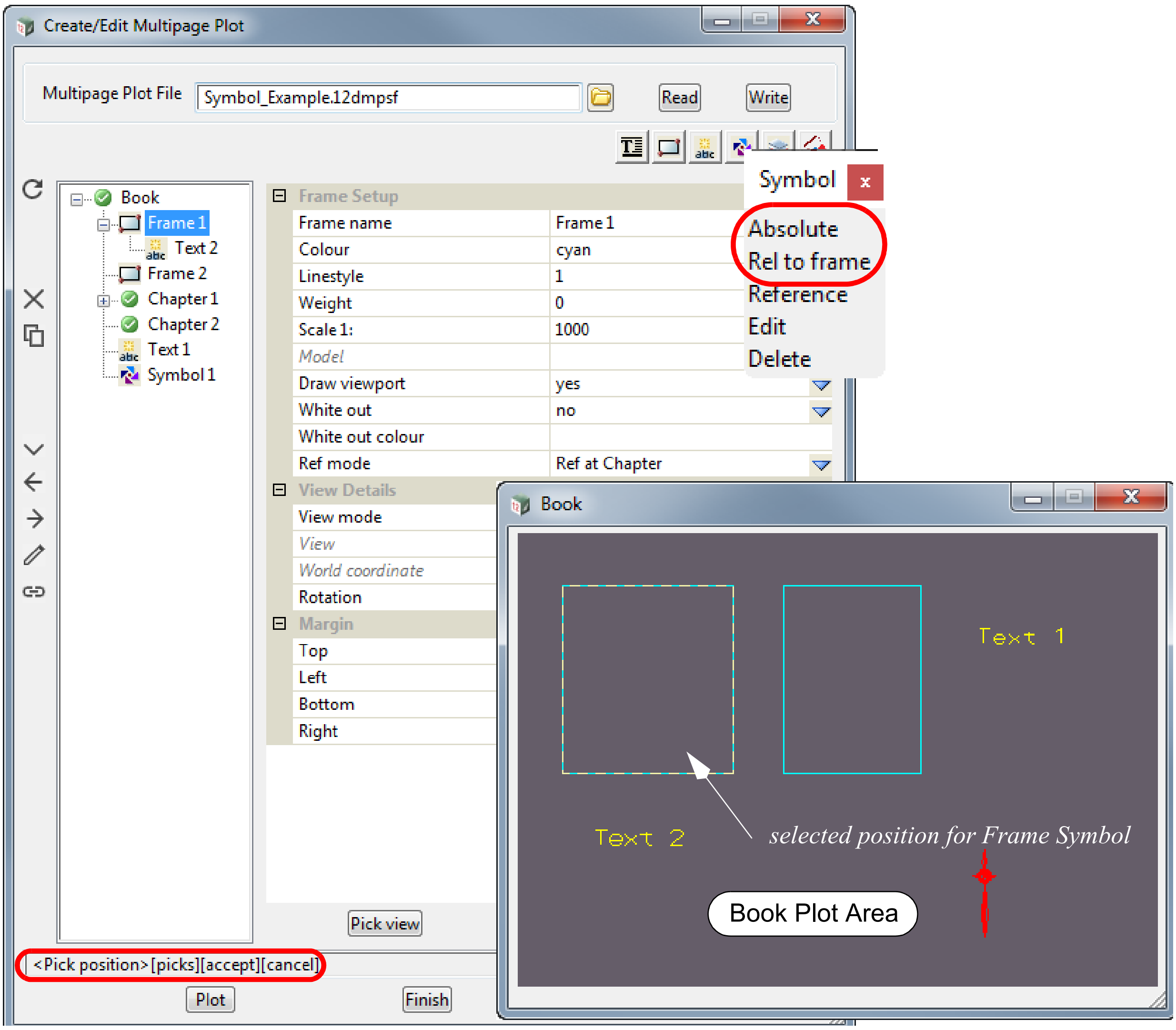
Next click on the **Symbol icon** at the top right to bring up the **Symbol** menu, and from the **Symbol** menu select:

(a) **Rel to frame** if you want the Symbol in the Plot Area to move with the **Frame**.

or

(b) **Absolute** if you want the Symbol to have a fixed position on the **Plot Area**. The Symbol does not move with the **Frame** but the Symbol will be deleted if the Frame is deleted.

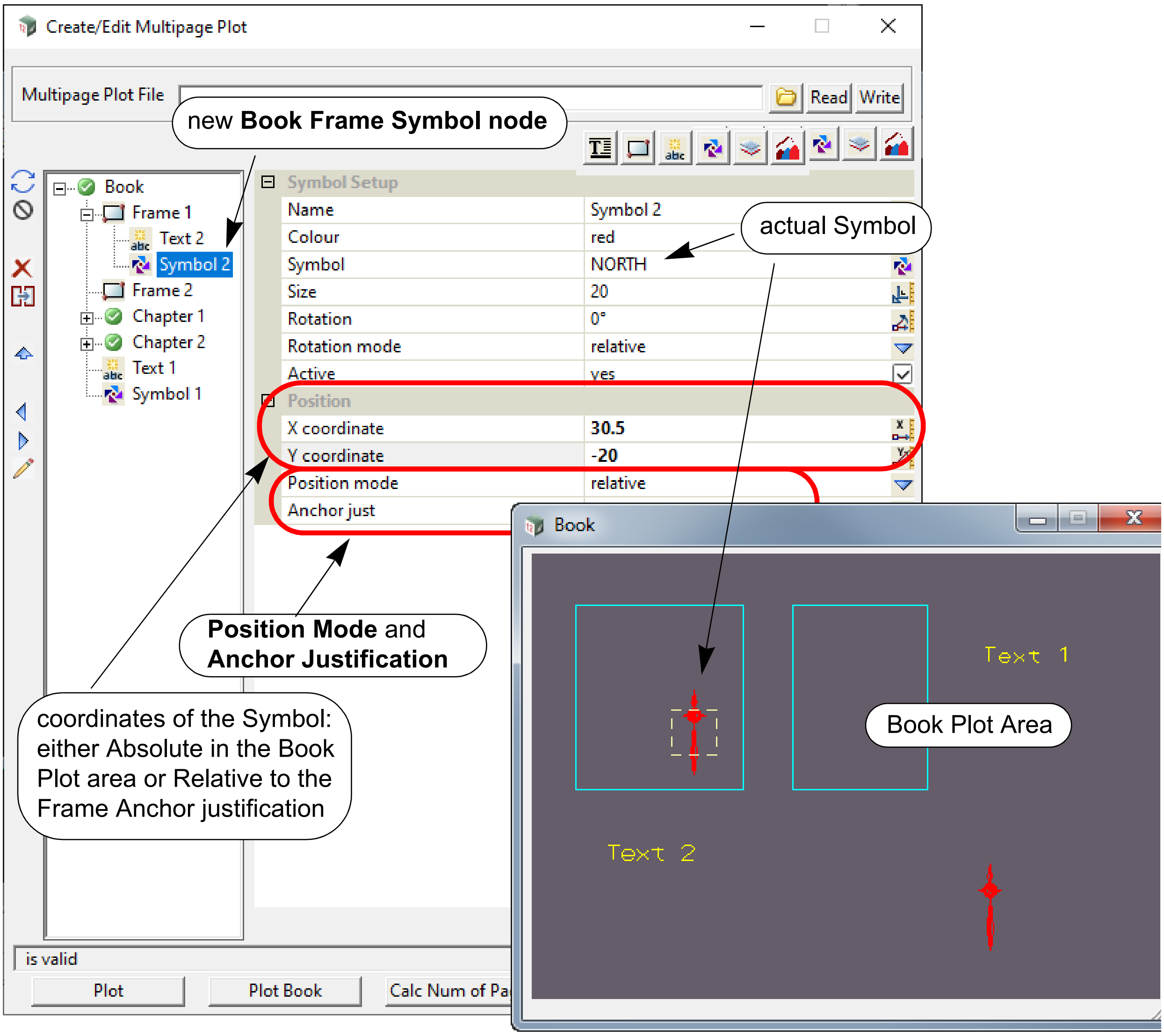
After picking **Rel to Frame** or **Absolute**, the position for the **Frame Symbol** is selected in the **Plot Area**.



Once the Symbol position is selected, a **Book Frame Symbol node** is automatically added at the bottom of the **Book Frame** with the default node name **Symbol n** where **n** is the next integer that makes the **Book Symbol node** name unique amongst all the **Book Symbol nodes** AND **Book Frame Symbol nodes**.

Similarly the name of a **Chapter Frame Symbol node** must be unique amongst all the **Chapter Symbol nodes** AND the **Chapter Frame Symbol nodes** for that **Chapter**. And the name of a **Page Frame Symbol node** must be unique amongst all the **Page Symbol nodes** AND the **Page Frame Symbol nodes** for that **Page**.

The default Symbol "4dNorth" is added to the **Symbol** field and displayed in the **Book Plot Area**.



If ***Absolute*** was chosen from the **Symbol** menu:

the **Position Mode** is set to ***Absolute*** and the values for **X coordinate** and **Y coordinate** are the position on the Book Plot area.

If ***Rel to Frame*** was chosen from the **Symbol** menu:

the **Position Mode** is set to ***Relative***, and the **Anchor just** is set to the closest of the nine justification positions for the Frame (bottom left, bottom centre, bottom right, middle left, middle centre, middle right, top left, top centre, top right). The values for **X coordinate** and **Y coordinate** are then relative to the Anchor justification point.

The values for **X coordinate, Y coordinate**, **Mode** and **Anchor just** can be changed at any time and the **Set** button pressed for them to take effect.

If **mode** is **Relative** and the Frame is moved, the Symbol also moves by the same amount.

If **mode** is **Relative** and the Frame is resized, the position of the Symbol relative to the **Anchor justification** is maintained.

For documentation on the fields and icons used for a **Frame Symbol**, see 21.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes.

21.1.4.9.2.2 Creating a Frame Symbol by Picking a Frame from a Plot Area

Instead of having to click on a **Frame node** in the **Book** tree to create a **Symbol**, a **Frame** can be **interactive selected** from either the **Book Plot Area**, **Chapter Plot Area** or **Page Plot Area**.

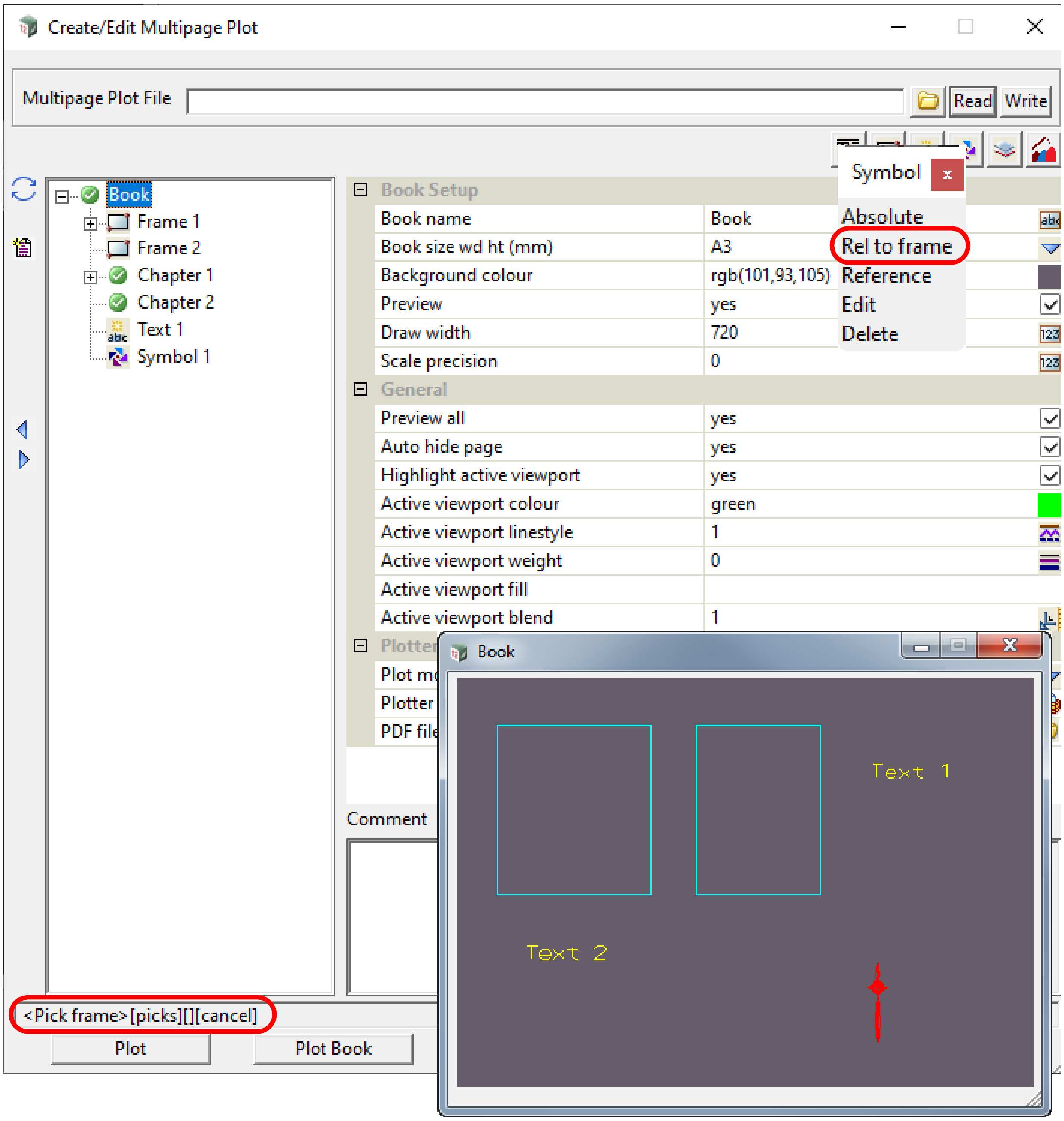
The process is similar to that for a **Book**, **Chapter** or **Page Symbol** except **Rel to frame** must be selected from the **Symbol** menu.

(The steps are identical for a **Book Frame**, **Chapter Frame** or **Page Frame** except that the word **Book** is replaced by **Chapter** or **Page** so the detailed discussion will only be for a **Book Frame**)

To create a **Frame Symbol** by picking a **Frame** on a **Plot Area**, click on and highlight the **Book node**, **Chapter node** or **Page node** to display the **Plot Area**.

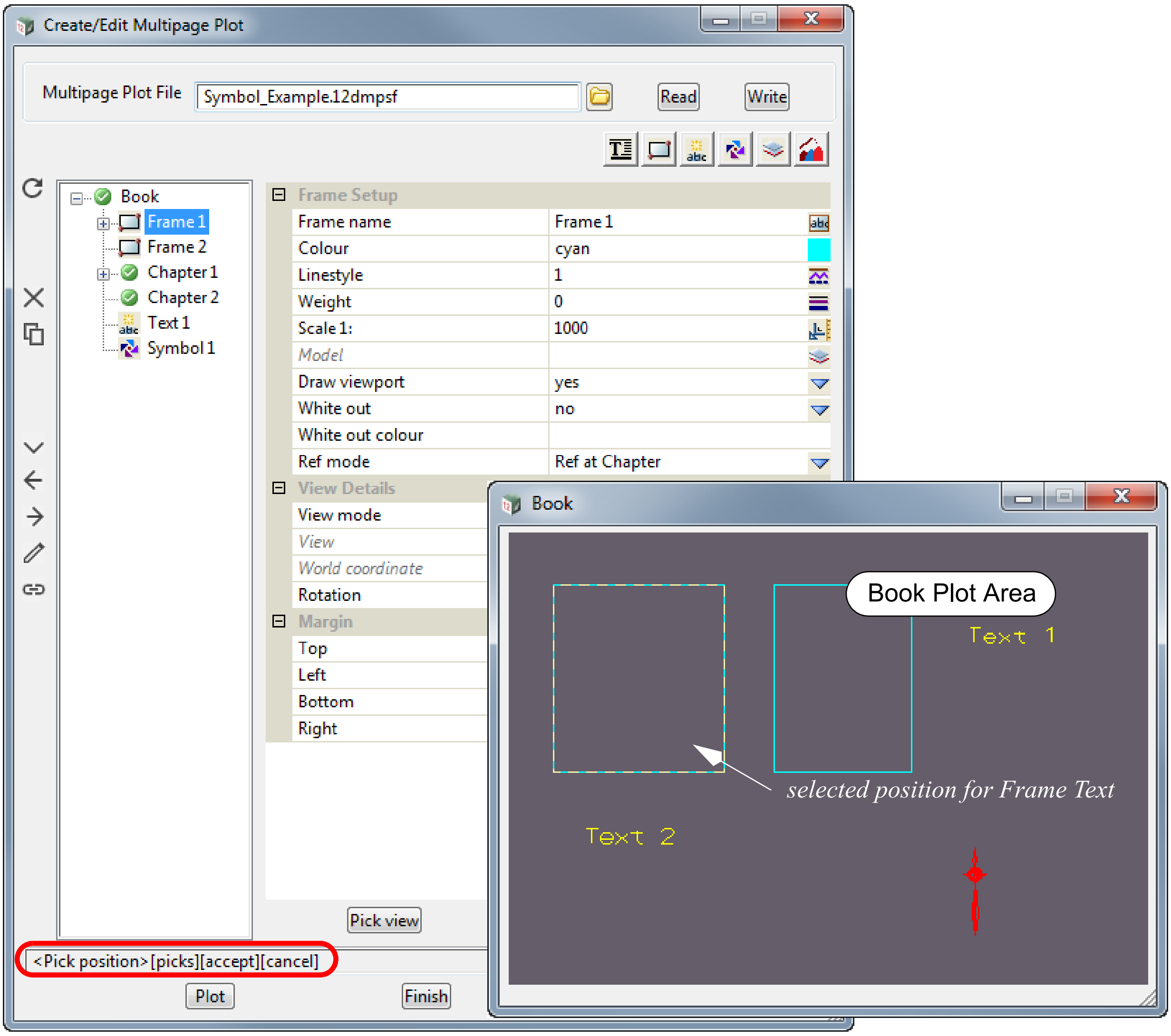
Next click on the **Symbol icon** at the top right to bring up the **Symbol** menu, and select ***Rel to frame*** from the **Symbol** menu.

The user is then asked to pick a **Frame** from the **Plot Area**.



When the **Frame** is **selected**, the **Frame** is highlighted in the **Plot Area** and the **Frame node** highlighted in the tree.

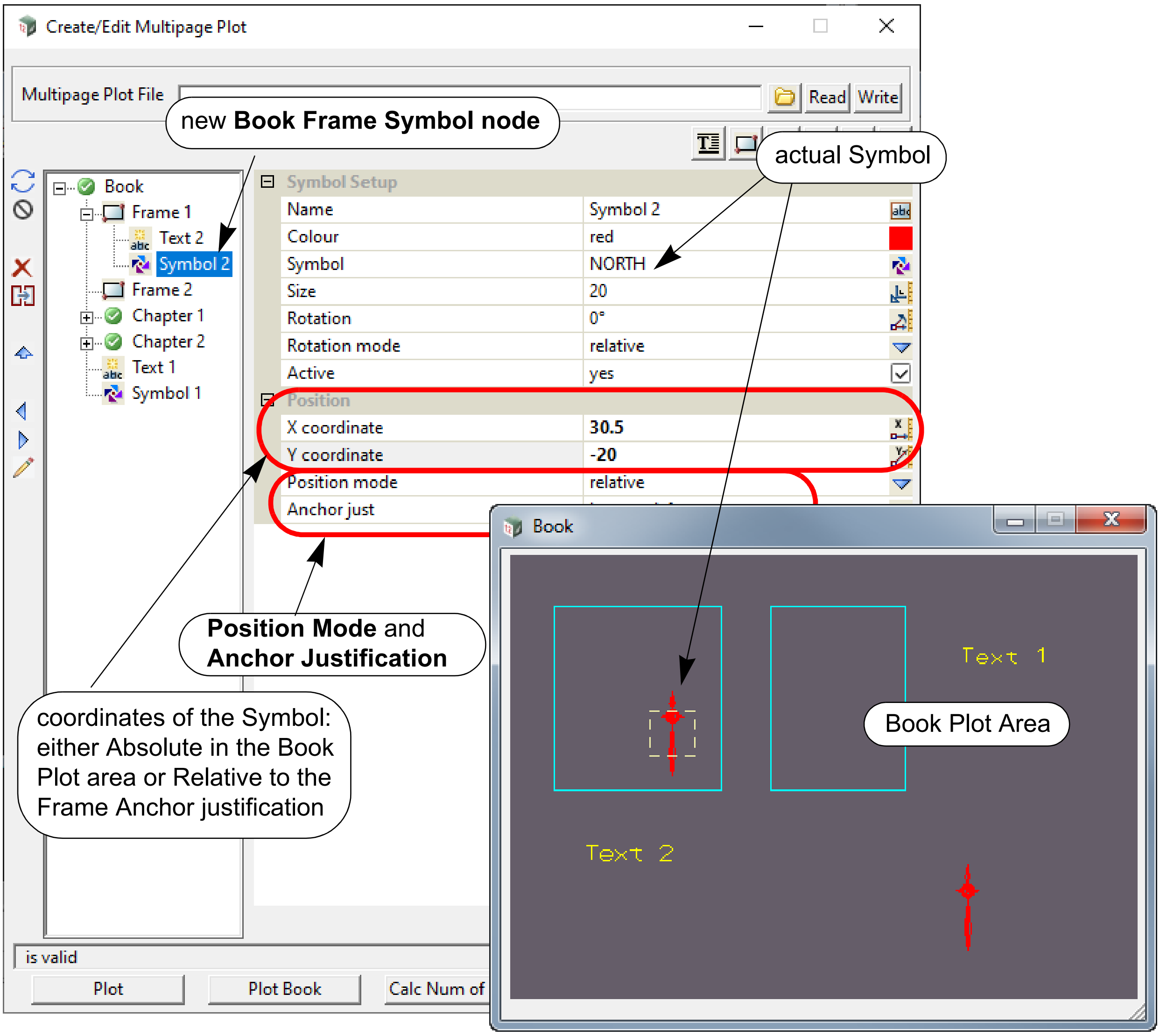
The position for the **Book Frame Symbol** is then selected in the **Plot Area**.



Once the Symbol position is selected, a **Book Frame Symbol node** is automatically added at the bottom of the **Book Frame** with the default name **Symbol n** where **n** is the next integer that makes the **Book Frame Symbol node** name unique amongst all the **Book Symbol nodes** AND **Book Frame Symbol nodes**.

Similarly the name of a **Chapter Frame Symbol node** must be unique amongst all the **Chapter Symbol nodes** AND the **Chapter Frame Symbol nodes** for that **Chapter**. And the name of a **Page Frame Symbol node** must be unique amongst all the **Page Symbol nodes** AND the **Page Frame Symbol nodes** for that **Page**.

The default Symbol "4dNorth" is added to the **Symbol** field and displayed in the **Book Plot Area**.



If ***Absolute*** was chosen from the **Symbol** menu:

the **Position Mode** is set to ***Absolute*** and the values for **X coordinate** and **Y coordinate** are the position on the Book Plot area.

If ***Rel to Frame*** was chosen from the **Symbol** menu:

the **Position Mode** is set to ***Relative***, and the **Anchor just** is set to the closest of the nine justification positions for the Frame (bottom left, bottom centre, bottom right, middle left, middle centre, middle right, top left, top centre, top right). The values for **X coordinate** and **Y coordinate** are then relative to the Anchor justification point.

The values for **X coordinate, Y coordinate**, **Mode** and **Anchor just** can be changed at any time and the **Set** button pressed for them to take effect.

If **mode** is **Relative** and the Frame is moved, the Symbol also moves by the same amount.

If **mode** is **Relative** and the Frame is resized, the position of the Symbol relative to the **Anchor justification** is maintained.

For documentation on the fields and icons used for **Frame Symbol**, see 21.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes.

21.1.4.9.3 Reference Symbol

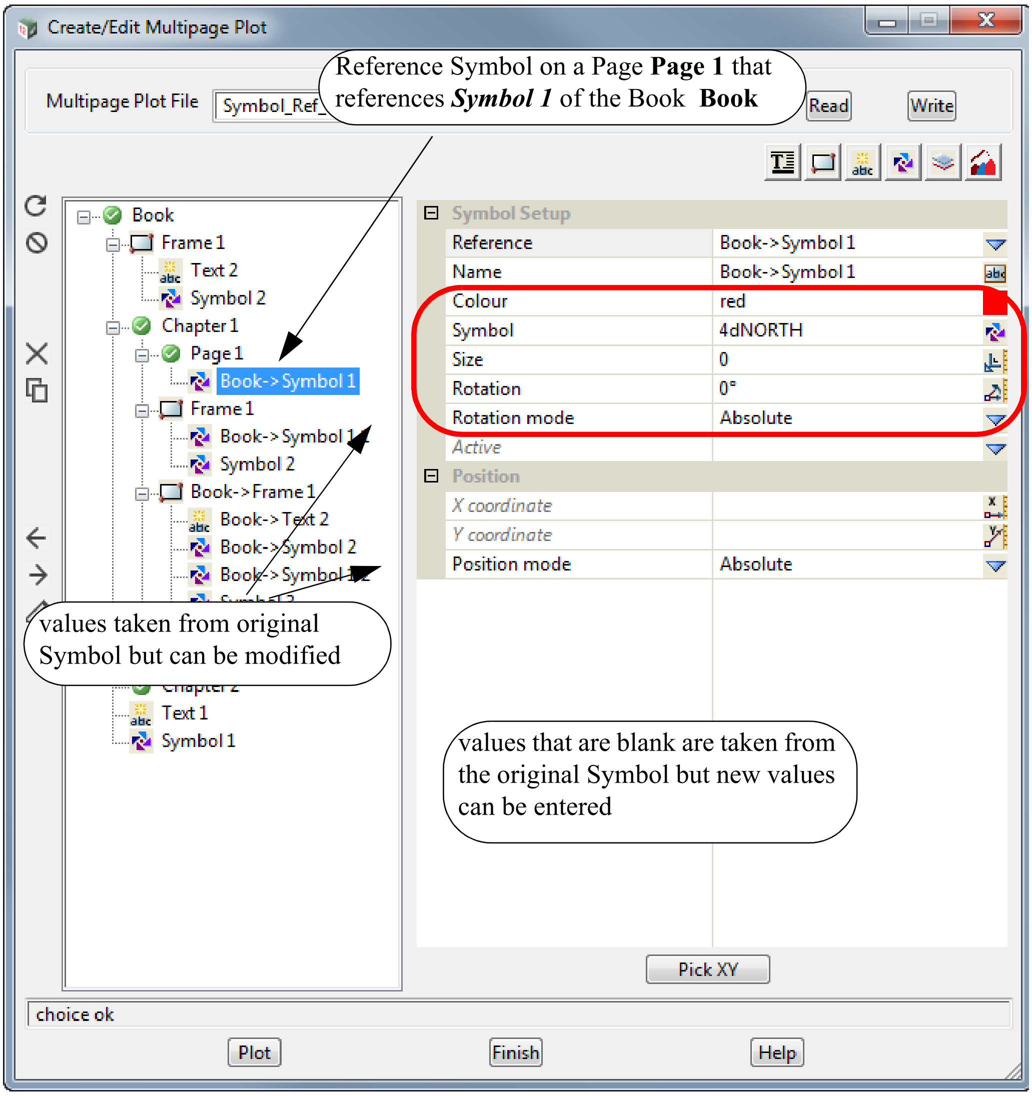
A **Relative Symbol** is not for creating a new **Symbol node** but creates a **Reference Symbol node that references** an existing **Symbol node** or **Reference Symbol node** at a higher level, and optionally replaces the values defining the new **Reference Symbol**.

That is, a **Reference Symbol** at a **Chapter** level can only reference a **Book Symbol** or a **Book Frame Symbol**. And a **Reference Symbol** at the **Page** level can only reference a **Book Symbol**, **Book Frame Symbol, Chapter Symbol, Chapter Frame Symbol, Chapter Reference Symbol**, **Chapter Reference Frame Symbol** or a **Chapter Reference Frame Reference Symbol.**

The **Reference Symbol** has as defaults all the values defined for the **Symbol** that is being referenced BUT any of those values can be modified for the **Reference Symbol**. In particular, the **Reference Symbol** can be made active/inactive independently of the original **Symbol**.

For example, if a **Book Symbol** was created then that symbol would by default be drawn exactly the same way on each **Page**. If a **Reference Symbol** was created on a **Page** and it referenced the **Book Symbol**, then the **Reference Symbol** would then specify how that **Book Symbol** was drawn on that **Page** and any of the Symbol values could be changed. For example, the actual symbol or its colour could be changed, or the **Reference Symbol** could be made inactive so that the **Symbol** is **no longer drawn** on that **Page**.

.



A **Reference Symbol** can be is created in six ways:

(a) **Chapter Reference Symbol.** *See* 21.1.4.9.3.1 Creating Chapter Reference Symbol.

(b) **Chapter Frame Reference Symbol** *See* 21.1.4.9.3.2 Creating Chapter Frame Reference Symbol.

(c) **Chapter Reference Frame Reference Symbol** *See* 21.1.4.9.3.3 Creating Chapter Reference Frame Reference Symbol.

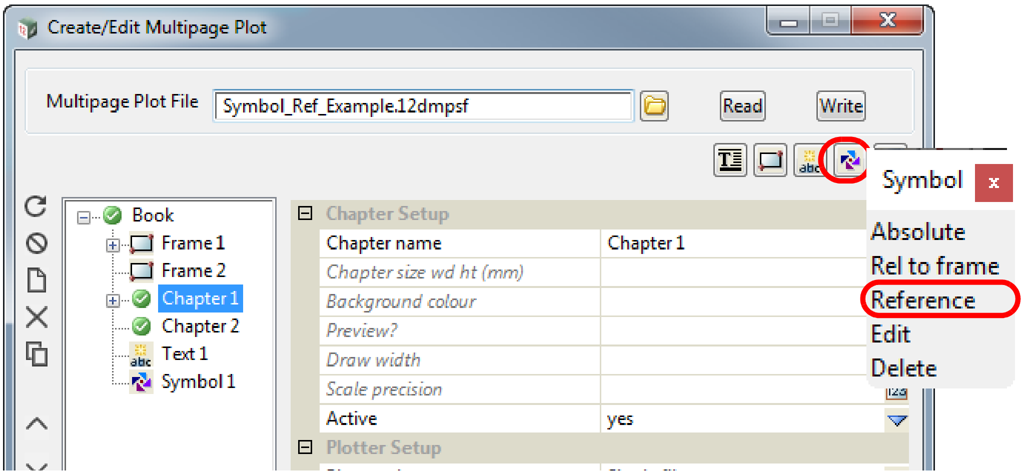
(d) **Page Reference Symbol.** *See* 21.1.4.9.3.4 Creating a Page Reference Symbol.

(e) **Page Frame Reference Symbol.** *See* 21.1.4.9.3.5 Creating Page Frame Reference Symbol.

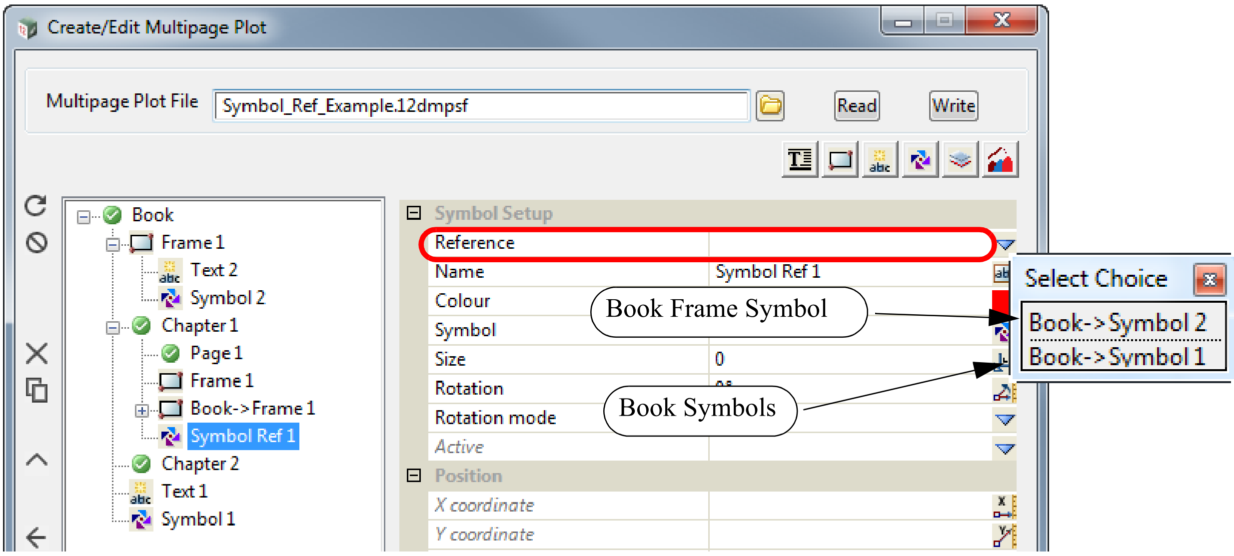
(f) **Page Reference Frame Reference Symbol.** *See* 21.1.4.9.3.6 Creating Page Reference Frame Reference Symbol.

21.1.4.9.3.1 Creating Chapter Reference Symbol

To create a **Chapter Reference Symbol** for a **Chapter**, click on the **Chapter node** and then click on the **Symbol** icon and select **Reference** from the **Symbol** menu.



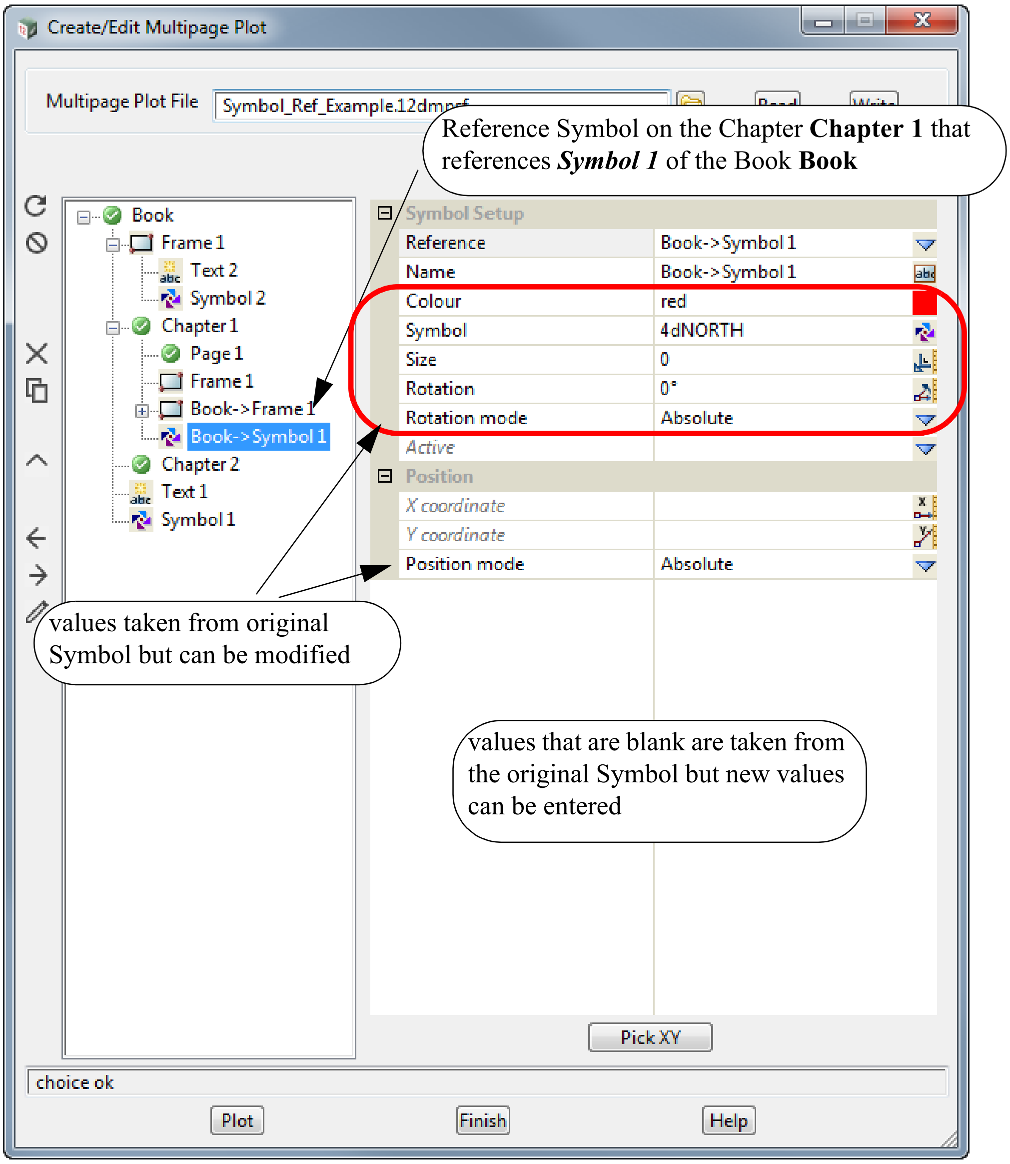
A new **Chapter Reference Symbol** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols** and **Book Frame Symbols** that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

.



If the **Chapter Reference Symbol** references a **Book Symbol** or **Book Frame Symbol,** any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Reference Symbol**.

Important Notes

1. If you don't want to display a **Book Symbol** for a particular chapter, then for that chapter, create a **Chapter Reference Symbol** which references the appropriate **Book Symbol**. And in the **Chapter Reference Symbol** fields, set the ***Active*** field to **No**.

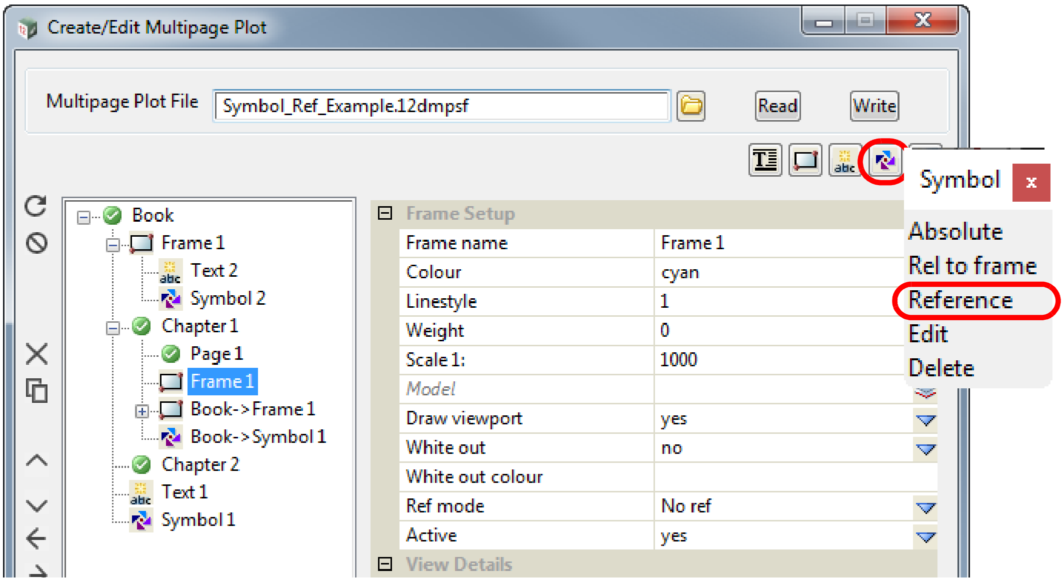
2. If you don't want to display **Book Frame Symbol** for a particular chapter, then for that chapter, create a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a **Chapter Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Chapter Reference Frame Reference Symbol** fields, set the ***Active*** field to **No**.

3. If a **Book Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a **Chapter Reference Symbol** that references the appropriate **Book Symbol**. And in the **Chapter Reference Symbol** fields, set the ***Active*** field to **Yes**.

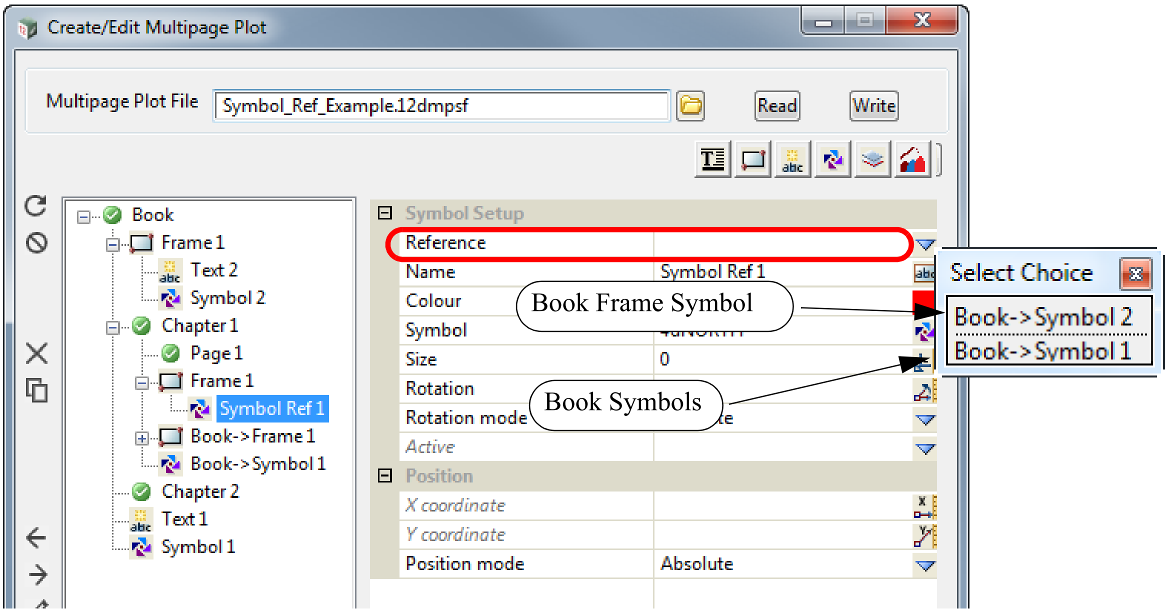
4. If a **Book Frame Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a **Chapter Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Chapter Reference Frame Reference Symbol** fields, set the ***Active*** field to **Yes**.

21.1.4.9.3.2 Creating Chapter Frame Reference Symbol

To create a **Chapter Frame Reference Symbol** for a **Chapter Frame**, click on the **Chapter Frame node** and then click on the **Symbol** icon and select **Reference** from the **Symbol** menu.



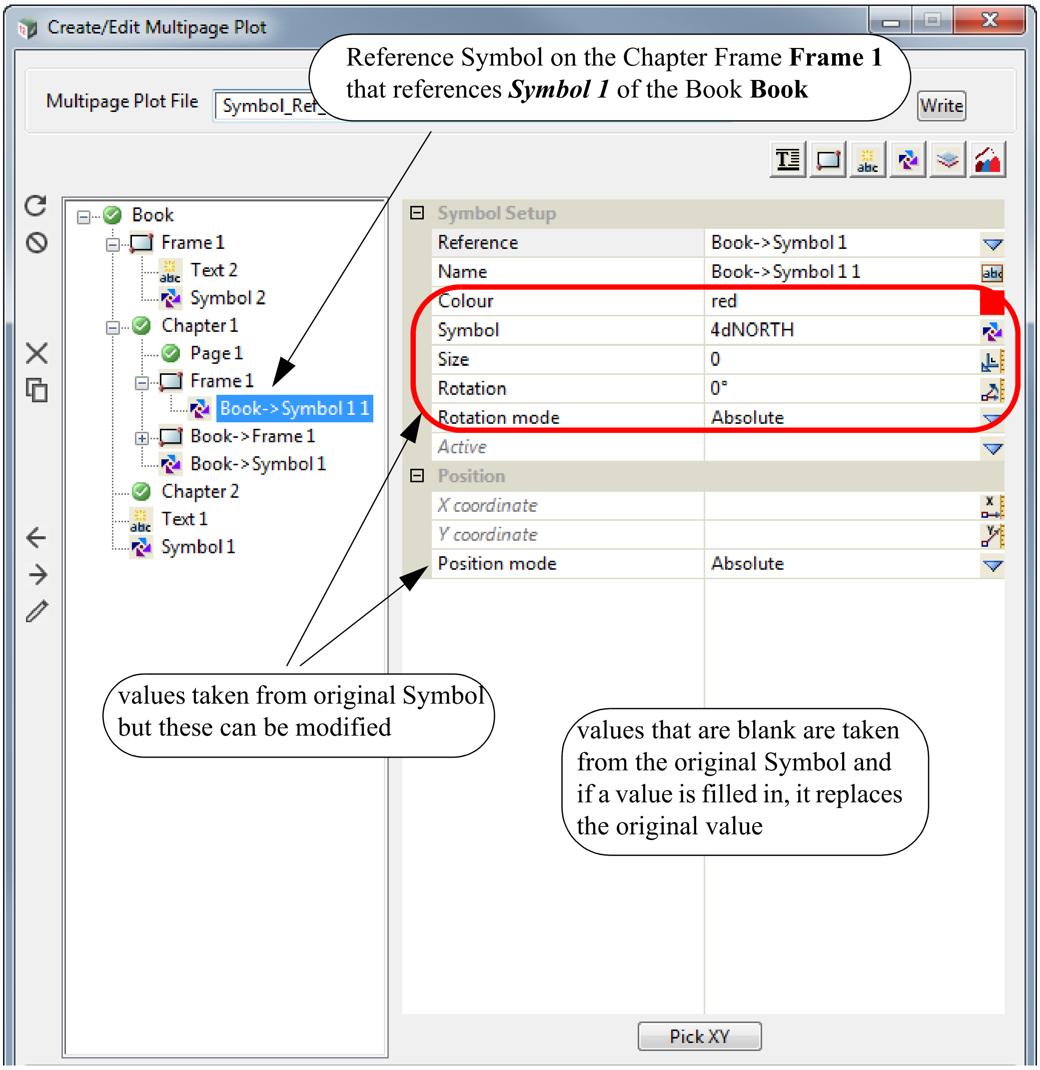
A new **Chapter Frame Reference Symbol** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols** and **Book Frame Symbols** that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

.



If the **Chapter Frame Reference Symbol** references a **Book Symbol** or **Book Frame Symbol,** any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Frame Reference Symbol**.

Important Notes

1. If you don't want to display **Book Symbol** for a particular chapter, then for that chapter, create a **Chapter Reference Symbol** which references the appropriate **Book Symbol**. And in the **Chapter Reference Symbol** fields, set the ***Active*** field to **No**.
2. If you don't want to display **Book Frame Symbol** for a particular chapter, then for that chapter, create a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a **Chapter Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Chapter Reference Frame Reference Symbol** fields, set the ***Active*** field to **No**.
3. If a **Book Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a **Chapter Reference Symbol** that references the appropriate **Book Symbol**. And in the **Chapter Reference Symbol** fields, set the ***Active*** field to **Yes**.
4. If a **Book Frame Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a

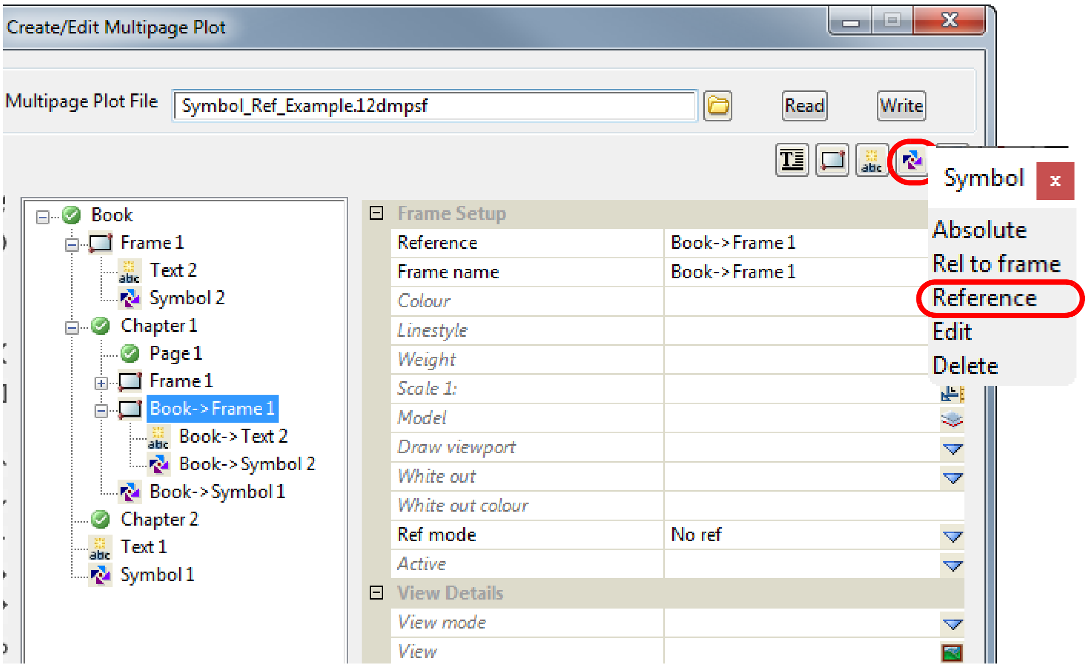
Chapter Reference Frame Reference Symbol that references the appropriate **Book Frame Symbol**. And in the **Chapter Reference Frame Reference Symbol** fields, set the ***Active*** field to **Yes**.

21.1.4.9.3.3 Creating Chapter Reference Frame Reference Symbol

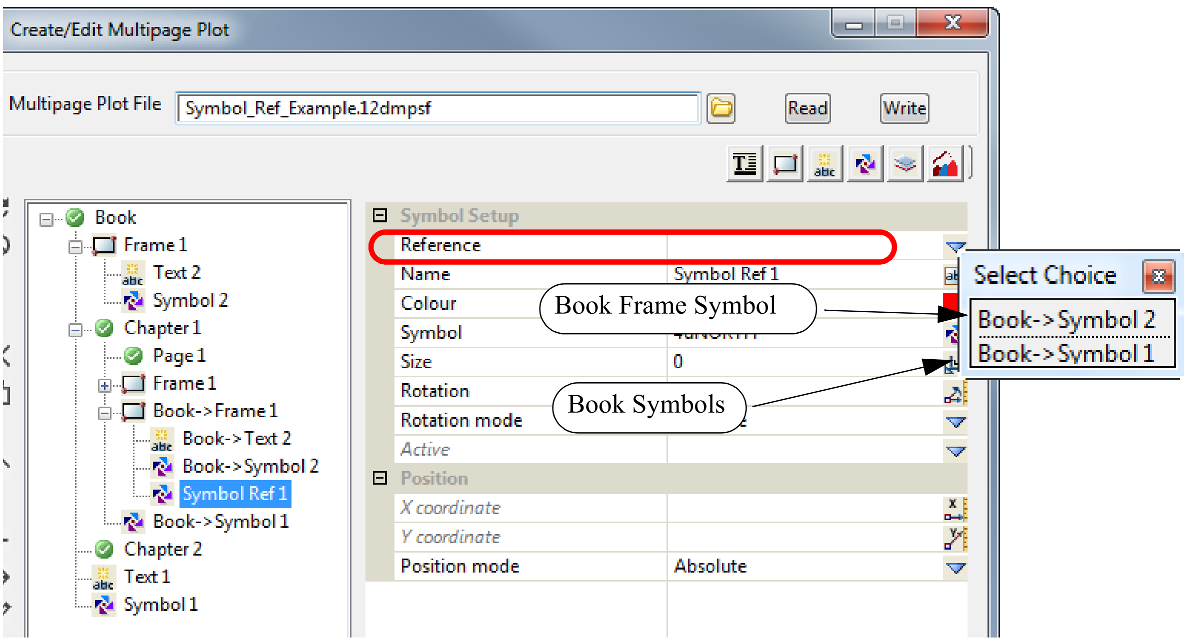
Important Note

Please note that the **Chapter Reference Frame Reference Symbol** and a **Chapter Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame**.

A **Chapter Reference Frame Reference Symbol** for a **Chapter Reference Frame** is created by clicking on the **Chapter Reference Frame node** and then clicking on the **Symbol** icon and selecting **Reference** from the **Symbol** menu.



A new **Chapter Reference Frame Reference Symbol** is created but it has a blank **Reference** Field.

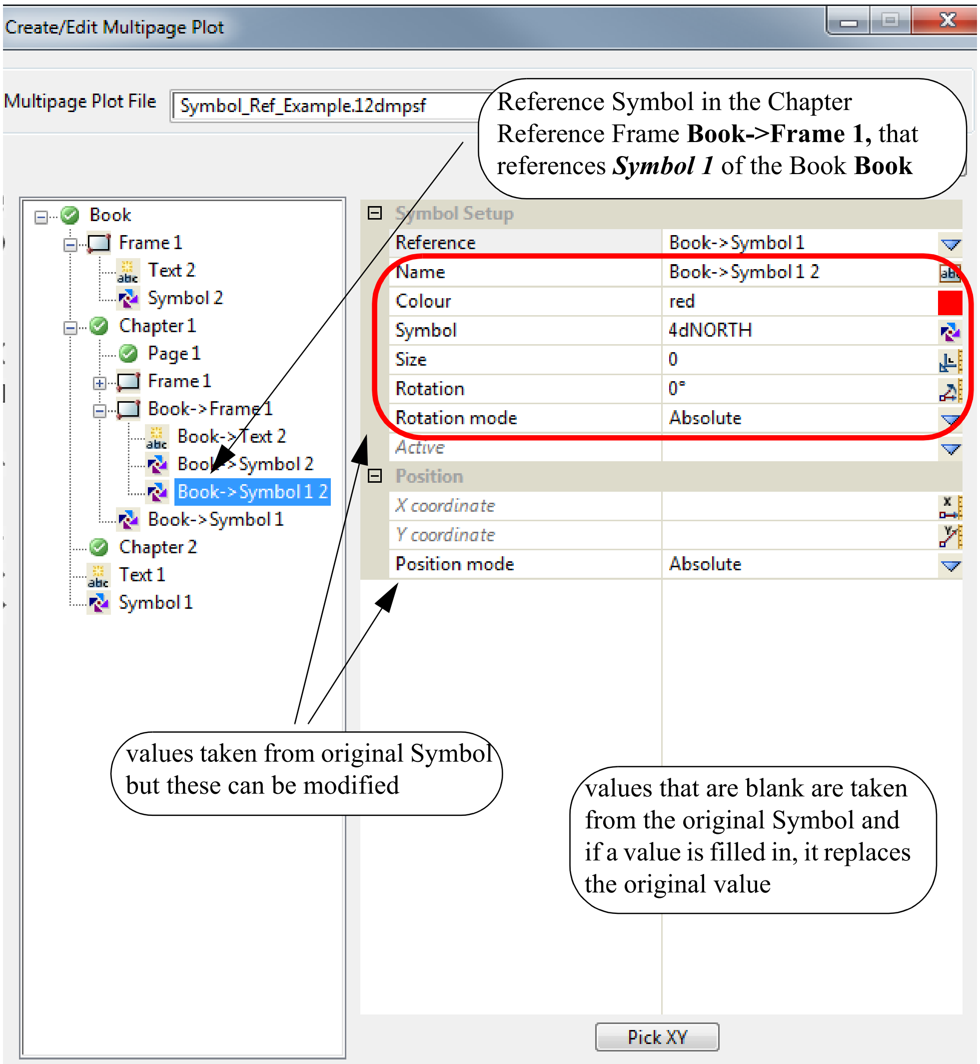


The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols** and **Book Frame**

Symbols that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

.



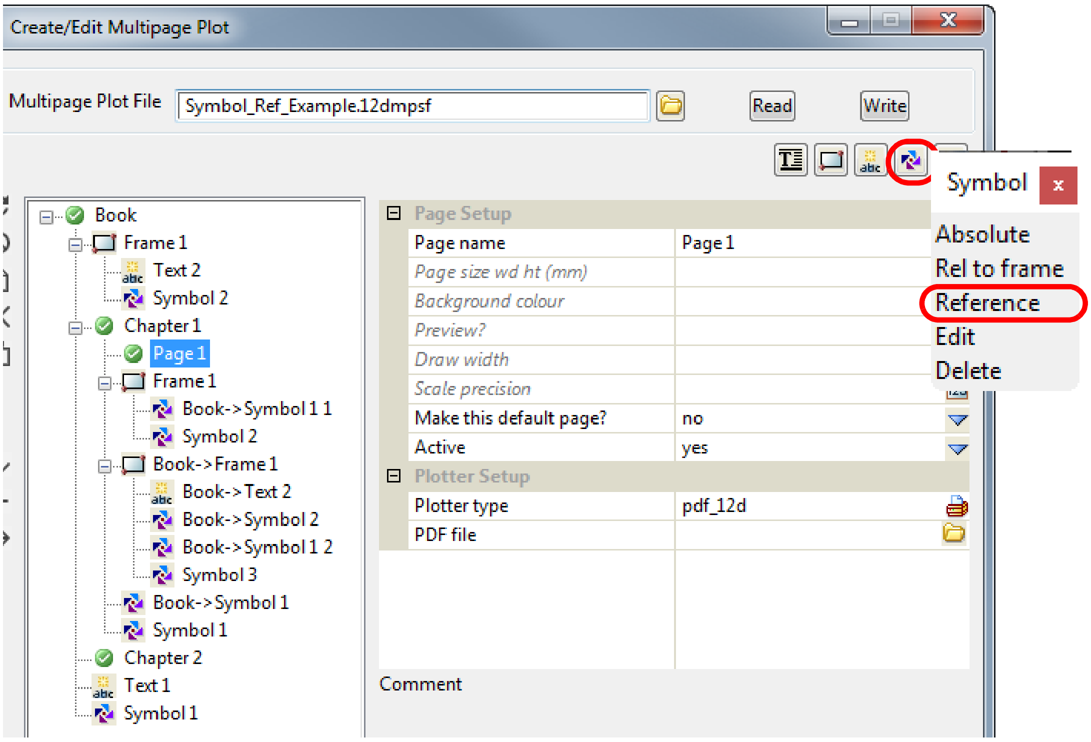
If the **Chapter Reference Frame Reference Symbol** references a **Book Symbol** or **Book Frame Symbol**, any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Reference Frame Reference Symbol**.

Important Notes

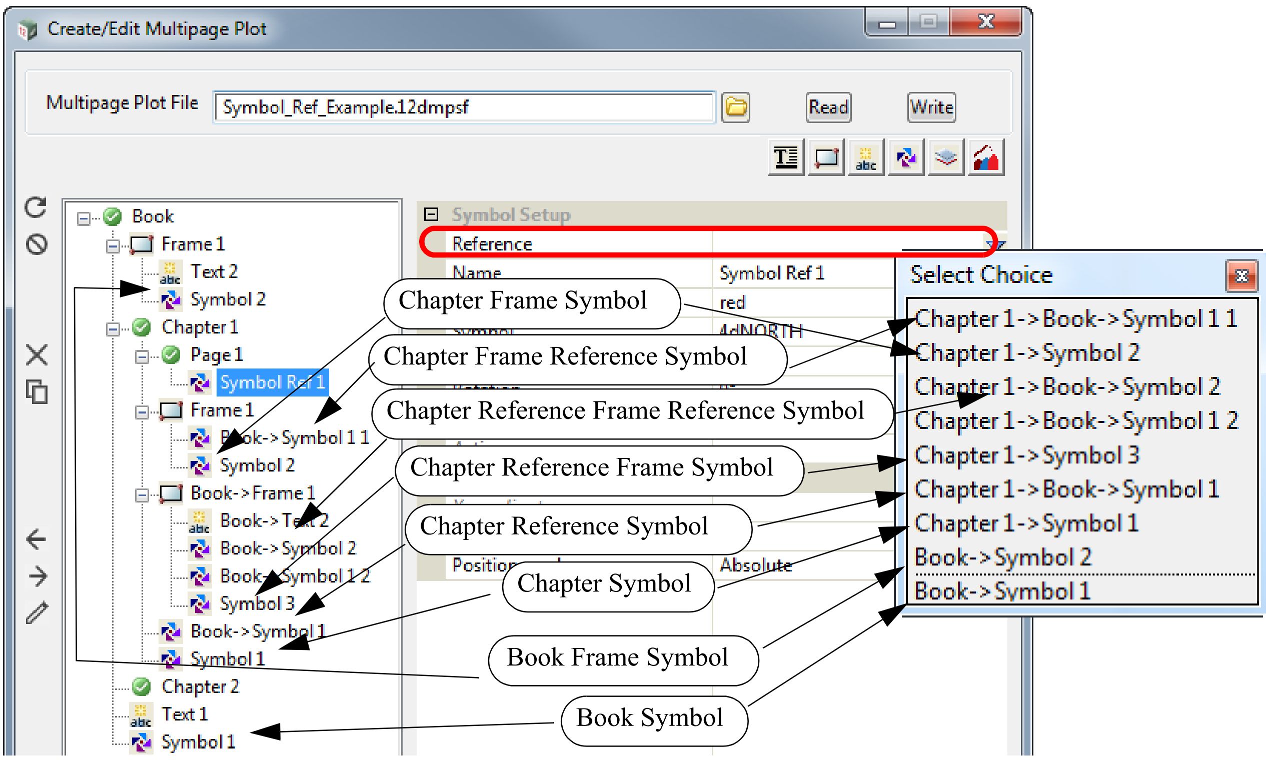
1. Please note that the **Chapter Reference Frame Reference Symbol** and the **Chapter Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame.**
2. The only way to tell if a **Symbol** references a **Book Symbol** or a **Book Frame Symbol** is that their names have to be unique at the **Book** level.

21.1.4.9.3.4 Creating a Page Reference Symbol

To create a **Page Reference Symbol** for a **Page**, click on the **Page node** and then click on the **Symbol** icon and select **Reference** from the **Symbol** menu.



A new **Page Reference Symbol** is created but it has a blank **Reference** Field.

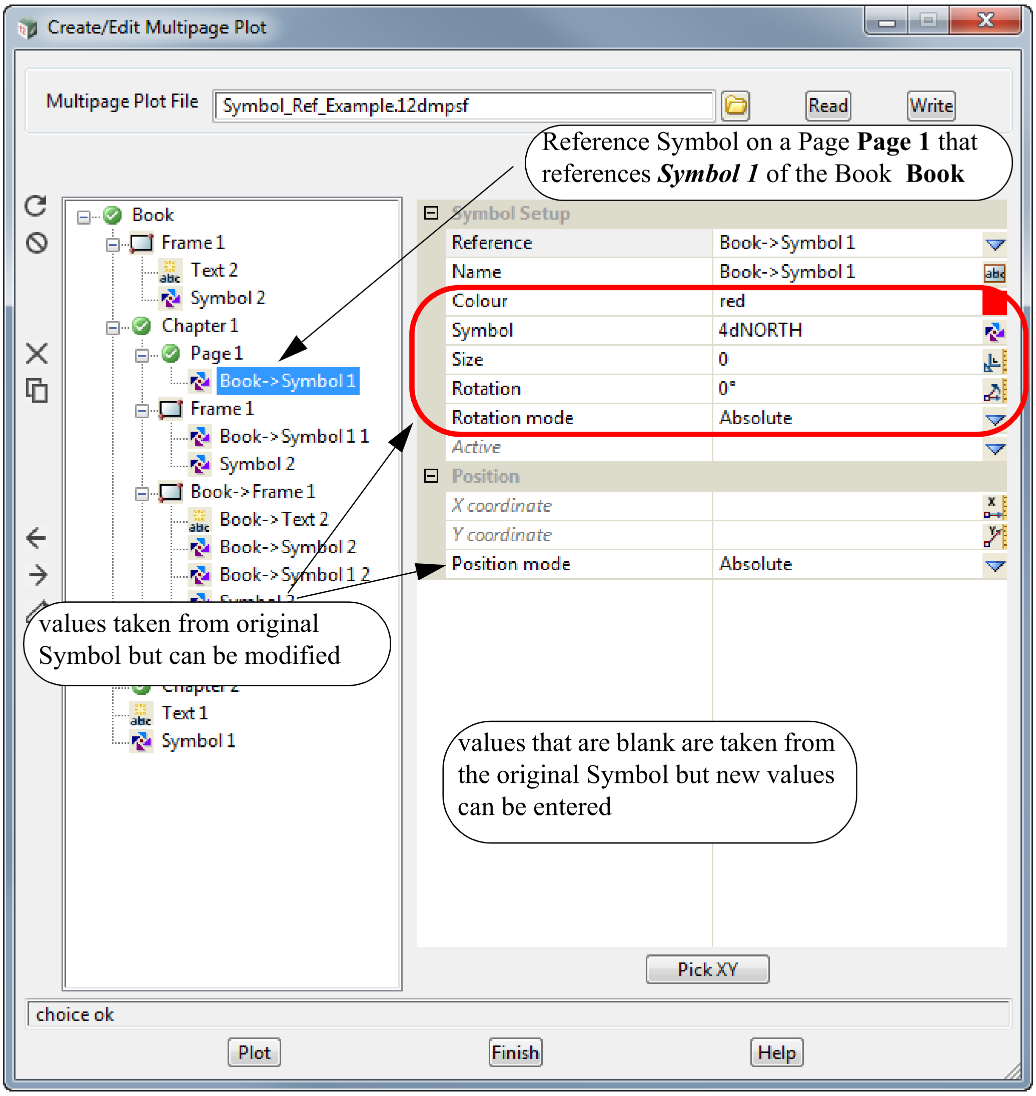


The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols**, **Book Frame Symbols**, **Chapter Symbols, Chapter Reference Symbols**, **Chapter Frame Symbols**, **Chapter Frame Reference Symbols**, **Chapter Reference Frame Symbols** and **Chapter Reference Frame**

Reference Symbols that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.

.



If the **Page Reference Symbol** references a **Book Symbol, Book Frame Symbol, Chapter Symbol** or **Chapter Frame Symbol**, any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Reference Symbol**.

If the **Page Reference Symbol** references a **Chapter Reference Symbol** or a **Chapter Frame Reference Symbol** or a **Chapter Reference Frame Reference Symbol** then the fields in the **Page Reference Symbol** override the fields in the **Chapter Reference Symbol** which in turn overrides the fields in the original **Book Symbol**.

Important Notes

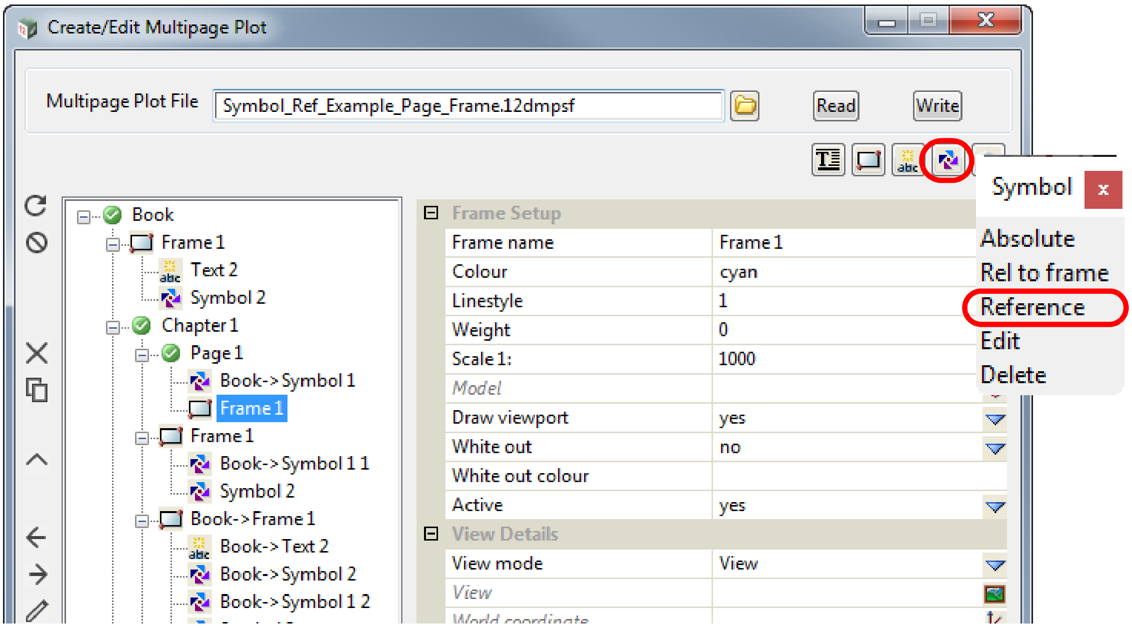
1. If you don't want to display **Book Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Book Symbol**, and in the **Page Reference Symbol** fields, set the ***Active*** field to **No**.
2. If you don't want to display **Chapter Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Chapter Symbol**, and in the **Page Reference Symbol** fields, set the ***Active*** field to **No**.

3. If you don't want to display **Chapter Reference Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Chapter Reference Symbol**, and in the **Page Reference Symbol** fields, set the ***Active*** field to **No**.

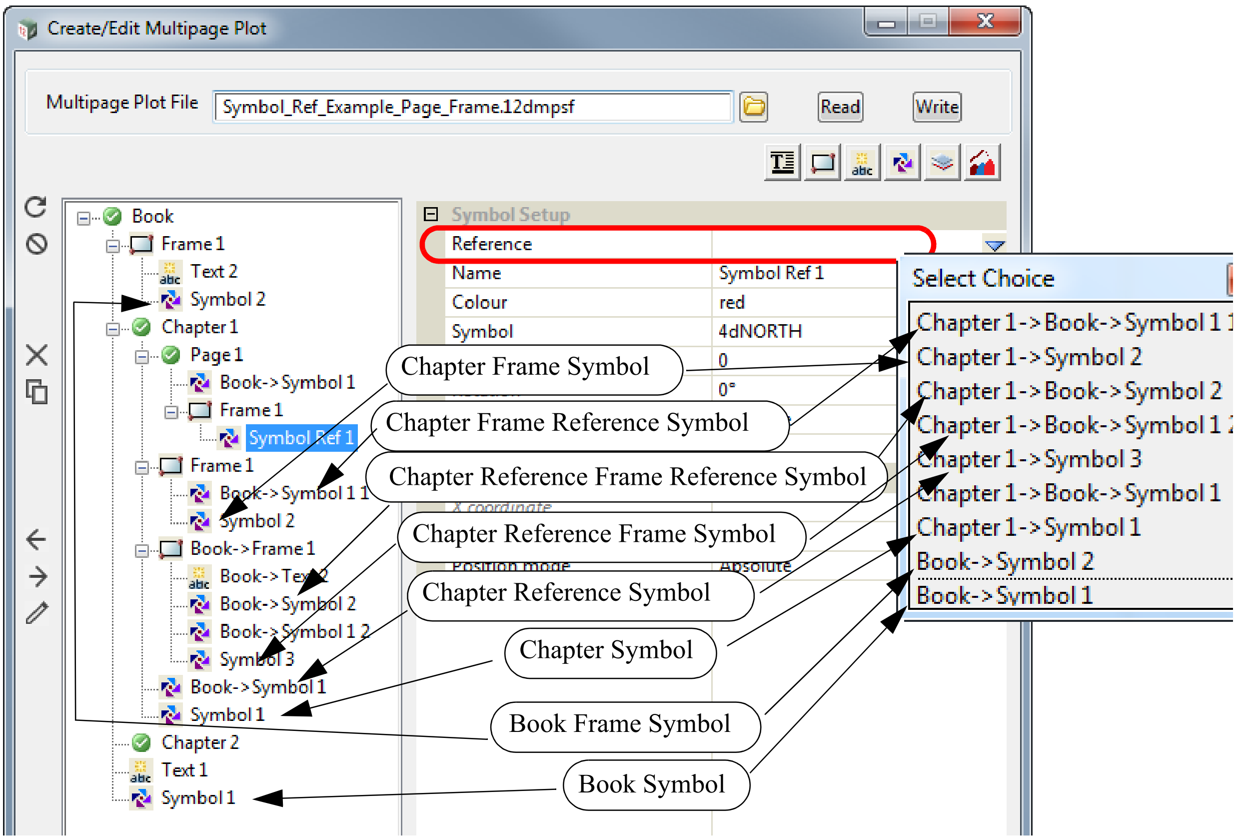
4. If a **Book Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Symbol** that references the appropriate **Book Symbol**. And in the **Page Reference Symbol** fields, set the ***Active*** field to **Yes**.
5. If a **Chapter Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Symbol** that references the appropriate **Chapter Symbol**. And in the **Page Reference Symbol** fields, set the ***Active*** field to **Yes**.
6. If a **Chapter Reference Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Symbol** that references the appropriate **Chapter Reference Symbol**. And in the **Page Reference Symbol** fields, set the ***Active*** field to **Yes**.

21.1.4.9.3.5 Creating Page Frame Reference Symbol

To create a **Page Frame Reference Symbol** for a **Page Frame**, click on the **Page Frame node** and then click on the **Symbol** icon and select **Reference** from the **Symbol** menu.

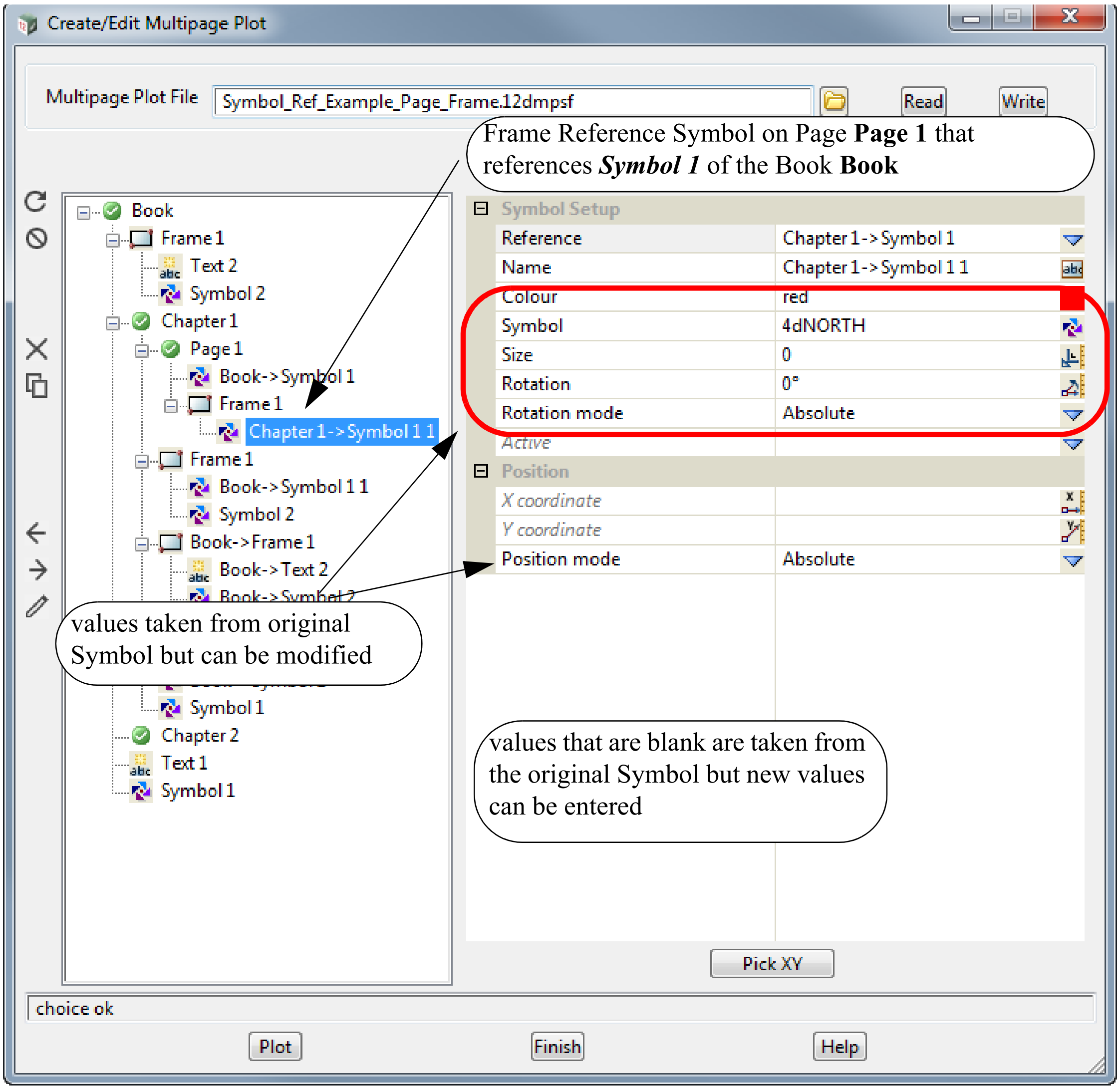


A new **Page Frame Reference Symbol** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols**, **Book Frame Symbols**, **Chapter Symbols, Chapter Reference Symbols**, **Chapter Frame Symbols**, **Chapter Frame Reference Symbols**, **Chapter Reference Frame Symbols** and **Chapter Reference Frame Reference Symbols** that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Page Frame Reference Symbol** references a **Book Symbol, Book Frame Symbol, Chapter Symbol** or **Chapter Frame Symbol**, any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Fame Reference Symbol**.

If the **Page Frame Reference Symbol** references a **Chapter Reference Symbol** then the fields in the **Page Frame Reference Symbol** override the fields in the **Chapter Reference Symbol** which in turn overrides the fields in the original **Book Symbol**.

Important Notes

1. If you don't want to display **Book Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Book Symbol**, and in the **Page Reference Symbol** fields, set the ***Active*** field to **No**.
2. If you don't want to display **Chapter Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Chapter Symbol**, and in the **Page Reference Symbol** fields, set the ***Active*** field to **No**.
3. If you don't want to display **Book Frame Symbol** for a particular page, then for that page, create a **Page Reference Frame** that references the **Book Frame** that contains the **Book Frame**

Symbol. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Page Reference Frame Reference Symbol** fields, set the ***Active*** field to **No**.

4. If you don’t want to display **Chapter Frame Symbol** for a particular page, then for that page, create a **Page Reference Frame** that references the **Chapter Frame** that contains the **Chapter Frame Symbol**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Chapter Frame Symbol**. And in the **Page Reference Frame Reference Symbol** fields, set the ***Active*** field to **No**.

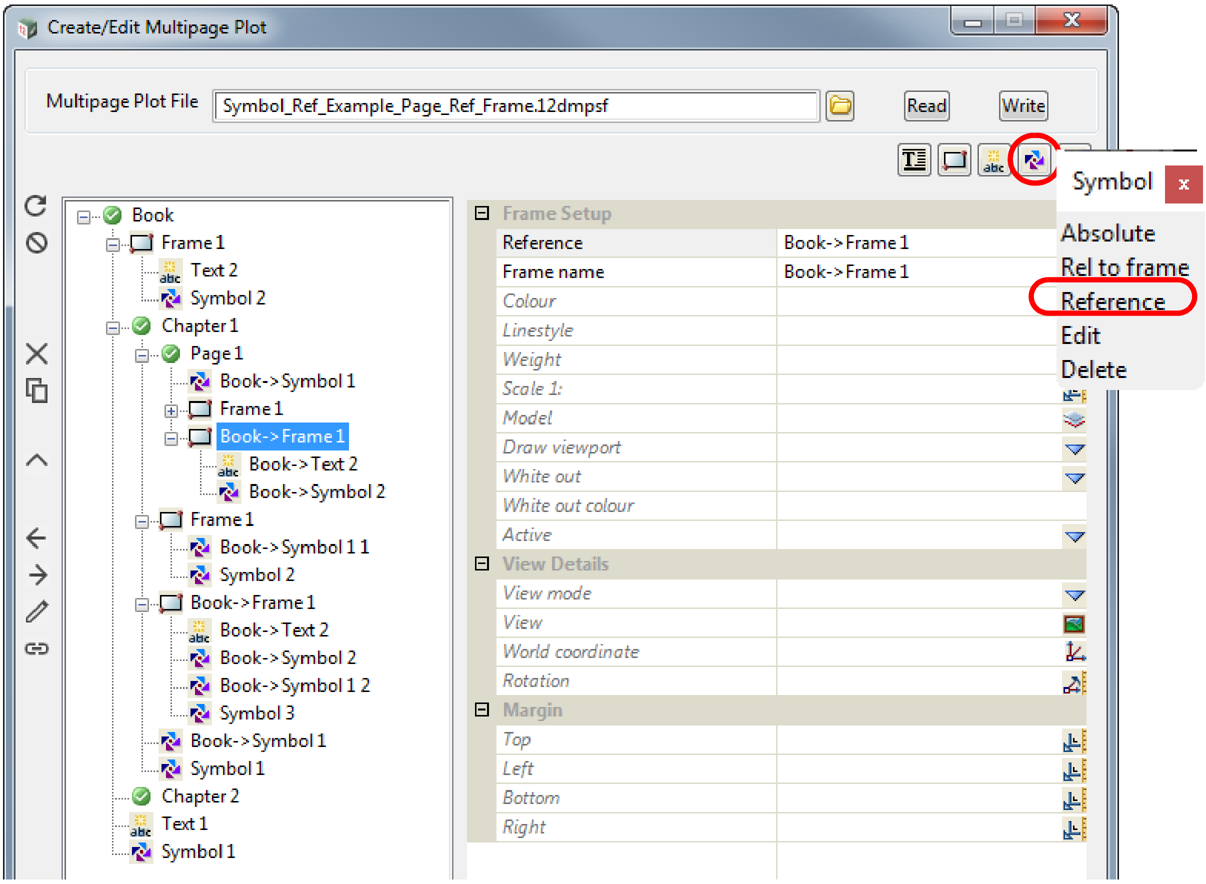
5. If a **Book Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Symbol** that references the appropriate **Book Symbol.** And in the **Page Reference Symbol** fields, set the ***Active*** field to **Yes.**
6. If a **Chapter Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a **Page Reference Symbol** that references the appropriate **Chapter Symbol**. And in the **Page Reference Symbol** fields, set the ***Active*** field to **Yes**.
7. If a **Book Frame Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol.** And in the **Page Reference Frame Reference Symbol** fields, set the ***Active*** field to **Yes**.
8. If a **Chapter Frame Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Chapter Frame** that contains the **Chapter Frame Symbol**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Chapter Frame Symbol**. And in the **Page Reference Frame Reference Symbol** fields, set the ***Active*** field to **Yes**.
9. If a **Chapter Reference Frame Symbol** has been set to ***Inactive*** (i.e. OFF) then it can be **displayed** for a **particular** page by creating a a **Page Reference Frame** that references the **Chapter Reference Frame** that contains the **Chapter Reference Frame Symbol**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Chapter Reference Frame Symbol**. And in the **Page Reference Frame Reference Symbol** fields, set the ***Active*** field to **Yes.**

21.1.4.9.3.6 Creating Page Reference Frame Reference Symbol

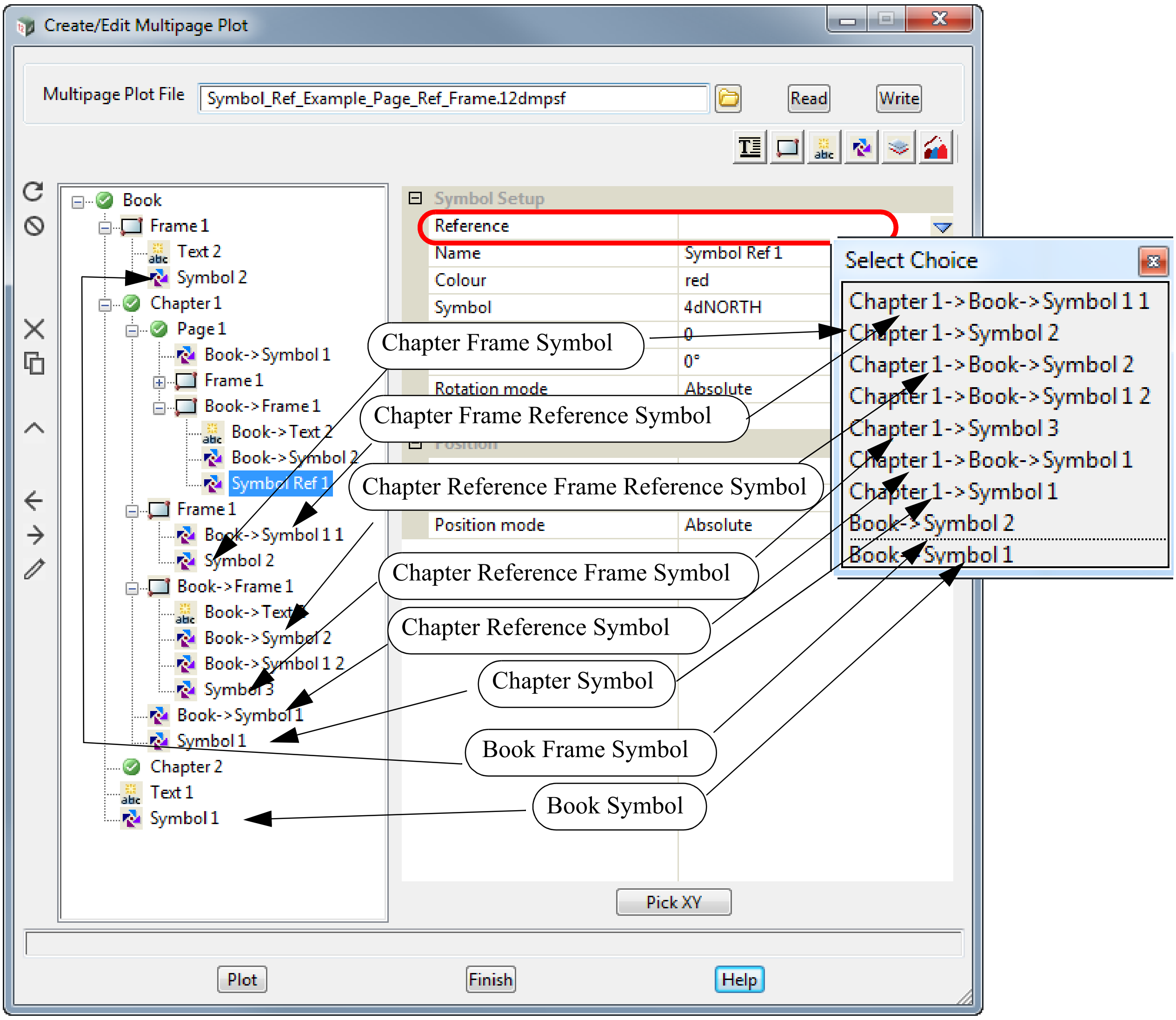
Important Note

Please note that the **Page Reference Frame Reference Symbol** and a **Page Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Page Reference Frame** and the other in a **Page Frame**.

To create a **Page Reference Frame Reference Symbol** for a **Page Reference Frame**, click on the **Page Reference Frame node** and then click on the **Symbol** icon and select **Reference** from the **Symbol** menu.

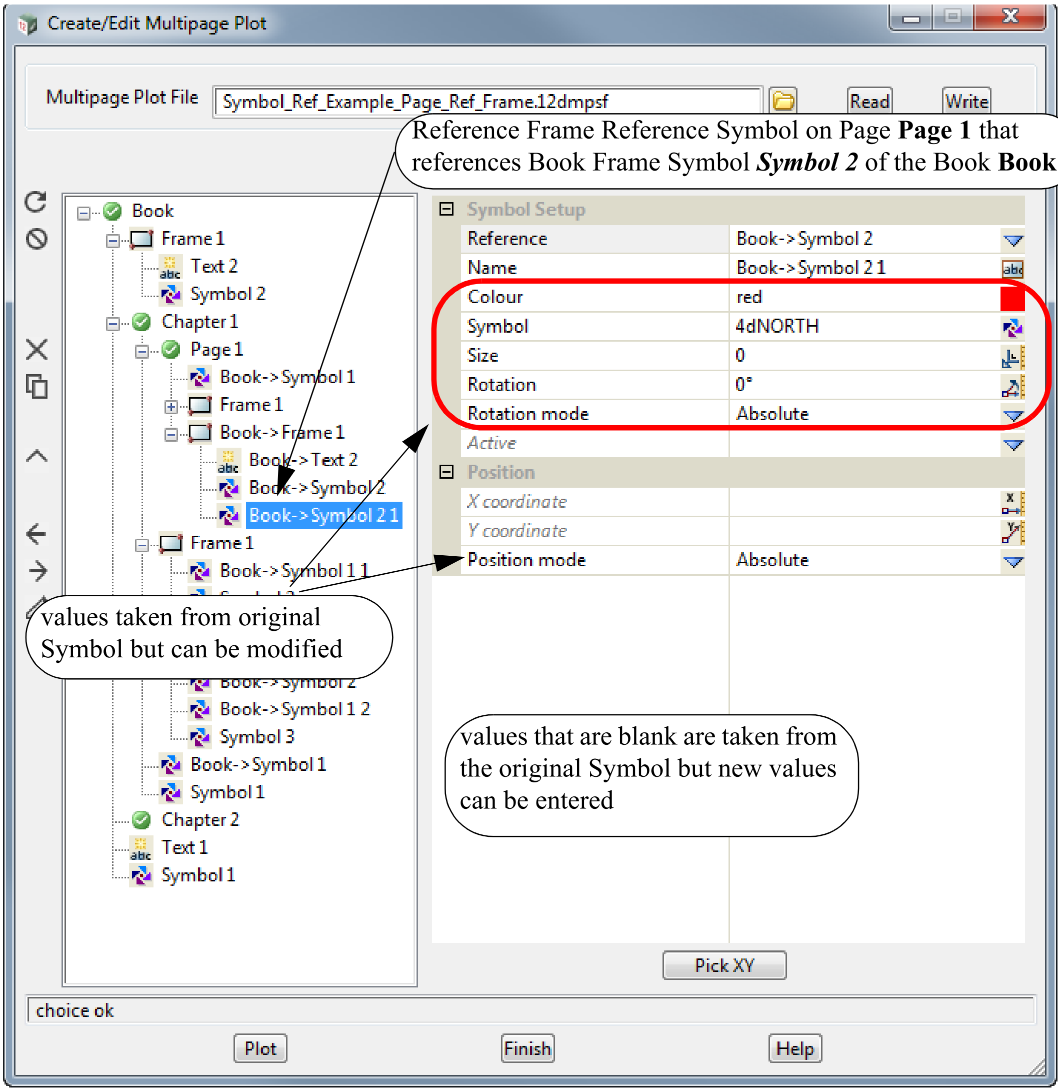


A new **Page Reference Frame Reference Symbol** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Symbols**, **Book Frame Symbols**, **Chapter Symbols, Chapter Reference Symbols**, **Chapter Frame Symbols**, **Chapter Frame Reference Symbols**, **Chapter Reference Frame Symbols** and **Chapter Reference Frame Reference Symbols** that this **Reference Symbol** could reference.

Once a **Symbol** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Symbol** is changed to the full path name of the **Symbol** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



If the **Page Reference Frame Reference Symbol** references a **Book Symbol, Book Frame Symbol, Chapter Symbol** or **Chapter Frame Symbol**, any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Page Reference Fame Reference Symbol**.

If the **Page Reference Frame Reference Symbol** references a **Chapter Reference Symbol** / **Chapter Reference Frame Symbol** then the fields in the **Page Reference Frame Reference Symbol** override the fields in the **Chapter Reference Symbol/ Chapter Reference Frame Symbol** which in turn overrides the fields in the original **Book Symbol**.

Important Notes

1. Please note that the **Page Reference Frame Reference Symbol** and the **Page Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Page Reference Frame** and the other in a **Page Frame**.
2. The only way to tell if a **Symbol** references a **Book Symbol** or a **Book Frame Symbol** is that their names have to be unique at the **Book** level.
3. The only way to tell if a **Symbol** references a **Chapter Symbol** or a **Chapter Frame Symbol** is that their names have to be unique at the **Chapter** level.

21.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes

The icons, fields and buttons used in the **Book Symbol, Chapter Symbol**, **Page Symbol, Book Frame Symbol, Chapter Frame Symbol** and **Page Frame Symbol** panels have the following functions.

Field Description	Type	Defaults	Pop-Up

Icons on Left Side

The icons on the left side change depending on what is applicable for the highlighted node.

The action of the icons are described in 21.1.4.3 Icons on the Left Side.

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Symbol** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Symbol Setup

Name	text box	Symbol n	

*Name of this Symbol Node. The default is **Symbol n** where **n** is the first number (integer from zero) to make the Symbol **Name** unique amongst all Symbol Nodes in the tree.*

Colour*	colour box	red	available colours

Colour for the Symbol.

Symbol*	symbol box	NORTH	available symbols

Symbol to use.

Size*	real box	20	

Size of the Symbol.

Rotation*	angle box	0	

Rotation angle of the Symbol.

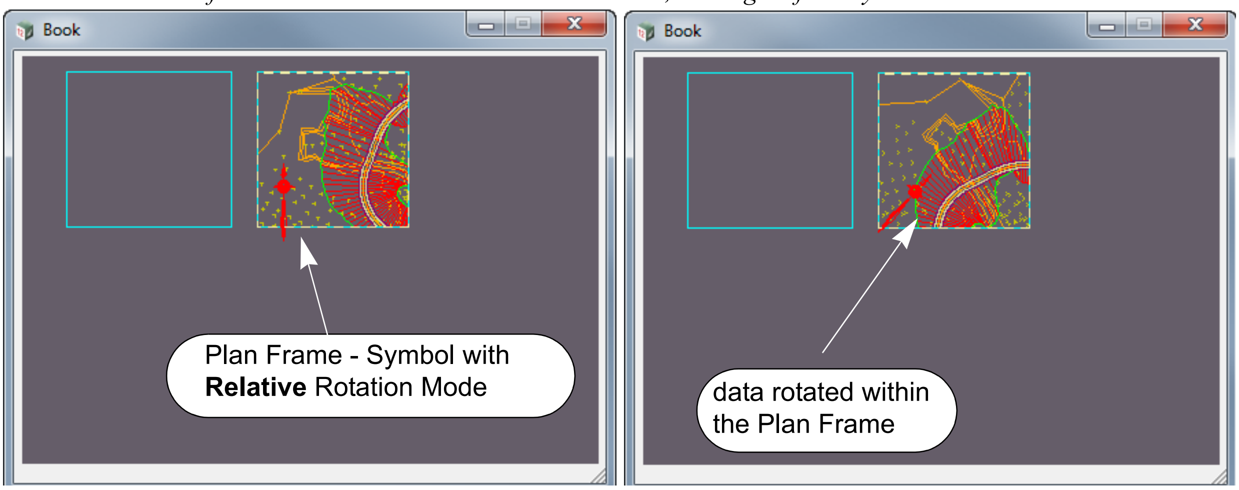
Rotation Mode*	choice box	absolute	absolute, relative

*If **absolute**, the rotation angle of the Symbol is fixed and is defined by the value of **Rotation**.*

*If **relative**, the rotation angle of the Symbol will match the rotation of the data within the parent Frame Node.*

***Note**: this field will only appear if the Symbol Node is a Subnode of a Frame Node.*

If the data within the Plan Frame is rotated, the angle of the Symbol rotates with the data.



Active	tick box	ticked	

*If **ticked**, the currently selected Node is made active and will be used when plotting. The Node's active/inactive icon will be set to active.*
*If **not ticked**, the currently selected Node is made inactive and it will be ignored when plotting. The Node's active/inactive icon will be set to inactive.*
***Note**: this tick box is linked to the Node's active/inactive icon. Changing one also changes the other.*

Position

X coordinate* real box x coordinate of Symbol location

X coordinate (in millimetres) for the Symbol.

Y coordinate* real box y coordinate of Symbol location

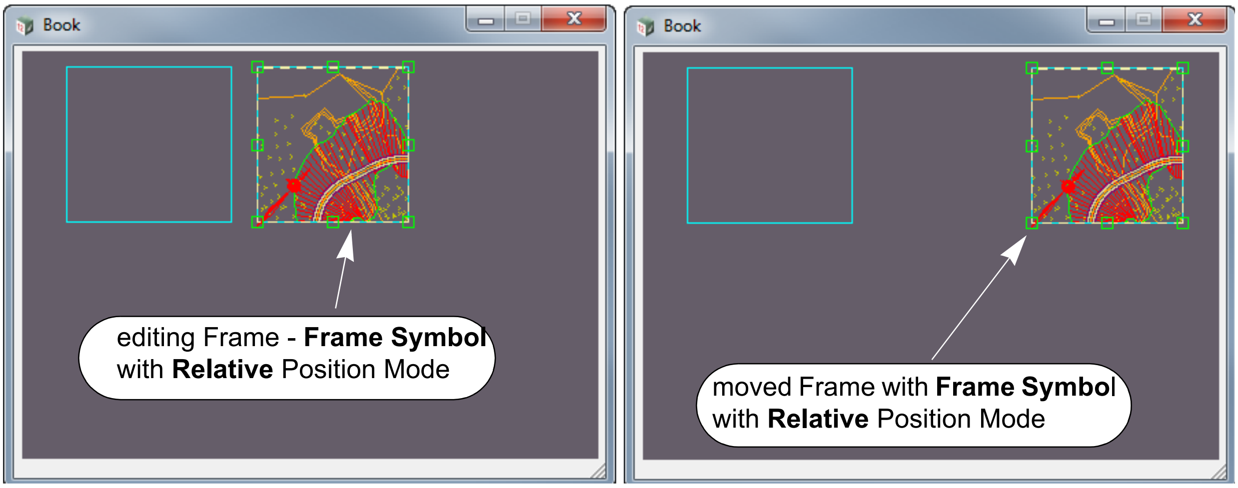
Y coordinate (in millimetres) for the Symbol.

Position Mode* choice box Absolute, Relative

*If **Absolute**, the Symbol is positioned in millimetre coordinates in the Plot Area.*
*If it is **Frame Symbol** and the Frame the Symbol is on is moved, the Symbol does not move with the Frame.*

*If **Relative**, the Symbol is positioned in millimetre relative to the Frame **Anchor justification**.*
*If it is a **Frame Symbol** and the Frame the Symbol is on is moved, the Symbol moves with the Frame.*

*If it is a **Frame Symbol** and the Frame is resized, the position of the Symbol relative to the Frame **Anchor justification** is maintained.*



Anchor just* choice box bottom left, bottom centre, bottom right
middle left, middle centre, middle right
top left, top centre, top right

*If **mode** is **Relative** then the Symbol is positioned relative to the selected Frame **Anchor justification**.*

*If **mode** is **Absolute** then **Anchor justification** is ignored.*

Set button

The **Set** *button must be pressed for any new values in the panel to take effect.*

Pick XY button

The **Pick XY** *button is used to select a position in the Plot Area and the values are piped into the* **X coordinate** *and* **Y coordinate fields**.

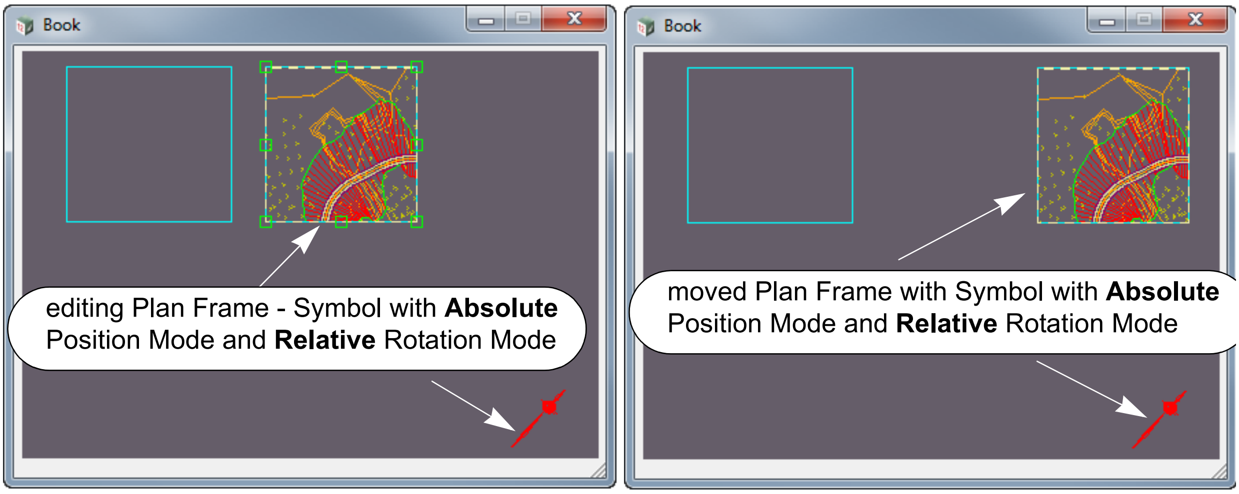
Important Notes

1. **Rotation Mode** and **Position Mode** are independent.

   That is, you can have a **Plan Frame Symbol** whose ***Rotation is relative*** to the data within the

Plan Frame but the **Plan Frame Symbol** is **placed absolutely** on the Page.

This means that a **Plan Frame Symbol** that rotates with the data can be placed in a fixed position on the Page so that its position doesn't move when the Plan Frame is moved.



2. For **Book Symbol**, **Chapter Symbol** and **Page Symbol**, the values ***Relative*** and ***Absolute*** for **Rotation Mode** are both treated as an absolute rotation with respect to the **Plot Area.**
3. For **Book Symbol**, **Chapter Symbol** and **Page Symbol**, the values ***Relative*** and ***Absolute*** for **Position Mode** are both treated as an absolute position on the **Plot Area.**

21.1.4.9.5 Plotting Order of Symbol Nodes

The order of the **Symbol node** in the tree is important because it determines the drawing order of the **Symbol** on each page of a plot.

All the **Book Symbols nodes** are plotted on each **Page**, but if the **Book Symbol node** is in the tree before a **Page** then the **Book Symbol** is plotted before the **Page** is plotted.

Similarly if the **Book Symbol node** is in the tree after a **Page** then the **Book Symbol** is plotted after the **Page** is plotted.

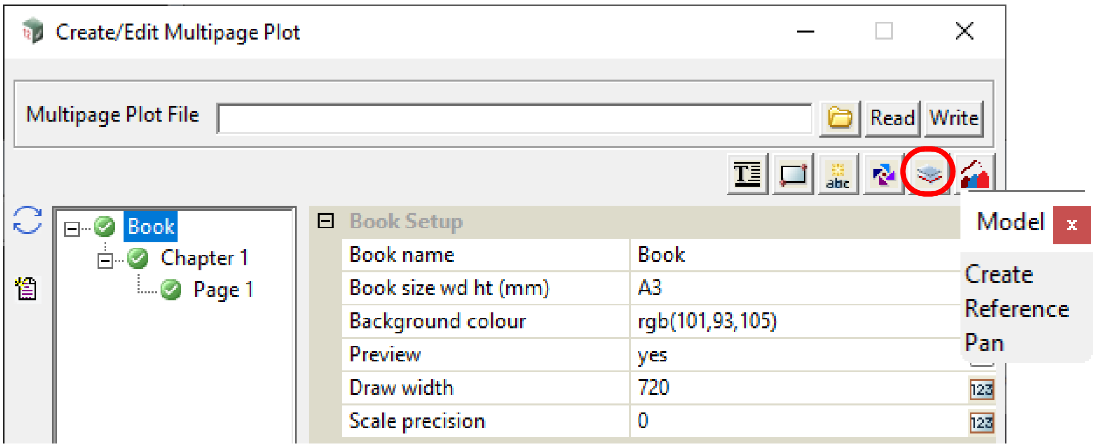
All the **Chapter Symbol nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Symbol node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Symbol** is plotted before that **Page** is plotted.

Similarly if the **Chapter Symbol node** is in the tree after a **Page** in the **Chapter** then the **Chapter Symbol** is plotted after the **Page** is plotted.

Finally for a **Page node**, the order of the plotting is in the order of the items in the **Page** subtree.

21.1.4.10 Model Icon for Use on a Book, Chapter or Page

A **Model** of data can be placed on a **Book**, **Chapter** or **Page node** using options on the **Model** menu which is brought up by clicking on the **Model** icon on the top right.



The options are:

Create - create a **Model** node in the tree at either the **Book**, **Chapter** or **Page** level.

A **Model node** allows users to add all the data that is in a model to the plot.

The units for the data in the model are assumed to be in **millimetres** with (0,0) in the left hand corner so that the data in the model overlays the Plot Area. See 21.1.4.10.1 Creating a Model Node at the Book, Chapter or Page Level.

Pan: can be used to move the position of the Model data on a **Plot Area**.

Model - Reference

The option **Reference** is not for creating new model data but creates a **Model** node that **references** an existing **Model** node. This means that the **Reference Model** has as default, all the values defined for the **Model node** that is being referenced BUT any of those values can be modified for the **Reference Model**.

See 21.1.4.10.4 Reference Model.

Important Note:

The names of the **Book Model nodes** must be unique amongst all the **Book Model nodes.**

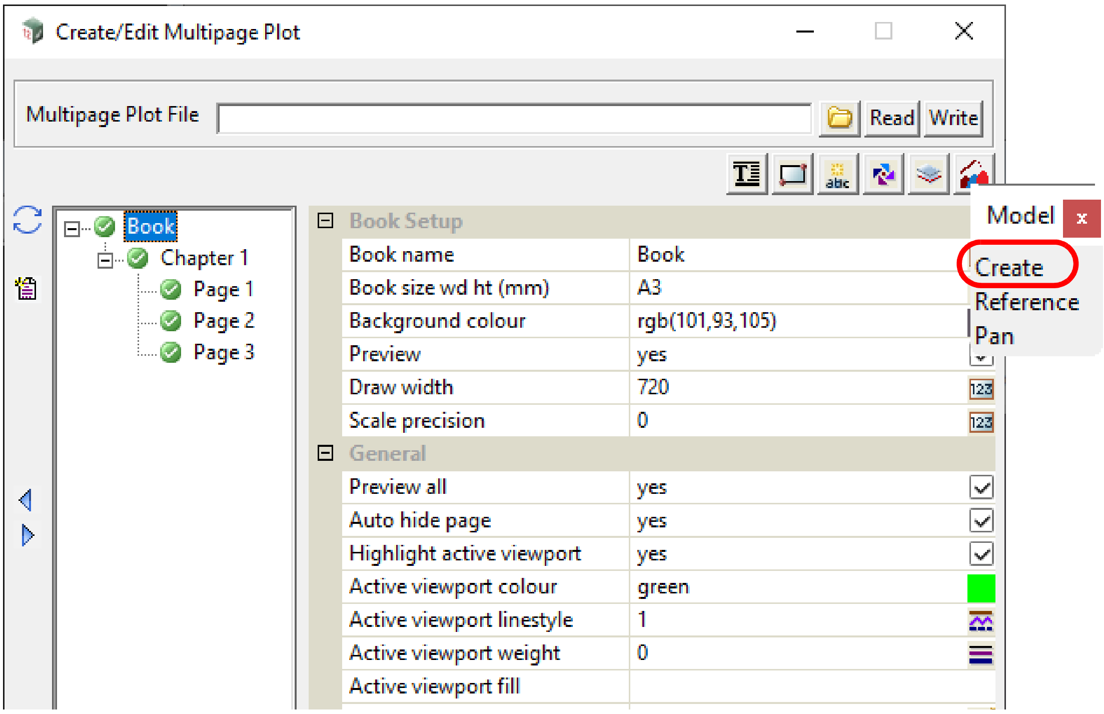
For a **Chapter**, the names of the **Chapter Model nodes** must be unique amongst all the **Chapter Model nodes** for that **Chapter**.

Similarly for a **Page**, the names of the **Page Model nodes** must be unique amongst all the **Page Model nodes** for that **Page**.

21.1.4.10.1 Creating a Model Node at the Book, Chapter or Page Level

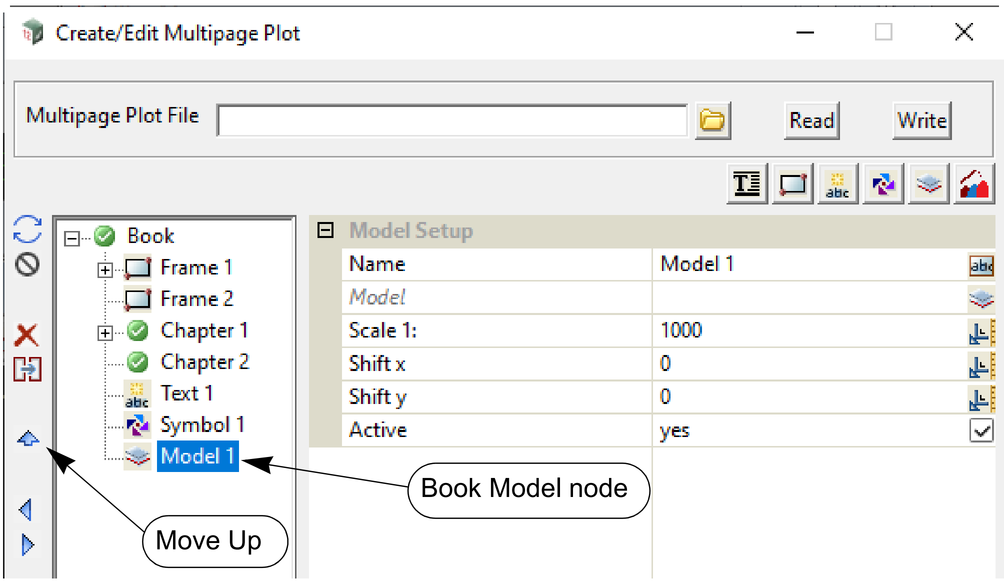
The process for creating a **Book Model** will be described in detail but the steps are identical for **Chapter** and **Page** except that the word **Book** in the description is replaced by **Chapter** or **Page**.

A **Model node** is created at the **Book**, **Chapter** or **Page** level by first clicking on and highlighting either the **Book**, **Chapter** or **Page** node, then clicking on the **Model** icon on the top right to bring up the **Model** menu and finally selecting ***Create*** from the **Model** menu.

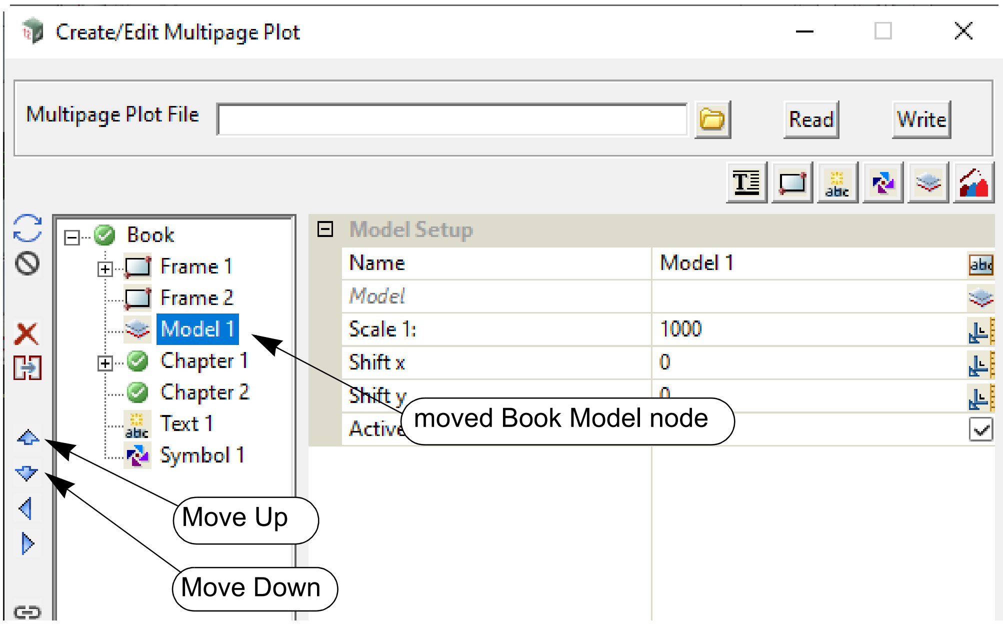


A **Book Model node** is automatically added at the bottom of the **Book** with the default name **Model n** where **n** is the next integer that makes the **Book Model node** name unique amongst all the **Book Model nodes**.

Similarly the name of a **Chapter Model node** must be unique amongst all the **Chapter Model nodes** for that **Chapter**, and the name of a **Page Model node** must be unique amongst all the **Page Model nodes** for that **Page**.

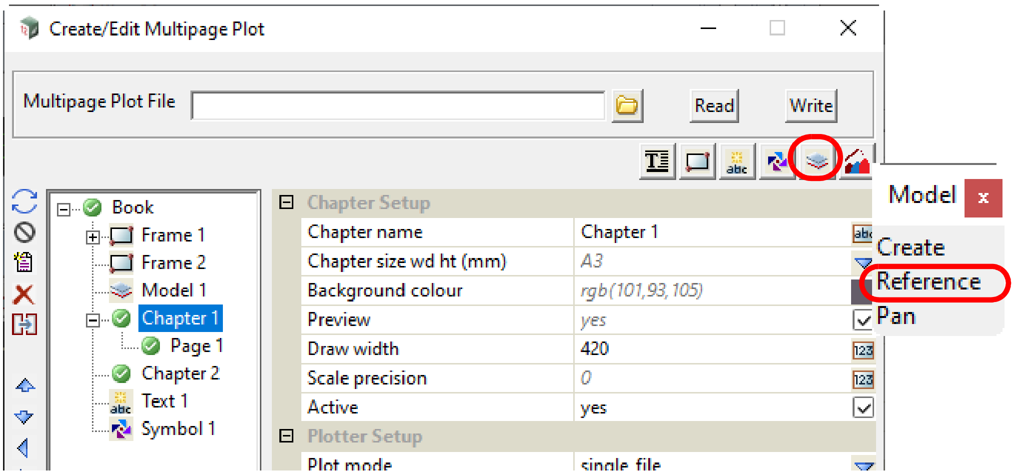


Once a **Model node** is created, it can be moved **Up** and **Down** at that level by using **Up** and **Down** on the left hand side.

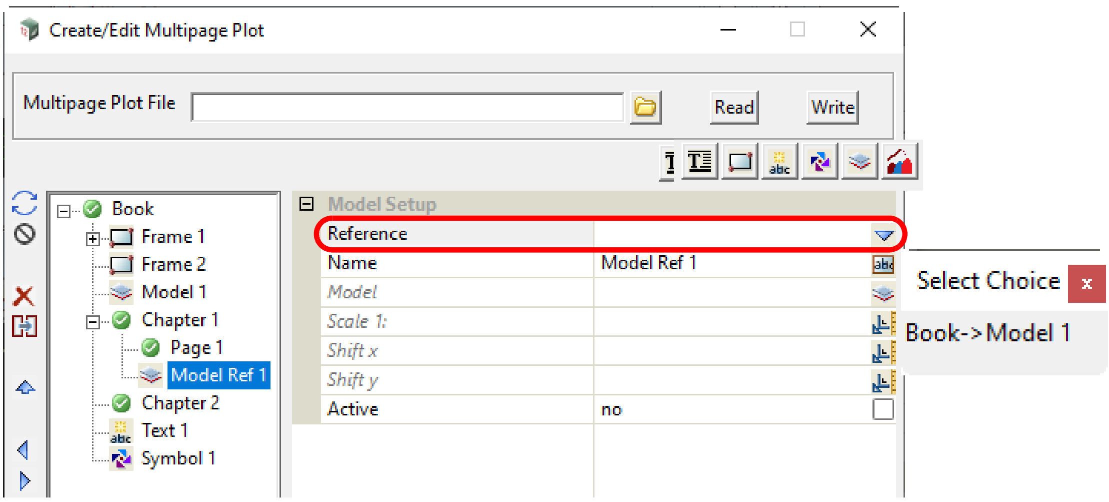


21.1.4.10.1.1 Chapter Reference Model

To create a **Chapter Reference Model** for a **Chapter**, click on the **Chapter node** and then click on the **Model** icon and select **Reference** from the **Model** menu.

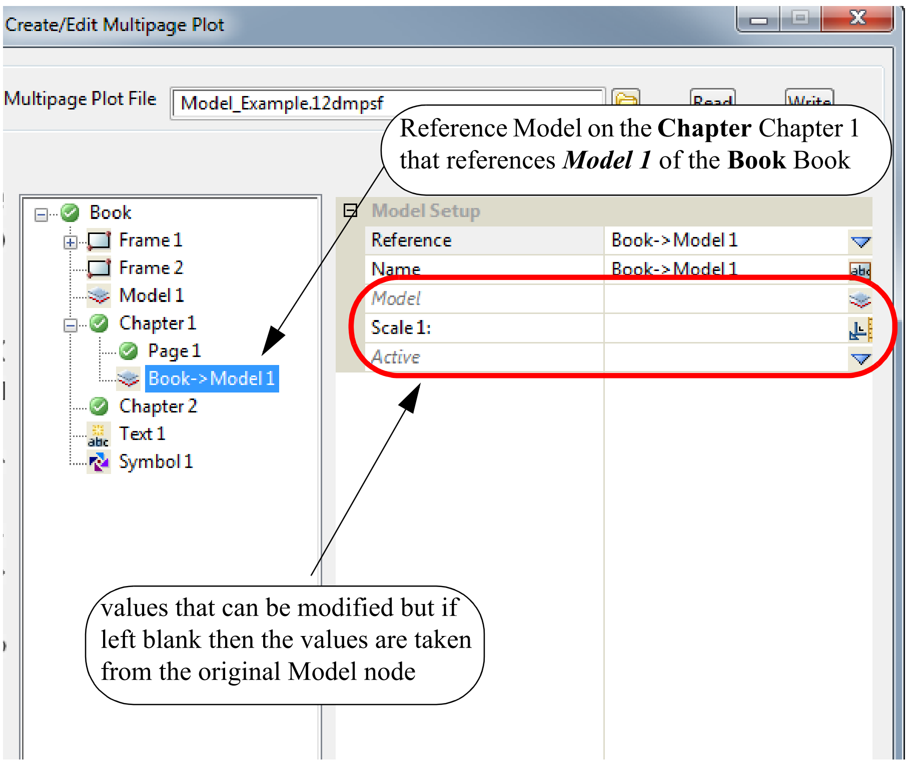


A new **Chapter Reference Model** node is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Models** that this **Reference Model** could reference.

Once a **Model** is selected, it is drawn in the **Chapter Plot Area** and the name of the **Reference Model** is changed to the full path name of the **Model** node that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



Most of the **Model Setup** fields are blank as their values are taken from the **Book Model** being referenced but any of them can be changed and the changed values will be used for this **Chapter Reference Model**.

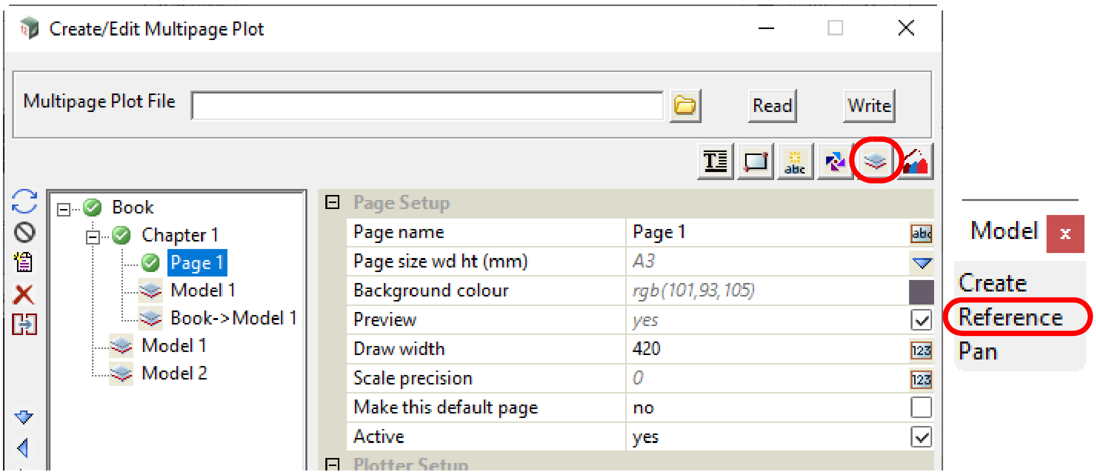
Important Note

If you don't want to display a **Book Model** for a particular chapter, then for that chapter, create a **Chapter Reference Model** which references the appropriate **Book Model**, and in the **Chapter Reference Model** fields, set the ***Active*** field to **No**.

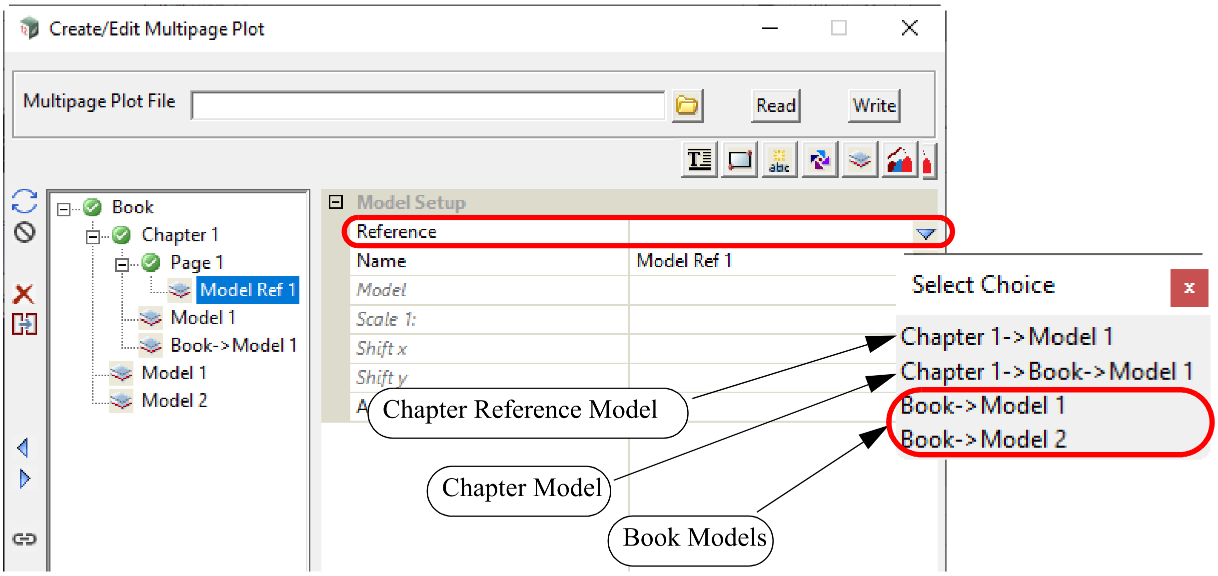
Similarly if a **Book Model** has been set to ***Inactive*** (i.e. OFF) then it can be displayed for a particular chapter by creating a **Chapter Reference Model** for that chapter and referencing the appropriate **Book Model**, and in the **Chapter Reference Model** fields, set the ***Active*** field to **Yes**.

21.1.4.10.1.2 Page Reference Model

To create a **Page Reference Model** for a **Page**, click on the **Page node** and then click on the **Model** icon and select **Reference** from the **Model** menu.

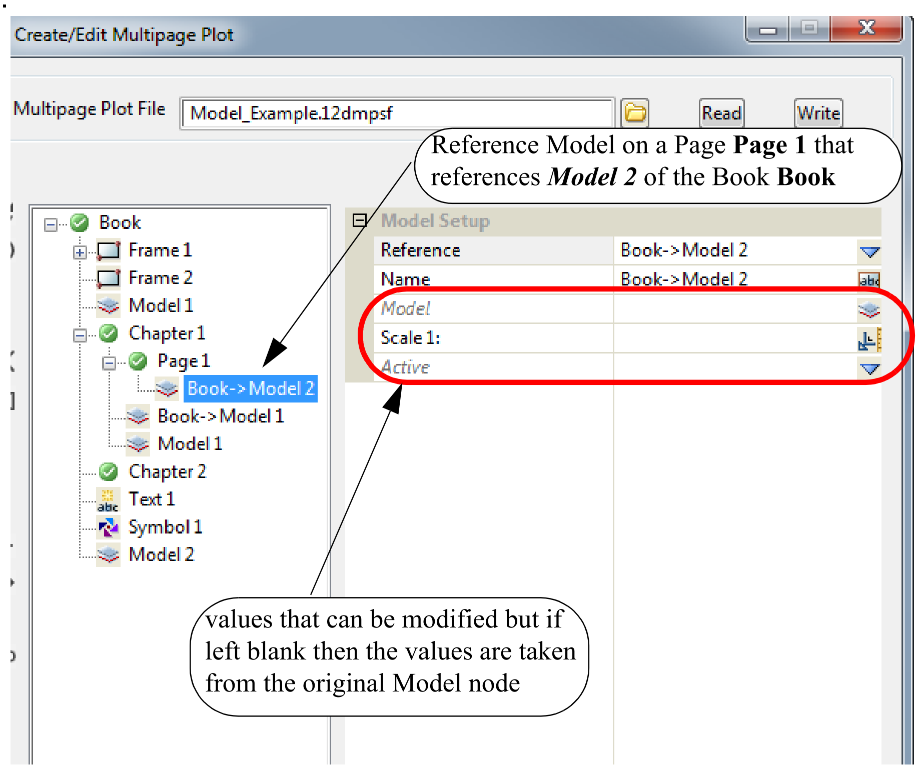


A new **Page Reference Model** is created but it has a blank **Reference** Field.



The Choice pop-up for the ***Reference field*** lists the existing **Book Models**, **Chapter Models** and **Chapter Reference Models** that this **Reference Model** could reference.

Once a **Model** is selected, it is drawn in the **Page Plot Area** and the name of the **Reference Model** is changed to the full path name of the **Model** that is referencing. If that name already exists then " **n**" is appended to the name where n is an integer starting with 1.



Most of the **Model Setup** fields are blank as their values are taken from the original **Model** being referenced but any of them can be changed and the changed values will be used for this **Page Reference Model**.

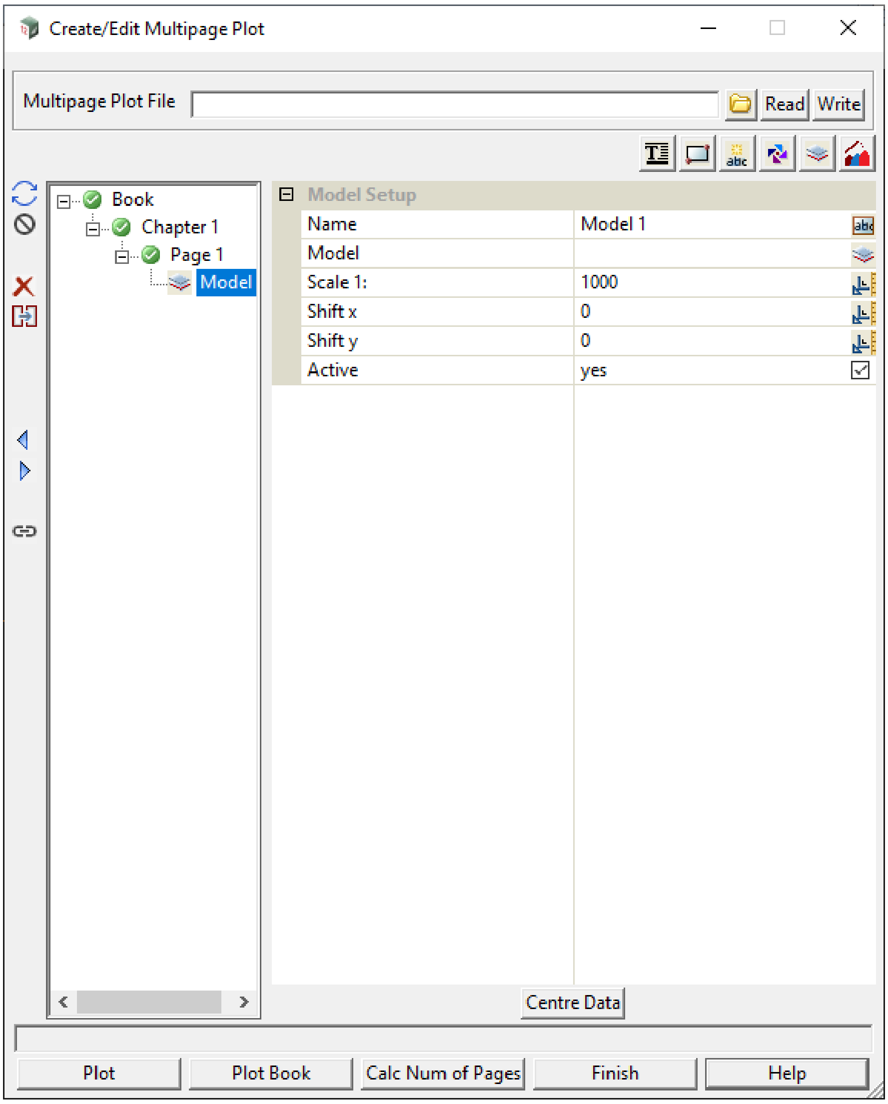
If the **Page Reference Model** references a **Chapter Reference Model** then the fields in the Page Reference Model override the fields in the **Chapter Reference Model** which in turn override the fields in the original **Book Model**.

Important Note

If you don't want to display a **Book Model**, **Chapter Model** or **Chapter Reference Model** for a particular **Page**, then for that page, create a **Page Reference Model** that references the appropriate **Book Model**, **Chapter Model** or **Chapter Reference Model**, and in the **Page Reference Model** fields, set the ***Active*** field to **No**.

Similarly if a **Book Model**, **Chapter Model** or **Chapter Reference Model** has been set to ***Inactive*** (i.e. OFF) then it can be displayed for a particular page by creating a **Page Reference Model** which references the appropriate **Book Model**, **Chapter Model** or **Chapter Reference Model**, and in the **Page Reference Model** set the ***Active*** field to **Yes**.

21.1.4.10.2 Icons and Fields for Model Nodes



The icons, fields and buttons used in the panels for the **Book Model, Chapter Model** and **Page Model** nodes have the following functions:

Field Description Type Defaults Pop-Up

Icons on Left Side

The icons on the left side change depending on what is applicable for the highlighted node.

The action of the icons are described in 21.1.4.3 Icons on the Left Side.

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

***Note**: Only **Reference Model** fields have inheritance support.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Model Setup

Name text box

Name of the Model node.

Model* model box available models

Model to be plotted.

*The coordinate for the data in the model are assumed to be in **millimetres** with (0,0) in the left hand corner.*

Scale 1:* real box

By default the units for the data is assumed to be millimetres and have a scale of 1:1000.

By changing the scale, the units of the data will be scaled up or down.

For example, a scale of 1:500 will double the size of the data.

Shift x* real box measures

The shift, in millimetres, to the horizontal (x) coordinate of the data in the Model. Adjust so that the desired Model data appears in the Plotting Area.

Shift y* real box measures

The shift, in millimetres, to the vertical (y) coordinate of the data in the Model. Adjust so that the desired Model data appears in the Plotting Area.

Active choice box Yes, No

*If **Yes**, the Model is drawn.*
*If **No**, the Model is not drawn.*
*For a Reference Model, the field can be left **blank** and then the value is taken from the Model that is referenced (referenced Model).*

Buttons at the Bottom

Centre Data button

Centres the model data by updating the Shift x and Shift y values. The centre of the Model will appear in the centre of the Plotting Area. Extremely helpful for initial positioning.

21.1.4.10.3 Plotting Order of Model Nodes

The order of the **Model node** in the tree is important because it determines the plotting order of the **Model** on each page of a plot.

All the **Book Model nodes** are plotted on each **Page**, but if the **Book Model node** is in the tree before a **Page** then the **Book Model** is plotted before the **Page** is plotted.

Similarly if the **Book Model node** is in the tree after a **Page** then the **Book Model** is plotted after the **Page** is plotted. See 21.1.4.10.5 Examples of Model Nodes.

All the **Chapter Model nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Model node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Model** is plotted before that **Page** is plotted.

Similarly if the **Chapter Model node** is in the tree after a **Page** in the **Chapter** then the **Chapter Model** is plotted after the **Page** is plotted. See 21.1.4.10.5 Examples of Model Nodes.

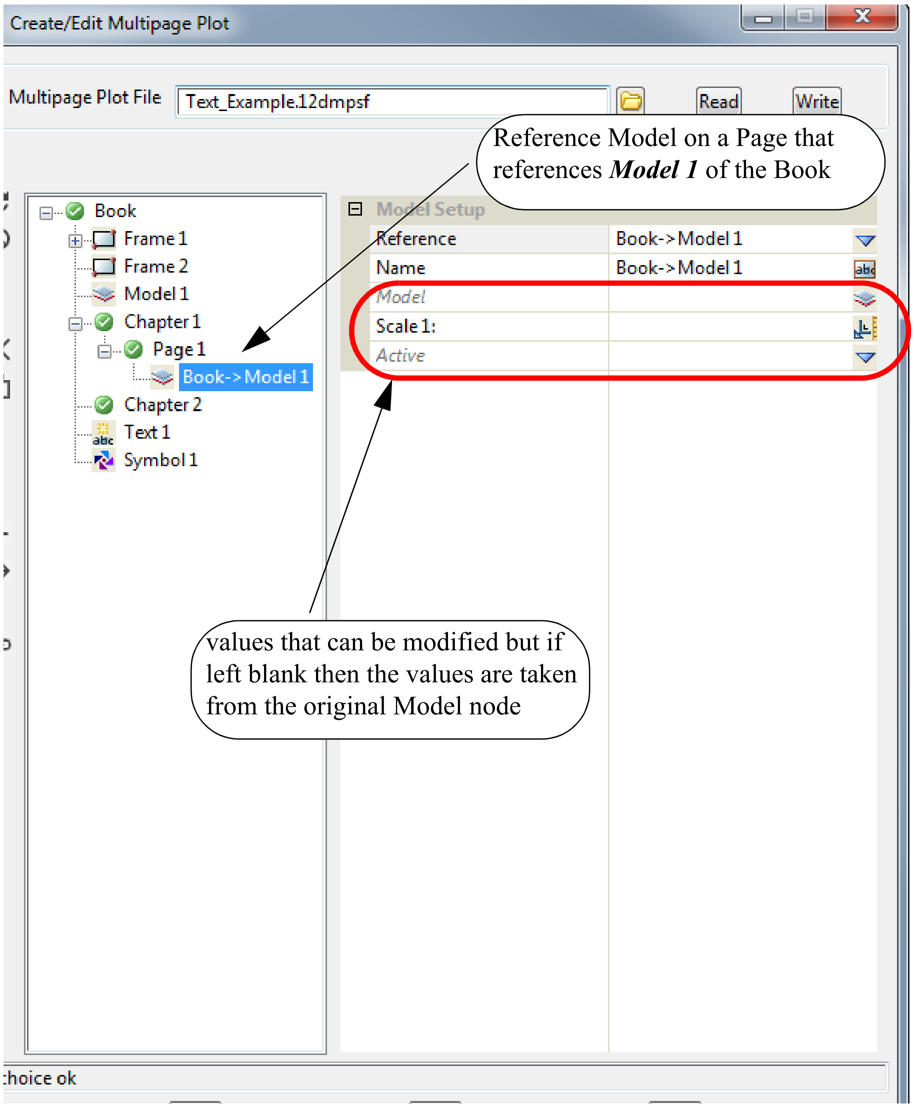
Finally for a **Page node**, the order of the plotting is in the order of the items in the **Page** subtree.

21.1.4.10.4 Reference Model

A **Relative Model** is not for creating new model data but creates a **Model** node that **references** an existing **Model node**. at a higher level, and replaces the existing **Model** fields at the level of the **Reference Model** with the values given for the **Reference Model**. That is, a **Reference Model** at a **Chapter** level can only reference a **Book Model,** and a **Reference Model** at the **Page** level can only reference a **Book Model**, a **Chapter Model** and a **Chapter Reference Model**.

The **Reference Model** node has as defaults all the values defined for the **Model** node that is being referenced BUT any of those values can be modified for the **Reference Model**. In particular, the **Reference Model** can be made ***active/inactive*** independently of the original **Model** node.

For example, if a **Book Model** was created then that **Model** would by default be drawn exactly the same way on each **Page**. If a **Reference Model** was created on a **Page** and it referenced the **Book Model**, then the **Reference Model** would then specify how that **Book Model** was drawn on that **Page** and any of the **Model** node's field values could be changed. For example, the actual model of data could be changed, or the **Reference Model** could be made inactive so that the **Model** is **no longer drawn** on that **Page**.



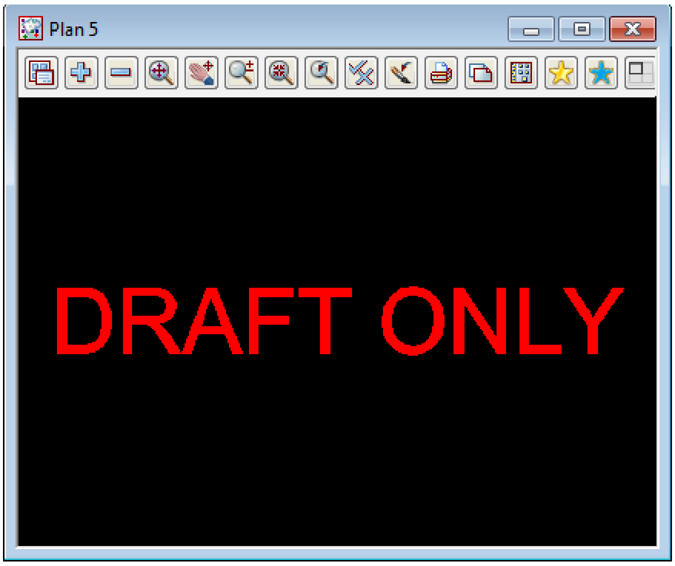
A **Reference Model** can be is created in two ways:

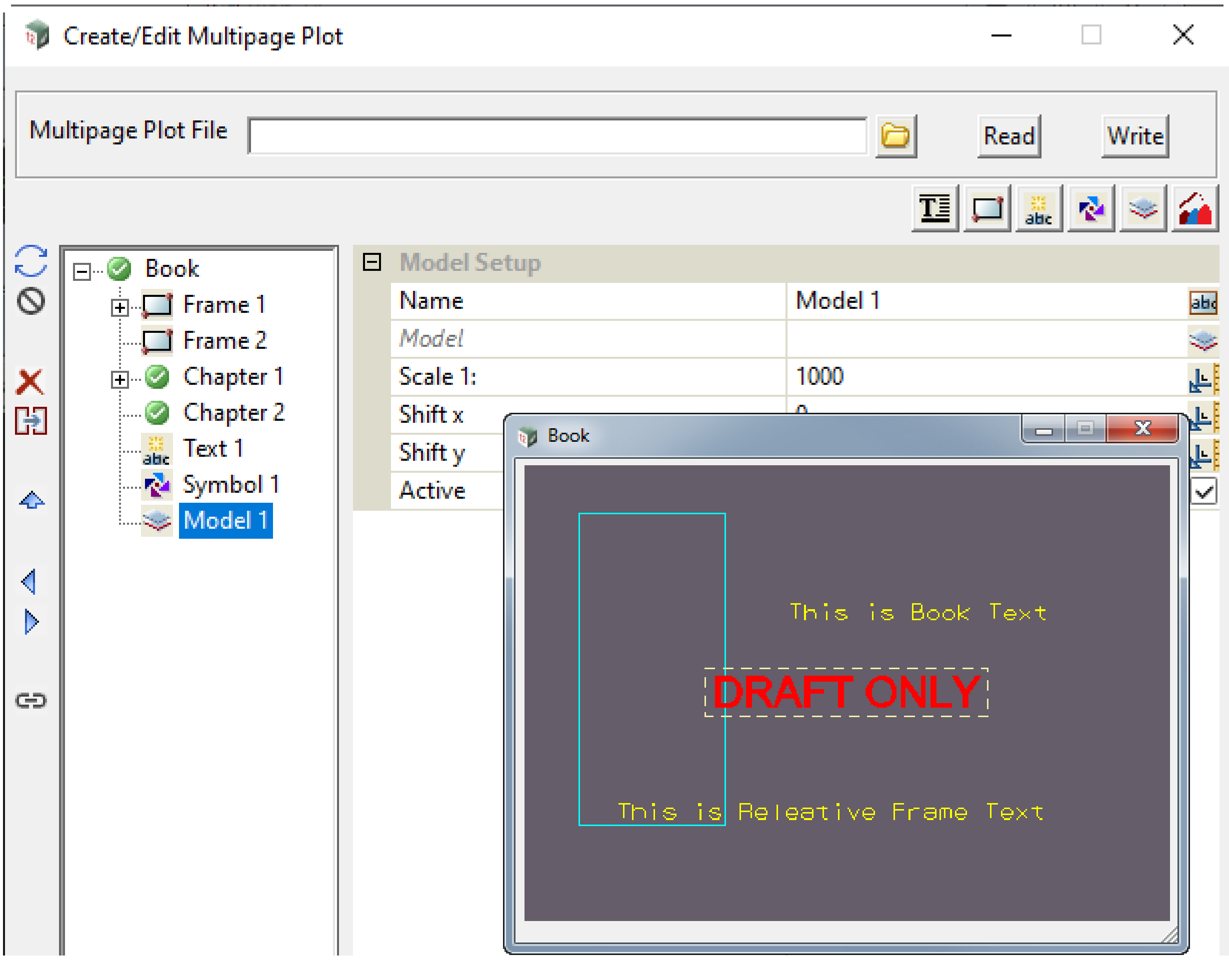
(a) **Chapter Reference Model.** *See* 21.1.4.10.1.1 Chapter Reference Model.

(b) **Page Reference Model.** *See* 21.1.4.10.1.2 Page Reference Model.

21.1.4.10.5 Examples of Model Nodes

As an example of **Model nodes**, if we have a ***12d Model*** with the words *Draft Only* in it, this can be added to every plot by simply adding a **Model node** at the Book level.



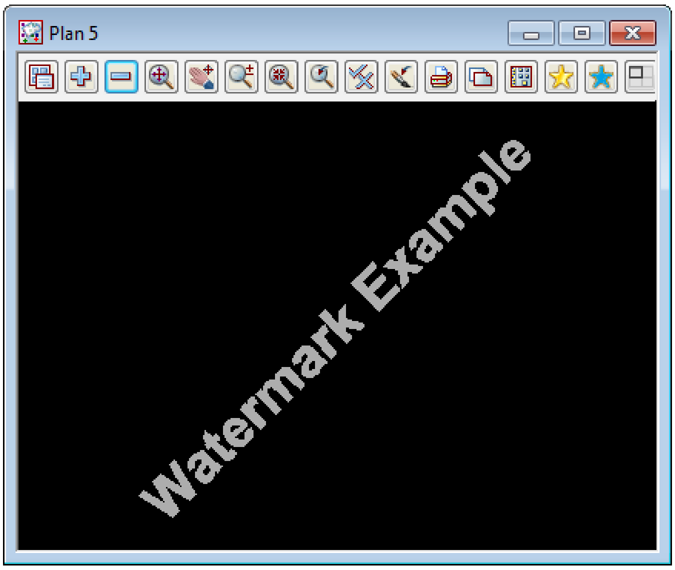


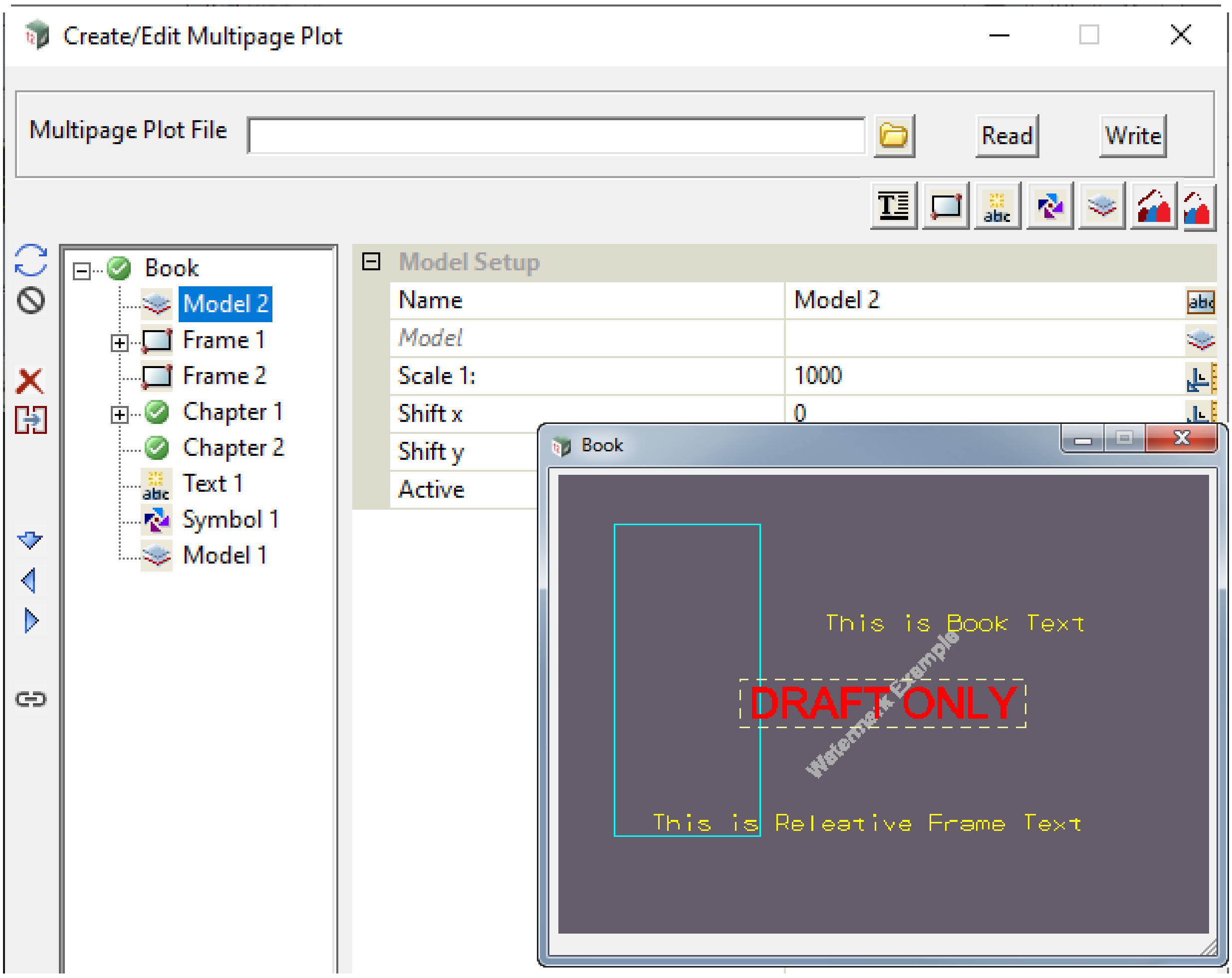
Although all the **Models** at **Book** level will be plotted on each **Page**, the order of the **Model node** in the tree is still very important.

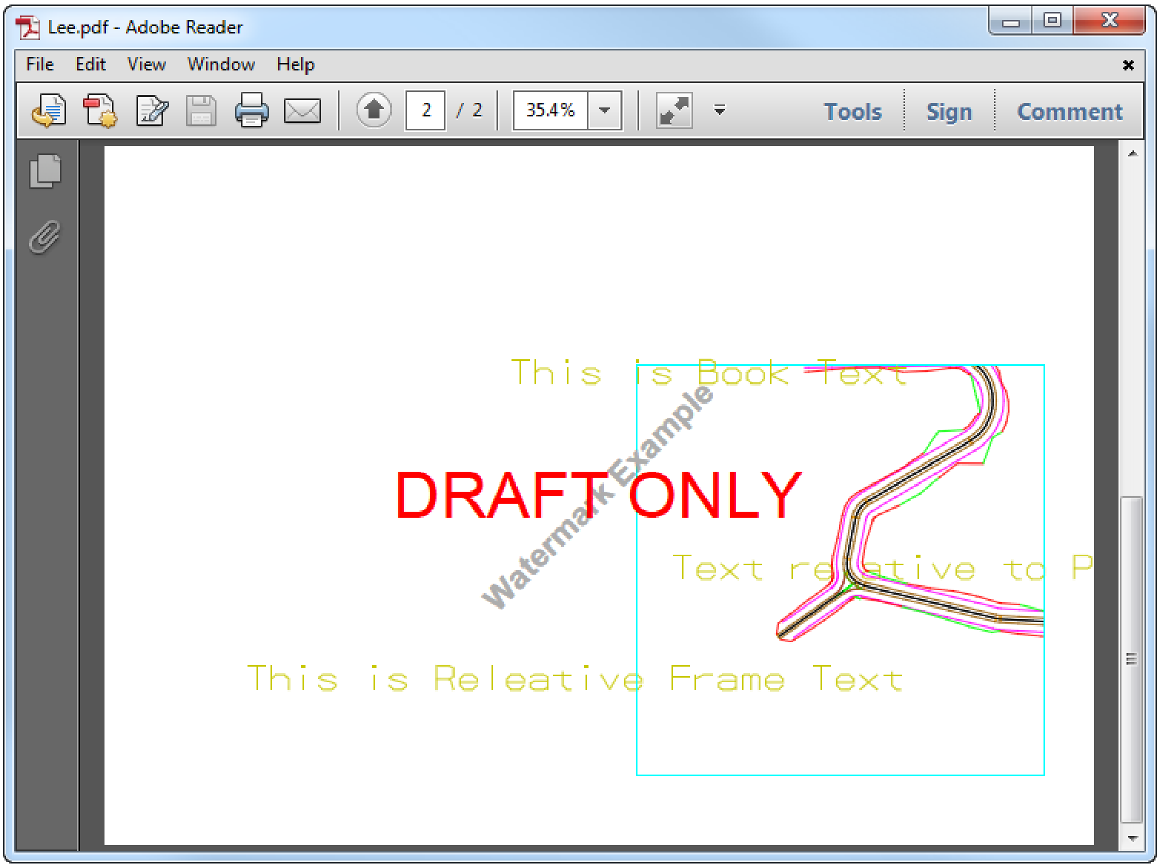
In the example just given, the **Model node** is at the bottom of the tree and so the words *Draft Only* are the last thing plotted on a **Page**.

If another **Model node** was added and moved to the top of the tree, it would be plotted first and then all the other information on a **Page** is plotted.

So if we added another **Model node** "Model 2" using the ***12d Model** Watermark*, and moved it to the top of the Book.






Lee.pdf - Adobe Reader
File Edit View Window Help
2 / 2
35.4%
Tools
Sign
Comment
This is Book Text
DRAFT ONLY
Watermark Example
Text relative to P
This is Releative Frame Text

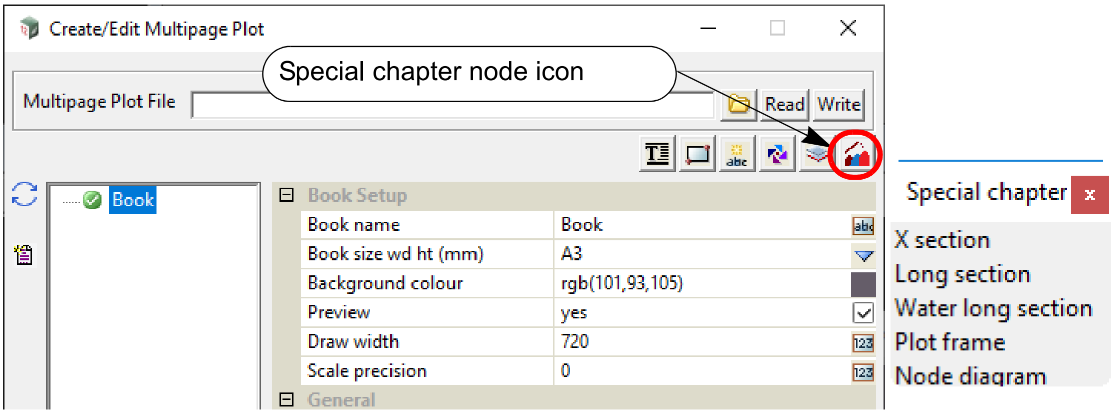
21.1.4.11 Special Chapter

Special Chapters are a Special kind of Chapter (hence the name) that allow the user to easily create multiple pages of plots by providing a single PPF file of a desired plot type. They don't allow Page Nodes as subnodes but do support most other Node types.

Not all plot types have Special Chapter support. The supported plot types are:

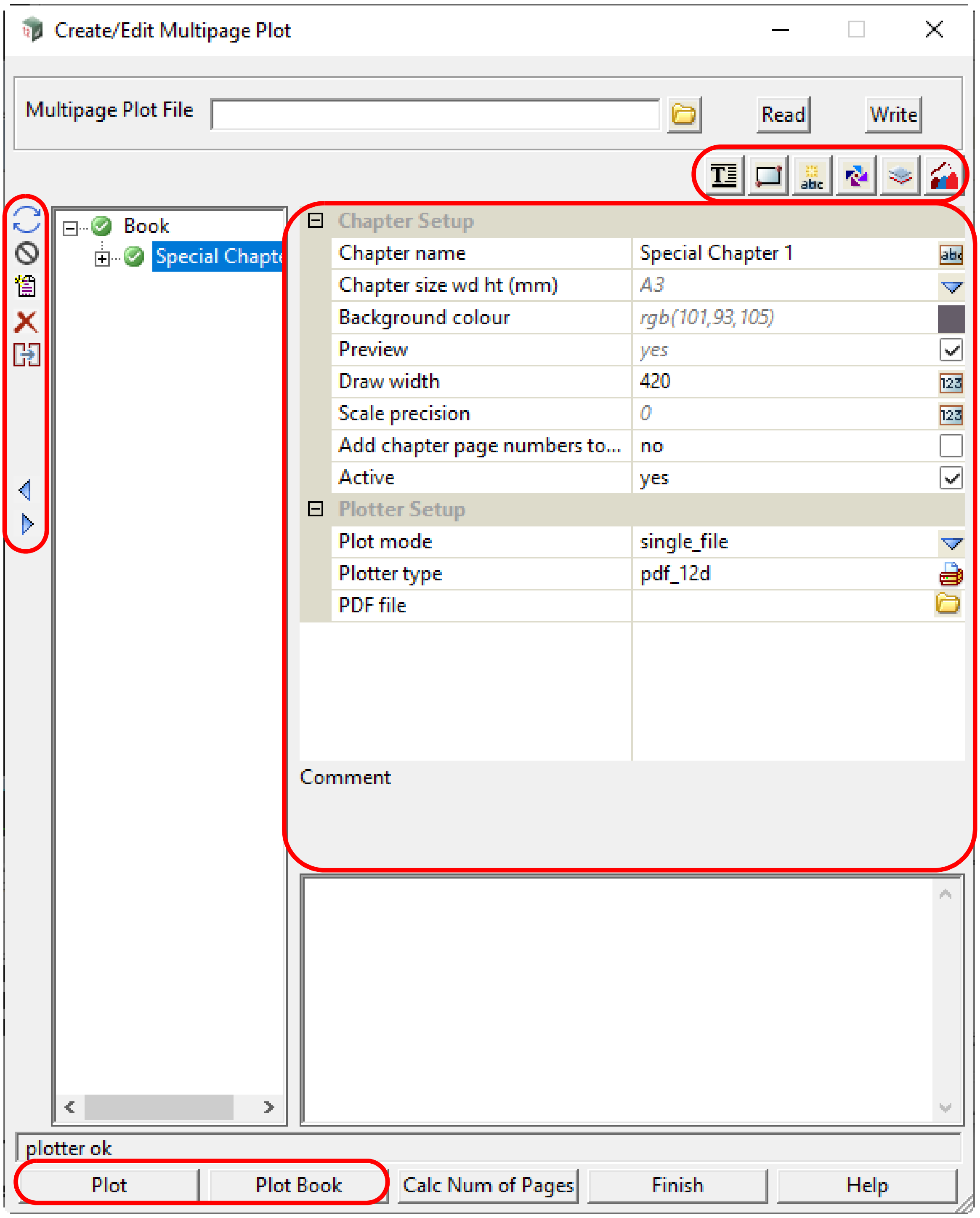
X-Section 21.1.4.11.2 X-Section Chapter
Long Section 21.1.4.11.3 Long Section Chapter
Water Long Section 21.1.4.11.4 Water Long Section Chapter
Plot Frame 21.1.4.11.5 Plot Frame Chapter
Water Node Diagram 21.1.4.11.6 Node Diagram Chapter

Special Chapters are created using the Special Chapter Node Icon.



When the Special Chapter Node Icon is clicked and a plot type is chosen two nodes are created. Firstly, a new Special Chapter Node is created as a subnode of the MPS Book. Secondly, a new Multi Node, of the plot type selected, is created as a subnode of the new Special Chapter Node.

21.1.4.11.1 Icons and Fields for a Special Chapter



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Icons on Left Side

The icons on the left side change depending on what is applicable for the currently selected node.

The icons common to most Nodes are described in 21.1.4.3 Icons on the Left Side.

The icon that is special for a Special Chapter is:

New Chapter icon

*Create a new **Chapter** Node immediately after the **Special Chapter** in the tree. See* 21.1.4.1 Chapter.

Icons on Right Side

The icons are described in 21.1.4.4 Icons on the Top Right.

Inherited Fields *

*Fields that support inheritance will be marked by a * symbol next to their **Field Description**.*

*For more information on **Inherited Fields** see,* 21.1.4.5 Inherited Fields *.

Special Chapter Setup

Chapter name text box Special Chapter n

*Name for this Special Chapter. The default is **Special Chapter n** where **n** is the first number to make the **Chapter name** unique amongst all the Special Chapters in the tree (the Multipage plot file).*

***Note**: the **Chapter name** can include **Project Attributes** as part of the name.*

For example:

Special chapter size wd ht (mm)* sheet box Book node value defined sheet sizes

*If **blank**, the Page size used for this Special Chapter is taken from the Book node.*

*If **not blank**, the Page size (in millimetres) to use for this Special Chapter.*

*The **Chapter page size** is given as **width** followed by one or more spaces and the height. Or clicking on the choice icon brings up the defined **Page sizes** and one can be selected from the pop-up list. Once a size has been typed in, or selected from the pop up, the **Special Chapter Plot Area** panel is drawn with an aspect ratio to match the selected page size.*

Background colour* colour box Book node value available colours

*If **blank**, the colour of the background for the **Special Chapter Plot** Area is taken from the Book node.*

*If **not blank**, the colour of the background for the **Special Chapter Plot** Area.*

Preview* tick box Book node value

*If **ticked**, the contents of the Frame and Title Block Nodes of this Special Chapter Node will be approximately drawn ("previewed") in the **Special Chapter Plot** Area.*

*If **not ticked**, the contents of the Frame and Title Block Nodes will not be drawn in the **Special Chapter Plot** Area.*

***Note**: Re-establishing an inheritance link cannot be done for this field since it only has two states and cannot be left 'blank' in the same way as other fields.*

Draw width* integer box Book node value

*If **blank**, the width in pixels of the **Special Chapter Plot** Area is taken from the Book node.*

*If **not blank**, the width in pixels of the **Special Chapter Plot** Area. This will change if the **Special Chapter Plot Area Panel** is resized. The height is then automatically determined by the aspect ratio of the **Chapter size wd ht**.*

Scale precision* integer box Book node value

*If **blank**, the Scale precision is taken from the Book node.*
*If **not blank**, the number of decimal places used in the $scale text variable when added to the **Special***

***Chapter Plot Area** or a Frame in this Special Chapter.*

Add chapter page numbers to plot file tick box not ticked

The default value for the plot_file $variable for individual pages in a Special Chapter is the Special Chapter Node name.

*If **ticked**, then the plot_file $variable for the pages in this Special Chapter will have the internal Special Chapter page number appended to the end to allow for unique matching when using a Title Block Drawing Register.*
e.g.. If the Special Chapter has the name of "Cabbage" and has 8 pages in it then the individual pages will have the $plot_file values of "Cabbage 1", "Cabbage 2",..., "Cabbage 8".

*If **not ticked**, then the page number will not be appended to plot_file $variable (default behaviour).*

Active tick box ticked

*If **ticked**, the highlighted node is made active and will be used when plotting (if plotting from this node). The node's active/inactive icon will be set to active.*
*If **not ticked**, the highlighted node and all of its children will be ignored when plotting. The node's active/inactive icon will be set to inactive.*

***Note**: This tick box is linked to the node's active/inactive icon. Changing one also changes the other.*

Plotter Setup

*If the **Plot** button is pressed then the following fields define how the plotting for the Special Chapter occurs.*

Plot mode choice box single_file single_file
multiple_file

*If **single_file**, then the field **PDF file** is displayed and all the pages produced by this **Special Chapter** are plotted to separate pages of a single pdf file whose name is given in the field **PDF file**.*
*If **multiple_file**, then the fields **Prefix** and **Digits in plot file number** are displayed and each page produced by this Special Chapter is plotted to a different pdf file. The name of each pdf file is the **Prefix** followed by the **Special Chapter name** followed by the **plot file number** for that page in the Special Chapter.*

Plotter type* plotter box Book node value pdf plotters

***Plotter type** to use for plotting. Currently this can only be a pdf plotter. This is an inherited field.*

*If **blank**, the value from the equivalent **Book** Node field will be used.*

Pdf file file box *.pdf files

*If **not blank**, the name of the pdf file that will be produced by the Special Chapter.*
*If **blank**, the pdf file produced will use the Special Chapter name as its filename.*

*This option only appears when **Plot mode** is **single_file**.*

Prefix text box

*If **not blank**, the prefix to use for the filename of each pdf file produced by the Special Chapter.*
*If **blank**, then no prefix will be used for pdf filenames.*

*This option only appears when **Plot mode** is **multiple_file**.*

Digits in plot file number integer box 1

*The **plot file number** starts at 1 and is incremented for each page in the Special Chapter. This field will accept integer values between 1 and 10 (inclusive). Setting a value of 1 will result in the **plot file number** being used without any modification. Setting a value of 2 or more ensures that there will be at least that number of digits in the **plot file number.** Zero-padding is used to achieve this. Eg. if **Digits in plot file number** is 3 then plot number 7 will appear as 007.*

*This option only appears when **Plot mode** is **multiple_file**.*

Fields and Buttons at Bottom

Comment text box

User comment about this Special Chapter.

Plot button

Triggers plotting from the currently highlighted node. If the highlighted node isn't a base node (Book, Chapter, Special Chapter or Page Node) then we recursively check parent nodes until a base node is found. The ***Plotter Setup*** *from the highlighted node is used for the plot.*

Plot Book button

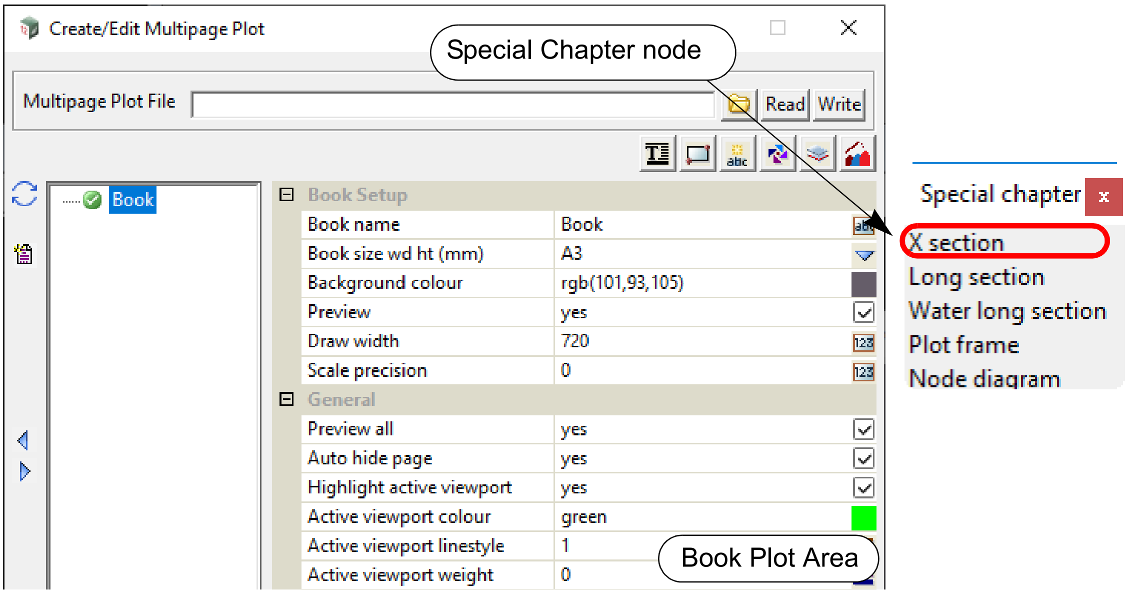
Triggers plotting from the Book Node regardless of the currently highlighted node. The ***Plotter Setup*** *from the Book Node is used for the plot.*

Important Notes

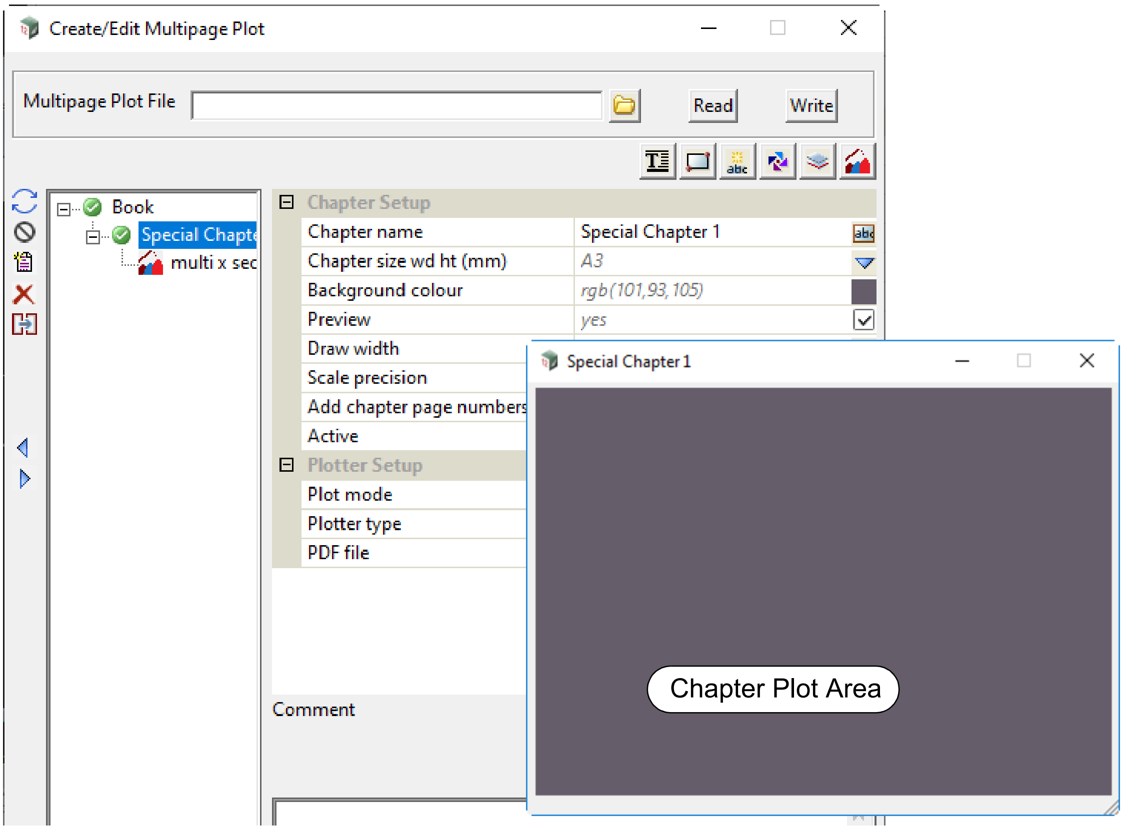
If the Special Chapter is inactive then nothing in the Special Chapter will plot.

The order of nodes in the tree is important because it determines the plotting order. However, for Special Chapters the Multi Node will always be plotted first regardless of order.

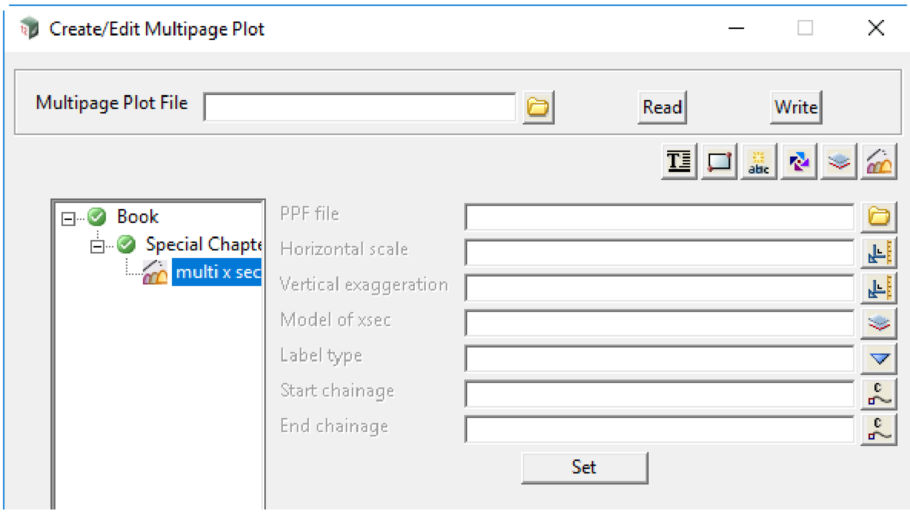
21.1.4.11.2 X-Section Chapter



Clicking on the **Special Chapter node >X-Section** option creates a X-sections Chapter with a subnode called **multi x-sections**.



Clicking on the **multi x-sections** node displays the information for controlling the pages generated by the X-Section Chapter.



PPF file X- section ppf box available x sec ppfs

Selected X-Section PPF file that contains all the information for drawing the pages of x-sections.

***Note**: the Title Block node in the PPF file is **NOT** used.*

Horizontal scale real box

*If **not blank**, this value will override the value in the* **Horizontal scale** *field in the X-Section Plot PPF file, and is used for the plot.*

*If **blank**, the value in the* **Horizontal scale** *field in the X-Section Plot PPF file is used for the plot.*

Vertical exaggeration real box

*If **not blank**, this value will override the value in the* **Vertical exaggeration** *field in the X-Section Plot PPF file, and is used for the plot.*

*If **blank**, the value in the* **Vertical exaggeration** *field in the X-Section Plot PPF file is used for the plot.*

Model of x sec model box available models

If a model is selected, this will override the **Model of xsect to plot** *field in the X-Section Plot PPF file, and this model will be used for the model of x-sections to plot.*

*If **blank**, the* **Model of xsect to plot** *field in the X-Section Plot PPF file is used for the model of x-sections to plot.*

Label type choice box centre line, boxes

If a Label type is selected, this will override the **Label type** *field in the X-Section Plot PPF file, and this Label type will be used for the x-sections plotted.*

*If **blank**, the* **Label type** *field in the X-Section Plot PPF file is used for x-sections plotted.*

Start/End chainage real box measures

*If Start chainage/End chainage is **not blank**, the value will override the value in the* **Start /End chainage** *field in the X- Section plot **PPF file**, and is used for the plots.*

*If **blank**, the value in the* **Start /End chainage** *field in the X- Section plot **PPF file** is used for the plots.*

*The Start and End chainage and other information in the X-Section **PPF file** will determine how many pages there will be in the X-Section Chapter.*

Set button

Update and use the values in the fields.

Note that a **Write** *needs to be done to update the Multipage plots file.*

21.1.4.11.2.1 Notes on Using the X-Section Chapter

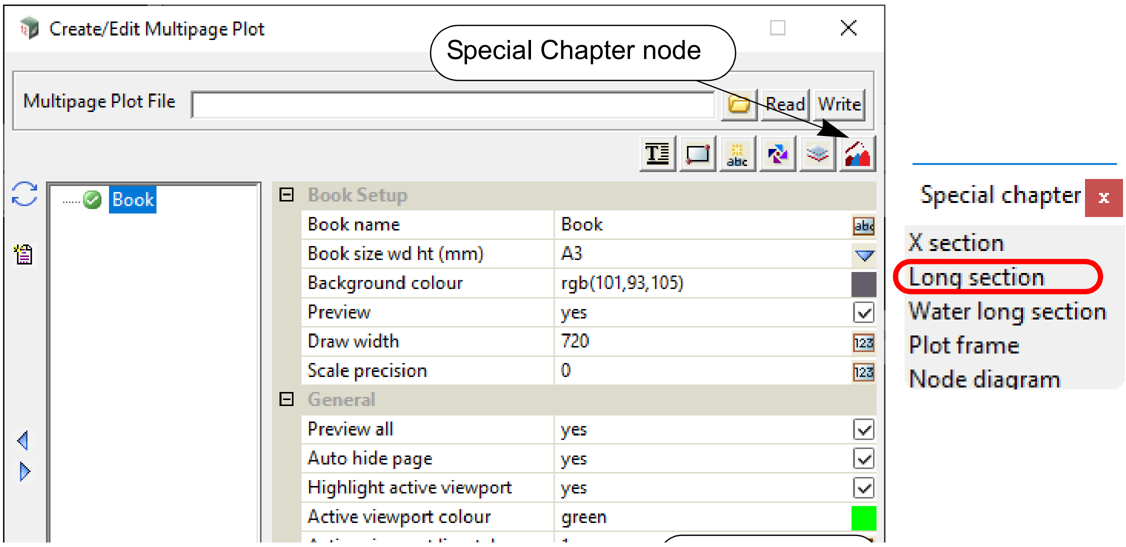
1. No other pages can be added to the X-Section Chapter and the drawing of the x-sections on each page is determined by the information in the X-Plot PPF file.
2. The *Title Block* in the X-Plot PPF is NOT used.
3. If they are not blank, the *Start and End Chainages* in the PPF are NOT used and are replaced by the values given in the **multi x-sections** node of the X-Section Chapter.

   If *Start chainage* in the multi-sections node is ***blank***, then the *Start chainage* in the PPF is used.

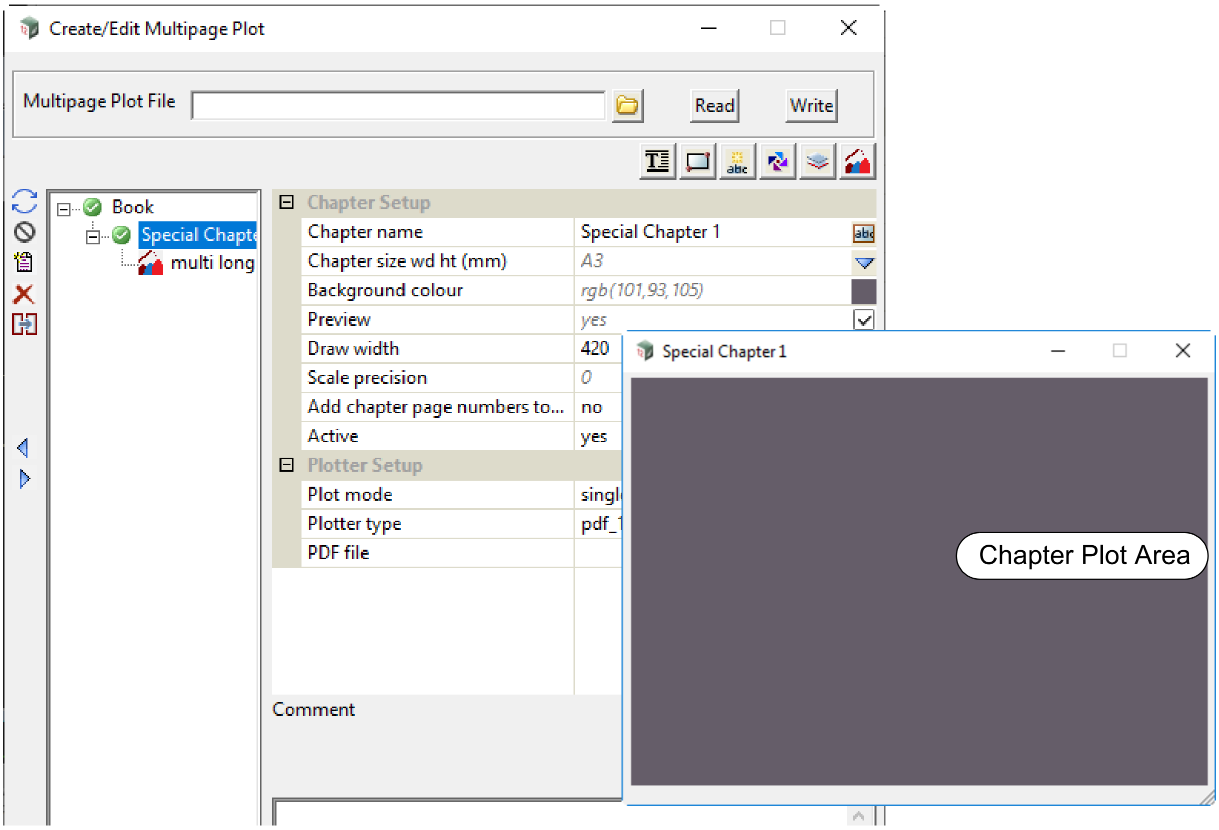
   If *End chainage* in the multi-sections node is ***blank***, then the *End chainage* in the PPF is used.
4. Title Blocks, Frames, Text, Symbols and Models can be added to the X-Section Chapter and they behave as they do for any other Chapter.
5. The number of pages created in the X-Section Chapter is included in the special text **$total_pages**.
6. If the special text **$current_page** is used in a X-Section Chapter, then it will be incremented correctly for each of the individual pages plotted in the X-Section Chapter.

For information on the special text $variables for MPS, see 21.1.4.8.6 MPS Text $variables.

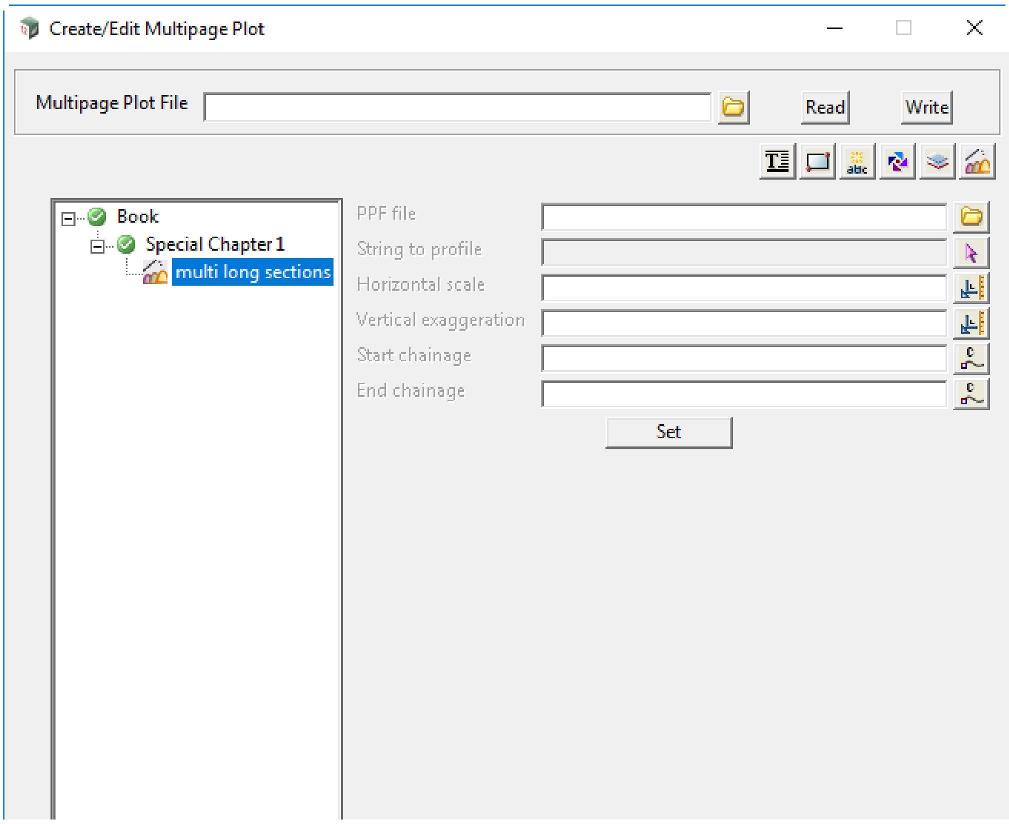
21.1.4.11.3 Long Section Chapter



Clicking on the **Special Chapter node >Long section** option creates a Long section Chapter with a subnode called **multi long sections**.



Clicking on the **multi long sections** node displays the information for controlling the pages generated by the Long Section Chapter.



Long Section Setup

Panel Field | **Type** | **Pop-Up**

PPF file | Long section ppf box | available long sec ppfs

Selected Long Section PPF file that contains all the information for drawing the pages of long sections.

***Note**: the Title Block node in the PPF file is **NOT** used.*

String to profile | string select box

If a string is selected, this will override the **String to profile** *field in the Long Section Plot PPF file, and this string will be used as the primary string for the Long Section plot.*

*If **blank**, the* **String to profile** *field value in the Long Section Plot PPF file is used for the plot.*

Model of strings to profile | Model box

*If a model is selected, this will override the **Model of strings to profile** field in the Long Section Plot PPF file, and a Long Section Plot will be produced for each string in this model.*

*If blank, the **Model of strings to profile** field value in the Long Section Plot PPF file is used for the plot.*

***Note**: When using this option the **Start chainage** and **End chainage** fields are ignored and the entire strings are plotted.*

Horizontal scale | real box

If a scale is provided, this value will override the value in the **Horizontal scale** *field in the Long Section Plot PPF file, and this scale will be used for the Long Section Plot.*

*If **blank**, the* **Horizontal scale** *field value in the Long Section Plot PPF file is used for the plot.*

Vertical exaggeration | real box

*If an exaggeration is provided**,** this value will override the value in the* **Vertical exaggeration** *field in the Long Section Plot PPF file, and this exaggeration will be used for the Long Section plot.*

*If **blank**, the* **Vertical exaggeration** *field value in the Long Section Plot PPF file is used for the plot.*

Start chainage real box

If a start chainage is provided, this value will override the value in the **Start chainage** *field in the Long Section plot **PPF file**, and this chainage will be used to restrict the primary string profile for the Long Section Plot.*

*If **blank**, the* **Start chainage** *field value in the Long Section plot **PPF file** is used for the plot.*

End chainage real box

*If a start chainage is provided, this value will override the value in the **Start chainage** field in the Long Section Plot **PPF file**, and this chainage will be used to restrict the primary string profile for the Long Section Plot.*

*If **blank**, the **Start chainage** field value in the Long Section Plot **PPF file** is used for the plot.*

Symbol Setup - only for plan plotting as part of long section plot

Allows for the creation of a symbol that will automatically set it's rotation value to match the plan produced when Plan Plotting.

***Note**: these parameters ONLY apply when Plan Plotting options are enabled in the supplied **PPF file**.*

Symbol Symbol box available symbols

Symbol to use. Default value: NORTH.

Colour Colour Box

Colour to use for the symbol. Default value: RED.

Scale mode Choice Box native, user and plot scale

Scale mode to use for the symbol. Default value: native scale

***native scale**:*

***user scale**: allows the user to enter a custom scale (**User scale** field below) for the sizing of the symbol.*

***plot scale**: the **Horizontal scale** field value in the **PPF file** will be used for the sizing of the symbol.*

User scale Real box 20

*Value to be used to size the Symbol if the **Scale mode** field is set to **user scale**.*

Default value: 20

Active Choice box yes, no

*If **yes** then a rotated symbol will be created using the parameters specified here.*

*If **no** then no creation will take place.*

Default value: no

***Note:** Plan Plotting must be enabled and set up in the PPF file otherwise no symbol will be created.*

X coordinate Real box

X coordinate (in mm) of the symbol on the sheet. Default value: 0

Y coordinate Real box

Y coordinate (in mm) of the symbol on the sheet. Default value: 0

Buttons at Bottom

Set button

Update and use the values in the fields.
Note that a **Write** *needs to be done to update the Multipage plots file.*

21.1.4.11.3.1 Notes on Using the Long Section Chapter

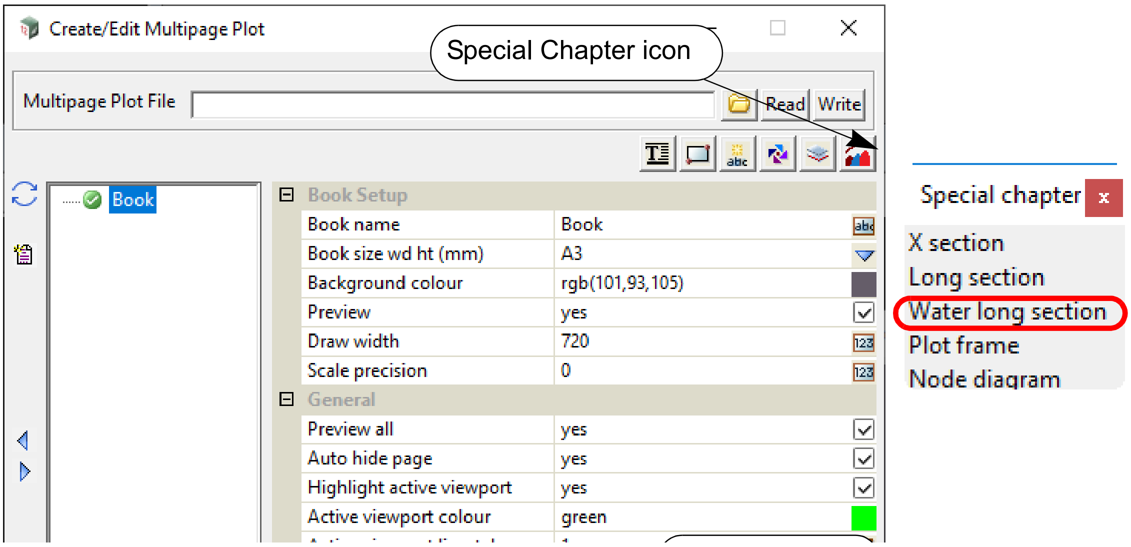
1. No other pages can be added to the Long Section Chapter and the drawing of the long section of the primary string on each page is determined by the information in the Long Plot PPF file.
2. The *Title Block* in the Long Plot PPF is NOT used.
3. If they are not blank, the *Start and End Chainages* in the PPF are NOT used and are replaced by the values given in the **multi- long sections** node of the Long Section Chapter.

   If *Start chainage* in the multi-sections node is ***blank***, then the *Start chainage* in the PPF is used.

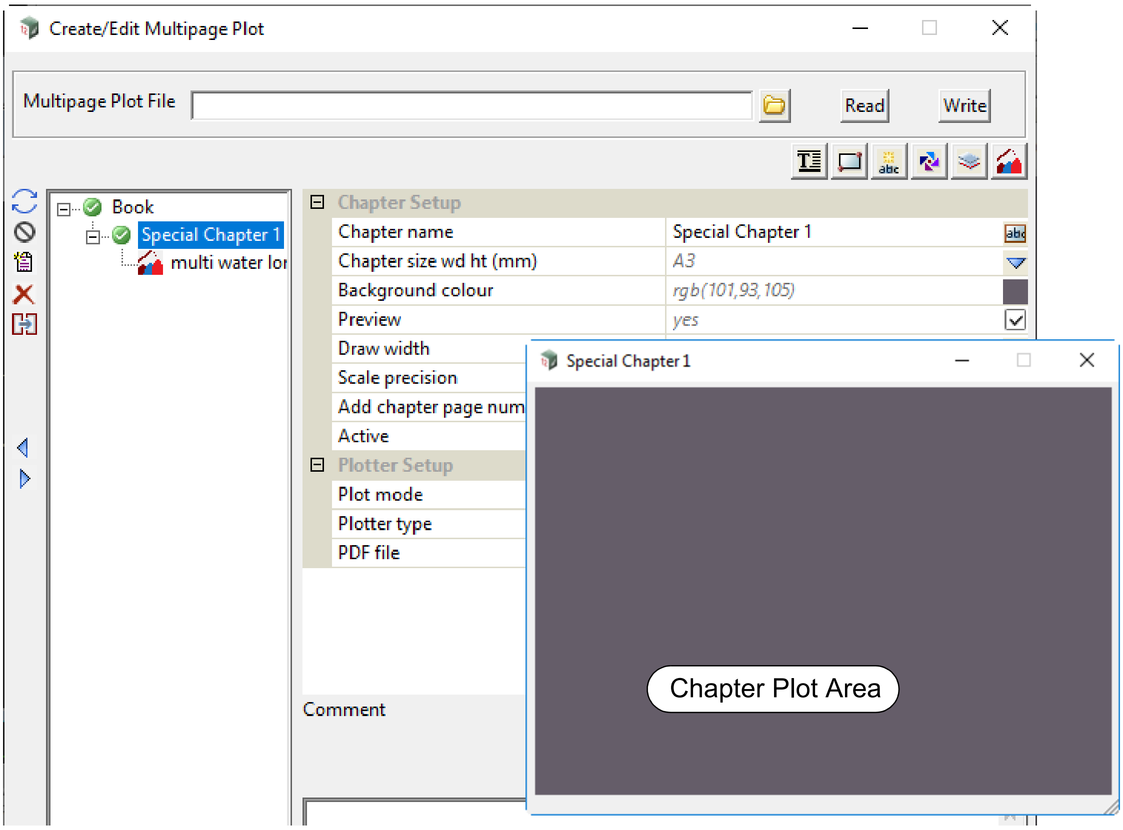
   If *End chainage* in the multi-sections node is ***blank***, then the *End chainage* in the PPF is used.
4. Title Blocks, Frames, Text, Symbols and Models can be added to the Long Section Chapter and they behave as they do for any other Chapter.
5. The number of pages created in the Long Section Chapter is included in the special text **$total_pages**.
6. If the special text **$current_page** is used in a Long Section Chapter, then it will be incremented correctly for each of the individual pages plotted in the Long Section Chapter.

For information on the special text $variables for MPS, see 21.1.4.8.6 MPS Text $variables.

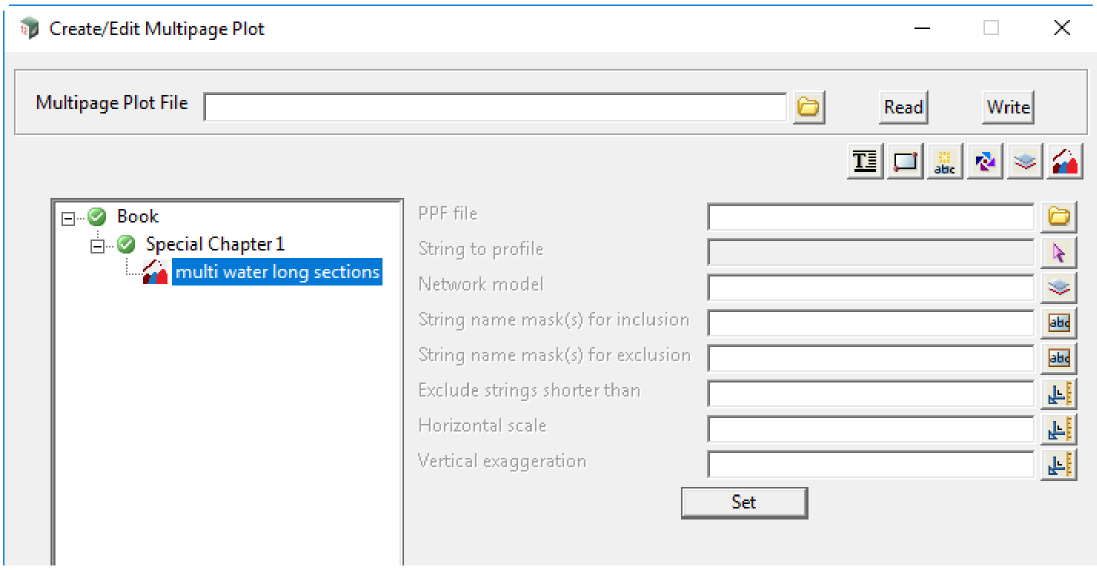
21.1.4.11.4 Water Long Section Chapter



Clicking on the **Special Chapter >Water long section** option creates a Water Long section Chapter with a subnode called **multi water long sections**.



Clicking on the **multi water long sections** node displays the information for controlling the pages generated by the Water Long Section Chapter.



PPF file Water Long section ppf box available water long sec ppfs

Selected Water Long Section PPF file that contains all the information for drawing the pages of water long sections.

Note*: the Title Block node in the PPF is* ***NOT*** *used.*

String to profile string select box

If a string is selected, this will override the **Single string to plot** *field in the Water Long Section Plot PPF file, and this string will be the only string plotted in the Water Long Section plot.*

If ***blank****, the* **Single string to plot** *field in the Water Long Section Plot PPF file is used as the primary sting for the Water Long section plot.*

Network model model box available models

If a model is selected, this will override the **Network model** *field in the Water Long Section Plot PPF file, and this model will be used for the model of water strings to plot.*

If ***blank****, the* **Network model** *field in the Water Long Section Plot PPF file is used for the model of water strings to plot.*

String name mask(s) for inclusion text box

If ***not blank****, this value will override the value in the* **String name mask(s) for inclusion** *field in the Water Long Section Plot PPF file, and is used for the plot.*

If ***blank****, the value in the* **String name mask(s) for inclusion** *field in the Water Long Section Plot PPF file is used for the plot.*

See 23.7.2.1 Name Masks.

String name mask(s) for exclusion text box

If ***not blank****, this value will override the value in the* **String name mask(s) for exclusion** *field in the Water Long Section Plot PPF file, and is used for the plot.*

If ***blank****, the value in the* **String name mask(s) for exclusion** *field in the Water Long Section Plot PPF file is used for the plot.*

See 23.7.2.1 Name Masks.

Exclude strings shorter than real box

If ***not blank****, this value will override the value in the* **Exclude string shorter than** *field in the Water Long Section Plot PPF file, and is used for the plot.*

If ***blank****, the value in the* **Exclude string shorter than** *field in the Water Long Section Plot PPF file is used* *for the plot*

Horizontal scale real box

*If **not blank**, this value will override the value in the* **Horizontal scale** *field in the Water Long Section Plot PPF file, and is used for the plot.*

*If **blank**, the value in the* **Horizontal scale** *field in the Water Long Section Plot PPF file is used for the plot.*

Vertical exaggeration real box

*If **not blank**, this value will override the value in the* **Vertical exaggeration** *field in the Water Long Section Plot PPF file, and is used for the plot.*

*If **blank**, the value in the* **Vertical exaggeration** *field in the Water Long Section Plot PPF file is used for the plot.*

Set button

Update and use the values in the fields.

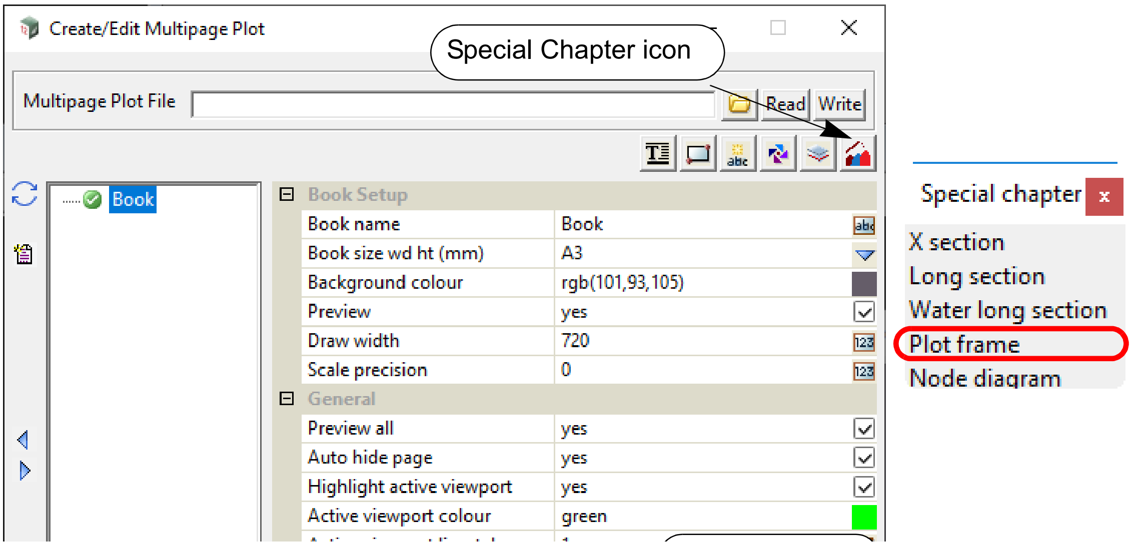
Note that a **Write** *needs to be done to update the Multipage plots file.*

21.1.4.11.4.1 Notes on Using the Water Long Section Chapter

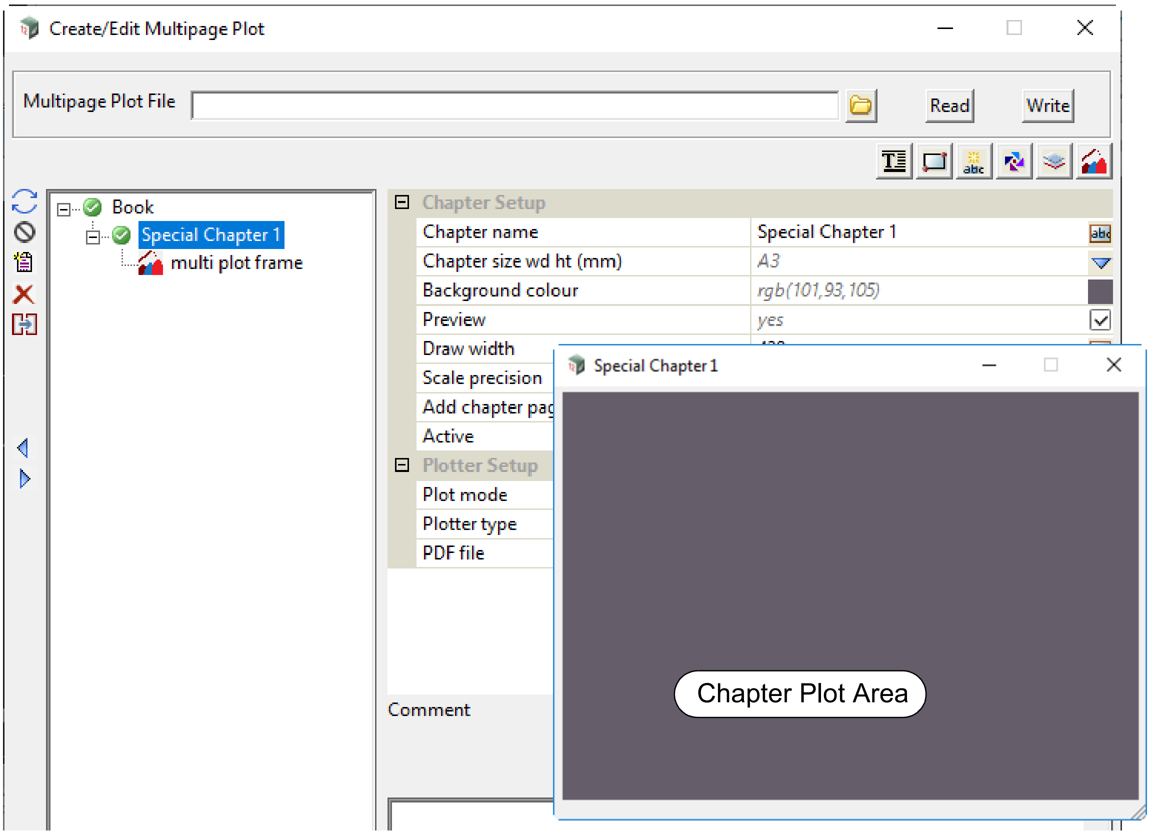
1. No other pages can be added to the Water Long Section Chapter and the drawing of the water long sections on each page is determined by the information in the Water Long Plot PPF file.
2. The *Title Block* in the Water Long Plot PPF is NOT used.
3. Title Blocks, Frames, Text, Symbols and Models can be added to the Water Long Section Chapter and they behave as they do for any other Chapter.
4. The number of pages created in the Water Long Section Chapter is included in the special text **$total_pages**.
5. If the special text **$current_page** is used in a Water Long Section Chapter, then it will be incremented correctly for each of the individual pages plotted in the Water Long Section Chapter.

For information on the special text $variables for MPS, see 21.1.4.8.6 MPS Text $variables.

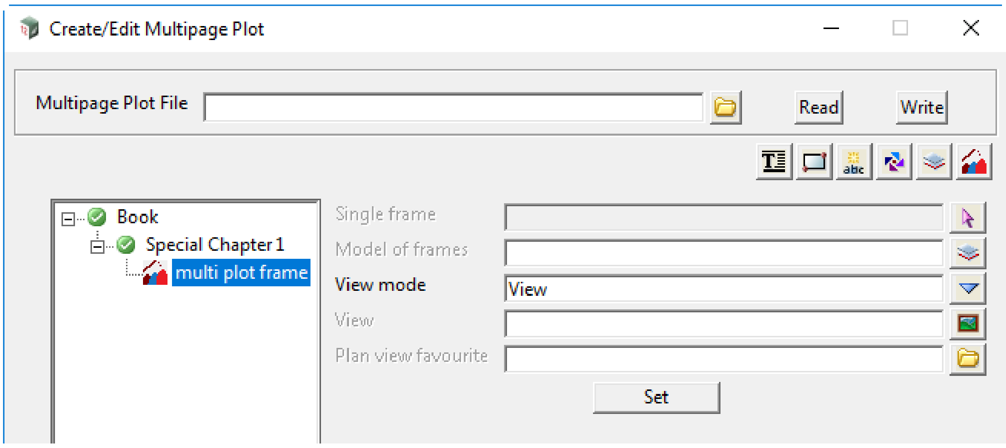
21.1.4.11.5 Plot Frame Chapter



Clicking on the **Special Chapter >Plot frame** option creates a Plot frame Chapter with a subnode called **multi plot frames**.



Clicking on the **multi plot frame** node displays the information for controlling the pages generated by the Plot Frame Chapter.



PPF file Plot Frames ppf box available plot frame ppfs

Selected Plot Frame PPF file that contains all the information for drawing the pages of a model of plot frames.

***Note**: the Title Block in the PPF is **NOT** used.*

Single frame Plot Frames select box

If a Plot Frame is selected, this will override the **Single frame** *field in the Plot Frame PPF file.*

*If **blank**, the* **Single frame** *field in the Plot Frame PPF file is used.*

Model of frames Model box available models

If a model is selected, this will override the **Model of frames** *field in the Plot Frame PPF file.*

*If **blank**, the* **Model of frames** *field in the Plot Frame PPF file is used.*

Set button

Update and use the values in the fields.

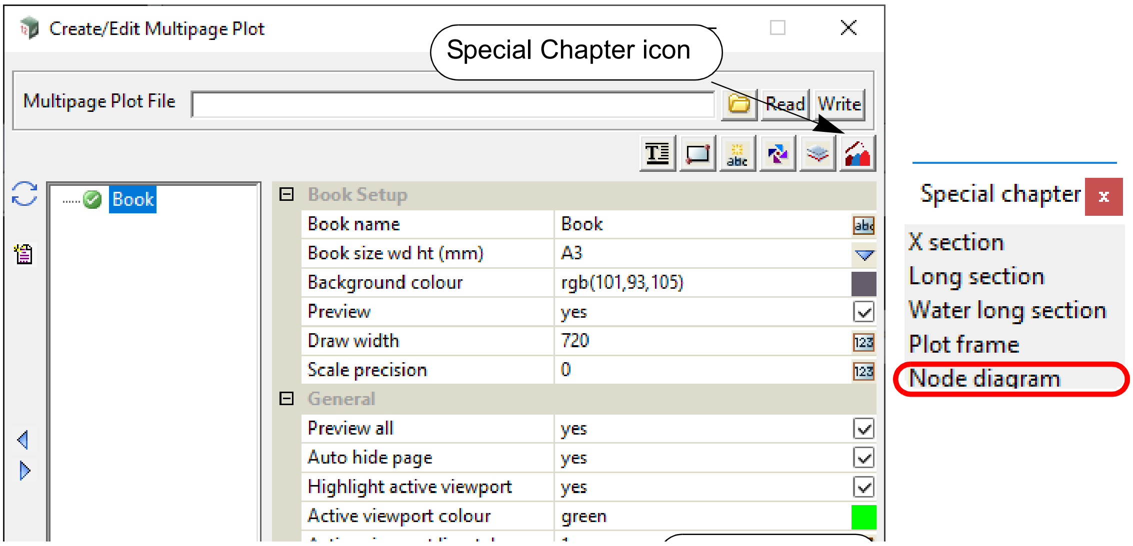
Note that a **Write** *needs to be done to update the Multipage plots file.*

21.1.4.11.5.1 Notes on Using the Plot Frames Chapter

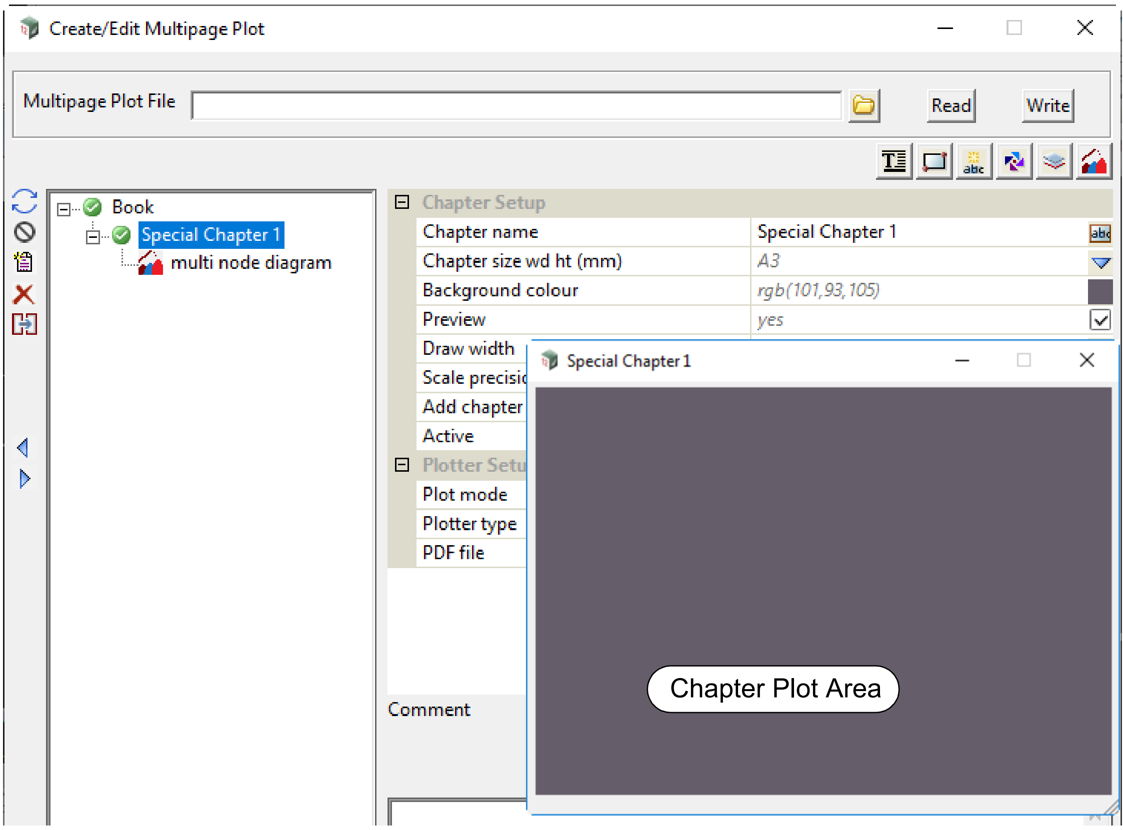
1. No other pages can be added to the Plot Frames Chapter and the drawing of the plot frame on each page is determined by the information in the Plot Frame PPF file.
2. The *Title Block* in the Plot Frame PPF is NOT used.
3. Title Blocks, Frames, Text, Symbols and Models can be added to the Plot Frame Chapter and they behave as they do for any other Chapter.
4. The number of pages created in the Plot Frame Chapter is included in the special text **$total_pages**.
5. If the special text **$current_page** is used in a Plot Frame Chapter, then it will be incremented correctly for each of the individual pages plotted in the Plot Frame Chapter.

For information on the special text $variables for MPS, see 21.1.4.8.6 MPS Text $variables.

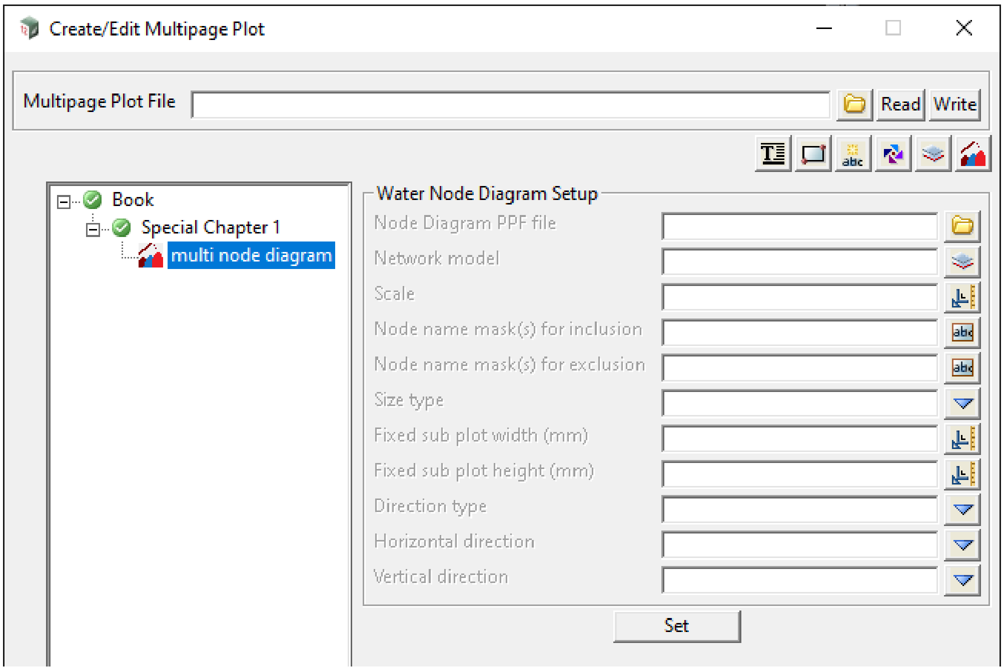
21.1.4.11.6 Node Diagram Chapter



Clicking on the **Special chapter >Node diagram** option creates a Plot frame Chapter with a subnode called **multi node diagram**.



Clicking on the **multi node diagram** node displays the information for controlling the pages generated by the Node Diagram Chapter.



Node Diagram PPF file Water Diagram ppf box available water diagram ppfs

Selected Node Diagram PPF file that contains all the information for drawing the pages of node diagrams.

***Note**: the Title Block in the PPF is **NOT** used.*

Network model Model box available models

Model containing the water string whose nodes are to be plotted.

*If **not blank**, this value will override the existing value of the **Network model** field in the **Node Diagram PPF file** when plotting.*

*If **blank**, no overriding will occur and the **Network model** field value specified in the **Node Diagram PPF file** will be used when plotting.*

Scale 1:

Scale to plot the node diagrams.

Node name mask(s) for inclusion inclusion_mask text box

*If **not blank** then only those nodes whose name matches one in the name mask are considered for plotting. If **blank**, all nodes are considered for plotting. So blank acts like "*".*

See 23.7.2.1 Name Masks.

Node name mask(s) for exclusion exclusion_mask text box

*If **not blank** then any node whose name matches one in the name mask is not plotted.*

*If **blank**, then no nodes are considered for excluding from plotting.*

See 23.7.2.1 Name Masks.

Set sub plot size to choice box fixed size, diagram size

*If **fixed size**, each node diagram is drawn in a rectangle defined by **Sub plot width in mm** and **Sub plot height in mm**.*

*If **diagram size**, each node diagram is drawn in a rectangle of a size calculated to fit that particular node. So the size will be different for each node.*

Fixed plot width in mm real box

Width of the imaginary box to draw each node diagram in.

Sub plot height in mm real box

Height of the imaginary box to draw each node diagram in.

Sub plot direction choice box

*If **by column**, then the plotted node diagrams are arranged into columns.*

*If **by row**, then the plotted node diagrams are arranged into rows.*

Horizontal direction choice box

*If **left to right**, the node diagrams in a row start on the left and move to the right.*
*If **right to left**, the node diagrams in a row start on the right and move to the left.*

Vertical direction choice box

*If **top to bottom**, the node diagrams in a column start at the top and go down to the bottom.*
*If **bottom to top**, the node diagrams in a column start at the bottom and go up to the top.*

Set button

Update and use the values in the fields.
Note that a **Write** *needs to be done to update the Multipage plots file.*

21.1.4.11.6.1 Notes on Using the Node Diagram Chapter

1. No other pages can be added to the Node Diagram Chapter and the drawing of the plot frame on each page is determined by the information in the Node Diagram PPF file.
2. The *Title Block* in the Node Diagram PPF is NOT used.
3. Title Blocks, Frames, Text, Symbols and Models can be added to the Node Diagram Chapter and they behave as they do for any other Chapter.
4. The number of pages created in the Node Diagram Chapter is included in the special text **$total_pages**.
5. If the special text **$current_page** is used in a Node Diagram Chapter, then it will be incremented correctly for each of the individual pages plotted in the Node Diagram Chapter.

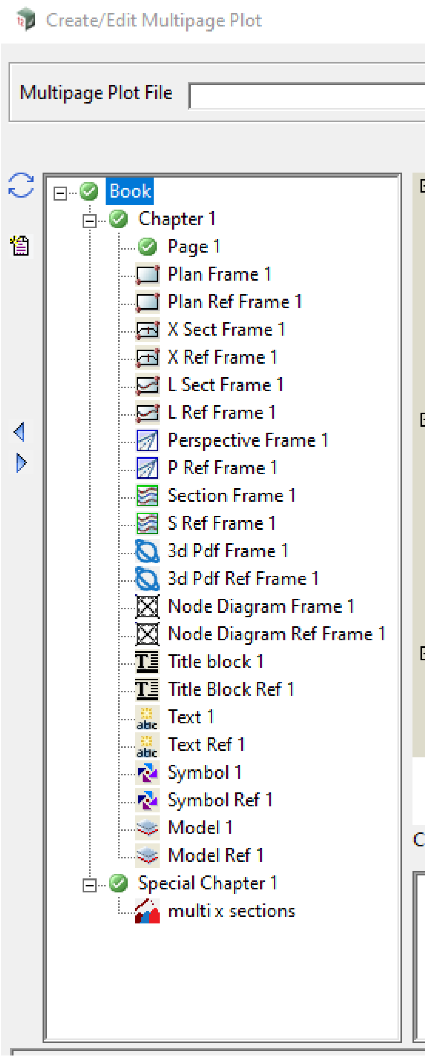
For information on the special text $variables for MPS, see 21.1.4.8.6 MPS Text $variables.

21.1.4.12 Node Insertion Order

When inserting new Nodes into the MPS tree there is an ordering that is used to determine the insertion position for the Node. The intention of the order is that Nodes be placed in a position that will hopefully require minimal manual repositioning from the user. The ordering also results in Nodes of the same type being grouped together in the MPS tree.

The insertion order is not enforced in any way after the insertion has occurred. The user is free to manually reposition the Nodes in the MPS tree to suite their preferences/requirements. However, the insertion order will only operate optimally when the MPS tree conforms to the order. So the more manual repositioning that occurs, the more the MPS tree will deviate from the order, which means it will be less likely that newly inserted Nodes will be in the correct position order wise.

The order was decided by taking into account the rules of MPS itself and by considering what users are using MPS to produce (predominately civil design and surveying drawings).



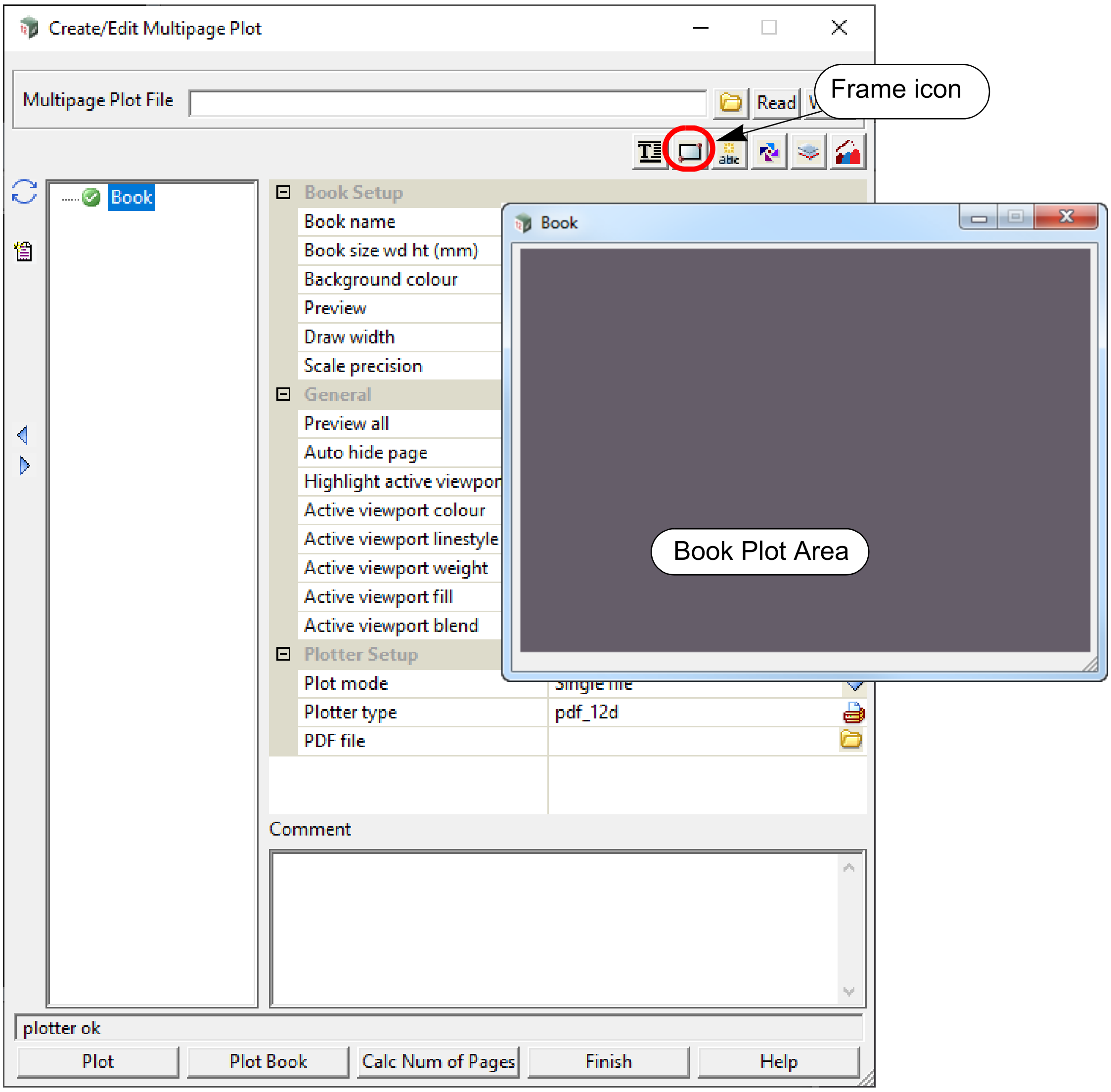
The **Node order** is as follows:
Book Node
Chapter Node
Special Chapter Node*
Page Node
Special Chapter Multi Node
Plan Frame Node
Plan Frame Reference Node
X Section Frame Node
X Section Frame Reference Node
Long Section Frame Node
Long Section Frame Reference Node
Perspective Frame Node
Perspective Frame Reference Node
Section Frame Node
Section Frame Reference Node
3D PDF Frame Node
3D PDF Frame Reference Node
Water Node Diagram Frame Node
Water Node Diagram Frame Reference Node
Title Block Node
Title Block Reference Node
Text Node
Text Reference Node
Symbol Node
Symbol Reference Node
Model Node
Model Reference Node

* **Special Chapters** only insert using the ordering if the Book Node is the currently selected node. Otherwise they insert directly underneath the Book level Subnode of the currently selected node.

21.1.5 Example Using Reference Frames

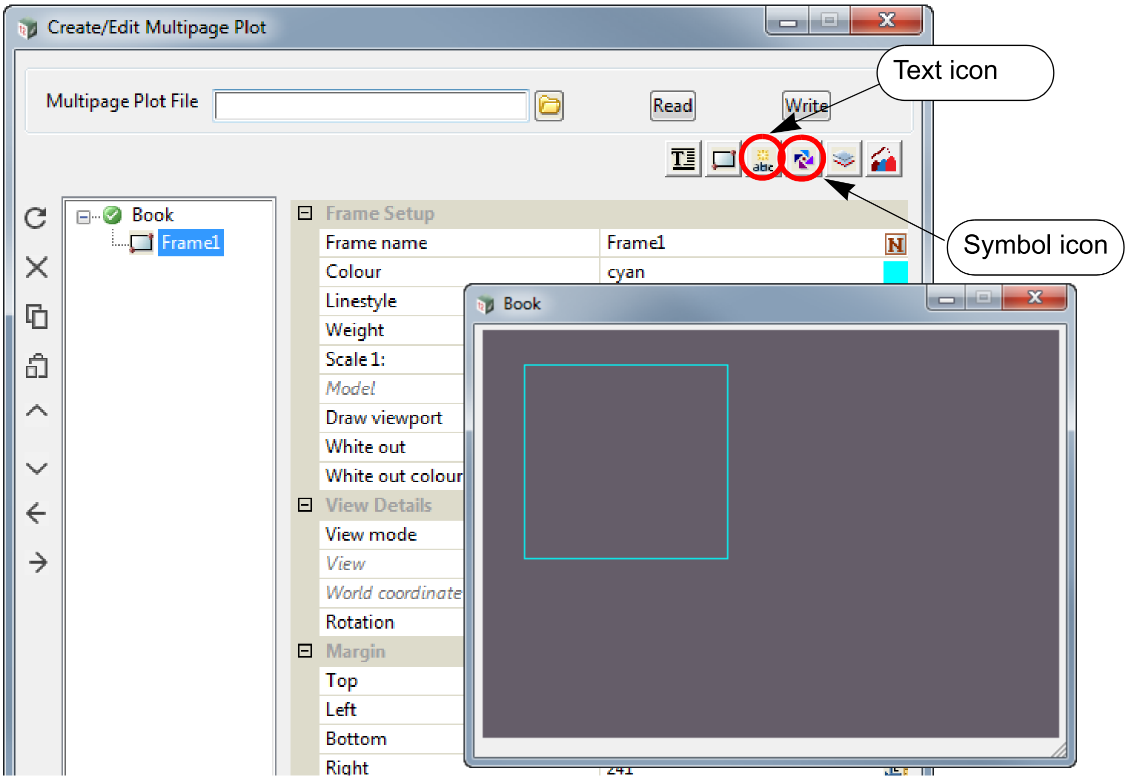
21.1.5.1 Creating Frames That Can Be Referenced

Click on the option ***Plots =>Multipage Plots =>Create*** to create a new **Multipage Plot Tree** with just the **Book node** and a **Book Plot Area**.



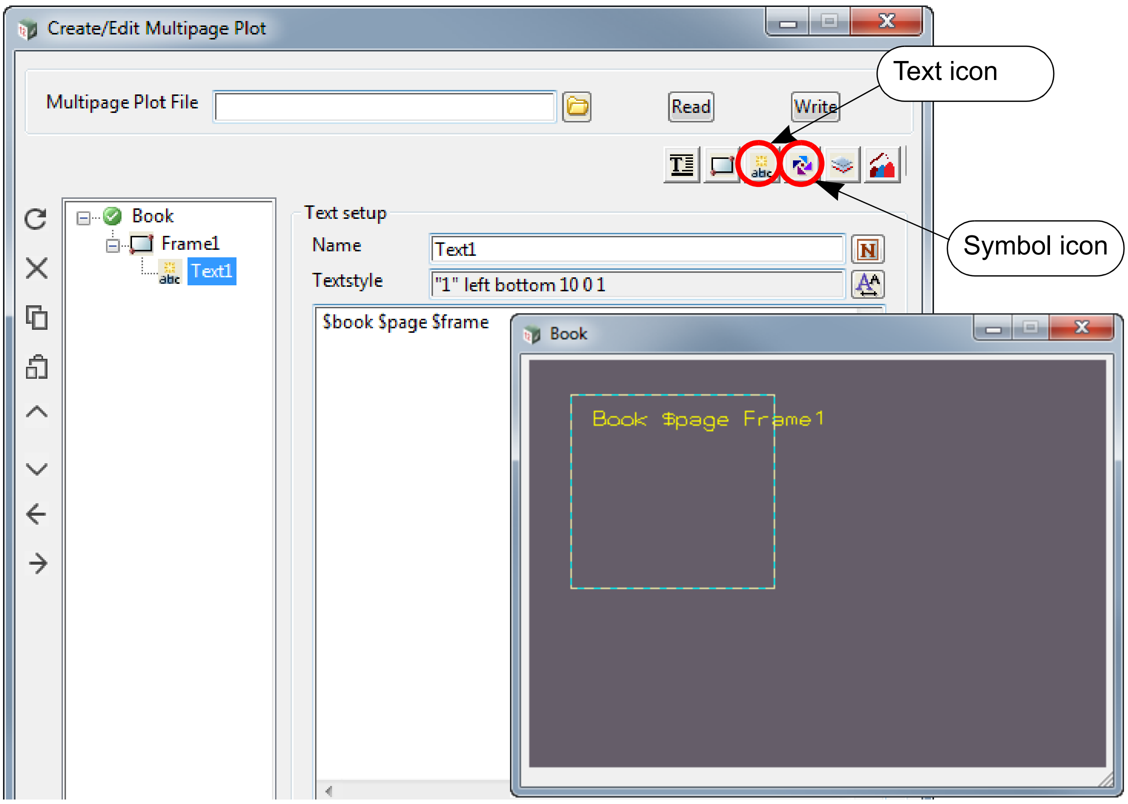
Click on the **Frame** icon and select **Plan** and then create a **Book Frame** on the left hand side of the **Book Plot Area**.

Say **Yes** to "Do you want to create reference frame(s) for Chapter(s)?"
Say **Yes** to "Do you want to create reference frame(s) for Pages(s)?"



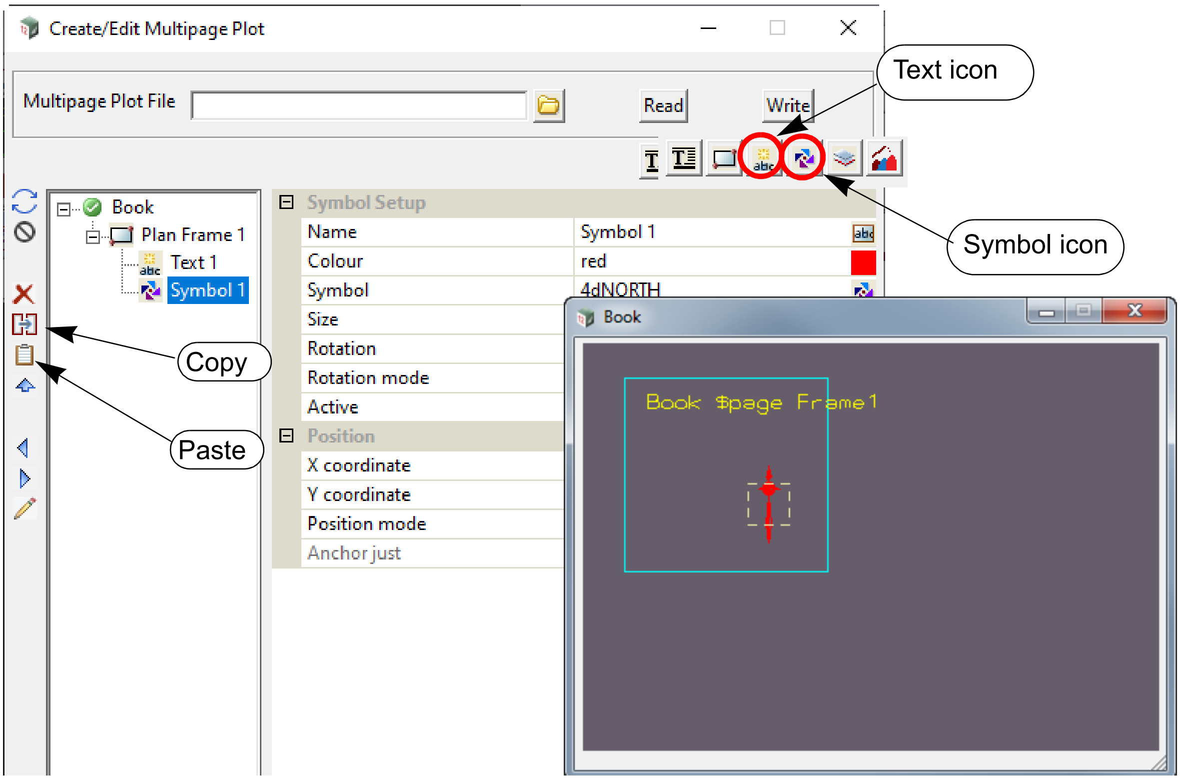
Highlight the *Frame 1* node and click on the **Text** icon, select **Rel to frame** and then place **Text** at the top of the **Book Frame** *Frame1*.

Click on the *Text 1* node and replace the text with "$book $page $frame" and click on the **Set** button.



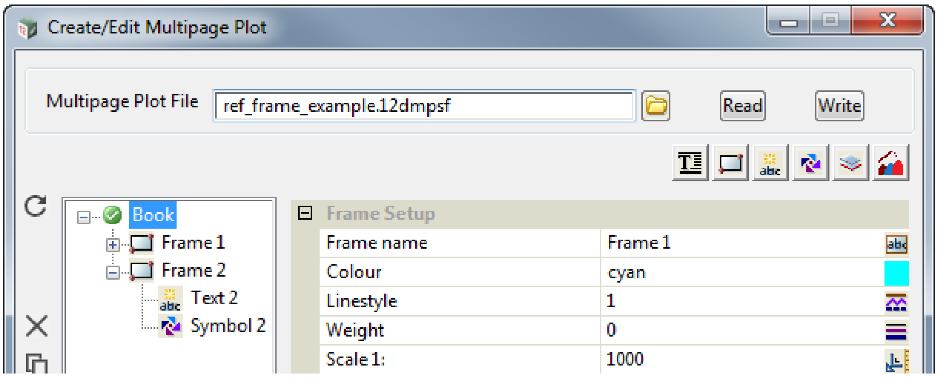
Highlight the *Frame 1* node and click on the **Symbol** icon, select **Rel to frame** and then place a Symbol at the bottom right of the **Book Frame** *Frame 1*.

A Symbol of name "Symbol 1" is created in *Book Frame 1*.



Before continuing, type **ref_frame_example** into the **Multipage Plot File** field and press **Write**.

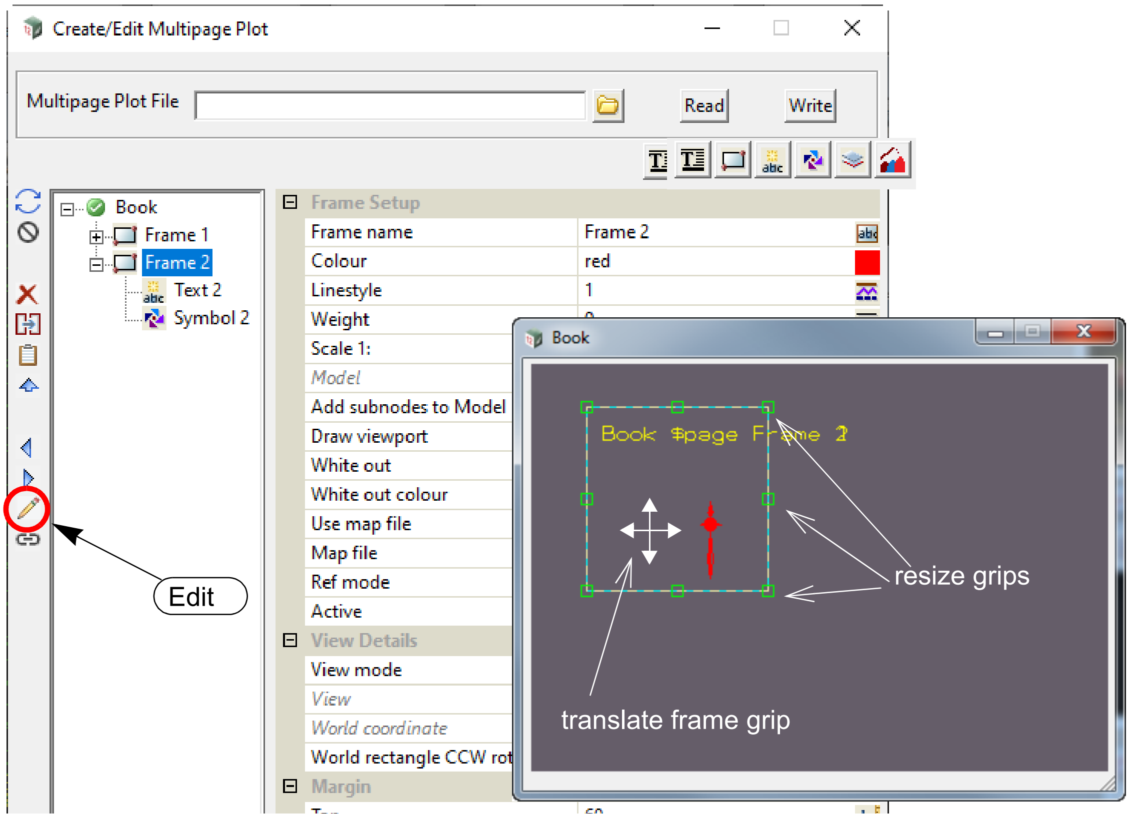
Now highlight the *Frame 1* node and click on the **Copy** icon and then the **Paste** icon. A new Frame is created at the bottom of the Books and the **Book** node is automatically highlighted.



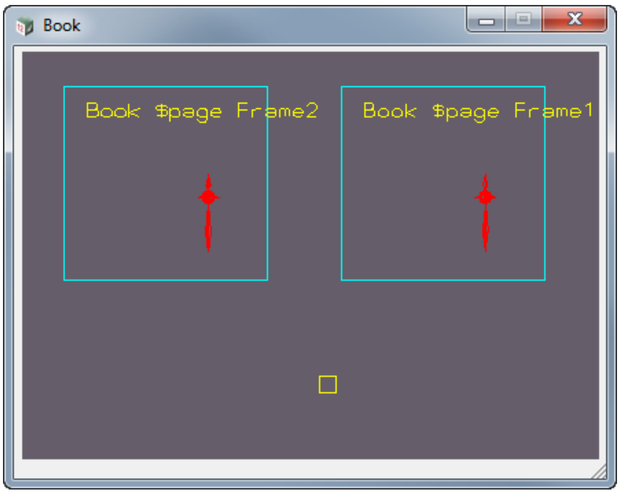
The copied frame is on top of the original frame so we will move one of the Frames by using the Frame Edit command which can be done in two ways:

(a) Highlight the **Frame** node to be edited and then click on the **Edit** icon on the left hand side.

The Frame will then highlight in the Book Plot Area and display nine resize grips and if you move your cursor inside the Frame, the translate frame grip is displayed.



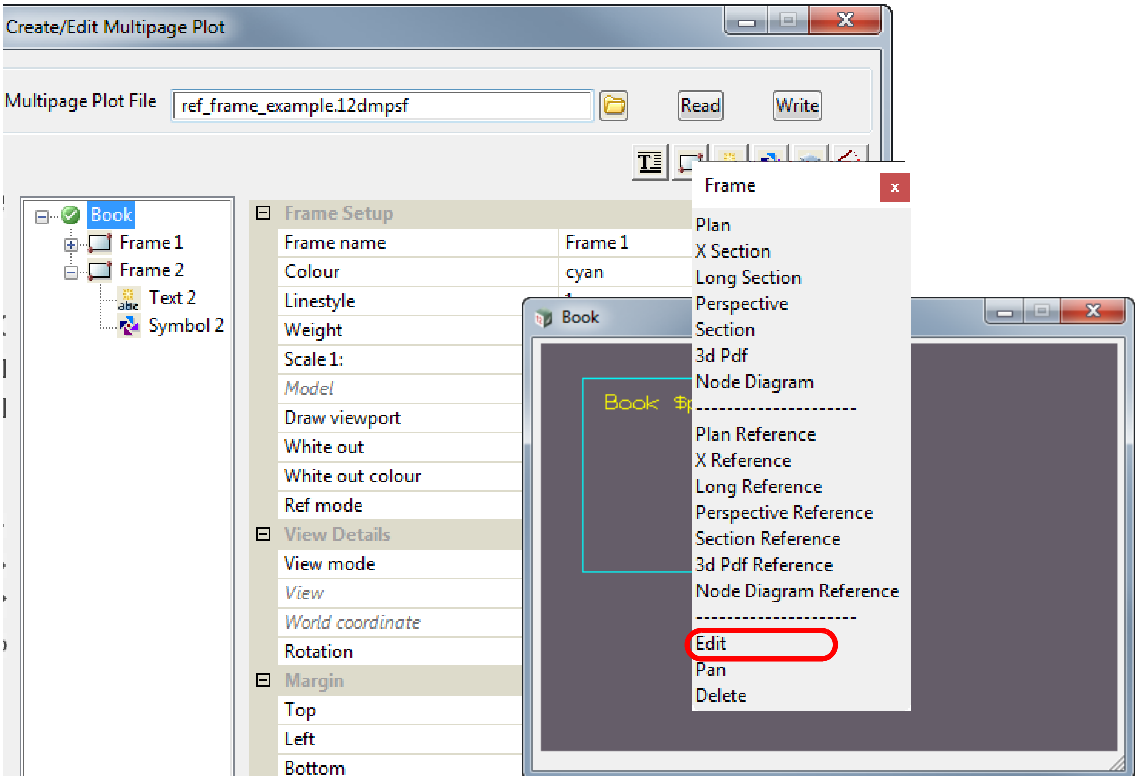
Hold down LB and move the Frame to the left.

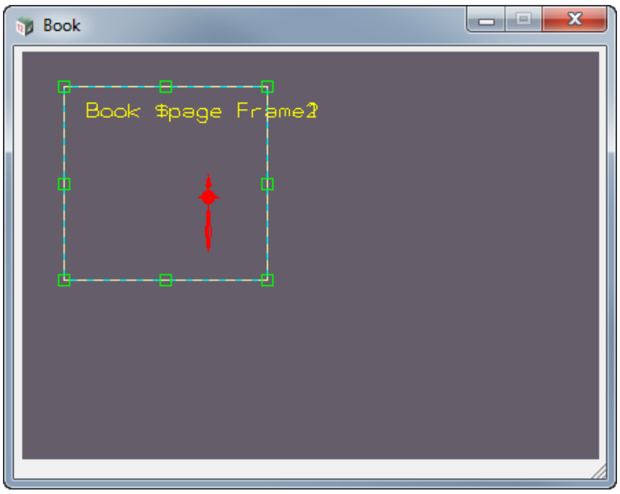


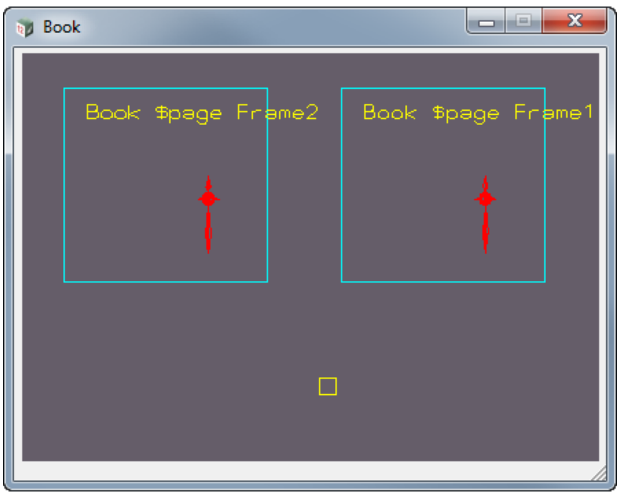
(b) Selecting the Frame from the Book Plot Area

With **Book** highlighted, click on the **Frame** icon and select **Edit** from the **Frame** menu.

Then click LB only on one of the Frames in the **Book Plot Area** and then move it to the right hand side of the **Book Plot Area**.

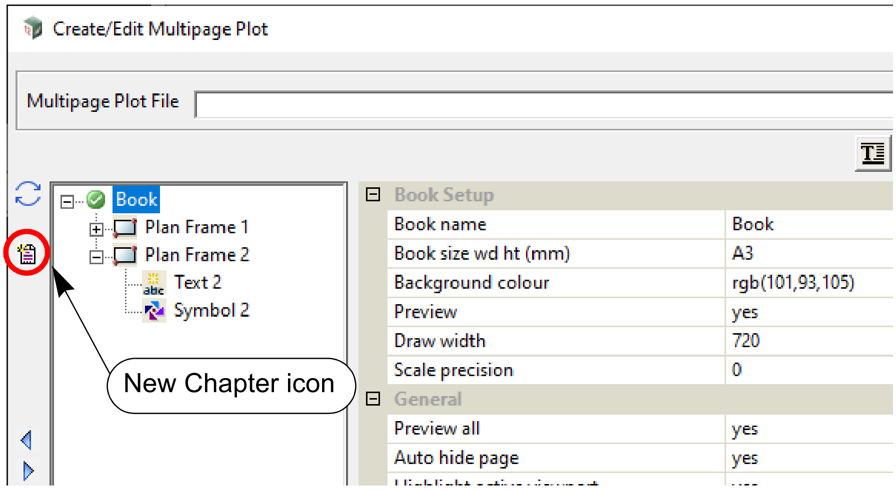

Create/Edit Multipage Plot
Multipage Plot File
ref_frame_example.12dmpsf
Read
Write
Book
Frame 1
Frame 2
Text 2
Symbol 2
Frame Setup
Frame name
Frame 1
Colour
cyan
Linestyle
Weight
Scale 1:
Model
Draw viewport
White out
White out colour
Ref mode
View Details
View mode
View
World coordinate
Rotation
Margin
Top
Left
Bottom
Book
Frame
Plan
X Section
Long Section
Perspective
Section
3d Pdf
Node Diagram
Plan Reference
X Reference
Long Reference
Perspective Reference
Section Reference
3d Pdf Reference
Node Diagram Reference
Edit
Pan
Delete

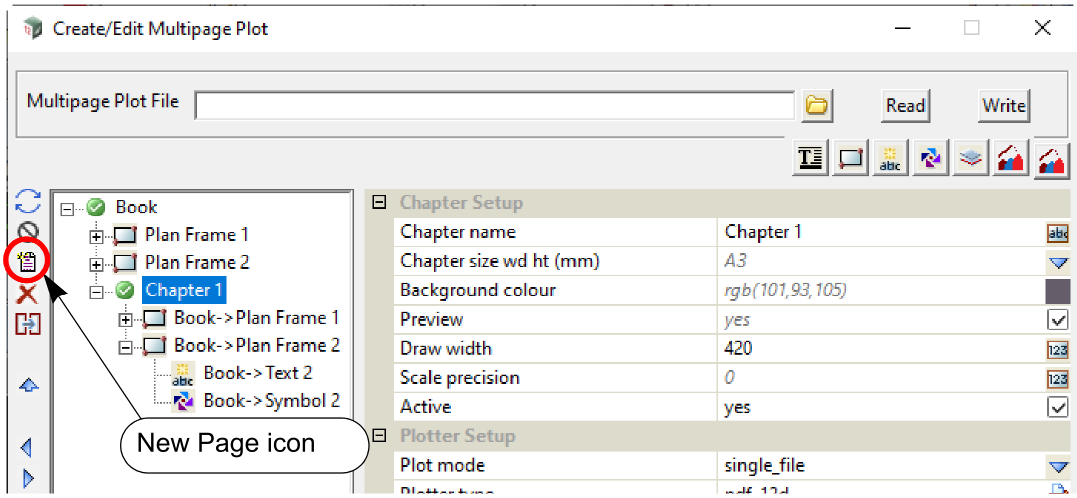

Book
Book $page Frame2


Book
Book $page Frame2
Book $page Frame1

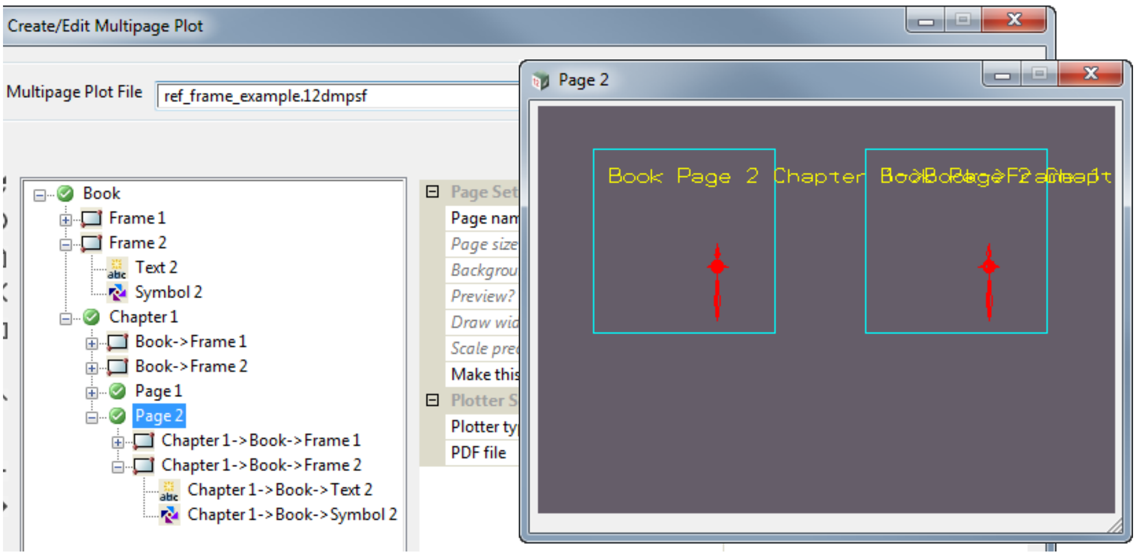
21.1.5.2 Automatic Reference Frame Creation

With the **Book** node highlighted, click on the **New Chapter** icon:





With the **Chapter** node highlighted, click on the **New page** icon twice to create two new pages in the **Chapter**:



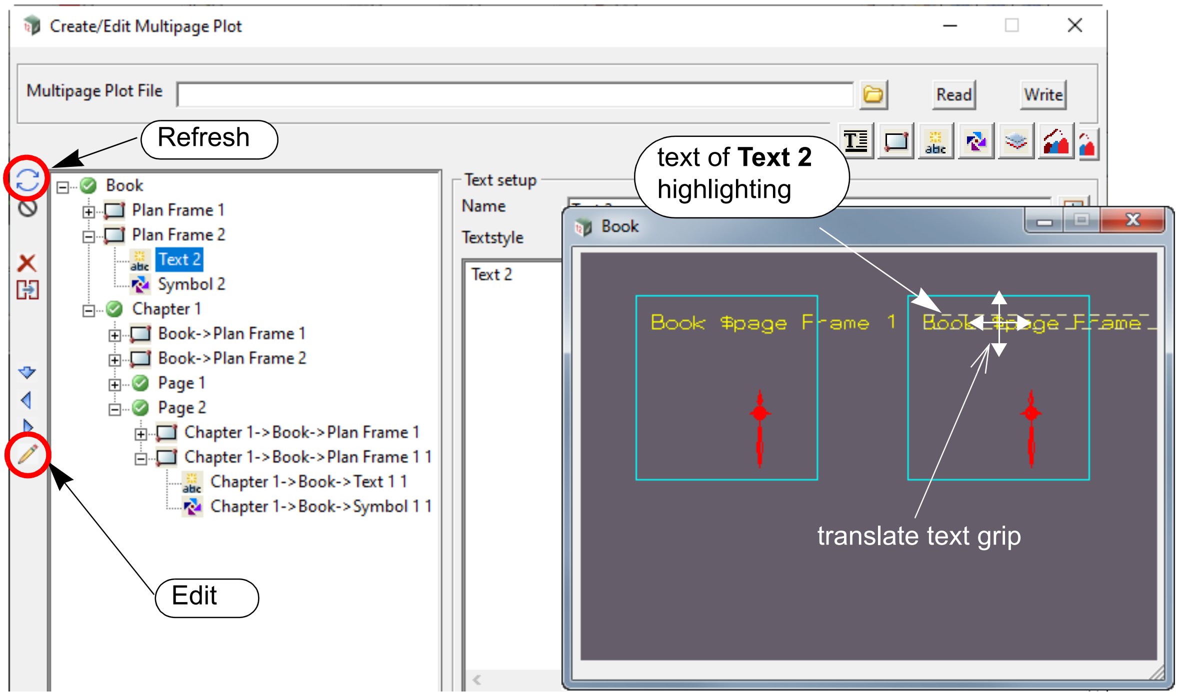
Click on the **Write** button to save the MPS file.

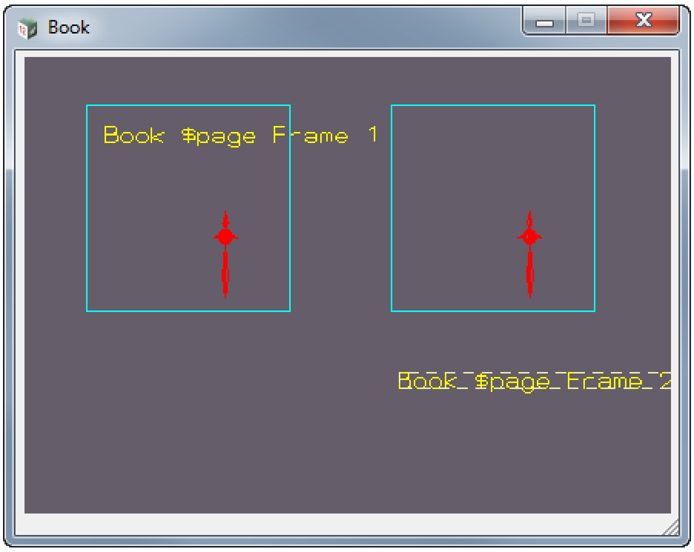
You'll notice the Text from the left hand frame is overwriting the Text in the right hand frame so we need to move it and we'll do that on the original **Book Frame** *Frame 2*.

To do so, click on the **Text 2 node** under **Book Frame 2**. The text for **Text 2** then highlights in the Page 2 Plot Area and if the cursor is moved over the highlight text then the translate text grip is displayed.

Hold down LB and move the text to the bottom of the right hand Frame.

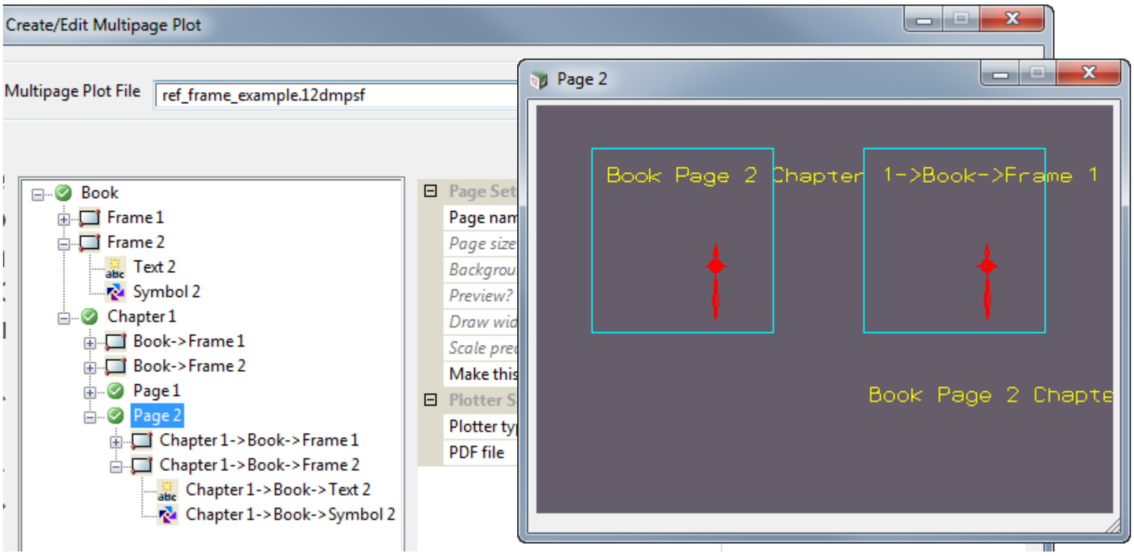
.





Click on the **Book** node again and then on Refresh to refresh all the Plot Areas for the Book.

Then click on the **Page2** node again.



Note

You can also edit the text by clicking on the **Book Frame** to show the **Book Plot Area** and then clicking on the **Text** icon on the top right and selecting **Edit.**

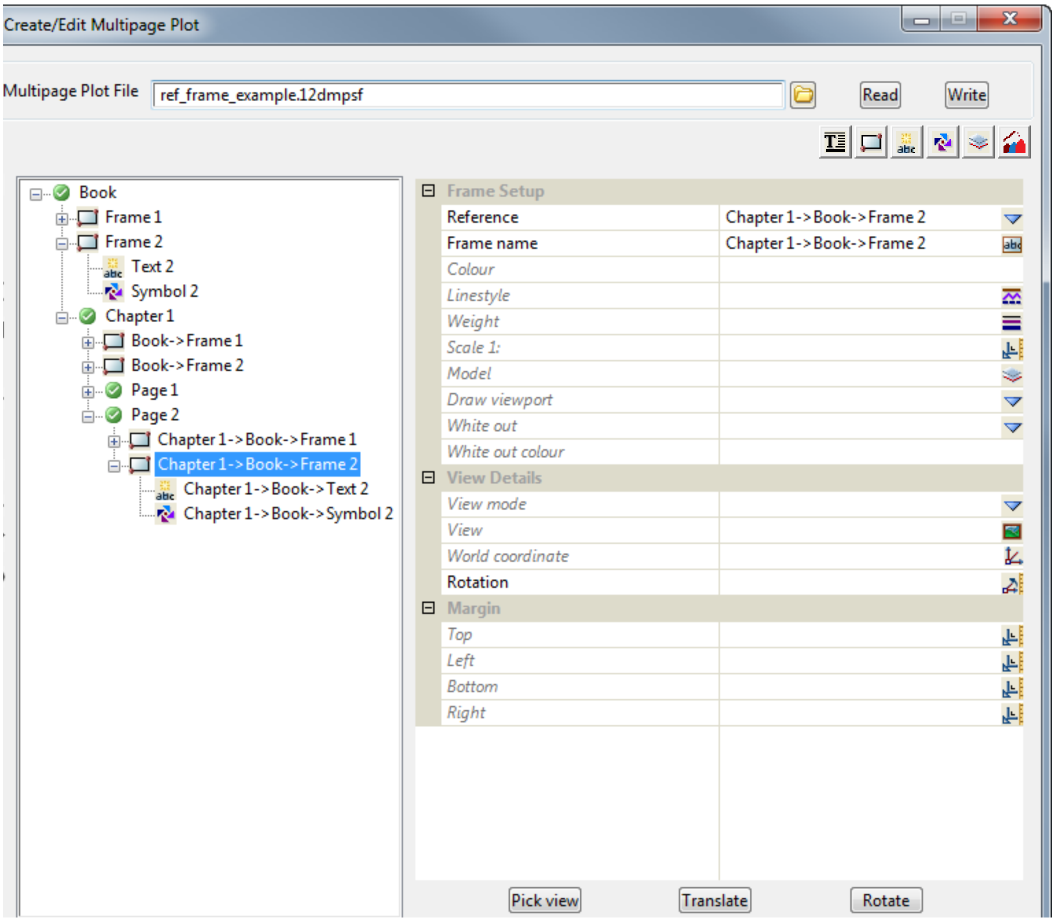
Next click LB down on the text to be moved to see the translate text grip and then move the text to the bottom of the right hand Frame and release LB.

21.1.5.3 Reference Frame Fields

We'll now work with these Reference Frames to give an idea of how Reference Frames can be used.

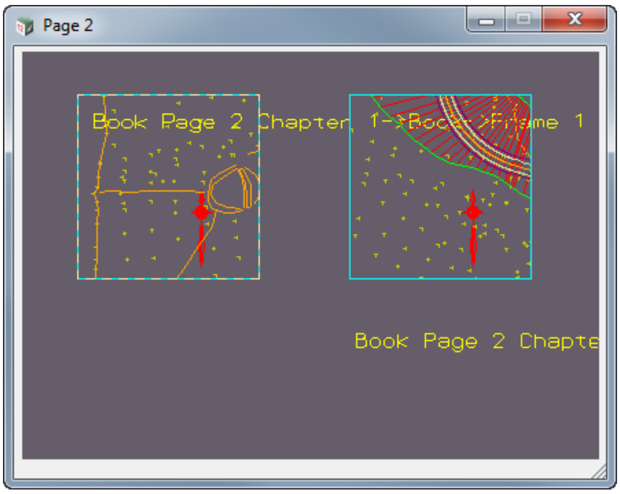
Highlight the **Reference Frame** *Chapter 1 ->Book ->Frame 2* under the **Page** node *Page 2.*

You will notice that most of the fields are blank which means that the values are taken from the Book Frame frame that is referenced (Book Frame *Book->Frame 2*) combined with those from the Chapter Frame that is also referenced (Chapter 1 Frame Book ->Frame 2) and we hadn't filled in any of these fields after creating the **Book Frame** or the **Reference Chapter Frame**.



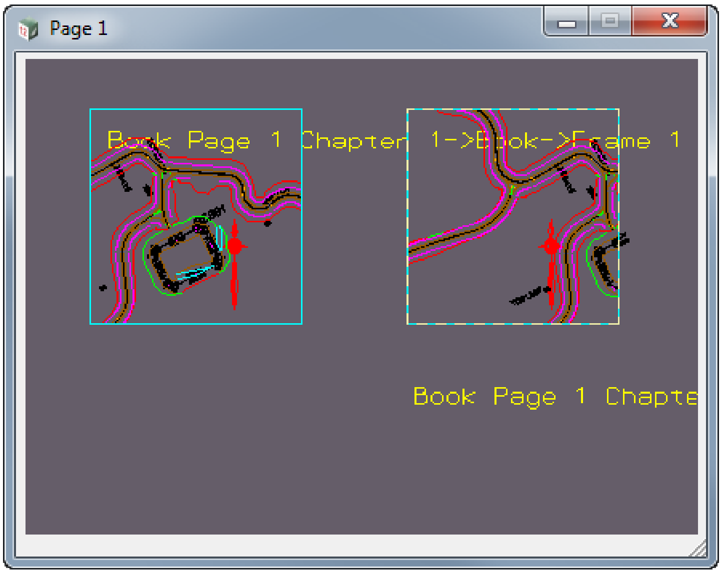
Click on **Pick View** and click in a view to get the data to draw in the Frame.

Similarly click on the **Reference Frame** *Chapter 1 ->Book ->Frame 1* under the **Page** node *Page2*, click on **Pick view** and then click in a view.



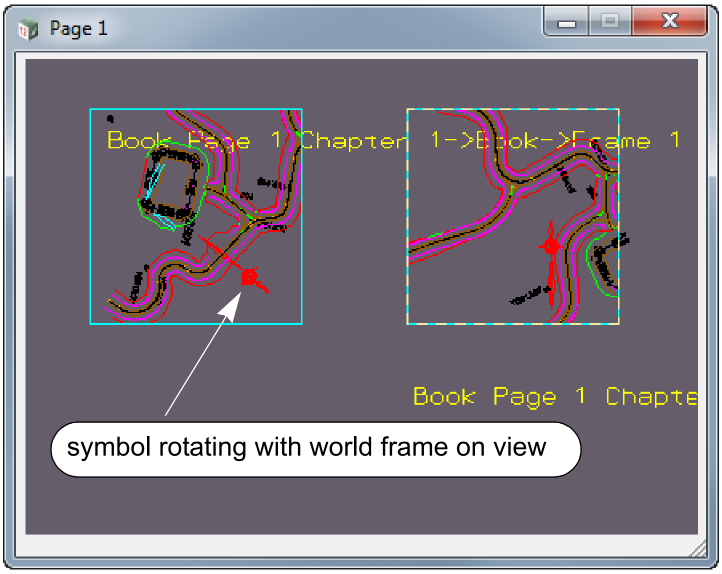
Now highlight the **Page Reference Frame** *Chapter 1 ->Book ->Frame 1* under the **Page** node *Page1* and again pick the *Pick view* button and select a View.

Do the same thing for the **Page Reference Frame** *Chapter 1 ->Book ->Frame 2* under the **Page** node *Page1.*



So the **Page Reference frame** *Chapter 1 ->Book ->Frame 1* on ***Page1*** and **Page Reference frame** *Chapter 1 ->Book ->Frame 1* on ***Page 2*** **both** used the **same Book Frame** *Frame 1* but have totally different values for some of their fields.

If you click on the node **Page Reference frame** *Chapter 1 ->Book ->Frame 1* on ***Page1***, and next the **Rotate** button and rotate the world frame on the View, then because the **Rotation mode** for the **Symbol** in the **original** Book Frame was **Relative**, the symbol will rotate in that one Frame.



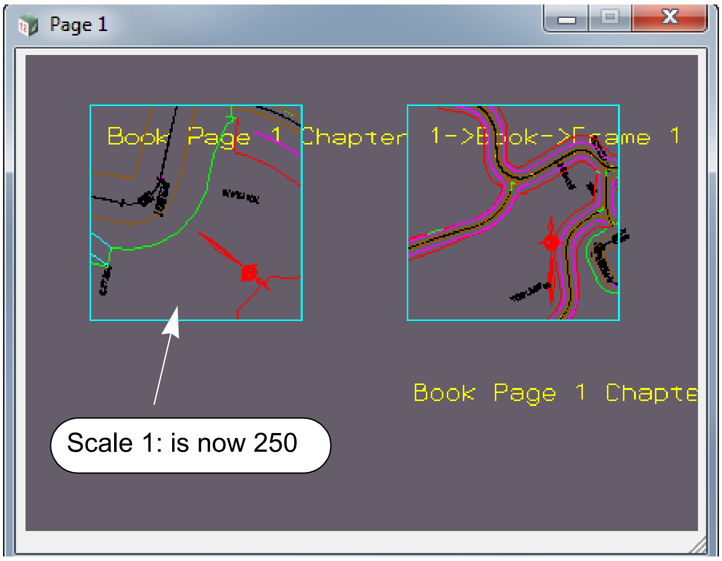
21.1.5.4 Changing Fields on the Original Frames

If you click on the **Frame 1** node at the **Book** level you will see that **Scale 1:** is *1000* and so it is for the frames on *Page 1* and *Page 2* that both reference **Book Frame1.**

Change **Scale 1:** to *250*, click on the **Book** node and then click on **Refresh** to update all the frames that reference Book Frame1 and update all the Plot Areas

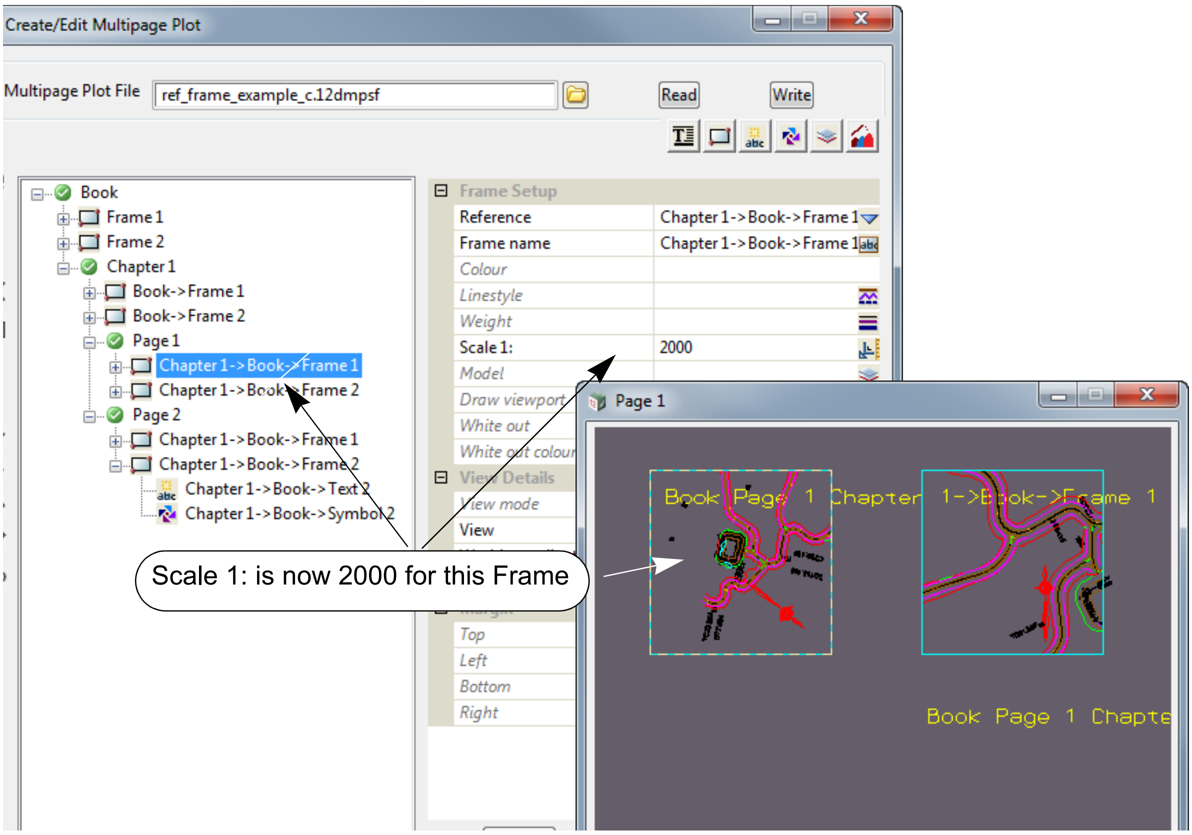
Click on the node Page 1 again and the scale has now changed on the Reference Frame that referenced Frame 1.

.



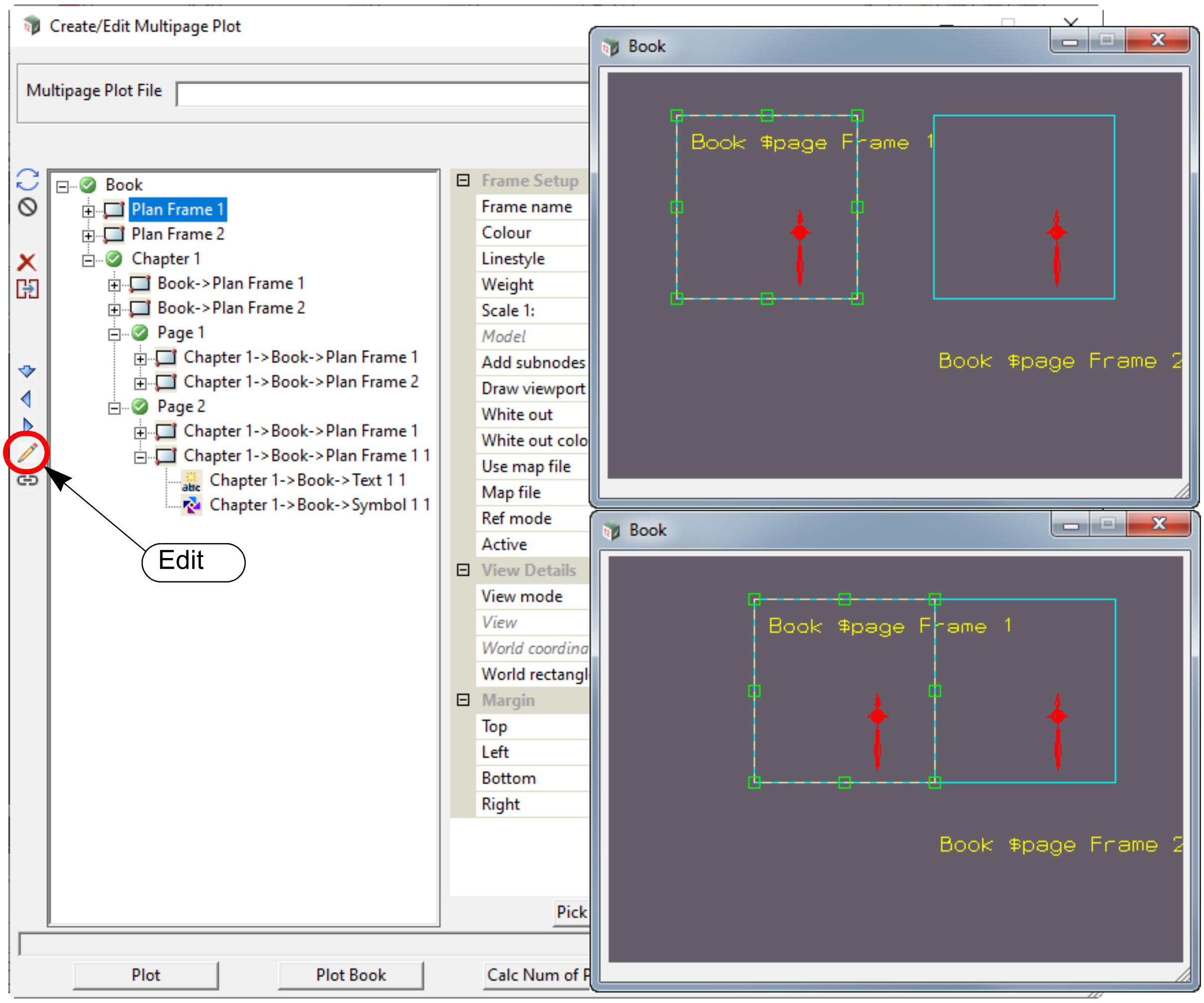
Even though ***Book Frame 1*** has **Scale 1:** to *250*, you can give a **Page Reference Frame** that references it a different scale by simply clicking that **Frame** node and where the field **Scale 1:** was blank, enter *2000*. Because the field is no longer blank, the scale for that particular Frame is no longer inherited from the original frame and will be *2000*.

.



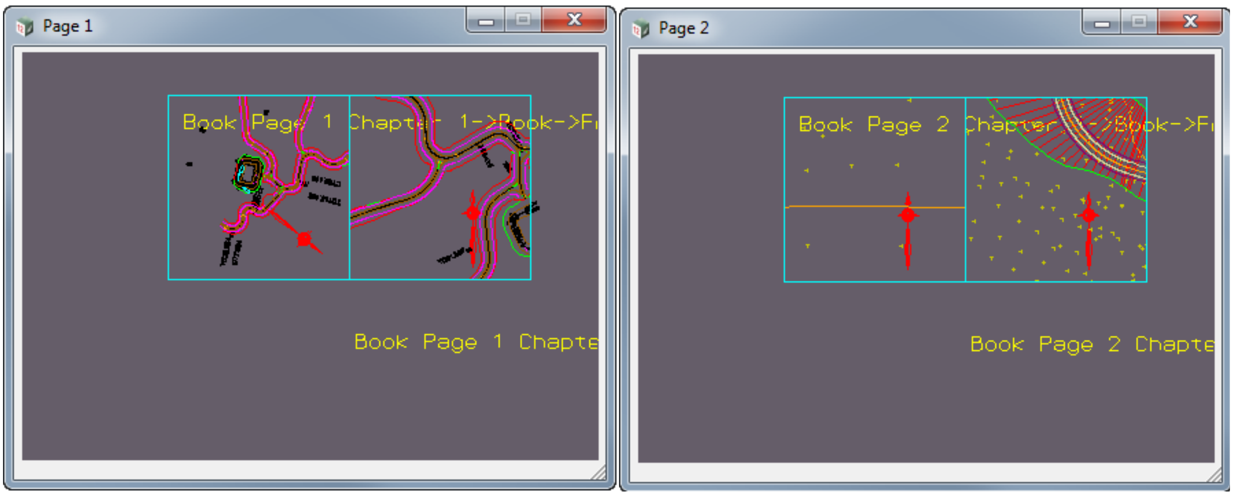
21.1.5.5 Moving an Original Frame

Now go back and highlight the **Book Frame** node *Frame 1*, click on **Edit** and then hold down LB on the Frame and move it so it touched the side of the right hand Frame.



Click on and highlight the Book node and click on **Refresh** to refresh all the **Plot Areas** for all the **Chapters** and **Pages** in the **Book**.

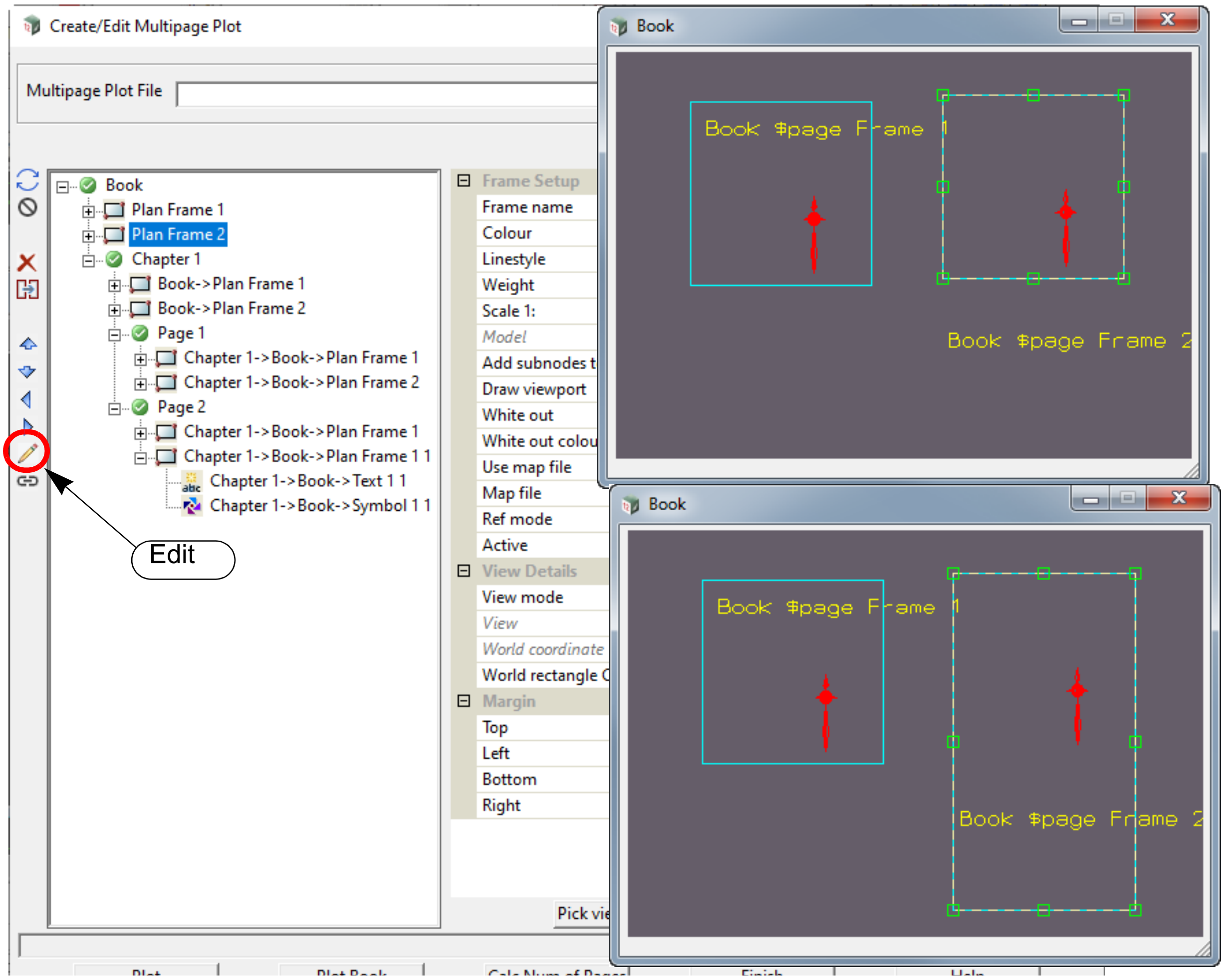
Then click on the **Page 1** and **Page 2** nodes again and you'll see that **all** the Reference Frames that reference **Book Frame 1** have moved.



Now move the **Book** Frame back to where it was, highlight **Book** and click on **Refresh**.

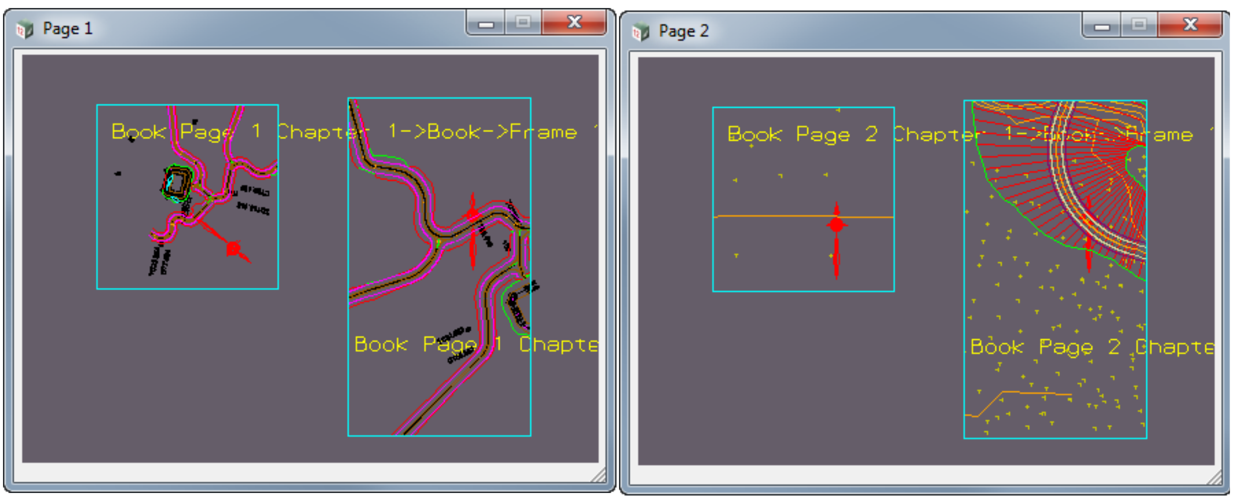
21.1.5.6 Resizing an Original Frame

Go back and highlight the **Book Frame** node **Frame 2**, click on **Edit** and then resize it *Frame 2*.



Click on and highlight the **Book** node and click on **Refresh** to refresh all the **Plot Areas** for all the **Chapters** and **Pages** in the **Book**.

Then click on the **Page 1** and **Page 2** nodes again and you'll see that **all** the Reference Frames that reference **Book Frame1** have resized.

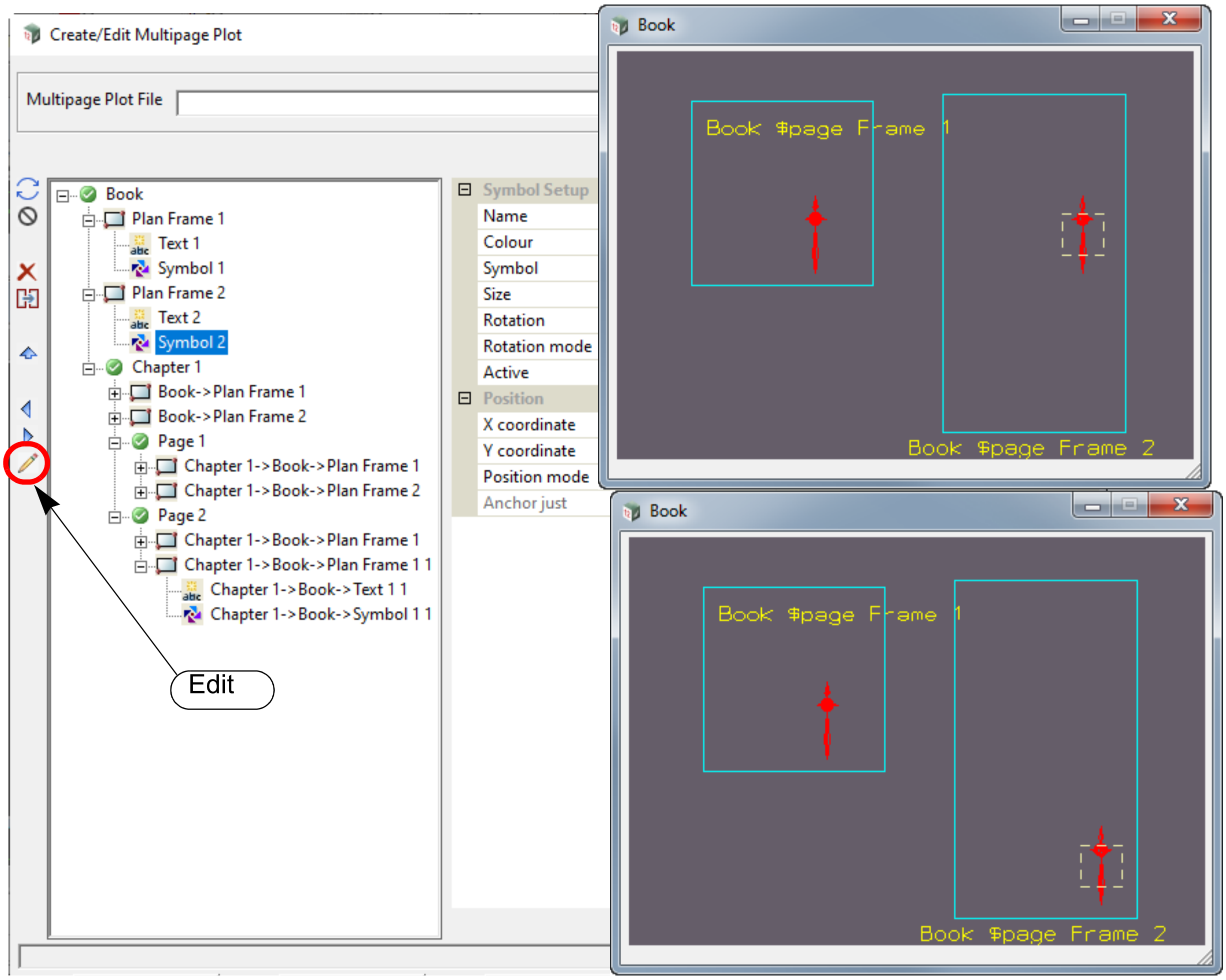


21.1.5.7 Moving an Original Text and Original Symbol

Go back and expand **Frame 2**, click on the **Text 2** node, then **Edit** and move the Text to the bottom of the Frame.

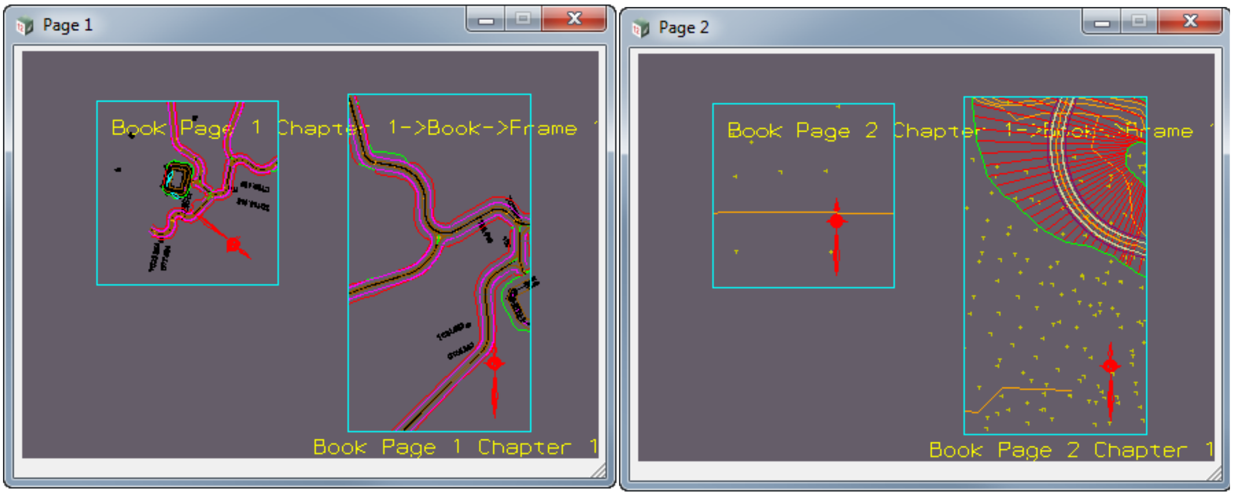
Or to do the same thing where the text is selected in the Book Page Area: Highlight the **Book** node, click on the **Text** icon, select **Edit** from the ***Text*** menu and then click LB down on the Text on the right hand side and move it to the bottom of the Frame.

Similarly, click on the **Symbol 2** node, then **Edit** and move the Symbol to the bottom of the Frame. Or highlight the **Book** node, click on the **Symbol** icon, select **Edit** from the ***Symbol*** menu and then click LB down on the Symbol on the right hand side and move it to the bottom of the Frame.



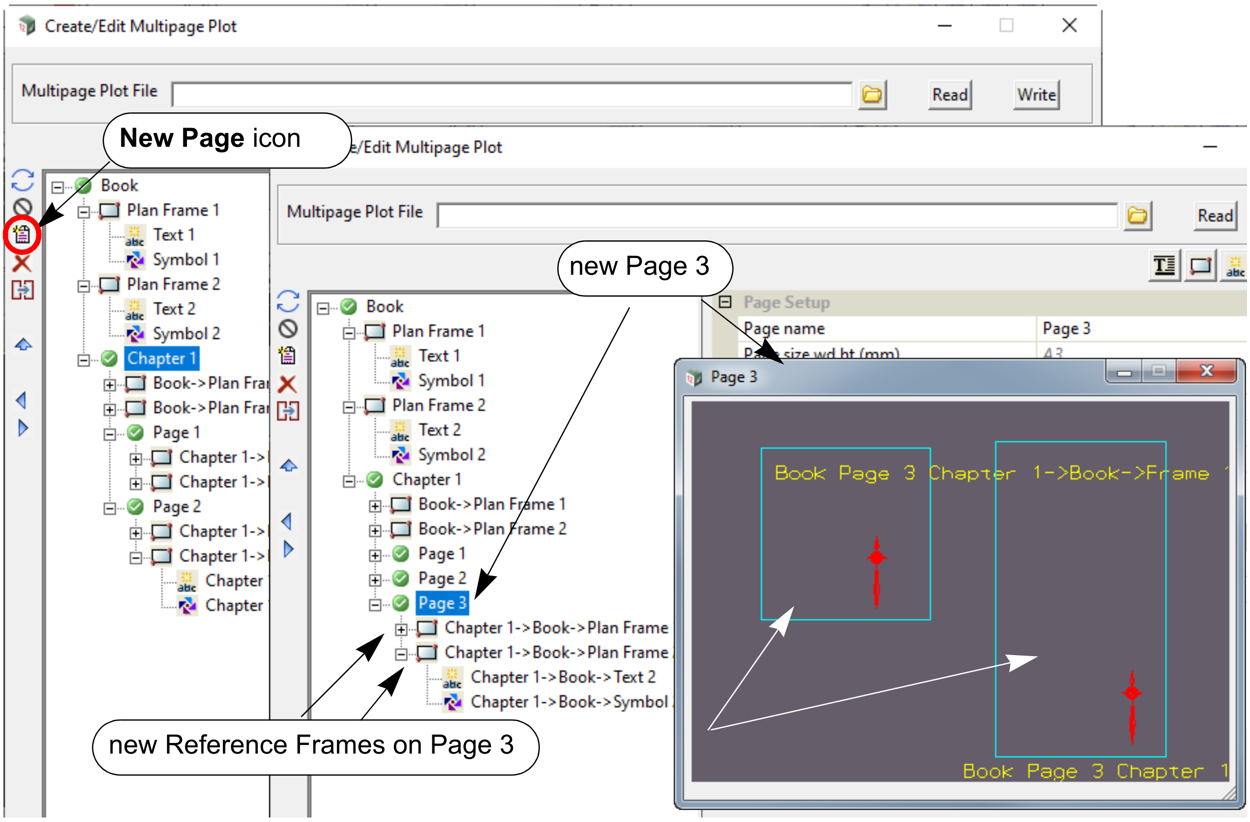
Click on and highlight the **Book** node and click on **Refresh** to refresh all the **Plot Areas** for all the **Chapters** and **Pages** in the **Book**.

Then click on the **Page1** and **Page2** nodes again and you'll see that **all** the Reference Frames that reference **Book Frame1** have the Text and Symbol moved.


Page 1
Book Page 1 Chapter 1->Book->Frame
Book Page 1 Chapter 1
Page 2
Book Page 2 Chapter
Book Page 2 Chapter 1

21.1.5.8 Adding A Page When Ref on Chapter and Page is On

Highlight the **Chapter 1** node and then click on the **New Page** icon to create **Page** *Page3*.



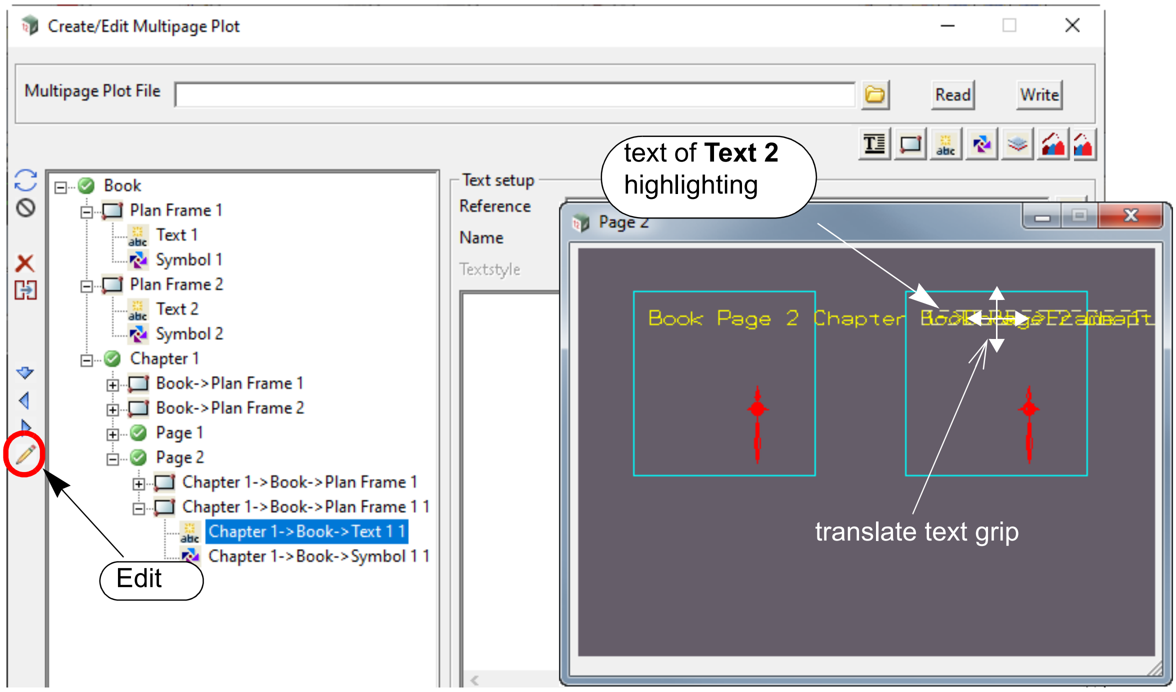
The new node **Page** *Page3* is added to the bottom of **Chapter** *Chapter1* and for each **Book Frame** that has the field ***Ref mode*** set to **Ref on Chapter and Page** or **Ref on Page,** a **Reference Frame** is automatically added to **Page** *Page3*.

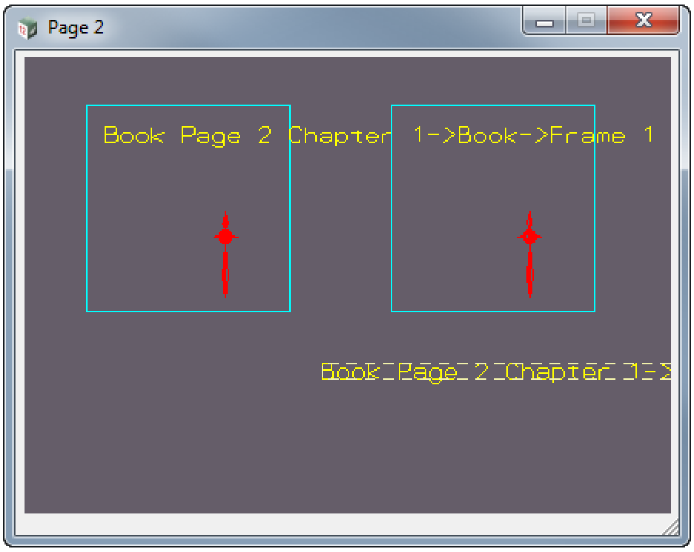
KEEP FOR A WHILE - MOVING TEXT ON A REFERENCE FRAME

You'll notice the Text from the left hand frame is overwriting the Text in the right hand frame so we need to move it.

To do so, click on the **Text 2 node** under **Page 2**. The text for **Text 2** then highlights in the Page 2 Plot Area and if the cursor is moved over the highlight text then the translate text grip is displayed.

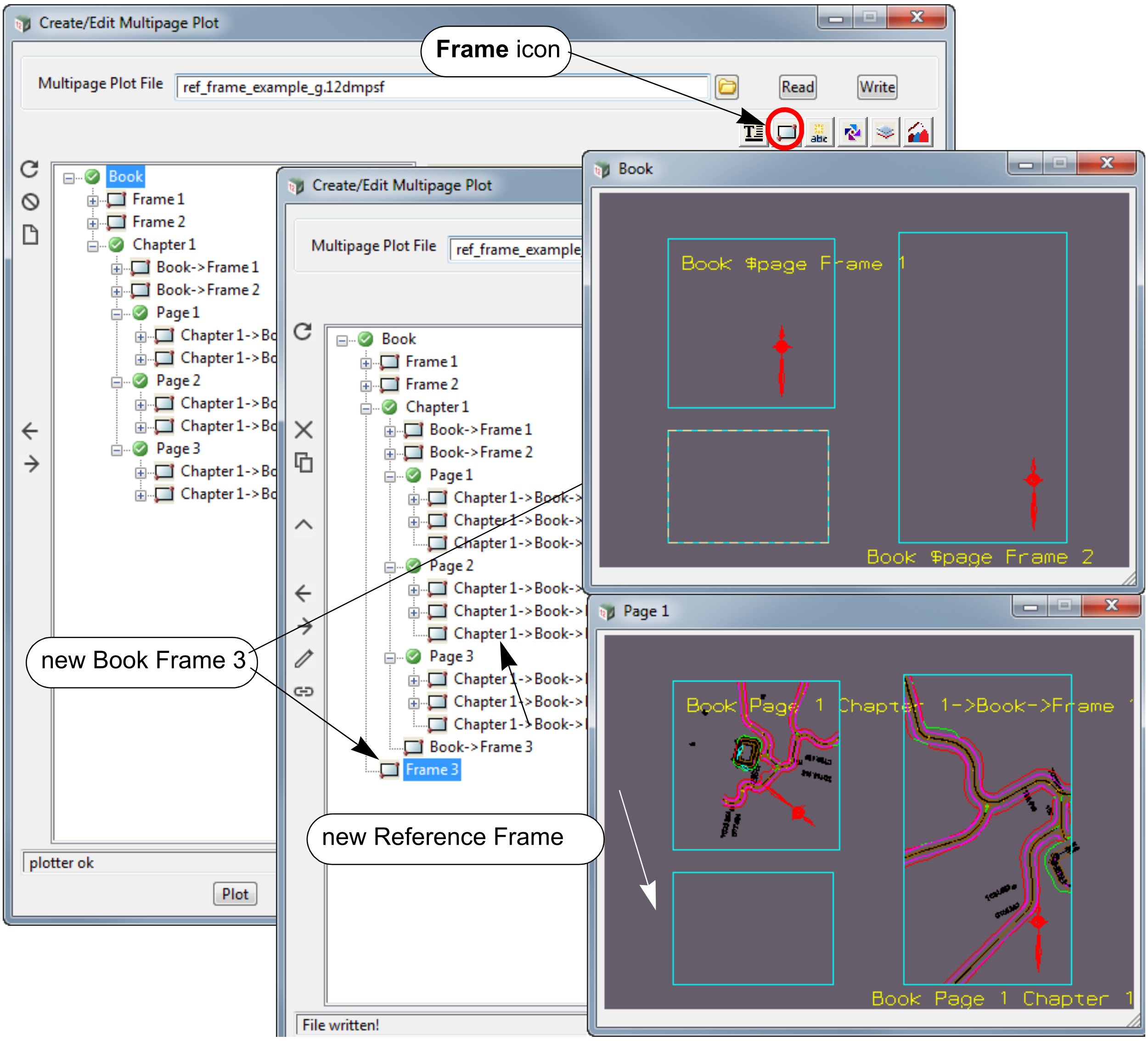
Hold down LB and move the text to the bottom of the right hand Frame.


Create/Edit Multipage Plot
Multipage Plot File
Read
Write
Book
Plan Frame 1
Text 1
Symbol 1
Plan Frame 2
Text 2
Symbol 2
Chapter 1
Book->Plan Frame 1
Book->Plan Frame 2
Page 1
Page 2
Chapter 1->Book->Plan Frame 1
Chapter 1->Book->Plan Frame 1 1
Chapter 1->Book->Text 1 1
Chapter 1->Book->Symbol 1 1
Edit
Text setup
Reference
Name
Textstyle
text of Text 2 highlighting
Page 2
Book Page 2 Chapter
translate text grip


Page 2
Book Page 2 Chapter 1->Book->Frame 1

21.1.5.9 Adding a New Book Frame

Highlight the **Book** node, click on the **Frame** icon and select ***Plan*** and then create a new **Book Frame** on the left hand side of the **Book Plot Area** and say **Yes** to "Do you want to create reference frame(s) for Chapter(s)?" and "Do you want to create reference frame(s) for Pages(s)?".



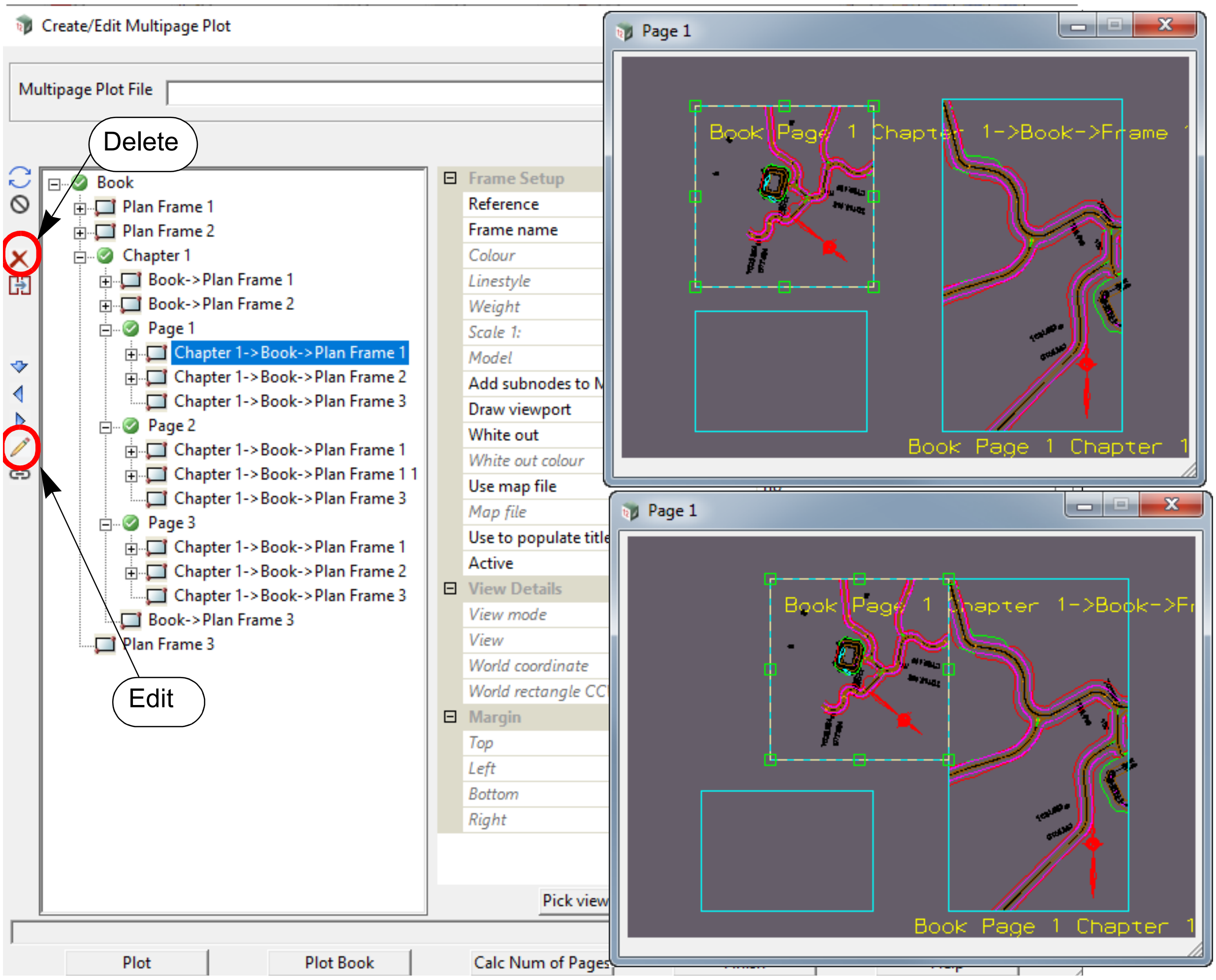
The new **Frame** node *Frame 3* is added to the bottom of the **Book** and because Yes was answered to the questions about creating reference frames for the Chapters and Pages, a **Reference Frame** is automatically added to each **Chapter** and each **Page** in the **Book**.

Notes

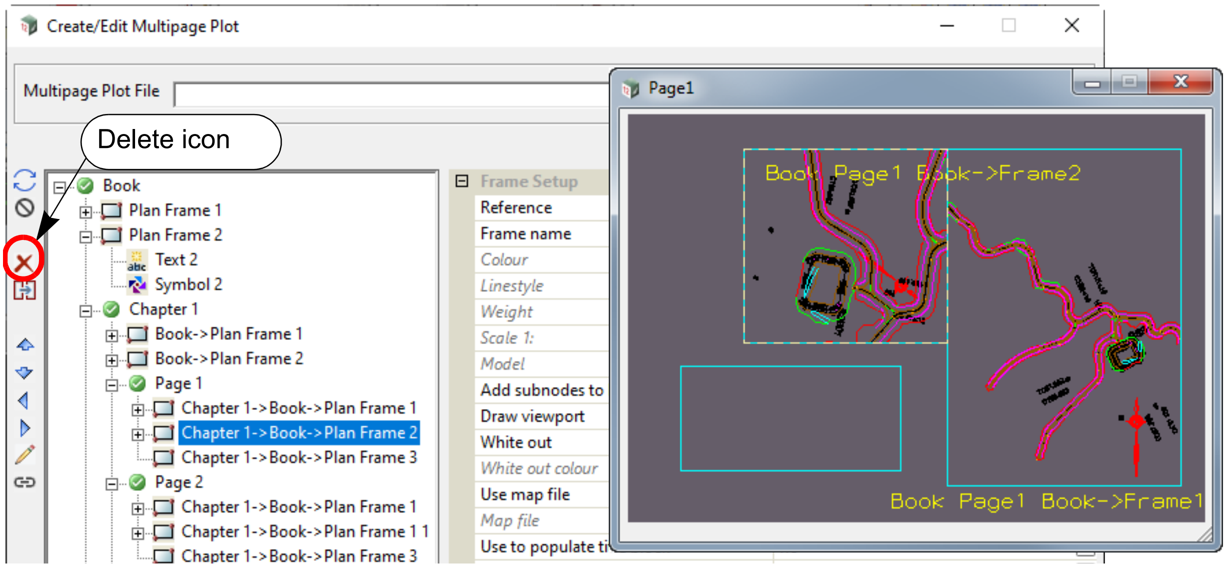
1. If when *Book Frame 3* was created, **Yes** was answered to "Do you want to create reference frame(s) for Chapter(s)?" and **No** to "Do you want to create reference frame(s) for Pages(s)?", then only the **Chapter Reference Frames** would be created.
2. If when *Book Frame 3* was created, **No** was answered to "Do you want to create reference frame(s) for Chapter(s)?" and **Yes** to "Do you want to create reference frame(s) for Pages(s)?", then only the **Page Reference Frames** would be created.
3. If when *Book Frame 3* was created, **No** was answered to "Do you want to create reference frame(s) for Chapter(s)?" and **No** to "Do you want to create reference frame(s) for Pages(s)?", then NO **Reference Frames** would have been created.

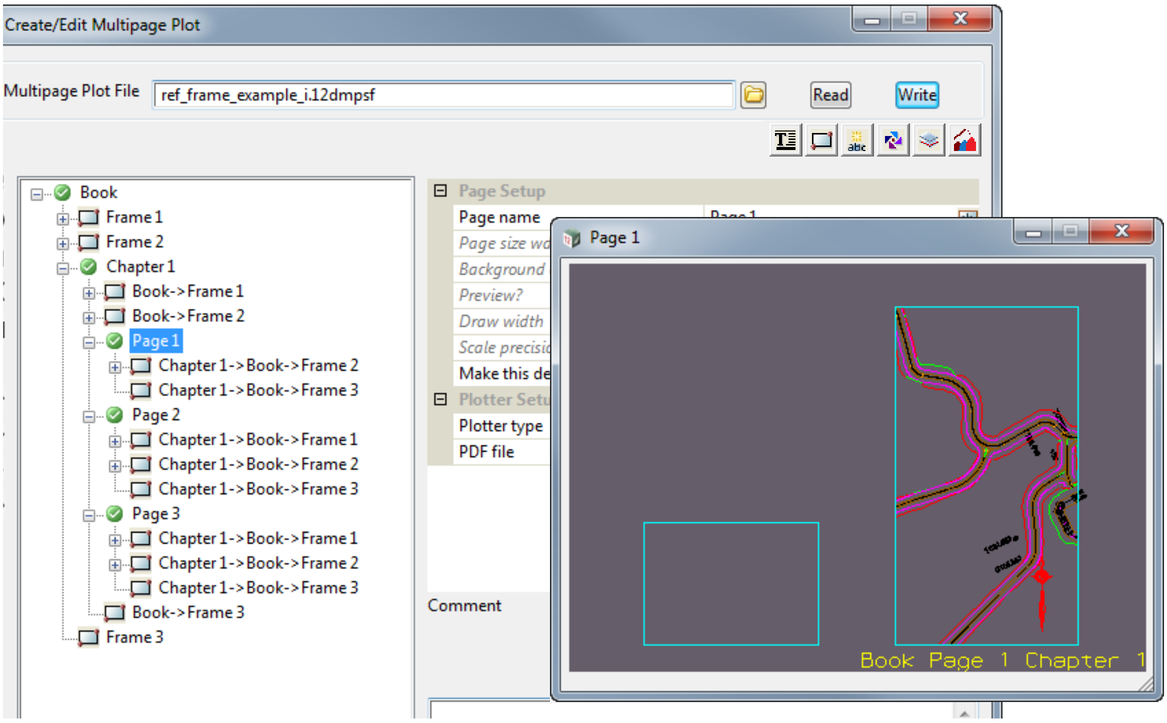
21.1.5.10 Working on an Individual Page

If you want the **Reference Frame** on one particular **Page** or **Chapter** to be in a different position to the Frame it references, click on the node for the **Reference Frame** to bring up the **Page or Chapter Plot Area** and highlight the Reference Frame on it, click **Edit** and then click LB down on the highlighted Frame and move it.



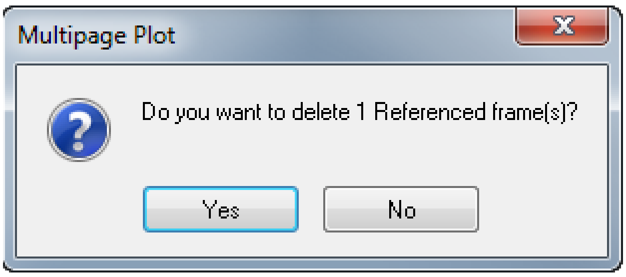
You can delete a **Reference Frame** by highlighting the **Reference Frame** node and clicking on the **Delete** on the left hand side.





Important Note:

If you delete an original Frame that has been referenced by other Frames, the Yes-No panel pops up.

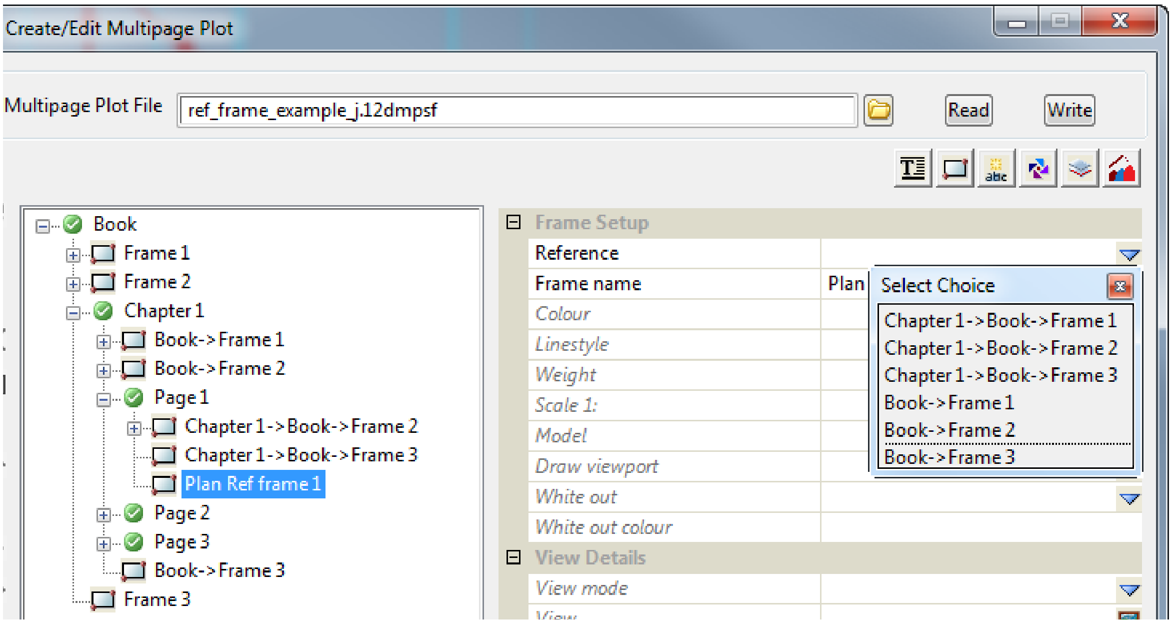


If you answer **Yes**, then the Frame and all the Frames that reference that Frame will be deleted.

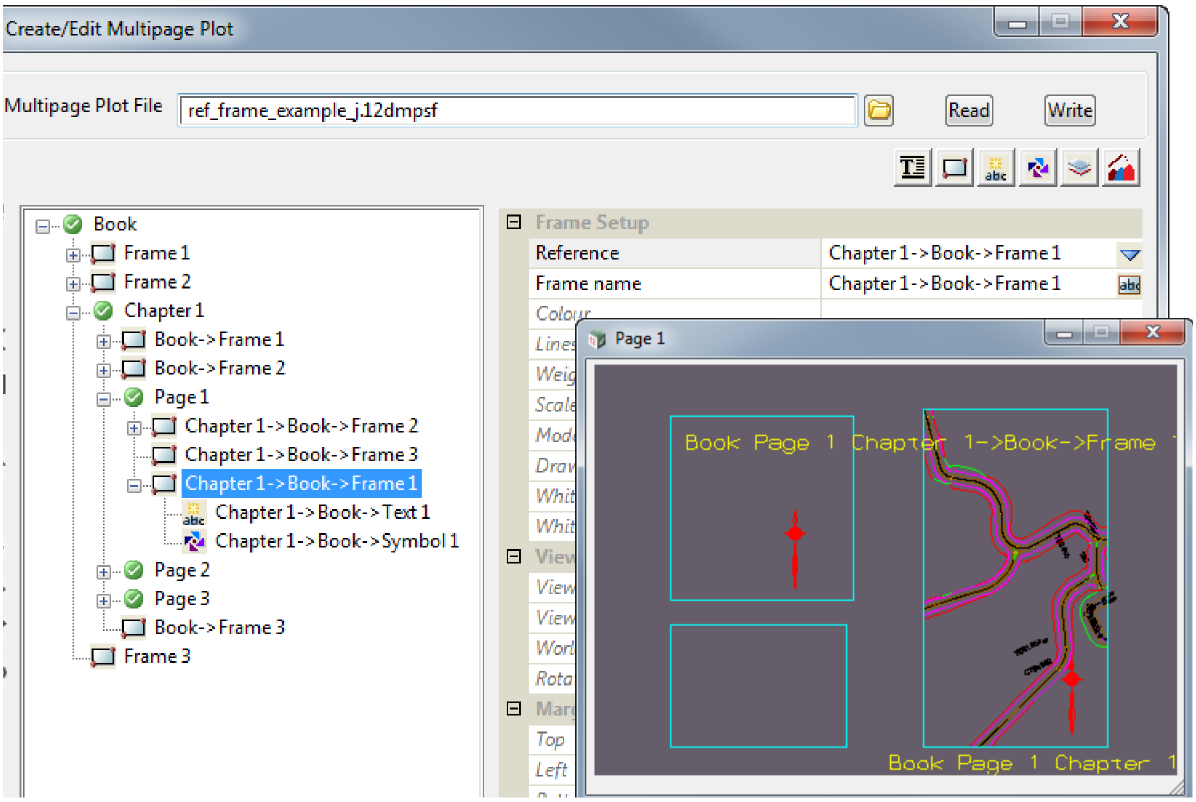
If you answer **No**, then the Frame is deleted and the Frames that reference it are left.

To add a Reference Frame to a Page, first click on the **Page** node, then the **Frame** icon and select **Plan Reference**, **X Reference** or **Long Reference**.

A **Reference Frame** node will be created at the bottom of the **Page** and the **Reference** field will be blank.



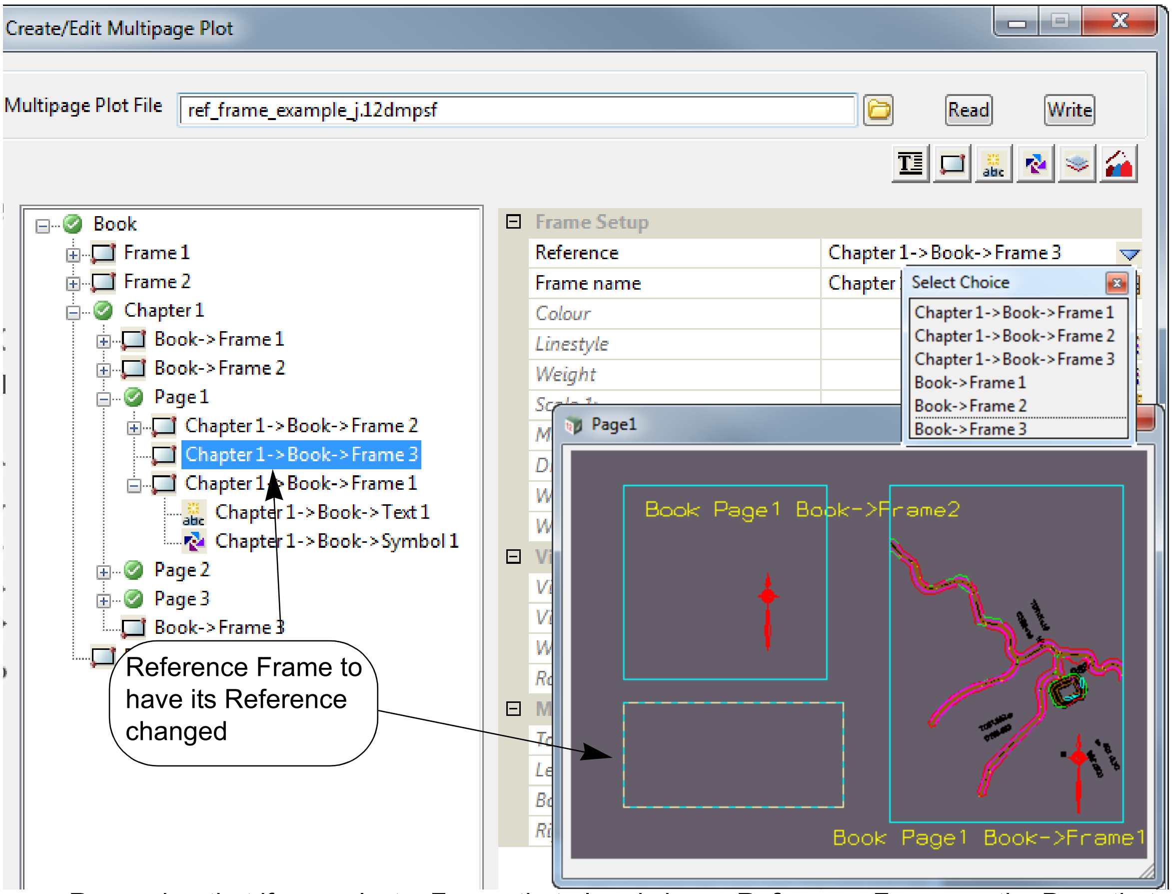
Click on the **Choice** icon for the **Reference** field and select the **Frame** you want to be the referenced from the list, and the referenced frame will appear on the **Plot Area** for the **Page**.



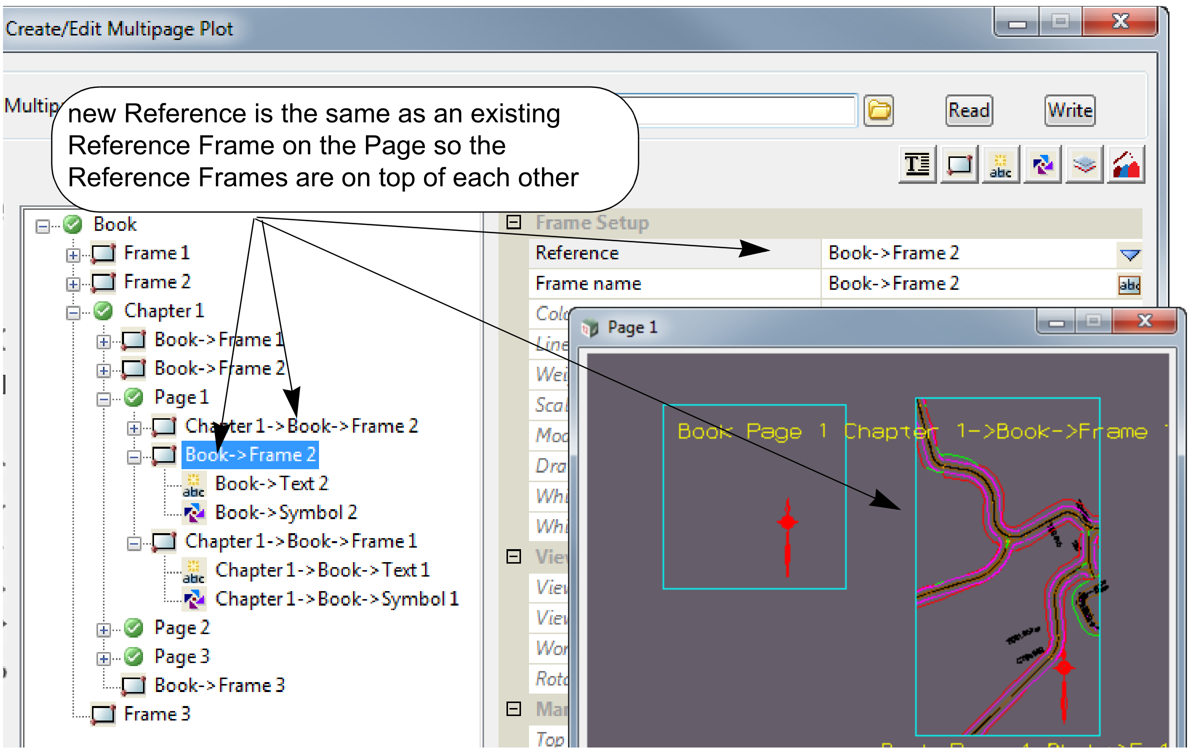
The ***Frame Setup***, ***View Details*** etc can then modified for the Reference Frame as required.

For more information on adding a **Reference Frame** to a **Chapter** or **Page**, see 21.1.4.7.2.2 Reference Frames for a Chapter or 21.1.4.7.3.2 Reference Frames for a Page.

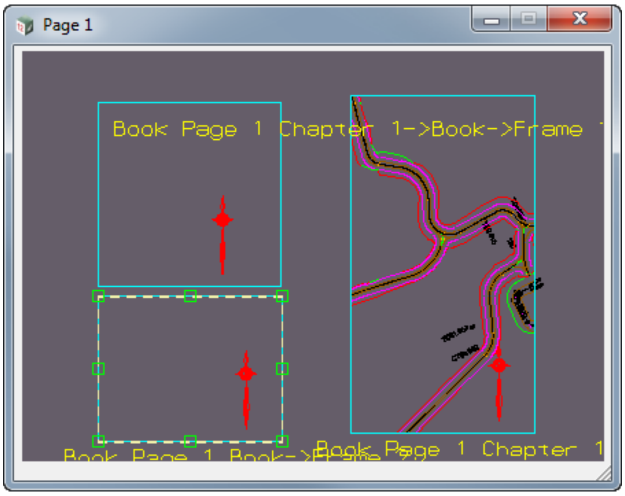
Finally the **Frame** that a **Reference Frame** references can be changed by clicking on the **Reference Frame** node and selecting another **Frame** in the **Reference** field.



Remember that if you select a **Frame** that already has a **Reference Frame** on the Page that references the same **Frame** then the new **Reference Frame** will probably be on top of the existing **Reference Frame** already on the **Page**.



One of the **Reference Frames** would then need to be moved and maybe resized on that **Page** so that you don’t get over plotting.



Continue to 23.2 Plans or return to 21.1 Multipage Plots (MPS).

22 PPF Editors

There has been changes to the **PPF Editors** chapter in the ***12d Model Reference manual***.

See 22.1 General Information on PPF Editors

See 22.2 Fields and Nodes Common to PPF Editors

See 22.3 Water Node Diagram PPF

See 22.4 Long Section Plot PPF Editor

See 22.5 Plot to Models - Long Section

22.1 General Information on PPF Editors

22.2 Fields and Nodes Common to PPF Editors

22.2.1 Title Blocks

22.2.1.1 Title Block Variables

22.2.1.1.1 Plot Details

22.2.1.1.1.1 X-Section Plots

$model_name variable has been added under X-Section Plots

$model_name // the name of the Model that the X-Sections are taken from for plotting

22.2.1.1.1.2 Water Node Diagrams

$horizontal_scale and **$model_name** variables has been added under Water Node Diagrams.

$horizontal_scale *// scale for the node diagram (1000/ppf scale)*

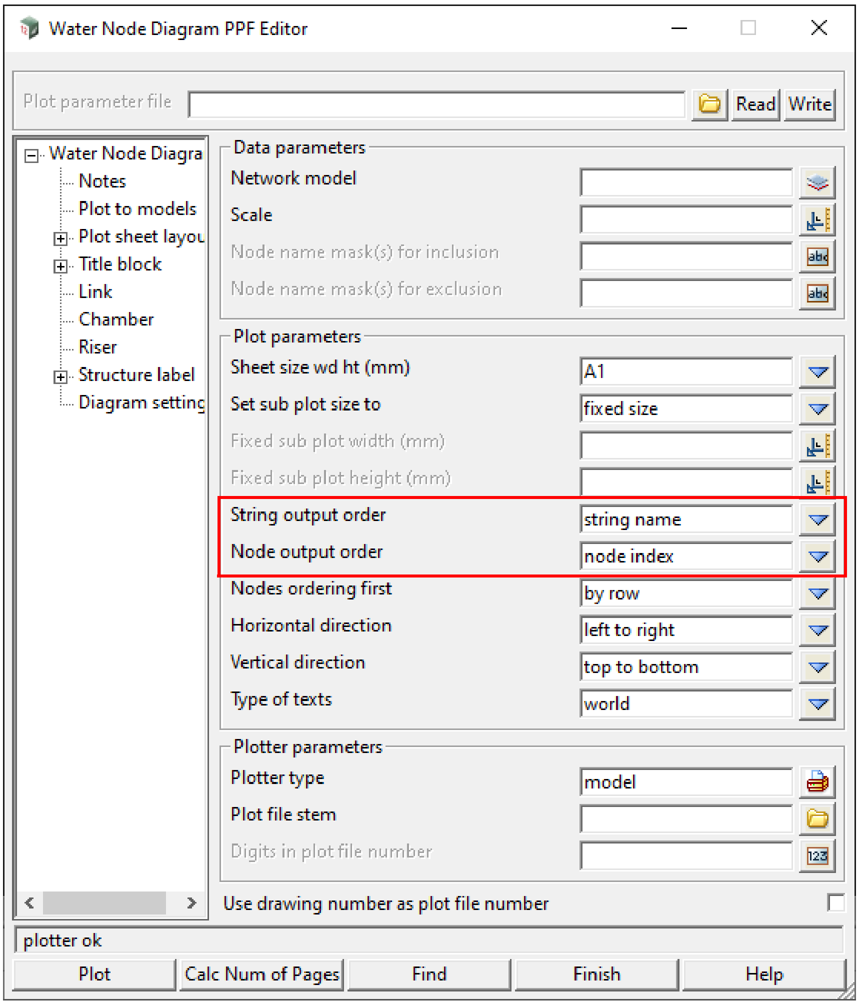
$model_name *// the name of the Network Model that the Nodes are taken from for plotting*

22.3 Water Node Diagram PPF

Position of option on menu: **Plot =>Plot and PPF Editors =>Water node diagram**

22.3.1 Water Node Diagram - Front Page

String output order and **Node output order** has been added to the *Water Node Diagram PPF Editor* panel.



The fields and buttons used in this section have the following functions.

Field Description	Type	Defaults	Pop-Up
String output order	choice box	string name	string name, upstream to downstream, downstream to upstream

*The order in which the water strings contained within the **Network model** are to be processed and plotted out.*

string name: *12d Model database string order.*

upstream to downstream: *most upstream branch line first. then repeatedly select the next most* *upstream branch line. trunk line last.*

downstream to upstream: *trunk line first. then repeatedly select the next most downstream branch line.*

Node output order	choice box	node index	node index, upstream to downstream, downstream to upstream

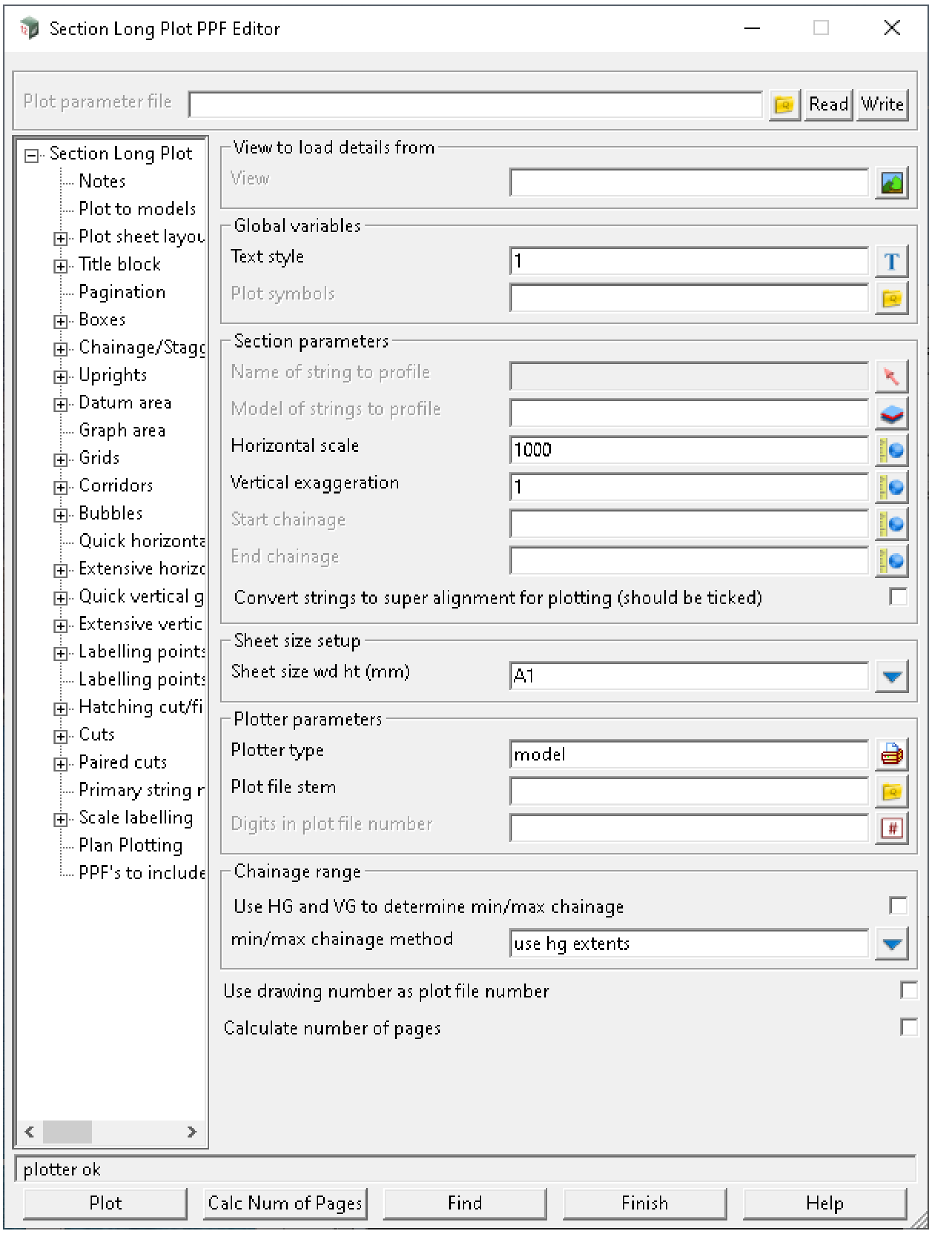
The order in which the nodes of each water string are to be processed and plotted out.

node index: *ascending order based on node index.*

upstream to downstream: *upstream end to downstream end of the water string.*

downstream to upstream: *downstream end to upstream end of the water string.*

22.4 Long Section Plot PPF Editor

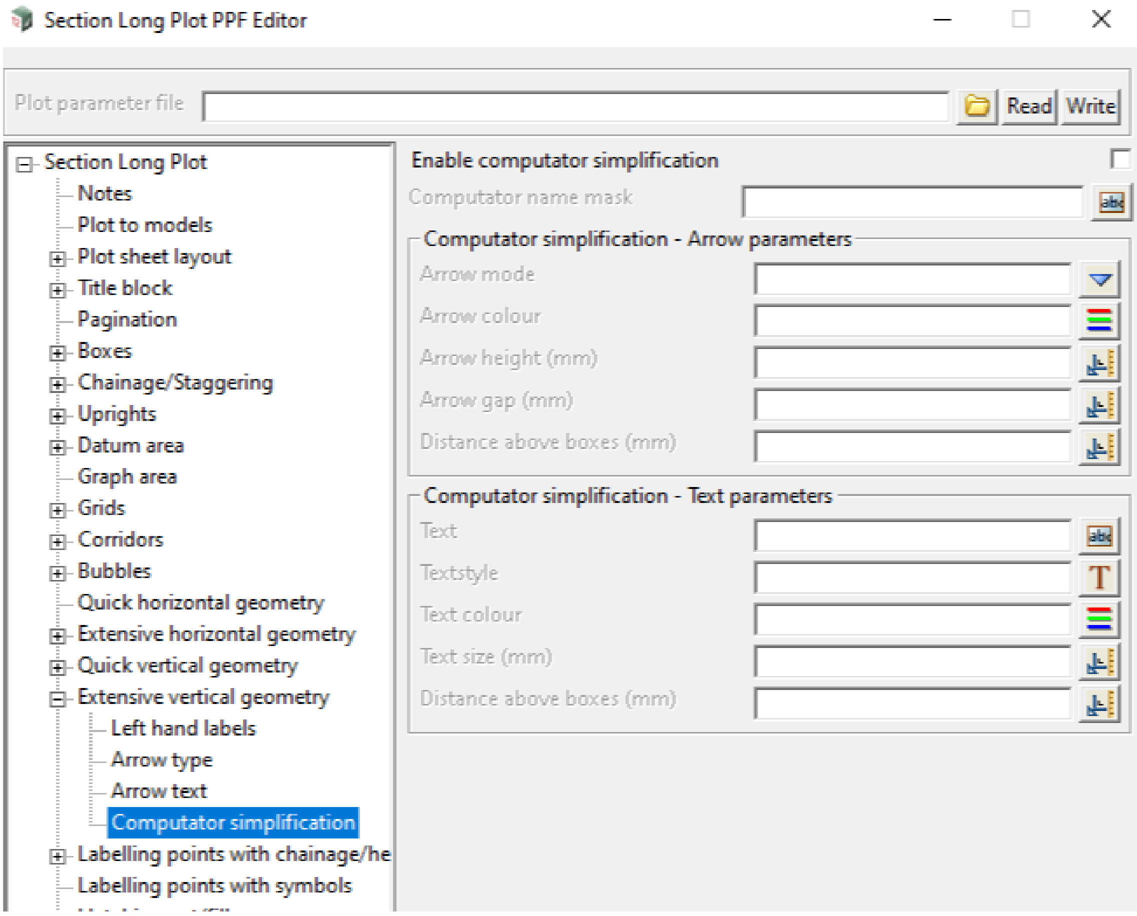


22.4.1 Extensive Vertical Geometry - Long Section

22.4.1.1 Extensive Vertical Geometry - Computator simplification

The extensive vertical geometry labelling can sometimes be too extensive when it comes to computators. The following options allow for the extensive vertical geometry of selected computators solved chainage range to be replaced by a simplified labelling scheme.

NOTE: Option may not perfectly handle complex cases of back-to-back computators where some are simplified and others are not.



Field Description	Type	Defaults	Pop-Up
Enable computator simplification	tick box	not ticked	

*If **ticked**, computator simplification will be performed.*

*if **not ticked**, then computator simplification will not be performed.*

Computator name mask text box

Identifies the computators to be simplified by matching the computator names against this mask.

supports partial matching. Does not support wildcards.

***NOTE**: if no mask is provided then all computators will be simplified.*

Computator simplification - Arrow parameters

The following options allow for customisation of the arrow that extends along the solved chainage range of the computator being simplified. If the computator straddles multiple Long Sections, then the *arrow will reflect this.*

Arrow mode choice box ticks ticks, arrows

*The style for the ends of the arrows. Either **ticks** or **arrows**.*

Arrow colour colour box GREEN_4D colour selection

The colour of the arrows.

Arrow height (mm) real box 1.5

The height of the ends of the arrows in millimetres.

Arrow gap (mm) real box 0

The length, in millimetres, of a desired gap in the arrows that extends outwards from the midpoint of the arrows range.

Distance above boxes (mm) real box -5

The distance above (or below) the top of the boxes that the arrows should be drawn. Can be positive or negative.

Computator simplification - Text parameters

The following options allow for customisation of the text that appears at the midpoint of the solved chainage range of the computator being simplified. If the computator straddles multiple Long Sections, then the text will appear at the midpoint of each arrow on each Long Section.

Text) text box

The text that will appear at the midpoint of the solved chainage range. If no text is specified, then no text will be drawn.

Textstyle textstyle box 1 text style selection

*The style of the **Text**.*

Text colour colour box WHITE_4D colour selection

*The colour of the **Text**.*

Text size (mm) real box 2.5

*The size of the **Text** in millimetres.*

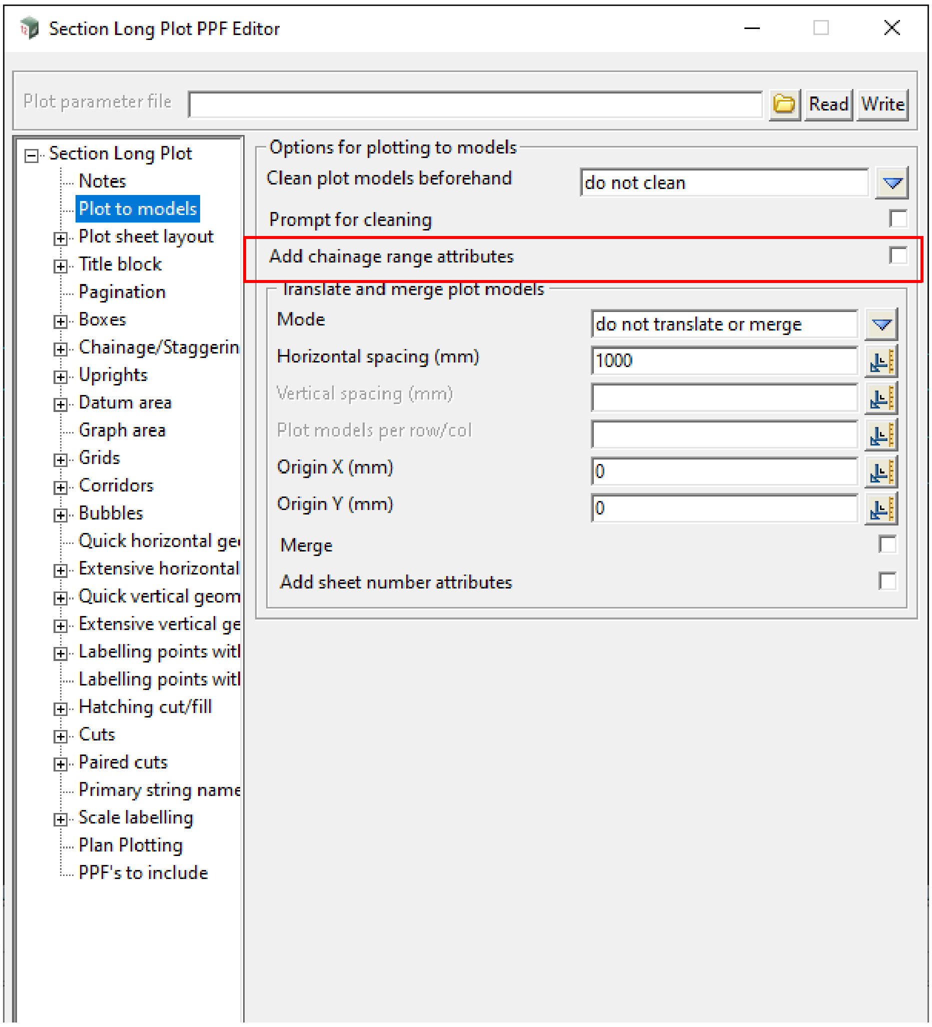
Distance above boxes (mm) real box -5

The distance above (or below) the top of the boxes that the Text should be drawn. Can be positive or negative.

22.5 Plot to Models - Long Section

This is documented for all the PPF Editors in **Plot to models.**

However, Long Section plots have an additional unique field in the Plot to Models node.



The columns for the fields documented in the sections are for.

Panel Field	Parameter name	Type	Pop-Up
Add chainage range attributes	chainage_range_attributes	tick box	

*If **ticked**, two **Real** attributes (**start_chainage** and **end_chainage**) will be added to every plot string in the produced plot models. Their values will be the start and end chainage of the section that is being plotted on each page.*

*if **not ticked**, the attributes will not be created.*

***Example**: plot strings on the first produced page that covers the chainage range of 0-400 will have the attribute values of start_chainage = 0.0 and end_chainage = 400.0. On the second produced page, that covers the 400-800 range, the string attributes will have the value of start_chainage = 400.0 and end_chainage = 800.0.*

23 Utilities

There has been changes to the **Utilities** chapter in the ***12d Model Reference manual***.

See

23.1 MetaConnex
23.2 Attributes Favourites
23.3 Conduit Banks from Attributes
23.4 Model from Attribute
23.5 Classify with Attributes
23.6 Convert Chain to Macro
23.7 Change Super Strings Closed
23.8 Real Attributes to Null
23.9 Regular Cuts Through Strings
23.10 Delete empty text attributes

23.1 MetaConnex

Position of option on menu: **Utilities =>MetaConnex**

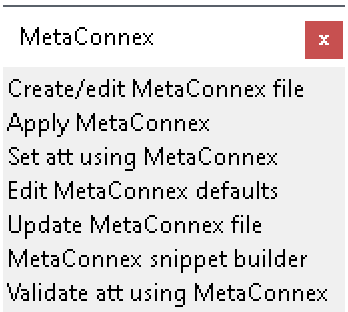
MetaConnex is a powerful tool for

(a) creating attributes for elements

and

(b) validating the existing attributes for elements.

The element (object) can be a string or a trimesh.

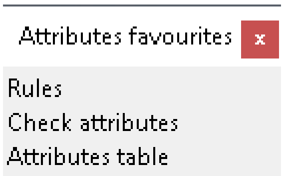


MetaConnex is documented in the V15 reference manual

Continue to 23.2 Attributes Favourites or return to 23 Utilities.

23.2 Attributes Favourites

Position of option on menu: **Utilities =>Attributes =>Favourites**



See
23.2.1 Attribute Rules
23.2.2 Attributes Query
23.2.3 Attributes Table

23.2.1 Attribute Rules

Position of option on menu: **Utilities =>Attributes =>Favourites =>Rules**

The **Attribute Rules** define what a set of rules (conditions) for element attributes. They are used in the panels **Attributes Table and Attributes Query.**

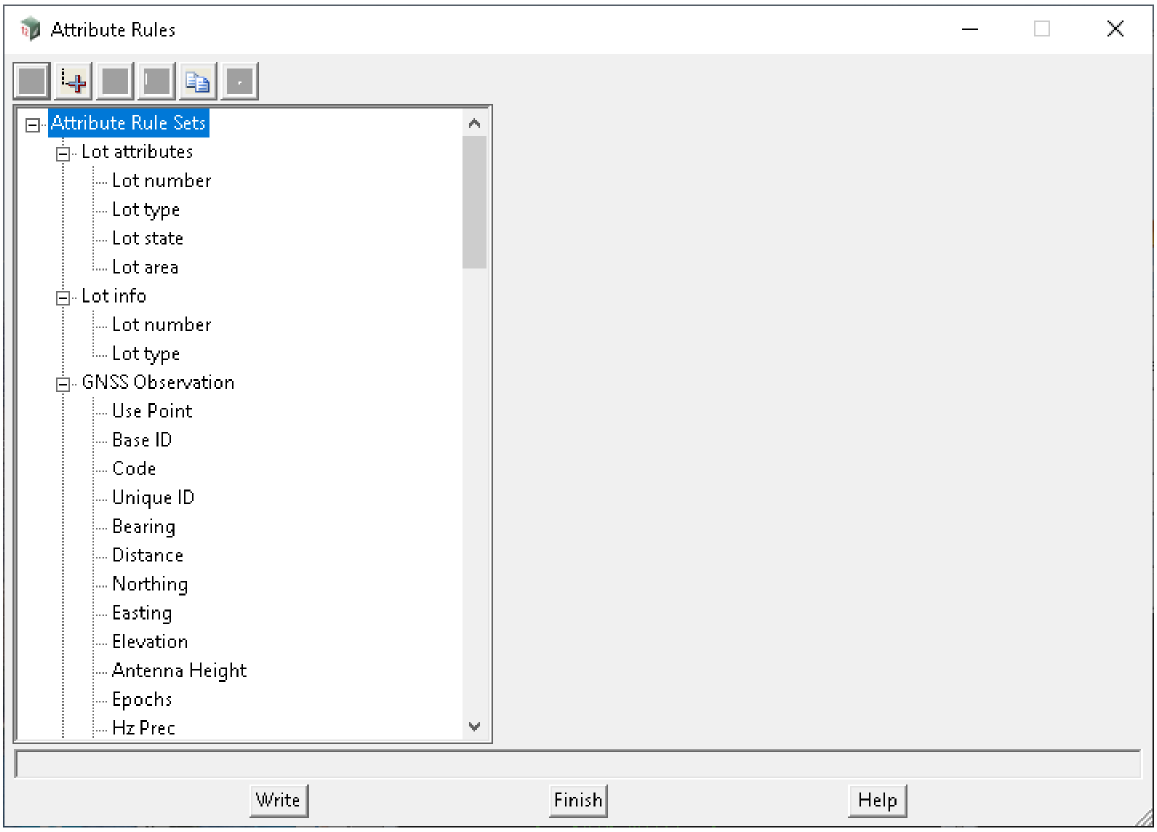
The **Attribute Rules** is a tree of *Attribute Rule Sets* and each set has a unique name.

The **Attributes Table** panel specifies which of the **Attribute Rule Sets** is to be used for a particular attributes edit.

The **Attribute Rules** are loaded from a file called **attribute_rules.xml** that is searched for as a standard **Set_Ups** file. See 45.2 Files for Setting Up 12d.

Note: It should be similar to Clash Detection Rules, see 29.11.10.1.2 Clash Detection Rules.

Selecting **Rules** brings up the **Attribute Rules** panel



Write Button at Bottom

When the **Write** *button is selected, a* **Write Setup File** *panel comes up to specify where the* ***attribute_rules.xml*** *file is to be written out to.*

For the choices on the panel, see 45.2.6 Writing Out Setup Files.

Reload of panels using attribute rules is required for the new file to take effect.

Attribute Rule Sets Tree

(a) Attribute Rule Set

A **Attribute Rule Set** is defined at the first level of the **Attribute Rule Sets** tree and each **Attribute Rule Set** must have a unique name. One **Attribute Rule Set** is selected in the

Attributes Table

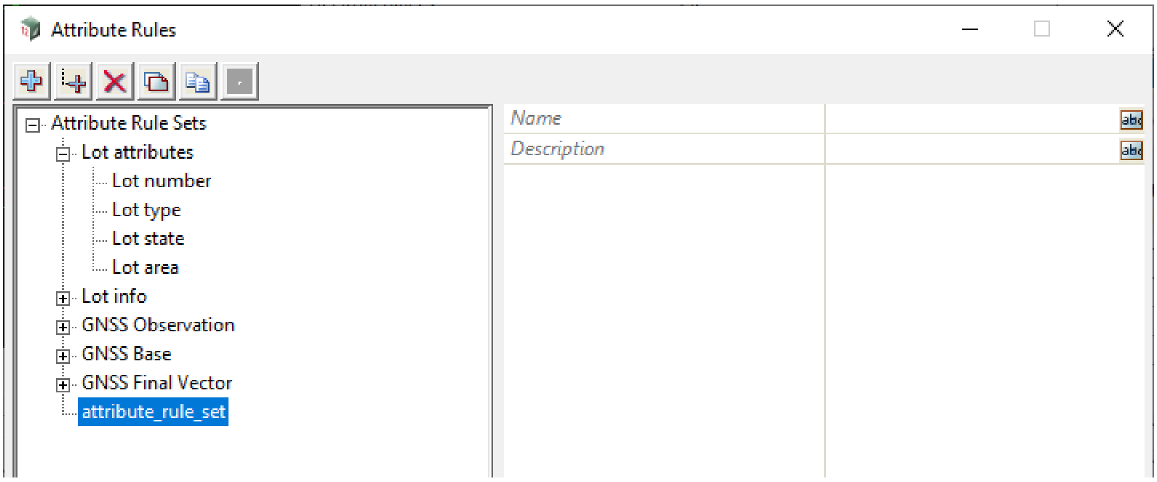
panel to provide the rules to be used for a particular attributes edit (see Attributes Table).

A new Attribute Rule Set is created by clicking and highlighting the top level *Attribute Rules Sets* and

then pressing the **Add Child** icon, or by clicking on and highlighting a first level *Attribute Rule Set* and then pressing the **Add** icon.

A new *Attribute Rules Set* with the dummy name **attribute_rule_set** is then created and a

new name must be entered in the **Name** field on the right hand side of the tree. The **Description** is optional.



The fields and buttons used in the right hand side of the panel for a **Attribute Rule Set** has the following functions.

Field Description	Type	Defaults	Pop-Up
Name	text box		

Name of the rule set. This must be unique within the sets of rules.

Field Description	Type	Defaults	Pop-Up
Description	text box		

Description of the rule set.

(b) Rules in an Attribute Rule Set

The rules for a named Attribute Rule Set as defined as second level items under the *Attribute Rule*

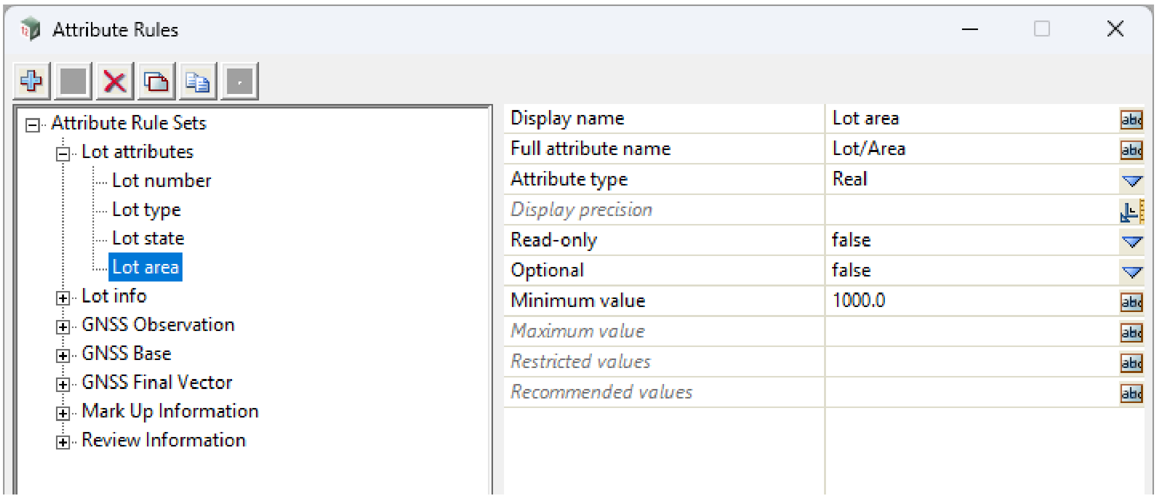
Set. The rules define what is meant by a particular attribute group.

A new *Rule* is created by clicking and highlighting the named *Attribute Rules Set* and then

pressing the **Add Child** icon, or by clicking on and highlighting a Rule already in the named

Attribute Rule Set and then pressing the **Add** icon.

A new *Rule* with the dummy name **attribute _rule** is then created and a new name must be entered in the **Name** field on the right hand side of the tree. The **Description** is optional.



The fields and buttons used in the right hand side of the panel for a **Clash Rule** has the following functions.

Field Description	Type	Defaults	Pop-Up
Display name	text box		

Name of the rule.

Full attribute name	text box		

Full attribute name this rule will be applied upon.

Attribute type	choice box		

*If **not blank**, the rule check for matching type of attribute.*

Display precision	long box		

*If **not blank**, real attribute value will be displayed with the number of decimal places specified. The default is 3 (when the field is blank).*

Read-only	yes/no box		

Allow the attribute being edited or not.

Optional	yes/no box		

*If **yes**, the attribute can be omitted, otherwise, a valid value must be provided.*

Minimum value	double box		

*If **not blank**, attribute value must not be less than the specified value.*

Maximum value	double box		

*If **not blank**, attribute value must not be greater than the specified value.*

Restricted value	choice box		

*If **not blank**, attribute value must be one of the values from the list.*

Recommended value	choice box		

*If **not blank**, attribute value should be one of the values from the list.*

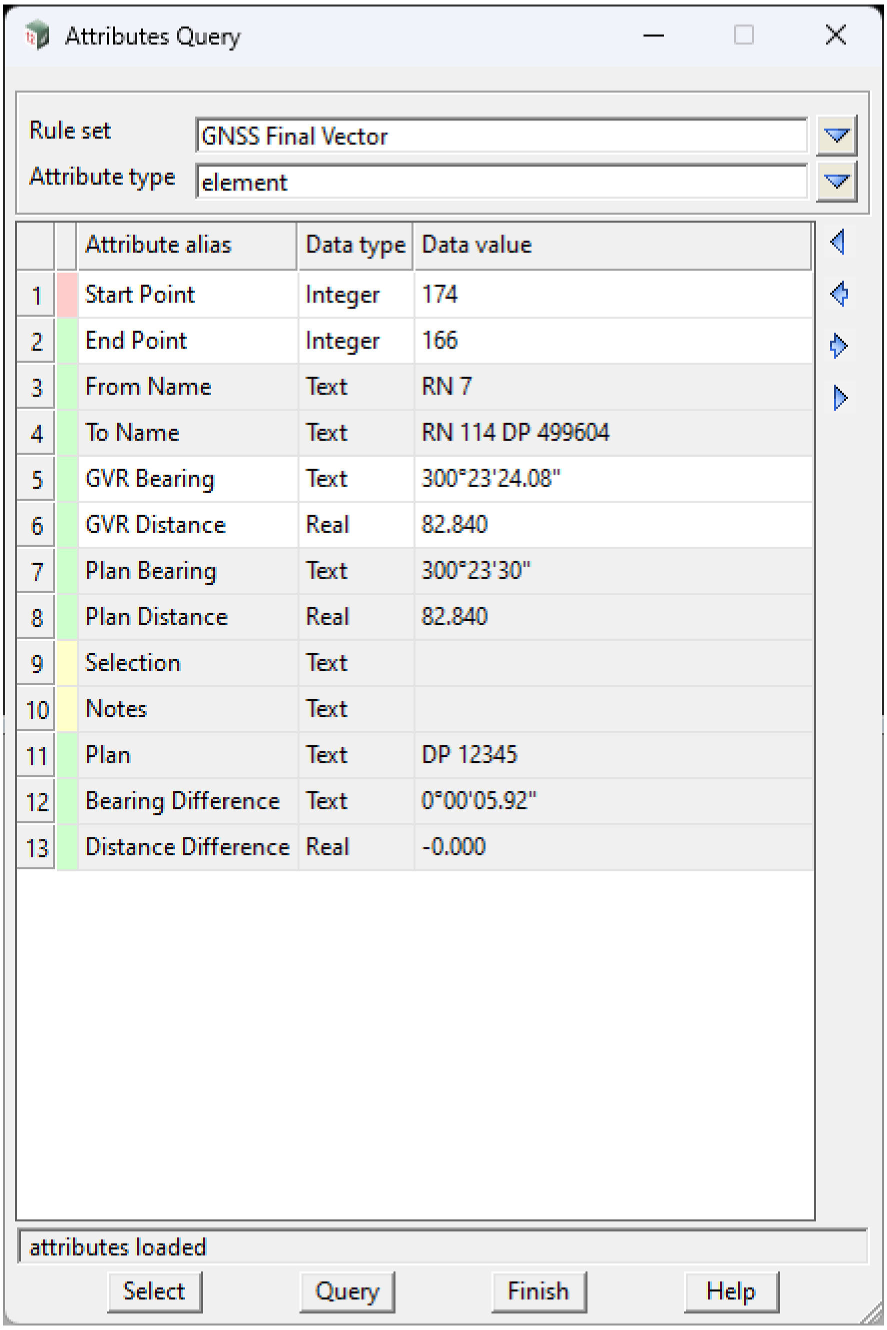
Continue to 23.2.2 Attributes Query or return to 23.2 Attributes Favourites.

23.2.2 Attributes Query

Position of option on menu: **Utilities =>Attributes =>Favourites =>Check attributes**

The **Attributes Query** takes a set of rules (conditions) from the file **attribute_rules.xml** and applies it to the selected element or segment/vertex of the element.

Selecting **Check attributes** brings up the **Attributes Query** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Rule set	choice box		List of rule sets available

Name of the rule set being used for the query.

Attribute type choice box element element, segment, vertex

Type of attributes being queried.

Grid area

Grid grid box

There are 4 columns on the grid.

*The first column is **colour** coded.*

Green indicates the attribute is within the rule.

Yellow indicates the attribute is within the rule but outside the recommendations.

Red indicates the attribute is outside the boundary of the rule.

***Alias** column shows the alias name of the attribute.*

***Data type** column shows the type of the attribute.*

***Data value** column shows the value of the attribute.*

Buttons on the right-hand side of the Grid

First button

Go to the first element (of the model) or first segment/vertex (of the element).

Prev button

Go to the previous element or previous segment/vertex.

Next button

Go to the next element or the next segment/vertex.

Last button

Go to the last element (of the model) or last segment/vertex (of the element).

Buttons at Bottom

Select button

Select the element or segment/vertex to query the attributes defined in the selected rule set.

Query button

Refresh the attributes information to reflect the latest changes.

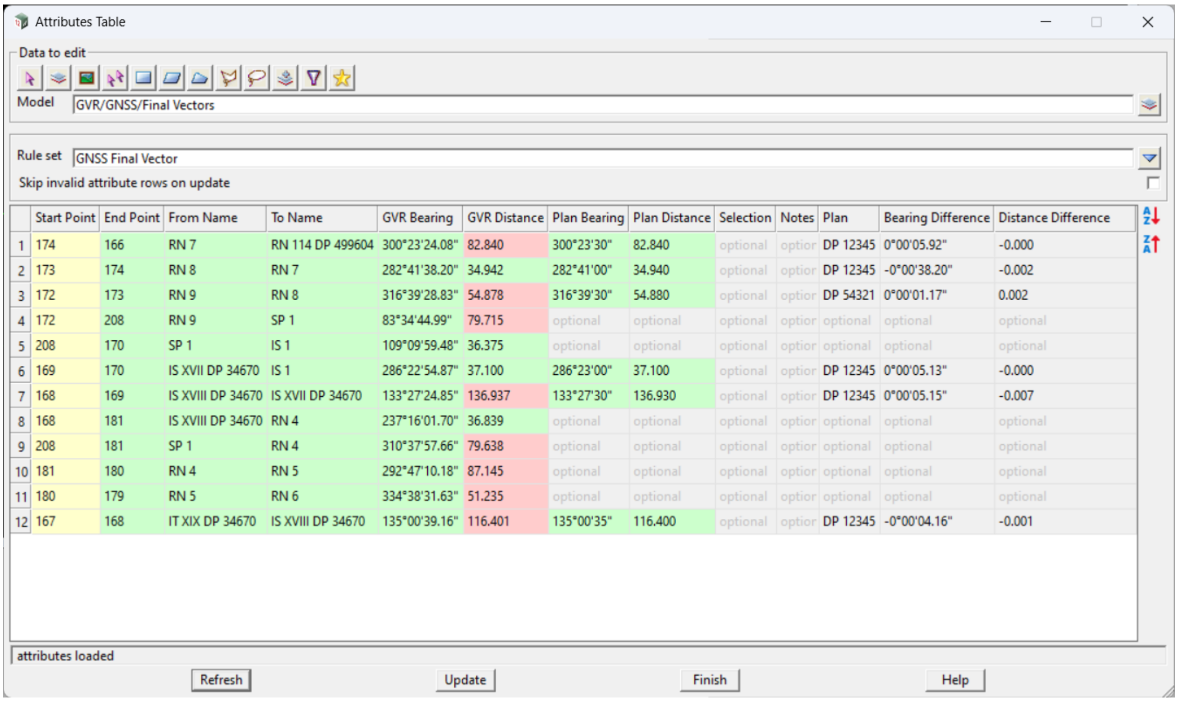
Continue to 23.2.3 Attributes Table or return to 23.2 Attributes Favourites.

23.2.3 Attributes Table

Position of option on menu: **Utilities =>Attributes =>Favourites =>Attributes table**

The **Attributes Table** takes a data source and a set of rules (conditions) from the file **attribute_rules.xml** and applies it to the selected elements in a table format. Attribute values then can be modified and updated.

Selecting **Attributes table** brings up the **Attributes Table** panel.



	Start Point	End Point	From Name	To Name	GVR Bearing	GVR Distance	Plan Bearing	Plan Distance	Selection	Notes	Plan	Bearing Difference	Distance Difference
1	174	166	RN 7	RN 114 DP 499604	300°23'24.08"	82.840	300°23'30"	82.840	optional	optior	DP 12345	0°00'05.92"	-0.000
2	173	174	RN 8	RN 7	282°41'38.20"	34.942	282°41'00"	34.940	optional	optior	DP 12345	-0°00'38.20"	-0.002
3	172	173	RN 9	RN 8	316°39'28.83"	54.878	316°39'30"	54.880	optional	optior	DP 54321	0°00'01.17"	0.002
4	172	208	RN 9	SP 1	83°34'44.99"	79.715	optional	optional	optional	optior	optional	optional	optional
5	208	170	SP 1	IS 1	109°09'59.48"	36.375	optional	optional	optional	optior	optional	optional	optional
6	169	170	IS XVII DP 34670	IS 1	286°22'54.87"	37.100	286°23'00"	37.100	optional	optior	DP 12345	0°00'05.13"	-0.000
7	168	169	IS XVIII DP 34670	IS XVII DP 34670	133°27'24.85"	136.937	133°27'30"	136.930	optional	optior	DP 12345	0°00'05.15"	-0.007
8	168	181	IS XVIII DP 34670	RN 4	237°16'01.70"	36.839	optional	optional	optional	optior	optional	optional	optional
9	208	181	SP 1	RN 4	310°37'57.66"	79.638	optional	optional	optional	optior	optional	optional	optional
10	181	180	RN 4	RN 5	292°47'10.18"	87.145	optional	optional	optional	optior	optional	optional	optional
11	180	179	RN 5	RN 6	334°38'31.63"	51.235	optional	optional	optional	optior	optional	optional	optional
12	167	168	IT XIX DP 34670	IS XVIII DP 34670	135°00'39.16"	116.401	135°00'35"	116.400	optional	optior	DP 12345	-0°00'04.16"	-0.001

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to edit	source box		

Data selection type - for a full description go to 3.26.3 Data Source.

Rule set	choice box		List of rule sets available

Name of the rule set being used for the query.

Skip invalid attribute rows on update tick box not ticked

*If **ticked**, invalid attribute data row will be ignored (i.e. the underline element attributes won't be updated)*

*If **not ticked**, all attribute data rows will be checked and nothing will be updated unless all rows passed the test*

Grid area

Grid grid box

The number of columns is the same as number of rules in the rule set. Each column is associated with a rule. Each cell of the table is the representation of an element attribute value. Each cell has a background colour which present the state of the attribute according to the rule.

***Green** indicates the attribute is within the rule.*

Yellow *indicates the attribute is within the rule but outside the recommendations.*

Red *indicates the attribute is outside the boundary of the rule and grey is for optional or read-only value.*

Buttons at Bottom

Refresh button

Load the elements attributes information and redraw the table.

Update button

Validate values in the table and update underline elements attributes.

Continue to 23.3 Conduit Banks from Attributes or return to 23.2 Attributes Favourites.

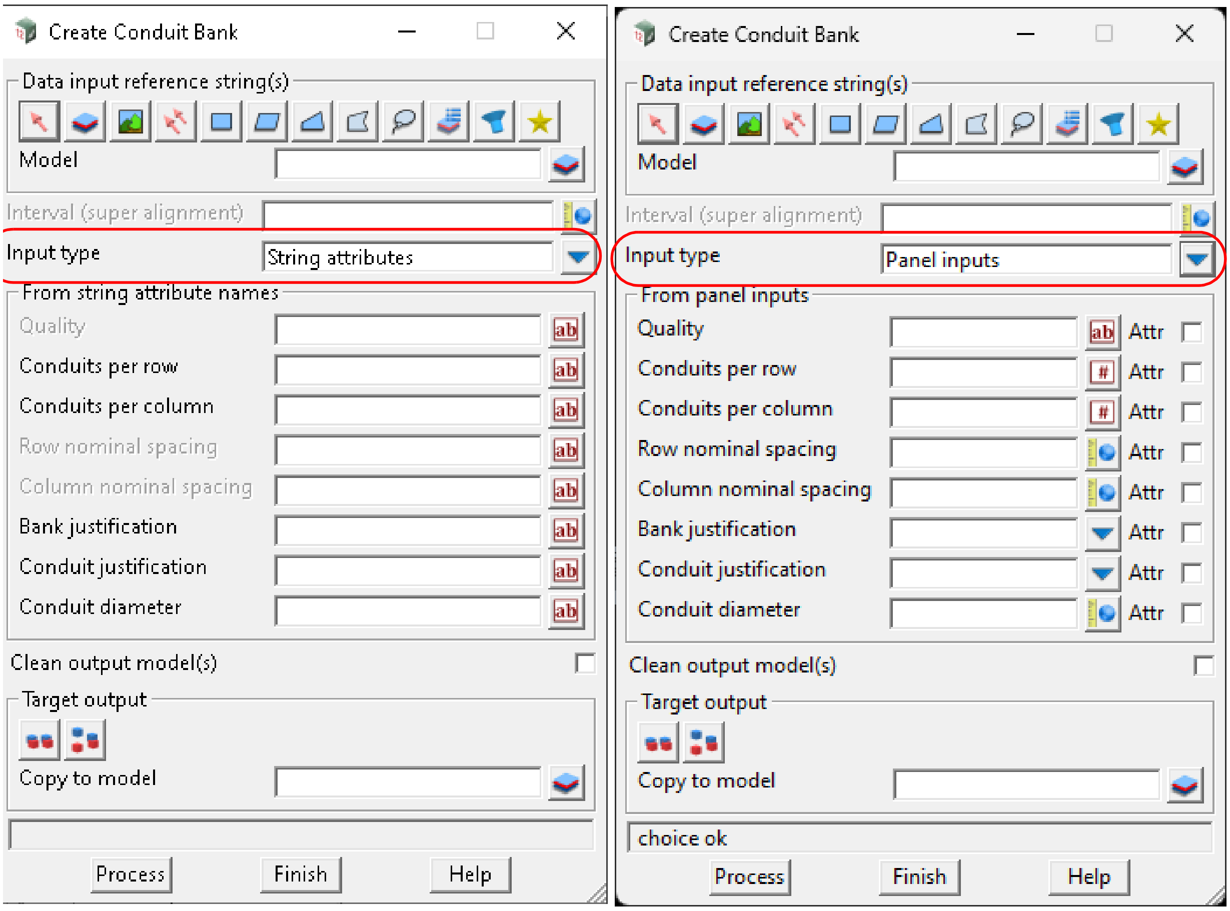
23.3 Conduit Banks from Attributes

Position of option on menu: **Utilities =>Attributes =>Conduit banks from attributes**

This option creates conduit banks around selected strings.

The data defining the conduit banks can come from string attributes, user input, or a combination of the two.

Selecting the **Conduit banks from attributes** brings up the **Create Conduit Bank** panel.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Data input reference string(S) data source

The super string(s) to create the conduits relative to.

For a full description go to 3.26.3 Data Source.

Selected data source input Model

Source of data to process.

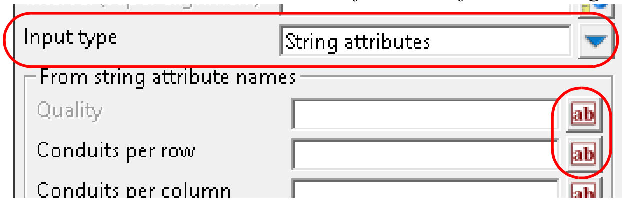
Interval (super alignment) real box

*The **chainage interval** when super alignments are selected. The smaller the interval, the more accurate the conduit banks created.*

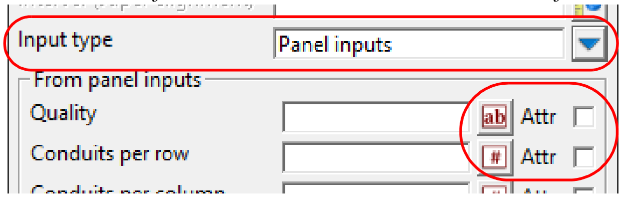
*The **Interval** field is not used for super strings.*

Input type choice box String attributes, Panel inputs

*If **String attributes** is selected, the text in the fields are for the string attribute to use for the value.*



*If **Panel input** is selected, the fields will have and an **Attr** tick box after the icon for the field.*



Attr tick box

*If **not ticked**, the value is taken from what is typed into the field.*

*If **ticked**, the value is taken from the name of string attribute typed into the field.*

The icon on the type will change based on the type of the field. The typed in values are saved independently for each field.

Note:

Fields for string attributes in both modes will automatically synchronize when changes are made in either mode.

Quality text or attribute name

*Text for conduit quality **or** the name of the attribute that contains the conduit quality.*

Conduits per row integer or attribute name

*Number of conduits for each row **or** the name of the attribute that contains the number of conduits for each row.*

Conduits per column integer or attribute name

*Number of conduits for each column **or** the name of the attribute that contains the number of conduits for each column.*

Row nominal spacing real or attribute name

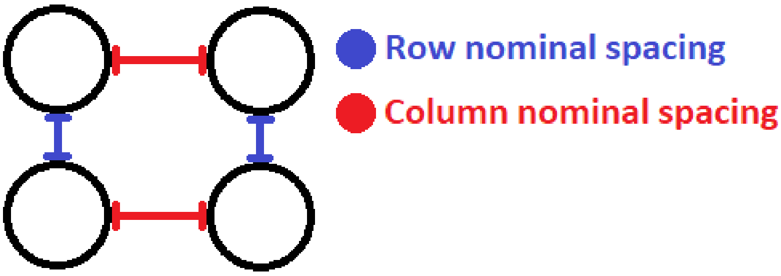
*Distance between each row of conduits **or** the name of the attribute that contains the distance between each row of conduits.*

*If **blank**, a default value of **0.05** is used.*

Column nominal spacing real or attribute name

*Distance between each column of conduits **or** the name of the attribute that contains the distance between each column of conduits.*

*If **blank**, a default value of 0.05 is used.*



Bank justification text or attribute name

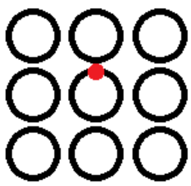
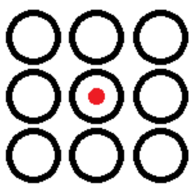
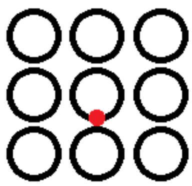
*Text **or** name of the text attribute, for the justification of the conduit bank relative to the entire conduit bank for the selected reference string.*

*Allowed values are "**top**", "**centre**" or "**bottom**".*

Conduit justification text or attribute name

*Text **or** name of the text attribute, for the justification for the conduit bank relative to a single conduit for the selected reference string.*

*Allowed values are "**top**", "**centre**" or "**bottom**".*

Bank Justification	Top	Top	Top
Conduit Justification	Top	Centre	Bottom
			
Bank Justification	Centre	Centre	Centre
Conduit Justification	Top	Centre	Bottom
			
Bank Justification	Bottom	Bottom	Bottom
Conduit Justification	Top	Centre	Bottom
			

Conduit diameter real or attribute name

*Diameter of every conduit in the bank **or** the name of the attribute that contains the diameter of every conduit in the bank.*

Clean output model(s) tick box not ticked

Clean all elements from the output model(s) before adding the conduits to the output model(s).

Target output target output Copy to original model/s

Copy to one model

*If **Copy to original model/s**, conduits will be created in the model of their reference string.*
*If **Copy to one model**, conduits will be created in the user specified model.*

For a full description go to 3.26.4 Data Target.

Buttons at Bottom

Process button

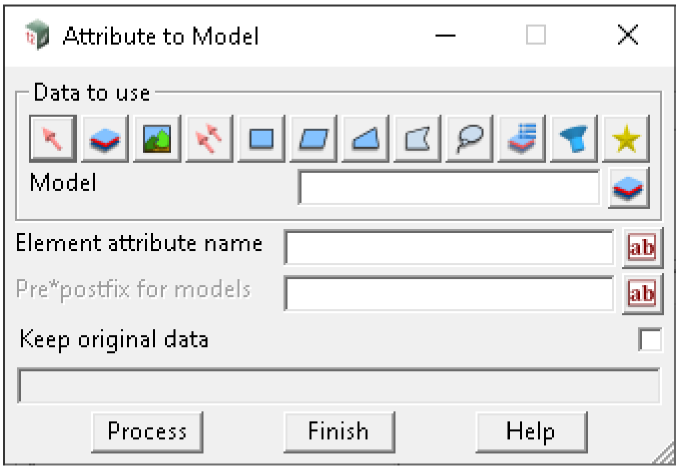
Process the option.

23.4 Model from Attribute

Position of option on menu: **Utilities =>Attributes =>Model from attribute**

For an element, this option uses the value of a attribute as the new model for the element.

Note that the attribute value may not be a valid model name. In that case, characters in the attribute value that can’t be part of a valid model name are replaced by spaces.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data to translate data source

Data selection type.

Selected data source input Model

Data source for data to have an attribute value used as a model name.

String attribute name text box

The name of the attribute whose value is to be used as the model for he element.

Pre*postfix for model text box

*The model name given by the attribute is pre*postfixed by this text.*

Keep original data tick box

*If **ticked**, the original data is kept in the original models and a copy of the data is placed in the new model.*

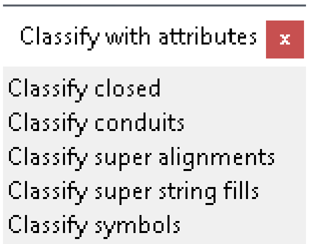
*If **not ticked**, the data is moved to the new model.*

Buttons at Bottom

Process button

When Process is pressed, the selected data is copied/moved to the model given by the attribute value.

23.5 Classify with Attributes



See

23.5.1 Set String Closed Attribute

23.5.2 Classify Super String Fills

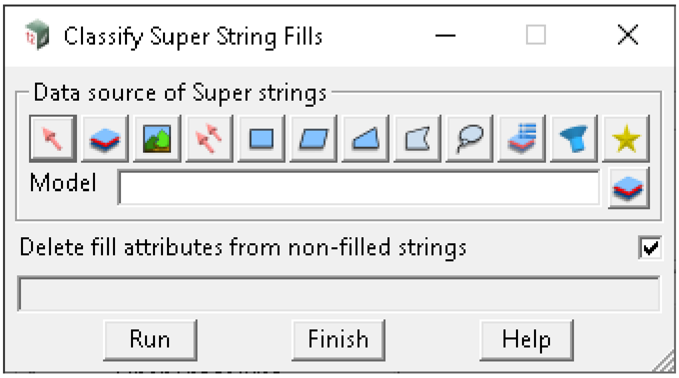
23.5.1 Set String Closed Attribute

Position of option on menu: **Utilities =>A-G =>Classify with attributes =>Classify closed**

Position of option on menu: **Utilities =>Attributes =>Classify with attributes =>Classify closed**

This option sets the integer attribute **Closed** on Super strings, based on whether or not the string is closed. An integer value of 1 is set if the string is closed, otherwise 0.

On selecting the **Classify closed** option, the **Set String Closed Attribute** panel is displayed.



The fields and buttons used in the panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to Attribute	data source		

Data selection type.

Selected data source	input	Model	

Source of data to be processed.

Buttons at Bottom

Run	button		

Runs the option.

23.5.2 Classify Super String Fills

Position of option on menu: **Utilities =>A-G =>Classify with attributes =>Classify super string fills**

Position of option on menu: **Utilities =>Attributes =>Classify with attributes =>Classify super string fills**

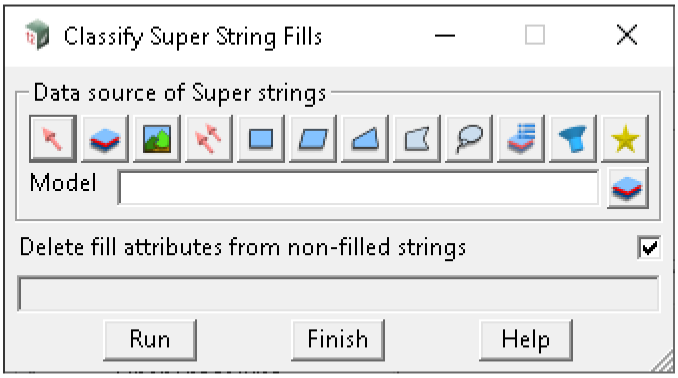
This option sets attributes on **Super** strings with solid fill.

String attributes set are:

solid fill colour (text) on all **Super** strings set with solid fill dimension.

solid fill blend (real) on all **Super** strings set with solid fill dimension.

On selecting the **Classify fills** option, the **Classify Super String Fills** panel is displayed.



The fields and buttons used in the panel have the following functions.

Field Description Type Defaults Pop-Up

Data source of Super strings data source

Data selection type.

Selected data source input Model

Source of data to be processed

Delete fill attributes from non-filled strings tick box ticked

Whether to delete the above mentioned string attributes (if present) from strings without fill.

Buttons at Bottom

Run button

Runs the option.

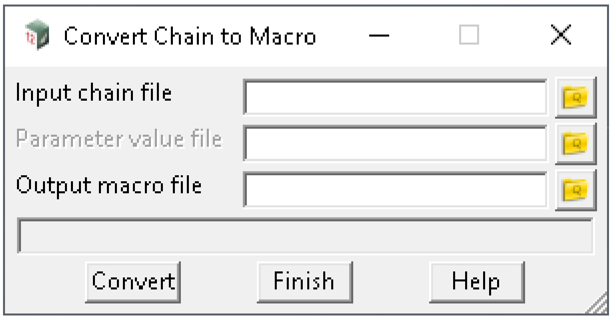
23.6 Convert Chain to Macro

Position of option on menu: **Utilities =>Chains =>Convert chain to macro**

Chains that call macros and/or macros that call chains can have problems running when there is no way of knowing what should be finished first.

For many chains, the **Convert chain to macro** option converts such problematic chains to a macro, and the macro can then be run instead of the chain.

Selecting **Convert chain to macro** bring up the **Convert Chain to Macro** panel.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Input chain file	file box		available *.chain, *.rcn files

Name of the chain to convert to a macro.

Parameter value file	file box		available *.pvf files

Parameter file to use with the chain.

Output macro file	file box		available *.4dm

Name of the macro file for the converted chain.

Buttons at Bottom

Convert button

Convert chain to a macro.

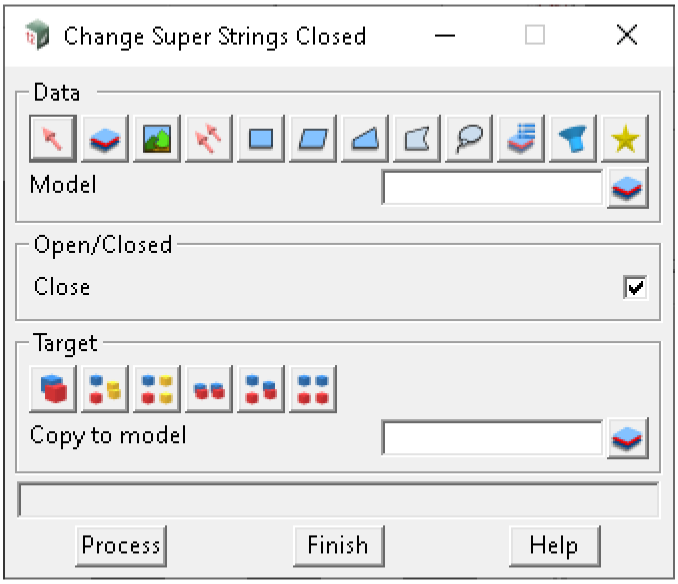
23.7 Change Super Strings Closed

Position of option on menu: **Utilities =>Super strings =>Close/open super strings**

Position of option on menu: **Utilities =>A-G =>Close**

Open and close multiple super strings in one.

Selecting **Close** brings up the **Change Super Strings Closed** panel.



The fields and buttons used in the panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data	data source		

Data selection type.

Selected data source	input	Model	

Source of data to be processed.

Closed	tick box	ticked	

States whether the strings will be closed or opened.

*If **ticked**, the strings will be closed.*

*If **not ticked**, the strings will be opened.*

Target type

Data target type.

Target info	input		

Extra information required for the target.

Buttons at Bottom

Process	button		

When pressed, the strings are processed to be opened/closed.

23.8 Real Attributes to Null

Position of option on menu: **Utilities =>Attributes =>Real attributes to null**

Used to convert real values that have been imported to ***12d Model*** (i.e. via 12da import) to a null value.

The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Model of strings	model box		available models

The model to check real attribute values for.

Field Description	Type	Defaults	Pop-Up
Real att value to null	real box	-999	

Real value to substitute with Null, wherever it occurs (vertex / segment / string attributes).

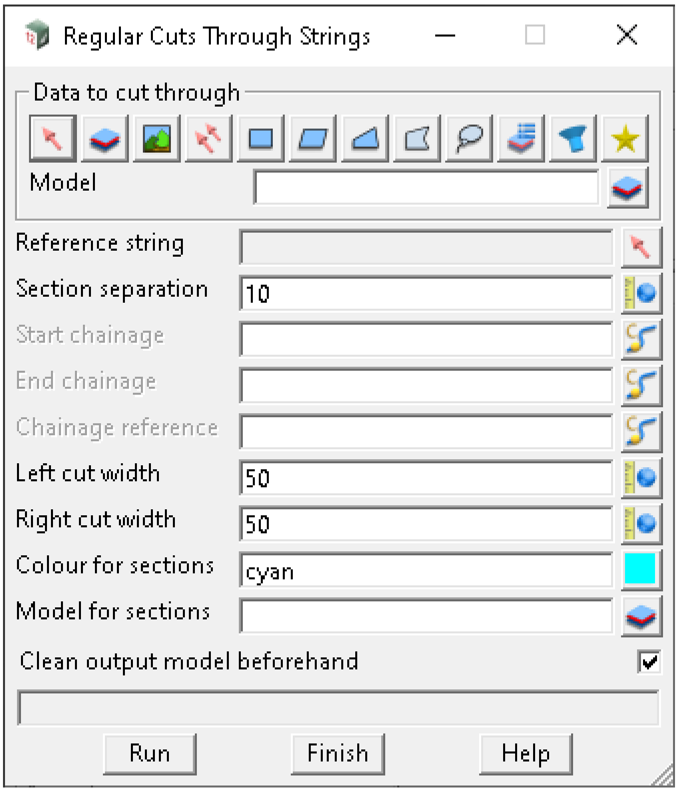
23.9 Regular Cuts Through Strings

Position of option on menu: **Utilities =>A-G =>Cuts =>by centreline (regular)**

Design =>X-sections =>Cuts =>X-section from regular cuts thru strings

This option creates x-section strings by cutting through a selection of strings, at regular intervals along a reference string.

Selecting **by centreline (regular)** displays the **Regular Cuts Through Strings** panel.



The fields and buttons used in this panel have the following functions

Field Description	Type	Defaults	Pop-Up

Data to cut through data source

*Use the most appropriate **12d Model** data selection method, to select the strings to be cut through. The strings should have z-values. For a full description of data source go to* 3.26.3 Data Source.

Selected data source input Model

Source of data to be processed.

Reference string select box

The string from which the regular chainages are defined. The x-section strings will be normal to the reference string.

Section separation real box 10

The regular chainage interval at which to cut the x-sections.

Start chainage chainage box

The lowest chainage value from which the regular x-sections will be cut. Optional - if unspecified, the start chainage of the reference string is used, which is the lowest acceptable value.

End chainage chainage box

The highest chainage value from which the regular x-sections will be cut. Optional - if unspecified, the end chainage of the reference string is used, which is the highest acceptable value.

Chainage reference chainage box

Each chainage within the set of regular chainages, is defined as an integer multiple of the section separation, plus this reference value. For example, if the reference is specified as 5, with the default separation of 10, the regular chainages are …, -15, -5, 5, 15, 25, …, etc. Optional - if unspecified, zero is used.

Left cut width real box 50

Maximum distance to the left of the reference string, to search for strings to cut through.

Right cut width real box 50

Maximum distance to the right of the reference string, to search for strings to cut through.

Colour for sections colour box cyan available colours

Colour for the x-section strings.

Model for sections model box available models

Model in which to create the x-section strings.

Clean output model beforehand tick box ticked

Whether to clean the output model of x-section strings beforehand.

Buttons at Bottom

Run button

Runs the option.

Finish button

Removes the panel from the screen.

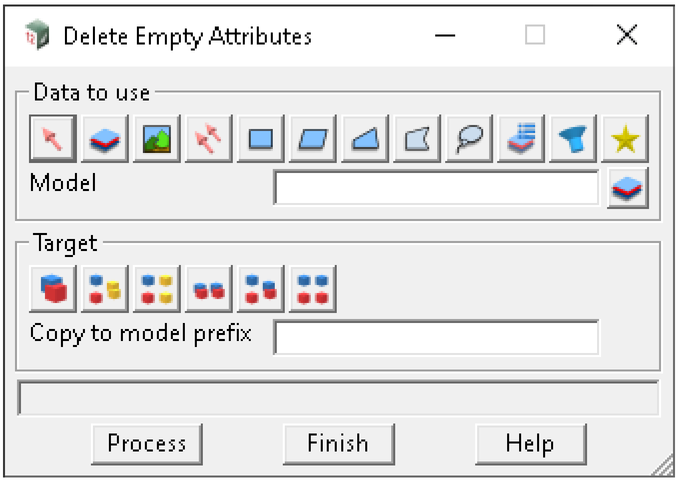
Help button

Launches the 12d help for the option.

23.10 Delete empty text attributes

Position of option on menu: **Utilities =>Attributes =>Delete empty text attributes**

The option **Delete empty text attributes** deletes text attributes from the selected data that have no value (empty). String, segment (link) and vertex (pit) attributes are processed.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Data to use	data source		

Data selection type - for a full description go to 3.26.3 Data Source.

Selected data source	input	Model	

Source of data to be used.

Target type

Data selection type - for a full description go to 3.26.3 Data Source.

Target info	input		

Extra information required for the target.

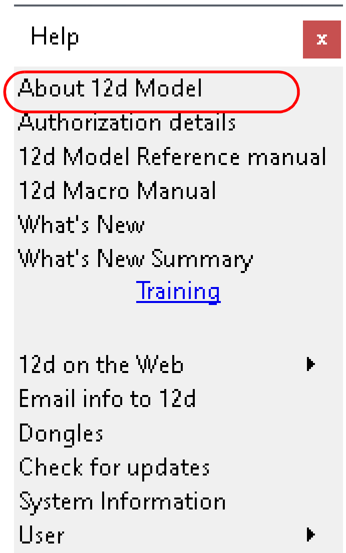
Buttons at Bottom

Process	button		

Run the process.

24 Help

There has been changes to the **Help** chapter in the ***12d Model Reference manual***.



See
24.1 About 12d Model
24.2 Check for updates

24.1 About 12d Model

Position of option on menu: **Help =>About 12d Model**

The menu item **About 12d Model** has been moved to the top of the **Help** menu.

24.2 Check for updates

Position of option on menu: **Help =>Check for updates**

The menu item **Check for Updates** has been added to the **Help** menu.

Clicking on the option will check if there is a new version available or not.

25 Setting Up

There has been changes to the **Setting Up** chapter in the ***12d Model Reference manual***.

25.1 Environment Variables

25.1.1 Alphabetical Environment Variables List

ALLOW_CONVERT_CHAINAGES_TO_DROPPED_XY_REF_4D

ALLOW_CONVERT_CHAINAGES_TO_DROPPED_XY_REF_4D value 0 or 1

if not zero, when using the template modifiers edit panel and RB on the row number column the option to convert the highlighted chainage/s to **Drop Point to Reference String** smart chainages will be added to the pop up "Edit row" menu.

CENTRELINE_ATTACH_APPLY_ATTRIBUTES_4D

CENTRELINE_ATTACH_APPLY_ATTRIBUTES_4D integer default 1

if **ticked**, standard apply details such as string lengths and polygon areas are added as an attribute group with the name of the MTF file, e.g. ROAD01.MTF to the apply reference string.

OPTIONS_LOGGING_FLUSH_COUNTER_4D

OPTIONS_LOGGING_FLUSH_COUNTER_4D integer 16

the logging file will be flushed every 16th line written.

So if you want to force a file flush after every line written, set OPTIONS_LOGGING_FLUSH_COUNTER_4D to 0

OPTIONS_LOGGING_FLUSH_INTERVAL_4D

OPTIONS_LOGGING_FLUSH_INTERVAL_4D integer 8

the logging file will be flushed to disk once 8 seconds has past since the last flush.

Note: this is only checked when attempting to write a line to the file.

REMEMBER_MTF_COLUMN_SIZE_4D

REMEMBER_MTF_COLUMN_SIZE_4D 0 or **1**

If ticked, and either REMEMBER_MTF_PANEL_SIZE_4D or REMEMBER_MTF_PANEL_SIZE_ON_OK_4D are set the width of the current columns are recorded and used when the panel is opened again.

Note: the panel positions are stored in the working directory file **mtf_panel_sizes.4d**

The default value is 0.

SHOW_SYNERGY_FILE_SYSTEM_EXECUTION_TIME_4D

SHOW_SYNERGY_FILE_SYSTEM_EXECUTION_TIME_4D 0/1

this will add lines to the current options.txt file as to the start and completion of each 12d Synergy call.

Very useful when diagnosing how long each call takes.

Note: the interaction with the following environment variables:

TOPMOST_BUTTON_LIST_4D

TOPMOST_BUTTON_LIST_4D text

A list of topmost most buttons to show in order of display and the text to display on screen for the button, the list is whitespace separated and contains pairs of the button id and screen text. It is an error if the list does not contain an even number of entries.

The available buttons ids are left_mouse_button, middle_mouse_button, right_mouse_button, enter_button, escape_button, typed_input_button, shift_next_mouse_button, control_next_mouse_button, middle_next_mouse_button right_next_mouse_button

For example, to display the right mouse button, enter and escape keys on screen as RMB, ENT & ESC the entry would be as such:

right_mouse_button RMB enter_button ENT escape_button ESC

USE_SYSTEM_IMAGE_FILE_CACHE_4D

USE_SYSTEM_IMAGE_FILE_CACHE_4D value 0, **1**

The purpose of this variable is to reduce the number of file system/synergy calls made when searching for an image for toolbars, main menu, view buttons, and others.

The folders normally searched is covered in Chapter 44 "Setting up and Configuring 12d", section 44.2.5 "Searching Order for Setup Files"

Within this search order, the program will search within sub-folders images\

If **not zero**, the existance of all these icon images is precomputed only once after env.4d or env_config is read. Thus, when a particular image is needed, its folder location can be known without searching.

If **zero**, the search occurs in the same way as earlier version of ***12d Model***.

Additionally, since the existance of all icon image files is recomputed, adding any new images into any folder within the Searching Order will not be found.

Work arounds are, restart 12d, change themes.

26 12d Survey Guide

The information contained in this chapter outlines the general options, terminology, definitions and methods used by***12d Model*** for the purpose of inputting survey data, and reducing the survey data to produce super strings and reports.

The guide covers the process using the ***12d Field*** option and also the background information required when ***12d Field*** is not being used to produce the survey data on a survey instrument.

For ***non-12d Field*** users, the chapter 42 12d and Survey Instruments contains the formation on how to pick up data on specific instruments so that the survey data can be used and reduced in ***12d Model***.

See

26.1 An Overview of Surveying and Reduction
26.2 Survey Reduction in 12d Model
26.3 Field Coding for 12d Model
26.4 Field Data Commands
26.5 Field Data Commands and 12d Field File Opcodes

Continue to 26.2 Survey Reduction in 12d Model.

26.1 An Overview of Surveying and Reduction

See

26.1.1 Collecting Survey Data in the Field
26.1.2 What is Survey Reduction?

26.1.1 Collecting Survey Data in the Field

Total Stations (**TPS**) and **GNSS** (GPS, Glonass etc) instruments are used to collect information in the field.

See

26.1.1.1 Total Stations - TPS
26.1.1.2 GNSS (GPS, Glonass etc)

26.1.1.1 Total Stations - TPS

Total station instruments (TPS) are used to measure the **vertical angle**, **horizontal angle** and **slope distance** to a point.

But what exactly are these values?

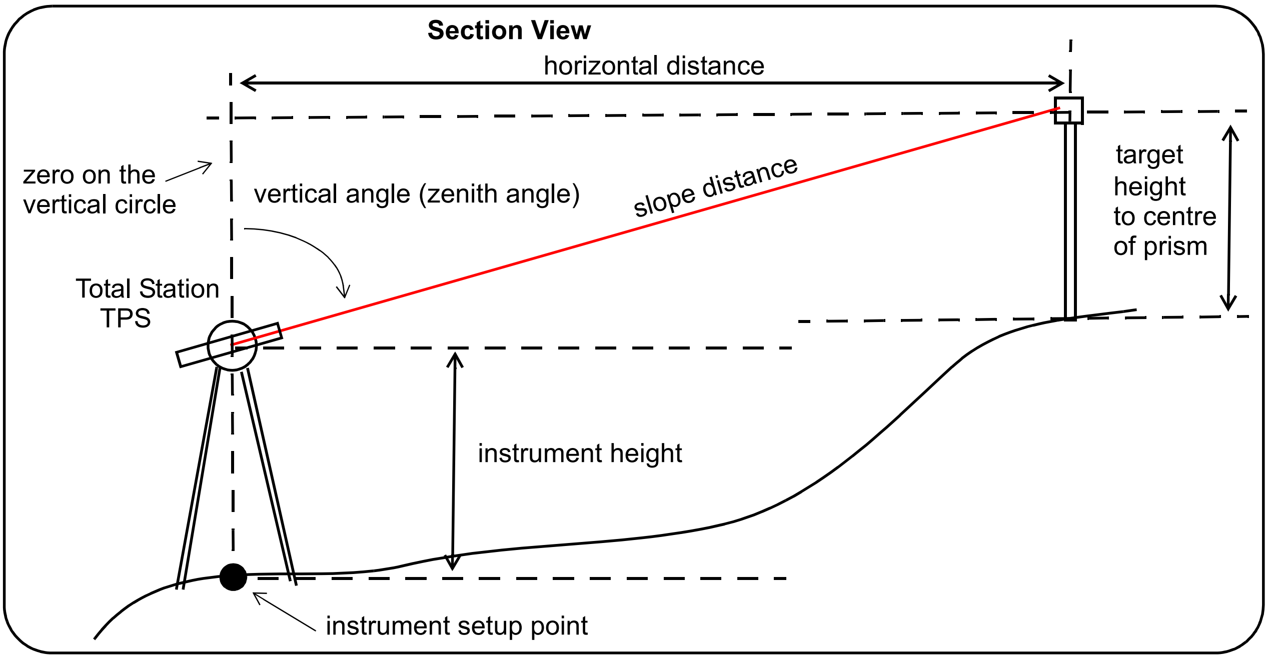
A TPS is set up over a point whose coordinates are known (or will be known) - the **instrument setup point**.

The TPS itself is mounted on plate that is levelled horizontally, and a plumb bob used so that the centre of the instrument is over the setup point. The distance form the centre of the instrument to the setup point is the ***instrument height***.

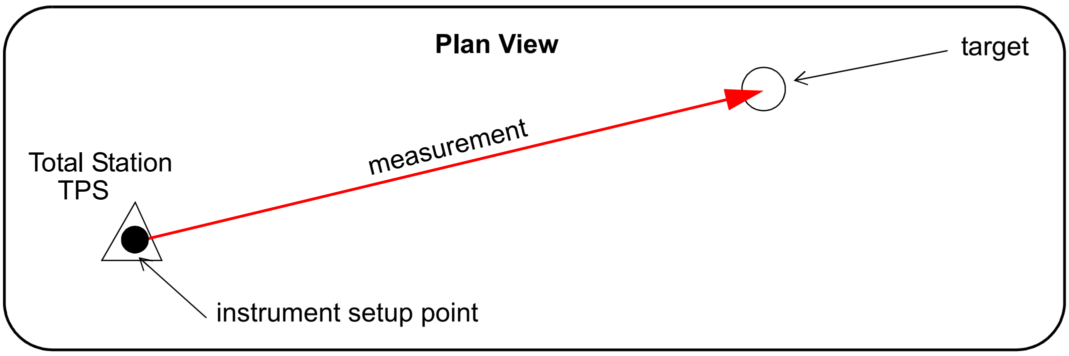
The TPS uses a laser to shoot to the centre of a prism that is mounted on a pole (pogo) that is kept vertical and the distance from the TPS to the centre of the prism on the pole is the **slope distance**.

The distance from the centre of the prism to the ground is the **target height**.

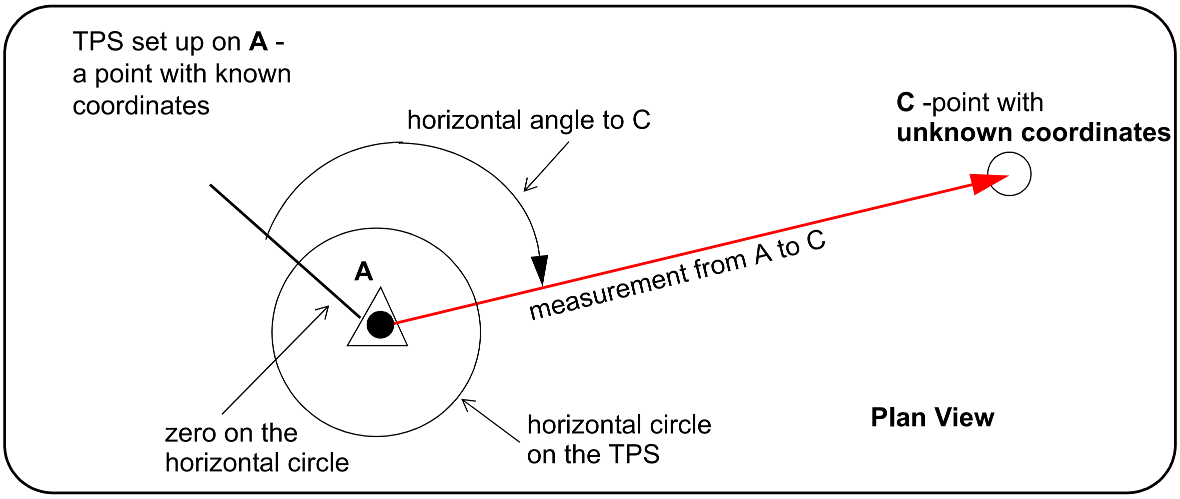
The **vertical circle** is used for measuring the vertical angle and it is set up in the vertical plane so that the zero of the vertical circle is on the plumb line. The **vertical angle** is the angle measured from zero to the line of the measurement. This is also known as the **zenith angle**.



horizontal_distance = **slope_distance x sin** (**vertical_angle**)



For the TPS, the **horizontal circle** is on the horizontal plate with a zero marked on it, and when the instrument is turned to measure to a point, then it is the angle turned through from zero that is the **horizontal angle** for the measurement.



Note that unlike the vertical circle, there is no natural zero for the horizontal circle and so the horizontal angles are only angles relative to where ever the zero was placed.

Hence TPS instruments measure slope distances, vertical angles and **relative horizontal angles** from the instrument.

So even though the coordinates of the setup point, A, are known and the horizontal angle, the vertical angle and the slope distance known, the **coordinates of C can't be calculated**. All you know is that C lies on the **circle around A**.

There are any number of ways you could get additional information to find where C lies on the circle. For example, you could observe C from three different instrument setups and C would be at the intersection of the three circles.

But the most common method used is much easier and only requires that from the same instrument set up, you can make a measurement to another point, **B**, **whose (x,y) coordinates are known**.

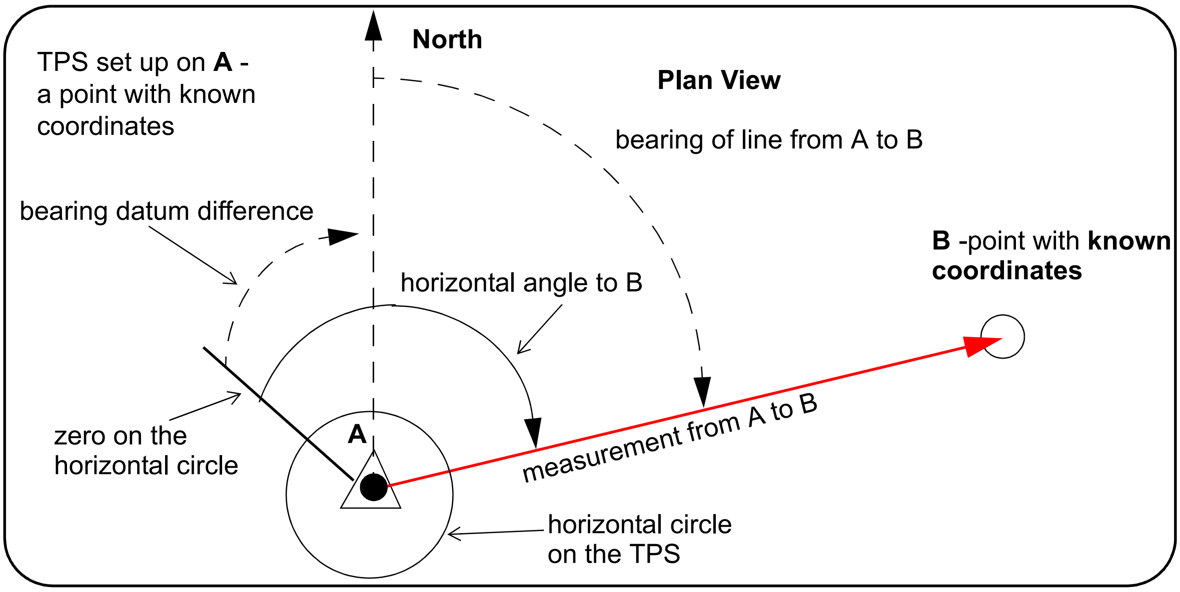
In fact, you only need the **horizontal angle to the known point B**.

This is called a **backsight**.

The theory is as follows:

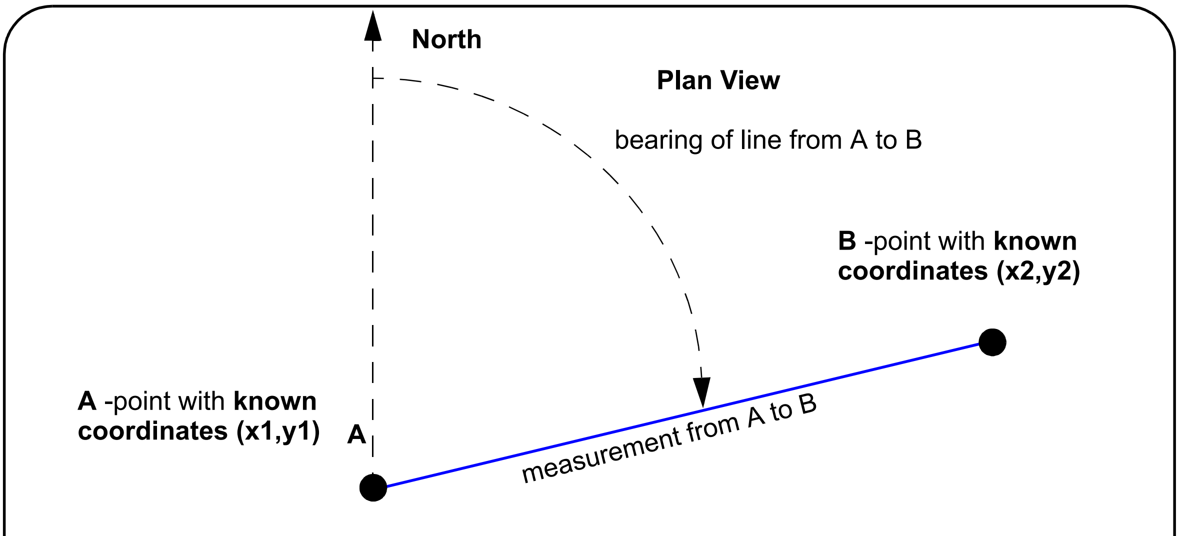
Backsight - Bearing Datum Difference

.



Because you know the (x,y) coordinates of **A** and **B,** you can calculate the **clockwise angle** that the line **AB** makes from the Y-axis (North). This is called the **bearing** of the line from **A** to **B**.

.



Bearing of line from A to B $= \left(\frac{\pi}{2} - \operatorname{atanh}\frac{y2 - y1}{x2 - x1}\right)$

You observe the point **B** from the setup point **A** and measure the horizontal angle to **B**.

The **bearing datum difference** is defined to be the **difference** between the **bearing** of the line from **A to B**, and the **horizontal angle** from **A to B**. That is,

Bearing datum difference = **(horizontal angle of B observed from A) - (bearing of line AB)**

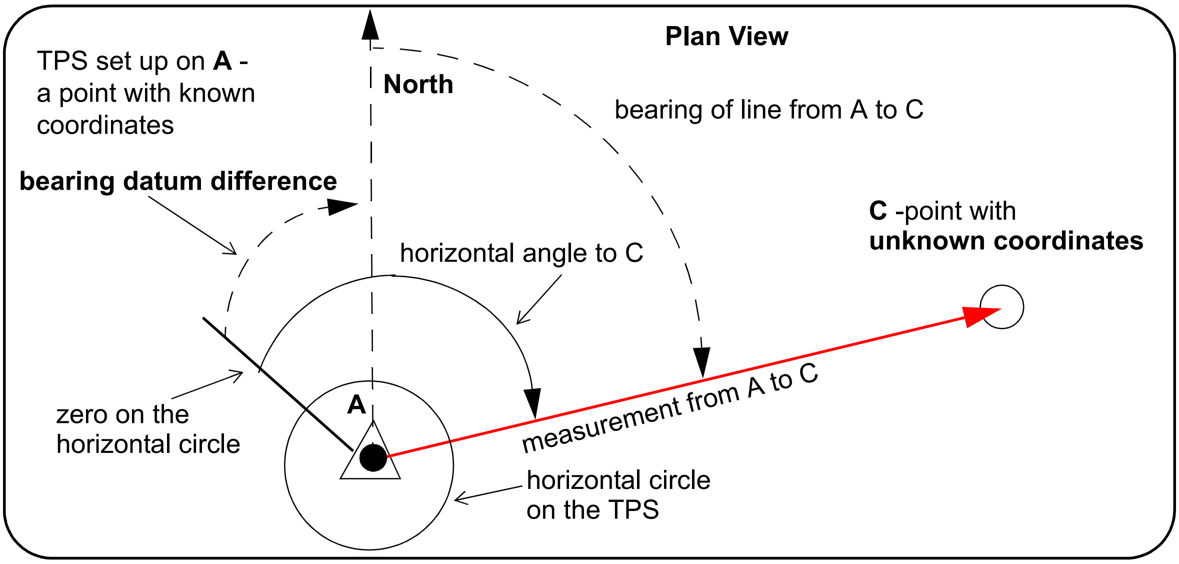
Because both the bearing of the line **AB** and the horizontal angle for **B** are both known quantities, the **bearing datum difference is a known value.**

How is the bearing datum difference used?

If you now measure from the same setup at A, to a point **C with unknown coordinates**, you measure the **horizontal angle from A to C**.

And using the known bearing datum difference, you can calculate the bearing of the line from A to C.

(bearing of line AC) = **(horizontal angle of C observed from A)** **-** **Bearing datum difference**



So using the **bearing data difference** for the instrument setup at **A**, you can turn the **relative horizontal angle** into an **absolute bearing** and use that to **finalise the calculation of the position of** the unknown point **C**.

So, in summary, TPS measure slope distances, vertical angles and relative horizontal angles from the instrument to points but do not produce (x,y,z) coordinates for the measurement points.

The **(x,y,z) coordinates** of the **measurement points** must be calculated from the measurements and other data such as the coordinates of known physical points (e.g. survey marks).

Important Notes

1. What is North?

Although **North** was mentioned in the above discussion, it glossed over the fact that what **North** actually is and hence what the calculated bearing refers to.

There are actually three Norths used in Surveying. See 29.4.3 True North, Grid North and Magnetic North.

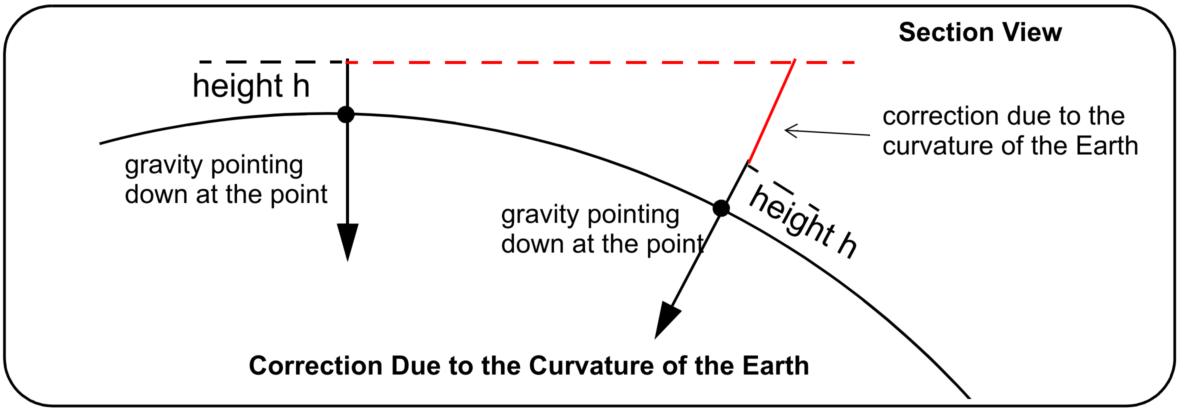
If the coordinates are Map coordinates (e.g. MGA 202), or at least truncated Map coordinates, then **North** will be **Grid North**.

2. Curvature of the Earth

Another problem is that the laser of the TPS travels in a straight line but the Earth is not flat.

So when the laser is pointed out horizontally at a height of **h**, the laser will be higher than **h** the further the beam is from the setup point.

12d Model can make the curvature of the earth corrections.



Continue to 26.1.1.2 GNSS (GPS, Glonass etc) or return to 26.1.1 Collecting Survey Data in the Field or 26.1 An Overview of Surveying and Reduction.

26.1.1.2 GNSS (GPS, Glonass etc)

A **GNSS** instrument measures the **longitude**, **latitude** and **ellipsoid height** at the position of the GNSS.

But the longitude, latitude and ellipsoid height are measured at a particular time (epoch) using a mass centred ellipsoid with zero longitude going through Greenwich.

However, due to continental drift, a point on the ground moves relative to Greenwich so calculations are needed on the longitude, latitude and ellipsoid heights from the GNSS to get the longitude, latitude and ellipsoid heights for the epoch that the project is using.

12d Model does not do any of this specialist processing and accepts the longitude, latitude and ellipsoid height produced by the GNSS which should be in the required epoch.

Once ***12d Model*** has the longitude and latitudes, ***12d Model*** can do the calculations to produces the coordinates needed for the project. For example, Eastings and Northings in a particular projection such as MGA2020.

Finally the heights measured by the GNSS are ellipsoid heights, which are never used in practice because with ellipsoid heights, water may not run down hill.

Instead of ellipsoid heights, the world uses **orthometric**, or **geoid heights**. That is, heights defined by the requirement that two points have the same height if water will not run between them. And the value of the orthometric height is the vertical distance it is above mean sea level.

The difference between the ellipsoid height at the orthometric height at a point is called the **N value**.

Unfortunately, because the density of the earth is not uniform, there is no formulae to calculate the orthometric height for a point - it must be determined from other points of known orthometric height.

Using N-values for a region surveyed, ***12d Model*** calculates the required orthometric heights.

So from a GNSS instrument, (x,y,z) coordinate can be obtained.

Note: Many GNSS units have N-values on board and can do all the calculations on board and produce the required (x,y,z) coordinates.

However the (x,y,z) coordinates produced are for where the GNSS instrument itself sits and so the actual ***instrument height*** must also be known to find the height on the ground.

For more information about the models of the Earth, longitude and latitude, N-values, continental drift and Map Projections, see 29 Geodetics Summary.

Continue to 26.1.2 What is Survey Reduction? or return to 26.1 An Overview of Surveying and Reduction or 26 12d Survey Guide.

26.1.2 What is Survey Reduction?

The process of using the measurements and the extra data to create coordinates for all the measurements, is called ***survey reduction***, or just ***reduction***, and it is the ***Survey Data Reduction Function*** (SDR Function) that does the survey reduction to produce ***12d Model*** strings.

However, the ***SDR Function*** can be created from a number of different sources:

(a) If the ***12d Field*** option ***Pickup*** (***12d Pickup***) is used for collecting the survey data, the instrument measurements and extra information are recorded in a ***SDR Function*** as ***field data commands***, and the ***SDR Function*** reduces the data and displays it on the screen as each measurement is taken.This means the survey data can be immediately verified and any errors corrected or gaps in the survey spotted. See 15 12d Field.

(b) If ***12d Field*** is ***NOT*** being used in the field, then the measurements are being generated by the instrument and hopefully written to a raw file that is stored either on the instrument itself, or in a data recorder. For these cases, the raw data file needs to be converted to a ***12d Field File*** and then, in ***12d Model***, a ***SDR Function*** is created using the ***12d Field File*** as its **initial** input. See 14.4.2 Creating a SDR Function from a 12d Field File.

(c) The data in the ***SDR Function*** is be created by ***Typed Input*** and no ***12d Field File*** used. See 14.4.3 Create a SDR Function by Typed Entry.

Plus

(d) In all cases, the ***SDR Function*** can be modified using the ***SDR Editor*** (14.5.9 Editing the SDR Function Field Data Commands) or by other options on the 14.5 Edit SDR Function menu.

However in all cases, it is the ***SDR Function*** that does the survey reduction to produce ***12d Model*** strings.

Important Note

The ***SRD Function*** stores the data as ***field data commands*** and in a ***12d Field FIle***, the survey data is stored as ***opcodes***.

However there is a one-to-one correspondence between the ***field data commands*** and the ***opcodes*** and they each contain the same information. See 26.5 Field Data Commands and 12d Field File Opcodes.

There are two steps in the reduction of a survey by a ***SDR Function.***

1. Calculate (x,y,z) coordinates for all the measured points

   The **first step of the reduction** takes the surveyor's measurements and produces (x,y,z) coordinates for each measurement.

   For this to be mathematically possible, the (x,y,z) coordinates of **known** physical points in the survey area are needed, and then used in the survey reduction.

   For example, the instrument can be set up over a known point, and the name of that known point recorded with the instrument set up. Or when a set up is done over an unknown point, measurements to known points can be made and these measurements used by resections, least squares etc to calculate the (x,y,z) coordinates of the unknown set up point.

   It is part of the surveyors skill to determine what known points and types of measurements are required so that the (x,y,z) coordinates can be calculated for all the measurement points in the survey.

   For redundancy, check measurements are regularly done to ensure that everything is still correct and no errors have crept in. Even if the instruments are measuring correctly, an incorrect instrument or target height may have been entered at some time. Or when a known point is being used, the wrong name may have been entered and hence the wrong (x,y,z) coordinate used for that point.

The coordinates of known points are provided in **Control models** and **Network models**, or typed into ***12d Pickup*** or the ***SDR Function.***

Also, during the survey, the surveyor can tag a measurement to a point as a **named measurement** and provide a unique name for the point (called a ***named point)*** and a list of named points is maintained by the ***SDR Function*** so that the named points can be referred to by other measurements in the survey.

Important Note

Named measurements are separate to other measurements which are known as standard measurements.

2. Creating strings, string properties and adding attributes

   Picking up points alone is almost useless (zero dimension and zero information) and surveyors are not just point gatherers.

   The surveyor's skill is knowing the correct points to measure to represent the required features, and how to add additional information to the measurements.

   During the survey, the surveyor can record additional information such as ***feature codes***, ***string numbers***, ***point ids*** etc in ***field data commands*** (***commands***) to turn measurement points into more valuable information.

   For example, ***feature codes*** and ***string numbers*** are used to create strings from the points and give them identifiable names. For example, a string named "CK TOP " for the string of points along the top of the bank of a creek, a string named "RD EB" for the string of points along the edge of bitumen or a single point string "EL H" for a high voltage electricity power pole.

   Field data commands define how each measurement and the associated data is to be used. As examples, the field data commands:

   - *denote a measurement as a backsight measurement and hold the name of the point that it is a backsight to*
   - *are used to enter the coordinates and the names of known points*
   - *define where an instrument is instrument set up and hold the instrument height.*
   - *add additional information such as pipe diameters, culvert widths and heights, add string, vertex and segment attributes and create arcs through points etc.*

It is the **second step of the reduction** that turns a collection of points into much more valuable information.

Once the survey data is in a SDR Function, the field data commands can be edited, both graphically or by selecting the commands and changing values, and additional commands added.

Continue to 26.2 Survey Reduction in 12d Model or return to 26 12d Survey Guide.

26.2 Survey Reduction in 12d Model

The ***12d Model*** **survey** options are used to reduce electronically recorded survey information and produce ***12d Model*** strings, a process called **survey reduction**.

12d Model stores survey data in a ***Survey Data Reduction Function*** (***SDR Function***) and the SDR Function does the survey reduction to produce super strings.

There are three typical paths for creating the ***SDR Function:***

(a) The ***12d Field*** option ***Pickup*** (***12d Pickup***) creates a ***SDR Function*** that automatically reduces and displays the resulting strings as the data is being picked up.

For information on survey coding and field data commands used in ***12d Model***, see 26.3 Field Coding for 12d Model.

(b) a ***12d Field File*** exists without an associated ***SDR Function***

The ***12d Field File*** may have been created by another ***12d Model*** option without the ***SDR Function*** being created, or sent to you without the associated ***SDR Function***, or the ***12d Field File*** may have been created by another survey product.

In this case, a ***SDR Function*** can be easily created and the ***12d Field File*** reduced. See 26.2.1 12d Field File and No Survey Data Reduction Function.

(c) Another survey file format is received

In this case the file, often a raw file from the instrument or data collector, must first be converted to a ***12d Field File*** and then used as input data to create a ***SDR Function*** See 26.2.2 A Non 12d Field File is Received.

Important Note

The ***SRD Function*** stores the survey data as ***field data commands*** and in a ***12d Field FIle***, the survey data is stored as ***opcodes***.

However there is a one-to-one correspondence between the ***field data commands*** and the ***opcodes*** and they each contain the same information. See 26.5 Field Data Commands and 12d Field File Opcodes.

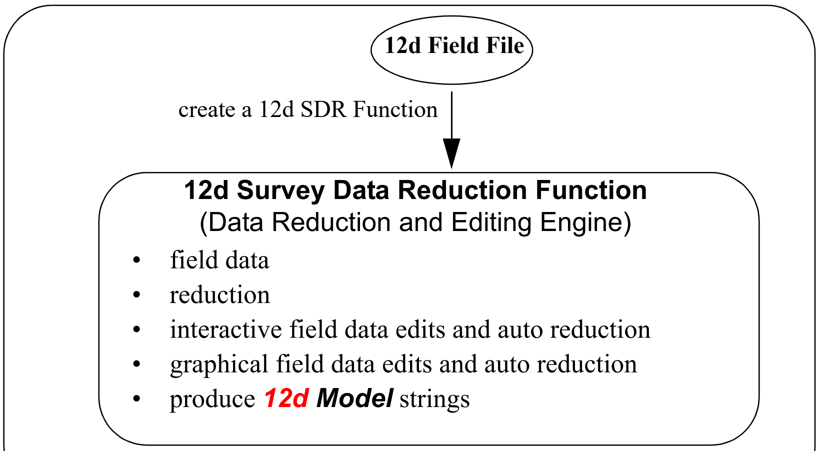
Continue to 26.2.1 12d Field File and No Survey Data Reduction Function or return to 26 12d Survey Guide.

26.2.1 12d Field File and No Survey Data Reduction Function

When only a ***12d Field File*** (extension ***.fld*** or ***.12dfield***) exists **without** an associated **SDR Function**, a **SDR Function** needs to be created for the ***12d Field File*** file so that the survey data can be reduced to produce strings. See 14.4.2 Creating a SDR Function from a 12d Field File.

If errors occur in the reduction, the ***SDR Function*** can then be interactively and/or graphically edited.

So when only a ***12d Field File*** exists with no associated **SDR Function***,* the data flow diagram for the survey reduction process is still fairly simple:



Data Flow for Survey Reduction with 12d Field File Only

Note

To understand survey coding in ***12d Field File***, the following information is required:

(a) There are field coding concepts used in ***12d Model*** that are common to all instruments. For example, feature codes and string numbers, offset, close strings *etc*.

These are described in 26.3 Field Coding for 12d Model

(b) There are template field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.11 Field Templates

(c) There are shape field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.12 Shape Field Coding

(d) There are traverse field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.13 Traverse Coding

Continue to 26.2.2 A Non 12d Field File is Received or return to 26.2 Survey Reduction in 12d Model or 26 12d Survey Guide.

26.2.2 A Non 12d Field File is Received

When the file produced or received is not a ***12d Field file*** then there are up to three steps involved:

1. ***12d Model*** downloads the raw data file from the data collector and stores it on the computer.
2. The raw data file is **converted** to a ***12d Field File***
3. The ***12d Field File*** is read into a ***SDR Function*** and reduced.

   The reduction produces ***12d Model*** super strings.

   If errors occur in the reduction, the ***SDR Function*** can be interactively and/or graphically edited within ***12d Model***.

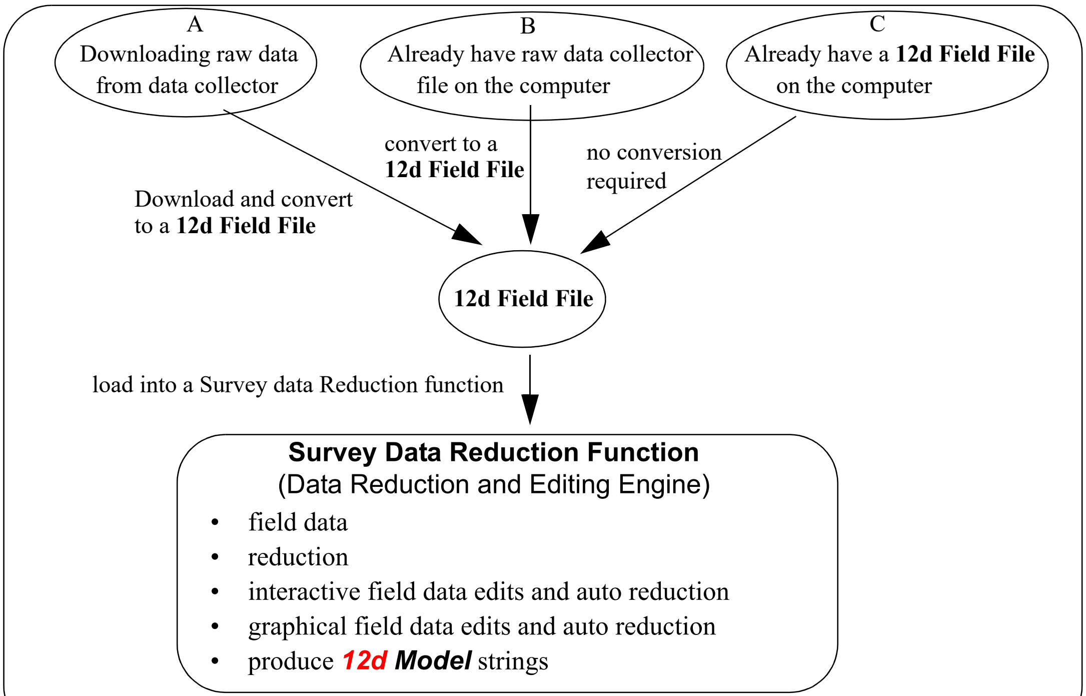
In some circumstances, not all steps are necessary.

For example, Step 1 is not necessary when the raw data file is already on the computer (and hence doesn't need downloading).

Steps 2 is not necessary when the survey data is already in the form of a ***12d Field File*** file.

This occurs when other software packages such as ***TP Setout*** produce a ***12d Field File*** directly, or if the ***12d Field File*** was created in a previous ***12d Model*** session, maybe even on a different computer.

The data flow diagram for the survey reduction process of a non-***12d Field File*** is:



Data Flow for Survey Reduction of non 12d Field File

Unfortunately, each brand of data collector has its own method of communicating with a computer and a software package, and different coding methods are needed on the different data collectors.

So in ***12d Model***, data collector definitions can be set up to work with each different data collector and the appropriate data collector definition used in the process of converting a raw data collector file to a ***12d Field File.***

For information on setting up a data collector definition, see 42.1 Data Collector Definitions.

Continue to 26.2.3 Using Data Collectors or return to 26.2 Survey Reduction in 12d Model or 26 12d Survey Guide.

26.2.3 Using Data Collectors

The process of converting raw files from data collector appears complicated because there are a multitude of methods of setting up coding in the field.

Why isn't there just one way of doing things?

Firstly, there is no industry standard and each brand of survey instrument has a totally different format for recording information. In fact, different instruments from the same survey instrument manufacturer can have different formats for recording data.

Secondly, many users are already familiar with another survey package and if possible, wan to continue field coding in the same way. Where possible, ***12d Model*** has tried to accommodate this.

12d Model has a method of field coding for each instrument to take advantage of features that are available in ***SDR Function***. For example, defining and using field templates and recording user-defined attributes on points and segments.

To understand survey coding in ***12d Model***, and how it is used for different data collectors, the following information is required:

(a) There are field coding concepts used in ***12d Model*** that are common to all instruments. For example, feature codes and string numbers, offset, close strings *etc*.

These are described in 26.3 Field Coding for 12d Model

(b) This include template field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.11 Field Templates

(c) Also shape field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.12 Shape Field Coding

(d) And traverse field coding concepts used in ***12d Model*** that are common to all instruments. These are described in 26.3.13 Traverse Coding

(e) For Leica instruments, the coding methods are different from most other types. These are described in 42.3 Field Coding for Leica TPS Instruments

(f) For non-Leica instruments, the concepts used in coding are similar for each type. These are described in 42.2 Field Coding for Non Leica Instruments

Continue to 26.3 Field Coding for 12d Model or return to 26 12d Survey Guide.

26.3 Field Coding for 12d Model

TPS and GNSS equipment is used in the field to make readings of points.

However, rather than just collecting points, it is desirable to add extra information by coding the readings in a way that can be interpreted during the data reduction process to produce more valuable information.

In ***12d Model***, the extra information is included in one or more of

- *feature code*
- *string number*
- commands and information

How ***12d Field*** stores the ***feature codes***, ***string number*** **etc** as ***field data commands*** is well defined in 26.4 Field Data Commands but unfortunately there is no industry standard for other survey instruments and data collectors.

For **non-*12d Field*** users, ***12d Model*** needs to converts the raw data files from the different survey instruments and data recorders using different coding conventions, into a ***12d Field File*** before the data can be loaded into a ***SDR Function*** and reduced.

So knowing how ***12d Model*** field data commands work is essential for any survey reductions done in ***12d Model***.

Some of the important concept used in ***12d Model*** field data commands will now be described:

See

26.3.1 Stringing in the Field.
26.3.2 Offsets.
26.3.4 Start New String.
26.3.5 Close String.
26.3.6 Squashed Rectangle - Parallelogram.
26.3.7 Rectangle by 2 Points.
26.3.8 Feature String.
26.3.9 Joining Strings
26.3.10 Arcs Through Points
26.3.11 Field Templates
26.3.12 Shape Field Coding
26.3.13 Traverse Coding

Continue to 26.3.1 Stringing in the Field or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.1 Stringing in the Field

To string data together, a feature coding convention is used and it is possible to string data when:

(a) *feature codes* and *string numbers* are used
or
(b) just *feature codes* and no string numbers are used.

Case (a) *feature codes* and *string numbers*

If ***feature codes*** **and** ***string numbers*** are entered with measurements in the field, a coding methodology is used so that strings are automatically created during reduction.

To control this stringing, the **feature code** and **string number** are interpreted in the following manner:

During reduction, ***12d Model*** connects measurement points with the **same *feature code* and *string number*** in the order they are measured in.

That is, the **feature code and string number** determines which points are joined together to form the vertices of a super string.

At the end of the reduction, the ***feature code*** remains as the ***name*** of the **super string** and the ***string number*** is recorded as a string attribute called ***string_no.***

Hence the *feature code* and *string number* combination allows any number of different super strings with the same name (feature code) to be produced.

If the ***string number*** is **zero**, then the **point-line type** of the super string is set to ***point***. If the ***string number*** is **non-zero,** the **point-line type** of the super string is set to ***line***.

Finally, during reduction, the ***feature code*** can be used as the key to a ***Map File*** to specify the name, model, colour, point-line type, linestyle, tinability and other details for the super string.

Note that the measurements of points with different feature codes and string numbers can be intertwined. That is, *not* all the points in one super string need to be measured before the points in a different super string.

Hence at the end of the reduction, ***12d Model*** super strings are created for each unique *feature code* and *string number* combination in the input data.

Note - if the *string number* is blank, the *string number* defaults to 0

Case (b) just *feature codes*

If **just *feature codes*** are used then a ***New String*** command is used to start a new super string rather than using string numbers.

During reduction, ***12d Model*** connects measurement points with the **same** *feature code* in the order they are measured until a ***New String*** command is found.

That is, just the feature code determines which points are joined together to form a super string and the ***New String*** command defines when a new super string begins.

At the end of the reduction, the ***feature code*** remains as the ***name*** for the **super string.**

Also during reduction, the ***feature code*** can be used as the key to a **Map File** to specify the name, model, colour, point-line type, linestyle, tinability and other details for the super string.

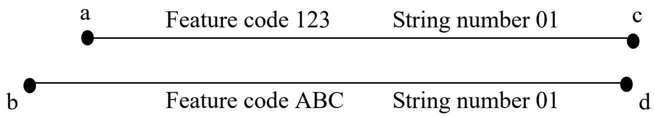
Note that the measurements of points with different feature codes can be intertwined. That is, *not* all the points in one super string need to be measured before the points in a different super string.

Important Note

Even in Case (a) when both feature codes and string number are used,.a ***New String*** command can be used to start a new string even though the string number has not changed.

An Example of Feature Coding to String Points Together

Two super strings are to be created, one joining points **a** and **c**, the other joining points **b** and **d**.



Points may be measured and assigned *feature codes* and *string numbers* as follows:

Measurement to point	Feature code	String Number
a	123	01
b	ABC	01
c	123	01
d	ABC	01

Alternatively, the points could have been measured in the order a, c, b, d as long as the correct *feature codes* and *string numbers* were entered.

Measurement to point	Feature code	String Number
a	123	01
c	123	01
b	ABC	01
d	ABC	01

Because the *string numbers* are non-zero, the default *point-line* type for both super strings is *line*.

As well as stringing data together, the ***SDR Function*** has field data commands to do other things with the strings such as:

- 26.3.2 Offsets
- 26.3.4 Start New String
- 26.3.5 Close String
- 26.3.6 Squashed Rectangle - Parallelogram
- 26.3.7 Rectangle by 2 Points
- 26.3.8 Feature String
- 26.3.5 Close String
- 26.3.9 Joining Strings
- 26.3.10 Arcs Through Points
- 26.3.11 Field Templates
- 26.3.12 Shape Field Coding
- 26.3.13 Traverse Coding

Continue to 26.3.2 Offsets or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.2 Offsets

It is not always possible to measure a point directly but it may be possible to measure a point nearby and then measure an offset to adjust the measured point by and so produce the coordinates of the required point.

The three offsets that are allowed as field data commands:

See

- Height opcode 44
- Radial opcode 42
- Tangential opcode 43

Height opcode 44

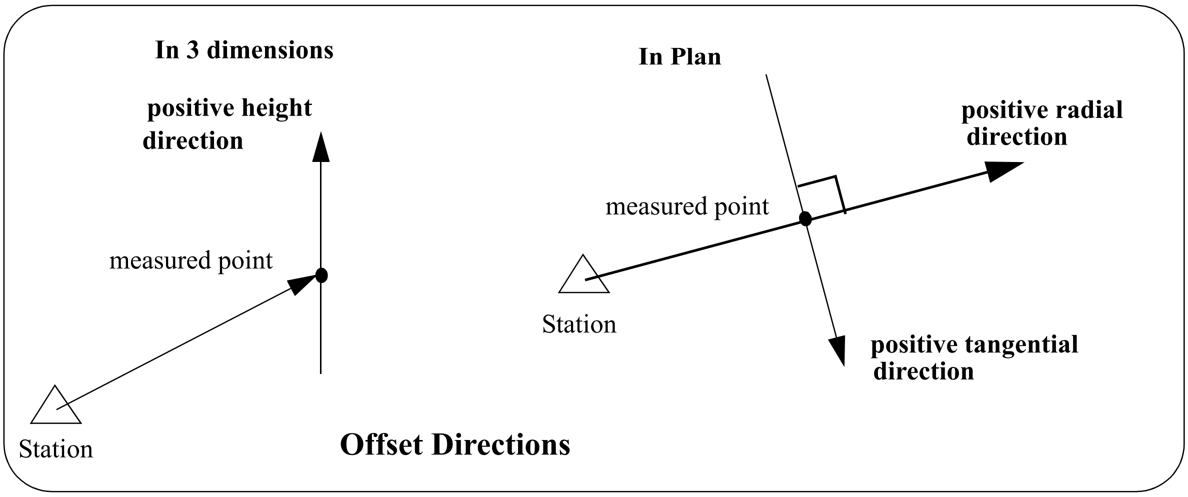
The ***height offset*** adjusts the height of a non-null point. A positive offset adds to the height and a negative offset reduces the height.

Radial opcode 42

The ***radial offset*** adjusts the position of the specified point by a *plan* distance from the specified points original position, along the plan line joining the current station to the specified point. A positive offset is away from the station and a negative offset is toward the station.

Tangential opcode 43

The ***tangential offset*** adjusts the position of the specified point by a *plan* distance from the specified points original position, at rights angles to the plan line joining the current station to the specified point. A positive offset is to the right (looking from the station to the point) and a negative offset is to the left.



For the Field Data Commands, see 26.4.2.40 Offset Measurement (opcodes 42, 43, 44).

Continue to 26.3.3 Extend or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.3 Extend

It can be beneficial to modify the position of a measured point by extending it along the next segment of the string that it is the start point of, or by extending it along the previous segment that it is the last point of.

The four extends that are allowed as field data commands:

See

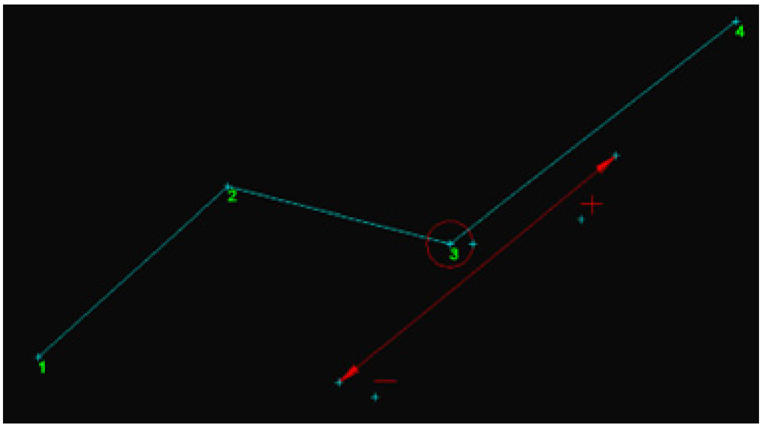
- Extend next segment by plan (2D) distance opcode 142
- Extend previous segment by plan (2D) distance opcode 143
- Extend next segment by 3D distance opocode 172
- Extend previous segment by 3D distance opocode 173

Extend next segment by plan (2D) distance opcode 142

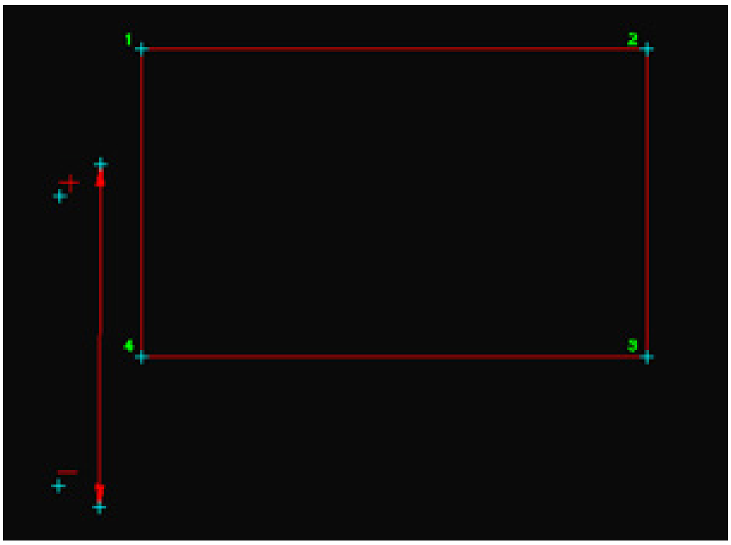
The Extend value is used to adjust the position of the specified point by a **plan** (**2D) distance** from the specified point’s original position along the **next segment** that the point is on.

The z-value of the point is not changed.

A positive Extend is along the direction of the next segment of the string and a negative Extend is against the direction of the next segment of the segment of the string.



If it is applied to the last vertex of a closed string.



Failures

If it is applied to the last point of an open string then the option fails.

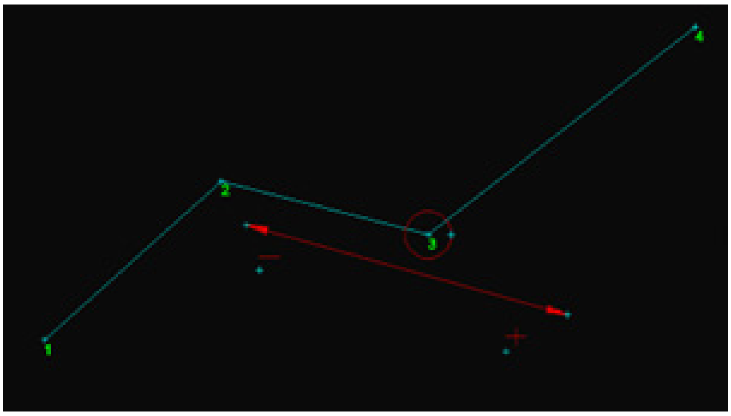
If it is applied Before arc last 3 then the option fails

If it is applied to a one vertex string then the option fails.

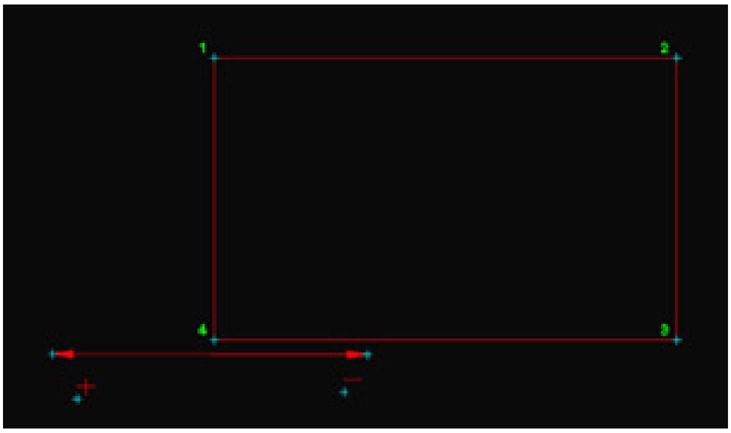
Extend previous segment by plan (2D) distance opcode 143

The Extend value is used to adjust the position of the specified point by a **plan** (**2D) distance** from the specified point's original position along the **previous segment** that the point is on. The z-value of the point is not changed.

A positive Extend is along the direction of the previous segment of the string and a negative Extend is against the direction of the previous segment of the segment of the string.



If it is applied to the last vertex a closed string.



Failures

If it is applied to the first point of an open string then the option fails.

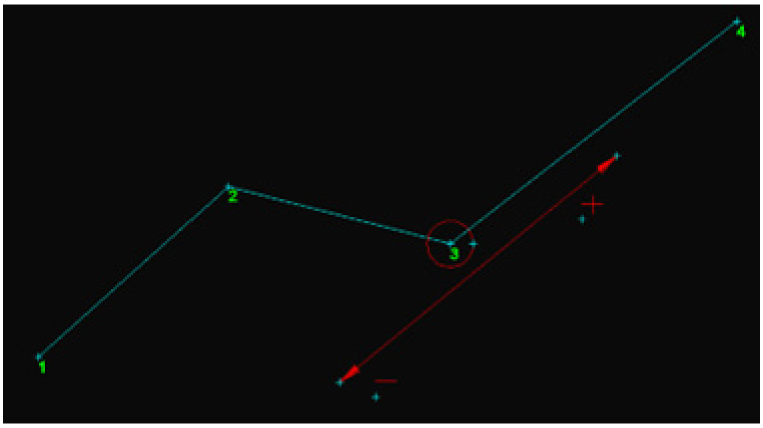
If it is applied to a one point string then the option fails.

Extend next segment by 3D distance opocode 172

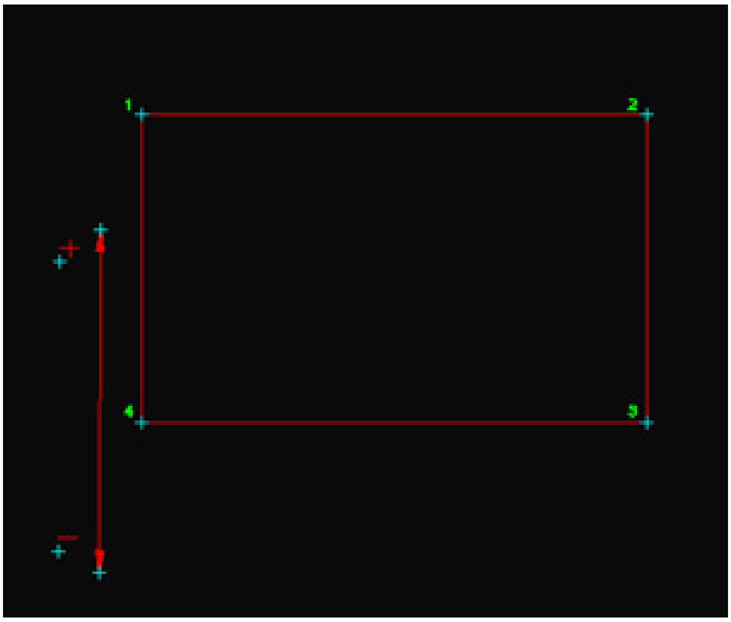
The Extend value is used to adjust the position of the specified point by a **3D distance** from the specified point's original position along the **next segment** that the point is on.

The z-value of the point is extrapolated using the grade of the next segment.

A positive Extend is along the direction of the next segment of the string and a negative Extend is against the direction of the next segment of the segment of the string.



If it is applied to the last vertex of a closed string.



Failures

If it is applied to the last vertex of an open string then the option fails.

If it is applied before Arc last 3 then the option fails.

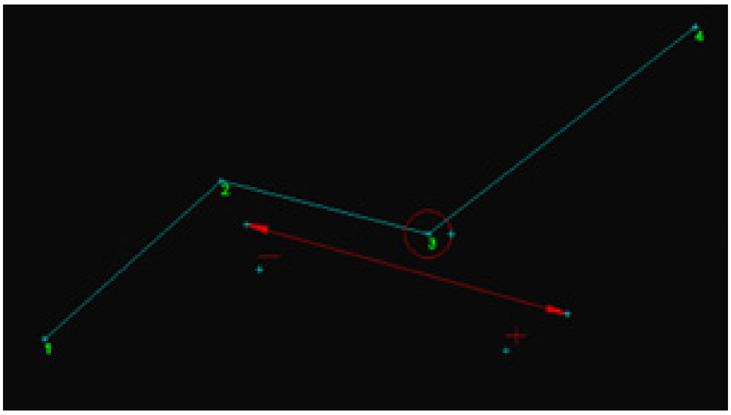
If it is applied to a one veretex string then the option fails.

Extend previous segment by 3D distance opocode 173

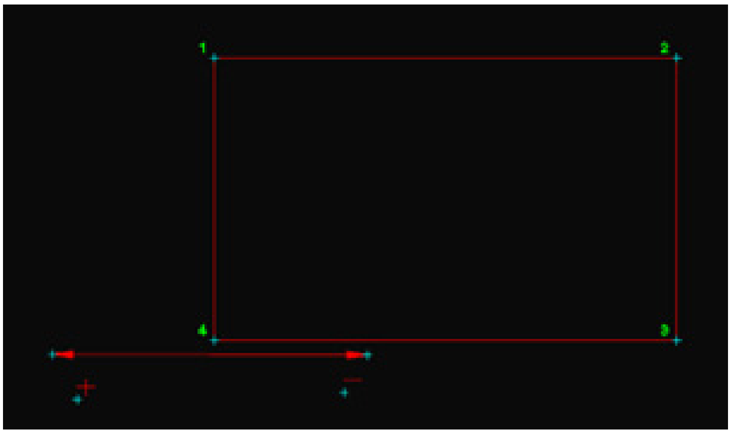
The Extend value is used to adjust the position of the specified point by a **3D distance** from the specified point's original position along the **previous segment** that the point is on.

The z-value of the point is extrapolated using the grade of the previous segment.

A positive Extend is along the direction of the previous segment of the string and a negative Extend is against the direction of the previous segment of the segment of the string.



If it is applied to the last vertex a closed string.



Failures

If it is applied to the first point of an open string then the option fails.

If it is applied after acr last 3 points then if the option fails.

If it is applied to a one point string then the option fails.

For the Field Data Commands, see 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173).

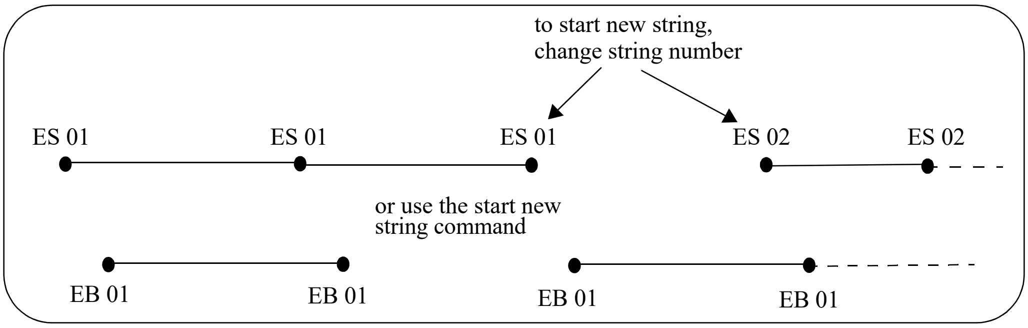
Continue to 26.3.4 Start New String or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.4 Start New String

A new string is automatically started whenever a different string number is used.

However there is also a ***start new string*** command which begins a new super string even if the string number is the same as the string number for previous points.

The ***Start New String*** command is particularly useful for correcting the field error of forgetting to change the string number.



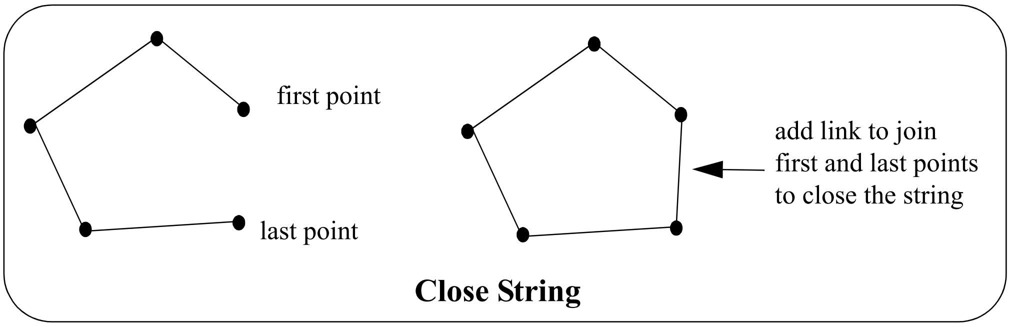
For the Field Data Command, see 26.4.2.55 String Start (opcode 47).

Continue to 26.3.5 Close String or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.5 Close String

The **close string** command closes a super string by joining the first and last points of the super string. If a super string is already closed, then the close has no effect.

The close string command can be given at the recording of any point of the string, and the entire string is closed.



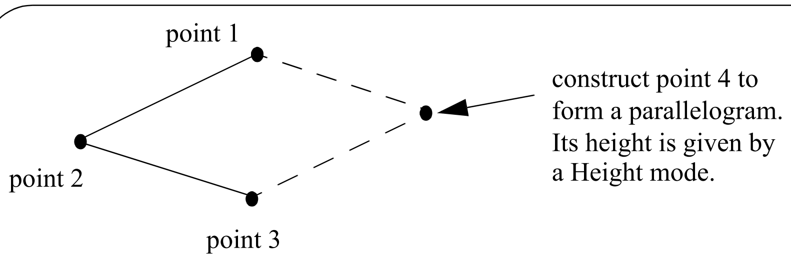
For the Field Data Command, see 26.4.2.50 String Close (opcode 20).

Continue to 26.3.6 Squashed Rectangle - Parallelogram or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.6 Squashed Rectangle - Parallelogram

The **rectangle** command acts on the last three points of a string and adds a new point after the last point to form a parallelogram (squashed rectangle). The string is then closed.

The height of the added point is determined by a ***Height mode***.



Form Parallelogram (Squashed Rectangle)

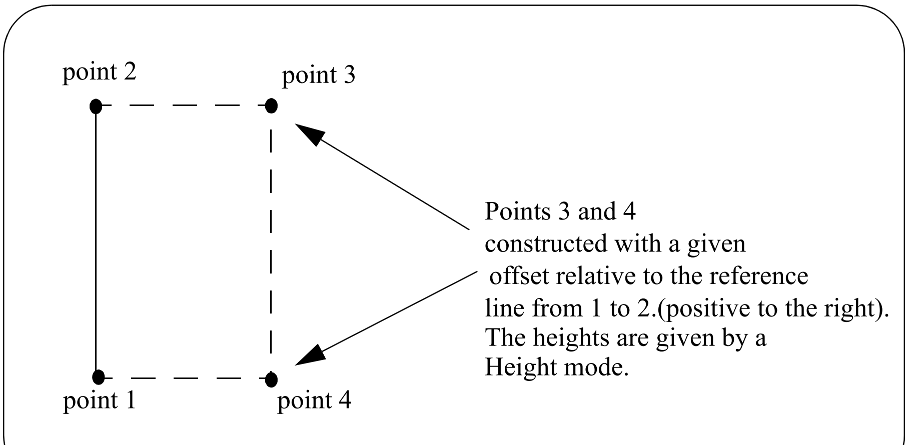
For the Field Data Command, see 26.4.2.52 String (Squashed) Rectangle (opcode 45).

Continue to 26.3.7 Rectangle by 2 Points or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.7 Rectangle by 2 Points

The **rectangle by 2 pts command** acts on the last two points of a string and adds two new points at a given offset after the last point to form a rectangle. The string is then closed.

The height of the added point is determined by a ***Height mode***.



Form Rectangle By 2 Points

For the Field Data Command, see 26.4.2.53 String Rectangle by 2 Points (opcode 37).

Continue to 26.3.8 Feature String or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

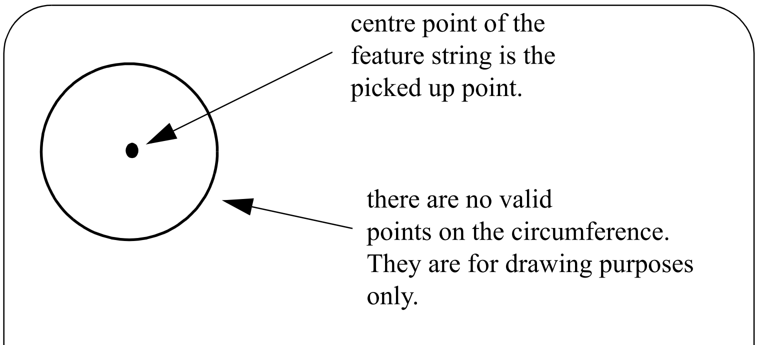
26.3.8 Feature String

A *feature string* is a 2D circle in the (x,y) plane with a z-value at the centre but only null values on the circumference of the circle.

The feature commands creates a *feature string* with the picked up point as its centre and the radius/ diameter being set by the feature command.

If a feature string is given a ***world*** line style, then the style is centred on the centre point of the feature string and scaled up to the radius of the feature string.

If a feature string is given a ***screen*** or ***paper*** line style, then the style is wrapped around the circumference of the feature string.



Feature String

For the Field Data Command, see 26.4.2.11 Circle Feature (opcode 18).

Continue to 26.3.9 Joining Strings or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.9 Joining Strings

There are three commands for joining two strings together.

See

- Join last points of strings opcode 21
- Join first to last points of strings opcode 22
- Join first points of strings opocde 23
- Join last to first of strings opocde 24

Join last points of strings opcode 21

The last point of the first string is joined to the last point of the second string. The direction of the final string is along the forward direction of the first string, across to the end of the second string and then in the reversed direction of the second string.

Join first to last points of strings opcode 22

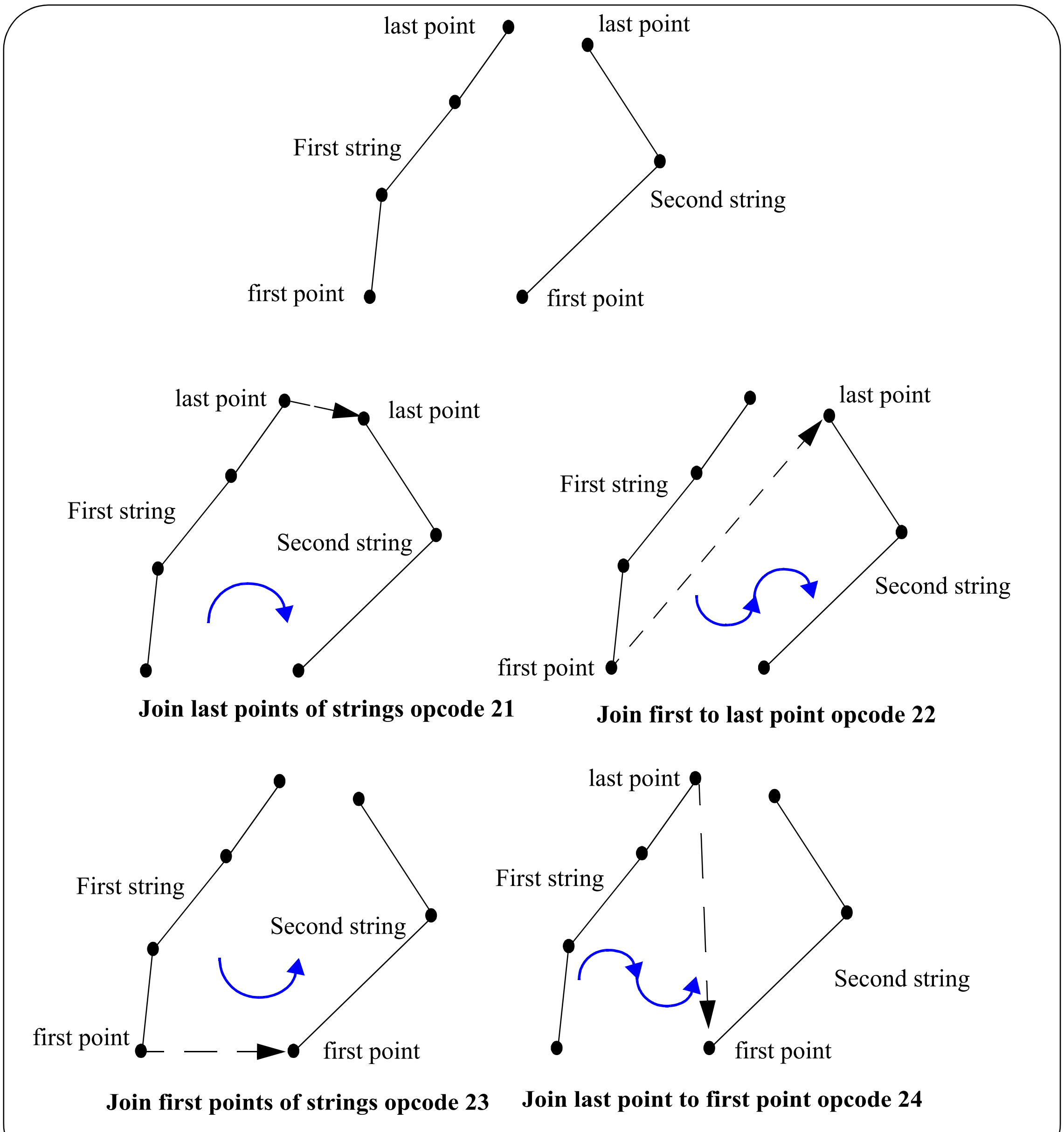
The first point of the first string is joined to the last point of the second string. The direction of the final string is in the reverse direction of the first string, across to the start of the second string and then in the forward direction of the second string.

Join first points of strings opocde 23

The first point of the first string is joined to the first point of the second string. The direction of the final string is in the reverse direction of the first string, across to the start of the second string and then in the forward direction of the second string.

Join last to first of strings opocde 24

The last point of the first string is joined to the first point of the second string. The direction of the final string is in the forward direction of the first string, across to the start of the second string and then in the forward direction of the second string.



Join Strings

For the Field Data Commands, see 26.4.2.29 Strings Join (opcodes 21 to 24).

Continue to 26.3.10 Arcs Through Points or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.10 Arcs Through Points

There are a number of commands to fit arcs through sequences of three or more points. Note that this is an **arc** in **plan**, with different z-values at each of the three points. The z-values are linearly interpolated around the arc between the points.

Hence it is a **helix** and **not** a circle in the plane containing the three points. Note that an 3D-arc in a plane not parallel to the x-y plane does **not** project onto an arc in the x-y plane.

There are four arc commands:

See

Fit an arc through the next three points opcode 60
Fit an arc through the previous three points opcode 17
Start fittintg arcs to sets of three points opcode 61
Stop fitting arcs to sets of three points opcode 62

Fit an arc through the next three points opcode 60

An arc is fitted through the next three points of the string.

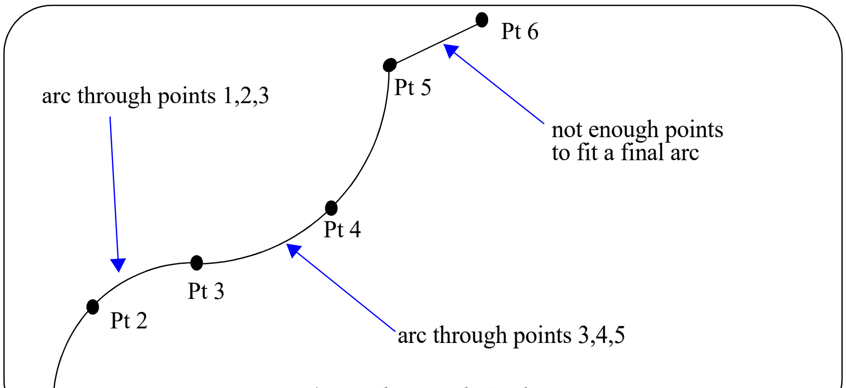
Fit an arc through the previous three points opcode 17

An arc is fitted through the previous three points of the string.

Start fittintg arcs to sets of three points opcode 61

An arc is fitted to the first three points 1, 2 and 3 of the string, and then another arc to points 3, 4 and 5 and then an arc through 5,6 and 7 and so on until an opcode 62 is done (Stop fitting arcs to sets of three points opcode 62**)**, or the end of the string.

If at any stage there is only one point left, then no arc can be fitted and a straight line is drawn to the final point.



Arcs through Points

Stop fitting arcs to sets of three points opcode 62

For the Field Data Commands, see 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62).

Continue to 26.3.11 Field Templates or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.11 Field Templates

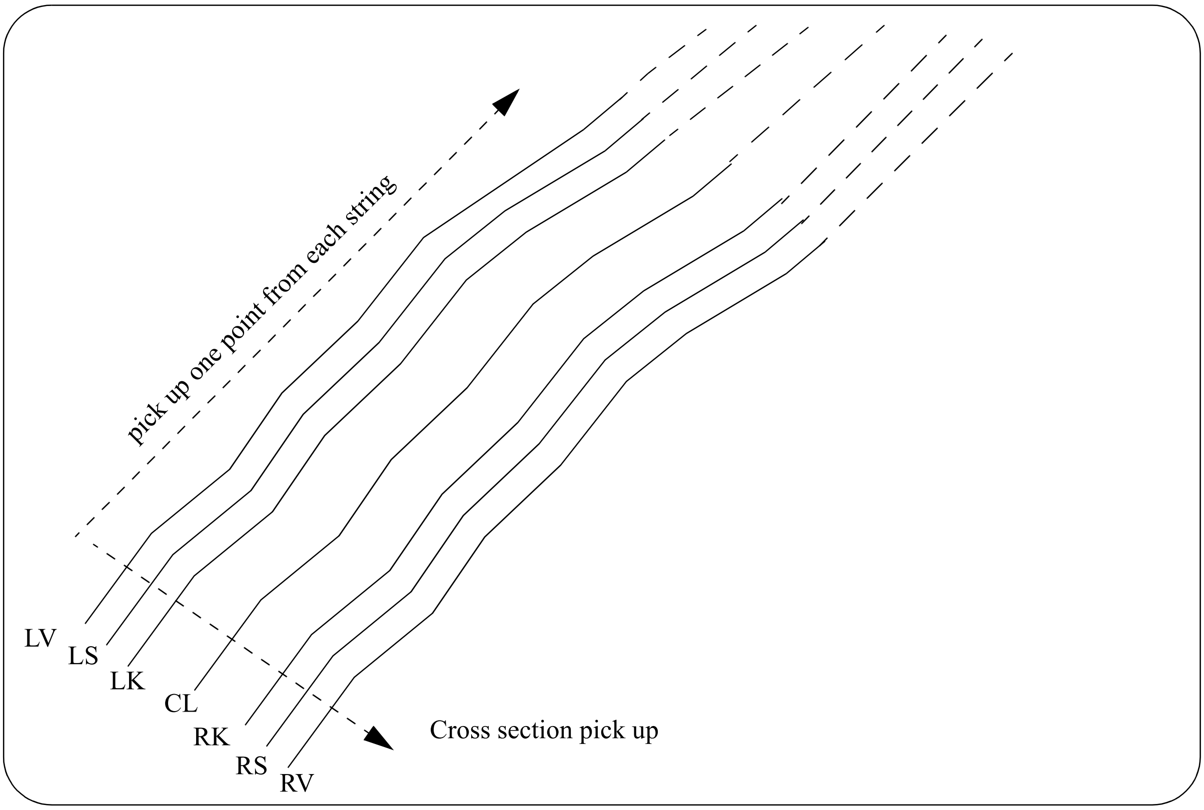
If a series of points are being picked up along the one string then the ***feature code*** and ***string number*** only need to be entered once since the **default** is for a measurement to use the **last *feature code* and *string number*** if no new ones are given.

However it is often much more efficient to pick up one point from a number of strings before moving onto the next point of each string (this is called a cross section pick up).

For example when picking up a road, it would be preferable to pick up the points for a section across the road and then move onto the next section rather than picking up all of one string at a time.

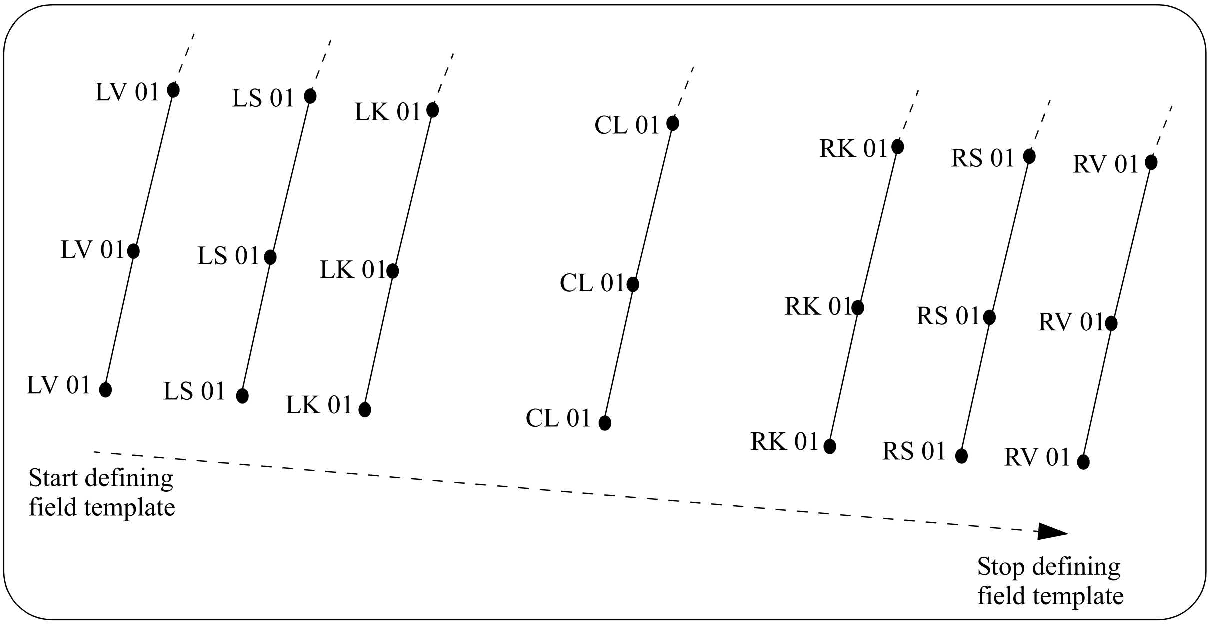
In the diagram below, this means picking up one point from each of the strings LV, LS, LK, CL, RK, RS, RV and then moving onto the next cross section rather than picking up all of LV and then all of LS and so on.

Normally if each measurement is from a different string, then the feature code and string number would need to be re-entered with each measurement which is a very time consuming process. To simplify the coding for section pick up, ***12d Model*** uses ***field templates***.



Basically, a ***12d Model*** *field template* consists of defining a sequence of *feature codes* and s*tring numbers* pairs for the field template. The field template can be given a unique name or have no name at all.

When a field template is used, measurements are taken without entering a *feature code* and *string number* and the *feature code* and *string number* for the measurement come from the *field template definition*.



For example, a field template could be defined as the sequence:

LV 01, LS 01, LK 01, CL 01, RK 01, RS 01, RV 01

When the field template is used, measurements are taken without giving a feature code or string number and the measurements will be sequentially given the codes LV 01, LS 01, LK 01 *etc*.

To define a ***12d Model*** *field template*, there is a command to *start recording* the field template.

The *feature codes* and *string numbers* for the next series of measurements until the *stop recording* command is given, are stored as the field template. There are also commands to *insert* and *delete* a point in the template when it is being used for picking up points.

When a field template is used, the feature code and string number from the field template can be used:

(a) in the same order as the codes are defined in the field template (forward direction).

(b) in the opposite order to how the codes are defined in the field template (reverse direction).

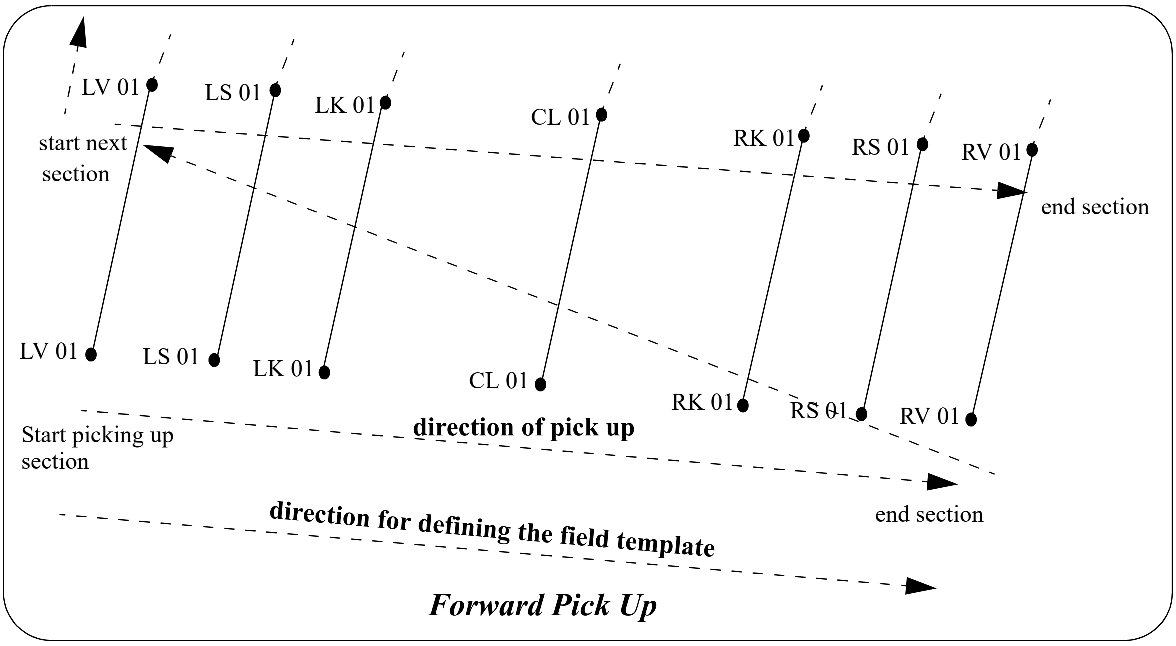
(c) in an alternating same and opposite order that the codes are defined in field template (zig-zag)

These three modes of usage of a field template will be described in the following sections.

Continue to 26.3.11.1 Forward Direction.

26.3.11.1 Forward Direction

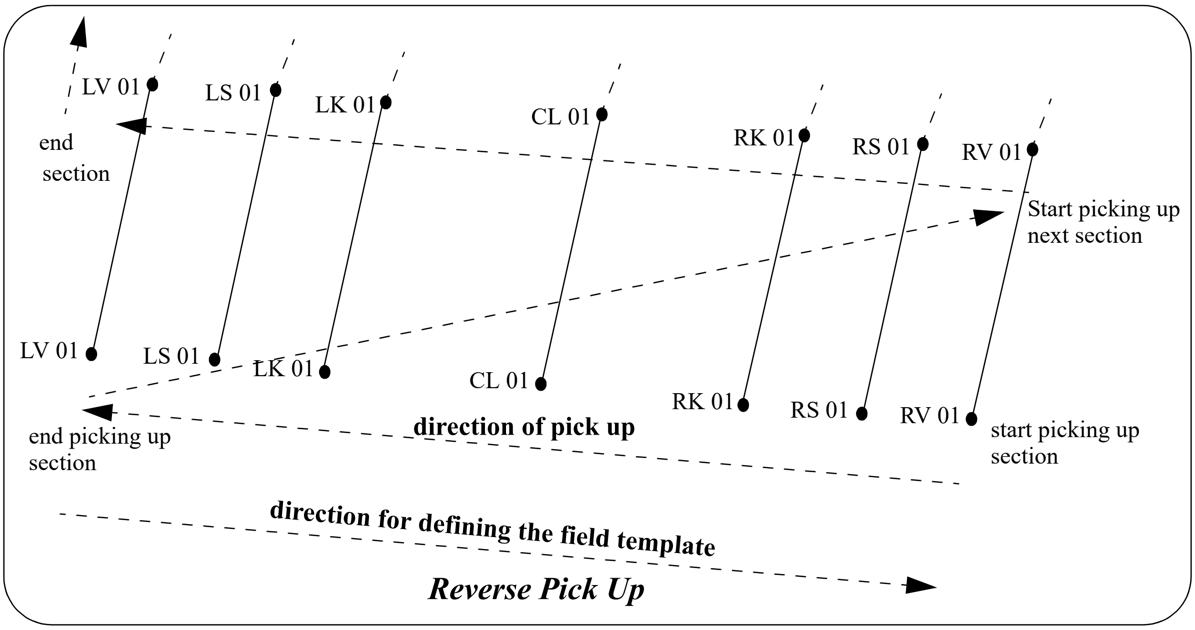
If the field template is used in the *forward* direction, then the feature codes and string numbers are used in the same order that they were defined to be in the field template. Once the end of the field template is reached, the feature codes and string numbers re-start at the beginning of the field template.



Continue to 26.3.11.2 Reverse Template Direction.

26.3.11.2 Reverse Template Direction

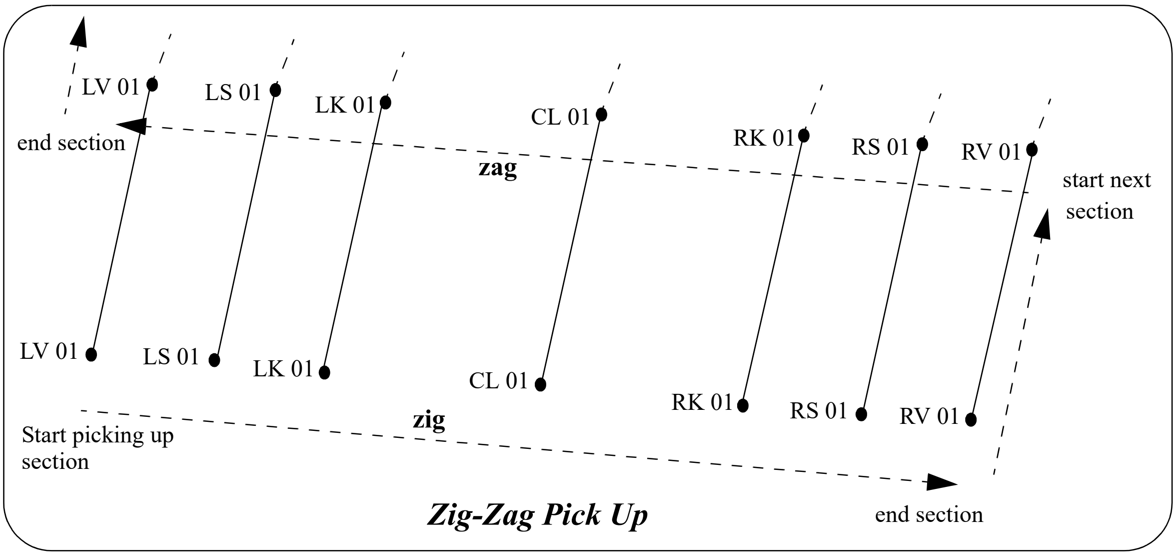
If the field template is used in the *reverse* direction, then the feature codes and string numbers are used in the reverse order to what they were defined to be in the field template. That is the feature codes and string numbers start at the *end* of the field template definition and are used in the reverse order. Once the beginning of the field template is reached, the feature codes and string numbers re-start at the end of the field template and are used in the reverse order.



Continue to 26.3.11.3 Zig-Zag.

26.3.11.3 Zig-Zag

When picking up a road in sections, it is often quickest to pick up the first section going from one side of the road to the other side, and then move onto to the next section point on the other side of the road and pick up points coming back across the road. Hence the points for the second section are in the reverse order to those in the first section. This process is known as zig-zagging.



This situation can be covered in two ways. A field template could be defined containing all the points for two sections and the field template used in the forward (or reverse) direction. For example, the field template to be used in the forward mode could be defined as:

LV 01, LS 01 LK 01, CL 01, RK 01, RS 01, RV 01, RV 01, RS 01, RK 01, CL 01, LK 01, LS 01, LV 01

However, in ***12d Model*** it is only necessary to define the *one* section

LV 01, LS 01 LK 01, CL 01, RK 01, RS 01, RV 01

and when the field template is used, it is specified that it is being used as a *zig-zag* field template starting on either the *zig* (the forward direction of the field template) or the *zag* (the reverse direction of the field template).

Once a *zig* is completed, ***12d Model*** automatically uses the reverse order of the field template and hence produces a *zag*. Similar, once a zag is completed, ***12d Model*** uses the forward order of the field template and produces a zig.

Thus a zag automatically follows a zig and a zig follows a zag.

Hence if a field template is used in the zig-zag mode, it can be used as either:

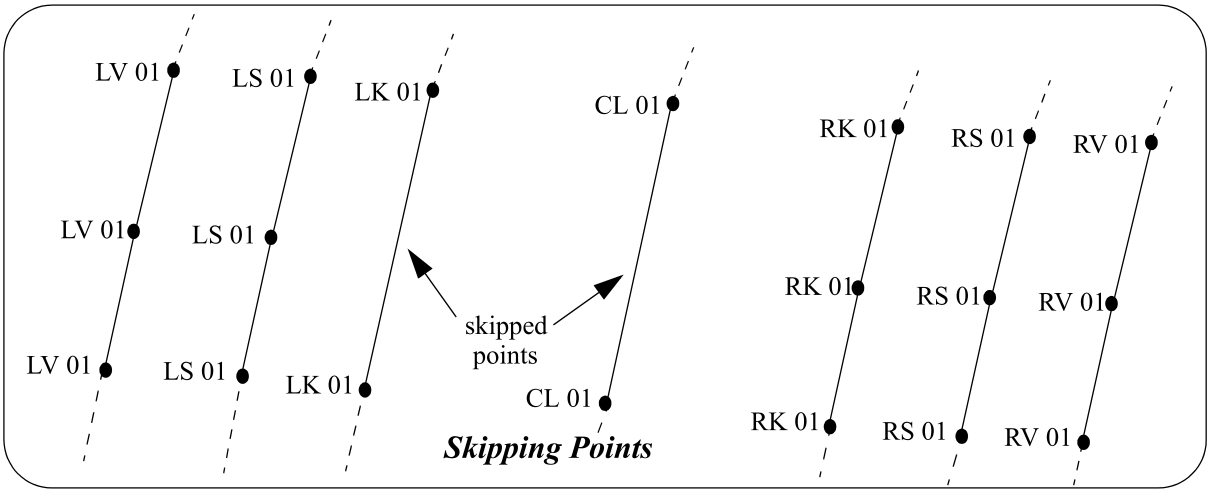
(a) a zig-zag field template starting on the zig

(b) a zig-zag field template starting on the zag.

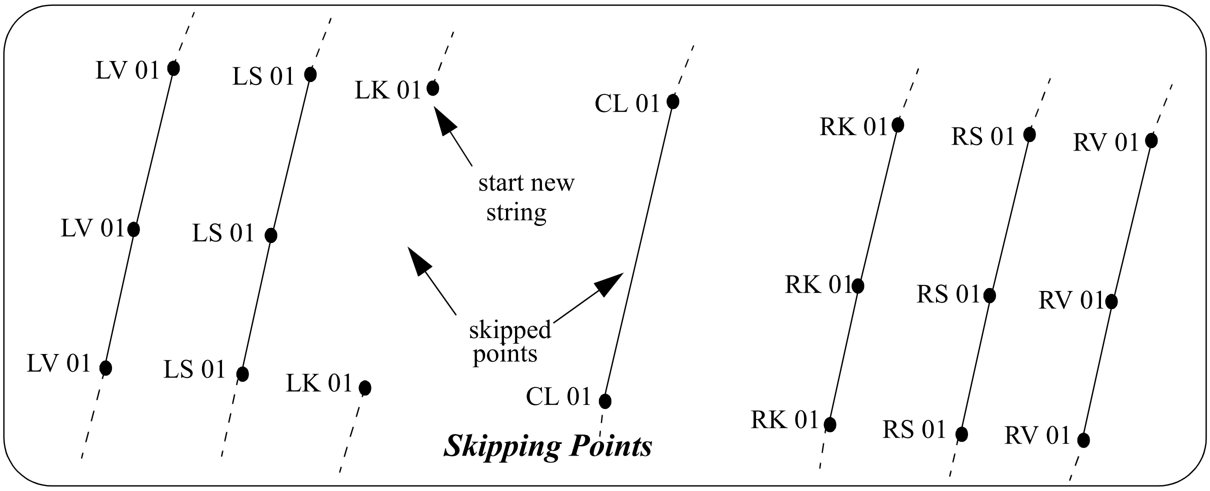
Continue to 26.3.11.4 Skipping Field Template Points.

26.3.11.4 Skipping Field Template Points

When picking up points using a field template, ***12d Model*** allows for one or more points to be skipped. By default, the points on the strings on either side of the skipped points will then be joined together.



By combining skipping points and start new string commands, points can be skipped and new strings started on the other side of the skipped points.



Continue to 26.3.11.5 Insert Template Points or Insert Multiple Codes.

26.3.11.5 Insert Template Points or Insert Multiple Codes

When picking up points using a field template, ***12d Model*** allows for one or more points to be inserted. The inserted points ***change*** the template from that point onwards so that extra strings can be picked up as they arise.

If the insert point command is given after the last point of a template, a flag can be applied to specify which template pick-up the inserted point is to be added to. That is, add it to the last series of points or the next series. This flag is called the "insert special" flag.

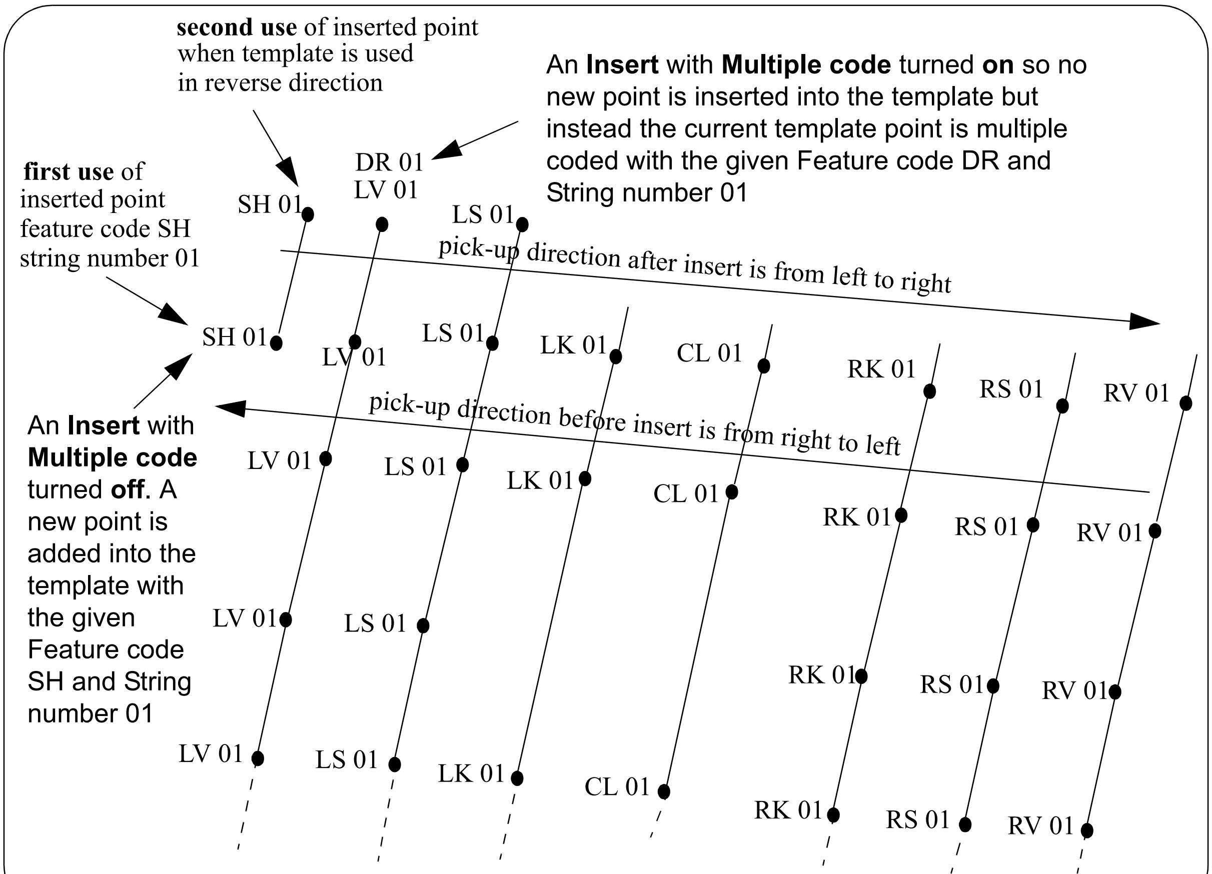
If ticked on in the insert panel, or if the flag given in the offset code is 1, the point will be added to the current series of points in the template being picked up.

In the case shown below where SH 01 is inserted, the insert special flag should be set to on so that the next picked up point will be on the current template. The insert would have been made after the last LV 01 observation in the last pick-up direction. The following pick-up will use the redefined template definition.

Note - in the example below, it is a zig-zag template so SH 01 is then used again straight away as the first point of the pickup when coming from left to right.

With the Insert, rather than insert new template points, it is also possible to give multiple codes to existing points in the template so that more than one code can be assigned to the one pick-up point (insert multiple codes).

In the case shown below, an insert was made on the next pick-up direction after the LV 01 observation. The multiple code tick box or flag was set on so that the last picked up point will be assigned the extra code specified, in this case DR 01. The template will be applied to all subsequent measurements so that the observed LV 01 string will also be coded DR 01.



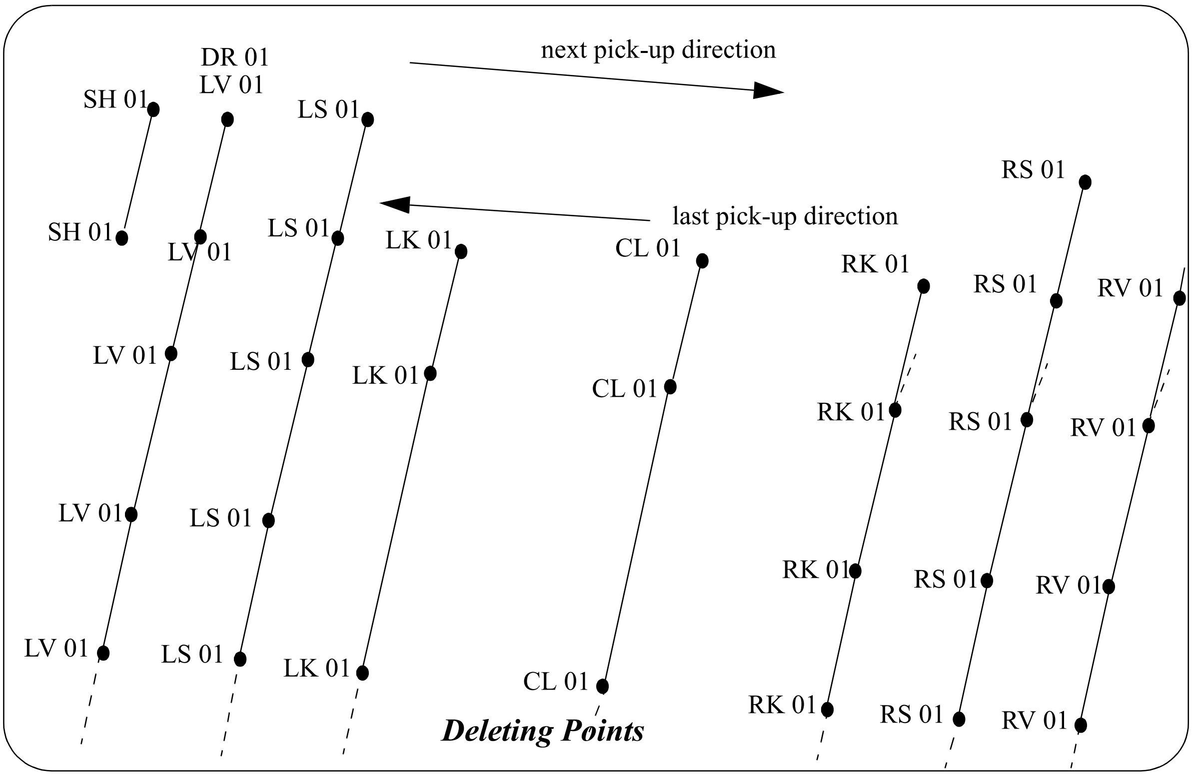
Inserting Points in a ZigZag Template

Continue to 26.3.11.6 Delete Template Points.

26.3.11.6 Delete Template Points

When picking up points using a field template, ***12d Model*** allows for one or more points to be deleted. The deleted points change the template from the next specified number of points inclusive of the current point. *i.e.* They are removed from the template.

If a template delete command was given after the LS 01 string in the next pick-up direction, and the number of specified points were 3, the template will be altered such that the next observed string will be RS 01.



Continue to 26.3.12 Shape Field Coding or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.12 Shape Field Coding

Normally when picking up a feature with a fixed cross section such as a kerb, each measurement is for a different string to represent the kerb (e.g back of kerb, lip kerb *etc)* and the feature code and string number would need to be re-entered with each measurement which is a very time consuming process.

To simplify the coding for a section pick up, ***12d Model*** uses ***shape field coding****.*

That is, if an object to be picked up has a standard cross section that can be picked up, a cross section shape can picked up and stored, and either:

(a) **parallelled** along the one pick-up string to produce a number of different strings

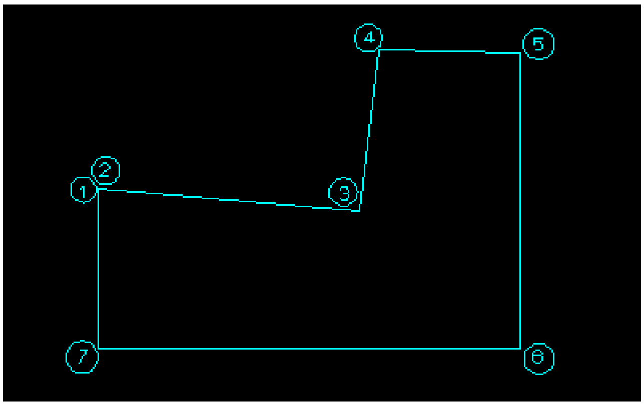
or

(b) **extruded** along the pick-up string to create a super string with an extrusion.

Then when picking up the entire object, only one **attach** (reference) string has to be picked up curve) and on reduction, ***12d Model*** can extrude or parallel the shape for the entire string pick-up.

So basically, a ***12d Model*** *shape* consists of observing a number of points on a given cross section of an object. The shape can be given a unique name or have no name at all.

For example, one point on the kerb can be picked up as the attach point (e.g. lip of kerb) and then kerb shape can be defined by observing all points on a typical section of the kerb.



In the diagram, a kerb shape is defined by observations shown in order above:

Point 1 is the **attach point** (**reference point**)

Points 2 to 7 define the **shape points**.

In this case, the first point of the shape pick-up coincides with the attach point.

To define a ***12d Model*** *shape*, there is a command to ***start shape*** *(opcode 83)* and ***end shape*** *(opcode 84)* the ***recording*** of the shape (26.4.2.48 Shaping (opcodes 83 to 86)).

After the ***Start recording a shape*** (opcode 83), the ***feature codes*** and ***string numbers*** for the next series of measurements are stored in the shape until the ***Stop recording a shape*** (opcode 84).

After the ***Stop recording*** opcode 84, a linear regression is performed on the (X,Y) coordinates of the shape, and then each measurement is converted to a distance (offset) and height from the **attach** point.

Important Notes

1. The first point is ony used to define the attach point and is not part of the shape.

   So if you want the first shape point to be at the same as the attach point, you need to take **two measurements** of the same point.

2. The ***Feature code*** and ***string number*** of each shape point will be used when generating string via Shape parallel (opcode 85).
3. Shape parallel (opcode 85) and Shape extrude (opcode 86) only apply to the **current string**. It is not possible to specify a previous string via a Point description.

As the shape is being defined, other field codes can be used such as **Offset** (26.4.2.40 Offset Measurement (opcodes 42, 43, 44)).

In the kerb example, an observation may be made at 5, and for the position of 6 a vertical offset is used. Similarly for point 7 using the observation at a point near point 2. In addition, points 6 and 7 can be made **non-tinable** so that formation of a tin is constrained to the surface of the kerb (26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)).

The next step is to pick up the entire length of the kerb at the attach string position using the **same *feature code*** and ***string number*** used for the **reference string** in the **shape pick-up**.

In the example, the attach string is the **lip of kerb**.

Once completed, the shape can be extruded or parallelled using the extrude (opcodes 87 and 85) or parallel commands (opcodes 88 and 86).

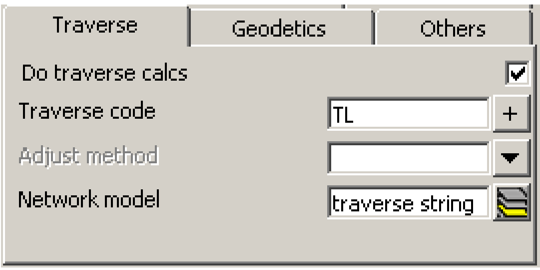
The **parallel** command will create a **number of strings** according to the number of points in the shape. Each string will be given the feature code and string number of the corresponding point in the shape.

The **extrude** will create a **super string** with the **shape** extruded along the reference string.

Continue to 26.3.13 Traverse Coding or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.3.13 Traverse Coding

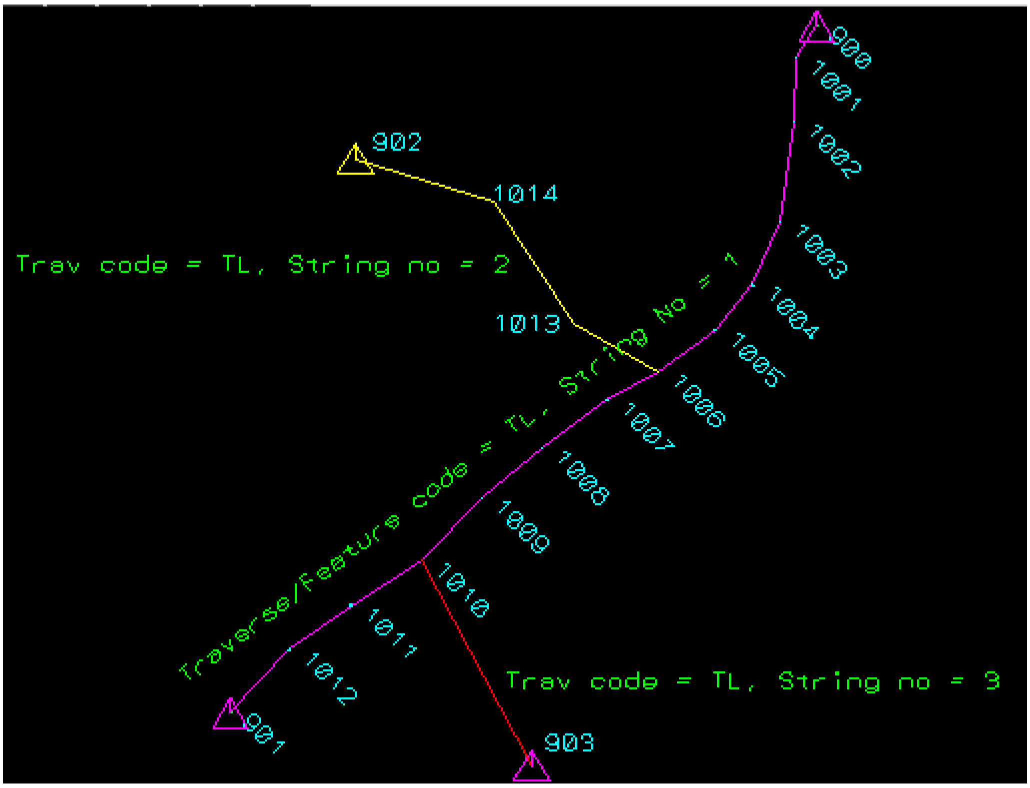
If a traverse is undertaken as part of a survey, a traverse code and string number can be coded so that ***12d Model*** can extract the traverse information. The specific traverse code can be supplied in the survey reduction panel under the traverse tab. An example is shown below:



In this case, the feature code of TL will be searched in the field file on reduction, so that a traverse string can be extracted. The user is required to nominate the foresight measurement with the TL code in this example. If they also include the TL code in a backsight to a previously defined traverse leg, a reciprocal calculation will be made. It uses the pair of observations (Foresight and Backsight observations of the same line *e.g.* Foresight 1001 to 1002 and backsight from 1002 to 1001). This reciprocal calculation takes the mean of the distance and vertical angles eliminating the effects of refraction.

A number of separate but interrelated traverses can be extracted using differing string numbers in the field.

The traverse code also allows for adjustments to be made between known stations. This adjustment maybe be chosen in the reduction panel. This field is optional.

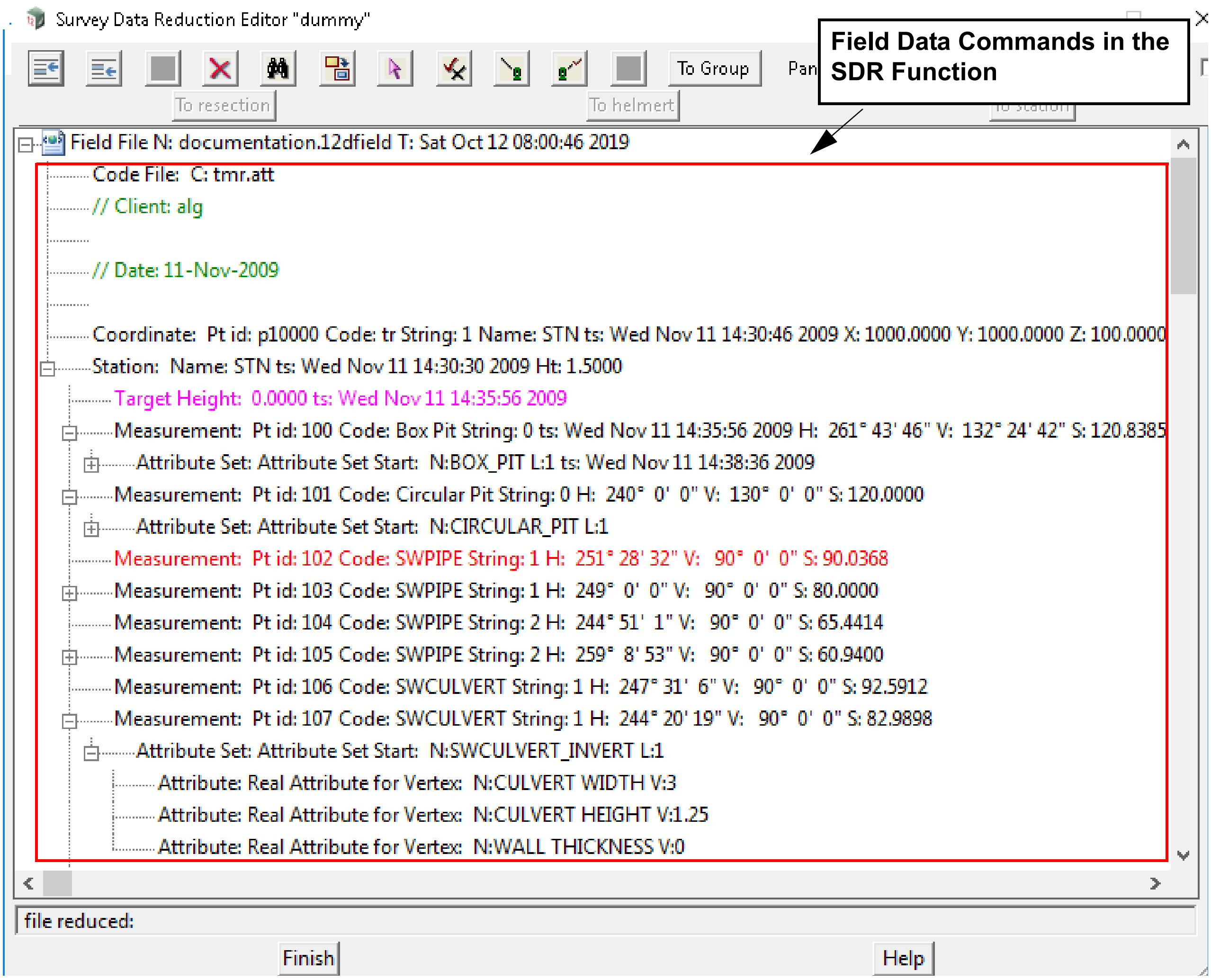


Continue to 26.4 Field Data Commands or return to 26.3 Field Coding for 12d Model or 26 12d Survey Guide.

26.4 Field Data Commands

The **Survey Data Reduction Editor** is used to interactively edit the field data of a ***SDR function***.

The **Survey Data Reduction Editor** panel displays the data loaded into the ***SDR Function***, either from ***12d Pickup*** or from a ***12d Field FIle***, as ***field data commands*** (***commands)***, and all the commands displayed in the **Survey Data Reduction Editor** panel can be modified, deleted, or new commands added.



The concepts used in the field data commands are described in [26.4.1 Common Information for Field Data Command Panels](#) and the field data commands themselves in [26.4.2 List of Field Data Commands](#).

26.4.1 Common Information for Field Data Command Panels

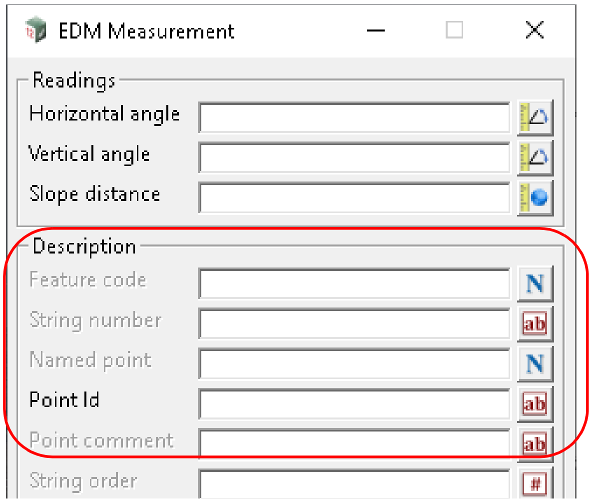
See

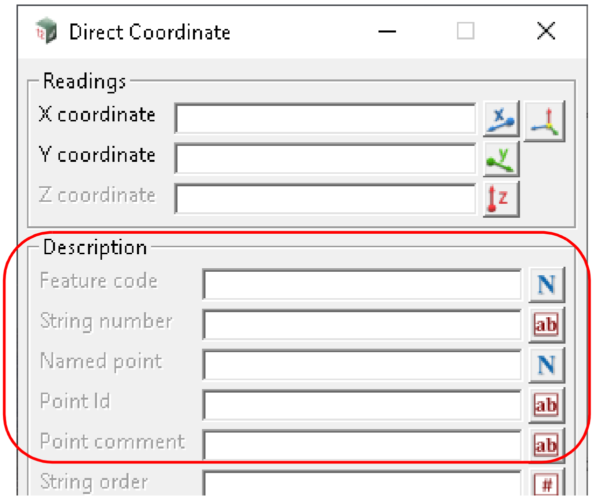
26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point
26.4.1.2 Searching for Coordinates, Points and Strings
26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point

When a **new point** is created by a **measurement** or a **directly entered coordinate**, reduction creates a vertex of a super string and the field data command supplies information for the new vertex.

This field data command information is displayed in the ***Description*** section of the panel for the field data command.





However there are two cases:

1. **Standard measurement**

   If the field ***Named point*** in the panel is ***blank***, or when working with a ***12d Field File*** and the ***point_name*** is ***blank***, then it is a ***standard measurement***.

   It this case, the measurement point becomes the vertex of a super string during the ***Feature code-String number*** processing.

   For details of the super sting vertex for a standard measurement, see 26.4.1.1.1 Standard Measurement

2. **Named measurement**

   If the field ***Named point*** in the panel is ***not blank***, or when working with a 1***12d Field File*** and ***point_name*** is ***not blank***, then it is a ***named measurement***.

   In this case, a special one point super string is created and the ***Named name*** (***point_name***) added to the ***named measurement list*** for the SDR Function so that it can be referenced by following measurements and opcodes.

   However, if the field **Use named points as measurements** in the associated Survey Data Reduction Function panel is ***ticked***, a standard measurement is also created.

   For the details of the super string vertex created for a named measurement, and if required, the super string vertex for the associated standard measurement, see 26.4.1.1.2 Named Measurement

26.4.1.1.1 Standard Measurement

If the **Named point** field in the panel is ***blank*** (or the ***point_name*** in the 12d Field File is ***blank***) then it is a ***standard measurement***.

When reduction occurs for a standard measure, the (x,y,z) coordinates are calculated for the measurement point and a **vertex** of a **super string** is created for that measurement point.

The name of the super string is ***Feature code*** (feature_code), and the ***String number*** (string_number) is recorded as the value of the string attribute, ***string_no***.

The ***Feature code*** and ***String number*** are processed to produce stringed data (see 26.3.1 Stringing in the Field).

Hence a ***standard measurement*** produces stringed data.

The ***Point number*** (***point_number***) is recorded as the ***point id*** for that vertex of the super string.

The ***Point comment*** (***point_comment***) is recorded as the ***vertex text*** for that vertex of the super string.

For the vertex, three attribute groups are created: *SDR Setup Details*, *SDR Measurement Details* and *SDR Measurement Geodetic Details*.

For ***SDR Setup Details***, the attribute names and values in the group are:

is_id	name of the station the measurement was taken from
is_x	x coordinate of the station
is_y	y coordinate of the station
is_z	z coordinate of the station
is_ht	height of the station
is_bearing_swing	the bearing swing in radians
is_setup_type	the type of setup (Station)

For ***SDR Measurement Details***, the attribute names and values are:

target_height	the height of the target
pu_hb_dms	horizontal angle in dms for the measurement
pu_va_dms	vertical angle in dms for the measurement
pu_sd	slope distance for the measurement

For ***SDR Geodetic Details***, the attribute names and values are:

So for a ***standard measurement***, the panel fields have the following use:

Feature code

feature_code

*For a standard measurement, then this is the **name of the super string** that this standard measurement point is part of.*

***Note:** for a standard measurement, the feature code and string number are used to string the data together and in the final strings, there is no actual feature code but its value is the **string name**.*

String number

string_number.

*If **not blank** and a standard measurement is being created, then this is the **string number** of the new standard measurement point.*

*The **string_number** is recorded as the value of a **string attribute** called **string_no, of the super string** that the new standard measurement point is part of.*

Named point

*this must be **blank** for a standard measurement.*

Point id

point_id.

*If **not blank** and a standard measurement is being created, then the **point_id** is recorded as the **vertex id** for the vertex of the super string that the new standard measurement point is part of. See*26.4.1.1.1 Standard Measurement.

Point comment

point_comment.

*If **not blank** and a standard measurement is being created, then the **point_comment** is recorded as the **vertex text** for the vertex of the super string that the new standard measurement point is part of. See*26.4.1.1.1 Standard Measurement.

26.4.1.1.2 Named Measurement

If the **Named point** field in the panel is ***not blank*** (or the ***point_name*** in the 12d Field File is ***not blank***) then it is a ***named measurement***.

When reduction occurs for a named measure, the (x,y,z) coordinates are calculated for the measurement point and:

(a) a ***one vertex super string*** of name ***Feature code*** (***feature_code***) is created and mapped using the Map File

(b) the ***vertex text*** of the vertex is the ***station prefix*** followed by the ***Named point*** (***point_name)***.

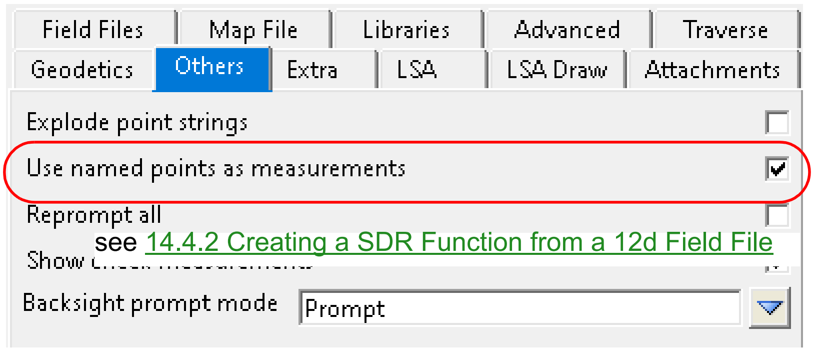
(c) the ***Named point*** (***point_name*** is added to the reduction functions internal list of ***named measurements list*** (***named points***) used in the reduction when searching for existing coordinates.

(d) the ***Point id*** of the one vertex of the super string is also set to ***Named name*** (***point_name***)

The one vertex super string is given a string attribute called ***Survey Control Station*** with the value 1.

So when creating a ***named measurement***, the ***String number*** (**string_number), *Point id* (*point_id***) and ***Point comment*** (***point_comment***), are **NOT** used when creating the special one vertex super string.

HOWEVER, for a named measurement, if **Use named points as measurements** is ticked **ON** in the **Others** tab for the Survey Data Reduction Function panel being used.



see 14.4.2 Creating a SDR Function from a 12d Field File

then a **separate standard measurement** is **also created** using the fields ***Feature code*** (feature_code), ***String number*** (string_number), ***Point id*** (point_id) and ***Point Comment*** (point_comment).

The ***Feature code*** and ***String number*** are for the separate standard measurement that can be processed to produce stringed data (see 26.3.1 Stringing in the Field).

So for a ***named measurement***, the panel fields can be used in two ways:

Feature code

feature_code.

*This is used as the **String name** of the named measurement and if a standard measurement is also being created, its **String name**. See* 26.4.1.1.1 Standard Measurement.

String number

string_number.

string_number is not used by the named measurement.

If a standard measurement is also being created, then this is its ***string number****. See*26.4.1.1.1 Standard Measurement.

Named point

point_name.

If ***not blank,*** *then this is a* **named measurement**.

In this case, a one vertex super string with the string name ***point_name*** *is created. The named measurement can be used in the reduction to provide coordinates for stations, backsights etc.*

If a standard measurement is also being created, it does not use ***point_name****. See*26.4.1.1.1 Standard Measurement.

Point id

point_id.

The point_id is not used in the **named measurement**.

If a standard measurement is also being created, then this is its ***point_id****. See*26.4.1.1.1 Standard Measurement.

Point comment

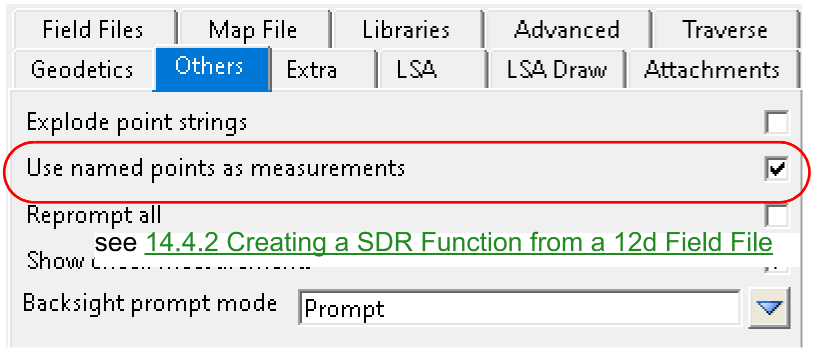
point_comment.

For a named measurement, the point_comment is used as the vertex text of the super string.

If a standard measurement is also being created, then the point_comment is the ***vertex text*** *of this super string. See*26.4.1.1.1 Standard Measurement.

Important Note - Named Measurement Also Producing a Standard Measurement

For a named measurement, the extra standard measurement is only created when **Use named points as measurements** is ticked ON in the **Others** tab for the Survey Data Reduction Function panel being used.



see 14.4.2 Creating a SDR Function from a 12d Field File

26.4.1.2 Searching for Coordinates, Points and Strings

When doing a survey there are two types of searches that are required.

(a) Searching for special known points critical to the reduction

Some field data commands such as ***Backsight***, ***New instrument*** and ***Check measurements***, allow the user to enter an **existing *Name***, and sometimes a ***known Point Id***, and they are used to search the Control model, the Network model and the list of ***Named Points*** created during the reduction, to find the special point and use its (x,y,z) coordinate and other details in the reduction.

See 26.4.1.2.1 Searching for the Coordinates of Special Points.

(b) Searching standard measurements for existing points or strings for stringing and attributing

Most field data commands are used for stringing, setting properties of the created super strings and string, vertex and segment attributes of the created super string.s

These options only use standard measurements.

See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings.

For a search, a confirmation of what is found for the search is written as loglines to the 3.6.9 Output Window and double clicking on the loglines will highlight the objects in the views they are on.

Also for a search, detailed information on what is found by the search is written to the **Report File**.

Continue to 26.4.1.2.1 Searching for the Coordinates of Special Points or return to 26.4.1 Common Information for Field Data Command Panels or 26.4 Field Data Commands.

26.4.1.2.1 Searching for the Coordinates of Special Points

For the field data commands ***Backsight***, ***New Instrument***, ***Check measurement*** and ***Check coordinate***, the values of the fields:

1. **Backsight point** field in the **Backsight** panel
2. **Named point** field in the **New Instrument** panel
3. **Check point** field in the **Check Measurement** panel
4. **Check point** field in the **Check Coordinate** panel

and sometimes also the value in the ***Point id*** field, are used **to *find a point*** whose coordinates are used in the reduction.

Note: in the ***12d Field File,*** these fields are all stored as the ***point_name,*** and the ***Point id*** field is store as the ***point_id***. See 26.5 Field Data Commands and 12d Field File Opcodes.

To save confusion, in this section we will use:

(a) ***Name*** for **Backsight point/Named point /Check point** in the field data command (***point_name*** in the ***12d Field File***).

and

(b) ***Id*** for the **Point Id** in the field data command (***point_id*** in the ***12d Field File***).

Given the ***Name*** and/or ***Id*** for the given field data commands, a point is found by searching in the following order:

First search the Control model (if it exists):

1. ***Name*** amongst **Vertex ids**

   A search is made of the **Control model** for a **vertex of a string** whose **point id** is the **same as *Name***. If a vertex is found its (x,y,z) coordinates and details are used.

2. ***Id*** amongst **Vertex ids**

   A search is made of the **Control model** for a **vertex of a string** whose **point id** is the **same as *Id***. If a vertex is found its (x,y,z) coordinates and details are used.

3. ***Name*** amongst **String names**

   A search is made of the **Control model** for a **string whose name** is the **same as *Name*.** If a string is found, the **first vertex of the string** is used for the (x,y,z) coordinates and details.

Next search the Network model (if it exists):

4. ***Name*** amongst **Vertex ids**

   A search is made of the **Network model** for a **vertex of a string** whose **point id** is the **same as *Name***. If a vertex is found its (x,y,z) coordinates and details are used.

5. ***Id*** amongst **Vertex ids**

   A search is made of the **Network model** for a **vertex of a string** whose **point id** is the **same as *Id***. If a vertex is found its (x,y,z) coordinates and details are used.

If *Use field coordinates* is ticked. next search the already entered Directly Entered Coordinates (DECs) in the SDR Function (12d Field File). Note that in the 12d Field file, a DEC has a point_name and point_id.

6. ***Name*** amongst **Named points (point_names)**

   A search is made of previously entered ***directly entered coordinates*** for a DEC whose ***Named point*** (***point_name***) is the **same as *Name***. If a DEC is found, its (x,y,z) coordinates are used.

7. ***Name*** amongst **Point ids**

A search is made of previously entered ***directly entered coordinates*** for a DEC whose ***Point id*** (***point_id***) is the same as ***Name***. If a DEC is found, its (x,y,z) coordinates are used.

8. ***Id*** amongst **Point ids** (**point_ids**)

   A search is made of previously entered ***directly entered coordinates*** for a DEC whose ***Point id*** (***point_id***) is the **same as** ***Id***. If a DEC is found, its (x,y,z) coordinates are used.

Next search the previous measurements in the SDR Function (12d Field File): Note that a measurement in the SDR Function has a Feature code which is stored as point_name in the 12d Field file, and a Point id which is stored as point_id in the 12d Field file.

9. ***Name*** amongst ***Feature code*** (**point_names**)

   A search is made of ***previous measurements*** for a measurement whose ***Feature code*** (**point_name**) is the **same as** ***Name***. If a measurement is found, its (x,y,z) coordinates are used.

10. ***Name*** amongst ***Point ids*** (**point_ids**)

    A search is made of **previous measurements** for a measurement whose ***Point id*** (***point_id)*** is the **same as** ***Name***. If a measurement is found, its (x,y,z) coordinates are used.

11. ***Id*** amongst ***Point ids*** (**point_ids**)

    A search is made of **previous measurements** for a measurement whose ***Point id*** (**point_id**) is the **same as** ***Id***. If a measurement is found, its (x,y,z) coordinates are used.

Finally

12.If **no match** is found, the user will be ***prompted for the details of the unfound point.***

The user is asked to type in the (x,y,z) coordinates in the **Define Station Coordinate** panel.

If a model is specified in the **Add to model** field of the panel, then a **new one point super string is created** with the **string name** ***Name*****,** and for the vertex text, the **Station label prefix** field value followed by ***Name.***

For a search for the coordidnates of special points, a confirmation of what is found for the search is written as loglines to the 3.6.9 Output Window and double clicking on the loglines will highlight the objects in the views they are on.

```
⊟-! Horizontal control by model
   ! "SURVEY TRAVERSE -> TL" : vertex 2

⊟-! Horizontal control by measurement point name
   ! Measurement:  Pt id: 1001 Code: PQAP Name: L1 H:  234° 39'  7" V:   98° 47' 56" S: 7.6280
```

Also for a search, detailed information on what is found by the search is written to the **Report File**.

For example,

```
Coordinate for station "STN1" defined from control model SURVEY TRAVERSE->TL
  Detailed Coordinate Source by Vertex
    Name        : STN1
    Model  name : SURVEY TRAVERSE
    Model  Uid  : 2088
    String name : TL
    String Uid  : 2089
    Vertex #    : 1
    Vertex Id   : -1
```

or

```
 Detailed Coordinate Source by SDR Command
    Name            : L1
    Feature code    : PQAP
```

```
String number :
Point name    : L1
Point id      : 1001
Point comment :
SDR Id        : 32908
```

For a summary of the **12d Field File Opcodes**, see 28.9 12d Survey Opcode Summary

For the full description of the **12d Field File Opcodes**, see 28.8 Full Description of 12d Survey Opcodes.

Continue to 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings or return to 26.4 Field Data Commands.

26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

The ***Feature Code***, ***String number*** and ***Point Id*** are used to find measurement points or strings already created in the ***12d Field File***.

Feature code

Feature code.

*If **not blank**, the feature code is used for searching.*

See Searching Using Feature Code, String Number and Point Id

String number

String number.

*If **not blank**, the string number is used for searching.*

See Searching Using Feature Code, String Number and Point Id

Point id

Point id.

*If **not blank**, the point id is used for searching.*

See Searching Using Feature Code, String Number and Point Id

Searching Using Feature Code, String Number and Point Id

Although the searching is the same for most options, it can vary from option to option.

However, how the ***result*** of the search is used definitely depends on the particular option.

So the searching and the use of the search results is described in each option.

In most cases, the searching is as follows

If **no Feature code**, **String number** or **Point id** is given, then the current measurement point is used.

If the **Feature code and String number** are given, then last previous measurement points of the same feature code and string number are used to find points or strings.

If **only the Point id** is given, then the feature code and string number are taken from the previous measurement point **with that Point id** and the feature code and string number of that measure point are used to search for points or strings.

Continue to 26.4.1.3 String Order Field or return to 26.4 Field Data Commands.

26.4.1.3 String Order Field

String order

The options on the **Order** menu (**Order** options) assign integers (**String order**) to the measurement points that will form a string.

During reduction, the measurement points are strung together as vertices of the string in the order of increasing **String order** integers.

So the panel field **String orde**r has the following use:

String order integer box

*If **not blank**, displays the integer created by the options in the **SDR String Ordering** menu. See 14.5.5 Order. This value can be modified.*

*If **blank**, then no option has created a value.*

Continue to 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons or return to 26.4 Field Data Commands.

26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

The panel fields have the following use:

Time surveyed

Time when the command (opcode) was created.

Comment

Comment to add with the command in the field file.

Error information

Any error messages for the Field Data Command are written to this field.

Command ID

Every instance of an Opcode in the project gets a unique Command ID.

The buttons that appear on the bottom of the panels used in this section have the following functions.

OK

Changes field data and closes the panel.

Apply

Changes the field data but keeps the panel in view.

Reset

If the record was an original field record (i.e. the command was not inserted manually) pressing the reset button will revert the record back to the original values.

Help and Finish

Standard 12d buttons.

Continue to 26.4.2 List of Field Data Commands or 26.4 Field Data Commands or return to 26 12d Survey Guide.

26.4.2 List of Field Data Commands

The list of **Field Data Commands** field commands for ***.fld*** and ***.12dfield*** files that are available in the pop-up except for the ***Extend Measurement*** Opcodes **142**, **143**, **172** and **173** that are only available in the ***.12dfield*** file.

Note: the **Insert** or **Batch Add** can only use the ***.fld*** data commands.

	See
Arc fitting end (opcode 62)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc fitting start (opcode 61)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc through last 3 points (opcode 17)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc through next 3 points (opcode 60)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Attachment (opcode 126)	26.4.2.2 Attachment (opcode 126)
Attribute for next segment (Measurement) (opcode 122)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
Attribute for next segment (integer) (opcode 74)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for next segment (real) (opcode 75)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for next segment (text) (opcode 76)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for previous segment (Measurement) (opcode 123)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
Attribute for previous segment (integer) (opcode 77)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for previous segment (real) (opcode 78)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for previous segment (text) (opcode 79)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for string (Measurement) (opcode 120)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
Attribute for string (integer) (opcode 68)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for string (real) (opcode 69)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for string (text) (opcode 70)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
Attribute for vertex (Measurement) (opcode 121)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for vertex (integer) (opcode 71)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for vertex (real) (opcode 72)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for vertex (text) (opcode 73)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute set end (opcode 125)	26.4.2.5 Attribute Set (opcodes 124 and 125)
Attribute set start (opcode 124)	26.4.2.5 Attribute Set (opcodes 124 and 125)
Backsight (opcode 4)	26.4.2.6 Backsight (opcode 4)
Backsight reference (opcode 50)	26.4.2.7 Backsight Reference (opcode 50)
Building end (opcode 111)	26.4.2.8 Buildings (opcodes 110, 111)
Building start (opcode 110)	26.4.2.8 Buildings (opcodes 110, 111)
Check coordinate (opcode 14)	26.4.2.9 Check Coordinate (opcode 14)
Check measurment (opcode 6)	26.4.2.10 Check Measurement (opcode 6)
Circle feature (opcode 18)	26.4.2.11 Circle Feature (opcode 18)
Code file (opcode 119)	26.4.2.12 Code File (opcode 119)

Only for 12dfield files

	See
Comment (opcode -2)	26.4.2.13 Comment (opcode -2)
Coordinate (opcode 2)	26.4.2.14 Coordinate (opcode 2)
Delta height (opcode 28)	26.4.2.15 Height Or Depth Comment (opcode 28)
Description (opcode 1)	26.4.2.16 Job Data (opcode 1)
Distance correction (opcode 127)	26.4.2.17 Distance Correction (opcode 127)
Distances (opcode 49)	26.4.2.18 Distances (opcode 49)
Error (opcode -1)	26.4.2.19 Error (opcode -1)
Extend next segment (opcode 142)	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173
Extend next segment 3d (opcode 172)	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173
Extend previous segment (opcode 143)	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173
Extend previous segment 3d (opcode 173)	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173
File end (opcode 99)	26.4.2.21 End File (opcode 99)
GPS Coordinate (opcode 140)	26.4.2.22 GNSS Coordinate (opcode 140)
GPS Offset Coordinate (opcode 145)	26.4.2.23 GNSS Offset Correction (opcode 145)
Group (opcode -3)	26.4.2.24 Helmert Start (opcode 138)
Helmert end (opcode 139)	26.4.2.25 Helmert End (opcode 139)
Helmert start (opcode 138)	26.4.2.26 Group (opcode -3)
Horizontal Distance PPM Correction (opcode 131)	26.4.2.27 PPM Correction (opcode 131)
Invisible next segment (opcode 108)	26.4.2.28 Invisibility (opcodes 107, 108, 109)
Invisible point (opcode 109)	26.4.2.28 Invisibility (opcodes 107, 108, 109)
Invisible previous segment (opcode 107)	26.4.2.28 Invisibility (opcodes 107, 108, 109)
Join first points of strings (opcode 23)	26.4.2.29 Strings Join (opcodes 21 to 24)
Join first to last point of strings (opcode 22)	26.4.2.29 Strings Join (opcodes 21 to 24)
Join last points of strings (opcode 21)	26.4.2.29 Strings Join (opcodes 21 to 24)
Join last to first point of strings (opcode 24)	26.4.2.29 Strings Join (opcodes 21 to 24)
Measurement EDM (opcode 7)	26.4.2.30 EDM Measurement (opcode 7)
Measurement EDM HT (opcode 11)	26.4.2.31 EDM Measurement (HA,HD,HT) (opcode 11)
Measurement EDM VD (opcode 12)	26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12)
Measurement Stadia (opcode 10)	26.4.2.33 Stadia Measurement (opcode 10)
Midpoint of 2 Points (opcode 146)	26.4.2.34 Midpoint of Two Points (opcode 146)
Midpoint of 3 Points (opcode 147)	26.4.2.35 Centre of Arc Through Three Points (opcode 147)

	See
Multiple coding (opcode 16)	26.4.2.36 Multiple Coding (opcode 16)
New instrument (opcode 3)	26.4.2.37 New Instrument Setup - Station (opcode 3)
Non tinable next segment (opcode 38)	26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
Non tinable point (opcode 40)	26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
Non tinable previous segment (opcode 39)	26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
Non tinable string (opcode 141)	26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
Note (opcode 29)	26.4.2.39 Note (opcode 29)
Offset height (opcode 44)	26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
Offset radial (opcode 42)	26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
Offset tangential (opcode 43)	26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
Order String Automatically (opcode 101)	26.4.2.41 Order String Automatically (opcode 101)
Pipe axial (opcode 81)	26.4.2.42 Pipe Justification (opcodes 80, 81, 82)
Pipe invert (opcode 80)	26.4.2.42 Pipe Justification (opcodes 80, 81, 82)
Pipe obvert (opcode 82)	26.4.2.42 Pipe Justification (opcodes 80, 81, 82)
Remove height (opcode 30)	26.4.2.43 Remove Height (opcode 30)
Remove point (opcode 31)	26.4.2.44 Remove (Delete) Point (opcode 31)
Remove string (opcode 144)	26.4.2.45 Remove (Delete) String (opcode 144)
Resection end (opcode 129)	26.4.2.47 Resection End (opcode 129)
Resection start (opcode 128)	26.4.2.46 Resection Start (opcode 128)
Shape end (opcode 84)	26.4.2.48 Shaping (opcodes 83 to 86)
Shape extrude (opcode 86)	26.4.2.48 Shaping (opcodes 83 to 86)
Shape parallel (opcode 85)	26.4.2.48 Shaping (opcodes 83 to 86)
Shape record (opcode 83)	26.4.2.48 Shaping (opcodes 83 to 86)
Slope Distance Scale factor (opcode 9)	26.4.2.49 Slope Distance Scale Factor (opcode 9)
String close (opcode 20)	26.4.2.50 String Close (opcode 20)
String end (opcode 48)	26.4.2.51 String End (opcode 48)
String rectangle (opcode 45)	26.4.2.52 String (Squashed) Rectangle (opcode 45)
String rectangle by 2 points (opcode 37)	26.4.2.53 String Rectangle by 2 Points (opcode 37)
String reverse (opcode 19)	26.4.2.54 String Reverse (opcode 19)
String start (opcode 47)	26.4.2.55 String Start (opcode 47)
String tinable (opcode 46)	26.4.2.56 String Tinable - Breakline String (opcode 46)

	See
String type 2d (opcode 92)	26.4.2.57 String Type (opcodes 92, 93, 94)
String type 3d (opcode 93)	26.4.2.57 String Type (opcodes 92, 93, 94)
String type 4d (opcode 94)	26.4.2.57 String Type (opcodes 92, 93, 94)
String type culvert (opcode 96)	26.4.2.58 Culvert (opcode 96)
String type pipe (opcode 95)	26.4.2.59 Pipe Diameter (opcode 95)
Target height (opcode 5)	26.4.2.60 Target Height (opcode 5)
Template change (opcode 59)	26.4.2.61 Templating (opcodes 51 to 59)
Template continue (opcode 54)	26.4.2.61 Templating (opcodes 51 to 59)
Template delete (opcode 57)	26.4.2.61 Templating (opcodes 51 to 59)
Template end (opcode 52)	26.4.2.61 Templating (opcodes 51 to 59)
Template insert (opcode 58)	26.4.2.61 Templating (opcodes 51 to 59)
Template pause (opcode 53)	26.4.2.61 Templating (opcodes 51 to 59)
Template record (opcode 55)	26.4.2.61 Templating (opcodes 51 to 59)
Template skip (opcode 56)	26.4.2.61 Templating (opcodes 51 to 59)
Template start (opcode 51)	26.4.2.61 Templating (opcodes 51 to 59)
Text (opcode 41)	26.4.2.62 Additional Text For Point (opcode 41)
Units (opcode 100)	26.4.2.63 Units (opcode 100)
Vertical circle correction (opcode 15)	26.4.2.64 Vertical Circle Correction (opcode 15)

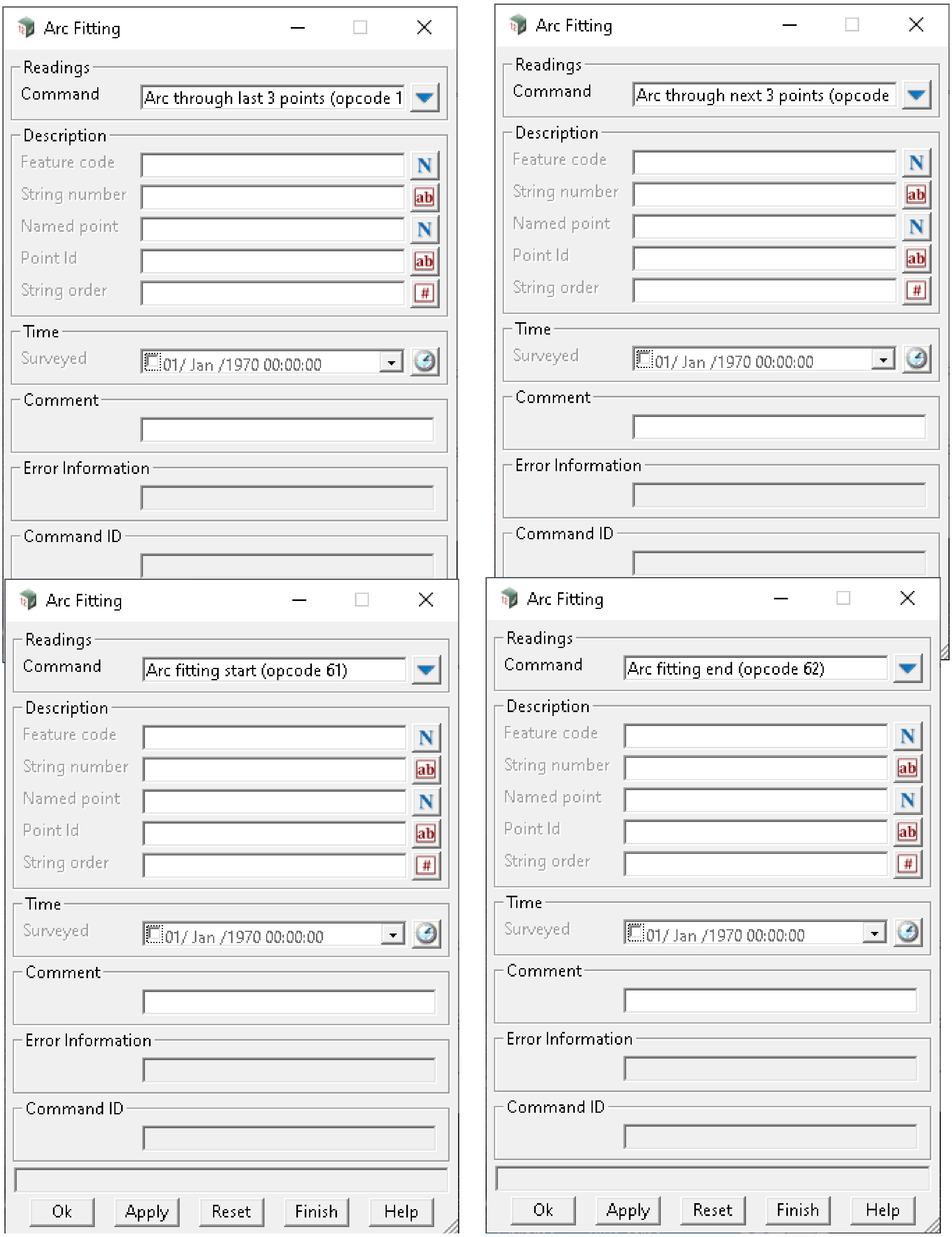
For a summary of the field file opcodes see the section 28.9 12d Survey Opcode Summary.

The documentation for each of the **Field Data Commands** in the pop-up list will now be given.

26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)

The **Arc Fitting** option fits arcs through existing or future measurements.

For a full description and diagrams, see 26.3.10 Arcs Through Points in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command	choice box		Arc through last 3 points (opcode 17) Arc through next 3 points (opcode 60) Arc fitting start (opcode 61) Arc fitting end (opcode 62)

for Arc through last 3 pts - uses standard measurements only

Named point *field is not used.*

If no ***Feature code****,* ***String number*** *or* ***Point id*** *is given, then the current measurement point and the two previous points with the same feature code and string number as the current measurement point, are joined by an arc. If there is less than three such points, no arc is fitted.*

If the ***Feature code*** *and* ***String number*** *are given, the last three previous measurement points of the same feature code and string number are joined by an arc. If the current measurement point has that feature code and string number, then it is the third of the three points used. If there is less than three points, no arc is fitted.*

If ***only the Point id*** *is given, then the feature code and string number are taken from the previous measurement point* ***with that Point id****. That point and two measurement points previous to the predefined point that have the same feature code and string number, are joined by an arc. If there is less than three points, no arc is fitted*

for Arc through next 3 pts - uses standard measurements only

Named point *field is not used.*

If no ***Feature code****,* ***String number*** *or* ***Point id*** *is given, an arc is inserted through the current measurement point and the next two measured points with the same feature code and string number as the current measurement point. If there is less than three points, no arc is fitted.*

If a ***Feature code****,* ***String number*** *or* ***Point id*** *is given, then either the Feature code and/or String number and/or the Point id is used.*

If the ***Feature code*** *or* ***String number*** *is given, a search is made for a previously defined measurement with the same feature code or string number. An arc is inserted through this previous measurement and the next two measured points following this previous measurement with the same feature code and string number. If the current point has that feature code and string number, then it is the first of the three points. If there is less than three points, no arc fitted.*

If ***only the Point id*** *is given, then the feature code and string number are taken from the previous measurement point* ***with that Point id****, and an arc is inserted through that point and the next two measurement points with the same feature code and string number. If there is less than three points, no arc is fitted*

for Start arc fitting - uses standard measurements only

Named point *field is not used.*

If no ***Feature code****,* ***String number*** *or* ***Point id*** *is given, arcs are inserted through the following sets of measurement points with the same feature code and string number as the current measurement point. The current measurement point is the first of the points.*

The arcs are fitted as follows - the first arc is fitted through points one, two and three, the next arc through points three, four and five etc. If the current point has that feature code and string number, then it is the first of the points. If there is less than three points, then no arc is fitted.

If the ***Feature code*** *and* ***String number*** *is given, a search is made for a previously defined measurement* *with the same feature code or string number. An arc is inserted through the following measured points with the same feature code and string number. If the current point has that feature code and string number, then it is the first of the points.*

*If **only the Point id** is given, then the feature code and string number are taken from the previous measurement point **with that Point id**, and arcs are inserted through that point and the following measured points with the same feature code and string number.*

for End arc fitting - uses standard measurements only

***Named point** field is not used.*

*If no **Feature code**, **String number** or **Point id** is given, the fitting of arcs through the current string is stopped. The current measurement point is the last of the points used in the arc fitting.*

*If the **Feature code** and **String number** are given, then the fitting of arcs through the points of the previous string with the same feature code and string number is stopped. If the current measurement point has that feature code and string number, then it is the last point used in the arc fitting.*

*If **only the Point id** is given, then the point **with that Point id** is the last point used in the arc fitting.*

If **12d Model** *encounters an End Arcs (62) but no Start Arcs through sets of three points (61) command for the string, then a Start Arcs through sets of three points (61) is assumed to apply at the beginning of the string and hence arc fitting will be applied to the entire string.*

Description - used for finding existing standard points

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

17 arc_fitting_last_3_points Arc through previous three points.

60 arc_fitting_next_3_points Arc through next three points.

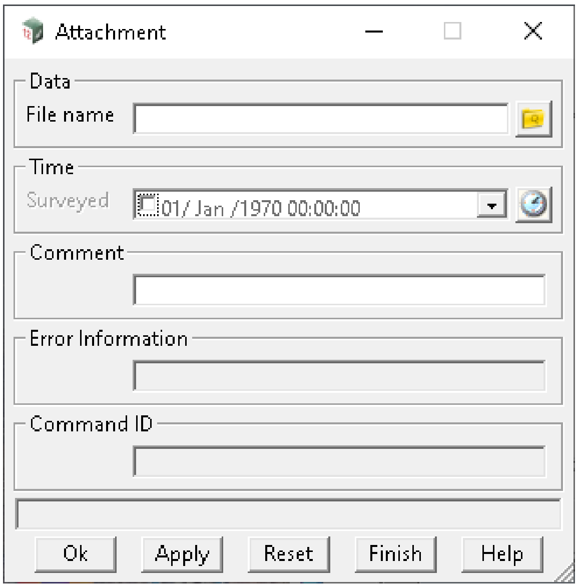
61 arc_fitting_start Start of arc through sets of three points until end of string, or a 62 occurs.

62 arc_fitting_end End the arcs begun by a 61 command.

Continue to 26.4.2.2 Attachment (opcode 126) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.2 Attachment (opcode 126)

The **Attachment** option attaches a file to the current measurement.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

File name

File to attach to the current measurement.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 126 attachment Attach a file.

Continue to 26.4.2.3 Measurement Attributes (opcodes 120 to 123) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

26.4.2.3 Measurement Attributes (opcodes 120 to 123)

The **Measurement Attributes** option uses the given horizontal angle, vertical angle, slope distance and target height and calculates the coordinates of the point resulting from these values.

No point is created by this but the following information is stored as attributes (**measurement attributes**):

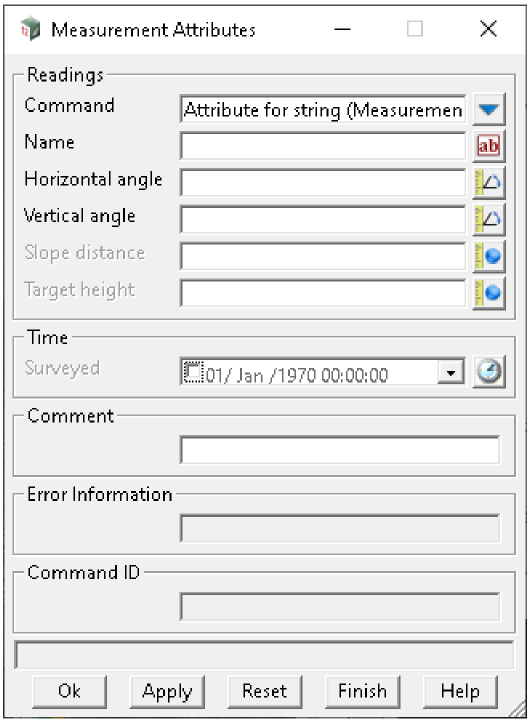
(a) x, y and z coordinates of the instrument

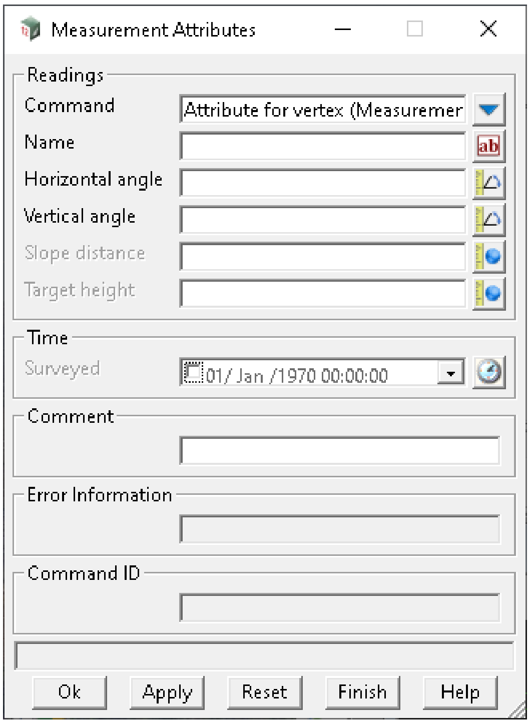
(b) instrument height

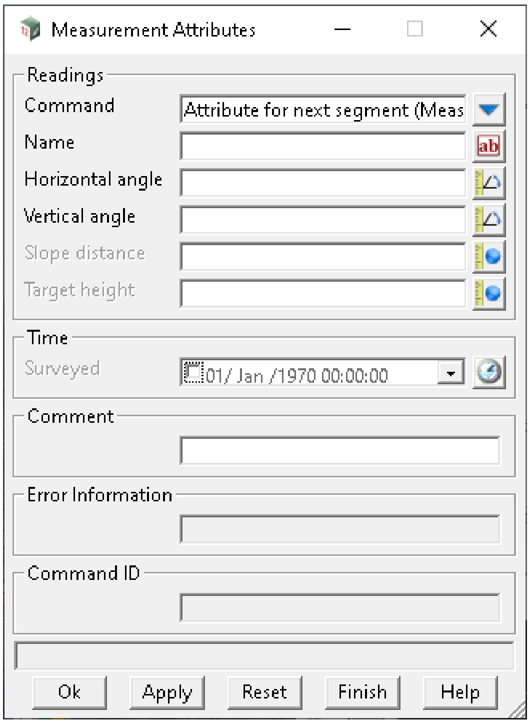
(c) x, y and z coordinates of the calculated point

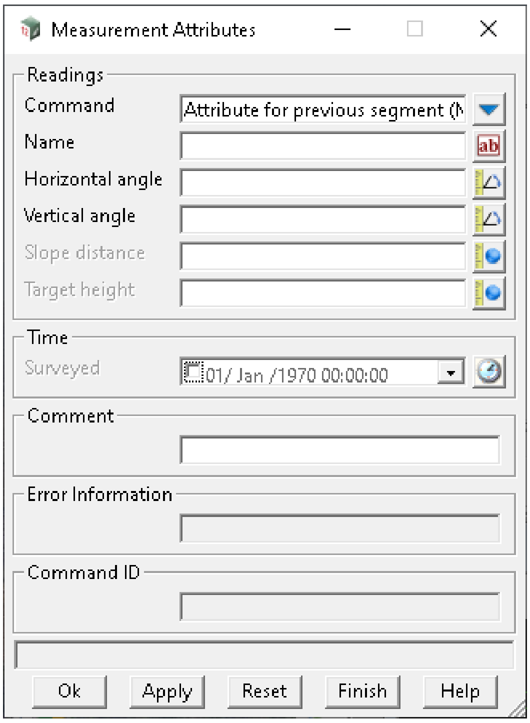
(d) horizontal angle, vertical angle, slope distance and target height.

These attributes can be used by macros and other ***12d Model*** options.









The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command	choice box	Attribute for string (Measurement) (opcode 120) Attribute for vertex (Measurement) (opcode 121) Attribute for next segment (Measurement) (opcode 122) Attribute for previous segment (Measurement) (opcode 123)

For string (measurement)

Add the measurement attributes to the current string.

For vertex (measurement)

Add the measurement attributes to the current vertex (current measurement point).

For next segment (measurement)

Add the measurement attributes to the next segment from the current measurement point.

For previous segment (measurement)

Add the measurement attributes to the previous segment to the current measurement point.

Name

***Name**, followed by a space " ", is used as a prefix for the names of the attributes used to store the values.*

Horizontal angle

Horizontal angle to use to calculate a point.

Vertical angle

Vertical angle to use to calculate a point.

Slope distance

Slope distance to use to calculate a point.

Target height

Target height to use to calculate a point.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

The actual attribute names and values stored for the measurement attributes are:

name_prefix ix	x coordinate of the instrument
name_prefix iy	y coordinate of the instrument
name_prefix iz	z coordinate of the instrument
name_prefix ih	instrument height
name_prefix tx	x coordinate of the target when using the values in the panel
name_prefix ty	y coordinate of the target when using the values in the panel
name_prefix tz	z coordinate of the target when using the values in the panel
name_prefix ha	**Horizontal angle** in radians
name_prefix va	**Vertical angle** in radians
name_prefix sd	**Slope distance** in radians
name_prefix t	**Target height**

For the description on how the field data command is stored in a ***12d Field File,*** see
120 measure_attribute_string Attribute for string (measurement).

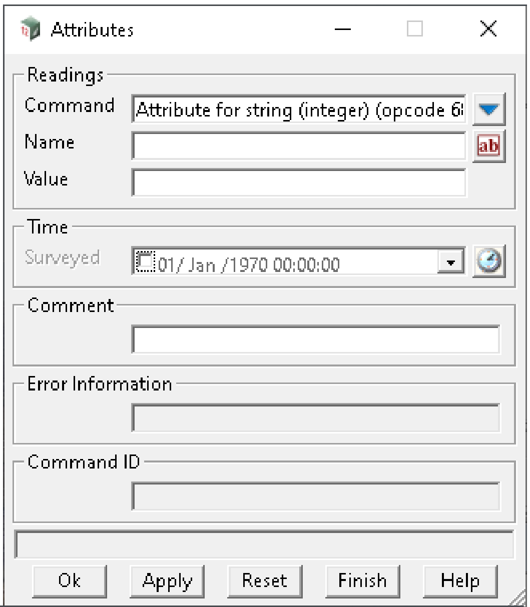
to

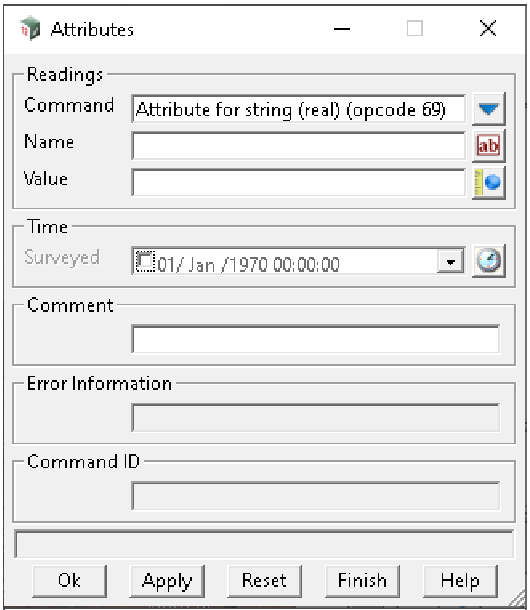
123 measure_attribute_previous_segment Attribute for previous segment (measurement).

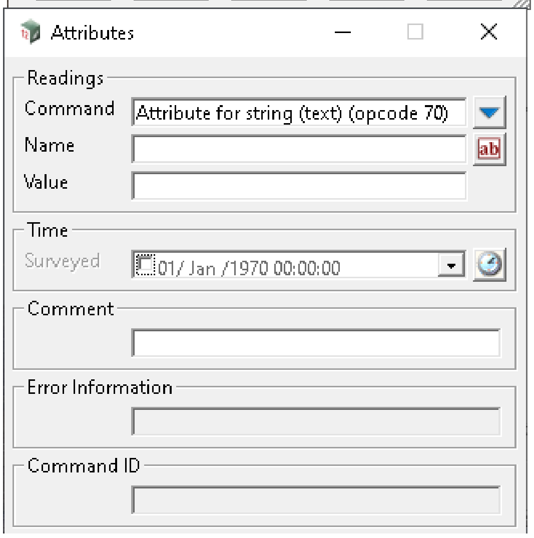
Continue to 26.4.2.4 Attributes (opcodes 68 to79) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

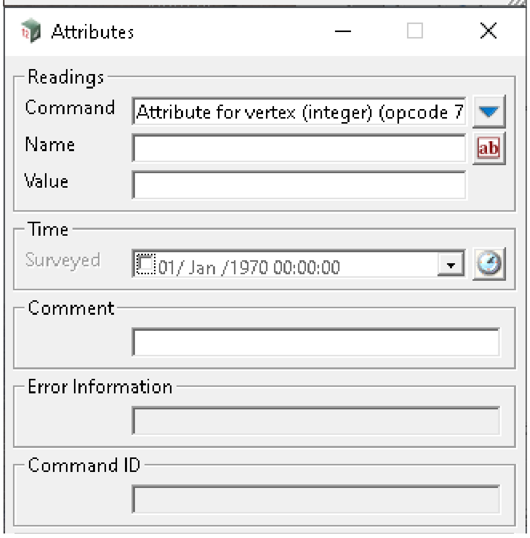
26.4.2.4 Attributes (opcodes 68 to79)

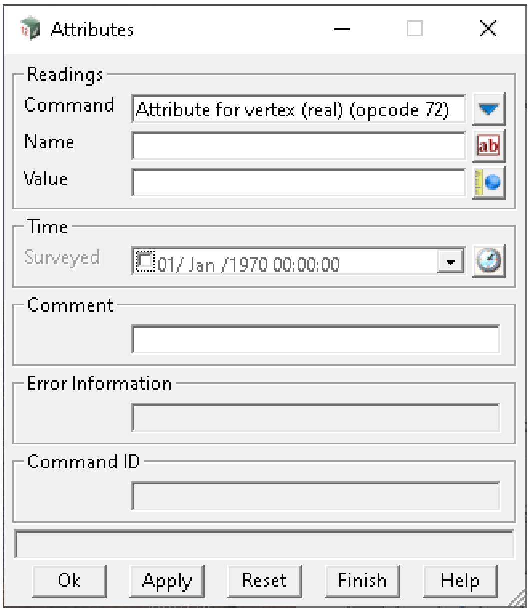
The ***Attributes*** option adds user named attributes and values of type integer, real or text to the current string, the current measurement point (vertex), and to the segment before and the segment after, the current measurement point.

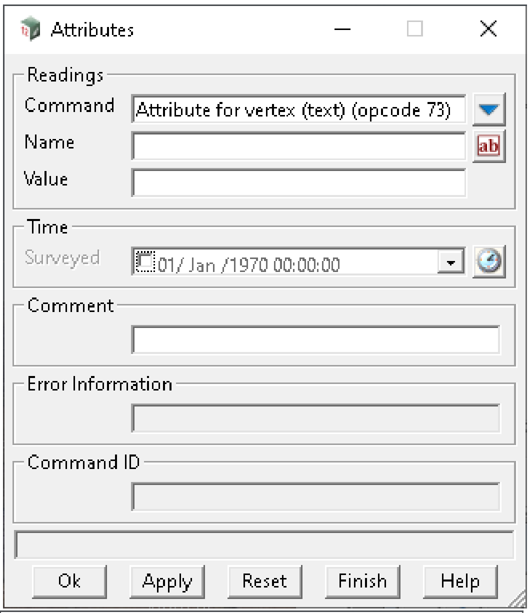


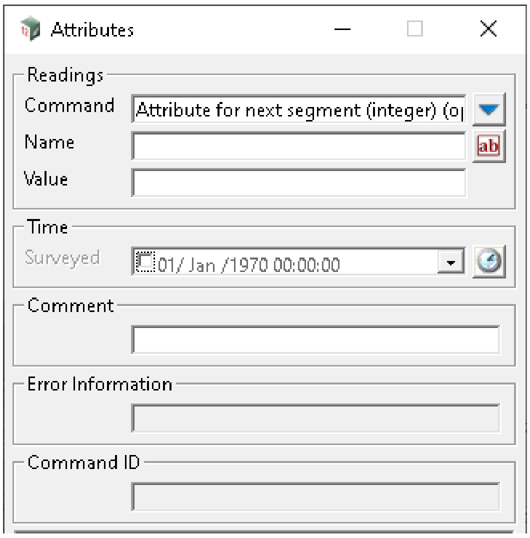


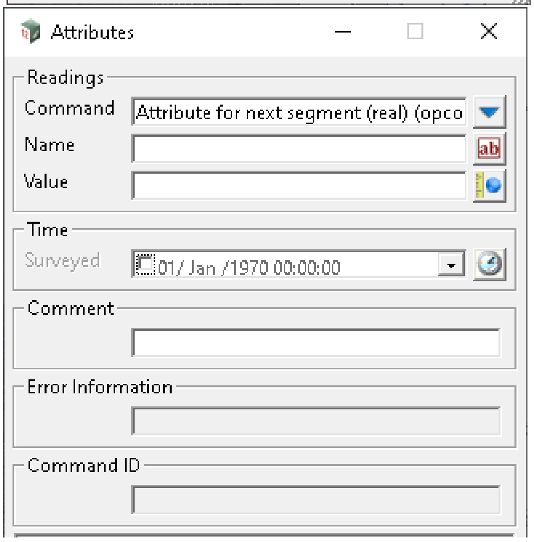


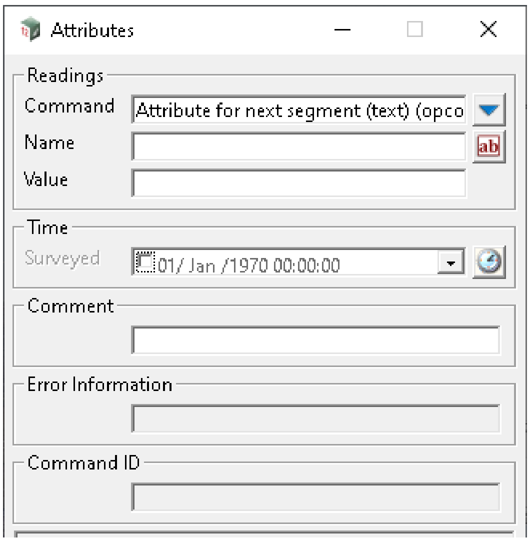


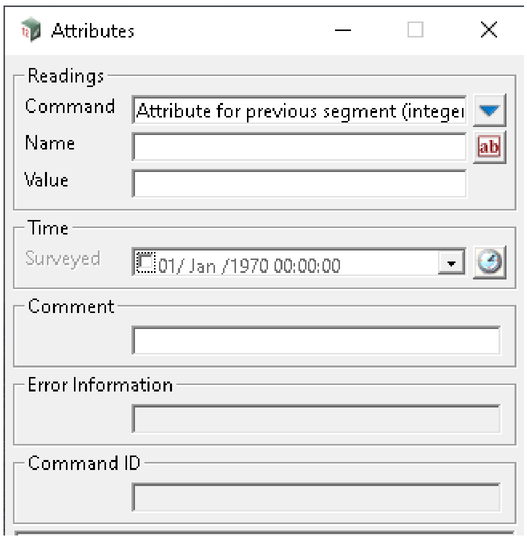

Attributes
Readings
Command
Attribute for vertex (real) (opcode 72)
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID
Ok
Apply
Reset
Finish
Help

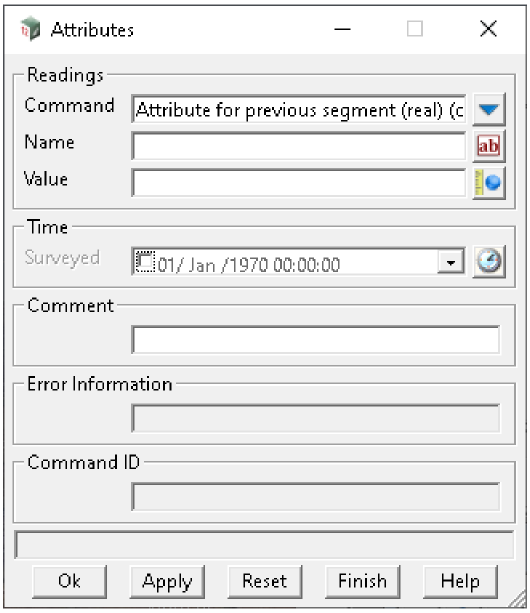

Attributes
Readings
Command
Attribute for vertex (text) (opcode 73)
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID
Ok
Apply
Reset
Finish
Help

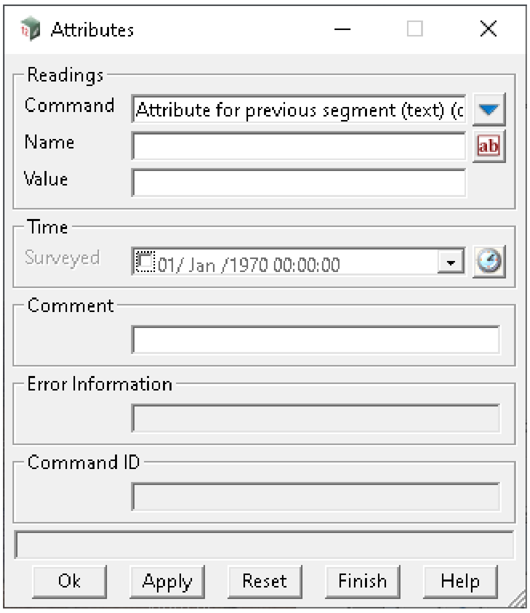

Attributes
Readings
Command
Attribute for next segment (integer) (op
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID


Attributes
Readings
Command
Attribute for next segment (real) (opco
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID


Attributes
Readings
Command
Attribute for next segment (text) (opco
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID


Attributes
Readings
Command
Attribute for previous segment (integer
Name
Value
Time
Surveyed
01/ Jan /1970 00:00:00
Comment
Error Information
Command ID





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command	choice box	Attribute for string (integer) (opcode 68) Attribute for string (real) (opcode 69) Attribute for string (text) (opcode 70) Attribute for vertex (integer) (opcode 71)) Attribute for vertex (real) (opcode 72)) Attribute for vertex (text) (opcode 73) Attribute for next segment (integer) (opcode 74) Attribute for next segment (real) (opcode 75)) Attribute for next segment (text) (opcode 76)) Attribute for previous segment (integer) (opcode 77)) Attribute for previous segment (real) (opcode 78) Attribute for previous segment (text) (opcode 79)

For String (integer/real/text)

Add user defined integer/real/text attribute to the current string.

For Vertex (integer/real/text)

Add user defined integer/real/text attribute to the current measurement point.

For Next segment (integer/real/text)

Add user defined integer /real/text attribute to the next segment from the current measurement point.

For Previous segment (integer/real/text)

Add user defined integer/real/text attribute to the previous segment to the current measurement point.

Name

Name of the attribute.

Value

Attribute value in the form specified by the mode.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

68 integer_attribute_string Add a user defined integer attribute to the current string.

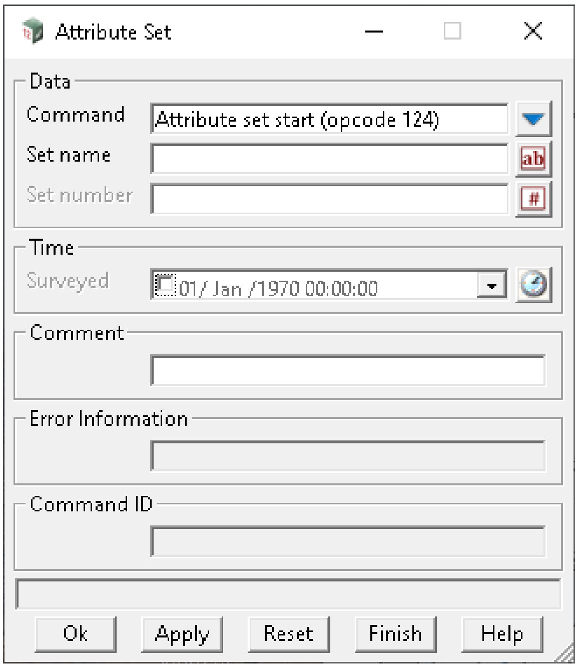
to

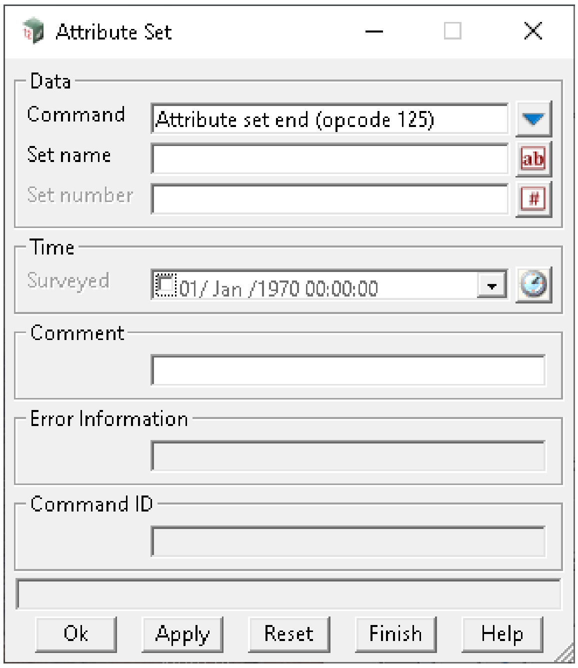
79 text_attribute_previous_segment Add a user defined text attribute to the previous segment.

Continue to 26.4.2.5 Attribute Set (opcodes 124 and 125) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.5 Attribute Set (opcodes 124 and 125)

The option ***Attribute set start*** starts an attribute group of a given name and all attributes are added to this group until the next ***Attribute set end*** option.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Data

Command	choice box		Attribute set start (opcode 124) Attribute set end (opcode 125)

Attribute set start

*Starts an attribute group called **Set name** and all attribute names are added to this group until an **Attribute set end** is done.*

Attribute set end

Ends the current attribute group.

Set name

Name of the attribute group.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

124 attribute_set Start an attribute group.

125 attribute_set_end End the current attribute group.

Continue to 26.4.2.6 Backsight (opcode 4) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.6 Backsight (opcode 4)

The ***Backsight*** option tags the measurement as a backsight measurement.

That it, it is a measurement to a **known** point (the **Backsight point**) so the difference between the measurement point and the known backsight point can be calculated and reported.

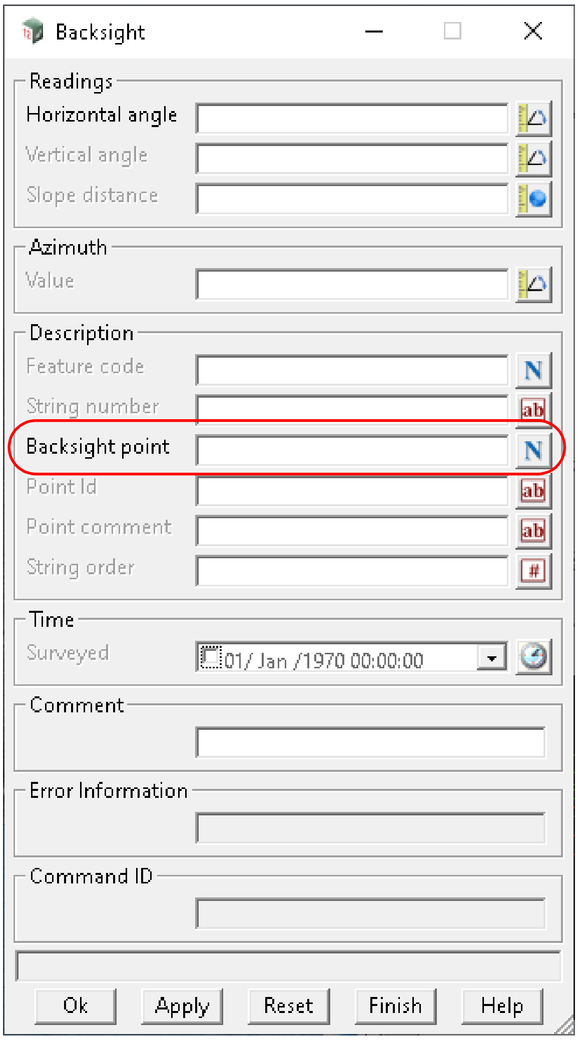
There are tolerances for displaying warnings and errors when the backsight measurement difference is outside a horizontal distance and/or a vertical distance. See Tolerances for Backsight Warnings and Errors.

If the **Backsight prompt mode** is set to **Prompt** in the SDR Function (Others tab) and the Backsight point is found, the **Bearing Datum Difference** panel is displayed to show the backsight measurement differences (see When Backsight Point is Found for a Backsight Command) and another panel when the given **Backsight point** can not be found (see When Backsight Point is Not Found for a Backsight Command).

Individual backsight measurements can be entered, or they can consist of pairs of Face1/Face2 measurements.

To enter a Face1/Face2 measurement, the backsight command should be entered twice, with the appropriate values entered into the **Backsight** panel each time.

The **Check Coordinate** panel is



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Horizontal angle

Horizontal angle to the backsight in dd.mmss format.

Vertical angle

Vertical angle to the backsight in dd.mmss format.

If the value is in the range 0 -180 degrees, the measurement is considered a Face 1 measurement, and measurements in the range 180-360 degrees are considered Face2.

Slope distance

Slope distance to the measurement to the backsight.

If a pair of face1/face2 measurements exist, the mean value of the slope distance is used for reduction purposes.

Value

*If **not blank**, the azimuth to the backsight in dd.mmss format.*

The azimuth_value may be specified when no coordinate for the backsight point exists.

This allows backsights to be specified by azimuth only. In the case of a differing azimuth and horizontal angle, a swing will be computed by the subtraction of the azimuth value and the horizontal angle.

Description

Feature code

This is only used in the special case given in When Backsight Point is Not Found for a Backsight Command.

String number

Not used.

Backsight point

The point name of the backsight point.

For a description of how the reduction finds the appropriate point, see 26.4.1.2.1 Searching for the Coordinates of Special Points

Point id output

Point id of the backsight point.

If a new backsight entry is inserted into the 12d Field File, this field will be non-editable since only the backsight point is required.

Point comment

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a 1***2d Field File,*** see 4 backsight Measurement to backsight.

See

When Backsight Point is Found for a Backsight Command
When Backsight Point is Not Found for a Backsight Command

Tolerances for Backsight Warnings and Errors

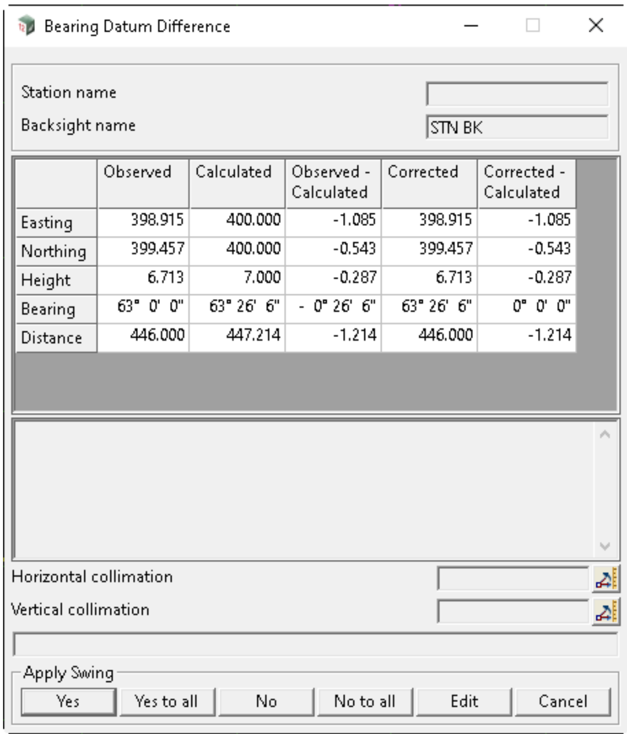
For backsight measurements there are warning and error messages for when the backsight measurement is outside tolerances for the horizontal distance and vertical distance between the measurement and the backsight point.

The tolerances are set by environment variables:

SDR_BACKSIGHT_WARNING_TOLERANCE_HORIZONTAL_4D
SDR_BACKSIGHT_ERROR_TOLERANCE_HORIZONTAL_4D
SDR_BACKSIGHT_WARNING_TOLERANCE_VERTICAL_4D
SDR_BACKSIGHT_ERROR_TOLERANCE_VERTICALL_4D

When Backsight Point is Found for a Backsight Command

If the **Backsight prompt mode** is set to **Prompt** in the SDR Function (Others tab) and the Backsight point is found, the **Bearing Datum Difference** panel is displayed:

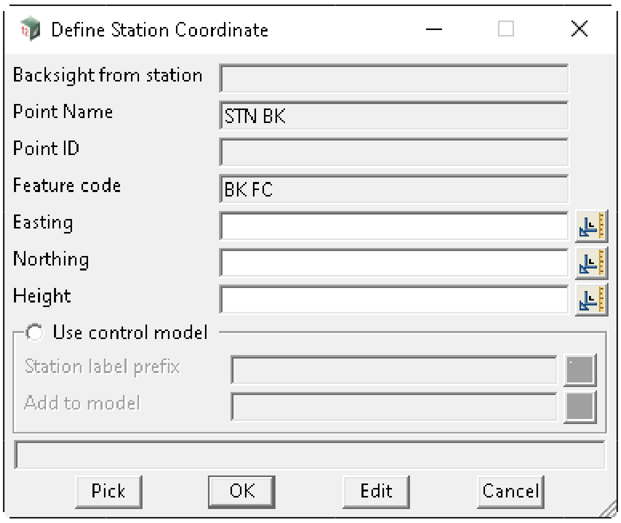


No point is created.

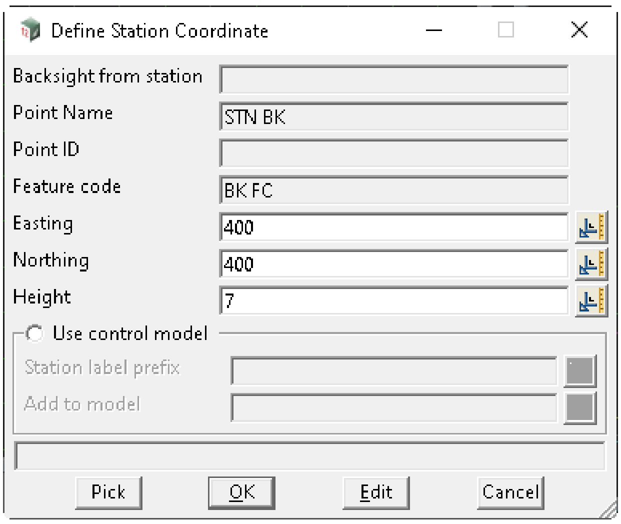
For information on the **Bearing Data Difference** panel, see 14.4.2.1.3 Bearing Datum Difference.

When Backsight Point is Not Found for a Backsight Command

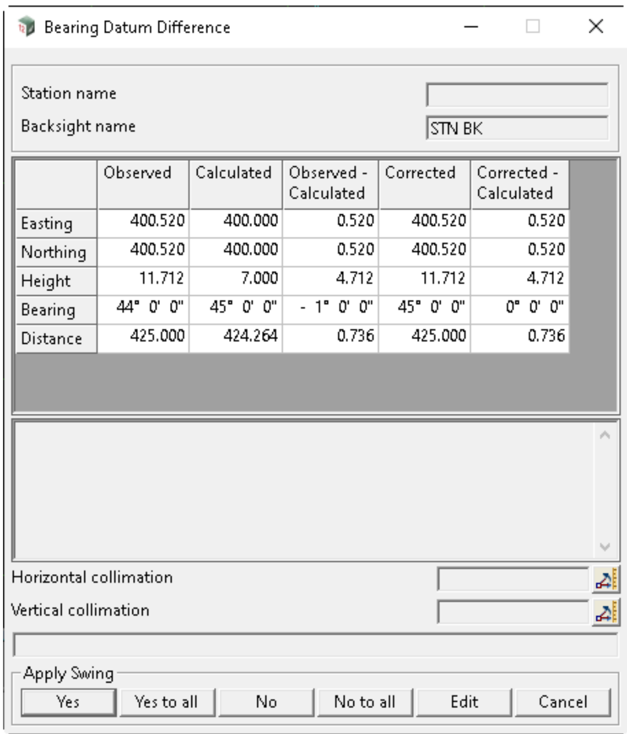
If the ***Backsight point*** can't be found, the **Define Station Coordinate** panel is displayed (see 14.4.2.1.1 Define Station Coordinate for Unknown Points):



Either **Pick** can be pressed and an existing vertex selected to fill in the **Easting**, **Northing** and **Height** fields, or values can be typed into the **Easting**, **Northing** and **Height** fields.



When **OK** is pressed, the **Bearing Datum Difference** panel is displayed (see 14.4.2.1.3 Bearing Datum Difference).



When **Yes, Yes to all, No**, or **No to all** is pressed, it is similar to a named measurement and one or two points are created.

1. a one vertex super string is created with:

   String name ***Feature code*** from the **Backsight** panel.

   Vertex id ***Backsight point*** from the **Backsight** panel.

   Vertex text ***Backsight point*** from the **Backsight** panel.

String attribute: ***Survey Control Station*** with the value ***1***

2. If **Used named points as measurements** is ***ticked*** in the **Others** tab in the SDR Function:

   a super string vertex is created with:

   String name ***Feature code*** from the **Backsight** panel.

   No string attribute ***string_no***.

   For the vertex, three attribute groups are created: ***SDR Setup Details***, ***SDR Measurement Details*** and ***SDR Measurement Geodetic Details***. See 26.4.2.65 Attributes for the Unknown Control Point Standard Measurement.

   This point is used in stringing.

Important Note:

A ***named Coordinate*** field data command (panel **Direct Coordinate**) is inserted **BEFORE** the ***Backsight*** field data command. The fields in the panel **Direct Coordinate** panel are:

X/Y/Z coordinate - ***Easting***, ***Northing*** and ***Height*** from the **Define Station Coordinate** panel.
Feature code - ***Feature code*** from the **Backsight** panel.
String number - blank.
Named point - ***Backsight point*** from the **Backsight** panel.
Point comment - blank.

The ***named Coordinate*** field data command may only be visible when the ***SDR Editor*** is restarted.

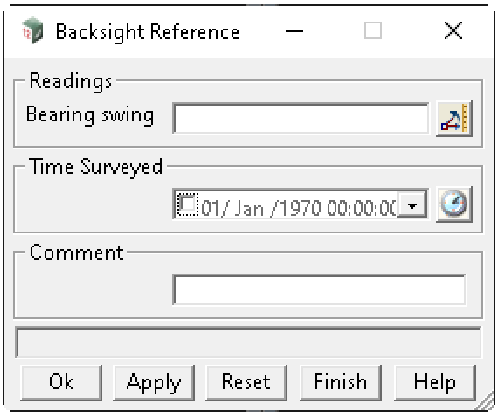
Continue to 26.4.2.7 Backsight Reference (opcode 50) or return to 26.4.2 List of Field Data Commandsor 26 12d Survey Guide.

26.4.2.7 Backsight Reference (opcode 50)

The ***Backsight Reference*** option specifies the bearing-datum-difference angle (**Bearing swing)** to use for the current instrument setup and it is used for all measurement from the current instrument setup that are after the Backsight reference command.

Hence the macerates from the current instrument that follow the Backsight Reference are rotated about the instrument setup point.

The ***Bearing swing*** angle is measured ***clockwise from North***.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Bearing swing

The angle (measured positive, clockwise from north) to swing the measurements following the Backsight Reference command, about the current instrument setup point.

It is equivalent to the bearing datum difference.

Note: *this Bearing swing is only applicable to measurements following the command and for that particular station setup. It also negates any previous swings calculated from backsight measurements (bearing datum difference) for that station setup. Therefore, measurements after the command will use the new swing value. The direction of the swing is positive in the clockwise direction from North.*

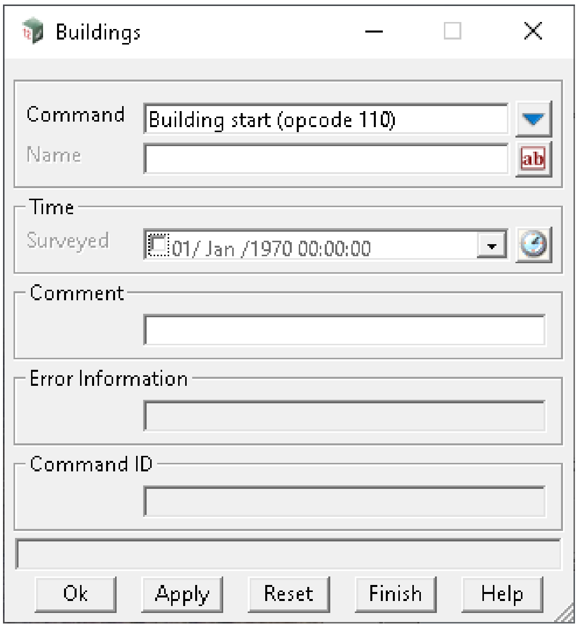
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

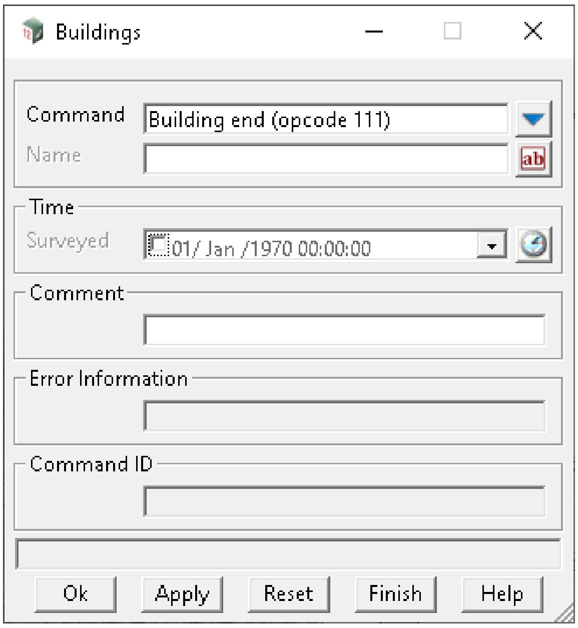
For the description on how the field data command is stored in a ***12d Field File,*** see
50 backsight_reference Specify bearing to correct for true north - used as bearing datum difference.

Continue to 26.4.2.8 Buildings (opcodes 110, 111) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.8 Buildings (opcodes 110, 111)

The ***Buildings*** option creates a building face.





The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Command	choice box		Building end (opcode 111) Building start (opcode 110)

for Buildings start

*Start recording a building face with the given **Name**.*

*If **Name** is blank, then the default building face is defined by the feature code and string number.*

Any following measurements until a Building end (op code 111), are stored as the building face. There is no limit to the number of points in a building face.

for Building end

*If **Name** is blank, the current measurement point is added to the current building face observation set and the current building face observation set is then finished.*

*If **Name** is not blank, the building face observation set of that **Name** is finished.*

Name

Name has the meaning as outlined above in Building end/start definition.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

110 building_face Start recording buildings face observations - before the measurements.

111 building_face_end End recording building face observations.

Continue to 26.4.2.9 Check Coordinate (opcode 14) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.9 Check Coordinate (opcode 14)

The ***Check Coordinate*** option tags the measurement as a **check coordinate** measurement.

That it, it is a measurement given as (x,y,z) by the user to check against a **known** point (**Check point**) so the difference between the measurement (x,y,z) and the Check point can be calculated and reported.

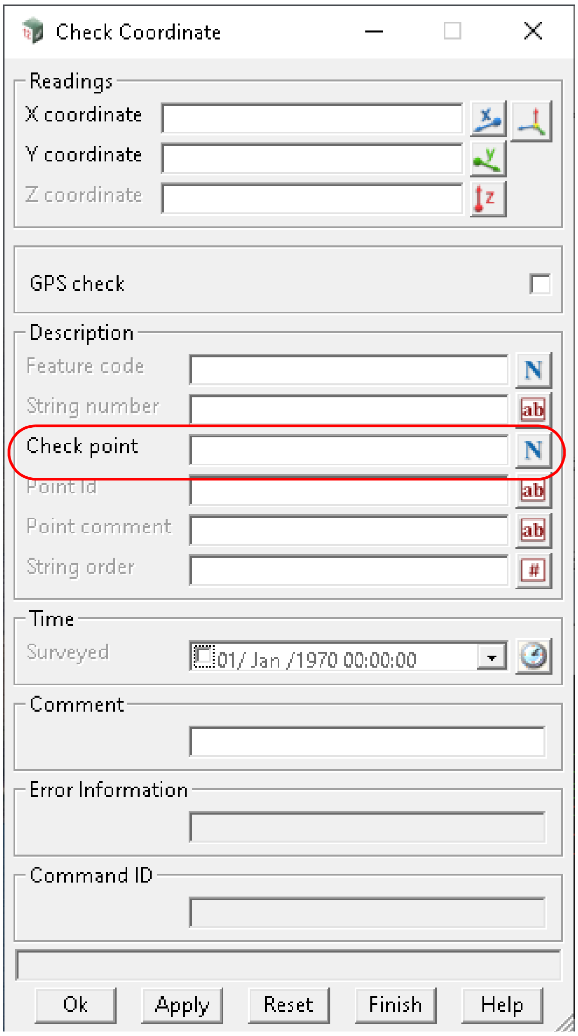
For a GNSS check coordinate, the active 26.4.2.23 GNSS Offset Correction (opcode 145) values are added to the (x,y,z) coordinate, and then compared against the nominated Check point

There are tolerances for displaying warnings and errors when the check coordinate difference is outside a horizontal distance and/or a vertical distance. See Tolerances for Check Coordinate Warnings and Errors.

There are different tolerances for displaying warnings and errors when the GNSS check coordinate measurement difference is outside a horizontal distance and/or a vertical distance. See Tolerances for GNSS Check Coordinate Warnings and Errors.

If **Show check measurements** is ***ticked*** in the SDR Function (Others tab) then for each check coordinate measurement, the **Check Coordinate Difference** panel is displayed (see When Check Coordinate Point is Found for the Check Coordinate Command) and another panel when the given Check point can not be found (see When Check Coordinate Point is Not Found for the Check Coordinate Command).

The **Check Coordinate** panel is:



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

X/Y/Z coordinate

X/Y/Z of the measurement.

GPS check tick box ticked

*If **ticked**, the active GPS Offset Correction values are added to the coordinate, and then compared against the nominated* **Check point**.

*If **not ticked**, the opcode acts as the standard Check Coordinate.*

*Note: if **ticked**, in the Survey Data Reduction Editor, the opcode is displayed with "GPS Check Coordinate". If **not ticked**, the opcode is displayed with "Check Coordinate".*

Description

Feature code

This is only used in the special case given in When Check Coordinate Point is Not Found for the Check Coordinate Command.

String number

Not used.

Check point

Point name of the point that the (x,y,z) is checking against.

For a description of how the reduction finds the appropriate point, see 26.4.1.2.1 Searching for the Coordinates of Special Points

Point id

Point id of the point that the (x,y,z) is checking against.

If a new Check point entry is inserted into the file, this field will be non-editable because only the **Check point** *is required.*

Point comment

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see
14 check_coordinate Check Coordinates.

See

When Check Coordinate Point is Found for the Check Coordinate Command
When Check Coordinate Point is Not Found for the Check Coordinate Command

Tolerances for Check Coordinate Warnings and Errors

For check coordinate measurements there are warning and error messages for when the check coordinate measurement is outside tolerances for the horizontal distance and vertical distance between the (x,y,z) and the Check coordinate point.

The tolerances are set by environment variables:

SDR_CHECK_COORDINATE_WARNING_TOLERANCE_HORIZONTAL_4D

[SDR_CHECK_COORDINATE_ERROR_TOLERANCE_HORIZONTAL_4D](#)
[SDR_CHECK_COORDINATE_WARNING_TOLERANCE_VERTICAL_4D](#)
[SDR_CHECK_COORDINATE_ERROR_TOLERANCE_VERTICALL_4D](#)

Tolerances for GNSS Check Coordinate Warnings and Errors

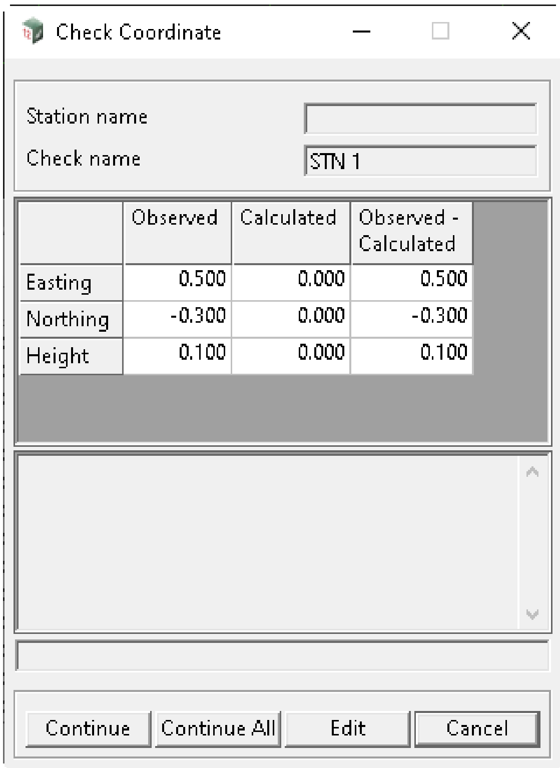
For GPS check coordinate measurements there are warning and error messages for when the GPS check coordinate measurement is outside tolerances for the horizontal distance and vertical distance between the (x,y,z) and the check coordinate point.

The tolerances are set by environment variables:

SDR_GPS_CHECK_COORDINATE_WARNING_TOLERANCE_HORIZONTAL_4D
SDR_GPS_CHECK_COORDINATE_ERROR_TOLERANCE_HORIZONTAL_4D
SDR_GPS_CHECK_COORDINATE_WARNING_TOLERANCE_VERTICAL_4D
SDR_GPS_CHECK_COORDINATE_ERROR_TOLERANCE_VERTICALL_4D

When Check Coordinate Point is Found for the Check Coordinate Command

If **Show check measurements** is ***ticked*** in the SDR Function (Others tab) then for each check coordinate measurement, the **Check Coordinate Difference** panel is displayed:

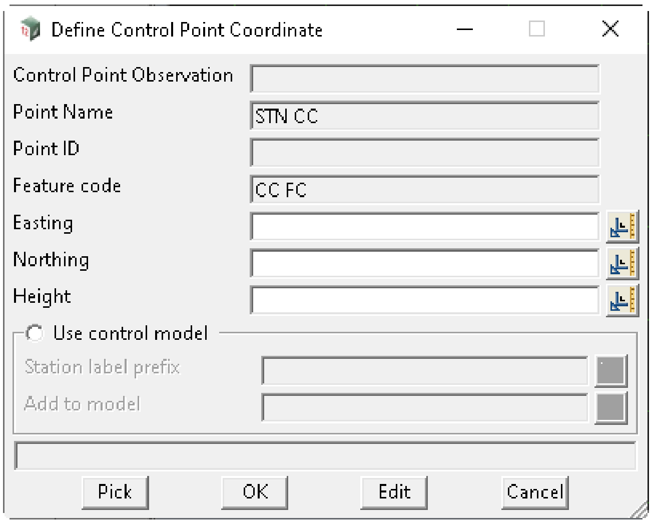


For information on the **Check Coordinate Difference** panel, see 14.4.2.1.5 Check Coordinate Difference.

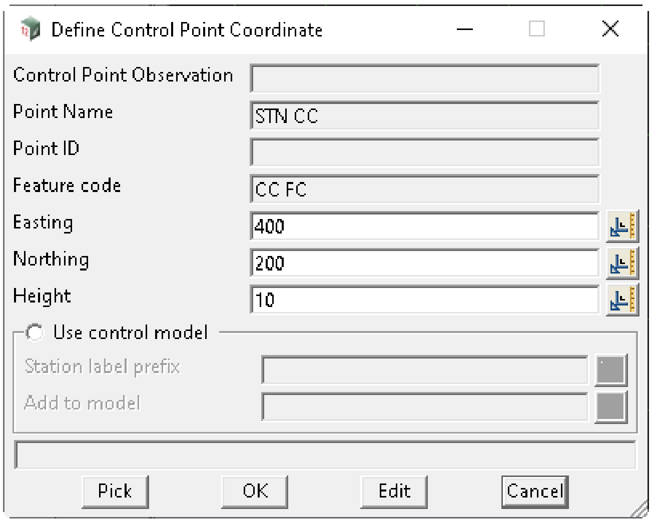
No point is created.

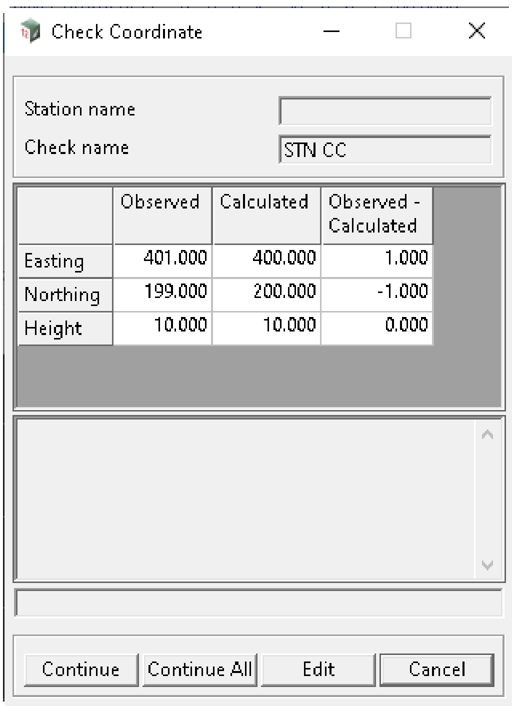
When Check Coordinate Point is Not Found for the Check Coordinate Command

If the ***Check point*** can't be found, the **Define Control Point Coordinate** panel is displayed (see 14.4.2.1.2 Define Control Point Coordinate for Unknown Point):



Either **Pick** can be pressed and an existing vertex selected to fill in the **Easting**, **Northing** and **Height** fields, or values can be typed into the **Easting**, **Northing** and **Height** fields.





When **OK** is pressed, the **Check Coordinate Difference** panel is displayed (see 14.4.2.1.4 Check Measurement Difference).

When **Continue** or **Continue All** is pressed, it is similar to a named measurement and one or two points are created.

1. a one vertex super string is created with:

   String name ***Feature code*** from the **Check Coordinate** panel.

   Vertex id ***Check point*** from the **Check Coordinate** panel.

   Vertex text ***Check point*** from the **Check Coordinate** panel.

String attribute: ***Survey Control Station*** with the value ***1***.

2. If **Used named points as measurements** is ***ticked*** in the **Others** tab in the SDR Function:

   a super string vertex is created with:

      String name ***Feature code*** from the **Check Coordinate** panel.

      No string attribute ***string_no***.

      For the vertex, three attribute groups are created: ***SDR Setup Details***, ***SDR Measurement Details*** and ***SDR Measurement Geodetic Details***. See 26.4.2.65 Attributes for the Unknown Control Point Standard Measurement.

      This point is used in stringing.

Important Note:

A ***named Coordinate*** field data command (panel **Direct Coordinate**) is inserted **BEFORE** the ***Check Coordinate*** field data command. The fields in the panel **Direct Coordinate** panel are:

X/Y/Z coordinate - *Easting*, *Northing* and *Height* from the **Define Control Point Coordinate** panel.
Feature code - *Feature code* from the **Check Coordinate** panel.
String number - blank.
Named point - *Check point* from the **Check Coordinate** panel.
Point comment - blank.

The ***named Coordinate*** field data command may only be visible when the ***SDR Editor*** is restarted.

Continue to 26.4.2.10 Check Measurement (opcode 6) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.10 Check Measurement (opcode 6)

The ***Check Measurement*** option tags the measurement as a **check measurement.**

That it, it is a measurement to a **known** point (the **Check point**) so the difference between the measurement point and the known check point can be calculated and reported.

There are tolerances for displaying warnings and errors when the check measurement difference is outside a horizontal distance and/or a vertical distance. See Tolerances for Check Measurements Warnings and Errors.

If **Show check measurements** is ***ticked*** in the SDR Function (Others tab) then for each check measurement, the **Check Coordinate Difference** panel is displayed (see When Check Point is Found for the Check Measurement Command) and another panel when the given Check point can not be found (see When Check Point in Not Found for the Check Measurement Command).

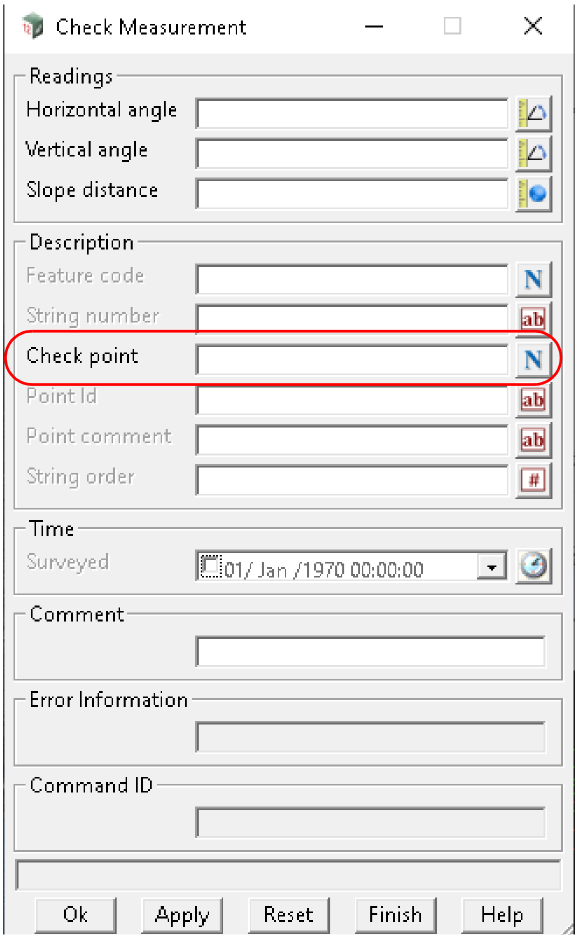
A two point super string (with string name ***Check point***) from the instrument point to the measured point is created and added to the model for the Check measurements (given by the **Check model** field on the **Advanced** tab of the SDR Function - see 14.4.2 Creating a SDR Function from a 12d Field File).

The instrument point name, the station name and the differences between the measurement point and coordinates and the station coordinates are written as text along the super string. The differences between the measurement and the known point is also written to the report file.

Individual check measurements can be entered, or they can consist of pairs of Face1/Face2 measurements.

To enter a Face1/Face2 measurement the check command should be entered twice, with the appropriate values entered into the panel each time.

The **Check Measurement** panel is



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Horizontal angle

Horizontal angle of the measurement to the check point in dd.mmss format.

Vertical angle

Vertical angle of the measurement to the check point in dd.mmss format.

If the value is in the range 0 -180 degrees the measurement is considered a Face 1 measurement, and for measurements in the range 180-360 degrees they are considered Face2.

Slope distance

Slope distance of the measurement to the check point.

If a pair of face1/face2 measurements exist, the mean value of the slope distance is used for reduction purposes.

Description

Feature code

This is only used in the special case given in When Check Point in Not Found for the Check Measurement Command.

String number

Not used.

Check point

Point name of the point that the measurement is checking against.

For a description of how the reduction finds the appropriate point, see 26.4.1.2.1 Searching for the Coordinates of Special Points

Point id — output

Point id of the point that the measurement is checking against.

If a new Check point entry is inserted into the file, this field will be non-editable because only the check point is required.

Point comment

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 6 check_measurement Check measurement.

See

When Check Point is Found for the Check Measurement Command
When Check Point in Not Found for the Check Measurement Command

Tolerances for Check Measurements Warnings and Errors

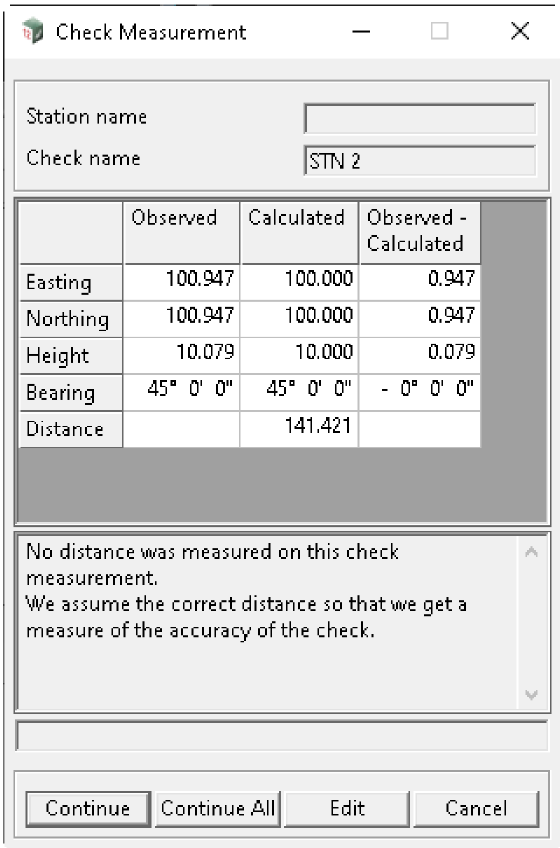
For check measurements there are warning and error messages for when the check measurement is outside tolerances for the horizontal distance and vertical distance between the measurement and the check point.

The tolerances are set by environment variables:

SDR_CHECK_MEASUREMENT_WARNING_TOLERANCE_HORIZONTAL_4D
SDR_CHECK_MEASUREMENT_ERROR_TOLERANCE_HORIZONTAL_4D
SDR_CHECK_MEASUREMENT_WARNING_TOLERANCE_VERTICAL_4D
SDR_CHECK_MEASUREMENT_ERROR_TOLERANCE_VERTICALL_4D

When Check Point is Found for the Check Measurement Command

If **Show check measurements** is ***ticked*** in the Survey Data Reduction Function panel then for each check measurement, the **Check Measurement Difference** panel is displayed:



For information on the **Check Measurement Difference** panel, see 14.4.2.1.4 Check Measurement Difference.

A one vertex super string is created in the ***Check model*** with values:

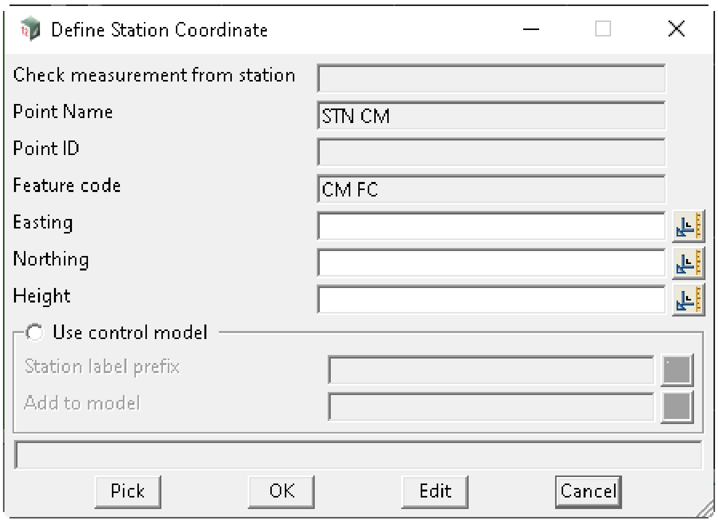
String name ***Check point***

Vertex text ***Check point***

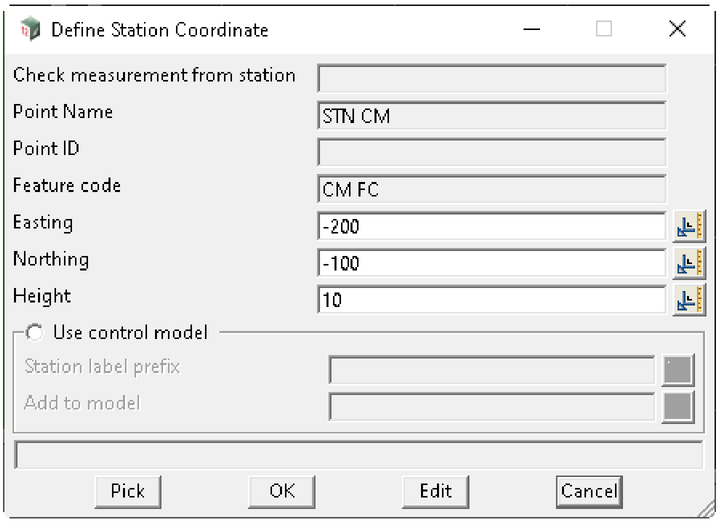
No string or vertex attributes are created.

When Check Point in Not Found for the Check Measurement Command

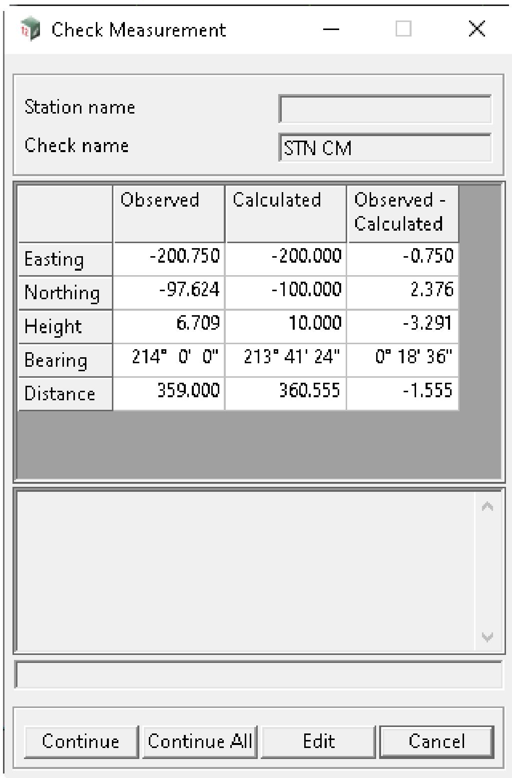
If the ***Check point*** can't be found, the **Define Station Coordinate** panel is displayed (see 14.4.2.1.1 Define Station Coordinate for Unknown Points):



Either **Pick** can be pressed and an existing vertex selected to fill in the **Easting**, **Northing** and **Height** fields, or values can be typed into the **Easting**, **Northing** and **Height** fields.



When **OK** is pressed, the **Check Measurement Difference** panel is displayed (see 14.4.2.1.4 Check Measurement Difference).



When **Continue** or **Continue All** is pressed, it is similar to a named measurement and one or two points are created.

1. a one vertex super string is created with:

   String name ***Feature code*** from the **Check Measurement** panel.

   Vertex id ***Check point*** from the **Check Measurement** panel.

Vertex text *__Check point__* from the **Check Measurement** panel.

String attribute: ***Survey Control Station*** with the value ***1***

2. If **Used named points as measurements** is ***ticked*** in the **Others** tab in the Survey Data Reduction Function panel:

   a super string vertex is created with:

   String name ***Feature code*** from the **Check Measurement** panel.

   No string attribute ***string_no***.

   For the vertex, three attribute groups are created: ***SDR Setup Details***, ***SDR Measurement Details*** and ***SDR Measurement Geodetic Details***. See 26.4.2.65 Attributes for the Unknown Control Point Standard Measurement.

   This point is used in stringing.

Important Note:

A ***named Coordinate*** field data command (panel **Direct Coordinate**) is inserted **BEFORE** the ***Check Measurement*** field data command. The fields in the panel **Direct Coordinate** panel are:

X/Y/Z coordinate - ***Easting***, ***Northing*** and ***Height*** from the **Define Station Coordinate** panel.

Feature code - ***Feature code*** from the **Check Measurement** panel.

String number - blank.

Named point - ***Check point*** from the **Check Measurement** panel.

Point comment - blank.

The ***named Coordinate*** field data command may only be visible when the ***SDR Editor*** is restarted.

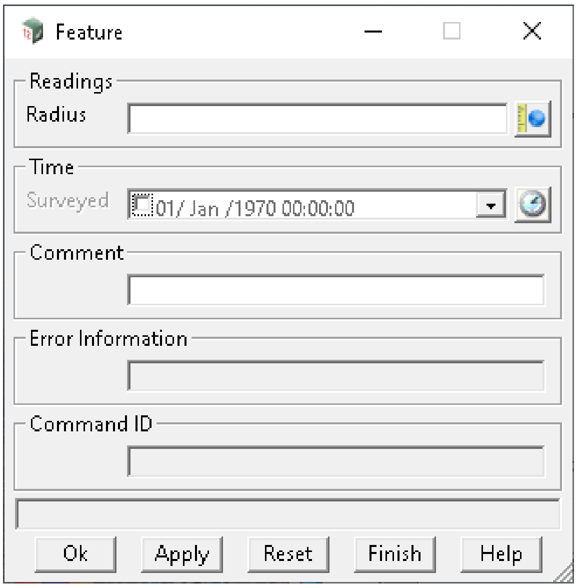
Continue to 26.4.2.11 Circle Feature (opcode 18) or return to 26.4.2 List of Field Data Commandsor 26 12d Survey Guide.

26.4.2.11 Circle Feature (opcode 18)

The ***Feature*** option create a feature string of the given ***Radius*** and centred in the current measurement point and with the height of the current measurement point.See 26.3.8 Feature String.

That is, the current measurement point is the centre of the feature string.

See 26.3.8 Feature String in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Radius

Radius of the circle to be drawn in the (x,y) plane around the current measurement point.

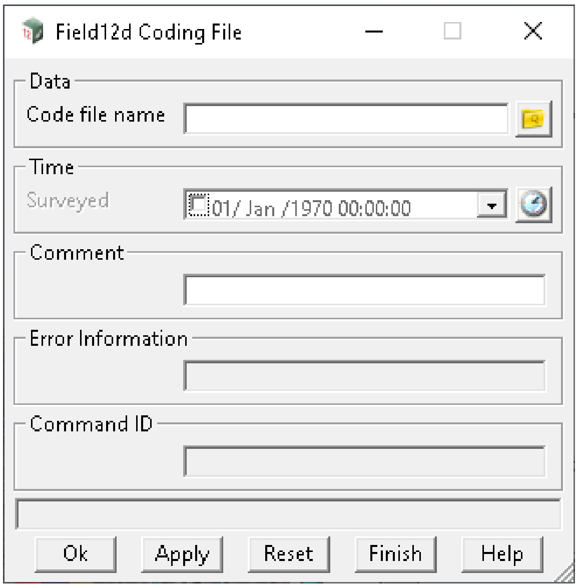
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 18 feature Circle Feature.

Continue to 26.4.2.12 Code File (opcode 119) or return to 26.4.2 List of Field Data Commandsor 26.4 Field Data Commands or 26 12d Survey Guide.

26.4.2.12 Code File (opcode 119)

The option ***Field12d Coding File*** records the name of the ***12d Field File***.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Code file name

Name of he 12d Field File.

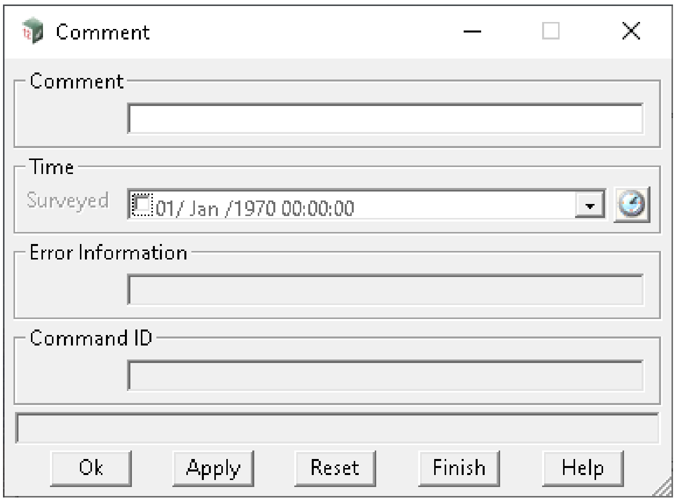
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 119 code_file Name of this 12d Field File.

Continue to 26.4.2.13 Comment (opcode -2) or return to 26.4.2 List of Field Data Commandsor 26.4 Field Data Commands or 26 12d Survey Guide.

26.4.2.13 Comment (opcode -2)

The ***Comment*** option inserts a comment into the field file.



The fields and buttons used in this panel have the following functions.

Field Description | Type | Defaults | Pop-Up

Comment

*If **not blank**, the text in the* **Comment** *filed is added as a comment in the 12d Field File.*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see -2 comment Insert a comment.

Continue to 26.4.2.14 Coordinate (opcode 2) or return to 26.4.2 List of Field Data Commandsor 26.4 Field Data Commands or 26 12d Survey Guide.

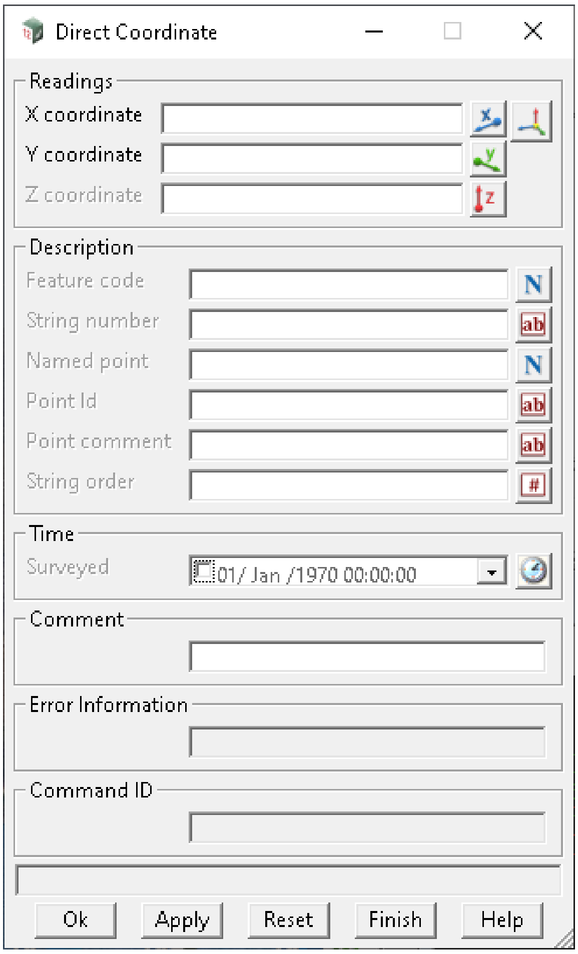
26.4.2.14 Coordinate (opcode 2)

The ***Coordinate*** opcode is for creating a point by typing in the points x, y and z coordinates. This is also referred to as a ***directly entered coordinate*** or ***DEC***.

Although no measurement by an instrument is required, the point is still referred to as a measurement point.

Because the (x,y,z) coordinates are given and so known, no reduction is needed to calculate them.

Selecting **Coordinate** brings up the **Direct Coordinate** panel:



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

X coordinate double box

X coordinate for the point.

Y coordinate double box

Y coordinate for the point.

Z coordinate double box

Z coordinate for the point.

Description - used for the new point or points

Feature code, String number, Named point, Point id and Point comment are used to define values for the new point. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

String order integer box blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 2 coordinate Directly entered coordinate measurement (DEC).

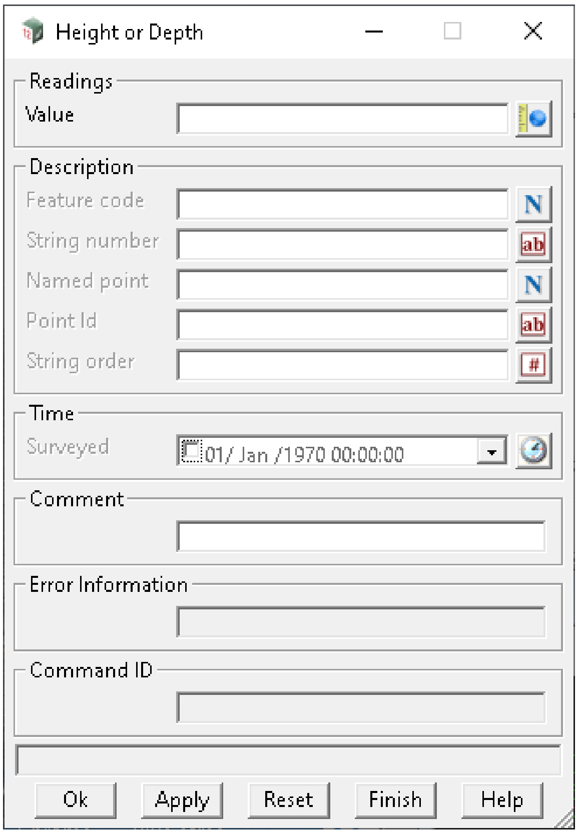
Continue to 26.4.2.15 Height Or Depth Comment (opcode 28) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.15 Height Or Depth Comment (opcode 28)

[/Dest /height_or_depth /DEST pdfmark

The ***Height or Depth*** option creates text consisting of a space (" ") followed by a real number converted to text, and the resulting text is appended to the selected string names.

Note - this option ***does not alter heights***.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Value real box

If ***not blank****, text is created consisting of a space (" ") followed by* ***Value*** *converted to text.*

The resulting text is appended to the string names as selected by the values in the ***Description*** *fields.*

Description - used for finding strings

Feature code, String number, Named point, Point id

Named point *field is not used.*

If ***no Feature code****,* ***String number*** *or* ***Point id*** *is given, the text is appended to all string names with the same feature code and string number* ***as the current measurement****. This applies to the entire field file.*

If the ***Feature code*** *and* ***String number*** *are given, then the text is appended to all string names with the same feature code and string number. This applies to the entire field file.*

If ***only the Point id*** *is given, then the text is appended to all string names with the same feature code and string number as the point defined by the* ***Point id****. This applies to the entire field file.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used

String order

Not used.

Rest of the Fields and Buttons

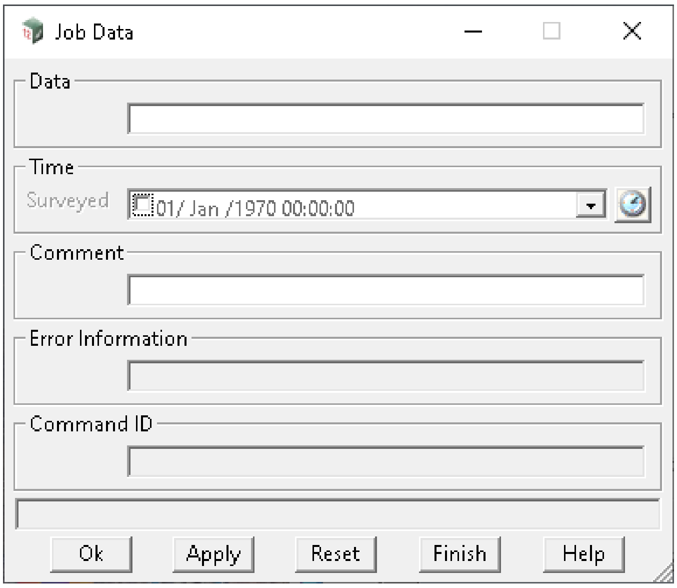
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 28 height_or_depth Add text to the string name - for delta height.

Continue to 26.4.2.16 Job Data (opcode 1) or return to 26.4.2 List of Field Data Commands 26 12d Survey Guide.

26.4.2.16 Job Data (opcode 1)

The ***Job Data*** option adds given text as header information in the ***12d Field File***.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Data

Text to be added as header information in the 12d Field File.

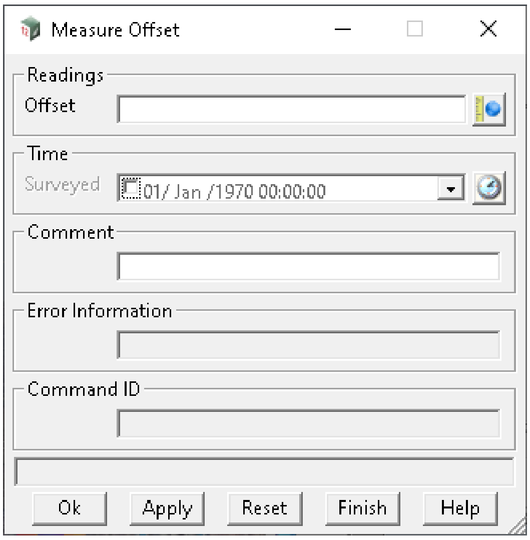
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 1 job_data Job Information.

Continue to 26.4.2.17 Distance Correction (opcode 127) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.17 Distance Correction (opcode 127)

??



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Offset

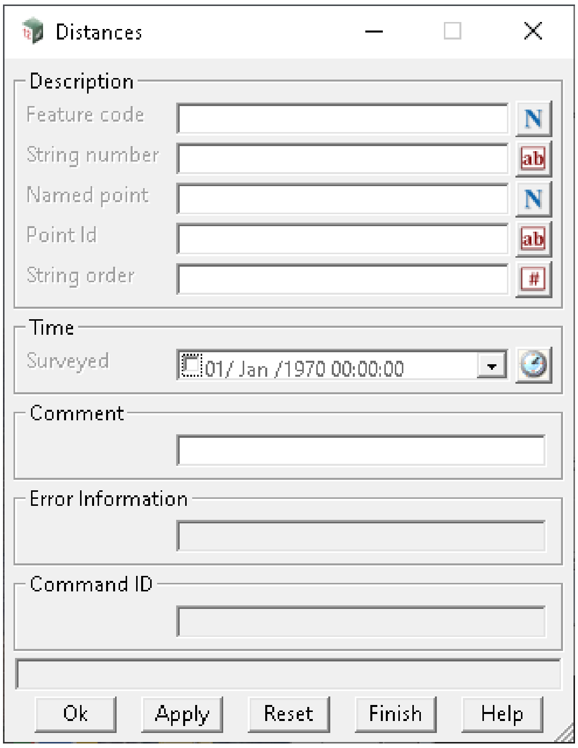
??

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 127 measurement_offset Distance correction.

Continue to 26.4.2.18 Distances (opcode 49) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.18 Distances (opcode 49)



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description

Feature code

Feature code of the nominated point.

String number

String number of the nominated point.

Named point

Point name of the point.

This can be an integer, real, text or alphanumeric. For a more detailed description of how the reduction finds/uses the appropriate point see the section 26.4.1.2.1 Searching for the Coordinates of Special Points

Point id

Point id of the point.

This can be an integer, real, text or alphanumeric. For a more detailed description of how the reduction finds/uses the appropriate point see the section 26.4.1.2.1 Searching for the Coordinates of Special Points*. If a new check point entry is inserted into the file, this field will be non-editable since only the check point is required.*

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

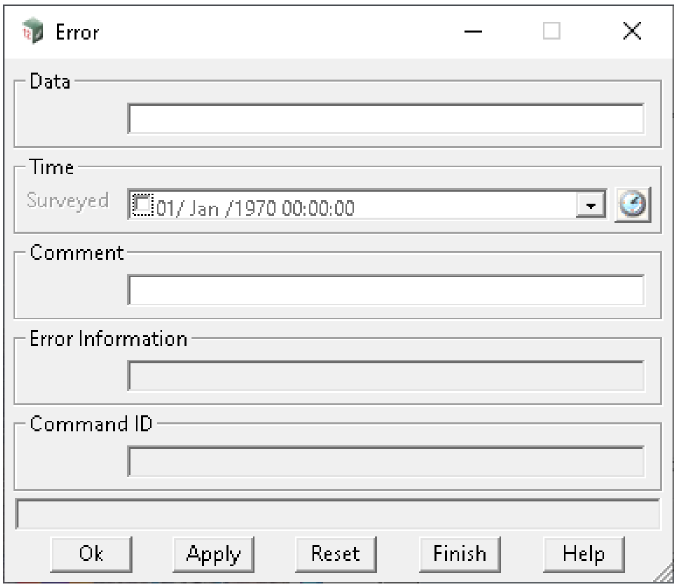
For the description on how the field data command is stored in a ***12d Field File,*** see
49 distances Distances.

Continue to 26.4.2.19 Error (opcode -1) or return to 26.4.2 List of Field Data Commandsor 26 12d Survey Guide.

26.4.2.19 Error (opcode -1)

If the ***12d Field FIle*** was produced from a raw data collector file, any records that can’t be parsed correctly will be made into an Error comment.

The ***Error*** option appends extra text to the Error comment.



The fields and buttons used in this panel have the following functions.

Field Description   Type   Defaults   Pop-Up

Data

Extra text to be added to Error comment.

If the 12d Field File was produced from a raw data collector file, any records that can’t be parsed correctly will have an Error comment.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help   See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

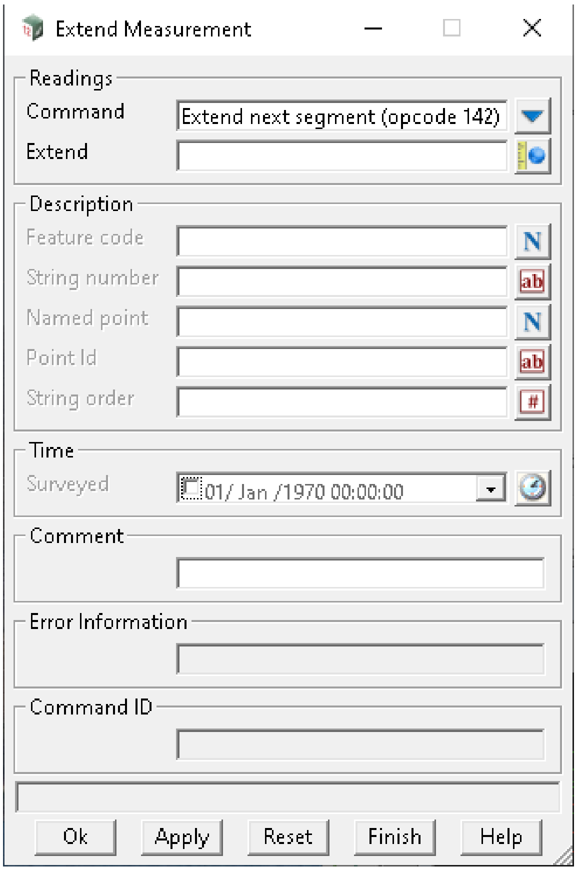
For the description on how the field data command is stored in a ***12d Field File,*** see -1 error Add text to information for an error.

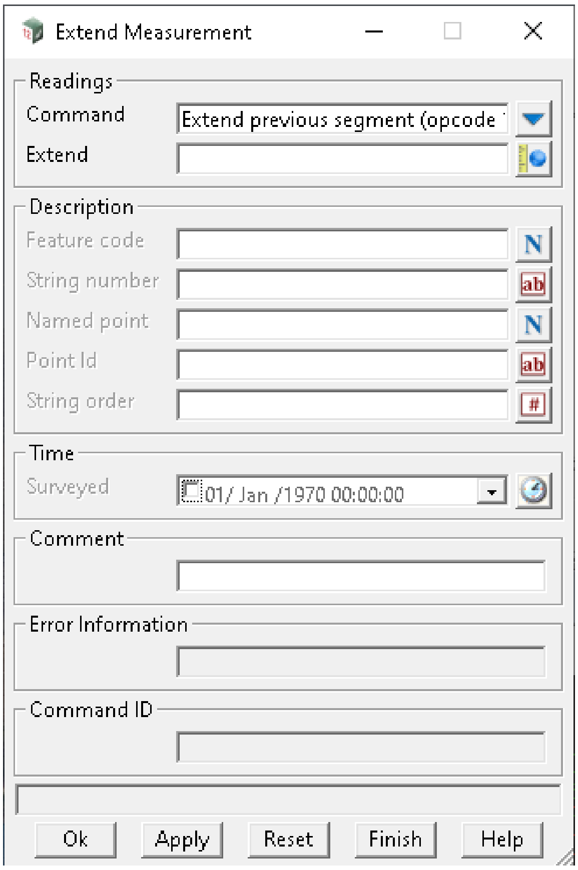
Continue to 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

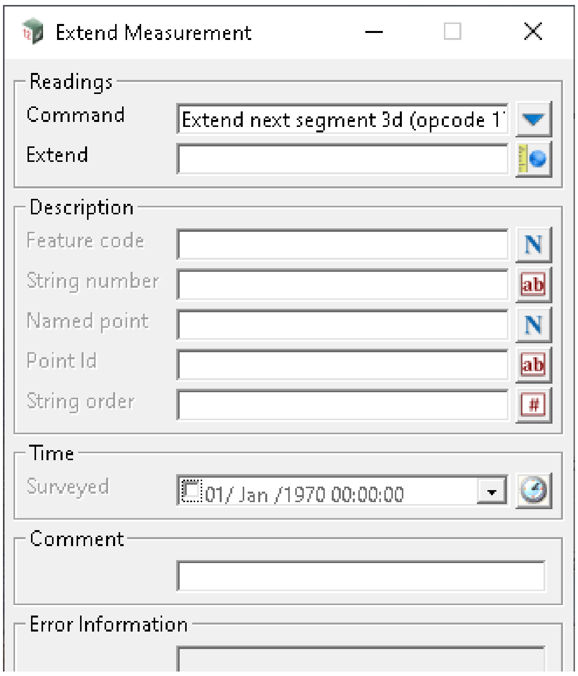
26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

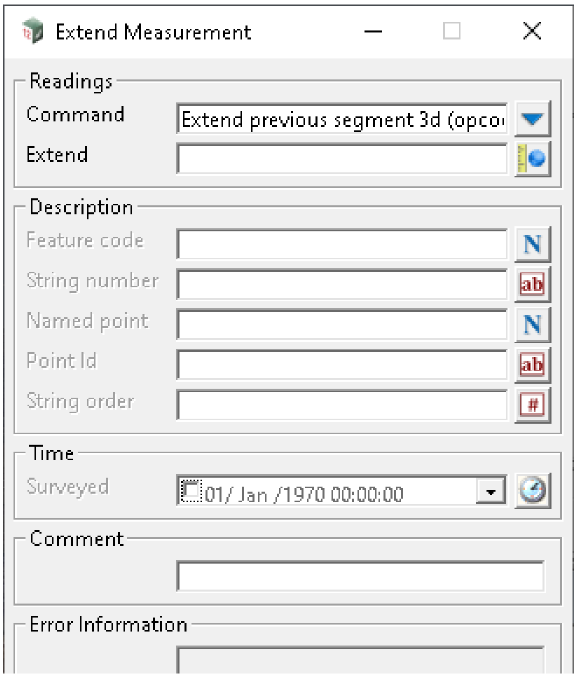
It is not always possible to measure a point directly but it may be possible to measure a point nearby and then measure offsets to adjust the measured point by to produce the coordinates of the required point.

For a full description and diagrams, see 26.3.3 Extend.









The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command	choice box	Extend next segment (opcode 142) Extend previous segment (opcode 143)) Extend next segment 3d (opcode 172) Extend previous segment 3d (opcode 173))	

For Extend next segment 142

*The Extend value is used to adjust the position of the specified point by a **plan (2D) distance** from the specified point's original position along the **next segment** that the point is on. The z-value of the point is not changed. A positive Extend is along the direction of the next segment of the string and a negative Extend is against the direction of the next segment of the segment of the string. For more information, see* 26.3.3 Extend

If it is applied to the last point of an open string then the option fails.

If it is applied to a one point string then the option fails.

For Extend previous segment 143

*The Extend value is used to adjust the position of the specified point by a **plan (2D) distance** from the specified point's original position along the **previous segment** that the point is on. The z-value of the point is not changed. A positive Extend is along the direction of the previous segment of the string and a negative Extend is against the direction of the previous segment of the segment of the string. For more information, see* 26.3.3 Extend

If it is applied to the first point of an open string then the option fails.

If it is applied to a one point string then the option fails.

For Extend next segment 3d 172

*The Extend value is used to adjust the position of the specified point by a **3D distance** from the specified point's original position along the **next segment** that the point is on. The z-value of the point is extrapolated using the grade of the next segment.*

A positive Extend is along the direction of the next segment of the string and a negative Extend is against the direction of the next segment of the segment of the string. For more information, see 26.3.3 Extend

If it is applied to the last point of an open string then the option fails.

If it is applied to a one point string then the option fails.

For Extend previous segment 3d 173

*The Extend value is used to adjust the position of the specified point by a **3D distance** from the specified point's original position along the **previous segment** that the point is on. The z-value of the point is extrapolated using the grade of the previous segment.*

A positive Extend is along the direction of the previous segment of the string and a negative Extend is against the direction of the previous segment of the segment of the string. For more information, see 26.3.3 Extend

If it is applied to the first point of an open string then the option fails.

If it is applied to a one point string then the option fails.

Description - used for finding an existing point

***Named point** field is not used in searching.*

*If **no Feature code**, **String number** or **Point id** is given, the offset is used to adjust the position of the current measured point.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is adjusted.*

*If **only the Point id** exists, then point with that **Point id** is adjusted.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

142 extend_measurement_next_segment Extend next segment by 2D distance.

143 extend_measurement_previous_segment Extend previous segment by 2D distance.

172 extend_measurement_next_segment_3d Extend next segment by 3D distance.

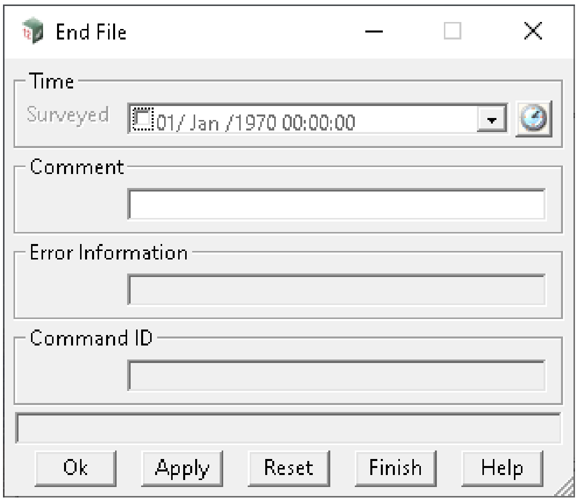
173 extend_measurement_previous_segment_3d Extend previous segment by 3D distance.

Continue to 26.4.2.21 End File (opcode 99) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

26.4.2.21 End File (opcode 99)

The ***End File*** option stops the processing of the ***12d Field File*** at this line.

This is useful for debugging errors.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

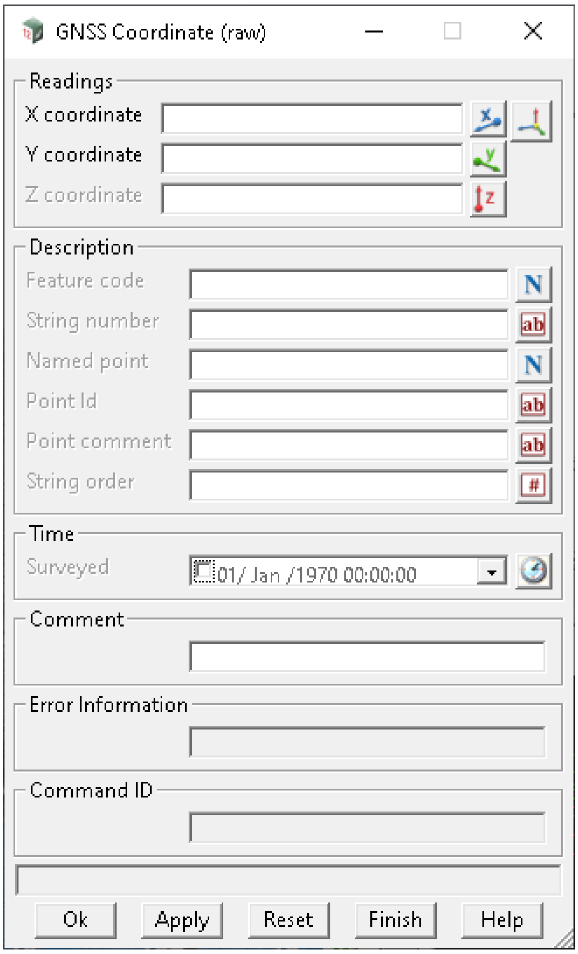
For the description on how the field data command is stored in a ***12d Field File,*** see
99 file_end Terminate processing.

Continue to 26.4.2.22 GNSS Coordinate (opcode 140) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.22 GNSS Coordinate (opcode 140)

The ***GNSS Coordinate*** options creates a point with the specified GNSS coordinates.

Also note. The GNSS coordinate is shifted by any current **GNSS Offset Correction** (see 26.4.2.23 GNSS Offset Correction (opcode 145))



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

X coordinate double box

X coordinate value of the nominated point.

Y coordinate double box

Y coordinate value of the nominated point.

Z coordinate double box

Z coordinate value of the nominated point.

The antenna height is not subtracted.

The reduced Z coordinate is calculated by subtracting the current target height.

Description - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code,

String Number, Named Point, Point Id and Point Comment for Measured Point.

String order integer box blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 140 gps_coordinate GNSS coordinate measurement.

Continue to 26.4.2.23 GNSS Offset Correction (opcode 145) or return to 26.4.2 List of Field Data Commands or26 12d Survey Guide.

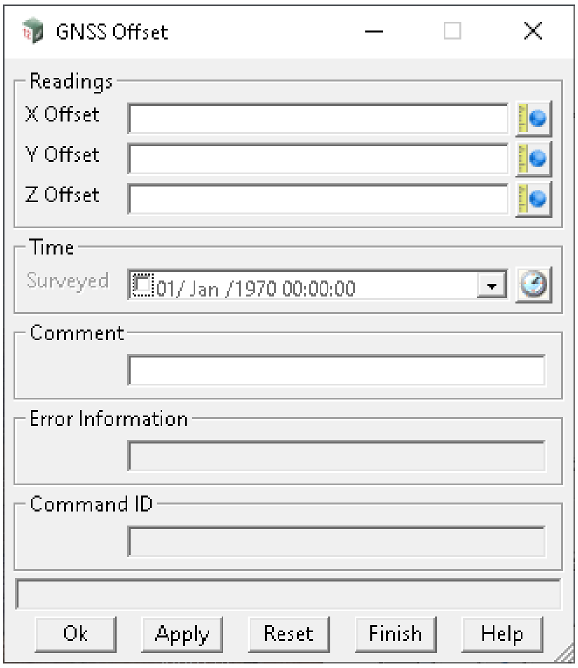
26.4.2.23 GNSS Offset Correction (opcode 145)

The ***GNSS Offset*** option applies corrections to subsequent GNSS coordinate measurements **until another opcode 145 is encountered**.

The X Offset, Y Offset, Z Offset is added to GNSS (x, y, z) coordinates in the following140 opcodes.

Using X Offset, Y Offset, Z Offset values of **0 0 0** in opcode 145 stops the effect of GNSS Offset.

Target height (Opcode 5) is applied after this correction to subtract the antenna pole height.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

X Offset double box

X offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.

Y Offset double box

Y offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.

Z Offset double box

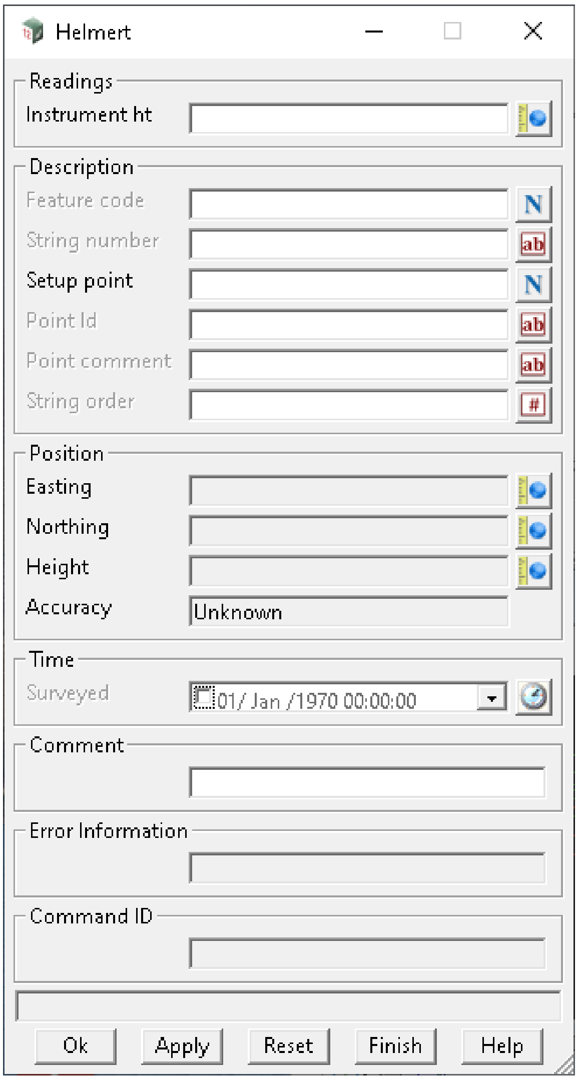
Z offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Continue to 26.4.2.24 Helmert Start (opcode 138) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.24 Helmert Start (opcode 138)

This option is under development.



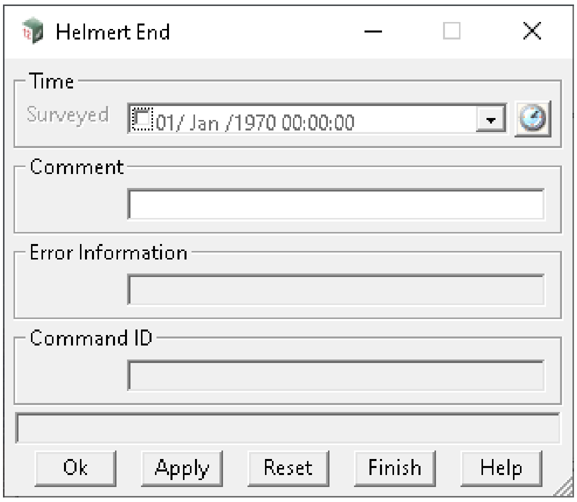
OK, Apply, Reset, Finish, Help See the description for the panel buttons in the section 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

For the description on how the field data command is stored in a ***12d Field File,*** see 138 helmert Helmert start.

Continue to 26.4.2.25 Helmert End (opcode 139) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.25 Helmert End (opcode 139)

This option is under development.



OK, Apply, Reset, Finish, Help   See the description for the panel buttons in the section 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

For the description on how the field data command is stored in a ***12d Field File,*** see 139 helmert_end End the Helmert.

Continue to 26.4.2.26 Group (opcode -3) or return to 26.4.2 List of Field Data Commandsor 26 12d Survey Guide.

26.4.2.26 Group (opcode -3)

This option is still under development.

This opcode is planned to allow user defined grouping of opcodes, including the grouping of groups and opcodes. Hence it is recursive.

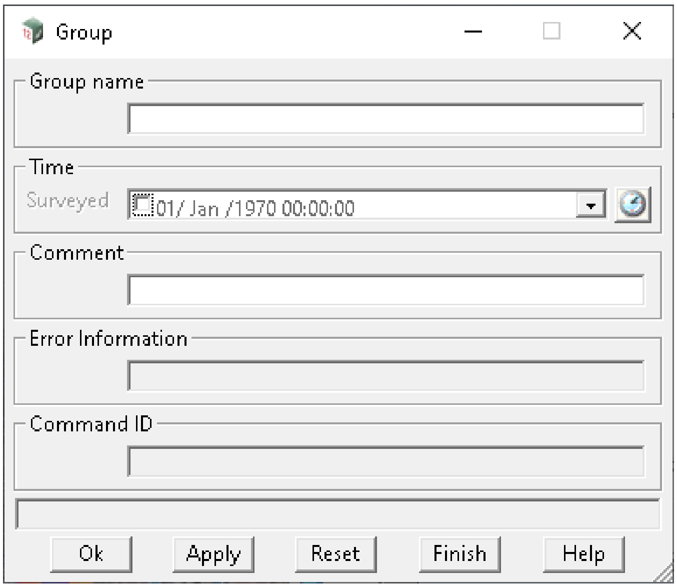
For example, if there are a number of measurements for a specific area (say a garden bed), by **Grouping** all the garden bed measurements into a group named "Garden Bed", the measurements will be displayed in the SDR Editor as a node with the name **Garden Bed** . The node can just appear or can be expanded to display all the measurments and subgroups.

The Group will also be grouped and annotated with the Group Name in the Report file.

```
PointID Horiz    Vert     SDist    HTar         East        North     Height    Code           State     /Garden Bed
=================================================================================================
1000                                       501297.800 6977103.794     10.861   KB        1      Field
1001                                       501295.327 6977104.176     10.888   KB        1      Field     |
```

Important Note

This option is still under development and currently when the opcode is used, all it will do is place a Group record in the SDR function with the name of the Group.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Group name

Name for the group.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see -3 group Group.

Continue to 26.4.2.27 PPM Correction (opcode 131) or return to v or 26 12d Survey Guide.

26.4.2.27 PPM Correction (opcode 131)

This opcode applies a correction to the reduced horizontal distance of a measurement

The value is defined as a parts per million number, both positive and negative.

Typically an "integer".

The resulting scaling is

horizontal_distance_scaling = **1.0** + (**correction_details_ppm_correction**/1.0e6);

So a ppm Correction of 10 results in a horizontal distance scaling of 1.000001

The horizontal_distance_scaling applies to the opcodes

26.4.2.6 Backsight (opcode 4)
26.4.2.30 EDM Measurement (opcode 7)
26.4.2.33 Stadia Measurement (opcode 10)
26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12)

and the non-Geodetic helmert and least squares measurements?

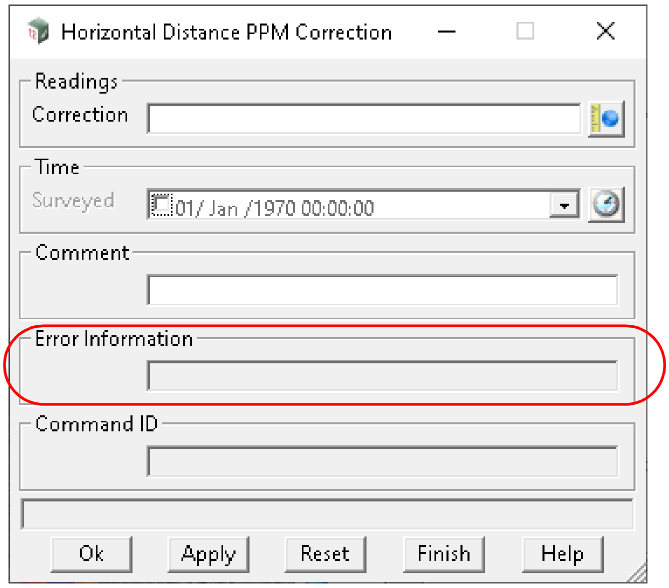
26.4.2.46 Resection Start (opcode 128)
26.4.2.24 Helmert Start (opcode 138)

Important Warning

If this opcode is used when the **Geodetics** is enabled in the Geodetics tab of the Survey Data Reduction Function panel then the following warning message in written to the **Output Window**, **Report File** and the **Error Information** field of this field command panel:

New Horizontal Distance PPM (opcode 131) of 'value' should not be used when Geodetic calculations are enabled

.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Correction	real box		

ppm correction value.

horizontal_distance_scaling = **1.0** + (**Correction/1.0e6**);

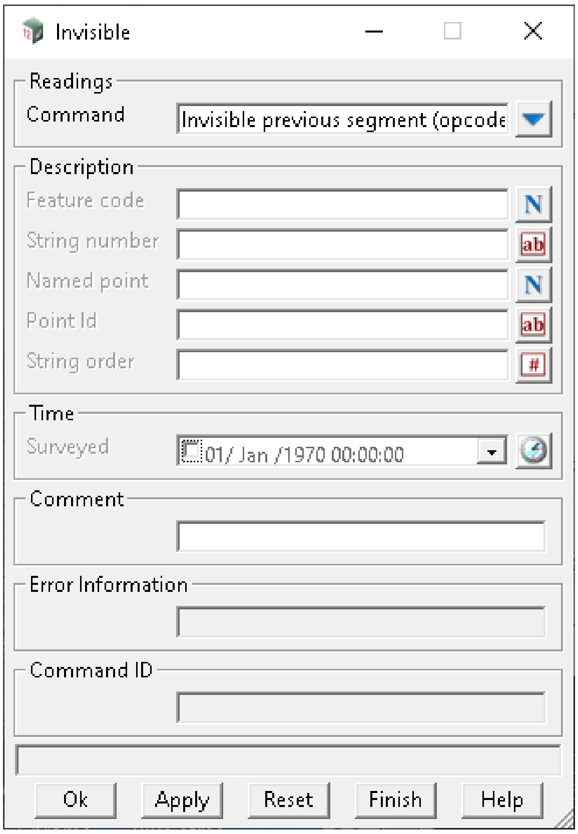
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

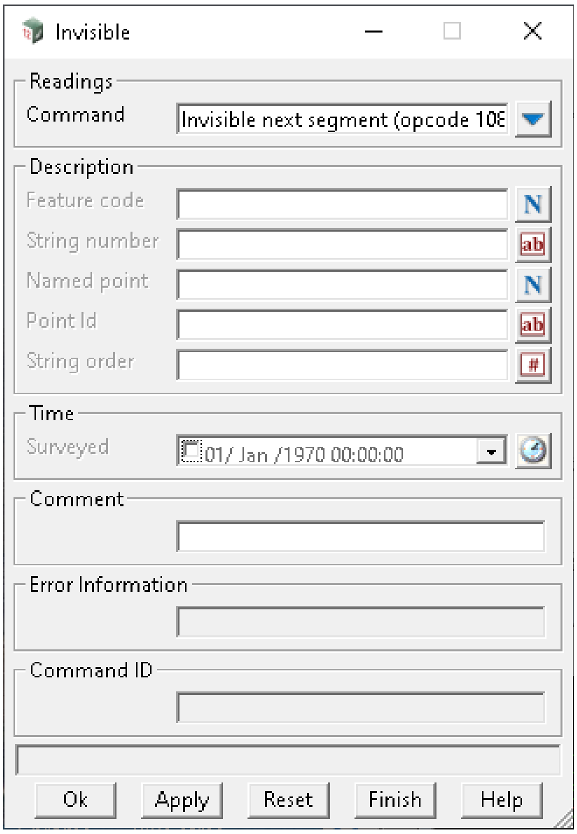
For the description on how the field data command is stored in a ***12d Field File,*** see 131 ppm_correction PPM correction.

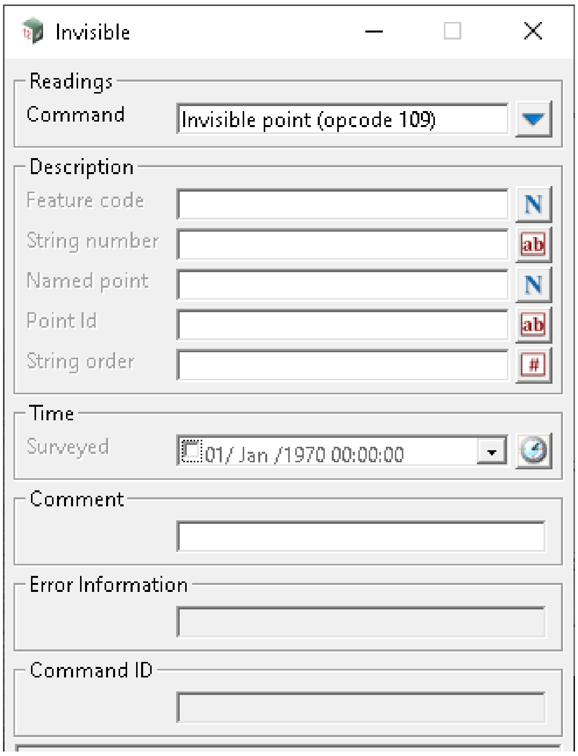
Continue to 26.4.2.28 Invisibility (opcodes 107, 108, 109) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.28 Invisibility (opcodes 107, 108, 109)

The ***Invisibility*** option make segments or vertices invisible.







The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command choice box — Invisible previous segment (opcode 107)
Invisible next segment (opcode 108)
Invisible point (opcode 109)

For Invisible previous segment

__Named point__ field is not used.

If __no Feature code__, __String number__ or __Point id__ is given, the previous segment containing the current measurement point is set to invisible.

If the __Feature code__ and __String number__ exist, then the last segment of the previous string with that feature code and string number is set to invisible.

If __only the Point id__ exists, then the segment containing the point with that point id as an end point, is set to invisible.

For Invisible next segment

If __no Feature code__, __String number__ or __Point id__ is given, the next segment containing the current measurement point as a starting point is set to invisible.

If the __Feature code__ and __String number__ exist, then the next segment with the current measurement point as a starting point, and with the same feature code and string number, is set to invisible.

If __only the Point id__ exists, then the segment containing the point with that point id as a starting point, is set to invisible.

For invisible point

If __no Feature code__, __String number__ or __Point id__ is given, the current measurement point is set to invisible.

If the __Feature code__ and __String number__ exist, then the last point of the previous string with that feature code and string number is set to invisible.

If __only the Point id__ exists, then the point with that point id is set to invisible.

Description - used for finding an existing point

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

107 invisible_previous_segmet Make the previous segment invisible - after the measurement.

108 invisible_next_segment Make next segment invisible - after measurement for first point of segment.

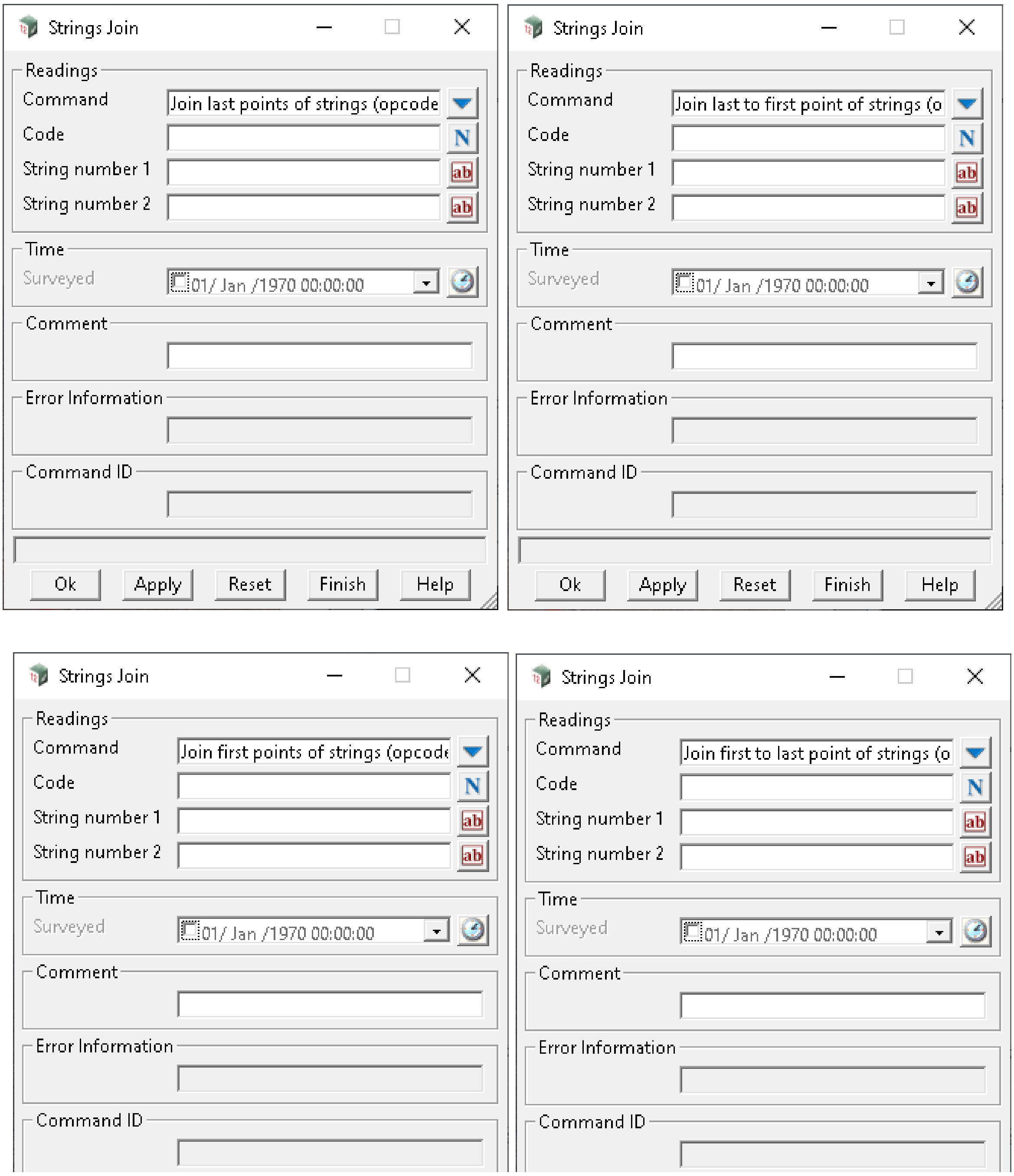
109 invisible_vertex Make a point invisible - after the measurement.

Continue to 26.4.2.29 Strings Join (opcodes 21 to 24) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.29 Strings Join (opcodes 21 to 24)

The ***Join String*** option joins two selected strings together by connecting the ends of the strings to form one string.

For a full description and diagrams, see 26.3.9 Joining Strings in Appendix 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Readings			
Command	choice box		Join last points of strings (opcode 21) Join first to last point of strings (opcode 22) Join first points of strings (opcode 23)

Join last to first point of strings (opcode 24)

For Join last points of strings

In the final reduction, the ***last*** *point of the string with the given* ***Feature code*** *and* ***String number 1*** *is joined to the* ***last*** *point of the string with given* ***Feature code*** *and* ***String number 2****.*

For Join first to last point of strings

In the final reduction, the ***first*** *point of the string with the given* ***Feature code*** *and* ***String number 1*** *is joined to the* ***last*** *point of the string with given* ***Feature code*** *and* ***String number 2****.*

For Join first points of strings

In the final reduction, the ***first*** *point of the string with the given* ***Feature code*** *and* ***String number 1*** *is joined to the* ***first*** *point of the string with given* ***Feature code*** *and* ***String number 2****.*

For Join last to first point of strings

In the final reduction, the ***last*** *point of the string with the given* ***Feature code*** *and* ***String number 1*** *is joined to the* ***first*** *point of the string with given* ***Feature code*** *and* ***String number 2****.*

Feature code

Feature code of the strings to be joined

String number 1

String number of the first string

String number 2

String number of the second string

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Note: The created string has the given **Feature code.** No string number is needed since it is the final phase of the reduction where the string numbers are dropped.

For the description on how the field data command is stored in a ***12d Field File,*** see

21 join_strings_last_to_last Join last points of strings.

22 join_strings_first_to_last Join first to last point of strings.

23 join_strings_first_to_first Join first points of strings.

24 join_strings_last_to_first Join last to first point of strings.

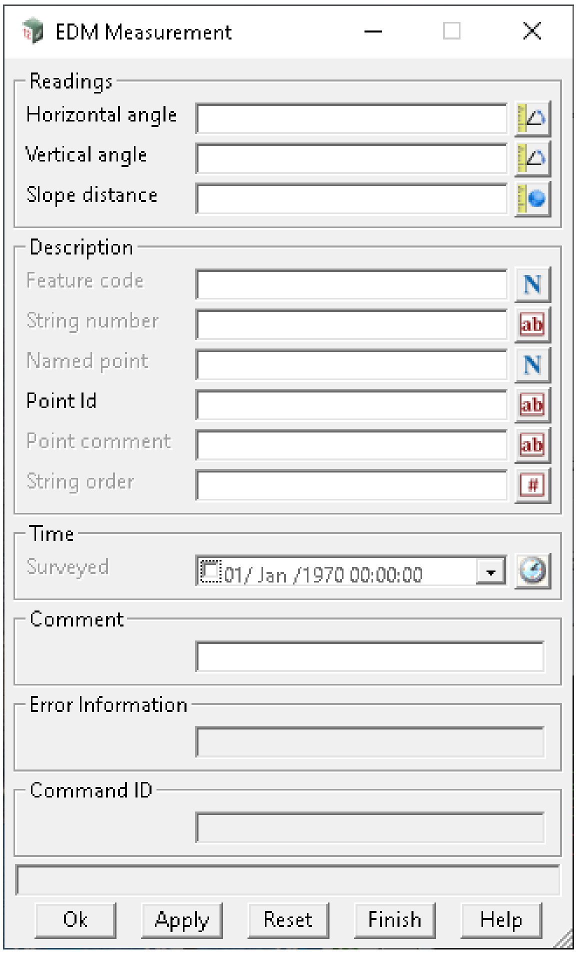
Continue to 26.4.2.30 EDM Measurement (opcode 7) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.30 EDM Measurement (opcode 7)

The ***EDM Measurement*** option stores a point from a measurement that is given by a horizontal angle, a vertical angle and slope distance.

Individual measurements can be entered or they can consist of pairs of Face1/Face2 measurements.

To enter a Face1/Face2 measurement, the command should be entered twice, with the appropriate values entered into the panel each time.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Horizontal angle

Horizontal angle to the measured point in dd.mmss format.

Vertical angle

Vertical angle to the measured point in dd.mmss format.

If the value is in the range 0 -180 degrees the measurement is considered a Face 1 measurement, and for measurements in the range 180-360 degrees they are considered Face2.

Slope distance

Slope distance to the measured point.

If a pair of face1/face2 measurements exist, the mean value of the slope distance is used for reduction *purposes.*

Description - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

String order integer box blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 7 edm_tachy_measurement Measurement - HA, VA, SD.

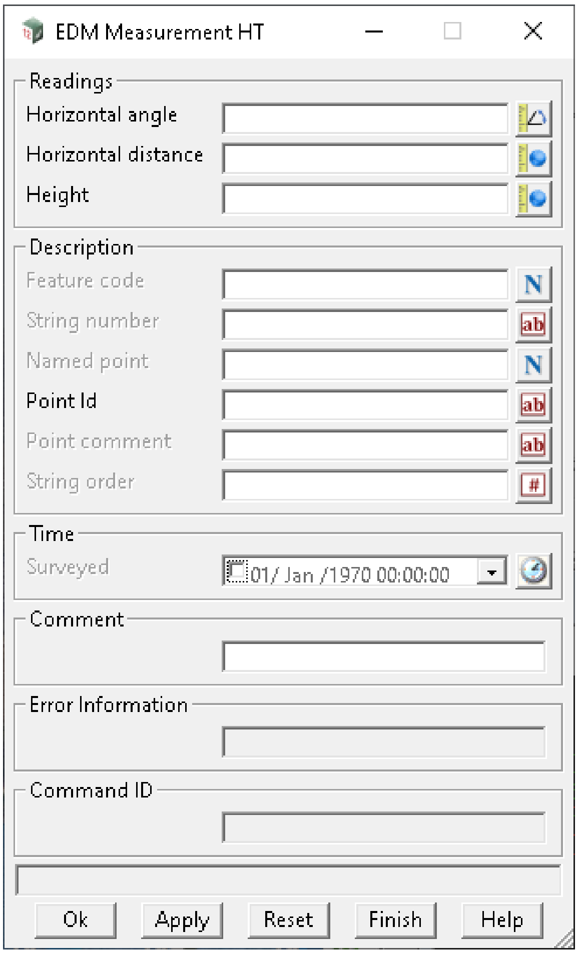
Continue to 26.4.2.31 EDM Measurement (HA,HD,HT) (opcode 11) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

26.4.2.31 EDM Measurement (HA,HD,HT) (opcode 11)

The ***EDM Measurement HT*** option stores a point from a measurement that is given by a horizontal angle, a horizontal distance and a height.

Individual measurements can be entered or they can consist of pairs of Face1/Face2 measurements.

To enter a Face1/Face2 measurement the command should be entered twice, with the appropriate values entered into the panel each time.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Horizontal angle

Horizontal angle to the measured point in dd.mmss format.

Horizontal distance

Reduced horizontal distance to the measured point.

Height

Height of the measured point.

Description - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code,

String Number, Named Point, Point Id and Point Comment for Measured Point.

String order integer box blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 11 edm_tachy_measurement_ht Measurement - HA, HD, Height.

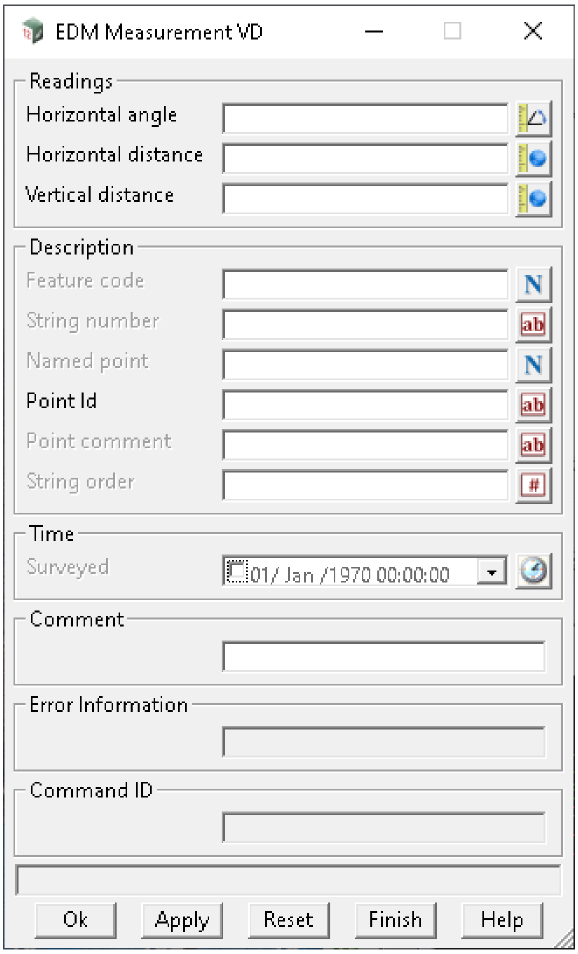
Continue to 26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12)

The ***EDM Measurement VD*** option stores a point from a measurement that is given by a horizontal angle, a horizontal distance and a vertical distance.

Individual measurements can be entered or they can consist of pairs of Face1/Face2 measurements.

To enter a Face1/Face2 measurement the command should be entered twice, with the appropriate values entered into the panel each time.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Horizontal angle

Horizontal angle to the measured point in dd.mmss format.

Horizontal distance

Reduced horizontal distance to the measured point.

Vertical distance

Change in height as measured from the collimation height of the instrument to the target point (usually centre of target).

Description - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

String order	integer box	blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

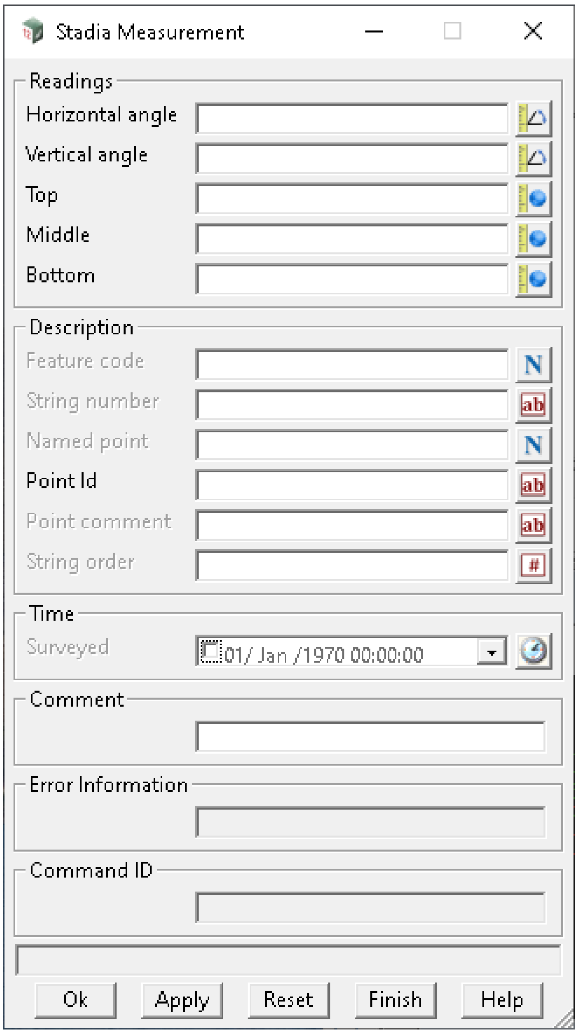
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 11 edm_tachy_measurement_ht Measurement - HA, HD, Height.

Continue to 26.4.2.33 Stadia Measurement (opcode 10) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.33 Stadia Measurement (opcode 10)

The ***Stadia Measurement*** option stores a point from a measurement that is given by a horizontal angle, a vertical angle and the Top, Middle and Bottom hair readings.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Horizontal angle

Horizontal angle to the measured point in dd.mmss format.

Vertical angle

Vertical angle to the measured point in dd.mmss format.

Top

Top hair reading.

Middle

Middle hair reading.

Bottom

Bottom hair reading.

Description - used for the new point

Feature code, String number, Named point, Point id and Point comment are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

String order	integer box	blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

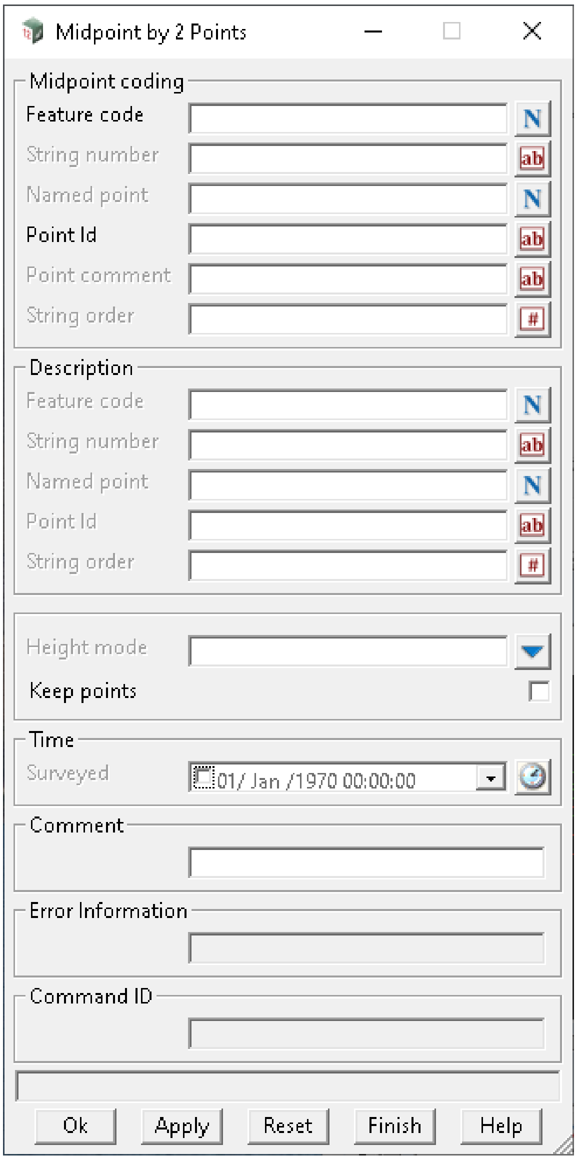
For the description on how the field data command is stored in a ***12d Field File,*** see 10 stadia_measurement Three hair stadia measurement.

Continue to 26.4.2.34 Midpoint of Two Points (opcode 146) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.34 Midpoint of Two Points (opcode 146)

The ***Midpoint by 2 Points*** option creates a new point which is the midpoint of the previous two measurement points.

The two points used to calculate the midpoint can also be deleted.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Midpoint coding - used for the new point

Feature code, String number, Named point, Point id and Point comment are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

Named point

??

String order integer box blank

See 26.4.1.3 String Order Field.

Description - used for finding two existing points

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point and one previous point from the current string are used. If found, the two points are used to create the midpoint of the two points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

*If the **Feature code** and **String number** exist, then a search is made for the last occurrence of two points with the same feature code and string number. If found, the two points are used to create the midpoint of the two points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

*If **only the Point id** exists, then a search is made for the last occurrence of two points with the same feature code and string number as the point given by the **Point id**. If found, the two points are used to create the midpoint of the two points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

In each case, if there is less than two points then no midpoint can be created.

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

??

String order integer box blank

See 26.4.1.3 String Order Field.

Rest of the Fields and Buttons

Height mode choice box null, non_tinable, interpolate

*If **null**, the created point has a null z-value.*

*If **interpolate**, the created point has a z-value which is the average of the z-values of the two points.*

*If **non_tinable**, the created point has a z-value which is the average of the z-values of the two points but the vertex is not tinable.*

Keep points tick box

*If **not ticked**, the two points used are deleted during the reduction.*

*If **ticked**, the two points are kept.*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

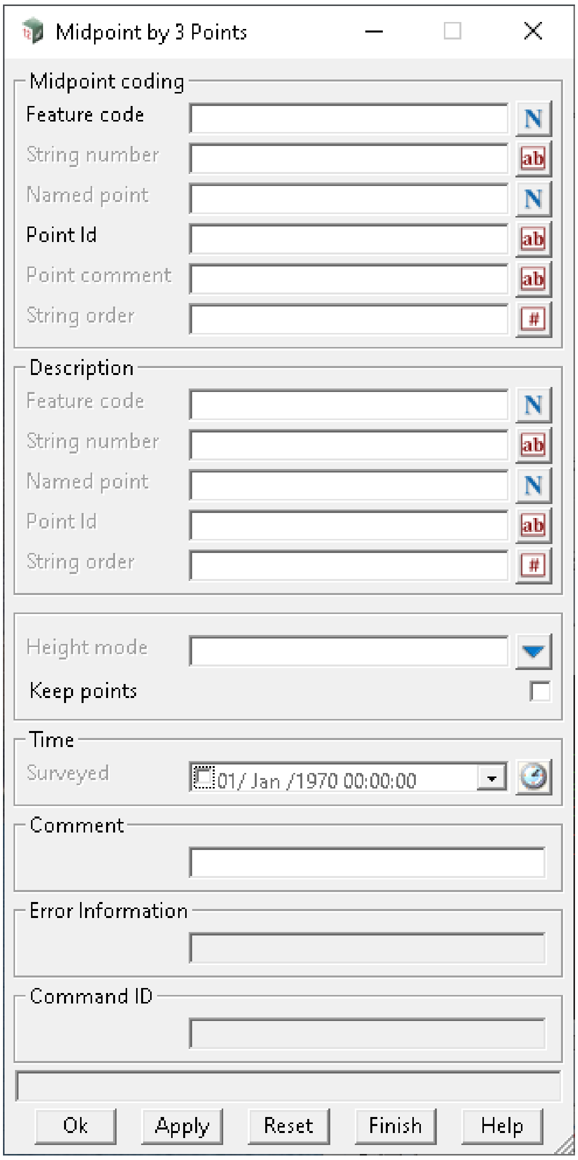
For the description on how the field data command is stored in a ***12d Field File,*** see 146 midpoint_2 Create midpoint of two points.

Continue to 26.4.2.35 Centre of Arc Through Three Points (opcode 147) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.35 Centre of Arc Through Three Points (opcode 147)

The ***Midpoint by 3 Points*** option creates a new point that is the centre of the arc that passes through three previous measurement points.

The three points used to calculate the arc centre can also be deleted. by the option.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Midpoint coding - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

Named point

??

String order

Not used.

Description - used for finding three existing points

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point and the two previous points from the current string are used, and a new point is created which is the centre of the arc through the three points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

*If the **Feature code** and **String number** exist, the last three points with that feature code and string number are used and a new point is created which is the centre of the arc through the three points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

*If **only the Point id** exists, then the feature code and string number of the point with that **Point id** are used and processed as above. Note that the point with the point id is not necessarily used.*

*If **only the Point id** is given, then the feature code and string number are taken from the previous measurement point **with that Point id**. That point and two measurement points previous to the predefined point that have the same feature code and string number, are used and a new point is created which is the centre of the arc through the three points. The height of the new point is determine by **Height mode** and the new point is given the coding values from the* **Midpoint Coding** *section.*

In each case, if there is less than three points then no arc can be fitted and no new point created.

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

??

String order

Not used.

Rest of the Fields and Buttons

Height mode choice box null, non_tinable, interpolate

*If **null**, the created point has a null z-value.*

*If **interpolate**, the created point has a z-value which is the average of the z-values of the three points.*

*If **non_tinable**, the created point has a z-value which is the average of the z-values of the three points but the vertex is not tinable.*

Keep points tick box

*If **not ticked**, the three points used are deleted during the reduction.*

*If **ticked**, the two points are kept.*

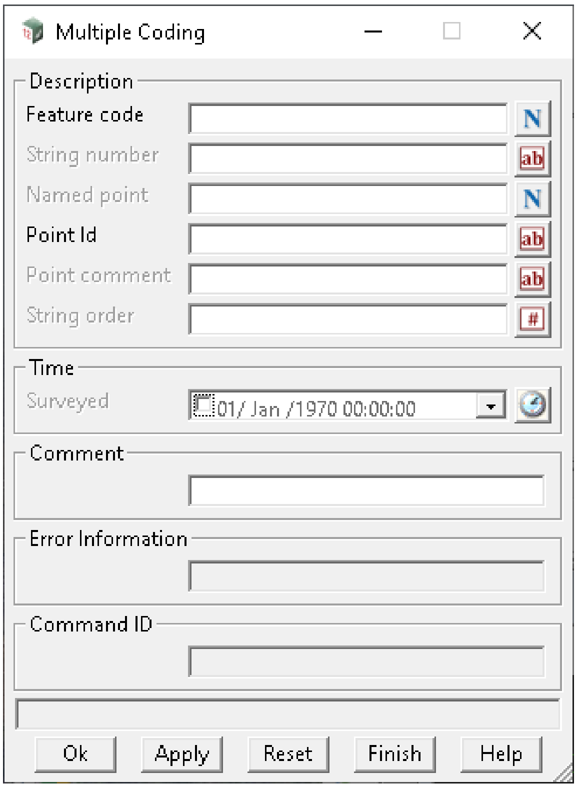
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see
147 midpoint_3 Create centre of arc that goes through three points.

Continue to 26.4.2.36 Multiple Coding (opcode 16) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.36 Multiple Coding (opcode 16)

The ***Multiple Coding*** option records a new point at the same position as the current measurement point but with possibly a different ***feature code*** and ***string number***.



A new point is created at the same position as the current measurement point but with the specified *Feature code* and *String number*.

The *Point id* and *Point comment* are recorded as the point id and vertex text for that vertex of the super string.

If a *Named point* exists, then its value is the ***point name*** and it is a ***named measurement***. A 4d point string of name *point name* is created and mapped using the Map File. The 4d text is the ***Station Prefix*** followed by *point name*. The *point name* is added to the internal list of named points for searching for coordinates.

The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for the new point

Feature code, String number, Named point, Point id, Point comment and String order are used to define values for the new point created by the measurement. See 26.4.1.1 Feature Code, String Number, Named Point, Point Id and Point Comment for Measured Point.

String order integer box blank

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 16 multiple_coding Multiply coded point.

Continue to 26.4.2.37 New Instrument Setup - Station (opcode 3) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.37 New Instrument Setup - Station (opcode 3)

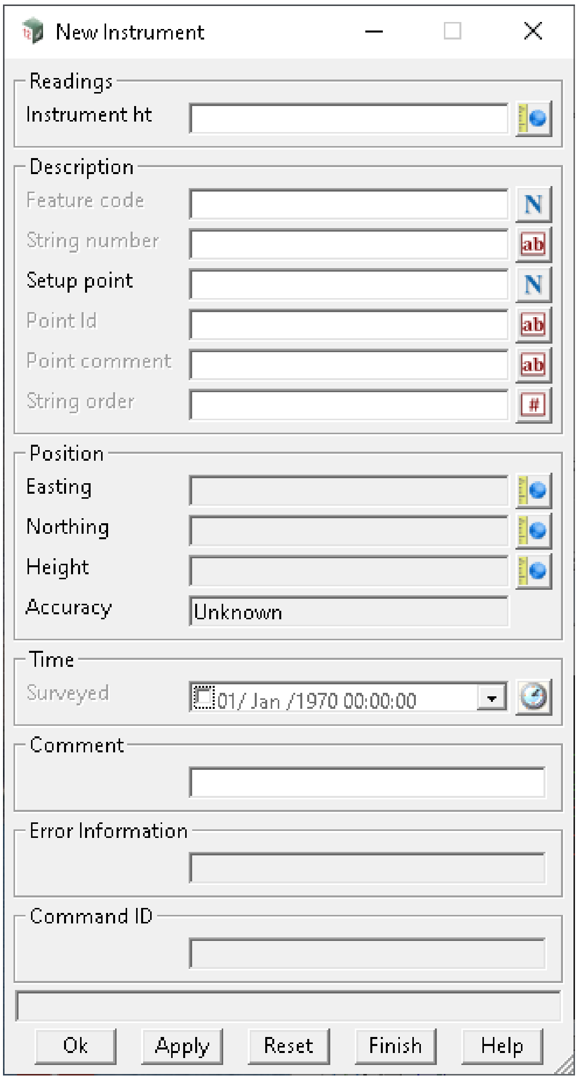
The ***New Instrument*** option defines a new instrument setup at an existing point.

That is, it is setting up an instrument at the point with name given in the **Setup point** field.

The (x,y,z) coordinates for **Setup point** are found by first searching the Control model, then the list of previously ***named points*** in the reduction, the ***point ids*** of previous measurements and finally if **Setup point** is still not found, the user is asked to type in the (x,y,z) coordinates.

See 28.5 Searching for Special Coordinates.

A record is written to the report file.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Instrument ht

Height of the instrument setup.

Description - for find the point to set up on

Feature code

This is only used in the special case given in When Setup Point is Not Found for the New Instrument Setup Command.

String number

Not used.

Setup point

Point name of the point that the instrument is being set up on.

For a description of how the reduction finds the appropriate point, see 26.4.1.2.1 Searching for the Coordinates of Special Points

Point id

*If **not blank**, the point id is used for searching.*

Point comment

Not used.

String order

Not used.

Rest of the Fields and Buttons

Position

Easting output

This field is non-editable and is populated if a valid coordinate exists for the nominated setup point.

Northing output

This field is non-editable and is populated if a valid coordinate exists for the nominated setup point.

Height output

This field is non-editable and is populated if a valid coordinate exists for the nominated setup point.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

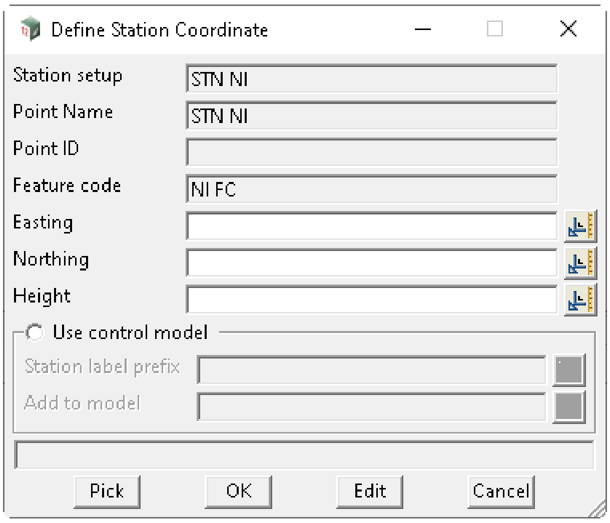
For the description on how the field data command is stored in a ***12d Field File,*** see 3 station New instrument setup on a point.

If the **Setup point** is found then no point is created by the New Instrument command.

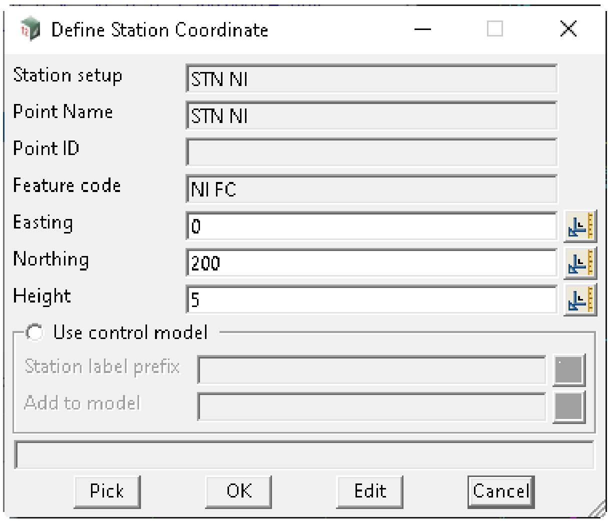
If the **Setup point** is not found then one or to new points can be created. See When Setup Point is Not Found for the New Instrument Setup Command'

When Setup Point is Not Found for the New Instrument Setup Command

If the ***Setup point*** can't be found, the **Define Station Coordinate** panel is displayed (see 14.4.2.1.1 Define Station Coordinate for Unknown Points):



Either **Pick** can be pressed and an existing vertex selected to fill in the **Easting**, **Northing** and **Height** fields, or values can be typed into the **Easting**, **Northing** and **Height** fields.



When **OK** is pressed, it is similar to a named measurement and one or two points are created.

1. a one vertex super string is created with:

   String name ***Feature code*** from the **New Instrument** panel.

   Vertex id ***Setup point*** from the **New Instrument** panel.

   Vertex text ***Setup point*** from the **New Instrument** panel.

   String attribute: ***Survey Control Station*** with the value ***1***

2. If **Used named points as measurements** is ***ticked*** in the **Others** tab in the Survey Data Reduction Function panel:

   a super string vertex is created with:

   String name ***Feature code*** from the **New Instrument** panel.

   No string attribute ***string_no***.

For the vertex, three attribute groups are created: ***SDR Setup Details***, ***SDR Measurement Details*** and ***SDR Measurement Geodetic Details***. See 26.4.2.65 Attributes for the Unknown Control Point Standard Measurement.

This point is used in stringing.

Important Note:

A ***named Coordinate*** field data command (panel **Direct Coordinate**) is inserted **BEFORE** the ***New Instrument*** field data command. The fields in the panel **Direct Coordinate** panel are:

X/Y/Z coordinate - ***Easting***, ***Northing*** and ***Height*** from the **Define Station Coordinate** panel.

Feature code - ***Feature code*** from the **New Instrument** panel.

String number - blank.

Named point - ***Setup point*** from the **New Instrument** panel.

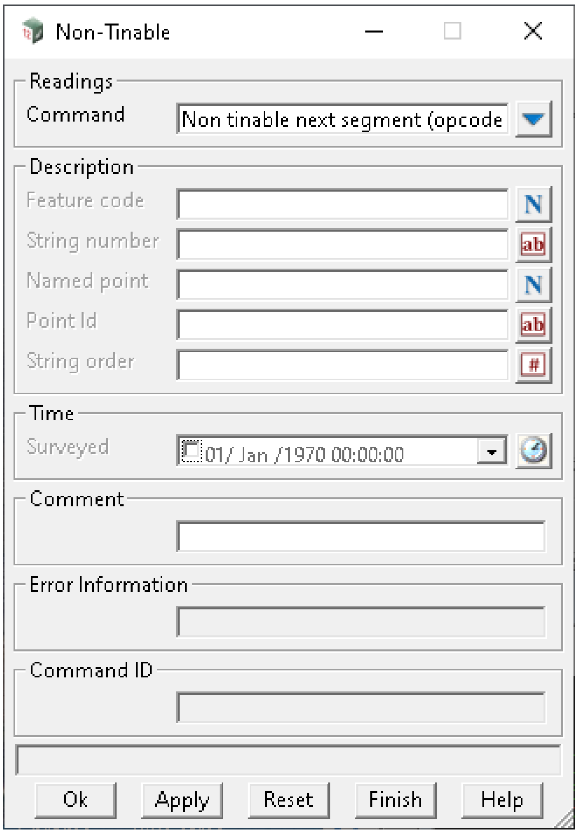
Point comment - blank.

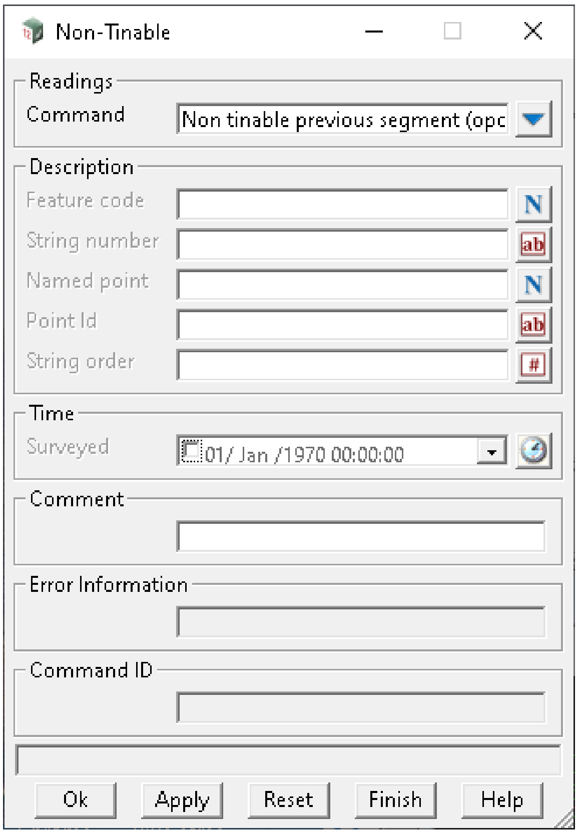
The ***named Coordinate*** field data command may only be visible when the ***SDR Editor*** is restarted.

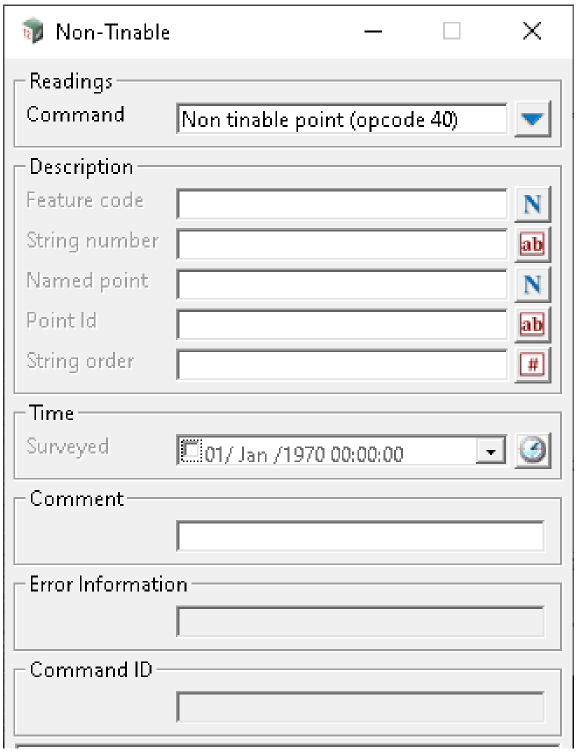
Continue to 26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

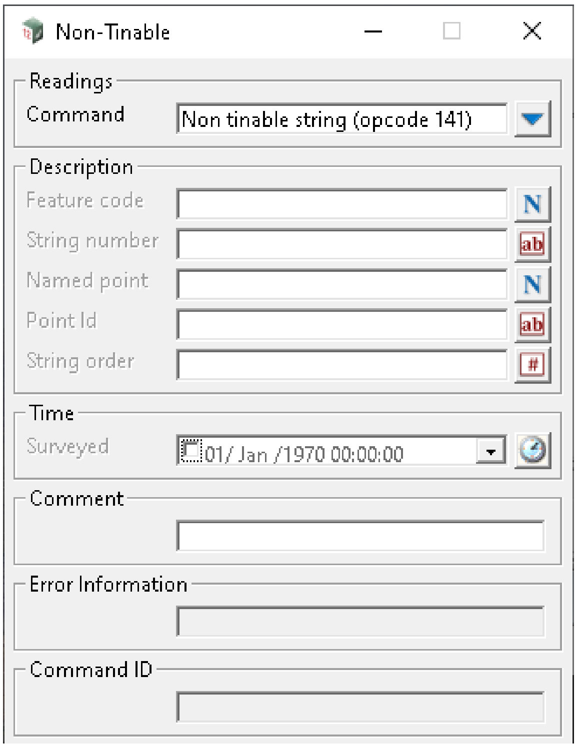
26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)

The ***Non-Tinable*** option sets selected vertices and/or segments to be non-tinable (not tinable).









The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Command choice box — Non tinable previous segment (opcode 39)
Non tinable next segment (opcode 38)
Non tinable point (opcode 40)

For Non tinable previous segment

Named point *field is not used.*

*If **no Feature code**, **String number** or **Point id** is given, the previous segment containing the current measurement point is set to non-tinable. That is, it will not be treated as a breakline in triangulations.*

*If the **Feature code** and **String number** exist, then the last segment of the previous string with that feature code and string number is set to non-tinable. That is, it will not be treated as a breakline in triangulations.*

*If **only the Point id** exists, then the segment containing the point with that point id as an end point, is set to non-tinable. That is, it will not be treated as a breakline in triangulations.*

For Non tinable next segment

*If **no Feature code**, **String number** or **Point id** is given, the next segment containing the current measurement point as a starting point is set to non-tinable. That is, it will not be treated as a breakline in triangulations.*

*If the **Feature code** and **String number** exist, then the next segment with the current measurement point as a starting point, and with the same feature code and string number, is set to non-tinable. That is, it will not be treated as a breakline in triangulations*

*If **only the Point id** exists, then the segment containing the point with that point id as a starting point, is set to non-tinable. That is, it will not be treated as a breakline in triangulations.*

For Non tinable point

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point is set to non-tinable. That is, it will not be used in triangulations.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is set to non-tinable. That is, it will not be used in triangulations.*

*If **only the Point id** exists, then the point with that point id is set to non-tinable. That is, it will not be used in triangulations.*

Description - used for finding an existing point or string

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

38 non_tinable_next_segment Make the next segment non-tinable.

39 non_tinable_previous_segment Make the previous segment non-tinable.

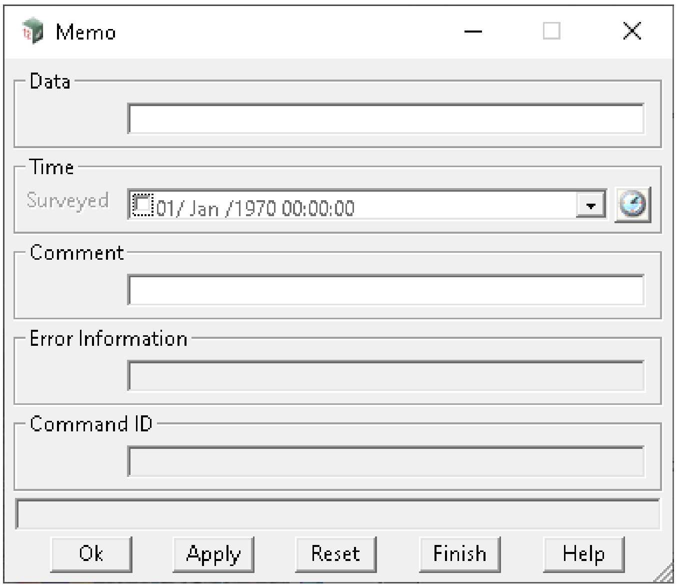
40 non_tinable_vertex Make a point non-tinable.

141 non_tinable_string Make a string non-tinable.

Continue to 26.4.2.39 Note (opcode 29) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.39 Note (opcode 29)

The ***Memo*** option gives text to be added as information in the ***12d Field File***.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Data

Extra text to be added as information in the field file.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

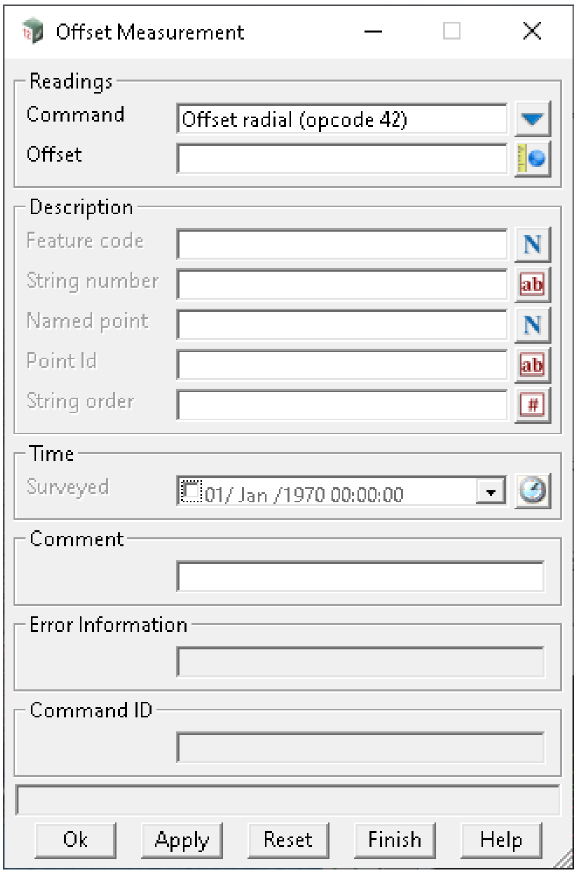
For the description on how the field data command is stored in a ***12d Field File,*** see 29 memo Note or memo.

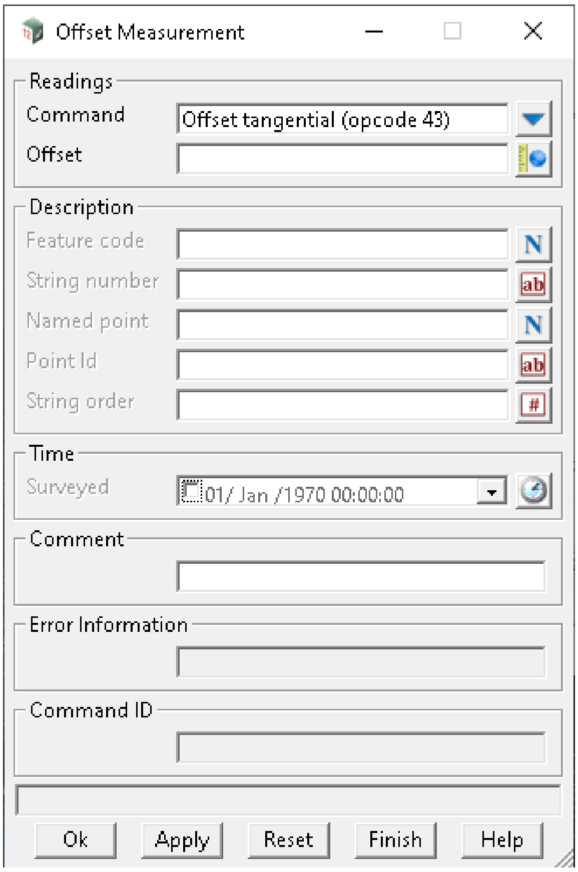
Continue to 26.4.2.40 Offset Measurement (opcodes 42, 43, 44) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

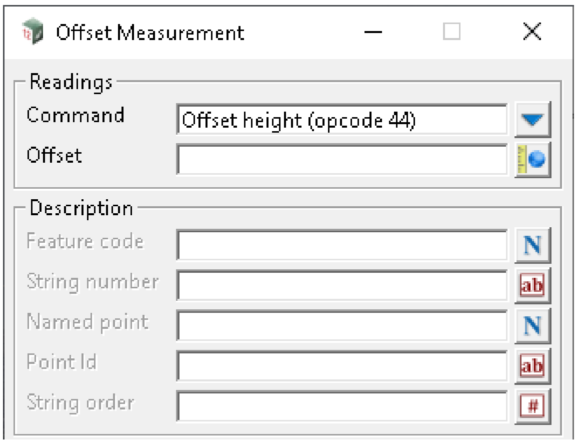
26.4.2.40 Offset Measurement (opcodes 42, 43, 44)

It is not always possible to measure a point directly but it may be possible to measure a point nearby and then measure offsets to adjust the measured point by to produce the coordinates of the required point.

For a full description and diagrams, see 26.3.2 Offsets in Appendix 26 12d Survey Guide.







The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Readings			
Command	choice box		Offset radial (opcode 42) Offset tangential (opcode 43)

Offset height (opcode 44)

For Radial

The radial offset is used to adjust the position of the specified point by a plan distance from the specified points original position, along the plan line joining the current station to the specified point. A positive offset is away from the station, negative is toward the station. For more information, see 26.3.2 Offsets

For Tangential

The tangential offset is used to adjust the position of the specified point by a plan distance from the specified points original position, at rights angles to the plan line joining the current station to the specified point. A negative offset is to the left (looking from the station), and positive is to the right (looking from the station). For more information, see 26.3.2 Offsets

For Height

If the height of the specified point is not null, then the height offset adjusts the height of the point. A positive offset adds to the height, a negative offset reduces the height.For more information, see 26.3.2 Offsets

Description - used for finding an existing point

***Named point** field is not used in searching.*

*If **no Feature code**, **String number** or **Point id** is given, the offset is used to adjust the position of the current measured point.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is adjusted.*

*If **only the Point id** exists, then point with that **Point id** is adjusted.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

??

String order

??

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

42 offset_measurement_radial Add a radial offset.

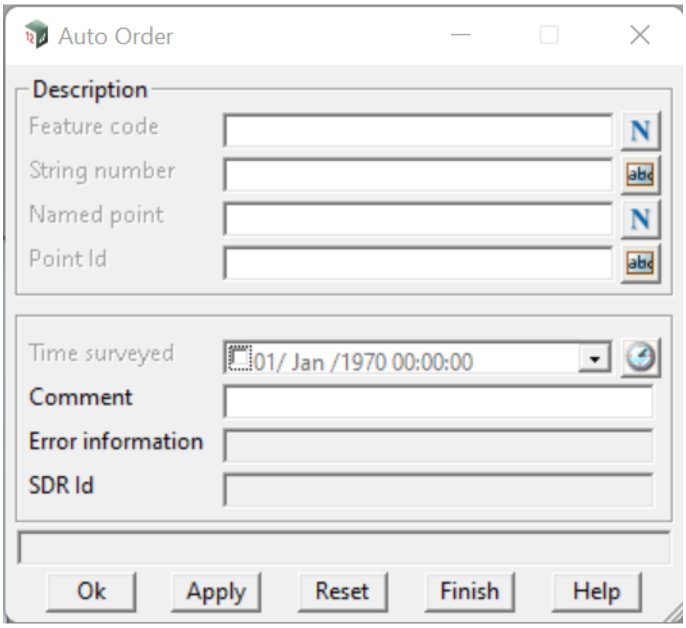
43 offset_measurement_tangential Add a tangential offset.

44 offset_measurement_height Add a height offset.

Continue to 26.4.2.41 Order String Automatically (opcode 101) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.41 Order String Automatically (opcode 101)

The ***Order string automatically*** command runs the 14.5.5.3 Auto Order option on the selected string.



Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

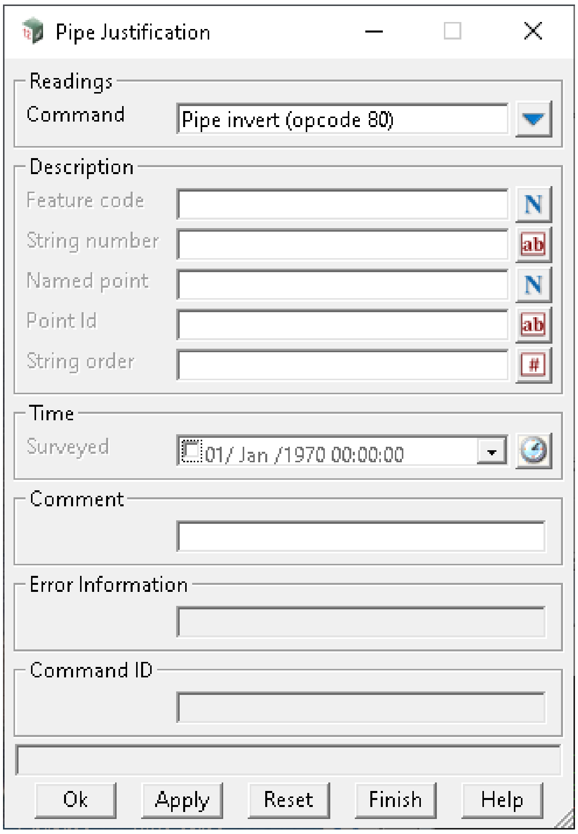
For the description on how the field data command is stored in a ***12d Field File,*** see 101 auto_order Order strings automatically.

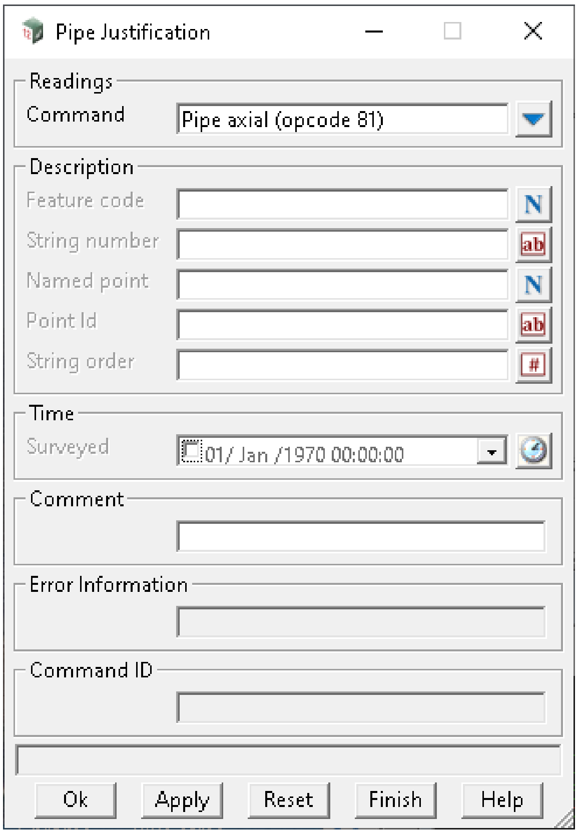
Continue to 26.4.2.42 Pipe Justification (opcodes 80, 81, 82) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

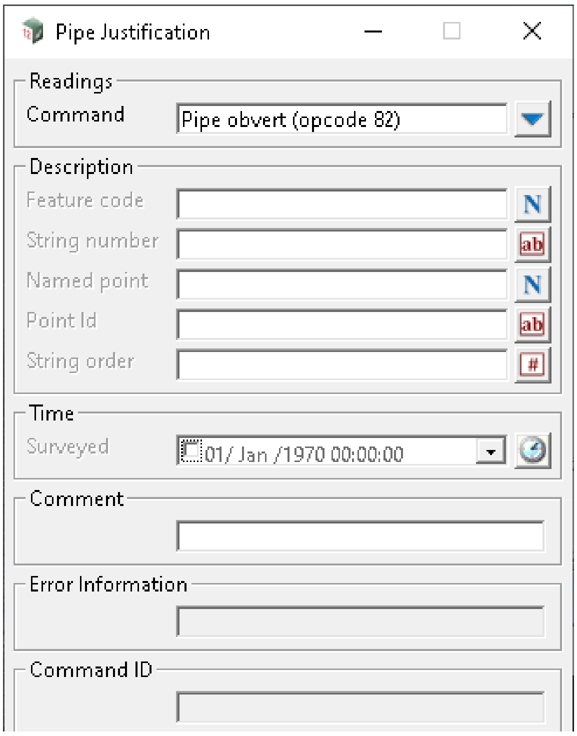
26.4.2.42 Pipe Justification (opcodes 80, 81, 82)

The ***Pipe Justification*** option sets the pipe justification type for a selected point.

If the selected point is not part of a pipe string then the command is ignored.







The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Readings			
Command	choice box		Pipe invert (opcode 80) Pipe axial (opcode 81) Pipe obvert (opcode 82)

For Pipe invert (opcode 80)

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point is on the invert (bottom) of a pipe. This is the default for measurements to points on pipe strings. If the point is not part of a pipe string, it is ignored.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is on the invert (bottom) of a pipe. If the point is not part of a pipe string, it is ignored.*

*If **only the Point id** exists, then the point with that point id is on the invert (bottom) of a pipe. If the point is not part of a pipe string, it is ignored.*

For Pipe axial (opcode 81)

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.*

*If **only the Point id** exists, then the point with that point id is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.*

For Pipe obvert (opcode 82)

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.*

*If **only the Point id** exists, then the point with that point id is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.*

Description - used for finding an existing point

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

80 pipe_justification_invert Pipe or culvert invert point (bottom of the pipe or culvert).

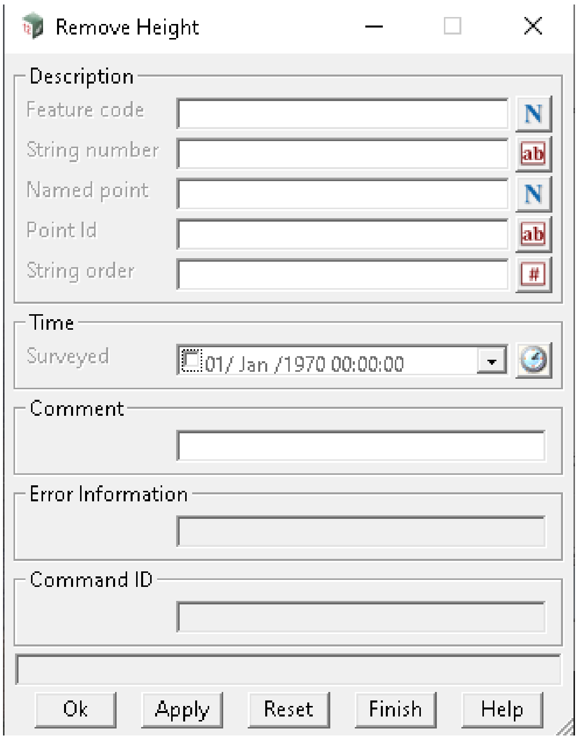
81 pipe_justification_axial Pipe or culvert axial point (centre of the pipe or culvert).

82 pipe_justification_obvert Pipe or culvert obvert point (top of the pipe or culvert).

Continue to 26.4.2.43 Remove Height (opcode 30) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.43 Remove Height (opcode 30)

The ***Remove Height*** option sets the height of a selected point (vertex) to null.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing point

*If **no Feature code**, **String number** or **Point id** is given, the height of the current measurement point is set to null.*

*If the **Feature code** and **String number** exist, then the height of the last point of the previous string with that feature code and string number is set to null.*

*If **only the Point id** exists, then the height of the point with that point id is set to null.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

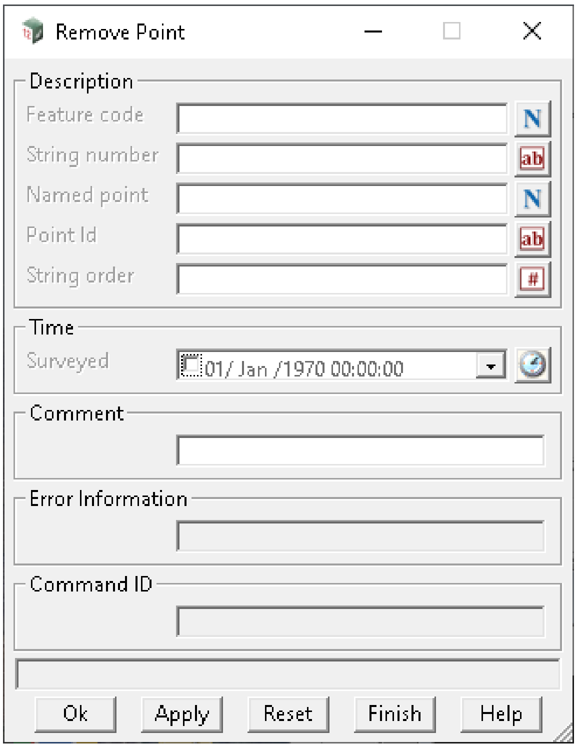
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see
30 remove_height Remove height from a point - that is make it a null height.

Continue to 26.4.2.44 Remove (Delete) Point (opcode 31) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.44 Remove (Delete) Point (opcode 31)

The ***Remove Point*** option deletes a selected point (vertex).



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing point

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point is deleted.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number is deleted.*

*If **only the Point id** exists, then the point with that point id is deleted.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

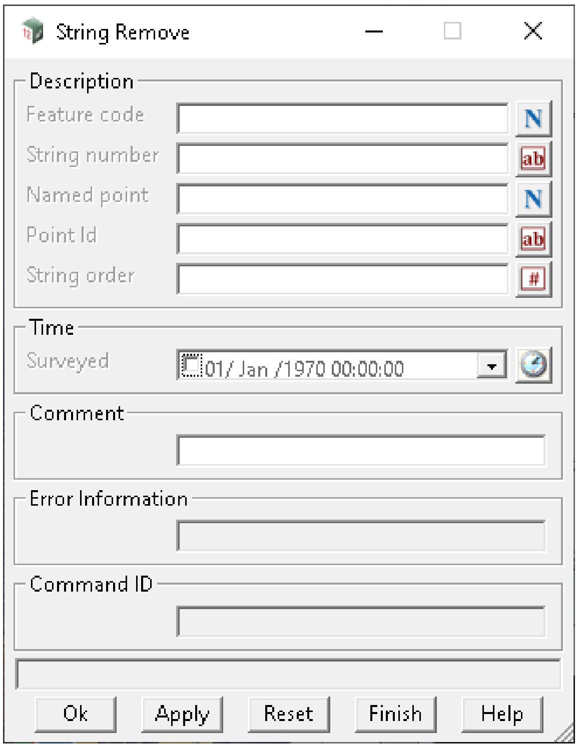
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 31 remove_point Delete point.

Continue to 26.4.2.45 Remove (Delete) String (opcode 144) or return to 26.4.2 List of Field Data Commands or26 12d Survey Guide.

26.4.2.45 Remove (Delete) String (opcode 144)

The ***String Remove*** option deletes a string.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is deleted.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is deleted.*

*If **only the Point id** exists, then the string containing the point with that point id, is deleted.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

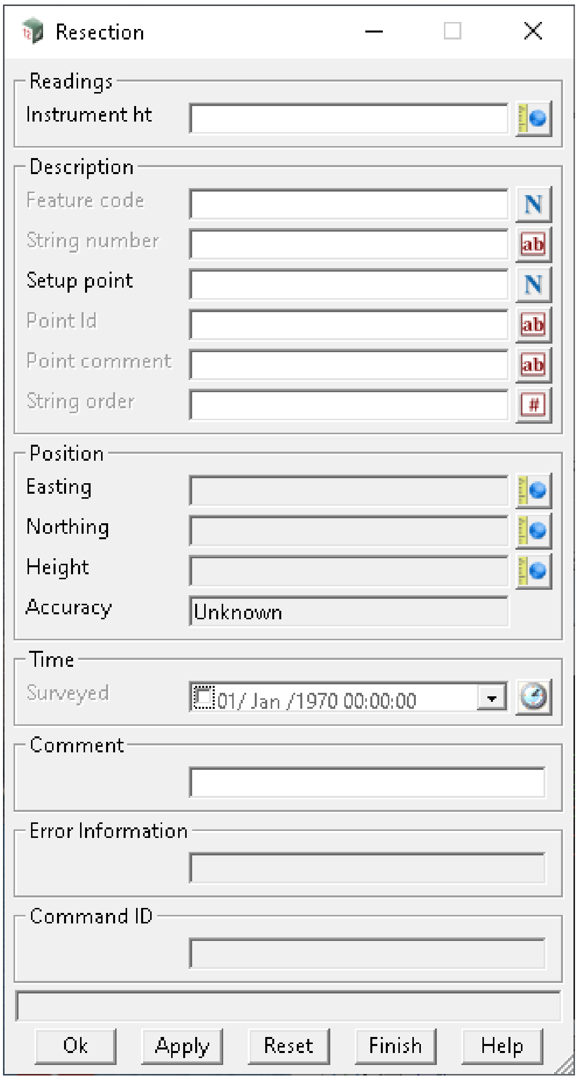
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see
144 remove_string Delete a string.

Continue to 26.4.2.46 Resection Start (opcode 128) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.46 Resection Start (opcode 128)

The ***Resection*** option is under development.



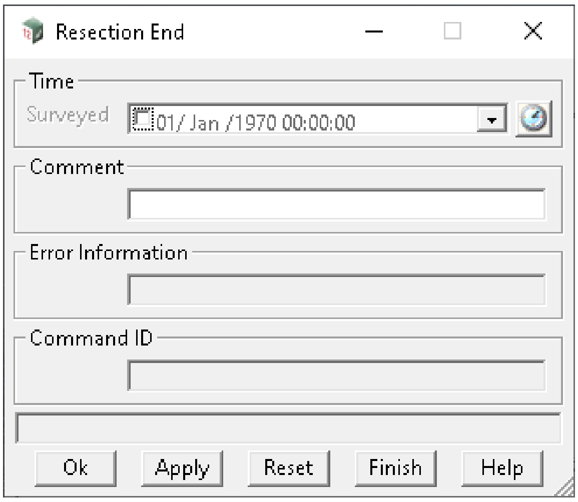
OK, Apply, Reset, Finish, Help See the description for the panel buttons in the section 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

For the description on how the field data command is stored in a ***12d Field File,*** see
128 resection Start a resection.

Continue to 26.4.2.47 Resection End (opcode 129) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.47 Resection End (opcode 129)

The ***Resection End*** option is under development.



OK, Apply, Reset, Finish, Help See the description for the panel buttons in the section 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons

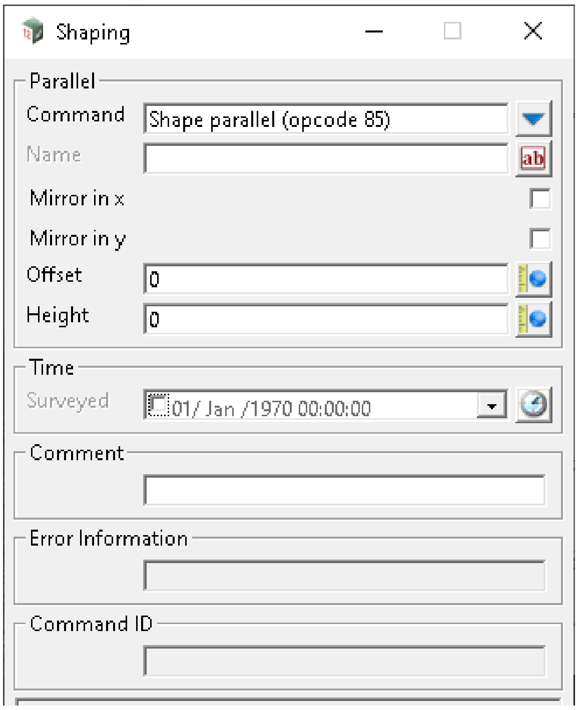
For the description on how the field data command is stored in a ***12d Field File,*** see 129 resection_end End the resection.

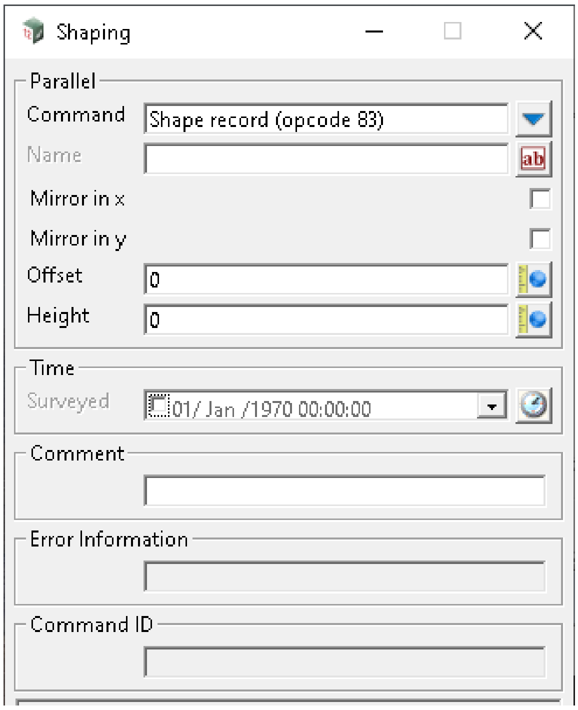
Continue to 26.4.2.48 Shaping (opcodes 83 to 86) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

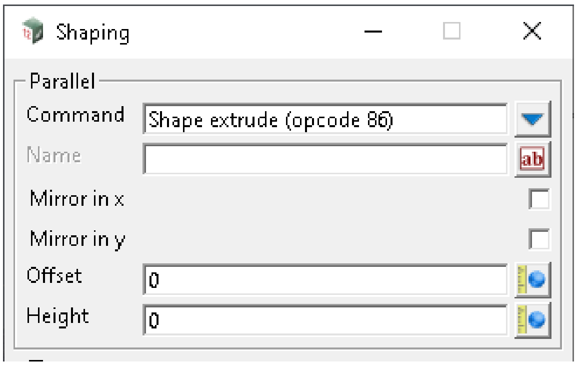
26.4.2.48 Shaping (opcodes 83 to 86)

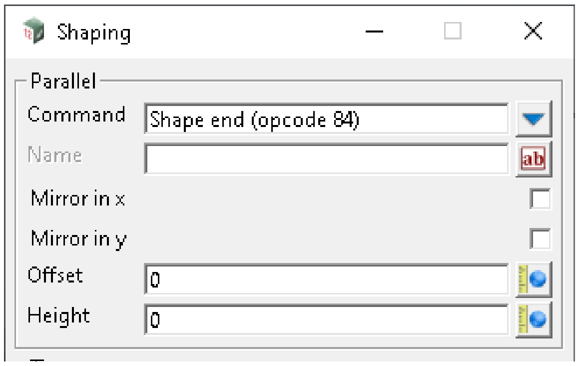
The ***Shaping*** option defines a shape and extrudes it down a string.

For a full description and diagrams, see 26.3.12 Shape Field Coding.









The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Parallel			
Command	choice box		Shape end (opcode 84) Shape record (opcode 83) Shape extrude (opcode 86) Shape parallel (opcode 85)

For Shape end

Stops *using* ***the current shape*** *or stops recording a shape.*

For Shape record

Start recording a shape *with the shape name.*

If ***Shape_name*** *is not blank, then the default field Shape is defined by the feature_code and string_number* *of the following measurements until a shape end command.*

There is no limit to the number of points in a shape.

for Shape extrude

Extrude the current shape along the current string.

For Shape parallel

Parallel the current shape along the current string.

*This creates a **number of strings** to represent each feature code of the shape record. In the case of shapes which contain curves, a number of strings will be created according to an chord-to-arc tolerance. See* 3.25.2 Chord-to-Arc Tolerance

Name

*If **not blank,** the name of the shape.*

Mirror in x

When a shape is recorder, each point becomes an offset/delta height relative to the first point.

Since a shape always has positive offsets, this option enables the shape to be applied to the left hand side of the string,

*If **ticked**, all shape offsets become negative hence the shape is applied to the left hand side of the string.*

Mirror in y

Reserved for future use. Not yet used.

Offset

Reserved for future use. Not yet used.

Height

Reserved for future use. Not yet used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

83 shape_record Start recording a shape - before the measurement.

84 shape_end Finish using a shape definition or finish recording a shape - after the measurement.

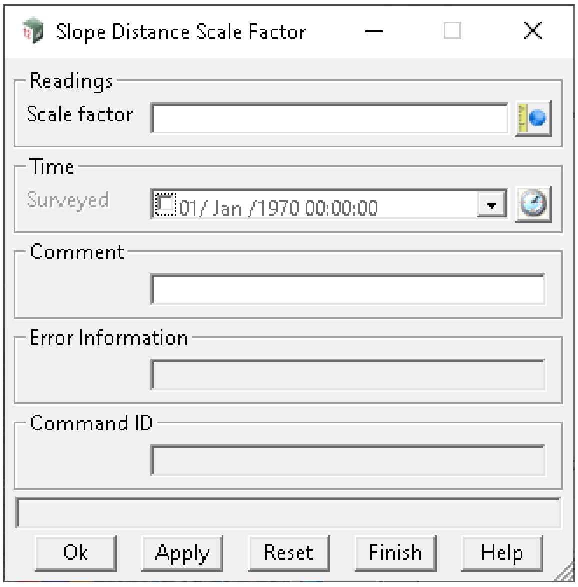
85 shape_parallel Parallel an existing shape.

86 shape_extrude Extrude an existing shape.

Continue to 26.4.2.49 Slope Distance Scale Factor (opcode 9) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.49 Slope Distance Scale Factor (opcode 9)

THe ***Slope Distance Scale Factor*** option specifies the slope distance scale factor to use for subsequent measurements.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Scale factor

*Scale factor to be applied to subsequent slope distance measurements. It is applied by multiplying raw slope distances by the **Scale factor** to give the corrected distance.*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 9 scale_factor Slope distance scale factor for subsequent distances.

Note:

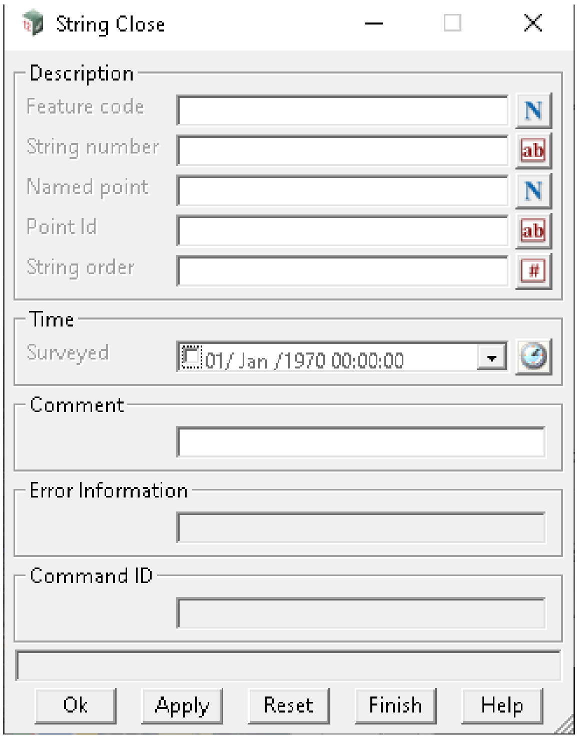
This opcode will invoke a warning as this correction is forbidden in many jurisdictions.

Continue to 26.4.2.50 String Close (opcode 20) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.50 String Close (opcode 20)

The ***String Close*** option closes the selected string.

For a full description and diagrams, see 26.3.5 Close String in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is closed.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is closed.*

*If **only the Point id** exists, then the string containing the point with that point id, is closed.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

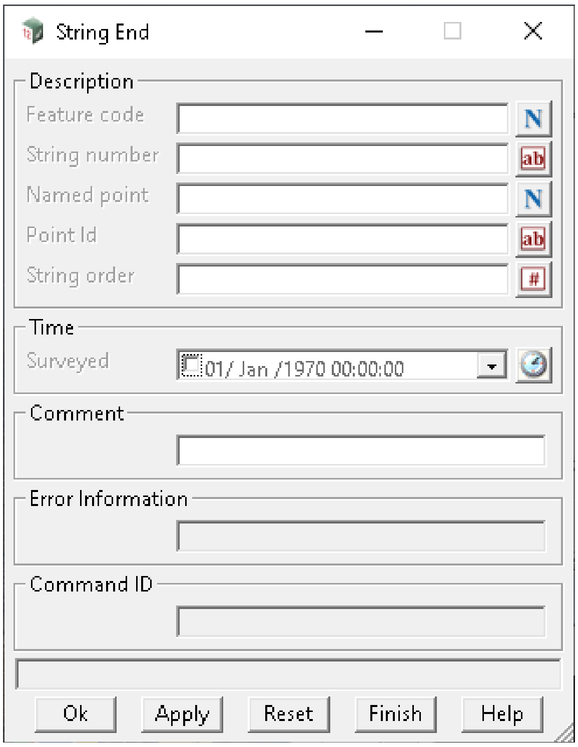
For the description on how the field data command is stored in a ***12d Field File,*** see 20 close_string Close string.

Continue to 26.4.2.51 String End (opcode 48) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.51 String End (opcode 48)

The ***String End*** option ends (stops) a string at a selected vertex of an existing string. Any vertices after the selected vertex form a new string. So the selected vertex will be the end of the first string.

Note that the selected vertex is NOT joined to the points in the string that followed it that form the new string. So there will be a gap between the two strings.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing point

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is the last point of that string. That is, the string is terminated.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number becomes the last point of that string. That is, that string is terminated.*

*If **only the Point id** exists, then the previous string containing the point with that point id, is terminated after the point with the point id. So the point with the point id is the last point of the string.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

??

String order

??

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

48 end_string End a string.

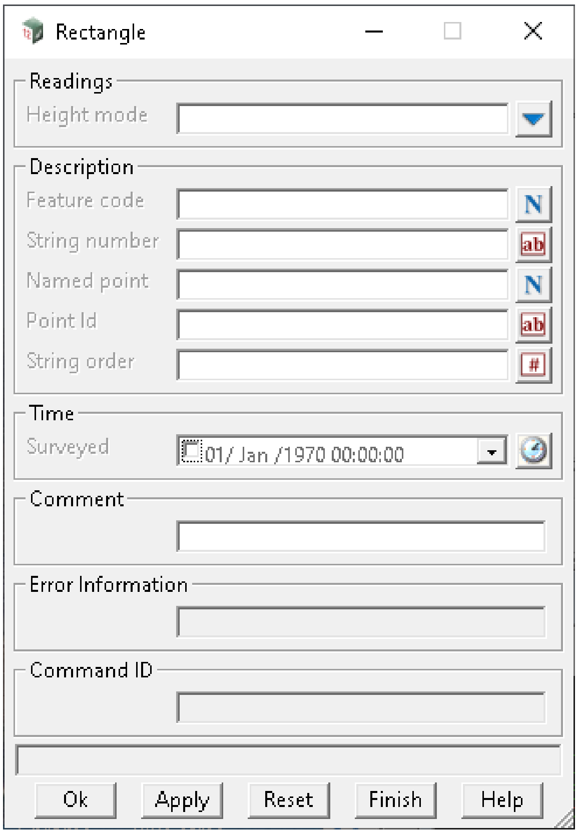
Continue to 26.4.2.52 String (Squashed) Rectangle (opcode 45) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.52 String (Squashed) Rectangle (opcode 45)

The ***Rectangle*** option selects three measurement points in the same string (i.e. the three points have the same ***Feature code*** and ***String number****),* and creates an extra vertex in the string to form a parallelogram (squashed rectangle).

The created vertex does not have any of the vertex attributes SDR Setup Details, SDR Measurement Details or SDR Measurement as it is not created by a measurement.

For a full description and diagrams, see 26.3.6 Squashed Rectangle - Parallelogram in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Height mode	choice box		null, non_tinable, interpolate

*If **null**, the created point has a null z-value.*

*If **interpolate**, the created point has a z-value which is the average of the z-values of the three points.*

*If **non_tinable**, the created point has a z-value which is the average of the z-values of the three points but the vertex is not tinable.*

Description - used for finding three existing points

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point and the two previous points from the current string are used, and a fourth point is created to form a parallelogram (squashed rectangle) and the height of the fourth point is given by **Height mode**.The string is then closed*

*If the **Feature code** and **String number** exist, the last three points with that feature code and string number are used and a fourth point is created to form a parallelogram (squashed rectangle) and the height of the fourth point is given by **Height mode**. The string is then closed.*

*If **only the Point id** exists, then the feature code and string number of the point with that **Point id** are used and processed as above. Note that the point with the point id is not necessarily used.*

*If **only the Point id** is given, then the feature code and string number are taken from the previous measurement point **with that Point id**. That point and two measurement points previous to the predefined point that have the same feature code and string number, are used and a fourth point is created to form a parallelogram (squashed rectangle) and the height of the fourth point is given by **Height mode**. The string is then closed. Note that the point with the point id is not necessarily used.*

In each case, if there is less than three points then a squashed rectangle can not be created and no new point created.

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 45 rectangle Make a parallelogram from the last three measurement points.

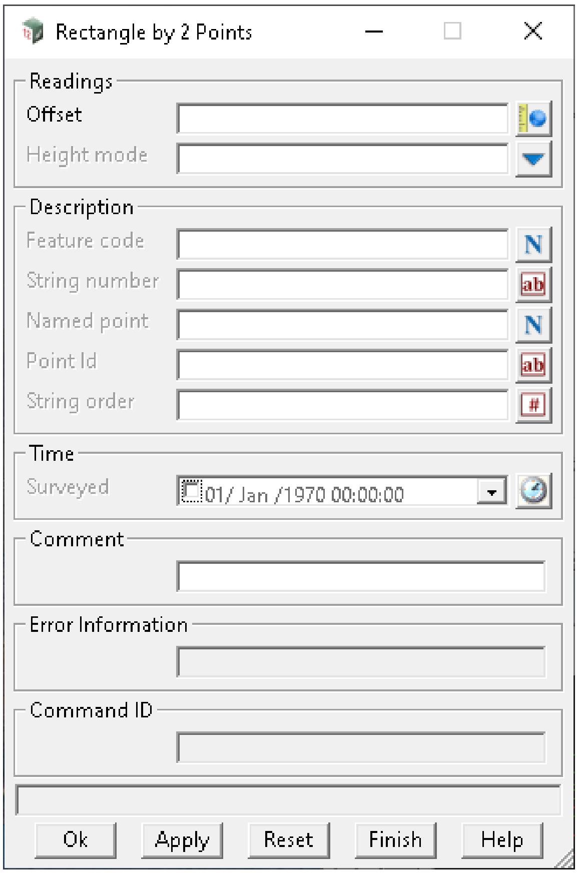
Continue to 26.4.2.53 String Rectangle by 2 Points (opcode 37) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

26.4.2.53 String Rectangle by 2 Points (opcode 37)

The ***Rectangle by 2 Points*** option selects two measurement points in the same string (the two points have the same ***Feature code*** and ***String number***), and uses the given ***Offset*** value to create two extra vertices in the string to form a rectangle.

The created vertices do not have any of the vertex attributes SDR Setup Details, SDR Measurement Details or SDR Measurement as they are not created by a measurement.

For a full description and diagrams, see 26.3.7 Rectangle by 2 Points in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Offset	real box		

Offset value.

*The rectangle is defined by two points (reference side) and an **Offset value.***

*If a positive **Offset value** is given, two new points will be created to the right of the reference side.*

*If a negative **Offset value** is given, two new points will be created to the left of the reference side.*

Height mode	choice box		null, non_tinable, interpolate

*If **null**, the created point has a null z-value.*

*If **interpolate**, the created point has a z-value which is the average of the z-values of the two points.*

*If **non_tinable**, the created point has a z-value which is the average of the z-values of the two points but the vertex is not tinable.*

Description - used for finding two existing points

*If **no Feature code**, **String number** or **Point id** is given, the current measurement point and one previous point from the current string are used. If found, the two points are used to define the reference side of the rectangle and two new points created using the given **Offset value**. The heights of the third and fourth points are given by **Height mode**. The string is then closed.*

*If the **Feature code** and **String number** exist, then a search is made for the last occurrence of two points with the same feature code and string number. If found, these points are used to define the reference side of the rectangle and two new points created using the given **Offset value**. The heights of the third and fourth points are given by **Height mode**. The string is then closed.*

*If **only the Point id** exists, then a search is made for the last occurrence of two points with the same feature code and string number as the point given by the **Point id**. If found, then these points are used to define the reference side of the rectangle and two new points created using the given **Offset value**. The heights of the third and fourth points are given by **Height mode**. The string is then closed.*

In each case, if there is less than two points then a rectangle can not be created and no new points created.

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Important Note

Two consecutive rectangles are unable to be defined side by side.

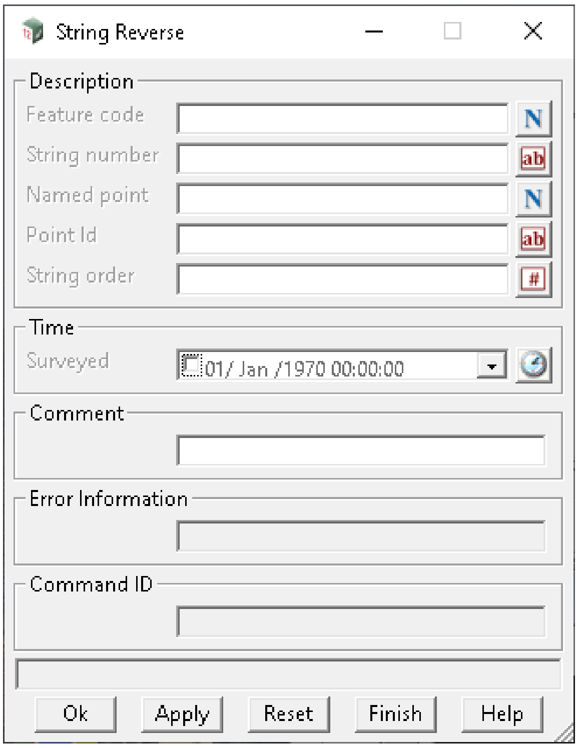
In other words if the two points given are part of string of greater than two vertices, the command will only work for sets of two points that are exclusively defined. That is, *f*or a 5 point string, a rectangle can be defined by points 1 and 2, and 4 and 5.

For the description on how the field data command is stored in a ***12d Field File,*** see 37 rectangle_2 Rectangle by two points.

Continue to 26.4.2.54 String Reverse (opcode 19) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.54 String Reverse (opcode 19)

The ***String Reverse*** option reverses the direction of the selected string.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is reversed.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is reversed.*

*If **only the Point id** exists, then the string containing the point with that point id, is reversed.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

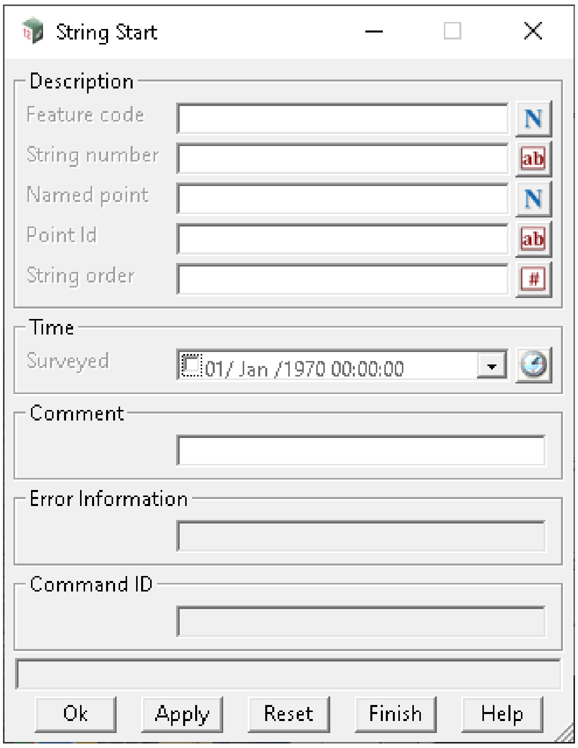
For the description on how the field data command is stored in a ***12d Field File,*** see 19 reverse_string Reverse string.

Continue to 26.4.2.55 String Start (opcode 47) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.55 String Start (opcode 47)

The ***String Start*** option starts a new string at the selected vertex of an existing string.

For a full description and diagrams, see 26.3.4 Start New String in 26 12d Survey Guide.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the current string is terminated (without including the current measurement point) and the current measurement point becomes the first point of a new string with the same feature code and string number.*

*If the **Feature code** and **String number** exist, then the last point of the previous string with that feature code and string number becomes the first point of a new string with the same feature code and string number.*

*If **only the Point id** exists, then the previous string containing the point with that point id is terminated before the point id point, and the point becomes the first point of a new string with the same feature code and string number.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

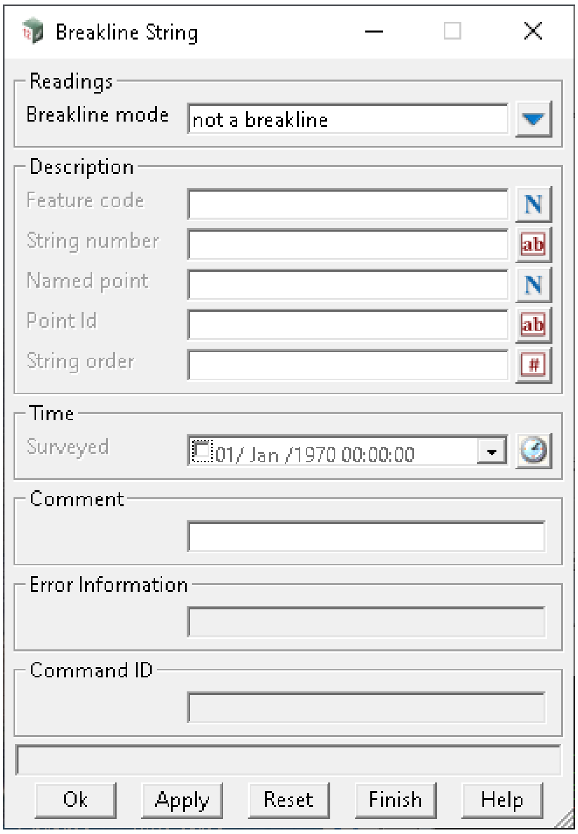
For the description on how the field data command is stored in a ***12d Field File,*** see 47 new_string Start a new string.

Continue to 26.4.2.56 String Tinable - Breakline String (opcode 46) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide

26.4.2.56 String Tinable - Breakline String (opcode 46)

The ***Breakline Start*** option sets the breakline type for a selected string.

That is, it makes the selected a breakline (*i.e.* all vertices and segments are tinable) or not a breakline (*i.e.* all vertices and segments are not tinable).



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up

Readings

Breakline mode	choice box		not a breakline, breakline

For Not a breakline

The selected string is set to a point string and hence is not a breakline (however the points are tinable).

For Breakline

The selected string is set to a line string (all vertices and segments are tinable) and is therefore a breakline.

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is selected and **Breakline mode** used to define the string as a breakline or not.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is selected and **Breakline mode** used to define the string as a breakline or not.*

*If **only the Point id** exists, then the string containing the point with that point id, is selected and **Breakline mode** used to define the string as a breakline or not.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

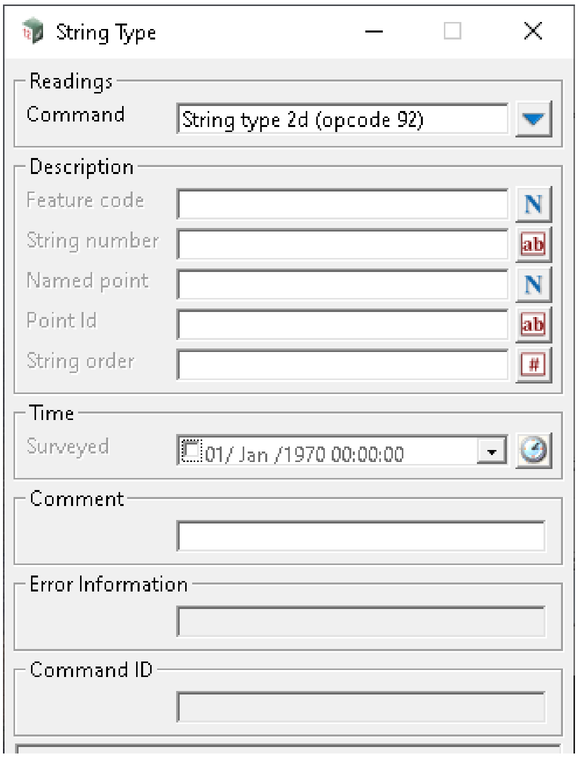
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

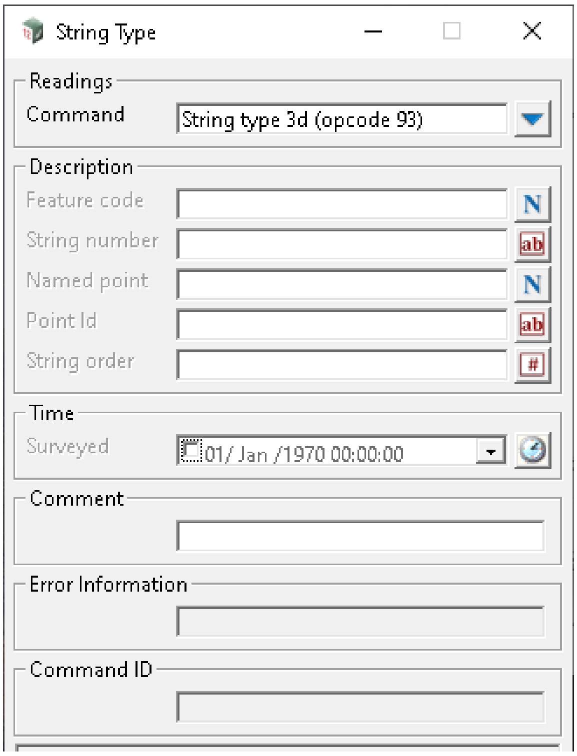
For the description on how the field data command is stored in a ***12d Field File,*** see 46 breakline Make the string a breakline or not.

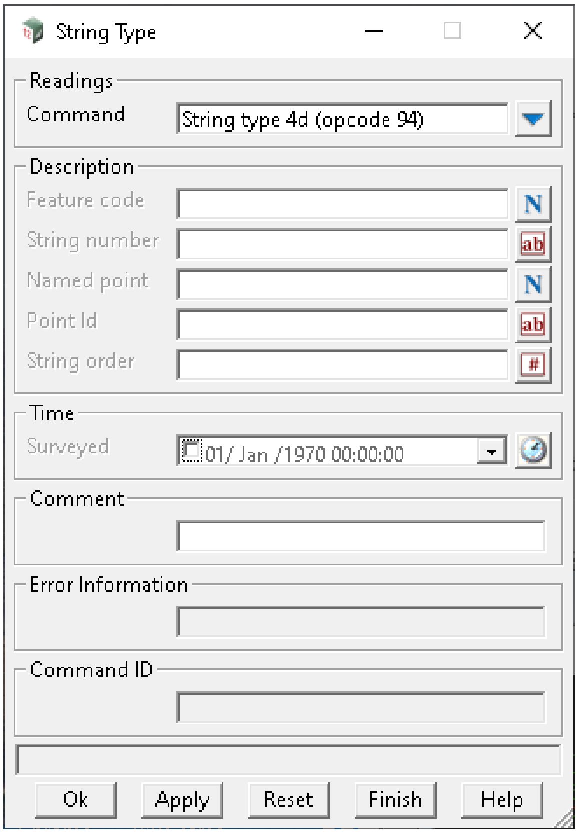
Continue to 26.4.2.57 String Type (opcodes 92, 93, 94) or return to 26.4.2 List of Field Data Commands or26 12d Survey Guide.

26.4.2.57 String Type (opcodes 92, 93, 94)

The ***String Type*** option sets whether a selected string is a **2d**, **3d** or **4d super string**.







The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Readings			
Command	choice box	String type 2d	String type 2d (opcode 92) String type 3d (opcode 93) String type 4d (opcode 94)

*If **2d** - the string has null height for the entire string*
*If **3d** - the string can have different heights at each vertex*
*If **4d** - the string can have different heights and text at each vertex*

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is selected and depending on the Opcode, is defined to be a 2d, 3d or 4d super string.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is selected and depending on the Opcode, is defined to be a 2d, 3d or 4d super string.*

*If **only the Point id** exists, then the string containing the point with that point id, is selected and depending on the Opcode, is defined to be a 2d, 3d or 4d super string.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see

92 string_type_2d Remove all z-values for a string (i.e. make all z-values null).

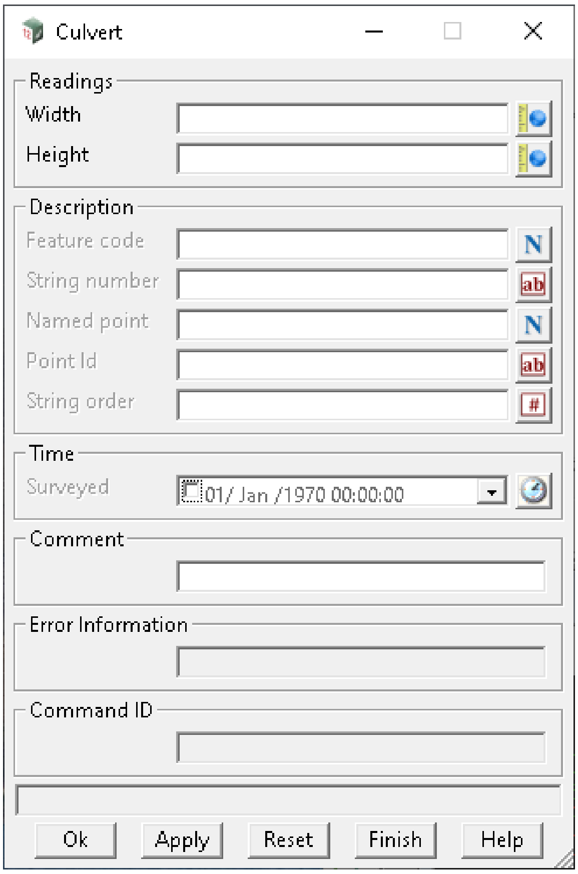
93 string_type_3d The string can have different z-values for each vertex.

94 string_type_4d Use name library file/ Map File for vertex text on the string - name mapping.

Continue to 26.4.2.58 Culvert (opcode 96) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.58 Culvert (opcode 96)

The ***Culvert*** option sets a string to be a culvert super string with a given culvert width and height.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Width

Width of the culvert

Height

Height of the culvert

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is selected and created as a culvert string with the given width and height.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is selected and is created as a culvert with the given width and height.*

*If **only the Point id** exists, then the string containing the point with that point id, is selected and is created as a culvert with the given width and height.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Important Note

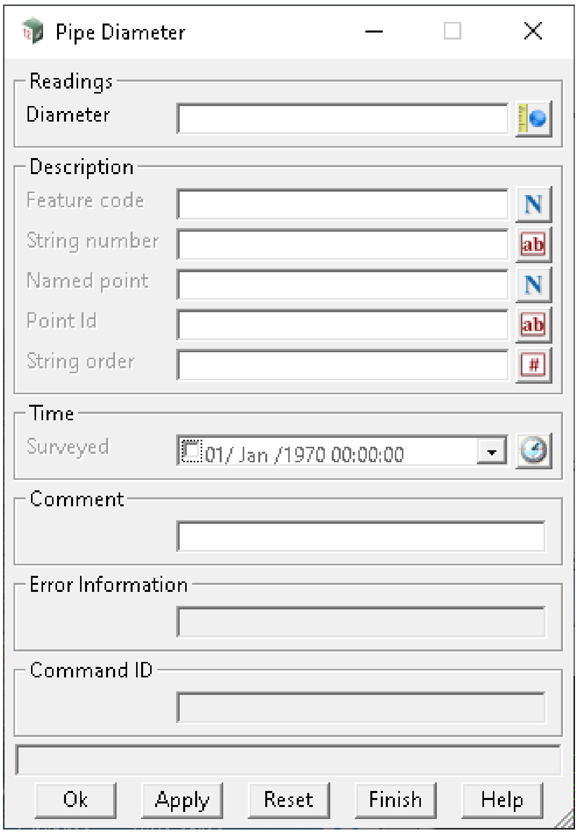
Culvert strings are always **line strings** and are stored with the justification of the majority of the string points. Individual culvert points are picked up by either top (obvert), centre (axial) or bottom (invert) of the culvert using opcodes 80, 81 and 82.

For the description on how the field data command is stored in a ***12d Field File,*** see 96 culvert width and height for a culvert super string.

Continue to 26.4.2.59 Pipe Diameter (opcode 95) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.59 Pipe Diameter (opcode 95)

The ***Pipe Diameter*** option sets a string to be a pipe super string with a given pipe diameter.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Readings

Diameter

Diameter of the pipe.

Description - used for finding an existing string

*If **no Feature code**, **String number** or **Point id** is given, the string of the current measurement point is selected and created as a pipe string with the given diameter.*

*If the **Feature code** and **String number** exist, then the last previous string with that feature code and string number is selected and is created as a pipe string with the given diameter.*

*If **only the Point id** exists, then the string containing the point with that point id, is selected and is created as a pipe string with the given diameter.*

Feature code, String number, Point id See 26.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings

Named point

Not used.

String order

Not used.

Rest of the Fields and Buttons

Time surveyed, Comment, OK, Apply, Reset, Finish, Help   See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Important Note

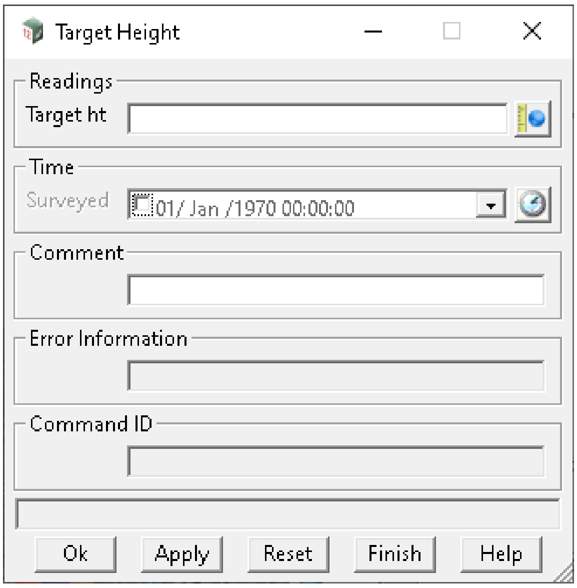
Pipe strings are always **line strings** and are stored with the justification of the majority of the string points. Individual culvert points are picked up by either top (obvert), centre (axial) or bottom (invert) of the pipe using opcodes 80, 81 and 82.

For the description on how the field data command is stored in a ***12d Field File,*** see 95 pipe_diameter Diameter for a super string pipe.

Continue to 26.4.2.60 Target Height (opcode 5) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.60 Target Height (opcode 5)

The ***Target Height*** option defines the target height to be used for the following measurements.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Target height

Target height of following measurements.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 5 target_height New target height.

Continue to 26.4.2.61 Templating (opcodes 51 to 59) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.61 Templating (opcodes 51 to 59)

The ***Templating*** option records and uses field templates when picking up strings.

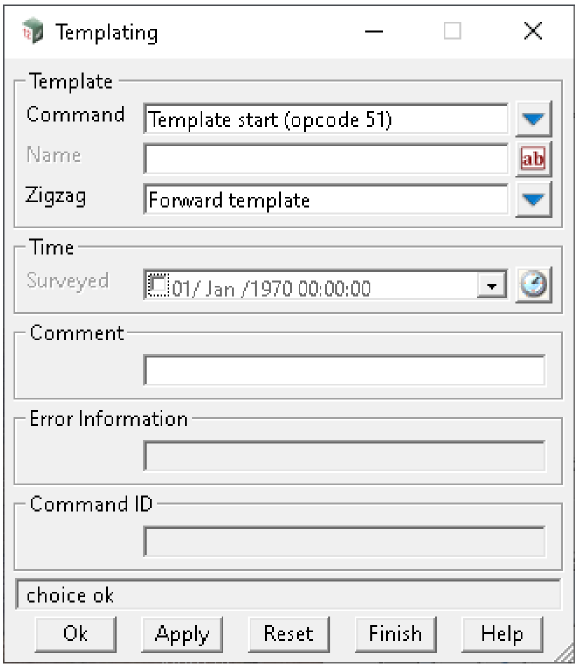
For a full description and diagrams, see 26.3.11 Field Templates in 26 12d Survey Guide.

For *Template start (opcode 51)*,go to	Template start
Template end (opcode 52)	Template end
Template pause (opcode 53)	Template pause
Template continue (opcode 54)	Template continue
Template record (opcode 55)	Template record
Template skip (opcode 56)	Template skip
Template insert (opcode 58)	Template insert
Template delete (opcode 57)	Template delete
Template change (opcode 59)	Template change

Template start

Selecting *Template start (opcode 51)* brings up the **Templating** panel with the *Command* field set to *Template start (opcode 51)*

Template start starts using the field template given in the field ***Name***.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Command		Template start	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)
Name	Text box		

Name of the field template to use.

*If **Name** is blank, the default field template is used.*

Zigzag	choice box	Forward template	Forward template Reverse template Start on zig of zigzag Start of zag of zigzag

*If zigzag is **forward template**, then the field template is used as a forward template.See* 26.3.11.1 Forward Direction *in Appendix* 26 12d Survey Guide

__reverse template__, then the field template is used as a reverse template.See 26.3.11.2 Reverse Template Direction *in Appendix* 26 12d Survey Guide

__start on zig__, then the field template is used as a zig_zag template and is used in the forward definition direction first (that is starts on a zig). See 26.3.11.3 Zig-Zag *in Appendix* 26 12d Survey Guide.

__start on zag__, then the template is used as a zig_zag template and is used in the reverse direction first (that is, starts on a zag).See 26.3.11.3 Zig-Zag *in Appendix* 26 12d Survey Guide.

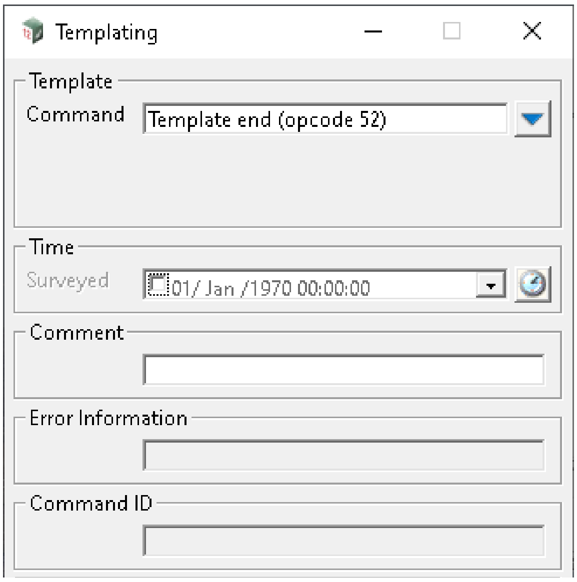
*If zigzag is **blank**, or anything other than **forward**, **reverse**, or **start on zag** then the field template is used as a zig-zag template starting on a **zig**.*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template end

Selecting Template end (opcode 52) brings up the **Templating** *panel with the Command field set to **Template end***

***Template end** stops using the current field template, or stops recording a field template.*



The fields and buttons used in this panel have the following functions.

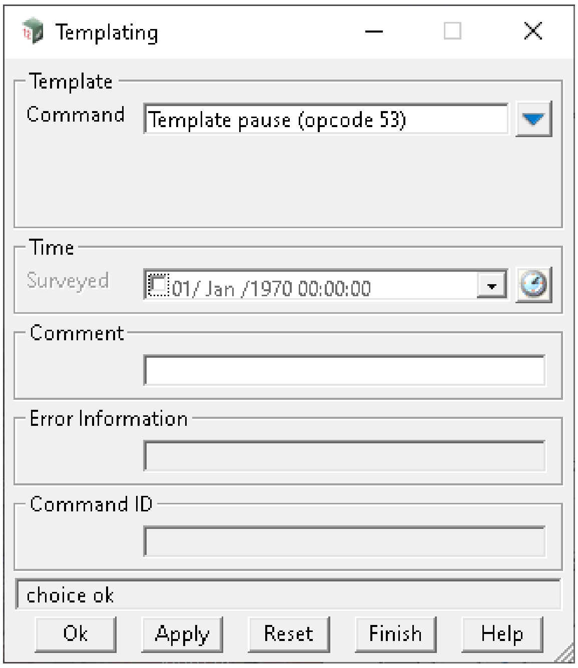
Field Description	Type	Defaults	Pop-Up
Command		Template end	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template pause

Selecting *Template pause (opcode 53)* brings up the **Templating** panel with the *Command* field set to **Template pause**

Pause using the current field template or defining a field template, until a *continue field template (54*) or a finish field *template (52) code* is given.



The fields and buttons used in this panel have the following functions.

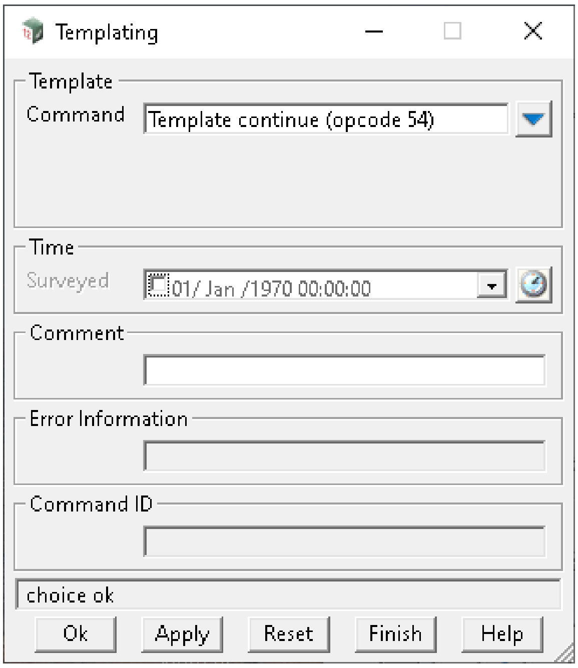
Field Description	Type	Defaults	Pop-Up
Command		Template pause	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template continue

Selecting *Template continue (opcode 54)* brings up the **Templating** panel with the *Command* field set to **Template continue**

Continue using or defining the current field template, which has been stopped by a *Template pause (opcode 53*). The *Continue* command only needs to be given once and applies to all following measurements until another *Pause* or *Finish* command is given.



The fields and buttons used in this panel have the following functions.

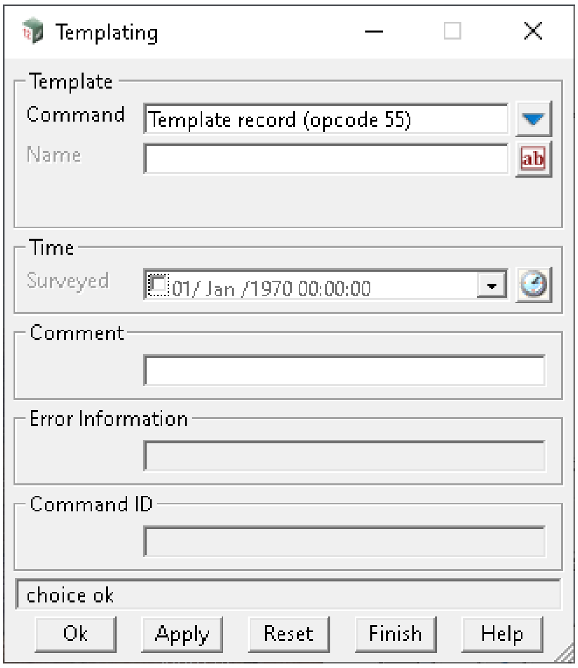
Field Description	Type	Defaults	Pop-Up
Command		Template continue	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template record

Selecting *Template record (opcode 55)* brings up the **Templating** panel with the Command field set to **Template record**

Template record stores the *feature code* and *string number* of the following measurements as a field template until a *Finish* code (52) is given.



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Command		Template record	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)

Name

Name of the template being created

Start recording a field template with the name **Name**. *If* **Name** *is blank, then it is the default field template that is defined.*

The feature code and string number of the following measurements are stored as the field template until a Finish code (52) is given. There is no limit to the number of feature code and string number pairs that can be stored in a field template.

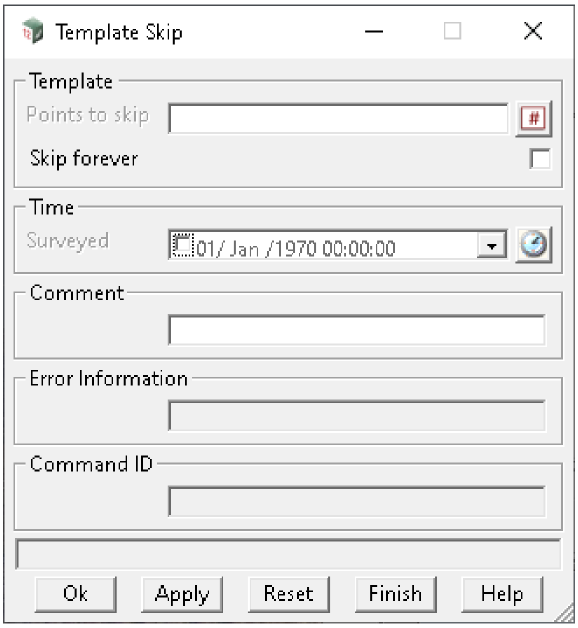
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template skip

Selecting *Template skip (opcode 56)* brings up the **Template Skip** panel.

This panel allows the user to skip picking up one or more points (feature code and string number pairs) from the field template currently being used. The next measurement takes the *feature code* and *string number* from the next point after the skipped points, from the field template definition.

See 26.3.11.4 Skipping Field Template Points in Appendix 26 12d Survey Guide



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Points to skip

Number of points (feature code and string number pairs) of the template to skip.
If **Points to skip** *is blank or zero, then only one point is skipped otherwise* **Points to skip** *points are skipped.*

Skip forever tick box

If ***ticked****, the given number of feature code and string number pairs are not used from then on.*
If ***not ticked****, only skip for this one used of the template.*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

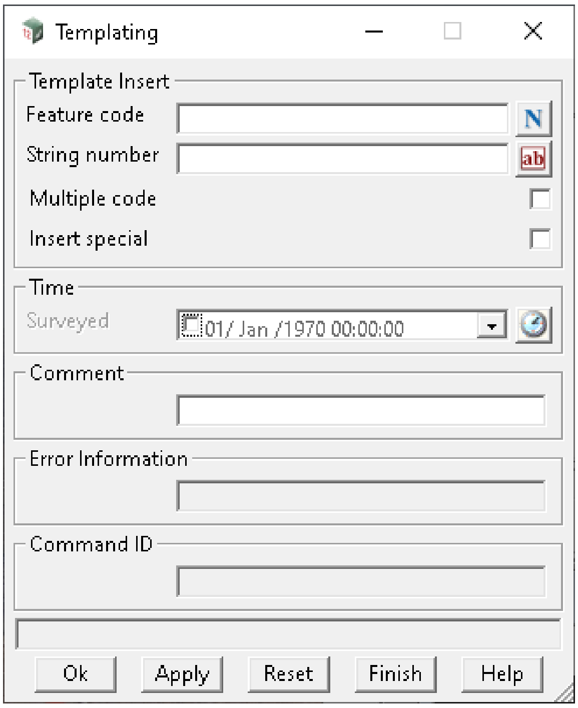
Template insert

Selecting *Template insert (opcode 58)* brings up the **Templating** panel.

This option allows the user to insert new point definitions into the template.

These may be **new points** or to **add a multiple code** to an **existing point** in the template.

See 26.3.11.5 Insert Template Points or Insert Multiple Codes in Appendix 26 12d Survey Guide



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Feature code

Feature code to be inserted (as a new point or a multiple code) with the string number, into the template

String number

String number to be inserted (as a new point or a multiple code) with the feature code, into the template

Multiple code tick box

*If **not ticked** (the default), a new point is inserted into the template with the Feature code and String number given in the panel.*

*If **ticked**, no new point is inserted but the current template point will be made a multiple coded point with the Feature code and String number given in the panel. The multiple coding will be used each time the template point is used.*

Insert special tick box

*If **ticked**, the point will be added to the current template being picked up (that is, to the end of the template).*
*If **not ticked**, the point will be added to the next template being picked up (that is, to the beginning of the template).*

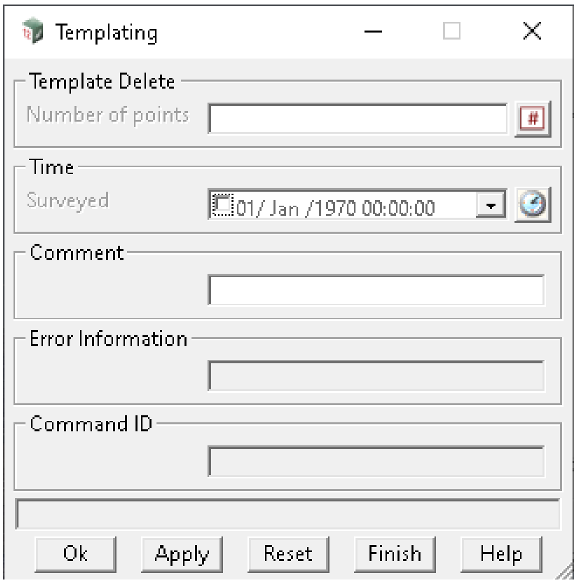
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template delete

Selecting *Template delete (opcode 57)* brings up the **Templating** panel.

Allows the user to delete one or more points on the template. Picking up will use the updated template definition.

See 26.3.11.6 Delete Template Points in Appendix 26 12d Survey Guide



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

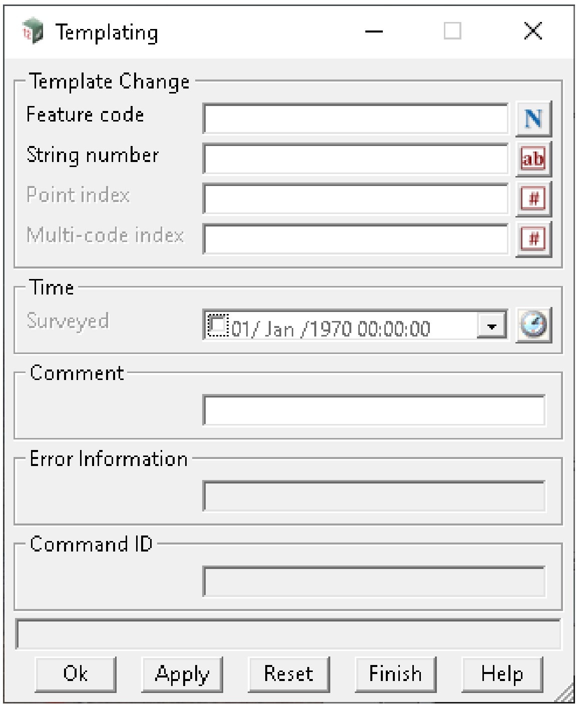
Number of points

Number of points to delete from the template. Any further use of the template will used the updated template definition.

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Template change

Selecting *Template change (opcode 59)* brings up the **Templating** panel.



The fields and buttons used in this panel have the following functions.

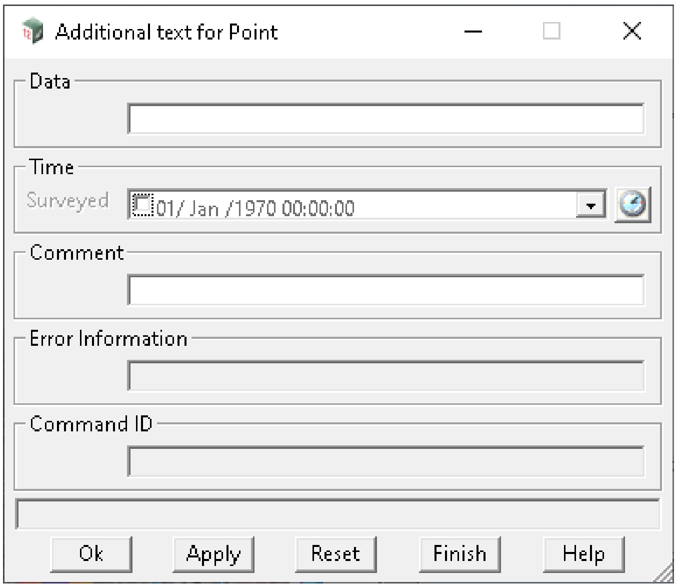
Field Description	Type	Defaults	Pop-Up

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

Continue to 26.4.2.62 Additional Text For Point (opcode 41) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.62 Additional Text For Point (opcode 41)

The ***Additional Text for Point*** option appends extra text to any vertex text of the current measurement.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Data

The text in **Data** *is appended to the vertex text of the current measurement point.*

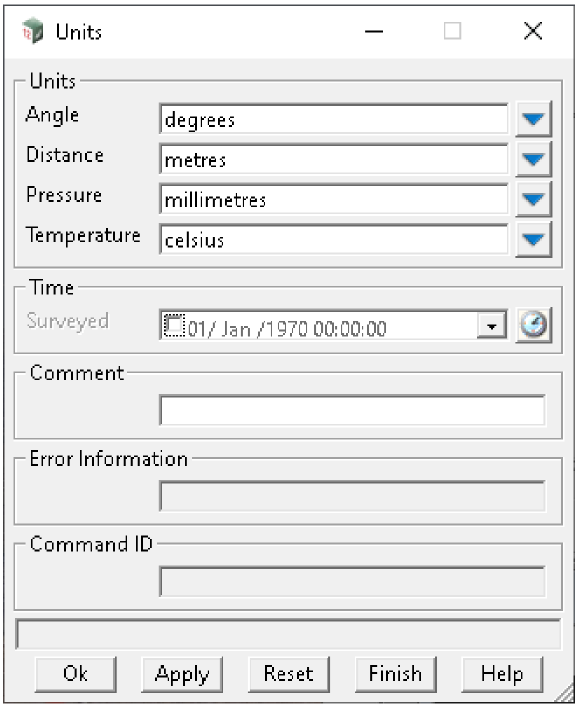
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 41 additional_text Add additional text to the current measurement point.

Continue to 26.4.2.63 Units (opcode 100) or return to 26.4.2 List of Field Data Commands or26 12d Survey Guide.

26.4.2.63 Units (opcode 100)

The ***Units*** option sets the units used in the ***12d Field File.***



The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
Angle	choice box		degrees, gons, mills

*If **degrees**, angles are given in **decimal degrees**.*

***Warning**: **gons** and **mils** are **not** implemented and even through chosen, **decimal degrees is still used**.*

Distance	choice box		metres, feet

*If **metres**, distance is given in metres.*

***Warning**: **feet** is **not** implemented and even through chosen, **metres is still used**.*

Pressure	choice box		millimetres, inches, millibars

*If **millimetres**, pressure is given in millimetres.*

***Warning**: **inches** and **millibars** are **not** implemented and even through chosen, **millimetres is still used**.*

Temperature	choice box		celsius, fahrenheit

*If **celsius**, temperatures are given in celsius.*

***Warning**: **fahrenheit** is **not** implemented and even through chosen, **celsius is still used**.*

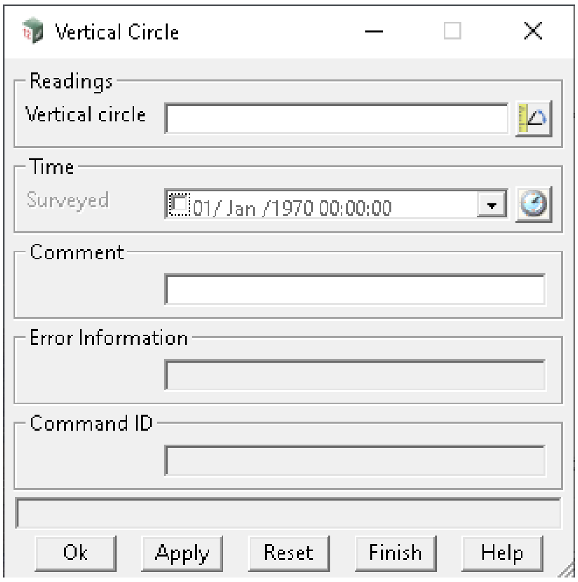
Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see
100 units Units used in the 12d Field File.

Continue to 26.4.2.64 Vertical Circle Correction (opcode 15) or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.64 Vertical Circle Correction (opcode 15)

The ***Vertical Circle*** option **subtracts** a given value (in decimal degrees) from the vertical circle value in subsequent measurements.



The fields and buttons used in this panel have the following functions.

Field Description Type Defaults Pop-Up

Vertical circle

The vertical circle (in decimal degrees) is ***subtracted*** *from the vertical circle value in any following measurements*

Time surveyed, Comment, OK, Apply, Reset, Finish, Help See 26.4.1.4 Time surveyed, Comment, Error, Command ID & Bottom Panel buttons.

For the description on how the field data command is stored in a ***12d Field File,*** see 15 vertical_circle Vertical circle correction.

Continue to 28 12d Field File Format or return to 26.4.2 List of Field Data Commands or 26 12d Survey Guide.

26.4.2.65 Attributes for the Unknown Control Point Standard Measurement

For the string, the string attribute ***string_no*** is **NOT** created.

For the vertex, three attribute groups are created: ***SDR Setup Details***, ***SDR Measurement Details*** and ***SDR Measurement Geodetic Details***.

For ***SDR Setup Details***, the attribute names and values in the group are:

is_id	name of the Instrument setup that the measurement was taken from
is_x	x coordinate of the station
is_y	y coordinate of the station
is_z	z coordinate of the station
is_ht	height of the station
is_bearing_swing	the bearing swing in radians
is_setup_type	the type of setup (Station)

For ***SDR Measurement Details***, the attribute names and values are:

target_height	0.0

For ***SDR Geodetic Details***, the attribute names and values are:

26.5 Field Data Commands and 12d Field File Opcodes

When picking up data in the field, ***12d Field,*** or editing a SDR Function***,*** creates ***field data commands*** in the SDR Function*.*

However at any time, the data in the ***SDR Function*** can be written out as a ***12d Field File*** using the **Survey =>Extras =>Reduction to field file** option (14.12.8 Survey Function to Field File) and in the ***12d Field File*** the information is only stored as ***opcodes*** with their associated data.

So to make this work, there must be a fixed relationship between the ***field data commands*** and the ***opcodes***.

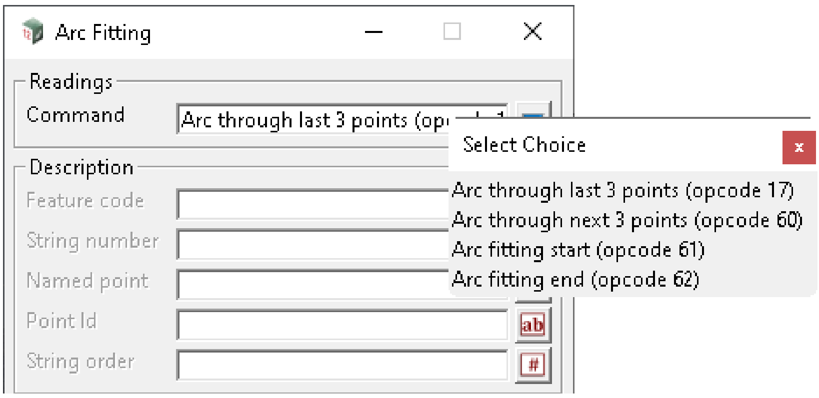
This relationship can be seen in the **pop-up** for the **list** of **field data commands** in the ***SDR Function*** editors (14.5.9 Editing the SDR Function Field Data Commands) where each choice has its equivalent ***opcode number*** as part of the text.

Select Choice

	See
Arc fitting end (opcode 62)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc fitting start (opcode 61)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc through last 3 points (opcode 17)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Arc through next 3 points (opcode 60)	26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
Attachment (opcode 126)	26.4.2.2 Attachment (opcode 126)
Attribute for next segment (Measurement) (opcode 122)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
Attribute for next segment (integer) (opcode 74)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for next segment (real) (opcode 75)	26.4.2.4 Attributes (opcodes 68 to79)
Attribute for next segment (text) (opcode 76)	26.4.2.4 Attributes (opcodes 68 to79)

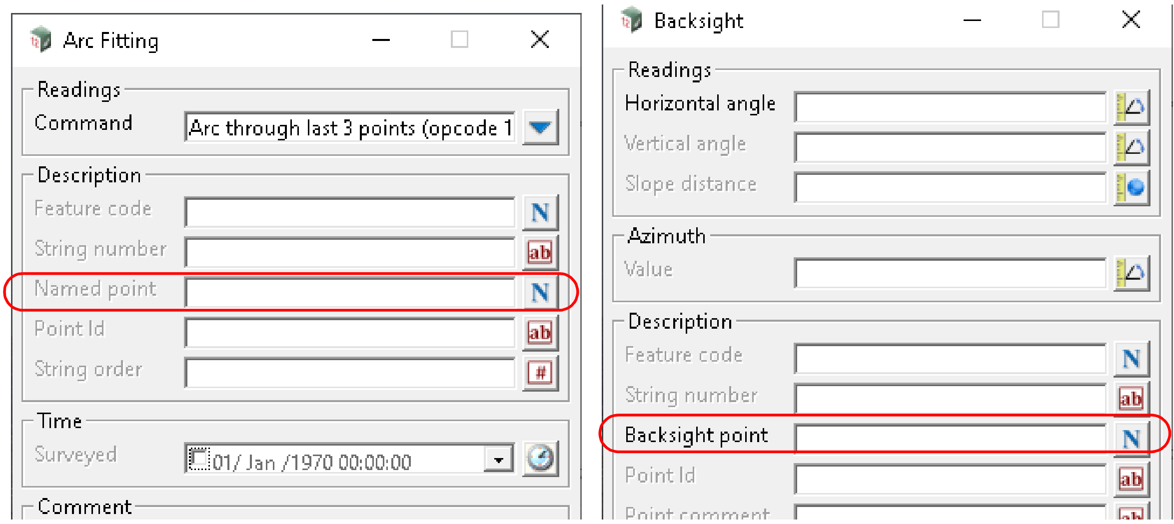
However, when the field data command is selected from the list, many of the opcodes bring up the same panel.

For example, although there are **four different opcodes** for **Arc Fitting,** in the ***SDR Editor*** they all bring up the **one** panel, **Arc Fitting**, and it is the pop-up of choices for the **Command** field on the panel that determines which of the four opcodes will be used to store the information if it is written out to a ***12d Field File****.*



Another major difference between the panels for the field data commands and the opcode written to a ***12d Field File*** is that the fields on the panel will have text describing the field, and that may vary between panels, but in the structure of the opcode record, the names in the record are fixed and how they are used can be different for each opcode.

For example, in the ***Arc Fitting*** panel, this the field **Named point** and in the **Backsight** panel, the field **Backsight point**.



But when writing out to the ***12d Field File,*** in the panel **Arc Fitting**, **Named point** is written out to ***point_id*** in the ***12d Field FIle*** but in the **Backsight** panel, **Backsight point** that is written out to ***point_id*** *in the* ***12d Field File***.

Note:

In the opcode record in a ***12d Field File***, a number of items are collective referred as the ***point description*** and in the documentation are given the names:

feature_code
string_number
point_id
point_name
point_comment

Depending on the field data command/opcode, some of fields may be compulsory and others can be blank or not used at all.

When writing out the data in a ***field data command*** panel to an opcode record in a ***12d Field File***, the fields:

(a) ***Feature code*** is written out to the opcode item ***feature_code***

(b) ***String number*** to ***string_number***

(c) ***Point id*** to ***point_id***

(d) ***Point comment*** to ***point_comment***.

(e) However the **name of the field** on the panel that is written out to ***point_name*** will **vary**.

For example, in the panel **Arc Fitting**, the field **Named point** is written out to ***point_name*** but in the **Backsight** panel, it is **Backsight point** that is written out to ***point_name*** *in the* ***12d Field File***.

26.6 stuff yet to use or remove

To Use

Important Note:

When examining an SDR Function with the ***SDR Editor,*** the data is the ***SDR Function*** displayed using the ***Field Data Commands*** where the panel fields are given appropriate names.

For example, ***Setup point*** in the field data command panel, ***New Instrument***, for the name of the point to set up the instrument. Or ***Backsight point*** in the field data command panel, ***Backsight*** for the name for the name of the backsight that the backsight macerate is being made to.

However, when the data is stored as ***opcodes*** in the ***12d Field File***, some of the panel fields in the field data command panels are stored in a fixed ***point description*** structure (***point_description)*** consisting of ***feature_code***, ***string_number***, ***point_id***, ***point_name*** and ***point_comment*** in the ***12d Field File***.

And which panel fields go into which part of the point description structure in an ***opcode*** in the ***12d Field File*** will depend on the particular field data command. And how each of the part of the point description of an opcode is used in the reduction to produce super strings, depends on opcode.

For example, for a directly entered coordinate which has the field data command panel ***Direct Coordinate,*** the panel field ***Feature code*** is stored as ***feature_code***, ***String number*** as ***string_number, Named point*** as ***point_name***, which in this case is optional, ***Point id*** as ***point_id*** and ***Point comment*** as ***point_comment***.

And when the reduction takes place, two super string vertices are created:

1. one vertex super string which can be part of a many vertex super string with:

   String name of Feature code (feature_code)

   Vertex id of Named point (point_name)

   Vertex text of Point comment (point_comment).

   The String number (string_number) is stored as an attribute of the super string

   The Named point (point_name) is not used.

2. if ***Named point*** (point_name) is ***not blank***, then an extra ***one vertex super string*** is created with:

   String name of Feature code (feature_code)

   Vertex id of Point id (point_id)

   Vertex text of Point comment (point_comment).

   The String number (string_number) and Point id (point id) are not used.

To Use

The difference between ***point names*** and ***point ids*** is that:

> ***point names*** are usually given by the user and should be a unique identifier for an easily recognised ***physical point*** that may be reused by other measurements.
>
> whilst for that **same physical point,** a number of measurements may be made to that physical point and each measurement will be assigned a different ***point ids***, by ***12d Field*** or the data collector.

For example, measurements to control stations where the measurements are made to a fixed control point identified by its control point name, but each measurement to the control station point is given a different ***point id*** by ***12d Field*** or the data collector.

In most instances, each measurement to the same point has a different ***point id*** and ***12d Model*** automatically gives the measurement the same ***point name*** as it is rare to measure a non-control point more than once, However the ***point name*** can be over ridden by the user.

The names allow the reduction routine to search for the details of that point (*e.g.* coordinates) to allow for the reduction of further measurements. The order in which this searching takes place is as follows:

-to be moved

The measurements themselves, and the extra information, is written out as operation codes (***opcodes***) which consists of a unique identifier such as a number or some text, and the required data that goes with that opcode.

Important Note - put somewhere

Most ***survey data commands*** only work with standard measurements and ignore any named measurements.

Old Section:

Some commands such as ***Backsight***, ***New instrument*** and ***Check*** allow the user to enter **existing *point names*** (*i.e.* Backsight point, Setup point and Check point), or in the case of measurements from ***12d Field*** or a data collector, **both *point name*** and ***point ids*.**

The difference between ***point names*** and ***point ids*** is:

(a) ***point names*** are usually specified by the user and should be a unique identifier for a known physical point

(b) for each measurement, a different ***point id*** is generated by ***12d Field*** or by the software on the survey instrument or data collector, hence when a number of measurements are taken to the same physical point, each measurement will have a different ***point id***. Point ids should be unique in the one a 12d Field File.

For example, when taking measurements to a control station with a given point name, more than one measurement can be made to the control station (**point name**) but **each measurement** is given a **different point id**.

In most instances, a **measurement to a known point** has a **point id** and ***12d Model*** automatically gives it the **same point name** as it is rare to measure to a non-control point more than once. However the ***point name*** can be over ridden by the user.

The use of ***point names*** and ***point ids*** means that the reduction routine can ***search for the details of a special point*** (e.g. coordinates) and these are used for producing the coordinates of other measurements in the reduction.

Given a ***search_point_name*** and/or a ***search_point_id,*** the order for searching to find a match is:

First search the Control model (if it exists):

1. A search is made of the control model for a string whose name is the same as the specified *search_point_name*. If a string is found, the first point of the string is used for the (x,y,z) coordinates.
2. A search is made of the control model for a vertex of a string whose point id is the same as the *search_point_name*. If a vertex is found its (x,y,z) coordinates are used.

3. If only a *search_point_id* was specified, a search is made of the control model for a vertex of a string whose point id is the same as the *search_point_id*. If a vertex is found its (x,y,z) coordinates are used.

Next search the already entered directly entered coordinates (DEC) in the field file:

4. A search is made of previously entered directly entered coordinates in the field file for a directly entered coordinate whose *point name* is the same as the specified *search_point_name*. If a DEC is found, its (x,y,z) coordinates are used.
5. A search is made of previously entered directly entered coordinates in the field file for a directly entered coordinate whose *point id* is the same as the *search_point_name*. If a DEC is found, its (x,y,z) coordinates are used.
6. A search is made of previously entered directly entered coordinates in the field file for a directly entered coordinate whose *point id* is the same as the specified *search_point_id*. If a DEC is found, its (x,y,z) coordinates are used.

Next search the previous measurements in the field file:

7. A search is made of previous measurements in the field file for a measurement whose *point name* is the same as the *search_point_name*. If a measurement is found, its (x,y,z) coordinates are used.
8. A search is made of previous measurements in the field file for a measurement whose *point id* is the same as the *search_point_name*. If a measurement is found, its (x,y,z) coordinates are used.
9. A search is made of previous measurements in the field file for a measurement whose *point id* is the same as the *search_point_id*. If a measurement is found, its (x,y,z) coordinates are used.

Finally

10. If no match is found, the user will be prompted for the details of the previously undefined point. The user is asked to type in the (x,y,z) coordinates in the **Define Station Coordinate** panel. If a model is specified in the **Add to model** field of the panel, then a new one point super string is created with the string name as *search_point_name*, and as the vertex text for the one point super string point, the **Station label prefix** field value followed by *search_point_name.*

27 Water Theory

See

27.1 Hydrology

Hydrology includes the properties of water and its distribution and movement across the ground (groundwater) and the atmosphere.

For analysis, large areas are broken up into catchments where a catchment is an area with a natural boundary (for example ridges, hills or mountains) where all surface water drains to a common channel to go into inlets (nodes) to a pipe system, or form creaks and rivers which flow into lakes or the sea.

The hydrological processes of a catchment are influenced by the physical characteristics of the catchment as well as by the broader region and subregion.

For analysis, large catchments are divided into smaller areas called subcatchments where all the area of subcatchment behaves in a similar way

Subcatchments are also separated by a raised ridge or natural boundary within a catchment. In general, surface water does not flow from one subcatchment to another, however in relatively flat areas flood waters may cross a subcatchment boundary. In some cases, groundwater may cross subcatchment boundaries due to the underlying geology.

Water can move through the landscape in many ways, including through **surface water runoff** and **groundwater** (groundwater recharge) and can transfer between the two systems.

The hydrological response of catchments to rainfall depends on the **intensity** and **duration of rainfall** and the **amount of infiltration** (losses) and **runoff**.

Where the rainfall exceeds the infiltration capacity of the soil, the excess rainfall will generate the surface runoff that provides a stream's flow. Water infiltrating into the soil may not go to a stream or is often delayed in its passage to the stream channel.

However, in catchments where infiltration rates are high enough to be only very rarely exceeded by storm rainfall intensities (e.g. sand islands), stream flows may either be generated almost entirely by subsurface flows or by surface flows when the soil is saturated. Water abstraction for agricultural and urban uses, and supplementation such as irrigation, also influence the movement of water.

Loss Models (infiltration) are methods that Hydrologists use to calculate **how much** of the **rainfall** on a catchment **runs off,** and **how much** is '**lost**'.

Hydraulic structures (pits, pipes, culverts and channels) **only** need to be **designed** for the **water** that **runs off** the catchment and **not** the **total amount that falls** onto the catchment.

12d Model has three methods of working with hydrology:

1. **Rational Method**

   In the Rational Method, **time is not considered** and each catchment is only **modelled as a point** which contribute a fixed peak flow. **Infiltration** is **not** considered separately.

2. **Dynamic Method**

   In the Dynamic Method, **time is considered** but each catchment is still only **modelled as a point**. However unlike the Rational Method, the response over time of each catchment is considered and so flows at that point vary over time. Also **infiltration** is also **modelled** because over time the soil can become saturated and excess water becomes runoff and contributes to the flow.

3. **2D Method**

   In the 2D Method, **time is considered** and the catchments is no longer a point but is **modelled as a 2D surface** which determined how the water will flow.

See

27.1.1 Water Catchments

27.1.1 Water Catchments

A water catchment is an area where water is collected by the natural landscape. A catchment is usually surrounded by hills or mountains.

Gravity causes rain, melting snow and other water in the catchment to run downhill and flow into the lowest parts of the landscape and eventually leaves the area via a single point or outlet.

The outlet may be a stormwater pit, a stream or river, wetland, lake, estuary or the ocean.

The water that seeps below ground and settles in the soil and the space between rocks is called groundwater.

For modelling purposes, catchments are divided into subcatchments where a subcatchment is an area that has the same or similar hydrology parameters referred to as Lands Use. For example, a catchment may be divided into a subcatchment for paved areas, a subcatchment for grass area etc. See 27.1.1.1.1 Default Land Use Sets 1 to 5.

Where the rainfall exceeds the infiltration capacity of the soil, the excess rainfall will generate the surface runoff that provides a stream's flow. See 27.1.2.3.7 Infiltration Losses.

Each catchment (subcatchment) can also be split into a **pervious** and an **impervious** area by using a **percent impervious**. See 27.1.1.1.2 Pervious and Impervious Sub Areas.

From now on, catchments will refer to both catchments and subcatchments.

The Dynamic methods also allow a user defined hydrograph to be defined.

Note: The effective catchment area of the minor drainage system may be different from the catchment area of the major drainage system. In some cases the piped drainage system may discharge to a location different from that of the overland flow.

When a network of pipes is being modelling in ***12d Model***, each **inlet node** can have:

(a) up to **five catchments** flowing into it

(b) a user entered **direct flow**

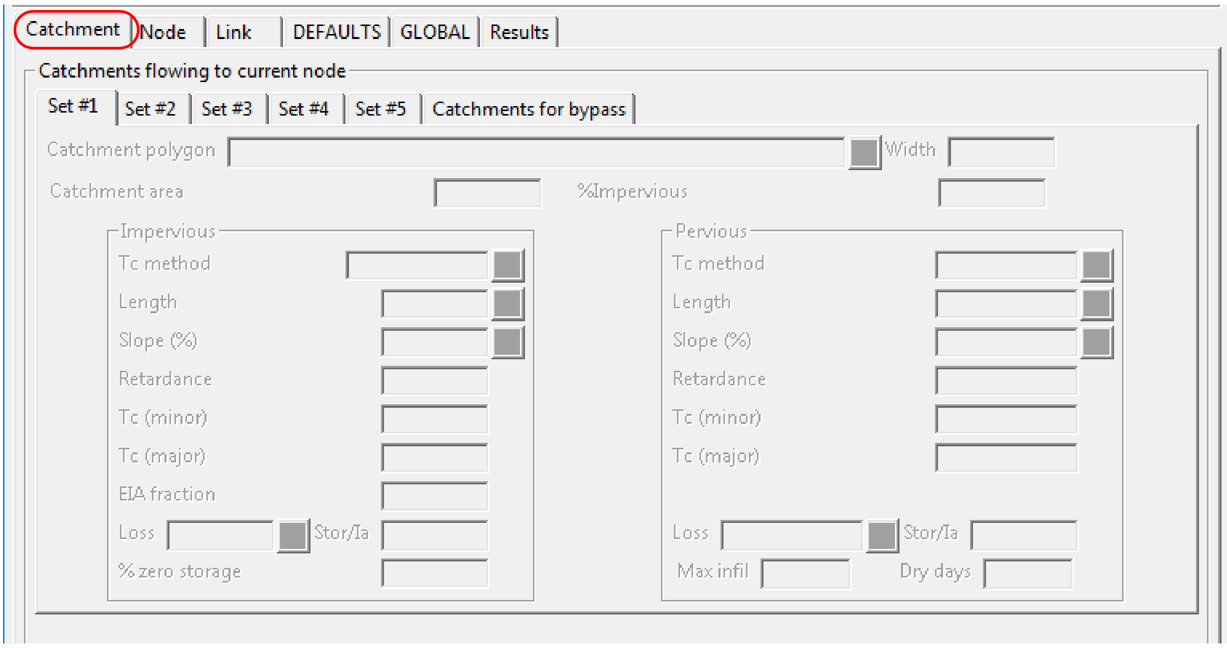
(c) a **bypass flow** for water that can't get into its natural inlet and so flow onto a different inlet.

These flows are combined to calculate the **total flow** for the inlet.

Continue to 27.1.1.1 Catchment Parameters or return to 27.1 Hydrology.

27.1.1.1 Catchment Parameters

The **Catchment** tab



See

27.1.1.1.1 Default Land Use Sets 1 to 5
27.1.1.1.2 Pervious and Impervious Sub Areas

27.1.1.1.1 Default Land Use Sets 1 to 5

12d Model has up to **five** catchment areas per inlet.

Each catchment area belongs to a different land use category, referred to as sets 1, 2, 3, 4 and 5.

Flows from the five areas plus the direct pit flow are combined to calculate the total local flow for the inlet. The dynamic methods also allow a user defined hydrograph to be defined.

The user defines the catchment characteristics of land use sets 1 to 5 and what type of catchment each set represents. For example set 1 for road catchments, set 2 for residential lots and set 3 for parklands.

All default catchment parameters must be defined for **DEFAULTS Set #1** (see 17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational).

For **DEFAULTS Set #2,** only the values that are different to **Set #1** need to be defined. When left blank, the values from **Set #1** are used.

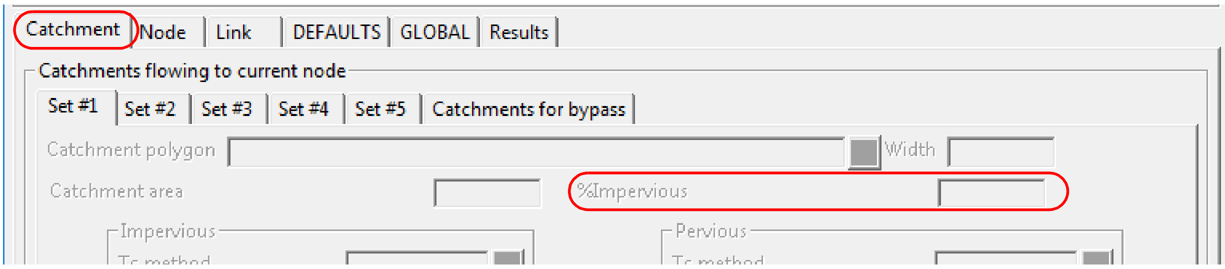
The same is true for **DEFAULTS Set #3, DEFAULTS Set #4** and **DEFAULTS Set #5,** when a field in the set is left blank, the value from **DEFAULTS Set #1** is used.

The **catchment characteristics** may be explicitly set on the Node Catchment Sets (1 to 5) to override the default settings - see 17.3.4.6.3 Catchment tab - Stormwater.

Continue to 27.1.1.1.2 Pervious and Impervious Sub Areas or return to 27.1 Hydrology.

27.1.1.1.2 Pervious and Impervious Sub Areas

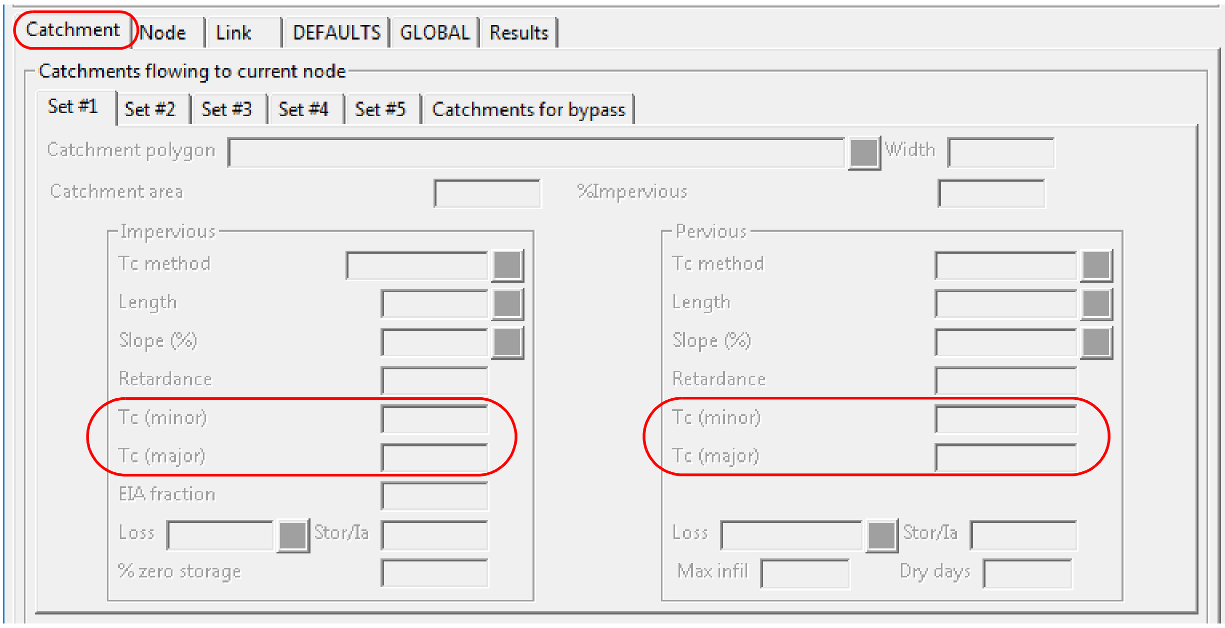
Each of the catchment areas in **Sets 1** to **5** for a node may be split into **pervious** and **impervious sub areas** using the **percent impervious** setting on the **Catchment** characteristic tabs



All pervious and impervious sub catchment characteristics may be uniquely set for each catchment area. See 17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational for a description of these characteristics.

Changing Settings via Return Period Classes (Minor and Major)

The catchment **Tc**, the **Rational Method C** and the **ILSAX AMC** may be defined separately for minor and major storm events. See 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater and 17.3.4.6.3 Catchment tab - Stormwater.



The user decides if the minor or major settings should be used for the ARI specified at run time. For example the time of concentration, **Tc**, for a major event is sometimes shorter than the minor event due to increased overland flow velocities.

Continue to 27.1.2 Hydrological Methods or return to 27.1 Hydrology.

27.1.2 Hydrological Methods

The **choice** of hydrologic method must be appropriate to the **type of catchment** and the required degree of **accuracy**.

Simplified hydrologic methods such as the Rational Method should not be used whenever a full design hydrograph is required for flood mapping or to assess flood storage issues. Instead the more reliable runoff-routing techniques presented in publications such as Australian Rainfall & Runoff (ARR) should be adopted.

All rainfall methods use percent impervious as described in 27.1.1.1.2 Pervious and Impervious Sub Areas and the additional parameters defined below.

See

27.1.2.1 None

This setting is used when no hydrology or hydraulic calculations are to be done. Typically as constructed data.

Continue to 27.1.2.2 Rational Method Hydrology or return to 27.1 Hydrology.

27.1.2.2 Rational Method Hydrology

The **Rational Method** provides a simple means for the assessment of the **peak discharge rate** for design storms, but does not provide a reliable basis for the determination of runoff volume, hydrograph shape, or peak discharge rates from historical (real) storms.

The method is based on the premise that the maximum rate of discharge from a catchment is proportional to the product of the area of the catchment and the rainfall intensity.

This method has been used for over 150 years, and known as the **Rational Method** for nearly 100 years. It is widely used in the design of stormwater drainage systems, farm dam spillways, and small culverts in road and railway embankments.

12d Model's implementation of the Rational Method references the ***Queensland Urban Design Manua***l (**QUDM**) guidelines.

So the **Rational Method** expresses a relationship between **rainfall intensity** (**I**) and **catchment area** (**A**) as **independent variables** and the **peak flood discharge** (**Q**) resulting from the rainfall as the **dependent variable**.

$$Q = Q(I,A)$$

In its general form, using the non-standard units of flow **Q** (m^3/s), intensity **I** (m/s), area **A** (m^2) and runoff coefficient (coefficient of discharge) **C** (dimensionless), the **Rational Method** is based on the following formula:

$$\mathbf{Q = C * I * A}$$

For **design purposes** the more common units of m^3/s, mm/hr and ha are used: That is

$$\mathbf{Q_y = (C_y * {}^{t}I_y * A) /360}$$

where:

$\mathbf{Q_y}$ = peak flow rate (m^3/s) for annual exceedence probability (AEP) of **1 in y years**

$\mathbf{C_y}$ = coefficient of discharge (dimensionless) for AEP of **1 in y years** (runoff coefficient)

A = area of catchment (ha)

$\mathbf{{}^{t}I_y}$ = average rainfall intensity (mm/h) for a design duration of **t** hours and an AEP of **1 in y years**

t = the nominal design storm duration as defined by the time of concentration ($\mathbf{t_c}$)

The value ‘360’ is a conversion factor to suit the units used.

Calculation of the flow at the various inlets and junctions along the drainage line is carried out from the top of the system progressively downstream.

The design discharge at any given location is **not the sum** of the individual sub-area peak discharges, but is a value calculated for that location based on the assessed **time of concentration** at that location.

The catchment parameters used are 27.1.4.1 Constant Rainfall, 27.1.3 Time of Concentration (Tc) and 27.1.2.2.2 Runoff Coefficient (C).

Important Note - Detention Basins

The **Rational Method** does not provide a reliable basis for the determination of runoff volume or hydrograph shape. Therefore the **Rational Method** is not normally suitable for the design of detention basins and Dynamic methods should be used. See 27.1.2.3 Dynamic Hydrology.

Continue to 27.1.2.2.1 Rational Peak Flow Qrat or return to 27.1 Hydrology.

27.1.2.2.1 Rational Peak Flow Qrat

The following explains how ***12d Model*** estimates the Rational Method **peak flow rates** (Qrat) at every **inlet node** and at **every link**. That is, how the hydrology calculations are done.

Each **inlet node** may have up to **five** catchments areas, $\mathbf{A_n}$, assigned to it and each $\mathbf{A_n}$ is further divided into two fractions (**impervious** and **pervious**, $\mathbf{A_n i}$ and $\mathbf{A_n p}$) based on each catchment's % Impervious setting (denoted by $\mathbf{f_n}$)

$\mathbf{A_n = A_n i + A_n p}$ where n goes from 1 to 5

$\mathbf{A_n i = f_n * A_n}$

Each **catchment fraction** has its own, independent $\mathbf{T_n C}$ and $\mathbf{C_n}$ value which may be specified directly, or calculated via a range of different methods, programmed to match various design guidelines.

The Qrat at every **inlet node** and at **every link,** is determined **independently**, based on all the **catchment fractions contributing** to it.

Each contributing fraction will have its own **Tc**, which in the case of links will have the travel time through upstream links added, between the fraction and the link.

The **longest Tc** of the **contributing fractions**, is considered the **full-area Tc** (which will be denoted $\mathbf{Tc_f}$).

If **not considering partial areas**, the **full-area calculation** is simple:

 Qrat = SUM OF FRACTIONS($\mathbf{C_n}$ *$\mathbf{A_n}$) * **I** {as a function of $\mathbf{Tc_f}$}

If **considering partial areas,** the **Tc** of **every contributing fraction** will be trialled, up to $\mathbf{Tc_f}$.

The **C*A** value of each fraction is reduced by the factor:

<**Tc trial**> **/** <**Tc of fraction**> with a maximum of unity,

and the sum of the reduced **C*A** values is multiplied by I {as a function of Tc trial}.

After every **Tc** has been trialled, the one that yields the **largest** Qrat, is considered to be the **critical** value. It will always be greater than, or equal to, the **full-area** Qrat.

Continue to 27.1.2.2.2 Runoff Coefficient (C) or return to 27.1 Hydrology.

27.1.2.2.2 Runoff Coefficient (C)

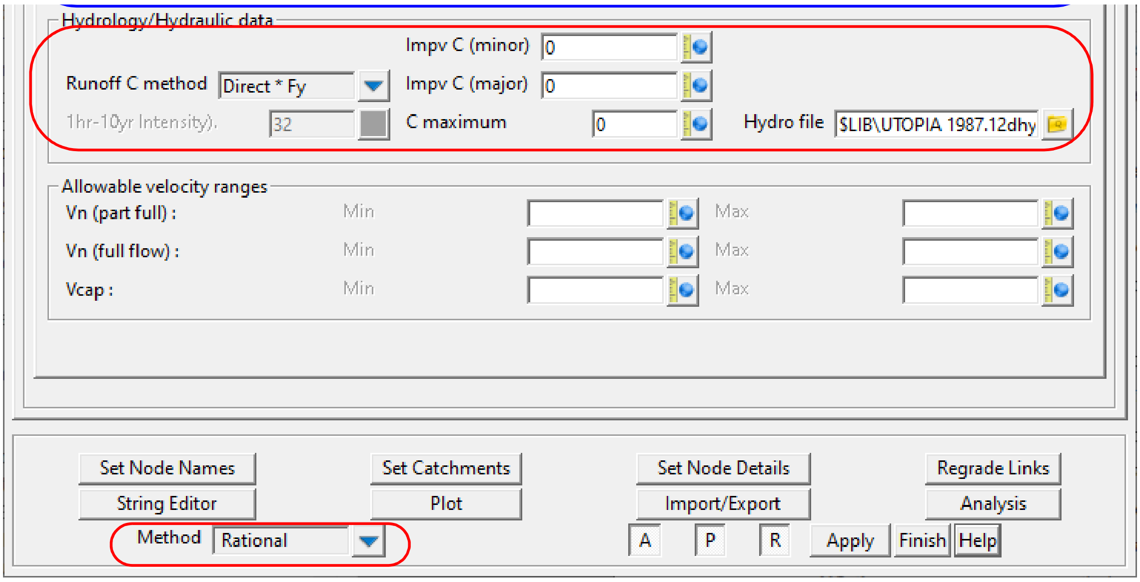
The **runoff coefficient** or **coefficient of discharge**, **C** is a coefficient used within the **Rational Method**.

The runoff coefficient for a specific runoff even is the ration of the **peak rate of runoff** to the **mean rainfall intensit**y.

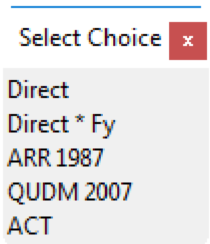
The value of **C** is linked, in a complex manner, to the infiltration characteristics of the catchment and impacts of other runoff ‘losses’. It should not be confused with the **volumetric runoff** coefficient **C_v**, which is a direct ratio of total runoff to total rainfall.

The value of **C** is a statistical composite not only for infiltration and other losses, but also the effects of channel storage and initial loss.

In ***12d Model*** there are a number of methods for defining the **Runoff Coefficient**.



Runoff C Method choice box



See
Direct
Direc*Fy
ARR 1987
QUDM 2007
ACT

Direct

*If **Direct:** there is a **global impervious C** value for **minor** and **major** storms. This can only be set once. The C values for the pervious areas may be changed for every catchment in your model.*

Direc*Fy

*If **Direct * Fy:** for urban areas in Australia the flood frequency factors (fy) are constant for urban hydrology. You are required to enter the f10 values, the same value for minor and major. For rural areas the direct method is required.*

ARR 1987

*If **ARR 1987:** the composite C value is calculated using the **1hr-10yr intensity,** the percent impervious, ARR frequency factors and the return period specified when hydrology runs are made. **You must enter the 1hr-10yr intensity value. No C values are entered if this method is used!***

QUDM 2007

*If **QUDM 2007:** similar to the ARR 1987 method (except when the %impervious for the catchment = 0.0). The **Veg/Soil** type must be entered for the catchment via the default catchment tab.*

ACT

*If **ACT: ??***

1hr-10yr Intensity

*Used for **Runoff C Methods ARR 1987** and **QUDM 2007***

This intensity is used to calculate a composite C value together with the percent intensity. The QUDM 2007 method also uses the Veg/Soil catchment characteristic (see 17.3.4.6.2.1.1 DEFAULTS >Catchment > Set #1 subtab - Rational*).*

Impv C (minor) real box

*Used for **Runoff C Methods Direct** and **Direct * Fy**.*

This value will be used for all impervious sub catchment areas when minor storms are analysed.

***Note**: If you use a **single composite C** value for your catchments, enter a **%impervious C** of zero and ignore the impervious settings*

Impv C (major) real box

*Used for **Runoff C Methods Direct** and **Direct * Fy***

This value will be used for all impervious sub catchment areas when major storms are analysed.

C maximum real box

*Used for **Runoff C Methods Direct * Fy***

When a calculated C values will be restricted to this maximum.

Hydro file file box

*Also known as the **Rainfall File***

*Used for all **Runoff C Methods** except **None***

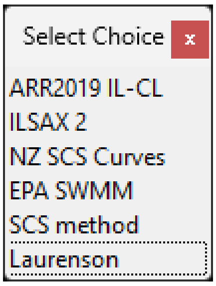
*This file contains the rainfall intensity data, patterns, soil infiltration, tailwater and pump data. The **Folder =>Open** button will launch an editor for this files (see* 17.5.1 Hydro (Rainfall) File Editor*). Samples of the file are contained in the 12d library.*

Continue to 27.1.2.3 Dynamic Hydrology or return to 27.1 Hydrology.

27.1.2.3 Dynamic Hydrology

Unlike in the **Rational Method, Dynamic Hydrology** changes over time. Dynamic hydrology also allows for infiltration losses.

There are various methods for defining the dynamic hydrology and infiltration losses.



See
27.1.2.3.1 ARR2019 IL-CL
27.1.2.3.2 ILSAX 2
27.1.2.3.3 NZ SCS Curves
27.1.2.3.4 EPA SWMM
27.1.2.3.5 SCS Curves
27.1.2.3.6 Laurenson

27.1.2.3.1 ARR2019 IL-CL

The **ARR2019 IL-CL**

The catchment parameters that are needed are:

- Pervious area
- Impervious area
- 27.1.3 Time of Concentration (**Tc**)

  Impervious Tc

  Impervious catchment time of concentration (minutes).

  Pervious Tc

  Pervious catchment time of concentration (minutes).

- Infiltration Loss method

  The only loss method is **Initial-Continuing** (27.1.2.3.1.1 ARR2019 IL-CL with Initial and Continuing Losses).

27.1.2.3.1.1 ARR2019 IL-CL with Initial and Continuing Losses

For **initial and Continuing Losses**, the required values are:

Impervious Loss

Soil type *for the impervious catchment as defined in the* ***Init-Cont Losses*** *section of the* ***12dhydro file****.*

This will define an initial loss (mm) and a continuing loss (mm/hr). See 27.1.2.3.7.4 Initial and Continuing Losses.

Impervious EIA fraction

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious Loss

Soil type *for the pervious catchment as defined in the* ***Init-Cont Losses*** *section of the* ***12dhydro file****.*

This will define an initial loss (mm) and a continuing loss (mm/hr). See 27.1.2.3.7.4 Initial and Continuing Losses.

Continue to 27.1.2.3.2 ILSAX 2 or return to 27.1 Hydrology.

27.1.2.3.2 ILSAX 2

The **ILSAX 2** hydrology uses a time area rainfall routing procedure for hydrograph generation.

The catchment parameters that are needed are:

- Pervious area
- Impervious area
- 27.1.3 Time of Concentration (**Tc**)

  Impervious Tc

  Impervious catchment time of concentration (minutes).

  Pervious Tc

  Pervious catchment time of concentration (minutes).
- Infiltration Loss method

  The available loss methods are **Horton** (27.1.2.3.2.1 ILSAX 2 with Horton Loss and **Initial-Continuing** (27.1.2.3.2.2 ILSAX 2 with Initial and Continuing Losses*)*.

27.1.2.3.2.1 ILSAX 2 with Horton Loss

For **Horton Losses**, the required values are:

Impervious Storage (mm)

Initial storage depth over the impervious catchment (mm of rainfall).

Impervious EIA fraction

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious Loss

***Soil type** for the impervious catchment as defined in the **Horton Losses** section of the **12dhydro file**.*

This will define an interpolation number, an initial loss, a final loss and decay rate for the Horton Equation. And four AMC points. see 27.1.2.3.7.1 Horton Losses.

Pervious Storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

AMC Point

Antecedent Moisture Condition for the catchment, prior to the storm burst. Defines the starting point on the Horton's curve.

27.1.2.3.2.2 ILSAX 2 with Initial and Continuing Losses

For **initial and Continuing Losses**, the required values are:

Impervious Loss

***Soil type** for the impervious catchment as defined in the **Init-Cont Losses** section of the **12dhydro file**.*

*This will define an **initial loss** (mm) and a **continuing loss** (mm/hr).* See 27.1.2.3.7.4 Initial and Continuing Losses.

Impervious Storage (mm)

Initial storage depth over the impervious catchment (mm of rainfall).

Impervious EIA fraction

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Pervious Loss

Soil type *for the pervious catchment as defined in the* ***Init-Cont Losses*** *section of the* ***12dhydro file****.*

This will define an ***initial loss (****mm) and a* ***continuing loss*** *(mm/hr).* See 27.1.2.3.7.4 Initial and Continuing Losses.

Pervious Storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

Continue to 27.1.2.3.3 NZ SCS Curves or return to 27.1 Hydrology.

27.1.2.3.3 NZ SCS Curves

NZ SCS Curves is a combination of the

(a) SCS hydrograph shapes.

(b) SCS curve number infiltration method. See 27.1.2.3.7.2 SCS Curves.

The catchment parameters that are needed are:

- Pervious area
- Impervious area
- 27.1.3 Time of Concentration (**Tc**)

  Impervious Tc

  Impervious catchment time of concentration (minutes).

  Pervious Tc

  Pervious catchment time of concentration (minutes).

- Infiltration Loss method

  The only loss method is **SCS Curves** with an **initial abstraction** value (27.1.2.3.3.1 NZ SCS with SCS Curve Loss).

27.1.2.3.3.1 NZ SCS with SCS Curve Loss

For **SCS Curve Loss**, the required values are:

Impervious loss - choice of soil type

__Soil type__ for the impervious catchment as defined in the __SCS Losses__ section of the __12dhydro file__.

This will define a curve number. See 27.1.2.3.7.2 SCS Curves.

Impervious EIA fraction

Equivalent Impervious Area, as a fraction, for the impervious catchment.

Impervious storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

***Note**: is this the initial abstraction value??*

Pervious loss - choice of soil type

__Soil type__ for the pervious catchment as defined in the __SCS Losses__ section of the __12dhydro file__.

This will define a curve number. See 27.1.2.3.7.2 SCS Curves.

Pervious storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

Continue to 27.1.2.3.4 EPA SWMM or return to 27.1 Hydrology.

27.1.2.3.4 EPA SWMM

The **EPA SWMM** routing method

The catchment parameters that are needed are:

- Pervious area
- Impervious area
- Infiltration Loss method

  The available loss methods are **Horton** (27.1.2.3.4.1 EPA SWMM with Horton Loss), **SCS Curves** (27.1.2.3.4.2 EPA SWMM with SCS Curve Loss) and **Green AMP** (27.1.2.3.4.3 EPA SWMM with Green Amp Loss).

  The available loss methods are 27.1.2.3.7.1 Horton Losses, 27.1.2.3.7.2 SCS Curves and 27.1.2.3.7.3 Green Ampt.

27.1.2.3.4.1 EPA SWMM with Horton Loss

For **Horton Losses**, the required values are:

Impervious Slope %

Impervious catchment slope (%).

Impervious catchment roughness

Mannings roughness of the impervious catchment.

Impervious Loss - choice of soil type

Soil type *for the impervious catchment as defined in the* ***Horton Losses*** *section of the* ***12dhydro file****.*

This will define an ***interpolation number,*** *an* ***initial loss,*** *a* ***final loss*** *and* ***decay rate*** *for the Horton Equation. And four* ***AMC points****.* see 27.1.2.3.7.1 Horton Losses.

Impervious Storage (mm)

Initial storage depth over the impervious catchment (mm of rainfall).

Pervious Slope %

Pervious catchment slope (%).

Pervious catchment roughness

Mannings roughness of the pervious catchment.

Pervious Loss - choice of soil type

Soil type *for the pervious catchment as defined in the* ***Horton Losses*** *section of the* ***12dhydro file****.*

This will define an ***interpolation number****, an* ***initial loss****, a* ***final loss*** *and* ***decay rate*** *for the Horton Equation. And four* ***AMC points.*** see 27.1.2.3.7.1 Horton Losses.

Pervious Storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

27.1.2.3.4.2 EPA SWMM with SCS Curve Loss

For **SCS Curves** the required values are:

Impervious slope %

Impervious catchment slope (%).

Impervious catchment roughness

Mannings roughness of the impervious catchment.

Impervious loss - choice of soil type

__Soil type__ for the impervious catchment as defined in the __SCS Losses__ section of the __12dhydro file__.

This will define a __curve number.__ See 27.1.2.3.7.4 Initial and Continuing Losses.

Impervious storage (mm)

Initial storage depth over the impervious catchment (mm of rainfall).

Pervious slope %

Pervious catchment slope (%).

Pervious catchment roughness

Mannings roughness of the pervious catchment.

Pervious loss - - choice of soil type

__Soil type__ for the pervious catchment as defined in the __SCS Losses__ section of the __12dhydro file__.

This will define a __curve number__. See 27.1.2.3.7.2 SCS Curves.

Pervious storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

27.1.2.3.4.3 EPA SWMM with Green Amp Loss

The **Green Ampt Loss** Infiltration method requires for the previous and impervious areas, the parameters **Initial moisture deficit**, **Hydraulic conductivity** and **Suction head.** These are defined in 27.1.2.3.7.3 Green Ampt.

On some panels the values can be typed in, and on panels where a ***12dhydro file*** is used, the values are recorded as **different soil types** in the **Green Amp Losses** section of the ***12dhydro file.***

Continue to 27.1.2.3.5 SCS Curves or return to 27.1 Hydrology.

27.1.2.3.5 SCS Curves

SCS hydrograph shapes with application of the SCS curve number infiltration method.

SCS Curves is a combination of the

(a) SCS hydrograph shapes.

(b) SCS curve number infiltration method. See 27.1.2.3.7.2 SCS Curves

(c) initial abstraction.

The catchment parameters that are needed are:

- Pervious area
- Impervious area
- 27.1.3 Time of Concentration (**Tc**)

  Impervious Tc

  Impervious catchment time of concentration (minutes).

  Pervious Tc

  Pervious catchment time of concentration (minutes).

- Infiltration Loss method

  The only loss method is **SCS Curves** with an **initial abstraction** value (27.1.2.3.5.1 SCS with SCS Curve Loss).

27.1.2.3.5.1 SCS with SCS Curve Loss

For **SCS Curve Loss**, the required values are:

Impervious loss - choice of soil type

Soil type *for the impervious catchment as defined in the* ***SCS Losses*** *section of the* ***12dhydro file****.*

This will define a ***curve number.*** *See* 27.1.2.3.7.2 SCS Curves.

Impervious storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

Note*: is this the initial abstraction value??*

Pervious loss - choice of soil type

Soil type *for the pervious catchment as defined in the* ***SCS Losses*** *section of the* ***12dhydro file****.*

This will define a ***curve number****. See* 27.1.2.3.7.2 SCS Curves.

Pervious storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall).

Continue to 27.1.2.3.6 Laurenson or return to 27.1 Hydrology.

27.1.2.3.6 Laurenson

The **Laurenson hydrology method** used in ***12d Model*** makes use of Eric Laurenson's 1964 runoff routing procedure, which was primarily aimed at rural catchments but modified by Tony Aitken in 1975 for use on urban catchments.

To maintain compatibility with the XP-RAFTS, XP-SWMM and XP-Storm Laurenson procedures, it uses a further modified procedure developed by Allan Goyen in 1979.

Unlike Laurenson's original method which was directed at single catchments, or more particularly, the derivation of a single hydrograph at the outlet of that catchment, Goyen's method further divided into 10 sub-areas by constructing isochrones, lines of equal travel time from the sub-catchment boundary to the sub-catchment outlet.

Although the model storage delay parameters were calibrated based on 10 isochronal areas making up a sub-catchment, Goyen found the division of a sub-catchment into 10 equal subareas provided very similar results, particularly in urban areas where isochrones vary with storm frequency and were often impossible to determine, due to the complexity of the pipe and overflow network.

12d Model uses this Goyen modification of Laurenson's method to derive separate sub-catchment outflow hydrographs, with these hydrographs transferred through the link network using an unsteady flow routing procedure.

See

27.1.2.3.6.1 Routing Method for Laurenson
27.1.2.3.6.2 Storage-Discharge Relationship for Laurenson
27.1.2.3.6.3 Laurenson with Initial and Continuing Loss infiltration

27.1.2.3.6.1 Routing Method for Laurenson

Routing for a particular sub-catchment is carried out using the Muskingum method. The storage, however, is a non-linear function of the discharge. That is:

$$\mathbf{s = K(q) \times q}$$

where:

s = volume of storage (hrs×m3/s)

q = instantaneous rate of runoff (m3/s)

K(q) = storage delay time as a function of q (hrs).

The storage function is used in the continuity equation in finite difference form:

$$\mathbf{(i_1 + I_2) \times (\Delta t/2) - (q_1 + q_2) \times (\Delta t/2) = s_2 - s_1}$$

where:

$\mathbf{i_1}, \mathbf{I_2}$ = inflow at beginning and end of routing period (m3/s)

$\mathbf{\Delta t}$ = routing interval (hrs)

$\mathbf{q_1}, \mathbf{q_2}$ = outflow from the storage at beginning and end of routing period (m3/s)

$\mathbf{s_1}, \mathbf{s_2}$ = storage volume at beginning and end of routing period (hrs x m3/s)

An iterative solution is then required due to the inter-relationship of variables.

27.1.2.3.6.2 Storage-Discharge Relationship for Laurenson

Each sub-area is treated as a concentrated conceptual storage.

Each storage has a storage delay time described by:

$$K(q) = B \times q^n$$

K(q) = subarea storage delay time as a function of **q** (hrs)

q = discharge (m3/s)

B = storage delay time coefficient

B is estimated from the equation derived by Aitken (1975):

$$B = 0.285.A^{0.52} (1 + U)^{-1.97} S_c^{-0.50}$$

where:

B = mean value of coefficient **B** for sub-catchment

A = sub-catchment area (km2)

U = fraction of catchment that is urbanised. (Where U = 1.0, the catchment is fully urbanised and when U = 0.0, the catchment is completely rural)

S_c = main drainage slope of the longest path of the sub-catchment (%)

n = storage non-linearity exponent.

The default value for the non-linearity exponent is 0.285 (a value of zero would indicate linear catchment response and equate with unit hydrograph theory).

As **U** can be rather vague, data input in this respect has been amended to use a routing **% impervious** parameter for each sub-catchment in place of the **U** term:

Table 1 – Relationship between catchment % impervious and U

% impervious	U
0	0
30	0.7
50	1.0
100	2.0

Goyen also found that the original regression equation did not differentiate between catchments with the same urbanisation but different roughness. An additional empirical parameter was therefore added to take pervious sub-catchment roughness into account, with B modified in accordance with the following table:

Table 2 – Modification of B based on Manning's n

Manning's n	Multiplication Factor f
0.010	0.4
0.015	0.5
0.025	1.0
0.100	3.0

The resulting form of the equation for term **B** follows:

$$B = 0.285.A^{0.52}\,(1 + U)^{-1.97}.\,S_c^{-0.50}.f$$

27.1.2.3.6.3 Laurenson with Initial and Continuing Loss infiltration

The only available infiltration loss method to use with Laurenson is 27.1.2.3.7.4 Initial and Continuing Losses.

For **Initial and Continuing Losses,** the required values are:

Impervious

Urbanisation %

The percentage of the impervious catchment area that is urbanised. This is typically a model calibration parameter and does not need to match the catchment impervious percentage.

Retardance

Resistance to runoff for the impervious catchment area. Similar to Manning's roughness, valid within the range 0.01 to 0.10.

Slope (%)

Average slope of the impervious catchment, as a percentage.

Percentage no storage

Percentage of the impervious catchment which has no storage loss.

Loss - choice of soil type

***Soil type** for the impervious catchment as defined in the **Init- Losses** section of the **12dhydro file**.*

*This will define **inital loss (**mm) and a **continuing loss** (mm/hr). See* 27.1.2.3.7.4 Initial and Continuing Losses.

Storage (mm)

Initial storage depth over the impervious catchment (mm of rainfall). This is applied in addition to the initial rainfall losses.

Pervious

Urbanisation %

Percentage of the pervious catchment area that is urbanised. This is typically a model calibration parameter and does not need to match the catchment impervious percentage.

Retardance

Resistance to runoff for the pervious catchment area. Similar to Manning's roughness, valid within the range 0.01 to 0.10.

Slope (%)

Average slope of the pervious catchment, as a percentage.

Loss

***Soil type** for the pervious catchment as defined in the **Init- Losses** section of the **12dhydro file**.*

*This will define **inital loss (**mm) and a **continuing loss** (mm/hr). See* 27.1.2.3.7.4 Initial and Continuing Losses.

Storage (mm)

Initial storage depth over the pervious catchment (mm of rainfall). This is applied in addition to the initial *rainfall losses.*

Continue to 27.1.2.3.7 Infiltration Losses or return to 27.1 Hydrology.

27.1.2.3.7 Infiltration Losses

Infiltration is the process by which water on the ground surface enters the soil.

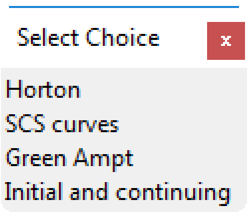
Loss Models are methods that Hydrologists use to calculate how much of the rainfall on a catchment **runs off**, and how much is '**lost**'.

Hydraulic structures (pits, pipes, culverts and channels) need only to be designed for the water that runs off the catchment and not the total amount that falls onto the catchment.

Infiltration loss is only used for **dynamic analysis** and **not** the Rational Method.

The **Infiltration (loss) methods** supported in ***12d Model*** are:

Infiltration method choice box



See
27.1.2.3.7.1 Horton Losses - *ILSAX 2, EPA SWMM*
27.1.2.3.7.2 SCS Curves -*EPA SWMM, NZ SCS and SCS*
27.1.2.3.7.3 Green Ampt - *EPA SWMM*
27.1.2.3.7.4 Initial and Continuing Losses - *ILSAX 2, Laurenson*

For the 17.3.4 Water Network Editor (WNE), the available **Infiltration (Loss)** methods are dependent on the **hydrology** selected in the 17.3.4.4.1 Method field on the WNE.

The **Infiltration methods** are used by the following **Methods**:

Hortons is used with **ILSAX 2** and **EPA SWMM**. See 27.1.2.3.7.1 Horton Losses.

SCS Curves is used with **EPA SWMM**, **NZ SCS Curves** and **SCS** curves). See 27.1.2.3.7.2 SCS Curves.

Green Ampt is used with **EPA SWMM**. See 27.1.2.3.7.3 Green Ampt.

Initial and continuing losses is used with **ILSAX 2** and **Laurenson**. See 27.1.2.3.7.4 Initial and Continuing Losses.

Hence the **Methods** can use the following **Infiltration method:**

EPA SWMM can use **Horton**, **SCS Curves**, and **Green Ampt.**

ILSAX 2 can use **Horton** and **Initial and Continuing** losses**.**

Laurenson can only use **Initial and Continuing** losses.

SCS and NZ SCS can only use **SCS curves**.

27.1.2.3.7.1 Horton Losses

Horton's Loss equation is:

$$f(t) = f_c + (f_o - f_c)e^{-kt}$$

where

f_0 = initial infiltration rate -initial loss millimetres/hour

f_c = final (limiting) infiltration rate - final loss millimetres/hour

k = decay rate: coefficient of the exponential term

Horton Losses in ***12d Model*** use a **soil type** based on the classifications of Terstriep and Stall (1974) developed for the U.S. Department of Agriculture.

Type A - low runoff potential, high infiltration rates (consists of sand and gravel

Type B - moderate infiltration rates and moderately well-drained

Type C - slow infiltration rates (may have layers that impede downward movement of water)

Type D - high runoff potential, very slow infiltration rates (consists of clays with a permanent high water table and a high swelling potential)

Each **soil type** is also assigned an **Interpolation Number** to allow for interpolation between the defined soil types. For work with **ILSAX 2**, **antecedent moisture condition** (**AMC**) points are also required.

So in ***12d Model*,** four preset **antecedent moisture condition** (**AMC**) points are used to mark AMC conditions ranging from dry (AMC1) to saturated (AMC4).

Hence each **soil type** has an **interpolation number** and values for each of **initial loss**, **final loss**, **decay rate** and **four antecedent moisture condition (AMC) points**.

In the data shipped with ***12d Model*,** two extra soil types, **Moderate to slow** and **Slow to very slow** are also defined. The values for the **default soil types** are:

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Horton Losses Data

	Name	Interpolation Number(0 or 1 to 4)	Initial Loss mm/hr(inch/hr)	Final Loss mm/hr(inch/hr)	Decay Rate	AMC 1 (mm)	AMC 2 (mm)	AMC 3 (mm)	AMC 4 (mm)
1	A-High infil-Sand gravel	1	250	25	2	0	50	100	150
2	B-Mod well drained	2	200	13	2	0	38	75	100
3	C-Slow infiltration	3	125	6	2	0	25	50	75
4	D-Very slow-clays	4	75	3	2	0	18	38	50
5	Mod to slow	2.5							
6	Slow to very slow	3.5							

In ***12d Model***, the **names of the soil types** and the their associated values of **interpolation number**, **initial loss**, **final loss, decay rate** and **AMC points** are defined in the 17.5.1.5 Rainfall Editor - Horton Losses section of the **Hydro file** (Rainfall file).

Horton losses are only used for **ILSAX 2** and **EPA SWMM**.

Notes

1. **Interpolation Numbers** are assigned to each soil type to allow interpolation between the defined soil types. When an interpolated value is used, there must already be an entry in the ***Horton Losses*** section of the Hydro file with that number. For example, 2.5 and 3.5 in the table above.
2. **Interpolated values** do not need loss data entered. **If loss data is entered** for the interpolated names then this data will be used rather than an interpolation occurring. If any loss data is entered then all of the values must be entered.

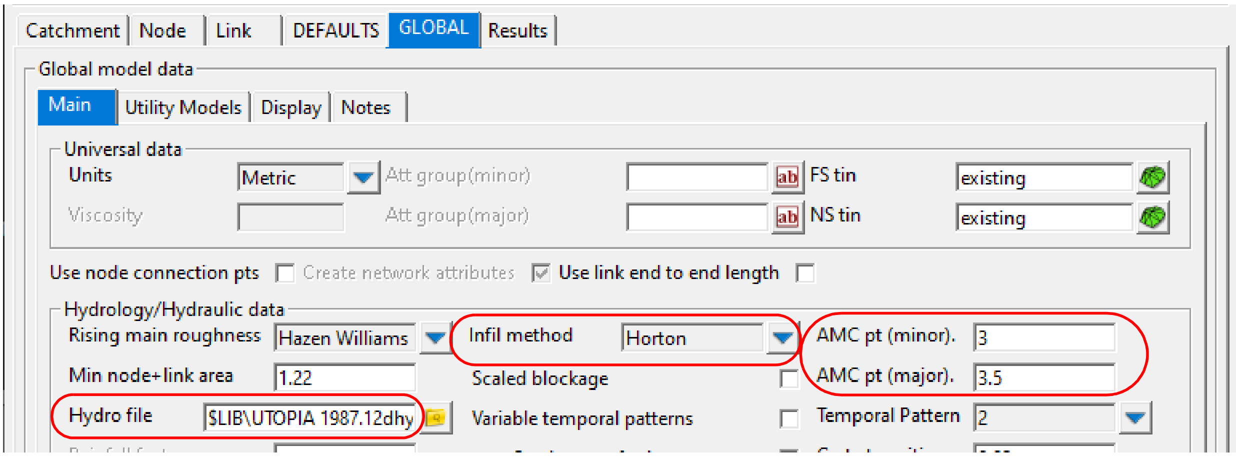
Continue to 27.1.2.3.7.1.1 Using Horton Loses in the Water Network Editor or return to 27.1.2.3.7 Infiltration Losses.

27.1.2.3.7.1.1 Using Horton Loses in the Water Network Editor

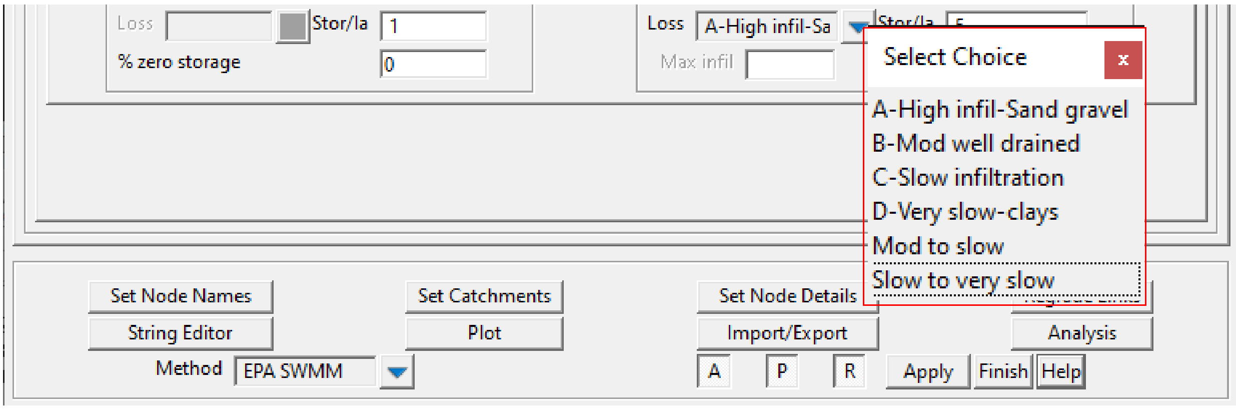
Horton Losses are only used in the 17.3.4 Water Network Editor (WNE) for the **ILSAX 2** and **EPA SWMM** Methods, See 17.3.4.4.1 Method field on the WNE.

For the **Horton losses** pop-up to be available, on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater, **Horton** must be selected as the choice for the **Infil method** field (infiltration method) and for the **Hydro file** field, a Hydro file that contains Horton Losses must be selected.

Default values for **AMC pt (minor)** and **AMC pt (major)** can also be set on that tab.



Then the **Pervious** section of the of the WNE tabs 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater and 17.3.4.6.3.1 Catchment Sets #1 to #5 tabs have a **Loss** field and the pop-up is the **soil types** from the ***Horton Losses*** node in the **Hydro file.**



The **AMC point numbers** are set once for all catchments on the 17.3.4.6.1.1 GLOBAL > Main subtab tab. Value between 1 and 4 (decimal value are permitted) are entered for the minor and major events in the **AMC pt (minor)** and **AMC pt (major)** fields.

Note: Although the choice for **Loss** can be different for different catchments, the selected **Infiltration method** (e.g. Horton) has to be used for all catchments.

27.1.2.3.7.2 SCS Curves

The runoff curve number (also called a curve number or simply CN) is an empirical dimensionless parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess.

The curve number method was developed by the USDA Natural Resources Conservation Service, which was formerly called the **Soil Conservation Service** or **SCS**.

In the Curve Number Method, the CN is related to land use, land treatment, hydrological condition, hydrological soil group, and antecedent soil moisture condition in the drainage basin.

CN has a range from 30 to 100; lower numbers indicate low runoff potential while larger numbers are for increasing runoff potential. The lower the curve number, the more permeable the soil is.

Runoff cannot begin until the initial abstraction has been met.

That is, **Initial Abstraction** defines the amount of precipitation that must fall before surface excess results.

So for **SCS** losses, a **curve number** and an **initial abstraction** is required.

In ***12d Model***, the **names of the soil types** and the their associated **Curve Number** are defined in the 17.5.1.8 Rainfall Editor - SCS Curves section of the **Hydro file** (Rainfall file).

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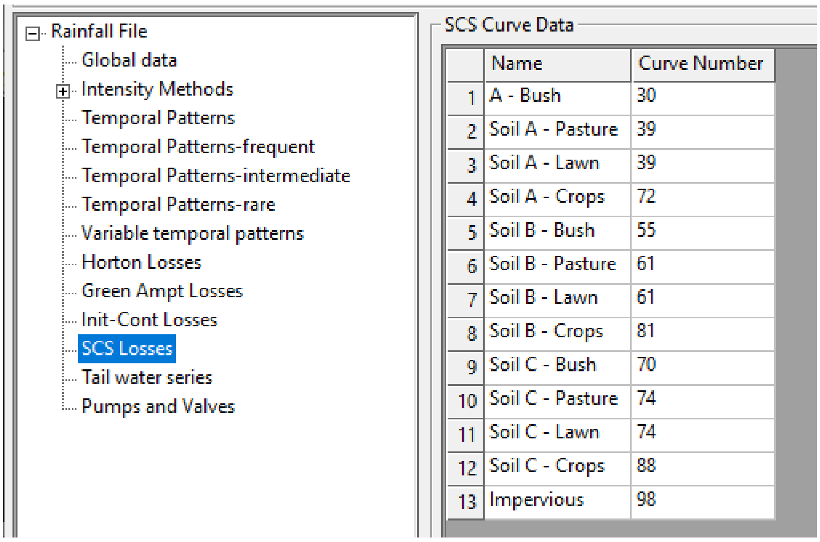
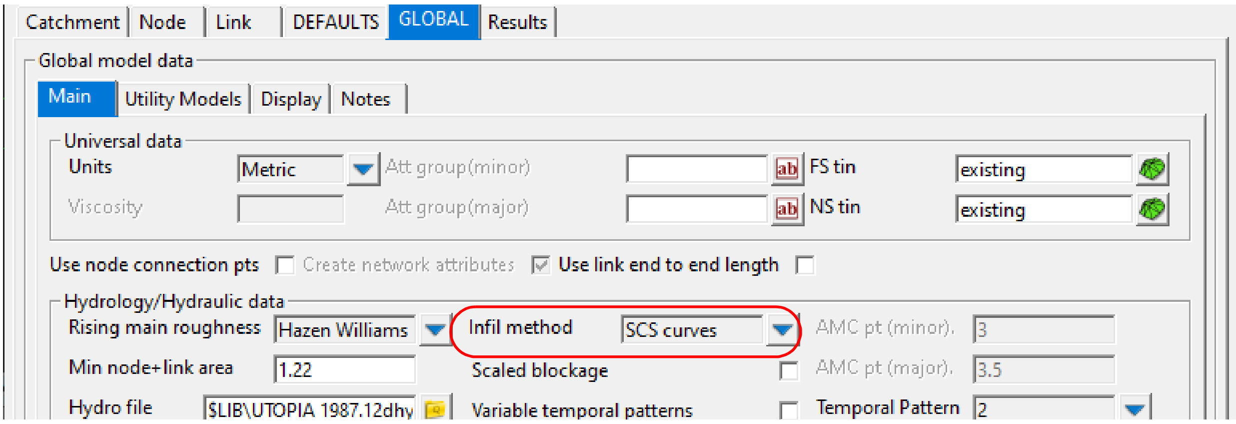


Continue to 27.1.2.3.7.2.1 Using SCS Curve Losses in the Water Network Editor or return to 27.1.2.3.7 Infiltration Losses.

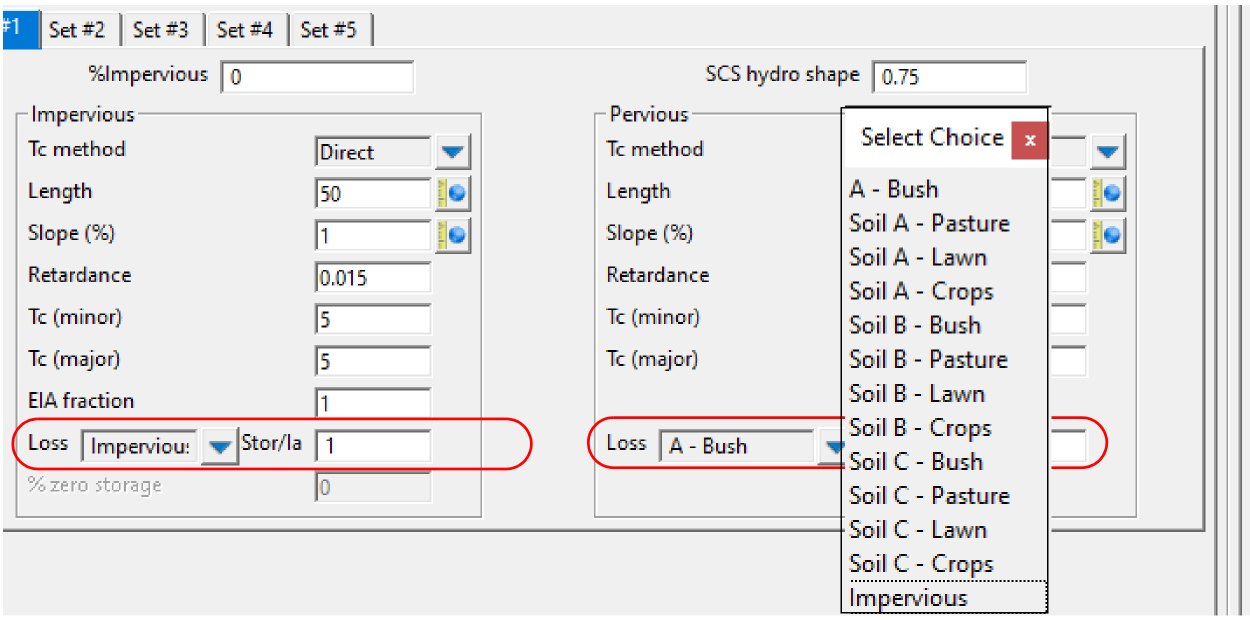
27.1.2.3.7.2.1 Using SCS Curve Losses in the Water Network Editor

SCS Curves can only be used when **EPA SWMM, NZ SCS Curves** or **SCS** curves is selected in 17.3.4.4.1 Method field on the WNE.

For the **SCS Curve** losses **pop-up** to be available in the 17.3.4 Water Network Editor (WNE), **SCS Curves** must be selected as the choice for the **Infil method** field on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater.



Then for the 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater and 17.3.4.6.3.1 Catchment Sets #1 to #5 tabs, the **Loss** field for the **Impervious** and **Pervious** portion of the catchments has a pop-up of **names of the soil types** for the **SCS Curve losses.** The **Stor/Ia field** is for the **Initial abstraction**.



The **names of the soil types** and their associated **Curve Number** are defined in the 17.5.1.8 Rainfall Editor - SCS Curves section of the selected **Hydro file** (Rainfall file) that is given in the **Hydro file** field on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater of the 17.3.4 Water Network Editor (WNE).

Note: Although the **Loss** can be different for different catchments, the selected **Infiltration method** (e.g. SCS Curves) has to be used for all catchments.

27.1.2.3.7.3 Green Ampt

The parameters required for each **Green Ampt** loss type include the **Initial moisture deficit** (NOT moisture content), **hydraulic conductivity** and **suction head**:

Initial moisture deficit

Fraction of the soil that is initially dry (i.e. difference between soil porosity and initial moisture content), as used in the Green-Ampt infiltration calculations.

Hydraulic conductivity

Saturated hydraulic conductivity, measured in mm per hour. Represents the ease that water can travel through the soil whilst it is saturated. Tends to be high for sandy soils but low for compact clays. Used in the Green-Ampt infiltration calculations.

Suction head

Suction head, in millimeters, is the average value of soil capillary suction along the wetting front. Tends to be large for fine grain soils (i.e. clays) and smaller for sandy soils. Used in the Green-Ampt infiltration calculations.

Many values are readily available online for various soil types, however for specific site data soil testing is generally simple to carry out and preferred.

On some panels the values can be typed in and on other panels where a ***12dhydro*** file is used, the values are recorded as different soil types.

In ***12d Model***, the **names of the soil types** and the their associated Initial moisture deficiency, hydraulic conductivity and suction head are defined in the 17.5.1.6 Rainfall Editor - Green Ampt Infiltration Losses section of the **Hydro file** (Rainfall file).

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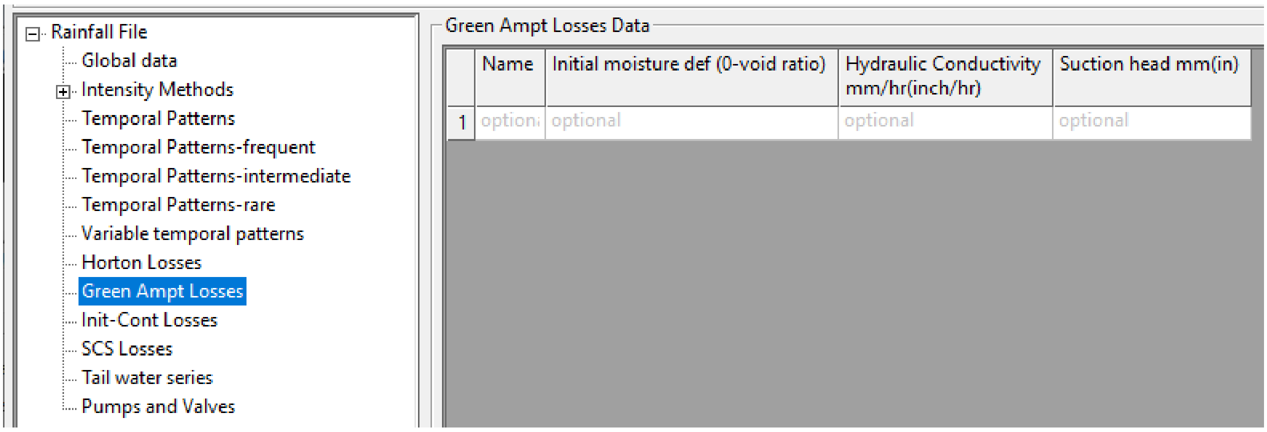


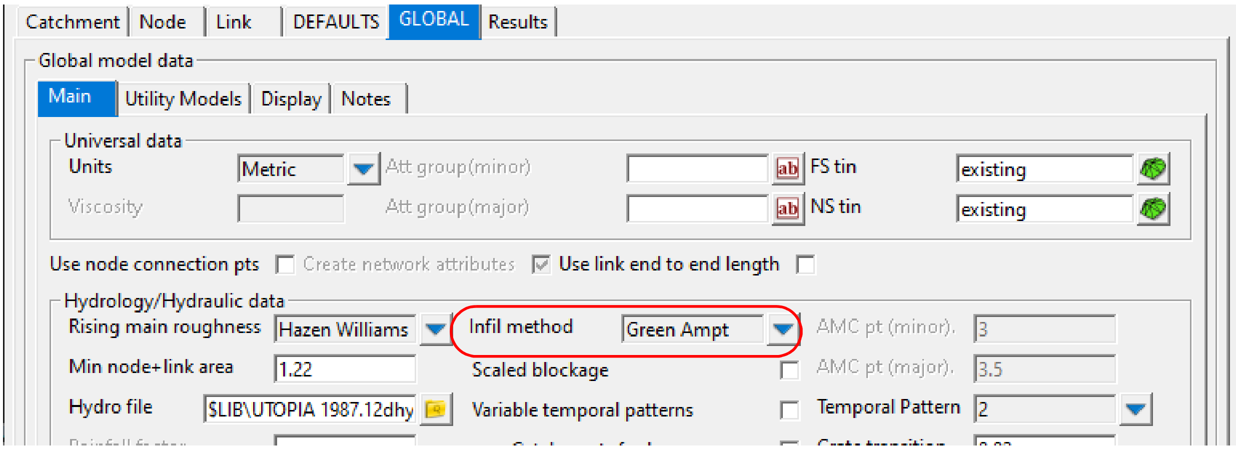
Note: Green Ampt is only used with **EPA SWMM.**

Continue to 27.1.2.3.7.3.1 Using Green Ampt Loses in the Water Network Editor or return to 27.1.2.3.7 Infiltration Losses.

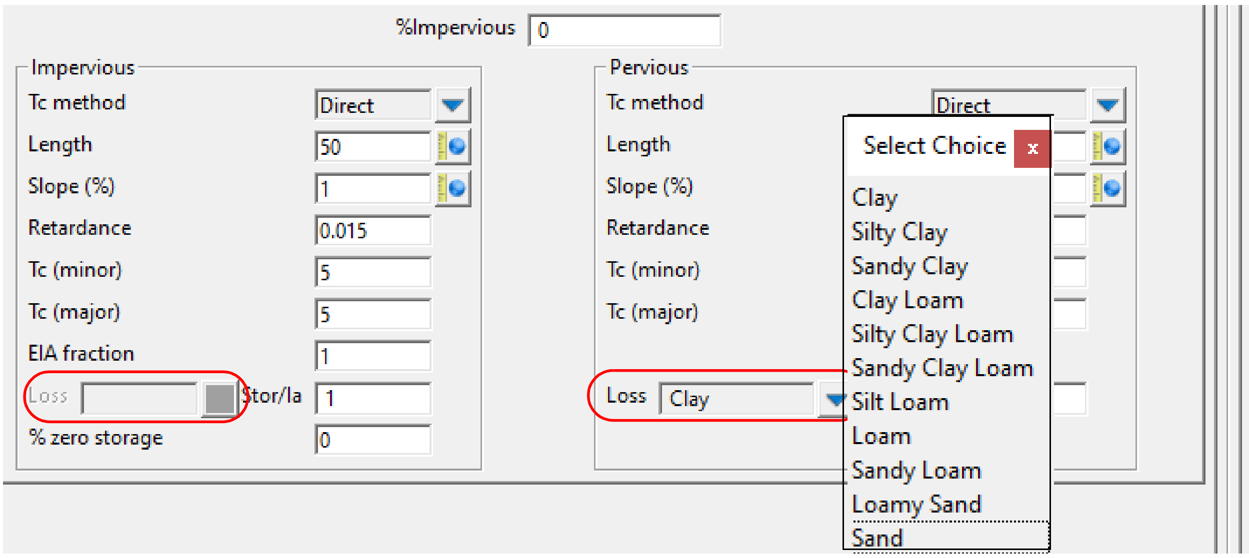
27.1.2.3.7.3.1 Using Green Ampt Loses in the Water Network Editor

Green Ampt losses are only used in the 17.3.4 Water Network Editor (WNE) for the **EPA SWMM** Method. See 17.3.4.4.1 Method field on the WNE.

For the **Green Ampt** losses **pop-up** to be available in the 17.3.4 Water Network Editor (WNE) as a choice for **EPA SWMM, Green Ampt** must be selected as the choice for the **Infil method** field on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater.



Then for the 17.3.4.6.2.1 DEFAULTS >Catchment subtab - Stormwater and 17.3.4.6.3.1 Catchment Sets #1 to #5 tabs, the **Loss** field for the **Impervious** and **Pervious** portion of the catchments has a pop-up of **names of the soil types** for the **Green Ampt losses.** The **Stor/la field** is for the **soil state prior to the storm event**.



The **names of the soil types** in this pop-up list and their associated **initial moisture deficit**, **hydraulic conductivity** and **suction head** are defined in the 17.5.1.6 Rainfall Editor - Green Ampt Infiltration Losses section of the selected **Hydro file** (Rainfall file).

Note: Although the **Loss** can be different for different catchments, the selected **Infiltration method** (e.g. Green Ampt) has to be used for all catchments.

27.1.2.3.7.4 Initial and Continuing Losses

The parameters required for the **Initial and Continuing** losses are the **Initial Loss** and the **Continuing Loss**.

In ***12d Model***, the **names of the soil types** and the their associated **Initial loss** and **continuing loss** are defined in the 17.5.1.7 Rainfall Editor - Initial and Continuing Losses section of the **Hydro file** (Rainfall file).

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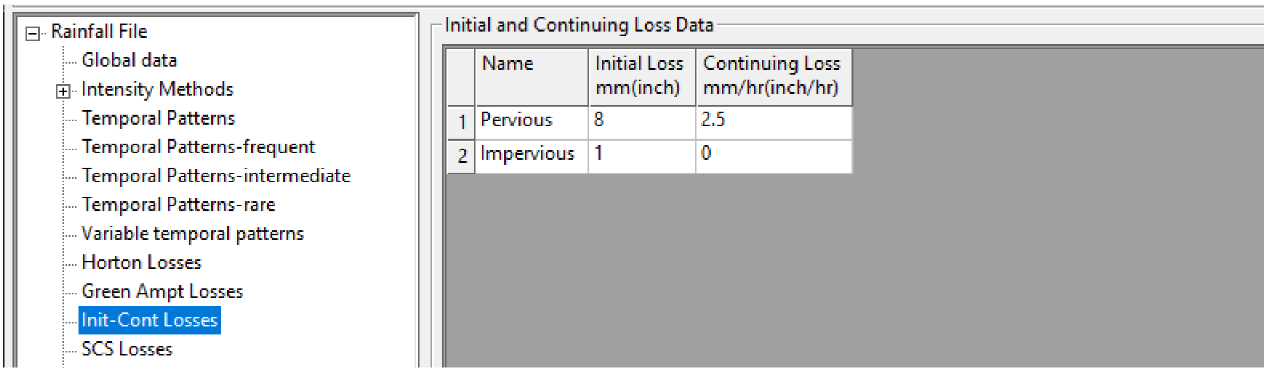
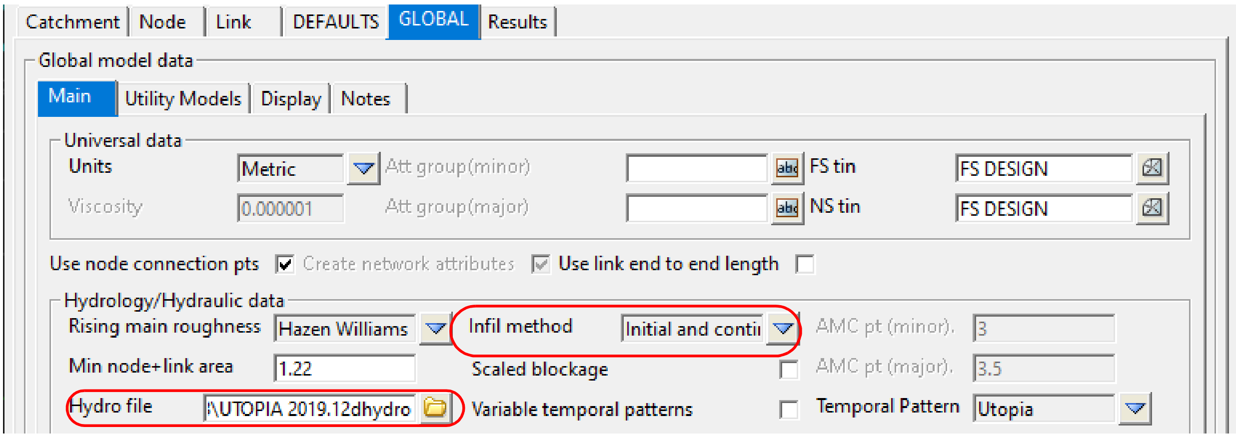


Continue to 27.1.2.3.7.4.1 Using Initial and Continuing Losses in the Water Network Editor or return to 27.1.2.3.7 Infiltration Losses.

27.1.2.3.7.4.1 Using Initial and Continuing Losses in the Water Network Editor

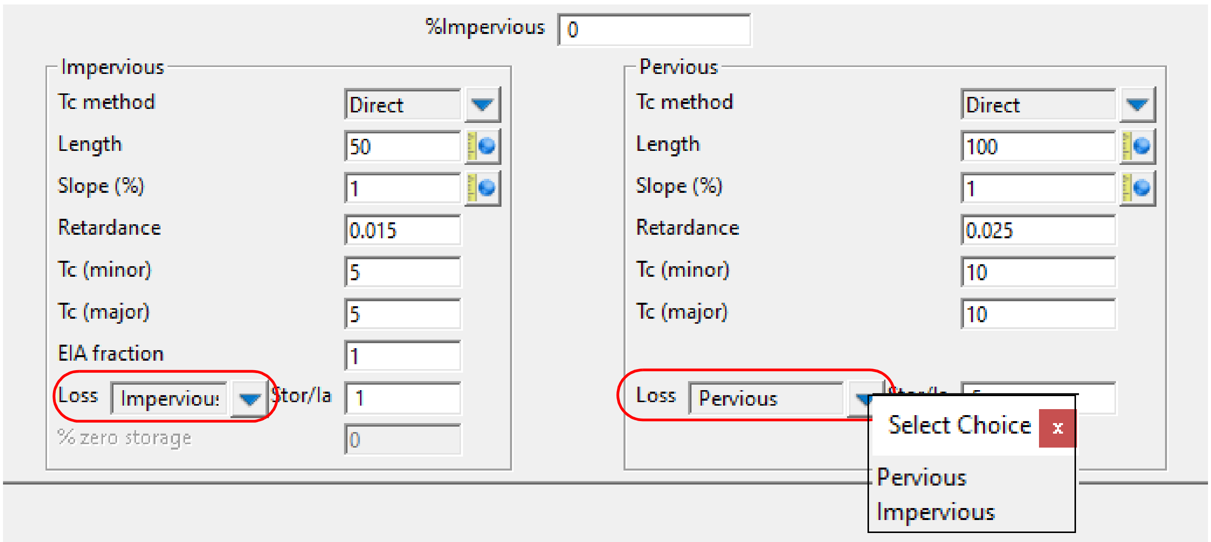
Initial and Continuing Losses are only used in the 17.3.4 Water Network Editor (WNE) for the **ARR2019 IL-CL**, **ILSAX 2**, **EPA SWMM** and **Laurenson** Methods. See 17.3.4.4.1 Method field on the WNE.

For the **Initial and Continuing** losses **pop-up** to be available in the 17.3.4 Water Network Editor (WNE) as a choice, **Initial and continuing** must be selected as the choice for the **Infil method** field on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater.



The **names of the soil types** and their associated **Initial loss** and **continuing loss** are defined in the 17.5.1.7 Rainfall Editor - Initial and Continuing Losses section of the selected **Hydro file** (Rainfall file) that is given in the **Hydro file** field on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater of the 17.3.4 Water Network Editor (WNE).

When **initial and continuing** losses is used, the **Impervious** and **Pervious** portion of the catchments used will have a **Loss** field which has a pop-up of **names of the soil types**.



Note: Although the **Loss** can be different for different catchments, the selected **Infiltration method** (e.g. initial and continuing) has to be used for all catchments.

Continue to 27.1.2.4 Sewer Tractive Force or return to 27.1 Hydrology.

27.1.2.4 Sewer Tractive Force

The tractive force method is used to design sewers to achieve self-cleansing conditions based on a required critical shear stress.

The sewer flows for this method are calculated using catchment land uses and equivalent populations.

Continue to 27.1.3 Time of Concentration or return to 27.1.2 Hydrological Methods or 27.1 Hydrology.

27.1.3 Time of Concentration

Time of concentration (**Tc)** in hydrology is used to measure the response of a catchment (watershed) to a rain event.

It is defined as the **time needed for water to flow from the most remote point in a catchment** to the **catchment outlet**. It is a function of the topography, geology and land use within the catchment.

Time of concentration is useful in predicting flow rates that would result from hypothetical storms, which are based on statistically derived return periods through IDF curves.

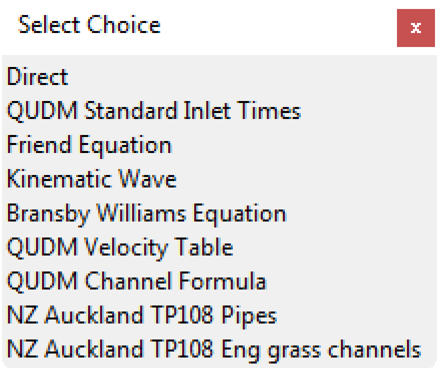
For water analysis, it is important for engineers and hydrologists to be able to accurately predict the response of a watershed to a given rain event.

There are times when one time of concentration is not enough to cover the situation and then the time of concentration for the **entire catchment** can be made up from of a number of **subcomponents**, and each subcomponent could use a different method to calculate either a time of concentration $\mathbf{t_c}$, or a travel time **t**.

These can be combined to create the **lumped** time of concentration **Tc** for the **entire catchment** using the 17.5.12 Time of Concentration Builder and then directly entering the value. See 27.1.3.1 Direct.

The following methods are supported in ***12d Model*** for calculating one time of concentration:

Tc method choice box



27.1.3.1 Direct
27.1.3.2 QUDM Standard Inlet Times
27.1.3.3 Friend Equation
27.1.3.4 Kinematic Wave Equation
27.1.3.5 Bransby Williams Equation
27.1.3.6 QUDM Velocity Table
27.1.3.7 QUDM Channel Formula
27.1.3.8 NZ Auckland TP108 Pipes
27.1.3.9 NZ Auckland TP108 Eng grass channels

For the **Rational method** the **Tc** is used to determine the rainfall intensity so an iterative solution is used.

For the **Dynamic hydrograph methods, excluding Variable temporal patterns**, the average rainfall intensity for the storm duration is used to calculate the **Tc**.

The longer the storm duration the less the average rainfall intensity.

The user can limit the maximum storm duration user to calculate the average rainfall intensity by setting the Real model attribute “dyn max duration for **Tc** kinematic wave intensity”.

The default value is 60 minutes.

When the **Dynamic hydrograph methods** with **variable temporal patterns** are selected, a fixed rainfall intensity is used. The intensity is specified via a Real model attribute “dyn kinematic wave intensity for **Tc**”. The default is 50mm/hr (approximately 2in/hr).

27.1.3.1 Direct

Direct allows users to enter the values **Minor Tc** and **Major Tc** for a catchment rather than using a ***12d Model*** supported equation to calculate the Tc.

It is also used when the 17.5.12 Time of Concentration Builder is used to generate a Tc when one method is not enough to cover the situation, and that value is entered using **Direct**.

Continue to 27.1.3.2 QUDM Standard Inlet Times or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.2 QUDM Standard Inlet Times

QUDM method requires the **retardance**, **length** and **slope** of the catchments to be entered.

Continue to 27.1.3.3 Friend Equation or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.3 Friend Equation

Friends equation is used for the determination of overland sheet flow times.

Friend method requires the following values for the catchment to be known for the **Tc** to be calculated:

(a) **Length** of the overland sheet flow path, in metres.

(b) **Average slope** of the flow path, in percent.

(c) Retardance (roughness n*)

The time of concentration overland travel time is calculated from these values.

$$\mathbf{t} = (107.\mathbf{n}.\mathbf{L}.^{0.333}) / \mathbf{S}^{\,0.2}$$

where

t = overland sheet flow travel time (minutes)

L = overland sheet flow path length (metres)

n = Horton’s surface roughness factor

S = slope of surface (%)

Friends equation was used in the **1977** edition of Australian Rainfall and Runoff (ARR 1977).

Continue to 27.1.3.4 Kinematic Wave Equation or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.4 Kinematic Wave Equation

Central to the concept of **kinematic wave** is the assumption that the flow velocity at any given depth is the same whether the flow is rising or falling. Consequently it should only be applied to planes of sheet flow that are homogeneous in slope and roughness.

It is best applied to large paved areas such as car parks and airports.

The **Kinematic Wave** equation requires the following values for the catchment to be known for the travel time to be calculated:

(a) **Length** of the overland sheet flow path, in metres.

(b) **Average slope** of the flow path.

(c) Rainfall **Intensity**

(d) Surface **roughness**/**Retardance** coefficient (**n***)

$$\mathbf{t} = 6.94\ (\mathbf{L.n^*})^{0.5}\ /(\mathbf{I}^{0.4}.\ \mathbf{S}^{\,0.3})$$

where

t = overland travel time (minutes)

L = overland sheet flow path length (metres)

n* = surface roughness/retardance coefficient

I = rainfall intensity (mm/hr)

S = slope of surface (m/m)

Because the planes of sheet flow need to be homogeneous in slope and roughness, the travel times need to be determined separately for areas of different slope or roughness.

The **Kinematic wave** equation was used in the **1987** edition of Australian Rainfall and Runoff (ARR 1987).

Continue to 27.1.3.5 Bransby Williams Equation or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.5 Bransby Williams Equation

Bransby-Williams equation, due to it s ease of use, is commonly adopted for rural catchments.

Bransby Williams method requires the following values for the catchment to be known for the t_c to be calculated:

(a) **Length** of the overland sheet flow path

(b) The **Equal Area Slope** of the flow path

(c) Area of the catchment

$$t_c = 58\, L\ /(A^{0.1}.\ S_e^{\ 0.2})$$

where

t_c= time of concentration (minutes)

L = length (km) of flow path from catchment divide to outlet

A = catchment area (ha)

S_e = equal-area slope of stream flow path (%)

Continue to 27.1.3.6 QUDM Velocity Table or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.6 QUDM Velocity Table

The ***Stream Velocity*** is taken from the ***Table 5.05.4 Steam Velocities for Catchment Areas < 5km²*** in the **QUDM** manual.

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Table 5.05.4

Stream Velocities for Catchment Areas < 5km²

Type of Country	Average Slope of Catchment Surface (%)	Approx. Velocity of Stream (m/s)
Flat	0 to 1.5	0.3
Rolling	1.5 to 4	0.7
Hilly	4 to 8	0.9
Steep	8 to 15	1.5
Very Steep) Rocky Mountainous)	> 15	3.0

Source: Hee (1983)

The user supplies ***Slope*** and ***12d Model*** determines the ***Velocity*** from this table.

For this lookup only the ***Slope*** is needed

Continue to 27.1.3.7 QUDM Channel Formula or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.7 QUDM Channel Formula

The ***Channel Formula*** referred to uses **Figure 4.6** from the ***QUDM*** manual.

.

4.6.8 Kerb flow travel times

Time of flow in kerb and channel should be determined by dividing the length of kerb and channel flow by the average velocity of the flow.

The average velocity of the flow may be determined in either of two ways:

- Izzard's equation—refer to Technical Note 4, Book 8, ARR (1998). Reference is also made to Section 7.4.6 (d) of this Manual for a more detailed explanation of Izzard's equation. Figure 4.7 provides a quick solution to Izzard's equation—accurate enough for travel time calculations.
- Using Figure 4.6.

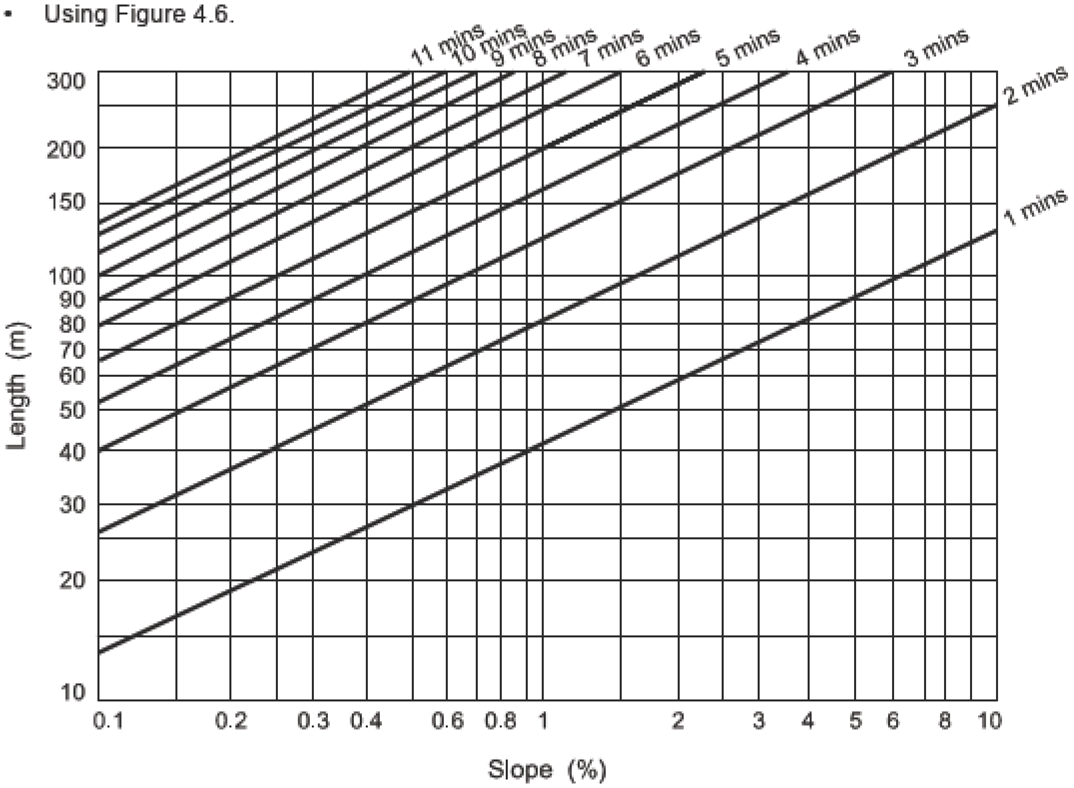


Figure 4.6 – Kerb and channel flow time using Manning's equation

Technical notes for Figure 4.6

Formula: $t = 0.025\, L / S^{0.5}$ (minutes)

where:

t = time of gutter flow in minutes

L = length of gutter flow in metres

S = slope of gutter (%)

Example Length of gutter flow = 100m

Average slope of gutter = 3%

Thus, time of travel = 1.5 minutes.

The user supplies ***Slope*** and ***Length*** area and ***12d Model*** determines the ***number of minutes*** from this graph.

Continue to 27.1.3.8 NZ Auckland TP108 Pipes or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.8 NZ Auckland TP108 Pipes

NZ Auckland TP108 Pipes method uses the equation derived from a regression analysis of Auckland catchments (BCHF, 1999c).

NZ Auckland TP108 Pipes method requires the following values for the catchment to be known for the Tc to be calculated:

(a) **Length** of the overland sheet flow path

(b) The **Equal Area Slope** of the flow path

(c) SCS Curve number

Continue to 27.1.3.9 NZ Auckland TP108 Eng grass channels or return to 27.1.3 Time of Concentration or 27.1.2 Hydrological Methods.

27.1.3.9 NZ Auckland TP108 Eng grass channels

NZ Auckland TP108 Eng Grass Channels method requires the following values for the catchment to be known for the Tc to be calculated:

(a) **Length** of the overland sheet flow path

(b) The **Equal Area Slope** of the flow path

(c) SCS Curve number

Continue to 27.1.4 Rainfall Definitions or return to 27.1 Hydrology.

27.1.4 Rainfall Definitions

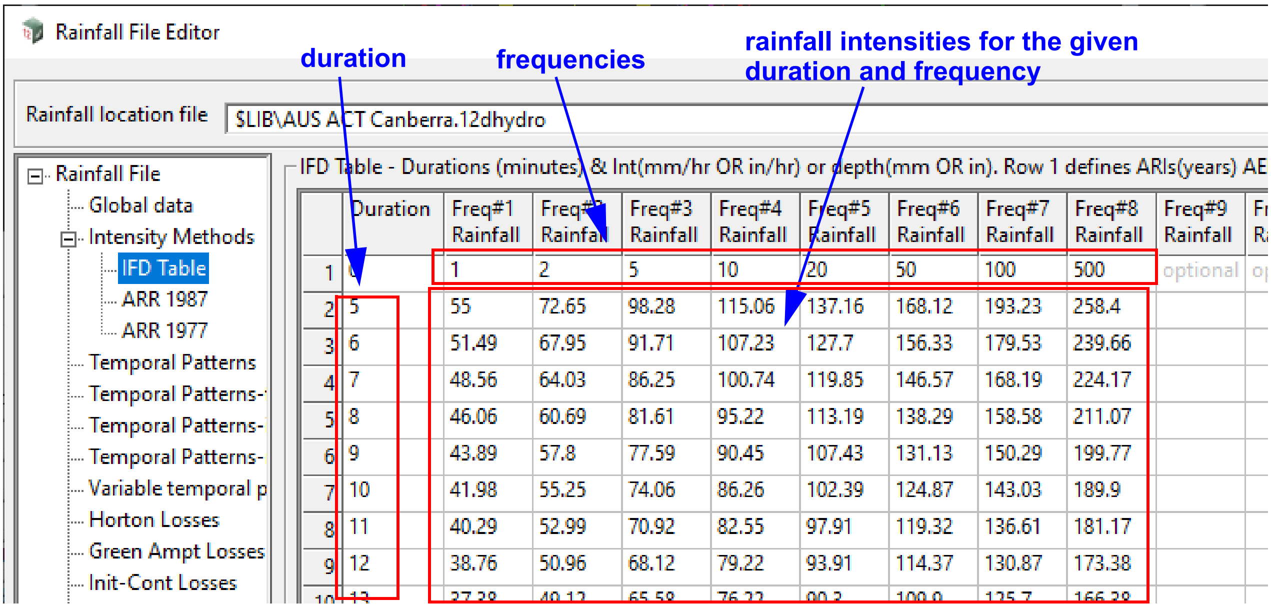
The frequency analysis of rainfall data is an important part of hydrological design procedures.

27.1.4.1 Constant Rainfall

Constant rainfall is when the rain falls is at a fixed rated over a given period of time.

27.1.4.1.1 IFD Tables

Intensity-Frequency-Duration (**IFD**) tables give the **Intensity** of the rainfall for a given **duration** and rainfall **frequency** (**return period**).



The unit for **duration** is **minutes**.

The unit for **frequency** are **average recurrence interval** (**ARI**) or **annual exceedence probability** (**AEP**).

The unit for **rainfall intensity** are **millimetres per hour (mm/hr)** or a **depth in millimetres (mm)**.

IFD tables are usually localised and are often available from meteorological services.

Intensity-Frequency-Duration data is entered in the 17.5.1.2.1 IFD Tables section of the 17.5.1 Hydro (Rainfall) File Editor, and selected on the 17.3.4.6.1.1 GLOBAL > Main subtab of the 17.3.4 Water Network Editor (WNE).

Continue to 27.1.4.1.2 Regional Coefficients for Constant Rainfall or return to 27.1 Hydrology.

27.1.4.1.2 Regional Coefficients for Constant Rainfall

??

Continue to 27.2 Hydraulics or return to 27.1 Hydrology.

27.2 Hydraulics

Hydraulics is concerned with the flow of water in the system.

This could be overland, in open channels or in pipes or culverts.

Hydraulics is talked about as being **1D** or **2D**, **time dependent** and **time independent**.

The term 2D is misleading as it is actually 2.5D.

That is, for each (x,y) coordinate there is a unique z value. So it is a surface in three dimensional space.

For example, the ground surface represented by a TIN is 2.5D. Or a TIN representing a water surface.

The term 1D is also misleading as it is not just a one dimensional line.

It is usually a profile along a string where chainage distance is one axis and a second axis could be height or water level.

Time dependence means that things vary over time.

For example, the St Venant equation used in **Dynamic Analysis** depends on time. See 27.2.4.1 Dynamic Hydraulic Equations).

Whereas **Rational Analysis** uses HGL and other methods which are independent of time. See 27.2.3.3 The Hydraulic Grade Line (HGL):.

See

27.2.1 Nodes
27.2.2 Links
27.2.3 Rational Method Hydraulics
27.2.4 Dynamic Hydraulics

27.2.1 Nodes

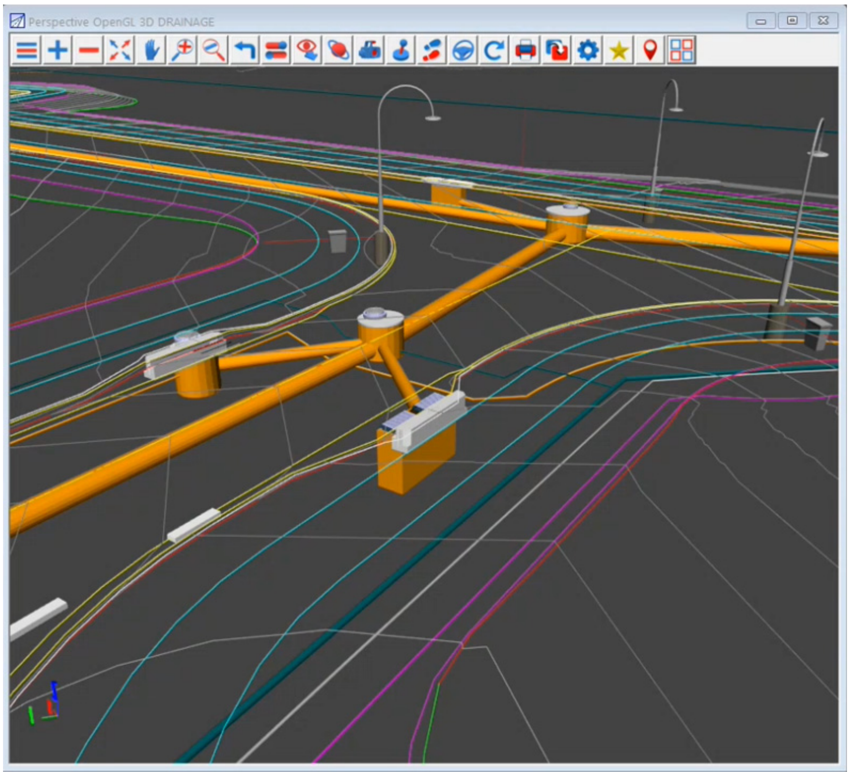
A node represents the junction of hydraulic elements (links) as well as a location for input of flows into the network system. A node can also represent a storage device,

Nodes are not just point on a page but can have round or rectangular shapes which then display in both 2D and 3D.

For example, rectangular nodes have width, length and height, as well as wall thicknesses. Nodes can also have risers. See 17.1.4.1.1 Node Shapes and Sizes with No Riser and 17.1.4.1.2 Risers on Nodes.

When links connect nodes, the links stop at the inner walls of the nodes and can be connected anywhere around the node.

Consequently nodes aren't just used for water analysis but can also be used for clash detection, construction and BIM systems.



For more information on nodes, see 17.1.4.1 Nodes (Pits, Maintenance Holes).

Continue to 27.2.1.1 Ku and Kw or return to 27.2 Hydraulics or 27.1 Hydrology.

27.2.1.1 Ku and Kw

This section describes the procedures for calculating Ku and Kw coefficients, as implemented in the Water Analysis module of ***12d Model***.

For stormwater **nodes** for pits, maintenance holes:

Ku coefficients apply to **pressure head** (**Hp**) **losses**.

Kw coefficients apply to **water surface elevation** (**WSE**) **losses**.

For stormwater **links** for **culvert inlets**:

Ku coefficients apply to **pressure head** (**Hp**) **losses**.

See

27.2.1.1.1 Piped Stormwater Systems
27.2.1.1.2 Culvert Inlets
27.2.1.1.3 Ku and Kw Calculations in 12d Model
27.2.1.1.4 How Does 12d Model Determine Ku and Kw Chart Inputs Qg/Qo, Du/Do, θg and θu?

27.2.1.1.1 Piped Stormwater Systems

For the design of piped stormwater systems where the **nodes** are **pits** or **maintenance holes** (where no grate inlet flow from above is possible) and the **links** are **pipes**, the **loss** (or **gain**) in **pressure head** (ΔHp) **through a node** is typically assumed proportional to the velocity head at the entrance of the downstream link. Likewise proportional, but sometimes of different magnitude, is the corresponding **change** in **effective water surface elevation** (ΔWSE) between the node and the downstream link.

However simple this may seem, the **two coefficients of proportionality** (denoted by **Ku** for **pressure head changes,** and **Kw** for **WSE changes)** are generally dependent on so many different factors, that their adequate estimation still relies largely on the results of empirical study.

Perhaps the most thorough sources emanating from such study, are the so called "Missouri Charts" (Sangster et al, 1958) and "Hare Charts" (Hare, 1981). The Australian Rainfall and Runoff (ARR, 1987), suggests the use of these sets of charts, in preference to any other method.

As originally published, the charts are highly complex, varied in presentation, and somewhat open to interpretation – reflective of the chaotic nature of flow through nodes. A good deal of judgement is required in selecting the appropriate chart to use for a particular node configuration, and in most cases, iterative calculations are required. For large stormwater networks, this typically leads to a huge time-cost for the designers, or alternatively, to an overly-conservative design approach. To overcome such problems, several semi-analytical methods have been proposed, with an aim to replace the dependence on charts.

These range from the relatively simple methods suggested by Argue (1986), Hare et al (1990)2, and Mills et al (1998), to the more accurate methods (which are arguably as complex as using the charts manually) suggested by Parsell (1992), and Stein et al (1999). A summary paper (O’Loughlin et al, 2002) reviewed the latter four of these methods, and concluded that none matched acceptably well, across the full range of node configurations covered by the charts, and that more work was required to develop a practical method suitable for implementation with a computer.

12d Model adopts a method that is purely numerical, rather than semi-analytical. It is based on the fact that the majority of the chart data (i.e. the charts for nodes with no more than a single upstream link) offer a range suitable for consideration in a continuous sense. This fact has allowed the chart data to be re-arranged and combined into a single database of **Ku** and **Kw** values – one that both spreads evenly across the full range of the charts used, and is convenient for computation.

The resultant database is used to calculate values which match the charts **perfectly**, for those nodes which **coincide** with one of the **discrete chart configurations**; otherwise, values are calculated which indicate a **linear transition** between **particular charts**.

The **Ku** and **Kw** calculations are ***all*** based on a robust, programmed sequence of one-dimensional and/or three-dimensional interpolations within the database.

The method may be thought of as a particular, holistic way of interpreting the chart data. It has been developed with an aim to minimise user input, and increase the overall efficiency of the design process.

Individual charts ***do not*** need to be nominated at each node, and horizontal and vertical misalignment of links (a key factor affecting **Ku** and **Kw**) is considered with minimal interaction.

The method is most reliable for nodes with either **no upstream link,** or **one upstream link**.

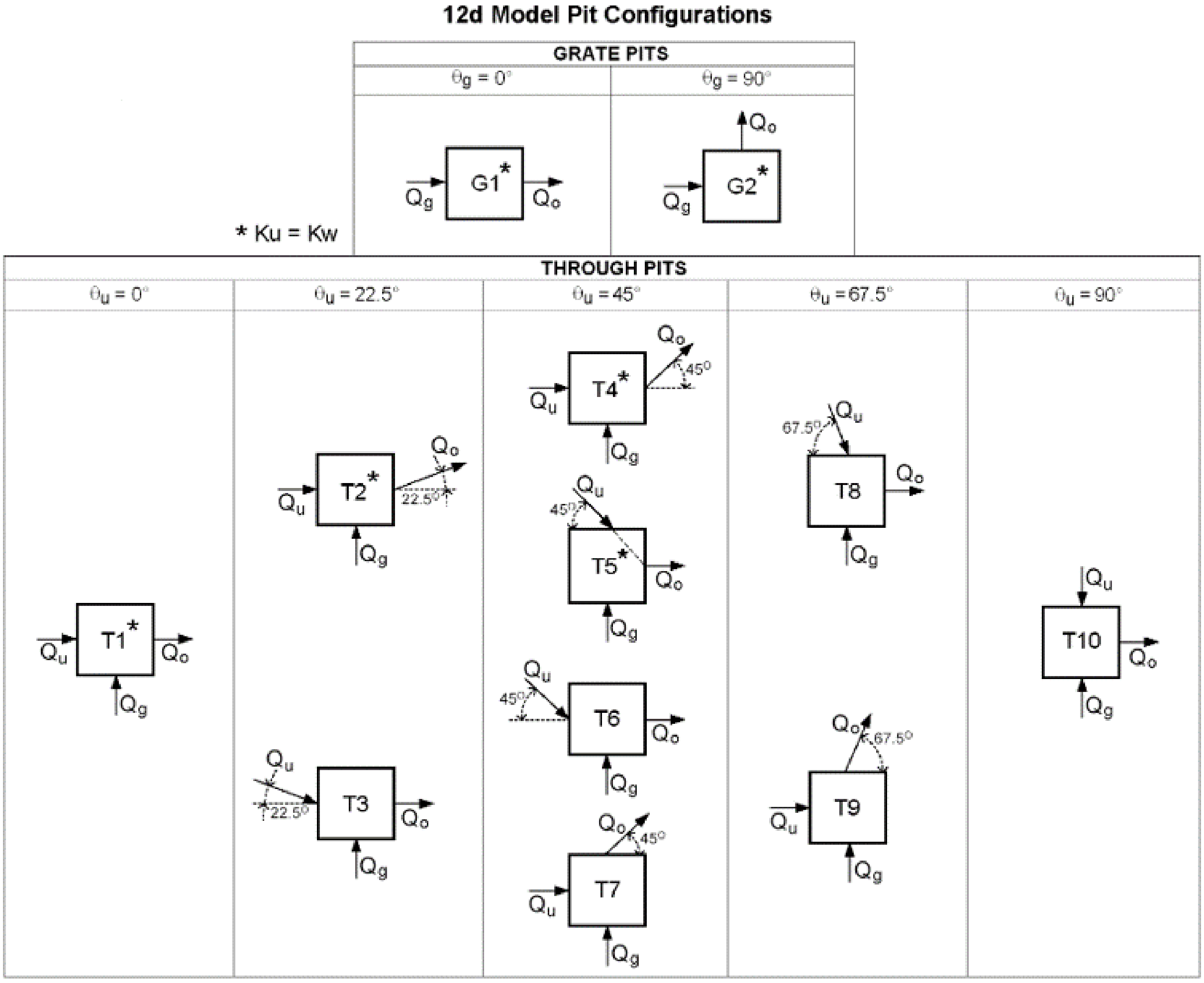
For nodes with t**wo or more upstream links** (for which very few discrete charts exist) a single equivalent upstream link is determined, yielding results which compare adequately with the limited chart data available.

27.2.1.1.2 Culvert Inlets

For **links** representing ***culvert inlets***, ***12d Model*** adopts a different method, based on data published by the U.S. Federal Highway Administration (HDS5, 2005), to calculate **Ku** values for culverts flowing under inlet or outlet control.

This method is detailed in 27.2.1.1.4.7 Ku Methods for Culvert Inlets and covers a wide range of different culvert configurations.

27.2.1.1.3 Ku and Kw Calculations in 12d Model



12d Controls	12d Settings	Remarks
Ku method	Direct Ku,Kw via Charts Ku,Kw>0 via Charts 33 culvert methods	Ku & Kw specified directly by user. Ku & Kw via chart interpolation. Prevents -ve Ku or Kw from charts. 27.2.1.1.4.7 Ku Methods for Culvert
Ku config	Preferred Good Fair Poor	Gives lowest Ku & Kw (on average). : : Gives highest Ku & Kw (on average).

27.2.1.1.4.4 Ku and Kw Charts for Through Pits

Independent Chart Variables :

θg = *angle between grate flow line and d/s pipe*
θu = *angle between equivalent u/s pipe and d/s pipe*
Qg/Qo = *equivalent grate flow ratio*
Du/Do = *equivalent pipe diameter ratio*
S/Do = *submergence ratio*

Procedural Steps

1A) Grate Pit chart is used for pits where Qg/Qo = 1.0.

- G1 used where θg <= 15°; G2 used where θg > 15°.

See 27.2.1.1.4.2 Example Calculation Grate Pits (i.e. grate flow only)

1B) Through Pit charts are used for pits where 0.0 <= Qg/Qo <= 0.5.

- Interpolation within a Through Pit chart is based on Qg/Qo and Du/Do.
- Interpolation between Through Pit charts is based on θu and *Ku config* : Preferred, Good, Fair, Poor.

	0°	22.5°	45°	67.5°	90°
Preferred	**T1**	**T2**	**T4**	**T8**	**T10**
Good	**T1**	**T2**	**T5**	**T8**	**T10**
Fair	**T1**	**T3**	**T6**	**T9**	**T10**
Poor	**T1**	**T3**	**T7**	**T9**	**T10**

See 27.2.1.1.4.3 Example Calculation Through Pits (i.e. through flow and grate flow)

1C) For pits where 0.5 < Qg/Qo < 1.0, a further (linear) interpolation based on Qg/Qo is made, between the interpolated data from steps 1A and 1B.

2) Step 1A, 1B or 1C produces a Ku and a Kw curve (both versus S/Do). Actual S/Do values are calculated to intersect the Kw curve, and thus find the applicable S/Do for the final Kw & Ku values.

Continue to 27.2.1.1.4 How Does 12d Model Determine Ku and Kw Chart Inputs Qg/Qo, Du/Do, θg and θu? or return to 27.2.1.1 Ku and Kw or 27.2.1 Nodes or 27.2 Hydraulics.

27.2.1.1.4 How Does 12d Model Determine Ku and Kw Chart Inputs Qg/Qo, Du/Do, θg and θu?

See

27.2.1.1.4.1 Example with grate flow and 3 upstream links
27.2.1.1.4.2 Example Calculation Grate Pits (i.e. grate flow only)
27.2.1.1.4.3 Example Calculation Through Pits (i.e. through flow and grate flow)
27.2.1.1.4.4 Ku and Kw Charts for Through Pits
27.2.1.1.4.5 Other Chart Data
27.2.1.1.4.6 Ku and Kw for Part-full Flow and/or Extreme Submergence Ratios
27.2.1.1.4.7 Ku Methods for Culvert Inlets
27.2.1.1.4.8 Design Checks

27.2.1.1.4.1 Example with grate flow and 3 upstream links

Qg/Qo *equivalent grate flow ratio* (Steps: 1A, 1B, 1C)

	From Rational Method	Rescaled to Conserve Mass			
	Qrat	**Qeq**			
Qg	53.0	48.8			
Qu1	246.0	226.7			
Qu2	151.0	139.2			
Qu3	98.0	90.3			
Qu	495.0	456.2			
Qg + Qu	548.0	505.0			Qg/Qo = (Qg)eq / Qo
Qo	505.0	505.0	**Qg/Qo =** 48.8/505.0 =	**0.097**	0.0 <= Qg/Qo <=1.0

Du/Do *equivalent pipe diameter ratio* (Steps: 1B, 1C)

Pipe Diameters		**Pipe Areas**				
Du1	375	**Au1**	0.110			
Du2	300	**Au2**	0.071			
Du3	225	**Au3**	0.040			
		Au	0.221			Du/Do = SQR(Au/Ao)
Do	600	**Ao**	0.283	**Du/Do =** SQR(.221/.283) =	**0.884**	0.6 <= Du/Do <= 1.0

θg *angle between grate flow line and d/s pipe* (Steps: 1A, 1C)

Angle between setout string and d/s pipe	**θg =**	**32.0**	0° <= θg <= 90°

θu *angle between equivalent u/s pipe and d/s pipe* (Steps: 1B, 1C)

	Horiz θ	**Drop**	**VAF***	**θ**			
Qu1->Qo	0	20	1.547	0	**θu =** (0.0) 226.7/456.2 +		θu = θ1.Qu1/Qu
Qu2->Qo	90	40	1.867	90	(90.0) 139.2/456.2 +		+ θ2.Qu2/Qu
Qu3->Qo	30	590	0.044	54.7	(54.7) 90.3/456.2 =	**38.3**	+ θ3.Qu3/Qu 0° <= θu <= 90°

*VAF = Vertical Alignment Factor = (Do - Drop) / Du
For VAF < +0.25 (i.e. excessive vertical misalignment),
θ is increased linearly to compensate, viz:
+0.25 > VAF > -0.25
Horiz θ < θ < 90°

27.2.1.1.4.2 Example Calculation Grate Pits (i.e. grate flow only)

Example of Kw calculation (Ku = Kw)

INPUT

θg	32.0
Do	0.300
Vo	0.920
ILo	27.224
HGLo	27.900

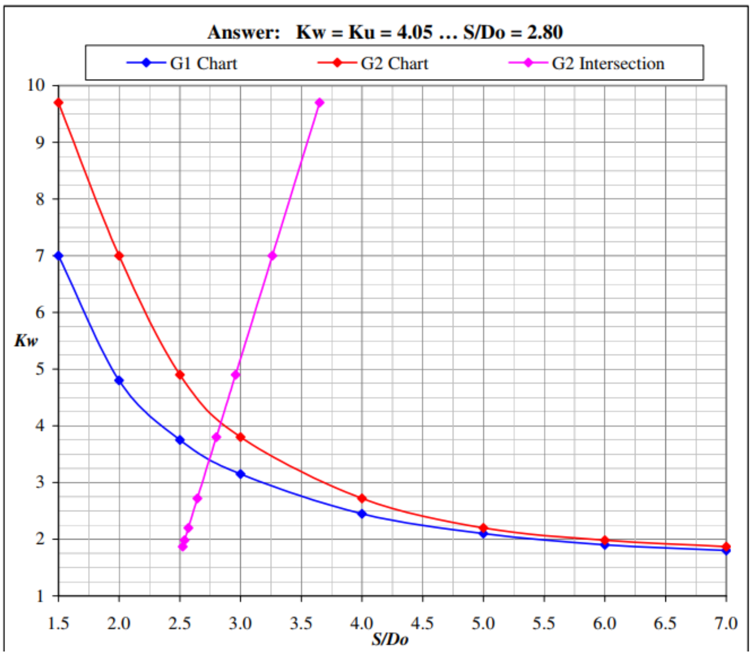
Chart :	G1	G2
θg	0°	90°
S/Do	Kw	Kw
1.5	7.00	9.70
2.0	4.80	7.00
2.5	3.75	4.90
3.0	3.15	3.80
4.0	2.45	2.72
5.0	2.10	2.20
6.0	1.90	1.98
7.0	1.80	1.87

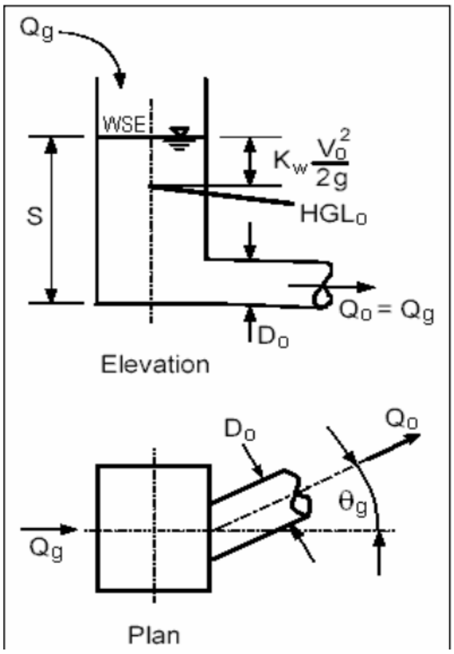
(G2)
(>15°)

$Kw.Vo^2/2g$	WSE	S	S/Do	Error
0.419	28.319	1.095	3.650	-2.150
0.302	28.202	0.978	3.261	-1.261
0.212	28.112	0.888	2.959	-0.459
0.164	28.064	0.840	2.800	0.200
0.117	28.017	0.793	2.645	1.355
0.095	27.995	0.771	2.570	2.430
0.086	27.986	0.762	2.538	3.462
0.081	27.981	0.757	2.523	4.477

G1 used where θg <= 15°
G2 used where θg > 15°
(as per Chart 32 of QUDM, 1994)

$-\Delta WSE = WSE - HGLo = Kw.Vo^2/2g$





27.2.1.1.4.3 Example Calculation Through Pits (i.e. through flow and grate flow)

Example of Ku and Kw calculation:

INPUT

θu	38.3
Qg/Qo	0.097
Du/Do	0.884
Ku config	Poor
Do	0.600
Vo	2.340
ILo	28.277
HGLo	29.100

Chart :	T3	T3	T3	T3	T7	T7	T7	T7
θu	22.5	22.5	22.5	22.5	45.0	45.0	45.0	45.0
Qg/Qo	0.0	0.0	0.5	0.5	0.0	0.0	0.5	0.5
Du/Do	0.8	0.9	0.8	0.9	0.8	0.9	0.8	0.9

S/Do	Kw1	Kw2	Kw3	Kw4	Kw5	Kw6	Kw7	Kw8
1.5	1.84	1.98	2.30	2.35	3.24	3.01	2.86	2.90
2.0	1.57	1.69	2.00	2.05	2.81	2.65	2.55	2.53
2.5	1.33	1.43	1.79	1.83	2.62	2.48	2.21	2.19
3.0	1.25	1.32	1.61	1.63	2.58	2.41	2.08	2.05
4.0	1.16	1.22	1.52	1.50	2.53	2.36	1.91	1.87
S/Do	**Ku1**	**Ku2**	**Ku3**	**Ku4**	**Ku5**	**Ku6**	**Ku7**	**Ku8**
1.5	1.60	1.71	1.79	1.79	2.40	2.40	2.55	2.59
2.0	1.44	1.53	1.69	1.72	2.20	2.21	2.23	2.29
2.5	1.25	1.32	1.66	1.61	2.13	2.18	2.13	2.09
3.0	1.09	1.12	1.57	1.54	2.07	2.09	1.99	1.97
4.0	0.96	1.00	1.50	1.44	1.97	2.00	1.82	1.81

3-d interpolation factors

a	0.702	1 - a	0.298
b	0.246	1 - b	0.754
c	0.840	1 - c	0.160

a = (θu - 22.5) / (45.0 - 22.5)
* b = (N - 0.0) / (0.5 - 0.0)
c = (Du/Do - 0.8) / (0.9 - 0.8)

Kw	$Kw.Vo^2/2g$	WSE	S	S/Do	Error
2.72	0.761	29.861	1.584	2.640	-1.140
2.38	0.665	29.765	1.488	2.479	-0.479
2.15	0.602	29.702	1.425	2.375	0.125
2.06	0.575	29.675	1.398	2.330	0.670
1.97	0.550	29.650	1.373	2.289	1.711
Ku					
2.23					
2.03					
1.92					
1.81					
1.70					

General 3-d interpolation equation

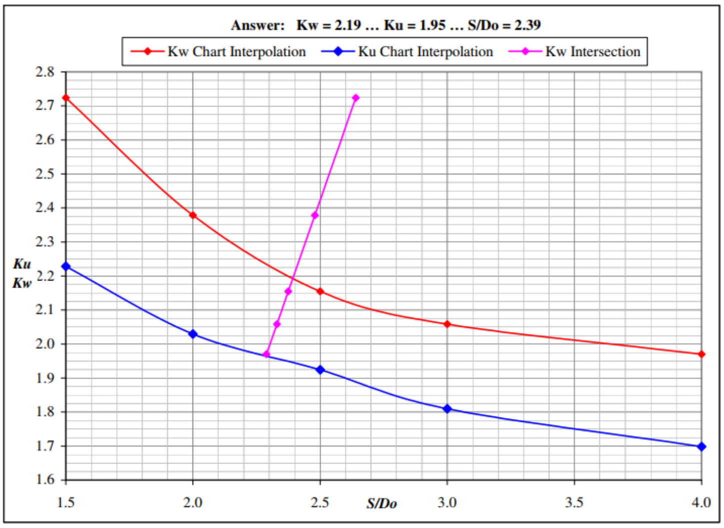
K =	(1-a) (1-b) (1-c)	K1	+	(1-a) (1-b) c	K2
+	(1-a) b (1-c)	K3	+	(1-a) b c	K4
+	a (1-b) (1-c)	K5	+	a (1-b) c	K6
+	a b (1-c)	K7	+	a b c	K8

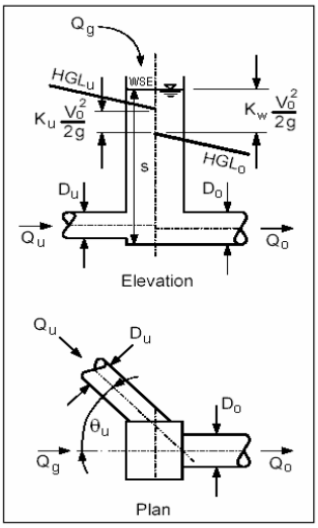
* Non-linear interpolation, as per QUDM (1994).

$N = 0.66\ (2.Qg/Qo - [Qg/Qo]^2)$

$-\Delta WSE = WSE - HGLo = Kw.Vo^2/2g$

$-\Delta Hp = HGLu - HGLo = Ku.Vo^2/2g$



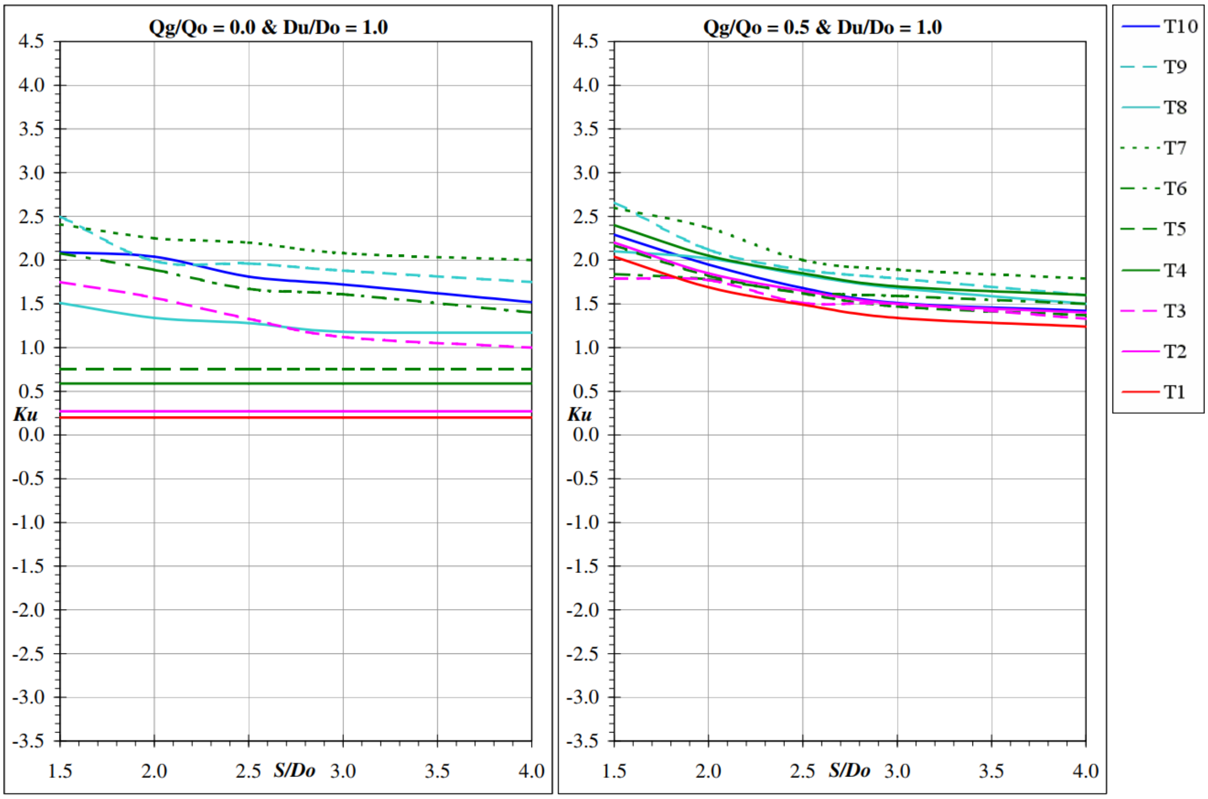


27.2.1.1.4.4 Ku and Kw Charts for Through Pits

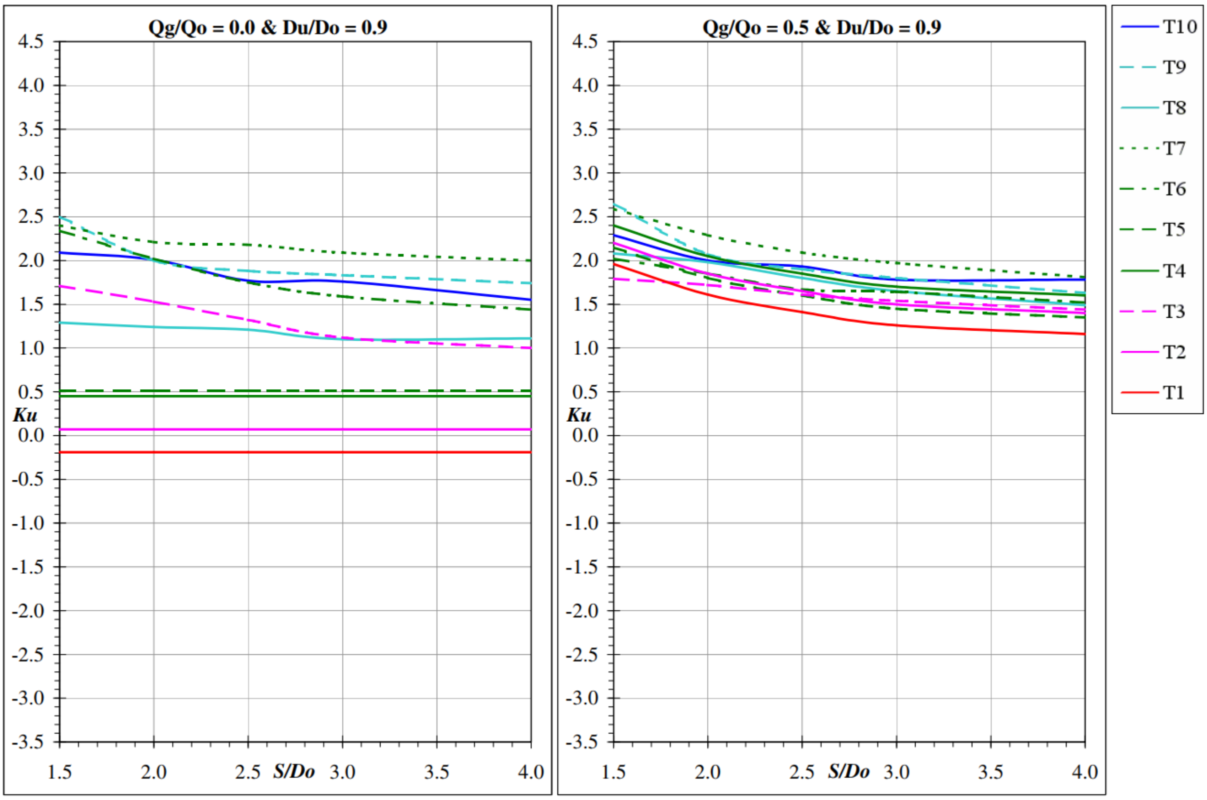
See

Ku Charts for Through Pits - Qg/Qo =0.0,0.5 Du/Do = 1.0
Ku Charts for Through Pits - Qg/Qo =0.0,0.5 Du/Do = 0.9
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.8
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.7
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.6
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 1.0
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.9
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.8
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.7
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.6
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.6

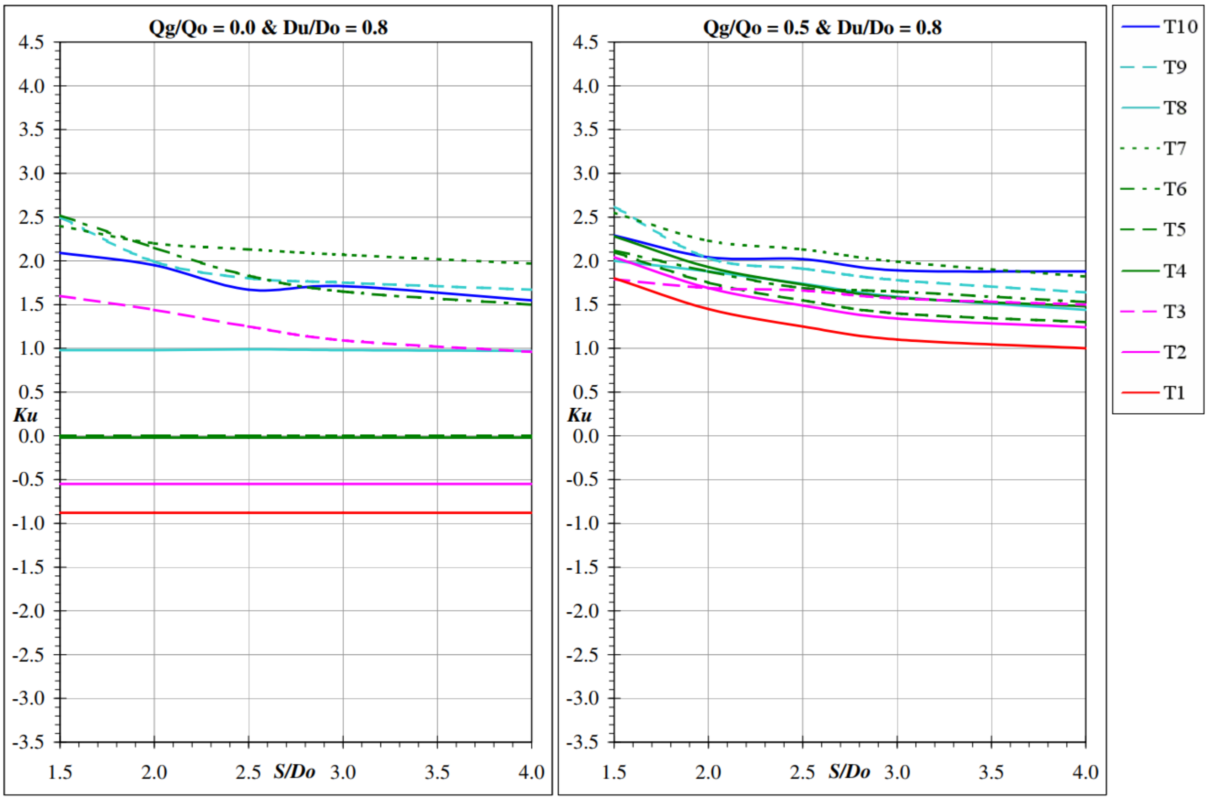
Ku Charts for Through Pits - Qg/Qo =0.0,0.5 Du/Do = 1.0



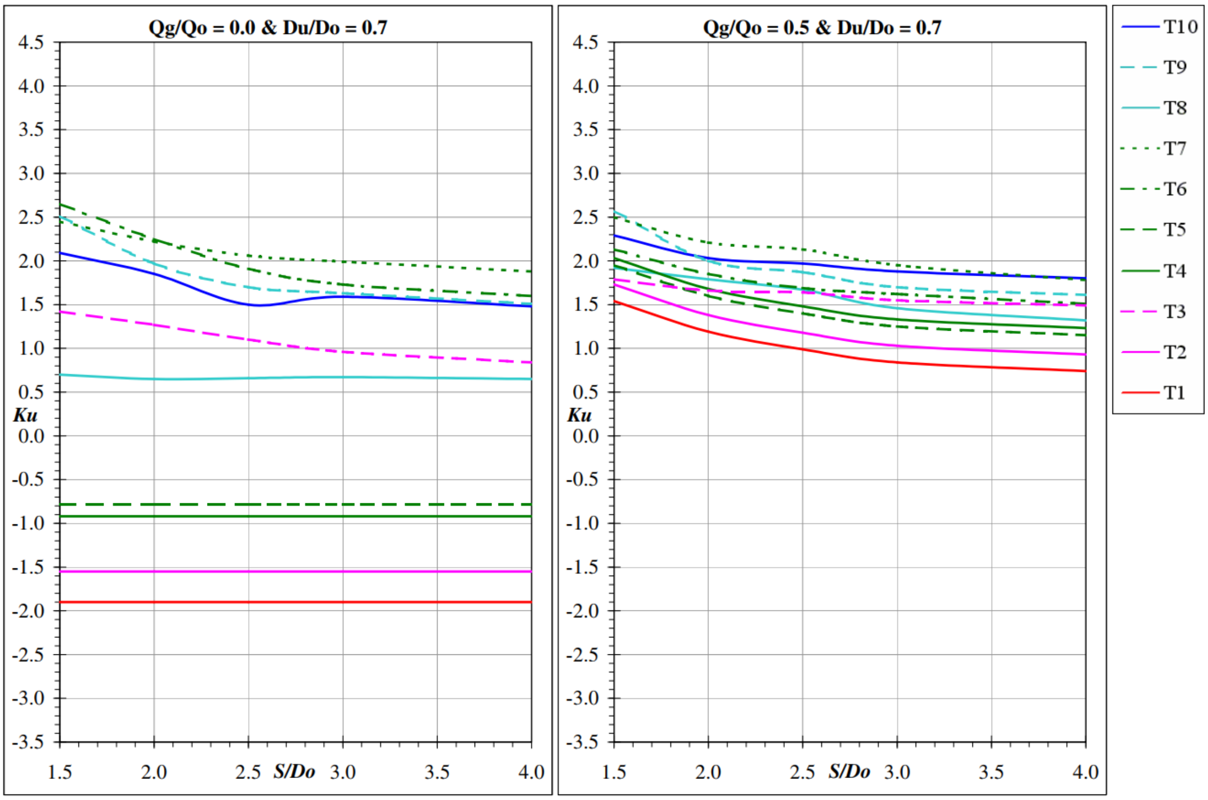
Ku Charts for Through Pits - Qg/Qo =0.0,0.5 Du/Do = 0.9



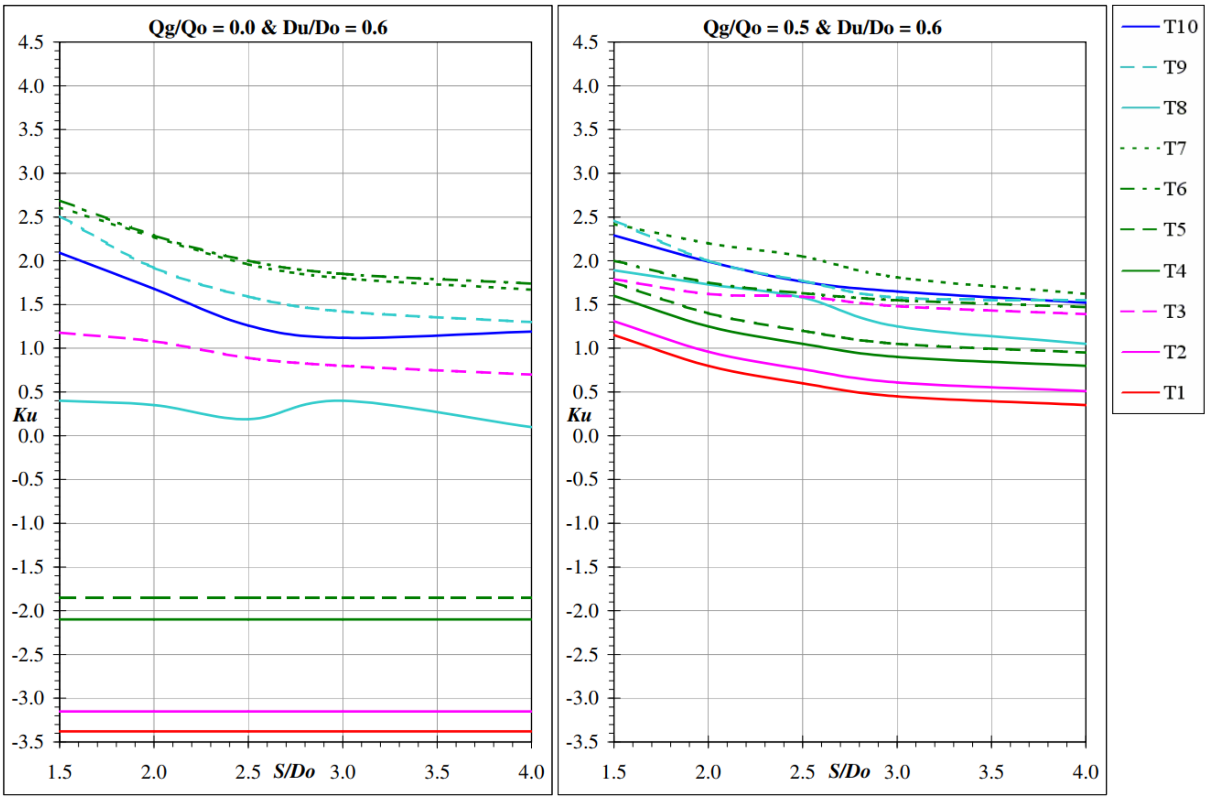
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.8



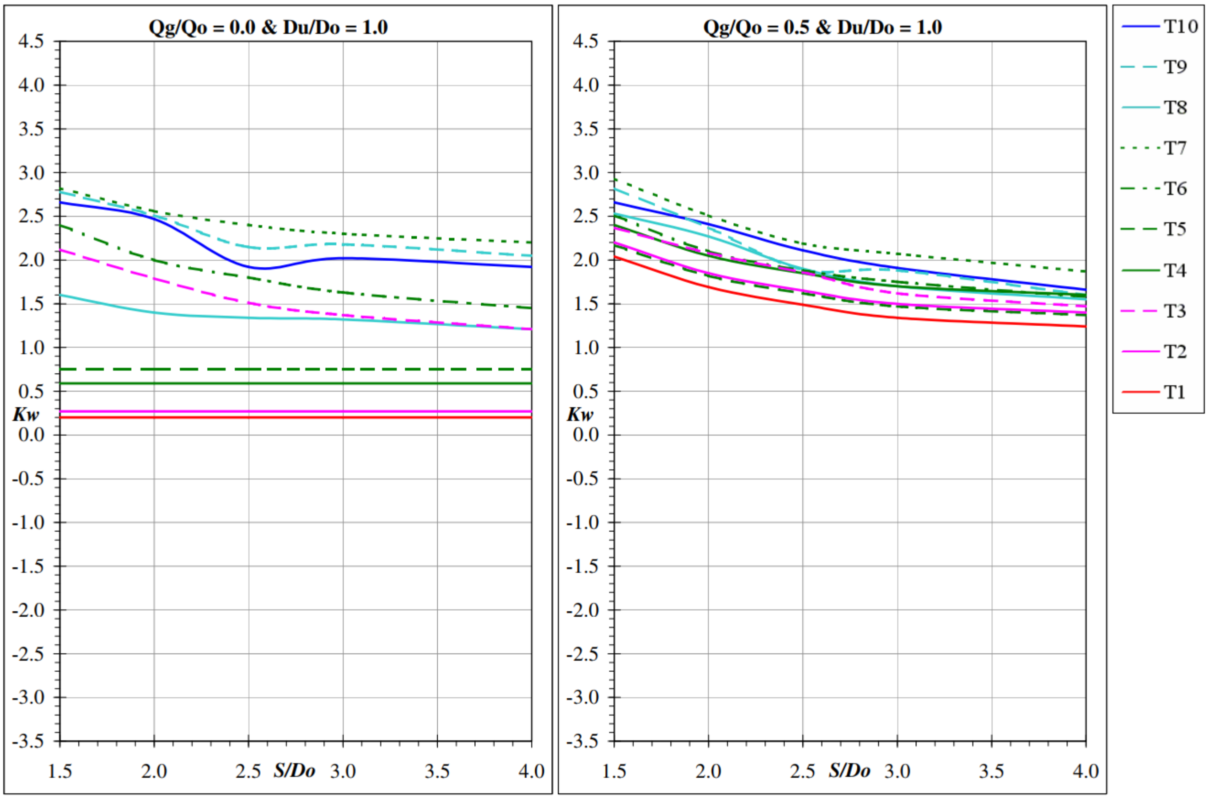
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.7



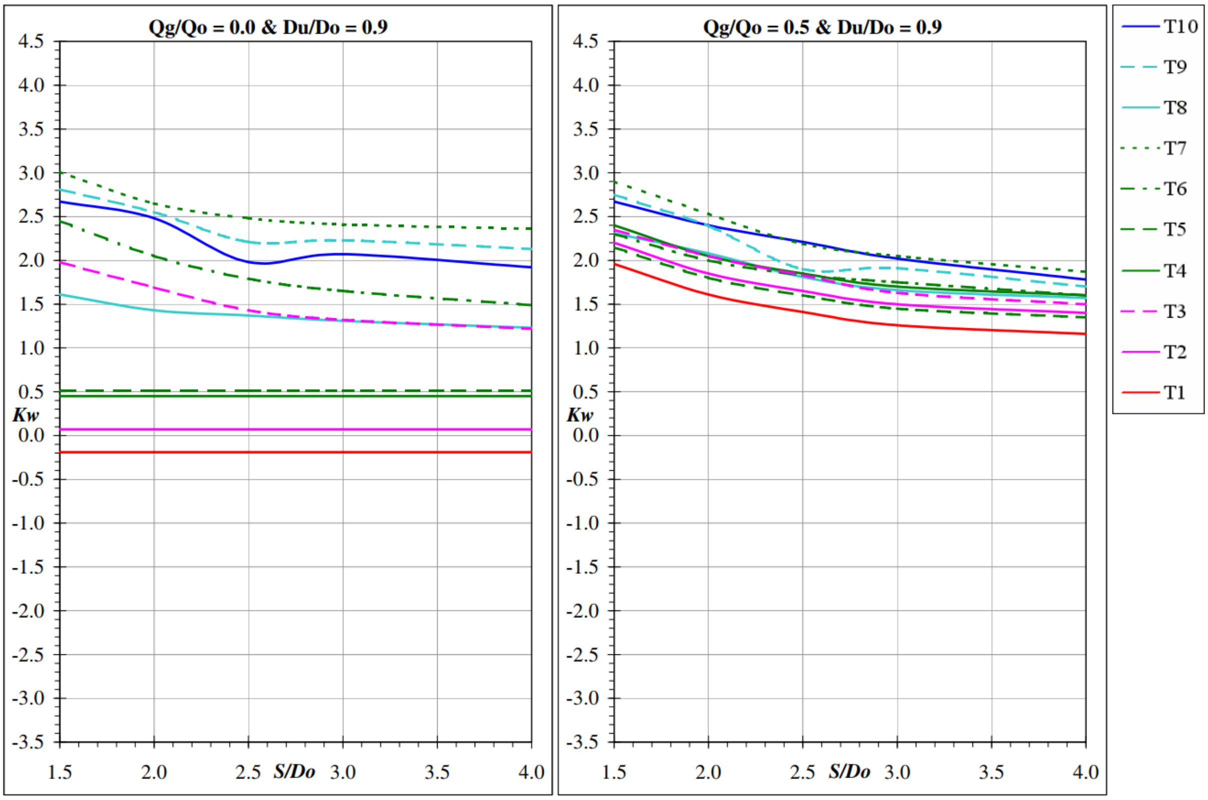
Ku Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.6



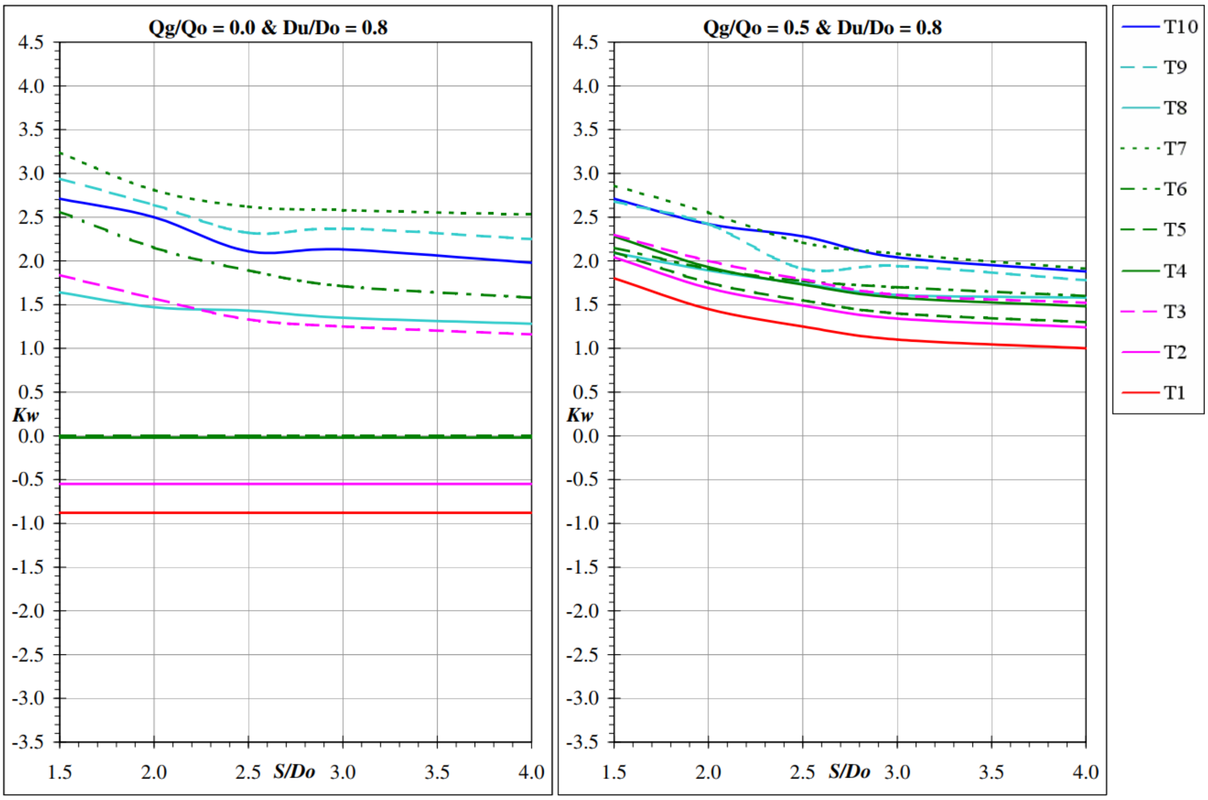
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 1.0



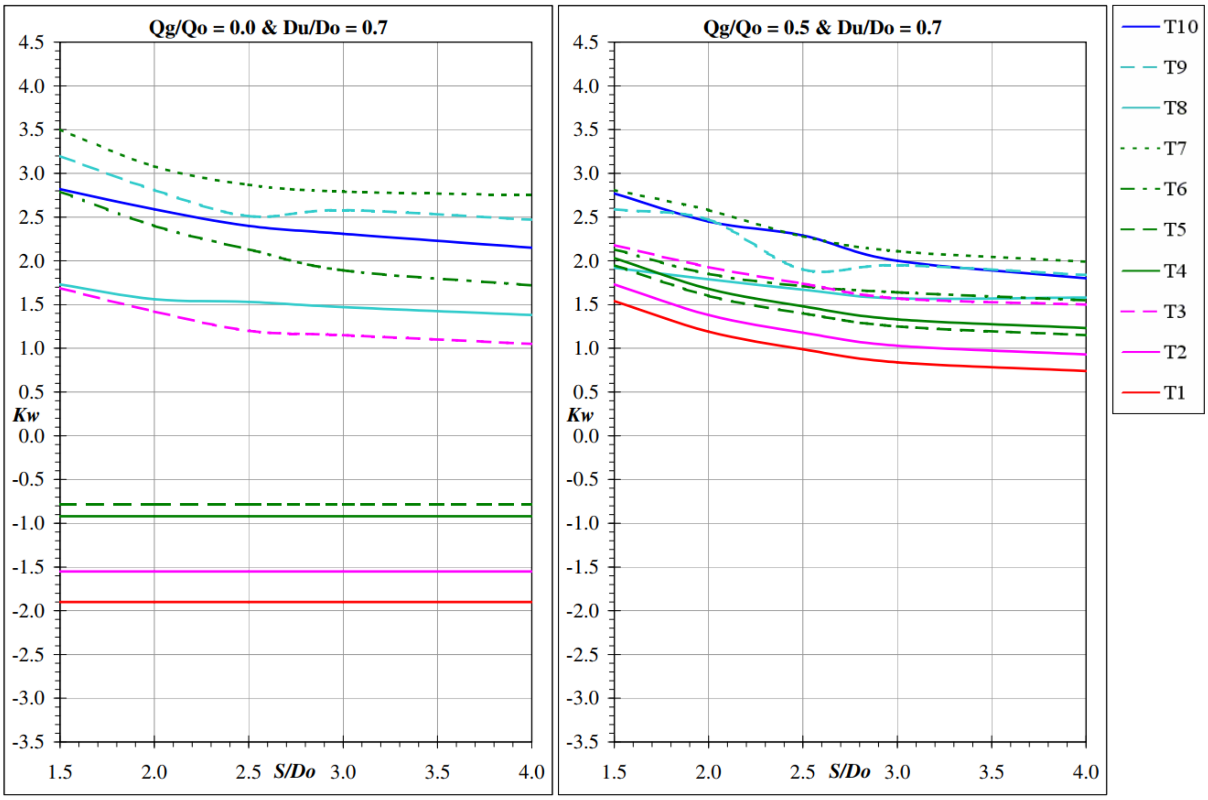
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.9



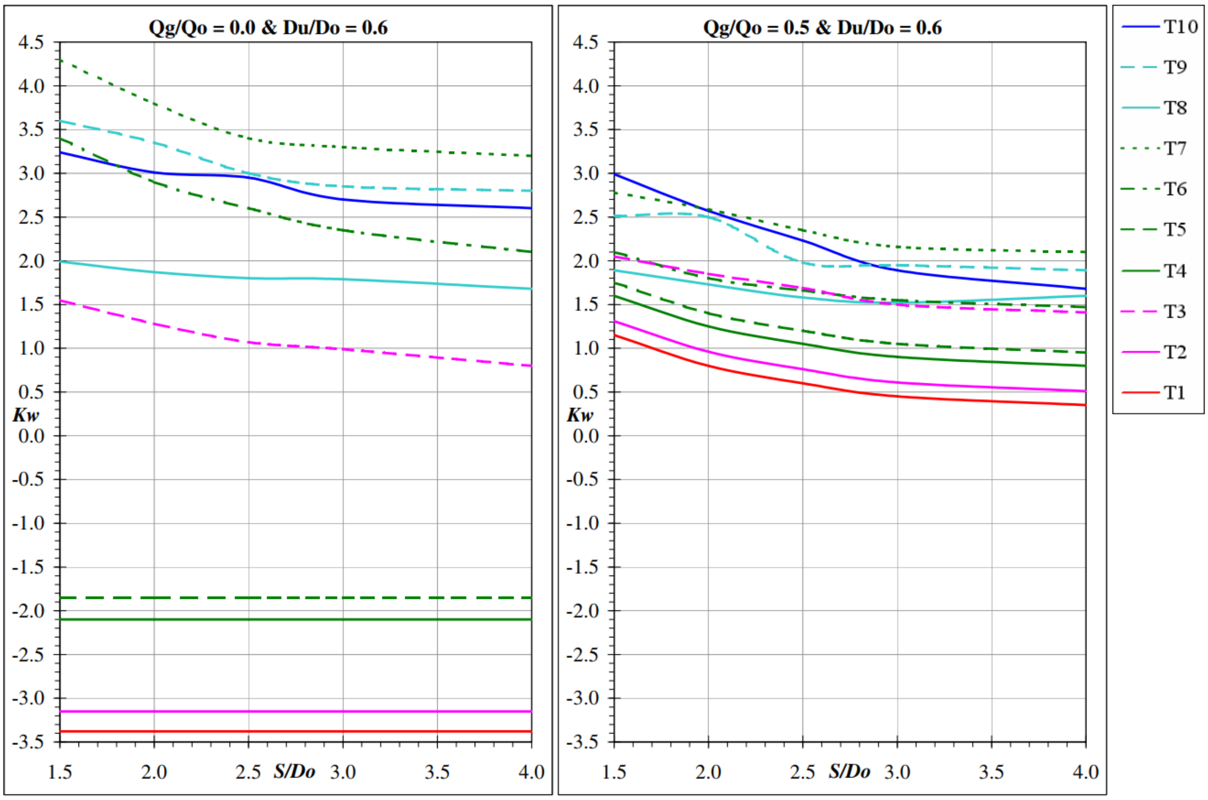
Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.8



Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.7

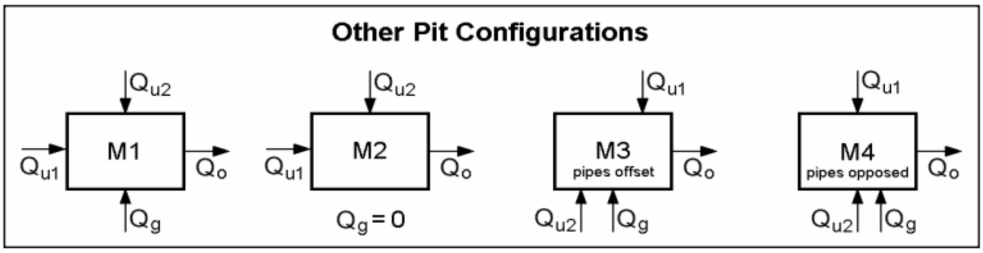


Kw Charts for Through Pits - Qg/Qo = 0.0,0.5 Du/Do = 0.6



27.2.1.1.4.5 Other Chart Data

Both source documents contain other charts not used by *12d Model* , covering the following limited set of four pit configurations, each with two upstream pipes:



Other Config	M1	M2	M3	M4
QUDM Ku Chart #	48	52, 53	49	49
QUDM Kw Chart #	48	52, 53	49	49
ACTDS Ku Chart #	3	4, 5, 6	11	12
ACTDS Kw Chart #	3	5, 6	11	12
ACTDS Pit Type #	4	5	9	10

The charts for M3, M4, and (under certain conditions) M2, suggest *slightly* independent (i.e. *slightly* different) Ku values for each of the two upstream pipes. However, the peak flows in each pipe (determined by *12d Model* via the Rational Method) do not, in general, occur at the same moment in time, and so provide little justification to account for these slight differences. As such, *12d Model* supports only a single Ku (and a single Kw) at each pit. The Rational Method is a statistical design method with much to commend it, but it is not sophisticated enough for these particular charts, which are perhaps better suited to a method based on unsteady flow simulations.

Using the *12d Model* method (of determining a single equivalent upstream pipe), the Ku and Kw values for M1 and M2 may be estimated adequately, if a little conservatively, with the *Ku config* set to "Fair". For M3 and M4, adequate estimations are made regardless of the *Ku config* setting.

For other configurations of multiple upstream pipes – especially those where the jet of each upstream pipe projects wholly into the downstream pipe – *Ku config* settings of "Preferred" or "Good", may be more appropriate.

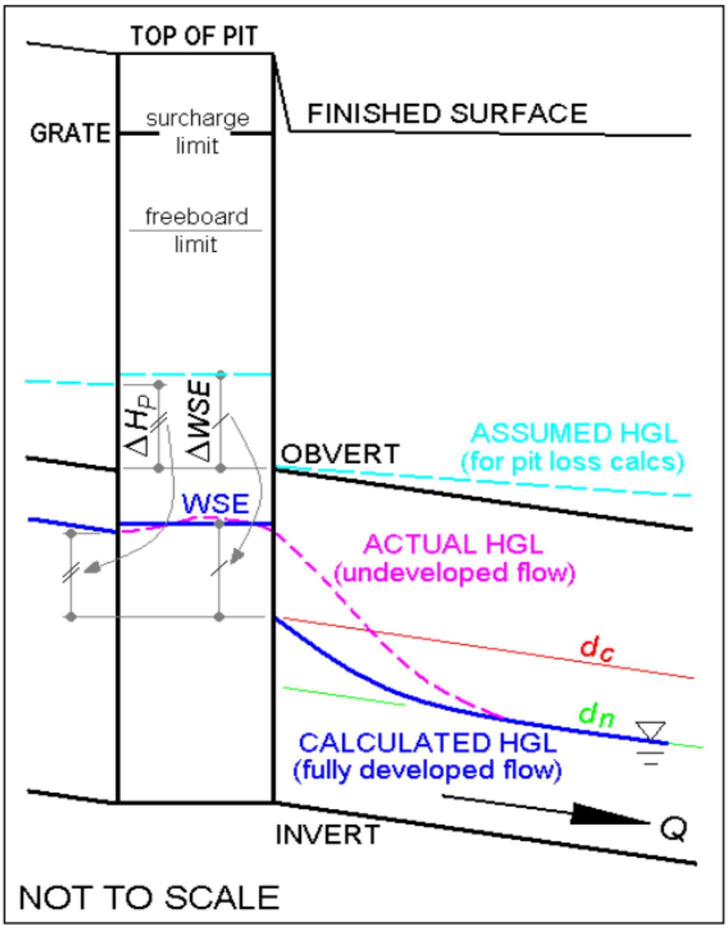
Notes:

The "**Missouri Chart**" used by ***12d Model*** for **Grate Pits**, possibly suggests conservatively high Kw values at low submergence ratios, compared with the evidence suggested by some other empirical and analytical studies. However, due to the typically low velocity head in the downstream pipe, a high Kw value rarely makes a significant difference in Grate Pits.

The "**Hare Charts**" used by ***12d Model*** for **Through Pits**, are all based on square pits with sides twice the diameter of the downstream pipe. Some of the comparable "Missouri Charts" consider pits with other geometries, and typically suggest lower Ku values.

If difficulties are encountered in adequately matching **Ku** and **Kw** values to a particular chart not considered by ***12d Model***, simply set the **Ku** method to "**Direct**", and enter the **chart values manually**. Alternatively, consider contacting the author (email: owen.thornton@12d.com) with information about the chart in question.

27.2.1.1.4.6 Ku and Kw for Part-full Flow and/or Extreme Submergence Ratios



An Example of Part-full Flow

Strictly speaking, the chart data are only applicable to pipes flowing full and under pressure. For pipes flowing part-full through pits, it is most common to assume reduced magnitudes of **ΔHp** and **ΔWSE**, which immediately questions the validity of the assumption that the head changes are proportional to the (higher, part-full) velocity head. Some of the current Australian design manuals provide estimation procedures for these uncertain cases, but they can often result in ***increased*** magnitudes of **ΔHp** and **ΔWSE**. In an attempt to provide a compromise, ***12d Model*** employs a procedure to ensure the magnitudes are neither increased nor reduced. At those pits where the downstream pipe flows part-full, ***12d Model*** determines **Ku** and **Kw** by assuming the **HGL** to be at the ***obvert*** of the pipe (with **ΔHp** and **ΔWSE** based on the full pipe velocity head). Once the head changes are determined in this way, they are applied from the calculated **HGL** in the downstream pipe, ***not*** the pipe obvert.

The chart data for **Grate Pits** give **Kw** values for **S/Do** ranging from 1.5 to 7.0, and for **Through Pits** give **Ku** and **Kw** values for S/Do ranging from 1.5 to 4.0. In ***12d Model***, the chart data are assumed to be applicable for all S/Do values greater than or equal to 1.0, with Ku and Kw extending horizontally beyond the chart limits, when plotted against S/Do. With the "**obvert assumption**" outlined above for part-full flow, it is only ever a ***negative*** Kw value that may ***potentially*** cause S/Do to be calculated less than 1.0. Since this situation is far enough outside the range of the charts to be deemed "in doubt", ***12d Model*** handles such instances by simply (and conservatively) increasing the **Ku** and **Kw** values, so as to give S/Do equal to 1.0.

27.2.1.1.4.7 Ku Methods for Culvert Inlets

For a **link** that is a **pipe** or **box culvert**, ***12d Model*** can calculate a **Ku** value to give the required loss in pressure head through the culvert entrance.

The **Ku** value is the greater of the two values determined from consideration of the culvert under **inlet** and **outlet control**.

The user need only set the **Ku** method to one of the **33 different methods** applicable to culverts, as shown in the table below.

el d	HDS5 Chart No.	HDS5 Chart Scale	*Inlet Control Unsubmerged* Form	 K	 M	*Inlet Control Submerged* c	 Y	*Inlet Control* F	*Outlet Control* Ke
e Culvert Inlet - Concrete; Square Edge with Headwall	1	1	1	0.0098	2.000	0.03980	0.670	-0.5	0.5
e Culvert Inlet - Concrete; Socket End with Headwall	1	2	1	0.0018	2.000	0.02920	0.740	-0.5	0.2
e Culvert Inlet - Concrete; Socket End Projecting	1	3	1	0.0045	2.000	0.03170	0.690	-0.5	0.2
e Culvert Inlet - CMP; Headwall	2	1	1	0.0078	2.000	0.03790	0.690	-0.5	0.5
e Culvert Inlet - CMP; Mitred to Slope	2	2	1	0.0210	1.330	0.04630	0.750	+0.7	0.7
e Culvert Inlet - CMP; Projecting	2	3	1	0.0340	1.500	0.05530	0.540	-0.5	0.9
e Culvert Inlet - Beveled ring 45°	3	A	1	0.0018	2.500	0.03000	0.740	-0.5	0.2
e Culvert Inlet - Beveled ring 33.7°	3	B	1	0.0018	2.500	0.02430	0.830	-0.5	0.2
e Culvert Inlet - Concrete; Tapered Inlet Throat	55	1	2	0.5340	0.555	0.01960	0.900	-0.5	0.2
e Culvert Inlet - CMP; Tapered Inlet Throat	55	2	2	0.5190	0.640	0.02100	0.900	-0.5	0.2
c Culvert Inlet - 30° to 70° Wingwalls	8	1	1	0.0260	1.000	0.03470	0.810	-0.5	0.4
c Culvert Inlet - 90° Headwall or 15° Wingwalls	8	2	1	0.0610	0.750	0.04000	0.800	-0.5	0.5
c Culvert Inlet - 0° Wingwalls (Extension of Sides)	8	3	1	0.0610	0.750	0.04230	0.820	-0.5	0.7
c Culvert Inlet - 45° Wingwalls; d=D/24 Top Bevel	9	1	2	0.5100	0.667	0.03090	0.800	-0.5	0.2
c Culvert Inlet - 18° to 33.7° Wingwalls; d=D/12 Top Bevel	9	2	2	0.4860	0.667	0.02490	0.830	-0.5	0.2
c Culvert Inlet - 90° Headwall; 20mm Chamfers	10	1	2	0.5150	0.667	0.03750	0.790	-0.5	0.2
c Culvert Inlet - 90° Headwall; 45° Bevels	10	2	2	0.4950	0.667	0.03140	0.820	-0.5	0.2
c Culvert Inlet - 90° Headwall; 33.7° Bevels	10	3	2	0.4860	0.667	0.02520	0.865	-0.5	0.2
c Culvert Inlet - 45° Skewed Headwall; 20mm Chamfers	11	1	2	0.5450	0.667	0.04505	0.730	-0.5	0.2
c Culvert Inlet - 30° Skewed Headwall; 20mm Chamfers	11	2	2	0.5330	0.667	0.04250	0.705	-0.5	0.2
c Culvert Inlet - 15° Skewed Headwall; 20mm Chamfers	11	3	2	0.5220	0.667	0.04020	0.680	-0.5	0.2
c Culvert Inlet - 10° to 45° Skewed Headwall; 45° Bevels	11	4	2	0.4980	0.667	0.03270	0.750	-0.5	0.2
c Culvert Inlet - 45° Non-offset Wingwalls; 20mm Top Chamfer	12	1	2	0.4970	0.667	0.03390	0.803	-0.5	0.2
c Culvert Inlet - 18.4° Non-offset Wingwalls; 20mm Top Chamfer	12	2	2	0.4930	0.667	0.03610	0.806	-0.5	0.2
c Culvert Inlet - 30° Skew; 18.4° Non-offset Wingwalls; 20mm Top Chamfer	12	3	2	0.4950	0.667	0.03860	0.710	-0.5	0.2
c Culvert Inlet - 45° Offset Wingwalls; d=D/24 Top Bevel	13	1	2	0.4970	0.667	0.03020	0.835	-0.5	0.2
c Culvert Inlet - 33.7° Offset Wingwalls; d=D/12 Top Bevel	13	2	2	0.4950	0.667	0.02520	0.881	-0.5	0.2
c Culvert Inlet - 18.4° Offset Wingwalls; d=D/12 Top Bevel	13	3	2	0.4930	0.667	0.02270	0.887	-0.5	0.2
c Culvert Inlet - Tapered Inlet Throat	57	1	2	0.4750	0.667	0.01790	0.970	-0.5	0.2
c Culvert Inlet - Side Tapered Inlet Throat; Less Favourable Edges	58	1	2	0.5600	0.667	0.04460	0.850	-0.5	0.2
c Culvert Inlet - Side Tapered Inlet Throat; More Favourable Edges	58	2	2	0.5600	0.667	0.03780	0.870	-0.5	0.2
c Culvert Inlet - Slope Tapered Inlet Throat; Less Favourable Edges	59	1	2	0.5000	0.667	0.04460	0.650	-0.5	0.2
c Culvert Inlet - Slope Tapered Inlet Throat; More Favourable Edges	59	2	2	0.5000	0.667	0.03780	0.710	-0.5	0.2

where

HW	=	Headwater depth above IL [m]
IL	=	Invert level at culvert entrance [m]
HGLo	=	HGL level *inside* culvert entrance [m]
U	=	SI units factor = 1.811
Q	=	Design flow rate per culvert barrel [cumecs]
D	=	Height of culvert barrel [m]
A	=	Cross-sectional area of culvert barrel [m^2]
S	=	Slope of culvert barrel [m/m]
d_c	=	Critical flow depth in culvert [m]
V_c	=	Critical flow velocity in culvert [m/s]
V_f	=	Full pipe velocity in culvert = Q/A [m/s]
g	=	Acceleration due to gravity [m/s/s]
K	=	Coefficient [-]
M	=	Coefficient [-]
c	=	Coefficient [-]
Y	=	Coefficient [-]
F	=	Coefficient [-]
Ke	=	*Energy-head* loss coefficient [-]
Ku	=	*Pressure-head* change coefficient [-]

Inlet Control:	**Unsubmerged Form 1:**	$HW/D = (d_c + V_c^2/2g) / D + \mathbf{K} [U.Q / (A\sqrt{D})]^{\mathbf{M}} + \mathbf{F}.S$	... $U.Q / (A\sqrt{D}) < 3.5$
	Unsubmerged Form 2:	$HW/D = \mathbf{K} [U.Q / (A\sqrt{D})]^{\mathbf{M}}$	... $U.Q / (A\sqrt{D}) < 3.5$
	Submerged:	$HW/D = \mathbf{c} [U.Q / (A\sqrt{D})]^2 + \mathbf{Y} + \mathbf{F}.S$	... $U.Q / (A\sqrt{D}) > 4.0$
		$Ku = (HW + IL - HGLo) . 2g / V_f^2$	

Outlet Control:	$Ku = \mathbf{Ke} + 1.0$

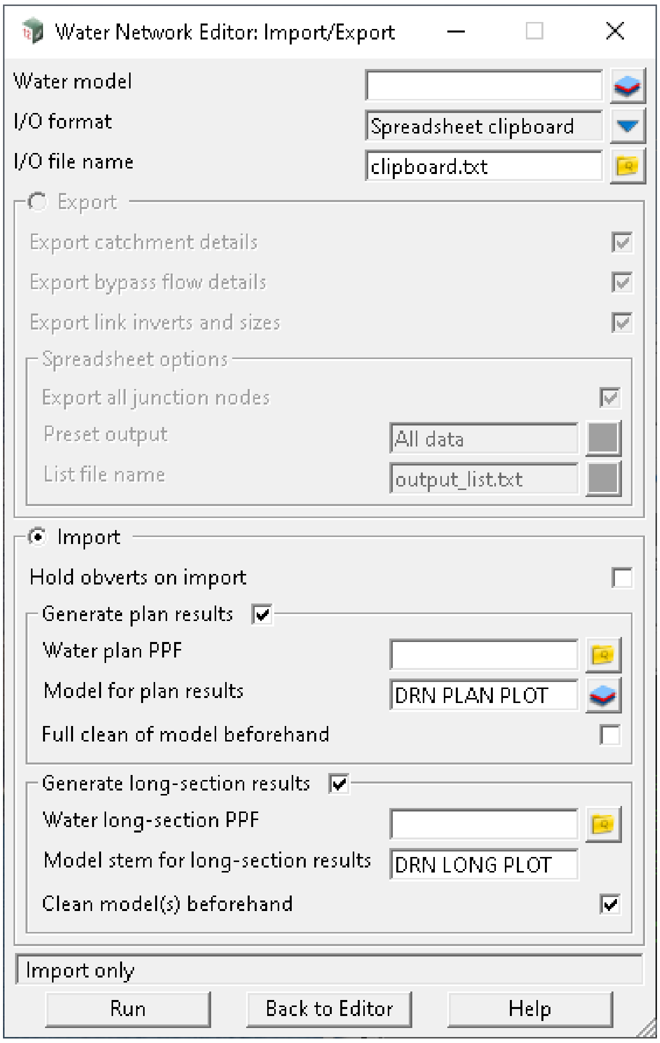
Notes:

1. A transition zone exists between the unsubmerged and submerged cases under inlet control. Results are obtained within this zone, via linear interpolation between the results at the limit of each case.
2. Technically, HW applies to the ***Total Energy Line*** (TEL), and not the *Hydraulic Grade Line* (HGL). However, the difference between the TEL and HGL in the upstream channel (i.e. the velocity head in the channel) is typically small, and is most commonly assumed to be negligible.
3. Culvert slope, S, is not squared in the these formulae ... the source document (p 192, eqn 26 & 28) refers to "NOTE 2 ", **not** "S to the power of 2".

27.2.1.1.4.8 Design Checks

Spreadsheet reports may be generated quickly and easily, to allow checking and auditing of the Ku and Kw values calculated by ***12d Model***

From the Import/Export panel of the Drainage Network Editor, simply Export to the Spreadsheet clipboard, using the Customised list file supplied in the installed Library folder (as shown below), and paste the results into your spreadsheet.



Standard "Customised list file" : $LIB\drainage_ku_calc_check.txt

header

Pit	Ku	Kw	V'head	P'head Loss	WSE Loss	Ku	Ku	Qg/Qo	Grate Flow	Pipe Flow	Du/Do	S/Do	Chart(s)

header

Name				(Ku.V'head)	(Kw.V'head)	Method	Config	Ratio	Deflection	Deflection	Ratio	Ratio	Used

header

(-)	(-)	(-)	(m)	(m)	(m)	(-)	(-)	(-)	(deg)	(deg)	(-)	(-)	(-)

pit data
pit name
calculated ku
calculated kw
pipe data
calculated velocity head
pit data
calculated pit pressure head loss
calculated pit wse loss
calculated ku method
calculated ku config
calculated ku grate flow ratio
calculated ku grate flow angle
calculated ku pipe flow angle
calculated ku diameter ratio
calculated ku submergence ratio
calculated ku chart

Sample Ku & Kw Design Check Report :

Pit Name	Ku	Kw	V'head	P'head Loss (Ku.V'head)	WSE Loss (Kw.V'head)	Ku Method	Ku Config	Qg/Qo Ratio	Grate Flow Deflection	Pipe Flow Deflection	Du/Do Ratio	S/Do Ratio	Chart(s) Used
(-)	(-)	(-)	(m)	(m)	(m)	(-)	(-)	(-)	(deg)	(deg)	(-)	(-)	(-)
1.6H	1.11		0.21	0.23	0.23	Inlet Headwall							Inlet Control
2.1S	1.83		0.07	0.13	0.13	Ku,Kw via Charts	Preferred	0.50		27.7	0.72	1.56	T2/T4
2.2S	7.37		0.06	0.48	0.48	Ku,Kw via Charts		1.00	90.0			1.93	G2
3.1G	0.72		0.57	0.41	0.41	Ku,Kw via Charts	Preferred	0.08		30.2	1.00	1.88	T2/T4
3.2G	0.42		0.49	0.21	0.21	Ku,Kw via Charts	Preferred	0.14		0.0	0.89	1.91	T1
3.4M	0.82	0.83	0.36	0.29	0.30	Ku,Kw via Charts	Good	0.00		48.3	1.00	2.74	T5/T8
3.8M	0.55		0.19	0.11	0.11	Ku,Kw via Charts	Good	0.00		35.5	1.00	2.83	T2/T5
3.9S	1.07		0.17	0.18	0.18	Ku,Kw via Charts	Preferred	0.26		29.5	1.00	3.48	T2/T4
3.10G	0.34		0.50	0.17	0.17	Ku,Kw via Charts	Good	0.00		25.9	1.00	4.79	T2/T5
3.11M	1.73	1.88	0.23	0.40	0.44	Ku,Kw via Charts	Fair	0.00		48.7	1.00	2.46	T6/T9
3.12G	0.83		0.24	0.20	0.20	Ku,Kw via Charts	Good	0.23		11.3	1.00	3.88	T1/T2
3.13G	1.59	1.63	0.17	0.27	0.28	Ku,Kw via Charts	Preferred	0.53	37.0	63.5	1.00	3.95	G2/T4/T8
3.14G	5.86		0.04	0.23	0.23	Ku,Kw via Charts		1.00	0.0			1.76	G1

Continue to 27.2.1.2 Ku - Node Pressure Losses or return to 27.2.3 Rational Method Hydraulics.

27.2.1.2 Ku - Node Pressure Losses

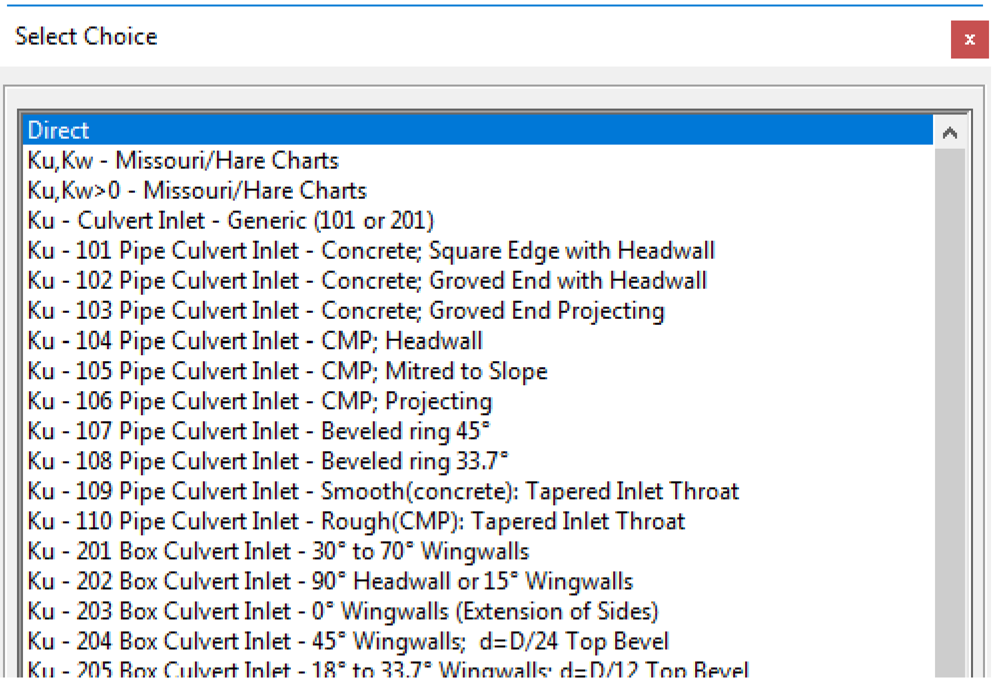
The node loss **Ku** is used to model the pressure losses through the nodes, and inlet control on culvert inlets.

See

27.2.1.2.1 Ku method
27.2.1.2.2 Ku config

27.2.1.2.1 Ku method

:



Direct - user entered Ku (in the **Ku** field)

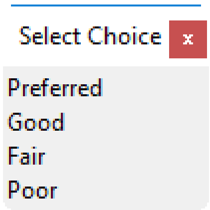
Ku, Kw via charts (may be negative), or

Ku, Kw > 0 via charts where all negative values are changed to zero.

The remaining methods specify various headwall types for culverts. These will use inlet control curves and backwater energy loss coefficients. For details see 27.2.1.1.3 Ku and Kw Calculations in 12d Model.

Continue to 27.2.1.2.2 Ku config or return to 27.2 Hydraulics.

27.2.1.2.2 Ku config



These settings have no effect for 100% grate flow, straight through and 90° bends. For nodes with other bend angles, they determine the charts to use. The following are guidelines in selecting the Ku config:

- **Preferred** water hits the pipe on the opposite wall where it exits through the pipe,
- **Good** water hits the pipe on the adjacent wall where it exits through the pipe,
- **Fair** water impacts the adjacent wall and exits though the pipe on the opposite wall,
- **Poor** water impacts the opposite wall of the node and exits through the pipe on the adjacent wall.

For additional details see 27.2.1.1.3 Ku and Kw Calculations in 12d Model.

The settings are repeated for the minor and major analysis. The minor major flag is set at analysis time.

Continue to 27.2.1.3 Node Inlet Configurations or return to 27.2 Hydraulics.

27.2.1.3 Node Inlet Configurations

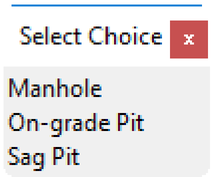
A node has a **Inlet configuration type** which is used to determine the node inlet capacities if overland flow routes are selected.

Inlet capacity equations and curves are used to model how the inlet behaves (see 27.2.1.3.1 Inlet Capacity Equation).

Fixed inlet capacities values may be set in the ***drainage.4d*** file while inlet capacities curves must be included in the ***drainage_startup.xpx*** file. The range of available curves for ***12d Model*** to choose from are set in the ***drainage.4d*** file and the curves are determined using the node type, road grade and road crossfall.

The choices for the inlet configuration are:

Inlet configuration choice box



Manhole (maintenance hole)

Nodes of type **Manhole** will **not receive bypass flow** and cannot have catchments assigned to them.

On-Grade Pit

On-grade Pit nodes are nodes where the water will flow past the node if not captured (velocity and momentum are important for these inlets). **Approach flow**, **road grade** and **road crossfall** generally determine the inlet capacity equations/curves.

So **on-grade pits** may require **road grade** and/or crossfall data to determine for inlet capacity. These may be entered manually or calculated using the road strings.

A **setout string** link is required to **measure road grade.**

If **road crossfall** measurement is needed then the **centre string** is also required.

Sag Pit:

Sag Pit inlets are inlets where the **water ponds at the surface** rather than flowing past. If a Sag inlet has a catchment string then the overflow depth and volume are calculated.

For a **Sag Pit** there is **only one inlet capacity curve**/equation **per inlet** and the ponding depth is used to determine the inlet capacity.

Sag Pits are usually located at sag locations where the water will pond around the node if there is not enough inlet capacity. Generally the water will stop at these locations and flow into the Sag pit inlet.

Notes:

1. For information on inlet capacity calculations, see 27.2.1.3.1 Inlet Capacity Equation
2. To display the Inlet curves, see 17.3.13.11 Write Inlet Curves to Model.

27.2.1.3.1 Inlet Capacity Equation

The **inlet capacity equation** is built up with three optional components:

(a) **single polynomial** - see 27.2.1.3.1.3 Single Polynomial

(b) **curve polynomial** - see 27.2.1.3.1.4 Ongrade Inlet Curve Polynomials

(c) **curve coordinates** - see 27.2.1.3.1.5 Inlet Curve Coordinates

Generally, only one of the three components is used for each node type but they may all be used if desired.

There are also two multipliers:

(d) **inlet efficiency (choke factor)** - see 27.2.1.3.1.1 Inlet Efficiency

(e) **inlet multiplier** - see 27.2.1.3.1.2 Inlet Multiplier

The full equation for inlet capacity is:

inlet capacity = **inlet efficiency** * **inlet multiplier** *
[**single polynomial** + **curve multiplier** * (**curve polynomial** + **curve coordinates**)]

27.2.1.3.1.1 Inlet Efficiency

An **inlet efficiency** (**choke factor**) is specified in the 17.3.4 Water Network Editor (WNE). An inlet efficiency (choke factor) of 0 would stop all water from entering the inlet.

27.2.1.3.1.2 Inlet Multiplier

The **inlet multiplier** is specified with a **cap_multi** parameter.

cap_multi

inside a **cap_curve_grade** block or **cap_curve_sag** block, the **curve inlet capacity** is multiplied by this value

outside a **cap_curve_grade** or **cap_curve_sag**, the total inlet capacity is multiplied by this value

See

27.2.1.3.1.3 Single Polynomial

The **inlet capacity** for an inlet may be specified by a single polynomial equation based on the **approach flow** (**Qa**) This is the most simplistic method and generally used for percentage capture or fixed capture rates.

inlet capacity = **cap_fixed + cap_percent*0.01*Qa + cap_coeff*Qa^cap_power**

Example
This example creates an inlet with a fixed inlet capacity of 0.010 (cms or cfs).

```
Manhole "fixed inlet capacity" {
        cap_fixed 0.010
}
```

Default values

cap_multi   = 1.0

cap_fixed   = 0.0

cap_percent = 0.0

cap_coeff   = 0.0

cap_power   = 1.0

For **on-grade inlets**:

(a) the inlet capacity is given by a series of named **polynomial equations** that applied over **road grade** and **cross fall threshold** values. See 27.2.1.3.1.4 Ongrade Inlet Curve Polynomials).

or

(b) the inlet capacity is given by a series of named **curves** in **Qapproach** and **Qin**. See 27.2.1.3.1.5.1 Curve Coordinates - On Grade Inlets

For **sag inlets**:

(a) the inlet capacity is given by one **polynomial**. See 27.2.1.3.1.3 Single Polynomial).

or

(b) the inlet capacity is given by a **curve** in **Depth** and **Qin**. See 27.2.1.3.1.5.1 Curve Coordinates - On Grade Inlets

27.2.1.3.1.4 Ongrade Inlet Curve Polynomials

For **on-grade inlets**, the polynomial parameters may **change** with **road grade** and **cross fall** threshold values.

The formula is the same for cap_fixed, cap_percent, cap_coeff and cap_power.

Note that each curve may have its **own curve multiplier** specified with a cap_multi parameter (discussed below). Some hydraulic model tests have their on grade inlet results converted to polynomial equations.

Example
This example creates an inlet where the inlet capacity polynomials have been determined for two road grades (1% and 3%).

Note that the **road_grade 0.0** is used for the 1% road grade. Since this is the flattest road grade curve we have calculated we will start using it at a road grade of 0%.

Note that the second curve "NJ G3" will be used when the road grade reaches 2.5. The threshold value where ***12d Model*** should change to the next curve is generally slight less than the road grade from the source.

```
Node "On grade pit type NJ" {
        cap_config G

        cap_curve_grade    "NJ 1G" {
                road_grade  0
                cap_coeff  0.215
                cap_power  0.67
        }

        cap_curve_grade    "NJ 3G" {
                road_grade  2.5
                cap_coeff  0.24
                cap_power  0.673
        }
}
```

27.2.1.3.1.5 Inlet Curve Coordinates

For **on-grade** and **sag inlets**, the **inlet capacity** may be determined by entering coordinates along the inlet capacity curve. These coordinates are usually obtained from hydraulic model studies or analytical methods such as HEC-22.

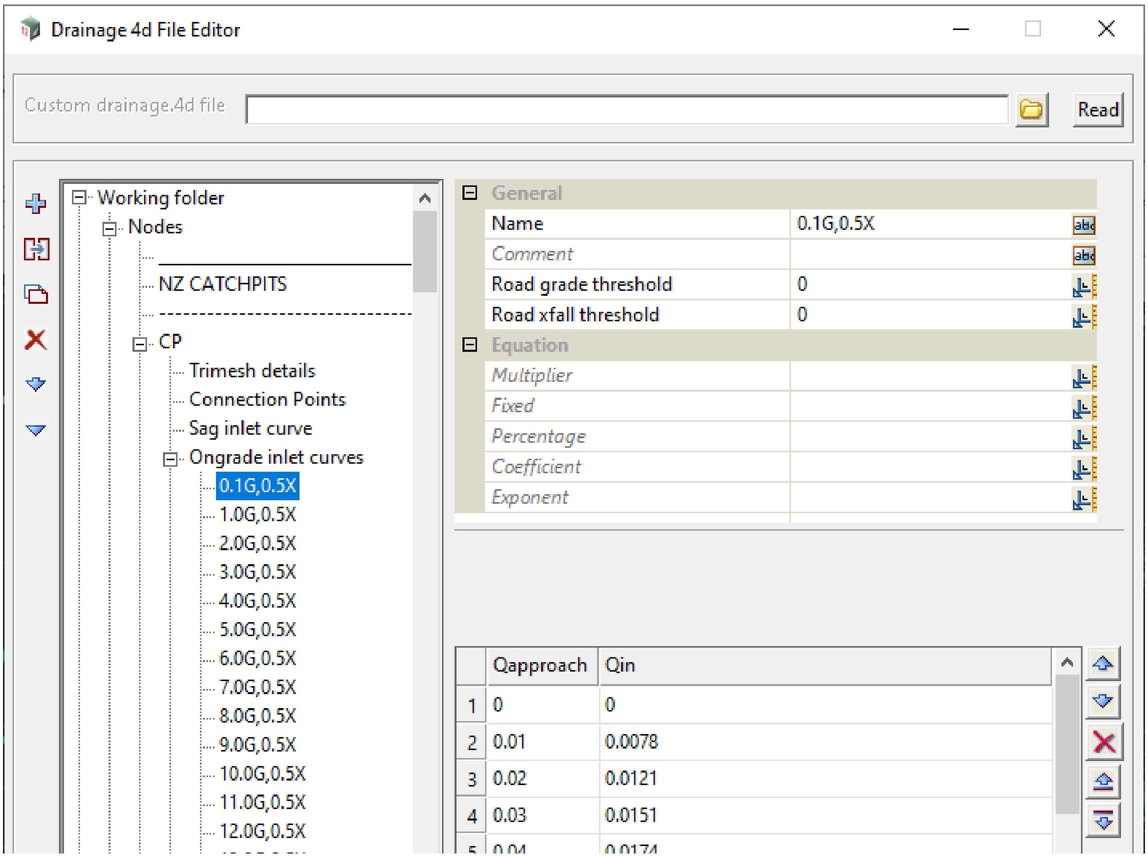
See

27.2.1.3.1.5.1 Curve Coordinates - On Grade Inlets
27.2.1.3.1.5.2 Curve Coordinates - Sag Inlets

27.2.1.3.1.5.1 Curve Coordinates - On Grade Inlets

For **on grade inlets**, the curve coordinates are **Qapproach** and **Qin**, and the curves may change with road grade and cross fall threshold values. These inlet capacity curves are never extrapolated.

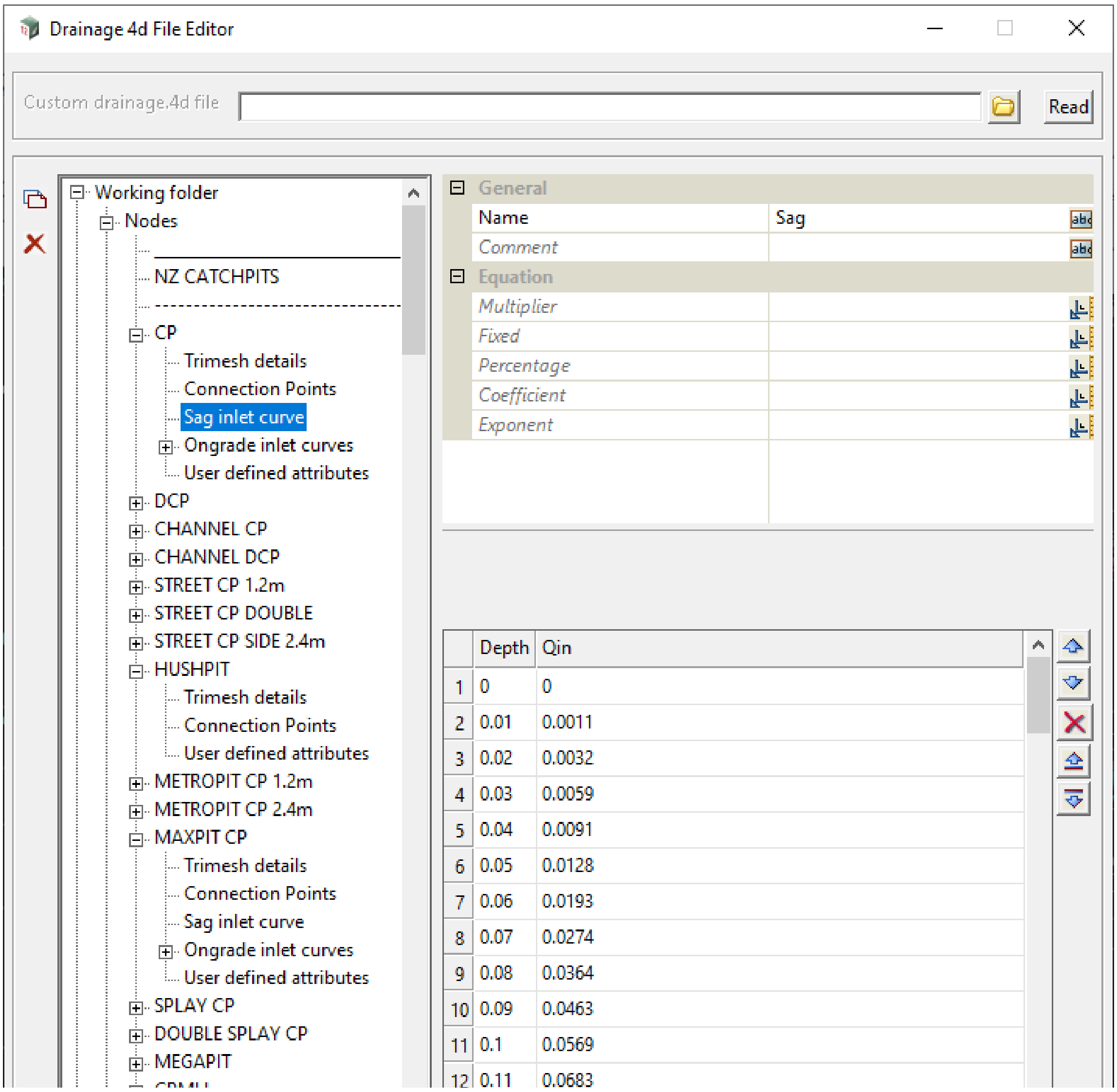
Example



27.2.1.3.1.5.2 Curve Coordinates - Sag Inlets

For **sag inlets**, the curve coordinates are **Depth** (base units) and **Qin**, and there is only one curve. The curve has a curve multiplier specified with a cap_multi parameter (discussed below).

Example



Continue to 27.2.1.4 Catchments for Bypass or return to 27.2 Hydraulics.

27.2.1.4 Catchments for Bypass

Bypass flow involves the calculation of node inlet capacity for **on-grade** or **sag inlets**.

These capacities are based on the **node type** and may use either **ponding depths** (**sag** inlets) or on the **road grade and/or crossfall upstream** of the inlet **(on grade** inlets). See 27.2.1.3 Node Inlet Configurations.

The ***Bypass*** *subtab* is used when **overland flow** is to be **analysed**.

The **overland flow model** is specified on the **GLOBAL >Utility Models** subtab (17.3.4.6.1.2 GLOBAL >Utility Models subtab.

The calculations are enabled on the **Main** tab of the **Water Network Editor Storm Analysis** panel, using the **Consider bypass flow** tick box (see 17.3.4.6.14.1 Analysis >Main tab). When this tick box is not selected, the inlets will have unrestricted inlet capacity.

The **Inlet config** setting on the **Node >Hydraulics** subtab is the main control for inlet capacity calculations (see 17.3.4.6.4.3 Node > Hydraulics subtab).

> **Note:** A **manhole** is **NOT** an inlet. It has no inlet capacity, cannot be linked to catchment strings and cannot be used as a bypass inlet.See 27.2.1.3 Node Inlet Configurations.

SAG and **On-grade** inlets have unrestricted inlet capacity when there is no **Bypass node** value on this tab. Exception: The dynamic analysis will always calculate inlet capacity for basin nodes set as a sag inlet.

For **Drainage 2d** calculations, the inlets inside the 2d extent **DO NOT** use the **Bypass node**. Inlets connected via the sump connection have unrestricted inlet capacity and those connected via the grate will use inlet capacity calculations.

When **inlet capacity is not unrestricted**, the inlet capacity must be defined in the *drainage.4d* file. If it is not defined for the node type selected, the inlet capacity is zero.

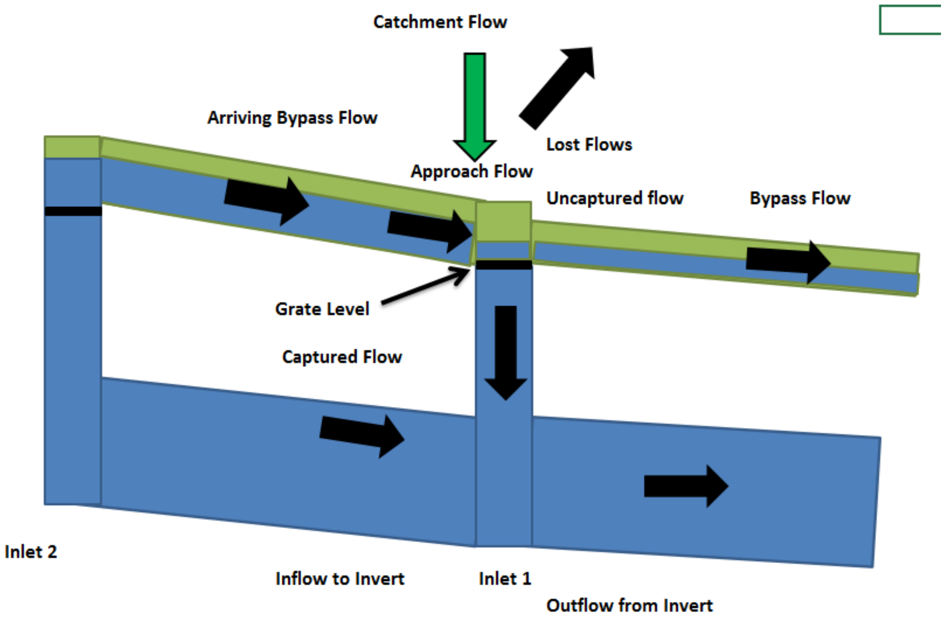
Bypass flow strings are used to trigger the bypass calculations in the water network editor and are used as a centre line for **flooded width** calculations.

See

27.2.1.4.1 Catchment flows onto the Grate of an Inlet
27.2.1.4.2 Catchment Flows into Approaching Bypass
27.2.1.4.3 Adding Bypass Nodes
27.2.1.4.4 Catchments for Bypass Tab

27.2.1.4.1 Catchment flows onto the Grate of an Inlet

Catchment flows are traditionally modelled as arrives onto the grate of an inlet.



Approach flow = Arriving bypass flow + Local Catchment flow

Uncaptured flow = Approach flow - Captured flow

Bypass flow = the hydraulics of the bypass channel determines the bypass flow

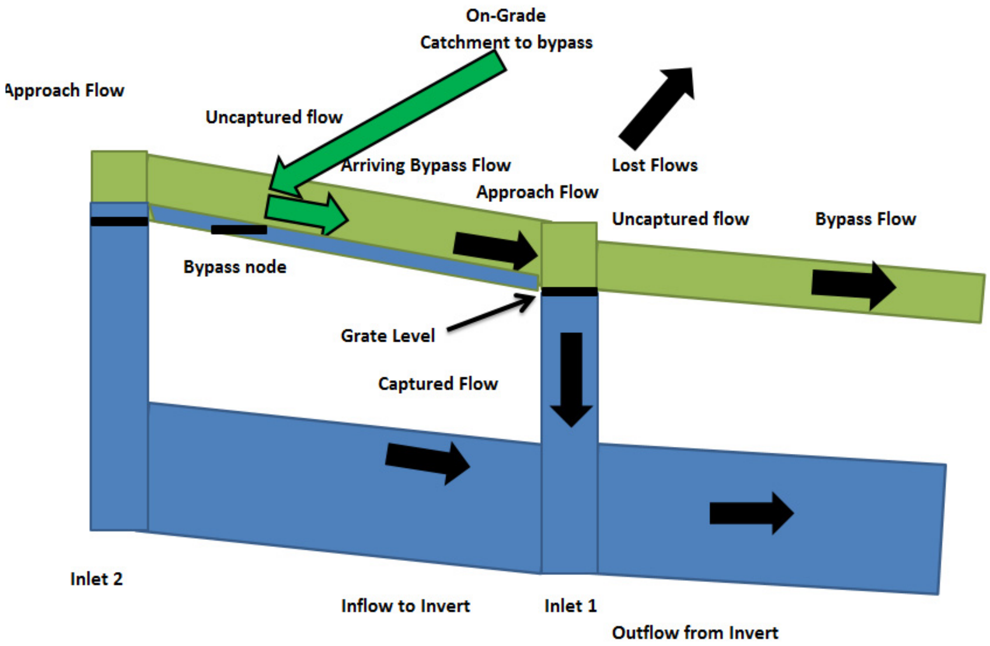
Lost flow = an error condition occurring when the surface HGL exceeds the top all the connected bypass channels, where they exist, or exceeding the grate elevation when bypass is not enabled.

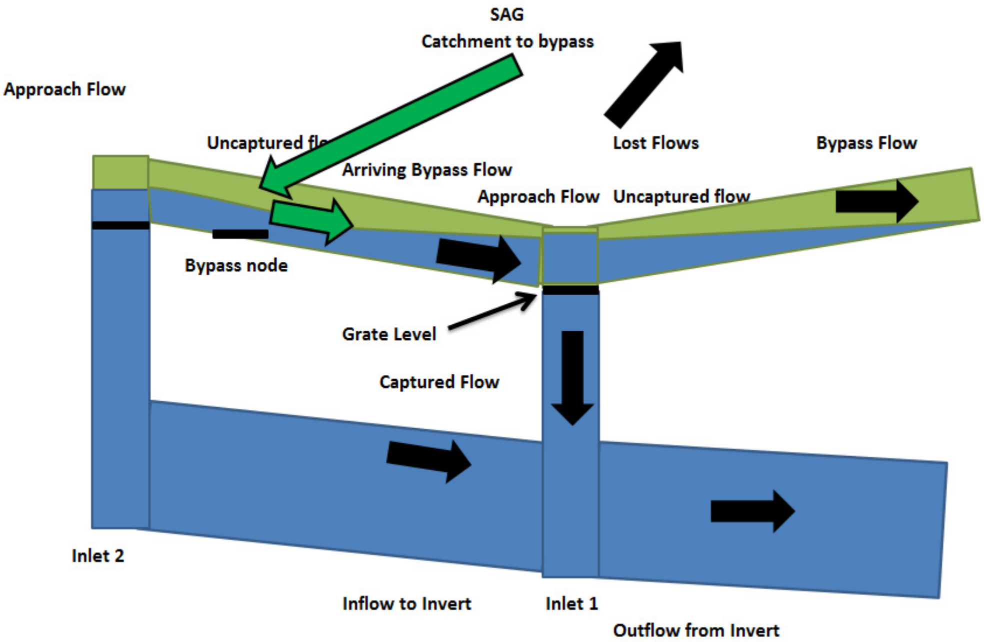
Continue to 27.2.1.4.2 Catchment Flows into Approaching Bypass or return to 27.2.1.4 Catchments for Bypass or 27.2 Hydraulics.

27.2.1.4.2 Catchment Flows into Approaching Bypass

In the diagram in 27.2.1.4.1 Catchment flows onto the Grate of an Inlet the catchment flow are shown as entering immediately upstream of the inlet and are not included in the flows for the approaching bypass unless the **Catchments for bypass** tick box is selected on the 17.3.4.6.1.1.3 GLOBAL > Main subtab - Dynamic Stormwater tab.

Including the catchment flows in the approaching bypass channels will provide a better estimate of the depths, widths and velocities in these links.





Continue to 27.2.1.4.3 Adding Bypass Nodes or return to 27.2.1.4 Catchments for Bypass or 27.2 Hydraulics.

27.2.1.4.3 Adding Bypass Nodes

The best solution would be to create a **Bypass node** along the upstream bypass link to receive these catchment flows The distance between the upstream inlet (inlet 2) and the bypass node would ensure there are no unexpected backwater effects onto the upstream inlet (inlet 2).

It is up to the modeller to decide if this is required. If you do create a bypass node upstream of the inlet, we highly recommend you give it the name of the inlet plus the suffix b (for bypass). This will make your printed reports much easier to understand.

There are three cases where a **bypass** node is **required**:

1. There is **no upstream inlet** (the most upstream inlet).

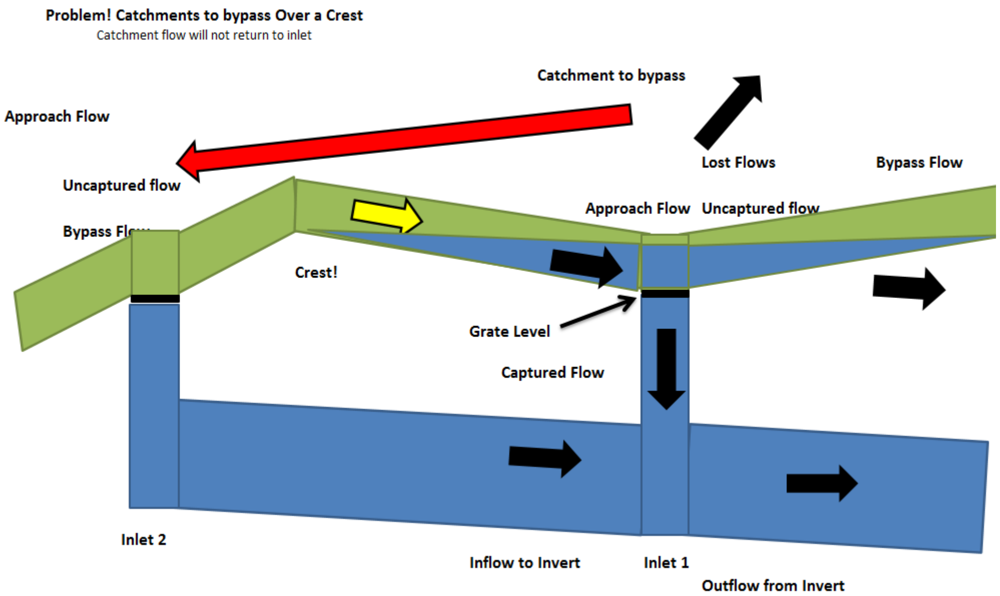
   The bypass node should be positioned just downstream of the crest. This is common.

2. There is a **crest** in the road upstream between the inlet 1 and inlet 2.

   The bypass node should be positioned just downstream of the crest.

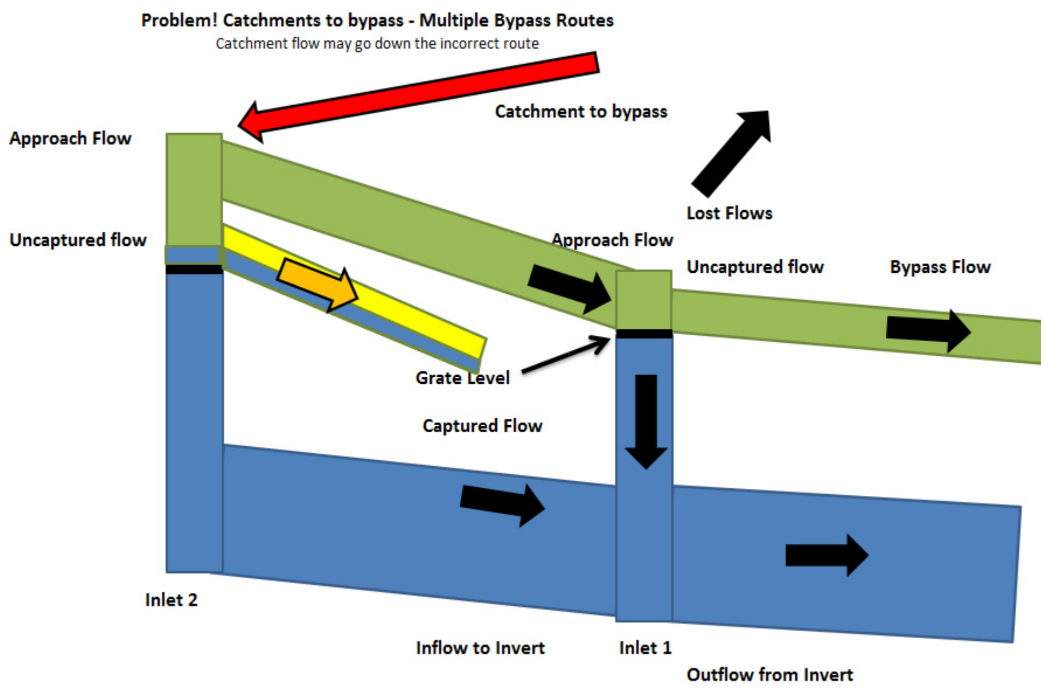
   This happens in scenarios such roadways with small grades, or sawtooth grading or "false grading" to create sag locations.

   The diagram below shows what would go wrong if there was no bypass node to the right of the crest. The catchment flow would go over the crest and not come back (unless the upstream inlet flooded over the crest level).



3. The **upstream inlet has more than 1 bypass string leaving the inlet** (possible but infrequent).

   There would be no guarantee which bypass string the flow would go down. In the example shown the water will go down the path shown with the orange arrow. The bypass node should be positioned just downstream of inlet 2 on the green conduit.



Continue to 27.2.1.4.4 Catchments for Bypass Tab or return to 27.2.1.4 Catchments for Bypass or 27.2 Hydraulics.

27.2.1.4.4 Catchments for Bypass Tab

For 17.3.4.6.3.2 Catchments for Bypass tab.

Select **Set Node Details** to calculate the percentage of flows that are allocated to each of the approaching bypass routes.

The **flow allocation** is divided using the **length of the bypass route** from the **upstream inlet**.

If the catchment shape dictates that the allocation should be different then RB in the select the **Percentage Mode** cell and select **Manual** and type the new percentage. The next time **Set Node Details** is selected the manual percentage is deducted from 100% and the remaining percentage is allocated to remaining routes not marked as Manual.

The percentage of the catchment flow shown will now be added to the upstream end of the bypass link by via the uncaptured flow.

If there are **no upstream inlets** then the grid will be blank.

To obtain flow widths and velocities for these upstream inlets, a **Bypass node** will need to be created. See Bypass nodes - changing bypass shapes, roughness and slope.

Note that if there are multiple bypass routes leaving the upstream inlet the catchment flow will be distributed from the upstream inlet according to the bypass links hydraulic characteristics.

Continue to 27.2.1.4.5 Bypass Shape or return to 27.2.1.4 Catchments for Bypass or 27.2 Hydraulics.

27.2.1.4.5 Bypass Shape

For the **Rational** method, bypass flows (water that could not enter the inlet because of either inlet constrictions or HGL levels) were **always bypassed** to the **Bypass** node so the **bypass shape is not needed** and the ***Bypass Shape*** tab does not appear.

For the **Dynamic Stormwater** methods, a **channel shape is required** so that the HGL levels and the storage effects can be modelled.

If all of the bypass routes have the same shape then you need only the one default shape and it will be used for all routes. However you can enter a shape for every bypass route if desired.

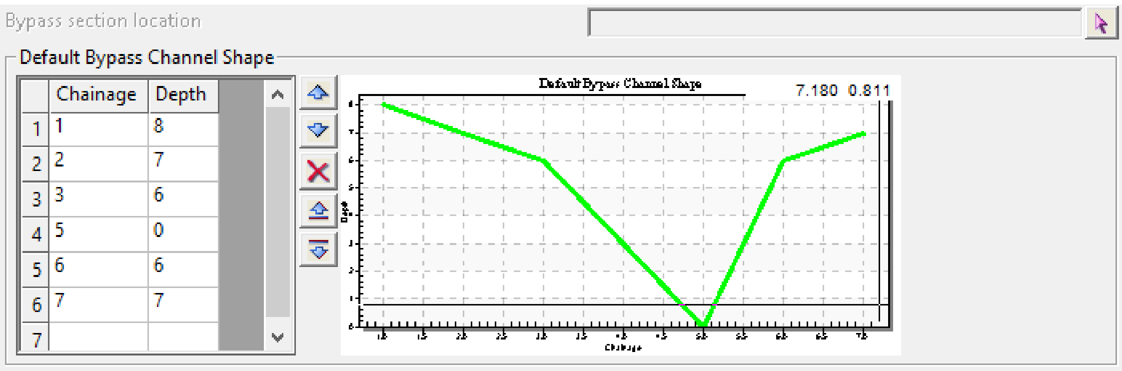
The channel shape may be entered manually values into the (Chainage, Depth) grid, or the values in the grid created by selecting a string (usually drawn beforehand perpendicular to the flow path.

(a) Manually entering data into the (Chainage, Depth) grid

The (chainage, depth) values for the profile of the bypass channel are typed into the (Chainage, Depth) grid, the **Set Node Details** or **Regrade Pipes** button is selected.

The bypass shape is then formed by finding the minimum depth in the Depth column and then subtracting this minimum depth from the all the depth values in the Depth column.

The resulting (Chainage, Depth) values are then drawn in the ***Default Bypass Channel Shape graph*** area.



Hence the depths in the **Depth** column will always be greater than or equal to zero.

This processing occurs whenever another string is selected, or when the **Set Node Details** or **Regrade Pipes** button is selected.

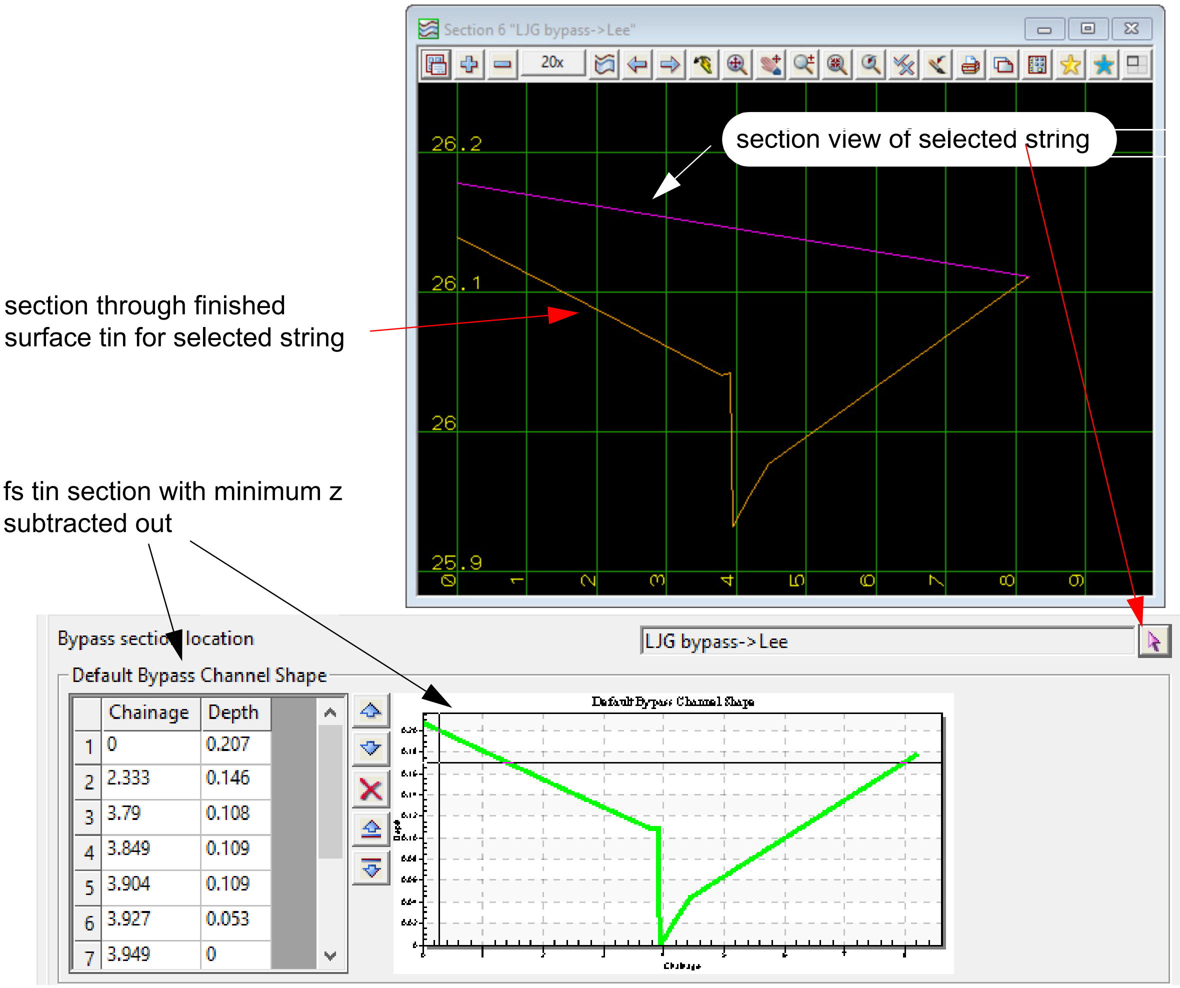
(b) Selecting a string and getting data for the (Chainage, Depth) grid

In the selecting the string case, ***12d Model*** drapes the selected string onto the finished surface tin to obtain the section through the finished surface tin.

The bypass shape is formed by finding the minimum z value of this section and then subtracting this minimum z value from the z-values for all the vertices in the section string.

The resulting string is drawn in the Default Bypass Channel Shape graph area, and the (chainage, height) values of the resulting string are written to the (Chainage, Depth) grid.

Hence the depths in the **Depth** column will always be greater than or equal to zero.



This processing occurs whenever another string is selected, or when the **Set Node Details** or **Regrade Links** buttons are selected.

It is recommended that you keep you section shape strings in one model for data management purposes. The strings are drawn from left to right looking in the direction of the bypass string (the direction of flow).

(c) Modifying the values in the (Chainage, Depth) grid

You can manually modify the values in the (Chainage, Depth) grid and the data is processed (by subtracting the minimum z-value and redrawing the graph) the next time the **Set Node Details** or **Regrade Links** button is selected.

Hence the depths in the **Depth** column will always be greater than or equal to zero.

Warning:

If you modify the values in the (Chainage, Depth) grid, make sure you the ***Bypass section location*** string select field is **cleared**. This is done by clicking RB on the string select and select **Clear.**

Otherwise your changes may be replaced by the drape of the string next time the **Set Node Details** or **Regrade Links** button is selected.

Note

To enlarge the graph, right click on the graph and select ***Maximise***. Use ***<ESC>*** to un-maximise.

The **Bypass shape** tab is used only by the **Dynamic Analysis**.

Bypass Route

Dynamic allows for 3 bypass routes.

***Bypass 1** used the bypass flow strings.*

***Bypass 2 and 3** require the bypass data to be entered on the **Bypass** tab.*

Bypass section location siring select

Pick the string to be draped onto the Water finished surface (FS) tin (the FS tin is set on 17.3.4.6.1.1 GLOBAL > Main subtab*).*

*The shape will be obtained from the tin and then adjusted vertically so that the lowest point on the draped string equals the grate levels on the upstream (current node) and bypass node. The resulting shape is entered into the grid and displayed in the **Bypass Channel Shape** graph area.*

*Pressing the **Set Node Details** button will recalc this data (*17.3.4.6.9 Set Node Details Button*).*

To raise or lower the upstream or downstream shape enter the new invert elevation on the **Bypass** tab.

Mode choice box

*If **Conduit,** this will use standard hydraulic conduit irregular shape calculations.*

*If **Road weir (sealed)** and **Road (weir gravel)**, these use the U.S. Department of Transportation, Federal Highway Administration, HYDRAULIC DESIGN OF HIGHWAY CULVERTS, Third Edition (**3.1.5 Roadway Overtopping**). These calculations use the depth of flow and bypass path length to determine a weir discharge coefficient. Tailwater submergence is also considered.*

***Note:** that weir calculations have no link storage associated with them.*

Bypass Channel Shape section

*Data is obtained using the **Bypass section location** above or the shape can be manually entered. Elevations will always be adjusted as discussed in the **Bypass section location** field.*

***CAUTION**: If data from the tin is manually changed, **Set Node Details** will overwrite these changes unless the **Bypass section location** selection is cleared (right mouse click the select button and select clear).*

*To enlarge the graph, right click on the graph and select **Maximise**. Use <ESC> to un-maximise.*

After a dynamic run is complete the critical hgl (water level) results will be displayed from the last dynamic analysis. The hgl results are stored in the following node attributes in the water results groups (see Water Results Group*).*

"calculated pit max bypass hgl us"

" calculated pit max bypass hgl ds"

Left and Right Bank Markers section

*The **Bypass section location** selection will look for settings on the string to set the left and right bank n values (see Stormwater->Utility String Editor).*

If not using a string then you may manually enter the n values and chainage.

*When **Centre n** is blank the Manning's n value from Defaults->Nodes->Main Bypass data is used. When **Left n** or **Right n** are blank they use the value from **Centre n** (as discussed above).*

27.2.2 Links

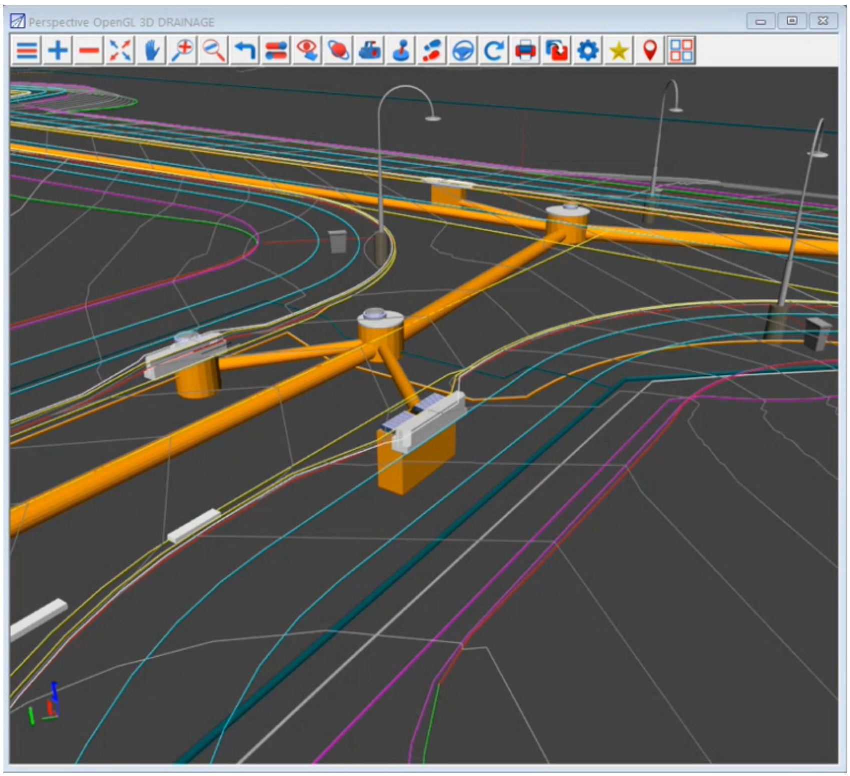
A link represents an hydraulic element of some kind for flow and constituent transport down the system. For example, links can be rectangular or round pipes, channels, weirs, basins, orifices, pumps etc. The junction of links is represented by nodes (see 17.1.4.1 Nodes (Pits, Maintenance Holes)).

Links are not just 1D lines on a page but can have a variety of cross-section shapes which then display in both 2D and 3D. See 17.1.4.2.1 Link Shapes.

For example, rectangular pipes have width, height and length, as well as wall thicknesses. See 17.1.4.2.1.1 Standard Link Shapes and Sizes.

When connecting to nodes, links stop at the inner walls of the nodes and can connect anywhere around the node.

Consequently the links aren't just used for water analysis but can also be used for clash detection, construction and BIM systems.

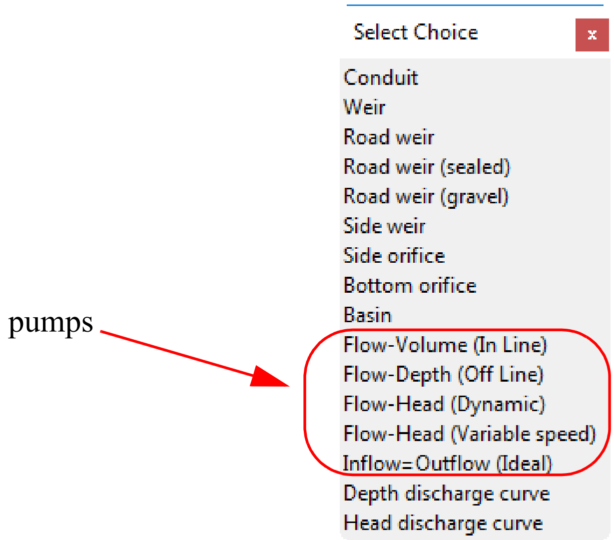


For more information on links, see 17.1.4.2 Links (Pipes) and 17.1.4.3 Node Connection Points for Links

Continue to 27.2.2.1 Link Modes or return to 27.2 Hydraulics or 27.1 Hydrology.

27.2.2.1 Link Modes

Link Mode choice box



Conduit *- acts as a conduit (normal situation).*

Weir *- outflow determined from the weir equation (weir shapes and coefficients need to be set for different types). By default these operate perpendicular to the flow direction.*

Road weir *- takes vertical slices along the road profile (user-supplied).*

Road weir (gravel) *- uses the FHWA-HDS5 procedure for weir flows across a gravel roadway (refer to Dynamic Culvert macro in 12d to find more information regarding inputs).*

Road weir (sealed) *- uses the FHWA-HDS5 procedure for weir flows across a sealed roadway (refer to Dynamic Culvert macro in 12d to find more information regarding inputs).*

Side weir *- for weirs operating on the side of a flow direction*

Side orifice *- an orifice positioned on the side face of a node (e.g. a field inlet in a basin).*

Bottom orifice *- an orifice positioned on the bottom face of a node (e.g. the base of a tank).*

Basin *- A basin link. This is a non-hydraulic link which only transfers water surface elevation data from one node to another (i.e. from a basin node to an inlet or outlet node).*

Flow-Volume (inline) *- for information on flow-volume (incline) see* 27.2.2.1.1 Pump Curve Types.

Flow-Depth (offline) *- for information on flow-depth (offline) see* 27.2.2.1.1 Pump Curve Types.

Flow-Head (Dynamic) *- for information on flow-head (dynamic) see* 27.2.2.1.1 Pump Curve Types.

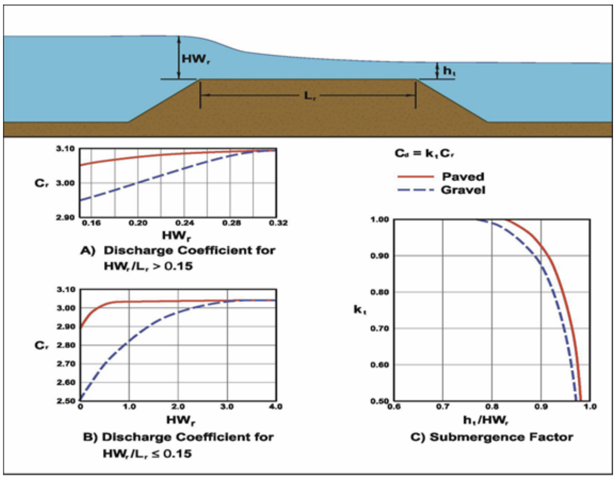
Flow-Head (Variable) *- for information on flow-head (variable) see* 27.2.2.1.1 Pump Curve Types.

Inflow=Outflow *- for pumps (ideal pump) see* 27.2.2.1.1 Pump Curve Types.

Depth-discharge *- The depth of the water at the upstream end of the link.*

Head-discharge *- The difference in water depth between the upstream and downstream ends of the link.*

Note*: For the FHWA-HDS5, the following image shows how the coefficients and submergence factor come into play:*



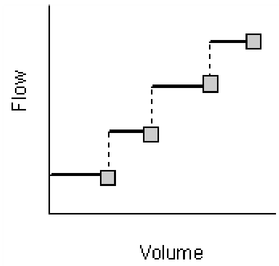
The equations used for the various weir shapes in the "Shape" choice list are shown below:

Weir Type	Cross Section Shape	Flow Formula
Transverse	Rectangular	$C_w L h^{3/2}$
Side flow	Rectangular	$C_w L h^{5/3}$
V-notch	Triangular	$C_w S h^{5/2}$
Trapezoidal	Trapezoidal	$C_w L h^{3/2} + C_{ws} S h^{5/2}$
Roadway	Rectangular	$C_w L h^{3/2}$
C_w = weir discharge coefficient, L = weir length, S = side slope of V-notch or trapezoidal weir, h = head difference across the weir, C_{ws} = discharge coefficient through sides of trapezoidal weir.		

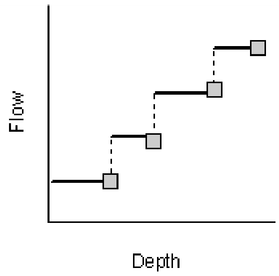
27.2.2.1.1 Pump Curve Types

Pumps are links used to lift water to higher elevations. A pump curve describes the relation between a pump's flow rate and conditions at its inlet and outlet nodes. Five different types of pump curves are supported.

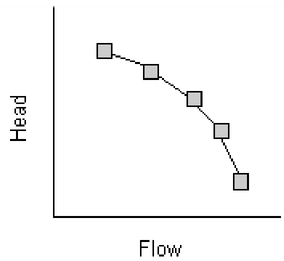
Flow-Volume *(Type 1) An* ***off-line pump*** *with a wet well where flow increases incrementally with available wet well.*



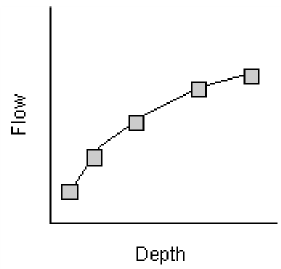
Flow-Depth (*Type 2) An* ***in-line pump*** *where flow increases incrementally with inlet node depth*.



Flow-Head *(Type 3 Dynamic) A* ***dynamic in-line pump*** *where flow varies continuously with head difference between the inlet and outlet nodes.*



Flow Head *(Type4 Variable) A* ***variable speed in-line pump*** *where flow varies continuously with inlet node depth.*

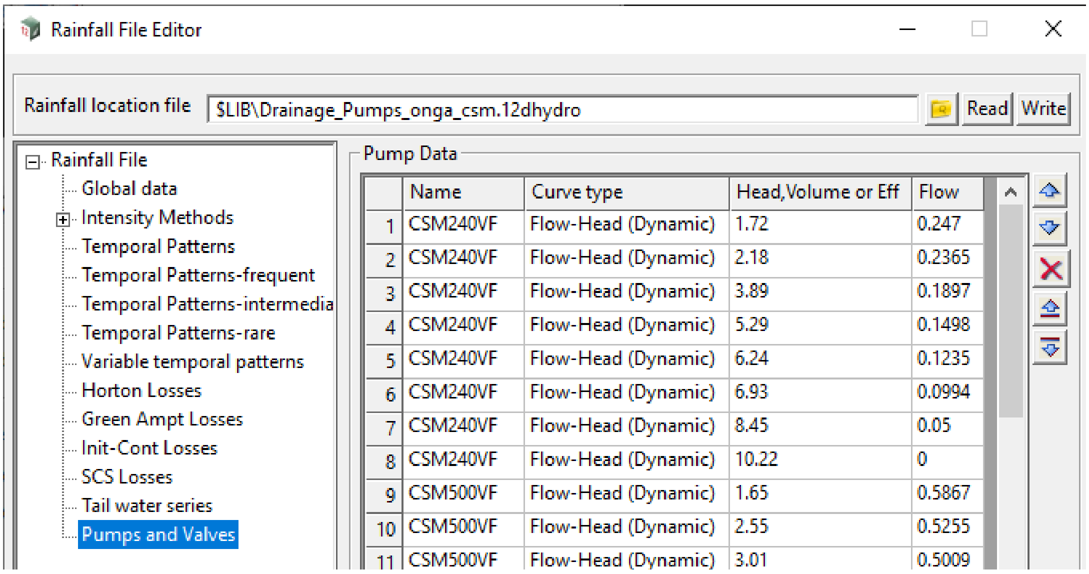


Inflow = Outflow *(Ideal) An* ***"ideal" transfer pump*** *whose flow rate equals the inflow rate at its inlet node. No curve is required as the outflow equals the inflow. The pump must be the only outflow link from its inlet node. Used mainly for preliminary design.*

The pump curves are defined in the ***Hydro file*** using the Pumps and Vales tree node in the ***Hydro file editor*** (***Rainfall File Editor***) at

Water =>Stormwater =>Hydro File Editor

Clicking on the option brings up the Rainfall File Editor. See 17.5.1.10 Pumps and Valves in the 17.5.1 Hydro (Rainfall) File Editor.



Pumping Summary Report

PUMPING SUMMARY

Pump	Percent Utilized	Number of Start-Ups	Min. Flow m^3/s	Avg. Flow m^3/s	Max. Flow m^3/s	Total Volume 10^6ltr	Power Usage kWh	% Time Off Pump Curve	
								Low	High
Pump	67.27	3	0.00	0.14	0.14	1.362	13.82	0.0	31.0

The report file of the results (***Water =>Stormwater =>Dynamic analysis =>Dynamic reports*** 17.5.5.7 Dynamic Graphs) shows results of the simulation, including the percentage of time the pump was running, the maximum and minimum flow during the simulation and the number of times the pump started during the simulation and the average flow rate for the time pump was running, volume pumped, power usage and the percentage of time off the pump curve.

The on/off status of pumps can be controlled dynamically by specifying startup and shutoff water depths at the inlet node or through user-defined Control Rules. Rules can also be used to simulate variable speed drives that modulate pump flow.

Continue to 27.2.3 Rational Method Hydraulics or return to 27.2.2.1 Link Modes or to 27.2 Hydraulics or 27.1 Hydrology.

27.2.3 Rational Method Hydraulics

This section defines the various terms relevant to the Rational hydraulic calculations performed by the ***Drainage Analysis*** module of ***12d Model,*** including how and where they are calculated.

The term **links** is used for pipes and channels are sometimes used interchangeably, as is the term **nodes** for pits, manholes, inlets and structures.

See

27.2.3.1 Rational Definitions for Flows, Velocities and Depths
27.2.3.2 Manning's Formula versus the Colebrook-White Formula:
27.2.3.3 The Hydraulic Grade Line (HGL):
27.2.3.4 Rational Hydraulic Equations
27.2.3.5 Determining the Critical and Normal Depths in Part-full Links

27.2.3.1 Rational Definitions for Flows, Velocities and Depths

Q_{rat}

Q_{rat} = Peak Flow

This is the Rational **peak flow rate** for the link, **without** consideration of **bypass flows**.

It is determined from the contributing catchments via the **Rational Method,** and includes any direct node or link flow that may have been specified upstream. See 27.1.2.2.1 Rational Peak Flow Qrat.

It is shown in the **Hydraulic Report** as "**Peak Flow Qrat**", and is also set as a **link attribute** named "**calculated peak flow**".

Q_b

Q_b = Net Bypass Flow

When considering **bypass flows**, *Qb* for the link is determined from an analysis of all the upstream nodes contributing to the link, as recommended in the Australian Rainfall and Runoff.

It represents the sum of the peak bypass flows approaching these nodes, minus the sum of the peak bypass flows leaving them.

It is shown in the **Hydraulic Report** as "**Net Bypass Flow Q_b**", and is also set as a **link attribute** named "**calculated net bypass flow**". Note: the peak bypass flow leaving each pit, is determined from the pit inlet capacity data, defined for each pit type in the drainage.4d setup file, as well as the relevant choke factor determined for each pit.

Q

Q = Link Flow = $Q_{rat} + Q_b$

The peak flow rate in the link, represented by the sum of *Qrat* and *Qb*. It is shown in the **Hydraulic Report** as "**Pipe Flow Q**", and is also set as a **link attribute** named "**pipe flow**".

Note: it is only when considering bypass flows, that$Q$ may differ from Q_{rat}.

Q_x

Q_x = Excess Pipe Flow

If the pipe flow, Q, is so large that the HGL would rise above the upstream node's grate level, then Q_x will represent the difference between Q and the flow rate that would keep the HGL just at the grate level.

It is shown in the **Hydraulic Report** as "**Excess Pipe Flow Qx**", and is also set as a link attribute named "**calculated excess flow**".

Note: the excess flow amount, Q_x, is still included in the link flow, Q, and is not automatically re-routed to the overland system. However, when considering bypass flows, the user may set the Q_x routing increment to a value greater than zero, which will initiate extra analysis passes to re-route just enough flow as is necessary, from the link network to the overland system, so as to eradicate the excess link flows. At each extra pass, an amount no greater than the Q_x routing increment is removed from the link network – from the most upstream link(s) with excess flow(s) – and re-routed to the overland system. If flow is entering from the top of a link's upstream node, the re-routing is achieved initially by reducing the node's choke factor by an amount calculated to have the same effect. Once the choke factor is reduced to zero, however, any remaining Q_x is re-routed as node surcharge flow, Q_x.

Q_s

Q_s = Node Surcharge Flow

When (and only when) excess pipe flows are re-routed to the overland system, it is possible for some nodes to surcharge (flow rising up and exiting the top of the node).

At such nodes, the choke factor will have been reduced to zero, and Q_s will have a positive value equal in magnitude to the negative node inflow.

In the **Hydrology Report**, a negative value of "**Inlet Flow Qi**" indicates a surcharge flow, and Q_s is also set as a node attribute named "**calculated surcharge flow**".

Note: node surcharge flow is automatically included in the bypass flow leaving a node, and may re-enter the link network elsewhere.

V_f

V_f = Full Pipe Velocity = Q / A_f

The **velocity in the link** when the pipe flow, Q, fills the **entire cross-sectional area**, A_f, of the link. This is the minimum velocity possible for this flow rate.

It is shown in the **Hydraulic Report** as "**Full Pipe Vel Vf=Q/Af**", and is also set as a **link attribute** named "full pipe velocity".

Note: V_f is the velocity used to determine pressure head and water surface elevation losses through the upstream pit. Typically, the loss coefficients Ku & Kw only apply to pipes under pressure.

Q_{cap}

Q_{cap}= Capacity Flow

For the particular size, grade and roughness of the link, and assuming no downstream tailwater restrictions, the **capacity flow** is the flow rate theoretically possible in the link, at the point where the flow would become pressurised (i.e. **flowing *exactly* full)**.

It is shown in the **Hydraulic Report** as "**Capacity Flow Qcap**", and is also set as a link attribute named "flow capacity".

V_{cap}

V_{cap} = Capacity Velocity =$Qcap$ / Af

The velocity corresponding to $Qcap$.

It is shown in the **Hydraulic Report** as "**Capacity Vel Vcap=Qcap/Af**", and is also set as a **link** attribute named "**capacity velocity**".

Note: V_{cap} is sometimes referred to by others as ***at grade velocity***, or more confusingly, as ***full pipe velocity***. Great care should be taken, to avoid confusing V_{cap} with Vf.

Capacity Ratio

Capacity Ratio = Q / $Qcap$

This is simply the ratio of the link flow to the capacity flow.

If greater than 1.0, Q will always be pressurised.

If less than 1.0, Q may or may not be pressurised, depending on the conditions downstream.

Some governing authorities specify that it should always be less than 1.0.

It is shown in the **Hydraulic Report** as "**Q/Qcap Ratio**", and is also set as a link attribute named "**flow capacity ratio**".

Q_{mcap}

Q_{mcap} = Max Capacity Flow

Similar to $Qcap$, but representing the **maximum unpressurised flow rate theoretically possible** in the link.

For a circular link, Q_{mcap} occurs at a depth of about 0.94x*D*.

For circular link,Q_{mca} is approximately 1.07x$Qcap$.

For a box-culvert, Q_{mca} occurs at a depth just below the obvert (0.999x*H*, say).

For box-culverts, Q_{mcap} may be considerably greater than $Qcap$, due to the sudden increase in friction losses when the flow comes into contact with the top wall – an effect more pronounced as the culvert's width/height ratio increases.

Note: Q_{mcap} is not calculated by ***12d Model***, as it is an inherently unstable flow, which can become pressurised with only the slightest increase in frictional resistance. Pipe manufacturers typically publish capacities which match more closely to $Qcap$.

V_{mcap}

V_{mcap} = Max Capacity Velocity

The velocity corresponding to $Qmcap$.

That is: V_{mcap} = V_{mcap} / **Aw** where **Aw** is the wetted cross-sectional area at the depth at which $Qmcap$ occurs.

d_n

d_n = Normal Depth

The depth in the link when the slope of the water surface of the pipe flow, Q, is parallel to the link slope.

If Q is greater than $Qcap$, d_n is set to the obvert of the link.

It is set as a **link attribute** named "**normal depth**", and the value [d_n / <link height>] is set as "**normal depth relative"**.

d_c

d_c = Critical Depth

The depth in the link when the local energy head (the sum of the pressure and velocity heads only, ignoring the gravity head) of the link flow, Q, is at a minimum.

It is set as a **link attribute** named "**critical depth**", and the value [d_c / <link height>] is set as "**critical depth relative"**.

V_n

V_n = Normal Depth Velocity

The velocity in the link when the link flow, Q, is flowing at the normal depth, dn.

This is the maximum velocity possible for this flow rate, in the most common case of a "steep" slope link (where dc **>** dn).

In the rare case of a "mild" slope pipe (where dc **<** dn), it is possible for the velocity to be slightly greater near the downstream end of the link, if the flow "drops off the end" and the depth approaches dc.

It is shown in the **Hydraulic Report** as "**Norm Depth Vel Vn=Q/An**", and is also set as a link attribute named "**normal velocity**".

V_c

V_c = Critical Depth Velocity

The velocity in the link when the pipe flow, Q, is flowing at the critical depth, dc.

When the flow is slower than V_c (deeper than dc) it is termed ***tranquil flow***.

When the flow is faster than V_c (shallower than V_c), it is termed ***rapid flow.***

It is shown in the **Hydraulic Report** as "**Crit Depth Vel Vc=Q/Ac"**, and is also set as a link attribute named "**critical velocity**".

V_{min} & V_{max} = Allowable Velocity Ranges for Vn and $Vcap$

These velocity limits are often specified by governing authorities, to ensure that all link flows are fast enough to wash away impediments, but not so fast as to scour the pipes.

If set on the 17.3.4.6.1.1 GLOBAL > Main subtab of the 17.3.4 Water Network Editor (WNE), they are checked against the calculated Vn and/or $Vcap$ values.

If ever a calculated velocity is too low or too high, a new link grade is recommended in the ***Output Window***, to help remedy the problem.

V_a

V_a = Actual Velocity (VicRoads manual)

The Victorian "VicRoads" manual refers to a chart for determining the so-called ***actual velocity***, V_a, in part-full pipes.

The chart shows a relationship between *Q* / *Qcap* values and V_a / *Vcap* values.

The resultant V_a values from this chart, are equivalent to the **normal depth velocity**, *Vn*, values calculated by ***12d Model***.

27.2.3.2 Manning's Formula versus the Colebrook-White Formula:

The ***Water Rational Analysis*** module allows **link** roughness to be specified as either **Manning's n** (based on metre-second units), or **Colebrook's k** (specified in mm in ***12d Model***.).

The choice of roughness type determines the formula – Manning or Colebrook-White – used to calculate: ***Qcap***, ***Vcap***, ***dn*** and ***Vn***.

It also governs how the **friction slope** is determined in both the **Darcy-Weisbach** equation and the **Gradually Varied Flow** equation, when calculating the HGL values along the link.

The **Colebrook-White** formula may be seen as an empirical combination of the Rough and Smooth Pipe Laws of turbulent flow, which were both derived from boundary-layer theory by Prandtl and von Kármán, but adjusted to match the experimental results of Nikuradse, who performed a series of lab tests on small pipes of uniform roughness.

Colebrook and White, however, performed tests on a range of commercial pipes (of non-uniform roughness) – with an equivalent k deduced from the constant friction factor, f, observed at high Reynolds number – and found that for most of the pipes they tested, their new combination-formula matched well.

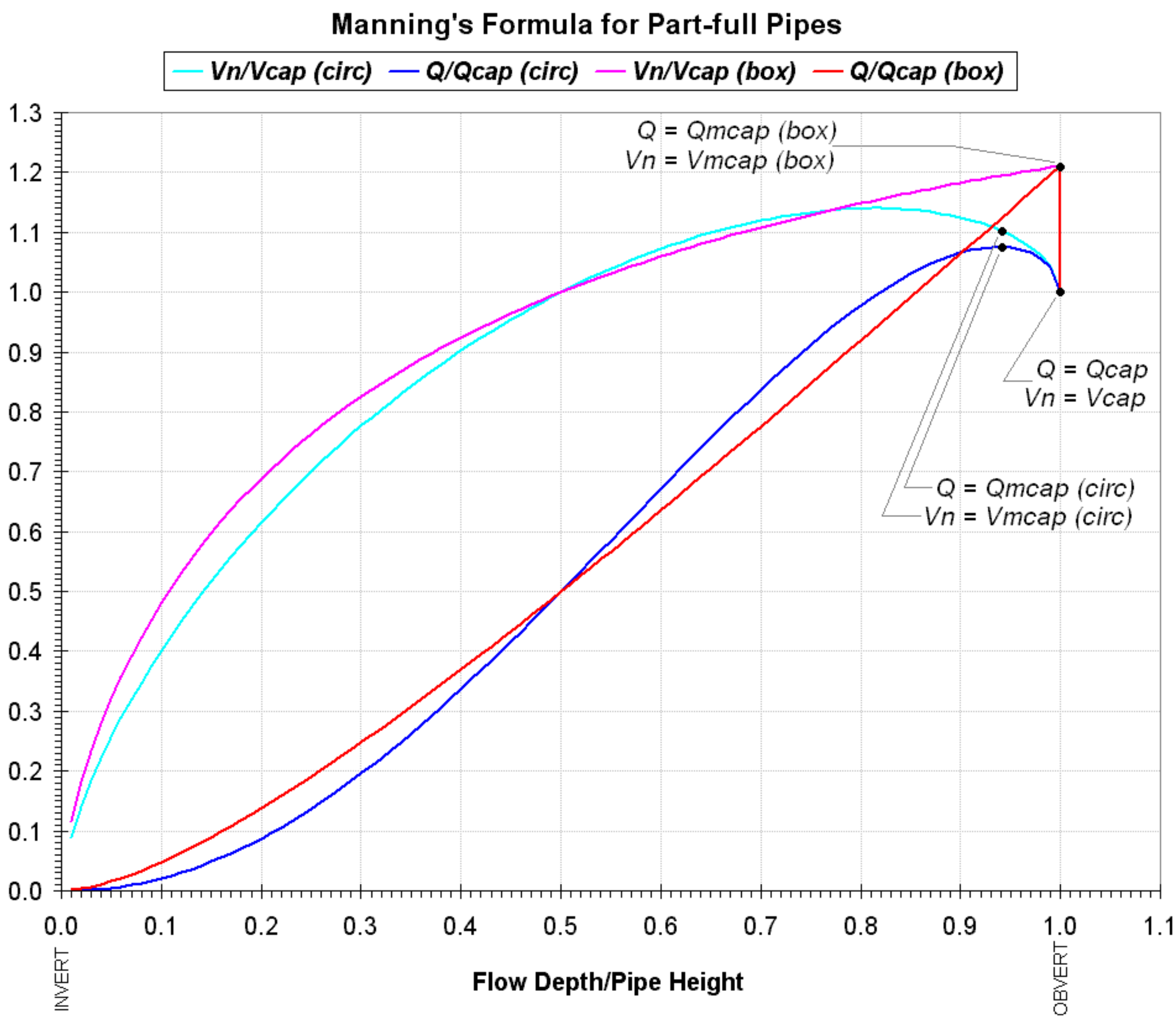
The turbulent range of the now widely-used **Moody Diagram**, is wholly based on the **Colebrook-White formula,** and represents the trend to be expected, in the absence of any specific data for particular links. Where non-circular links are used, or where part-full flow occurs in any kind of pipe or open channel of reasonably uniform cross-section, substitution of 4R for D (four times the hydraulic radius for diameter) can be justified, with the assumption that the mean shear-stress around the wetted perimeter is not too dissimilar from the uniform stress around a circular perimeter (true enough for box-culverts and many open channels).

Because the **Colebrook-White** formula accounts for the variations in **f** dependent on the relative roughness (k/R or k/D) and the Reynolds number (Re), it is slightly more reliable, when considered across the range of pipe sizes and flow rates commonly found in stormwater systems.

Most of the values published for Manning’s n are for relatively large open channels, where the dependency on Re is slight, and relative roughness is implied in the n value. As such, Manning’s formula is good for larger systems (especially natural channels), but when applied to smaller systems like typical stormwater pipes, the Colebrook-White formula suggests that these published n values should be reduced somewhat.

Overall, the primary difficulty with both formulae lies in the selection of suitable n or k values, and significant errors are not uncommon.

The following figure shows a normalised graph of Manning's formula, for a full range of flow depths in both circular pipes and (square) box-culverts. (The corresponding Colebrook-White graph is so similar on this normalised scale, that it may be considered identical.) Note the difference between ***Qcap*** and ***Qmcap*** on the graph.


Manning's Formula for Part-full Pipes
Vn/Vcap (circ)
Q/Qcap (circ)
Vn/Vcap (box)
Q/Qcap (box)
Q = Qmcap (box)
Vn = Vmcap (box)
Q = Qcap
Vn = Vcap
Q = Qmcap (circ)
Vn = Vmcap (circ)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1
INVERT
Flow Depth/Pipe Height
OBVERT

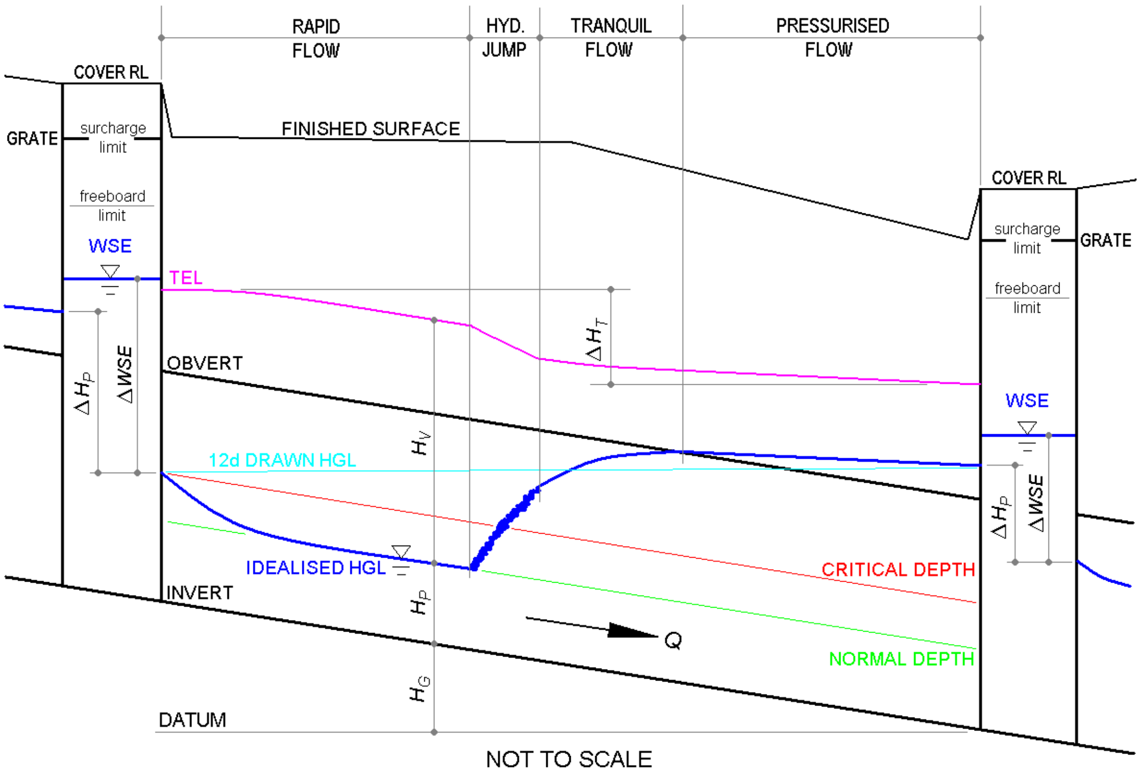
27.2.3.3 The Hydraulic Grade Line (HGL):

In ***12d Model***. when a ***Water string*** is profiled or plotted, you have the option to display the **HGL** determined from a ***storm analysis*** of the water network.

The **HGL** represents the peak sum of the pressure and gravity heads throughout the network, and in ***12d Model***, it is idealised to show separate head losses along the links and through the nodes. *In reality, these losses are not separate, but continuous, with the often highly un-developed flow near the nodes, progressively forming fully-developed, one-dimensional flow, in the links reaches sufficiently distant from the nodes*.

HGL Along Links: The **HGL** drawn along a **link** in ***12d Model***, is simply the straight line joining the link's idealised entrance and exit HGL levels. As such, in links where the steady flow is wholly pressurised, it is a good representation of the friction slope, and consequent loss of total head (DHT) due to friction. However, where part-full flow occurs in any portion of the pipe, neither the friction slope nor the water surface slope is constant, and so the straight line implies nothing other than the idealised entrance and exit HGL levels. For these cases, the idealised HGL is calculated internally, assuming fully-developed flow, via numerical integration of the Gradually Varied Flow Equation. This handles all possible cases of tranquil and rapid flow on mild and steep slope pipes, including the hydraulic jumps that can occur on steep slopes. Note that, due to the non-uniform velocity head in these cases, DHT due to friction cannot be determined from the idealised HGL, and must instead be determined from the Total Energy Line (TEL).

HGL At Nodes: The horizontal HGL drawn across a node, represents the peak water surface elevation (WSE) in that node, and is tested against the freeboard and surcharge limits imposed there. The jump in the HGL between a node's entrance and exit, represents the change (normally a loss) in pressure head (DHP) through that node (it does **not** represent the loss in total head). If a node's entrance HGL level is higher than the level formed by the minimum of ***dn*** and ***dc*** in an upstream link, then this HGL level also forms a tailwater condition for that upstream link. Note that DWSE is typically equal to, or slightly greater than DHP, and that both these jumps may, to a certain extent, be thought of as the effect that a node has on what would otherwise be fully-developed, one-dimensional flow.



NOT TO SCALE

Schematic of a Typical HGL in a Steep Slope Link

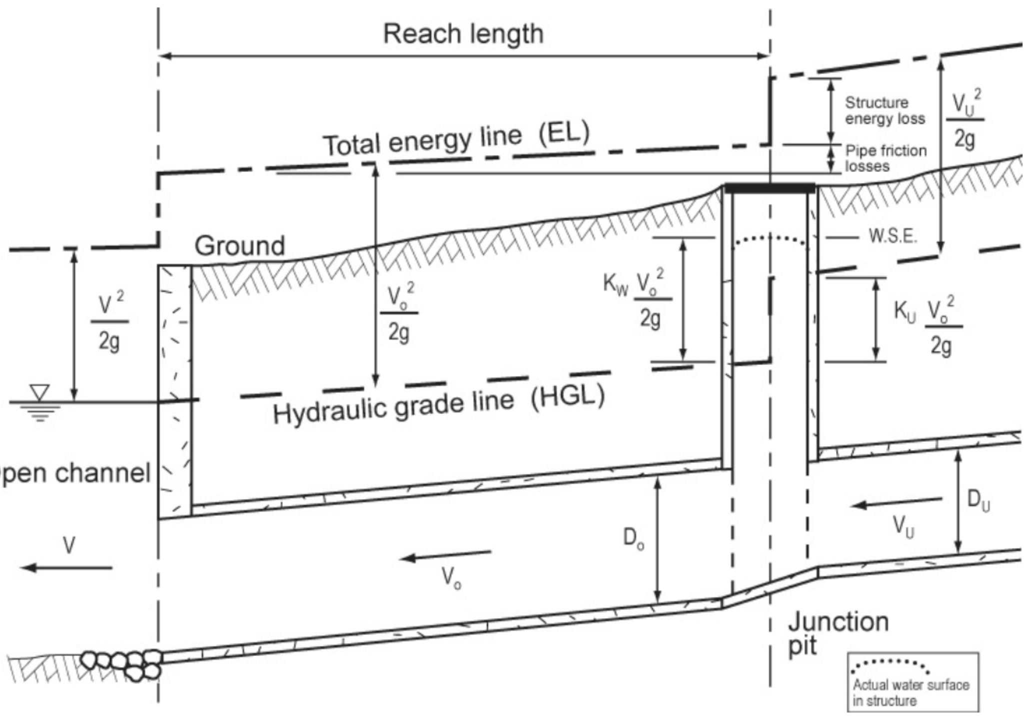


Diagram from the QUDM manual

27.2.3.4 Rational Hydraulic Equations

Bernoulli's Equation (for the head of a streamline)

$$H_T = H_V + H_P + H_G = \frac{V^2}{2g} + h + z$$

Reynolds Number (laminar flow < 2000 < critical zone < 4000 < turbulent flow)

$$\mathrm{Re} = \frac{VD}{\nu} = \frac{4VR}{\nu}$$

Darcy-Weisbach Equation (for steady, uniform [pressurised] flow)

$$\frac{-\Delta H_T}{L} = S_f = \frac{f}{D}\frac{V^2}{2g} = \frac{f}{4R}\frac{V^2}{2g} = \frac{m}{R}\frac{V^2}{2g}$$

Gradually Varied Flow Equation

for steady, non-uniform [free-surface] flow

$$\frac{dh}{dL} = \frac{S_0 - S_f}{\left(1 - \frac{V^2 B}{g A_w}\right)}$$

Manning's Formula (for complete turbulence, high Re)

$$\sqrt{\frac{8g}{f}} = \sqrt{\frac{2g}{m}} = \frac{R^{1/6}}{n}$$

(Manning's relation to Chézy's coefficient, for metre-second units)

$$V = \frac{S^{1/2} R^{2/3}}{n}$$ **for metre-second units**

OR

$$V = 1.49 \frac{S^{1/2} R^{2/3}}{n}$$ **for foot-second units**

Colebrook-White Formula (for transition zone flow and complete turbulence, Re > 4000)

$$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{k}{3.7\,D} + \frac{2.51}{\mathrm{Re}\sqrt{f}}\right)$$ **(as published by Colebrook, 1939)**

$$V = -2\sqrt{2gDS}\,\log_{10}\left(\frac{k}{3.7\,D} + \frac{2.51\nu}{D\sqrt{2gDS}}\right) = -4\sqrt{2gRS}\,\log_{10}\left(\frac{k}{14.8\,R} + \frac{0.314\nu}{R\sqrt{2gRS}}\right)$$

Pressure Head Change Formula (through pit directly upstream of pipe)

$$-\Delta H_P = K_u V_f^{\,2} / 2g$$

WSE Change Formula (between pit directly upstream of pipe and pipe entrance)

$$-\Delta WSE = K_w V_f^{\,2} / 2g$$

where:		**[dimensions]**
H_T	= total head (energy per unit weight of water)	[L]
H_V	= velocity head = $V^2 / 2g$	[L]
H_P	= pressure head = h	[L]
H_G	= gravity head = z	[L]
V	= mean velocity of flow through a cross-section	[L/T]
g	= acceleration due to gravity	[L/T^2]
h	= pressure head (and depth of flow in an open channel) at a cross-section	[L]
z	= height of channel invert at a cross-section, from a constant horizontal datum	[L]
Re	= Reynolds number	[-]
ν	= kinematic viscosity of water	[L^2/T]
D	= diameter of circular pipe	[L]
R	= hydraulic radius of flow at a cross-section = A_w / P_w = D/4 for full circular pipe	[L]
A_w	= wetted cross-sectional area	[L^2]
P_w	= wetted cross-sectional perimeter	[L]
L	= plan length of channel	[L]
f	= Darcy friction factor (based on D)	[-]
m	= Fanning friction factor (based on R) = f/4 … confusingly, often denoted by f	[-]
dh/dL	= longitudinal slope of water surface at a cross-section, relative to S_0	[-]
B	= lateral breadth of water surface at a cross-section	[L]
S_0	= channel slope	[-]
S_f	= friction slope (energy lost, per unit weight of water, per unit length of channel)	[-]
S	= context dependent – typically: S_0 when solving for V; S_f when solving for S	[-]
n	= Manning roughness factor	[T/L$^{1/3}$]
k	= Colebrook roughness factor	[L]

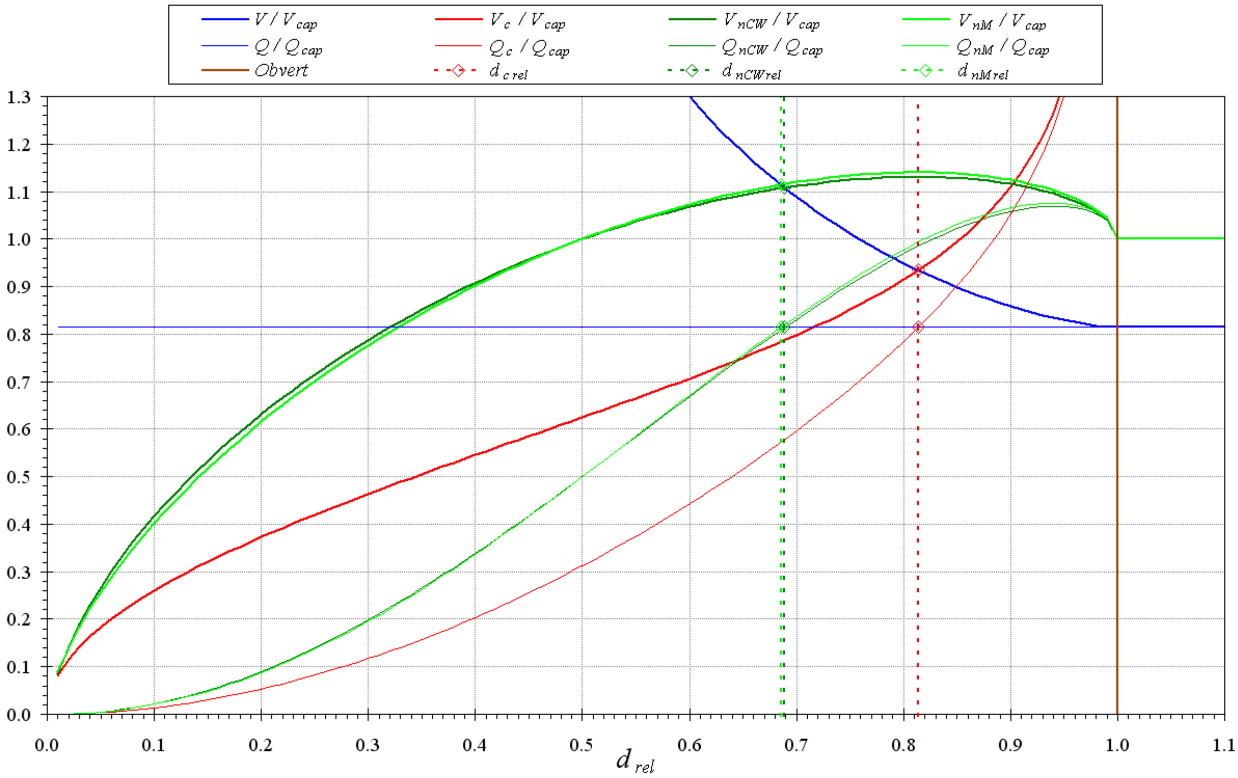
WSE	= water surface elevation in node	[L]
K_u	= pressure head change factor for node directly upstream of link	[-]
K_w	= WSE change factor for node directly upstream of link	[-]
Vf	= full link velocity	[L/T]

27.2.3.5 Determining the Critical and Normal Depths in Part-full Links

Wherever the pipe flow, ***Q***, is less than the capacity flow, ***Qcap***, the potential exists for part-full (free surface) flow to occur. In these instances, the critical and normal flow depths are determined by ***12d Model***, using the equations shown in the figure below. Note that the graph within the figure, shows the solutions for a circular link on a normalised scale.

The Critical Depth, and the Colebrook-White and Manning Normal Depths

d_c $\quad$ d_{nCW} $\quad$ d_{nM}



$$Q = const < Q_{cap}$$

$$V_{cap} = -4\sqrt{2gRS_0}\,\log_{10}\left(\frac{k}{14.8R} + \frac{0.314\nu}{R\sqrt{2gRS_0}}\right) = \frac{S_0^{1/2} R^{2/3}}{n}$$

$$Q_{cap} = AV_{cap}$$

$$V = \frac{Q}{A_w}$$

$$V_c = \sqrt{\frac{gA_w}{B}}$$

$$V_{nCW} = -4\sqrt{2gR_wS_0}\,\log_{10}\left(\frac{k}{14.8R_w} + \frac{0.314\nu}{R_w\sqrt{2gR_wS_0}}\right)$$

$$V_{nM} = \frac{S_0^{1/2} R_w^{2/3}}{n}$$

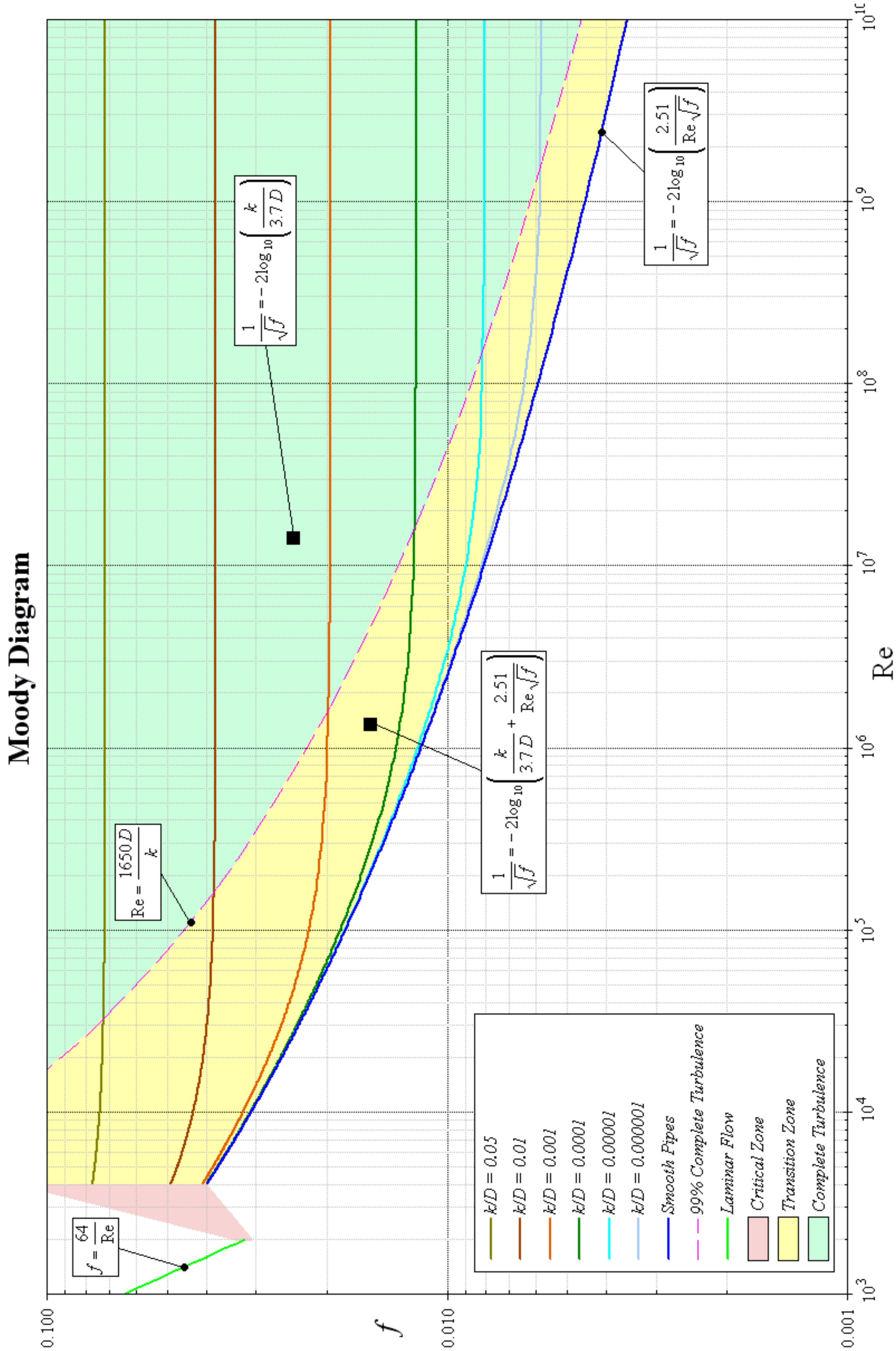
$$Q_c = A_wV_c; \quad Q_{nCW} = A_wV_{nCW}; \quad Q_{nM} = A_wV_{nM}$$

Circular Pipes	Box Culverts
$A = \pi D^2/4$	$A = WH$
$R = D/4$	$R = WH/(2W+2H)$
$\theta = \cos^{-1}(1-2d_{rel})$	
$B = D\sin\theta$	$B = W$
$A_w = (\theta - \frac{1}{2}\sin(2\theta))D^2/4$	$A_w = WHd_{rel}$
$R_w = A_w/(D\theta)$	$R_w = A_w/(W+2Hd_{rel})$

$$d_{c\,rel} = d_{rel}\,|(V=V_c) = d_{rel}\,|(Q=Q_c)$$

$$d_{nCW\,rel} = d_{rel}\,|(V=V_{nCW}) = d_{rel}\,|(Q=Q_{nCW})$$

$$d_{nM\,rel} = d_{rel}\,|(V=V_{nM}) = d_{rel}\,|(Q=Q_{nM})$$



Continue to 27.2.4 Dynamic Hydraulics or return to 27.2.3 Rational Method Hydraulics or 27.2 Hydraulics.

27.2.4 Dynamic Hydraulics

This section defines the various terms relevant to the dynamic hydraulic calculations performed by the ***Dynamic Drainage Analysis*** module of ***12d Model***, including how and where they are calculated.

The term **links** is used for pipes and channels are sometimes used interchangeably, as is the term **nodes** for pits, maintenance holes (manholes), inlets and structures.

See

27.2.4.1 Dynamic Hydraulic Equations

27.2.4.1 Dynamic Hydraulic Equations

St Venant Dynamic 1D Equation

The one-dimensional (1D) Saint-Venant equation was derived by Adhémar Jean Claude Barré de Saint-Venant, and is used to model transient open-channel flow.

Local Acceleration (proportional to change in velocity over **time t**)

Pressure Force Acceleration (proportional to change in **depth H**)

$$\boxed{\frac{\partial Q}{\partial dt}} + \boxed{\frac{\partial}{\partial x}\left(\beta \cdot \frac{Q^2}{A}\right)} + \boxed{gA \cdot \frac{\partial H}{\partial x}} = \boxed{gA(S_o - S_f)}$$

Convective Acceleration (proportional to change in velocity over **distance x**)

Kinematic Wave (proportional to **friction slope S_f** and **bed slope S_0**)

where

x is distance along the pipe/channel

H is the water depth

t is time

Q is the flow rate

A is the channel cross-sectional area

β is the momentum coefficient (associated with nonuniform velocities integrated over A)

g is gravity

S_0 is the channel slope cross-sectional area

S_f is the friction slope

Note that the **Local Acceleration** term is depend on time.

Dampening and the St Venant Dynamic 1D Equation

Dampening in ***12d Model*** implements a form of Jin and Fread's Local Partial Inertial (LPI) modification used in the SWMM engine.

Inertial Terms

$$\boxed{\frac{\partial Q}{\partial dt} + \frac{\partial}{\partial x}\left(\beta \cdot \frac{Q^2}{A}\right)} + gA \cdot \frac{\partial H}{\partial x} = gA(S_o - S_f)$$

Under this option a weighting factor SIGMA between 0 and 1 is computed that damps out the contribution of the inertial terms as the **Froude number** (**Fr**) gets closer to 1.0 and ignores them completely when Fr > 1.0 (i.e., **supercritical** flow).

The equation for SIGMA is:

SIGMA = 1.0 for Fr < 0.5

SIGMA = 2 * (1 - Fr) for 0.5 <= Fr <= 1.0

SIGMA = 0 for Fr > 1.0.

Continue to 27.3 Sewer Methods or return to 27.2.4 Dynamic Hydraulics or 27.2 Hydraulics.

27.3 Sewer Methods

See

27.3.1 Tractive Force Method

27.3.1 Tractive Force Method

??

Continue to 27.4 Drainage Templates or return to 27.3 Sewer Methods.

27.4 Drainage Templates

??

Continue to 27.5 Analysis Results or return to 17 Water.

27.5 Analysis Results

The rational and dynamic analysis store most of their results as pit and pipe attributes. The rational method attributes are at the root level and the dynamic results under the dynamic group.

The maximum hgl values for both methods are stored at the root level attributes and in the string properties as these value are used to display the hgl levels in the section plots. The values will show the results from the last successfully complete analysis. The maximum flow and velocity results from the last successfully completed analysis are also stored in the flow and velocity string properties that you will find in the drainage plotting ppf editors.

Attributes that are calculated during the analysed have the prefix "calculated".

See

27.5.1 Rational Analysis Results
27.5.1.1 Ku results - Rational
27.5.2 Dynamic Analysis

27.5.1 Rational Analysis Results

Pre defined hydrology and hydraulic reports are available from the drainage analysis panel. User defined reports may also be created using the Import/Export option on the WNE. Sample customised list files are included in library. These files are prefixed with "drainage" to make them easy to locate in the library folder.

Continue to 27.5.1.1 Ku results - Rational or return to 27.5 Analysis Results or 27 Water Theory.

27.5.1.1 Ku results - Rational

The rational method stores the calculated ku as pit attributes. A check report is available using the WNE Import/Export customised list file **drainage_ku_calc_check.txt** found in the library.

calculated ku

calculated kw

calculated kukw text

calculated pit pressure head loss

calculated pit wse loss

calculated ku method

calculated ku config

calculated ku grate flow ratio

calculated ku grate flow angle

calculated ku pipe flow angle

calculated ku diameter ratio

calculated ku submergence ratio

calculated ku chart

Continue to 27.5.2 Dynamic Analysis or return to 27.5 Analysis Results or 27 Water Theory.

27.5.2 Dynamic Analysis

User defined reports are created using the Import/Export option on the WNE. Sample customised list files are included in library. These files are prefixed with "drainage_dynmamic" to make them easy to locate in the library folder.

Time series graphs are available via the ***WNE Results*** tab. See. 17.3.4.6.6 Results Tab.

See

27.5.2.1 Node Volume Attributes
27.5.2.2 Ku results - Dynamic

27.5.2.1 Node Volume Attributes

All nodes, except network outlets will have this node attributes. Unless explicitly stated below the volumes are for the node only and do not contain the volume in the links.

calculated node + links max volume
the volume in the node plus, for all connected links, one half the length times the wetted cross section area at the node.

calculated node average percent full

calculated node average volume

calculated node full volume

calculated node max outflow

calculated node max percent full

calculated node max volume

A basin node is a node that has an explicit elevation area curve specified in the WNE. These nodes will also have the additional basin node attributes. These are a duplicate of the others for users who want this data plotted or reported only for basin nodes.

calculated basin + links max volume

calculated basin average percent full

calculated basin average volume

calculated basin full volume

calculated basin max outflow

calculated basin max percent full

calculated basin max volume

Continue to 27.5.2.2 Ku results - Dynamic or return to 27.5.2 Dynamic Analysis or 27.5 Analysis Results or 27 Water Theory.

27.5.2.2 Ku results - Dynamic

The dynamic method stores the calculated ku results as pipe attributes and has a time series graph on the results tab of the WNE. The graph is found on the **Pit graph type**, **Ku**.

As the ku values usually change with each time step, the ku values are stored as attributes at 3 critical points in the analysis:

when the Ku * vel head is at its maximum. the attributes are:

calculated pipe max ku

calculated pipe max ku head loss

calculated pipe max kw

calculated pipe max kw head loss

when the Ku * vel head is at its maximum. the attributes are:

calculated pipe ku head loss at max hgl

when the pipe flow is at its maximum. the attributes are:

calculated pipe ku at max flow

Continue to 27.6 Water Glossary or return to 27.5.2 Dynamic Analysis or 27.5 Analysis Results or 27 Water Theory.

27.6 Water Glossary

Surface Flow

flow in bypass routes (or conduits) where the conduit invert level is at or above the pit grate level.

Sub surface flow

generally pipe and conduit flow where the conduit invert level is below the grate level.

Minor Storm/Major Storm

at analysis time the flag for minor or major storm settings is set. This flag controls direct grate surface flow, direct pipe flow, surface flow hydrograph, time of concentration, rational C, AMC and sag:on-grade inlet efficiency factors.

Pipe capacity

Pipe capacity is full pipe flow with no pressurisation. The capacity figure should be used to help designers know if the friction loss in the pipe is greater or less than the pipe slope.

Case 1: Flow less than capacity....friction slope is less than pipe slope. except for maybe for pit losses, surcharging is not a problem

Case 2: Flow greater than capacity....friction slope is MORE than pipe slope. You can do this for a short length of pipe but watch out for surcharging because you cannot keep it up for too long without flooding occurring!

Pits levels

Pits (nodes) have four levels

1. the **cover level** is used in plotting and pit depth calculations. This is also the maximum obvert level drawn for all connecting pipes.
2. the **grate level** is used for the freeboard measurements, the surcharge to bypass level and the reference level for pond flooding depths. The grate level is the most important level in 12d hydraulics.
3. the **setout level** is used for survey setout to construct the pit.
4. the **sump level** (bottom of the pit) is used in plotting and for depth calculations. If the pit is set to *floating mode*, the sump level is calculated from the lowest pipe invert connected to the pit plus the ***sump offset***.

Pipe Levels

Pipes have the upstream and downstream invert levels that can set by the minimum grade and cover criteria. The invert drop across a pit can also be fixed or change with the deflection angle.

Continue to 27.7 Water Definitions File - XML drainage.4d or return to 17 Water.

27.7 Water Definitions File - XML drainage.4d

A ***water definitions file*** (***drainage.4d***) contains definitions of nodes (***node types*** or ***mh_types***), links (***link types*** or ***pipe_types***) and house connections (***house connection types*** or ***hc_types***) that are used when creating nodes, links and house connections for a water string.

The use of node types, link types and house connection types is one method to easily set many of the objects properties such as inlet capacity, thickness and roughness along with the objects user defined attributes.

Note: the name **drainage.4d** is from earlier versions of ***12d Model*** when the water string was known as the drainage string or drainage-sewer string. Similarly the words pit or maintenance hole are interchangeably used for node, and pipe used for link.

However the water definitions file used after ***12d Model*** starts up in a project, is not just one file but is **accumulated** from the **drainage.4d** files in:

(a) Working folder

This drainage.4d file contains specified types for a particular project.

(b) Customer User folder (if it exists)

This drainage.4d file contains specified types for a particular customer.

(c) user folder

This drainage.4d file contains general types for a company.

(d) set_ups folder

This drainage.4d file is supplied by 12d Solutions and is installed with ***12d Model***.

If there is a **node** of the same name, the one in **Working folder** takes priority over the one in **Customer User folder**, which takes priority over the one in **User folder,** which takes priority over the one in **Set_ups** folder. Similarly for **links** and **house connections.**

The **Drainage.4d File Editor** is used the edit the different drainage.4d files. See 17.4.1 Drainage.4d File Editor.

When ***12d Model*** begins, it checks to see if an environment variable called DRAINAGE_4D exists and if it does, then the file it points to is used to provide the available types of nodes and links.

If the environment variable is not set, then***12d Model*** searches for a file called **drainage.4d** in the standard ***12d Model*** search sequence for set up files.

Each drainage.4d file is an XML format and consists of one or nodes, links and house control definitions.

IMPORTANT: the file is only read when ***12d Model*** starts up. When the file is changed while, ***12d Model*** is running, you must restart ***12d Model*** for the changes to become active.

Continue to 27.7.1 drainage.4d XML File Structure or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.1 drainage.4d XML File Structure

The file structure is:

<?xml version="1.0"?>

<xml12d>

<settings_4d>

<drainage_4d>

<node_types_structure>

. . . See 27.7.2 Node Types Structure

</node_types_structure>

<link_types_structure>

. . . See 27.7.3 Link Types Structure

</link_types_structure>

<house_connection_types_structure>

. . . See 27.7.4 House Connection Types Structure

</house_connection_types_structure>

</drainage_4d>

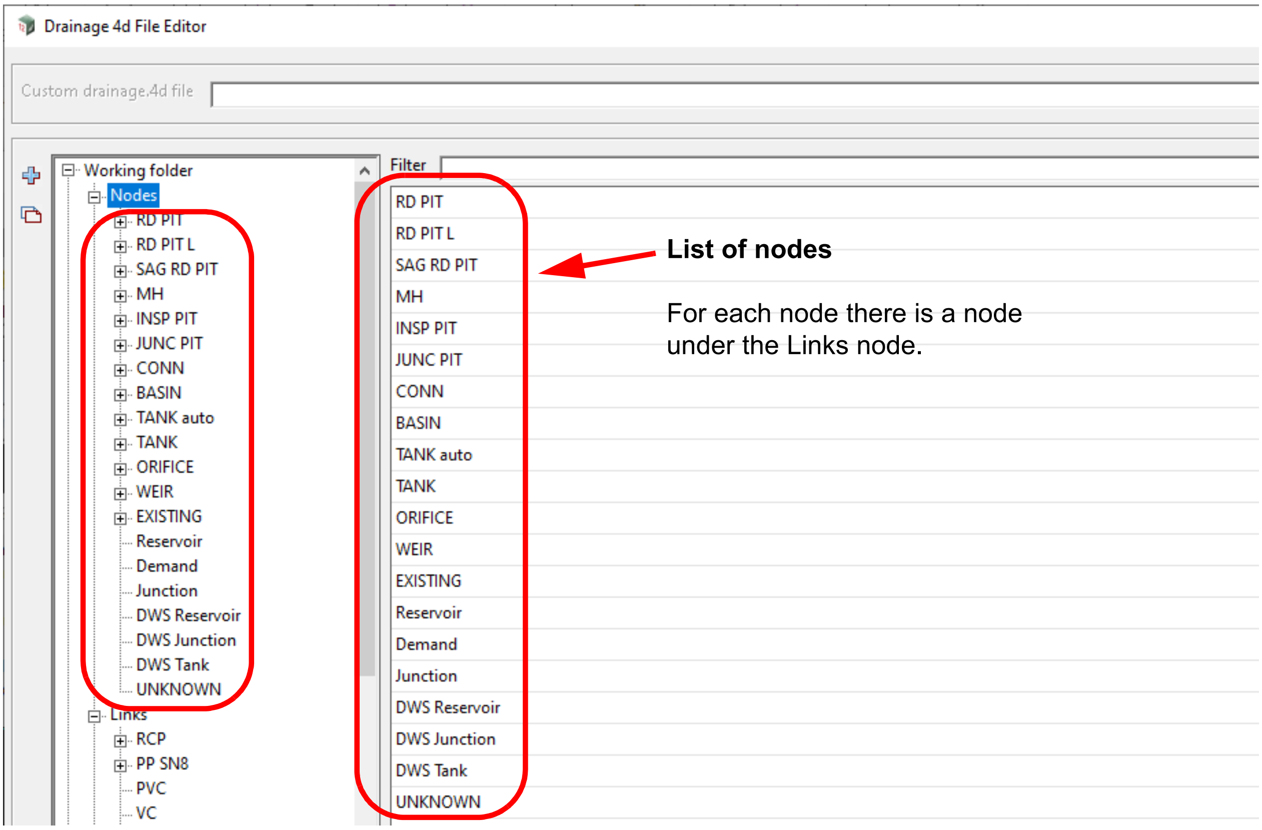
</settings_4d>

</xml12d>

Continue to 27.7.2 Node Types Structure or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.2 Node Types Structure

The documentation of the **node types structure** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



The list of **node types** is contained in a ***mh_types block*** which begins with **<mh_types>** and ends with **</mh_types>**

Within the ***mh_types*** block is a **node_block** for each individual node and the **node_block** contains all the information for that node.

<mh_types>

<filter></filter> see 27.7.2.1 Nodes Filter

<node_block_1> see 27.7.2.2 <node_block_i>

<node_block_2>

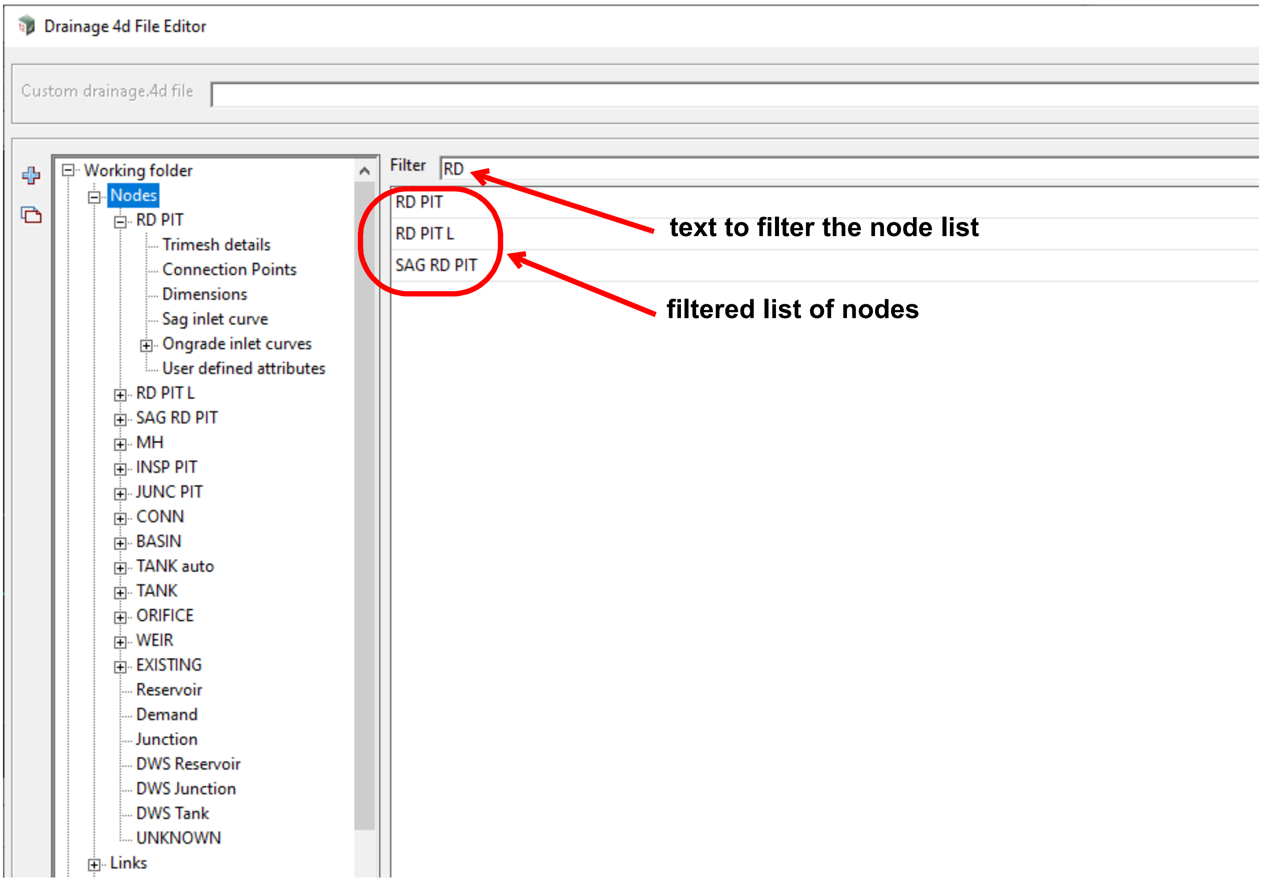
. . .

<node_block_n>

<mh_types>

Continue to 27.7.2.1 Nodes Filter or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.1 Nodes Filter



The **Filter** field is used to restrict which nodes are used from the **Nodes** list

<**filter**>*filter_text*</filter>

where *filter_text* is the text to filter the list of nodes

filter_text is made up of texts, separated by commas, and any node names in the full list of names that includes part of any of the texts, are included in the final list of nodes. For the Filter, the texts and node names are case insensitive.

For example:

Filter RD

includes RD PIT, RD PIT L and SAG RD PIT

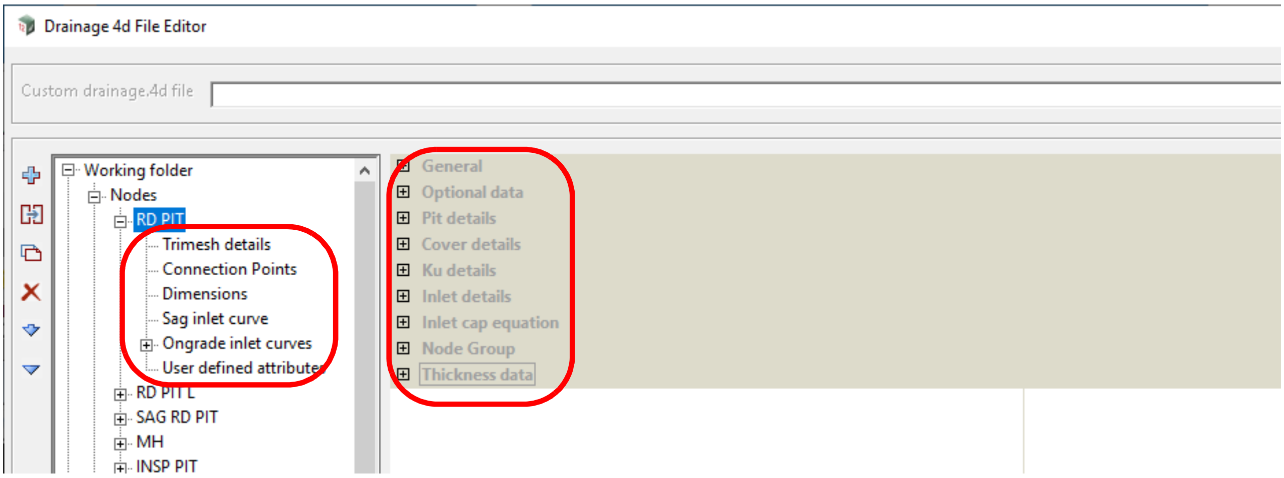
Filter RD,j

includes RD PIT, RD PIT L, SAG RD PIT, JUNC PIT, Junction and DWS Junction.

Continue to 27.7.2.2 <node_block_i> or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.2 <node_block_i>

The documentation of the **node block** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



Each individual link block begins with **<type>** and ends with **</type>** and In between are the various sections that hold all the information for that link.

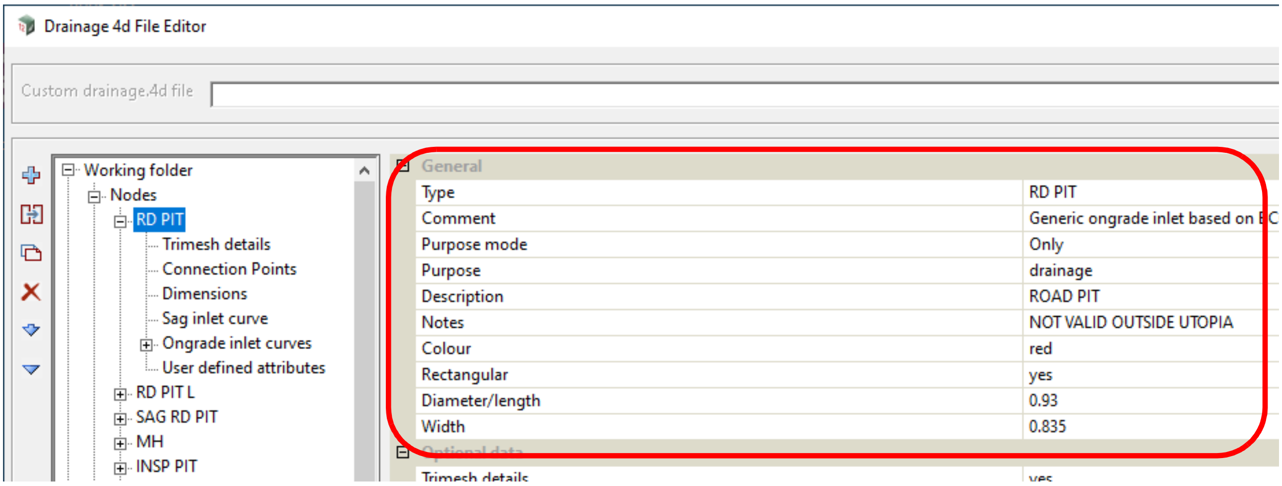
<type>

General section	see 27.7.2.3 Node: General
Optional data	see 27.7.2.4 Node: Optional data
Pit details	see 27.7.2.5 Node: Pit details
Cover details	see 27.7.2.6 Node: Cover details
Ku details	see 27.7.2.7 Node: Ku details
Inlet details	see 27.7.2.8 Node: Inlet details
Inlet cap equations	see 27.7.2.9 Node: Inlet cap equation
Node Group	see 27.7.2.10 Node Group
Thickness data	see 27.7.2.11 Node: Thickness data
Trimesh details	see 27.7.2.12 Node: Trimesh details Tree node
Connection points	see 27.7.2.13 Node: Connection Points Tree Node
Dimensions	see 27.7.2.14 Node: Dimensions Tree Node
Sag inlet curve	see 27.7.2.15 Node: Sag inlet curve Tree Node
Ongrade inlet curves	see 27.7.2.16 Node: Ongrade inlet curves Tree Node
User defined attributes	see 27.7.2.17 Node: User defined attributes Tree Node

</type>

Continue to 27.7.2.3 Node: General or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.3 Node: General



<**type**>*node_name*</type>

where *node_name* is the name of the node

<**comment**>*user_comment*</comment>

where *user_comment* is a user defined comment

<**string_purpose_mode**>***string_purpose_mode_choice***</string_purpose_mode>

where *string_purpose_mode_choice* is:

"Only"??

"Exclude"

"All"

blank then <string_purpose_mode> is left out of the file.

<**string_purpose**>*string_purpose_choice*</string_purpose>

where *string_purpose_choice* is:

"drainage"??

"foul"

"water supply"

"all"

If it is blank then <string_purpose> is left out of the file.

<**desc**>*description_text*</desc>

where *description_text* is the user's description of the node.

<**note**>*note_text*</note>

where *note_text* is the user's note.

<**colour**>*colour_text*</colour>

where *colour_text* is the name of the colour.

<**mh_size**>

<**length**> *node_length*</length>

<**width**> *node_width*</width>

</mh_size>

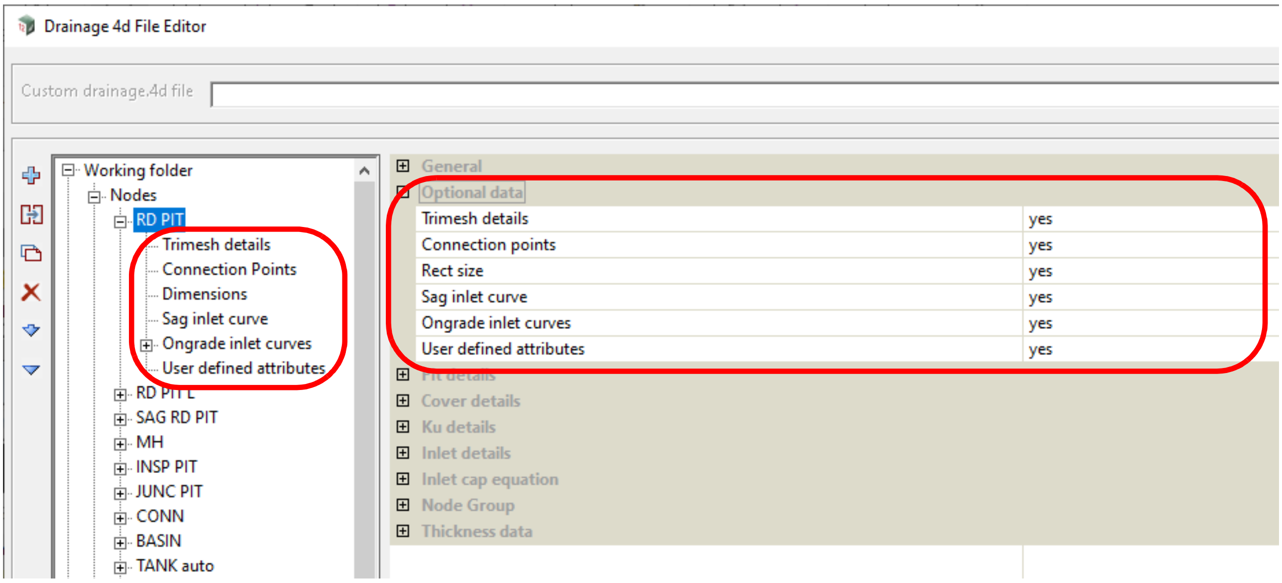
where *node_length* is the diameter if it a round node and length if it is a rectangular node

where *node_width* is the width of a rectangular node.

If <width> does not exist then it is a round node.

Continue to 27.7.2.4 Node: Optional data or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.4 Node: Optional data



In the **Drainage.4d File Editor**, the **Optional data** section for a node has the entries Trimesh details, Connection points, Rect size, Sag inlet curve, ongrade inlet curves and User defined attributes.

For ***Trimesh details:***

If ***yes*** is selected then a ***Trimesh details*** node is created to hold the trimesh information for drawing links. See 27.7.2.12 Node: Trimesh details Tree node.

If ***no*** is selected then there is no ***Trimesh details*** node and nothing is written to the file. If a ***Trimesh details*** node already existed and then ***no*** is selected then the ***Trimesh details*** node is deleted and any data in it is lost.

For ***Connection points:***

If ***yes*** is selected then a ***Connection Points*** node is created to hold the user defined attributes the link. See 27.7.2.13 Node: Connection Points Tree Node.

If ***no*** is selected then there is no ***Connection Points*** node and nothing is written to the file. If a ***Connection Points*** node already existed and then ***no*** is selected then the ***Connection Points*** node is deleted and any data in it is lost.

For ***Rect size:***

If ***yes*** is selected then a ***Dimensions*** node is created to hold the user defined attributes the link. See 27.7.2.14 Node: Dimensions Tree Node.

If ***no*** is selected then there is no ***Dimensions*** node and nothing is written to the file. If a ***Dimensions*** node already existed and then ***no*** is selected then the ***Dimensions*** node is deleted and any data in it is lost.

For ***Sag inlet curve:***

If ***yes*** is selected then a ***Sag inlet curve*** node is created to hold the data to defined the sag inlet curve for the node. See 27.7.2.15 Node: Sag inlet curve Tree Node.

If ***no*** is selected then there is no ***Sag inlet curve*** node and nothing is written to the file. If a ***Sag inlet curve*** node already existed and then ***no*** is selected then the ***Sag inlet curve*** node is deleted and any data in it is lost.

For ***Ongrade inlet curves:***

If ***yes*** is selected then a ***Ongrade inlet curves*** node is created to hold the data to defined the ongrade inlet curve for the node. See 27.7.2.16 Node: Ongrade inlet curves Tree Node.

If ***no*** is selected then there is no ***Ongrade inlet curves*** node and nothing is written to the file. If a ***Ongrade inlet curves*** node already existed and then ***no*** is selected then the ***Ongrade inlet curves*** node is deleted and any data in it is lost.

For ***User defined attributes:***

If ***yes*** is selected then a ***User defined attributes*** node is created to hold the user defined attributes the link. See 27.7.2.17 Node: User defined attributes Tree Node.

If ***no*** is selected then there is no ***User defined attributes*** node and nothing is written to the file. If a ***User defined attributes*** node already existed and then ***no*** is selected then the ***User defined attributes*** node is deleted and any data in it is lost.

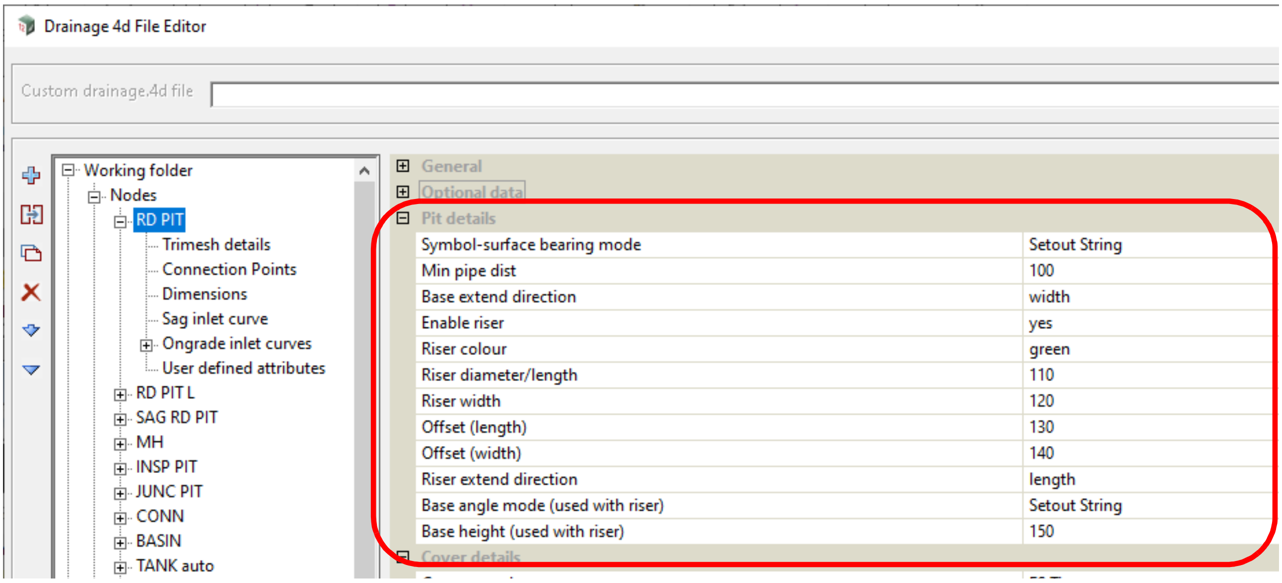
Note

Nothing is written to the file if **no** is selected for the field on the right hand side.

If **yes** is selected, nothing is written to the file for the field on the right hand side but data is written out for each of the associated nodes.

Continue to 27.7.2.5 Node: Pit details or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.5 Node: Pit details



For full definitions of these fields, see 17.4.1.2.1.3 Node Type: Pit details *or* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

<**pit_symbol_angle_mode**>*node_symbol_angle_mode_choice*</pit_symbol_angle_mode>

where *node_symbol_angle_mode_choice* is:

"Setout String"
"Manual"
"Low chainage"
"High chainage"
"Average"
"Same as symbol"

See 17.1.4.7.1 Bearing of Base (Chamber) with Riser

<**pit_extend_direction**>*node_extend_direction_choice*</pit_extend_direction>

where *node_extend_direction_choice* is "none" if the node is not extended

"width" if the node is extended in width direction

"length" if the node is extended in length direction

See 17.1.4.1 Nodes (Pits, Maintenance Holes)

<**pit_wall_clearance**>*node_wall_clearance_value*</pit_wall_clearance>

where *node_wall_clearance_value* is??

<**pit_riser_enable**>*node_riser_choice*</pit_riser_enable>

If *node_riser_choice* is "yes" then the node has a riser.

"no" then the node has no riser.

If <pit_riser_enable> is missing then the node has no riser.

<**pit_riser_colour**>*node_riser_colour_text*</pit_riser_colour>

where *node_riser_colour_choice* is the colour of the node riser.

<**pit_riser_diameter**>*node_riser_diameter_value*</pit_riser_diameter>

where *node_riser_diameter_value* is diameter for a round riser & length for a rectangular riser.

<**pit_riser_width**>*node_riser_width_value*</pit_riser_width>

where *node_riser_width_value* is the width of a rectangular riser.

If <pit_riser_width> does not exist then it is a round node.

<**pit_riser_offset_x**>*node_riser_offset_x_value*</pit_riser_offset_x>

where *node_riser_offset_x_value* is the x-offset of the riser from the centre of the node.

<**pit_riser_offset_y**>*node_riser_offset_y_value*</pit_riser_offset_y>

where *node_riser_offset_y_value* is the y-offset of the riser from the centre of the node.

<**pit_riser_extend_direction**>*node_riser_extend_direction_choice*</pit_riser_extend_direction>

where *node_riser_extend_direction_choice* is:

"none" if the riser is not extended

"width" if the riser is extended in width direction

"length" if the riser is extended in length direction

See 17.1.4.1.2 Risers on Nodes

<**pit_base_angle**>*node_base_angle_choice*</pit_base_angle>

where *node_base_angle_choice* is:

"Setout String"	// angle is taken from the setout string
"Manual"	// the angle is supplied
"Low chainage"	// the angle is the same as the low chainage node
"High chainage"	// the angle is the same as the high chainage node
"Average"	// average of the high and low chainage nodes
"Same as symbol"	// angle is same as the symbol angle

See 17.1.4.7.1 Bearing of Base (Chamber) with Riser

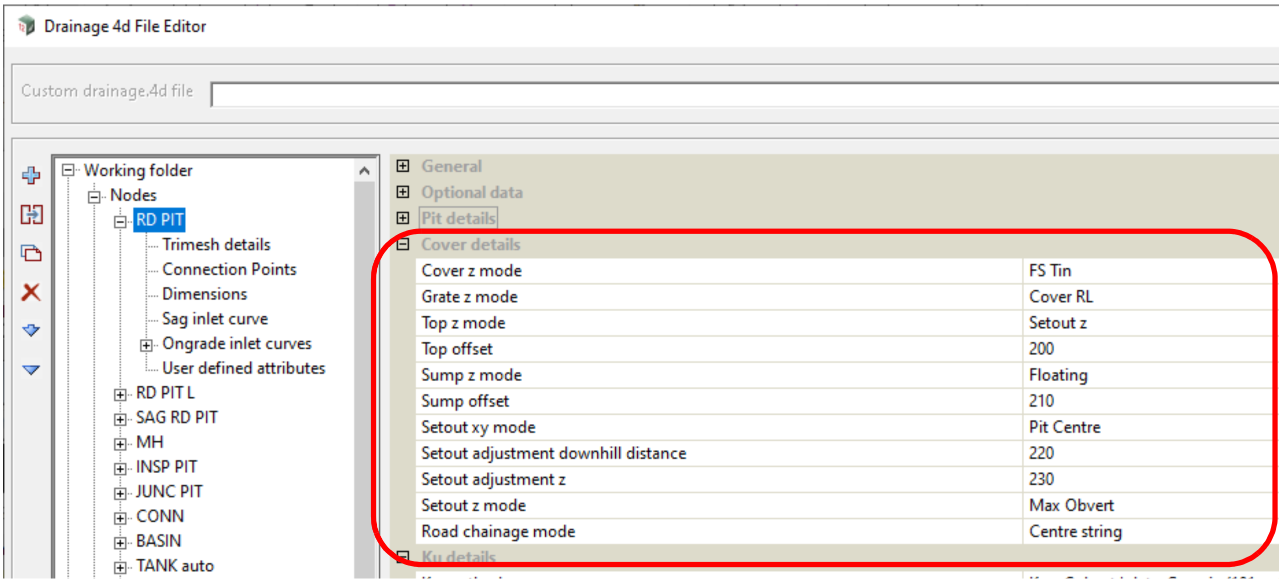
<**pit_base_height**>*node_base_height_value*</pit_base_height>

where *node_base_height_value* is the internal height of the chamber.

See 17.1.4.4 Z Point Definitions for Nodes and Links

Continue to 27.7.2.6 Node: Cover details or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.6 Node: Cover details



For full definitions of these fields, see 17.4.1.2.1.4 Node Type: Cover details *or* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

<**cover_rl_mode**>*node_cover_rl_mode_choice*</cover_rl_mode>

where *node_cover_rl_mode_choice* is:

"FS Tin" // Finished surface tin

"NS Tin" // Natural surface tin

"Setout String"

"Sz + setout string"

"Max Obvert"

"Manual"

See 17.1.4.5.1.1 Cover RL (z) Mode and Cover RL (z).

<**grate_rl_mode**>*node_grate_rl_mode_choice*</grate_rl_mode>

where *node_grate_rl_mode_choice* is:

"Cover RL"

"FS Tin" // Finished surface tin

"NS Tin" // Natural surface tin

"Setout String"

"Sz + setout string"

"Max Obvert"

"Manual"

See 17.1.4.5.1.2 Grate RL (z) Mode and Grate RL (z).

<**top_rl_mode**>*node_top_rl_mode_choice*</top_rl_mode>

where *node_top_rl_mode_choice* is:

"Cover"

"Setout z"

"Grate"

"Manual"

See 17.1.4.5.1.3 Top RL (z) Mode and Top RL (z).

<**top_rl_offset**>*node_top_rl_offset_value*</top_rl_offset>

where *node_top_rl_offset_value* is the distance that the top of the pit is below the cover.

See 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

<**sump_floating**>*node_sump_floating_choice*</sump_floating>

where *node_top_rl_mode_choice* is:

"Manual"

"Floating"

See 17.1.4.5.1.4 Sump RL (z) Mode and Sump RL (z).

<**sump_offset**>*node_sump_offset_value*</sump_offset>

where *node_sump_offset_value* is the distance between the lowest link in the chamber and the sump lever.

See 17.1.4.5 Definitions for Node RL Modes and Setout Modes.

<**setout_xy_mode**>*node_setout_xy_mode_choice*</setout_xy_mode>

where *node_setout_xy_mode_choice* is:

"Pit Centre"

"Setout String"

"Manual"

See 17.1.4.6.1 Setout xy Mode and Setout xy.

<**setout_adjustment**>*node_setout_adjustment_value*</setout_adjustment>

where *node_setout_adjustment_value* is the??

<**setout_adjustment_z**>*node_setout_adjustment_z_value*</setout_adjustment_z>

where *node_setout_adjustment_z_value* is the??

<**setout_z_mode**>*node_setout_z_mode_choice*</setout_z_mode>

where *node_setout_z_mode_choice* is:

"Cover RL"

"FS Tin"

"NS Tin"

"Setout String"

"Sz + setout string"

"Max Obvert"

"DS Invert"

"Sump Invert"

"Manual"

See 17.1.4.6.2 Setout Z Mode, String Setout RL, Sz and Setout RL.

<**road_ch_mode**>*node_road_ch_mode_choice*</road_ch_mode>

where *node_road_ch_mode_choice* is:

"No Road"

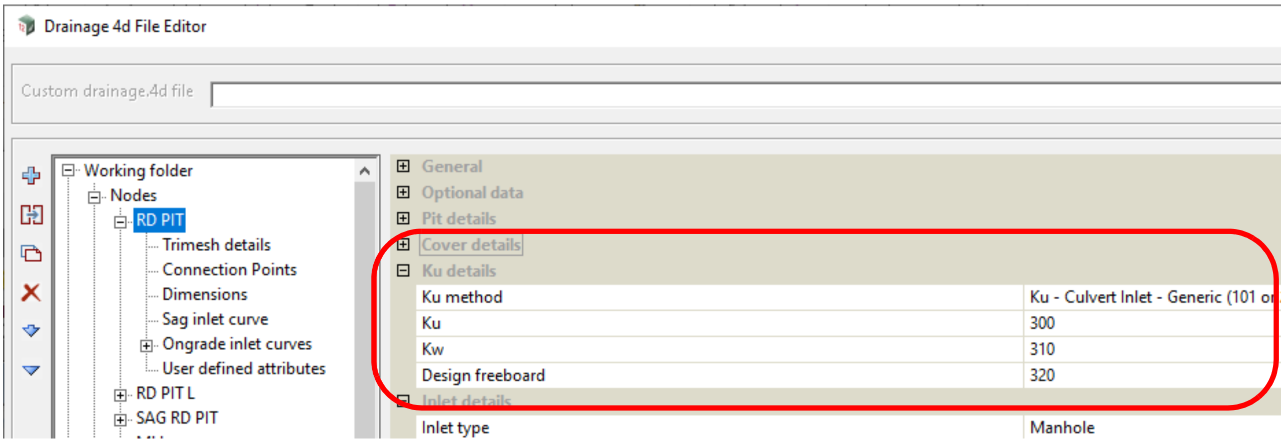
"Centre string"

"Manual"

See 17.1.4.6.3 Node Road Chainage Mode.

Continue to 27.7.2.7 Node: Ku details or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.7 Node: Ku details



For full definitions of these fields, see 17.4.1.2.1.5 Node Type: Ku details *or* 17.3.4.6.2.2.2 DEFAULTS >Nodes >Setout.

<**ku_method**>*node_ku_method_choice*</ku_method>

where *node_ku_method_choice* is "Direct"??

"Ku,Kw - Missouri/Hare Charts"??

"Ku,Kw>0 - Missouri/Hare Charts"??

"Ku Culvert Inlet - Generic (101 or200)"??

. . .

<**ku**>*node_ku_value*</ku>

where *node_ku_value* is the??

<**kw**>*node_kw_value*</kw>

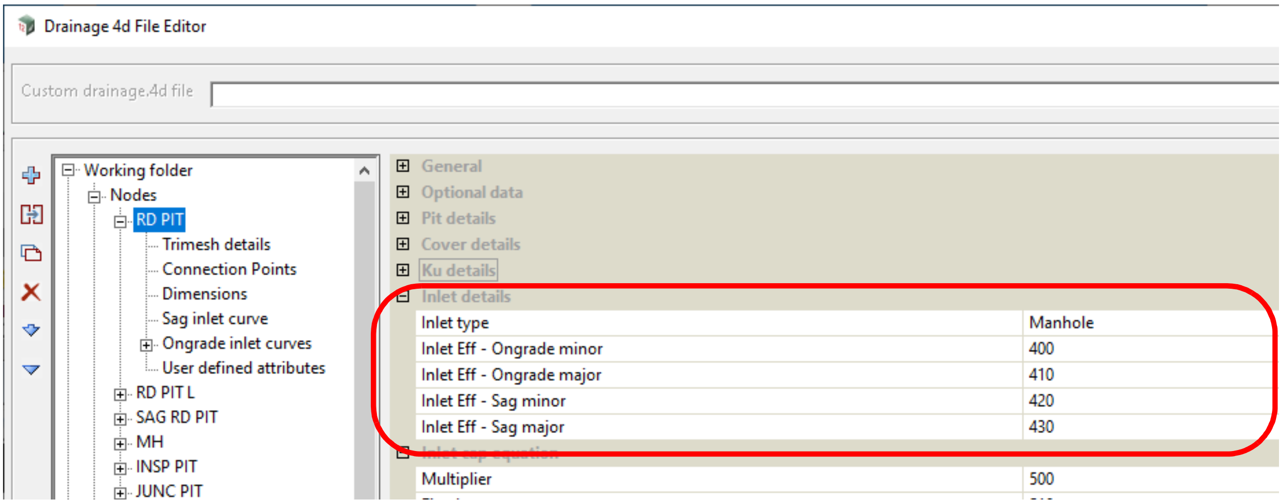
where *node_kw_value* is the??

<**design_freeboard**>*node_design_freeboard_value*</design_freeboard>

where *node_design_freeboard_value* is the??

Continue to 27.7.2.8 Node: Inlet details or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.8 Node: Inlet details



<**cap_config**>*node_cap_config_choice*</cap_config>

where *node_cap_config_choice* is the Inlet type and it is "Ongrade"

"Sag"??

"Manhole"??

<**choke_pog_minor**>*node_choke_pog_minor_value*</choke_pog_minor>

where *node_choke_pog_minor_value* is the inlet efficiency for minor ongrade.

<**choke_pog_major**>*node_choke_pog_major_value*</choke_pog_major>

where *node_choke_pog_major_value* is the inlet efficiency for major ongrade.

<**choke_sag_minor**>*node_choke_sag_minor_value*</choke_sag_minor>

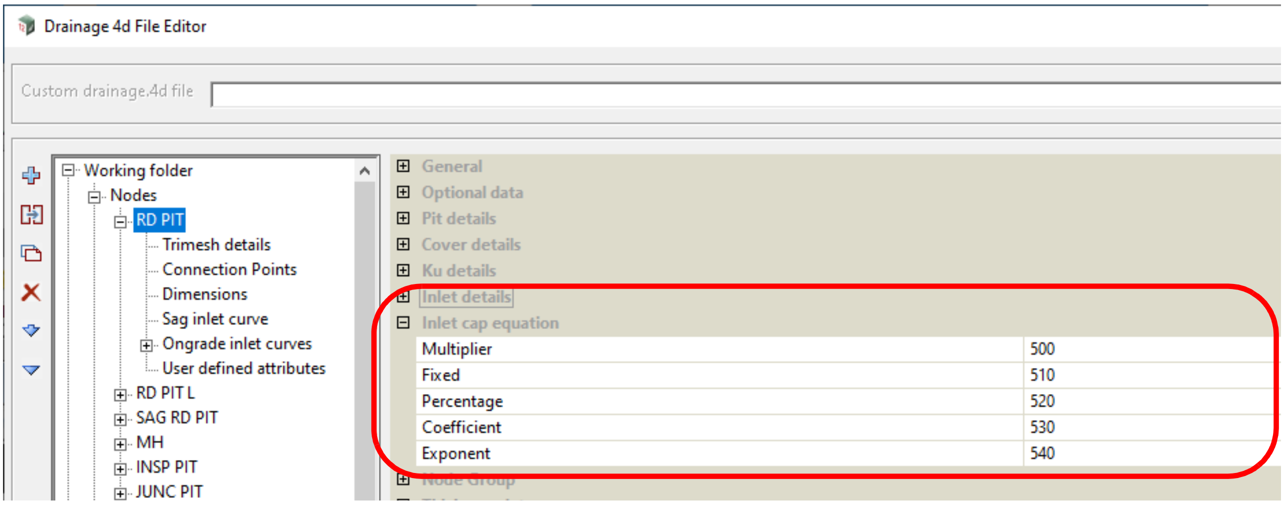
where *node_choke_sag_minor_value* is the inlet efficiency for minor sag.

<**choke_sag_major**>*node_choke_sag_major_value*</choke_sag_major>

where *node_choke_sag_major_value* is the inlet efficiency for major sag.

Continue to 27.7.2.9 Node: Inlet cap equation or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.9 Node: Inlet cap equation



<**inlet_cap_equation**>

<**multiplier**>*node_cap_equation_multiplier_value*</multiplier>

where *node_cap_equation_multiplier_value* is??

<**fixed**>*node_cap_equation_fixed_value*</fixed>

where *node_cap_equation_fixed_value* is??

<**percentage**>*node_cap_equation_percentage_value*</percentage>

where *node_cap_equation_percentage_value* is??

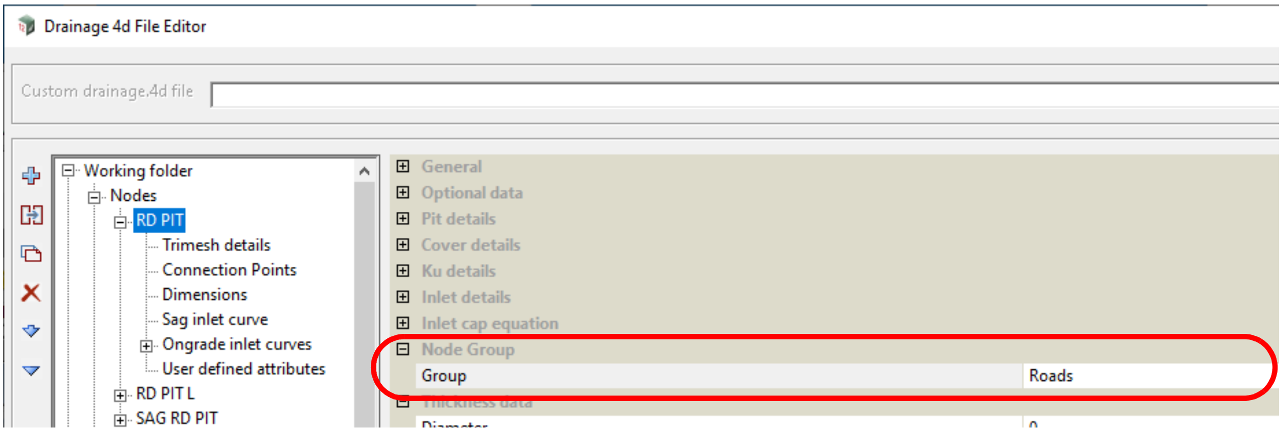
<**exponent**>*node_cap_equation*_exponent_*value*</exponent>

where *node_cap_equation*_exponent_*value* is??

</inlet_cap_equation>

Continue to 27.7.2.10 Node Group or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.10 Node Group

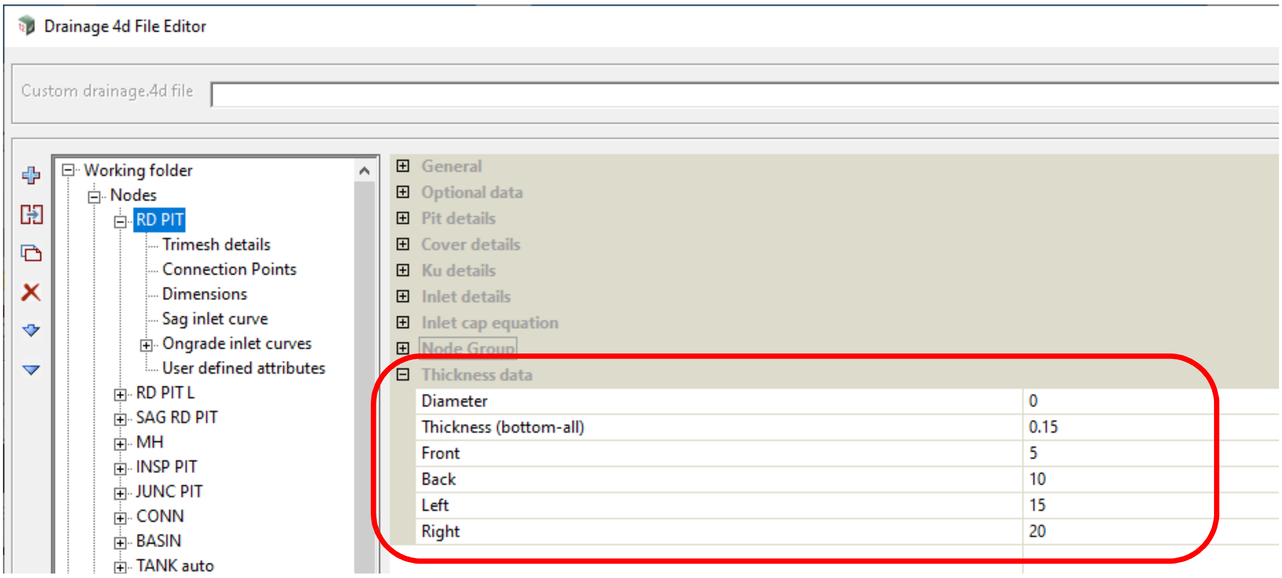


<**mh_group**>*node_mh_group_text*</mh_group>

where *node_mh_group_text* is the group that the node is in.

Continue to 27.7.2.11 Node: Thickness data or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.11 Node: Thickness data



<**mh_thickness**>

<**diameter**> *node_diameter*</diameter>

where *node_diameter* is the diameter if it a round node

<**bottom**> *node_bottom*</bottom>

where *node_bottom* is the thickness of the node.

<**front**> *node_front*</front>

where *node_front* is the thickness of the front of a rectangular node, and is **not present** if it is a round node.

<**back**> *node_back*</back>

where *node_back* is the thickness of the back side of a rectangular node, and is **not present** if it is a round node.

<**left**> *node_left*</left>

where *node_left* is the thickness of the left side of a rectangular node, and is **not present** if it is a round node.

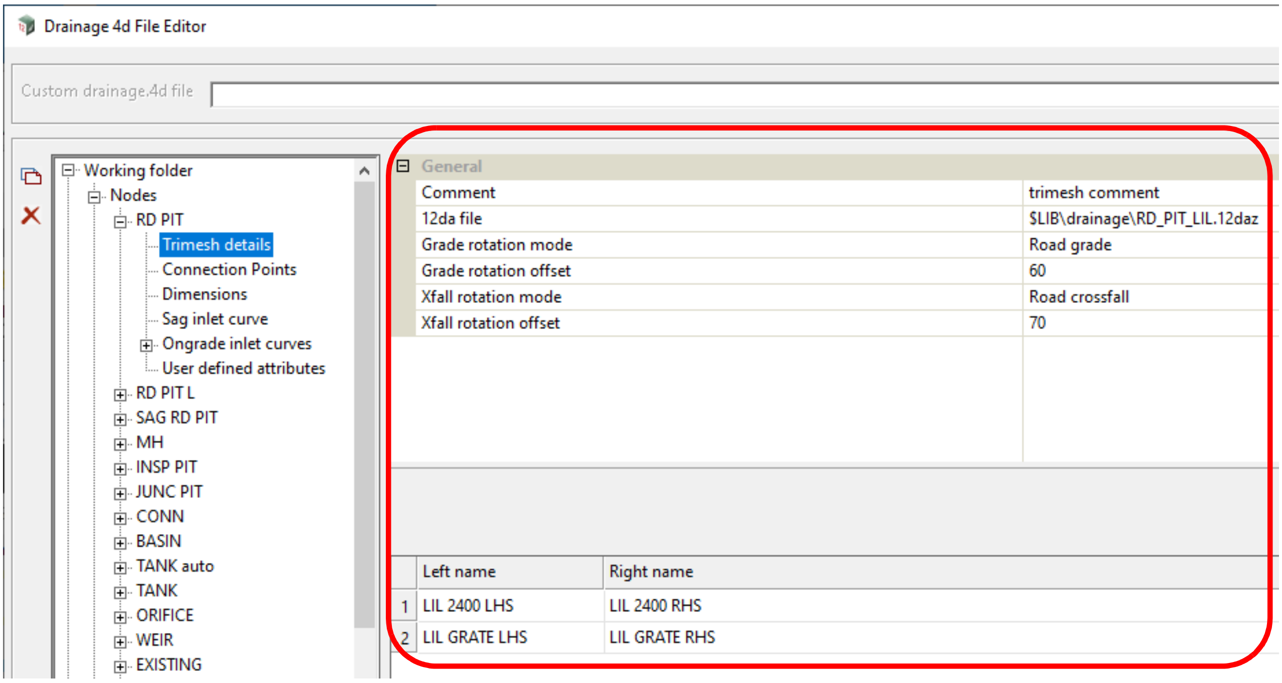
<**right**> *node_right*</right>

where *node_right* is the thickness of the right side of a rectangular node, and is **not present** if it is a round node.

</mh_thickness>

Continue to 27.7.2.12 Node: Trimesh details Tree node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.12 Node: Trimesh details Tree node



<**trimeshlist**>

<**comment**>*user_comment*</comment>

where *user_comment* is a user defined comment

<**file_name**> *trimesh_file_name*</file_name>

where *trimesh_file_name* is the name of the file containing trimeshes that are used by the node.

<**trimesh_grade_mode**> *trimesh_grade_mode_choice*</trimesh_grade_mode>

where *trimesh_grade_mode_choice* is "Road grade" or "Manual".

<**trimesh_grade_offset**> *trimesh_grade_offset_value*</trimesh_grade_offset>

where *trimesh_grade_offset_value* is??

<**trimesh_xfall_mode**> *trimesh_xfall_mode_choice*</trimesh_xfall_mode>

where *trimesh_xfall_mode_choice* is "Road crossfall" or "Manual".

<**trimesh_xfall_offset**> *trimesh_xfall_offset_value*</trimesh_xfall_offset>

where *trimesh_xfall_offset_value* is??

<**trimesh_names**>

<**trimesh_name_left**>> *trimesh_name_left_1*</trimesh_name_left>

where *trimesh_name_left_i* is the left name of the i-th row of the grid.

where *trimesh_name_right_i* is the right name of the i-th row of the grid.

<**trimesh_name_right**>> *trimesh_name_right_1*</trimesh_name_right>

</trimesh_names>

<trimesh_names>

<trimesh_name_left>> *trimesh_name_left_2*</trimesh_name_left>

<trimesh_name_right>> *trimesh_name_right_2*</trimesh_name_right>

</trimesh_names>

. . .

<trimesh_names>

<trimesh_name_left>> *trimesh_name_left_n*</trimesh_name_left>

<trimesh_name_right>> *trimesh_name_right_n*</trimesh_name_right>

</trimesh_names>

</trimeshlist>

Continue to 27.7.2.13 Node: Connection Points Tree Node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.13 Node: Connection Points Tree Node

Continue to 27.7.2.14 Node: Dimensions Tree Node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.14 Node: Dimensions Tree Node

<**node_dimensions**>

</node_dimensions>

Continue to 27.7.2.15 Node: Sag inlet curve Tree Node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.15 Node: Sag inlet curve Tree Node

<**cap_curve_sag**>

<**name**>node_sag_name</name>

<**comment**>node_sag_comment</comment>

<**inlet_cap_equation**>

<**multiplier**>*node_sag_cap_equation_multiplier_value*</multiplier>

<**fixed**>*node_sag_cap_equation_fixed_value*</fixed>

<**percentage**>*node_sag_cap_equation_percentage_value*</percentage>

<**exponent**>*node_sag_cap_equation*_exponent_*value*</exponent>

</inlet_cap_equation>

</cap_curve_sag>

where *node_sag_cap_equation_multiplier_value* is??

where *node_sag_cap_equation_fixed_value* is??

where *node_sag_cap_equation_percentage_value* is??

where *node_sag_cap_equation*_exponent_*value* is??

Continue to 27.7.2.16 Node: Ongrade inlet curves Tree Node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.16 Node: Ongrade inlet curves Tree Node

<**cap_curve_grades**>

<**cap_curve_grade**>

<**name**>name_text_1</name>

<**comment**>comment_text_1</comment>

<**road_grade**>road_grade_value_1</road_grade>

<**road_xfall**>road_xfall_value_1</road_xfall>

<**inlet_cap_equation**>

<**multiplier**>21</multiplier>

<**fixed**>22</fixed>

<**percentage**>23</percentage>

<**coefficient**>24</coefficient>

<**exponent**>25</exponent>

</inlet_cap_equation>

<cap_curve>

<x>0</x>

<y>0</y>

</cap_curve>

<cap_curve>

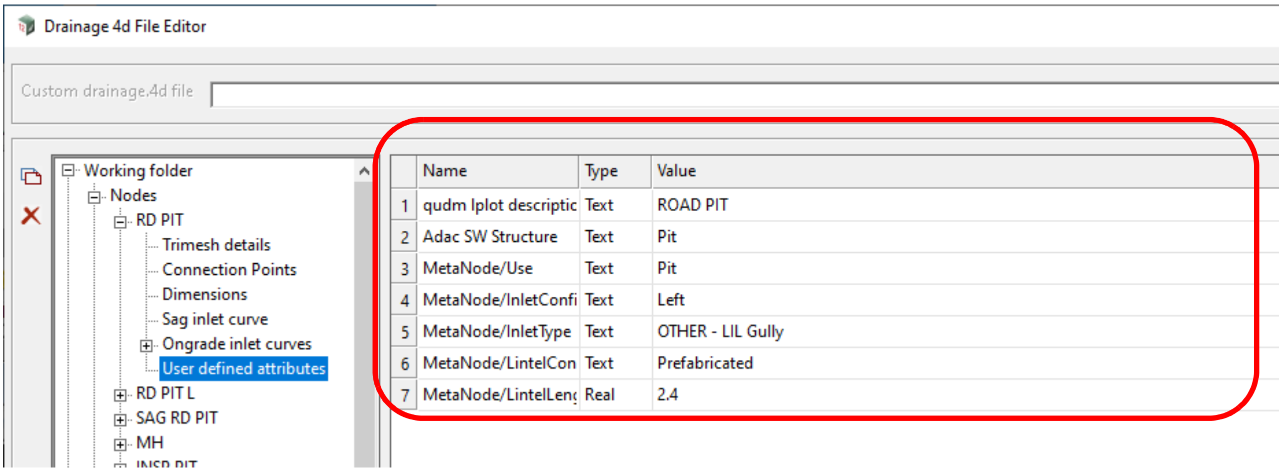
<x>0.03</x>

<y>0.03</y>

</cap_curve>

Continue to 27.7.2.17 Node: User defined attributes Tree Node or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.2.17 Node: User defined attributes Tree Node



<**user_attributes**>

<**user_attribute**>

<**name**>> *attribute_name_1*</name>

<**type**>> *attribute_type_1*</type>

<**value**>> *attribute_value_1*</value>

</user_attribute>

<name>> *attribute_name_2*</name>

<type>> *attribute_type_2*</type>

<value>> *attribute_value_2*</value>

</user_attribute>

. . .

</user_attribute>

<name>> *attribute_name_n*</name>

<type>> *attribute_type_n*</type>

<value>> *attribute_value_n*</value>

</user_attribute>

</user_attributes>

where *attribute_name_i* is the name of the i-th attribute.

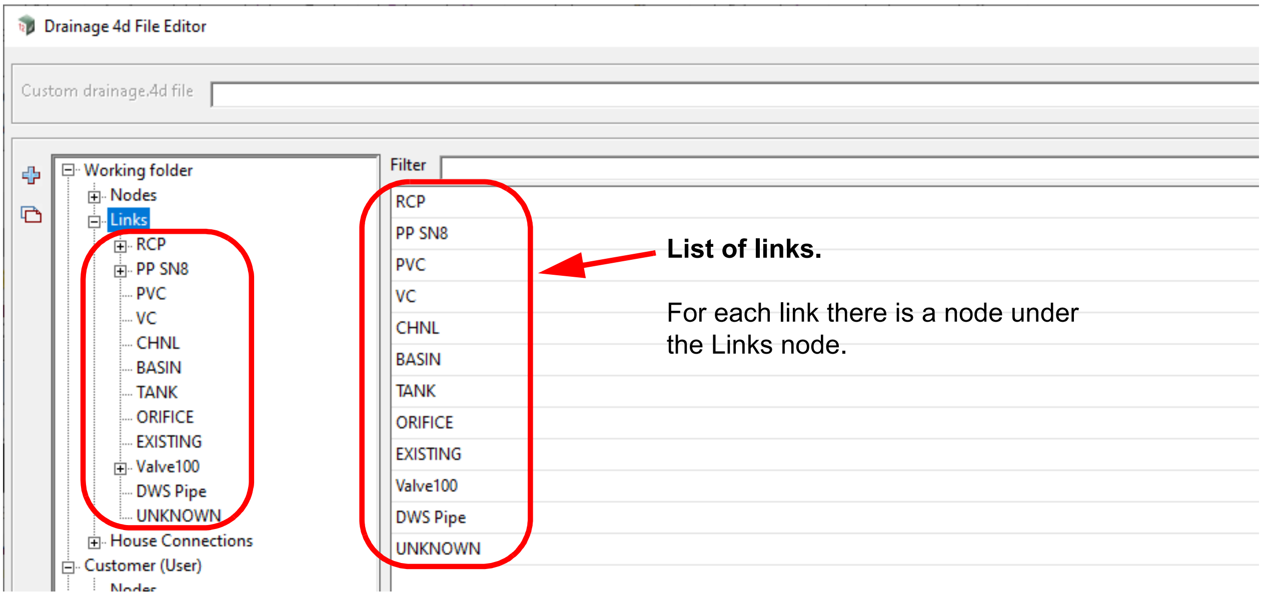
where *attribute_type_i* is the type of the i-th attribute.

where *attribute_value_i* is the value of the i-th attribute.

Continue to 27.7.3 Link Types Structure or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3 Link Types Structure

The documentation of the **link types structure** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



The list of **link types** is contained in a ***pipe_types block*** which begins with **<pipe_types>** and ends with **</pipe_types>**

Within the ***pipe_types*** block is a **link_block** for each individual link and the **link_block** contains all the information for that link.

<pipe_types>

<filter></filter> see 27.7.3.1 Links Filter

<link_block_1> see 27.7.3.2 <link_block_i>

<link_block_2>

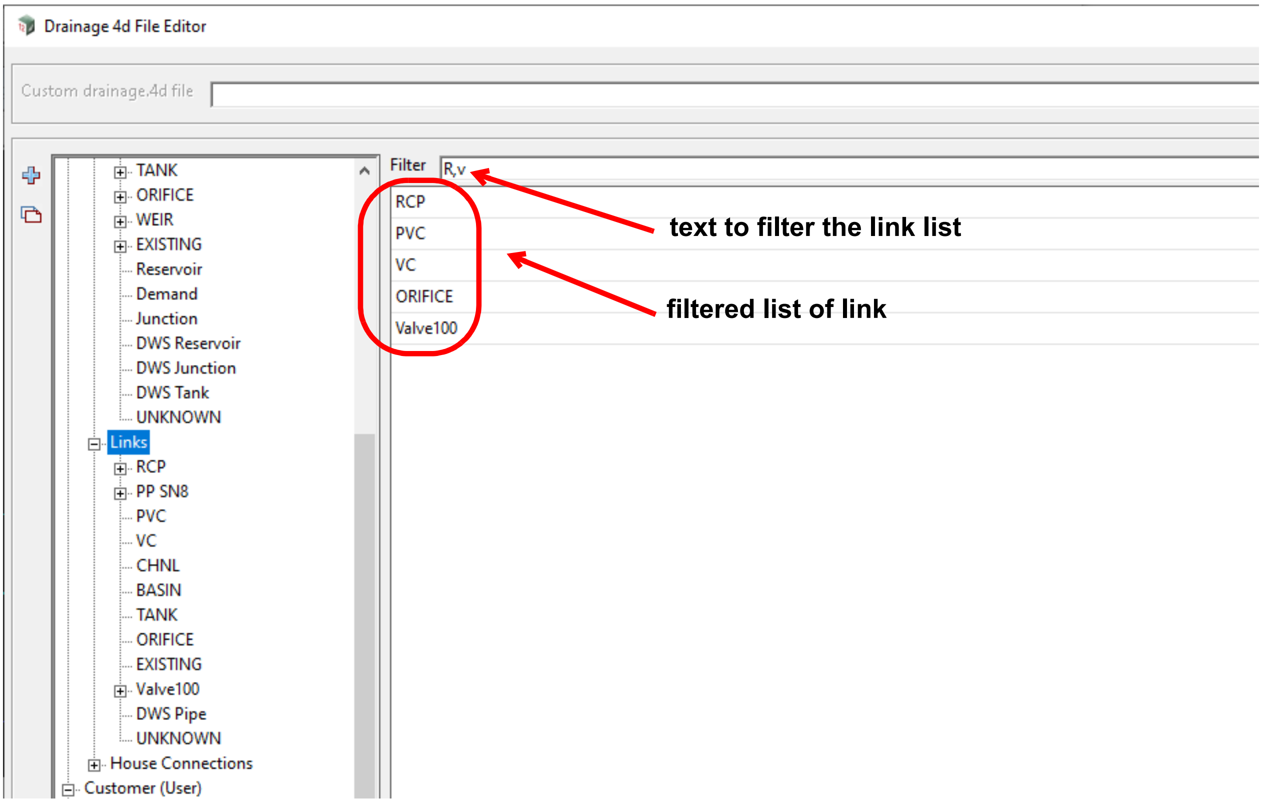
. . .

<link_block_n>

<pipe_types>

Continue to 27.7.3.1 Links Filter or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.1 Links Filter



The **Filter** field is used to restrict which links are used from the **Links** list

<**filter**>*filter_text*</filter>

where *filter_text* is the text to filter the list of links

filter_text is made up of texts, separated by commas, and any link names in the full list of names that includes part of any of the texts, are included in the final list of links. For the Filter, the texts and link names are case insensitive.

For example:

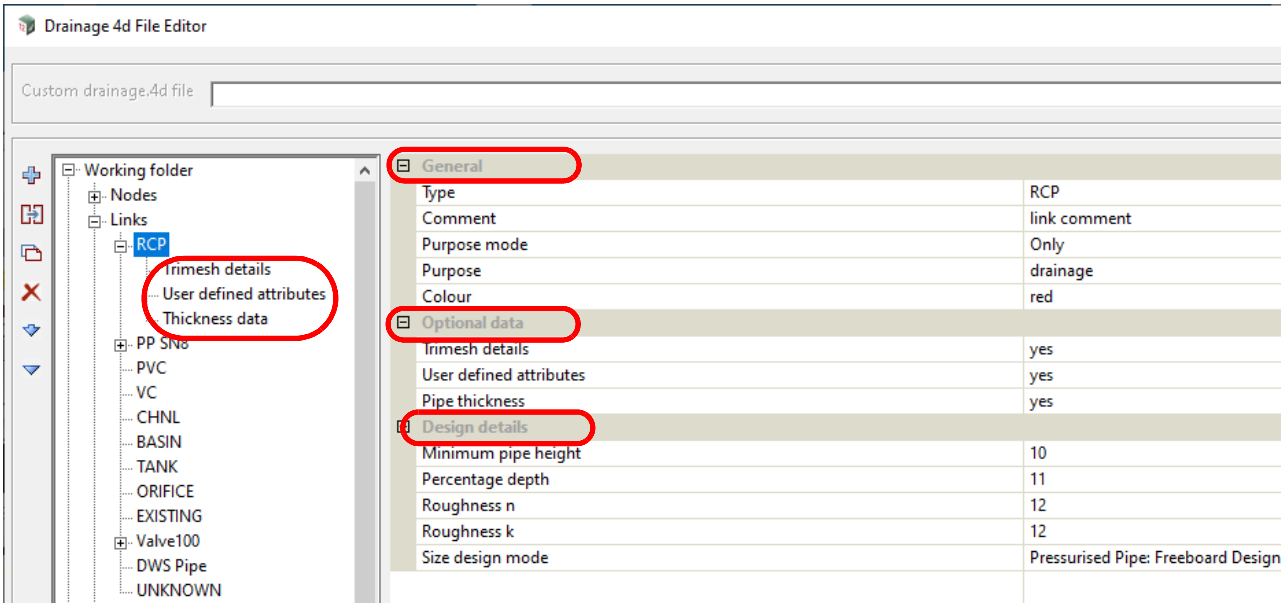
Filter R
includes RCP and ORIFICE

Filter R,v
includes RCP, PVC, VC, ORIFICE, Valve100.

Continue to 27.7.3.2 <link_block_i> or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.2 <link_block_i>

The documentation of the **link block** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



Each individual link block begins with **<type>** and ends with **</type>** and In between are the various sections that hold all the information for that link.

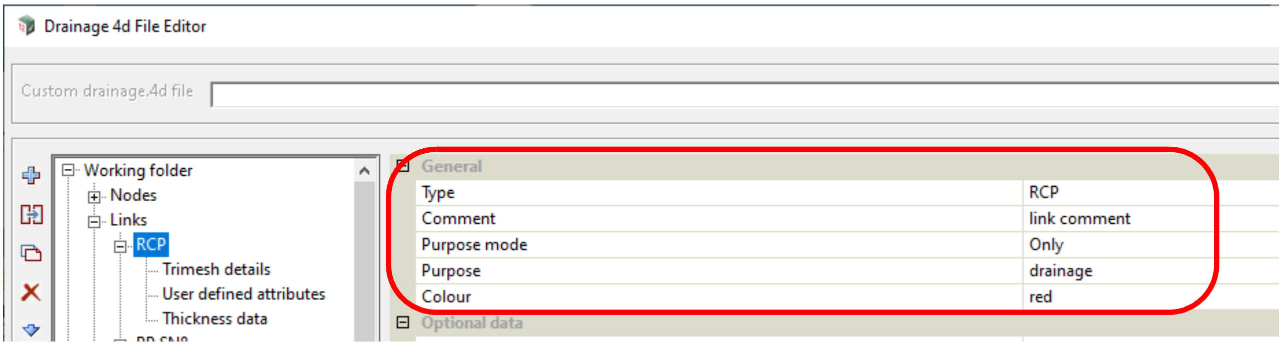
<type>

General section	see 27.7.3.3 Link: General
Optional data	see 27.7.3.4 Link Block: Optional data
Design details	see 27.7.3.5 Link: Design details
Trimesh details	see 27.7.3.6 Link: Trimesh details Node
User defined attributes	see 27.7.3.7 Link Block: User defined attributes
Thickness data	see 27.7.3.8 Link Block: Thickness data

</type>

Continue to 27.7.3.3 Link: General or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.3 Link: General



<**type**>*link_name*</type>

where *link_name* is the name of the link

<**comment**>*user_comment*</comment>

where *user_comment* is a user defined comment

<**string_purpose_mode**>***string_purpose_mode_choice***</string_purpose_mode>

where *string_purpose_mode_choice* is "Only"??

"Exclude"

"All"

blank then <string_purpose_mode> is left out of the file.

<**string_purpose**>*string_purpose_choice*</string_purpose>

where *string_purpose_choice* is "drainage"??

"foul"

"water supply"

"all"

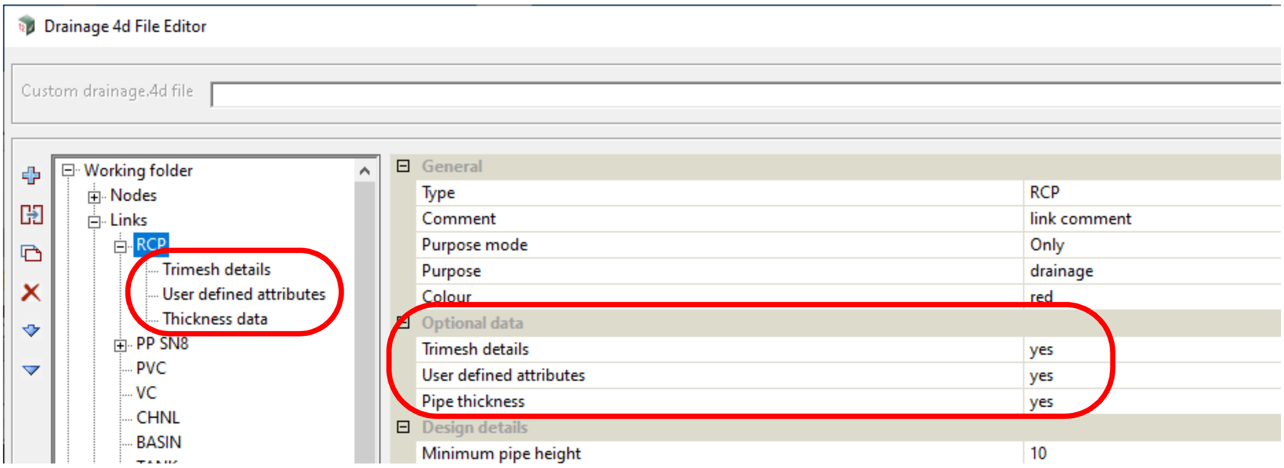
If it is blank then <string_purpose> is left out of the file.

<**colour**>*colour_text*</colour>

where *colour_text* is the name of the colour.

Continue to 27.7.3.4 Link Block: Optional data or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.4 Link Block: Optional data



In the **Drainage.4d File Editor**, the **Optional data** section for a link has the three entries Trimesh details, User defined attributes and Pipe thickness.

For ***Trimesh details:***

If ***yes*** is selected then a ***Trimesh details*** node is created to hold the trimesh information for drawing links. See 27.7.3.6 Link: Trimesh details Node.

If ***no*** is selected then there is no ***Trimesh details*** node and nothing is written to the file. If a ***Trimesh details*** node already existed and then ***no*** is selected then the ***Trimesh details*** node is deleted and any data in it is lost.

For ***User defined attributes:***

If ***yes*** is selected then a ***User defined attributes*** node is created to hold the user defined attributes the link. See 27.7.3.7 Link Block: User defined attributes.

If ***no*** is selected then there is no ***User defined attributes*** node and nothing is written to the file. If a ***User defined attributes*** node already existed and then ***no*** is selected then the ***User defined attributes*** node is deleted and any data in it is lost.

For ***Thickness data:***

If ***yes*** is selected then a ***Thickness data*** node is created to hold the user defined attributes the link. See 27.7.3.8 Link Block: Thickness data.

If ***no*** is selected then there is no ***Thickness data*** node and nothing is written to the file. If a ***Thickness data*** node already existed and then ***no*** is selected then the ***Thickness data*** node is deleted and any data in it is lost.

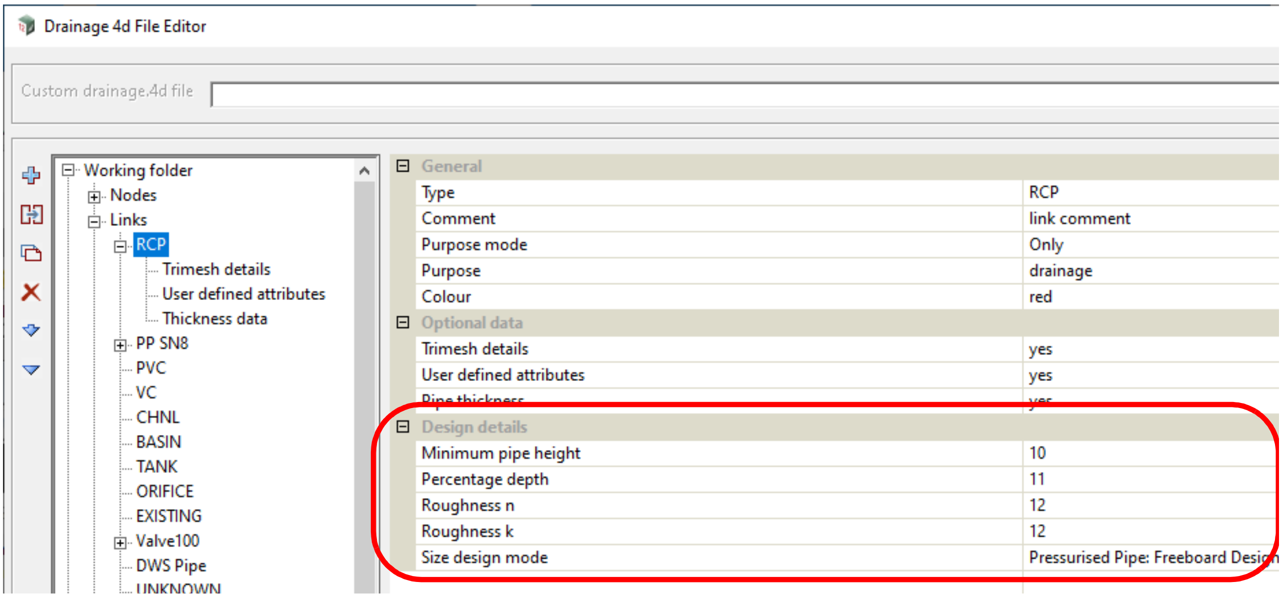
Note

Nothing is written to the file if **no** is selected for the field on the right hand side.

If **yes** is selected, nothing is written to the file for the field on the right hand side but data is written out for each of the associated nodes.

Continue to 27.7.3.5 Link: Design details or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.5 Link: Design details



<**min_height**>link_minimum_height_value</min_height>

where *link_minimum_height_value* is??

<**design_percent_depth**>link_design_percent_depth_value</design_percent_depth>

where *link_design_percent_depth_value* is??

<**roughness_n**>link_roughness_n_value</roughness_n>

where *link_roughness_n_value* is Manning’s n value.

<**roughness_k**>link_roughness_k_value</roughness_k>

where *link_roughness_k_value* is Colebrook k value.

<**design_size_mode**>link_design_size_mode_choice</design_size_mode>

where *link_design_size_mode_choice* is:

"Pressurised Pipe: Freeboard Design"

"Part-full Pipe: Freeboard Design"

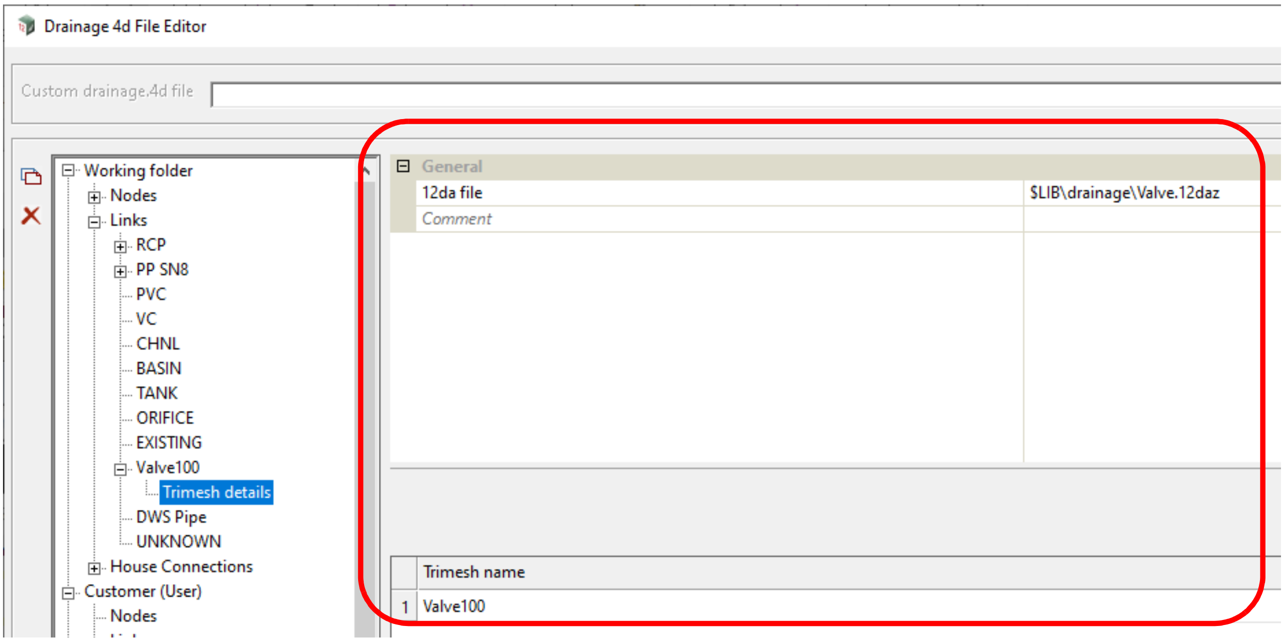
"Part-full Pipe: Flow-depth Design"

"Open Channel: Freeboard Design"

See 17.3.4.6.2.3 DEFAULTS >Links subtab

Continue to 27.7.3.6 Link: Trimesh details Node or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.6 Link: Trimesh details Node



<**trimeshlist**>

<**file_name**> *trimesh_file_name*</file_name>

where *trimesh_file_name* is the name of the file containing trimeshes that are used by the link.

<**comment**>*comment_text*<comment>

where *comment_text* is a user supplied comment.

<**trimesh_names**>

<**trimesh_name**>*trimesh_name_1*</trimesh_name>

where *trimesh_name_1* is the name of the first row of the grid.

</trimesh_names>

. . .

<trimesh_names>

<trimesh_name>> *trimesh_name_n*</trimesh_name_left>

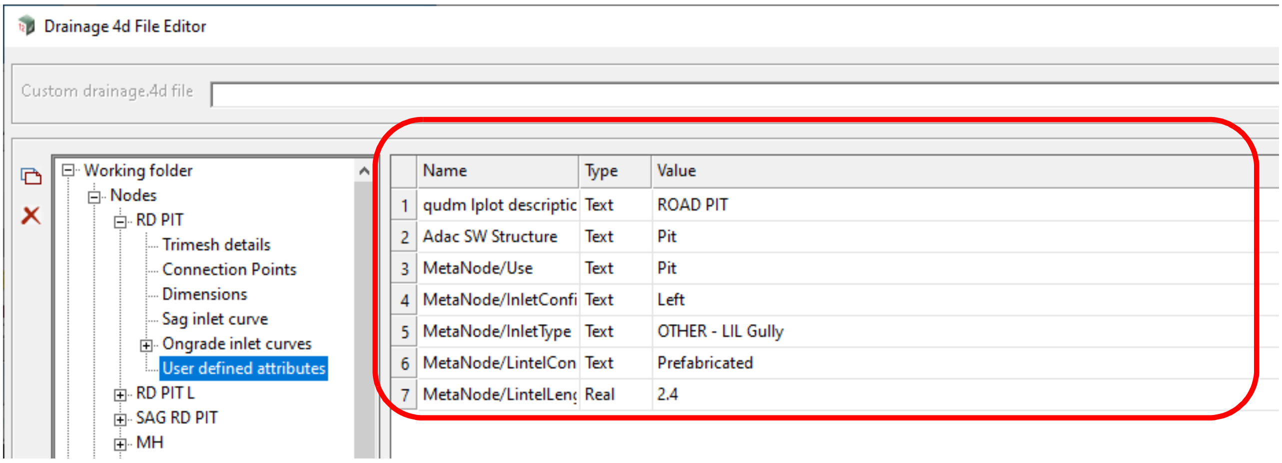
where *trimesh_name_n* is the name of the n-th row of the grid.

</trimesh_names>

</trimeshlist>

Continue to 27.7.3.7 Link Block: User defined attributes or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.3.7 Link Block: User defined attributes



<**user_attributes**>

<**user_attribute**>

<**name**>> *attribute_name_1*</name>

<**type**>> *attribute_type_1*</type>

<**value**>> *attribute_value_1*</value>

</user_attribute>

<name>> *attribute_name_2*</name>

<type>> *attribute_type_2*</type>

<value>> *attribute_value_2*</value>

</user_attribute>

. . .

</user_attribute>

<name>> *attribute_name_n*</name>

<type>> *attribute_type_n*</type>

<value>> *attribute_value_n*</value>

</user_attribute>

</user_attributes>

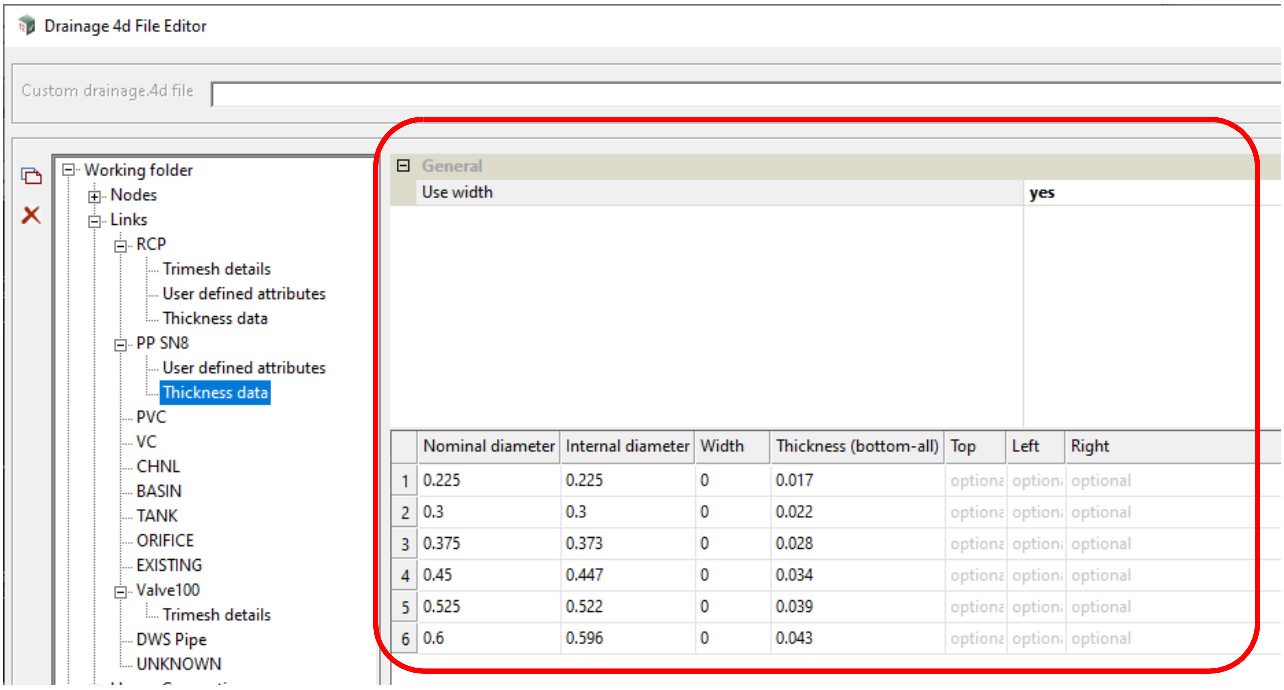
where *attribute_name_i* is the name of the i-th attribute.

where *attribute_type_i* is the type of the i-th attribute.

where *attribute_value_i* is the value of the i-th attribute.

Continue to 27.7.3.8 Link Block: Thickness data or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

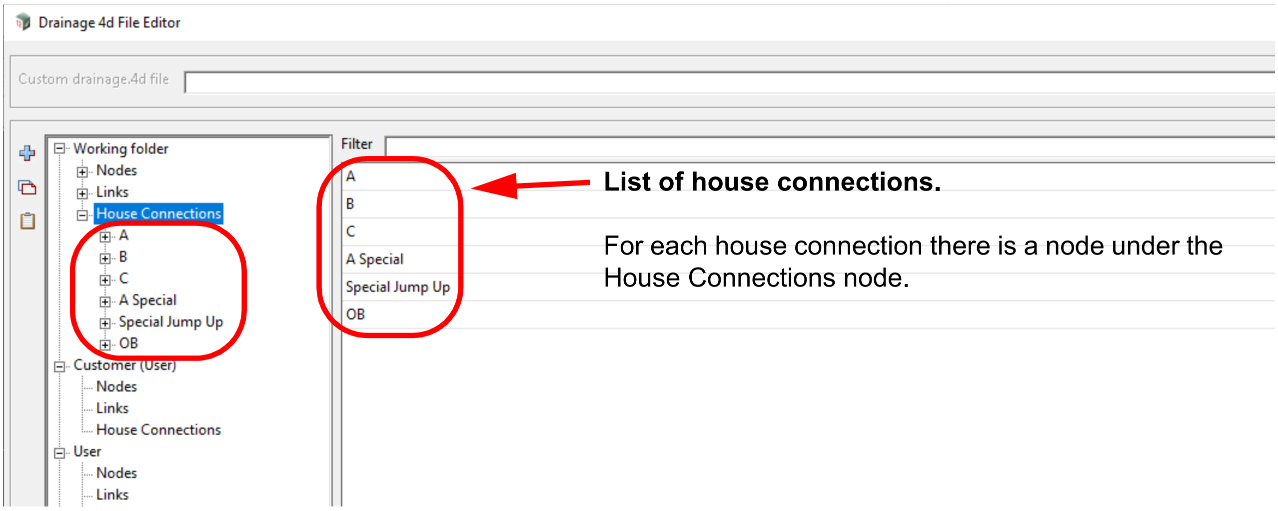
27.7.3.8 Link Block: Thickness data



Continue to 27.7.4 House Connection Types Structure or return to 27.7.3 Link Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4 House Connection Types Structure

The documentation of the **house connection types structure** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



The list of **house connection types** is contained in a ***hc_types block*** which begins with **<hc_types>** and ends with **</hc_types>**

Within the ***hc_types*** block is a **hc_block** for each individual house connection and the **hc_block** contains all the information for that house connection.

<hc_types>

<filter></filter> see 27.7.4.1 House Connections Filter

<hc_block_1> see 27.7.4.2 <hc_block_i>

<hc_block_2>

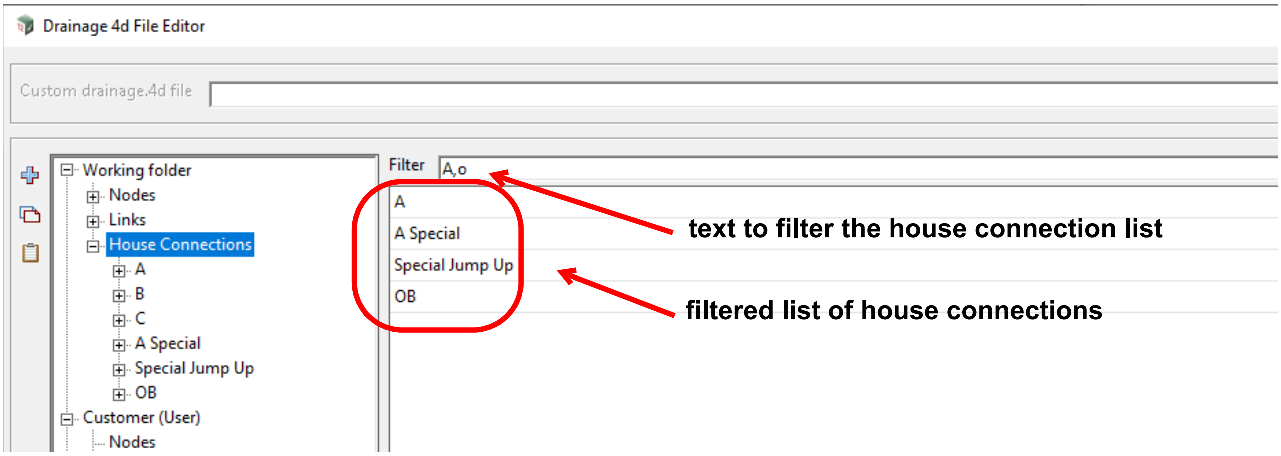
. . .

<hc_block_n>

</hc_types>

Continue to 27.7.4.1 House Connections Filter or return to 27.7.2 Node Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.1 House Connections Filter



The **Filter** field is used to restrict which house connections are used from the **House Connection** list

<**filter**>*filter_text*</filter>

where *filter_text* is the text to filter the list of house connections

filter_text is made up of texts, separated by commas, and any house connections names in the full list of names that includes part of any of the texts, are included in the final list of house connections. For the Filter, the texts and house connections names are case insensitive.

For example:

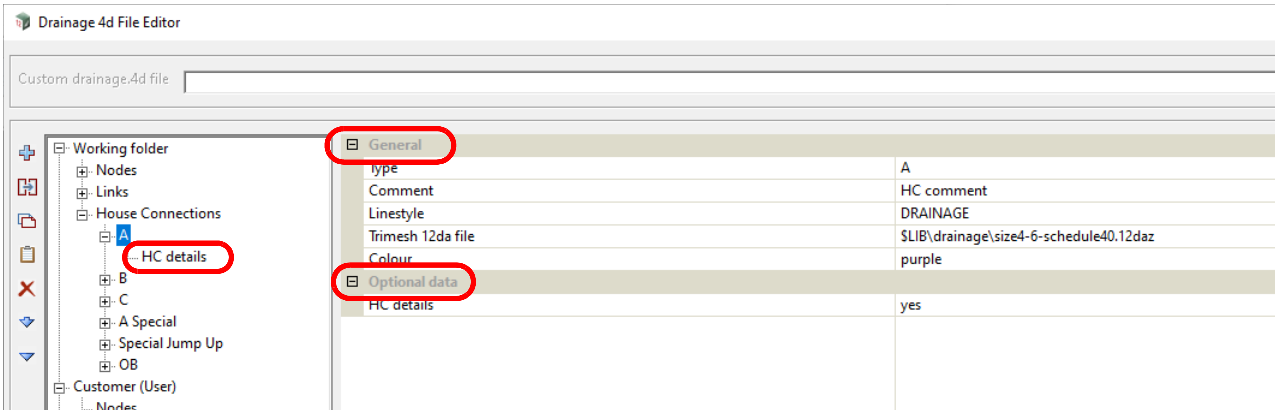
Filter A
includes A, A Special, Special Jump Up

Filter A,o
includes A, A Special, Special Jump Up, OB.

Continue to 27.7.4.2 <hc_block_i> or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.2 <hc_block_i>

The documentation of the **house connection block** is broken up into sections that reflects the structure inside the **Drainage.4d File Editor** (17.4.1 Drainage.4d File Editor).



Each individual house connection block begins with **<type>** and end with **</type>** and in between are various sections that hold all the information for that house connection.

<type>

General section - see 27.7.4.3 House Connection: General

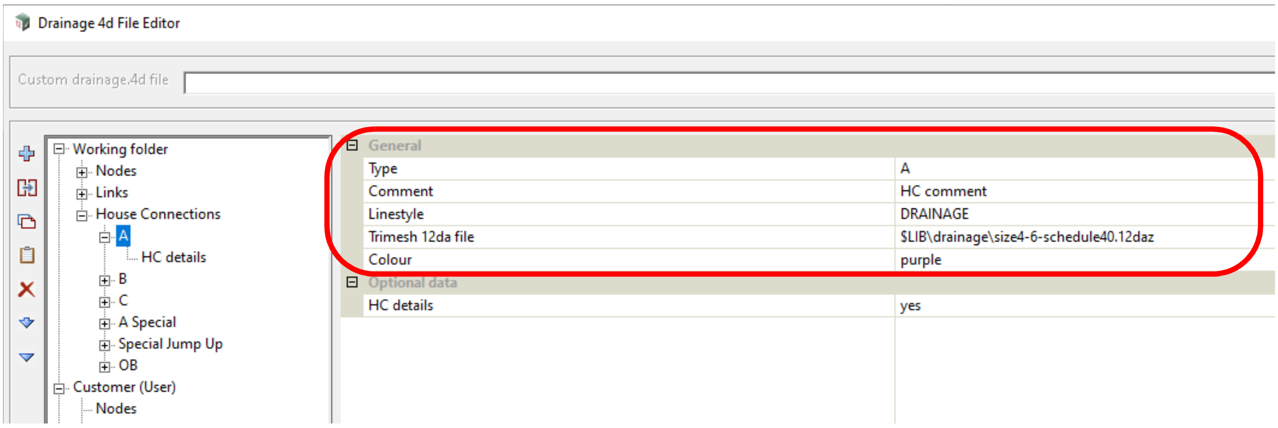
Optional data - 27.7.4.4 House Connection: Optional data

House connection details - 27.7.4.5 House Connection: HC details node

</type>

Continue to 27.7.4.3 House Connection: General or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.3 House Connection: General



Each house connection block contains general information for that house connection.

<**type**>*house_control_name*</type>

where *house_control_name* is the name of the link

<**comment**>*user_comment*</comment>

where *user_comment* is a user defined comment

<**line_style**>*house_connection_linestyle*</line_stylec>

where *house_connection_linestyle* is the linestyle used for the house connection.

<**file_name**> *trimesh_file_name*</file_name>

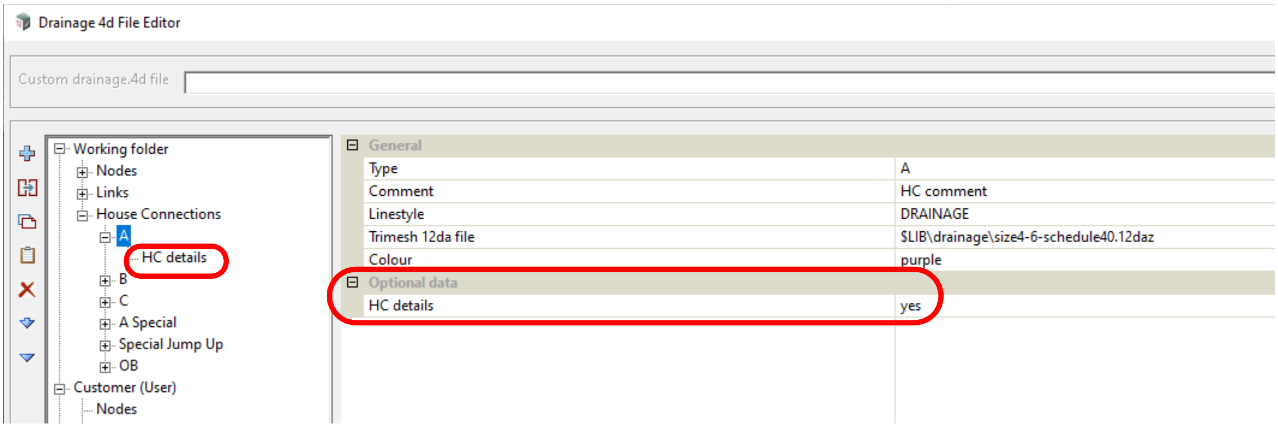
where *trimesh_file_name* is the name of the file containing trimeshes that are used by the house connection.

<**colour**>*colour_text*</colour>

where *colour_text* is the name of the colour.

Continue to 27.7.4.4 House Connection: Optional data or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.4 House Connection: Optional data



In the **Drainage.4d File Editor**, the **Optional data** section for a house connection just has the one entry ***HC details.***

For ***HC details:***

If ***yes*** is selected then a ***HC details*** node is created to hold the drawing information for the house connection. See 27.7.4.5 House Connection: HC details node.

If ***no*** is selected then there is no ***HC details*** node and nothing is written to the file. If a ***HC details*** node already existed and then ***no*** is selected then the ***HC details*** node is deleted and any data in it is lost.

Note

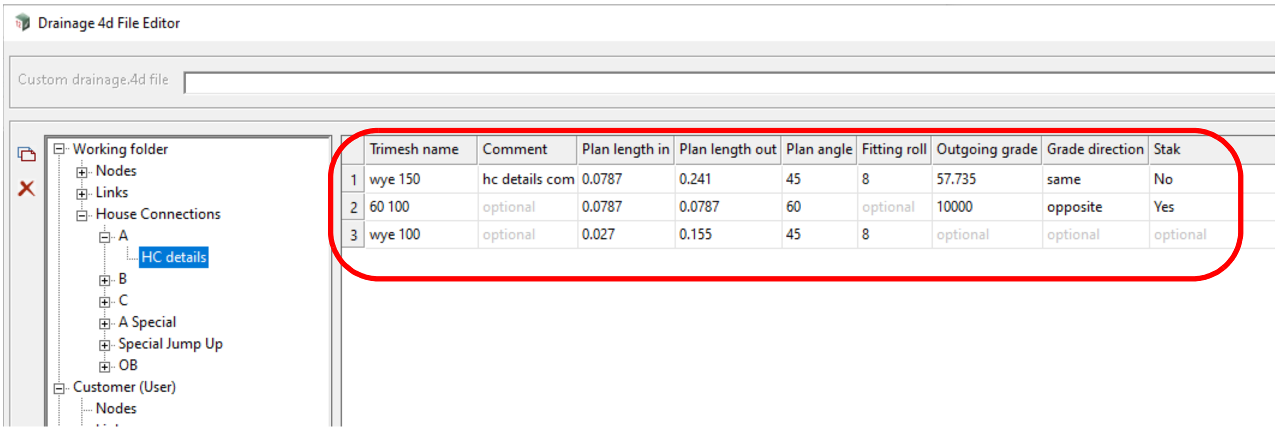
Nothing is written to the file if **no** is selected for the field on the right hand side.

If **yes** is selected, nothing is written to the file for the field on the right hand side but data is written out for each of the associated nodes.

Continue to 27.7.4.5 House Connection: HC details node or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.5 House Connection: HC details node

The 3D drawing details of the house connection is entered in the **Drainage.4d File Editor** as a grid of links going out from the water node. Each row of the grid describes the next link of the house connection:



Each row of the ***HC_Details*** grid is written out inside <hc_grid> and </hc_grid>:

<hc_grid>

<hc details for link 1> - see 27.7.4.5.1 House Connection Details for link i

</hc_grid>

. . .

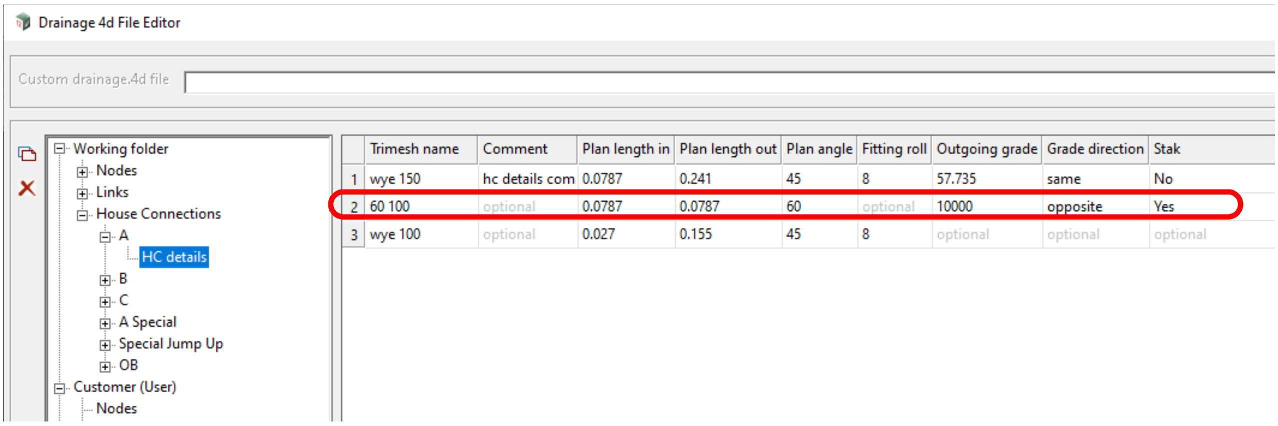
<hc_grid>

<hc details for link n> - see 27.7.4.5.1 House Connection Details for link i

</hc_grid>

Continue to 27.7.4.5.1 House Connection Details for link i or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.4.5.1 House Connection Details for link i



<**trimesh_name**>*hc_trimesh_name_i*</trimesh_name>

where *hc_trimesh_name_i* is the trimesh used for the i-th link of the house connection

<**comment**>*hc_comment_text_i*</comment>

where *hc_comment_text_i* is a user comment for the i-th link of the house connection.

If blank then <comment> is left out.

<**plan_length**>*hc_plan_length_in_value_i*</plan_length>

where *hc_plan_length_in_value_i* is the plan length in of the ithlink of the house connection

<**plan_length_out**>*hc_plan_length_out_value_i*</plan_length_out>

where *hc_plan_length_out_value_i* is the plan length out of the i-th link of the house connection

<**plan_angle**>*hc_plan_angle_value_i*</plan_angle>

where *hc_plan_angle_value_i* is the plan angle of the i-th link of the house connection

<**roll_in**>*hc_fitting_roll_value_i*</roll_in>

where *hc_fitting_roll_value_i* is the fitting roll in of the i-th link of the house connection

<**grade_out**>*hc_grade_out_value_i*</grade_out>

where *hc_grade_out_value_i* is the grade out of the i-th link of the house connection

<**grade_direction**>*hc_grade_direction_choice_i*</grade_direction>

where *hc_grade_direction_choice_i* is the grade direction of the i-th link of the house connection and is one of:

"same"

"opposite"

blank - <grade_direction> is then left out

<**stack**>*hc_stack_choice_i*</stack>

where *hc_stack_choice_i* is one of:

"yes"

"no"

blank - <stack> is then left out

Continue to 18 Water 2D or return to 27.7.4 House Connection Types Structure or 27.7 Water Definitions File - XML drainage.4d.

27.7.5 Stuff to use from old text file

---------------------- Info to use in doco ----------------------

are used to set the following manhole properties via the Water Network Editor (WNE 17.3.4 Water Network Editor (WNE)).

- manhole diameter, length/width and thickness
- manhole description, notes, group, ku/kw method, ku/kw values, rational engine design freeboard,
- manhole level modes for cover level, grate level, survey setout level and sump levels,
- survey setout xy modes and road chainage modes
- user defined manhole attributes

Each definition (manhole block) in the file begins with the key word **Manhole**, followed by the manhole type and then curly braces **{ }**. The order that the definitions appear in the file determines the order they appear in the drop down lists inside ***12d Model***.

The minimum requirement for a pit type definition is

Manhole “type name” {

}

The type name must be unique and the braces {} cannot be () or [].

Optional manhole commands may be placed inside the braces. These commands include may include 27.7.5.1 Node Editor Commands, 27.7.5.3 Node Water Network Editor Commands and Manhole Calculation Commands.

Continue to 27.7.5.1 Node Editor Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.1 Node Editor Commands

These optional commands change the properties of the manhole objects. Changes to these commands will used in creating new drainage strings and the 17.3.4 Water Network Editor (WNE) will prompt you to update the object if these settings are different to the strings current settings. A list of these commands follows

mhdiam x.x	set the manhole as circular (internal diameter in base units)

mhsize x.x y.y	set the manhole as rectangular (over rides mhdiam) length and width in base units

```
mhthickness     {
   diam_thickness   x.xxx a.aaa b.bbb c.ccc d.ddd
}
```

x.xxx	nominal diameter choices will appear in the WNE->Pipe->Diameter drop down
a.aaa	optional front thickness (base units) 0.000 if omitted
b.bbb	optional back thickness (base units), front thickness if omitted
c.ccc	opt left thickness in direction of chainage (base units), front thickness if omitted
d.ddd	opt right thickness in direction of chainage (base units), front thickness if omitted

Continue to 27.7.5.2 Node Level Modes or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.2 Node Level Modes

Continue to 27.7.5.3 Node Water Network Editor Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.3 Node Water Network Editor Commands

These optional commands store user defined data on the nodes or change the calculation modes available in the 17.3.4 Water Network Editor (WNE).

The **Set Node Details** button in the WNE will **recalculate** these for all manholes in the network.

A list of these commands follows

mhdesc "description" creates a pit text attribute "pit type description" and is used in the drainage pit schedule report.

mhnotes "note" creates a pit text attribute "pit type remarks" and is used in the drainage pit schedule report.

mhgroup "group" routines that select manholes will select from a manhole belonging to the same group

attribute_integer "attribute name1" x x is an integer value (no decimal, stored exactly by computers

attribute_real "attribute name2" x.xxx x is a real value (used to store numbers with decimals or very large or very small numbers

attribute_text "attribute name3" "text" text is a series of words or numbers not intended for calculations

Note: If a non-special attribute name is set for some, but not all manhole types, that attribute will be deleted on all manholes with types where the attribute is not defined.

The following special attribute commands create/modify an attribute as described above but these attributes also control calculations performed by the **Set Node Details** button on the 17.3.4 Water Network Editor (WNE).

The WNE fields will be locked when these attributes are defined for the selected pit type. If these attribute are not defined for the selected pit type, the WNE field will not be locked and remain unchanged.

attribute_integer "cover rl mode" x WNE field ->Pit =>Main =>Cover RL mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Sz + setout string	8

attribute_integer "grate rl mode" x WNE field ->Pit =>Main =>Grate RL mode

Mode	**x**
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Cover RL	7
Sz + setout string	8

attribute_real "sump offset" x.xx WNE field ->Pit =>Main =>Sump offset
if sump RL mode is floating then this is the offset (negative down) from the lowest pipe invert <base units>

attribute_integer "ku method" WNE field is Pit =>Main =>Ku method

Mode	x	Description
Direct	0	user enters the ku value stored as pit real attribute "ku"
Ku,Kw - Missouri/Hare Charts		
	1	ku calculated during analysis
Ku,Kw>0 - Missouri/Hare Charts		
	2	ku calculated during analysis (ku < 0.0 changed to 0.0)
Ku - Culvert Inlet - Generic (101 or 201)		
	3	Culvert analysis using inlet control and backwater control (entrance and exit losses automatically set)
Remaining	xxx	Culvert analysis - use numbers from WNE drop down list

attribute_real "ku" x.xx WNE field is Pit =>Main =>Ku
x.xx is used to calculate pit upstream hgl when ku method is Direct

attribute_real "kw" x.xx WNE field is Pit =>Main =>Kw
x.xx is used to calculate pit hgl when ku method is Direct

attribute_integer "setout xy mode" x WNE field is Pit =>Setout =>Setout xy mode

Mode	x
FS tin	0
Setout string	1
Manual	2

attribute_integer "setout z mode" x WNE field is Pit =>Setout =>Setout z mode

Mode	x
FS tin	0
Setout string	1
Manual	2
NS tin	3
Max Obvert	4
Cover RL	7
Sz + setout string	8

attribute_integer "road chainage mode" WNE field is Pit =>Setout =>Chainage mode

Mode	x
No Road	0
Centre string	1
Manual	2

attribute_real "setout adjustment" WNE field is Pit =>Setout =>Sxy

attribute_real "setout adjustment z" WNE field is Pit =>Setout =>Sz

attribute_real "design freeboard" WNE field is Pipe =>Design =>Freeboard limit
at US pit

The following example of a channel ip point is given below. The setout modes are set, the cover and grate level modes are set and the ku (losses) are set. Finally, the inlet capacity is set to an on-grade pit with200% inlet capacity so that even in a major storm with a choke factor of 0.5 it will still have 100% inlet capacity.

```
Manhole "CHNL auto" {

  mhdesc  "channel hip-vip"
  attribute_text "lplot description1"  "OPEN CHANNEL"

  mhsize  0.0
  mhdiam  0.0
  attribute_integer "setout xy mode"         0 // centre of the channel
```

```
  attribute_integer "setout z mode"        6 // sump invert is the bottom of the channel
  attribute_integer "cover rl mode"        4 // max obvert - top of the channel
  attribute_integer "grate rl mode"        4 // max obvert - top of the channel
  attribute_integer "ku method"            0    // direct
  attribute_real    "ku"                   0.0  // zero unless interested in bend losses

  cap_config G

  cap_percent 200 // if a choke factor of 0.5 is applied then it will still have 100% inlet capacity
}

// attribute_real    "design freeboard"      Pipe =>Design =>Freeboard limit at US pit
```

Continue to 27.7.5.4 Node Drainage Analysis Inlet Capacity Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.4 Node Drainage Analysis Inlet Capacity Commands

Node inlet configuration and bypass pit entries determine if these inlet capacity commands are used. Both may be set in the 17.3.4 Water Network Editor (WNE).

27.7.5.4.0.1 cap_config

The inlet configuration may be set via the following command

cap_config x

Mode	**x**
Manhole	m
Ongrade	g
Sag	s

Inlet Configuration = manhole - no water will enter the pit through the grate. Commands not used.

Inlet configuration = on grade or sag

Bypass pit not set - 100% of the approach flow will enter the pit. Commands not used.
Bypass pit is entered. The following commands define the storm water inlet capacity characteristics.

Continue to 27.2.1.3.1 Inlet Capacity Equation or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.4.1 Inlet Capacity Equation in Old Drainage.4d

The inlet capacity equation is built up with optional components (**single polynomial** + **curve polynomial** + **curve coordinates**). Generally, only one of the components is used for each manhole type but they may all be used if desired.

inlet capacity = inlet efficiency * inlet multiplier *
[**single polynomial** + curve multiplier (**curve polynomial** + **curve coordinates**)]

An inlet efficiency (choke factor) is specified in the 17.3.4 Water Network Editor (WNE). An inlet efficiency (choke factor) of 0 would stop all water from entering the inlet.

The inlet multiplier is specified with a cap_multi parameter.

Multipliers

cap_multi x.x inside a cap_curve_grade block or cap_curve_sag block, the curve inlet capacity is multiplied by this value
outside a cap_curve_grade or cap_curve_sag, the total inlet capacity is multiplied by this value

Single Polynomial

The inlet capacity for an inlet may be specified by a single polynomial equation based on the approach flow. This is the most simplistic method and generally used for percentage capture or fixed capture rates.

inlet capacity = cap_fixed
+ cap_percent*0.01*Qa
+ cap_coeff*Qa^cap_power

Example
This example creates an inlet with a fixed inlet capacity of 0.010 (cms or cfs).

```
Manhole "fixed inlet capacity" {
        cap_fixed 0.010
}
```

Default values

cap_multi = 1.0

cap_fixed = 0.0

cap_percent = 0.0

cap_coeff = 0.0

cap_power = 1.0

Curve Polynomial

For on-grade inlets, the polynomial parameters may change with road grade and cross fall threshold values. The formula is the same for cap_fixed, cap_percent, cap_coeff and cap_power. Note that each curve may have its own curve multiplier specified with a cap_multi parameter (discussed below). Some hydraulic model tests have their on grade inlet results converted to polynomial equations.

Example
This example creates an inlet where the inlet capacity polynomials have been determined for 2 road grades (1% and 3%). Note that the road_grade 0.0 command is used for the 1% road grade. Since this is the flattest road grade curve we have calculated we will start using it at a road grade of 0%.

Note that the second curve "NJ G3" will be used when the road grade reaches 2.5. The threshold value where 12d should change to the next curve is generally slight less than the road grade from the source.

```
Manhole "On grade pit type NJ" {
        cap_config G

        cap_curve_grade   "NJ 1G" {
                road_grade  0
                cap_coeff  0.215
                cap_power  0.67
        }

        cap_curve_grade   "NJ 3G" {
                road_grade  2.5
                cap_coeff  0.24
                cap_power  0.673
        }
}
```

Curve Coordinates (On grade and SAG)

For on-grade and sag inlets, the inlet capacity may be determined by entering coordinates along the inlet capacity curve. These coordinates are usually obtained from hydraulic model studies or analytical methods such as HEC-22.

For on grade inlets, the coordinates are Qapproach and Qin, and the curves may change with road grade and cross fall threshold values. The inlet capacity curves are never extrapolated.

Example

```
Manhole "Ongrade coordinates" {
        cap_config G
        cap_curve_grade "0.5G" {
                road_grade  0
                coord 0.000 0.000
                coord 0.060 0.060
                coord 0.140 0.112
                coord 0.260 0.174
                coord 0.430 0.244
                coord 0.500 0.270
        }
        cap_curve_grade "1G" {
                road_grade  0.75
                coord 0.000 0.000
                coord 0.060 0.060
                coord 0.140 0.108
                coord 0.260 0.164
                coord 0.430 0.227
                coord 0.500 0.248
        }
}
```

For sag inlets, the coordinates are Depth (base units) and Qin, and there is only one curve. Each curve has a curve multiplier specified with a cap_multi parameter (discussed below).

Example

```
Manhole "SAG coordinates" {
        cap_config S
        cap_curve_sag "SAG" {
                coord 0.000 0.040
                coord 0.045 0.101
```

```
                coord 0.070 0.151
                coord 0.095 0.245
                coord 0.120 0.302
                coord 0.170 0.347
                coord 0.220 0.371
                coord 0.270 0.391
        }
}
```

Continue to 27.7.5.4.2 Polynomial Inlet Capacity Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.4.2 Polynomial Inlet Capacity Commands

The following commands are used to set the parameters in the following polynomial equation

inlet capacity = cap_fixed
+ cap_percent*0.01*Qa
+ cap_coeff*Qa^cap_power

cap_fixed	x.x	cms or cfs
cap_percent	x.x	percentage (0 to 100)
cap_coeff	x.x	multiplier
cap_power	x.x	exponent

Continue to 27.7.5.4.3 Inlet Curve Block Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.4.3 Inlet Curve Block Commands

Inlet curve blocks may be specified for both on-grade or sag inlets. Inside the curve block you may include the 27.7.5.4.2 Polynomial Inlet Capacity Commands and 27.7.5.4.4 Coordinate Inlet Capacity Commands.

cap_curve_grade "unique name for the pit type" {
road_grade x.xx
road_xfall x.xx
}

Inside the cap_curve_grade block the road grade and road crossfall threshold values (percent) may be set. The road grade and crossfall are calculated by the 17.3.4 Water Network Editor (WNE). When the 12d analysis engine selects the inlet curve, all curves with the same road_xfall are grouped together and then within the crossfall group the road_grade curves is selected.The inlet curve with the maximum grade threshold that is less than or equal to the road grade is selected.

Rules for 'cap_curve_grade' entries:

Only applicable to on-grade pits.
All cap_curve_grade names must be unique within a Manhole block
If both 'road_grade' and 'road_xfall' entries are omitted, only one cap_curve_grade entry is allowed within a pit.
The cap_curve_grade 'coord' entries (if used) must be in order of increasing Qa.

cap_curve_sag "unique name for the pit type" {

}

Rules for 'cap_curve_sag' entries:

Only applicable to sag pits.
Only one cap_curve_sag entry is allowed within a pit, and it must have a valid name.

Continue to 27.7.5.4.4 Coordinate Inlet Capacity Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.4.4 Coordinate Inlet Capacity Commands

The coord command must be used inside the cap_curve_grade or cap_curve_sag grouping

coord x.xx y.yy

x.xx must be in increasing order.

For cap_curve_grade group, the coord command has the parameters Qapproach and Qin

For cap_curve_sag group, the coord command has the parameters Depth and Qin

Continue to 27.7.5.5 Water Definitions -Link (Pipe) Types or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.5 Water Definitions -Link (Pipe) Types

Link types are used to set the following link properties via the WNE.

- pipe nominal/actual diameters and thickness
- roughness method and value
- rational method design mode and design percent depth
- minimum pipe height for the rational design engine
- user defined pipe attributes

Each definition (pipe block) in the file begins with the key word **Pipe**, followed by the pipe type and then curly braces **{ }**. The order that the definitions appear in the file determines the order they appear in the drop down lists inside ***12d Model***.

The minimum requirement for a pipe type definition is

```
Pipe “name” {
}
```

The name must be unique and the braces {} cannot be () or [].

Example:

```
Pipe "CHNL GRASS PROPOSED" {    //Open Channel created below the tin.
                                // cover set in cover file to 0.0
  roughness_n 0.040
  attribute_integer "design size mode"     3  // open channel mode
}
```

Continue to 27.7.5.5.1 Link Water Network Editor Commands or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.5.1 Link Water Network Editor Commands

27.7.5.5.1.1 Link Thickness

```
pipethickness   {
   diam_thickness   x.xxx y.yyy a.aaa b.bbb c.ccc d.ddd
}
```

x.xxx	nominal diameter choices will appear in the WNE->Pipe->Diameter drop down
y.yyy	internal diameter (base units) will be entered into the WNE->Pipe->Diameter field
a.aaa	optional top thickness (base units) 0.000 if omitted
b.bbb	optional bottom thickness (base units) top thickness if omitted
c.ccc	optional left thickness in direction of chainage (base units) top thickness if omitted
d.ddd	optional right thickness in direction of chainage (base units) top thickness if omitted

Continue to 27.7.5.5.1.2 Link Attributes or return to 27.7 Water Definitions File - XML drainage.4d.

27.7.5.5.1.2 Link Attributes

attribute_integer "attribute name1" x   x is an integer value (no decimal, stored exactly by computers

attribute_real "attribute name2" x.xxx   x is a real value (used to store numbers with decimals or very large or very small numbers

attribute_text "attribute name3" "text"   text is a series of words or numbers not intended for calculations

The following special attribute commands create/modify an attribute as described above but these attributes also control calculations performed by the **Set Node Details** button on the 17.3.4 Water Network Editor (WNE). The WNE fields will be locked when these attributes are defined for the selected pipe type. If these attribute are not defined for the selected pipe type the WNE field will not be locked and remain unchanged.

roughness_n x.xx> WNE field ->Pipe =>Main =>Roughness
WNE field ->Pipe =>Main =>Roughness type (set to Manning)

roughness_k x.xx WNE field ->Pipe =>Main =>Roughness
Colebrook k roughness value in millimetres
WNE field ->Pipe =>Main =>Roughness type (set to Colebrook)

attribute_real x.xx WNE field ->Pipe =>Design =>Min pipe height
min height in base units

attribute_integer "design size mode" x WNE field ->Pipe =>Design =>Design mode

Mode	**x**
Pressurised Pipe: 7	0
Part-full Pipe: Freeboard design	1
Part-full Pipe: Flow depth design	2
Open Channel: Freeboard design	3

attribute_real "design percent depth" x.xx WNE field
Pipe =>Design =>Flow-depth at pipe entrance

Continue to 18 Water 2D or return to 17 Water.

28 12d Field File Format

The detailed definition of the ***.12dfield*** and ***.fld*** files will now be given.

The ***.fld*** file is the original ***12d Solutions*** text field file format and many raw files from survey instruments or data collector are converted to a ***.fld*** file before reduced by ***12d Model***.

However, the limitations in the structure of the ***.fld*** file made it incapable of supporting all the functionality required for ***12d Field*** and consequently a new, and more easily extendable, field file format was required. The new file format is the ***.12dfield*** file and it is an XML file.

This documentation consists of some definitions used in describing the two file formats, followed by the complete description of the ***.12dfield****. and* ***.fld*** file formats.

Note:

Unless a distinction is required, both ***.12dfield*** or ***.fld*** files will be referred to as ***12d Field Files***.

See

28.1 Structure of the .12dfield File
28.2 Structure of the .fld File
28.3 Point Description
28.4 Measurements and Named Measurements
28.5 Searching for Special Coordinates
28.6 Definitions in the .12dfield File
28.7 Keyword Blocks in the .12dfield File
28.8 Full Description of 12d Survey Opcodes
28.9 12d Survey Opcode Summary

28.1 Structure of the .12dfield File

The ***.12dfield*** file is an XML file and is made up of **blocks** that can extend over many lines but the information within each block has identifiable starts and ends.

Having identifiable starts and ends has the advantage that XML readers can jump over information they do not understand and can keep reading data the XML file.

Square brackets **[ ]** around an item means that the item is optional.

Most ***.12dfield*** files consist of the data for one visit to the field, but to allow for larger jobs that may take many days and/or involve a number of surveyors, the ***SDR Function*** can reduce any number of separate ***.12dfield*** files as the one job. Hence a ***.12dfield*** file can be written out from the ***SDR Function*** that maintains the integrity of each individual ***.12dfield*** file that is included in the ***SDR Function***.

So there are two possibilities for the structure of the ***.12dfield*** file:

(a) the ***.12dfield*** file - all the data is in the one file (28.1.1 One .12dfield file)

or

(b) internally the ***.12d field*** file consists of a number of separate ***.12d field*** files (28.1.2 More Than One .12dfield File).

28.1.1 One *.12dfield* file

The structure of the ***.12dfield*** file is:

<?xml version= *xml_version_number***>**

<xml12d xmlns = ...>

[<meta_data_block>]

<field12>

[<version> *12dfield_file_version_number* **</version>]**

<opcode_text_block>

<opcode_text_block>

...

....

...

<opcode_text_block>

</field12d>

</xml12d>

28.1.2 More Than One *.12dfield* File

When the ***.12dfield*** file is an amalgamation of more than one ***.12dfield*** file, the data for each separate ***.12dfield*** file is enclosed in a ***<field file block>.***

The structure of the ***.12dfield*** file is:

<?xml version= *xml_version_number***>**

<xml12d xmlns = ...>

[<meta_data_block>]

<field12>

[<version> *12dfield_file_version_number* **</version>]**

<field_file_block>

<field_file_block>

...

....

...

<field_file_block>

</field12d>

</xml12d>

Continue to 28.3 Point Description.

28.2 Structure of the .fld File

Each line in the ***.fld*** file is called a record and consists of a **numeric *operation code*** (or ***opcode*** for short) followed by zero or more tabs and pieces of information.

What actually follows the ***opcode*** depends on the *opcode*.

Hence the ***.fld*** file record is:

opcode
99

or

opcode	tab	value	...	tab	value
02		abcS			fred

Continue to 28.3 Point Description.

28.3 Point Description

See

feature code string number point ID

point name point comment point description

other Information

feature code

A ***feature code*** is one or more text characters entered by the surveyor to differentiate surveyed items. For example, **EB** for edge of bitumen and **SPOT** for a spot height.

A ***feature code*** must be a **valid *12d Model* string name** as during survey data reduction, the feature code often becomes the name of a created string. See 3.7.1.1.1 String Name and Model.

string number

A ***string number*** is a positive integer entered by the surveyor to differentiate between different items that have the **same** feature code**.**

The feature code and string number are used for stringing points together as described in 26.3.1 Stringing in the Field.

point ID

The ***point id*** is the EDM tacheometry measurement point id which is not normally entered by the user but is written into the ***12d Field File*** either by ***12d Field***, or in the raw data file, by the data collector. The ***point id*** is ***alphanumeric*** and is normally ***unique*** in a particular survey

During reduction, the measure point is converted to a vertex of a super string and the ***point id*** is stored as the ***point id*** for that vertex.

point name

During a survey, a user can give points a special name called a ***point name*** so that they are easily identified and referred to. For example, **STN01** to represent a setup station or BS01 for a backsite.

The point name must be a **valid *12d Model* string name** as during survey data reduction, the point name often becomes the name of a created string. See 3.7.1.1.1 String Name and Model.

For some operations, a ***point name*** becomes a named point and can be searched for by other operations. See 28.4 Measurements and Named Measurements.

point comment

During a survey, a user can add a text comment to a surveyed point. This is called the ***point comment***.

The ***point comment (***or **point text)** is stored as the **vertex text** for the vertex of the super string.

point description

In most records of a ***12d Field File***, a feature code, string number, point ID**,** point name and point comment are present and are stored together as sequential lines in the ***.12dfield*** file, or on the same line separated by tabs in the ***.fld*** file. For simplicity, these five pieces of information are referred to as the ***point description***.

In the ***12dfield*** file, the point description is denoted by the <point_description> block, and is up to five separate lines of information:

<feature_code>abc</feature_code>

<string_number>01</string_number>

<point_id>1002</point_id>

<point_name>STN 4</point_name>

<point_comment>freddie</point_comment>

The order of the items in the <point_description> block is not important as each item is easily identified.

In the ***fld*** file, the feature code, string number**,** point ID, point nameand point comment **MUST** be given **in that order** and the values are separated by tabs. Each value can be up to sixty-three characters in length. If a value is missing then a tab is still needed so there may be two or more sequential tabs.

In the ***.fld*** file, the point description is denoted by Point_description and is five items of information separated by tabs

Point_description

feature code	string number	point id	point name	point comment
abc	01	1002	STN 4	freddie

other Information

Other information can also be entered by the surveyor using ***12d Survey Opcodes***. See 28.8 Full Description of 12d Survey Opcodes.

For ***12d Field*** this is entered in a well defined way.

but the extra information must be entered in such a way that it can to be used by ***12d Model***.

However for **non-*12d Field*** users, how this extra information must be entered depends on:

(a) the data recorder

and

(b) the **coding convention** used.

To enable ***12d Model*** to work with different data recorders and coding conventions, users can set up ***Data Collector Definitions*** that specify how the stored information is converted into a ***12d Field File*** so that it can then be used by ***12d Model*** See 42.1 Data Collector Definitions.

Continue to 28.4 Measurements and Named Measurements or return to 28 12d Field File Format.

28.4 Measurements and Named Measurements

measurement point

The ***12d Field File*** allows for six types of measurements or entered coordinates, that create points (vertices) in super strings. They are

(a) EDM measurement (HA,VA,SD, + point description) - opcode 7

7 edm_tachy_measurement Measurement - HA, VA, SD

(b) EDM measurement HT (HA,HD,HT, + point description) - opcode 11

11 edm_tachy_measurement_ht Measurement - HA, HD, Height

(c) EDM measurement VD (HA,HD,VD + point description) - opcode 12

12 edm_tachy_measurement_vd Measurement - HA, HD, Height difference (VD)

(d) three hair stadia measurement - opcode 10

10 stadia_measurement Three hair stadia measurement

(e) directly entered coordinate - opcode 2

2 coordinate Directly entered coordinate measurement (DEC)

(f) GNSS coordinate - opcode 140

140 gps_coordinate GNSS coordinate measurement

For convenience, the six types will all be referred to as **measurements**.

Each of the above measurements creates a new point which in the reduction, is appended to previous points with the same feature code and string number.

current measurement point

When collecting the data, the measurement that is currently being done is referred to as the ***current measurement point*** or ***current point***, and the string it is appended to is the ***current string*.**

current string

The string that the current measurement point is appended to is called the ***current string*.**

named measurement

If a point name **exists** in the point description for a measurement point, then it is called a ***named measurement*** and a named point is created.

An ordinary measurement point is also created for a ***named measurement*** if **Used named points as measurements** is **ticked** on the **Others** tab of the ***12d Model SDR Function*** (14.4.2 Creating a SDR Function from a 12d Field File).

named point

For a named measurement a **one vertex super string** with the name point name is created and mapped using the Map file. given on the **Map File** tab of the ***12d Model SDR Function*** (14.4.2 Creating a SDR Function from a 12d Field File).

The **vertex text** for the one vertex super string is the **station prefix followed by** point name.

The point name is added to an internal list of named points.

internal list of named points

When a named point is created, its name added to an **internal list of named points.** This list is used during the survey reduction when searching for a **known** point to get (x,y,z) coordinates from.

Continue to 28.5 Searching for Special Coordinates or return to 28 12d Field File Format.

28.5 Searching for Special Coordinates

When

- **setting up** the instrument on a point
- **measuring** to a **backsight**
- doing a **check measurement**
- **manually** entering a bearing to use as the **bearing datum difference**

a point name and/or point ID in the point description of the **Opcode record** is used to **find a point** whose coordinates are then used for the reduction of further measurements.

Given the point name and/or point ID, the search for a **known point** is done in the following order and the search stops once a point is found:

First search the Control model (if it exists) in *12d Model*:

1. point name amongst **Vertex ids** in the Control model

   A search in ***12d Model*** is made of the ***Control model*** for a **vertex of a string** whose **point id** is the **same as** point name. If a vertex is found its (x,y,z) coordinates and details are used.

1. point ID amongst **Vertex ids** in the Control model

   A search in ***12d Model*** is made of the ***Control model for*** a **vertex of a string** whose **point id** is the **same as** point ID. If a vertex is found its (x,y,z) coordinates and details are used.

1. point name amongst **String names** in the Control model

   A search in ***12d Model*** is made of the ***Control model*** for a **string whose name** is the **same as** point name**.** If a string is found, the **first vertex of the string** is used for the (x,y,z) coordinates and details.

Next search the Network model (if it exists) in *12d Model*:

2. point name amongst **Vertex ids** in the Network model

   A search in ***12d Model*** is made of the ***Network model*** for a **vertex of a string** whose **point id** is the **same as** point name. If a vertex is found its (x,y,z) coordinates and details are used.

3. point ID amongst **Vertex ids** in the Network model

   A search in***12d Model*** is made of the ***Network model*** for a **vertex of a string** whose **point id** is the **same as** point ID. If a vertex is found its (x,y,z) coordinates and details are used.

If ***Use field coordinates*** is **ticked** in the **SDR Function** in ***12d Model*** ??**,** then next search the already entered **Directly Entered Coordinates** (**DECs**) in the ***12d Field File***. A **DEC** has its own **point name** and a **point ID.**

4. point name amongst **point names** of the directly entered coordinates

   A search is made of previously entered ***directly entered coordinates*** in the field file for a **DEC point name** that is the **same as** point name. If a **DEC** is found, its (x,y,z) coordinates are used.

5. point name amongst **point ids** of the directly entered coordinates

   A search is made of previously entered ***directly entered coordinates*** in the field file for a **DEC** whose **point id** is the same as point name. If a **DEC** is found, its (x,y,z) coordinates are used.

6. point ID amongst **point ids** of the directly entered coordinates

   A search is made of previously entered ***directly entered coordinates*** in the field file for a **DEC** whose **point id** is the **same as** point ID. If a **DEC** is found, its (x,y,z) coordinates are used.

Next search the **previous measurements** in the field file (a measurement has a **point name** and a **point id**).

7. point name amongst the **point names** of the previous measurements

   A search is made of ***previous measurements*** in the field file for a measurement whose **point name** is the **same as** point name. If a measurement is found, its (x,y,z) coordinates are used.

8. point name amongst the **point ids** of the previous measurements

   A search is made of **previous measurements** in the field file for a measurement whose ***point id*** is the **same as** point name. If a measurement is found, its (x,y,z) coordinates are used.

9. point ID amongst the **point ids** of the previous measurements

   A search is made of **previous measurements** in the field file for a measurement whose **point id** is the **same as** point ID. If a measurement is found, its (x,y,z) coordinates are used.

Finally

10. If **no match** is found, then in ***12d Model***, the user will be ***prompted for the details of the unfound point.***

    The user is asked to type in the (x,y,z) coordinates in the **Define Station Coordinate** panel. See Define Station Coordinate for Unknown Points.

    If a model is specified in the **Add to model** field of the panel, then a **new one point super string is created** with the **string name** point name**,** and for the vertex text, the **Station label prefix** field value followed by point name.

For a summary of the **12d Field File Opcodes**, see 28.9 12d Survey Opcode Summary

For the full description of the **12d Field File Opcodes**, see 28.8 Full Description of 12d Survey Opcodes.

Note

The difference between a point name and a point ID is that:

a point name is usually given by the user and should be an unique identifier for an easily recognised ***physical point*** that may be reused by other measurements.

Whilst for that **same physical point,** a number of measurements may be made to that physical point and each measurement will be assigned a different point ID by ***12d Field*** or the data collector.

For example, measurements to control stations are made to a fixed control point identified by its **control point name**, but each measurement to the control station point is given a different point ID.

In most instances, each measurement to the same point has a different point ID and ***12d Model*** automatically gives the measurement the same point name as it is rare to measure a non-control point more than once, However the point name can be over ridden by the user.

Continue to 28.6 Definitions in the .12dfield File or return to 28 12d Field File Format

28.6 Definitions in the *.12dfield* File

There are definitions used in the ***12dfield*** file that will be documented here so that they can be referenced throughout the document.

comment_text

comment_text is a string of characters.

feature_code_value

feature_code_value is used to represent a particular value of a feature code.

string_number_value

string_number_value is used to represent a particular value of a string number.

point_id_value

point_id_value is used to represent a particular value of a point ID.

point_name_value

point_name_value is used to represent a particular value of a point name.

point_comment_value

point_comment_value is used to represent a particular value of a point comment.

time_text

time_text is a string of characters in the W3C time format.

*YYYY***-***MM***-***DD***T***hh***:***mm***:***ss***Z** *see* 37.3.8 W3C Time Format.

For example, 2015-09-28T06:42:45Z

Continue to 28.7 Keyword Blocks in the .12dfield File or return to 28 12d Field File Format

28.7 Keyword Blocks in the *.12dfield* File

There are many regularly used blocks of information in ***.12dfield*** file that will be identified and documented as keywords.

The keyword and its block consist of a starting **<keyword>**, followed by the information in the keyword block, and ending in **</keyword>**

That is

<keyword> *information in the keyword block* **</keyword>**

Square brackets **[ ]** around an item means that the item is ***optional***.

The keyword blocks used in the ***.12dfield*** file are:

<meta_data_block>

<units_block>

<application_block>

<field_file_block>

<opcode_text_block>

<time_created>

<time_updated>

<time_surveyed>

<id>

<comment>

<State>

<original>

Finally there are <point_description>and [<op_code_properties>] which are not actual keyword blocks but are shorthand for a **collection** of **keyword blocks**

<meta_data_block>

This is optional header data for the ***.12dfield file***.

The format of the **meta_data_block** keyword block is:

<meta_data>

<units_block>

<application_block>

</meta_data>

<units_block>

This is the units used in the ***.12dfield*** file.

Import note: the ***.12dfield file*** currently only supports the one set of units as given below.

The units_block is currently optional as only one set of units is currently used.

The format of the **units_block** keyword block is:

<units>

<linear> *metres* </linear>

<area> *square metres* </area>

<volume> *cubic metres* </volume>

<temperature> *celsius* </temperature>

<pressure> *millibars* </pressure>

<angular> *decimal degrees* </angular>

<direction> *decimal degrees* </direction>

</units>

<application_block>

This is an option block containing information about the application (software) that created the ***.12dfield file***, plus some information about the ***12d Model*** setups used.

The application_block is optional.

The format of the **application_block** keyword block is:

<application>

<name> *name of software creating the 12dfield file* </name>

<manufacturer> *name of company creating the software* </manufacturer>

<manufacturer_url> *url of the manufacturer* </manufacturer_url>

<application> *full name including version of the software* </application>

<application_build> *build number of the software* </application_build>

<application_path> *path to the software* </application_path>

<application_date_gmt> time_text (*gmt time when was application created)*
</application_date_gmt>

<application_date> time_text (*local time when application was created)*
</application_date>

<project_name> *12d Model project that created the 12dfield file* </project_name>

<project_guid> *guid 12d Model project that created the 12dfield file* </project_guid>

<project_folder> *folder the 12d Model project is in* </project_folder>

<client> *name of client using 12d Model* </client>

<dongle> *hardware lock being used for 12d Model* </dongle>

<maintenance> *maintenance_status* </maintenance>

<environment/

<env4d> *path of the env file being used by 12d Model* </env4d>

<user> *computer name of the user using 12d Model* </user>

<export_file_name> *name of the 12dfield file* </export_file_name>

<export_date_gmt> time_text (*gmt time when file was created)* </export_date_gmt>

<export_date> time_text (*local time when file was created)* </export_date>

</application>

<field_file_block>

This contains the opcodes for a field file within the ***.12dfield file***.

The format of the **field_file_block** keyword block is:

<field_file>

<name>*field_file_name***</name>**

<time> time_text**</time>**

<time_created> time_text **</time_created>**

<time_updated> time_text **</time_updated>**

<id>

<comment>

<state>*state_text* **</state**

<children>

<opcode_text_block>

<opcode_text_block>

...

...

...

<opcode_text_block>

</children>

</field_file>

<opcode_text_block>

The ***<opcode_text_block>*** block consists of the ***opcode_text*** for the particular opcode as the header and footer of the block which enclose the zero or more lines of information that is required for the particular opcode.

<opcode_text>

...

...

...

</opcode_text>

What follows the ***<opcode_text***> depends on the particular ***opcode***.

For the list of opcode_texts, see 28.8 Full Description of 12d Survey Opcodes.

For those familiar with the ***.fld*** format which uses ***numeric opcodes***, when ***12d Model*** writes out an ***.12dfield*** opcode record, it often precedes the record by a comment that gives the equivalent numeric opcode. But it is only a comment and is not required in the ***.12dfield*** file.

As an example, for the ***opcode_text*** *arc_fitting_next_3_points*, the ***opcode_text_block*** is

<!-- opcode number 60 -->

```
<arc_fitting_next_3_points>
  <feature_code/>
  <string_number/>
  <point_id/>
  <point_name/>
  <point_comment/>
    <time_created>2021-12-27T06:14:59Z</time_created>
    <time_updated>2021-12-27T06:14:59Z</time_updated>
    <id>516</id>
  <comment/>
  <state>Unknown</state>
</arc_fitting_next_3_points>
```

<time_created>

This is the time that the opcode was first created.

The format of the **time_created** keyword block is:

<time_created> time_text</time_created>

Note that the time format for 12da is different from the one of 12dxml.

<time_updated>

This is the time that the opcode was last modified.

The format of the **time_updated** keyword block is:

<time_updated> time_text</time_updated>

Note that the time format for 12da is different from the one of 12dxml.

<time_surveyed>

The format of the **time_surveyed** keyword block is:

<time_surveyed> time_text</time_surveyed>

Note that the time format for 12da is different from the one for 12dxml.

<id>

The id is an internal session identifier.

The format of the **id** keyword block is:

<id>*id_value*</id>

<comment>

A comment can be included with an opcode.

The format of the **comment** keyword block is:

<comment> comment_text</comment>

<State>

The format of the **state** keyword block is:

<state>*state_value*</state>

where ***state_value*** is one of:

Unknown

Field

Deleted

Changed

Added

Auto added

Change deleted

Add deleted

<original>

Some ***12d Model*** options can edit the **opcodes** and when such edits occur, an **<original>** block is created inside the <opcode> block, and the original information inside the ***<op_code>*** block is copied to the **<original>** block.

Important Note
if subsequent edits occur to the opcode block, only the final data and the original data is maintained and none of the in between edits.

As an example of an <original> block, if a <coordinate> opcode was edited, the entry in the ***12dfield*** file would be:

```
<coordinate>
   <x>100</x>
   <y>100</y>
   <z>100</z>
   <feature_code/>
    <string_number/>
    <point_id/>
    <point_name/>
    <point_comment/>
       <time_created>2021-12-27T06:14:59Z</time_created>
       <time_updated>2021-12-27T06:14:59Z</time_updated>
       <id>468</id>
      <comment/>
      <state>Changed</state>
      <original>
        <x>-42.0</x>
        <y>42.0</y>
        <z>4.24242</z>
          <feature_code>OC</feature_code>
          <string_number/>
```

<point_id/>

<point_name/>

<point_comment/>

<time_created>2021-12-27T06:14:59Z</time_created>

<time_updated>2021-12-27T06:14:59Z</time_updated>

<id>468</id>

<comment/>

<state>Field</state>

</original>

</coordinate>

<point_description>

point description has been previously documented and is shorthand for five pieces of information. See 28.3 Point Description.

For a ***.12dField file***, **<point_description>** consists of the five items:

<feature_code> feature_code_value**</feature_code>**

<string_number> string_number_value**</string_number>**

<point_id> point_id_value**</point_id>**

<point_name> point_name_value **</point_name>**

<point_comment> point_comment_value**</point_comment>**

<XYZ>

The **XYZ** block is shorthand for a number of properties that go with most opcodes.

That is, <XYZ> is shorthand for the three items:

<x>*x_value***</x>**

<y>*y_value***</y>**

<z>*z_value***</z>**

[<op_code_properties>]

The op_code_properties block is shorthand for a number of properties that go with most opcodes.

That is, <op_code_properties> is shorthand for the six items:

<time_created>

<time_updated>

<time_surveyed>

<id>

<comment>

<State>

Continue to 28.8 Full Description of 12d Survey Opcodes or return to 28 12d Field File Format.

28.8 Full Description of 12d Survey Opcodes

The record for each *opcode* will now be described in detail for both versions of the ***12d Field Files***,***12dfield*** and ***fld***.

For each ***opcode*** record, the following information is given:

- The first line consists of the ***numeric opcode***, the **text opcode** and a **short description** of the opcode.
- The next block gives the **full syntax** for the opcode in the ***12dfield*** file.
- The next line gives the **full syntax** for the opcode in the ***fld*** file.
- The next paragraph gives a **detailed description** of the opcode record.
- If it exists, the final line gives a link to the ***12d Model Reference Manual*** to the panel for the field data command for the opcode.

Optional information is enclosed in square brackets **[ ]**.

The ***op_code_properties*** block only exists in the ***12dfield*** file and is ***optional***.

All **angles** in the ***12d Field File*** are given in ***decimal* degrees**.

For a summary of the **12d Field File Opcodes**, see 28.9 12d Survey Opcode Summary.

Numeric Opcode	Text Opcode	Short Description of Opcode

-3 **group** **Group**

.12dfield file syntax

<group>
<name>*Group_name*</name>
[<op_code_properties>]
</group>

.fld file syntax

-3 Group_name

The field data command panel in the **SDR Editor** is documented in 26.4.2.26 Group (opcode -3)

-2 **comment** **Insert a comment**

.12dfield file syntax

<comment>
<data>comment_text</data>
[<op_code_properties>]
</comment>

.fld file syntax

-2 Comment_text

The field data command panel in the **SDR Editor** is documented in 26.4.2.13 Comment (opcode -2).

-1 **error** **Add text to information for an error**

.12dfield file syntax

<error>
<data>*Error_value*</data>

[<op_code_properties>]

</error>

.fld file syntax

-1 Error_value

The field data command panel in the **SDR Editor** is documented in 26.4.2.19 Error (opcode -1).

1 job_data Job Information

.12dfield file syntax

<job_data>

<description>*description_text*</description>

[<op_code_properties>]

</job_data>

.fld file syntax

01 block1 block2 block3 block4 where each block can be up to 10 characters.

description

Job header information.

The field data command panel in the **SDR Editor** is documented in 26.4.2.16 Job Data (opcode 1)

2 coordinate Directly entered coordinate measurement (DEC)

.12dfield file syntax

<coordinate>

<XYZ>

<point_description>

[<op_code_properties>]

</coordinate>

.fld file syntax

02 Point_description *X Y Z*

description

A measurement point is created with the feature code and string number from the point description and given the supplied (x, y,z) coordinates. No reduction is needed.

The point ID and point comment from the point description are recorded as the **point id** and **vertex text** for that vertex of the super string.

If a point name exists in the point description, then it is a named measurement and a 4d point string of name point name *(or* feature code *??)* is created and mapped using the Map File. The 4d text is the station prefix followed by point name. The point name is added to the internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.14 Coordinate (opcode 2)

3 station New instrument setup on a point

.12dfield file syntax

<station>

<height>*instrument_height*</height>

<point_description>

[<op_code_properties>]

</station>

.fld file syntax

03 Point_description *instrument_height*

description

Setting up an instrument at the point with name given in the point name section of the point description. The (x,y,z) coordinates for point name are found by first searching the control model, then the list of previously named points in the reduction, point ids of previous measurements and finally if point name is still not found, the user is asked to type in the (x,y,z) coordinates. A record is written to the report file.

The field data command panel in the **SDR Editor** is documented in 26.4.2.37 New Instrument Setup - Station (opcode 3)

4 **backsight** **Measurement to backsight**

.12dfield file syntax

<backsight>

<horizontal_angle>*horizontal_circle*</horizontal_angle>

<vertical_angle><*vertical_circle*</vertical_angle>

<slope_distance><*splope_distance_value*</slope_distance>

<azimuth><*azimuth_value*</azimuth>

<point_description>

[<op_code_properties>]

</backsight>

.fld file syntax

04 Point_description *horizontal_circle* *vertical_circle* *slope_distance_value* *azimuth_value*

description

Measurement to a **backsight** whose name is given in the point name section of the point description.

If the ***Backsight prompt mode*** in the Others tab of the **Survey Data Reduction Function** panel is **Prompt** then the **Survey Data Bearing Datum Difference** panel shows the *bearing datum difference* and the *horizontal distance difference*. A record is written to the report file.

The units for *horizontal_circle* and *vertical_circle* are decimal degrees.

The *azimuth_value*, in decimal degrees, may be specified when no coordinate for the backsight point exists.

The field data command panel in the **SDR Editor** is documented in 26.4.2.6 Backsight (opcode 4)

5 **target_height** **New target height**

.12dfield file syntax

<target_height>

<height>*Target_height*</height>

<point_description>

[<op_code_properties>]

</target_height>

.fld file syntax

05 Target_height

description

Set a new target height. This applies to the Opcodes 4, 6, 7 and 140.

The field data command panel in the **SDR Editor** is documented in 26.4.2.60 Target Height (opcode 5)

6 **check_measurement** **Check measurement**

.12dfield file syntax

<check_measurement>

<horizontal_angle>*horizontal_circle*</horizontal_angle>

<vertical_angle><*vertical_circle*</vertical_angle>

<splope_distance><*splope_distance_value*</splope_distance>

<azimuth><*azimuth_value*</azimuth>

<point_description>

[<op_code_properties>]

</check_measurement>

.fld file syntax

06 Point_description *horizontal_circle vertical_circle slope_distance_value*

description

A check measurement is made **to the station** given in the _point name section of the _point description. A one vertex super string (with string name _point name) is created at the measured point in the default model for the check measurement.

The instrument point name, the station name and the differences between the measurement point coordinates and the station coordinates are written to the report file as well as the differences between the measurement and the known point.

The units for *horizontal_circle* and *vertical_circle* are decimal degrees.

The field data command panel in the **SDR Editor** is documented in 26.4.2.10 Check Measurement (opcode 6)

7 edm_tachy_measurement **Measurement - HA, VA, SD**

.12dfield file syntax

<edm_tachy_measurement>

<horizontal_angle>*horizontal_circle*</horizontal_angle>

<vertical_angle><*vertical_circle*</vertical_angle>

<splope_distance><*splope_distance_value*</splope_distance>

<point_description>

[<op_code_properties>]

</edm_tachy_measurement>

.fld file syntax

07 Point_description *horizontal_circle vertical_circle slope_distance_value*

description

Measurement made by the instrument. A *measurement* point is created with the _feature code and _string number from the _point description. The units for *horizontal_circle* and *vertical_circle* are decimal degrees.

The _point ID and _point comment from the _point description are recorded as the **point id** and **text** for that vertex of the super string.

If a _point name exists in the _point description, then it is a _named measurement and a **4d point string** of string name _point name is created and mapped using the Map File. The 4d text is the **station prefix** followed by _point name. The _point name is added to the _internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.30 EDM Measurement (opcode 7)

8 not yet used

9 scale_factor **Slope distance scale factor for subsequent distances**

.12dfield file syntax

<scale_factor>

<factor>*Scale_factor*</factor>

[<op_code_properties>]

</scale_factor>

.fld file syntax

09 Scale_factor

description

Scale factor to apply to subsequent slope distances.

The field data command panel in the **SDR Editor** is documented in 26.4.2.49 Slope Distance Scale Factor (opcode 9)

10 stadia_measurement Three hair stadia measurement

.12dfield file syntax

<stadia_measurement>

<horizontal_angle>*horizontal_circle*</horizontal_angle>

<vertical_angle><*vertical_circle*</vertical_angle>

<bottom><*bottom_value*</bottom>

<middle><*middle_value*</middle>

<top><*top_value*</top>

<point_description>

[<op_code_properties>]

</stadia_measurement>

.fld file syntax

10 Point_description *horizontal_circle vertical_circle bottom_value bottom_value top_value*

description

Manual measurement. A measurement point is created with the feature code and string number from the point description. The units for *horizontal_circle* and *vertical_circle* are decimal degrees.

The point ID and point comment from the point description are recorded as the **point id** and **text** for **that vertex** of the super string.

If a point name exists in the point description, then it is a named measurement and a 4d point string of name point name is created and mapped using the Map File. The 4d text is the station prefix followed by point name. The point name is added to the internal list of named pointsfor searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.33 Stadia Measurement (opcode 10)

11 edm_tachy_measurement_ht Measurement - HA, HD, Height

.12dfield file syntax

<edm_tachy_measurement_ht>

<horizontal_angle>*horizontal_circle*</horizontal_angle>

<horizontal_distance>*horizontal_distance_value*</horizontal_distance>

<height><*height_value*</height>

<point_description>

[<op_code_properties>]

</edm_tachy_measurement_ht>

.fld file syntax

11 Point_description *horizontal_circle horizontal_distance_value height_value*

description

Measurement made by the instrument. A measurement point is created with the feature code and string number from the point description. The unit for *horizontal_circle* is decimal degrees.

The point ID and point comment from the point description are recorded as the **point id** and **text** for that **vertex** of the super string.

If a point name exists in the point description, then it is a named measurement and a **4d super string** of string name point name is created and mapped using the Map File. The 4d text is the station prefix followed by point name. The point name is added to the internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.31 EDM Measurement (HA,HD,HT) (opcode 11)

12 edm_tachy_measurement_vd Measurement - HA, HD, Height difference (VD)

.12dfield file syntax

<edm_tachy_measurement_vd>

<horizontal_angle>*horizontal_angle_value*</horizontal_angle>

<horizontal_distance>*horizontal_distance_value*</horizontal_distance>

<vertial_distance>*height_difference*</vertical_distance>

<point_description>

[<op_code_properties>]

</edm_tachy_measurement_vd>

.fld file syntax

12 Point_description *horizontal_circle horizontal_distance height_difference*

description

Measurement made by the instrument. A measurement point is created with the feature code and string number from the point description. The unit for *horizontal_circle* is decimal degrees.

The point ID and point comment from the point description are recorded as the **point id** and **text** for that **vertex** of the super string.

If a point name exists in the point description, then it is a named measurement and a 4d super string of string name point name is created and mapped using the Map File. The 4d text for the vertex is the station prefix followed by point name. The point name is added to the internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12).

13 not yet used

14 check_coordinate Check Coordinates

.12dfield file syntax

<check_coordinate>

<XYZ>

<point_description>

[<op_code_properties>]

</check_coordinate>

.fld file syntax

14 Point_description *X Y Z*

description

Measurement to a coordinate whose name is given in the point name section of the point description.

If the ***Display panel for backsights*** field in the **Survey Data Reduce** panel is **ticked**, then the **Survey Data Check Coordinate** panel shows the differences in the coordinates. A record is written to the report file.

The field data command panel in the **SDR Editor** is documented in 26.4.2.9 Check Coordinate (opcode 14)

15 vertical_circle Vertical circle correction

.12dfield file syntax

<vertical_circle>

<correction>*vertical_circle_in_decimal_degrees*</correction>

[<op_code_properties>]

</vertical_circle>

.fld file syntax

09 Vertical_circle_in_decimal_degrees

The *vertical_circle_in_decimal_degrees* is **subtracted** from the vertical circle value in any measurements.

description

The units for *vertical_circle_in_decimal_degrees* is decimal degrees.

The field data command panel in the **SDR Editor** is documented in 26.4.2.64 Vertical Circle Correction (opcode 15)

16 multiple_coding Multiply coded point

.12dfield file syntax

<multiple_coding>

<point_description>

[<op_code_properties>]

</multiple_coding>

.fld file syntax

16 Point_description

description

Additional coding for the current measurement point created by opcodes **02**, **07**, **10**, **11**, **12**, or **140**.

A new measurement point is created at the same position as the current measurement point but with the feature code and string number from the point description for this opcode.

The point ID and point comment from the point description are recorded as the **point id** and **text** for that vertex of the super string.

If a point name exists in the point description, then it is a named measurement and a 4d super string of string name point name is created and mapped using the Map File. The 4d text is the station prefix followed by point name. The point name is added to the internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.36 Multiple Coding (opcode 16)

17 arc_fitting_last_3_points Arc through previous three points

.12dfield file syntax

<arc_fitting_last_3_points>

[<point_description>**]**

[<op_code_properties>]

</arc_fitting_last_3_points>

.fld file syntax

17 [Point_description*]*

description

If no point description is given, then the current measurement point and the two previous points with the same feature code and string number as the current measurement point, are joined by an arc. If there is less than three such points, no arc is fitted.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number from the point description exist*,* the last three previous measurement points of the same string number and string number are joined by an arc. If the current measurement point has that feature code and string number, then it is the third of the three points used. If there is less than three points, no arc is fitted.

If _point ID exists, then the _feature code and _string number are taken from the previous measurement point **with** that _point ID. That point and the two measurement points previous to the predefined point of the same _feature code and _string number, are joined by an arc. If there is less than three points, no arc is fitted

See 26.3.10 Arcs Through Points.

The field data command panel in the **SDR Editor** is documented in 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)

18 feature **Circle Feature**

.12dfield file syntax

<feature>

<radius>*Radius_value*</radius>

[<op_code_properties>]

</feature>

.fld file syntax

18 Radius_value

description

Creates a Feature string with the given *Radius_value* and centred on the _current measurement point.

See 26.3.8 Feature String

The field data command panel in the **SDR Editor** is documented in 26.4.2.11 Circle Feature (opcode 18)

19 reverse_string **Reverse string**

.12dfield file syntax

<reverse_string>

[<point_description>**]**

[<op_code_properties>]

</reverse_string>

.fld file syntax

19 [Point_description]

description

If no _point description is given, the _current string is reversed.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number from the _point description exist, the last previous string with that _feature code and _string number is reversed.

If the _point ID from the _point description exists, then the string containing that point id will be reversed.

The field data command panel in the **SDR Editor** is documented in 26.4.2.54 String Reverse (opcode 19)

20 close_string **Close string**

.12dfield file syntax

<close_string>

[<point_description>**]**

[<op_code_properties>]

</close_string>

.fld file syntax

20 [Point_description]

description

If no _point description is given, the _current string is closed.

If a _point description exists, then either the _feature code and _string number, or the _point ID section of the _point description can be used.

If the _feature code and _string number from the _point description exist, the last previous string with that _feature code and _string number is closed.

Otherwise if the _point ID from the _point description exists, then the string containing that _point ID will be closed.

See 26.3.5 Close String

The field data command panel in the **SDR Editor** is documented in 26.4.2.50 String Close (opcode 20)

21 join_strings_last_to_last Join last points of strings

.12dfield file syntax

<join_strings_last_to_last>

<feature_code> feature_code_value</feature_code>

<string_number_1> string_number_value</string_number_1>

<string_number_2> string_number_value</string_number_2>

[<op_code_properties>]

</join_strings_last_to_last>

.fld file syntax

21 _feature code _string number_***1*** _string number_***2***

description

In the final reduction, the last point of the string with the given _feature code and _string number_***1*** is joined to the last point of the string with given _feature code and _string number_***2***. The created string has the given _feature code (no _string number is needed since it is the final phase of reduction when the string numbers are dropped).

See 26.3.9 Joining Strings

The field data command panel in the **SDR Editor** is documented in 26.4.2.29 Strings Join (opcodes 21 to 24)

22 join_strings_first_to_last Join first to last point of strings

.12dfield file syntax

<join_strings_first_to_last>

<feature_code> feature_code_value</feature_code>

<string_number_1> string_number_value</string_number_1>

<string_number_2> string_number_value</string_number_2>

[<op_code_properties>]

</join_strings_first_to_last>

.fld file syntax

22 _feature code _string number_***1*** _string number_***2***

description

In the final reduction, the first point of the string with the given _feature code and _string number_***1*** is joined to the last point of the string with given _feature code and _string number_***2***. The created string has the given _feature code (no string number is needed since it is the final phase of reduction when the string numbers are dropped).

See 26.3.9 Joining Strings

The field data command panel in the SDR Editor is documented in 26.4.2.29 Strings Join (opcodes 21 to 24)

23 join_strings_first_to_first Join first points of strings

.12dfield file syntax

<join_strings_first_to_first>

<feature_code> feature_code_value</feature_code>

<string_number_1> string_number_value</string_number_1>

<string_number_2> string_number_value</string_number_2>

[<op_code_properties>]

</join_strings_first_to_first>

.fld file syntax

23 feature code string number_***1*** string number_***2***

description

In the final reduction, the first point of the string with the given feature code and string number_***1*** is joined to the first point of the string with given feature code and string number_***2***. The created string has the given feature code (no string number is needed since it is the final reduction when the string numbers are then dropped).

See 26.3.9 Joining Strings

The field data command panel in the **SDR Editor** is documented in 26.4.2.29 Strings Join (opcodes 21 to 24)

24 join_strings_last_to_first Join last to first point of strings

.12dfield file syntax

<join_strings_last_to_first>

<feature_code> feature_code_value</feature_code>

<string_number_1> string_number_value</string_number_1>

<string_number_2> string_number_value</string_number_2>

[<op_code_properties>]

</join_strings_last_to_first>

.fld file syntax

24 feature code string number_***1*** string number_***2***

description

In the final reduction, the last point of the string with the given feature code and string number_***1*** is joined to the first point of the string with given feature code and string number_***2***. The created string has the given feature code (no string number is needed since it is the final reduction when the string numbers are then dropped).

See 26.3.9 Joining Strings

The field data command panel in the **SDR Editor** is documented in 26.4.2.29 Strings Join (opcodes 21 to 24)

25 not yet used

26 not yet used

27 not yet used

28 height_or_depth Add text to the string name - for delta height

.12dfield file syntax

<height_or_depth>

<value>*Text*</value>

[<point_description>**]**

[<op_code_properties>]

</height_or_depth>

.fld file syntax

28 [Point_description*]* *Text*

description

A space (" ") followed by Text is appended to the string name. For example, if **1.200** is entered, “ 1.200” is appended to the string name.

If no point description is given, *Text* is appended to the string name of the current string.

If a point description exists, then either the feature code and string number, or the point ID section of the point description can be used.

If the feature code and string number exist, then the last previous string with that feature code and string number has *Text* appended to the string name.

If the point ID exists, then the string containing that point ID has *Text* appended to the string name.

The field data command panel in the **SDR Editor** is documented in 26.4.2.15 Height Or Depth Comment (opcode 28)

29 memo **Note or memo**

.12dfield file syntax

<memo>

<data>*Text*</data>

[<op_code_properties>]

</memo>

.fld file syntax

29 Text

description

Any Text may be entered and will be added to the check measurements model at the position of the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.39 Note (opcode 29)

30 remove_height **Remove height from a point - that is make it a null height**

.12dfield file syntax

<remove_height>

[<point_description>**]**

[<op_code_properties>]

</remove_height>

.fld file syntax

30 [Point_description*]*

description

If no point description is given, the height of the current measurement point is set to null.

If a point description exists, then either the feature code and string number, or the point ID section of the point description can be used.

If the feature code and string number exist, then the height of the last point of the previous string with that feature code and string number is set to null.

Otherwise, if the point ID exists, then the height of the point with that point ID is set to null.

The field data command panel in the **SDR Editor** is documented in 26.4.2.43 Remove Height (opcode 30)

31 remove_point **Delete point**

.12dfield file syntax

<remove_point>

[<point_description>**]**

[<op_code_properties>]

</remove_point>

.fld file syntax

31 [Point_description]

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.44 Remove (Delete) Point (opcode 31).

32 not yet used

33 not yet used

34 not yet used

35 not yet used

36 not yet used

37 rectangle_2 Rectangle by two points

.12dfield file syntax

<rectangle_2>

<offset>*offset_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</rectangle_2>

.fld file syntax

37 [Point_description] offset_in_metres

description

The rectangle is defined by **two points** (reference side) and an **offset**.

If a positive offset value is given, two points will be created to the right of the reference side.

If a negative offset value is given, two points will be created to the left of the reference side.

If no point description is given, the two new points will be joined to the given points in a closed rectangular string, and will have the same feature code as the points given.

If the feature code and string number exist, then a search is made for the last occurrence of two points with the same feature code and string number. If found, then these points are used to define the reference side of the rectangle.

Otherwise, if the point ID exists, then a search is made for the last occurrence of two points with the same feature code and string number as the point given by the point ID. If found, then these points are used to define the reference side of the rectangle.

Two consecutive rectangles are unable to be defined side by side. In other words if the two points given are part of string of greater than two vertices, the command will only work for sets of two points that are exclusively defined. *i.e.* For a 5 point string, a rectangle can be defined by points 1 and 2, and 4 and 5.

See 26.3.7 Rectangle by 2 Points

The field data command panel in the **SDR Editor** is documented in 26.4.2.53 String Rectangle by 2 Points (opcode 37)

38 non_tinable_next_segment Make the next segment non-tinable

.12dfield file syntax

<non_tinable_next_segment>

[<point_description>**]**

[<op_code_properties>]

</non_tinable_next_segment>

.fld file syntax

38 [Point_description*]*

description

If no _point description is given, the next segment containing the _current measurement point as a starting point is set to non-tinable. That is, it will not be treated as a breakline in triangulations.

If a _point description exists, then either the _feature code and _string number, or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then the segment that is created in the future from the last point of the previous string with that _feature code and _string number is set to non-tinable.

If the _point ID exists, then the segment containing the point with that _point ID as a start point, is set to non-tinable.

The field data command panel in the **SDR Editor** is documented in 26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)

39 non_tinable_previous_segment Make the previous segment non-tinable

.12dfield file syntax

<non_tinable_previous_segment>

[<point_description>**]**

[<op_code_properties>]

</non_tinable_previous_segment>

.fld file syntax

39 [Point_description*]*

description

If no _point description is given, the previous segment containing the _current measurement point is set to non-tinable. That is, it will not be treated as a breakline in triangulations.

If a _point description exists, then either the _feature code and _string number, or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then the last segment of the previous string with that _feature code and _string number is set to non-tinable.

If the _point ID exists, then the segment containing the point with that _point ID as an end point, is set to non-tinable.

The field data command panel in the **SDR Editor** is documented in 26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)

40 non_tinable_vertex Make a point non-tinable

.12dfield file syntax

<non_tinable_vertex>

[<point_description>**]**

[<op_code_properties>]

</non_tinable_vertex>

.fld file syntax

40 [Point_description*]*

description

If no _point description is given, the _current measurement point is set to non-tinable. That is, it will not be included in triangulations.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _ point description can be used.

If the _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is set to non-tinable.

If the _point ID exists, then the point with that _point ID is set to non-tinable.

The field data command panel in the **SDR Editor** is documented in 26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)

41 additional_text **Add additional text to the current measurement point**

.12dfield file syntax

<additional_text>

<text>*Text*</text>

<point_description>

[<op_code_properties>]

</additional_text>

.fld file syntax

41 Text

description

The given *Text* is appended to the vertex text for the _current measurement point.

In the ***fld*** file, any spaces from column four onwards will be part of the text.

The field data command panel in the **SDR Editor** is documented in 26.4.2.62 Additional Text For Point (opcode 41)

42 offset_measurement_radial **Add a radial offset**

.12dfield file syntax

<offset_measurement_radial>

<offset>*Radial_offset_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</offset_measurement_radial>

.fld file syntax

42 [Point_description*]* *Radial_offset_in_metres*

description

The *Radial_offset_in_metres* is used to adjust the position of the specified point by a plan distance from the specified points original position, along the plan line joining the current station to the specified point. A positive offset is away from the station, negative is toward the station.

If no _point description is given, the offset is used to adjust the position of the current measured point.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is adjusted.

If the _point ID exists, then the point with that _point ID is adjusted.

See 26.3.2 Offsets

The field data command panel in the **SDR Editor** is documented in 26.4.2.40 Offset Measurement (opcodes 42, 43, 44)

43 offset_measurement_tangential **Add a tangential offset**

.12dfield file syntax

<offset_measurement_tangential>

<offset>*Tangential_offset_in_metres*</offset>

[[<point_description>] **]**

[[<op_code_properties>]]

</offset_measurement_tangential>

.fld file syntax

43 [[Point_description] *]* *Tangential_offset_in_metres*

description

The *tangential_offset_in_metres* is used to adjust the position of the specified point by a plan distance from the specified points original position, at rights angles to the plan line joining the current station to the specified point. A negative offset is to the left (looking from the station), and positive is to the right (looking from the station).

If no point description is given, the offset is used to adjust the position of the current measured point.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, then the last point of the previous string with that feature code and string number is adjusted.

If the point ID exists, then the point with that point ID is adjusted.

See 26.3.2 Offsets

The field data command panel in the **SDR Editor** is documented in 26.4.2.40 Offset Measurement (opcodes 42, 43, 44)

44 offset_measurement_height **Add a height offset**

.12dfield file syntax

<offset_measurement_height>

<offset>*Height_offset_in_metres*</offset>

[[<point_description>] **]**

[[<op_code_properties>]]

</offset_measurement_height>

.fld file syntax

44 [[Point_description] *]* *Height_offset_in_metres*

description

If the height of the specified point is not null, then the *height_offset_in_metres* adjusts the height of the point. A positive offset adds to the height, a negative offset reduces the height.

If no point description is given, the offset is used to adjust the position of the current measured point.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, then the last point of the previous string with that feature code and string number is adjusted.

If the point ID exists, then the point with that point ID is adjusted.

See 26.3.2 Offsets

The field data command panel in the **SDR Editor** is documented in 26.4.2.40 Offset Measurement (opcodes 42, 43, 44)

45 rectangle **Make a parallelogram from the last three measurement points**

.12dfield file syntax

<rectangle>

[<point_description>]
[<op_code_properties>]
</rectangle>

.fld file syntax

45 [Point_description]

description

If no point description is given, the current measurement point and the two previous points from the current string are used and a fourth point is created to form a parallelogram (squashed rectangle) and the height of the fourth point is set to null. The string is then closed.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last three points with that feature code and string number are used and a fourth point is created to form a parallelogram (squashed rectangle) and the height of the fourth point is set to null. The string is then closed.

If the point ID exists, then the feature code and string number of the point with that point ID are used and processed as above. Note that the point with the point ID is not necessarily used.

See 26.3.6 Squashed Rectangle - Parallelogram

The field data command panel in the **SDR Editor** is documented in 26.4.2.52 String (Squashed) Rectangle (opcode 45)

46 breakline Make the string a breakline or not

.12dfield file syntax

<breakline>
[<mode>*mode_value*</mode>]
[<point_description>]
[<op_code_properties>]
</breakline>

.fld file syntax

46 [Point_description] [mode_value]

description

The point description is used to select a string and the *mode_value* is used specify if the string is a breakline or not.

point_description:

If no point description is given, the current string is selected.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last string with that feature code and string number is selected.

If the point ID exists, then the string containing the point with that point ID is selected.

***mode*_value:**

If no *mode_value* is given, the selected string is set as a point string (that is, not a breakline).

If *mode_value* is given, then

if *mode_value* is 0, the selected string is set to a point string and hence is not a breakline.

if *mode_value* is 1, the selected string is set to a *line* string and is therefore a breakline

The field data command panel in the **SDR Editor** is documented in 26.4.2.56 String Tinable - Breakline String (opcode 46)

47 new_string **Start a new string**

.12dfield file syntax

<new_string>

[<point_description>**]**

[<op_code_properties>]

</new_string>

.fld file syntax

47 [Point_description*]*

description

If no point description is given, the current string is terminated (without including the current measurement point) and the current measurement point becomes the first point of a new string with the same feature code and string number.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, then the last point of the previous string with that feature code and string number becomes the first point of a new string with the same feature code and string number.

If the point ID exists, then the previous string containing the point with that point ID is terminated *before* the point ID point, and the point becomes the first point of a new string with the *same* feature code and string number.

See 26.3.4 Start New String

The field data command panel in the **SDR Editor** is documented in 26.4.2.55 String Start (opcode 47)

48 end_string **End a string**

.12dfield file syntax

<end_string>

[<point_description>**]**

[<op_code_properties>]

</end_string>

.fld file syntax

48 [Point_description*]*

description

If no point description *exist*s, the current string is terminated (the terminated string includes the current measurement point).

If feature code and string number exist, then the last point of the previous string with that feature code and string number becomes the last point of that string.

If point ID exists, then the previous string containing the point with that point ID is terminated *after* the point ID point

The field data command panel in the **SDR Editor** is documented in 26.4.2.51 String End (opcode 48)

49 distances **Distances**

.12dfield file syntax

<distances>

<data>*distance_value*</data>

<point_description>

[<op_code_properties>]

</distances>

.fld file syntax

49 ?????

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.18 Distances (opcode 49)

50 backsight_reference Specify bearing to correct for true north - used as bearing datum difference

.12dfield file syntax

<backsight_reference>

<angle_difference>*bearing_in_decimal_degrees*</angle_difference>

<point_description>

[<op_code_properties>]

</backsight_reference>

.fld file syntax

50 Point_description *bearing_in_decimal_degrees*

description

The *bearing_in_decimal_degrees* is used as the bearing datum difference for the current instrument set up for all measurements from the current instrument set up that follow the Backsight Reference record.

The point name in the point description and the *bearing_in_decimal_degrees* are written to the report file.

The field data command panel in the **SDR Editor** is documented in 26.4.2.7 Backsight Reference (opcode 50)

51 template_start Start using an existing field template

.12dfield file syntax

<template_start>

<name>*Template_name*</name>

<zigzag_mode>*zig_zag_mode*</zigzag_mode>

[<op_code_properties>]

</template_start>

.fld file syntax

51 Template_name zig_zag_mode

description

Start using the field template *Template_name.* If *Template_name* is blank, the default field template is used.
If *mode* is "for", then the field template is used as a *forward* template.
"rev", then the field template is used as a *reverse* template.
"zig", then the field template is used as a zig_zag template and is used in the *forward* definition direction first (that is starts on a zig).
"zag", then the template is used as a zig_zag template and is used in the *reverse* direction first (that is, starts on a zag).
If *mode* is blank, or anything other than "for", "rev", or "zag" then the field template is used as a zig-zag template starting on a *zig*.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

52 template_end Finish using a field template or finish recording a field template

.12dfield file syntax

<template_end>

[<op_code_properties>]

</template_end>

.fld file syntax

52

description

Stops using the current field template or stops recording a field template.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

53 template_pause Pause the current field template until opcode 54 or finish template 52

.12dfield file syntax

<template_pause>

[<op_code_properties>]

</template_pause>

.fld file syntax

53

description

Pause using the current field template or defining a field template, until a continue field template (54) or a finish field template (52) code is given.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

54 template_continue Continue the current field template

.12dfield file syntax

<template_continue>

[<op_code_properties>]

</template_continue>

.fld file syntax

54

description

Continue using or defining the current field template, which has been stopped by a *Pause* field template command (53). The *Continue* command only needs to be given once and applies to all following measurements until another *Pause* or *Finish* command is given.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

55 template_record Start recording a field template

.12dfield file syntax

<template_record>

[<name>*Template_name*</name>**]**

[<op_code_properties>]

</template_record>

.fld file syntax

55 [Template_name]

description

Start recording a field template with the name *Template_name*. If *Template_name* is blank, then it is the default field template that is defined. The feature code and string number of the following measurements until a *Finish* code (52) are stored as the field template. There is no limit to the number of points in a field template.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

56 template_skip **Skip picking up one or more points from a field template**

.12dfield file syntax

<template_skip>

[<point_count>*num_skipped_points*</point_count>]

[<op_code_properties>]

</template_skip>

.fld file syntax

56 [num_skipped_points]

description

Allows the user to skip picking up one or more points from the field template currently being used. The next measurement takes the feature code and string number from the next point of the field template definition. If *num_skipped_points* is missing, then only one point is skipped otherwise *num_skipped_points are skipped.*

See 26.3.11.4 Skipping Field Template Points

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

57 template_delete **Delete points from a field template - after the measurement of last point**

.12dfield file syntax

<template_delete>

[<point_count>*num_points_to_delete*</point_count>]

[<op_code_properties>]

</template_delete>

.fld file syntax

57 [num_points_to_delete]

description

Allows the user to delete one or more points from the field template currently being used. The *next measurement* takes the feature code and string number from the next point of the field template definition.

See 26.3.11 Field Templates

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

58 template_insert **Insert points when using a field template - after the measurement of last point**

.12dfield file syntax

<template_insert>

<feature_code>*Feature_code*</feature_code>

<string_number>*String_number*</string_number>

<multiple_code>*Multiple_code_flag*</multiple_code>

<insert_special>*Insert_special_flag*</insert_special>

[<op_code_properties>]

</template_insert>

.fld file syntax

58 Feature_code String_number Multiple_code_flag Insert_special_flag

description

Allows the user to insert points into the field template currently being used, or give an existing point a multiple code.

If the *Multiple_code_flag = 1, then the* feature code *will be added to the previous defined template point* *else if Multiple_code_flag = 0 (default), it will be added to the template as a separate point.*

If the insert is done at the end of a section and the *Insert_special_flag = 1 the point will be added to the end of the current template section else it will be at the start of the next section.*

The *next measurement* takes the feature code and string number from the next point of the field template definition.

See 26.3.11.5 Insert Template Points or Insert Multiple Codes

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

59 template_change Change points in a field template

.12dfield file syntax

<template_change

[<feature_code>*Feature_code*</feature_code>**]**

[<string_number>*String_number*</string_number>**]**

<point>*Point_value*</point>

<count>*Count_value*</count>

[<op_code_properties>]

</template_change>

.fld file syntax

59 [Point_description] String_number Point_value Count_value

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.61 Templating (opcodes 51 to 59)

60 arc_fitting_next_3_points Arc through next three points

.12dfield file syntax

<arc_fitting_next_3_points>

[<point_description>**]**

[<op_code_properties>]

</arc_fitting_next_3_points>

.fld file syntax

60 [Point_description]

description

If no point description is given, an arc is inserted through the current measurement point and the next two measured points with the same feature code and string number as the current measurement point. If there is less than three points, no arc is fitted.

If a point description exists, then either the feature code and/or string number and/or the point ID section of the point description can be used.

If the feature code or string number from the point description exist*,* a search is made for a previously defined measurement with the same feature code or string number. An arc is inserted through this previous measurement and the next two measured points following this previous measurement with the same feature code and string number, as given in point description. If the current point has that feature code and string number, then it is the first of the three points. If there is less than three points, no arc fitted.

If the point ID *exists,* then the feature code and string number are taken from the previous measurement point **with** that point ID, and an arc is inserted through that point and the next two measurement points with the same feature code and string number. If there is less than three points, no arc is fitted

See 26.3.10 Arcs Through Points

The field data command panel in the **SDR Editor** is documented in 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)

61 arc_fitting_start **Start of arc through sets of three points until end of string, or a 62 occurs**

.12dfield file syntax

<arc_fitting_start>

[<point_description> **]**

[<op_code_properties>]

</arc_fitting_start>

.fld file syntax

61 [Point_description*]*

description

If no point description is given, arcs are inserted through the following sets of measurement points with the same feature code and string number as the current measurement point. The current measurement point is the first of the points.

The arcs are fitted as follows - the first arc is fitted through points one, two and three, the next arc through points three, four and five *etc*. If the current point has that feature code and string number, then it is the first of the points. If there is less than three points, then no arc is fitted.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number *exist*, a search is made for a previously defined measurement with the same feature code or string number. An arc is inserted through the following measured points with the same feature code and string number as given in point description. If the current point has that feature code and string number, then it is the first of the points.

If the point ID exists, then the feature code and string number are taken from the previous measurement point **with** that point ID, and arcs are inserted through that point and the following measured points with the same feature code and string number.

See 26.3.10 Arcs Through Points

The field data command panel in the **SDR Editor** is documented in 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)

62 arc_fitting_end **End the arcs begun by a 61 command**

.12dfield file syntax

<arc_fitting_end>

[<point_description> **]**

[<op_code_properties>]

</arc_fitting_end>

.fld file syntax

62 [Point_description*]*

description

If no point description is given, then the fitting of arcs through the points of the current string is stopped. The current measurement point is the last of the points used in the arc fitting.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number from the point description exist, then the fitting of arcs through the points of the previous string with the same feature code and string number is stopped. If the current measurement point has that feature code and string number, then it is the last point used in the arc fitting.

If the point ID from the point description exists, then the point with that point ID is the last point used in the arc fitting.

If ***12d Model*** encounters an *End Arcs (62)* but no *Start Arcs through sets of three points* (61) command for the string, then a *Start Arcs through sets of three points* (61) is assumed to apply at the beginning of the string and hence arc fitting will be applied to the entire string.

See 26.3.10 Arcs Through Points

The field data command panel in the **SDR Editor** is documented in 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)

63 not yet used

64 not yet used

65 not yet used

66 not yet used

67 not yet used

There are opcodes for **adding user defined attributes** to:

(a) the current string being measured (*i.e.* the string containing the current measurement point)

(b) the current measurement point

(c) the next segment from the current measurement point (*i.e.* the segment joining thecurrent measurement point and the *next* measured point *of the same* feature code *and* string number)

or

(d) the previous segment to the current measurement point (*i.e.* the segment joining the current measurement point to the previous measured point *of the same* feature code *and* string number).

If there is no name for the attribute (name is just spaces or a tab), then the attribute is *unnamed*. The attributes are coded in the following way:

68 integer_attribute_string Add a user defined integer attribute to the current string

.12dfield file syntax

<integer_attribute_string>

<name>*Name*</name>

<value>*Integer*</value>

[<op_code_properties>]

</integer_attribute_string>

.fld file syntax

68 Name Integer

description

Add an user defined integer attribute to the current string.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

69 real_attribute_string Add a user defined real attribute to the current string

.12dfield file syntax

<real_attribute_string>

<name>*Name*</name>

<value>*Real*</value>

[<op_code_properties>]

</real_attribute_string>

.fld file syntax

69 Name Real

description

Add a real user defined attribute to the current string.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

70 text_attribute_string **Add a user defined text attribute to the current string**

.12dfield file syntax

<text_attribute_string>

<name>*Name*</name>

<value>*Text*</value>

[<op_code_properties>]

</text_attribute_string>

.fld file syntax

70 Name Text

description

Add a text user defined attribute to the current string.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

71 integer_attribute_vertex **Add a user defined integer attribute to the current point**

.12dfield file syntax

<integer_attribute_vertex>

<name>*Name*</name>

<value>*Integer*</value>

[<op_code_properties>]

</integer_attribute_vertex>

.fld file syntax

71 Name Integer

description

Add an integer user defined attribute to the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

72 real_attribute_vertex **Add a user defined real attribute to the current point**

.12dfield file syntax

<real_attribute_vertex>

<name>*Name*</name>

<value>*Real*</value>

[<op_code_properties>]

</real_attribute_vertex>

.fld file syntax

72 Name Real

description

Add a real (floating point) user defined attribute to the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

73 text_attribute_vertex **Add a user defined text attribute to the current point**

.12dfield file syntax

<text_attribute_vertex>

<name>*Name*</name>

<value>*Text*</value>

[<op_code_properties>]

</text_attribute_vertex>

.fld file syntax

73 Name Text

description

Add a text user defined attribute to the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

74 integer_attribute_next_segment Add a user defined integer attribute to the next segment

.12dfield file syntax

<integer_attribute_next_segment>

<name>*Name*</name>

<value>*Integer*</value>

[<op_code_properties>]

</integer_attribute_next_segment>

.fld file syntax

74 Name Integer

description

Add an integer user defined attribute to the next segment from the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

75 real_attribute_next_segment Add a user defined real attribute to the next segment

.12dfield file syntax

<real_attribute_next_segment>

<name>*Name*</name>

<value>*Real*</value>

[<op_code_properties>]

</real_attribute_next_segment>

.fld file syntax

75 Name Real

description

Add a real (floating point) user defined attribute to the next segment from the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

76 text_attribute_next_segment Add a user defined text attribute to the next segment

.12dfield file syntax

<text_attribute_next_segment>

<name>*Name*</name>

<value>*Text*</value>

[<op_code_properties>]

</text_attribute_next_segment>

.fld file syntax

76 Name Text

description

Add a text user defined attribute to the next segment from the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

77 integer_attribute_previous_segment Add a user defined integer attribute to the previous segment

.12dfield file syntax

<integer_attribute_previous_segment>

<name>*Name*</name>

<value>*Integer*</value>

[<op_code_properties>]

</integer_attribute_previous_segment>

.fld file syntax

77 Name Integer

description

Add an integer user defined attribute to the previous segment for the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

78 real_attribute_previous_segment Add a user defined real attribute for the previous segment

.12dfield file syntax

<real_attribute_previous_segment>

<name>*Name*</name>

<value>*Real*</value>

[<op_code_properties>]

</real_attribute_previous_segment>

.fld file syntax

78 Name Real

description

Add a real (floating point) user defined attribute to the previous segment for the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

79 text_attribute_previous_segment Add a user defined text attribute to the previous segment

.12dfield file syntax

<text_attribute_previous_segment>

<name>*Name*</name>

<value>*Text*</value>

[<op_code_properties>]

</text_attribute_previous_segment>

.fld file syntax

79 Name Text

description

Add a text user defined attribute to the previous segment for the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.4 Attributes (opcodes 68 to79)

In addition, extra codes allow ***12d Model*** super pipe strings to be coded in the field

80 pipe_justification_invert Pipe or culvert invert point (bottom of the pipe or culvert)

.12dfield file syntax

<pipe_justification_invert>

[<point_description>]
[<op_code_properties>]
</pipe_justification_invert>

.fld file syntax

80 [Point_description]

description

If no point description is given, the current measurement point is on the invert (bottom) of a pipe. This is the default for measurements to points on pipe strings. If the point is not part of a pipe string, it is ignored.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last point of the previous string with the same feature code and string number as given in point description is on the invert (bottom) of a pipe. If the point is not part of a pipe string, it is ignored.

If the point ID exists, then the point with that point ID is on the invert (bottom) of a pipe. If the point is not part of a pipe string, it is ignored.

The field data command panel in the **SDR Editor** is documented in 26.4.2.42 Pipe Justification (opcodes 80, 81, 82)

81 pipe_justification_axial **Pipe or culvert axial point (centre of the pipe or culvert)**

.12dfield file syntax

<pipe_justification_axial>
[<point_description>]
[<op_code_properties>]
</pipe_justification_axial>

.fld file syntax

81 [Point_description]

description

If no point description is given, the current measurement point is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last point of the previous string with the same feature code and string number as given in point description is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.

If the point ID exists, then the point with that point ID is on the axis (centre) of a pipe. If the point is not part of a pipe string, it is ignored.

The field data command panel in the **SDR Editor** is documented in 26.4.2.42 Pipe Justification (opcodes 80, 81, 82)

82 pipe_justification_obvert **Pipe or culvert obvert point (top of the pipe or culvert)**

.12dfield file syntax

<pipe_justification_obvert>
[<point_description>]
[<op_code_properties>]
</pipe_justification_obvert>

.fld file syntax

82 [Point_description]

description

If no _point description is given, the _current measurement point is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, the last point of the previous string with the same _feature code and _string number as given in _point description is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.

If the _point ID exists, then the point with that _point ID is on the obvert (top) of a pipe. If the point is not part of a pipe string, it is ignored.

The field data command panel in the **SDR Editor** is documented in 26.4.2.42 Pipe Justification (opcodes 80, 81, 82)

83 shape_record **Start recording a shape - before the measurement**

.12dfield file syntax

<shape_record>

[<name>*Shape_name*</name>**]**

<mirror_x>*Mirror_x_status*</mirror_x>

<mirror_y>*Mirror_y_status*</mirror_y>

<offset>*Offset_value*</offset>

<height>*Height_value*</height>

[<op_code_properties>]

</shape_record>

.fld file syntax

83 [Shape_name] Mirror_x_status Mirror_y_status Offset_value Height_value

description

Start recording a shape with the name *Shape_name*. If *Shape_name* is not blank, then the default field Shape is defined by the _feature code and _string number of the **following measurements** until a *Finish* code (84) are stored as the shape. There is no limit to the number of points in a shape.

See 26.3.12 Shape Field Coding

The field data command panel in the **SDR Editor** is documented in 26.4.2.48 Shaping (opcodes 83 to 86)

84 shape_end **Finish using a shape definition or finish recording a shape - after the measurement**

.12dfield file syntax

<shape_end>

[<name>*Shape_name*</name>**]**

<mirror_x>*Mirror_x_status*</mirror_x>

<mirror_y>*Mirror_y_status*</mirror_y>

<offset>*Offset_value*</offset>

<height>*Height_value*</height>

[<op_code_properties>]

</shape_end>

.fld file syntax

84 [Shape_name] Mirror_x_status Mirror_y_status Offset_value Height_value

description

Stops using the current shape or stops recording a shape.

See 26.3.12 Shape Field Coding

The field data command panel in the **SDR Editor** is documented in 26.4.2.48 Shaping (opcodes 83 to 86)

85 shape_parallel **Parallel an existing shape**

.12dfield file syntax

<shape_parallel>

[<name>*Shape_name*</name>]

<mirror_x>*Mirror_x_status*</mirror_x>

<mirror_y>*Mirror_y_status*</mirror_y>

<offset>*Offset_value*</offset>

<height>*Height_value*</height>

[<op_code_properties>]

</shape_parallel>

.fld file syntax

85 [Shape_name] Mirror_x_status Mirror_y_status Offset_value Height_value

description

Takes all the points on the defined shape of *Shape_name* and parallels them the entire length of the **current** string. Once paralleled, a number of strings are created.

See 26.3.12 Shape Field Coding

The field data command panel in the **SDR Editor** is documented in 26.4.2.48 Shaping (opcodes 83 to 86)

86 shape_extrude **Extrude an existing shape**

.12dfield file syntax

<shape_extrude>

[<name>*Shape_name*</name>]

<mirror_x>*Mirror_x_status*</mirror_x>

<mirror_y>*Mirror_y_status*</mirror_y>

<offset>*Offset_value*</offset>

<height>*Height_value*</height>

[<op_code_properties>]

</shape_extrude>

.fld file syntax

86 [Shape_name] Mirror_x_status Mirror_y_status Offset_value Height_value

description

Takes the defined shape of *Shape_name* and extrudes it along the entire length of the **current** string.Once extruded, only one strings is created.

See 26.3.12 Shape Field Coding

The field data command panel in the **SDR Editor** is documented in 26.4.2.48 Shaping (opcodes 83 to 86)

87 shape_parallel_start **not yet implemented**

88 shape_extrude_start **not yet implemented**

89 not yet used

90 not yet used

91 not yet used

92 string_type_2d **Remove all z-values for a string (*i.e.* make all z-values null)**

.12dfield file syntax

<string_type_2d>

[<point_description>]
[<op_code_properties>]
</string_type_2d>

.fld file syntax

92 [Point_description]

description

If no point description is given, all z-values for the current string are removed.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist*,* the last string with the same feature code and string number has all its z-values removed.

A *point-line type* can be embedding as a 0 or 1 in the *point name* part of the *point description* field. A zero value specifies a point string, and a non-zero value specifies a line string. If the field was omitted, a line string is assumed.

The point-line type may be overridden by the Map File.

The field data command panel in the **SDR Editor** is documented in 26.4.2.57 String Type (opcodes 92, 93, 94)

93 string_type_3d The string can have different z-values for each vertex

.12dfield file syntax

<string_type_3d>
[<point_description>]
[<op_code_properties>]
</string_type_3d>

.fld file syntax

93 [Point_description]

description

A *point-line type* can be embedding as a 0 or 1 in the *point name* part of the *point description* field. A zero value specifies a point string, and a non-zero value specifies a line string. If the field was omitted, a line string is assumed.

If no point description is given, the point-line type for the current string is set to *line*.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist*,* the point-line type is set for the last previous string with the same feature code and string number.

If the point ID exists*,* then the point-line type is set for the string containing that point ID.

The point-line type may be overridden by the Map File.

The field data command panel in the **SDR Editor** is documented in 26.4.2.57 String Type (opcodes 92, 93, 94)

94 string_type_4d Use name library file/ Map File for vertex text on the string - name mapping

.12dfield file syntax

<string_type_4d>
<point_description>
[<op_code_properties>]
</string_type_4d>

.fld file syntax

94 [Point_description]

description

If this opcode exists then during reduction, vertex text is creating using either the name library, or if the name library doesn't exist, the map file. If neither exist then the opcode is ignored.

if a name library is used and the _feature code of the string is found in the first column of the name library, then the entry from the second column of that row will be used as text for *all* vertices of the string that don't already have vertex text. As a default, the string is set as a point string.

if the map file is used and the _feature code of the string is found in the first column of the map file, then the *string name* field of the map file is used as vertex text for all vertices that don't already have text. As a default, the string is set as a point string.

If no _point description is given, then name mapping is applied to the _current string.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then name mapping is applied to the last previous string with the same _feature code and _string number.

If the _point ID from the _point description exists, then name mapping is applied to the string containing that _point ID.

A *point-line type* can be embedding as a 0 or 1 in the *point name* part of the *point description* field. A zero value specifies a point string, and a non-zero value specifies a line string. If the field was omitted, a line string is assumed.

The point-line type may be overridden by the mapping file.

The field data command panel in the **SDR Editor** is documented in 26.4.2.57 String Type (opcodes 92, 93, 94)

95 pipe_diameter **Diameter for a super string pipe**

.12dfield file syntax

<pipe_diameter>

<diameter>*pipe_diameter*</diameter>

[<point_description>**]**

[<op_code_properties>]

</pipe_diameter>

.fld file syntax

95 [Point_description] diameter

description

Pipe strings are always line strings and are stored with the justification of the majority of the string points. Individual pipe points are picked up either top (obvert), centre (axial) or bottom (invert) of the pipe using opcodes 80, 81 and 82.

If no _point description is given, the _current string is created as a pipe string with the given *pipe_diameter*.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, the last string with the same _feature code and _string number is created as a pipe with the given *pipe_diameter*.

If the _point ID exists, then the string containing that _point ID is created as a pipe string with the given *pipe_diameter*.

The field data command panel in the **SDR Editor** is documented in 26.4.2.59 Pipe Diameter (opcode 95)

96 culvert **width and height for a culvert super string**

.12dfield file syntax

<culvert>

<width>*culvert_width*</width>

<height>*culvert_height*</height>

<point_description>50

[<op_code_properties>]

</culvert>

.fld file syntax

96 [Point_description] width height

description

Culvert strings are always line strings and are stored with the justification of the majority of the string points. Individual culvert points are picked up either top (obvert), centre (axial) or bottom (invert) of the culvert using opcodes 80, 81 and 82.

If no point description is given, the current string is created as a culvert string with the given *culvert_width* and *culvert_height*.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last string with the same feature code and string number is created as a culvert with the given *culvert_width* and *culvert_height*.

If the point ID exists, then the string containing that point ID is created as a culvert string with the given *culvert_width* and *culvert_height*.

The field data command panel in the **SDR Editor** is documented in 26.4.2.58 Culvert (opcode 96)

97 not yet used

98 not yet used

99 file_end Terminate processing

.12dfield file syntax

<file_end>

[<op_code_properties>]

</file_end>

.fld file syntax

99

description

Stop processing the ***12d Field File*** at this line. Useful for debugging errors.

The field data command panel in the **SDR Editor** is documented in 26.4.2.21 End File (opcode 99)

100 units Units used in the *12d Field File*

.12dfield file syntax

<units>

<angle>*angle_unit*</angle>

<distance>*metres*</distance>

<pressure>*millimetres*</pressure>

<temperature>*celcius*</temperature>

[<op_code_properties>]

</units>

.fld file syntax

100 angle_unit distance_unit pressure_unit temperature_unit

description

The units being used in the ***12d Field File***.

Currently there is only one choice for each unit and the choice for each unit is:

angle_unit is **degrees** which is ***decimal degrees***.
distance_unit is **metres**
pressure_unit is **millimetres**
temperature_unit is **celsius**

The field data command panel in the **SDR Editor** is documented in 26.4.2.63 Units (opcode 100)

101 auto_order Order strings automatically

.12dfield file syntax

<auto_order>
[<point_description>]
[<op_code_properties>]
</auto_order>

.fld file syntax

101 [Point_description]

description

Takes the string and applies the 14.5.5.3 Auto Order option to it.

If no point description is given, the current string has Auto Order applied to it.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, the last string with the same feature code and string number has Auto Order applied to it.

If the point ID exists, then the string containing that point ID has Auto Order applied to it.

The field data command panel in the **SDR Editor** is documented in 26.4.2.41 Order String Automatically (opcode 101).

102 not yet used

103 not yet used

104 not yet used

105 not yet used

106 not yet used

107 invisible_previous_segmet Make the previous segment invisible - after the measurement

.12dfield file syntax

<invisible_previous_segment>
[<point_description>]
[<op_code_properties>]
</invisible_previous_segment>

.fld file syntax

107 [Point_description]

description

If no point description exists, the previous segment containing the current measurement point is set to invisible.

If the feature code and string number exist, then the last segment of the previous string with that feature code and _string number is set to invisible.

If *Point_number* exists, then the segment containing the point with that _point ID as an end point, is set to invisible.

The field data command panel in the **SDR Editor** is documented in 26.4.2.28 Invisibility (opcodes 107, 108, 109)

108 invisible_next_segment Make next segment invisible - after measurement for first point of segment

.12dfield file syntax

<invisible_next_segment>

[<point_description>**]**

[<op_code_properties>]

</invisible_next_segment>

.fld file syntax

108 [Point_description*]*

description

If no _point description exists, the next segment containing the _current measurement point as a starting point is set to invisible.

If the _feature code and _string number exist, then the segment that is created in the future from the last point of the previous string with that _feature code and _string number is set to invisible.

If _point ID exists, then the segment containing the point with that _point ID as a start point, is set to invisible.

The field data command panel in the **SDR Editor** is documented in 26.4.2.28 Invisibility (opcodes 107, 108, 109)

109 invisible_vertex Make a point invisible - after the measurement

.12dfield file syntax

<invisible_vertex>

[<point_description>**]**

[<op_code_properties>]

</invisible_vertex>

.fld file syntax

109 [Point_description*]*

description

If no _point description exists, the _current measurement point is set to invisible.

If _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is set to invisible.

If _point ID exists, then the point with that _point ID is set to invisible.

The field data command panel in the **SDR Editor** is documented in 26.4.2.28 Invisibility (opcodes 107, 108, 109)

110 building_face Start recording buildings face observations - before the measurements

.12dfield file syntax

<building_face>

[<name>*Building_name*</name>**]**

[<op_code_properties>]

</building_face>

.fld file syntax

110 [Building_name]

description

Start recording a field template with the name *Building_name*.

If *Building_name* is not blank, then the default building face is defined. The feature code and string number of the following measurements until a *Finish* code (111) are stored as the building face. There is no limit to the number of points in a building face.

The field data command panel in the **SDR Editor** is documented in 26.4.2.8 Buildings (opcodes 110, 111)

111 building_face_end **End recording building face observations**

.12dfield file syntax

<building_face_end>

[<name>*Building_name*</name>**]**

[<op_code_properties>]

</building_face_end>

.fld file syntax

111 [Building_name]

description

If no *Building_name exist*s, the current building face observation set is finished (including the current measurement point).

The field data command panel in the **SDR Editor** is documented in 26.4.2.8 Buildings (opcodes 110, 111)

112 set_collection **Start set collection observations - before the measurements**

.12dfield file syntax

<set_collection>

[<op_code_properties>]

</set_collection>

.fld file syntax

112

description

Set collection opcode 112 has not been implemented and if its number is typed into the editor it will give an error.

113 set_collection_end **End set collection observations**

.12dfield file syntax

<set_collection_end>

[<op_code_properties>]

</set_collection_end>

.fld file syntax

113

description

Set collection end opcode 113 has not been implemented and if its number is typed into the editor it will give an error.

114 not yet used

115 not yet used

116 not yet used

117 not yet used

118 not yet used

119 code_file Name of this *12d Field File*

.12dfield file syntax

<code_file>

<name>*file_name*</name>

[<op_code_properties>]

</code_file>

.fld file syntax

119 file_name

description

file_name is the name of this ***12d Field File***.

The field data command panel in the **SDR Editor** is documented in 26.4.2.12 Code File (opcode 119)

120 measure_attribute_string Attribute for string (measurement)

.12dfield file syntax

<measure_attribute_string>

<name>*Attribute_name*>

<horizontal_angle>*horizontal_angle_value*</horizontal_angle>

<vertical_angle><*vertical_angle_value*</vertical_angle>

<slope_distance><*splope_distance_value*</slope_distance>

<target_height><*splope_distance_value*</target_height>

[<op_code_properties>]

</measure_attribute_string>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The measure_attribute_string opcode uses the given horizontal angle, vertical angle, slope distance and target height and calculates the coordinates of the point resulting from these values.

No point is created by this but the following information is stored as attributes of the current string.

x, y and z coordinates of the instrument
instrument height
x, y and z coordinates of the calculated point
horizontal angle, vertical angle, slope distance and target height.

The *Attribute_ name* plus a space (" ") is used to prefix the names for each of the attributes.

For the panel in the Insert command and the names for each of the attributes, see 26.4.2.3 Measurement Attributes (opcodes 120 to 123)

121 measure_attribute_vertex Attribute for vertex (measurement)

.12dfield file syntax

<measure_attribute_vertex>

<name>*Attribute_name*>

<horizontal_angle>*horizontal_angle_value*</horizontal_angle>

<vertical_angle><*vertical_angle_value*</vertical_angle>

<slope_distance><*splope_distance_value*</slope_distance>

<target_height><*splope_distance_value*</target_height>

[<op_code_properties>]

</measure_attribute_vertex>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The measure_attribute_vertex opcode uses the given horizontal angle, vertical angle, slope distance and target height and calculates the coordinates of the point resulting from these values.

No point is created by this but the following information is stored as attributes of the current measurement.

x, y and z coordinates of the instrument
instrument height
x, y and z coordinates of the calculated point
horizontal angle, vertical angle, slope distance and target height.

The *Attribute_ name* plus a space (" ") is used to prefix the names for each of the attributes.

For the panel in the Insert command and the names for each of the attributes, see 26.4.2.3 Measurement Attributes (opcodes 120 to 123)

122 measure_attribute_next_segment Attribute for next segment (measurement)

.12dfield file syntax

<measure_attribute_next_segment>

<name>*Attribute_name*>

<horizontal_angle>*horizontal_angle_value*</horizontal_angle>

<vertical_angle><*vertical_angle_value*</vertical_angle>

<slope_distance><*splope_distance_value*</slope_distance>

<target_height><*splope_distance_value*</target_height>

[<op_code_properties>]

</measure_attribute_next_segment>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The measure_attribute_vertex opcode uses the given horizontal angle, vertical angle, slope distance and target height and calculates the coordinates of the point resulting from these values.

No point is created by this but the following information is stored as attributes of the next segment from the current measurement point.

x, y and z coordinates of the instrument
instrument height
x, y and z coordinates of the calculated point
horizontal angle, vertical angle, slope distance and target height.

The *Attribute_ name* plus a space (" ") is used to prefix the names for each of the attributes.

For the panel in the Insert command and the names for each of the attributes, see 26.4.2.3 Measurement Attributes (opcodes 120 to 123)

123 measure_attribute_previous_segment Attribute for previous segment (measurement)

.12dfield file syntax

<measure_attribute_previous_segment>

<name>*Attribute_name*>

<horizontal_angle>*horizontal_angle_value*</horizontal_angle>

<vertical_angle><*vertical_angle_value*</vertical_angle>

<slope_distance><*splope_distance_value*</slope_distance>

<target_height><*splope_distance_value*</target_height>

[<op_code_properties>]

</measure_attribute_previous_segment>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The measure_attribute_vertex opcode uses the given horizontal angle, vertical angle, slope distance and target height and calculates the coordinates of the point resulting from these values.

No point is created by this but the following information is stored as attributes of the previous segment to the current measurement point.

x, y and z coordinates of the instrument
instrument height
x, y and z coordinates of the calculated point
horizontal angle, vertical angle, slope distance and target height.

The *Attribute_ name* plus a space (" ") is used to prefix the names for each of the attributes.

For the panel in the Insert command and the names for each of the attributes, see 26.4.2.3 Measurement Attributes (opcodes 120 to 123)

124 attribute_set Start an attribute group

.12dfield file syntax

<attribute_set>

<name>*Attribute_group_name*</name>

<level>*Attribute_group_level*</level>

[<op_code_properties>]

</attribute_set>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

Starts an attribute group with the name Attribute_group_name.

All the following attributes are then under the Attribute_group_name unit and attribute_set_end (125).

The field data command panel in the **SDR Editor** is documented in 26.4.2.5 Attribute Set (opcodes 124 and 125)

125 attribute_set_end End the current attribute group

.12dfield file syntax

<attribute_set_end>

[<op_code_properties>]

</attribute_set_end>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

End the current attribute group.

The field data command panel in the **SDR Editor** is documented in 26.4.2.5 Attribute Set (opcodes 124 and 125)

126 attachment **Attach a file**

.12dfield file syntax

<attachment>

<name>*file_name*</name>

[<op_code_properties>]

</attachment>

.fld file syntax

126 file_name

description

The file *file_name* is attached to the current measurement point.

The field data command panel in the **SDR Editor** is documented in 26.4.2.2 Attachment (opcode 126)

127 measurement_offset **Distance correction**

.12dfield file syntax

<measurement_offset>

<correction>*correction_vaue*</correction>

[<op_code_properties>]

</measurement_offset>

.fld file syntax

127 correction_vaue

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.17 Distance Correction (opcode 127)

128 resection **Start a resection**

.12dfield file syntax

<resection>

<height>*height_value*</height>

<point_description>

[<op_code_properties>]

</resection>

.fld file syntax

128 height_value

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.46 Resection Start (opcode 128)

129 resection_end **End the resection**

.12dfield file syntax

<resection_end>

[<op_code_properties>]

</resection_end>

.fld file syntax

129

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.47 Resection End (opcode 129)

130 field_file **12d Model internal use only**

.12dfield file syntax

<field_file>

<name>*file_name*</name>

[<op_code_properties>]

</field_file>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

file_name is the name of an internal ***12d Field File***.

This option is for ***12d Model*** internal use only.

131 ppm_correction **PPM correction**

.12dfield file syntax

<ppm_correction>

<value>*PPM_correction*</value>

[<op_code_properties>]

</ppm_correction>

.fld file syntax

131 PPM_correction

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.27 PPM Correction (opcode 131)

132 not yet used

133 not yet used

134 not yet used

135 not yet used

136 not yet used

137 not yet used

138 helmert **Helmert start**

.12dfield file syntax

<helmert>

<height>*height_value*</height>

<point_description>

[<op_code_properties>]

</helmert>

.fld file syntax

138 height_value

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.24 Helmert Start (opcode 138)

139 helmert_end **End the Helmert**

.12dfield file syntax

<helmert_end>

[<op_code_properties>]

</helmert_end>

.fld file syntax

139 ?????

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.25 Helmert End (opcode 139)

140 gps_coordinate GNSS coordinate measurement

.12dfield file syntax

<gps_coordinate>

<XYZ>

<point_description>

[<op_code_properties>]

</gps_coordinate>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

A measurement point is created with the feature code and string number from the point description and given GNSS (x, y,z) coordinates. The reduced X,Y,Z is affected by any current GNSS Offset Correction opcode, and the current target height.

So the entered GNSS Z coordinate **does not** have the antenna height subtracted!

The point ID and point comment from the point description are recorded as the **point id** and **text** for that **vertex** of the super string.

If a point name exists in the point description, then it is a named measurement and a 4d point string of name point name is created and mapped using the Map File. The 4d text is the station prefix followed by point name. The point name is added to the internal list of named points for searching for coordinates.

The field data command panel in the **SDR Editor** is documented in 26.4.2.22 GNSS Coordinate (opcode 140)

141 non_tinable_string Make a string non-tinable

.12dfield file syntax

<non_tinable_string>

<point_description>

[<op_code_properties>]

</non_tinable_string>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

If no point description is given, the current string is made non-tinable.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number from the point description exist, the last previous string with that feature code and string number is made non-tinable.

If the point ID from the point description exists, then the string containing that point ID will be made non-tinable.

The field data command panel in the **SDR Editor** is documented in 26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141).

142 extend_measurement_next_segment Extend next segment by 2D distance

.12dfield file syntax

<extend_measurement_next_segment>

<offset>*Extend_2D_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</extend_measurement_next_segment>

.fld file syntax- THIS OPTION DOES NOT EXIST IN A *.fld* FILE

*This opcode does not exist in the **fld** file.*

description

The *Extend_2D_in_metres* is used to adjust the position of the specified point by a plan distance from the specified point's original position, along the next segment that the point is the point is on.

The z-value of the point does not change.

A positive extend is along the direction of the next segment and a negative extend is against the direction of the next segment that the point is on.

The option will fail if it is applied to the last point of a string or to a one point string.

If no point description is given, the extend is used to adjust the position of the current measured point.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the feature code and string number exist, then the last point of the previous string with that feature code and string number is adjusted.

If the point ID exists, then the point with that point ID is adjusted.

See 26.3.3 Extend

The field data command panel in the **SDR Editor** is documented in 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

143 extend_measurement_previous_segment Extend previous segment by 2D distance

.12dfield file syntax

<extend_measurement_previous_segment>

<offset>*Extend_2D_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</extend_measurement_previous_segment>

.fld file syntax- THIS OPTION DOES NOT EXIST IN A *.fld* FILE

*This opcode does not exist in the **fld** file.*

description

The *Extend_2D_in_metres* is used to adjust the position of the specified point by a plan distance from the specified point's original position, along the previous segment that the point is the point is on.

The z-value of the point does not change.

A positive extend is along the direction of the previous segment and a negative extend is against the direction of the previous segment that the point is on.

The option will fail if it is applied to the first point of a string or to a one point string.

If no point description is given, the extend is used to adjust the position of the current measured point.

If a point description exists, then either the feature code and string number or the point ID section of the point description can be used.

If the _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is adjusted.

If the _point ID exists, then the point with that _point ID is adjusted.

See 26.3.3 Extend

The field data command panel in the **SDR Editor** is documented in 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

144 remove_string Delete a string

.12dfield file syntax

<remove_string>

<point_description>

[<op_code_properties>]

</remove_string>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

If no _point description is given, the _current string is deleted.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number from the _point description exist, the last previous string with that _feature code and _string number is deleted.

If the _point ID from the _point description exists, then the string containing that _point ID is deleted.

The field data command panel in the **SDR Editor** is documented in 26.4.2.45 Remove (Delete) String (opcode 144)

145 gps_offset GNSS Offset correction

.12dfield file syntax

<gps_offset>

<xofffset>*Xoffset_vaue*</xofffset>

<yofffset>*Yoffset_vaue*</yofffset>

<zofffset>*Zoffset_vaue*</zofffset>

<point_description>

[<op_code_properties>]

</gps_offset>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The *Xoffset_vaue*,*Yoffset_vaue*,*Zoffset_vaue* is **added** to GNSS (x, y,z) coordinate in the following140 opcodes.

This applies to subsequent GNSS coordinate measurements until another 145 is encountered.

A 145 0 0 0 is used to **stop** the effect of GNSS Offsets.

Opcode 5 is applied after this correction to subtract the antenna pole height.

The field data command panel in the **SDR Editor** is documented in 26.4.2.23 GNSS Offset Correction (opcode 145)

146 midpoint_2 Create midpoint of two points

.12dfield file syntax

<midpoint_2>

<keep_points>*keep_point_value*</keep_points>

<coding>

<point_description>

</coding>

<point_description>

[<op_code_properties>]

</midpoint_2>

.fld file syntax

*This opcode does not exist in the **fld** file.*

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.34 Midpoint of Two Points (opcode 146)

147 midpoint_3 Create centre of arc that goes through three points

.12dfield file syntax

<midpoint_3>

<keep_points>*keep_point_value*</keep_points>

<coding>

<point_description>

</coding>

<point_description>

[<op_code_properties>]

</midpoint_3>

.fld file syntax - THIS OPTION DOES NOT EXIST IN A *.fld* FILE

*This opcode does not exist in the **fld** file.*

description

The field data command panel in the **SDR Editor** is documented in 26.4.2.35 Centre of Arc Through Three Points (opcode 147)

172 extend_measurement_next_segment_3d Extend next segment by 3D distance

.12dfield file syntax

<extend_measurement_next_segment_3d>

<offset>*Extend_3D_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</extend_measurement_next_segment_3d>

.fld file syntax - THIS OPTION DOES NOT EXIST IN A *.fld* FILE

*This opcode does not exist in the **fld** file.*

description

The *Extend_3D_in_metres* is used to adjust the position of the specified point by a 3D distance from the specified point's original position, along the next segment that the point is the point is on.

The z-value of the point is extrapolated using the grade of the next segment.

A positive extend is along the direction of the next segment and a negative extend is against the direction of the next segment that the point is on.

The option will fail if it is applied to the last point of a string or to a one point string.

If no _point description is given, the extend is used to adjust the position of the current measured point.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is adjusted.

If the _point ID exists, then the point with that _point ID is adjusted.

See 26.3.3 Extend

The field data command panel in the **SDR Editor** is documented in 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

173 extend_measurement_previous_segment_3d Extend previous segment by 3D distance

.12dfield file syntax

<extend_measurement_previous_segment_3d>

<offset>*Extend_3D_in_metres*</offset>

[<point_description>**]**

[<op_code_properties>]

</extend_measurement_precious_segment_3d>

.fld file syntax- THIS OPTION DOES NOT EXIST IN A .*fld* FILE

*This opcode does not exist in the **fld** file.*

description

The *Extend_3D_in_metres* is used to adjust the position of the specified point by a 3D distance from the specified point's original position, along the previous segment that the point is the point is on.

The z-value of the point is extrapolated using the grade of the previous segment.

A positive extend is along the direction of the previous segment and a negative extend is against the direction of the previous segment that the point is on.

The option will fail if it is applied to the first point of a string or to a one point string.

If no _point description is given, the extend is used to adjust the position of the current measured point.

If a _point description exists, then either the _feature code and _string number or the _point ID section of the _point description can be used.

If the _feature code and _string number exist, then the last point of the previous string with that _feature code and _string number is adjusted.

If the _point ID exists, then the point with that _point ID is adjusted.

See 26.3.3 Extend

The field data command panel in the **SDR Editor** is documented in 26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

Notes

1. Arc fitting is applied *after* the Joins are processed. Hence the new joined strings are created and then curve fitting is applied according to the arc codes (start arc, end arc, fit arcs, stop fitting arcs *etc.*) on any vertex of the string.
2. The *point description* has several pieces of information embedded in it and has been described in the previous section. For some opcodes, the *point name* section of the *point description* is used to hold other information. See <point_description>

For a summary of the **12d Field File Opcodes**, go to the section 28.9 12d Survey Opcode Summary.

Continue to 28.9 12d Survey Opcode Summary or return to 28 12d Field File Format.

28.9 12d Survey Opcode Summary

When ***12d Field*** is run and a ***12dfield*** file created, or a raw data collector file is converted into a ***12dfield*** or ***fld*** file, the survey information is recorded as a series of **opcodes**.

In the ***12dfield*** file, the **opcodes** are **text opcodes** and in the ***fld*** file, the opcodes are **numeric opcodes**.

Typed entry can also be used in the ***Survey Data Editor*** and for typed entry, the numeric opcodes are used to call up the survey data Insert panels.

The ***12d survey opcodes*** *are:*

Line 1: Numeric Opcode Text Opcode Description of Opcode

Line 2: Link to Insert panel that creates the opcode

Numeric Opcode	Text Opcode	Description of Opcode
-3	group	Group 26.4.2.26 Group (opcode -3)
-2	comment	Insert a comment 26.4.2.13 Comment (opcode -2)
-1	error	Add text to information for an error 26.4.2.19 Error (opcode -1)
1	job_data	Job Information 26.4.2.16 Job Data (opcode 1)
2	coordinate	Directly entered coordinate measurement (DEC) 26.4.2.14 Coordinate (opcode 2)
3	station	New instrument setup on a point 26.4.2.37 New Instrument Setup - Station (opcode 3)
4	backsight	Measurement to backsight 26.4.2.6 Backsight (opcode 4)
5	target_height	New target height 26.4.2.60 Target Height (opcode 5)
6	check_measurement	Check measurement 26.4.2.10 Check Measurement (opcode 6)
7	edm_tachy_measurement	Measurement - HA, VA, SD 26.4.2.30 EDM Measurement (opcode 7)
8	not yet used	
9	scale_factor	Slope distance scale factor for subsequent distances 26.4.2.49 Slope Distance Scale Factor (opcode 9)
10	stadia_measurement	Three hair stadia measurement 26.4.2.33 Stadia Measurement (opcode 10)
11	edm_tachy_measurement_ht	Measurement - HA, HD, Height 26.4.2.31 EDM Measurement (HA,HD,HT) (opcode 11)
12	edm_tachy_measurement_vd	Measurement - HA, HD, Height difference (VD) 26.4.2.32 EDM Measurement (HA,HD,Diff HT) (opcode 12)
13	not yet used	
14	check_coordinate	Check Coordinates 26.4.2.9 Check Coordinate (opcode 14)
15	vertical_circle	Vertical circle correction 26.4.2.64 Vertical Circle Correction (opcode 15)
16	multiple_coding	Multiply coded point 26.4.2.36 Multiple Coding (opcode 16)
17	arc_fitting_last_3_points	Arc through previous three points 26.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)
18	feature	Circle Feature 26.4.2.11 Circle Feature (opcode 18)
19	reverse_string	Reverse string

26.4.2.54 String Reverse (opcode 19)
20 close_string Close string
26.4.2.50 String Close (opcode 20)
21 join_strings_last_to_last Join last points of strings
26.4.2.29 Strings Join (opcodes 21 to 24)
22 join_strings_first_to_last Join first to last point of strings
26.4.2.29 Strings Join (opcodes 21 to 24)
23 join_strings_first_to_first Join first points of strings
26.4.2.29 Strings Join (opcodes 21 to 24)
24 join_strings_last_to_first Join last to first point of strings
26.4.2.29 Strings Join (opcodes 21 to 24)
25 not yet used
26 not yet used
25 not yet used
28 height_or_depth Add text to the string name - for delta height
26.4.2.15 Height Or Depth Comment (opcode 28)
29 memo Note or memo
26.4.2.39 Note (opcode 29)
30 remove_height Remove height from a point - that is make it a null height
26.4.2.43 Remove Height (opcode 30)
31 remove_point Delete point
26.4.2.44 Remove (Delete) Point (opcode 31)
32 not yet used
33 not yet used
34 not yet used
35 not yet used
36 not yet used
37 rectangle_2 Rectangle by two points
26.4.2.53 String Rectangle by 2 Points (opcode 37)
38 non_tinable_next_segment Make the next segment non-tinable
26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
39 non_tinable_previous_segment Make the previous segment non-tinable
26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
40 non_tinable_vertex Make a point non-tinable
26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
41 additional_text Add additional text to the current measurement point
26.4.2.62 Additional Text For Point (opcode 41)
42 offset_measurement_radial Add a radial offset
26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
43 offset_measurement_tangential Add a tangential offset
26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
44 offset_measurement_height Add a height offset
26.4.2.40 Offset Measurement (opcodes 42, 43, 44)
45 rectangle Make a parallelogram from the last three measurement points
26.4.2.52 String (Squashed) Rectangle (opcode 45)
46 breakline Make the string a breakline or not
26.4.2.56 String Tinable - Breakline String (opcode 46)
47 new_string Start a new string
26.4.2.55 String Start (opcode 47)
48 end_string End a string
26.4.2.51 String End (opcode 48)
49 distances Distances
26.4.2.18 Distances (opcode 49)
50 backsight_reference Specify bearing to correct for true north - used as bearing datum difference
26.4.2.7 Backsight Reference (opcode 50)
51 template_start Start using an existing field template
26.4.2.61 Templating (opcodes 51 to 59)
52 template_end Finish using a field template or finish recording a field template

84	shape_end	Finish using a shape definition or finish recording a shape - after the measurement	26.4.2.48 Shaping (opcodes 83 to 86)
85	shape_parallel	Parallel an existing shape	26.4.2.48 Shaping (opcodes 83 to 86)
86	shape_extrude	Extrude an existing shape	26.4.2.48 Shaping (opcodes 83 to 86)
87	shape_parallel_start	not yet implemented	
88	shape_extrude_start	not yet implemented	
89	not yet used		
90	not yet used		
91	not yet used		
92	string_type_2d	Remove all z-values for a string (i.e. make all z-values null)	26.4.2.57 String Type (opcodes 92, 93, 94)
93	string_type_3d	The string can have different z-values for each vertex	26.4.2.57 String Type (opcodes 92, 93, 94)
94	string_type_4d	Use name library file/ Map File for vertex text on the string - name mapping	26.4.2.57 String Type (opcodes 92, 93, 94)
95	pipe_diameter	Diameter for a super string pipe	26.4.2.59 Pipe Diameter (opcode 95)
96	culvert	width and height for a culvert super string	26.4.2.58 Culvert (opcode 96)
97	not yet used		
98	not yet used		
99	file_end	Terminate processing	26.4.2.21 End File (opcode 99)
100	units	Units used in the 12d Field File	26.4.2.63 Units (opcode 100)
101	auto_order	Order strings automatically	26.4.2.41 Order String Automatically (opcode 101)
102	not yet used		
103	not yet used		
104	not yet used		
105	not yet used		
106	not yet used		
107	invisible_previous_segmet	Make the previous segment invisible - after the measurement	26.4.2.28 Invisibility (opcodes 107, 108, 109)
108	invisible_next_segment	Make next segment invisible - after measurement for first point of segment	26.4.2.28 Invisibility (opcodes 107, 108, 109)
109	invisible_vertex	Make a point invisible - after the measurement	26.4.2.28 Invisibility (opcodes 107, 108, 109)
110	building_face	Start recording buildings face observations - before the measurements	26.4.2.8 Buildings (opcodes 110, 111)
111	building_face_end	End recording building face observations	26.4.2.8 Buildings (opcodes 110, 111)
112	set_collection	Start set collection observations - before the measurements	
113	set_collection_end	End set collection observations	
114	not yet used		
115	not yet used		
116	not yet used		
117	not yet used		
118	not yet used		
119	code_file	Name of this 12d Field File	26.4.2.12 Code File (opcode 119)
120	measure_attribute_string	Attribute for string (measurement)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
121	measure_attribute_vertex	Attribute for vertex (measurement)	

			26.4.2.3 Measurement Attributes (opcodes 120 to 123)
122	measure_attribute_next_segment	Attribute for next segment (measurement)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
123	measure_attribute_previous_segment	Attribute for previous segment (measurement)	26.4.2.3 Measurement Attributes (opcodes 120 to 123)
124	attribute_set	Start an attribute group	26.4.2.5 Attribute Set (opcodes 124 and 125)
125	attribute_set_end	End the current attribute group	26.4.2.5 Attribute Set (opcodes 124 and 125)
126	attachment	Attach a file	26.4.2.2 Attachment (opcode 126)
127	measurement_offset	Distance correction	26.4.2.17 Distance Correction (opcode 127)
128	resection	Start a resection	26.4.2.46 Resection Start (opcode 128)
129	resection_end	End the resection	26.4.2.47 Resection End (opcode 129)
130	field_file	12d Model internal use only	
131	ppm_correction	PPM correction	26.4.2.27 PPM Correction (opcode 131)
132	not yet used		
133	not yet used		
134	not yet used		
135	not yet used		
136	not yet used		
137	not yet used		
138	helmert	Helmert start	
139	helmert_end	End the Helmert	
140	gps_coordinate	GNSS coordinate measurement	26.4.2.22 GNSS Coordinate (opcode 140)
141	non_tinable_string	Make a string non-tinable	26.4.2.38 Non Tinability (opcodes 38, 39, 40, 141)
142	extend_measurement_next_segment	Extend next segment by 2D distance	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)
143	extend_measurement_previous_segment	Extend previous segment by 2D distance	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)
144	remove_string	Delete a string	26.4.2.45 Remove (Delete) String (opcode 144)
145	gps_offset	GNSS Offset correction	26.4.2.23 GNSS Offset Correction (opcode 145)
146	midpoint_2	Create midpoint of two points	26.4.2.34 Midpoint of Two Points (opcode 146)
147	midpoint_3	Create centre of arc that goes through three points	26.4.2.35 Centre of Arc Through Three Points (opcode 147)
172	extend_measurement_next_segment_3d	Extend next segment by 3D distance	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)
173	extend_measurement_previous_segment_3d	Extend previous segment by 3D distance	26.4.2.20 Extend Measurement (opcodes 142, 143, 172, 173)

For the full description of the **12d Field File Opcodes**, see 28.8 Full Description of 12d Survey Opcodes

Return to 28 12d Field File Format.

TO BE MOVED

Users can enter text for each measurement (observation 09 record or position 08 record) which is appended to the end of the record and this is used as the text of blocks that are interpreted according to the descriptions given in the earlier section 42.2 Field Coding for Non Leica Instruments.

The **13** record can also be used after a measurement record to add additional information to the preceding blocks using the *extra coding* control code at the end of the previous line (see Extra Coding in the section 42.2.4 Control Code Blocks

Strictly speaking the Sokkia SDR20/33 formats use fixed length lines and if the lengths are incorrect, an error message will be written to the Output Window. For example,

’Line 248 line incorrect length. required length is 58. received length is 50.’

These messages often appear after a raw file has been manually edited because most editors remove space padding at the end of a line.

29 Geodetics Summary

Various options in ***12d Model*** use geodetic calculations to present and change data. These options use terminology that are common to the field of geodetics and will be defined here.

Most of the terminology in ***12d Model*** follows definitions given in the Australian **GDA Technical Manual** which is published by the **Intergovernmental Committee on Surveying and Mapping** (ICSM), although the alternate name of Grid Azimuth will be used instead of Grid Bearing because of the differences in definitions in different parts of the world.

This publication is a valuable reference document and the reader is encouraged to obtain a copy for a full understanding of the topic. The document can be accessed on the internet at the following address https://www.icsm.gov.au/gda2020-and-gda94-technical-manuals

See

29.1 Shape Of The Earth
29.2 Horizontal and Vertical Datums
29.3 Coordinate Systems for the Earth
29.4 Norths, Azimuths and Bearings
29.5 Distances
29.6 Calculating Distances and Scale Factors
29.7 Defining a Projection in 12d Model
29.8 Coordinate Conversions and Transformations

29.1 Shape Of The Earth

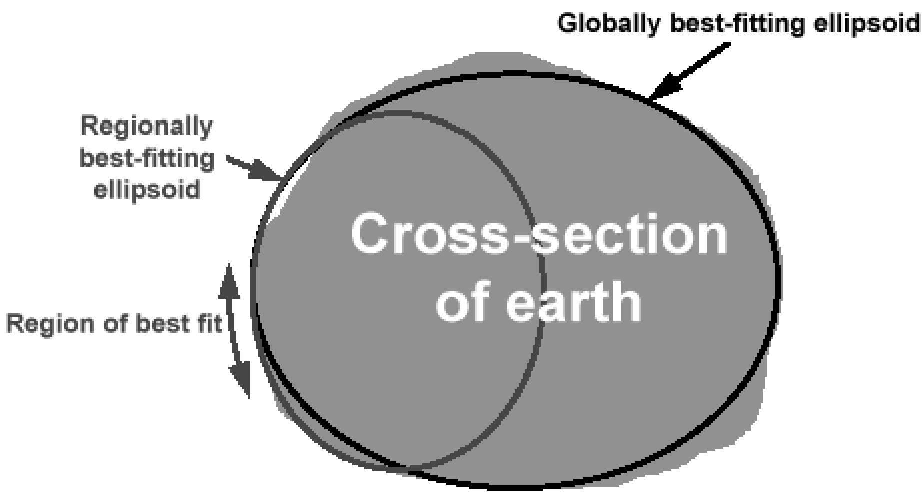
The determination of the Earth’s shape is a science known as **Geodesy**.

What is meant by "shape of the Earth" needs to be exactly defined and for computational purposes, a mathematical model of the Earth is required.

Today, it is widely accepted that the Earth’s shape is best approximated by an **ellipsoid** revolved around the **Earth’s polar axis**. That is, the shape is a sphere that has been squashed at the north and south poles. The non-spherical shape is due to gravity.

Glossing over where is the north and south poles a number of ellipsoids have been calculated to best approximate the Earth’s shape at local locations and others that best approximation to the Earth as a whole.

Traditionally the best fit is concerned with matching the geoid to a geometric ellipsoid shape. As such, there a wide number of definitions. See 29.1.1 Ellipsoid.



When thinking about the shape of the Earth, most people think about **heights**.

The **height** at two points is usually considered to be the **same** if **water** will **not flow between them**, and one height is **greater** than the other if **water flows** from the **higher point to the lower point**.

Gravity is what determines how water flows so the definition of equal heights is defined by gravity (**orthometric** height). Unfortunately the gravitational field of the Earth is not uniform and varies because density varies throughout the planet.

The **Geoid** is defined as the shape of the Earth that the ocean surface would take under the influence of the gravity and rotation of the Earth alone. The geoid is best approximated by Mean Sea Level. See 29.2.2 Geoid.

However due to the undulations of the earths density and surface, an exact mathematical model of the geoid is not currently available.

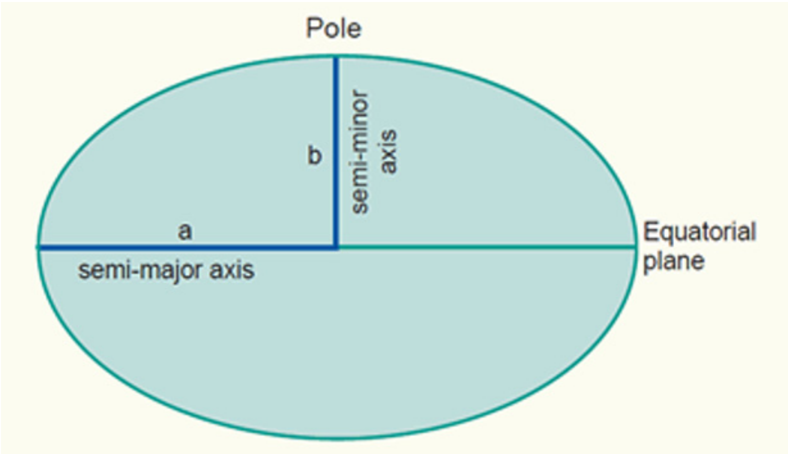
So to understand how the shape of the Earth is mathematically modelled, one must know how an ellipsoid is defined for the Earth, and then the relationship between the defined ellipsoid and the geoid.

Continue to 29.1.1 Ellipsoid or return to 29 Geodetics Summary.

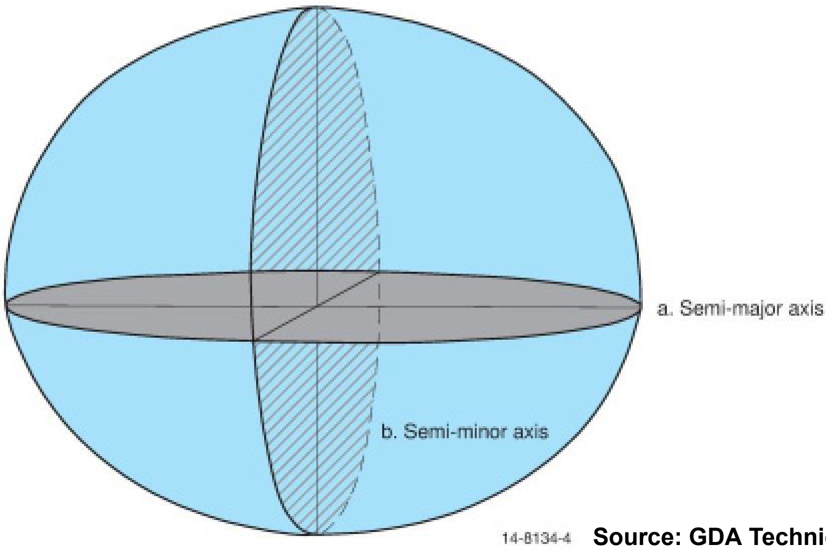
29.1.1 Ellipsoid

The Earth is not a round sphere but one that is squashed at the north and south poles and with a bulge at the equator. So the Earth is closer to being an ellipsoid than a sphere.

A 2D ellipse is defined by giving the length of **semi-major axis (a)** and the **semi-minor axis (b).**



The ellipsoid in obtained by rotating the 2D ellipse about its **semi-minor axis** (**polar axis**) through 360 degrees.



Source: GDA Technical Manual

The **semi-major** axis is also known as the **equatorial axis.**

However rather than giving the value of the semi-minor axis, the value for the **flattening** (**f**) of the ellipsoid is often given instead where

flattening = f = (a - b)/ a

or

the reciprocal of the flattening **1/f.**

So given the **semi-major axis** (a) and the **flattening** (f) or the **inverse flattering (reciprocal flattening rf** =1/f), the semi-minor axis (b) is given by:

b = a (1-f) = b(rf -1)/rf where **rf = 1/f**

When calculating an ellipsoid for the Earth, the North and South pole of the ellipsoid is approximately aligned with the Earth's axis of rotation and the difference between the semi-major axis (**equatorial axis**) and the semi-minor axis (**polar axis**) is about 21 km, or 0.335%

For the Earth, the polar axis of the ellipse is also referred to as the **True North Pole**.

In the past there have been two approaches to defining the ellipsoid representing the Earth:

(a) calculating the best approximation to the Earth's shape at a **local location.** That is, as a best fit matching the Earth's local geoid over a limited area. For example, Australia

(b) calculating the best approximation to the Earth's shape as a best fit matching the geoid for the whole Earth

Because of the use of local fitting, there are many definitions of ellipsoids and some of the commonly used **older ones** are:

1. ANS

Ellipsoid	**Semi-major axis**	**Reciprocal Flattening**
ANS	6,378,160 metres	298.25

This was the ellipsoid used to define the Australian Geodetic datum (AGD 84) used for AMG (Australian Map Grid) calculations and ISG (Integrated Survey Grid) coordinates.

2. NZ Geodetic 49

Ellipsoid	**Semi-major axis**	**Reciprocal Flattening**
NZ Geodetic 49	6,378,399.065 metres	297.0

This was the ellipsoid used to define the NZ 1949 Geodetic datum. The semi-major axis given here has been adjusted to compensate for errors in units conversion from links to meters.

3. Airy 1830

Ellipsoid	**Semi-major axis**	**Reciprocal Flattening**
Airy 1830	6,377,563.396 metres	299.3249646

This was the ellipsoid used by Ordnance Survey of Great Britain to define the Ordnance Survey National Grid.

For these older ellipsoids, not only were the definitions of the semi-major and semi minor axes different, but also the centres of the ellipsoids were also different.

Although there are many possible ellipsoids, **Global Navigation Satellite Systems** (**GNSS** - GPS, GLONAS, Galileo, BeiDou, RNSS-India etc) are now widely used in navigation and GNSS uses satellites which orbit around the **centre of mass** of the Earth.

So using an **ellipsoid** with its **centre** at the **mass centre of the Earth** is best when working with GNSS, and this ellipsoid has been standardised and is now used around the world. See 29.1.1.1 Mass Centred Ellipsoid.

Continue to 29.1.1.1 Mass Centred Ellipsoid or return to 29 Geodetics Summary.

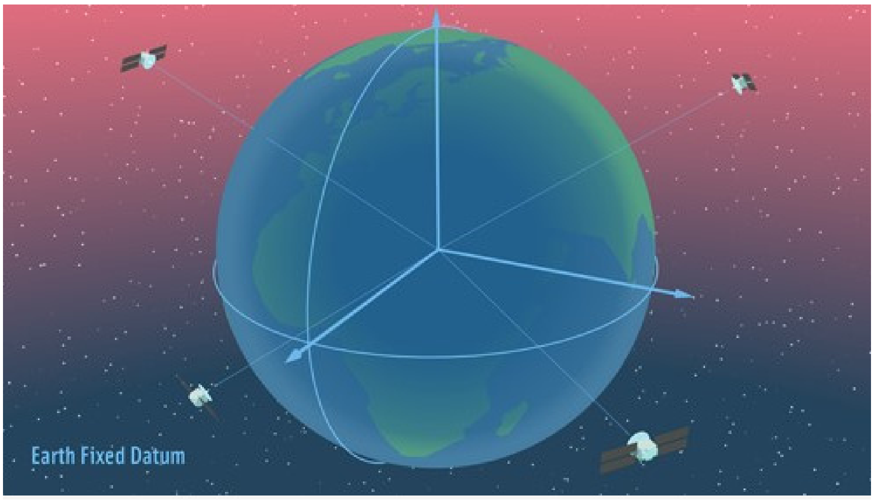
29.1.1.1 Mass Centred Ellipsoid

Global Navigation Satellite Systems **GNSS** (GPS, GLONAS, Galileo, BeiDou, RNSS-India etc) are now widely used in navigation, and GNSS uses satellites.

All satellites orbit around the centre of mass of the Earth so using an ellipsoid with its centre at the mass centre of the Earth is best for working with GNSS.

Because GNSS works around the world, having just one ellipsoid used throughout the world rather than myriad of different locally fitting ellipsoids is very beneficial.

So **mass centred** ellipsoids (known as the **geocentric** ellipsoids) are now the preferred ellipsoids.



There are now two mass centred ellipsoids that are in common used as **reference ellipsoids** are.

1. **GRS80**

Ellipsoid	Semi-major axis	Reciprocal Flattening
GRS80	6,378,137.0	298.257222101

This ellipsoid is used for Australia's GDA definition (Geocentric Datum of Australia GDA94 and GDA2020) that are used for MGA94 and MGA2020 (Map Grid of Australia) calculations. New Zealand's NZGD2000 datum as well as many other geocentric Earth model datums around the world also use GRS80.

2. **WGS84**

Ellipsoid	Semi-major axis	Reciprocal Flattening
WGS84	6,378,137.0	298.257223563

WGS84 differs slightly from GRS80 due to later refinements.

Even though a reference ellipsoid has been defined, more information is required for it to be well defined and used for the definitions of longitude and latitude (geographic or geodetic coordinates).

For more information, see 29.2.1 Geodetic or Horizontal Datum.

Continue to 29.2 Horizontal and Vertical Datums or return to 29.1 Shape Of The Earth or 29 Geodetics Summary.

29.2 Horizontal and Vertical Datums

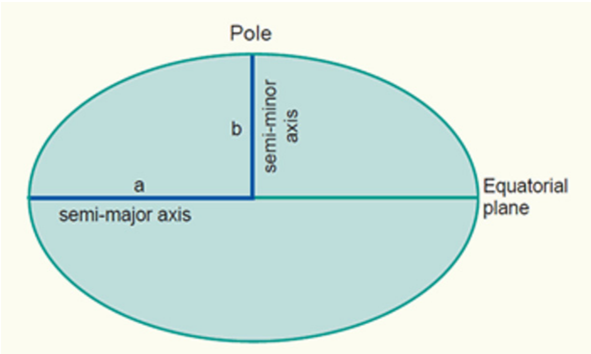
See

29.2.1 Geodetic or Horizontal Datum

In simple terms, a **horizontal datum** is a mathematical model of the Earth which serves as a reference for calculating the longitude, latitude and heights of any point on the surface of the Earth.

However, each of the terms in this definition need to be precisely defined.

As discussed in 29.1.1 Ellipsoid, the most common mathematical model of the Earth is an ellipsoid of revolution and ellipsoid is defined by giving its **semi-major axis** (**a**) and **semi-minor axis** (**b**).



However to **fix the ellipsoid to the Earth** so that a longitude and latitude can be defined for each point on the Earth, we need a **reference frame** defining:

(a) **centre of the ellipsoid** with respect to the Earth

(b) **polar axis of the ellipsoid** with respect to the Earth.

The polar axis of the ellipsoid (north pole) is now taken as the International Reference Pole (IRP) as defined by the International Earth Rotation Service (IERS).

(c) geodetic latitude

Once the polar axis is defined, the equator is also well defined, and hence Latitude which is measured from the equator.

(d) **zero longitude** (the prime meridian) with respect to the Earth.

Longitude is then well defined as it is measure from the zero longitude.

The zero longitude is usually defined as going through Greenwich in the UK. Although due to how the prime meridian is measure, is it now 5.3 seconds east of the historical line through the Royal Observatory in Greenwich.

Once this connection between the ellipse and the Earth is fully defined, heights for points on the Earths surface can be specified as ellipsoid heights (distance above and below the ellipsoid).

Unfortunately the surface of the Earth is constantly moving (continental drift, earthquakes etc.) and so the longitude and latitude of a point on the surface is also constantly changing. So to uniquely define a position on the Earth's surface, the **time** that the position was calculated is also required (**epoch**).

So as defined by Geosciences Australia, a **geodetic datum** or **horizontal datum** is composed of:

(a) an ellipsoid

(b) a reference frame

and

(c) a reference time (epoch).

geodetic datums can be **local geodetic datums** that are based on an ellipsoid that best fits the Earths surface in a particular area of interest, or **global geodetic datums** that best fits the entire

Earth.

A **geocentric datum**, or earth-centred datum, uses the Earth's centre of mass as the centre of the ellipsoid.

Although In the **mass centred** ellipsoid (known as the **geocentric** ellipsoid), the North star is used as the true north reference as it's position in the sky causes it to appear almost stationary with the other stars rotating around it.

So the ellipsoid is positioned so that the **polar axis** (the line through the south to the north poles) points to the **North star**.

Such a mass centred ellipsoid was Internationally agreed upon and was defined as the **1980 Geodetic Reference System or GRS80**.

GRS80 is now used by most mapping systems around the world.

Within the Geodetic sections of ***12d Model***, the term ***datum*** relates to the reference ellipsoid adopted by countries/organisations for mapping projects.

For example, **AGD** is the Australian Geodetic Datum, using the ANS ellipsoid parameters. **GDA94** refers to the Geocentric Datum of Australia, using the GRS80 ellipsoid as the basis for defining geodetic coordinates for where Australia was at 1st January 1994, and **GDA2020** refers to the Geocentric Datum of Australia again using the GRS80 ellipsoid but defining geodetic coordinates for where Australia was at 1st January 2020.

In New Zealand, the NZGD49 datum refers to the NZ Geodetic 49 ellipsoid. The NZGD2000 datum is the New Zealand Geodetic Datum 2000 which again refers to the GRS80 ellipsoid.

Important Note:

Due to continental drift, Australia moves about 7 cm per annum with respect to Greenwich and the equator, so the longitude and latitude of each point in Australia varies with time.

GDA94 is the Geodetic Datum for the position of where Australia was in1994, and GDA2020 is where Australia is in 2020. See 29.8.2.3.2 Transforming Between MGA94 and MGA2020.

Continue to 29.2.2 Geoid or return to 29.1 Shape Of The Earth or 29 Geodetics Summary.

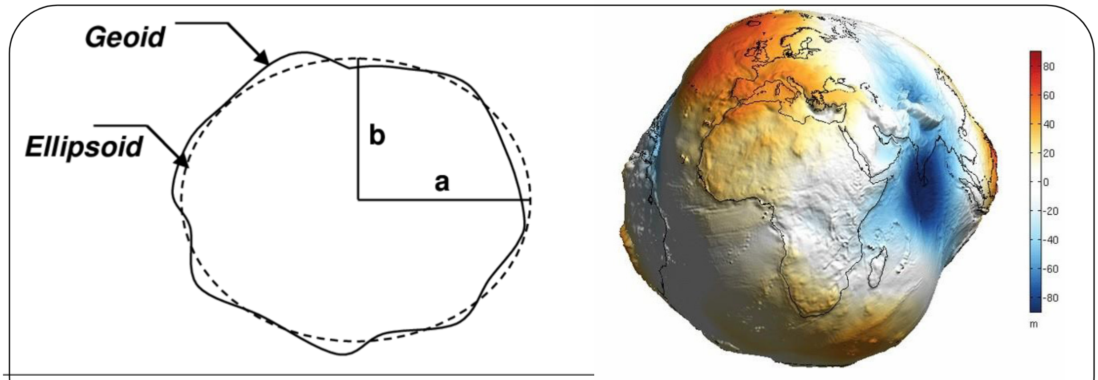
29.2.2 Geoid

Ellipsoid heights are measured perpendicular to the ellipsoid, and are defined at all points on the Earth. But ellipsoid heights are not what most people think of as "heights".

The most common definition of height is that the height at two points is the same if water will not flow between them, and one height is greater than the other if water flows from the higher point to the lower point. This is a gravity definition of height.

Because the gravity definition of height makes sense for most applications, most height datums are not based on ellipsoid height but are based on the gravity height. These are called **orthometric heights**.

The **zero height for orthometric height** is called the **geoid** and this is defined as the shape that the ocean surface would take under the influence of the gravity and rotation of the Earth alone. So orthometric heights are also known as **geoid** or **geoidal heights**.



The Earth Potato - exaggerated difference between Geoid and the Ellipsoid

For more information on the Geoid, see 29.2.3 Geoids and N Values.

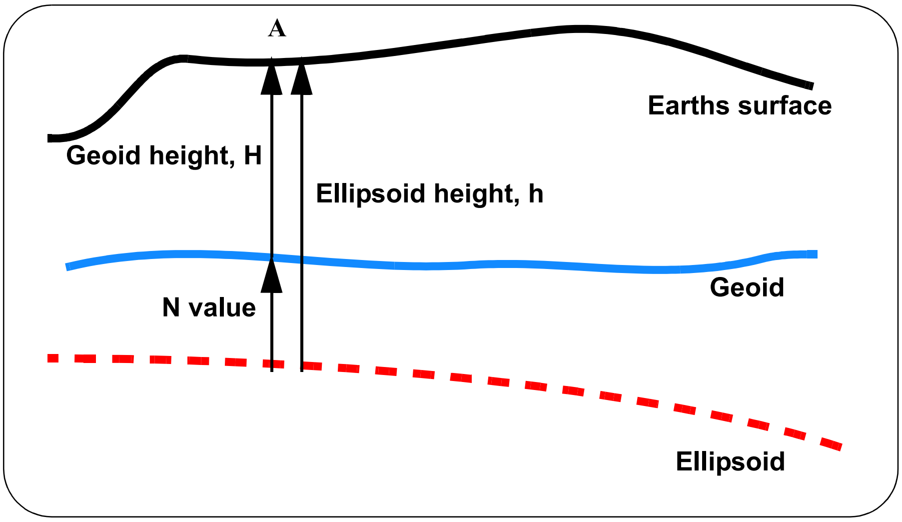
29.2.3 Geoids and N Values

Gravity is what determines how water flows so the normal definition of equal heights is defined by gravity. These are orthometric heights.

The zero height for orthometric height is called the **geoid** which is defined as the shape that the ocean surface would take under the influence of the gravity and rotation of the Earth alone. So orthometric heights are also known as **geoid** or **geoidal heights**. The geoid is best approximated by **Mean Sea Level**.

For a given ellipsoid, the geoid can be defined at each point in terms of the difference in height between the ellipsoid and the geoid at that point. This is known as the **undulation of the geoid.**

The difference between the **geoid height (H)** and the **ellipsoid height (h)** at a point is called the **N value (N)** for that point, and **N** is positive when the ellipsoid is above the geoid.



That is:

N value = Ellipsoid Height - Geoid height

N = h - H

or

Ellipsoid height = Geoid height + N value

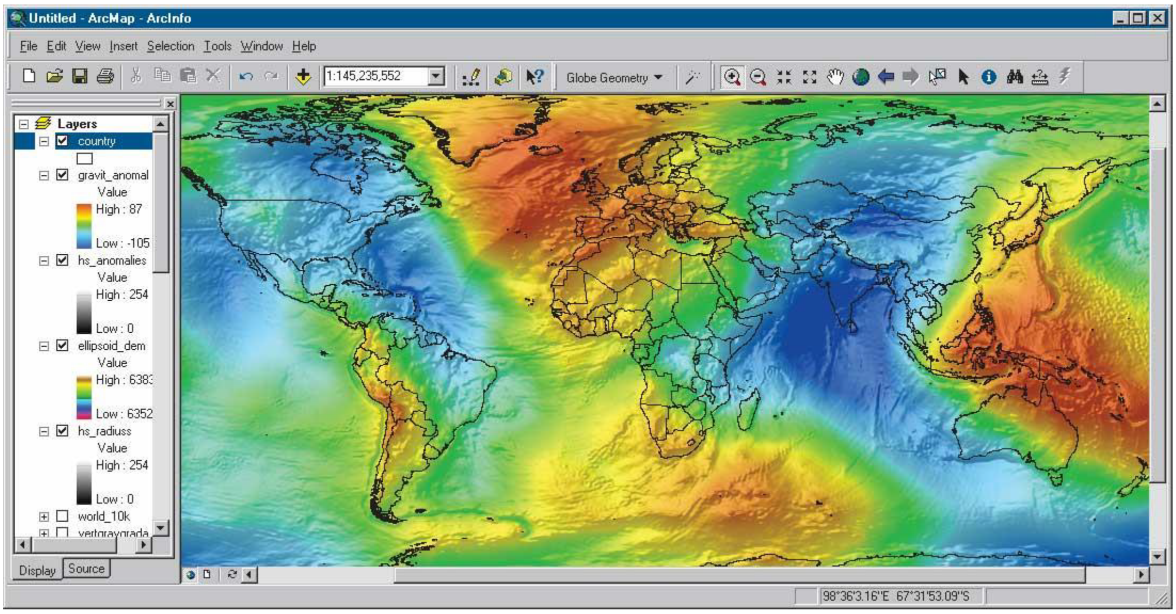
h = H + N

or

Geoid height = Orthometric height = Ellipsoid height - N value

H = h - N

N values can be positive or negative.



Distance between the Geoid and the Ellipsoid GRS80

Even though there is universally accepted definition of the ellipsoid (GRS80), the wide variation in the geoid has meant that local models of the geoid are still the norm today.

For example, in Australia, N values have been defined for the whole of Australia as **Ausgeod98** but the values are only to a certain accuracy and are only given at regular positions on a grid. If more accurate N values are required for an application then additional N values need to be measured. and used.

Consequently there are a variety of methods for providing N values and which one is used will depend on where the project is and what precision is required (see 29.2.4 Vertical Datum).

Since most geodetic calculations are based on the ellipsoid, any observations should be reduced onto the ellipsoid. But before observations can be reduced onto the geoid, the heights must be ellipsoid heights. And this is particularly true for precise calculations.

In GNSS surveys, heights are often given in ellipsoid heights but most other level datums are based on a geoid. and not an ellipsoid.

The Survey reduction process can take into the consideration the height above the ellipsoid but that means in the reduction process, it is necessary to first convert non ellipsoid heights to ellipsoid heights, and this is done by using the geoid-ellipsoid separations (N values).

In ***12d Model*** there are various methods for supplying the N values and which one is used depends on the work being done and how precise the calculations need to be.

Also depending on how the values for a method are defined, a particular method may only be used with a particular coordinate system. For example, the N values may be defined for positions given in map coordinates or they may be defined for position given in longitudes and latitudes.

The methods currently available ***12d Model*** are:

(a) no N values required - N is zero everywhere

(b) constant N value - a constant N value is used everywhere

(c) an N value plane

A plane of N values is defined in map coordinates and for a particular (x,y) coordinate, the N value is taken from the N value plane at that point.

(d) a N value tin

A tin of N values is used and for a particular (x,y) coordinate, the N value is taken from the N value on the tin at that point.

This is often used for very precise work in a limited area where the N values are known at a number of points in the area.

(e) a grid of N values (GSB)

A grid of N values at regular coordinate points in either a text file format or as a binary file in NTv2 format (.gsb file) is used.

For a particular coordinate, the N value is taken from the grid points surrounding the point.

The calculation can use either a bi-linear (4-point) or bi-cubic (16 point) method.

The Winter bicubic interpolation method (supplied by Auslig) can be used for calculating N values within the grid.

For more information on the Australian Height Datum (AHD) and the available NTv2 grids for converting between ellipsoid heights and AHD go to 29.2.4.1 Height Datum and Geoid Models.

(f) a Geotiff file representing a grid of N values

A grid of N values at regular coordinate points in stored in a geotiff file.

For a particular coordinate, the N value is taken from the grid points surrounding the point.

The calculation uses the bi-linear (4-point) method.

The parameters for particular N value methods can be stored under a unique name using the **Create/Edit N Value Settings** panel (see 6.10.7.2 Create/Edit N-Value Definitions).

This unique name can be used when defining the Vertical Datum for a ***12d Model*** projection (see 6.10.6.1 Projection Editor) and/or a particular method set as the default method to use in a Project (see 6.10.7.1 Set N-Values for Project).

Continue to 29.2.4 Vertical Datum or return to 29.2 Horizontal and Vertical Datums or 29 Geodetics Summary.

29.2.4 Vertical Datum

Because the gravity definition of height is what makes sense for most applications, most heights are not based on ellipsoid height but are based on the ***geoid height*** (also known as **geoidal** or **orthometric height)**. For example, the Australian Height Datum *(***AHD**).

The definition of heights is the **vertical datum**.

A **Vertical Datum** is the zero surface (geoid) from which all elevations or heights are measured. Generally mean sea level is used as the vertical datum.

Local vertical datums are defined to serve the georeferencing needs of a country or group of adjacent countries.

The N-values for the geoid depend on the chosen ellipsoid and now that there is a standardised ellipsoid (**GRS80**) used around the world, the N-values of the geoid can also be standardised by giving the values with respect to **GRS80.**

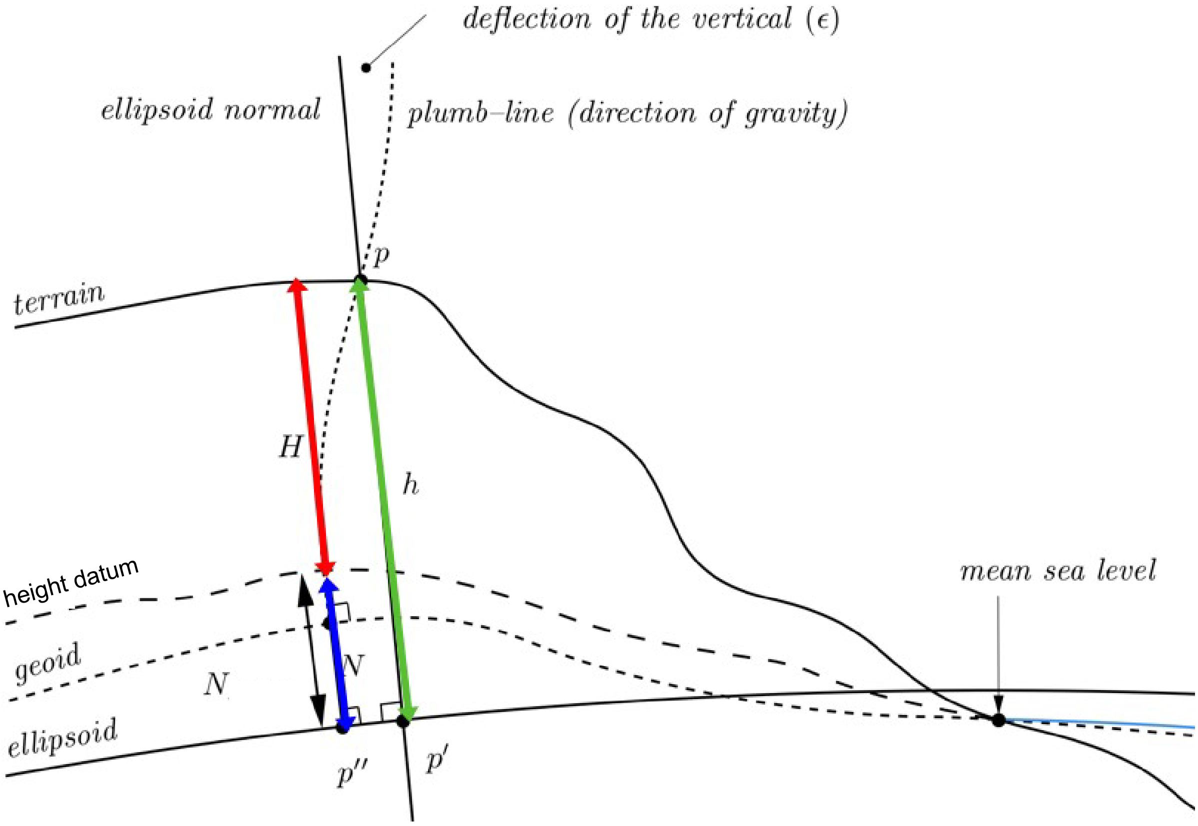
However the universal Geoid is not normally accurate enough to use everywhere. Consequently local models of the geoid are often still in use today.

For examples of the height datums currently in use in Australia, continue to 29.2.4.1 Height Datum and Geoid Models.

29.2.4.1 Height Datum and Geoid Models

Height determination in any jurisdiction requires a level of care due to the number and type of reference and working surfaces to which heights can be referred, including: Mean Sea Level, Mean Sea Surface (MSS), ellipsoid and geoid (gravimetric or combined gravimetric and geometric).

In most regions, an official **height datum** is usually defined but this could be local, regional or country wide.

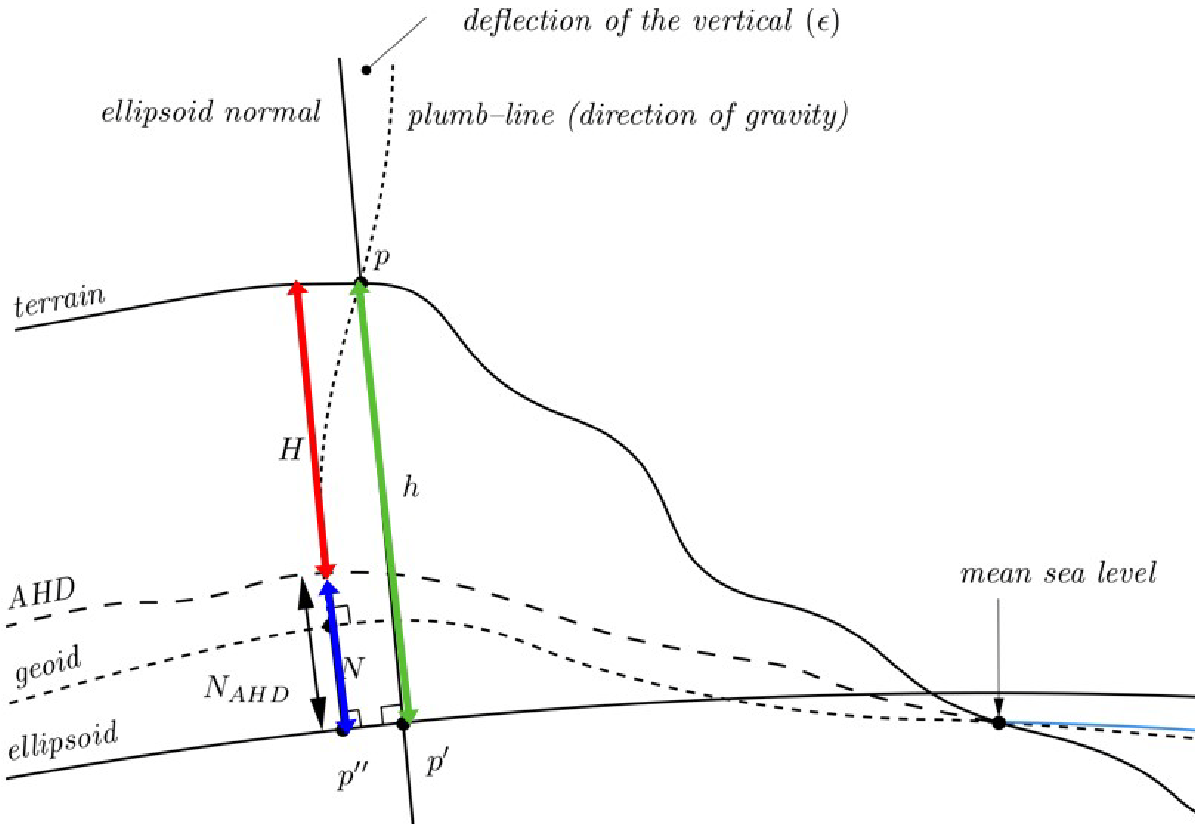


See

29.2.4.1.1 Australian Height Datum (AHD)
29.2.4.1.2 AUSGeoid09
29.2.4.1.3 AUSGeoid2020

29.2.4.1.1 Australian Height Datum (AHD)

In Australia, the **Australian Height Datum** (**AHD**) is the official national vertical datum for Australia and refers to Australian Height Datum 1971. Prior to AHD, many local height datums were used in the states and territories.



When the AHD was established, insufficient gravity observations were available to apply gravimetric height corrections. Instead, a truncated version of the normal-orthometric correction of Rapp (1961) was applied to the spirit levelling observations (Roelse et la., 1975; Featherstone and Kuhn 2006) which has no requirement for observed gravity in the correction. Instead it uses the normal gravity field only to derive all necessary gravity field related quantities.

Continue to 29.2.4.1.2 AUSGeoid09 or return to 29.2.4.1 Height Datum and Geoid Models or 29.2 Horizontal and Vertical Datums or 29 Geodetics Summary.

29.2.4.1.2 AUSGeoid09

AUSGeoid09 is the Australia-wide gravimetric quasigeoid model that has been a posteriori fitted to the Australian Height Datum (AHD) so as to provide a product that is practically useful for the more direct determination of AHD heights from Global Navigation Satellite Systems (GNSS).

That is, the **AUSGeoid09** model provides the offset between the GDA94 ellipsoid and AHD. The model is only valid onshore.

AUSGeod09 is available as a NTv2 (.gsb) file from https://www.ga.gov.au/scientific-topics/positioning-navigation/australian-geospatial-reference-system/agrstoolsandmodels.

Important Note

Only GDA94 coordinates can be used with AUSGeoid09.

Continue to 29.2.4.1.3 AUSGeoid2020 or return to 29.2.4.1 Height Datum and Geoid Models or 29.2 Horizontal and Vertical Datums or 29 Geodetics Summary.

29.2.4.1.3 AUSGeoid2020

The **AUSGeoid2020** model provides the offset between the GDA2020 ellipsoid and AHD. The model is only valid onshore.

AUSGeoid2020 is provided in two formats; ASCII text file (.txt) and NTv2 binary grid (.gsb). The NTv2 (.gsb) file is available at https://www.ga.gov.au/scientific-topics/positioning-navigation/australian-geospatial-reference-system/agrstoolsandmodels.

Important Note

The change in the reference frame used for the development of GDA2020 (i.e. ITRF2014 compared to ITRF92 used for GDA94) means the ellipsoidal height of a point in GDA94 is approximately 9 cm higher than GDA2020. As a result, **AUSGeoid2020 is incompatible with GDA94.**

Only GDA2020 coordinates can be used with AUSGeoid2020.

Continue to 29.3 Coordinate Systems for the Earth or return to 29.1 Shape Of The Earth or 29 Geodetics Summary.

29.3 Coordinate Systems for the Earth

The Earth can be modelled as an ellipsoid with a given semi-major and semi-minor axis but for a given point **p**, a coordinate system is required so that the point can be uniquely defined by giving its coordinates.

Coordinate systems can be defined in an infinitely number of ways but the ones commonly used for modelling the Earth will now be discussed.

See

29.3.1 Geodetic Coordinates
29.3.3 Global XYZ Coordinates
29.3.4 Map (Cartographic) Projections and Map Coordinates
29.3.5 Map Coordinates are Independent of Ellipsoid Height

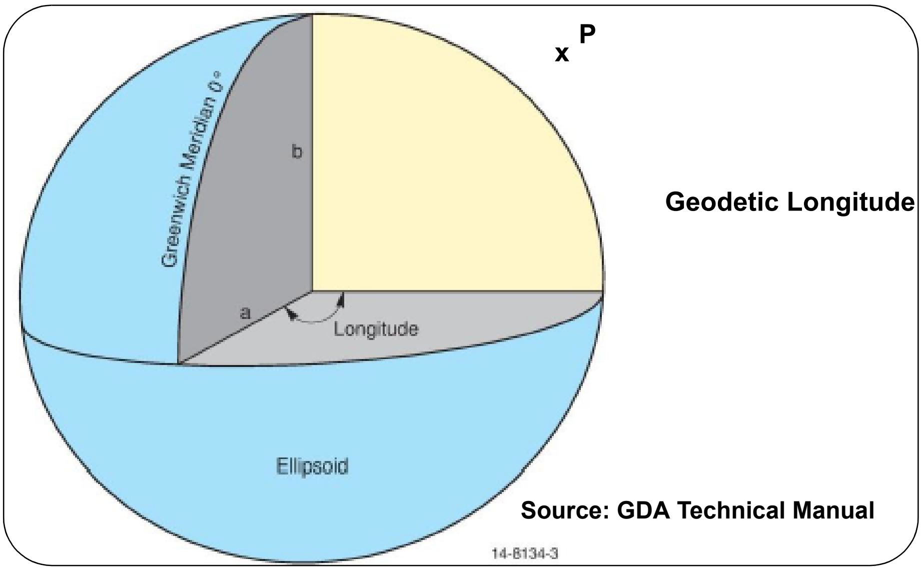
Continue to 29.3.1 Geodetic Coordinates or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.1 Geodetic Coordinates

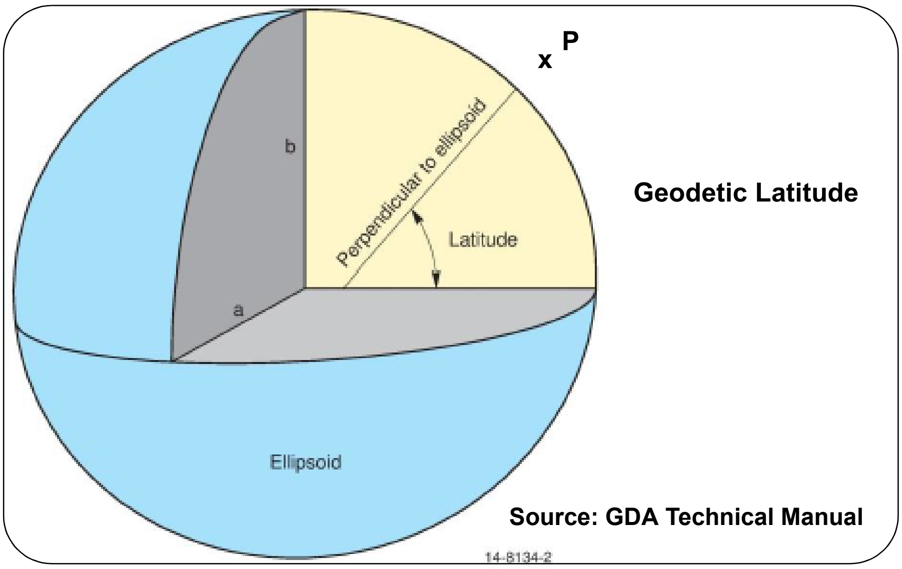
Once an ellipsoid is defined, a position **P** on the earths surface can be described in terms of **Longitude**, **Geodetic Latitude** and **Ellipsoid height**. These are called **Geodetic Coordinates** of the point P.

To define the longitude and latitude of P, a plane is taken through the polar axis and containing P.

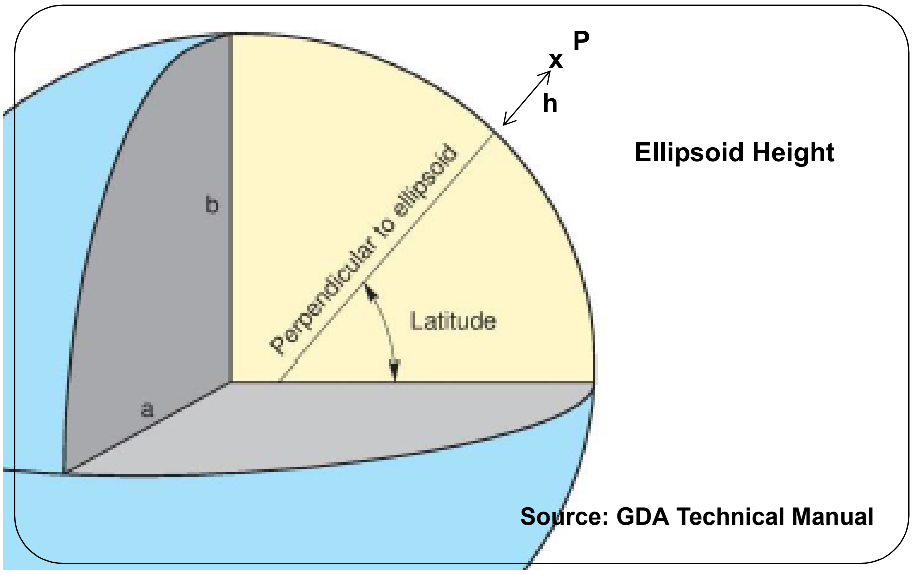
Longitude is a angular quantity measured **from the Greenwich meridian** to this plane. It is most commonly described in terms of degrees, minutes and seconds East or West of the Greenwich meridian.



Geodetic latitude is an angular quantity measured from the equatorial plane, to the plane defined by the position of the point P, and the perpendicular through P to the ellipsoid surface. It is most commonly described in terms of degrees, minutes, seconds South or North of the Equator.



The ***ellipsoid height***, **h**, is the distance along the perpendicular to the ellipsoid from where the perpendicular cuts the ellipsoid to P.



So for any point **P**, it can be uniquely defined by its **Geodetic** (Geographic) **coordinates** of **latitude** (**phi**), **longitude** (**lambda**) and **ellipsoid height** (**h**).

And today with GNSS, these values can be easily obtained to a fairly high degree of accuracy.

Special Notes

1. The perpendicular to the ellipsoid does NOT go through the centre of the ellipsoid.
2. **All** the points along the perpendicular that goes through P have the **same latitude and longitude**.

Continue to 29.3.2 Deflection of the Vertical - Three Latitudes or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.2 Deflection of the Vertical - Three Latitudes

What has been defined as geodetic latitude, is usually what is meant by latitude but there are actually three distinct latitudes used in surveying.

1. Geodetic Latitude

   When **defining latitude on an ellipsoid**, the **geodetic** angle of **latitude** at a point is calculated by projecting **perpendicularly to the ellipsoid** at that point and intersecting with the equatorial plane. **Geodetic latitude** is the latitude that a GNSS unit returns and it is the main latitude used for points today.

2. Astronomic Latitude

   It is difficult to measure the geodetic latitude with traditional instruments as there is no easy way of measuring perpendicular to the ellipsoid. Instead instruments are traditionally set up using **gravity** to measure "**down**" (**plumb line**) and so are being set up **perpendicular to the geoid**.

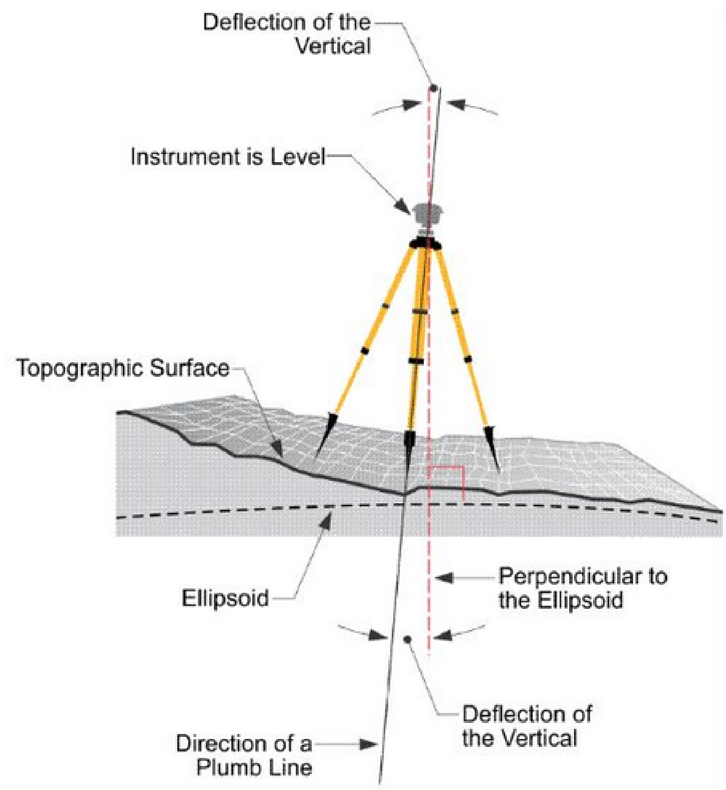
   When astronomic observations are used to calculate the longitude and latitude of a point, "down" is perpendicular to the geoid and NOT perpendicular the ellipsoid and so the value obtained for latitude by astronomic observations is not the same as the geodetic latitude. The latitude derived from astronomic observations is called the **astronomic latitude**.

The **difference** between the **astronomic latitude** and the **geodetic latitude** at a point is called the **deflection of the vertical** (**eta**).

That is:

Deflection of the vertical = geodetic latitude - astronomical latitude

Eta = geodetic latitude - astronomical latitude



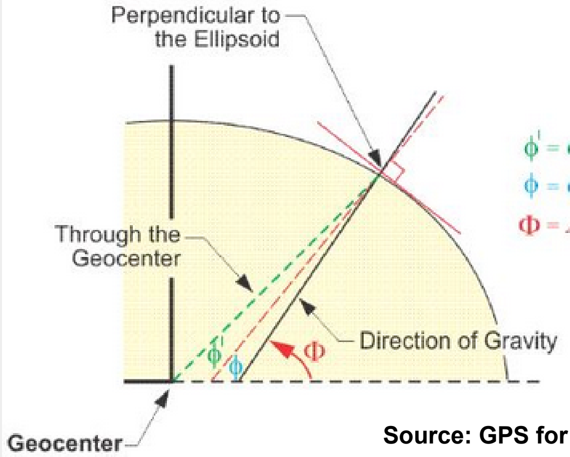
Source: GPS for Land Surveyors

Because they are related to a particular ellipsoid, deflection of the vertical, like geoid-ellipsoid separation, will be different for different datums.

Deflection of the vertical is the reason why the current prime meridian passes more than 100m to the east of the historical astronomical prime meridian in Greenwich.

3. Geocentric Latitude

   For completeness. there is another latitude called **geocentric latitude**, and it is defined as the latitude when the point is joined to the **centre** of the **ellipse**.



Source: GPS for Land Surveyors

However, although there are three latitudes, the **geodetic latitude** is the one that is mainly used today when the word **latitude is used**.

Continue to 29.3.3 Global XYZ Coordinates or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.3 Global XYZ Coordinates

For an ellipsoid, the **Global XYZ** coordinate system is a cartesian coordinate system defined by:

(a) the origin is at the centre of the ellipsoid

(b) the Z-axis is the direction of the rotational axis of the ellipsoid of revolution.

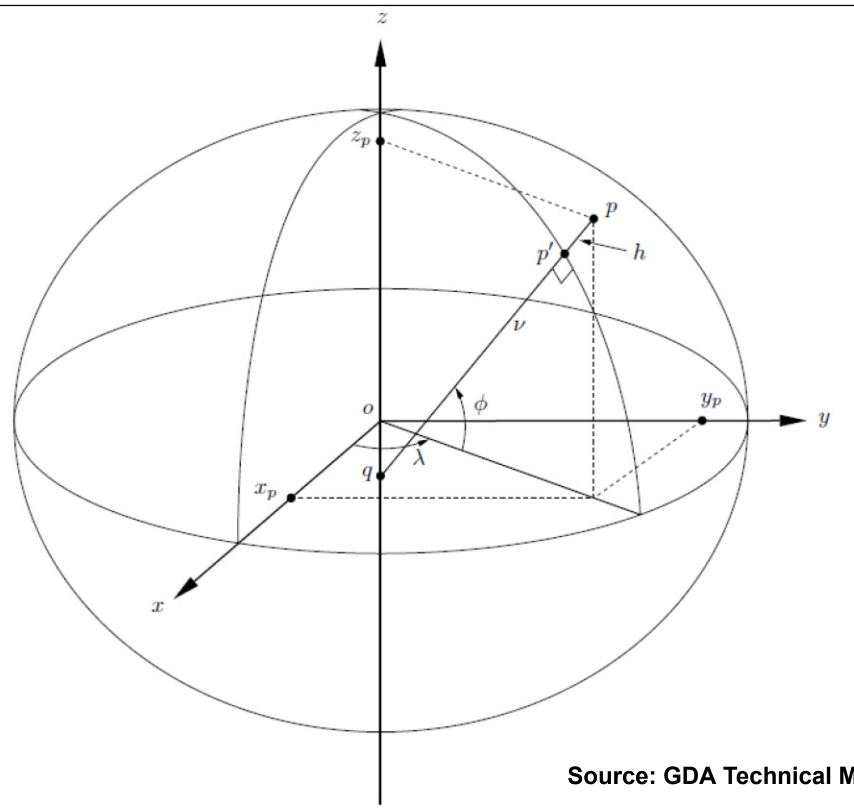
(c) the X-Y plane is the equatorial plane of the ellipsoid and the origin of latitude

(d) the X-Z plane the prime meridian plane. That is, the origin of longitudes.

So for any point P, it can be uniquely defined by its Global XYZ coordinates (xp,yp,zp).

The point P has **Global XYZ coordinates (xp,yp,zp)** and **Geodetic coordinates** of **latitude phi**, **longitude lambda** and **ellipsoid height h** for a given ellipse.

For a given ellipse, there is actually a **one-to-one mapping** between the **Geodetic coordinate system** and the **Global XYZ coordinate system**. That means if the coordinates are known in one system, then the coordinates in the other system can be calculated from the known system (if you know the parameters of the ellipse).



Source: GDA Technical Manual

Figure 2.1: Relationship between Cartesian and geographic coordinate systems.

Global XYZ coordinates are also **often called** Cartesian coordinates or **Global Cartesian coordinates.**

Important Note

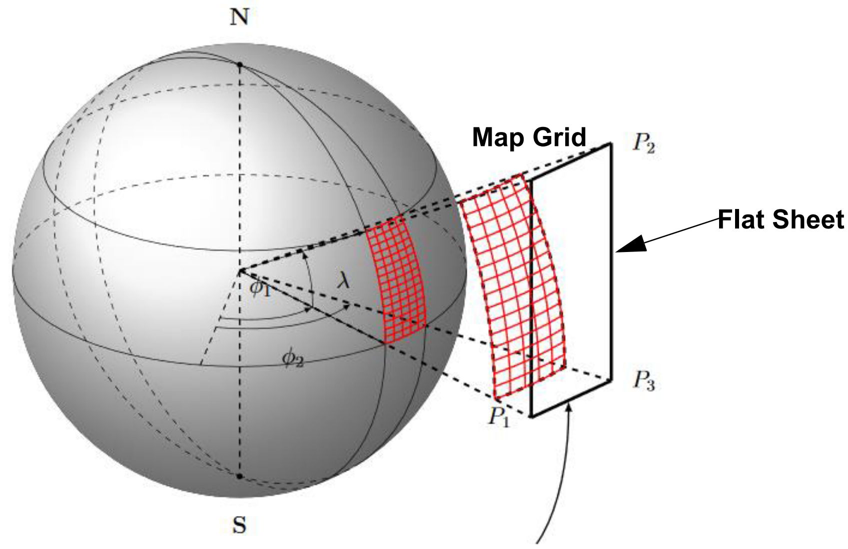
The calculations are more difficult than for the spheroid case because unlike the spheroid case, the tangent to a point on the ellipsoid does NOT go through the centre of the ellipse.

Continue to 29.3.4 Map (Cartographic) Projections and Map Coordinates or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.4 Map (Cartographic) Projections and Map Coordinates

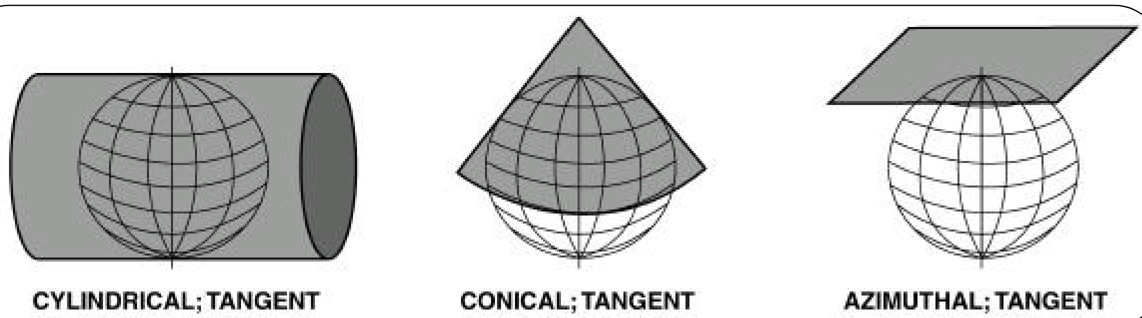
In order to represent ellipsoid data on a flat surface for mapping, it is necessary to use a map projection. A **map projection** enables points on the earths surface to be mathematically projected onto an imaginary developable **surface**.

This surface can then be developed or “rolled flat” to draw the images on a flat sheet.

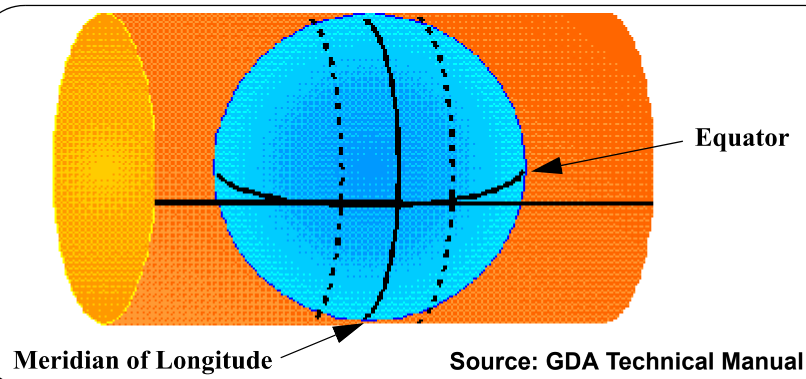


Source: GPS for Land Surveyors

The the surface that the ellipsoid is projected onto is often a cylinder, a cone or a flat plane.

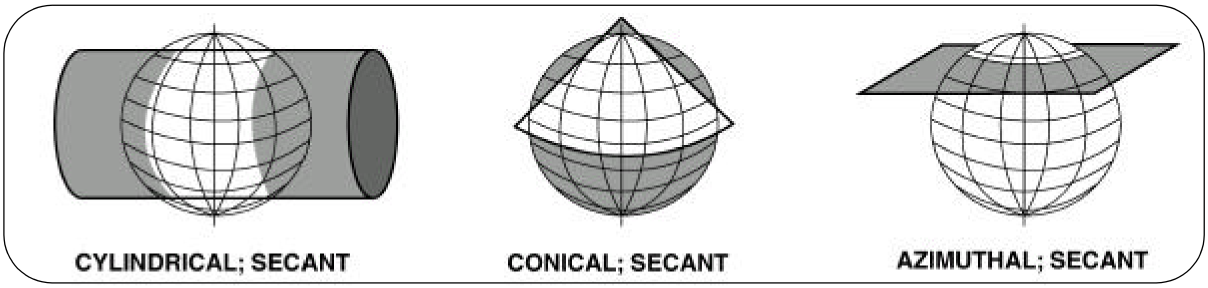


The **Transverse Mercator** system (TM) projects coordinates onto a cylinder that is tangent to the equator and the entire length of a meridian of Longitude.

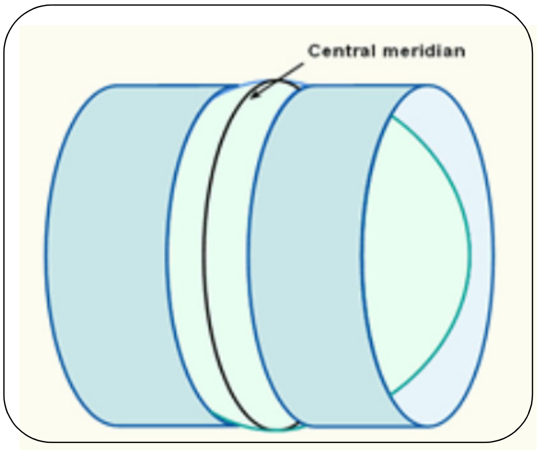


Source: GDA Technical Manual

In practice, the more used versions are the secant versions. That is, the cylinder, cone etc is slightly inside the ellipsoid:

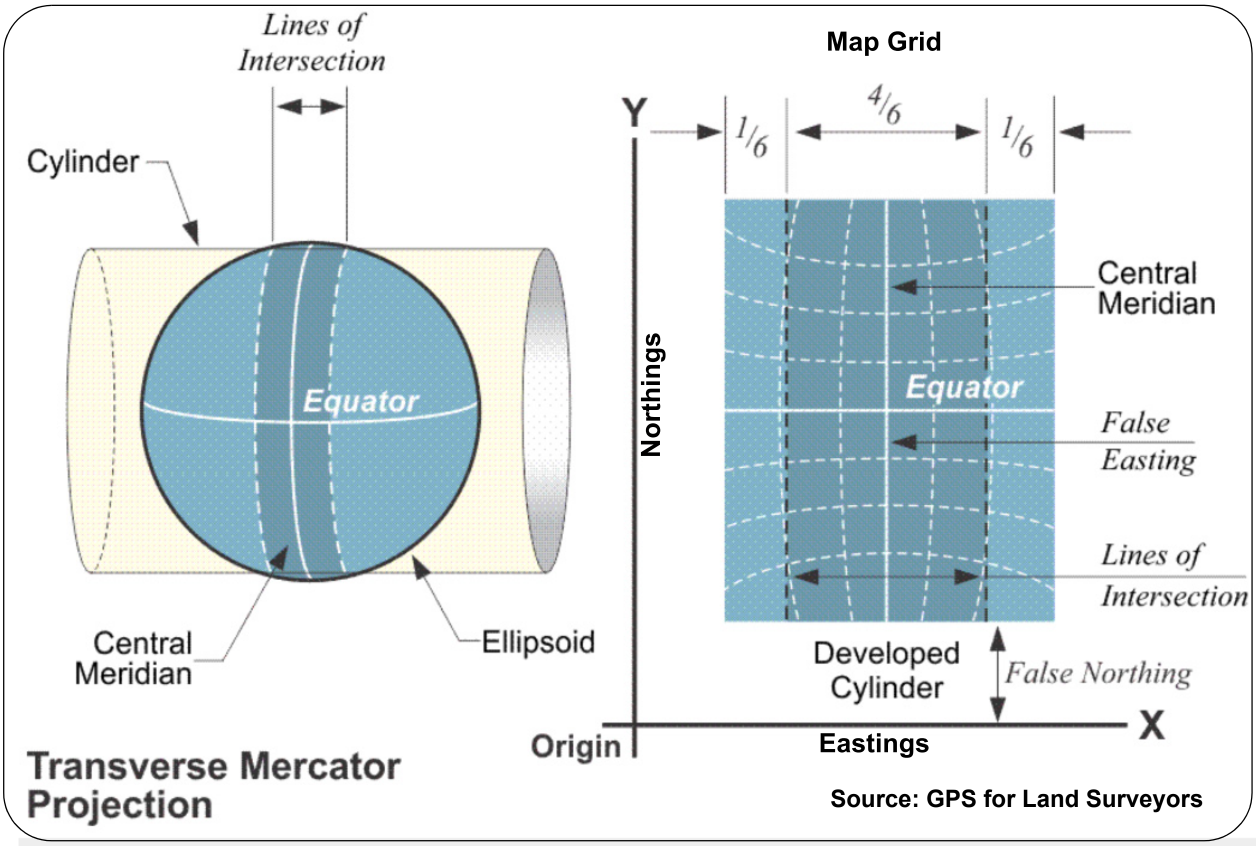


The Transverse Mercator projection used in **Universal Transverse Mercator** (**UTM**) is a **Secant Transverse Mercator.**



So the cylinder no longer touches the sphere on the central meridian but instead on two lines on either side of the central meridian.

When a map projection is used, the coordinates on the flat sheet are called **Eastings** and **Northings**. This is the map grid and the coordinates are called **grid coordinates** or **map coordinates**.



Important Note

The points can not be projected from the ellipsoid onto the developable surfaces (flat sheets) without introducing **distortions** in the lengths of lines or the shapes of areas.

These distortions can be minimised in an area by the selected placement of the cylinder or cone, to the ellipsoid, or by limiting the extent of coverage of the earth's surface for a particular projection. See 29.3.4.1 Map Zones.

Another Important Note

Because the map coordinates are finally projected onto a flat sheet, they are sometimes referred to as plane coordinates, especially in the USA where the projections used for the various States are called State Plane Coordinates.

In particular, these should not be confused with what is often referred to as "local engineering coordinates", where the earth is considered to be a flat plane at a particular local point and the coordinates and distances are in ground metres and not map metres.

Continue to 29.3.4.1 Map Zones or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.4.1 Map Zones

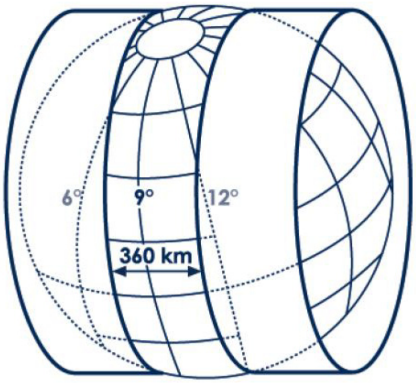
Points can not be projected from the ellipsoid onto a developable surface (flat sheet) without introducing **distortions** in the lengths of lines or the shapes of areas.

This means that distances between points on a map (**map metres**) are NOT the same as the standard metres used for measuring on the ground (**ground metres)**. See 29.6.4 Combined Scale Factor

These distortions can be minimised in an area by the selected placement of the cylinder or cone, to the ellipsoid, and by limiting the extent of coverage of the earth's surface for a particular projection.

For a projection, the limiting of the of the extent of coverage of the earths surface, and having the placement of the cylinder or cone specially for that coverage, is called breaking the projection into **zones**. Each **zone** will have the cylinder or cone positioned so that the distortions are minimised in the area covered by the zone.

For example, the Universal Transverse projection (UTM) splits the world into **sixty** zones of **six degree** with the **central meridian** of the projection in the **middle of the zone**.

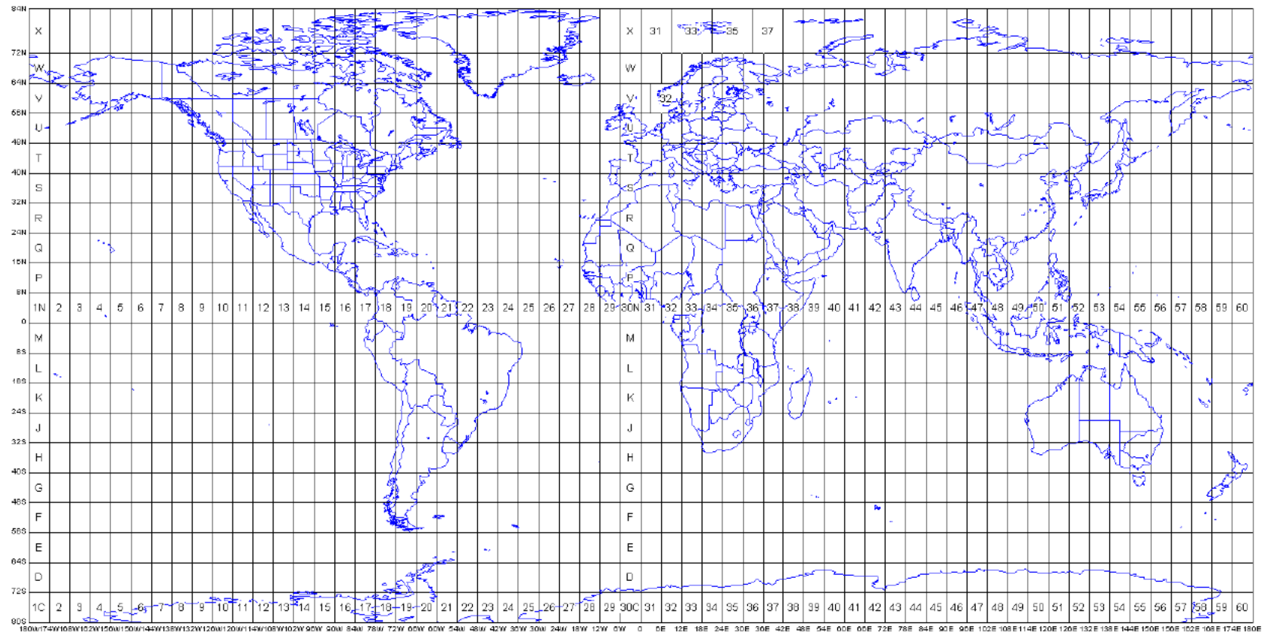


UTM which has 6 degree zones

The UTM zones are numbered from 1 to 60, the first zone being 180 degrees West, longitude. So UTM Zone 1 goes from 180 degrees to 186 degrees and the central meridian is along 183 degrees.

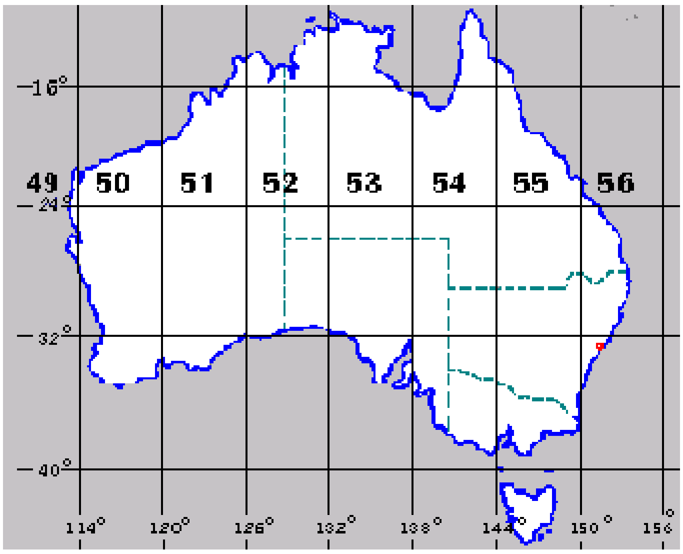
So each UTM zone has a specific central meridian and range of longitude that defines it. As such, by supplying a zone number, a number of parameters about a projection can be deduced.

UTM Grid Zones of the World compiled by Alan Morton (www.dmap.co.uk)



This meaning of ***zone*** is specific to the UTM projection type which is commonly used around the world as a mapping projection. This includes AMG and MGA in Australia.

For example, Australia is covered by the UTM zones 49 to 56.



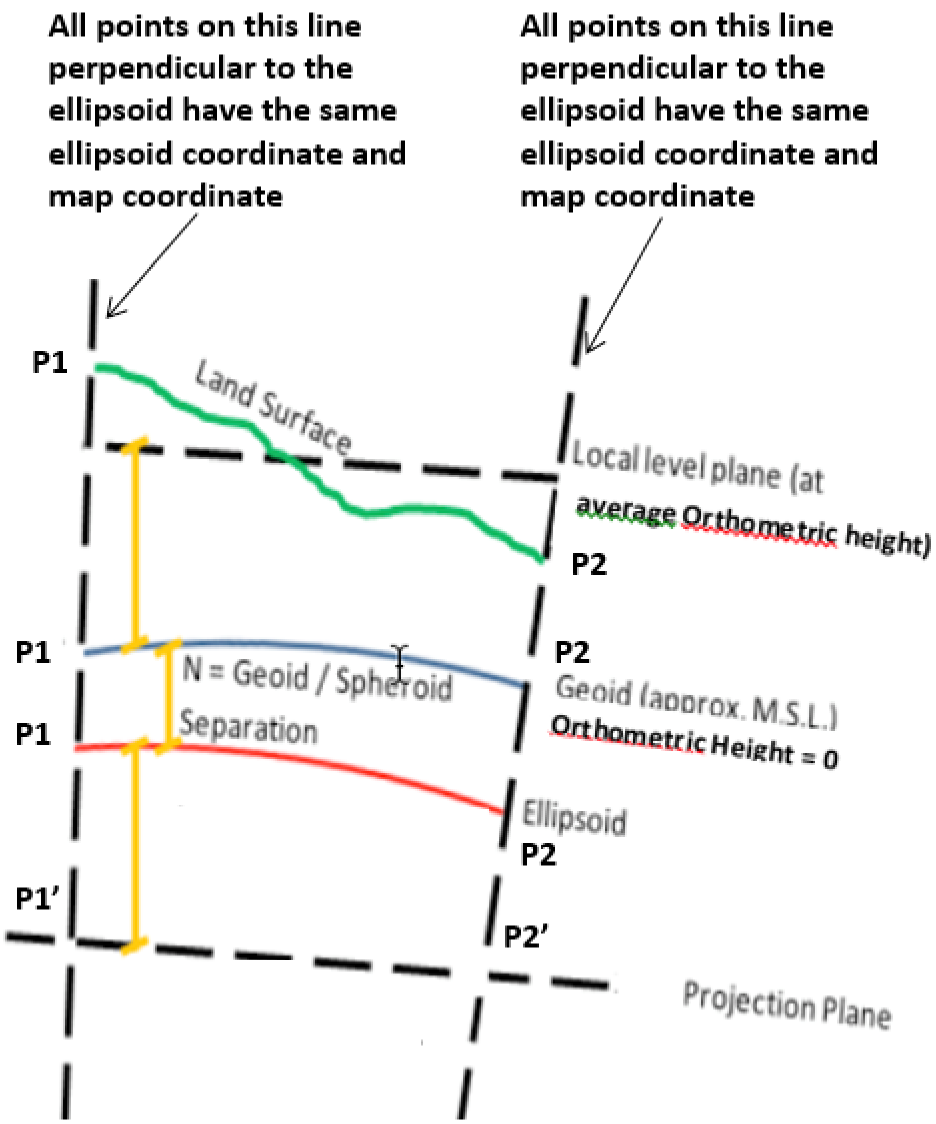
Important Note:

MGA94 and MGA2020 use the same map projection **BUT** MGA94 refers to the map coordinates using GDA94 which is where all the points in the world are at 1 January 1994, and MGA2020 are the map coordinates when using GDA2020 which is where the points are at 1 January 2020. See 29.8.2.3.2 Transforming Between MGA94 and MGA2020.

Continue to 29.3.5 Map Coordinates are Independent of Ellipsoid Height or return to 29.3 Coordinate Systems for the Earth or 29 Geodetics Summary.

29.3.5 Map Coordinates are Independent of Ellipsoid Height

The definition of ellipsoid coordinates and map (projection or plane) coordinates are independent of the ellipsoid height so all the points on a perpendicular to the ellipsoid will have the same ellipsoid coordinate and the same map coordinate.



Continue to 29.4 Norths, Azimuths and Bearings or return to 29 Geodetics Summary.

29.4 Norths, Azimuths and Bearings

See

29.4.1 Azimuth

The **azimuth of a line** is its direction as given by the horizontal angle between the meridian and the line measured in a clockwise direction usually from the north branch of the meridian.

Depending on the reference meridian, azimuths maybe geodetic, astronomical, magnetic, plane, or assumed.

The geodetic meridian is the north-south reference line that passes through the ellipsoid's north and south poles.

The plane meridian for a map projection is the direction of the geodesic north for the central meridian of the projection and is held parallel to it over the entire area covered by the plane (grid or map) coordinate system.

The magnetic meridian is defined by a freely suspended magnetic needle that is only influenced by the earths magnetic field.

An assumed meridian can be established by merely assigning any arbitrary direction. The directions of all other lines are then found in relation to it.

29.4.2 Bearing

The ***12d Model*** *d*efinition of the ***bearing of a line*** is the same as the azimuth of a line.

That is, the **bearing of a line** is its direction as given by the horizontal angle between the meridian and the line measured in a clockwise direction usually from the north branch of the meridian.

The **USA bearing of a line** is the acute horizontal angle between a reference meridian and the line. the angle is measured from either the north or south towards either the east of west, to give a reading smaller than 09 degrees. For example, N 70 deg W.

The ***12d Model*** does **NOT** use the **USA bearing of a line**.

WARNING

The term grid bearing is avoided in this manual because it has a different meaning in different parts of the world - see 29.4.5 Grid Azimuth, Australian Grid Bearing.

The term **plane bearing** is used for the angle between two points on a map grid - see 29.4.4 Plane Bearing, Projection Bearing.

29.4.3 True North, Grid North and Magnetic North

Any use of the word North has to be very specific as there are three different Norths used in mapping surveying, and a couple of other arbitrary "Norths".

(a) True North

The **True North Pole** is the axis of the rotation of the ellipsoid.

Meridians of longitude converge at the True North and South Pole so the lines or meridians of longitude can also be used as True North reference lines. Where True North is depends on the definition of the definition of the Ellipsoid.

(b) Grid North

Grid north is the direction of the constant Easting lines on the Map Grid.

It is the direction of the geodesic north for the central meridian of the projection and is held parallel to it over the entire area covered by the plane (grid or map) coordinate system.

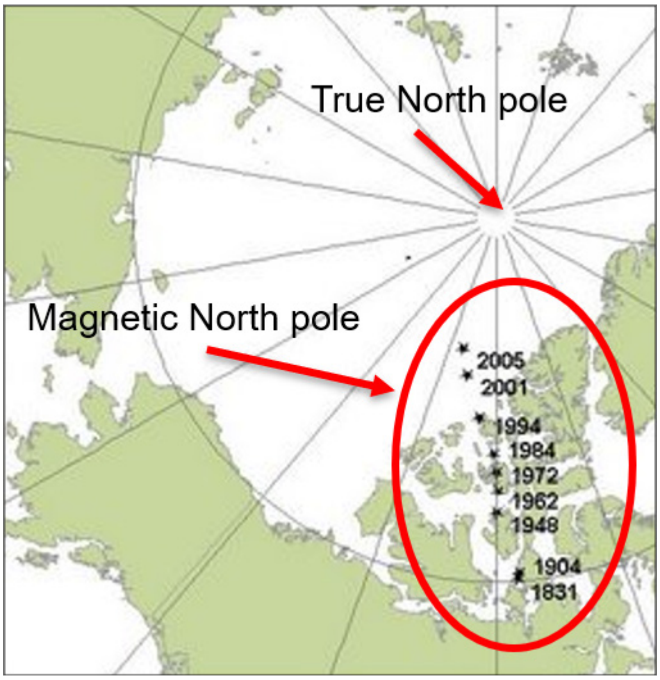
Grid north is useful because it allows the Easting grid lines on the map to be the North reference. Grid North depends on the Ellipsoid, the Map Projection and the Epoch.

(c) Magnetic North

The magnetic poles are aligned with the Earth’s magnetic field.

A free floating magnetic needle in a compass will align itself with the magnetic field and thus points to the magnetic poles.

Unfortunately the magnetic pole moves over time. Consequently the magnetic pole is not very useful for recording directions.



The Magnetic Pole may appear to be either east or west of the True North Pole.

(d) North Arrow on a Plan

Many drawings have a North Arrow on them but without extra information, it has no relationship to the other three Norths.

(e) Y-Axis

If it just an arbitrary (X,Y) coordinate system then the Y-axis is sometime referred to a North. But without extra information, it has no relationship to the other three Norths.

29.4.3.1 Declination Diagram

Declination is the angular difference between **true north** and **magnetic north** for a given location.

Declination changes depending on your position relative to the two poles. Declination also changes over time because the location of the magnetic poles changes with time.

Grid Convergence is the angular difference between the **grid north** and **true north** for a given location (see 29.4.7 True Azimuth and Grid Convergence).

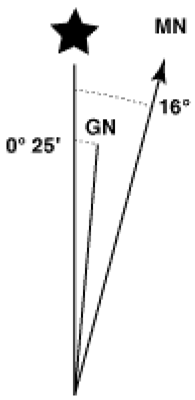
Although the value of the declination and gird convergence varies from location to location, over a small distance, the values can be considered to be constant.

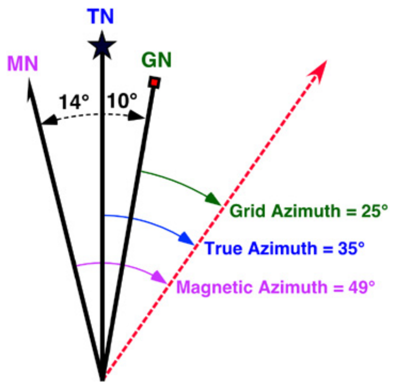
Most paper maps have a printed **declination diagram** to show the **relative direction of the three north references** and it assumed that the values will be the same for any location on the map.

Typically there will be an arrow that points to the top of the map and is parallel to the edges of the map. This is the "top of the map" north reference that was used when the map was printed.

It is usually either Grid North (often designated with the letters GN) or True North (sometimes designated with a star, or the letters TN). The angles between the three north references will be printed on the diagram.

The diagram should also have a date that the angle between True North and Magnetic North was determined. This declination angle changes over time so a current value should be used and not a value from years ago that is printed on an old map.





29.4.4 Plane Bearing, Projection Bearing

If a straight line is drawn in the plane between two points on a map grid, the ***plane bearing*** and ***projection bearing***, is the **angle between grid north and the straight line** between the two points.

In other words, if the two point's coordinates are known, standard plane trigonometry can be used to calculate the plane bearing of the line.

tan (plane bearing) = (N2 - N1) / (E2 - E1)

Projection bearing and *plane* bearing is used interchangeably in ***12d Model***.

Warning:
Some countries, including New Zealand and the USA, use the term "**grid bearing"** for what is defined here as **Plane bearing**.

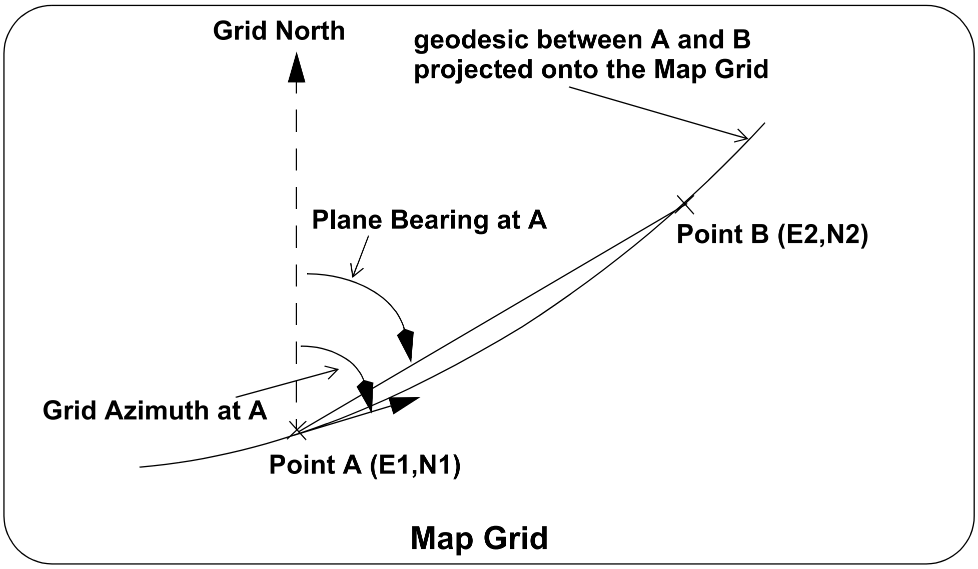
However the **Australian GDA Technical Manual** has a different definition of "***grid bearing***". So to avoid confusion, the term "grid bearing" will be avoided in this manual unless it is referred to as the ***Australian grid bearing.***

Continue to 29.4.5 Grid Azimuth, Australian Grid Bearing or return 29 Geodetics Summary.

29.4.5 Grid Azimuth, Australian Grid Bearing

The ***grid azimuth*** at the point A for the measure from point A to the point B, is the *clockwise angle* between Grid North and the ***tangent* at A to the curve going from A to B**.

The grid azimuth of A to B, at A, is **not** equal to the reverse grid azimuth B to A, at B.



Warning:
In Australia, the **grid bearing** as defined in the **Australian GDA Technical Manual** is that same as the above definition of grid azimuth. However in some countries, including New Zealand and the USA, the term **grid bearing** is used for the previously defined term **plane bearing**. To avoid confusion, the term grid bearing will be avoided in this manual.

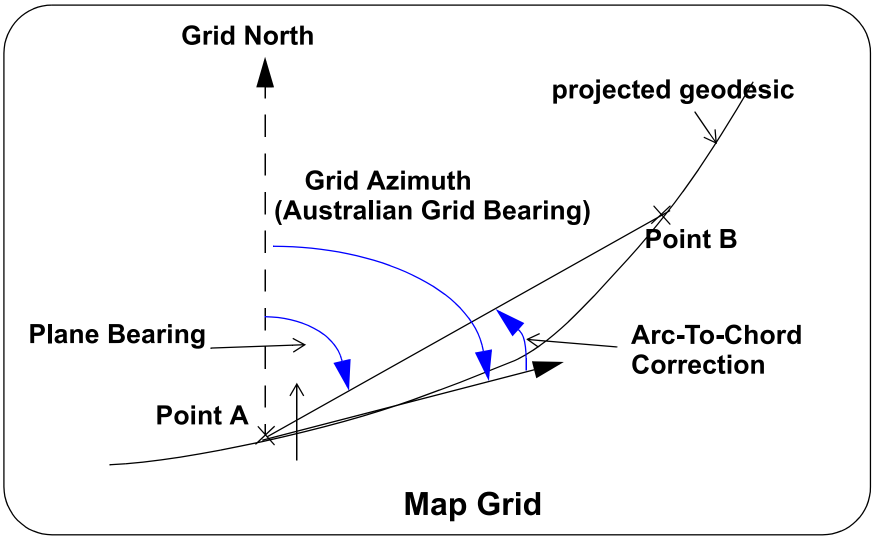
Continue to 29.4.6 Arc to Chord Correction (t-T correction) or return to 29 Geodetics Summary.

29.4.6 Arc to Chord Correction (t-T correction)

The ***arc-to-chord*** correction is the quantity to be added algebraically to a Grid Azimuth (Australian grid bearing) to obtain a Plane bearing.

Plane Bearing = Grid Azimuth + Arc_To_Chord_Correction

This correction is only really applicable for lines over 10 km but it is included in calculations for completeness. The correction shown in the example below is negative in sign but it can also be positive.



Continue to 29.4.7 True Azimuth and Grid Convergence or return to 29 Geodetics Summary.

29.4.7 True Azimuth and Grid Convergence

The ***True Azimuth*** between the two points A and B is the horizontal angle measured clockwise from the ***tangent at A of the ellipsoidal meridian that goes through A*** and the ***tangent at A of the great circle*** between the two points A and B.

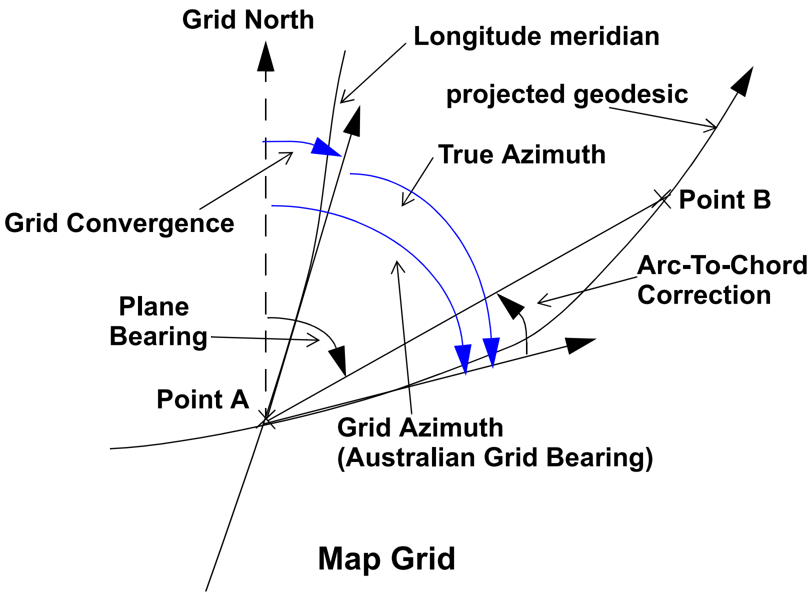
In the **Australian GDA Technical Manual** this is just called the ***Azimuth***. But in this manual the term Grid Azimuth is used so True Azimuth is preferred to avoid confusion.

In general, this value will be calculated internally in ***12d Model***.

Grid Convergence or ***Convergence*** is the angular quantity to be added algebraically to the ***True Azimuth*** to obtain the ***Grid Azimuth*** (Australian grid bearing). *i.e.*

Grid Azimuth = True Azimuth + Grid Convergence

Warning: In some countries, the *Grid Convergence* has the opposite sign.



Combining

Grid Azimuth = True Azimuth + Grid Convergence

and

Plane Bearing = Grid Azimuth + Arc_To_Chord_Correction

produces the equation

Plane Bearing = True Azimuth + Grid Convergence + Arc_To_Chord_Correction

or

True Azimuth = Plane Bearing - Grid Convergence - Arc_To_Chord_Correction

Continue to 29.5 Distances or return to 29 Geodetics Summary.

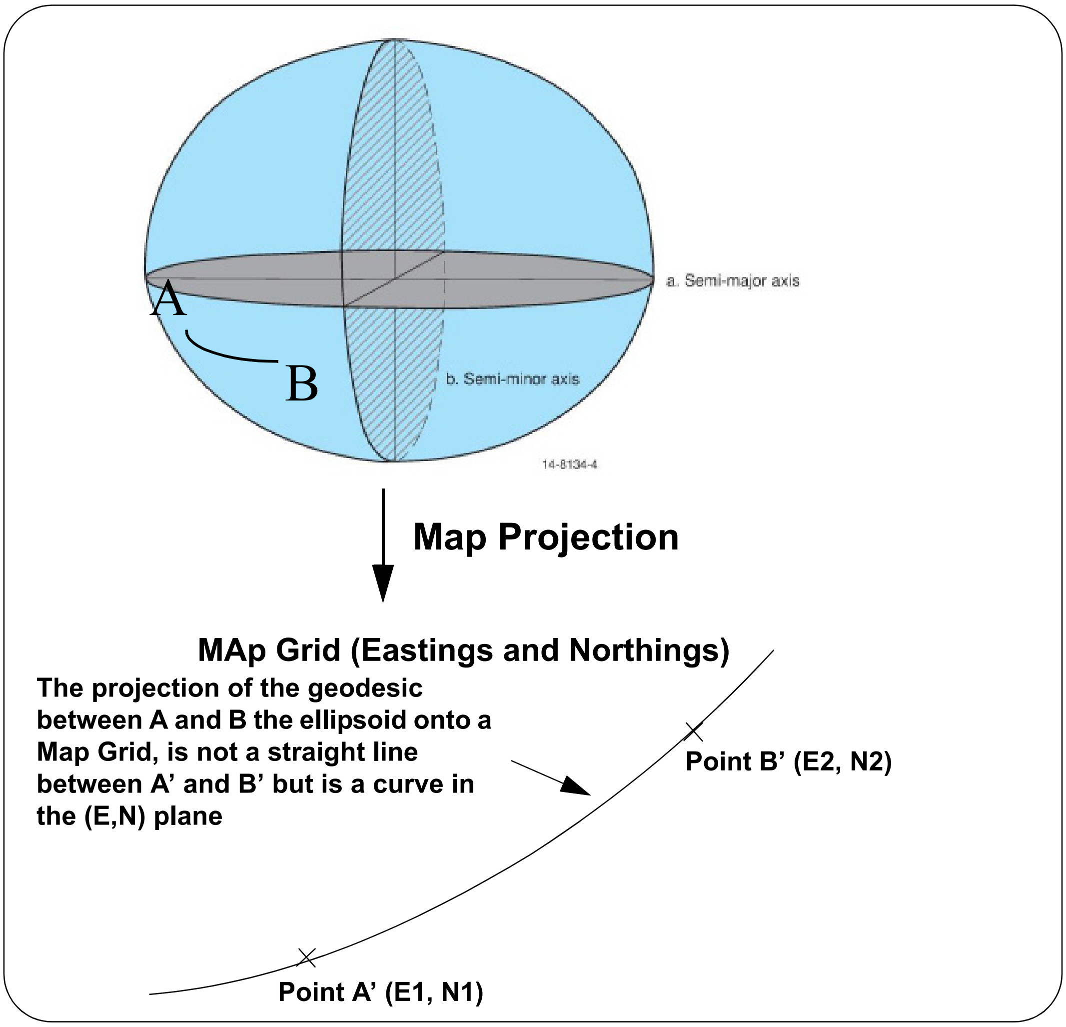
29.5 Distances

If you have a point on an ellipsoid and a Map Projection (such as UTM), the coordinates of the projected point (projection or map coordinates) are called the grid coordinates of the point and are named Easting and Northings (Easting, Northing).

The shortest distance (***"straight line")*** between two points on an ellipsoid is the **geodetic line**, or **geodesic**. The geodetic line on an ellipsoid is analogous to the ***great circle*** on a sphere.

If each point along the geodesic between two points A and B on the ellipsoid, is projected onto a map grid, the path traced out in the map grid is a ***curve*** between the points.

That is, a *"straight line"* on an ellipsoid does not project onto the (Easting, Northing) grid as a straight line but as a curve.



So the ***straight line*** joining the two points A' and B' in the **(Easting, Northing) plane** *is* ***different*** from the projection of the **geodesic** ("straight line" on the ellipse) joining the two points A and B on the ellipse, which is different to the geodesic (ellipsoid) distance.

These distances all assume that the points are on the ellipsoid but when the points are on the surface of the Earth which is not on the ellipsoid, different distances are also involved.

The following sections discuss the different distances used in surveying and geodetics.

See

29.5.1 Ellipsoid Distance

The ***ellipsoid distance*** (**s**) between two points **A** and **B** on a ellipsoid is the length of the geodesic between the two points.

Given the latitude and longitude of two points **A** and **B** on the ellipsoid, **Vincenty's inverse formula** can be used to calculate the ellipsoid distance between the two points.

Because GNSS natively produces ellipsoid coordinates, GNSS observations are easily reduced to the ellipsoid.

Continue to 29.5.2 Plane or Projection Distance or return to 29 Geodetics Summary.

29.5.2 Plane or Projection Distance

The two points A and B on the ellipsoid are projected to the points A1 and B1 in map coordinates.

The ***plane distance*** (**projection distance**) between two points A' (E1, N1) and B' (E2, N2) on the map grid, is the standard square-root distance of the straight line joining the points in the plane

plane distance = square root [(E2 - E1)*(E2 - E1) + (N2 - N1)*(N2 - N1)]

Warning: In some countries (e.g. New Zealand), the term *grid distance* is defined to be the **plane distance** (**projection distance**). However, in Australia, grid distance has another definition hence to avoid confusion, the term grid distance will be not be used in ***12d Model***.

Given that the longitude and latitude can be uniquely calculated for the two point A' and B', the ellipsoid distance between the two projected points A' and B' can also be calculated.

Continue to 29.5.3 Australian Grid Distance or return to 29 Geodetics Summary.

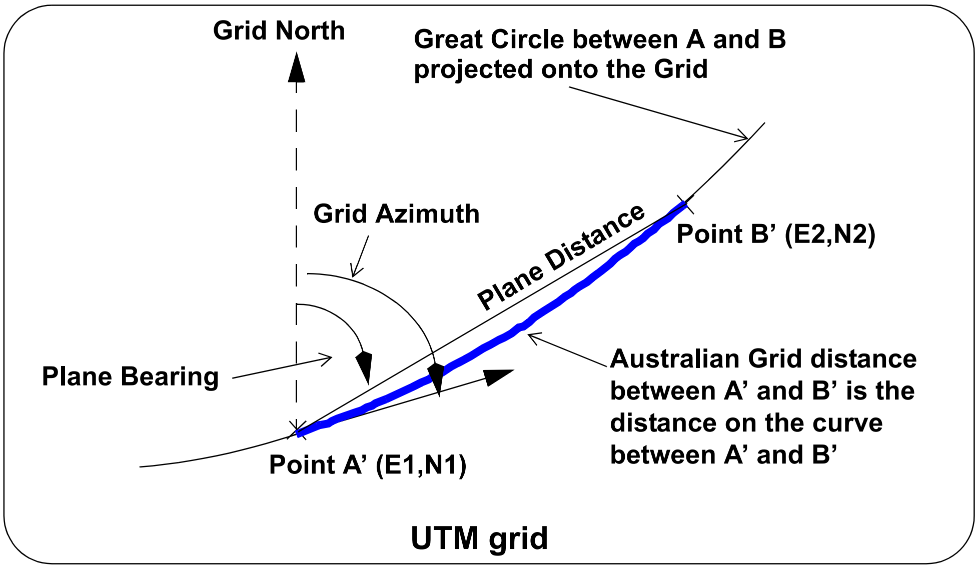
29.5.3 Australian Grid Distance

On an ellipsoid, the *straight line* joining two points on the ellipsoid is the geodesic between the two points.

However a *geodesic* on an ellipsoid projects onto a map grid as a curve and not a straight line.

In the diagram below, the curve shown through points A' and B' is the projection of the geodesic on the ellipse going through points A and B.

In the **Australian GDA Technical Manual**, the ***grid distance*** is the distance **on this *curve*** from point A' to B'.



The difference between the plane distance and the Australian grid distance is usually negligible.

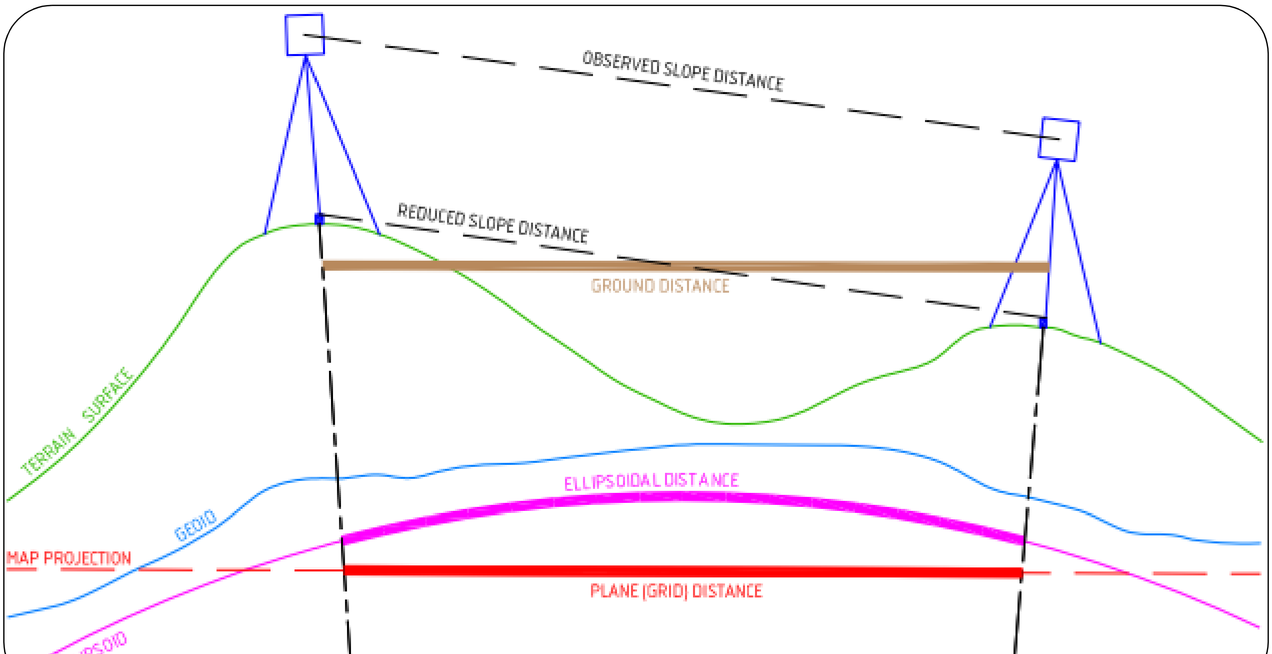
Warning: In some countries (e.g. New Zealand), the term *grid distance* is defined to be the **plane distance** (**projection distance**). Hence to avoid confusion, the term ***grid distance*** will be not be used in ***12d Model.*** If the Australian definition is being used, then it will be written as the ***Australian grid distance***.

Continue to 29.5.4 Ground or Level Terrain Distance or return to 29 Geodetics Summary.

29.5.4 Ground or Level Terrain Distance

Observations using total stations are often reduced to level terrain distances.

For example, in survey plans in NSW, the distance required to be displayed between two points is the "horizontal plane distance at ground level", otherwise known as level terrain distance, or simply, ground distance.



Source: Hine and Gardner APAS 2018

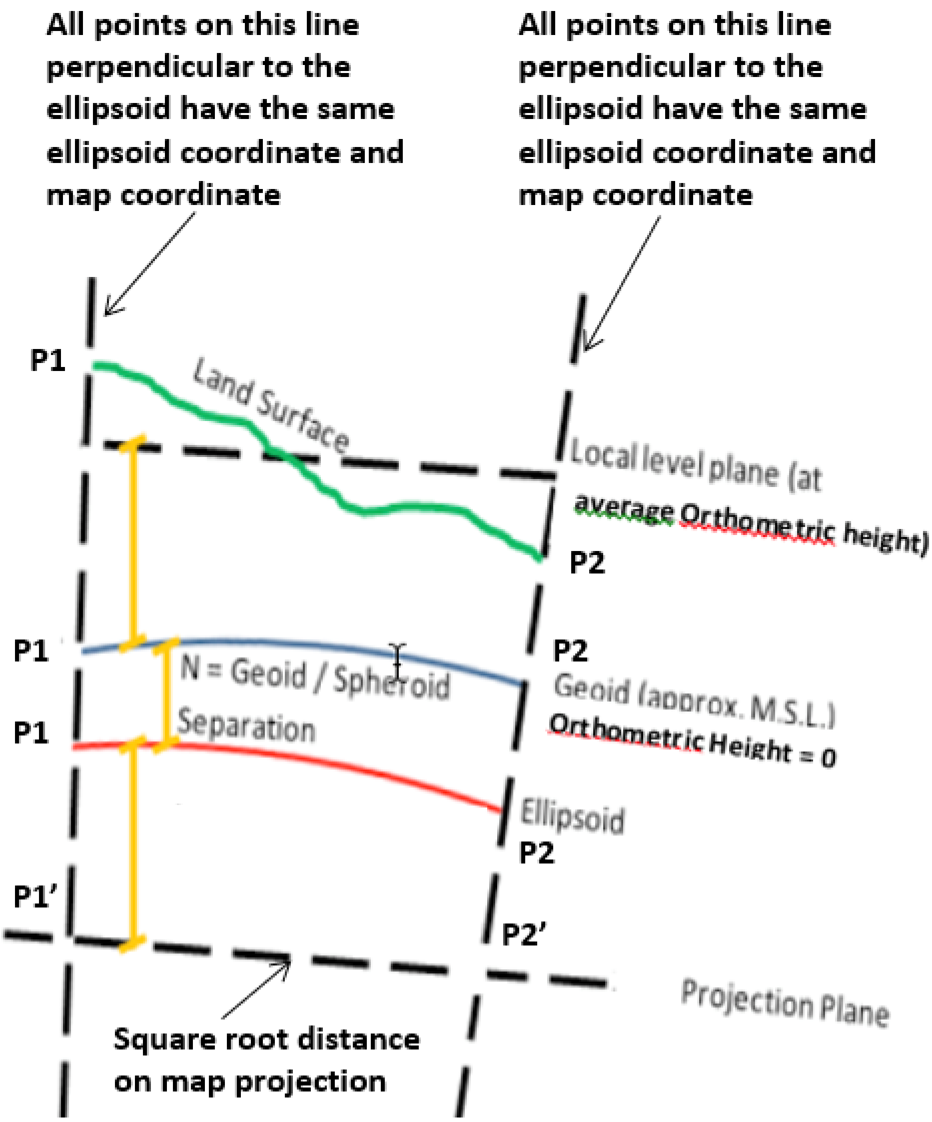
The **ground distance** is a reduced slope distance projected onto a local horizontal plane at mean ground level.

Continue to 29.5.5 Ellipsoid and Plane Distances are Independent of Height or return to 29 Geodetics Summary.

29.5.5 Ellipsoid and Plane Distances are Independent of Height

The definition of ellipsoid coordinates and map (projection or plane) coordinates does not take height into account and all the points on a perpendicular to the ellipsoid will have the same ellipsoid coordinate and the same map coordinate.

Hence the ellipsoid distance between two points will be the same for all the points on the perpendiculars through the points. Similarly for the and map (plane or projection) distance



The following sections will discuss how to calculate ellipsoid and map (pane or projection) distances when the points are not on the ellipsoid.

Continue to 29.6 Calculating Distances and Scale Factors or return to 29 Geodetics Summary.

29.6 Calculating Distances and Scale Factors

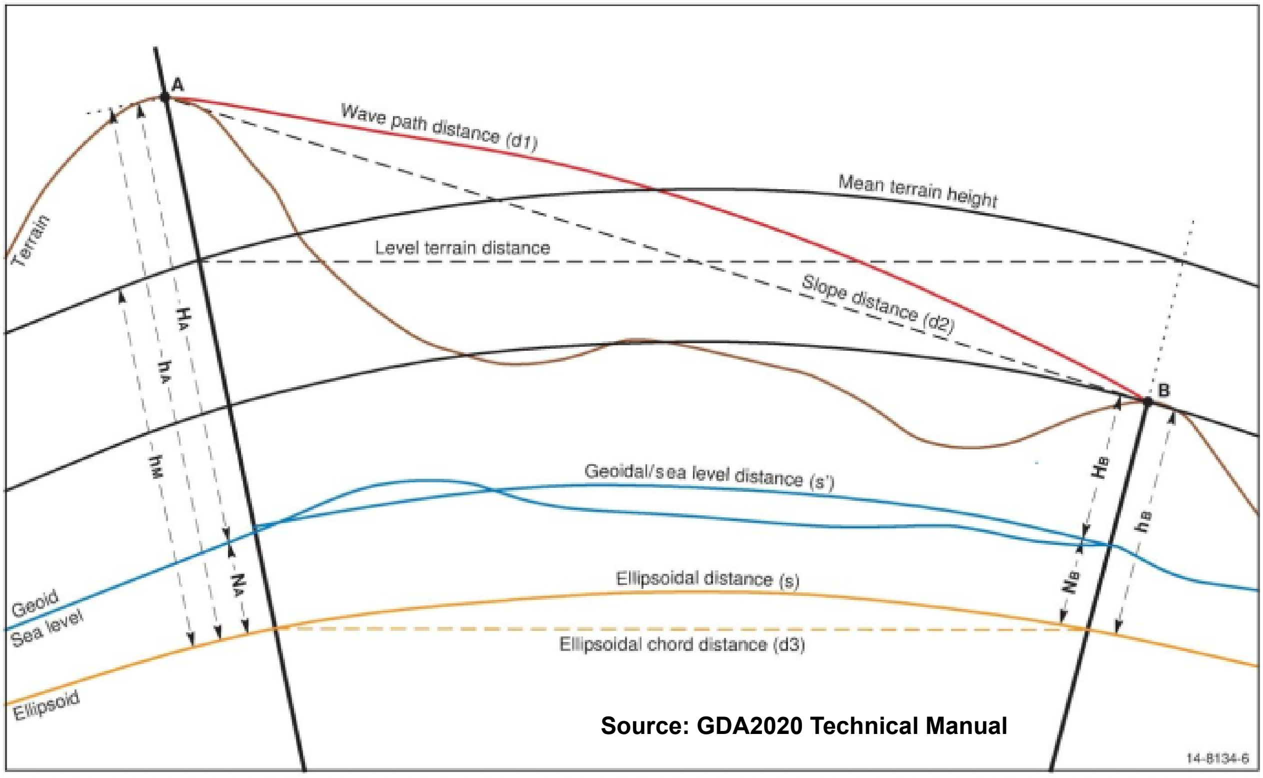
See

Continue to 29.6.1 Reduction of Measured Distances to the Ellipsoid or return to 29 Geodetics Summary.

29.6.1 Reduction of Measured Distances to the Ellipsoid

When GNSS is used, the longitude and latitude of points is readily available and hence the ellipsoid distance can be easily calculated.

However, when total stations with electronic distance measurement (EDM) devices are used, finding the ellipsoid distance is much more complicated.



The difference between the wave path length **d1** and the wave path chord (slope distance) **d2** is a function of the EDM equipment used and also of the meteorological conditions prevailing along the wave path at the time of measurement. The difference can often be ignored for distance measurements of up to 15 kilometres, using either light waves or microwaves.

The reduction of the wave path chord distance **d2** to the ellipsoid chord distance **d3**, can be given by a single rigorous formula (Clark D., 1966, Plane and Geodetic Surveying, London, England, Constable and Company Ltd):

$$d_3 = \sqrt{\left[\left({d_2}^2 - (h_A - h_B)^2\right)/(1 + h_A/R_\alpha)(1 + h_B/R_\alpha)\right]}$$

The ellipsoid chord distance **d3** can then be reduced to the ellipsoid distance **s** by

$$s = d_3\left[1 + \left({d_3}^2/24{R_\alpha}^2 + 3{d_3}^4/640{R_\alpha}^4 + \ldots\right)\right]$$

where R_α is the radius of curvature in the azimuth of the line.

The radius of curvature of the ellipsoid is a function of latitude and for many applications, the geometric mean radius R_m can be used instead of the radius in the azimuth of the line. However, there can be large differences between the tow and for high accuracy applications, the radius of curvature of the azimuth of the line should be used.

The formulae just given use ellipsoid heights h. If the geoid-ellipsoid separation N is ignored and only the height above the geoid H (orthometric height) is used, and error of 1 ppm will be introduced for every 6.5 m of N (plus any error due to change in N value along the line).

In Australia, the geoid-ellipsoid separation N value varies from -35m in southwest Australia, to approximately 70m in northeast Australia so errors of -5 to approximately 11 ppm could be expected.

When a total station is levelled to make an angular observation (direction or azimuth) it is levelled according to the plumb line at that point, i.e. the normal to the geoid. This is generally different from the normal to the ellipsoid (see 29.3.2 Deflection of the Vertical - Three Latitudes) and a correction for this difference should be applied for the highest quality results.

Continue to 29.6.2 Point and Line Scale Factors or return to 29.6 Calculating Distances and Scale Factors or 29 Geodetics Summary.

29.6.2 Point and Line Scale Factors

For a given projection, the **point** and **line scale factor** are ratios of the plane distance to the ellipsoid distance.

That is, the point and line scale factors are used to convert ellipsoid distances to plane distances.

See

29.6.2.1 Point Scale Factor

29.6.2.2 Line Scale Factor

29.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor

29.6.2.1 Point Scale Factor

For a given projection, the ***point scale factor*** is the ratio of an infinitesimal plane distance at a point on the grid to a corresponding ellipsoid distance. That is:

Point Scale factor = Infinitesimal Plane Distance / Infinitesimal Ellipsoid Distance

For a given projection, there are formulae to calculate the point scale factor at each point but in general, the point scale factor will vary for each point.

The ***Point Scale Factor*** can be used as an approximation to convert an ellipsoid distance near a point to a plane distance:

Plane Distance = Ellipsoid Distance x Point Scale Factor*,*

or to convert a plane distance near a point to an ellipsoid distance

Ellipsoid Distance = Plane Distance / Point Scale Factor*.*

However the distances from the point should be fairly short.

Continue to 29.6.2.2 Line Scale Factor or return to 29.6.2 Point and Line Scale Factors or 29 Geodetics Summary.

29.6.2.2 Line Scale Factor

The ***Line Scale Factor*** is the ratio of the plane distance on a grid to a corresponding ellipsoid distance. that is*:*

Line Scale Factor = Plane Distance / Ellipsoid Distance

The ***Line Scale Factor*** can be used to convert an ellipsoid distance to a plane distance:

Plane Distance = Ellipsoid Distance x Line Scale Factor*,*

or to convert a plane distance to an ellipsoid distance

Ellipsoid Distance = Plane Distance / Line Scale Factor*.*

Unlike point scale factors which can be calculated for each point, the line scale factor depends on the route that the line takes.

Continue to 29.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor or return to 29.6.2 Point and Line Scale Factors or 29 Geodetics Summary.

29.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor

For lines measured in surveys, the Point Scale Factor can, depending on the length of the line, be used to calculate the Line Scale Factor.

Some of the methods are:

(a) Mean of the Point Scale factors at each end of a line

Line Scale Factor = (Points Scale factor at A + Point Scale factor at B) / 2

(b) Use of Simpsons Rule

Line Scale Factor = (PSF(A) + 4x PSF(mid-point) + PSF(B)) / 6

where

PSF(A) is the Point Scale Factor at A

PSF(B) is the Point Scale Factor at B

PSF(mid-point) is the Point Scale Factor at the midpoint of A and B

Method (b) is more accurate than method (a).

Continue to 29.6.2.4 Calculating the Line Scale Factor for a UTM or return to 29 Geodetics Summary.

29.6.2.4 Calculating the Line Scale Factor for a UTM

For an UTM and points (E1,N1) and (E2,N2), the **Line Scale Factor** can be calculated by:

Line Scale Factor (1 to 2) = $k_0\left\{1+\left[\frac{\left(E_1'^2+E_1'E_2'+E_2'^2\right)}{6r_m^2}\right]\left[1+\frac{\left(E_1'^2+E_1'E_2'+E_2'^2\right)}{36r_m^2}\right]\right\}$

where

$$r_m^2 = \rho_m \nu_m k_0^2$$

$$\nu_m = \frac{a}{\sqrt{(1-e^2\sin^2\varphi_m)}} \qquad \rho_m = \frac{a(1-e^2)}{(1-e^2\sin^2\varphi_m)^{\frac{3}{2}}}$$

$$e^2 = \frac{(a^2-b^2)}{a^2} \qquad \varphi_m = \frac{\varphi_1+\varphi_2}{2}$$

a = length of the reference ellipsoid semi-major axis
b = length of the reference ellipsoid semi-minor axis

E_1 = false Easting of point 1
E_2 = false Easting of point 2

$$E_1' = E_1 - 500{,}000 \qquad E_2' = E_2 - 500{,}000$$

E_1' = Easting of point 1 measured from a central meridian, positive eastwards
E_2' = Easting of point 2 measured from a central meridian, positive eastwards

k_0 = central scale factor = 0.9996 for **UTM**

φ_1 = latitude of point 1
φ_2 = latitude of point 2
φ_m = mean latitude
ν_m = radius of curvature in the prime vertical at the mean latitude
ρ_m = radius of curvature in the meridian at the mean latitude

Continue to 29.6.3 Point and Line Height Factor or return to 29 Geodetics Summary.

29.6.3 Point and Line Height Factor

The **Height Factor** is the ratios of the ellipsoid distance to the ground distance.

Height Factor = Ellipsoid Distance / Ground Distance

Hence the ***Height Scale Factor*** is used to convert a ground distance to an ellipsoid distance:

Ellipsoid Distance = Ground Distance x Height Factor

or an ellipsoid distance to a ground distance:

Ground Distance = Ellipsoid Distance / Height Factor

Note:

In the USA, the **Height Factor** is also called the **Elevation Factor.**

See

29.6.3.1 Height Factor for a Point

29.6.3.2 Height Factor for a Line

29.6.3.3 Calculating Line Height Factor (Height Scale Factor)

29.6.3.1 Height Factor for a Point

The **Height Factor (Point)** is the ratio of the infinitesimal ellipsoid distance to the infinitesimal ground distance at the point. By multiplication it is used to convert the infinitesimal ground distance at a point to the infinitesimal ellipsoid distance

Height Factor (Point) = Infinitesimal Ellipsoid Distance / Infinitesimal Ground Distance

Strictly speaking, the Height Factor (Point) describes the reduction to the ellipsoid chord distance. However, for a point, as the infinitesimal ellipsoidal chord distance approaches a length of zero, it will be the same as the infinitesimal ellipsoid distance.

The Height Factor (point) can be used as an approximation to multiply measured plane distances from the point, to ellipsoid distances. By dividing, it converts ellipsoid distances at the point to plane distances. However the distances from the point should be fairly short.

Continue to 29.6.3.2 Height Factor for a Line or return to 29.6.3 Point and Line Height Factor or 29 Geodetics Summary.

29.6.3.2 Height Factor for a Line

the **Height Factor (Line)** is the ratio of the ellipsoid distance to the ground distance. By multiplication it is used to convert the ground distance to the ellipsoid distance

Height Factor (Line) = Ellipsoid Distance / Ground Distance

Strictly speaking, the Height Factor (Line) describes the reduction to the ellipsoid chord distance but for surveys of limited extent, the difference between the ellipsoid distance and the ellipsoid chord distance is negligible.

The Height Factor (Line) can be used as an approximation to multiply measured plane distances to give ellipsoid distances. By dividing, it converts ellipsoid distances to plane distances.

Continue to 29.6.3.3 Calculating Line Height Factor (Height Scale Factor) or return to 29.6.3 Point and Line Height Factor or 29 Geodetics Summary.

29.6.3.3 Calculating Line Height Factor (Height Scale Factor)

The Height Factor for a Line is also called the Height Scale Factor.

For lines measured in surveys, the Point Height Factor can, depending on the length of the line, be used to calculate the Line Height Factor.

(a) Mean of the Point Height Factor sat each end of a line

Line Height Factor = (Height Factor at A + Height Factor at B) / 2

(b) Use of Simpsons Rule

Line Height Factor = (PHF(A) + 4x PHF(mid-point) + PHF(B)) / 6

where

PHF(A) is the Point Height Factor at A

PHF(B) is the Point Height Factor at

PHF(mid-point) is the Point Height Factor at the midpoint of A and B

(c) Another Derived Formula

An equation can be derived for the Line Height factor (Height Scale Factor) which takes into account the ellipsoid height at each end of the measured line:

$$Height\ factor\ (line) = \left(1 - \frac{h_m}{R_\alpha + h_m}\right)$$

where:

h_1 = ellipsoidal height of point 1

h_2 = ellipsoidal height of point 2

h_m = mean ellipsoidal height $= \dfrac{h_1 + h_2}{2}$

R_α = radius of curvature in the azimuth of the line

Note: An error of 60 meters in the value of h_m will introduce an error of 10 ppm in the reduced ellipsoid distance. With the introduction of the Australian Geocentric datums, the N values have increased markedly over Australia.

So even if a survey is undertaken at sea level (Geoid height approximately 0.0), the ellipsoid heights may very well be greater than 60 meters.

As the Ellipsoid height = Geoid height + N value, N values should be considered when reducing measured distances to these datums.

For older Australian ellipsoids, Mean seal level approximated the surface of the ellipsoid (*i.e.* N value approximately 0.0), so corrections could use geoidal heights to bring the distances down onto the reference surface.

The ellipsoid distance can be calculated using the calculated height factor:

Ellipsoid Distance = **Reduced Horizontal Distance** x **height scale factor**.

Continue to 29.6.4 Combined Scale Factor or return to 29 Geodetics Summary.

29.6.4 Combined Scale Factor

The **Combined Scale Factor** (CSF) is a combination of scale factors that describes the ratio of the plane distance to the ground distance.

Combined Scale Factor = Plane Distance / Ground Distance

Hence a combined scale factor can be used to convert a ground distance to a plane distance

Plane Distance = Ground Distance x Combined Scale Factor

or a plane distance to a ground distance.

Ground Distance = Plane Distance / Combined Scale Factor

The CSF can be calculated for either a line of a point.

Note:

In the USA, the **Combined Scale Factor** is also called the **Grid Factor.**

See

29.6.4.1 Combined Scale Factor - Line

29.6.4.2 Combined Scale Factor - Point

29.6.4.3 Using the CSF (Point) to Calculate the CSF (Line)

29.6.4.4 Calculating the Combined Scale Factor (Line)

29.6.4.1 Combined Scale Factor - Line

The basic equation for the **CSF (line)** is:

Combine Scale Factor (Line) = Plane Distance / Ground Distance

This is also expressed as:

Combine Scale Factor (Line) = Height Factor (line) x Line Scale Factor

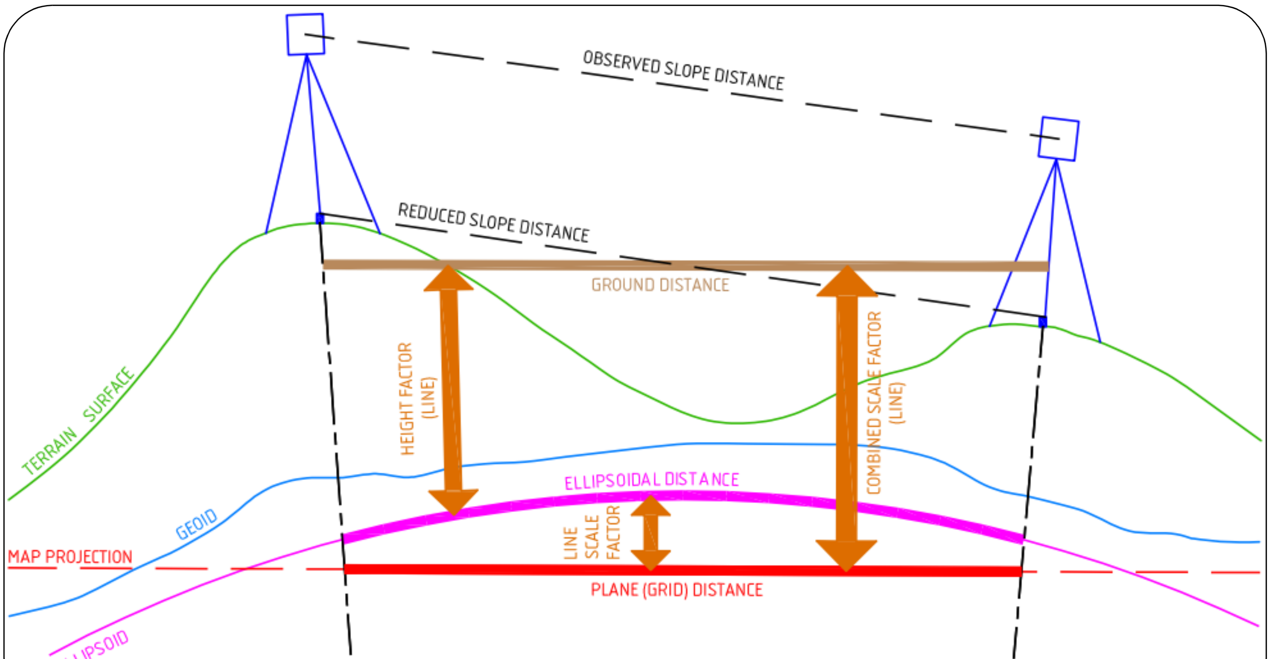
For surveys of limited extent"

(a) the **Height Factor (Line)** is the ratio of the ellipsoid distance to the ground distance and is used to reduce the ground distance to the ellipsoid distance. See 29.6.3.2 Height Factor for a Line.

Height Factor (Line) = Ellipsoid Distance / Ground Distance

(b) the **Line Scale Factor** is the ratio of the plane distance to a corresponding ellipsoid distance and so is used to reduce the ellipsoidal distance to the plane distance. See 29.6.2.2 Line Scale Factor.

Line Scale factor = Plane Distance / Ellipsoid Distance



Combined Scale Factor (line) for Surveys of Limited Extent

Continue to 29.6.4.2 Combined Scale Factor - Point or return to 29.6.4 Combined Scale Factor or 29 Geodetics Summary.

29.6.4.2 Combined Scale Factor - Point

The CSF can also be calculated for a point. The CSF for a point describes the ratio of an infinitesimal plane distance to an infinitesimal ground distance.

The basic equation for the **CSF (Point)** is:

CSF (Point) = Infinitesimal Plane Distance / infinitesimal Ground Distance

This is also expressed as:

Combine Scale Factor (Point) = Height Factor (point) x Point Scale Factor

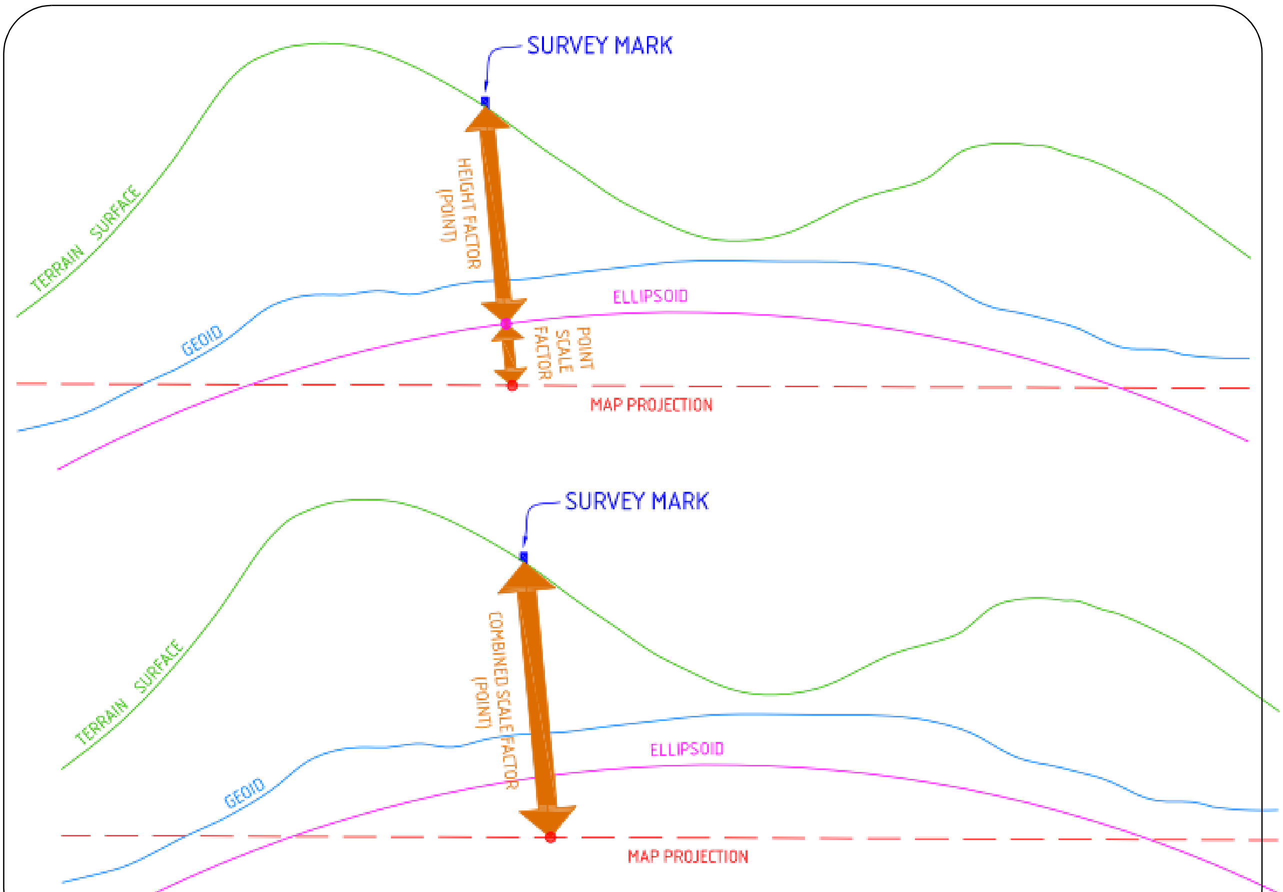
For surveys of limited extent"

(a) the **Height Factor (point)** is the ratio of the infinitesimal ellipsoid distance to the infinitesimal ground distance at the point and is used to reduce the infinitesimal ground distance to the infinitesimal ellipsoid distance. See 29.6.3.1 Height Factor for a Point.

Height Factor (Point) = Infinitesimal Ellipsoid Distance / Infinitesimal Ground Distance

(b) the **Point Scale Factor** is the ratio at a point of the infinitesimal plane distance to a corresponding infinitesimal ellipsoid distance and so is used to reduce the ellipsoidal distance to the plane distance. See 29.6.2.1 Point Scale Factor.

Point Scale factor = Infinitesimal Plane Distance / Infinitesimal Ellipsoid Distance



Combined Scale Factor (Point)

Continue to 29.6.4.3 Using the CSF (Point) to Calculate the CSF (Line) or return to 29.6.4 Combined Scale Factor or 29 Geodetics Summary.

29.6.4.3 Using the CSF (Point) to Calculate the CSF (Line)

For lines measured in surveys of limited extend, the CSF (Point) can, depending on the length of the line and the terrain over which the line is used, be used to calculate the CSF (Line).

Some of the methods for calculating the CSF(Line) using CSF(Point) are:

(a) Mean of the CSF(Point) at each end of a line

CSF(Line) = (CSF(Point) at A + CSF(Point) at B) / 2

(b) Use of Simpsons Rule

CSF(Line) = (CSF(A) + 4x CSF(mid-point) + CSF(B)) / 6

where

CSF(A) is the CSF(Point) at A

CSF(B) is the CSF(Point) at B

CSF(mid-point) is the CSF(Point) at the midpoint of A and B

Method (b) is more accurate than method (a).

Continue to 29.6.4.4 Calculating the Combined Scale Factor (Line) or return to 29.6.4 Combined Scale Factor or 29 Geodetics Summary.

29.6.4.4 Calculating the Combined Scale Factor (Line)

A surveyor can calculate a more rigorous CSF(Line) that the methods shown in the previous section 29.6.4.3 Using the CSF (Point) to Calculate the CSF (Line) by:

(a) Calculating the Height Factor (Line) using the method (c) in 29.6.3.3 Calculating Line Height Factor (Height Scale Factor):

$$Height\ factor\ (line) = \left(1 - \frac{h_m}{R_\alpha + h_m}\right)$$

(b) Calculating the Line Scale Factor using the best method in 29.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor or for a UTM, 29.6.2.4 Calculating the Line Scale Factor for a UTM:

Then:

Combined Scale Factor (Line) = Height Factor (Line) from (a) x Line Scale Factor from (b)

Hence, for a UTM

CSF(Line) = $\left(1 - \frac{h_m}{R_\alpha + h_m}\right) \times k_0 \left\{1 + \left[\frac{\left(E_1'^2 + E_1'E_2' + E_2'^2\right)}{6r_m^2}\right]\left[1 + \frac{\left(E_1'^2 + E_1'E_2' + E_2'^2\right)}{36r_m^2}\right]\right\}$

Continue to 29.7 Defining a Projection in 12d Model or return to 29.6.4 Combined Scale Factor or 29.6 Calculating Distances and Scale Factors or 29 Geodetics Summary.

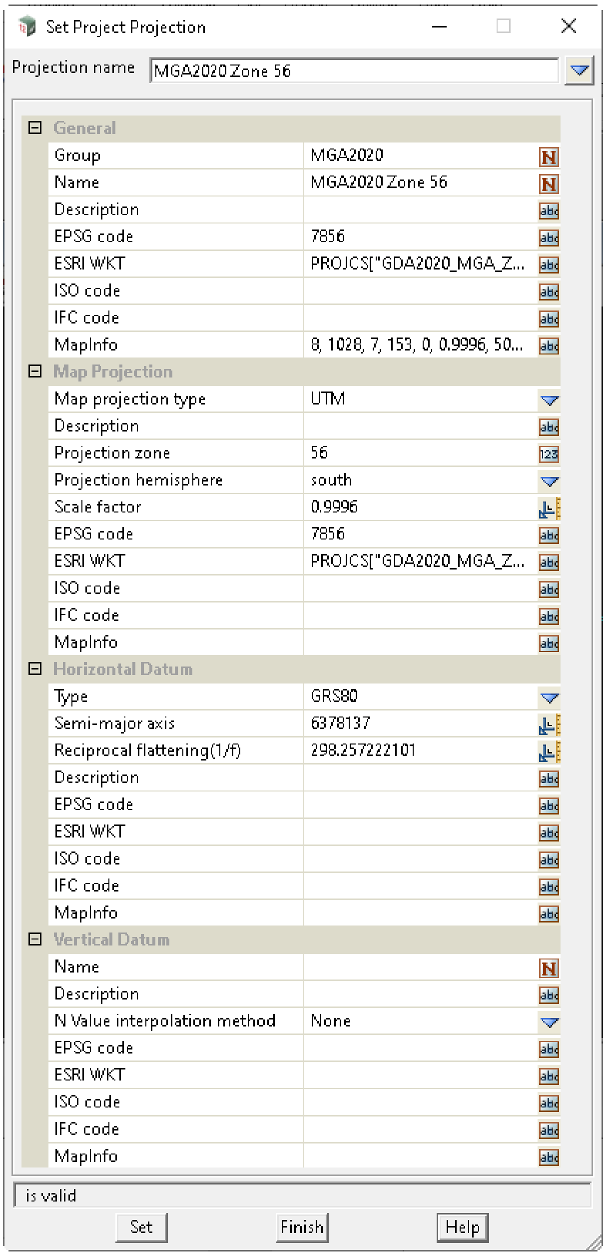
29.7 Defining a Projection in 12d Model

Within ***12d Model***, a projection is given a unique name and is defined by specifying the ***reference ellipsoid*** (the ***Horizontal Datum***), the ***Map Projection type*** and optionally, the **Vertical Datum**.

Hence a projection defined in ***12d Model*** can be used for geodetic, and other, calculations.

In ***12d Model***, each projection is given a unique name and the parameters for the projection entered in the **Projection File Editor** panel (see 6.10.6.1 Projection Editor). The projection can then be used in other options.

For example MGA2020 Zone 56 projection is defined as follows:



Continue to 29.8 Coordinate Conversions and Transformations or return to 29 Geodetics Summary.

29.8 Coordinate Conversions and Transformations

Coordinate conversion is a conversion of coordinates from one coordinate system to a different coordinate system referenced to the **same datum** (i.e. the same ellipsoid, reference frame and Epoch - see 29.2.1 Geodetic or Horizontal Datum).

For example, converting from Geodetic coordinates (latitude, longitude) to Map coordinates (eastings, Northing) using a given projection when both are defined using the same ellipsoid for the Earth (e.g. GDA2020). See 29.8.1 Coordinate Conversions.

Coordinate transformation is a process of changing coordinates from one datum to another datum. That is, there are **different datums**.

For example, transforming longitude and latitude defined for AGD84 and longitude and latitude defined for GDA94. See 29.8.2 Coordinate Transformations

See

29.8.1 Coordinate Conversions
29.8.2 Coordinate Transformations

29.8.1 Coordinate Conversions

Coordinate conversion is a conversion of coordinates from one coordinate system to a different coordinate system referenced to the **same datum.** That is, the ellipsoid, reference frame and epoch of the Earth remains the same for the two coordinate system.

The most common conversions are between the (Easting, Northing) coordinates in a map projection and longitude and latitude, or between (longitude, latitude, ellipsoid height) and Global XYZ coordinates.

The conversion between the longitude and latitude and map coordinates (Eastings, Northings) is by a unique map projection which can go in both directions. That is,

(E,N) map coordinates for map projection ⟷ map projection ⟷ (longitude, latitude)

The conversion between the (Eastings, Northings) coordinates for two map projections usually uses latitude and longitude as an intermediate step. That is,

(E,N) map coordinates in original projection ⟷ map projection 1 ⟷ (longitude, latitude) ⟷ map projection 2 ⟷ (E',N') map coordinates in new projection

Notice that height is not mentioned because the ellipsoid for the Earth is the same for both map coordinates systems so the height remains the same.

In contrast, the mapping between to and from Global XYZ coordinates involves the three dimensions and so (longitude, latitude, ellipsoid height) are required. That is,

(X, Y, Z) coordinates in Global XYZ ⟷ (longitude, latitude, ellipsoid height)

Continue to 29.8.2 Coordinate Transformations or return to 29.8 Coordinate Conversions and Transformations or 29 Geodetics Summary.

29.8.2 Coordinate Transformations

Coordinate transformation is a process of changing coordinates from one datum to another datum. That is, there are different datums.

For example, transforming the longitude and latitude of a point for AGD84 to the longitude and latitude of the same point for GDA94. In this case, the ellipsoid is different for AGD66 and GDA94 as well as the Epoch.

Another example is transforming the longitude and latitude of a point in GDA94 to the longitude and latitude for that point in GDA2020. In this case, the ellipsoid is the same but the Epoch is different.

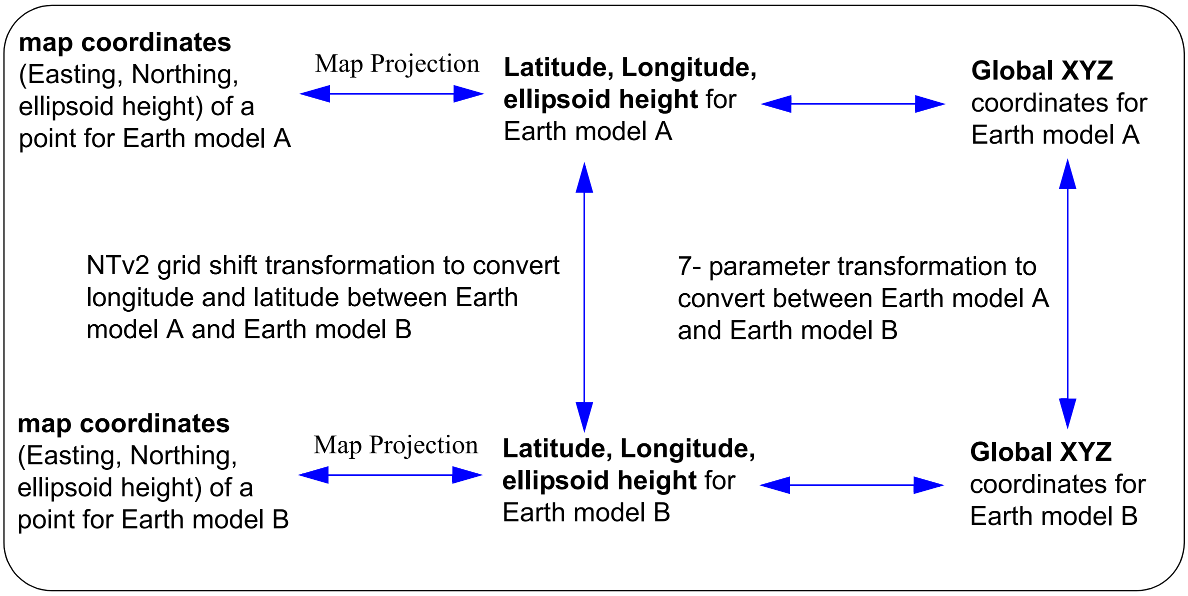
That is, for GDA94, the longitude and latitude of the point is where the point was at 1 January 1994 and for GDA2020, it is the longitude and latitude of where that same point is at 1 January 2020.

There are two major methods used for coordinate transformations:

(a) a seven parameter (7) similarity transformation for converting Global XYZ coordinates.

and

(b) a NTV2 grid shift transformation for latitude and longitudes.



See

29.8.2.1 7-Parameter Similarity Transformation
29.8.2.2 NTv2 Grid Shift Transformation
29.8.2.3.2 Transforming Between MGA94 and MGA2020

29.8.2.1 7-Parameter Similarity Transformation

The 7-Parameter similarity transformation is a transformation between two cartesian coordinates systems (x,y,z) using a 3D translation, rotations about three axis and one scale factor.

For Geodetic work, a 7-parameter transformation is used to transform between two Global XYZ coordinate systems.

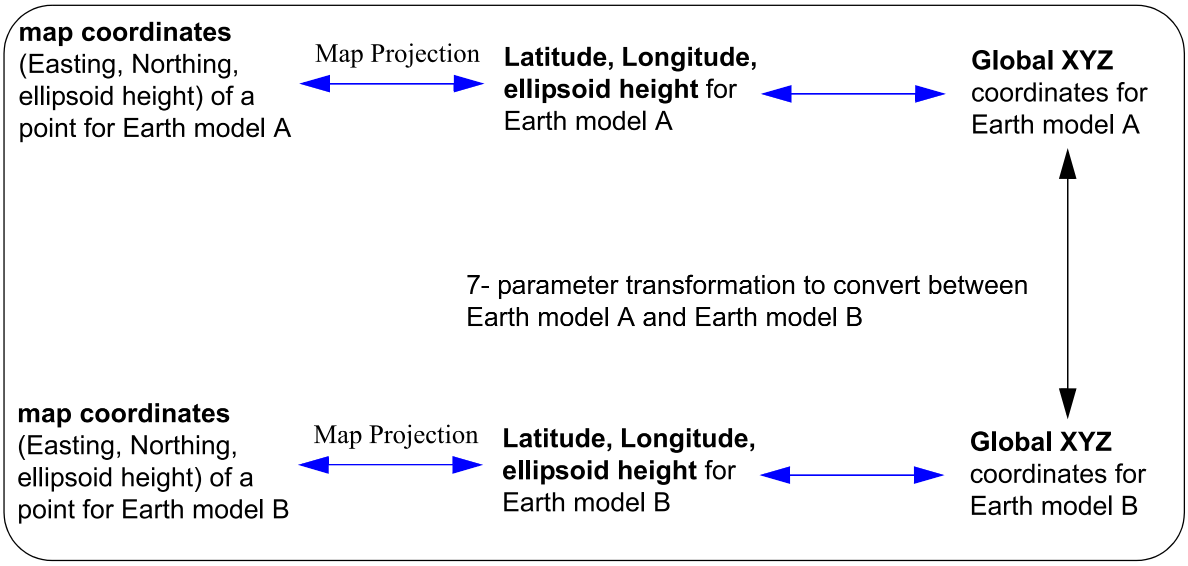
So to use a 7-parameter transformation, if the coordinates are not Global XYZ coordinates then the coordinates must first be converted to Global XYZ coordinates (using the same datum).

The 7-parameter transformation is then used to give the Global XYZ coordinates in the new Global XYZ system (i.e. transform from the old datum to the new datum).

Finally the new Global XYZ coordinates are converted to whatever coordinate system is finally required (on the same new datum).

Important Note

To use a 7-parameter transformation, the ellipsoid height is required.



As an example, in Australia a local-fitting Earth model was used in AGD84 but in 2000 the ellipsoid was changed to the mass-centred ellipsoid GRS80 and a datum defined to be where the points were at 1 January 1994 (GDA94). The 7-parameters for transforming between the two datums were calculated and published.

Also in Australia, because the land mass moves due to continental drift, the longitude and latitude of points in GDA94 were out by about 1.8 metres when compared to where they were at 1 January 2020. So a new datum was defined using the same ellipsoid GRS80 but using the longitude and latitude of where points were at 1 January 2020 (GDA2020). Again the 7-parameters for transforming between the two datums were calculated and published.

29.8.2.2 NTv2 Grid Shift Transformation

Another common method for transforming between the longitude and latitude of two datums is by using a grid of values of the difference between the longitudes and latitudes of point on the two datums. Then to convert a longitude and latitude from one datum to the other, the grid of differences is used - a grid shift transformation.

The accuracy of the results will depend on how fine the grid is. That is, how small the distance is between grid points.

A common format binary used throughout the world for story the grid is the **NTv2** format (**.gsb** files).

Important Note

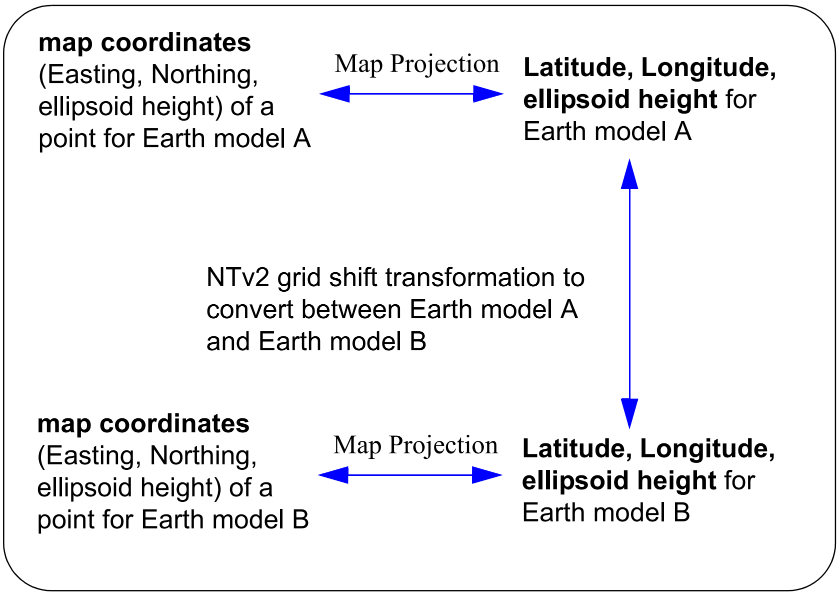
The NTv2 format does not store ellipsoid height information and therefore cannot be used to transform the height of data from one datum to another.

But for many applications, only the longitude and latitude is known or is required to be transformed. Or often the height is NOT an ellipsoid height but a geoid height (e.g. AHD) and so although the longitude and latitude will change, the geoid height will be the same.

To use a NTv2 grid-shift transformation, if the coordinates are not longitude and latitude then the coordinates must first be converted to longitude and latitude (using the same datum).

The NTv2 transformation is then used to give the longitude and latitude in the new datum (i.e. transform from the old datum to the new datum).

Finally the new longitude and latitudes are converted to whatever coordinate system is finally required (on the same new datum).



In Australia an NTv2 file was calculated and published to transform between the local-fitting Earth used in AGD84 to the mass-centres ellipsoid used GDA94.

Also another NTv2 grid was calculated and published to transform between GDA94 and GDA2020.

29.8.2.3 Australian Coordinate Transformations

See

29.8.2.3.1 Transforming Between AMG, ISG and MGA94
29.8.2.3.2 Transforming Between MGA94 and MGA2020
29.8.2.3.3 Transforming from AGD66 or AGD84 to MGA2020

29.8.2.3.1 Transforming Between AMG, ISG and MGA94

In Australia the ellipsoid used to represent the shape of the Earth used to be defined by AGD84 but in 2000, it was changed to an ellipsoid that has its centre at the centre of mass of the Earth (geocentric - GDA94). See 29.1 Shape Of The Earth.

The change was to work efficiently with GNSS (Global Navigation Satellite System - GPS, Glonass, Galileo, BeiDou etc.) because satellites orbits are centred on the centre of mass of the Earth and so an Earth mass centred ellipsoid was the logical choice.

The change of ellipsoid meant that the Latitude and Longitude of every point changed.

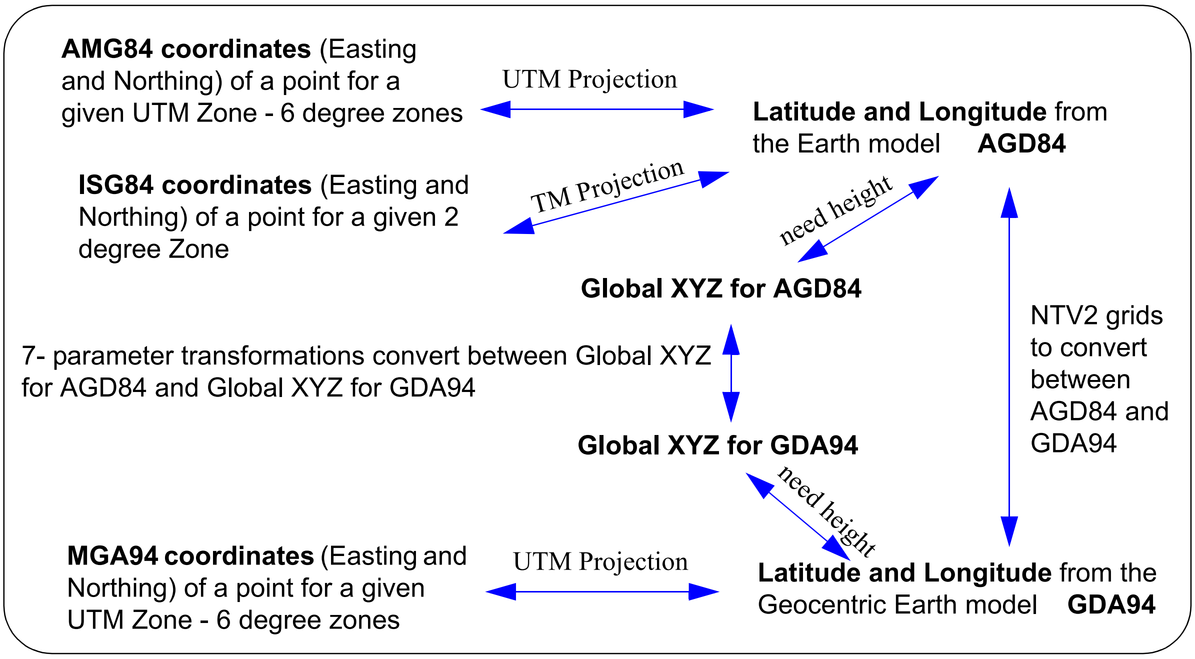
The use of UTM projections (Universal Transverse Mercator - see 29.3.4 Map (Cartographic) Projections and Map Coordinates) and Zones still applied but because the latitude and longitude of each point has changed, the Easting and Northing for a point in a UTM zone has also changed.

AMG84 Zones are the coordinates for the UTM Projections defined for six degree zones using the ellipsoid defined by AGD84.

MGA94 Zones are the coordinates for the UTM Projections defined for six degree zones using ellipsoid define by GDA94.

MGA2020 Zones are the coordinates for the UTM Projections defined for six degree zones using ellipsoid define by GDA2020.

Note - ISG84 Zones are the coordinates for the TM Projections defined for two degree zones using the ellipsoid defined by AGD84.



For converting between the ***different datums*** AGD66/84 and GDA94 (*i.e.* AMG, ISG, Long Lat <-> MGA, Long Lat), use the option

Survey =>Conversions =>AGD66/84 <-> GDA94 (see 14.8.5 AGD66/84 <---> GDA94 Transformation

For converting between different AMG Zones (AMG <->AMG) or different MGA 94 Zones (MGA<->MGA) use the option

Survey =>Conversions =>Australian conversions See 14.8.2 Australian Conversions.

For converting between different ISG/AMG Zones (AMG,ISG <->AMG, ISG)

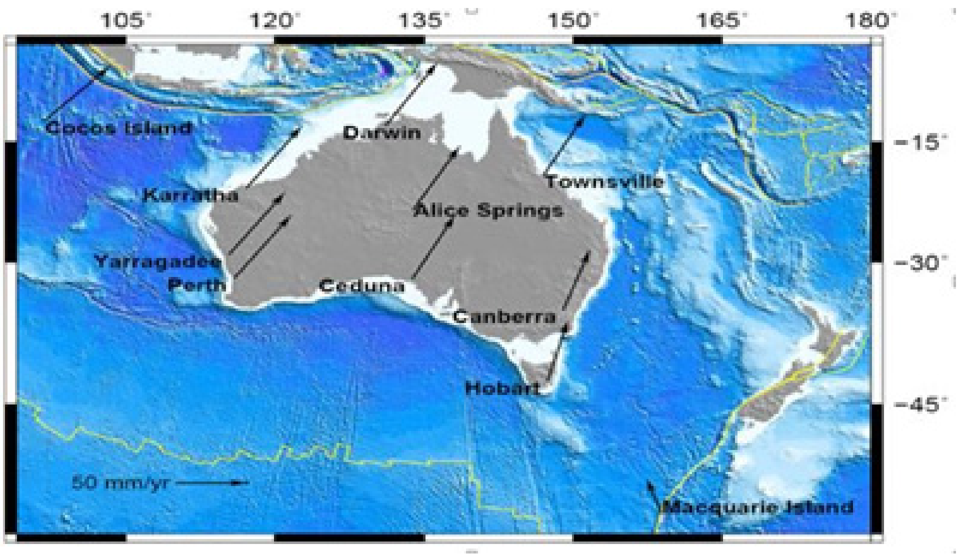
Survey =>Conversions =>Cartographic. See 14.8.1 Notes on Cartographic Conversions.

Continue to 29.8.2.3.2 Transforming Between MGA94 and MGA2020 or return to 29 Geodetics Summary.

29.8.2.3.2 Transforming Between MGA94 and MGA2020

GDA94 was the datum introduced in 2000 and the longitude and latitude for a point was defined to be where the point in the Australian continent was at 1 January, 1994.

But due to the continental drift of the plate that Australia is on, Australia moves on the ellipsoid in a North-East direction with respect to Greenwich and hence the longitude and latitude of a point in Australia changes each day. SInce 1994, has moved by about 1.8 metres.



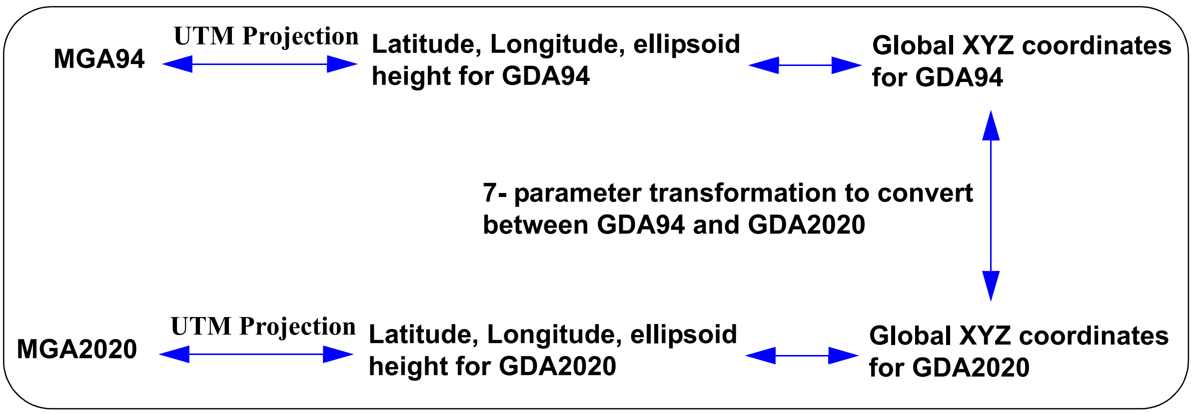
So the Australian Government decide to define a new datum which represented where the Australian Continent is at 1st January 2020.

The new datum is called **GDA2020** and the new map coordinates base on the UTM are **MGA2020**.

The transformation between the two datums GDA94 and GDA2020 can be by either

(a) a 7-parameter similarity transformation

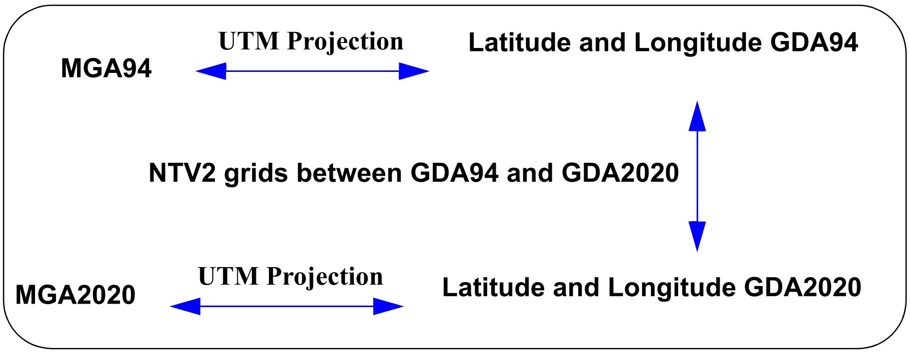
See 29.8.2.3.2.1 7-Parameter Transformation Parameters GDA94 to GDA2020



or

(b) a NTv2 grid.

See 29.8.2.3.2.2 Transformation Grids GDA94 to GDA2020



12d Model is GDA2020 compliant for both the 7 parameter similarity transformations and NTv2 grids.

GDA

The **GDA94** data can be either in longitude and latitude, Global XYZ or coordinates in a MGA Zone.

Similarly the **GDA 2020** data can be in either longitude and latitude, Global XYZ or coordinates in a MGA Zone.

The option to transform between the two datums is

Survey =>Conversions =>GDA94 <-> GDA2020

For information on this option, see 14.8.7 GDA94 <---> GDA2020 Transformation.

Return to 29.8.2 Coordinate Transformations or 29.8 Coordinate Conversions and Transformations or 29 Geodetics Summary.

29.8.2.3.2.1 7-Parameter Transformation Parameters GDA94 to GDA2020

This information has been taken from the **Geocentric Datum of Australia 2020 Technical Manual Version 1.5 - 9 Dec 2020**

https://www.icsm.gov.au/gda2020-and-gda94-technical-manuals

The official GDA94 to GDA2020 7 transformation parameters and associated uncertainties (Table 3.2) were computed using 18 GNSS CORS common to both the GDA94 RVS and the GDA2020 RVS. The GDA94 RVS (from 2011) had 21 AFN stations. GNSS CORS located at Cocos Island (COCO), Christmas Island (XMIS) and Macquarie Island (MAC1) were excluded from the computation due to earthquake deformation. Two types of GDA94-GDA2020 transformation grids have been developed:

$$\begin{pmatrix} X'_{GDA2020} \\ Y'_{GDA2020} \\ Z'_{GDA2020} \end{pmatrix} = \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix} + (1 + s_c) \begin{pmatrix} 1 & r_z & -r_y \\ -r_z & 1 & r_x \\ r_y & -r_x & 1 \end{pmatrix} \begin{pmatrix} X_{GDA94} \\ Y_{GDA94} \\ Z_{GDA94} \end{pmatrix} \quad (18)$$

Table 3.2

Table 3.2: Transformation parameters for GDA94 to GDA2020 along with the one-sigma uncertainties (1σ). Units are in metres for the translation, parts-per-million for scale, and arcseconds for rotations.

	t_x	t_y	t_z	s_c	r_x	r_y	r_z
	0.06155	-0.01087	-0.04019	-0.009994	-0.0394924	-0.0327221	-0.0328979
uncertainty	0.0007	0.0006	0.0007	0.00010	0.000011	0.000010	0.000011

The parameters to transform from GDA2020 to GDA94 can be computed by multiplying the values in the above table (Table 3.2) by **-1**.

29.8.2.3.2.2 Transformation Grids GDA94 to GDA2020

This information has been taken, and slightly rearranged, from the **Geocentric Datum of Australia 2020 Technical Manual Version 1.5 - 9 Dec 2020**

https://www.icsm.gov.au/gda2020-and-gda94-technical-manuals

Two types of GDA94-GDA2020 transformation grids have been developed:

(a) **Conformal:** predominantly plate tectonic motion

The GDA94 - GDA2020 conformal only transformation grid delivers the same result as the 7-parameter similarity transformation. It has been developed at the request of some software providers who are moving towards the use of grids as the preferred method of geodetic transformation in selected software platforms.

(b) **Conformal + Distortion**: includes regional distortion

The combined conformal and distortion grids model both the conformal transformation (i.e. translation, rotation and scale) and distortion components of the differences in the datums. In the case of GDA94 to GDA2020, the distortion component is caused by the different strategies used by state and territories to propagate GDA94 coordinates onto ground survey control mark networks from the AFN and surface movement of parts of the Australian crust. The magnitude of the distortion varies between jurisdictions and can be in the order of decimetres.

If GDA94 coordinates were observed using Global Navigation Satellite System (GNSS) technology, with corrections coming from a network of reference stations (e.g. GPSnet, CORSnet-NSW), it is likely that the coordinates are unaffected by localised distortions and the **conformal only grid would be most suitable**.

However, if survey ground marks were used for referencing / control, localised distortions will likely need to be accounted for and the combined 'conformal and distortion' grid should be used. Some recommendations are shown in Table 3.5, but if in doubt, contact your state / territory land survey authority.

Table 3.5

Table 3.5: Advice on the use of NTv2 transformation grid files across jurisdictions

Jurisdiction	NTv2 transformation grid	Comments
ACT	GDA94_GDA2020_conformal	Recommended for users transforming from GDA94 coordinates derived from CORS
ACT	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates derived from survey control marks within ACTmapi
NSW	GDA94_GDA2020_conformal	Appropriate for users transforming GDA94 coordinates derived from unlocalised CORS or AUSPOS control.
NSW	GDA94_GDA2020_conformal_and_distortion	Appropriate for users transforming GDA94 coordinates derived from SCIMS (Survey Control Information Management System) or SCIMS-localised CORS control.
NT	GDA94_GDA2020_conformal	Appropriate for users transforming from GDA94 coordinates determined from CORS.
NT	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates determined from the survey ground control network.

Qld	GDA94_GDA2020_conformal	Recommended for transforming all GDA94 data sets in Queensland.
Qld	GDA94_GDA2020_conformal_and_distortion	Not recommended for use on Queensland data sets due to distortions at the state borders.
SA	GDA94_GDA2020_conformal	Appropriate for users transforming from GDA94 coordinates determined from CORS.
SA	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates determined from the survey ground control network.
Tas	GDA94_GDA2020_conformal	Appropriate for users transforming from GDA94 coordinates determined solely from unlocalised CORS or AUSPOS observations and recommended where the origin of survey control is unknown or mixed (e.g. aggregated datasets available from LISTdata).
Tas	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates determined solely from the survey ground control network.
Vic	GDA94_GDA2020_conformal	Recommended for users transforming from GDA94 coordinates derived directly from GNSS CORS.
Vic	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates derived from survey control marks within the Survey Marks Enquiry Service (SMES).
WA	GDA94_GDA2020_conformal	Appropriate for users transforming from GDA94 coordinates determined from CORS.
WA	GDA94_GDA2020_conformal_and_distortion	Recommended for users transforming from GDA94 coordinates determined from the local geodetic network (GOLA).
WA – Christmas and Cocos Island	GDA94_GDA2020_conformal	Recommended for Christmas and Cocos Island when they become available.

IMPORTANT NOTE:

The NTv2 format does not store ellipsoidal height information and therefore cannot be used to transform the heights of data from one datum to the other.

To transform heights it is recommended that you convert your data from latitude, longitude, height LLH (ellipsoid height) to earth-centred Cartesian coordinates XYZ, apply the 7-parameter transformation from GDA94 to GDA2020 and then convert back to LLH using equations 1-3.

29.8.2.3.3 Transforming from AGD66 or AGD84 to MGA2020

ICSM has not defined a set of parameters that directly transform between historical Australian geodetic datums (AGD66 and AGD84) and GDA2020. It is recommended to first transform to GDA94 and then to GDA2020.

For transforming AGD66 or AGD84 coordinates to GDA94 the grid transformation process using the appropriate ICSM transformation grids is the most accurate and preferred transformation method.

30 BIM and Digital Engineering

Kerbs, pavement, material courses etc as digital data (strings, trimeshes etc) in *12d Model*

There is no universally excepted definition for ***Digital Engineering*** but mostly it refers to the use of digital data rather than paper plans and reports. ***12d Model*** is a parametric 3D surveying and civil engineering software and fully supports digital engineering. ***12d Model*** has numerous options for reading and writing digital data, and supports as many published open standards as it can. See 30.1 12d Model and Digital Engineering

Building Information Modelling or ***BIM***, is not as vague as digital engineering and usually refers to **Industry Foundation Classes** (**IFC**'s). See 30.2 What is BIM?.

12d Solutions is actively involved in the development of **IFC**'s, in particular for linear infrastructure, and is:

(a) a founding member of the **Open BIM Alliance of Australia** which supports the transferring of BIM data using the ISO Standard for IFCs.

(b) a coauthor if the buildingSMART International publication ***Model Setup Information Delivery Manual***.

(c) developing methods of passing Civil objects such as road surfaces, pavement layers, kerb and gutters *etc* to BIM systems even though there may be no currently IFC standards for such data.

For example using current IFC objects in IFC 2x3 and ***IFC 4x3*** for writing out alignments, super strings, water strings, trimeshes and tins.

(d) working with **buildingSMART** on extending existing IFCs (IFC 4x1, IFC 4x3, IFC 4x4 etc) to cover alignments, roads, railways and tunnels.

Some of this work was released in 2024 as ***IFC 4x3*** which is the first IFC standard for infrastructure (Civil BIM).

For more information on ***BIM***, see

30.2 What is BIM?

30.3 12d Model and IFC's

30.4 Structure of IFC

30.5 Some More IFC Entity Definitions

30.6 Common Terms in BIM

Continue to 30.1 12d Model and Digital Engineering.

30.1 12d Model and Digital Engineering

12d Model is a parametric 3D surveying and civil engineering software that fully supports digital engineering.

12d Model can read and/or write the following digital engineering and BIM formats:

(a) the published text formats ***12da*** and ***12dXML***.

12da and ***12dXML*** are text formats published by ***12d Solutions*** for reading and writing out data in ***12d Model. 12da*** was the format that started with the first release of ***12d Model*** and ***12dXML*** is an XML version of the same data.

See 7.2 Write 12d Solutions Data and 7.1 Read 12d Solutions Data.

(b) the open standards ***International Foundation Classes*** (**IFC**) as defined by **buildingSMART International**. See 30.3 12d Model and IFC's),

See 11.3.2.1 IFC Infrastructure Writer and 11.3.1.1 IFC Express Reader.

(c) the open standard ***Asset Design and As Construction*** (**ADAC**) as defined by IPWEA

See 11.3.2.1 IFC Infrastructure Writer and 11.3.1.1 IFC Express Reader.

(d) the open formats for **Point Clouds**

12d Model an read in most open Point Cloud formats. See 11.4.1 Import Point Cloud Files.

(e) the open format for **OBJ**

Drainage and sewer strings, super strings with round or rectangular sections, extrusions and trimeshes can be **written out** as OBJ files (see 7.5.17 Export OBJ).

OBJ files can be **read** into to ***12d Model*** as trimeshes. See 7.4.19 Wavefront OBJ Input

(f) the open format for **STL**

Drainage and sewer strings, super strings with round or rectangular sections, extrusions and trimeshes can be **written out** as STL files (7.5.18 Export STL).

(g) as far as possible, the unpublished proprietary binary formats of **DWG** and FBX.

Drainage and sewer strings, super strings with round or rectangular sections, extrusions and trimeshes can be written out to ***DWG*** files as Polyface Meshes. See 7.5.7 Output DWG/DFX/DXB Files.

Polyface mesh in a DWG file can be **read** into to ***12d Model*** as trimeshes. See 7.4.10 DWG/DXF Input.

(h) NOT the unpublished proprietary binary format of Revit.

Although the Revit database itself is unreadable, Revit can write data out in the IFC format and the Autodesk FBX format. There are options in ***12d Model*** to read these in IFC files (11.3.1.1 IFC Express Reader) and FBX file trimeshes. See 7.4.11 FBX Input.

Also if data can be written out from Revit as Polyface Meshes to a DWG file then that can be read in into ***12d Model*** as trimeshes. See 7.4.10 DWG/DXF Input.

EXDS have developed routines that run from within Revit to read in ***12d Model*** data in 12d.XML format See www.EXDS.com.au.

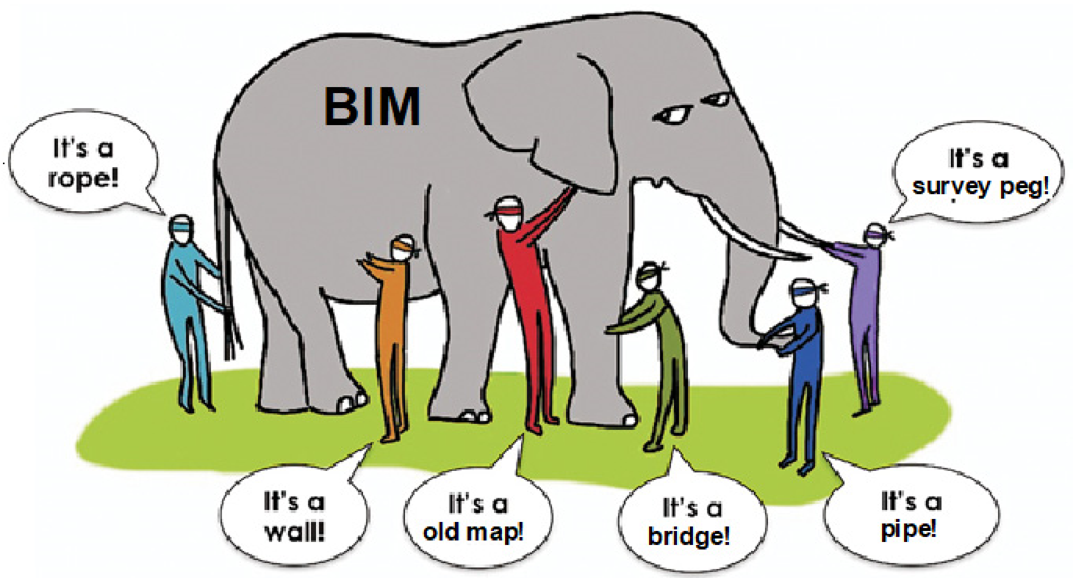
Revit should also be able to read in IFC files written by ***12d Model***.

Continue to 30.2 What is BIM? or return to 30 BIM and Digital Engineering.

30.2 What is BIM?

There is no exact meaning for Digital Engineering but mostly it refers to the use of digital data, and in particular, ***Building Information Modelling*** (***BIM***)

What BIM is depends on who you are talking to and the various participants in the design, construction and management of the asset (building or infrastructure) also emphasise different aspects of BIM.



There are two sides to BIM - BIM as a process and BIM as a transfer medium for data.

Although BIM as a process is important, as ***12d Model*** is concerned with data and attributes, this discussion will concentrate on the **Open BIM** format for data transfer using **Industry Foundation Classes** or **IFCs**.

The definition and development of IFC's is the responsibility of **buildingSMART International** (**bSI**), an open, neutral, international not-for-profit organisation (http://www.buildingsmart-tech.org) and **12d Solutions** is actively involved with buildingSMART, both in the defining and testing of IFCs.

Although IFC's traditionally only catered for vertical buildings and local engineering coordinates, **buildingSMART** committees are actively working on extending IFCs to linear infrastructure including roads, railways, bridges and tunnels where long distances and map coordinates are involved (georeferencing).

Some of the Civil extensions including alignments, tins and georeferencing have been released in **IFC 4x3**.

Continue to 30.2.1 buildingSMART International or return to 30 BIM and Digital Engineering.

30.2.1 buildingSMART International

Industry Foundation Classes (IFC) is an object-based file format with a data model developed by **buildingSMART International** (formerly the International Alliance for Interoperability, IAI) to facilitate interoperability in the architecture, engineering and construction (AEC) industry, and is the Open collaboration format in **Building Information Modelling** based projects (Open BIM). See http://www.buildingsmart-tech.org.

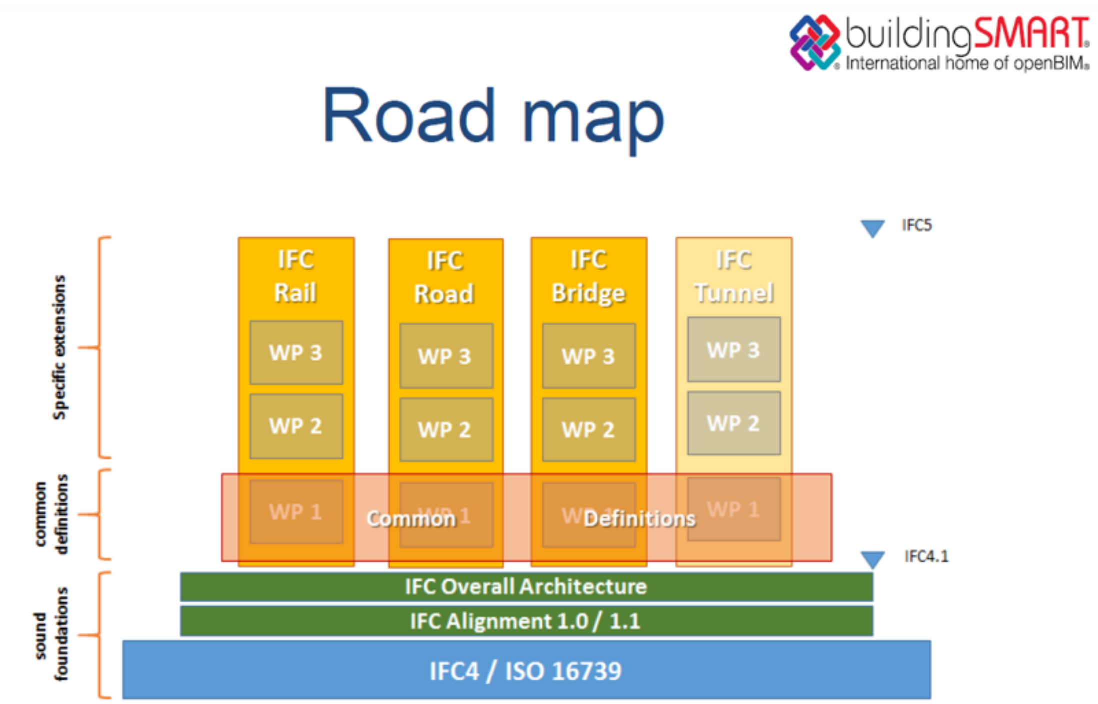
The IFC model specification is a software platform neutral, open file format specification that is not controlled by a single vendor or group of vendors. It is registered by **ISO** and is an official International Standard ISO 16739:2013. See http://www.iso.org/iso/catalogue_detail.htm?csnumber=51622 and http://www.buildingsmart-tech.org/specifications/ifc-releases/summary.

It should be noted that from the ISO website, the following are outside the scope of ISO 16739:2013:

- exchange format definitions outside of the domain of construction and facility maintenance;
- project structure and component breakdown structures **outside of building engineering**;
- behavioural aspects of components and other information items.

Hence the IFC data model for IFC 2x3 and IFC 4 were developed to describe vertical buildings and not horizontal (linear) infrastructure.

However the buildingSMART International committees that **12d Solutions** is actively involved with, are working to extend IFC to horizontal (linear) infrastructure area such as roads, railways, bridges, tunnels and ports.



The beginning of this work was released in **2024** as **IFC 4x3,** and this is the first IFC standard for linear infrastructure (**Civil BIM**).

For a general overview of IFC's, see http://en.wikipedia.org/wiki/Industry_Foundation_Classes

Continue to 30.3 12d Model and IFC's or return to 30 BIM and Digital Engineering.

30.3 12d Model and IFC's

In ***12d Model***, the **IFC Export** options write out ***12d Model*** data in the IFC STEP or IfcXML format where **IFC** stands for **Industry Foundation Classes (IFCs)** as defined by **buildingSMART International** (see 30.2.1 buildingSMART International.).

As IFC tries to covers most aspects of buildings and linear infrastructure the IFC data model is complex but what is needed to write ***12d Model*** elements to an IFC file only uses a small subset of IFC.

See

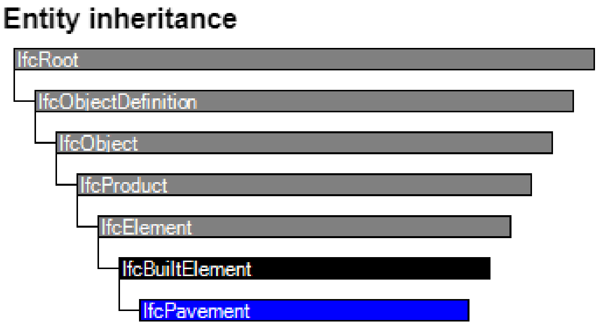
Some important IFC concepts to understand are:
When writing out a12d Model element, only a few things are needed:
Important Note: A Major Difference between 12d Model and IFC

Some important IFC concepts to understand are:

(a) IFC consists of entities with fixed parameters (called ***named attributes***) and the IFC structure is hierarchical with respect to the named attributes.

That is, the IFC entities are in a tree structure and when an entity is derived from another entity, the named attributes are inherited from that other entity.

For example, the entity inheritance for ***IfcPavement*** is



This can be written as:

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement >IfcPavement

So ***IfcPavement*** inherits the name attributes from the entities ***IfcRoot***, ***IfcObjectDefinition***, ***IfcProduct***, ***IfcElement*** and ***IfcBuiltElement*** that precede it.

(b) Many of the IFC entities are **abstract**.

Being ***abstract*** means that an IFC entity can not be used in an IFC file. In this document **abstract entities** are coloured ***salmon*** and **non-abstract entities** shown in ***black***.

For example, even though ***IfcPavement*** is way down in the hierarchy tree, only ***IfcBuiltElement*** and ***IfcPavement*** are not abstract and can be in an IFC file. So although IFC has hundreds of entities, only a few can be used for modelling ***12d Model*** elements. See 30.4.8.2 Non-Abstract Entities Derived from IfcProduct in IFC 4x3.

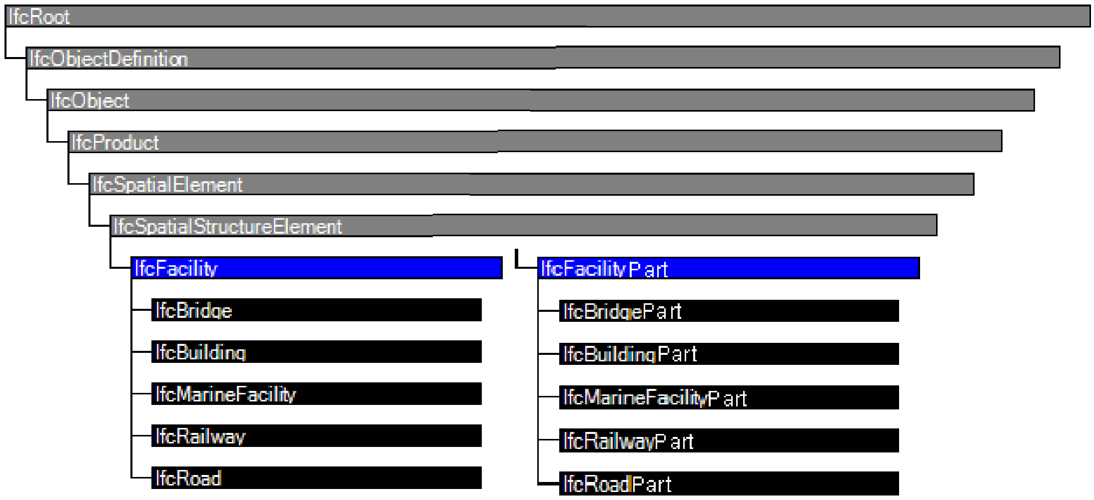
(c) IFC has Spatial Structure

Rather than using element names and models to identify data, IFC has what it calls a hierarchical Spatial Structure and each ***IfcProduct*** must belong to **one**, and **only one**, part of the Spatial Structure. **Note**: in ***12d Model*** elements, except tins, can only belong to one, and only one model.

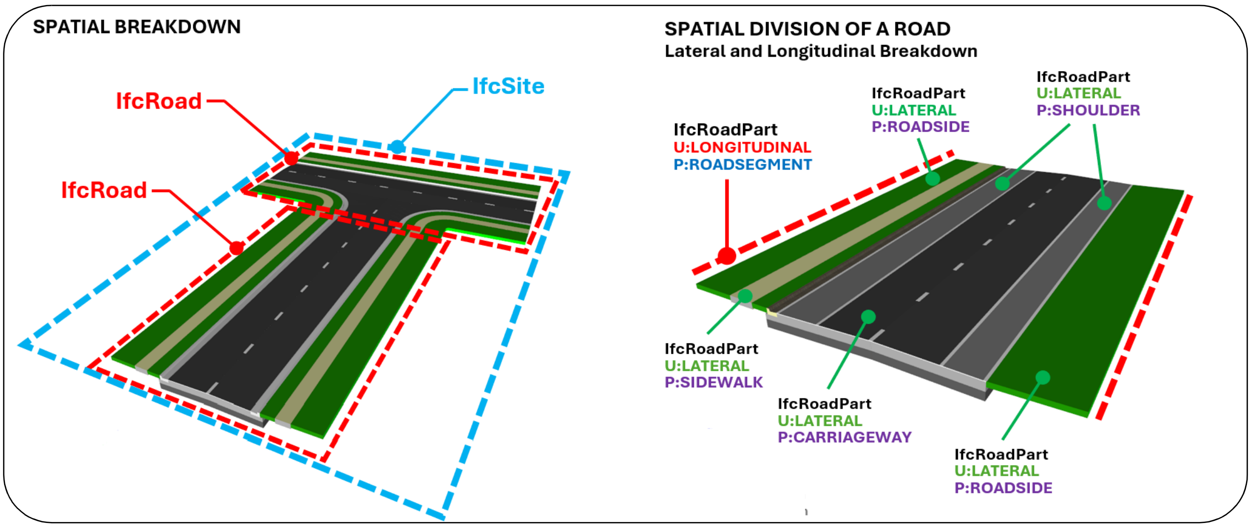
In ***IFC 2x3*** the Spatial Structure consisted of ***IfcSite***, ***IfcBuilding***, and ***IfcStorey*** for vertical buildings.

For ***IFC 4x3*** an ***IfcFacility*** with subtypes of ***IfcBridge***, ***IlfcMarineFacilty***, ***IfcRailway*** and ***IfcRoad,*** and ***IfcFacilityPart*** with subtypes ***IfcBridgePart***, ***IfcMarinePart***, ***IfcRailwayPart*** and ***IfcRoadPart,*** were added for representing the Spatial Structure of linear infrastructure.

Entity inheritance



For example a road could be divided ***longitudinally*** into separates lanes (30.4.5.2.1.3.1 IfcRoadPart) and these grouped ***laterally*** going across the road in an 30.4.5.2.1.2.1 IfcRoad.



For more information on Spatial Structure, see 30.4.5 IFC Spatial Structure.

Important Notes:

1. For ***12d Model*** elements written out to IFC, the name of the element is automatically written out as the named attribute Name of the IFC entity.
2. ***12d Model*** models can be written out to IFC ***PresentationLayers.*** See 30.5.1 IfcPresentationLayerAssignment, 11.3.2.1.11 Write Infrastructure IFC File - Settings tab and 11.3.1.1 IFC Express Reader.

Continue to When writing out a12d Model element, only a few things are needed: or return to 30.3 12d Model and IFC’s.

When writing out a*12d Model* element, only a few things are needed:

(a) Determine the IFC entity name to use for the ***12d Model*** element.

That is, the entity's name in the IFC hierarchy.

A super string without pipes (round or rectangular) is an 30.4.2.1.2.1.1 IfcAnnotation and a super string with pipes (round or rectangular) could be an 30.5.2.1.2 IfcFlowSegment

A ground tin is an 30.4.2.1.2.1.2.2 IfcGeographicElement.

An alignment is an 30.4.2.1.2.1.3.1.1 IfcAlignment which is an 30.4.2.1.2.1.3.1 IfcLinearPositioningElement.

If a suitable entity is not found then 30.4.2.1.2.1.2.1.5 IfcBuildingElementProxy can be used.

To set the ***IFC entity name*** for a ***12d Model*** element, see 30.3.2.3 Setting the IFC Entity for 12d Elements.

(b) Name of the ***12d Model*** element versus ***GlobalId***

The Name of the ***12d Model*** element (e.g. **EB**) is automatically written out as the named attribute ***Name***.of the selected IFC entity. ***Name*** is **named attribute 3** but is optional in IFC.

Each IFC entity must have the named attribute GlobalId (named attribute 1). The GlobalId is suppose to be unique within the entire software world.

For information on how the ***GlobalId*** is set in ***12d Model***, see 30.3.2.5 Special Case - IFC Entity Named Attribute "GlobalId".

(c) If a ***PredefinedType*** is also needed for the entity. ***PredefinedType*** is **named attribute 9** for many entities derived from ***IfcElement***. For example, see 30.4.2.1.2.1.2.1.3 IfcPavement.

To set the ***PredefinedType*** for a ***12d Model*** element, see 30.3.2.4 Setting IFC Entity "Named Attributes".

(d) If any extra information is to be output in named attribute ***Tag***. ***Tag*** is **named attribute 8** for all entities derived from ***IfcElement***. For example, a serial number of the item.

To set the ***Tag*** for a ***12d Model*** element, see 30.3.2.4 Setting IFC Entity "Named Attributes".

(e) The IFC geometry to use for the ***12d Model*** element.

IFC entities derived from ***IfcProduct*** can have an IFC geometry but unlike in ***12d Model,*** the ***IFC Geometry*** is ***optional***.

And what ***12d Model*** users think of as being a product may only be an IFC geometry.

For example, a ground tin is an 30.4.2.1.2.1.2.2 IfcGeographicElement and its geometry is an 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork.

A trimesh modelling a pavement is an 30.4.2.1.2.1.2.1.3 IfcPavement and its geometry is an 30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet.

(f) What ***12d Model*** attributes to write out

Many applications read an IFC files to only get information from the IFC ***IfcPropertySets*** (***12d Model*** attributes) that are attached to entities, and the IFC Geometry, if it exists, is ignored.

In practise this means that before writing out an ***12d Model*** element, some of the information about its geometry may need to be recorded as attributes. For example, 2D length, 3D length, volume, surface area, longitude and latitude of the element. In ***12d Model*** the Attribute Manipulator, MetaConnex and Mapping Files automate this process. See 25.3.4 Create/Edit Attribute Manipulator File, 25.8 Metaconnex and 7.10 Map Files.

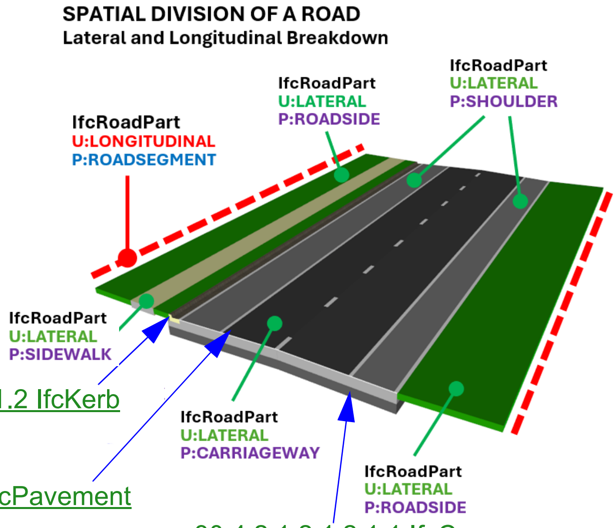
(g) Its place in the IFC Project's Spatial Structure

Each IFC project has its own spatial structure and each ***IfcProduct*** has to be in exactly one spatial structure. See 30.4.5 IFC Spatial Structure.

(h) Which version of IFC is required for the client

New versions of IFC add new entities and redefine or deprecate (i.e. should no longer use) existing entities so what version of IFC the data is being written to is very important.

For example, there are entities in ***IFC 4x3*** such as ***IfcAlignment***, ***IfcKerb***, ***IfcCourse***, ***IfcPavement IfcTriangulatedIrregularNetwork*** but none of then existed in ***IFC 2x3***.



Kerb, layers as Trimeshes Mapped to IfcKerb, IfcPavement, IfcCourse etc

30.4.2.1.2.1.2.1.2 IfcKerb

30.4.2.1.2.1.2.1.3 IfcPavement

30.4.2.1.2.1.2.1.1 IfcCourse

Continue to Important Note: A Major Difference between 12d Model and IFC or return to 30.3 12d Model and IFC's.

Important Note: A Major Difference between *12d Model* and IFC

12d Model has only a small number of element types (super string, super alignment, tin, water string) but each element can have a name and the name often identifies what the element represents. For example, names starting with **EB** for edge of bitumen, **GS** for gas design and **GA MT** for a surveyed gas meter. ***12d Model*** element attributes can also be used as part of the identification. One downside is that what the ***12d Model*** names represent must be agreed to by all parties. An advantage is that it is easy to add new names.

In IFC, entity names must come from the list in the IFC Specification. For example ***IfcPavement*** and **IfcSlab.** Consequently an IFC entity name can not be made up and if there is nothing suitable in the IFC Specifications then nondescript entities like ***IfcBuildingElementProxy*** must be used. User defined IFC property sets (attributes) can also be used as part of the identification. One benefit is that everyone knows what the entity is but the downside is that new entities can only be added with new versions of the IFC Specification.

For more information on IFC entities and their structure, see

30.4 Structure of IFC
30.4.3 Representation (Geometry) for IFC Products
30.4.4 Object Placement for IFC Products
30.4.5 IFC Spatial Structure
30.4.6 IfcRelationship
30.4.7 IFC Property Sets, IFC Properties and Psets
30.4.8 List of Non-Abstract Entities Derived from IfcProduct

Continue to the next section 30.3.1 Representing 12d Model Elements in IFC or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.1 Representing 12d Model Elements in IFC

IFC 2x3 is a commonly supported version of IFC but the entities in ***IFC 2x3*** are mainly for vertical buildings and do not cover linear infrastructure. So most ***12d Model*** data has to go out to ***IFC 2x3*** as ***IfcBuildingElementProxy***.

Another limitation of some vertical BIM softwares is that it does not support super strings with non-zero diameters. The only way to overcome this in IFC 2x3 is to write out such super strings with a small diameter.

A final hurdle for IFC 2x3 is that because they only needed to deal with buildings, some BIM softwares can only support projects that are contained within a radius of a few kilometres and insist that all coordinates should be small. However all major infrastructure projects use map coordinates which require large coordinates to be accurately stored and for the project to cover tens of kilometres.

To overcome these limitation ***IFC 4x3*** was released in 2024.

IFC 4x3 provides more support for linear infrastructure such as roads and rail with added entities for pavements, tins, alignments etc. It is also possible to represent super strings with zero diameters as ***IfcAnnotation***.

IFC 4x3 can record the geodetic (horizontal) and vertical datums, map projections and zones that the coordinates are in (**georeferencing**) and hence supports the use of absolute map coordinates.

Given all these things are critical to large linear infrastructure, where ever possible ***12d Model*** supports ***IFC 4x3***.

How ***12d Model*** elements are written to IFC 4x3 files are explained in:

Continue to the 30.3.1.1 Super String or return or 30.3 12d Model and IFC’s or 30 BIM and Digital Engineering.

30.3.1.1 Super String

Super strings with string, vertex and segment attributes can be written out faithfully as points and segments, and combined using 30.4.6.2.1 IfcRelNests.

Two types of super strings must be treated differently when writing to IFC:

(a) Super strings without pipes (round for rectangular) which will have no volume.

For this case, the super string is written out as 30.4.6.2.1 IfcRelNests of 30.4.2.1.2.1.1 IfcAnnotation entities.

(b) Super string with non-zero sized pipes (round or rectangular)

For a super string with **rectangular pipes with thickness**, each segment is written out as an 30.5.2.1.2 IfcFlowSegment with a representation ***IfcShapeRepresentation*** with ***RepresentationIdentifier*** "Body" and ***RepresentationType*** "SweptSolid" and ***IfcExtrudedAreaSolid*** with a profile 30.5.2.2.1.2.1 IfcRectangleHollowProfileDef.

For a super string with **circular pipes with thicknesses,** each segment is written out as an 30.5.2.1.2 IfcFlowSegment with a representation ***IfcShapeRepresentation*** with ***RepresentationIdentifier*** "Body" and ***RepresentationType*** "SweptSolid" and ***Items*** ***IfcExtrudedAreaSolid*** with a profile 30.5.2.2.1.1.1 IfcCircleHollowProfileDef.

In IFC 2x3 if it is a Civil Pipe (it projects onto an arc in2D), then it is broken into smaller segments as there is no Civil arc in IFC 2x3.

The string's ***string attributes*** are written out as 30.4.7.1.1.1 IfcPropertySet's attached to the overall entity, and **vertex** and **segment attributes** are attached as ***IfcPropertySets*** to the individual segments that are combined using ***IfcRelNests***.

Continue to the 30.3.1.2 Trimesh or return to 30.3.1 Representing 12d Model Elements in IFC or 30.3 12d Model and IFC's or 30 BIM and Digital Engineering.

30.3.1.2 Trimesh

A **Trimesh** can represent a wide number of ***IfcProducts*** and for a polymesh uses the geometric representation of 30.4.3.3.1.4.1.1 IfcPolygonalFaceSet and a 30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet for a trimesh of just triangles.

Trimesh attributes can be written out as 30.4.7.1.1.1 IfcPropertySet's. See 11.3.2.1 IFC Infrastructure Writer.

Continue to the 30.3.1.3 Tin or return to 30.3.1 Representing 12d Model Elements in IFC or 30.3 12d Model and IFC's or 30 BIM and Digital Engineering.

30.3.1.3 Tin

In ***IFC 4x3***, the representation (geometry) of a **Tin** is given by 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork.

For a ground tin, the ***IfcProduct*** would be an 30.4.2.1.2.1.2.2 IfcGeographicElement with the ***PredefinedType*** **TERRAIN**.

Tin attributes can be written out as an 30.4.7.1.1.1 IfcPropertySet's. See 11.3.2.1 IFC Infrastructure Writer.

For an example of a tin in an **IFC 4x3** STEP file, see 30.4.3.3.1.4.1.2.1.1 IFC STEP File Format For IfcTriangulatedIrregularNetwork.

Continue to the 30.3.1.1 Super String or return to 30.3.1 Representing 12d Model Elements in IFC or 30 BIM and Digital Engineering.

30.3.1.4 Super Alignment

In ***IFC 2x3***, a **Super Alignment** is written out as an ***IfcBuildingElementProxy***.

In **IFC 4x3,** a **Super Alignment** is written out as 30.4.2.1.2.1.3.1.1 IfcAlignment.

In **IFC 4x3** the ***IfcAlignment*** concept is organised into two parts. These two parts work together, but they can also be used and exchanged independently.

1. Business logic of alignment

   Business logic: the IFC schema allows to describe an alignment using terminology and concepts that all civil designers use. That is, Horizontal Geometry consisting of horizontal segments of lines, arcs and transitions and Vertical Geometry consisting of vertical segments lines, parabolas and arcs. Also, the business logic part provides the **anchor point** for domain specific properties, such as **cant**, **design speed** and **cant deficiency**. See 30.4.2.2 Business Logic for an IfcAlignment.

   Any Civil software should be able to create a traditional alignment from the Business logic.

2. Geometry definition of alignment

   Geometry definition: the IFC schema provides well established IFC geometric entities to represent the business concepts. Unfortunately there IFC geometric entities bear little resemblance to traditional horizontal and vertical geometry.

The super alignment attributes can be written out as 30.4.7.1.1.1 IfcPropertySet's.

Given the limitations of the IFC Geometric definition for ***IfcAlignment***, it is recommended that any Authority should insist that the ***Business logic*** is always written to the IFC file.

For examples of the ***Business logic*** for an ***IfcAlignment*** in an IFC STEP file, see For example, for the Horizontal Geometry: and For example, for the Vertical Geometry:.

NOTE:

In IFC, ***IfcAlignment*** is a 30.4.2.1.2.1.3 IfcPositioningElement. That is, it is used to position other elements.

Continue to the 30.3.1.5 Water Network or return to 30.3.1 Representing 12d Model Elements in IFC or 30 BIM and Digital Engineering.

30.3.1.5 Water Network

The entire water network can be written out as an ***IfcDistributionSystem***.

In that case the network is preprocessed and the network broken up into nodes and links joining the nodes.

TO DOCO - Tick for IfcSystem or not.

30.3.1.5.1 Water Node

Each **Node** is written out as an ***IfcFlowStorageDevice.***

Depending on its geometry the node will be written out as combination of IfcElements "nested together" to form the IfcGlowStorageDevice.broken up.

TO DOCO - How is this made up - IfcRelAggregates or IfcRelNests?

For a circular pit, the shape representation is ***IfcCircleHollowProfileDef***. See 30.5.2.2.1.1.1 IfcCircleHollowProfileDef.

For a rectangular pit, the shape representation is ***IfcRectangleHollowProfileDef***.

Note however that this has only one wall thickness so when writing the pit out, the outer shape is correct but the maximum value of the top, bottom, left and right thicknesses is used for the wall thickness. So if the top, bottom, left and right thickness are not all the same value then the inner rectangle is smaller than it actually is. See 30.5.2.2.1.2.1 IfcRectangleHollowProfileDef.

The node attributes can be written out as ***IfcPropertySets*** (see 11.3.2.1 IFC Infrastructure Writer).

30.3.1.5.2 Water Link

Each **link** is written out as an **IfcFlowSegment**.

For a circular pipe, the shape representation is ***IfcCircleHollowProfileDef***. 30.5.2.2.1.1.1 IfcCircleHollowProfileDef.

For a rectangular pipe, the shape representation is ***IfcRectangleHollowProfileDef***.

Note however that this has only one wall thickness so when writing the pipe out, the outer shape is correct but the maximum value of the top, bottom, left and right thicknesses is used for the wall thickness. So if the top, bottom, left and right thickness are not all the same value then the inner rectangle is smaller than it actually is.

The pipe attributes can be written out as an ***IfcPropertySet*** (see 11.3.2.1 IFC Infrastructure Writer).

Continue to the 30.3.1.6 12d Element History or return to 30.3.1 Representing 12d Model Elements in IFC or 30.3 12d Model and IFC's or 30 BIM and Digital Engineering.

30.3.1.6 12d Element History

When reading an IFC file, each ***12d Model*** element created from an IFC entity has three Text attributes contain information about the entity read in.

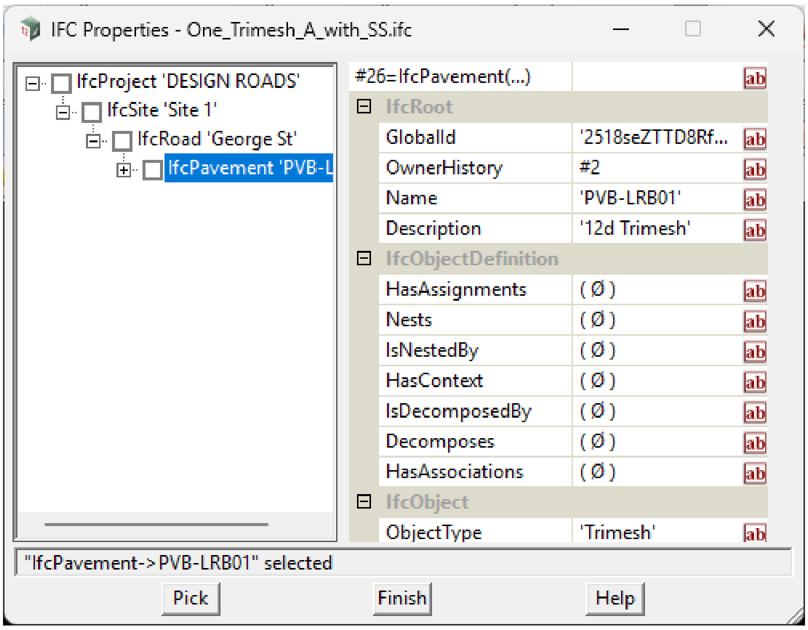
The three attributes are:

FileName	name of the file being read in
Date	date and time that the entity was read in
StepId	the # number of the entity in the file that was read in

This is to provide some history for the created ***12d Model*** element.

The **FileName** and **StepId** means that the entity used to create the ***12d Model*** element can be found in the IFC file by the **IFC Properties** panel (***BIM =>Import =>IFC =>IFC properties***).

The **IFC Properties** panel uses the **Filename** and **Stepid** from an element that was created from reading an IFC file to create a tree of the spatial structure and information about each IFC entity in each spatial structure. See 11.3.1.2 IFC Properties.



Continue to the next section 30.3.2 Setting Up and Writing IFC Information or return to 30.3.1 Representing 12d Model Elements in IFC or 30.3 12d Model and IFC's or 30 BIM and Digital Engineering.

30.3.2 Setting Up and Writing IFC Information

The values used for the IFC project header information and project units are stored as ***12d Model*** Project attributes.

Similarly for each ***12d Model*** element being written to the IFC file, ***12d Model*** attributes on the element are used to pass IFC information to the IFC file.

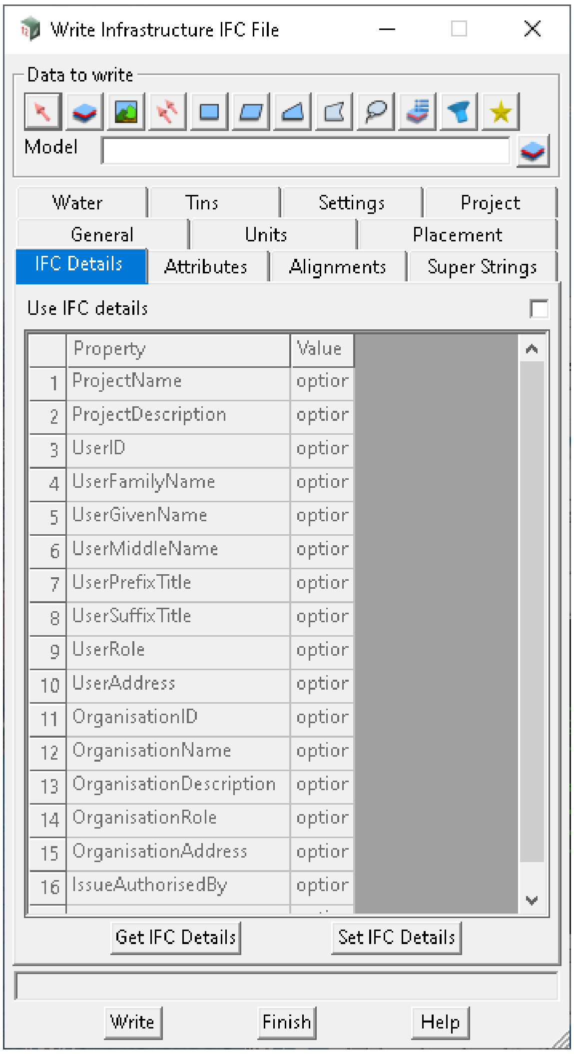
This means that standard ***12d Model*** processes using Map files, Attribute Manipulator, MetaConnex, Macros etc can be used to set up the information required to go to the IFC file.

For a summary on how the ***12d Model*** information is set up to go out to an IFC file, see

30.3.2.1 Setting IFC Project Header Information
30.3.2.2 Setting the IFC Project Units
30.3.2.3 Setting the IFC Entity for 12d Elements
30.3.2.4 Setting IFC Entity "Named Attributes"
30.3.2.5 Special Case - IFC Entity Named Attribute "GlobalId"
30.3.2.6 Special Case - IFC Entity Named Attribute "Name"
30.3.2.7 Setting IFC Property Set Information in 12d Model
30.3.2.8 Setting the IFC Project CRS and Map Projection
30.3.2.9 Setting Up IFC Information Using a Map File

30.3.2.1 Setting IFC Project Header Information

The IFC Details tab on the 11.3.2.1 IFC Infrastructure Writer panel is used to pass IFC header information through to the IFC file.



The values for the **Project Details** tab are taken from the Project attribute group:

ifc_attributes/ifc_project_details

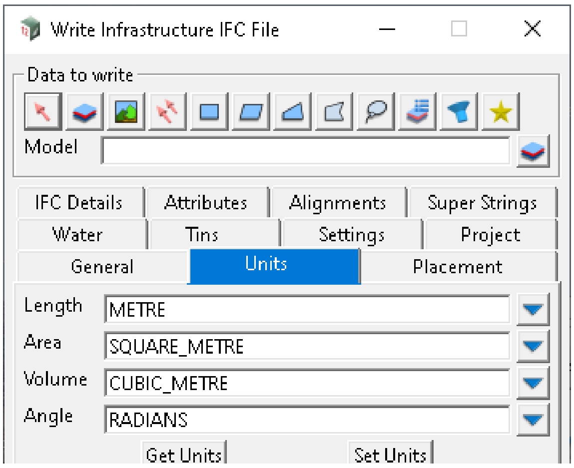
and if the values are changed on the IFC Details tab **IFC Details** tab then the values in the ***12d Model*** Project attribute group are updated when the **Write** button is pressed.

See the IFC Details tab on the 11.3.2.1 IFC Infrastructure Writer panel for more information and example.

Continue to 30.3.2.2 Setting the IFC Project Units or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.2 Setting the IFC Project Units

The Units tab on the11.3.2.1 IFC Infrastructure Writer panel is used to pass information on the Units being used through to the IFC file.



The values for the Units tab are taken from the ***12d Model*** Project attribute group:

ifc_attributes/ifc_project_units

and if the values are changed on the Units tab then the values in the ***12d Model*** Project attribute group are updated when the **Write** button is pressed.

Continue to 30.3.2.3 Setting the IFC Entity for 12d Elements or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.3 Setting the IFC Entity for 12d Elements

The first step to decide for each ***12d Model*** element, which IFC entity it will be exported to as an instance of. For example, ***IfcSlab***, ***IfcWall***, ***IfcPavement*** etc.

Unfortunately this can be confusing because the IFC geometry for an ***IfcProduct*** is **NOT** an ***IfcProduct***.

For example, the geometry for a tin is ***IfcTriangulatedIrregularNetwork*** in an ***IfcPresentationItem*** which is not an ***IfcProduct*** (30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork).

The appropriate ***IfcProduct*** is an instance of ***IfcGeographicElement*** with the geometry ***IfcTriangulatedIrregularNetwork*** (30.4.2.1.2.1.2.2 IfcGeographicElement).

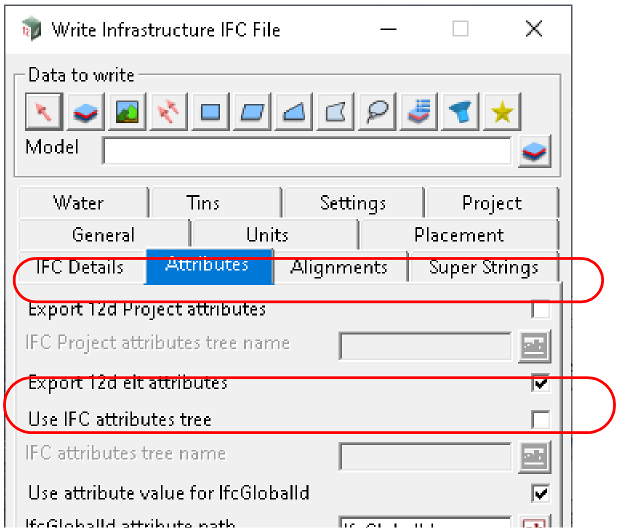
Once the IFC entity for a given ***12d Model*** element is selected, the value of a common string/tin/trimesh attribute can be used to record the selected IFC entity name.

For example, if a particular trimesh is to be ***IfcPavement***, the value is set to "IfcPavement".

If no suitable IFC entity exists then ***IfcBuildingElementProxy***, which has no predefined meaning, is used.

Note that different ***12d Model*** elements can be different ***IfcProduct's***.

The fields **Export attributes**, **Use IFC attribute tree** and **IFC attribute tree name** on the Attributes tab of the 11.3.2.1 IFC Infrastructure Writer panel are used to set what ***12d Model*** attribute on all ***12d Model*** elements is used to store the appropriate ***IfcProduct***.



Note

When writing out ***12d Model*** elements to the IFC file, ***12d Model*** checks if the name is valid for that IFC version. If the name is invalid, or does not exist, ***IfcBuildingElementProxy*** is used.

For a list of the valid ***IfcProduct*** names for IFC 4x3, see 30.4.8 List of Non-Abstract Entities Derived from IfcProduct.

Continue to 30.3.2.4 Setting IFC Entity "Named Attributes" or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.4 Setting IFC Entity "Named Attributes"

Depending on the IFC entity, an instance of an IFC entity can have up to ***twelve named attributes*** and the names of these can vary between IFC entities.

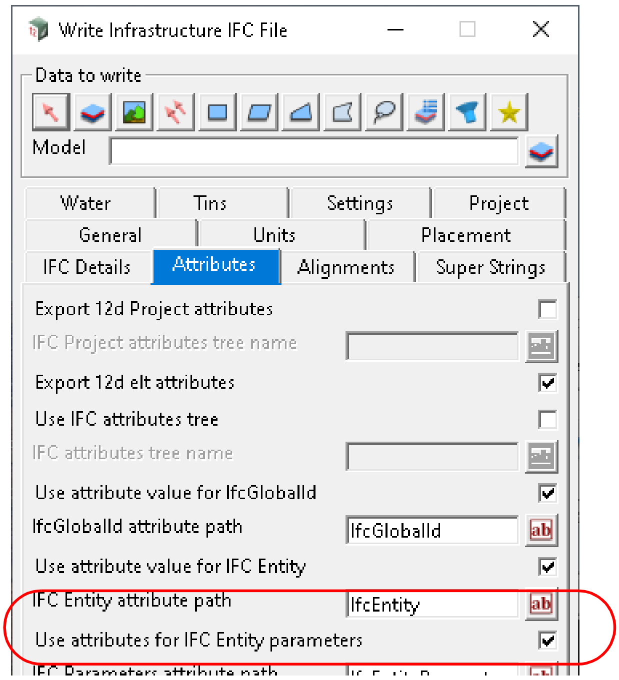
Note: an ***IFC name attribute*** is not the same as a ***12d Model*** attribute.

For each ***12d Model*** element, ***12d Model*** attributes can be used to set the value for any of the named attributes of the IFC entity that the element is mapped to.

As there can be from zero to twelve ***IFC named attributes*** with differing names used for each IFC entity, a ***12d Model*** attribute group is used to hold the values for each of the ***IFC named attributes.***

To allow for the arbitrary number of IFC named attributes with arbitrary names, a ***12d Model*** attribute group (subnode) is used for each IFC named attribute, a ***12d Model*** attribute created in the group and the "name" of the IFC named attribute is used as the ***12d Model*** attribute name. The value of the attribute is the value for the IFC named attribute.

The fields **Use attributes for IFC Entity parameters** and **IFC Parameter attribute path** on the Attributes tab of the 11.3.2.1 IFC Infrastructure Writer panel are used to set what ***12d Model*** attribute group on all ***12d Model*** elements is used to store the IFC named attributes and values.



See the Attributes tab on the 11.3.2.1 IFC Infrastructure Writer panel and 11.3.2.1.6.1.5 Writing Attributes for IFC Entity Parameters for an example.

Special Notes

1. The named attributes ***ObjectPlacement*** and ***Representation*** are set by ***12d Model*** as they depend on what geometry is being written out for the ***12d Model*** elements.
2. If an attribute for an IFC entity named attribute does not exist in the ***12d Model*** attribute group, a **$** is placed in the appropriate field in the IFC STEP file. So in a STEP file, **$** means no value supplied for that named attribute.

   As most of the named attributes are optional this means that they can be omitted from the ***12d Model*** attribute group. That is, only those named attributes that have values for the instance need exist. See 30.4.1 IFC STEP File Format.

Continue to 30.3.2.5 Special Case - IFC Entity Named Attribute "GlobalId" or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.5 Special Case - IFC Entity Named Attribute "GlobalId"

The IFC named attribute GlobalId is the first named attribute of *IfcRoot* and so is a named attribute for all IFC entities derived from *IfcRoot*.

1	GlobalId	IfcGloballyUniqueId		Assignment of a globally unique identifier within the entire software world.

GlobalId is meant to be a unique identifier that is assigned to each instance of an IFC entity derived from *IfcRoot*. This means that once an instance of an IFC entity is given a value for ***GlobalId***, it doesn't change.

What that means in practice is that when a ***12d Model*** element is written out to an IFC file it is given a value for the ***GlobalId*** and that value is stored as an attribute of the ***12d Model*** element so that i the element is written out again, the attribute can be used for the ***GlobalId***.

How is this achieved in *12d Model?*

In computer systems, there is 128-bit number used to identify information called a **globally unique identifier** (**GUID**) or universally unique identifier (UUID). When generated according to the standard methods, **GUID's** are, for practical purposes, unique.

Microsoft has a function for creating an **IFC GUID** and when a new ***IFC GlobalId*** is required in ***12d Model*** that function is used.

For an element in ***12d Model,*** an ***IFC GlobalId*** can be created (by the Attribute Manipulator or a macro) and stored as the value of an attribute for the element. It is recommended that the name of the ***12d Model*** attribute is ***IfcGlobalId***.

When writing a *12d Model* element out to an IFC file:

(a) if the attribute ***IfcGlobalId*** exists, its value can be written out as the value of the ***GlobalId*** for the IFC Entity

(b) If the ***12d Model*** attribute ***IfcGlobalId*** does not exist then a GUID is generated and used as the value for the ***GlobalId*** for the element and written out to the IFC file for that element, and if the ***12d Model element*** is not read-only, then an attribute named ***IfcGlobalId*** is created and the GUID value recorded in it.

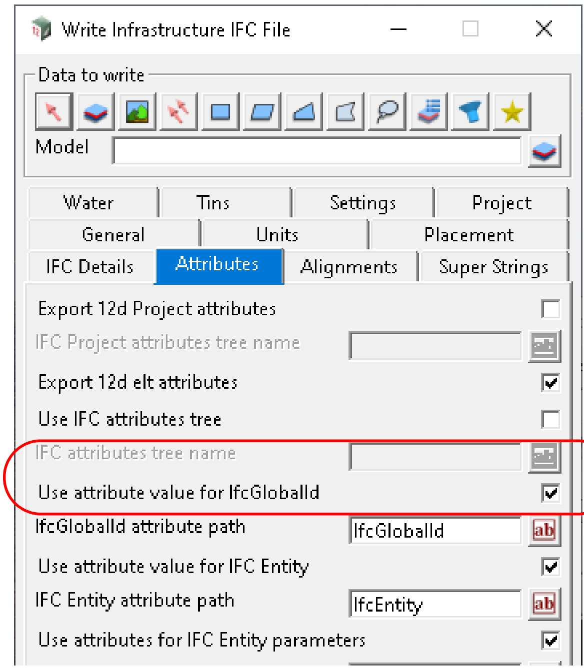
This process means that value of the ***GlobalId*** is the same in the IFC file when the ***12d Model*** element is written out again to an IFC file.

When reading in an IFC file:

As a ***12d Model*** element is created from an instance of an IFC entity in the IFC file, a ***12d Model*** attribute called ***IfcGlobalId*** is created for the element and its value is the ***GlobalId*** of the instance in the IFC file.

Consequently if the ***12d Model*** element is written out again to an IFC file then the value of the ***GlobalId*** is the same as when it was created from the original IFC file.

The fields **Use attributes value for IfcGlobalId** and **IfcGlobalId attribute path** on the Attributes tab of the 11.3.2.1 IFC Infrastructure Writer panel are used to set what ***12d Model*** attribute on all ***12d Model*** elements is used to store the ***IfcGlobalId***.



For an example, see 11.3.2.1.6.1.3 Writing Attribute for IfcGlobalId.

Important Note:

When writing out a ***12d Model*** element, the **IFC Parameters attribute path** can be used to change the value for the GlobalId that is written to the IFC file. *See* 30.3.2.4 Setting IFC Entity "Named Attributes".

Continue to 30.3.2.6 Special Case - IFC Entity Named Attribute "Name" or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.6 Special Case - IFC Entity Named Attribute "Name"

The IFC entity named attribute called ***Name*** is the third attribute of ***IfcRoot*** and so is an attribute for all IFC entities derived from ***IfcRoot***.

1	GlobalId	IfcGloballyUniqueId		Assignment of a globally unique identifier within the entire software world.
2	OwnerHistory	IfcOwnerHistory	?	Assignment of the information about the current ownership of that object, including owning actor, application, local identification and information captured about the recent changes of the object, NOTE only the last modification in stored - either as addition, deletion or modification. IFC4 CHANGE The attribute has been changed to be OPTIONAL.
3	Name	IfcLabel	?	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
4	Description	IfcText	?	Optional description, provided for exchanging informative comments.

The IFC named attribute ***Name*** does not have to be unique and given that most ***strings***, ***tins*** and ***trimeshes*** have names, the default action is to use that name for the IFC entity.

However, this can be overridden by using the **IFC Parameters attribute path** to change the value ***Name***. *See* 30.3.2.4 Setting IFC Entity "Named Attributes" and 11.3.2.1.6.1.5 Writing Attributes for IFC Entity Parameters.

Continue to 30.3.2.7 Setting IFC Property Set Information in 12d Model or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.7 Setting IFC Property Set Information in 12d Model

12d Model allows the user:

(a) to write out all the string, tin and trimesh attributes

or

(b) to only write out selected group attributes

In both cases, the names and the types of the attributes, and the attribute hierarchy in ***12d Model*** is maintained.

So the first step to find out what ***property sets*** and ***properties*** are required for each ***12d Model*** element being written out to the IFC file, and what the **name** is for each required **property set** and the **name** and **definition** for each **property** in the property sets.

Then standard ***12d Model*** options such as Map files, Attribute Manipulator, MetaConnex, Macros etc can be used to set up the required attributes to write out to IFC.

For more information, see

30.3.2.7.1 Writing Out All Attributes
30.3.2.7.2 Writing Out Selected Group Attributes

30.3.2.7.1 Writing Out All Attributes

The simplest method is to write out **all** the ***12d Model*** attributes for a string, tin or trimesh.

In this case:

(a) the ***12d Model*** **group attribute names** are used as the **property set names**

and

(b) the ***12d Model*** **single attribute names** are set as the **property names.**

However because in IFC, the top level can only be a Property Set, a property set called "**12d Model**" is created and all the ***12d Model*** attributes for an item are placed in that property set.

So to write out all the attributes in a property set called ***12d Model***, on the Attributes tab of the 11.3.2.1 IFC Infrastructure Writer panel:

1. tick ***Export attributes***
2. don't tick ***Use IFC attributes tree***

Continue to 30.3.2.7.2 Writing Out Selected Group Attributes or return to 30.3.2.7 Setting IFC Property Set Information in 12d Model or 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.7.2 Writing Out Selected Group Attributes

There is also a method to only write out the group attributes that are **contained within** a given group attribute, called the **containing group attribute.**

In this case:

(a) the **group attribute names** are used as the **property set names**

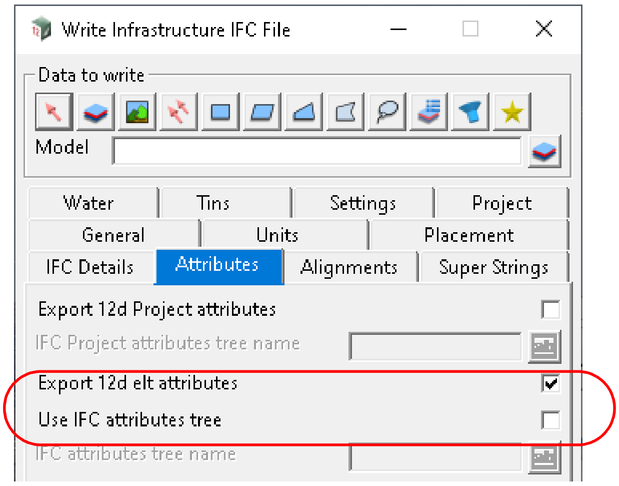
and

(b) the **single attribute names** are used as the **property names**

(c) the **containing group attribute** is **NOT** written out

(d) any single attributes in the containing group attribute are **NOT** written out. This is because there is no property set name for them.

So to write out all the attributes in a user given containing group attribute, on the Attributes tab of the 11.3.2.1 IFC Infrastructure Writer panel:



1. tick ***Export attributes***

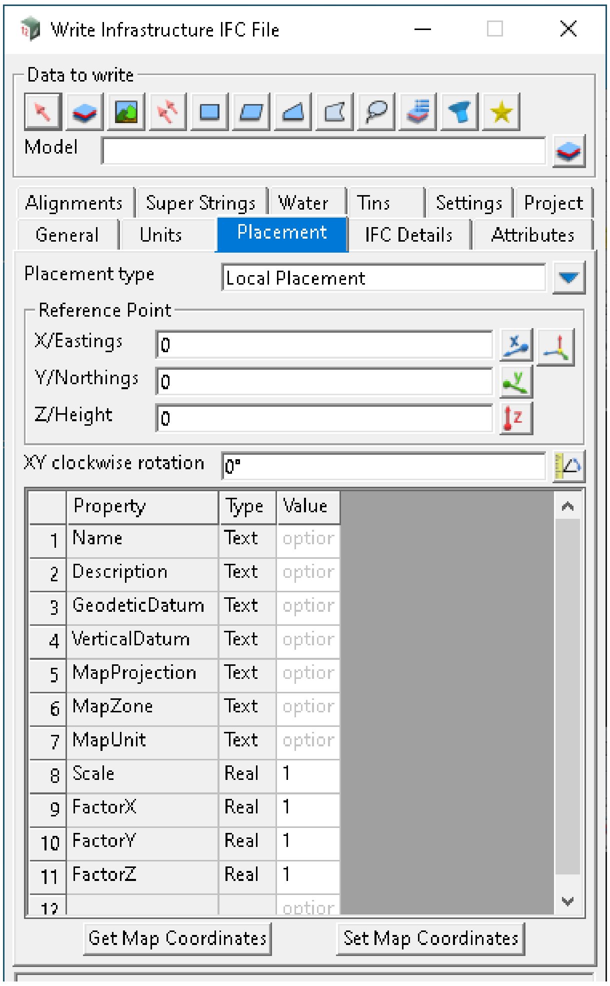
2. tick ***Use IFC attributes tree***
3. fill in the path to the **containing group attribute** in ***IFC attribute tree name***

For an example see 11.3.2.1.6.1.2 Writing 12d Element Attributes.

Continue to the next section 30.3.2.8 Setting the IFC Project CRS and Map Projection or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.8 Setting the IFC Project CRS and Map Projection

Information about the coordinate systems used for the infrastructure project is set by on the Placement tab of the 11.3.2.1 IFC Infrastructure Writer panel.



If the infrastructure project is using map coordinates (which is usually the case. E.g. MAG2020 Zone 56), the Geodetic (Horizontal) and the Vertical Datums, Map Projection and Map Zone defined for the project is entered on the Placement tab.

See 11.3.2.1.4 Write Infrastructure IFC File - Placement tab and for examples, see 30.4.4.3 Setting Up For Map Coordinates.

Continue to the next section 30.3.2.9 Setting Up IFC Information Using a Map File or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.9 Setting Up IFC Information Using a Map File

When ***12d Model*** is used for an infrastructure project, a strict naming convention is normally used so that the name of a string, tin or trimesh usually provides definitive information on what the ***12d Model*** element represents.

A ***12d Model*** Map file can be used set up information about a ***12d Model*** element ready to write out to an IFC file.

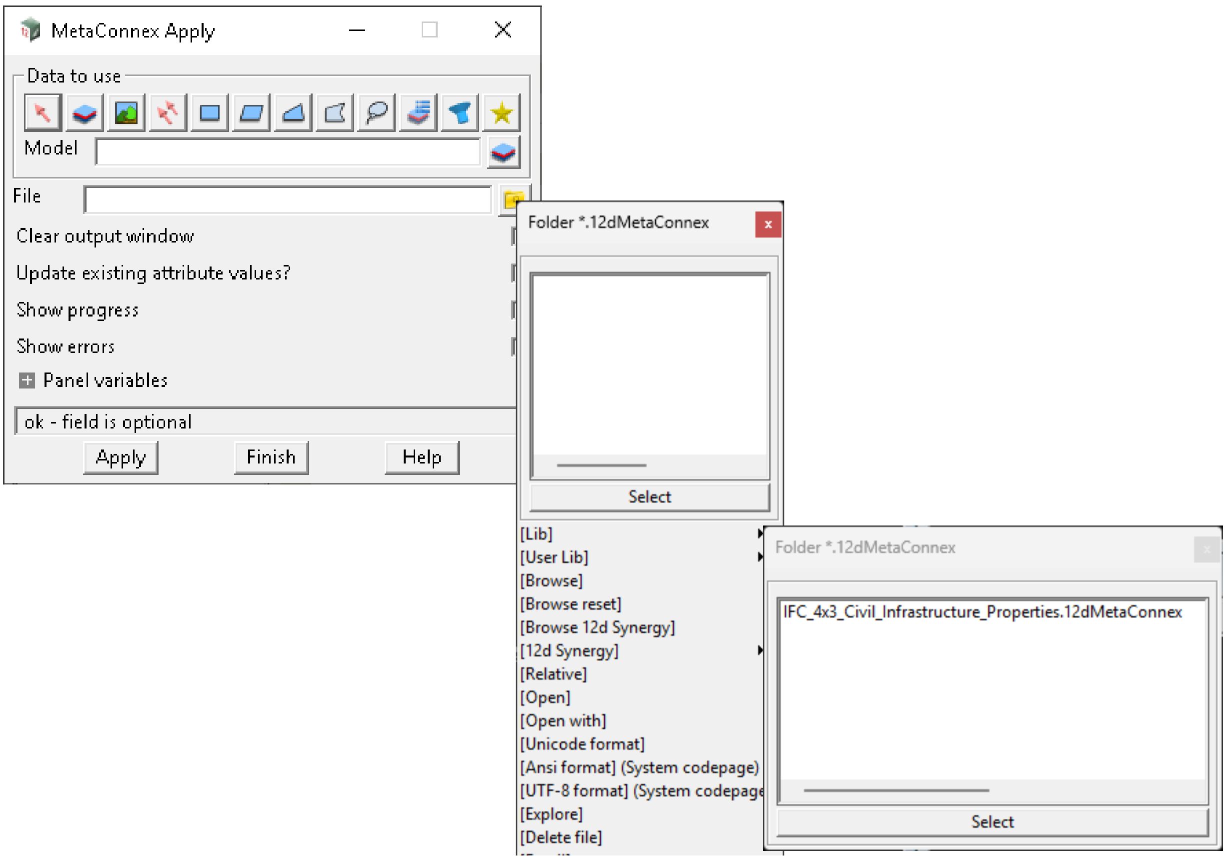
Continue to 30.3.2.10 Setting Up IFC Information Using a MetaConnex File or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.3.2.10 Setting Up IFC Information Using a MetaConnex File

When ***12d Model*** is used for an infrastructure project, a strict naming convention is normally used so that the name of a string, tin or trimesh usually provides definitive information on what the ***12d Model*** element represents.

A ***12d Model*** MetaConnex file can be used set up information about a ***12d Model*** element ready to write out to an IFC file.

Such a MetaConnex file called ***IFC_4x3_Civil_Infrastructure_Properties.12dMetaConnex*** is shipped with ***12d Model*** in [Lib].



Continue to 30.4 Structure of IFC or return to 30.3.2 Setting Up and Writing IFC Information or 30 BIM and Digital Engineering.

30.4 Structure of IFC

Important Warning

IFC talks of "attributes" but these are not the same as attributes in ***12d Model*** but are more like the arguments of a computer function. They will be referred to as **IFC named attributes**, or **named attributes** for short.

IFC has **properties** that are almost the same as ***12d Model*** attributes.

The IFC definition is built on objects called Entities.

In general IFC Entities have:

(a) a well defined hierarchy that is published in the IFC specification

(b) each entity type has a fixed number of **named attributes** (arguments) that are defined in the IFC specification. The name of the name attributes in this document will be coloured **Blue**. For example, ***GlobalId*** is a named attribute.

(c) each entity in the hierarchy inherits the named attributes (arguments) that are specified before it in the hierarchy.

Note: Entities derived from the same supertype are not necessarily related in any way. They just share the same named attributes derived from the common supertype.

(d) a named attribute for an entity is uniquely referred to as IfcEntity**.**NamedAttribute

For example IfcPavment.Name and IfcPavement.PredefinedType

(e) not all entities can have an instantiation. That is, not all entities can appear in the IFC file.

The entities that can’t have an instantiation are called **abstract** and will be coloured **Salmon** in this document. For example, ***IfcElement*** is abstract and in the documentation will have:

IfcElement **is abstract and can not be instantiated.**

(f) entities derived from the entity ***IfcProduct*** can have a **placement in space** (***ObjectPlacement***) and a **geometric representation** (***Representation***).

(g) some entities have additional attributes (call ***properties*** in IFCs) with given names and definitions that are specified in the IFC Specification. These special attributes are grouped together in defined **P_Sets** and their names start with "Pset_"

(h) entities can have additional User defined attributes that are grouped together in **Property Sets**. The User defined Property Sets must have a name but the name cannot start with "Pset_" as that is reserved for property sets defined in the IFC Specification.

(i) IFC has a hierarchical spatial structure of ***IfcSpatialStructureElement***’s where the top of each hierarchy is assigned to the one and only one ***IfcProject*** in the IFC file.

The non-abstract spatial structure elements that can be used to build the spatial structure are: ***IfcSite***, ***IfcBuilding***, ***IfcBridge***, ***IfcMarineFacility***, ***IfcRoad***, ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart*** and ***IfcRoadPart***.

Each ***IfcElement*** must belong to zero or one spatial structure element. The spatial structure is often used to provide a project structure to organise a project.

(j) An IFC file contains one and only one ***IfcProject***.

IfcProject defines the default units, what is know as the geometric representation context for the geometry of the objects (project coordinate system, precision for coordinates etc) and optionally, the phase of the project The top of all spatial structures must be assigned to the ***IfcProject***.

However, ***IfcProject*** is **NOT** top of the entity hierarchy.

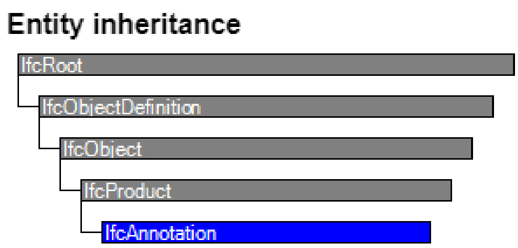
It's entity inheritance is:

IfcRoot >IfcObjectDefinition >IfcContext >IfcProject

The best way to understand the concept of IFC hierarchy and named attributes is to work through some examples and this will now be done for:

1. **a super string without pipes**

   A super string with no round or rectangular pipes has no area or volume and hence is mapped to an ***IfcAnnotation*** whose inheritance is given in the diagram below (taken from IFC 4x3).

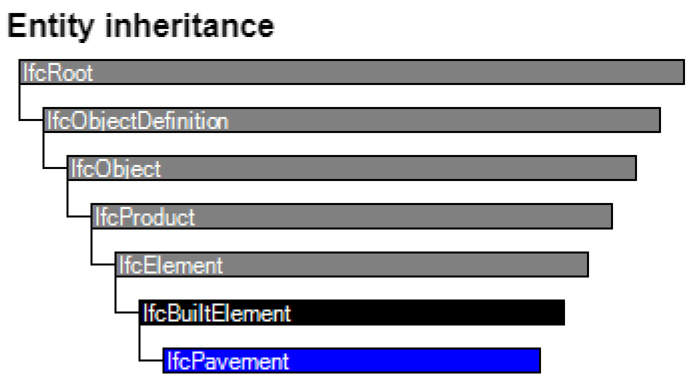


This diagram says that the hierarchy path for ***IfcAnnotation*** is:

IfcRoot >IfcObjectDefinition >IfcProduct >IfcAnnotation

2. **a trimesh representing a pavement**

   This is mapped to the an ***IfcPavement*** whose inheritance is given in the diagram below (taken from IFC 4x3).



   This diagram says that the hierarchy path for ***IfcPavement*** is:

   IfcRoot >IfcObjectDefinition >IfcProduct >IfcElement >IfcBuiltElement >IfcPavement

3. **a spatial structure for the project**

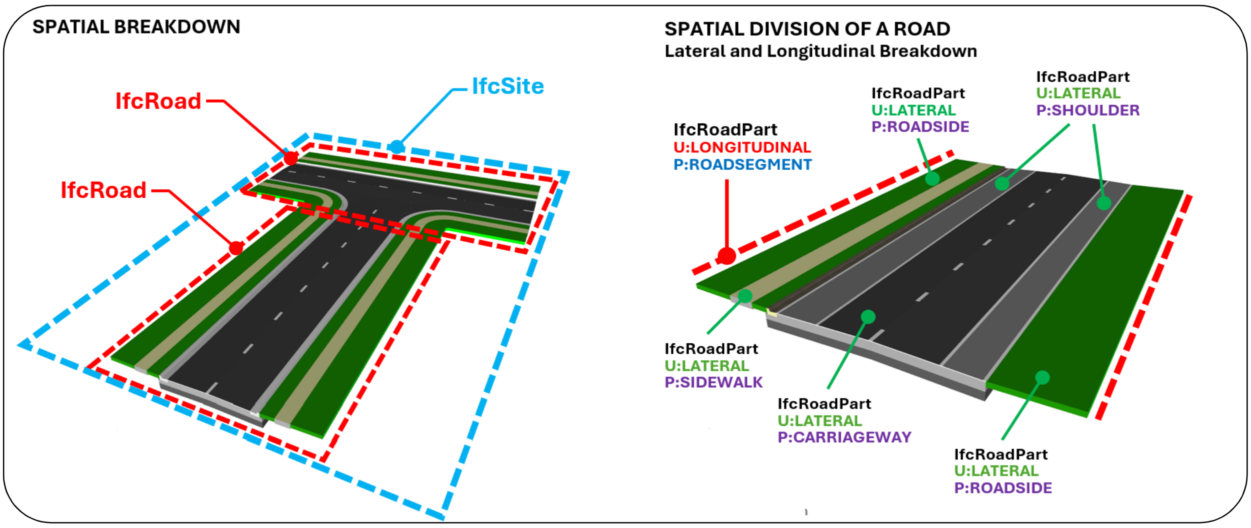
   In IFC a spatial structure can be used to provide a spatial organisation of a project.

   In ***IFC 4x3***, spatial structure was extended to linear infrastructure including **roads**, **rail**, **bridges**, and **marine** and the non-abstract spatial structure elements that can be used to build the spatial structure are: ***IfcSite***, ***IfcBuilding***, ***IfcBridge***, ***IfcMarineFacility***, ***IfcRoad***, ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart***, ***IfcRoadPart*** and ***IfcSpace***

   Each instance of an ***IfcProduct*** can only be in **zero** or **one** of the **spatial structure elements**.

   See 30.4.5 IFC Spatial Structure

.



Notes

1. A detailed discussion of the common entities used by ***12d Model*** in an IFC file is described in this chapter using text from the IFC Specifications. For each entity it describes how they are defined in the entity hierarchy and what are the named attributes (arguments) for the entity. This starts in 30.4.2 IfcRoot and SubTypes.
2. Some additional IFC entities are documented in 30.5 Some More IFC Entity Definitions.
3. For a discussion on what ***12d Model*** elements are output as what IFC entities, see 30.3 12d Model and IFC's.

Continue to 30.4.1 IFC STEP File Format or return to 30 BIM and Digital Engineering.

30.4.1 IFC STEP File Format

All IFC files can be written out in the International **ST**andard for the **E**xchange of **P**roduct model data (**STEP**) format, and for versions from IFC 4x0 and above, there is also an XML format.

As **STEP** is still the most commonly used IFC format in software, any examples of IFC files will only be given in the STEP format.

A brief summary of the structure of a STEP file will now be given so that IFC examples will make more sense but it is not necessary to understand the STEP format to produce IFC files from ***12d Model.***

An **important warning** is that STEP and IFC talk of "attributes" or "named attributes" but these are not the same as attributes in ***12d Model*** but are more like the arguments of a computer function. Instead IFC has **properties** which are the same as ***12d Model*** attributes.

Each record in a STEP file can be spread over a number of physical lines so a STEP record is terminated by a "**;**"

Comments in the STEP file are preceded by a "**/***" and continue to the end "**;**" unless terminated by "***/**"

A **STEP** file starts with the ISO version number followed by **two sections** - the **HEADER** and the **DATA** section.

The **HEADER** section contains the **FILE_DESCRIPTION**, **FILE_NAME**, **FILE_SCHEMA** and is terminated by **ENDSEC**.

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(
/* description */ ('ViewDefinition[ ]'),
/* implementation_level */ '2;1');
FILE_NAME(
/* name */ 'demo.ifc',
/* time_stamp */ '2020-11-18T13:52:09',
/* author */ ('Lee Gregory'),
/* organization */ ('12d Solutions'),
/* preprocessor_version */ ' IFC Engine rev 1198',
/* originating_system */ '12d Model',
/* authorization */ ' ');
FILE_SCHEMA (('IFC4x3'));
ENDSEC;
```

The **DATA** section contains application data according to one specific express schema. For example, IFC4x3.

The encoding of this data follows some simple principles:

Instance name:

Every entity instance in the exchange structure is given a unique name in the form **"#1234".** The **instance name** must consist of a **positive number**.

The instance name is only valid locally within the STEP file.

If the same content is exported again from a system the instance names may be different for the same instances.

The instance name is also used to reference other entity instances through attribute values or aggregate members. The referenced instance may be defined **before or after** the current instance. The **instance name** is followed by a "**=**".

For example,   #31=

Instances of entity data type

are represented by writing the name of the entity in **capital letters** and then followed by the IFC named attribute values in the defined order surrounded by **parentheses**. For example

IFCPROJECT**(**'04P1_IPYbDSOWnTArB5goB', #2, 'ifc Data', '', $, $, $, (#12), #7**)**

Unset attribute values are given as "$"

Enumeration, boolean and logical values

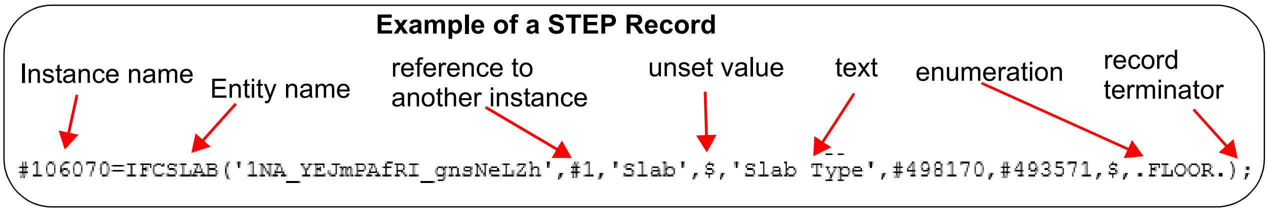
These are given in capital letters with a leading and trailing dot such as ".TRUE."

Text values are surrounded by quotes

For example,   'some text'

A list of items is the separate items separated by commas and then surrounded by parentheses.

For example, **(**#27, #51, #301**)** or **(**(1,0,0),(2,1,1),(3,2,1)**)** - a list of 3D points.



For some examples of parts of an IFC file, see

[30.4.2.1.2.1.1.1 IFC STEP File Format For IfcAnnotation](#)
[30.4.2.1.2.1.2.1.4.1 IFC STEP File Format For IfcSlab](#)
[30.4.4.3 Setting Up For Map Coordinates](#)

Continue to 30.4.2 IfcRoot and SubTypes or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.2 IfcRoot and SubTypes

IfcRoot is the root class for almost all entity definitions.

Definition from IFC 4x3:

IfcRoot is the most abstract and root class for all entity definitions that roots in the kernel or in subsequent layers of the IFC specification. It is therefore the common supertype of all IFC entities, beside those defined in an IFC resource schema.

All entities that are subtypes of IfcRoot can be used independently, whereas resource schema entities, that are not subtypes of IfcRoot, are not supposed to be independent entities.

IfcRoot is abstract and can not be instantiated.

IfcRoot **has four named attributes, *GlobalId* (Att 1), *OwnerHistory* (Att 2), *Name* (Att 3)and *Description (Att 4)* which are defined as:**

IfcRoot (4)			
1	GlobalId	IfcGloballyUniqueId	Assignment of a globally unique identifier within the entire software world.
2	OwnerHistory	OPTIONAL IfcOwnerHistory	Assignment of the information about the current ownership of that object, including owning actor, application, local identification and information captured about the recent changes of the object, NOTE Only the last modification is stored - either as addition, deletion or modification.
3	Name	OPTIONAL IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
4	Description	OPTIONAL IfcText	Optional description, provided for exchanging informative comments.

Two of these named attributes will be mentioned again and again.

GlobalId

The named attribute ***GlobalId*** is unique within the entire software world and what that means is that ***every entity derived*** from ***IfcRoot*** is uniquely tagged. Unfortunately ***GlobalId***s are not human friendly. For example, ***2518seZTTD8Rf0_Pc9se$o***. In civil infrastructure the Name is more usable.

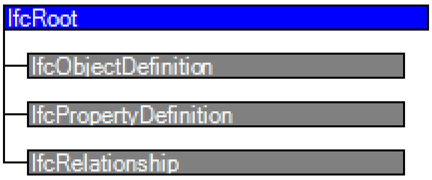
Name

The named attribute ***Name*** (IfcRoot.Name) is **optional** which is unfortunate as it is more friendly that GlobalId.

In ***12d Model***, all ***12d Model*** elements written out to IFC go to entities derived from ***IfcRoot*** and the name of the element is written out to that entity's named attribute ***Name***. See 30.3.1 Representing 12d Model Elements in IFC.

When an IFC file is read into ***12d Model***, the entity's ***Name*** is used as the name of the created ***12d Model*** element.

Entities directly derived from ***IfcRoot***



30.4.2.1 IfcObjectDefinition

30.4.7 IFC Property Sets, IFC Properties and Psets

30.4.6 IfcRelationship

Continue to 30.4.2.1 IfcObjectDefinition or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1 IfcObjectDefinition

IfcRoot >IfcObjectDefinition

Definition from IFC 4x3:

*An **IfcObjectDefinition** is the generalization of any semantically treated thing or process, either being a type or an occurrence.*

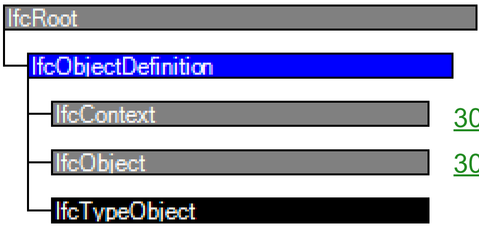
*Object definitions can be **named**, using the **inherited Name attribute** from **IfcRoot** which should be a user recognizable label for the object occurrence. Further explanations to the object can be given using the inherited Description attribute. A context is a specific kind of object definition as it provides the project or library context in which object types and object occurrences are defined.*

IfcObjectDefinition is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

There are no additional named attributes for *IfcObjectDefinition*

Entities directly derived from ***IfcObjectDefinition***



30.4.2.1.1 IfcContext

30.4.2.1.2 IfcObject

Continue to 30.4.2.1.1 IfcContext or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.1 IfcContext

IfcRoot >IfcObjectDefinition >IfcContext

Definition from IFC 4x3:

IfcContext is the generalization of a project context in which objects, type objects, property sets, and properties are defined.

*The **IfcProject** as subtype of IfcContext provides the context for all information on a construction project, it may include one or several IfcProjectLibrary's as subtype of IfcContext to register the included libraries for the project. A library of products that is referenced is declared within the IfcProjectLibrary as the context of that library.*

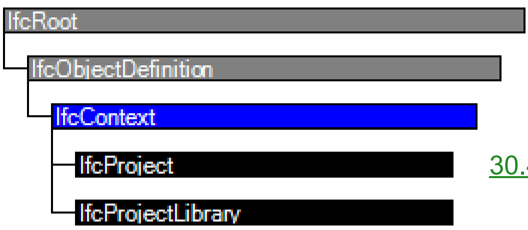
IfcContext is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

***IfcContext* has four additional named attributes *ObjectType* (Att 5), *LongName* (Att 6), *Phase* (Att 7) and *RepresentationContexts* *(Att 8)*:**

IfcContext (7)			
5	ObjectType	OPTIONAL IfcLabel	The object type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes.
6	LongName	OPTIONAL IfcLabel	Long name for the context as used for reference purposes.
7	Phase	OPTIONAL IfcLabel	Current project phase, or life-cycle phase of this project. Applicable values have to be agreed upon by view definitions or implementer agreements.
8	RepresentationContexts see 30.4.2.1.1.1 IfcRepresentationContext	OPTIONAL SET [1:?] OF IfcRepresentationContext	Context of the representations used within the context. When the context is a project and it includes shape representations for its components, one or several geometric representation contexts need to be included that define e.g. the world coordinate system, the coordinate space dimensions, and/or the precision factor.
9	UnitsInContext	OPTIONAL IfcUnitAssignment	Units globally assigned to measure types used within the context.

The entities directly derived from *IfcContext* are



30.4.2.1.1.2 IfcProject

Continue to 30.4.2.1.1.1 IfcRepresentationContext or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.2.1.1.1 IfcRepresentationContext

IfcRepresentationContext

Definition from IFC 4x3:

*The **IfcRepresentationContext** defines the context to which the **IfcRepresentation** of a product is related.*

IfcRepresentationContext is abstract and can not be instantiated.

***IfcRepresentationContext* has two named attributes *ContextIdentifier* (Att 1), *ContextType* (Att 2):**

IfcRepresentationContext (3)			
1	ContextIdentifier	OPTIONAL IfcLabel	The optional identifier of the representation context as used within a project.
2	ContextType	OPTIONAL IfcLabel	The description of the type of a representation context. The supported values for context type are to be specified by implementers agreements.

Entities directly derived from ***IfcRepresentationContext***

Entity inheritance

IfcRepresentationContext

IfcGeometricRepresentationContext 30.4.2.1.1.1.1

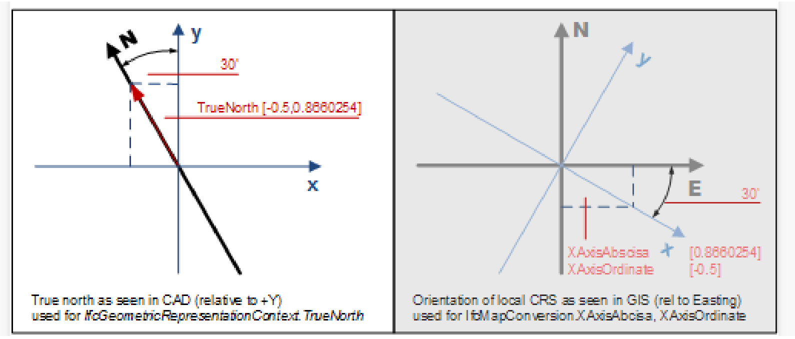
Continue to 30.4.2.1.1.1.1 IfcGeometricRepresentationContext or return to30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.2.1.1.1.1 IfcGeometricRepresentationContext

IfcRepresentationContext >**IfcGeometricRepresentationContext**

Definition from IFC 4x3:

*The **IfcGeometricRepresentationContext** defines the context that applies to several shape representations of products within a project. It defines the type of the context in which the shape representation is defined, and the numeric precision applicable to the geometric representation items defined in this context. In addition it can be used to offset the project coordinate system from a global point of origin, using the **WorldCoordinateSystem** attribute. The main representation context may also provide the true north direction.*



From 12d: In the situation in the diagram on the right, a 30.4.4.2.4.1 IfcProjectedCRS is used and consequently the Geodetic (Horizontal) datum, Vertical datum map projection and zone is fully defined. And so Eastings and Northings are fully defined. In the Easting-Northing diagram, the **N** axis is **Grid North** and **not True North**.

The use of **one instance** of ***IfcGeometricRepresentationContext*** to represent the **model** (**3D**) view is **mandatory**. The use of a second instance of ***IfcGeometricRepresentationContext*** to represent the plan (2D) view is optional (but needs to be given, if there are scale dependent plan views).

Use of representation contexts defined at 30.4.2.1.1.2 IfcProject for 3D model and 2D plan context, including sub context definitions for different target scales. There shall always be a **maximum of one geometric representation context** for **2D** and for **3D** coordinate space.

From 12d: I think that says for 3D it is mandatory to have one, and only one, 3D coordinate space.

Name attributes 1, 2 See 30.4.2.1.1.1 IfcRepresentationContext

***IfcGeometricRepresentationContext* has four additional named attributes *CoordinateSpaceDimension* (Att 3), *Precision* (Att 4), *WorldCoordinateSystem* (Att 5), *TrueNorth* (Att 6)**

IfcGeometricRepresentationContext (6)			
3	CoordinateSpaceDimension	IfcDimensionCount	The integer dimension count of the coordinate space modeled in a geometric representation context.
4	Precision	OPTIONAL IfcReal	Value of the model precision for geometric models. It is a double value (REAL), typically in 1E-5 to 1E-8 range, that indicates the tolerance under which two given points are still assumed to be identical. The value can be used e.g. to sets the maximum distance from an edge curve to the underlying face surface in brep models.

5	WorldCoordinateSystem	IfcAxis2Placement	Establishment of the engineering coordinate system (often referred to as the world coordinate system in CAD) for all representation contexts used by the project.

NOTE: It can be used to provide better numeric stability if the placement of the building(s) is far away from the origin. In most cases however it would be set to origin: (0.,0.,0.) and directions x(1.,0.,0.), y(0.,1.,0.), z(0.,0.,1.).

If an geographic placement is provided using ***IfcMapConversion*** then the ***WorldCoordinateSystem*** attribute is used to define the offset between the zero point of the local engineering coordinate system and the geographic reference point to which the ***IfcMapConversion*** offset relates. In preferred practise both points (also called "project base point" and "survey point") should be coincidental. However it is possible to offset the geographic reference point from the local zero point

12d: I'm not certain what this means.

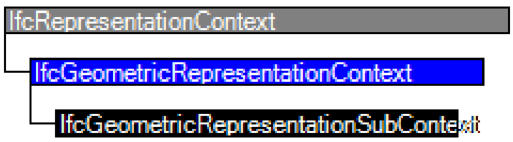
6	TrueNorth	OPTIONAL IfcDirection	Direction of the true north, or geographic northing direction, relative to the underlying project coordinate system. It is given by a 2 dimensional direction within the xy-plane of the project coordinate system. If not present, it defaults to 0. 1., meaning that the positive Y axis of the project coordinate system equals the geographic northing direction.

NOTE: If a geographic placement is provided using ***IfcMapConversion*** then the true north is for information only. In case of inconsistency, the value provided with ***IfcMapConversion*** shall take precedence.

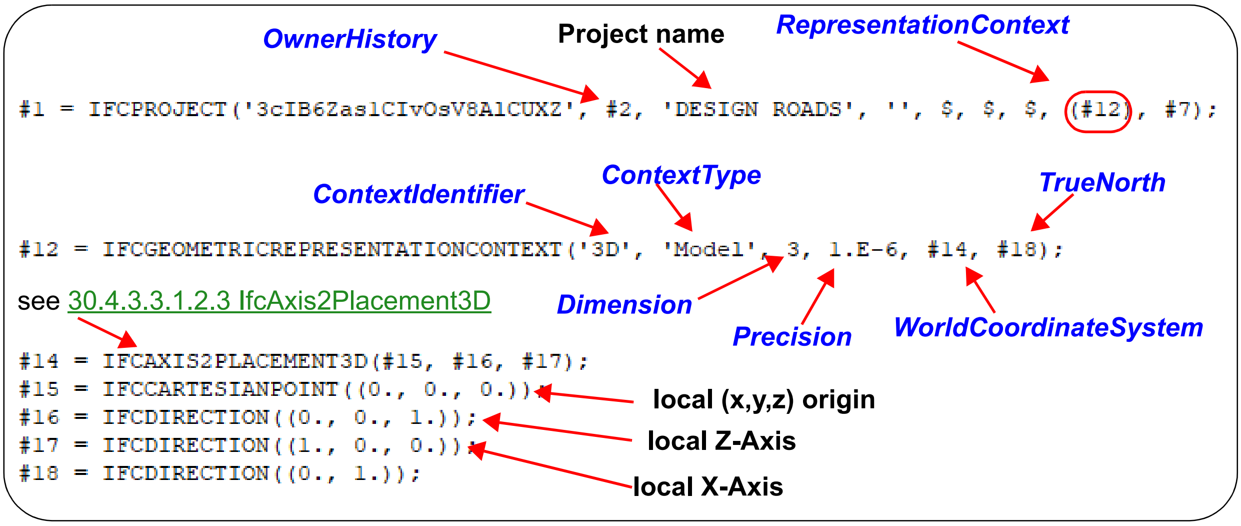
12d: There is no *True North* in *IfcMapConversion*.

Entities directly derived from ***IfcGeometricRepresentationContext***

Entity inheritance



A record in the IFC STEP file for ***IfcGeometricRepresentationContext*** is:



Continue to 30.4.2.1.1.2 IfcProject or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.1.2 IfcProject

IfcRoot >IfcObjectDefinition >IfcContext ***>IfcProject***

Definition from IFC 4x3

IfcProject *establishes the context for information to be exchanged or shared, and it may represent a construction project but does not have to.*

The IfcProject's main purpose in an exchange structure is to provide the root instance and the context for all other information items included.

There are no additional named attributes for IfcProject

Important Rules for IfcProject:

1. There is **only one *IfcProject*** in an IFC file.
2. The named attribute called ***Name*** for ***IfcProject*** must have a **non-blank value**. It is the short name for the project.

The context provided by the ***IfcProject*** includes:

(a) project phase

Named attribute 7 ***Phase***

(b) the default units

Named attribute 9 ***UnitsinContext***

(c) the geometric representation contexts for exchange structures including shape representations

Named attribute 8 ***IfcRepresentationContexts*** which is a set of one or more ***IfcRepresentationContext*** of which the only non-abstract subtype is currently 30.4.2.1.1.1.1 IfcGeometricRepresentationContext.

Each geometric representation context (30.4.2.1.1.1.1 IfcGeometricRepresentationContext) adds

(d) the coordinate space dimension

Named attribute 3 ***CoordinateSpaceDimension*** in ***IfcGeometricRepresentationContext***.

(e) the precision used within the geometric representations

Named attribute 4 ***Precision*** in ***IfcGeometricRepresentationContext***.

(f) the project coordinate system

Named attribute 5 ***WorldCoordinateSystem*** in ***IfcGeometricRepresentationContext***.

(g) optionally the indication of the true north

Named attribute 6 ***TrueNorth*** in ***IfcGeometricRepresentationContext***.

(h) optionally the conversion between the project coordinate system and the geospatial coordinate reference system.

Using a subtype of ***IfcCoordinateReferenceSystem*** (***e.g. IfcProjectedCRS***) and a subtype of ***IfcCoordinateOperation*** (e.g. ***IfcRigidOperation*** or ***IfcMapConversionScaled***) to provide the transformation from the ***WorldCoordinateSystem*** to the ***IfcCoordinateReferenceSystem.***

Although there are no additional named Attributes for *IfcProject*, it inherits eight named Attributes:

IfcRoot (4)			
1	GlobalId	IfcGloballyUniqueId	Assignment of a globally unique identifier within the entire software world.
2	OwnerHistory	OPTIONAL IfcOwnerHistory	Assignment of the information about the current ownership of that object, including owning actor, application, local identification and information captured about the recent changes of the object, NOTE Only the last modification is stored - either as addition, deletion or modification.
3	Name can't be optional for ***IfcProject***	OPTIONAL IfcLabel	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
4	Description	OPTIONAL IfcText	Optional description, provided for exchanging informative comments.

IfcContext (7)			
5	ObjectType	OPTIONAL IfcLabel	The object type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes.
6	LongName	OPTIONAL IfcLabel	Long name for the context as used for reference purposes.
7	Phase	OPTIONAL IfcLabel	Current project phase, or life-cycle phase of this project. Applicable values have to be agreed upon by view definitions or implementer agreements.
8	RepresentationContexts see 30.4.2.1.1.1 IfcRepresentationContext	OPTIONAL SET [1:?] OF IfcRepresentationContext	Context of the representations used within the context. When the context is a project and it includes shape representations for its components, one or several geometric representation contexts need to be included that define e.g. the world coordinate system, the coordinate space dimensions, and/or the precision factor.
9	UnitsInContext	OPTIONAL IfcUnitAssignment	Units globally assigned to measure types used within the context.

Within the ***IfcProject***, a spatial structure is defined and it is a strict hierarchical structure. See 30.4.5 IFC Spatial Structure.

Continue to 30.4.2.1.1.2.1 IFC STEP File Format For IfcProject or return to 30.4 Structure of IFC.

30.4.2.1.1.2.1 IFC STEP File Format For IfcProject

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcProject*** is:

OwnerHistory **Project name** *RepresentationContext* **Two of them**

```
#1 = IFCPROJECT('04P1_IPYbDSOWnTArB5goB', #2, 'ifc Data', '', $, $, $, (#12, #375), #7);

#2 = IFCOWNERHISTORY(#3, #6, $, .NOCHANGE., $, $, $, 1727696961);
#3 = IFCPERSONANDORGANIZATION(#4, #5, $);
#4 = IFCPERSON($, $, 'lee.gregory', $, $, $, $, $);
#5 = IFCORGANIZATION($, '12d Solutions', '12d Solutions', $, $);
#6 = IFCAPPLICATION(#5, '15.0C1q', '12d Model', '12d Model');
#7 = IFCUNITASSIGNMENT((#8, #9, #10, #11));
#8 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#9 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#10 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#11 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);

#12 = IFCGEOMETRICREPRESENTATIONCONTEXT('3D', 'Model', 3, 1.E-6, #14, #18);
#13 = IFCLOCALPLACEMENT($, #14);
#14 = IFCAXIS2PLACEMENT3D(#15, #16, #17);
#15 = IFCCARTESIANPOINT((0., 0., 0.));
#16 = IFCDIRECTION((0., 0., 1.));
#17 = IFCDIRECTION((1., 0., 0.));
#18 = IFCDIRECTION((0., 1.));

#19 = IFCPROJECTEDCRS('EPSG:7856', 'MGA2020 Zone 56', $, 'EPSG:511', 'UTM', '56', $);

#20 = IFCRIGIDOPERATION(#12, #19, 0., 0., 0.);
```

Units

Dimension *Precision*

#12 is one of the RepresentationContexts
The other is at **#375**

#19 and **#20** say that when the IFC file is read in, the data is in MGA2020 and AHD

Continue to 30.4.2.1.2 IfcObject or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2 IfcObject

IfcRoot >IfcObjectDefinition >IfcObject

Definition from IFC 4x3:

*An **IfcObject** is the generalization of any semantically treated thing or process. Objects are things as they appear - i.e. occurrences.*

NOTE

*Examples of **IfcObject** include physically tangible items such as wall, beam or covering, physically existing items such as spaces, or conceptual items such as grids or virtual boundaries.*

It also stands for processes such as work tasks, for controls such as cost items, or for actors such as persons involved in the design process.

IfcContext is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

***IfcObject* has one additional named attribute *ObjectType* (Att 5):**

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it holds the user defined type, if the enumeration of the attribute *PredefinedType* is set to USERDEFINED or when the concrete entity instantiated does not have a PredefinedType attribute. The latter is the case in some exceptional leaf classes and when instantiating IfcBuiltElement directly.

Because ***IfcObject*** is derived from ***IfcRoot***, due to inheritance it automatically has the four attributes from ***IfcRoot*** as well. That is, ***IfcObject*** has a total of five (5) named attributes.

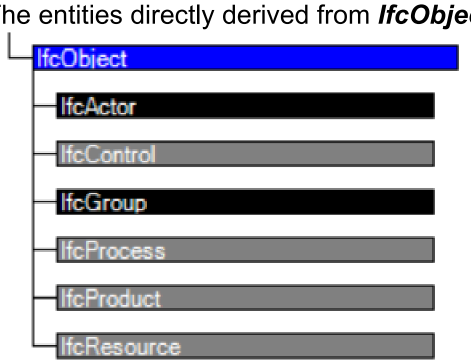
Objects can be named, using the inherited ***Name*** attribute (att 1), which should be a user recognizable label for the object occurrence. Further explanations to the object can be given using the inherited ***Description*** attribute (att 4).

The ***ObjectType*** attribute is used:

(a) to store the user defined value for all subtypes of ***IfcObject***, where a ***PredefinedType*** attribute is given, and its value is set to **USERDEFINED.**

(b) to provide a type information (could be seen as a very lightweight classifier) of the subtype of ***IfcObject***, if no ***PredefinedType*** attribute is given. This is often the case, if no comprehensive list of predefined types is available.

The entities directly derived from ***IfcObject*** are



Because ***IfcObject*** is derived from ***IfcRoot***, due to inheritance it automatically has the four attributes from ***IfcRoot*** as well.

Continue to 30.4.2.1.2.1 IfcProduct or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1 IfcProduct

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct

Definition from IFC 4x3:

*The IfcProduct is an **abstract** representation of any object that relates to a geometric or spatial context. An IfcProduct occurs at a specific location in space if it has a geometric representation assigned.*

*It can be placed relatively to other products, but ultimately relative to the project coordinate system. The ObjectPlacement attribute establishes the coordinate system in which all points and directions used by the geometric representation items under Representation are founded. The Representation is provided by an **IfcProductDefinitionShape** being either a geometric shape representation, or a topology representation (with or without underlying geometry of the topological items).*

*Products include manufactured, supplied or created objects (referred to as **elements**) for incorporation into an AEC/FM project. This also includes objects that are created indirectly by other products, as spaces are defined by bounding elements. Products can be designated for permanent use or temporary use, an example for the latter is formwork. Products are defined by their properties and representations.*

*In addition to **physical products** (covered by the subtype 30.4.2.1.2.1.2 IfcElement) and **spatial items** (covered by the subtype 30.4.5.2.1 IfcSpatialStructureElement) the IfcProduct also includes non-physical items, that relate to a geometric or spatial contexts, such as grid, port, annotation, structural actions, etc.*

IfcProduct is abstract and can not be instantiated.

From 12d

12d Model mainly uses *IfcProduct* which represents occurrences in space such as physical building elements and spatial locations.

IfcProduct is the **base class** for all physical objects and is subdivided into:

(a) physical elements

Physical building elements include IfcKerb, IfcCourse, IfcPavement, IfcWall *etc*.

(b) spatial items

The non-abstract spatial items used are ***IfcSite***, ***IfcBuilding***, ***IfcBridge***, ***IfcMarineFacility***, ***IfcRoad***, ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart*** and ***IfcRoadPart***

The spatial structure elements are linked together, and to the *IfcProject*, by using the objectified relationships ***IfcRelContainedInSpatialStructure*** and ***IfcRelAggregates***.

(c) other concepts including ***IfcAnnotation***.

IfcProduct and any entities derived from it may have associated materials, **shape representations**, and **placements in space**.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

IfcProduct **has two additional named attributes *ObjectPlacement* (Att 6) and *Representation***

***(Att 7)* which are defined as:**

IfcProduct (5)			
6	ObjectPlacement	OPTIONAL IfcObjectPlacement	This establishes the object coordinate system and placement of the product in space. The placement can either be absolute (relative to the world coordinate system), relative (relative to the object placement of another product), or constrained (e.g. relative to grid axes, or to a linear positioning element). The type of placement is determined by the various subtypes of *IfcObjectPlacement*. An object placement must be provided if a representation is present.
7	Representation	OPTIONAL IfcProductRepresentation	Reference to the representations of the product, being either a representation (*IfcProductRepresentation*) or as a special case of a shape representation (*IfcProductDefinitionShape*). The product definition shape provides for multiple geometric representations of the shape property of the object within the same object coordinate system, defined by the object placement.

An ***IfcProduct*** occurs at a specific location in space **if** it has a geometric representation assigned by ***Representation***.

The attribute ***ObjectPlacement*** places the ***IfcProduct*** and it can be placed relatively to other products, but ultimately to the project coordinate system.

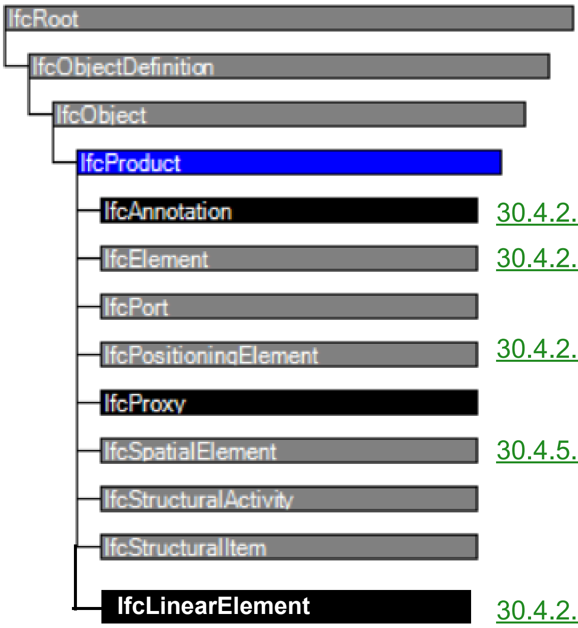
Because ***IfcProduct*** is derived from ***IfcObject***, due to inheritance it automatically has the five attributes from ***IfcObject***. That is, ***IfcProduct*** has a total of seven (7) named attributes.

So all IFC entities derived from ***IfcProduct*** can have an ***ObjectPlacement*** and a ***Representation***.

In fact, the **only IFC entities** that have a ***Representation*** (geometry) are entities derived from ***IfcProduct***. Hence any ***12d Model*** object with geometry that is to be written out to an IFC file **needs to be written out as an IFC Entity derived** from ***IfcProduct***. For a full list of entities derived from ***IfcProduct*** see 30.4.8 List of Non-Abstract Entities Derived from IfcProduct.

For more information on ***Representation*** and ***ObjectPlacement***, *see* 30.4.3 Representation (Geometry) for IFC Products *and* 30.4.4 Object Placement for IFC Products

Entities directly derived from ***IfcProduct***



30.4.2.1.2.1.1 IfcAnnotation

30.4.2.1.2.1.2 IfcElement

30.4.2.1.2.1.3 IfcPositioningElement

30.4.5.2 IfcSpatialElement

added in IFC 4x3 for parts of an Alignment

30.4.2.2.1 IfcLinearElement

At this point, the paths for ***a super string with no pipes*** and ***pavements*** diverge.

A ***a super string with no pipes*** has no area or volume and hence uses ***IfcProduct >IfcAnnotation***. See 30.4.2.1.2.1.1 IfcAnnotation.

A ***pavement*** has a volume and so is derived from ***Product >IfcElement***. See 30.4.2.1.2.1.2 IfcElement and 30.4.2.1.2.1.2.1.3 IfcPavement.

Continue to 30.4.2.1.2.1.1 IfcAnnotation or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.1 IfcAnnotation

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcAnnotation

Definition from IFC 4x3

An annotation is an information element within the geometric (and spatial) context of a project, that adds a note or meaning to the objects which constitutes the project model.

Annotations include additional points, curves, text, dimensioning, hatching and other forms of graphical notes. It also includes virtual or symbolic representations of additional model components, not representing products or spatial structures, such as survey points and lines, contour lines or similar.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

***IfcAnnotation* has one additional Named Attribute *PredefinedType* (Att 8) which is defined as:**

#	Attribute	Type	Cardinality	Description
8	PredefinedType	IfcAnnotationTypeEnum	?	

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcAnnotationTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcAnnotationTypeEnum***:

Type	Description
CONTOURLINE	Annotation used to illustrate lines connecting points of equal elevation or depth, on a map or chart. EXAMPLE Typically used in cartography, geography, or geology maps, where the spacing of lines at constant intervals of elevation may be used as an indication of slope.
DIMENSION	Annotation used to illustrate the measurement or size of an object, often accompanied by numerical values.
ISOBAR	Annotation used to illustrate lines connecting points of equal pressure on a map or chart. EXAMPLE Typically used on weather maps or to show pressure gradient in spaces, chambers or externally.
ISOLUX	Annotation used to illustrate lines connecting points of equal illuminance or light intensity. EXAMPLE Typically used in lighting design or photometry to show the distribution of illumination levels and/or day lighting in a space or externally.
ISOTHERM	Annotation used to illustrate lines connecting points of equal temperature on a map or chart. EXAMPLE Typically used in to show the heating or cooling distribution within a space or to show temperature distribution on a geographic map.

LEADER	Annotation that includes a line or arrow. EXAMPLE Typically used to connect an object to a specific point of reference or to an explanation.
SURVEY	Annotation used for survey information, such as survey points, survey lines or survey areas. EXAMPLE Typically used in surveying or mapping to indicate the location, elevation, or other relevant data about a specific point or area. NOTE The shape representation of the *IfcAnnotation* indicates if it is a survey point, survey line, survey area or any other type of representation connected to survey.
SYMBOL	Annotation that employs graphical symbols or icons to represent specific meanings.
TEXT	A textual annotation.
USERDEFINED	User-defined type
NOTDEFINED	Undefined type.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcAnnotation is the end of the hierarchy and when used, has a total of eight (8) named attributes.

1	GlobalId	IfcGloballyUniqueId		Assignment of a globally unique identifier within the entire software world.
2	OwnerHistory	IfcOwnerHistory	?	Assignment of the information about the current ownership of that object, including owning actor, application, local identification and information captured about the recent changes of the object, NOTE only the last modification in stored - either as addition, deletion or modification. IFC4 CHANGE The attribute has been changed to be OPTIONAL.
3	Name	IfcLabel	?	Optional name for use by the participating software systems or users. For some subtypes of IfcRoot the insertion of the Name attribute may be required. This would be enforced by a where rule.
4	Description	IfcText	?	Optional description, provided for exchanging informative comments.
5	ObjectType	IfcLabel	?	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it holds the user defined type, if the enumeration of the attribute *PredefinedType* is set to USERDEFINED.
6	ObjectPlacement	IfcObjectPlacement	?	Placement of the product in space, the placement can either be absolute (relative to the world coordinate system), relative (relative to the object placement of another product), or constraint (e.g. relative to grid axes). It is determined by the various subtypes of IfcObjectPlacement, which includes the axis placement information to determine the transformation for the object coordinate system.
7	Representation	IfcProductRepresentation	?	Reference to the representations of the product, being either a representation (IfcProductRepresentation) or as a special case a shape representations (IfcProductDefinitionShape). The product definition shape provides for multiple geometric representations of the shape property of the object within the same object coordinate system, defined by the object placement.
8	PredefinedType	IfcAnnotationTypeEnum	?	

Note that ***IfcAnnotation*** is derived from ***IfcProduct*** and so can have a **placement** as its sixth (6th) named attribute ***ObjectPlacement*** and a ***geometric representation*** as its seventh (7th) attribute ***Representation*** (see 30.4.2.1.2.1 IfcProduct).

For an example of how an instance of ***IfcAnnotation*** is written in an IFC STEP file, see 30.4.2.1.2.1.1.1 IFC STEP File Format For IfcAnnotation.

Continue to 30.4.2.1.2.1.1.1 IFC STEP File Format For IfcAnnotation or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.1.1 IFC STEP File Format For IfcAnnotation

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcAnnotation*** is:

Att 1 ***GlobalId*** Att 3 ***Name*** Att 5 ***ObjectType*** Att 7 ***Representation***

```
#26 = IFCANNOTATION('3vIdY8TiT4KRhDYbKOxxMH', #2, 'EB', $, 'Super', #13, $, .NOTDEFINED.);
```

Att 2 ***OwnerHistory*** Att 4 ***Description*** Att 8 ***PredefinedType***
Att 6 ***ObjectPlacement***

This example shows how a STEP file is interpreted.

In line #26 defining the string **EB**, the named attribute **Representation** has no value.

However, the next line **#27** has a **IFCRELNESTS** which defines part of the geometry for #26.

#27 says the string EB (#26) is made of three objects defined at lines #28, #42 and #53, and in that order.

Line #28 says that the object #28 is an IfcAnnotation and its geometry is given at line #29.

Line #29 says that the geometry is given in #31.

And #31 says that it is a straight line between the points (IfcCartesianPoint) given in #32 and #33.

.

```
#26 = IFCANNOTATION('3vIdY8TiT4KRhDYbKOxxMH', #2, 'EB', $, 'Super', #13, $, .NOTDEFINED.);
#27 = IFCRELNESTS('1e4aLcSdD8_xaCPA2mfrH0',#2,'EB Segments','',#26,(#28, #42, #53));
#28 = IFCANNOTATION('21Cfy4$1D6MuwaymL20M6y',#2,'EB Segment','Segment 1','Segment',#13,#29,.USERDEFI
#29 = IFCPRODUCTDEFINITIONSHAPE($, $, (#30));
#30 = IFCSHAPEREPRESENTATION(#12, 'Body', 'GeometricCurveSet', (#31));
#31 = IFCPOLYLINE((#32, #33));
#32 = IFCCARTESIANPOINT((256289.629711436, 7411453.74757743, 30.2009382707654));
#33 = IFCCARTESIANPOINT((256287.497183447, 7411451.93310109, 30.1449382707654));
```

In #26 the named attribute PredefinedType is **NOTDEFINED**.

But in **#28** which is also an IfcAnnotation, the *PredefinedType* is **USERDEFINED** and the user defined value is given as Attribute 5 and is **Segment**.

```
#26 = IFCANNOTATION('3vIdY8TiT4KRhDYbKOxxMH', #2, 'EB', $, 'Super', #13, $, .NOTDEFINED.);
#27 = IFCRELNESTS('1e4aLcSdD8_xaCPA2mfrH0',#2,'EB Segments','',#26,(#28, #42, #53));
#28 = IFCANNOTATION('21Cfy4$1D6MuwaymL20M6y',#2,'EB Segment','Segment 1','Segment',#13,#29,.USERDEFINED.);
#29 = IFCPRODUCTDEFINITIONSHAPE($, $, (#30));
#30 = IFCSHAPEREPRESENTATION(#12, 'Body', 'GeometricCurveSet', (#31));
#31 = IFCPOLYLINE((#32, #33));
```

Att 5

Continue to 30.4.2.1.2.1.2 IfcElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2 IfcElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement

Definition from IFC 4x3

An element is a *generalization of all components that make up a facility.*

Elements are physically existent objects, although they might be void elements, such as holes.

Elements either remain permanently in the facility, or only temporarily, as formwork does. Elements can be either assembled on site or premanufactured and built in on site.

EXAMPLES of elements in a building construction context are walls, floors, windows and recesses.

IfcElement is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

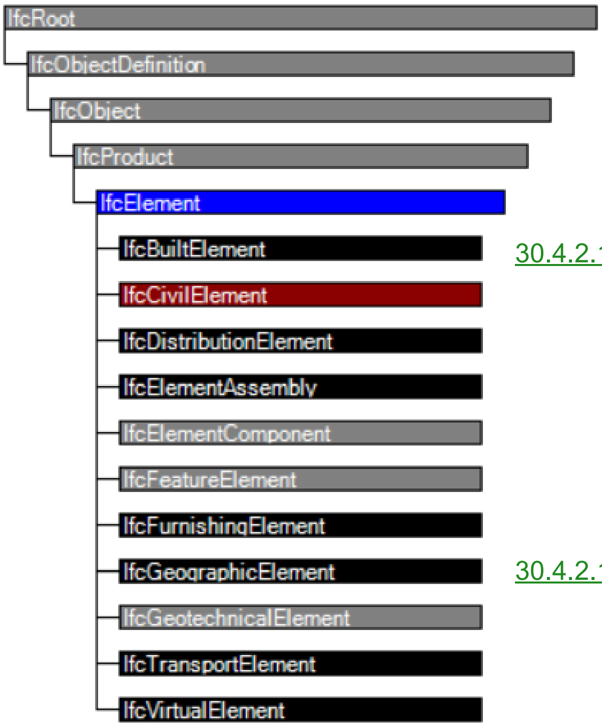
IfcElement has one additional Named Attribute *Tag* (Att 8) which is defined as:

IfcElement				
8	Tag	IfcIdentifier	?	The tag (or label) identifier at the particular instance of a product, e.g. the serial number, or the position number. It is the identifier at the occurrence level.

The elements can be logically contained by a spatial structure element that constitutes a certain level within a project structure hierarchy (site, building, storey or space). This is done by using the ***IfcRelContainedInSpatialStructure*** relationship. An element can have material and quantity information assigned through the ***IfcRelAssociatesMaterial*** and ***IfcRelDefinesByProperties*** relationship.

In addition an element can be declared to be a specific occurrence of an element type (and thereby be defined by the element type properties) using the ***IfcRelDefinesByType*** relationship. An element can also be defined as an element assembly that is a group of semantically and topologically related elements that form a higher level part of the facility. Those element assemblies are defined by virtue of the ***IfcRelAggregates*** and ***IfcRelNests*** relationship.

Entities directly derived from ***IfcElement***



30.4.2.1.2.1.2.1 IfcBuiltElement

30.4.2.1.2.1.2.2 IfcGeographicElement

Note that ***IfcElement*** is derived from ***IfcProduct*** and so can have a **placement** as its sixth (6th) named attribute ***ObjectPlacement*** and a ***geometric representation*** as its seventh (7th) attribute ***Representation*** (see 30.4.2.1.2.1 IfcProduct).

Important Note

Standard Surveying and Civil Design items such as ***12d Model*** strings without diameters (points, polylines and polygons) are **NOT** ***IfcElements***. They are **IfcAnnotation**.

Some BIM software will not display IfcAnnotation.

Continue to 30.4.2.1.2.1.2.1 IfcBuiltElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1 IfcBuiltElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement

Definition from ISO 6707-1:1989: *Major functional part of a building, examples are foundation, floor, roof, wall*.

Definition from IFC 4x3:

The built element comprises all elements that are primarily part of the construction of a built facility, i.e., its structural and space separating system. Built elements are all ***physically existent*** *and* ***tangible*** *things.*

This ***IfcBuiltElement*** is a generalization of all elements that are major functional parts of the structural or space separation system of a built facility. Typical examples of ***IfcBuiltElement*** entities are (among others):

- built elements within a space separation system
- built elements within an enclosure system (such as a facade)
- built elements within a fenestration system
- built elements within a load bearing system
- built elements within a foundation system
- built elements within an infrastructure facility

EXAMPLES: built elements are curtain wall, doors, and others in case of buildings; walls, columns, pile, beams in case of buildings or infrastructure works; bearings in case of bridges; **pavements** in case of roads or **rails** in case of railways.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

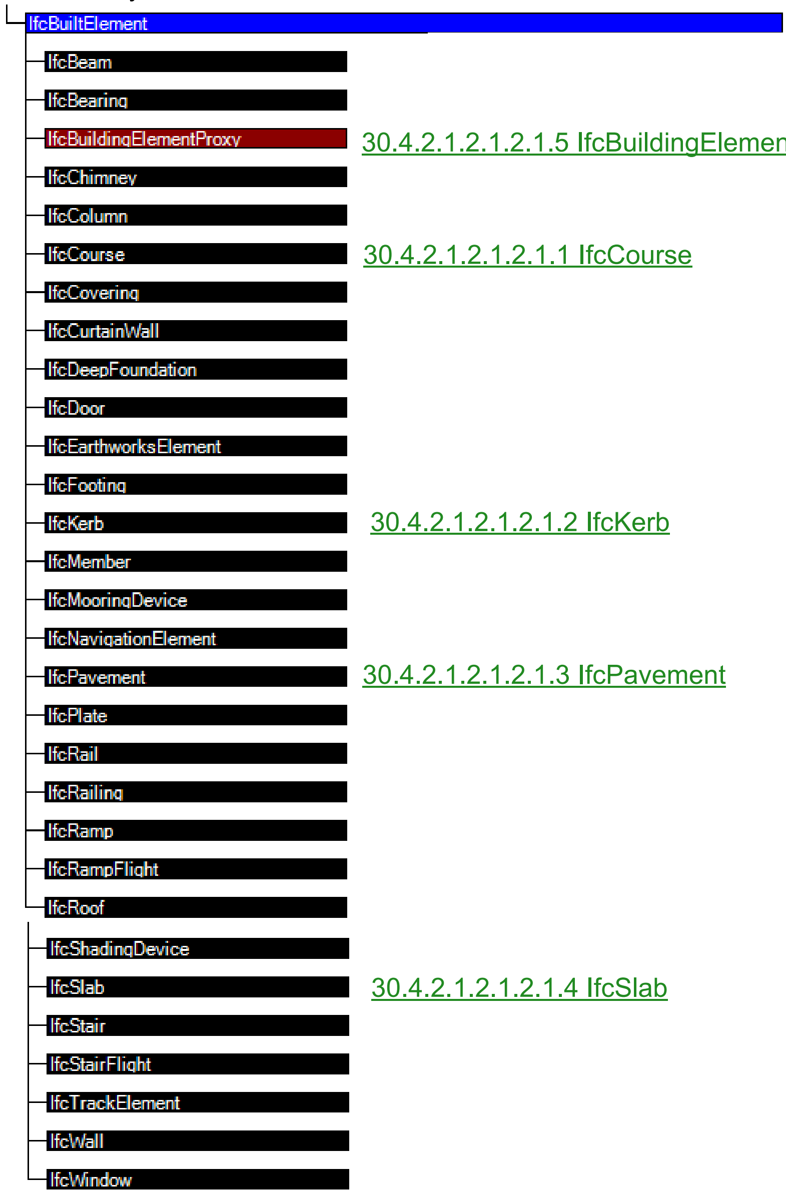
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

There are no additional IFC Named Attributes for IfcBuiltElement

Entities directly derived from ***IfcBuiltElement***



30.4.2.1.2.1.2.1.5 IfcBuildingElementProxy
30.4.2.1.2.1.2.1.1 IfcCourse
30.4.2.1.2.1.2.1.2 IfcKerb
30.4.2.1.2.1.2.1.3 IfcPavement
30.4.2.1.2.1.2.1.4 IfcSlab

IfcBuiltElement has no additional named attributes but because it is derived from ***IfcElement***, it automatically has eight (8) named attributes.

IfcBuiltElement is used for items that are not covered by any of the entities derived from ***IfcBuiltElement***.

Note that ***IfcBuiltElement*** is derived from ***IfcElement*** which is derived from ***IfcProduct*** and so can have a **placement** as its sixth (6th) named attribute ***ObjectPlacement*** and a ***geometric representation*** as its seventh (7th) attribute ***Representation*** (see 30.4.2.1.2.1 IfcProduct).

IfcBuldingElementProxy was going to be deprecated in IFC 4x3 but that didn't happen.

Continue to 30.4.2.1.2.1.2.1.1 IfcCourse or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.1 IfcCourse

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement >IfcCourse

Definition from IFC 4x3:

A built element whose length greatly exceeds its thickness and often also its width, usually of a single material laid on site on top of another horizontal or nearly horizontal built element.

A course is distinctive from a earthworks element in that a course is a graded granular (which can be bound or unbound) material that is generally processed in some fashion, where as earthworks elements are soil earthen based structure that can be formed by removal and transport of general ground material.

*Structurally a course does not have capacity to carry loads over open span, or to be removed or replaced as a single unit. examples of courses include: * Graded aggregate layers * Graded sand layers * Cement bounded material (CBM) * Asphalt layers.*

See also 30.4.2.1.2.1.2.1.2 IfcKerb and 30.4.2.1.2.1.2.1.3 IfcPavement.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

***IfcCourse* has one additional named attribute *PredefinedType*:**

IfcCourse (1)			
9	PredefinedType	OPTIONAL IfcCourseTypeEnum	Identifies the predefined type of a course element. This type may associate additional specific property sets. NOTE The PredefinedType shall only be used, if no *IfcCourseType* is assigned, providing its own *IfcCourseType*.PredefinedType.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification. That is, ***PredefinedType*** must be one of the following values:

Type	Description
ARMOUR	An Aggregate layer whose primary function is to protect against erosion of the underlying material by water e.g. riprap. NOTE Definition from ISO 21650: protective layer on a breakwater, seawall or other rubble mound structures composed of armour units
BALLASTBED	Layer composed of broken stones under the sleepers.
CORE	A core course is the bulk internal structure of aggregate structures.
FILTER	An Intermediate layer whose primary function is to prevent the washing through of fine materials.
PAVEMENT	A layer within a pavement structure that forms a paved area or road.
PROTECTION	Layer with the primary task to provide protection against erosion and scour.

USERDEFINED	User-defined type
NOTDEFINED	Undefined type.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcCourse is the end of the hierarchy and when used, has a total of nine (9) named attributes.

Continue to 30.4.2.1.2.1.2.1.2 IfcKerb or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.2 IfcKerb

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement ***>IfcBuiltElement >IfcKerb***

Definition from IFC 4x3:

A border of stone, concrete or other rigid material formed at the edge of the carriageway or footway.

See also 30.4.2.1.2.1.2.1.1 IfcCourse and 30.4.2.1.2.1.2.1.3 IfcPavement.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

***IfcKerb* has one additional named attribute *PredefinedType*:**

IfcKerb (1)			
9	PredefinedType	OPTIONAL IfcKerbTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types. NOTE If the object has an associated IfcTypeObject with a *PredefinedType*, then this attribute shall not be used.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification. That is, ***PredefinedType*** must be one of the following values:

Type	Description
USERDEFINED	User-defined type.
NOTDEFINED	Undefined type.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcKerb is the end of the hierarchy and when used, has a total of nine (9) named attributes.

Continue to 30.4.2.1.2.1.2.1.3 IfcPavement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.3 IfcPavement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement >IfcPavement

Definition from IFC 4x3:

Type of built element in a road or other paved area to provide an even surface sustaining loads from vehicles or pedestrians, usually comprising several courses.

See also 30.4.2.1.2.1.2.1.1 IfcCourse and 30.4.2.1.2.1.2.1.2 IfcKerb.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

***IfcPavement* has one additional named attribute *PredefinedType*:**

IfcPavement (1)			
9	PredefinedType	OPTIONAL IfcPavementTypeEnum	Identifies the predefined type of a pavement element. This type may associate additional specific property sets. NOTE The PredefinedType shall only be used, if no IfcPavementType is assigned, providing its own IfcCourseType.PredefinedType.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification. That is, ***PredefinedType*** must be one of the following values:

Type	Description
FLEXIBLE	Pavement with a bituminous surfacing and with a base layer with or without a hydrocarbon binder. NOTE Definition according to PIARC
RIGID	Pavement substantially constructed of cement concrete. NOTE Definition according to PIARC
USERDEFINED	User-defined type.
NOTDEFINED	Undefined type.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcPavement is the end of the hierarchy and when used, has a total of nine (9) named attributes.

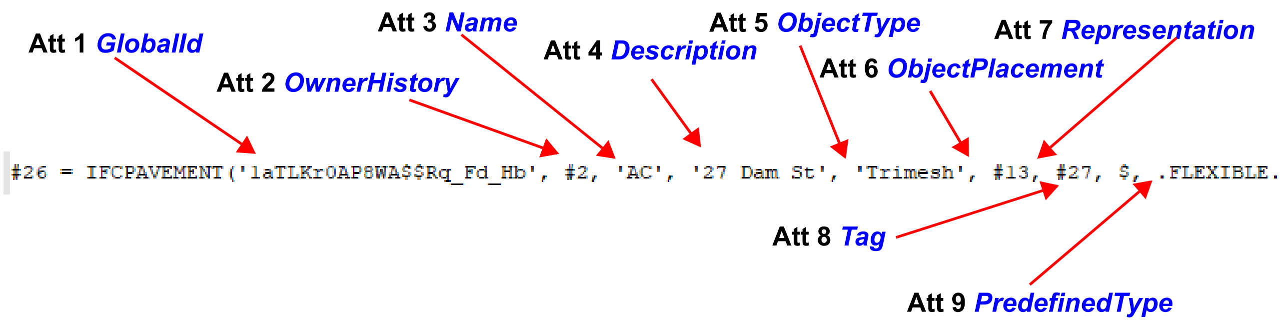
For an example of how an instance of ***IfcPavement*** is written in an IFC STEP file, see 30.4.2.1.2.1.2.1.3.1 IFC STEP File Format For IfcPavement.

Continue to 30.4.2.1.2.1.2.1.3.1 IFC STEP File Format For IfcPavement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

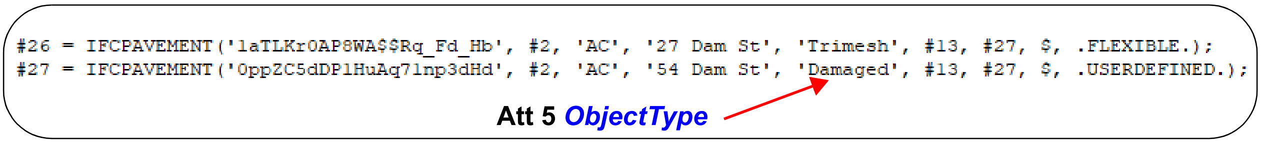
30.4.2.1.2.1.2.1.3.1 IFC STEP File Format For IfcPavement

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcPavement*** is:



And when *PredefinedType* is .USERDEFINED., the user defined value can be given as Attribute 5.



Continue to 30.4.2.1.2.1.2.1.4 IfcSlab or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.4 IfcSlab

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement >IfcSlab

Definition from IFC 4x3:

A slab is a component of the construction that may enclose a space vertically. The slab may provide the lower support (floor) or upper construction (roof slab) in any space in a building.

Only the core or constructional part of this construction is considered to be a slab. The upper finish (flooring, roofing) and the lower finish (ceiling, suspended ceiling) are considered to be coverings. A special type of slab is the landing, described as a floor section to which one or more stair flights or ramp flights connect.

A slab is a component of the construction that may enclose a space vertically. The slab may provide the lower support (floor) or upper construction (roof slab) in any space in a building.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

IfcSlab has one additional named attribute *PredefinedType* that is defined as:

IfcSlab				
9	PredefinedType	IfcSlabTypeEnum	?	Predefined generic type for a slab that is specified in an enumeration. There may be a property set given specifically for the predefined types. NOTE The *PredefinedType* shall only be used, if no IfcSlabType is assigned, providing its own *IfcSlabType.PredefinedType*.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification. That is, ***PredefinedType*** must be one of the following values:

Constant	Description
FLOOR	The slab is used to represent a floor slab or a bridge deck.
ROOF	The slab is used to represent a roof slab (either flat or sloped).
LANDING	The slab is used to represent a landing within a stair or ramp.
BASESLAB	The slab is used to represent a floor slab against the ground (and thereby being a part of the foundation). Another name is mat foundation.
APPROACH_SLAB	Iis part of bridge abutment providing transition from embankment to the bridge
PAVING	Rigid pavement course of a road or other paved area, usually concrete.
WEARING	The slab is used to represent a wearing surface.
SIDEWALK	The slab is used to represent a sidewalk.
TRACKSLAB	A track slab is a reinforced concrete slab or prestressed reinforced concrete slab, which is a main element of slab track. It can be prefabricated or cast on site and may have sleepers embedded.
USERDEFINED	
NOTDEFINED	

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcSlab is the end of the hierarchy and when used, has a total of nine (9) named attributes.

For an example of how an instance of ***IfcSlab*** is written in an IFC STEP file, see 30.4.2.1.2.1.2.1.4.1 IFC STEP File Format For IfcSlab.

Continue to 30.4.2.1.2.1.2.1.4.1 IFC STEP File Format For IfcSlab or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.4.1 IFC STEP File Format For IfcSlab

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcSlab*** is:

Att 1 ***GlobalId***
Att 2 ***OwnerHistory***
Att 3 ***Name***
Att 4 ***Description***
Att 5 ***ObjectType***
Att 6 ***ObjectPlacement***
Att 7 ***Representation***

```
#106070=IFCSLAB('1NA_YEJmPAfRI_gnsNeLZh',#1,'Slab',$,'Slab Type',#498170,#493571,$,.FLOOR.);
```

Att 8 ***Tag***
Att 9 ***PredefinedType***

And when ***PredefinedType*** is **.USERDEFINED.**, the user defined value can be given as Attribute 5.

```
#106070=IFCSLAB('1NA_YEJmPAfRI_gnsNeLZh',#1,'Slab',$,'Slab Type',#498170,#493571,$,.FLOOR.);
#106071=IFCSLAB('2OUvnKmM98yhPyGrB7QEAZ',#1,'Slab',$,'Unstyled Slab',#498330,#493717,$,.USERDEFINED.);
```

Att 5 ***ObjectType***

Continue to 30.4.2.1.2.1.2.1.5 IfcBuildingElementProxy or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.1.5 IfcBuildingElementProxy

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcBuiltElement >IfcBuildingElementProxy

Definition from IFC 4x3:

*The **IfcBuildingElementProxy** is a proxy definition that provides the same functionality as subtypes of IfcBuiltElement, but without having a predefined meaning of the special type of building element it represents.*

***IfcBuildingElementProxy** may be used:*

- To exchange special types of building elements for which the current specification does not yet provide a semantic definition.
- To represent building elements for which the participating applications can not provide a semantic definition.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

***IfcBuildingElementProxy* has one additional Named Attribute *PredefinedType* (Att 9):**

IfcBuildingElementProxy (1)			
9	PredefinedType	OPTIONAL IfcBuildingElementProxyTypeEnum	Predefined generic type for a building element proxy that is specified in an enumeration. There may be a property set given specifically for the predefined types. NOTE The *PredefinedType* shall only be used, if no *IfcBuildingElementProxyType* is assigned, providing its own *IfcBuildingElementProxyType.PredefinedType*.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcBuildingElementProxyTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcBuildingElementProxyTypeEnum:***

Type	Description
COMPLEX	Not used - kept for upward compatibility.
ELEMENT	Not used - kept for upward compatibility.
PARTIAL	Not used - kept for upward compatibility.
PROVISIONFORSPACE	The proxy denotes a provision for space (e.g. the space allocated as a provision for mechanical equipment or furniture). IFC4.3.0.0-DEPRECATION Use IfcVirtualElement with CLEARANCE instead.

PROVISIONFORVOID	The proxy denotes a provision for voids (a proposed opening not applied as void yet). IFC4.3.0.0-DEPRECATION Use IfcVirtualElement with PROVISIONFORVOID instead.
USERDEFINED	User-defined building element proxy.
NOTDEFINED	Undefined building element proxy.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it

IfcBuildingElementProxy is the end of the hierarchy and when used, has a total of nine (9) named attributes.

NOTE

Any data In ***12d Model*** that does not have an attribute to give the IFC entity is written to the IFC file as an ***IfcBuildingElementProxy***.

Continue to 30.4.2.1.2.1.2.2 IfcGeographicElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.2.2 IfcGeographicElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement ***>IfcGeoGraphicElement***

Definition from IFC 4x3:

*An **IfcGeographicElement** is a generalization of all elements within a geographical landscape. It includes occurrences of typical geographical elements, often referred to as features, such as trees or terrain. Common type information behind several occurrences of **IfcGeographicElement** is provided by the **IfcGeographicElementType**.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

IfcGeographicElement **has one additional Named Attribute *PredefinedType* (Att 9):**

IfcGeographicElement (1)			
9	PredefinedType	OPTIONAL IfcGeographicElementTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types. NOTE If the object has an associated IfcTypeObject with a *PredefinedType*, then this attribute shall not be used.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcGeographicElementTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcGeographicElementTypeEnum:***

Type	Description
SOIL_BORING_POINT	Soil boring point IFC4.3.0.0-DEPRECATION Use IfcBorehole instead.
TERRAIN	Terrain
VEGETATION	Plant life or plant cover (as of an area). For example trees, shrubs, herbs, grasse ferns, and mosses.
USERDEFINED	User defined
NOTDEFINED	Not defined

IfcGeographicElement has no entities derived from it.

Continue to 30.4.2.1.2.1.3 IfcPositioningElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.3 IfcPositioningElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcPositioningElement

Definition from IFC 4x3:

Abstract entity definition for positioning and annotating elements that are used to position other elements relatively.

IfcPositioningElement is abstract and can not be instantiated.

EXAMPLE A grid is a positioning element to position building components mainly in vertical structures, an **alignment** is a linear positioning element to position geographic and civil elements mainly in infrastructure works.

EXAMPLE An alignment is a linear positioning element for using a linear referencing method to position other items. See ISO 19148 “Linear referencing” for general information about linear referencing methods and expressions.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

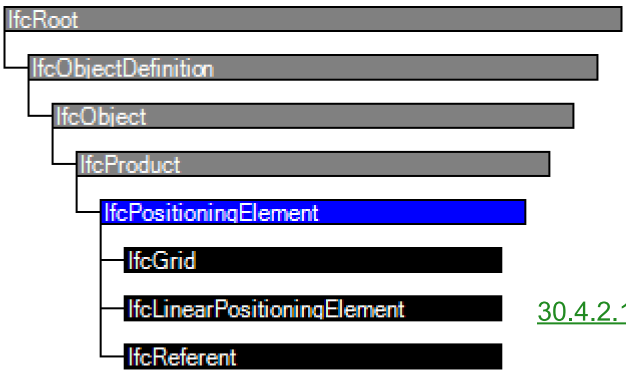
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

IfcPositioningElement **has no additional named attributes.**

The entities directly derived from ***IfcPositioningElement*** are:

Entity inheritance



30.4.2.1.2.1.3.1 IfcLinearPositioningElement

Continue to 30.4.2.1.2.1.3.1 IfcLinearPositioningElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.1.2.1.3.1 IfcLinearPositioningElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcPositioningElement >LinearPositioningElement

Definition from IFC 4x3:

An IfcLinearPositioningElement is an entity describing positioning according to a curve.

LinearPositioningElement is abstract and can not be instantiated.

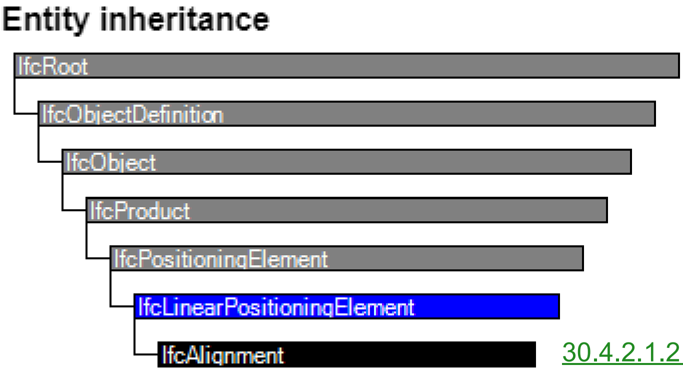
Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

***LinearPositioningElement* no additional named attributes.**

Entities directly derived from *LinearPositioningElement*



30.4.2.1.2.1.3.1.1 IfcAlignment

Continue to 30.4.2.1.2.1.3.1.1 IfcAlignment or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.2.1.2.1.3.1.1 IfcAlignment

Although alignments were not critical for vertical buildings they are fundamental to linear (horizontal) infrastructure.

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcPositioningElement >LinearPositioningElement >IfcAlignment

Definition from IFC 4x3

For the purposes of IFC the English term "alignment" defines three separate but closely interconnected concepts.

1. *definition of a reference system for linear positioning*
2. *safeguarding and optimization of the movement of vehicles - kinematic perspective*
3. *geometric construction of roads, railway tracks or other linear infrastructure*

Reference system for linear positioning

An alignment is used to define a reference system to position elements mainly for linear construction works, such as roads, rails, bridges, and others. The relative positioning along the alignment is defined by the linear referencing methodology.A site is a defined area of land, possibly covered with water, on which the project construction is to be completed. A site may be used to erect, retrofit or turn down building(s), or for other construction related developments.

Kinematic perspective

In the kinematic perspective, the focus is on the safe and optimized movement of a vehicle under the constraints induced by changes in the direction of the horizontal and the vertical layout.

Geometric perspective

In the geometric perspective the focus is on the proper placement of horizontal and vertical segments to connect certain points along a proposed path. A huge body of knowledge has been developed over a long period of time, in many aspects predating the availability of modern computers and their software.

Distinction between business logic and geometry definition

The alignment concept is organised into two parts. These two parts work together, but they can also be used and exchanged independently.

1. *Business logic of alignment*
2. *Geometry definition of alignment*

Business logic: *the IFC schema allows to describe an alignment using terminology and concepts that are as close as possible to business ones. It allows to describe the layouts that make up the alignment (i.e.* ***horizontal****,* ***vertical****,* ***cant****), their segments' structure and attributes. Also, the business logic part provides the* ***anchor point*** *for domain specific properties, such as* ***design speed*** *or* ***cant*** *deficiency.*

Geometry definition: *the IFC schema provides well established IFC geometric entities to represent the business concepts.*

A mapping between the business logic and its geometry definition in IFC is described by the concept templates related to the alignment geometry.

From 12d:

The ***Business Logic*** writes the alignment out as ***horizontal segments*** (lines, arcs, transitions) and cant, and ***vertical segments*** (lines, arcs, parabolas) which is what civil infrastructure people call **Horizontal** and **Vertical Geometry**. Anyone wanting sensible information about the alignment should insist that the ***Business Logic*** is **always written** to the IFC file. Any civil software should be able to create an alignment from the ***Business Logic***. See 30.4.2.2 Business Logic for an IfcAlignment.

The ***Geometry definition*** is useless for civil people and should be ignored. The ***Business Logic*** should be used instead.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

***IfcAlignment* has one additional named attribute *PredefinedType* (Att 8):**

IfcAlignment (1)			
8	PredefinedType	OPTIONAL IfcAlignmentTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcAlignmentTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcAlignmentTypeEnum:***

Type	Description
USERDEFINED	*No description available.*
NOTDEFINED	*No description available.*

IfcAlignment has no entities derived from it.

An example of an ***IfcAlignment*** in a STEP File is:

```
#26 = IFCALIGNMENT('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String',
                'natural clothoid', #268, #271, $);
```

Att 7 Representation

#271 defines the ***Representation*** in terms of IFC ***geometric entities*** but because the geometric entities are devoid of any traditional civil elements, that representation is of limited use. The ***Business logic*** for the ***IfcAlignment*** is required for items such as a non-zero start chainage, design speeds, chainage equalities and cant.

For the definition of the ***Business Logic***, see 30.4.2.2 Business Logic for an IfcAlignment

Continue to 30.4.2.2 Business Logic for an IfcAlignment or return to 30.4 Structure of IFC.

30.4.2.2 Business Logic for an IfcAlignment

An example of an ***IfcAlignment*** in a STEP File is:

#26 = IFCALIGNMENT('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String', 'natural clothoid', #268, **#271**, $);

Att 6 ObjectPlacement **Att 7 Representation**

#271 defines the ***Representation*** in terms of IFC ***geometry entities*** but because the geometric entities are devoid of any traditional civil elements, that representation is of limited use.

So the ***Civil Horizontal Geometry*** of ***straights***, ***arcs*** and ***transitions***, and the ***Civil Vertical Geometry*** of ***straights***, ***arcs*** and ***parabolas*** that is used in all the National Standards for Road and Rail has to be supplied for the ***IfcAlignment*** in a roundabout way. In the IFC Specification, this is referred to as the ***Business logic***.

Apart from providing the basic civil geometry required for the National Standards for Road and Rail, the ***Business logic*** is also required for including important items such as a ***non-zero start chainage, design speeds***, ***chainage equalities*** and ***cant*** which are all critical for Road and Rail design.

The ***Business Logic*** for an Alignment specifies the:

(a) ***Horizontal Geometry*** in terms of ***Horizontal Segments*** of type ***straights***, ***arcs*** and ***transitions***

(b) ***Vertical Geometry*** in terms of ***Vertical Segments*** of type ***straights***, ***parabolas*** and ***arcs***

and uses 30.4.6.2.1 IfcRelNests to attach them to the ***IfcAlignment*** entity.

:

#26 = IFCALIGNMENT('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String', 'natural clothoid', #268, #271, $);

#28 and #57 are being related to IfcAlignment #26

#27 = **IFCRELNESTS**('05XAKxuGj9cubbd1yaYzZ_', #2, '', '', **#26**, **(#28, #57)**)

Horizontal Geometry **Vertical Geometry**

#28 = **IFCALIGNMENTHORIZONTAL**('1s6eobcKb7kOVKJF3C2WOy', #2, 'Horizontal Alignment', '12d Horizontal Alignment', $, #191, $);

#57 = **IFCALIGNMENTVERTICAL**('3N3auEsLT6k8Jq22Vt_rSr', #2, 'Vertical Alignment', '12d Vertical Alignment', $, #265, $);

The **Horizontal Segments** and **Vertical Segments** are also bound to the ***IfcAlignmentHorizontal*** and ***IfcAlignmentVerticalGeometry*** by ***IfcRelnests*** of entities derived from ***IfcAlignmentParameterSegment*** *(**IfcAlignmentHorizontalSegment*** and ***IfcAlignmentVerticalSegment***).

See For example, for the Horizontal Geometry: and For example, for the Vertical Geometry:

For example, for the Horizontal Geometry:

#26 = **IFCALIGNMENT**('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String',
'natural clothoid', #268, #271, $);

HG #28 and VG #57 are being related to ifcAlignment #26

#27 = **IFCRELNESTS**('05XAKxuGj9cubbd1yaYzZ_', #2, '', '', **#26**, (**#28**, **#57)**)

Horizontal Geometry #28

#28 = **IFCALIGNMENTHORIZONTAL**('1s6eobcKb7kOVKJF3C2WOy', #2,
'Horizontal Alignment', '12d Horizontal Alignment', $, #191, $);

#29 = **IFCRELNESTS**('1fgm2wOtP0mucR0ki1DIeJ',#2,'', 'Horizontal Segments',**#28**,
(#32, #35, #38, #41, #44, #47, #50, #53, #56));

Segments defining the Horizontal Geometry

Horizontal Geometry Segments #32, #35, #41 etc are being related to the Horizontal Geometry #28

/* **HG #30 straight** starting at #31(256243.8751, 7411537.8183)
with counterclockwise angle 4.74237515812321E-1 2D length 36.3477698922907;

#32 = **IFCALIGNMENTSEGMENT**('0c7UvlWc92Nx1hL2UQc8yd', $, $, $, $, #71, #74, **#30)**;

#30 = **IFCALIGNMENTHORIZONTALSEGMENT**($, $, **#31**, 4.74237515815107E-1, 0., 0.,
36.3477698922907, $,**.LINE.**);

#31 = IFCCARTESIANPOINT((256243.8751, 7411537.8183));

/* **HG #33 natural clothoid** starting at #34 (256276.211572767,7411554.41688142)
with start CCW angle 4.74237515812321E-1 start radius 0 end CW radius 100 2D length 30.;

#35 = **IFCALIGNMENTSEGMENT**('1JaOo8TO19jQD60hWGKC09', $, $, $, $, #84, #87, **#33**);

#33 = **IFCALIGNMENTHORIZONTALSEGMENT**($, $, **#34**, 4.74237515812321E-1, -0., -100., 30.,
$,**.CLOTHOID.**);

#34 = IFCCARTESIANPOINT((256276.211572767, 7411554.41688142));

For more information, see 30.4.2.2.1.3 IfcAlignmentSegment and 30.4.2.2.1.1 IfcAlignmentHorizontal.

Continue to For example, for the Vertical Geometry:

For example, for the Vertical Geometry:

#26 = **IFCALIGNMENT**('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String',
'natural clothoid', #268, #271, $);

HG #28 and VG #57 are being related to IfcAlignment #26

#27 = **IFCRELNESTS**('05XAKxuGj9cubbd1yaYzZ_', #2, '', '', **#26**, (**#28**, **#57**))

Vertical Geometry #57

#57 = **IFCALIGNMENTVERTICAL**('3N3auEsLT6k8Jq22Vt_rSr', #2,
'Vertical Alignment', '12d Vertical Alignment', $, #265, $);

Vertical Geometry Segments #60, #62, #64, #66, #68
are being related to the Vertical Geometry #57

#58 = **IFCRELNESTS**('16dvccOSXC3wiFNfPdEPbd', #2, '', 'Vertical Segments', **#57**,
(#60, #62, #64, #66, #68));

Segments defining the Vertical Geometry

/* **VG #60 straight** starting at Chainage -20.3069442770755 with horizontal length 84.3630442770537
Start height -7.42362038995511 gradient 9.64098015696478E-2;

#60 = **IFCALIGNMENTSEGMENT**('3Ui0hv2AL9Mv5AmS2rTDGZ', $, $, $, $, #196, #199, **#59**);

#59 = **IFCALIGNMENTVERTICALSEGMENT**($, $, -20.3069442770755, 84.3630442770537,
-7.42362038995511, 9.64098015696478E-2, 9.64098015696478E-2, $,**.CONSTANTGRADIENT.**);

/* **VG #62 parabola** starting at Chainage 64.0560999999782 with horizontal length 7.0980396860705E-1
Start height 9.64098015696477E-2; start gradient 9.64098015696478E-2
End gradient -4.32806554030692E-2 clockwise radius 286.347406020818;

#62 = **IFCALIGNMENTSEGMENT**('3xOwkuAsf38vGGAm_F1NGu', $, $, $, $, #209, #212, **#61**);

#61 = **IFCALIGNMENTVERTICALSEGMENT**($, $, 64.0560999999782, 40., 7.0980396860705E-1,
9.64098015696477E-2, -4.32806554030692E-2, 286.347406020818,**.PARABOLICARC.**);

For more information, see 30.4.2.2.1.3 IfcAlignmentSegment and 30.4.2.2.1.2 IfcAlignmentVertical.

Continue to 30.4.2.2.1 IfcLinearElement or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1 IfcLinearElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcLinearElement

Definition from IFC 4x3

A generalization of all linear elements that are parts of an alignment.

similar.

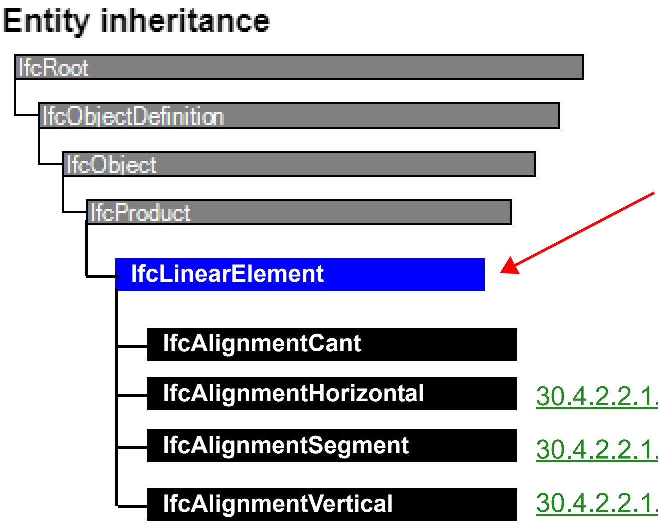
Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

***IfcLinearElement* has no additional named attributes**.

Entities directly derived from ***IfcLinearElement***



added in IFC 4x3 for parts of an Alignment

30.4.2.2.1.1 IfcAlignmentHorizontal

30.4.2.2.1.3 IfcAlignmentSegment

30.4.2.2.1.2 IfcAlignmentVertical

Continue to 30.4.2.2.1.1 IfcAlignmentHorizontal or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1.1 IfcAlignmentHorizontal

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct ***>IfcLinearElement >IfcAlignmentHorizontal***

Definition from IFC 4x3

An ***IfcAlignmentHorizontal*** *is a linear reference projected onto the horizontal x/y plane. Points along a horizontal alignment have two coordinate values, x and y in the local Cartesian engineering system.*

The horizontal alignment is defined by ***segments*** *that are* ***connected end-to-start.*** *The transition at the segment connection is not enforced to be tangential, if the "tangential continuity" flag is set to false, otherwise a tangential continuity shall be preserved. Based on the context of the project, they are georeferenced and convertible into Northing and Easting values.*

NOTE *Georeferencing is provided by IfcMapConversion through the IfcGeometricRepresentationContext defined at IfcProject.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

IfcAlignmentHorizontal **has no additional named attributes**.

IfcAlignmentHorizontal has no entities derived from it.

From 12d: USAGE of IfcAlignmentHorizontal:

IfcAlignmentHorizontal is attached to the ***IfcAlignment*** via an ***IfcRelNests***.

#26 = **IFCALIGNMENT**('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String', 'natural clothoid', #268, #271, $);

HG #28 and VG #57 are being related to ifcAlignment #26

#27 = **IFCRELNESTS**('05XAKxuGj9cubbd1yaYzZ_', #2, '', '', **#26**, **(#28, #57)**)

Horizontal Geometry #28

#28 = **IFCALIGNMENTHORIZONTAL**('1s6eobcKb7kOVKJF3C2WOy', #2, 'Horizontal Alignment', '12d Horizontal Alignment', $, #191, $);

IfcAlignmentHorizontal does not hold the ***Horizontal Geometry segments*** () but has them attached to it via one or more ***IfcAlignmentSegment***'s via an ***IfcRelNests***. Each 30.4.2.2.1.3 IfcAlignmentSegment has a named attribute ***DesignParameters*** (**Att 8**) that points to an 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment of the required type (**LINE**, **CIRCULARARC**,

CLOTHOID etc)

#28 = **IFCALIGNMENTHORIZONTAL**('1s6eobcKb7kOVKJF3C2WOy', #2,
'Horizontal Alignment', '12d Horizontal Alignment', $, #191, $);

#29 = **IFCRELNESTS**('1fgm2wOtP0mucR0ki1DIeJ',#2,'', 'Horizontal Segments',**#28**,
(#32, #35, #38, #41, #44, #47, #50, #53, #56));

Segments defining the Horizontal Geometry

Horizontal Geometry Segments #32, #35, #41 etc are being related to the Horizontal Geometry #28

/* **HG #30 straight** starting at #31(256243.8751, 7411537.8183)
with counterclockwise angle 4.74237515812321E-1 2D length 36.3477698922907;

#32 = **IFCALIGNMENTSEGMENT**('0c7UvlWc92Nx1hL2UQc8yd', $, $, $, $, #71, #74, **#30)**;

#30 = **IFCALIGNMENTHORIZONTALSEGMENT**($, $, **#31**, 4.74237515815107E-1, 0., 0.,
36.3477698922907, $,**.LINE.**);

etc

So ***IfcAlignmentHorizontal*** is attached to the required ***IfcAlignment*** via an ***IfcRelNests.*** And the horizontal geometry for the alignment is attached to the ***IfcAlignmentHorizontal*** by an ***IfcRelNests*** which is an **ordered sequence** of ***IfcAlignmentSegment's****,* each of which through named attribute ***DesignParameters*** (**Att 8**) points to the appropriate 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment for that segment (e.g. line, arc or transition).

Continue to 30.4.2.2.1.2 IfcAlignmentVertical or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1.2 IfcAlignmentVertical

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct ***>IfcLinearElement >IfcAlignmentVertical***

Definition from IFC 4x3

An ***IfcAlignmentVertical*** *is a* ***height*** *profile* ***along the horizontal alignment****. Points along a vertical alignment have two coordinate values. The first value is the distance along the horizontal alignment, the second value is the height according to the project engineering coordinate system. Based on the context of the project, they are georeferenced and the height value is convertible into orthogonal height above/below the vertical datum.*

IfcAlignmentVertical **has no additional named attributes.**

IfcAlignmentVertical has no entities derived from it.

From 12d: USAGE of IfcAlignmentVertical:

IfcAlignmentVertical is attached to the ***IfcAlignment*** via an ***IfcRelNests***.

#26 = **IFCALIGNMENT**('2MEpUqCJX3yenQ7byka_OF', #2, 'RSA', '12d Alignment String', 'natural clothoid', #268, #271, $);

HG #28 and VG #57 are being related to ifcAlignment #26

#27 = **IFCRELNESTS**('05XAKxuGj9cubbd1yaYzZ_', #2, '', '', **#26**, **(#28, #57)**)

Vertical Geometry #57

#57 = **IFCALIGNMENTVERTICAL**('3N3auEsLT6k8Jq22Vt_rSr', #2, 'Vertical Alignment', '12d Vertical Alignment', $, #265, $);

IfcAlignmentVertical does not hold the ***Vertical Geometry segments*** but has them attached to it as one or more ***IfcAlignmentSegment***'s via an ***IfcRelNests***. Each 30.4.2.2.1.3 IfcAlignmentSegment has a named attribute ***DesignParameters*** (**Att 8**) that points to an 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment of the required type (**LINE**, **CIRCULARARC**, **PARABOLA**)

#57 = **IFCALIGNMENTVERTICAL**('3N3auEsLT6k8Jq22Vt_rSr', #2, 'Vertical Alignment', '12d Vertical Alignment', $, #265, $);

#58 = **IFCRELNESTS**('16dvccOSXC3wiFNfPdEPbd', #2, '', 'Vertical Segments', **#57**, **(#60, #62, #64, #66, #68)**);

Segments defining the Vertical Geometry

Vertical Geometry Segments #60, #62, #64, #66, #68 are being related to the Vertical Geometry #57

/* **VG #60 straight** starting at Chainage -20.3069442770755 with horizontal length 84.3630442770537
Start height -7.42362038995511 gradient 9.64098015696478E-2;

#60 = **IFCALIGNMENTSEGMENT**('3Ui0hv2AL9Mv5AmS2rTDGZ', $, $, $, $, #196, #199, **#59**);

#59 = **IFCALIGNMENTVERTICALSEGMENT**($, $, -20.3069442770755, 84.3630442770537, -7.42362038995511, 9.64098015696478E-2, 9.64098015696478E-2, $,**.CONSTANTGRADIENT.**);

/* **VG #62 parabola** starting at Chainage 64.0560999999782 with horizontal length 7.0980396860705E-1
Start height 9.64098015696477E-2; start gradient 9.64098015696478E-2
End gradient -4.32806554030692E-2 clockwise radius 286.347406020818;

#62 = **IFCALIGNMENTSEGMENT**('3xOwkuAsf38vGGAm_F1NGu', $, $, $, $, #209, #212, **#61**);

#61 = **IFCALIGNMENTVERTICALSEGMENT**($, $, 64.0560999999782, 40., 7.0980396860705E-1, 9.64098015696477E-2, -4.32806554030692E-2, 286.347406020818,**.PARABOLICARC.**);

etc

So ***IfcAlignmentVertical*** is attached to the required ***IfcAlignment*** via an ***IfcRelNests.*** And the vertical geometry for the alignment is attached to the ***IfcAlignmentVertical*** by an ***IfcRelNests*** which is an **ordered sequence** of ***IfcAlignmentSegment***'s, each of which through named attribute ***DesignParameters*** (**Att 8**) points to the appropriate 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment for that segment (e.g. line, arc or parabola).

Continue to 30.4.2.2.1.3 IfcAlignmentSegment or return to 30.4.2.2 Business Logic for an IfcAlignment or 30.4 Structure of IFC.

30.4.2.2.1.3 IfcAlignmentSegment

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcLinearElement >IfcAlignmentSegment

Definition from IFC 4x3

*An **IfcAlignmentSegment** is a segment of an **IfcAlignment** where **either** the **vertical** or **horizontal** direction or **cant** (in the case of track design) obey a unique mathematical description as a function of the horizontal projection segment length of the alignment.*

NOTE 1 Unless otherwise stated, for railway, the appertaining track alignment design parameters are defined for the track centre line.

***NOTE 2** For roads, the alignment typically describes the path of the road centre line, but in certain situations, e.g. ramps, the alignment may describe the path of other edges of the road body.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

***IfcAlignmentSegment* has one additional named attribute *DesignParameters* (Att 8):**

IfcAlignmentSegment (1)			
8	DesignParameters	IfcAlignmentParameterSegment	The design parameters of the alignmnent segment.

IfcAlignmentSegment has no entities derived from it.

From 12d:** each segment of horizontal or vertical geometry has an **IfcAlignmentSegment** which points to the appropriate **IfcAlignmentParameterSegment for the parameters defining the lines, arc, transition or parabola. That is *an* 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment *or* 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment which are derived from 30.4.2.2.1.3.1 IfcAlignmentParameterSegment.

Note: Entities derived from ***IfcAlignmentParameterSegment*** that have the information about each of the ***Horizontal Geometry Segments*** or the ***Vertical Geometry Segments*** or the **Cant** for the alignment

Entity Inheritance

- **IfcAlignmentParameterSegment**
  - **IfcAlignmentCantSegment**
  - **IfcAlignmentHorizontalSegment** 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment
  - **IfcAlignmentVerticalSegment** 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment

For Example

#28 = **IFCALIGNMENTHORIZONTAL**('1s6eobcKb7kOVKJF3C2WOy', #2,
'Horizontal Alignment', '12d Horizontal Alignment', $, #191, $);

#29 = **IFCRELNESTS**('1fgm2wOtP0mucR0ki1DIeJ',#2,'', 'Horizontal Segments',**#28**,
(#32, #35, #38, #41, #44, #47, #50, #53, #56));

Segments defining the Horizontal Geometry

Horizontal Geometry Segments #32, #35, #41 etc are being related to the Horizontal Geometry #28

/* **HG #30 straight** starting at #31(256243.8751, 7411537.8183)
with counterclockwise angle 4.74237515812321E-1 2D length 36.3477698922907;

#32 = **IFCALIGNMENTSEGMENT**('0c7UvlWc92Nx1hL2UQc8yd', $, $, $, $, $, #71, #74, **#30)**;

#30 = **IFCALIGNMENTHORIZONTALSEGMENT**($, $, **#31**, 4.74237515815107E-1, 0., 0.,
36.3477698922907, $,**.LINE.**);

etc

Each Horizontal segment defining the Horizontal Geometry consists of an *IfcAlignmentSegment* and associated *IfcAlignmentHorizontalSegment to provide the parameters*

Continue to 30.4.2.2.1.3.1 IfcAlignmentParameterSegment or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1.3.1 IfcAlignmentParameterSegment

IfcAlignmentParameterSegment

Definition from IFC 4x3

An abstract entity defining common information about horizontal, vertical and cant alignment segments.

NOTE *The start and end tag are defined as annotations, not as referents along the alignment. Only absolute distance expressions are in scope, not distances ahead or behind a referent, such as a station. However such information can be exchanged as tags.*

IfcAlignmentParameterSegment is abstract and can not be instantiated.

***IfcAlignmentParameterSegment* has two named attributes *StartTag* (Att 1), *EndTag* (Att 2):**

#	Attribute	Type	Description
IfcAlignmentParameterSegment (2)			
1	StartTag	OPTIONAL IfcLabel	Tag to annotate the start point of the alignment segment.
2	EndTag	OPTIONAL IfcLabel	Tag to annotate the end point of the alignment segment.

Entities derived from ***IfcAlignmentParameterSegment*** have the information about each of the ***Horizontal Geometry Segments*** or the ***Vertical Geometry Segments*** or the **Cant** for the alignment

Entity Inheritance

IfcAlignmentParameterSegment

- **IfcAlignmentCantSegment**
- **IfcAlignmentHorizontalSegment** 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment
- **IfcAlignmentVerticalSegment** 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment

Continue to 30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1.3.1.1 IfcAlignmentHorizontalSegment

***IfcAlignmentParameterSegment* >IfcAlignmentHorizontalSegment**

Definition from IFC 4x3

*Individual segment along the **IfcAlignmentHorizontal**, being defined in the x/y coordinate space. Each single horizontal alignment segment has an optional associated segment definition. The placement of **IfcAlignmentHorizontalSegment** and the **IfcCurveSegment StartPlacement** correspond to each other.*

The following checks can be done to validate the correct exchange:

***continuity** – does the calculated end point of the previous segment matches with the provided start point of this segment*

***tangential continuity** – does the calculated end direction of the previous segment matches with the provided start direction of this segment.*

From 12d: *IfcAlignmentHorizontalSegment* holds the information required to define the Horizontal straights, arcs and transitions.

Name attributes 1- 2 See 30.4.2.2.1.3.1 IfcAlignmentParameterSegment

***IfcAlignmentHorizontalSegment* has an additional seven named attributes *StartPoint* (Att 3), *StartDirection* (Att 4), *StartRadiusCurvature* (Att 5), *EndRadiusCurvature* (Att 6), *SegmentLength* (Att 7), *GravityCentreLineHeight* (Att 8), *PredefinedType* (Att 9):**

IfcAlignmentHorizontalSegment (7)			
3	StartPoint	IfcCartesianPoint	The start point of the segment defined by a Cartesian point.
4	StartDirection	IfcPlaneAngleMeasure	The direction of the tangent at the start point. Direction value 0. indicates a curve with a start tangent along the positive x-axis. Values increases counter-clockwise, and decreases clockwise. Depending on the plane angle unit, either degree or radians, the sensible range is -360° ≤ n ≤ 360° (or -2π ≤ n ≤ 2π). Values larger then a full circle (>|360°| or >|2 π| shall not be used.

Continued on next page

:

5	StartRadiusOfCurvature	IfcLengthMeasure	For a NONLINEAR horizontal segment type the radius of the curve at the start point (*Placement* of the segment). For CIRCULAR type it is constant i.e. *StartRadiusOfCurvature* and *EndRadiusOfCurvature* are always the same. For LINE type, both *StartRadiusOfCurvature* and *EndRadiusOfCurvature* is 0. If the radius is 0 it shall be interpreted as INFINITE. Positive values imply a CCW direction whereas negative CW.
6	EndRadiusOfCurvature	IfcLengthMeasure	For a NONLINEAR horizontal segment type the radius of the curve at the end point. If the radius is 0 it shall be interpreted as INFINITE. Positive values imply a CCW direction whereas negative CW.
7	SegmentLength	IfcNonNegativeLengthMeasure	The length along the curve.
8	GravityCenterLineHeight	OPTIONAL IfcPositiveLengthMeasure	Optional attribute require for the exchange of Vienna bend transition segment.
9	PredefinedType	IfcAlignmentHorizontalSegmentTypeEnum	Predefined type of the horizontal alignmnent segment.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcAlignmentHorizontalSegmentTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcAlignmentHorizontalSegmentTypeEnum***:

Type	Description
BLOSSCURVE	**See IFC 4x3 Specification for more details**
CIRCULARARC	In the geometric perspective, it denotes a connection between two points that follows a circular path. In the dynamic perspective, it denotes a segment with constant lateral acceleration on the moving vehicle, i.e. constant curvature. **Base formula (Curvature) ** $\kappa = const, \kappa <> 0$

Continued on next page

CLOTHOID	In the geometric perspective, a clothoid denotes a connection between two points where the radius of curvature changes along the segment at a constant rate. The clothoid was an early achievement of geometry, also known as Euler's spiral or Cornu's spiral. It became very popular in road and rail design even before the widespread availability of computers because of the availability of tabulations of the normalized clothoid. Proper application of the so called clothoid constant provided fast solutions for all relevant parameters necessary to integrate clothoid segments between two consecutive segments with constant curvature. In most cases the clothoid smooths the curvature between a straight line and a circular arc. In the dynamic perspective, it denotes a segment with constant rate of lateral acceleration change induced by the curvature. The kinematic properties of the clothoid both reduce the exerted forces on the track by a train, improve the travel experience of train passengers and also reduce the stress of a car driver by avoiding sudden movements of the steering wheel. The kinematic advantages of the clothoid as a smoothing segment are true also for all the other transition bends currently in use. **Base formula (Curvature)** $\xi = \frac{s}{L}$ $\kappa(s) = \kappa_1 + \xi\Delta\kappa$

COSINECURVE **See IFC 4x3 Specification for more details**

CUBIC **See IFC 4x3 Specification for more details**

HELMERTCURVE **See IFC 4x3 Specification for more details**

LINE	In the geometry perspective it denotes a straight connection between two points. In the dynamic perspective, it denotes a segment with a curvature with a value of 0. This means that no lateral acceleration acts on the moving vehicle. **Base formula (Curvature) ** $\kappa = 0$

SINECURVE **See IFC 4x3 Specification for more details**

VIENNESEBEND **See IFC 4x3 Specification for more details**

IMPORTANT NOTE

Unfortunately although a number of presentations where made to buildingSMART International, **NSW Cubic Parabola** (10.2.16.3.1.5 NSW Cubic Parabola) and **WestRail Cubic** (10.2.16.3.1.3 Westrail Cubic Spiral) were both left of the list.

Although the ***MX Clothoid*** (10.2.16.3.1.2 Clothoid (Moss)) was also not included, the **CLOTHOID** can be used in its place.

In ***12d Model,*** the Super Alignment Transition choice of **natural clothoid** (10.2.16.3.1.1 Natural Clothoid) is the IFC **CLOTHOID**.

Continue to 30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.4.2.2.1.3.1.2 IfcAlignmentVerticalSegment

IfcAlignmentParameterSegment ***>IfcAlignmentVerticalSegment***

Definition from IFC 4x3

Individual segment along the ***IfcAlignmentVertical****, being defined in the distance-along/z coordinate space.*

The vertical alignment is defined by segments that connects end-to-start. The vertical alignment curve geometry is defined in a plane with x = distance along horizontal, the y = height (or elevation). The transition at the segment connection is not enforced to be tangential, The IfcSegment Transition enumeration specifies the type of transition explicitly.

The following vertical segment types are defined:

(a) **line segment** - ***IfcAlignmentVerticalSegmentTypeEnum*** **LINE**.

(b) **circular arc segment** - ***IfcAlignmentVerticalSegmentTypeEnum*** **ARC**.

(c) **parabolic arc segment** - ***IfcAlignmentVerticalSegmentTypeEnum*** **PARABOLICARC**. which can describe symmetric parabolas, unsymmetric parabolas can be created by defining two symmetric parabolas segments

(d) transition segment with **linear curvature variation** - ***IfcAlignmentVerticalSegmentTypeEnum*** **CLOTHOID**.

The following checks can be done to validate the correct exchange:

continuity *– does the calculated end distance along of the previous segment matches with the provided start distance along of this segment*

tangential continuity *– does the calculated end gradient of the previous segment matches with the provided start gradient of this segment*

From 12d: IfcAlignmentVerticalSegment **holds the information required to define the Vertical straights, arcs and parabolas.**

Name attributes 1- 2 See 30.4.2.2.1.3.1 IfcAlignmentParameterSegment

IfcAlignmentVerticalSegment **has an additional seven named attributes** ***StartDistanceAlong*** **(Att 3),** ***HorizontalLength*** **(Att 4),** ***StartHeight*** **(Att 5),** ***StartGradient*** **(Att 6),** ***EndGradient*** **(Att 7),**

RadiusOfCurvature **(Att 8),** ***PredefinedType*** **(Att 9):**

IfcAlignmentVerticalSegment (7)			
3	StartDistAlong	IfcLengthMeasure	Distance along the horizontal alignment as measured along the corresponding *IfcAlignmentHorizontal*. NOTE 1 The distance along is measured from the start point of *IfcAlignmentHorizontal*. 2 The unit of measurement is the global length unit, as set by *IfcContext*.UnitInContext
4	HorizontalLength	IfcNonNegativeLengthMeasure	Length measured as distance along the horizontal alignment of the segment.
5	StartHeight	IfcLengthMeasure	Elevation in Z of the start point relative to the IfcAlignment coordinate system. NOTE It is strongly advised to not offset the IfcAlignment coordinate system from the project engineering coordinate system.

Continued on the next page

:

6	StartGradient	IfcRatioMeasure	Start gradient of the segment.
7	EndGradient	IfcRatioMeasure	End gradient of the segment. In the case of a PredefinedType='.CONSTANTGRADIENT.' the value is the same as *StartGradient*.
8	RadiusOfCurvature	OPTIONAL IfcLengthMeasure	Radius of parabola or arc. Positive values imply a CCW direction whereas negative CW. NOTE1 For *PredefinedType* is ARC. The radius of the basis circle for the arc. NOTE2 For *PredefinedType* is PARABOLICARC. Parabola constant (determining the "steepness" of the parabola). The parabola constant is provided by the "minimum parabola radius", the true radius of a parabola at its vertical axis (the zero-gradient point of the parabola). The minimum radius is twice the focal length of the parabola (the distance between the focal point and the vertex). NOTE3 For *PredefinedType* that is not either ARC or PARABOLICARC the value should be empty.
9	PredefinedType	IfcAlignmentVerticalSegmentTypeEnum	Predefined type of the vertical alignmnent segment.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcAlignmentVerticalSegmentTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcAlignmentVerticalSegmentTypeEnum***:

Type	Description
`CIRCULARARC`	Vertical alignment segment where the derivative of vertical angle with respect to sloping length along the track (3D length) is constant. The curvature for vertical circular arc segment is provided by: $$\kappa_v = \frac{1}{R_v(s)} = \frac{d\theta}{ds}$$

Continued on the next page

CLOTHOID	Vertical alignment segment where the derivative of vertical angle with respect to sloping length along the track (3D length) obeys a linear change. The curvature equation of the vertical clothoid segment is provided by: $$\xi = \frac{s}{L}$$ $$\kappa_v(s) = \kappa_{v1} + \xi\Delta\kappa_v$$
CONSTANTGRADIENT	Vertical alignment segment with constant gradient.
PARABOLICARC	Vertical alignment segment where the derivative of gradient with respect to distance along is constant. General equation of the parabolic arc segment is provided by: $$y = ax^2 + bx + c$$ The gradient (slope) of this curve at any point (first derivative) is provided by: $$\frac{dy}{dx} = 2ax + b$$ The rate of change of gradient of the parabolic arc segment is constant. The variation of curvature is therefore provided by: $$\frac{d^2y}{d^2x} = 2a$$

Continue to 30.4.3 Representation (Geometry) for IFC Products or return to 30.4 Structure of IFC.

30.4.3 Representation (Geometry) for IFC Products

All ***IfcProduct's*** have an optional seventh named attribute called ***Representation*** that defines the shape (geometry) of the ***IfcProduct***.

7	Representation	OPTIONAL IfcProductRepresentation	Reference to the representations of the product, being either a representation (*IfcProductRepresentation*) or as a special case of a shape representation (*IfcProductDefinitionShape*). The product definition shape provides for multiple geometric representations of the shape property of the object within the same object coordinate system, defined by the object placement.

The seventh named attribute of ***IfcProduct*** is ***Representation*** and it points to an 30.4.3.1 IfcProductRepresentation.

Important Notes

1. ***Representation*** is optional.
2. ***IfcProductRepresentation*** is **NOT** derived from ***IfcRoot***.
3. All ***12d Model*** elements being written to an IFC file do have geometric so how that geometry is represented in IFC file is important.
4. New entities are added to each new IFC versions so how the geometry of ***12d Model elements*** is written out to an IFC file is version dependent.

   For example, the most natural IFC geometry to use for a Tin is 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork but this was only added in IFC 4x1. Consequently if data is being written out as IFC 2x3, then another IFC geometry must be used for a Tin.
5. The route to get to the definition of geometry in the IFC appears circuitous but it has been designed to be comprehensive and very flexible.
6. The IFC Specification is very large so only the major points to cover the geometry for ***12d Model elements*** will covered. All the IFC definitions are taken from ***IFC 4x3***.

Continue to 30.4.3.1 IfcProductRepresentation or return to 30.4 Structure of IFC.

30.4.3.1 IfcProductRepresentation

IfcProductRepresentation

Definition from IFC 4x3:

IfcProductRepresentation *defines a representation of a product, including its (geometric or topological) representation. A product can have zero, one or many geometric representations, and a single geometric representation can be shared among various products using mapped representations.*

IfcProductRepresentation is abstract and can not be instantiated.

IfcProductRepresentation **has three named attributes** ***Name*** **(Att 1)**, ***Description*** **(Att 2), *Representations*** **(Att 3)**:

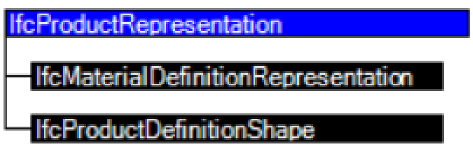
#	Attribute	Type	Description
IfcProductRepresentation (3)			
1	Name	OPTIONAL IfcLabel	The word or group of words by which the product representation is known.
2	Description	OPTIONAL IfcText	The word or group of words that characterize the product representation. It can be used to add additional meaning to the name of the product representation.
3	Representations	LIST [1:?] OF IfcRepresentation	Contained list of representations (including shape representations). Each member defines a valid representation of a particular type within a particular representation context.

So the seventh named attribute of an ***IfcProduct*** is ***Representation*** and its type is ***IfcProductRepresentation*** which has as its third named attribute ***Representations*** which is a **list** of ***IfcRepresentation***'s.

So the geometry ***Representation*** for an ***IfcProduct*** can be made up of multiple parts.

The Entities derived from ***IfcProductRepresentation***

▼ Entity inheritance



30.4.3.1.1 IfcProductDefinitionShape

IfcProductDefinitionShape is the only appropriate non-abstract subtype of ***IfcProductRepresentation***.

That is, ***IfcProductRepresentation*** **>*IfcProductDefinitionShape***

At first it appears confusing but it is the list of ***IfcRepresentation*** entities (referenced by Att 3 ***Representations***) that provide the geometry for the ***IfcProduct*** that the ***IfcProductDefinitionShape*** is the seventh named attribute for.

30.4.3.1.1 IfcProductDefinitionShape

IfcProductRepresentation >IfcProductDefinitionShape

Definition from IFC 4x3:

*The **IfcProductDefinitionShape** defines all shape relevant information about an **IfcProduct**. It allows for m**ultiple geometric shape representations of the same product**. The shape relevant information includes:*

(a) the shape representation including geometric representation items (for 3D solids, 2D annotations, etc.) and:

(b) associated presentation information (line colour, line type, surface rendering properties)

(c) assignment to presentation layers (CAD layers for visibility control)

(d) or the topological representation items for connectivity systems (vertex, edge, face representations) that may include geometric representation items (vertex points, edge curves, face surfaces)

Name attributes 1- 3 See 30.4.3.2 IfcRepresentation

***IfcProductDefinitionShape* has no additional named attributes.**

But *IfcProductDefinitionShape inherits the thee* named attributes *Name* (Att 1), *Description* (Att 2), *Representations* (Att 3) from *IfcProductRepresentation*:

#	Attribute	Type	Description
IfcProductRepresentation (3)			
1	Name	OPTIONAL IfcLabel	The word or group of words by which the product representation is known.
2	Description	OPTIONAL IfcText	The word or group of words that characterize the product representation. It can be used to add additional meaning to the name of the product representation.
3	Representations	LIST [1:?] OF IfcRepresentation	Contained list of representations (including shape representations). Each member defines a valid representation of a particular type within a particular representation context.

IfcProductDefinitionShape is the only non-abstract entity derived from ***IfcProductRepresentation.***

So the seventh named attribute of any IFC entity derived from ***IfcProduct*** is ***Representation*** whose only non-abstract type is ***IfcProductDefinitionShape***.

IfcProductDefinitionShape has as its third named attribute ***Representations*** which is a **list** of ***IfcRepresentation***'s.

So the geometry for any IFC entity derived from ***IfcProduct*** can be made up of multiple ***IfcRepresentation***'s.

Continue to the new section 30.4.3.2 IfcRepresentation or return to 30.4 Structure of IFC.

30.4.3.2 IfcRepresentation

IfcRepresentation

Definition from IFC 4x3:

*The **IfcRepresentation** defines the general concept of representing product properties and in particular the product shape.*

IfcRepresentation is abstract and can not be instantiated.

IfcRepresentation **has four named attributes** ***ContextOfItems*** **(Att 1),** ***RepresentationIdentifier*** **(Att 2),** ***RepresentationType*** **(Att 3),** ***Items*** **(Att 4)**:

IfcRepresentation (7)			
1	ContextOfItems	IfcRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
2	RepresentationIdentifier	OPTIONAL IfcLabel	The optional identifier of the representation as used within a project.
3	RepresentationType	OPTIONAL IfcLabel	The description of the type of a representation context. The representation type defines the type of geometry or topology used for representing the product representation. More information is given at the subtypes *IfcShapeRepresentation* and *IfcTopologyRepresentation*. The supported values for context type are to be specified by implementers agreements.
4	Items	SET [1:?] OF IfcRepresentationItem	Set of geometric representation items that are defined for this representation.

The Entities derived from ***IfcRepresentation***:

▼ Entity inheritance

- IfcRepresentation
  - IfcShapeModel — 30.4.3.2.1 IfcShapeModel
  - IfcStyleModel

IfcShapeModel is the appropriate subtype of ***IfcRepresentation***. for geometry.

Continue to 30.4.3.2.1 IfcShapeModel or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.2.1 IfcShapeModel

IfcRepresentation >IfcShapeModel

Definition from IFC 4x3:

IfcShapeModel *represents the concept of a particular geometric and/or topological representation of a product's shape or a product component's shape within a representation context. This representation context has to be a geometric representation context (with the exception of topology representations without associated geometry).*

*The two subtypes are **IfcShapeRepresentation** to cover geometric models that represent a shape, and **IfcTopologyRepresentation** to cover the connectivity of a product or product component. The topology may or may not have geometry associated.*

*The IfcShapeModel can be a shape representation (geometric and/or topologogical) of a product (via **IfcProductDefinitionShape**), or a shape representation (geometric and/or topologogical) of a component of a product shape (via **IfcShapeAspect**).*

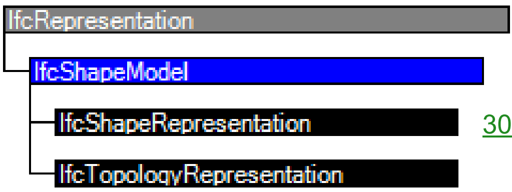
IfcShapeModel is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.3.2 IfcRepresentation

IfcShapeModel **has no additional named attributes**.

Entities directly derived from ***IfcShapeModel***

Entity inheritance



30.4.3.2.1.1 IfcShapeRepresentation

IfcShapeRepresentation is the appropriate subtype of ***IfcShapeModel***. for geometry.

Continue to 30.4.3.2.1.1 IfcShapeRepresentation or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.2.1.1 IfcShapeRepresentation

IfcRepresentation >IfcShapeModel >IfcShapeRepresentation

Definition from IFC 4x3:

*The **IfcShapeRepresentation** represents the concept of a particular geometric representation of a product or a product component within a specific geometric representation context.*

***IfcShapeRepresentation* has no additional named attributes but four items inherited from *IfcRepresentation: ContextOfItems* (Att 1), *RepresentationIdentifier* (Att 2), *RepresentationType* (Att 3), *Items* (Att 4). These now have specified values and will be discussed:**

IfcRepresentation (7)			
1	ContextOfItems	IfcRepresentationContext	Definition of the representation context for which the different subtypes of representation are valid.
2	RepresentationIdentifier	OPTIONAL IfcLabel	The optional identifier of the representation as used within a project.
3	RepresentationType	OPTIONAL IfcLabel	The description of the type of a representation context. The representation type defines the type of geometry or topology used for representing the product representation. More information is given at the subtypes *IfcShapeRepresentation* and *IfcTopologyRepresentation*. The supported values for context type are to be specified by implementers agreements.
4	Items	SET [1:?] OF IfcRepresentationItem	Set of geometric representation items that are defined for this representation.

The inherited named attribute **Items** **(Att4)** is a list 30.4.3.3 IfcRepresentationItem entities which define the IFC geometry for the ***IfcShapeRepresentation***.

IfcShapeRepresentation is ***IfcRepresentation >IfcShapeModel >IfcShapeRepresentation*** hence ***IfcShapeRepresentation*** is the only entity that appears in the IFC file.

The inherited named attribute **RepresentationIdentifier (Att 2)** is used to denote the kind of the representation captured by the **IfcShapeRepresentation** (e.g. 'Axis', 'Body', etc.). See RepresentationIdentifier Choices for IfcShapeRepresentation.

The inherited named attribute **RepresentationType (Att 3)** is used to define the **geometric model** used for the shape representation (e.g. 'SweptSolid', or 'Brep'). See RepresentationType Choices for IfcShapeRepresentation. RepresentationType Choices for IfcShapeRepresentation

Continue to RepresentationIdentifier Choices for IfcShapeRepresentation or 30.4.3.3.1.3.1 IfcCartesianPoint, or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

RepresentationIdentifier Choices for IfcShapeRepresentation

Several representation identifiers for shape representation are included as predefined values for ***RepresentationIdentifier*** ***(Att 2)***r

Identifier	Description
CoG	Point to identify the center of gravity of an element. This value can be used for validation purposes.
Box	Bounding box as simplified 3D box geometry of an element
Annotation	2D or 3D annotations
Axis	2D or 3D Axis, or single line, representation of an element
FootPrint	2D Foot print, or double line, representation of an element, projected to ground view
Profile	3D line representation of a profile being planar, e.g. used for door and window outlines
Surface	3D Surface representation (an analytical surface of an element plane)
Reference	3D representation that is not part of the Body representation. This is used, e.g., for opening geometries, if there are to be excluded from an implicit Boolean operation.
Body	3D Body representation, e.g. as wireframe, surface, or solid model, of an element
Body-FallBack	3D Body representation, e.g. as tessellation, or other surface, or boundary representation, added in addition to the solid model (potentially involving Boolean operations) of an element
Clearance	3D clearance volume of the element. Such clearance region indicates space that should not intersect with the 'Body' representation of other elements, though may intersect with the 'Clearance' representation of other elements.
Lighting	Representation of emitting light as a light source within a shape representation

Continue to RepresentationType Choices for IfcShapeRepresentation or 30.4.3.3.1.3.1 IfcCartesianPoint, or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

RepresentationType Choices for IfcShapeRepresentation

Several representation types for shape representation are included as ***RepresentationType*** ***(Att 3)***:
r

Type	Description
Point	2 or 3 dimensional point(s). Points can be represented by a point list
PointCloud	3 dimensional points represented by a point list. DEPRECATED. Use 'Point' instead.
Curve	2 or 3 dimensional curve(s)
Curve2D	2 dimensional curve(s)
Curve3D	3 dimensional curve(s)
Surface	2 or 3 dimensional surface(s)
Surface2D	2 dimensional surface(s) (a region on ground view)
Surface3D	3 dimensional surface(s)
SectionedSurface	swept surface(s) created by sweeping open profiles along a directrix
FillArea	2D region(s) represented as a filled area (hatching)
Text	text defined as text literals
AdvancedSurface	3 dimensional b-spline surface(s)
GeometricSet	points, curves, surfaces (2 or 3 dimensional)
GeometricCurveSet	points, curves (2 or 3 dimensional)
Annotation2D	points, curves (2 or 3 dimensional), hatches and text (2 dimensional)
SurfaceModel	face based and shell based surface model(s), or tessellated surface model(s)
Tessellation	Tessellated surface representation(s) only
Segment	partial geometry of curves that shall not be rendered separately from the main curve
SolidModel	including swept solid, Boolean results and Brep bodies; more specific types are:
SweptSolid	swept area solids, by extrusion and revolution, excluding tapered sweeps
AdvancedSweptSolid	swept area solids created by sweeping a profile along a directrix, and tapered sweeps
Brep	Faceted Brep's with and without voids
AdvancedBrep	Brep's based on advanced faces, with b-spline surface geometry, with and without voids
CSG	Boolean results of operations between solid models, half spaces and Boolean results

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r

Clipping	Boolean differences between swept area solids, half spaces and Boolean results
BoundingBox	simplistic 3D representation by a bounding box
SectionedSpine	cross section based representation of a spine curve and planar cross sections. It can represent a surface or a solid and the interpolations of the between the cross sections is not defined
LightSource	light source with (depending on type) position, orientation, light colour, intensity and attenuation
MappedRepresentation	representation based on mapped item(s), referring to a representation map. Note: it can be seen as an inserted block reference. The shape representation of the mapped item has a representation type declaring the type of its representation items.

Continue to 30.4.3.3 IfcRepresentationItem or return to 30.4 Structure of IFC.

30.4.3.3 IfcRepresentationItem

IfcRepresentationItem

Definition from IFC 4x3:

The ***IfcRepresentationItem*** *is used within an* ***IfcRepresentation*** *(directly or indirectly through other IfcRepresentationItem's) to represent an* ***IfcProductRepresentation****.*

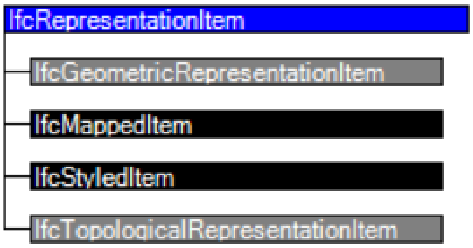
Most commonly these ***IfcRepresentationItem****'s are geometric or topological representation items, that can (but not need to) have presentation style information assigned.*

IfcRepresentationItem is abstract and can not be instantiated.

IfcRepresentationItem **has no named attributes and no inherited named attributes.**

The entities derived from ***IfcRepresentationItem:***

▼ Entity inheritance



30.4.3.3.1 IfcGeometricRepresentationItem

Continue to the new section 30.4.3.3.1 IfcGeometricRepresentationItem or return to 30.4 Structure of IFC.

30.4.3.3.1 IfcGeometricRepresentationItem

IfcRepresentationItem >IfcGeometricRepresentationItem

Definition from IFC 4x3:

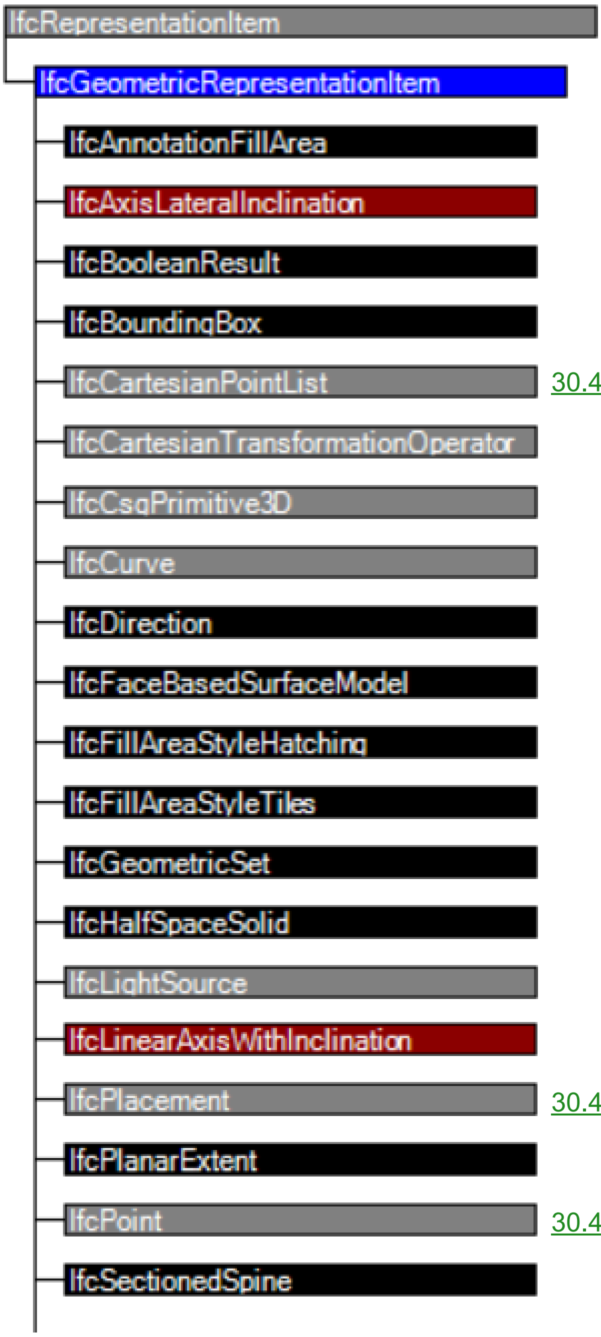
*An **IfcGeometricRepresentationItem** is the common supertype of all **geometric items used within a representation**. It is positioned within a geometric coordinate system, directly or indirectly through intervening items.*

IfcGeometricRepresentationItem is abstract and can not be instantiated.

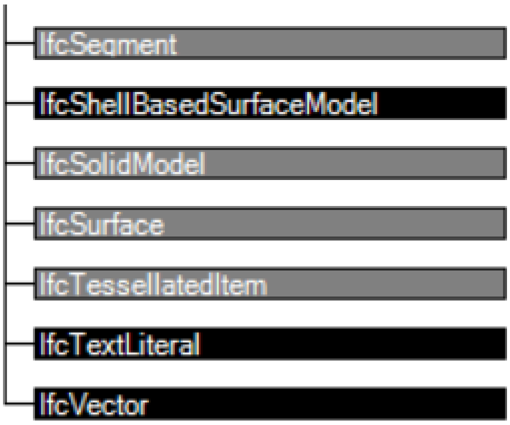
IfcGeometricRepresentationItem **has no named attributes and no inherited named attributes.**

IfcGeometricRepresentationItem is abstract and so can't be in the IFC file. Hence a non-abstract entity derived from ***IfcGeometricRepresentationItem*** (a subtype) is needed.

The IFC entities derived from ***IfcGeometricRepresentationItem***:



30.4.3.3.1.1 IfcCartesianPointList
30.4.3.3.1.2 IfcPlacement
30.4.3.3.1.3 IfcPoint



30.4.3.3.1.4 IfcTesselatedItem

IfcCurve includes straights, arcs, parabolas and transitions (***ifcSpiral***) to draw horizontal and vertical geometry.

Entities derived from ***IfcSolidModel*** and ***IfcSurface*** are used for ***12d Model*** extrusions, super strings with either circular or rectangular cross sections, and the nodes and links of water strings.

IfcTessellatedItem includes ***IfcTriangulatedIrregularNetwork*** for tins:

> ***IfcPresentationItem >IfcGeometricPresentationItem >IfcTessellatedItem >IfcTessellatedFaceSet >IfcTriangulatedFaceSet >IfcTriangulatedIrregularNetwork.***
>
> See 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork.

IfcPoint includes 2D and 3D points as

> ***Ifcpoint >IfcCartesianPoint***

IfcCartesianPointList is list of 2D or 3D points. A 3D list in used in ***IfcTriangulatedIrregularNetwork.***

Continue to 30.4.3.3.1.1 IfcCartesianPointList or return to 30.4 Structure of IFC.

30.4.3.3.1.1 IfcCartesianPointList

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcCartesianPointList

Definition from IFC 4x3:

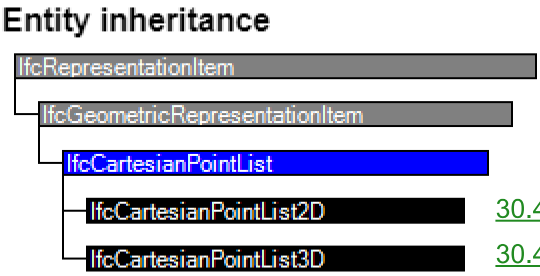
*The **IfcCartesianPointList** is the abstract supertype of list of points.*

NOTE *The **IfcCartesianPointList** is introduced to provide a compact representation of potentially larger list of points, such as in point clouds, and in indexable representation of points.*

IfcCartesianPointList is abstract and can not be instantiated.

IfcCartesianPointList **has no named attributes and no inherited attributes**.

Entities derived from ***IfcCartesianPointList***



30.4.3.3.1.1.1 IfcCartesianPointList2D

30.4.3.3.1.1.2 IfcCartesianPointList3D

Continue to 30.4.3.3.1.1.1 IfcCartesianPointList2D or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.1.1 IfcCartesianPointList2D

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcCartesianPointList* >*IfcCartesianPointList2D*

Definition from IFC 4x3:

*The **IfcCartesianPointList2D** defines an ordered collection of two-dimensional Cartesian points. Each Cartesian point is provided as an two-dimensional point by a fixed list of two coordinates. The attribute **CoordList** is a two-dimensional list, where*

1. first dimension is an unbounded list representing each 2D Cartesian point;
2. second dimension is a fixed list of two list members, where [1] is the x-coordinate, and [2] the y-coordinate of the Cartesian point.

***IfcCartesianPointList2D* has two named attributes *CoordList* (Att 1), *TagList* (Att 2)**

IfcCartesianPointList2D (2)			
1	CoordList	LIST [1:?] OF LIST [2:2] OF IfcLengthMeasure	Two-dimensional list of Cartesian points provided by two coordinates.
2	TagList	OPTIONAL LIST [1:?] OF IfcLabel	List of tags corresponding to each point that may be used to identify a basis curve according to the Tag attribute at *IfcOffsetCurveByDistances*. Also used to identify *IfcSectionedSolidHorizontal* or *IfcSectionedSurface* shape string lines ("guide curves") when used within an *IfcProfileDef* curve of type *IfcIndexedPolyCurve*.

There are no entities derived from ***IfcCartesianPointList2D***.

Continue to 30.4.3.3.1.1.2 IfcCartesianPointList3D or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.1.2 IfcCartesianPointList3D

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcCartesianPointList*
>IfcCartesianPointList3D

Definition from IFC 4x3:

*The **IfcCartesianPointList3D** defines an ordered collection of three-dimensional Cartesian points. Each Cartesian point is provided as an three-dimensional point by a fixed list of three coordinates. The attribute CoordList is a two-dimensional list, where*

1. first dimension is an unbounded list representing each 3D Cartesian point;
2. second dimension is a fixed list of three list members, where [1] is the x-coordinate, and [2] the y-coordinate and [3] the z coordinate of the Cartesian point.

***IfcCartesianPointList3D* has two named attributes *CoordList* (Att 1), *TagList* (Att 2)**

IfcCartesianPointList3D (2)			
1	CoordList	LIST [1:?] OF LIST [3:3] OF IfcLengthMeasure	Two-dimensional list of Cartesian points provided by three coordinates.
2	TagList	OPTIONAL LIST [1:?] OF IfcLabel	List of tags corresponding to each point that may be used to identify a basis curve according to the Tag attribute at *IfcOffsetCurveByDistances*.

There are no entities derived from ***IfcCartesianPointList3D***.

Continue to 30.4.3.3.1.2 IfcPlacement or return to 30.4 Structure of IFC.

30.4.3.3.1.2 IfcPlacement

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcPlacement

Definition from IFC 4x3:

*An **IfcPlacement** is an abstract supertype of placement subtypes that define the location of an item, or an entire shape representation, and provide its orientation. All placement subtypes define right-handed Cartesian coordinate systems and do not allow mirroring.*

NOTE** Cartesian transformations including mirroring and scaling are supported by **IfcCartesianTransformationOperator

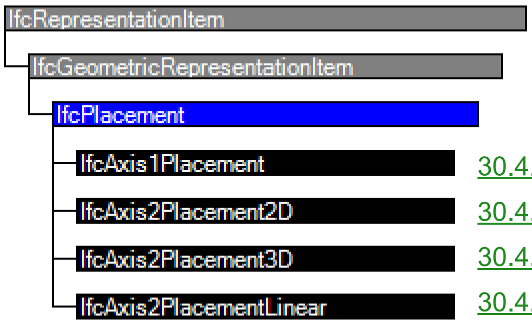
IfcPlacement is abstract and can not be instantiated.

***IfcPlacement* has one named attribute *Location* (Att 1)**

IfcPlacement (2)			
1	Location	IfcPoint	The geometric position of a reference point, such as the center of a circle, of the item to be located.

Entities derived from ***IfcPlacement***

Entity inheritance



30.4.3.3.1.2.1 IfcAxis1Placement
30.4.3.3.1.2.2 IfcAxis2Placement2D
30.4.3.3.1.2.3 IfcAxis2Placement3D
30.4.3.3.1.2.1 IfcAxis1Placement

Continue to 30.4.3.3.1.2.1 IfcAxis1Placement or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.2.1 IfcAxis1Placement

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcPlacement* >*IfcAxis1Placement*

Definition from IFC 4x3:

*The **IfcAxis1Placement** provides location and direction of a single axis.*

***NOTE** Definition according to ISO/CD 10303-42:1992 The direction and location in three dimensional space of a single axis. An **axis1_placement** is defined in terms of a **locating point** (inherited from placement supertype) and an **axis direction**: this is either the direction of axis or defaults to (0.0,0.0,1.0). The actual direction for the axis placement is given by the derived attribute z.*

Name attribute 1 See 30.4.3.3.1.2 IfcPlacement - this is the **locating point**.

***IfcAxis1Placement* has one additional named attributes *Axis* (Att 2)**

IfcAxis1Placement (2)			
2	Axis	OPTIONAL IfcDirection	The direction of the local Z axis.

There are no entities derived from ***IfcAxis1Placement***.

Continue to 30.4.3.3.1.2.2 IfcAxis2Placement2D or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.2.2 IfcAxis2Placement2D

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcPlacement*
>IfcAxis2Placement2D

Definition from IFC 4x3:

*The **IfcAxis2Placement2D** provides location and orientation to place items in a **two-dimensional** space. The attribute **RefDirection** defines the **x axis,** the y axis is derived.*

*If the attribute **RefDirection** is not given, the placement defaults to P[1] (x-axis) as [1.,0.] and P[2] (y-axis) as [0.,1.].*

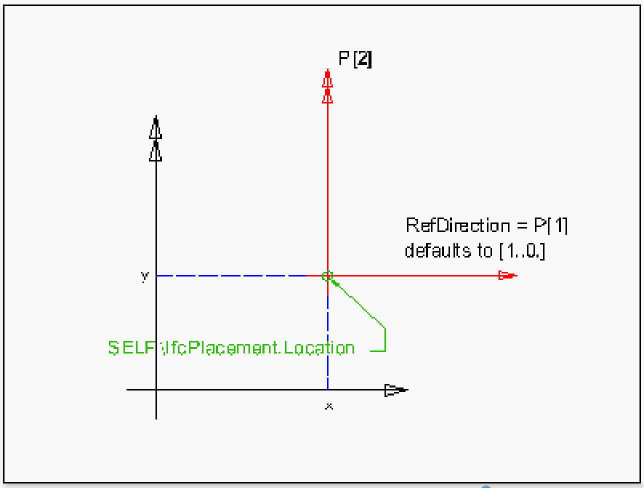


Figure 8.9.3.2.A — Axis2 placement 2D

*Figure 8.9.3.2.A illustrates the definition of the **IfcAxis2Placement2D** within the **two-dimensional** coordinate system.*

Name attribute 1 See 30.4.3.3.1.2 IfcPlacement - this is the **locating point**

***IfcAxis2Placement2D* has one additional named attribute *RefDirection* (Att 2)**

IfcAxis2Placement2D (2)			
2	RefDirection	OPTIONAL IfcDirection	The direction used to determine the direction of the local X axis. If a value is omitted that it defaults to [1.0, 0.0.].

There are no entities derived from ***IfcAxis2Placement2D***.

Continue to 30.4.3.3.1.2.3 IfcAxis2Placement3D or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.2.3 IfcAxis2Placement3D

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcPlacement*
>IfcAxis2Placement3D

Definition from IFC 4x3:

*The **IfcAxis2Placement3D** provides location and orientation to place items in a **three-dimensional** space. The attribute **Axis** defines the Z direction, **RefDirection** the X direction. The Y direction is derived.*

***NOTE** The **RefDirection** does not have to be orthogonal to **Axis**.*

*If the attribute values for **Axis** and **RefDirection** are not given, the placement defaults to P[1] (x-axis) as [1.,0.,0.], P[2] (y-axis) as [0.,1.,0.] and P[3] (z-axis) as [0.,0.,1.].*

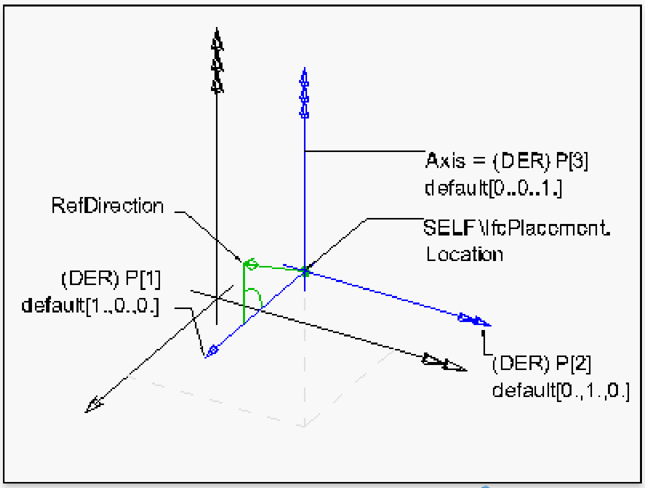


Figure 8.9.3.3.A — Axis2 placement 3D

*Figure 8.9.3.3.A illustrates the definition of the **IfcAxis2Placement3D** within the three-dimensional coordinate system.*

***NOTE** Definition according to **ISO/CD 10303-42:1992** The location and orientation in three dimensional space of three mutually perpendicular axes. An **axis2_placement_3D** is defined in terms of a **point** (inherited from placement supertype) and two (ideally orthogonal) axes. It can be used to locate and orientate a non axi-symmetric object in space and to define a placement coordinate system. The entity includes a **point** which forms the origin of the placement coordinate system. Two direction vectors are required to complete the definition of the placement coordinate system. The **axis** is the placement **Z axis direction** and the **ref_direction** is an approximation to the placement **X axis direction**.*

Name attribute 1 See 30.4.3.3.1.2 IfcPlacement - this is the **locating point**

***IfcAxis2Placement3D* has two additional named attributes *Axis* (Att 2), *RefDirection (Att 3*)**

IfcAxis2Placement3D (3)			
2	Axis	OPTIONAL IfcDirection	The exact direction of the local Z Axis.
3	RefDirection	OPTIONAL IfcDirection	The direction used to determine the direction of the local X Axis. If necessary an adjustment is made to maintain orthogonality to the Axis direction. If Axis and/or RefDirection is omitted, these directions are taken from the geometric coordinate system.

There are no entities derived from ***IfcAxis2Placement3D***.

Continue to 30.4.3.3.1.2.4 IfcAxis2PlacementLinear or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.2.4 IfcAxis2PlacementLinear

IfcRepresentationItem > IfcGeometricRepresentationItem >*IfcPlacement*
>IfcAxis2PlacementLinear

Definition from IFC 4x3:

*The **IfcAxis2PlacementLinear** provides location and orientation to place items in a **three-dimensional** space confined to the **context of a curve**.*

*Relative placement axes (**Axis** and **RefDirection**) are relative to the curve used for linear referencing provided in IfcPlacement Location (IfcPointByDistanceExpression BasisCurve), maintaining the relationship to the tangent of the curve.*

Name attribute 1 See 30.4.3.3.1.2 IfcPlacement

***IfcAxis2PlacementLinear* has two additional named attributes *Axis* (Att 2), *RefDirection (Att 3*)**

IfcAxis2PlacementLinear (2)			
2	Axis	OPTIONAL IfcDirection	The exact direction of the local Z Axis.
3	RefDirection	OPTIONAL IfcDirection	The direction used to determine the direction of the local X Axis. In case both Axis and RefDirection are set and not perpendicular an adjustment is necessary to maintain orthogonality to the Axis direction. If RefDirection is omitted, the direction is taken from the curve tangent at Location.

There are no entities derived from ***IfcAxis2PlacementLinear***.

Continue to 30.4.3.3.1.3 IfcPoint or return to 30.4 Structure of IFC.

30.4.3.3.1.3 IfcPoint

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcPoint

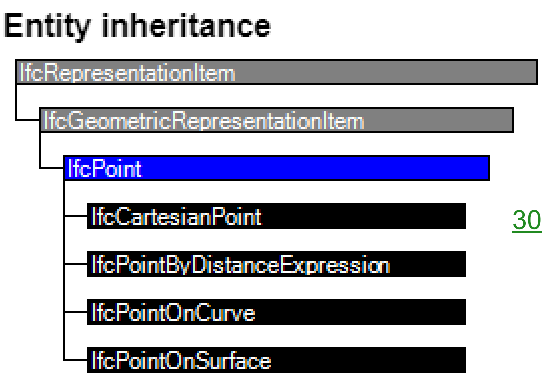
Definition from IFC 4x3:

The IfcPoint is the abstract generalisation of all point representations within a Cartesian coordinate system.

IfcPoint is abstract and can not be instantiated.

***IfcPoint* has no named attributes and no inherited attributes.**

Entities derived from *IfcPoint*



30.4.3.3.1.3.1 IfcCartesianPoint

Continue to 30.4.3.3.1.3.1 IfcCartesianPoint or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.3.3.1.3.1 IfcCartesianPoint

IfcRepresentationItem > IfcGeometricRepresentationItem >IfcPoint >IfcCartesianPoint

Definition from IFC 4x3:

*An **IfcCartesianPoint** defines a point by coordinates in an orthogonal, right-handed Cartesian coordinate system. For the purpose of this specification only two and three dimensional Cartesian points are used.*

NOTE

Definition according to ISO/CD 10303-42:1992 A cartesian point is a point defined by its coordinates in a rectangular Cartesian coordinate system, or in a parameter space. The entity is defined in a one, two or three-dimensional space as determined by the number of coordinates in the list. Depending upon the geometric representation context in which the point is used the names of the coordinates may be (x,y,z), or (u,v), or any other chosen values.

***IfcCartesianPoint* has one named attribute *Coordinates* (Att 1)**:

IfcCartesianPoint (1)			
1	Coordinates	LIST [1:3] OF IfcLengthMeasure	The first, second, and third coordinate of the point location. If placed in a two or three dimensional rectangular Cartesian coordinate system, Coordinates[1] is the X coordinate, Coordinates[2] is the Y coordinate, and Coordinates[3] is the Z coordinate.

There are no entities derived from ***IfcCartesianPoint***.

Continue to 30.4.3.3.1.4 IfcTesselatedItem or return to 30.4 Structure of IFC.

30.4.3.3.1.4 IfcTesselatedItem

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcTesselatedItem

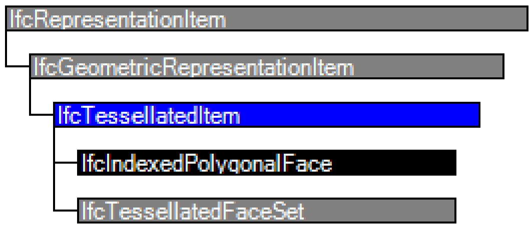
Definition from IFC 4x3:

*The **IfcTesselatedItem** is the abstract supertype of all tessellated geometric models.*

IfcTesselatedItem is abstract and can not be instantiated.

***IfcTesselatedItem* has no named attributes and no inherited attributes.**

Entities derived from ***IfcTesselatedItem***



30.4.3.3.1.4.1 IfcTesselatedFaceSet

Continue to 30.4.3.3.1.4.1 IfcTesselatedFaceSet or return to 30.4 Structure of IFC.

30.4.3.3.1.4.1 IfcTesselatedFaceSet

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcTesselatedItem >IfcTesselatedFaceSet

Definition from IFC 4x3:

The IfcTesselatedFaceSet is a boundary representation topological model limited to ***planar faces*** *and* ***straight edges****.*

The IfcTesselatedFaceSet is the abstract supertype of all tessellated geometric models.

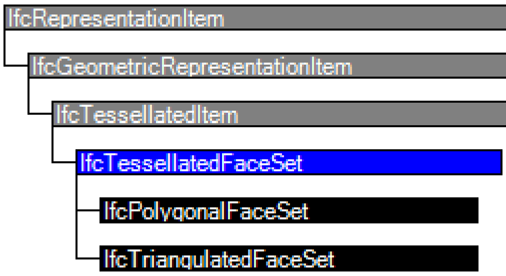
IfcTesselatedFaceSet is abstract and can not be instantiated.

IfcTesselatedFaceSet has one named attribute ***Coordinates*** **(Att 1):**

IfcTessellatedFaceSet (4)			
1	Coordinates	IfcCartesianPointList3D	An ordered list of Cartesian points used by the coordinate index defined at the subtypes of *IfcTessellatedFaceSet*.

Entities derived from *IfcTesselatedFaceSet*

Entity inheritance



30.4.3.3.1.4.1.1 IfcPolygonalFaceSet

30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet

Continue to 30.4.3.3.1.4.1.1 IfcPolygonalFaceSet or return to 30.4 Structure of IFC.

30.4.3.3.1.4.1.1 IfcPolygonalFaceSet

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcTesselatedItem >IfcTesselatedFaceSet ***>IfcPolygonalFaceSet***

Definition from IFC 4x3:

*The **IfcPolygonalFaceSet** is a tessellated face set with **all faces being bound by polygons**. The **planar faces** are constructed by implicit polylines defined by three or more Cartesian points. Each planar face is defined by an instance of **IfcIndexedPolygonalFace**, or in case of faces with inner loops by **IfcIndexedPolygonalFaceWithVoids**.*

*if **TRUE**, a boundary representation (or B-rep);*

*if **FALSE**, a face based surface representation.*

Name attribute 1 See 30.4.3.3.1.4.1 IfcTesselatedFaceSet

IfcPolygonalFaceSet **has three additional named attributes** ***Closed*** **(Att 2),** ***Faces*** **(Att 3),** ***PnIndex*** **(Att 4):**

IfcPolygonalFaceSet (3)			
2	Closed	OPTIONAL IfcBoolean	Indication whether the face set is a closed shell (TRUE) or an open shell (FALSE). If omitted no such information can be asserted.
3	Faces	LIST [1:?] OF UNIQUE IfcIndexedPolygonalFace	The list of polygonal faces, with or without inner loops, that bound the faceted face set.
4	PnIndex	OPTIONAL LIST [1:?] OF IfcPositiveInteger	The list of integers defining the locations in the *IfcCartesianPointList3D* to obtain the point coordinates for the indices at the indexed polygonal faces. If the *PnIndex* is not provided the indices at the indexed polygonal faces point directly into the *IfcCartesianPointList3D*.

There are no entities derived from ***IfcPolygonalFaceSet***.

Continue to 30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet or return to 30.4 Structure of IFC.

30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet

IfcRepresentationItem >IfcGeometricRepresentationItem >IfcTesselatedItem >IfcTesselatedFaceSet ***>IfcTriangulatedFaceSet***

Definition from IFC 4x3:

*The **IfcTriangulatedFaceSet** is a tessellated face set with **all faces being bound by triangles**. The faces are constructed by implicit polylines defined by three Cartesian points. Depending on the value of the inherited attribute **Closed** the instance of **IfcTriangulatedFaceSet** represents:*

*if **TRUE**, a boundary representation (or B-rep);*

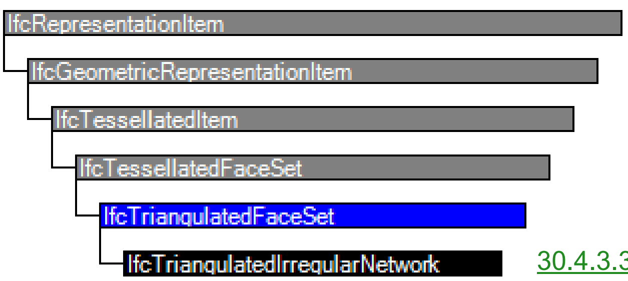
*if **FALSE**, a face based surface representation.*

Name attribute 1 See 30.4.3.3.1.4.1 IfcTesselatedFaceSet

***IfcTriangulatedFaceSet* has four additional named attributes *Normals* (Att 2), *Closed* (Att 3), *CoordIndex* (Att 4), *PnIndex* (Att 5):**

IfcTriangulatedFaceSet (5)			
2	Normals	OPTIONAL LIST [1:?] OF LIST [3:3] OF IfcParameterValue	An ordered list of three directions for normals. It is a two-dimensional list of directions provided by three parameter values. * The first dimension corresponds to the vertex indices of the *Coordindex* * The second dimension has exactly three values, [1] the x-direction, [2] the y-direction and [3] the z-directions
3	Closed	OPTIONAL IfcBoolean	Indication whether the face set is a closed shell (TRUE) or an open shell (FALSE). If omitted no such information can be asserted.
4	CoordIndex	LIST [1:?] OF LIST [3:3] OF IfcPositiveInteger	Two-dimensional list for the indexed-based triangles, where * The first dimension represents the triangles (from 1 to N) * The second dimension has exactly three values representing the indices to three vertex points (from 1 to 3). NOTE The coordinates of the vertices are provided by the indexed list of *SELF\IfcTessellatedFaceSet.Coordinates.CoordList*.
5	PnIndex	OPTIONAL LIST [1:?] OF IfcPositiveInteger	The list of integers defining the locations in the *IfcCartesianPointList3D* to obtain the point coordinates for the indices withint the *CoordIndex*. If the *PnIndex* is not provided the indices point directly into the *IfcCartesianPointList3D*.

Entities derived from ***IfcTriangulatedFaceSet***



30.4.3.3.1.4.1.2.1

Continue to 30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork or return to 30.4 Structure of IFC.

30.4.3.3.1.4.1.2.1 IfcTriangulatedIrregularNetwork

IfcPresentationItem >IfcGeometricPresentationItem >IfcTessellatedItem >IfcTessellatedFaceSet >IfcTriangulatedFaceSet >IfcTriangulatedIrregularNetwork

Definition from IFC 4x3:

*The **IfcTriangulatedIrregularNetwork** is a triangulated face set for representing horizontal surfaces (**one unique Z coordinate for all X and Y coordinates within domain**) with additional flags for each face indicating breaklines between faces or designation as a hole or void. Triangles shall be defined with vertices in **counterclockwise** order as viewing from above (following right-hand rule).*

Name attribute 1 See 30.4.3.3.1.4.1 IfcTesselatedFaceSet

Name attribute 2 - 5 See 30.4.3.3.1.4.1.2 IfcTriangulatedFaceSet

***IfcTriangulatedIrregularNetwork* has one additional named attribute *Flags* (Att 6)**:

IfcTriangulatedIrregularNetwork (1)			
6	Flags	LIST [1:?] OF IfcInteger	Indicates attributes of each triangle in a compact form as follows: -2 = invisible void; -1 = invisible hole; 0 = no breaklines; 1 = breakline at edge 1; 2 = breakline at edge 2; 3 = breakline at edges 1 and 2; 4 = breakline at edge 3; 5 = breakline at edges 1 and 3; 6 = breakline at edges 2 and 3; 7 = breakline at edges 1, 2, and 3.

IfcTriangulatedIrregularNetwork is **NOT** derived from ***IfcRoot*** and has **no subtypes**.

For an example of how an instance of ***IfcTriangulatedIrregularNetwork*** is written in an IFC STEP file, see 30.4.3.3.1.4.1.2.1.1 IFC STEP File Format For IfcTriangulatedIrregularNetwork.

Continue to 30.4.3.3.1.4.1.2.1.1 IFC STEP File Format For IfcTriangulatedIrregularNetwork or return to 30.4 Structure of IFC.

30.4.3.3.1.4.1.2.1.1 IFC STEP File Format For IfcTriangulatedIrregularNetwork

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcTriangulatedIrregularNetwork*** is:

Att 3 ***Representations*** which is a list of ***IfcRepresentation***

Att 4 ***Items*** which is a list of ***IfcRepresentationItem***

```
:27 = IFCPRODUCTDEFINITIONSHAPE($, $, (#28));
:28 = IFCSHAPEREPRESENTATION(#12, 'Body', 'Tessellation', (#30));
:29 = IFCCARTESIANPOINTLIST3D(((42656.372, 36830.544, 66.978), (42643.283, 36845.693, 66.086), (42663
:30 = IFCTRIANGULATEDIRREGULARNETWORK(#29, $, .F., ((1, 3, 2), (5, 7, 6), (8, 10, 9), (8, 4, 12), (11
```

Att 1 ***Coordinates*** which is an ***IfcCartesianPointList3D***

Continue to 30.4.4 Object Placement for IFC Products or return to 30.4 Structure of IFC.

30.4.4 Object Placement for IFC Products

All ***IfcProduct's*** have an optional sixth named attribute called ***ObjectPlacement*** that defines the placement of the product in space. Its type is ***IfcObjectPlacement***.

IfcProduct (5)			
6	ObjectPlacement	OPTIONAL IfcObjectPlacement	This establishes the object coordinate system and placement of the product in space. The placement can either be absolute (relative to the world coordinate system), relative (relative to the object placement of another product), or constrained (e.g. relative to grid axes, or to a linear positioning element). The type of placement is determined by the various subtypes of *IfcObjectPlacement*. An object placement must be provided if a representation is present.

IfcObjectPlacement is **NOT** derived from ***IfcRoot.***

Continue to 30.4.4.1 IfcObjectPlacement or return to 30.4.4.1 IfcObjectPlacement.

30.4.4.1 IfcObjectPlacement

IfcObjectPlacement

IfcObjectPlacement is **NOT** derived from ***IfcRoot.***

Definition from IFC 4x3:

IfcObjectPlacement *is an abstract supertype for the different ways of defining the coordinates of the object. The* ***IfcObjectPlacement*** *has to be provided for each product that has a geometric (shape) representation so that it is placed correctly (see* 30.4.3 Representation (Geometry) for IFC Products*).*

IfcObjectPlacement is abstract and can not be instantiated.

The object placement can be given

(a) **absolute**: by an axis2 placement, relative to the world coordinate system

(b) relative: by an axis2 placement, relative to the object placement of another product

(c) by grid reference: by the virtual intersection and reference direction given by two axes of a design grid

and in IFC 4x3,

(d) linear **placement:**. by distance along a curve with possible offsets.

In any case the object placement has to unambiguously define the object coordinate system as either two-dimensional axis placement (IfcAxis2Placement2D) or three-dimensional axis placement (IfcAxis2Placement3D). The axis placement may have to be calculated.

IfcObjectPlacement **has one named attribute** ***PlacementRelTo*** **(Att 1):**

IfcObjectPlacement (3)			
1	PlacementRelTo	OPTIONAL IfcObjectPlacement	Reference to object placement that provides the relative placement with its placement in a grid, local coordinate system or linear referenced placement. If it is omitted, then in the case of linear placement it is established by the origin of horizontal alignment of the referenced IfcAlignment Axis. In the case of local placement it is established by the geometric representation context.

IfcObjectPlacement is abstract and so can't be in the IFC so a non-abstract entity derived from it (subtype) is needed.

- IfcObjectPlacement
  - IfcGridPlacement
  - IfcLinearPlacement — 30.4.4.1.2 IfcLinearPlacement
  - IfcLocalPlacement — 30.4.4.1.1 IfcLocalPlacement

IfcGridPlacement is not appropriate for ***12d Model*** work and will not be discussed.

Continue to 30.4.4.1.1 IfcLocalPlacement or return to 30.4.4.1 IfcObjectPlacement.

Still to add to earlier sections:

Need Level of Detail - LOD - see TfNSW document I put on Distributor forum

Need Level of information - LOI - see TfNSW document I put on Distributor forum

30.4.4.1.1 IfcLocalPlacement

***IfcObjectPlacement* >IfcLocalPlacement**

Definition from IFC 4x3:

*An **IfcLocalPlacement** defines the relative placement of a product in relation to the placement of another product or the **absolute placement of a product within the geometric representation context** of the project.*

*The **IfcLocalPlacement** allows that an IfcProduct can be placed by this **IfcLocalPlacement** (through the attribute **ObjectPlacement**) within the local coordinate system of the object placement of another IfcProduct, which is referenced by the **PlacementRelTo**. Rules to prevent cyclic relative placements have to be introduced on the application level.*

*If the **PlacementRelTo** is not given, then the IfcProduct is placed **absolutely** within the world coordinate system.*

***IfcLocalPlacement* has one additional named attribute *RelativePlacement* (Att 2):**

IfcObjectPlacement (3)			
1	PlacementRelTo	OPTIONAL IfcObjectPlacement	Reference to object placement that provides the relative placement with its placement in a grid, local coordinate system or linear referenced placement. If it is omitted, then in the case of linear placement it is established by the origin of horizontal alignment of the referenced IfcAlignment Axis. In the case of local placement it is established by the geometric representation context.
IfcLocalPlacement (1)			
2	RelativePlacement	IfcAxis2Placement	Geometric placement that defines the transformation from the related coordinate system into the relating. The placement can be either 2D or 3D, depending on the dimension count of the coordinate system.

In vertical BIM (buildings etc), a local origin is usually used. Also in vertical BIM, many objects are placed relative to another object or to a Spatial Structure.

However in most infrastructure projects (horizontal BIM), map coordinates (e.g. MGA2020) are usually mandated and data placed absolutely.

IFC 4 added the entity ***IfcProjectedCRS*** to define the Horizontal and Vertical datums, and the map projection and zone that the final data in the IFC is to be delivered in.

IFC 4x3 added two additional entities, ***IfcRigidOperation*** and ***IfcMapProjectionScaled*** so that the following cases can be covered.

1. data in the IFC file is already in map coordinates
2. data in the IFC file is not in map coordinates but only requires a translation to be in map coordinates
3. data in the IFC file is in local engineering coordinates but when read in, needs to be in map coordinates

For a discussion on these cases, see 30.4.4.3 Setting Up For Map Coordinates.

Continue to 30.4.4.1.2 IfcLinearPlacement or return to 30.4.4.1 IfcObjectPlacement.

30.4.4.1.2 IfcLinearPlacement

***IfcObjectPlacement* >IfcLinearPlacement**

Definition from IFC 4x3:

IfcLinearPlacement *provides a specialization of* ***IfcObjectPlacement*** *in which the placement and axis direction of the object coordinate system is defined by a reference to a curve. RelativePlacement is therefore restricted to IfcAxis2PlacementLinear.*

This is not currently used when writing out data from 12d Model.

Continue to the next section 30.4.4.2 Placement and Georeferencing or return to 30.4 Structure of IFC.

30.4.4.2 Placement and Georeferencing

Vertical building projects are usually contained within a rectangle with sides of only a few hundreds of metres and generally use what is called a **local engineering coordinate system**.

In such a **local engineering coordinate system,** a local origin (0,0) is placed at a convenient position on the building site and one of the x or y axes oriented to be parallel to a side of the building. Distances are measured in ground units and often recorded in millimetres.

Heights are usually measure in an orthometric systems (i.e. water runs downhill) and often a local zero for height, such as 0 at the bottom of the building, is also used.

It is assumed that the three axis (x,y,z) are perpendicular to one another throughout the site, and everyone one site is able to easily measure back to the local (x,y) origin (0,0) and height origin.

Basically it is assumed that the Earth is flat.

There is nothing wrong in using a local, flat earth, engineering coordinate system for a small site as long as everyone is aware that it is only for a small site. Even Einstein noted that for General Relativity, "space is locally flat".

However for a large site, the fact that the Earth is not flat means that local engineering coordinates can not be used.

For large sites, map coordinates and orthometric heights are used.

These are described in detail in 29 Geodetics Summary but a brief summary is given in the next three sections

See

30.4.4.2.1 Geodetic or Horizontal Datum

30.4.4.2.2 Map (Cartographic) Projections - Eastings and Northings.

30.4.4.2.3 Orthometric Heights Instead of Ellipsoid Heights.

30.4.4.2.1 Geodetic or Horizontal Datum

To give everything on earth a unique coordinates that fits in with GNSS systems (GPS, GLONASS, BeiDou and Galileo), a **reference ellipsoid for the earth** has been defined with:

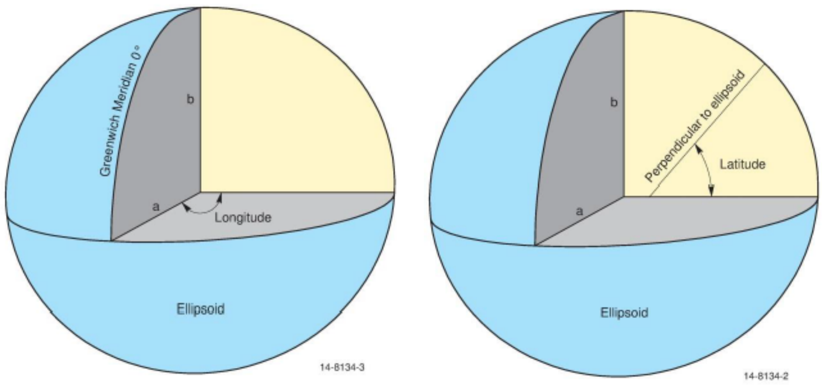
(a) (0,0,0) at the Mass centre of the earth (geocentre), a semi major axis of 6,378,137 m, and an inverse flattening of 298.257222101. This is known as **GRS80**.

The north pole points towards the North star.

The mass centre of the earth is used because satellites orbit around the mass centre.

(b) Longitude is an angular quantity measured from the Greenwich meridian.

(c) Latitude is an angular quantity measured from the equatorial plane, to the plane defined by the point position and the plumb line to the ellipsoid surface.



(d) Ellipsoid height is the height above the reference ellipsoid.

Longitude, latitude and ellipsoid heights are referred to as **Geodetic Coordinates.**

Using a GNSS system, the Geodetic coordinates of (Latitude, Longitude, Ellipsoid height) can be directly obtained for any position on earth that can see the satellites.

However there is the problem of Continental Drift.

Because continents move around, every day a position on earth moves relative to Greenwich and the equator so the longitude and latitude of a point changes everyday.

So the time that the longitude and latitude is taken is critical. This time is called the **Epoch**.

The model of the earth, the definition of longitude and latitude and the Epoch is referred to as the **Geodetic or Horizontal Datum**.

Continue to 30.4.4.2.2 Map (Cartographic) Projections - Eastings and Northings or return to 30 BIM and Digital Engineering.

30.4.4.2.2 Map (Cartographic) Projections - Eastings and Northings

Although Geodetic coordinates give unique coordinates for a point, they are not very useful for civil design as working on an ellipsoid is difficult.

Civil data is usually represented on a map by mathematically "projecting" the ellipsoid onto a surface, which can be laid flat.

A Map or Cartographic Projection is a transformation of the longitudes and latitudes of locations on the surface of an ellipsoid onto locations on a plane. The projection coordinates are usually referred to as **Eastings** (x) and Northings (y).

An ellipsoid cannot be reversibly mapped onto a single sheet of paper so the mapping is broken up into sections of the ellipsoid called **zones**.

The most important property of a Cartographic projection with zones is that it can be reversed. That is, there is an inverse function that converts map coordinates in a zone back to longitudes and latitudes.

So the Cartographic projection

(a) for a given zone, maps (Longitude, Latitude) to a unique (Easting, Northing) in a zone

and

(b) the inverse projection maps the (Easting, Northing) in a zone to a unique (Latitude, Longitude).

Consequently if you have the (Easting, Northing) and zone then you can calculate the equivalent (Latitude, Longitude) and vice versa.

The most commonly used Cartographic projection for civil works is the **Transverse Mercator** projection.

In mathematical speak, **Transverse Mercator** projections are **conformal** projections and preserve angles locally, implying that they map infinitesimal circles of constant size anywhere on the Earth to infinitesimal circles of **varying sizes** on the map. In contrast, mappings that are not conformal distort small circles into ellipses of distortion.

An important consequence of conformality is that relative angles at each point of the map are correct, and the local scale (although varying throughout the map) **in every direction around any one point is constant**.

Transverse Mercator projections are commonly used for road projects by the Road Authorities in each State of Australia, and throughout the rest of the world. They are used for the Meridional Circuits in New Zealand.

The Transverse Mercator projection is also used as the basis of the **UTM** (Universal Transverse Mercator). The UTM is not a single map projection but divides the Earth into sixty zones, each a six-degree band of longitude, and uses a Transverse Mercator projection.

In Australia, **MGA** coordinates (Map Grid of Australia) are based on the UTM using the ellipsoid GRS80 previously defined.

So each MGA coordinate (Easting, Northing) has a unique (Latitude, Longitude).

And a reading from a GNSS device (commonly called a GPS) uniquely converts to a MGA coordinate, and conversely a MGA coordinate converts to (Latitude, Longitude) for use in a GNSS device without knowing anything about a local coordinate system.

??Add note that map metres are not equal to ground metres.

Continue to 30.4.4.2.3 Orthometric Heights Instead of Ellipsoid Heights or return to 30 BIM and Digital Engineering.

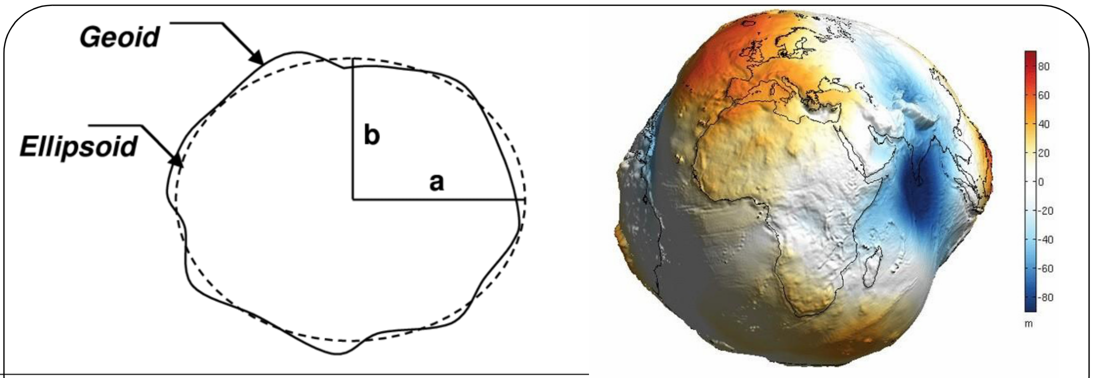
30.4.4.2.3 Orthometric Heights Instead of Ellipsoid Heights

Ellipsoid heights are measured perpendicular to the ellipsoid, and are defined at all points on the Earth. But ellipsoid heights are not what most people think of as "heights".

The most common definition of height is that the height at two points is the same if water will not flow between them, and one height is greater than the other if water flows from the higher point to the lower point. This is a gravity definition of height.

Because the gravity definition of height makes sense for most applications, most height datums are not based on ellipsoid height but are based on the **gravity height**. These are called **orthometric heights**.

The **zero height for orthometric height** is called the **geoid** and this is defined as the shape that the ocean surface would take under the influence of the gravity and rotation of the Earth alone. So orthometric heights are also known as **geoid** or **geoidal heights**.



The Earth Potato - exaggerated difference between Geoid and the Ellipsoid

The reference vertical system used for vertical positions is called the **Vertical Datum**.

Note: Heights on the Australia mainland are not usually quoted as Ellipsoid heights **h** but instead in AHD **H** (Australian Height Datum 1971) which is defined in terms of Mean Sea Level. The difference between the ellipsoid height and AHD is known as the **N Value**.

AHD (Geoid height) = Ellipsoid height - N (AHD) Value

30.4.4.2.4 IfcCoordinateReferenceSystem

IfcCoordinateReferenceSytem

Definition from IFC 4x3:

The IfcCoordinateReferenceSytem is a definition of a coordinate reference system by means of qualified identifiers only. The interpretation of the identifier is expected to be well-known to the receiving software.

IfcCoordinateReferenceSytem is abstract and can not be instantiated.

***IfcCoordinateReferenceSytem* has three named attributes *Name* (Att 1), *Description* (Att 2), *Geodetic Datum* (Att 3):**

IfcCoordinateReferenceSystem (5)			
1	Name	OPTIONAL IfcLabel	Name by which the coordinate reference system is identified. NOTE The name shall be taken from the list recognized by the European Petroleum Survey Group EPSG. It should then be qualified by the EPSG namespace, for example as 'EPSG:5555'. NOTE The *Name* shall contain only one EPSG code. When there is not one EPSG that unambiguously identifies the CRS, *IfcWellKnownText* shall be used. Combining multiple EPSG codes in one string for *Name* (e.g., 'EPSG:2056,EPSG:5728') is not allowed. NOTE The name shall be 'WKT' if an EPSG code does not exist for the coordinate reference system (CRS). In this case, the CRS shall be further specified using the *IfcWellKnownText* entity.
2	Description	OPTIONAL IfcText	Informal description of this coordinate reference system.
3	GeodeticDatum	OPTIONAL IfcIdentifier	Name by which this datum is identified. The geodetic datum is associated with the coordinate reference system and indicates the shape and size of the rotation ellipsoid and this ellipsoid's connection and orientation to the actual globe/earth. It needs to be provided, if the *Name* identifier does not unambiguously define the geodetic datum as well.

The unambiguous identifier by which the coordinate reference system is know, is stored in the ***Name*** *attribute. Well defined identifiers include the geodetic and the vertical CRS, each with its own* *datum. In these cases the **GeodeticDatum** can be omitted.*

Important Note: This is different to IFC 4 where there was a fourth named attribute **VerticalDatum.**

In IFC 4x3 **VerticalDatum** has been moved to ***IfcProjectedCRS*** when ***IfcGeographicCRS*** was added. This does not cause any compatibility problems because ***IfcCoordinateReferenceSytem*** is abstract and ***IfcProjectedCRS*** is derived from it.

IfcCoordinateReferenceSytem is abstract and can't be in the IFC file so a non-abstract entity derived from it (a subtype) is needed.

IfcCoordinateReferenceSystem

IfcProjectedCRS — 30.4.4.2.4.1 IfcProjectedCRS

IfcGeographicCRS — 30.4.4.2.4.2 IfcGeographicCRS — **added in IFC 4x3**

When the data being read in from the created IFC file is to be in **map coordinates** and a **vertical datum**, ***IfcProjectedCRS*** is used to record the **georeferencing information** in the IFC file. See 30.4.4.2.4.1 IfcProjectedCRS.

IfcGeographicCRS is not currently supported when writing out data from ***12d Model***.

Continue to 30.4.4.2.4.1 IfcProjectedCRS or return to 30.4.4.1 IfcObjectPlacement.

30.4.4.2.4.1 IfcProjectedCRS

IfcCoordinateReferenceSytem* >*IfcProjectedCRS

Definition from IFC 4x3:

***IfcProjectedCRS** is a **coordinate reference system** (**CRS**) of the map to which the map translation of the local engineering coordinate system of the construction or facility engineering project relates. The projected coordinate reference system is assumed to be a **2D** or **3D** right-handed Cartesian coordinate system, the optional **MapUnit** attribute can be used to determine the length unit used by the map.*

Name attributes 1, 2, 3 See 30.4.4.2.4 IfcCoordinateReferenceSystem

***IfcProjectedCRS* has the three named attributes *Name* (Att 1), *Description* (Att 2)** and ***Geodetic Datum* (Att 3) inherited from *IfcCoordinateReferenceSytem* plus four additional named attributes *VerticalDatum* (Att 4), *MapProjection* (Att 5), *MapZone* (Att 6), *MapUnit* (Att 6):**

IfcProjectedCRS (4)			
4	VerticalDatum	OPTIONAL IfcIdentifier	Name by which the vertical datum is identified. The vertical datum is associated with the height axis of the coordinate reference system and indicates the reference plane and fundamental point defining the origin of a height system. It needs to be provided, if the *Name* identifier does not unambiguously define the vertical datum as well and if the coordinate reference system is a 3D reference system. EXAMPLE vertical datums include:
5	MapProjection	OPTIONAL IfcIdentifier	Name by which the map projection is identified. EXAMPLE map projections include:
6	MapZone	OPTIONAL IfcIdentifier	Name by which the map zone, relating to the *MapProjection*, is identified. EXAMPLE map zones includes:
7	MapUnit	OPTIONAL IfcNamedUnit	Unit of the coordinate axes composing the map coordinate system. NOTE Only length measures are in scope and all two or three axes of the map coordinate system shall have the same length unit. NOTE If MapUnit is omitted, the unit for the coordinate axes is taken from the default units, as stated in IfcProject.UnitInContext.

Important Note:

Despite what its name ***ProjectedCRS*** suggests (i.e. it is only for x and y):

- If the referenced 30.4.2.1.1.1.1 IfcGeometricRepresentationContext is **3D**, then ***IfcProjectedCRS*** shall be a **compound coordinate reference system**, meaning a combination of multiple CRS from which a **GeodeticDatum** and a **VerticalDatum** can always be unambiguously identified.

- If the referenced ***IfcGeometricRepresentationContext*** is **2D**, then ***IfcProjectedCRS*** can be either a projected coordinate reference system or a compound coordinate reference system.

The unambiguous identifier by which the coordinate reference system is known, is stored in the inherited ***Name*** attribute. Well defined identifiers include the map projection, the map zone information, and all required datums. In these cases the attributes ***VerticalDatum***, ***MapProjection***, ***MapZone*** as well as the inherited attribute ***GeodeticDatum*** can be omitted.

Warning: The definition of *IfcProjectedCRS* in IFC 4x3 is different to IFC 4.

When ***IfcGeographicCRS*** was added to IFC 4x3, **VerticalDatum** was moved from ***IfcCoordinateReferenceSytem*** to ***IfcProjectedCRS***. This does not cause any compatibility issues because ***IfcCoordinateReferenceSytem*** is abstract and ***IfcProjectedCRS*** is derived from it.

Continue to 30.4.4.2.4.2 IfcGeographicCRS or return to 30.4.4.1 IfcObjectPlacement.

30.4.4.2.4.2 IfcGeographicCRS

IfcCoordinateReferenceSytem ***>IfcGeographicCRS***

Definition from IFC 4x3:

A ***IfcGeographicCRS*** *is a coordinate reference system (CRS) that uses a three-dimensional* ***ellipsoid surface*** *to reference locations on the Earth. Any location on Earth can be described by a point with* ***longitude*** *and* ***latitude*** *coordinates and the height above or below the ellipsoid surface (****ellipsoid height****).*

Name attributes 1, 2, 3 See 30.4.4.2.4 IfcCoordinateReferenceSystem

IfcGeographicCRS **has three additional named attributes** ***PrimeMeridian*** **(Att 4),** ***AngleUnit*** **(Att 5),** ***HeightUnit*** **(Att 6):**

IfcGeographicCRS (3)			
4	PrimeMeridian	OPTIONAL IfcIdentifier	The identification of the meridian defining zero longitude in the used geographic CRS.
5	AngleUnit	OPTIONAL IfcNamedUnit	Unit of latitude and longitude coordinate axes composing the geographic coordinate system. NOTE Only plane angle measures are in scope and both longitude and latitude coordinate axes of the geographic coordinate system shall have the same plane angle unit. NOTE If *AngleUnit* is omitted, the unit for latitude and longitude coordinate axes is taken from the default project angle units, as stated in *IfcProject.UnitInContext*.
6	HeightUnit	OPTIONAL IfcNamedUnit	Unit of the height coordinate axis of the geographic coordinate system. NOTE Only length measures are in scope. NOTE If *HeightUnit* is omitted, the unit for the height coordinate axis is taken from the default project length units, as stated in *IfcProject.UnitInContext*.

IfcGeographicCRS is not currently supported in ***12d Model***.

Continue to 30.4.4.2.5 IfcCoordinateOperation or return to 30.4.4.1 IfcObjectPlacement.

30.4.4.2.5 IfcCoordinateOperation

IfcCoordinateOperation

Definition from IFC 4x3:

IfcCoordinateOperation *is an abstract supertype to handle any operation (transformation or conversion) between two coordinate reference systems (CRS's).*

By convention, a coordinate operation is given ***between*** *a* ***source CRS,*** *being the more local (or child) CRS;* ***and target CRS***, *being the more remote (or parent) CRS.*

EXAMPLE

A common coordinate operation is the one between the local engineering coordinate system of a construction project and any map or other coordinate reference system.

IfcCoordinateOperation is abstract and can not be instantiated.

IfcCoordinateOperation **has two named attributes, *SourceCRS* (Att 1) and *TargetCRS (Att 2)* which are defined as:**

#	Attribute	Type	Description
IfcCoordinateOperation (2)			
1	SourceCRS	IfcCoordinateReferenceSystemSelect	Source coordinate reference system for the operation.
2	TargetCRS	IfcCoordinateReferenceSystem	Target coordinate reference system for the operation.

An ***IfcCoordinateOperation*** allows to connect:

(a) an ***IfcGeometricRepresentationContext*** - a reference system of a virtual model

to

(b) an ***IfcCoordinateReferenceSystem*** - the coordinate system which is related to the real world by datums.

EXAMPLE

This can is done by setting:

1. the ***IfcCoordinateOperation.SourceCRS*** to ***IfcGeometricRepresentationContext***
2. the ***IfcCoordinateOperation.TargetCRS*** either to: ***IfcProjectedCRS***, for defined easting, northing and orthogonal height or ***IfcGeographicCRS*** for defined latitude, longitude and ellipsoidal height.

NOTE

IfcProjectedCRS can be used to represent a projected CRS or a compound CRS, comprising of a projected CRS with a vertical CRS. See 30.4.4.2.4.1 IfcProjectedCRS for further details.

Entities directly derived from ***IfcCoordinateOperation***

IfcCoordinateOperation

- IfcMapConversion
- IfcRigidOperation ← **added in IFC 4x3 for Translation**

Continue to 30.4.4.2.5.2 IfcMapConversion or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.4.2.5.1 IfcRigidOperation

IfcCoordinateOperation >IfcRigidOperation

Definition from IFC 4x3:

*A rigid operation specifies an offset in the coordinate reference system. It does not specify any conversion or distortion. It is a coordinate operation that tells that the whole virtual model is **translated** in the same way. For example, using lengths to translate along x,y,z; or using angles for a 2D translation (e.g., lambda, phi), plus a change in height.*

EXAMPLE

If data is in truncated map coordinates (i.e., the map coordinates have the leading digits removed in x and y), then IfcRigidOperation simply translates the data in x and y to replace the ignored leading digits. This is also known as subtraction.

Name attributes 1, 2 See 30.4.4.2.5 IfcCoordinateOperation

IfcRigidOperation **has three additional named attributes, *FirstCoordinate* (Att 3), *SecondCoordinate* (Att 4) and *Height* *(Att 5)* which are defined as:**

IfcRigidOperation (3)			
3	FirstCoordinate	IfcMeasureValue	The first coordinate of the translation. Can be a length measure in case of map coordinates or a plane angle measure in case of geographic reference systems.
4	SecondCoordinate	IfcMeasureValue	The second coordinate of the translation. Can be a length measure in case of map coordinates or a plane angle measure in case of geographic reference systems.
5	Height	OPTIONAL IfcLengthMeasure	Translation above (positive) or below (negative) the coordinate surface. NOTE In case of *IfcGeographicCRS*, *Height* is a translation relative to the geodetic datum ellipsoid's surface. In case of a *IfcProjectedCRS*, *Height* is a translation relative to the vertical datum.

For examples 30.4.4.3.1 Data is Already in Map Coordinates and 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates.

Continue to 30.4.4.2.5.2 IfcMapConversion or return to 30.5 Some More IFC Entity Definitions or 30 BIM and Digital Engineering.

30.4.4.2.5.2 IfcMapConversion

IfcCoordinateOperation >IfcMapConversion

Definition from IFC 4x3:

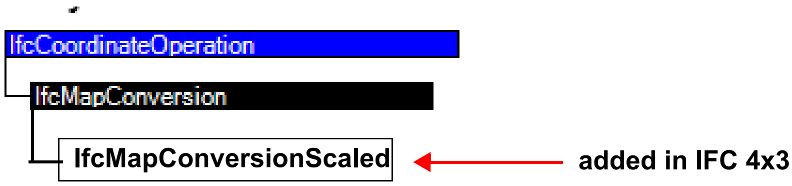
The map conversion deals with transforming the local engineering coordinate system, often called world coordinate system, into the coordinate reference system of the underlying map.

Name attributes 1, 2 See 30.4.4.2.5 IfcCoordinateOperation

***IfcMapConversion* has six additional named attributes, *Eastings* (Att 3), *Northings* (Att 4), *OrthogonalHeight* (Att 5), *XAxisAbscissa* (Att 6), *XAxisOrdinate* (Att 7) and *Scale (Att 8)* which are defined as:**

IfcMapConversion (6)			
3	Eastings	IfcLengthMeasure	Specifies the location along the easting of the coordinate system of the target map coordinate reference system. NOTE for right-handed Cartesian coordinate systems this would establish the location along the x axis.
4	Northings	IfcLengthMeasure	Specifies the location along the northing of the coordinate system of the target map coordinate reference system. NOTE for right-handed Cartesian coordinate systems this would establish the location along the y axis
5	OrthogonalHeight	IfcLengthMeasure	Orthogonal height relative to the vertical datum specified. NOTE for right-handed Cartesian coordinate systems this would establish the location along the z axis
6	XAxisAbscissa	OPTIONAL IfcReal	Specifies the value along the easting axis of the end point of a vector indicating the position of the local x axis of the engineering coordinate reference system. NOTE for right-handed Cartesian coordinate systems this would establish the location along the x axis NOTE together with the *XAxisOrdinate* it provides the direction of the local x axis within the horizontal plane of the map coordinate system
7	XAxisOrdinate	OPTIONAL IfcReal	Specifies the value along the northing axis of the end point of a vector indicating the position of the local x axis of the engineering coordinate reference system. NOTE for right-handed Cartesian coordinate systems this would establish the location along the y axis *XAxisAbscissa* it provides the direction of the local x axis within the horizontal plane of the map coordinate system.
8	Scale	OPTIONAL IfcReal	Scale to be used, when the units of the CRS are not identical to the units of the engineering coordinate system. If omitted, the value of 1.0 is assumed.

Entities directly derived from ***IfcMapConversion***



Continue to 30.4.4.2.5.2.1 IfcMapConversionScaled or return to 30.5 Some More IFC Entity Definitions or 30 BIM and Digital Engineering.

30.4.4.2.5.2.1 IfcMapConversionScaled

IfcCoordinateOperation >IfcMapConversion >IfcMapConversionScaled

Definition from IFC 4x3:

An IfcMapConversionScaled is a type of IfcMapConversion that supplies factors for coordinate conversion. The usage is restricted to when factors are explicitly exchanged.

NOTE Typically, these are relatively smaller facilities such as buildings where constant factors are agreed on a project.

Name attributes 1, 2 See 30.4.4.2.5 IfcCoordinateOperation

Name attributes 5, 6, 7, 8 See 30.4.4.2.5.2 IfcMapConversion

IfcMapConversionScaled **has three additional named attributes** ***FactorX*** **(Att 9),** ***FactorY*** **(Att 10) and** ***FactorZ*** ***(Att 11)*** **which are defined as:**

IfcMapConversionScaled (3)			
9	FactorX	IfcReal	*No description available.*
10	FactorY	IfcReal	*No description available.*
11	FactorZ	IfcReal	*No description available.*

For this transformation, *IfcMapConversionScaled* data are used for:

1. a scaling of the three axes (x,y,z), by the same *IfcMapConversionScaled.Scale*
2. a multiplication of the x-axis by *IfcMapConversionScaled.FactorX*
3. a multiplication of the y-axis by *IfcMapConversionScaled.FactorY*
4. a multiplication of the z-axis by *IfcMapConversionScaled.FactorZ*
5. followed by an **anti-clockwise** rotation about the z-axis of θ, where:

$$\theta = arctan\left(\frac{\text{XAxisOrdinate}}{\text{XAxisAbscissa}}\right)$$

Equations

Below are the relevant equations for *IfcMapConversionScaled*. The equations are given: a) in transformation matrix form, useful for programmers to understand the exact sequence of operations and b) in a simplified equation form, which is sufficient for calculating a single point.

a) matrix form

$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} cos\theta & -sin\theta & 0 \\ sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} \text{FactorX} & 0 & 0 \\ 0 & \text{FactorY} & 0 \\ 0 & 0 & \text{FactorZ} \end{bmatrix} \cdot \begin{bmatrix} \text{Scale} & 0 & 0 \\ 0 & \text{Scale} & 0 \\ 0 & 0 & \text{Scale} \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} \text{Eastings} \\ \text{Northings} \\ \text{OrthogonalHeight} \end{bmatrix}$$

b) equation form

$$\begin{aligned} x' &= \text{Scale} \cdot \text{FactorX} \cdot cos\theta \cdot x - \text{Scale} \cdot \text{FactorY} \cdot sin\theta \cdot y + \text{Eastings} \\ y' &= \text{Scale} \cdot \text{FactorX} \cdot sin\theta \cdot x + \text{Scale} \cdot \text{FactorY} \cdot cos\theta \cdot y + \text{Northings} \\ z' &= \text{Scale} \cdot \text{FactorZ} \cdot z + \text{OrthogonalHeight} \end{aligned}$$

For an example see 30.4.4.3.3 Data in Local Engineering Coordinates but is Required in Map Coordinates.

Continue to 30.4.4.3 Setting Up For Map Coordinates or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.4.3 Setting Up For Map Coordinates

For most infrastructure projects (horizontal BIM) the data has to be delivered in map coordinates (e.g. MGA2020).

This requires the entity ***IfcProjectedCRS*** to be in the IFC file to define the Horizontal and Vertical datums, and the map projection and zone, that the data read in from the IFC file is in.

Three cases will be shown:

1. The data being written to the IFC file is already in map coordinates.

   See 30.4.4.3.1 Data is Already in Map Coordinates

2. The data in being written to the IFC file is not in map coordinates but only requires a translation to be in map coordinates

   See 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates

3. The data being written to the IFC file is in local engineering coordinates but when read in, needs to be in map coordinates.

   See 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates

30.4.4.3.1 Data is Already in Map Coordinates

This example is when the (x,y) data written out from ***12d Model*** is already in map coordinates and the z-values are in a vertical datum.

In the IFC file, the project is first set up with a 3D coordinate system using 30.4.4.2.5.1 IfcRigidOperation and ***IfcGeometricRepresentationContext***.

The definition of the Geodetic (Horizontal) datum, the Vertical datum, the Map Projection and the Map Zone is given in an 30.4.4.2.4.1 IfcProjectedCRS.

Finally a coordinate operation that does nothing is required to say that the data is already in Map Coordinates.

This is done with an 30.4.4.2.5.1 IfcRigidOperation where translation in x, y and z in zero.

Att 8 RepresentationContext - two of them

```
#1 = IFCPROJECT('04P1_IPYbDSOWnTArB5goB', #2, 'ifc Data', '', $, $, $, (#12, #375), #7);

#2 = IFCOWNERHISTORY(#3, #6, $, .NOCHANGE., $, $, $, 1727696961);
#3 = IFCPERSONANDORGANIZATION(#4, #5, $);
#4 = IFCPERSON($, $, 'lee.gregory', $, $, $, $, $);
#5 = IFCORGANIZATION($, '12d Solutions', '12d Solutions', $, $);
#6 = IFCAPPLICATION(#5, '15.0C1q', '12d Model', '12d Model');
#7 = IFCUNITASSIGNMENT((#8, #9, #10, #11));
#8 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#9 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#10 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#11 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);
```

#12 is 3D Coordinate System Origin (0,0,0)

```
#12 = IFCGEOMETRICREPRESENTATIONCONTEXT('3D', 'Model', 3, 1.E-6, #14, #18);
#13 = IFCLOCALPLACEMENT($, #14);
#14 = IFCAXIS2PLACEMENT3D(#15, #16, #17);
#15 = IFCCARTESIANPOINT((0., 0., 0.));
#16 = IFCDIRECTION((0., 0., 1.));
#17 = IFCDIRECTION((1., 0., 0.));
#18 = IFCDIRECTION((0., 1.));
```

Att 1 EPSG code MGA2020 Zone 56

Att 4 EPSG code AHD

```
#19 = IFCPROJECTEDCRS('EPSG:7856', 'MGA2020 Zone 56', $, 'EPSG:511', 'UTM', '56', $);

#20 = IFCRIGIDOPERATION(#12, #19, 0., 0., 0.);
```

The data which is in a 3D Coordinate System defined in **#12** has the Coordinate Operation **#20** which does nothing as the data is already in the map coordinates and vertical datum given in **#19**

Att 8 RepresentationContexts - two of them

```
#1 = IFCPROJECT('04P1_IPYbDSOWnTArB5goB', #2, 'ifc Data', '', $, $, $, (#12, #375), #7);

#2 = IFCOWNERHISTORY(#3, #6, $, .NOCHANGE., $, $, $, 1727696961);
#3 = IFCPERSONANDORGANIZATION(#4, #5, $);
#4 = IFCPERSON($, $, 'lee.gregory', $, $, $, $, $);
#5 = IFCORGANIZATION($, '12d Solutions', '12d Solutions', $, $);
#6 = IFCAPPLICATION(#5, '15.0C1q', '12d Model', '12d Model');
#7 = IFCUNITASSIGNMENT((#8, #9, #10, #11));
#8 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#9 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#10 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#11 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);
```

#12 is 3D Coordinate System Origin (0,0,0)

```
#12 = IFCGEOMETRICREPRESENTATIONCONTEXT('3D', 'Model', 3, 1.E-6, #14, #18);
#13 = IFCLOCALPLACEMENT($, #14);
#14 = IFCAXIS2PLACEMENT3D(#15, #16, #17);
#15 = IFCCARTESIANPOINT((0., 0., 0.));
#16 = IFCDIRECTION((0., 0., 1.));
#17 = IFCDIRECTION((1., 0., 0.));
#18 = IFCDIRECTION((0., 1.));
```

Att 1 EPSG code MGA2020 Zone 56

Att 4 EPSG code AHD

```
#19 = IFCPROJECTEDCRS('EPSG:7856', 'MGA2020 Zone 56', $, 'EPSG:511', 'UTM', '56', $);

#20 = IFCRIGIDOPERATION(#12, #19, 0., 0., 0.);
```

The data which is in a 3D Coordinate System defined in **#12** has the Coordinate Operation **#20** which does nothing as the data is already in the map coordinates and vertical datum given in **#19**

See 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates

30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates

In this example the (x,y) data written out from ***12d Model*** is in map coordinates that have been **translated in (x,y)**. The z-values are already in a vertical datum. For example, truncated map coordinates.

So the data needs the translation to get the data back to map coordinates.

In the IFC file, the project is first set up with a 3D coordinate system using 30.4.4.2.5.1 IfcRigidOperation and ***IfcGeometricRepresentationContext***.

The definition of the Geodetic (Horizontal) datum, the Vertical datum, the Map Projection and the Map Zone is giving in an 30.4.4.2.4.1 IfcProjectedCRS.

Finally an coordinate operation is required to translate the data to map coordinates.

This is done with an 30.4.4.2.5.1 IfcRigidOperation with the required translation in x and y.

Att 8 RepresentationContext - set of one

```
#1 = IFCPROJECT('19S2rVW_v6h9wDt$Ub99R0', #2, 'Truncated Coords', 'Tin', $, $, $, (#14), #9);

#2 = IFCOWNERHISTORY(#3, #8, $, .NOCHANGE., $, $, $, 1727832570);
#3 = IFCPERSONANDORGANIZATION(#4, #6, $);
#4 = IFCPERSON('ljg', 'Gregory', 'Lee', $, $, $, (#5), $);
#5 = IFCACTORROLE(.USERDEFINED., 'Designer', $);
#6 = IFCORGANIZATION($, '12d Solutions', $, (#7), $);
#7 = IFCACTORROLE(.USERDEFINED., 'Engineering', $);
#8 = IFCAPPLICATION(#6, '15.0C1q Build 01-10-2024', '12d Model', '12d Model');
#9 = IFCUNITASSIGNMENT((#10, #11, #12, #13));
#10 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#11 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#12 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#13 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);

#14 = IFCGEOMETRICREPRESENTATIONCONTEXT('3D', 'Model', 3, 1.E-6, #16, #20);

#15 = IFCLOCALPLACEMENT($, #16);
#16 = IFCAXIS2PLACEMENT3D(#17, #18, #19);
#17 = IFCCARTESIANPOINT((0., 0., 0.));
#18 = IFCDIRECTION((0., 0., 1.));
#19 = IFCDIRECTION((1., 0., 0.));
#20 = IFCDIRECTION((0., 1.));

#21 = IFCPROJECTEDCRS('EPSG:7856', 'MGA2020 Zone 56 and AHD', $, 'EPSG:5711', 'UTM', '56', $);

#22 = IFCRIGIDOPERATION(#14, #21, 256400., 7011600., 0.);
```

#14 is a 3D Coordinate System Origin (0,0,0)

Att 1 EPSG code MGA2020 Zone 56

Att 4 EPSG code AHD

translation to apply to x,y,z

The data is in a 3D Coordinate System defined in **#14,** which in this case is in truncated map coordinates, has the Coordinate Operation **#21** applied to it to translate the truncated coordinates to the map coordinates and vertical datum given in **#21**

See 30.4.4.3.2 Data Only Requires a Translation to be Map Coordinates

30.4.4.3.3 Data in Local Engineering Coordinates but is Required in Map Coordinates

This example is when the (x,y) data written out from ***12d Model*** to the IFC file is in local engineering coordinates but when the data is read in from the IFC file, it needs to be in map coordinates.

The z-values are already in a vertical datum.

In the IFC file, the project is first set up with a local 3D coordinate system using 30.4.2.1.1.2 IfcProject and ***IfcGeometricRepresentationContext***.

The definition of the Geodetic (Horizontal) datum, the Vertical datum, the Map Projection and the Map Zone is giving in an 30.4.4.2.4.1 IfcProjectedCRS.

In the case in the example, to convert from local coordinates to map coordinates requires a rotation about the Z-axis (i.e. in the X-Y plane), followed by a factor applied to X and Y and a factor of 1.0 applied to Z, and then a translation in XYZ.

This is done with an 30.4.4.2.5.2.1 IfcMapConversionScaled with the required values of the named attributes.

Att 8 RepresentationContext - set of one

```
#1 = IFCPROJECT('3IAdNPIqL2Kv6zpWTCiEey', #2, 'Local data to Map coords', '', $, $, $, (#12), #7);

#2 = IFCOWNERHISTORY(#3, #6, $, .NOCHANGE., $, $, $, 1727823317);
#3 = IFCPERSONANDORGANIZATION(#4, #5, $);
#4 = IFCPERSON($, $, 'lee.gregory', $, $, $, $, $);
#5 = IFCORGANIZATION($, '12d Solutions', '12d Solutions', $, $);
#6 = IFCAPPLICATION(#5, '15.0C1q INT Build 01-10-2024', '12d Model', '12d Model');

#7 = IFCUNITASSIGNMENT((#8, #9, #10, #11));
#8 = IFCSIUNIT(*, .LENGTHUNIT., $, .METRE.);
#9 = IFCSIUNIT(*, .AREAUNIT., $, .SQUARE_METRE.);
#10 = IFCSIUNIT(*, .VOLUMEUNIT., $, .CUBIC_METRE.);
#11 = IFCSIUNIT(*, .PLANEANGLEUNIT., $, .RADIAN.);

#12 = IFCGEOMETRICREPRESENTATIONCONTEXT('3D', 'Model', 3, 1.E-6, #14, #18);
#13 = IFCLOCALPLACEMENT($, #14);
#14 = IFCAXIS2PLACEMENT3D(#15, #16, #17);
#15 = IFCCARTESIANPOINT((0., 0., 0.));
#16 = IFCDIRECTION((0., 0., 1.));
#17 = IFCDIRECTION((1., 0., 0.));
#18 = IFCDIRECTION((0., 1.));

#19 = IFCPROJECTEDCRS('EPSG:7856', 'MGA2020 Zone 56', $, 'EPSG:5711', 'UTM', '56', $);

#20 = IFCMAPCONVERSIONSCALED(#12, #19, 400039.894467965, 7000014.35492672, 0.,
      -2.83688214730348E-1, 9.58916574485554E-1,1., 9.99587E-1, 9.99587E-1, 1.);
```

#12 is 3D Coordinate System Origin (0,0,0)

Att 1 EPSG code MGA2020 Zone 56

Att 4 EPSG code AHD

translation in x,y,z

defines rotation about the z-axis

factors to apply to x,y,z

The data is in a 3D Coordinate System defined in **#12,** which in this case is local engineering coordinates, has the Coordinate Operation **#20** applied to it to convert the local engineering coordinates to the map coordinates and vertical datum given in **#19**

For the equations to be applied to the data for IfcMapConversionScaled see 30.4.4.2.5.2.1 IfcMapConversionScaled.

Continue to 30.4.4.4 Why Map Coordinates Aren't Used on a Small Building Site or return to 30 BIM and Digital Engineering.

30.4.4.4 Why Map Coordinates Aren't Used on a Small Building Site

It is very easy to gloss over one very important fact about Transverse Mercator projections used to produce map coordinates.

Transverse Mercator projections are **conformal projections** and although they **preserve angles**, they do **not preserve distances**.

So a small circle will transform to a small circle but the radius will vary depending on where you are in a Map Projection zone.

The amount of the distortion is known as a **scale factor** and it varies from point to point. Over a small distance the scale factor is almost a constant but that constant value **is rarely 1**.

What that means in practise is if you draw everything up in MGA coordinates, the actual distance between two points in **NOT the standard square root distance between the two points**.

This means that on a plan in map coordinates such as MGA, you can't simply use a ruler to measure the map distance between two points. You need to allow for the scale factor.

Over a small distance the scale factor will be a constant (for example 0.9996) but over a large distance you need to do the correct Geodetic calculations.

This also means that in a standard drafting system, the usual distance between two points that is used in conventional drafting dimension options, will not give the correct value.

For those working in a local coordinate project you may have noticed the scale factor effect when you have identified two points a good distance apart and you also have their map projection coordinates. If you measure between the points in your local coordinate system and then calculate the square root distance between the two points using the actual map coordinates then you won't get the same number.

Luckily over a small distance (say one kilometre) the scale factor is fairly constant. The result of this is that for a small regions you can calculate a 2D Helmert transformation (a translation, a rotation and a scale applied to x and y) to fairly accurately convert between the local coordinates and map coordinates.

The result is that if you only have a small building site then you can obtain fairly accurate map coordinates by applying a 2D Helmert transformation to the local coordinates. That is, a translation, a rotation of the axes and a **constant multiplication factor** for x and y.

Similarly if you apply a translation, rotating and scale to convert data given in map coordinates (say from a GIS system or the State Road Authority) to local coordinates, then there will be errors the further away from the "best fitted" point.

Notes

1. The above is a simplification and the height also plays a apart. Hence the scale factor used is normally the **combined scale factor** which takes height into account.
2. To calculate the combined scale factor you need the local coordinates and map coordinates of at least two points.
3. Because of 2., if for a project defined in local coordinates and only give the map coordinates for o**ne point** and a **rotation of the axes** is not enough information to determine to combined scale factor.
4. If you are not a surveyor you will probably not be aware that in***12d Model***, you can specify the Cartographic projection that the coordinates are in and can then obtain the (Longitude, Latitude) for selected points, and measure between points and get the square-root distance and also the **ellipsoid distance** between the points.

Continue to 30.4.5 IFC Spatial Structure or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.5 IFC Spatial Structure

See

[30.4.5.1 Overview of Spatial Structure](#)
[30.4.5.4 Spatial Composition](#)
[30.4.5.2 IfcSpatialElement](#)
[30.4.5.3 Using Spatial Structure](#)
[30.4.5.5 Defining Spatial Structure in 12d Model](#)

30.4.5.1 Overview of Spatial Structure

In IFC a spatial structure can be used to provide a hierarchical organisation of a project.

The spatial structure can be simple or complex but in all cases it is extremely important because every ***IfcProduct*** in a project must belong to an instance of **one, and only one, part** of the ***Spatial Structure***.

The IFC spatial structure entities are hierarchical and are all derived from 30.4.5.2 IfcSpatialElement. ***IfcSpatialElement*** is abstract and is itself derived from ***IfcRoot***:

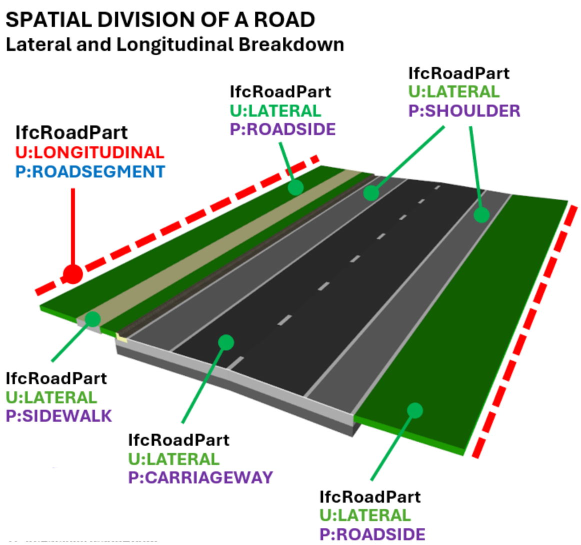
IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement

Before ***IFC 4x3***, apart from ***IfcSite***, spatial structure was only defined for vertical buildings and the only non-abstract spatial structure elements were ***IfcBuilding***, ***IfcBuildingStorey*** and ***IfcSpace***,

In ***IFC 4x3***, spatial structure was extended to linear infrastructure including **roads**, **rail**, **bridges**, and **marine** and the non-abstract spatial structure elements included ***IfcSite***, ***IfcBuilding***, ***IfcBridge***, ***IfcMarineFacility***, ***IfcRoad***, ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart***, ***IfcRoadPart*** and ***IfcSpace***.

Rather than being vertical, the spatial structure for linear infrastructure is longitude and can often then be broken up laterally. For example, the road is a longitudinal spatial infrastructure element and this has lateral subparts of pavements for each lane, gutters etc.

For example:



The entity ***IfcSpatialElement*** will be defined and its relevant derived entities (30.4.5.2 IfcSpatialElement), then how to use spatial structure (30.4.5.3 Using Spatial Structure) and finally how IFC spatial structure is defined in ***12d Model*** (30.4.5.5 Defining Spatial Structure in 12d Model).

Continue to 30.4.5.2 IfcSpatialElement or return to 30.4.5 IFC Spatial Structure or 30.4 Structure of IFC.

30.4.5.2 IfcSpatialElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement

Definition from IFC 4x3:

*A spatial element is the generalization of all spatial elements that might be used to define a **spatial structure** or to define **spatial zones**.*

IfcSpatialElement is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

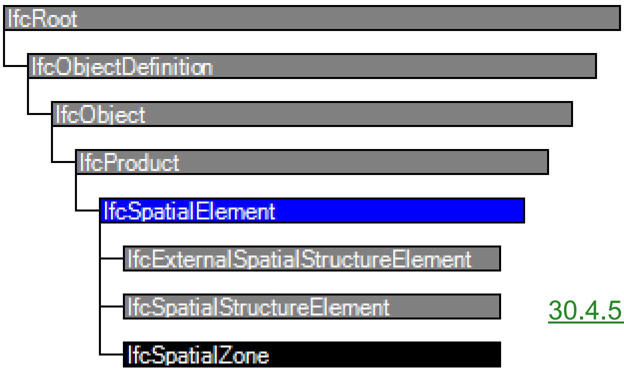
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

IfcSpatialElement **has one additional Named Attribute *LongName* (Att 8) which is defined as:**

IfcSpatialElement (6)			
8	LongName	OPTIONAL IfcLabel	Long name for a spatial structure element, used for informal purposes. It should be used, if available, in conjunction with the inherited *Name* attribute. NOTE In many scenarios the *Name* attribute refers to the short name or number of a spacial element, and the *LongName* refers to the full descriptive name.

The entities directly derived from ***IfcSpatialElement*** are:



30.4.5.2.1 IfcSpatialStructureElement

*The subtype **IfcSpatialStructureElement** is for **spatial structure**.*

(a) a spatial structure is a **hierarchical** decomposition of the project. That spatial structure is often used to provide a project structure to organize a project.

(b) a spatial project structure might define as many levels of decomposition as necessary for the project. Some examples of elements within the spatial breakdown can be: site, building, storey, space. And for infrastructure projects also: bridge, railway, road, ports, tunnel and parts of them.

*The subtype **IfcSpatialZone** is for **spatial zones**.*

(a) a spatial zone is a **non-hierarchical** and potentially overlapping decomposition of the project under some functional consideration.

(b) a spatial zone might be used to represent a thermal zone, a lighting zone, a usable area zone.

(c) a spatial zone might be used to represent a horizontal spatial structure as used in civil works.

(d) a spatial zone might have its independent placement and shape representation.

Continue to 30.4.5.2.1 IfcSpatialStructureElement or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.5.2.1 IfcSpatialStructureElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement

Definition from IFC 4x3:

A spatial structure element is the generalization of all spatial elements that might be used to define a ***spatial structure.*** *The spatial structure can be used to provide a spatial organization of a project.*

IfcSpatialStructureElement is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.5.2 IfcSpatialElement

CompositionType

IfcSpatialStructureElement **has one additional Named Attribute** ***CompositionType*** **(Att 9) which is defined as:**

IfcSpatialStructureElement (1)			
9	CompositionType	OPTIONAL IfcElementCompositionEnum	Denotes, whether the predefined spatial structure element represents itself, or an aggregate (complex) or a part (part). The interpretation is given separately for each subtype of spatial structure element. If no *CompositionType* is asserted, the default value "ELEMENT" applies.

A **spatial project structure** might define as many levels of decomposition as necessary for the project. Elements within the spatial project structure are:

(a) site as ***IfcSite***

(b) story of a building as ***IfcBuildingStorey***

(c) facility as ***IfcFacility,*** or specifically as subtypes

building as ***IfcBuilding***

bridge as ***IfcBridge***

marine facility as ***IfcMarineFacility***

railway as ***IfcRailway***

road as ***IfcRoad***

(d) facility part as ***IfcFacilityPart***, or specifically as subtypes

part of bridge as ***IfcBridgePart***

facility part as ***IfcFacilityPartCommon***

part of marine facility as ***IfcMarineFacilityPart***

part of railway as ***IfcRailwayPart***

part of road as ***IfcRoadPart***

(e) space as ***IfcSpace***

(f) or **aggregations** or **parts thereof**.

The composition type declares an element to be either **an element itself**, or an **aggregation** (**complex**) or a **decomposition** (**part**). The interpretation of these types is given at each subtype of *IfcSpatialStructureElement*.

The ***IfcRelAggregates*** is defined as an 1-to-many relationship and used to establish the relationship between exactly two levels within the spatial project structure. Finally the highest level of the spatial structure is assigned to ***IfcProject*** using the ***IfcRelAggregates***.

The named attribute ***CompositionType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcElementCompositionEnum***.

That is, ***CompositionType*** must be one of the following values defined by ***IfcElementCompositionEnum***:

Type	Description
COMPLEX	A group or aggregation of similar elements.
ELEMENT	An (undivided) element itself.
PARTIAL	A subelement or part.

The ***CompositionType*** declares an element to be either an element itself, or an aggregation (complex) or a decomposition (part). The interpretation of these types is given at each subtype of ***IfcSpatialStructureElement***. For example see 30.4.5.2.1.1 IfcSite.

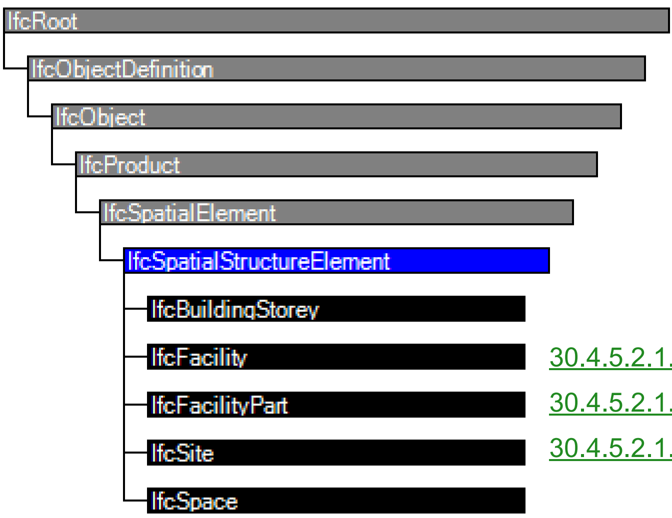
The *IfcRelAggregates* is defined as an 1-to-many relationship and used to establish the relationship between exactly two levels within the spatial project structure.

Finally the highest level of the spatial structure is assigned to *IfcProject* using the *IfcRelAggregates*. See 30.4.6.2.2 IfcRelAggregates.

Some Rules on What is Allowed

1. The spatial project structure, established by the ***IfcRelAggregates***, shall be acyclic. ***That is, it doesn't loop***.
2. A **site** should **not** be (directly or indirectly) associated to a **building**, **storey** or **space**.
3. A **building** should **not** be (directly or indirectly) associated to a **storey** or **space**.
4. A **storey** should not be (directly or indirectly) associated to a **space**.

Entities directly derived from ***IfcSpatialStructureElement***



30.4.5.2.1.2 IfcFacility
30.4.5.2.1.3 IfcFacilityPart
30.4.5.2.1.1 IfcSite

Continue to 30.4.5.2.1.1 IfcSite or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.5.2.1.1 IfcSite

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement ***>IfcSite***

Definition from ISO 6707-1:1989: *Area where construction works are undertaken*.

Definition from IFC 4x3

A site is a defined area of land, possibly covered with water, on which the project construction is to be completed. A site may be used to erect, retrofit or turn down building(s), or for other construction related developments.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.5.2 IfcSpatialElement

Name attribute 9 See 30.4.5.2.1 IfcSpatialStructureElement

***IfcSite* has five additional named attributes *RefLatitude* (Att 10), *RefLongitude* *(Att 11)*, *RefElevation* *(Att 12)*, *LandTitleNumber* *(Att 13)* and *SiteAddress* *(Att 14)* which are defined as:**

IfcSite (5)			
10	RefLatitude	OPTIONAL IfcCompoundPlaneAngleMeasure	World Latitude at reference point (most likely defined in legal description). Defined as integer values for degrees, minutes, seconds, and, optionally, millionths of seconds with respect to the world geodetic system WGS84.
11	RefLongitude	OPTIONAL IfcCompoundPlaneAngleMeasure	World Longitude at reference point (most likely defined in legal description). Defined as integer values for degrees, minutes, seconds, and, optionally, millionths of seconds with respect to the world geodetic system WGS84.
12	RefElevation	OPTIONAL IfcLengthMeasure	Datum elevation relative to sea level.
13	LandTitleNumber	OPTIONAL IfcLabel	The land title number (designation of the site within a regional system).
14	SiteAddress	OPTIONAL IfcPostalAddress	Address given to the site for postal purposes.

LandTitleNumber is deprecated in 4x3. Use ***LandTitleId*** at ***Pset_LandRegistration*** instead

SiteAddess is deprecated in 4x3. Use ***Pset_Address*** instead.

Precise geospatial information of a site shall be derived from the georeferencing entities that relate the ***IfcProject*** to the real world, using sets of datum (see ***IfcCoordinateOperation*** and ***IfcCoordinateReferenceSystem***).

In small-scale projects (e.g., building), when georeferencing is not provided as recommended above, the Longitude, Latitude and Elevation attributes of ***IfcSite*** can be used for approximate indication of the site location. This methodology is not meant to replace precise georeferencing, but can still be useful for those use cases that do not require accurate geospatial information (e.g., sun shading simulations). If asserted, the Longitude, Latitude and Elevation establish the point in

WGS84 where the point (0.,0.,0.) of the LocalPlacement of ***IfcSite*** is situated. **Added by 12d: Be careful. There is no Epoch (time) recorded for the WGS84 definition of longitude and latitude.**

The geometrical placement of the site, defined by the IfcLocalPlacement, shall be always relative to the spatial structure element, in which this site is included, **or absolute**, i.e. to the world coordinate system, as established by the geometric representation context of the project. The world coordinate system, established at the ***IfcProject.RepresentationContext***s, may include a definition of the true north within the XY plane of the world coordinate system, if provided, it can be obtained at ***IfcGeometricRepresentationContext.TrueNorth.*** **Added by 12d: Be careful. This is True North and not magnetic north, grid north or site north.**

A project may span over several connected or disconnected sites. Therefore **site complex** provides for a collection of sites included in a project. A site can also be decomposed in parts, where each part defines a **site section** (site partial).

Whether it is a site, site complex or site section, is defined by the named attribute ***CompositionType*** (att 9) of the super type ***IfcSpatialStructureElement*** which is interpreted as follow:

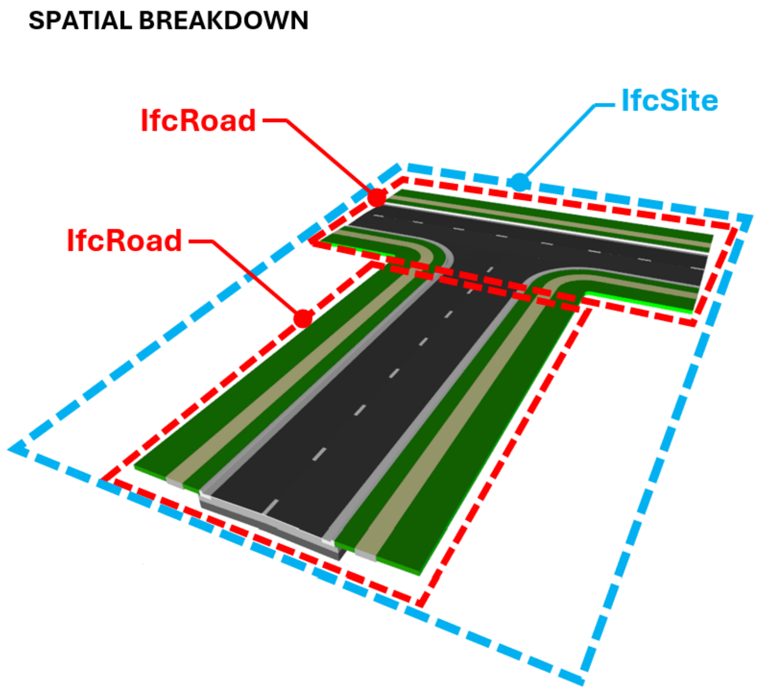
If the ***CompositionType*** value is

COMPLEX then it is a **site complex**

ELEMENT then it is a **site**

PARTIAL then it is a **site section** (**site partial)**.

Note that in ***12d Model***, you can currently only have a **site** and **site partial**.



Continue to 30.4.5.2.1.2 IfcFacility or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.5.2.1.2 IfcFacility

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement ***>IfcFacility***

Definition in IFC 4x3:

A Facility (derived from IfcSpatialStructureElement) may be an IfcBuilding, an IfcBridge, an IfcRailway, an IfcRoad, an IfcMarineFacility (or any other type of built facility defined in the future, such as IfcTunnel).

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

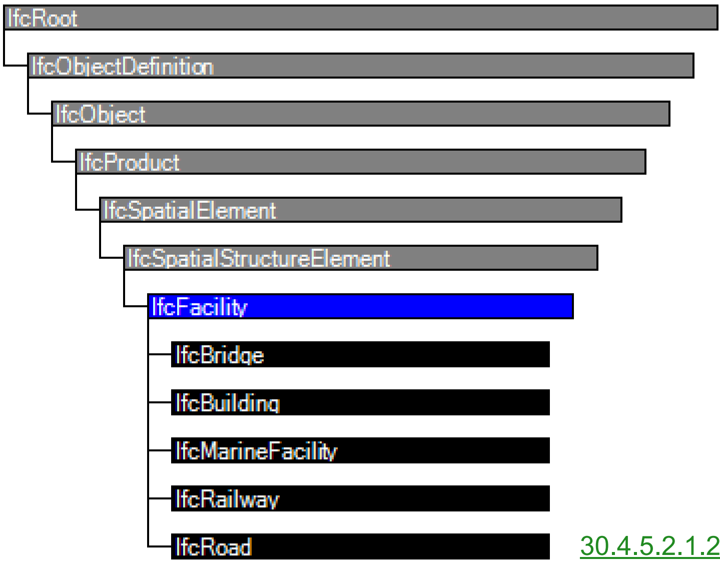
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

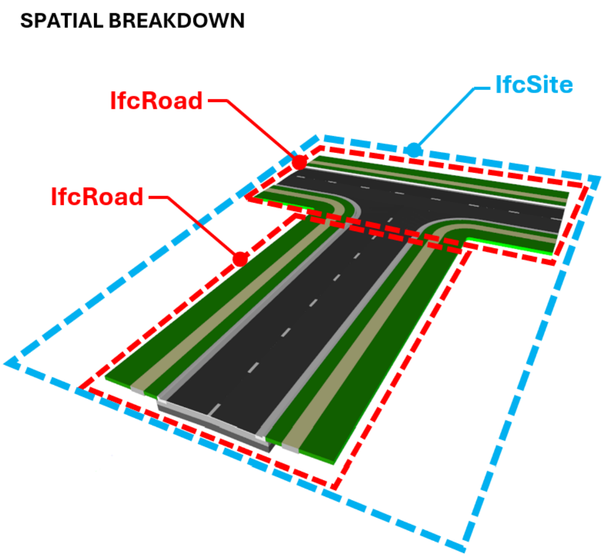
Name attribute 8 See 30.4.5.2 IfcSpatialElement

Name attribute 9 See 30.4.5.2.1 IfcSpatialStructureElement

There are no additional named attributes for IfcFacility
Entities directly derived from **IfcFacility**



30.4.5.2.1.2.1 IfcRoad



See

30.4.5.2.1.1 IfcSite

30.4.5.2.1.2.1 IfcRoad

Continue to 30.4.5.2.1.2.1 IfcRoad or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.5.2.1.2.1 IfcRoad

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement ***>IfcFacility >IfcRoad***

Definition in IFC 4x3:

A route built on land to allow travel from one location to another, including highways, streets, cycle and foot paths, but excluding railways. As a type of Facility, Road provides the basic element in the project structure hierarchy for the components of a road project (i.e. any undertaking such as design, construction or maintenance).

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.5.2 IfcSpatialElement

Name attribute 9 See 30.4.5.2.1 IfcSpatialStructureElement

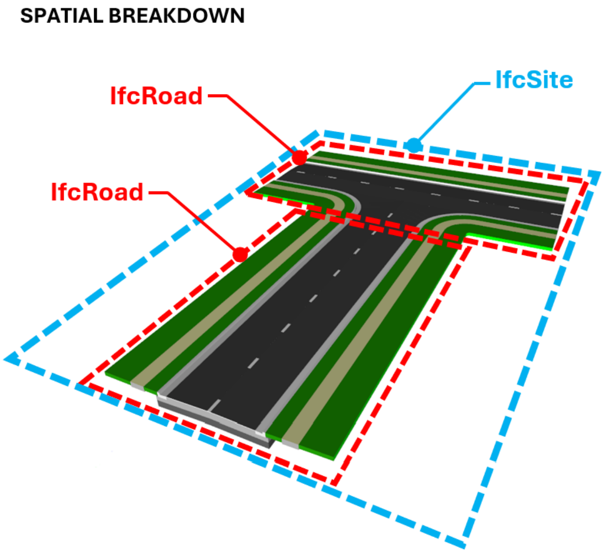
***IfcRoad* has one additional named attribute *PredefinedType* (Att 10) which is defined as:**

IfcRoad (1)			
10	PredefinedType	OPTIONAL IfcRoadTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types. NOTE If the object has an associated IfcTypeObject with a *PredefinedType*, then this attribute shall not be used.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcRoadTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcRoadTypeEnum:***

Type	Description
USERDEFINED	User-defined type.
NOTDEFINED	Undefined type.



See

[30.4.5.2.1.1 IfcSite](#)

[30.4.5.2.1.2.1 IfcRoad](#)

Continue to 30.4.5.2.1.3 IfcFacilityPart or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.4.5.2.1.3 IfcFacilityPart

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement >IfcFacilityPart

Definition in IFC 4x3:

NOTE *This entity is a subtype of IfcProduct or IfcTypeProduct and hence part of every standardized schema subset and implementation level.*

IfcFacilityPart is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.5.2 IfcSpatialElement

Name attribute 9 See 30.4.5.2.1 IfcSpatialStructureElement

IfcFacilityPart **has one additional named attribute *UsageType* (Att 10) which is defined as:**

IfcFacilityPart (1)			
10	UsageType	IfcFacilityUsageEnum	Defines the convention used to subdivide or decompose the facility.

The named attribute ***UsageType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcFacilityUsageEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcFacilityUsageEnum:***

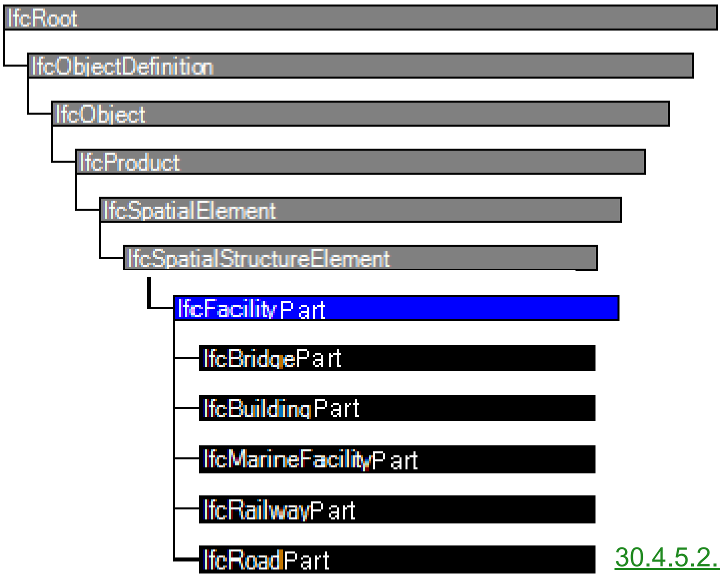
Type	Description
LATERAL	A Lateral usage implies a facility part is a lateral (left, right, centre etc.) subdivision of a longitudinal segment or facility. Common uses include traffic lanes, road or rail side embankments etc.
LONGITUDINAL	A longitudinal usage implies a subdivision along a linear facility where the part has a defined start and end along the facility alignment(s).
REGION	A regional usage implies a bounded subdivision in the "X-Y plane" of a parent *IfcSpatialStructureElement*. The parent *IfcSpatialStructureElement* can be longitudinal or regional in nature.
VERTICAL	A vertical usage implies a subdivision in the "Z plane" usually signifying a defined elevation level or controlled volume within a segment of the Z plane.
USERDEFINED	User-defined type.
NOTDEFINED	Undefined type.

Note from 12d:

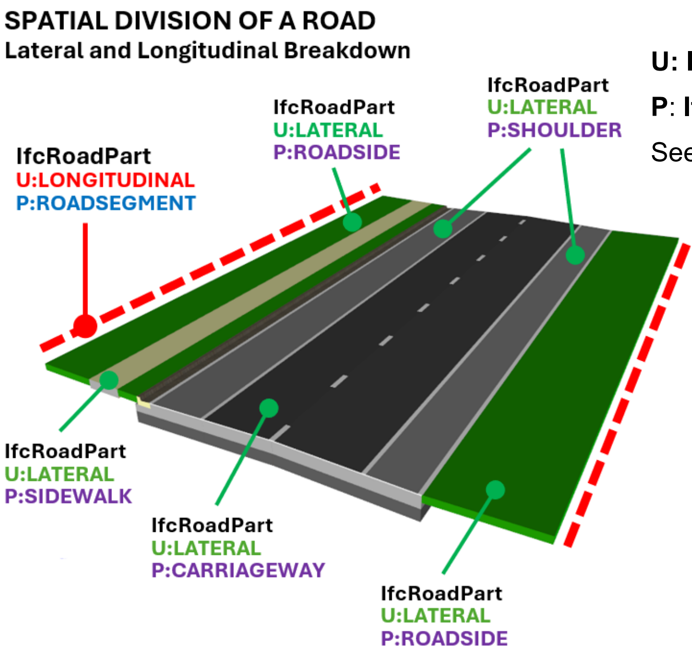
The ***IfcFacilityUsageEnum*** is used to break the ***spatial structure*** up in a way that is more conducive to linear infrastructure that the Building spatial structure of Building, Storey etc.

Entities directly derived from ***IfcFacilityPart***

Entity inheritance



30.4.5.2.1.3.1 IfcRoadPart



U: IfcFacilityUsageEnum Att 10

P: **IfcRoadPartTypeEnum Att 11**

See 30.4.5.2.1.3.1 IfcRoadPart

Continue to 30.4.5.2.1.3.1 IfcRoadPart or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.4.5.2.1.3.1 IfcRoadPart

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcSpatialElement >IfcSpatialStructureElement ***>IfcFacilityPart >IfcRoadpart***

Definition in IFC 4x3

Part of a road.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.5.2 IfcSpatialElement

Name attribute 9 See 30.4.5.2.1 IfcSpatialStructureElement

Name attribute 10 See 30.4.5.2.1.3 IfcFacilityPart

IfcRoadpart **has one additional named attribute** ***PredefinedType*** **(Att 11) which is defined as:**

IfcRoadPart (1)			
11	PredefinedType	OPTIONAL IfcRoadPartTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcRoadPartTypeEnum***.

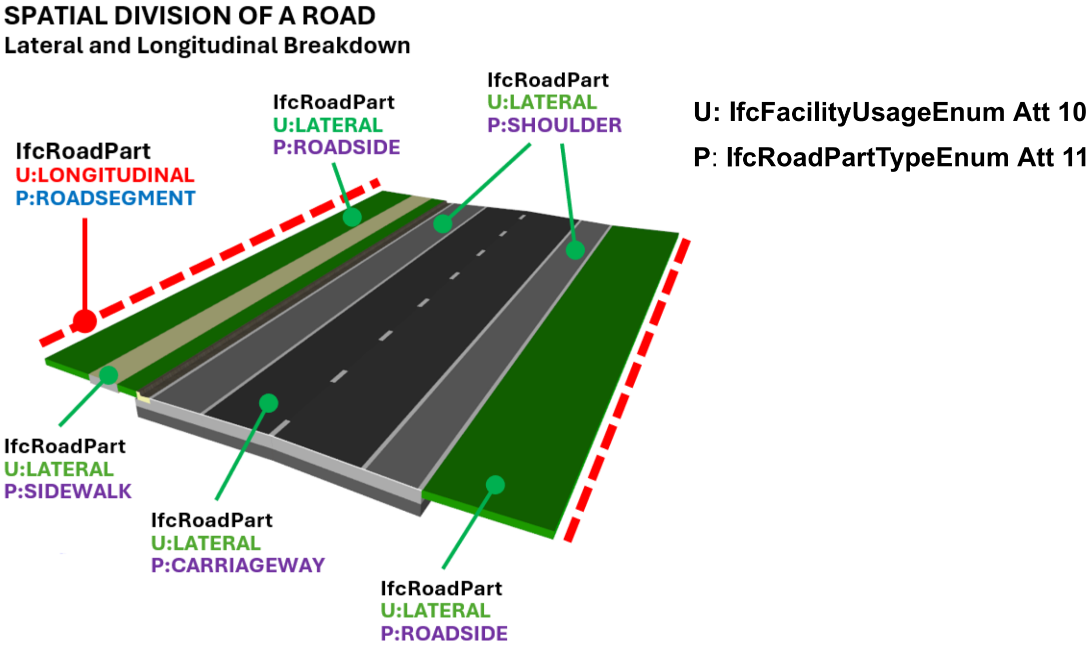
That is, ***PredefinedType*** must be one of the following values defined by ***IfcRoadPartTypeEnum:***

Type	Description
BICYCLECROSSING	Designated level crossing over a road for cyclists.
BUS_STOP	Lateral part of Road for stopping buses allowing them to draw out of the traffic lanes and wait for short periods.
CARRIAGEWAY	Unitary lateral part of Road built for traffic. Carriageway may comprise several kinds of traffic lanes and lay-bys, as well as traffic islands, and in case of dual carriageway road they are separated by central reserve.
CENTRALISLAND	The center of a roundabout not intended for traffic, can be painted or upraised.
CENTRALRESERVE	Lateral RoadPart separating two carriageways of the same road or separating traffic lanes and sidewalk.
HARDSHOULDER	A type of Shoulder that is surfaced, providing for safe use by vehicles in distress.
INTERSECTION	At-grade junction where two or more roads meet or cross. Intersections may be further classified by number of road segments, traffic controls, and/or lane design.
LAYBY	A lateral part of Road where vehicles can divert from ordinary stream of traffic.

`PARKINGBAY`	Lateral part of Road for parking vehicles.
`PASSINGBAY`	A lateral part of Road that is a widening of an otherwise single lane road where a vehicle may move over to enable another vehicle to pass.
`PEDESTRIAN_CROSSING`	Designated level crossing over a road for pedestrians.
`RAILWAYCROSSING`	At-grade crossing between road and railway.
`REFUGEISLAND`	A raised platform or a guarded area so sited in the carriageway as to divide the streams of traffic and to provide a safety area for pedestrians.
`ROADSEGMENT`	Longitudinal, linear segment of a road, either defined by uniform characteristics, or as a transition segment (e.g. number of lanes changing).
`ROADSIDE`	A lateral RoadPart located along the Road adjoining the outer edges of the Shoulders. A general concept comprising the areas outside RoadwayPlateau not intended for vehicles.
`ROADSIDEPART`	A general concept for various parts of the Roadside. NOTE Examples of roadside parts may be side slopes, roadside ditches, back slopes, bunds etc.
`ROADWAYPLATEAU`	Lateral part of Road comprising the carriageway(s), shoulders and medians.
`ROUNDABOUT`	Type of at-grade junction at which traffic streams are directed around a circle.
`SHOULDER`	A lateral part of Road adjacent to, and usually at the same level as the Carriageway; not intended for vehicular traffic but may be used in case of emergency.
`SIDEWALK`	A footpath along the side of a road. May accommodate moderate changes in grade (elevation) and is normally separated from the vehicular section by a kerb. There may be a central reserve or road verge between the sidewalk and traffic lanes.
`SOFTSHOULDER`	A type of Shoulder that is not surfaced.
`TOLLPLAZA`	A part of road facility where tolls are collected for use of toll road, tunnel or bridge.
`TRAFFICISLAND`	A central or subsidiary area raised or marked on the carriageway, generally at a road junction or level crossing, shaped and placed so as to direct traffic movement and/or provide refuge for pedestrians.
`TRAFFICLANE`	Lateral part of carriageway designated to vehicular traffic for a particular purpose.
`USERDEFINED`	User-defined type
`NOTDEFINED`	Undefined type.

Note that one of the choices is **USERDEFINED** and in that case, the user defined value can be the value of Attribute 5, ***ObjectType***.

IfcObject (5)			
5	ObjectType	OPTIONAL IfcLabel	The type denotes a particular type that indicates the object further. The use has to be established at the level of instantiable subtypes. In particular it



Continue to 30.4.5.3 Using Spatial Structure or return to 30.4.5 IFC Spatial Structure or 30.4 Structure of IFC.

30.4.5.3 Using Spatial Structure

In IFC a spatial structure can be used to provide a spatial organisation of a project.

In **IFC 4x3**, the non-abstract spatial structure elements that can be used to build the spatial structure are: ***IfcSite***, ***IfcBuilding***, ***IfcBridge***, ***IfcMarineFacility***, ***IfcRoad***, ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart***, ***IfcRoadPart*** and ***IfcSpace***

At the top level is ***IfcProject*** although 30.4.2.1.1.2 IfcProject is not actually a Spatial Structure entity and there can be only once instance of ***IfcProject*** in an IFC file.

Under ***IfcProject***, spatial project structure can define as many levels of decomposition as necessary for the project.

Elements within the spatial project structure are:

- site as ***IfcSite***
- facility as ***IfcFacility***, or an entity derived from ***IfcFacility***

  building as ***IfcBuilding***

  bridge as ***IfcBridge***

  marine facility as ***IfcMarineFacility***

  railway as ***IfcRailway***

  road as ***IfcRoad***
- facility parts derived from the abstract ***IfcFacilityPart***, or specifically

  bridge part as ***IfcBridgePart***

  a general part as ***IfcFacilityPartCommon***

  marine part as ***IfcMarinePart***

  railway part as ***IfcRailwayPart***

  road part as ***IfcRoadPart***
- space as ***IfcSpace***

The spatial structure forms a hierarchy and for information on what spatial composition combinations are allowed, see 30.4.5.4 Spatial Composition.

An instance of a spatial structure is **directly contained in only one other spatial structures** and each instance of a spatial structure has its own GlobalId. Because GlobalId's are unique in an IFC file, each instance of a spatial structure is unique.

Hence the instances of a spatial structure in IFC is **NOT** exactly like an **Object Tree** in ***12d Model*** where in ***12d Model***, only the full path name must be unique.

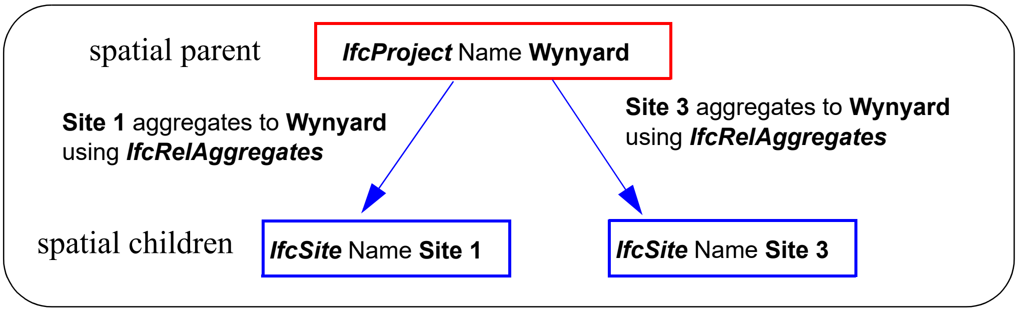
GlobalId's are not user friendly (e.g. 3lm8kkkpPDS8HU5dCNDAjF) so ***12d Model*** currently insists that the **name** of an **instance** of the **spatial structure** must be **unique amongst** the **names** of **ALL** the **spatial structure instances** in a ***12d Model*** project.

The hierarchy of the overall spatial structure is specified by defining when an instance of spatial structure B is directly contained in the instance of another spatial structure A.

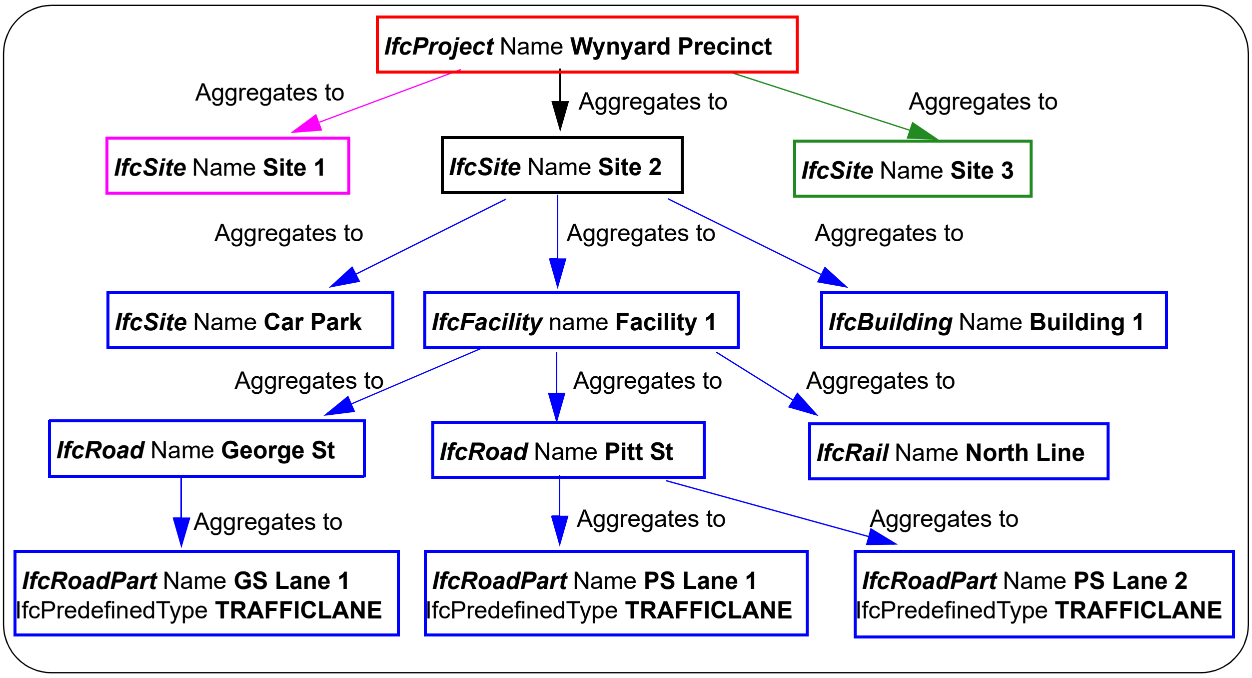
In IFC speak, this is expressed as the instance of spatial structure **B aggregates to** the instance of spatial structure **A**. Or in ***12d Model*** speak, **A** is the spatial structure **parent** of **B** and **B** is the spatial structure child of **A.**

In an IFC file, the entity ***IfcRelAggregates*** is used to specify which spatial structure instances **aggregate to** another spatial structure instance (the **spatial parent**). *See* 30.4.6.2.2 IfcRelAggregates.

In IFC diagrams, a directed arrow going from the spatial parent to the spatial child is often used to denote the "aggregates to" relationship.



As an example of a spatial structure for a Project:



So when a spatial structure is referred to by its name, all the spatial structures contained beneath it are also uniquely specified.

For example, **Pitt St** contains **PS Lane 1** and **PS Lane 2**, and **Site 2** contains all the instances of spatial structures in the **blue** boxes (Car Park, Facility 1, Building 1, George St etc).

Finally, within the ***IfcProject*** every ***IfcProduct*** must belong to an instance of **one, and only one, part** of the ***Spatial Structure***.

In an IFC file, the entity ***IfcRelContainedInSpatialStructure*** is used to specify which spatial structure instance an instance of an ***IfcProduct*** is in. *See* 30.4.6.1.1 IfcRelContainedInSpatialStructure.

```
#1 = IFCPROJECT('2jkyVJXqH1sutn5zr0KLld', #2, 'DESIGN ROADS', '', $, $, $, (#12), #7);
#21 = IFCSITE('0qugzND2bBj8LaruiHnBEJ', #2, 'Site 1', 'Greenfield',
        $, #13, $, $, .ELEMENT., $, $, $, $, $);
#22 = IFCRELAGGREGATES('3MMF_bGO12EAmh2w9Aa7Z2', #2, 'ProjectContainer',
        'ProjectContainer for Sites', #1, (#21));
#23 = IFCROAD('3ZJPPA4kj5GQgKmEGvkOng', #2, 'George St',
        'Description of George St', $, #13, $, $, .ELEMENT.);
#24 = IFCRELAGGREGATES('0NCJNYUd55TPVjcH5fh6bR', #2, 'SiteContainer',
        'SiteContainer For All Models', #21, (#23));
#26 = IFCPAVEMENT('2518seZTTD8Rf0_Pc9se$o', #2, 'PVB-LRB01', '12d Trimesh', 'Trimesh',
        #13, #27, $, .USERDEFINED.);
#25 = IFCRELCONTAINEDINSPATIALSTRUCTURE('0wZsgn1Sn2QAS8nkljDRb6', #2, 'RoadContainer',
        'RoadContainer for Elements', (#26), #23);
```

name of the Project

name of the Site

Site 1 is aggregated to DESIGN ROADS

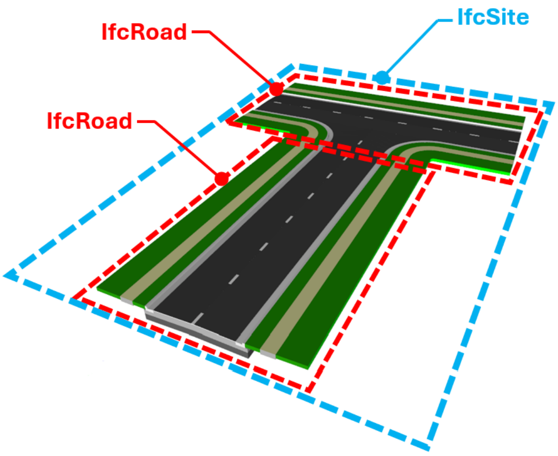
name of the Road

George St is aggregated to Site 1

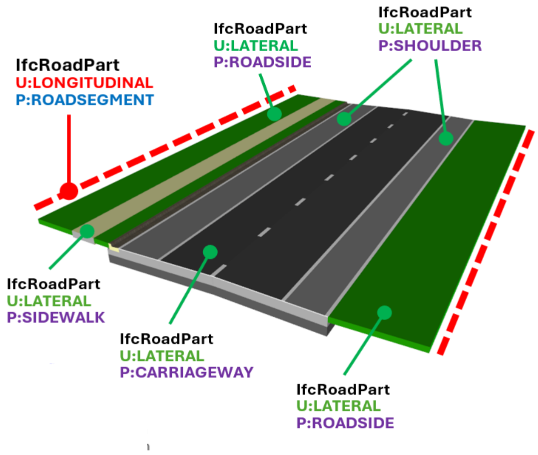
name of the Pavement

Pavement PVB-LRB01 is in the spatial structure George St

SPATIAL BREAKDOWN



SPATIAL DIVISION OF A ROAD
Lateral and Longitudinal Breakdown



For an example of a STEP file with spatial structure using **Att 10** ***UsageType*** and **Att 11** ***PredefinedType***, see 30.4.5.5.1 IFC STEP File Format For Spatial Structure.

Continue to 30.4.5.5 Defining Spatial Structure in 12d Model or return to 30.4.5 IFC Spatial Structure or 30.4 Structure of IFC.

30.4.5.4 Spatial Composition

The spatial structure is a hierarchical tree of spatial elements ultimately assigned to the project.

Spatial Composition refers to the relationship to a higher level element (e.g. this road segment is part of a road).

The project spatial structure may be made up of a selection of different spatial structure elements with the most generic and simplest form from **Level 1** to **Level 4** as follows:

Level 1: ***IfcProject*** - there is only one ***IfcProject***.

Level 2 ***IfcSite***. IfcSite can be a child of IfcProject or of itself (IfcSite)

That is:

IfcSite can be a child of IfcSite and IfcProject.

Level 3 ***IfcFacility*** or any of ***IfcFacility’***s subtypes ***IfcBridge***, ***IfcBuilding***, ***IfcMarineFacility***, ***IfcRailway***, and ***IfcRoad***. These can be children of the **Level 1** spatial structure element ***IfcProject,*** the **Level 2** spatial structure element ***IfcSite,*** and of themselves.

?? Except ***IfcFacility*** can also be a child of the **Level 4** ***IfcFacilityPart***.

That is:

IfcBridge can be a child of ***IfcBridge***, ***IfcSite*** and ***IfcProject***.

IfcFacility can be a child of IfcFacility, ***IfcSite***, ***IfcProject*** and ***IfcFacilityPart***

IfcMarineFacility can be a child of ***IfcMarineFacility***, ***IfcSite*** and ***IfcProject***.

IfcRailway can be a child of ***IfcRailway***, ***IfcSite*** and ***IfcProject***.

IfcRoad can be a child of ***IfcRoad***, ***IfcSite*** and ***IfcProject***.

Level 4: ***IfcFacilityPart*** which is abstract so any of ***IfcFacilityPart’***s subtypes ***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart***, and ***IfcRoadPart***. These can be children of **Level 3** spatial structure elements of their related name, and of themselves.

That is:

IfcRoadPart can only be a child of ***IfcRoad*** and ***IfcRoadPart***.

IfcRailwayPart can only be a child of ***IfcRailway*** and ***IfcRailwayPart***.

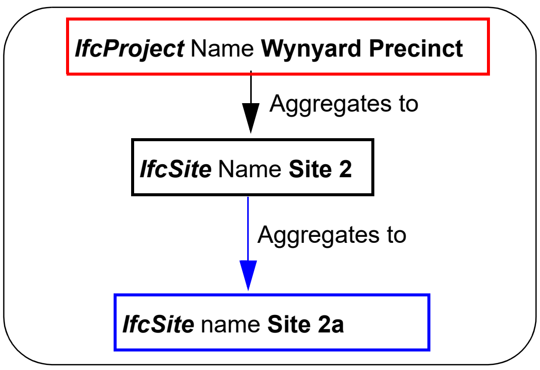
IfcBridgePart can only be a child of ***IfcBridge*** and ***IfcBridgePart***.

IfcFacilityPartCommon can only be a child of IfcFacility and ***IfcFacilityPartCommon***.

Important Note:

Although documentation talks about a spatial structure entity being a child of another spatial structure element, remember that it is referring to instances of the spatial structure elements.

So if ***IfcSite*** being a child of ***IfcSite***, there will be an **instance** of an ***IfcSite*** (e.g. Site 2b) which is a child of a **different instance** of an ***IfcSite*** (Site 2).

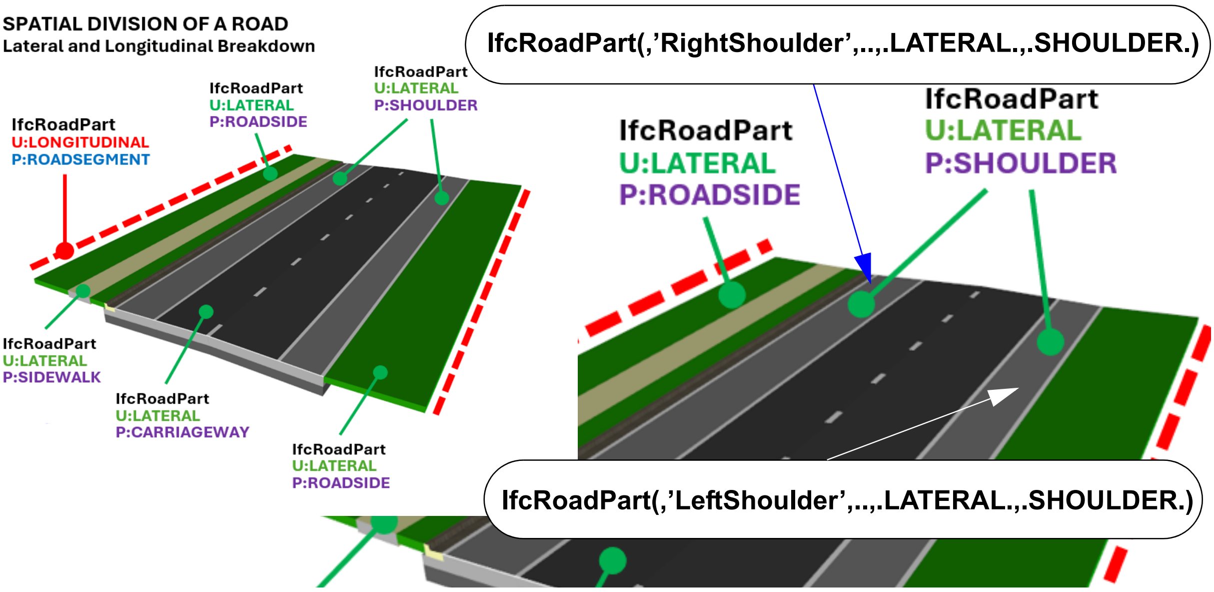


Also each of the spatial structure elements derived from ***IfcFacilityPart***'s (***IfcBridgePart***, ***IfcFacilityPartCommon***, ***IfcMarinePart***, ***IfcRailwayPart***, and ***IfcRoadPart***) have a tenth named attribute ***UsageType*** which gives more information about what the spatial structure element is.used for. See 30.4.5.2.1.3 IfcFacilityPart.

And also an eleventh named attribute ***PredefinedType*** which gives even more information about the instance of the spatial structure element. For example, see 30.4.5.2.1.3.1 IfcRoadPart.

For example, there could be two instance called **LeftShoulder** and **RightShoulder** of entity type ***IfcRoadPart*** could have ***UsageType*** **LATERAL** and ***PredefinedType*** **SHOULDER**.

.



For an example of a STEP file with spatial structure using **Att 10** ***UsageType*** and **Att 11** ***PredefinedType***, see 30.4.5.5.1 IFC STEP File Format For Spatial Structure.

There is one other concept needed for spatial structure and that is ***CompostionType.*** See 30.4.5.4.1 COMPLEX, PARTIAL and ELEMENT CompositionType

Continue to 30.4.5.4.1 COMPLEX, PARTIAL and ELEMENT CompositionType or return to 30.4.5 IFC Spatial Structure or 30.4 Structure of IFC.

30.4.5.4.1 COMPLEX, PARTIAL and ELEMENT CompositionType

Each spatial structure elements derived from ***IfcSpatialStructureElement*** has a ninth named attribute ***CompositionType*** with values

COMPLEX = A group or aggregation of similar elements

ELEMENT = An (undevided) element itself

PARTIAL = A subelementor part.

So ***IfcBuildingStorey, IfcFacility, IfcSite, IfcSpace, IfcBridgePart, IfcFacilityPartCommon, IfcMarinePart, IfcRailwayPart and IfcRoadPart*** all can have a ***CompositionType***.

For example, a project may span over several connected or disconnected sites. Therefore site complex provides for a collection of sites included in a project. A site can also be decomposed in parts, where each part defines a site section.

The named attribute ***CompositionType*** for each instance of ***IfcSite***

COMPLEX = site complex

ELEMENT = site

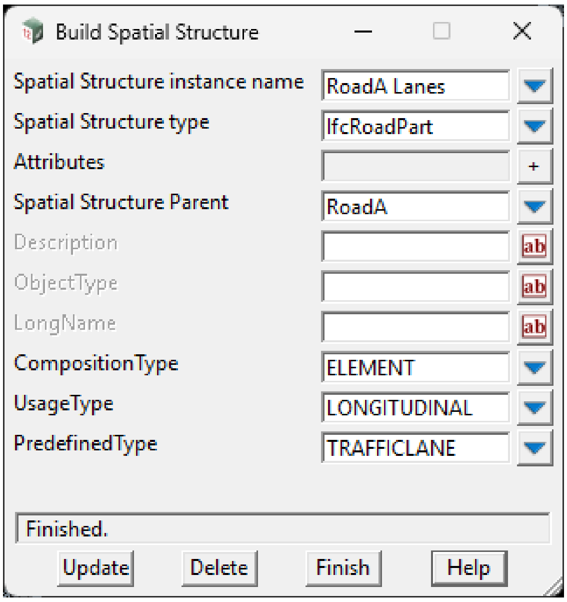
PARTIAL = section of a site

allows for these cases.

Continue to 30.4.5.5 Defining Spatial Structure in 12d Model or return to 30.4.5 IFC Spatial Structure or 30.4 Structure of IFC.

30.4.5.5 Defining Spatial Structure in 12d Model

The **Build Spatial Structure** panel (11.3.3.1 Build IFC Spatial Infrastructure) is used to define each instance of the spatial structure elements and which instance of the spatial structure that it is ***aggregates to*** (i.e. the name of its spatial structure parent):



The spatial structure created by the **Build Spatial Structure** panel is stored as project attributes. See 11.3.3.1 Build IFC Spatial Infrastructure.

The **Apply Spatial Structure** panel assigns a named spatial structure to ***12d Model*** elements. See 11.3.3.2 Apply IFC Spatial Infrastructure.

For an example of a STEP file defined spatial structure see 30.4.5.5.1 IFC STEP File Format For Spatial Structure

Continue to 30.4.5.5.1 IFC STEP File Format For Spatial Structure or return to 30.4 Structure of IFC.

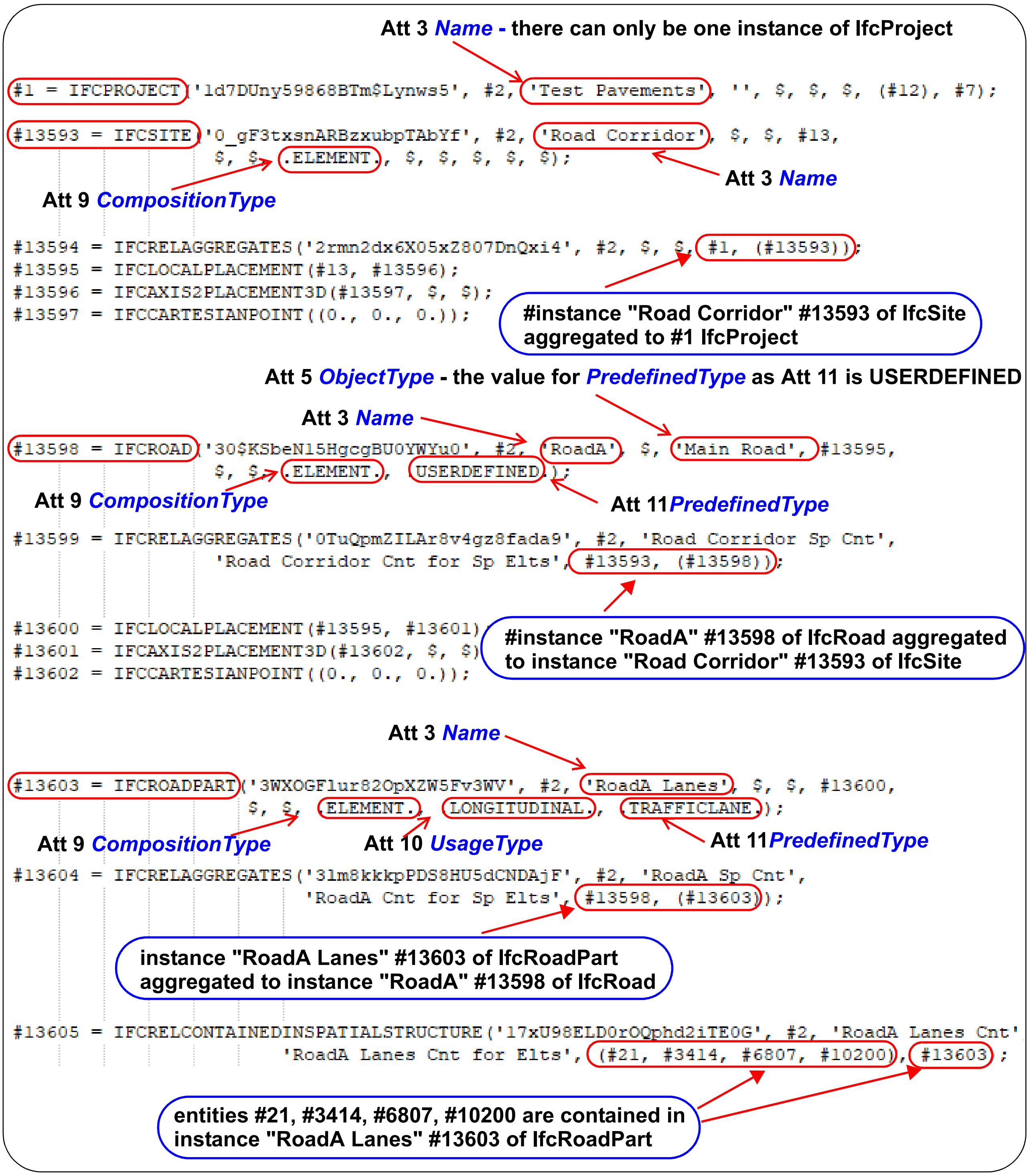
30.4.5.5.1 IFC STEP File Format For Spatial Structure

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

Records in the IFC STEP file for setting up instances of the spatial structure:

IfcProject >IfcRoad >IfcRoadPart

are



Continue to 30.4.6 IfcRelationship or return to 30.4 Structure of IFC.

30.4.6 IfcRelationship

IfcRoot >IfcRelationship

Definition from IFC 4x3

IfcRelationship *is the abstract generalization of all objectified relationships in IFC. Objectified relationships are the preferred way to handle relationships among objects. This allows to keep relationship specific properties directly at the relationship and opens the possibility to later handle relationship specific behaviour.*

There are two different types of relationships, 1-to-1 relationships and 1-to-many relationships, used within the subtypes of ***IfcRelationship****.*

The following convention applies to all subtypes:

The two sides of the objectified relationship are named:

(a) 1-to-1: **Relating**+<name of **relating** object>

and

(b) 1-to-many: **Related**+<name of **related** object>

In case of the 1-to-many relationship, the related side of the relationship shall be an **aggregate** being a set 1:N

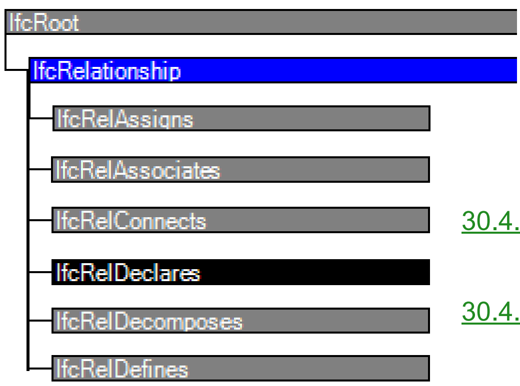
IfcRelationship is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

IfcRelationship **has no additional Named Attributes.**

Entities directly derived from ***IfcRelationship***

Entity inheritance



30.4.6.1 IfcRelConnects

30.4.6.2 IfcRelDecomposes

Continue to 30.4.6.1 IfcRelConnects or return to 30.4 Structure of IFC.

30.4.6.1 IfcRelConnects

IfcRoot >IfcRelationship >IfcRelconnects

Definition from IFC4x3:

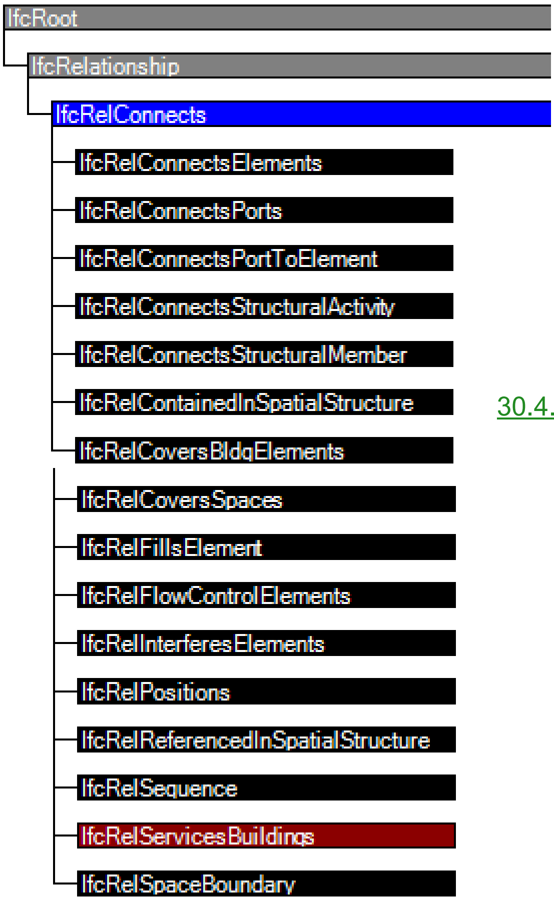
IfcRelconnects *is a connectivity relationship that connects objects under some criteria. As a general connectivity it does not imply constraints, however subtypes of the relationship define the applicable object types for the connectivity relationship and the semantics of the particular connectivity.*

IfcRelconnects is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

IfcRelconnects **has no additional Named Attributes.**

Entities directly derived from ***IfcRelconnects***



30.4.6.1.1 IfcRelContainedInSpatialStructure

Continue to 30.4.6.1.1 IfcRelContainedInSpatialStructure or return to 30.4 Structure of IFC.

30.4.6.1.1 IfcRelContainedInSpatialStructure

IfcRoot >IfcRelationship >IfcRelConnects >IfcRelContainedInSpatialStructure

Definition from IFC 4x3:

*This objectified relationship, **IfcRelContainedInSpatialStructure**, is used to **assign elements** to a **certain level of the spatial project structure**.*

*Any **element** can only be **assigned once to a certain level of the spatial structure**.*

The question, which level is relevant for which type of element, can only be answered within the context of a particular project and might vary within the various regions.

EXAMPLE: A multi-storey space **is contained** (or belongs to) the building storey at which its ground level is.

The containment relationship of an element within a spatial structure has to be a hierarchical relationship; an **element can only be contained within a single spatial structure element.**

Occurrences of the same element type **can be assigned to different spatial structure elements** depending on the context of the occurrence.

EXAMPLE: A wall (***ifcWall*** STANDARD) might be normally assigned to a storey, however the curtain wall (***IfcWall*** USERDEFINED) might be assigned to the building and the retaining wall (***IfcWall*** RETAININGWALL) in the terrain might be assigned to the site.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

***IfcRelContainedInSpatialStructure* has two additional named attribute *RelatedElements* (att 5), *RelatingStructure* (att 6):**

IfcRelContainedInSpatialStructure (2)			
5	RelatedElements	SET [1:?] OF IfcProduct	Set of products, which are contained within this level of the spatial structure hierarchy.
6	RelatingStructure	IfcSpatialElement	Spatial structure element, within which the element is contained. Any element can only be contained within one element of the project spatial structure.

So ***RelatedElements*** in a list of ***IfcProduct***'s that are contained in the ***IfcSpatialElement*** given by ***RelatingStructure.***

There are no entities derived from ***IfcRelContainedInSpatialStructure.***

Predefined spatial structure elements that elements can be assigned to are

- site as ***IfcSite***
- facility as ***IfcFacility*** or its subtypes ***IfcBridge***, ***IfcBuilding***, ***IfcMarineFacility***, ***IfcRailway*** or ***IfcRoad***
- part of facility as ***IfcFacilityPart***, or more specifically as ***IfcBuildingStorey***, ***IfcBridgePart***, ***IfcMarinePart***, ***IfcRailwayPart***, ***IfcRoadPart*** or ***IfcSpace***

The **reference relationship** between an element and the spatial structure need not be hierarchical; that is, an element can **reference** many spatial structure elements.

EXAMPLE: A multi-storey space **is contained** (or belongs to) the building storey at which its ground level is., but **it is referenced** by all the other building storeys, in which it spans. A lift shaft might be contained by the basement, but referenced by all storeys, through which it spans.

NOTE: The **reference relationship** is expressed by ***IfcRelReferencedInSpatialStructure.***

Continue to 30.4.6.2 IfcRelDecomposes or return to 30.4 Structure of IFC.

30.4.6.2 IfcRelDecomposes

IfcRoot >IfcRelationship >IfcRelDecomposes

Definition from IFC 4x3:

*The decomposition relationship, **IfcRelDecomposes**, defines the general concept of elements being **composed** or **decomposed**. The decomposition relationship denotes a whole/part hierarchy with the ability to navigate from the whole (the composition) to the parts and vice versa.*

IfcRelDecomposes is abstract and can not be instantiated.

*Decompositions may be constrained by requiring both, the whole and its parts, to be of the same type - thus establishing a **nesting** relationship. Or they may require some form of physical containment, thus establishing special types of aggregation relationships.*

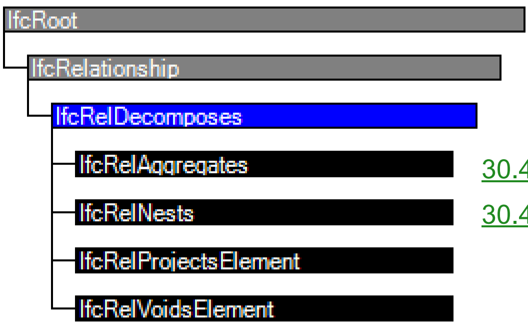
***NOTE** There are two special names for decomposition, which are linguistically distinguished, **nesting** (an **ordered collection** of parts) and **aggregation** (an **unordered collection** of parts). The subtypes of **IfcRelDecomposes** will introduce either the nesting or aggregation convention (see **IfcRelNests** and **IfcRelAggregates**).*

*Decompositions imply a dependency, i.e. the definition of the whole depends on the definition of the parts and the parts depend on the existence of the whole. The decomposition relationship can be applied in a recursive manner, i.e. a decomposed element can be part in another decomposition. **Cyclic references have to be prevented at application level**.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

IfcRelDecomposes **has no additional Named Attributes.**

Entities directly derived from ***IfcRelDecomposes***



30.4.6.2.2 IfcRelAggregates

30.4.6.2.1 IfcRelNests

Continue to 30.4.6.2.1 IfcRelNests or return to 30.4 Structure of IFC.

30.4.6.2.1 IfcRelNests

IfcRoot >IfcRelationship >IfcRelDecomposes >IfcRelNests

Definition from IFC 4x3:

*The nesting relationship **IfcRelNests** is a special type of the general composition/decomposition (or whole/part) relationship **IfcRelDecomposes**.*

The nesting relationship can be applied to all subtypes of object and object types.

For example, processes, controls (like cost items), and resources. It can also be applied to alignment, nesting its different layouts; and to physical subtypes of object and object types, such as elements having ports.

The **nesting** implies an **order among the nested parts**.

EXAMPLE

*A series of **IfcDistributionPort** entities can be nested within an **IfcDistributionElement**. They decompose the distribution element and have an implied order.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

***IfcRelNests* has two additional named attribute *RelatingObject* (att 5), *RelatedObjects* (att 6):**

IfcRelNests (2)			
5	RelatingObject	IfcObjectDefinition	The object definition, either an object type or a object occurrence, that represents the nest. It is the whole within the whole/part relationship.
6	RelatedObjects	LIST [1:?] OF IfcObjectDefinition	The object definitions, either object type or object occurrence, that are being nested. They are defined as the parts in the ordered whole/part relationship - i.e. there is an implied order among the parts expressed by the position within the list of *RelatedObjects*.

So ***RelatedObjects*** is an ordered list of ***IfcObjectDefinitions'***s that are parts of the ***IfcObjectDefinition*** given by ***RelatingObject***. *See* 30.4.2.1 IfcObjectDefinition.

There are no entities derived from ***IfcRelNests.***

Continue to 30.4.6.2.2 IfcRelAggregates or return to 30.4 Structure of IFC.

30.4.6.2.2 IfcRelAggregates

IfcRoot >IfcRelationship >IfcRelDecomposes >IfcRelAggregates

Definition from IFC 4x3:

*The aggregation relationship **IfcRelAggregates** is a special type of the general composition/ decomposition (or whole/part) relationship **IfcRelDecomposes**. The aggregation relationship can be applied to all subtypes of **IfcObjectDefinition**.*

In cases of aggregation of physical elements into a physical aggregate the shape representation of the whole (within the same representation identifier) can be taken from the sum of the shape representations of the parts.

The **aggregation** does **not imply any order among the aggregated parts**.

EXAMPLE A roof is the aggregation of the roof elements, such as roof slabs, rafters, purlins, etc. Within the same representation identifier (such as the body geometric representation), the shape representation of the roof is given by the shape representation of its parts.

Decompositions imply a dependency, implying that the whole depends on the definition of the parts and the parts depend on the existence of the whole. The behaviour that is implied from the dependency relationship has to be established inside the applications.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

***IfcRelAggregates* has two additional named attribute *RelatingObject* (att 5), *RelatedObjects* (att 6):**

IfcRelAggregates (2)			
5	RelatingObject	IfcObjectDefinition	The object definition, either an object type or an object occurrence, that represents the aggregation. It is the whole within the whole/part relationship.
6	RelatedObjects	SET [1:?] OF IfcObjectDefinition	The object definitions, either object occurrences or object types, that are being aggregated. They are defined as the parts in the whole/part relationship. No order is implied between the parts.

So ***RelatedObjects*** is an unordered list of ***IfcObjectDefinitions'***s that are parts of the ***IfcObjectDefinition*** given by ***RelatingObject****. See* 30.4.2.1 IfcObjectDefinition.

There are no entities derived from ***IfcRelAggregates.***

Continue to 30.4.7 IFC Property Sets, IFC Properties and Psets or return to 30.4 Structure of IFC.

30.4.7 IFC Property Sets, IFC Properties and Psets

In ***12d Model*** extra data can be attached to the ***Projects***, ***Models***, ***Strings***, ***Trimeshes***, ***Tins*** and other elements as attributes.

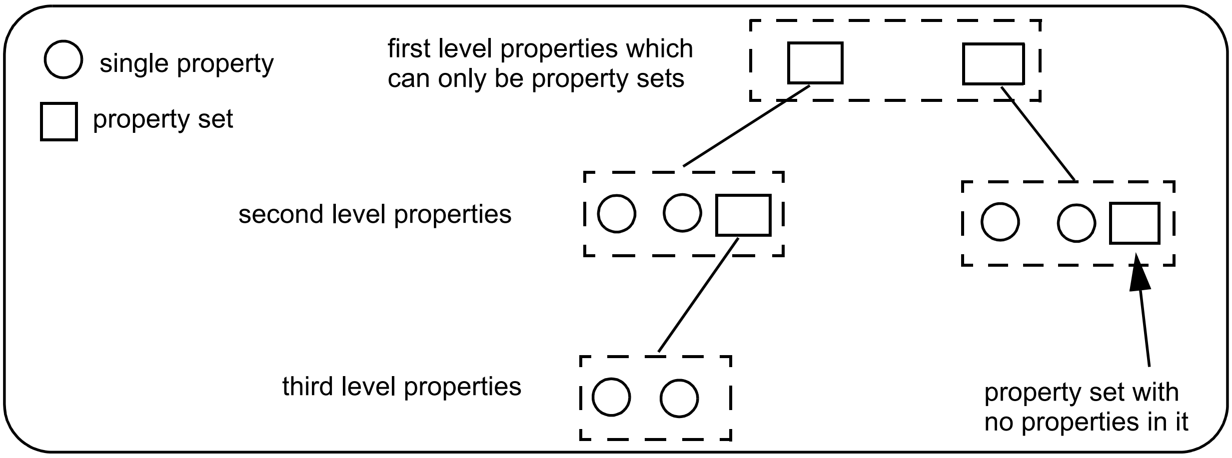
A ***12d Model*** attribute can be a single item that has a name and can store either an integer (32-bit), a real (64-bit double precision), a text, or a 64-bit integer, or it can be a ***group attribute*** that can store other attributes.

Hence attributes in ***12d Model*** can be grouped into a ***hierarchy*** (also known as a ***tree*** or ***root structure***). *See* 3.9 Attributes (Meta Data).

IFC also has the concept of attributes and a hierarchy of attributes but in IFC they are called ***Properties*** and group attributes are called ***Property Sets***.

There are two major differences between properties in IFC and attributes in ***12d Model***.

Firstly, in IFC, the top level can only contain ***Property Sets*** (group attributes). That is:



Secondly, ***property sets*** are more like **string**, **tin, model** and **trimesh attributes** where they only exist for the whole entity whereas in ***12d Model***, there are also vertex and segment attributes for each vertex and segment of a string.

In IFC there are **special property sets** that are totally defined in the IFC specification and these are called ***Psets*** and their names start with "***Pset_***". *See* 30.4.7.3 Examples of Psets.

Consequently the name of **user defined property set cannot start** with "***Pset_***".

Continue to 30.4.7.1 IfcPropertyDefinition or return to 30.4 Structure of IFC.

30.4.7.1 IfcPropertyDefinition

IfcRoot >IfcPropertyDefinition

Definition from IFC 4x3:

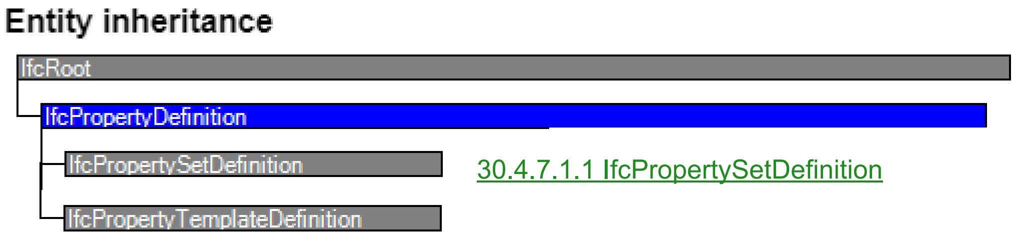
IfcPropertyDefinition *defines the generalization of all characteristics (i.e. a grouping of individual properties), that may be assigned to objects. Currently, subtypes of* ***IfcPropertyDefinition*** *include property set occurrences, property set templates, and property templates.*

IfcPropertyDefinition is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

There are no additional Named Attributes for ***IfcPropertyDefinition***

Entities directly derived from ***IfcPropertyDefinition***



30.4.7.1.1 IfcPropertySetDefinition

Continue to 30.4.7.1.1 IfcPropertySetDefinition or return to 30.4 Structure of IFC.

30.4.7.1.1 IfcPropertySetDefinition

IfcRoot >IfcPropertyDefinition >IfcPropertySetDefinition

Definition from IFC 4x3:

IfcPropertySetDefinition *is a generalization of all individual property sets that can be assigned to an object or type object.*

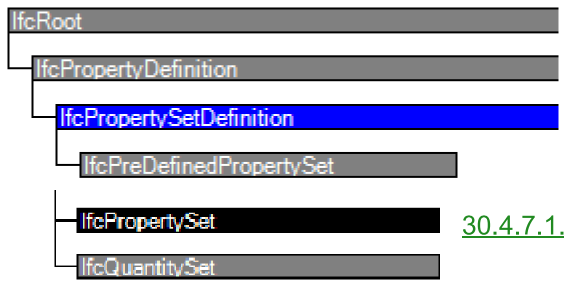
IfcPropertySetDefinition is abstract and can not be instantiated.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

There are no additional Named Attributes for *IfcPropertyDefinition*

Entities directly derived from **IfcPropertySetDefinition**

Entity inheritance



30.4.7.1.1.1 IfcPropertySet

Continue to 30.4.7.1.1.1 IfcPropertySet or return to 30.4 Structure of IFC.

30.4.7.1.1.1 IfcPropertySet

IfcRoot >IfcPropertyDefinition >IfcPropertySetDefinition ***>IfcPropertySet***

Definition from IFC 4x3:

The ***IfcPropertySet*** *is a container that holds* ***properties within a property tree.*** *These properties are interpreted according to their name attribute. Each individual property has a significant name string.*

Some property sets are included in the specification of this standard and have a ***predefined set of properties*** *indicated by assigning a significant name. These property sets are listed under "property sets" within the IFC 4x3 specification. Property sets applicable to certain objects are listed in the IFC 4x3 object specification. The naming convention "****Pset_Xxx****" applies to all those property sets that are* ***defined as part of the IFC 4x3 specification*** *and it shall be used as the* ***value*** *of the* ***Name attribute****.*

In addition ***any user defined*** *property set can be captured. Property sets that are not declared as part of the IFC specification shall have a Name value* ***not including the "Pset_" prefix****.*

IfcPropertySet *can be assigned to* ***object occurrences*** *and* ***object types****. An* ***IfcPropertySet*** *assigned to an object type is shared among all occurrences of the same object type.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

IfcPropertySet **has one additional named attribute** ***HasProperties*** **(Att 5) which is a container set of** ***IfcProperty's*****:**

IfcPropertySet (1)			
5	HasProperties	SET [1:?] OF IfcProperty	Contained set of properties. For property sets defined as part of the IFC Object model, the property objects within a property set are defined as part of the standard. If a property is not contained within the set of predefined properties, its value has not been set at this time.

There are no entities derived from **IfcPropertySet**.

For an example of IFC Property Sets, see 30.4.7.2.1.2.1.1 IFC STEP File Format for IFC Property Sets.

Continue to 30.4.7.2 IfcPropertyAbstraction or return to 30.4 Structure of IFC.

30.4.7.2 IfcPropertyAbstraction

IfcPropertyAbstraction

Definition from IFC 4x3:

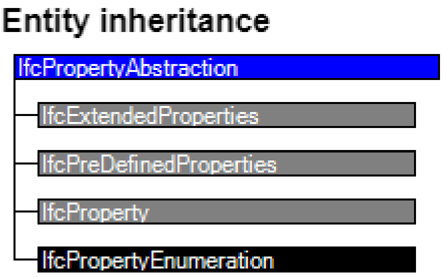
*The **IfcPropertyAbstraction** is an abstract supertype of all property related entities defined as dependent resource entities within the specification.*

It may have an external reference to a dictionary or library that provides additional information about its definition. Instantiable subtypes have property name, value and other instance information.

IfcPropertySetDefinition is abstract and can not be instantiated.

There are no named attributes for IfcPropertyAbstraction

Entities directly derived from **IfcPropertyAbstraction**



30.4.7.2.1 IfcProperty

Continue to 30.4.7.2.1 IfcProperty or return to 30.4 Structure of IFC.

30.4.7.2.1 IfcProperty

IfcPropertyAbstraction >IfcProperty

Definition from IFC 4x3:

IfcProperty *is an abstract generalization for all types of properties that can be associated with IFC objects through the property set mechanism.*

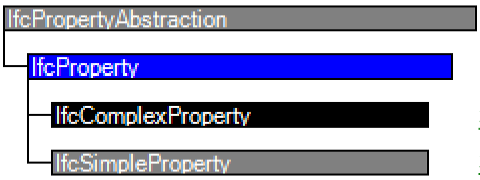
IfcProperty is abstract and can not be instantiated.

IfcProperty has two named attributes *Name* (Att 1) and *Specification* (Att 2)

IfcProperty (8)			
1	Name	IfcIdentifier	Name for this property. This label is the significant name string that defines the semantic meaning for the property.
2	Specification	OPTIONAL IfcText	URI reference to a location with semantic definition or informative text to explain the property.

Entities directly derived from **IfcProperty**

Entity inheritance



30.4.7.2.1.1 IfcComplexProperty
30.4.7.2.1.2.1 IfcPropertySingleValue

Continue to 30.4.7.2.1.1 IfcComplexProperty or return to 30.4 Structure of IFC.

30.4.7.2.1.1 IfcComplexProperty

IfcPropertyAbstraction >IfcProperty >***IfcComplexProperty***

Definition from IFC 4x3:

IfcComplexProperty *is used to define complex properties to be handled completely within a property set. The* ***included set of properties*** *may be a mixed or consistent collection of* ***IfcProperty*** *subtypes. This enables the definition of a set of properties to be included as a single 'property' entry in an IfcPropertySet. The definition of such an* ***IfcComplexProperty*** *can be reused in many different* ***IfcPropertySet'****s.*

Name attributes 1, 2 See 30.4.7.2.1 IfcProperty

IfcComplexProperty **has two additional named attributes *UsageName* (Att 3) and *HasProperties* (Att 4) which is a set of properties**

IfcComplexProperty (2)			
3	UsageName	IfcIdentifier	Usage description of the *IfcComplexProperty* within the property set which references the *IfcComplexProperty*. NOTE Consider a complex property for glazing properties. The *Name* attribute of the *IfcComplexProperty* could be *Pset_GlazingProperties*, and the UsageName attribute could be *OuterGlazingPane*.
4	HasProperties	SET [1:?] OF IfcProperty	Set of properties that can be used within this complex property (may include other complex properties).

There are no entities derived from ***IfcComplexProperty***.

Continue to 30.4.7.2.1.2 IfcSimpleProperty or return to 30.4 Structure of IFC.

30.4.7.2.1.2 IfcSimpleProperty

IfcPropertyAbstraction >IfcProperty >IfcSimpleProperty

Definition from IFC 4x3:

IfcSimpleProperty *is a generalization of a* ***single property object****.*

The various subtypes of ***IfcSimpleProperty*** *establish different ways in which a property value can be set.*

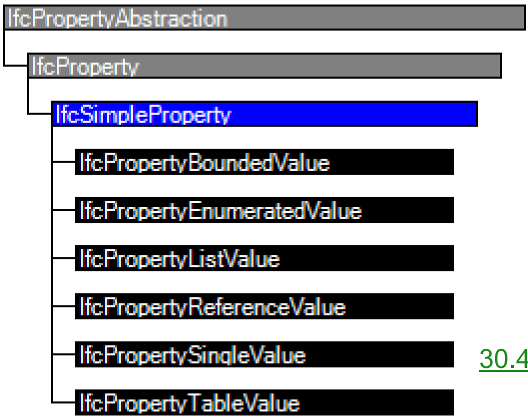
IfcSimpleProperty is abstract and can not be instantiated.

Name attributes 1, 2 See 30.4.7.2.1 IfcProperty

IfcSimpleProperty **has no additional named attributes.**

Entities directly derived from ***IfcSimpleProperty***

Entity inheritance



30.4.7.2.1.1 IfcComplexProperty

Continue to 30.4.7.2.1.2.1 IfcPropertySingleValue or return to 30.4 Structure of IFC.

30.4.7.2.1.2.1 IfcPropertySingleValue

IfcPropertyAbstraction >IfcProperty >IfcSimpleProperty >IfcPropertySingleValue

Definition from IFC 4x3:

*The property with a single value **IfcPropertySingleValue** defines a property object which has a single (numeric or descriptive) value assigned.*

*It defines a property - single value combination for which the property **Name**, an optional **Description**, and an optional **NominalValue** with measure type is provided.*

*In addition, the default unit as specified within the project unit context can be overridden by assigning an **Unit**.*

The unit is handled by the ***Unit*** attribute. If the ***Unit*** attribute is

(a) **not given**, then the unit is already implied by the type of ***IfcMeasureValue*** or ***IfcDerivedMeasureValue***. The associated unit can be found at the ***IfcUnitAssignment*** globally defined at the project level ***(IfcProject.UnitsInContext)***.

(b) **given**, then the unit assigned by the ***Unit*** attribute overrides the globally assigned unit.

Name attributes 1, 2 See 30.4.7.2.1 IfcProperty

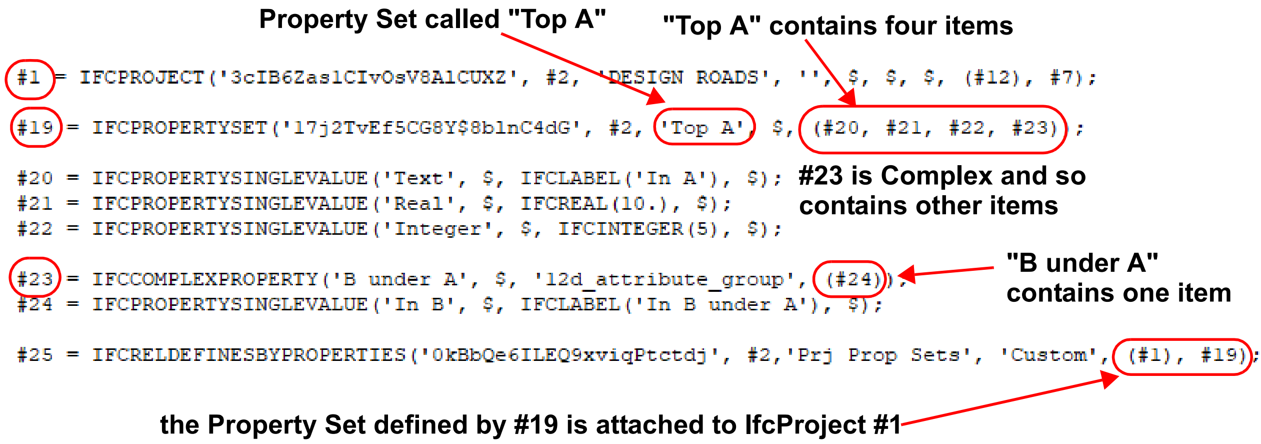
***IfcPropertySingleValue* has two named attributes *Name* (Att 1) and *Specification* (Att 2) inherited from *IfcProperty* and two additional name attributes *NominalValue* (Att 3) and *Unit* (Att 4)**

IfcProperty (8)			
1	Name	IfcIdentifier	Name for this property. This label is the significant name string that defines the semantic meaning for the property.
2	Specification	OPTIONAL IfcText	URI reference to a location with semantic definition or informative text to explain the property.
IfcPropertySingleValue (2)			
3	NominalValue	OPTIONAL IfcValue	Value and measure type of this property. NOTE By virtue of the defined data type, that is selected from the SELECT *IfcValue*, the appropriate unit can be found within the *IfcUnitAssignment*, defined for the project if no value for the unit attribute is given.
4	Unit	OPTIONAL IfcUnit	Unit for the nominal value, if not given, the default value for the measure type (given by the TYPE of nominal value) is used as defined by the global unit assignment at IfcProject.

Note: Unit **DEGREES** is decimal degrees.

Continue to 30.4.7.2.1.2.1.1 IFC STEP File Format for IFC Property Sets or return to 30.4 Structure of IFC.

30.4.7.2.1.2.1.1 IFC STEP File Format for IFC Property Sets



So this defines a Property Set called "Top A" which has in it the four Properties:

1. a Text property called "Text" with the value "In A"
2. a Real property called "Real" with the value 10.
3. an Integer property called "Integer" with the value 5.
4. a complex property called "B under A"

"B under A" is a complex property and has the one property under it

5. a Text property called "in B" with the value "In B under A".

The Property Set "Top A" is attached to ***IfcProject***.

Continue to 30.4.7.3 Examples of Psets or return to 30.4 Structure of IFC.

30.4.7.3 Examples of Psets

In IFC there are **special property sets** that are totally defined in the IFC specification and these are called ***Psets*** and their names start with "***Pset_***".

For some examples, see

30.4.7.3.1 Pset_BerthCommon
30.4.7.3.2 Pset_BoreholeCommon
30.4.7.3.3 Pset_PavementSurfaceCommon

30.4.7.3.1 Pset_BerthCommon

Definition from IFC 4x3:

*properties common to the definition of all occurrences of **IfcSpace** and types of **IfcSpaceType** with the predefined type set to **BERTH***

***Pset_BerthCommon has* five IfcProperty's:**

Name	Property Type	Data Type	Description
BerthApproach	IfcPropertyEnumeratedValue	PEnum_BerthApproach	How the vessel approaches the berth
BerthMode	IfcPropertyEnumeratedValue	PEnum_BerthMode	Orientation of vessel as it approaches berth
BerthingAngle	IfcPropertySingleValue	IfcPlaneAngleMeasure	Angle of approach for the vessel to the berth
BerthingVelocity	IfcPropertySingleValue	IfcLinearVelocityMeasure	Velocity of the vessel as it berths
AbnormalBerthingFactor	IfcPropertySingleValue	IfcPositiveRatioMeasure	Risk assessed safety factor

Continue to 30.4.7.3.2 Pset_BoreholeCommon or return to 30.4.7.3 Examples of Psets or 30.4 Structure of IFC.

30.4.7.3.2 Pset_BoreholeCommon

Definition from IFC 4x3:

Properties describing the features of a borehole (if not modelled separately).

***Pset_BoreholeCommon has eight* IfcProperty's:**

Name	Property Type	Data Type	Description
BoreholeState	IfcPropertyEnumeratedValue	PEnum_BoreholeState	The state the borehole or trial pit has been left in. (boreholeML).
CapDepth	IfcPropertySingleValue	IfcPositiveLengthMeasure	Depth of cap (boreholeML).
CapMaterial	IfcPropertySingleValue	IfcLabel	Cap material or 'NOT CAPPED' or 'UNKNOWN' (boreholeML).
FillingDepth	IfcPropertySingleValue	IfcPositiveLengthMeasure	Depth of filling (boreholeML).
FillingMaterial	IfcPropertySingleValue	IfcLabel	Filling material or 'NOT FILLED' or 'UNKNOWN' (boreholeML).
GroundwaterDepth	IfcPropertySingleValue	IfcPositiveLengthMeasure	Depth groundwater encountered (boreholeML).
LiningMaterial	IfcPropertySingleValue	IfcLabel	Lining material or 'NOT LINED' or 'UNKNOWN' (boreholeML).
LiningThickness	IfcPropertySingleValue	IfcPositiveLengthMeasure	Thickness of the lining.

Continue to 30.4.7.3.3 Pset_PavementSurfaceCommon or return to 30.4.7.3 Examples of Psets or 30.4 Structure of IFC.

30.4.7.3.3 Pset_PavementSurfaceCommon

Definition from IFC 4x3:

Properties for a pavement surface.

***Pset_PavementSurfaceCommon* two IfcProperty's:**

Name	Property Type	Data Type	Description
PavementRoughness	IfcPropertySingleValue	IfcNumericMeasure	An assessment of the functional condition of the pavement surface indicated as an index according to the International Roughness Index (IRI).
PavementTexture	IfcPropertySingleValue	IfcPositiveLengthMeasure	Characterization of pavement texture by mean profile depth

Continue to 30.4.8 List of Non-Abstract Entities Derived from IfcProduct or return to 30.4.5 IFC Spatial Structure or 30 BIM and Digital Engineering.

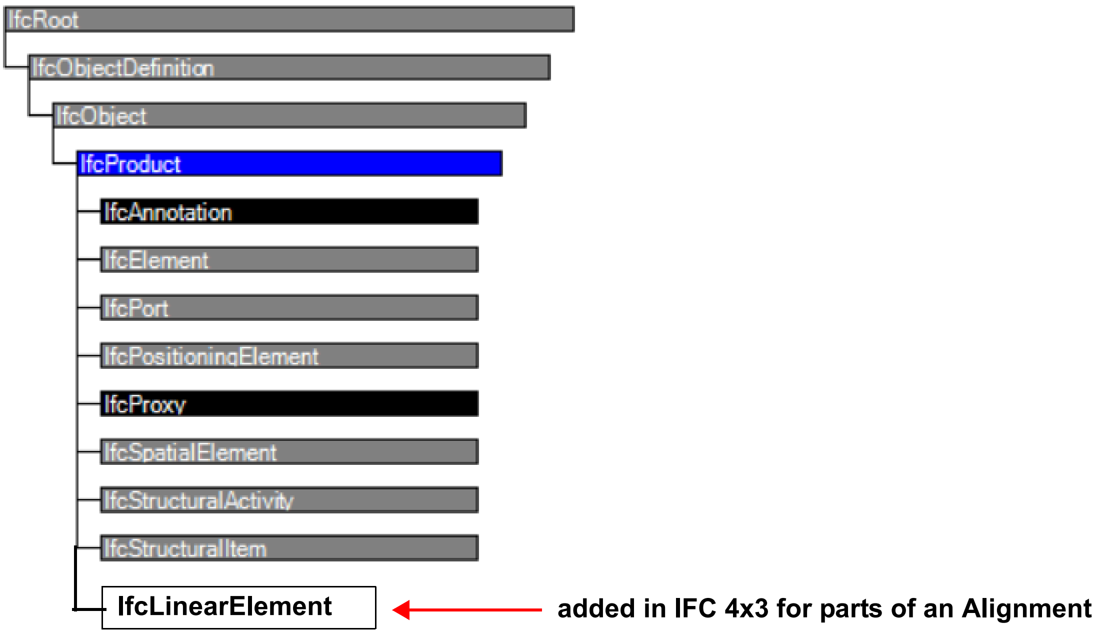
30.4.8 List of Non-Abstract Entities Derived from IfcProduct

As discussed in 30.4.2.1.2.1 IfcProduct ***IfcProduct*** is a representation of any object that relates to a geometric or spatial context so ***12d Model*** elements need to be mapped to the appropriate entity derived from ***IfcProduct.***

For example, if a trimesh is representing a slab then it needs to be written out to the IFC file as an ***IfcSlab***. This is done by setting the appropriated attribute value in ***12d Model*** to "IfcSlab".

Not all entities derived from **IfcProduct** have the same named attributes so it is important to check the buildingSMART document to know which "names attributes" exist for the selected IFC entity.

The first level of entities derived from ***IfcProduct*** are show below:



For a full list of the entities of all levels derived from ***IfcProduct*** that have an instantiation, see

30.4.8.1 Some Entities Derived from IfcProduct in IFC 2x3
30.4.8.2 Non-Abstract Entities Derived from IfcProduct in IFC 4x3

30.4.8.1 Some Entities Derived from IfcProduct in IFC 2x3

ifcElement	IfcDistributionElement
IfcBuildingElement	IfcDistributionControlElement
IfcBeam	IfcDistributionFlowElement
IfcBuildingElementComponent	IfcDistributionChamberElement
IfcBuildingElementPart	IfcEnergyConversionDevice
IfcReinforcingElement	IfcFlowController
IfcReinforcingBar	IfcElectricDistributionPoint
IfcReinforcingMesh	IfcFlowFitting
IfcTendon	IfcFlowMovingDevice
IfcTendonAnchor	IfcFlowSegment
IfcBuildingElementProxy	IfcFlowStorageDevice
IfcColumn	IfcFlowTerminal
IfcCovering	IfcFlowTreatmentDevice
IfcCurtainWall	IfcElectricalElement
IfcDoor	IfcElementAssembly
IfcFooting	IfcElementComponent
IfcMember	IfcDiscreteAccessory
IfcPile	IfcFastener
IfcPlate	IfcMechanicalFastener
IfcRailing	IfcEquipmentElement
IfcRamp	IfcFeatureElement
IfcRampFlight	IfcFeatureElementAddition
IfcRoof	IfcProjectionElement
IfcSlab	IfcFeatureElementSubtraction
IfcStair	IfcEdgeFeature
IfcStairFlight	IfcOpeningElement
IfcWall	IfcFurnishingElement
IfcWallStandardCase	IfcTransportElement
IfcWindow	IfcVirtualElement

Continue to 30.4.8.2 Non-Abstract Entities Derived from IfcProduct in IFC 4x3 or return to 30.4.8 List of Non-Abstract Entities Derived from IfcProduct.

30.4.8.2 Non-Abstract Entities Derived from IfcProduct in IFC 4x3

IfcActuator
IfcAirTerminalBox
IfcAirtoAirHeatRecovery
IfcAlarm
IfcAnnotation
IfcBeam
IfcBearing
IfcBoiler
IfcBuildingElementProxy
IfcBuiltElement
IfcBurner
IfcChiller
IfcChimney
IfcCoil
IfcColumn
IfcCondenser
IfcController
IfcCooledBeam
IfcCoolingTower
IfcCourse
IfcCovering
IfcCurtainWall
IfcDamper
IfcDeepFoundation
IfcDiscreteAccessory
IfcDistributionBoard
IfcDistributionChamber
IfcDistributionControlElement
IfcDistributionElement
IfcDistributionFlowElement
IfcDistributionPort
IfcDoor
IfcEarthworksElement
IfcEarthworksCut
IfcElectricGenerator
IfcElectricMotor
IfcElectricTimeControl
IfcEngine
IfcEvaporativeCooler
IfcEvaporator
IfcFastener
IfcFlowElement
IfcFlowInstrument
IfcFlowFitting
IfcFlowMeter
IfcFlowMovingDevice
IfcFlowSegment
IfcFlowStorageDevice
IfcFlowTerminal
IfcFlowTreatmentDevice
IfcFooting
IfcFurnishingElement
IfcGeotechnicalStrartum
IfcHeatExchanger
IfcHumidifier
IfcImactProtectionDevice
IfcKerb
IfcMechanicalFastner
IfcMember
IfcMooringDevice
IfcMotorConnection
IfcNavigationElement
IfcPavement
IfcPlate
IfcProjectionElement
IfcProtectiveDevice
IfcProtectiveDeviceTrippiingUnit
IfcRail
IfcRailing
IfcRamp
IfcRampFlight
IfcReinforcingBar
IfcReinforcingMesh
IfcRoof
IfcSensor
IfcShadingDevice
IfcSlab
IfcSlab
IfcSolarDevice
IfcStair
IfcStairflight
IfcSwitchingDevice
IfcTendon
IfcTendonAnchor
IfcTendonConduit
IfcTrackElement
IfcTransformer
IfcTransportElement
IfcTubeBundle
IfcUnitaryControlElement
IfcUnitaryEquipment
IfcValve
IfcVehicle
IfcVibrationDamper
IfcVibrationIsolator
IfcWall
IfcWindow

Continue to 30.5 Some More IFC Entity Definitions or return to 30.4 Structure of IFC or 30 BIM and Digital Engineering.

30.5 Some More IFC Entity Definitions

Here is some more detailed information on some of the IFC entities used when writing IFC file from ***12d* Model.**

See

30.5.1 IfcPresentationLayerAssignment
30.5.2 IfcDistributionElement
30.4.3.2.1.1 IfcShapeRepresentation
30.5.2.2 IfcProfileDef
30.5.2.2.1 IfcParameterizedProfileDef
30.5.2.2.1.1 IfcCircleProfileDef
30.5.2.2.1.1.1 IfcCircleHollowProfileDef
30.5.2.2.1.2 IfcRectangleProfileDef
30.5.2.2.1.2.1 IfcRectangleHollowProfileDef
30.5.2.2.2 IfcArbitaryClosedProfileDef

For the complete information on IFCs, see http://www.buildingsmart-tech.org/specifications.

Continue to 30.5.1 IfcPresentationLayerAssignment or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.1 IfcPresentationLayerAssignment

IfcPresentationLayerAssignment

Definition from IFC 4x3:

The presentation layer assignment provides the **layer name** (and optionally a description and an identifier) for a collection of geometric representation items. The ***IfcPresentationLayerAssignment*** corresponds to the term "CAD Layer" and is used mainly for grouping and visibility control.

***IfcPresentationLayerAssignment* has four named attributes *Name* (Att 1), *Description* (Att 2), *AssignedItems* (Att 3), *Identifier* (Att 4):**

#	Attribute	Type	Description
IfcPresentationLayerAssignment (4)			
1	Name	IfcLabel	Name of the layer.
2	Description	OPTIONAL IfcText	Additional description of the layer.
3	AssignedItems	SET [1:?] OF IfcLayeredItem	The set of layered items, which are assigned to this layer.
4	Identifier	OPTIONAL IfcIdentifier	An (internal) identifier assigned to the layer.

where ***IfcLayerItem*** is the collection of all those items, that are assigned to a single layer.

These items are representation items (30.4.3.3 IfcRepresentationItem) or complete representations (30.4.3.2 IfcRepresentation)). If an ***IfcRepresentation*** is referenced, all ***IfcRepresentationItem*** within its set of Items are assigned to the same layer.

For an example of how an instance of ***IfcPresentationLayerAssignment*** is written in an IFC STEP file, see 30.5.1.1 IFC STEP File Format For IfcPresentationLayerAssignment.

Continue to 30.5.1.1 IFC STEP File Format For IfcPresentationLayerAssignment or return to 30.4.2 IfcRoot and SubTypes or 30.4 Structure of IFC.

30.5.1.1 IFC STEP File Format For IfcPresentationLayerAssignment

For information on the STEP file format, see 30.4.1 IFC STEP File Format.

A record in the IFC STEP file for ***IfcPresentationLayerAssignment*** is:

Att 3 ***Name*** - the ***12d Model*** model name is used

Att 4 ***AssignedItems*** -list of entities in the layer

```
#3420 = IFCPRESENTATIONLAYERASSIGNMENT('Road A/Pavements/Right/Lanes', '', (#28, #3423), '');

#26 = IFCPAVEMENT('0AeRV_YoX57PS17KFLDGQ0', #2, 'RS1OWD', '12d Trimesh',
                  'Trimesh', #13, #27, $, .USERDEFINED.);
#27 = IFCPRODUCTDEFINITIONSHAPE($, $, (#28));
#28 = IFCSHAPEREPRESENTATION(#12, 'Body', 'Brep', (#875));
#875 = IFCFACETEDBREP(#876);

#3421 = IFCPAVEMENT('00O3Zz1JL01w77fPpNG1BU', #2, 'ECR', '12d Trimesh',
                    'Trimesh', #13, #3422, $, .USERDEFINED.);
#3422 = IFCPRODUCTDEFINITIONSHAPE($, $, (#3423));
#3423 = IFCSHAPEREPRESENTATION(#12, 'Body', 'Brep', (#4270));
#4270 = IFCFACETEDBREP(#4271);
```

IfcShapeRepresentation **is under the** ***IfcRepresentation*** **hierarchy**

Continue to 30.5.2 IfcDistributionElement or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2 IfcDistributionElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement ***>IfcDistributionElement***

Definition from IFC 4x3:

IfcDistributionElement *is a generalization of all elements that participate in a distribution system. Typical examples of* ***IfcDistributionElement*** *entities are (among others):*

(a) building service elements within a heating system

(b) building service elements within a cooling system

(c) building service elements within a ventilation system

(d) building service elements within a plumbing system

(e) building service elements within a drainage system

(f) electrical elements

(g) building service elements within a communication network

(h) building service elements within a sensor (monitoring) network

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

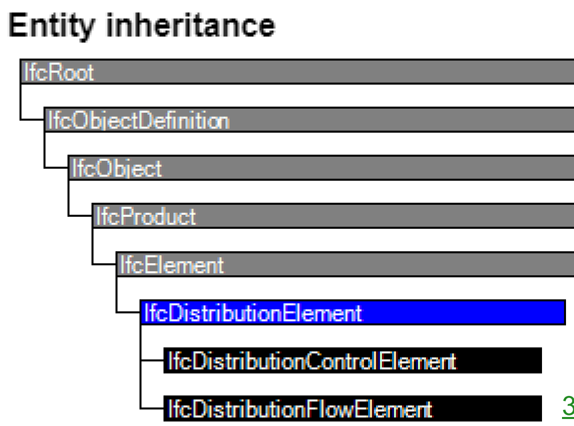
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

There are no additional named attributes for *IfcDistributionElement.*

Entities directly derived from ***IfcDistributionElement***



30.5.2.1 IfcDistributionFlowElement

Continue to 30.5.2.1 IfcDistributionFlowElement or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.1 IfcDistributionFlowElement

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcDistributionElement >DistributionFlowElement

Definition from IFC 4x3:

*The distribution element **DistributionFlowElement** defines occurrence elements of a distribution system that facilitate the distribution of energy or matter, such as air, water or power.*

EXAMPLE

Examples of distribution flow elements are ducts, pipes, wires, fittings, and equipment.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

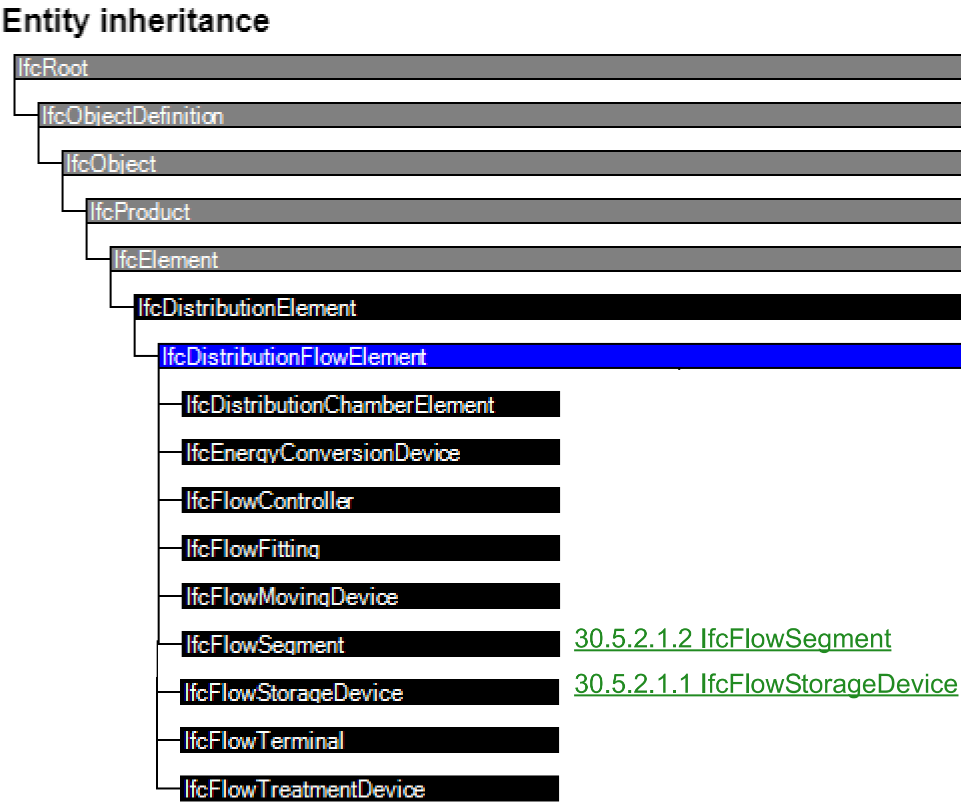
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

There are no additional named attributes for *DistributionFlowElement.*

Entities directly derived from ***IfcDistributionFlowElement***



30.5.2.1.2 IfcFlowSegment

30.5.2.1.1 IfcFlowStorageDevice

Continue to 30.5.2.1.1 IfcFlowStorageDevice or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.1.1 IfcFlowStorageDevice

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcDistributionElement >IfcDistributionFlowElement >IfcFlowStorageDevice

Definition from IFC 4x3:

*The distribution flow element **IfcFlowStorageDevice** defines the occurrence of a device that participates in a distribution system and is used for **temporary storage** (such as a **tank**).*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

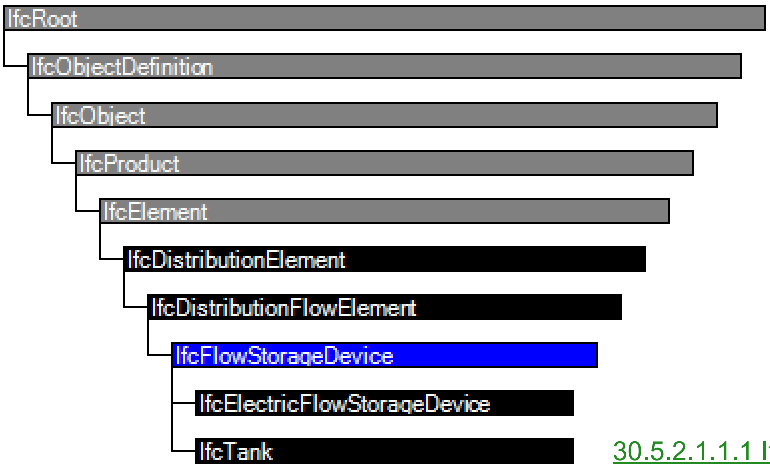
Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

There are no additional named attributes for *IfcFlowStorageDevice.*

Entities directly derived from ***IfcFlowStorageDevice:***

Entity inheritance



30.5.2.1.1.1 IfcTank

Continue to 30.5.2.1.1.1 IfcTank or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.1.1.1 IfcTank

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcDistributionElement >IfcDistributionFlowElement >IfcFlowStorageDevice >IfcTank

Definition from IFC 4x3:

A tank is a vessel or container in which a fluid or gas is stored for later use.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

***IfcTank* has one additional named attribute *PredefinedType* (Att 9):**

IfcTank (1)			
9	PredefinedType	OPTIONAL IfcTankTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcTankTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcTankTypeEnum***:

Type	Description
BASIN	An arbitrary open tank type.
BREAKPRESSURE	An open container that breaks the hydraulic pressure in a distribution system, typically located between the fluid reservoir and the fluid supply points. A typical break pressure tank allows the flow to discharge into the atmosphere, thereby reducing its hydrostatic pressure to zero.
EXPANSION	A closed container used in a closed fluid distribution system to mitigate the effects of thermal expansion or water hammer. The tank is typically constructed with a diaphragm dividing the tank into two sections, with fluid on one side of the diaphragm and air on the other. One example application is when connected to the primary circuit of a hot water system to accommodate the increase in volume of the water when it is heated.
FEEDANDEXPANSION	An open tank that is used for both storage and thermal expansion. A typical example is a tank used to store make-up water at ambient pressure for supply to a hot water system, simultaneously accommodating increases in volume of the water when heated.
OILRETENTIONTRAY	An open container for environmental protection and storage of chemical products.
PRESSUREVESSEL	A closed container used for storing fluids or gases at a pressure different from the ambient pressure. A pressure vessel is typically rated by an authority having jurisdiction for the operational pressure.

Continued on next page

STORAGE	An open or closed container used for storing a fluid at ambient pressure and from which it can be supplied to the fluid distribution system. There are many examples of storage tanks, such as potable water storage tanks, fuel storage tanks, etc.
VESSEL	An arbitrary closed tank type.
USERDEFINED	User-defined tank type.
NOTDEFINED	Undefined tank type.

Continue to 30.5.2.1.2 IfcFlowSegment or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.1.2 IfcFlowSegment

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement >IfcDistributionElement >IfcDistributionFlowElement >IfcFlowSegment

Definition from IFC 4x3:

*The distribution flow element **IfcFlowSegment** defines the occurrence of a segment of a flow distribution system.*

*The **IfcFlowSegment** defines a particular occurrence of a segment inserted in the spatial context of a project. The parameters defining the type of the segment and/or its shape are defined by the IfcFlowSegmentType, which is related by the inverse relationship IsDefinedBy pointing to IfcRelDefinesByType.*

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

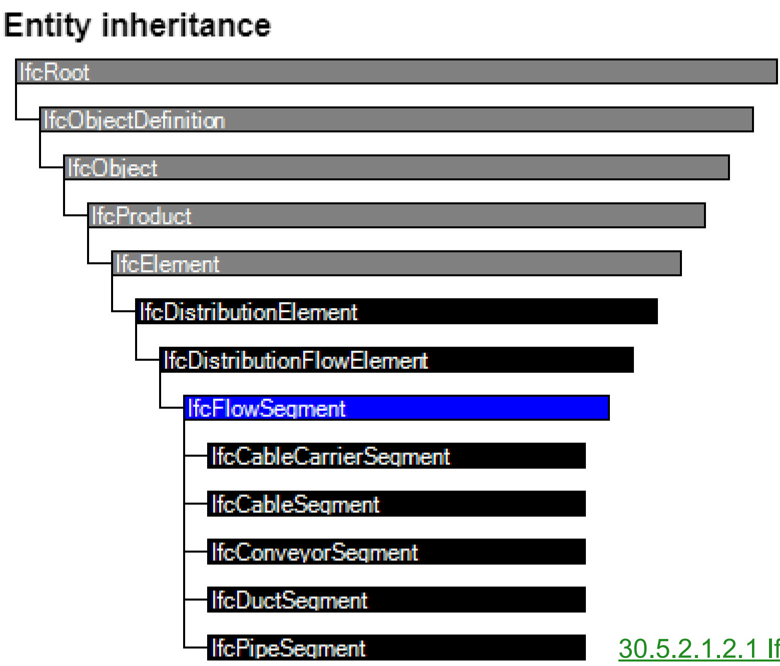
Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

There are no additional named attributes for *IfcFlowSegment.*

Entities directly derived ***IfcFlowSegment:***



30.5.2.1.2.1 IfcPipeSegment

30.5.2.1.2.1 IfcPipeSegment

IfcRoot >IfcObjectDefinition >IfcObject >IfcProduct >IfcElement ***>IfcDistributionElement >IfcDistributionFlowElement >IfcFlowSegment >IfcPipeSegment***

Definition from IFC 4x3:

A pipe segment is used to typically join two sections of a piping network.

Name attributes 1- 4 See 30.4.2 IfcRoot and SubTypes

Name attribute 5 See 30.4.2.1.2 IfcObject

Name attributes 6, 7 See 30.4.2.1.2.1 IfcProduct

Name attribute 8 See 30.4.2.1.2.1.2 IfcElement

IfcPipeSegment **has one additional named attribute** ***PredefinedType*** **(Att 8):**

IfcPipeSegment (1)			
9	PredefinedType	OPTIONAL IfcPipeSegmentTypeEnum	A list of types to further identify the object. Some property sets may be specifically applicable to one of these types.

The named attribute ***PredefinedType*** is an enumeration which has the list of values fully defined in the IFC 4x3 specification as ***IfcPipeSegmentTypeEnum***.

That is, ***PredefinedType*** must be one of the following values defined by ***IfcPipeSegmentTypeEnum***:

Type	Description
CULVERT	A covered channel or large pipe that forms a watercourse below ground level, usually under a road or railway.
FLEXIBLESEGMENT	A flexible segment is a continuous non-linear segment of pipe that can be deformed and change the direction of flow.
GUTTER	A gutter segment is a continuous open-channel segment of pipe.
RIGIDSEGMENT	A rigid segment is continuous linear segment of pipe that cannot be deformed.
SPOOL	A type of rigid segment that is typically shorter and used for providing connectivity within a piping network.
USERDEFINED	User-defined segment.
NOTDEFINED	Undefined segment.

Continue to 30.5.2.2 IfcProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.2 IfcProfileDef

IfcProfileDef

Definition from IFC4x3

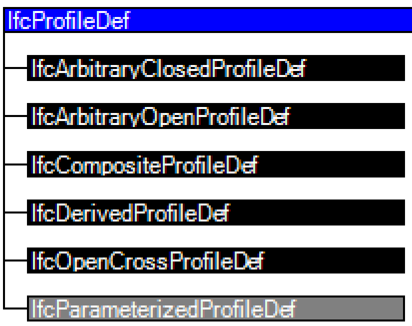
IfcProfileDef *is the supertype of all definitions of standard and arbitrary profiles within IFC. It is used to define a standard set of commonly used section profiles by their parameters or by their explicit curve geometry.*

1. *Parameterized profiles are 2D primitives, which are used within the industry to describe cross sections by a description of its parameters.*
2. *Arbitrary profiles are cross sections defined by an outer boundary as bounded curve, which may also include holes, defined by inner boundaries.*
3. *Derived profiles, based on a transformation of a parent profile, are also part of the profile definitions available.*
4. *In addition composite profiles can be defined, which include two or more profile definitions to define the resulting profile*

IFC Definitions for Named Attributes 1 and 2:

#	Attribute	Type	Description
IfcProfileDef (4)			
1	ProfileType	IfcProfileTypeEnum	Defines the type of geometry into which this profile definition shall be resolved, either a curve or a surface area. In case of curve the profile should be referenced by a swept surface, in case of area the profile should be referenced by a swept area solid.
2	ProfileName	OPTIONAL IfcLabel	Human-readable name of the profile, for example according to a standard profile table. As noted above, machine-readable standardized profile designations should be provided in *IfcExternalReference.ItemReference*.

Entity inheritance



See 30.5.2.2.2 IfcArbitaryClosedProfileDef

See 30.5.2.2.1 IfcParameterizedProfileDef

Continue to 30.5.2.2.1 IfcParameterizedProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.2.1 IfcParameterizedProfileDef

IfcProfileDef >IfcParameterizedProfileDef

Definition from IFC4x3

The parameterized profile definition defines a 2D position coordinate system to which the parameters of the different profiles relate to. All profiles are defined centric to the origin of the position coordinate system, or more specific, the origin [0.,0.] shall be in the centre of the bounding box of the profile.

The Position attribute of IfcParameterizedProfileDef is used to position the profile within the XY plane of the underlying coordinate system of the swept surface geometry, the swept area solid or the sectioned spine. It can be used to position the profile at any point which becomes the origin [0.,0.,0.] of the extruded or rotated surface or solid.

The Position attribute should not be used if the transformation can be specified in a containing object instead. In particular, this applies if the IfcParameterizedProfileDef is referenced as SweptArea in subtypes of IfcSweptAreaSolid or as CrossSections in IfcSectionedSpine.

Several subtypes of IfcParameterizedProfileDef provide shape parameters which are optional. Sending systems should always provide values for these parameters if possible. If these parameters are left unspecified, receiving systems may retrieve values for them by external reference (if a reference to an external document or library is given; see guidance at IfcProfileDef), or estimate them, or simply assume zero values.

IfcParameterizedProfileDef is abstract and can not be instantiated.

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

IfcParameterizedProfileDef has one additional named attribute *Position* (Att 3) which is defined as:

#	Attribute	Type	Description
IfcProfileDef (4)			
Click to show 4 hidden inherited attributes			
IfcParameterizedProfileDef (1)			
3	Position	OPTIONAL IfcAxis2Placement2D	Position coordinate system of the parameterized profile definition. If unspecified, no translation and no rotation is applied.

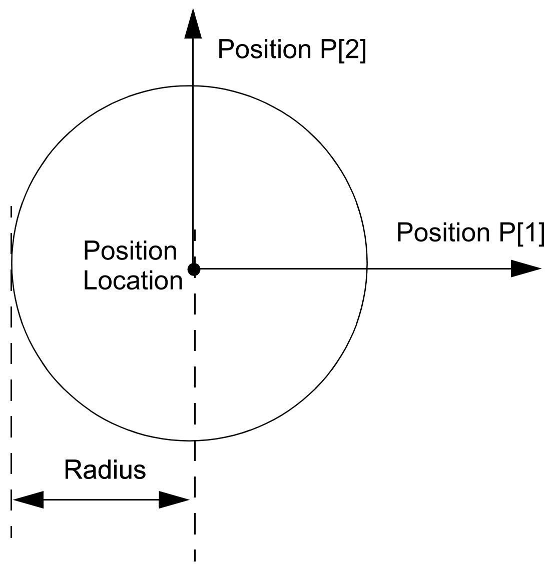
Continue to 30.5.2.2.1.1 IfcCircleProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.2.1.1 IfcCircleProfileDef

IfcProfileDef >IfcParameterizedProfileDef >IfcCircleProfileDef

Definition from IFC4x3

IfcCircleProfileDef *defines a circle as the profile definition used by the swept surface geometry or by the swept area solid. It is given by its Radius attribute and placed within the 2D position coordinate system, established by the Position attribute.*



Position
The parameterized profile defines its own position coordinate system. The underlying coordinate system is defined by the swept surface or swept area solid that uses the profile definition. It is the xy plane of either:

IfcSweptSurface.Position

IfcSweptAreaSolid.Position

or in case of sectioned spines the xy plane of each list member of IfcSectionedSpine.CrossSectionPositions.

By using offsets of the position location, the parameterized profile can be positioned centric (using x,y offsets = 0.), or at any position relative to the profile. Explicit coordinate offsets are used to define cardinal points (*e.g.* upper-left bound).

Parameter
The ***Position*** attribute defines the 2D position coordinate system of the circle.

The ***Radius*** attribute defines the radius of the circle.

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

Name attribute 3 See 30.5.2.2.1 IfcParameterizedProfileDef

IfcCircleProfileDef **has one additional named attribute *Radius* (Att 4) which is defined as:**

#	Attribute	Type	Description
IfcProfileDef (4)			
IfcParameterizedProfileDef (1)			
Click to show 5 hidden inherited attributes			
IfcCircleProfileDef (1)			
4	Radius	IfcPositiveLengthMeasure	The radius of the circle.

Continue to 30.5.2.2.1.1.1 IfcCircleHollowProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.2.1.1.1 IfcCircleHollowProfileDef

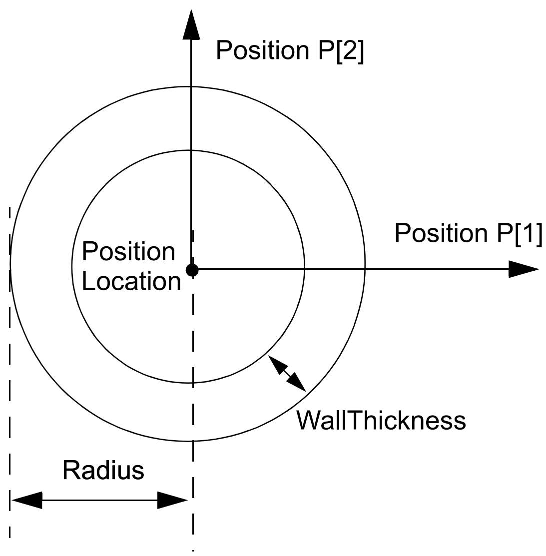
IfcProfileDef >IfcParameterizedProfileDef >IfcCircleProfileDef >IfcCircleHollowProfileDef

Definition from IFC 4x3

IfcCircleHollowProfileDef defines a section profile that provides the defining parameters of a circular hollow section (tube) to be used by the swept area solid.

Its parameters and orientation relative to the position coordinate system are according to the following illustration.

The centre of the position coordinate system is in the profile's centre of the bounding box (for symmetric profiles identical with the centre of gravity).



Position
The parameterized profile defines its own position coordinate system. The underlying coordinate system is defined by the swept area solid that uses the profile definition. It is the xy plane of:

IfcSweptAreaSolid.Position

by using offsets of the position location, the parameterized profile can be positioned centric (using x,y offsets = 0), or at any position relative to the profile. Explicit coordinate offsets are used to define cardinal points (*e.g.* upper-left bound).

Parameter
The parameterized profile is defined by a set of parameter attributes, see attribute definition below.

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

Name attribute 3 See 30.5.2.2.1 IfcParameterizedProfileDef

Name attribute 4 See 30.5.2.2.1.1 IfcCircleProfileDef

***IfcCircleHollowProfileDef* has one additional named attribute *WallThickness* (Att 5) which is defined as:**

#	Attribute	Type	Description
IfcProfileDef (4)			
IfcParameterizedProfileDef (1)			
IfcCircleProfileDef (1)			
Click to show 6 hidden inherited attributes			
IfcCircleHollowProfileDef (1)			
5	WallThickness	IfcPositiveLengthMeasure	Thickness of the material, it is the difference between the outer and inner radius.

The wall thickness must be smaller than the radius

Continue to 30.5.2.2.1.2 IfcRectangleProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

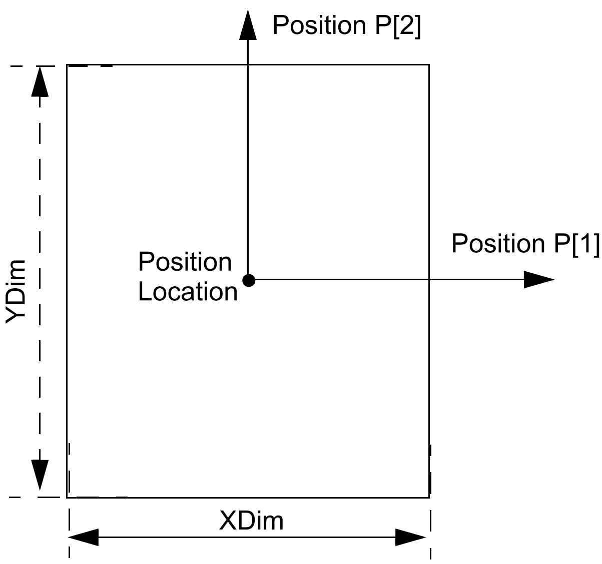
30.5.2.2.1.2 IfcRectangleProfileDef

IfcProfileDef >IfcParameterizedProfileDef >IfcRectangleProfileDef

Definition from IFC 4x3:

IfcRectangleProfileDef *defines a rectangle as the profile definition used by the swept surface geometry or the swept area solid.*

It is given by its X extent and its Y extent, and placed within the 2D position coordinate system, established by the Position attribute. It is placed centric within the position coordinate system.



Position
The parameterized profile defines its own position coordinate system. The underlying coordinate system is defined by the swept surface or swept area solid that uses the profile definition. It is the xy plane of either:

IfcSweptSurface.Position

IfcSweptAreaSolid.Position

or in case of sectioned spines the xy plane of each list member of IfcSectionedSpine.CrossSectionPositions.

By using offsets of the position location, the parameterized profile can be positioned centric (using x,y offsets = 0.), or at any position relative to the profile. Explicit coordinate offsets are used to define cardinal points (*e.g.* upper-left bound).

Parameter
The ***IfcRectangleProfileDef*** is defined within the position coordinate system, where the **XDim** defines the length measure for the length of the rectangle (half along the positive x-axis) and the **YDim** defines the length measure for the width of the rectangle (half along the positive y-axis).

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

Name attribute 3 See 30.5.2.2.1 IfcParameterizedProfileDef

***IfcRectangleProfileDef* has two additional named attributes *XDim* (Att 4) and *YDim* *(Att 5)* which are defined as:**

#	Attribute	Type	Description
IfcProfileDef (4)			
IfcParameterizedProfileDef (1)			
Click to show 5 hidden inherited attributes			
IfcRectangleProfileDef (2)			
4	XDim	IfcPositiveLengthMeasure	The extent of the rectangle in the direction of the x-axis.
5	YDim	IfcPositiveLengthMeasure	The extent of the rectangle in the direction of the y-axis.

Continue to 30.5.2.2.1.2.1 IfcRectangleHollowProfileDef or return to 30.5 Some More IFC Entity

Definitions or 30.4 Structure of IFC.

30.5.2.2.1.2.1 IfcRectangleHollowProfileDef

IfcProfileDef >IfcParameterizedProfileDef >IfcRectangleProfileDef >IfcRectangleHollowProfileDef

Definition from IFC 4x3

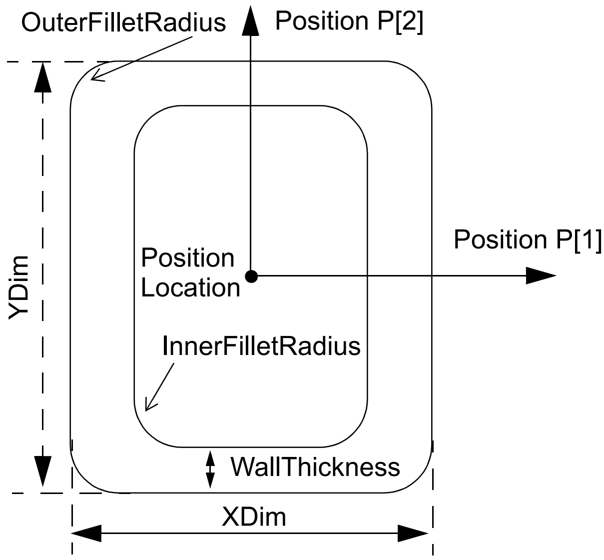
IfcRectangleHollowProfileDef *defines a section profile that provides the defining parameters of a rectangular (or square) hollow section to be used by the swept surface geometry or the swept area solid.*

Its parameters and orientation relative to the position coordinate system are according to the following illustration.

A square hollow section can be defined by equal values for X and Y.

The centre of the position coordinate system is in the profiles centre of the bounding box (for symmetric profiles identical with the centre of gravity).

Normally, the longer sides are parallel to the y-axis, the shorter sides parallel to the x-axis.



Position
The parameterized profile defines its own position coordinate system. The underlying coordinate system is defined by the swept area solid that uses the profile definition. It is the xy plane of:

IfcSweptAreaSolid.Position

by using offsets of the position location, the parameterized profile can be positioned centric (using x,y offsets = 0), or at any position relative to the profile. Explicit coordinate offsets are used to define cardinal points (*e.g.* upper-left bound).

Parameter
The parameterized profile is defined by a set of parameter attributes, see attribute definition below

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

Name attribute 3 See 30.5.2.2.1 IfcParameterizedProfileDef

Name attribute 4, 5 See 30.5.2.2.1.2 IfcRectangleProfileDef

***IfcRectangleHollowProfileDef* has three additional named attributes *WallThickness* (Att 6),**

***InnerFilletRadius* (Att 7)and *OuterFilletRadius (Att 8)* which are defined as:**

#	Attribute	Type	Description
IfcProfileDef (4)			
IfcParameterizedProfileDef (1)			
IfcRectangleProfileDef (2)			
Click to show 7 hidden inherited attributes			
IfcRectangleHollowProfileDef (3)			
6	WallThickness	IfcPositiveLengthMeasure	Thickness of the material.
7	InnerFilletRadius	OPTIONAL IfcNonNegativeLengthMeasure	Inner corner radius.
8	OuterFilletRadius	OPTIONAL IfcNonNegativeLengthMeasure	Outer corner radius.

The wall thickness must be smaller than the X and Y dimension of the rectangle.

InnerFilletRadius: Radius of the circular arcs, by which all four corners of the outer contour of rectangle are equally rounded. If not given, zero (= no rounding arcs) applies.

The inner fillet radius (if given) must be smaller than or equal to the X and Y dimension of the rectangle minus the wall thickness.

OuterFilletRadius: Radius of the circular arcs, by which all four corners of the outer contour of rectangle are equally rounded. If not given, zero (= no rounding arcs) applies.

The outer fillet radius (if given) must be smaller than or equal to the X and Y dimension of the rectangle

Continue to 30.5.2.2.2 IfcArbitaryClosedProfileDef or return to 30.5 Some More IFC Entity Definitions or 30.4 Structure of IFC.

30.5.2.2.2 IfcArbitaryClosedProfileDef

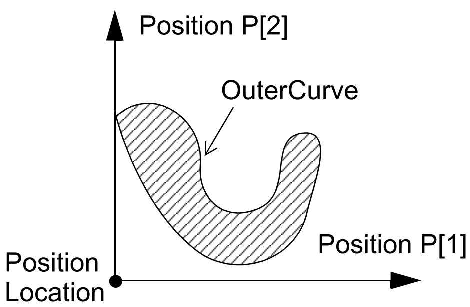
IfcProfileDef >IfcArbitraryClosedProfileDef

Definition from IFC 4x3

*The closed profile **IfcArbitraryClosedProfileDef** defines an arbitrary two-dimensional profile for the use within the swept surface geometry, the swept area solid or a sectioned spine. It is given by an outer boundary from which the surface or solid can be constructed.*

Informal proposition:

1. *The **OuterCurve** has to be a closed curve.*
2. *The **OuterCurve** shall not intersect.*



Position
The ***OuterCurve*** is defined in the underlying coordinate system. The underlying coordinate system is defined by the swept surface or swept area solid that uses the profile definition. It is the xy plane of either:

IfcSweptSurface.Position

IfcSweptAreaSolid.Position

or in case of sectioned spines the xy plane of each list member of *IfcSectionedSpine.CrossSectionPositions.*

By using offsets of the position location, the parameterized profile can be positioned centric (using x,y offsets = 0.), or at any position relative to the profile. Explicit coordinate offsets are used to define cardinal points (*e.g.* upper-left bound).

Parameter
The ***OuterCurve*** attribute defines a two dimensional closed bounded curve.

Name attributes 1,2 See 30.5.2.2 IfcProfileDef

***IfcArbitraryClosedProfileDef* has one additional named attribute *OuterCurve* (Att 3) which is defined as:**

#	Attribute	Type	Description
IfcProfileDef (4)			
Click to show 4 hidden inherited attributes			
IfcArbitraryClosedProfileDef (1)			
3	OuterCurve	IfcCurve	Bounded curve, defining the outer boundaries of the arbitrary profile.

Continue to 30.6 Common Terms in BIM or return to 30 BIM and Digital Engineering.

30.6 Common Terms in BIM

Here is a list of some need-to-know BIM terms and their definitions taken from the **NBS** website http://www.thenbs.com.

NBS is part of RIBA Enterprises Ltd, which is wholly owned by the Royal Institute of British Architects (RIBA) and was contracted by the UK Government to build the National BIM Library.

1. . 4D, 5D, 6D

First there was 2D CAD, then 3D CAD – now there are extra dimensions to refer to the linking of the BIM model with time-, cost- and schedule-related information (although the precise order hasn't to date been agreed across the whole industry).

2. . Asset Information Model (AIM), Building Information Model (BIM)

Not only is there the 'Building' information model, but the 'Asset' information model – which is the name given to the same model post-construction, *i.e.* supplemented with the data needed to assist in the running of the completed asset. Note that 'asset' can also refer to civil engineering and infrastructure work.

3. . Common Data Environment (CDE)

This is a central information repository that can be accessed by all stakeholders in a project. Whilst all the data within the CDE can be accessed freely, ownership is still retained by the originator.

The scope and requirements for a CDE are defined in PAS 1192-2 (see 8. . PAS 1192).

4. Level 0 BIM, Level 1 BIM, Level 2 BIM, Level 3 BIM

The move to 'full' collaborative working via distinct and recognisable milestones, in the form of 'levels'. These have been defined within a range from 0 to 3, and, whilst there is some debate about the exact meaning of each level, the broad concept is:

Level 0 – no collaboration.

2D CAD drafting only. Output and distribution is via paper or electronic prints, or a mixture of both.

Level 1 – a mixture of 3D CAD for concept work, and 2D for drafting of statutory approval documentation and Production Information.

CAD standards are managed to BS 1192:2007, and electronic sharing of data is carried out from a common data environment (CDE), often managed by the contractor.

There is no collaboration between different disciplines – each publishes and maintains its own data.

Level 2 – collaborative working – all parties use their own 3D CAD models.

Design information is shared through a common file format, which enables any organisation to be able to combine that data with their own in order to carry out interrogative checks on it.

Hence any CAD software that each party used must be capable of exporting to a common file format.

This is the method of working that has been set as a minimum target by the UK government for all public-sector work, by 2016.

Level 3 – integrated working between all disciplines by using a single, shared project model which is held in a common data environment.

All parties can access and modify that same model, removing the final layer of risk for conflicting information. This is known as 'Open BIM' (see 7. Open BIM), and the UK government's target date for public-sector working is 2018, although the precise requirements have yet to be determined.

Note that the definition of BIM maturity Level 2 was originally developed as part of the UK Government strategy in 2011. It is also defined in PAS 1192-2, with reference to best practice and the adoption tools and standards.

It is also worth noting, though, PAS 1192-2 acknowledges that, given the early stages of adoption of managed methods of working in BIM at the time the PAS was drafted, it can be expected that Level 2 practices will continue to evolve, and that the scope of information sharing and exchange will vary from project to project.

Therefore, PAS 1192-2 anticipates that the definition of Level 2 BIM will continue to evolve around the core principles of the shared use of individually authored models in a CDE.

5. Construction Operations Building Information Exchange (COBie)

COBie is a data schema which is delivered in a spreadsheet data format, and contains a 'subset' of the information in the building model (all except graphical data, and hence a subset of IFC (see 6. Industry Foundation Class (IFC)), for FM handover. It was originally devised by the US Army Engineering Corps.

Over the course of a project, data can be added to it from a range of sources (besides CAD programs), relating to brief, design, construction, operation, refurbishment or demolition, as the case may be.

The UK Government's Level 2 - mandated requirement is for COBie-compliant information exchange. BS 1192-4 documents best practice for the implementation of COBie.

6. Industry Foundation Class (IFC)

IFC is an object-based format, to enable exchange of information between different software. Developed by **buildingSMART**, a global alliance specialising in open standards for BIM, IFC is an official standard, BS ISO 16739, and contains geometric as well as other data.

7. Open BIM

An open-source approach to collaborative design, realisation and operation of buildings, based on open standards and work flows.

Open BIM is an initiative of several leading software vendors using the buildingSMART Data Model, which incorporates data to ISO 16739 (via the IFC file format), terms to ISO 12006-3 (using the International Framework for Dictionaries, which maps different technical terms that have the same meaning) and process to ISO 29481-1 (the Information Delivery Manual).

8. . PAS 1192

The PAS 1192 framework sets out the requirements for the level of model detail (the graphical content), model information (non-graphical content, such as specification data), model definition (its meaning) and model information exchanges:

(a) PAS 1192-2 deals with the construction (CAPEX) phase, and specifies the requirements for Level 2 maturity; sets out the framework, roles & responsibilities for collaborative BIM working; builds on the existing standard of BS 1192, and expands the scope of the Common Data Environment (see 3. . Common Data Environment (CDE)).

(b) PAS 1192-3 deals with the operational (OPEX) phase, focussing on use & maintenance of the Asset Information Model, for Facilities Management.

(c) BS 1192-4 documents best practice for the implementation of COBie.

(d) PAS 1192-5 is currently under development, and will cover security of data.

Return to 30.6 Common Terms in BIM or 30 BIM and Digital Engineering.

31 Moving to 12d Model 15

See

31.1 Hardware Locks for 12d Model 15

Since ***12d Model 11***, ***CodeMeters*** have been the default Hardware locks shipped with ***12d Model*** however the Wibu stand alone and Wibu network dongles that you already have will still work for Perpetual licenses of ***12d Model 15***.

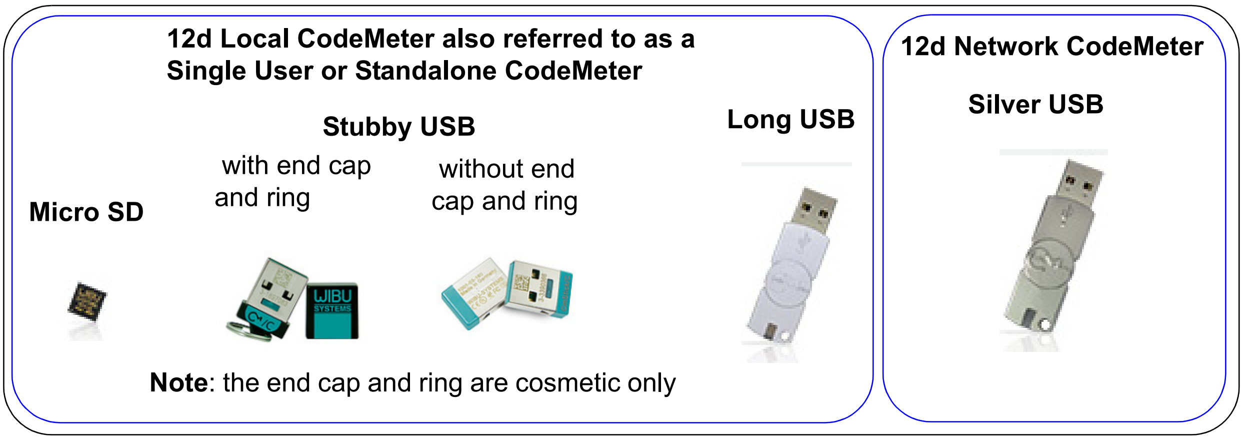
However Subscription licenses of ***12d Model 15*** must have ***CodeMeters***.

12d Model 15 will **NOT WORK** with **Hardlock** dongles. If you have a **Hardlock** dongle, please contact your ***12d Model*** Reseller.

So ***12d Model 15*** will only work with the following physical hardware locks:

(a) Codemeter Containers (from Wibu)

The **Codemeter Containers** (also from Wibu) are similar to the earlier Wibu standalone and network dongles except that they come in a wider variety of hardware shapes some of which will be more suitable for portable and tablet computers



We will refer to the ***Wibu CodeMeter Containers*** as **CodeMeter Containers** or **CodeMeters**.

CodeMeters have ***12d dongle numbers*** starting with **5c2d.**

Codemeters as standalone hardware locks can be used with ***12d Model 10 C1n*** onwards but will not work with earlier versions of ***12d Model***.

As network hardware locks, **Codemeters** can **NOT** be used for***12d Model 10*** but only for ***12d Model 11*** onwards.

So if you move to a **CodeMeter**, you won't be able to run the ***12d Model 10*** and ***earlier*** 12d.exe's. But of course you can always open projects from those versions in the latest versions of ***12d Model***.

(b) **Older Wibu hardware locks**

Some users have Wibu hardware locks that predated the **CodeMeters**.These are:

Wibu Standalone hardware locks (12d dongle number starting with **572d)** or **Wibu Network hardware locks** (12d dongle number starting with **e151**)

.

The **Wibu drivers** for ***12d Model 15*** must be at least version **6.3**. See 31.2 Installers for Lock Drivers and 12d Model

Important Note for 12d Field users:

In ***12d Model 15***, the ***12d Field modules*** will only work with **CodeMeters**.

If you are a ***12d Field*** user and are still using a ***Wibu*** hardware lock, your ***12d Model*** Reseller will probably have already contacted you but if not, please contact them when you are preparing to upgrade to ***12d Model 15***.

Important Note

DO NOT ATTACH a hardware lock to your computer until after the appropriate driver is installed.

Continue to 31.2 Installers for Lock Drivers and 12d Model or return to 31 Moving to 12d Model 15.

31.2 Installers for Lock Drivers and 12d Model

See

31.2.1 Installing CodeMeter Drivers
31.2.2 Installers for 12d Model

Or return to 31 Moving to 12d Model 15

31.2.1 Installing CodeMeter Drivers

If you have no CodeMeter drivers installed, then the installer for the CodeMeter drivers can be downloaded from:

https://dwonloads.12dmodel.com/v15/12d_Model_15/CodeMeterRuntime_latest.exe

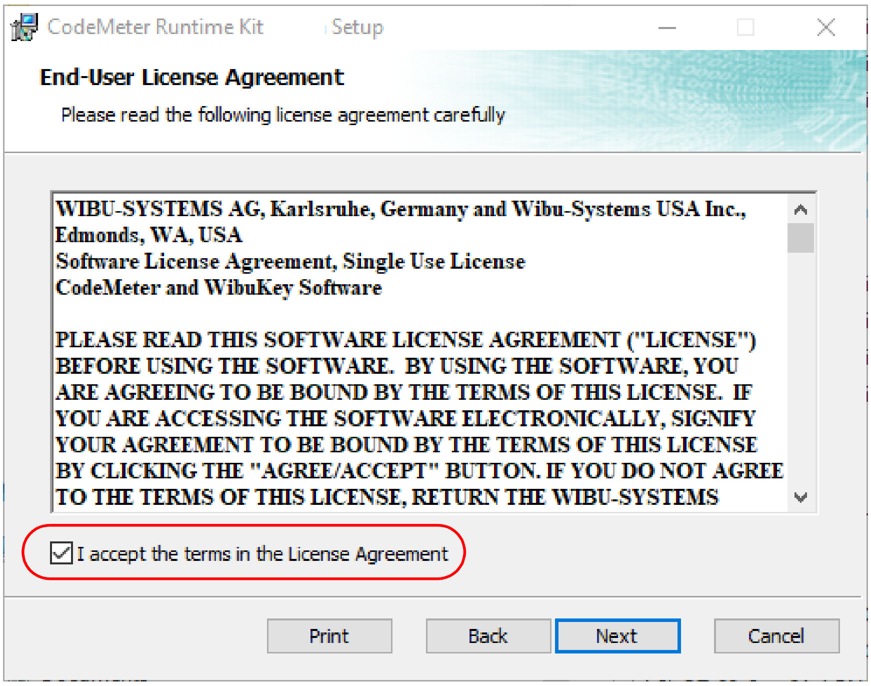
Installing the CodeMeter Drivers:

After clicking on the installer exe, the script to install the **CodeMeter** drivers begins.

CodeMeter Setup *CodeMeter Runtime Kit Setup*

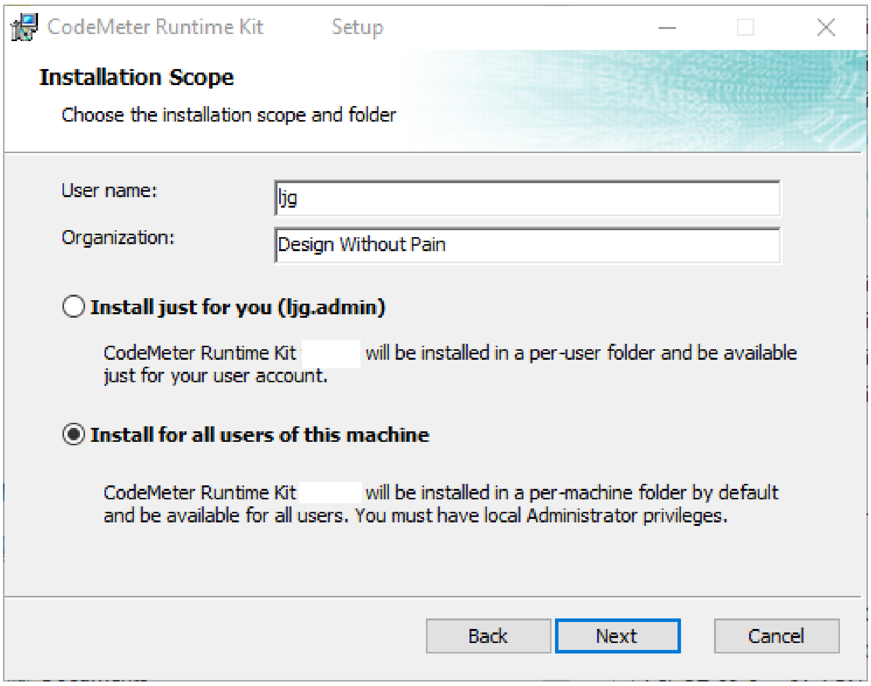
Select ***Next*** to continue.

End-User License Agreement *CodeMeter Runtime Kit Setup*



Read the License Agreement and if you are happy with it,
tick "I accept the terms in the License Agreement" and then select ***Next*** to continue.

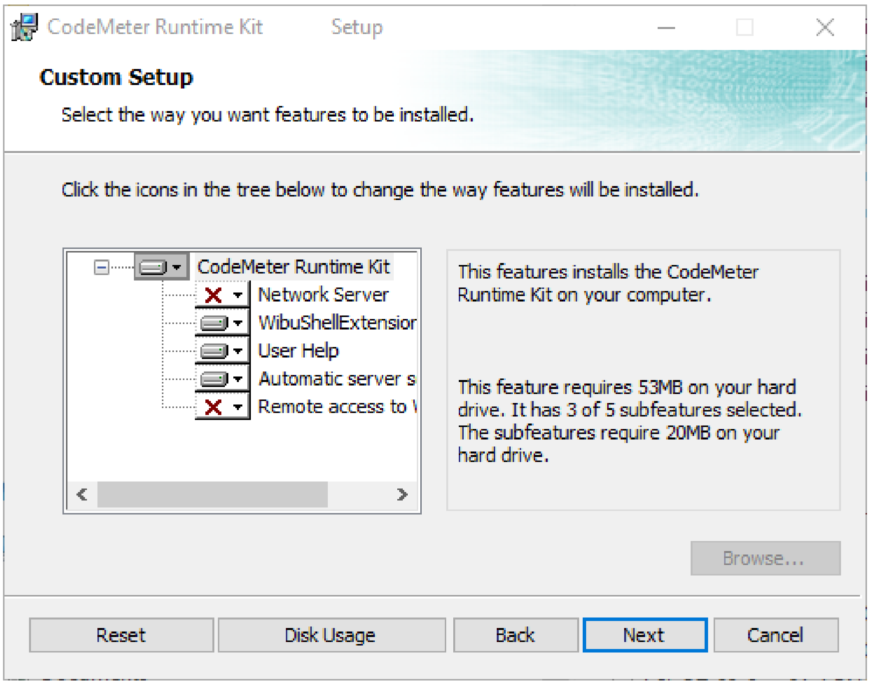
Installation Scope *CodeMeter Runtime Kit Setup*



Enter your **User name** and **Organisation**.

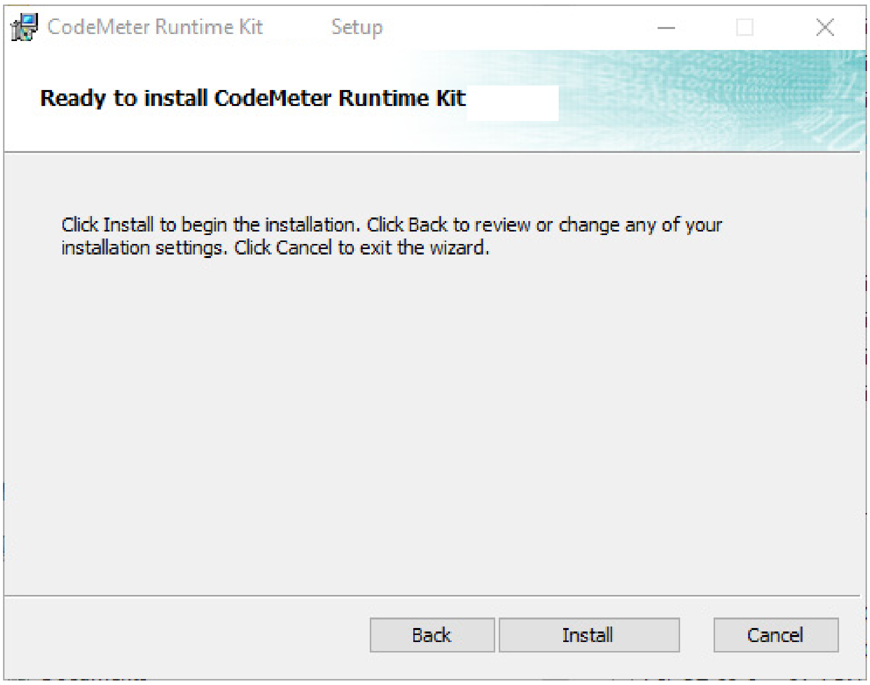
Click on either **Install just for you** or **Install for all users of this machine** and then select ***Next*** to continue.

Custom Setup *CodeMeter Runtime Kit Setup*



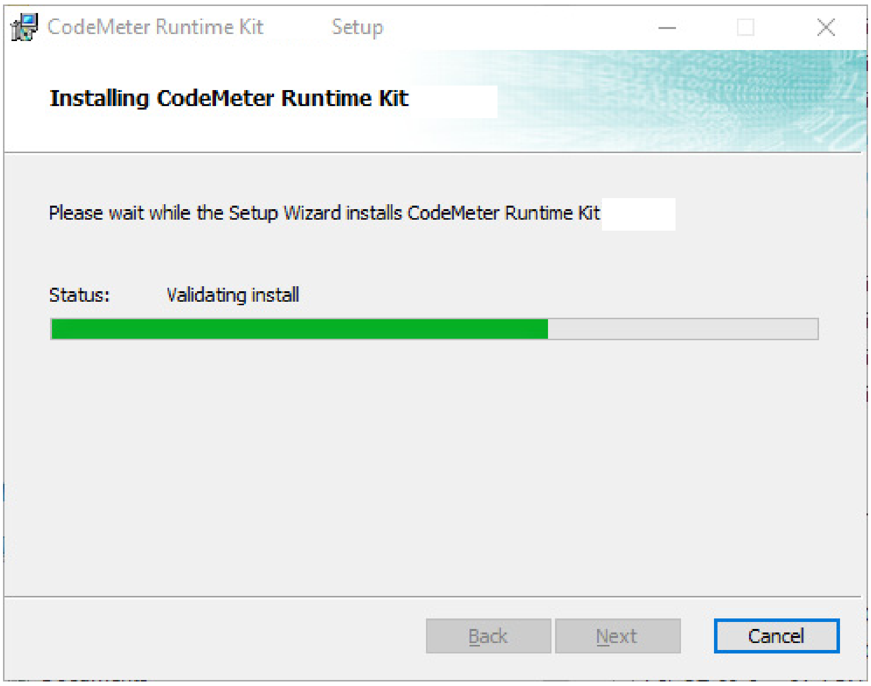
Select ***Next*** to continue.

Ready to Install *CodeMeter Runtime Kit Setup*

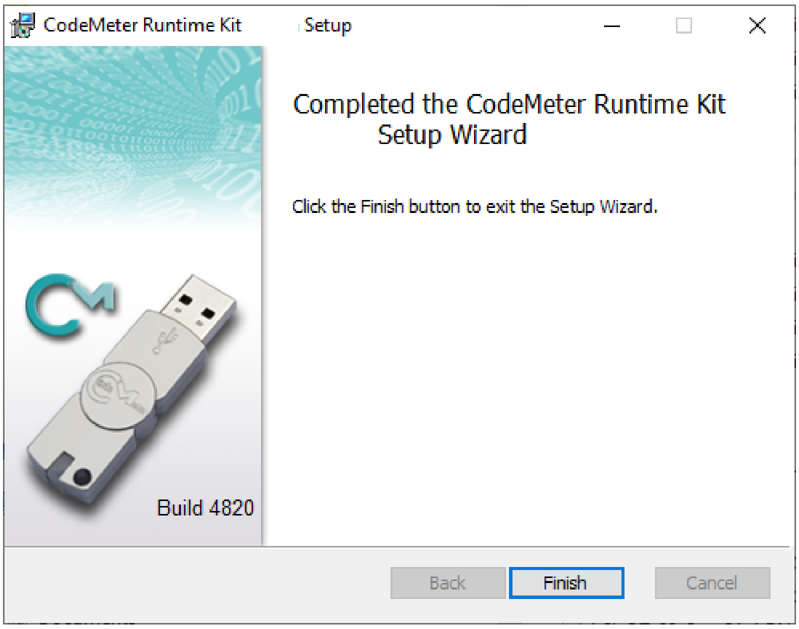


Select ***Install*** to continue.

Installing *CodeMeter Runtime Kit Setup*



Completed *CodeMeter Runtime Kit Setup*



Select ***Finish*** to end.

Note: A **CodeMeter** icon, that is used to bring up the **CodeMeter Control Center**, is also installed on your task bar.

Important Notes

1. Do not attach a hardware lock to your computer until after the appropriate driver is installed

2. The CodeMeter drivers need to be at least version **6.3.**

   If your computer already has drivers installed and they are NOT at least version the version you required, when ***12d Model 15*** is started it will stop and complain that the hardware lock drives are **NOT** up to date**.**

   If that is the case then

   (a) Uninstall the existing drivers

   (b) Install new drivers from the **12d Driver installer**. See 31.2.1 Installing CodeMeter Drivers.

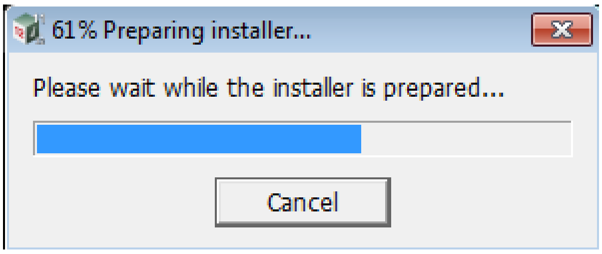
Continue to 31.2.2 Installers for 12d Model or return to 31.2 Installers for Lock Drivers and 12d Model.

31.2.2 Installers for 12d Model

There is only a 64-bit **Installer** for ***12d Model 15***.

After starting the appropriate **Installer**, panels come up to guide you through the process.

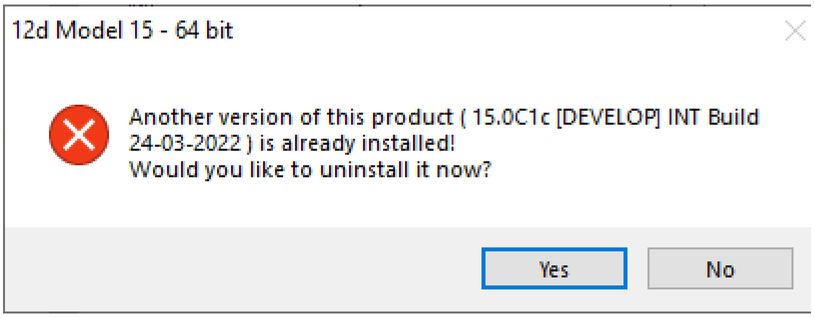
The ***12d Model 15*** installation starts by first unpacking the information in the installation exe and then begins the installation.



If a ***12d Model 15*** of the same bit type is already installed on your computer, it must be uninstalled before the installation can proceed.

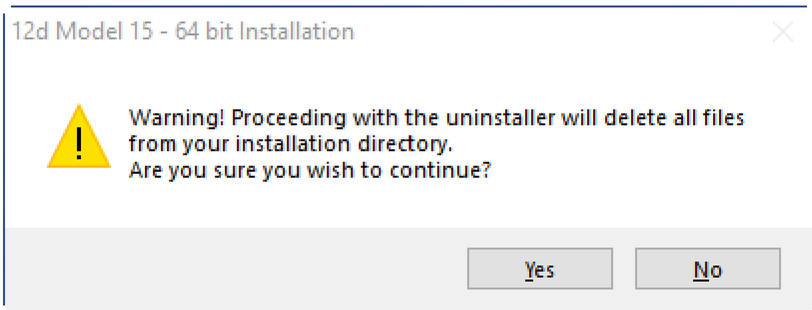
If the Installer detects this case, you will be asked if the Installer can **uninstall the existing version**. Unless this is done, the installation can not proceed.

Note: The uninstall deletes everything in the ***12d\12dmodel\15.00*** folder in ***Program Files*** so you should never modify any of those files.



Click on **Yes** to continue.

You then receive a **Warning** that the files will be deleted.

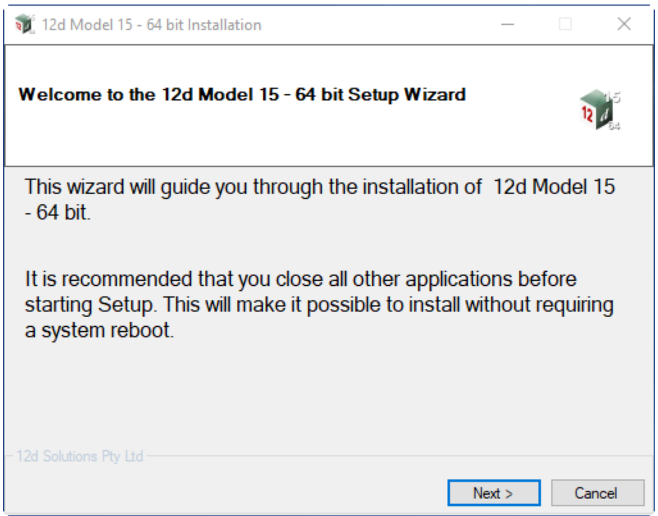


Click on **Yes** to continue.

All the files in the ***12d\12dmodel\15.00*** folder in ***Program Files*** will then be deleted, and the ***12d Model xx*** entry removed from the Windows Registry.

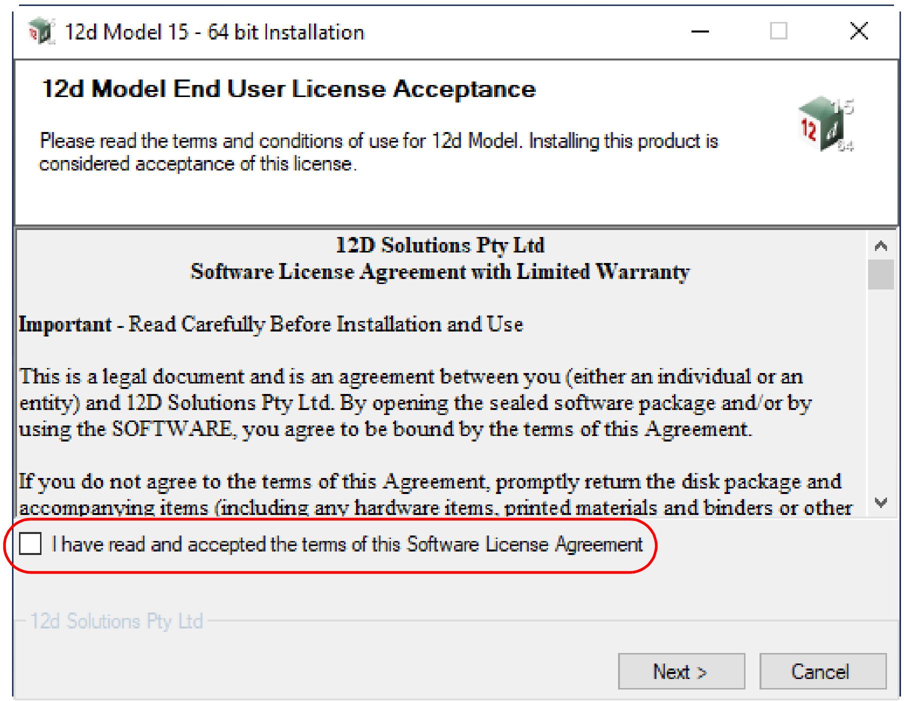
The installation of the new ***12d Model*** can now begin and the **Welcome** screen is displayed.

Welcome *Welcome message*

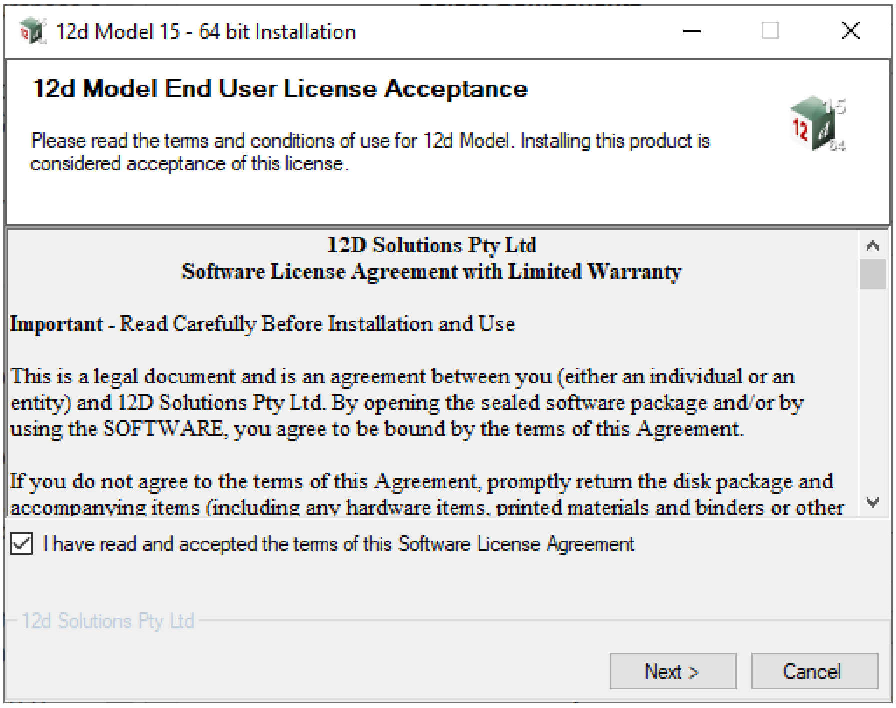


Select ***Next*** to continue with the installation

Software License Agreement *12d Solutions license agreement*

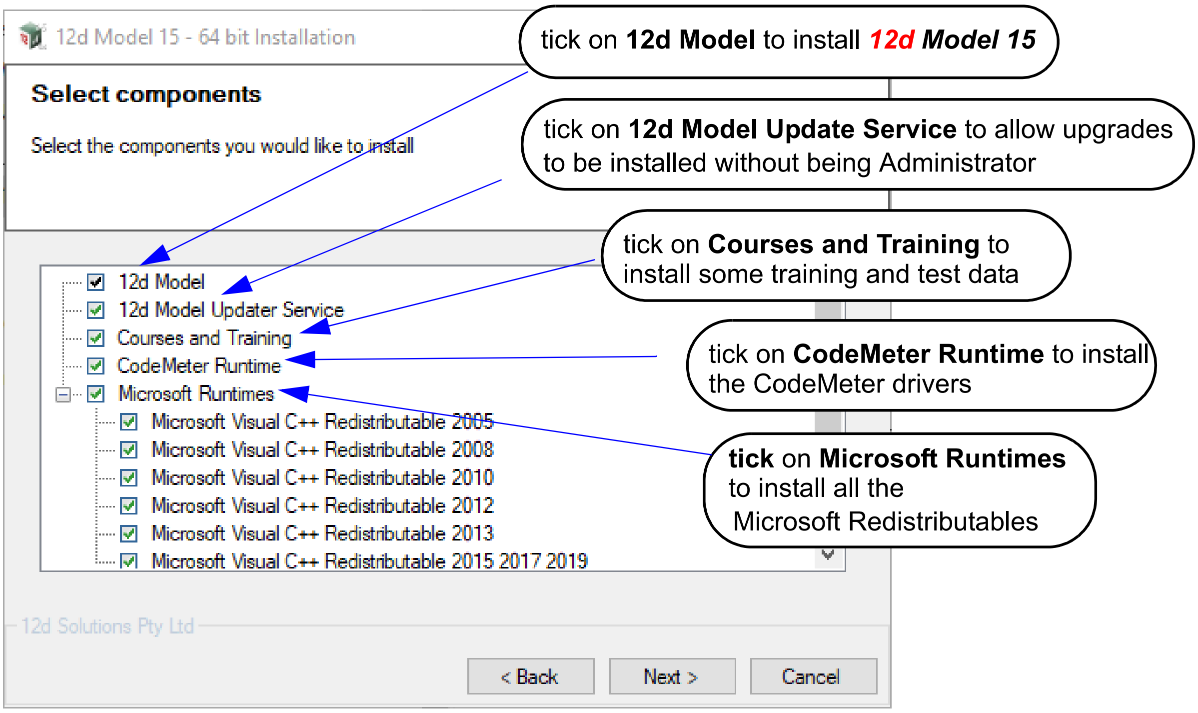


If you agree with the License conditions, **tick** on ***I have read and accept the terms of the Software License Agreement***.



Select ***Next*** to continue with the installation

Select Components



Tick on ***12d Model*** to install ***12d Model***.

Tick on ***12d Model Updater Service*** to allow the installation of ***12d Model*** upgrades without being logged in as ***Administrator***.

Tick on ***Courses and Training*** to install training and test data.

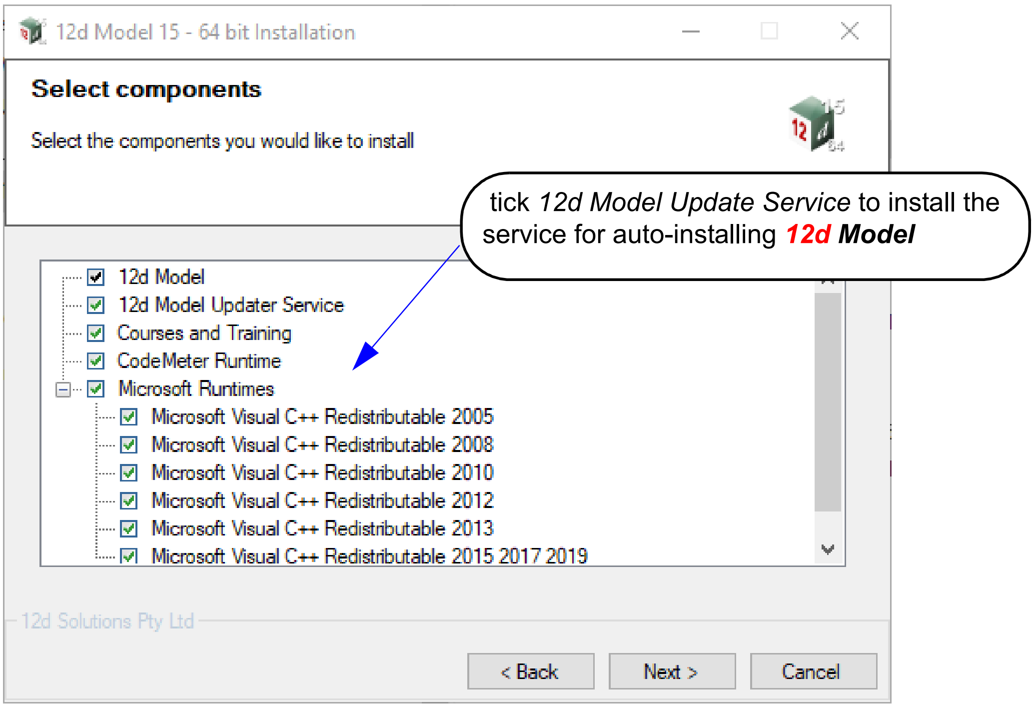
Tick on ***CodeMeter Runtime*** to install the latest CodeMeter drivers.

Tick on ***Microsoft Runtimes*** if this is the first time you have installed ***12d Model 15*** on this computer, and it will tick on all the ***Microsoft Visual C++ Redistributables***.

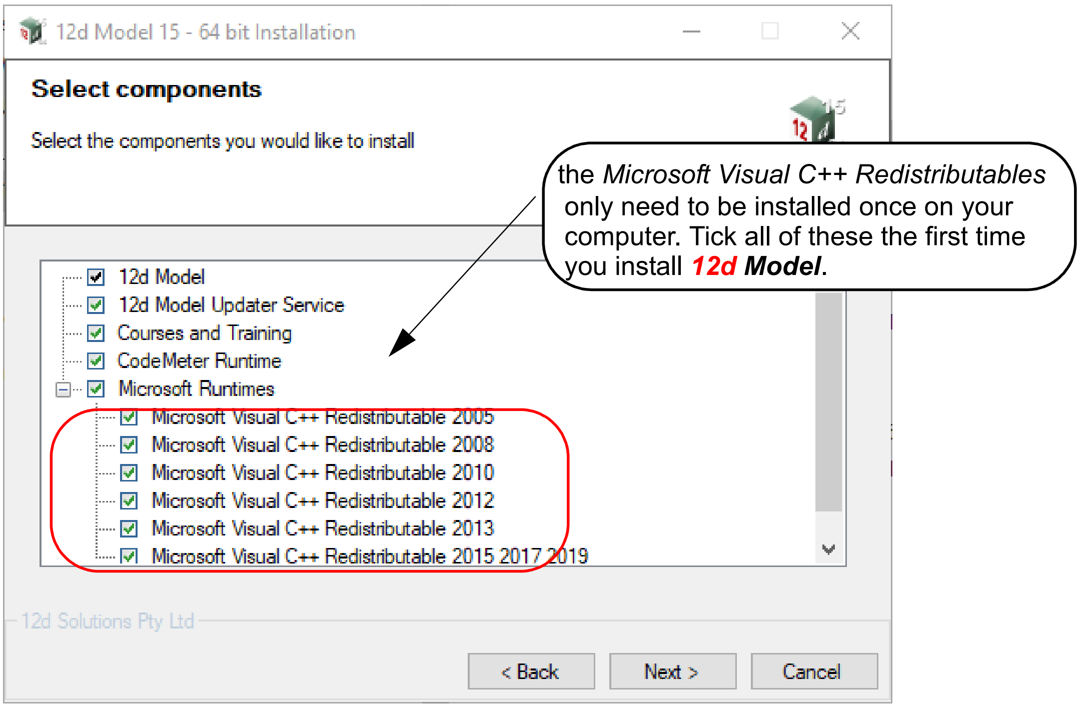
Notes on the Components

The ***12d Model Updater Service*** creates a **background Service** that is used to install new versions of ***12d Model 15*** without needing Admin privileges.

For information on setting up and using the ***12d Model Updater Service***, see 2.6 AutoUpdater for 12d Model 15.

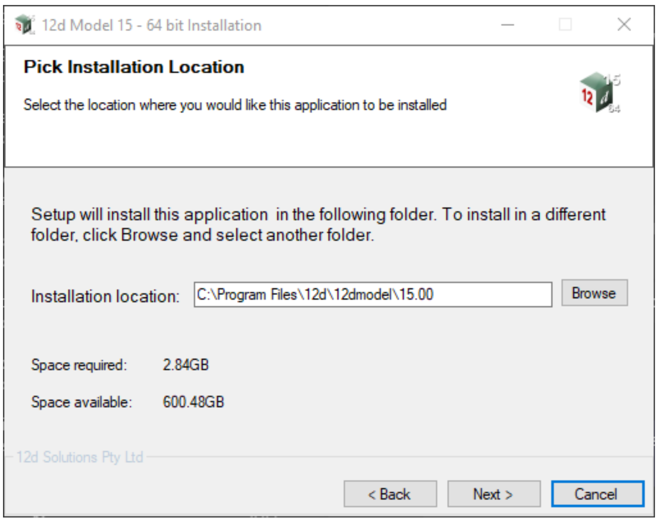


The ***Microsoft Visual C++ Redistributables*** only needs to be installed once on your computer. If you install ***12d Model*** again then you can leave them unticked.



After ticking on the required components, select ***Next*** to continue with the installation

Installation Location



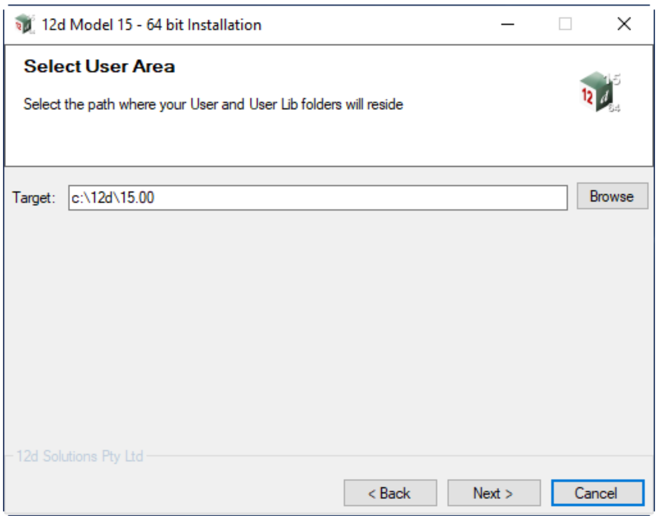
Continue with the default installation folder for the software:

C:\Program Files\12d\12dmodel\15.0

or click on ***Browse*** to browse to another folder for the installation

Select ***Next*** to continue with the installation

User Area



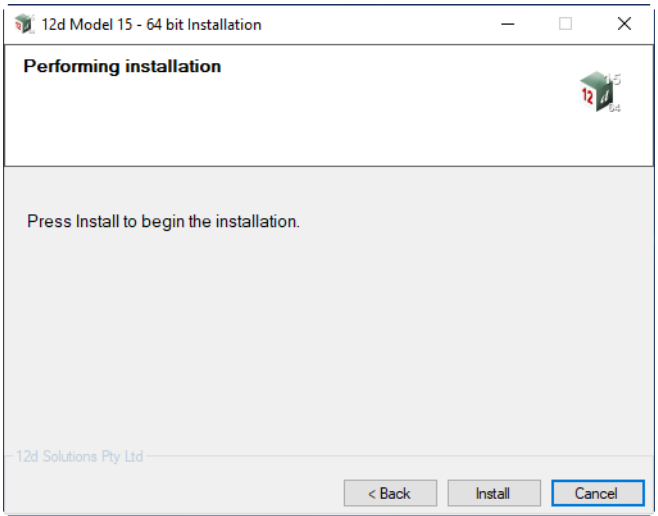
Continue with the default folder for the ***User Area*** for the software:

c:\12d\15.0

or click on ***Browse*** to browse to another folder for the User Area.

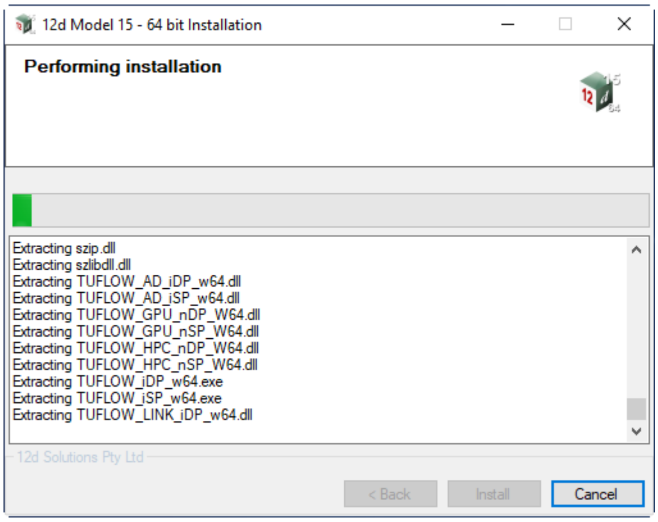
Select ***Next*** to continue with the installation

Ready to Install

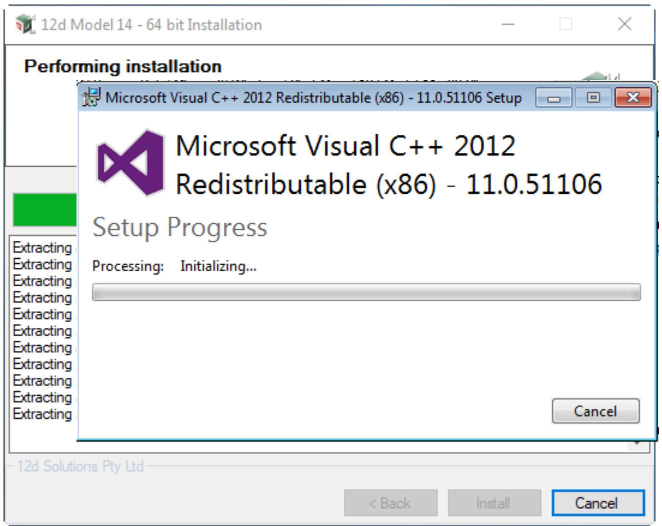


Select ***Install*** to begin the actual installation.

The software will be copied and installed onto the computer.

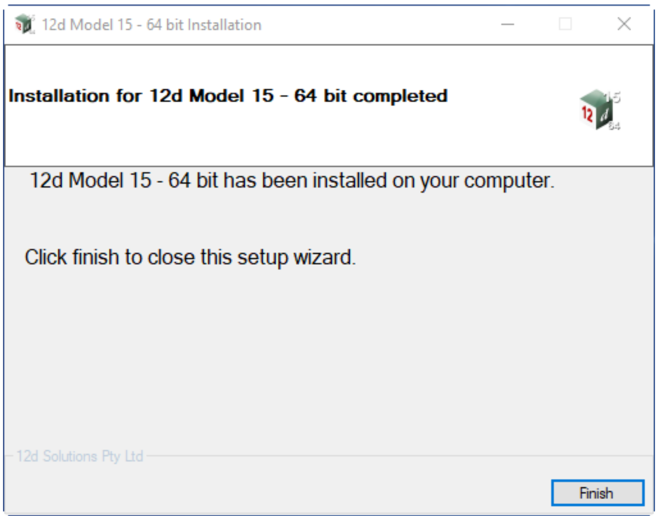


The Microsoft C++ Redistributables will be automatically installed (64 & 32 for 64-bit install)



DO NOT CLICK on anything on the Microsoft Redistributable panels, especially ***Cancel***.
The panels will disappear by itself.

Installation Complete



End of the installation. Select ***Finish*** to complete the installation

This completes the installation of the ***12d Model*** software.

Continue to 31.3 User, User_Lib and env.4d for 12d Model 15 or return to 31.2 Installers for Lock Drivers and 12d Model.

31.3 User, User_Lib and env.4d for *12d Model 15*

See

Or continue to 31.4 Network Hardware Locks and 12d Model or return to 31 Moving to 12d Model 15

31.3.1 User

User contains the files that you have modified files and are to be used instead of the files of the same name in **Set_ups** (e.g. names.4d, linestyl.4d).

No **User** folder is created when ***12d Model 15*** is installed but if you had files in your **User** for ***12d Model 14*** then you will probably also want them to be used in ***12d Model 15****.*

If this is the case you will need to create a **User** folder for **V15**.

In **V14**, the default place for **User** is **c:\12d\14.00\User** but it could have an entirely different location and name, and then the pathname to it is given by the V14 environment variable **USER_4D**.

In **V15**, the default place for **User** is **c:\12d\15.00\User** or it could be pointed to by the V15 environment variable **USER_4D**.

So if you require a **User** folder in V15, you need to create the **User** folder in the correct location and copy the files from V14 User that you want to use for V15 to the new V15 **User** location.

A Note on a Problem When NOT Using the Default Location for User.

If you are going to use the environment variable **USER_4D** to point to the location of **User**, then you need to update the value of *USER_4D* in the **env.4d** file to be the pathname to **User**.

Unfortunately a "chicken or the egg" situation exists here because the value for *USER_4D* is usually given inside the file **env.4d** which is in the *User* pointed to by USER_4D.

There are ways around this but if you leave **User** in a default location then you don't have to worry about this conundrum.

Continue to 31.3.2 User_Lib or return to 31.3 User, User_Lib and env.4d for 12d Model 15.

31.3.2 User_Lib

User_Lib contains your own library files.

No **User_Lib** folder is created when ***12d Model 15*** is installed but if you had library files in your **User_Lib** for ***12d Model 14*** then you will probably also want them to be used in ***12d Model 15****.*

If this is the case you will need to create a **User_Lib** folder for **V15**.

In **V14**, the default place for **User_Lib** is **c:\12d\14.00\User_Lib** but it could have an entirely different location and name, and then the pathname to it is given by the V14 environment variable **USER_LIB_4D**.

In **V15**, the default place for **User_Lib** is **c:\12d\15.00\User_Lib,** or it could be pointed to by the V15 environment variable **USER_LIB_4D**.

So if you require a **User_Lib** folder in V15, you need to create the **User_Lib** folder in the correct location and copy the files from V14 User_Lib that you want to use for V15 to the new V15 **User_Lib** location.

If in V15 you are going to use the V15 environment variable **USER_LIB_4D** to point to the location of **User**, then you need to update the value of *USER_LIB_4D* in the **env.4d** file for V15 to be the pathname to **User_Lib**.

Continue to 31.3.3 env.4d or return to 31.3 User, User_Lib and env.4d for 12d Model 15.

31.3.3 env.4d

env.4d is the file that contain the values you want for any of the ***12d Model*** environment variables. The location for a user version of the file **env.4d** is in the **User** folder.

A default *env.4d* file is installed with the V15 **Set_Ups** folder but if you were using your own *env.4d* file in V14 then you will probably want to also use your own env.4d file in V15.

If this is the case you will need to make sure that you have copied your **env.4d** file from your V14 **User** folder to the V15 **User**. See 31.3.1 User.

Continue to 31.3.4 nodes.4d or return to 31.3 User, User_Lib and env.4d for 12d Model 15.

31.3.4 nodes.4d

A new **nodes.4d** for ***12d Model 15*** will be emailed to you by your ***12d Model Reseller*** along with instructions on how to install it.

Note that the ***nodes.4d*** for **V15** is an XML format and so can not be easily edited.

However there is a program installed with ***12d Model 15*** that can:

(a) Install a V15 nodes.4d

and also load an existing nodes.4d and

(b) load another nodes.4d

(c) look at all the entries in the file and display information on each entry (start & end dates, modules authorised etc)

(d) move entries up and down

(e) delete entries

(f) create an html report on the entries

(g) create a new nodes.4d file from selected entries

This program is accessible from inside ***12d Model*** by

(a) the **Nodes.4d** button on the Front screen (the one before you select a ***12d Model*** project)

(b) the option ***Projects =>Management =>Dongles =>Nodes.4d editor***

and also from outside ***12d Model***.

(c) the program is called ***12dNodesUtility.exe*** and is installed as a 32-bit program in

Program Files (x86) \12d\Nodes\15.0

For information on the ***nodes.4d*** editor, see the documentation on the ***Nodes.4d Editor*** in the ***12d Model*** reference manual.

Continue to 31.4 Network Hardware Locks and 12d Model or return to 31.3 User, User_Lib and env.4d for 12d Model 1531.3.4 nodes.4d or 31 Moving to 12d Model 15.

31.4 Network Hardware Locks and *12d Model*

If you are using a **12d Network hardware lock** with ***12d Model*** then a ***dongles.4d*** will be required to tell the system to use a network hardware lock instead of a stand alone hardware lock, and possibly which computer or IP address the network hardware lock is on.

So if you are wanting to use the network hardware lock after ***12d Model 15*** is installed, you need to copy your ***dongles.4d*** from your V14 **User** to your V15 **User**. See 31.3.1 User.

Otherwise ***12d Model 15*** will not see the network hardware lock and so won't be able to be authorised.

The ***dongles.4d*** file can also be created/edited by

(a) the **Dongles.4d** button on the Front screen (the one before you select a ***12d Model*** project)

(b) the option ***Projects =>Management =>Dongles =>Dongles.4d editor***

For information on the ***dongles.4d*** editor, see the documentation on the ***Dongles.4d Editor*** in the ***12d Model*** reference manual.

Return to 31 Moving to 12d Model 15.

32 12d Programming Language

It is the available functions in the ***12d Model Programming Language*** (macros) that gives the language its power.

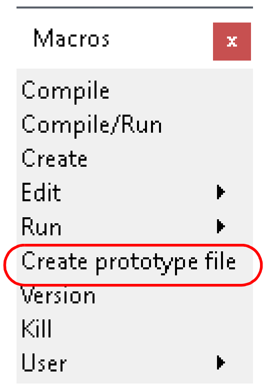
So new functions calls are added to the ***12d Model Programming Language*** (12dPL) with each release of ***12d Model,*** and often in sub-versions.

As each new function is added to 12dPL, it is given an increasing unique number which never changes. This is called the function's ID.

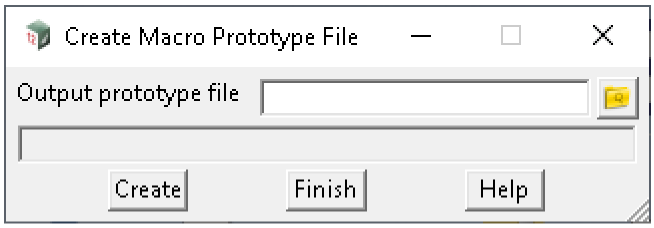
Hence for each version and subversion of ***12d Model***, the last function number is well defined and only function calls with numbers less than that number can be run with that version.

It is possible to generate a list of the available functions with their arguments and their unique number by creating what is called a ***prototype file*** with the option

Utilities =>Macros =>Create prototype file.



Generate a list of the 12dPL function calls



For example, the first 5 lines of any prototype file are:

Real Sin(Real value); // ID = 1
Real Cos(Real value); // ID = 2
Real Tan(Real value); // ID = 3
Real Acos(Real value); // ID = 4
Real Asin(Real value); // ID = 5

For ***12d Model 12 C1t***, the highest ID is 3208:

Integer Trimesh_section(Element trimesh,Real point_x,Real point_y,Real point_z,Real point_direction,Real point_grade,Real width,Real height,Integer &internal_return,Integer &result_closed,Integer &size_section_points,Dynamic_Real &section_xs,Dynamic_Real &section_ys,Dynamic_Real &section_world_xs,Dynamic_Real &section_world_ys,Dynamic_Real &section_world_zs,Dynamic_Integer &section_edge_indexes,Dynamic_Text &section_edge_names,Dynamic_Integer &section_edge_colours,Dynamic_Integer &section_vertex_indexes,Dynamic_Text &section_vertex_names,Dynamic_Integer &section_vertex_colours); // ID = 3208

For ***12d Model 14 C2e***, the highest ID is 3763

Integer Append_log_line(Log_Line line,Log_Line parent); // ID = 3763

So 455 new function calls have been added going from ***12d Model 12 C1t*** to ***12d Model 14 C2e.***

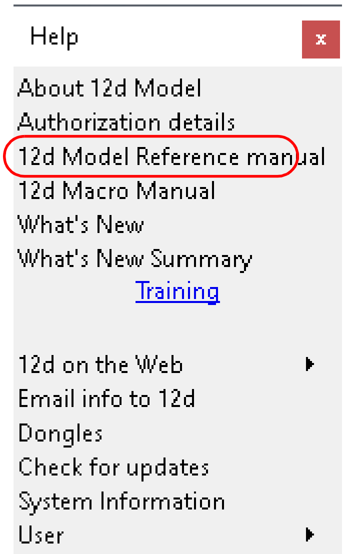
For ***12d Model 15 C1r***, the highest ID is 7997

Integer Triangulate_points(Integer npts,Real x[],Real y[],Real z[],Text tin_name,Tin &tin); // ID = 7997

So 4,234 new function calls have been added going from ***12d Model 14 C2e*** to ***12d Model 15 C1r.***

When a function call is documented in the ***12d Model Programming Language*** manual its **ID** is also recorded so that the ID can be used for a search.

The ***12d Model Programming Language*** manual is shipped with each version of ***12d Model,*** and in ***12d Model 15*** is available by clicking on **12d Macro manual** option on the **Help** menu.



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