



**12d Model**  
Civil and Surveying Software

# What's New in **12d** Model 15

May 2024



**12d Model**

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HIGHWAYS



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SEWER AND  
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INFRASTRUCTURE



PORTS AND  
DREDGING



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SURVEYING



OIL AND GAS



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CONSTRUCTION



ENVIRONMENTAL



# What's New in **12d Model 15**

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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 [23 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**.

[28.1 Hardware Locks for 12d Model 15](#)

[28.2 Installers for Lock Drivers and 12d Model](#)

[28.3 User, User\\_Lib and env.4d for 12d Model 15](#)

[28.4 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 Features Not Yet Completed for 12d Model 15](#)
- [1.1.2 Windows Operating Systems Supported](#)
- [1.1.3 The old Hardlock dongles will NOT work with 12d Model 15.](#)
- [1.1.4 CodeMeters Need Drivers of at Least Version 6.1](#)
- [1.1.5 Installer Deletes the Program Files 15.00 Areas](#)
- [1.1.6 New Guid File Naming Convention](#)
- [1.1.7 12d Model 15 Projects](#)
- [1.1.8 Using V15 Projects with 12d Synergy](#)

## 1.1.1 Features Not Yet Completed for 12d Model 15

Because of a number of major changes done for **12d Model 15** including **Themes**, **Object Tree** and **GUID naming on disk** (for Models, Tins, Functions and Templates), **12d Model 15 C1a** was released with some features not completed.

This decision was made so that users who do not currently need the missing features can start using **12d Model 15**.

However most of these missing features have been finished for **12d Model 15**.

The features that will **NOT** be completed for **12d Model 15** are:

- (a) Water to zip for Shared in models and tins
- (b) **Getting Started for Design** pdf and data is still only for V14 as it is being rewritten for V15 using a new dataset.
- (c) **Getting Started for Surveying** pdf and data is still only for V14 as it is being rewritten for V15 using a new dataset

If you have any issues with **12d Model 15**, please let your **Reseller** know as soon as possible so that we can endeavour to fix them for future releases of **12d Model 15**.

## 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 10**.
- (c) **Windows 11** has been released and most of our staff, and a Win 11 version of our Test Suite are using it. Please let us know if you have any problems on **Windows 11** that didn't occur on **Windows 10**.
- (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 Reseller.

## 1.1.4 CodeMeters Need Drivers of at Least Version 6.1

To obtain new CodeMeter drivers, see [28.2 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 **12d Synergy 5**.

However, it requires **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](#)

[2.2 Guid Naming Convention for 12d Model 15](#)

[2.3 Migrating a Project](#)

[2.4 Themes](#)

[2.5 E Snap](#)

[2.6 AutoUpdater for 12d Model 15](#)

[2.7 Time Warning When NOT a Release Version](#)

[2.8 Active Tab Coloured Blue](#)

[2.9 Options Log Files Saved & Emailed to 12d](#)

[2.10 Preventing Open GL Views](#)

[2.11 Outputting Missing Super Tin Components](#)

[2.12 Trimeshes and Drafting Elements Working with Polygon Choices in Source Boxes](#)

[2.13 Additional Items for Attribute Manipulator](#)

[2.14 Options No Longer Using Old String Types](#)



## 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.

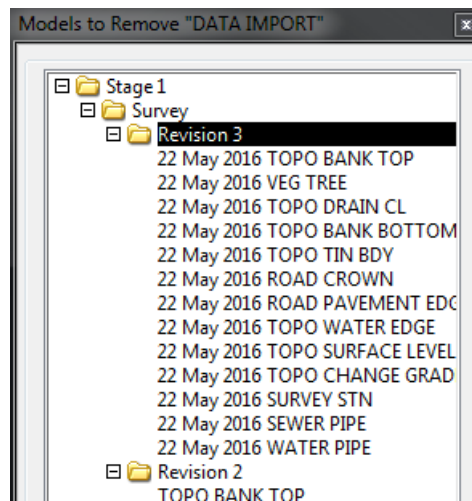
That is, the wish is to allow some object names to have a tree structure and full path names like attributes or Windows folders so that it is easier to group the objects together in pop-up lists.

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 relying 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 it 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:

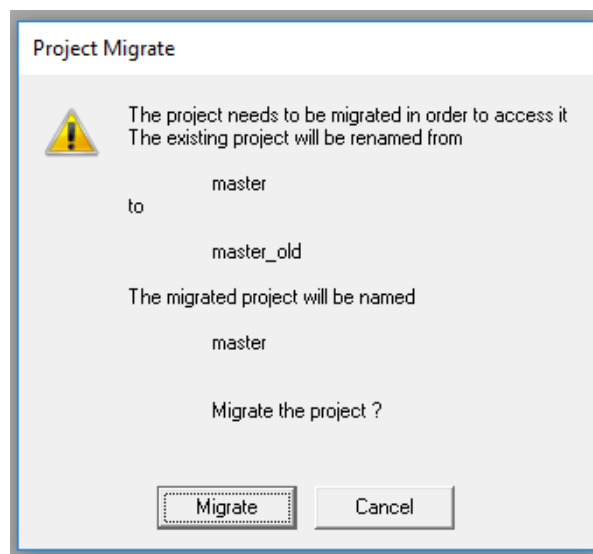
- (a) for the existing project called XXX, renames it to XXX\_old
- (b) in the same working folder as the existing project, creates a new V15 project with the original project name XXX
- (c) copies the models, tins, functions and templates from the original project to the new project. In the new project 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.

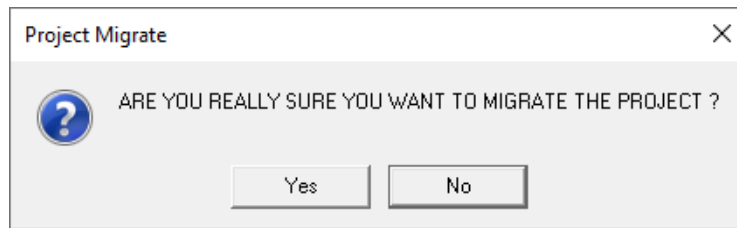
### Notes

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

Now documented in the V15 reference manual

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

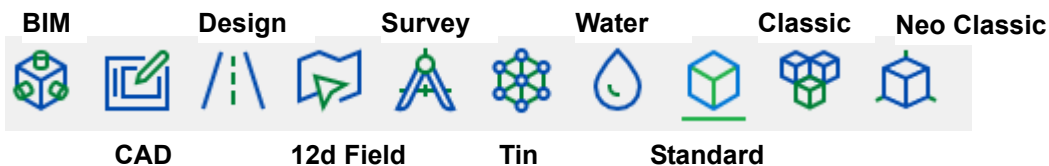
has the same menu layout as Classic but the icons are different and the size of the icons can be selected as **small**, **medium**, **large** and **extra large**. The small size is slightly larger



than for **12d Model 14** and **Classic** so that they can have more detail in the icons.

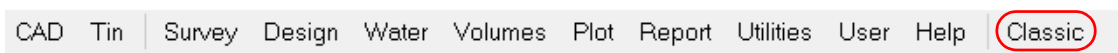
- (c) Design  
a theme set up with the Design options on the main menu. The icon size can be selected from **small, medium, large** and **extra large**.
- (d) Water  
a theme set up with Water options on the main menu. The icon size can be selected from **small, medium, large** and **extra large**.
-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



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](mailto: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](#).

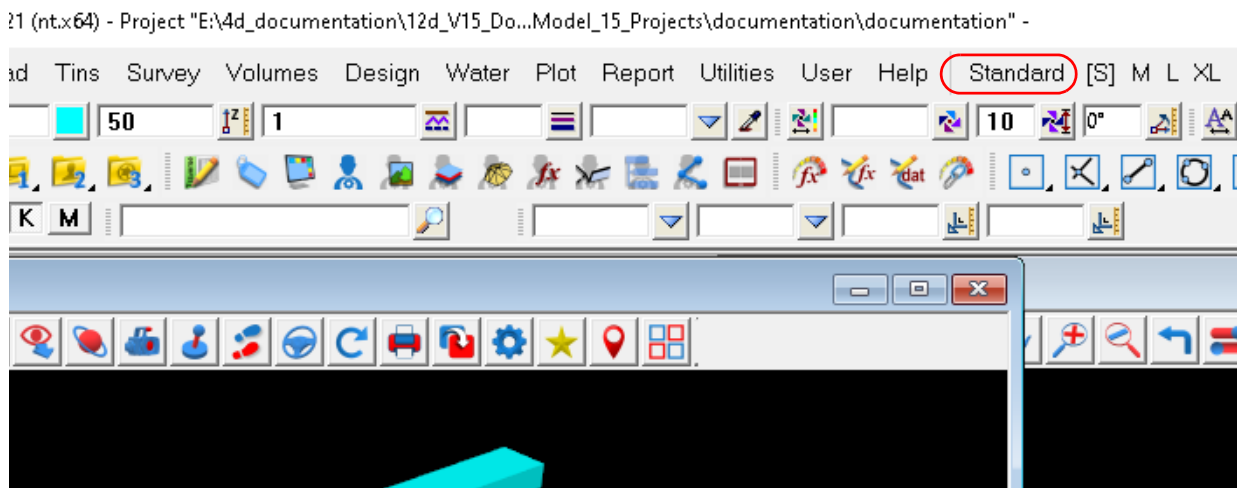
Continue to [2.4.1 Changing Themes and Icon Size](#) or return to [2 General Items](#).

## 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 use for the selected **Theme**. The choices are:

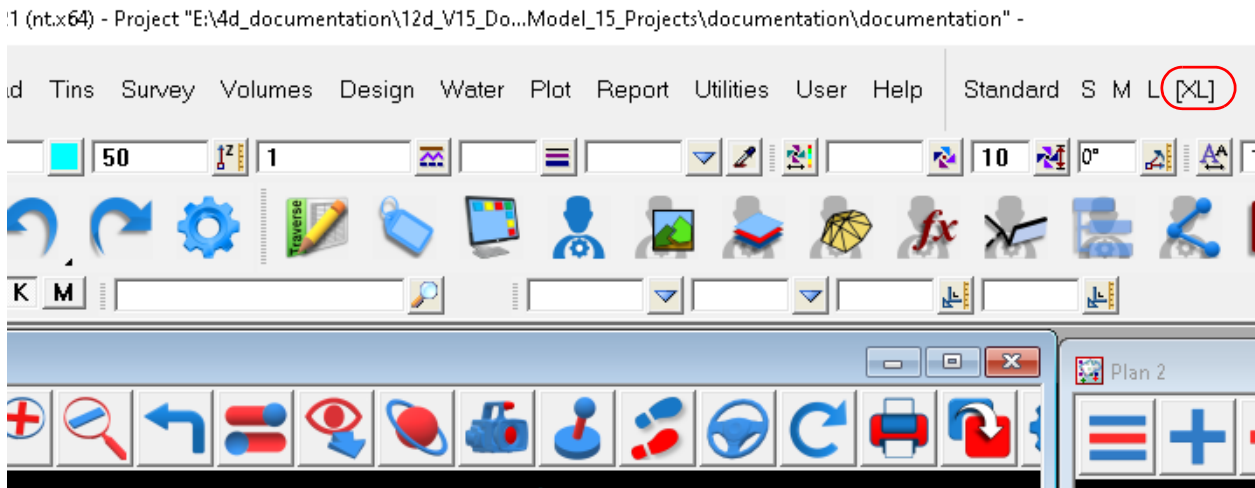
- (a) Small (**S**) - 20x20 pixels
  - (b) Medium (**M**) - 24x24 pixels
  - (c) Large (**L**) - 32x32 pixels
- and
- (d) Extra Large (**XL**) - 36x36 pixels

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](#).

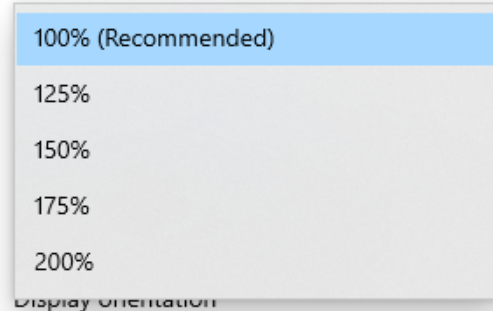
Continue to [2.4.2 Changing Text Size on Menus](#) or return to [2.4 Themes](#).

## 2.4.2 Changing Text Size on Menus

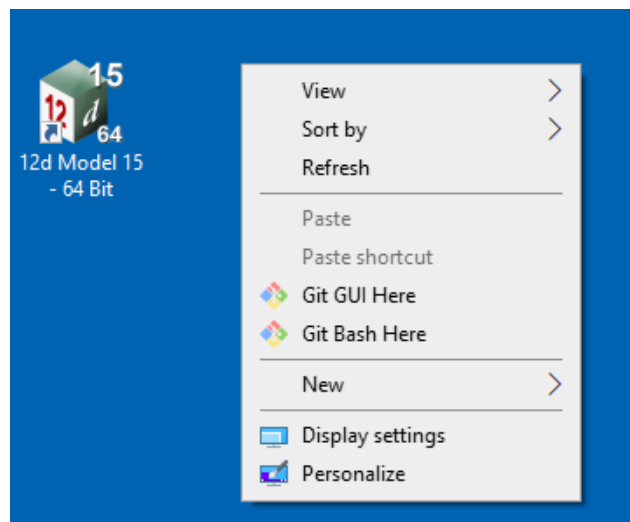
The size of the text on menus is controlled separately to the size of the icons and is controlled by the **Microsoft Display Settings**.

### Scale and layout

Change the size of text, apps, and other items

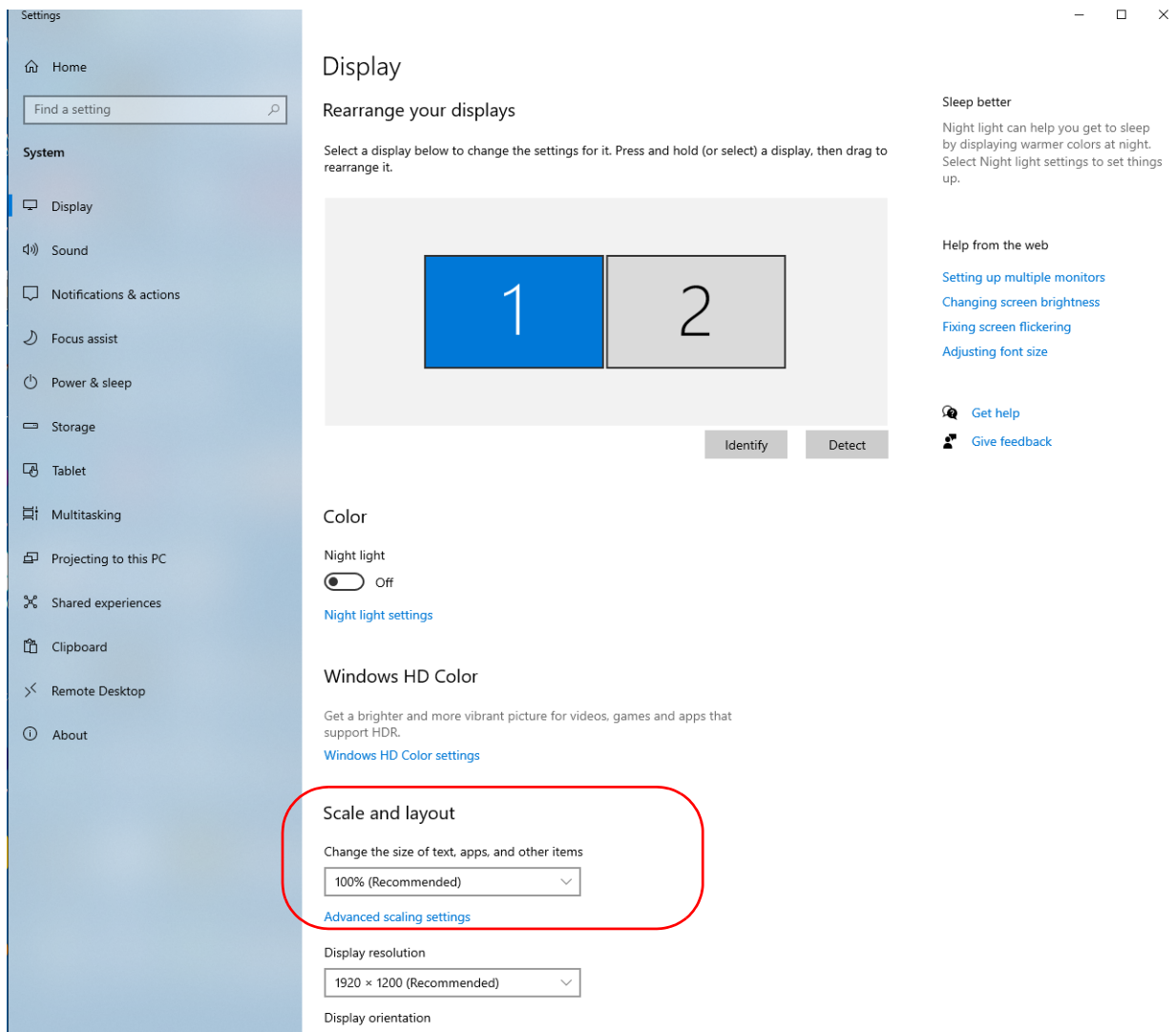


To access the **Microsoft Display setting**, click RMB (right mouse button) in the Microsoft window to bring up the menu:



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



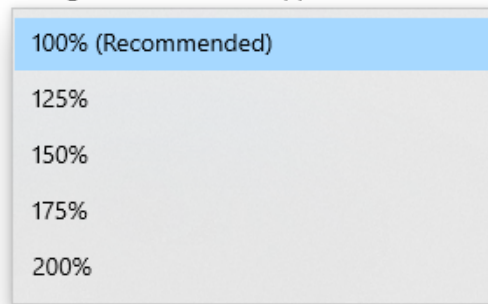


The screenshot shows the Windows Settings application, specifically the 'Display' section. The left sidebar lists various settings categories, with 'Display' selected. The main content area is titled 'Display' and includes sections for 'Rearrange your displays', 'Color', 'Windows HD Color', and 'Scale and layout'. The 'Scale and layout' section is highlighted with a red oval. It contains a dropdown menu for 'Change the size of text, apps, and other items' currently set to '100% (Recommended)'. Below it are options for 'Display resolution' (1920 x 1200) and 'Display orientation'. The right sidebar contains links for 'Sleep better', 'Help from the web', 'Get help', and 'Give feedback'.

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.

## Scale and layout

Change the size of text, apps, and other items

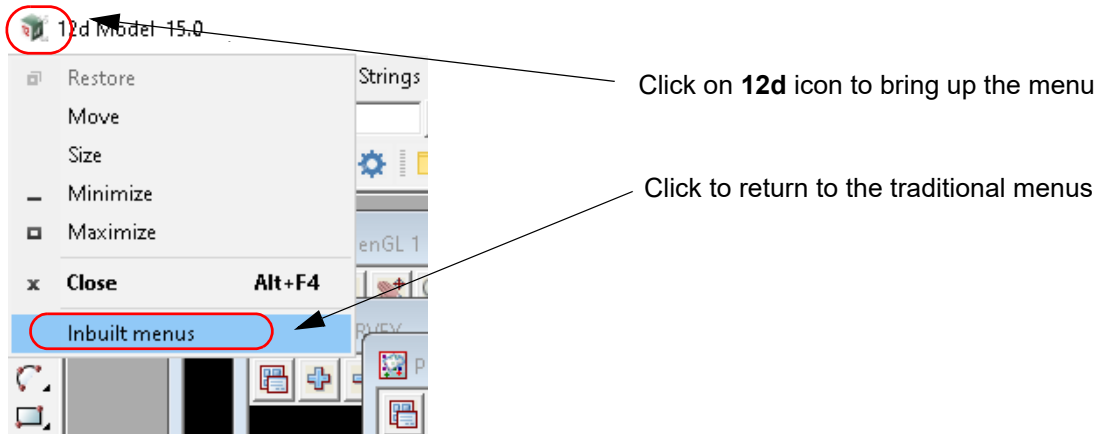


Select the percentage that you want the text size to become.

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 Menu

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**.



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

Please report any problems in a **Theme** to 12d Solutions on [support@12d.com](mailto: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

Now documented in the V15 reference manual

E for Extrusion snap



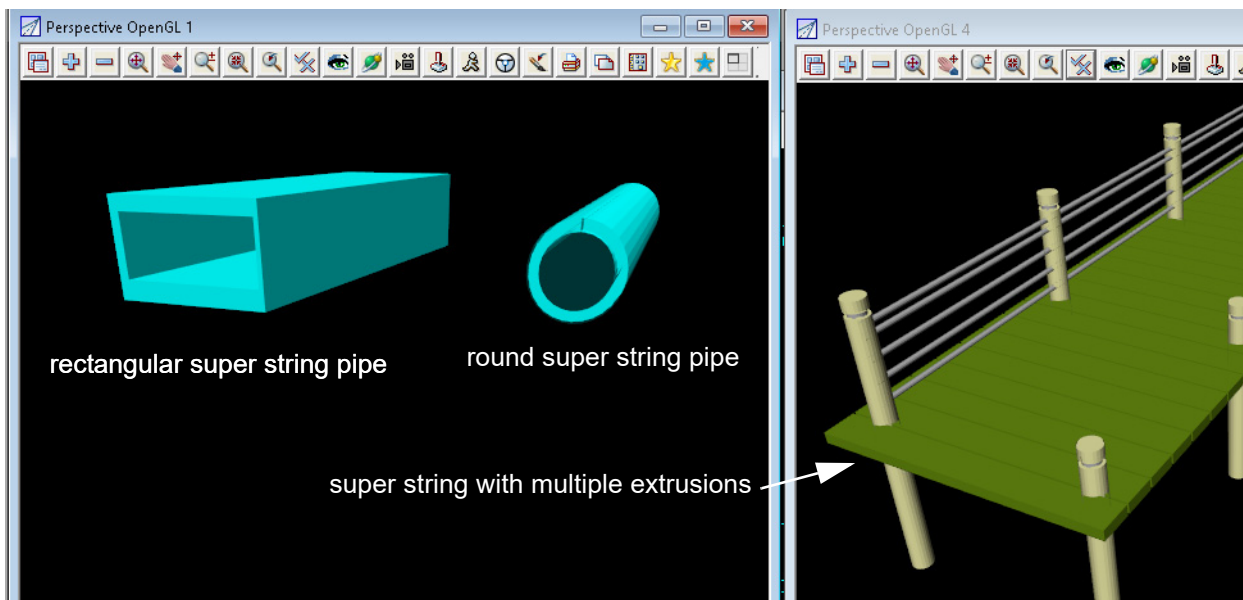
In **12d Model 14**, **Face** snap (**F**) was introduced and when turned on, allowed you to pick on the triangle face of a trimesh. So using **P**, **L** and **F** snap, you can select the vertex, edge or face a Trimesh.

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

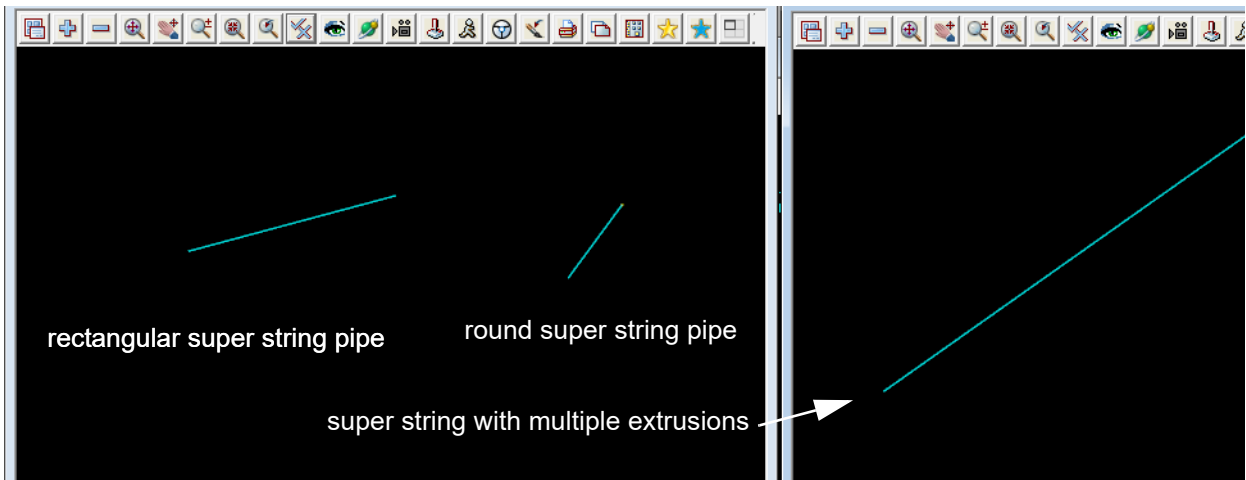
In **12d Model super string extrusions** are created in a number of ways.

- super string as a round pipe
- super string as a rectangular pipe
- super string with a 2D super string (with and without holes) swept along the super string
- 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.

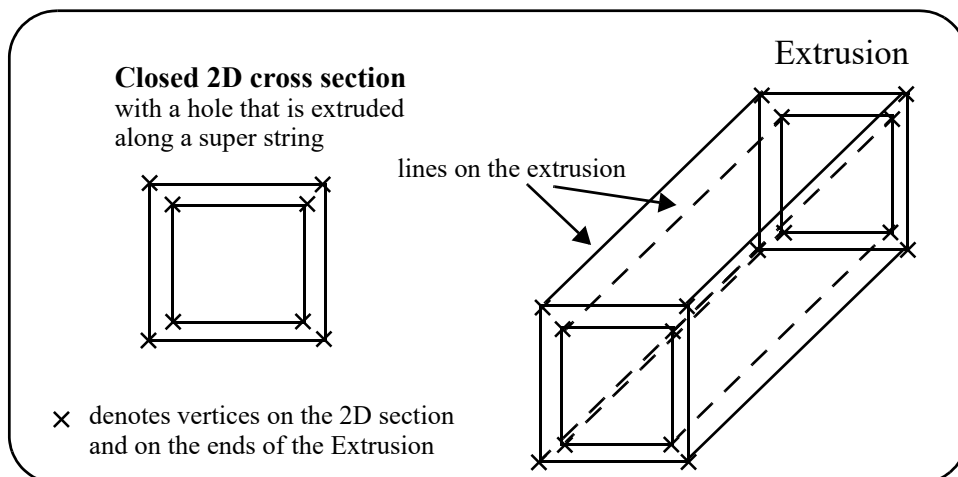
When **E** snap is **off**, picking a super string is the same as in **12d Model 14**.

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

Now documented in the [V15 reference manual](#)

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 then automatically download and **install** the new version.

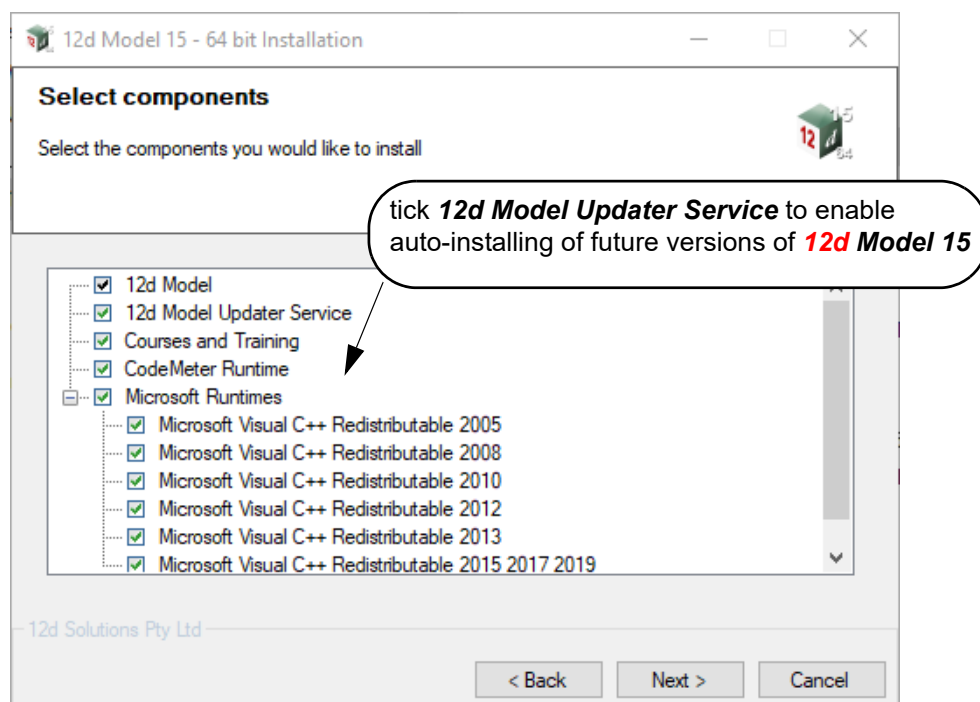
You can set whether the installation exe is automatically deleted after the installation, or it is left in case you want to use it for a manual install at a later time.

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** consists of a few simple steps:

### Step 1. Ticking on 12d Model Updater Service when Installing 12d Model 15

First **12d Model 15** needs to be installed by the Administrator and the Administrator needs to select the **12d Model Updater Service** component. See [28.2.2 Installers for 12d Model](#).



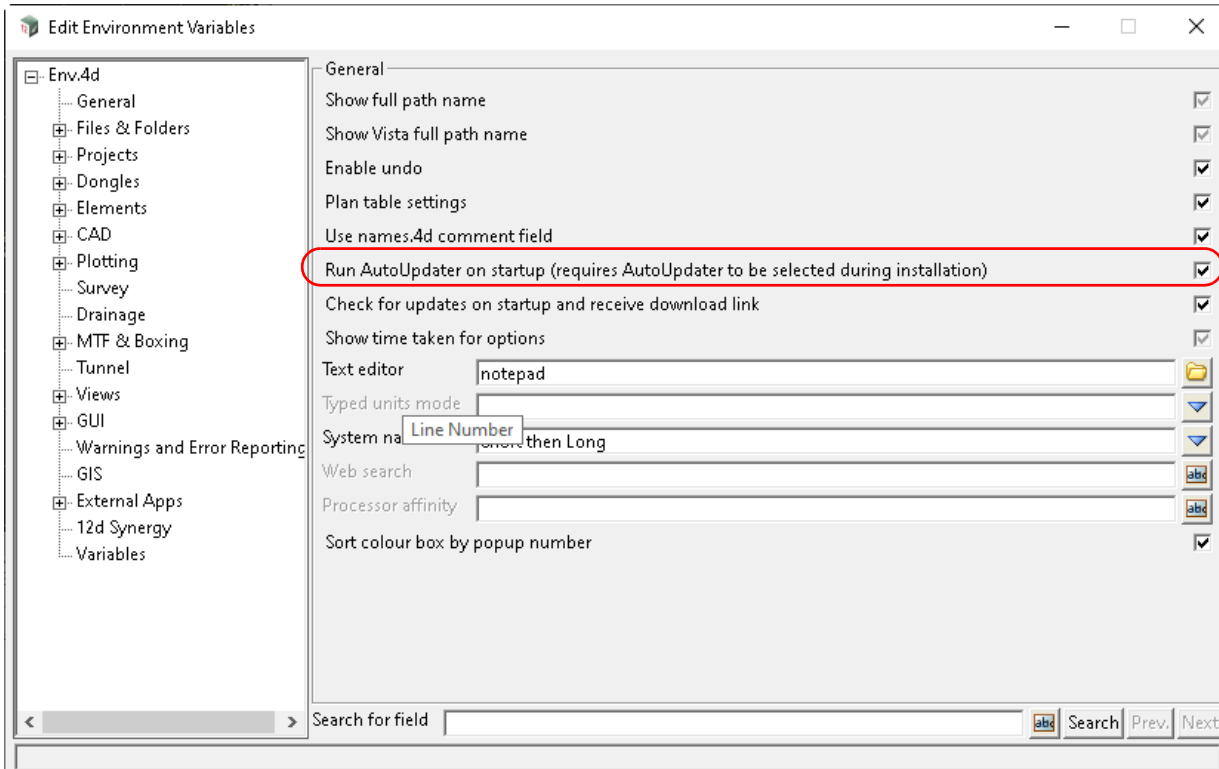
This creates a background service on your computer that has Administrator rights, and each time **12d Model 15** is started, it checks if a new version is available and if so, asks if you would like it to automatically download and install the new version.

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**.

### Step 2. Setting up an environment variable

After **12d Model 15** is installed, even though the background service is running, the environment variable **auto\_updater\_4d** needs to be set to **1** for it to be used.

This is done in the **General** section of the **Edit Environment Variables** panel by ticking on the **Run AutoUpdater on startup**.



After these steps are done, each time **12d Model 15** is started a check is made to see if a newer version of **12d Model 15** is available and if one is available, then you will get either the panel:

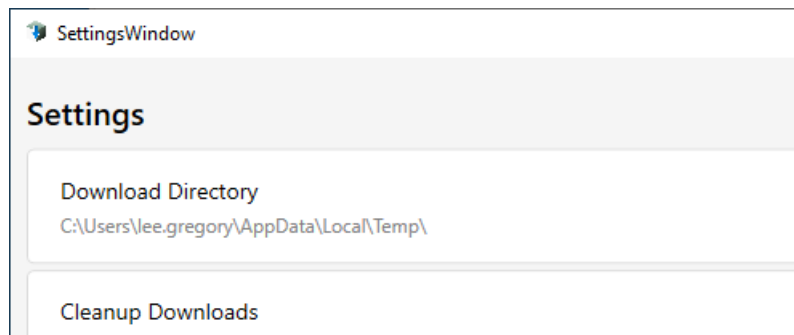


or the panel

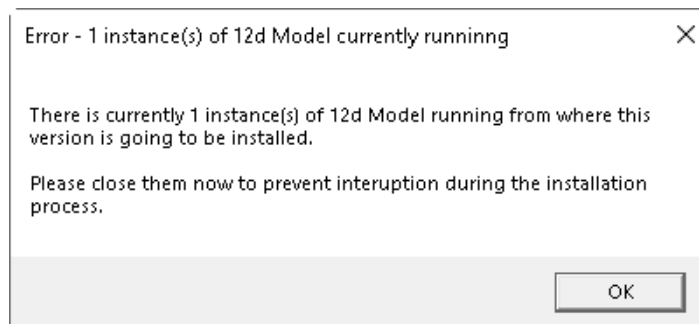


Clicking the **Settings** icon allows you to change the location that the installation file will be downloaded to, and to specify if the installation file is to be deleted, or not, after the

installation is completed.



On the **12d Model Downloader** panel, if **Update** 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.

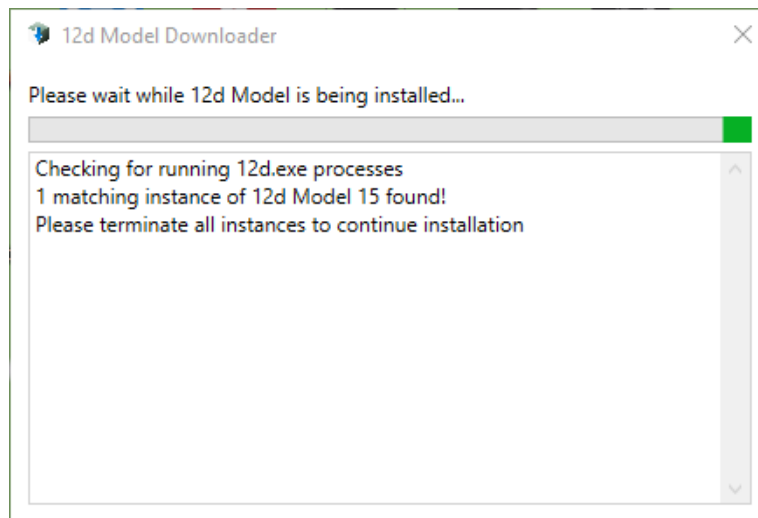


This often occurs because you need to start **12d Model 15** to be asked about AutoUpdating. Even if all copies are not closed, the download will begin when **OK** is pressed.



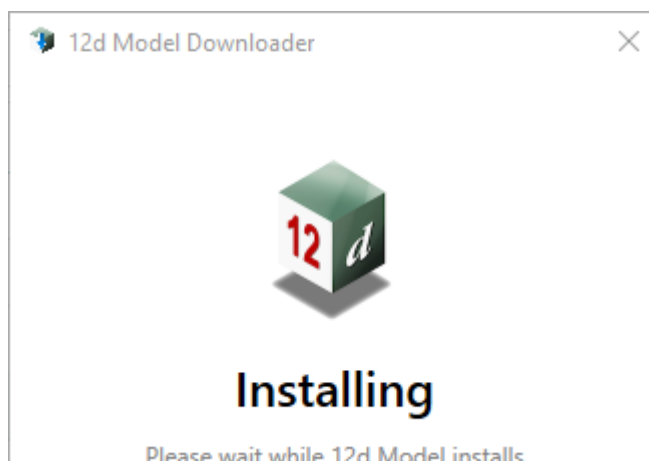
Once the download is complete, the installation process begins.

However, a check is again made to see if all copies of **12d Model 15** are be closed otherwise you will get the message:



The installation will not continue until all instances for Once all instances of **12d Model 15** are closed.

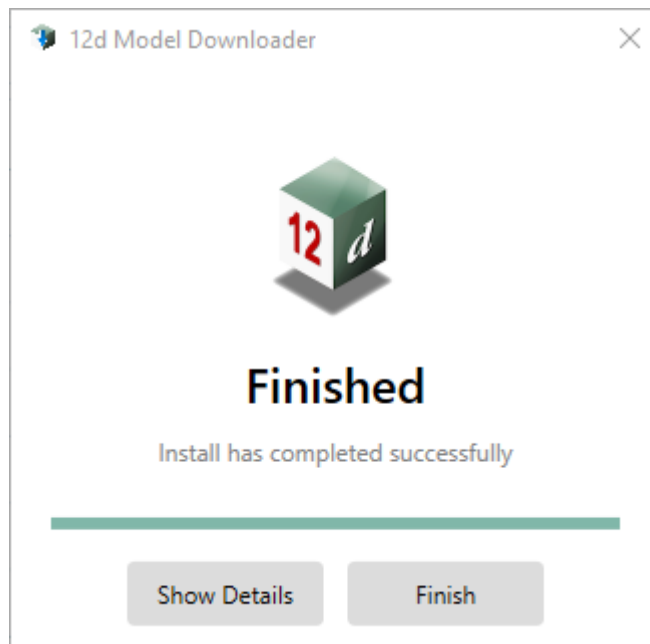
Once all instances closed of **12d Model 15** have been closed, the **AutoUpdater** will proceed with the installation and posts the message **Please wait while installing...**:



Because the **12d Model Update Service** is now doing the installation, you no longer have to provide an Administrator account and password, or answer any Installation questions.

During the installation the only thing you will notice is that at some stage the **12d Model 15** icon is removed from the screen.

Once the installation is complete, the **12d Model 15** icon is restored and the message **"Install has completed successfully"** is displayed.



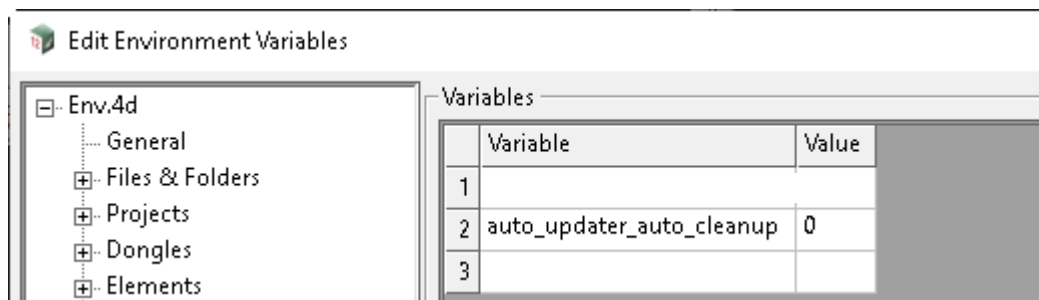
Click on **Finish** to remove the panel.

### Step 3. Delete or Not Delete the Installation Exes 12d Model as Administrator

You can select to delete, or to not delete, the installation exes after the installation has completed. The **default** is to automatically **delete** the installation exes.

To **not delete** the installation exes, set the env variable **auto\_updater\_auto\_cleanup\_4d** to **0**.

This is done in the **Variables** section of the **Edit Environment Variables** panel.

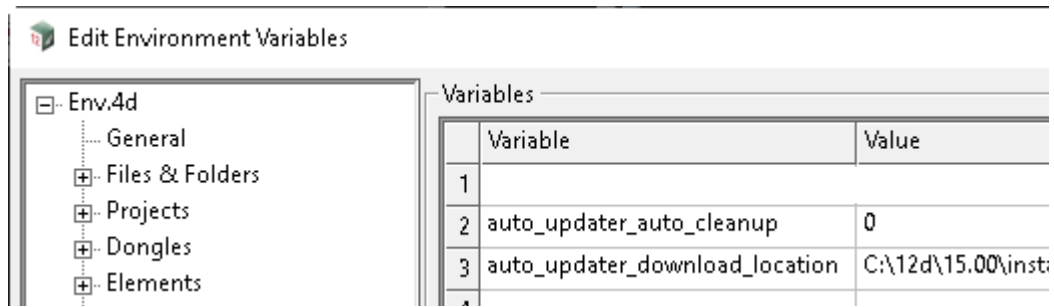


### Step 4. Where to Put the Installation Exes

By default, the installation exe's are in the %temp% folder inside 12d\downloads.

But you can specify a different folder by setting the env variable **auto\_updater\_download\_location\_4d** to **your preferred folder**

This is done in the **Variables** section of the **Edit Environment Variables** panel.



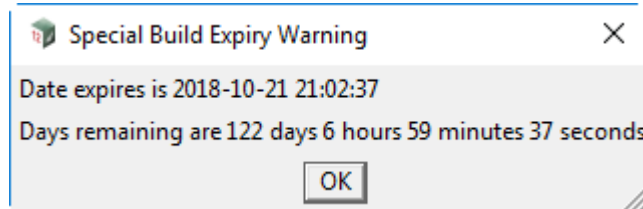
### IMPORTANT NOTES

1. Because the **12d Model Update Service** has the **Administrator rights to install 12d Model 15**, after the initial installation of **12d Model 15** by the Administrator, the user no longer needs Administrator rights for the subsequent installations to occur.
2. The installation exes are given a name with the date in the form **dd\_mmm\_yy** imbedded in the name.
3. If the installation exe already exists, it won't be downloaded again.



## 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.

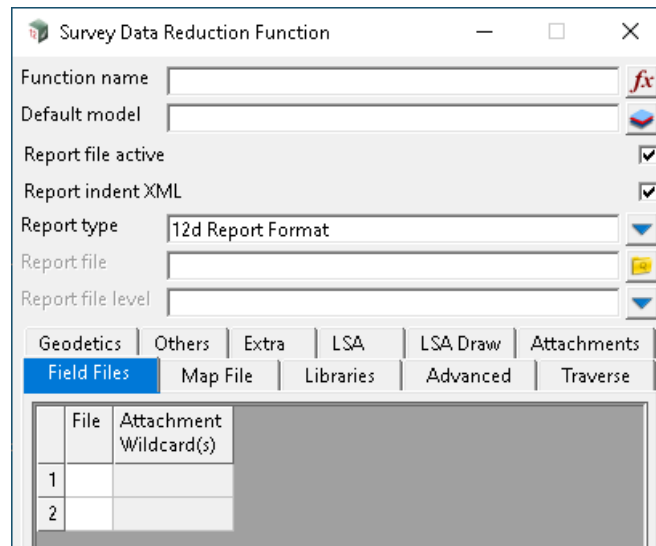


The only way to continue running after the three months has expired is to install full Release version or non Full Release version that was built in the last three months.

**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)



## 2.14 Options No Longer Using Old String Types

More **12d Model** options that were producing old string types have been modified to produce super strings instead.

1. Project =>Tree node Symbols/Create symbols
2. Project =>Tree node Linestyles/Create linestyle
3. Strings =>Label =>Cut/fill => Ticks
4. Strings =>Label =>Cut/fill => Tadpoles - no file
5. Tins =>Utilities =>Grid DTM
6. Tins =>Utilities =>Rotated Grid DTM
7. Tins =>Utilities =>Z diffs from tins
8. Tins =>Drape =>Drape - vertices only mode
9. Tins =>Tin analysis =>Slope =>Slope analysis 2 (new)
10. Tins =>Tin analysis =>Flow arrows
11. Design => Sight lines => Sight distance enhanced
12. Utilities =>A-G =>Explodes =>Explode text - for non-multiline text



# 3 Starting Up

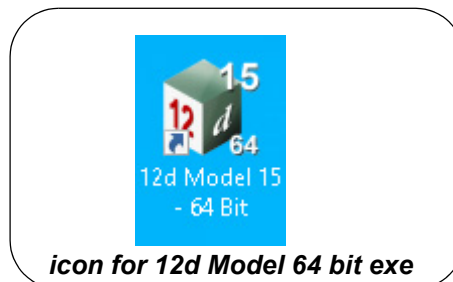
This chapter contains information about how to start **12d Model**, organising **12d Model** error logging and how to run chains and macros when starting up **12d Model**.

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.

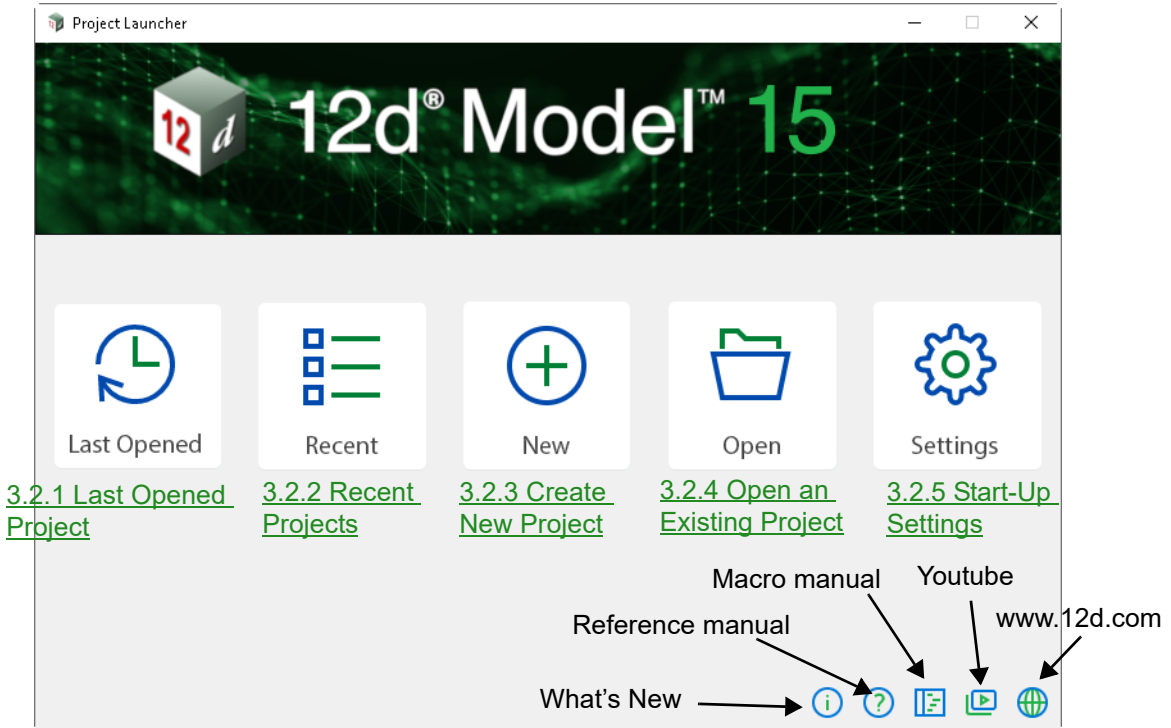


The **12d Model** icon is a **shortcut** to start **12d Model** and then attach to the folder **C:\12d\15.00**

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

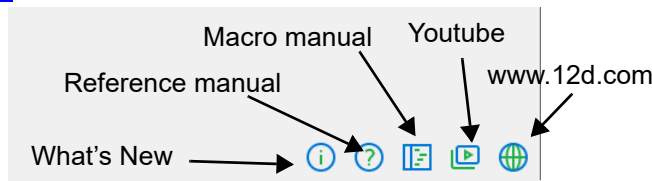
## 3.2 Project Launcher

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](http://www.12d.com)



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

See

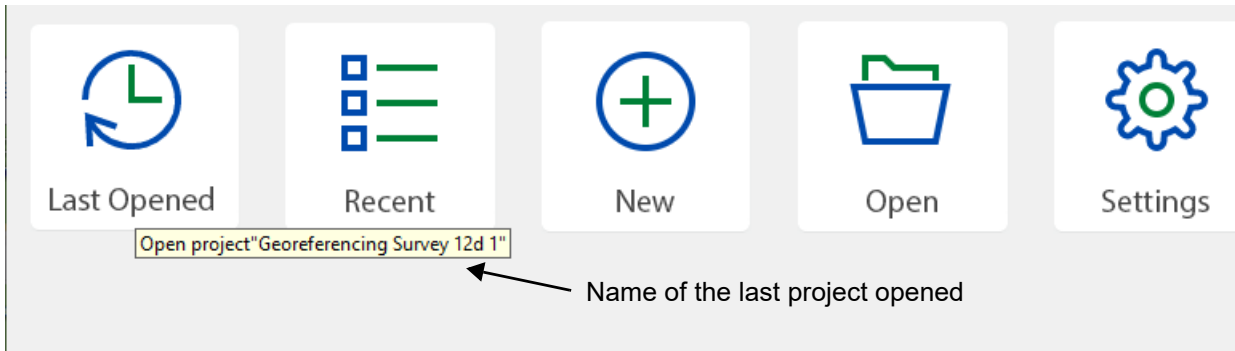
- [3.2.1 Last Opened Project](#)
- [3.2.2 Recent Projects](#)
- [3.2.3 Create New Project](#)
- [3.2.4 Open an Existing Project](#)
- [3.2.5 Start-Up Settings](#)
- [3.2.6 Selecting a Theme Using the Theme Icons](#)
- [3.2.7 Recent Projects List](#)

### 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](#)).

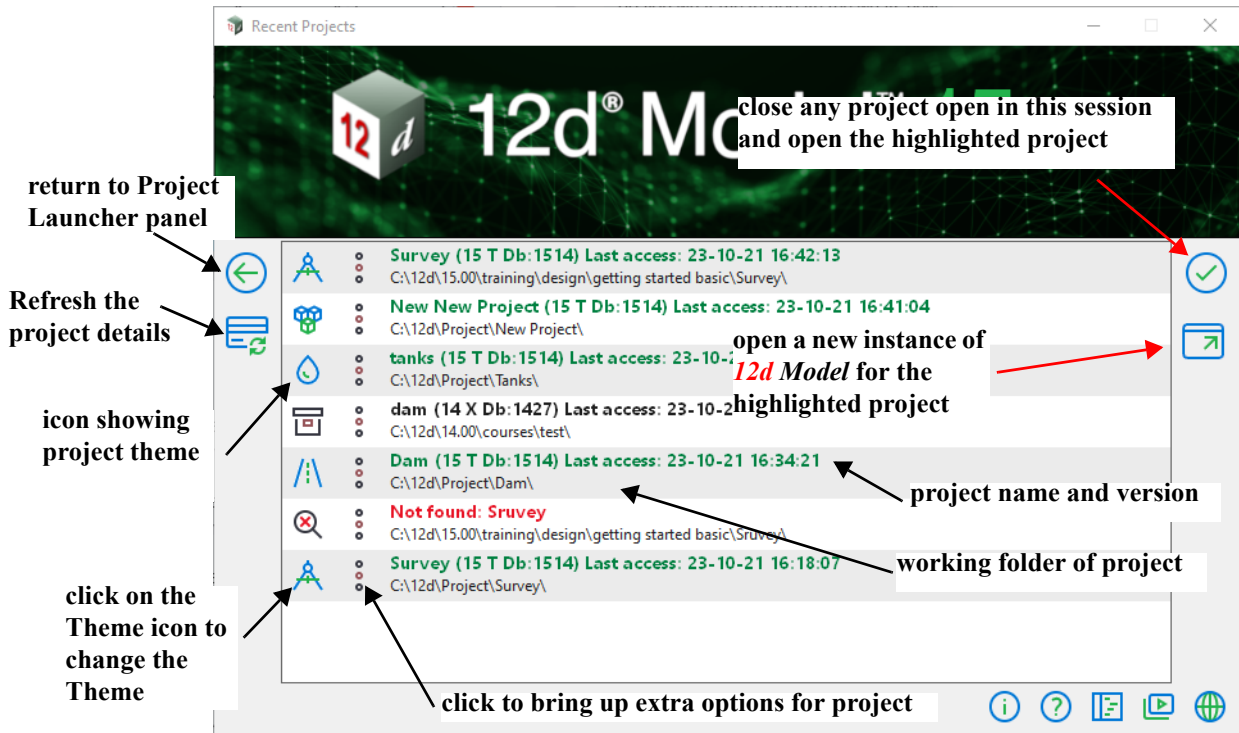
Hovering over the **Last Opened** icon displays the name of the last opened project as a **tool tip**.



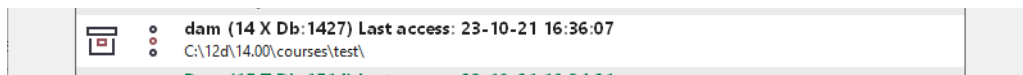
Continue to [3.2.2 Recent Projects](#) or return to [3.2 Project Launcher](#).

### 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
<b>Project location</b> <i>Location of the working folder for the project.</i>	output only		Pop-Up
<b>Project name</b> <i>Name of the project.</i>	output only		
<b>Theme name</b> <i>Name of the theme for the project.</i> <i>The theme can be changed by clicking on the required Theme icon just above <b>Project location</b> field.</i>	Theme select		

BIM	Design	Survey	Water	Classic
<b>CAD</b>	<b>12d Field</b>	<b>Tin</b>	<b>Standard</b>	<b>Neo Classic</b>

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

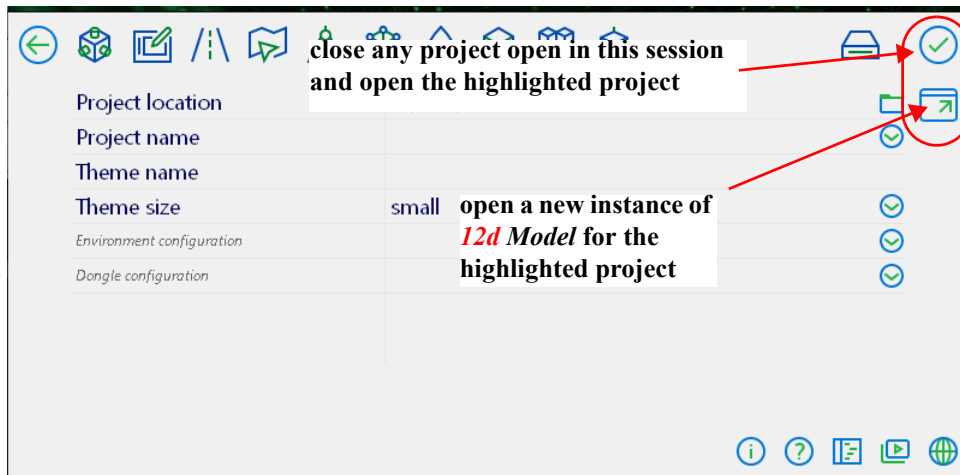
If the project already has a **Dongle configuration** then it will be displayed in this field.

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



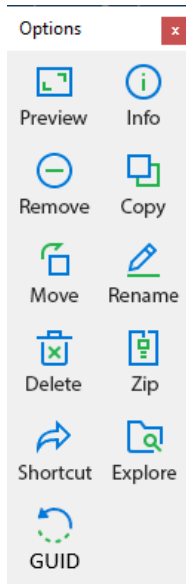
After filling in the details for the project to be opened, there are two icons on the right hand side of the panel to open the project.

Click: on the:

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

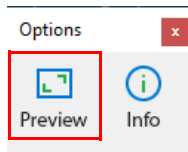
**Explore** - Open Windows explorer at the working folder.

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

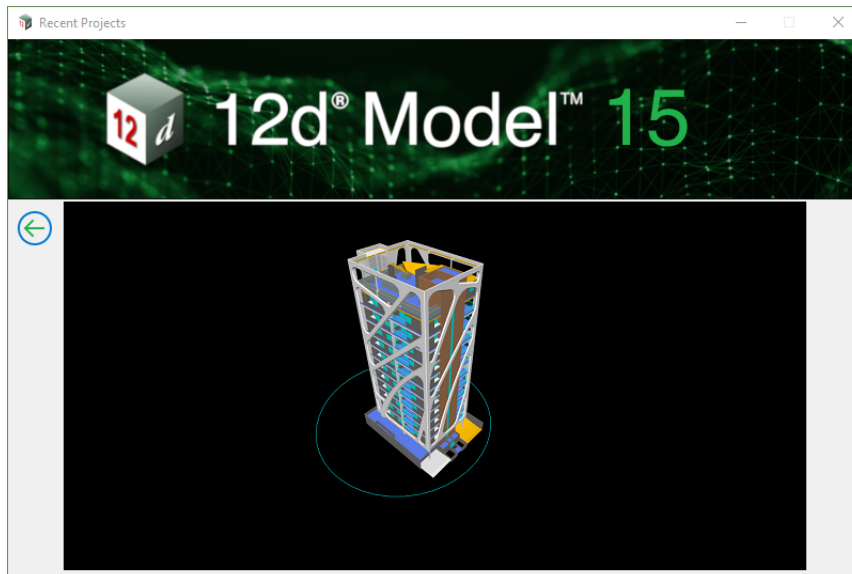
Click the left arrow icon  to return to the **Project Launcher** panel.




### 3.2.2.4.1 Preview icon



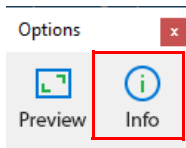
Clicking on the **Preview** icon displays the **preview** of the **project**



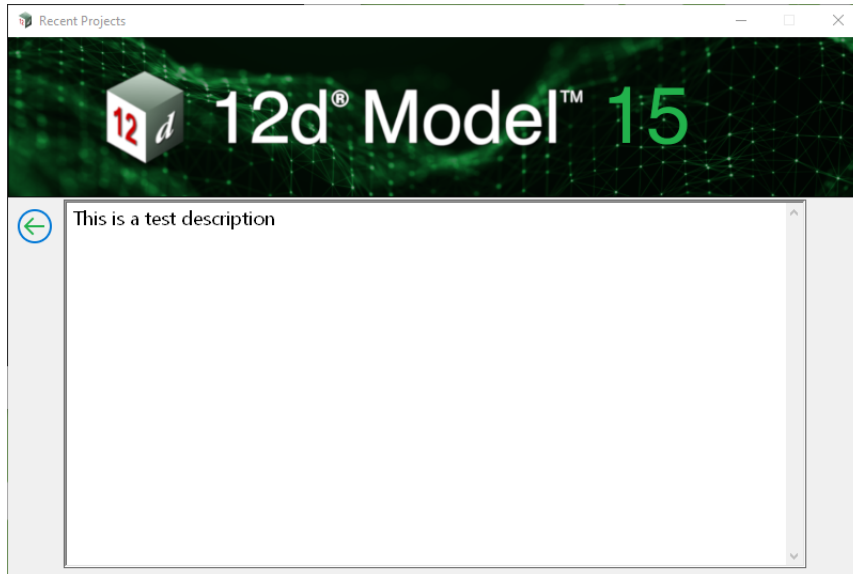
Click the left arrow icon  to return to the **Project Launcher** panel.


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.

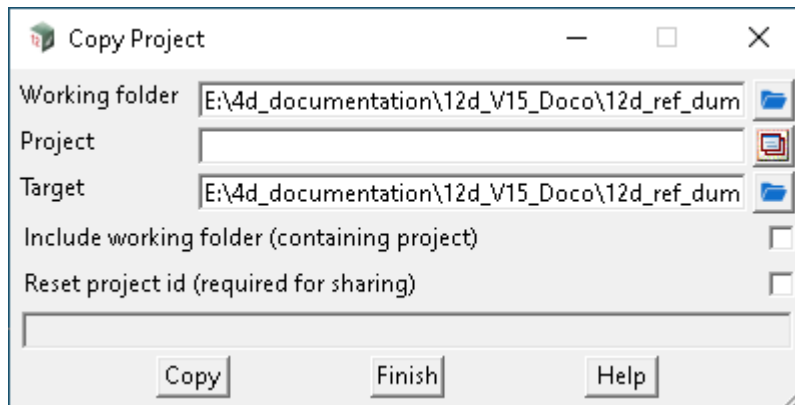
Continue to [3.2.2.4.3 Copy Project icon](#) or return to [3.2.2.4 Extra Options for the Project](#).

### 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.*

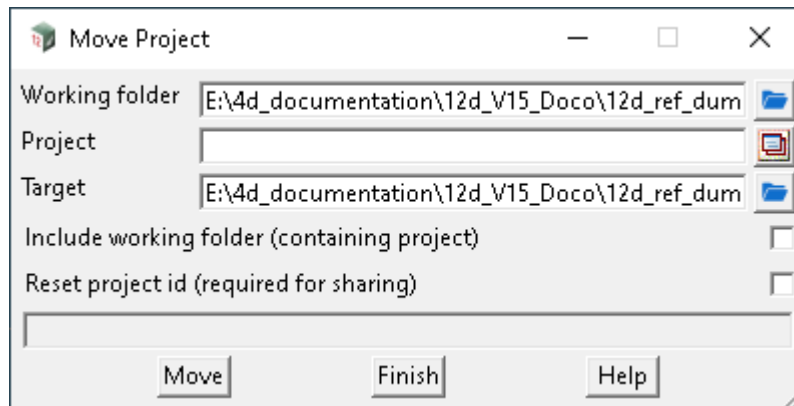
Continue to [3.2.2.4.4 Move Project icon](#) or return to [3.2.2.4 Extra Options for the Project](#).

### 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.*

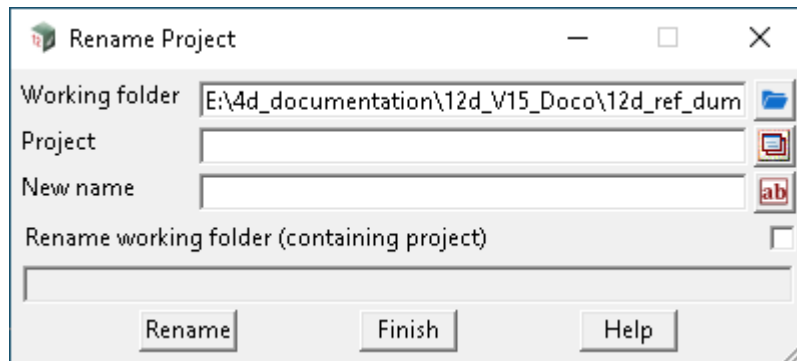
Continue to [3.2.2.4.5 Rename Project icon](#) or return to [3.2.2.4 Extra Options for the Project](#).

### 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](#).

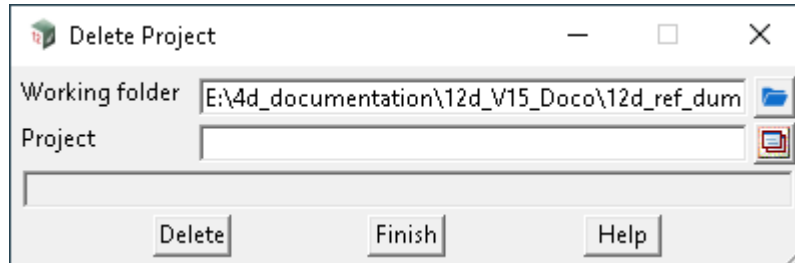


### 3.2.2.4.6 Delete Project icon

**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
-------------------	------	----------	--------

<b>Working folder</b>	file		
-----------------------	------	--	--

*Folder containing the project to be deleted.*

#### **Project**

*Name of the project to delete.*

#### **Buttons at Bottom**

<b>Delete</b>	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](#).

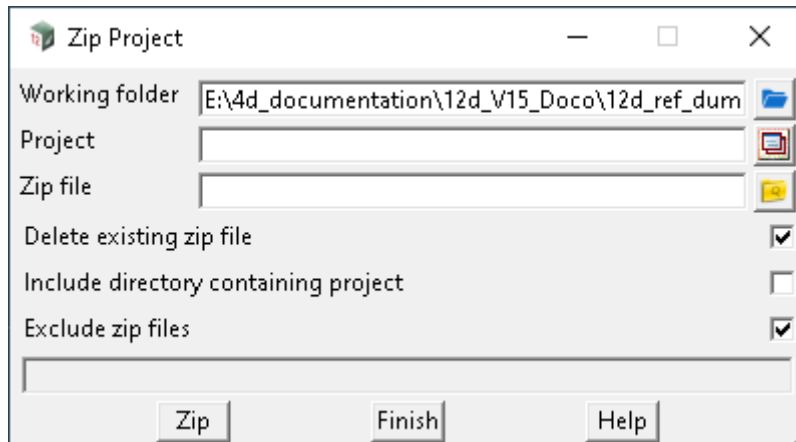
### 3.2.2.4.7 Zip Project icon

**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
<b>Working folder</b> <i>Folder where the project resides.</i>	file box		
<b>Project</b> <i>Name of the project you wish to zip.</i>	project box		
<b>Zip file</b> <i>The file to zip into.</i>	file box		
<b>Delete existing zip file</b> <i>If <b>ticked</b>, any existing zip file will be deleted.</i>	tick box		
<b>Include directory containing project</b> <i>If <b>ticked</b>, the directory containing the project (the working directory) will also be zipped, along with all sub folders.</i>	tick box		

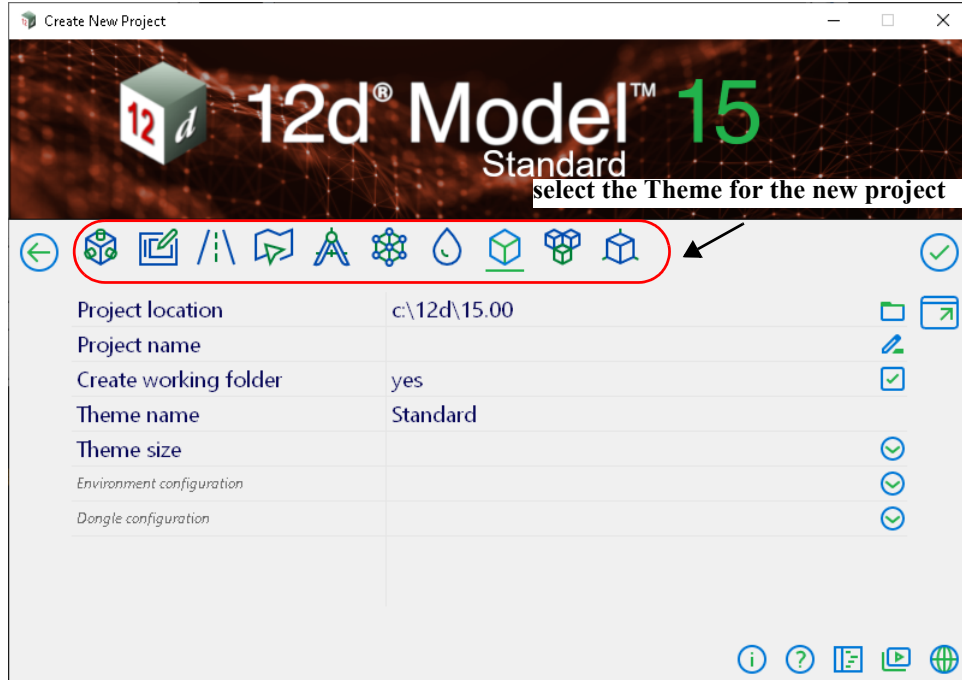
#### Buttons at Bottom

<b>Zip</b> <i>Zips the project.</i>	button
--	--------

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
-------------------	------	----------	--------

<b>Project location</b>	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).*

<b>Project name</b>	text box		
---------------------	----------	--	--

*Name of the new project.*

<b>Create working folder</b>	tick box		
------------------------------	----------	--	--

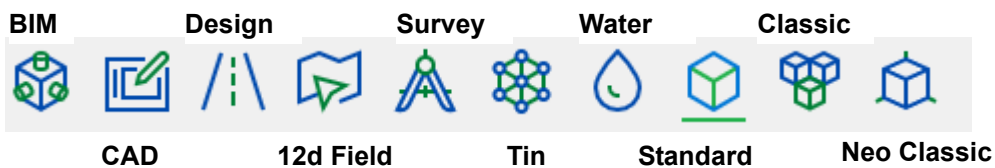
*If **ticked** then a folder of the same name as the **Project name** is created in the **Project location** and the project is created inside that folder. In that case the working folder and the project will have the same name.*

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

<b>Theme name</b>	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.

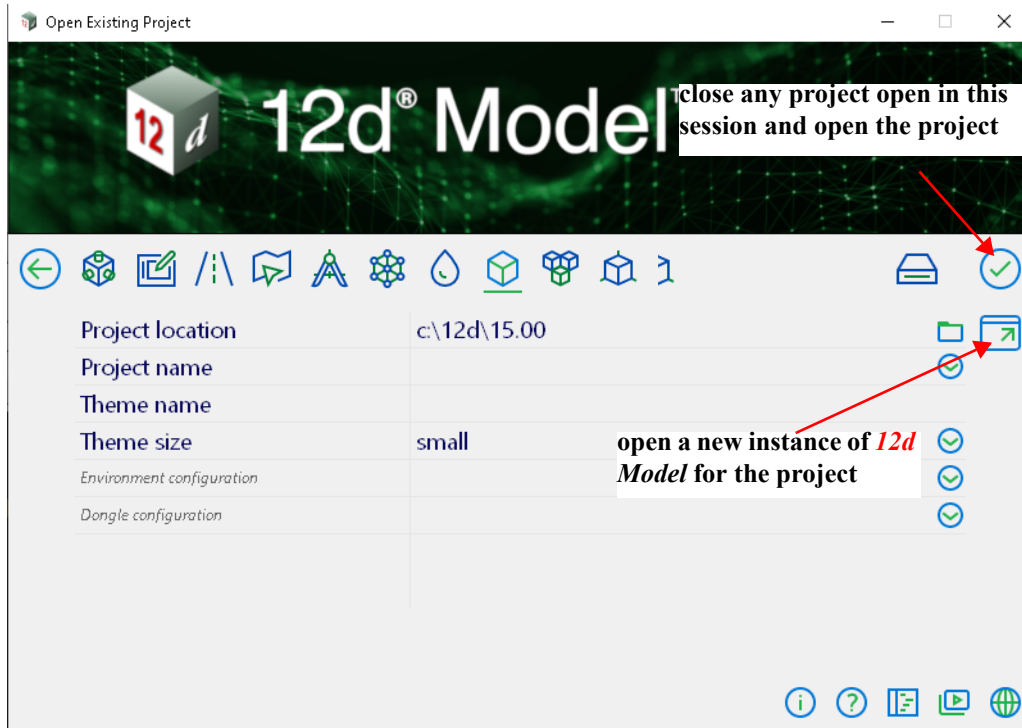
For documentation on the Open icons,  and  , see [3.2.2.3 Open and Open New Instance Icons](#)

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](#).

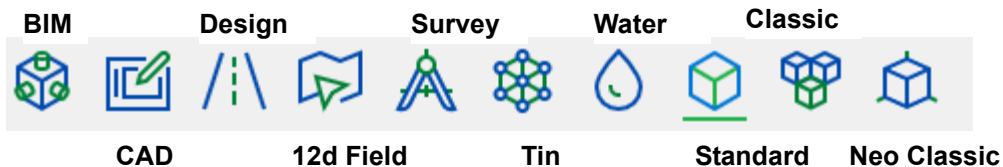
### 3.2.4 Open an Existing Project

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
<b>Project location</b> <i>Location for the project to be opened. The field will initially be filled with the <b>Default project location</b> field from the <a href="#">3.2.5 Start-Up Settings</a> panel (which may be blank).</i>	folder box		
<b>Project name</b> <i>Name of the project to be opened.</i>	project box		projects in <b>Project location</b>
<b>Theme name</b> <i>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 <b>Project location</b> field.</i>	Theme select		



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](#)

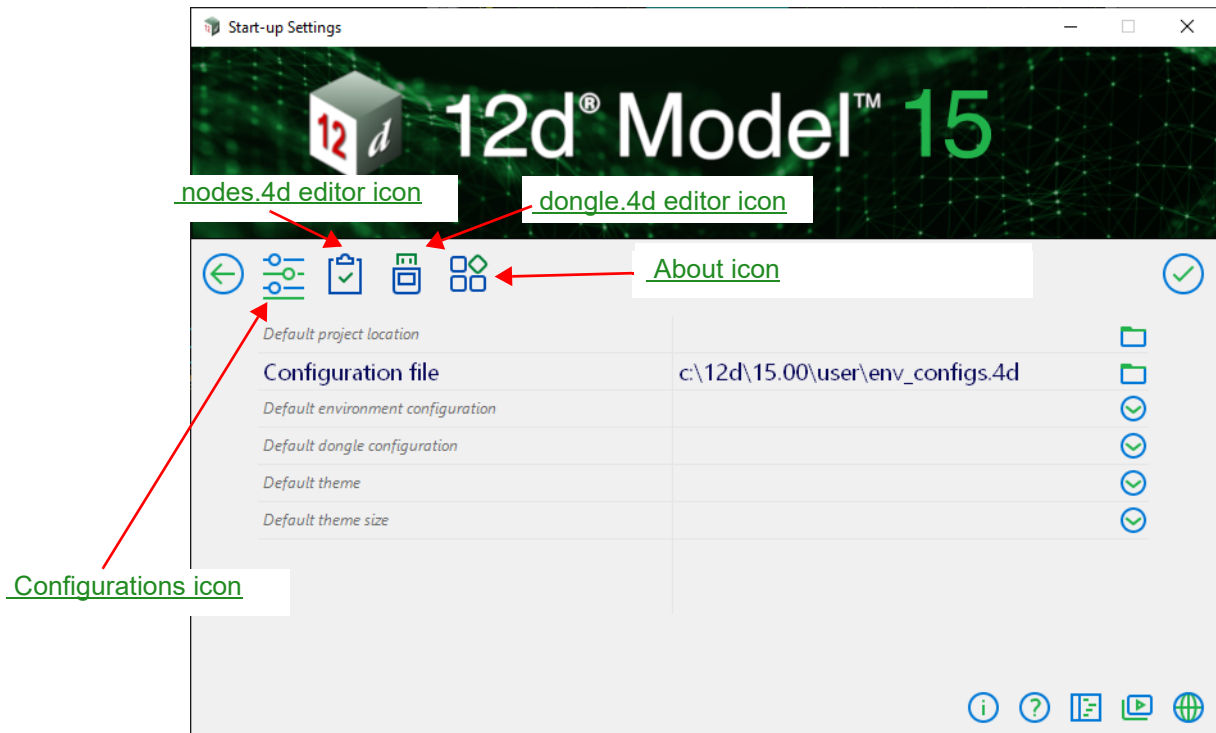
Clicking the left arrow icon  will return to the **Project Launcher** panel **without** opening a project.

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**

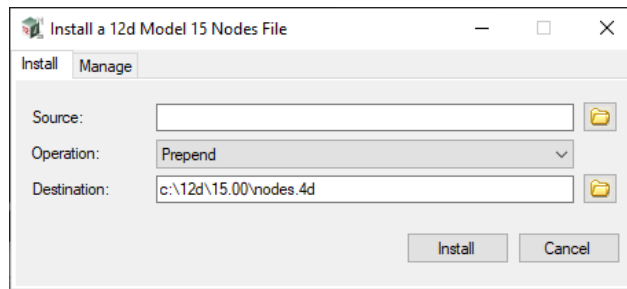
*The size of the Theme to use for a new project.*

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.

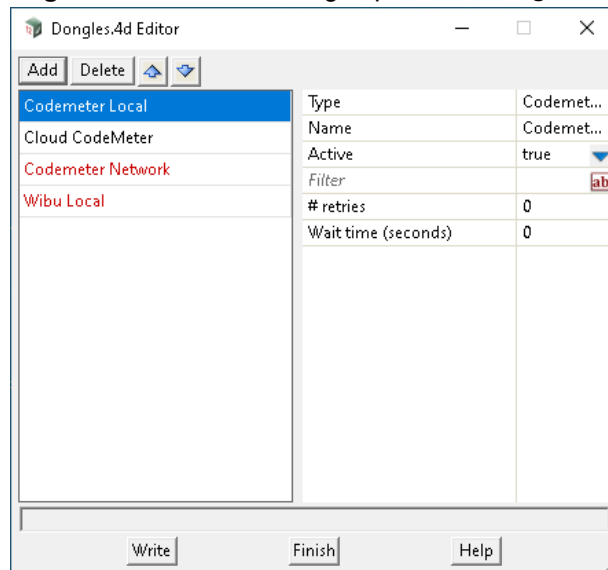
**nodes.4d editor icon**

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



**dongle.4d editor icon**

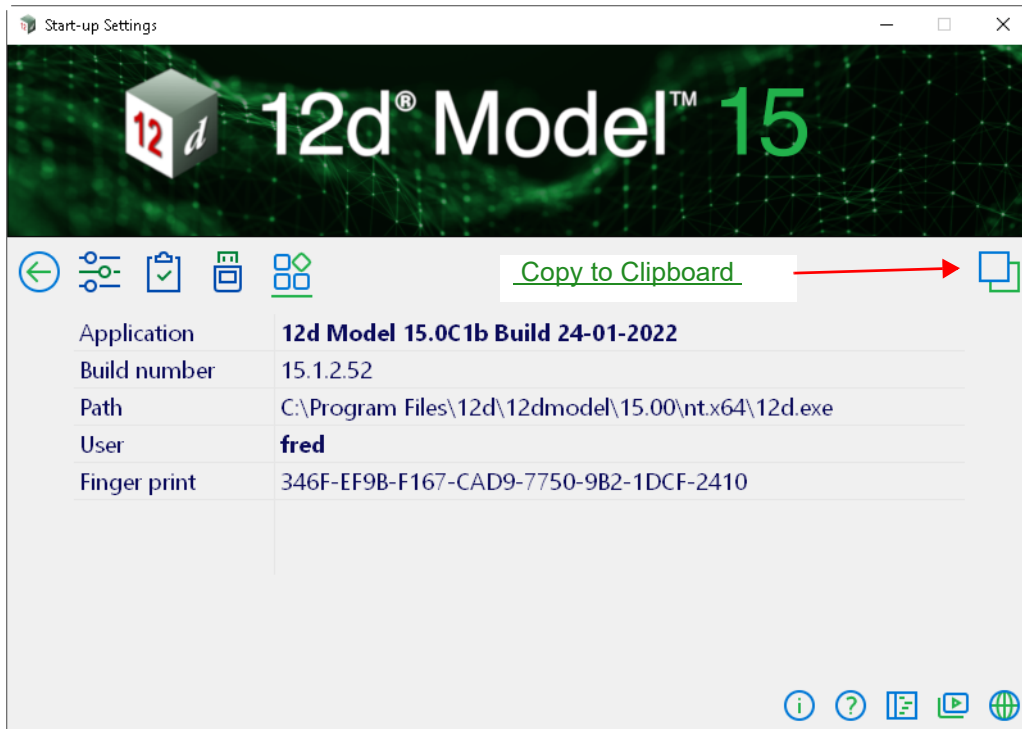
Clicking on the **dongles.4d editor** icon brings up the **Installing a 12d Model Nodes File** panel



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

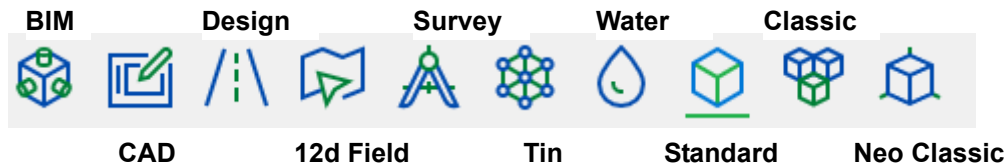
Clicking on the **Copy to clipboard** copies the information on the panel to the clipboard.

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](#).

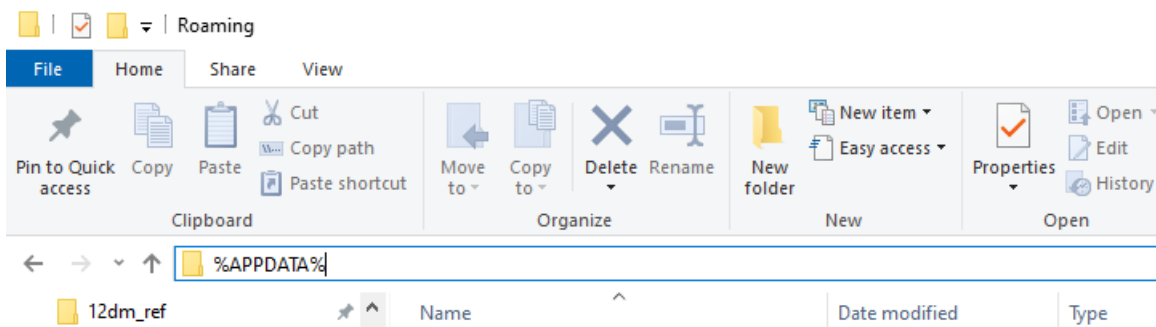
## 3.2.7 Recent Projects List

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.

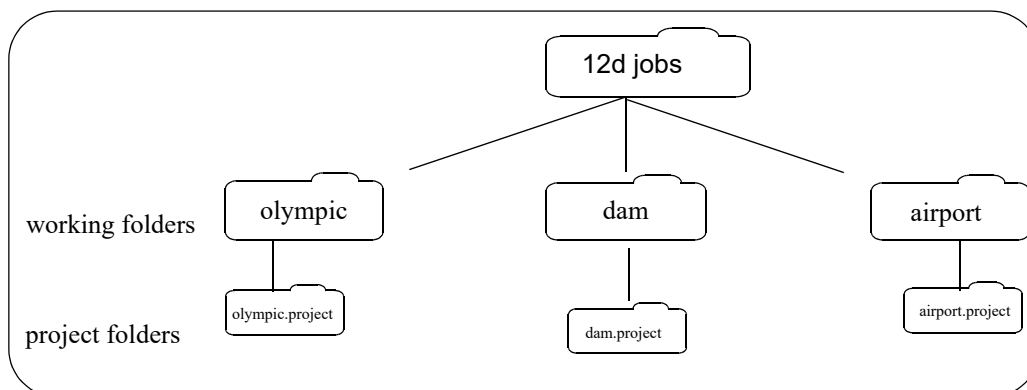
All outputs, reports and plots are written to the working folder (the folder containing the project) and are **not** held inside the project area.

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**.



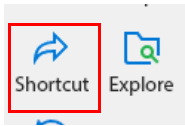
To help users adhere to this convention, when creating new projects, there is a **Create working folder** tick box which if ticked, will first create a folder of the same name as the project being created and then create the project in that folder.

Continue to [3.4 Project Shortcuts](#).

Continue to [3.4 Project Shortcuts](#) or return to [3 Starting Up](#).



### 3.4 Project Shortcuts

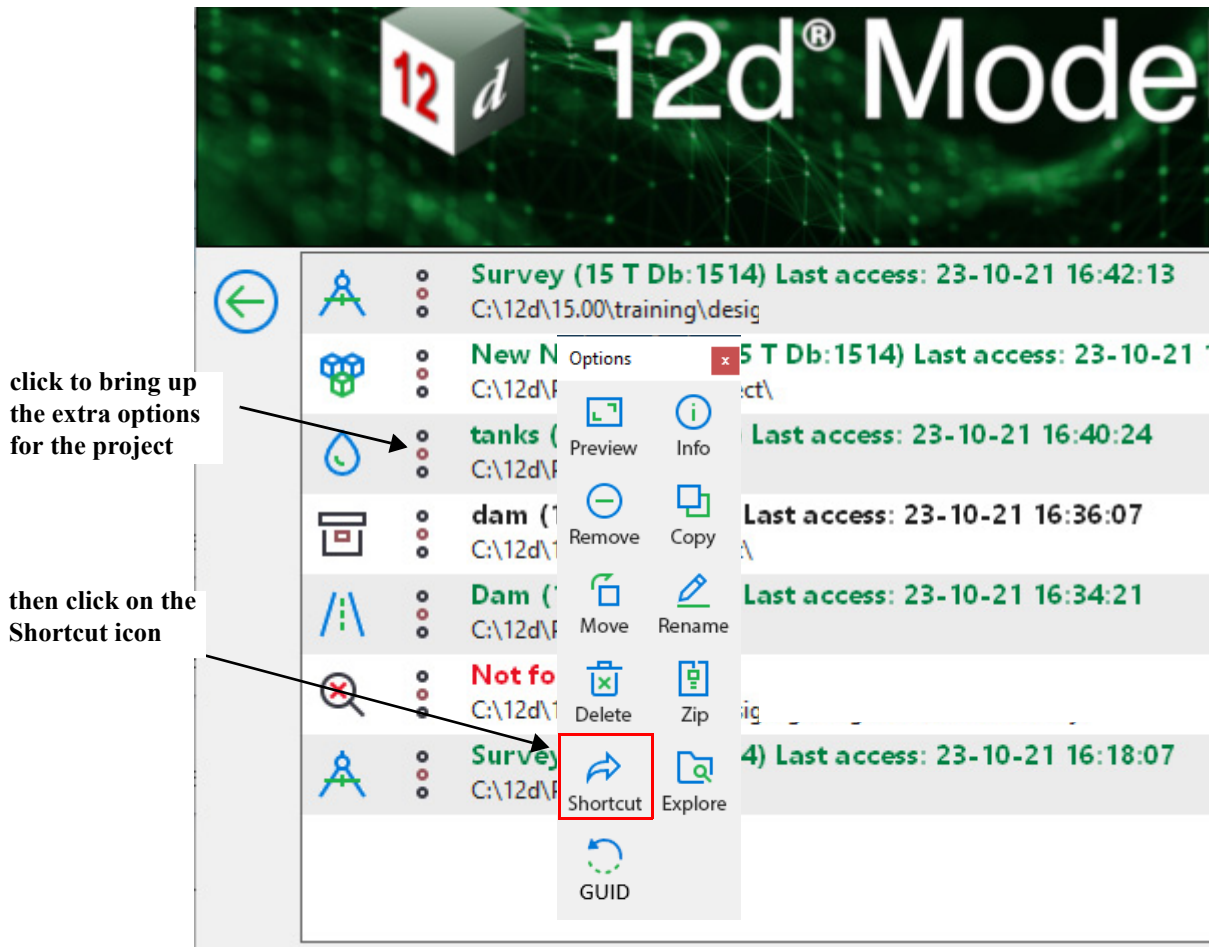


The list of most recent projects makes it very easy for **12d Model** operators to get into their projects. However if there is a folder of projects, or even a particular project, that a user wants to get into by simply double clicking on an Icon on the screen, then a Windows shortcut can be used to do it.

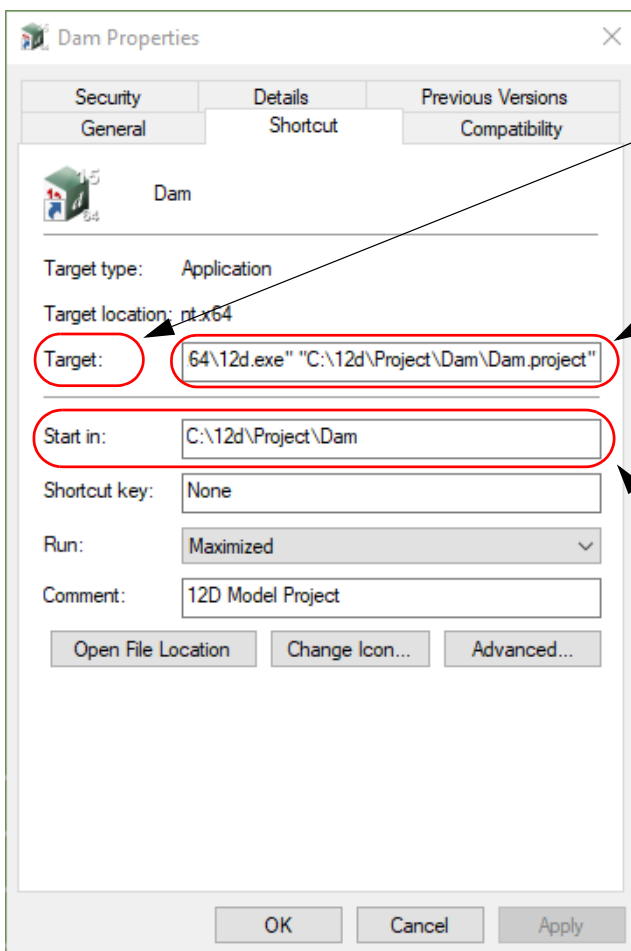
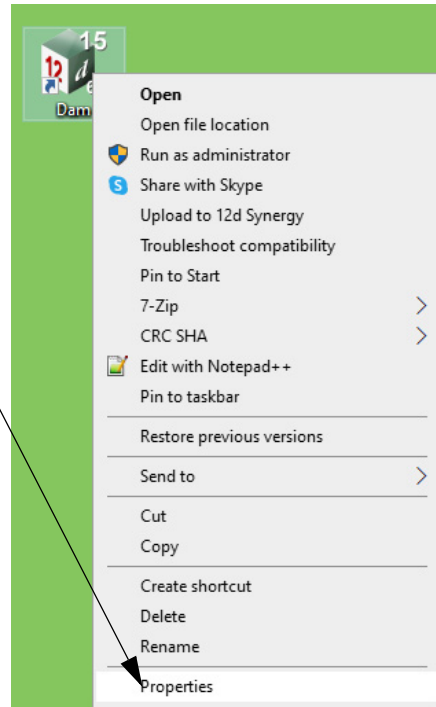
The easiest way to create the Windows shortcut is to

- (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:**

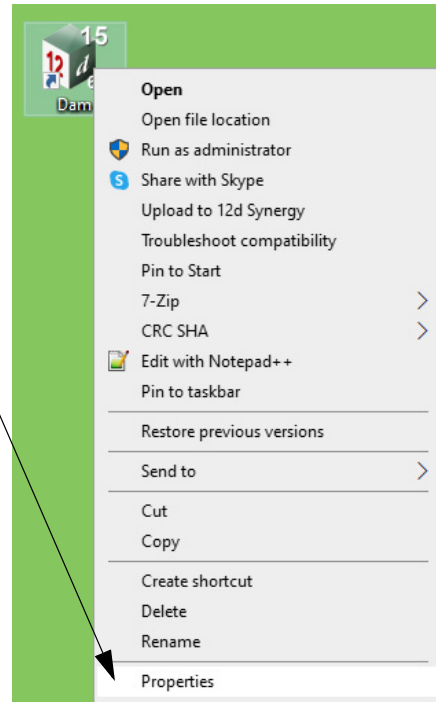
Continue to [3.5 Creating Project Shortcuts by Hand](#) or return to [3 Starting Up](#).

## 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) is 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 [35.7 Arguments When Starting 12d Model](#) in Appendix [35 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 [34 Environment Variables](#) in Appendix [35 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 [35.7 Arguments When Starting 12d Model](#) in Appendix [35 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 **log?????.4de**

where **?????** 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](#).

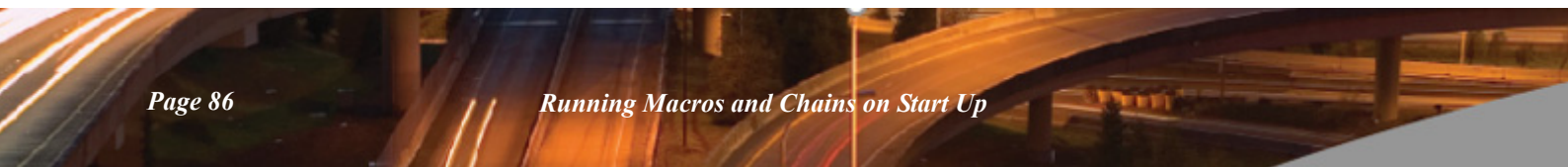
## 3.8 Running Macros and Chains on Start Up

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 [35.6 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](#)

[4.2 Polymesh](#)

[4.3 Border and Border Style](#)

[4.4 Options Search Bar](#)

[4.5 Panel Fields](#)

[4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#)

[4.7 Chainage Equalities](#)

[4.8 Sharing of Models and Tins](#)

[4.9 Enabling Long Paths in Windows](#)

[4.10 Migration of Projects From Command Line](#)

[4.11 Startup Information in Output Window](#)

[4.12 Comparing Attribute Data](#)

[4.13 Writing XSLT Files](#)

## 4.1 Attribute Data Panel

Now documented in the V15 reference manual

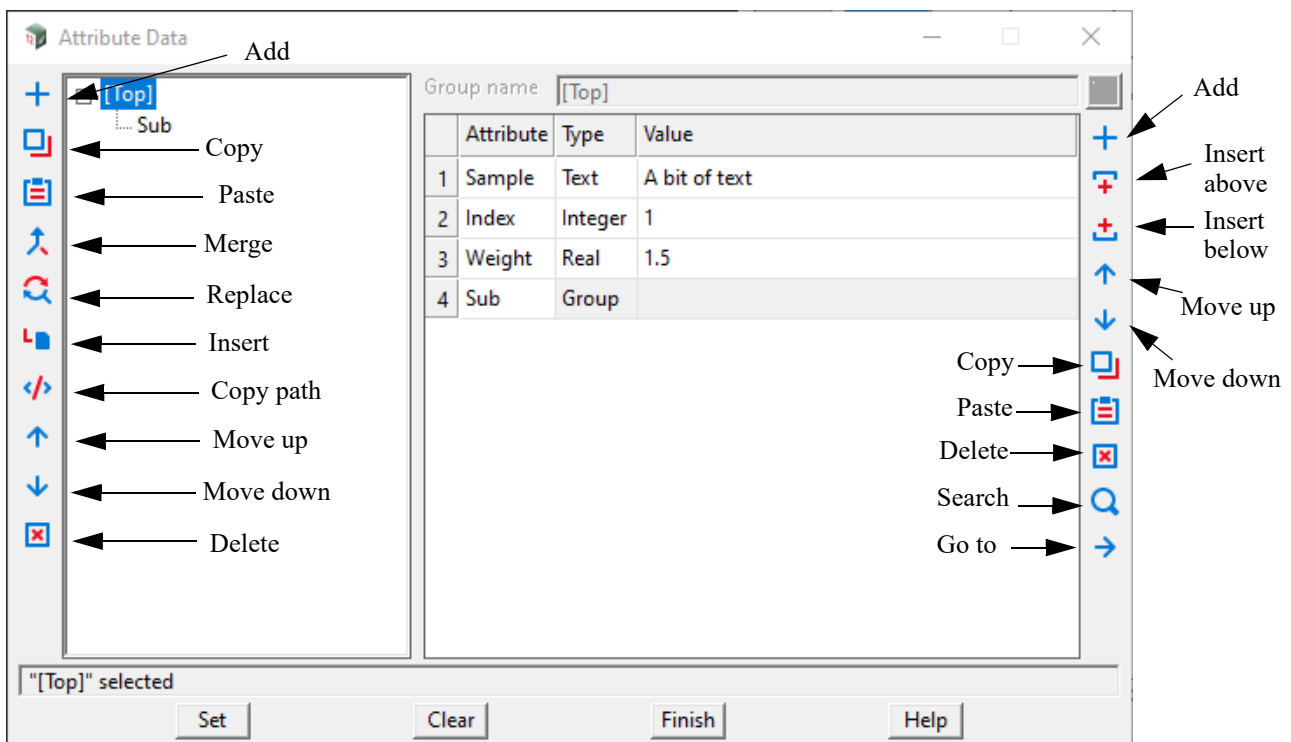
In many options when attributes are to be defined, the Attribute Data panel is displayed. Or similar panel with the name of the Object having attributes added to it. For example, Project, or Model, or String.

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.

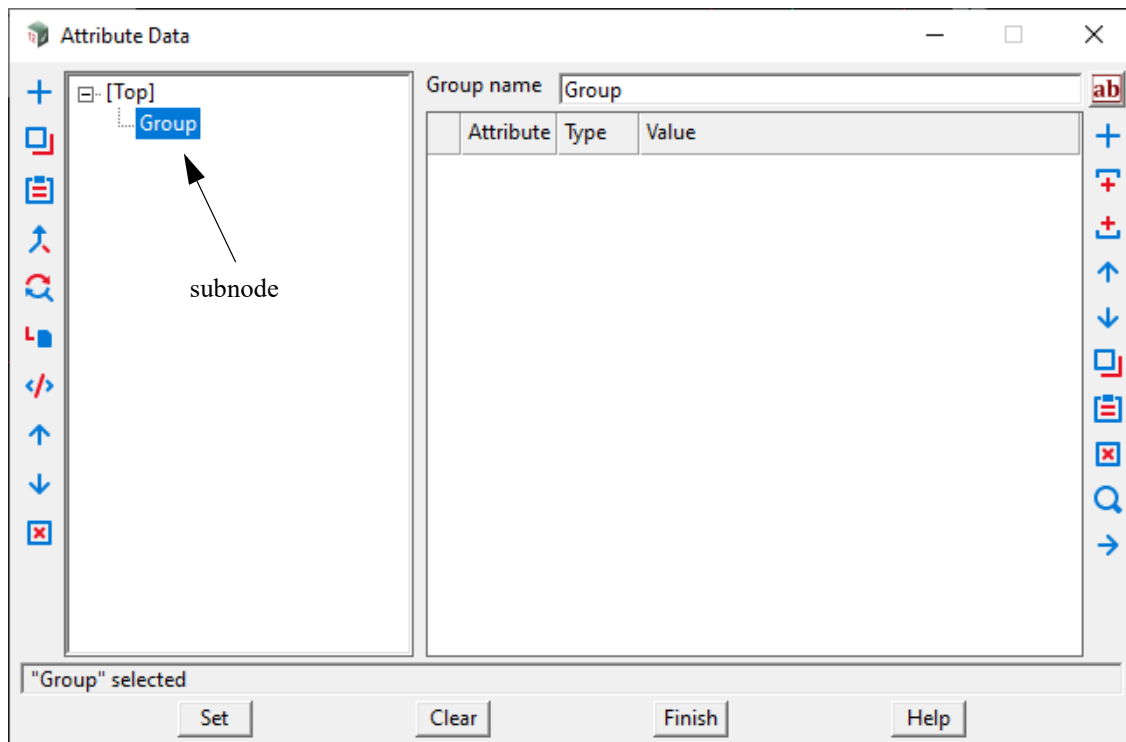
The value for the attribute is entered using the pop up in the Value column.

Click on Set to save the attributes.

### Sub nodes:

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

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

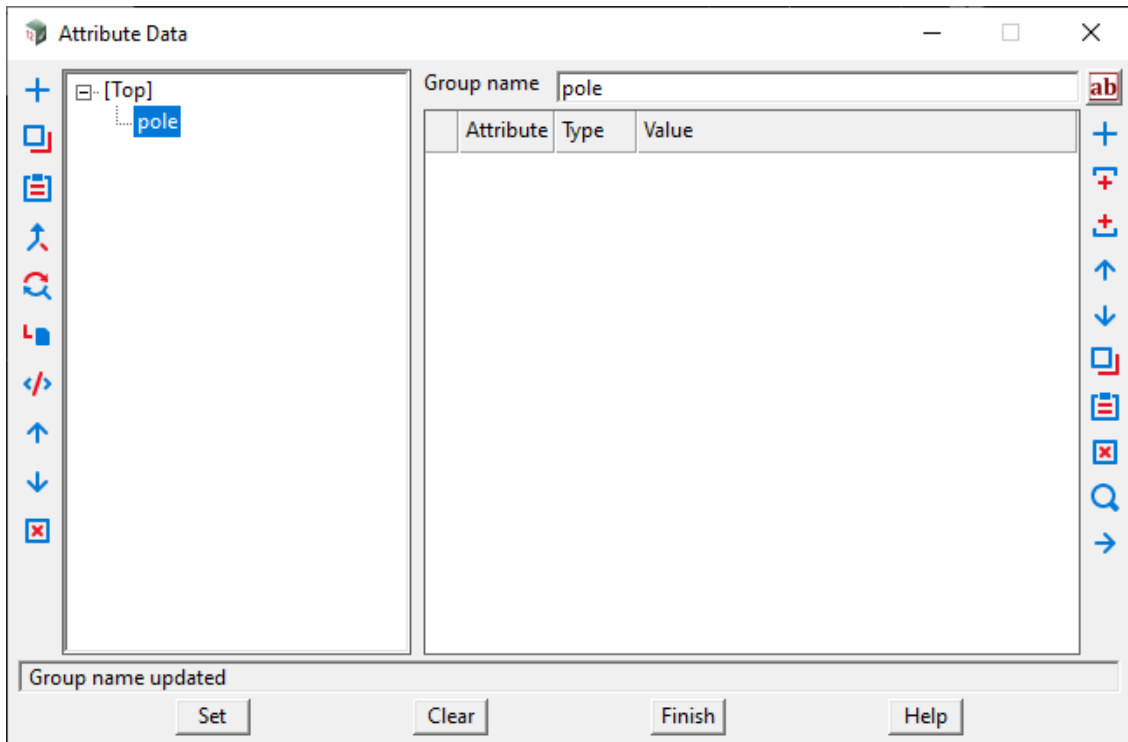


A sub node call Group is then created.

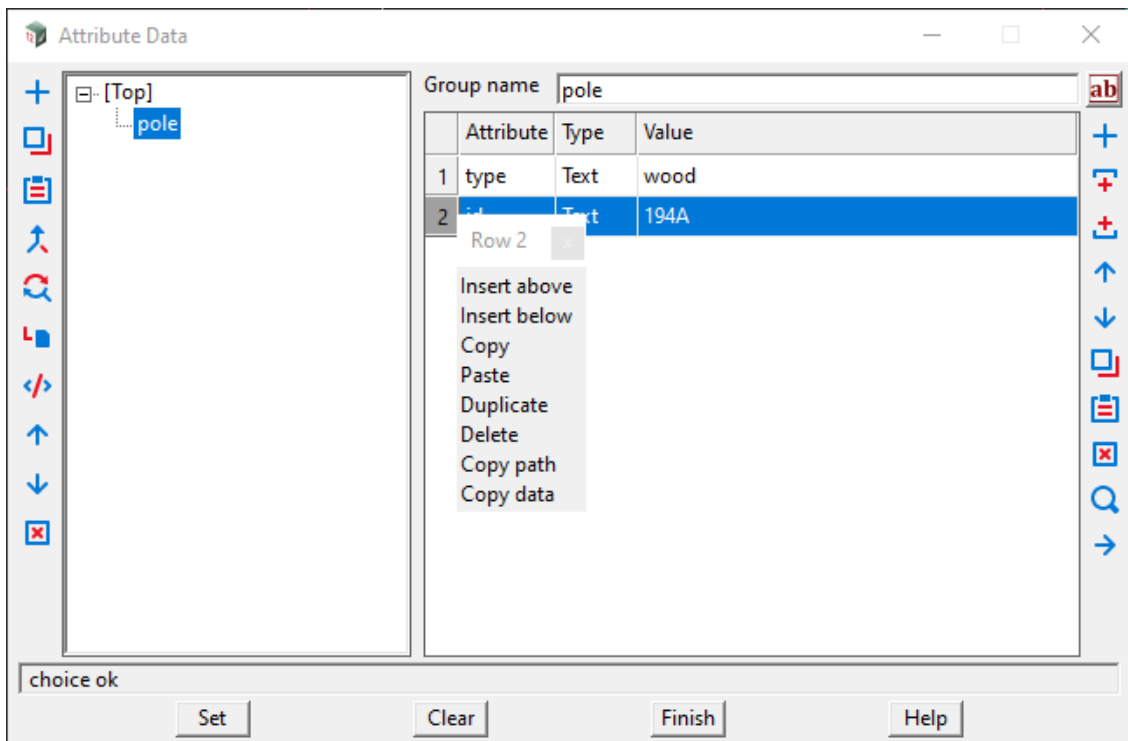
Any attributes for the sub node are then entered into the right hand grid that displays when the Sub node is highlighted. Clicking the Set button saves the attributes.

To change the name of the sub node 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.

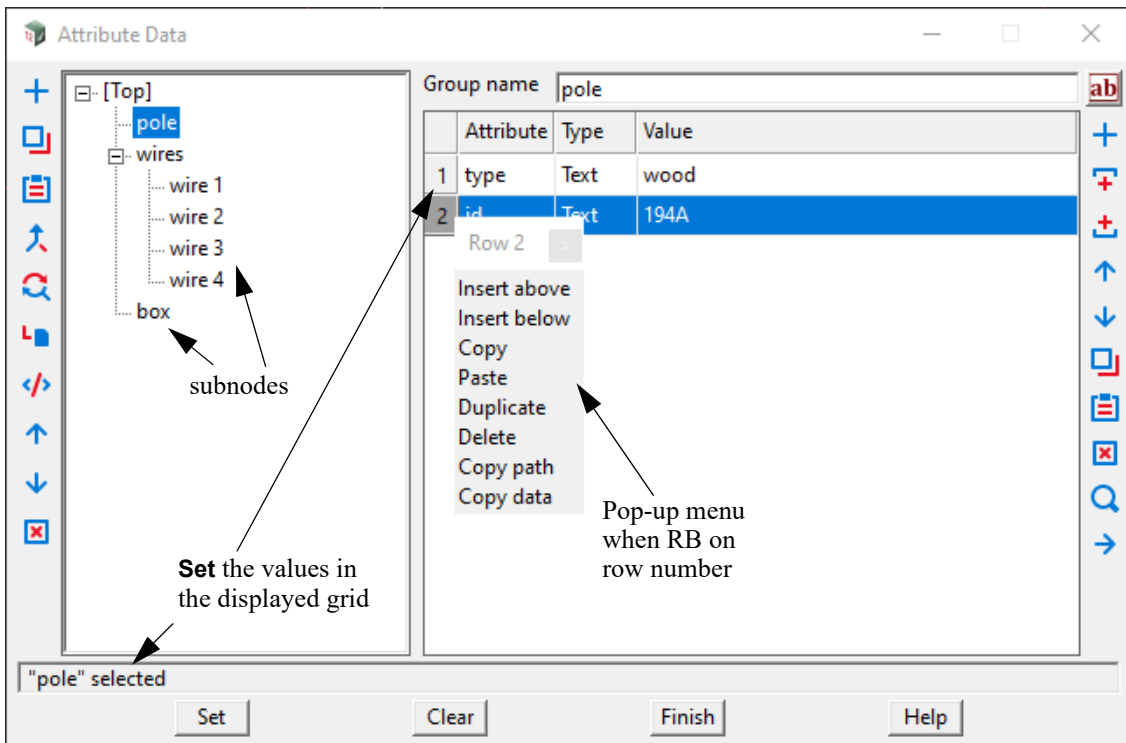
The sub node will then be displayed with the new name.



Attributes can be added to the new sub node



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

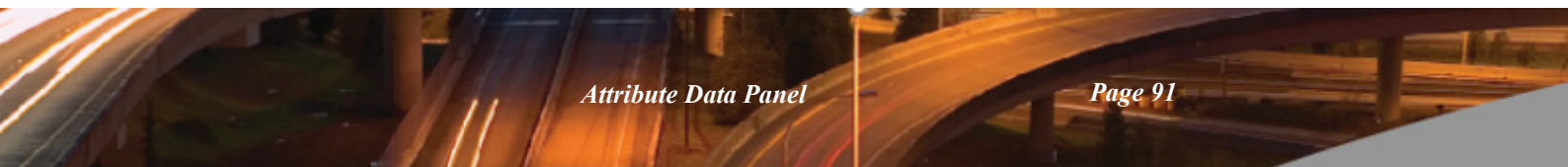
*Insert the attribute buffer as a child to the highlighted attribute node.*

**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

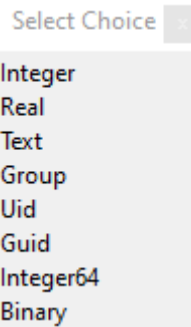
*Delete the highlighted attribute node.*

### 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

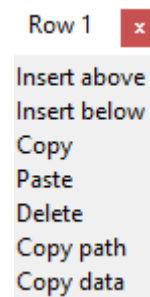
Paste the content of the current clipboard from 12d Model and other software (tab delimited format) to the currently selected cells and create new attributes if the clipboard buffer has more data.

**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 [4.2 Polymesh](#) or return to [4 Tools and Concepts](#).

## 4.2 Polymesh

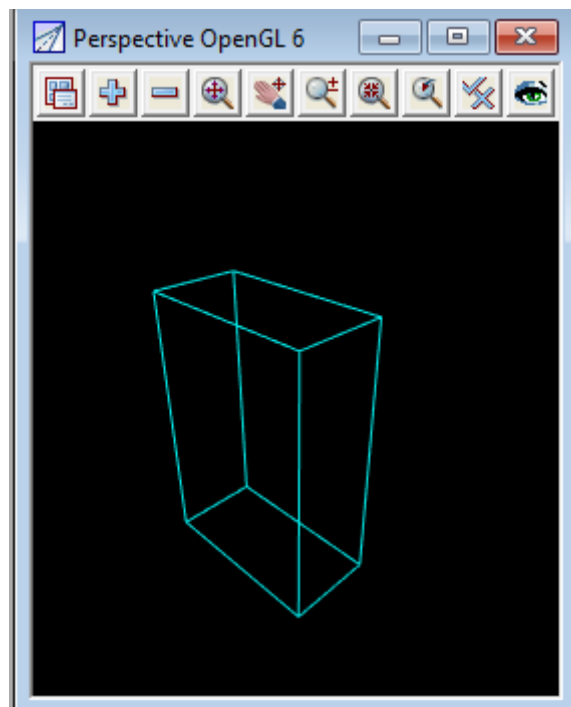
Now documented in the V15 reference manual

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 wireframe** is [on].

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

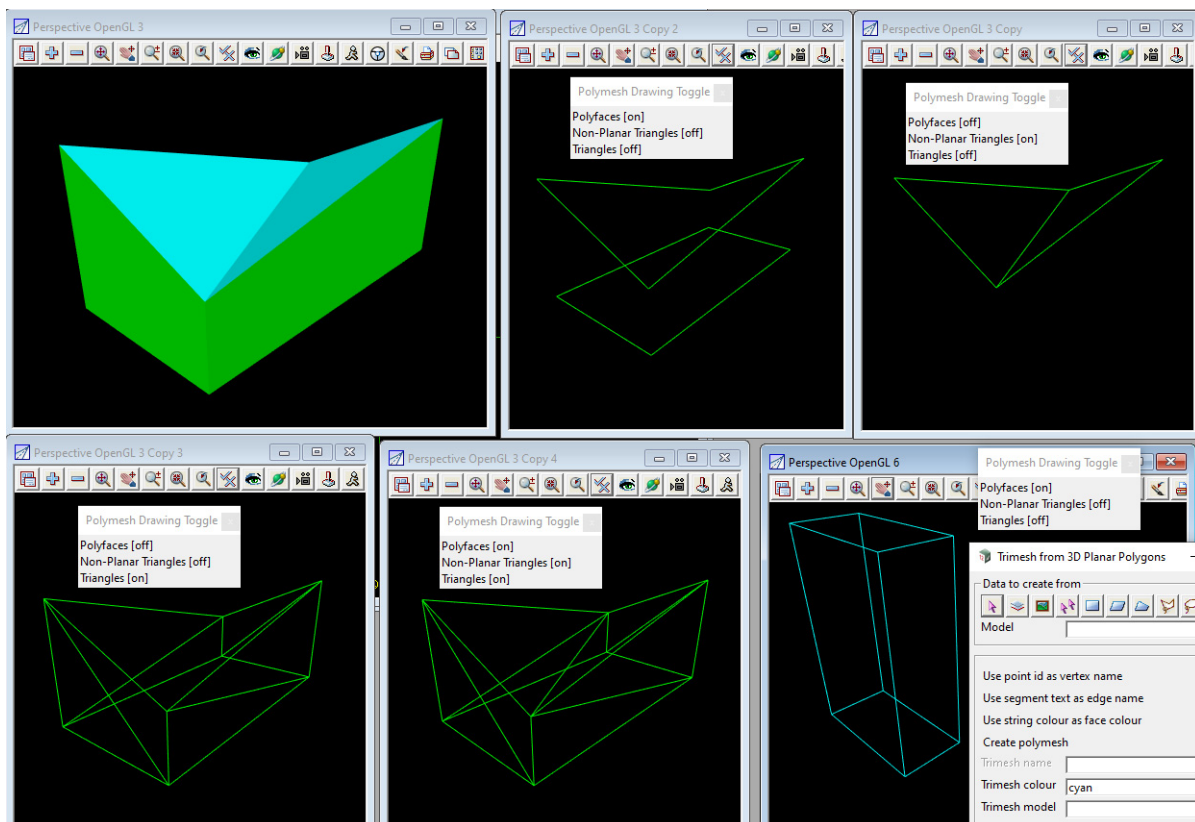
**Polyfaces** - when toggled on, the boundary polygon of any planar faces are drawn on the view. This probably should say Planar polyfaces.

**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.



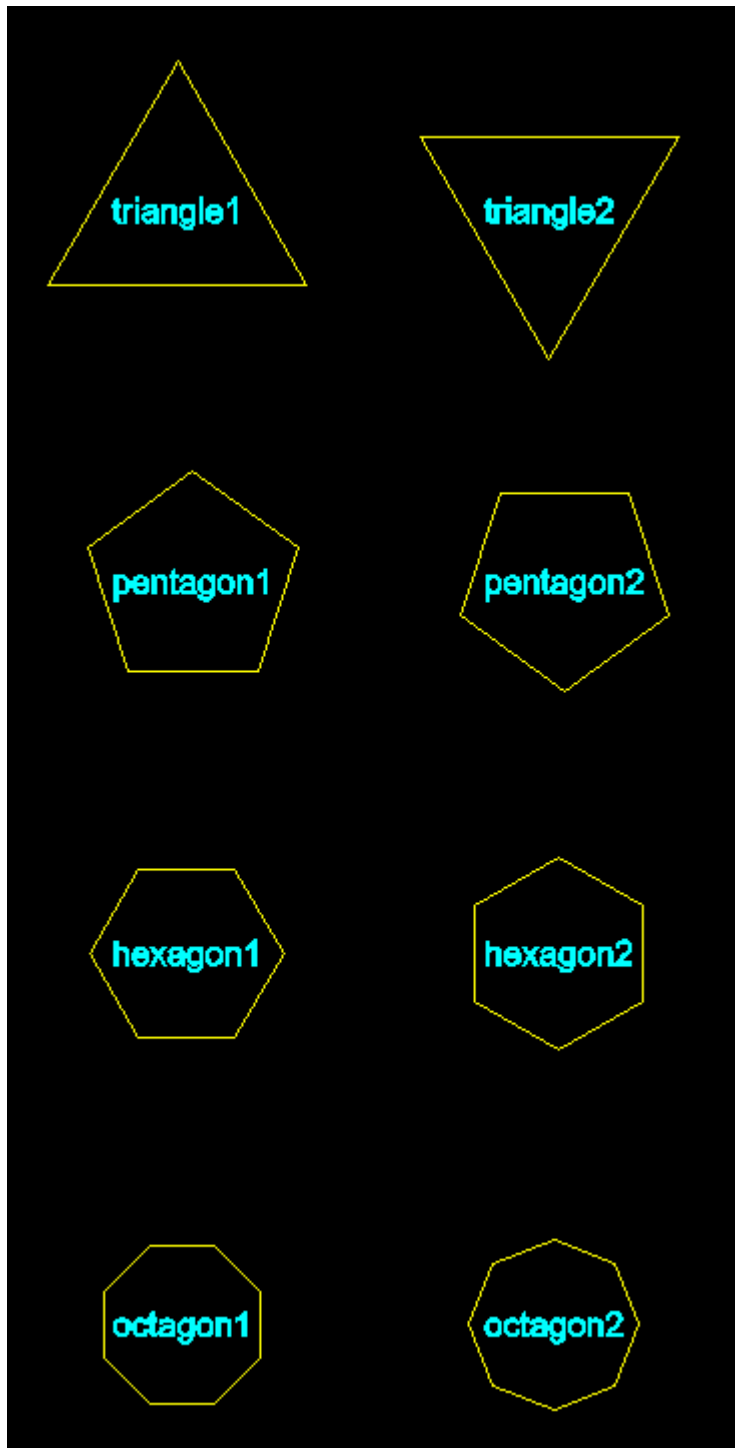
Continue to [4.3 Border and Border Style](#) or return to [4 Tools and Concepts](#).

## 4.3 Border and Border Style

Now documented in the V15 reference manual

Additional styles include:

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

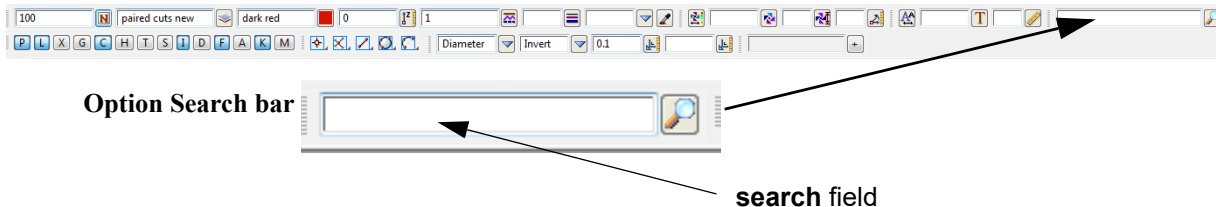


Continue to [4.4 Options Search Bar](#) or return to [4 Tools and Concepts](#).

## 4.4 Options Search Bar

Now documented in the V15 reference manual

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



Option Search bar

search field

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

- the **titles of the hard coded panels** (i.e. not macros) that satisfy the search criteria  
The full title of the panel is shown
- 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.
- 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.

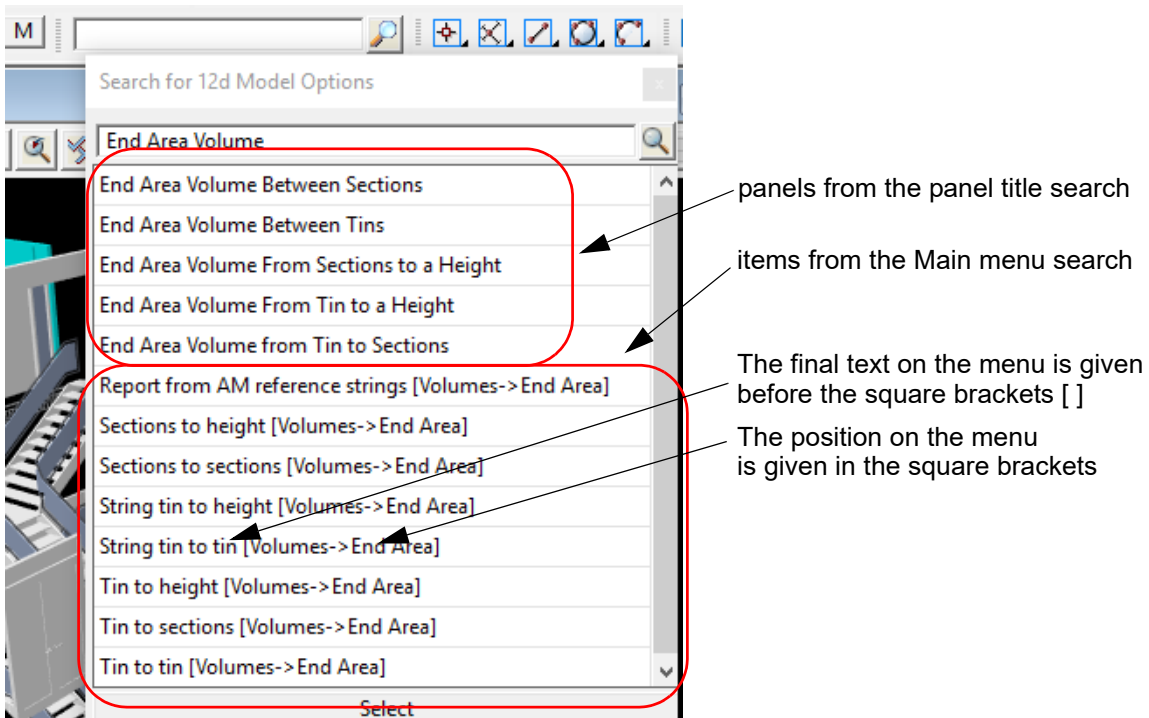
The search only needs a partial match and is case insensitive. That is, the keyword only has to match part of the text and case is ignored. For example, "vol" will match "Volume".

For information on the logic operators used in the search, see [4.4.1 Options Search Bar Syntax](#).

In the simplest case, the **key words** are separated by spaces and a space is an **AND** operator so the search finds the text with **case insensitive partial matches** to **all** the key words.

For example, typing in the key words **End Area Volume** into the **Search field** will bring up the list of found options as a **Search for 12d Model Options** panel which is **separate** to the **Options Search bar**:

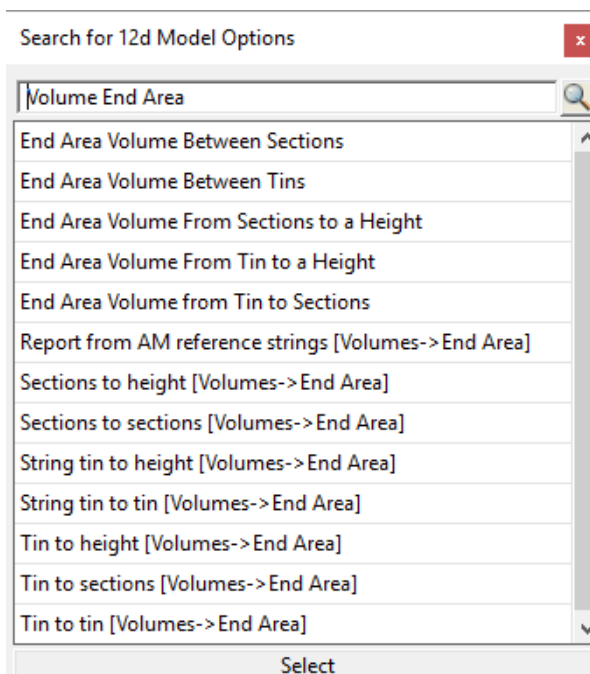




Double clicking on an item in the list brings up the panel for that option.

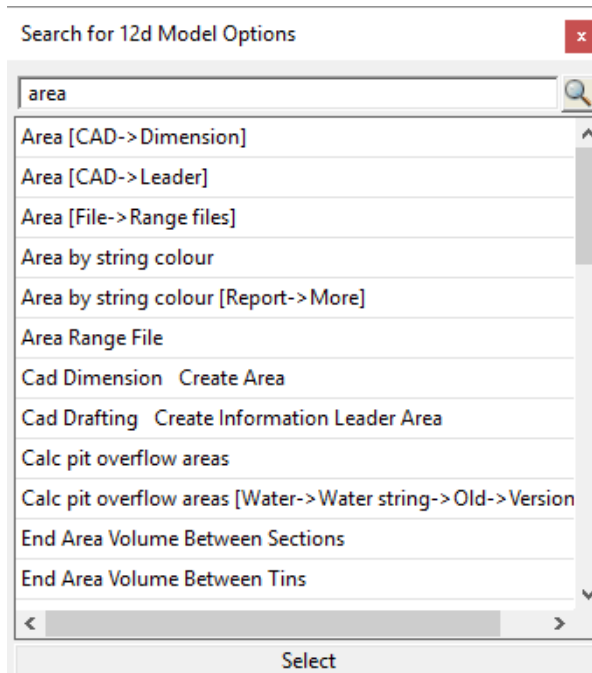
**Important Note**

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

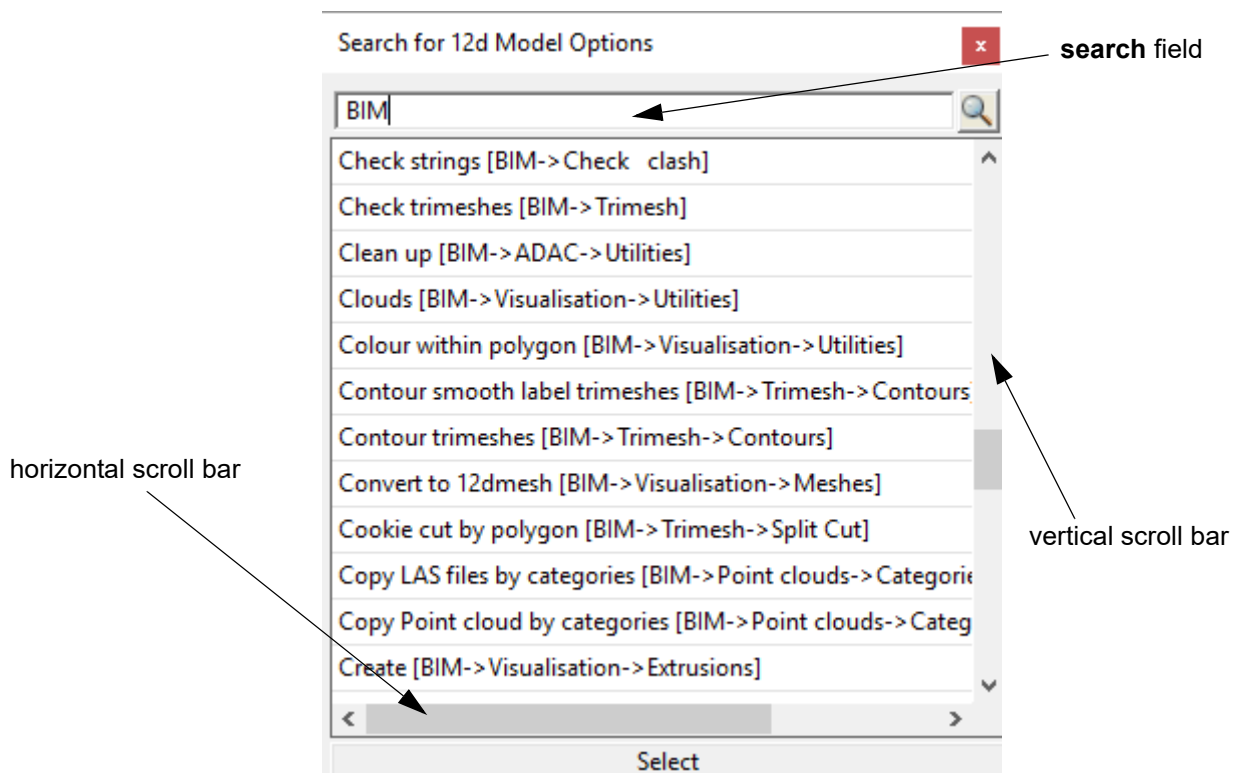


Also note that **Volume** matched with **Volumes** as a keyword only requires a match with part of a word.

And it was just luck that in this list all the panel names came before the Main menu path names. Typing in **area** will mix them up.



The settings for controlling the size of the list of options in the **Search for 12d Model Options Bar panel** are saved as **Project Settings** (see [6.8.2.11 Search Bar Settings](#)) and if the selected options list is either wider or higher than the width of the pop-up list, then horizontal and/or vertical scroll bars are added to the panel.



Search bars can be pinned ([4.4.2 Moving the Search for 12d Model Options Panel](#)) and the Search text can also be saved for reuse ([4.4.3 Saving and Reusing Searches](#)).

## 4.4.1 Options Search Bar Syntax



The **search** field in the **Options Search Bar** does allow more than 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

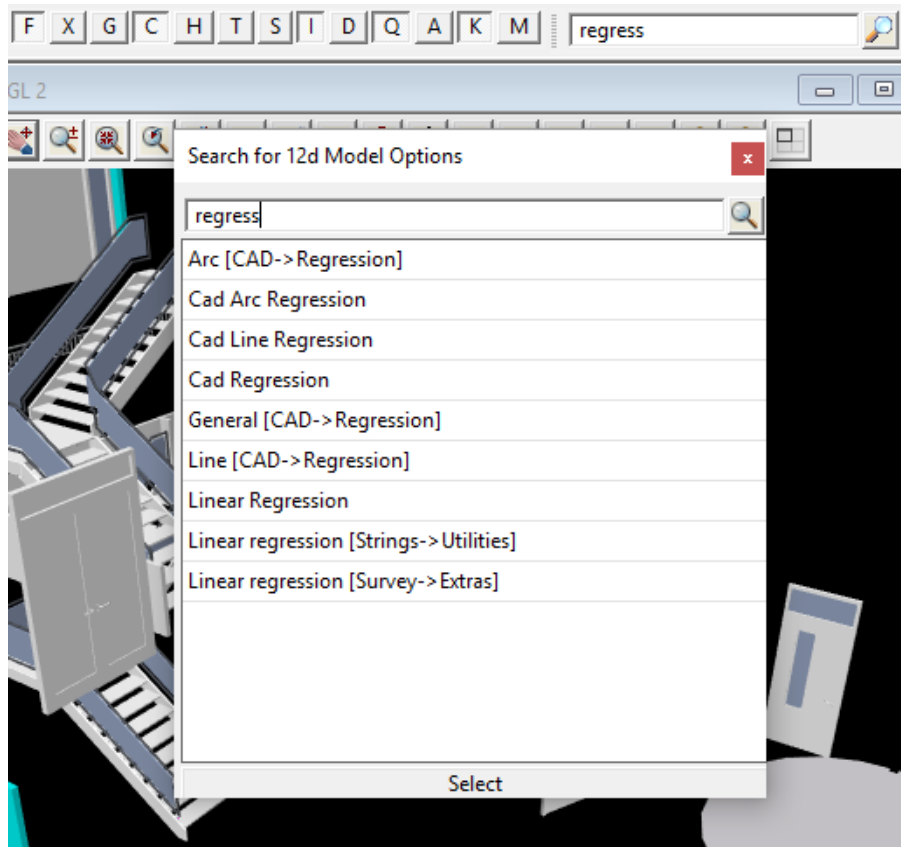
### Important Note

The search for **12d Model** options is **case insensitive**.

## 4.4.2 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 then 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 Option** panel.

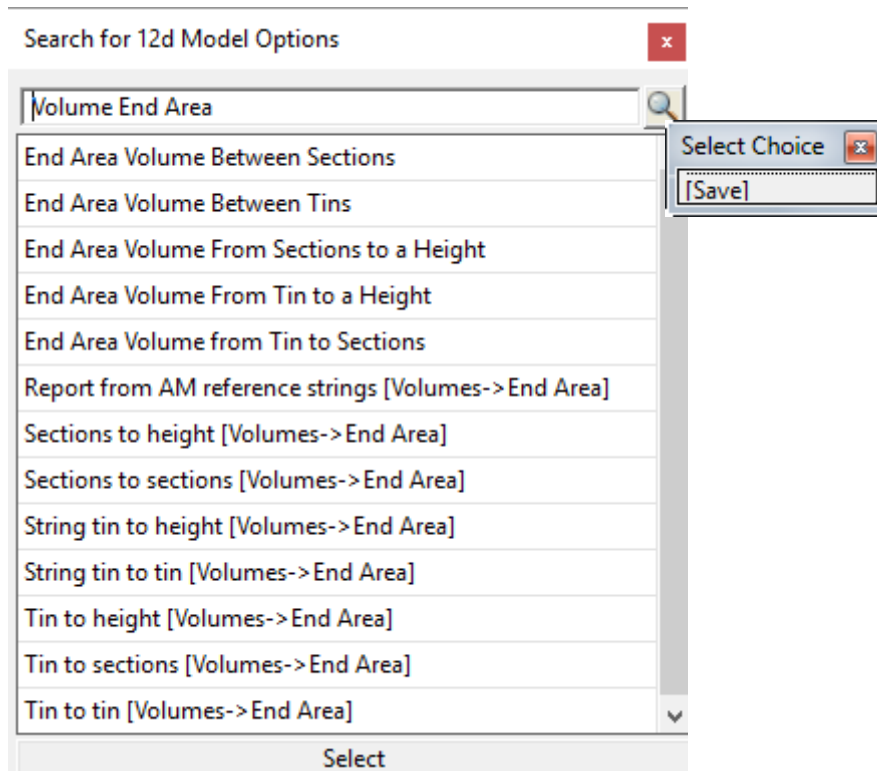
When the pinned panel is removed, the text in the **Search** field of the **Search for 12d Model Option** panel is written to the **Options Search Bar**.

Any text in the **Search** field text can be saved and reused for future **Search for 12d Model Option** panels (see [4.4.3 Saving and Reusing Searches](#)).

### 4.4.3 Saving and Reusing Searches

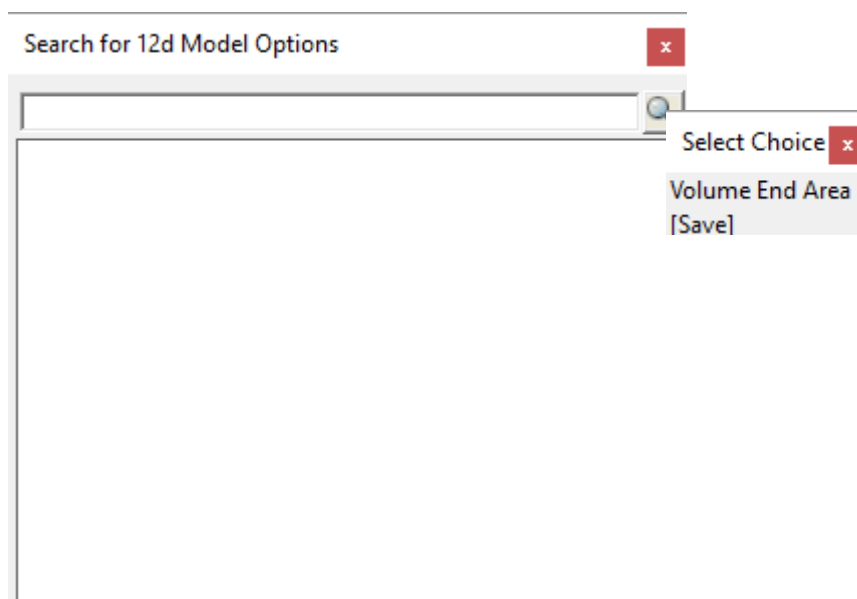
When text is typed into the **Search** field in the **Search for 12d Model Options** panel, the text typed in can be saved and reused for future Searches.

When the information is typed, click on the **Information** (magnifying glass) icon and click on **[Save]**.

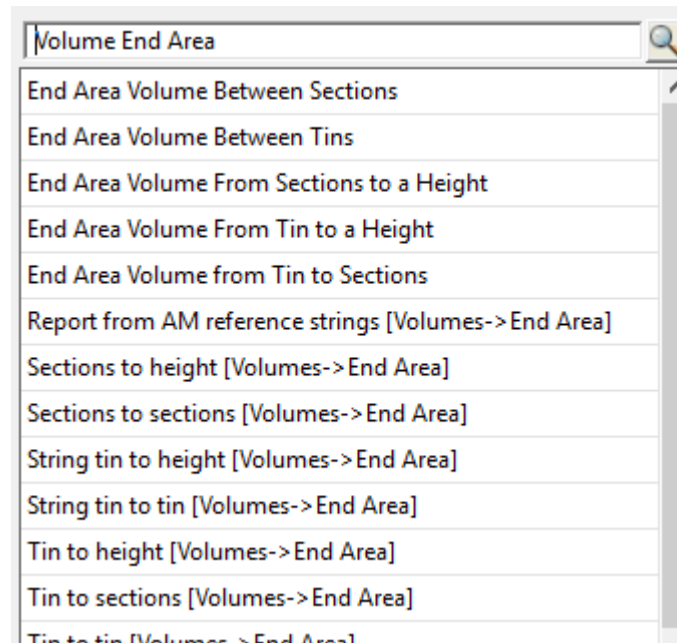


The text will be saved away when a Project **Save** is one.

In future, for any **Searches** of the same type, clicking on the **Information** icon will display the list of saved **Search** texts.



Clicking on a **Select Choice** text will pipe it into the panel and apply it.

**Note:**

The Search text is only saved for the Project when a **Project =>Save** is done.

The **Saved Searches** can also be examined and modified via the **Project Settings** panel.

Continue to [4.5 Panel Fields](#) or return to [4 Tools and Concepts](#).



## 4.5 Panel Fields

See

[4.5.1 Unit Conversions in Real Value Fields](#)

[4.5.2 Choice Box](#)

### 4.5.1 Unit Conversions in Real Value Fields

Now documented in the V15 reference manual

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 1/2"** 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

## 4.5.2 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 [4.5.2.1 .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 [4.5.2.2 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 [4.5.2.3 Older Style Choice Box](#)

**Note:**

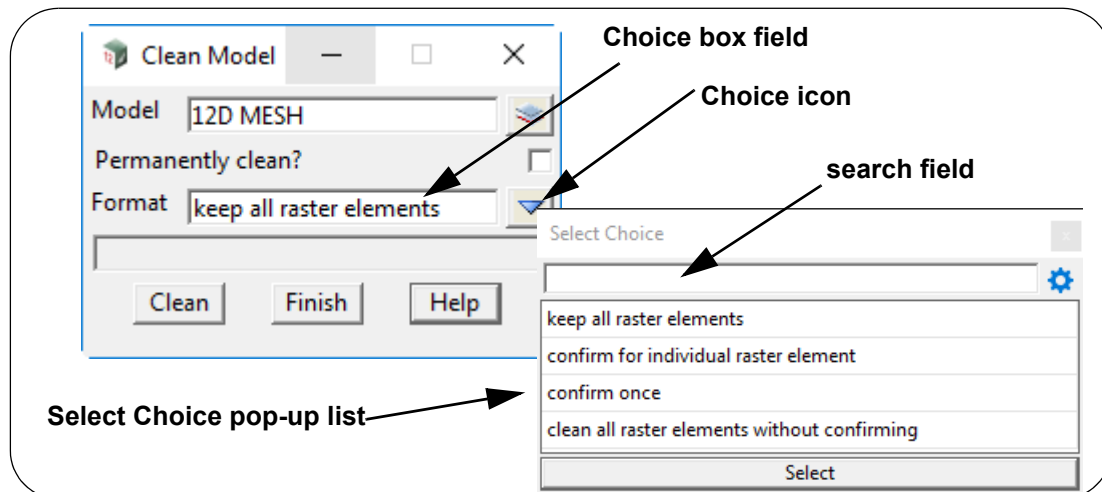
There are other specialised boxes such as **Model box** or a **Tin Box** that also allow users to select from a pop-up list.

#### 4.5.2.1 .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.

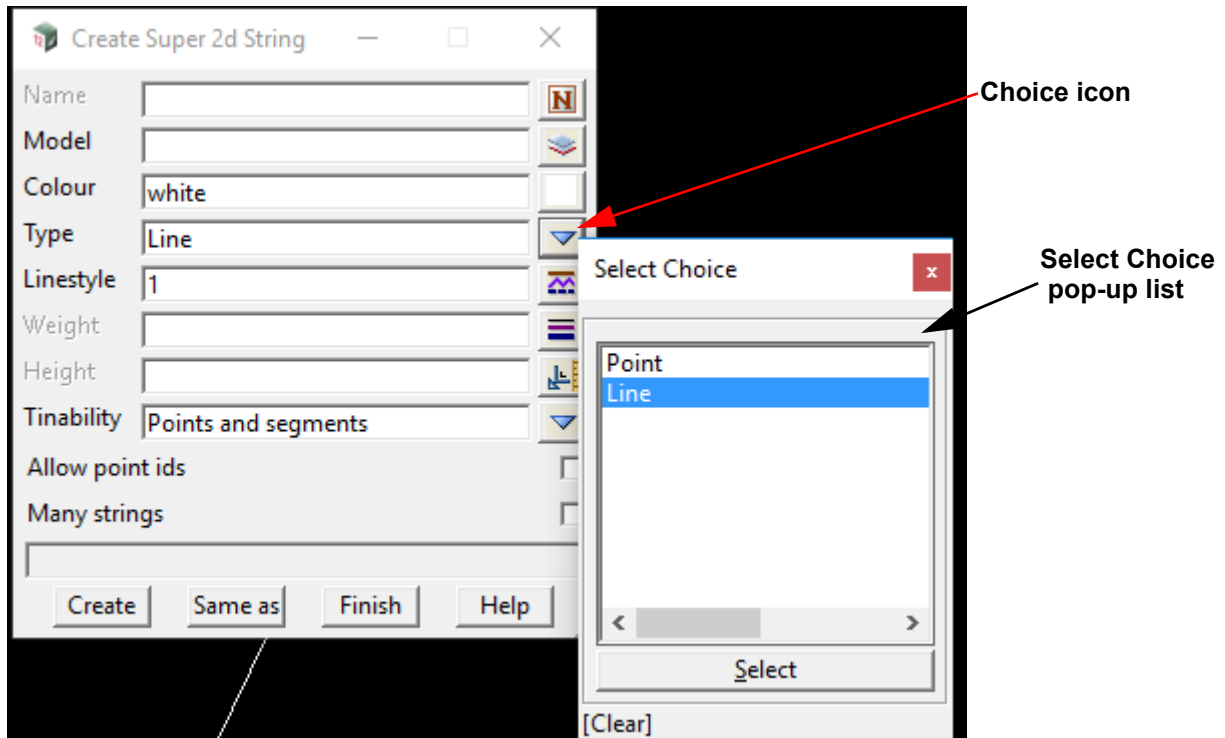
The choices above **[Clear]** will be different for each option.

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 [4.6.6 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 [4.6.1 Search Field for Model, Tin, Function and Template Box](#).

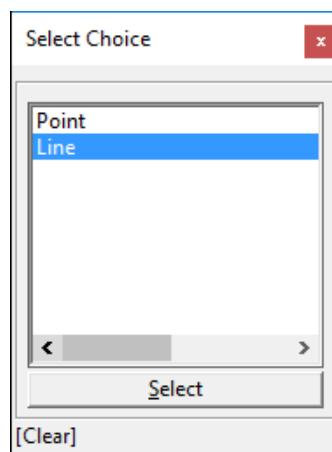
Continue to [4.5.2.2 Choice Box With No Search Field on Select Choice Pop-Up](#) or return to [4.5.2 Choice Box](#) or [4.5 Panel Fields](#).

#### 4.5.2.2 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.

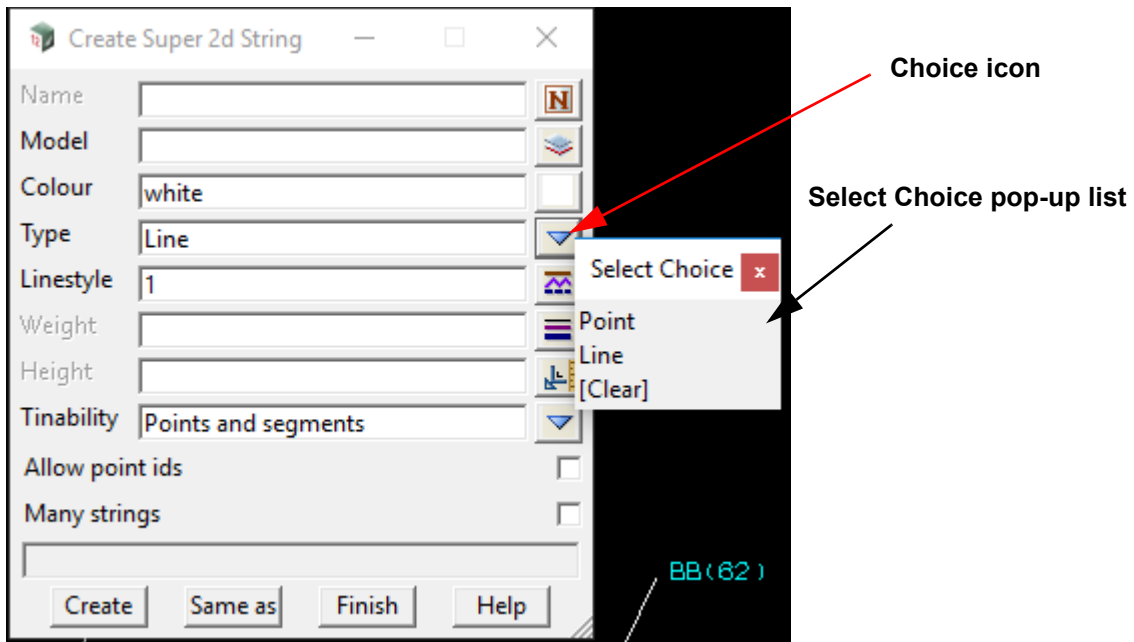
The **Select** button uses the current selection in the list and populates the panel field.

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

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

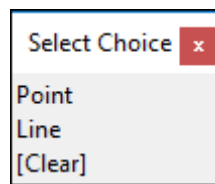
Continue to [4.5.2.3 Older Style Choice Box](#).

### 4.5.2.3 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 [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#) or return to [4 Tools and Concepts](#).

## 4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons

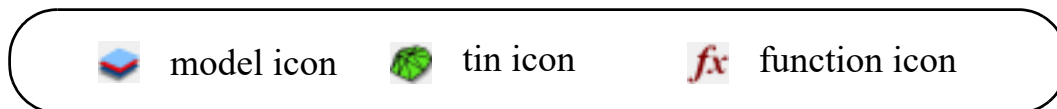
Now documented in the V15 reference manual

For Plan, Section and Perspective views, clicking on the View Buttons **+** (**Add** models) or **-** (**Remove** models) brings up a list of models to add to, or remove from, the view. One or many models can be selected to add/remove by using the <Shift> and <Ctrl> keys.



By typing a \* over the **+** or the **-** brings up the **Add Models to View** and **Remove Models from View** panels where wild cards (\*) and wild characters (?) can be used to Add model to, or Remove from, a view.

Similarly by clicking on a model, tin or function icon at the end of the Model box, Tin box or Function box panel fields, a list of available models, tins or functions is displayed so that a model/tin/function can be selected



Also for a model/tin/function box, if you enter characters into the panel field and then type <ctrl>+d, a list of all the items that start with the typed characters will appear to select from.

From **12d Model 12** onwards, an improved **Search** field with associated icons is used to provide a more powerful method for selecting the models to appear in the pop-up list when using the **Add (+)** or **Remove (-)** icon on Views, and for selecting the models/tins/functions/templates that appear in the pop-ups for the model, tin, function or template icons.

From **12d Model 15**, the new method is **on** by default and to NOT use the new method, the environment variable `model_search_4d` must be set to 0:

```
model_search_4d    0
```

**Note:** for setting this environment variable, see the [Variables](#) section in the env.4d editor [6.10.2 Create/Edit env.4d](#)).

Although some of the actions and icons used for the **Search** field for the **+** and **-** are different to how they work for model, tin, function and template boxes, most are the same and can be documented together.

See

[4.6.1 Search Field for Model, Tin, Function and Template Box](#)

[4.6.2 Search Field for the Add \(+\) and Remove \(-\) View Buttons](#)

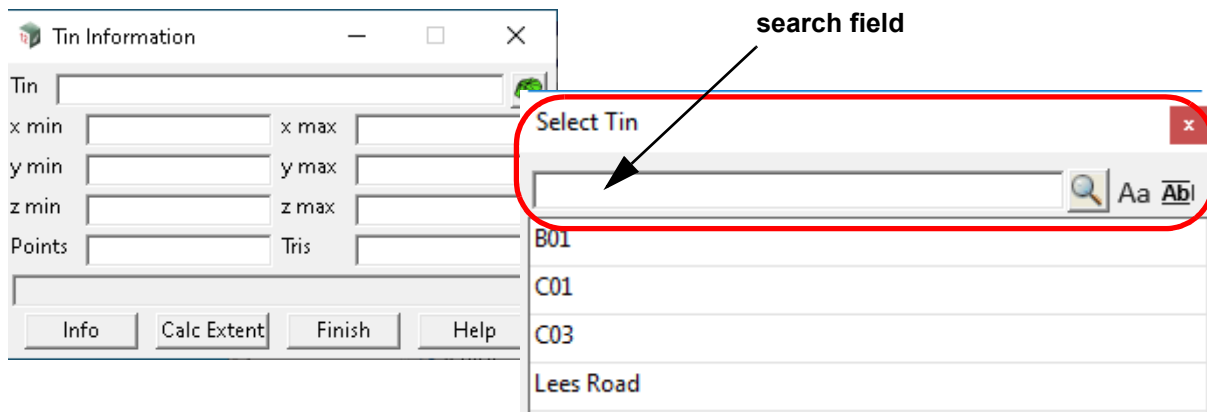
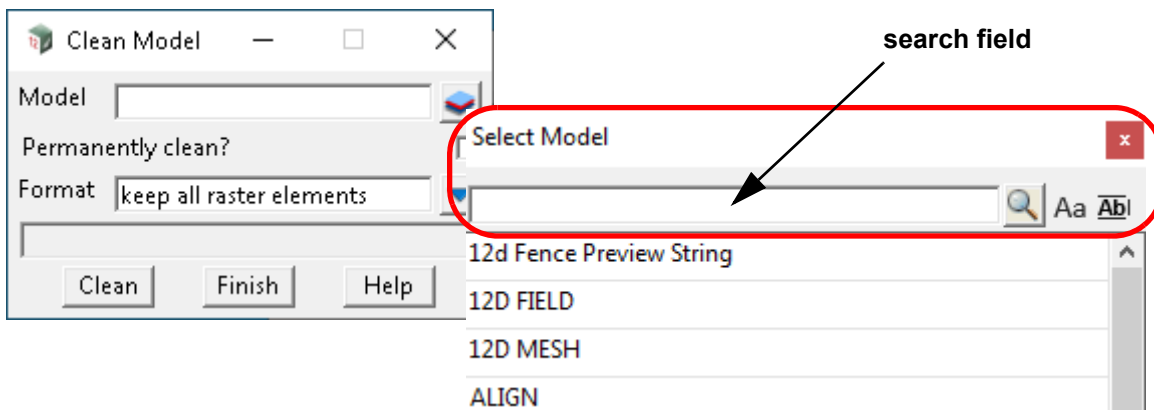


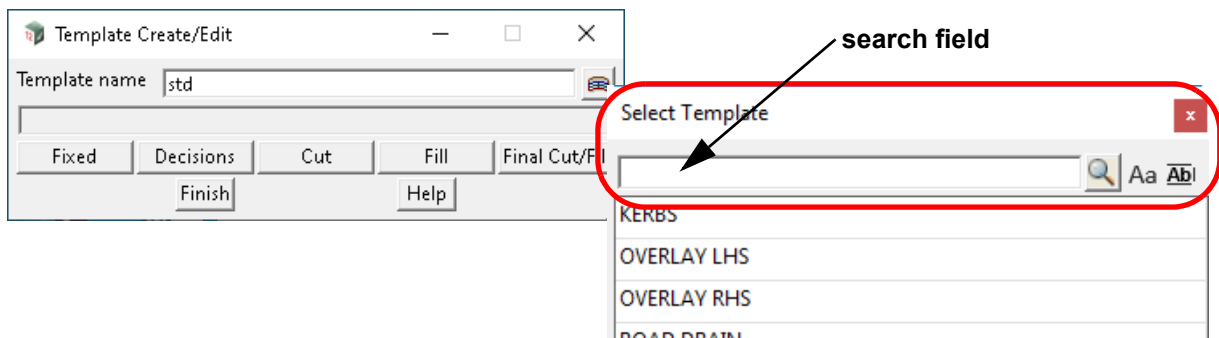
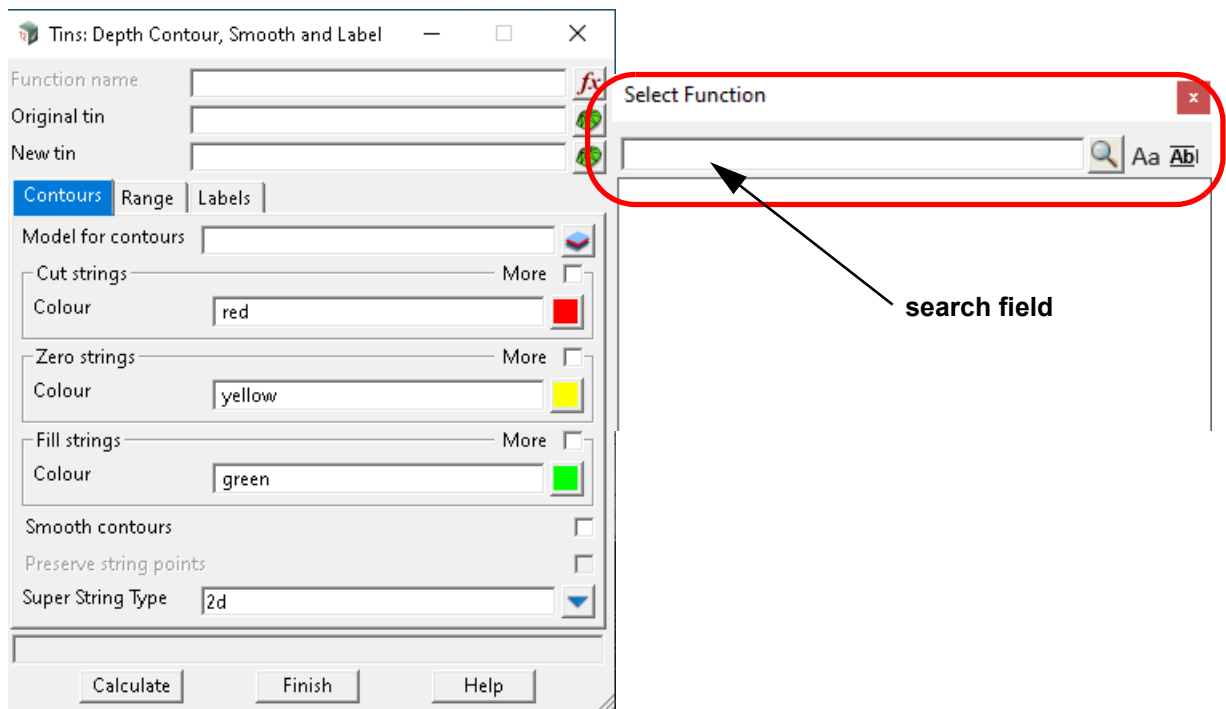
### 4.6.1 Search Field for Model, Tin, Function and Template Box

By clicking on the model, tin, function or template icon at the end of the Model box, Tin box, Function box and Template box panel fields, a list of available models, tins, functions or templates is displayed so that a model/tin/function/template can be selected



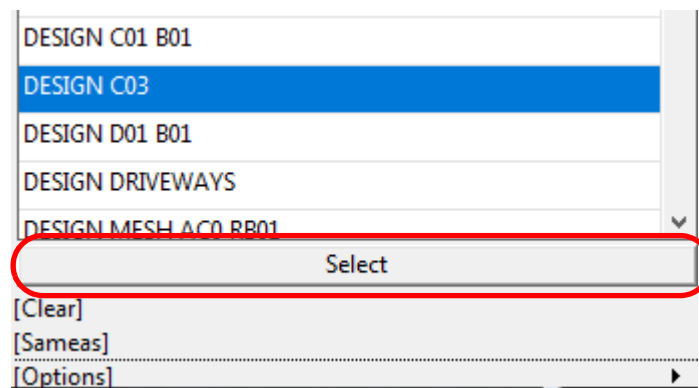
When the environment variable **model\_search\_4d** is set to **1**, the **Select Model/Tin/Function/Template** panel has a **Search** field and four extra icons above the list of models/tins/functions/templates. This is the default for **12d Model** and so doesn't have to be set by the User.





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

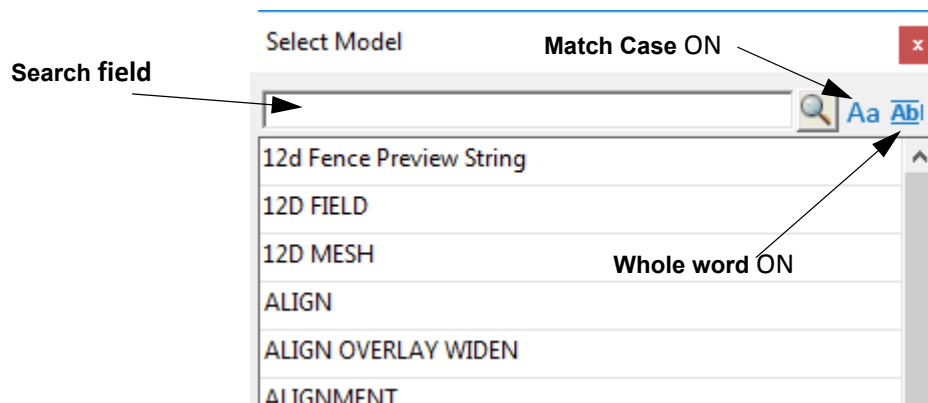
- (a) **double clicking** on the item in the list
- or by
- (b) clicking on an item in the list to highlight it and then clicking on **Select** at the bottom of the list.



The selected item is then written to the panel field.

This behaviour is identical to the original **Select Model/Tin/Function/Template** panel.

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



The use of the **Search field**, **Match Case** and **Whole word** icons restricts the items in the list from the list of all available items making it easier to make a single selection.

For a description of the behaviour of each icon, see

**Match Case icon** [4.6.3 Match Case and Don't Match Case Modes](#)

**Whole Word Icon** [4.6.4 Whole Word is Off - Anywhere Search](#)

[4.6.5 Whole Word is On - Pattern Search](#)

**Name and View icons** [4.6.7 Name Icon and View Order Icon For Views](#)

Note that the **Match sensitive** and **Whole word** icons are **off** when they display in **black** and **on** when they are displayed in **blue**.

Continue to [4.6.2 Search Field for the Add \(+\) and Remove \(-\) View Buttons](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

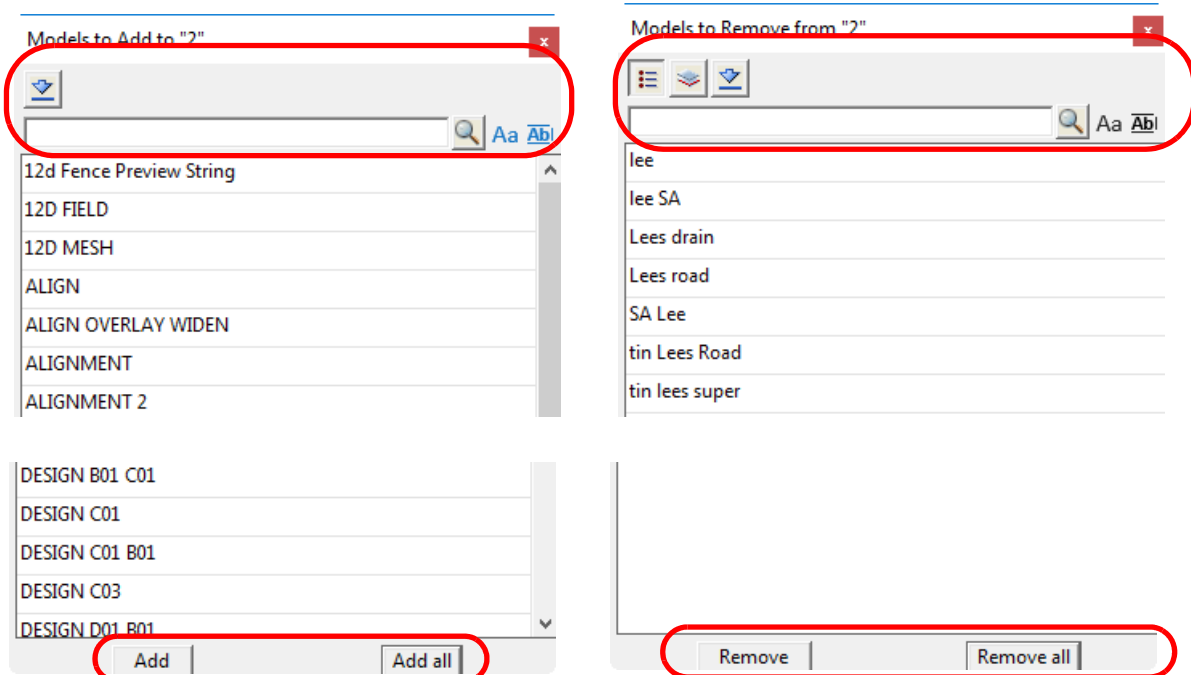
## 4.6.2 Search Field for the Add (+) and Remove (-) View Buttons

For Plan, Section and Perspective views, clicking LB on the View Buttons **+** (**Add** models) or **-** (**Remove** models) brings up a list of models to add to, or remove from, the view. One or many models can be selected. to add/remove by using the <Shift> and <Ctrl> keys.



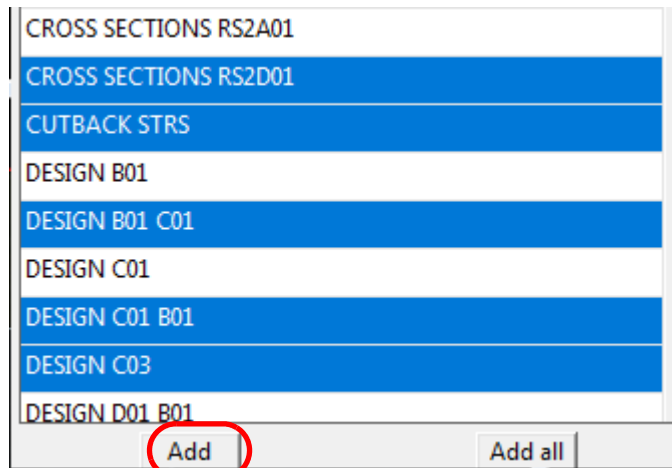
Similarly typing a character over the View Buttons **+** (**Add** models) or **-** (**Remove** models) also brings up a list of models to add to, or remove from, the view. One or many models can be selected. to add/remove by using the <Shift> and <Ctrl> keys.

When the environment variable **model\_search\_4d** is set to **1**, and **LB** is clicked on **+** or **-**, the **Model to Add** and **Models to Remove** panels have a **Search** field and extra icons above the list of models.



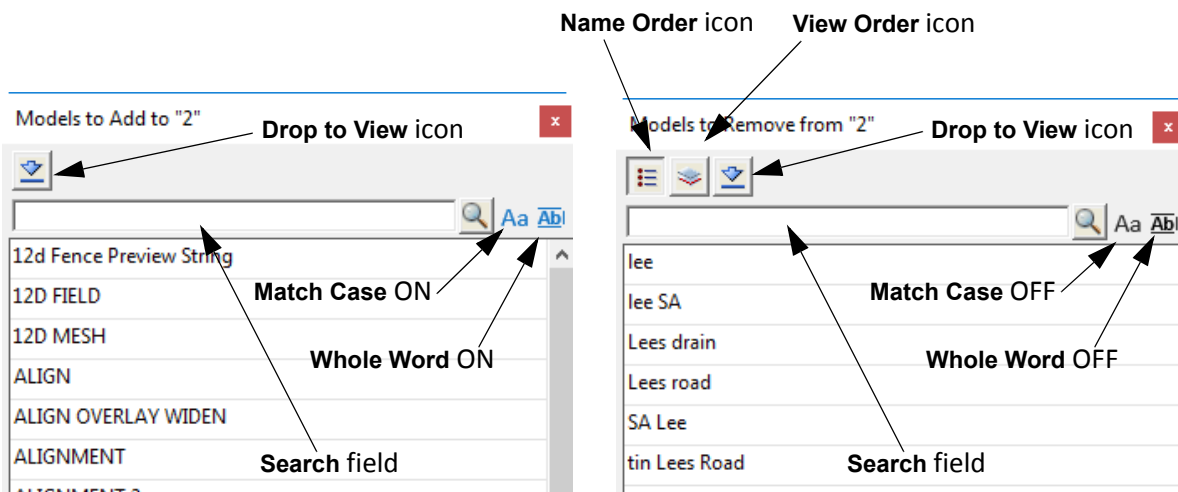
When there are models displayed in the list, models can be selected from the list by either:

- (a) clicking on **Add/Remove all** to Add/Remove all the models in the list
  - (b) **double clicking** on a model in the list
- or by
- (c) highlighting models by picking and using the <Ctrl> and <Shift> keys to select multiple models and then clicking on **Add/Remove** at the bottom of the list.



This behaviour is identical to the original **Model to Add/Remove** panels.

The **Search** field in conjunction with the **Match Case** and **Whole word** icons adds increased functionality over selecting models Models to add or remove.



The use of the **Search** field, **Match Case** and **Whole word** icons restricts the models in the list from the list of available models making it easier to make a single or multiple selections, or select the entire list of models.

For a description of the behaviour of each icon, see

- Name and View Order icons**      [4.6.7 Name Icon and View Order Icon For Views](#)
- Drop to View Icon**      [4.6.9 Drop to View icon - Adding Selected Models to Another View](#)
- Case Sensitive icon**      [4.6.3 Match Case and Don't Match Case Modes](#)
- Whole Word Icon**      [4.6.4 Whole Word is Off - Anywhere Search](#)  
    [4.6.5 Whole Word is On - Pattern Search](#)
- Typing above + or -**      [4.6.8 Typing a Character Above the + or - View Buttons](#)

Note that the **Match Case** and **Whole Word** icons are **off** when they display in **black** and **on** when they are displayed in **blue**.

Continue to [4.6.3 Match Case and Don't Match Case Modes](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

### 4.6.3 Match Case and Don't Match Case Modes

When the **Match Case** icon is **on (Aa)** the search matches on case. That is, it is case **sensitive**.

When the **Match Case** icon is **off (Aa)**, the search does not match case. That is, it 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 [6.8.2.9 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 [6.8.2.7 Select >View Models Settings](#).

Continue to [4.6.4 Whole Word is Off - Anywhere Search](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

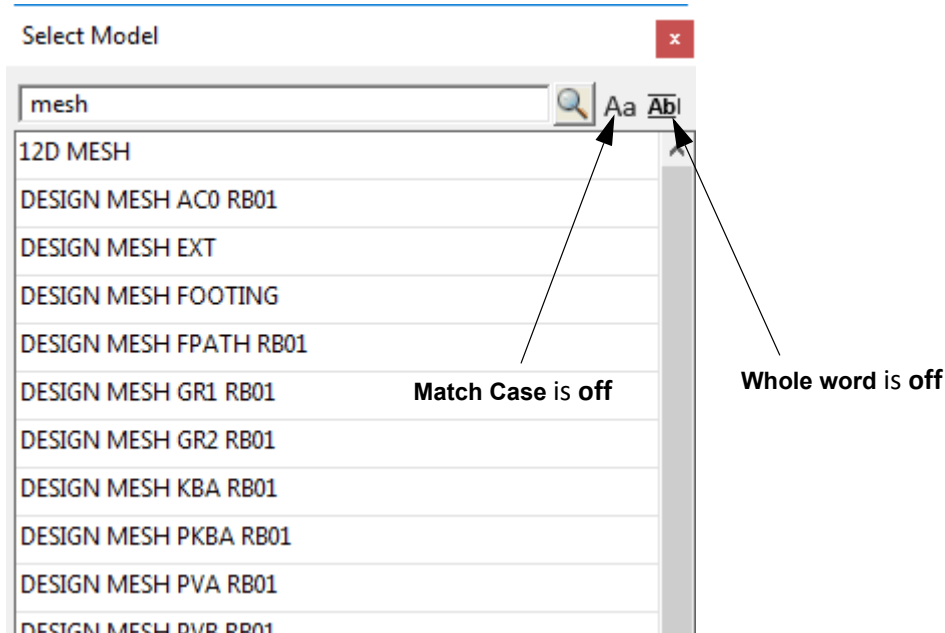


## 4.6.4 Whole Word is Off - Anywhere Search

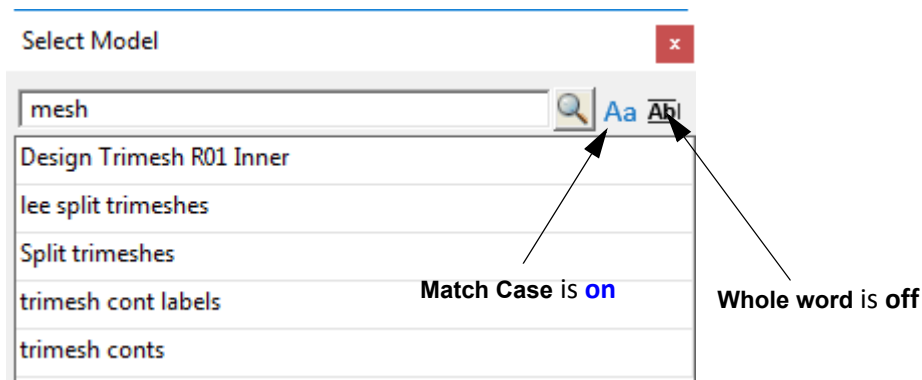
When the **Whole word** icon is **off** the search looks for the characters **anywhere** in the item names. That is, if **Whole word** is **off**, when you type text into the search field it will display in the list the items that **contain** the typed letters **anywhere** in the item name.

**Note:** The search will only consider case if the **Match Case** icon is **on (Aa)**

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



For example, typing in "mesh" with **Match Case on (Aa)** displays

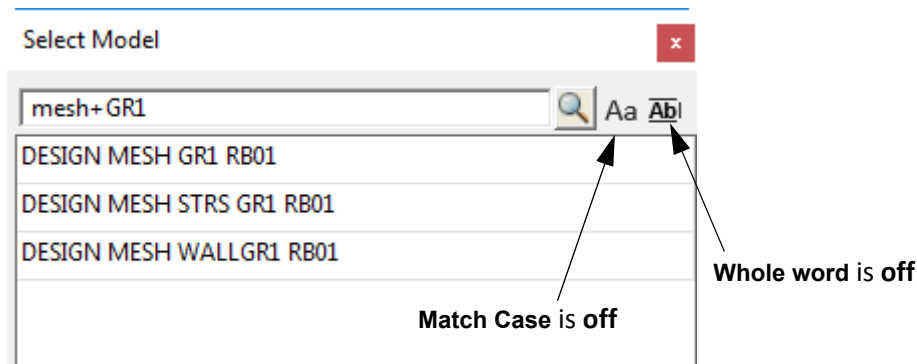


None of the models containing MESH are then listed.

Having one or 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

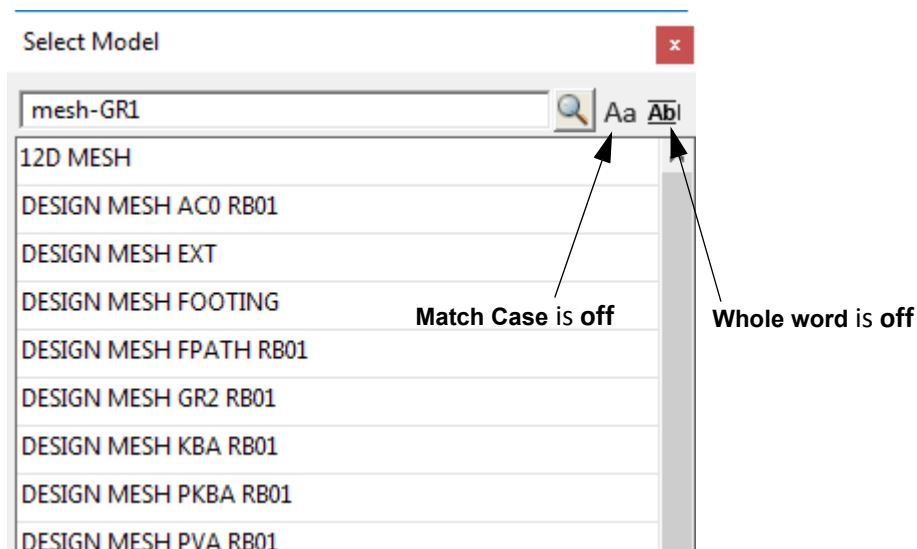
only selects items that contain the letters **mesh AND** the letters **GR** in them.



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**



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 [6.8.2.9 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 [6.8.2.7 Select >View Models Settings](#).

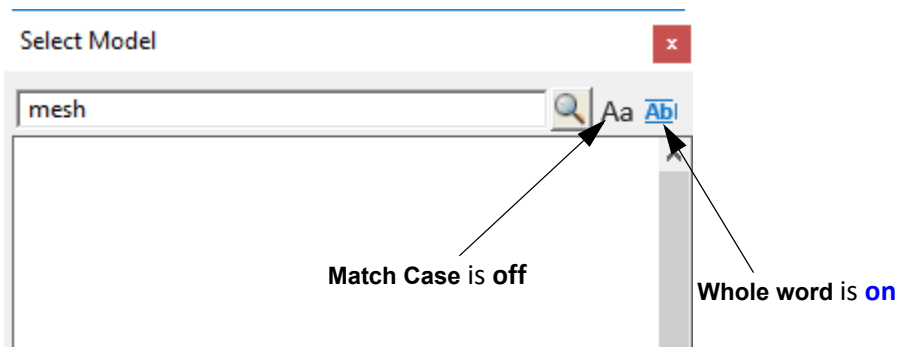
Continue to [4.6.5 Whole Word is On - Pattern Search](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

## 4.6.5 Whole Word is On - Pattern Search

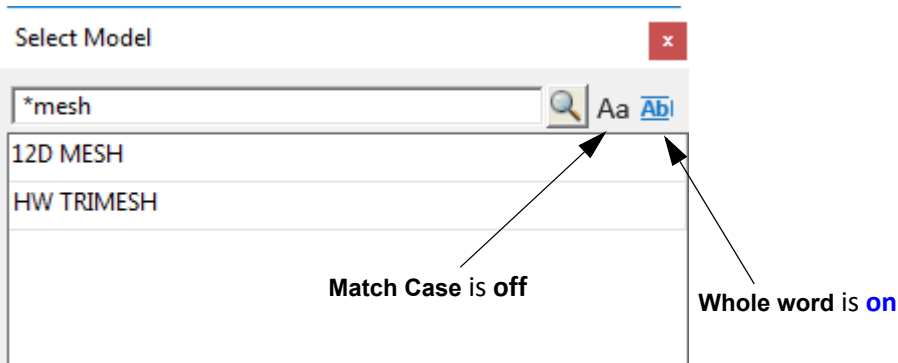
When the **Whole word** icon is **on** the search is switched to **pattern** mode and the text searched for must exactly match the typed in text. Wild cards (\*) and wild characters (?) can be included in the search text.

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

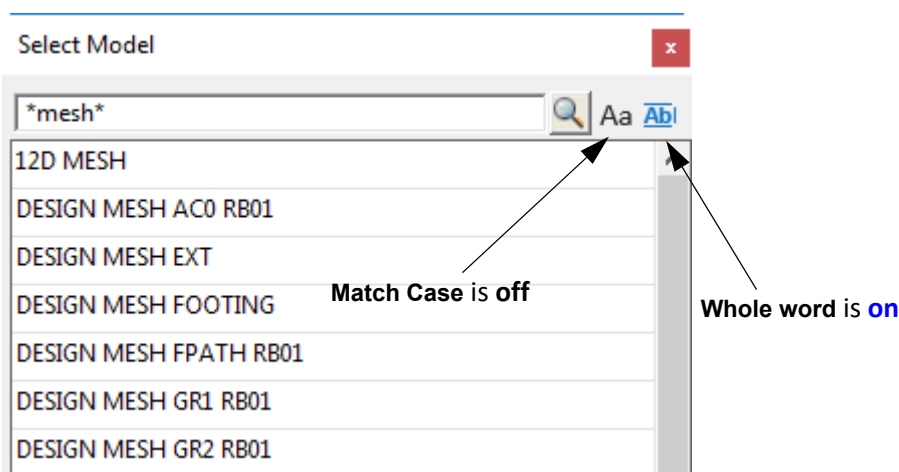
So when **Whole word** is **on**, typing **mesh** does not select any items.



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



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 [6.8.2.9 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 [6.8.2.7 Select >View Models Settings](#).

Continue to [4.6.6 Search Field Syntax for Selects](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

## 4.6.6 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 [4.4.1 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

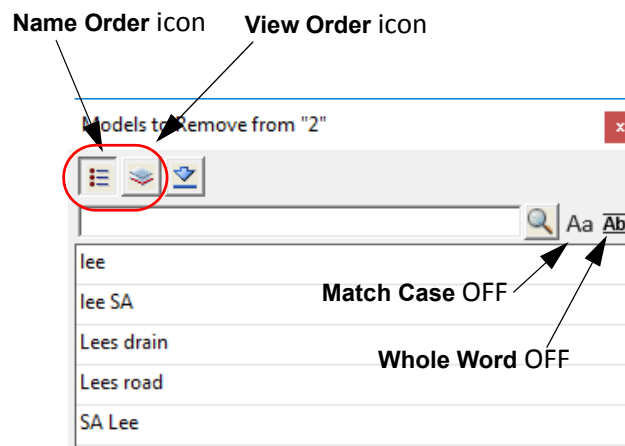
(X and Y) or Z, but none of them containing A

### Important Note

The search in the search field for a **Select Choice** is **case insensitive**.

Continue to [4.6.7 Name Icon and View Order Icon For Views](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

## 4.6.7 Name Icon and View Order Icon For Views



For the **Models to Remove** panel:

- (a) clicking on the **Name** icon means that the items in the list are sorted alphabetically.

Whether the list is sorted in ascending or descending order is controlled by Project Settings. See [6.8.2.7 Select >View Models Settings](#).

- (b) 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 [6.8.2.7 Select >View Models Settings](#).

Continue to [4.6.8 Typing a Character Above the + or - View Buttons](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).



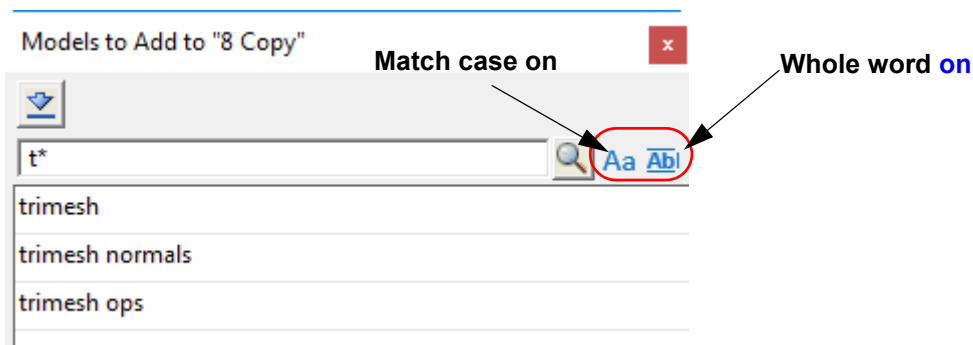
## 4.6.8 Typing a Character Above the + or - View Buttons

Typing one alphanumeric character above the + or the – brings up the new panel with the **Search** field and what then happens depends on the setting of the icons **Match Case** and **Whole Word**.

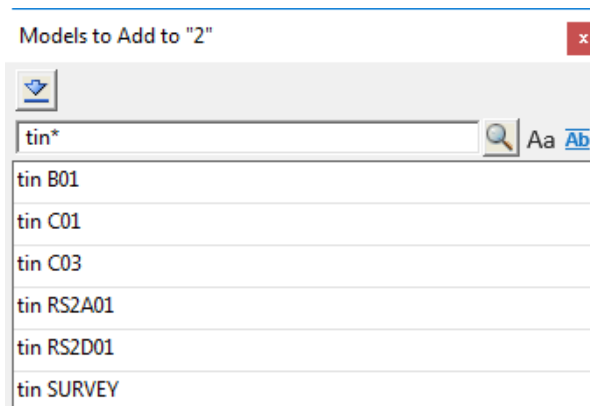
If the **Whole Word** icon is **off (Bb)** then the typed character is added into the **Search** field so any appropriate model containing that letter will be displayed. If **Match Case** is **off (Aa)** then any model name containing either the upper or lower case character is displayed.

If the **Whole Word** icon is **on** then the typed character followed by a \* is added into the search field so any appropriate model name starting with that letter will be displayed. If **Match Case** is **off (Aa)** then any model name starting with either the upper or lower case character is displayed.

So if **t** is typed above the + and **Whole Word** is **on**, the **Models to Add** panel comes up with **t\*** in it and the model selection already made.



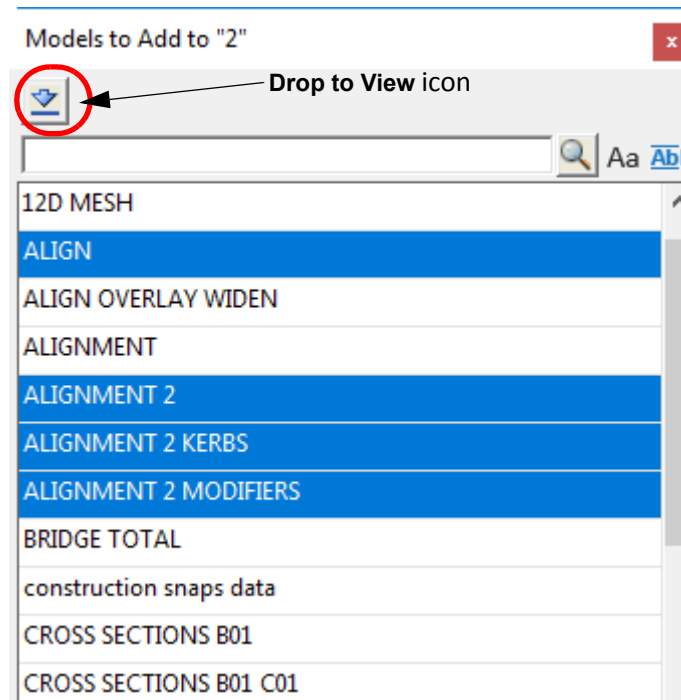
Note that with the new Search, you can continue typing after the **t** and the extra characters will be piped into the Search and immediately acted upon.



Continue to [4.6.9 Drop to View icon - Adding Selected Models to Another View](#) or return to [4.6 Search Field for Model, Tin, Template and Functions, and + and - View Buttons](#).

## 4.6.9 Drop to View icon - Adding Selected Models to Another View

To add selected models to another view, if you have models **highlighted** in the **Models to Add** or **Models to Remove** panel then click on the **Drop to view** icon.



A view is then selected by picking and accepting anywhere inside that view and on accepting, **all the highlighted models** are **added to the selected view**.

Continue to [4.7 Chainage Equalities](#) or return to [4 Tools and Concepts](#).

## 4.7 Chainage Equalities

Now documented in the V15 reference manual

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.

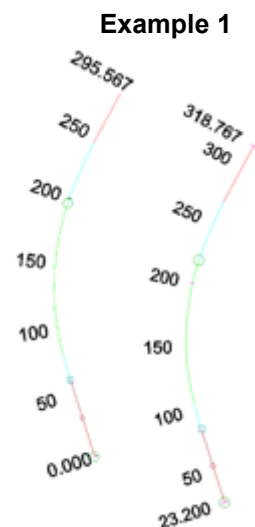
**Natural/Raw chainage of a place on the alignment = Start chainage + Horizontal distance from the start of the alignment to the place**

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.



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, where 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:

$$\text{Chainage of a place after an internal equality} = \text{"After" chainage at the internal equality} + \text{Horizontal distance from the internal equality}$$

An **Internal equality** is written as:

$$\text{Before value} = \text{After value}$$

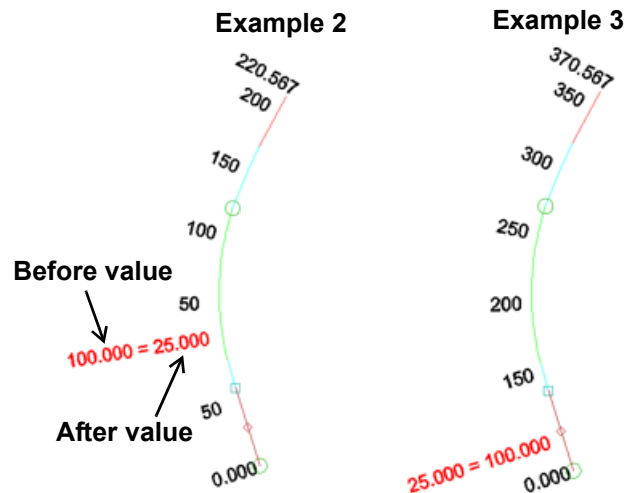
where the **value** in **Before value** is the **equality chainage of where the chainage equality occurs**. That is, the **Before value** takes into account the previous chainage equalities.

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 = K-Post name followed by Horizontal distance from the K-post equality after a K-post**

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](#)

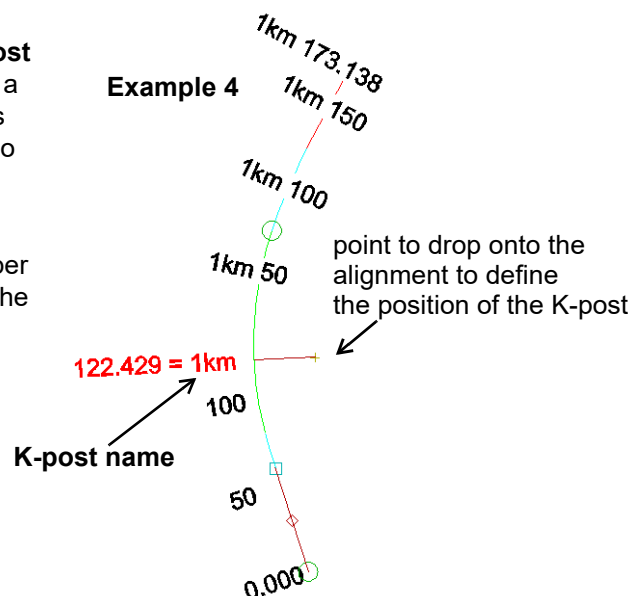
**Note:** If the preceding chainage equality to an **internal equality** is a [4.7.4 K-Post](#), the **Before value** is the horizontal distance from that **K-post**.

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**.



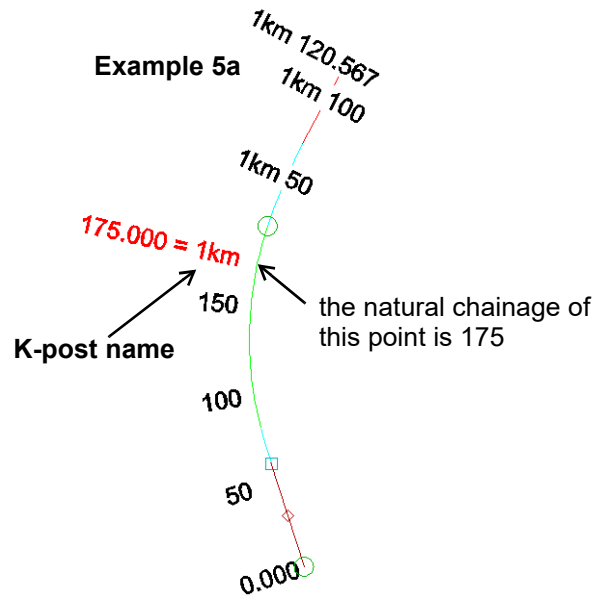
Continue to [4.7.4.2 K-post chainage](#) or return to [4.7 Chainage Equalities](#)



### 4.7.4.2 K-post chainage

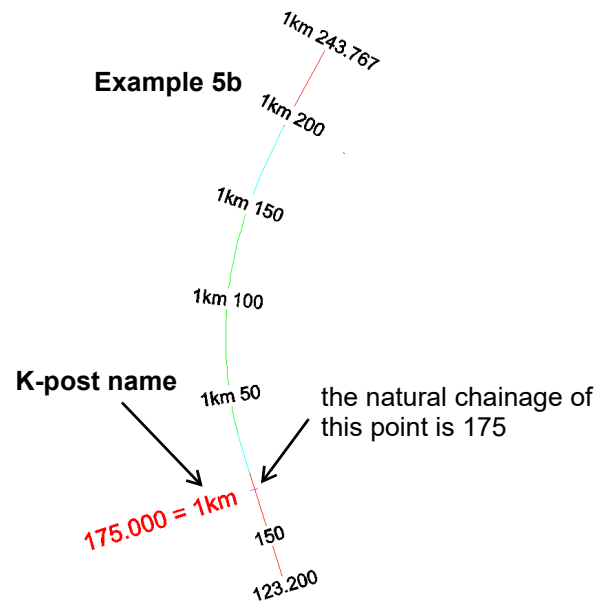
For **K-post chainage**, the position of the **K-post** by giving its [4.7.1 Natural/Raw Chainage](#).

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.



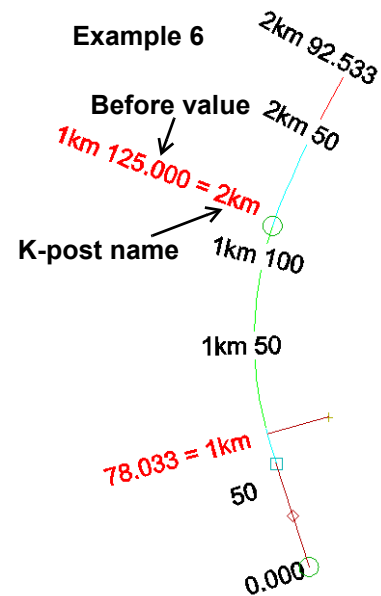
#### 4.7.4.3 K-post relative

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**.

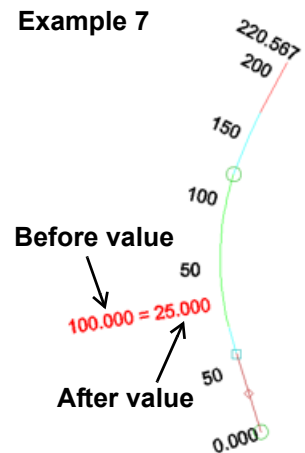


Continue to [4.7.5 Zones](#) or return to [4.7 Chainage Equalities](#)

## 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.

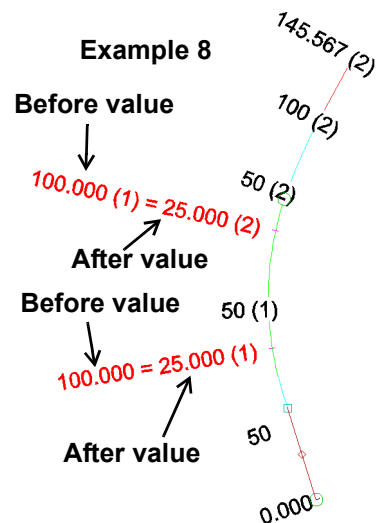
The following **Zones** are labelled as 1, 2, 3, etc until a **K-post** occurs and then the **Zone numbering is reset to Zone 0** (or zoneless) and the **chainage is reset to zero**.

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.

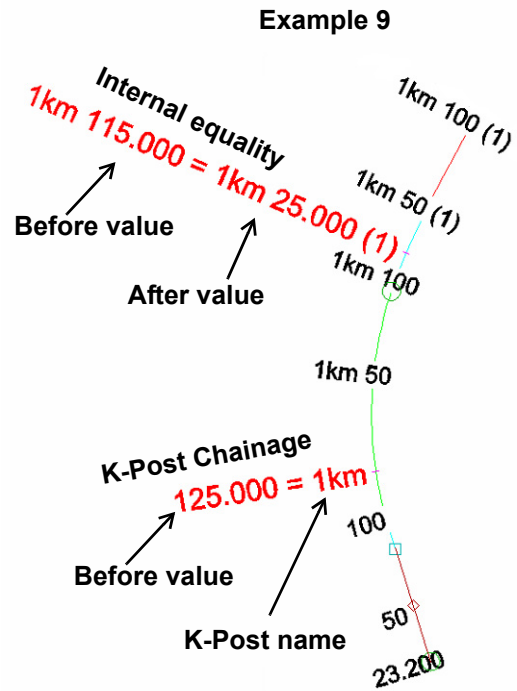
The first chainage equality is a **K-post Chainage** with a **Before value** of 125 and a **K-Post name** of 1 km.

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.



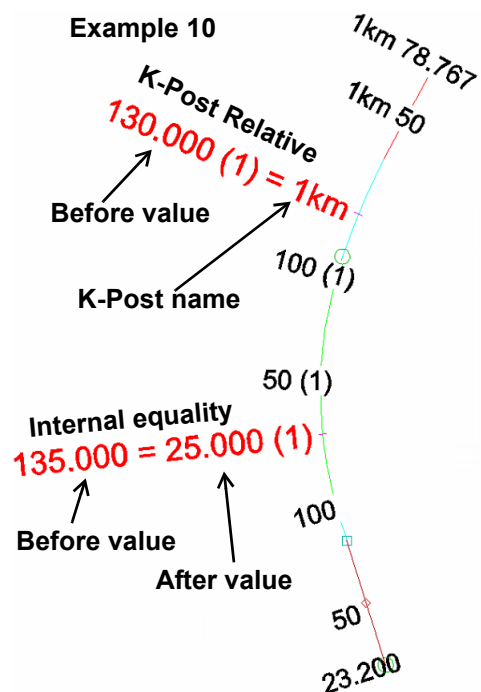
In example 10, there are two chainage equalities for the super alignment.

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**



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

Now documented in the V15 reference manual

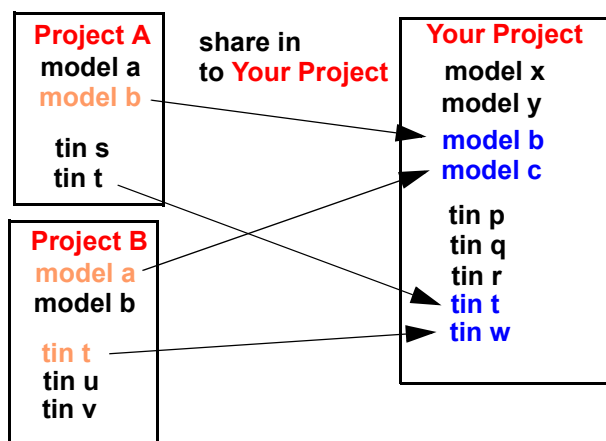
See

- [4.8.1 Share In](#)
- [4.8.2 Share Out](#)
- [4.8.3 Share In and Out](#)
- [4.8.5 Sharing Cache Folder](#)
- [4.8.6 Master Share Files](#)

### 4.8.1 Share In

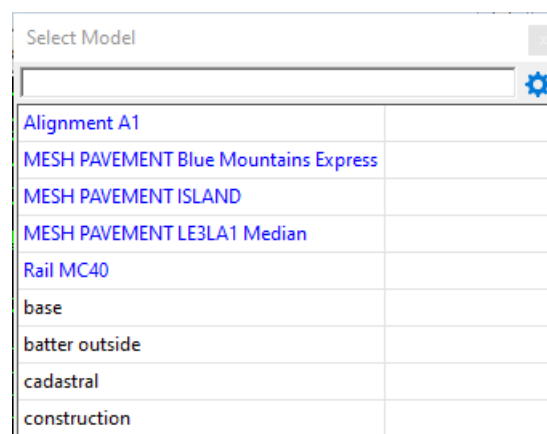
**Models** and **Tins** can be **shared into your project** from other projects.

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**.



**Note:** the colour denoting **shared out** models and tins can be changed in the env.4d file. See\_



[Projects > Sharing](#) or [\\_SHARING\\_ELEMENT\\_COLOUR\\_4D](#).

To share in models, see [9.8.7.2 Share In Other Models](#).

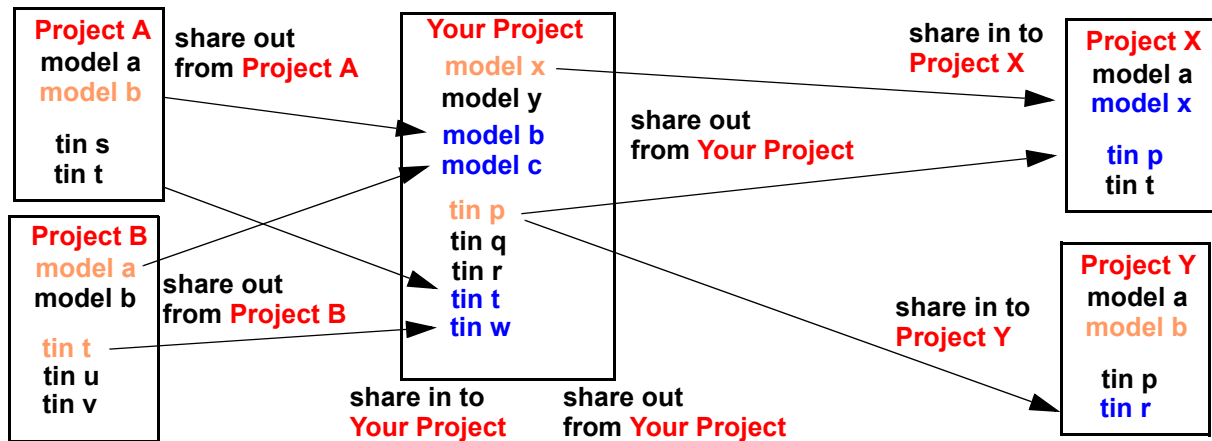
To share in tins, see [13.14.16.2 Share In Other Tins](#).

Continue to [4.8.2 Share Out](#) or return to [4.8 Sharing of Models and Tins](#).

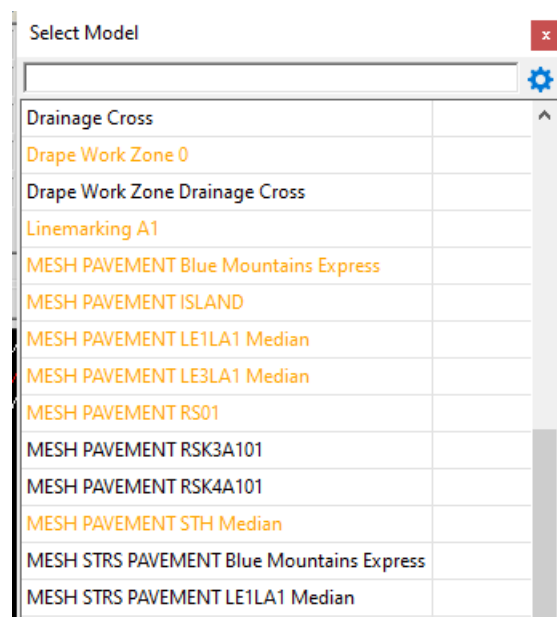


## 4.8.2 Share Out

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**.



**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](#).

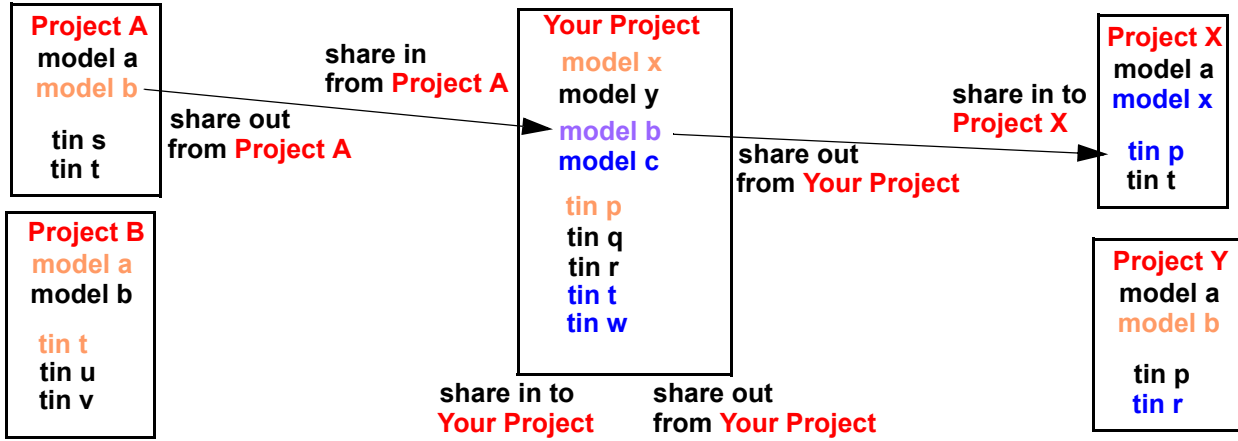
To share out models, see [9.8.7.1 Share Out Models](#) and [6.12.2 Share Manager](#).

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](#).

The screenshot shows the 'Select Model' dialog box with the following items listed:

- Alignment A1 (mauve)
- MESH PAVEMENT Blue Mountains Express (mauve)
- MESH PAVEMENT ISLAND (mauve)
- MESH PAVEMENT LE3LA1 Median (mauve)
- Rail MC40 (mauve)
- base
- batter outside (orange)
- cadastral (orange)
- construction
- conts
- mesh (orange)
- movie
- pad polygons

Annotations with arrows point to:

- model shared in from another project and the shared out:** Points to 'Alignment A1'.
- model shared in from another project:** Points to 'MESH PAVEMENT ISLAND'.
- model in the project that are allowed to be shared out:** Points to 'batter outside'.

Continue to [4.8.4 Synchronising Shares](#) or return to [4.8 Sharing of Models and Tins](#).

## 4.8.4 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.

**Synchronization** regularly checks each model and tin shared in to the current project to see if the model or tin has been modified in the original project since the model or tin was last copied to the current project. If any tin or model has been modified, it is re-copied to the current project.

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](#)).

Finally, synchronizing can be done manually at anytime using the options **Synchronize Shared In Models** ([9.8.7.4 Synchronize Shared In Models](#)) and **Synchronize Shared In Tins** ([13.14.16.4 Synchronize Shared In Tins](#)).

Continue to [4.8.5 Sharing Cache Folder](#) or return to [4.8 Sharing of Models and Tins](#).

## 4.8.5 Sharing Cache Folder

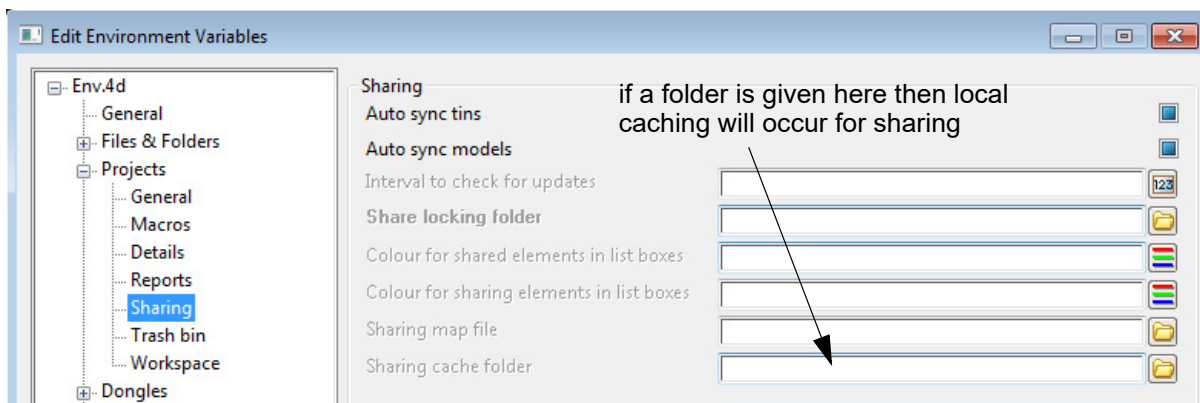
### NOT YET IMPLEMENTED FOR V15

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 [4.8.5 Sharing Cache Folder](#) or return to [4.8 Sharing of Models and Tins](#).

## 4.8.6 Master Share Files

Although for each project you can define which models and tins are shared into the project, this can become unwieldy when there are a large number of projects sharing in data from many other projects. Master share files are very useful 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.

Any number of projects can use one or more Master Share Files.

Using a master share file with a project shares in all the models and tins listed in the master share files without having to do them individually.

So master share files are an easy way to set up the models and tins to be automatically shared in by a group of users.

Master share files are created and edited using the **Share Manager** panel. For a particular project, the **Share Manager** panel also specifies which master share files are used by the project. See [6.12.2 Share Manager](#).

### Important Note

A master share file **CANNOT** 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 a master share file.

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

Now documented in the V15 reference manual

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\Long PathsEnabled**

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>



Registry Editor

File Edit View Favorites Help

Computer\HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem

Name	Type	Data
(Default)	REG_SZ	(value not set)
DisableDeleteNotification	REG_DWORD	0x00000000 (0)
FilterSupportedFeaturesMode	REG_DWORD	0x00000000 (0)
LongPathsEnabled	REG_DWORD	0x00000000 (0)
NtfsAllowExtendedCharacter8dot3Rename	REG_DWORD	0x00000000 (0)
NtfsBugcheckOnCorrupt	REG_DWORD	0x00000000 (0)
NtfsDisable8dot3NameCreation	REG_DWORD	0x00000002 (2)
NtfsDisableCompression	REG_DWORD	0x00000000 (0)
NtfsDisableEncryption	REG_DWORD	0x00000000 (0)
NtfsDisableLastAccessUpdate	REG_DWORD	0x80000003 (2147483651)
NtfsDisableLfsDowngrade	REG_DWORD	0x00000000 (0)
NtfsDisableVolSnapHints	REG_DWORD	0x00000000 (0)
NtfsEncryptPagingFile	REG_DWORD	0x00000000 (0)
NtfsMemoryUsage	REG_DWORD	0x00000000 (0)
NtfsMftZoneReservation	REG_DWORD	0x00000000 (0)
NtfsQuotaNotifyRate	REG_DWORD	0x00000e10 (3600)
RefsDisableLastAccessUpdate	REG_DWORD	0x00000001 (1)
ScrubMode	REG_DWORD	0x00000001 (1)
SymlinkLocalToLocalEvaluation	REG_DWORD	0x00000001 (1)
SymlinkLocalToRemoteEvaluation	REG_DWORD	0x00000001 (1)
SymlinkRemoteToLocalEvaluation	REG_DWORD	0x00000000 (0)
SymlinkRemoteToRemoteEvaluation	REG_DWORD	0x00000000 (0)
UdfsCloseSessionOnEject	REG_DWORD	0x00000003 (3)
UdfsSoftwareDefectManagement	REG_DWORD	0x00000000 (0)
Win31FileSystem	REG_DWORD	0x00000000 (0)
Win95TruncatedExtensions	REG_DWORD	0x00000001 (1)

Computer

- HKEY\_CLASSES\_ROOT
- HKEY\_CURRENT\_USER
- HKEY\_LOCAL\_MACHINE
  - BCD00000000
  - HARDWARE
  - SAM
  - SECURITY
  - SOFTWARE
  - SYSTEM
    - ActivationBroker
    - ControlSet001
      - CurrentControlSet
        - Control
          - {7746D80F-97E0-41
          - AccessibilitySettin
          - ACPI
          - AppID
          - AppReadiness
          - Arbiters
          - BackupRestore
          - BitLocker
          - BitlockerStatus
          - Bluetooth
          - CI
          - Citrix
          - Class
          - CloudDomainJoin
          - CMF
          - CoDeviceInstallers
          - COM Name Arbitr
          - CommonGlobUse
          - Compatibility
          - ComputerName
          - ContentIndex
          - CrashControl
          - Cryptography
          - DeviceClasses
          - DeviceContainerPi
          - DeviceContainers
          - DeviceGuard
          - DeviceMigration
          - DeviceOverrides
          - DevicePanels
          - DevQuery
          - Diagnostics
          - DmaSecurity
          - EarlyLaunch
          - Els
          - Errata
          - FileSystem
          - FileSystemUtilities
          - GraphicsDrivers

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

Now documented in the V15 reference manual

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** will 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

Now documented in the V15 reference manual

The logline group Licensing contains information about the current licensing.

```

! Important variables
  using PDF_HELP_VIEWER_4D = C:\Program Files\Adobe\Acrobat DC\Acrobat\Acrobat.exe
! Other variables
  Auto updater skipped because running debug version or already check for update on startup screen
  ECW12d started as service
  using Registry Key "SOFTWARE\Microsoft\Windows\CurrentVersion\App Paths\12d.exe\15\UserP
Nodes file found <c:\12d\15.00\nodes.4d>
! File found <d:\unicode.12d\12dmodel\15.00\set_ups\12dModel.public.signature>
! File found <c:\12d\15.00\user\dongles.4d>
login to dongle "12d AWS Cloud Network" successful
! Licensing
  ! Current login details
    Client 12D Solutions - AWS - NSW
    Dongle number 12dc
    Days remaining 92
    Network login
  ! Special build details
    Todays date 27-Sep-2022 23:15:14
    Expiry date 01-Jan-2023 21:01:31
    Days remaining 95 days 21 hours 46 minutes 16 seconds
  ! OpenCL configuration
  
```

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

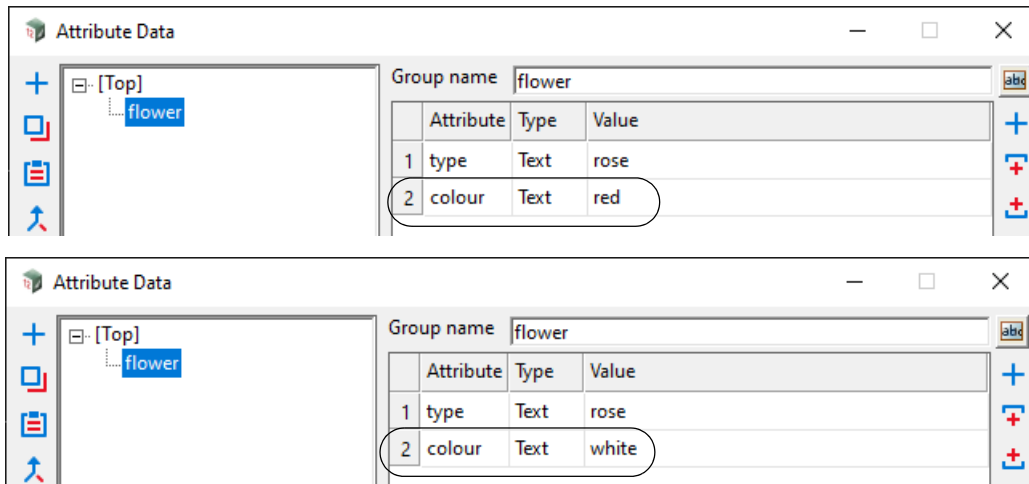
- Todays date
- Expiry date

Continue to [4.12 Comparing Attribute Data](#) or return to [4 Tools and Concepts](#).

## 4.12 Comparing Attribute Data

Now documented in the V15 reference manual

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](#)

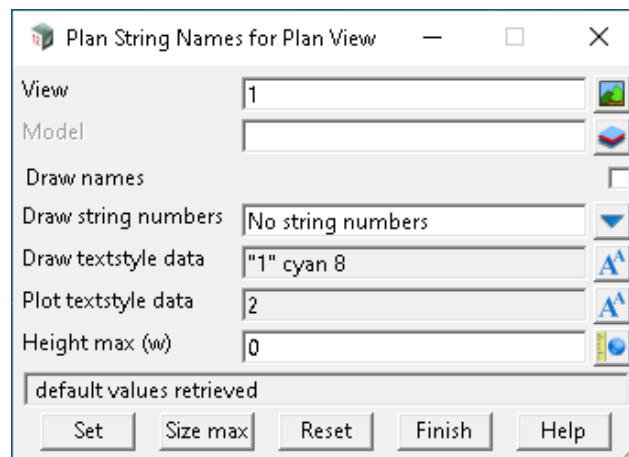
See [5.3 Section View Menu](#)

## 5.1 Plan View Menu

### 5.1.1 Single for Values Text, Crosses and Text on Plan Views

Now documented in the V15 reference manual

The option **Draw string numbers** has changed from a tick box to a choice box.



#### For Plan String Names

<b>Draw string numbers</b>	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](#).

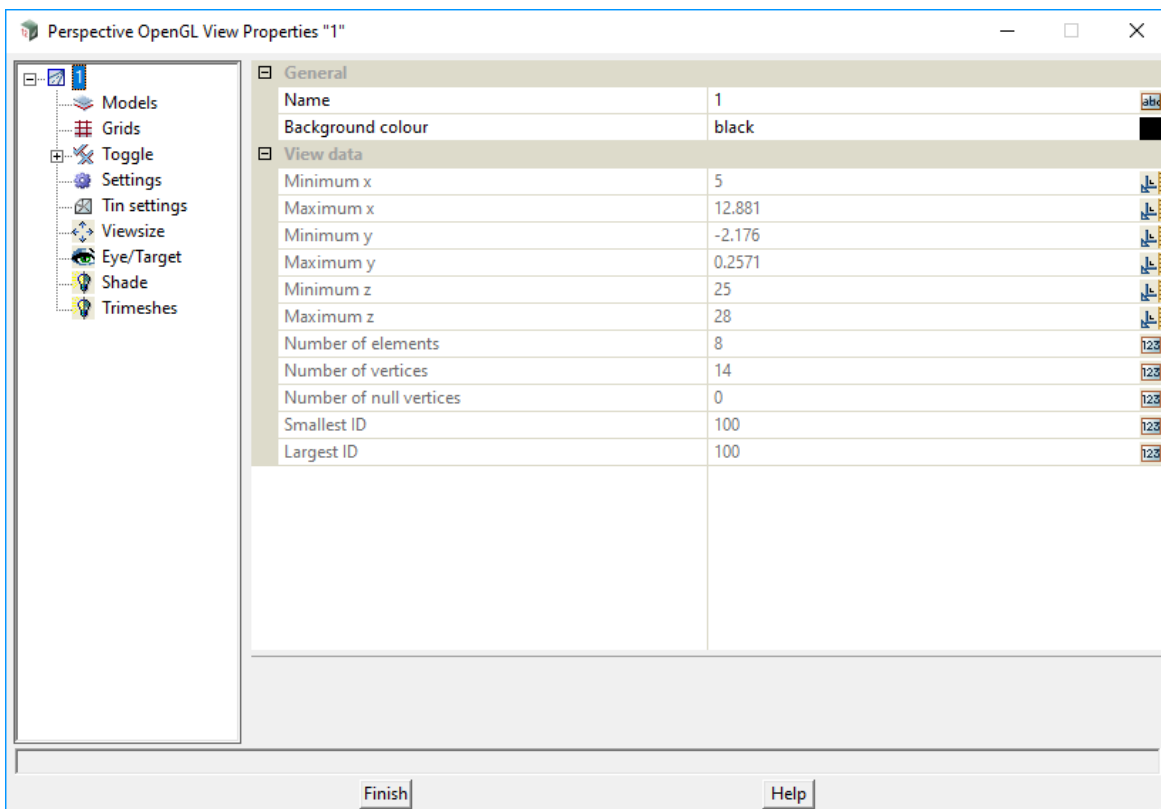
## 5.2 Perspective View Menu

See [5.2.1 Perspective/Perspective OpenGL View Properties](#)

See [5.2.2 Perspective View Settings](#)

### 5.2.1 Perspective/Perspective OpenGL View Properties

Now documented in the V15 reference manual



Continue to [5.2.2 Perspective View Settings](#) or return to [5.2 Perspective View Menu](#) or [4 Tools and Concepts](#).

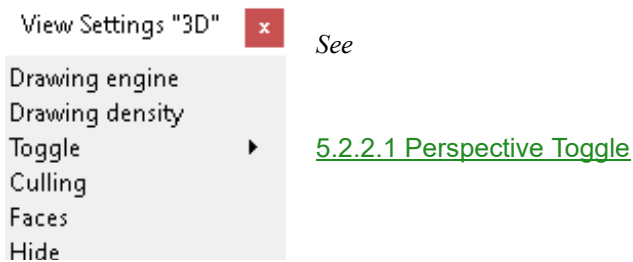
## 5.2.2 Perspective View Settings

Now documented in the V15 reference manual

**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




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

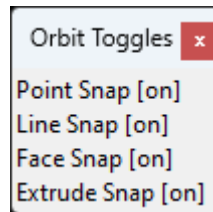
**Toggle button**  on Perspective View buttons

The Toggle walk right brings up the **Toggle** perspective view menu with a number of new options:

Toggle "5"		<i>See</i>
Orbit Toggles	▶	<a href="#">5.2.2.1.1 Orbit Toggles</a>
Text [on]	▶	
Vertices [off]	▶	
Vertex indices [off]	▶	
Z Values [off]	▶	
String names [off]	▶	
Attributes [off]	▶	
Tin contours [off]		
Tin edges [off]		
Tin flow [off]		
Tin mesh [off]		
Draw solid [yes - mixed]	▶	<a href="#">5.2.2.1.2 Toggle Draw Solid Coloured Faces</a>
Draw edges [no]	▶	<a href="#">5.2.2.1.3 Toggle Draw Edges</a>
Shade solids [yes - mixed]	▶	<a href="#">5.2.2.1.4 Toggle Shade Solids</a>
Shade edges [no]	▶	<a href="#">5.2.2.1.6 Toggle Shade Edges</a>
Height rendering [on]		
Trimesh texture maps [on]		<a href="#">5.2.2.1.7 Toggle Displaying Trimeshes with Texture Mapping</a>
Polymesh drawing	▶	<a href="#">5.2.2.1.8 Polymesh Drawing</a>
Drawing density [global]	▶	<a href="#">5.2.2.1.9 Drawing Density Toggle</a>
Extrusions [on]		<a href="#">5.2.2.1.10 Toggle Extrusions</a>
1x		
2x		
5x		
Grid [off]		

### 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](#).

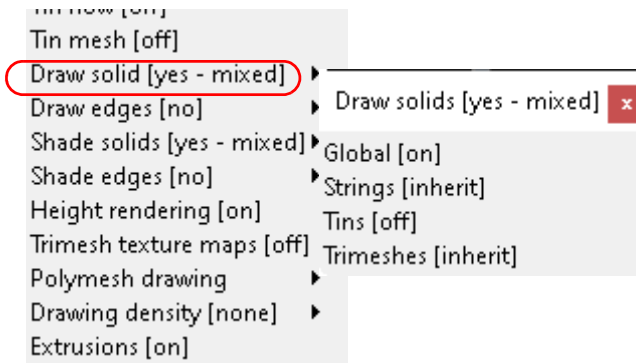


### 5.2.2.1.2 Toggle Draw Solid Coloured Faces

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](#).

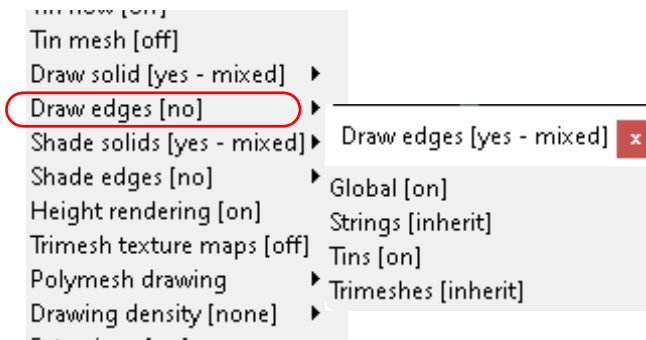
Continue to [5.2.2.1.3 Toggle Draw Edges](#) or return to [5.2.2.1 Perspective Toggle](#).

### 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**.

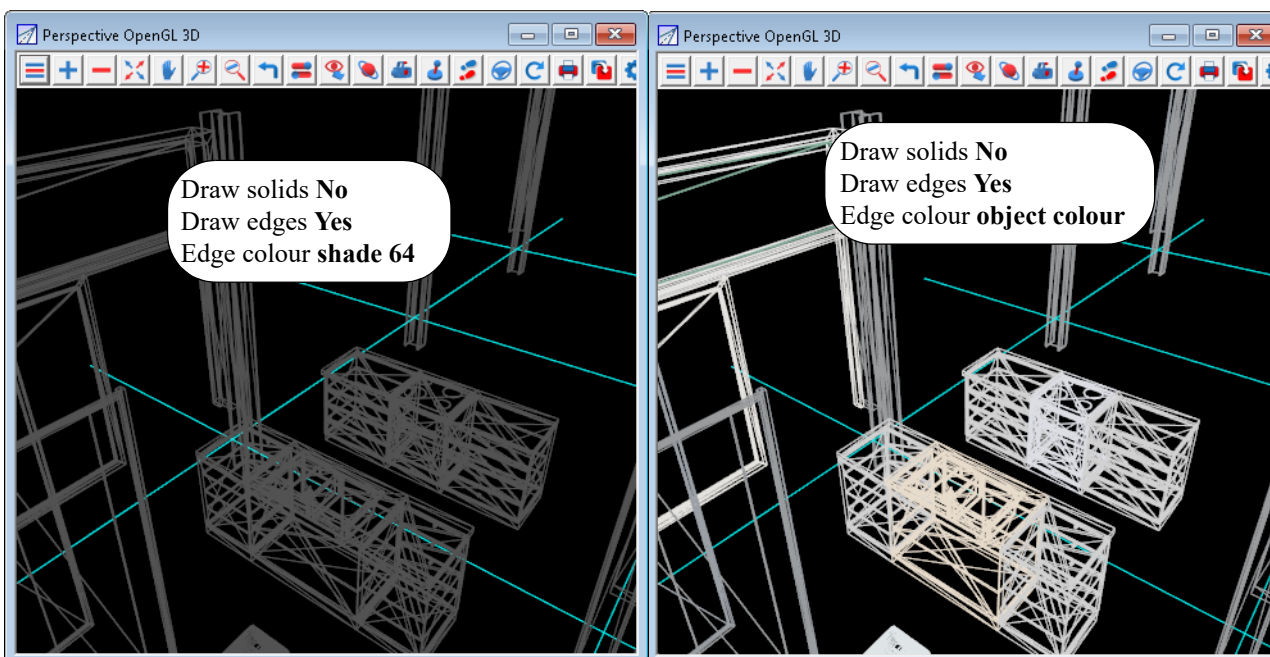
So the **Draw edges** menu item has a walk-right menu as well:



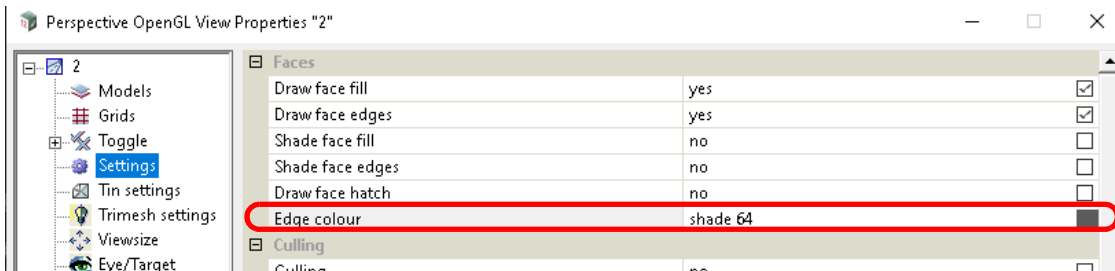
Clicking on **Draw edges** menu items itself toggles the **displaying of edges on and off**.

**Note:**

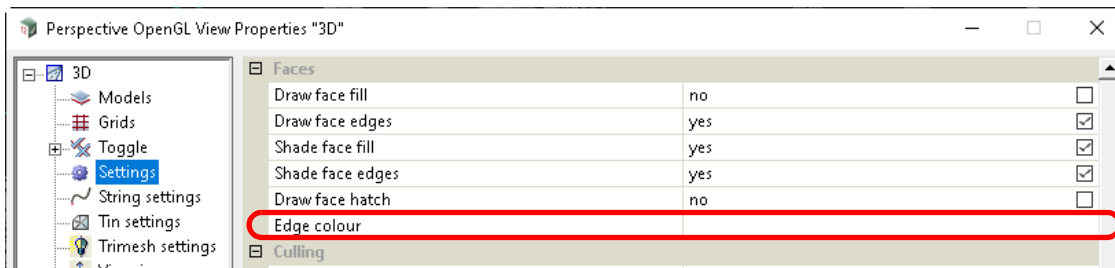
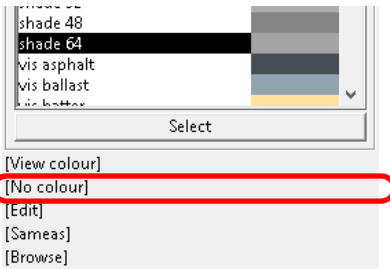
The colour of the edges can be a set colour, or the edges can be drawn in the colour of the object that it is an edge for.



The edge colour is set in the file **Settings > Edge colour** in the view **Properties**.

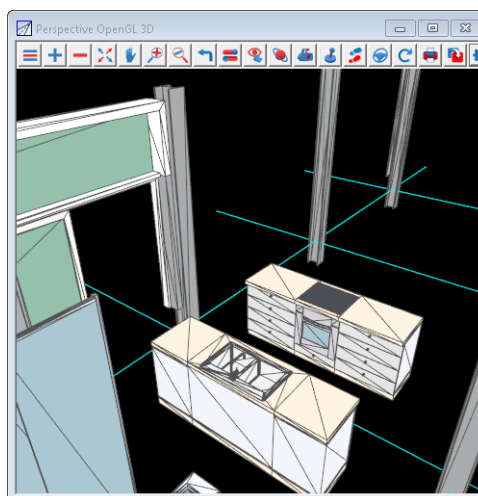


To select **object colour**, select **[No colour]** from the colour pop-up



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](#)

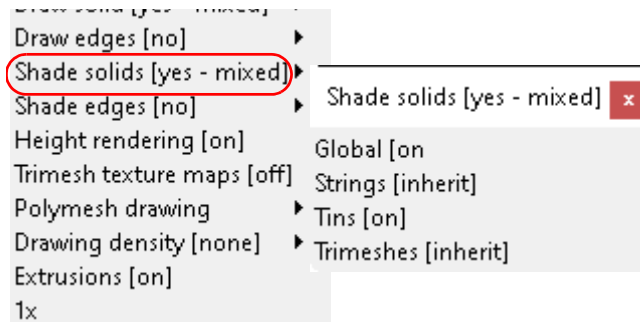
### Perspective View Settings.

#### 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**.

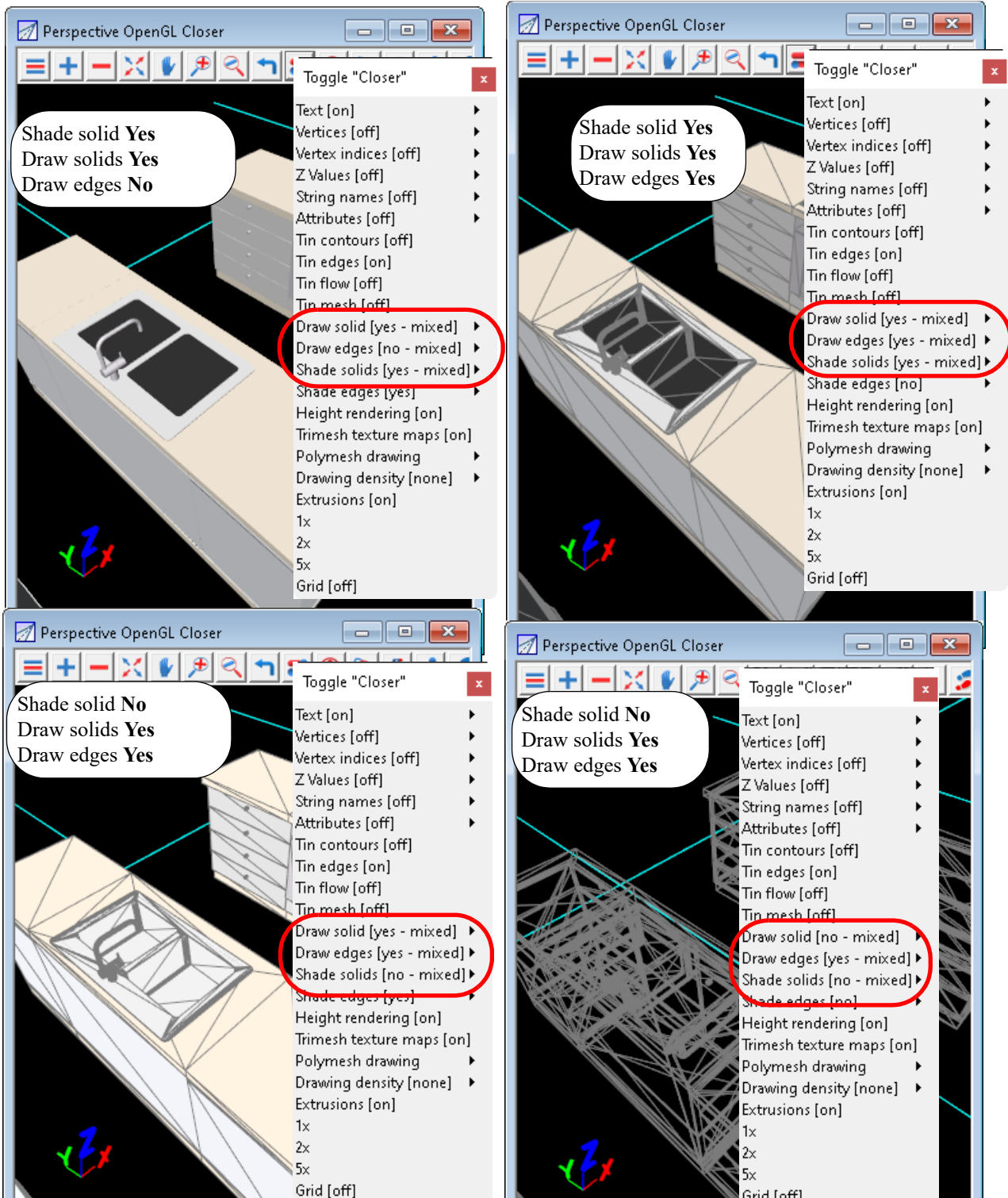
Continue to [5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids](#) or return to [5.2.2.1 Perspective Toggle](#) or [5.2.2 Perspective View Settings](#).

### 5.2.2.1.5 Drawing Solid Coloured Faces and/or Edges and/or Shade Solids

There are two important representations 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.



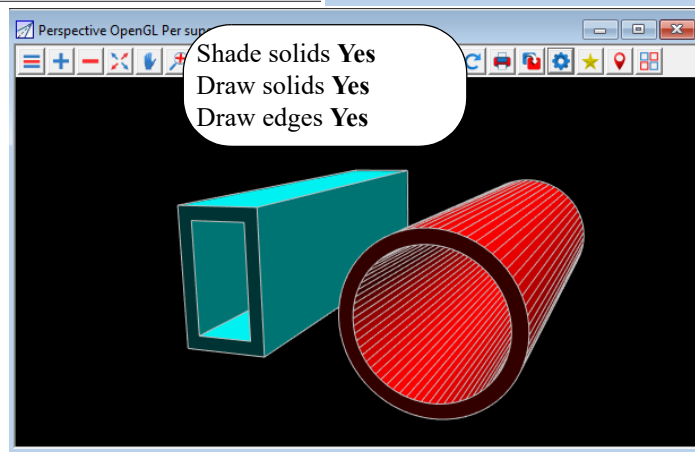
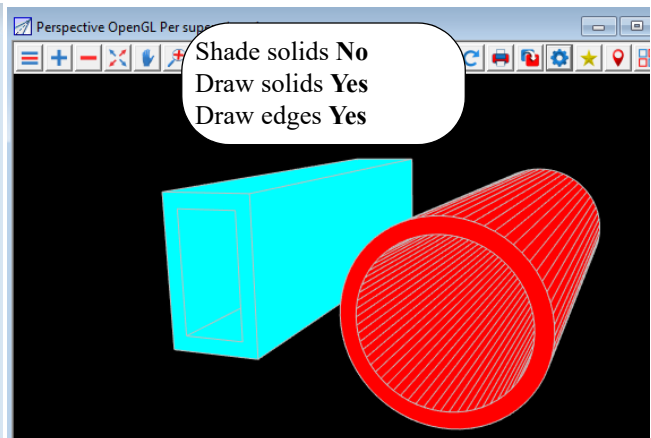
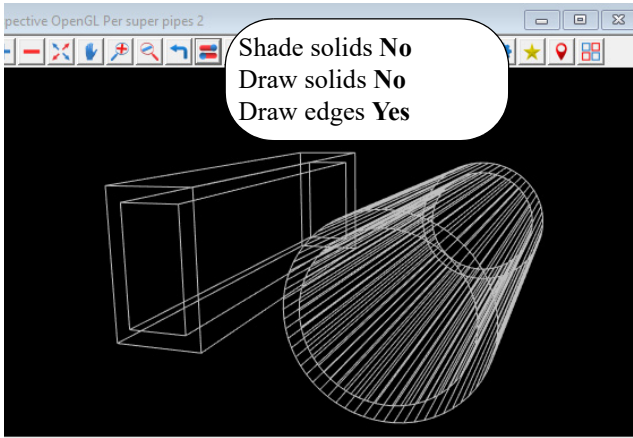
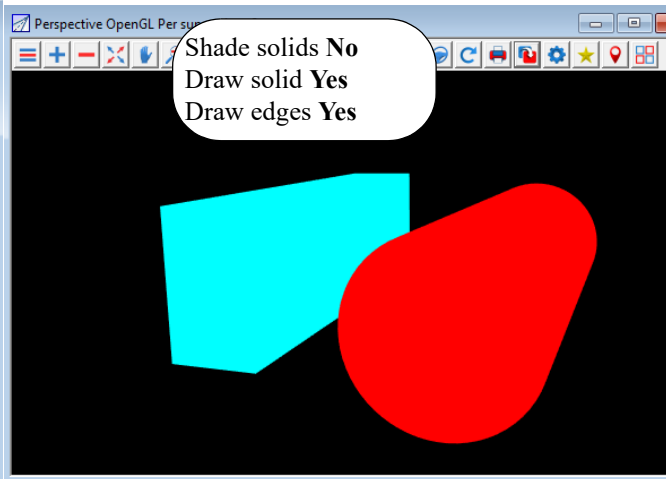
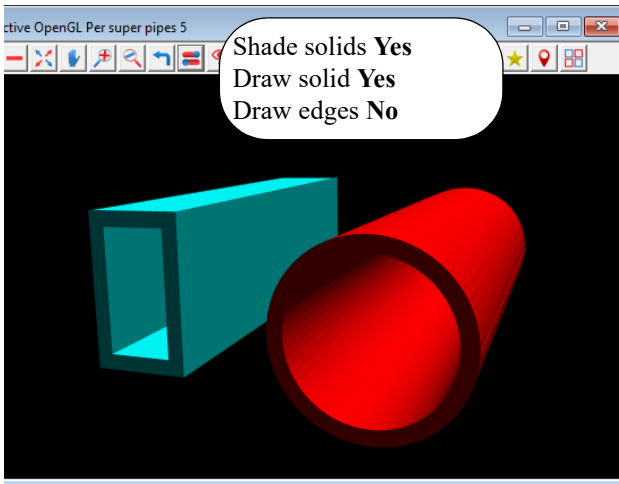


In the given example, the colour for drawing of the edges was set to a grey colour (pen 018). This stands out fairly well on most coloured solid faces.

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.

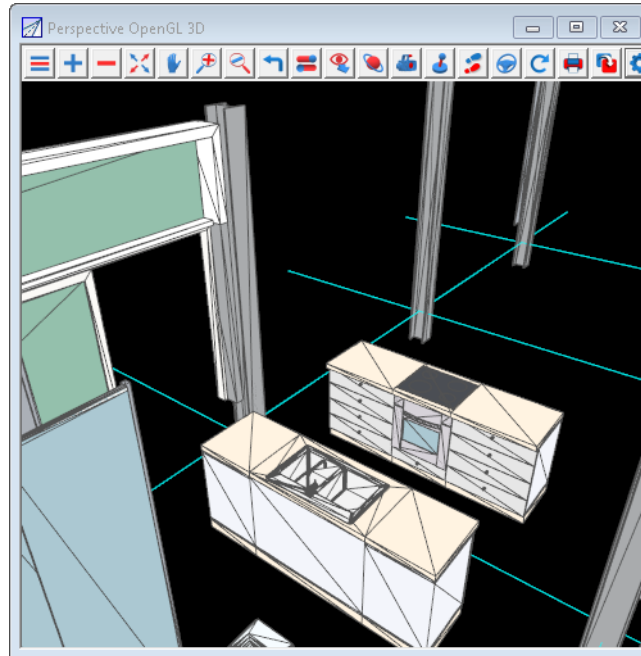
Examples of the effect of the different settings for a round and rectangular super pipe are:



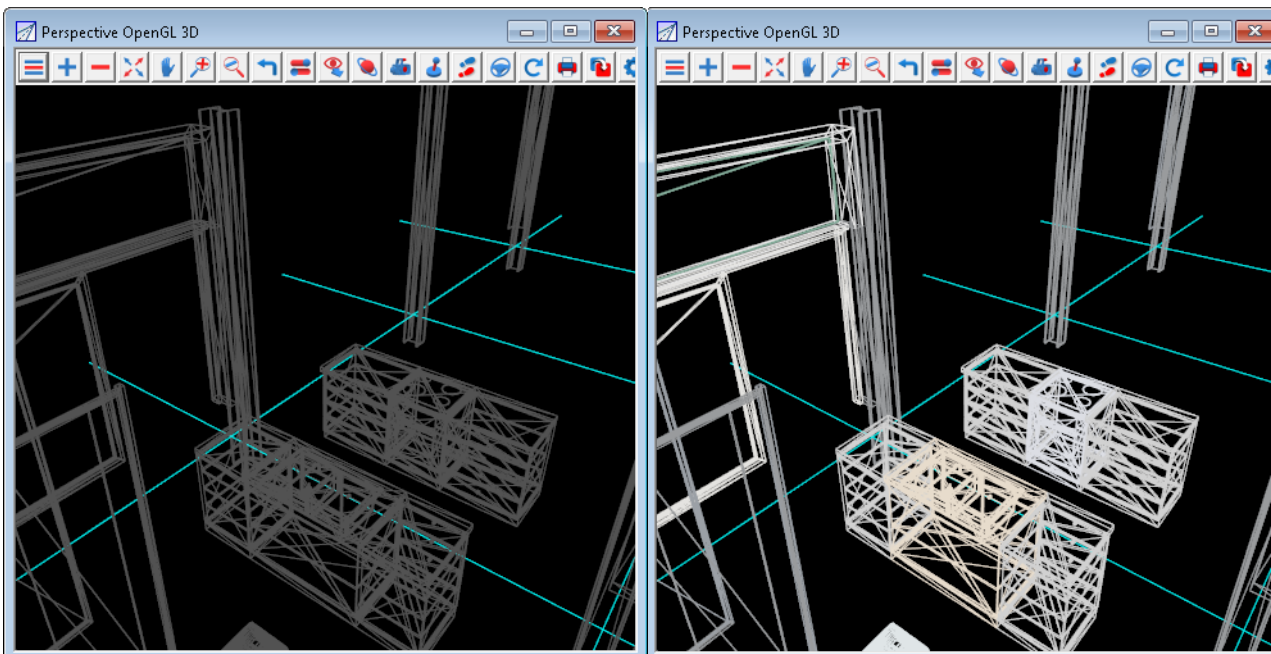


Note that for edges, the colour of the edges can be a set colour, or the edges are drawn in the colour of the object that it is an edge for.

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.



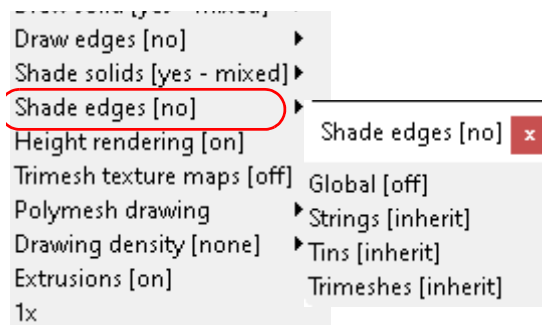
Continue to [5.2.2.1.6 Toggle Shade Edges](#) or return to [5.2.2.1 Perspective Toggle](#) or [5.2.2 Perspective View Settings](#).

### 5.2.2.1.6 Toggle Shade Edges

On Open GL views, edges of **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**.

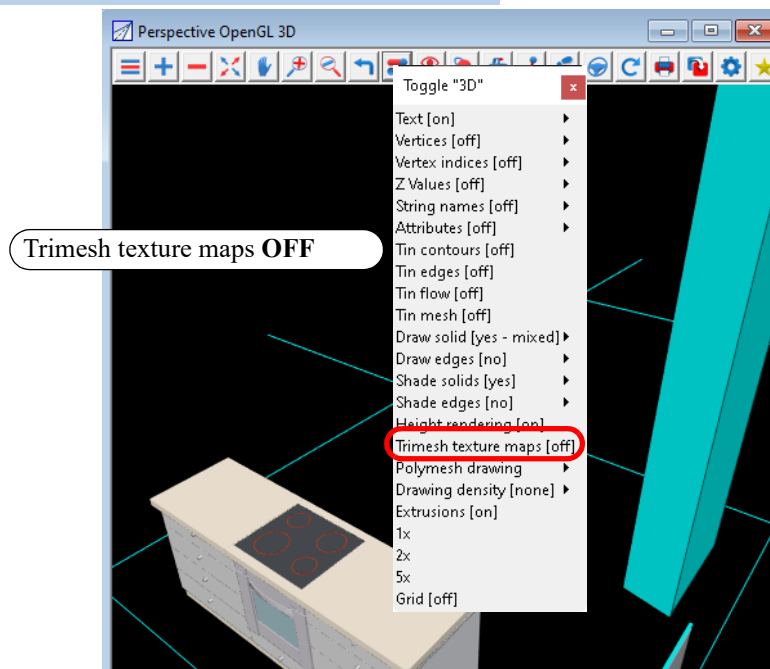
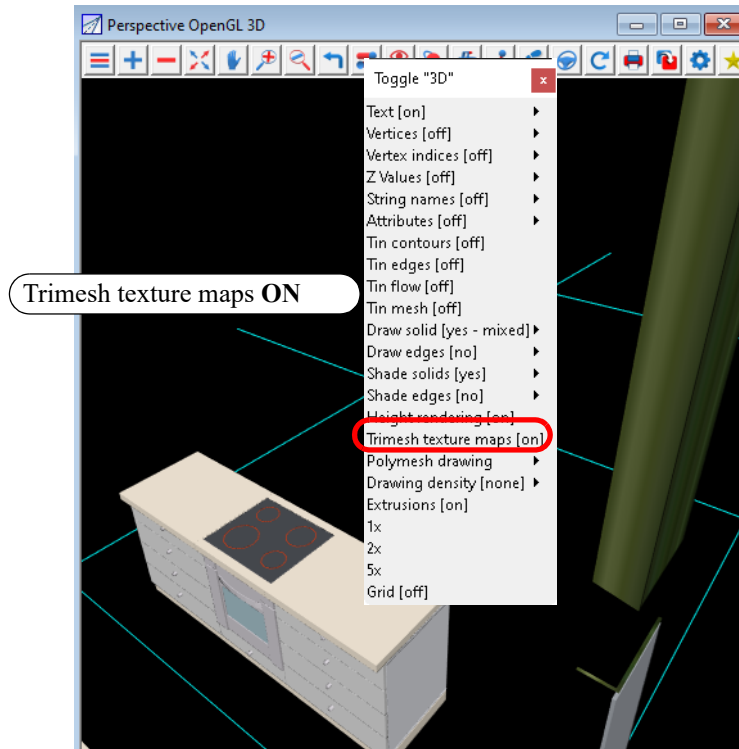
Continue to [5.2.2.1.7 Toggle Displaying Trimeshes with Texture Mapping](#) or return to [5.2.2.1 Perspective Toggle](#) or [5.2.2 Perspective View Settings](#).

### 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.

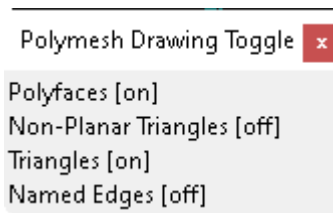
When **Trimesh texture maps** is toggled **OFF**, the mapping of colours to textures is NOT applied to the faces of the trimeshes.

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:

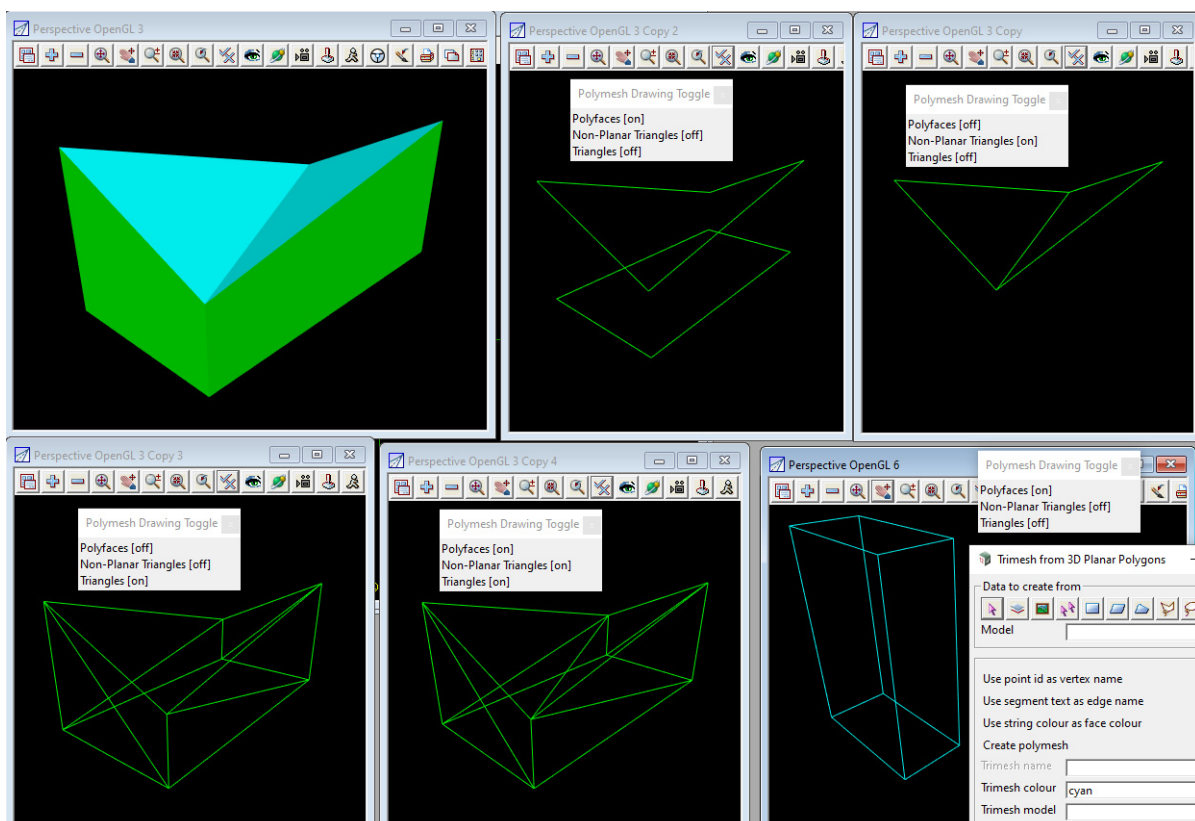
**Polyfaces** - when toggled on, the boundary polygon of any planar polyfaces are drawn on the view. This probably should say Planar polyfaces.

**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](#).



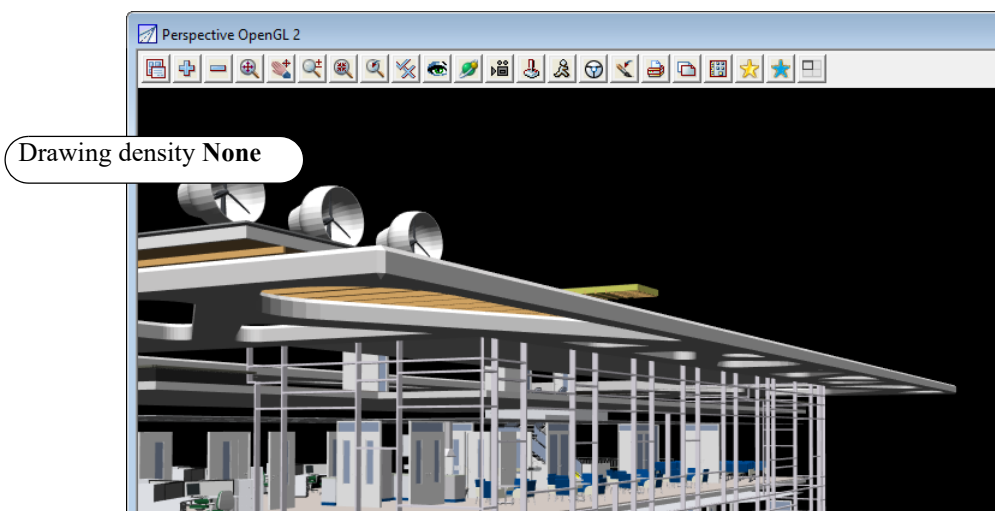
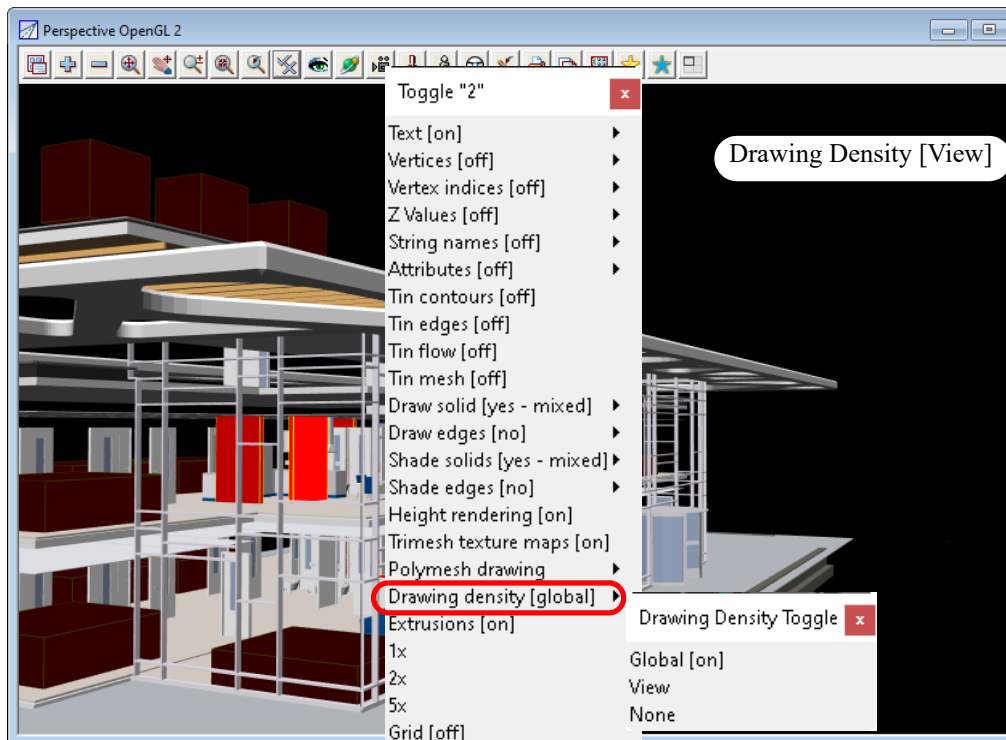
### 5.2.2.1.9 Drawing Density Toggle

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

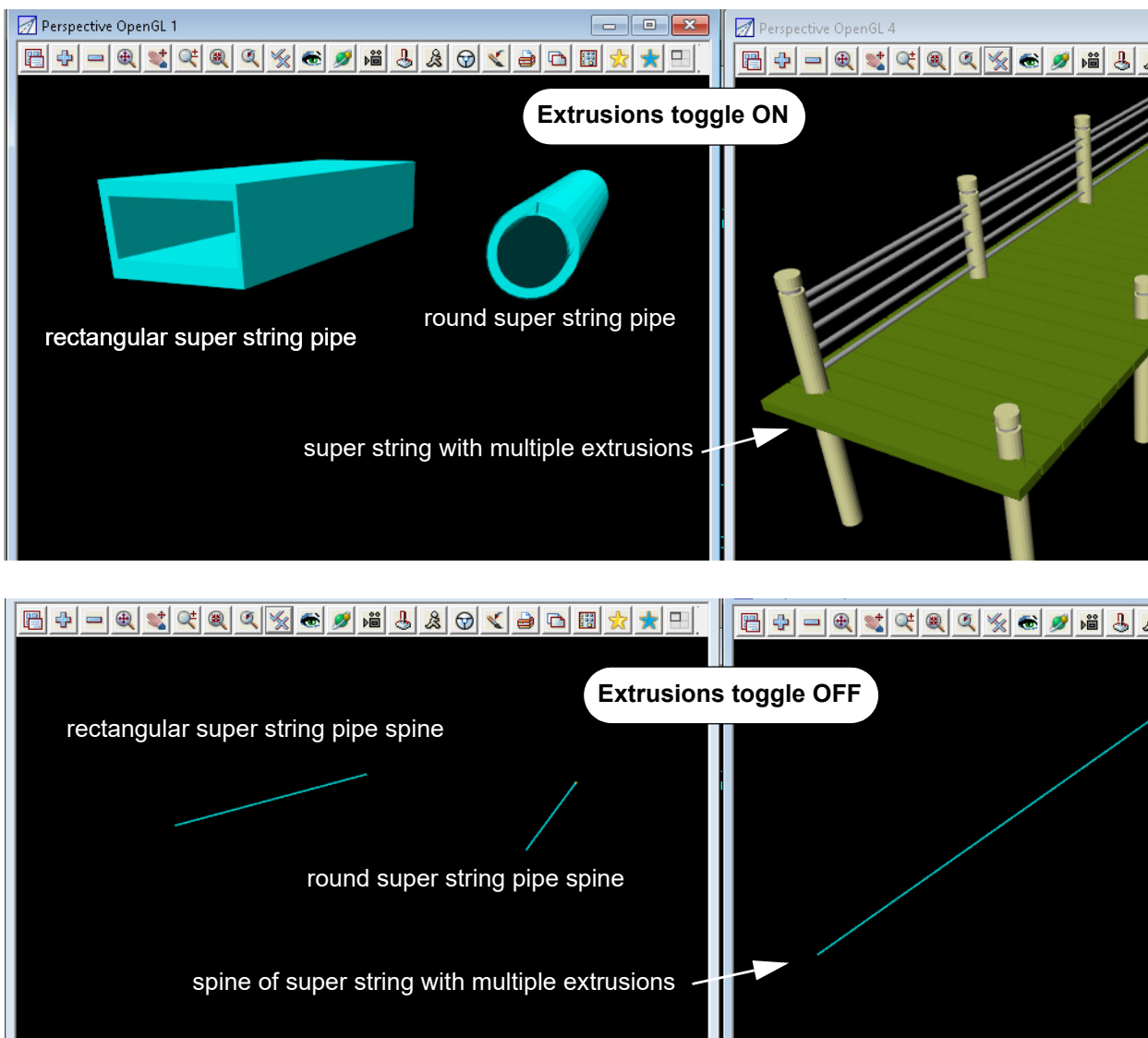
**12d Model super string extrusions** are created in a number of ways:

- super string as a round pipe
- super string as a rectangular pipe
- super string with a 2D super string (with and without holes) swept along the super string
- 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

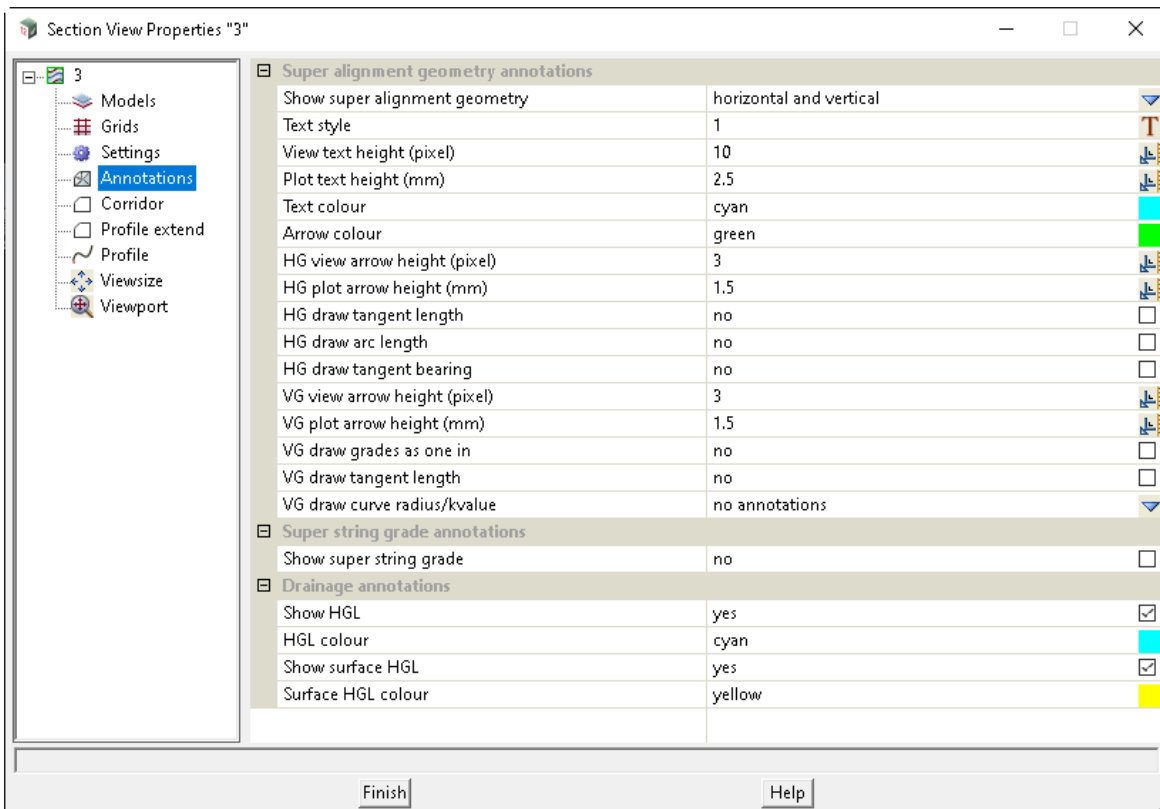


Continue to [5.3 Section View Menu](#) or return to [5.2.2.1 Perspective Toggle](#) or [5.2.2 Perspective View Settings](#).

## 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.

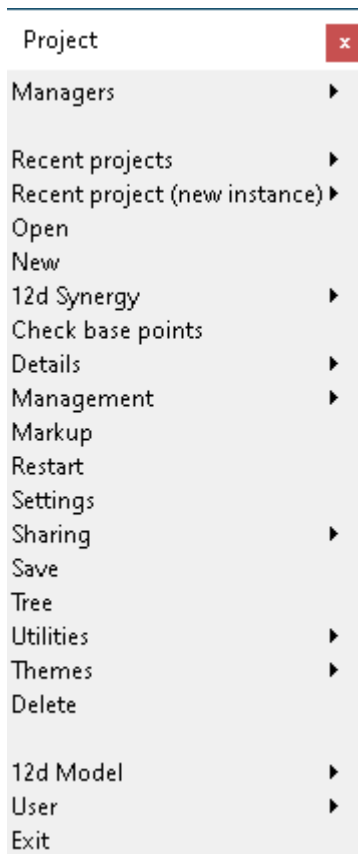


Continue to [6 Project](#) or return to [5.3 Section View Menu](#).

# 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**

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](#)

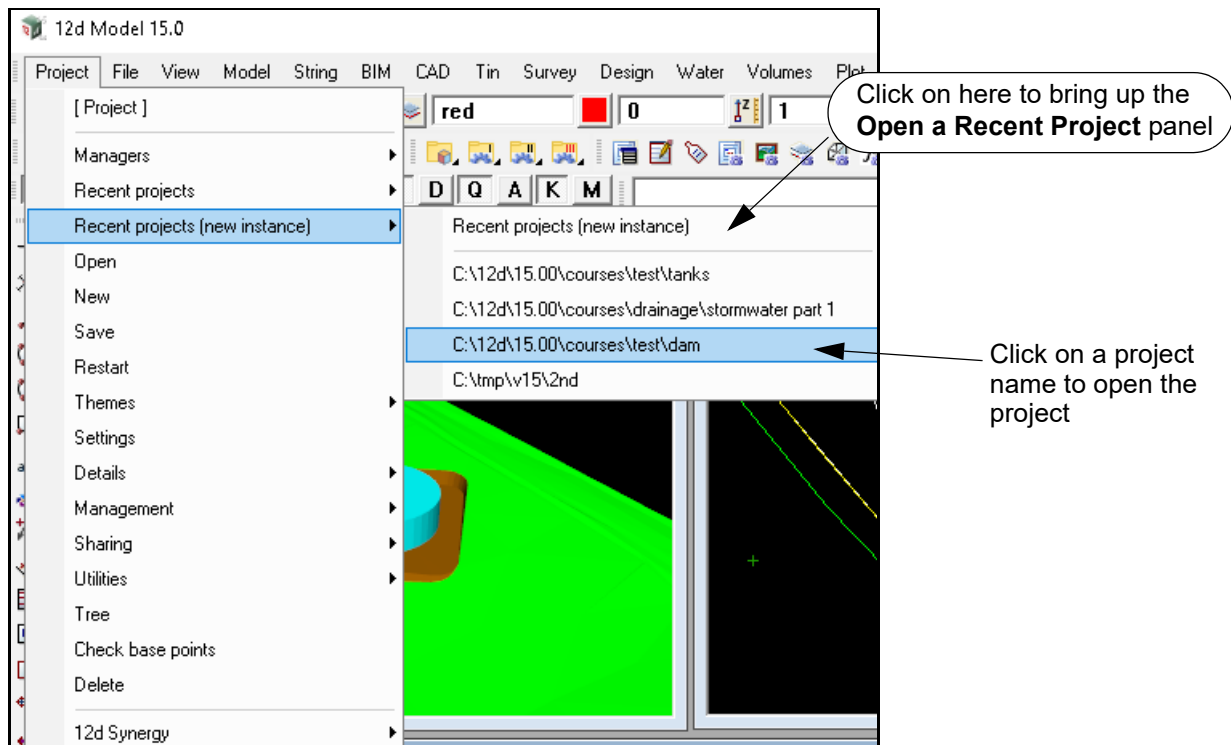
See [6.6 Project Sharing](#)

## 6.1 Recent Projects - New Instance

**Position of option on menu:** Project =>Recent projects (new instance)

Now documented in the [V15 reference manual](#)

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

Now documented in the V15 reference manual.

The Themes option changes the **Theme** being used for **12d Model**.

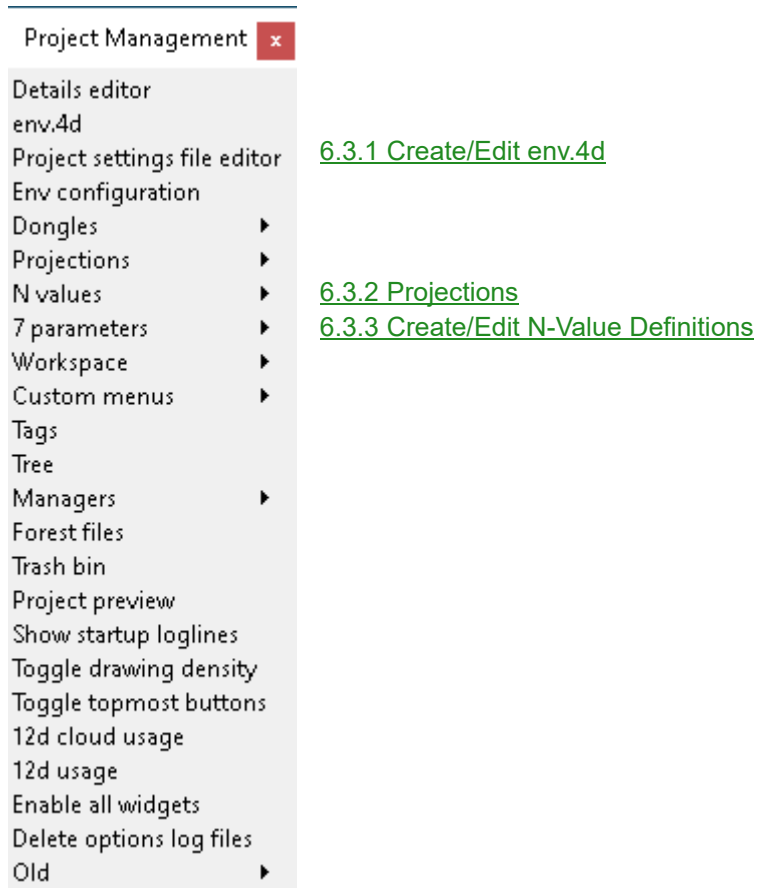
Selecting a new Theme from the Themes menu removes all the menus and toolbars for the current Theme and replaces them with the selected Theme.



Continue to [6.3 Management](#) or return to [6 Project](#).

## 6.3 Management

There has been the following additions to the **Project Management** menu:



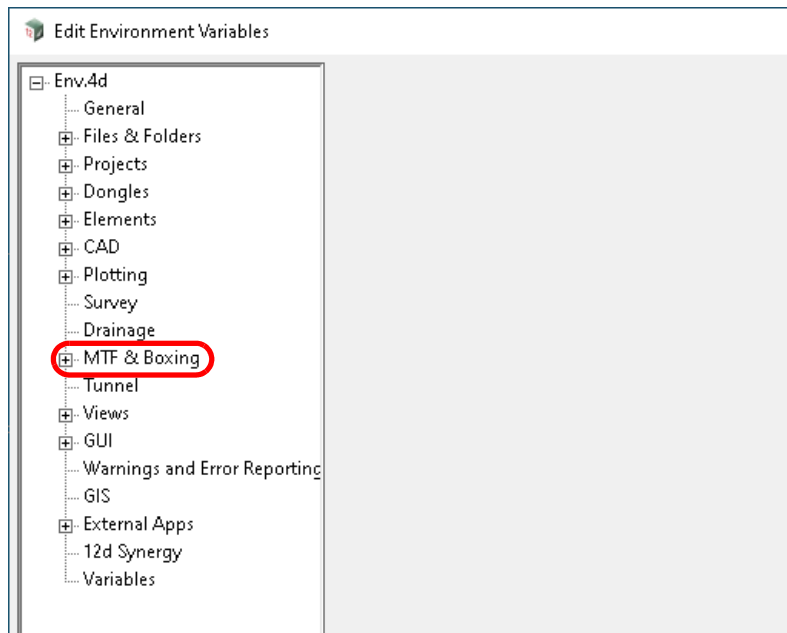


## 6.3.1 Create/Edit env.4d

Now documented in the V15 reference manual

Position of option on menu: Project =>Management =>env.4d

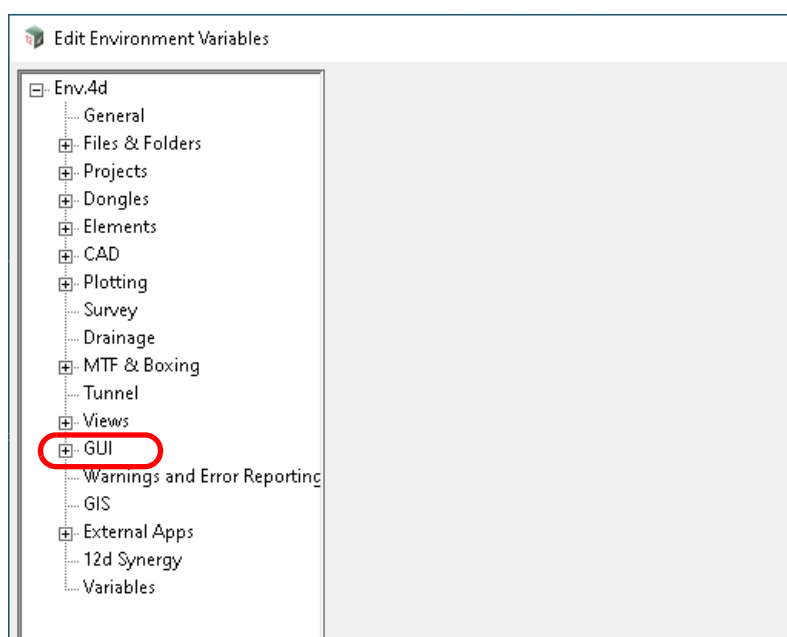
Selecting env.4d displays the **Edit Environmental Variables** panel.



Show convert chainages to dropped xy in 'Edit now' menu  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.*

*Env variable and full documentation: see [ALLOW\\_CONVERT\\_CHAINAGES\\_TO\\_DROPPED\\_XY\\_REF\\_4D](#)*



**GUI > Topmost buttons**

**Use topmost buttons** tick box

*If ticked, topmost buttons will be displayed.*

Env variable see [USE\\_TOPMOST\\_BUTTONS\\_4D](#)

**Visible buttons/text** input default blank

*The list of buttons and screen text for the buttons to display.*

Env variable see [TOPMOST\\_BUTTON\\_LIST\\_4D](#)

**Position** choice box

*If basic orientation of the buttons, vertical left/right or horizontal from top of screen.*

Env variable see [TOPMOST\\_BUTTON\\_EDGE\\_4D](#)

**Side offset** integer box

*If not blank, the offset from the left/right of the screen.*

Env variable see [TOPMOST\\_BUTTON\\_OFFSET\\_X\\_4D](#)

**Top offset** integer box

*If not blank, the offset from the top of the screen.*

Env variable see [TOPMOST\\_BUTTON\\_OFFSET\\_Y\\_4D](#)

**Button width** integer box

*If not blank, the width of the button.*

Env variable see [TOPMOST\\_BUTTON\\_WIDTH\\_4D](#)

**Button height** integer box

*If not blank, the height of the button.*

Env variable see [TOPMOST\\_BUTTON\\_LIST\\_4D](#)

**Gap between buttons** integer box

*If not blank, the gap between buttons.*

Env variable see [TOPMOST\\_BUTTON\\_GAP\\_4D](#)

**Transparency (0-255)** integer box

*If not blank, the transparency applied to the buttons.*

Env variable see [TOPMOST\\_BUTTON\\_TRANSPARENCY\\_4D](#)

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

Now documented in the V15 reference manual

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**.

Projections	
Projection editor	<a href="#">6.3.2.1 Projection Editor</a>
Set projection	<a href="#">6.3.2.2 Set Projection</a>
Clear projection	<a href="#">6.3.2.3 Clear Projection</a>
Convert projection 4d to 12dcarto	<a href="#">6.3.2.4 4 Convert projection 4d to 12dcarto</a>

See

### 6.3.2.1 Projection Editor

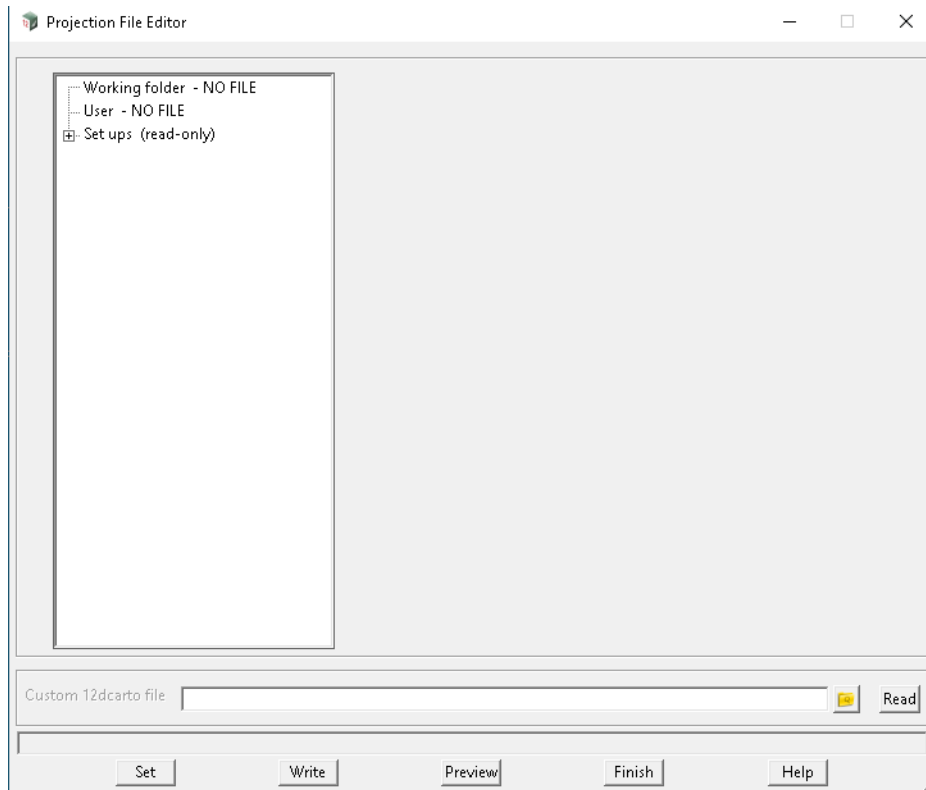
**Position of option on menu:** Project => Management => Projections => Projection editor

Now documented in the V15 reference manual

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
<b>Custom projection .12dcarto</b>	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](#).

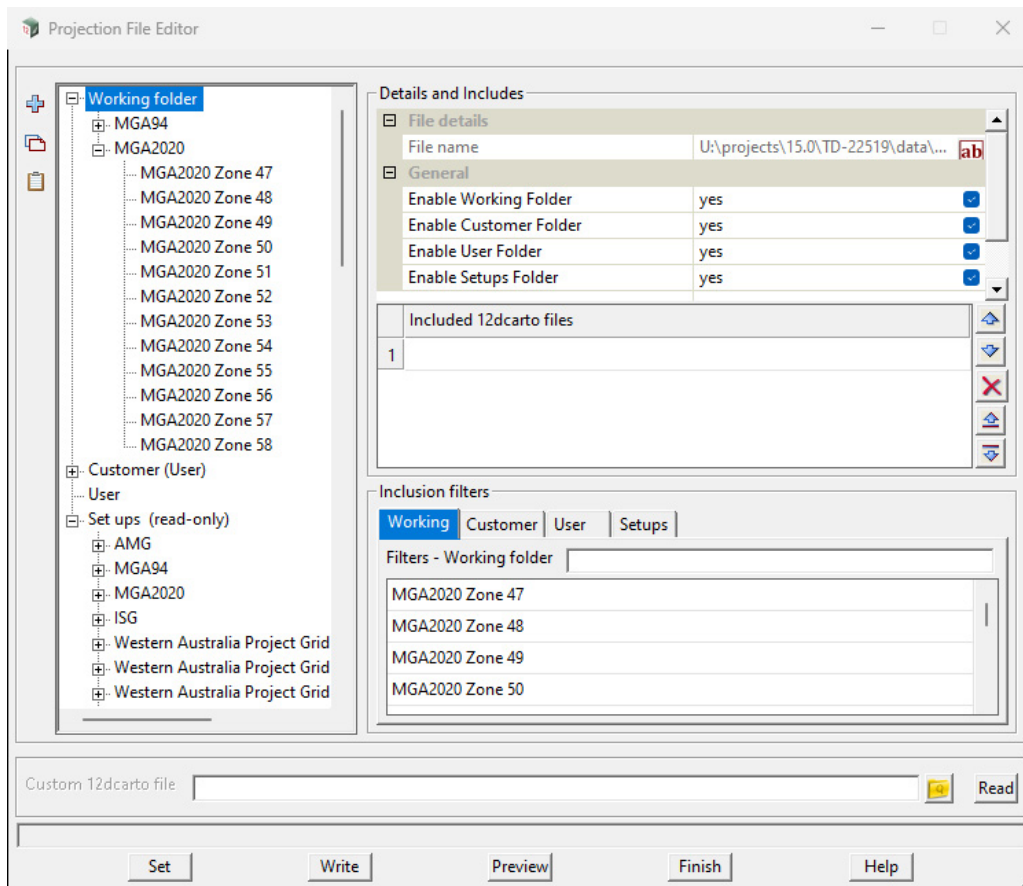
See [6.3.2.1.2 Group of Projections](#).

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
<b>Details and Includes</b>			
<b>File name</b>	text box		
<i>Showing the path to the file's location.</i>			
<b>Enable Working Folder</b>	tick box	ticked	
<i>If <b>ticked</b>, all Projection from <b>Working folder</b> will be included in Projection choice box pop-up (Projection Box).</i>			
<b>Enable Customer Folder</b>	tick box	ticked	
<i>If <b>ticked</b>, all Projection from <b>User folder</b> will be included in Projection choice box pop-up (Projection Box).</i>			
<b>Enable User Folder</b>	tick box	ticked	
<i>If <b>ticked</b>, all Projection from <b>User folder</b> will be included in Projection choice box pop-up (Projection Box).</i>			
<b>Enable Setups Folder</b>	tick box	ticked	
<i>If <b>ticked</b>, all Projection from <b>Setups folder</b> will be included in Projection choice box pop-up (Projection Box).</i>			

*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.*

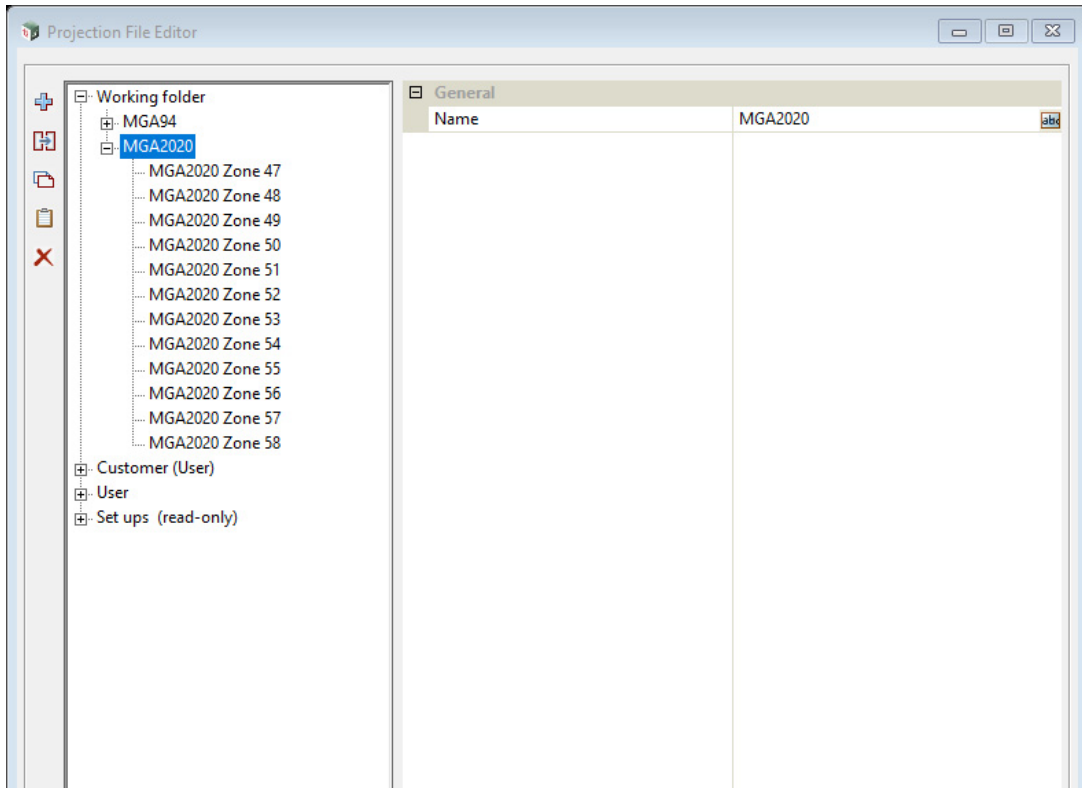
**Note:** The file is structured as a tree where the top node is the file itself. The top node can have 2 types of children as [6.3.2.1.3 Projection](#) and/or [6.3.2.1.2 Group of Projections](#).

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:



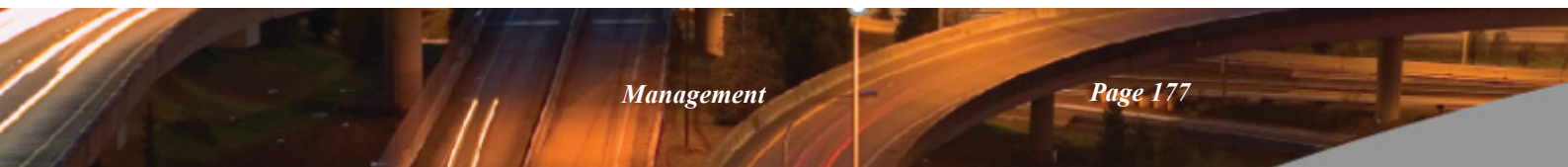
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Name</b>	text box		

*The name of the group.*

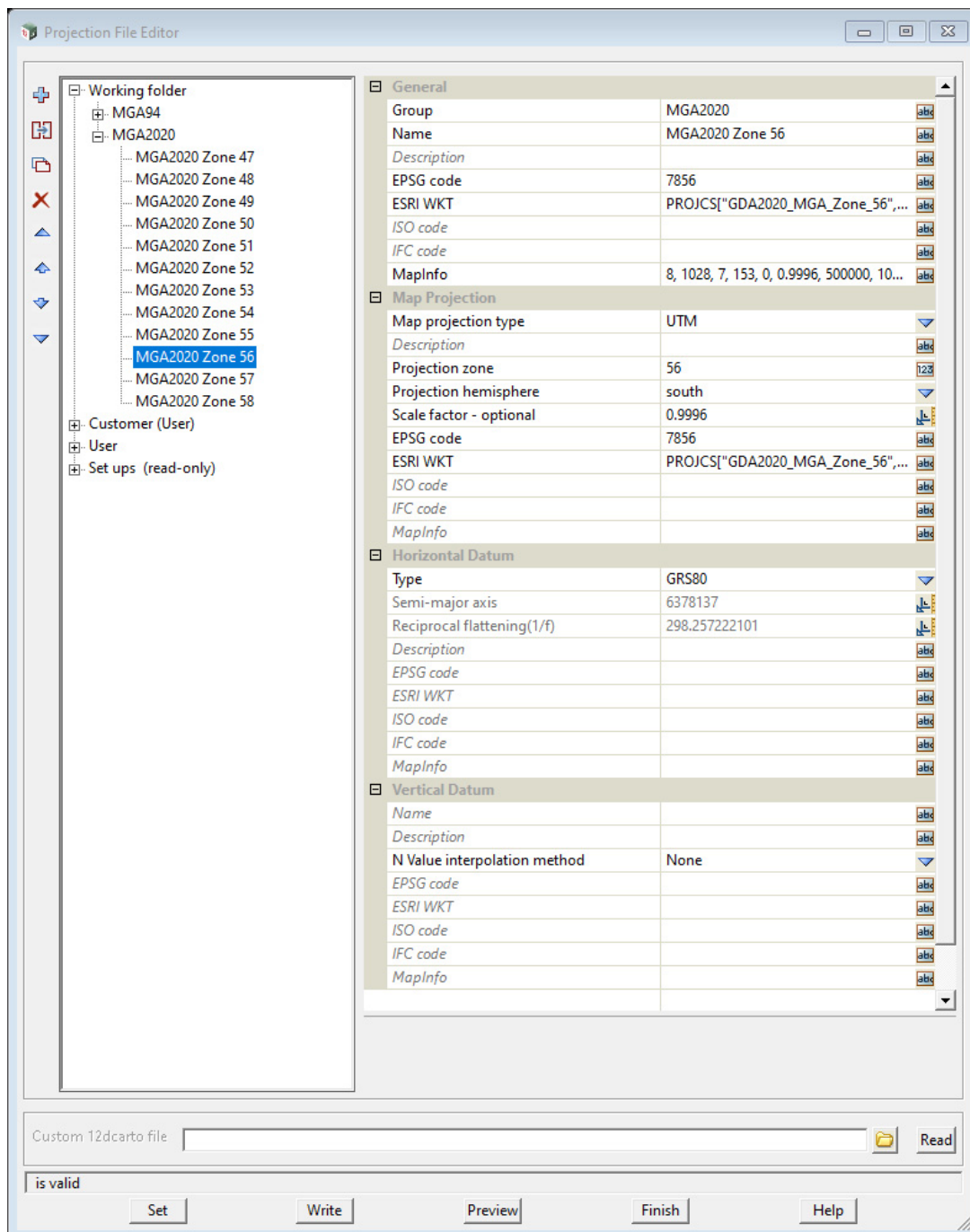
**Note:** Each of the **group of projections** node also has 1 or many [6.3.2.1.3 Projection](#).

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**

General	
Group	MGA 2020
Name	MGA2020 Zone 55
Description	
EPSG code	7855
ESRI WKT	PROJCS["GDA2020_MGA_Zone_55",...
ISO code	
IFC code	
MapInfo	8, 1028, 7, 147, 0, 0.9996, 500000, 10...

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

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

<b>Group</b>		name box	optional	
--------------	--	----------	----------	--

*Name of group where this projection belongs to.*

<b>Name</b>		name box		
-------------	--	----------	--	--

*Name of projection (must be unique).*

<b>Description</b>		text box	optional	
--------------------	--	----------	----------	--

*Description of the projection.*

<b>EPSG code</b>		text box	optional	
------------------	--	----------	----------	--

*The EPSG code for this projection.*

<b>ISO code</b>		text box	optional	
-----------------	--	----------	----------	--

*The ISO code for this projection.*

<b>ESRI WKT</b>		text box	optional	
-----------------	--	----------	----------	--

*The ESRI WKT format for this projection.*

<b>IFC code</b>		text box	optional	
-----------------	--	----------	----------	--

*The IFC code for this projection.*

<b>Map Info</b>		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](#)

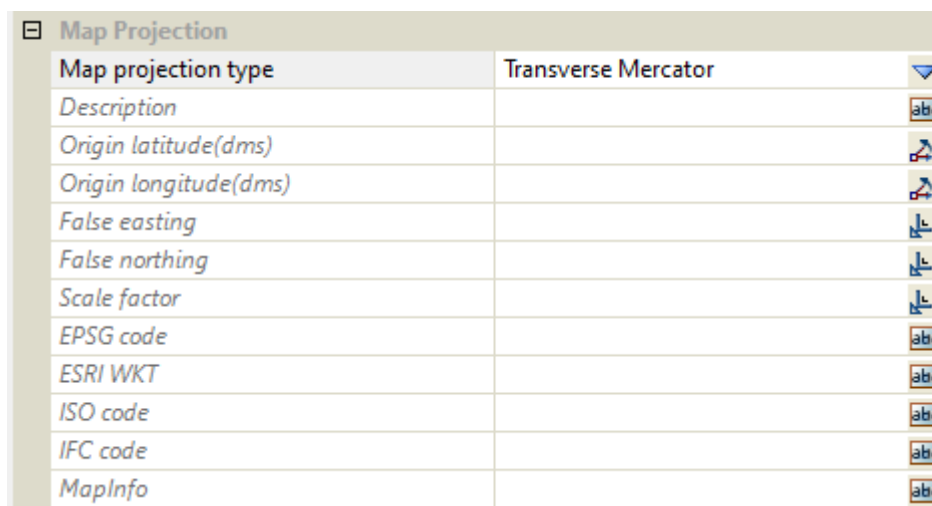
RSO - see [RSO](#)

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
<b>Origin latitude (dms)</b> <i>Latitude of projection centre (+lat_0). If blank, default to 0.0</i>	angle box	optional	
<b>Origin longitude (dms)</b> <i>Longitude of projection centre (+lon_0). If blank, default to 0.0</i>	angle box	optional	
<b>False Easting</b> <i>False easting (+x_0). If blank, default to 0.0</i>	double box	optional	
<b>False Northing</b> <i>False northing (+y_0). If blank, default to 0.0</i>	double box	optional	
<b>Scale factor</b> <i>Scale factor used in the projection (+k_0). If blank, default to 1.0</i>	double box	optional	
<b>EPSG code</b>	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

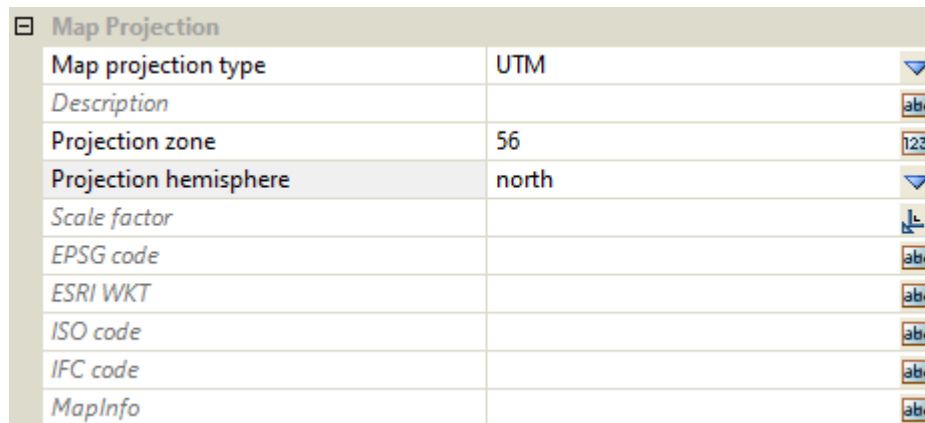
The IFC code of the projection.

**Mapinfo** text box optional

MapInfo of the projection.

For more information about Transverse Mercator, see <https://proj.org/operations/projections/tmerc.html>.

**UTM**



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

Field Description	Type	Defaults	Pop-Up
<b>Projection zone</b>	angle box	optional	
<i>The UTM zone (+zone). Value can be from 1 to 60.</i>			
<b>Projection hemisphere</b>	choice box	north	North, South
<i>The hemisphere of which the projection is on.</i>			
<b>Scale factor</b>	double box	optional	
<i>Scale factor used in the projection (+k_0). If <b>blank</b>, default to 0.9996.</i>			
<b>EPSG code</b>	text box	optional	
<i>The EPSG code of the projection.</i>			
<b>ESRI WKT</b>	text box	optional	
<i>The ESRI WKT format of proj for this projection.</i>			
<b>ISO code</b>	text box	optional	

The ISO code of the projection.

**IFC code**                      text box                      optional

The IFC code of the projection.

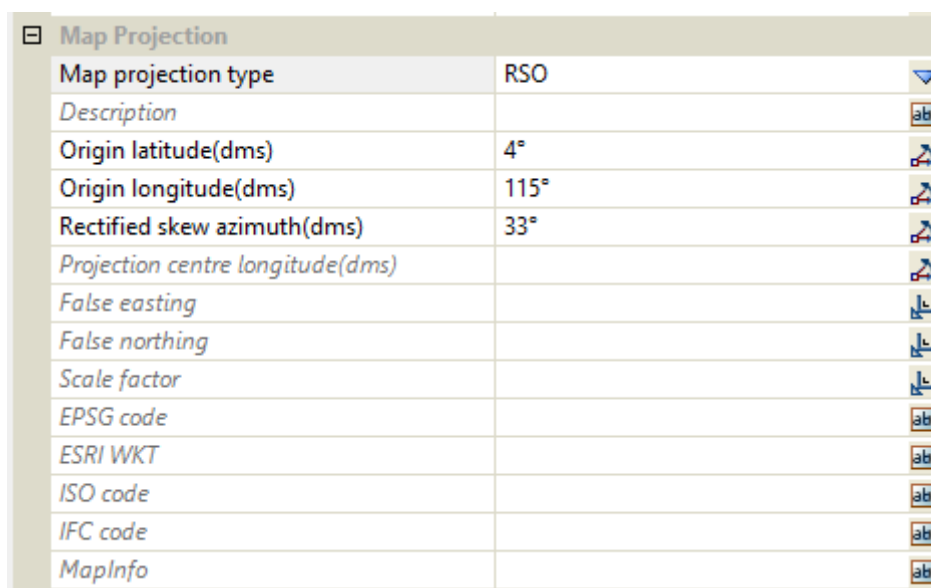
**Mapinfo**                      text box                      optional

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

<b>EPSG code</b>	text box	optional
	<i>The EPSG code of the projection.</i>	
<b>ESRI WKT</b>	text box	optional
	<i>The ESRI WKT format of proj for this projection.</i>	
<b>ISO code</b>	text box	optional
	<i>The ISO code of the projection.</i>	
<b>IFC code</b>	text box	optional
	<i>The IFC code of the projection.</i>	
<b>Mapinfo</b>	text box	optional
	<i>MapInfo of the projection.</i>	

For more information about RSO, see <https://proj.org/operations/projections/omerc.html>.

### Lambert Conformal

Map Projection	
Map projection type	Lambert Conformal
Description	
First standard parallel(dms)	33°
Second standard parallel(dms)	
Origin latitude(dms)	
Origin longitude(dms)	
False easting	
False northing	
Scale factor	
EPSG code	
ESRI WKT	
ISO code	
IFC code	
MapInfo	

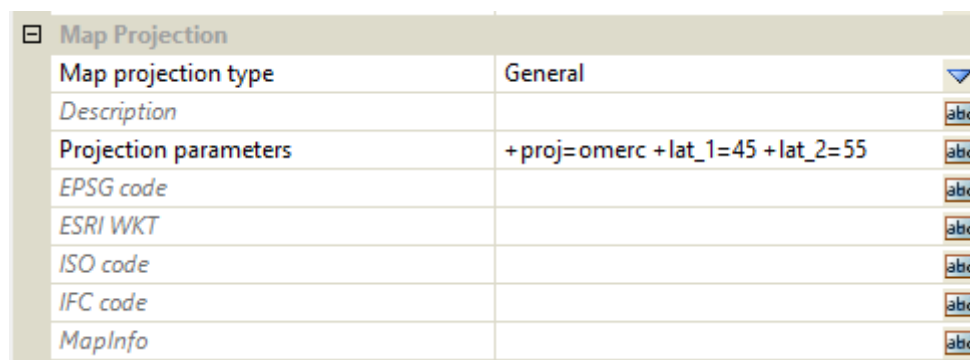
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>First standard parallel (dms)</b>	angle box	optional	
	<i>First standard parallel (+lat_1).</i>		
<b>Second standard parallel (dms)</b>	angle box	optional	
	<i>Second standard parallel (+lat_2). If <b>blank</b>, default to 0.0.</i>		
<b>Origin latitude (dms)</b>	angle box	optional	
	<i>Latitude of projection centre (+lat_0). If <b>blank</b>, default to 0.0</i>		

<b>Origin longitude (dms)</b>	angle box	optional
<i>Longitude of projection centre (+lon_0). If <b>blank</b>, default to 0.0</i>		
<b>False Easting</b>	double box	optional
<i>False easting (+x_0). If <b>blank</b>, default to 0.0</i>		
<b>False Northing</b>	double box	optional
<i>False northing (+y_0). If <b>blank</b>, default to 0.0</i>		
<b>Scale factor</b>	double box	optional
<i>Scale factor used in the projection (+k_0). If <b>blank</b>, default to 1.0</i>		
<b>EPSG code</b>	text box	optional
<i>The EPSG code of the projection.</i>		
<b>ESRI WKT</b>	text box	optional
<i>The ESRI WKT format of proj for this projection.</i>		
<b>ISO code</b>	text box	optional
<i>The ISO code of the projection.</i>		
<b>IFC code</b>	text box	optional
<i>The IFC code of the projection.</i>		
<b>Mapinfo</b>	text box	optional
<i>MapInfo of the projection.</i>		

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
<b>Projection parameter</b>	text box	optional	
<i>Contains the proj string for any unavailable projections in <b>12d Model</b>.</i>			
<b>EPSG code</b>	text box	optional	
<i>The EPSG code of the projection.</i>			

<b>ESRI WKT</b>	text box	optional
<i>The ESRI WKT format of proj for this projection.</i>		
<b>ISO code</b>	text box	optional
<i>The ISO code of the projection.</i>		
<b>IFC code</b>	text box	optional
<i>The IFC code of the projection.</i>		
<b>Mapinfo</b>	text box	optional
<i>MapInfo of the projection.</i>		

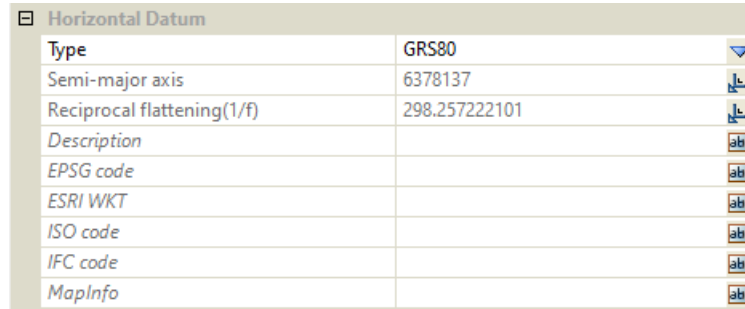
**None Type**

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.

Map Projection	
Map projection type	None
Description	
Projection parameters	
Origin latitude(dms)	
Origin longitude(dms)	
Rectified skew azimuth(dms)	
Projection centre longitude(dms)	
False easting	
False northing	
Projection zone	
projection hemisphere	undefined
Scale factor	
EPSG code	
ESRI WKT	
ISO code	
IFC code	
MapInfo	



### Horizontal Datum



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

Field Description	Type	Defaults	Pop-Up
<b>Type</b>	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

Vertical Datum	
Name	<input type="text"/>
Description	<input type="text"/>
N Value interpolation method	None
EPSG code	<input type="text"/>
ESRI WKT	<input type="text"/>
ISO code	<input type="text"/>
IFC code	<input type="text"/>
MapInfo	<input type="text"/>

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

Field Description	Type	Defaults	Pop-Up
<b>N value interpolation method</b>	choice box	optional	all defined N values
<i>N value interpolation method for projection. The choices can be setup using N value settings.</i>			
<b>EPSG code</b>	text box	optional	EPSG code
<i>The EPSG code of the vertical datum.</i>			
<b>ISO code</b>	text box	optional	ISO code
<i>The ISO code of the vertical datum.</i>			
<b>ESRI code</b>	text box	optional	ESRI code
<i>The ESRI WKT format of proj for this vertical datum.</i>			
<b>IFC code</b>	text box	optional	IFC code
<i>The IFC code of the vertical datum.</i>			
<b>Map Info</b>	text box	optional	Map Info
<i>MapInfo of the vertical datum.</i>			

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

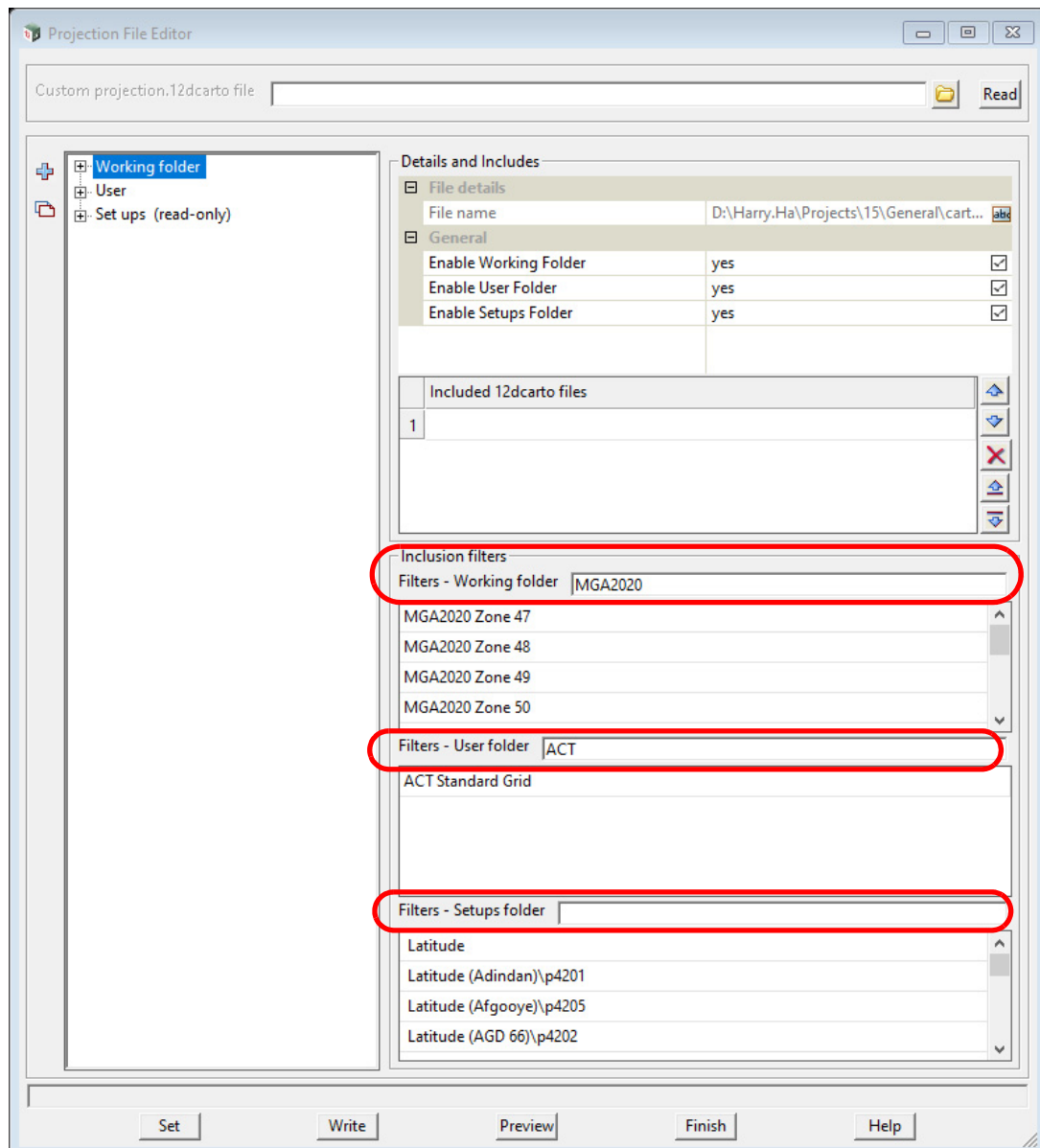
General		
Enable Working Folder	yes	<input checked="" type="checkbox"/>
Enable User Folder	yes	<input checked="" type="checkbox"/>
Enable Setups Folder	yes	<input checked="" type="checkbox"/>

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](#).

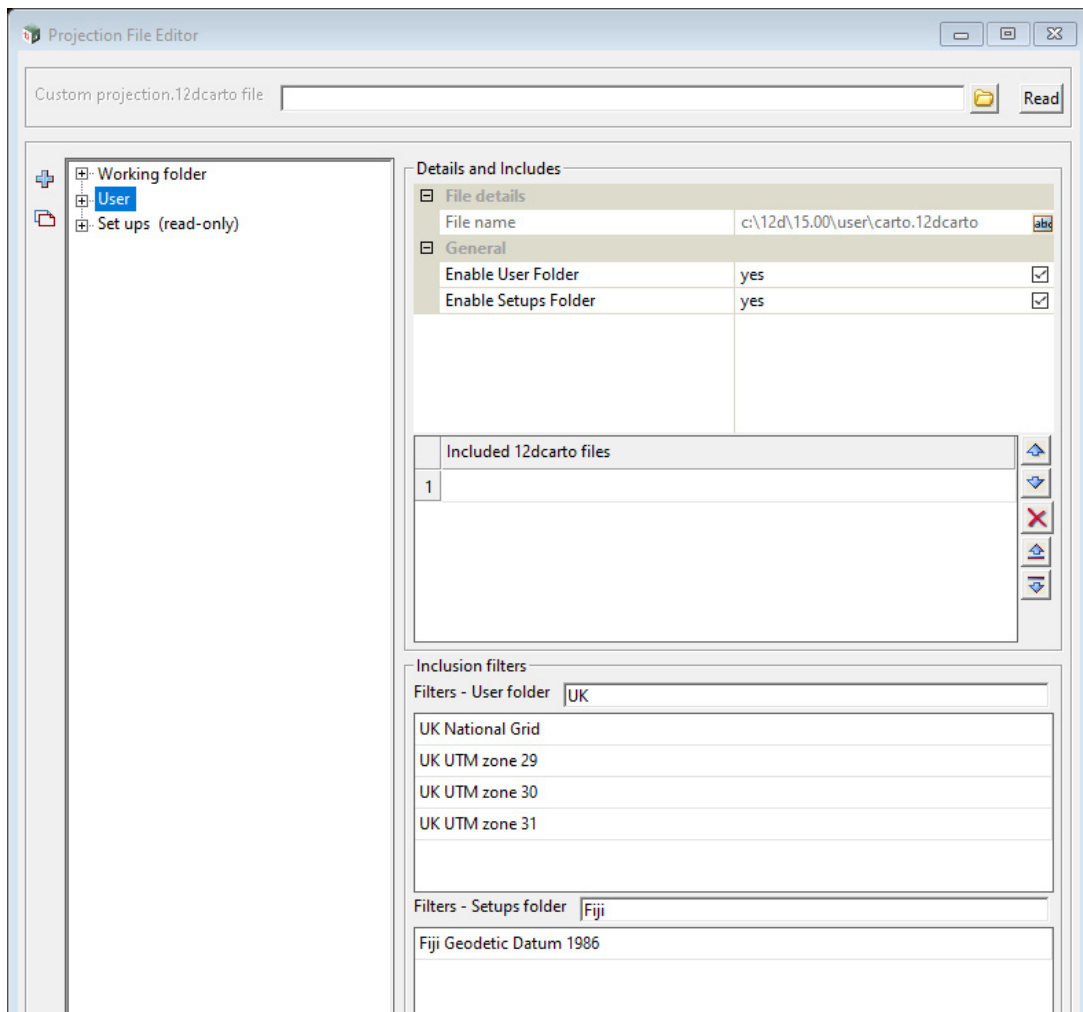
In the example above, the **Inclusion Filters** mean that

**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**).

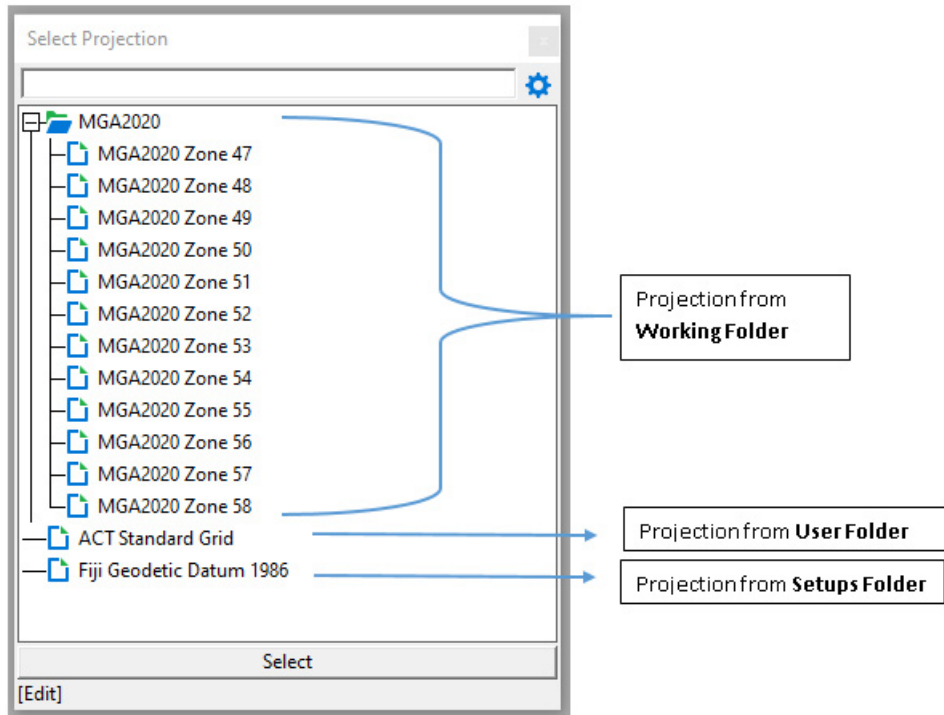


*In User (next priority location), there are 2 filters:*

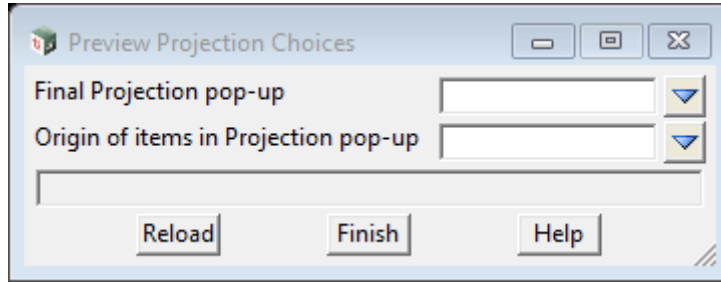
***User Folder** has "UK" filter. However, this filter will be ignored because **User Folder filter** has been used by the higher priority folder*

***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:



### 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.*

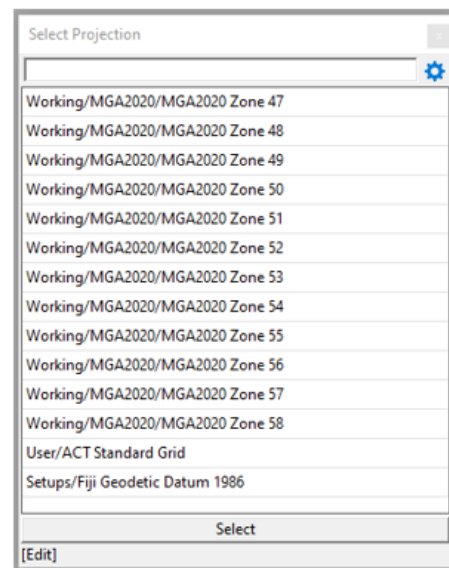
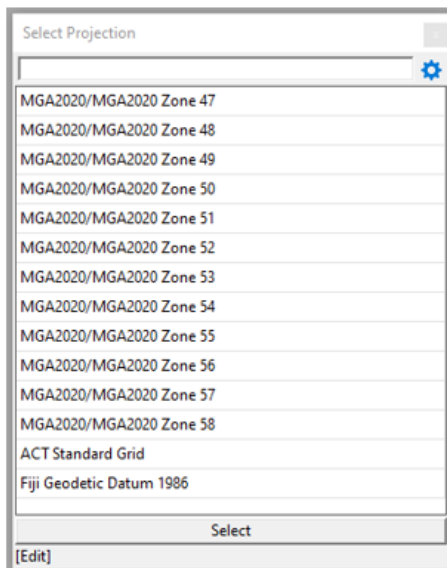
### Buttons at Bottom

**Reload** button

*To reload after changes/updates to projection editor settings.*

Final Projection pop-up

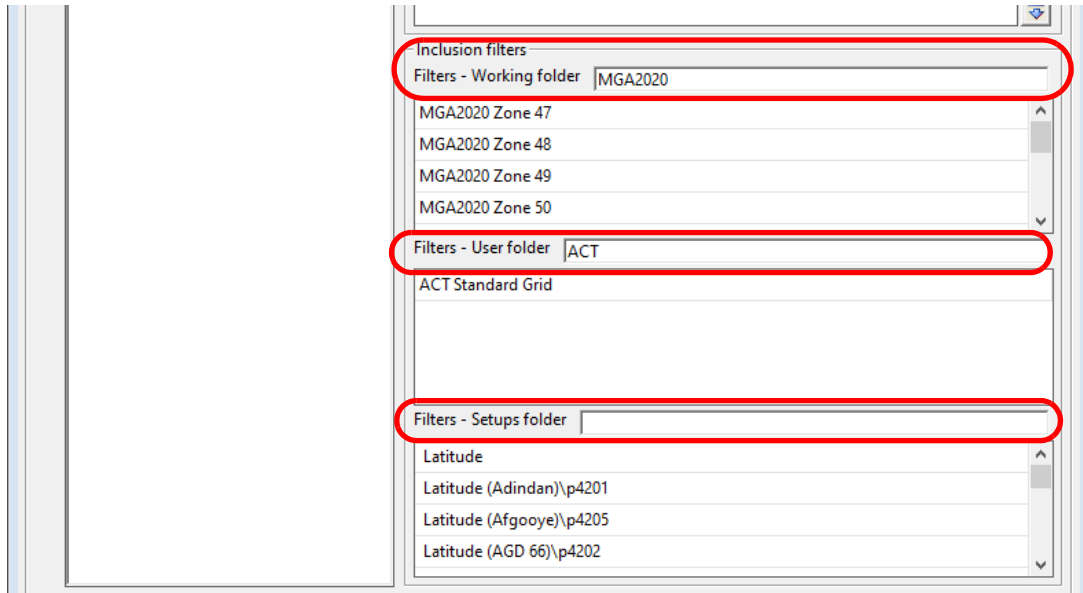
Final Projection pop-up with origin of items



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

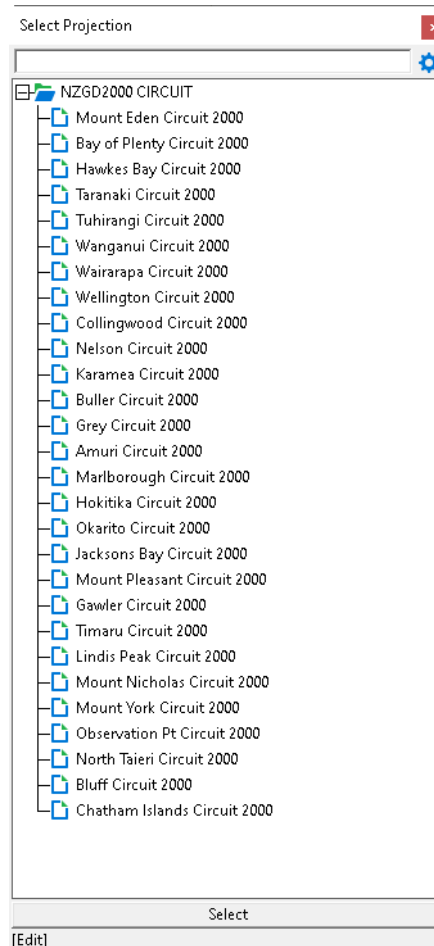
which means the search will find text with

(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](#).

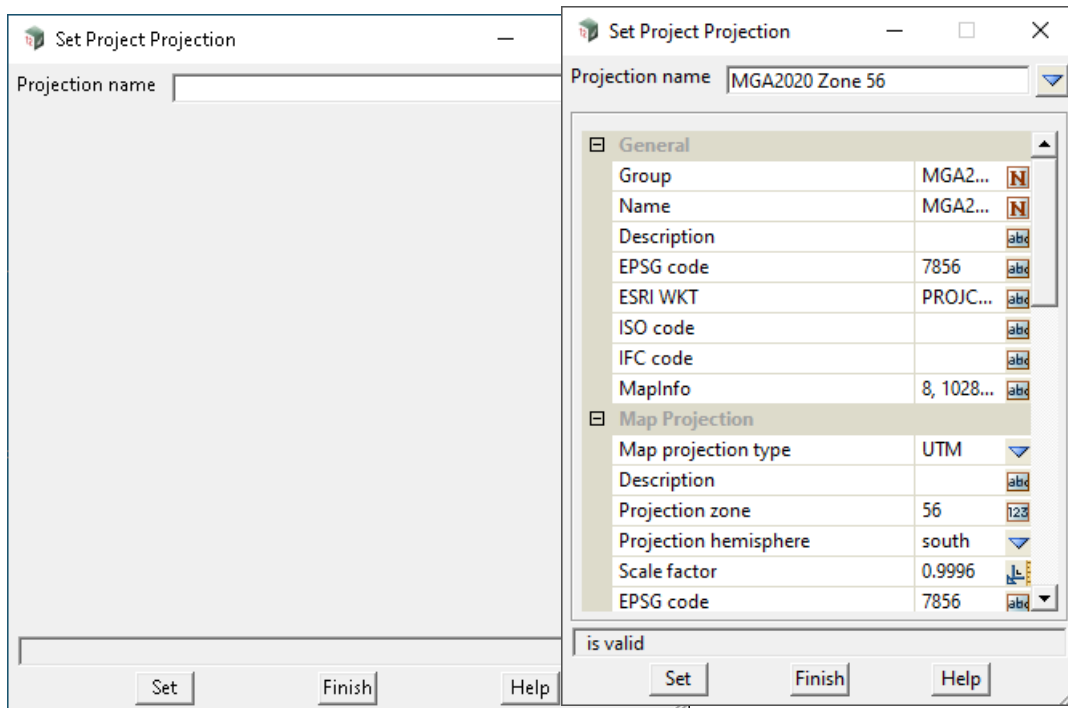


### 6.3.2.2 Set Projection

**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
<b>Projection name</b>	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.*

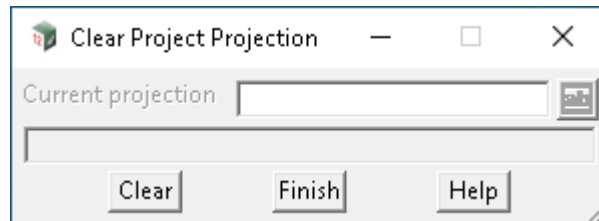
Continue to [6.3.2.3 Clear Projection](#) or return to [6.3.2 Projections](#) or [6.3 Management](#).

### 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
<b>Current projection</b>	choice box		

*Name of the current projection set for the project.*

#### Buttons at Bottom

**Clear** button

*Remove the current projection from the project.*

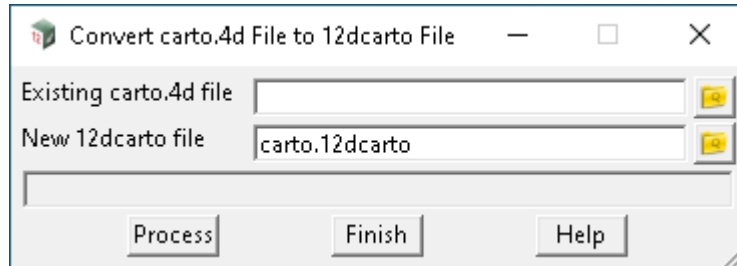
Continue to [6.3.2.4 4 Convert projection 4d to 12dcarto](#) or return to [6.3.2 Projections](#) or [6.3 Management](#).

### 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
<b>Existing carto.4d file</b>	file box		*.4d files
<i>Choose old carto file (4d format) to convert into new carto file (12dcarto format).</i>			
<b>New 12dcarto file</b>	file box		*.12dcarto files
<i>New name for the converted carto file. New carto file will have format 12dcarto.</i>			

#### 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](#).

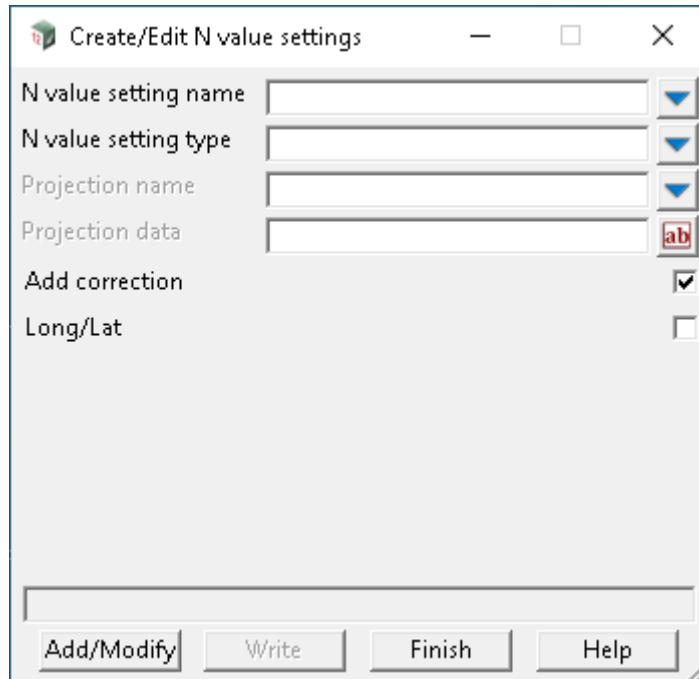


### 6.3.3 Create/Edit N-Value Definitions

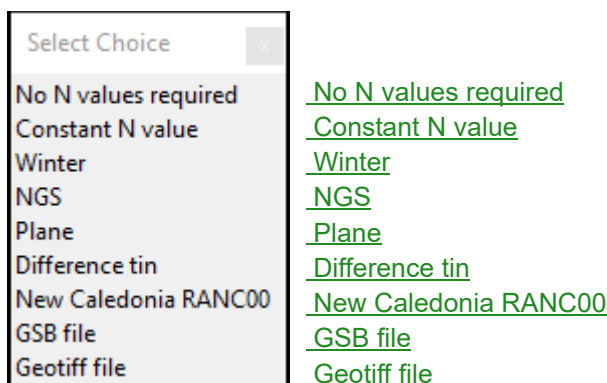
Position of option on menu: Project =>Management =>N values=>Create/Edit

Now documented in the V15 reference manual

On selecting the Create/edit option, the Create/edit N value settings panel is displayed.



Field Description	Type	Defaults	Pop-Up
<b>N value setting name</b> <i>Name of the n value setting to be set as the Project N value setting.</i>	choice box		all defined N value settings
<b>N value setting type</b> <i>There are various methods for the determination of the N values. These are given in the choice box:</i>	choice box		defined N value types



Depending on the setting type chosen, the panel will display the appropriate fields. See [6.3.3.1 N value Setting Types](#).

<b>Projection name</b> <i>The projection as selected from carto.12dcarto</i>	choice box		
---	------------	--	--

**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 [35.2.6 Writing Out Setup Files](#) in the Appendix [35 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
<b>Constant N value</b>	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
<b>Select Ausgeoid file map scale</b>	choice box		1:100,000 1:250,000 1:1,000,000
<b>Use bicubic interpolation if possible</b>	tick box	ticked	
<b>Environment variable for Winter path</b>	text box		

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.**

**Use bicubic interpolation if possible** tick box      **ticked**  
 If **ticked**, the bicubic interpolation method will be used if possible.

**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.*

NGS format binary file

### Plane

*This method allows a plane to be defined allowing N values to be derived from that plane.*

Origin easting

Origin northing

Correction constant

Correction per unit easting

Correction per unit northing

Field Description	Type	Defaults	Pop-Up
<b>Origin easting</b> <i>Origin easting value.</i>	input box		
<b>Origin northing</b> <i>Origin northern value.</i>	input box		
<b>Correction constant</b> <i>Constant Z value of the plane.</i>	input box		
<b>Correction per unit easting</b> <i>Z value correction per unit easting.</i>	input box		
<b>Correction per unit northing</b> <i>Z value correction per unit nothing.</i>	input box		

### 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.*

Difference tin

Field Description	Type	Defaults	Pop-Up
<b>Difference tin</b> <i>The difference tin from which the N values will be interpolated.</i>	tin box		Available tins



### New Caledonia RANC00

### GSB file

Field Description	Type	Defaults	Pop-Up
<b>GSB file</b>	file box		*.gsb
<i>A gsb file to find N value according to provided longitude/latitude or easting/northing.</i>			
<b>Interpolation method</b>	choice box	Bi-Cubic	Bi-Linear, Bi-Cubic
<i>If <b>Bi-Linear</b> is chosen, a 4-point-calculation is used to calculate the element's N value.</i>			
<i>If <b>Bi-Cubic</b> is chosen, a 16-point-calculation is used to calculate the element's N value.</i>			

### Geotiff file

Field Description	Type	Defaults	Pop-Up
<b>Geotiff file</b>	file box		*.tif
<i>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).</i>			

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

Now documented in the V15 reference manual

The purpose of **12d Markup** is to provide users with functionality to digitally Markup/Review **12d Model** information and can 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 within 12d Model Projects, as well as outside 12d in other BIM systems.

The **12d Markup** option works both within **12d Model** and **12d View**.

### Markups versus Reviews

#### Markups

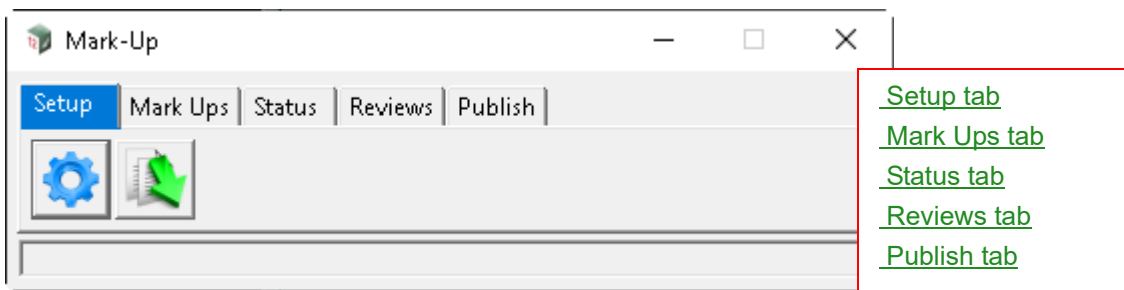
Markups are intended to follow historical markup procedures that users may be familiar with. Traditionally these markups are created to present on a final submitted on drawing plan as tracked Revisions.

The markup options reflect these traditional practices but aim 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

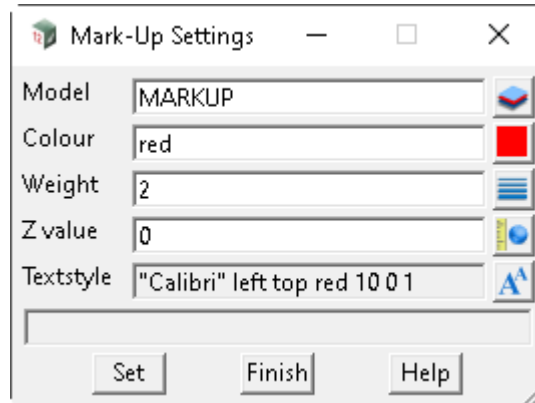


- [Setup tab](#)
- [Mark Ups tab](#)
- [Status tab](#)
- [Reviews tab](#)
- [Publish tab](#)

[Mark-up Settings](#)

[Import Settings](#)

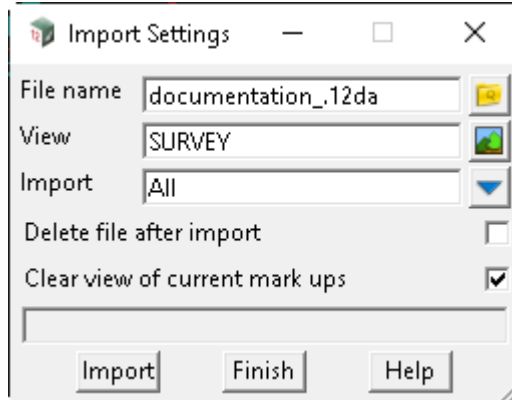
### Mark-up Settings



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

Field Description	Type	Defaults	Pop-Up
<b>Model</b>	model box		available models
<i>If a User defined Model name is entered, this name will be added as a Model postfix to the automatic markup Model name.</i>			
<b>Colour</b>	colour box	red	available colours
<i>The initial colour for the markup objects.</i>			
<b>Weight</b>	real box	2	
<i>The line weight for the markup objects.</i>			
<b>Z value</b>	real box	0	
<i>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.</i>			
<b>Textstyle</b>	textstyle box		
<i>The default text properties entered when creating Markup text or Review automatic labelling.</i>			

## 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

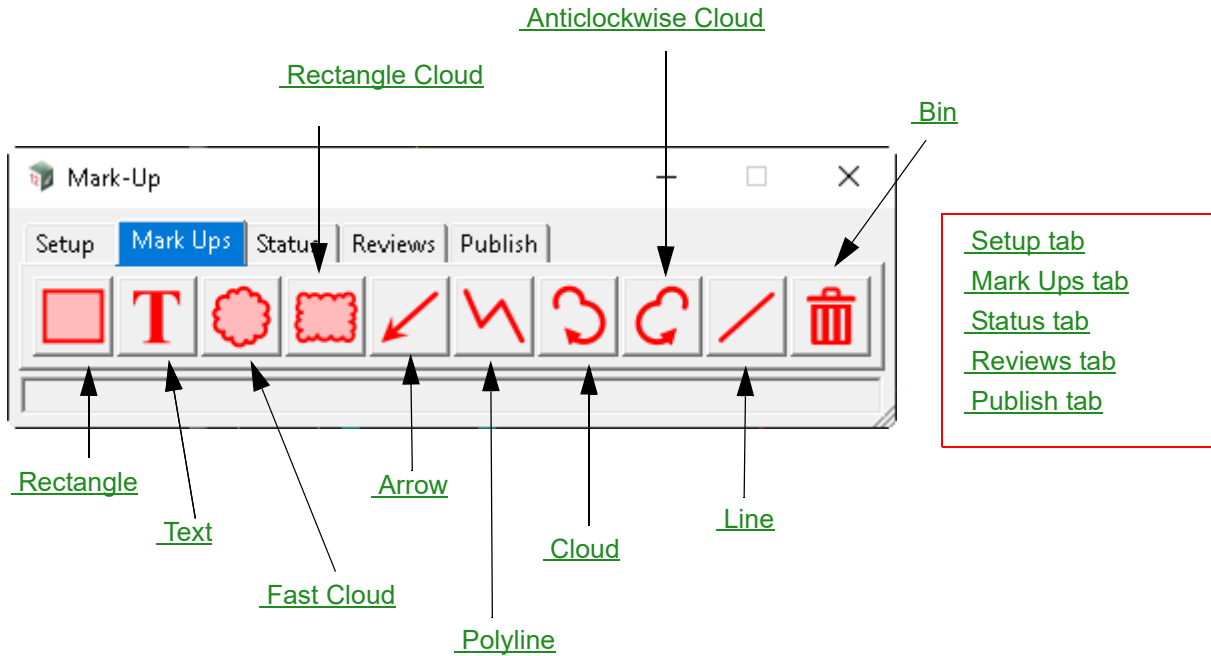
*If ticked, the original 12d markup file will be deleted.*

**Clear view of current mark ups** tick box ticked

*This will remove all markup Models currently on the selected import View.*

### Mark Ups tab

This panel provides various markup display tools to be created on the currently active View.



### Rectangle

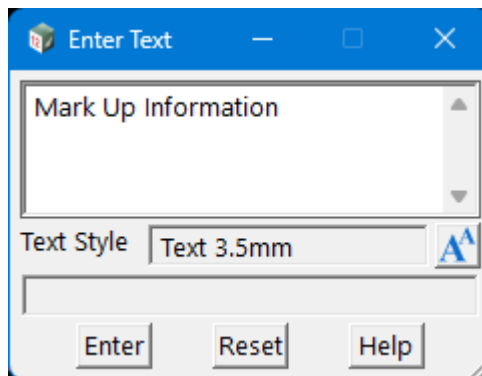
Pick and accept the left-hand rectangle extent, the pick and accept the right-hand extent to complete the creation of a rectangle markup.



### Text

Pick and accept on a View the location for markup text to be created.

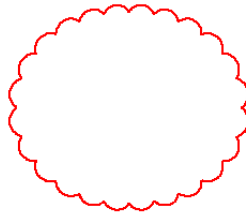
This will then pop up a text entry panel to enter the text to be displayed.





### 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.*



### 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.*



### 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*



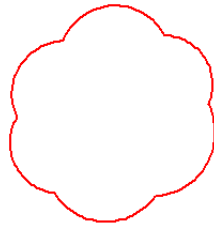
### Polyline

*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.*



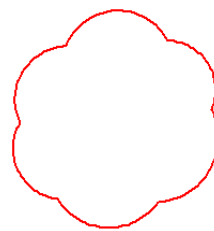
### Cloud

*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.*



### Anticlockwise Cloud

*Pick and accept on multiple vertex locations in an **anti-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.*



### Line

*Pick and accept on a start location and then pick and accept on the final location for the creation of a line object.*



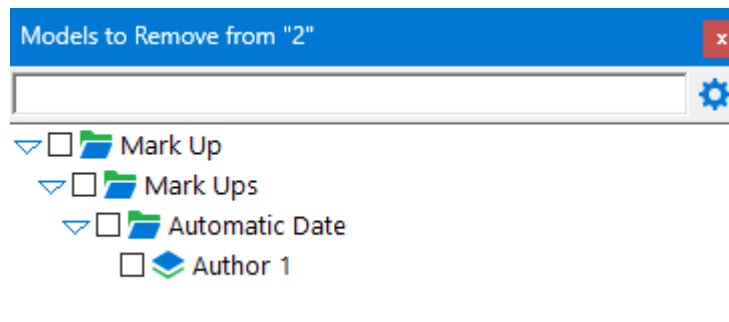
### Bin

*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).*

### 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 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 than 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.

### 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.

String Attributes

String | Vertex | Segment

Name: Mark Up/Mark Ups/Mon Sep 25 2023/DylanRevell User->

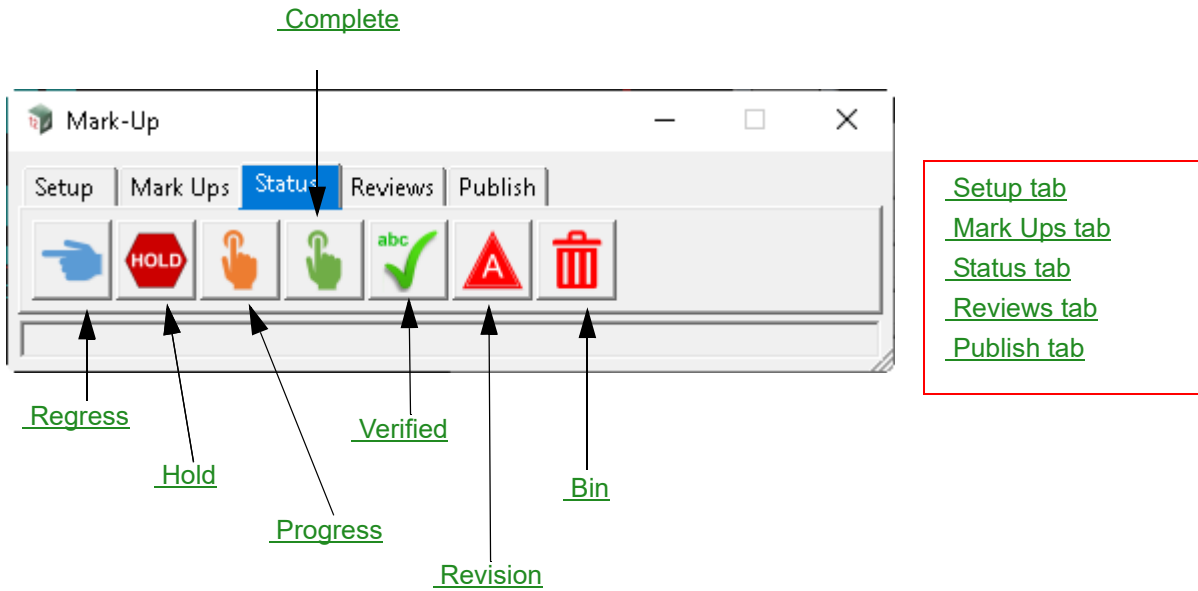
Group name: Mark Up Information

Attribute	Type	Value
1 Status	Integer	3
2 Status Text	Text	Verified
3 Date Created	Text	Mon Sep 25 2023
4 Created By	Text	Name of Creator
5 Hold Date	Text	Mon Sep 25 2023
6 Hold By	Text	Name of Creator
7 In Progress Date	Text	Mon Sep 25 2023
8 In Progress By	Text	Name of person who marked status
9 Date Completed	Text	Mon Sep 25 2023
10 Completed By	Text	Name of person who marked status
11 Date Verified	Text	Mon Sep 25 2023
12 Verified By	Text	Name of person who marked status
13 Revision ID	Text	A
14 Revision By	Text	Name of person who assigned Revision

"Mark Up Information" selected

Pick Ok Apply Refresh Finish Help

Status tab



**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.

**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.

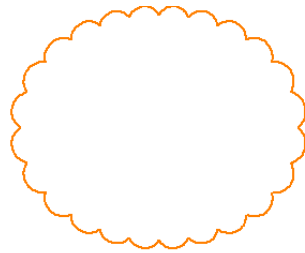


**Progress**

Choose and select markup which has been created/unassigned. Selecting the markup will:

Change the colour of the markup to Orange.

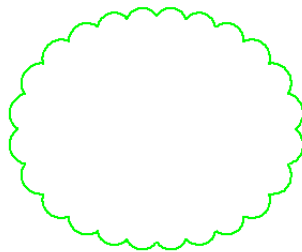
Automatically add attributes to the object with the Username and Date that the status was assigned.

**Complete**

*Choose and select markup which has been marked as In Progress. Selecting the markup will*

*Change the colour of the markup to Green.*

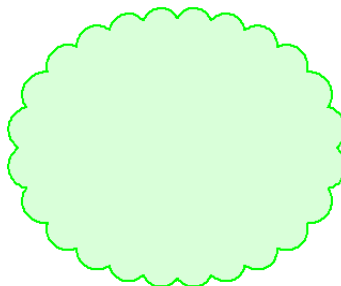
*Automatically add attributes to the object with the Username and Date that the status was assigned.*

**Verified**

*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 Username and Date that the status was assigned.*

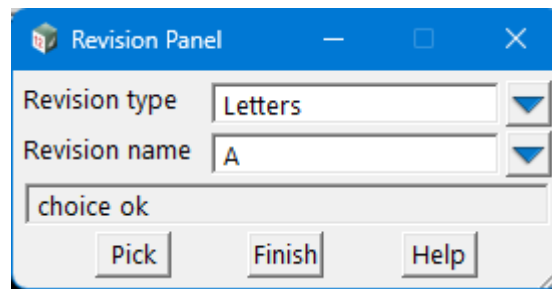
**Revision**

*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.*

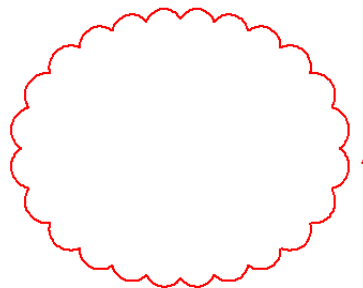




Choose the Pick button and then select a markup which has been marked as Verified. This will

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 Username 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.

### 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).

### Reviews 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.

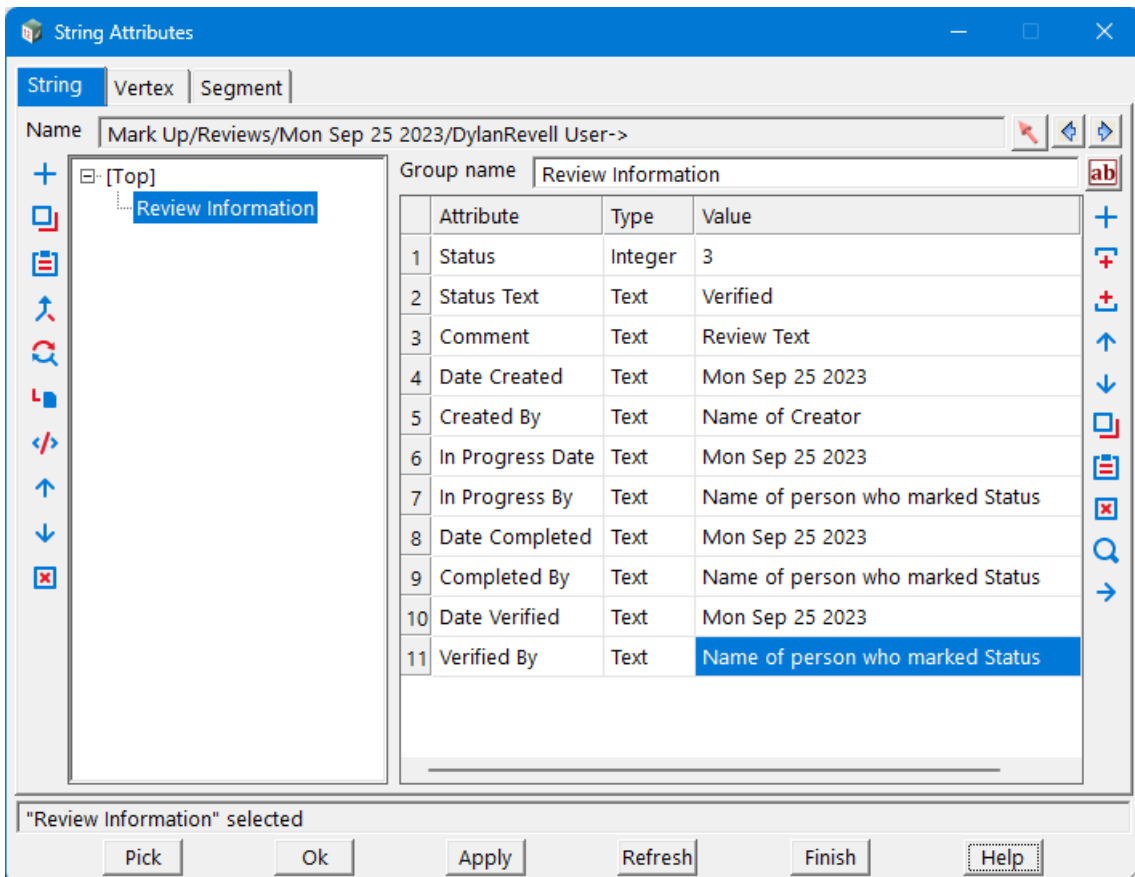
Reviews follow the same Gateway Status workflow as Markups. This provides an inbuilt quality control system to capture whether required changes have been done and completed changes captured. These Status Gateways are.

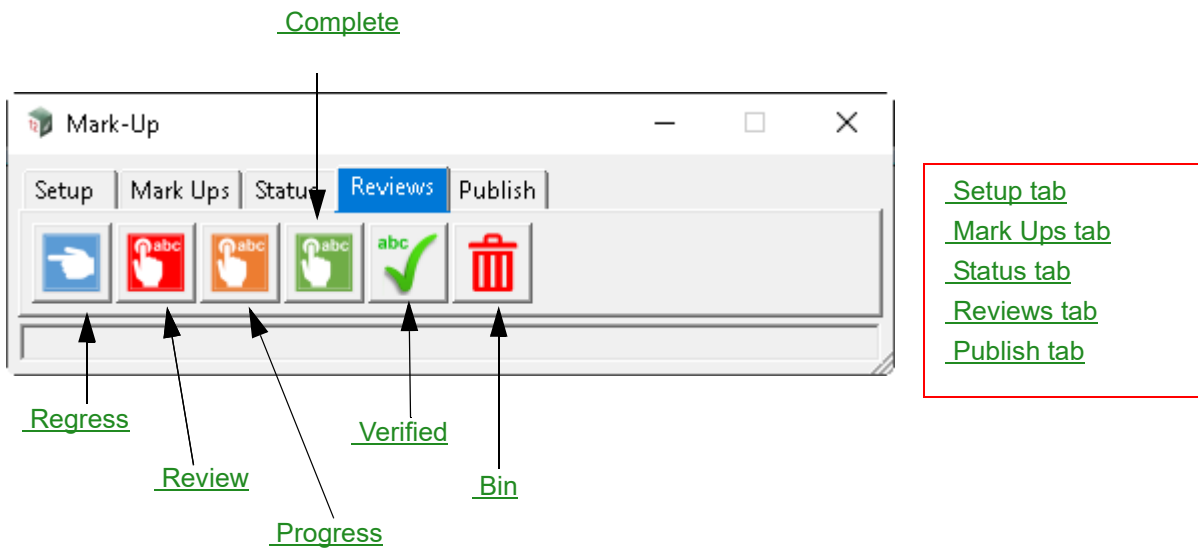


When assigning the status of the reviews, attributes will be automatically added to the object itself. This provides digital tracking of the status and answers the questions posed at the start of this help.

- 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.





**Regress**

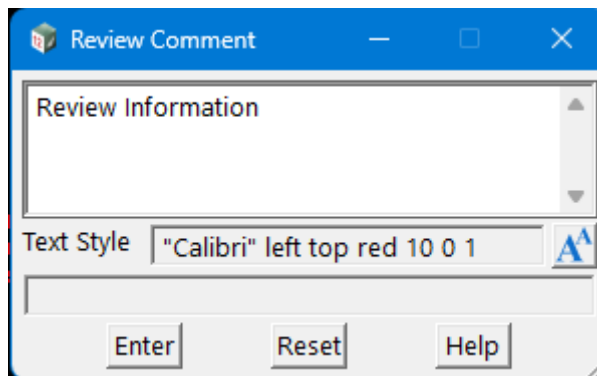
When the regress option is selected, the User will select a review, and this will regress the Gateway status of the review back one step. E.g., Regress status from Completed back to In Progress.

**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.





**Tue Sep 26 2023**  
**DylanRevell**  
**Review Comment:**  
**Review Information**

### 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 Username and Date that the status was assigned.*

*Automatically add the Username and Date as vertex text in the top-left corner of the review rectangle*

**In Progress:**  
**Tue Sep 26 2023**  
**DylanRevell**



**Tue Sep 26 2023**  
**DylanRevell**  
**Review Comment:**  
**Review Information**

### Complete

*Choose and select review which has been marked a In Progress. Selecting the review will*

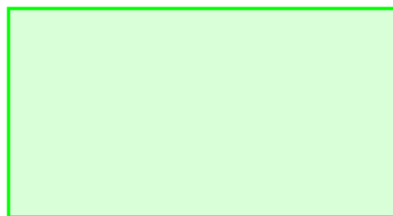
*Change the colour and transparent fill of the review to Green.*

*Automatically add attributes to the object with the Username and Date that the status was assigned.*

*Automatically add the Username and Date as vertex text in the bottom-left corner of the review rectangle*

**In Progress:**  
**Tue Sep 26 2023**  
**DylanRevell**

**Completed:**  
**Tue Sep 26 2023**  
**DylanRevell**



**Tue Sep 26 2023**  
**DylanRevell**  
**Review Comment:**  
**Review Information**

### Verified

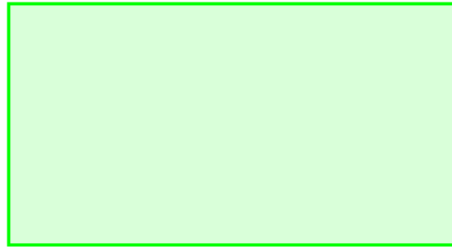
*Choose and select review which has been marked as Complete. Selecting the review will*

*Automatically add attributes to the object with the Username and Date that the status was assigned.*

Automatically add the Username and Date as vertex text in the bottom-right corner of the review rectangle

**In Progress:**  
 Tue Sep 26 2023  
 DylanRevell

**Completed:**  
 Tue Sep 26 2023  
 DylanRevell



**Tue Sep 26 2023**  
**DylanRevell**  
**Review Comment:**  
**Review Information**

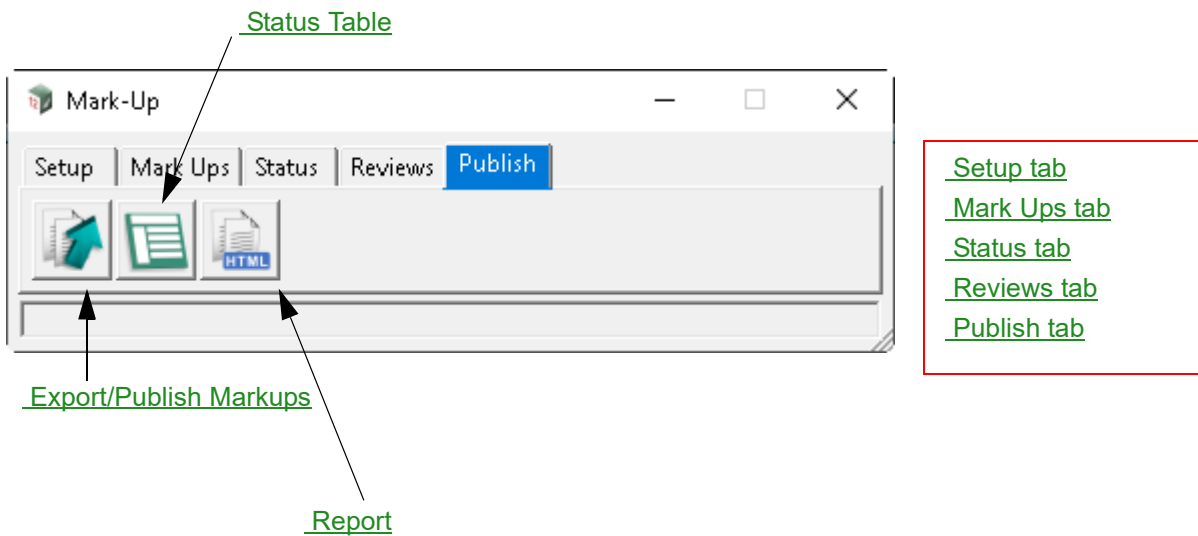
**Verified:**  
 Tue Sep 26 2023  
 DylanRevell

**Bin**

Selecting this option will bring up a panel for the creation/editing of either a new or existing markup file.

**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.



**Export/Publish Markups**

Selecting this option will bring up a panel for the creation/editing of either a new or existing markup file. See [6.4.1 Export Settings](#).



**Status Table**

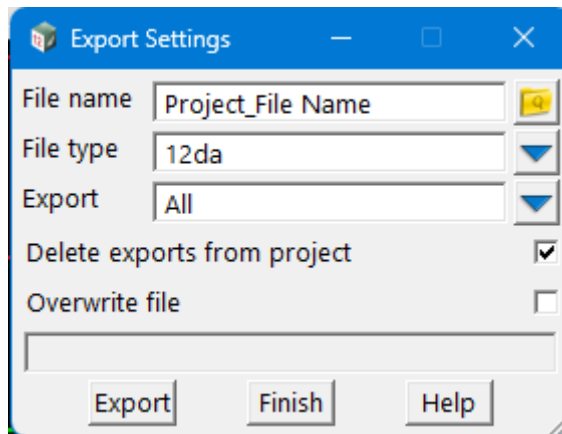
*Not yet Implemented.*

**Report**

*Not yet Implemented.*

Continue to [6.4.1 Export Settings](#) or return to [6.4 12d Markup](#) or [6 Project](#).

## 6.4.1 Export Settings



**File name** file box

*The file location and name of the markup file to be written.*

*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

All, Started Reviews, Reviews in Progress, Completed Reviews, Reviews, Mark Ups

*Selecting this option will allow Users to control the content that is published.*

**Delete exports from project** tick box      ticked

*If **ticked**, this will delete all the Markup and Review model information from the project on export. This option is recommended as it will prevent errors for duplicate Models when trying to Import the markup file back into the Project.*

**Overwrite file** tick box      not ticked

*If **ticked** this will overwrite the entire existing content of the Markup file.*

*If **not ticked**, it will append the Model data to the Markup file.*

*Note: The Revision Plot Models will not be exported in the file and will remain with the Project save.*

Continue to [6.5 Project Settings](#) or return to [6.4 12d Markup](#) or [6 Project](#).

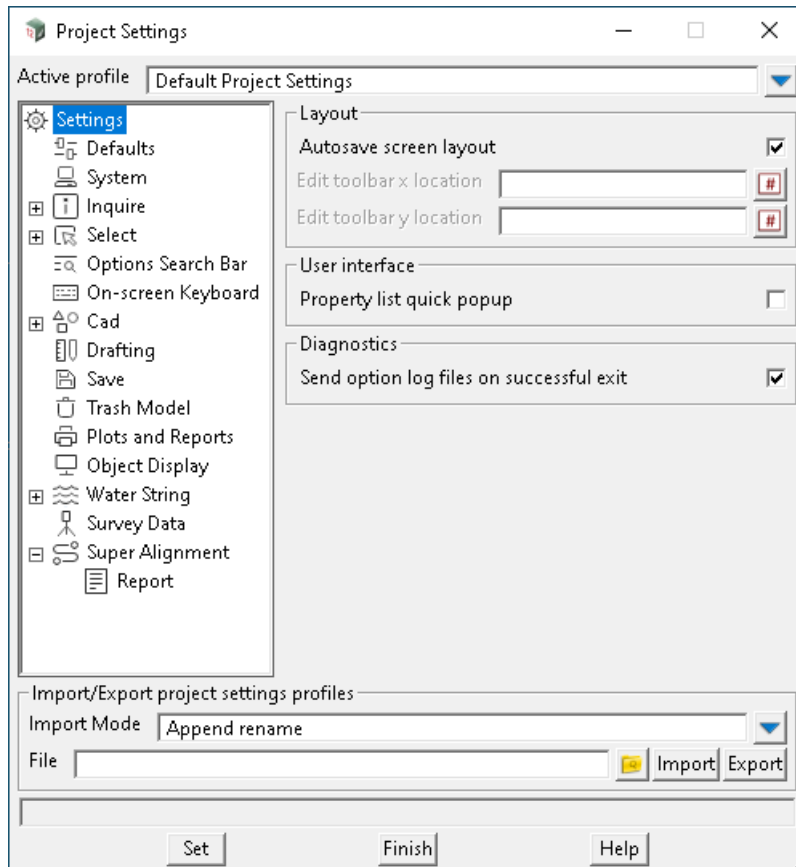


## 6.5 Project Settings

Position of option on menu: **Project =>Settings**

Now documented in the [V15 reference manual](#)

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



See

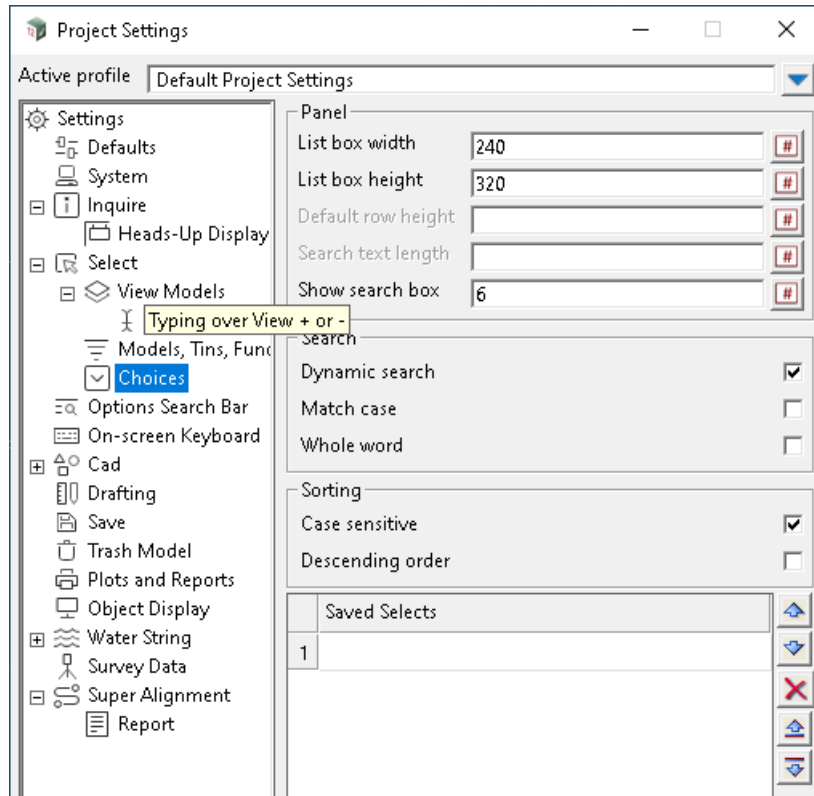
[6.5.1 Select >Choices](#)

[6.5.2 CAD >Heads-Up Display](#)

## 6.5.1 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/height** Integer box

*Width/height (in pixels) of the area listing the items displayed in the Select panel that comes up.*

*If the width or height is exceeded, a horizontal or vertical scroll bar is added to the panel.*

**Default row height** Integer box

*The height of each row (in pixels) in the list.*

**Search text length** Integer box

*The length (in characters) of the **Select** box in the panel that comes up.*

### Saved Selects

*See .*

### Important Note

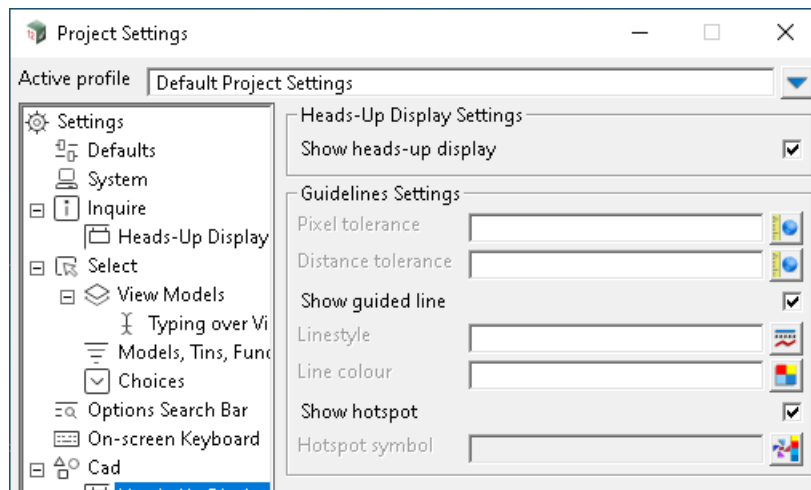
*When the values of any fields are changed on a right side page for a node, the **Set** button must be pressed for the values in the displayed fields to become active and set as the values for the current Active Profile.*

Continue to [6.5.2 CAD >Heads-Up Display](#) or return to [6.5 Project Settings](#) or [6 Project](#).

## 6.5.2 CAD >Heads-Up Display

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 **CAD =>Point** and **CAD =>Line =>2 points**.



See

[6.5.2.1 CAD >Heads-Up Display - Main](#)

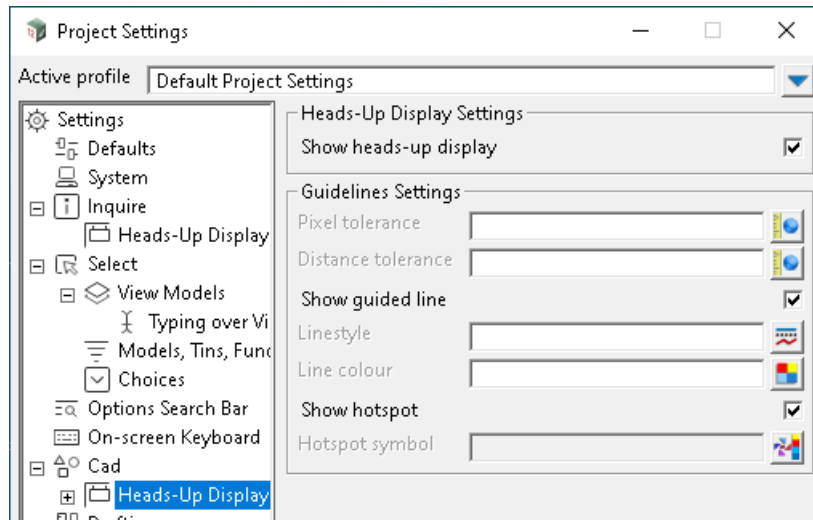
[6.5.2.2 CAD >Heads-Up Display >Coordinates](#)

[6.5.2.3 CAD >Heads-Up Display >Angle](#)

[6.5.2.4 CAD >Heads-Up Display >Distance](#)

[6.5.2.5 CAD >Heads-Up Display >Text](#)

### 6.5.2.1 CAD >Heads-Up Display - Main



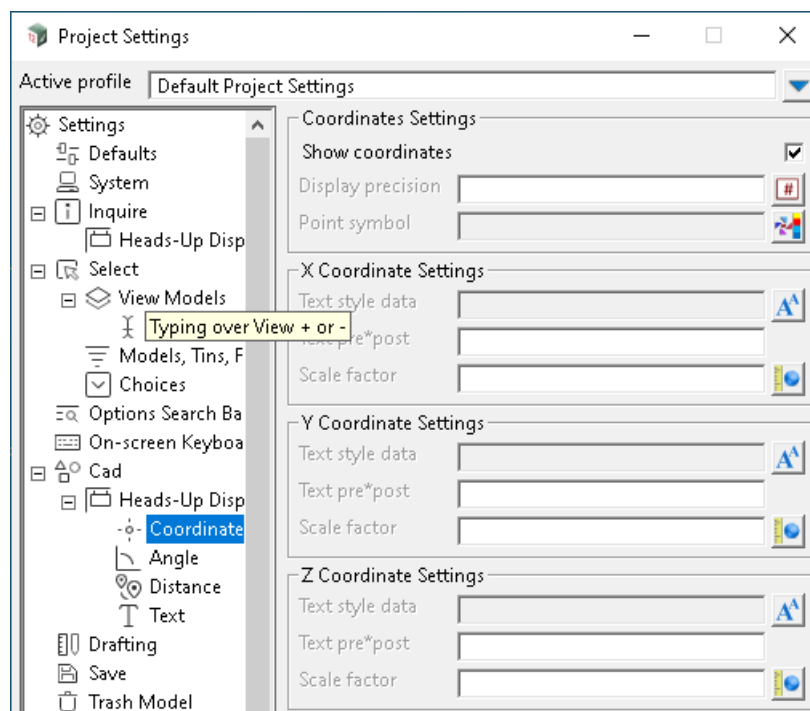
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Heads-Up Display Settings section</b>			
<b>Show heads-up display</b>	tick box	ticked	
<i>If <b>ticked</b>, 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.</i>			
<i>If <b>not ticked</b>, no heads-up information is not displayed.</i>			
<b>Guidelines Settings section</b>			
<b>Pixel tolerance</b>	real box		
.??.			
<b>Distance tolerance</b>	real box		
.??.			
<b>Show guide line</b>	tick box		
<i>If <b>ticked</b>, guide lines are displayed for placing segments and text.</i>			
<i>If <b>not ticked</b>, guide lines are not displayed.</i>			
<b>Linestyle</b>	linestyle box		
<i>Linestyle for the guidelines.</i>			
<b>Line colour</b>	colour box		
<i>Colour for the guidelines.</i>			
<b>Show hotspot</b>	tick box	ticked	
??.			
<b>Hotspot symbol</b>	real box		
??.			

Continue to [6.5.2.2 CAD >Heads-Up Display >Coordinates](#) or return to [6.5.2 CAD >Heads-Up Display](#) or [6.5 Project Settings](#).

### 6.5.2.2 CAD >Heads-Up Display >Coordinates

This section defines how the X, Y and Z coordinates are displayed in the Heads-Up information.



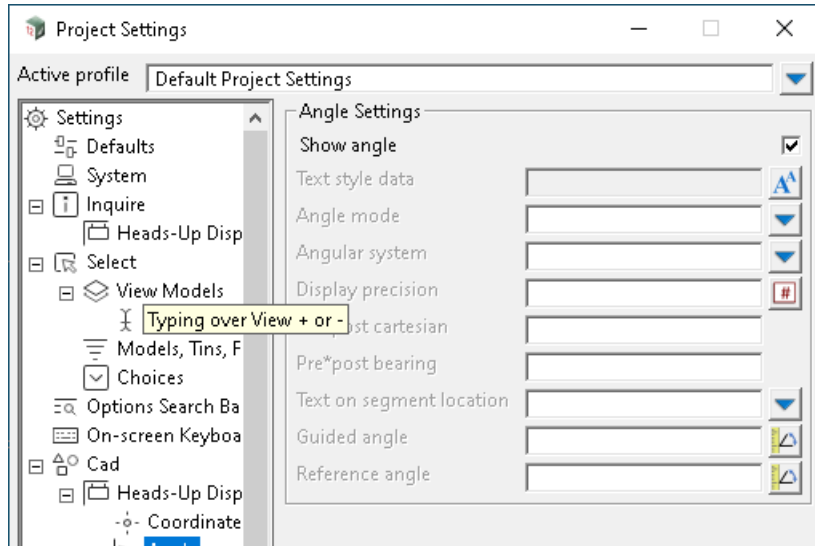
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Coordinate Settings section</b>			
<b>Show coordinates</b>	tick box		
<i>If <b>ticked</b>, the X, Y and Z coordinates are shown in the heads-up information</i>			
<i>If <b>not ticked</b>, the X, Y and Z coordinates are <b>not</b> shown in the heads-up information</i>			
<b>Display precision</b>	integer box		
<i>The number of decimal places to show for the X, Y and Z coordinates.</i>			
<i>If <b>blank</b>, "2" is used.</i>			
<b>Point symbol</b>	symbol box		
<i>Symbol to use at the cursor position.</i>			
<b>X/Y/Z Coordinate Settings section</b>			
<b>Textstyle data</b>	textstyle data box		
<i>textstyle data to use for the X /Y/Z coordinate.</i>			
<i>If <b>blank</b>, a reasonable textstyle data is used so this can be left blank.</i>			
<b>Text pre*post</b>	input box		
<i>The text is use before and after the X/Y/Z coordinate value.</i>			
<i>If <b>blank</b>, "X /Y /Z " is used.</i>			
<b>Scale factor</b>	real box		
<i>The value of the X/Y/Z coordinate is multiplied by <b>Scale factor</b> before being displayed.</i>			
<i>If <b>blank</b>, "1" is used.</i>			

Continue to [6.5.2.3 CAD >Heads-Up Display >Angle](#) or return to [6.5.2 CAD >Heads-Up Display](#) or [6.5 Project Settings](#).

### 6.5.2.3 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
<b>Angle Settings section</b>			
<b>Show angle</b>	tick box		
<i>If <b>ticked</b>, the angle of the segment being drawn is shown in the heads-up information</i>			
<i>If <b>not ticked</b>, the angle of the segment is <b>not</b> shown in the heads-up information</i>			
<b>Textstyle data</b>	textstyle data box		
<i>Textstyle data to use for angle.</i>			
<i>If <b>blank</b>, a reasonable textstyle data is used so this can be left blank.</i>			
<b>Angle mode</b>	choice box		cartesian, bearing
<i>How the angle is calculated.</i>			
<i>If <b>cartesian</b>, the angle is measured from the positive x-axis and in a counter-clockwise direction.</i>			
<i>If <b>bearing</b>, the angle is measured from the positive y-axis and in a clockwise direction.</i>			
<b>Angular system</b>	choice box		360 deg min sec, 360 dec, 400 gons, 6400 mil, Circular
<i>The system of units is used for the angle.</i>			
<i>If <b>blank</b>, " 360 deg min sec" is used.</i>			
<i>If <b>360 deg min sec</b>, the angle is measured degrees, minutes and decimal seconds.</i>			
<i>If <b>360 dec</b>, the angle is measured in decimal degrees.</i>			
<i>If <b>400 gons</b>, the angle is measured in decimal gons.</i>			
<i>If <b>6400 mil</b>, the angle is measured in military mils.</i>			
<i>If <b>Circular</b>, the angle is measured in radians.</i>			
<b>Display precision</b>	integer box		
<i>The number of decimal places used.</i>			
<i>If <b>blank</b>, "2" is used.</i>			



**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

The text is 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

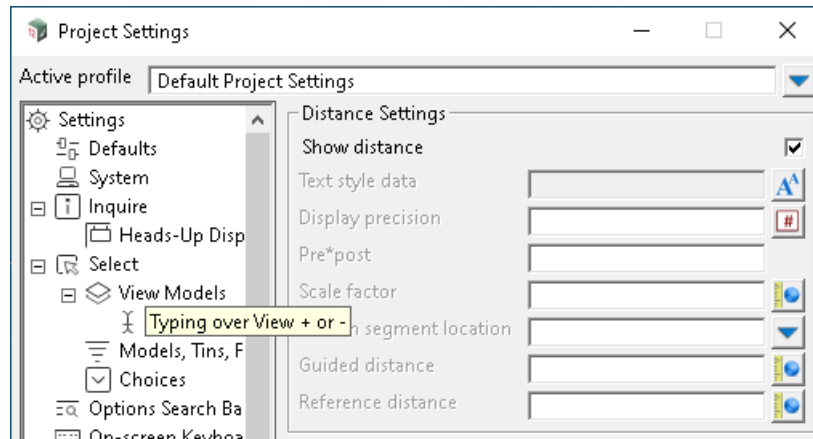
Used with **Guide angle** for calculating when a guide line is displayed.

If **blank**, "0" is used.

Continue to [6.5.2.4 CAD >Heads-Up Display >Distance](#) or return to [6.5.2 CAD >Heads-Up Display](#) or [6.5 Project Settings](#).

### 6.5.2.4 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
<b>Distance Settings section</b>			
<b>Show distance</b>	tick box		
<i>If <b>ticked</b>, the length of the segment being drawn is shown in the heads-up information</i>			
<i>if <b>not ticked</b>, the length of the segment is <b>not</b> shown in the heads-up information</i>			
<b>Textstyle data</b>	textstyle data box		
<i>Textstyle data to use for the length of the segment.</i>			
<i>If <b>blank</b>, a reasonable textstyle data is used so this can be left blank.</i>			
<b>Display precision</b>	integer box		
<i>The number of decimal places used.</i>			
<i>If <b>blank</b>, "2" is used.</i>			
<b>Pre*post</b>	text box		
<i>The text is use before and after the length value.</i>			
<i>If <b>blank</b>, "d " is used.</i>			
<b>Text on segment location</b>	choice box		start, middle, end
<i>The positioning of the distance text with respect to the segment being drawn. The Textstyle data is then applied to this position.</i>			
<i>If <b>blank</b>, the text is positioned at the end of the segment being drawn.</i>			
<i>If <b>start</b>, the text is positioned at the start of the segment being drawn.</i>			
<i>If <b>middle</b>, the text is positioned at the middle of the segment being drawn.</i>			
<i>If <b>end</b>, the text is positioned at the end of the segment being drawn.</i>			
<b>Guide distance</b>	angle box		
<i>If <b>not blank</b>, when the length of the segment is close to</i>			
<i><b>Reference distance</b> + <b>n*Guide distance</b> where n is an integer</i>			
<i>then the cursor is snapped to the point at that distance and remains there until the cursor is outside the</i>			
<i><b>Distance tolerance</b> or <b>Pixel Tolerance</b>.</i>			
<i>If <b>blank</b>, no guide lines are shown.</i>			
<b>Reference distance</b>	angle box		
<i>Used with <b>Guide angle</b> for calculating when a guide line is displayed.</i>			



If **blank**, "0" is used.

Continue to [6.5.2.5 CAD >Heads-Up Display >Text](#) or return to [6.5.2 CAD >Heads-Up Display](#) or [6.5 Project Settings](#).

### 6.5.2.5 CAD >Heads-Up Display >Text

**THIS TEXT SECTION IS A WORK IN PROGRESS AS I FIND OUT EXACTLY WHAT IT DOES**

When CAD text is being created hotspots and guidelines drawn relative to nearby text to allow text to be easily lined up with respect to other text.

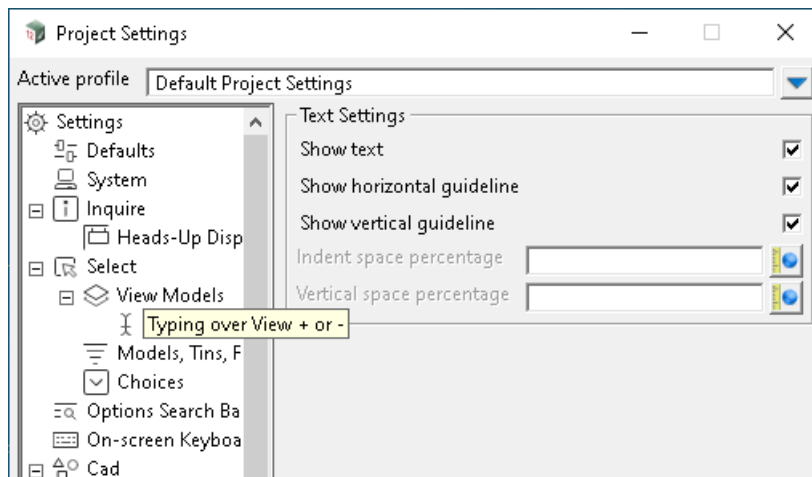
There are two guidelines:

- (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

**Use guideline and hotspot settings**      tick box

*If ticked, the guideline and hotspot settings on the main Heads-Up Display node are used.*

*If not ticked, no guidelines or hotspots 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 [6.6 Project Sharing](#) or return to [6.5.2 CAD >Heads-Up Display](#) or [6.5 Project Settings](#).

## 6.6 Project Sharing

**Position of menu:** Project =>Sharing

Now documented in the V15 reference manual

**Important note:**

Sharing has been totally rewritten for V15.

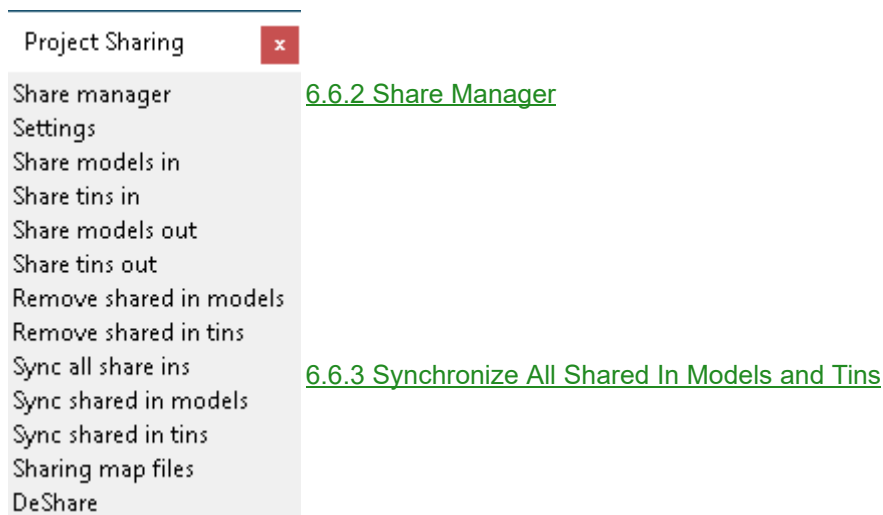
For information about sharing, see [6.6.1 Information on Sharing of Models and Tins](#).

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:



## 6.6.1 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 and 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 people's projects. That is, you say which of 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 [3.42 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

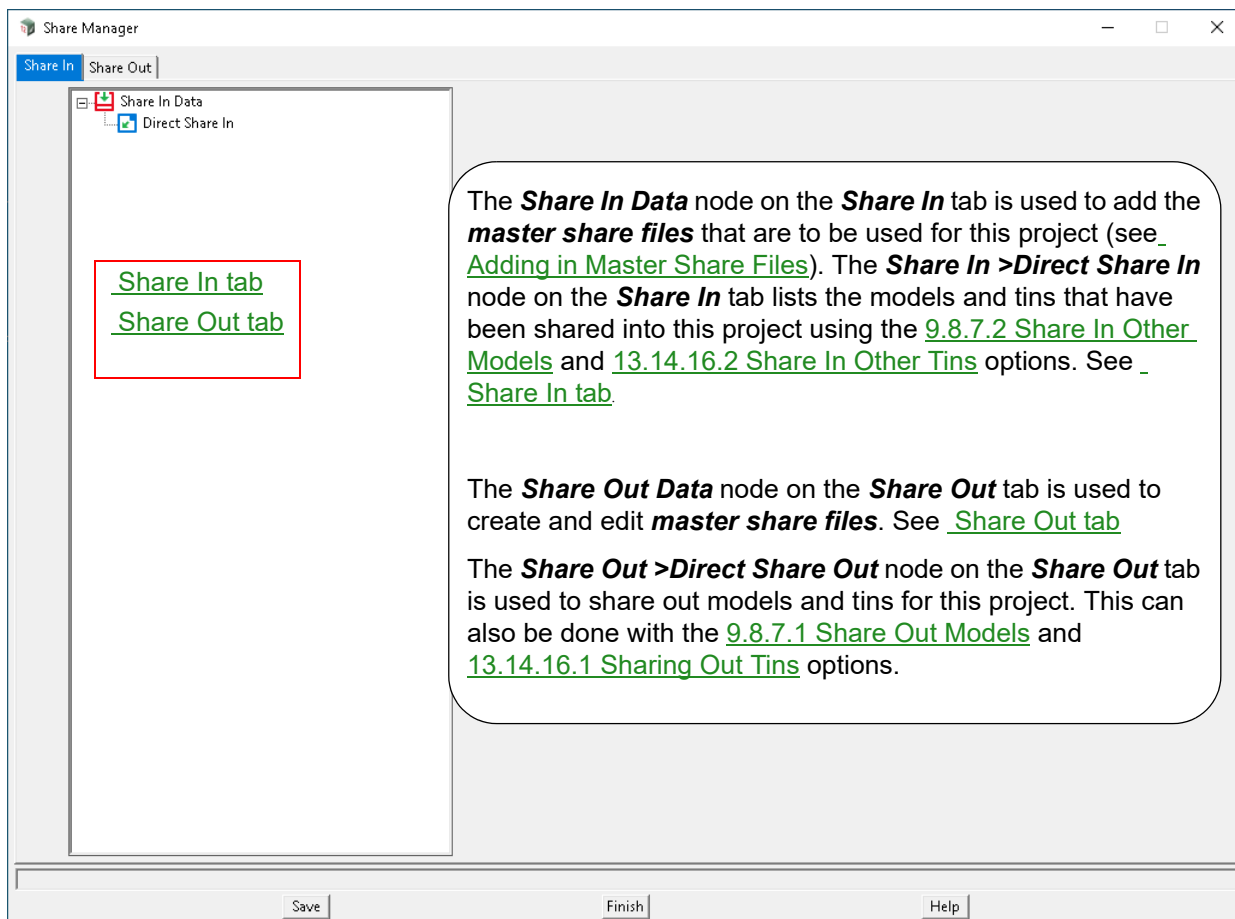
**Position of option on menu:** Project =>Sharing =>Share manage

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 [3.42 Sharing of Models and Tins](#).

Selecting **Share manage** brings up the **Share Manager** panel

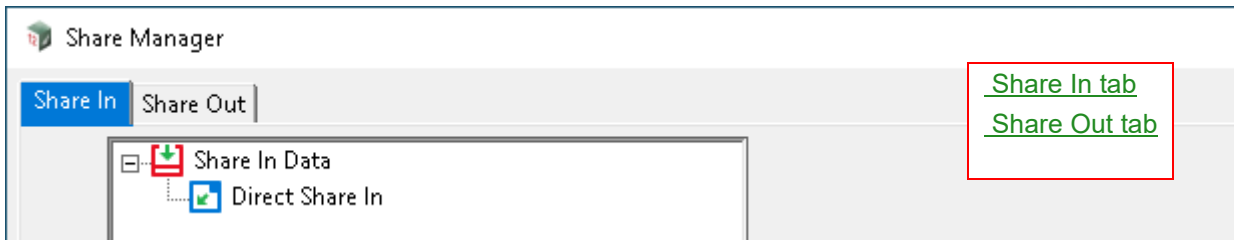


### Button at Bottom

Field Description	Type	Defaults	Pop-Up
<b>Save</b>	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

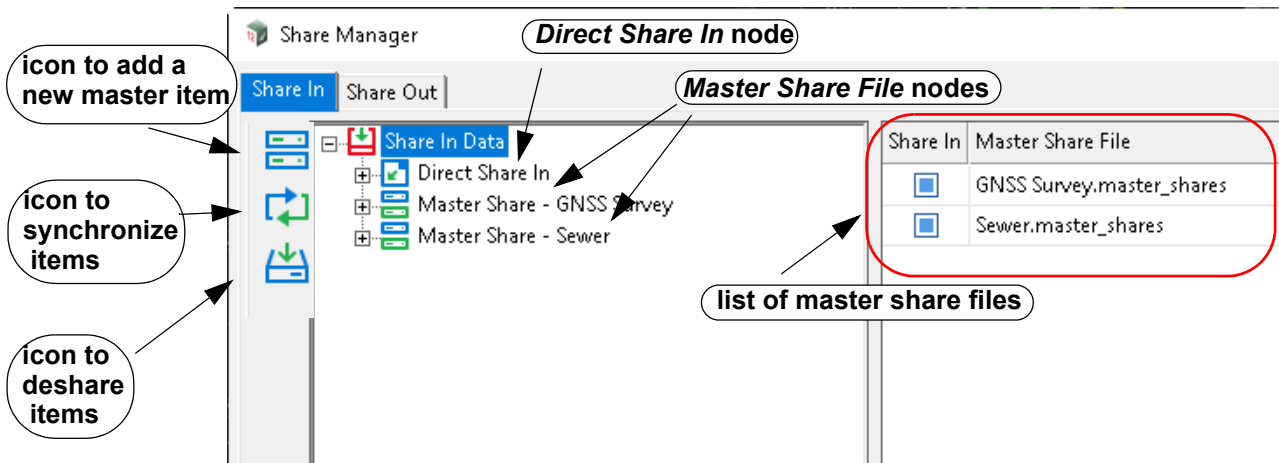
Models and tins that have been shared into the current project using [9.8.7.2 Share In Other Models](#) and [13.14.16.2 Share In Other Tins](#) options are known as **Direct Share Ins** or just **Direct Shares**.

### 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](#)

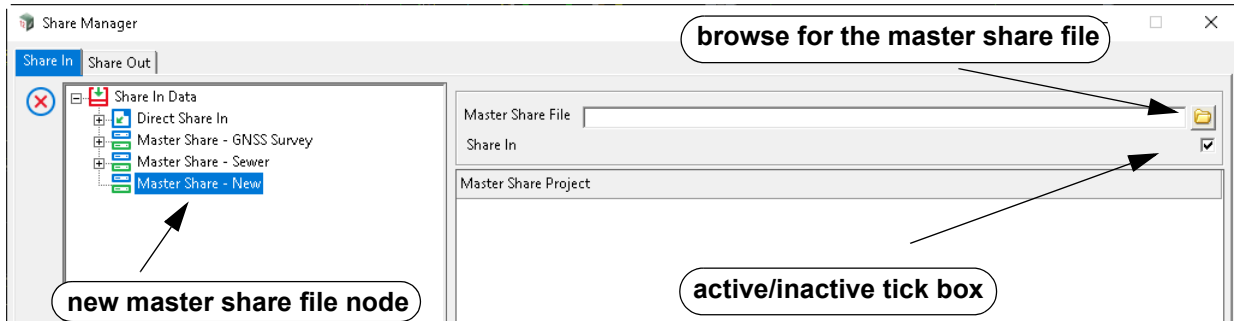
[Synchronize Items](#)

[DeShare Items](#)

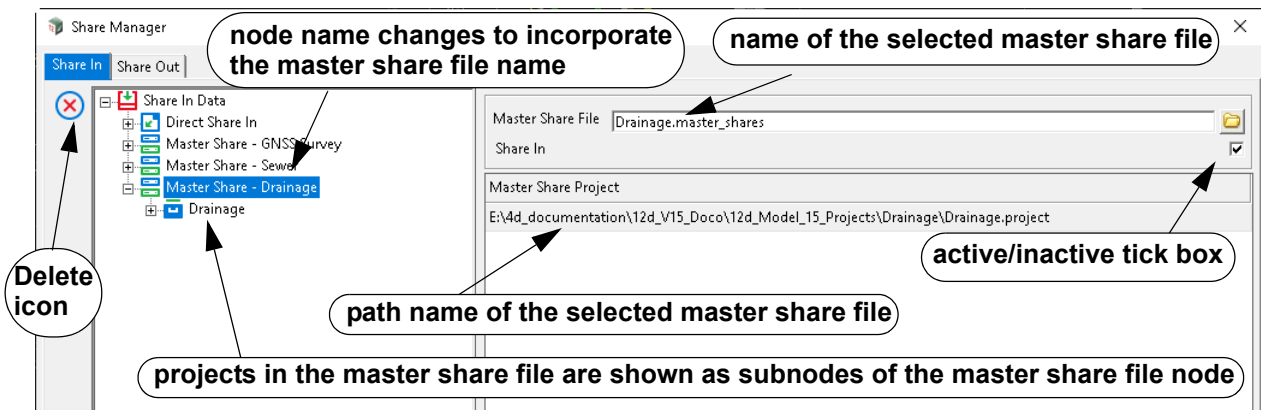
### Adding in Master Share Files

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.



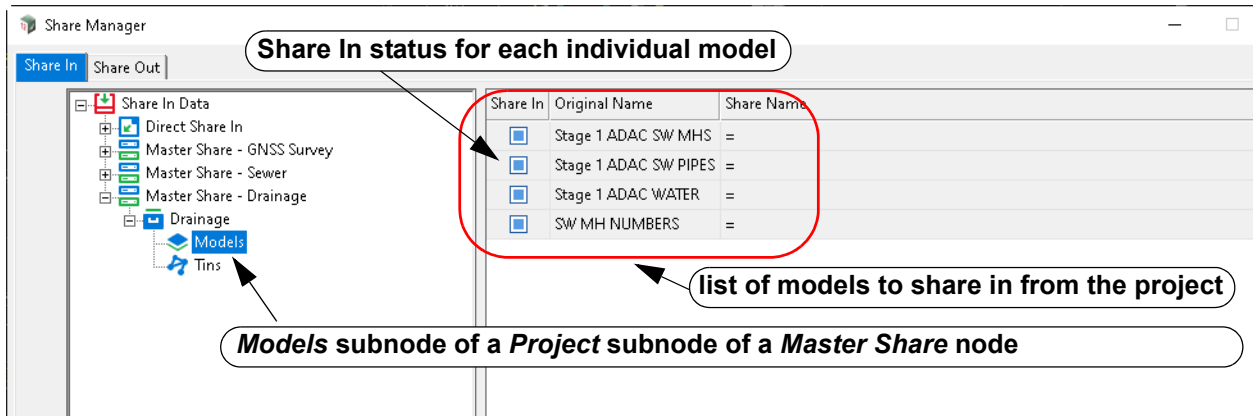
After selecting a master share file, the master share file node changes to **Master share - master\_share\_file\_name**, and the full path name of the selected master share file is displayed on the right hand side of the panel under the **Master Share Project** heading.

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**.



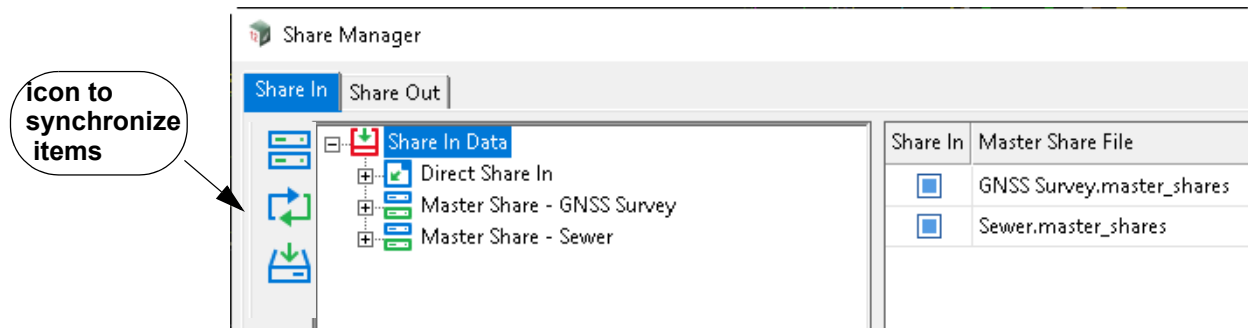
Continue to [Synchronize Items](#) or [Share In Data >Direct Share In node](#) or return to [6.6.2 Share Manager](#).

### 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 than 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

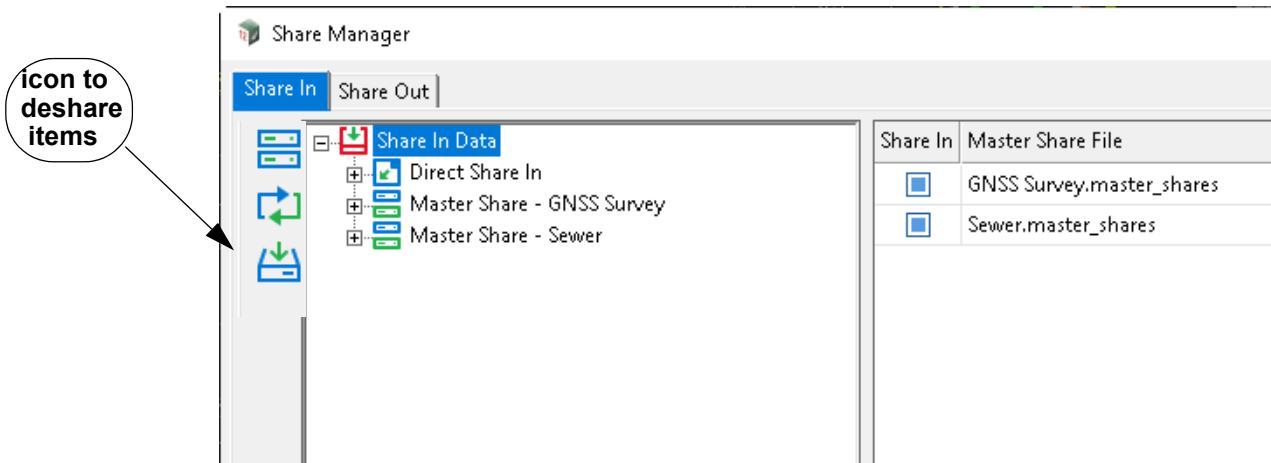
The **deshare item** icon is used to create copies of shared in models and/or shared in tins in the current project and removed them from being shared in.

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**.

Share In	Original Name	Share Name	New Name
<input type="checkbox"/>	Existing contours	=	
<input checked="" type="checkbox"/>	ROAD BOUNDARY	Existing road boundaries	Existing road boundaries
<input type="checkbox"/>	Existing contours labels	=	

Annotations in the screenshot:

- project directly shared in (points to the 'Share In Data' tree)
- model directly shared in from the highlighted Models node (points to the 'Models' node)
- list of models that have been shared out from the highlighted Models node (points to the table)

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.

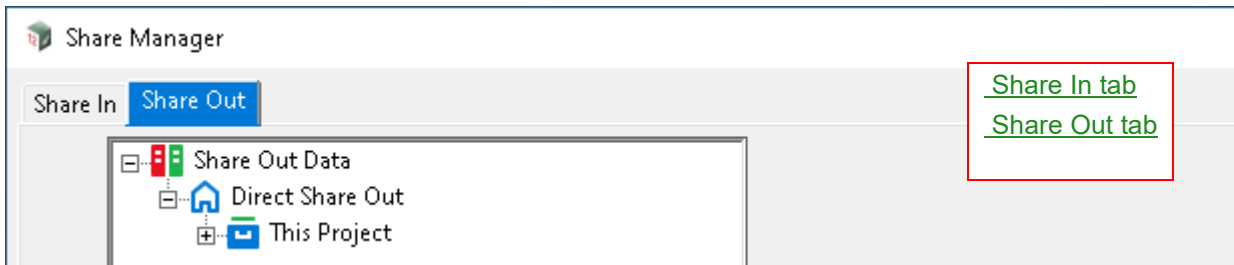
Annotations in the screenshot:

- The Delete icon appears when the a node that can be deleted is highlighted (points to the 'Delete' icon)

Continue to [Share Out tab](#) or return to [6.6.2 Share Manager](#).



### Share Out tab



The **Share Out** tab is 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

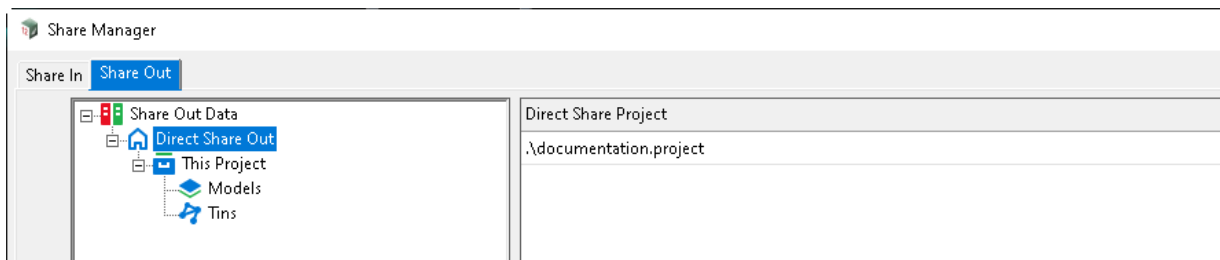
See [9.8.7.1 Share Out Models](#) and [13.14.16.1 Sharing Out Tins](#)

##### 2. Using the Direct Share Out node in the Share Manager

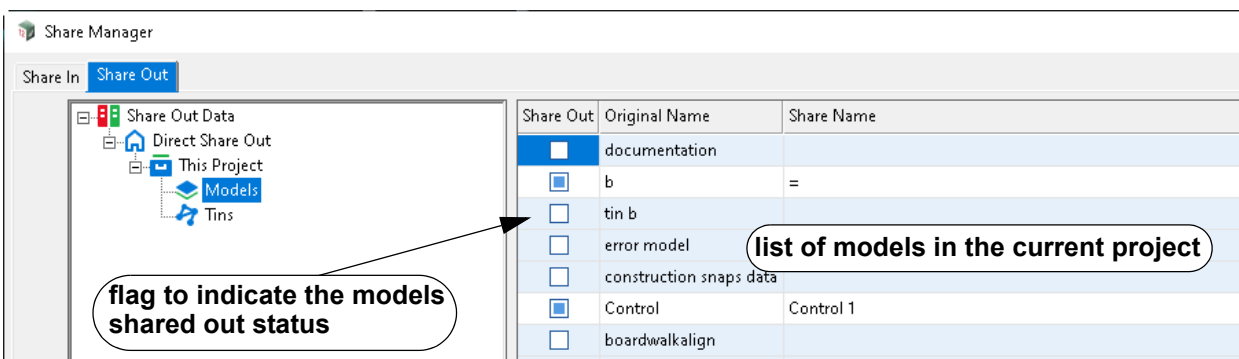
Using the **Direct Share Out** node will now be discussed.

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).

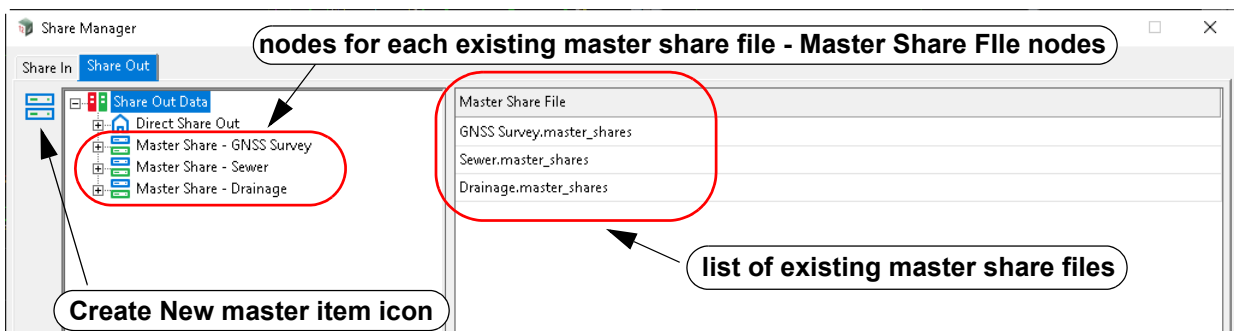
To change the **Share Out** status for a mode/tin, click on the **Share Out** flag to the status is required, and then click on **Save**.

### Creating a Master Share File

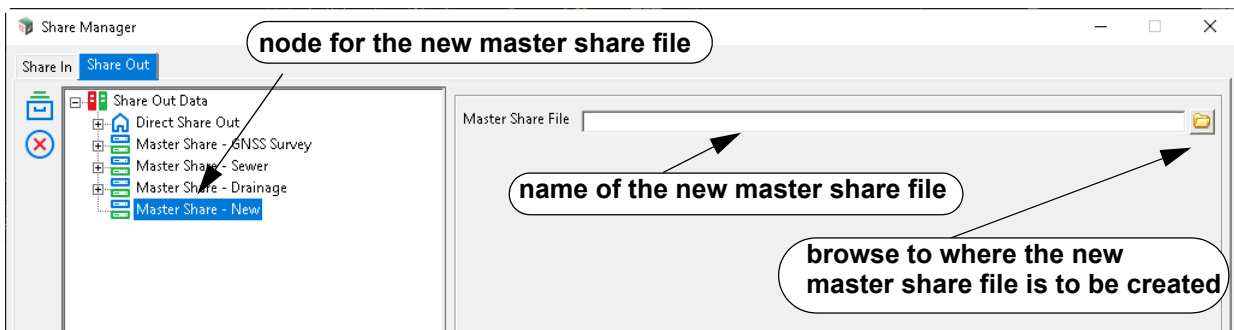
A master share file contains a list of projects, and the models and tins in those projects, that are to be automatically shared into any project that uses the master share file. When a master share file is used by a project, The sharing in occurs every time the project using the master share file is 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.

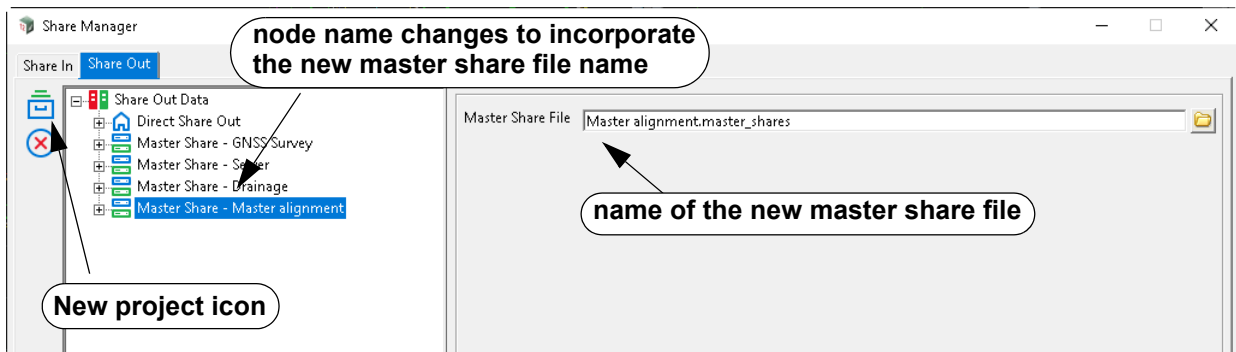
Clicking on the **New master item** icon creates a new **Master Share File** node with the name **Master share-new**.



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**.

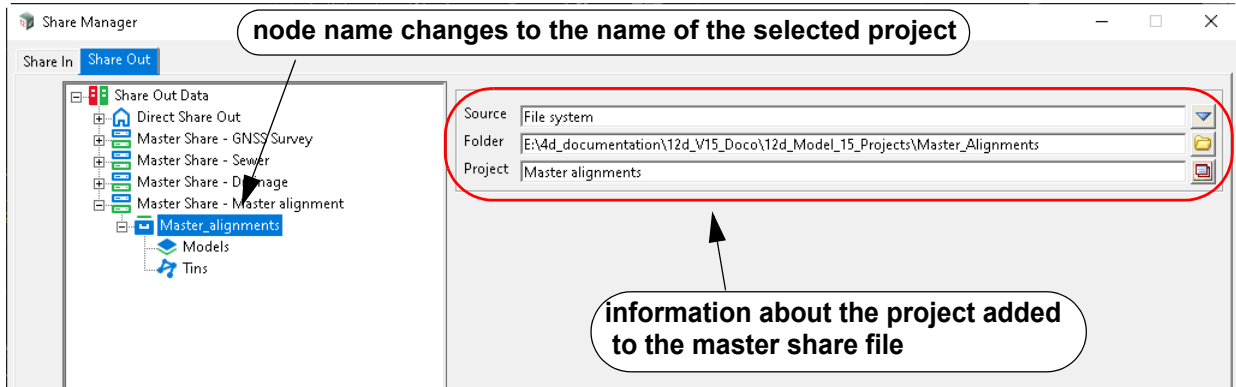


Click on the **New project** icon on the left had side, to **add a project** to the master share file so that models

and/or tins to add to the master share file can be selected from the project.

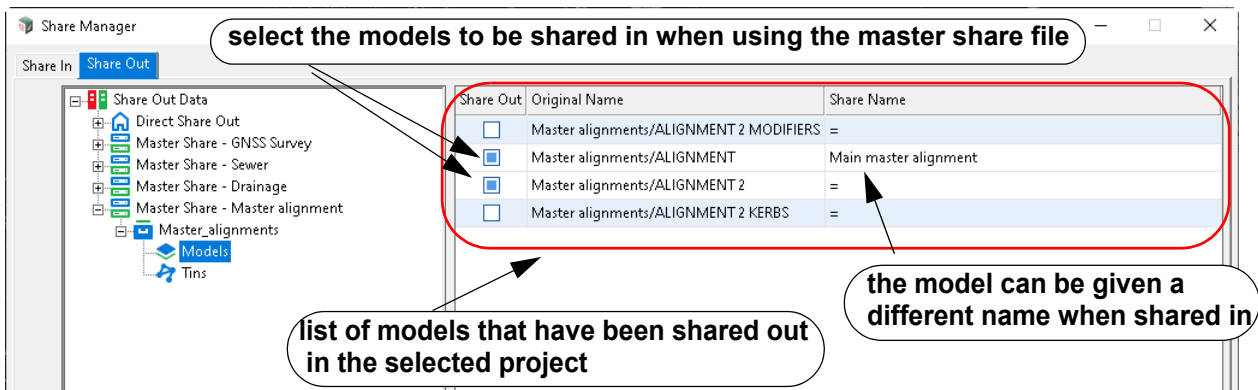
A subnode called **New Project** is then added to the **Master Share File** node and the fields required to select a project, from either a file system or 12d Synergy, are displayed on the right hand side of the panel.

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.



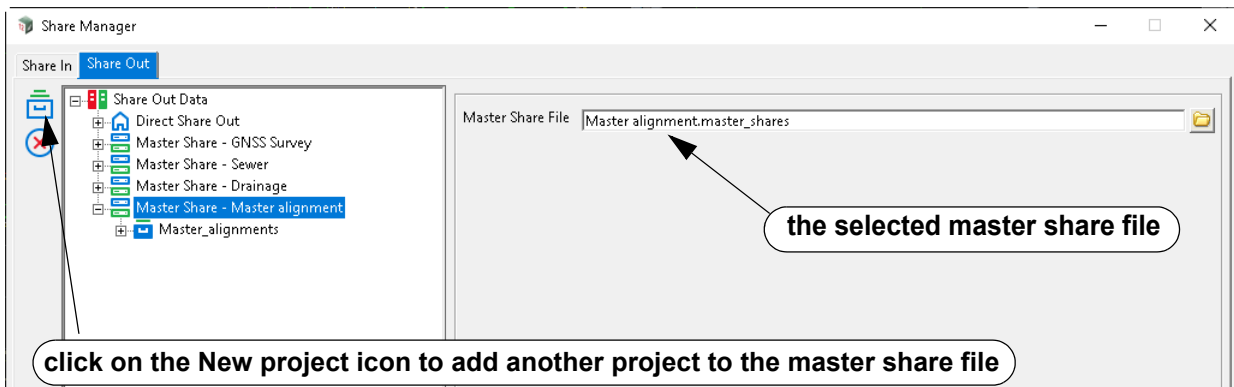
Clicking on the **Models/Tins** node will show all the models/tins that have been shared out of the selected project and hence available to be shared into other projects.

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.

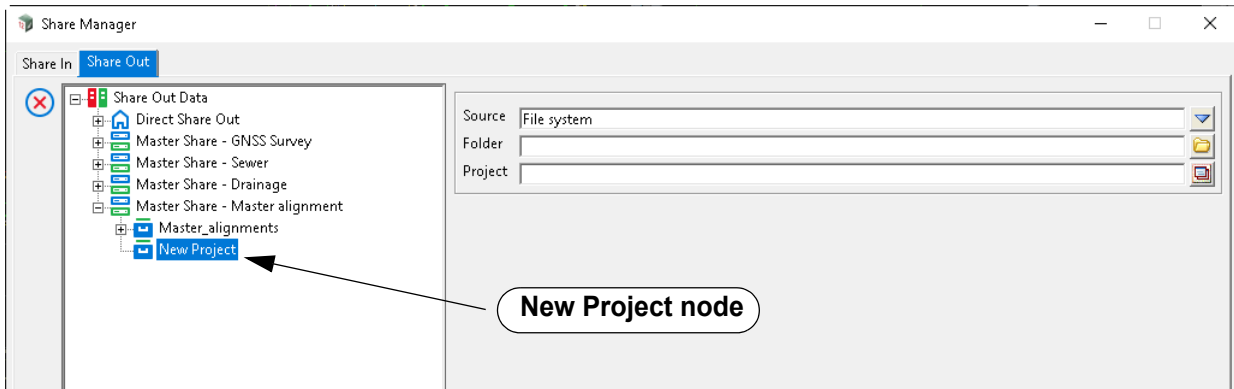


Click on **Save** to update the master share file and the information in the **Share Manager**.

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.



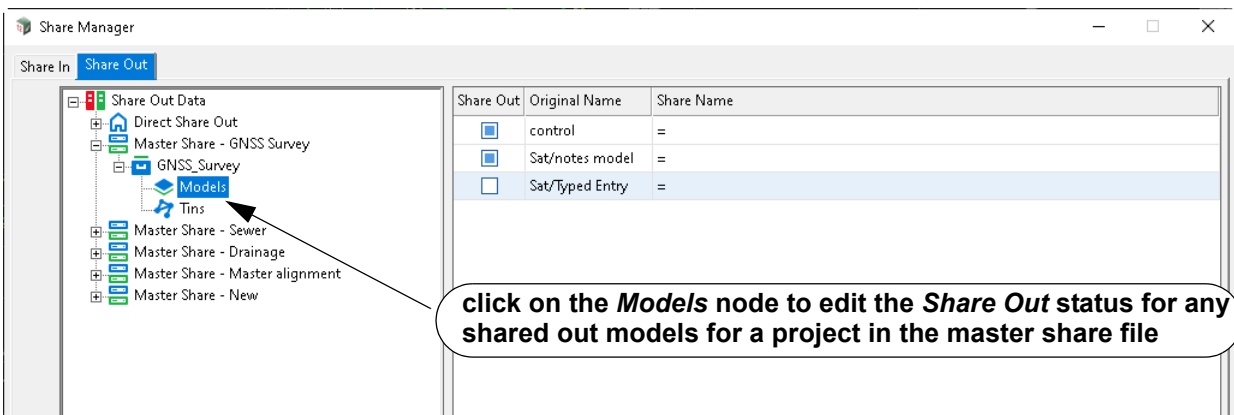
Continue as described before by first selecting a project, and then selecting for that project, the models and tins to be shared in when using this master share file.  
Click on **Save** to update the master share file and the information in the **Share Manager**.

### 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](#)

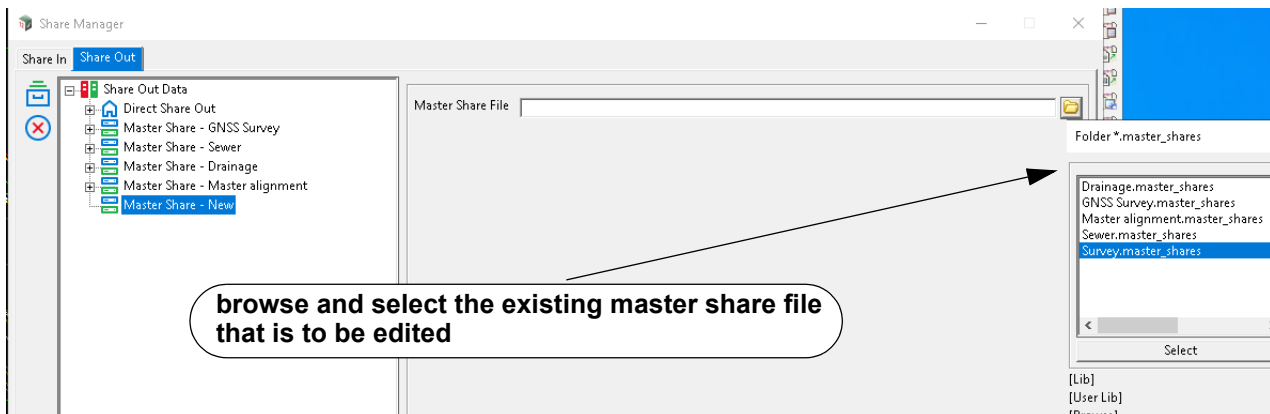
### Editing an Existing Master Share File Not Under the Direct Share Out Node

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.

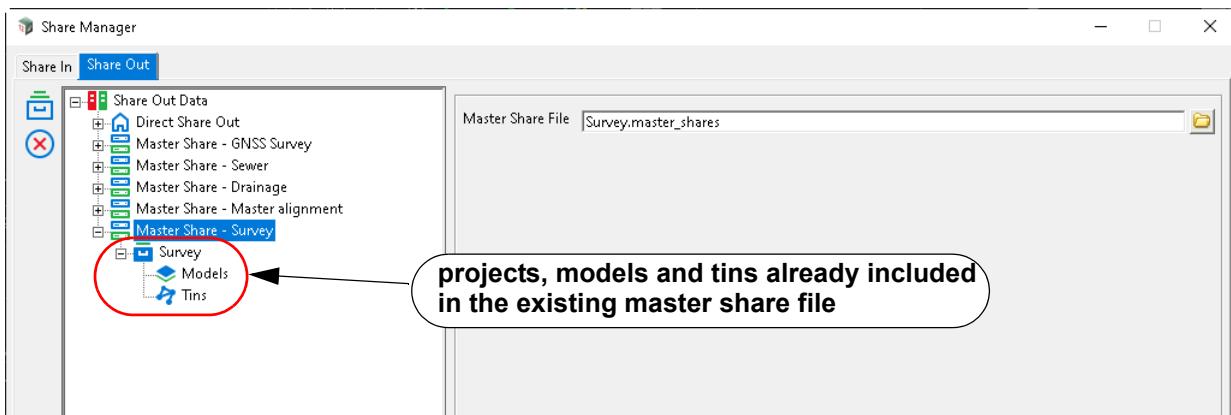
To add an existing master share file to the **Direct Share Out** node, first click on the **Direct Share Out** node and then select the **New master item** icon that appears on the left hand side of the panel.

A new Master Share File node is then created and the Master Share File field displayed on the right hand side of the 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](#).

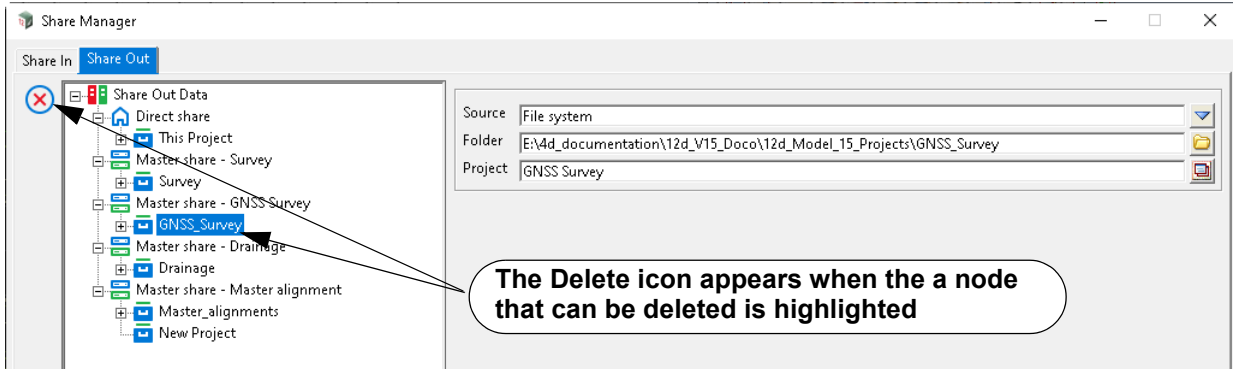
Continue to [Deleting a Subnode of the Share Out Data Node](#) or return to [6.6.2 Share Manager](#).



### 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

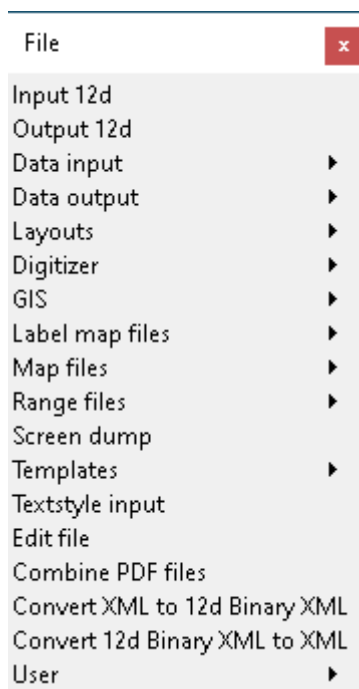
The **Sync all share ins** option is used to update any shared in models and tins in the project.

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](#)

[7.7.5 Read LINZ WFS Data](#)

[7.8 MapInfo Write Tab/MIF Files](#)

[7.9 Map File Create/Edit](#)

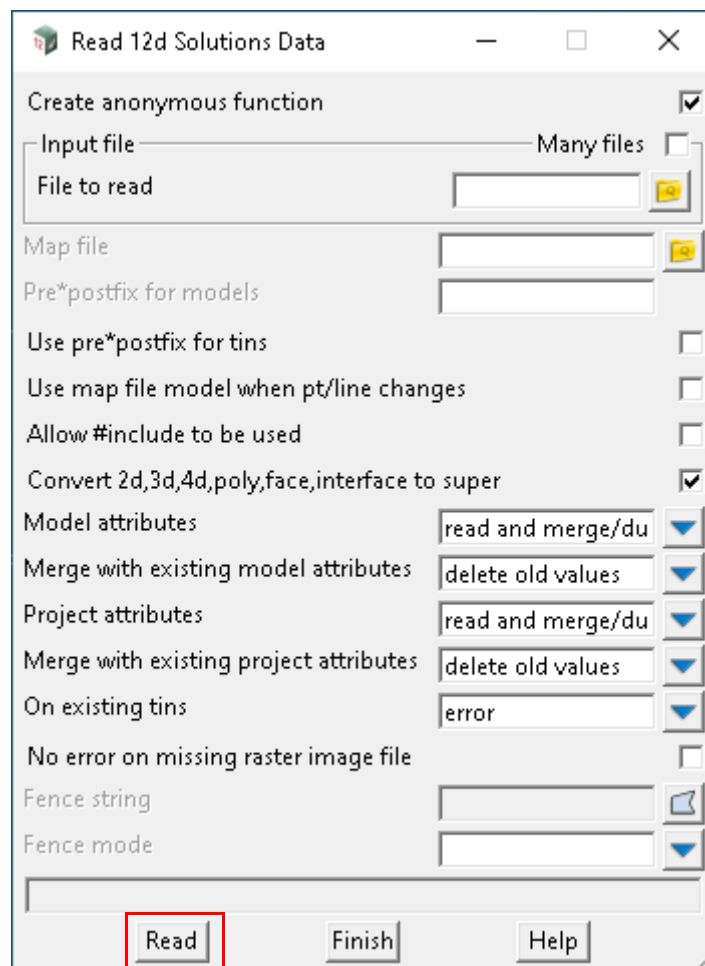
[7.11 12d Binary XML Files](#)

## 7.1 Read 12d Solutions Data

**Position of option on menu:** File =>Input 12d

Now documented in the V15 reference manual

Documentation has been added on the **Read** button.



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

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

### Buttons at Bottom

<b>Read</b>	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.*

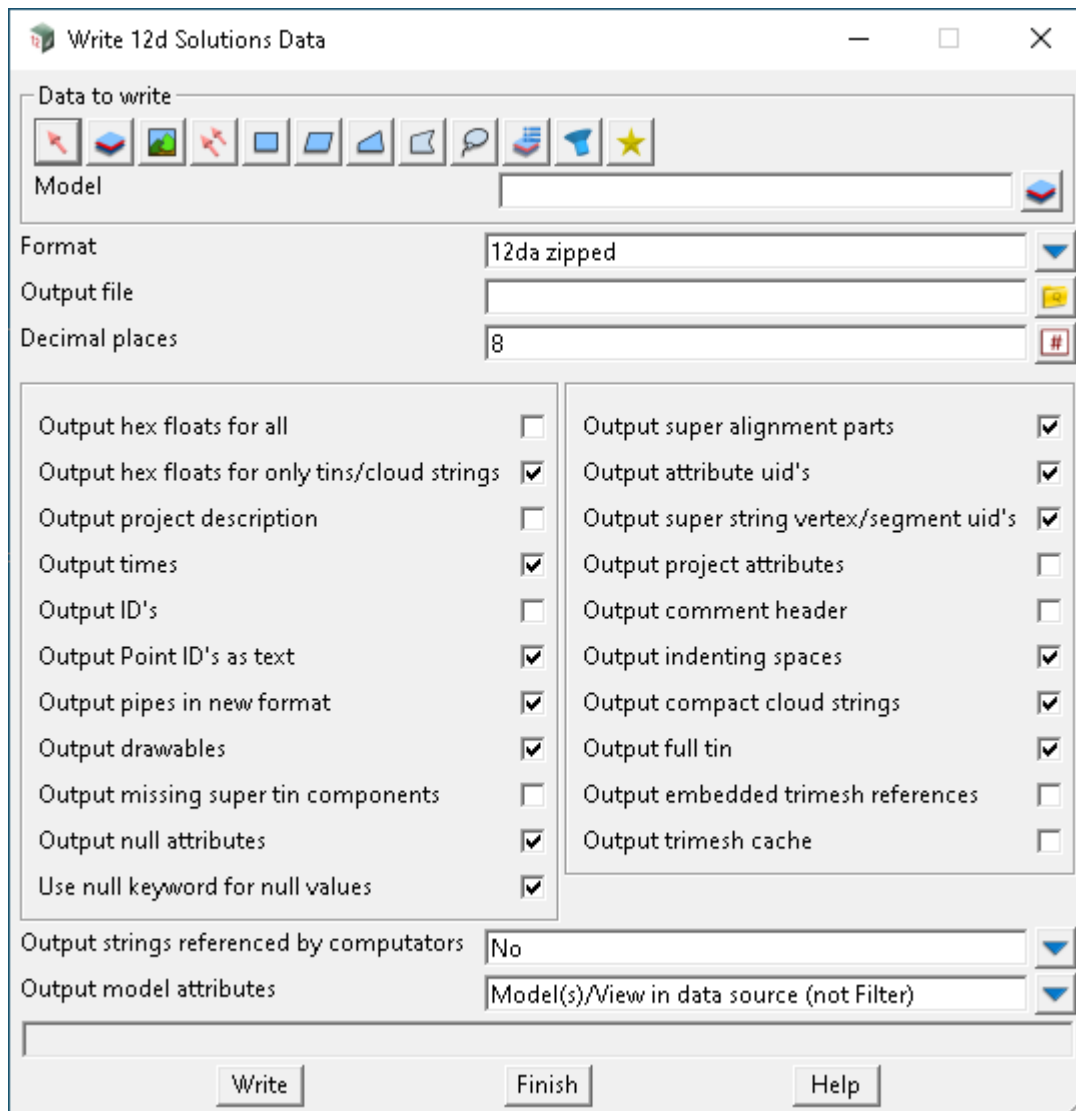
Continue to [7.2 Write 12d Solutions Data](#) or return to [7 File](#).

## 7.2 Write 12d Solutions Data

Position of option on menu: **File =>Output 12d**

Now documented in the V15 reference manual

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](#).



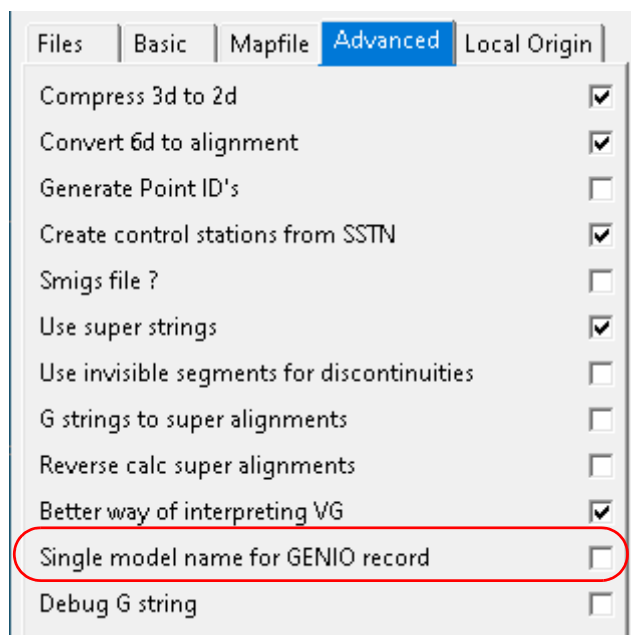
## 7.3 Genio Input

**Position of option on menu:** File =>Data input =>Genio

Now documented in the V15 reference manual

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

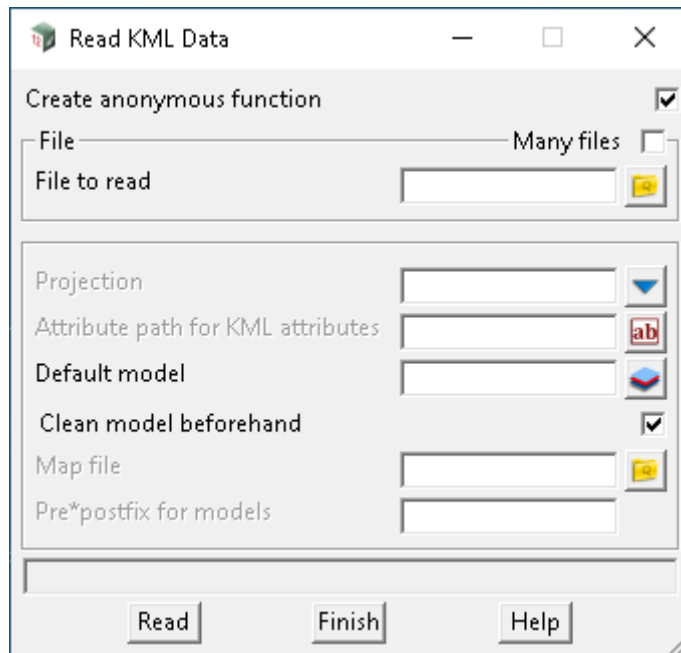
Position of option on menu: File =>Data input =>KML

Position of option on menu: BIM =>Import =>KML

Now documented in the V15 reference manual

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**

<b>Create anonymous function</b>	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**

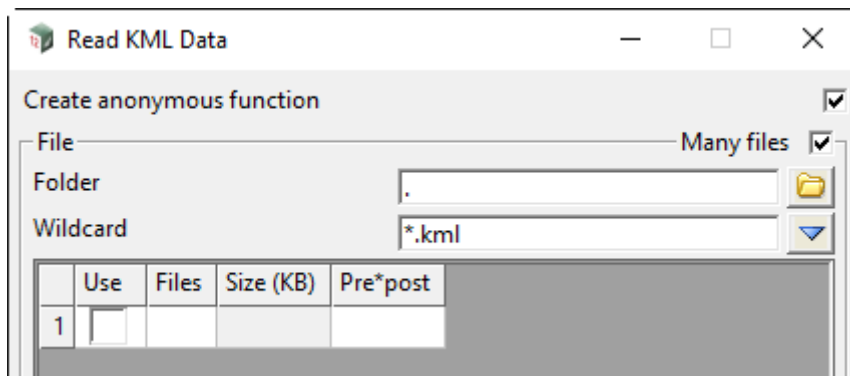
<b>Many files</b>	tick box	not ticked	
-------------------	----------	------------	--

*If **not ticked**, **File To Read** field is visible.*

<b>File to read</b>	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 [3.25.2 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](#).

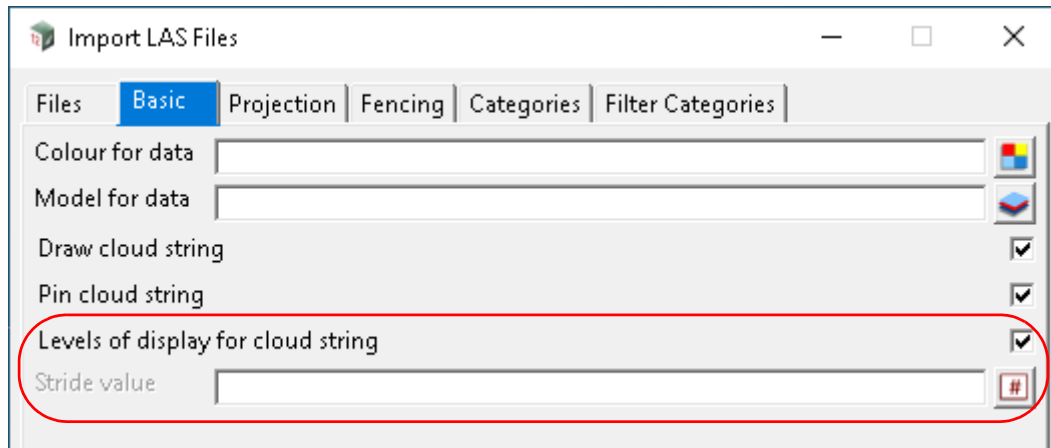
## 7.5 Import LAS

**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

Now documented in the V15 reference manual

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](#).

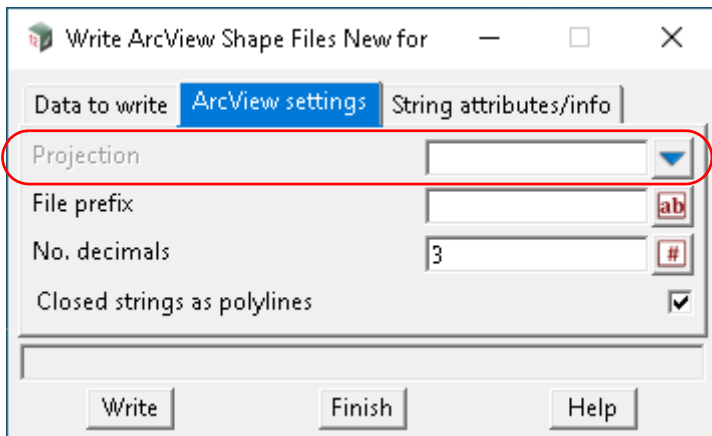
# 7.6 ArcView SHP New Output

**Position of option on menu:** File =>Data output =>ArcView =>ArcView SHP (new)

Now documented in the V15 reference manual

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
<b>ArcView Settings tab</b>			
<b>Projection</b>	choice box		All defined projections
<i>OPTIONAL - if a projection is chosen, the RSRI WKT string of the projection (if available) shall be written out to a .prj file.</i>			

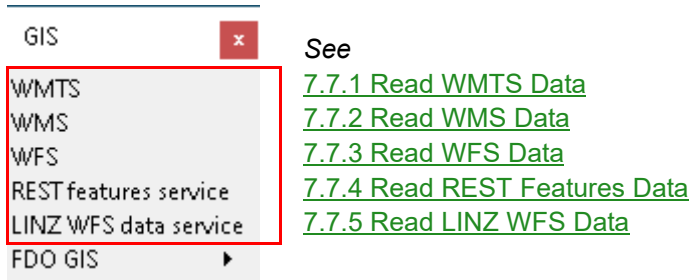
Continue to [7.7 GIS](#) or return to [7 File](#).



## 7.7 GIS

Position of option on menu: File =>GIS

The GIS walk-right menu containing these options is:



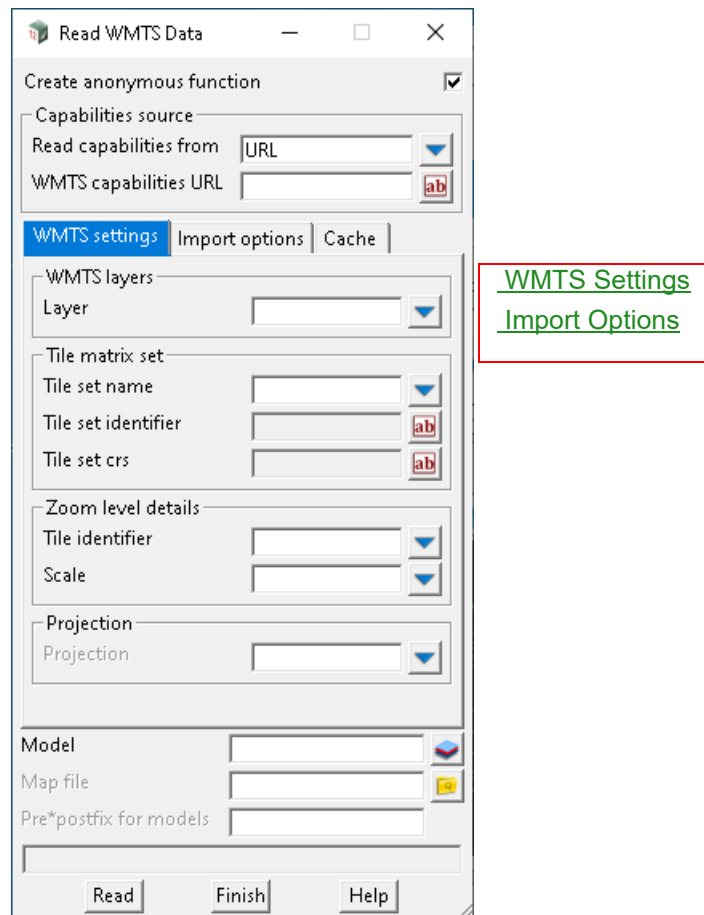


## 7.7.1 Read WMTS Data

Position of option on menu: File =>GIS =>WMTS

Now documented in the V15 reference manual

Selecting WMTS brings up the Read WMTS Data panel.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Create anonymous function</b>	tick box	ticked	
----------------------------------	----------	--------	--

*If **ticked**, a function using all the fields in the panel is automatically created when data is read in.*

<b>Cache location</b>	directory box		
-----------------------	---------------	--	--

*Copies of downloaded images will be cached for reusability.*

### Capabilities source

<b>Read capabilities from</b>	choice box		URLURL, File
-------------------------------	------------	--	--------------

*The capabilities could be access directly from the URL or local file.*

<b>WMTS capabilities URL</b>	input box		
------------------------------	-----------	--	--

*The capabilities URL for WMTS.*

*Set project attribute **GIS\_WMTS\_CAPABILITIES\_URL** to auto fill this field.*

**WMTS Settings****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  
*The alias name for tile set name.*

**Tile set crs** input box Read-only  
*The projection identifier (often shown as EPSG code) for the selected matrix set.*

**Zoom level details**

**Tile identifier** choice box  
*The level of detail for map tile images.*

**Scale** choice box  
*The 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 box optional  
*The projection for input reference geometry and output images.*

**Import Options**

**Import option** choice box by point, by extent,  
by boundary, by tile range

*Options for importing tile images.*

*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](#).*

**Buttons at Bottom**

**Read** button  
*Reads the option.*

**By point**
**Option to import data****Point coordinate**          XYZ box

*A single tile image that contains the point's XY coordinate will be read into 12d Model.*

**By extent**
**Option to import data****Point coordinate**          XYZ box

*Coordinate of the point in the centre of an extent.*

**Distance from point**          XYZ box

*The distance from 4 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**
**Option to import data****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.*

Option to import data

Import option

Row

Row min  #

Row max  #

Start row  #

End row  #

column

column min  #

column max  #

Start column  #

End column  #

**Row**

**Row min**                      number box              Read-only

*The lowest row value that has imagery data.*

**Row max**                      number box              Read-only

*The highest row value that has imagery data.*

**Start row**                      number box

*The row where the map image grid should start.*

*The value should be greater than or equal to Row min.*

**End row**                      number box

*The 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

*The lowest column value that has imagery data.*

**column max**                      number box              Read-only

*The highest column value that has imagery data.*

**Start column**                      number box

*The column where the map image grid should start.*

*The value should be greater than or equal to Column min.*

**End column**                      number box

*The column where the map image grid should end.*

*The value should be greater than or equal to Column max.*

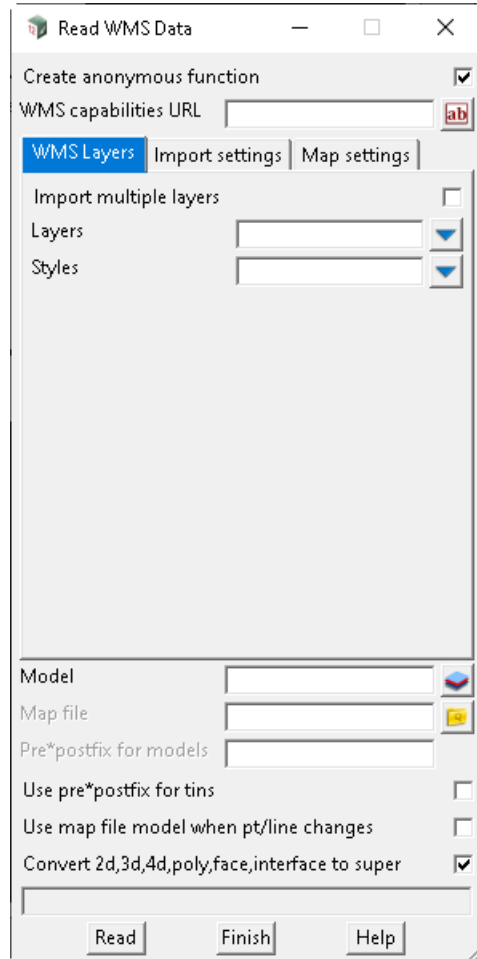
Continue to [7.7.2 Read WMS Data](#) or return to [7.7 GIS](#) or [7 File](#).

## 7.7.2 Read WMS Data

Position of option on menu: File =>GIS =>WMS

Now documented in the V15 reference manual

Selecting WMS brings up the Read WMS Data panel.



[WMS Layers tab](#)  
[Import settings tab](#)  
[Map settings tab](#)

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

Field Description	Type	Defaults	Pop-Up
<b>Create anonymous function</b>	tick box	ticked	

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

<b>WMS Capabilities URL</b>	input box		
-----------------------------	-----------	--	--

*The capabilities URL for WMS.*

<b>Map file</b>	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.*

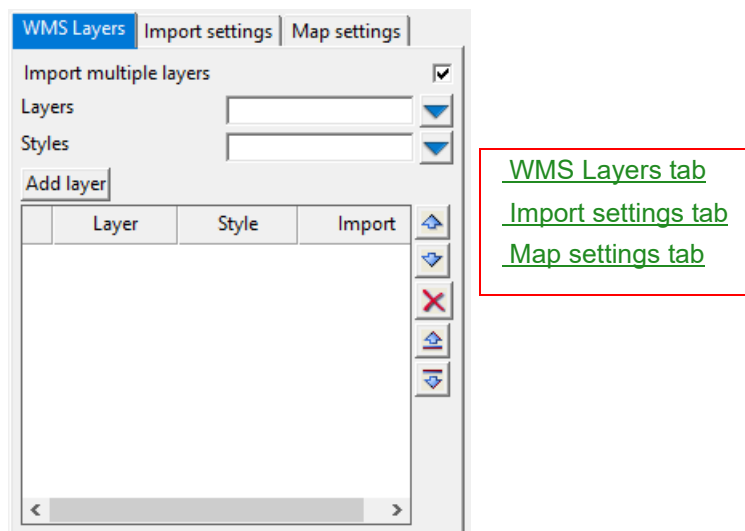
**Use map file model when pt/line changes** tick box not ticked

*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.*

## WMS Layers tab



**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.*

**Add layer** button Hidden

*This option is hidden unless "import multiple layers" is **ticked**.*

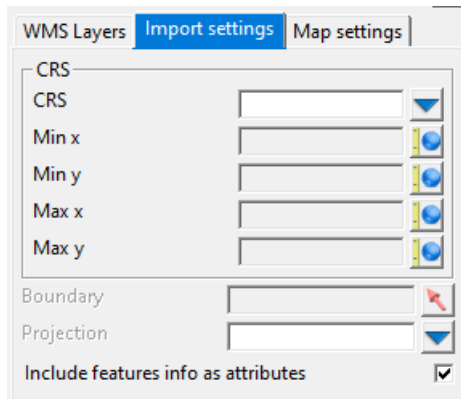
*To import multiple layers, choose each layer and its style from Layers and Styles choice box above and press **Add layer** to add the layer into the table below.*

*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.*



### Import settings tab



[WMS Layers tab](#)  
[Import settings tab](#)  
[Map settings tab](#)

### 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

*The 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

*The 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

*The 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

*The 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

*The 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.*



## Map settings tab

[WMS Layers tab](#)  
[Import settings tab](#)  
[Map settings tab](#)

### Image options

**Max allowable width**      number box      Read-Only

*The maximum number of pixels for the image's width that WMS server can accept.*

**Max allowable height**      number box      Read-Only

*The maximum number of pixels for the image's height that WMS server can accept.*

**Map pixel width**      number box

*The 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

*The 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

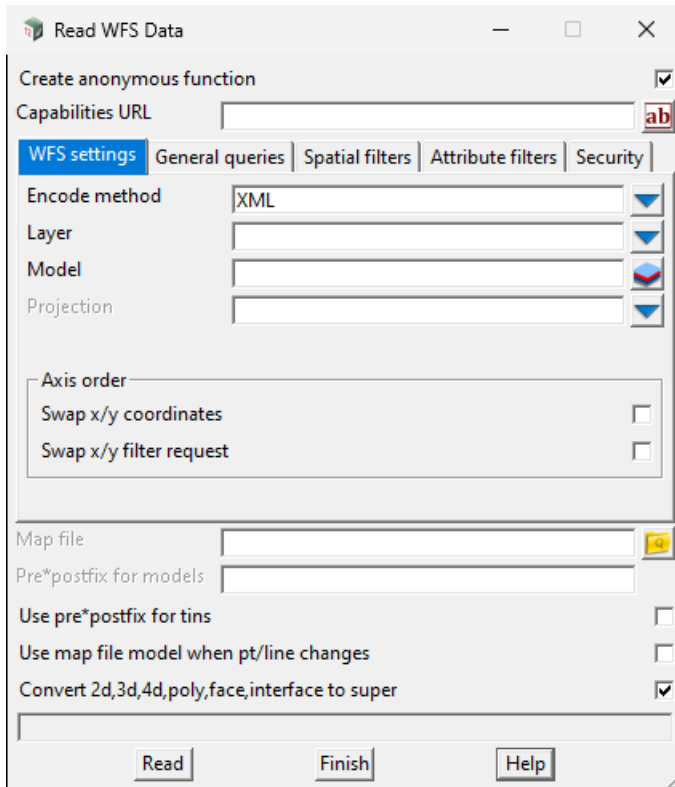
*The size of each image tile if the map is being sliced into smaller image tiles.*

Continue to [7.7.3 Read WFS Data](#) or return to [7.7 GIS](#) or [7 File](#).

### 7.7.3 Read WFS Data

**Position of option on menu:** File =>GIS =>WFS

Selecting WFS brings up the **Read WFS Data** panel.



- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Create anonymous function</b>	tick box	ticked	
----------------------------------	----------	--------	--

*If **ticked**, a function using all the fields in the panel is automatically created when the data is read in.*

<b>Capabilities URL</b>	input box		
-------------------------	-----------	--	--

*The capabilities URL for WFS.*

<b>Map file</b>	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.*

<b>Pre*postfix for model</b>	pre*postfix box		
------------------------------	-----------------	--	--

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file.*

<b>Use pre*postfix for tins</b>	pre*postfix box		
---------------------------------	-----------------	--	--

*If **not blank**, a prefix and a postfix to be applied to the model names used in the map file.*

<b>Use map file model when pt/line changes</b>	tick box	not ticked	
--	----------	------------	--

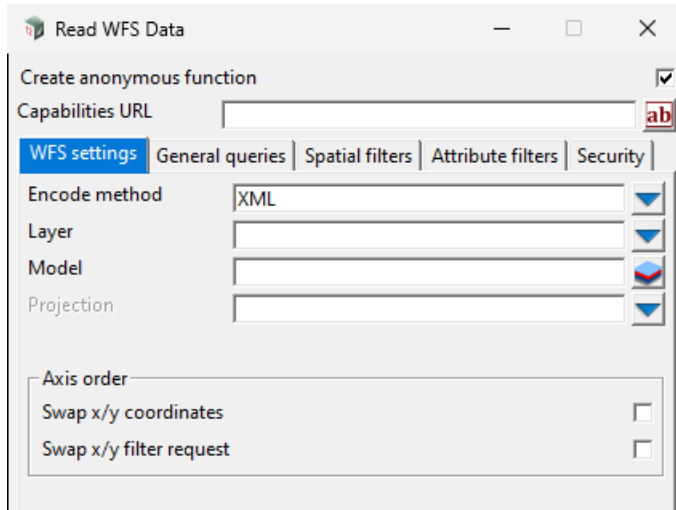
*If **not ticked** and the pt/line type of the string does not match that in the map file, then the string is placed*

in.

**Convert 2d, 3d, 4d, poly, face, interface to super**    tick box   

*If **ticked**, non super string versions of 2d/3d/4d/poly/face/interface strings are converted to super strings.*

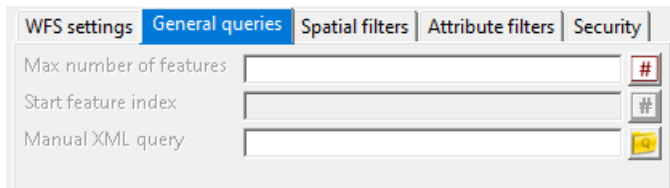
**WFS settings tab**



- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

<b>Encode name</b>	choice box	XML	XML, KVP
<i>Data can be queried with POST method using XML encoding or GET method using KVP encoding.</i>			
<b>Layer</b>	choice box		list of layer names
<i>Show list of layer names after downloading from LINZ server.</i>			
<b>Model</b>	model box		available models
<i>Model to keep the imported GIS data.</i>			
<i>Note: model name must not exist.</i>			
<b>Projection</b>	projection box	optional	list of projections
<i>The projection that the output data should be converted to.</i>			
<b>Filter type</b>	choice box		OGC filter, CQL filter
<i>Type of filter to be used to query data.</i>			
<i>For more details, see <a href="https://docs.geoserver.org/stable/en/user/filter/syntax.html">https://docs.geoserver.org/stable/en/user/filter/syntax.html</a></i>			
<b>Swap x/y coordinates</b>	tick box	not ticked	
<i>If <b>ticked</b>, x and y values of output data will be swapped.</i>			
<b>Swap x/y filter request</b>	tick box	not ticked	
<i>If <b>ticked</b>, x and y value of input data will be swapped.</i>			

### General queries tab



- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

**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.*

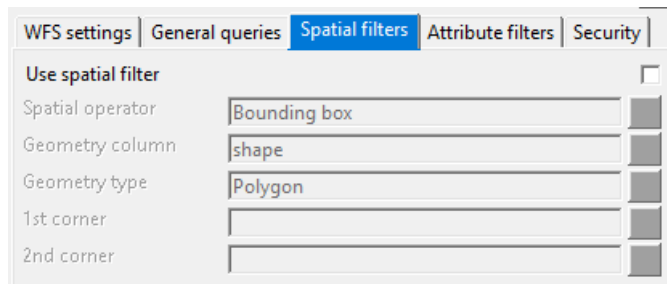
*e.g. "Start index" is 10 and "max number of feature" is 50, panel will import all feature from 10 to 59 inclusively.*

**Manual OGC/CQL query**    input 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](https://docs.geoserver.org/stable/en/user/filter/filter_reference.html) and [https://docs.geoserver.org/stable/en/user/filter/ecql\\_reference.html](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.*

### Spatial filters tab



- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

**Use spatial filter**    tick box    ticked

*Turn on and off the filter by spatial functionality.*

**Spatial operator**    choice box    Bounding box    Bounding box, Intersects, Disjoint, Contains, Within, Touches, Cross, Overlaps, Equals, Distance within, Beyond

*Spatial predicate for data filtering. Details are divided into smaller section below. See [7.7.5.1 Spatial operator options](#).*

**Geometry column**    choice box    Geometry    Shape, Geometry

*"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.*



### Attribute filters tab

- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

**Use filter by attributes**      tick box      not ticked

*Turn on and off the filter by attributes functionality.*

**Reload attributes**      button

*Re-download a list of attribute names of a chosen layer.*

**Relation**      choice box

=, >, <, >=, <=, !=, is like, is between, is null, is nil

*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 imported.*

### Security

- [WFS settings tab](#)
- [General queries tab](#)
- [Spatial filters tab](#)
- [Attribute filters tab](#)
- [Security](#)

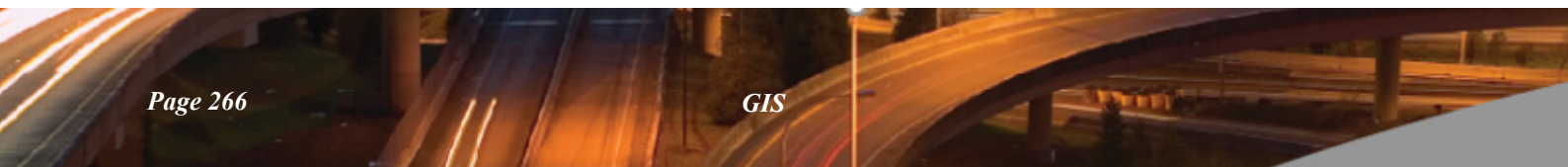
**Username**      input box      optional

*The username to access private data set.*

**Password**      input box      optional

*The password to access private data set.*

Continue to [7.7.4 Read REST Features Data](#) or return to [7.7 GIS](#) or [7 File](#).





## 7.7.4 Read REST Features Data

**Position of option on menu:** File =>GIS =>REST features service

Now documented in the V15 reference manual

Selecting REST features service brings up the **REST Features Service Reader** panel.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Create anonymous function</b>	tick box	ticked	
----------------------------------	----------	--------	--

*If **ticked**, a function using all the fields in the panel is automatically created when data is read in.*

<b>REST token</b>	input box		
-------------------	-----------	--	--

*The token (or API key) to be used as authentication method for accessing private dataset.*

<b>REST URL</b>	input box		
-----------------	-----------	--	--

*URL to REST services folder from GIS server.*

*Set project attribute **GIS\_REST\_URL** to auto fill this field.*

<b>Map file</b>	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

*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

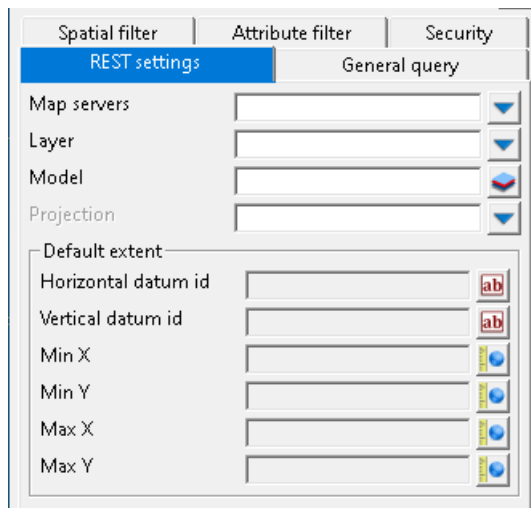
*If **ticked** and a **Map file** is used, the **column** in the map file that specifies the point/line type of the string is used to set the point/line type of the string.*

*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.*

**REST settings tab**



[REST settings tab](#)  
[General query tab](#)  
[Spatial filter tab](#)  
[Attribute filter tab](#)

**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.*

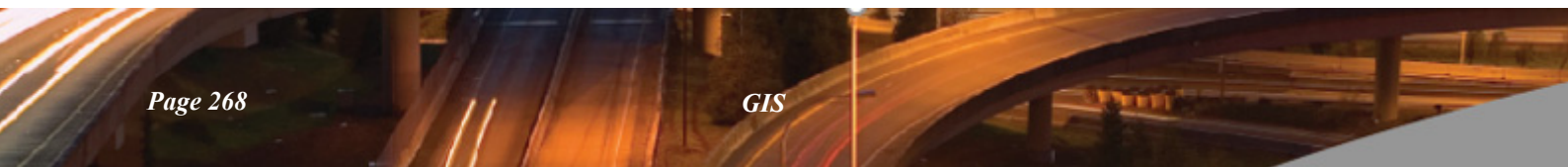
**Projection**                      projection box                      optional                      available projections

*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**

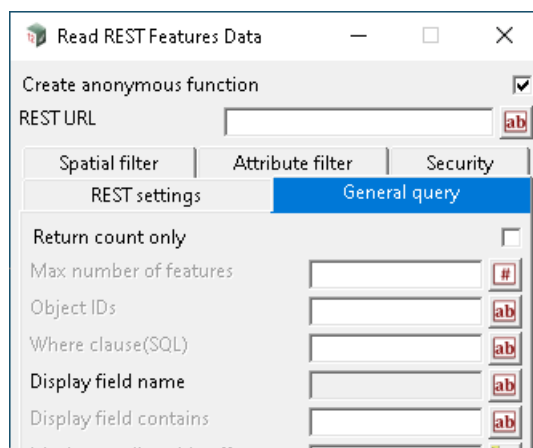
**Horizontal datum id**              input box                              Read-only

*ID number of defaults horizontal datum, It is often EPSG code.*



<b>Vertical datum id</b>	input box	Read-only
	<i>ID number of defaults vertical datum, It is often EPSG code.</i>	
<b>Min X</b>	double box	Read-only
	<i>Minimum X coordinate of the bounding box.</i>	
<b>Min Y</b>	double box	Read-only
	<i>Minimum Y coordinate of the bounding box.</i>	
<b>Max X</b>	double box	Read-only
	<i>Maximum X coordinate of the bounding box.</i>	
<b>Max Y</b>	double box	Read-only
	<i>Maximum Y coordinate of the bounding box.</i>	

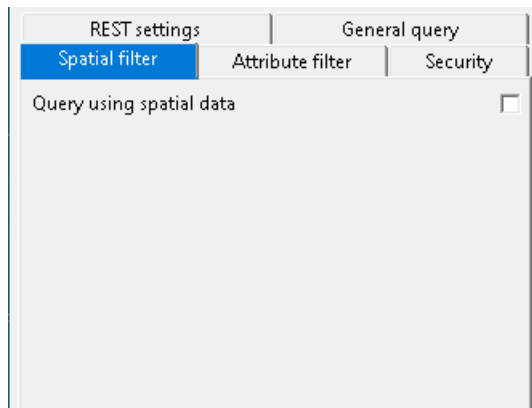
### General query tab



[REST settings tab](#)  
[General query tab](#)  
[Spatial filter tab](#)  
[Attribute filter tab](#)

<b>Where clause(SQL)</b>	input box	optional
	<i>The Where Clause condition in SQL format to query data from the server.</i>	
<b>Display field name</b>	input box	Read-only
	<i>The display field (if available)s associated with chosen layer.</i>	
<b>Display field contains</b>	input box	optional
	<i>Any feature/layers that which its display field contains this value will be read in.</i>	
<b>Maximum allowable offset</b>	double box	optional
	<i>It's used for generalising geometries returned in the read process.</i>	
<b>Geometry's number of decimal</b>	number box	optional
	<i>The number of decimal places in the output geometry.</i>	
<b>Include all fields</b>	tick box	ticked
	<i>If <b>ticked</b>, all available fields will be imported as attribute.</i>	
	<i>If <b>not ticked</b>, user can specify individually which field to be imported as attribute.</i>	

### Spatial filter tab



- [REST settings tab](#)
- [General query tab](#)
- [Spatial filter tab](#)
- [Attribute filter tab](#)

**Query using spatial data**    tick box                    not ticked

*If ticked, geometry will be used as reference to read data from server.*

**Geometry type**                            choice box                    Polygon                    Point, Line, Polygon, Envelope, Multipoint

*The type of geometry to be used as reference to import data from server.*

See [Additional Geometry type panel fields](#).

**Geometry relationship**            choice box                    Intersects                    Intersects, Contains, Crosses Envelop intersects, Index Intersects, Overlaps, Touches, Within, Relation

*The 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

*The 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

*The unit used for distance when query data from server.*

#### Polygon

??.

### Additional Geometry type panel fields

#### Point

**Point coordinate**                    XYZ box

*The 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.*

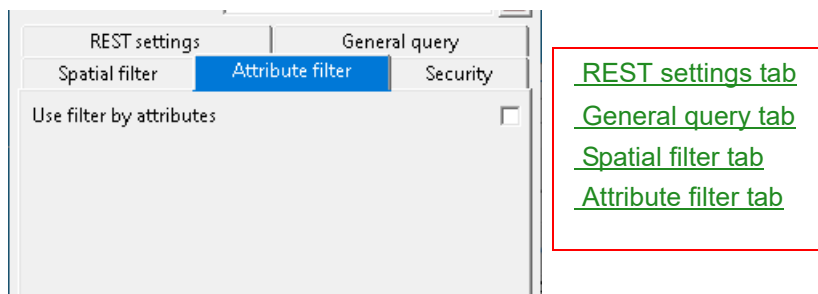
*It must be a diagonal corner to the 1st corner.*

### 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.*

### Attribute filter tab



**Use filter by attributes** tick box not ticked

*If **ticked**, attributes will be used to query data from server.*

**Download attributes** button

*Download all available attributes for the chosen layer and display them in the table.*

### Grid

**Type** input 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** input 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 [7.7.5 Read LINZ WFS Data](#) or return to [7.7 GIS](#) or [7 File](#).

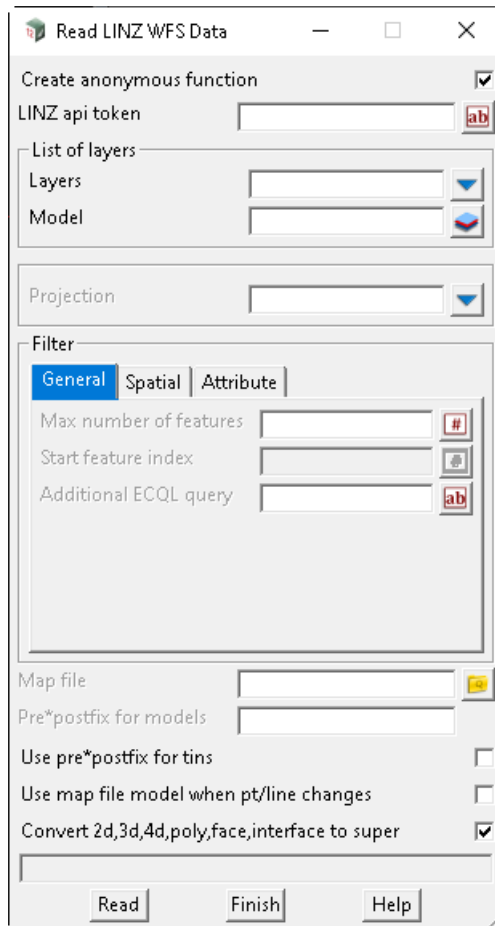


## 7.7.5 Read LINZ WFS Data

**Position of option on menu:** File =>GIS =>LINZ WFS data service

Now documented in the V15 reference manual

Selecting LINZ WFS data service brings up the LINZ WFS Data Service Reader panel.



[General tab](#)  
[Spatial tab](#)  
[Attribute tab](#)

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Create anonymous function</b>	tick box	ticked	
----------------------------------	----------	--------	--

*If ticked, a function using all the fields in the panel is automatically created when the data is read in.*

<b>LINZ api token</b>	input		
-----------------------	-------	--	--

*Set project attribute **LINZ\_API\_TOKEN** to auto fill the input at startup.*

*List of layers.*

### List of layers

<b>Layers</b>	choice box		list of layer names
---------------	------------	--	---------------------

*Show list of layer names after downloading from LINZ server.*

<b>Model</b>	model box		available models
--------------	-----------	--	------------------

*Model name must not exist.*



Name of model to store all imported data

**Projection** optional list of projections

The projection that the output data should be converted to.

**General tab**

**Max number of feature** number box

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 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.

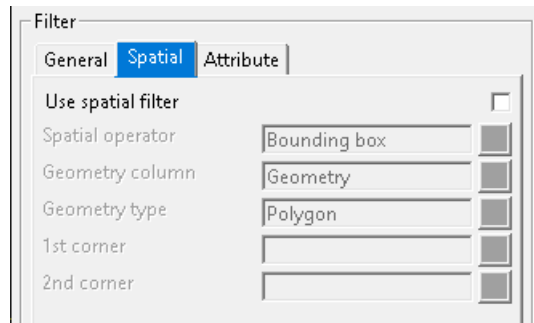
**Additional ECQL query** input box optional

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](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.

**Spatial tab**



[General tab](#)  
[Spatial tab](#)  
[Attribute tab](#)

**Use spatial filter** tick box ticked

Turn on and off the filter by attributes functionality.

**Spatial operator** choice box Bounding box Bounding box, Intersects, Disjoint, Contains, Within, Touches, Cross, Overlaps, Equals, Distance within, Beyond

Spatial predicate for data filtering. Details are divided into smaller section below. See [7.7.5.1 Spatial operator options](#).

**Geometry column** choice box Geometry Shape, Geometry

"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.

**Geometry type** choice box

Type of geometry to use as reference for filtering.



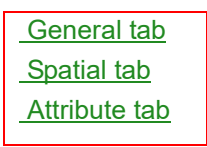
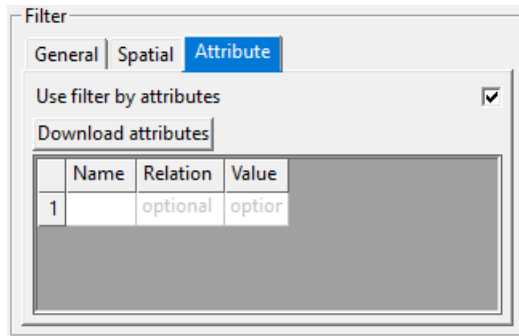
**1st corner** XYZ box

*The first corner of the rectangular bounding box. It must be diagonal to the 2nd corner.*

**2nd corner** XYZ box

*The diagonal corner to the first corner of the rectangular bounding box.*

**Attribute tab**



**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.*

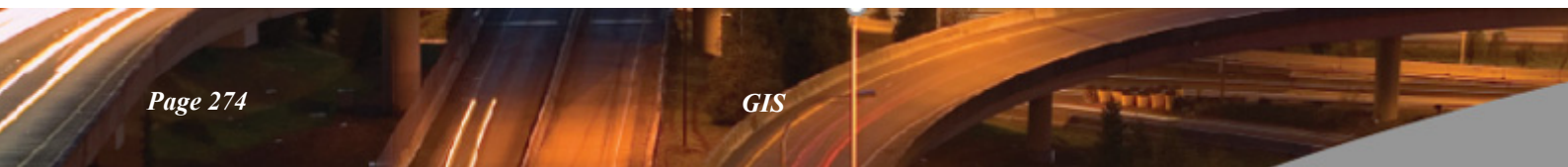
**Relation** choice box =, >, <, >=, <=, <>

*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 [7.7.5.1 Spatial operator options](#) or return to [7.7.5 Read LINZ WFS Data](#) or [7.7 GIS](#).



### 7.7.5.1 Spatial operator options

See [Bounding box](#)

See [Intersects](#)

See [Disjoint](#)

See [Contains](#)

See [Within](#)

See [Touches](#)

See [Crosses](#)

See [Overlaps](#)

See [Equals](#)

See [Distance within](#)

See [Beyond](#)

#### Bounding box

*Functionality: Data to be imported using Bounding box are:*

*Within the bounding box and*

*Intersects with the bounding box*

Filter

General **Spatial** Attribute

Use spatial filter

Spatial operator

Geometry column

Geometry type

1st corner

2nd corner

**1st corner** XYZ box

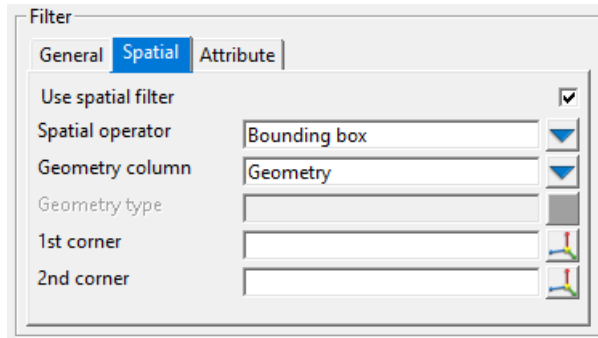
*"XYZ value of first corner of the box.*

**2nd corner** XYZ box

*XYZ 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](#).*

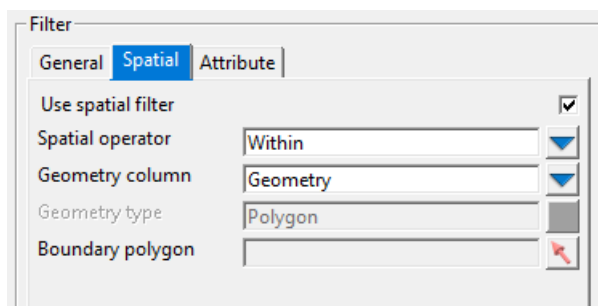
**Contains**

*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](#).*

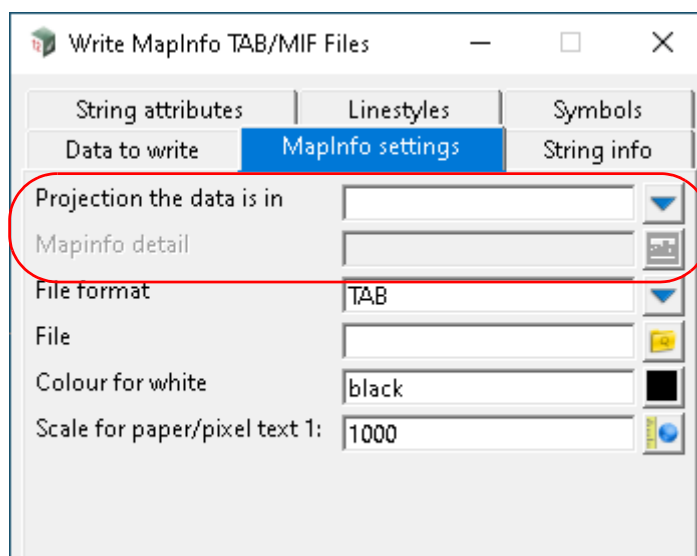
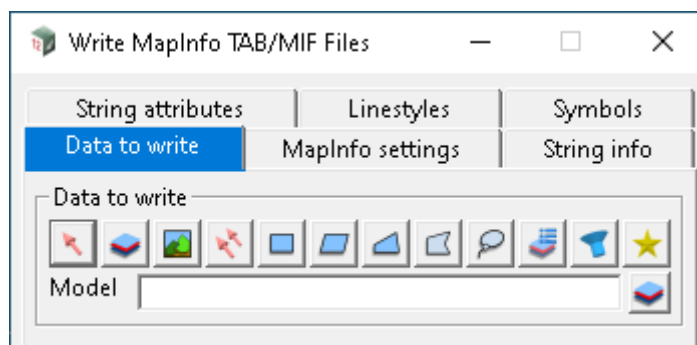
Continue to [7.8 MapInfo Write Tab/MIF Files](#) or return to [7.7 GIS](#) or [7 File](#).

## 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

Now documented in the V15 reference manual

**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

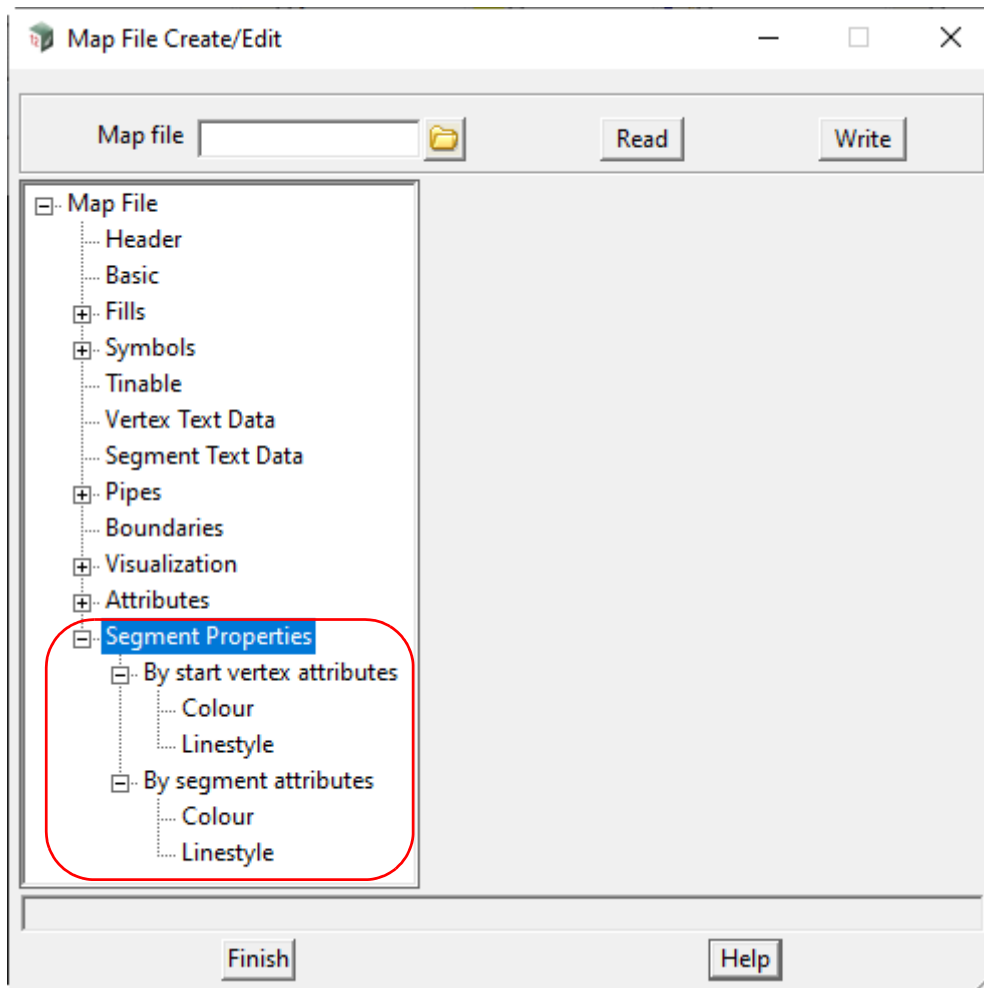
The **Segment Properties** node in the **Map File Create/Edit** panel is used to change the colour or linestyle of a super string segment by using:

- (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**

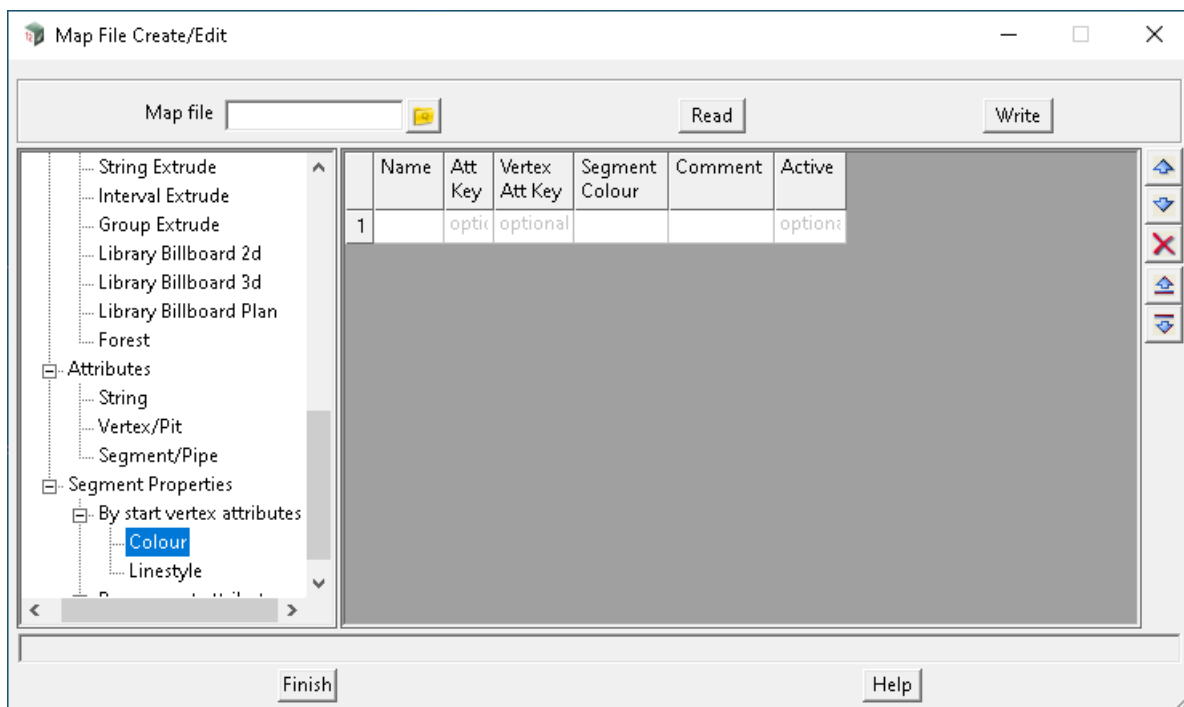
See [7.9.0.2 By Start Vertex Attribute - Colour/LineStyle](#)

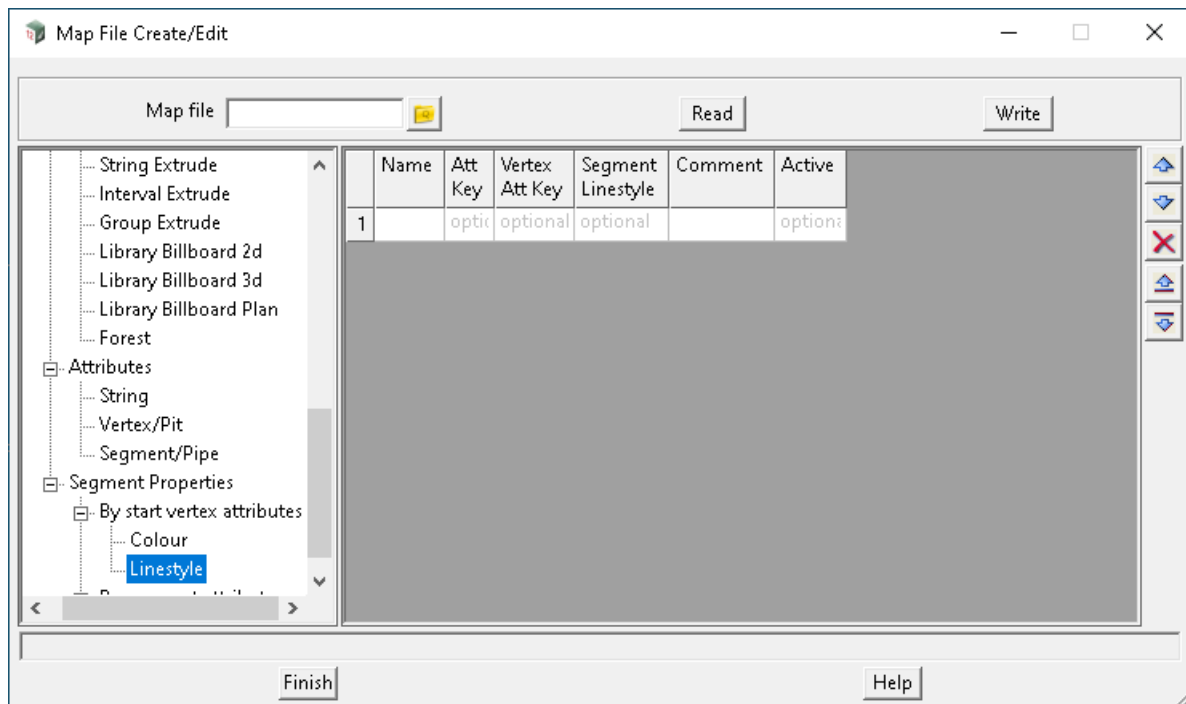


### 7.9.0.2 By Start Vertex Attribute - Colour/Linestyle

**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/Linstyle** 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 [3.8.3 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** is 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** is 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

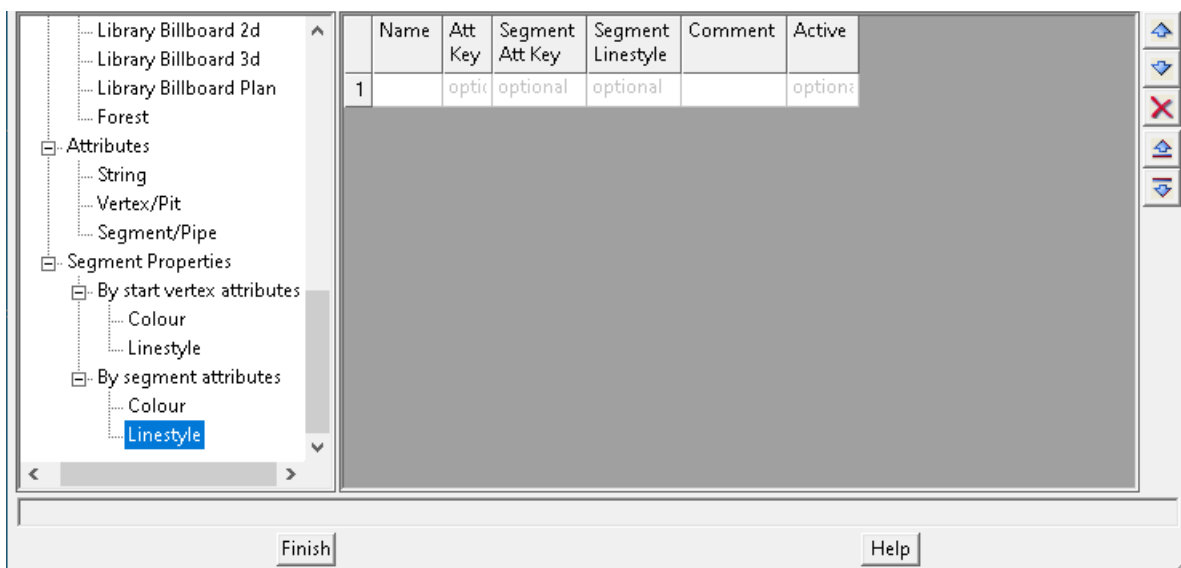
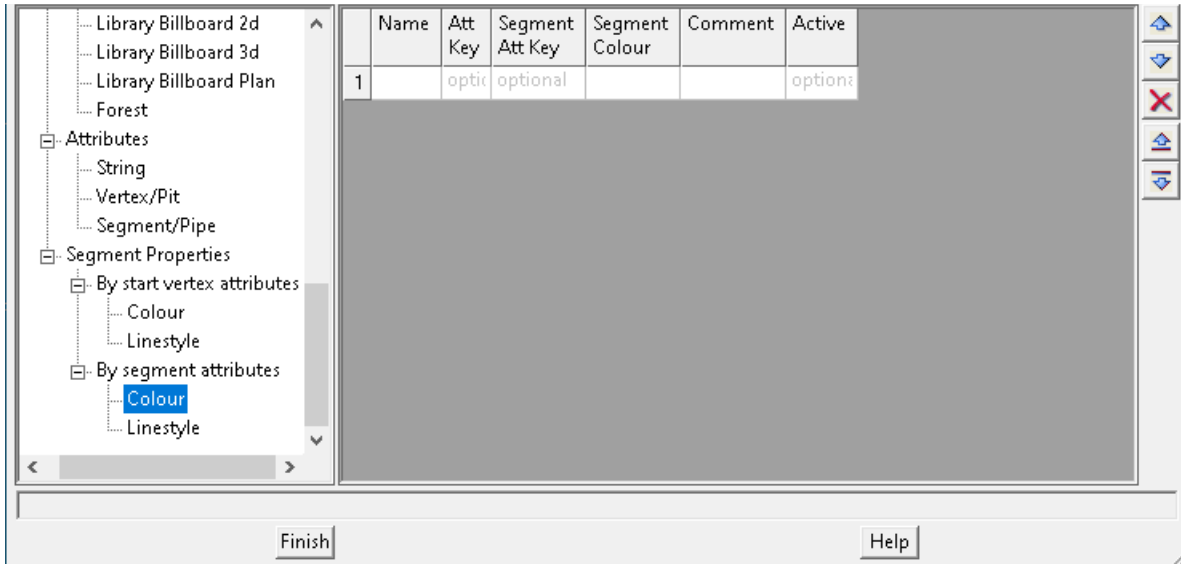
See .

To assist in 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 [3.8.3 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** is 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** is 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 in 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](#).

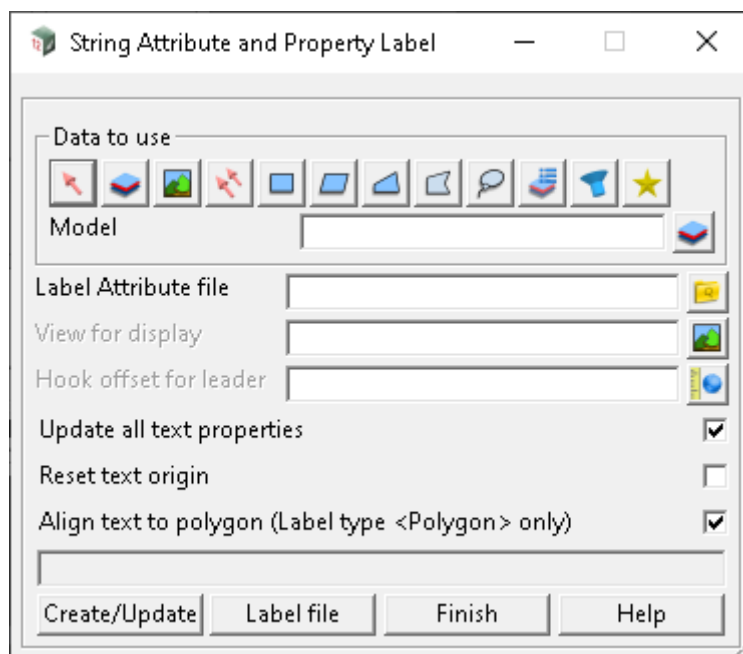
## 7.10 Apply String Attribute and Property Label

**Position of option on menu:** File =>Label Map files =>Apply string attribute/property label file

Now documented in the [V15 reference manual](#)

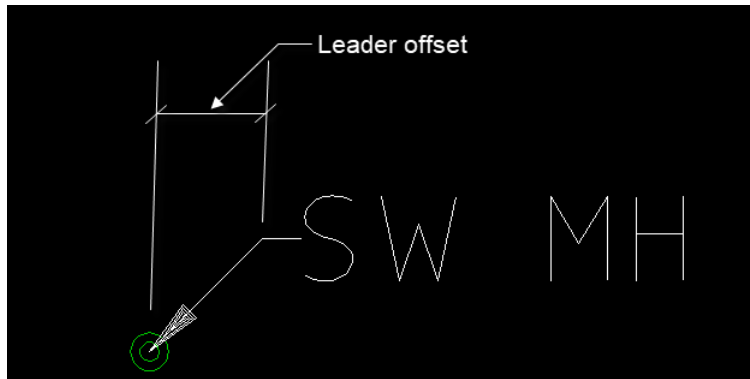
This option runs the string and properties label map file to label string attributes and properties with leaders and dimensions.

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	Defaults	Pop-Up
<b>Data to use</b>	data source		
<i>Data selection type - for a full description go to <a href="#">3.25.3 Data Source</a>.</i>			
<b>Label Attribute file</b>	file box		*.12dlf
<i>Label file to be applied.</i>			
<b>View for display</b>	view box		
<i>View for displaying the result.</i>			
<b>Hooks offset for leader</b>	tick box	ticked	
<i>If <b>not blank</b>, entry will be used as the hook offset when a leader is used.</i>			



**Update all text properties**    tick box        **ticked**

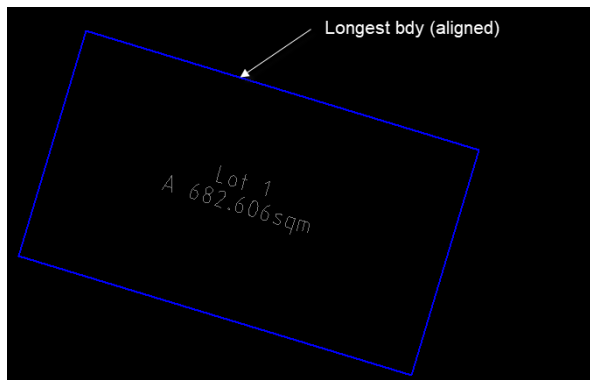
*If **ticked**, any changes to text parameters (Style, Height etc) that may have been set in the label file, will be applied to any existing text.*

**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.*

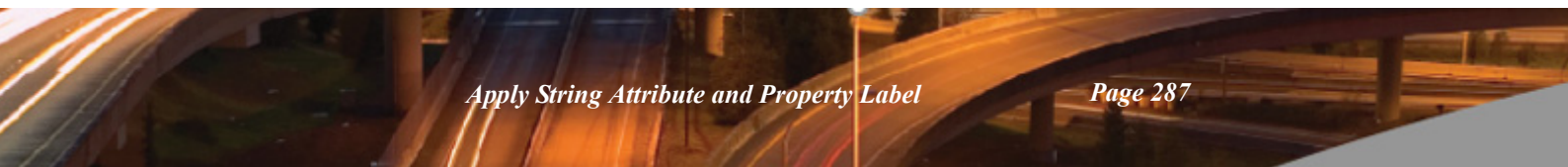


**Buttons at Bottom**

**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

Now documented in the [V15 reference manual](#)

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](#).

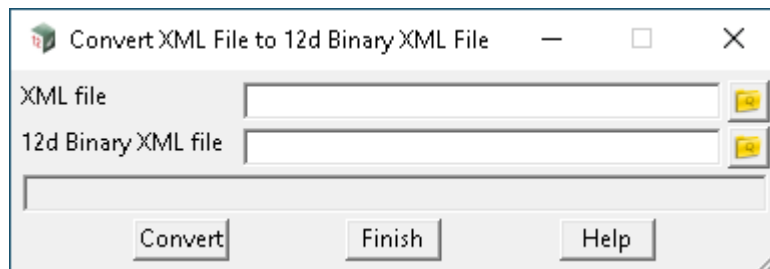
For information on converting **12d Binary XML** file to **XML** see [7.11.2 Convert 12d Binary XML File to XML File](#).

## 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
<b>XML file</b> <i>The file to be converted into binary.</i>	file box		*.xml files
<b>12d Binary XML file</b> <i>The resulting binary file.</i>	file box		*.xml files

### Buttons at Bottom

<b>Convert</b> <i>The resulting text file.</i>	button
---	--------

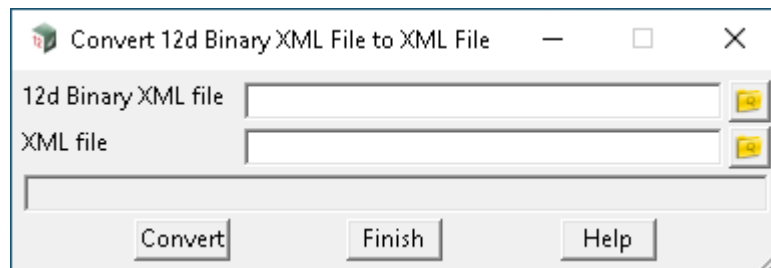
Continue to [7.11.2 Convert 12d Binary XML File to XML File](#) or return to [7.11 12d Binary XML Files](#) or [7 File](#).

## 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
<b>12d Binary XML file</b>	file box		*.xml files
<i>The file to be converted into text.</i>			
<b>XML file</b>	file box		*.xml files
<i>The file to be converted into binary.</i>			

### Buttons at Bottom

<b>Convert</b>	button
<i>The resulting text file.</i>	

Continue to [8 View](#) or return to [7.11 12d Binary XML Files](#) or [7 File](#).



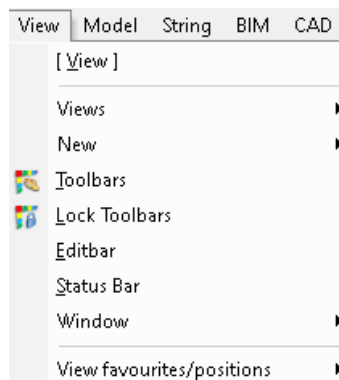
# 8 View

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

on Main menu

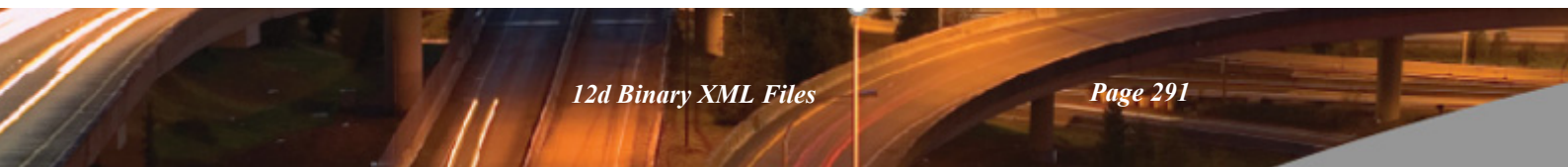


- Create floating **View** menu
- ▶ walk-right list of views
- ▶ create new views
- turn toolbars on/off
- Lock toolbars so that they can't be moved
- turn the status bar on/off
- ▶ arrange (eg cascade) the views
- ▶

floating View menu



[8.1 Street View](#) display a Google Map Street View



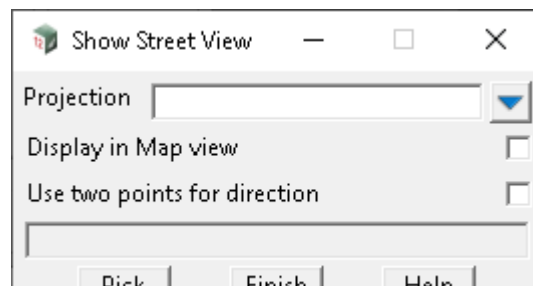
## 8.1 Street View

**Position of option on menu:** View =>Street view

Now documented in the [V15 reference manual](#)

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
<b>Projection</b>	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

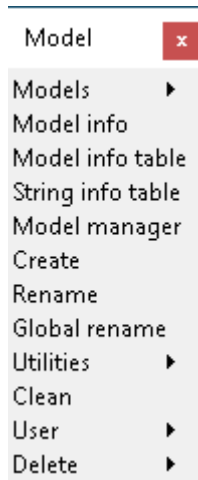
*If **User two points for direction** is **ticked**, then a Street View from Google Earth is displayed looking in the direction from the first picked point to the second picked point.*

*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](#)

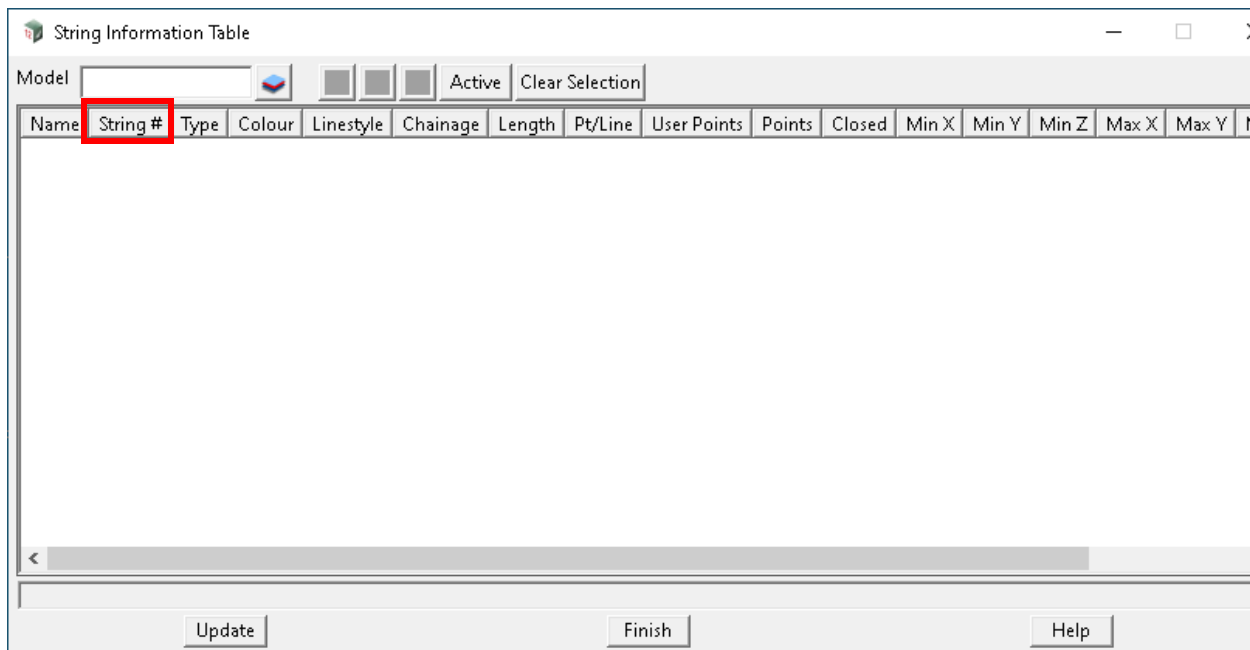
See [9.2 Share Out Models](#)

## 9.1 Strings in Model Information Table

Position of option on menu: Model =>String info table

Now documented in the V15 reference manual

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](#).

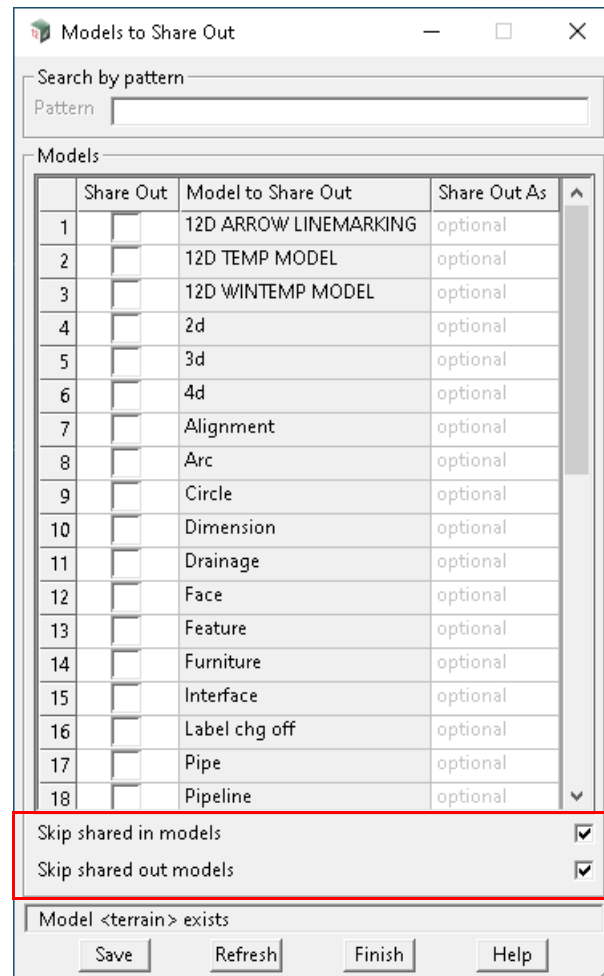
## 9.2 Share Out Models

**Position of option on menu:** Model =>Utilities =>Sharing =>Share out

Now documented in the V15 reference manual

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



See [10.1 Segment Attributes](#)

See [10.2 Vertex Attributes](#)

See [10.3 Create/Edit Service Conduit](#)

See [10.4 Create - Pipe Super](#)

See [10.5 Create - Super](#)

See [10.6 Create Super Alignment](#)

See [10.7 Super Alignment Style Output](#)

See [10.8 Equality Query](#)

See [10.9 Chainage Query](#)

See [10.10 Compute Strings](#)

See [10.11 Grids and DEMS](#)

See [10.12 String Inquire](#)

See [10.13 Super Edit - Properties Toolbar](#)

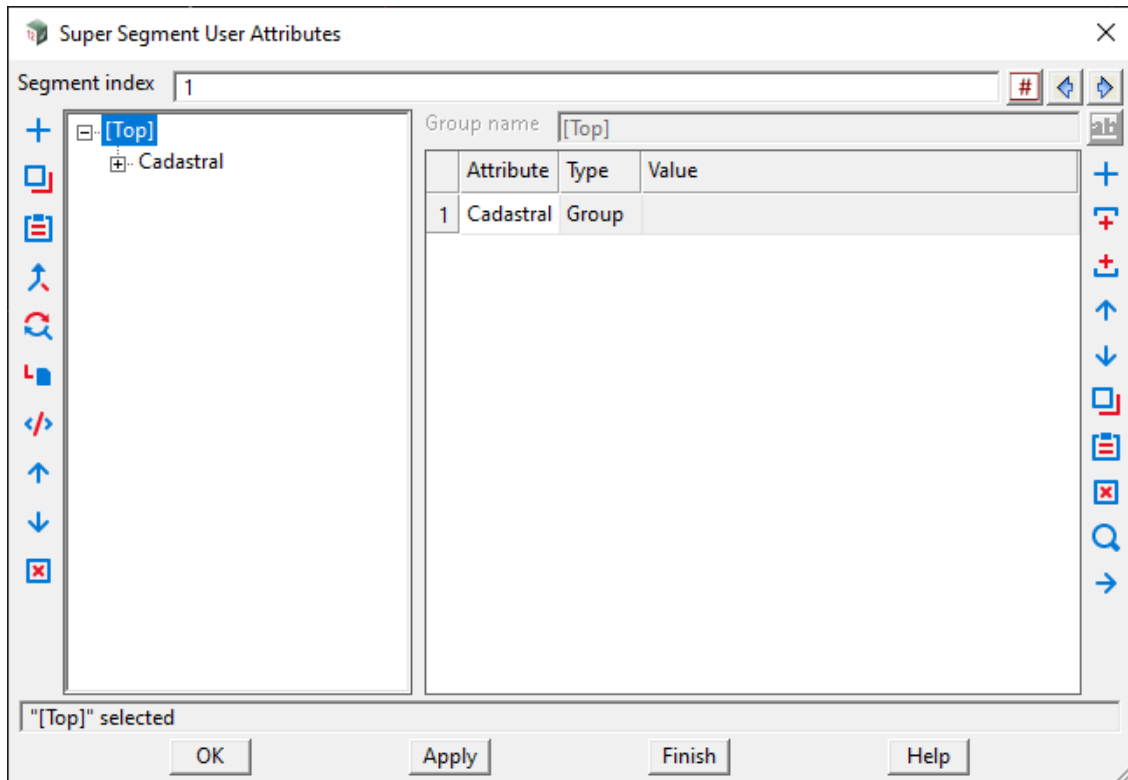
See [10.14 Generate Unique String Names](#)

## 10.1 Segment Attributes

Now documented in the V15 reference manual

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 [3.8 Attributes \(Meta Data\)](#) and the description of how to add attributes and groups of attributes in an **Attributes** panel is given in the section [3.8.3 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
<b>Segment index</b>	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.*

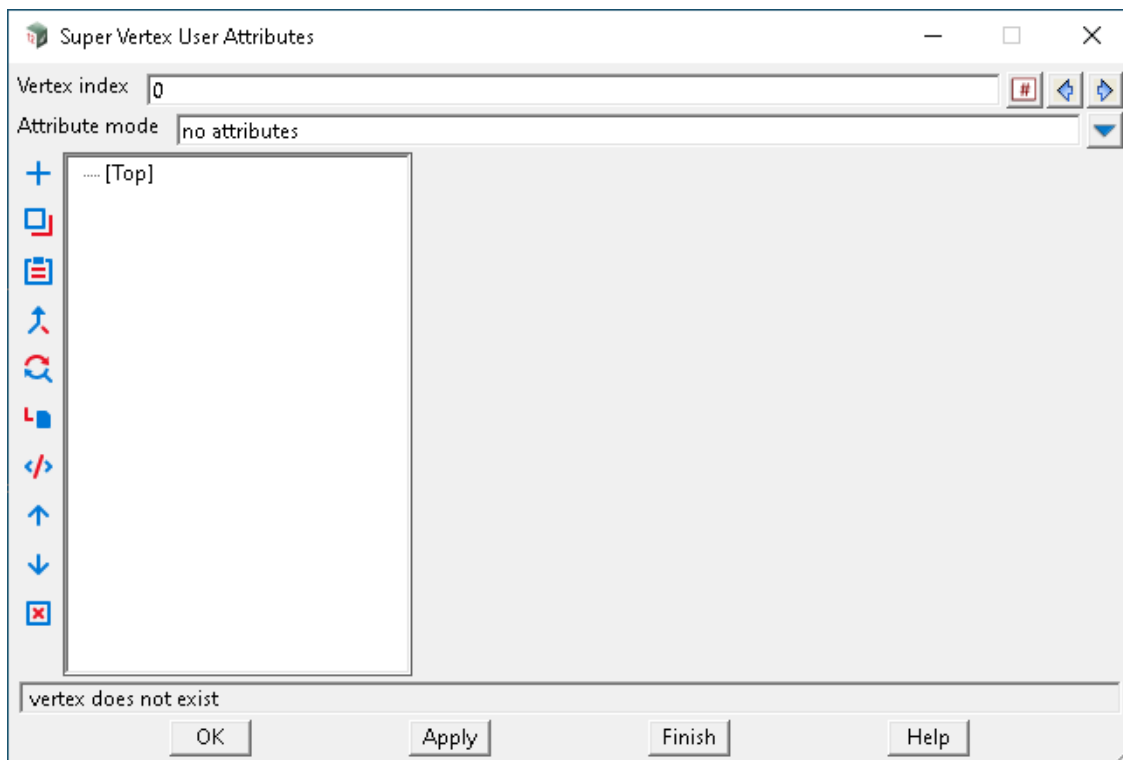
Continue to [10.2 Vertex Attributes](#) or return to [10 String](#).

## 10.2 Vertex Attributes

Now documented in the V15 reference manual

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 [3.8 Attributes \(Meta Data\)](#) and the description of how to add attributes and groups of attributes in an Attributes panel is given in the section [3.8.3 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
<b>Vertex index</b>	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

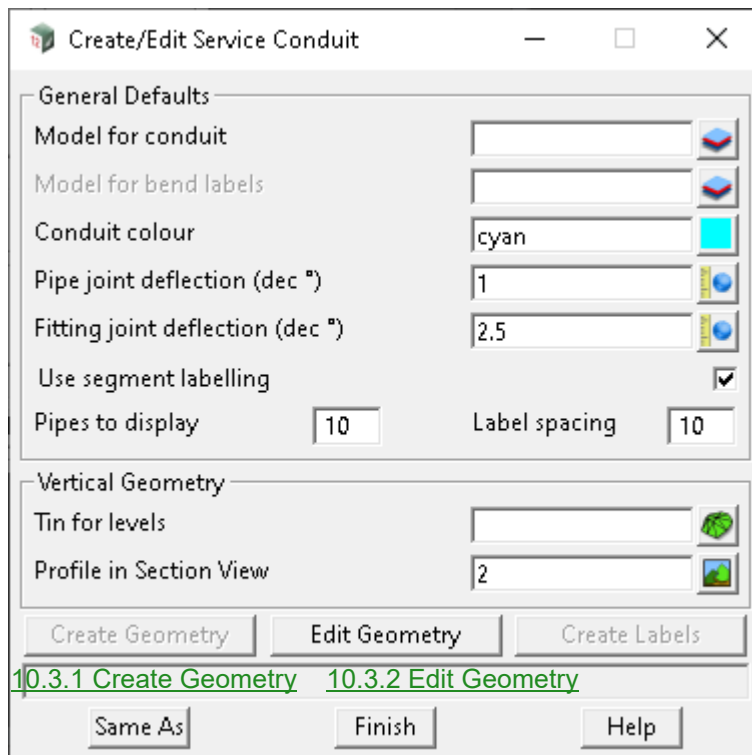
Position of menu: String =>Create =>Conduit-service

Now documented in the V15 reference manual

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
<b>General defaults</b>			
<b>Model for conduit</b>	model box		
<i>The model that the string will be added to.</i>			
<b>Model for bend labels</b>	model box		available colours
<i>[Optional] The model that bend labels will be added to.</i>			
<b>Conduit colour</b>	colour box	cyan	available colours
<i>The colour the new string will have.</i>			



<b>Pipe joint deflection (dec*)</b>	real box	1.0
<i>The maximum deflection allowable for pipe joints.</i>		
<b>Fitting joint deflection (dec*)</b>	real box	1.0
<i>The maximum deflection allowable through fitting (i.e. bend) sockets.</i>		
<b>Use segment labelling</b>	tick box	ticked
<i>Is segment labelling required for geometry options strings.</i>		
<b>Pipe lengths to display</b>	Integer box	10
<i>Number of standard pipe lengths to use for geometry options strings.</i>		
<b>Segment label spacing</b>	Integer box	10
<i>For geometry options string labels, what segment spacing is required.</i>		

### Vertical Geometry

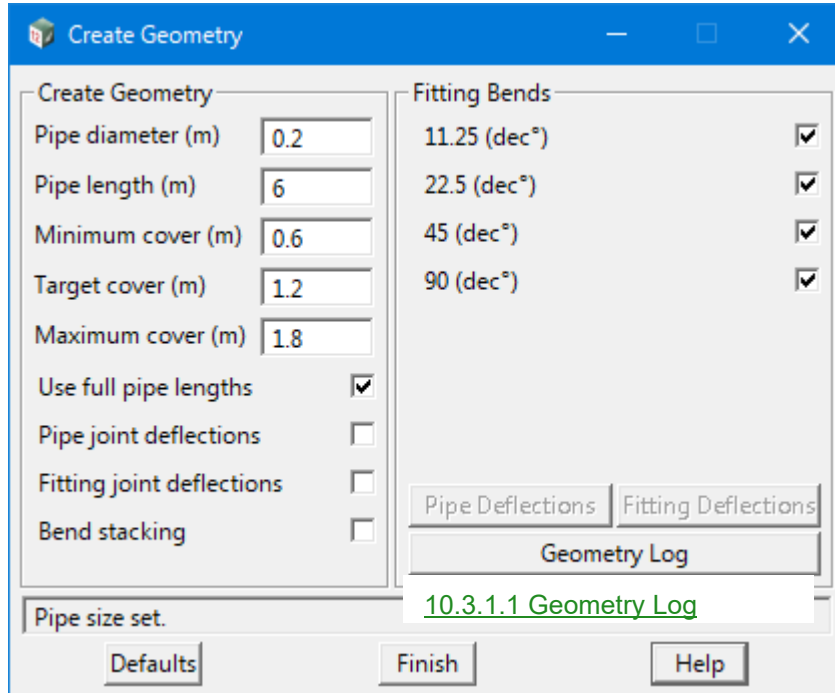
<b>Tin for levels</b>	tin box
<i>The tin to be used for vertical geometry calculations.</i>	
<b>Profile in Section View</b>	tin box
<i>The view to display a profile of the conduit as it's created.</i>	
<b>Create Geometry</b>	button
<i>Opens the Create Geometry panel. See <a href="#">10.3.1 Create Geometry</a>.</i>	
<i>Note: Not active until a Model and Tin have been selected.</i>	
<b>Edit Geometry</b>	button
<i>Opens the Edit Geometry panel. See <a href="#">10.3.2 Edit Geometry</a>.</i>	
<b>Create Labels</b>	button
<i>Opens the Edit Geometry panel. See <a href="#">10.3.2 Edit Geometry</a>.</i>	
<i>Note: Not active until geometry has been created.</i>	

### Buttons at Bottom

<b>Same As</b>	button
<i>Sets the defaults widgets to match the selected service conduit properties (if applicable).</i>	
<b>Finish</b>	button
<i>Close the panel.</i>	
<b>Help</b>	button
<i>Opens the reference manual.</i>	
Continue to <a href="#">10.3.1 Create Geometry</a>	

### 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.



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

Field Description	Type	Defaults	Pop-Up
<b>Create Geometry</b>			
<b>Pipe Diameter (m)</b> <i>The diameter of the conduit.</i>	real box	0.2	
<b>Pipe length (m)</b> <i>The standard length of one pipe.</i>	real box	6	
<b>Minimum cover (m)</b> <i>The minimum allowable cover for the conduit. This will form the upper limit of the vertical corridor.</i>	real box	0.6	
<b>Target cover (m)</b> <i>The target for grading. It is recommended that this value be kept as close as practicable to the centre of the vertical corridor.</i>	real box	1.2	
<b>Maximum cover (m)</b> <i>The maximum allowable cover for the conduit. This forms the lower limit of the vertical corridor.</i>	real box	1.8	
<b>Use full pipe lengths</b> <i>Determines whether full pipe lengths or partial pipe lengths may be used for the geometry</i>	tick box	ticked	
<b>Pipe joint deflections</b> <i>Determines whether pipe joint deflections should be used for the geometry. If selected then standard bends, stacking and fitting joint deflections are disabled.</i>	tick box	not ticked	

**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

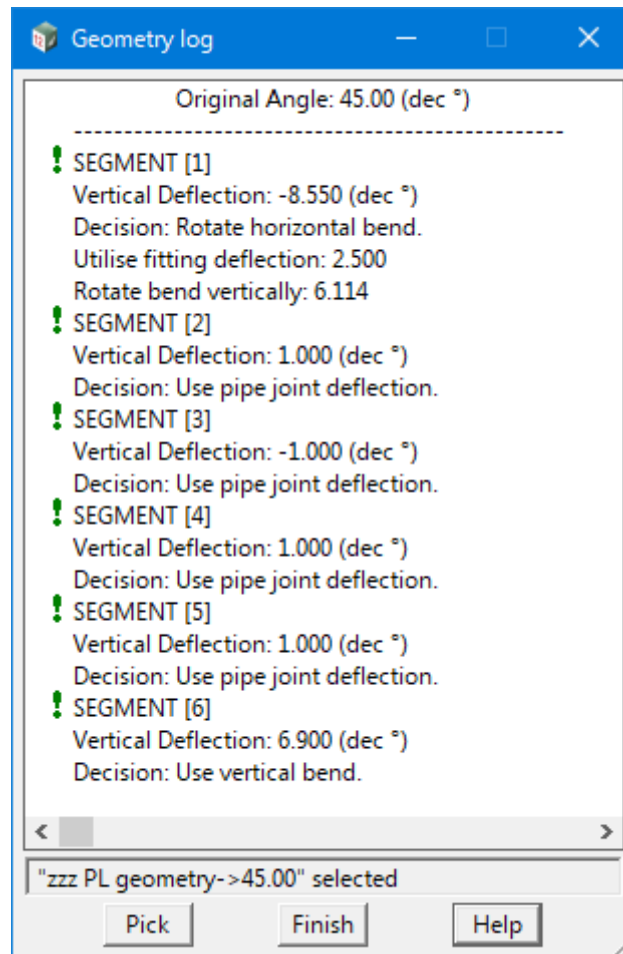
**Defaults**                    button

*Returns to the General Defaults (main) panel.*

Continue to [10.3.1.1 Geometry Log](#).

### 10.3.1.1 Geometry Log

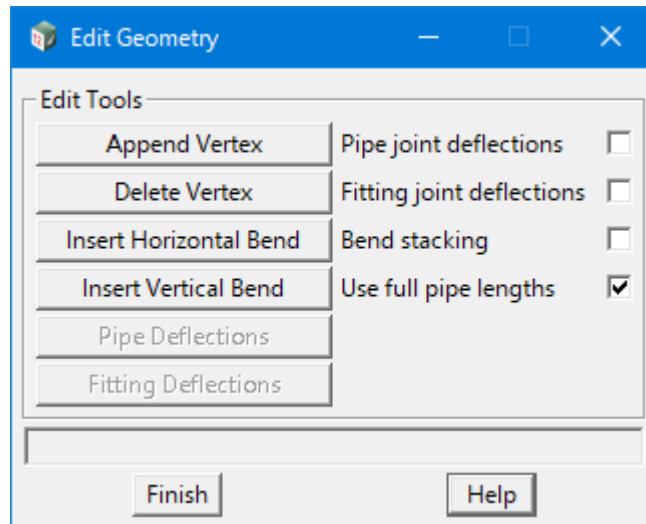
The **Geometry Log** panel allows the constraints and decision behind each segment of the geometry options strings to be reviewed prior to selecting the next fitting location. The original angle of the geometry option string is displayed at the top. Each segment of the geometry option string is then 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
<b>Edit Tools</b>			
Append Vertex	button		
<i>Allows the user to append a vertex to the end of the current geometry.</i>			
Delete Vertex	button		
<i>Allows the user to delete a vertex from the current geometry.</i>			
Insert Horizontal Bend	button		
<i>Allows the user to insert a horizontal bend within the current geometry.</i>			
Insert Vertical Bend	button		
<i>Allows the user to insert a vertical bend within the current geometry.</i>			

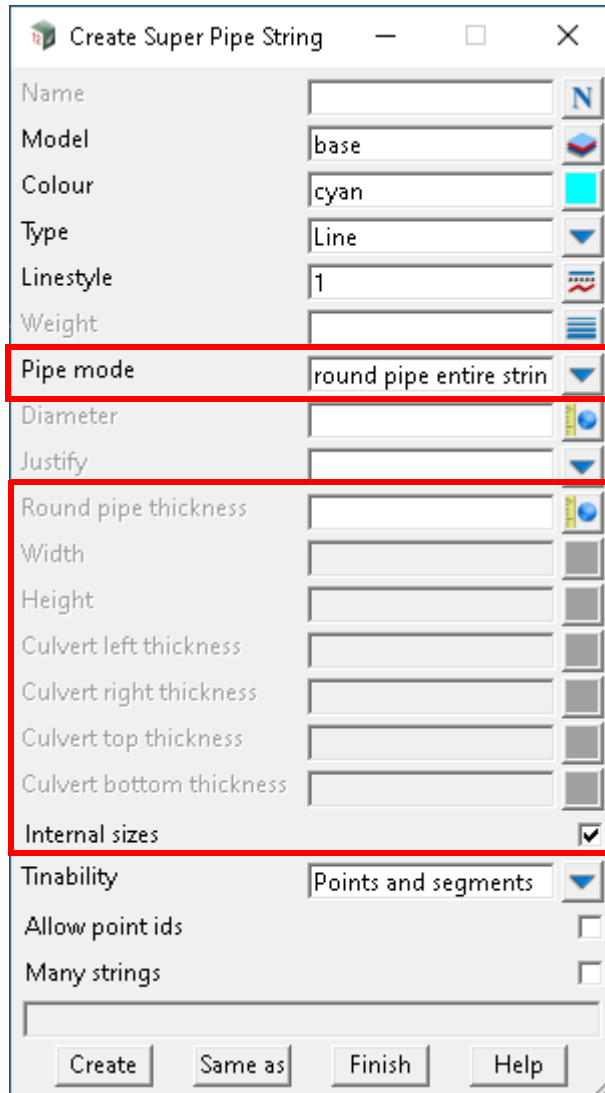
The remaining widgets on the Edit Geometry panel operate in the same manner as described for the Create Geometry panel above. See [10.3.1 Create Geometry](#).

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

Now documented in the V15 reference manual



The fields and buttons used in the **Create Super Pipe String** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Pipe mode</b>	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**, there 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.*

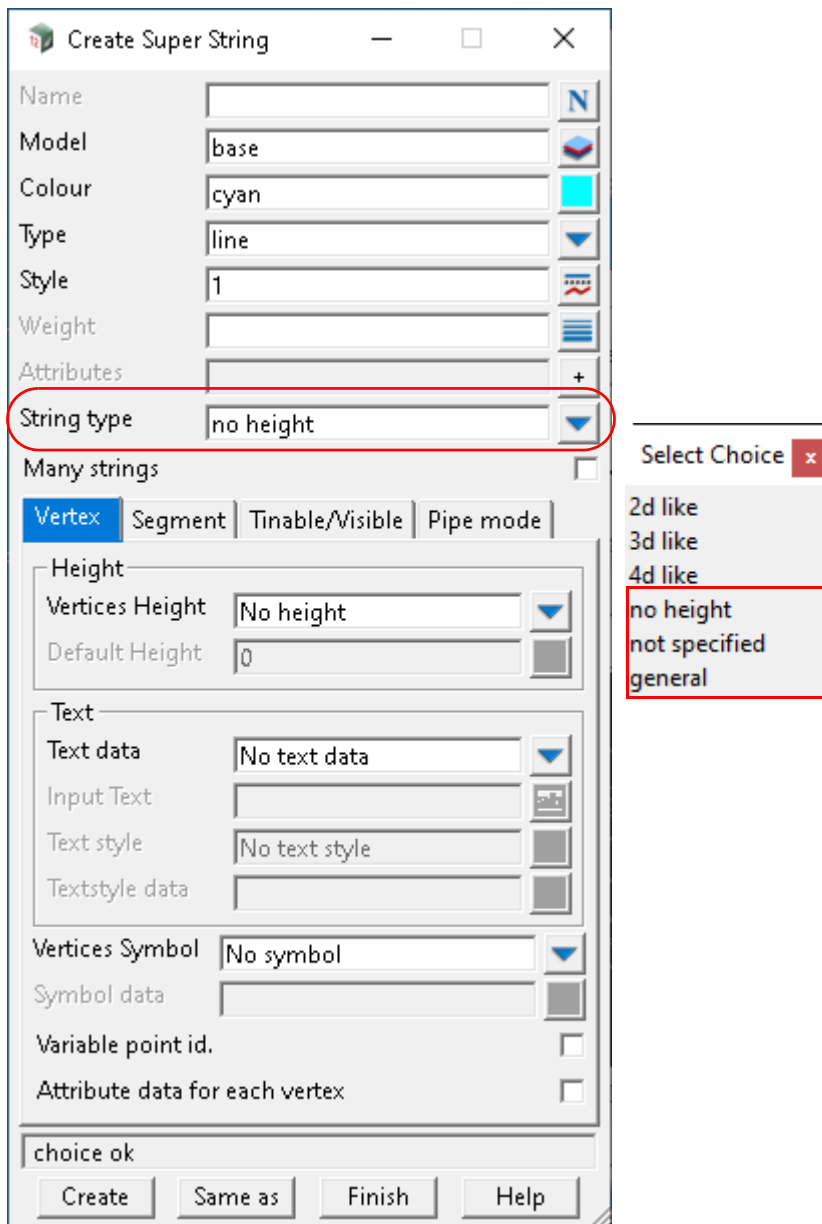
Continue to [10.5 Create - Super](#) or return to [10 String](#).

# 10.5 Create - Super

**Position of option on menu:** String =>Create =>Super

Now documented in the V15 reference manual

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
<b>String type</b>	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.

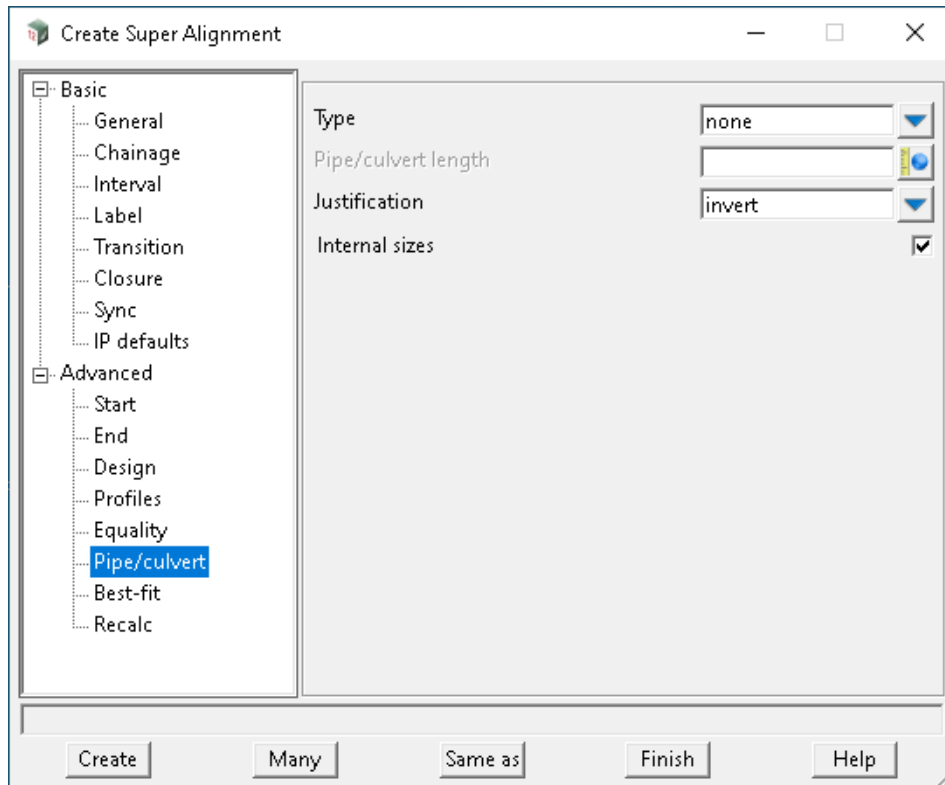
Continue to [10.6 Create Super Alignment](#) or return to [10 String](#).

# 10.6 Create Super Alignment

**Position of option on menu:** String =>Super Alignments =>Create super alignment

Now documented in the V15 reference manual

**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
<b>Internal sizes</b>	tick box	ticked	

*If ticked, sizing parameters are for the inside, otherwise they are for the outside.*

**Type: Pipe**

<b>Internal sizes</b>	tick box	ticked	
-----------------------	----------	--------	--

*If ticked, pipe diameter is for the inside of the pipe, otherwise it is for the outside.*

<b>Pipe thickness</b>	real box		measure box
-----------------------	----------	--	-------------

*This field only appears if Type is **pipe**.*

*The thickness of the pipe. Pipe thickness is in metres.*

**Type: Culvert**

<b>Culvert left thickness</b>	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

Now documented in the [V15 reference manual](#)

**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**

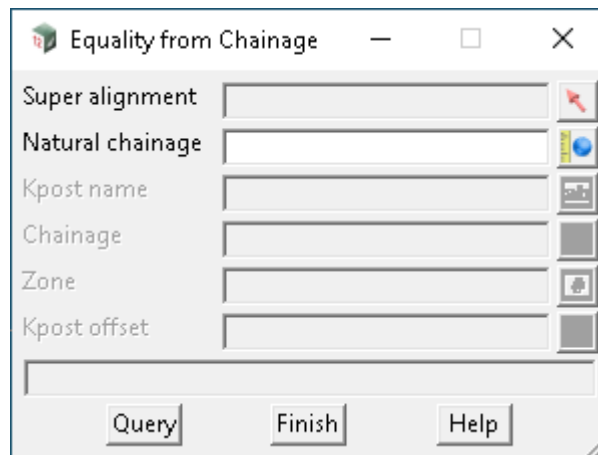
Now documented in the V15 reference manual

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 [3.41 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
<b>Super alignment</b>	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.*

<b>Natural chainage</b>	real box		
-------------------------	----------	--	--

*The selected raw chainage to get the **Kpost name**, **Chainage**, **Zone** and **Kpost offset**.*

<b>Kpost name</b>			
-------------------	--	--	--

*Prefix for interval labels for a given chainage on a super alignment defined by a K-post. For more information see [3.41.4 K-Post](#).*

<b>Chainage</b>			
-----------------	--	--	--

*The chainage length from the selected chainage to previous chainage equality.*

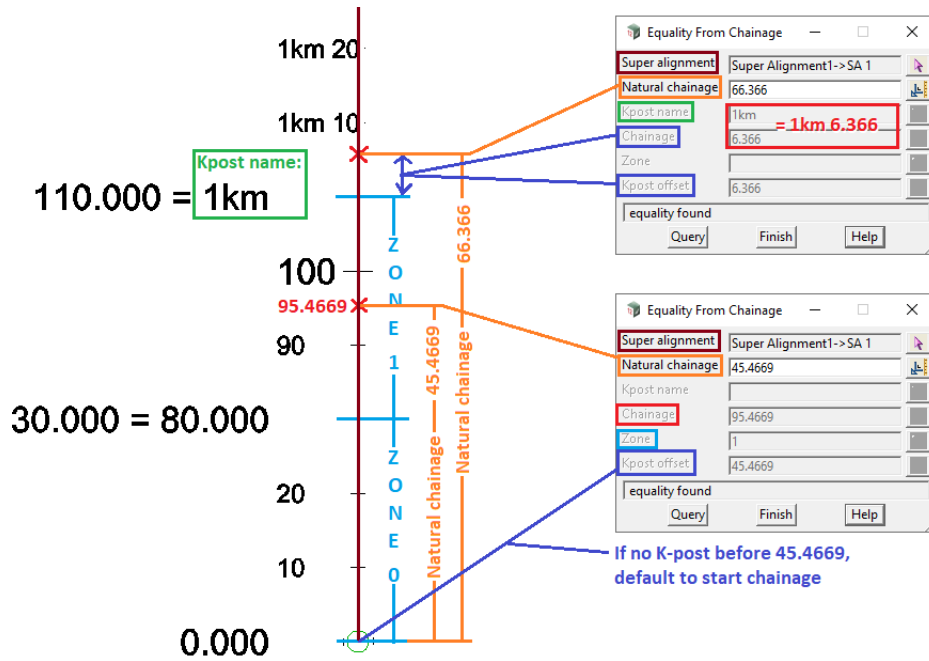
<b>Zone</b>			
-------------	--	--	--

*Displays chainage region the selected chainage is located in. For more information see [3.41.5 Zones](#).*

<b>Kpost offset</b>			
---------------------	--	--	--

*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**

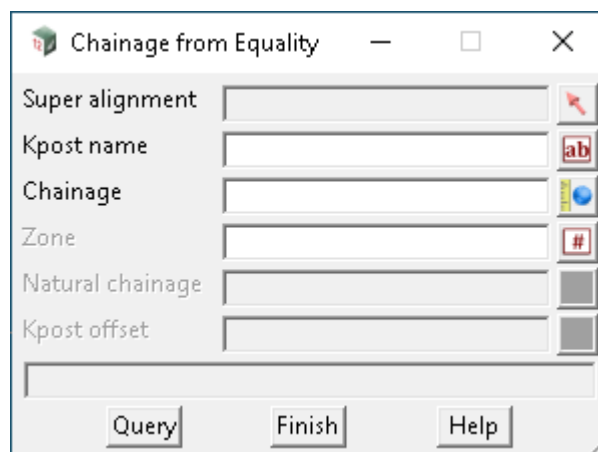
Now documented in the [V15 reference manual](#)

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 [3.41 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
-------------------	------	----------	--------

<b>Super alignment</b>	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.*

<b>Kpost name</b>	input box	disabled	
-------------------	-----------	----------	--

*Prefix for interval labels for a given chainage on a super alignment defined by a K-post. For more information see [3.41.4 K-Post](#).*

<b>Chainage</b>			
-----------------	--	--	--

*The chainage length from the selected chainage to previous chainage equality.*

<b>Zone</b>			
-------------	--	--	--

*Displays chainage region the selected chainage is located in. For more information see [3.41.5 Zones](#).*

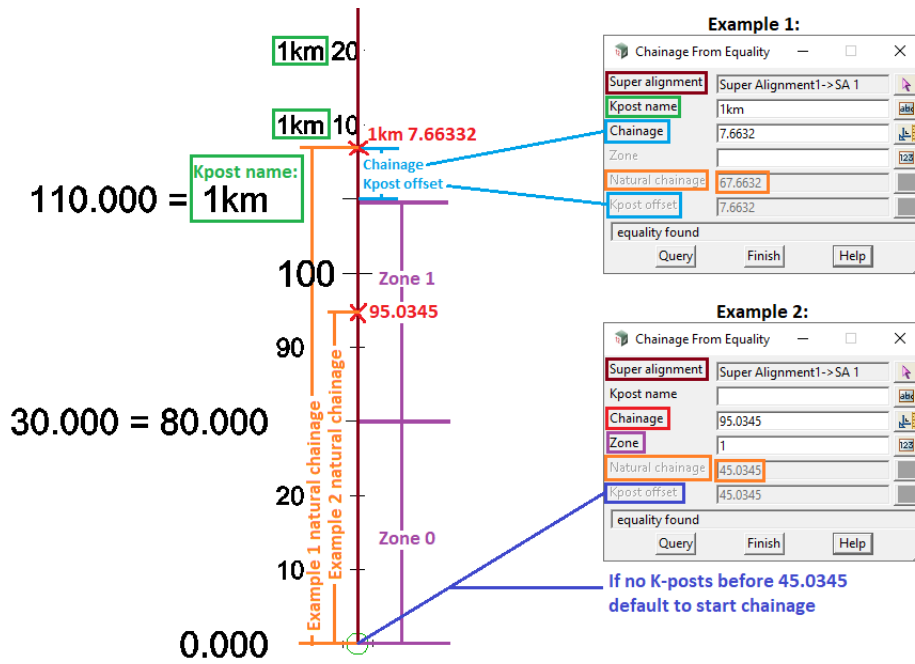
<b>Natural chainage</b>			
-------------------------	--	--	--

*The raw chainage of the selected point on the super alignment.*

<b>Kpost offset</b>			
---------------------	--	--	--

*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 Compute Strings](#) or return to [10 String](#).

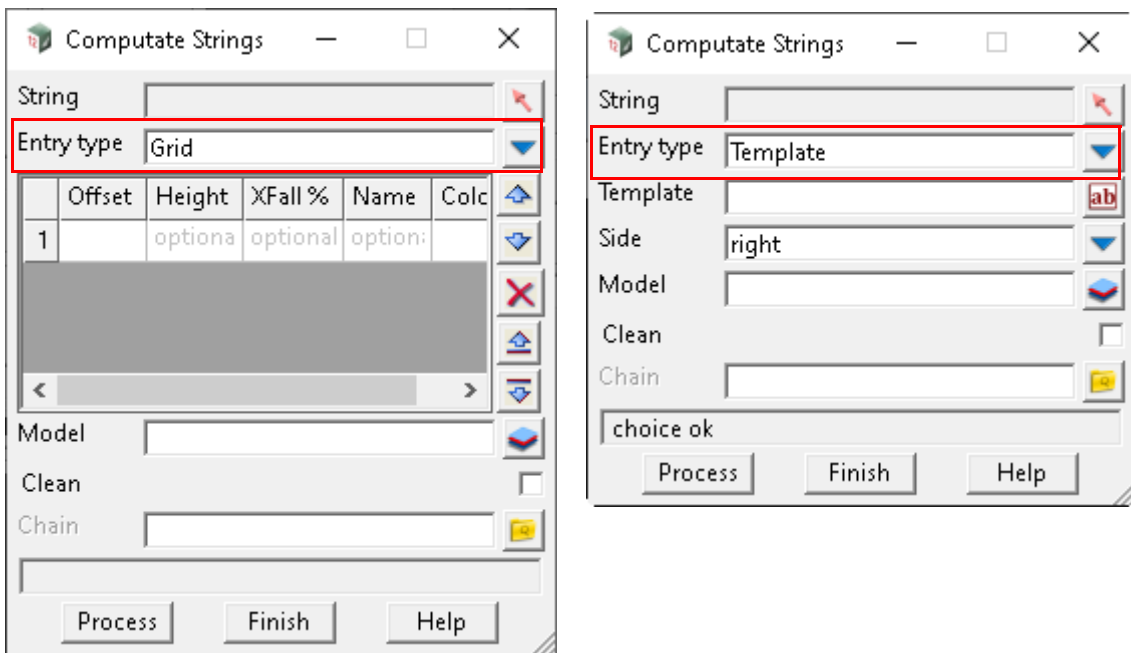
# 10.10 Compute Strings

Position of option on menu: **String =>Super alignments =>Tools =>Compute strings**

Now documented in the V15 reference manual

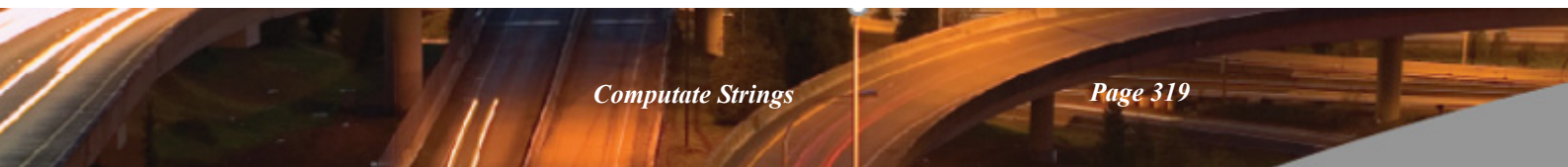
This option has been written for use with the Design "Create ramps/driveways" option and generates computed super alignments from a set string to form a defined number of links that form a user defined shape. Users can add their shape via the grid entry or via a template and the produced strings are 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 **Compute strings** displays the **Compute Strings** panel.



The fields and buttons used in the **Compute Strings** panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>String</b>	string select		
<i>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.</i>			
<b>Entry Type</b>	choice box		Grid or Template
<i>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.</i>			
<i>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.</i>			
<b>Side</b>	choice box		
??.			
<b>Model</b>	model box		
<i>The model into which the newly created Super Alignment strings will be produced when processed.</i>			



**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 strings 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](#).

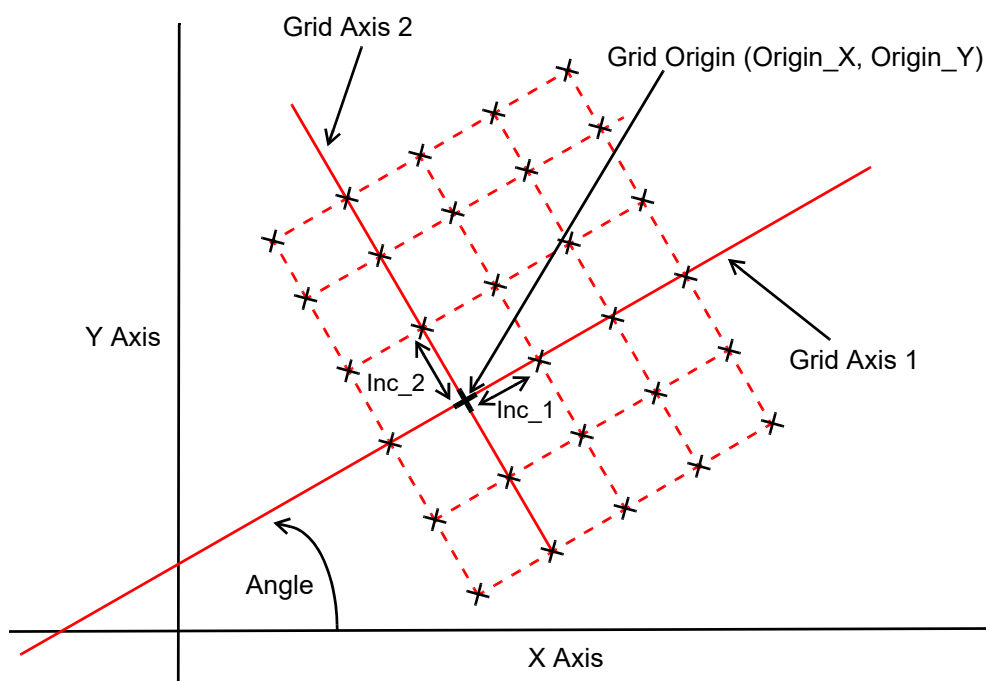
See [10.11.2 Raster and Cell-Based Systems](#).

### 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:

$$X \text{ Grid point} = \text{Origin}_X + N * \text{Inc}_X \quad \text{where } N \text{ is an integer (positive or negative)}$$

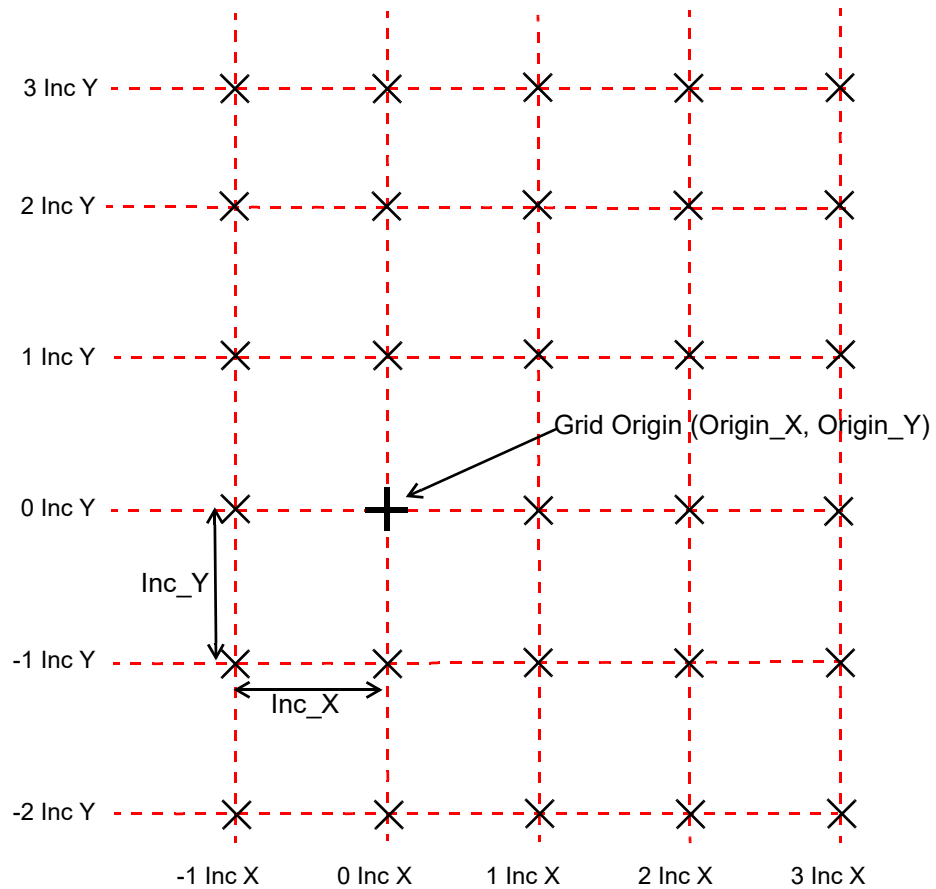
$$Y \text{ Grid point} = \text{Origin}_Y + M * \text{Inc}_Y \quad \text{where } M \text{ is an integer (positive or negative)}$$

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.



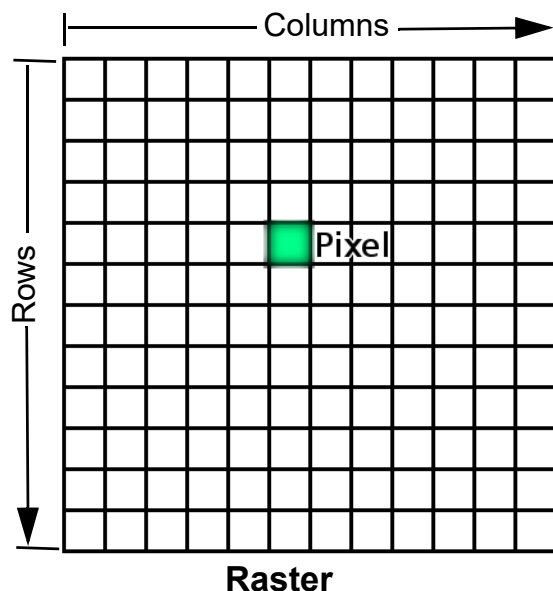
A **Grid String** is a special type of string where each of the vertices is a point of a **12d Model Grid**. The values for a Grid string often come from a tin.

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.

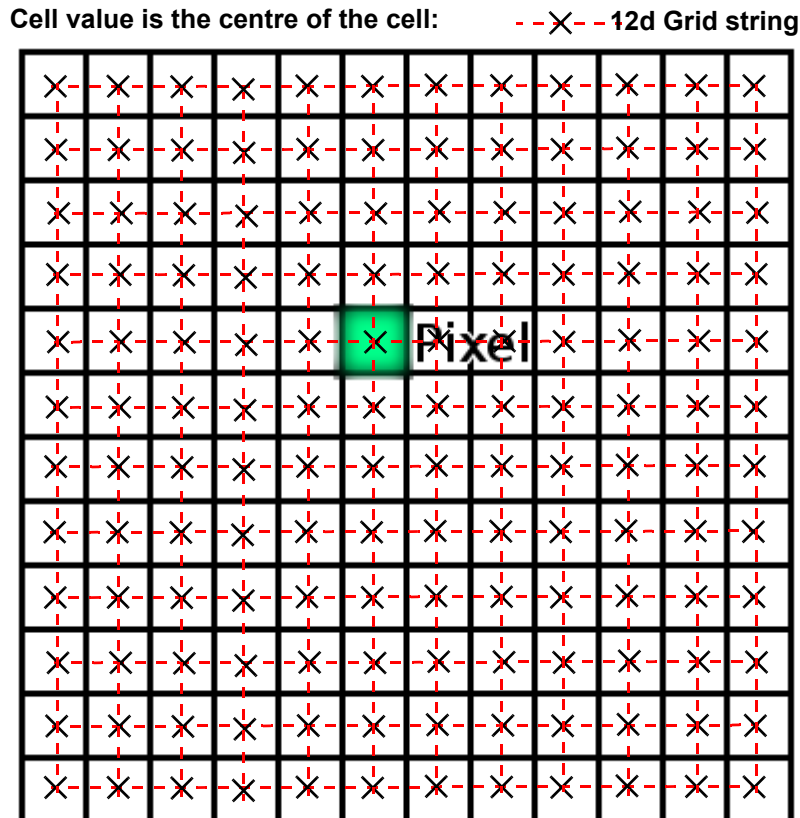
Sometimes this geolocation information is part of the raster format, at other times it is in a separate file and often it is entirely missing and must be calculated after the raster is loaded into **12d Model**.

### 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.

**Value applies to the center point of the cell**

For certain types of data, the cell value represents a measured value at the center point of the cell. An example is a raster of elevation

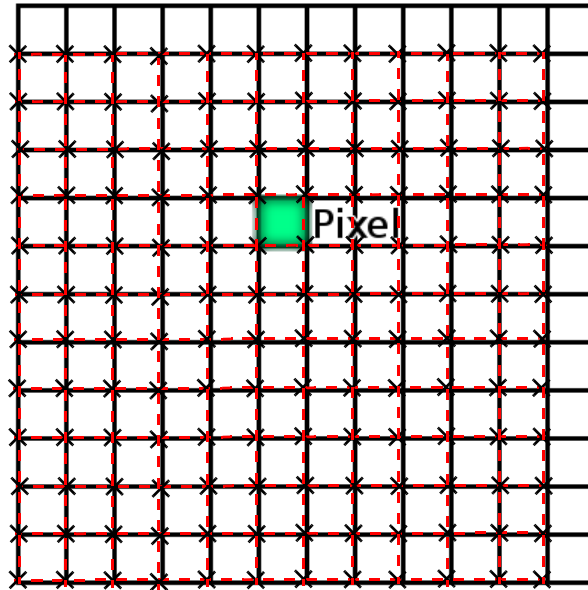
+	+	+	+
315	319	321	323
+	+	+	+
317	323	328	326
+	+	+	+
313	318	325	323

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:  12d Grid string



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](#).

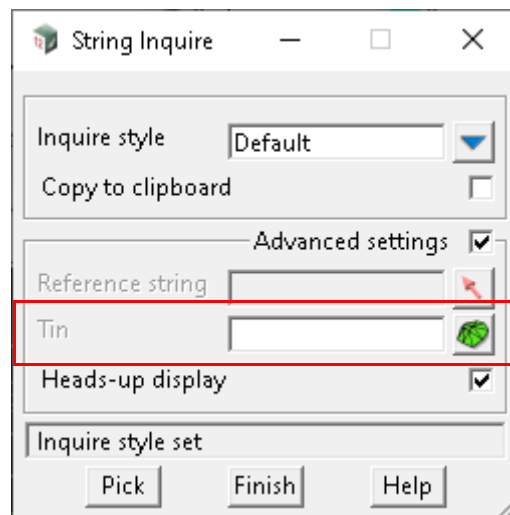
## 10.12 String Inquire

**Position of option on menu:** Strings => Inquire

Now documented in the [V15 reference manual](#)

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
<b>Reference string</b>	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.*

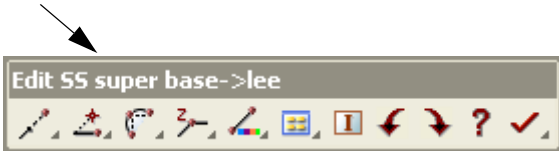
Continue to [10.13 Super Edit - Properties Toolbar](#) or return to [10 String](#).



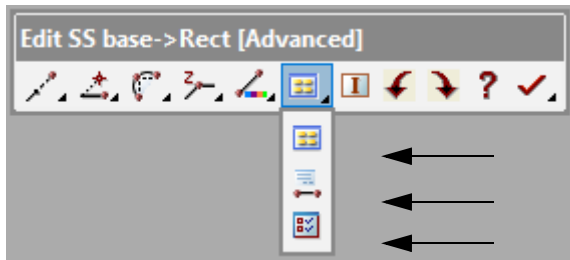
# 10.13 Super Edit - Properties Toolbar

The option **Super String User Attributes** has been added to the properties toolbar, located under the **Super Edit** menu.

Edit toolbar

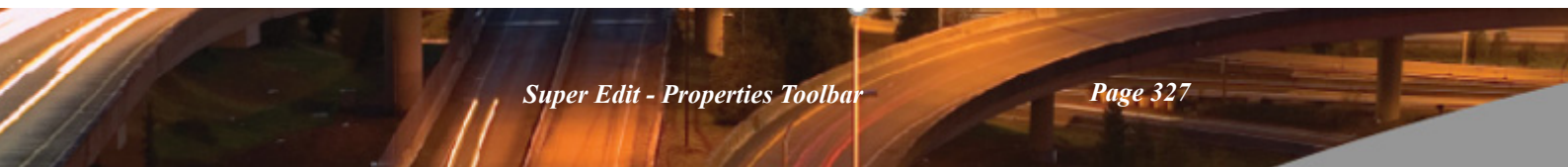


Properties



See

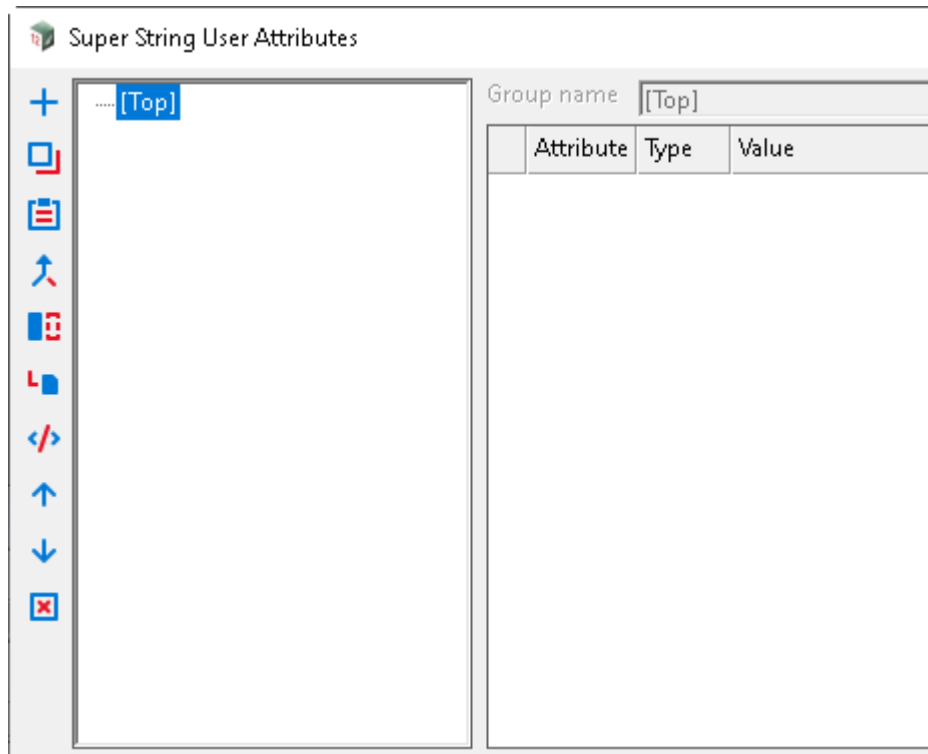
[10.13.1 Super String User Attributes](#)



## 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 [3.8 Attributes \(Meta Data\)](#) and the description of how to add attributes and groups of attributes in an Attributes panel is given in the section [3.8.3 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
<b>OK/Apply</b>	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

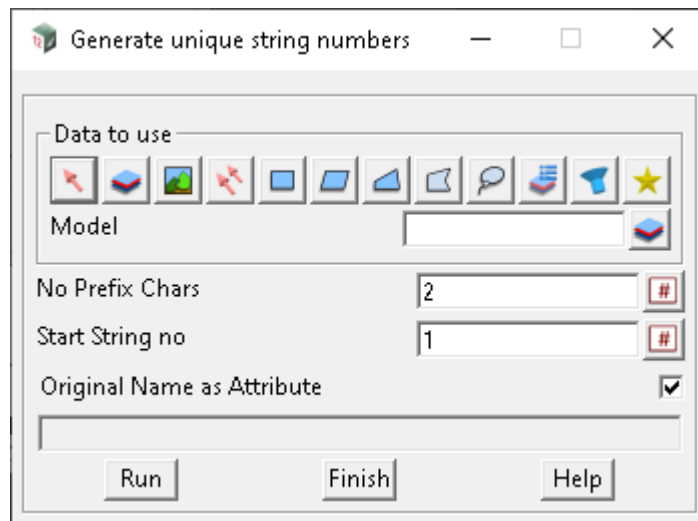
Position of option on menu: **String =>Utilities =>Generate unique string names**

Now documented in the V15 reference manual

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) 36<sup>2</sup>. 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
-------------------	------	----------	--------

<b>Data to use</b>	data source		
--------------------	-------------	--	--

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be changed.*

<b>No Prefix Chars</b>	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.*

<b>Start String no</b>	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).

<b>Original Names as Attribute</b>	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

BIM	
Import	▶ <a href="#">11.1 Import</a>
Export	▶ <a href="#">11.2 Export</a>
ADAC	▶
Trimesh	▶ <a href="#">11.3 Trimesh</a>
Point clouds	▶ <a href="#">11.4 Point Clouds</a>
Check / clash	▶
Visualisation	▶ <a href="#">11.5 Visualisation</a>
User	▶

See [11.1 Import](#)

[11.1.1 IFC Express Reader](#)

See [11.2 Export](#)

[11.2.1 IFC Infrastructure Express Writer](#)

[11.2.2 IFC Express Writer](#)

See [11.3 Trimesh](#)

[11.3.1 Create Trimesh](#)

[11.3.3 Trimesh Edit](#)

[11.3.4 Convert Trimesh](#)

[11.3.5 Trimesh Union/Difference](#)

[11.3.6 Contour Trimeshes](#)

[11.3.7 Trimesh Intersection Lines](#)

[11.3.8 Trimesh Utilities](#)

See [11.4 Point Clouds](#)

[11.4.1 Create Levels of Display](#)

See [11.5 Visualisation](#)

[11.5.1 Remove all Duplicate Extrudes in Project](#)

# 11.1 Import

## 11.1.1 IFC Express Reader

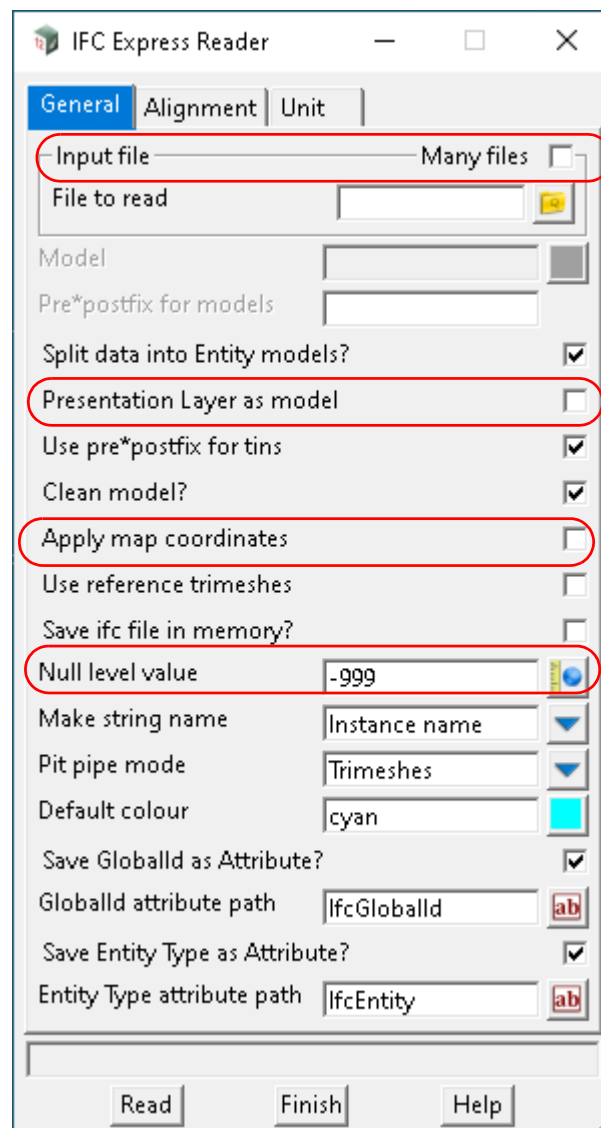
**Position of option in menu:** BIM =>Import =>IFC Express Reader

Now documented in the V15 reference manual

The IFC file under general tab has been replaced with the **Input file** option.

The options **Presentation Layer as model**, **Apply map coordinates** and **Null level value** have been added to the panel.

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**

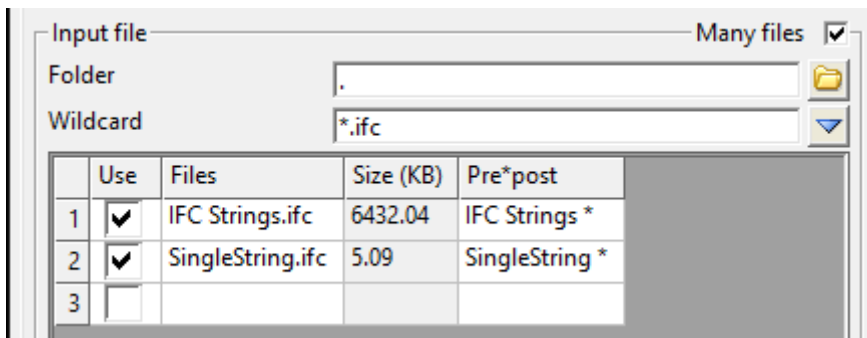
**Many files**                      tick box                      not ticked

*If not ticked, File To Read field is visible.*

**File to read**                      file box    \*ifc, \*ifczip, \*ifcxml files

*Name of the 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 [3.25.8 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.*

**Presentation Layer as model**   tick box                      not ticked

*If **ticked**, if the ifc data is part of a presentation layer the data is read into a model with the same name as the layer.*

***NOTE** if any ifc data is not part of a layer 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**.*

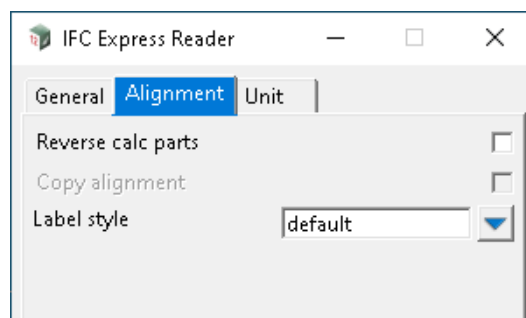
**Apply map coordinates**   tick box                      not ticked

*If **ticked**, the map coordinates that are specified in the ifc file are applied to the imported ifc data.*

**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.*

**Alignment tab**



**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.  
Sets the label style for any imported IFC Alignments.*

Continue to [11.2 Export](#) or return to [11 BIM](#).

## 11.2 Export

### 11.2.1 IFC Infrastructure Express Writer

**Position of option on menu:** BIM =>Export =>IFC write infrastructure

Now documented in the V15 reference manual

The **Write IFC IFC File** option is a rewrite of the **V14 IFC Write IFC File**.

More tabs have been added to group settings in hopefully a more logical fashion.

As we learn more about IFC files, more fields and functionality are added to the **Write Infrastructure IFC File** option.

The **Write Infrastructure IFC File** option has all the capabilities as the **Write IFC File** plus the additional capabilities that data can be written out in **IFC 4x3** format which is the format for **Civil BIM** and includes IFC entities for **alignments, tins** and **trimeshes**.

#### NOTE

*The Write IFC File option has been kept for upwards compatibility from V14.*

#### Things to be Careful About When Writing Out IFC Files

Unfortunately not all software read in IFC's in the same way so how 12d objects need to be written out to an IFC file depends on the software that is being used to read in the IFC file.

The IFC Reader in **Solibri** is one of the most comprehensive IFC Readers unto and include IFC 4 and it is used to test out the IFC files produced by **12d Model** although even Solibri has limitations (e.g. Solibri can not display strings unless they have a non-zero diameter).

The IFC Readers in **Revit** and **NavisWorks** are not as comprehensive as the IFC Reader in **Solibri** and unfortunately the IFC Reader in **Revit** does not work the same way as the IFC Reader in **NavisWorks**.

To handle these differences in IFC Readers, there are a number of tick boxes on the **Write Infrastructure IFC File Writer** that will determine how the 12d object is written to the IFC file.

As an example, using the **Infrastructure IFC File Writer**, the data in each model is placed in the IFC Spatial Structure IFCFACILITY with the name of the model as the name of the instance of IfcFacility except for Tins that will have to be written out as IfcSite if the data is going to **Revit**.

And **Output polylines as tiny pipes?** needs to be ticked and the value in **Tiny pipe diameter** used if data is to go out to **Solibri, Revit** and **NavisWorks**.

Also IFC's have mainly been defined for vertical buildings and do not have special entities to cover Civil objects such as Alignments and Tins. So for example, an Alignment can only be written out as a 3d string and Tins as ifcBuildingElementProxy (see [46.2.7 Representation of 12d Model Objects as IFCs](#)).

However as we learn more about IFC's, and how other software reads them in, we will upgrade our IFC Writer.

#### Warnings for Large Horizontal Civil Projects

IFC's have no limitation on the size or coordinates or the horizontal or vertical size of projects but be aware that not all software is like **12d Model** and may not be able handle data for large horizontal projects and display such data correctly. For example **Revit** and **Solibri** have problems with data that extends over more than a 10 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

IFC entities have attributes and they are stored in **IFC Property Sets** and each IFC Property Set must have a non blank name.

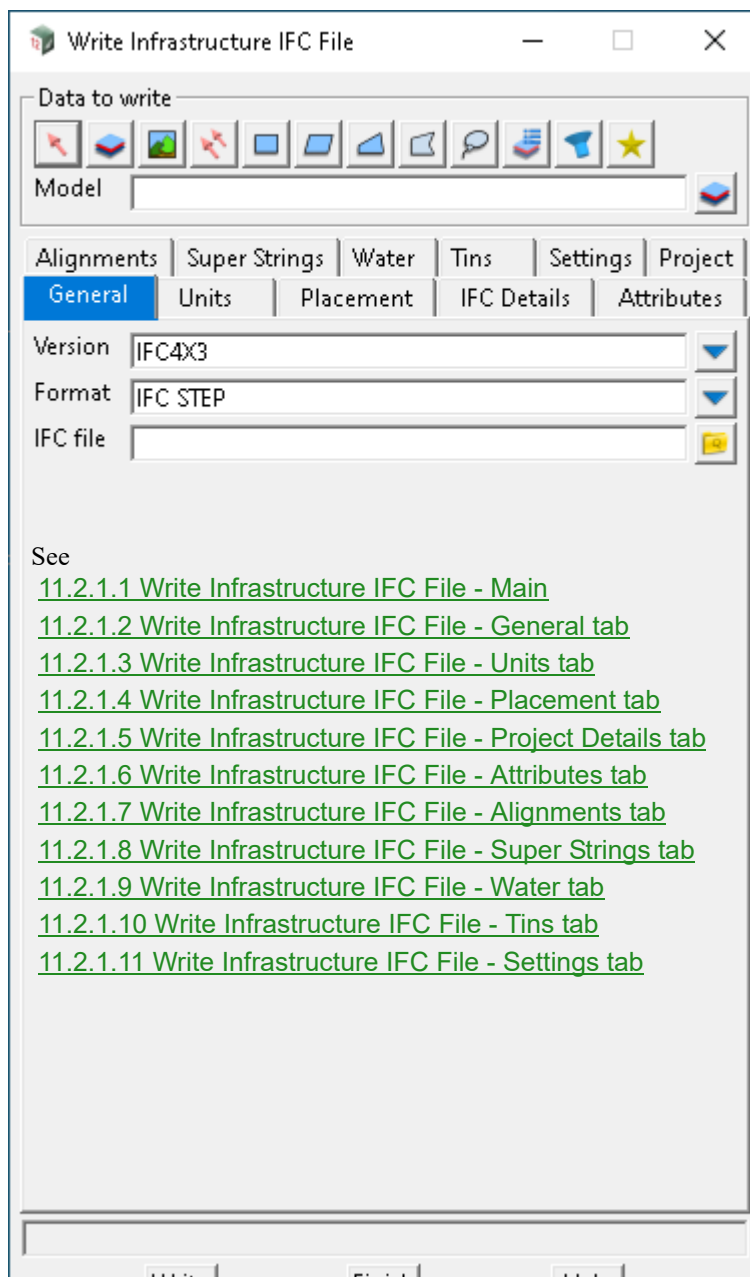
For each 12d object written out as an IFC entity, an IFC property set called **12d Model** is created and has the three Text attributes written to it:

FileName	name of the file being written out
Date	date and time that the object was written out
StepId	the # number of the object in the file

This is to provide some history for the 12d object being written out.

If **Export attributes** is ticked, then the attribute tree of the 12d Object (string attributes for a string) are also written out. What IFC Property Sets they are written to depends on whether **Use IFC attributes tree** is ticked on or not.

Selecting **IFC Write Infrastructure** brings up the **Write Infrastructure IFC File** panel.



[Main tab](#)

[General tab](#)

[Units tab](#)

[Placement tab](#)

[Project Details tab](#)

[Attribute tab](#)

[Alignment tab](#)

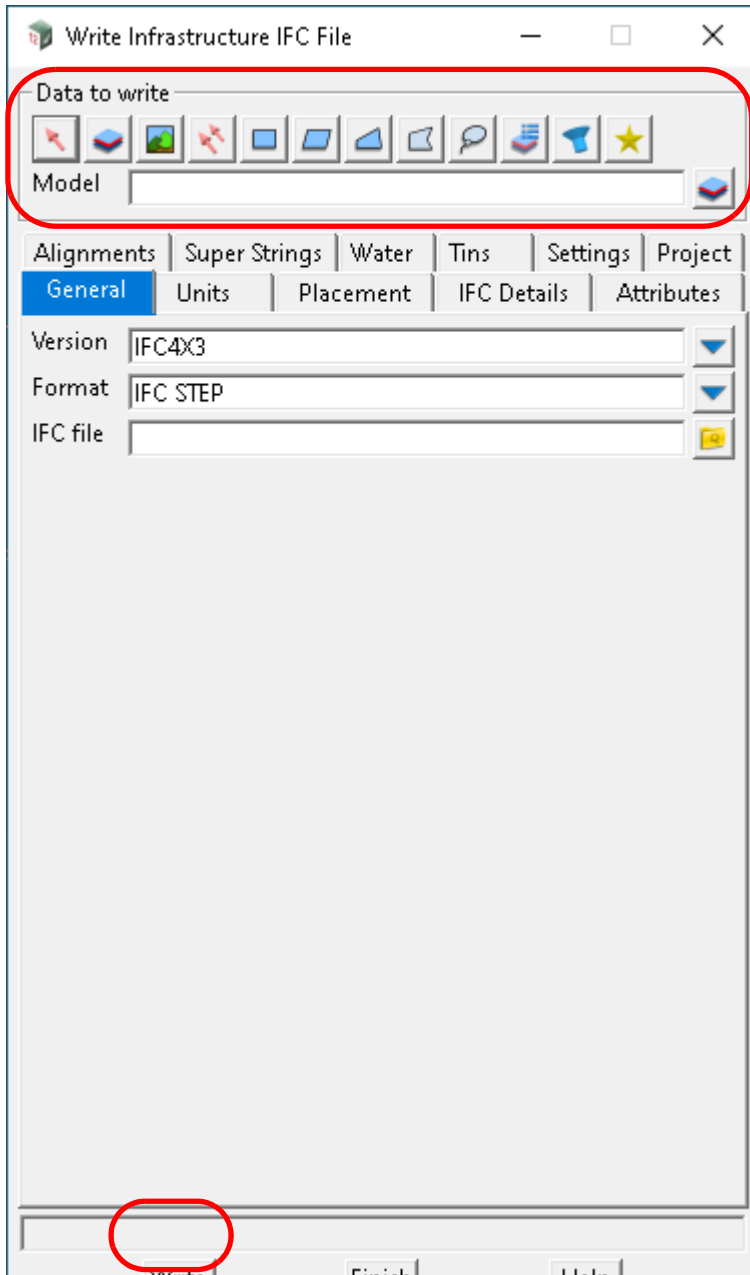
[Super Strings tab](#)

[Water tab](#)

[Tins tab](#)

[Settings tab](#)

### 11.2.1.1 Write Infrastructure IFC File - Main



- [Main tab](#)
- [General tab](#)
- [Units tab](#)
- [Placement tab](#)
- [Project Details tab](#)
- [Attribute tab](#)
- [Alignment tab](#)
- [Super Strings tab](#)
- [Water tab](#)
- [Tins tab](#)
- [Settings tab](#)

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

**Main tab**

**Data to write**                      data source

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

**Selected data source**            input                      Model

*Data source of data to be written out to IFC.*



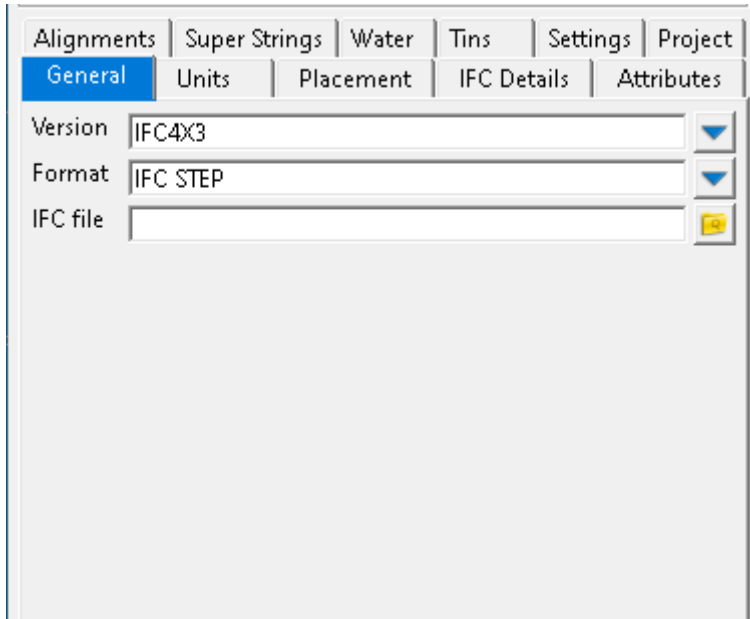
**Buttons at Bottom**

**Write** button

*Write out the IFC file.*

Continue to [11.2.1.2 Write Infrastructure IFC File - General tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.2 Write Infrastructure IFC File - General tab



- [Main tab](#)
- [General tab](#)
- [Units tab](#)
- [Placement tab](#)
- [Project Details tab](#)
- [Attribute tab](#)
- [Alignment tab](#)
- [Super Strings tab](#)
- [Water tab](#)
- [Tins tab](#)
- [Settings tab](#)

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

#### General tab

- |   |            |  |
|---|------------|--|
| <b>Version</b>  | choice box | IFC2x3, IFC4, FC4x3                            |
| <i>If IFC 2x3, the data is written out as an IFC 2x3 file.</i>  |            |  |
| <i>If IFC 4, the data is written out as an IFC 4 file.</i>  |            |  |
| <i>If IFC 4x3, the data is written out as an IFC 4x3 file.</i>  |            |  |
| <i>Note: for versions IFC 4x3 and later there are specific ifcEntities for Super Alignments and Tins.</i> |            |  |
| <b>Format</b>   | choice box | IFC STEP, IFC XML<br>IFC STEP ZIP, IFC XML ZIP |
| <i>If IFC STEP, the data is written out in the IFC STEP format.</i>                                       |            |  |
| <i>If IFC XML, the data is written out in the IFC XML format.</i>   |            |  |
| <i>If IFC STEP ZIP, the data is written out in the IFC STEP format, then compressed to a zip file.</i>    |            |  |
| <i>If IFC XML ZIP, the data is written out in the IFC XML format, then compressed to a zip file.</i>      |            |  |
| <b>IFC file</b>   | input      | *.ifc file                                     |
| <i>Name for the file to write the IFC data to.</i>  |            |  |

Continue to [11.2.1.3 Write Infrastructure IFC File - Units tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).



### 11.2.1.3 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.

The screenshot shows the 'Write Infrastructure IFC File' dialog box with the 'Units' tab selected. The dialog has a top row of tabs: Alignments, Super Strings, Water, Tins, Settings, and Project. Below this is a row of sub-tabs: General, Units (selected), Placement, IFC Details, and Attributes. The main area contains four dropdown menus: Length (METRE), Area (SQUARE\_METRE), Volume (CUBIC\_METRE), and Angle (RADIANS). At the bottom are 'Get Units' and 'Set Units' buttons. To the right of the dialog is a red-bordered box containing a list of navigation links: [Main tab](#), [General tab](#), [Units tab](#), [Placement tab](#), [Project Details tab](#), [Attribute tab](#), [Alignment tab](#), [Super Strings tab](#), [Water tab](#), [Tins tab](#), and [Settings 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 Aq

*If **SQUARE\_METRE**, the areas are written out in metre<sup>2</sup>.*

*If **SQUARE\_MILLIMETRE**, the areas are written out in millimetre<sup>2</sup>.*

*If **SQUARE\_KILOMETRE**, the areas are written out in kilometre<sup>2</sup>.*

**Volume** choice box CUBIC\_METRE, CUBIC\_MILLIMETRE, CUBIC\_KILOMETRE

*If **CUBIC\_METRE**, the volumes are written out in metre<sup>3</sup>*

*If **CUBIC\_MILLIMETRE**, the volumes are written out in millimetre<sup>3</sup>.*

*If **CUBIC\_KILOMETRE**, the volumes are written out in kilometre<sup>3</sup>.*

**Angle** choice box RADIANS, DEGREES

*If **RADIANS**, the plane angles are written out in radians.*

*If **DEGREES**, the plane angles are written out in 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 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 group **ifc\_attributes/ifc\_project\_units***

Continue to [11.2.1.4 Write Infrastructure IFC File - Placement tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.4 Write Infrastructure IFC File - Placement tab

When the **12d Model** data is written to an IFC file, the coordinates can be written out with the same x,y and z values as they have in **12d Model** or they can be translated with respect to a user given **Reference point** and **XY rotation** which by default is (0,0,0) and 0° respectively.

If the data is in a map projection then there are fields in the IFC file to record the Horizontal datum (Geodetic datum), the Vertical Datum, the Map Projection and Zone, and Scale factors for X, Y and Z.

In IFC 4x3 the information for the map projection is recorded in the entities **IfcProjectedCRS** and **IfcMapConversion** and in IFC 2x3 the information is written to property sets attached to the main **IfcSite**.

This information about the map projection can also be written to **12d Model** project attributes group **ifc\_attributes/Map Coordinates** and when the **Write Infrastructure IFC File** panel is started, the values from the **Project** attribute group **ifc\_attributes/Map Coordinates** are automatically loaded into the fields of the **Placement** tab.

Property	Type	Value
1 Name	Text	option
2 Description	Text	option
3 GeodeticDatum	Text	option
4 VerticalDatum	Text	option
5 MapProjection	Text	option
6 MapZone	Text	option
7 MapUnit	Text	option
8 Scale	Real	1
9 FactorX	Real	1
10 FactorY	Real	1
11 FactorZ	Real	1
12		option

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

#### Placement tab

**Placement type** choice box Local Placement, Map Coordinates

*In all cases the **Reference point** values for x, y and z are subtracted from the (x,y,z) coordinates of the data and rotated clockwise by the **XY rotation** before it is written out to the IFC file. The other system may or may not use the **Reference point** values.*

If **Local Placement**, 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 entities **ifcProjectedCRS** and **ifcMapConversion** are **NOT** used.

*This is often used if the IFC reading system cannot handle large coordinates and needs a "local origin".*

If **Map Coordinates** and **IFC 4x3**, the **Reference point** values **AND** the data in the grid box are written out to the appropriate parameters for **ifcProjectedCRS** and **ifcMapConversion**.

If **Map 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**.

*This is often used when the data is to be written out as truncated map coordinates.*

### Reference Point group

**X/Easting**                      measure box

*Value to be subtracted from the x coordinate of all the data before the value is written to the IFC file.*

**Y/Northing**                    measure box

*Value to be subtracted from the y coordinate of all the data before the value is written to the IFC file.*

**Z/Height**                      measure box

*Value to be subtracted from the z coordinate of all the data before the value is written to the IFC file.*

*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

*Rotates the exported data by the specified amount.*

### Grid box

**Property:** the name of the property or parameter for the **ifcProjectedCRS** or **ifcMapConversion** EPset or **IfcEntity** respectively. The property can not be changed.

**Type:** the type of the property or parameter. The **Type** can not be changed.

**Value:** the value to use for the **ifcProjectedCRS** or **ifcMapConversion** EPset or **ifcEntity**.

**Get Map Coordinates**        button

*Pressing the 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 **Placement** 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 required.

**Set Map Coordinates**        button

*After pressing the button, the values in the **Placement** tab are loaded 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**.

Continue to [11.2.1.5 Write Infrastructure IFC File - Project Details tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).



### 11.2.1.5 Write Infrastructure IFC File - Project 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 **Project Details** tab.

	Property	Value
1	ProjectName	option
2	ProjectDescription	option
3	UserID	option
4	UserFamilyName	option
5	UserGivenName	option
6	UserMiddleName	option
7	UserPrefixTitle	option
8	UserSuffixTitle	option
9	UserRole	option
10	UserAddress	option
11	OrganisationID	option
12	OrganisationName	option
13	OrganisationDescription	option
14	OrganisationRole	option
15	OrganisationAddress	option
16	IssueAuthorisedBy	option
17		option

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

#### Project Details tab

**Use IFC details**                      tick box                      not ticked

*If **ticked**, IFC files will include information specified by 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 the 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 **Project 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 required.*

**Set IFC Details**                      button

*After pressing the button, the values in the **Project Details** tab are loaded into **Project** attributes group **ifc\_attributes/Project Details***

*Note: this is only necessary if you have changed any values in the **Project Details** tab and the new values are to be stored in the Project attribute group **ifc\_attributes/Project Details**.*

Continue to [11.2.1.6 Write Infrastructure IFC File - Attributes tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.6 Write Infrastructure IFC File - Attributes tab

Alignments	Super Strings	Water	Tins	Settings	Project
General	Units	Placement	IFC Details	<b>Attributes</b>	
Export attributes <input checked="" type="checkbox"/>					
Export project attributes <input type="checkbox"/>					
IFC Project attributes tree name		<input type="text"/>		<input type="button" value="..."/>	
Use IFC attributes tree <input type="checkbox"/>					
IFC attributes tree name		<input type="text"/>		<input type="button" value="..."/>	
Use attribute value for IfcGlobalId <input checked="" type="checkbox"/>					
IfcGlobalId attribute path		<input type="text" value="IfcGlobalId"/>		<input type="button" value="ab"/>	
Use attribute value for IFC Entity <input checked="" type="checkbox"/>					
IFC Entity attribute path		<input type="text" value="IfcEntity"/>		<input type="button" value="ab"/>	
Use attributes for IFC Entity parameters <input checked="" type="checkbox"/>					
IFC Parameters attribute path		<input type="text" value="IfcEntityParameters"/>		<input type="button" value="ab"/>	
Use attributes for IFC Assembly parameters <input checked="" type="checkbox"/>					
IFC Assembly Parameters attribute path		<input type="text" value="IfcAssemblyParame"/>		<input type="button" value="ab"/>	
Use Library References <input type="checkbox"/>					

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

#### Attribute tab

**Export attributes**      tick box     

If **ticked**, the **12d Model** Project Attributes and attributes on entities are written to the IFC file.

Project attributes will be exported to the IFC file as a property set on the `ifcProject`. For **12d Model** Objects that are represented as `ifcBuildingElementProxy` elements, the `string/tin/trimesh` attributes are exported as an `ifcPropertySet`. What the Property Set is called depends on **Use IFC attribute tree**.

**Export project attributes**      tick box     

If **Export project attributes** is **ticked**, then the Project attributes in the attributes tree given in **IFC Project attributes tree name**, are written out. See the field **IFC attributes tree name** for more details.

**IFC project attributes tree name**      text box

If **Export attributes** and **Export project attributes** are **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 **IFC attribute tree name** for more details.

If **Export project attributes** is **not ticked**, then no project attributes are written out to the IFC file.

**Use IFC attributes tree**      tick box     

If **Use IFC attributes tree** is **NOT ticked**, then the string attributes of a **12d Model** element that is written out, are written to a Property Set 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 the attributes tree beginning from the tree given in **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 **IFC 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, if For example, if you had the following string attributes:

Description/Name  
Water/Type  
Water/SEW/Owner  
Water/SH/Properties/Name  
Water/SH/Properties/Diameter  
Water/SH/Connections/Type

then if **IFC attributes tree name** was **Water/SH** then 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.

**Use attributes as IFC GlobalId** tick box 

If **Use attributes as IFC GlobalId** is ticked, then when writing out an object, the value in the **GlobalId attribute path** is checked and if it is **not blank**, its value is used as the IFC GlobalId. when writing the object out. If **GlobalId attribute path** is **blank**, the GlobalId is calculated and used as the IFC GlobalId when writing the object out. The calculated GlobalId is also saved to the attribute **GlobalId attribute path** of the **12d Model** object.

If **Use attributes as IFC GlobalId** is **not ticked**, then when writing out an object, a GlobalId is calculated and used as the IFC GlobalId when writing the object out. The calculated GlobalId is not saved in the attribute **GlobalId attribute path**.

**GlobalId attribute path** text box ifcGlobalId

Attribute to use/saving for the IFC GlobalId.

**Use attributes as IFC Element Type** tick box 

If **Use attributes as IFC Element Type** is ticked, then when writing out an element, the value in the **Element Type attribute Path** is checked and if it is **not blank**, its value is used as the IFC Element type when writing the object out. If **Element Type attribute Path** is **blank** or **invalid**, then the general Element type defaults to the standard output type for the object, namely **ifcBuildingElementProxy** for most objects. An Element type may be **invalid** due to the **IfcElement** not existing or not being applicable to the version of IFC.

**Note:** this does **not** include Super Alignments in **IFC4x1** and later.

If **Use attributes as IFC Element Type** is **not ticked**, then the standard Element type for the object is used.

**Use attributes as IFC Element Type** tick box 

If **Use attributes as IFC Element Type** is ticked, then when writing out a **trimesh** or **string** type, the value in the **Element Type attribute Path** is checked and if it is **not blank**, its value is used as the IFC Element type when writing the object out, if the IFC Element type exists for the IFC version being written out. If **Element Type attribute path** is **blank** or **invalid**, then the general Element type defaults to the standard output type for the object, namely **ifcBuildingElementProxy** for most objects.

**Note:** that this does **not** include Super Alignments or Tins.

If **Use attributes as IFC Element Type** is **not ticked**, then when writing out a **trimesh** or **string** type, the standard Element type for the object used.

**Element type attribute path** text box ifcElementType

*Attribute to use as the IFC Element Type.*

**Use attributes as IFC Element parameters** tick box

*if **ticked**, the parameters of the ifcElement can be set using the attribute group specified by the IFC **Parameters attribute path**. Only valid parameters will be set as the ifcElement parameter - to check which attributes you can set see <https://standards.buildingsmart.org/IFC/RELEASE/> and pick the IFC version and ifcElement 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.*

**Use attributes as IFC Assembly parameters** tick box

*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.*

*To see how to setup an element assembly for IFC see [11.2.1.1.2 IFC Element Assembly](#).*

**IFC Assembly Parameters attribute path** text box ifcAssemblyParameters

*Path to the attribute group where the ifcElementAssembly parameters are defined.*

Continue to [11.2.1.7 Write Infrastructure IFC File - Alignments tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).



### 11.2.1.7 Write Infrastructure IFC File - Alignments tab

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

#### Alignment 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

**Arc to Chord Interval**      real box

*If **Output 3d alignment** is **ticked** and the Version is **not** IFC 4x3, a super alignment is 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.*

**Distance Interval**      real box

*If **Output 3d alignment** is **ticked** and the Version is **not** IFC 4x3, a super alignment is 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.*

#### Vertical

**Arc to chord interval**      real box      0.01

*If **Output 3d alignment** is **ticked** and the Version is **not** IFC 4x3, a super alignment is 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.*

**Distance interval**      real box      10

*If **Output 3d alignment** is **ticked** and the Version is **not** IFC 4x3, a super alignment is 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.*

**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.*

Continue to [11.2.1.8 Write Infrastructure IFC File - Super Strings tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.8 Write Infrastructure IFC File - Super Strings tab

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

#### Super Strings tab

**Export pipe/culvert in segments** tick box     

*If **ticked**, all super strings with non-zero diameter will be exported in segments with segment attributes attached.*

*If **not ticked**, all super strings (and string alignments) with non-zero diameter will be exported as a single ifcEntity extruded along the string with string attributes attached.*

*When this option is set as **not ticked** the **Arc to chord** option will also be set to **not ticked**.*

**Arc to chord interval**      real box      0.01

*The interval in which arcs will be broken into straight segments.*

**Distance interval**      real box      10

*The chainage interval in which strings will be split.*

**Export as tiny pipes** tick box     

*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     

*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 [11.2.1.9 Write Infrastructure IFC File - Water tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.9 Write Infrastructure IFC File - Water tab

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

#### Water tab

**Export entire water network** tick box

*If **ticked**, allows users to export the whole drainage network if only a part of it is selected for export, otherwise individual drainage strings get exported.*

**Export water as IFCSYSTEM** tick box

*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 [46.2.8.6 ifcBuildingElementProxy](#) and [46.2.8.7 ifcFlowStorageDevice](#).*

**Arc to Chord Interval** real box

*If **Output 3d alignment** is ticked and the Version is IFC 4x1, a super alignment is broken up by this chainage interval when written as an IFC 3d alignment (basically a series of 3d straights).*

**Distance Interval** real box

*If **Output 3d alignment** is ticked and the Version is IFC 4x1, a super alignment is broken up by this chainage interval when written as an IFC 3d alignment (basically a series of 3d straights).*

**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 [11.2.1.10 Write Infrastructure IFC File - Tins tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.10 Write Infrastructure IFC File - Tins tab

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

#### Tins tab

**Export tins as IFC SITE**      tick box              not ticked

*If **ticked**, tins are written out to the Spatial Structure IFC SITE.  
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 be 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

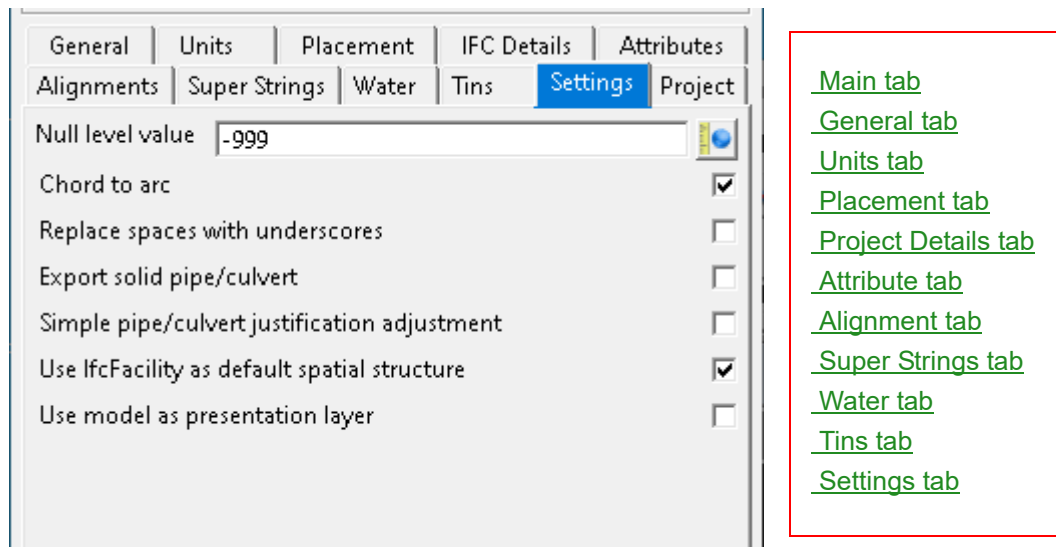
*Path to the attribute that holds either 'cut' or 'fill' depending on whether the element is a cut or a fill.*

**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.*

Continue to [11.2.1.11 Write Infrastructure IFC File - Settings tab](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

### 11.2.1.11 Write Infrastructure IFC File - Settings 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.

**Arc to chord**                              tick box                              ticked

*If **ticked**, super strings will be broken into straight segments according to **Arc to chord interval** and **Distance Interval** values.*

*If **not ticked**, curved segments of the super string will be exported as a profile swept along the segment or string.*

*When **Export string as segments** is **not ticked** 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

*This is a 4x3 only option that will replace IfcBuilding with IfcFacility as the default spatial structure for exported models.*



**Use model as presentation layer** tick box  not ticked

*If **ticked**, export the elements into an `IfcPresentationLayerAssignment` with the name of the model that contains the element.*

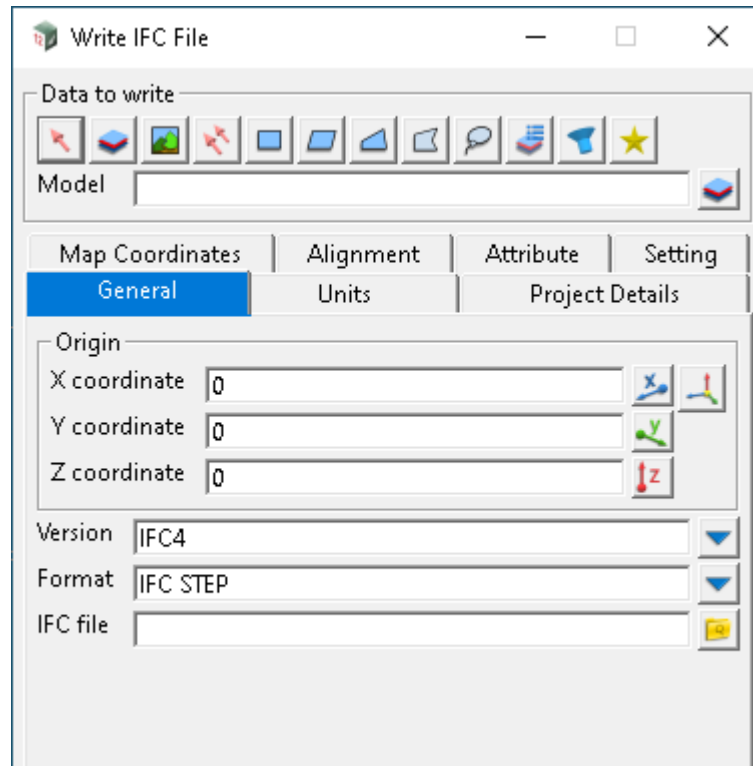
Continue to [11.2.2 IFC Express Writer](#) or return to [11.2.1 IFC Infrastructure Express Writer](#) or [11.2 Export](#).

## 11.2.2 IFC Express Writer

**Position of option on menu:** BIM =>Export =>IFC =>Old =>IFC express writer V14

This is the V14 option and has now been replaced by the [11.2.1 IFC Infrastructure Express Writer](#).

Selecting IFC express writer brings up the **Write IFC File** panel.



### 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<sup>2</sup>.*

*If SQUARE\_MILLIMETRE, the areas are written out in millimetre<sup>2</sup>.*

*If SQUARE\_KILOMETRE, the areas are written out in kilometre<sup>2</sup>.*

**Volume** choice box CUBIC\_METRE, CUBIC\_MILLIMETRE, CUBIC\_KILOMETRE

*If CUBIC\_METRE, the volumes are written out in metre<sup>3</sup>.*

*If CUBIC\_MILLIMETRE, the volumes are written out in millimetre<sup>3</sup>.*

*If CUBIC\_KILOMETRE, the volumes are written out in kilometre<sup>3</sup>.*

**Angle** choice box RADIANS, DEGREES

*If RADIANS, the plane angles are written out in radians.*

If **DEGREES**, the plane angles are written out in degrees.

### Project Details tab

**Use project details**      tick box      not ticked

If **ticked**, IFC files will include information specified by the Grid box.

*Note:* When exporting project details the details will be updated when exporting the IFC file for the current project.

### Map Coordinates tab

**Use project CRS**      tick box      not ticked

If **ticked**, use the grid box to set the parameters for *ifcProjectedCRS* and *ifcMapConversion* entities. The values will be saved as project attributes so can be reused for future exports for the current project.

If **not ticked**, the values will be ignored and will not be saved as project attributes.

*Note:* if exporting in IFC version 2x3, these entities will be replaced with a property sets, 'EPset\_ProjectedCRS' and 'EPset\_MapConversion', attached to the top level *ifcSite*.

### Grid box

**Property:** the name of the property or parameter for the *ifcProjectedCRS* or *ifcMapConversion* EPset or *ifcEntity* respectively.

**Value:** the value to use for the *ifcProjectedCRS* or *ifcMapConversion* EPset or *ifcEntity*.

**Set** - Saves the current state of the grid box to project attributes.

**Update** - Fills the grid box with the project attributes for the project map coordinates from *ifc\_attributes/Map Coordinates*

### Attribute tab

**Use attributes as IFC Element Type**      tick box      ticked

If **Use attributes as IFC Element Type** is **ticked**, then when writing out an element, the value in the **Element Type attribute Path** is checked and if it is **not blank**, its value is used as the IFC Element type when writing the object out. If **Element Type attribute Path** is **blank** or **invalid**, then the general Element type defaults to the standard output type for the object, namely **ifcBuildingElementProxy** for most objects. An Element type may be **invalid** due to the *IfcElement* not existing or not being applicable to the version of IFC.

*Note:* this does **not** include Super Alignments in **IFC4x1** and later.

If **Use attributes as IFC Element Type** is **not ticked**, then the standard Element type for the object is used.

**Use attributes as IFC Element parameters**      tick box      ticked

If **ticked**, the parameters of the *ifcElement* can be set using the attribute group specified by the **IFC Parameters attribute path**. Only valid parameters will be set as the *ifcElement* parameter - to check which attributes you can set see <https://standards.buildingsmart.org/IFC/RELEASE/> and pick the IFC version and *ifcElement* type.

*Note:* only numeric and text attributes, such as Enums, can be set.

**IFC Parameters attribute path**      text box      *IfcElementParameters*

The path to the attribute group where the *ifcElement* parameters are defined.

**Use attributes as 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.

To see how to setup an element assembly for IFC see 11.2.1.1.2 IFC Element Assembly.

**IFC Assembly Parameters attribute path** text box IfcAssemblyParameters

*The path to the attribute group where the ifcElementAssembly parameters are defined.*

#### Settings tab

**Export string as segments** tick box

*If **ticked**, all super strings with non-zero diameter will be exported in segments with segment attributes attached.*

*If **not ticked**, all super strings (and string alignments) with non-zero diameter will be exported as a single ifcEntity extruded along the string with string attributes attached.*

*When this option is set as **not ticked** the **Arc to chord** option will also be set to **not ticked**.*

**Arc to chord** tick box

*If **ticked**, super strings will be broken into straight segments according to **Arc to chord interval** and **Distance Interval** values.*

*If **not ticked**, curved segments of the super string will be exported as a profile swept along the segment or string.*

*When **Export string as segments** is **not ticked** the string profile will be swept over the whole string.*

***Warning:** Many IFC viewers do not support profiles swept along a defined path.*

Continue to [11.3 Trimesh](#) or return to [11.2 Export](#) or [11 BIM](#).

## 11.3 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.

Trimesh		x
Info		
Create	▶	<a href="#">11.3.1 Create Trimesh</a>
Edit	▶	<a href="#">11.3.3 Trimesh Edit</a>
Convert	▶	<a href="#">11.3.4 Convert Trimesh</a>
Union/Difference	▶	<a href="#">11.3.5 Trimesh Union/Difference</a>
Contour	▶	<a href="#">11.3.6 Contour Trimeshes</a>
Check		
Heal		
Intersection lines	▶	<a href="#">11.3.7 Trimesh Intersection Lines</a>
Utilities	▶	<a href="#">11.3.8 Trimesh Utilities</a>
Old	▶	

### See

#### [11.3.1 Create Trimesh](#)

[11.3.1.1 Trimesh BIM Create/Edit](#)

[11.3.1.2 BIM Objects Map File](#)

[11.3.1.3 Cut and Fill Trimeshes Between Two Tins](#)

[11.3.1.4 Create Trimesh From](#)

[19.5.13 Create Culvert Headwalls](#)

[11.3.1.5 Trimesh Traffic Signals](#)

#### [11.3.2 Trimesh Editor.](#)

#### [11.3.3 Trimesh Edit](#)

[11.3.3.1 Flip a Trimesh Face](#)

[11.3.3.2 Flip Trimeshes Faces](#)

[11.3.3.3 Split Trimesh](#)

[11.3.3.4 Colour Trimesh](#)

#### [11.3.4 Convert Trimesh](#)

[11.3.4.1 Get Spines from Trimeshes](#)

[11.3.4.2 Top and Bottom Tins From Trimeshes](#)

[11.3.4.3 Convert Trimesh to Polymesh](#)

[11.3.4.4 Convert Trimesh Named Faces to Polymesh](#)

#### [11.3.5 Trimesh Union/Difference](#)

[11.3.5.1 Trimeshes Union](#)

#### [11.3.6 Contour Trimeshes](#)


#### [11.3.7 Trimesh Intersection Lines](#)

#### [11.3.8 Trimesh Utilities](#)

## 11.3.1 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.

Create Trimesh		<i>See</i>
From	▶	<a href="#">11.3.1.1 Trimesh BIM Create/Edit</a>
Create/edit BIM Objects		
BIM objects apply		<a href="#">11.3.1.2 BIM Objects Map File</a>
BIM objects map file apply		
BIM objects map file		<a href="#">11.3.1.3 Cut and Fill Trimeshes Between Two Tins</a>
Cut and fill trimeshes between two tins		<a href="#">11.3.1.4 Create Trimesh From</a>
By Profile along a string		
Create culvert headwalls		<a href="#">19.5.13 Create Culvert Headwalls</a>
Service chamber		
Service chamber many		
Solid shapes		
Traffic signals		<a href="#">11.3.1.5 Trimesh Traffic Signals</a>
Old	▶	



### 11.3.1.1 Trimesh BIM Create/Edit

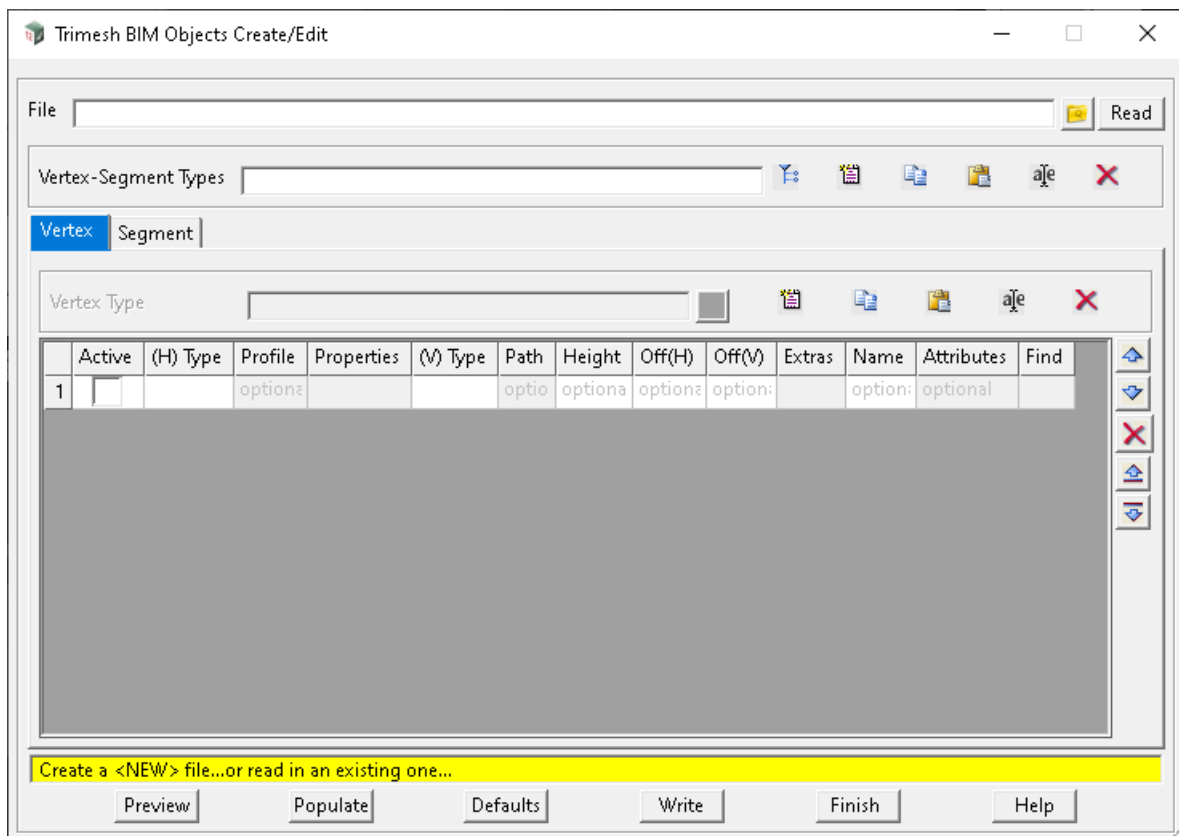
**Position of option on menu:** BIM =>Trimesh =>Create =>Create/edit BIM objects

Now documented in the V15 reference manual

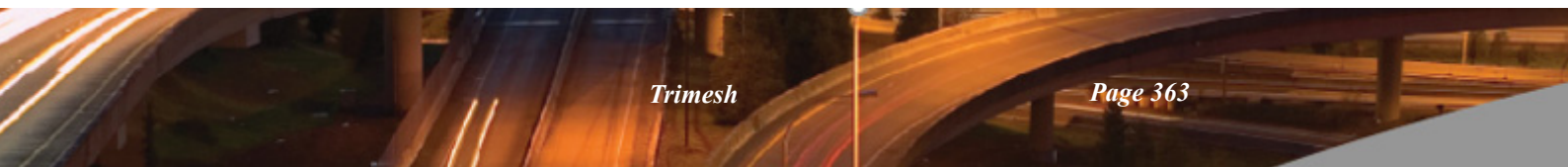
For information on **how to create a user defined vertex type using a 12da file**, see [11.3.1.1.1 How to create a user defined vertex type using a 12da file.](#)

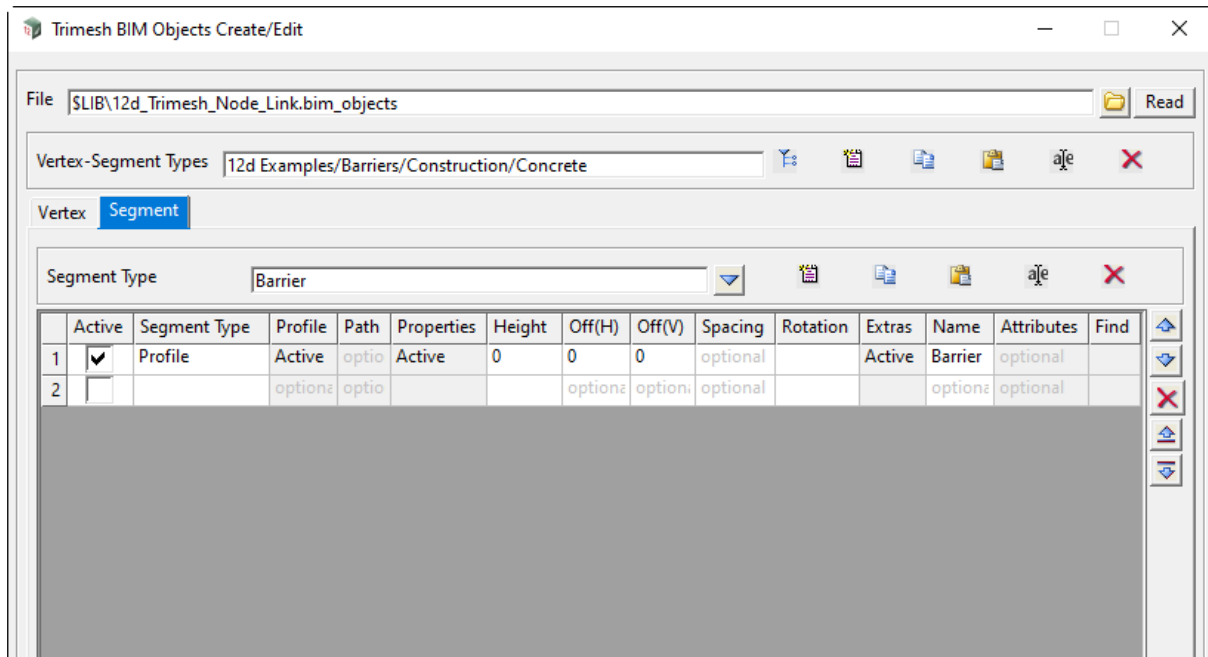
For information on **how to create a user defined pipe trench trimesh from a profile string, using a 12da file**, see [11.3.1.1.2 How to create a user defined pipe trench trimesh from a profile string, using a 12da file.](#)

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**.

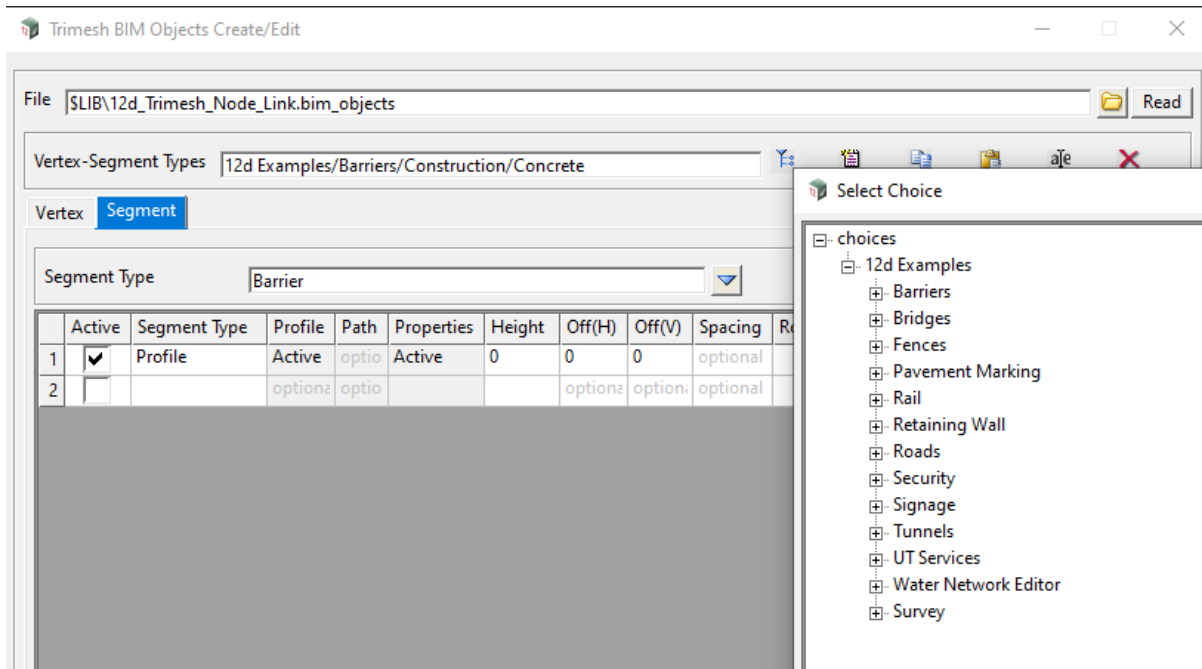
**The benefit of this is you can now name the file whatever you want and simply browse to its location.**

**Note:**

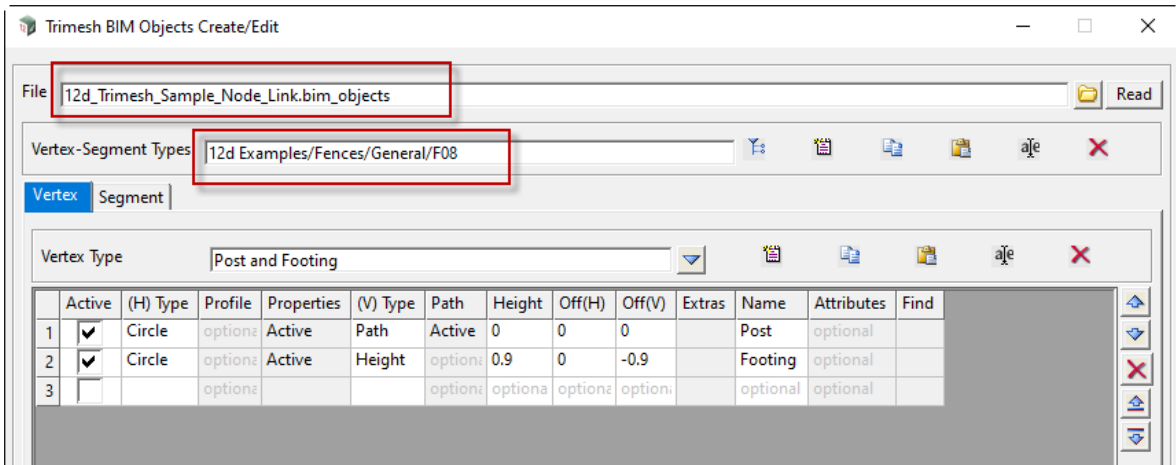
At start up, you are able to either **Create a <NEW> file**, create some Vertex-Segment Types, and save that file.

That way you do not have to include all the example types shipped in the library file.

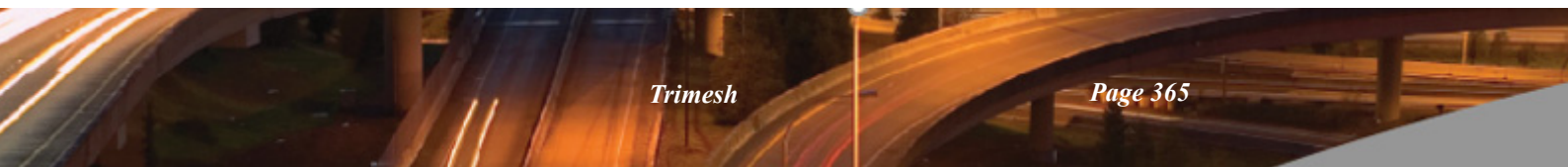
Expanded below is a list of the types available in the library file

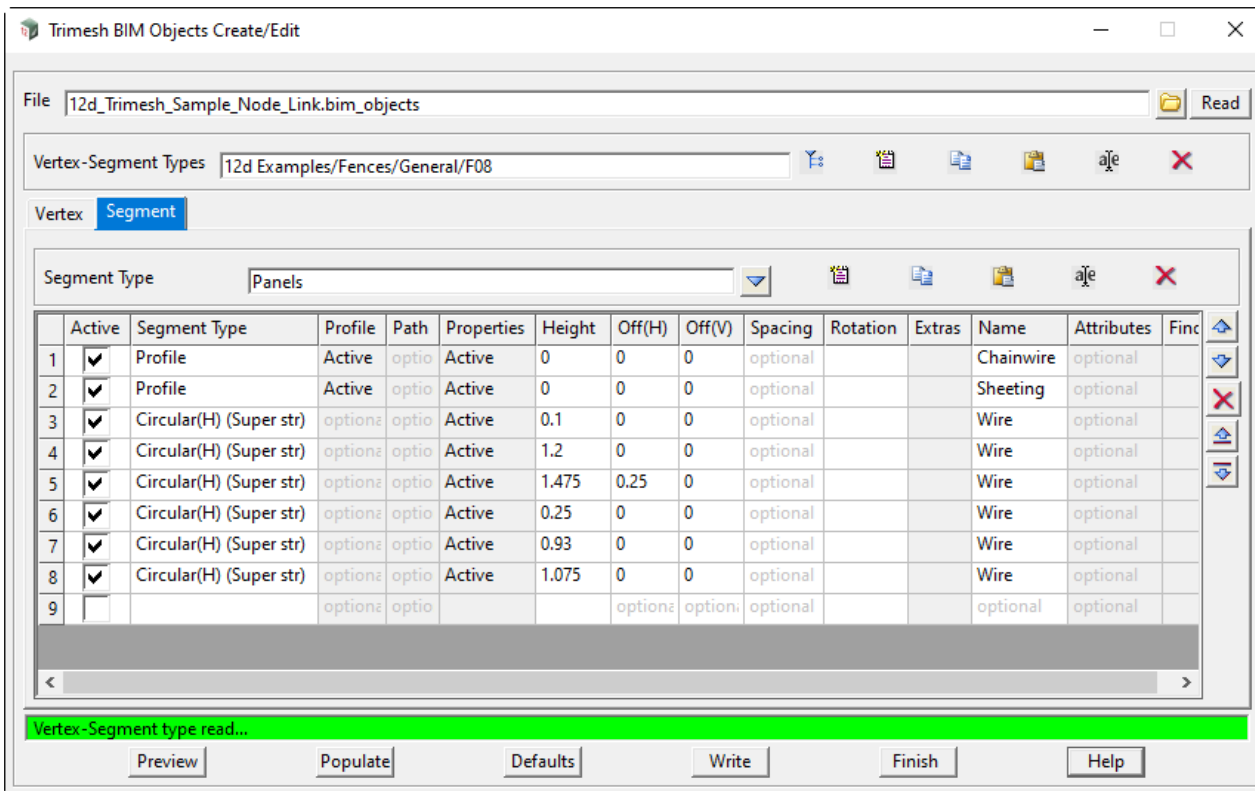


To save this file (under any name), simple click in the File field, and overwrite the name. Select the "Write" button to save it to the working directory, or to wherever you may have browsed to.



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.

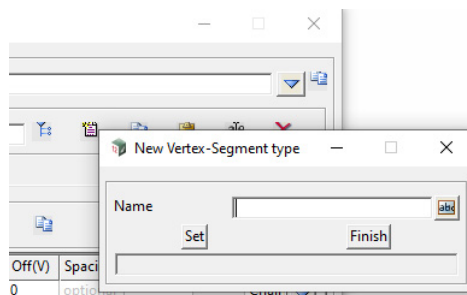




**Vertex-Segment Type edits:**

**Create**

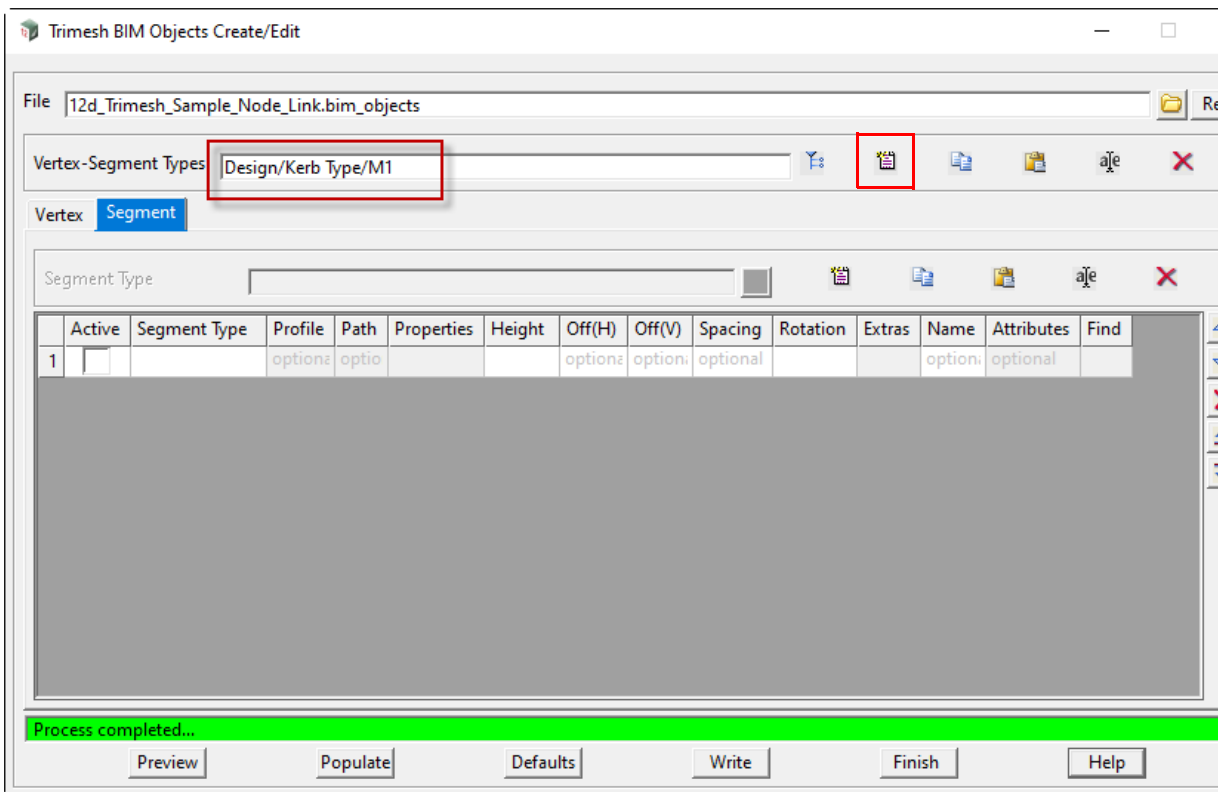
Once selected the panel below will be displayed.



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.

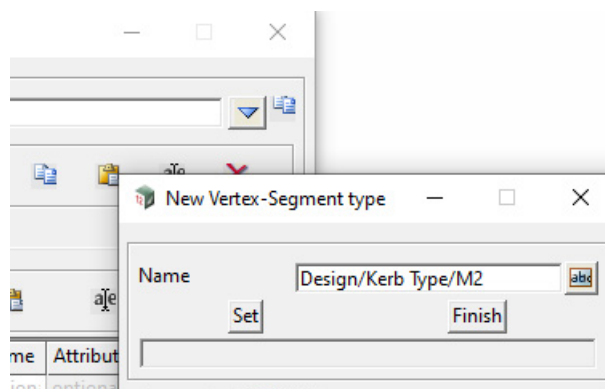


**Copy** button

*Makes a copy of whatever is in the Vertex-Segment Types field.*

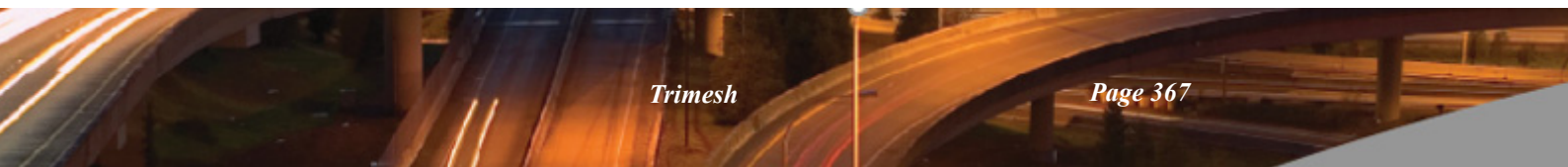
**Paste** button

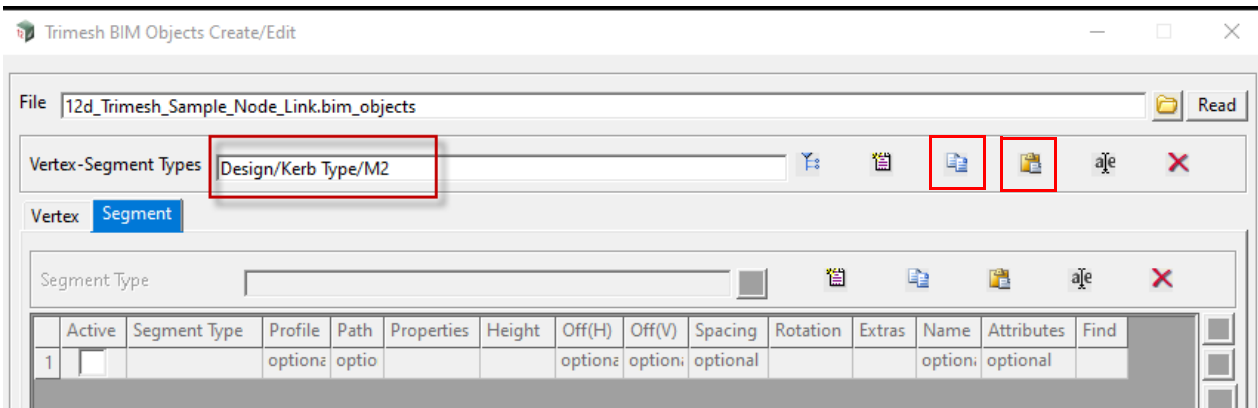
*Will display the panel below, allowing you to enter an appropriate name for your new type.*



*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.*

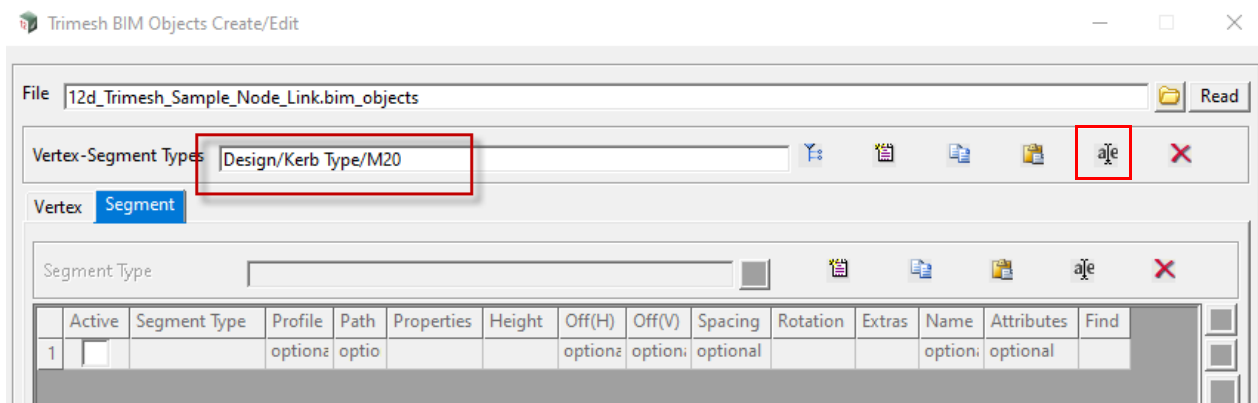
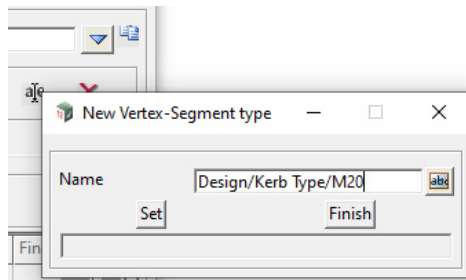




The heading above is available on the drop-down list even if you change from one choice to another...**BUT** must be **Written** out before selecting another type.

**a|e** **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

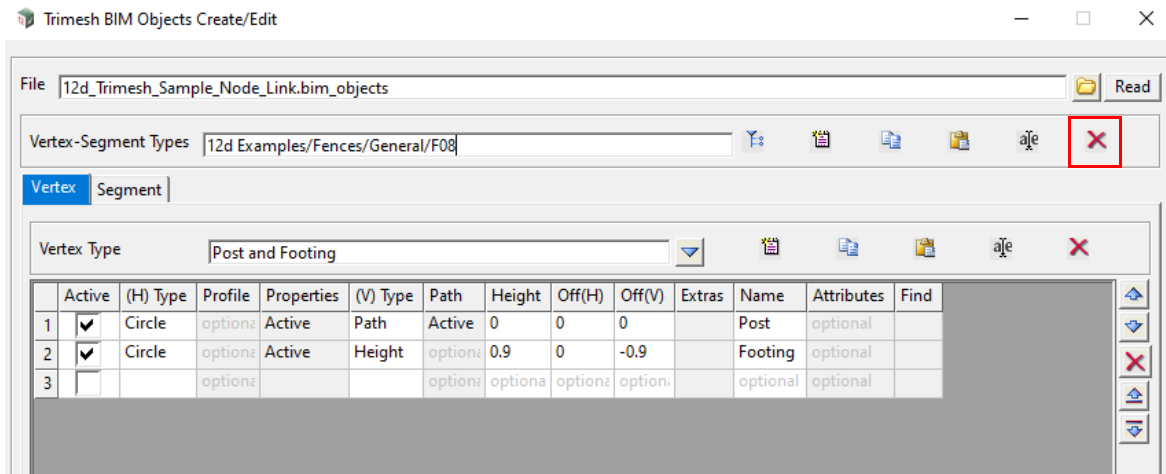


The heading above is available on the drop-down list even if you change from one choice to another...**BUT** must be **Written** out before selecting another type.

**X** **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.

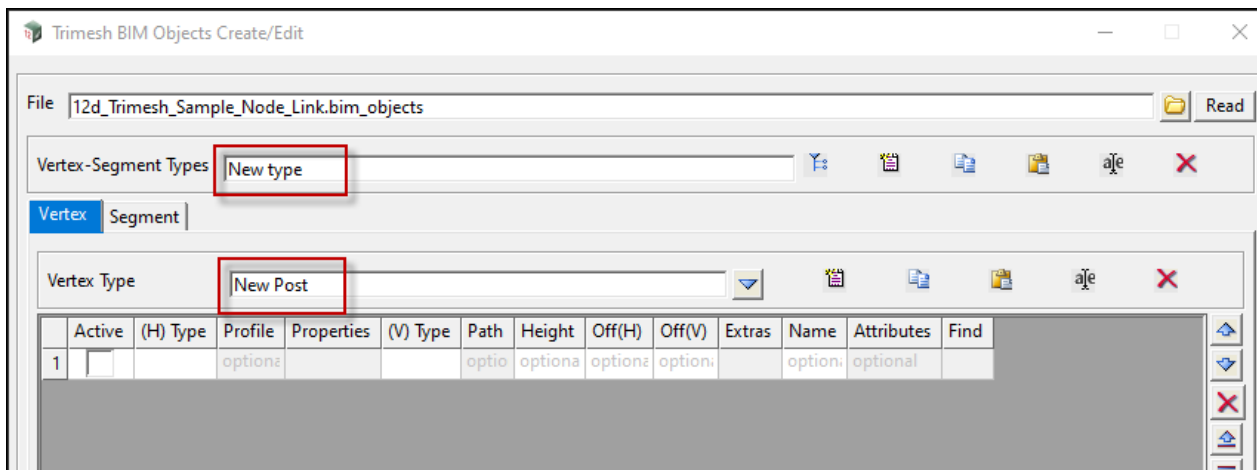
**Vertex edits:**

**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.



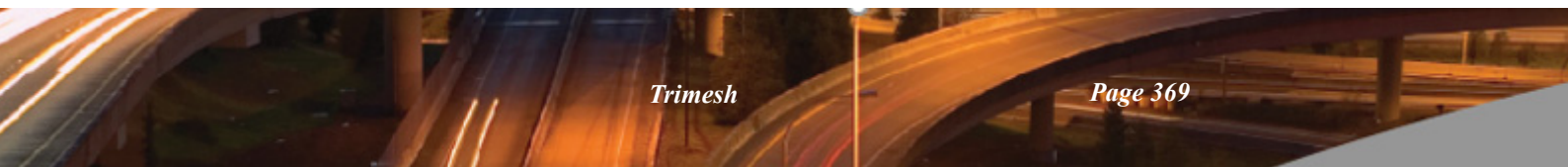
**Segment edits:**

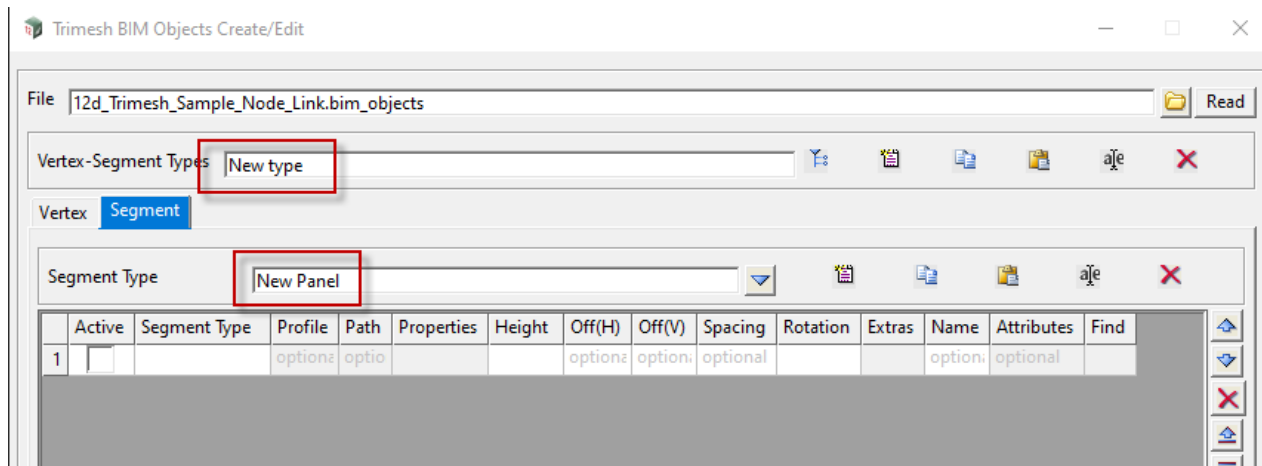
**NOTE:** Edits in this grid area **MUST** be **written** out in order to **Save** any data, before **changing** types.

**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.*

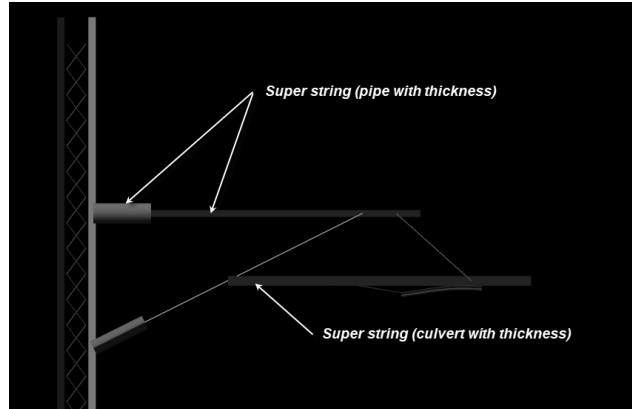
**Populate** button

*The Populate button on the Vertex & Segment tabs.*

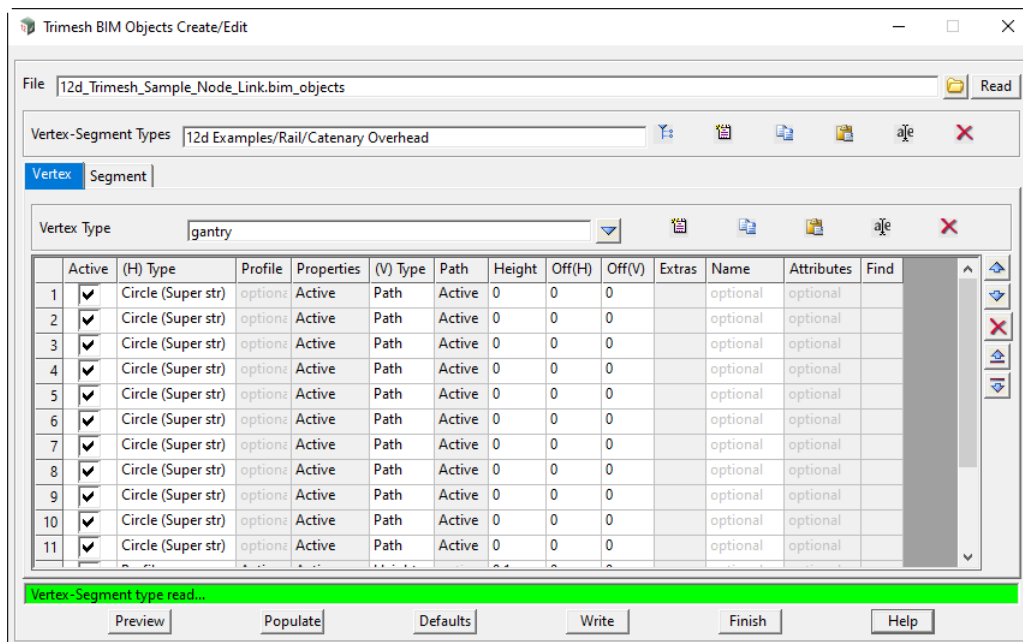
**Vertex Tab:**

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



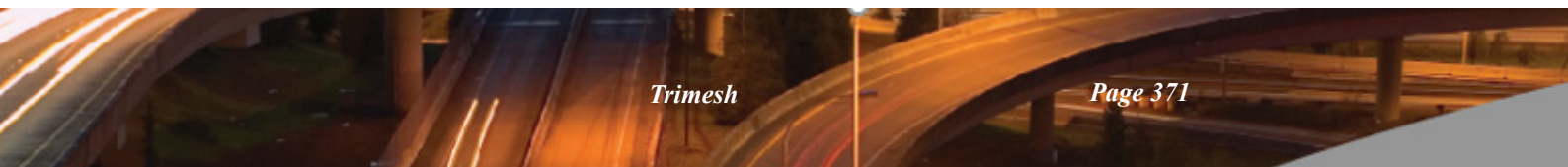
Once completed, "(H) Type" and "Path" entries are made in the **Vertex** grid e.g



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.

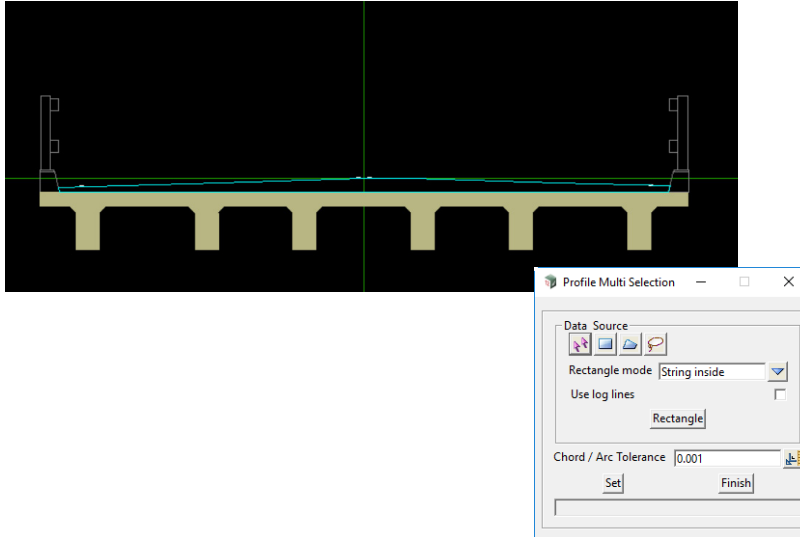
If **not ticked**, then no rotation is done.

**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.

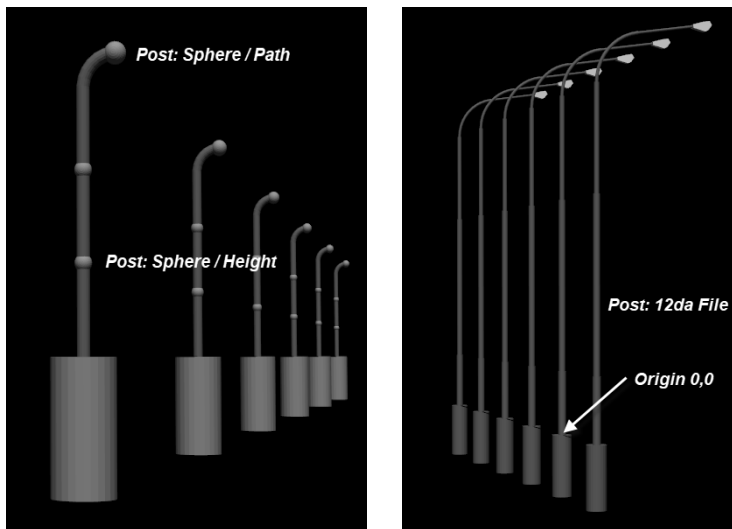
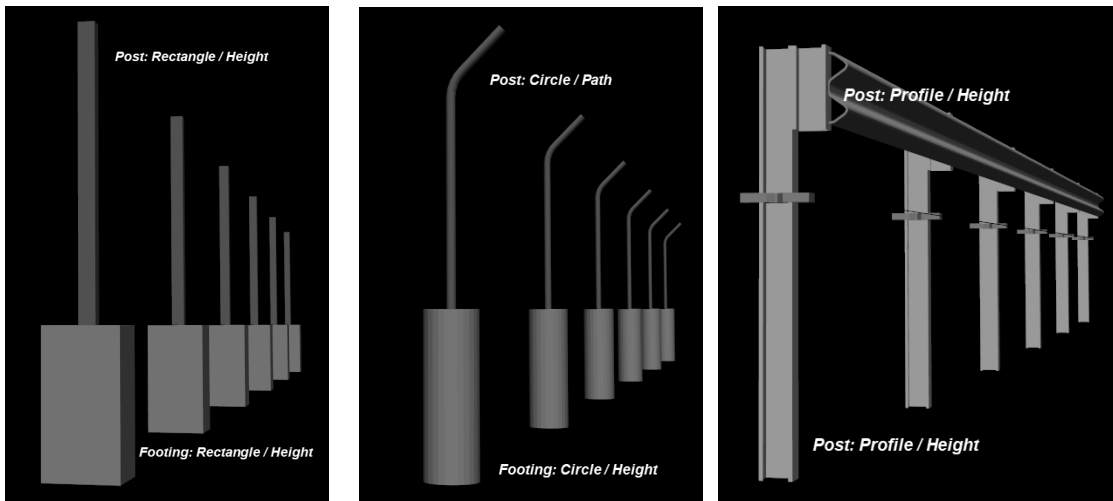
**Height** is a real value (2m high fence post e.g.)

**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.

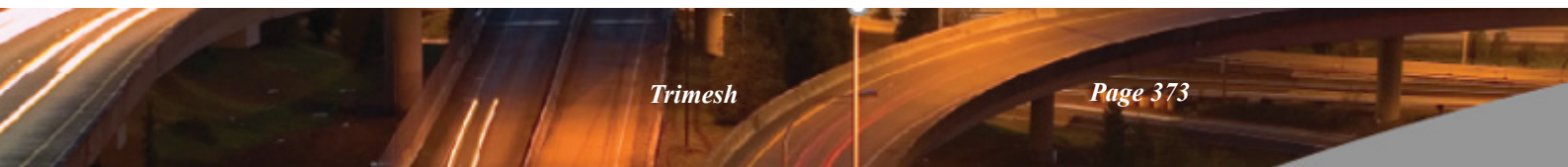
**Vertex Examples:**

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
<b>Active</b>	tick box		
<i>If ticked, line is active.</i>			
<b>Shape(H)</b>	choice box		
<i>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).</i>			
<b>Rectangle</b> (Width & Depth required)			
<b>Rectangle (Super str)</b> (Width & Depth required)			
<b>Circle</b> (Diameter required)			
<b>Circle (Super str)</b> (Diameter required)			
<b>Sphere</b> (Diameter required)			
<b>Profile</b> (String shape required)			
<b>Capping</b> (Width & Depth or Diameter required)			

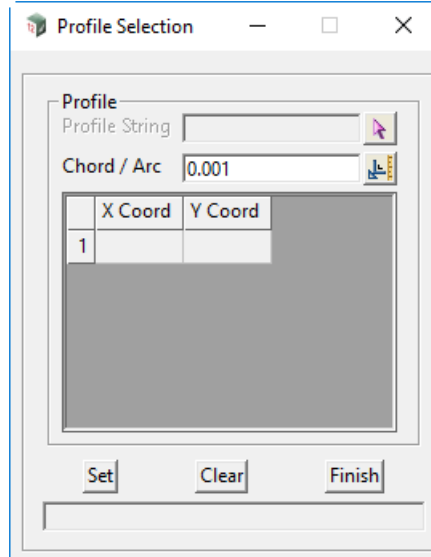


**12da File**

**Profile**

select

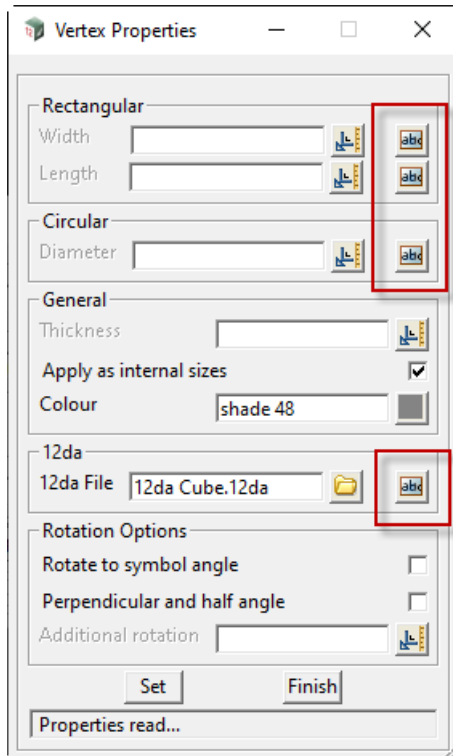
LMB will activate the panel below in order to select a profile string (usually drawn at origin 0,0).



**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

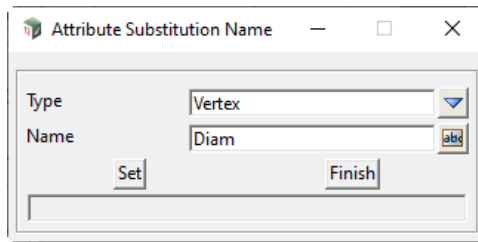
Rotate perpendicular & half angle refers to the angle at a vertex when placed

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.

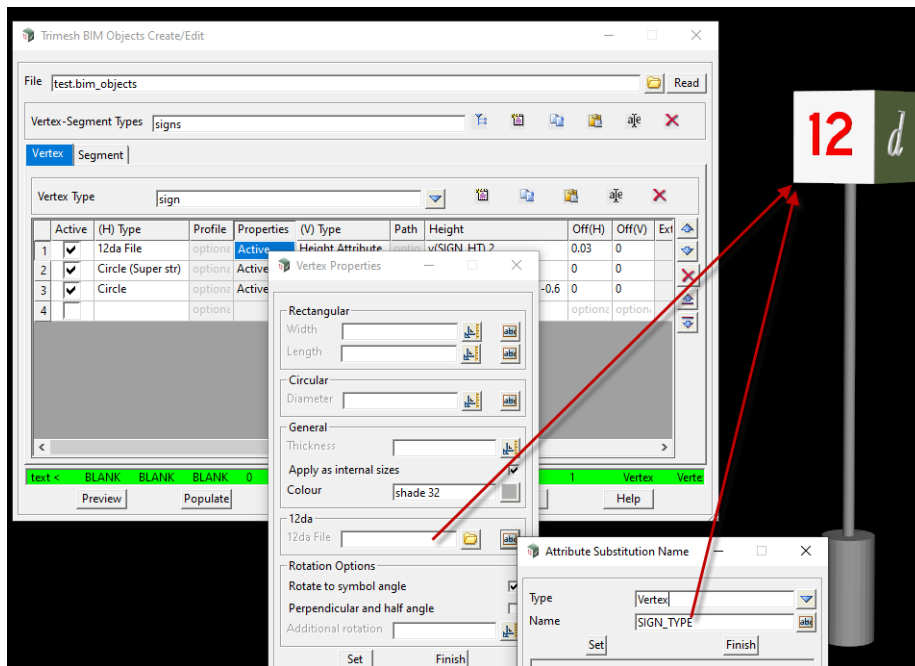
For **rectangular** parameters: a default Width and Length is required, if using an attribute.

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

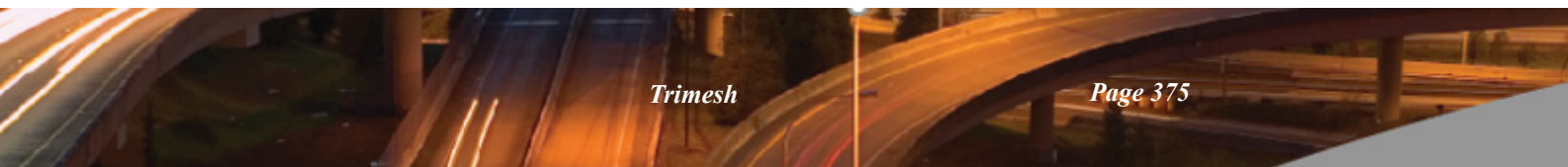
As the attribute value is not known for previewing, a **12da cube insert** is used.

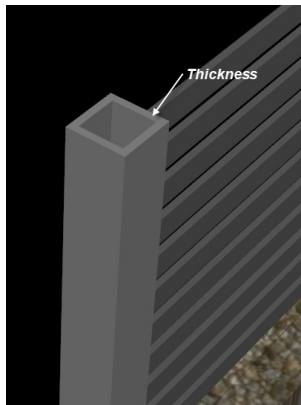
This enables previewing, and is also used as a locator, if the attribute file name does not exist at the final apply stage.



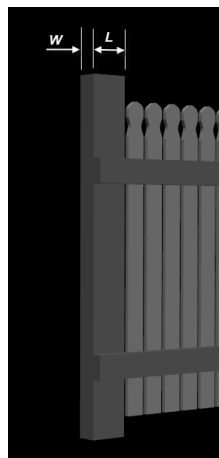
**Note:** 12da and 12daz files can be used

**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.

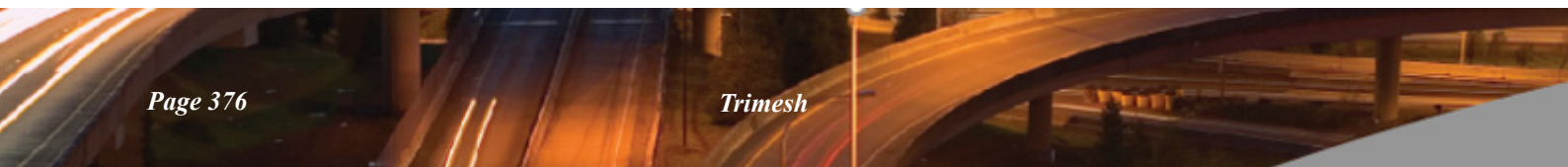
+ve and -ve values allowed.

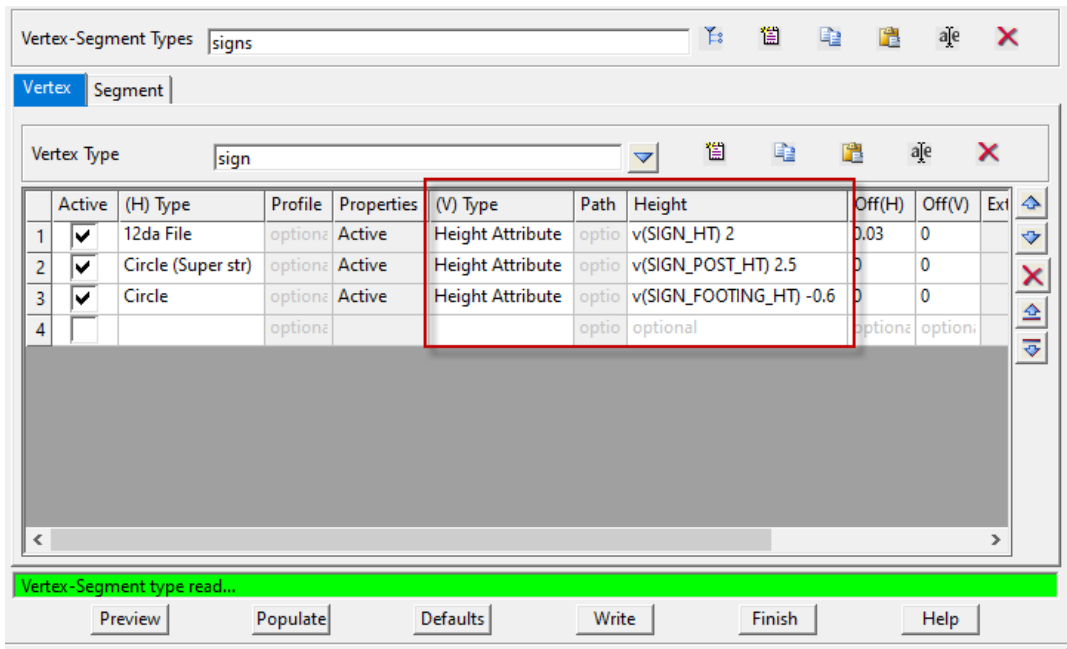
**Height Attribute** real box

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.

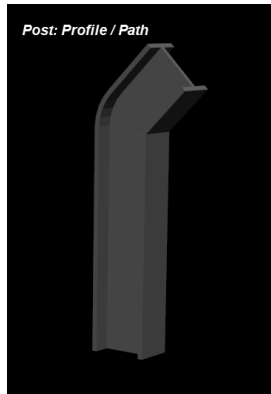




**Path**

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

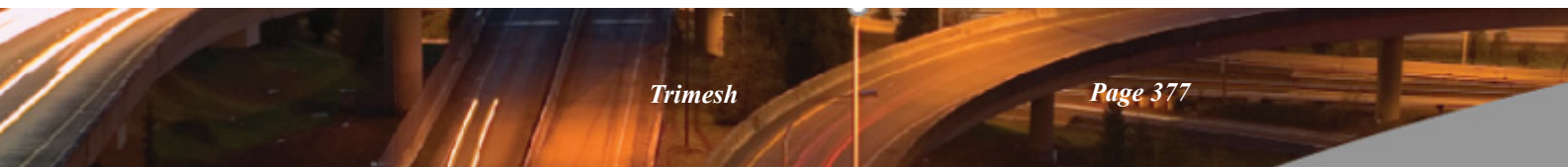
*Vertical offset measured from the final placement string of the Trimesh.*

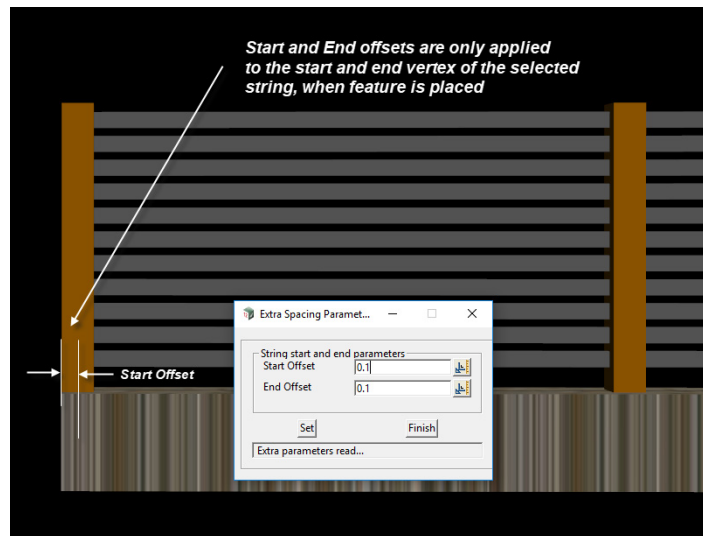
*+ve and -ve values allowed.*

**Extras**

select

*LMB will activate the panel below.*





**Name** input

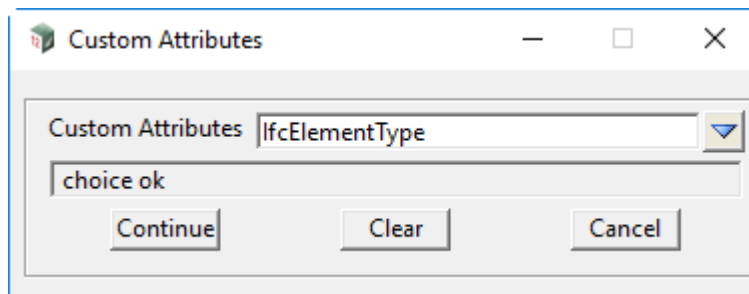
*Name of the trimesh.*

**Attributes** select

*This option activates a selection of attributes created from the option below.*

*Menu: Utilities->Attributes->Global Attributes->Set global attributes*

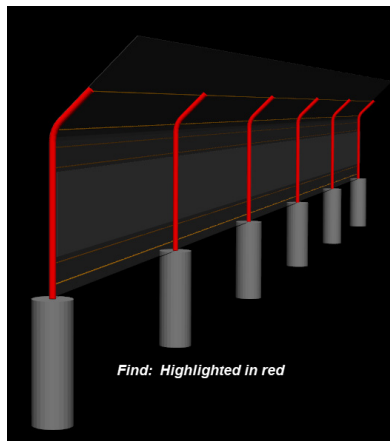
*The attributes are set to all the Trimesh elements and are typically BIM attributes.*



**Find** select

*This option will highlight the Trimesh created from the row in the grid.*

*The **Preview** button must be activated first though.*

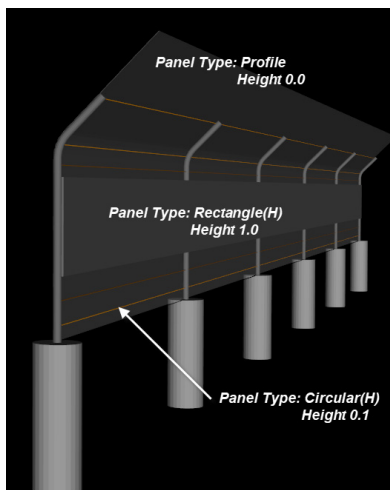


### Segment Tab

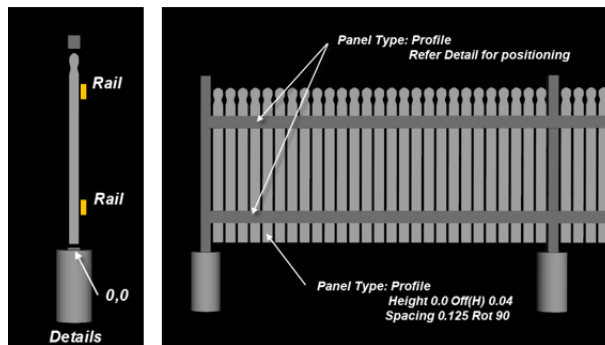
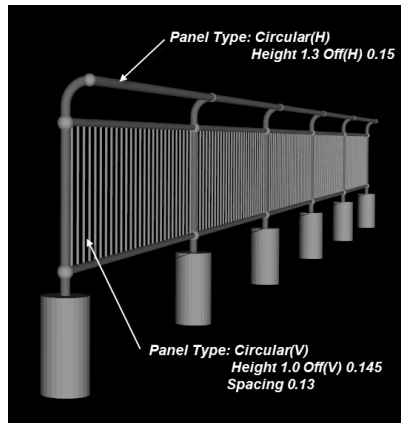
The Segment tab has a selection of **Panel types** that can be extruded along a selected string.

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.



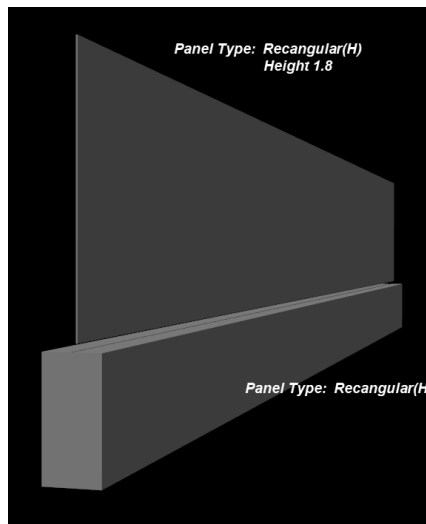
### Segment Examples:



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)

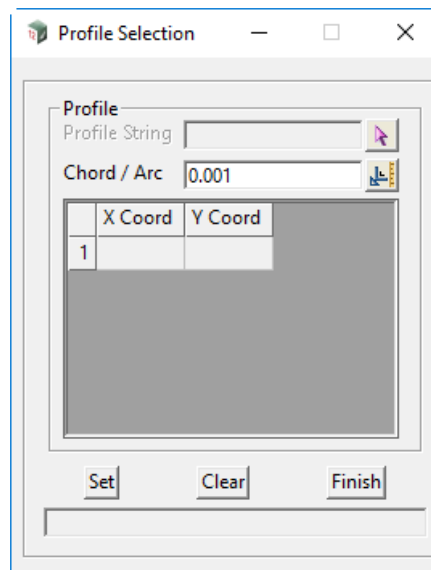
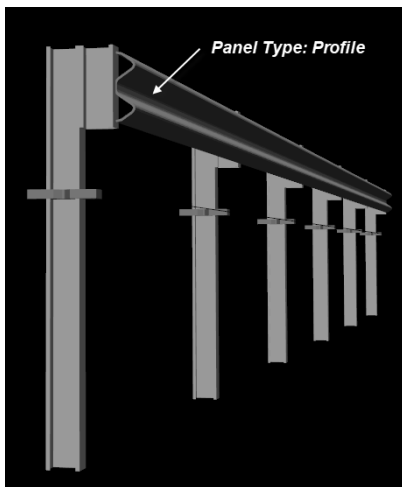
**Circular(H) (Super str)** (Diameter required)

**Circular(V) (Super str)** (Diameter required)

**12da Profile(s)**

**Profile** select

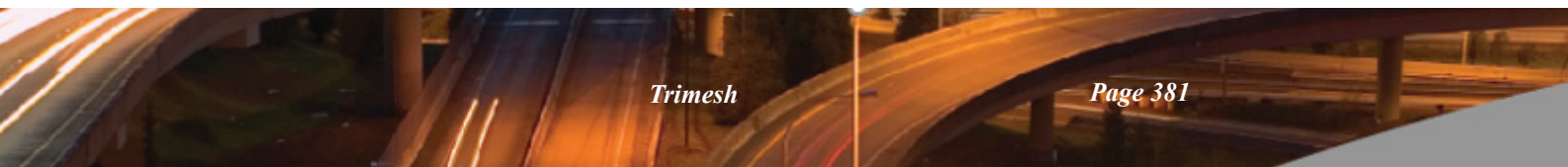
*LMB will activate the panel below in order to select a profile string (usually drawn at origin 0,0).*

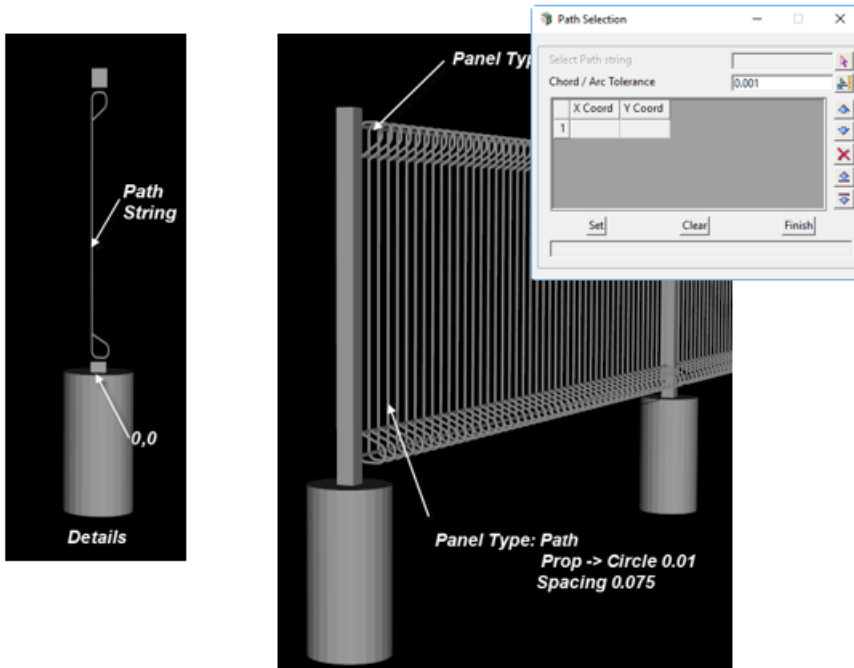


**Profile string (W Beam) was drawn in position, referenced to 0,0**

**Path** select

*LMB will activate the panel below in order to select a path string (usually drawn at origin 0,0).*



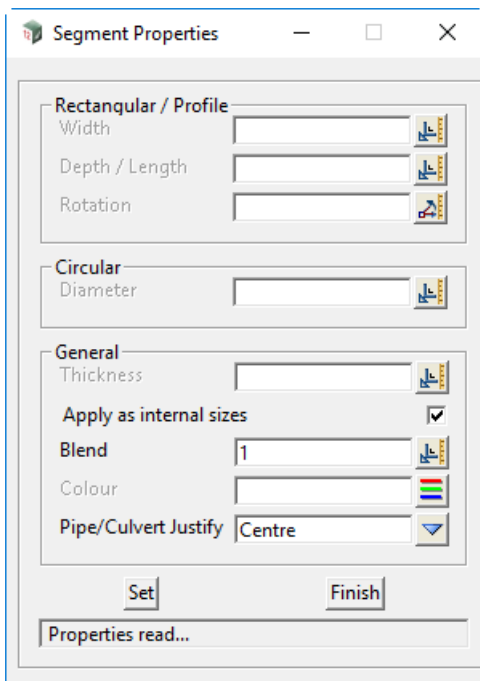


Path string was drawn in position, referenced to 0,0

**Properties**

select

LMB will activate the panel below to enter a selection of properties used to define the Shape(H) and the Trimesh features.



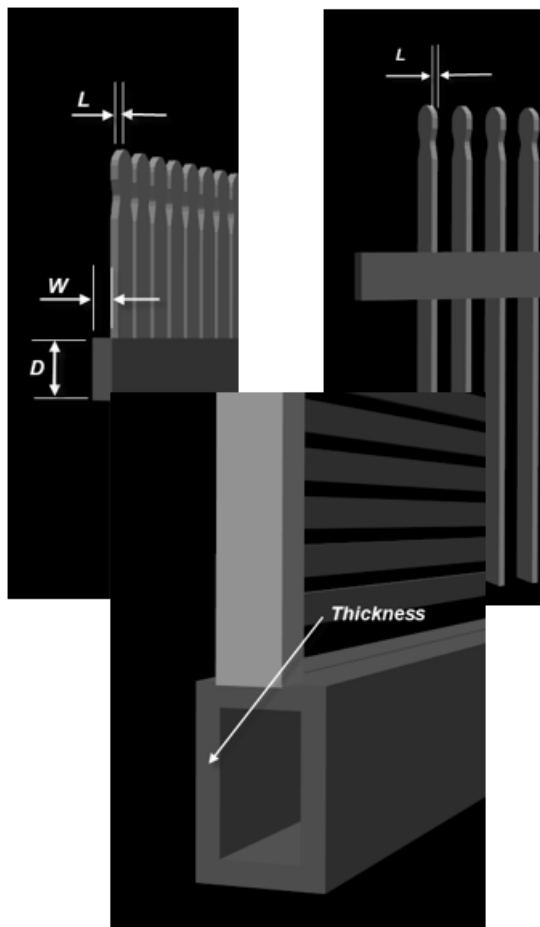
Fields required for type **Rectangle**

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.*

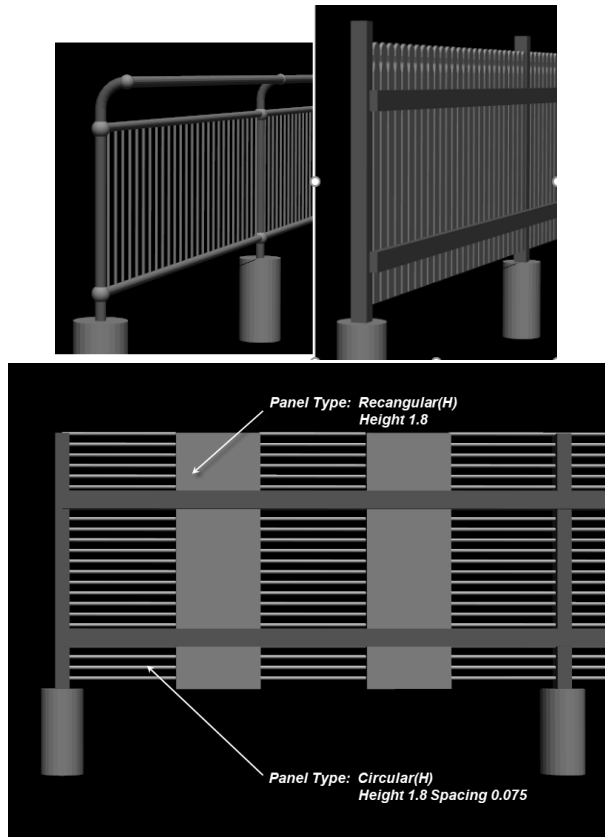
**Off(V)** real box

*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.*

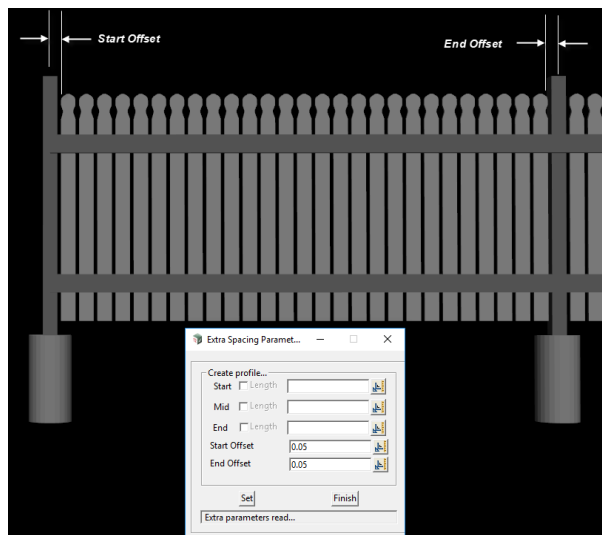
**Extras** select

*LMB will activate the panel below.*

**Segment Extras:**

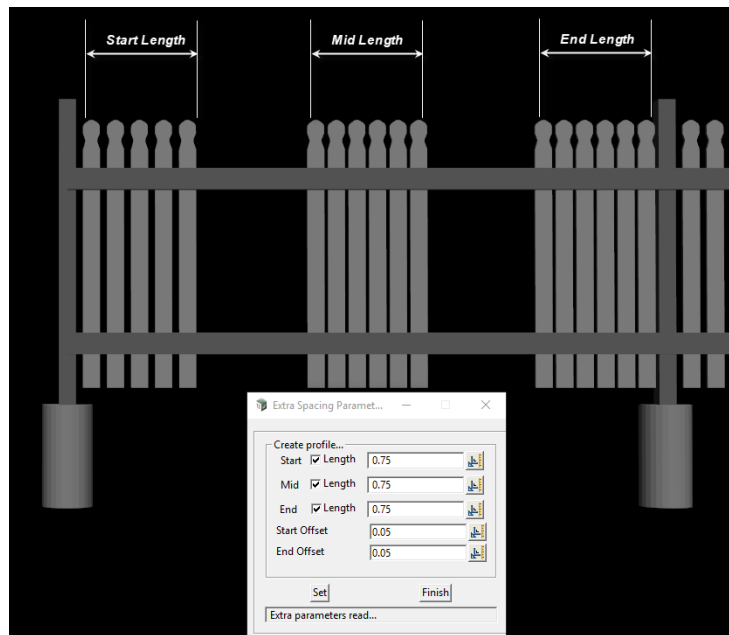
*Extra parameters are used to space any Panel Type, between two vertices.*

**Start Offset and End offset**



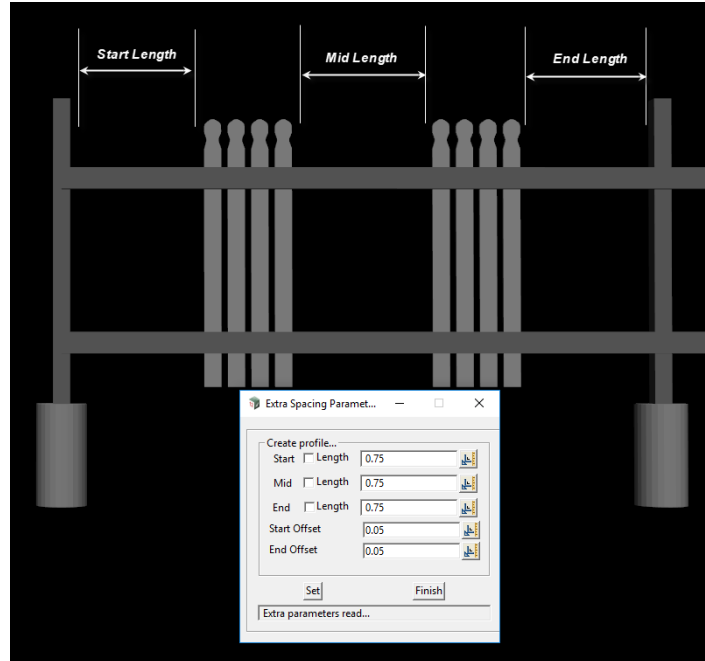
The **Start & End Offsets** are measured from each vertex, or in this case the centre of the post.

### Start Mid and End



The **Start, Mid & End** parameters can be used together, on their own or any combination thereof.

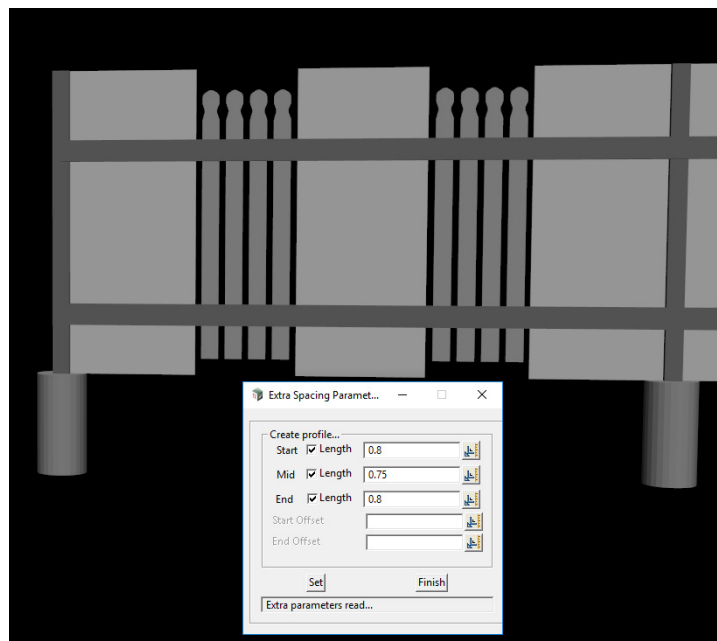
### Start Mid and End (Intermediate)



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.

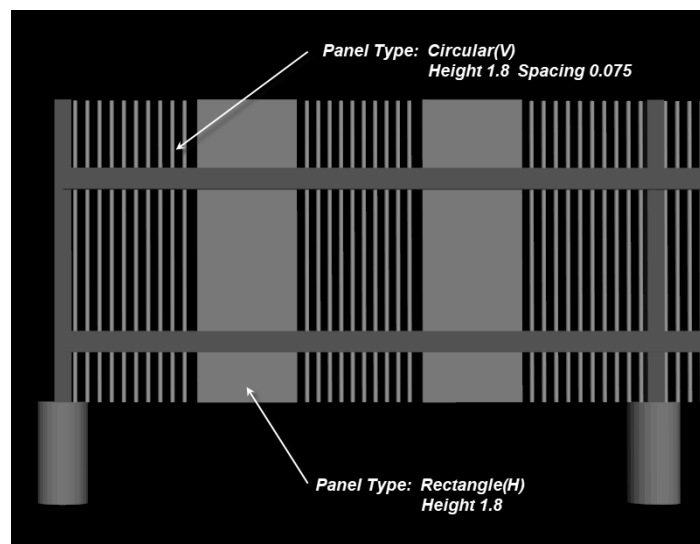
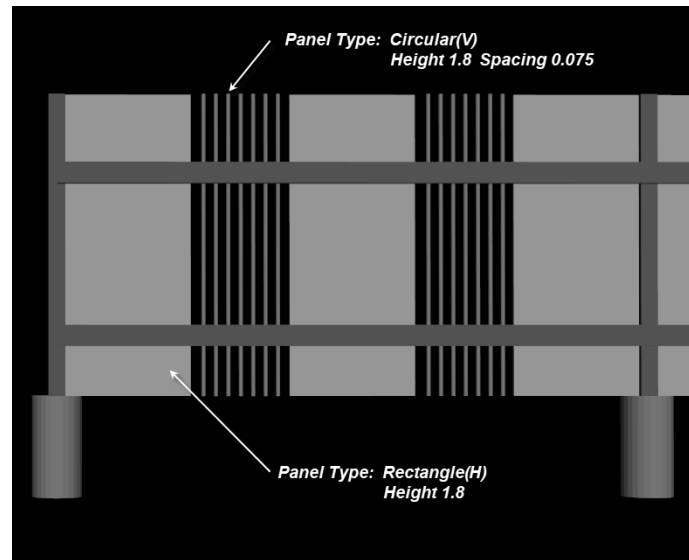
### Combining two Panel types using Start Mid and End (Intermediate)



The solid 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.

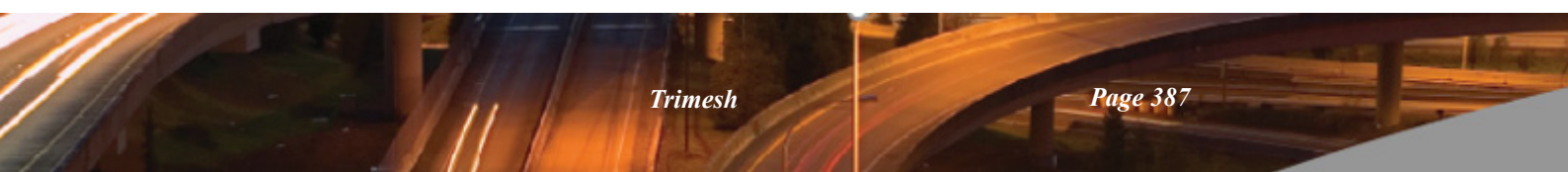


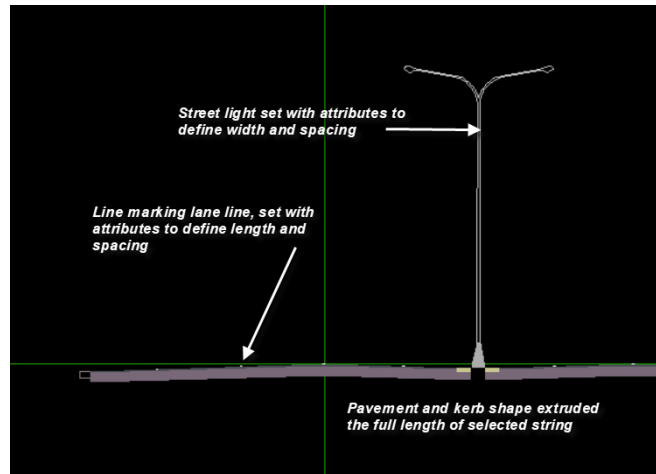
### 12da Profiles(s) select

*Profiles generally drawn at origin 0,0 and define shapes that are to be 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.*

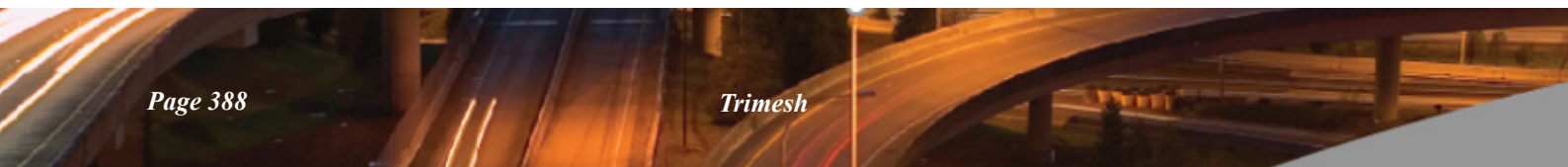
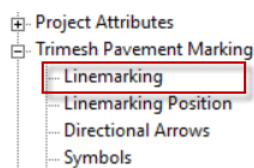
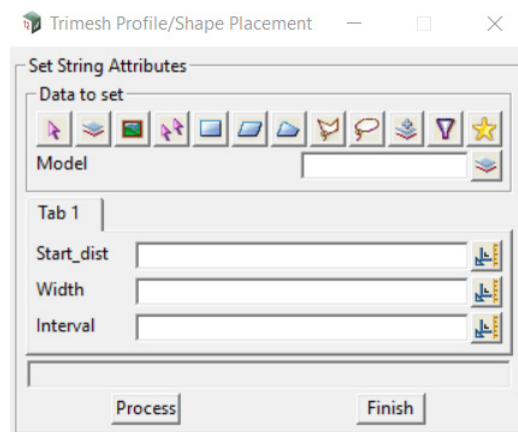
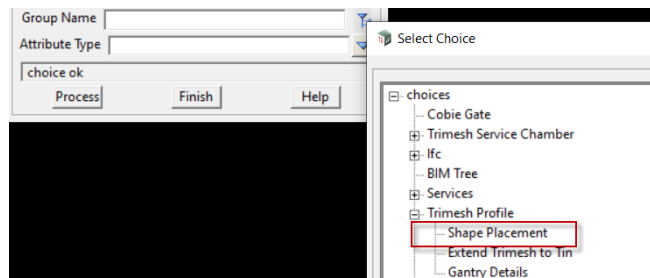
*The same can be set for linemarking.*

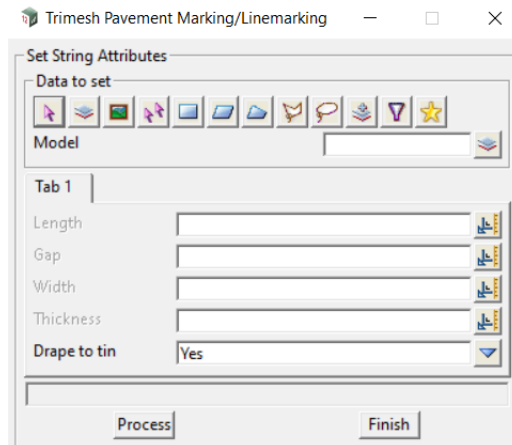




Attributes for the above settings are available from the menu item below

**Menu: Utilities->Attributes->Global Attributes->Set global attributes**





**Name** input

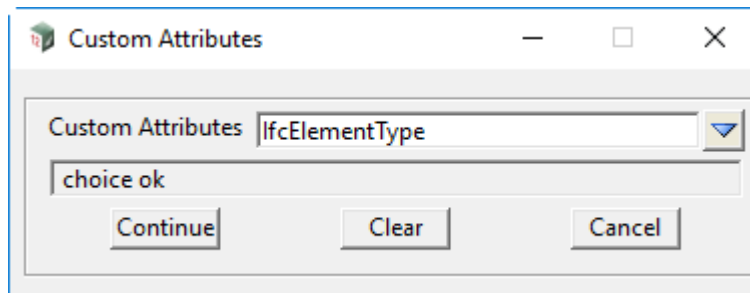
*Name of the Trimesh.*

**Attributes** select

*This option activates a selection of attributes created from the option below.*

**Menu:** Utilities->Attributes->Global Attributes->Set global attributes

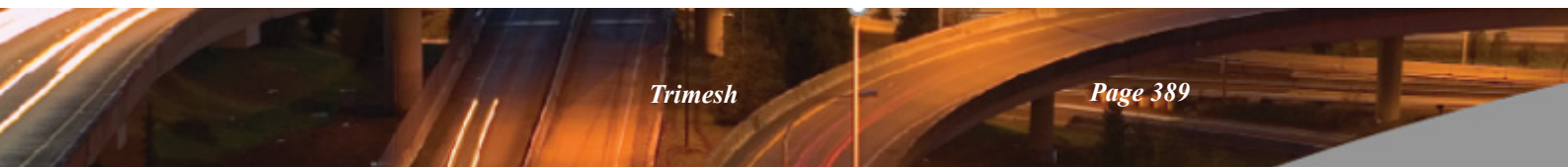
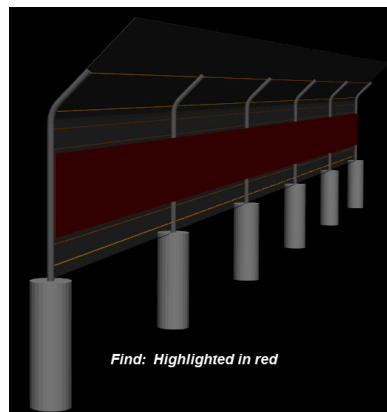
*The attributes are set to all the Trimesh elements and are typically BIM attributes.*



**Find** select

*This option highlights the Trimesh created from the row in the grid.*

*The **Preview** button must be activated first though.*



**Process** button

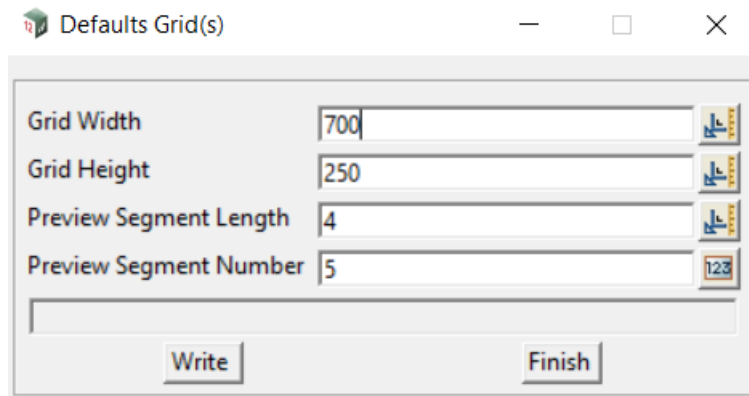
*Creates an open GL perspective view titled "Preview".*

*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.*



12d Defaults Grid(s)

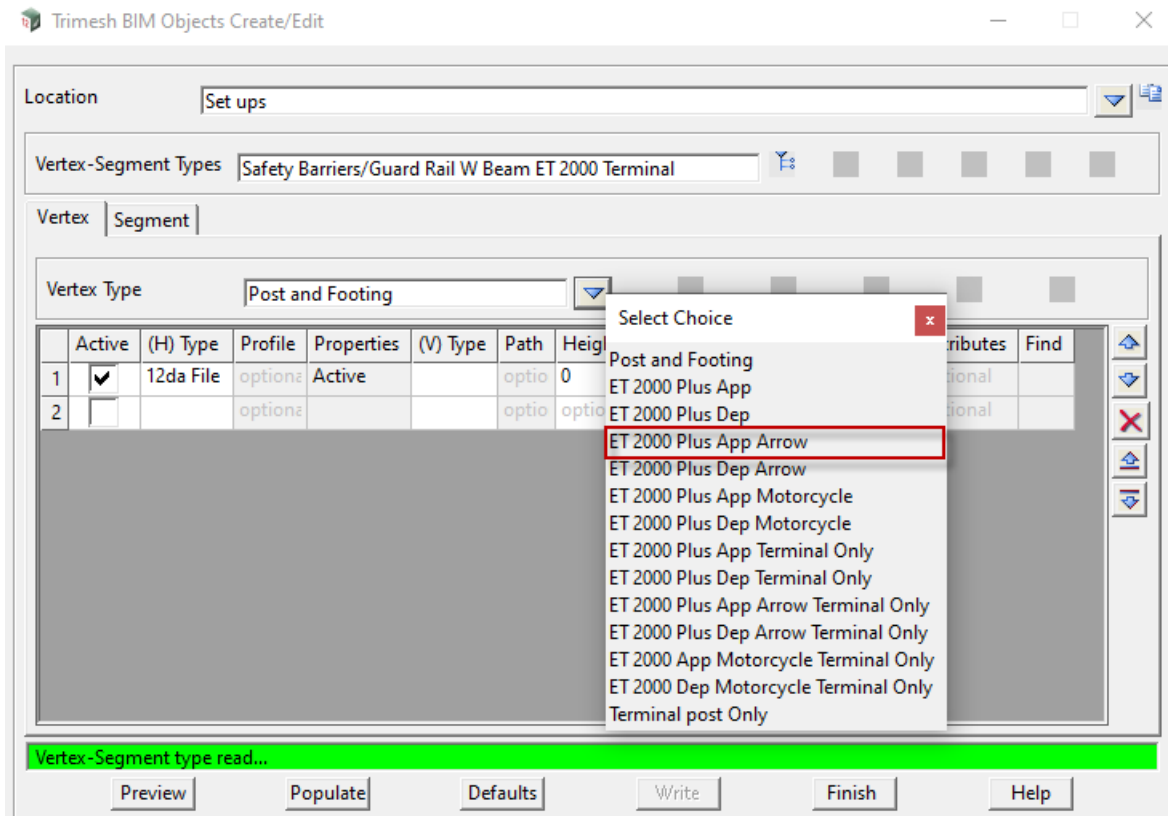
Grid Width	700	
Grid Height	250	
Preview Segment Length	4	
Preview Segment Number	5	

**Finish** button

*Finish button.*

### 11.3.1.1.1 How to create a user defined vertex type using a 12da file

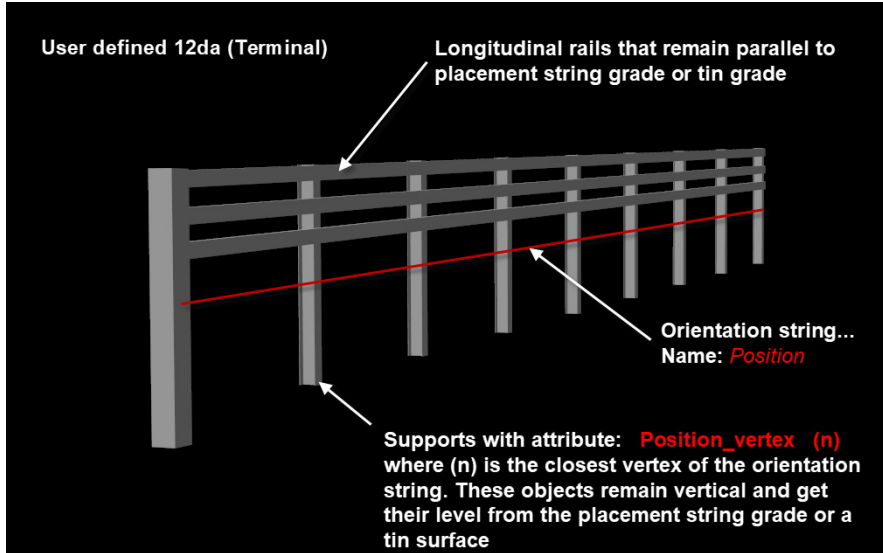
Below is an example of a **12da file** that is part of the install.



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.

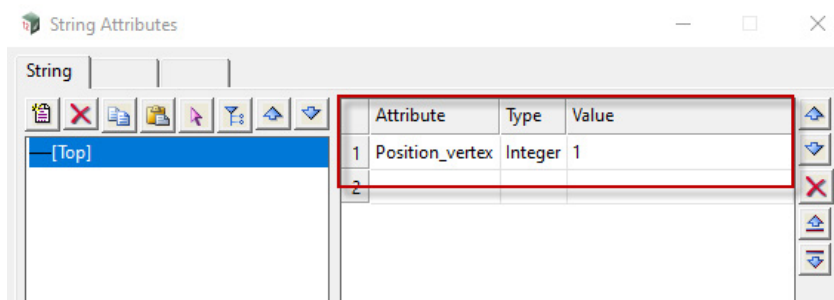
We will focus on a terminal that is to be positioned at the start of a string, with vertical supports or posts and some longitudinal rails that will follow the tin surface.



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."

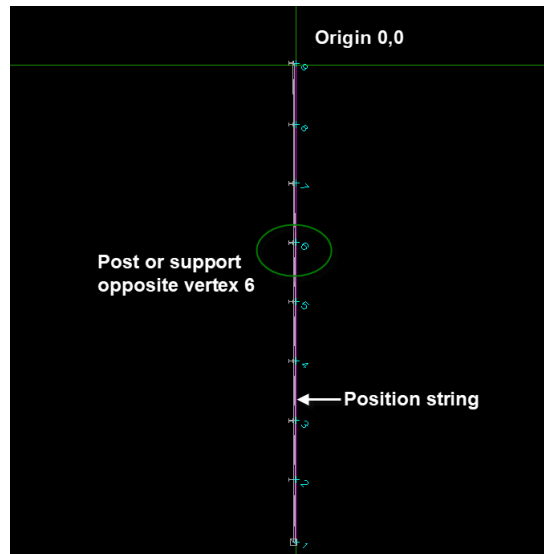
**Attribute syntax:**



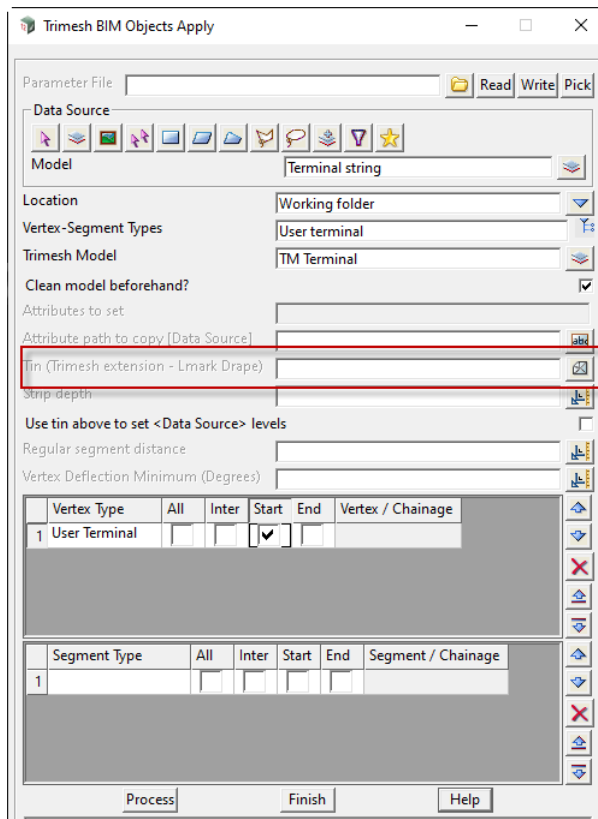
The value above comes from the 'position" string, that the post or support is opposite.

**Refer image below:**

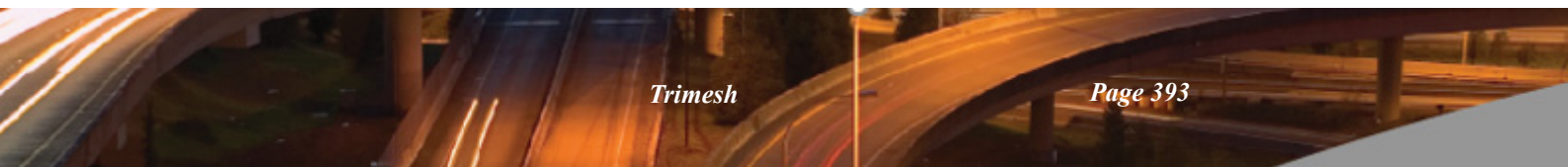




As the rails run in a longitudinal direction, there is no need to set any attributes to them. So, any elements that have the attribute set, are treated as posts or supports and remain in a vertical position when placed. Their final level, and that of the longitudinal rails, come from either a tin surface 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.



### 11.3.1.1.2 How to create a user defined pipe trench trimesh from a profile string, using a 12da file

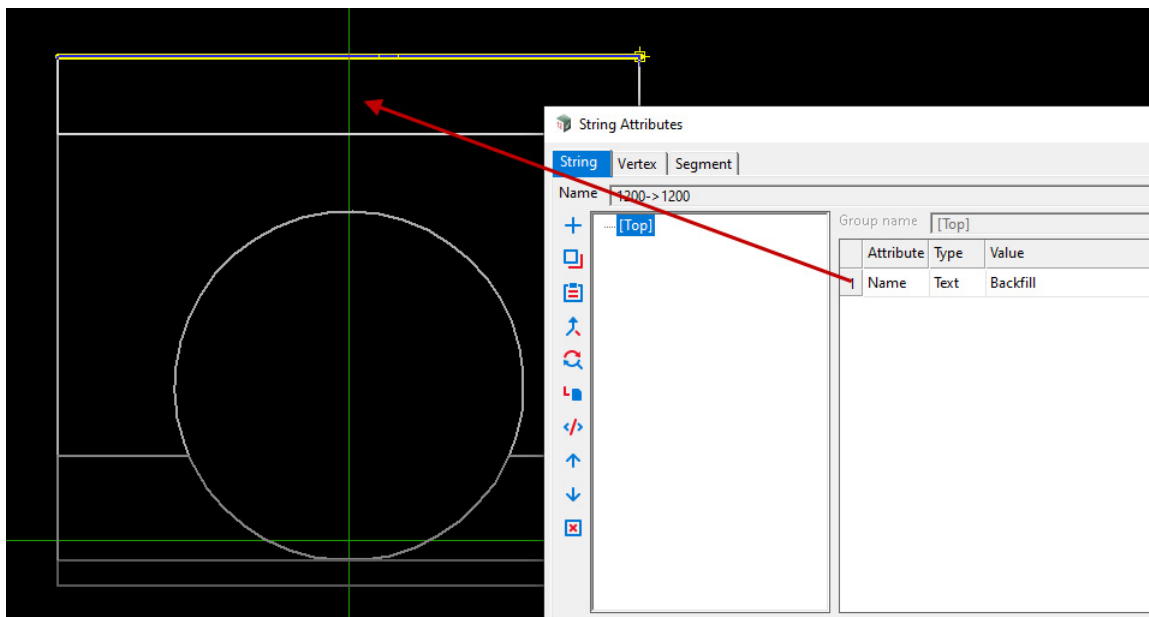
Example 12da file that is part of the install.

12d Drainage Trench.12da

#### 12da Profiles(s)

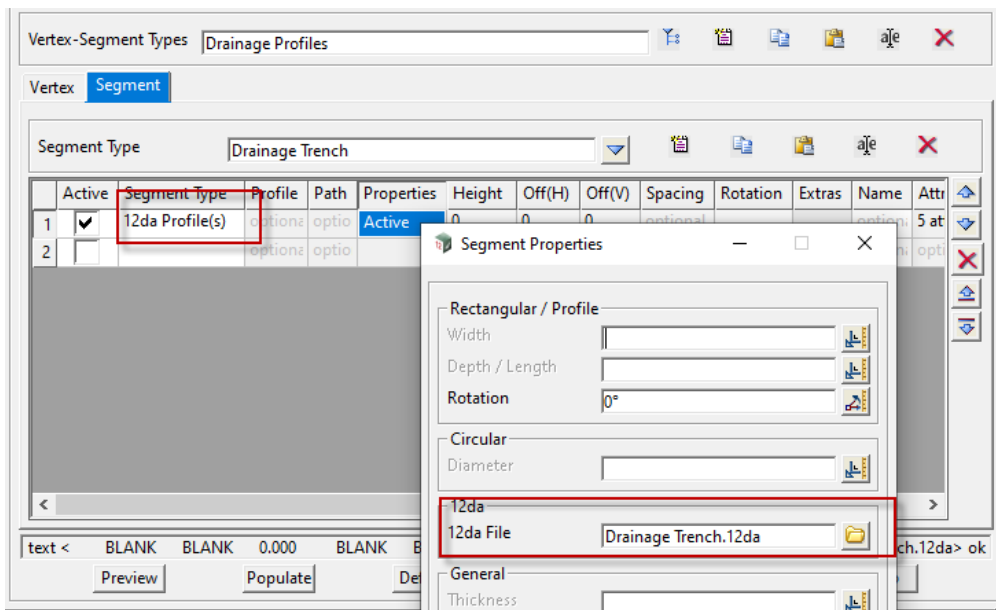
Profiles generally drawn at origin 0,0 and define shapes that are to be extruded along a selected super string.

Attributes are to be set to each profile that defines the name of the trimesh trench profile

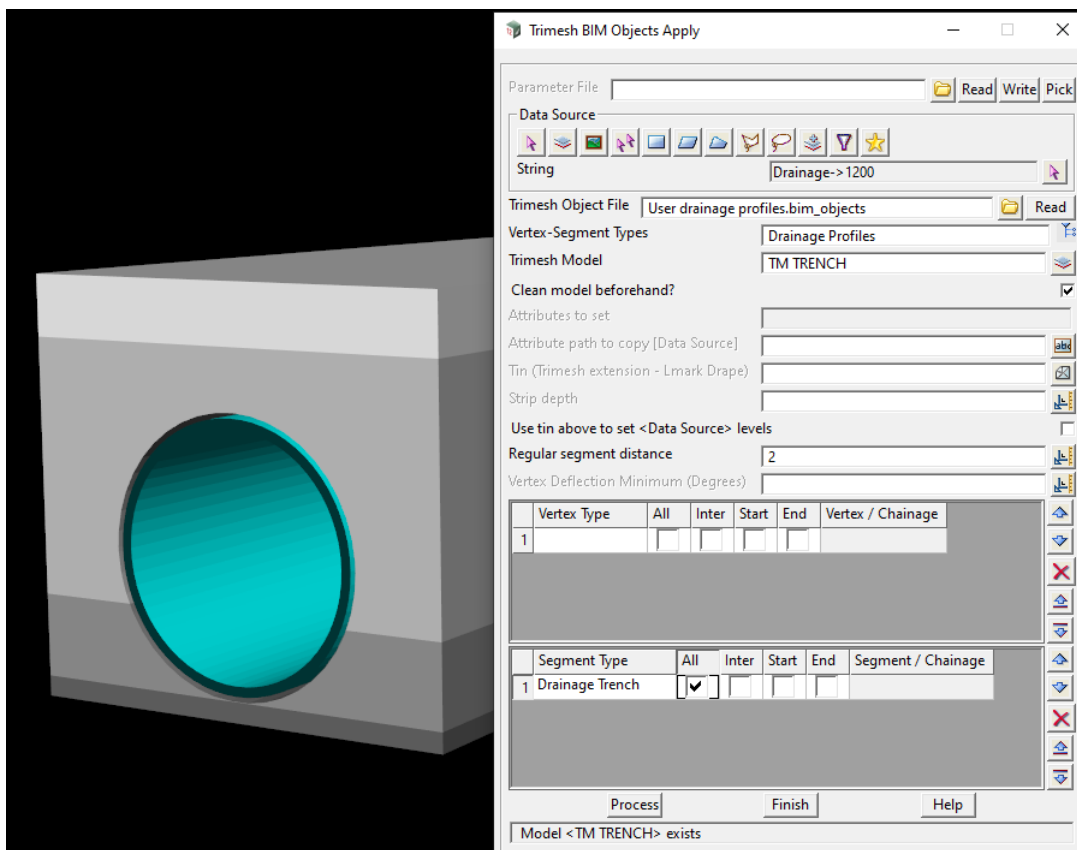


e.g. For a 1200 diameter pipe, its profiles are drawn on a model called 1200 with a name 1200. Write out a 12da file of the profiles.

Create a Vertex Segment Type ->Segment...as per below



**Note:** When applying the above, the name of the super string must be called **1200**.

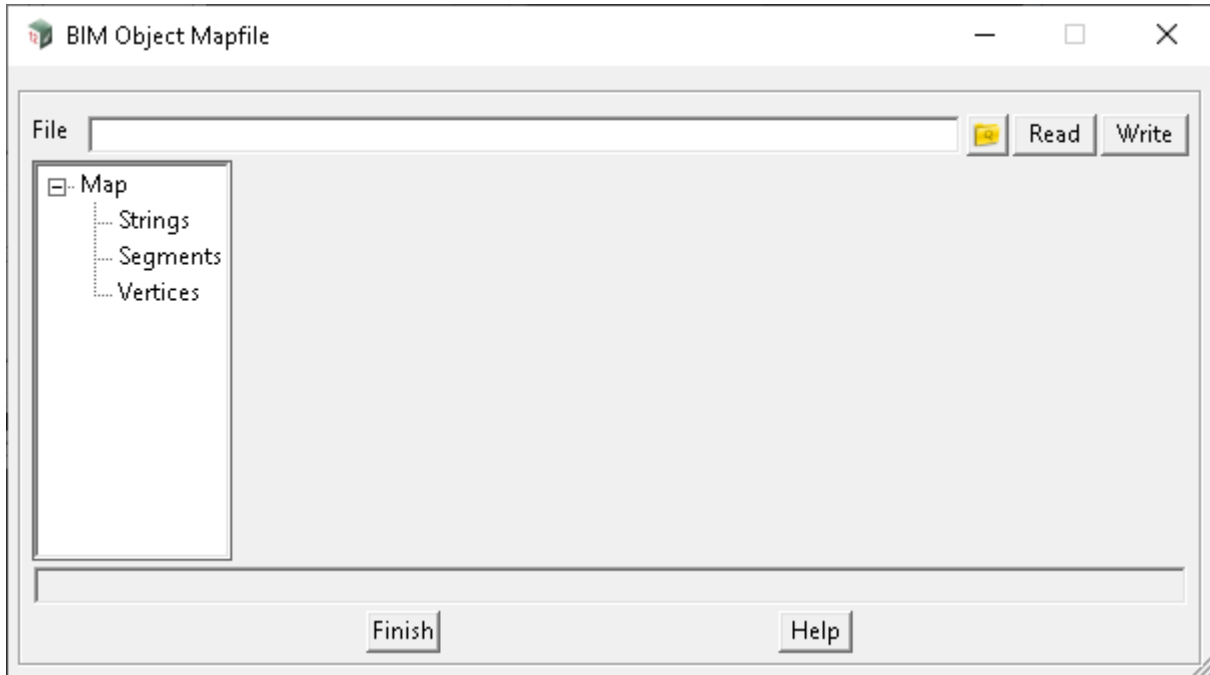


### 11.3.1.2 BIM Objects Map File

**Position of option on menu:** BIM =>Trimesh =>Create =>BIM objects map file

Now documented in the V15 reference manual

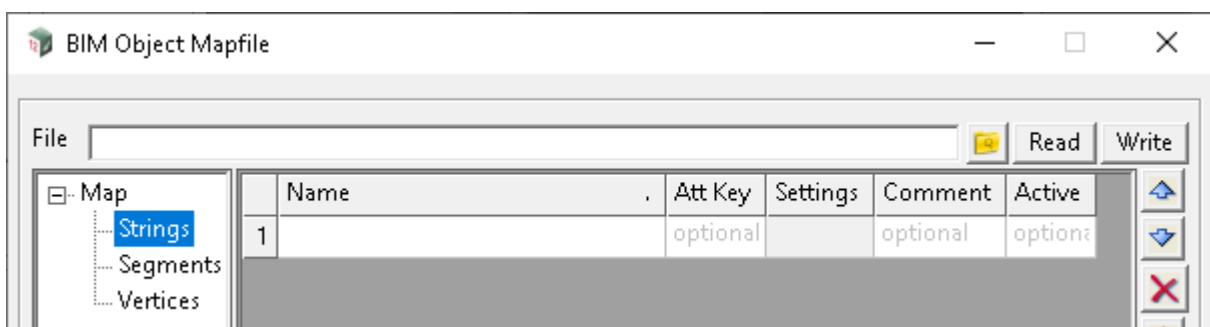
Selecting **BIM objects map file** brings up the **BIM object Mapfile** panel.

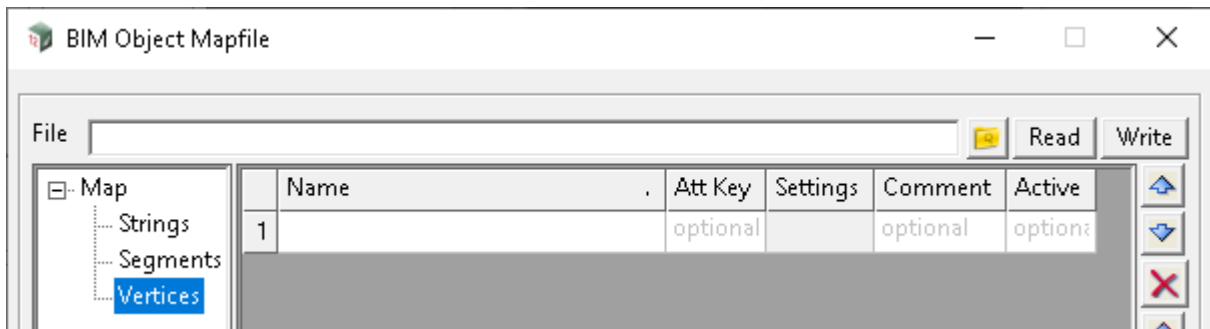
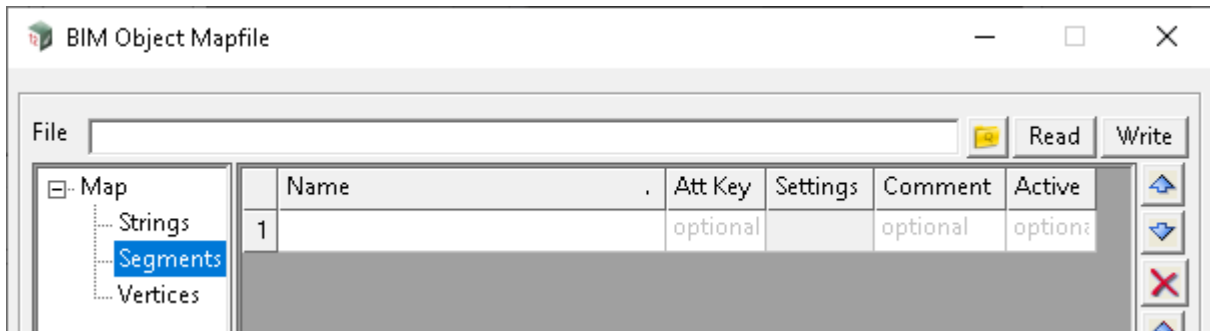


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>File</b> <i>The file to read/write.</i>	file box		*.bim_mapfile
<b>Read</b> <i>Reads a *.bim_mapfile.</i>	button		
<b>Write</b> <i>Writes a *.bim_mapfile.</i>	button		

#### String/Segment/Vertices Grid cell

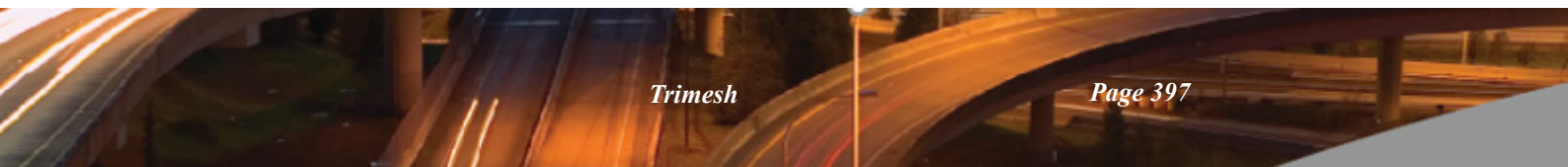




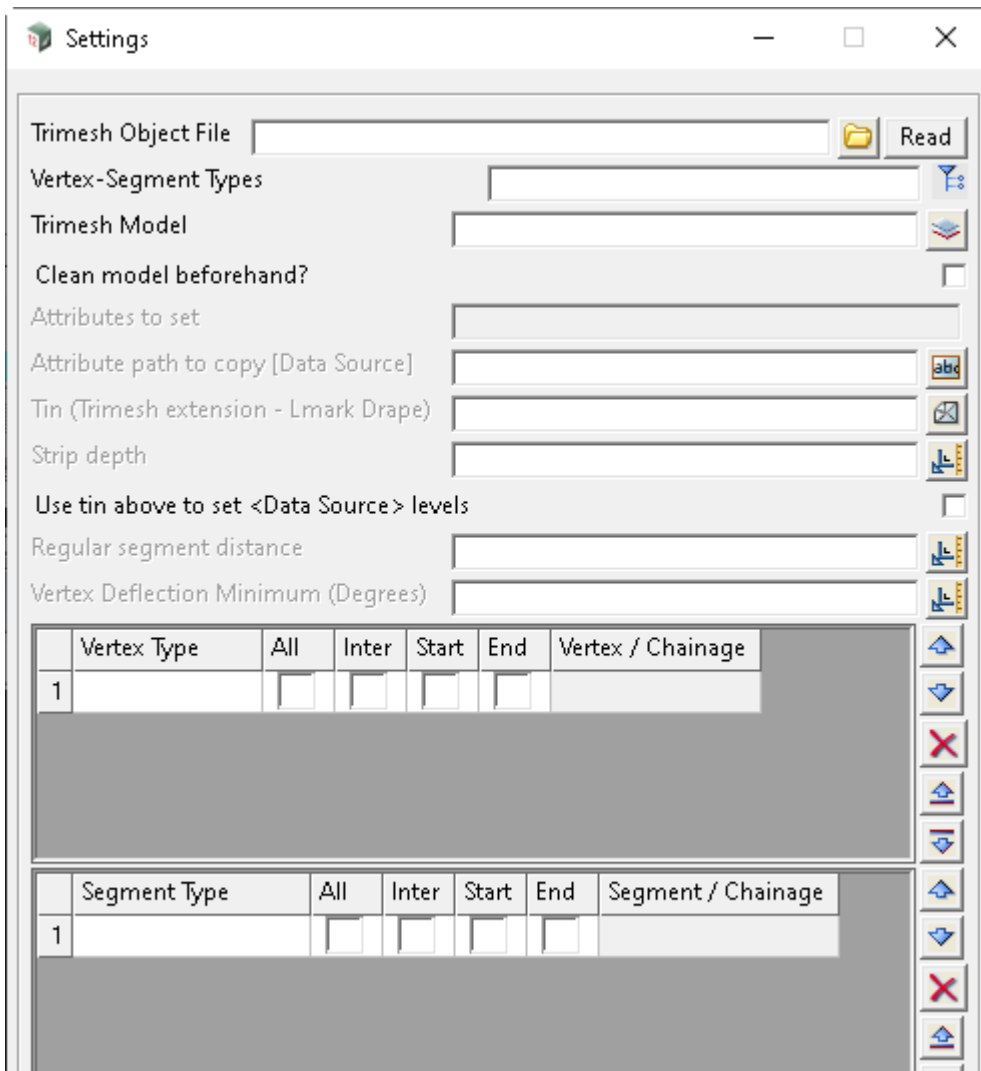
<b>Name</b>	input	.
<b>Att Key</b>	input	optional
??		
<b>Settings</b>	pop up panel	
	<i>For information on the Settings pop up panel see.</i>	
<b>Comment</b>	input	optional
??		
<b>Active</b>	input	optional
??		

**Buttons at Bottom**

<b>Finish</b>	button
	<i>Closes the BIM object mapfile panel.</i>



### 11.3.1.2.1 Settings Panel



**Trimesh Object File** file box \*.bim\_objects files  
??

**Vertex-Segment Types**  
*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).

**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 input 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 (Degreest)** real input optional

A default value is used that caters for small changes of direction along a string.

So small deflections are ignored e.g.

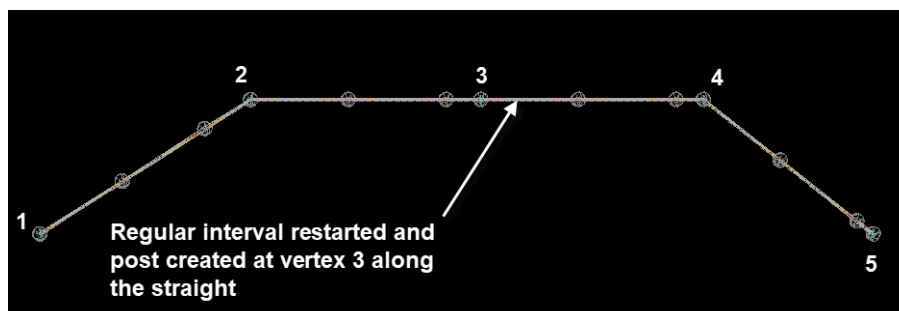
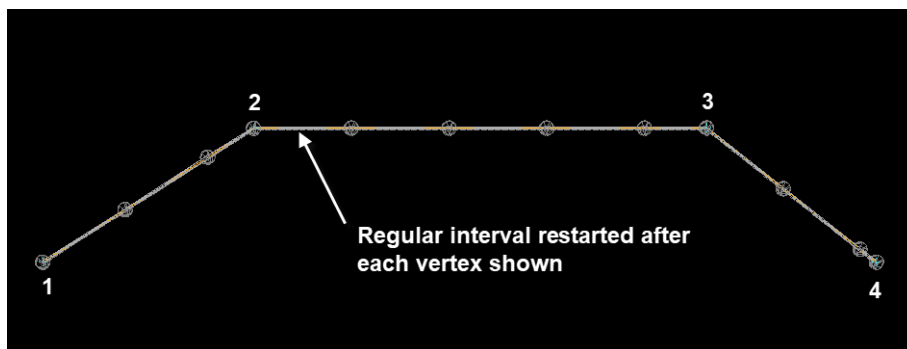
An Apply Many string (created around a large radius curve).

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.

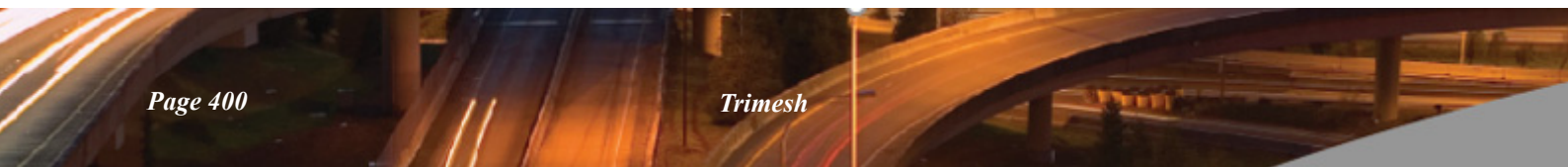
The regular segment distance is restarted after each horizontal point.

**Hint:** Particularly useful, if e.g. you require a vertex post at a HIP that falls on a straight.





Continue to [11.3.1.3 Cut and Fill Trimeshes Between Two Tins](#) or return to [11.3.1 Create Trimesh](#).



### 11.3.1.3 Cut and Fill Trimeshes Between Two Tins

**Position of option on menu:** BIM =>Create =>Cut and fill trimeshes between two tins

Now documented in the [V15 reference manual](#)

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 dialog box 'Cut and Fill Trimeshes Between Two Tins' contains the following fields and controls:

- Existing tin:** Text input field with a green trimesh icon.
- New tin:** Text input field with a green trimesh icon.
- Model for cut trimeshes:** Text input field with a blue trimesh icon.
- Cut name:** Text input field with a blue 'N' icon.
- Cut colour:** Text input field containing 'red' with a red color swatch icon.
- Model for cut trimeshes without volume:** Text input field with a blue trimesh icon.
- Combine all cut trimeshes:** Check box (unchecked).
- Model for fill trimeshes:** Text input field with a blue trimesh icon.
- Fill name:** Text input field with a blue 'N' icon.
- Fill colour:** Text input field containing 'green' with a green color swatch icon.
- Model for fill trimeshes without volume:** Text input field with a blue trimesh icon.
- Combine all fill trimeshes:** Check box (unchecked).
- Extra settings:**
  - Ignore trimeshes with volume less than:** Text input field with a blue trimesh icon.
  - Model for small volume trimeshes:** Text input field with a blue trimesh icon.
  - Cut or fill type attribute:** Text input field with an 'ab' icon.
  - Existing tin attribute:** Text input field with an 'ab' icon.
  - New tin attribute:** Text input field with an 'ab' icon.
  - Clean trimeshes models beforehand:** Check box (unchecked).
- Polygon options:**
  - Use a polygon:** Radio button (selected). Includes a 'Polygon' text input field with a blue trimesh icon.
  - Use a model of polygons:** Radio button (unselected). Includes a 'Model' text input field with a blue trimesh icon.

Buttons at the bottom: **Create**, **Finish**, **Help**.

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

Field Description	Type	Defaults	Pop-Up
<b>Existing tin</b> <i>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.</i>	tin box		available tins
<b>New tin</b> <i>Name of the tin to be considered the design or modified surface.</i>	tin box		available tins
<b>Model for cut trimeshes</b> <i>Model for the resulting cut trimeshes.</i>	model box		available models
<b>Cut name</b> <i>Name for the cut trimeshes.</i>	name box		names.4d
<b>Cut colour</b> <i>Colour of the resulting cut trimeshes.</i>	colour box		available models
<b>Model for cut trimeshes without volume</b> <i>If a trimesh does not closed then it will have no volume. If <b>not blank</b> any cut trimeshes that are not closed will be added to this model. <i>Note: this is for checking if there are any ill-formed trimeshes.</i></i>	model box		available models
<b>Combine all cut trimeshes</b> <i>If <b>ticked</b>, all the cut trimeshes will combined into the one trimesh.</i>	tick box		not ticked
<b>Model for fill trimeshes</b> <i>Model for the resulting fill trimeshes.</i>	model box		available models
<b>Fill name</b> <i>Name for the fill trimeshes.</i>	name box		names.4d
<b>Fill colour</b> <i>Colour of the resulting fill trimeshes.</i>	colour box		available models
<b>Model for fill trimeshes without volume</b> <i>If a trimesh does not closed then it will have no volume. If <b>not blank</b> any fill trimeshes that are not closed will be added to this model. <i>Note: this is for checking if there are any ill-formed trimeshes.</i></i>	model box		available models
<b>Combine all fill trimeshes</b> <i>If <b>ticked</b>, all the fill trimeshes will combined into the one trimesh.</i>	tick box		not ticked
<b>Extra settings</b>			
<b>Ignore trimeshes with volume less than</b> <i>If <b>not blank</b>, all cut and fill trimeshes with volume less than this value will not be added to the cut and fill models.</i>	real box		
<b>Model for small volume trimeshes</b> <i>If <b>not blank</b> any trimesh with volume less than <b>Ignore trimeshes with volume less</b> that will be added to this model.</i>	model box		available models
<b>Clean trimeshes models beforehand</b> <i>If <b>ticked</b>, the models are cleaned before the cut and fill calculations are done.</i>	tick box	not ticked	

## 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 [3.25.13 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

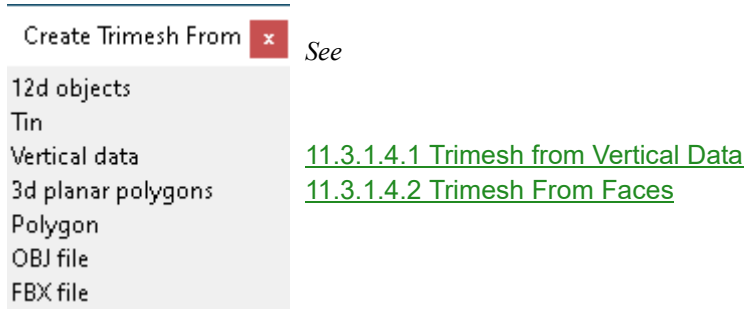
*The option is run when **Create** is pressed.*

Continue to [11.3.1.4 Create Trimesh From](#) or return to [11.3.1 Create Trimesh](#).

### 11.3.1.4 Create Trimesh From

**Position of option on menu:** BIM =>Trimesh =>Create =>From

All the options on this menu were in **V14**.



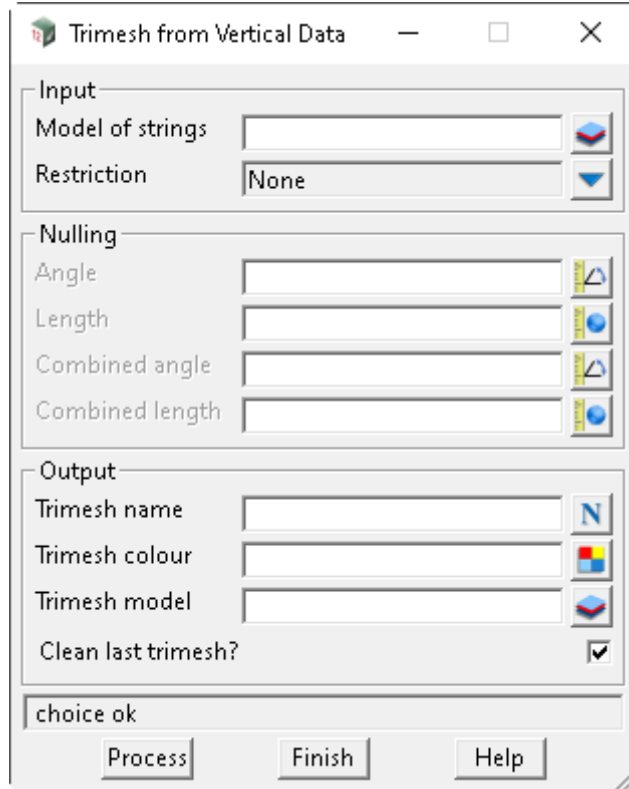


### 11.3.1.4.1 Trimesh from Vertical Data

Position of option on menu: BIM =>Trimesh =>Create =>From =>Vertical data

Now documented in the V15 reference manual

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
<b>Input</b>			
<b>Model of strings</b>	model box		available models
<i>Model of super strings that contain the points to create the trimesh from.</i>			
<b>Restriction</b>	choice box	None	None, 2 Points
<i>If <b>None</b>, do not exclude input points from the trimesh triangulation.</i>			
<i>If <b>2 Points</b>, exclude input points from the trimesh triangulation if they cannot be dropped perpendicularly to the user defined 2 point line.</i>			



*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

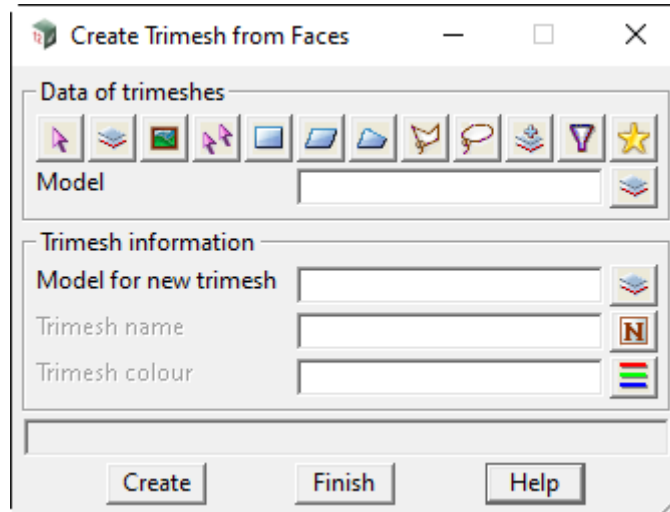
*Process the option.*

### 11.3.1.4.2 Trimesh From Faces

Position of option on menu:

Now documented in the V15 reference manual

Selecting Create Trimesh from Faces displays the **Create Trimesh from Faces** 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.*

#### Trimesh information

<b>Model for new trimesh</b>	model box		available models
<i>Model for the created trimesh.</i>			

<b>Trimesh name</b>	name box		
<i>Name for the created trimesh.</i>			

<b>Trimesh colour</b>	colour box		available colours
<i>Colour for the created trimesh.</i>			

#### Buttons at bottom

<b>Create</b>	button		
<i>Create trimesh.</i>			

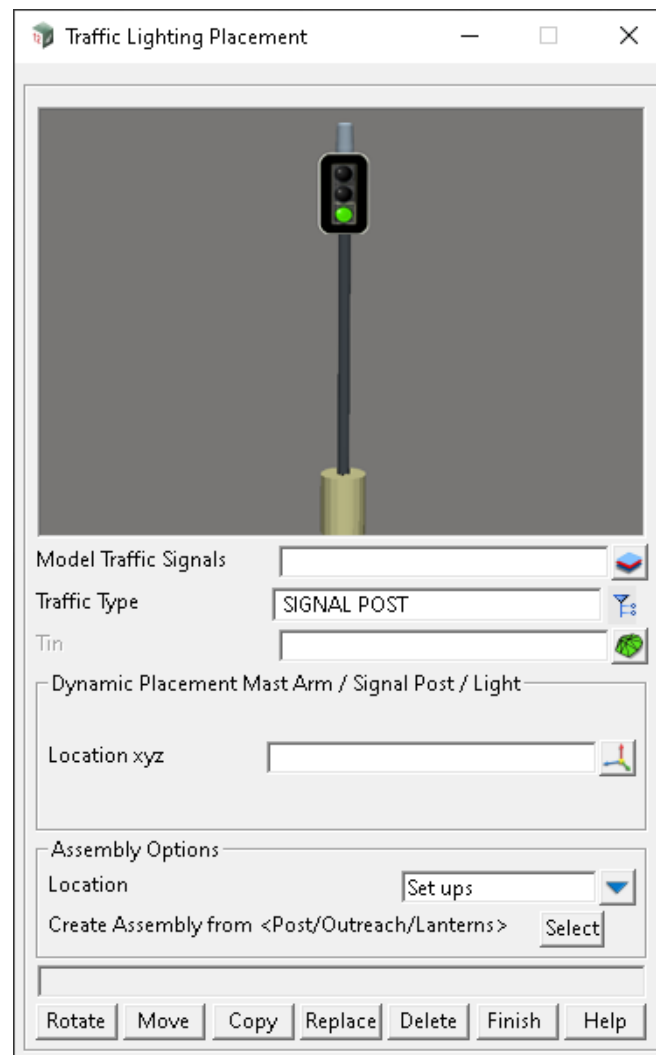
### 11.3.1.5 Trimesh Traffic Signals

**Position of option on menu:** BIM =>Trimesh =>Create =>Traffic signals

Now documented in the V15 reference manual

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
<b>Model Traffic Signals</b>	model box		available models

*Model to place signals on.*

<b>Traffic type</b>	choice box	SIGNAL POST	
---------------------	------------	-------------	--

*Selection of signals posts, outreach and lanterns.*

<b>Tin</b>	tin box		
------------	---------	--	--

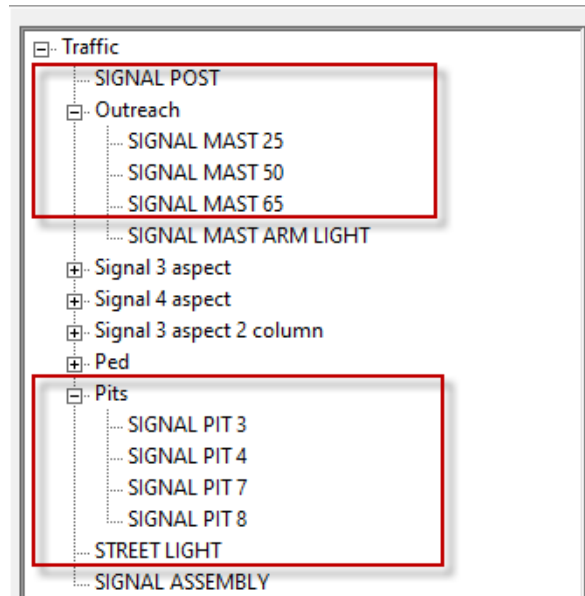
*If tin is used then the level insert selection point is taken from the tin, otherwise a selection with a valid x,y and z is required.*

## Dynamic Placement (Mast Arm/Signal Post and Light)

**Location xyz** pick

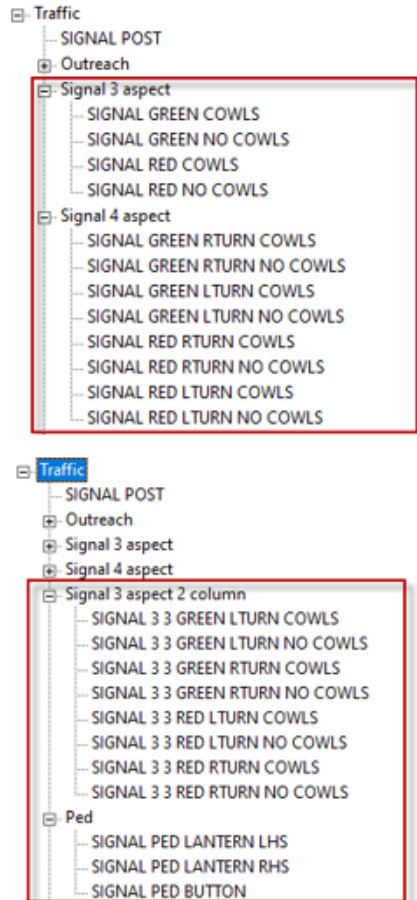
*The Traffic types below require a "Location xyz".*

*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.*



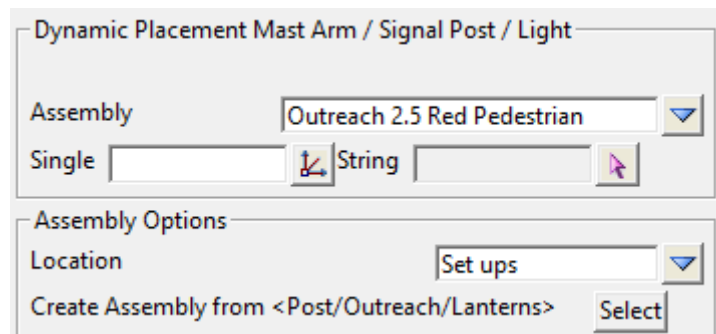
**Select Arm, Post or Light** pick

*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

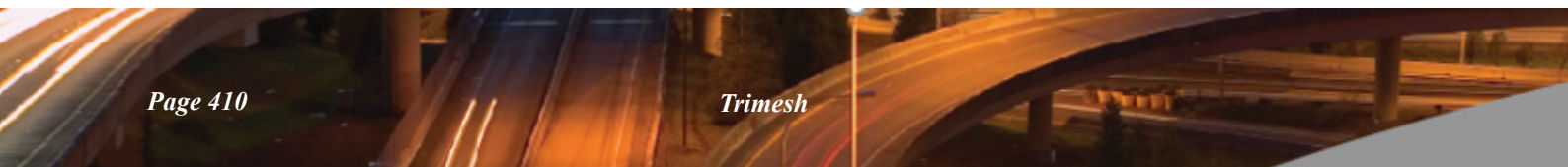
*Choice list from the location option under Assembly Options.*

**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.*

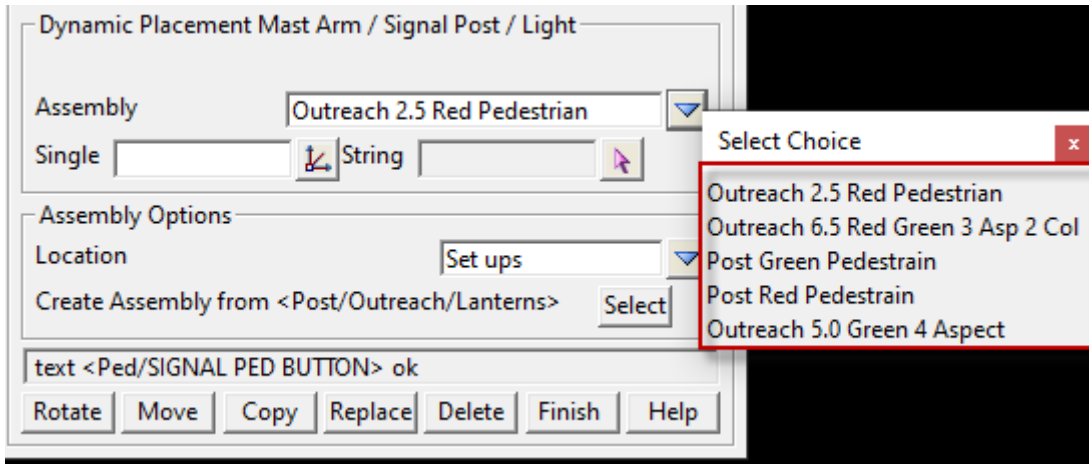
*Assembly file: 12d\_Traffic\_Assembly.*

### Create Assembly from <Post/Outreach/Lanterns>

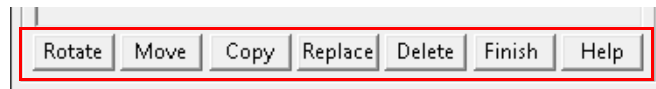
**Select** button

*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.*

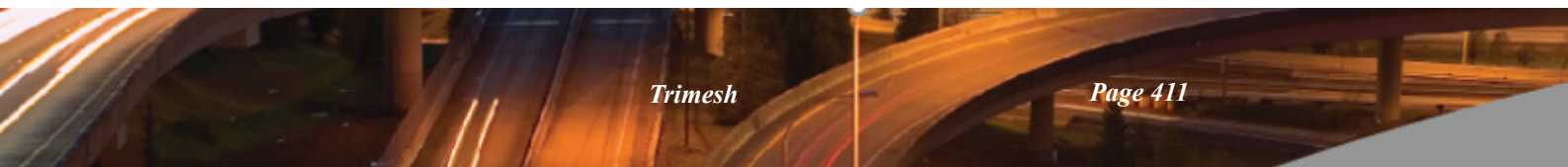
*A valid xyz point is required as the final position.*

**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

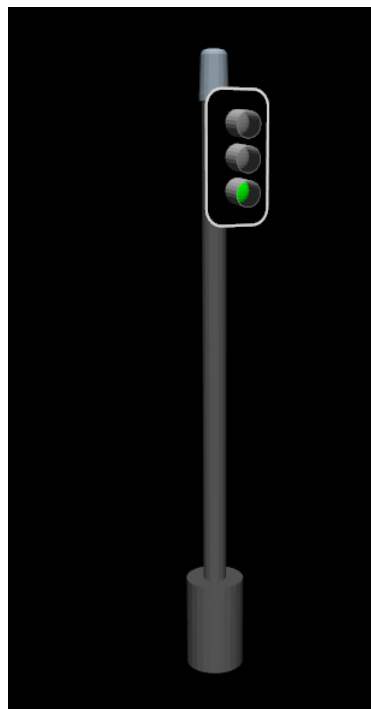
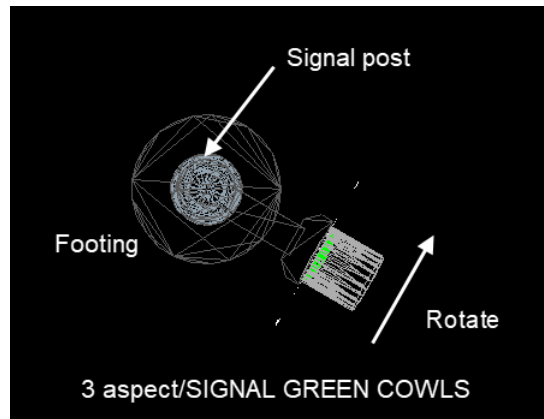


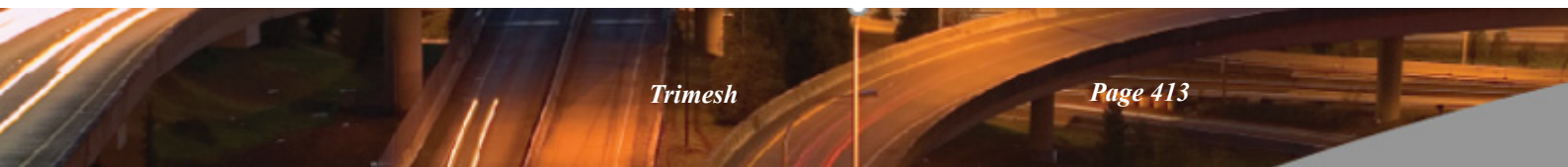
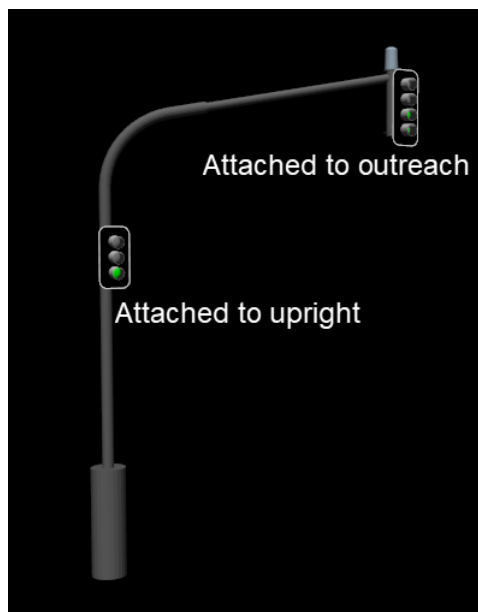
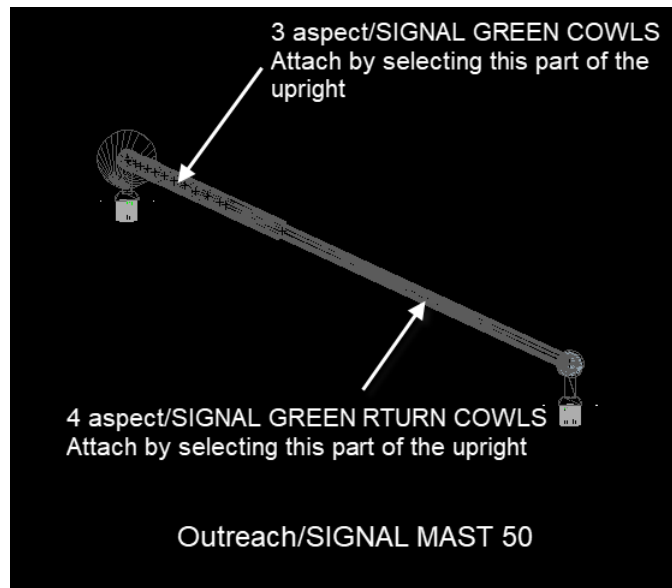
*Parts of the entire signal assembly, can be replaced by another.  
e.g., a 3-phase lantern could be replaced with a 4 phase etc.*

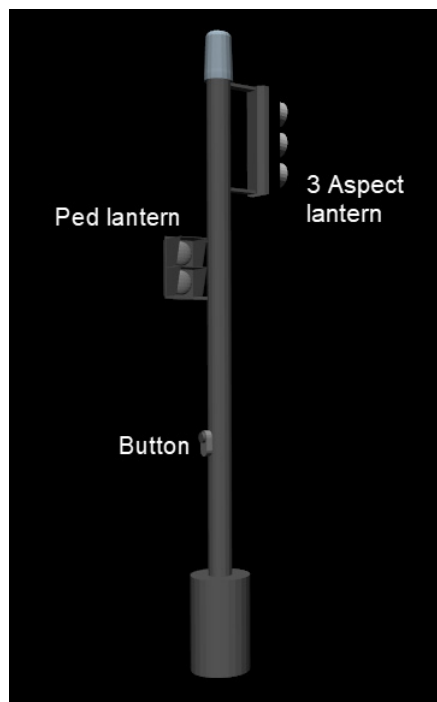
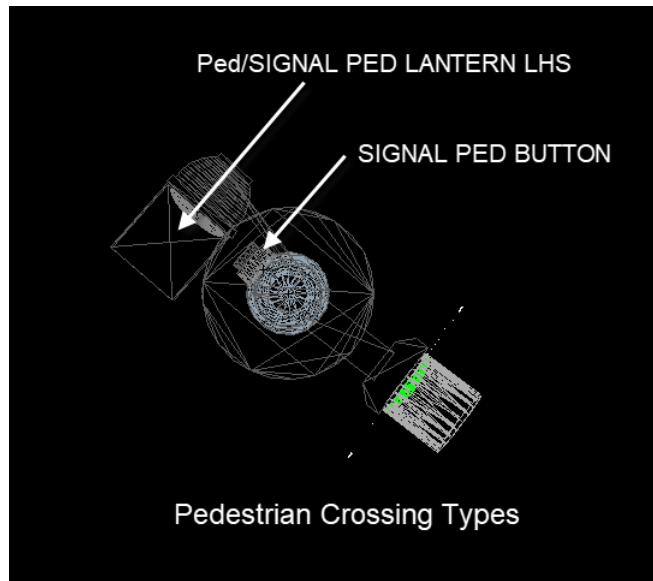
**Delete** button

*Individual parts can be deleted from a signal assembly, already placed.*

### General Placement



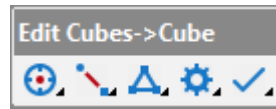




## 11.3.2 Trimesh Editor

Now documented in the V15 reference manual

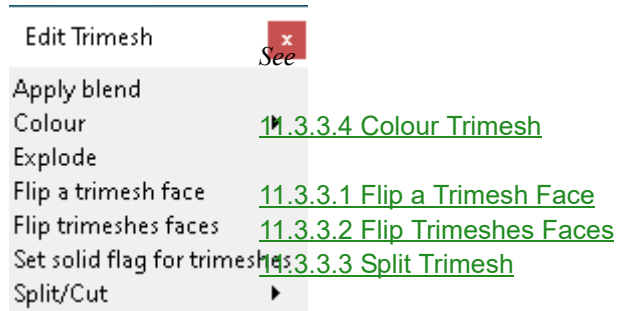
The **Undo** and **Redo** buttons have been removed from the **Trimesh Editor** toolbar.



## 11.3.3 Trimesh Edit

Position of option on menu: **BIM =>Trimesh =>Edit**

The Edit Trimesh options edits trimeshes directly.



Continue to [11.3.3.1 Flip a Trimesh Face](#) or return to [11.3.3 Trimesh Edit](#).



### 11.3.3.1 Flip a Trimesh Face

**Position of menu:** BIM =>Trimesh =>Edit =>Flip a trimesh face

Now documented in the [V15 reference manual](#)

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.*

<b>Trimesh</b>	trimesh pick box		
----------------	------------------	--	--

*If the **Select** icon is pressed, the user then picks the face of 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.*

<b>Face number</b>	integer box		
--------------------	-------------	--	--

*The number of the face in the trimesh given in the **Trimesh** field. This value can be changed.*

<b>Flip</b>	button		
-------------	--------	--	--

*When **Flip** is pressed, the face **Face number** of the trimesh given in the **Trimesh** field, is reversed.*

<b>Flip all</b>	button		
-----------------	--------	--	--

*When **Flip all** is pressed, all the faces of the trimesh given in the **Trimesh** field are reversed.*

<b>Select &amp; flip</b>	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 [11.3.3.2 Flip Trimeshes Faces](#) or return to [11.3.3 Trimesh Edit](#).

### 11.3.3.2 Flip Trimeshes Faces

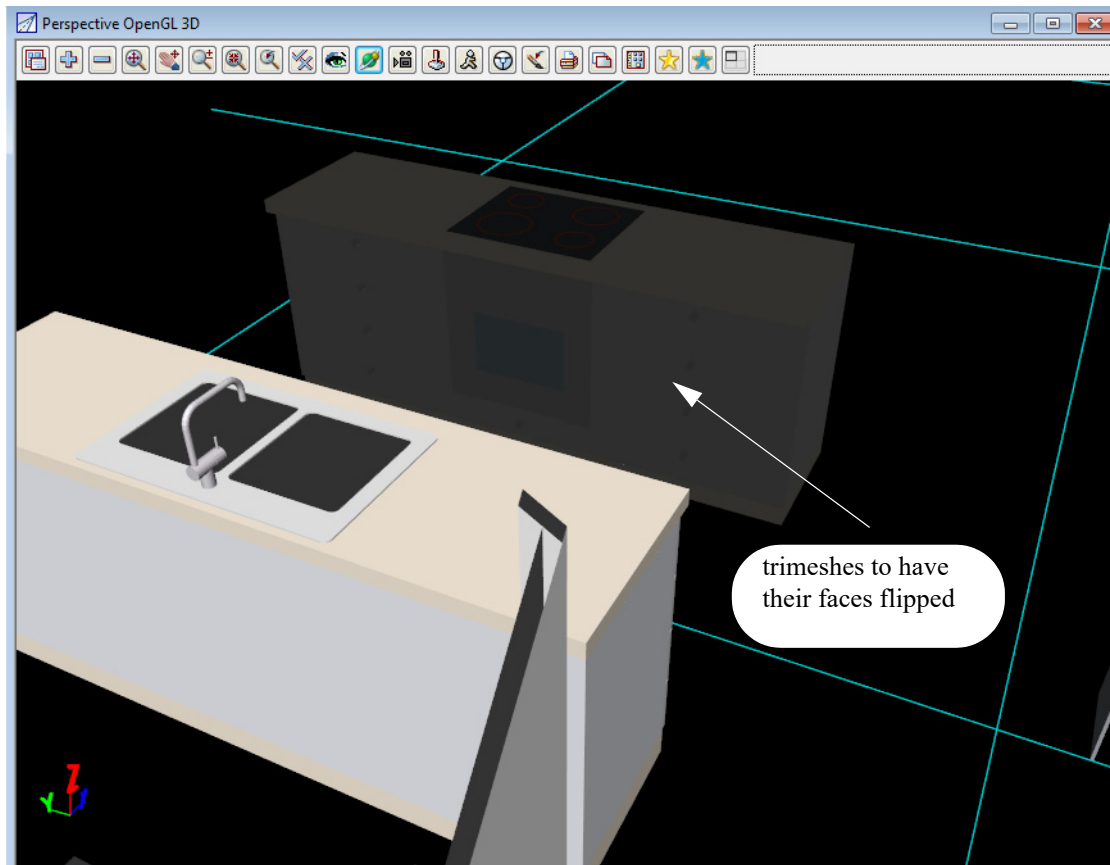
**Position of menu:** BIM =>Trimesh =>Edit =>Flip trimeshes faces

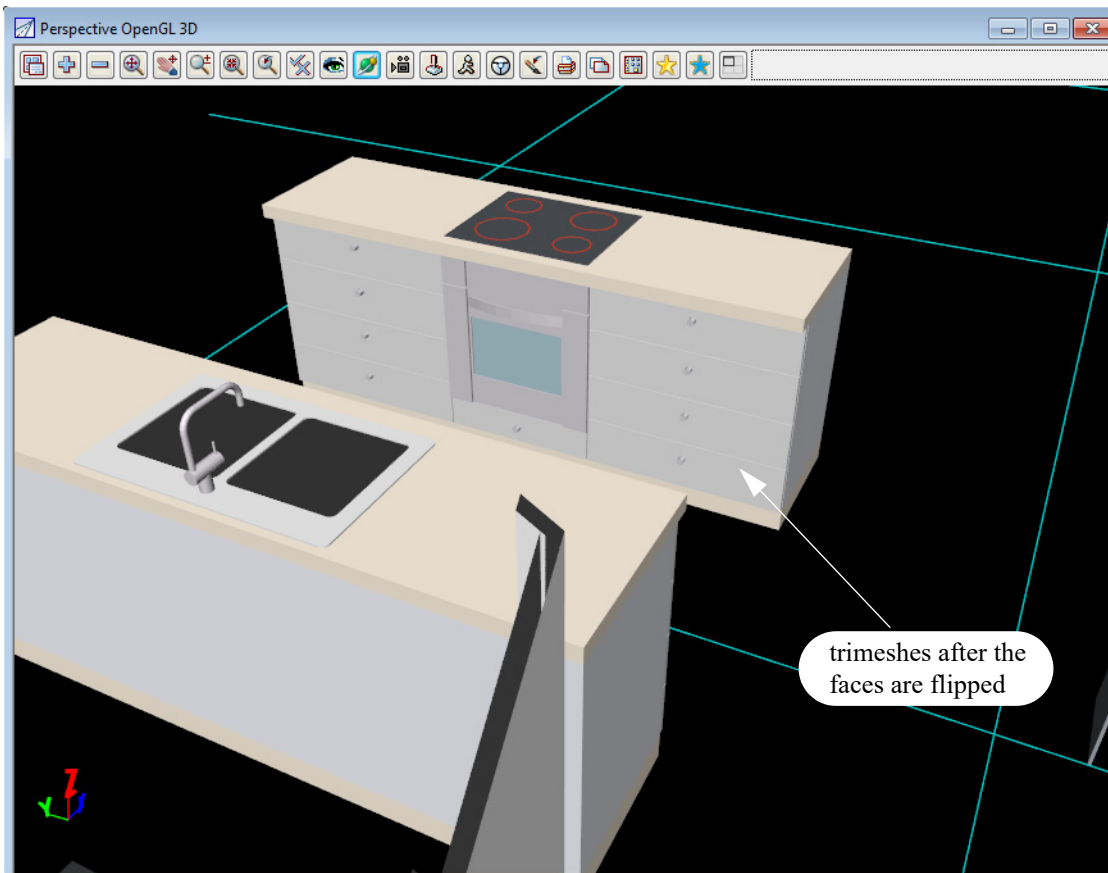
Now documented in the V15 reference manual

This option reverses the order of the vertices in **all** the triangles in a trimesh.

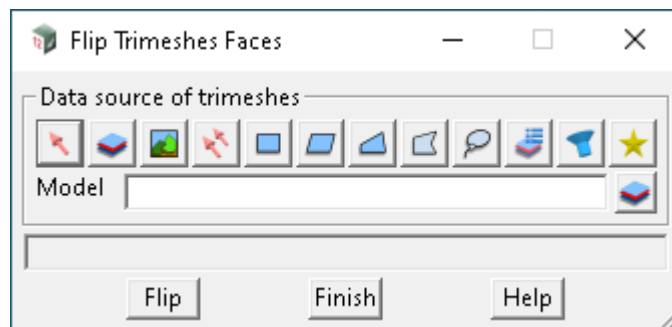
This is often needed when the triangles in the trimesh are ordered the wrong way and the normal to the triangles face inward instead of outward.

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
-------------------	------	----------	--------

<b>Data source of trimeshes</b>	data source		
---------------------------------	-------------	--	--

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Data source of trimeshes to be have all their faces flipped.*

<b>Flip</b>	button		
-------------	--------	--	--

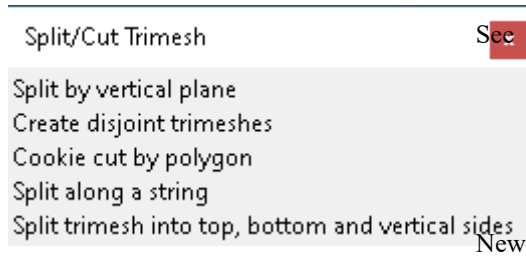
*Reverse the order of the vertices in all the triangles in the selected trimeshes.*

Continue to [11.3.3.3 Split Trimesh](#) or return to [11.3.3 Trimesh Edit](#).

### 11.3.3.3 Split Trimesh

**Position of option on menu:** BIM =>Trimesh =>Edit =>Split/Cut

These options are for splitting trimeshes into smaller trimeshes etc.




Continue to [11.3.3.4 Colour Trimesh](#) or return to [11.3.3.3 Split Trimesh](#).

### 11.3.3.4 Colour Trimesh

**Position of option on menu:** BIM =>Trimesh =>Edit => Colour

These options are to colour trimeshes.

Colour Trimesh		See
Colour by slope		<a href="#">11.3.3.4.1 Colour Trimesh By Slope</a>
Colour by aspect		<a href="#">11.3.3.4.2 Colour Trimesh by Aspect</a>
Replace colour by colour		
Colour sides		<a href="#">11.3.3.4.3 Colour Trimesh Sides</a>

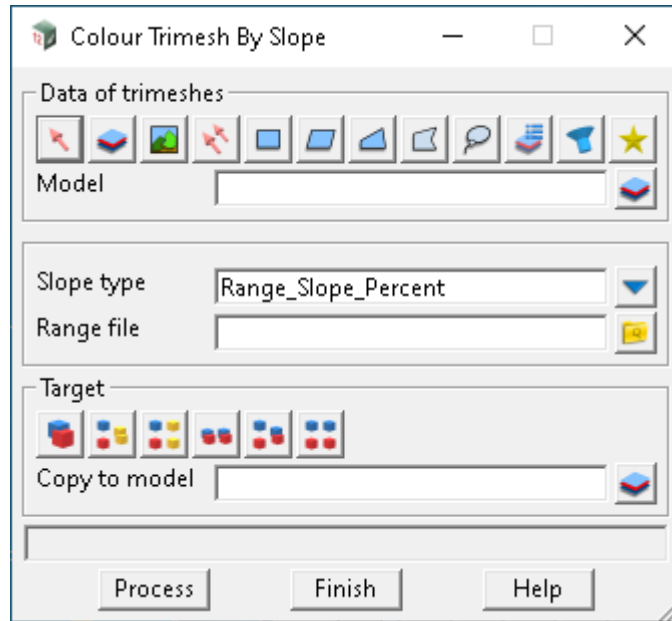
### 11.3.3.4.1 Colour Trimesh By Slope

**Position of option on menu:** BIM =>Trimesh =>Edit =>Colour =>Colour by slope

Now documented in the V15 reference manual

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 [3.25.3 Data Source](#).*

<b>Selected data source</b>	Input	Model
-----------------------------	-------	-------

*Data source*

<b>Slope type</b>	choice box	Range_Slope_Percent, Range_Slope_1v in, Range_Slope_Degrees
-------------------	------------	---

*The units used for slope in the range file.*

<b>Range file</b>	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 [3.25.3 Data Source](#).*

<b>Target info</b>	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 [11.3.3.4.2 Colour Trimesh by Aspect](#) or return to [11.3.3.4 Colour Trimesh](#).

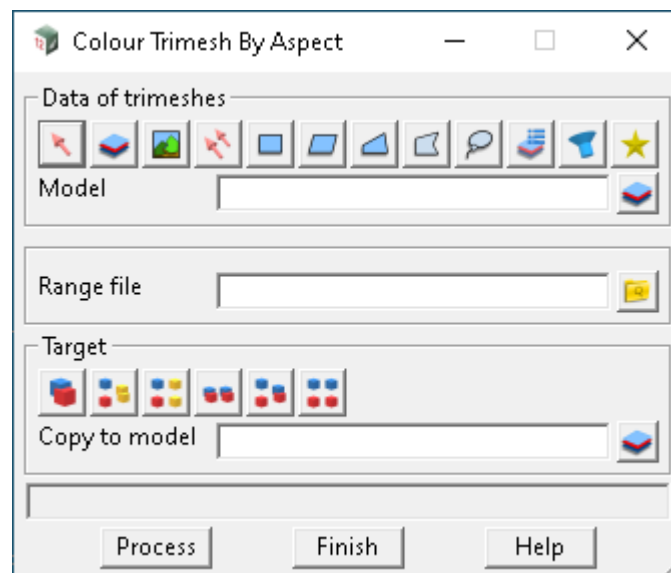
### 11.3.3.4.2 Colour Trimesh by Aspect

**Position of option on menu:** BIM =>Trimesh =>Edit =>Colour =>Colour by aspect

Now documented in the [V15 reference manual](#)

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 [3.25.3 Data Source](#).*

<b>Selected data source</b>	Input	Model
-----------------------------	-------	-------

*Data source*

<b>Range file</b>	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 [3.25.3 Data Source](#).*

<b>Target info</b>	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

<b>Process</b>	button
----------------	--------

*The option is run when **Process** is pressed.*

Continue to [11.3.3.4.3 Colour Trimesh Sides](#) or return to [11.3.3.4 Colour Trimesh](#).

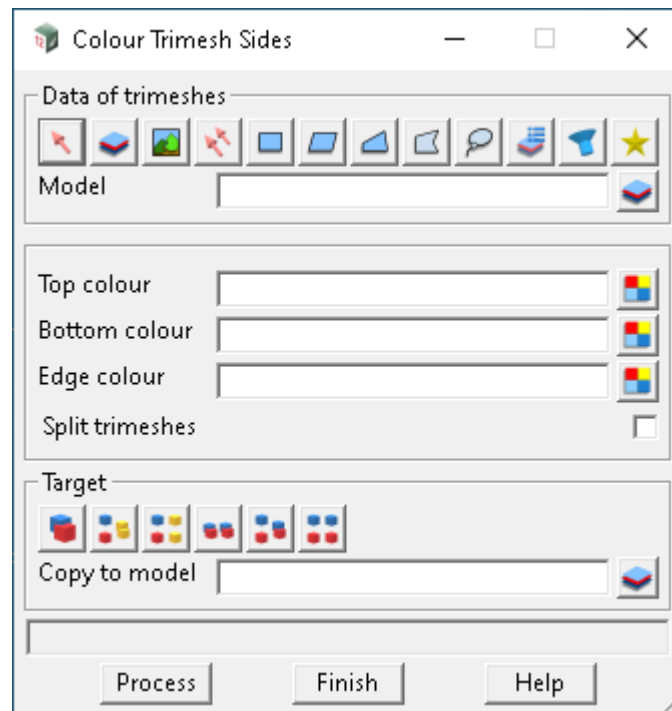
### 11.3.3.4.3 Colour Trimesh Sides

**Position of option on menu:** BIM =>Trimesh =>Edit =>Colour =>Colour sides

Now documented in the V15 reference manual

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 [3.25.3 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 [3.25.3 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 [11.3.4 Convert Trimesh](#) or return to [11.3.3.4 Colour Trimesh](#).

## 11.3.4 Convert Trimesh

**Position of option on menu:** BIM =>Trimesh =>Edit => Colour

These options that work on trimeshes.

Convert Trimeshes		See
Explode		
Create trimesh spines		<a href="#">11.3.4.1 Get Spines from Trimeshes</a>
Get strings from trimesh edges		
Get strings from un-named trimesh edges		
Set trimesh edge info by strings		
Top/bottom tin from trimeshes		<a href="#">11.3.4.2 Top and Bottom Tins From Trimeshes</a>
Trimesh section to plan		
Convert to polymesh		<a href="#">11.3.4.3 Convert Trimesh to Polymesh</a>
Convert named faces to polymesh		<a href="#">11.3.4.4 Convert Trimesh Named Faces to Polymesh</a>

### 11.3.4.1 Get Spines from Trimeshes

**Position of menu:** BIM =>Trimesh =>Convert =>Create trimesh spine

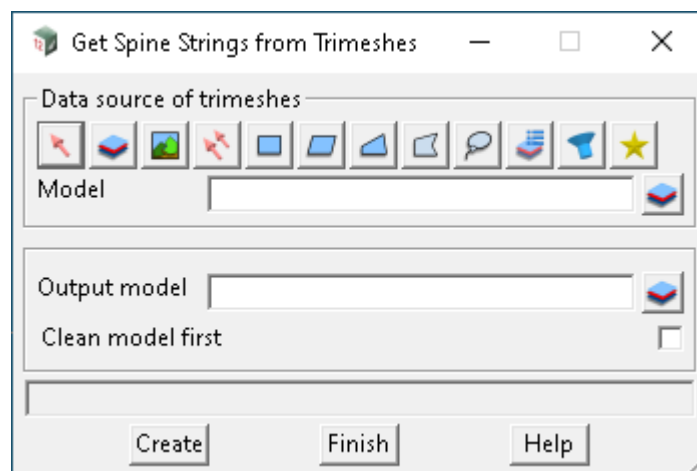
Now documented in the V15 reference manual

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 best 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
-------------------	------	----------	--------

<b>Data source of trimeshes</b>	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 [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of trimeshes.*

<b>Output model</b>	model box		available models
---------------------	-----------	--	------------------

*The model to put the created spine strings into.*

<b>Clean model first</b>	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*

<b>Create</b>	button		
---------------	--------	--	--

*The option is run when **Create** is pressed.*

Continue to [11.3.4.2 Top and Bottom Tins From Trimeshes](#) or return to [11.3.4 Convert Trimesh](#).



### 11.3.4.2 Top and Bottom Tins From Trimeshes

**Position of option on menu:** BIM =>Trimesh =>Convert =>Top/bottom tin from trimesh

Now documented in the V15 reference manual

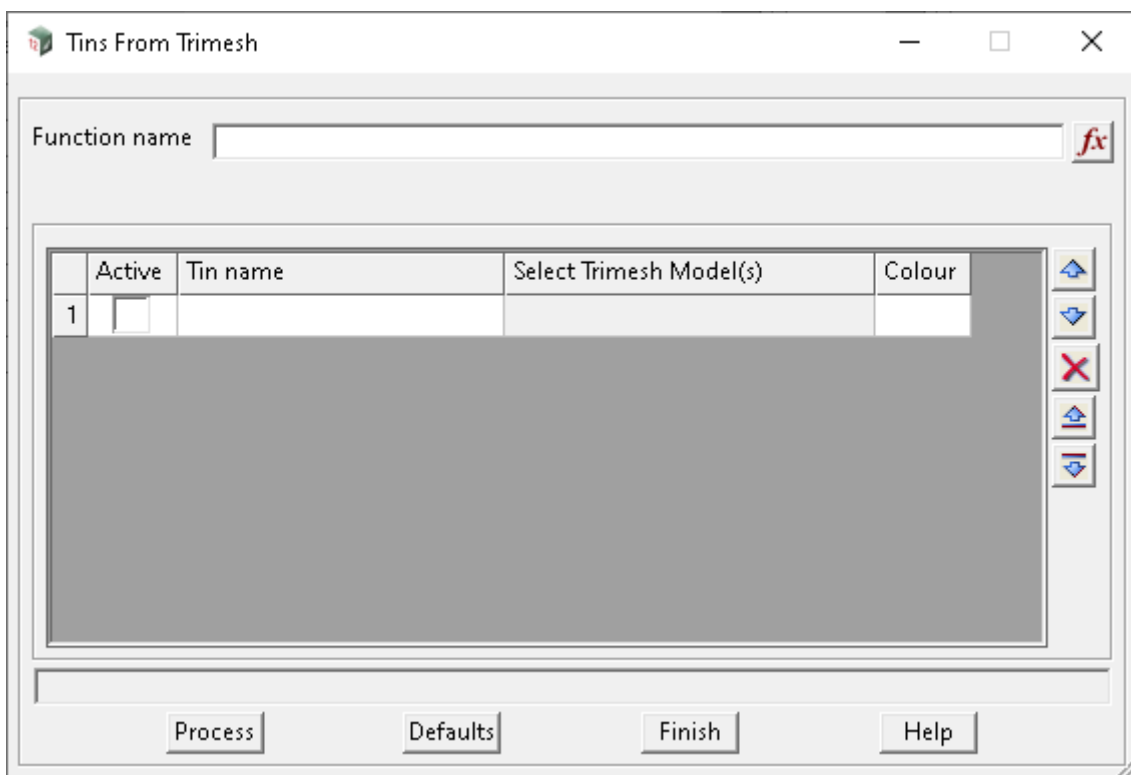
Trimeshes are now often created, or provided from another source, for many objects including the various pavement layers for a road.

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.*

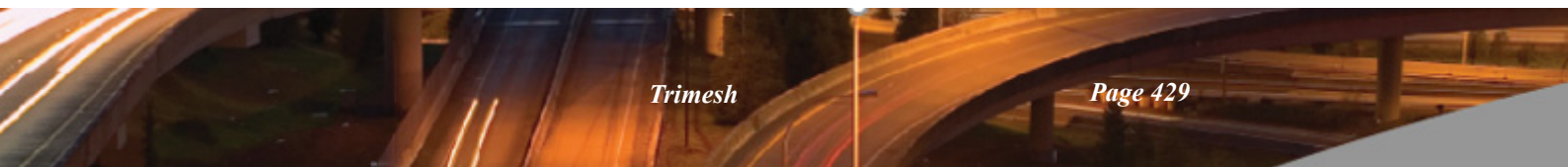
**Main Grid information**

**Active**                                      toggle

*Make line in grid active or inactive.*

**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

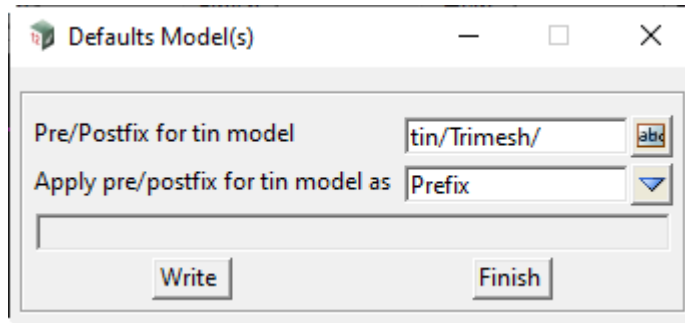
*Click in this column to bring up the **Trimesh Selection** grid to define the trimeshes used to create the tin or this row. See [11.3.4.2.1 Trimesh Selection Panel](#).*

**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**

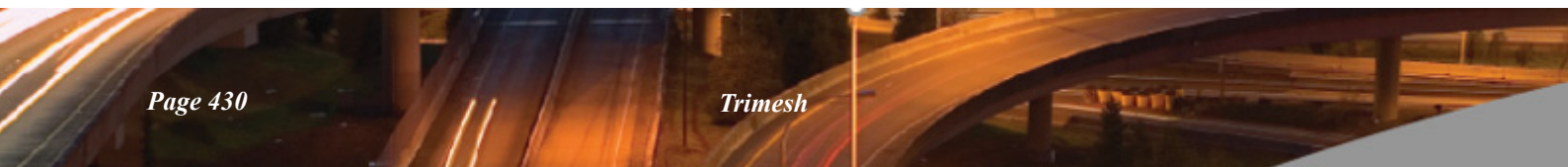
**Write**    button

*Defaults entered will be written to the <.project> folder*

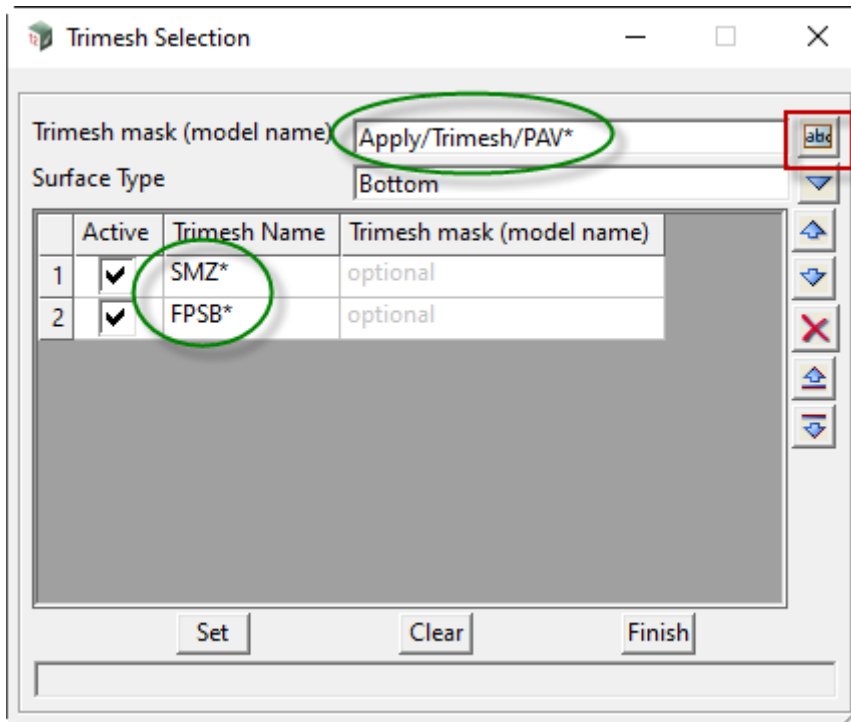
***Tins\_From\_Trimesh\_Panel.def***

*This file can be copied into the \$user folder, as a default.*

Continue to [11.3.4.2.1 Trimesh Selection Panel](#) or return to [11.3.4 Convert Trimesh](#).



### 11.3.4.2.1 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

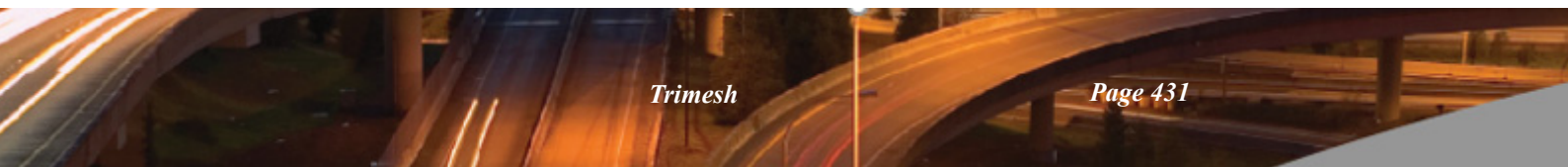
*Can be used instead of any global model entered previously.*

*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 [11.3.4.3 Convert Trimesh to Polymesh](#) or return to [11.3.4 Convert Trimesh](#).

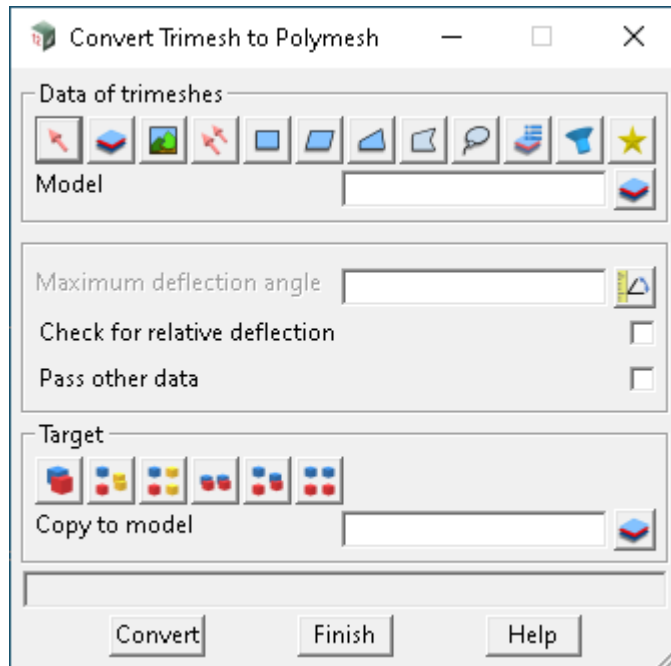
### 11.3.4.3 Convert Trimesh to Polymesh

**Position of option on menu:** BIM =>Trimesh =>Convert =>Convert to polymesh

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data of trimeshes</b>	source box	mode	
<i>Trimeshes to process. For more info <a href="#">3.25.3 Data Source</a>.</i>			

<b>Selected data source</b>	input	Model	
<i>Source of data to process.</i>			

<b>Check for relative deflection</b>	tick box	not ticked	
<i>If ticked,??</i>			

<b>Maximum deflection angle</b>	angle box	0	measures menu
<i>??</i>			
<i>Target type</i>			

*Sets where the processed data goes to. For a full description go to [3.25.3 Data Source](#).*

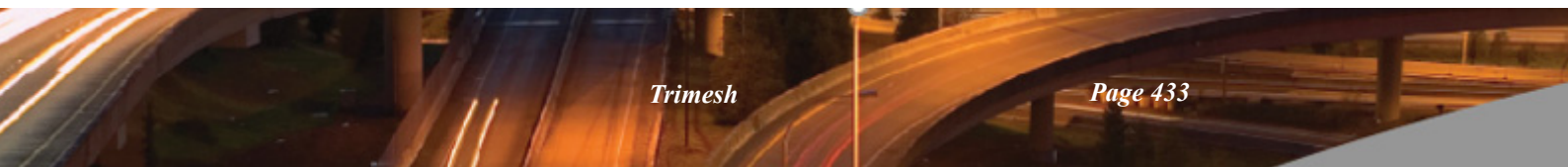
<b>Target info</b>	input	Copy to model	
--------------------	-------	---------------	--

*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

<b>Convert</b>	button
----------------	--------

*Run the option.*



Continue to [11.3.4.4 Convert Trimesh Named Faces to Polymesh](#) or return to [11.3.4 Convert Trimesh](#).



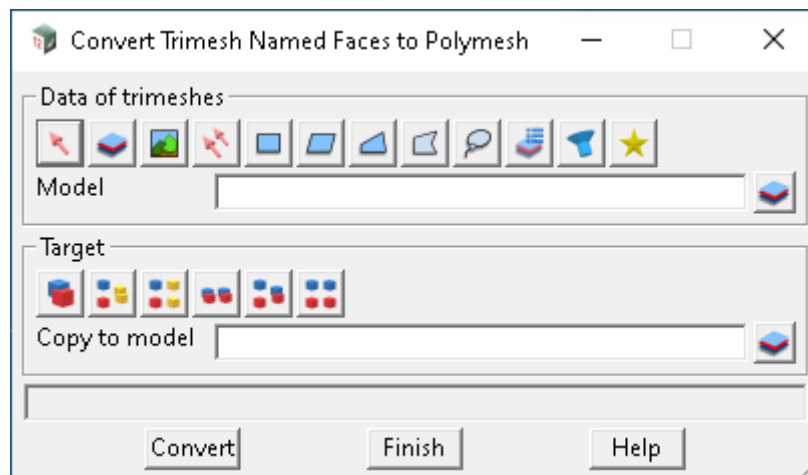
### 11.3.4.4 Convert Trimesh Named Faces to Polymesh

**Position of option on menu:** BIM =>Trimesh =>Convert =>Convert named faces to polymesh

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data of trimeshes</b>	source box	mode	
--------------------------	------------	------	--

*Trimeshes to process. For more info [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to process.*

#### Target type

*Sets where the processed data goes to. For a full description go to [3.25.3 Data Source](#).*

<b>Target info</b>	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

<b>Convert</b>	button	
----------------	--------	--

*Run the option*

Continue to [11.3.5 Trimesh Union/Difference](#) or return to [11.3.4 Convert Trimesh](#).

## 11.3.5 Trimesh Union/Difference

Position of option on menu: BIM =>Trimesh =>Union/Difference



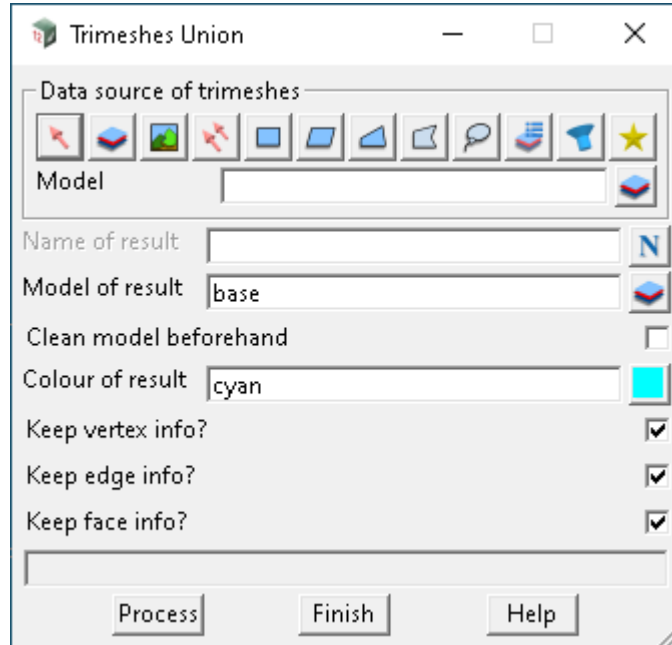
### 11.3.5.1 Trimeshes Union

**Position of option on menu:** BIM =>Trimesh =>Union/Difference =>Trimeshes union

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data source of trimeshes</b>		Model	
---------------------------------	--	-------	--

*Data selection of trimeshes - for a full description go to [3.25.3 Data Source](#).*

<b>Data source</b>	input		
--------------------	-------	--	--

*Data source of trimeshes to union.*

<b>Name of result</b>	names box	CAD name	names.4d
-----------------------	-----------	----------	----------

*Name of the resulting trimesh.*

<b>Model of result</b>	model box	CAD model	available models
------------------------	-----------	-----------	------------------

*Model for the resulting trimesh.*

<b>Colour of result</b>	colour box	CAD colour	available models
-------------------------	------------	------------	------------------

*Colour of the resulting trimesh.*

<b>Keep vertex info</b>	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.*

<b>Keep edge info</b>	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.*

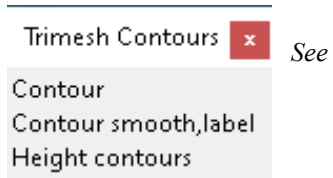
Continue to [11.3.6 Contour Trimeshes](#) or return to [11.3.5 Trimesh Union/Difference](#).

## 11.3.6 Contour Trimeshes

**Position of option on menu:** BIM =>Trimesh =>Contours

This menu is the same as in V14

.

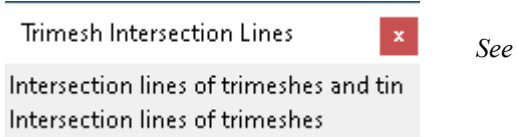


Continue to [11.3.7 Trimesh Intersection Lines](#) or return to [11.3 Trimesh](#).

## 11.3.7 Trimesh Intersection Lines

**Position of option on menu:** BIM =>Trimesh =>Intersection Lines

This menu is the same as in **V14**.

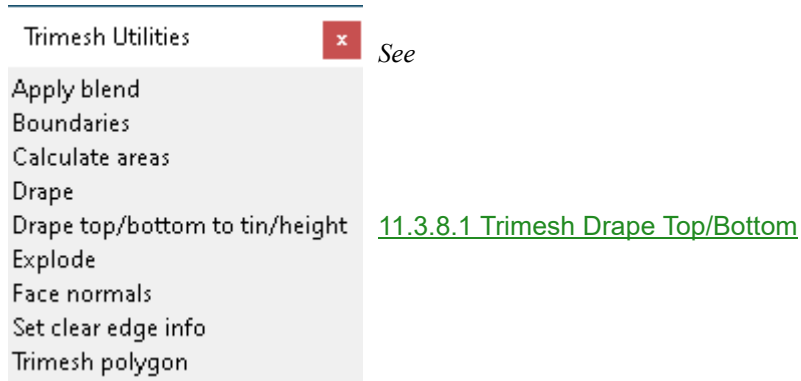


Continue to [11.3.8 Trimesh Utilities](#) or return to [11.3.7 Trimesh Intersection Lines](#).



## 11.3.8 Trimesh Utilities

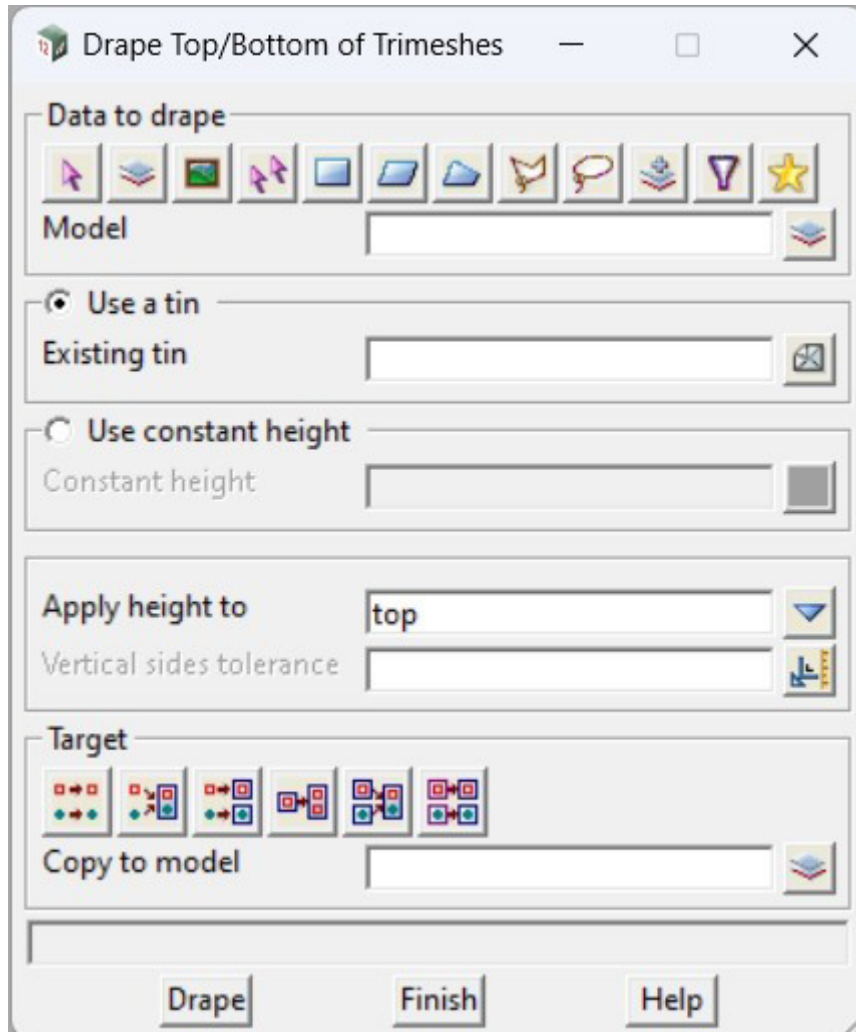
Position of option on menu: BIM =>Trimesh =>Utilities



### 11.3.8.1 Trimesh Drape Top/Bottom

Position of menu: BIM =>Trimesh =>Utilities =>Drape top/bottom to tin/height

Now documented in the V15 reference manual



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Data to drape data source</b>	data source		
----------------------------------	-------------	--	--

*Data selection type - selection of trimeshes to drape. For a full description go to [3.25.3 Data Source](#).*

<b>Use a tin</b>	radio button		
------------------	--------------	--	--

*When selected, the **Existing tin** box is enabled and selection of a tin to drape trimeshes top or bottom is allowed.*

<b>Existing tin</b>	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.*

<b>Use constant height</b>	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.*

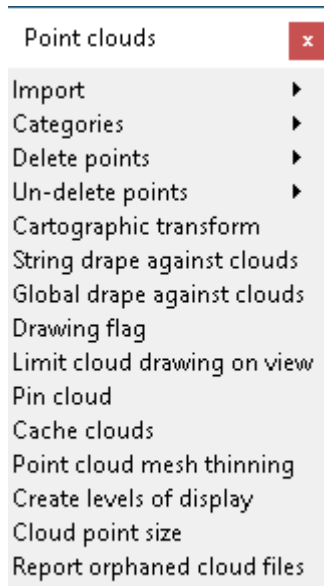
**Target**                                      target box

*Sets where the processed data goes to. For a full description go to [3.25.3 Data Source](#).*

Continue to [11.4 Point Clouds](#) or return to [11.3.8 Trimesh Utilities](#).

## 11.4 Point Clouds

There has been additions to Point Clouds.



*See*

[11.4.1 Create Levels of Display](#)

## 11.4.1 Create Levels of Display

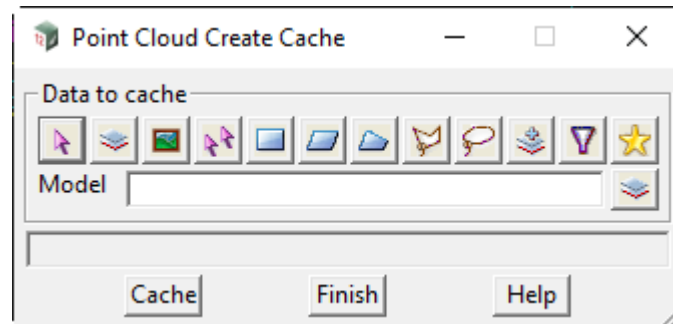
**Position of option on menu:** Bim =>Point clouds =>Cache clouds

Position of option on menu: String =>Point clouds =>Cache clouds

Now documented in the V15 reference manual

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
<b>Data to cache</b>	data source		
<i>Data selection type - for a full description go to <a href="#">3.25.3 Data Source</a>.</i>			
<b>Selected data source</b>	input	Model	
<i>Source of data to be processed.</i>			

### Buttons at bottom

<b>Cache</b>	button
<i>Attempts to create caching information for all the points clouds points in the selected point clouds.</i>	

### 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 many 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 coarser 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 [11.5 Visualisation](#) or return to [11.4 Point Clouds](#).



## 11.5 Visualisation

### 11.5.1 Remove all Duplicate Extrudes in Project

**Position of option on menu:** BIM => Visualisation => Extrusions => Remove duplicates

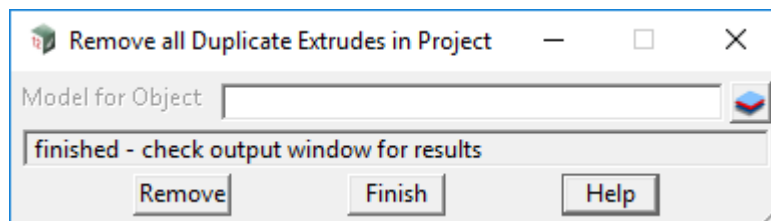
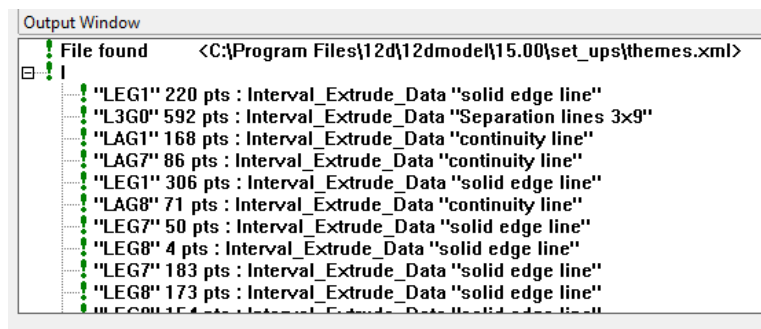
Now documented in the V15 reference manual

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
<b>Model for Object</b>	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.*

Continue to [11.6 ADAC](#) or return to [11.5 Visualisation](#).



## 11.6 ADAC

# 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](#)

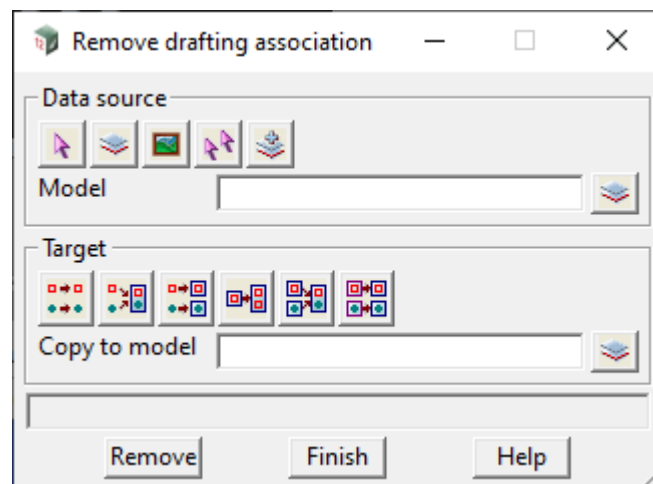
See [12.4 Weight from Conduit Width](#)

## 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

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data to cache</b>	data source		
----------------------	-------------	--	--

*data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*source of drafting elements to be processed.*

**Target type**

*sets where the processed data goes to.*

<b>Target info</b>	input	Copy to model	
--------------------	-------	---------------	--

*extra information required to fully define where the processed drafting elements are going to.*

### Buttons at bottom

<b>Remove</b>	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

Now documented in the V15 reference manual

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.

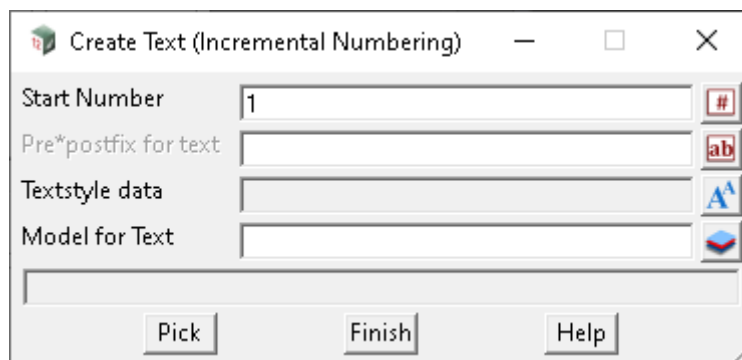
The text can have a Pre\*postfix, which can include "\n", for a new line

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
<b>Start number</b> <i>Enter start number (default set to 1).</i>	integer box	1	
<b>Pre*postfix for text</b> <i>If blank, only number is used.</i>	text box	optional	
<b>Textstyle data</b> <i>Font, height etc for text.</i>	textstyle box		
<b>Model for Text</b> <i>Model to place text on.</i>	model box		available models

### 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*

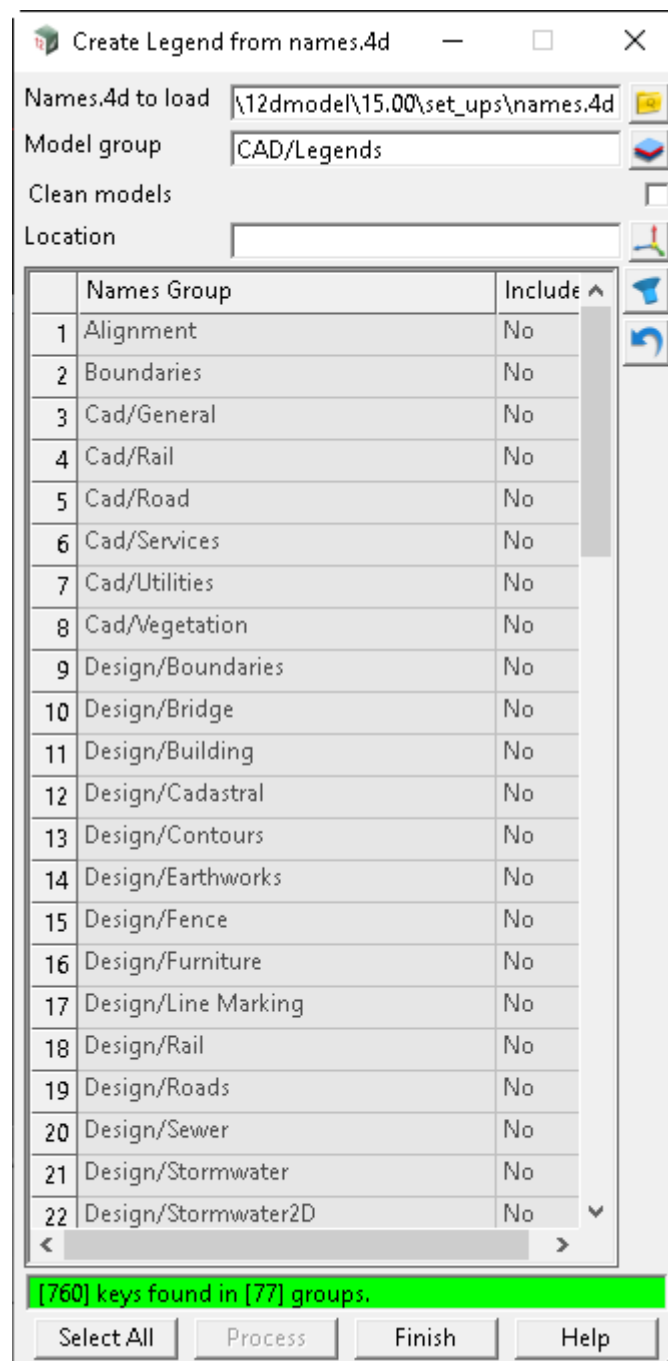
Continue to [12.3 Tabulate Names.4d](#) or return to [12 CAD](#).

## 12.3 Tabulate Names.4d

**Position of option on menu:** CAD =>Drafting =>Text and Tables =>Tabulate names.4d

Now documented in the V15 reference manual

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
<b>Names.4d to load</b> <i>The names.4d file used to populate this panel.</i>	file box	Names.4d in 12d set_ups folder	
<b>Model group</b> <i>The default model pathway for all legends created by the panel.</i>	model box	CAD/legends	
<b>Clean models</b> <i>Should existing models be cleaned before processing?</i>	tick box	not ticked	
<b>Location</b> <i>Where the generated legend should be positioned in the view.</i>	XYZ box		
<b>Names group/Include</b> <i>A list of every group in the names.4d. Can be configured to show specified groups in the legend.</i>	Grid box		
<b>Filter</b> <i>Open the filter settings panel. See <a href="#">12.3.1 Filter Settings Panel</a>.</i>	button		Filter settings
<b>Reset</b> <i>Disable all filter settings and reset any changes made to the names groups.</i>	button		

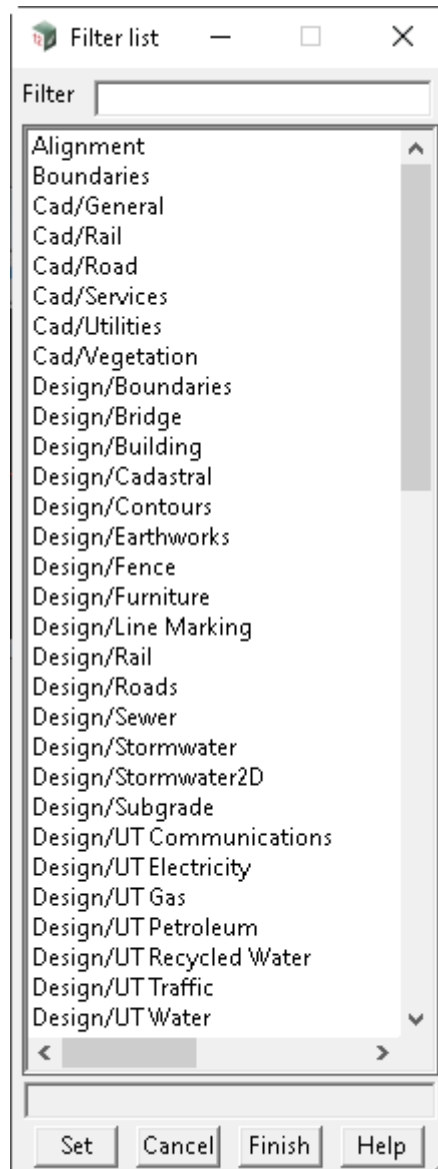
#### Buttons at Bottom

<b>Select all/Remove all</b> <i>Toggle all visible name groups to yes/no.</i>	button
<b>Process</b> <i>Create legend models for all currently enabled names groups.</i>	button
<b>Finish</b> <i>Close the panel.</i>	button
<b>Help</b> <i>Access this help section in the 12d Reference Manual.</i>	button

Continue to [12.3.1 Filter Settings Panel](#) or return to [12.3 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
<b>Filter</b>	input box		

*Only show data matching text input in this field.*

### Buttons at Bottom

<b>Set</b>	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](#).

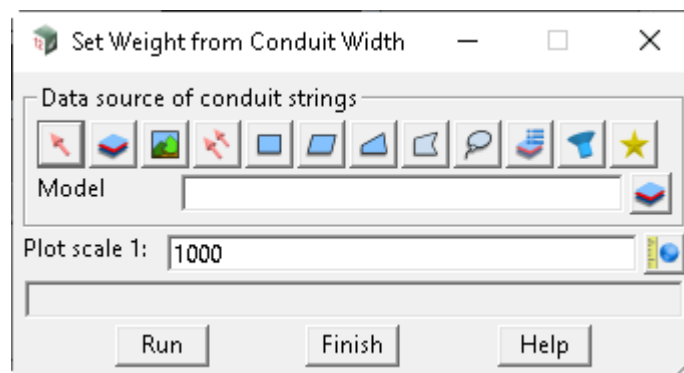
## 12.4 Weight from Conduit Width

**Position of option on menu:** CAD =>Drafting =>Weight from conduit width

Now documented in the [V15 reference manual](#)

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
-------------------	------	----------	--------

<b>Data source of conduit stings</b>	data source		
--------------------------------------	-------------	--	--

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data is to be processed.*

<b>Plot scale 1:</b>	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:*

$$\langle \text{string weight} \rangle = 1000 * \langle \text{conduit width} \rangle / \langle \text{plot scale} \rangle$$

### Buttons at Bottom

<b>Run</b>	button
------------	--------

*Runs the option.*

<b>Finish</b>	button
---------------	--------

*Removes the panel from the screen.*

<b>Help</b>	button
-------------	--------

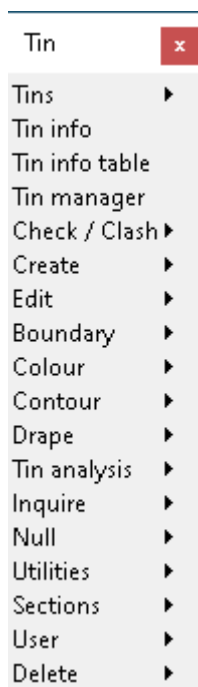
*Launches the 12d help for the option.*

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

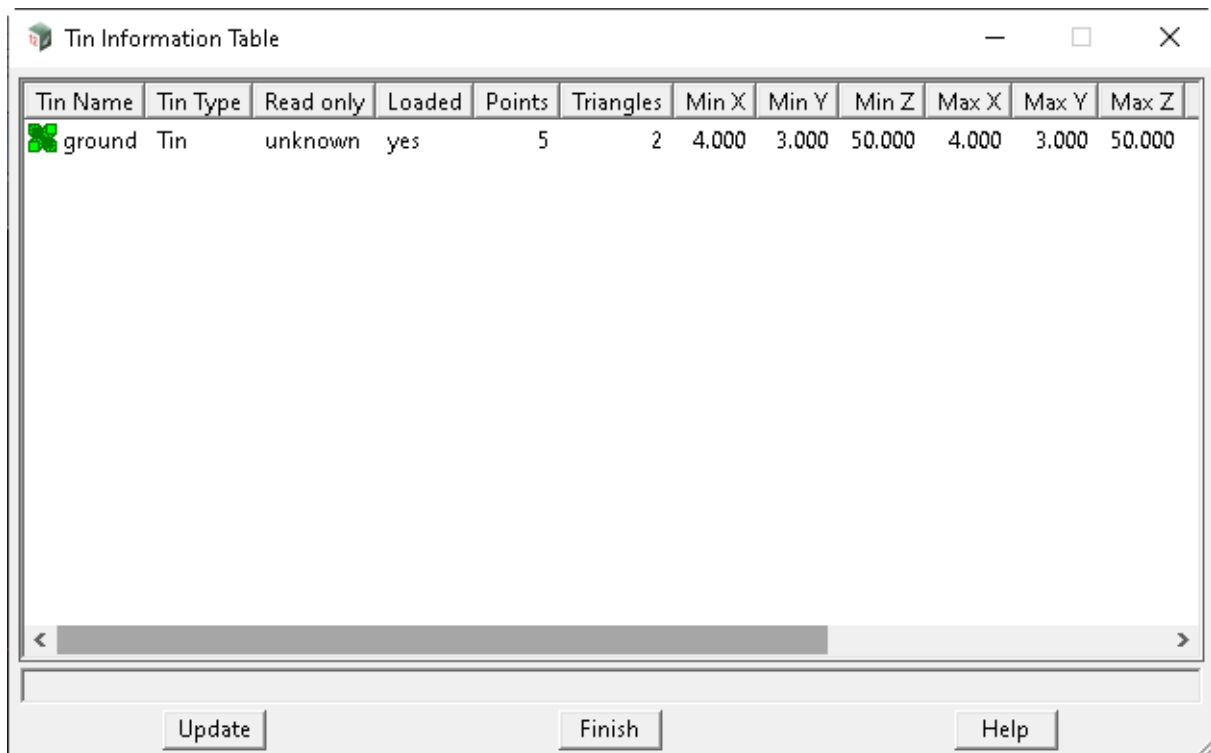
**Position of option on menu:** Tin =>Tin Info Table

Now documented in the V15 reference manual

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
<b>Tin name</b> <i>All the tins in the project are listed in the <b>tin</b> column.</i>	column		sort menu
<b>Tin type</b> <i>Type of the tin. Tin, Supertin, Gridtin.</i>	column		sort menu
<b>Read only</b> <i>The tin is read only if true, modifiable if false otherwise unknown.</i>	column		sort menu
<b>Loaded</b> <i>If <b>no</b>, in this current opening of the project, the model has not yet been fully loaded into <b>12d Model</b>.</i>	column		sort menu
<b>Points</b> <i>Number of points in the tin.</i>	column		sort menu



**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](#).

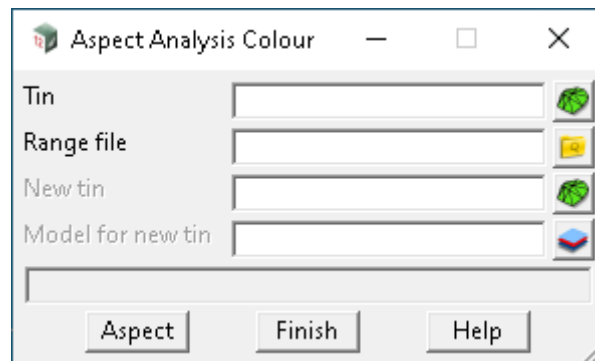
## 13.2 Tin Aspect Colouring

**Position of option on menu:** Tin =>Colour =>Aspect colouring

Now documented in the [V15 reference manual](#)

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
<b>Tin</b> <i>Name of the tin for which the aspects of the triangles will be calculated and either this tin or New tin is coloured.</i>	tin box		available tins
<b>Range file</b> <i>The user supplied range file is used to give the colour ranges for aspects to use to colour the triangles.</i>	aspect range file box		*.arf
<b>New tin</b> <i>If <b>not blank</b>, a new tin of this name is created and it is this new tin that is coloured. If <b>blank</b>, the tin given in <b>Tin</b> is coloured.</i>	tin box		available tins
<b>Model for new tin</b> <i>If <b>not blank</b> and a new Tin is created, the new tin is added to this model. If <b>blank</b> and a new Tin is to be created then the option won't run.</i>	tin box		available tins

### Buttons on bottom

<b>Aspect</b> <i>On selecting this button, the aspects of the triangles of the tin are calculated and the triangle coloured according to the range file.</i>	button
---	--------

<esc> can be used to terminate the option during aspect calculations.

Continue to [13.3 Tin Slope Colouring](#) or return to [13 Tin](#).

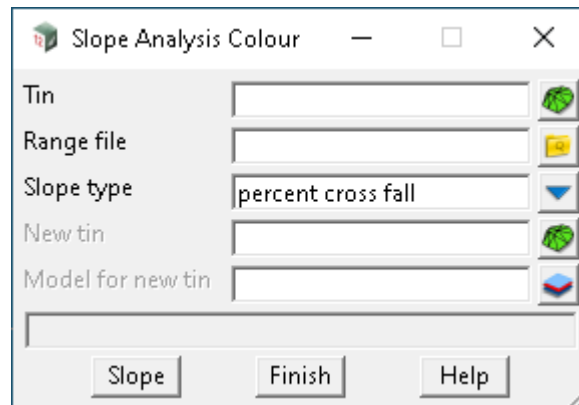
## 13.3 Tin Slope Colouring

**Position of option on menu:** Tin =>Colour =>Slope colouring

Now documented in the [V15 reference manual](#)

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
<b>Tin</b> <i>Name of the tin for which the slope of the triangles will be calculated and either this tin or <b>New tin</b> is coloured.</i>	tin box		available tins
<b>Range file</b> <i>The user supplied range file is used to give the colour ranges for slopes to use to colour the triangles.</i>	slope range file		*.srf
<b>Slope type</b> <i>The units used for slope in the range file.</i>	input	percent cross fall	percent cross fall, degrees, 1v in
<b>New tin</b> <i>If <b>not blank</b>, a new tin of this name is created and it is this new tin that is coloured. If <b>blank</b>, the tin given in <b>Tin</b> is coloured.</i>	tin box		available tins
<b>Model for new tin</b> <i>If <b>not blank</b> and a new Tin is created, the new tin is added to this model. If <b>blank</b> and a new Tin is to be created then the option won't run.</i>	model box		available tins

### 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.

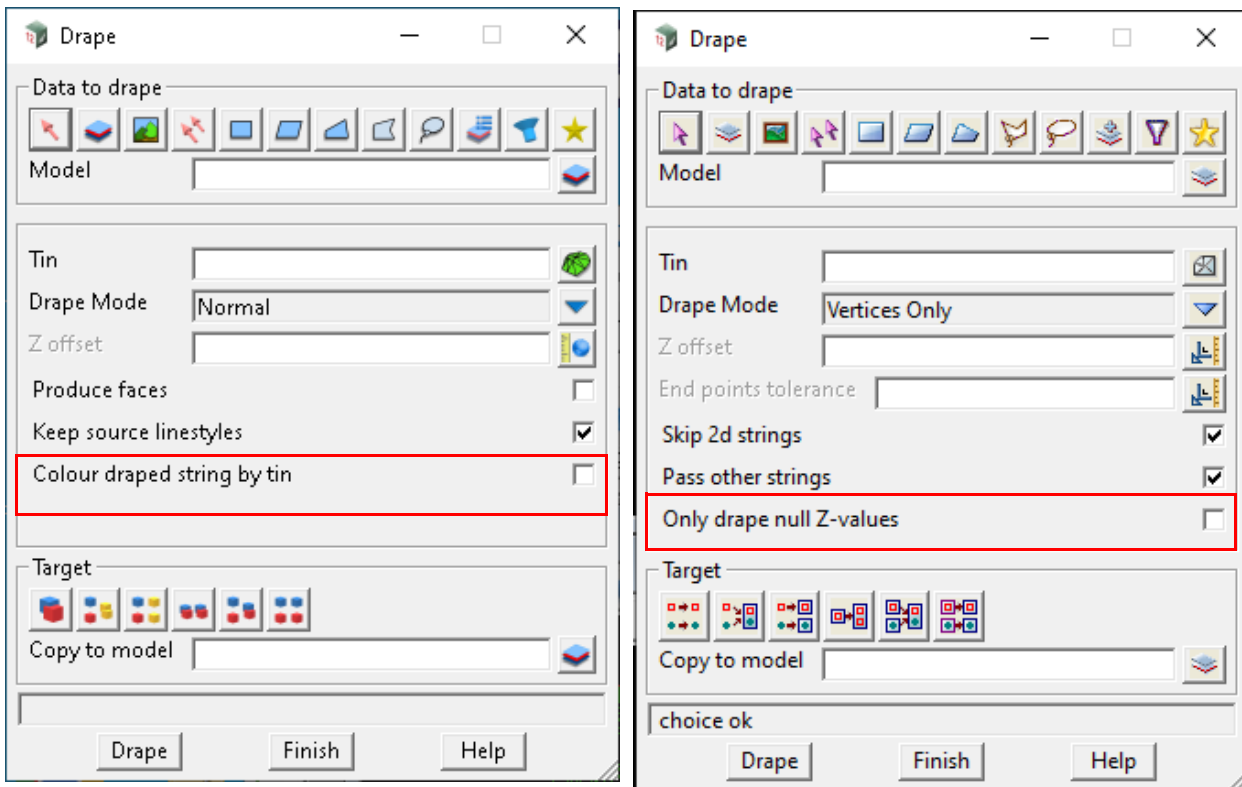
Continue to [13.4 Drape Strings](#) or return to [13 Tin](#).

# 13.4 Drape Strings

Position of option on menu: Tin =>Drape =>Drape

Now documented in the V15 reference manual

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**

<b>Colour draped string by tin</b>	tick box	not ticked	
------------------------------------	----------	------------	--

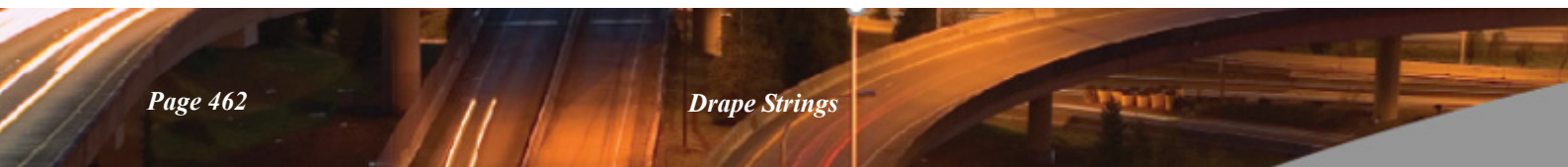
*If ticked, each segment of draped string is given the colour of the triangle that it is on.*

**If Drape mode is Vertices Only**

<b>Only drape null Z-values</b>	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

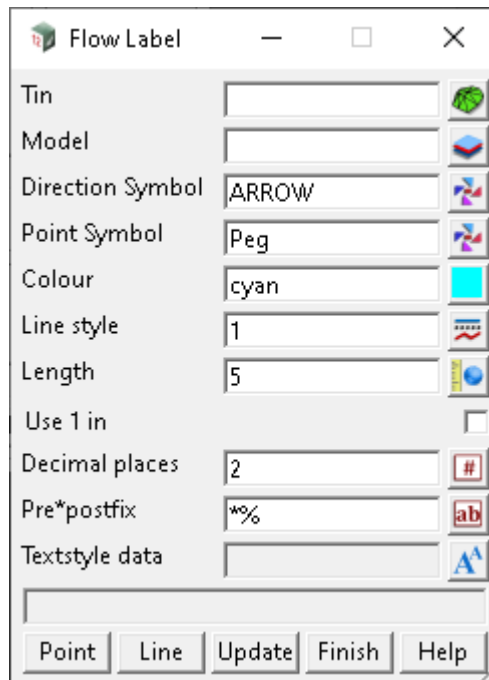
Position of option on menu: Tin =>Tin analysis =>Label flow arrow

Now documented in the V15 reference manual

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
<b>Tin</b>	tin box		available tins
<i>Name of the tin to calculate flow arrows label values.</i>			
<b>Model</b>	model box		available models
<i>Model name of the produced arrows and labels. Must not be blank.</i>			
<b>Direction Symbol</b>	symbol box		available symbols
<i>Symbol name of the produced arrow (at the end of the line) to indicate the direction of slope or crossfall.</i>			
<b>Point Symbol</b>	symbol box		available symbols
<i>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.</i>			
<i>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.</i>			

<b>Colour</b>	colour box	cyan	available colours
<i>The colour selected is used for the symbols and line work at all locations using either the "point" or "line" method.</i>			
<b>Linestyle</b>	linestyle box	1	available linestyles
<i>The line style selected is used for the line produced to indicate the direction of slope or crossfall.</i>			
<b>Length</b>	measure box	5	length value
<i>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.</i>			
<b>Use 1 in</b>	tick box	not ticked	
<i>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.</i>			
<b>Decimal places</b>	number box	2	
<i>The number of decimal places to be displayed for the text label produced when calculated. This field cannot be blank.</i>			
<b>Pre*postfix</b>	text box	*%	
<i>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.</i>			
<b>Textstyle data</b>	textstyle data box		available textstyles
<i>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.</i>			

### Buttons on Bottom

<b>Point</b>	button
<i>After selecting <b>Point</b>, 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.</i>	
<b>Line</b>	button
<i>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.</i>	
<b>Update</b>	button
<i>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.</i>	

Continue to [13.6 Depth Range Polygons](#) or return to [13 Tin](#).

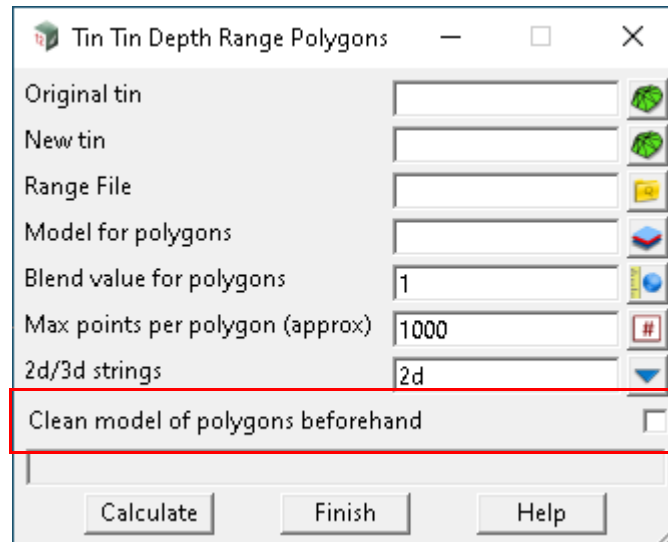


## 13.6 Depth Range Polygons

**Position of option on menu:** Tin =>Tin analysis =>Depth range polygons

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Clean model of polygons beforehand</b>	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.*

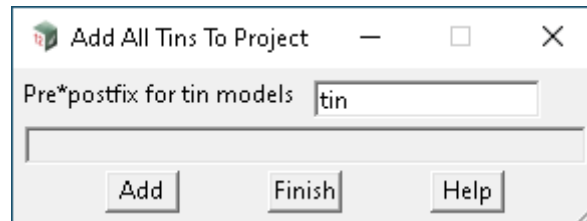
Continue to [13.7 Adding Removed Tins](#) or return to [13 Tin](#).

## 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

Now documented in the V15 reference manual

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**.

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 though 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.

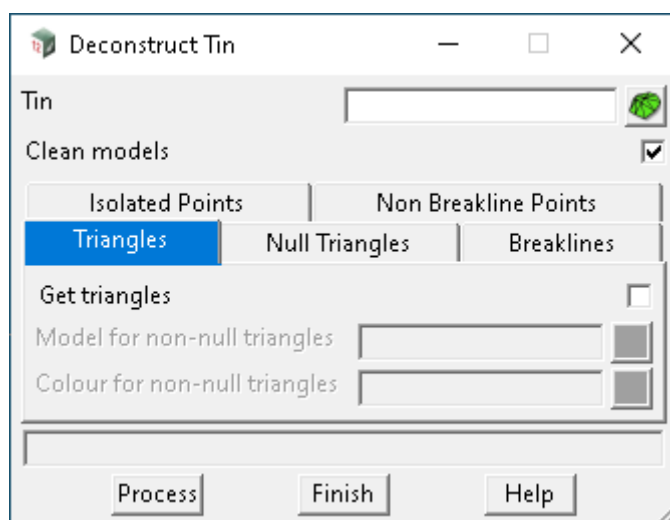
The vertices of a null triangle that are not shared with any non-null triangles are called **isolated points**. So an isolated point is surrounded by null triangles.

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.*

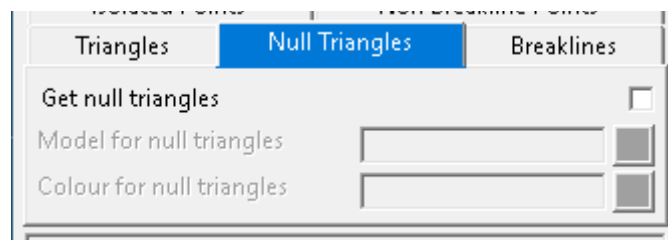
**Model for non-null triangles** model box available models

*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

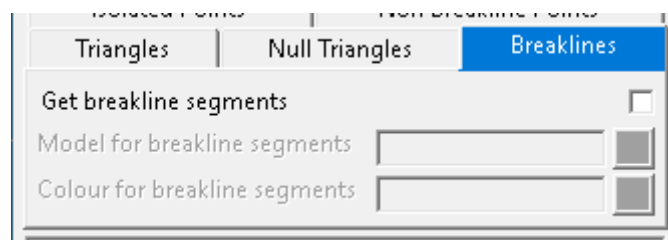
*Model for the super strings of null triangles.*

**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.*

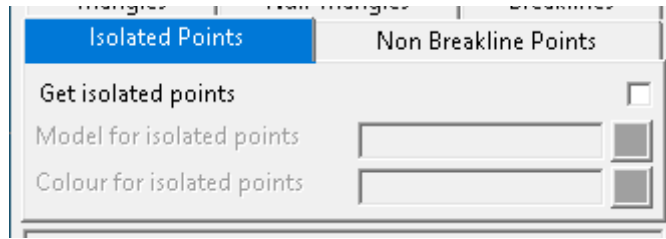
**Model for breakline segments** model box available models

*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.*

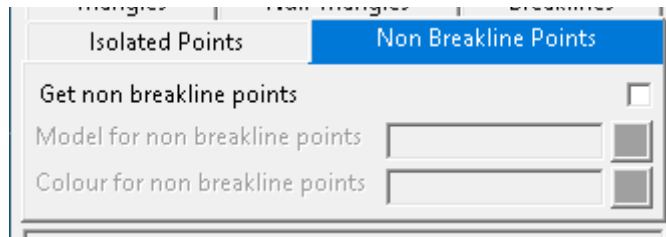
**Model for isolated points**    model box                                      available models

*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](#).



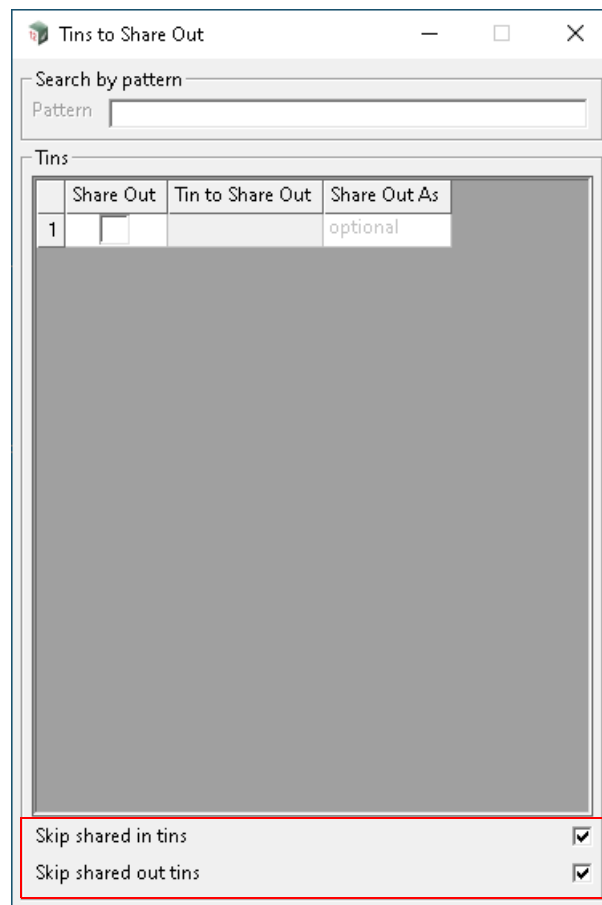
## 13.9 Share Out Tins

Position of option on menu: Tin =>Utilities =>Sharing =>Share out

Now documented in the V15 reference manual

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 [25 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 [26 12d Field File Format](#).

The section [27 Geodetics Summary](#) has been substantially updated for V15.

The Survey menu in the **Classic** Theme is:



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](#)

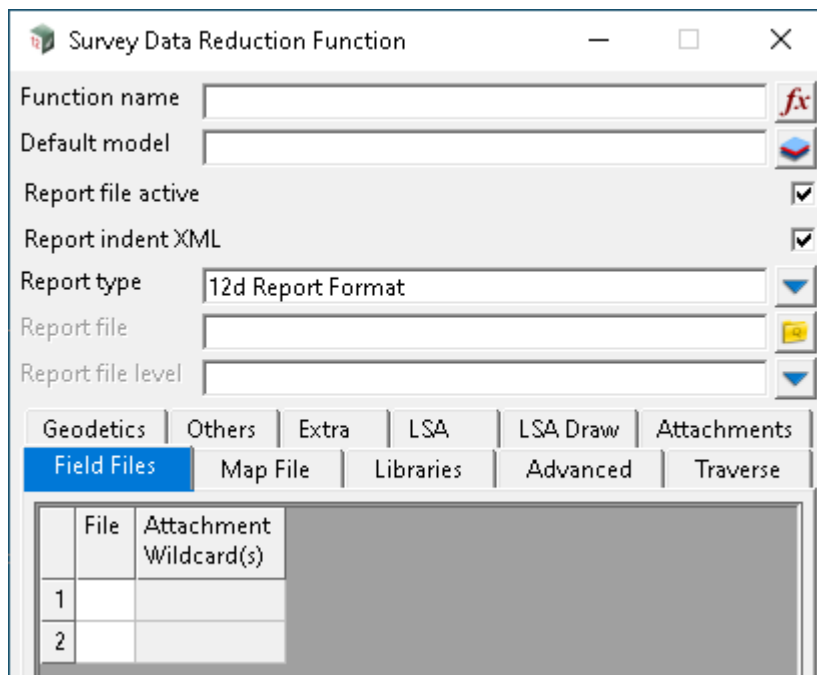
[14.6 Create SDR Function from a 12d Field File](#)

[14.7 Survey Data Reduction Editor](#)

## 14.1 Reduction Quick Start and Config Start

Now documented in the V15 reference manual

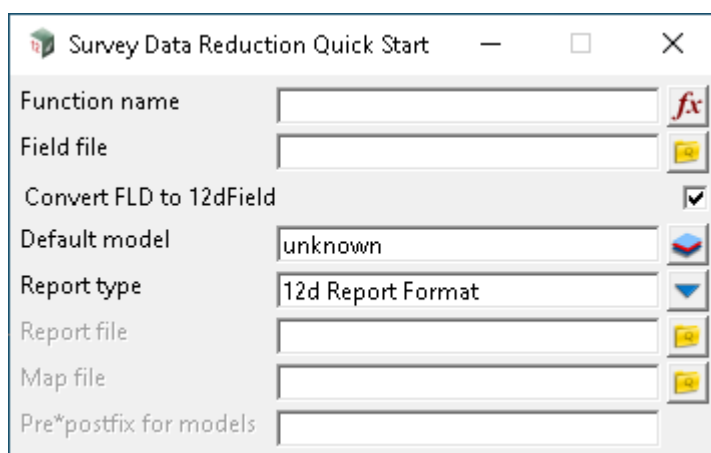
For **12d Model 14**, the Field file option for reducing survey data brings up the **Survey Data Reduction Function** panel which has tabs for **all** the possible settings that a user could use in a reduction.



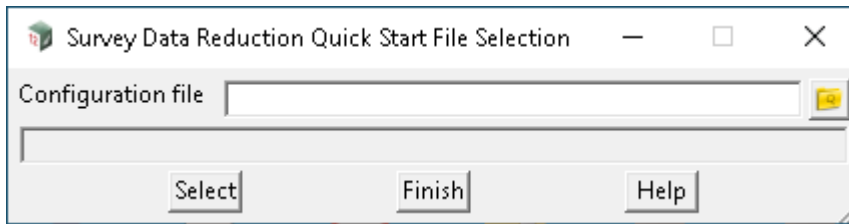
In **12d Model 15**, a SDR configuration file (.12d\_sdr\_config) can be used to supply in advance many of the answers and reduce the amount of information displayed.

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:



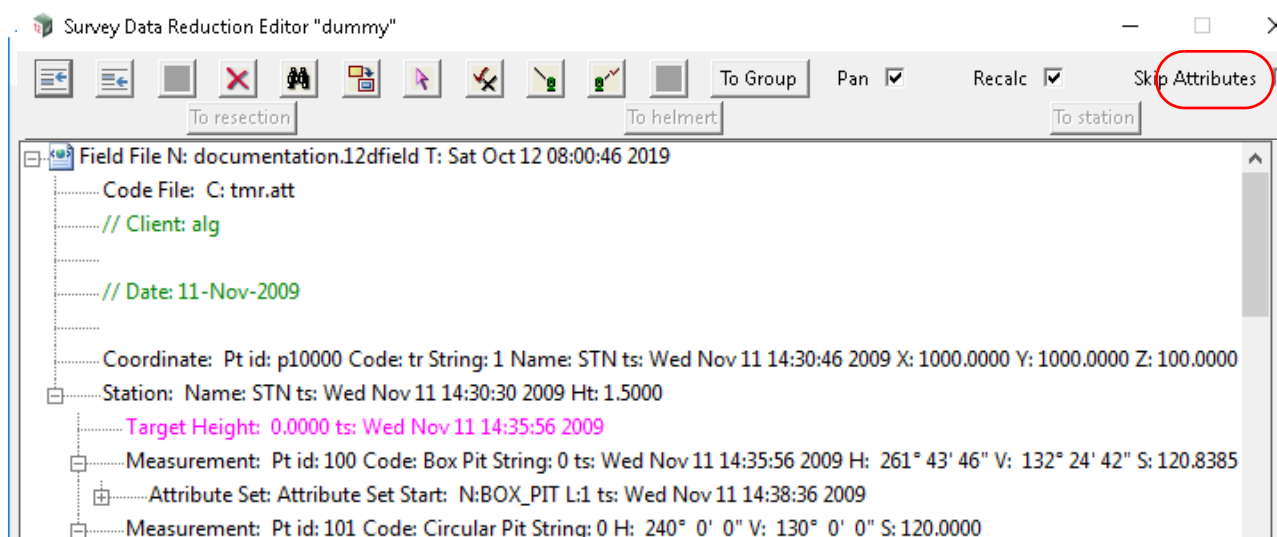
A **12d\_sdr\_config** file is then selected using the **Configuration file** pop-up and when **Select** is pressed, the **Survey Data Reduction Quick Start** panel is brought up using the selected config file.

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

Now documented in the V15 reference manual

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**

Now documented in the [V15 reference manual](#)

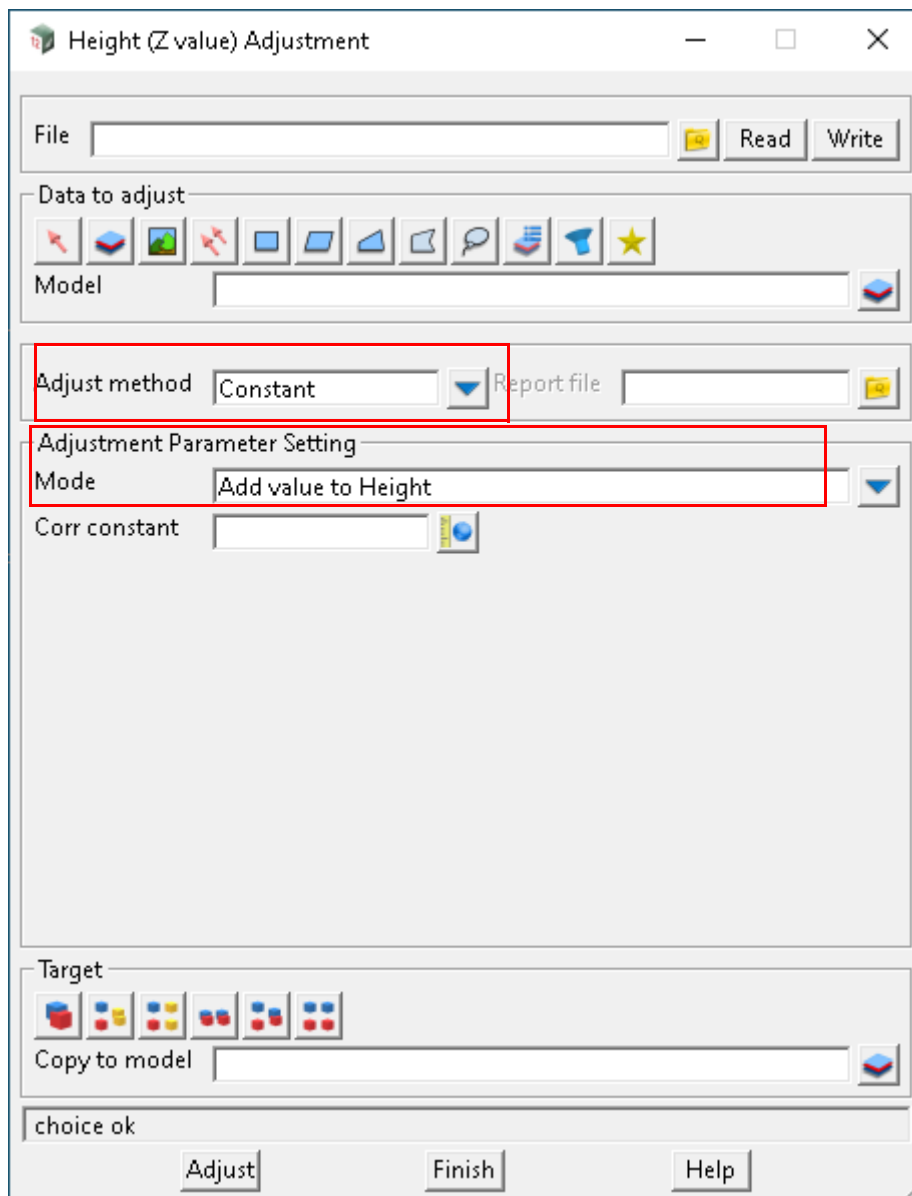
**GSB file** has been added to the adjust method choice box options.

**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

Selecting **Height adjustment** brings up the **Height (Z value) Adjustment** panel





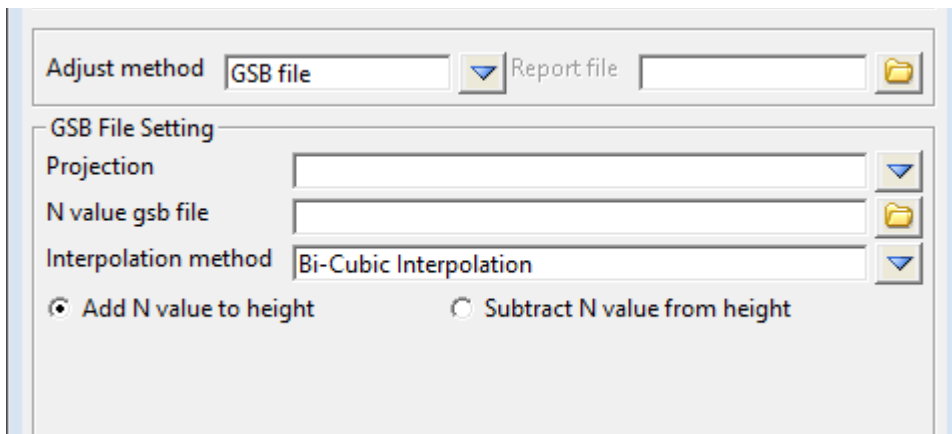
### Adjustment Parameter Setting

**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
<b>Projection</b> <i>Projection is used to determine the Lat/Long values from Element coordinates (Assuming they are in Easting/Northing).</i>	projection box		all projection data
<b>N value GSB File</b> <i>GSB file to extract N values at the element coordinates.</i>	file box		
<b>Interpolation method</b> <i>If <b>Bi-Linear</b> is chosen, the calculation is done on 4 points around each element coordinate. If <b>Bi-Cubic</b> is chosen, the calculation is done on 16 points around each element coordinate.</i>	choice box		Bi-Cubic Interpolation Bi-Linear Interpolation
<b>Add N value to height</b> <i>If <b>ticked</b>, the N value is added to the element's Z value.</i>	radio button	ticked	
<b>Subtract N value from height</b> <i>If <b>ticked</b>, the N value is subtracted from the element's Z value.</i>	radio button	un-ticked	

Continue to [14.4 Conversions/Transformations](#) or return to [14 Survey](#).

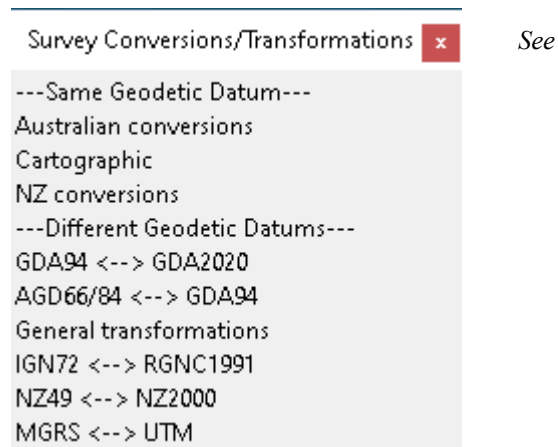
## 14.4 Conversions/Transformations

Now documented in the V15 reference manual

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.



Continue to [14.5 Conformance](#) or return to [14 Survey](#).

## 14.5 Conformance

Survey Conformance ×

*See*

General conformance

[14.5.1 General Conformance](#)

Batter slope report

Pavement report

Chainage offset filter

[14.5.2 Chainage Offset Filter](#)

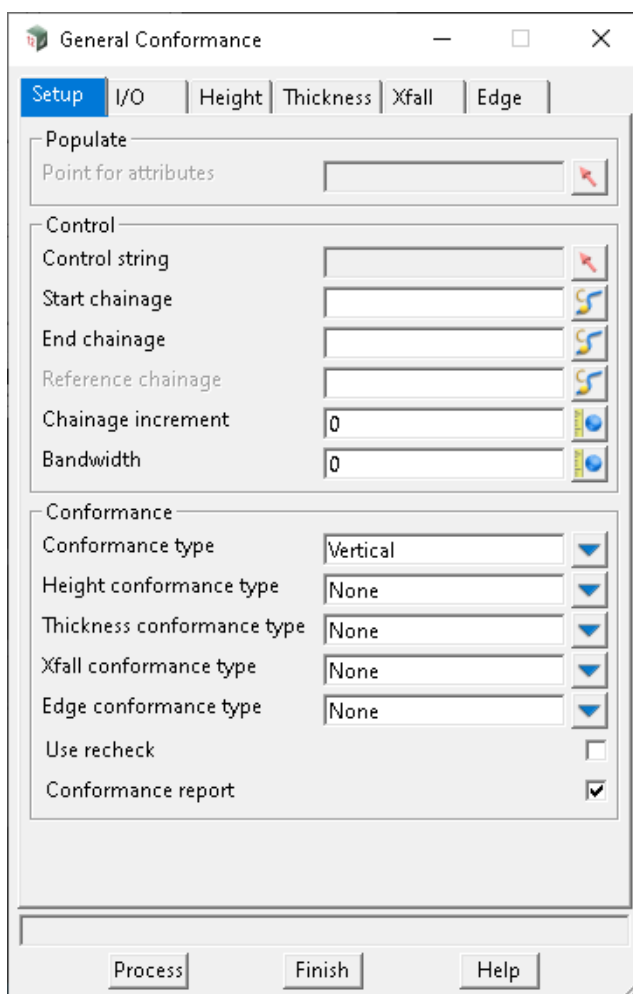
## 14.5.1 General Conformance

**Position on menu:** Survey =>Conformance =>General conformance

Now documented in the V15 reference manual

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.*

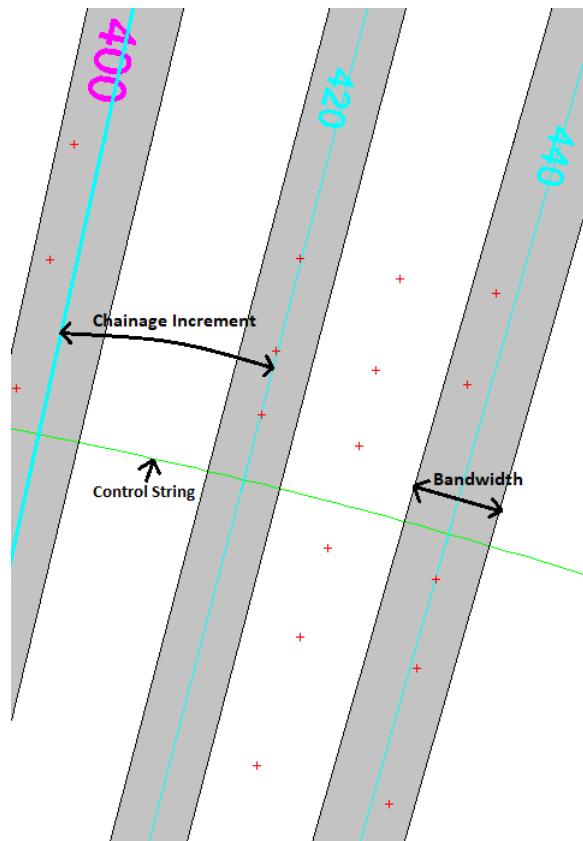
**Control****Control string**                      select box*Control string that all chainage and offset calculations will be relative to.***Start chainage**                      chainage box      start chainage of control string*If the chainage of a given point dropped to the control string is less 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*

$$(1) \rightarrow \left( r + N \times i - \frac{b}{2} \right) \leq P \leq \left( r + N \times i + \frac{b}{2} \right)$$

$$(2) \rightarrow (\text{Start chainage}) \leq P \leq (\text{End chainage})$$

*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.*

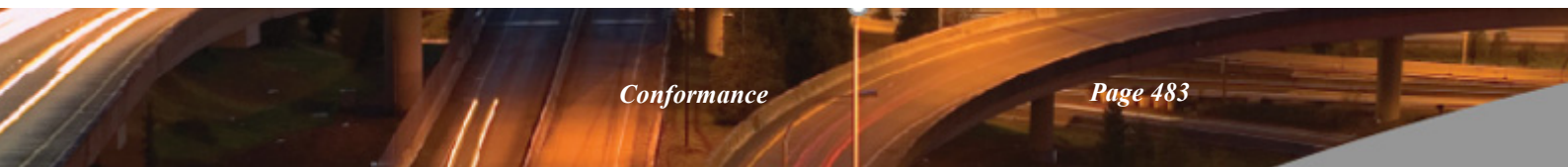
*For more information on Thickness conformances see [Thickness Tab](#).*

**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

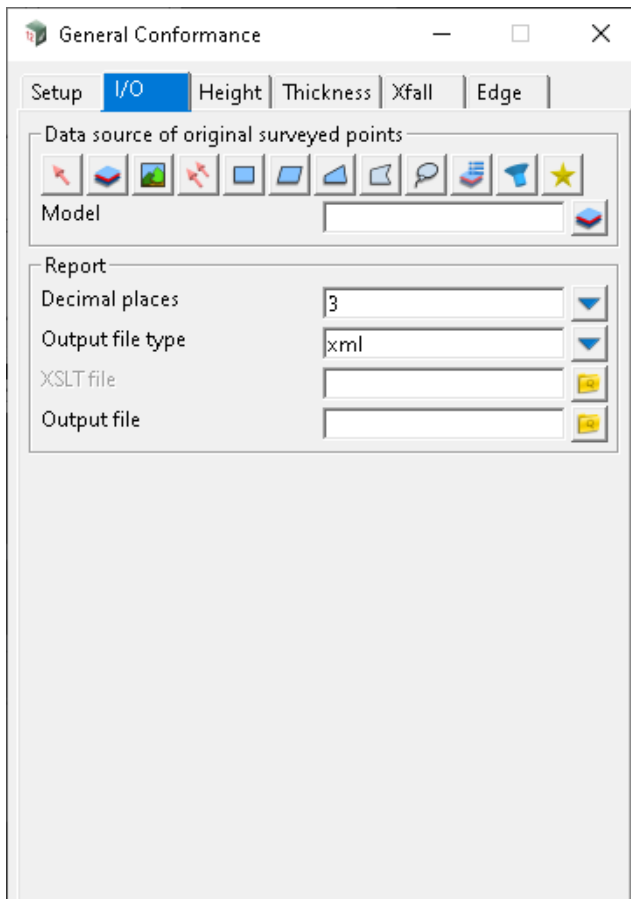
*If ticked, display the Report group on the I/O tab.*

*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 [3.25.3 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 [3.25.3 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 [3.25.4 Data Target](#).

**Clean output model**      tick box      not ticked

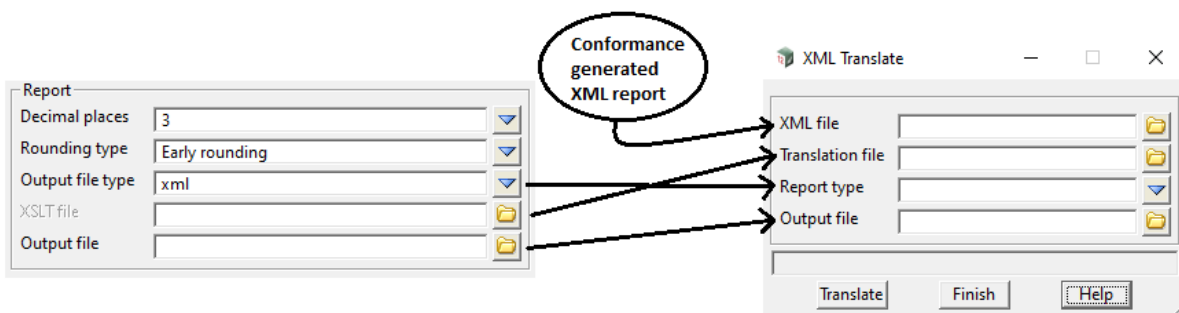
*Note:* This box is only enabled if the Target output mode is set to Copy to one model.

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 [27.9.2 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

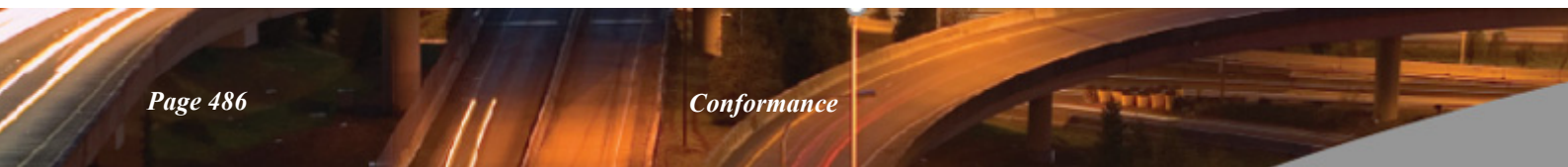
*Note:* If the Output file type is not xml, txt or csv then the XSLT file is not optional.

If **blank**, use the default XSLT for the given Output file type.

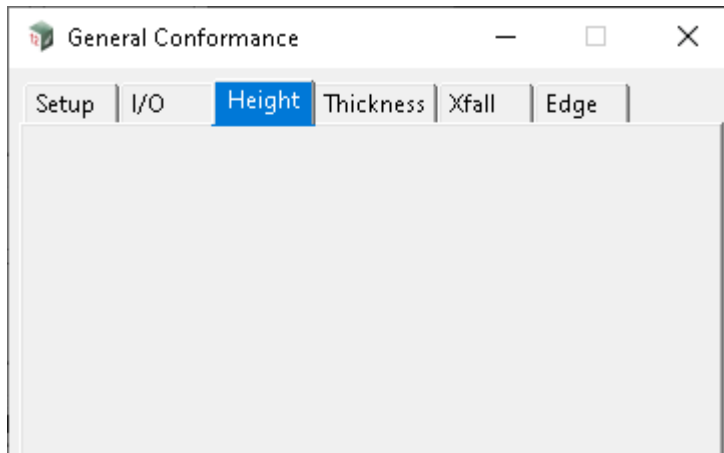
If **not blank**, use the given XSLT that must be compatible with the Output file type.

**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	<input type="text" value="0"/>	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

**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

Height	<input type="text"/>	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

All points will be conformed against a constant z value.

For more information on the other widgets, see [Common height widgets](#).

### Tin

Tin	<input type="text"/>	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

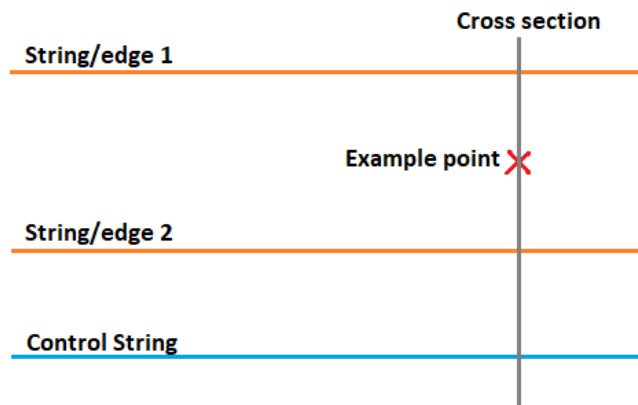
All points will be conformed against a tin surface.

For more information on the other widgets, see [Common height widgets](#).

### 2 strings/edges

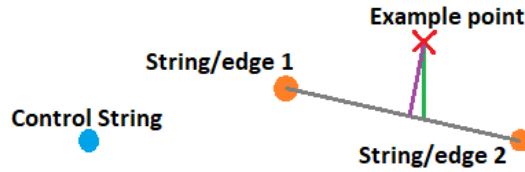
String/edge 1	<input type="text"/>	
String/edge 2	<input type="text"/>	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

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	<input type="text"/>	
String/edge 2	<input type="text"/>	
Crown string/edge	<input type="text"/>	
Design height difference	<input type="text" value="0"/>	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

**String/edge 1**                      select box  
*Edge of surface that points are conformed against.*

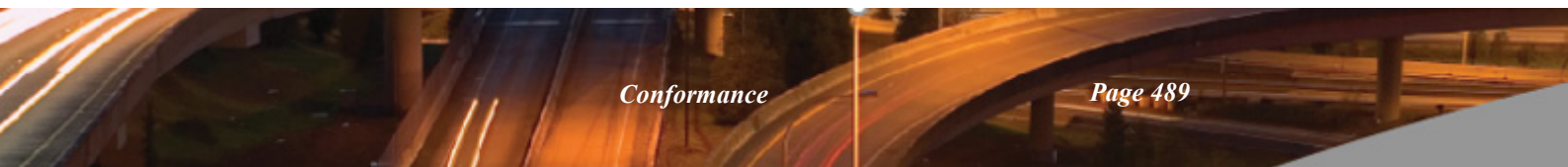
**String/edge 2**                      select box  
*Edge of surface that points are conformed against.*

**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	<input type="text"/>	
Polymesh edge 1	<input type="text"/>	
Polymesh edge 2	<input type="text"/>	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

- 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**

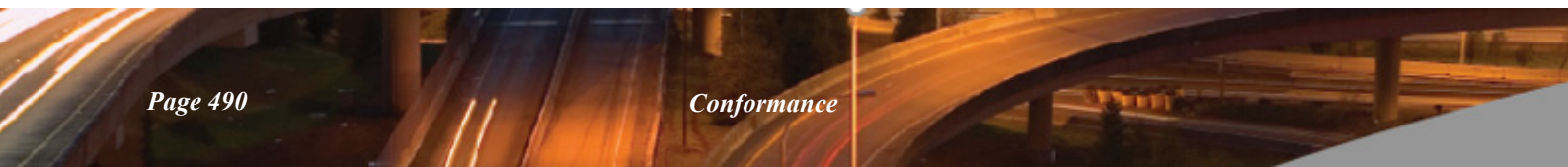
Polymesh	<input type="text"/>	
Polymesh surface	Top	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

- 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	<input type="text"/>	
Design height difference	0	
Upper tolerance	<input type="text"/>	
Lower tolerance	<input type="text"/>	

- Polyface** select box  
*All points will be conformed against a polyface.*



For more information on the other widgets, see [Common height widgets](#).

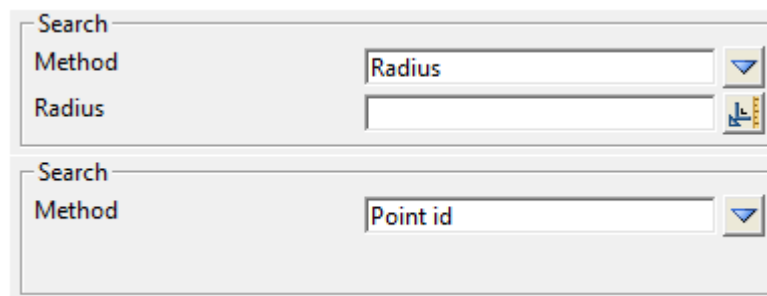
**Points XY & Z**



**Data source of points**      source box      model

The points that the original surveyed points will be conformed against.

For a full description go to [3.25.3 Data Source](#).



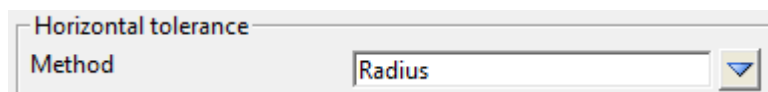
**Method**      choice box      Radius      Radius, Point id

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.

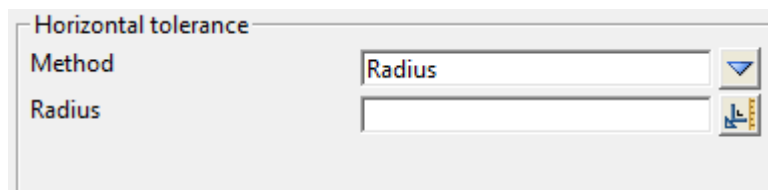
**Radius**      real box

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.



Horizontal tolerance	
Method	Chainage/offset
Chainage tolerance	
Offset tolerance	

**Chainage tolerance**      real box

*The original survey point will not be within the horizontal tolerance if it's chainage falls outside  $\pm$  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  $\pm$  the Offset tolerance of the offset of the other point.*

Horizontal tolerance	
Method	X/Y
X tolerance	
Y tolerance	

**X tolerance**      real box

*The original survey point will not be within the horizontal tolerance if it's x-coordinate falls outside  $\pm$  the X tolerance of the x-coordinate of the other point.*

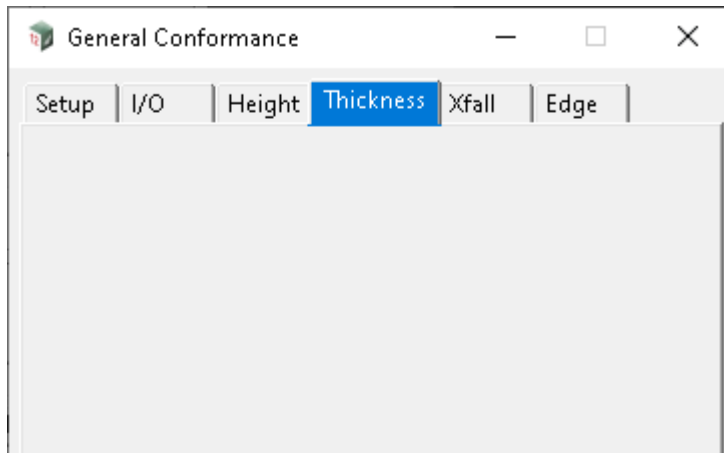
**Y tolerance**      real box

*The original survey point will not be within the horizontal tolerance if it's y-coordinate falls outside  $\pm$  the Y tolerance of the y-coordinate of the other point.*

Vertical tolerance	
Design height difference	0
Upper tolerance	
Lower tolerance	

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	<input type="text"/>	
Maximum thickness	<input type="text"/>	
Minimum thickness	<input type="text"/>	

**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	<input type="text"/>	
Polymesh surface	Top	
Maximum thickness	<input type="text"/>	
Minimum thickness	<input type="text"/>	

**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	<input type="text"/>	
Maximum thickness	<input type="text"/>	
Minimum thickness	<input type="text"/>	

**Polyface** select box

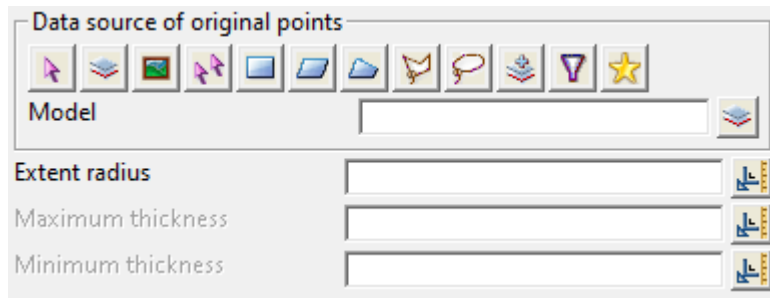
All points will be conformed against a polyface.

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.*

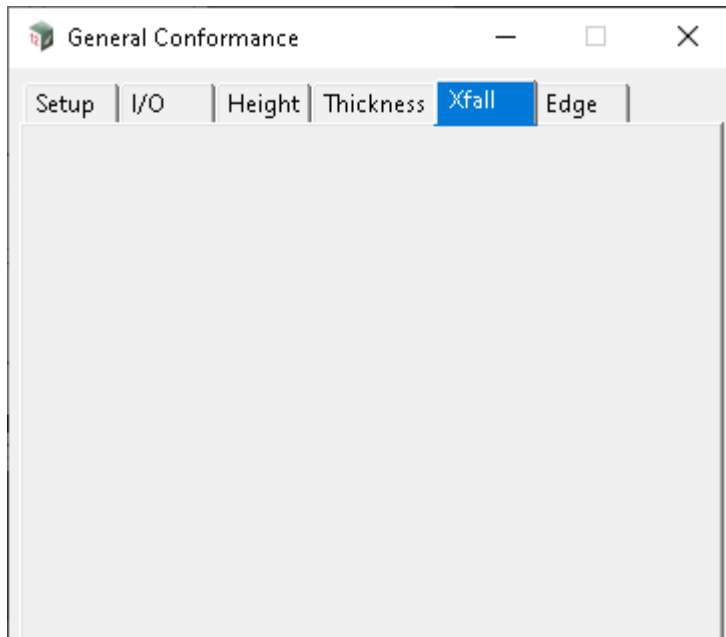
*For a full description go to [3.25.3 Data Source](#).*

**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**

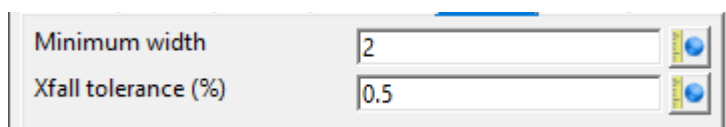


- [Setup Tab](#)
- [I/O Tab](#)
- [Height Tab](#)
- [Thickness Tab](#)
- [Xfall Tab](#)
- [Edge Tab](#)

**None**

*A blank page is displayed, and no Xfall conformance data is outputted.*

**Simple**



**Minimum width**    real box    2

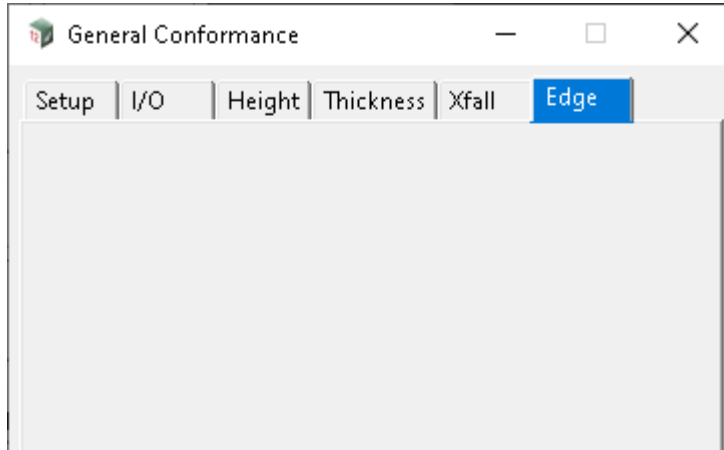


Do not measure the Xfall between any 2 adjacent points in a chainage band if they are less than this width apart from each other.

**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.

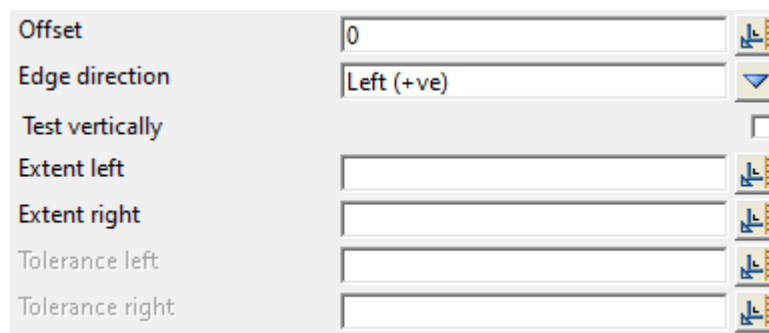
## Edge Tab



- [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

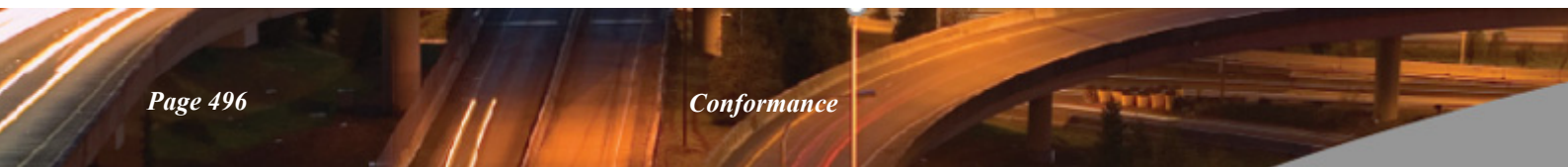


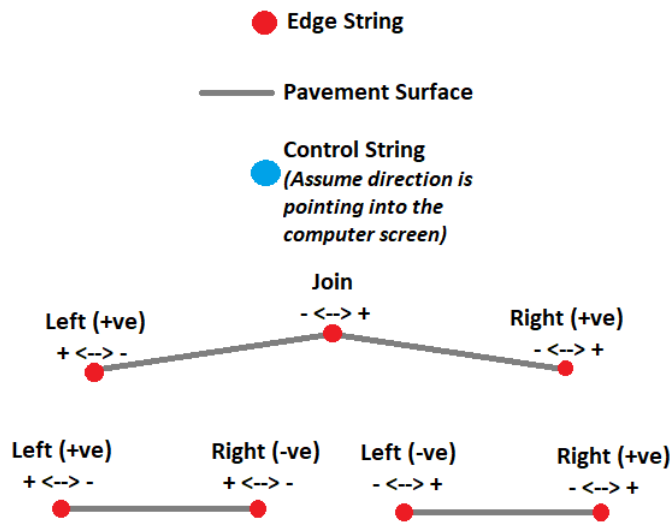
**Offset**    real box

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	<input type="text"/>	
Offset	<input type="text"/>	
Edge direction	Left (+ve)	
Test vertically	<input type="checkbox"/>	
Extent left	<input type="text"/>	
Extent right	<input type="text"/>	
Tolerance left	<input type="text"/>	
Tolerance right	<input type="text"/>	

#### Edge

Surveyed points within extent range will be horizontally conformed to this edge.

For more information on the other widgets, see [Common edge widgets](#).

### 2 strings/edges

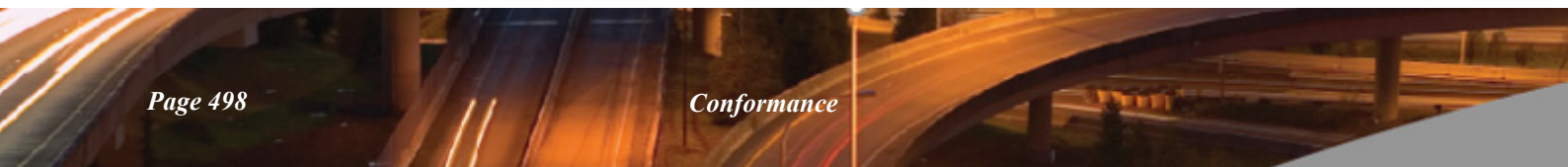
<b>Edge 1</b>		
Edge 1	<input type="text"/>	
Offset	0	
Edge direction	Left (+ve)	
Test vertically	<input type="checkbox"/>	
Extent left	<input type="text"/>	
Extent right	<input type="text"/>	
Tolerance left	<input type="text"/>	
Tolerance right	<input type="text"/>	
<b>Edge 2</b>		
Edge 2	<input type="text"/>	
Offset	0	
Edge direction	Right (+ve)	
Test vertically	<input type="checkbox"/>	
Extent left	<input type="text"/>	
Extent right	<input type="text"/>	
Tolerance left	<input type="text"/>	
Tolerance right	<input type="text"/>	

#### Edge 1

##### Edge 1

Surveyed points within extent range will 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 will be horizontally conformed to this edge.*

*For more information on the other widgets, see [Common edge widgets](#).*

**1 polymesh named edge**

Polymesh	<input type="text"/>	
Polymesh edge 1	<input type="text"/>	
Offset	<input type="text" value="0"/>	
Edge direction	<input type="text" value="Left (+ve)"/>	
Test vertically	<input type="checkbox"/>	
Extent left	<input type="text"/>	
Extent right	<input type="text"/>	
Tolerance left	<input type="text"/>	
Tolerance right	<input type="text"/>	

**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 will 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 will be horizontally conformed to this edge.*

**Polymesh Edge 2** select box selected polymesh's edges

*Surveyed points within extent range will 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

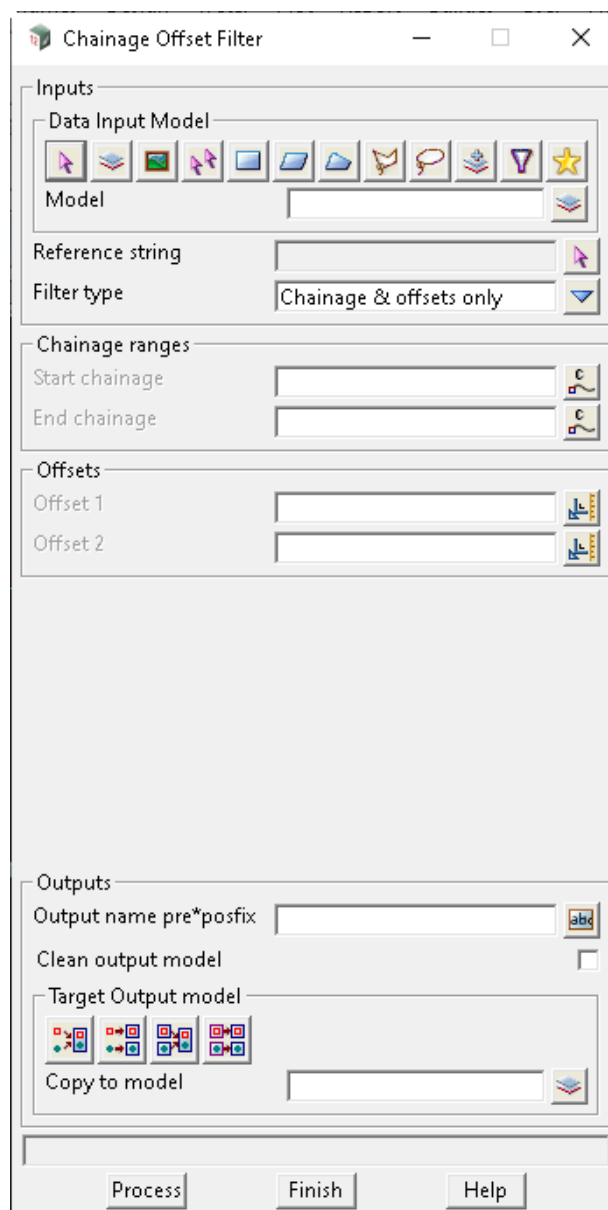
**Position on menu:** Survey =>Conformance =>Chainage offset filter

Now documented in the V15 reference manual

Chainage Offset Filter filters 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.



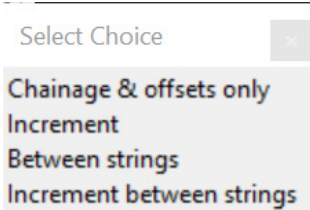
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Inputs</b>			
<b>Data to filter Model</b> <i>Strings with vertices to filter.</i>	source box	model	
<b>Selected data source</b> <i>Source of data to process.</i>	input	Model	
<b>Reference string</b> <i>Reference string to be used for chainage and offset used to filter vertices of strings in the data source.</i>	select box		
<b>Filter type</b>  <i>Filters for the vertices.</i> <i>For information on filter types see <a href="#">Filter types</a>.</i>	choice box		Chainage & offsets only Increment Between strings Increment between strings

**Outputs**

<b>Output name pre*postfix</b>	text box		
<b>Clean output models</b> <i>if <b>ticked</b>, the output models are cleaned before any data is added to them.</i> <i>If <b>not ticked</b>, the output models are not cleaned.</i>	tick box		
<b>Target output model</b>  <i>If <b>Move to model</b>, remove vertices from input strings and place them in the output model.</i> <i>if <b>Move to model prefix</b>, remove vertices from input strings and place in many output models.</i> <i>if <b>Copy to model</b>, copy vertices from input strings and place in output model.</i> <i>if <b>Copy to model prefix</b>, copy vertices from input strings and place in many output models.</i>  <i>Find more info <a href="#">2.23.4 Data Target</a></i>	target box	Move to model	Move to model Move to model prefix Copy to model Copy to model prefix

**Filter types**



- [Chainage & offsets only](#)
- [Increment: \(Includes optional chainages and offsets\)](#)
- [Between strings: \(Includes optional chainages\)](#)
- [Increment between strings: \(Includes optional chainages\)](#)

## Chainage &amp; offsets only

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

Field Description	Type	Defaults	Pop-Up
<b>Start chainage</b>	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.*

<b>End chainage</b>	real box	End chainage of Reference String	
---------------------	----------	----------------------------------	--

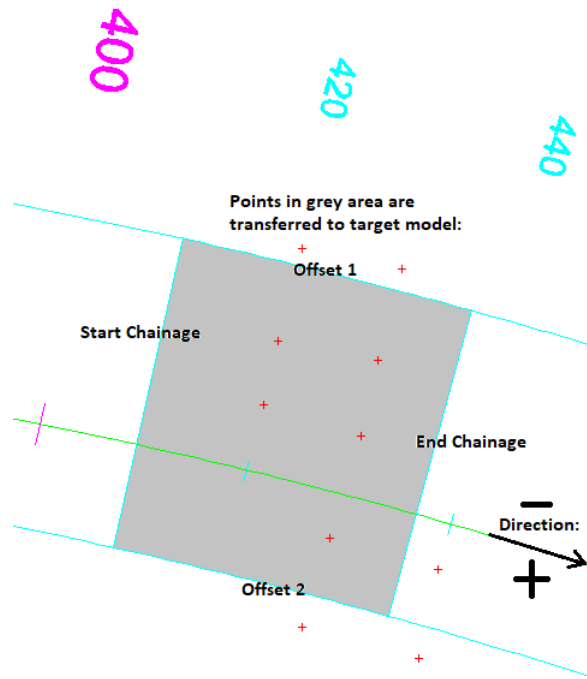
*If **not blank**, select the vertices of strings whose chainage when dropped onto the reference string are less than **End chainage**.*

*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.*

<b>Offset 1 &amp; 2</b>	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.

<b>Chainage ranges</b>	
Start chainage	<input type="text"/>
End chainage	<input type="text"/>
<b>Offsets</b>	
Offset 1	<input type="text"/>
Offset 2	<input type="text"/>
<b>Increment settings</b>	
Reference chainage	<input type="text"/>
Chainage increment	<input type="text"/>
<b>Bandwidth</b>	<input type="text"/>
Special chainage file	<input type="text"/>

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Reference chainage</b>	real box		
---------------------------	----------	--	--

*If not blank, used if start chainage box is left default to set start chainage of the increment filter.*

<b>Chainage increment (opt)</b>	real box		
---------------------------------	----------	--	--

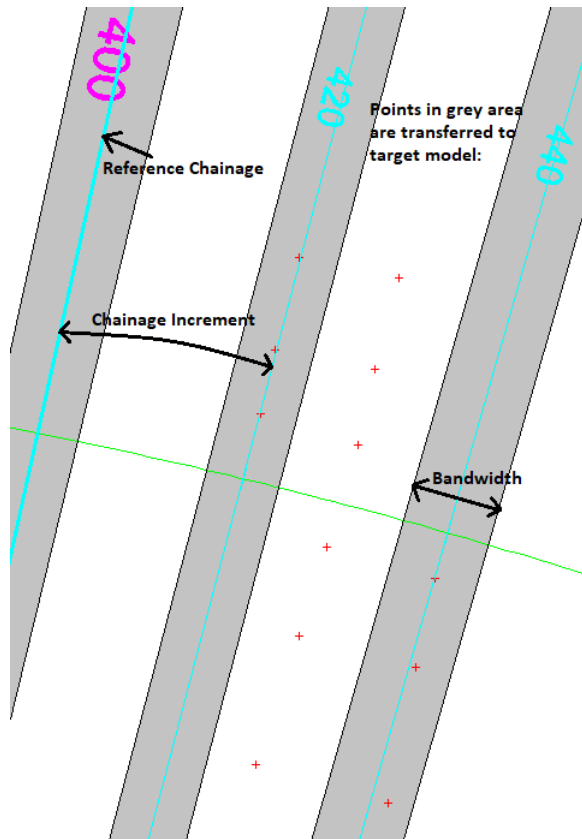
*Distance between each chainage the bandwidth is applied to filter points.*

**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.*



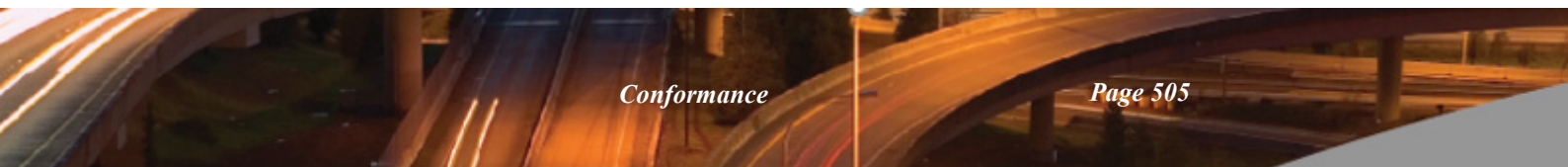
**Between strings: (Includes optional chainages)**

See **Chainage & offsets only** for information on the Chainage Ranges part of the panel.

Filter type	Between strings
<b>Chainage ranges</b>	
Start chainage	<input type="text"/>
End chainage	<input type="text"/>
<b>Between strings</b>	
String 1	<input type="text"/>
String 1 offset	<input type="text"/>
String 2	<input type="text"/>
String 2 offset	<input type="text"/>

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

Field Description	Type	Defaults	Pop-Up
<b>String 1, String 2</b>	select box		



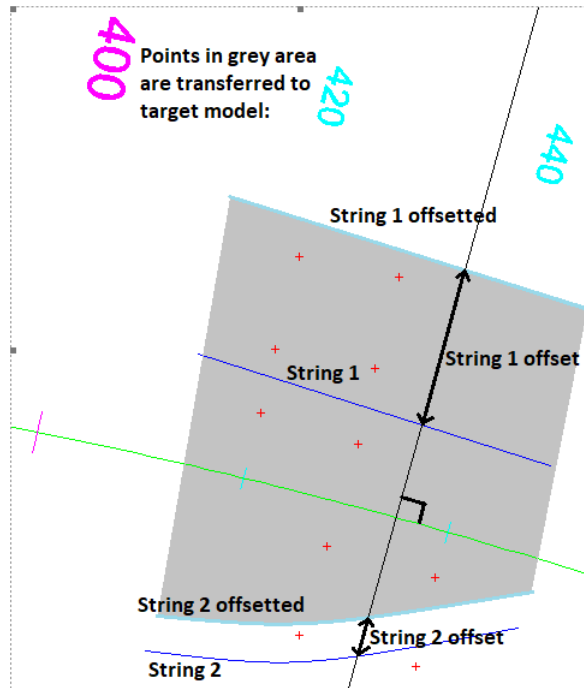
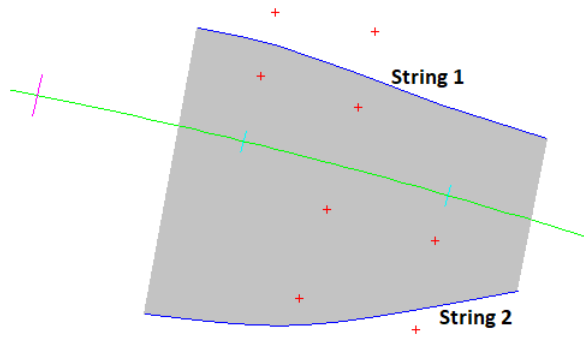
Strings to filter between.

**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.

The screenshot shows a software panel with three main sections: 'Chainage ranges', 'Offsets', and 'Increment settings'. Each section contains input fields and a small icon button to the right.

Section	Field Name	Field Type	Icon
Chainage ranges	Start chainage	Text input	12d icon
	End chainage	Text input	12d icon
Offsets	Offset 1	Text input	12d icon
	Offset 2	Text input	12d icon
Increment settings	Reference chainage	Text input	12d icon
	Chainage increment	Text input	12d icon
	Bandwidth	Text input	12d icon
	Special chainage file	Text input	Folder icon

**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

Now documented in the V15 reference manual

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:

Survey Data Reduction Function

Function name

Default model

Report file active

Report indent XML

Report type

Report file

Report file level

Geodetics | Others | Extra | LSA | LSA Draw | Attachments

**Field Files** | Map File | Libraries | Advanced | Traverse

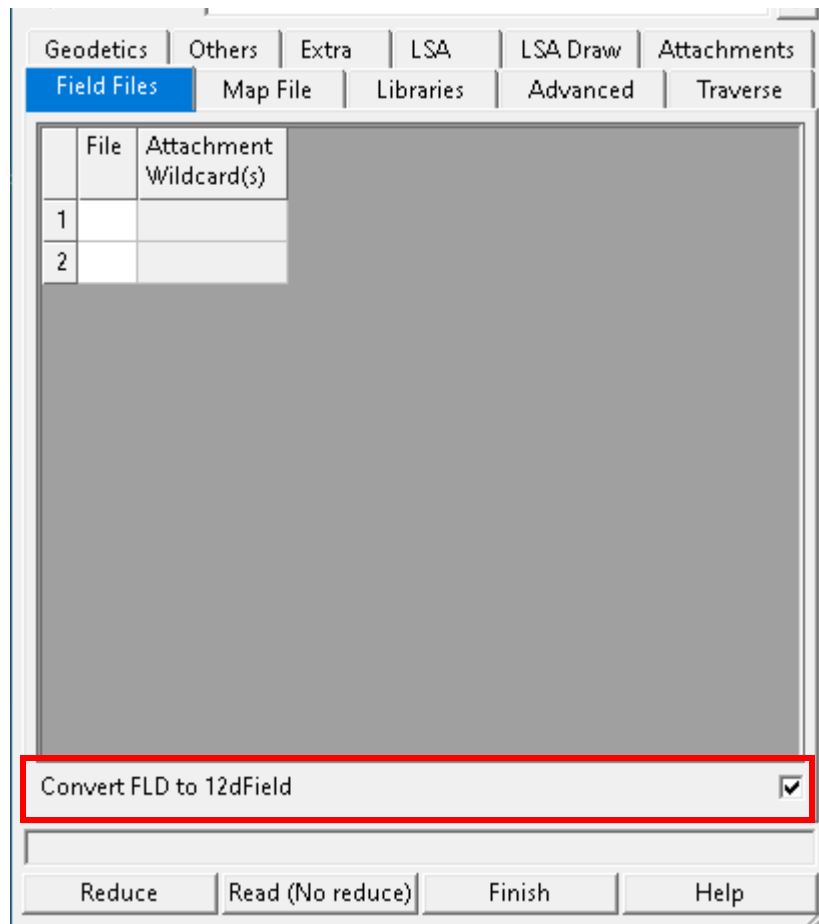
	File	Attachment Wildcard(s)
1		
2		

Convert FLD to 12dField

Reduce | Read (No reduce) | Finish | Help

### 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
<b>Convert FLD to 12dField</b>	tick box	ticked	

*The SDR function is converted from FLD (flat) to 12dField (tree) format.*

*For all .FLD files, equivalent .12dField files are created.*

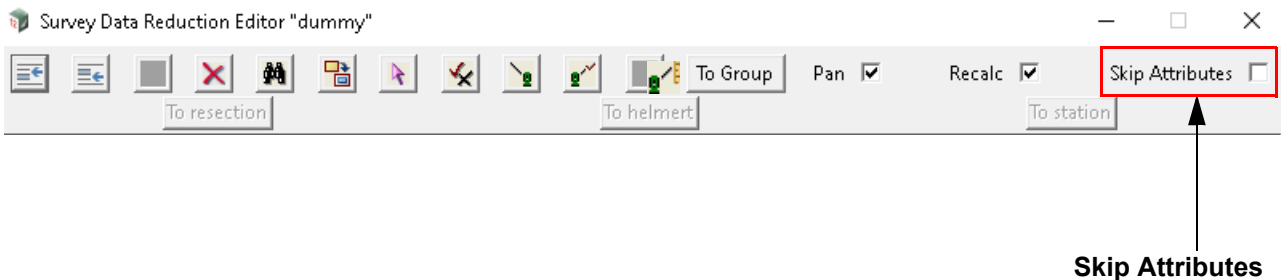
*If any .12dField files already exist, the convert fails.*

Continue to [14.7 Survey Data Reduction Editor](#) or return to [14 Survey](#).

## 14.7 Survey Data Reduction Editor

Now documented in the V15 reference manual

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

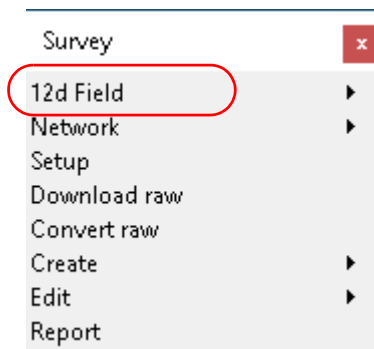
See

[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 [25.1.1.1 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.

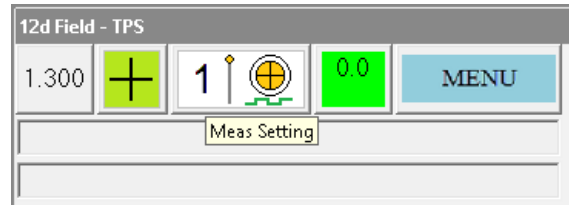
Connection to a Topcon Generic TPS instrument is completely controlled by **12d Field**.

**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](#).

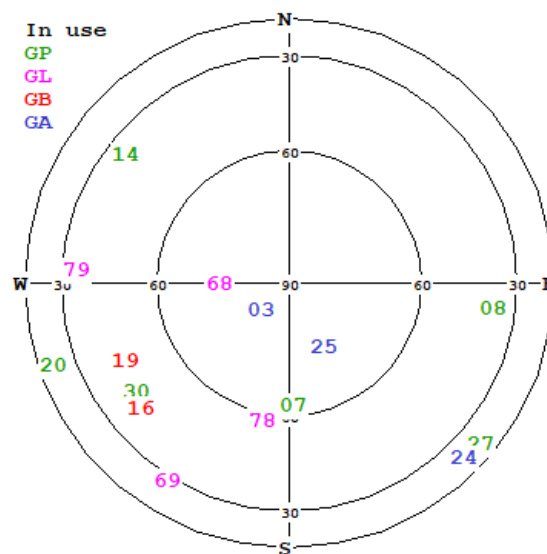
Continue to [15.1.2 GNSS Instruments](#) or go back to [15.1.1 TPS Instruments](#).

## 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 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 [15.1.2.8 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**.

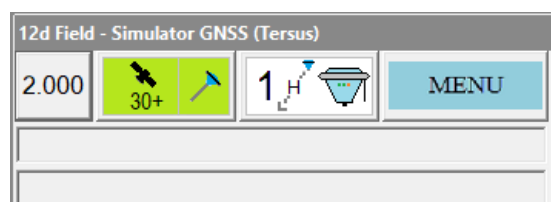
### 15.1.2.7 Tersus GNSS Instrument

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 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.



Instrument	
Simulator type	Tersus
Phase centre	0.082

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](#)
- [15.1.3.2 Panel Field Behaviour](#)
- [15.1.3.3 Primary Setout Panel and Hot Keys](#)
- [15.1.3.4 Customising Panel Field Descriptions](#)
- [15.1.3.5 Top most buttons](#)
- [15.1.3.6 On screen keyboard](#)
- [15.1.3.7 Hotkeys and Toolbars](#)
- [15.1.3.9 12d Field Panels](#)
- [15.1.3.10 Logging](#)
- [15.8.5.1 Search paths in 12d Field](#)
- [15.1.3.11 Attributes](#)

### 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

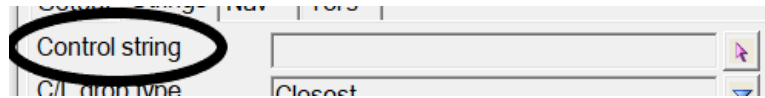
In general **12d Field** can have any number of **Setout** panels open which all can process measurements and display results but the first panel opened is the **primary** panel.

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 [15.8.4.11 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 [6.10.18 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 [6.8.2.12 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 [15.8.5.6 12dF\\_HOTKEY\\_BARS.4D file format](#).

For more details on 12d Field keyboard shortcuts see [15.8.5.7 12dF\\_USER\\_KEYS.4D file format](#).

For more details on how to use user\_toolbars.4d with 12d Field see [15.8.5.13 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 six/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:

---

12d Field		See
12d Field		<a href="#">15.3 Starting and Configuring 12d Field</a>
12d Field Utilities	▶	<a href="#">15.9 12d Field Utilities</a>
12d Field Codes	▶	<a href="#">15.10 12d Field Codes</a>
Setout FLD file to strings		<a href="#">15.11 12dField Setout FLD File To Strings</a>

## 15.3 Starting and Configuring 12d Field

**Position of menu:** Survey =>12d Field =>12d Field

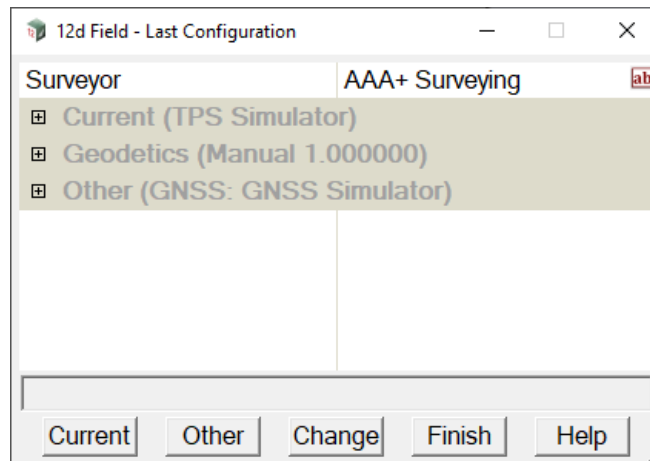
### Important

**12d Field** uses many text files to store its configurations and allow easy customisation.

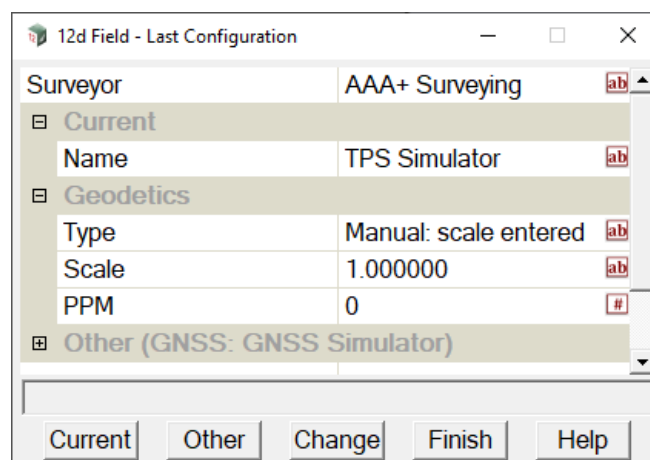
Generally, but not always these files start with the prefix **12dF\_** and have the extension **.4D**, by default these files are stored in the **USER** area so that they are common to all projects. A user can then copy individual files in the **CUSTOMER\_USER** or **working directory** to allow extra flexibility where needed. Please refer [35.2.5 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](#).

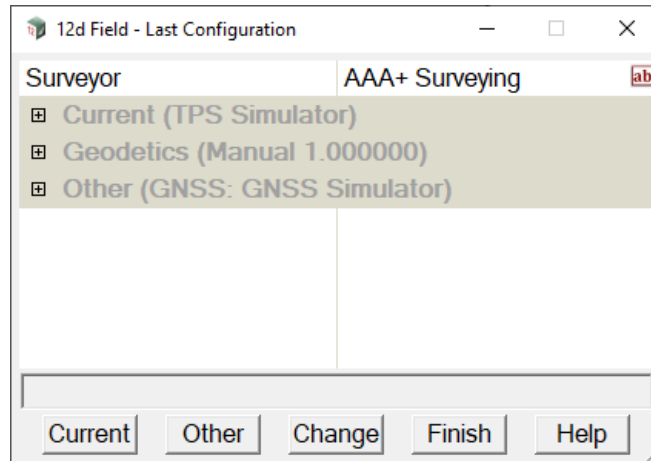
### 15.3.1 12d Field - Last Configuration

**Position of option on menu:** Survey =>12d Field=>12d Field

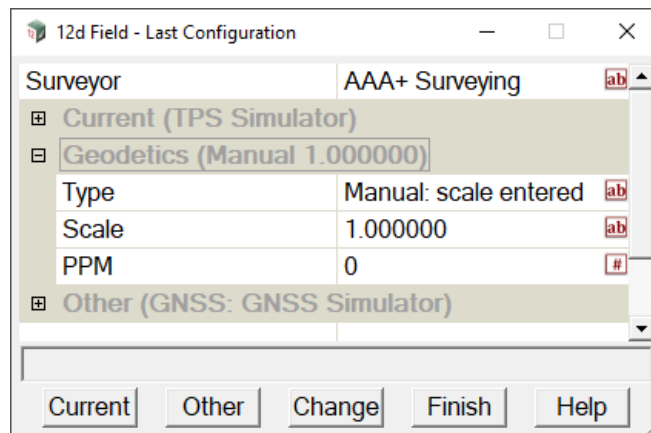
Clicking on the **12d Field** options displays the **12d File - Last Configuration** panel.

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 [15.6.7 General Settings - TPS Panels >General 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](#)).*

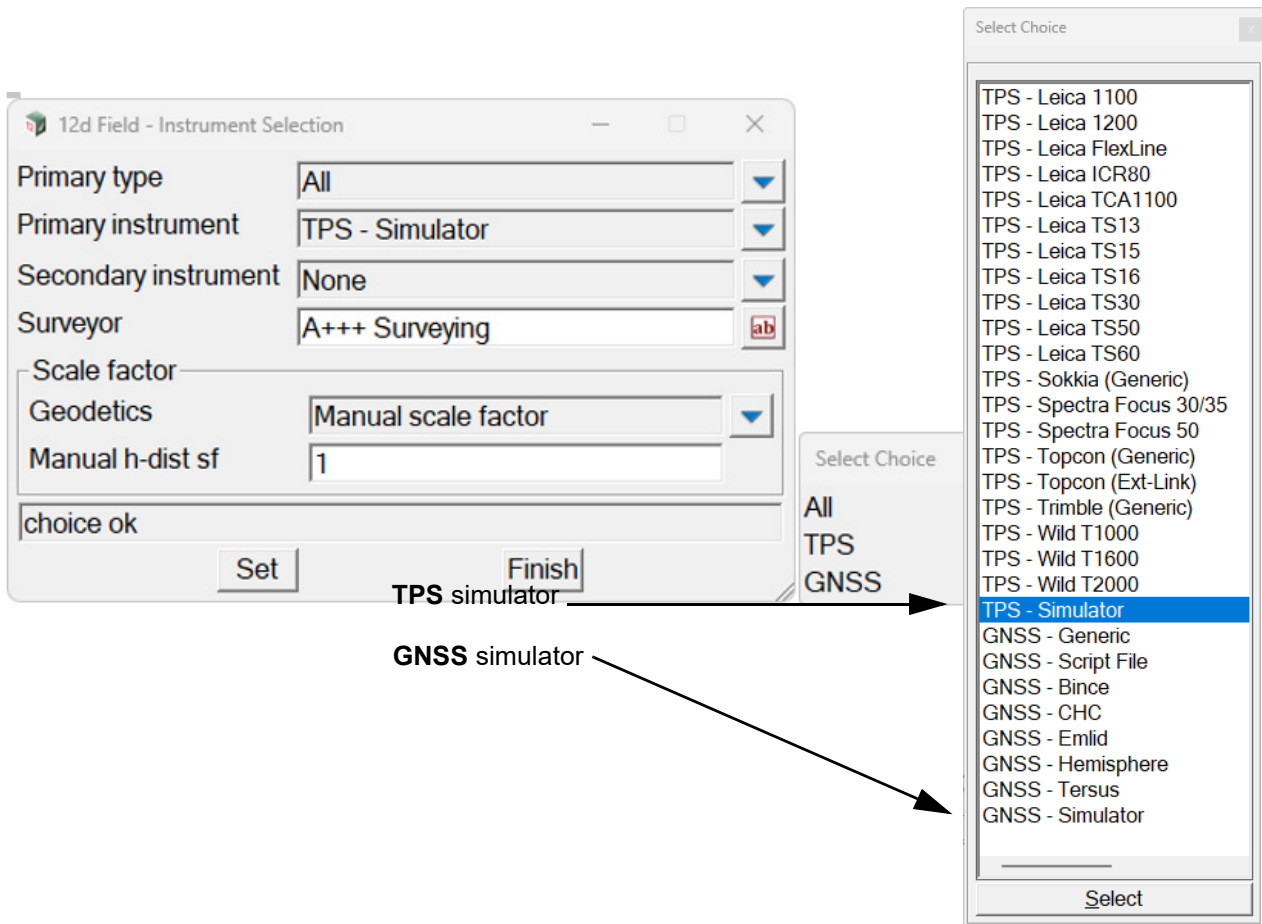
If there are no configuration changes to be made and there are no configuration or connections errors, either the [15.4.1 12d Field TPS Control Bar](#) or the [15.4.2 12d Field GNSS Control Bar](#) is brought up.

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

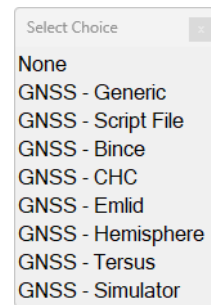
The **12d Field - Instrument Selection** panel is used to select the type of instrument to connect to and then the connection method for the selected instrument.

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
<b>Primary type</b>	choice box		All, TPS, GNSS
<i>The user can restrict the instruments shown in the Primary instrument choice box to either TPS or GNSS instruments if desired.</i>			
<b>Primary instrument</b>	choice box		defined instruments
<i>List of possible instruments to connect to.</i>			
<i>The list is comprehensive and can be filtered to only the instruments actually used- for more details please see <a href="#">15.8.1.2 12dF_INSTRUMENT_SELECTION.4D</a>.</i>			
<b>Secondary instrument</b>	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

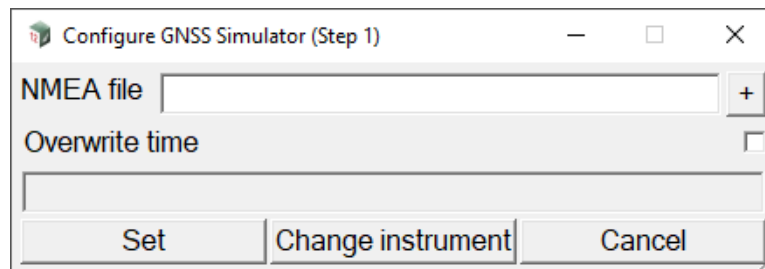
This panel selects the NMEA file, See [15.3.1.1.1.1 Configure GNSS Simulator \(Step 1\)](#)

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
<b>NMEA file</b>	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 [15.6.15.4 Create NMEA String](#).*

*A default file "Default\_LLQ.NMEA" is created automatically for first up usage.*

<b>Overwrite time</b>	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

<b>Set</b>	button
------------	--------

*After selecting **Set**, the panel **Configure GNSS Device (Step 2)** is displayed. See [15.3.1.1.1.2 Configure GNSS Simulator \(Step 2\)](#).*

<b>Change instrument</b>	button
--------------------------	--------

*Return to the **12d Field - Instrument Selection** panel. See [15.3.1.1 12d Field - Instrument Selection](#).*

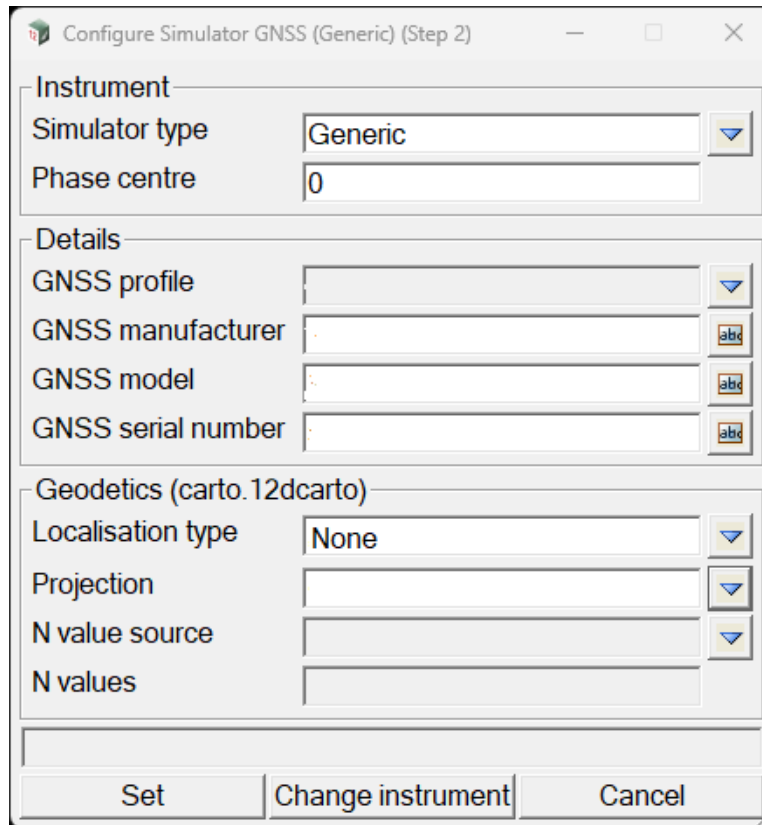
<b>Cancel</b>	button
---------------	--------

*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

<b>Simulator type</b>	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

<b>GNSS Profile</b>	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](#).*

<b>GNSS Manufacturer</b>	input box		
--------------------------	-----------	--	--

*Name of the manufacturer.*

<b>GNSS Model</b>	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.*

N value source     

*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:*

Projection	<input type="text" value="MGA2020 Zone 56 NV2020"/>	
N value source	<input type="text" value="12d"/>	
N value	<input type="text" value="2020"/>	

*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.

N value source      Receiver

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 **12d 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 [15.3.1.1.3 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 [15.3.1.1.3 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
<b>Connection</b>	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.*

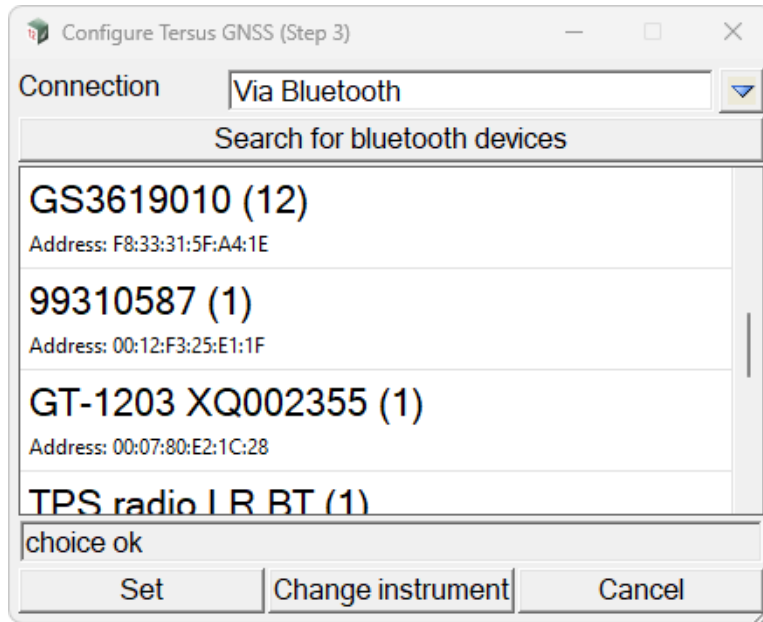
*If Via Bluetooth COM Port, the **Com port** field is displayed - this is deprecated*

**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 devices** button is displayed and a list of previously discovered devices shown.*

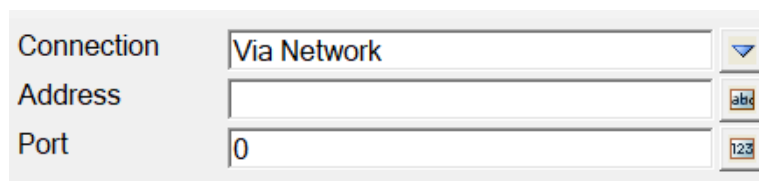


If your device is not listed, clicking on the **Search for bluetooth devices** button lists the available bluetooth devices to select from. Existing devices will not be removed from the list if they are not available when the search is done.

**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**.

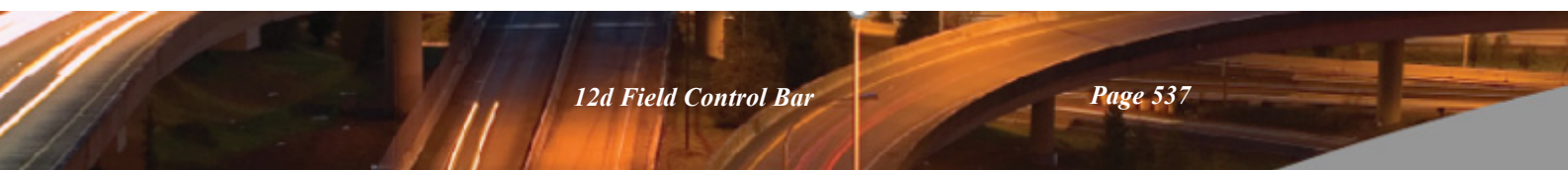
Continue to [15.4.1 12d Field TPS Control Bar](#) or return to [15.3.1 12d Field - Last Configuration](#).



## 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](#).

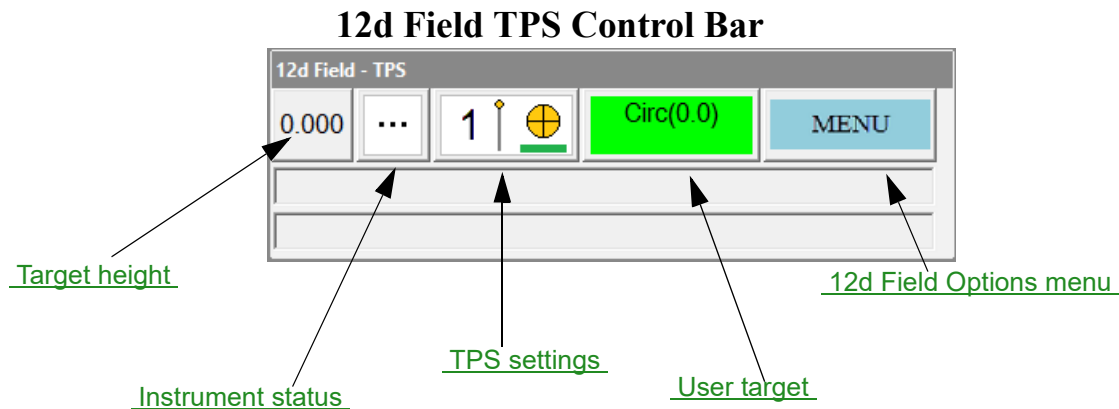


## 15.4.1 12d Field TPS Control Bar

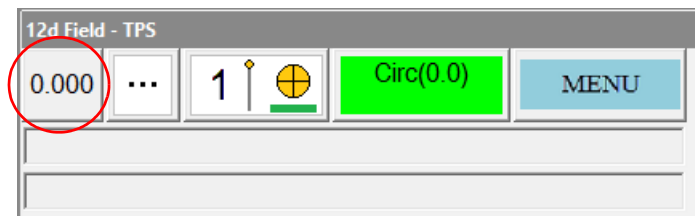
Once a TPS instrument has been selected and **12d Field** has successfully connected to the instrument, the **TPS control bar** will appear.

The **TPS control bar** is identical in functionality and layout for all TPS.

The **TPS control bar** has all the options for working with TPS for both **Pickup** and **Setout**.

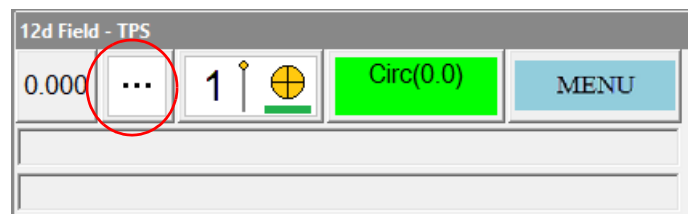


### Target height



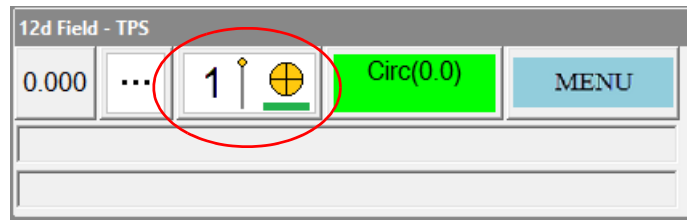
The button displays the current overall target height in use, if the target height is suffixed by an asterisk. For example **1.850\*** this indicates the extra target field is being used. Pressing the button brings up the **12d Field - Target Heights** panel. See [15.4.1.1 12d Field - TPS Target Heights](#) for full details on setting and using TPS target heights.

### Instrument status



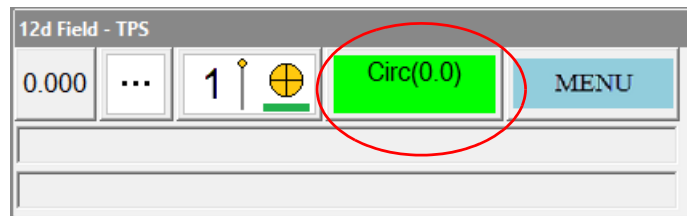
The button displays the current operational status of the TPS instrument. For example whether it is idle, measuring a distance, rotating, locked onto and tracking a prism or lost lock and awaiting search instructions. Pressing the instrument status button does not bring up a panel but dependent on the 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](#).

## TPS settings



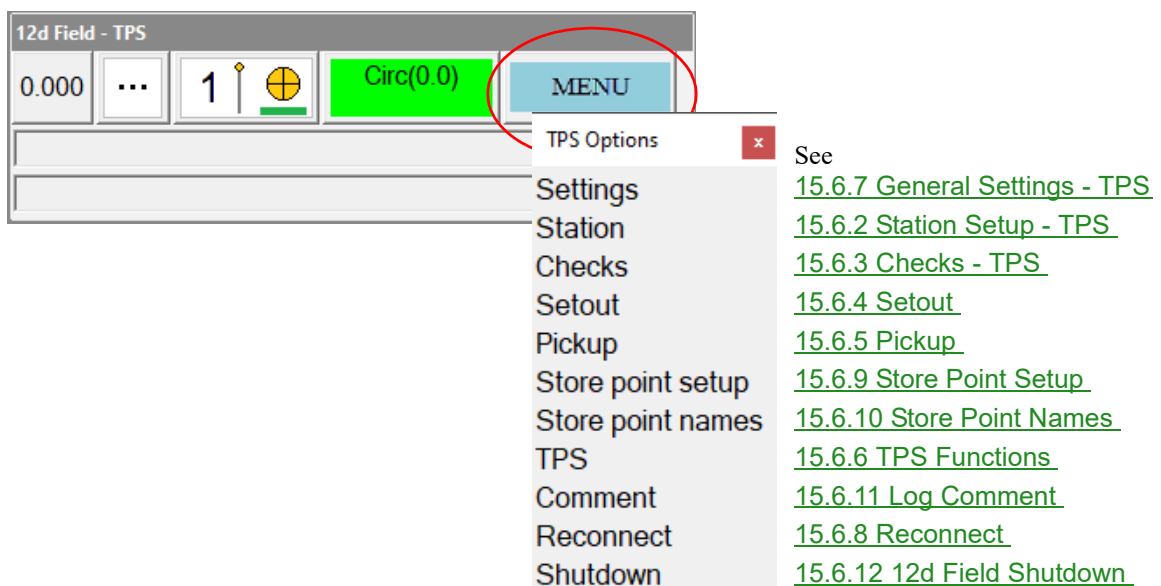
The button displays the combined **12d Field** and TPS instrument measurement settings. The left hand side of the icon indicates the **12d Field** measurement style, single, continuous, etc, the middle the target pole type if applicable and the right hand side the TPS target acquisition and measurement 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



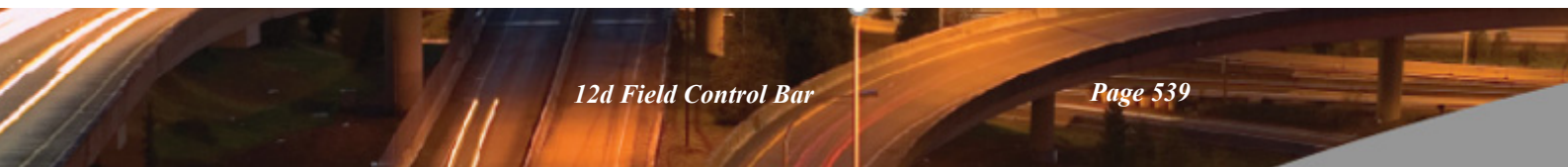
The button displays user definable information indicating what sort of target is currently in use. For full details on configuring targets for use with **12d Field** see [115.8.2.1 12dF\\_TPS\\_INS\\_USER\\_TARGETS.4D file format](#) file format. Pressing the button will also bring up the **12d Field - 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



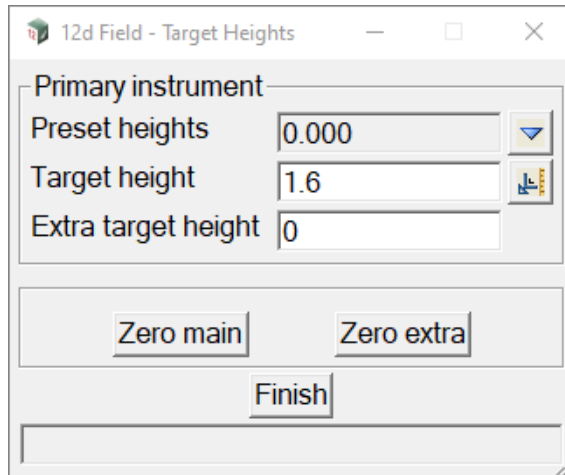
This button brings up the 12d Field Options menu, access to all of the available panels and functionality for the TPS instrument being used. All panels can also be accessed directly via user definable hotkeys and toolbars, see [15.1.3.7 Hotkeys and Toolbars](#) for full details.

Continue to next section [15.4.1.1 12d Field - TPS Target Heights](#) or return to [15.4 12d Field Control Bar](#).

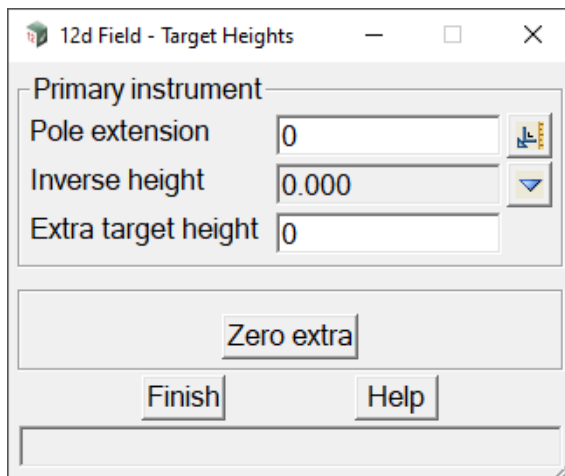


### 15.4.1.1 12d Field - TPS Target Heights

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
<b>Preset heights</b>	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.*

<b>Target height</b>	real box
----------------------	----------

*Target height.*

<b>Pole extension</b>	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.*

<b>Inverse height</b>	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 **1.5m** and selects an inverse height of **0.4m** 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](#).

**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).

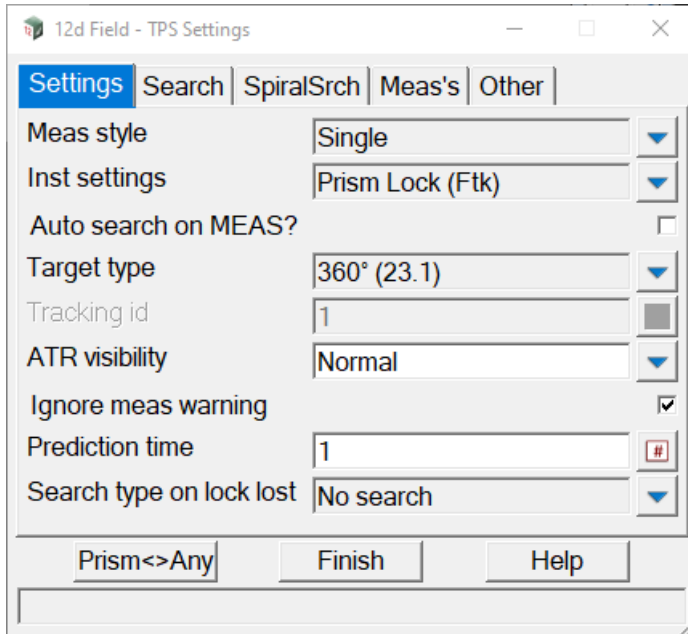
**Zero extra**                                      button

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
-------------------	------	----------	--------

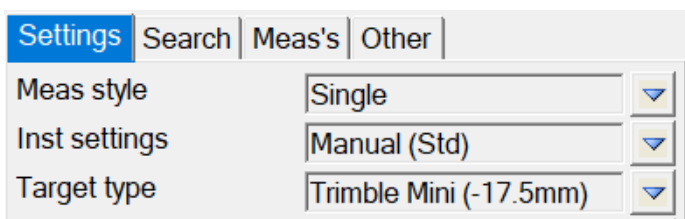
#### Buttons at Bottom

**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

The screenshot shows a settings panel with the following items:

- Auto search on MEAS?
- Target type: 360° (23.1) [dropdown arrow]
- Tracking id: 1 [text box]
- ATR visibility: Normal [dropdown arrow]
- Ignore meas warning
- Prediction time: 1 [text box]
- Search type on lock lost: No search [dropdown arrow]

**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.

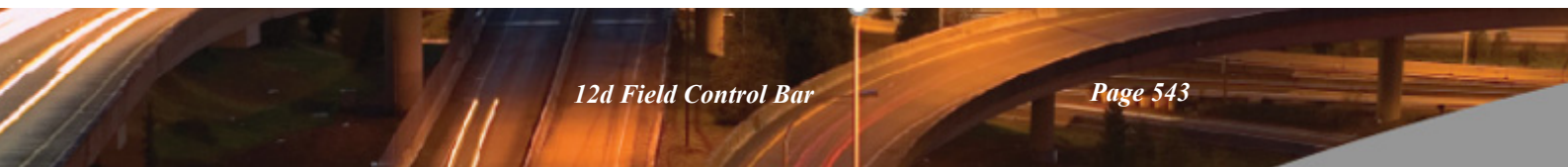
**Prediction time**                      integer box

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.*

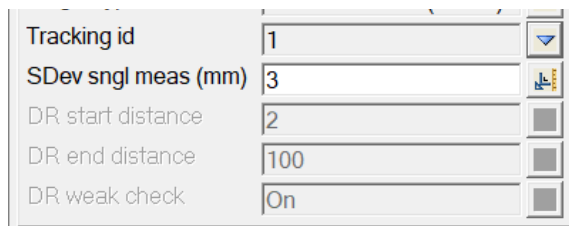
**No search** the instrument will do no automatic search, it will wait for the user to send commands to position it and reacquire lock.

**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 snl 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.*

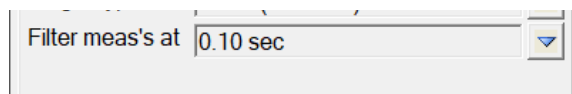
**DR end distance**

*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		
Horizontal range	0°	
Vertical range	0°	
Lost target follow time(s)	5	

### 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	2°	
AC search range vert	2°	
Search range horz	90°	
Search range vert	20°	
Search type	Pattern 1	
Prediction time	3 sec	
Wait before search time	3599	

#### 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

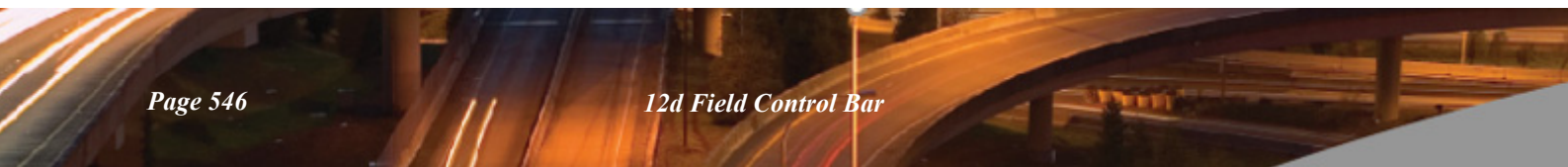
Select the predefined search pattern on the instrument.

#### 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

12d Field - TPS Settings

Settings | Search | **SpiralSrch** | Meas's | Other

Default dist from inst for searches

Spiral search angles

Range horizontal

Range vertical

Spiral search area

Full width

Full height

IR<>RL Finish

angle is valid

[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.*

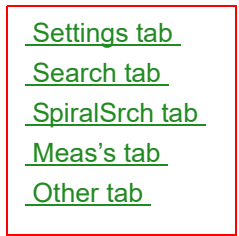
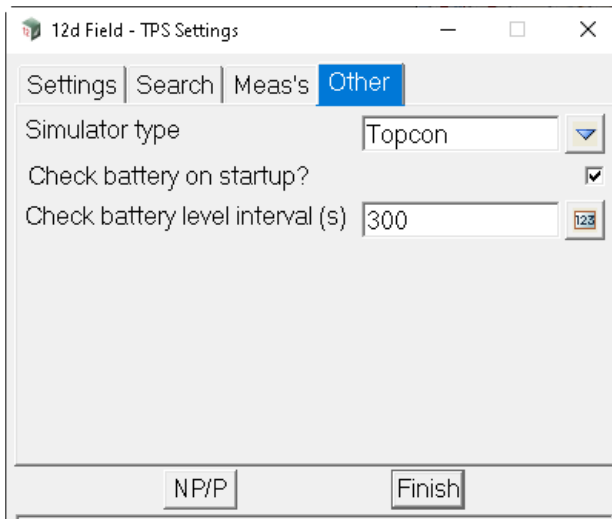
**Avg max va std-dev**                real box

*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



**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



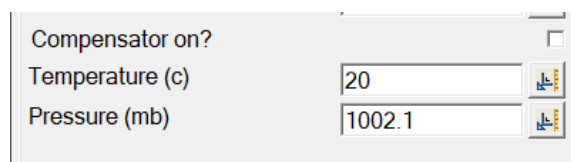
**Add MPR122 to targets list?** tick box      **ticked**

***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](#).

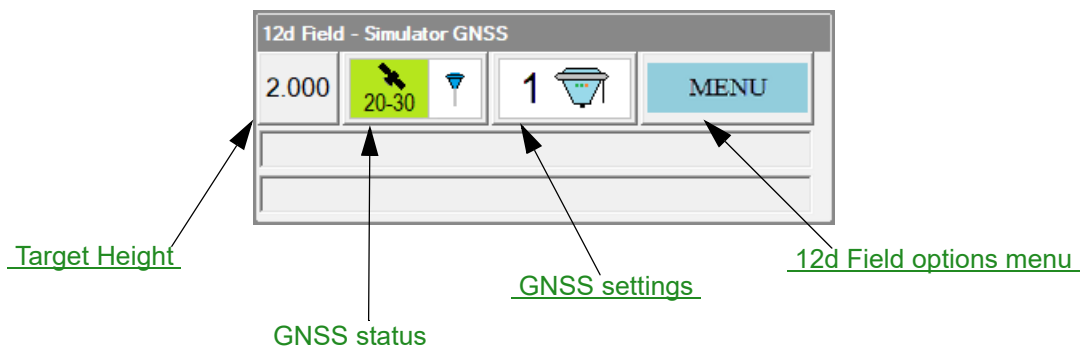
## 15.4.2 12d Field GNSS Control Bar

Once a GNSS instrument has been selected and **12d Field** has successfully connected to the instrument, the **GNSS control bar** will appear.

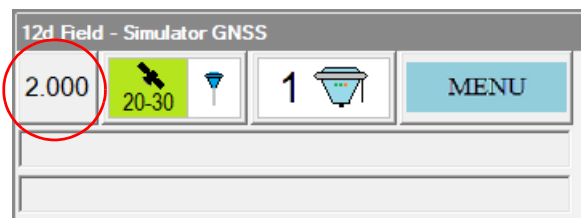
The **GNSS control bar** is identical in functionality and layout for all GNSS instruments but individual icons may vary from instrument type to instrument type.

The **GNSS control bar** has all the options for working with GNSS for both **Pickup** and **Setout**.

### 12d Field GNSS Toolbar

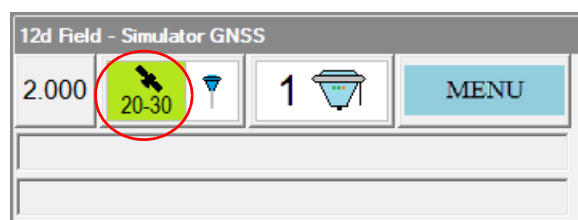


### Target Height



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

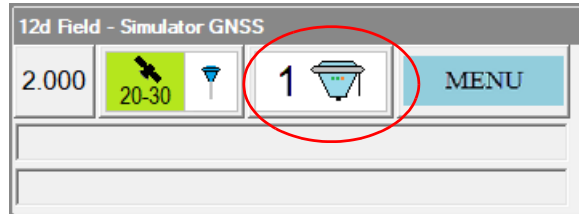


The button displays an indication of the status of the GNSS instrument, this comprises the satellite and tilt pole status for tilt capable receivers. For example, here the left side of the button is indicating the RTK status of the receiver is considered good via the green colouring and that there are 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.

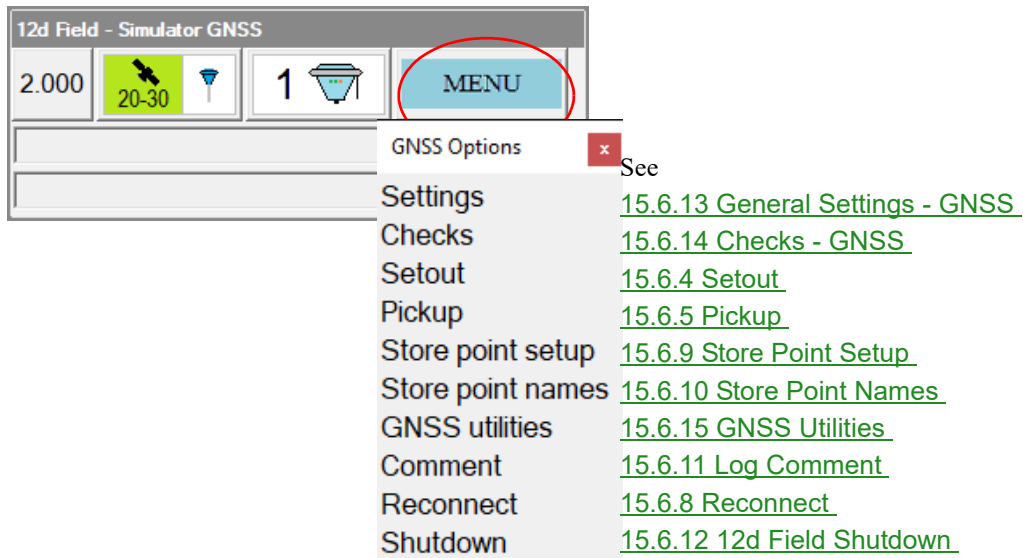
For full information on interpreting the GNSS status see [15.5.3.1 GNSS Status Button Bitmaps](#). Pressing the button brings up the **12d Field - GNSS Status** panel, see [15.4.2.2 12d Field - GNSS Status](#).

## 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



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
<b>Preset heights</b>	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** field.*

<b>Target height</b>	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.*

<b>Extra tar height</b>	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.*

<b>Zero main</b>	button
------------------	--------

*When pressed, the **Target height** is set to zero (0).*

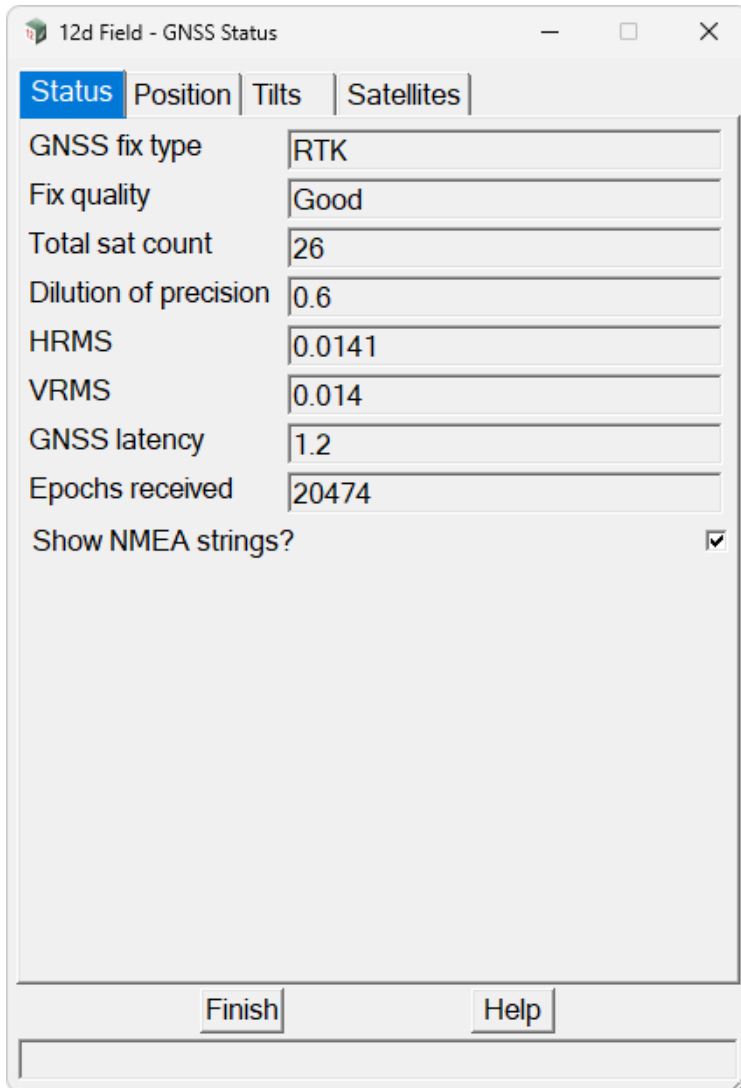
<b>Zero extra</b>	button
-------------------	--------

*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

Field	Value
<b>Global position</b>	
Longitude	151°11'44.34414"
Latitude	-33°40'38.85887"
Proj'n easting	332734.1574
Proj'n northing	6272144.9228
Ellipsoid height	203.854
<b>N values</b>	
N value source	12d: "RANCH LL GSB"
N value	23.3282
Orthometric height	180.5138
<b>Local position</b>	
Localisation dx/dy	
Local easting	332734.1574
Local northing	6272144.9228
Localisation dz	
Localisation n-value	
Local height	180.5138

- [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

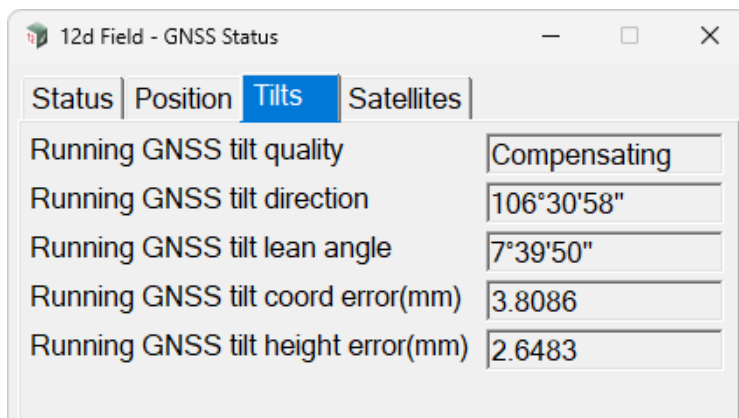
*Current n-value*

**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

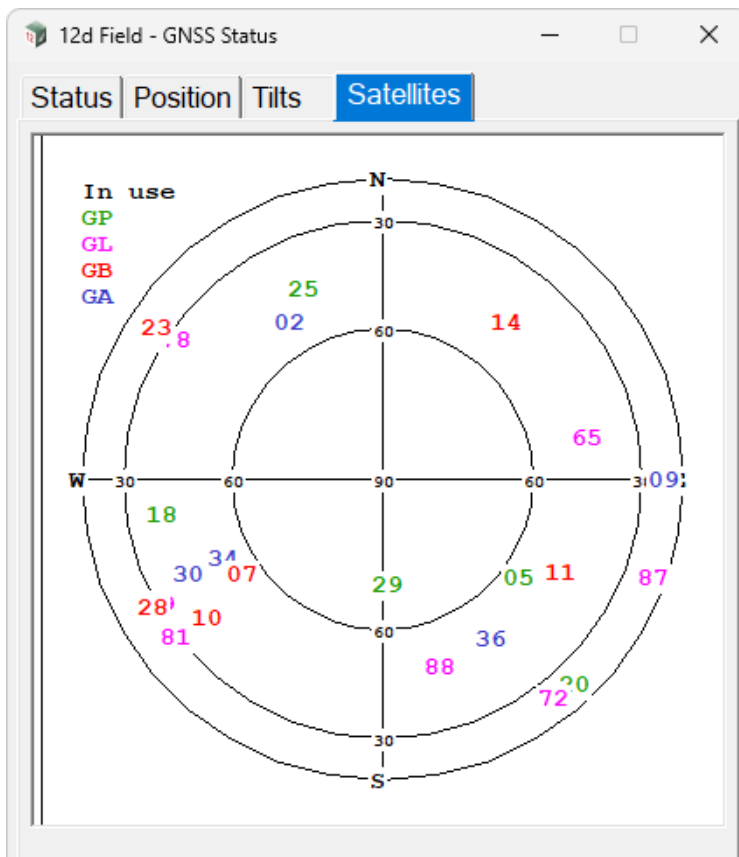
*An estimate of the xy error at the corrected pole tip position.*

**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.*

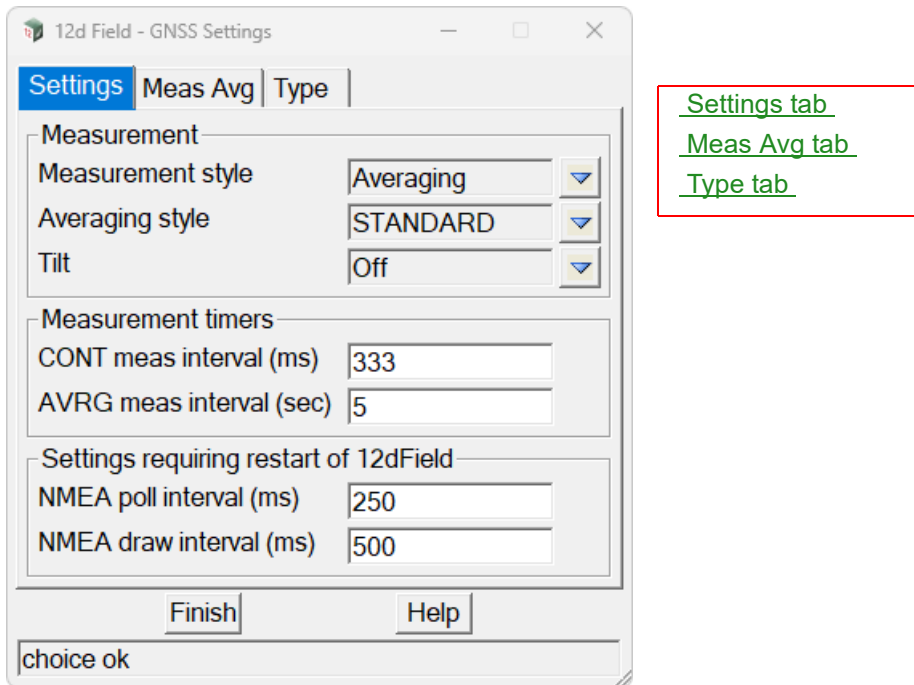


- [Status tab](#)
- [Position tab](#)
- [Tilts tab](#)
- [Satellites tab](#)

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.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Settings tab

##### Measurement

<b>Measurement style</b>	choice box		Single Meas, Averaging, Continuous, Hidden Pt
--------------------------	------------	--	---

For information on GNSS Measurements see [15.5.1.1 Measurement styles](#).

<b>Averaging style</b>	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](#).

<b>Tilt</b>	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**.

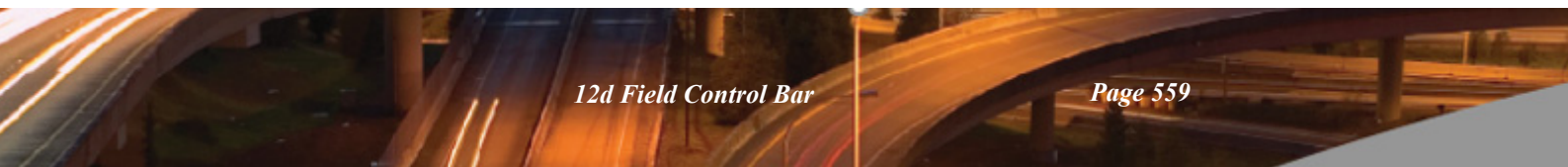
**On**, start using tilt corrections, 12d will display a single warning box if the NMEA sentences being broadcast are not the necessary sentences needed to do the tilt calculations.

**Off**, **12d Field** will accept the phase centre reading for the GNSS as is ignoring all tilt sentences being broadcast.

##### Measurement timers

<b>CONT meas interval (ms)</b>	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**

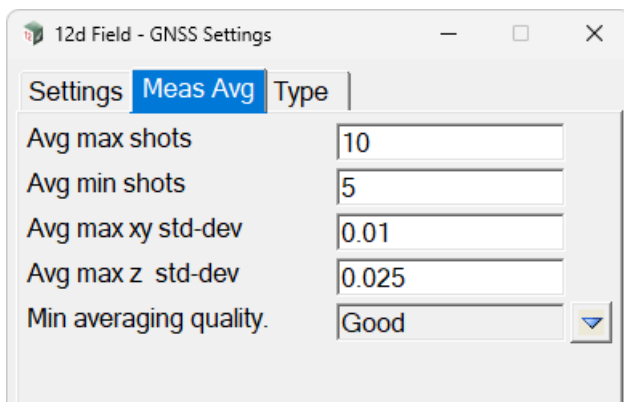
**NMEA poll interval (ms)** integer box

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.

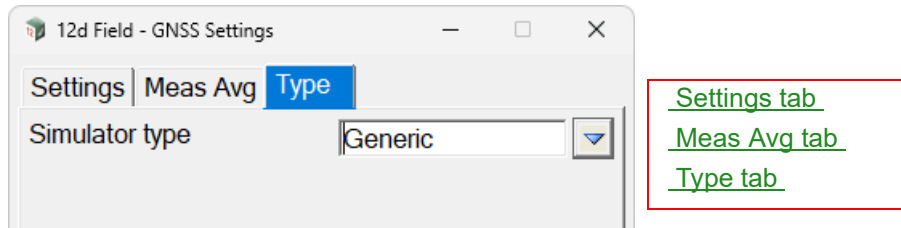
**Min averaging quality** choice box

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



**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.

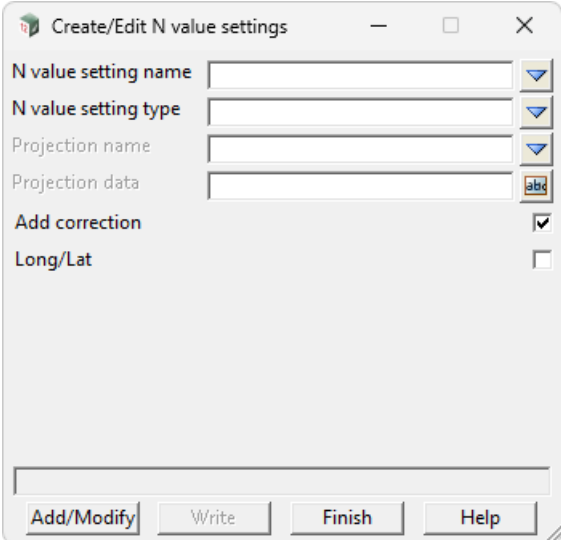
See [15.5.1.2.1 Setting up an n value for 12d Field](#)

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**.

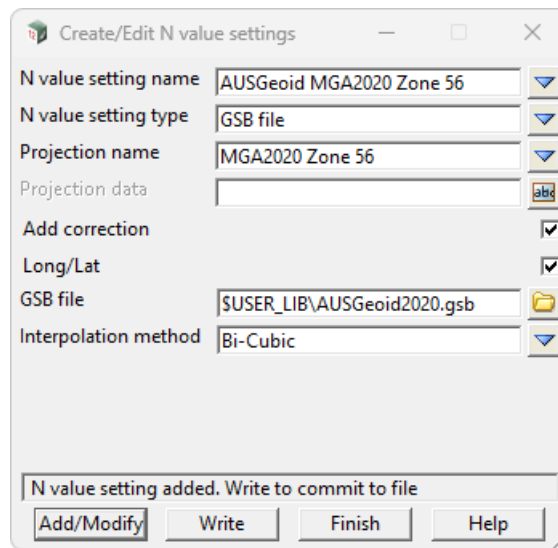
**Add correction**, this will typically be ticked **on**.

**Long/Lat**, this will typically need to be ticked on as for this case.

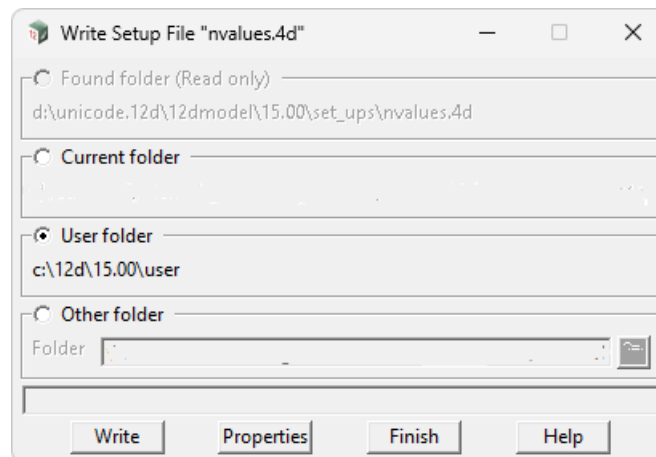
**GSB file**, browse to the GSB file to use, typically in user lib.

**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.



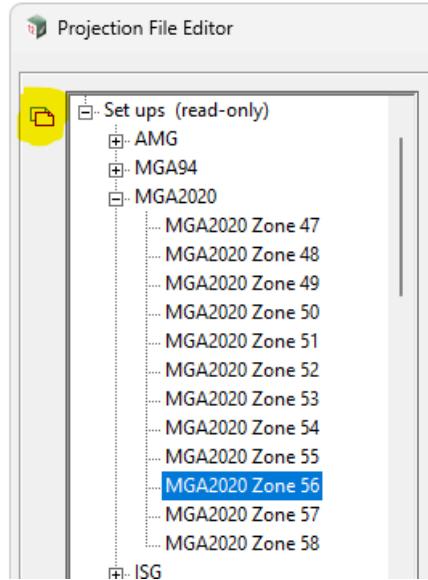
Typically you would choose to save this in the user folder.



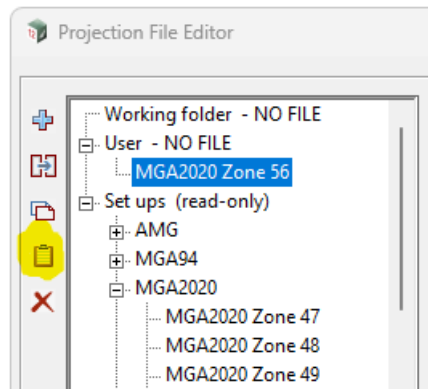
### 15.5.1.2.2 Setting up a projection for 12d Field

Open **Project-> Management-> Projections-> Projections editor**

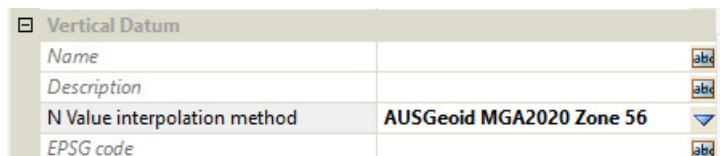
Select the projection to use and press the copy button in the top left corner.



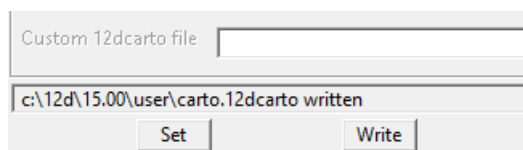
Paste this into the **User** area.



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.

Geodetics (carto.12dcarto)		Select Projection
Localisation type	None	
Projection	MGA2020 Zone 56	MGA2020 Zone 56
N value source	12d	AMG
N values	AUSGeoid MGA2020 Zone 56	MGA94
		MGA2020

And the n values are now used inside **12d Field**.

N values	
N value source	12d: "AUSGeoid MGA2020 Zo
N value	23.3285
Orthometric height	182.5678

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 2 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.



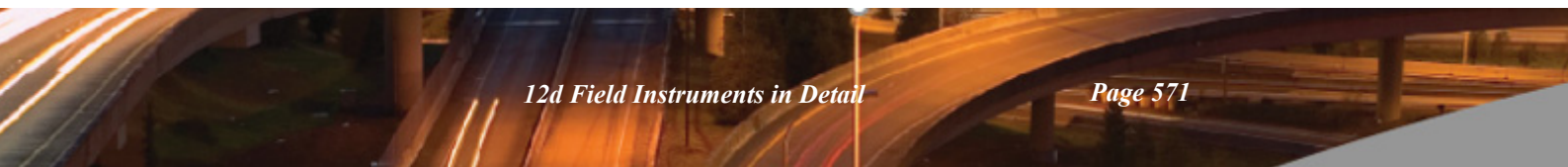
The instrument is locked onto and following the target, if the user presses the button the instrument will manually unlock from the target.



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.

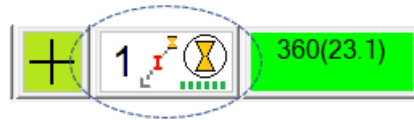
Continue to [15.5.2.5 TPS Settings Bitmaps](#) or return to [15.5.2 TPS Instruments Only](#) or [15.5 12d Field Instruments in Detail](#).



### 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.

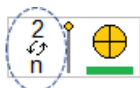
**SNGL** - Single



**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

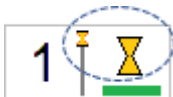
Any surface



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

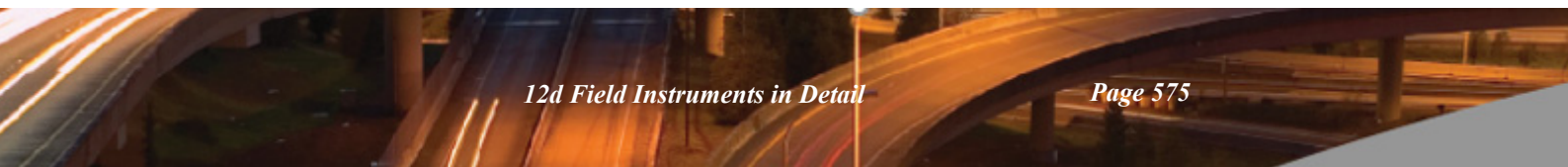


**Tape or any surface** targets do not display any information.



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.

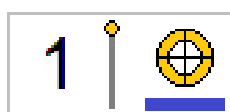
**STK**, standard tracking measurement, continuous distance measurement to a higher accuracy, (not recommended), the screen position of the target in **12d Field** is continuously updated.

**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

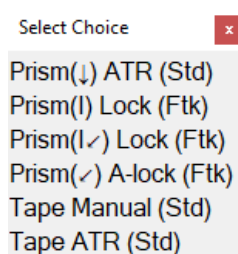
It takes the AP20 a relatively short time for the IMU to activate but substantially longer for it to be able to be held stationary for a longer period of time. When using the AP20 with **12d Field** first open the appropriate panels and enter the data necessary for the job at hand prior to moving the 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.

#### 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(?)

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 (l)

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(?)

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?)

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 from 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

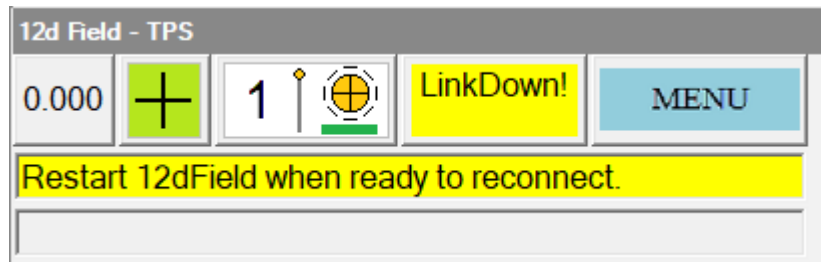
Unlike **Pole extension** this value is applied vertically from the calculated pole tip position, i.e. this value is subtracted from the pole tip RL to give the final measured RL. See [15.6.3.3 Check Target Height Calibrate - TPS](#) for how to accurately determine pole heights.

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](#).

### 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.

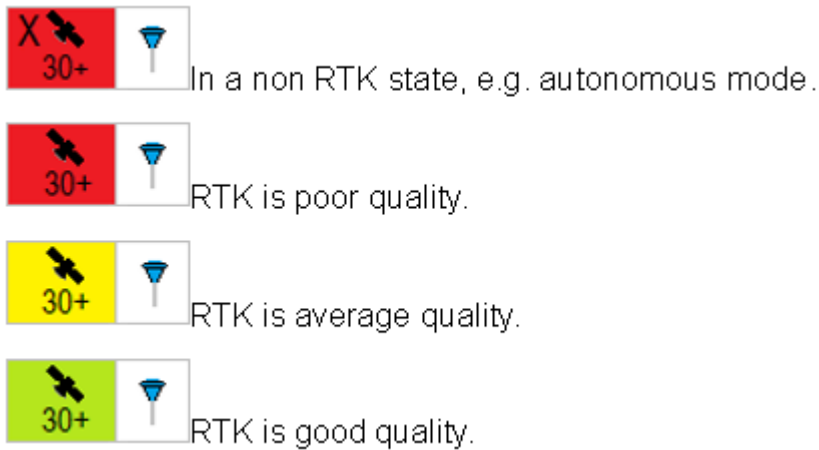


No satellite status received, tilt pole is not calibrated.

If these bitmaps remain it is an indication no NMEA strings are being received.

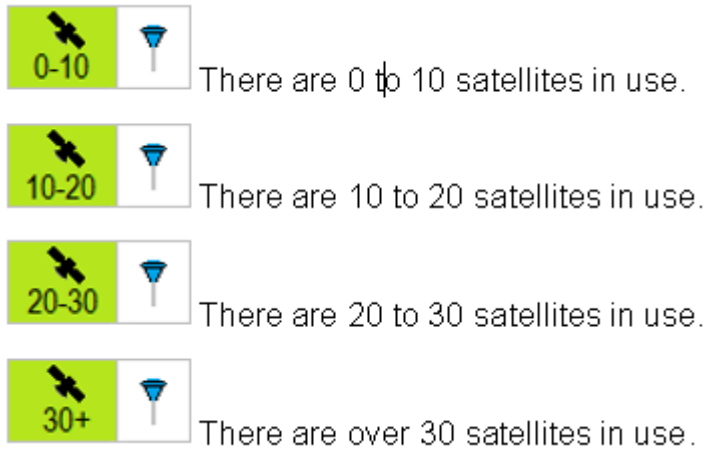
### 15.5.3.1.2 RTK status

The RTK status is shown by the colour of the LHS of the bitmaps.



### 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.



### 15.5.3.1.4 Tilt pole status

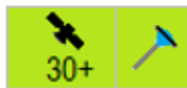
Tilt status is shown as a combination of colour and pole images on the RHS of the bitmaps.



Tilt is not available or not active.



Tilt is active but the quality is poor.



Tilt is active and the quality is good.

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 <span>✕</span>	See
Settings	<a href="#">15.6.7 General Settings - TPS</a>
Station	<a href="#">15.6.2 Station Setup - TPS</a>
Checks	<a href="#">15.6.3 Checks - TPS</a>
Setout	<a href="#">15.6.4 Setout</a>
Pickup	<a href="#">15.6.5 Pickup</a>
Store point setup	<a href="#">15.6.9 Store Point Setup</a>
Store point names	<a href="#">15.6.10 Store Point Names</a>
TPS	<a href="#">15.6.6 TPS Functions</a>
Comment	<a href="#">15.6.11 Log Comment</a>
Reconnect	<a href="#">15.6.8 Reconnect</a>
Shutdown	<a href="#">15.6.12 12d Field Shutdown</a>

### 12d Field GNSS Options

GNSS Options <span>✕</span>	See
Settings	<a href="#">15.6.13 General Settings - GNSS</a>
Checks	<a href="#">15.6.14 Checks - GNSS</a>
Setout	<a href="#">15.6.4 Setout</a>
Pickup	<a href="#">15.6.5 Pickup</a>
Store point setup	<a href="#">15.6.9 Store Point Setup</a>
Store point names	<a href="#">15.6.10 Store Point Names</a>
GNSS utilities	<a href="#">15.6.15 GNSS Utilities</a>
Comment	<a href="#">15.6.11 Log Comment</a>
Reconnect	<a href="#">15.6.8 Reconnect</a>
Shutdown	<a href="#">15.6.12 12d Field Shutdown</a>

Continue to [15.6.1 Common Buttons, Panel Tabs and Fields](#).



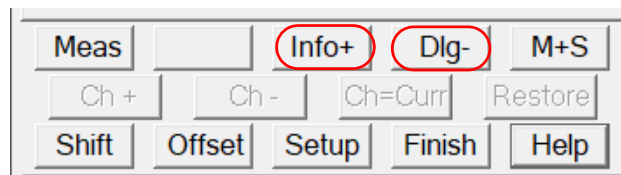
## 15.6.1 Common Buttons, Panel Tabs and Fields

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 [15.8.4.4 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.*

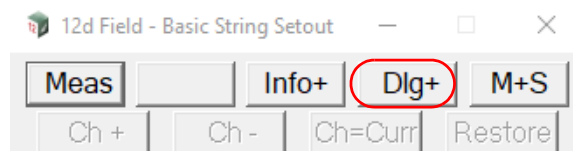
*When the information panel closed, the button changes to **Info+**.*

#### 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 \(GNSS only\)](#)

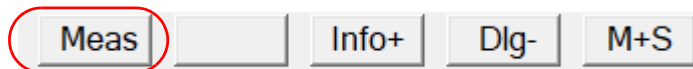
### 15.6.1.2.0.1 Single (GNSS/TPS) and Multiface (TPS only) Measurement Modes

In **Single** and **Multiface** modes, the **Meas**, **Store** and **MS\_ST** buttons can be used.



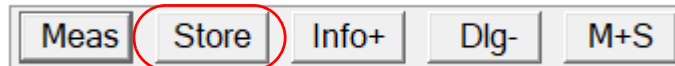
However, the **Store** button is disabled until a measurement is made.

**Meas**



Starts the measurement and on completion of the measurement, the **Store** button appears:

**Store**

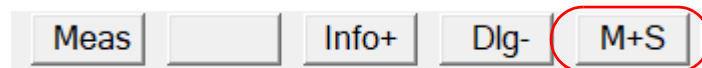


Stores the point as per the settings in the [15.6.9 Store Point Setup](#) panel.

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**



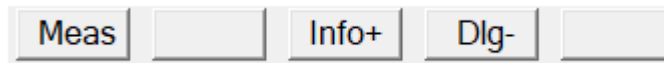
Starts a measurement and stores the point as per the settings in the [15.6.9 Store Point Setup](#) panel.

The **Store** button remains disabled.

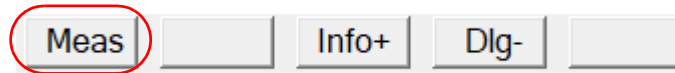
Continue to [15.6.1.2.0.2 Continuous \(GNSS/TPS\) Measurement Mode](#) or return to [15.6.1 Common Buttons, Panel Tabs and Fields](#).

### 15.6.1.2.0.2 Continuous (GNSS/TPS) Measurement Mode

In **Continuous** mode, the **MS+ST** button is disabled.



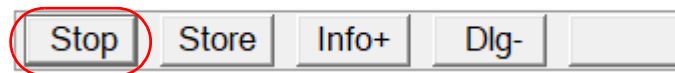
Meas - Continuous



*Start continuous measurement.*

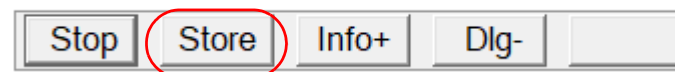
*The **Stop** button then replaces the **Meas** button and the **Store** button is enabled.*

Stop



*Stop the continuous measurement.*

Store



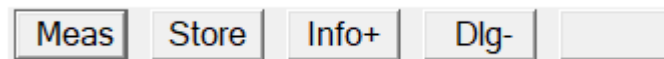
*Store the point as per the settings in the [15.6.9 Store Point Setup](#) panel.*

*The button state does not change meaning the user can continue to store points at a single press of the **Store** button.*

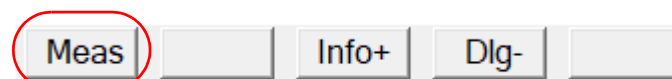
Continue to [15.6.1.2.0.3 Averaging measurement mode \(GNSS only\)](#) or return to [15.6.1 Common Buttons, Panel Tabs and Fields](#).

### 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.*

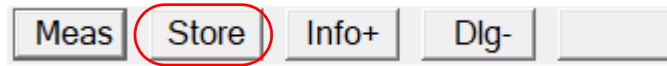
*The details of the averaging, standard deviations in x, y, and z are displayed in the third message line of the panel. The **Stop** button then replaces the **Meas** button.*

Stop



*Stop the averaging measurement.*

Store

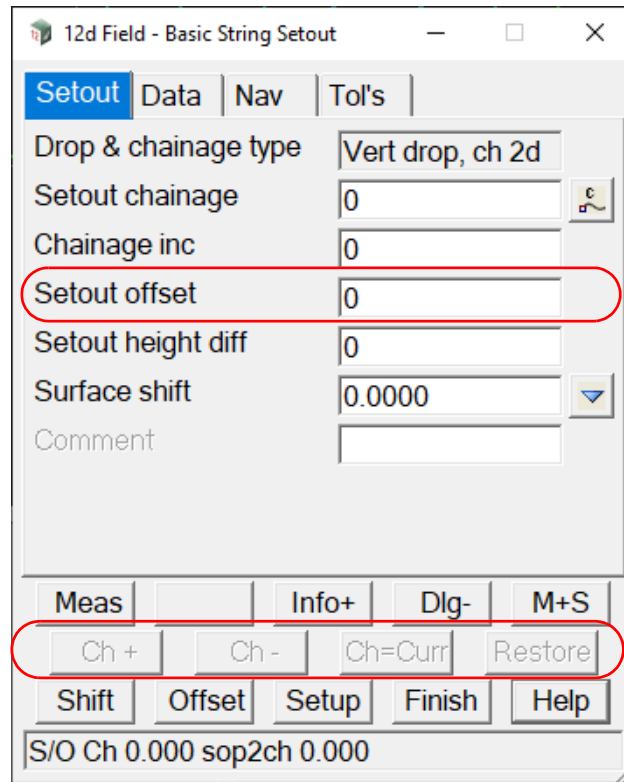


*Store the point as per the settings in the [15.6.9 Store Point Setup](#) panel.*

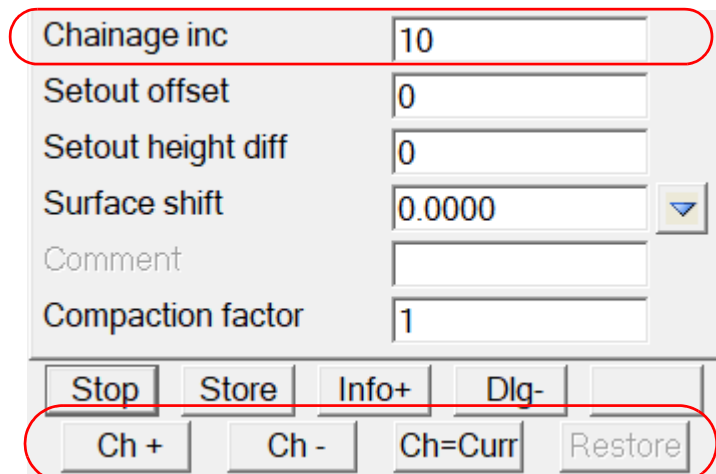
Continue to [15.6.1.3 Ch+, Ch-, Ch=Curr and Restore Buttons](#) or return to [15.6.1 Common Buttons, Panel Tabs and Fields](#).

### 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.

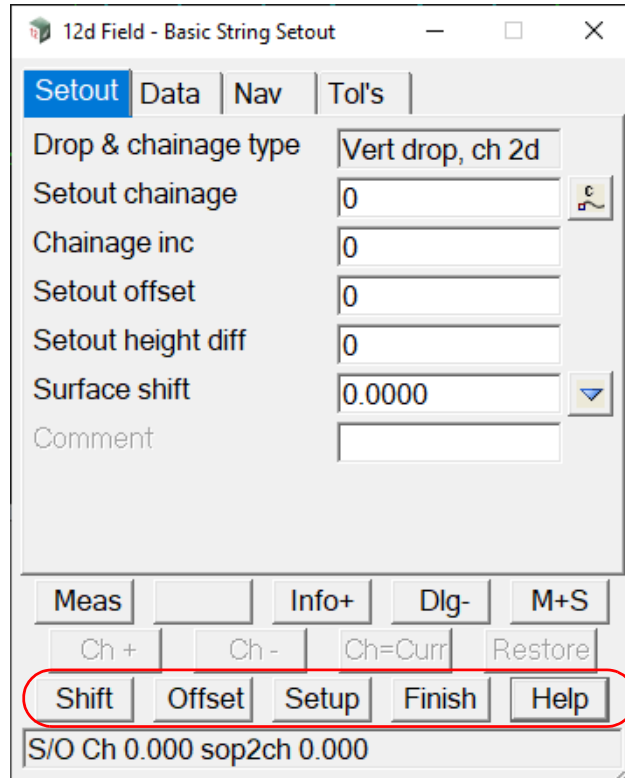
Restore

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](#).

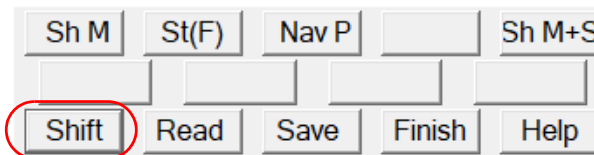


### 15.6.1.4 Shift, Offset and Setup Buttons



**Shift**

*Display extra functionality available for each panel button.*



**Offset**

*Open the Offset Measurement panel. See [15.6.6.6 TPS Offset Measurement](#).*

**Setup**

*Open the Store Point Setup panel. See [15.6.9 Store Point Setup](#).*

**Setup >**

**Sh M**

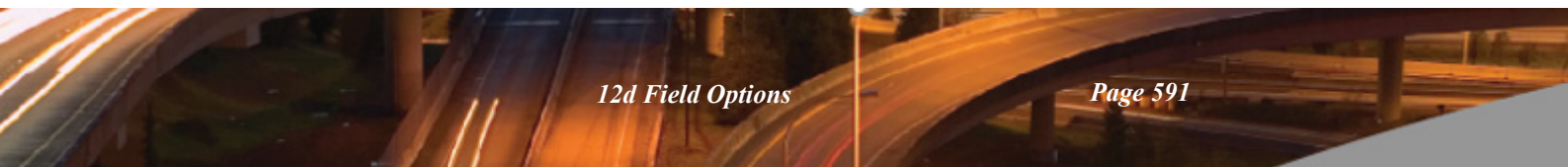
*Prepares the tablet to take a measurement by a touch anywhere on the screen.*

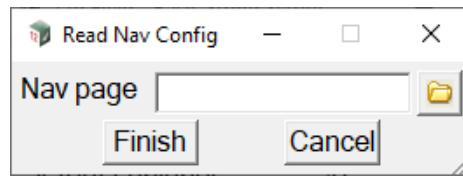
**Sh M+S**

*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 stored 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.

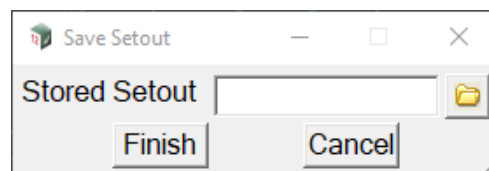
### Save and Read

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

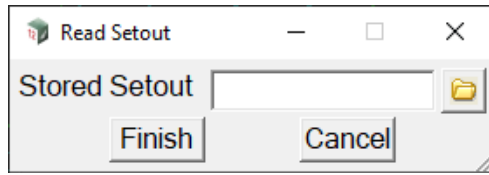
Save the contents of the current panel for future use.

**Cancel** button

Exit without saving.

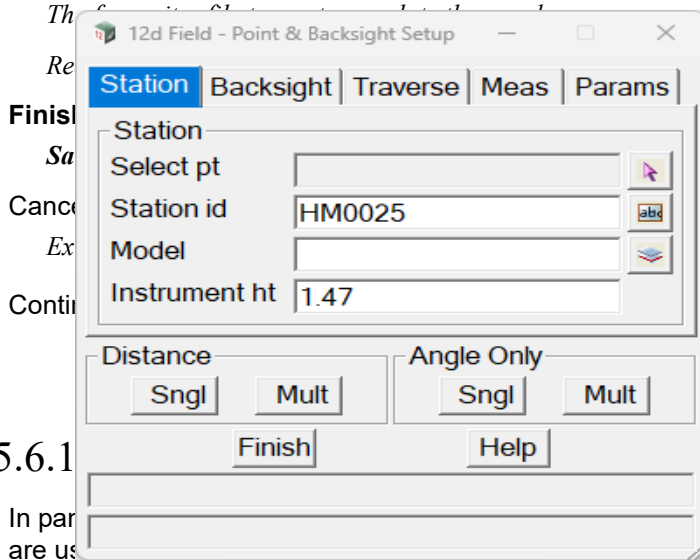
### Read

Brings up the **Read Setout** panel.



**Stored Setout**

file box



[Common Buttons, Panel Tabs and Fields](#)

15.6.1

In par  
are us

tons

ing by the point id the following buttons



**Inc Id**

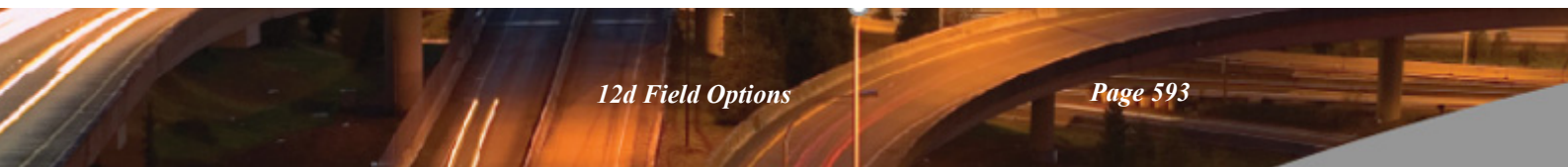
Increment the point id and update finding a point matching the new point id on the super string. This is an alpha numeric increment, it will not change the length of the point id, it updates only numbers or letters walking backwards from the last character.

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.

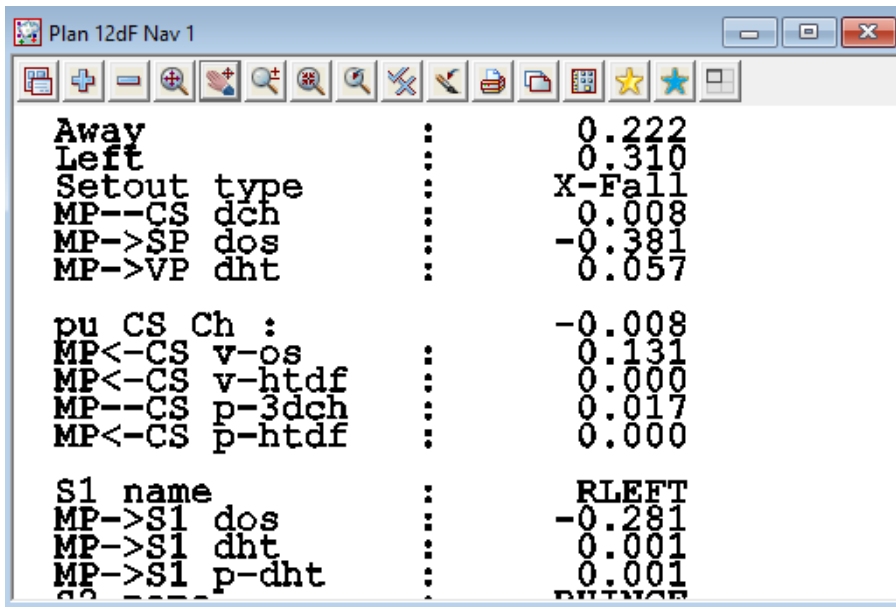
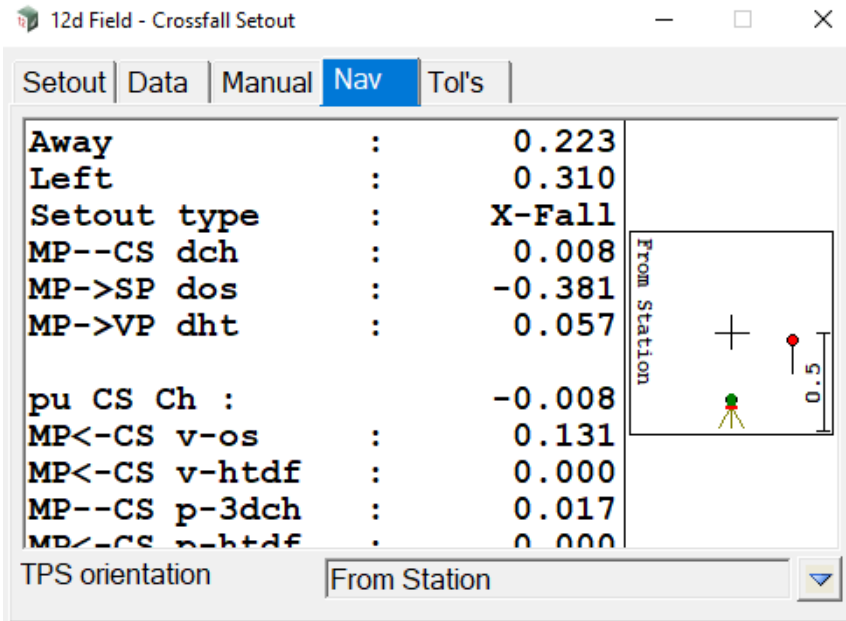
E.g 2->1, 0->9, B->A, A->Z, PM03->PM02, PM00->PM99



### 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](#).

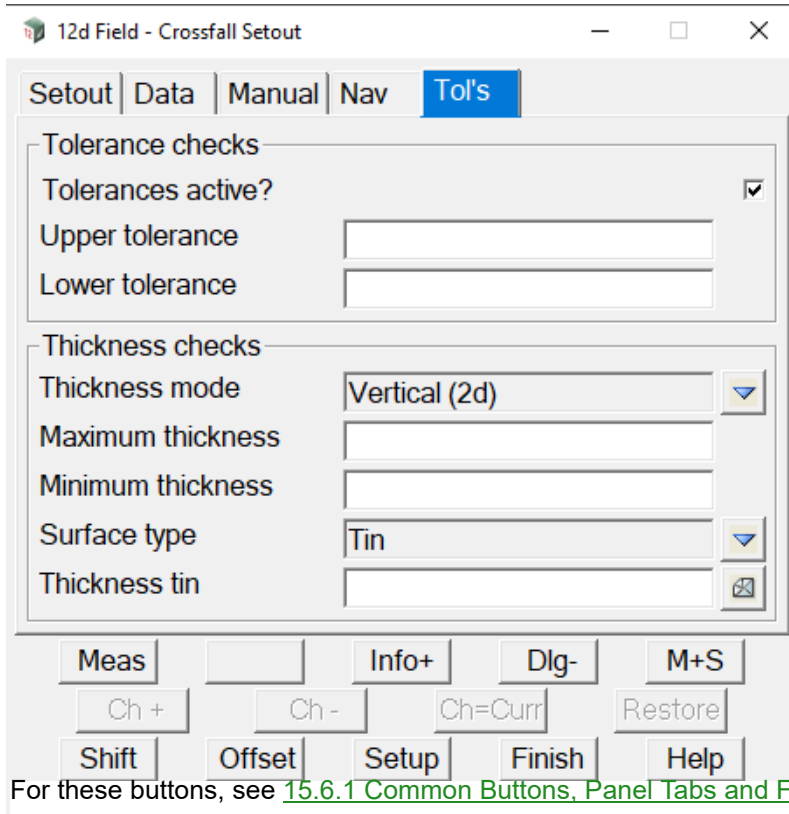
For details on settings for the navigation plan views see [Views >Nav Plan tab](#).

For details on configuring the attributes displayed see [15.8.4.5 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

<b>Tolerances active?</b>	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".*

<b>Upper tolerance</b>	12dF real box		
------------------------	---------------	--	--

*The upper tolerance from design at which a warning is triggered, +ve = above design level.*

*Attribute "st\_tol\_pav\_upper\_tol".*

<b>Lower tolerance</b>	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

<b>Thickness mode</b>	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.

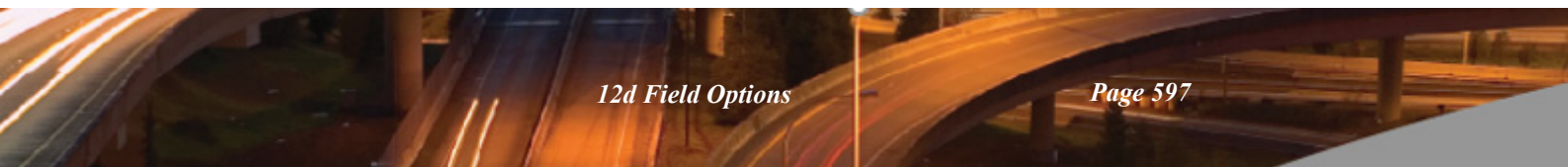
**st\_tol\_pav\_out\_of\_thickness\_value** - if over or under thickness this value is valid and the amount over or under thickness.

The user is able to configure these attributes for use in the message area of the setout panels, see [15.8.4.7 12dF\\_PICKUP\\_MESSAGE\\_LINE\\_CONFIG.4D file format](#) and [15.8.4.9 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.

Chainage type	2d
Drop/project type	Vertical
Setout chainage	

The setout chainage can be one of the 4 available chainage types, [18.5 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.

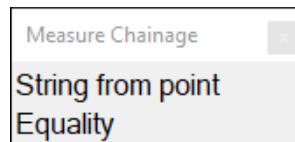
Note, the attribute **so\_cs\_ch** accesses one of the 4 the underlying ch/drop values dependent on the current settings, the raw types are:

- 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 3d chainage.
- 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 Station Setup - TPS](#) or return to [15.6.1 Common Buttons, Panel Tabs and Fields](#).

## 15.6.2 Station Setup - TPS

Clicking on the **Station Setup** menu option brings up the **Station Setup** menu.

Station Setup	×	See
Details		<a href="#">15.6.2.1 Station Details - TPS</a>
Standard		<a href="#">15.6.2.2 Station Standard - TPS</a>
Helmert		<a href="#">15.6.2.3 Station Helmert - TPS</a>
Least squares		<a href="#">15.6.2.4 Station Least Squares Resection - TPS</a>
Height calibrate		<a href="#">15.6.2.5 Instrument Station Height Calculation - TPS</a>
Upload		<a href="#">15.6.2.6 Station Upload - TPS</a>

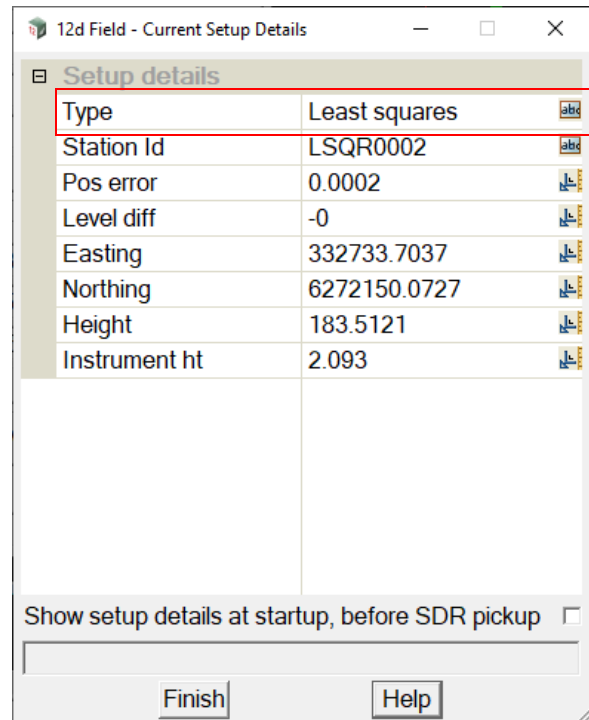
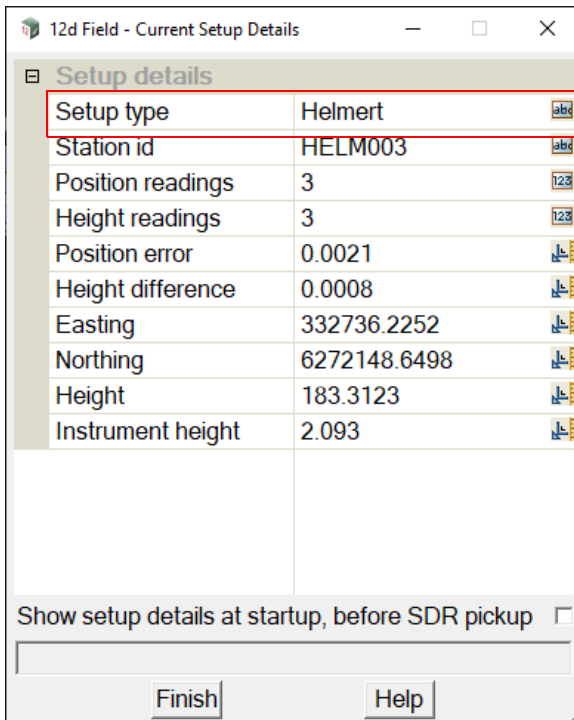
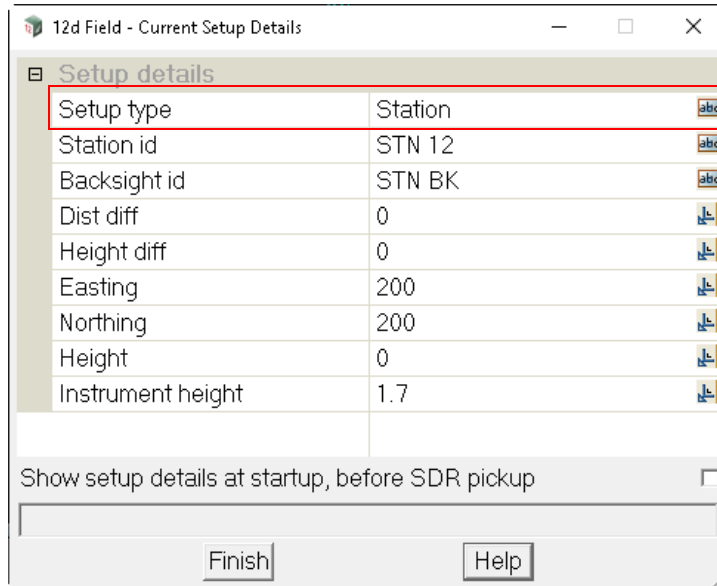


### 15.6.2.1 Station Details - TPS

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
<b>Type</b>	output		
<i>Station</i>			
<i>Setup over a known point and sight to a backsight.</i>			
<b>Station (Hgt Cal)</b>			
<i>Same as station but height has been recalibrated to one or more points.</i>			
<b>Helmert</b>			
<i>A linearised resection with distance measurements to all points</i>			
<b>Helmert (Hgt Cal)</b>			
<i>Same as <b>helmert</b> but height has been recalibrated to one or more points.</i>			
<b>Least squares</b>			
<i>A resection allowing a combination of distance and angle only measurements.</i>			
<b>Least squares (Hgt Cal)</b>			
<i>Same as <b>least squares</b> but height has been recalibrated to one or more points.</i>			
<b>Station id</b>	output		
<i>Name of the point that the TPS is set up on or the name of the newly resected point.</i>			
<b>Backsight id</b>	output		
<i><b>Station only</b>, the name of the point that the backsight was made to.</i>			
<b>Position readings</b>	output		
<i><b>Resections only</b>, number of readings used to determine the xy position of the calculated point.</i>			
<b>Height readings</b>	output		
<i><b>Resections only</b>, number of readings used to determine the position of the calculated point.</i>			
<b>Dist diff</b>	output		
<i><b>Station only</b>, difference in distance measured to the backsight and the distance calculated from the coordinates of the instrument and the backsight.</i>			
<b>Position error</b>	output		
<i><b>Resections only</b>, estimated positional error of the calculated point.</i>			
<b>Level diff</b>	output		
<i><b>Station</b>: Difference in z-value measured to the backsight.</i>			
<i><b>Resections</b>: maximum difference between all calculated z values.</i>			
<b>Easting, Northing, Height</b>	output		
<i>X/Y/Z coordinate of the instrument set up point.</i>			
<b>Instrument height</b>	output		
<i>Height of the TPS at the instrument set up point.</i>			
<b>Show setup details at start up, before SDR pickup</b>	tick box		
<i>If <b>ticked</b>, the set up details are show at start up and when starting up SDR Pickup.</i>			
<i>If <b>not ticked</b>, the set up details are NOT show at start up and when starting up SDR Pickup.</i>			
Continue to <a href="#">15.6.2.2 Station Standard - TPS</a> or return to <a href="#">15.6.2 Station Setup - TPS</a> .			

## 15.6.2.2 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

<b>Select pt</b>	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.*

<b>Station id</b>	text box		
-------------------	----------	--	--

*Point id of the point to setup the TPS over.*

<b>Model</b>	model box		available models
--------------	-----------	--	------------------

*Model of the point to setup the TPS over.*

<b>Instrument ht</b>	real box		
----------------------	----------	--	--

*Height of the instrument. See [25.1.1.1 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 [25.1.1.1 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.

[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

12d Field - Point & Backsight Setup

Station | Backsight | Traverse | Meas | **Params**

Max diff horz dist

Max diff height

Distance:

Angle Only:

[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 [15.6.2.3 Station Helmert - TPS](#) or return to [15.6.2 Station Setup - TPS](#).

### 15.6.2.3 Station Helmert - TPS

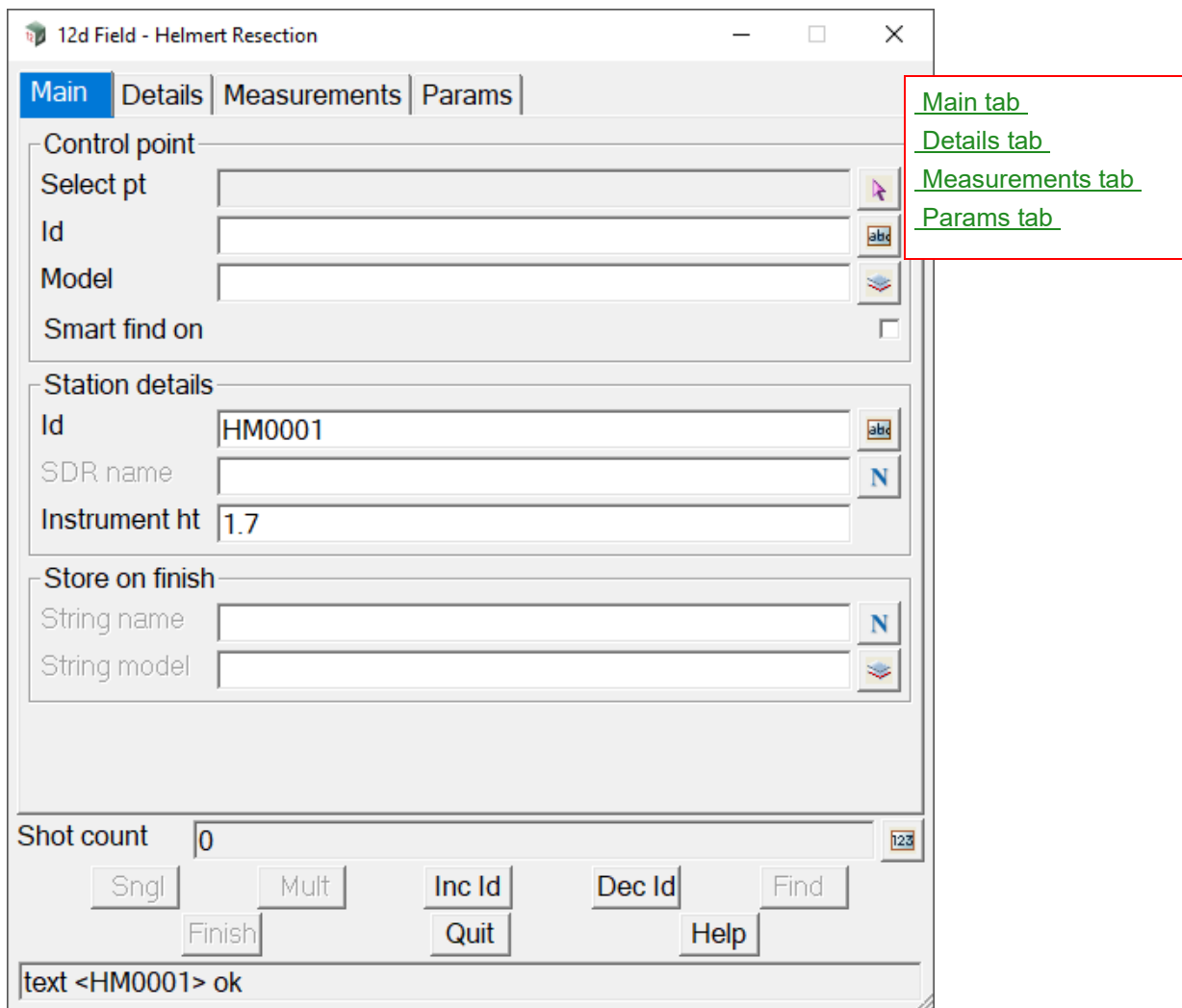
The **12d Field - Helmert Resection** panel can be used to establish a station setup by taking readings to up to 6 known points.

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.



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.

**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.

## 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

12d Field - Helmert Resection

Main | **Details** | Measurements | Params

Geodetic Settings

Scale factor type

Manual h-dist sf

Calculated position

Easting

Northing

Height

Position errors

Pos error

Height diff

Calculated helmert scale factors

Scale factor

Scale as ppm

Scale as mm/100m

Shot count  #

[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.

	Station Id	Apx Pos Error	Use Coord?	Station Height	Height Diff	Use Height?
1	S2	0.001	<input checked="" type="checkbox"/>	184.3929	-0.0013	<input checked="" type="checkbox"/>
2	S7	0.001	<input checked="" type="checkbox"/>	184.3962	0.0020	<input checked="" type="checkbox"/>
3	S5	0.001	<input checked="" type="checkbox"/>	184.3958	0.0016	<input checked="" type="checkbox"/>

### 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

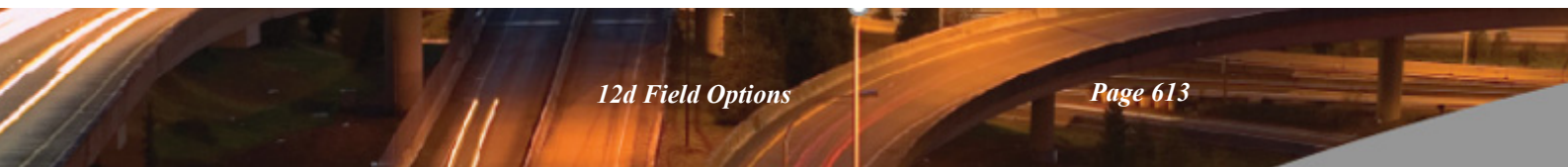
*Calculated height from this control point.*

**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 [15.6.2.4 Station Least Squares Resection - TPS](#) or return to [15.6.2 Station Setup - TPS](#)

### 15.6.2.4 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.

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.*

**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.*

### 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

12d Field - Least Squares Resection

Main **Details** Measurements Params Solver

Geodetic Settings

Scale factor type

Manual h-dist sf

Calculated position

Easting

Northing

Height

Position errors

Su

Sv

RL diff

Calculated resection scale factors

Scale factor

Scale as ppm

Scale as mm/100m

[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.

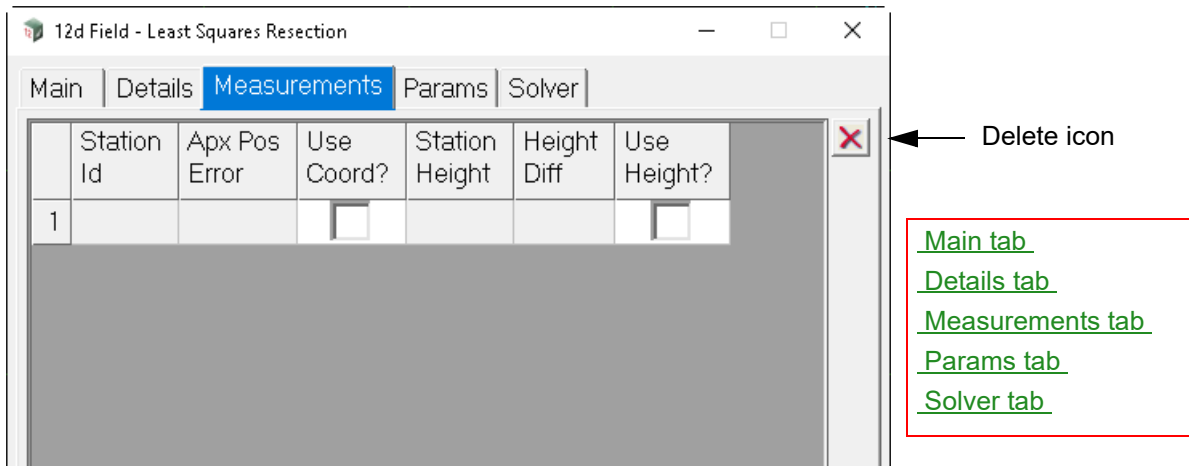
**Scale as mm/100m** integer box

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.



### 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

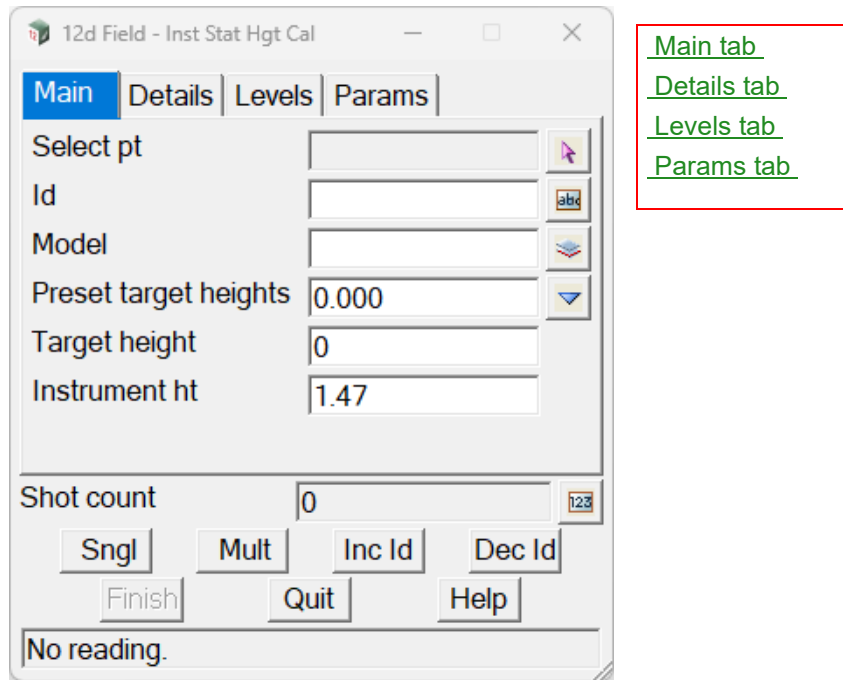
*Decrement the point ID E.g. BOLT31 -> BOLT30*

Continue to [15.6.2.5 Instrument Station Height Calculation - TPS](#) or return to [15.6.2 Station Setup - TPS](#).

### 15.6.2.5 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.



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.*

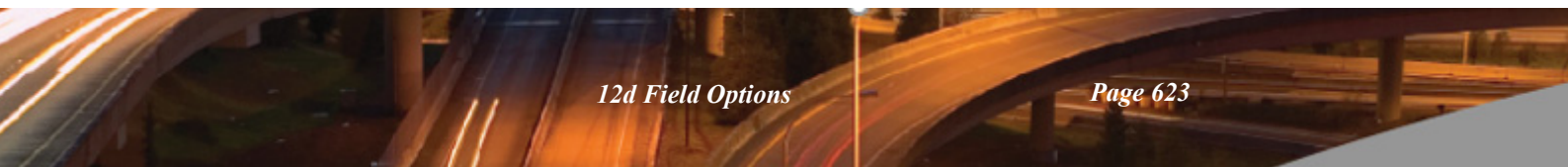
*For more information on the standard buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields](#).*

#### 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.*

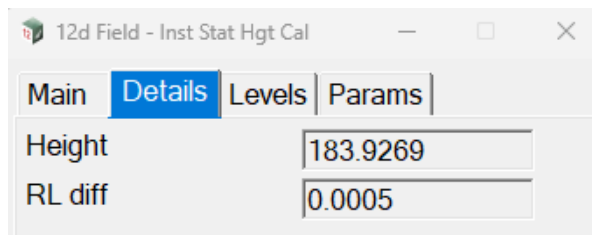
**Id** text box  
*The point id of the calibration point.*  
*Attribute "su\_hm\_id"*

**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"*

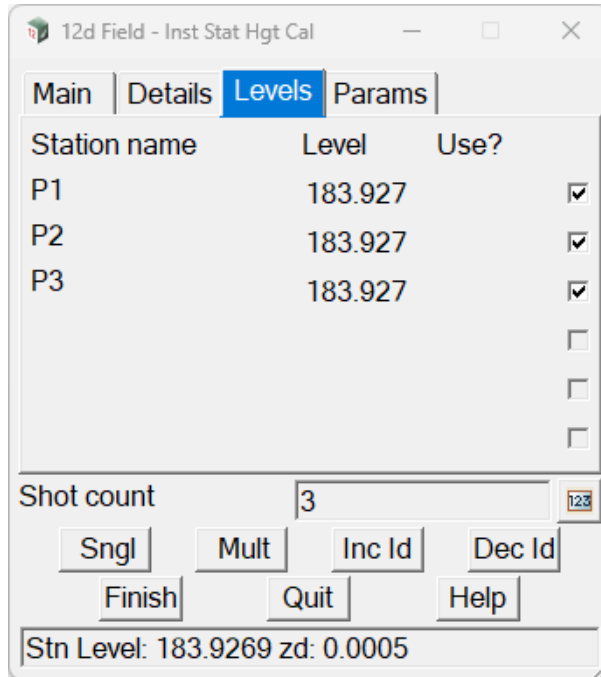
**Details tab**



- [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



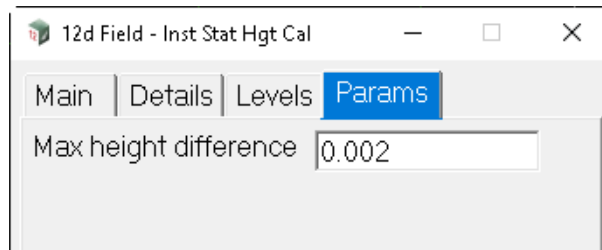
- [Main tab](#)
- [Details tab](#)
- [Levels tab](#)
- [Params tab](#)

**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.*

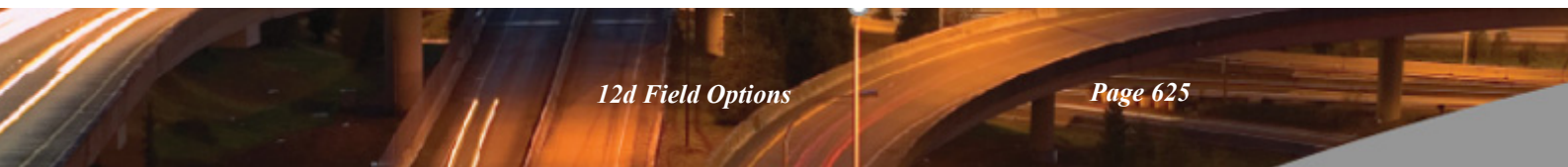
**Use**    tick box  
*If **ticked**, use this calibration point in the height calculation.*  
*If **not ticked**, exclude this calibration point from the height calculation.*

### 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"*

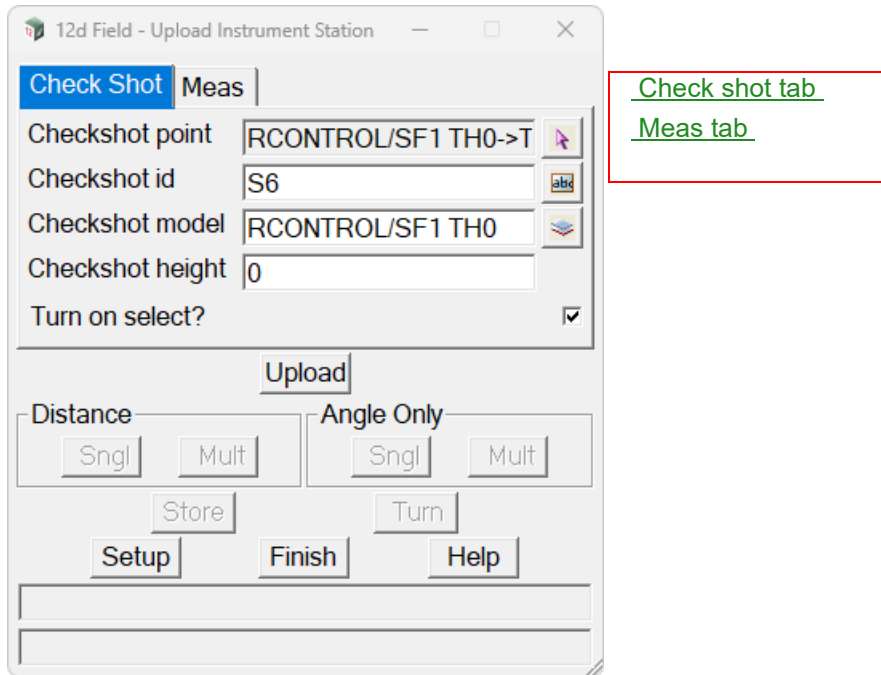


### 15.6.2.6 Station Upload - TPS

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.



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.](#)*

## 15.6.3 Checks - TPS

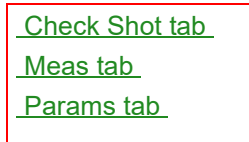
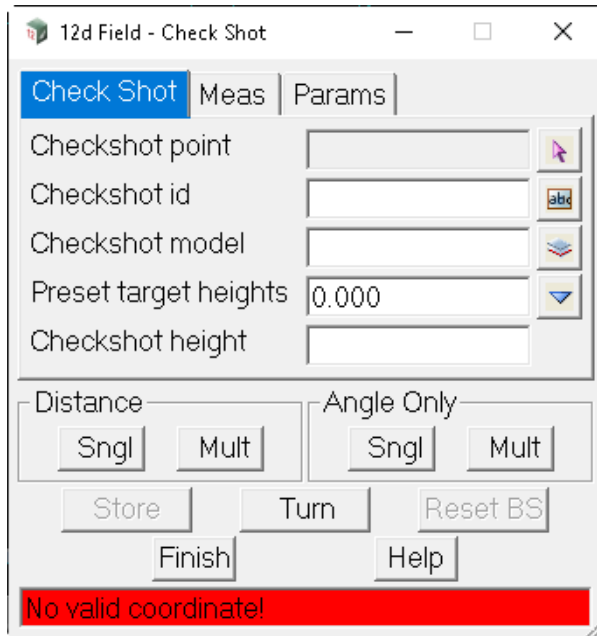
Clicking on the **Checks** menu option brings up the **TPS Checks** menu.

TPS Checks	×	See
Check shot		<a href="#">15.6.3.1 Check Shot - TPS</a>
Check coord		<a href="#">15.6.3.2 Check Coord - TPS</a>
Target height cal		<a href="#">15.6.3.3 Check Target Height Calibrate - TPS</a>
User values		<a href="#">15.6.3.4 Check User Values - TPS</a>

### 15.6.3.1 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.



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

- |  |                   |                               |
|--|-------------------|-------------------------------|
| <b>Checkshot point</b>   | string select box |                               |
| <i>Select the point to take a checkshot to.</i>  |                   |                               |
| <b>Checkshot id</b>  | text box          |                               |
| <i>Id of the selected checkshot point.</i>   |                   |                               |
| <b>Checkshot model</b>   | model box         | available models              |
| <i>Model of the selected checkshot point.</i>  |                   |                               |
| <b>Preset target heights</b>   | choice box        | list of preset target heights |
| <i>Select a target height from the pop-up list. The selected target height is piped into the <b>Checkshot height</b> field.</i>  |                   |                               |
| <b>Checkshot height</b>  | real box          |                               |
| <i>Height of the target at the checkshot point.</i>  |                   |                               |
| <i>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.</i> |                   |                               |

## 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.*

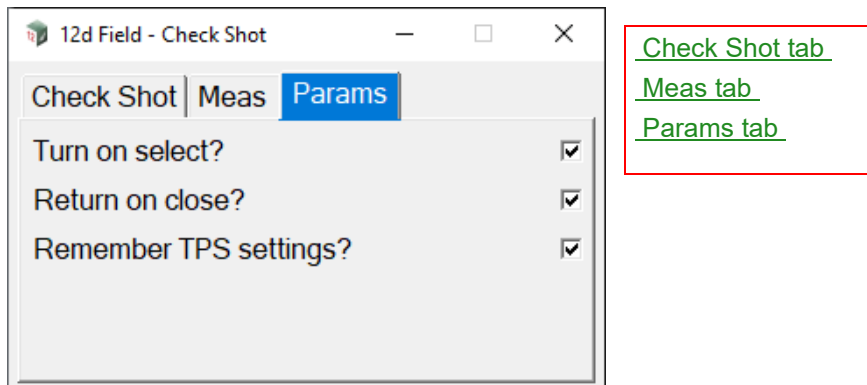
**TPS measurement differences****Horz distance** real box

*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



### 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.

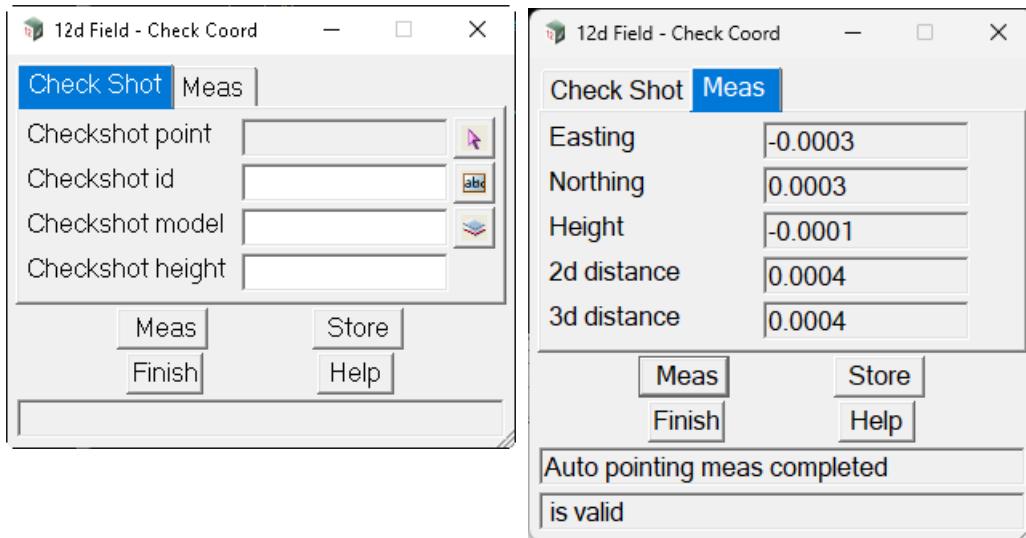
Note this button can be used with all setup types, Standard, Helmert and Least Squares resections.

Continue to [15.6.3.2 Check Coord - TPS](#) or go back to [15.6.3 Checks - TPS](#).

### 15.6.3.2 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.

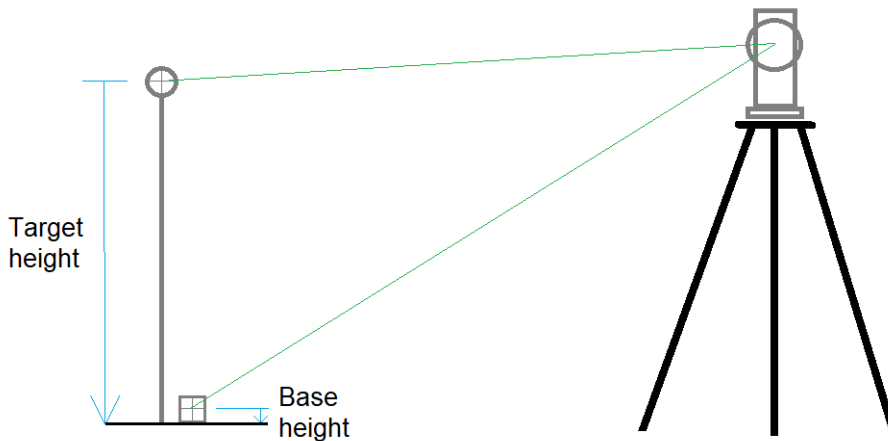
12dField setout stores up to 6 sets of vertex check coord attributes, i.e., each instance of a setout panel, (or Basic Pickup and any other non SDR panel) can open and use the check coord panel 6 times, this is an automatic process.

Continue to [15.6.3.3 Check Target Height Calibrate - TPS](#) or go back to [15.6.3 Checks - TPS](#).

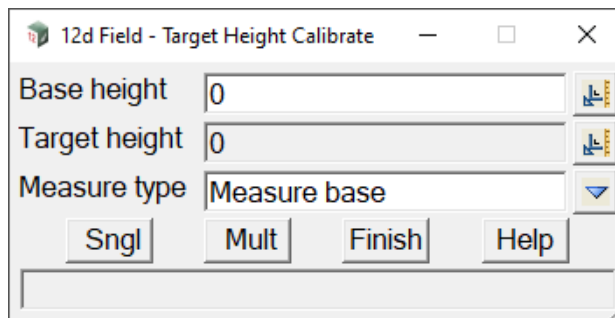
### 15.6.3.3 Check Target Height Calibrate - TPS

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
<b>Base height</b> <i>Enter the height of the target to be used as the base measurement.</i>	measures box		
<b>Target height</b> <i>Calculated height of the current pole and prism.</i>	measures box		
<b>Measure type</b> <i>Measure base - take a measurement to establish the basis height for the calibration.</i> <i>Measure target - take a measurement to determine the height of a pole and prism combination after the base height has been established.</i>	choice box		Measure base. Measure target

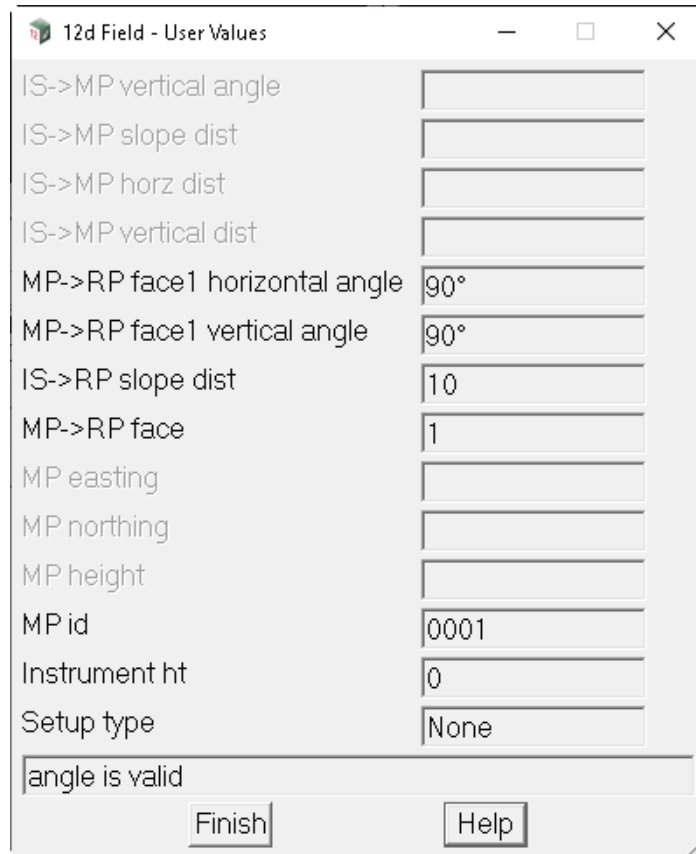
## Buttons at Bottom

For more information on these buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields](#).

Continue to [15.6.3.4 Check User Values - TPS](#) or go back to [15.6.3 Checks - TPS](#).

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

Field Description	Type	Defaults	Pop-Up
<b>IS-&gt;MP vertical angle</b>	output		
<i>Instrument to measured point vertical angle.</i>			
<b>IS-&gt;MP slope distance</b>	output		
<i>Instrument to measured point slope distance.</i>			
<b>IS-&gt;MP horz dist</b>	output		
<i>Instrument to measured point horizontal distance.</i>			
<b>IS-&gt;MP vert dist</b>	output		
<i>Instrument to measured point vertical distance.</i>			
<b>MP-&gt;RP face 1 horizontal angle</b>	output		
??.			
<b>MP-&gt;RP face 1 vertical angle</b>	output		
??.			
<b>IS-&gt;RP slope dist</b>	output		
??.			

**MP->RP face**                      output

??.

**MP easting/northing/height**    output

*Easting/northing/height of the measured point.*

**MP id**                                output

*Point id of the measured point.*

**Instrument ht**                      output

*Height of the instrument.*

**Setup type**                         output

*Setup type.*

Continue to [15.6.4 Setout](#) or go back to [15.6.3 Checks - TPS](#).

## 15.6.4 Setout

Clicking on the **Setout** menu option brings up the **Setout** menu.

<b>TPS Setout</b>	
TPS Setout <span style="float: right;">✕</span>	See
String basic	<a href="#">15.6.4.1 Setout String Basic</a>
Point	<a href="#">15.6.4.2 Setout Point</a>
Surface	<a href="#">15.6.4.3 Setout Surface</a>
Crossfall	<a href="#">15.6.4.4 Setout Crossfall</a>
String advanced	<a href="#">15.6.4.5 Setout String Advanced</a>
Batter	<a href="#">15.6.4.6 Setout Batter</a>
Grid	<a href="#">15.6.4.7 Setout Grid</a>
Segment advanced	<a href="#">15.6.4.8 Setout Advanced Segment</a>
Segment basic	<a href="#">15.6.4.9 Setout Basic Segment</a>
Trimesh edge	<a href="#">15.6.4.10 Setout Trimesh Edge</a>
Crown	<a href="#">15.6.4.11 Setout Crown</a>
Tunnel	<a href="#">15.6.4.12 Setout Tunnel</a>
Drainage	<a href="#">15.6.4.13 Water Network Setout</a>
Piles	<a href="#">15.6.4.14 Setout Piles</a>
<b>GNSS Setout</b>	
GNSS Setout <span style="float: right;">✕</span>	See
String basic	<a href="#">15.6.4.1 Setout String Basic</a>
Point	<a href="#">15.6.4.2 Setout Point</a>
Surface	<a href="#">15.6.4.3 Setout Surface</a>
Crossfall	<a href="#">15.6.4.4 Setout Crossfall</a>
String advanced	<a href="#">15.6.4.5 Setout String Advanced</a>
Batter	<a href="#">15.6.4.6 Setout Batter</a>
Grid	<a href="#">15.6.4.7 Setout Grid</a>
Segment advanced	<a href="#">15.6.4.8 Setout Advanced Segment</a>
Segment basic	<a href="#">15.6.4.9 Setout Basic Segment</a>
Trimesh edge	<a href="#">15.6.4.10 Setout Trimesh Edge</a>
Crown	<a href="#">15.6.4.11 Setout Crown</a>
Drainage	<a href="#">15.6.4.13 Water Network Setout</a>

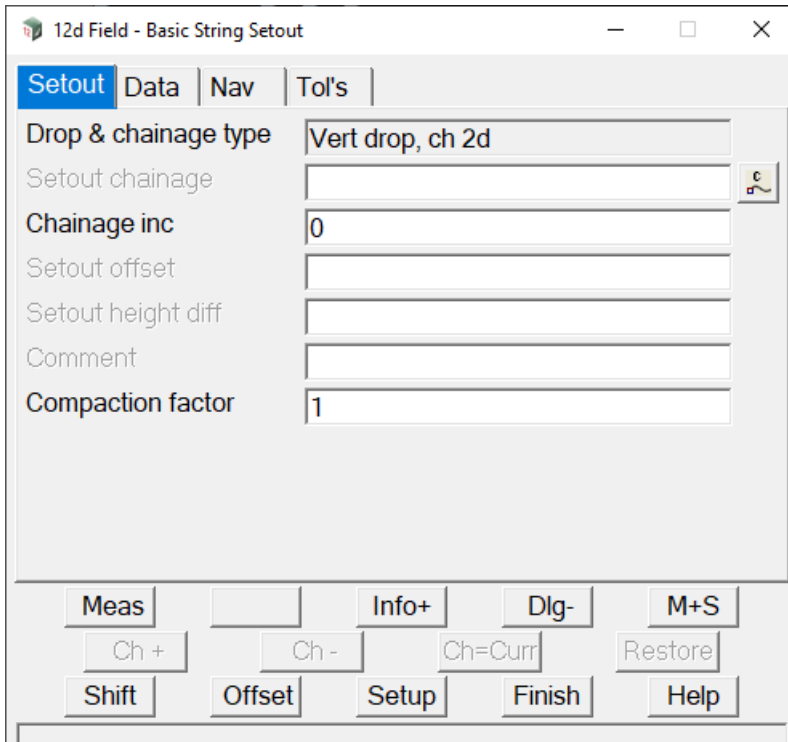


### 15.6.4.1 Setout String Basic

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

<b>Drop &amp; chainage type</b>	Vert drop, ch 2d
---------------------------------	------------------

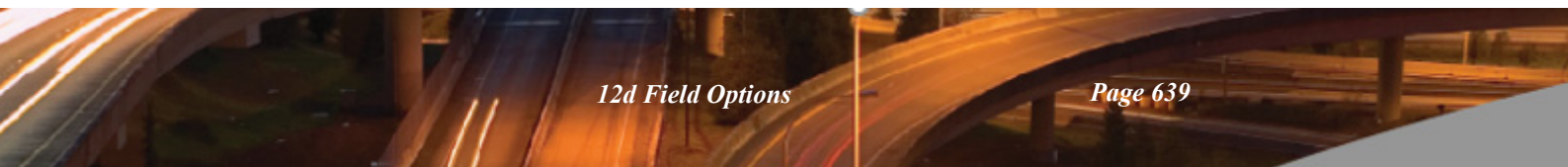
The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see [18.5 Different Types of Chainage Drop Point](#) for more information.

#### Setout chainage

The natural, no equalities setout chainage on the control string, for more information see [15.6.1.8.1 Setout Chainage \(so\\_cs\\_ch\)](#).

<b>Chainage inc</b>	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 \(so\\_vpl\\_spl\\_htdf\)](#).

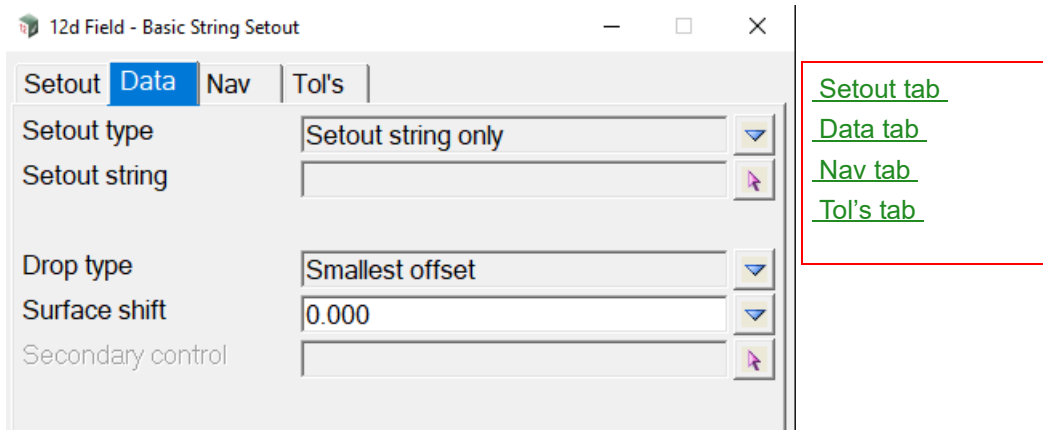
**Comment**

A user entered comment, for more information see [15.6.1.8.6 Comment \(st\\_gui\\_display\\_pu\\_comment\\_line\)](#).

**Compaction factor**

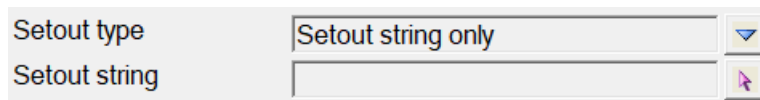
If turned on a value to multiple delta heights by for certain construction situations, it would be set to 1.0 in most situations, for more information see [15.6.1.8.7 Compaction factor \(so\\_compaction\\_factor\)](#).

**Data tab**



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

Field Description	Type	Defaults	Pop-Up
<b>Data tab</b>			
<b>Setout type</b>	choice box	Setout string only	Setout string only String & control string
<i>Setout string only</i>			



**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**

Setout type	String & control	▼
Control string		↕
Setout string		↕

**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.

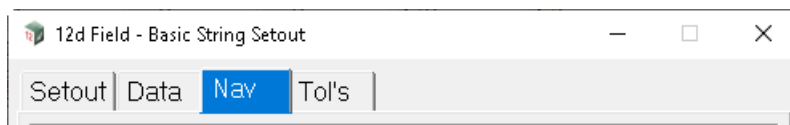
**Surface shift**                  choice box

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

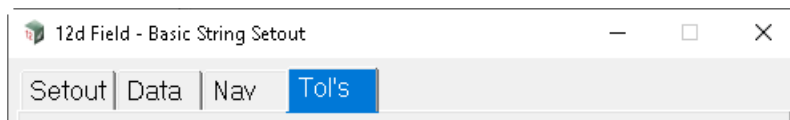
For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).

**Nav tab**



For information on the **Navigation tab** see [15.6.1.6 Navigation Tab](#).

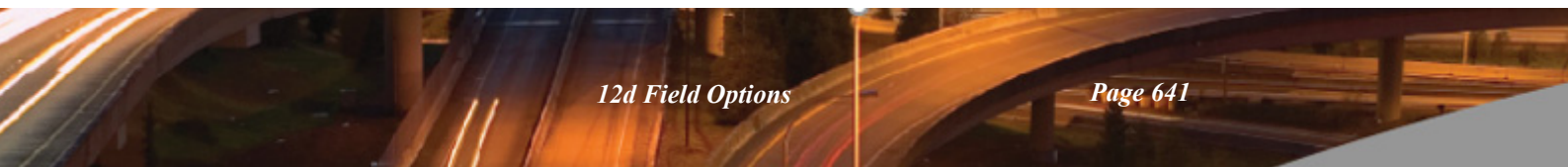
**Tol's tab**



**Tol's tab**

For information on the **Tolerance tab** see [15.6.1.7 Tolerances Tab](#).

Continue to [15.6.4.2 Setout Point](#) or go back to [15.6.4 Setout](#).



## 15.6.4.2 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                 

*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                 

*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.*

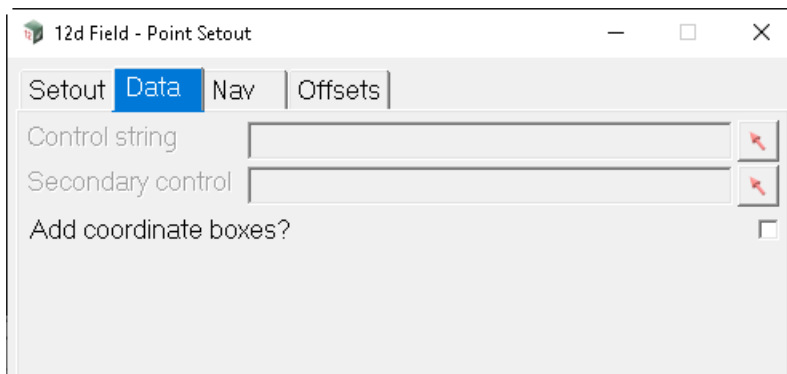
*Attribute "so\_sp\_y"*

**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
-------------------	------	----------	--------

<b>Control string</b>	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

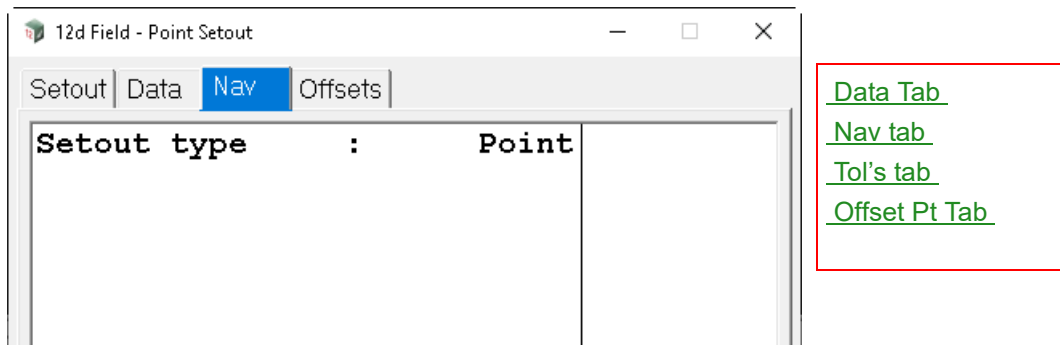
For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).

**Add coordinate boxes** tick box                      ticked

If **ticked**, the setout easting/northing and height 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.

## Nav Tab



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

**Navigation Box** draw box

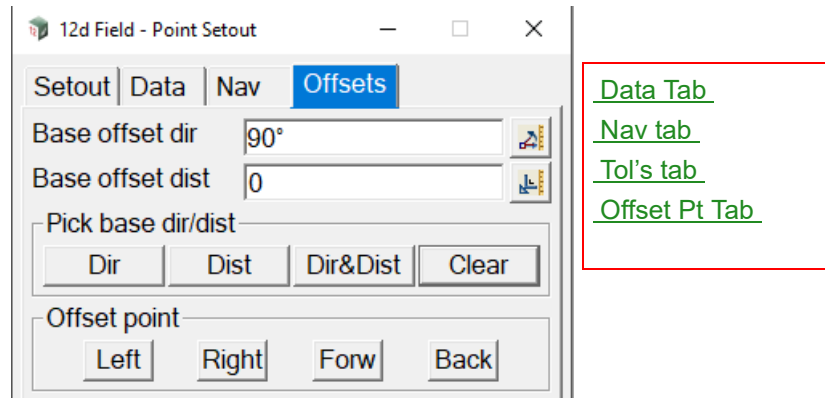
The **12d Field** navigation box augments setout by displaying user definable information rows plus a bullseye as a visual aid.

See [15.6.1.6 Navigation Tab](#).



## 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.



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

Field Description	Type	Defaults	Pop-Up
<b>Base offset dir</b>	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"

<b>Base offset dist</b>	real box	0	
-------------------------	----------	---	--

The distance to offset the setout point.

Attribute "so\_offset\_point\_base\_dist"

### Pick base dir/dist

<b>Dir</b>	button
------------	--------

Select a point, the **Offset direction** will be set to the bearing from the setout point to the selected point.

<b>Dist</b>	button
-------------	--------

Select a point, the **Offset distance** will be set to the distance from the setout point to the selected point.

<b>Dir&amp;Dist</b>	button
---------------------	--------

Combine **Dir** and **Dist** into the one select.

<b>Clear</b>	button
--------------	--------

Reset the **Offset direction** to **90** and the **Offset distance** to **0**.

### Offset point

<b>Left</b>	button
-------------	--------

Offset the setout point by the **Offset distance** at 90 degrees to the left of the **Offset direction**.

<b>Right</b>	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 [15.6.4.3 Setout Surface](#) or go back to [15.6.4 Setout](#).

### 15.6.4.3 Setout Surface

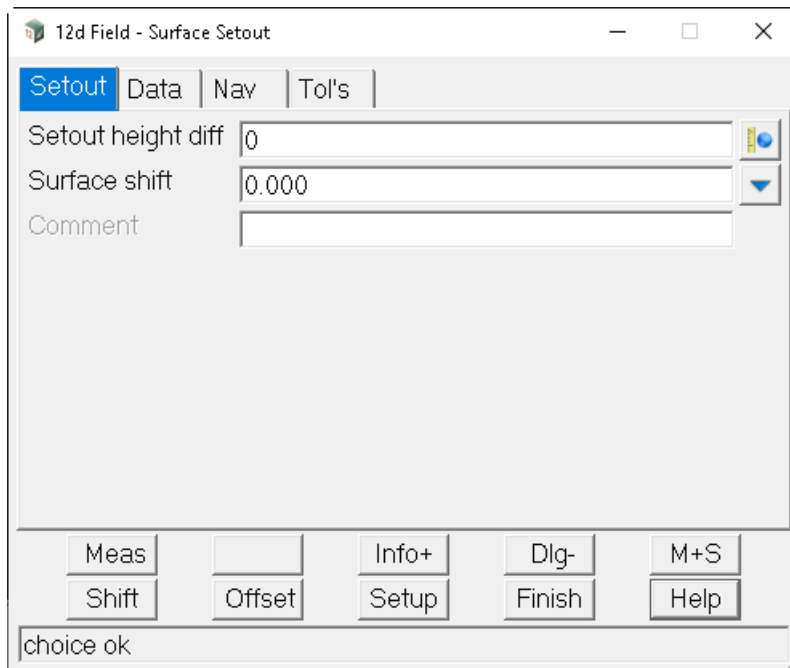
The setout surface panel enables the user to take measurements, primarily for height differences to a **tin** or **trimesh**.

**Tins** can typically be used for things such as design road pavements and as built 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

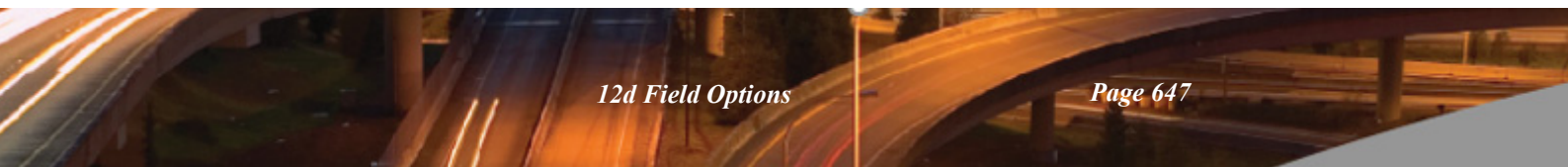
**Setout height diff**                      real box

*This is added to the height of the drop to the surface to produce the final setout height.*

*Attribute "so\_ypl\_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").

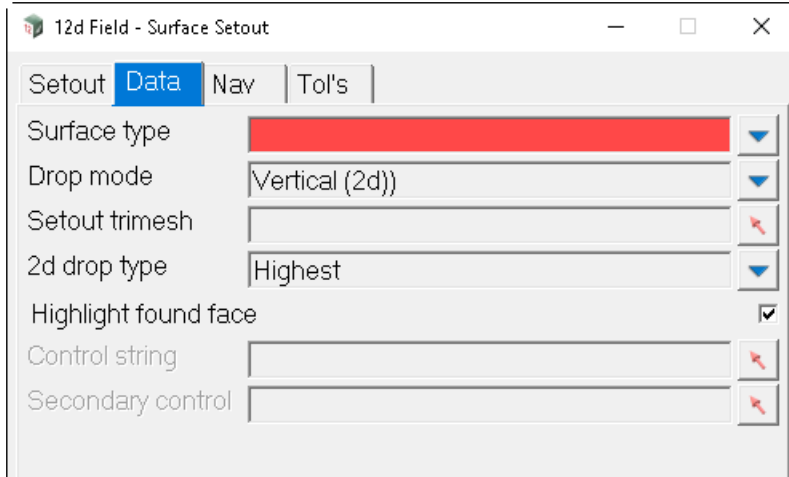
Attribute "so\_spl\_dpl\_htdf".

**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.

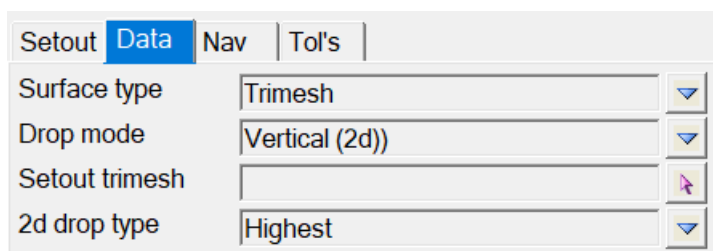
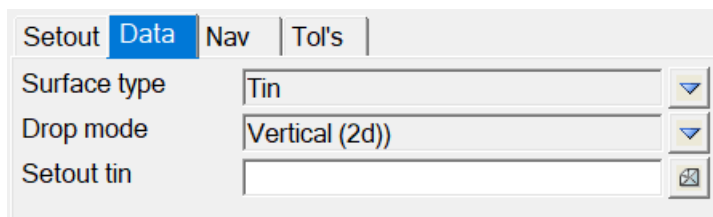
Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Data tab

<b>Surface type</b>	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".



Setout	Data	Nav	Tol's
Surface type	Trimesh		
Drop mode	Perpendicular (3d)		
Setout trimesh			
3d drop type	Closest		

**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

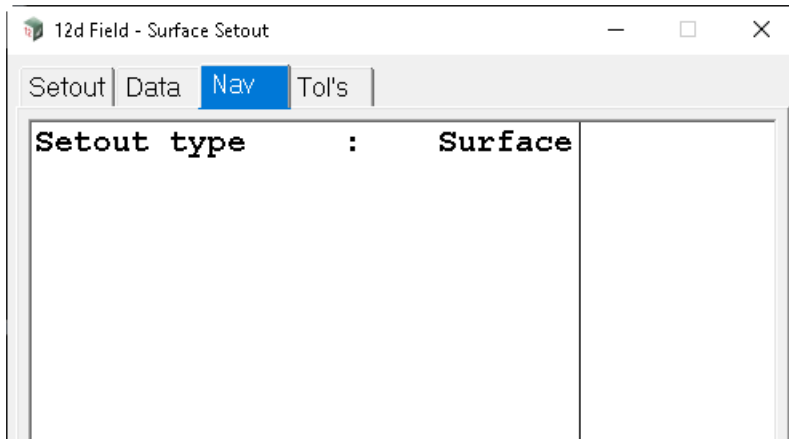
*Control string, the string to which the other strings are cut normal to for calculations.*

*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
-------------------	------	----------	--------

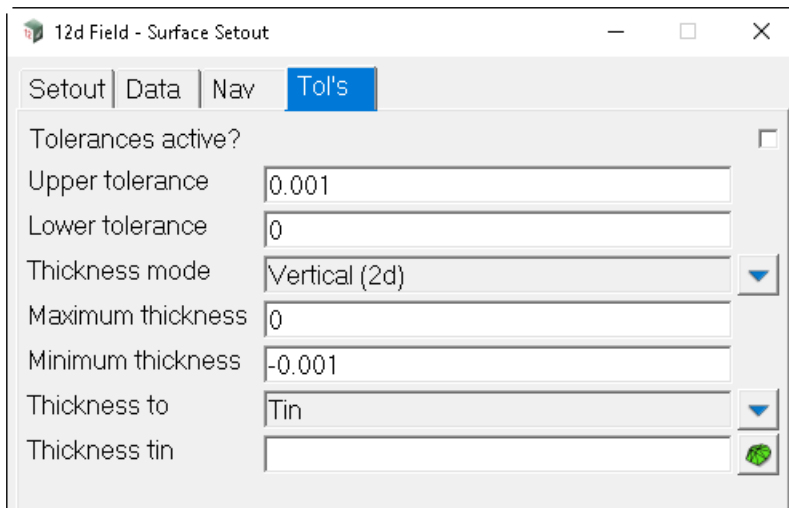
### Nav tab

**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 [15.6.4.4 Setout Crossfall](#) or go back to [15.6.4 Setout](#).



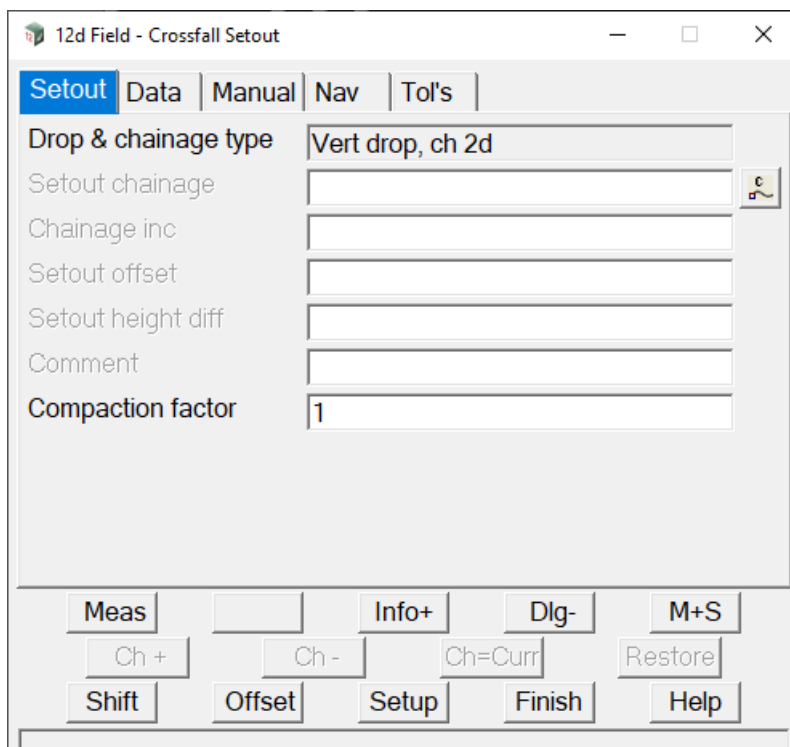
### 15.6.4.4 Setout Crossfall

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](#).

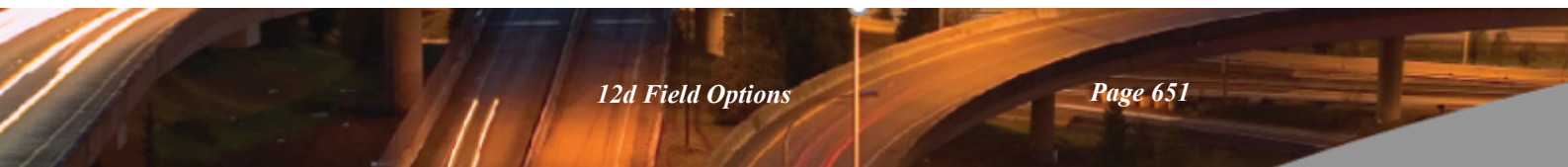
#### Setout tab

**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 [18.5 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 \(so\\_vpl\\_spl\\_htdf\)](#).

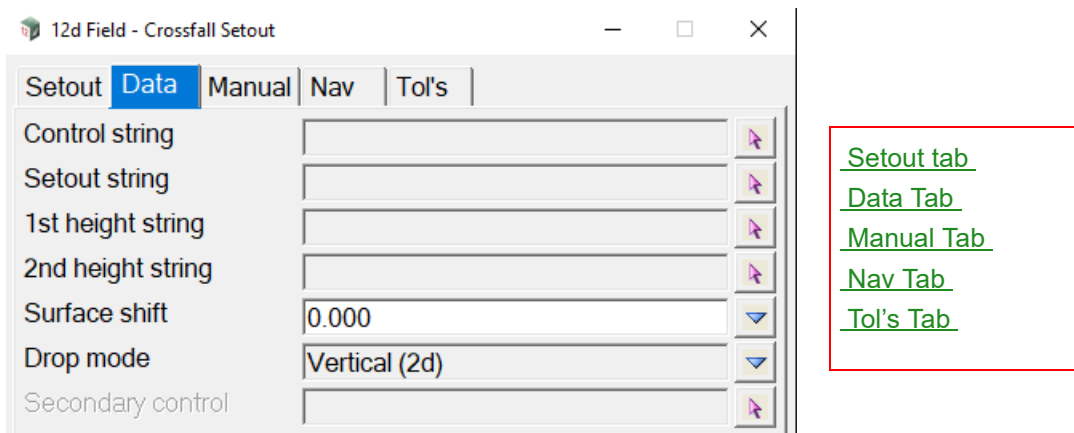
**Comment**

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**



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Control string</b>	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 \(so\\_cs\\_strr\)](#).

<b>Setout string</b>	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"

<b>1st height string</b>	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.

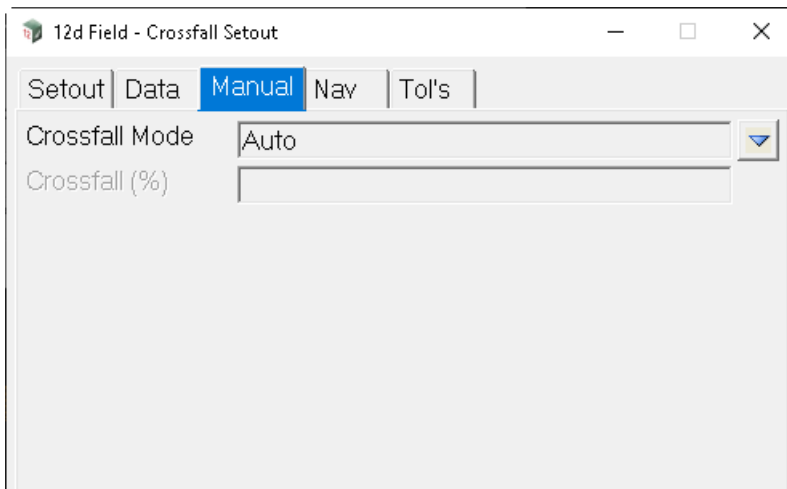
*Vertical (2d):* The height difference is applied vertically to the design surface.

*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
<b>Crossfall Mode</b>	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.

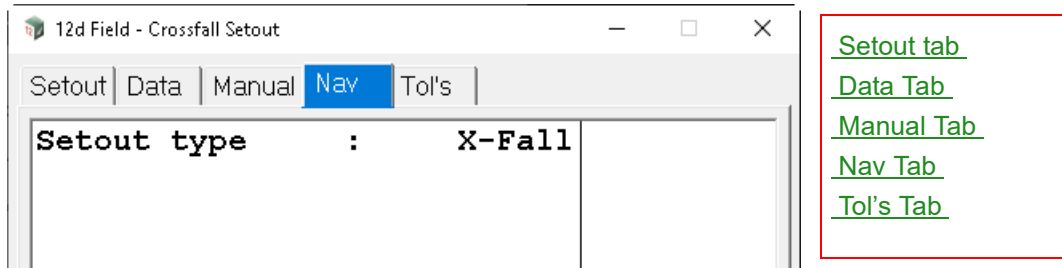
**Centreline, string & x-fall:** The crossfall is entered manually, only the 1st string is cut and the crossfall projected from this.

**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



For details on using and populating the Nav tab see [15.6.1.6 Navigation Tab](#).

## Tol's Tab



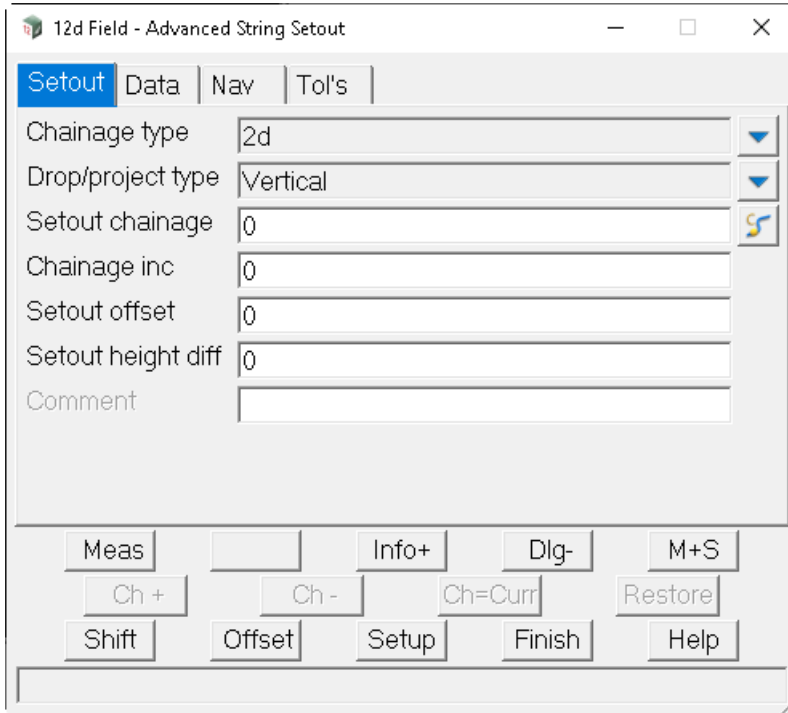
For details on using and populating the Tol's tab see [15.6.1.7 Tolerances Tab](#).

Continue to [15.6.4.5 Setout String Advanced](#) or go back to [15.6.4 Setout](#).

### 15.6.4.5 Setout String Advanced

The Advanced String Setout panel allows the ability to use all 4 chainage and drop types as opposed to [15.6.4.1 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.



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 [18.5 Different Types of Chainage Drop Point](#) for more information.

Attribute "so\_cs\_ch\_type"

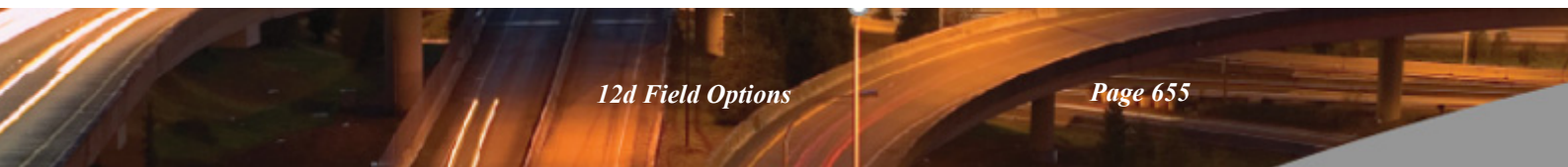
Drop/project type	choice box	Vertical	Vertical, Perpendicular
-------------------	------------	----------	-------------------------

Whether points are dropped to/projected from the control string vertically, Vertical or perpendicular to the vertical alignment, Perpendicular; see [18.5 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**

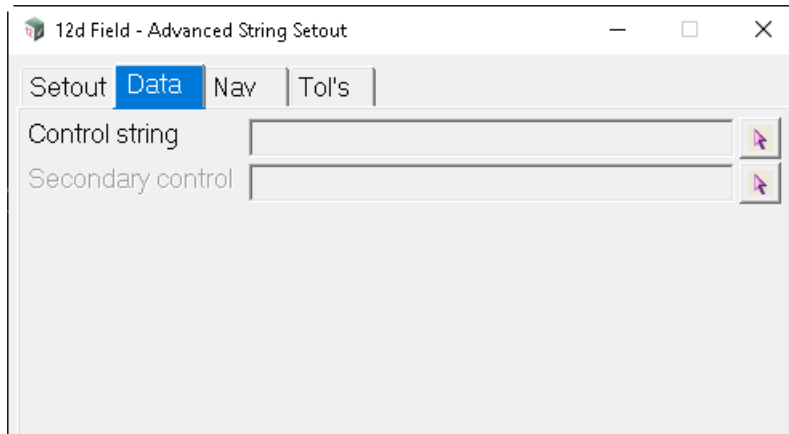
*The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see [15.6.1.8.5 Setout height diff \(so\\_vpl\\_spl\\_htdf\)](#).*

**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

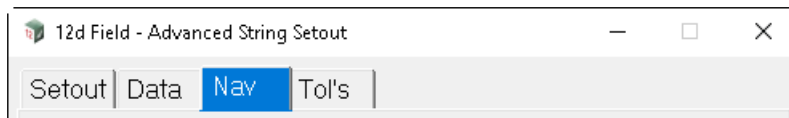
*Control string, the string to which the other strings are cut normal to for calculations.*

*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 [15.6.4.6 Setout Batter](#) or go back to [15.6.4 Setout](#).

### 15.6.4.6 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.

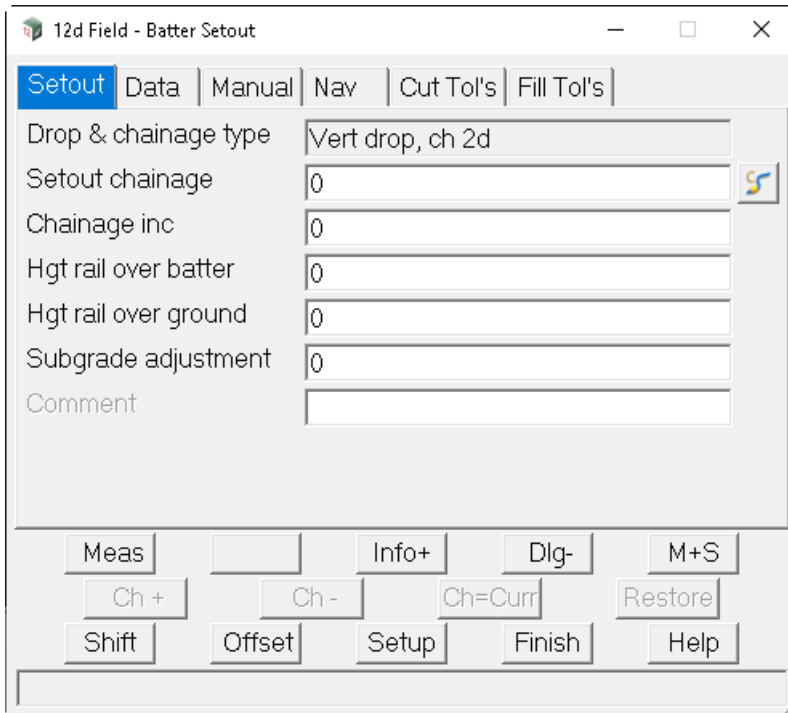
**Note**, unlike other string setout routines the batter setout does not have a setout string, just the control string and the 2 design strings.

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
-------------------	------	----------	--------

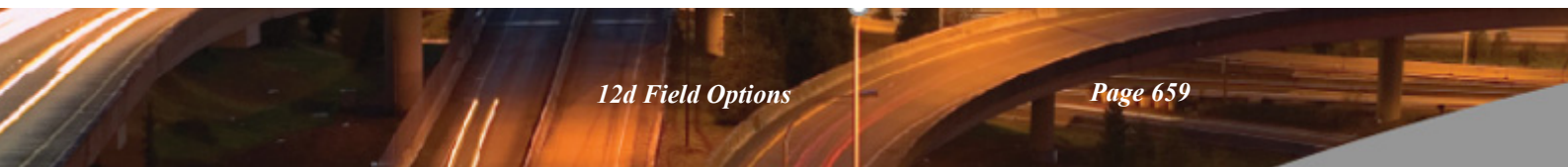
#### Buttons at Bottom

For more information on these buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields](#).

#### Setout Tab

<b>Drop &amp; chainage type</b>	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 [18.5 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.

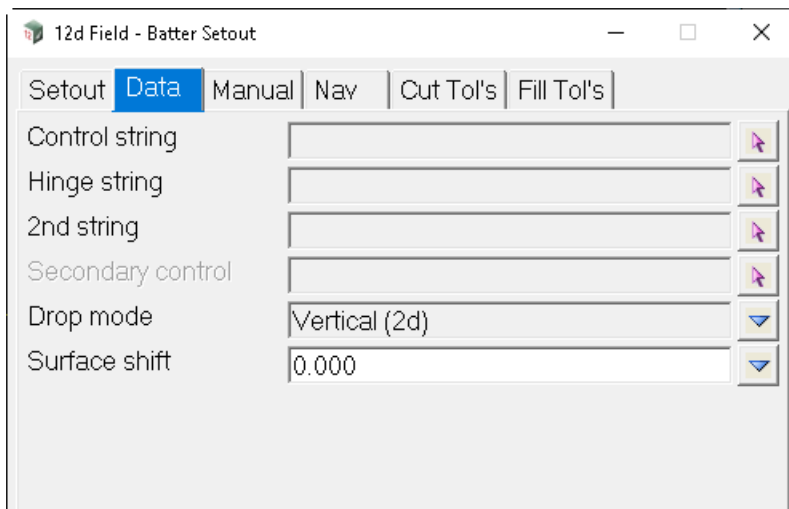
Attribute "so\_batter\_rail\_ground"

**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
-------------------	------	----------	--------

<b>Control string</b>	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 \(so\\_cs\\_strr\)](#).

<b>Hinge string</b>	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\_str"

<b>2nd string</b>	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.

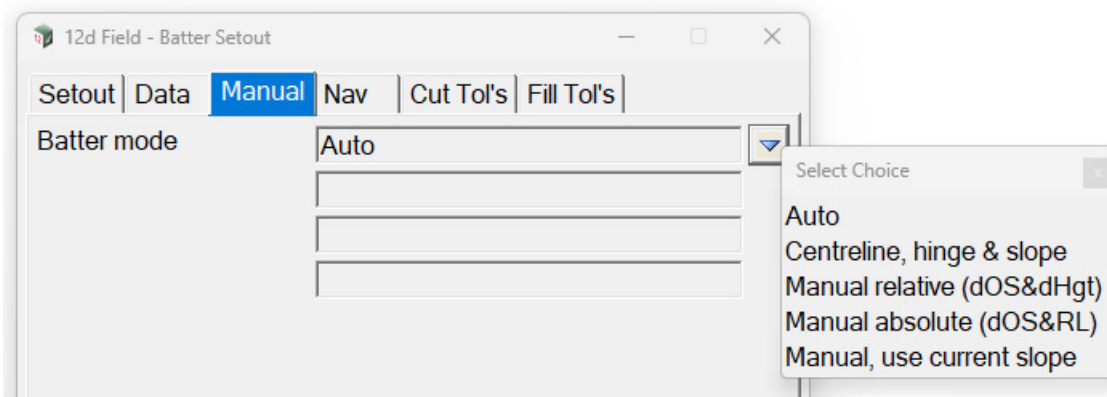
Attribute "so\_spl\_dpl\_htdf\_mode"

**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.

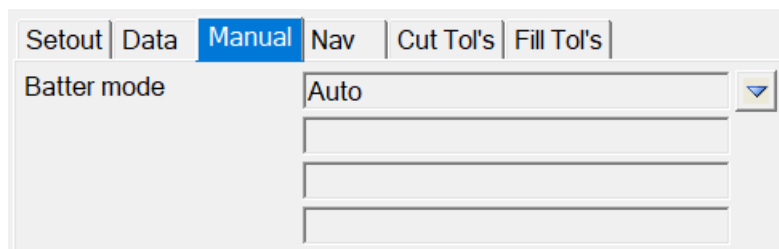


The fields and buttons used in this panel have the following functions.

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.

Setout	Data	Manual	Nav	Cut Tol's	Fill Tol's
Batter mode	Centreline, hinge & slope				
	<input type="text"/>				
Slope h/v	<input type="text"/>				

**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.

Setout	Data	Manual	Nav	Cut Tol's	Fill Tol's
Batter mode	Manual relative (dOS&dHgt)				
Offset	<input type="text"/>				
Hgt diff from hinge	<input type="text"/>				
Slope h/v	<input type="text"/>				

**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.



Setout	Data	<b>Manual</b>	Nav	Cut Tol's	Fill Tol's
Batter mode	Manual absolute (dOS&RL)				
Offset					
Absolute height					
Slope h/v					

**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**

Setout	Data	<b>Manual</b>	Nav	Cut Tol's	Fill Tol's
Batter mode	Manual, use current slope				
Slope h/v					

**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.*

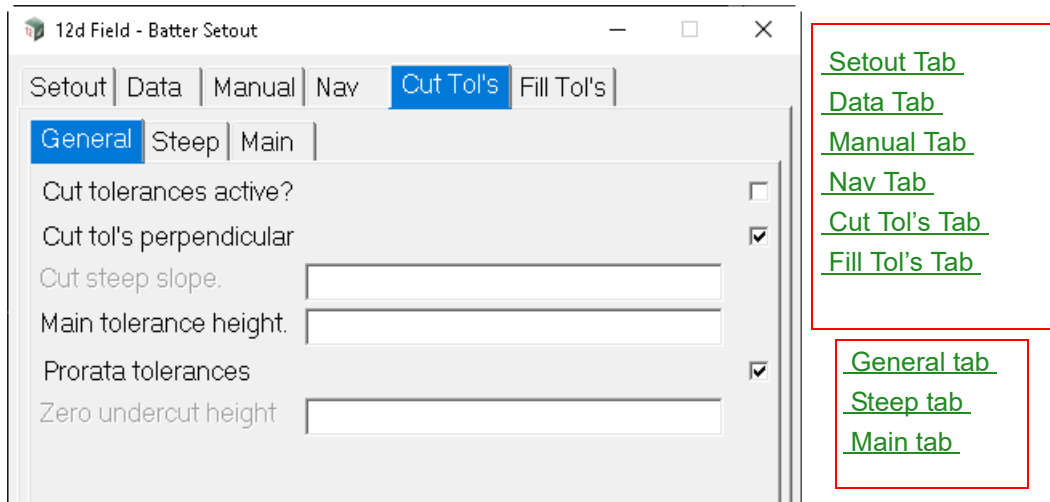
*Attribute "so\_batter\_manual\_slope"*

**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](#).

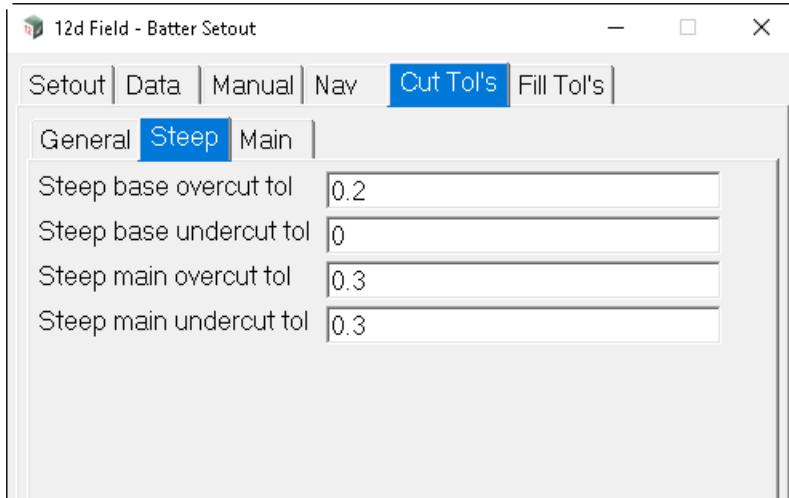
## Cut Tol's Tab



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

Field Description	Type	Defaults	Pop-Up
<b>General tab</b>			
<b>Cut tolerances active?</b> ??	tick box	not ticked	
<b>Cut tol's perpendicular</b> ??	tick box	ticked	
<b>Cut steep slope</b> ??			
<b>Main tolerance height</b> ??			
<b>Prorata tolerance</b> ??	tick box	ticked	
<b>Zero undercut height</b> ??			

## Steep tab



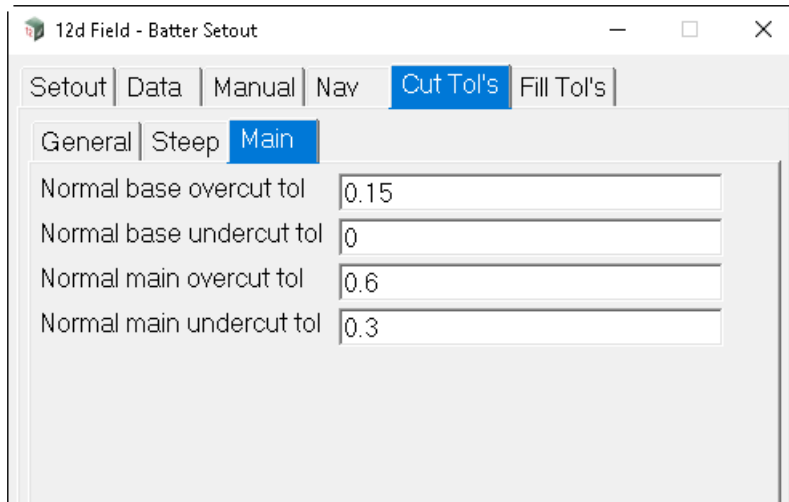
- [Setout Tab](#)
- [Data Tab](#)
- [Manual Tab](#)
- [Nav Tab](#)
- [Cut Tol's Tab](#)
- [Fill Tol's Tab](#)

- [General tab](#)
- [Steep tab](#)
- [Main tab](#)

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

Field Description	Type	Defaults	Pop-Up
<b>Steep base overcut tol</b>			
??.			
<b>Steep base undercut tol</b>			
??.			
<b>Steep main overcut tol</b>			
??.			
<b>Steep main undercut tol</b>			
??.			

## Main tab



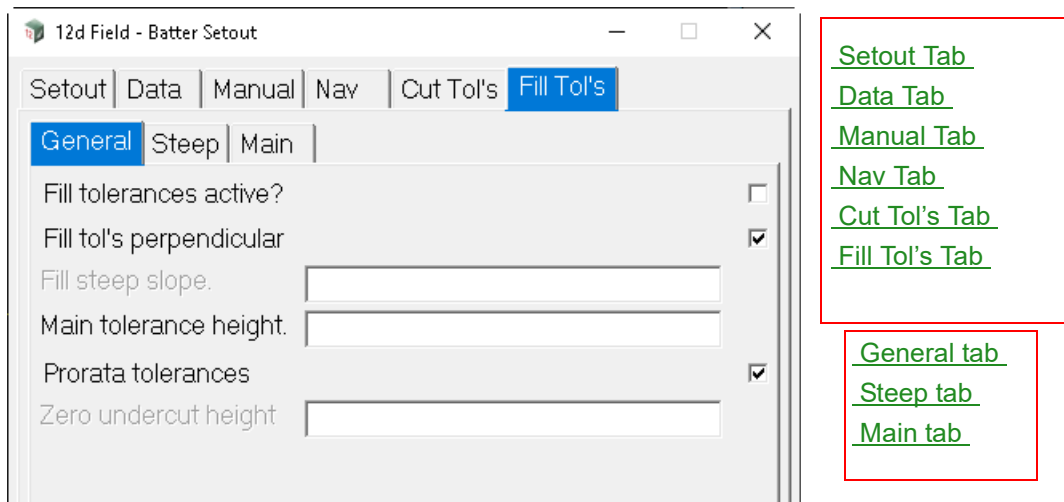
[Setout Tab](#)  
[Data Tab](#)  
[Manual Tab](#)  
[Nav Tab](#)  
[Cut Tol's Tab](#)  
[Fill Tol's Tab](#)

[General tab](#)  
[Steep tab](#)  
[Main tab](#)

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

Field Description	Type	Defaults	Pop-Up
<b>Normal base overcut tol</b>			
??			
<b>Normal base undercut tol</b>			
??			
<b>Normal main overcut tol</b>			
??			
<b>Normal main undercut tol</b>			
??			

## Fill Tol's Tab

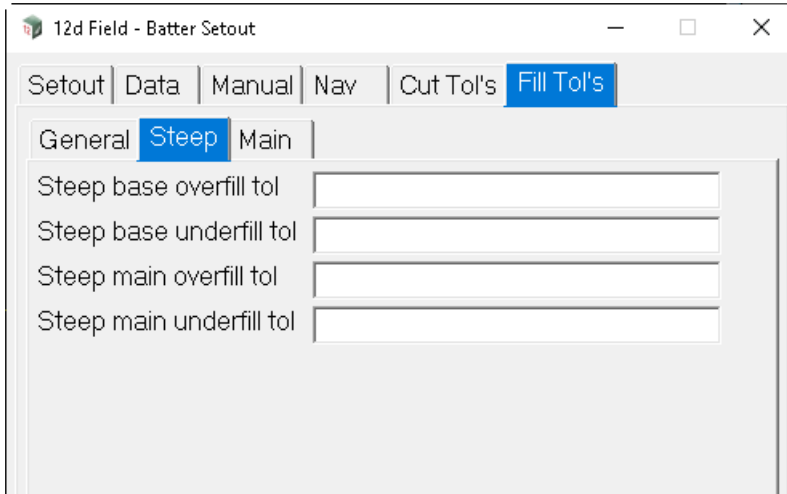


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>General tab</b>			
<b>Fill tolerances active?</b> ??.	tick box	not ticked	
<b>Fill tol's perpendicular</b> ??.	tick box	ticked	
<b>Fill steep slope</b> ??.			
<b>Main tolerance height</b> ??.			
<b>Prorata tolerance</b> ??.	tick box	ticked	
<b>Zero undercut height</b> ??.			



### Steep tab



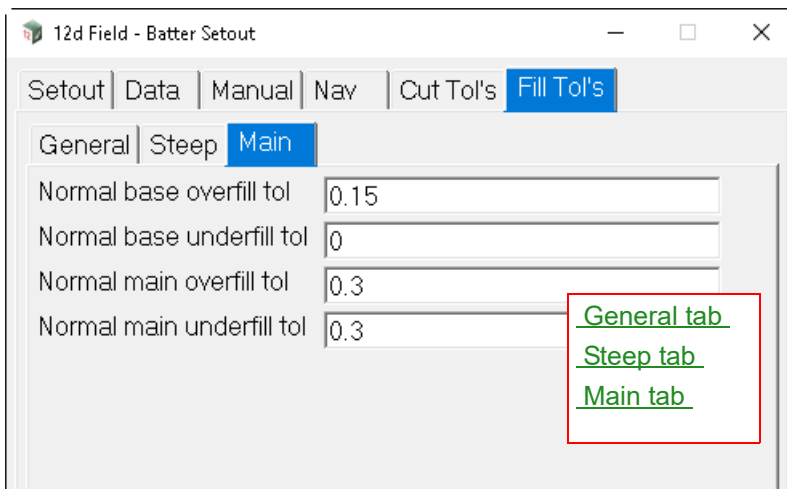
- [Setout Tab](#)
- [Data Tab](#)
- [Manual Tab](#)
- [Nav Tab](#)
- [Cut Tol's Tab](#)
- [Fill Tol's Tab](#)

- [General tab](#)
- [Steep tab](#)
- [Main tab](#)

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

Field Description	Type	Defaults	Pop-Up
<b>Steep base overcut tol</b>			
??			
<b>Steep base undercut tol</b>			
??			
<b>Steep main overcut tol</b>			
??			
<b>Steep main undercut tol</b>			
??			

### Main tab

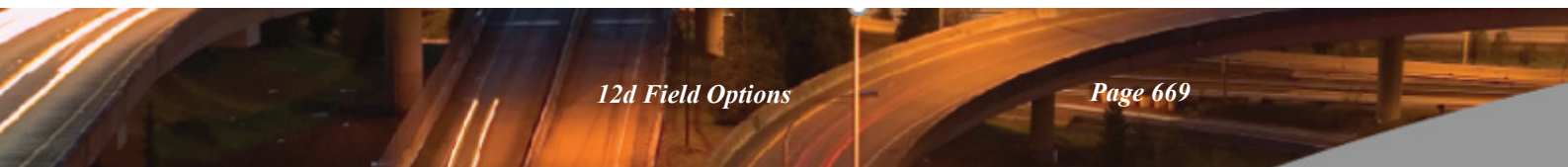


- [Setout Tab](#)
- [Data Tab](#)
- [Manual Tab](#)
- [Nav Tab](#)
- [Cut Tol's Tab](#)
- [Fill Tol's Tab](#)

- [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**

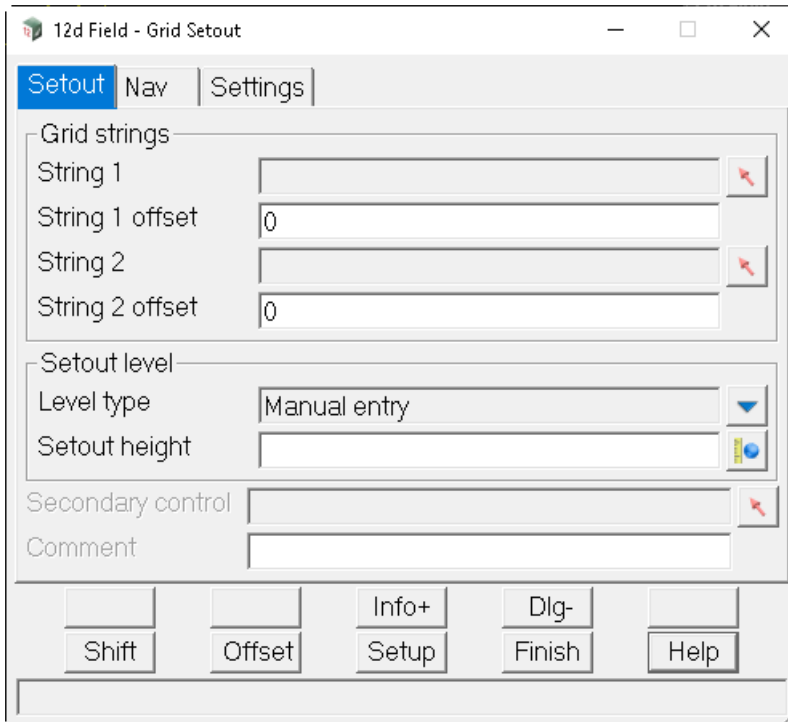
??.

Continue to [15.6.4.7 Setout Grid](#) or go back to [15.6.4 Setout](#).

### 15.6.4.7 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 that 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**

<b>Level type</b>	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

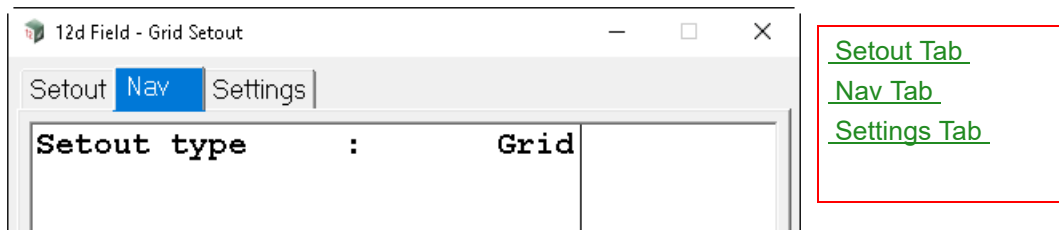
The height to setout, see **Level type** above for a full description.

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**

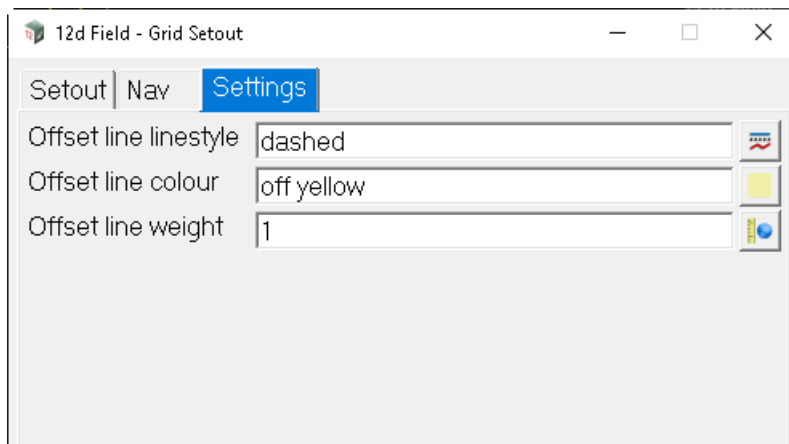
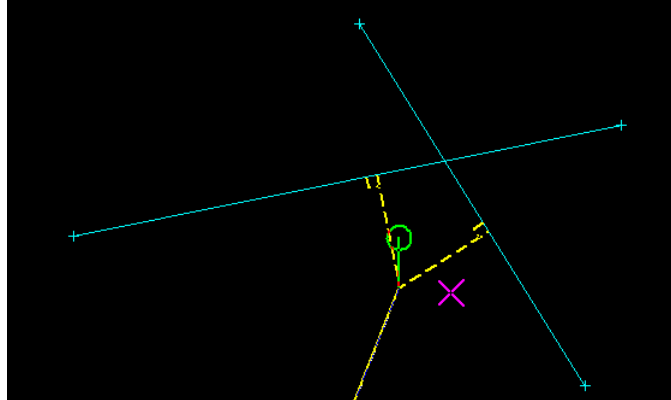


For details on using and populating the Nav tab see [15.6.1.6 Navigation Tab](#).

## 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 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

The linestyle drawn from the measured point to the grid strings.

<b>Offset line colour</b>	colour box	yellow	
---------------------------	------------	--------	--

The colour of the line drawn from the measured point to the grid strings.

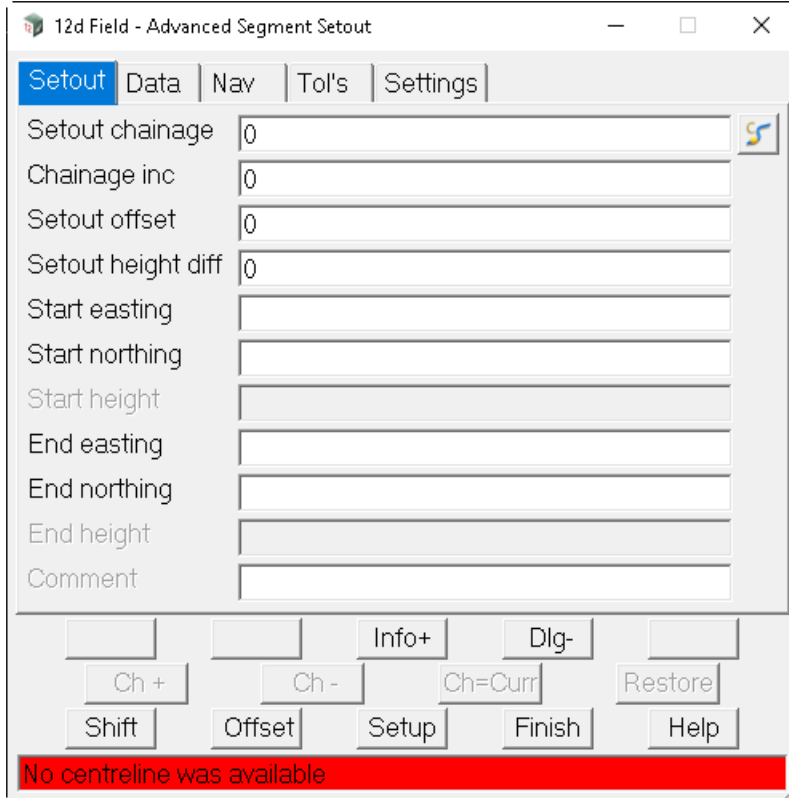
<b>Offset line weight</b>	real box	1	
---------------------------	----------	---	--

The thickness of the line drawn from the measured point to the grid strings.

Continue to [15.6.4.8 Setout Advanced Segment](#) or go back to [15.6.4 Setout](#).

### 15.6.4.8 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**

??.

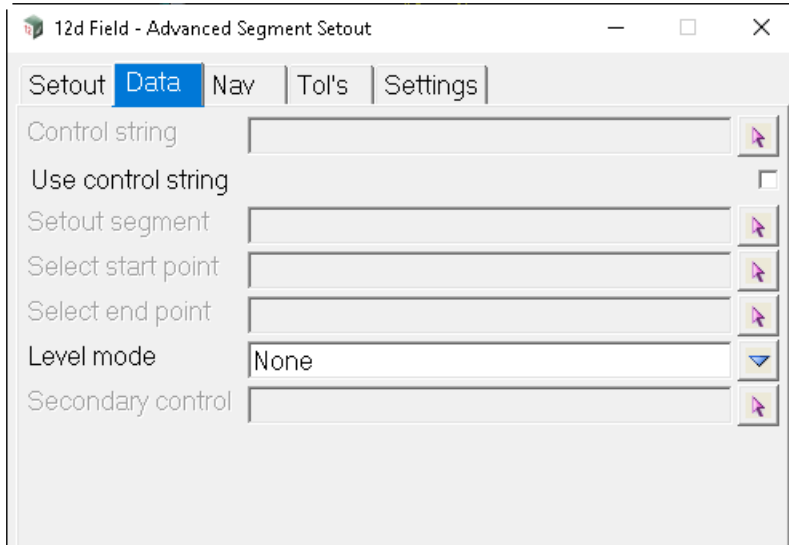
**End northing**

??.

**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
-------------------	------	----------	--------

<b>Control string</b>	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 \(so\\_cs\\_strr\)](#).*

<b>Use control string</b>	tick box	not ticked	
---------------------------	----------	------------	--

??.

<b>S/O segment</b>	string select		
--------------------	---------------	--	--

??.

<b>Select start point</b>	string select		
---------------------------	---------------	--	--

??.

<b>Select end point</b>			
-------------------------	--	--	--

??.

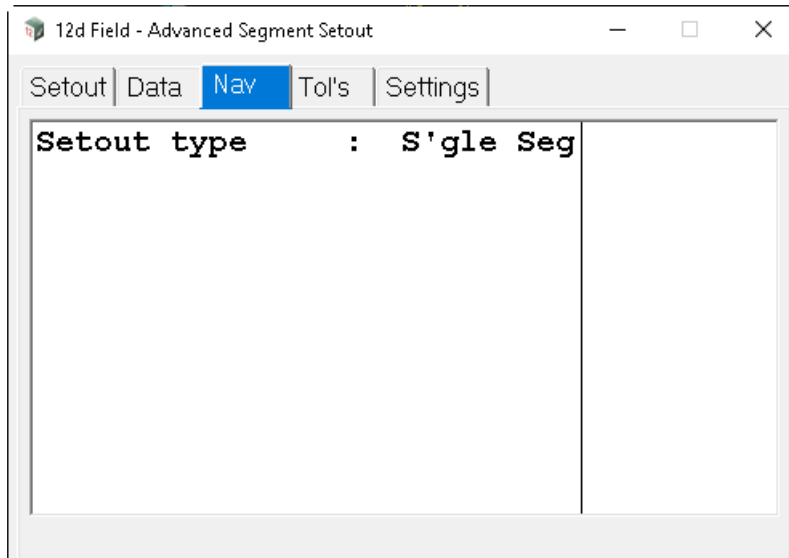
<b>Level mode</b>	choice box		
-------------------	------------	--	--

??.

<b>Secondary control</b>	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](#)

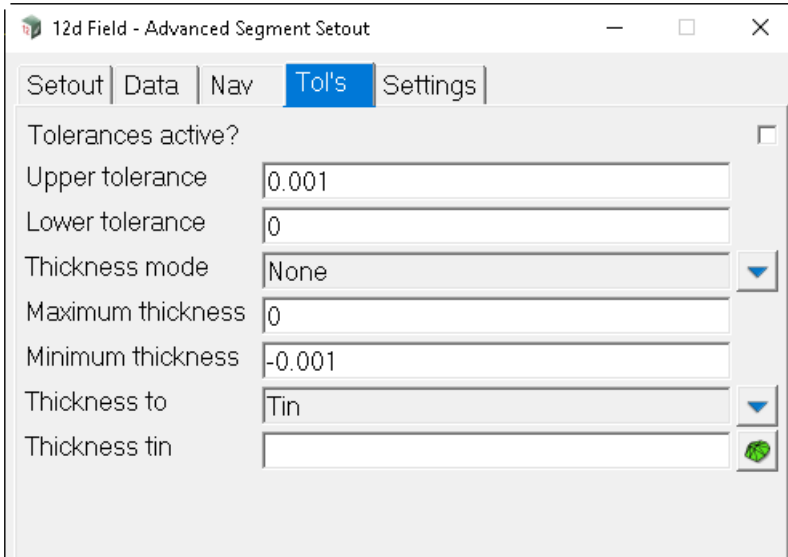
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Navigation Box</b>		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



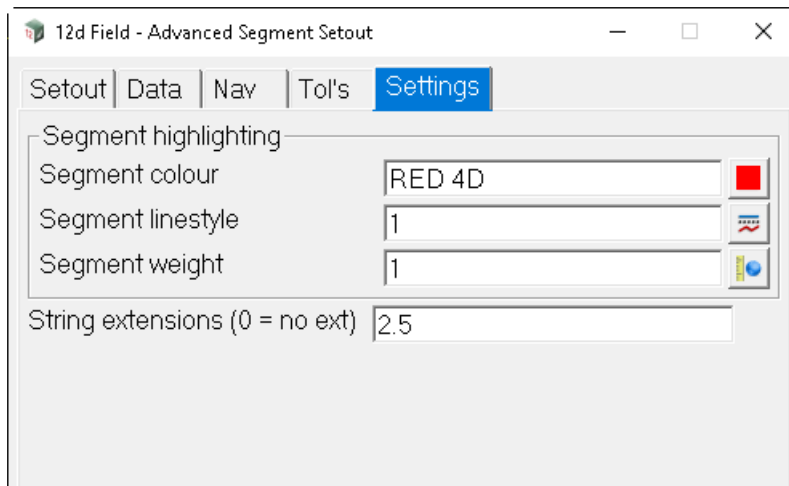
- [Setout Tab](#)
- [Data Tab](#)
- [Nav Tab](#)
- [Tol's Tab](#)
- [Settings Tab](#)

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.

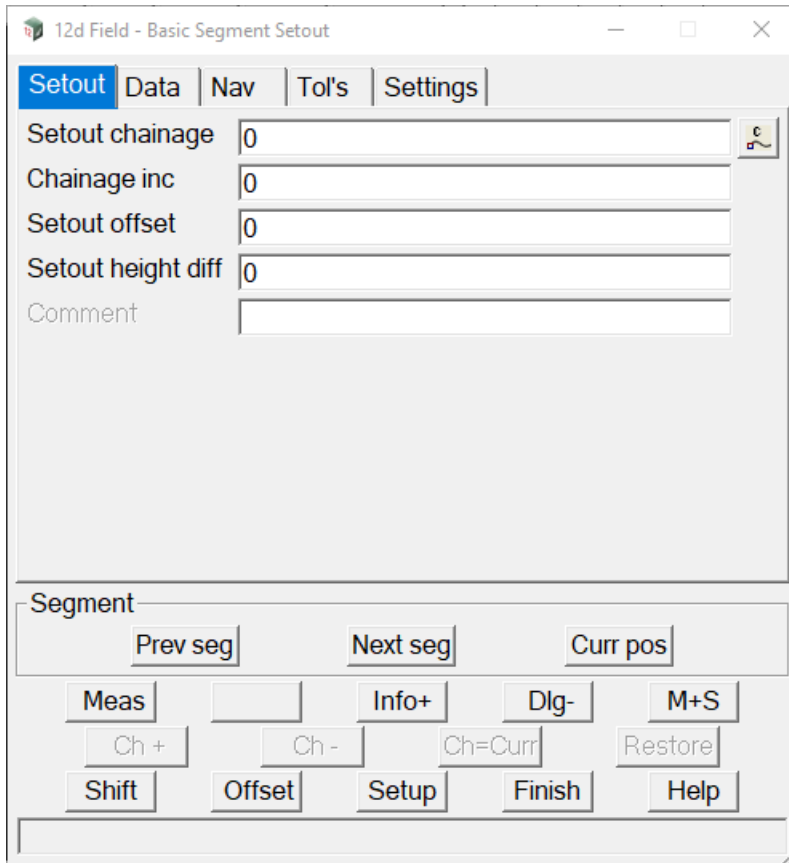
Field Description	Type	Defaults	Pop-Up
<b>Segment highlighting</b>			
<b>Segment colour</b>	colour box	red	available colours
??			
<b>Segment linestyle</b>			
??			
<b>Segment weight</b>	real box		
??			
<b>String extensions (o = no ext)</b>			
??			

Continue to [15.6.4.9 Setout Basic Segment](#) or go back to [15.6.4 Setout](#).

### 15.6.4.9 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](#)
- [Setout 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 \(so\\_cs\\_ch\)](#).*

<b>Chainage inc</b>	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

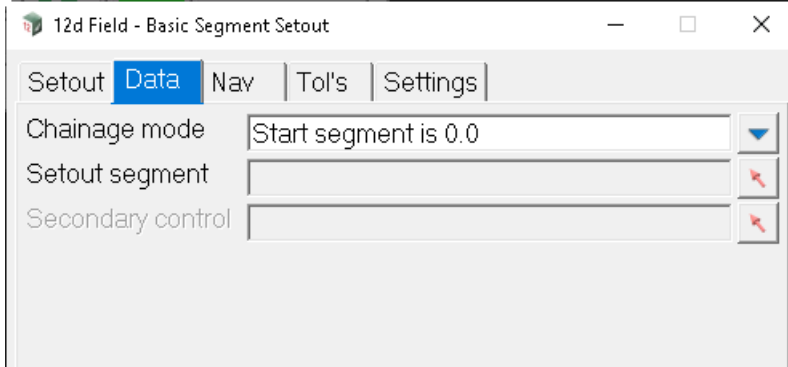
*The height difference from the setout surface after the surface shift is applied, +ve is above, for more information see [15.6.1.8.5 Setout height diff \(so\\_vpl\\_spl\\_htdf\)](#).*



**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  
String chainage

*Start segment is 0.0, the start chainage of the selected string segment is set to 0.0.*

*String chainage, the start chainage of the selected string segment is set to the parent string chainage at that point.*

*Attribute "so\_seg\_ch\_mode"*

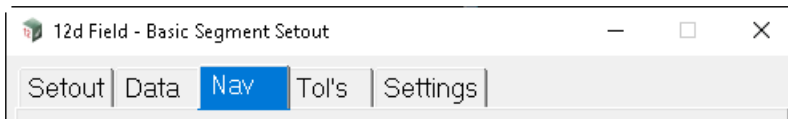
**Setout segment**

*Select either a line or arc segment of a string to use.*

**Secondary control**

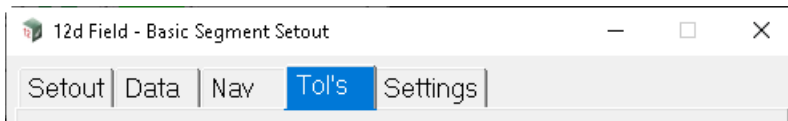
*For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_str\)](#).*

**Nav Tab**

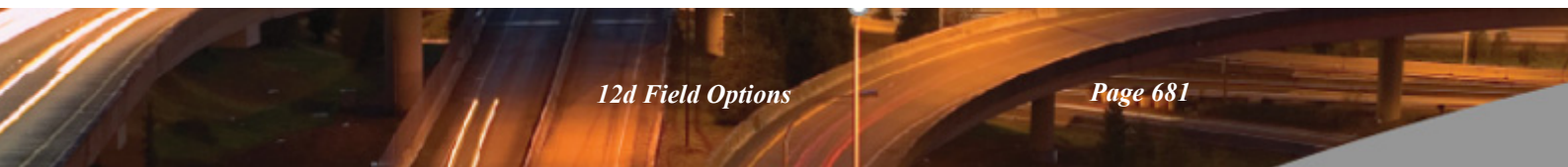


*For details on using and populating the Nav tab see [15.6.1.6 Navigation Tab](#).*

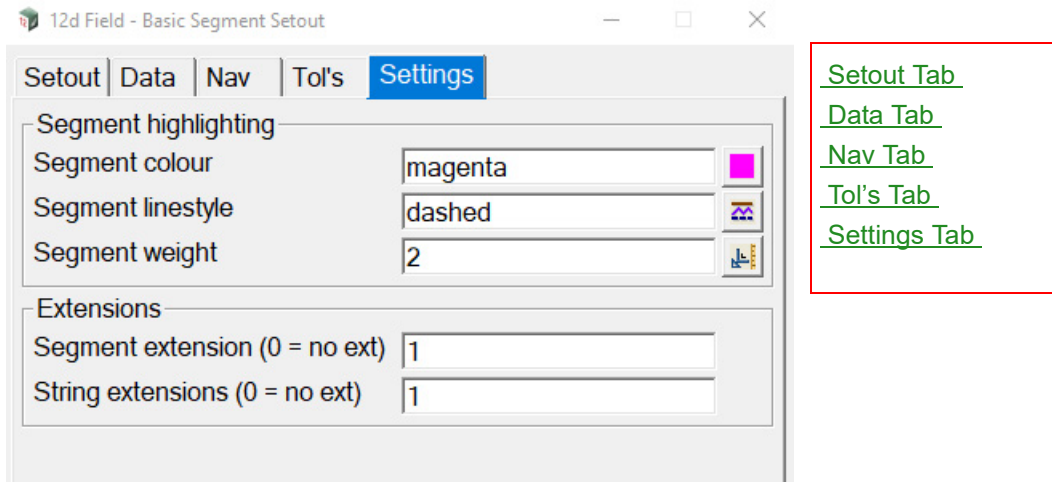
**Tol's Tab**



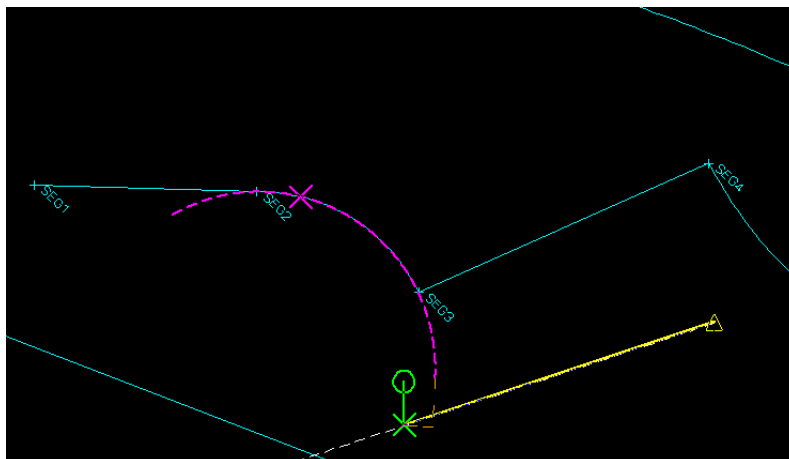
*For details on using and populating the Tol's tab see [15.6.1.7 Tolerances Tab](#).*



## 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"

### 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.

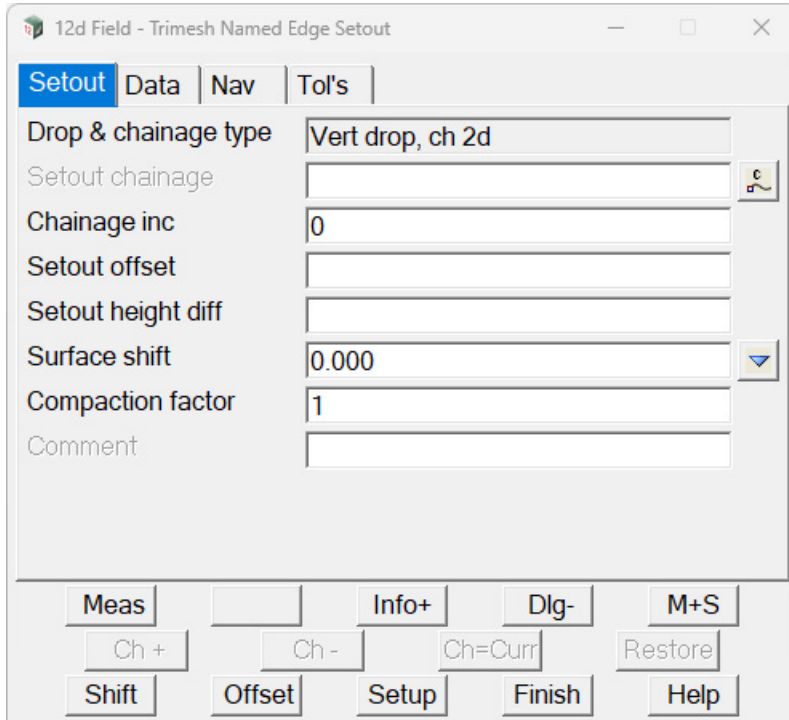
For more information on the standard buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields](#).

Continue to [15.6.4.10 Setout Trimesh Edge](#) or go back to [15.6.4 Setout](#).

### 15.6.4.10 Setout Trimesh Edge

The **Trimesh Named Edge Setout** is very similar in functionality to the [15.6.4.1 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 [18.5 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



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

Field Description	Type	Defaults	Pop-Up
<b>Drop type</b>	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 closest to the setout chainage.

**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 trimesh** trimesh select

Select the trimesh to use for named edge setout.

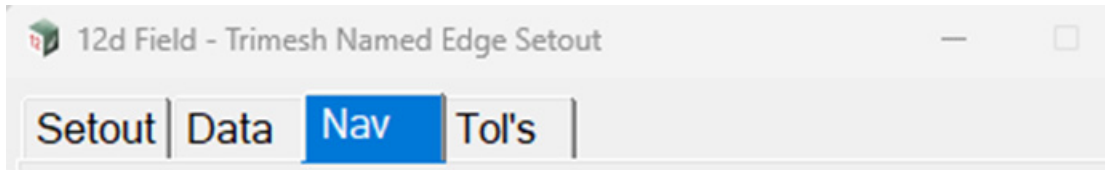
**Edge name** choice box

On selecting the trimesh the choice box will be populated with the available named edges to use, select the named edge to setout.

**Secondary control** string select

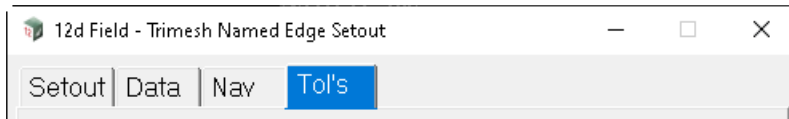
For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).

## 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 [15.6.4.11 Setout Crown](#) or go back to [15.6.4 Setout](#).

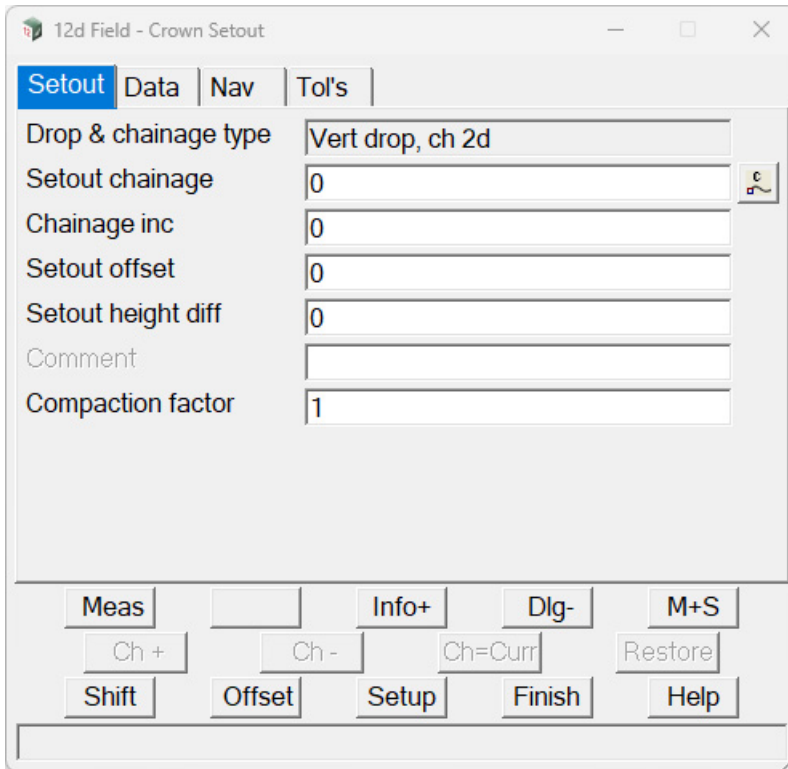


### 15.6.4.11 Setout Crown

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

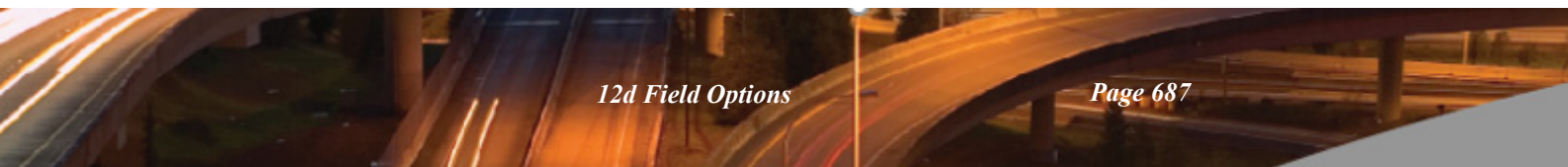
*The type of drop of a point to the centreline and the type of chainage used, this panel only uses the standard vertical drop and 2d chainage mode, see 19.5 Different Types of Chainage Drop Point for more information.*

**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 \(so\\_vpl\\_spl\\_htdf\)](#).

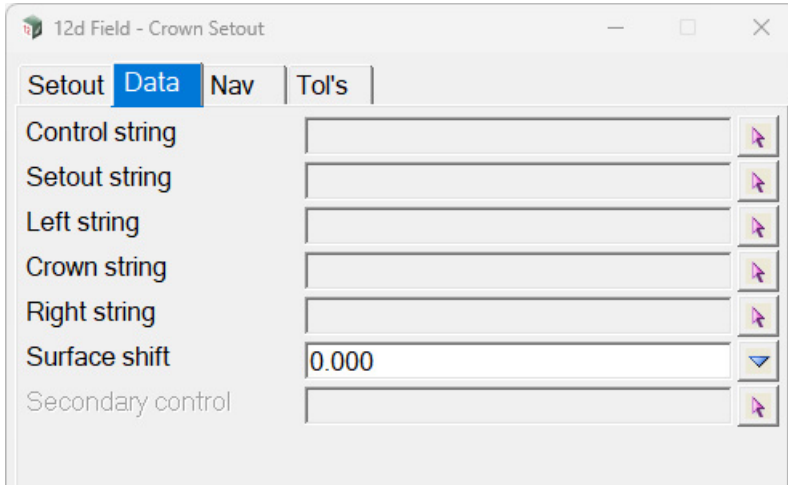
**Comment**

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



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Control string</b>	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 \(so\\_cs\\_strr\)](#).*

<b>Setout string</b>	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.*

<b>Left string</b>	string select		
--------------------	---------------	--	--

*The outer height string on the left hand side of the road.*

<b>Crown string</b>	string select		
---------------------	---------------	--	--

*The crown string, the central height string used by both side of the road.*

<b>Right string</b>	string select		
---------------------	---------------	--	--

*The outer height string on the right hand side of the road.*

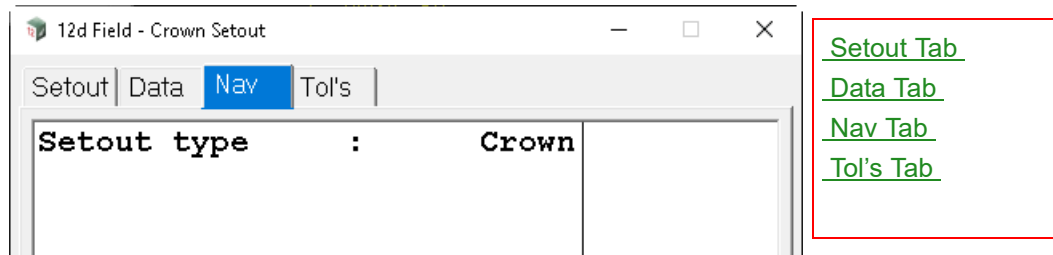
<b>Surface shift</b>	choice box	0.000	
----------------------	------------	-------	--

*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 \(so\\_vpl\\_spl\\_htdf\)](#).*

<b>Secondary control</b>	string select		
--------------------------	---------------	--	--

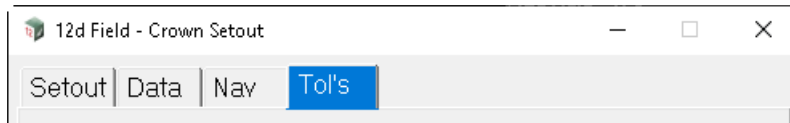
*For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).*

## 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 [15.6.4.12 Setout Tunnel](#) or go back to [15.6.4 Setout](#).

## 15.6.4.12 Setout Tunnel

The **12d Field - Tunnel Setout** panel allows use of a standard 12d tunnel definition in the field to perform related tasks.

See [17.15 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 last 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.*

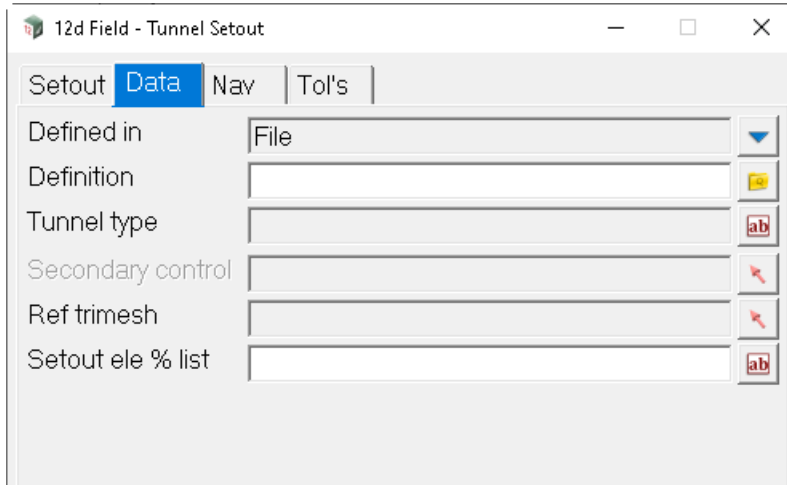
**Chainage inc** 0

*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
<b>Defined in</b>	choice box	file	File, Centreline

*Tunnel definitions can either be stored in a text file or as control string attributes.*

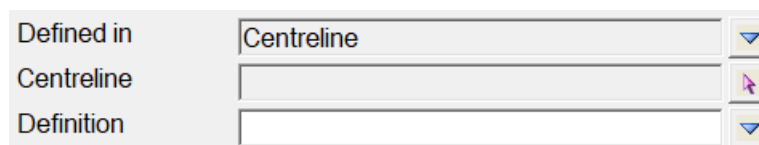
### File



**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 [17.15.2 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`.*

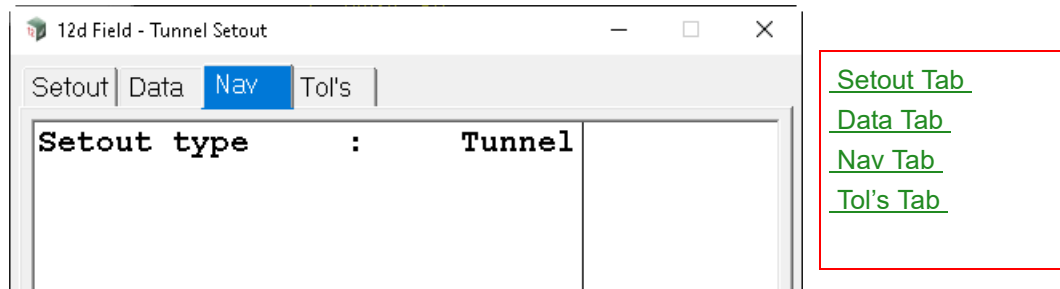
*Attribute "so\_tun\_trimesh\_eler"*

**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.*

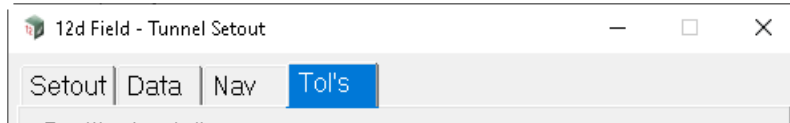
*Also note the function keys "`next_tunnel_seg`" and "`prev_tunnel_seg`" can be use to iterate through the **Setout ele name** choice list.*

## Nav Tab



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 [15.6.4.13 Water Network Setout](#) or go back to [15.6.4 Setout](#).

### 15.6.4.13 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

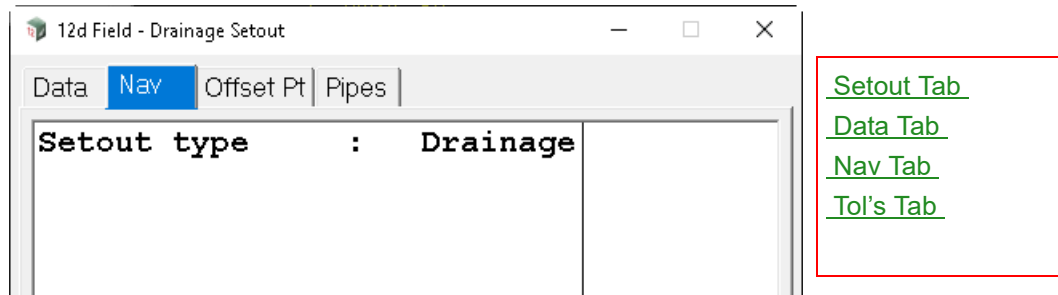
For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).



**Comment**

*A user entered comment, for more information see [15.6.1.8.6 Comment \(st\\_gui\\_display pu comment line\)](#).*

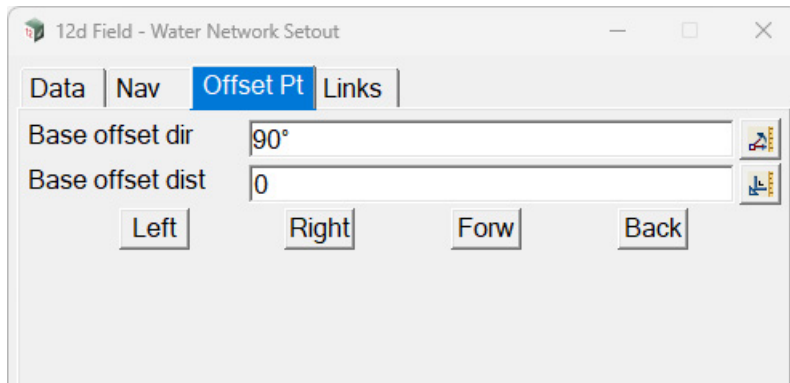
## Nav Tab



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.

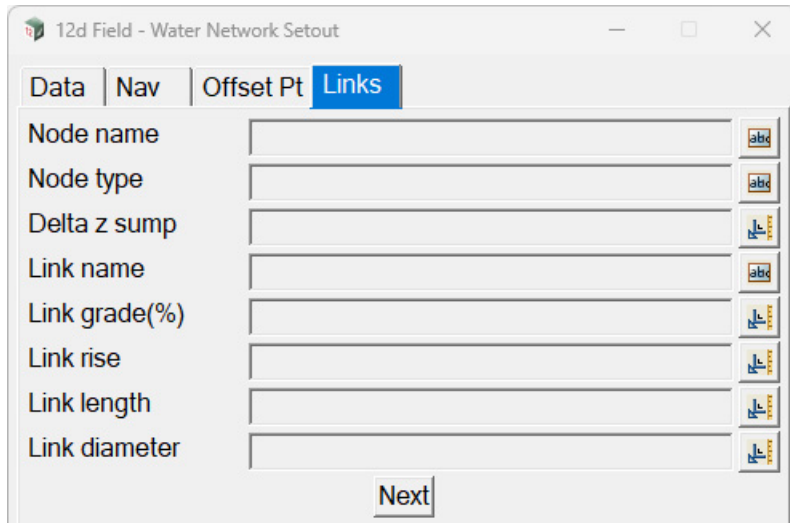


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Base offset dir</b>	angle box	90 degrees	
<i>The direction for offsetting points.</i>			
<b>Base offset dis</b>	real box	0	
<i>The distance for offsetting points.</i>			
<b>Left</b>	button		
<i>Create a setout point to the left of the base direction at the offset distance.</i>			
<b>Right</b>	button		
<i>Create a setout point to the right of the base direction at the offset distance.</i>			
<b>Forw</b>	button		
<i>Create a setout point in the base direction at the offset distance.</i>			
<b>Back</b>	button		
<i>Create a setout point reverse to the base direction at the offset distance.</i>			

## 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.



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

Field Description	Type	Defaults	Pop-Up
<b>Node name</b>	text box		
<i>The name of the selected node.</i>			
<b>Node type</b>	text box		
<i>The type of the selected node.</i>			
<b>Delta Z sump</b>	real box		
<i>The delta height from the measured point to the sump level of the node/pit.</i>			
<b>Link name</b>	text box		
<i>Displays the names of the 2 nodes of the upstream link/pipe.</i>			
<b>Link grade (%)</b>	real box		
<i>The actual grade of the upstream link/pipe, this is not the centre to centre grade of the 2 nodes.</i>			
<b>Link rise</b>	real box		
<i>The height difference from the sump level of the node/pit to the invert level of the upstream link/pipe.</i>			
<b>Link length</b>	real box		
<i>The actual length of the upstream link/pipe, this is not the centre to centre length of the 2 nodes.</i>			

**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 [15.6.4.14 Setout Piles](#) or go back to [15.6.4 Setout](#).

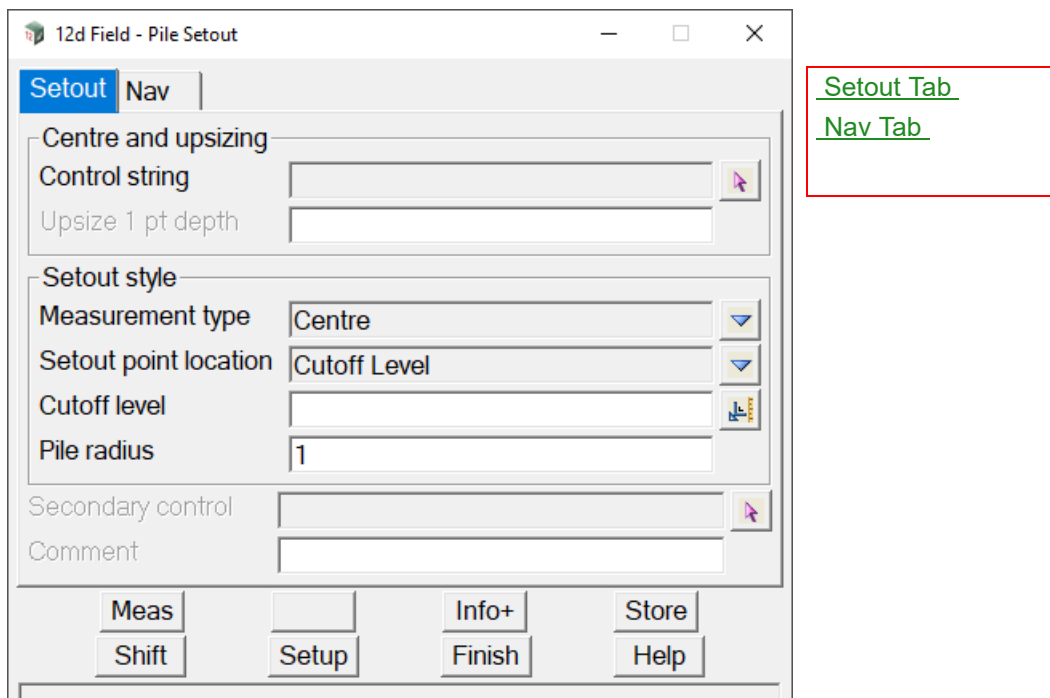
### 15.6.4.14 Setout Piles

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.



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**.

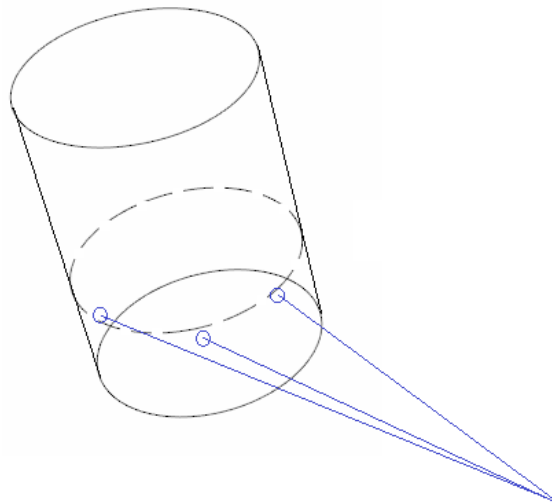
#### **Fit 2 bands, known radius**

#### **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 calculate 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 "

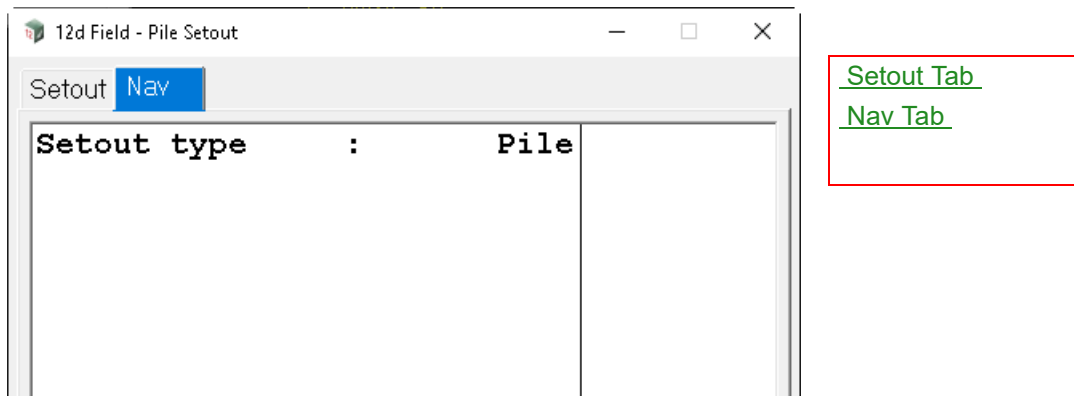
For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).

**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



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](#).

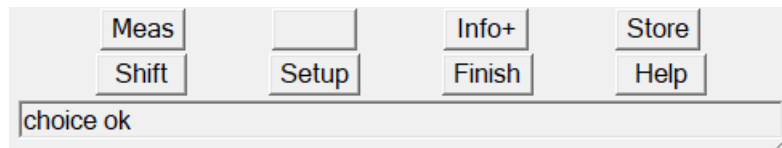
## Buttons at Bottom

The buttons at the bottom vary dependent on the pile setout mode.

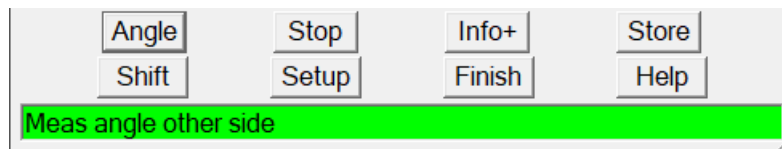
For information on the standard buttons see [15.6.1 Common Buttons, Panel Tabs and Fields](#).

The behaviour of the special Pile Setout buttons is as follows.

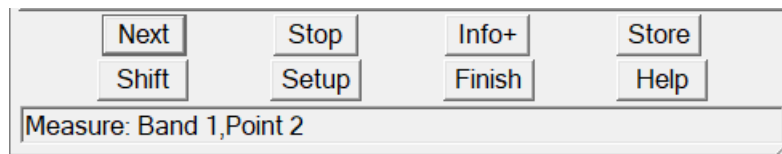
For setout types **Measure the cutoff level** and **Centre, (manual aim)** the buttons look as such.



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 [15.6.5 Pickup](#) or go back to [15.6.4 Setout](#).

## 15.6.5 Pickup

Clicking on the **Pickup** menu option brings up the **Pickup** menu.

### TPS Pickup

TPS Pickup	See
SDR	<a href="#">15.6.5.1 Pickup SDR</a>
Basic	<a href="#">15.6.5.2 Pickup Basic</a>
Face	<a href="#">15.6.5.3 Pickup Face</a>
Face scan	<a href="#">15.6.5.4 Pickup Face Scan</a>
Tunnel	<a href="#">15.6.5.5 Pickup Tunnel</a>
Section	<a href="#">15.6.5.6 Pickup Section</a>
Tunnel scan	<a href="#">15.6.5.7 Pickup Tunnel Scan</a>
Tunnel PRS define	<a href="#">15.6.5.8 Pickup Tunnel PRS Define</a>
Meas rounds	<a href="#">15.6.5.9 Pickup Measurement Rounds</a>

### GNSS Pickup

GNSS Pickup	See
SDR	<a href="#">15.6.5.1 Pickup SDR</a>
Basic	<a href="#">15.6.5.2 Pickup Basic</a>
Occupy point	<a href="#">15.6.5.10 Pickup Occupy Point - GNSS</a>

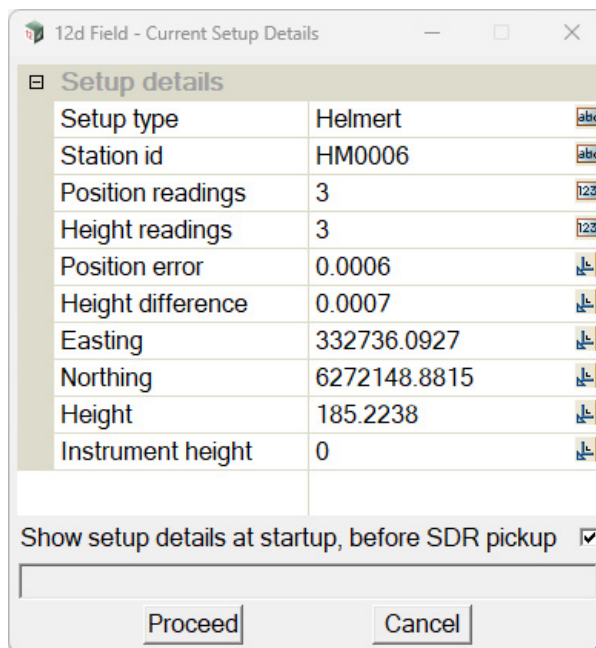
### 15.6.5.1 Pickup SDR

**12d Field - SDR Pickup** is a panel which populates an **SDR Function** directly in the field. Unlike [15.6.5.2 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.

Clicking **SDR** first 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
<b>Show setup details at startup, before SDR pickup</b>	tick box	ticked	ticked

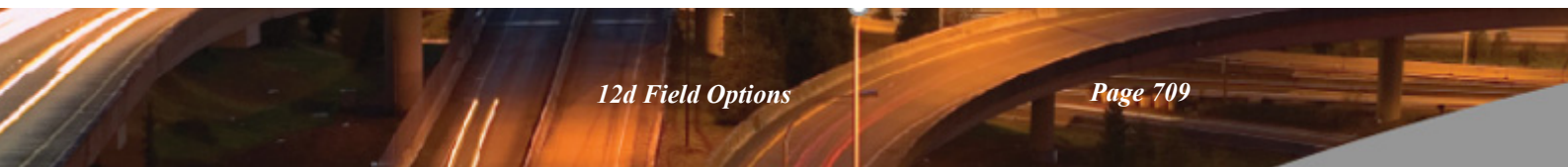
*If **ticked**, the current setup details are displayed on starting 12dField and every time SDR Pickup is started.*

*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

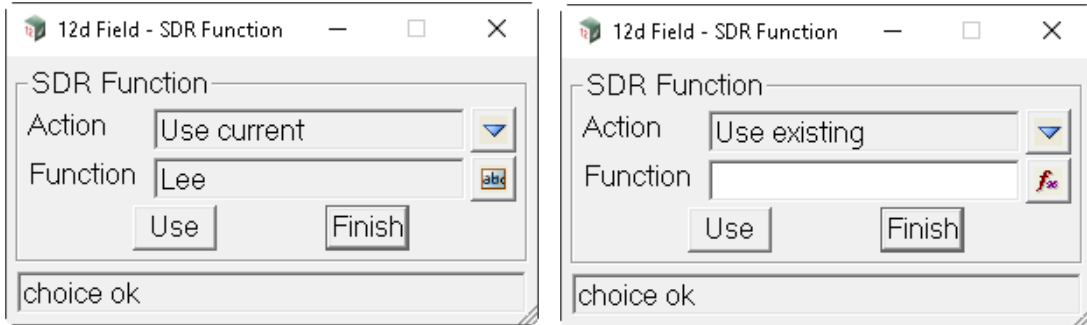
**Proceed** button  
*Proceed to 16.6.5.1.2 SDR Function.*

**Cancel** button  
*Exit SDR Pickup.*



The fields in 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:



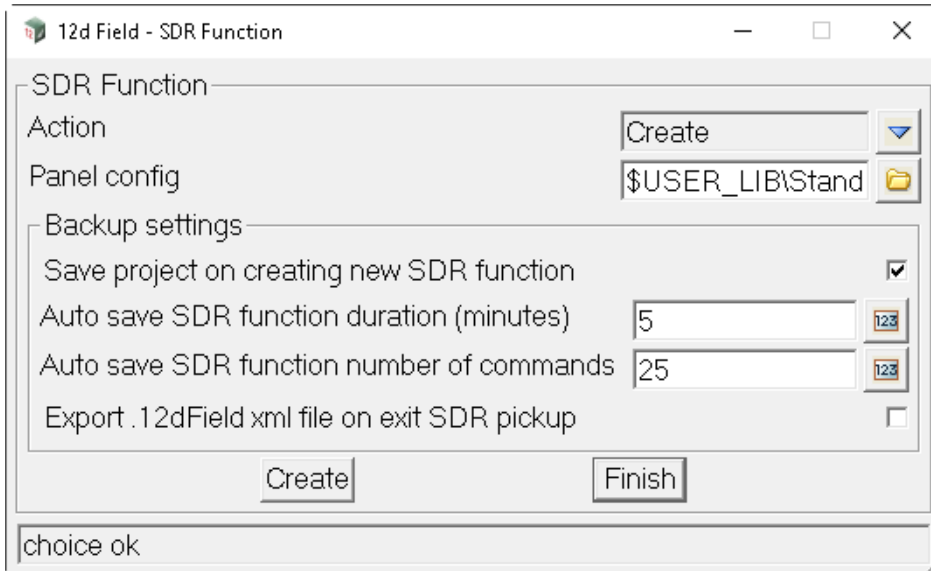
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Action</b>	choice box		Use current, Use existing Create, Create (no codes)

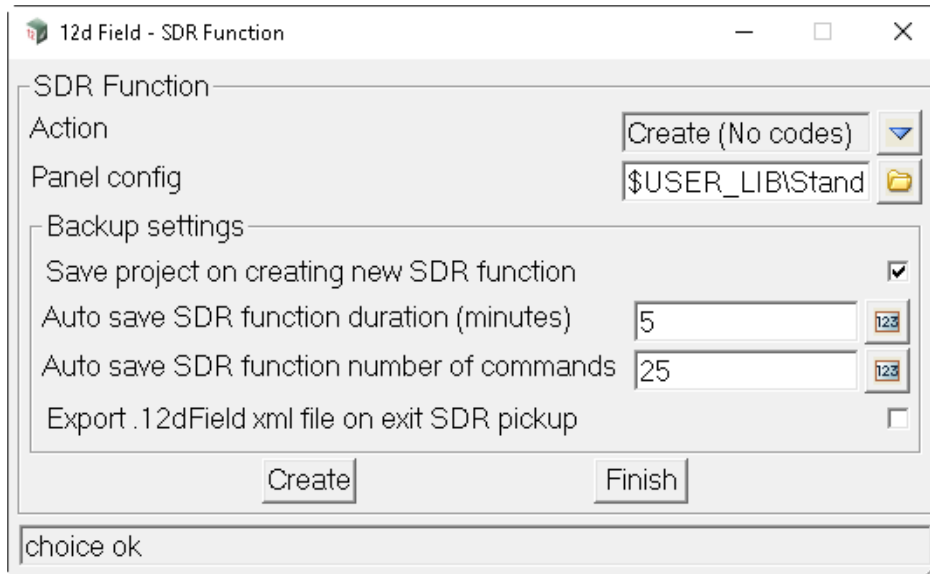
*If **Use current**, the SDR Function currently being used and is used when the **Use** button is pressed.*

*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, bring up the 12d Field - Create a Pickup Function panel is displayed.*

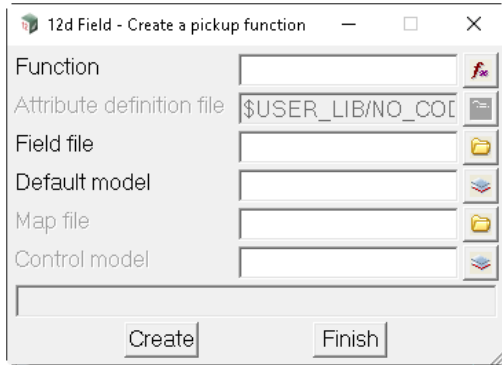
*What tabs are on the panel will depend on the Panel config file.*

When **Create (NO CODES)** is used (and the **Panel config** NO\_CODES.12dfield\_sdr\_coding), the **12d Field - Create a Pickup Function** panel is a simplified pane with fewer fields and tabs:

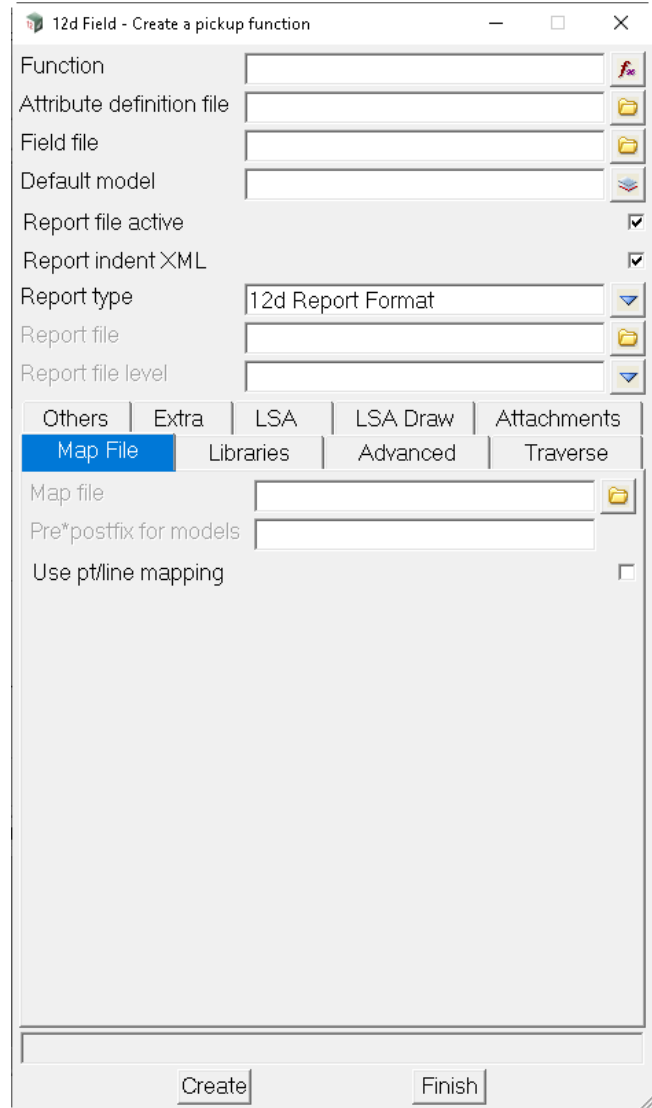
When **Create** is used (and the **Panel config** Standard.12dfield\_sdr\_coding), the **12d Field -**

Create a Pickup Function panel is the full panel with all field and tabs:

**Create (NO CODES) Used**



**Create Used**



Continue to [15.6.5.1.1 Configuring the "12d Field - Create a pickup function" panel](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.1.1 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 Create 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.

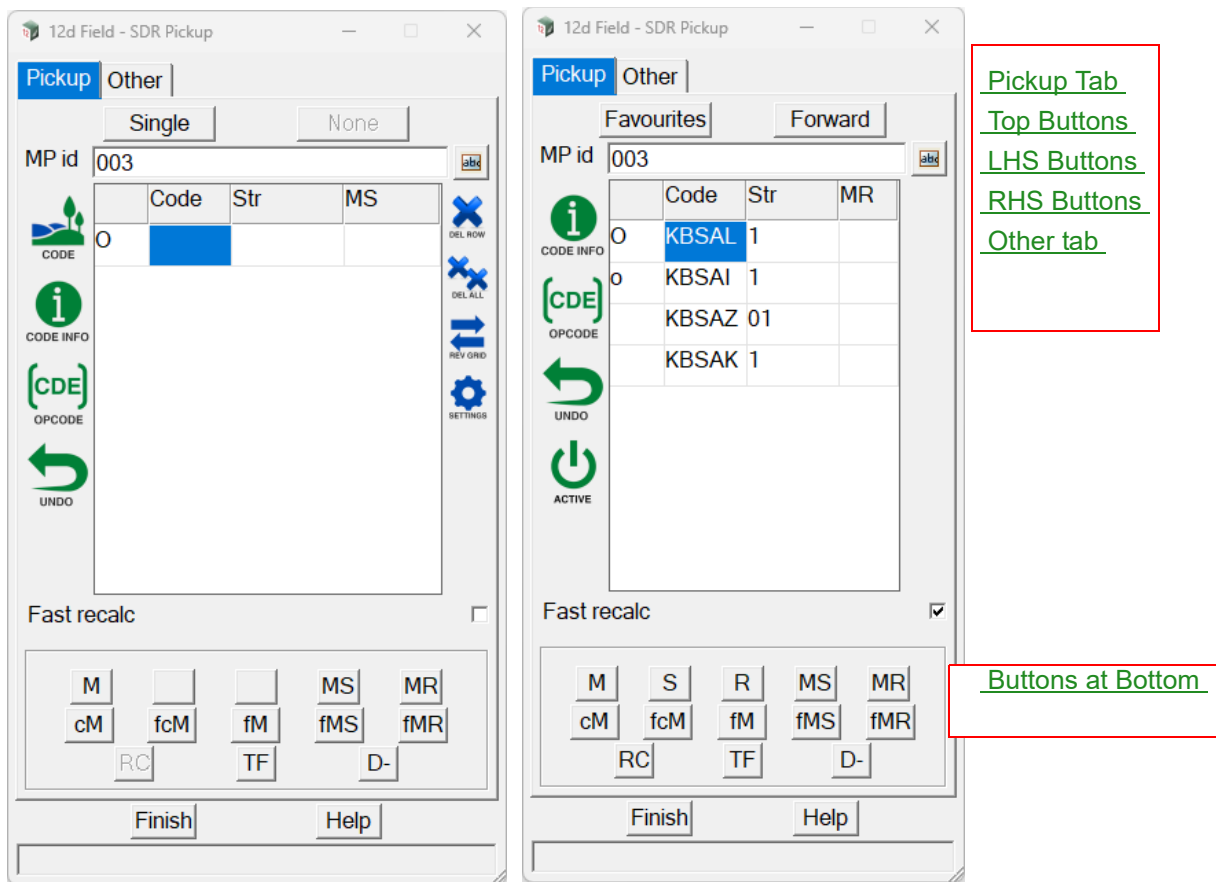
### 15.6.5.1.2 SDR Pickup Panel

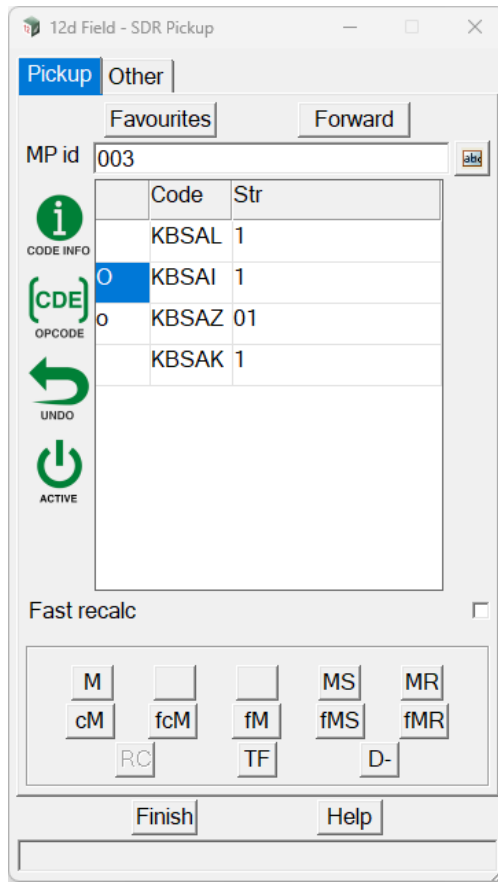
The **12d Field - SDR Pickup** panel is used to take and store measurements from TPS and GNSS instruments to the SDR Function, allow the user to select codes to use and enter the details necessary for each of them, control aspects of the SDR Function amongst many other things.

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 is 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.*

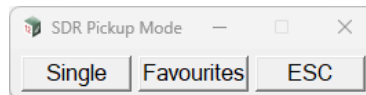
**Top Buttons**

*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.

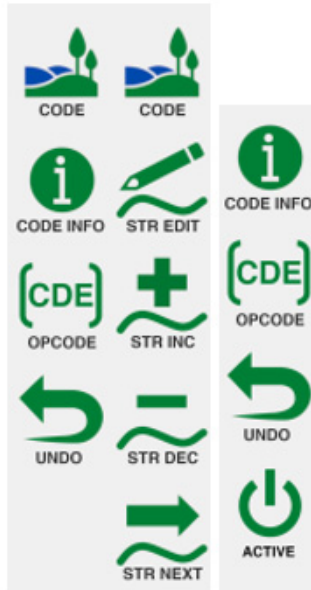
	KBSAL	1
O	KBSAI	1
o	KBSAZ	01
	KBSAK	1

**ESC** button

Return to the current node.

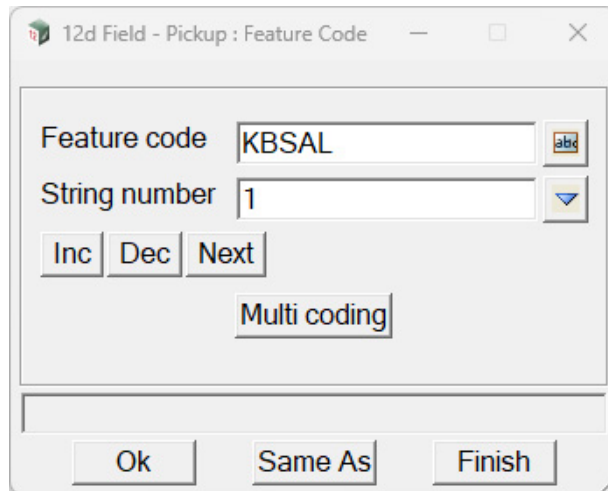
## LHS Buttons

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

If the information is stored with the current selected feature code.

**OPCODE** button

??.

**Undo** button

Undo the last reading only.

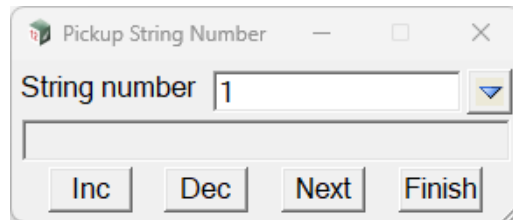
**ACTIVE** button

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.

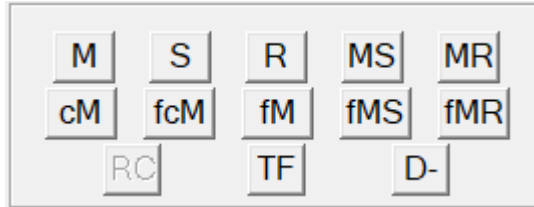
**REV GRD** button

Reverse the order of the grid.

**SETTINGS** button

Open the *SDR Pickup Settings* panel.

### Buttons at Bottom



See [15.8.4.12 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

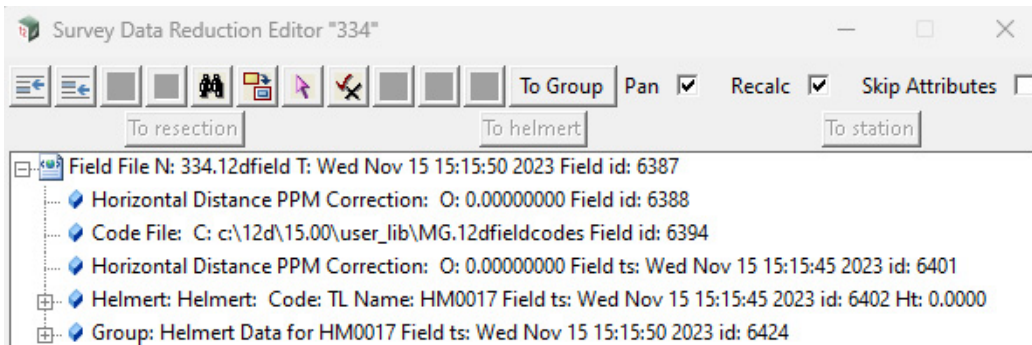


[Pickup Tab](#)  
[Other tab](#)

### 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.*

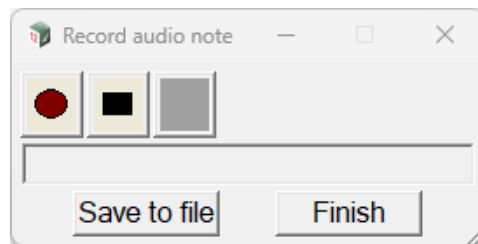
**Report** button

*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.*

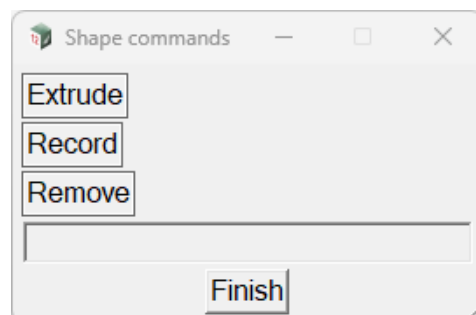
**Sundries**

**Attributes** button

??.

**Shapes** button

*Open the Shape commands panel.*



**Extrude** button

??.

**Record** button

??.

**Remove** button

??.

See [25.3.11 Shape Field Coding](#) for details.

### Settings

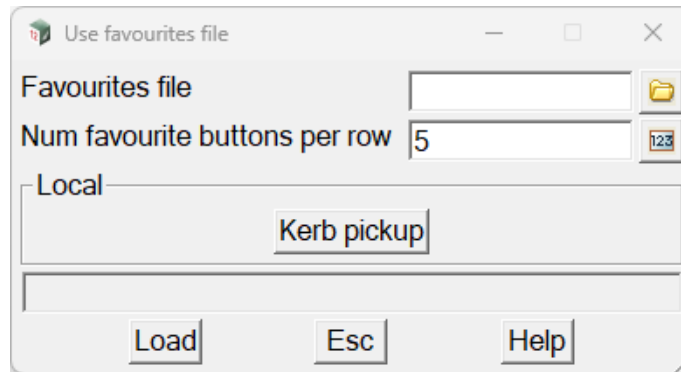
**SDR Settings** button

??.

### 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.*

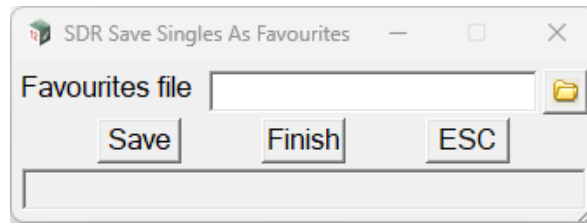
**Esc** button

*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

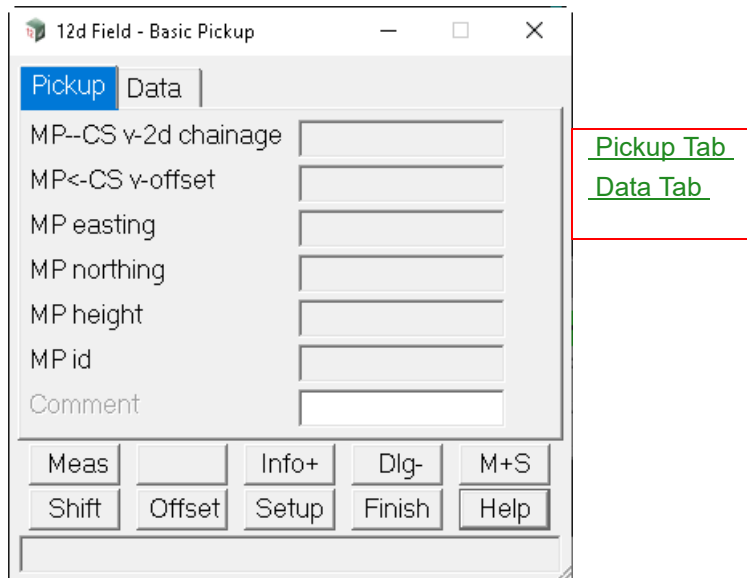
*Exit the panel without saving a file.*

Continue to [15.6.5.2 Pickup Basic](#) or go back to [15.6.5 Pickup](#).

## 15.6.5.2 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 [15.6.5.1 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.



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"*

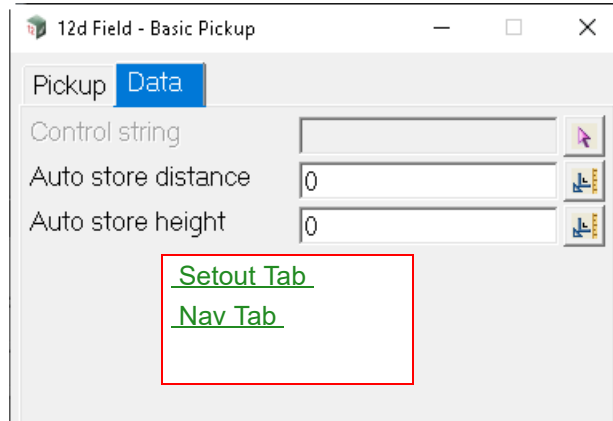
**MP id**

0001

*Point id of the measured point.*

*See **MP id** in the [Vertex point id style](#) section of the [15.6.9 Store Point Setup](#) panel.*

## Data Tab



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Control string</b>	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 \(so\\_cs\\_strr\)](#).*

<b>Auto store distance</b>	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"*

<b>Auto store height</b>	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.*

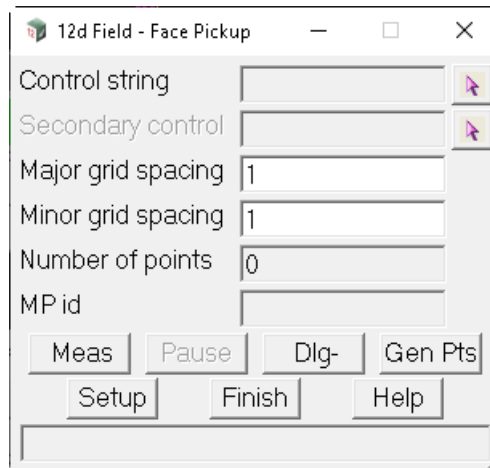
*Attribute "so\_panel\_auto\_store\_height"*

Continue to [15.6.5.3 Pickup Face](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.3 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
-------------------	------	----------	--------

<b>Control string</b>	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.*

<b>Secondary control</b>	string select		
--------------------------	---------------	--	--

*For standard secondary control string functionality see [15.7.2.2 The Secondary Control String \(so\\_sc\\_strr\)](#).*

<b>Major grid spacing</b>	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"*

<b>Minor grid spacing</b>	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"*

<b>Number of points</b>	integer box	0	
-------------------------	-------------	---	--

*The number of points generated to scan from the axis settings.*

*Attribute "so\_face\_pu\_num\_pts"*

<b>MP id</b>		0001	
--------------	--	------	--

*Point id of the measured point.*

*See **MP id** in the [Vertex point id style](#) section of the [15.6.9 Store Point Setup](#) panel.*

#### Buttons at Bottom

The initial state of the buttons is as follows:

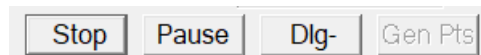


**Meas** button

*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.*



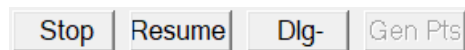
Once the scan has been started the buttons change behaviour as above.

**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.*

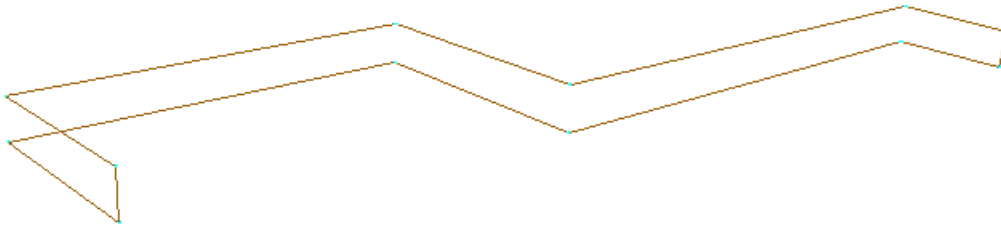
*For more information on these buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields.](#)*

Continue to [15.6.5.4 Pickup Face Scan](#) or go back to [15.6.5 Pickup](#).



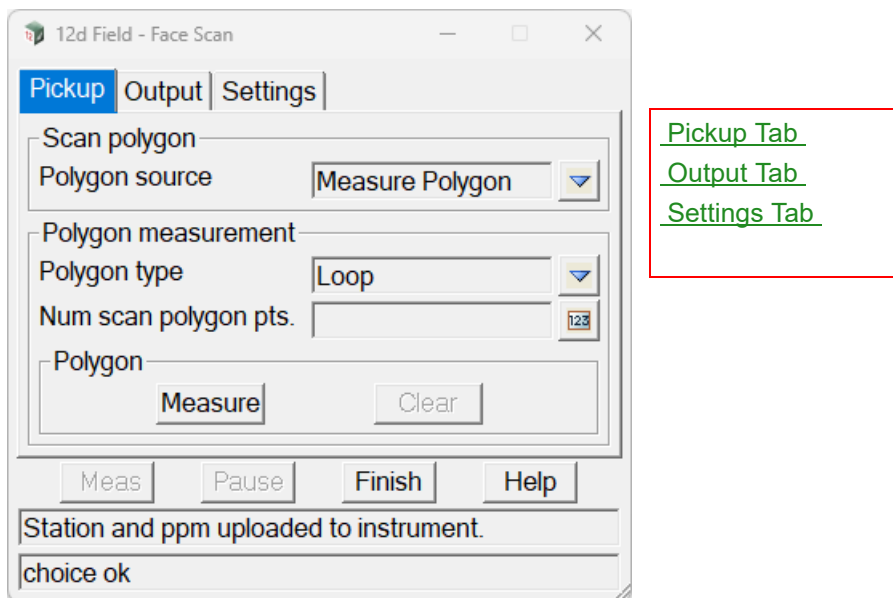
### 15.6.5.4 Pickup Face Scan

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.



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

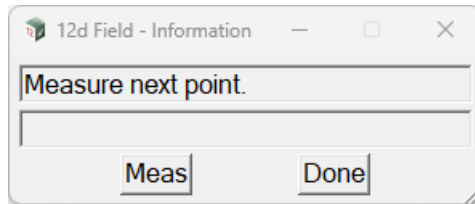
The number of points in the polygon to be scanned, information only.

### Polygon

**Measure**

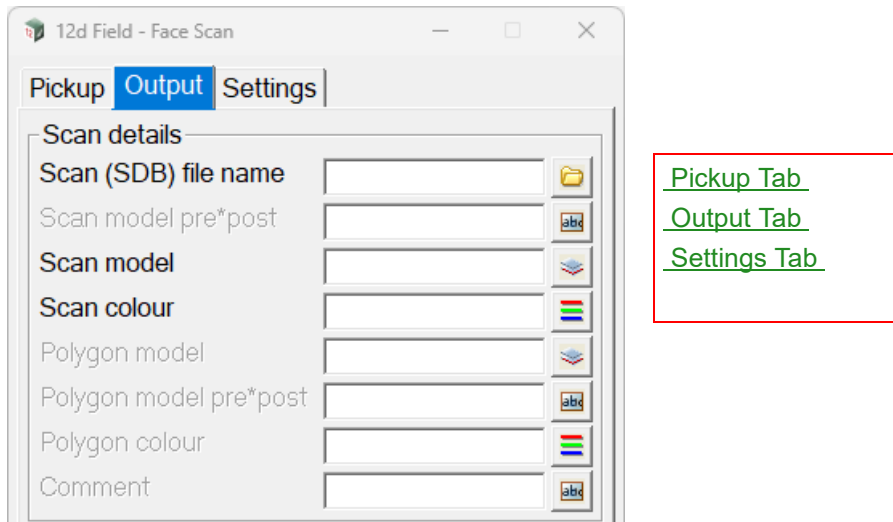
button

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



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Scan details

<b>Scan (SDB) file name</b>	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"

<b>Scan model</b>	model box		available models
-------------------	-----------	--	------------------

The model for the scan to be stored in.

Attribute "st\_scan\_model"

<b>Scan model pre*post</b>	text box		
----------------------------	----------	--	--

An optional pre/post that can be added to the scanning model name.

Attribute "st\_scan\_model\_pre\_post"

<b>Scan colour</b>	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.

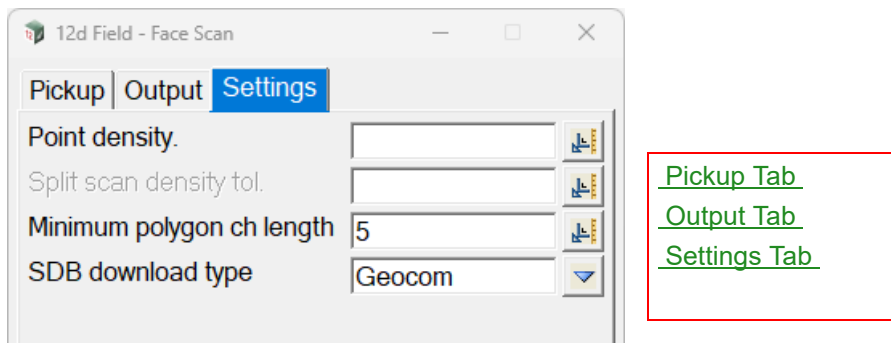
Attribute "st\_scan\_poly\_colour"

**Comment**                                      text box

And optional comment stored the 12d Field attributes.

Attribute "pu\_panel\_comment\_line"

## Settings Tab



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Point density</b>	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"

<b>Spit scan density tol</b>	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"

<b>Minimum polygon ch length</b>	real box	5	
----------------------------------	----------	---	--

A quadrangle will not be split to side lengths less than this value.

Attribute "st\_scan\_minimum\_ch\_length"

<b>SDB download type</b>	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.



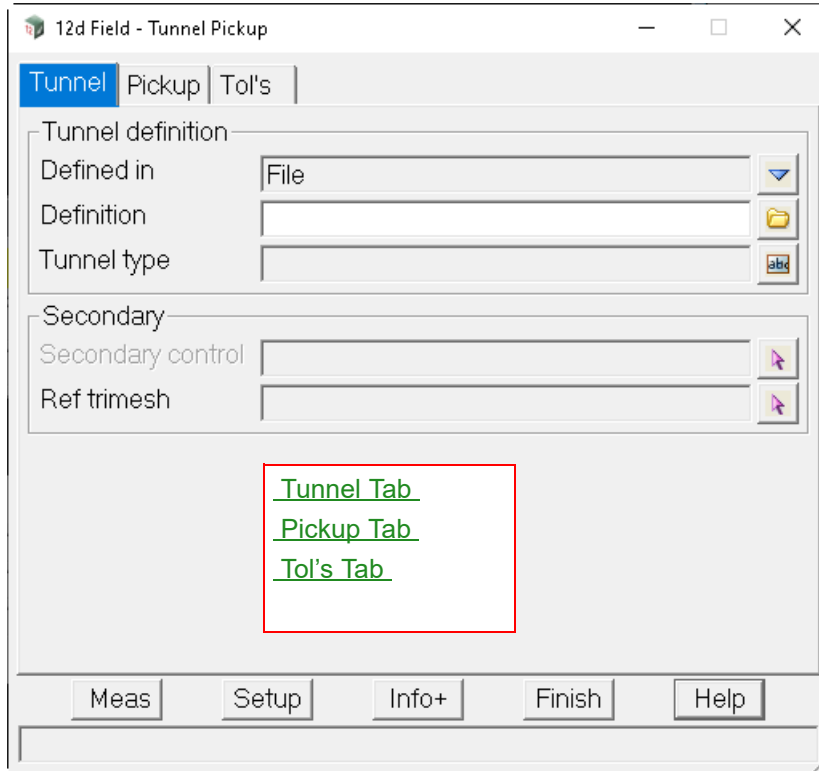
### Resume button

Recommence the scanning.

Continue to [15.6.5.5 Pickup Tunnel](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.5 Pickup Tunnel

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

<b>Defined in</b> ??.	choice box	File	File, Centreline
<b>Definition</b> ??.	file box		*.12d_tunnel files
<b>Tunnel type</b> ??.	text box		

##### Secondary

<b>Secondary control</b> ??.	string select		
<b>Ref trimesh</b> ??.	string select		



## Pickup Tab

[Tunnel Tab](#)  
[Pickup Tab](#)  
[Tol's Tab](#)

### Pickup type

**P/U type**

choice box

Manual range,  
 PRS file,  
 Previous Model

??.

### Manual ranges

**Start chainage**

??.

**End chainage**

??.

**Chainage inc**

??.

**Start element**

??.

**End element**

??.

**Element inc**

??.

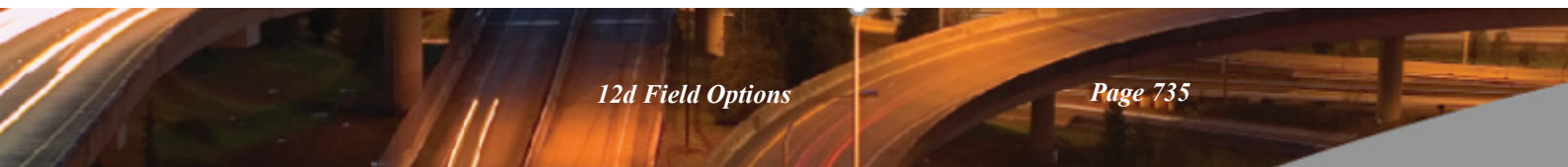
### Buttons

??.

### MP id

*Point id of the measured point.*

See *MP id* in the [Vertex point id style](#) section of the [15.6.9 Store Point Setup](#) panel.



## Tol's Tab

The screenshot shows a dialog box titled "12d Field - Tunnel Pickup" with three tabs: "Tunnel", "Pickup", and "Tol's". The "Tol's" tab is selected. It contains the following fields and values:

Field	Value
Ch tol	0.005
Profile tol	0.005
Max pos iterations	5
Max retries	1
Under tolerance	
Over tolerance	

[Tunnel Tab](#)

[Pickup Tab](#)

[Tol's Tab](#)

**Ch tol** 0.005  
??.

**Profile tol** 0.005  
??.

**Max pos iterations** 5  
??.

**Max retries** 1  
??.

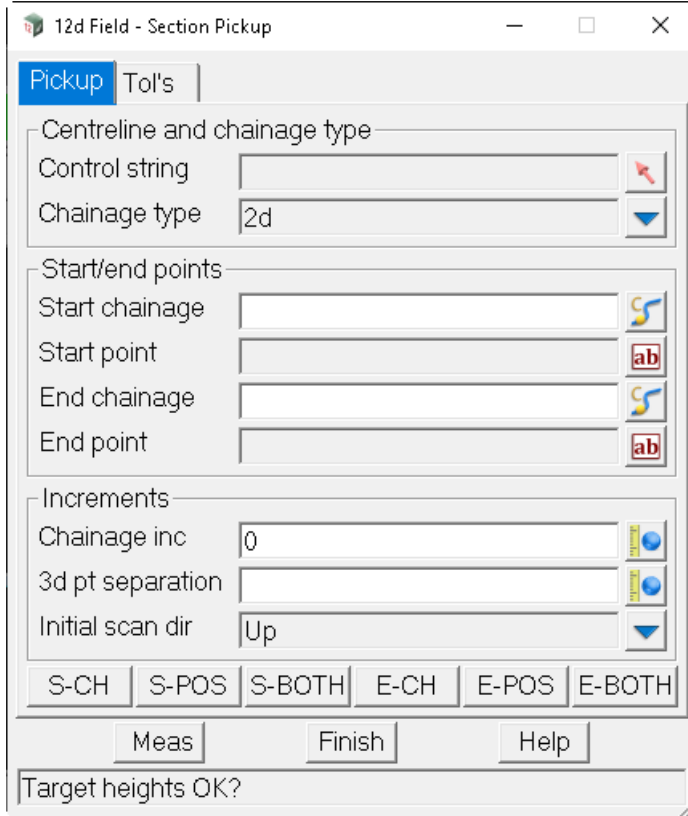
**Under tolerance**  
??.

**Over tolerance**  
??.

Continue to [15.6.5.6 Pickup Section](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.6 Pickup Section

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

##### 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

??.

##### Start/end points

**Start chainage**

??.

**Start point**

??.

**End chainage**

??.

**End point**

??.

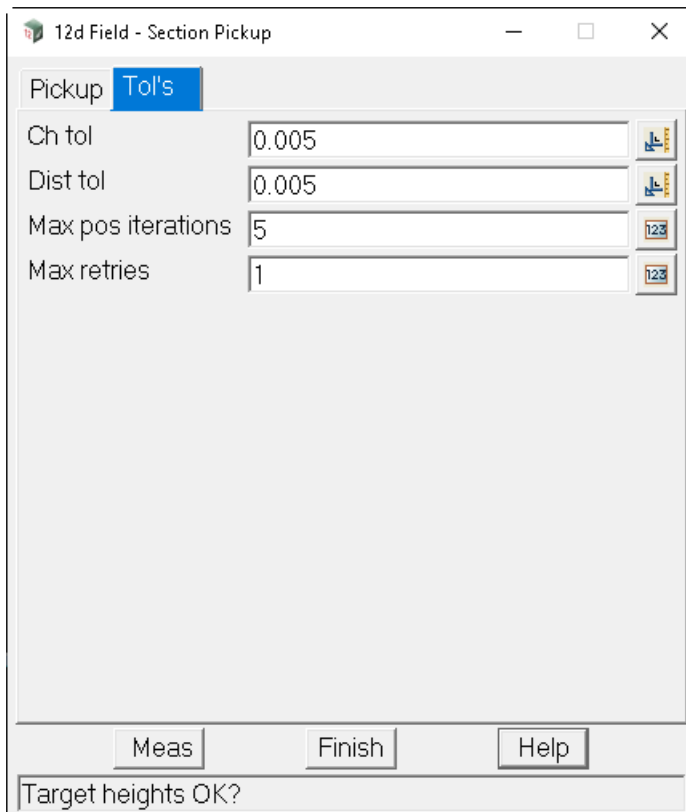
**Increments**

**Chainage inc**                      real box                      0  
 ??.

**3d pt separation**                      real box  
 ??.

**Initial scan dir**                      choice box                      Up  
 ??.

**Tol's Tab**



[Pickup Tab](#)  
[Tol's Tab](#)

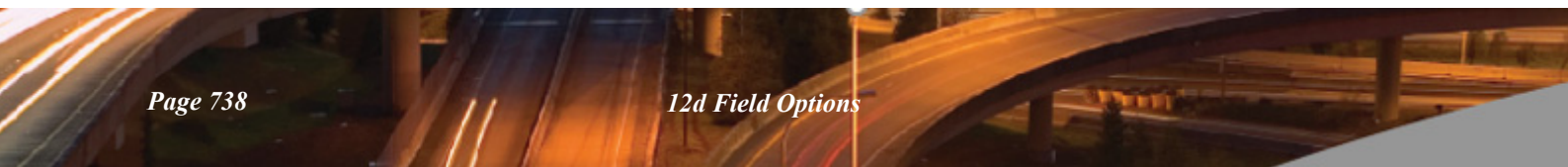
**Ch tol**                                      real box  
 ??.

**Dist tol**                                      real box  
 ??.

**Max pos iterations**                      real box  
 ??.

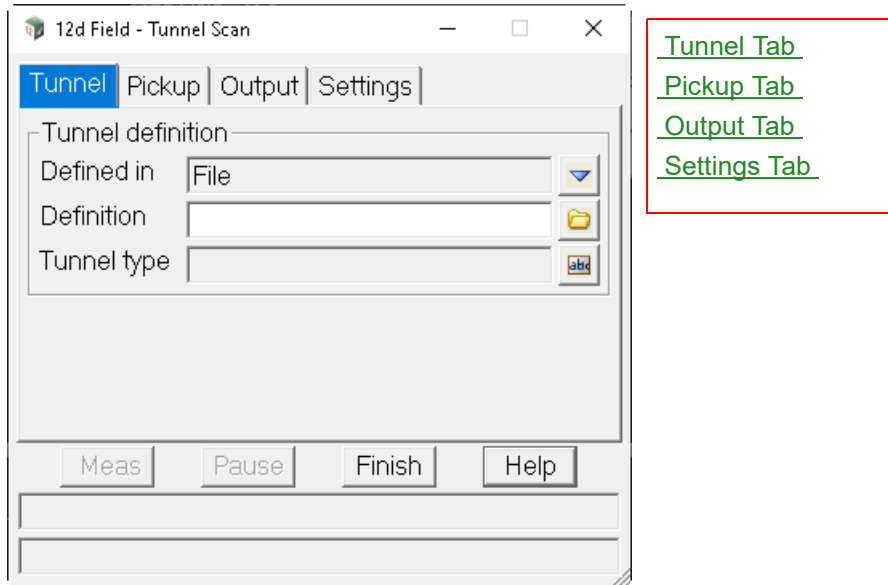
**Max retries**                                      real box  
 ??.

Continue to [15.6.5.7 Pickup Tunnel Scan](#) or go back to [15.6.5 Pickup](#).



### 15.6.5.7 Pickup Tunnel Scan

Clicking **Section** brings up the **12d Field - Tunnel Scan** panel.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Buttons at Bottom

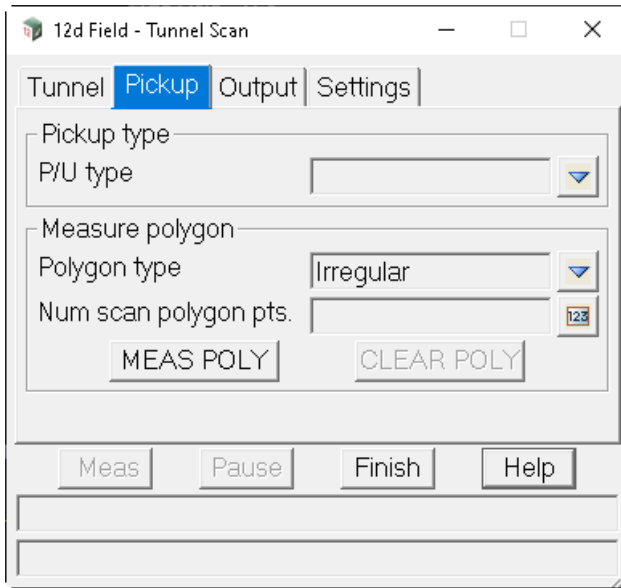
For more information on these buttons, see [15.6.1 Common Buttons, Panel Tabs and Fields.](#)

#### Tunnel Tab

##### Tunnel definition

Field Description	Type	Defaults	Pop-Up
<b>Defined in</b> ??	choice box	File	File, Centreline
<b>Definition</b> ??	file box		*.12d_tunnel files
<b>Tunnel type</b> ??	text box		

## Pickup Tab



- [Tunnel Tab](#)
- [Pickup Tab](#)
- [Output Tab](#)
- [Settings Tab](#)

### Pickup type

**P/U type**

choice box

Manual range,  
PRS File

??.

### Measure polygon

**Polygon type**

choice box

Irregular

??.

**Num scan polygon pts**

??.

**MEAS POLY**

button

??.

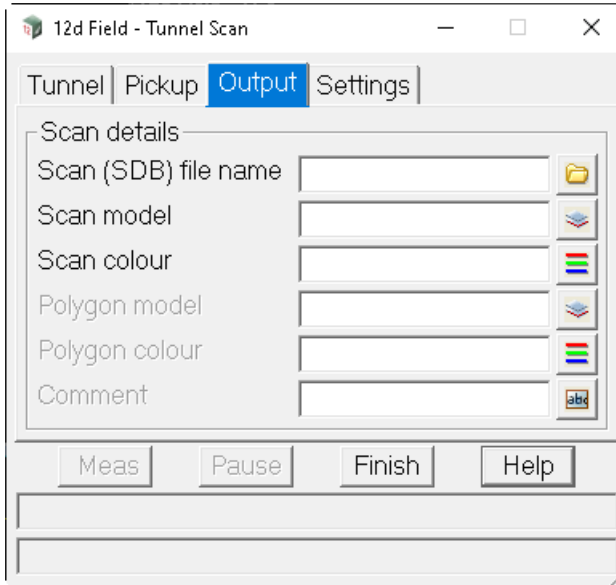
**CLEAR POLY**

button

??.



## Output Tab

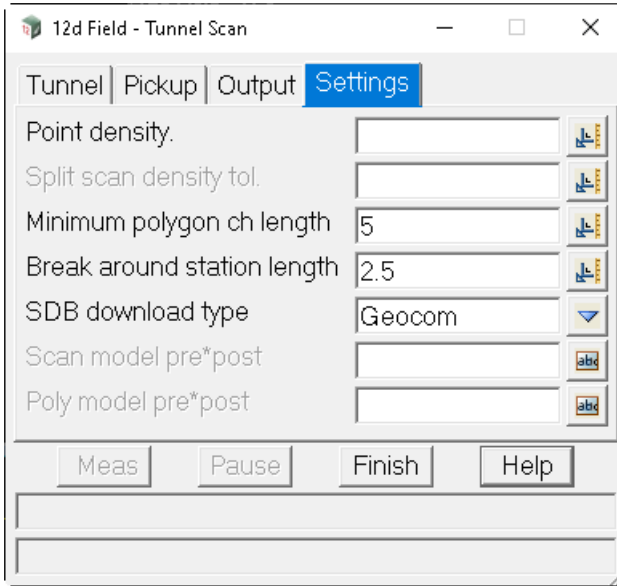


- [Tunnel Tab](#)
- [Pickup Tab](#)
- [Output Tab](#)
- [Settings Tab](#)

### Scan details

<b>Scan (SDB) file name</b> ??.	file box	*.SDB files
<b>Scan model</b> ??.	model box	available models
<b>Scan colour</b> ??.	colour box	available colours
<b>Polygon model</b> ??.	model box	available models
<b>Polygon colour</b> ??.	colour box	available colours
<b>Comment</b> ??.	text box	

## Settings Tab



- [Tunnel Tab](#)
- [Pickup Tab](#)
- [Output Tab](#)
- [Settings Tab](#)

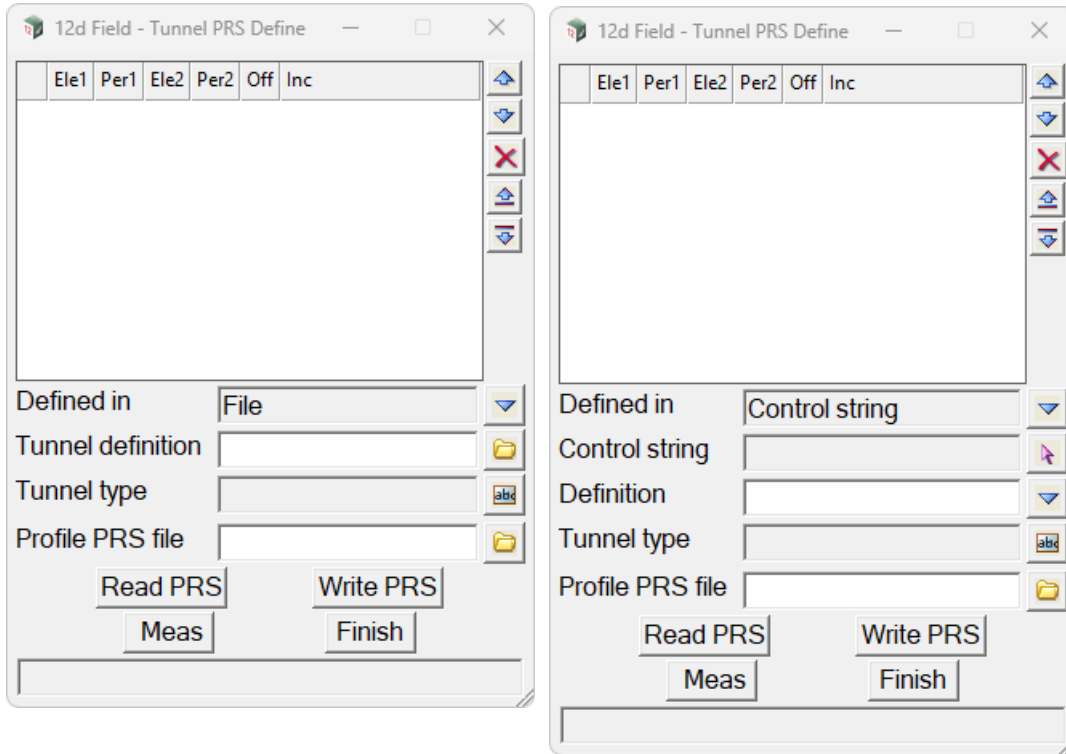
<b>Point density</b>	real box		
??.			
<b>Split scan density tol</b>	real box		
??.			
<b>Minimum polygon ch length</b>	real box	5	
??.			
<b>Break around station length</b>	real box	2.5	
??.			
<b>SDB download type</b>	choice box	Geocom	Geocom, USB
??.			
<b>Scan model pre*post</b>	text box		
??.			
<b>Poly model pre*post</b>	text box		
??.			

Continue to [15.6.5.8 Pickup Tunnel PRS Define](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.8 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
<b>Defined in</b>	choice box	File	File, Centreline
<b>Control string</b>	string select		
<b>Tunnel definition</b>	file box		*.12d_tunnel files
<b>Tunnel type</b>	text box		

*These boxes are used for choosing the tunnel definition, see [15.6.4.12 Setout Tunnel](#) for full details.*

<b>Profile PRS file</b>	file box	*.PRS files
-------------------------	----------	-------------

*Enter/select the PRS file to edit or create.*

#### Grid

<b>Ele1</b>	grid box
-------------	----------

*Enter the start element for the pickup.*

<b>Per1</b>	grid box
-------------	----------

*Enter the percentage around the start element for the pickup.*

<b>Ele2</b>	grid box
-------------	----------

*Enter the end element for the pickup.*

<b>Per2</b>	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](#).*

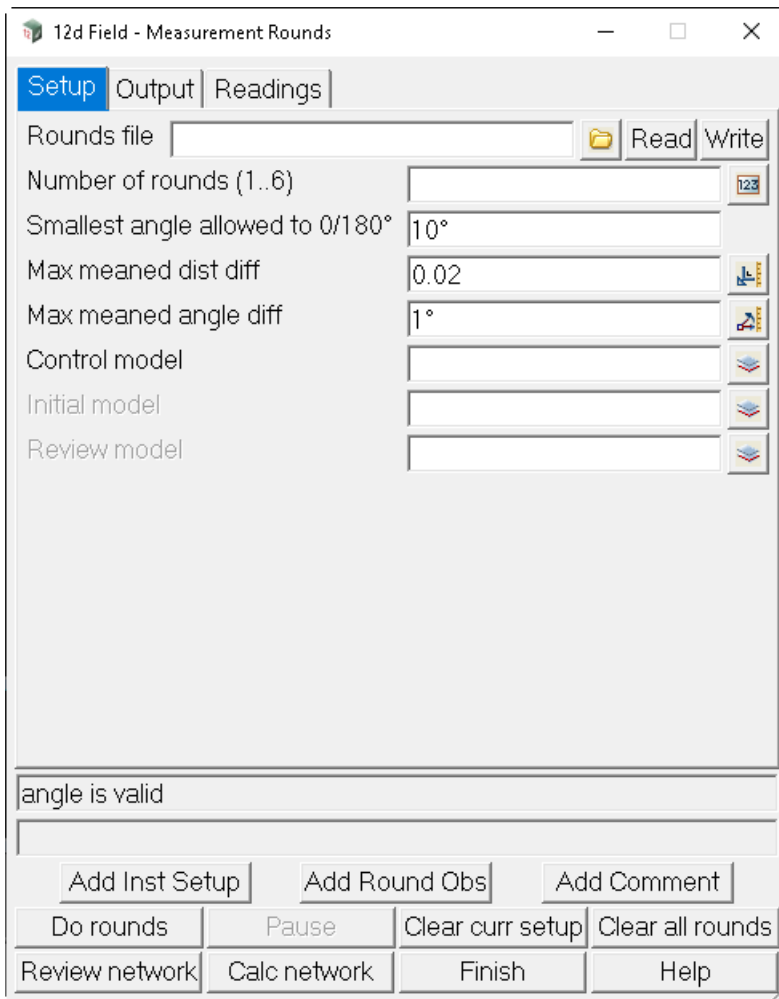
Continue to [15.6.5.9 Pickup Measurement Rounds](#) or go back to [15.6.5 Pickup](#).

### 15.6.5.9 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.



[Setup Tab](#)  
[Output Tab](#)  
[Readings Tab](#)

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Setup Tab

<b>Rounds file</b>	file box		*.12dF_Meas_Rounds files
<i>The 12dF_Meas_Rounds format file to store the measurement rounds reading in.</i>			

<b>Read</b>	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.

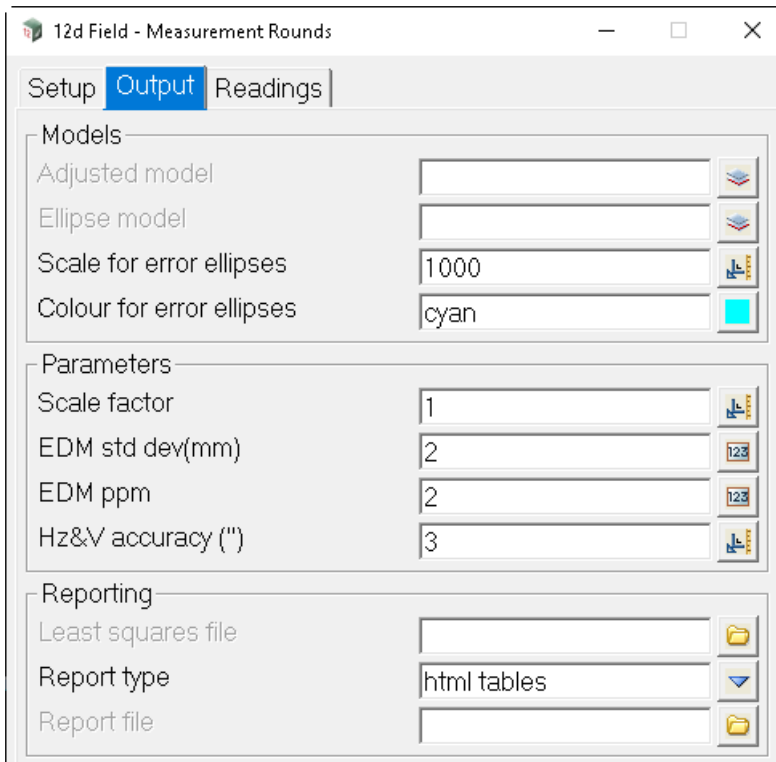
**Initial** model box available models

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 box available models

The model populated when the user presses the **Review network** button.

## 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. See ??? for standard reporting functionality.*

## Readings Tab

The readings tab shows all of the current setups and observations.

	Name	Init	Done	Height	Settings	Meas style	Reflector	Use angle	Use
1	SOP Abut /			1					
2	PM182969	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
3	45009L	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
4	4350	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
5	45108L	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
6	45163R	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
7	45068R	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
8	4350			1					
9	45009L	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
10	45108L	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
11	45163R	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
12	SOP Abut /	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
13	45068R	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
14	PM182969	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes
15	45009L			1					
16	45108L	Yes	Yes	1	Prism ATR (Std)	Multi face	Circular (0.0)	Yes	Yes

Review model completed.

### 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 angle	Use dist	Comm
1.0)	Yes	Yes	
1.0)	Yes		
1.0)	Yes	yes	
1.0)	Yes	no	

**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.

245	45506L	Yes	Yes	1	P
246				0	

The user must double click on this to bring up the settings panel to fill in the setup details.

The dialog box titled "12d Field - Target Settings" contains the following fields and controls:

- Stn Id**: An empty text input box with a search icon on the right.
- Stn id (select)**: A selection box with a search icon on the right.
- Stn Hgt**: A text input box containing the value "0" with a search icon on the right.
- Comment**: An empty text input box with a search icon on the right.
- Finish**: A button located below the input fields.

**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

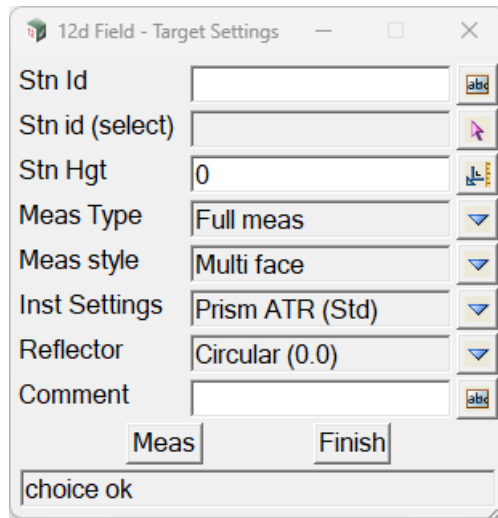
If the user is calculating heights in the network adjustment enter the instrument height here.

**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.

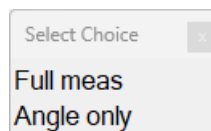
**Stn Id (select)** select

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.

242	PM85190			1	
243	KS01	Yes	No	1	Prism
244	45590L	Yes	Yes	1	Prism
245	45506L	Yes	Yes	1	Prism
246	This is a comment				

**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,

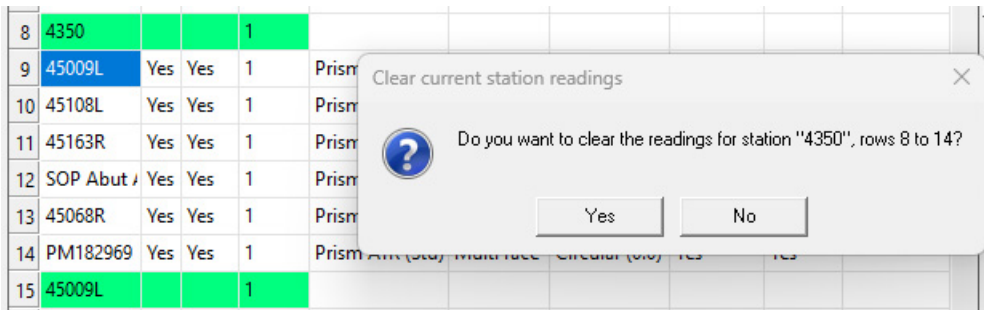
**Skip next**, skip the next point and resume the measurement round.

**Continue**, resume the measurement round.

**Stop rounds**, abandon the current measurement round in progress.

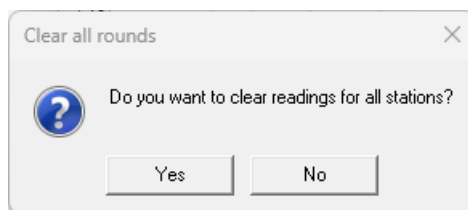
**Clear curr setup** button

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.



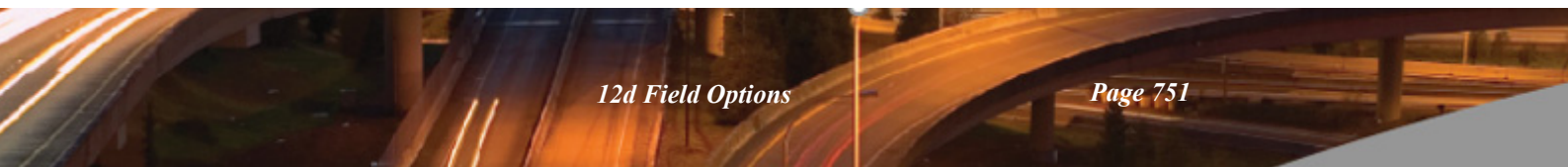
**Clear all rounds** button

The user is offered to clear all of the readings for all group as being complete, no observations are deleted.



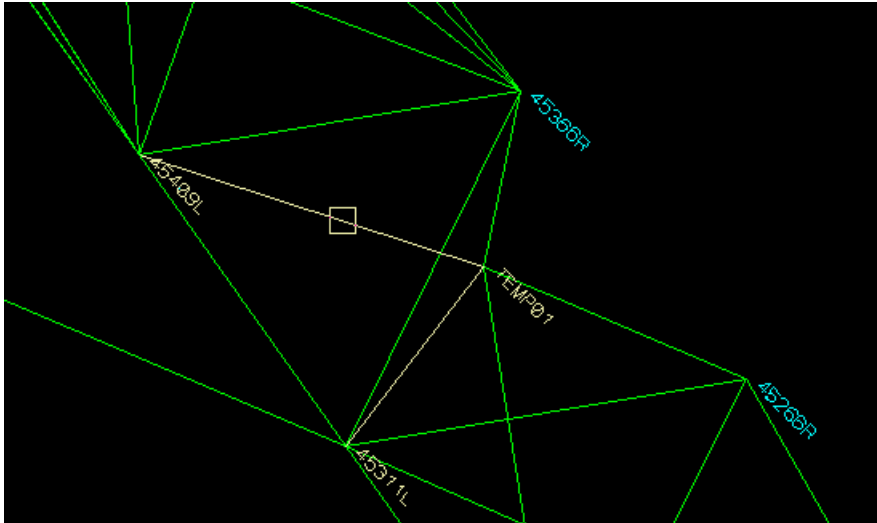
**Review network** button

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

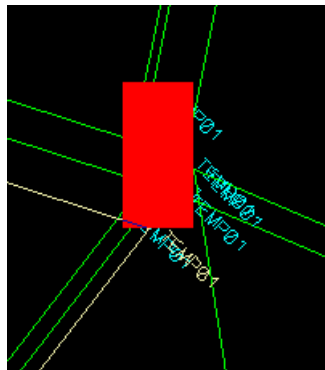




the observations so far and display blunders. The following diagram shows a temporary point in a network and the observations to and from it.



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 extent 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 [15.6.6 TPS Functions](#) or go back to [15.6.5 Pickup](#).



### 15.6.5.10 Pickup Occupy Point - GNSS

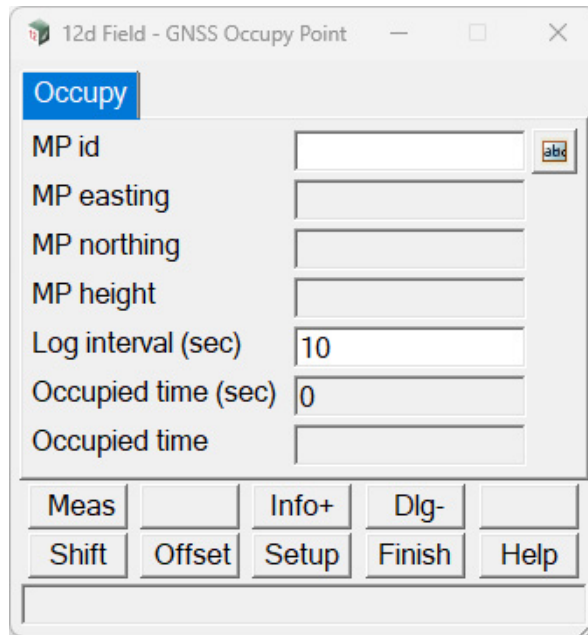
**Position of option on menu:** Survey =>Field 12d=>Pickup =>Occupy point

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.

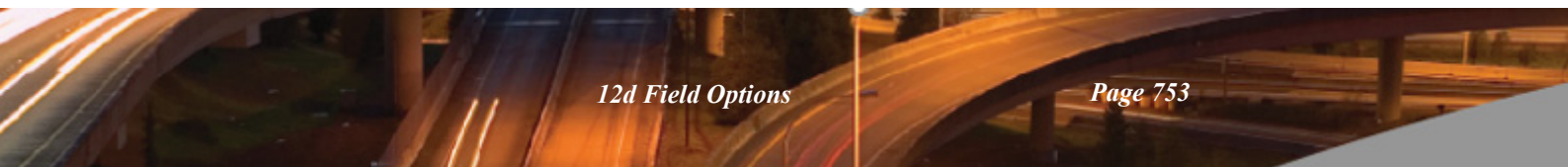


Selecting **Occupy Point** brings up the **12d Field - Occupy Point** panel:



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

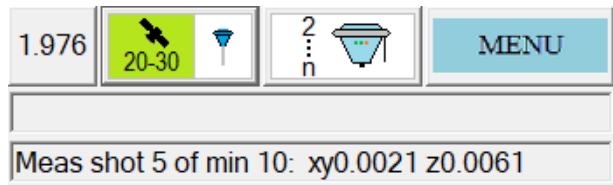
Field Description	Type	Defaults	Pop-Up
<b>MP id</b>	text box		
<i>The Point Id for the occupied point.</i>			
<b>MP easting/northing/height</b>	output		
<i>Easting/northing/height for the occupied point.</i>			
<b>Log interval (sec)</b>	real box		
<i>The current GNSS reading is added to the averaged data at this interval if the GNSS quality meets the users specifications.</i>			
<b>Occupied time (sec)</b>	output		
<i>Shows the time in seconds from when the <b>Meas</b> button was pressed.</i>			
<b>Occupied time</b>	output		
<i>Shows the time in hours, minutes and seconds from when the <b>Meas</b> button was pressed.</i>			



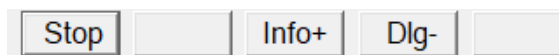
## Buttons at bottom

### 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 [15.6.6 TPS Functions](#) or return to [15.6.5 Pickup](#).

## 15.6.6 TPS Functions

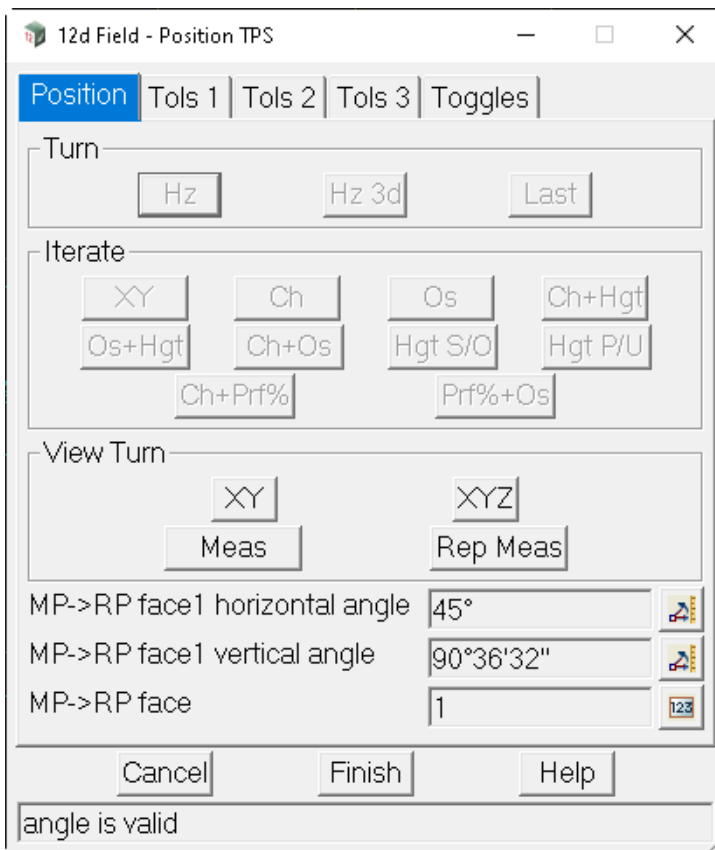
Clicking on the **TPS** menu option brings up the **TPS Functions** menu.

TPS Functions	Sec
Position	<a href="#">15.6.6.1 TPS Position</a>
Joystick	<a href="#">15.6.6.2 TPS Joystick</a>
Status	<a href="#">15.6.6.3 TPS Status</a>
Bubble	<a href="#">15.6.6.4 TPS Bubble</a>
Locate prism	<a href="#">15.6.6.5 TPS Locate Prism</a>
Offset measure	<a href="#">15.6.6.6 TPS Offset Measurement</a>
Sim settings	<a href="#">15.6.6.7 TPS Simulator Settings</a>

### 15.6.6.1 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.



[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
-------------------	------	----------	--------

#### 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"

**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
<b>Max pos iterations</b>	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

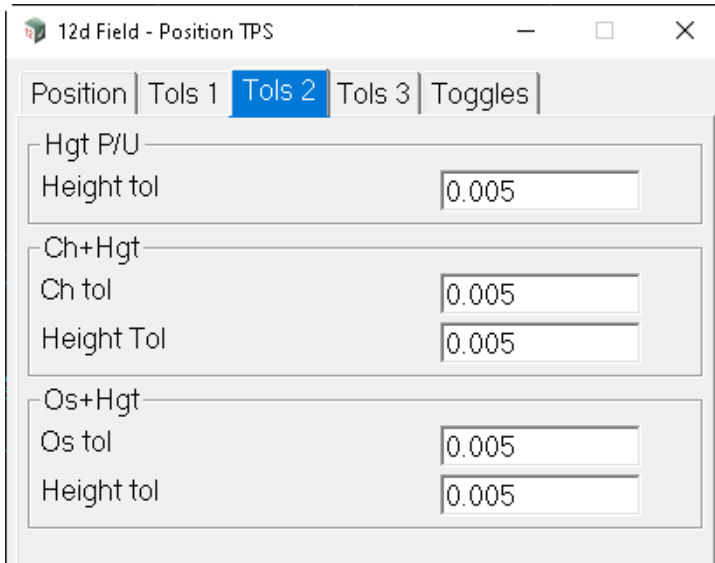
*Attribute "st\_tps\_pos\_os\_os\_tol"*

### 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

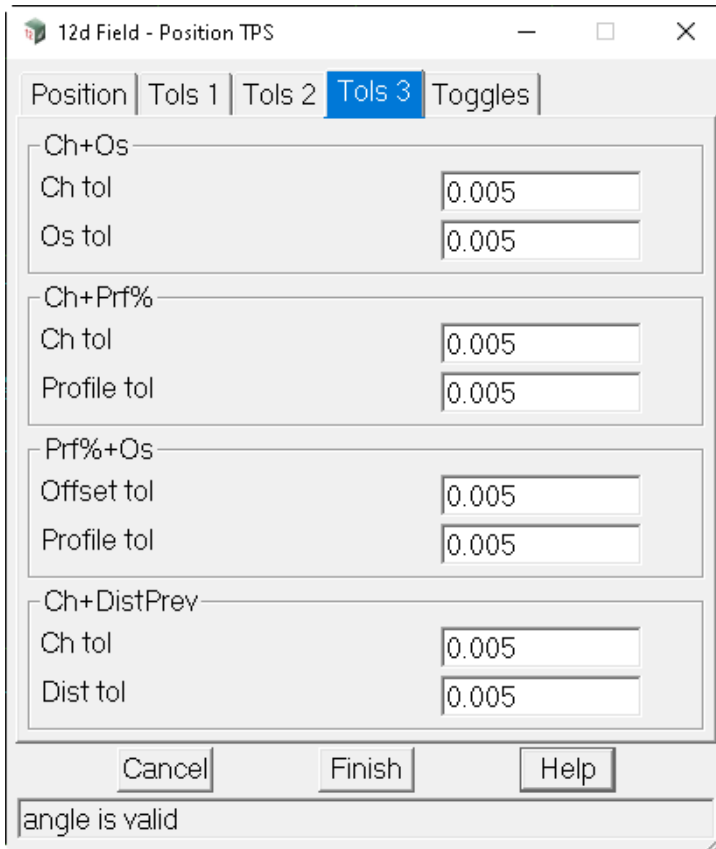
#### Os tol

*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**

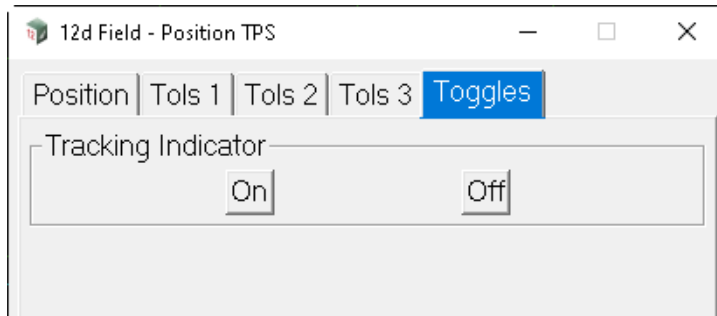
**Offset tol**

*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

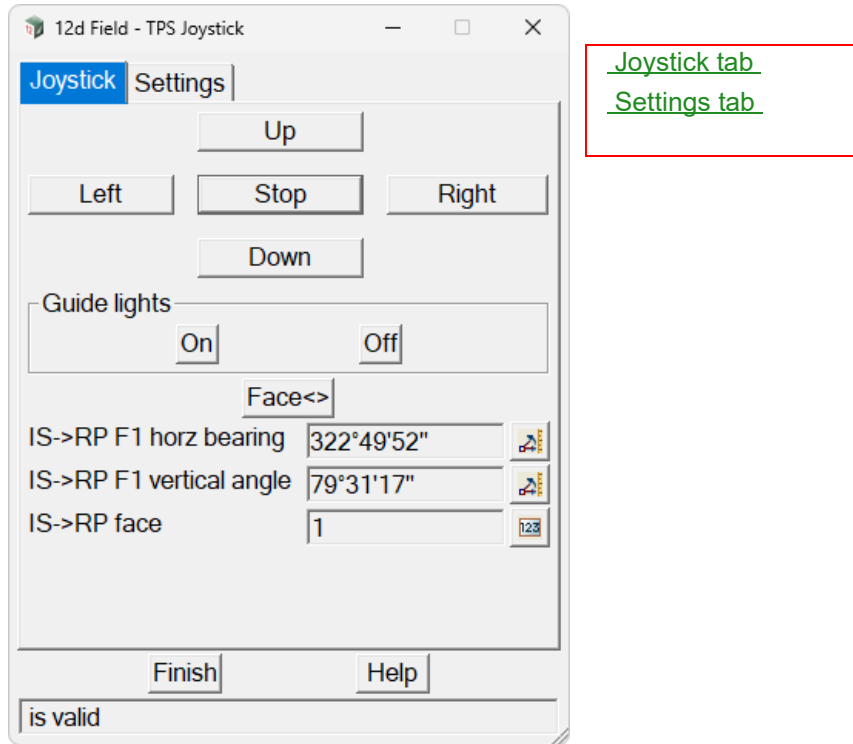
*Turn the TPS guide lights off.*

Continue to [15.6.6.2 TPS Joystick](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.2 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.



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

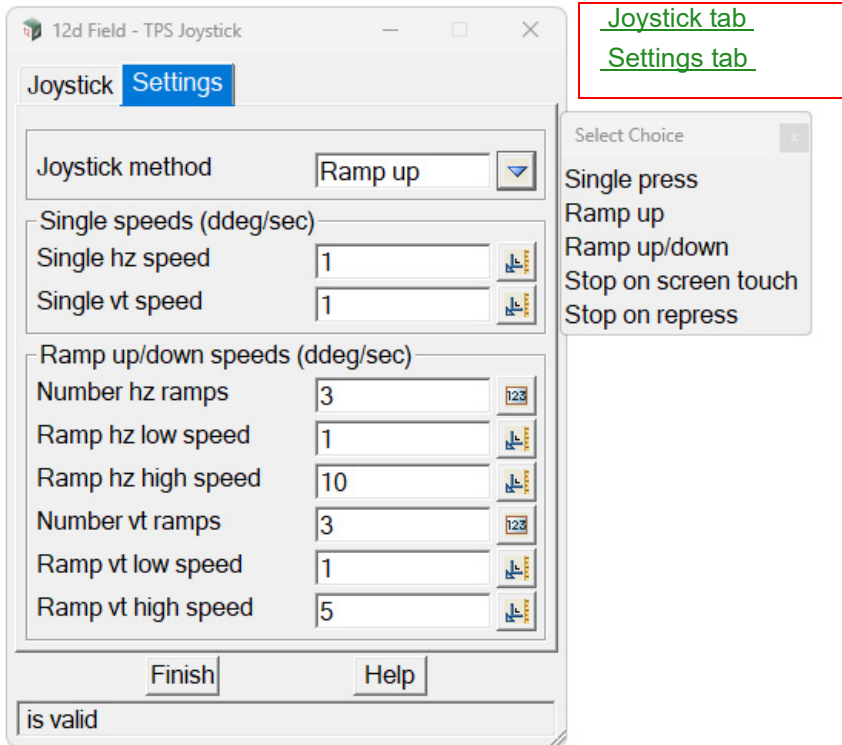
*The current TPS vertical angle.*

**IS->RP face** integer box

*The current TPS face.*



## Settings tab



### Joystick 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.

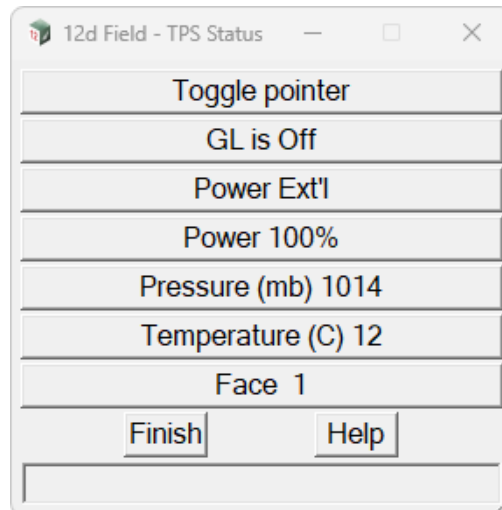
Attribute "st\_tps\_joystick\_single\_vt\_speed"

**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 [15.6.6.3 TPS Status](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.3 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
-------------------	------	----------	--------

<b>Toggle pointer</b>	button		
-----------------------	--------	--	--

*Press to toggle the laser pointer on/off, the button text does not change.*

<b>GL is *</b>	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.*

<b>Power *</b>	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.*

<b>Power ??%</b>	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.*

<b>AP20 *</b>	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.*

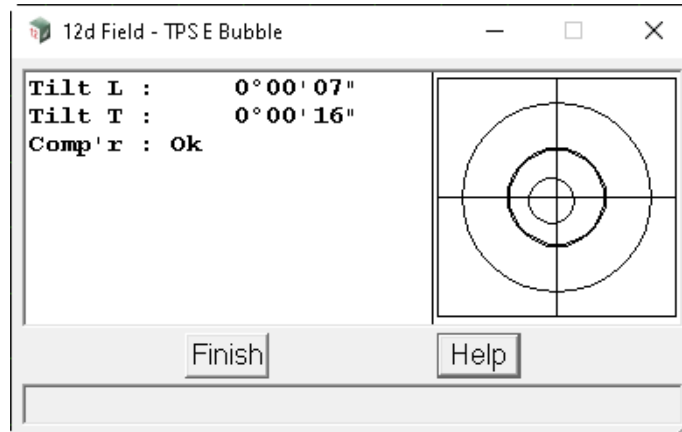
**Face \***                                      button

*Shows the current face of the TPS, pressing the button will make the TPS change face.*

Continue to [15.6.6.4 TPS Bubble](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.4 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.

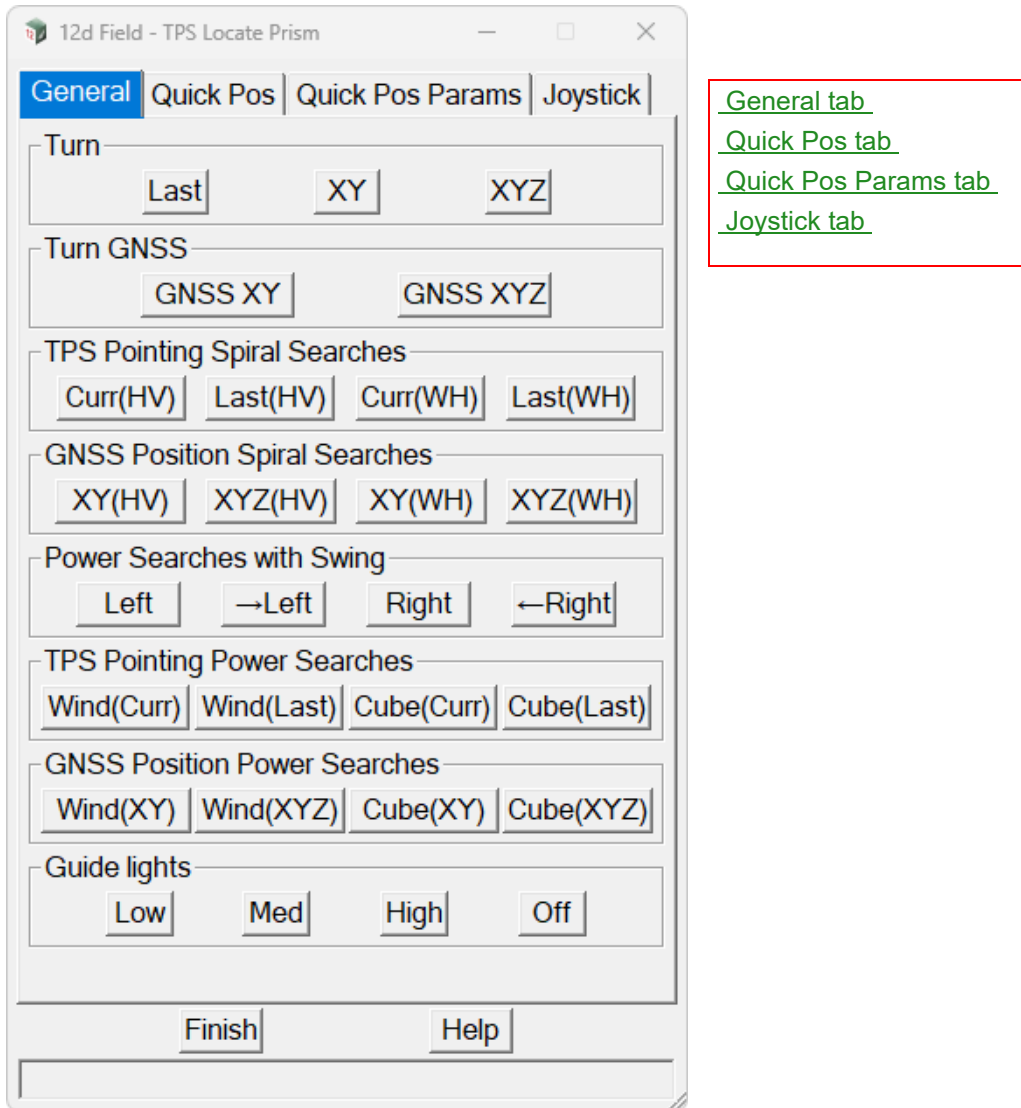
Continue to [15.6.6.5 TPS Locate Prism](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.5 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.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### General tab

##### Turn

<b>Last</b>	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**

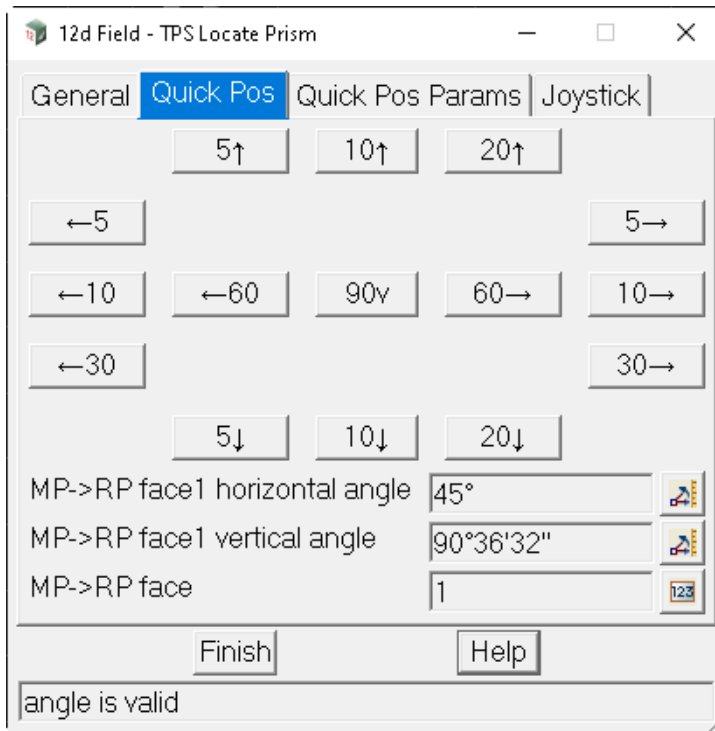
**On, Off, High, Low, Medium** button

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

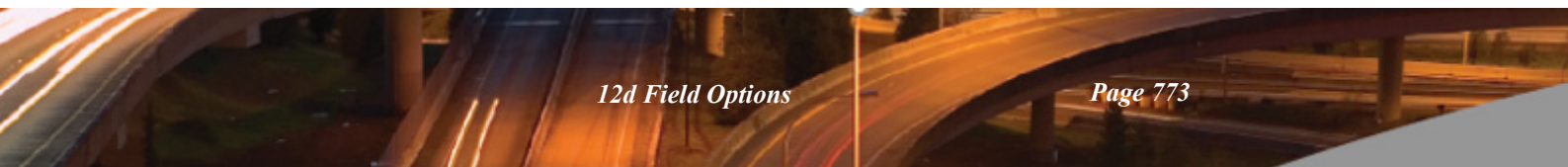
This button is fixed in functionality, it positions the TPS vertically to 90°

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\_fl\_hb"

**IS->RP F1 vertical angle**      angle box

The current TPS vertical angle.

Attribute "pu\_tps\_running\_fl\_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.

[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"

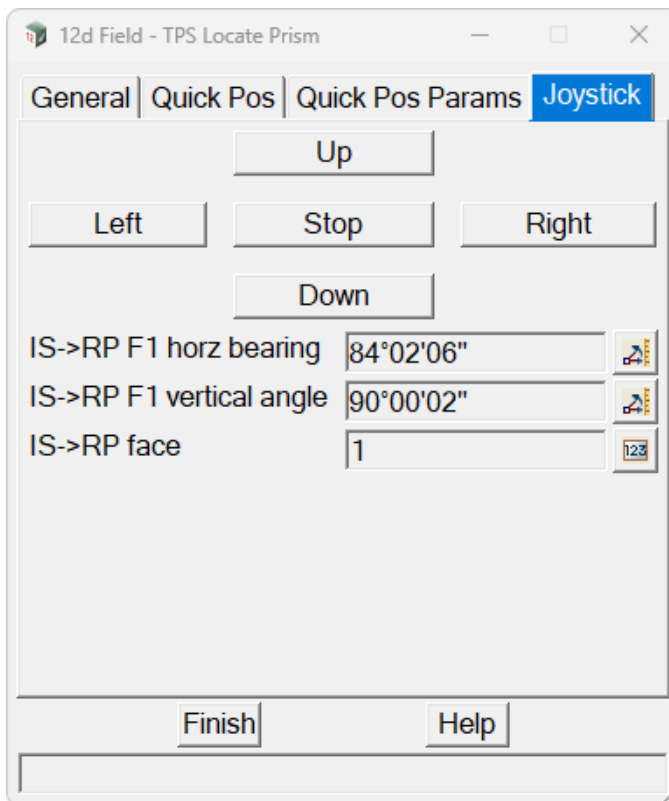
**Quick poz vt 3** integer box

The angle to turn for the right side vertical buttons.

Attribute "st\_tps\_quickpos\_vt\_3"

**Joystick tab**

See [15.6.6.2 TPS Joystick](#) for joystick functionality.



[General tab](#)  
[Quick Pos tab](#)  
[Quick Pos Params tab](#)  
[Joystick tab](#)

Continue to [15.6.6.6 TPS Offset Measurement](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.6 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
-------------------	------	----------	--------

<b>Left/right (+ve right)</b>	real box		
-------------------------------	----------	--	--

*The distance to move the measured point left/right of the original measured bearing.*

*Attribute "pu\_mp\_os\_right\_left"*

<b>Up/down (+ve up)</b>	real box		
-------------------------	----------	--	--

*The value to move the original measured point up or down.*

*Attribute "pu\_mp\_os\_up\_down"*

<b>To/away (+ve away)</b>	real box		
---------------------------	----------	--	--

*The distance to move the measured point to or away from the TPS in the direction of the original measured bearing.*

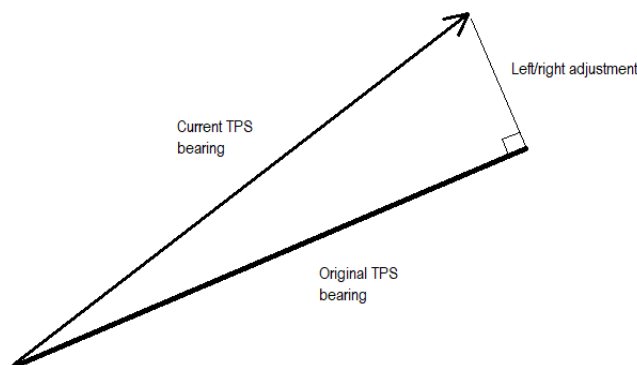
*Attribute "pu\_mp\_os\_away\_to"*

<b>Curr va</b>	button		
----------------	--------	--	--

*This calculates a new **Up/down** value using the current TPS vertical angle.*

<b>Curr ha</b>	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

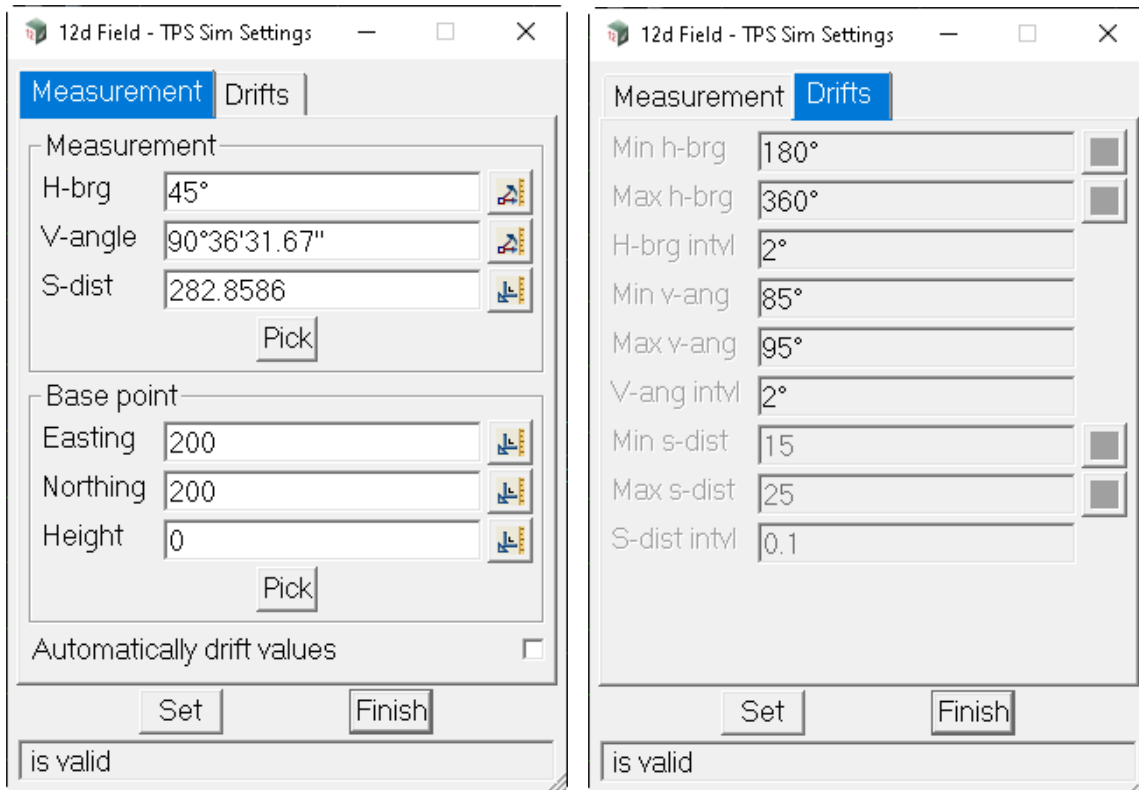
*Reset the measurement point to the original TPS reading.*

Continue to [15.6.6.7 TPS Simulator Settings](#) or go back to [15.6.6 TPS Functions](#).

### 15.6.6.7 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.



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**

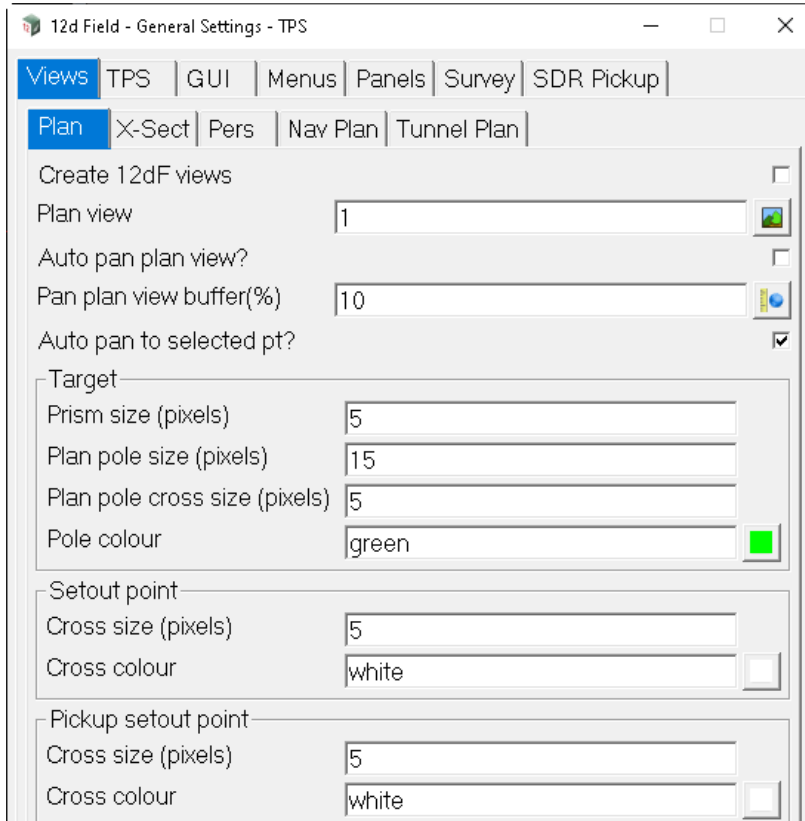
**Set** button

Validate and set the simulator settings for use, start or stop the simulator rotating according to the drift tick box.

Continue to [15.6.7 General Settings - TPS](#) or go back to [15.6.6 TPS Functions](#).

## 15.6.7 General Settings - TPS

Clicking **Settings** brings up the **12d Field - Settings** panel for a TPS.



### Menu tab

- [Menu >General tab](#)
- [Menu >Setup tab](#)
- [Menu >Setout tab](#)
- [Menu >Pickup](#)
- [Menu >TPS](#)

### Panels tab

- [Panels >General tab](#)
- [Panels >Nav Page](#)
- [Panels >E Bubble](#)
- [Panels >To'l'r tabs](#)
- [Panels >HotKeys](#)
- [Panels >Strings](#)

### Survey tab

- [Survey >General tab](#)
- [Survey >Keys tab](#)
- [Survey >Storage](#)
- [Survey >Spec Ch's](#)
- [Survey >Setup](#)

### Views tab

- [Views >Plan 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](#)

### GUI tab

- [GUI >Gen tab](#)
- [GUI >Sounds tab](#)
- [GUI >Colours tab](#)
- [GUI >Logging tab](#)

### Pickup tab

- [SDR Pickup >General tab](#)
- [SDR Pickup >GUI](#)

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

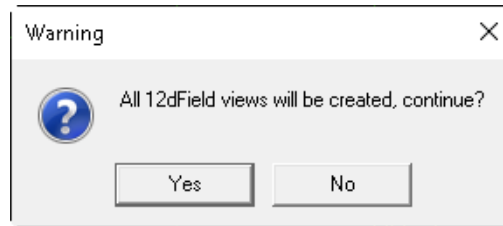
Field Description	Type	Defaults	Pop-Up
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### Views tab

#### Views >Plan tab

<b>Create 12dF views</b>	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.*

#### 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.*

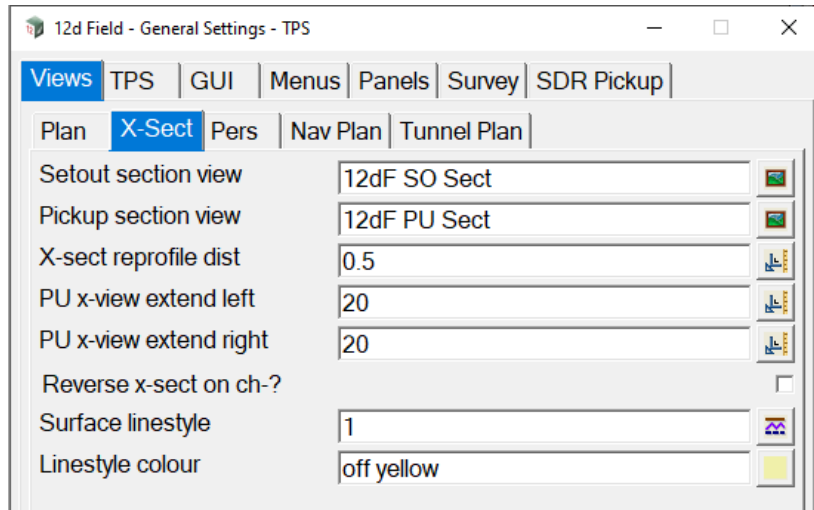
#### Pickup setout point

**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.*



**Views >X-Sect 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.*

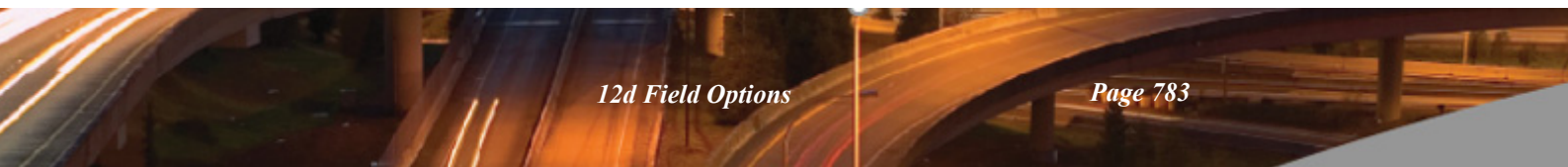
*Note: Chainage increment must be set to negative to reverse the section view display.*

**Surface linestyle**      linestyle box

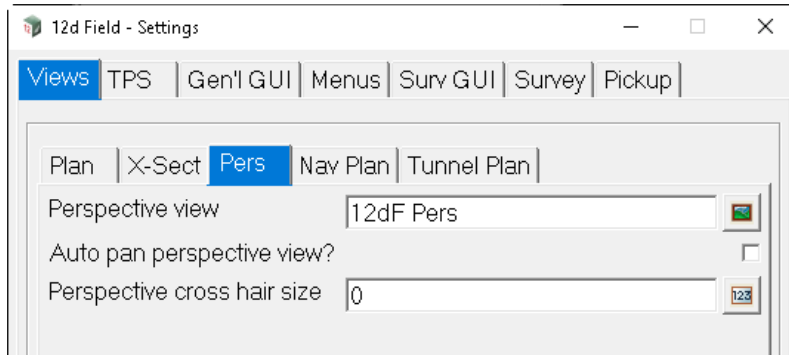
*Linestyle to use to display the profile through the surface.*

**Linestyle colour)**      colour box

*Colour of the linestyle.*



## Views >Pers 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.*

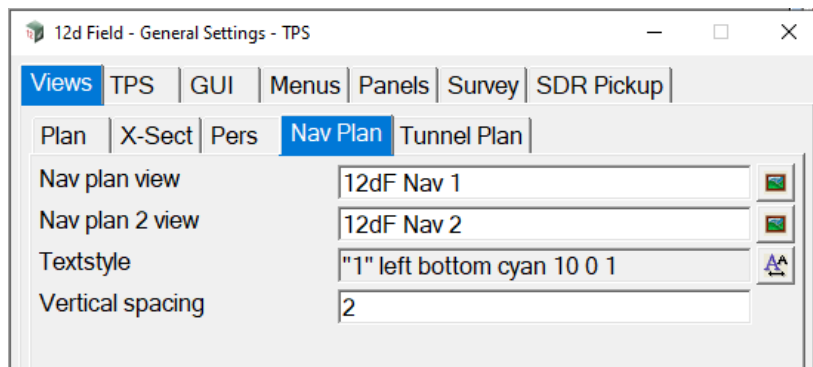
**Auto pan Plan view?**                      tick box

*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.*

## Views >Nav 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.*

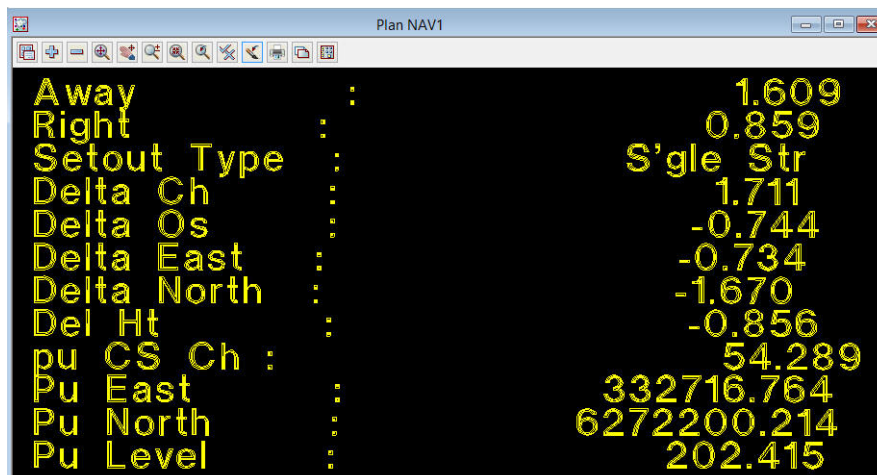
**Textstyle**                                      textstyle data box

*Textstyle data used to display the information in the Nav plan view and Nav plan 2 view.*

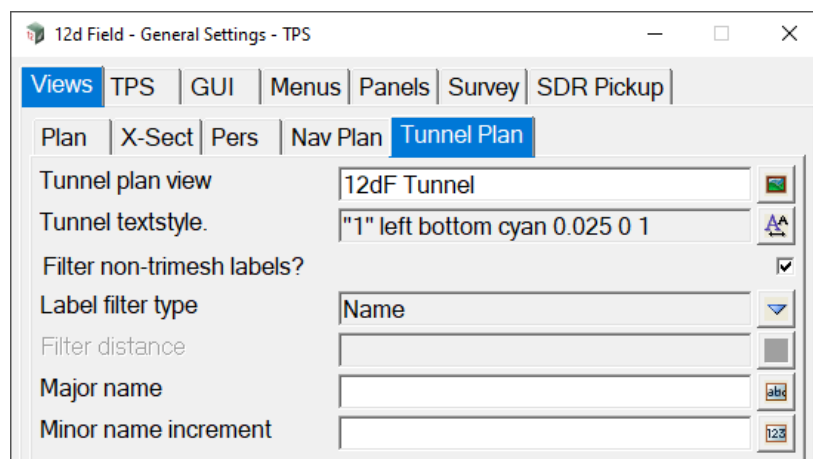
*Note - it is recommended to use a monospaced font such as Courier to prevent the misalignment of text as shown in following image.*

**Vertical spacing**                      real box                                      measures

*Spacing to use between the line of text when displaying the information.*



**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/pru 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

Label filter type	Show all labels	▼
Filter distance		■
Major name		■
Minor name increment		■

*No filtering takes place and all labels are shown.*

Label filter type	No labels	▼
Filter distance		■
Major name		■
Minor name increment		■

*No labels are shown.*

Label filter type	Filter by distance	▼
Filter distance		■
Major name		■
Minor name increment		■

*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.*

Label filter type	Filter by name	▼
Filter distance		■
Major name		■
Minor name increment		■

*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.*

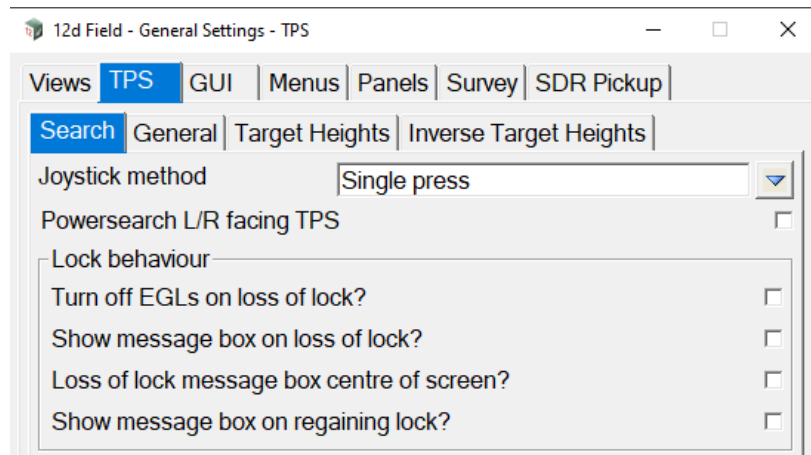
**Major name**                                      text box

*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*

## TPS tab



### TPS >Search 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*

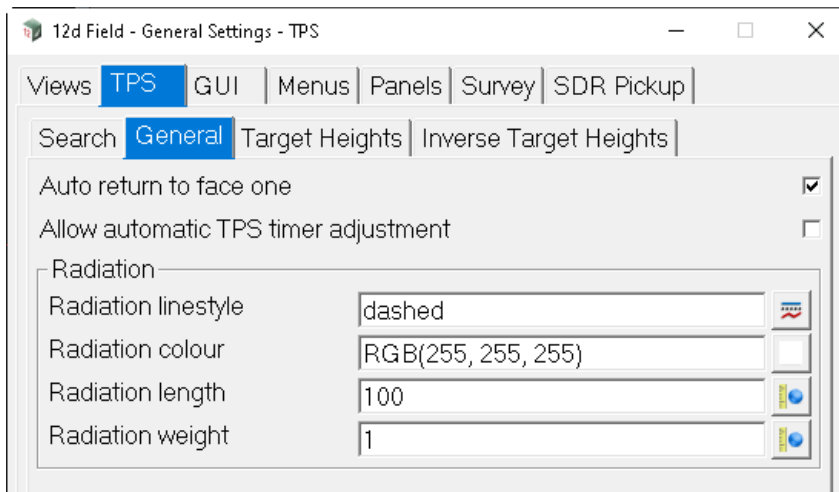
**Show message box centre on regaining lock?** tick box      not ticked

*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*



## TPS &gt;General 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.

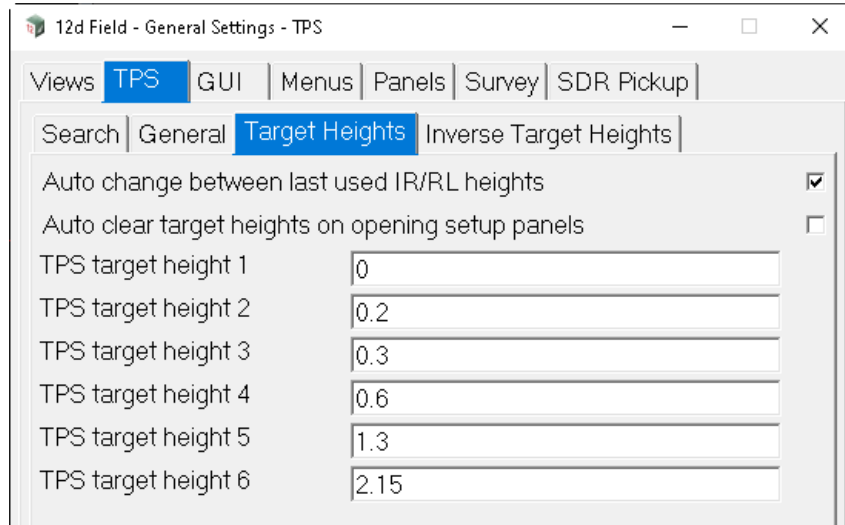
**Radiation weight**    real box

Weight used for drawing the radiation line.



### TPS >Target Heights tab

Up to six target heights can be stored. They are displayed in the pop-up list for **Preset heights** fields.



**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.*

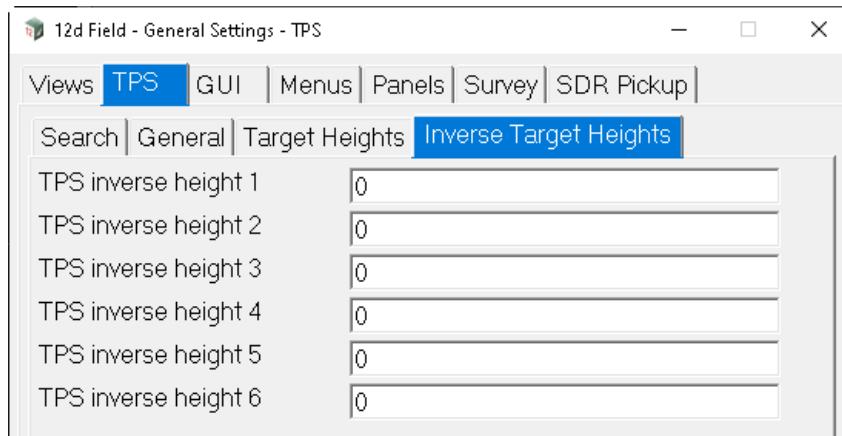
*If **not ticked**, the target height value is untouched when starting the panel.*

**TPS target height 1-6** real box measures

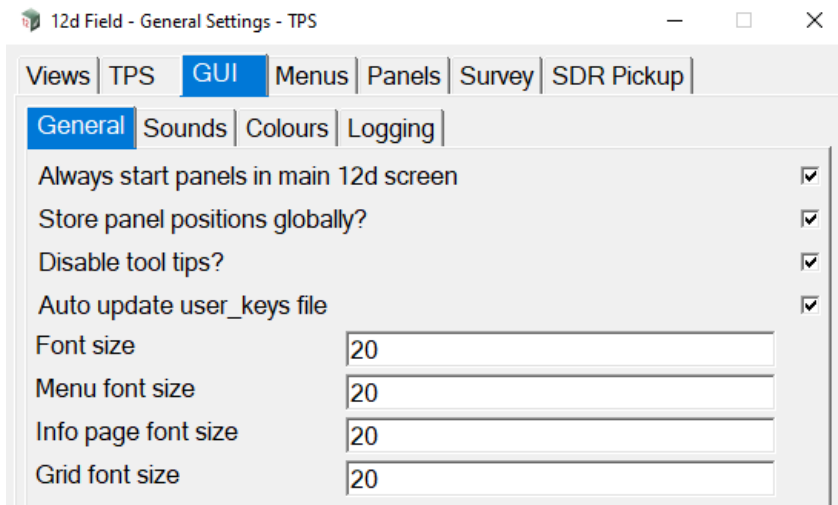
*Up to six target heights can be stored. They are displayed in the pop-up list for Preset heights fields.*

### TPS >Inverse Target Heights

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.



## GUI &gt;Gen 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**

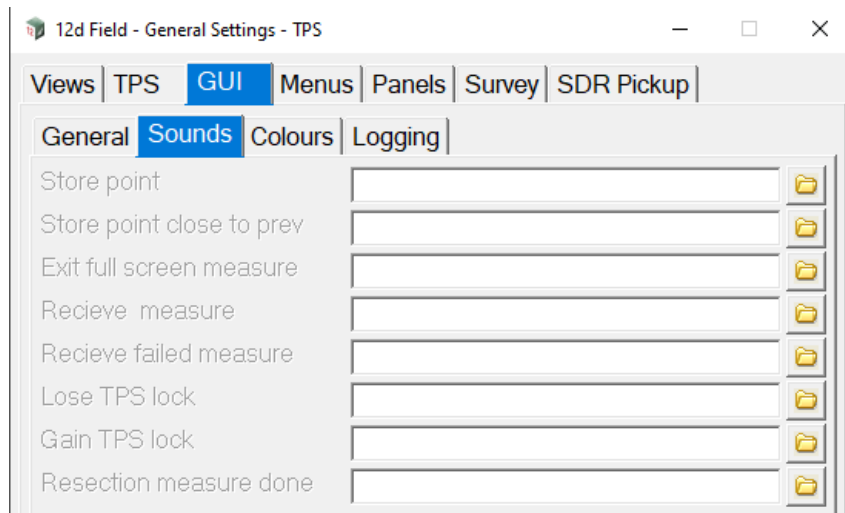
*Size of the font for the grid.*

## 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.



**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

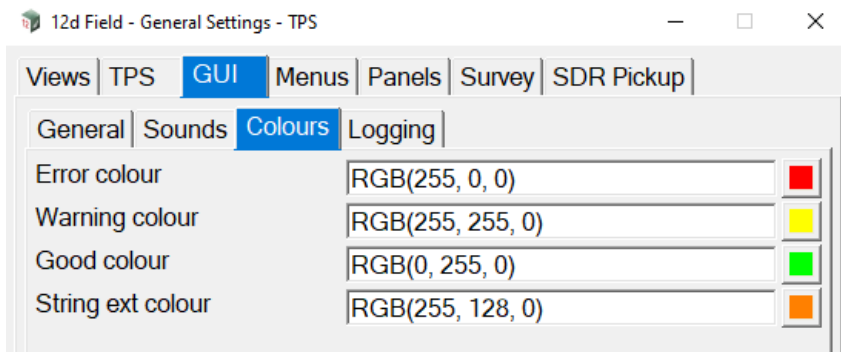
*Play a sound on gaining TPS lock.*

**Resection measure done** file box

??.

## GUI > Colours tab

**12d Field** messages are generally a white background when informational but can have special colours set for various purposes.



**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.*

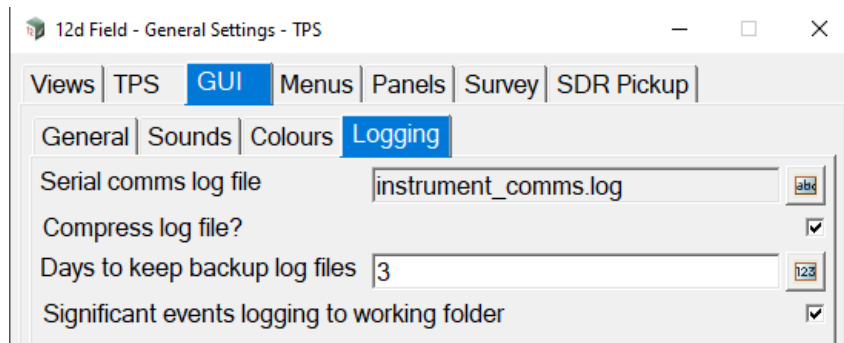
**Good colour**                      colour box                      green

*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.*

## 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.*

### Compress log file      tick box      ticked

*Normally the logging will attempt to filter repetitive information to greatly reduce the size of the log file, in some support situations it might be requested to untick this box so every communication between **12d Field** and the attached instrument is recorded.*

*If **ticked**, logging is filtered to only included critical information.*

*If **not ticked**, all communications with the instrument are logged.*

### 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.*

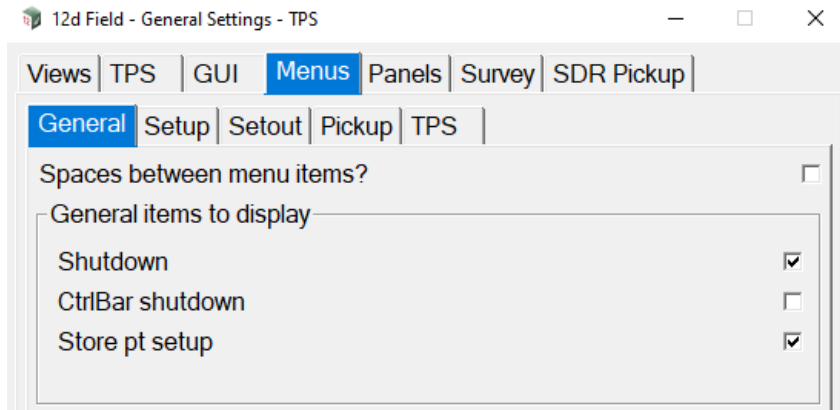
### Significant events logging to working folder tick box      ticked

*`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.*

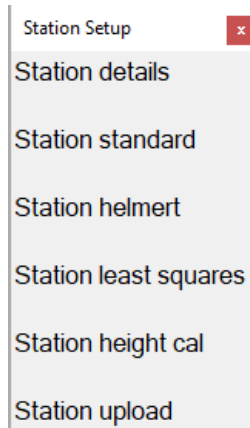
*If **not ticked**, `12DF_SIGNIFICANT_EVENTS_LOGGING.TXT` is always created in accordance with the standard search paths.*

## Menus >General tab



**Spaces between menu items?**    tick box    not ticked

*If **ticked**, add a space between all menu items.*

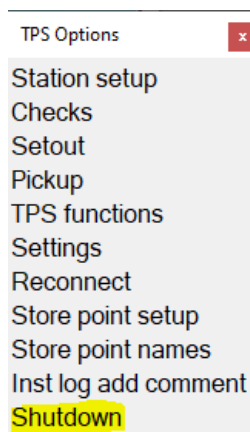


*If **not ticked**, menus do not add an extra space between menu items.*

### 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.

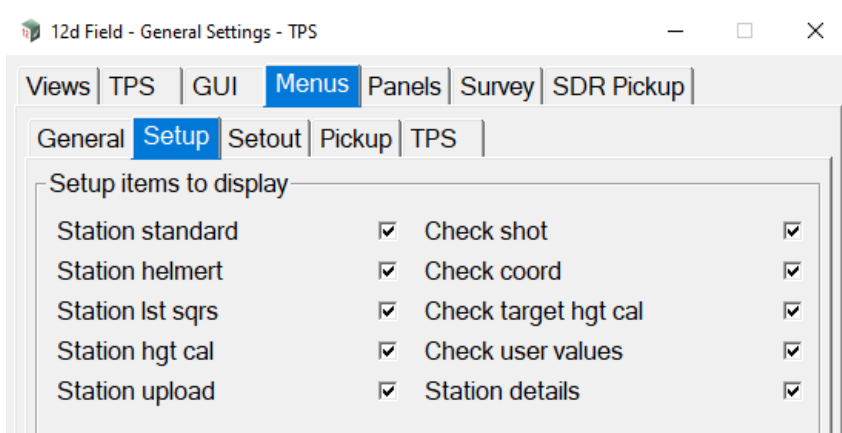
If **not ticked**, the shutdown button is not added to the end of the control bar and will be added to the options menu.

**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.

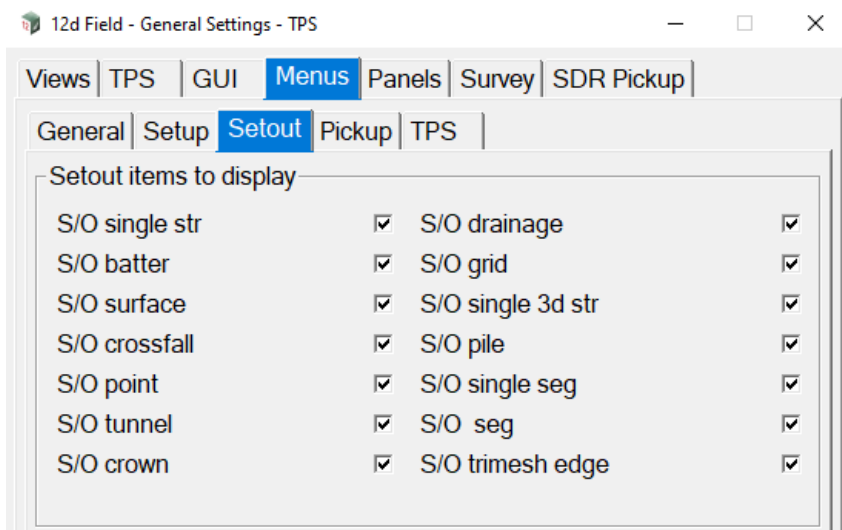
## Menus >Setup tab



Setup items to display

Select the items to display on the **Station setup** and **Checks** menus.

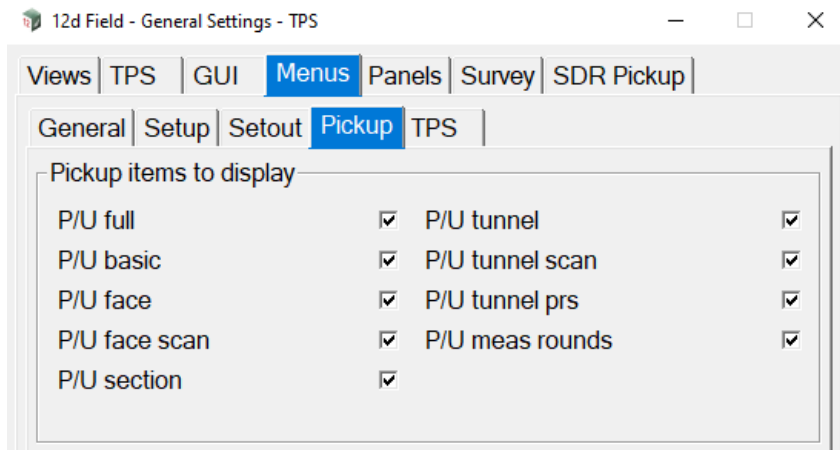
## Menus >Setout tab



Setout items to display

Select the items to display on the **Setout** menu.

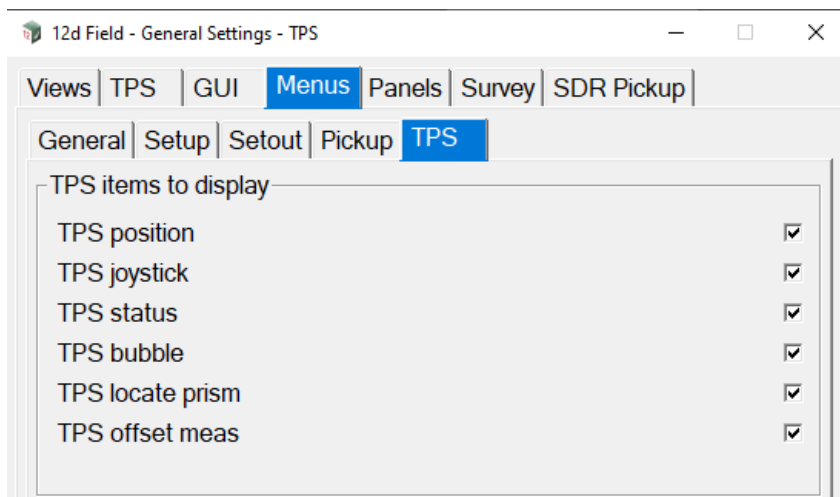
## Menus >Pickup



### Pickup items to display

Select the items to display on the **Pickup** menu.

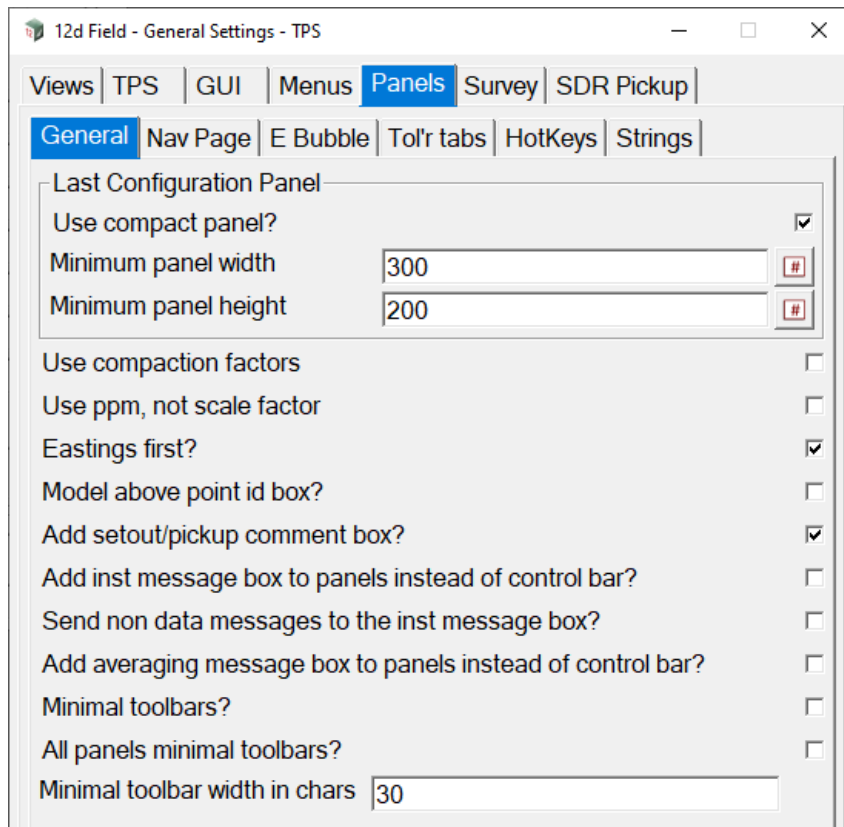
## Menus >TPS



### TPS items to display

Select the items to display on the **TPS functions** menu.

## Panels >General tab

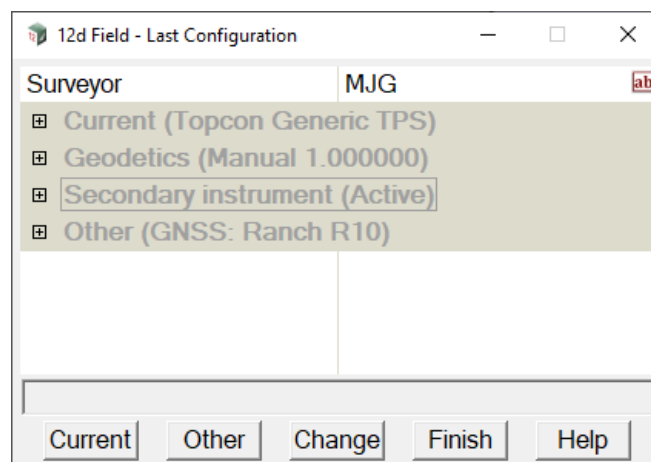


### Last Configuration Panel

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 of 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.*

**Use compaction factors**      tick box              ticked

*If **ticked**, the compaction factor widget will be added to the appropriate setout panels.*

A screenshot of a software interface showing a 'Compaction factor' widget. The widget consists of a text input field containing the number '1' and a vertical scrollbar to its right. The text 'Compaction factor' is displayed to the left of the input field.

*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.*

**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.*

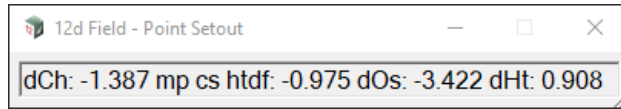
**Add average message box to panels instead of control bar?**      tick box      not ticked

*If **ticked**, the message box with progress information about multiface and averaging measurements is added to each panel rather than the control bar.*

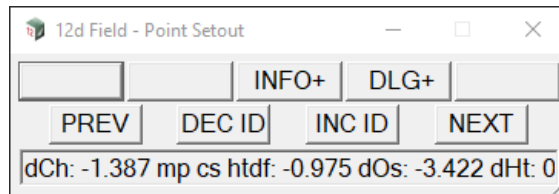
*If **not ticked**, the message box with information about multiface and averaging measurements is added only to the control bar.*

**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

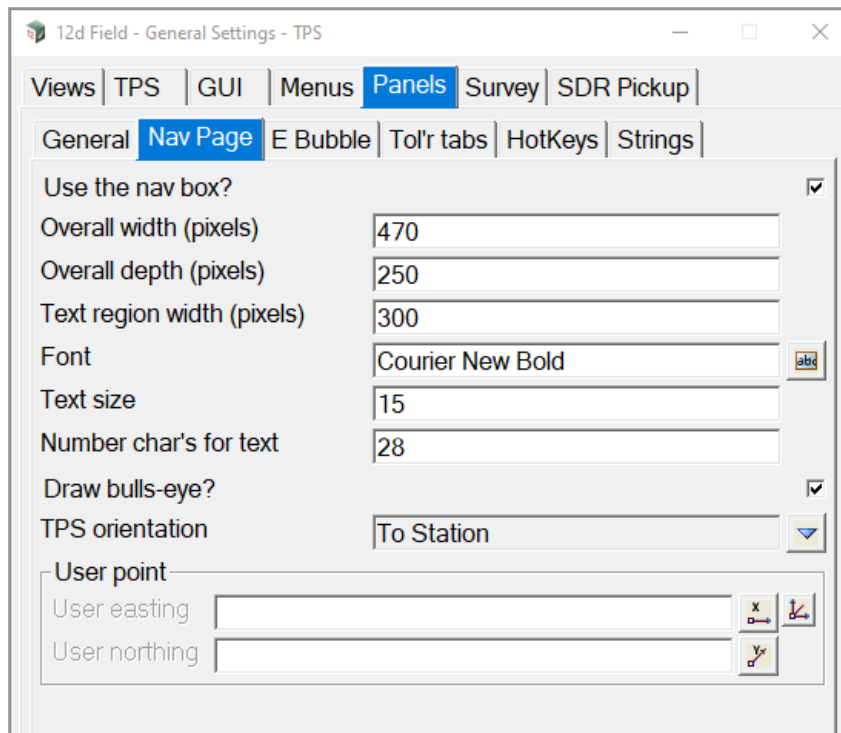
If **ticked**, all panels, including the primary panel when minimised will only display the message box with delta values.

If **not ticked**, the primary panel when minimised will display its button and the message box with delta values.

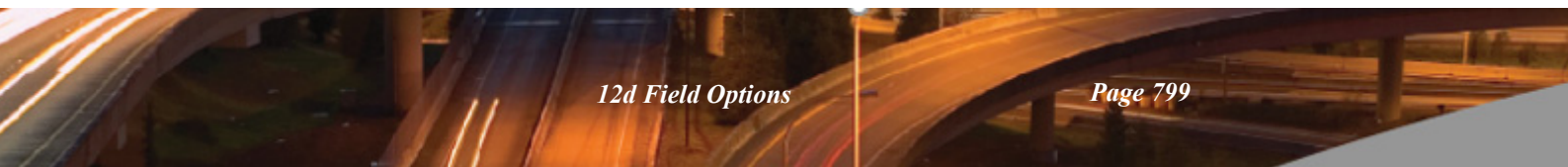
**Minimal toolbar width in chars**

Width of the minimised toolbar in characters, this setting is deprecated and set for removal at a latter stage.

**Panels >Nav Page**

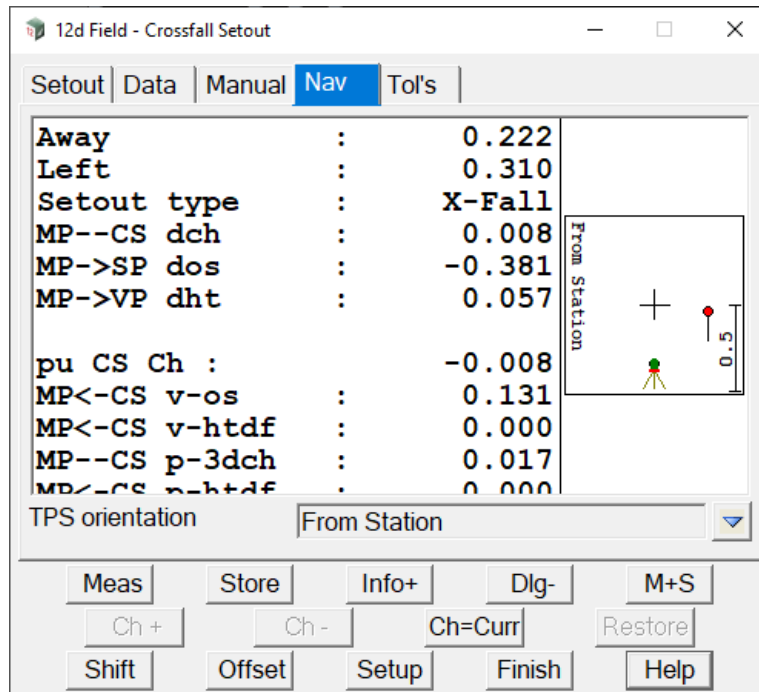


The **12d Field** navigation page is a 2 part page with a user definable information table and a bulls-





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.*

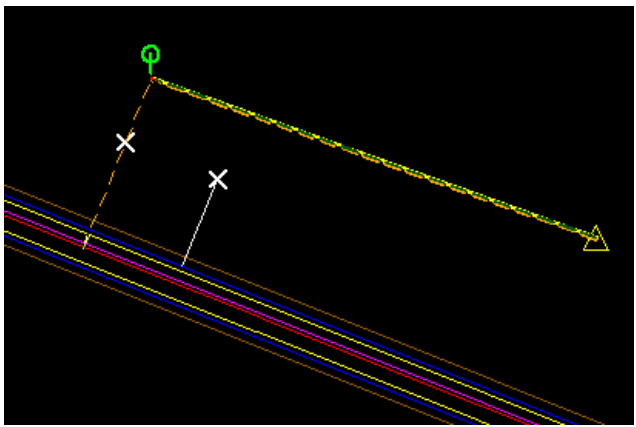
**TPS orientation** choice box  None, Centreline,  From Station, To Station,



To North, To User Point

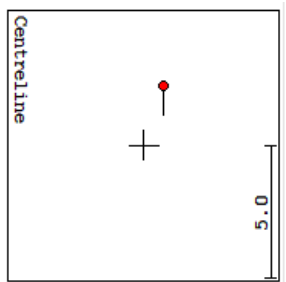
The bull-eye box shows the position of the target and setout point orientated in a certain direction to make it easier to move towards the setout point.

Take the following example, the centreline runs from the station to the measured point.

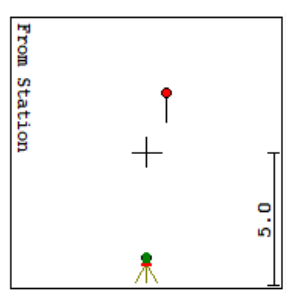


*None* - nothing is drawn in the bull-eye box.

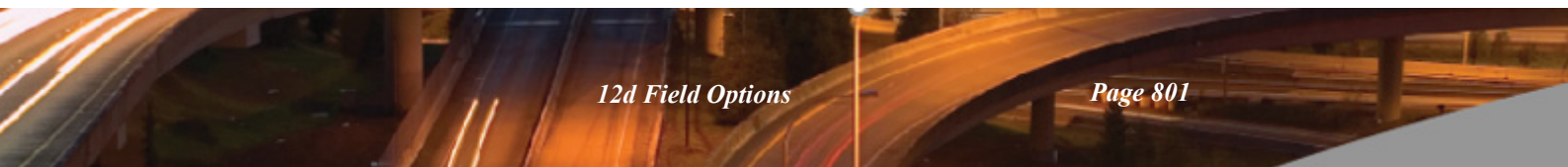
*Centreline* - the box is orientated with the centreline direction as 'north'.

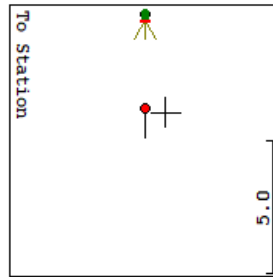


*From Station*

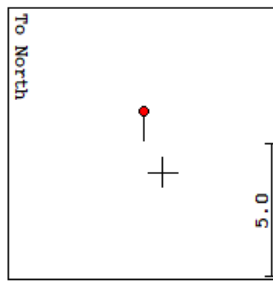


*To Station*



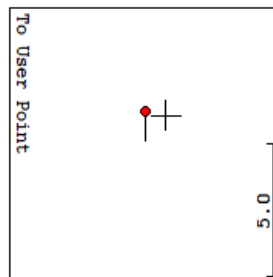


*To North*



*To user point*

*In this case the user point has been set to the setup point.*



**User point**

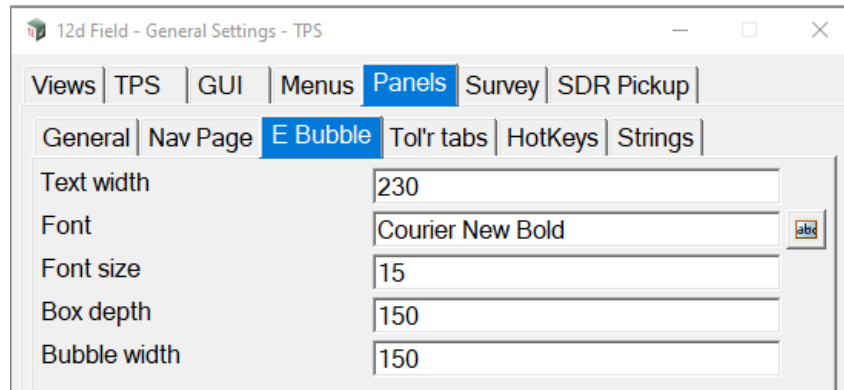
**User easting**

*Easting of the user orientation point.*

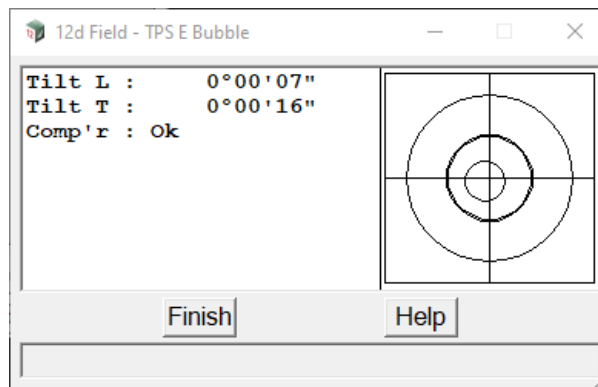
**User northing**

*Northing of the user orientation point.*

## Panels &gt;E Bubble



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.*

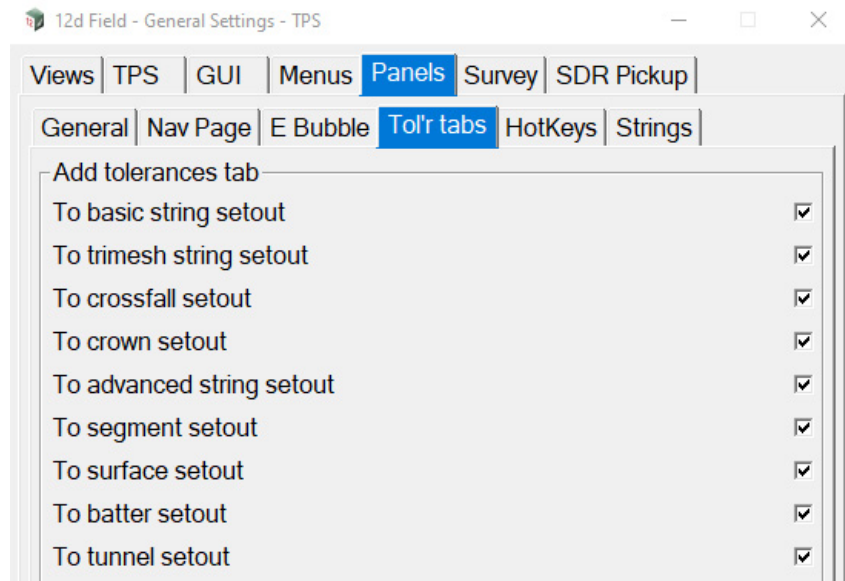
**Box depth** integer box

*Depth of the bubble box.*

**Bubble width** integer box

*Width of the bubble box.*

## Panels > Tol'r tabs

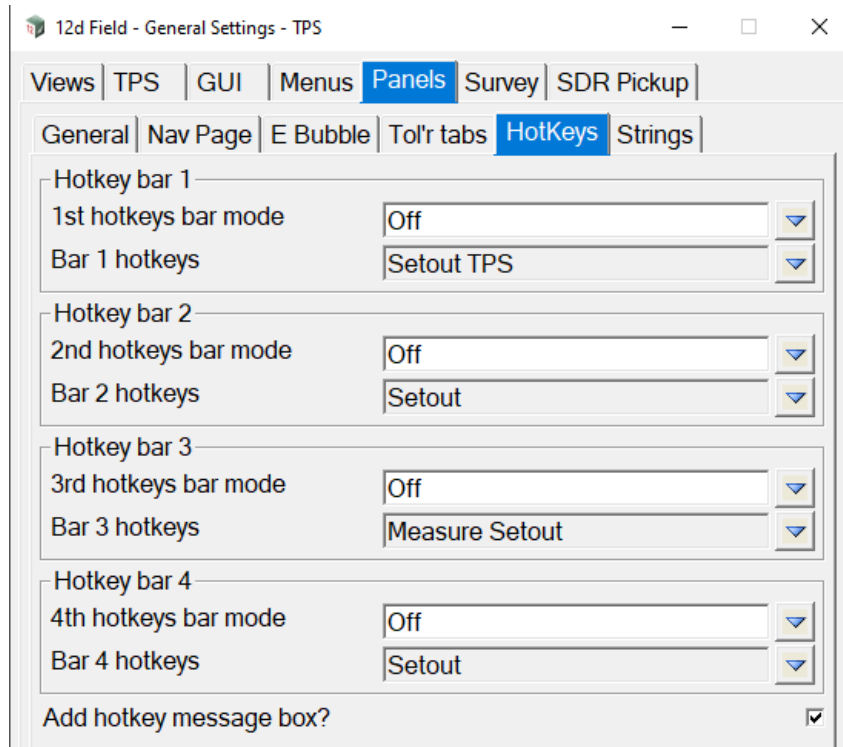


### Add tolerances tab

*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.*

## Panels > HotKeys



### 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

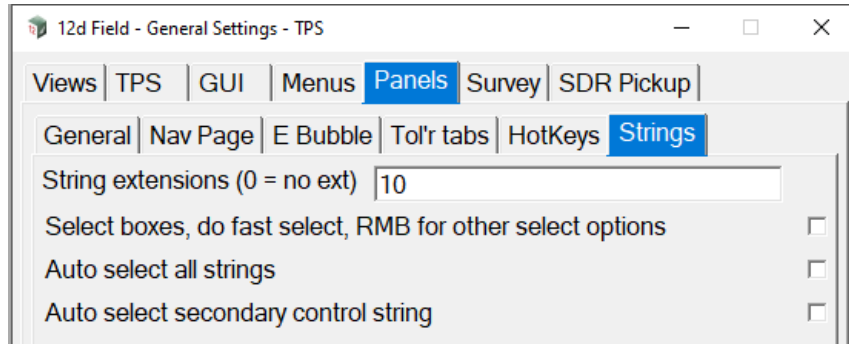
*If using a keyboard for hotkeys it is essential that 12d has Windows focus, e.g. in a view or a widget.*

*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.*

## Panels >Strings

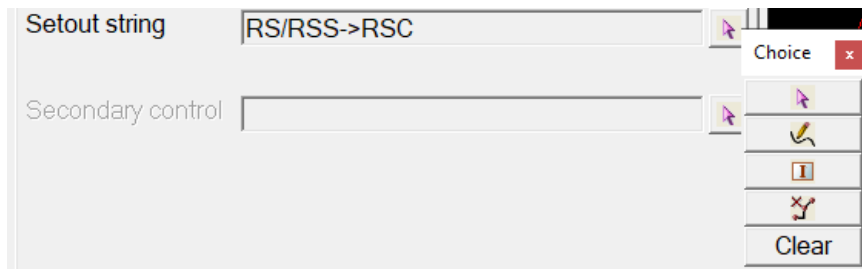


**String extensions (0 = no ext)** tick box not ticked

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

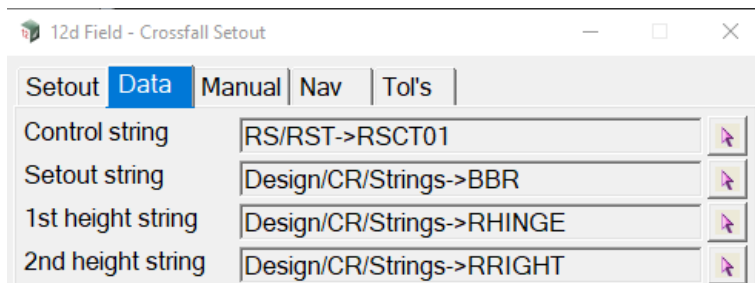
If **ticked**, when clicking on the select widget the panel will minimise and restore when the element is selected. To access the options the user must right click on the select.



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.

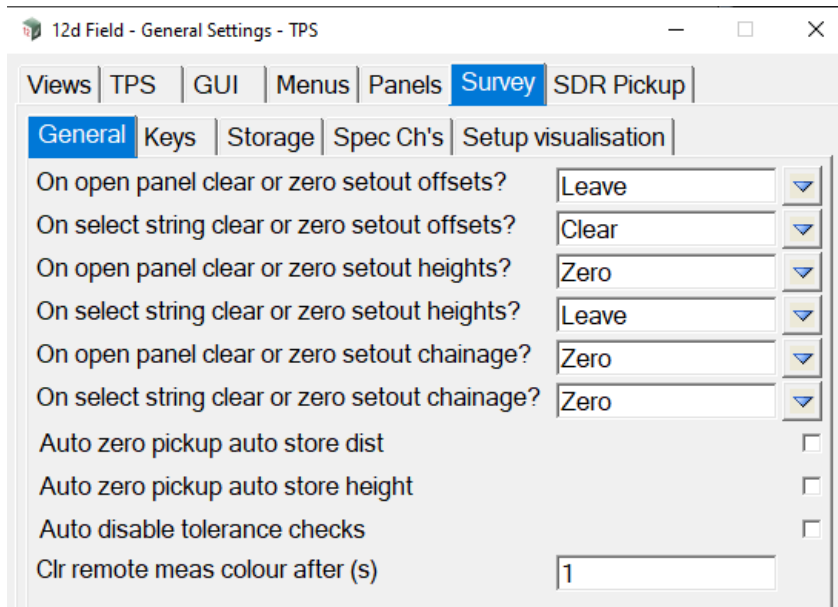


**Auto select secondary control string** tick box not ticked

*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.*

## Survey >General tab



**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.*

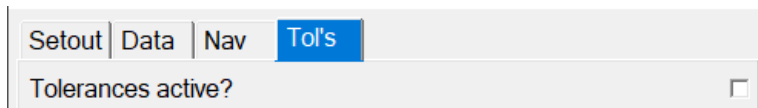
*If not ticked, on starting Basic Pickup the Auto store distance is left unchanged.*

**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.*

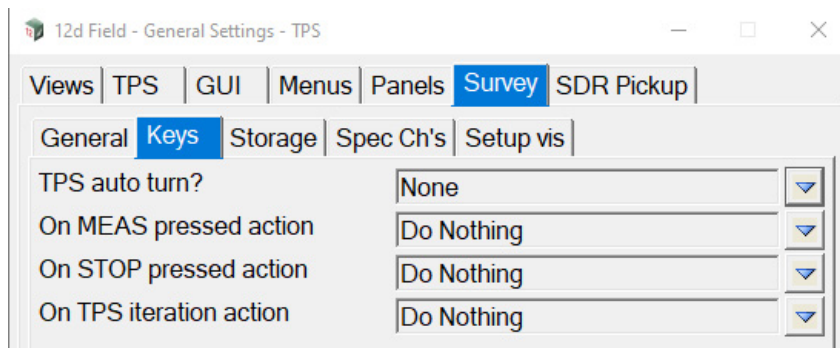
*If not ticked, the tolerance checks status will be left unchanged when starting a panel.*

**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.*

## Survey >Keys tab



**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.

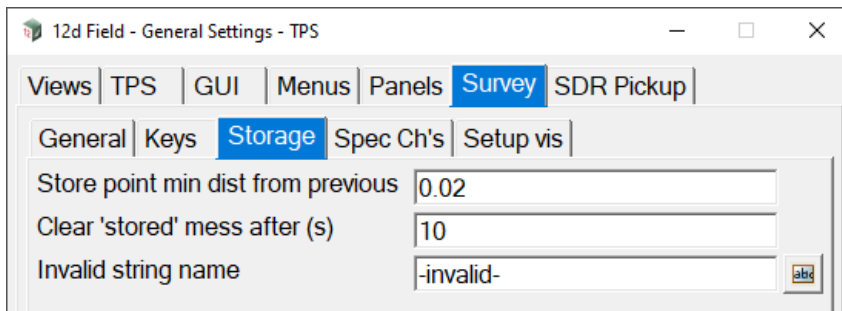
**On TPS iteration action** choice box

Do Nothing, Focus to Nav Page

If **Do Nothing** - do nothing.

If **Focus To Nav Page** - change to the navigation page.

## Survey >Storage



**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.

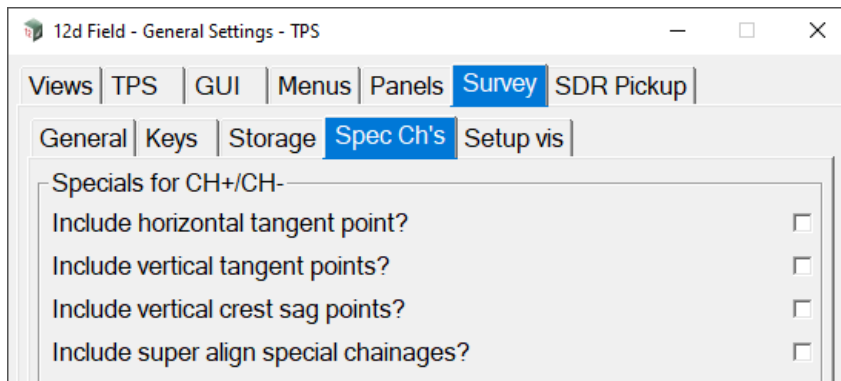
**Clear 'stored' mess after (s)** integer box

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.

## Survey >Spec Ch's



### 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

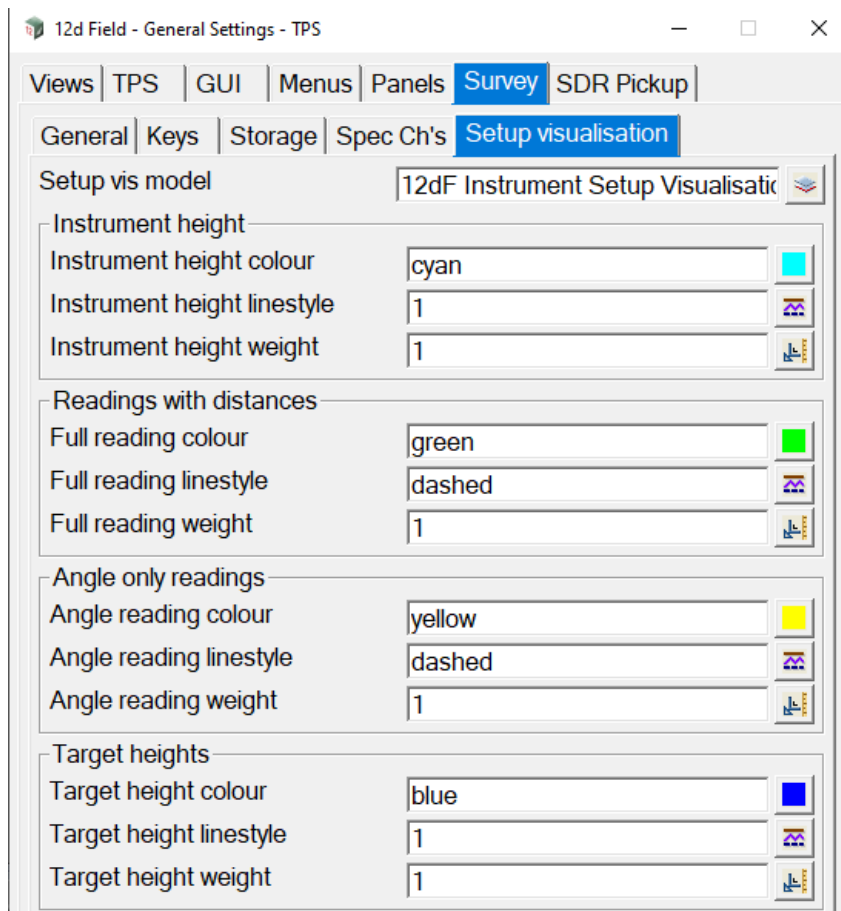
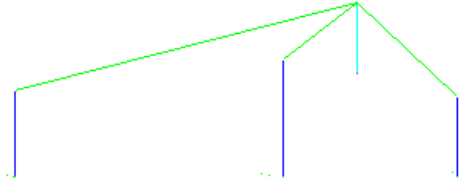
*Includes all crest/high and sag/low vertical chainages.*

**Include super alignment special chainages?** tick box not ticked

*Includes the list of super alignment special chainages.*

## 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.



### 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.

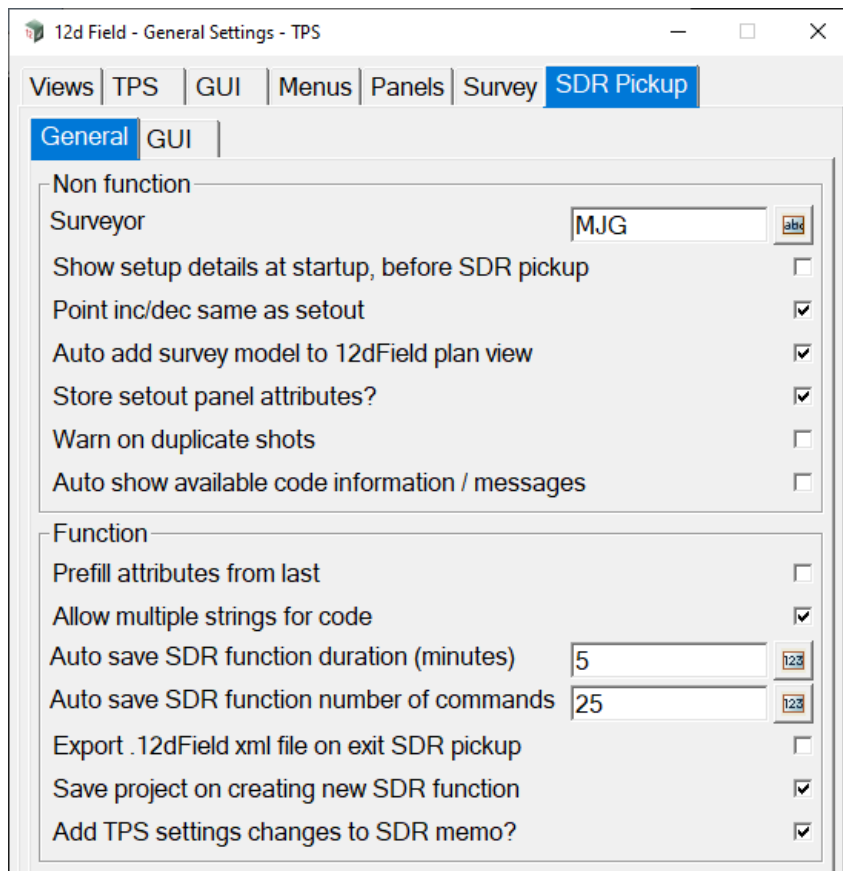
**Angle only readings**

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.

**SDR Pickup >General tab**



**Non function**

Setting not related to the SDR function

**Surveyor** model box

Company/surveyor name to be written to all stored attributes.

Show setup.

**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 sa 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   

*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   

*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   

*This setting is obsolete and will be removed.*

**Auto show available code information/messages** tick box   

*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.*

## Function

setting associated directly with the SDR function

**Prefill attributes from last code input** tick box   

*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   

*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   

*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   

*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.*

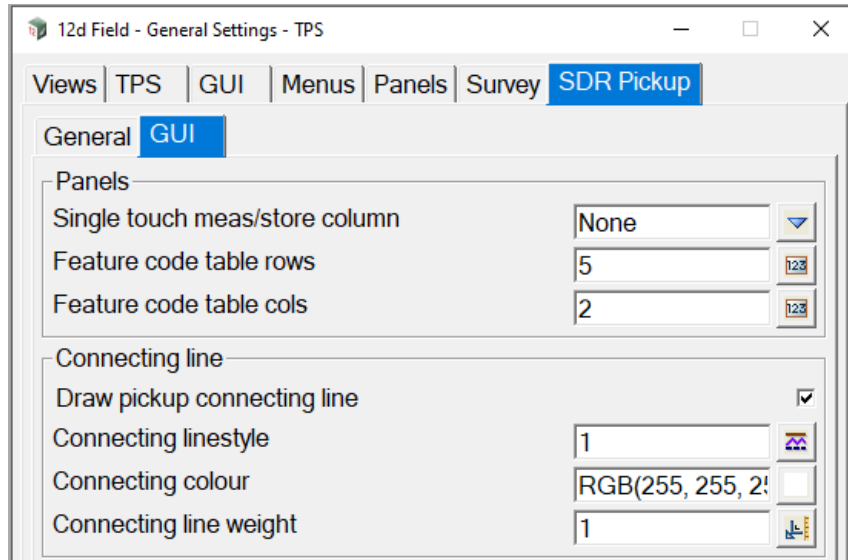
*If **not ticked**, the project will have to be saved manually. If 12d terminates unexpectedly before a subsequent save of the project the function will still be there and valid but will have to be manually added to the project.*

**Add TPS settings changes to SDR memo** tick box   

*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.*

## SDR Pickup &gt;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 [15.6.8 Reconnect](#) or return to [15.6 12d Field Options](#)

## 15.6.8 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 [15.6.9 Store Point Setup](#) or return to [15.6 12d Field Options](#).

## 15.6.9 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.*

<b>Model</b>	model box	available models
	<i>Model to store the string in. (This model will automatically be added to your defined <b>12d Field</b> plan view)</i>	
<b>Line string</b>	tick	not ticked
	<i>If <b>ticked</b>, the string is a line string.</i>	
	<i>If <b>not ticked</b>, the string is a point string.</i>	
<b>Colour</b>	colour box	green
	<i>Colour of the string.</i>	
<b>Linestyle</b>		
	<i>Linestyle of the string.</i>	
<b>Weight</b>		
	<i>Thickness of the string.</i>	
<b>Same as</b>	button	
	<i>Select an existing point/line and the fields will set to it's properties.</i>	

#### 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 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 [15.6.10 Store Point Names](#) or return to [15.6 12d Field Options](#).



## 15.6.10 Store Point Names

The **Store Point Names** panel contains 3 of the common fields from the much larger [15.6.9 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
-------------------	------	----------	--------

<b>Names</b>	names box		
--------------	-----------	--	--

See *Name* in the [Model and string settings](#) section of the [15.6.9 Store Point Setup](#) panel.

<b>MP id type</b>	choice box		
-------------------	------------	--	--

See *MP id type* in the [Vertex point id style](#) section of the [15.6.9 Store Point Setup](#) panel.

<b>MP id</b>	text box		
--------------	----------	--	--

See *MP id* in the [Vertex point id style](#) section of the [15.6.9 Store Point Setup](#) panel.

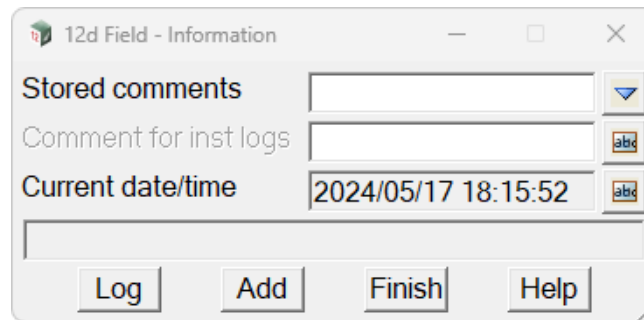
Continue to [15.6.11 Log Comment](#) or return to [15.6 12d Field Options](#).

## 15.6.11 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
-------------------	------	----------	--------

<b>Stored comments</b>	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.*

<b>Comment for inst logs</b>	text box		
------------------------------	----------	--	--

*If **not blank**, the text is written to the instrument log file.*

<b>Current date/time</b>	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

<b>Log</b>	button
------------	--------

*The current comment and time are logged to the internal **instrument\_comms.log** file and the user **12DF\_SIGNIFICANT\_EVENTS\_LOGGING.TXT** file.*

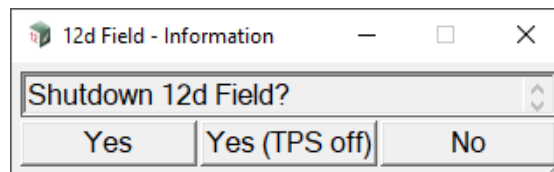
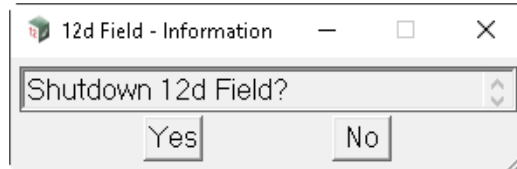
<b>Add</b>	button
------------	--------

*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 [15.6.12 12d Field Shutdown](#) or return to [15.6 12d Field Options](#).

## 15.6.12 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
-------------------	------	----------	--------

<b>Yes</b>	button		
------------	--------	--	--

*If pressed, **12d Field** is shutdown.*

<b>Yes (TPS off)</b>	button		
----------------------	--------	--	--

*If pressed, **12d Field** is shutdown and the TPS is powered off.*

*Note this is only available on instruments that support this feature.*

<b>No</b>	button		
-----------	--------	--	--

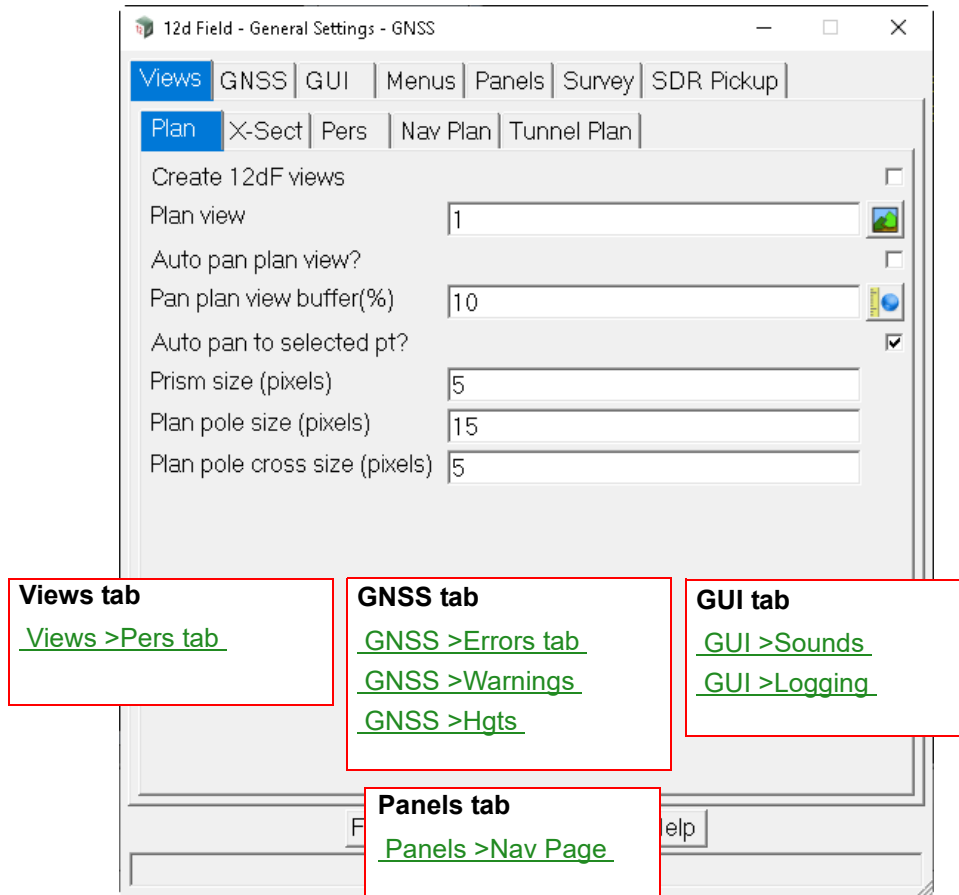
*If pressed, **12d Field** is not shutdown.*

Continue to [15.6.13 General Settings - GNSS](#) or return to [15.6 12d Field Options](#).

## 15.6.13 General Settings - GNSS

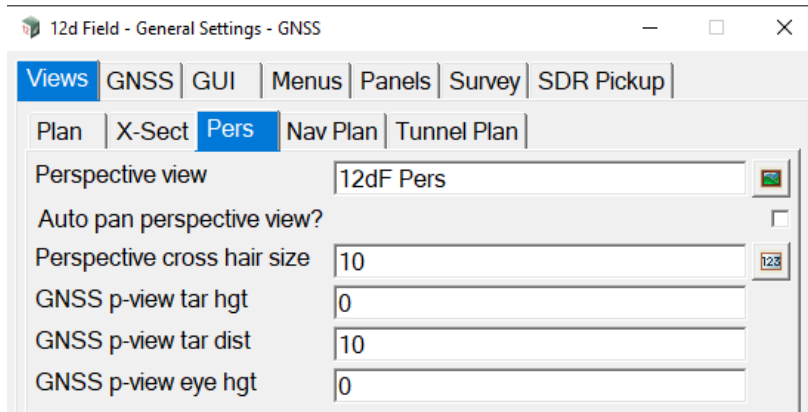
The GNSS version of this panel is largely identical to the TPS version, differences only are shown. For common fields see [15.6.7 General Settings - TPS](#).

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.*

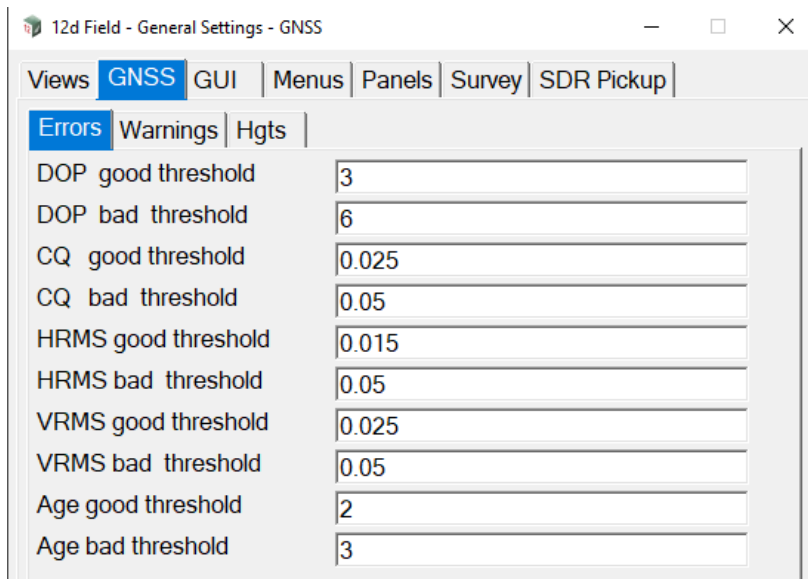
#### GNSS p-view tar hgt      real box

*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

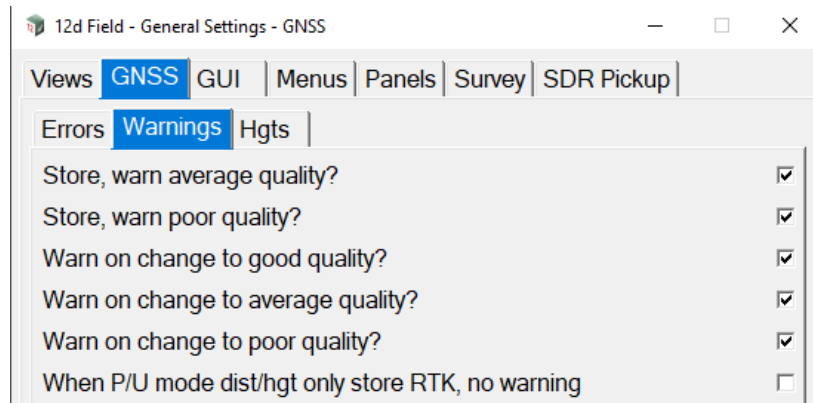
CQ coordinate quality

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.*

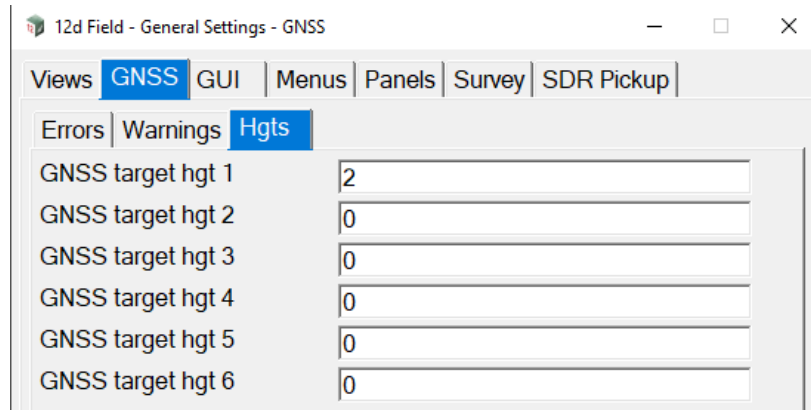
*If **ticked**, a change from **good** quality to **poor** or **average** will not show a message box and points will be*



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

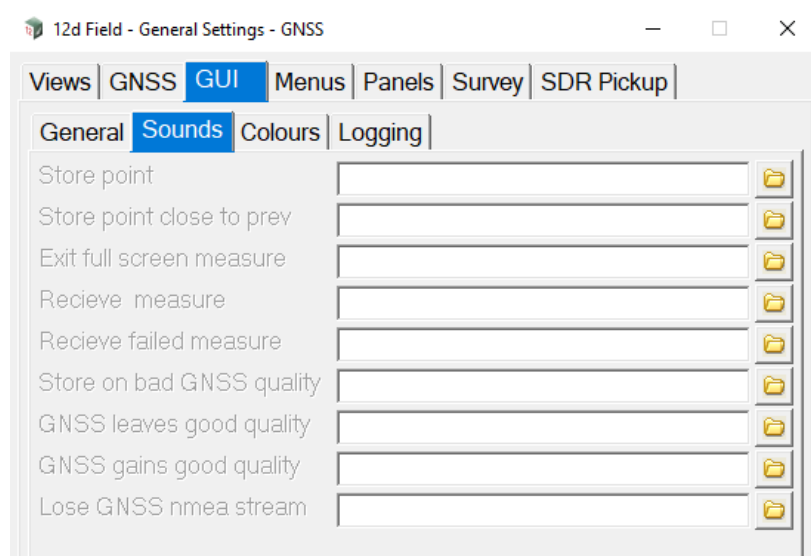


**GNSS target hgt 1- 6**      real box

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**.

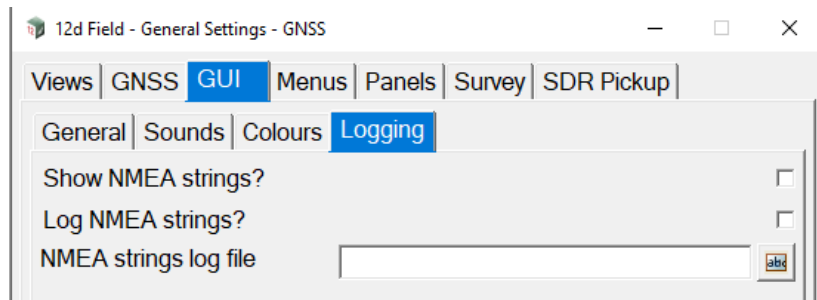
If **not ticked**, do not play a sound when the quality changes back to **good**.

**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.

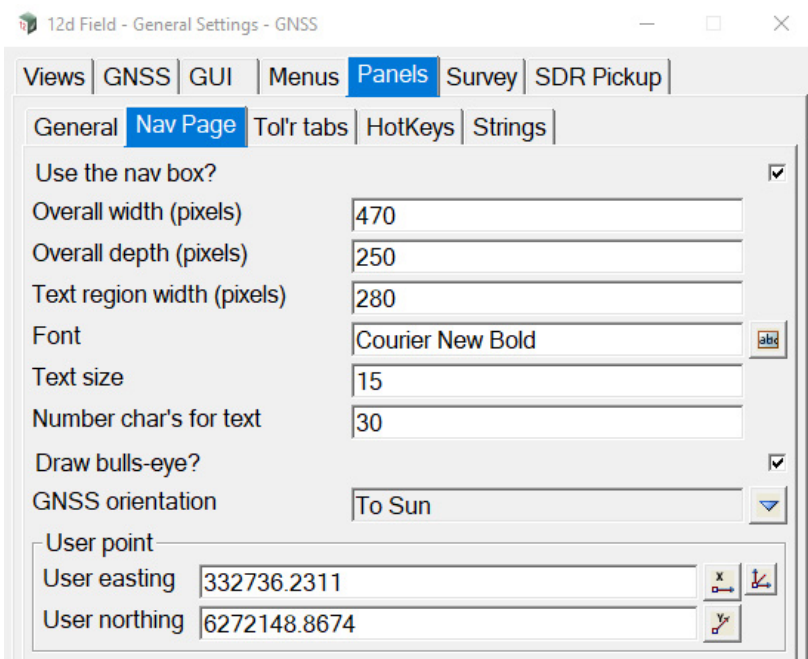
If **not ticked**, the received NMEA sentence bundles are not written to file.

**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](#).

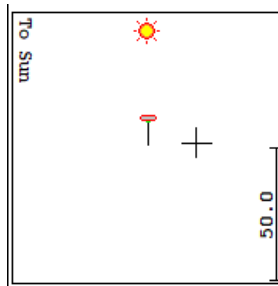


**GNSS only options**

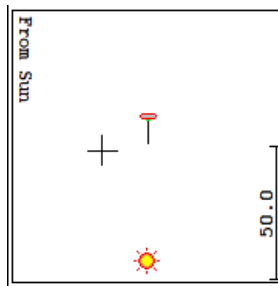
The GNS orientation is identical to TPS orientation except the options To Sun and From Sun are present.

**GNSS orientation** choice box  
 None, Centreline, From Station, To Station, To North, To Sun, From Sun, To User Point

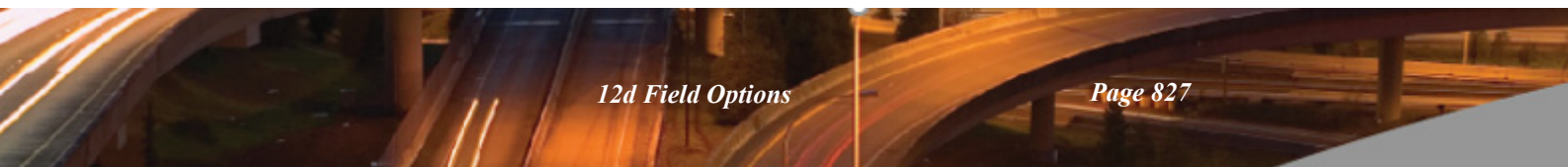
**To Sun**



**To From**

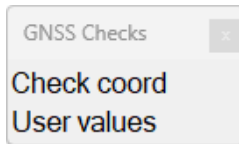


Continue to [15.6.14 Checks - GNSS](#) or go back to [15.6 12d Field Options](#).



## 15.6.14 Checks - GNSS

Clicking on the **Checks** menu option brings up the **GNSS Checks** menu.



See

[15.6.14.1 Check Coord - GNSS](#)

[15.6.14.2 User values - GNSS](#)

### 15.6.14.1 Check Coord - GNSS

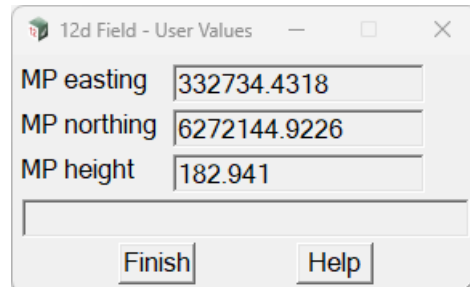
This panel is identical to the TPS version, see [15.6.3.2 Check Coord - TPS](#) for a description of the panel functionality.

Continue to [15.6.14.2 User values - GNSS](#) or go back to [15.6.14 Checks - GNSS](#).

## 15.6.14.2 User values - GNSS

This panel is identical in functionality to [15.6.3.4 Check User Values - TPS](#), it is mainly there for compatibility with the TPS menus and currently is restricted to the last measured coordinates.

Clicking **User values** brings up the **12d Field** -panel.



Field	Value
MP easting	332734.4318
MP northing	6272144.9226
MP height	182.941

Refer to [15.6.3.4 Check User Values - TPS](#) for details on configuring and using this panel.

Continue to [15.6.15 GNSS Utilities](#) or go back to [15.6.14 Checks - GNSS](#).



## 15.6.15 GNSS Utilities

Clicking on the **GNSS Utilities** menu option brings up the **GNSS Utilities** menu:

GNSS Utilities	See
Localization params	<a href="#">15.6.15.1 GNSS localisation Calculations</a>
Create base station	<a href="#">15.6.15.2 Create a Base Station</a>
Send script	<a href="#">15.6.15.3 Send a Script</a>
Create NMEA string	<a href="#">15.6.15.4 Create NMEA String</a>

## 15.6.15.1 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.

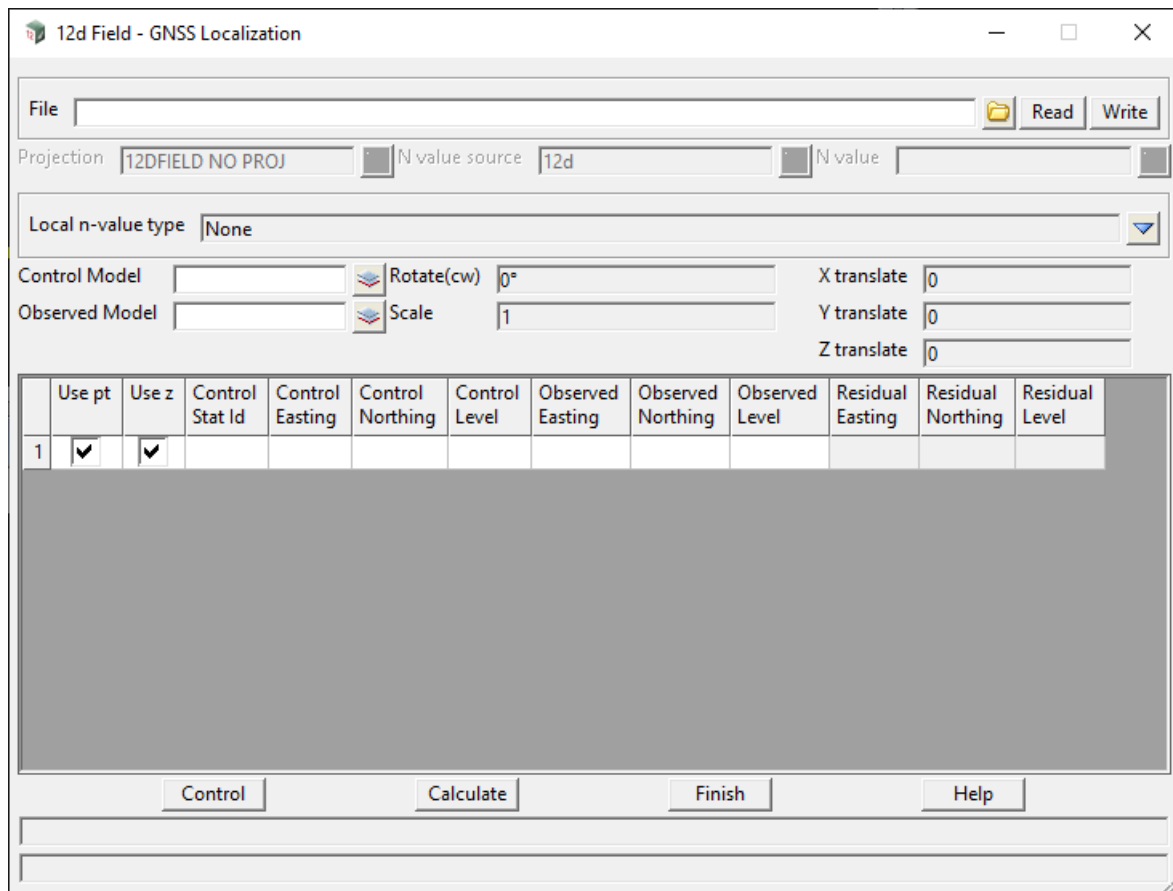
The horizontal transformation is a 2D Helmert with 2D translation, 2D rotation and uniform scaling of the x and y axes, the observed points are the raw WGS84 cartesian coordinates, reduced from long/lat via the current projection. The helmert transformation is used to fine tune the raw coordinates into 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
<b>File</b>			*.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.*

<b>Read</b>	button
-------------	--------

*Read in the TDF\_HEL file.*

<b>Write</b>	button
--------------	--------

*Write out the TDF\_HEL file.*

<b>Projection</b>	input box
-------------------	-----------

*Informational only, the projection used by 12d Field to calculate the WGS84 cartesian coordinates.*

<b>N value source</b>	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.

Local n-value type  ▾

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.

Local n-value type   
 Orig e     Orig n     Corr c     Corr e     Corr n

Dialog box titled "Create/Edit N value settings" with fields for:  
 N value setting name (dropdown)  
 N value setting type (dropdown, set to "Plane")  
 Origin easting (text field)  
 Origin northing (text field)  
 Correction constant (text field)  
 Correction per unit easting (text field)  
 Correction per unit northing (text field)  
 Add correction (checkbox, checked)  
 choice ok (text field)  
 Buttons: Add/Modify, Write, Finish, Help

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.

Local n-value type   
 Local geoid string

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.

Local n-value type   
 Local geoid trimesh

**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 **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 the 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 [15.6.15.2 Create a Base Station](#) or return to [15.6.15 GNSS Utilities](#) .



## 15.6.15.2 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
<b>Base height</b>	measure box		
<i>Height of the base station.</i>			
<b>Base point</b>	string select box		
<i>The vertex to be the base station.</i>			
<b>Script file</b>	file box		
<i>The file to write the base station script to.</i>			

### Buttons at Bottom

<b>Write</b>	button
<i>Write out the script file.</i>	

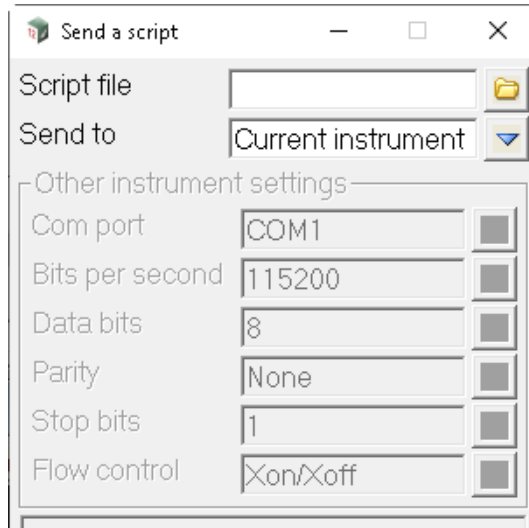
Continue to [15.6.15.3 Send a Script](#) or go back to [15.6.15 GNSS Utilities](#).

### 15.6.15.3 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
<b>Script file</b> <i>Height of the base station.</i>	file box		
<b>Send to</b>	choice box		Current instrument Other instrument
<i>If <b>Current instrument</b> then the script file is uploaded to the current GNSS instrument.</i>			
<i>If <b>Other instrument</b> then the script file is uploaded to the current GNSS instrument using the settings in the "Other Instrument settings" section of the panel.</i>			
<b>COM port</b> <i>Com port to write the data out to.</i>	choice box		
<b>Bits per second</b> <i>Number of bits per second when sending the data.</i>	choice box		
<b>Data bits</b> <i>Number of bits that make up a data word.</i>	choice box		5, 6, 7, 8, Mark
<b>Parity</b> <i>Parity for the data word.</i>	choice box		None, Odd, Even, Mark, Space
<b>Stop bits</b> <i>Number of stop bits in the data word.</i>	choice box		1, 1.5, 2
<b>Flow control</b> <i>Protocol to use to control the flow of data.</i>	choice box		Xon/Xoff, Hardware, None
<b>Send</b> <i>Transmit the script file.</i>	button		

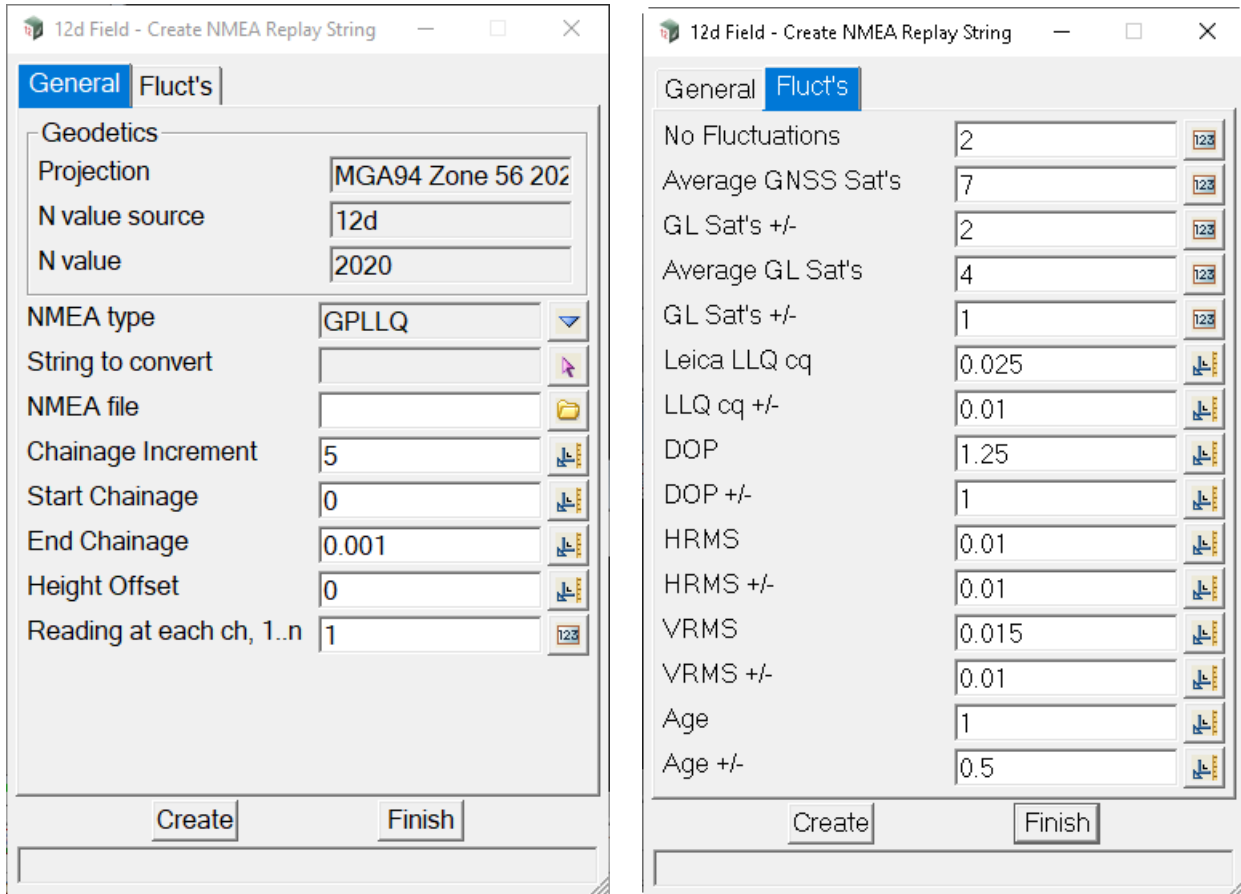
Continue to [15.6.15.4 Create NMEA String](#) or go back to [15.6.15 GNSS Utilities](#).

### 15.6.15.4 Create NMEA String

**Position of option on menu:** Survey =>Field 12d=>GNSS Utilities =>Create Base Station

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:



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

<b>NMEA type</b>	choice box	GPLLQ, GNLLQ, GPGGA GNGNS, GNGNS & GNGST
------------------	------------	---

*Standard for the NMEA string.*

<b>String to convert</b>	string select
--------------------------	---------------

*String to create a NMEA file for.*

<b>NMEA file</b>	file box
------------------	----------

*Name for the created NMEA file.*

<b>Chainage increment</b>	measure box
---------------------------	-------------

*Value that the setout chainage will be changed by when chainage increment/decrement is called.*

**Start chainage**                      measure box  
??.

**End chainage**                      measure box  
??.

**Height offset**                      measure box  
??.

**Reading at each ch, 1... n**    integer box  
??.

### Fluct's tab

**Num fluctuations**                  integer box  
??.

**Average GNSS Sat's**              integer box  
*The average number of GNSS satellites.*

### 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 [15.6.15 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

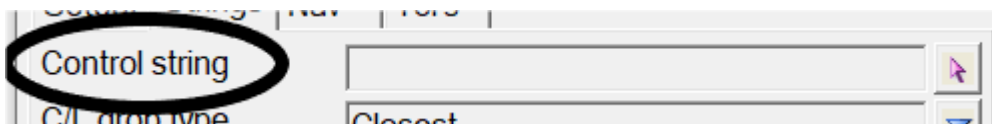
In this section the mathematical term **normal** will be used as well as **perpendicular** dependent on the context, **normal** tends to mean the physical object representing something **perpendicular** to an object.

### 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 [18.5 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 [3.41 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 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 [3.24.2 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](#).

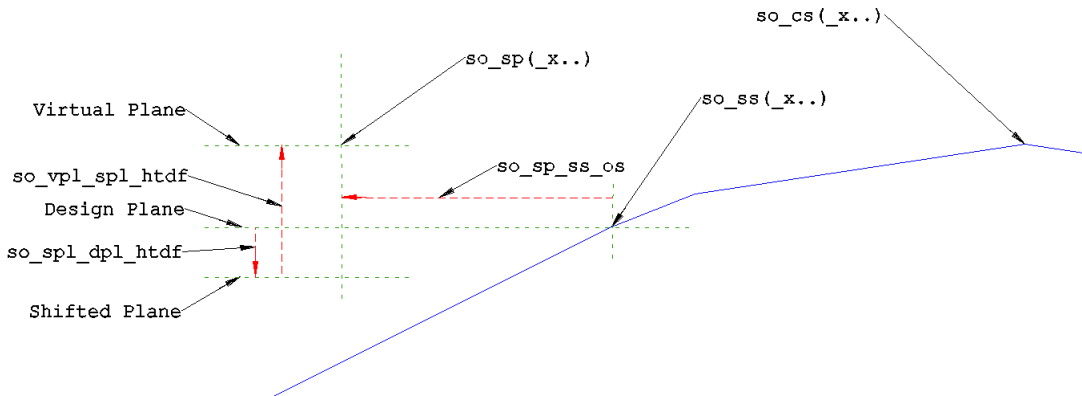
See [15.7.3.2.5.4 Batter Diagrams](#).

### 15.7.3.2.5.1 Basic String Diagrams

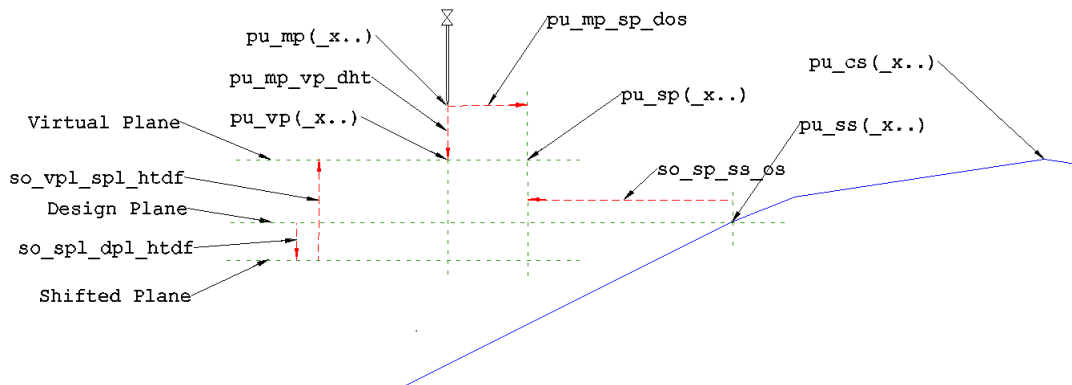
See [15.7.3.2.5.1.1 Single String](#).

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](#).

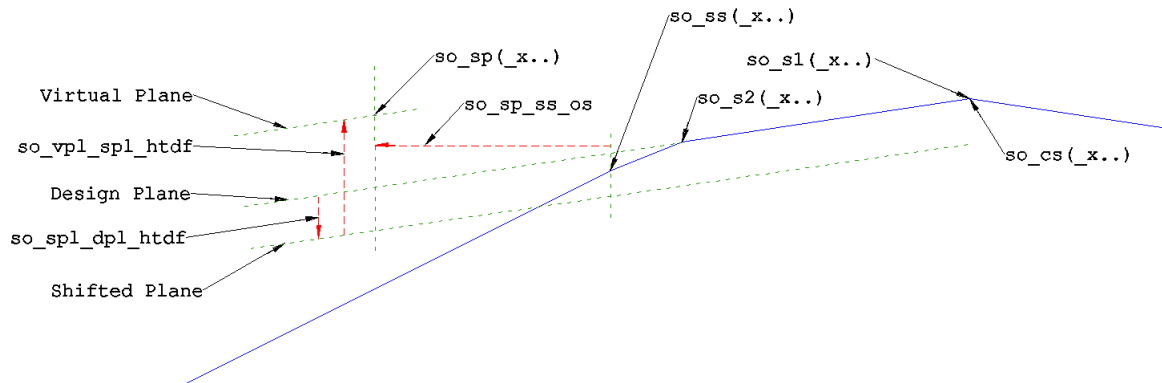


### 15.7.3.2.5.2 Crossfall Diagrams

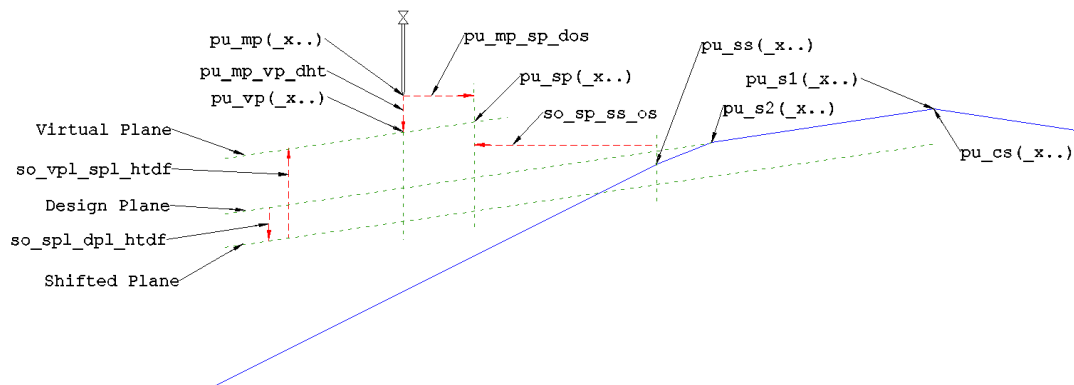
See [15.7.3.2.5.2.1 Setout Section](#).

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



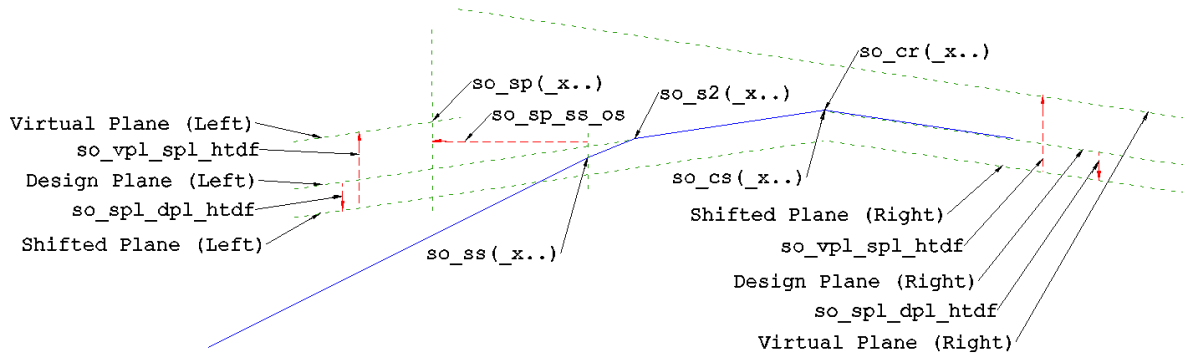
Continue to [15.7.3.2.5.3 Crown Diagrams](#) or return to [15 12d Field](#).

### 15.7.3.2.5.3 Crown Diagrams

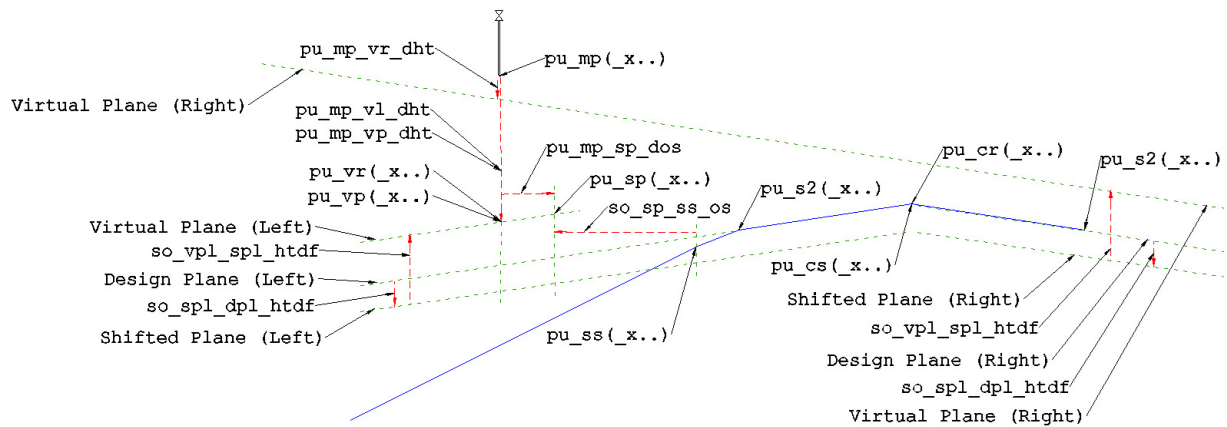
See [15.7.3.2.5.3.1 Setout Section](#)

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

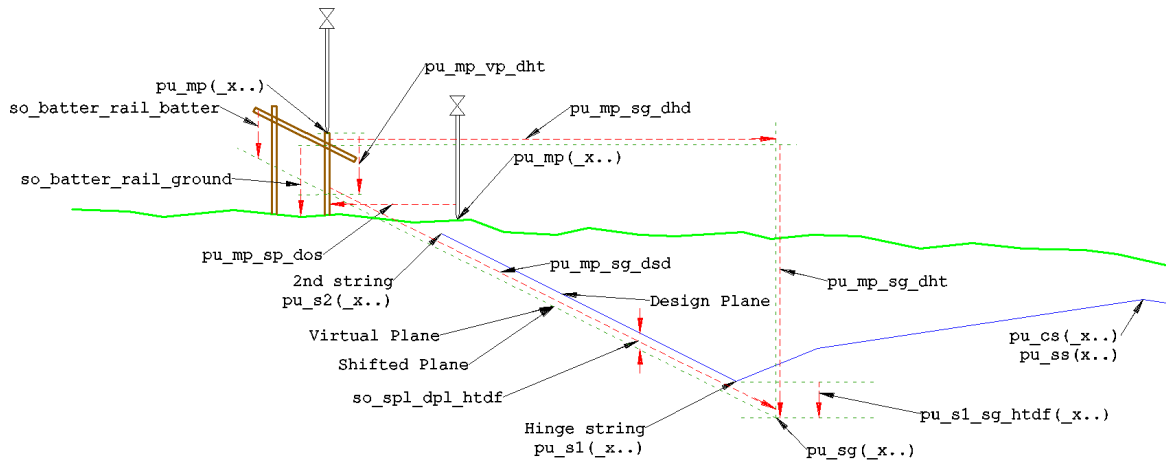


Continue to [15.7.3.2.5.4 Batter Diagrams](#) or return to [15 12d Field](#).

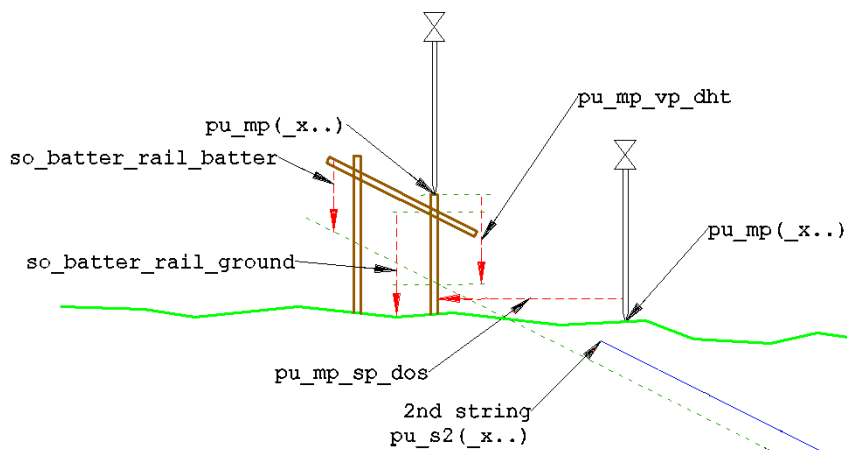
### 15.7.3.2.5.4 Batter Diagrams

**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.

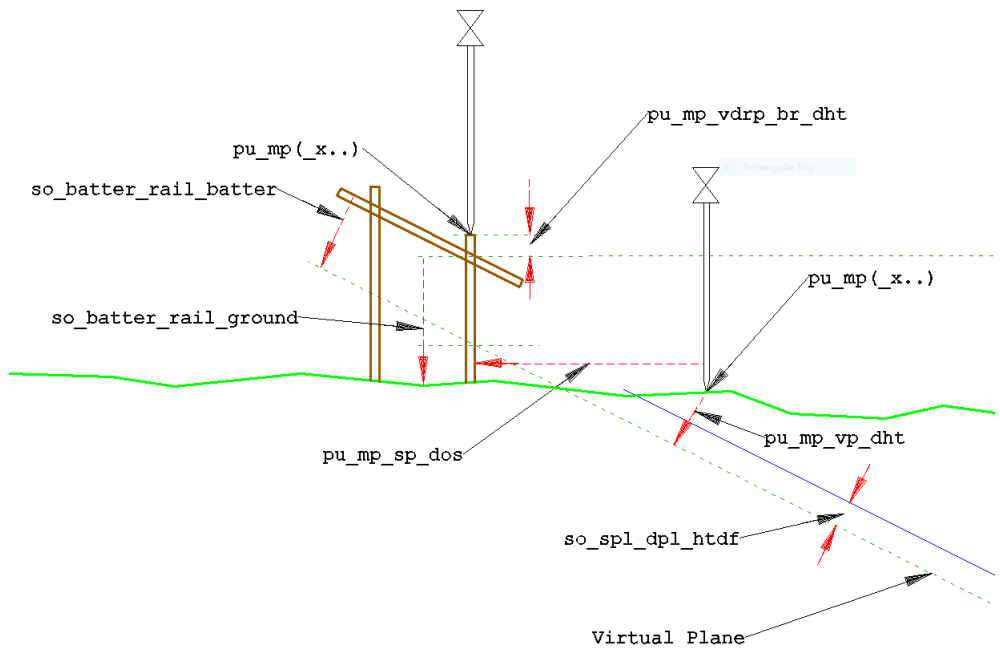
#### Pickup Attributes



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,  $\text{square\_root}(\text{dos}^2 + \text{dht}^2)$

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

### 15.7.4.2 General Logging

## 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](#).

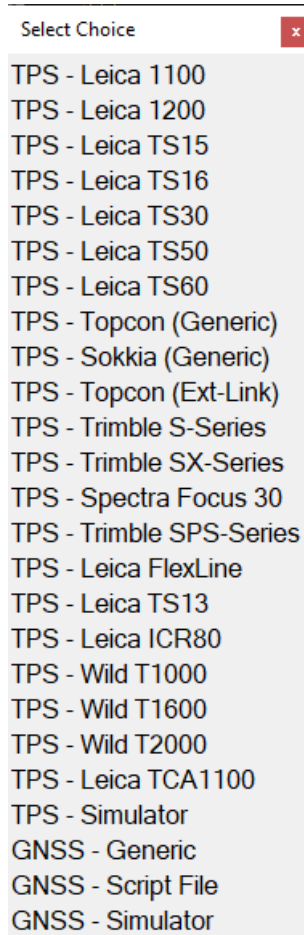
See [15.8.1.2 12dF\\_INSTRUMENT\\_SELECTION.4D](#).

See [15.8.1.3 12dF\\_INSTRUMENT\\_SETTINGS.4D](#).

#### 15.8.1.1 12dF\_BLUETOOTH\_DEVICES.TXT file format

### 15.8.1.2 12dF\_INSTRUMENT\_SELECTION.4D

**12d Field** supports a large range of TPS and GNSS instruments, this is the default V15C1k list.



To restrict the list shown to TPS and GNSS instruments only relevant to the user the **12dF\_INSTRUMENT\_SELECTION.4D** is available for manual editing.

```

Version 150111
TPS_Leica_1100 1 // Leica 1100 series TPS
TPS_Leica_1200 1 // Leica 1200 series TPS
TPS_Leica_TS15 1 // Leica TS15 TPS
TPS_Leica_TS16 1 // Leica TS16 TPS
TPS_Leica_TS30 1 // Leica TS30 TPS
TPS_Leica_1300 1 // Leica TS/MS50 TPS
TPS_Leica_TX60 1 // Leica TS/MS60 TPS
TPS_Trimble_S_Series 1 // Trimble S Series TPS
TPS_Trimble_SX_Series 1 // Trimble SX Series TPS
TPS_Trimble_SPS_Series 1 // Trimble SPS Series TPS
TPS_Trimble_Focus30 1 // Trimble Focus30 TPS
TPS_Topcon_ExtLink 1 // Topcon TPS (Ext-Link)
TPS_Topcon_Generic 1 // Topcon Generic TPS
TPS_Sokkia_Generic 1 // Sokkia Generic TPS
TPS_Leica_FlexLine 1 // Leica FlexLine TPS
TPS_Wild_T2000 1 // Wild T2000 TPS
TPS_Wild_T1600 1 // Wild T1600 TPS
TPS_Wild_T1000 1 // Wild T1000 TPS
TPS_Leica_TCA1100 1 // Leica TCA1100 TPS
TPS_Leica_TS13 1 // Leica TS13 TPS
TPS_Leica_ICR80 1 // Leica ICR80 TPS
TPS_Simulator 1 // TPS Simulator
GPS_Generic 1 // GNSS instruments without startup script
GPS_Generic_Script 1 // GNSS instruments using startup script
GPS_Simulator 1 // GNSS Simulator

```

To filter an instrument out of the displayed list change the 1 to a 0 on the line in question. For example, to filter out the legacy Wild instruments.

```

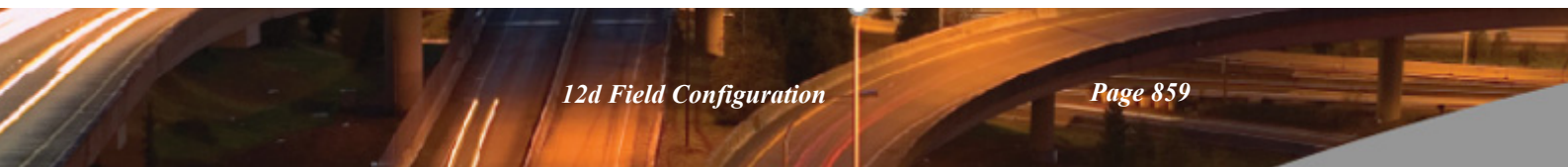
TPS_Wild_T2000 0 // Wild T2000 TPS
TPS_Wild_T1600 0 // Wild T1600 TPS
TPS_Wild_T1000 0 // Wild T1000 TPS

```

Note - the 1st line is the version number of 12d when the users **12dF\_INSTRUMENT\_SELECTION.4D** file was created. If the users **12dF\_INSTRUMENT\_SELECTION.4D** files version is less than their current version of 12d then any new instruments supported will be automatically added to the file as an active instrument so the user is aware it is now supported.

Continue to [15.8.1.3 12dF\\_INSTRUMENT\\_SETTINGS.4D](#) or return to [15 12d Field](#).

### 15.8.1.3 12dF\_INSTRUMENT\_SETTINGS.4D



## 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 white space 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"

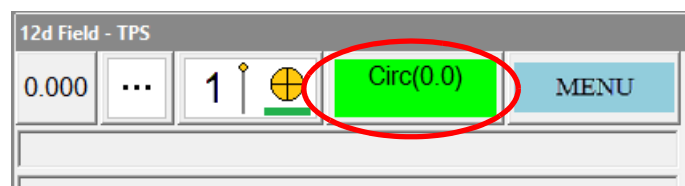
When the user starts 12dField only the target definitions related to the selected instrument will be loaded/shown.

#### 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"

### 3rd 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  $\approx$  means approximately equals

Topcon/Trimble  $\approx$  Leica - 34.4, hence Leica  $\approx$  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
GPHIP	0.0	-34.4		GPHIP
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:

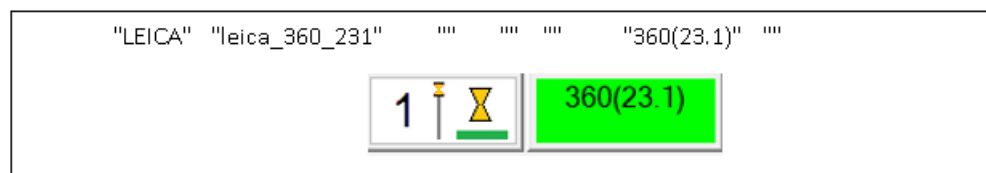


For information on TPS settings as Bitmaps see [15.5.2.5 TPS Settings Bitmaps](#).

**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**

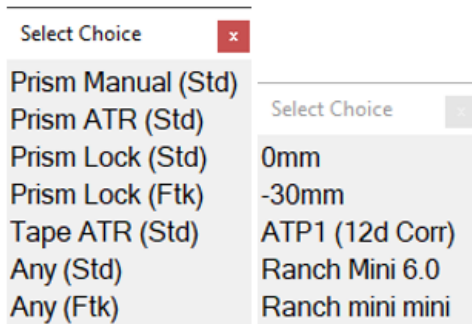
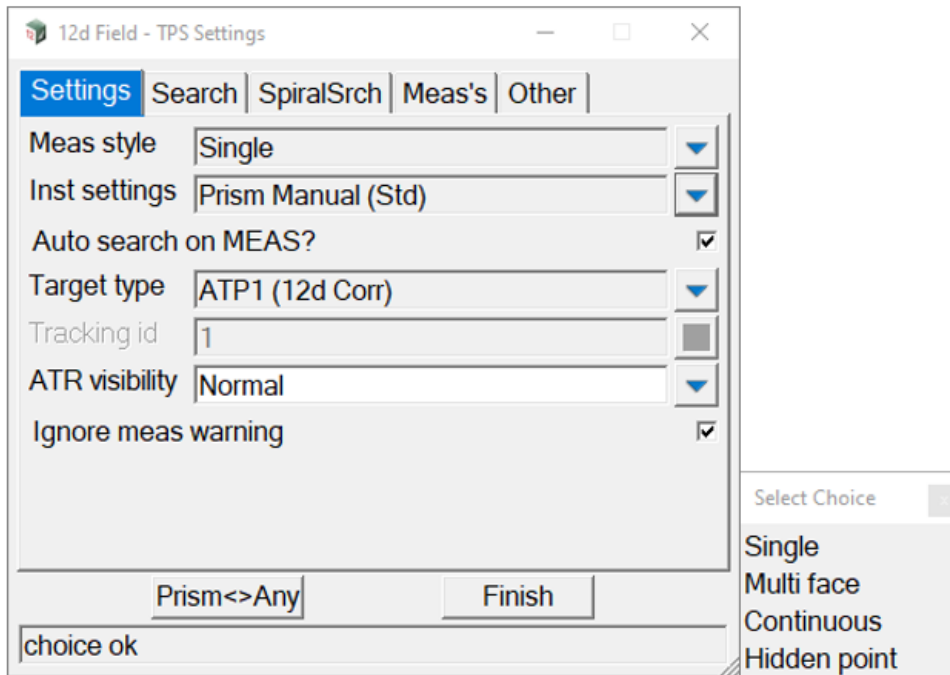
Informational only

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 GPRI Circ"	"-34.4"	"50"	"PRISM"	"GPRI -34.4"	"Survey manager"
"TOPCON"	"Leica GR24 360"	"-11.3"	"47"	"PRISM360"	"GR24 -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_m17p5"	""	""	""	"Mini 17.5"	""

Continue to next section [Continue to next section or return to 15.3 Starting and Configuring 12d Field.](#) or return to [15.3 Starting and Configuring 12d Field.](#)

### 15.8.2.1.0.1 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)*

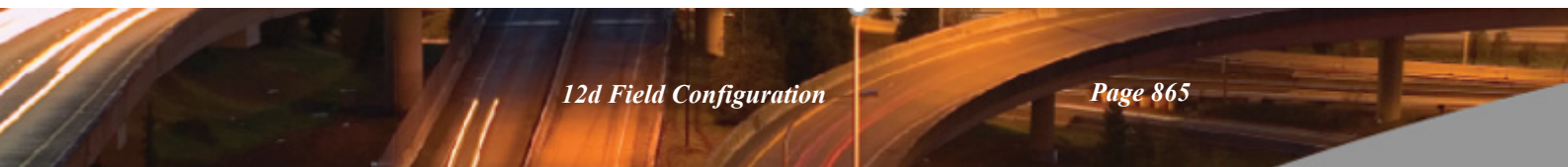
*Tape ATR (Std)*

*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



## 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\\_DLG\\_USER\\_KEYS.4D file format](#)
- See [15.8.4.3 12dF\\_USER\\_VALUES\\_PANEL\\_CONFIG.4D file format](#)
- See [15.8.4.4 12dF\\_INFO\\_PAGE\\_CONFIG.4D file format](#)
- See [15.8.4.5 12dF\\_NAV\\_PAGE\\_CONFIG.4D file format](#)
- See [15.8.4.6 12dF\\_USER\\_TEXT\\_NAV.4D file format](#)
- See [15.8.4.7 12dF\\_PICKUP\\_MESSAGE\\_LINE\\_CONFIG.4D file format](#)
- See [15.8.4.8 12dF\\_SETOUT\\_MESSAGE\\_LINE\\_CONFIG.4D file format](#)
- See [15.8.4.9 12dF\\_USER\\_TEXT\\_PICKUP\\_MESSAGE.4D file format](#)
- See [15.8.4.10 12dF\\_USER\\_TEXT\\_SETOUT\\_MESSAGE.4D file format](#)
- See [15.8.4.11 12dF\\_USER\\_TEXT\\_BOX\\_INFO.4D file format](#)
- See [15.8.4.12 12DF\\_SDR\\_PICKUP\\_PANEL\\_BUTTON\\_LAYOUT.4D file format](#)

### 15.8.4.1 12dF\_AUTO\_START\_PANEL.4D file format

### 15.8.4.2 12dF\_DLG\_USER\_KEYS.4D file format

### 15.8.4.3 12dF\_USER\_VALUES\_PANEL\_CONFIG.4D file format

### 15.8.4.4 12dF\_INFO\_PAGE\_CONFIG.4D file format

The configuration format of the navigation and information pages are identical, please see [15.8.4.5 12dF\\_NAV\\_PAGE\\_CONFIG.4D file format](#) for details.

### 15.8.4.5 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
```

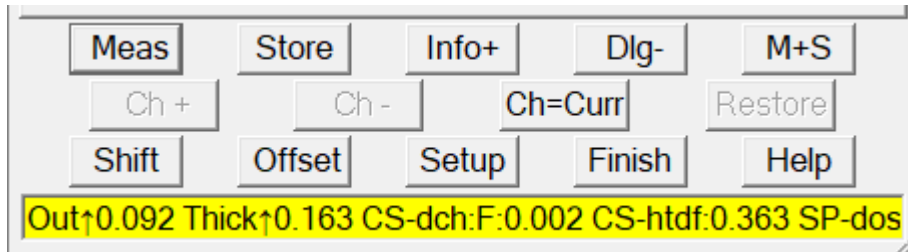
Lines that do not have 2 words or contain an unknown attribute are ignored.

There is no definitive list available of attributes that can be added to the navigation tab/views at this point in time.

#### 15.8.4.6 12dF\_USER\_TEXT\_NAV.4D file format

### 15.8.4.7 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
.
.
.
```

This file only controls the adding of attributes to the message line, for extra functionality customizing the display of the attributes see [15.8.4.9 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 [15.8.4.7.1 12dF\\_PICKUP\\_MESSAGE\\_LINE\\_CONFIG.4D supported attributes](#).

### 15.8.4.7.1 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

#### 15.8.4.7.2 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

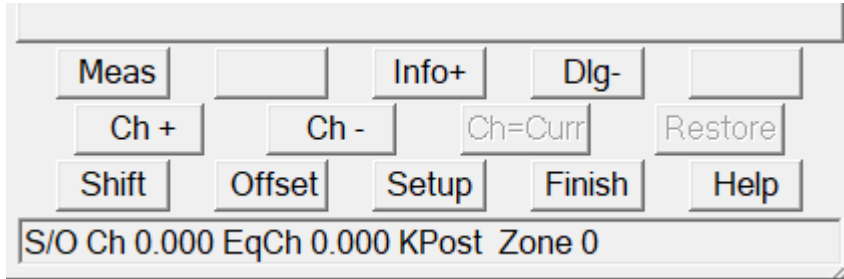
delta chainage to actual chainage: **pu\_mp\_cs\_dch >> pu\_cs\_ch**

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**

### 15.8.4.8 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 [15.8.4.8.1 12dF\\_SETOUT\\_MESSAGE\\_LINE\\_CONFIG.4D supported attributes](#).

### 15.8.4.8.1 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

### 15.8.4.9 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 [15.8.4.7 12dF\\_PICKUP\\_MESSAGE\\_LINE\\_CONFIG.4D file format](#) for the basics of adding pickup attributes to panel message lines and for supported attributes see [15.8.4.7.1 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: "
//
```

### 15.8.4.10 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 [15.8.4.8 12dF\\_SETOUT\\_MESSAGE\\_LINE\\_CONFIG.4D file format](#) for the basics of adding setout attributes to panel message lines and for supported attributes see [15.8.4.8.1 12dF\\_SETOUT\\_MESSAGE\\_LINE\\_CONFIG.4D supported attributes](#).

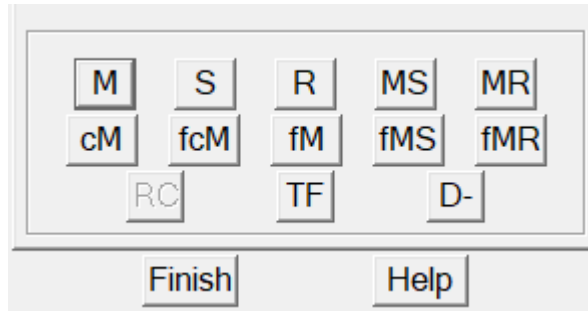
The default file has the details for configuring attributes.

```
// 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"
//
```

#### 15.8.4.11 12dF\_USER\_TEXT\_BOX\_INFO.4D file format

## 15.8.4.12 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](#)
- See [15.8.5.2 12dF\\_GLOBAL\\_CONFIG.4D file format](#)
- See [15.8.5.3 12dF\\_CUSTOMER\\_CONFIG.4D file format](#)
- See [15.8.5.4 12dF\\_WORKING\\_CONFIG.4D file format](#)
- See [15.8.5.5 12dF\\_EXCLUDED\\_ATTRIBUTES.4D file format](#)
- See [15.8.5.6 12dF\\_HOTKEY\\_BARS.4D file format](#)
- See [15.8.5.7 12dF\\_USER\\_KEYS.4D file format](#)
- See [15.8.5.8 12dF\\_JOB\\_CATEGORIES.4D file format](#)
- See [15.8.5.9 12dF\\_JOB\\_DESCRIPTIONS.4D file format](#)
- See [15.8.5.10 12dF\\_JOB\\_LOT\\_NUMBERS.4D file format](#)
- See [15.8.5.11 12dF\\_SURFACE\\_SHIFTS.4D file format](#)
- See [15.8.5.12 12dF\\_VIEWS.4D file format](#)

### 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 **12dF\_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
```

#### 15.8.5.2 12dF\_GLOBAL\_CONFIG.4D file format

#### 15.8.5.3 12dF\_CUSTOMER\_CONFIG.4D file format

#### 15.8.5.4 12dF\_WORKING\_CONFIG.4D file format

#### 15.8.5.5 12dF\_EXCLUDED\_ATTRIBUTES.4D file format

15.8.5.6 12dF\_HOTKEY\_BARS.4D file format

15.8.5.7 12dF\_USER\_KEYS.4D file format

15.8.5.8 12dF\_JOB\_CATEGORIES.4D file format

15.8.5.9 12dF\_JOB\_DESCRIPTIONS.4D file format

15.8.5.10 12dF\_JOB\_LOT\_NUMBERS.4D file format

15.8.5.11 12dF\_SURFACE\_SHIFTS.4D file format

15.8.5.12 12dF\_VIEWS.4D file format

15.8.5.13 12d Field and User\_Toolbars.4d

## 15.9 12d Field Utilities

**Position of menu:** Survey =>12d Field =>12d Field Utilities

The 12d Field Utilities walk right menu is:

12d Field Utilities <span style="float: right; color: red;">x</span>	See
Close 12d Field	<a href="#">15.9.1 Close 12d Field</a>
Check control bar position	<a href="#">15.9.2 Check Control Bar Position</a>
Licensing <span style="float: right;">▶</span>	<a href="#">15.9.3 Licensing</a>
Convert geoid to points	<a href="#">15.9.4 Convert Geoid to Points</a>

### 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:

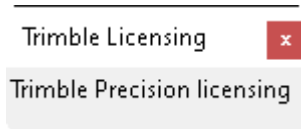
1. The position of the control bar is checked and if fully or partially outside the **12d Model** screen the control bar will be moved to the centre of the **12d Model** screen.
2. Then, moved or unmoved, the **12d Field** control bar will be refreshed and brought to the front of the **12d Model** screen.

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

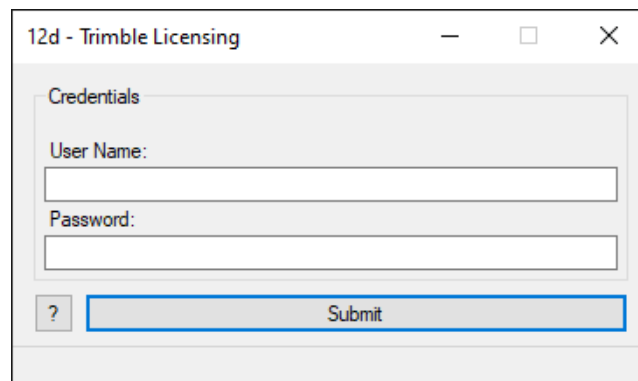
[15.9.3.1 Trimble Precision Licensing](#)

### 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*.

A screenshot of a dialog box titled '12d - Trimble Licensing'. It contains a 'Credentials' section with two input fields: 'User Name:' and 'Password:'. Below the fields is a 'Submit' button and a small question mark icon.

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](#).

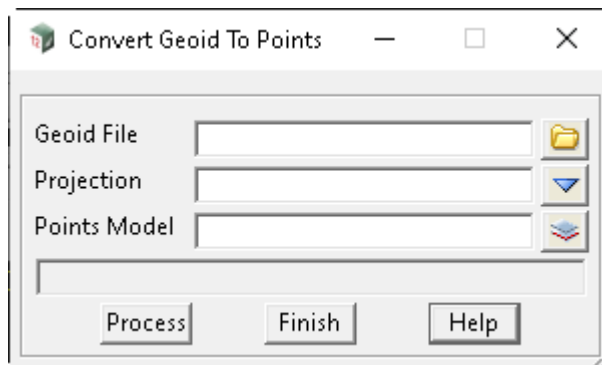


## 15.9.4 Convert Geoid to Points

**Position of option on menu:** Survey =>Field 12d=>12d Field Utilities =>GNSS Localisation =>Convert geoid to points

Purpose

- 1.Convert \*.dat files from (<https://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
<b>Geoid File</b>	file box		*.dat
<b>Projection</b>	projection box	current projection	available projections

*Select downloaded files from ftp site <ftp://ftp.ga.gov.au/geodesy-outgoing/gravity/ausgeoid>.*

*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.*

<b>Points Model</b>	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

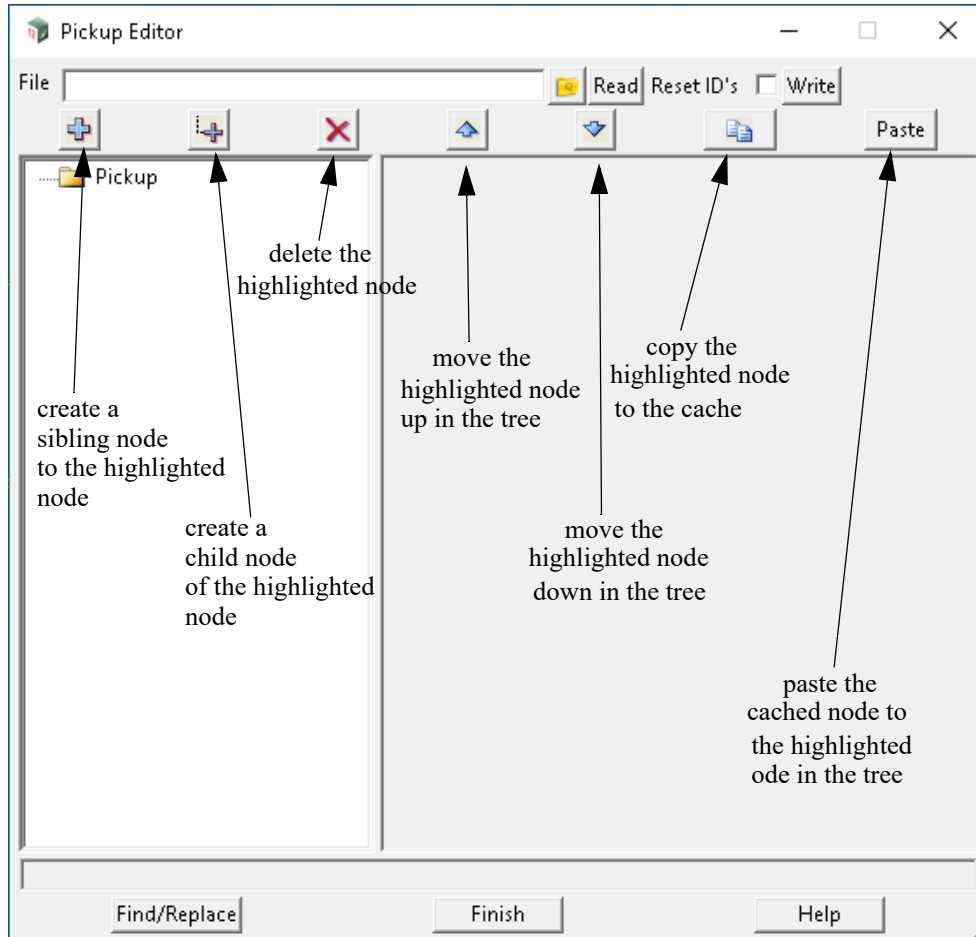
12d Field Codes	See
12d Field Codes Editor	<a href="#">15.10.1 12d Field Codes Editor</a>
12d Field Favourites	<a href="#">15.10.2 12d Field Favourites</a>
Mapfile to 12d Pickup Codes	<a href="#">15.10.3 Mapfile to 12d Pickup Codes</a>
Adac XSD to 12d Pickup Codes	<a href="#">15.10.4 ADAC XSD to 12d Pickup Codes</a>
12d Pickup Codes to 4dm	<a href="#">15.10.5 12d Pickup Codes to Macro</a>
Filter linestyles/symbols via mapfile	<a href="#">15.10.6 Filter Linestyles/Symbols via Mapfile</a>
Save binary linestyles	<a href="#">15.10.7 Save Binary Linestyles</a>
Save binary symbols	<a href="#">15.10.8 Save Binary Symbols</a>

## 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.

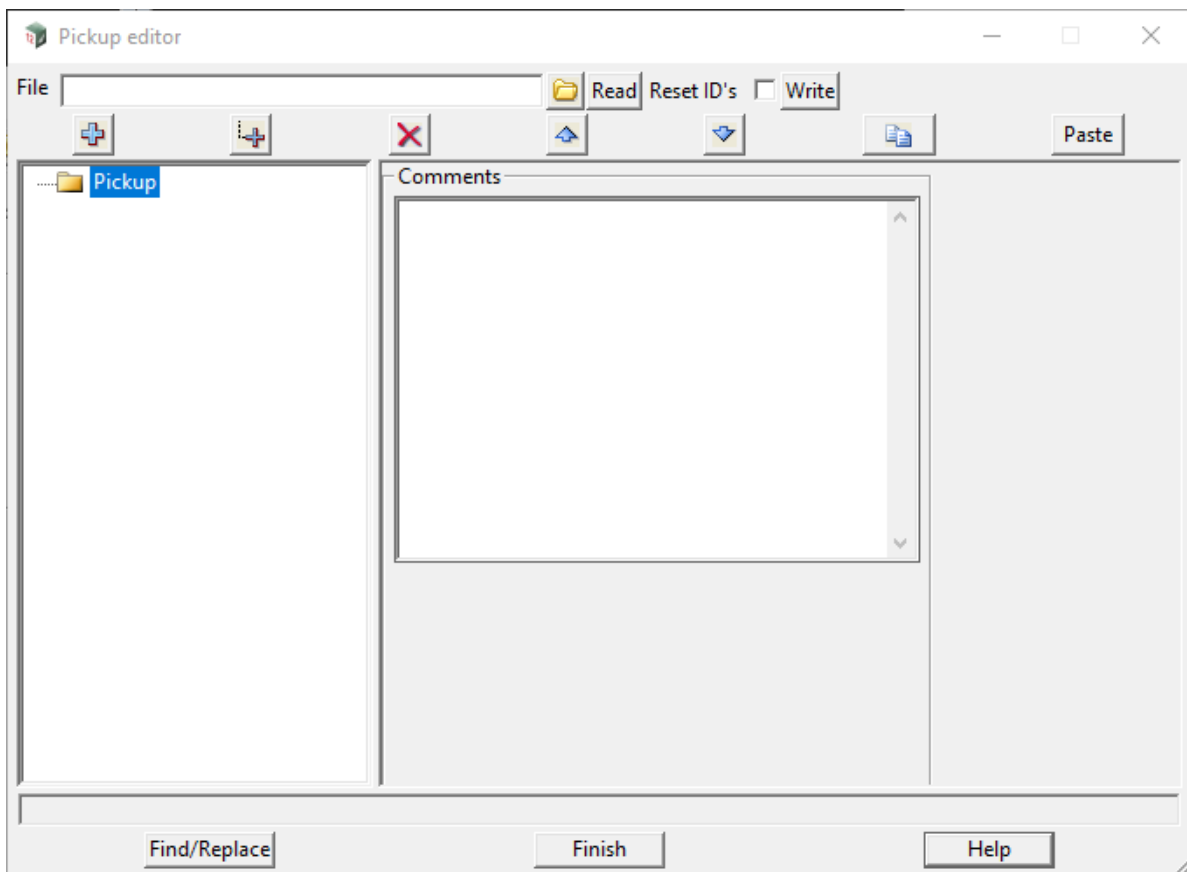
 Moves the current highlighted node in the tree up.

 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.

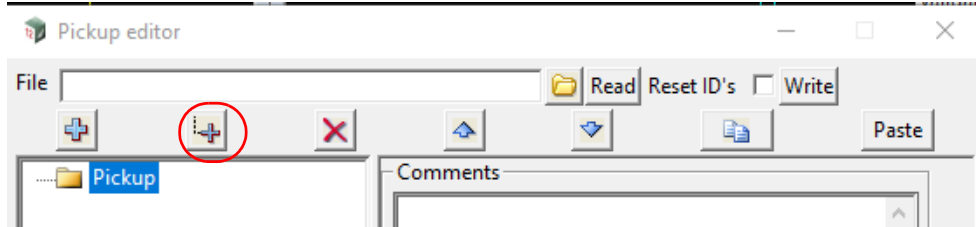


Text can be entered into the **Comments** area and it will be saved with the **Pickup Codes File**.

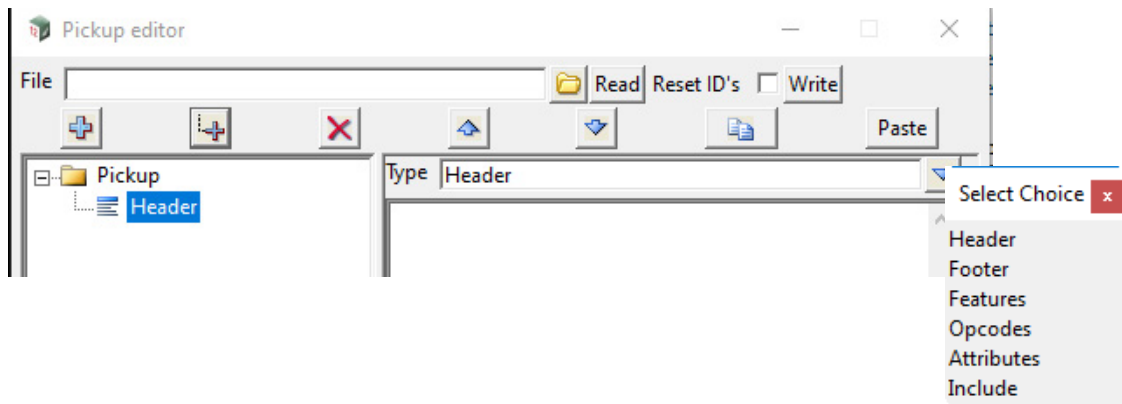
For information on using the panel, continue to next section [15.10.1.1 Defining Pickup Codes](#), or return to [15.3 Starting and Configuring 12d Field](#).

### 15.10.1.1 Defining Pickup Codes

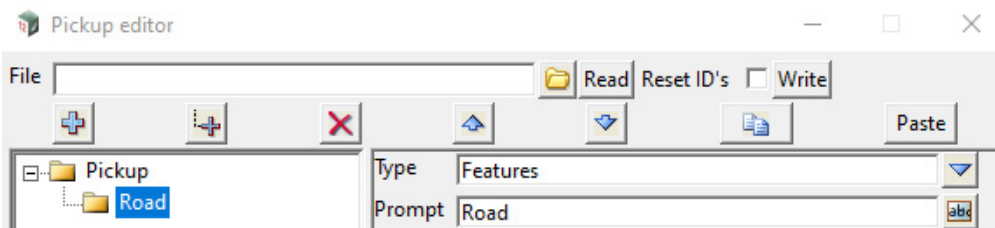
At the first level under **Pickup**, there are a number of different **Types of nodes** that can be added to the **Pickup Codes File** by first clicking on and highlighting the **Pickup** node, and then clicking on the **Add a Child** icon .



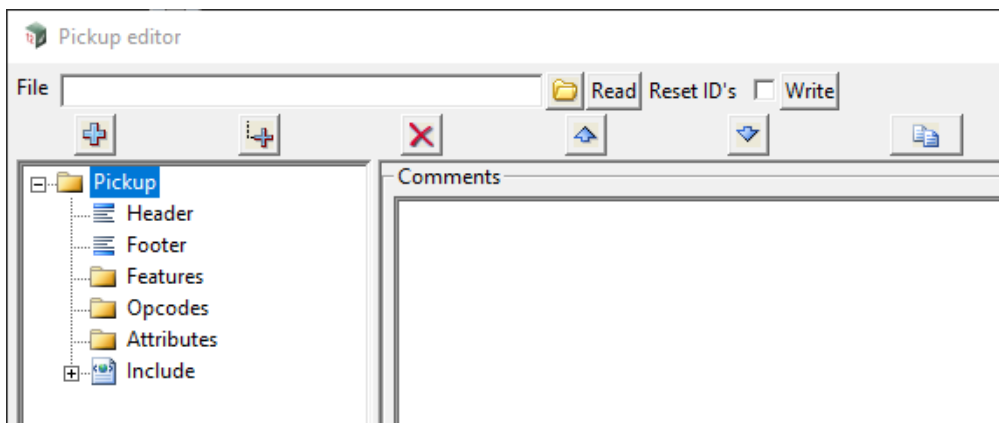
By default a **Header Type** is created but this can then be changed by clicking on the choice icon for the **Type** field and selecting from the pop-up list.



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**.



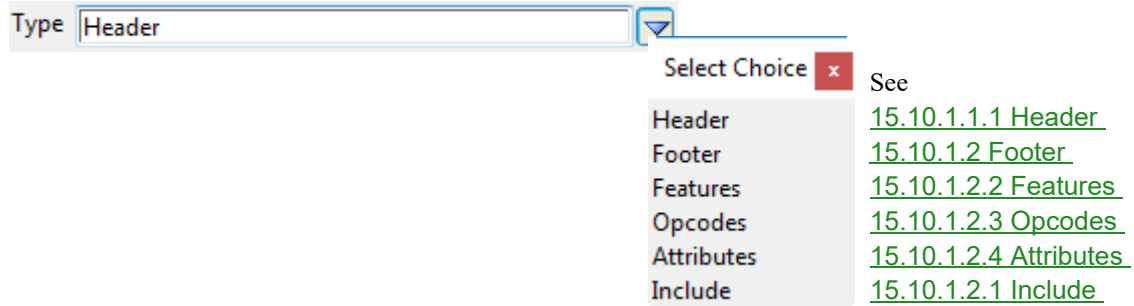
Or an example with one of each Type with the type of Type as the Prompt:



**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.

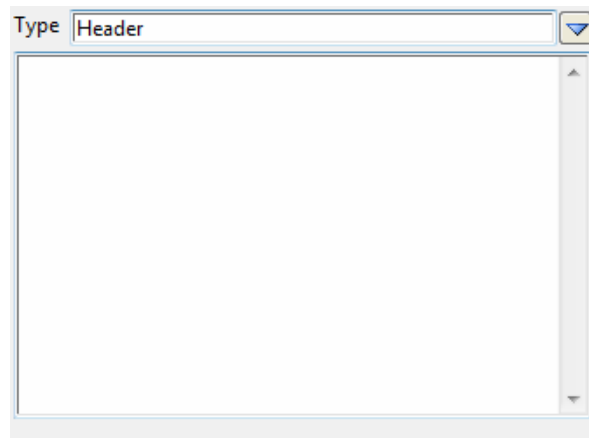
For information on each of the **Types**, see:





### 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.

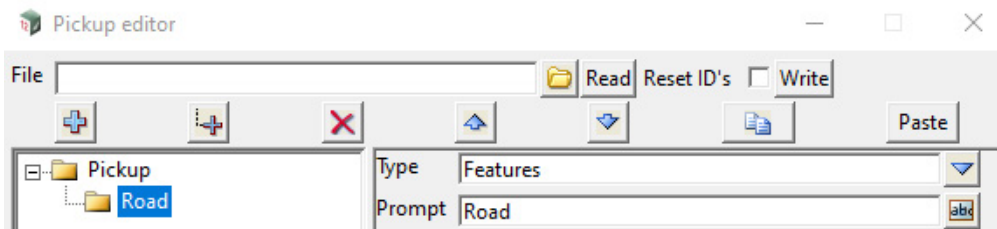
Given that a **Features** can contain a **Features Group** which can contain a **Features Group** then a tree structure can be defined under any **Features**.

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

Field Description	Type	Defaults	Pop-Up
<b>Prompt</b>	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**:

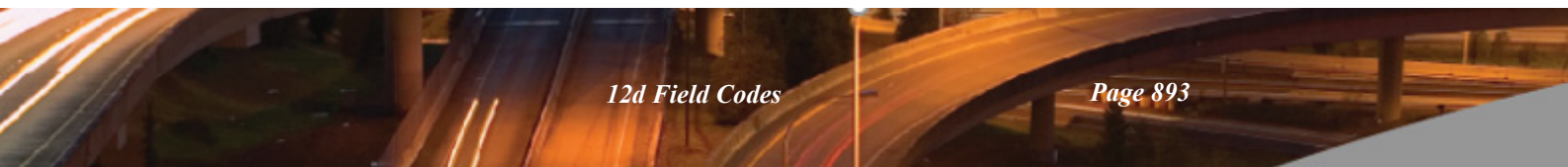


#### Important Note

To 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

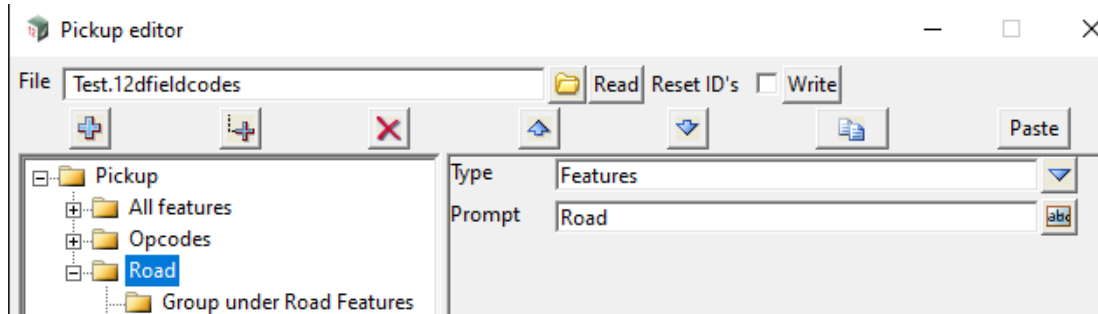
Select Choice	See
Feature	<a href="#">15.10.1.2.2.1.1 Feature</a>
Group	<a href="#">15.10.1.2.2.1 Features Group</a>
Include	<a href="#">15.10.1.2.1 Include</a>



### 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
<b>Prompt</b>	input		
<i>Cosmetic name for the Features Group.</i>			

### Allowed Children of a Features Group

Select Choice	See
Feature	<a href="#">15.10.1.2.2.1.1 Feature</a>
Group	<a href="#">15.10.1.2.2.1 Features Group</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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

<b>Prompt</b>	text box		
---------------	----------	--	--

*Name to be displayed when this Feature is used during 12d Field Pickup. For example, Edge of Bitumen or EB.*

<b>Output</b>	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**.*

<b>Object</b>	text box		
---------------	----------	--	--

*If **not blank**, the value to be used to define a set of attributes.  
If **blank** it uses the value in **Output**.*

<b>Message</b>	text box		
----------------	----------	--	--

*A message to display when picking up the feature.*

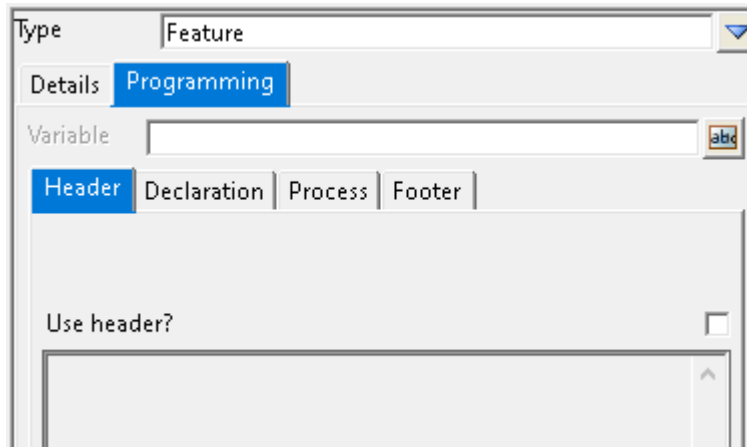
<b>Default</b>	text box		
----------------	----------	--	--

*Default value.*

<b>Breakline</b>	choice box		Both, Point, Line
------------------	------------	--	-------------------

*Breakline type for the created feature string.*

## Programming tab



See [15.10.1.2.5 Programming](#).

## Allowed Children of a Feature

Select Choice	See
Group	<a href="#">15.10.1.2.2.1.2 Feature Group</a>
Choice group	<a href="#">15.10.1.2.2.1.3 Choice Group Attribute</a>
Opcode	<a href="#">15.10.1.2.2.1.6 Opcode</a>
Feature	<a href="#">15.10.1.2.2.1.7 Feature Attribute</a>
Real	<a href="#">15.10.1.2.2.1.8 Real Attribute</a>
Text	<a href="#">15.10.1.2.2.1.9 Text Attribute</a>
Integer	<a href="#">15.10.1.2.2.1.10 Integer Attribute</a>
Measure	<a href="#">15.10.1.2.2.1.11 Measure Attribute</a>
Choice	??
Include	<a href="#">15.10.1.2.1 Include</a>



## 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
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name for the group.*

<b>Optional?</b>	tick box		
------------------	----------	--	--

*If ticked, filling out the group is optional.*

*If not ticked, at least one field in the group must be filled out.*

<b>Bundle?</b>	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

Select Choice	See
Group	<a href="#">15.10.1.2.2.1.2 Feature Group</a>
Choice group	<a href="#">15.10.1.2.2.1.3 Choice Group Attribute</a>
Feature	<a href="#">15.10.1.2.2.1.7 Feature Attribute</a>
Real	<a href="#">15.10.1.2.2.1.8 Real Attribute</a>
Text	<a href="#">15.10.1.2.2.1.9 Text Attribute</a>
Integer	<a href="#">15.10.1.2.2.1.10 Integer Attribute</a>
Measure	<a href="#">15.10.1.2.2.1.11 Measure Attribute</a>
Choice	??
Include	<a href="#">15.10.1.2.1 Include</a>

### 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

<b>Prompt</b>		input		
---------------	--	-------	--	--

*Cosmetic name to be displayed during 12d field pickup*

<b>Output</b>		input		
---------------	--	-------	--	--

*Optional value to output to the pickup file - uses prompt if undefined*

<b>Message</b>		input		
----------------	--	-------	--	--

*A message to display when displaying the choice group*

<b>Default</b>		input		
----------------	--	-------	--	--

*Default value*

<b>Data type</b>		choice box		
------------------	--	------------	--	--

Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

*How the attribute should be attached*

<b>Optional?</b>		tick box		
------------------	--	----------	--	--

*If **ticked**, this attribute is treated as optional.  
If **not ticked**, this attribute must be filled out.*

<b>Bundle?</b>		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

Select Choice	See
Group	<a href="#">15.10.1.2.2.1.4 Choice Group</a>
Choice data	<a href="#">15.10.1.2.2.1.5 Choice Data</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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**.

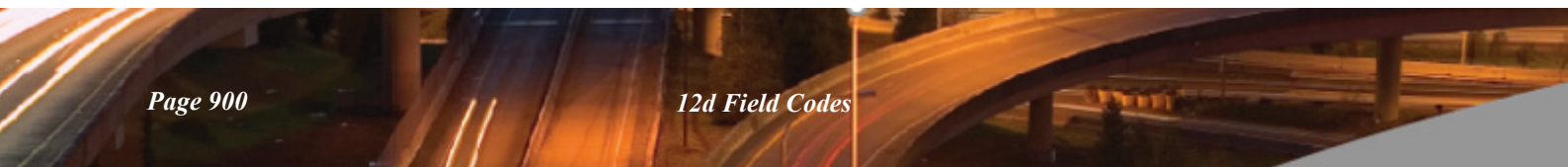
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Prompt</b>	input		
<i>Cosmetic name of the group to display.</i>			

### Allowed Children under a Choice Group

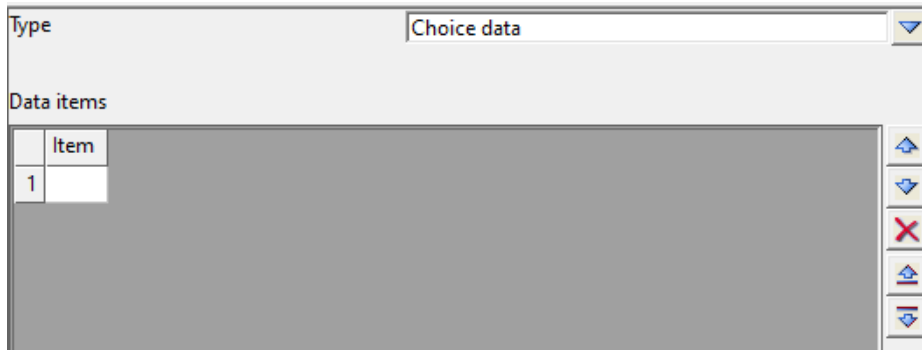
Select Choice	See
Group	<a href="#">15.10.1.2.2.1.4 Choice Group</a>
Choice data	<a href="#">15.10.1.2.2.1.5 Choice Data</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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**

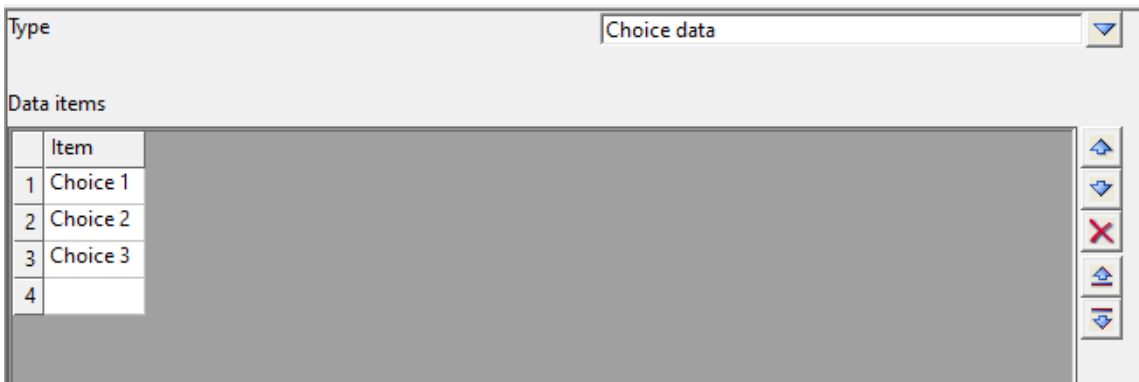
*Grid.*

**Item**

column of texts

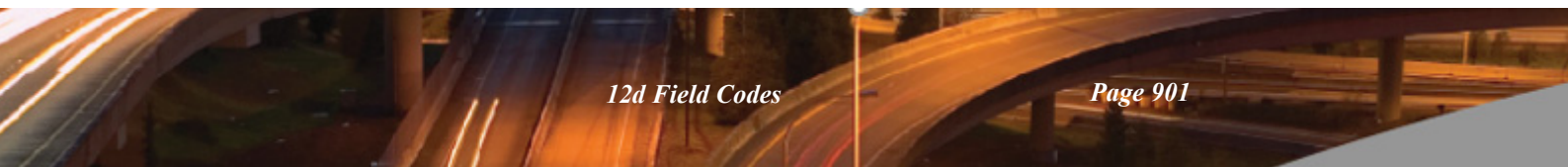
*Values for a Choice.*

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
<b>Prompt</b> <i>Cosmetic name for the opcode.</i>	text box		
<b>Command</b> <i>Opcode to be recorded in the attribute. For the choice of Opcodes, see <a href="#">26.8 12d Survey Opcode Summary</a>.</i>	opcode box		
<b>Message</b> <i>An optional message to display when entering the opcode.</i>	input		
<b>Pt desc</b> <i>Specifies if there is a point description or not.</i>	choice box	No pt desc, Pt desc, Null pt desc	
<b>Optional</b> <i>If ticked, this opcode attribute is optional. If not ticked, this opcode attribute must be entered in the field.</i>	tick box		

#### Allowed Children under an Opcode

Select Choice	See
Feature	<a href="#">15.10.1.2.2.1.7 Feature Attribute</a>
Real	<a href="#">15.10.1.2.2.1.8 Real Attribute</a>
Integer	<a href="#">15.10.1.2.2.1.10 Integer Attribute</a>
Text	<a href="#">15.10.1.2.2.1.9 Text Attribute</a>
Choice	<a href="#">15.10.1.2.2.1.12 Choice Attribute</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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 screenshot shows a configuration panel for a Feature Attribute. At the top, the 'Type' is set to 'Feature'. Below this, there are two tabs: 'Details' and 'Programming'. The 'Details' tab is active, showing several input fields and checkboxes. The fields are: 'Prompt', 'Output', 'Message', and 'Default', each with a small 'abc' button to its right. The 'Data type' is set to 'Vertex' in a dropdown menu. The 'Optional?' checkbox is checked, and the 'Bundle?' checkbox is unchecked.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Details tab

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Output</b>	input		
---------------	-------	--	--

*Optional value to output to the pickup file - uses prompt if undefined.*

<b>Message</b>	input		
----------------	-------	--	--

*A message to display when picking up the code.*

<b>Default</b>	input		
----------------	-------	--	--

*Default value.*

<b>Data type</b>	choice box		
------------------	------------	--	--

Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

*How the attribute should be attached.*

<b>Optional?</b>	tick box		
------------------	----------	--	--

*If **ticked**, this attribute is treated as optional.*

*If **not ticked**, this attribute must be filled out*

<b>Bundle?</b>	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 screenshot shows a configuration window for a 'Real' attribute. The 'Type' dropdown is set to 'Real'. The 'Details' tab is selected, showing the following fields and their values:

- Type: Real
- Prompt: (empty text box)
- Output: (empty text box)
- Message: (empty text box)
- Default: (empty text box)
- Minimum value: (empty text box)
- Maximum value: (empty text box)
- Data type: Vertex
- Optional?:
- Bundle?:

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

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

### Details tab

<b>Prompt</b>		text box		
---------------	--	----------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Output</b>		text box		
---------------	--	----------	--	--

*Optional value to output to the pickup file - uses prompt if undefined.*

<b>Message</b>		text box		
----------------	--	----------	--	--

*A message to display when picking up the code.*

<b>Default</b>		text box		
----------------	--	----------	--	--

*Default value.*

<b>Minimum value</b>		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.*

<b>Maximum value</b>		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.*

<b>Data type</b>		choice box		
------------------	--	------------	--	--

Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment

*How the attribute should be attached.*

<b>Optional?</b>		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
<b>Details tab</b>			
<b>Prompt</b>	text box		
<i>Cosmetic name to be displayed during 12d field pickup.</i>			
<b>Output</b>	text box		
<i>Optional value to output to the pickup file - uses prompt if undefined.</i>			
<b>Message</b>	text box		
<i>A message to display when picking up the code.</i>			
<b>Minimum value</b>	integer box		
<i>If <b>not blank</b>, the entered value must be greater than or equal to this value.</i>			
<i>If <b>blank</b> then there is no minimum value restriction.</i>			
<b>Maximum value</b>	integer box		
<i>If <b>not blank</b>, the entered value must be less than or equal to this value.</i>			
<i>If <b>blank</b> then there is no maximum value restriction.</i>			
<b>Default</b>	text box		
<i>Default value.</i>			
<b>Data type</b>	choice box		Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment
<i>How the attribute should be attached.</i>			
<b>Optional?</b>	tick box		
<i>If <b>ticked</b>, this attribute is treated as optional.</i>			
<i>If <b>not ticked</b>, this attribute must be filled out.</i>			

**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

<b>Prompt</b>	input		
<i>Cosmetic name to be displayed during 12d field pickup.</i>			
<b>Output</b>	input		
<i>Optional value to output to the pickup file - uses prompt if undefined.</i>			
<b>Message</b>	input		
<i>A message to display when picking up the code.</i>			
<b>Default</b>	input		
<i>Default value.</i>			
<b>Horizontal angle</b>	choice box		Off, On - Required, On - Optional
<i>If the horizontal angle is to be captured.</i>			
<b>Vertical angle</b>	choice box		Off, On - Required, On -Optional
<i>If the vertical angle is to be captured.</i>			
<b>Slope distance</b>	choice box		Off, On - Required, On -Optional
<i>If the slope distance is to be captured.</i>			
<b>Target height</b>	choice box		Off, On - Required, On - Optional

*If the target height is required.*

<b>Data type</b>	choice box	Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment
------------------	------------	--

*How the attribute should be attached.*

<b>Optional?</b>	tick box
------------------	----------

*If **ticked**, this attribute is treated as optional.*

*If **not ticked**, this attribute must be filled out.*

<b>Bundle?</b>	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**

<b>Prompt</b>	input		
<i>Cosmetic name to be displayed during 12d field pickup.</i>			
<b>Output</b>	input		
<i>Optional value to output to the pickup file - uses prompt if undefined.</i>			
<b>Message</b>	input		
<i>A message to display when picking up the code.</i>			
<b>Default</b>	input		
<i>Default value.</i>			
<b>Data type</b>	choice box		Vertex, Next Segment, Prev Segment, String, Prompt, Prompt Segment
<i>How the attribute should be attached.</i>			
<b>Optional?</b>	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.


Type	Opcodes	
Prompt	Opcodes	

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

Field Description	Type	Defaults	Pop-Up
<b>Prompt</b>	input		

*Cosmetic name of the opcodes group.*



### Allowed Children under an Opcodes

Select Choice 	See
Group	<a href="#">15.10.1.2.3.1 Opcodes Group</a>
OpCode	<a href="#">15.10.1.2.3.2 OpCode</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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

Type	Group	
Prompt		

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name of the group of opcodes.*

#### Available children types

Select Choice	See
Group	<a href="#">15.10.1.2.3.1 Opcodes Group</a>
OpCode	<a href="#">15.10.1.2.3.2 OpCode</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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
<b>Prompt</b> <i>Cosmetic name to be displayed during 12d field pickup.</i>	input		
<b>Output</b> <i>Optional value to output to the pickup file - uses prompt if undefined.</i>	input		
<b>Message</b> <i>A message to display when entering the opcode.</i>	input		
<b>Pt desc</b> <i>Point description.</i>	choice box	No pt desc, Pt desc, Null pt desc	
<b>Optional?</b> <i>If <b>ticked</b>, this opcode is treated as optional. If <b>not ticked</b>, it is required.</i>	tick box		

#### Available children types

Select Choice	See
Feature	<a href="#">15.10.1.2.3.3 Feature Attribute (OpCode)</a>
Real	<a href="#">15.10.1.2.3.4 Real Attribute (OpCode)</a>
Integer	<a href="#">15.10.1.2.3.5 Integer Attribute (OpCode)</a>
Text	<a href="#">15.10.1.2.3.6 Text Attribute (OpCode)</a>
Choice	<a href="#">15.10.1.2.3.7 Choice Attribute (OpCode)</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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 screenshot shows a configuration panel for a 'Feature' attribute. At the top, the 'Type' dropdown menu is set to 'Feature'. Below this, a 'Details' section contains four items: 'Prompt', 'Message', 'Default', and 'Optional?'. Each of the first three items has a text input field followed by a small button with the '12d' logo. The 'Optional?' item has a checked checkbox.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Message</b>	input		
----------------	-------	--	--

*A message to display when entering the opcode attribute.*

<b>Default</b>	input		
----------------	-------	--	--

*Default value for the attribute.*

<b>Optional?</b>	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 screenshot shows a configuration panel for a Real Attribute. At the top, the 'Type' dropdown menu is set to 'Real'. Below this, a 'Details' section contains three input fields: 'Prompt', 'Message', and 'Default'. Each input field has a small 'abc' button to its right. At the bottom of the 'Details' section, there is a checkbox labeled 'Optional?' which is currently checked.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Message</b>	input		
----------------	-------	--	--

*A message to display when entering the opcode attribute.*

<b>Default</b>	input		
----------------	-------	--	--

*Default value for the attribute.*

<b>Optional?</b>	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 screenshot shows a configuration panel for an Integer Attribute. At the top, the 'Type' is set to 'Integer'. Below this, a 'Details' section contains four rows: 'Prompt', 'Message', 'Default', and 'Optional?'. Each of the first three rows has a text input field and a small 'abc' button to its right. The 'Optional?' row has a checked checkbox.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Message</b>	input		
----------------	-------	--	--

*A message to display when entering the opcode attribute.*

<b>Default</b>	input		
----------------	-------	--	--

*Default value for the attribute.*

<b>Optional?</b>	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 screenshot shows a configuration window for a 'Text' attribute. At the top, the 'Type' dropdown is set to 'Text'. Below this is a 'Details' section with four rows: 'Prompt', 'Message', 'Default', and 'Optional?'. Each of the first three rows has a text input field followed by a small button labeled 'abc'. The 'Optional?' row has a checked checkbox.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Prompt</b>	input		
---------------	-------	--	--

*Cosmetic name to be displayed during 12d field pickup.*

<b>Message</b>	input		
----------------	-------	--	--

*A message to display when entering the opcode attribute.*

<b>Default</b>	input		
----------------	-------	--	--

*Default value for the attribute.*

<b>Optional?</b>	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 screenshot shows a configuration panel for a 'Choice' attribute. At the top, the 'Type' dropdown is set to 'Choice'. Below this, a 'Details' section contains four rows: 'Prompt', 'Message', 'Default', and 'Optional?'. Each of the first three rows has a text input field followed by a small button labeled 'abc'. The 'Optional?' row has a checked checkbox.

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



Field Description	Type	Defaults	Pop-Up
<b>Prompt</b> <i>Cosmetic name to be displayed during 12d field pickup.</i>	input		
<b>Message</b> <i>A message to display when entering the opcode attribute.</i>	input		
<b>Default</b> <i>Default value for the attribute.</i>	input		
<b>Optional?</b> <i>If <b>ticked</b>, this attribute is treated as optional. If <b>not ticked</b>, it is required.</i>	tick box		

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.


Type	Attributes	
Prompt		

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

Field Description	Type	Defaults	Pop-Up
<b>Prompt</b>	input		

*Cosmetic name for the group of attributes.*



#### Available children types

Select Choice 	See
Group	<a href="#">15.10.1.2.4.1 Group (Attributes)</a>
Attribute	<a href="#">15.10.1.2.4.2 Attribute</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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.

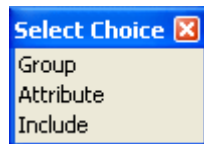
Type	Group	
Prompt		

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

Field Description	Type	Defaults	Pop-Up
<b>Prompt</b>	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

<b>Prompt</b>	input		
<i>Cosmetic name to be displayed during 12d field pickup.</i>			
<b>Output</b>	input		
<i>Optional value to output to the pickup file - uses prompt if undefined.</i>			
<b>Object</b>	input		
<i>Optional value to be used to define a set of attributes - uses output if undefined.</i>			
<b>Message</b>	input		
<i>A message to display when picking up the code.</i>			
<b>Default</b>	input		
<i>Default value.</i>			

#### Programming tab

See [15.10.1.2.5 Programming](#)

Available children types

Select Choice	See
Feature	<a href="#">15.10.1.2.2.1.7 Feature Attribute</a>
Real	<a href="#">15.10.1.2.2.1.8 Real Attribute</a>
Text	<a href="#">15.10.1.2.2.1.9 Text Attribute</a>
Integer	<a href="#">15.10.1.2.2.1.10 Integer Attribute</a>
Measure	<a href="#">15.10.1.2.2.1.11 Measure Attribute</a>
Choice	<a href="#">15.10.1.2.2.1.12 Choice Attribute</a>
Include	<a href="#">15.10.1.2.1 Include</a>

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 screenshot shows a software window with a 'Details' tab and a 'Programming' sub-tab. Below the sub-tab is a 'Variable' input field. Underneath are four tabs: 'Header', 'Declaration', 'Process', and 'Footer'. Below the tabs is a 'Use header?' checkbox and a large text area for programming code.

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

Field Description	Type	Defaults	Pop-Up
<b>Variable</b>	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
<b>Use header?</b>	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 screenshot shows a software interface with four tabs: 'Header', 'Declaration', 'Process', and 'Footer'. The 'Declaration' tab is highlighted with a red circle. Below the tabs, there is a checkbox labeled 'Use declaration?' and a large empty text area for entering macro code.

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

Field Description	Type	Defaults	Pop-Up
<b>Use declaration?</b>	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 screenshot shows a software interface with four tabs at the top: 'Header', 'Declaration', 'Process', and 'Footer'. The 'Process' tab is highlighted with a red circle. Below the tabs, there is a section labeled 'Use process?' with a small square checkbox to its right. Underneath this is a large, empty rectangular text area with a vertical scrollbar on the right side, intended for entering macro code.

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

Field Description	Type	Defaults	Pop-Up
<b>Use process?</b>	tick box		

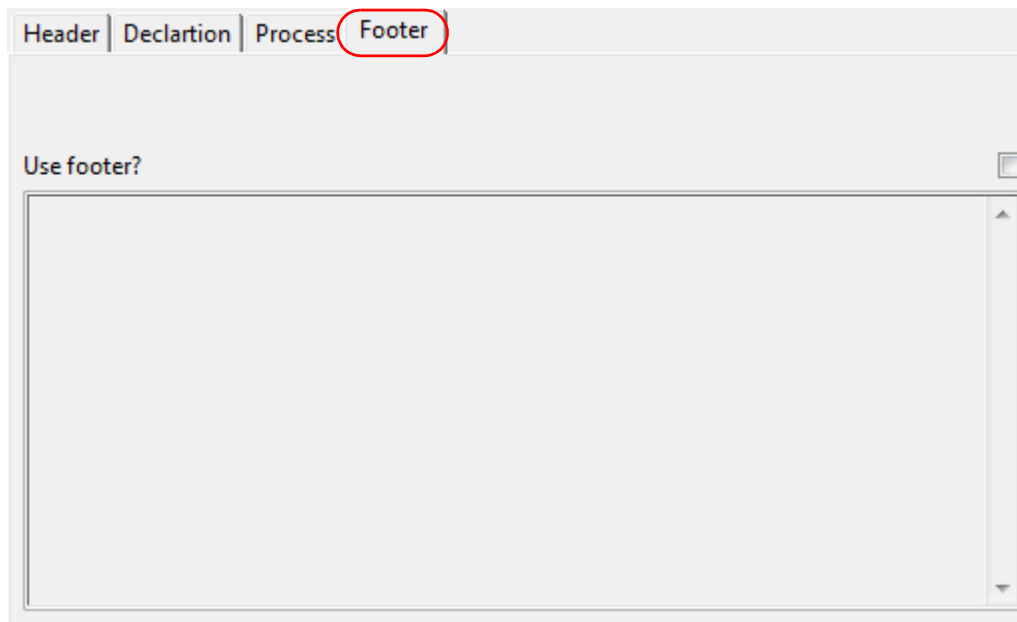
*If **ticked**, the process data will be output into the generated file.  
If **not ticked**, no process data will be output.*

### 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 screenshot shows a software interface with four tabs: 'Header', 'Declaration', 'Process', and 'Footer'. The 'Footer' tab is selected and highlighted with a red circle. Below the tabs is a section labeled 'Use footer?' with a checkbox. Below this is a large, empty text area for entering macro code.

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

Field Description	Type	Defaults	Pop-Up
<b>Use footer?</b>	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](#).

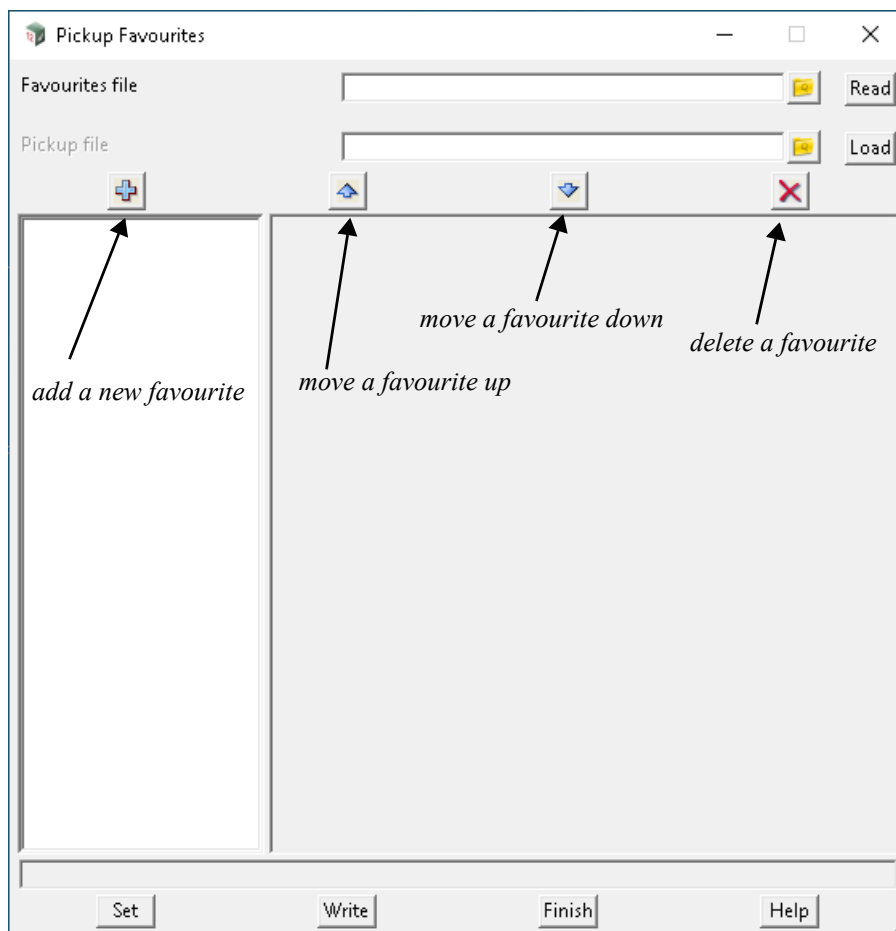
## 15.10.2 12d Field Favourites

**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
<b>Favourites file</b> <i>Favourites file to create or edit.</i>	file		*.12dfieldfavourites
<b>Read</b> <i>Reads the favourites file, if it exists.</i>	button		
<b>Pickup file</b> <i>Optional 12d field pickup codes file to use as the source of feature codes available as favourites.</i>	file		*.12dfieldcodes
<b>Load</b> <i>Loads the optional 12d field pickup codes file for use.</i>	button		

### Buttons at Bottom

**Set** button

??.

**Write** button

*Writes the Pickup favourites to the specified file.*

### Icons



*add a new favourite*



*move a favourite up*

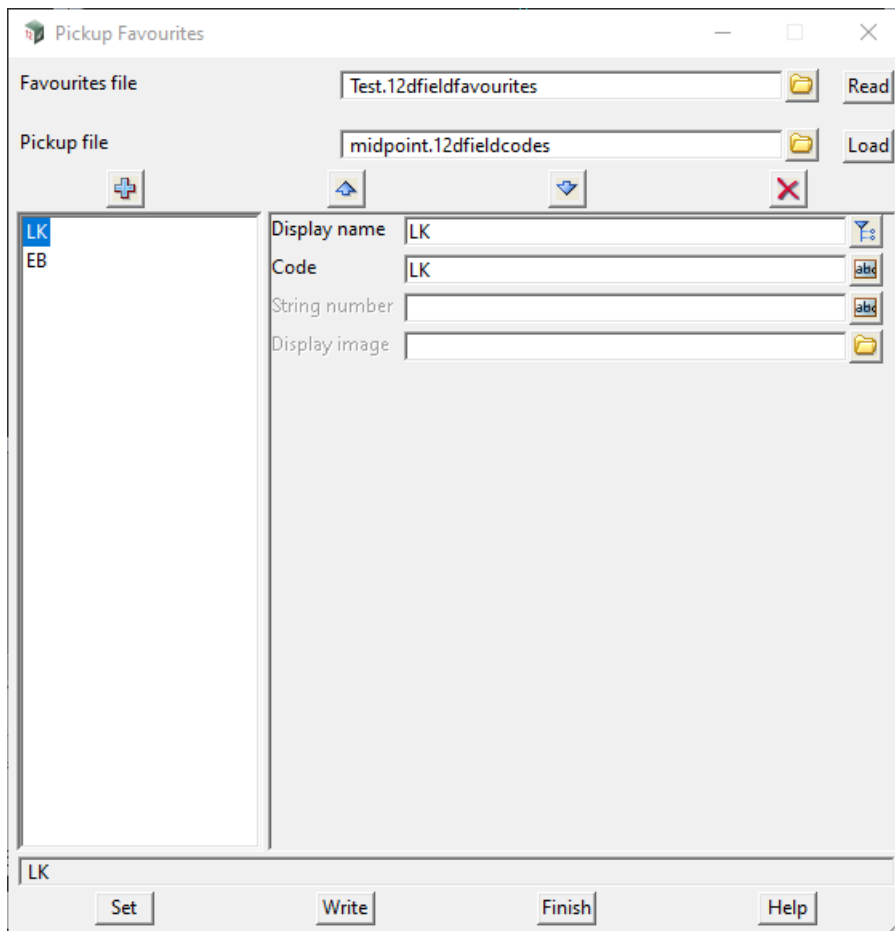


*move a favourite down*



*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
<b>Display name</b>	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

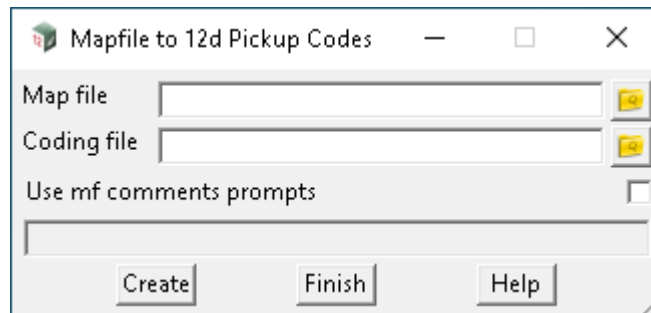
**Position of option on menu:** Survey =>12d Field =>12d Field Codes => Mapfile to 12d Pickup Codes

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
<b>Mapfile</b> <i>Name of the 12d mapfile to convert from.</i>	file		*.mapfile *.mf
<b>Coding file</b> <i>Name of the coding file to convert to.</i>	file		*.12dfieldcodes

**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](#).

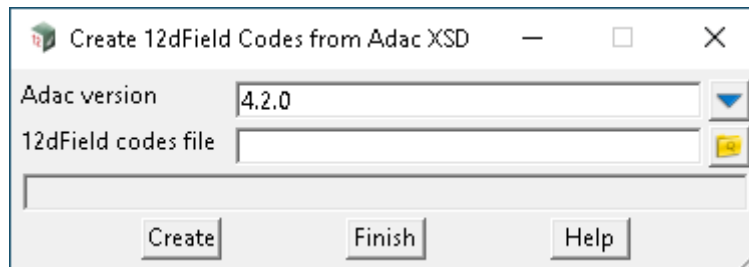


## 15.10.4 ADAC XSD to 12d Pickup Codes

**Position of option on menu:** Survey =>12d Field =>12d Field Codes => ADAC XSD to 12d Pickup Codes

This section of documentation is a work in progress and will be updated in subsequent releases.

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
<b>ADAC Version</b>	choice box		
<i>The version of ADAC being used.</i>			
<b>12dField codes file</b>	file box		*.12dfieldcodes
??.			

### Buttons at Bottom

<b>Create</b>	button
<i>Convert the file.</i>	

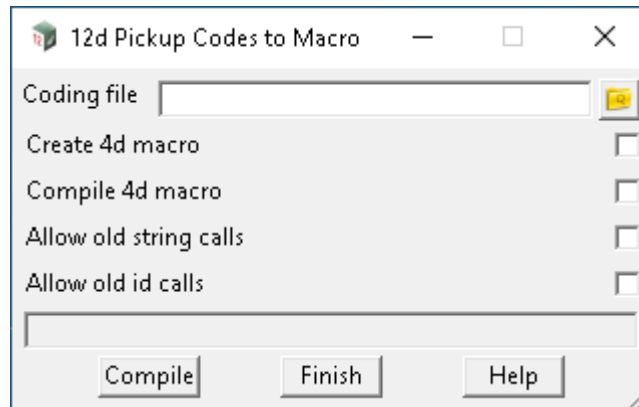
Continue to next section [15.10.5 12d Pickup Codes to Macro](#) or return to [15.3 Starting and Configuring 12d Field](#).

## 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
<b>Coding file</b>	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.*

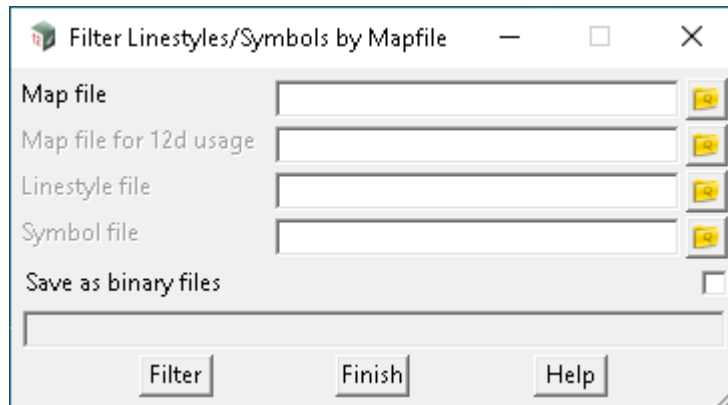
Continue to [15.10.6 Filter Linestyles/Symbols via Mapfile](#) or return to [15.3 Starting and Configuring 12d Field](#).

## 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
<b>Map file</b> ??.	file box		available map files
<b>Map file for 12d usage</b> ??.	file box		available map files
<b>Linestyle file</b> ??.	file box		
<b>Symbol file</b> ??.	file box		
<b>Save as binary files</b> ??.	tick box	not ticked	

### Buttons at Bottom

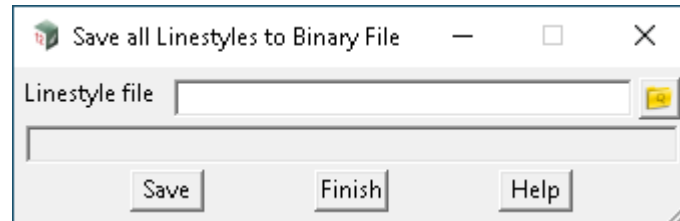
<b>Filter</b> ??.	button
----------------------	--------

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
<b>Linstyle file</b>	file box		available *.4d files

*Name of the binary form of the linstyle file.*

<b>Save</b>	button
-------------	--------

### Buttons at Bottom

*Saves the linstyle data as a binary file.*

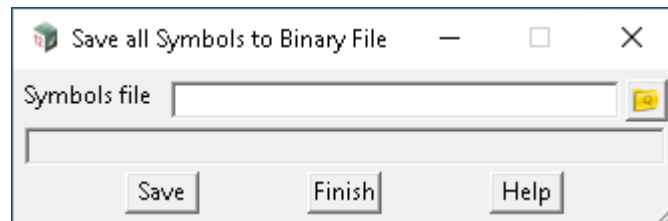
Continue to next section [15.10.8 Save Binary Symbols](#) or return to [15.3 Starting and Configuring 12d Field](#).

## 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
<b>Symbols file</b>	file box		available *.4d files
??.			

### Buttons at Bottom

<b>Save</b>	button
<i>Saves file.</i>	

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 as 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_coloured
```

```
73      st_pickup_bsc_pt_linestyle1
```

```
72      st_pickup_bsc_pt_weight0.0000000000000000
```

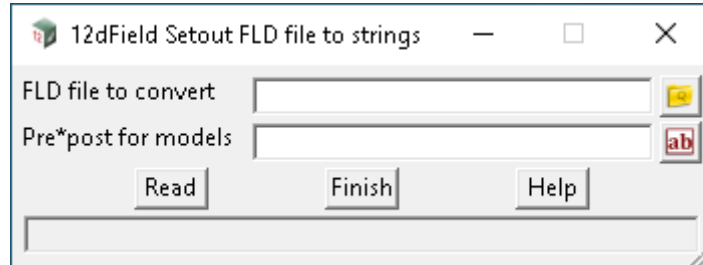
```
71      st_pickup_bsc_pt_point_line1
```



**125****Original String Details**

All op-code **124s** 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
-------------------	------	----------	--------

<b>FLD file to convert</b>	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 [3.25.2 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**.

Design	x
Quick Start	▶
Quick Tools	▶
Templates	▶
Apply	▶
MTF	▶
Boxing	▶
Estate-lots	▶
Pads	▶
Pavement	▶
Roads	▶
Sight lines	▶
Track	▶
Tunnel-Structures	▶
Overlay	▶
X-sections	▶
More	▶
User	▶

See [16.1 Quick Start](#)

See [16.2 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](#)

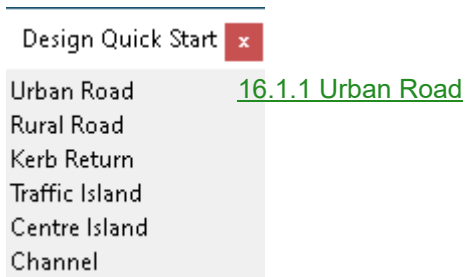
- See [16.19 Debugging Snippets](#)
- See [16.20 Road Widening - with Snippet](#)
- See [16.21 Create Ramps and Driveways](#)
- See [16.23 Track](#)
- See [16.24 Fixed Link - To String](#)
- See [16.25 Create Polygon](#)
- See [16.26 Fixed Decisions - String Exists](#)
- See [16.27 MTF Modifiers File Format](#)

## 16.1 Quick Start

**Position of menu:** Design =>Quick start

Now documented in the V15 reference manual

The Quick start walk- right menu is



For information on toolbar commands see [16.2.5 Toolbar Commands](#).

*Clears out the entire attribute tree.*

Continue to [16.1.1 Urban Road](#) or return to [16 Design](#).

## 16.1.1 Urban Road

**Position of menu:** Design =>Quick start =>Urban road

This option uses an MTF Seed File from the 12d install

DQ\_Road\_Urban.mtf\_seed

It comprises **start up snippets** for the placement of the design road surface.

It also contains various **regions** defining example modifiers. Some are example modifiers and are **inactive**.

Last of all there is a region for applying the **Pavement Manager** attribute snippets.

**Note:** In order to automatically create an Apply Many, using the above seed file, certain key lines need to be in the LHS and or RHS modifiers. These entries are made up of Comments, Chainage Aliases and Region titles. Their position in the seed file is essential, in order to use the **Design Quick Tools**.

Rural Road   Kerb Return   Islands   Channel

The above Seed options are also available, and operate in the same manner.

### Seed File extract...LHS

The first two lines **must** be as per below:

**Comment:** Created by Quick Design

**Chainage Alias:** LHS EXTENTS ...set to Start & End (ref)

Type	Alias	Start ch	End ch	Details	Value	Active	Cor
1	Created by Quick Design						
2	Chainage Alias	LHS EXTENTS	Start (ref)	End (ref)		<input checked="" type="checkbox"/>	opt
3	DESIGN SURFACE						
4	Create Design by Snippets						
5	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_R_ROADKG	Relative LHS EXTENTS	Relative LHS EXTENTS	Lane 1 width Lane 2 width Shoulder width Road xfall	3.5 -3.0	<input checked="" type="checkbox"/>	Lan
6	MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/INS_V_PATH	Relative LHS EXTENTS	Relative LHS EXTENTS	Grass width Footpath width Landscape width Footpath xfall	1 1.5 2.5 2	<input checked="" type="checkbox"/>	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 LHS EXTENTS	Relative LHS EXTENTS	Tin Final cut slope (1v in) Final fill slope (1v in) Strip	SURVEY 2 4	<input type="checkbox"/>	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	<input type="checkbox"/>	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	<input type="checkbox"/>	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	<input type="checkbox"/>	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	<input type="checkbox"/>	opt

### Design Region:

The design is made up of a few snippets to define the road surface.

The pavement modifiers, are snippets, and have been set to inactive.



They are positioned after a region called:

**LHS PAVEMENTS**

Again, this region is **mandatory**.

**Seed File extract...RHS**

The first two lines **must** be as per below:

**Comment:** Created by Quick Design

**Chainage Alias:** **RHS EXTENTS** ...set to Start & 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)			<input checked="" type="checkbox"/>
3 <input type="checkbox"/> 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	<input checked="" type="checkbox"/>
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	<input checked="" type="checkbox"/>
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	<input type="checkbox"/>
8 <input type="checkbox"/> RHS PAVEMENTS						
9 MTF Snippet C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_NEW_KERB_FROM_J		Start (ref)	End (ref)	Reference_Style Kerb_Style	PT01 SA	<input type="checkbox"/>
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	<input type="checkbox"/>
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	<input type="checkbox"/>
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	<input type="checkbox"/>

**Design Region:**

The design is made up of a few snippets to define the road surface.

The pavement modifiers, are snippets, and have been set to inactive.

They are positioned after a region called:

**RHS PAVEMENTS**

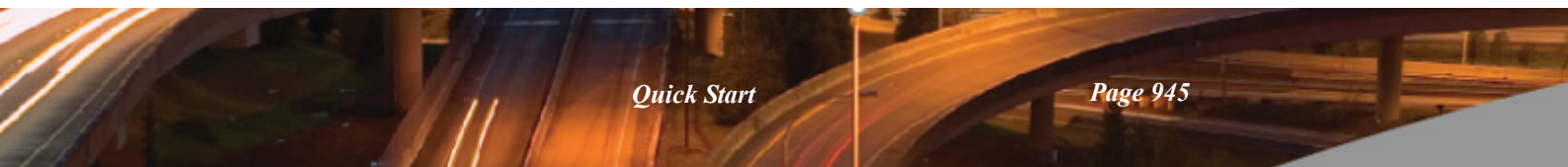
Again, this region is **mandatory**.

**Why the above restrictions?**

The Design Quick Tools require the user to select strings created from the Apply Many, in order to activate the edit options. The MTF is read and modifiers edited or inserted to reflect the Design Quick Tool used. The first comment is read, searching for the words "Quick Design".

THE MTF IS UPDATED AND SAVED.

Continue to [16.2 Quick Tools](#) or go back to [16.1 Quick Start](#).



## 16.2 Quick Tools

**Position of menu:** Design =>Quick tools

Now documented in the V15 reference manual

The Quick tools walk- right menu is

Design Quick Tools <span>×</span>	See
Start Clean	<a href="#">16.2.1 Start Clean</a>
End Clean	<a href="#">16.2.2 End Clean</a>
Intersection Clean ▶	<a href="#">16.2.3 Intersection Clean</a>
Pavements off	<a href="#">16.2.4 Pavement On/Off</a>
Pavements on	<a href="#">16.2.4 Pavement On/Off</a>

For information on toolbar commands see [16.2.5 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 **AM strings**, 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.

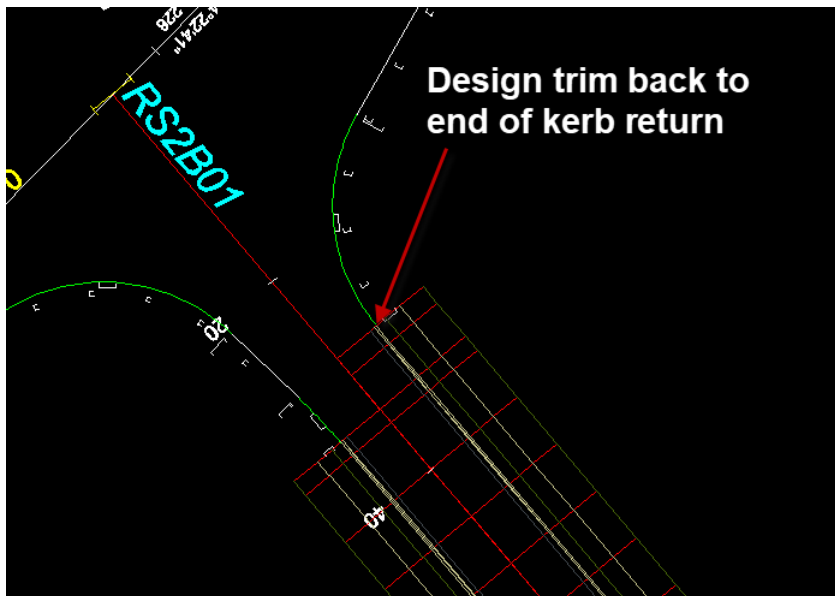
Continue to [16.2.2 End Clean](#) or go back to [16.2 Quick Tools](#).

## 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.



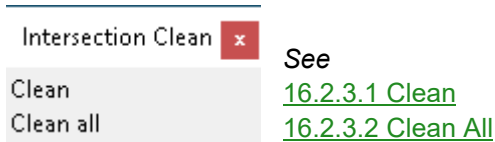
The AM is recalced.

Continue to [16.2.3 Intersection Clean](#) or go back to [16.2 Quick Tools](#).

## 16.2.3 Intersection Clean

**Position of menu:** Design =>Quick tools =>Intersection clean

The **Intersection clean** walk- right menu is



### 16.2.3.1 Clean

**Position of menu:** Design =>Quick tools =>Intersection clean =>Clean

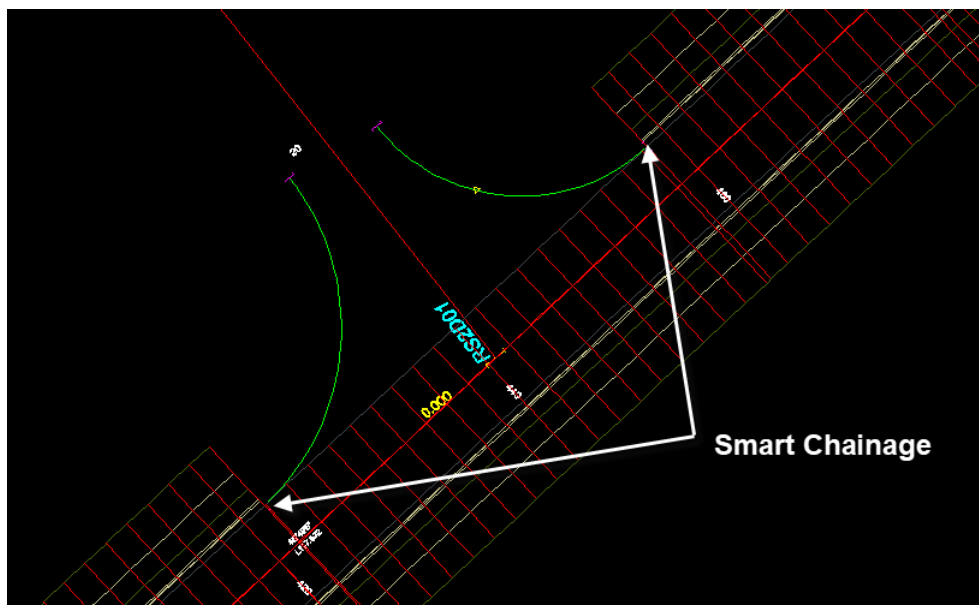
This option is used to remove parts of your design from the first link outwards (Lip of Kerb e.g.).

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.

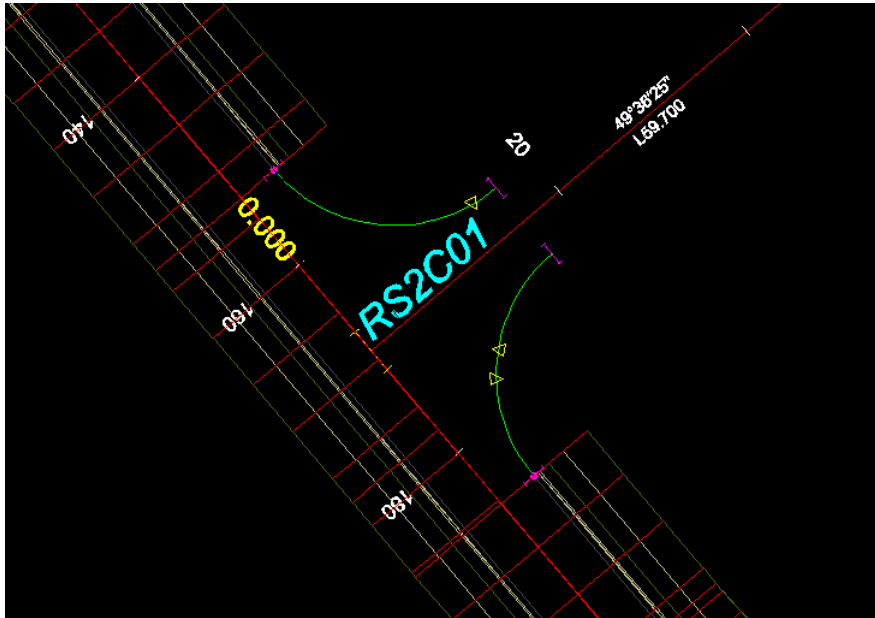


Continue to [16.2.3.2 Clean All](#) or go back to [16.2.3 Intersection Clean](#).

### 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** snippets using **Attributes** e.g.

	TRI_VERGE_ONLY_FROM_ATTRS.MTFSNIPPET	:
	TRI_UNDER_KERB_PAV_NAMED_GRADES.MTFSNIPPET	:
	TRI_TIN_UTILITY_FROM_ATTRS.MTFSNIPPET	:
	TRI_PAVEMENT_STRINGS_ONLY_FROM_ATTRS.MTFSNIPPET	:
	TRI_PAVEMENT_RETURN_BATTER_FROM_ATTRS.MTFSNIPPET	:
	TRI_PAVEMENT_ONLY_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_KRETURN_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_KERB_ONLY_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_KERB_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_CULDESAC_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_BATTER_ONLY_FROM_ATTRS.mtfsnippet	:
	TRI_PAVEMENT_BATTER_FROM_ATTRS.MTFSNIPPET	:
	TRI_PAVEMENT_BARRIER_ONLY_FROM_ATTRS.MTFSNIPPET	:
	TRI_PAVEMENT_BAR_CHANNEL_FROM_ATTRS.MTFSNIPPET	:

Once found, the modifier is either made **active** or **inactive**.

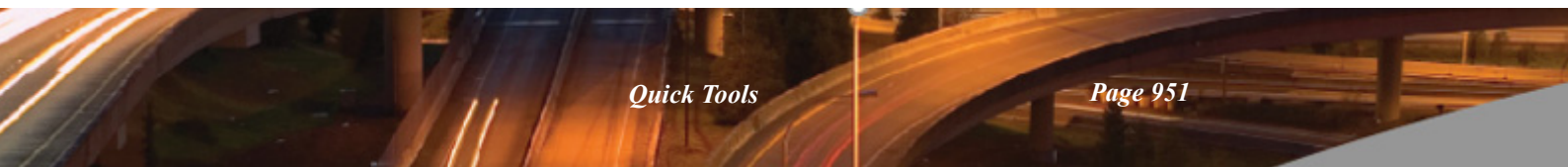
35 LHS PAVEMENTS				
MTF Snippet				
36	C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_KERB_FROM_ATTRS	Relative Alias Start LHS EXTENTS 0	Relative Alias End LHS EXTENTS 0	Reference_Style Zone Number Trimesh Suffix (Descriptor -> refer li

35 LHS PAVEMENTS				
MTF Snippet				
36	C:/Program Files/12d/12dmodel/15.00/library/TRI_PAVEMENT_KERB_FROM_ATTRS	Relative Alias Start LHS EXTENTS 0	Relative Alias End LHS EXTENTS 0	Reference_Style Zone Number Trimesh Suffix (Descriptor -> refer li

**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 Toolbar Commands](#) or go back to [16.2 Quick Tools](#).



## 16.2.5 Toolbar Commands

Even though the "Design Quick" toolbar uses seed files shipped with 12d, there is no reason that any user defined seeds could be added to a User defined Toolbar

**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 Quick Tools](#).

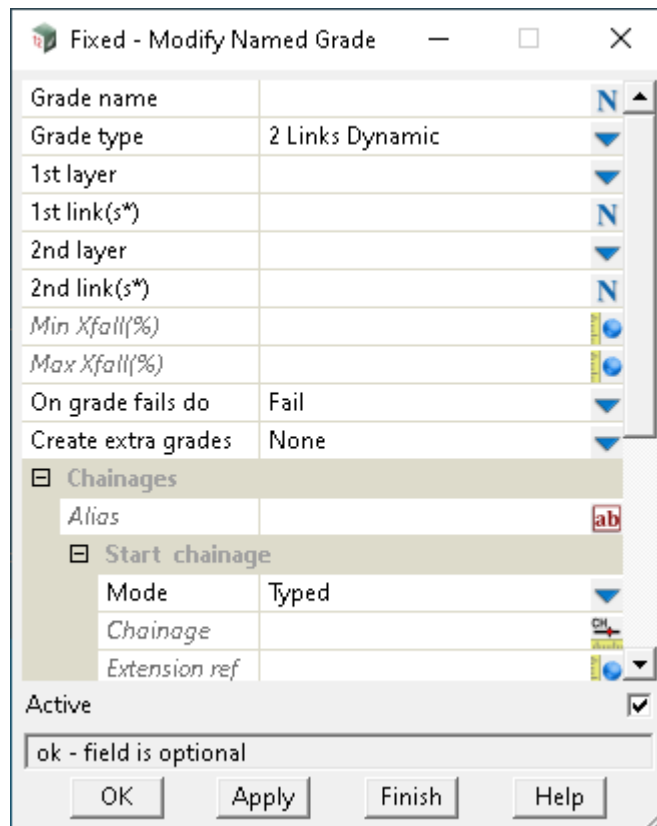
## 16.3 Boxing - Named Grade

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.

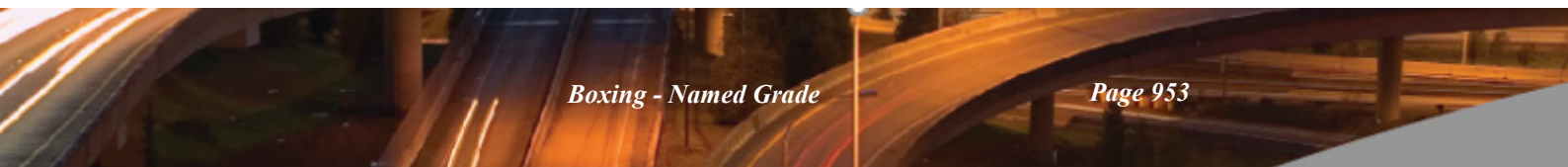
Named grades are typically defined for pavements and batter slopes which have to be constantly paralleled and intersected to produce subgrade layers.



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

Field Description	Type	Default	Pop-Up
<b>Grade Name</b>	name box		available names

*Name of the grade defined in this modifier, this name will be referenced by other modifiers that use named grades.*



<b>Grade Type</b>	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](#).*

<b>On grade fails do</b>	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		N
Grade type	2 Links Dynamic	▼
1st layer	Design	▼
1st link		N
2nd layer	Design	▼
2nd link		N
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

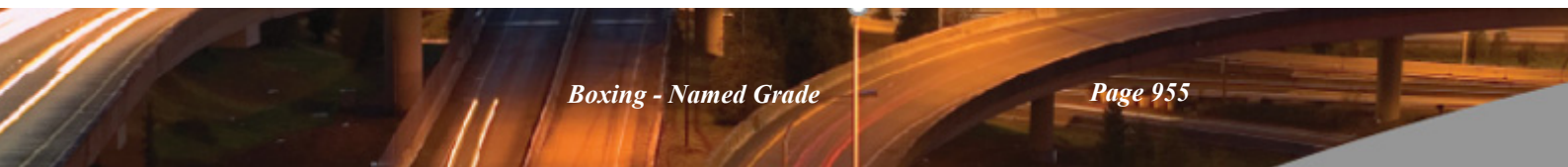
*Name of the 2nd link to evaluate.*

**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.*

Grade type	2 Links	▼
1st layer	Design	▼
1st link		N
2nd layer	Design	▼
2nd link		N
Min Xfall(%)		F
Max Xfall(%)		F
On grade fails do	Fail	▼
Create extra grades	None	▼

### 16.3.0.1.3 Grade type is Horizontal

*Grade will be a Xfall(%) of 0%.*

Grade type	Horizontal	▼
------------	------------	---

### 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.*

Grade type	Vertical	▼
------------	----------	---

### 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](#).*

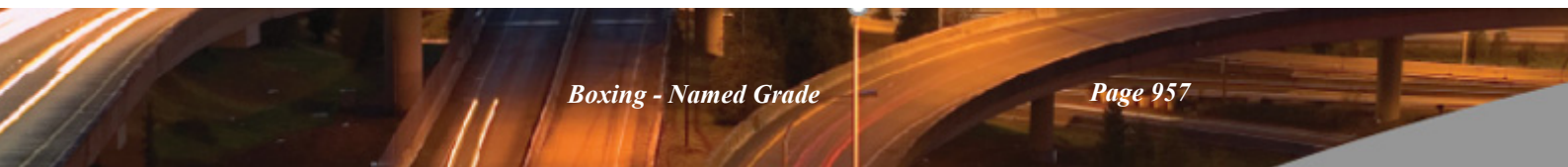
### 16.3.0.1.7 Grade Type Link & Tin (deprecated)

*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.*





Grade type	Link & Tin Dynamic	
Layer	Design	
Link		
Offset	0.1	
Tin		
Min Xfall(%)		
Max Xfall(%)		
On grade fails do	Fail	
Create extra grades	None	

- 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)

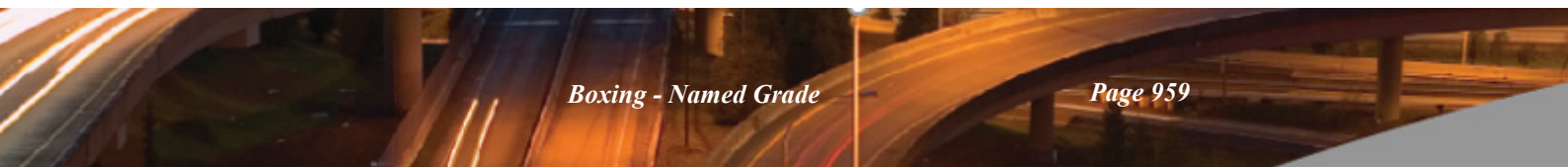
*When grade cannot be evaluated at a chainage, either fail or fall back to a named grade type that will always produce a grade.*

*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

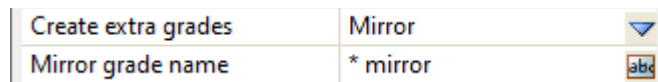
Create no extra named grade(s) relative to the named grade being defined in this panel.



#### 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.

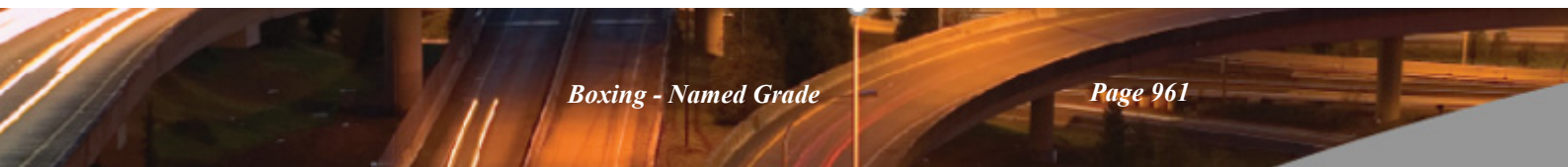
E.g. Mirror Grade as  $Xfall = -(Named\ Grade\ as\ Xfall)$



**Mirror grade name**      input box      \* mirror

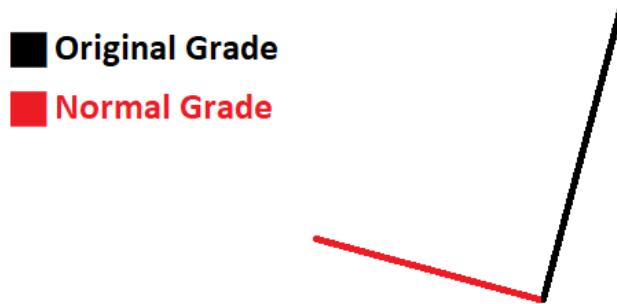
Name of the mirror grade defined in this modifier, this name will be referenced by other modifiers that use named grades.

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

Now documented in the V15 reference manual

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<<EFL" 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.

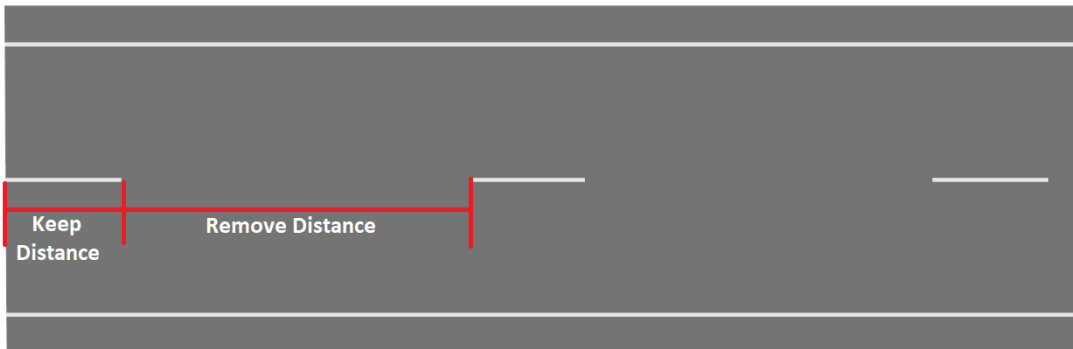
The colon operator is intended for use in snippets only, it can be manually entered into the MTF file but when the individual modifier panel is opened the link names will be expanded and upon closing written in the semicolon format.

Continue to [16.5 Fixed link - Remove by Pattern](#) or go back to [16.4 MTF Links and Layers File Format](#).

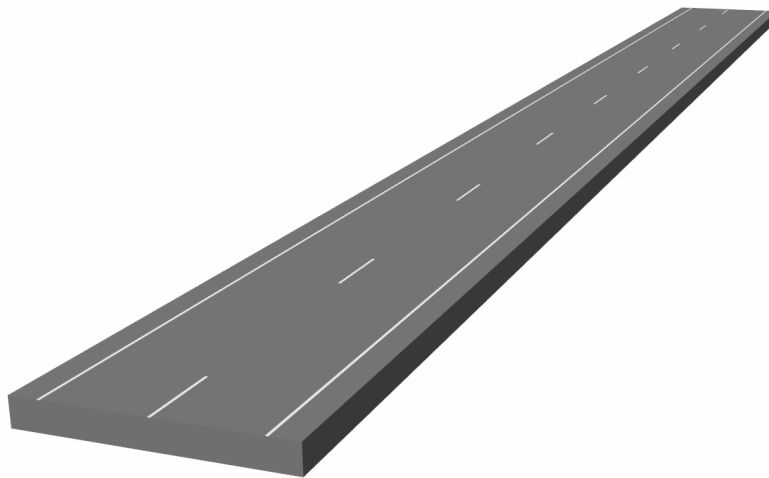
## 16.5 Fixed link - Remove by Pattern

Now documented in the V15 reference manual

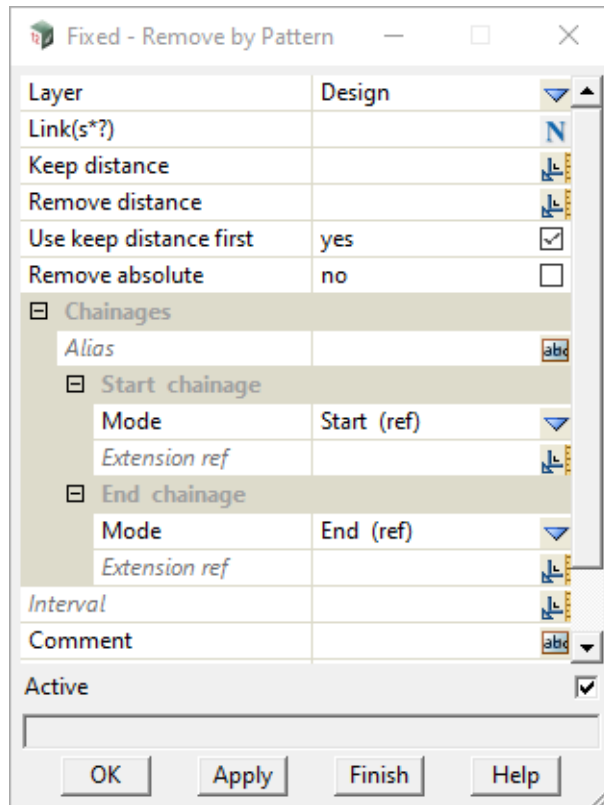
The **Remove by Pattern** option deletes links between given chainages at an interval. Because the link is no longer there, any following links will then be relative to the link before the deleted link. To remove by pattern a **Keep Distance** and **Remove Distance** must be specified.



An 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
<b>Layer</b>	layer box		available Layers

*Layer to remove the link. For information on Layers, see 20.1.1.2 MTF Links and Layers.*

<b>Link(s)</b>	name box	select name	menu
----------------	----------	-------------	------

*Name of the links to remove. See 20.2.2.1.2 Link, Link(s) or Link(s\*).*

<b>Keep distance</b>	double box		
----------------------	------------	--	--

*The length of the distance that is not removed in the pattern.*

<b>Remove distance</b>	double box		
------------------------	------------	--	--

*The length of the distance that is removed in the pattern.*

<b>Use keep distance first</b>	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.*

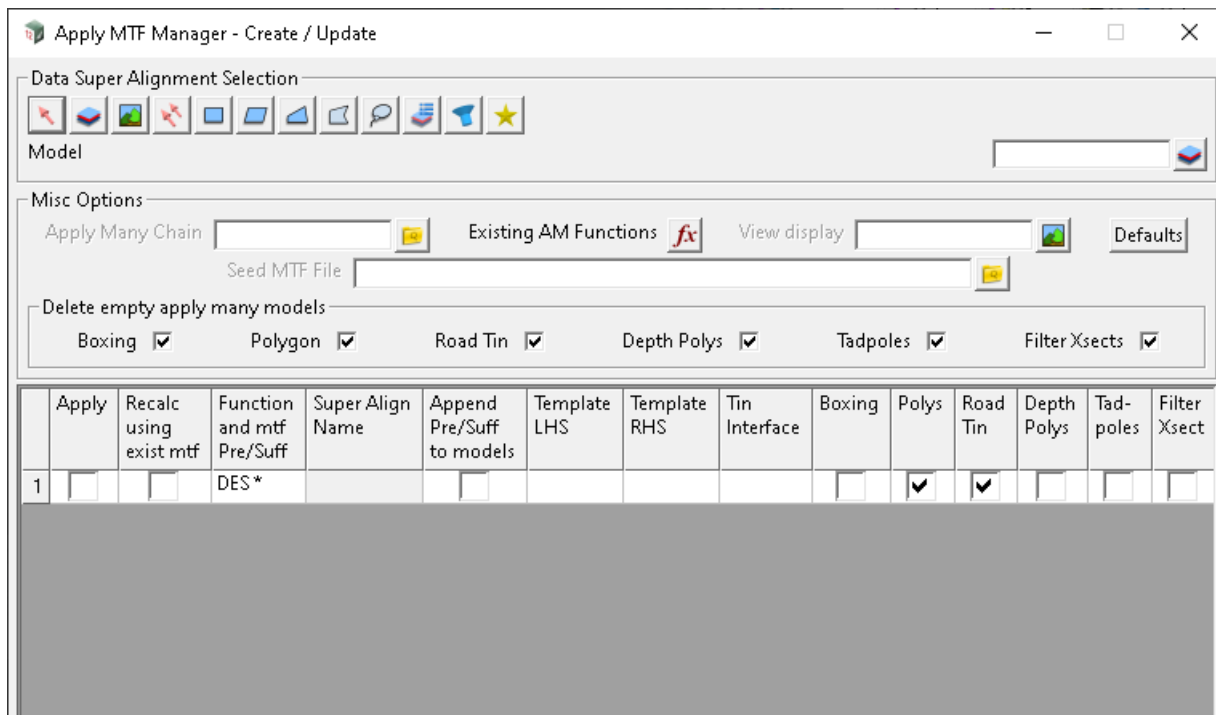
Continue to [16.6 Apply MTF Manager - Create/Update](#) or go back to [16.5 Fixed link - Remove by Pattern](#).

# 16.6 Apply MTF Manager - Create/Update

**Position of option on menu:** Design =>Apply =>Apply MTF manager

Now documented in the V15 reference manual

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 [3.25.3 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.*



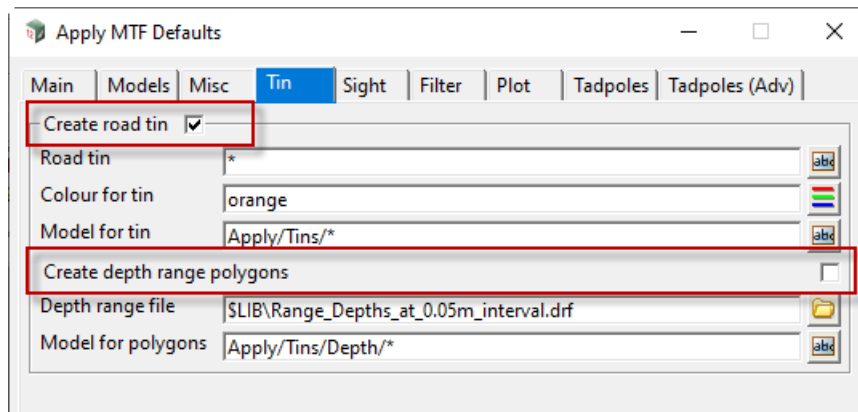
**View Display**                      view box                      available views

*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.*

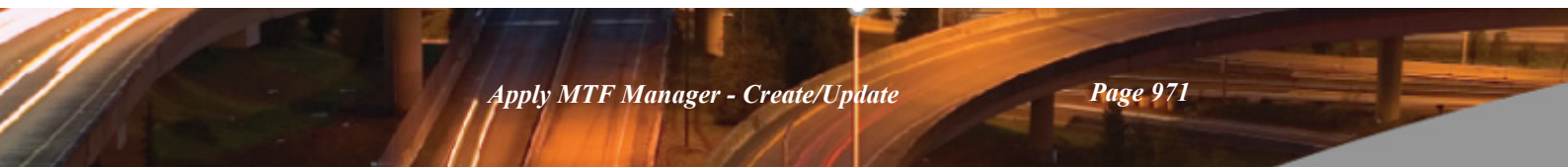
**Template RHS**                   input

*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

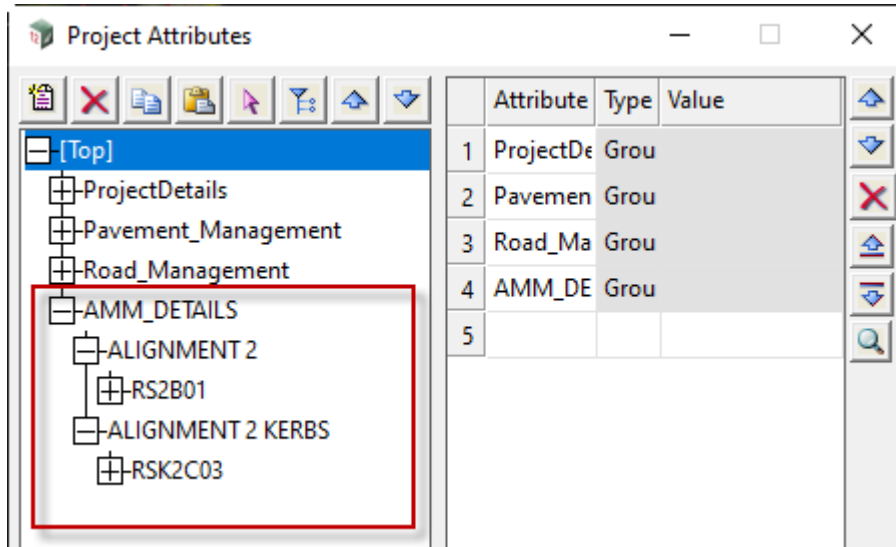
*For clarity...clear the grid first and then select the Super Alignment you wish to add another Apply MTF Function to.*

**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.

Now documented in the V15 reference manual

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**.

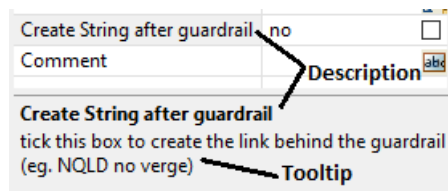
The general syntax for **param\_desc** is:

"**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

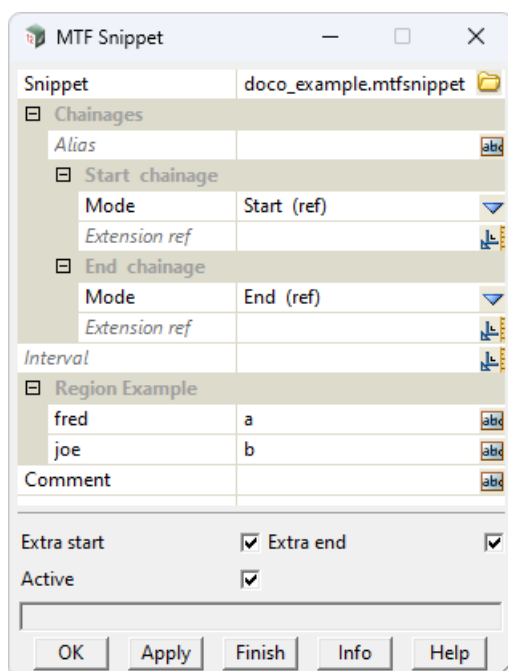
See [16.7.2.1 Snippet Parameter Region](#)

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 collapsible 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.



Inbuilt "Chainages"  
Snippet Region

User defined "Region Example"  
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 [19.7.9.1 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"
```



Region Example	
fred	a
joe	b

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](#)

[16.7.3.2 \\_MODIFY\\_EXTRAS](#)

[16.7.3.3 \\_ABS\\_ES\\_EE](#)

[16.7.3.4 \\_ASE](#)

[16.7.3.5 \\_ABS](#)

[16.7.3.6 \\_ABS\\_ES](#)

[16.7.3.7 \\_ABS\\_EE](#)

[16.7.3.8 \\_CL\\_REF\\_MODEL](#)

[16.7.3.9 \\_ES](#)

[16.7.3.10 \\_ES\\_EE](#)

[16.7.3.11 \\_EE](#)

[16.7.3.12 \\_MODEL\\_ATTRIBUTE](#)

[16.7.3.13 \\_ROW](#)

### 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.

[-] Start chainage		[-] Start chainage	
Mode	Start (ref)	Mode	Use Model Strings
Extension ref		Model	
[-] End chainage		[-] End chainage	
Mode	Use Model Strings	Wildcard	
Model		Max os left	
Wildcard		Max os right	

**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.*

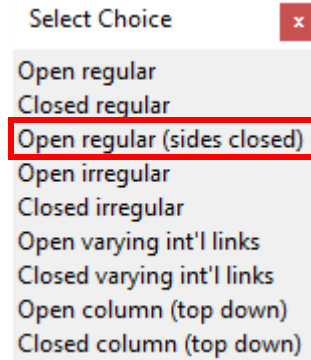
Continue to [16.9 Create Shapes](#) or go back to [16.8 Snippet Placed to Model of Strings](#).



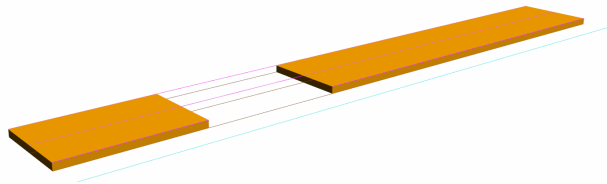
## 16.9 Create Shapes

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

Now documented in the V15 reference manual

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

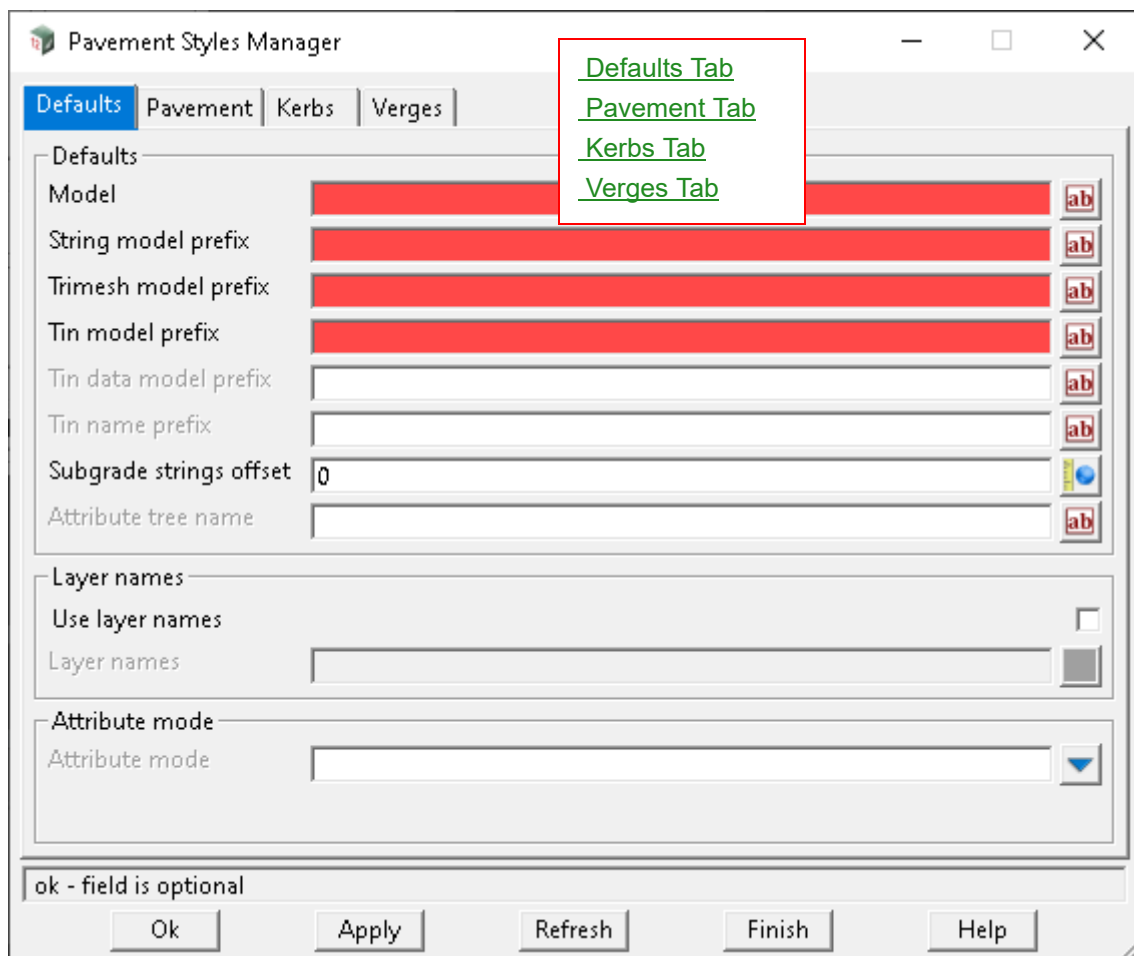
Duplication or copy and paste (in a grid system)

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)*

**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**

**Use layer names** tick box  ticked

**Layer names** file box

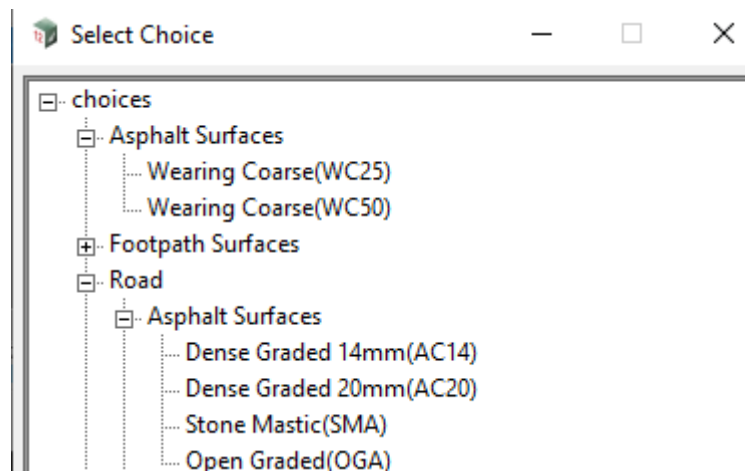
*Layer names and descriptions can be set as a **choice list** for Pavement, Kerbs and Verges.*

*There is a library example called **layer\_names.12dpln***

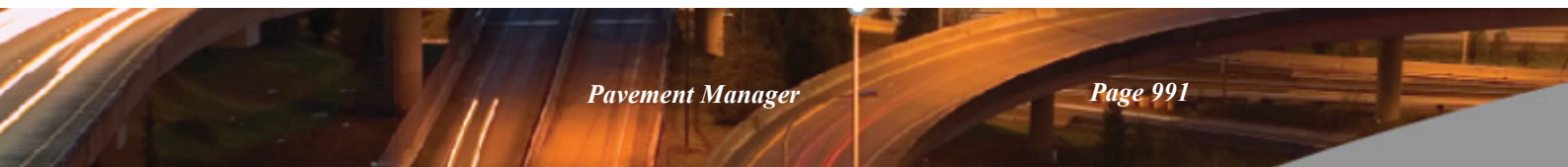
**File Extract:**

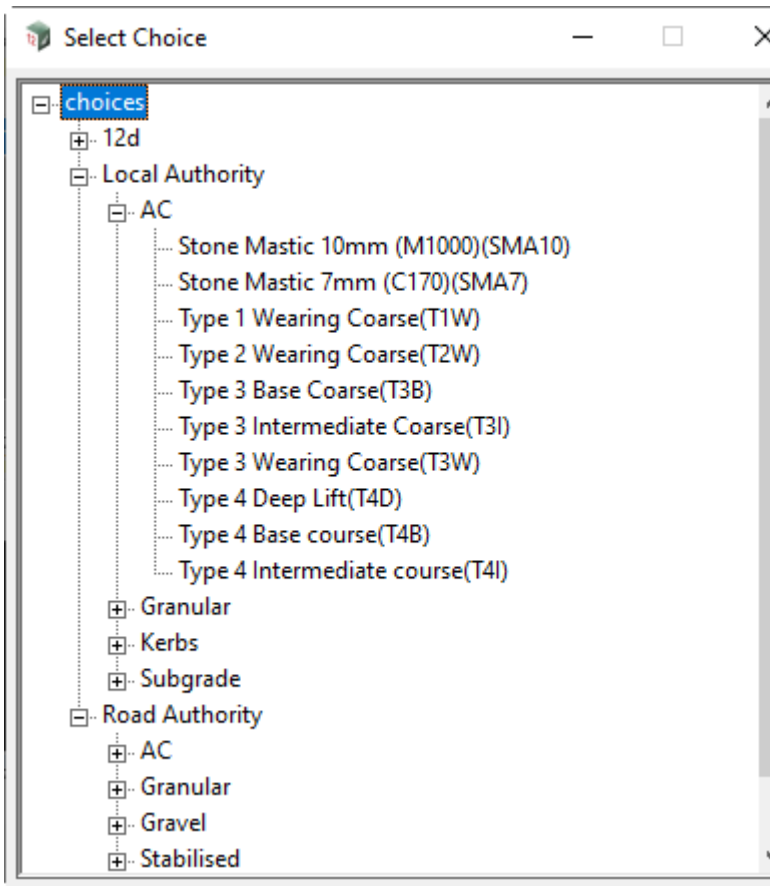
<i>Name</i>	<i>Description</i>	<i>Choice list headings</i>
<i>WC25</i>	<i>Wearing Coarse</i>	<i>Asphalt Surfaces</i>
<i>WC50</i>	<i>Wearing Coarse</i>	<i>Asphalt Surfaces</i>
<i>FPPAV</i>	<i>Paved Footpath</i>	<i>Footpath Surfaces</i>

<i>FPCONC</i>	<i>Concrete Footpath</i>	<i>Footpath Surfaces</i>
<i>AC14</i>	<i>Dense Graded 14mm</i>	<i>Road/Asphalt Surfaces</i>
<i>AC20</i>	<i>Dense Graded 20mm</i>	<i>Road/Asphalt Surfaces</i>
<i>SMA</i>	<i>Stone Mastic</i>	<i>Road/Asphalt Surfaces</i>
<i>OGA</i>	<i>Open Graded</i>	<i>Road/Asphalt Surfaces</i>
<i>PCP</i>	<i>Plain</i>	<i>Road/Concrete Pavements</i>
<i>CRCP</i>	<i>Continuously Reinforced</i>	<i>Road/Concrete Pavements</i>
<i>JRCP</i>	<i>Jointed Reinforced</i>	<i>Road/Concrete Pavements</i>
<i>SFCP</i>	<i>Steel Fibre Reinforced</i>	<i>Road/Concrete Pavements</i>



A second example file called *Pavement\_layer\_names.12dpln* is also available:





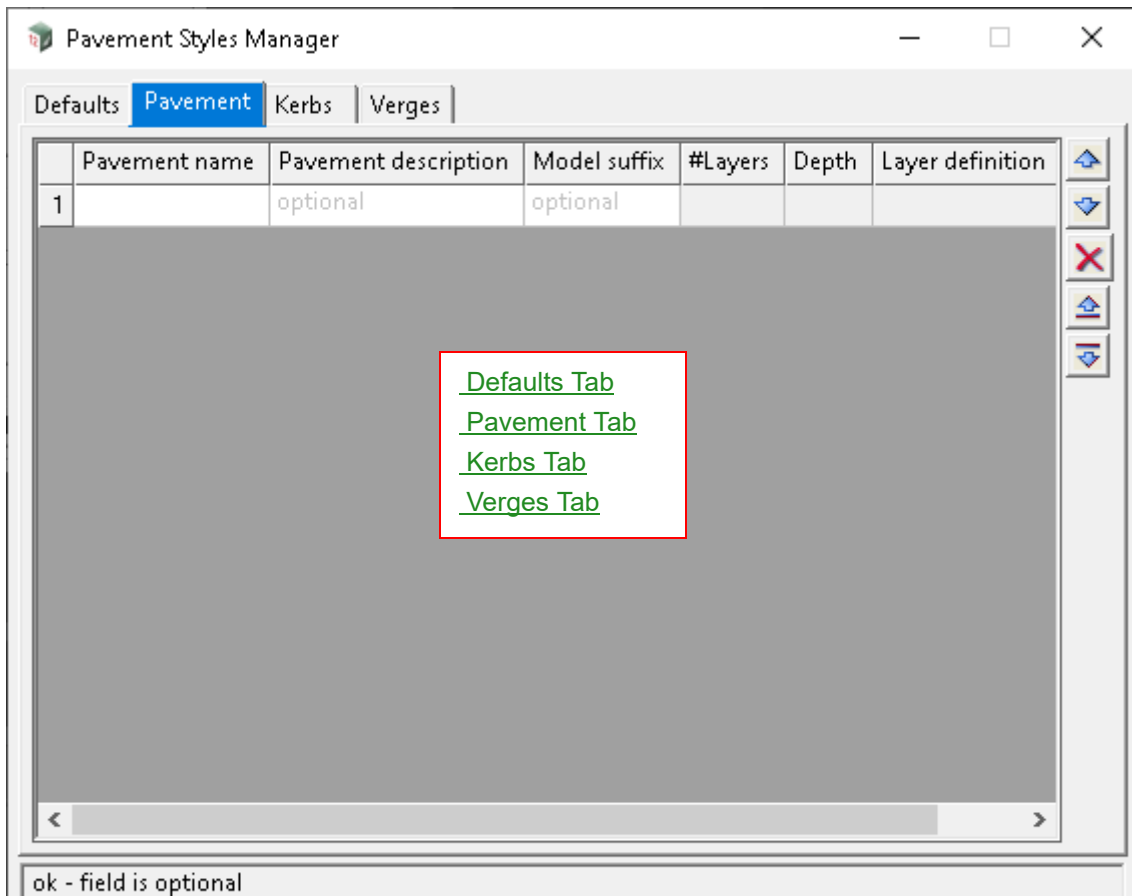
**Attribute mode**

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
<b>Name</b> <i>Pavement type name.</i>	input		
<b>Description</b> <i>Pavement type description.</i>	input		
<b>#Layers</b> <i>Number of layers in pavement type.</i>	info only		
<b>Depth</b> <i>Total depth of layers in pavement type (m).</i>	info only		
<b>Layer definition</b> <i>LMB to activate layer creation panel.</i>	LMB		

## Layer Definition

	Description	Name	Depth	Attributes	Inner offset	Outer offset	Start slope 1v in	End slope 1v in	Colour	Edge Colour	End Colour	Tin	Active
1	Dense Graded 14mm	AC14	0.05	optional	0	0	optional	optional	vis rd asphalt	grey	grey	no	optional
2	Base	BASE	0.35	optional	0	0	optional	optional	vis granular1	shade 32	shade 32	no	optional
3	Selected Material	SMZ	0.3	optional	0	0	optional	optional	vis granular2	shade 64	shade 64	yes	optional
4	optional			optional	option	option	optional	optional				opti	optional

ok - field is optional

Ok Cancel

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Description</b>	LMB		
--------------------	-----	--	--

*If layer names file is used, LMB will activate choice list for layer description and name.*

<b>Name</b>	input		
-------------	-------	--	--

*Pavement layer name.*

<b>Attributes</b>	LMB		
-------------------	-----	--	--

*Attribute choice activated.*

<b>Inner offset</b>	real		
---------------------	------	--	--

*Layer offset from 1st link in snippet.*

*(+ve to the outside of link and -ve to the inside)*

<b>Outer offset</b>	real		
---------------------	------	--	--

*Layer offset from 2nd link in snippet.*

*(+ve to the outside of link and -ve to the inside)*

<b>Start slope 1v in</b>	real		
--------------------------	------	--	--

*Layer start slope from 1st link in snippet.*

*(+ve to the outside of link and -ve to the inside)*

<b>End slope 1v in</b>	real		
------------------------	------	--	--

*Layer start slope from end link in snippet.*

*(+ve to the outside of link and -ve to the inside)*

<b>Colour</b>	input		
---------------	-------	--	--

*Trimesh colour (vis colours will display a texture with visualisation module).*

<b>Edge Colour</b>	input		
--------------------	-------	--	--

*Trimesh edge colour.*

<b>End Colour</b>	input		
-------------------	-------	--	--

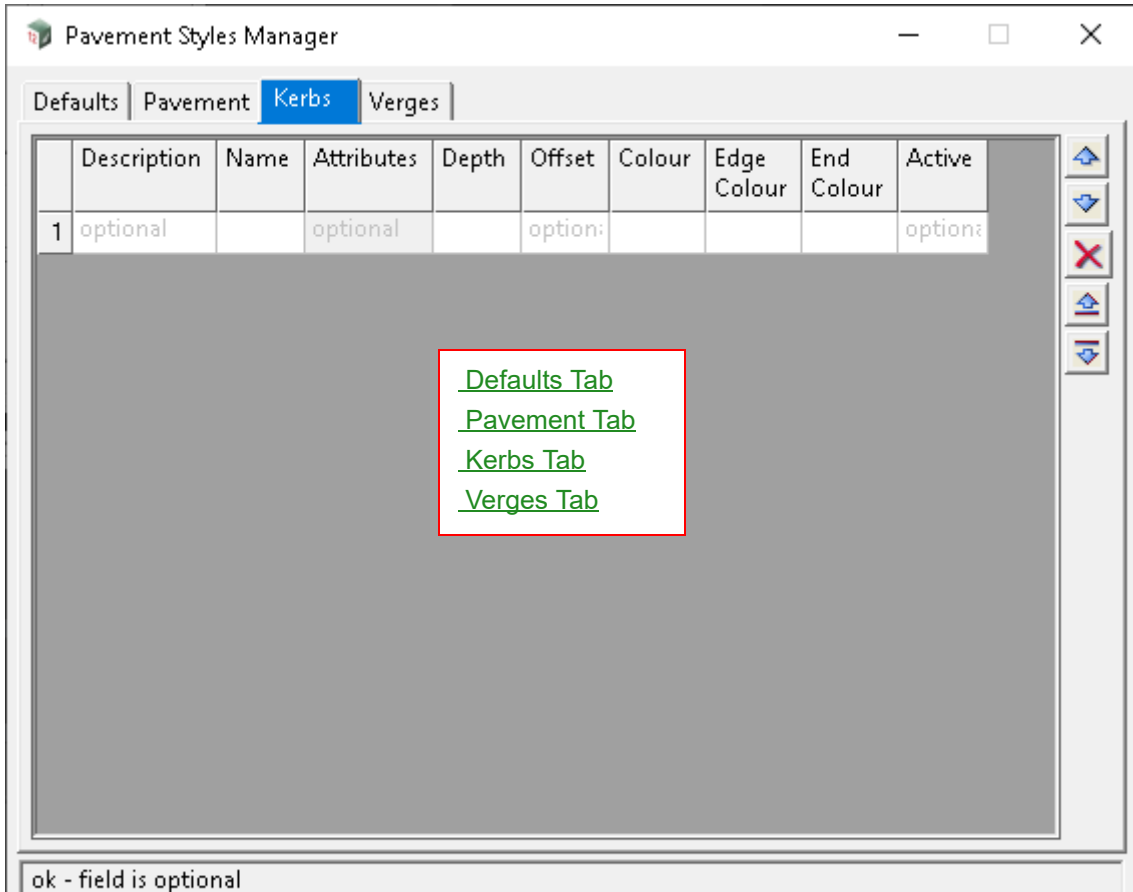
*Trimesh end colour.*



**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
-------	-------------	------	----------	--------

<b>Description</b>		LMB		
--------------------	--	-----	--	--

*If layer names file is used, LMB will activate choice list for the kerb layer description and name.*

<b>Name</b>		input		
-------------	--	-------	--	--

*Kerb layer name.*

<b>Attributes</b>		LMB		
-------------------	--	-----	--	--

*Attribute choice activated.*

<b>Depth</b>		real		
--------------	--	------	--	--

*Depth at kerb lip (typically) in metres.*

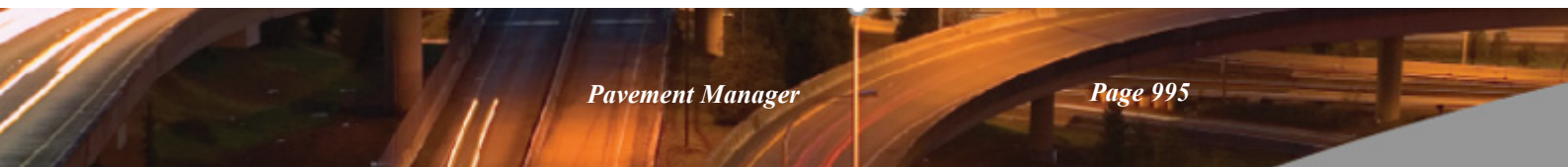
<b>Offset</b>		real		
---------------	--	------	--	--

*Offset behind back of kerb (typically) in metres.*

<b>Colour</b>		input		
---------------	--	-------	--	--

*Trimesh colour (vis colours will display a texture with visualisation module).*

<b>Edge Colour</b>		input		
--------------------	--	-------	--	--

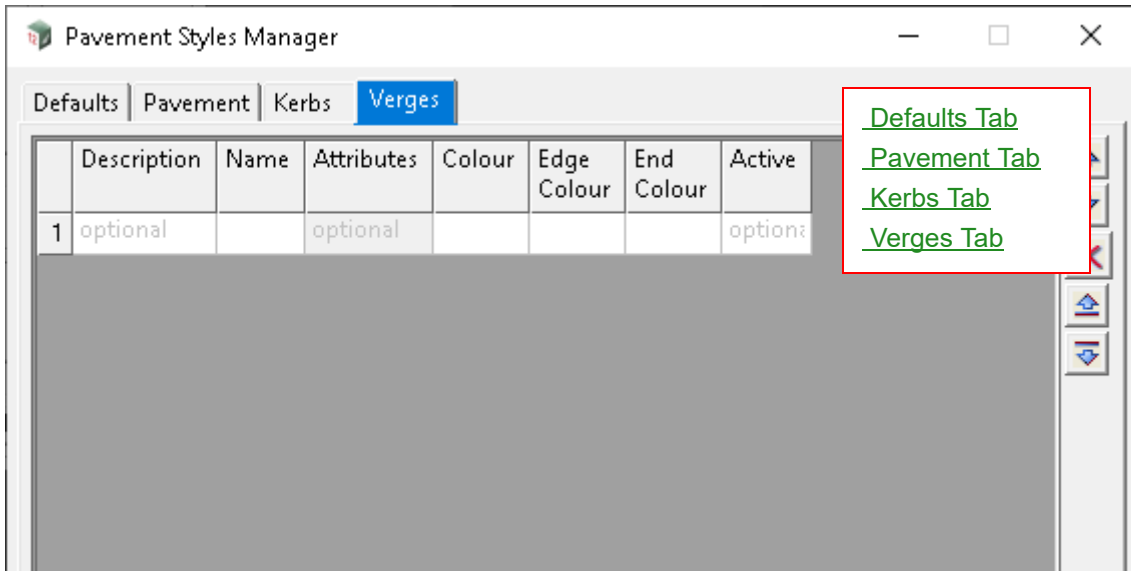


Trimesh edge colour:

**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).*

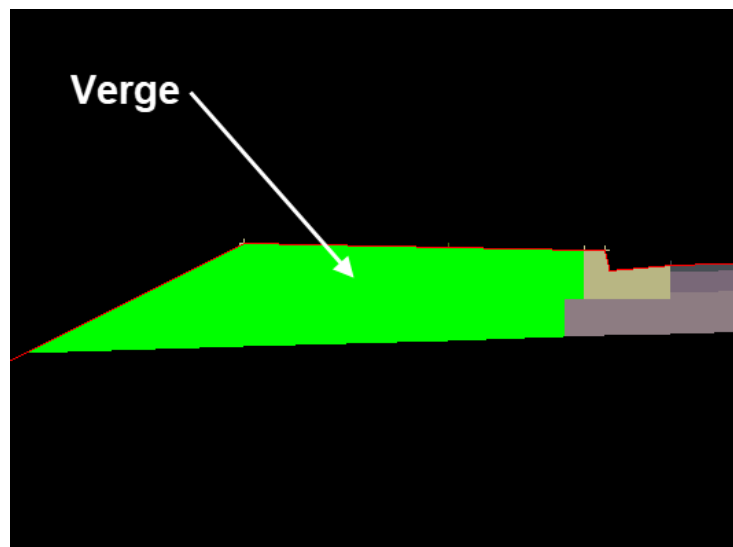
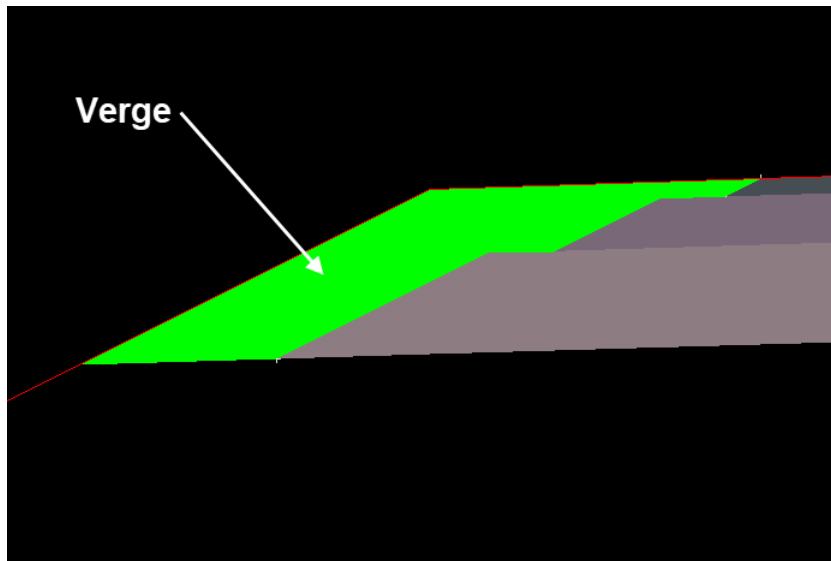
**Edge Colour**                      input

*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

Now documented in the V15 reference manual

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	SLIB\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
-------------------	------	----------	--------

<b>Reference_type</b>	choice box		
<i>A range from pavement manager.</i>			

<b>Kerb_type</b>	choice box		
<i>A range from pavement manager.</i>			

<b>Trimesh Ref Name Suffix</b>	choice box	All Chars	
<i>This option will add the Reference Alignment name to the names of all pavement elements created, including model names.</i>			

*Refname 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.*

<b>Trimesh Suffix</b>	input		
<i>This suffix is used to make up the <b>unique name</b> of the trimesh and strings <b>NOT</b> the model names.</i>			

*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)*

<b>Start link mode</b>	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.*

<b>Start link slope (name grade)</b>	choice box	Vertical	
--------------------------------------	------------	----------	--

*This grade is used on each layer if there is no "Start slope" defined in the pavement style.*

<b>End link slope</b>	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

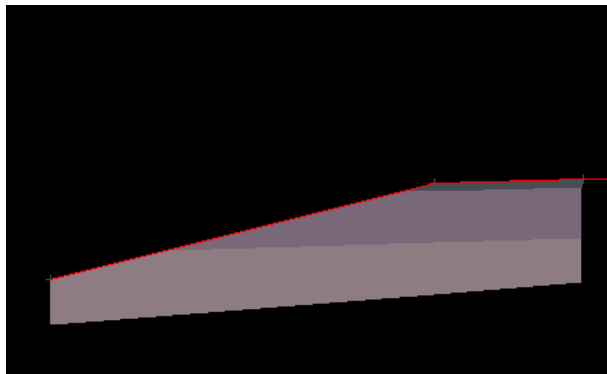
*This option refers to pavement that extends past the end link.*

*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.*

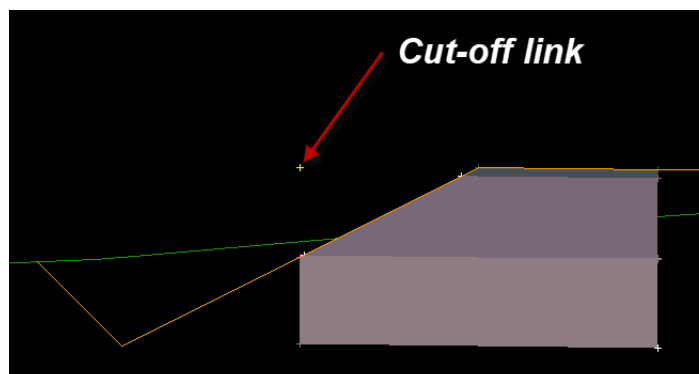


**Pavement cut-off Link** input

*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

Now documented in the V15 reference manual

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	
<b>Snippet</b>	SLIB\TRI_PAVEMENT_NEW_KERB_FRO...
<b>Chainages</b>	
Alias	
<b>Start chainage</b>	
Mode	Start (ref)
Extension ref	
<b>End chainage</b>	
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

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

Field Description	Type	Defaults	Pop-Up
<b>Pavement type</b> <i>A range from pavement manager.</i>	choice box		
<b>Kerb_type</b> <i>A range from pavement manager.</i>	choice box		
<b>Trimesh Ref Name Suffix</b> <i>This option will add the Reference Alignment name to the names of all pavement elements created, including model names.</i> <i>Ref name RS01, then RS01 is added.</i> <i>Models created: MESH PAVEMENT <b>RS01</b> MESH PAVEMENT STRS <b>RS01</b></i> <i>Note: MESH PAVEMENT &amp; MESH PAVEMENT STRS are taken from the Pavement Manager, under the Defaults tab.</i>	choice box	All Chars	
<b>Trimesh Suffix</b> <i>This suffix is used to make up the <b>unique name</b> of the trimesh and strings</i> <i>NOT the model names</i> <i>e.g. Suffix = A and snippet used on LHS</i> <i>Mesh name = AC14-L-A- <b>RS01</b> (Layer name-side-suffix-ref)</i> <i>Mesh strings name:</i> <i>AC14-L1-Z-L-A- <b>RS01</b> (Layer name-layer number-str-side-suffix-ref)</i>	input		
<b>Start link mode</b> <i>Reference refers to the AM selected reference string.</i> <i>3d Cut of Link refers to a Design Link (maybe a lane line e.g.).</i> <i>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.</i>	choice box	Reference	
<b>Start Link, Start String and Start Link Layer Name</b> <i>Fill in only what is required, depending on what is chosen as Start Link Mode.</i>			
<b>Start link slope (name grade)</b> <i>This grade is used on each layer if there is no "Start slope" defined in the pavement style.</i>	choice box	Vertical	
<b>Up of kerb link</b> <i>A valid design layer link name (e.g. KLL).</i>	name box		
<b>Back of kerb link</b> <i>A valid design layer link name (e.g. KIL).</i>	name box		
<b>Kerb links layer</b> <i>Generally, the layer is design.</i>	input	Design	
<b>Pavement slope (behind kerb)</b> <i>This grade is used on each layer if there is no "End slope" defined in the pavement style.</i>	choice box	Vertical*	
<b>Named grade kerb base</b> <i>this option refers to the base of the kerb. It can use the road surface, but that surface needs to be defined</i>	choice box	Horizontal*	

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\_FRO M\_ATTRS.mtfsnippet

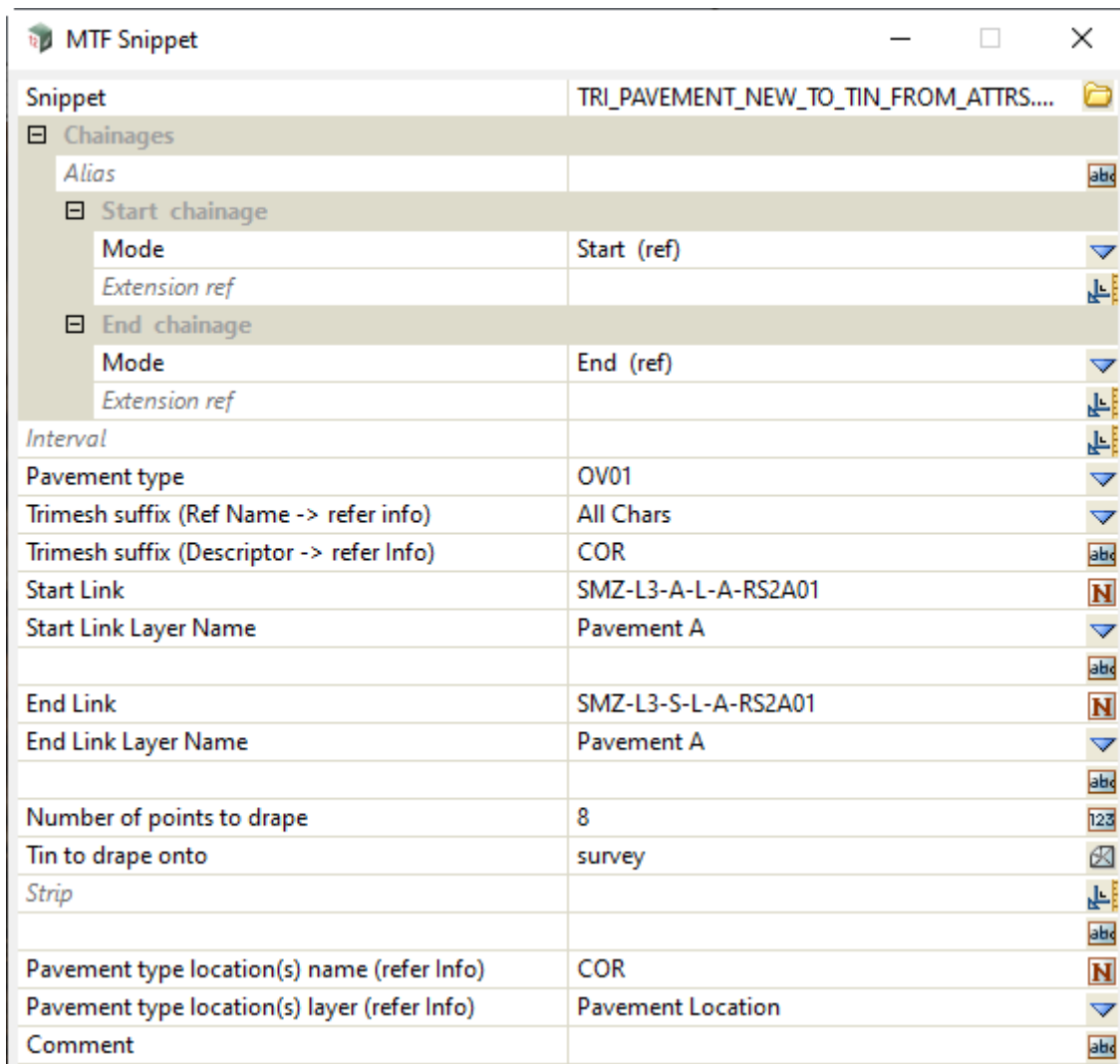
Now documented in the V15 reference manual

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
<b>Pavement_type</b> <i>A range from pavement manager.</i> <i>Note: Only the first layer will be used for the trimesh created.</i>	choice box		
<b>Trimesh Ref Name Suffix</b>	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.*

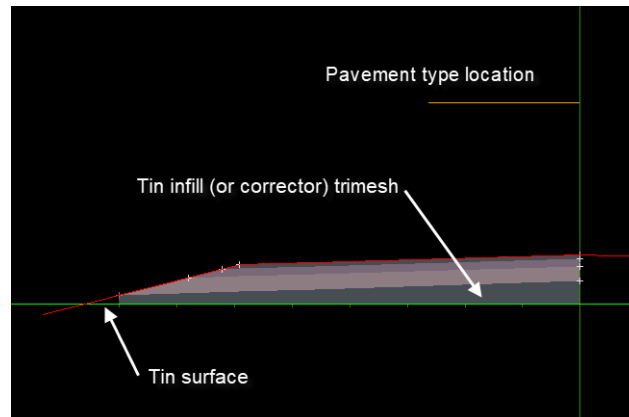
**Apply** button

*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

Now documented in the V15 reference manual

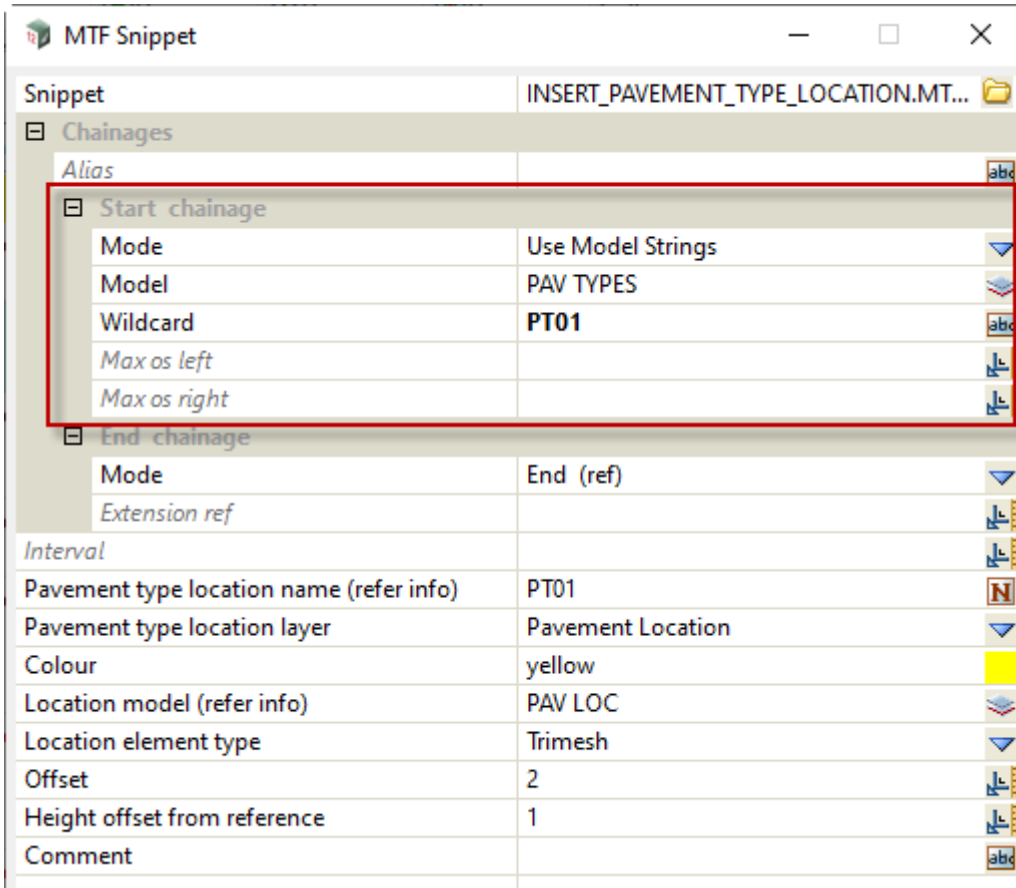
This snippet is used in conjunction with the **new** Pavement Manager

And any relevant NEW pavement snippets that use it

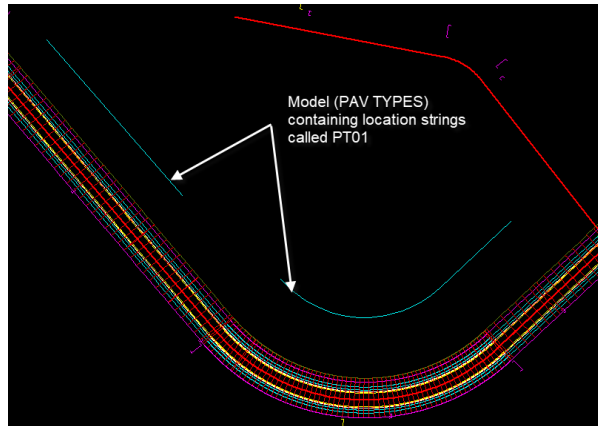
The snippet can create links on a user specified layer, that can then be used in other pavement snippets.

This process is used instead of the start/end chainages at the top of that snippet panel.

The MTF modifier called "Snippet" is used.





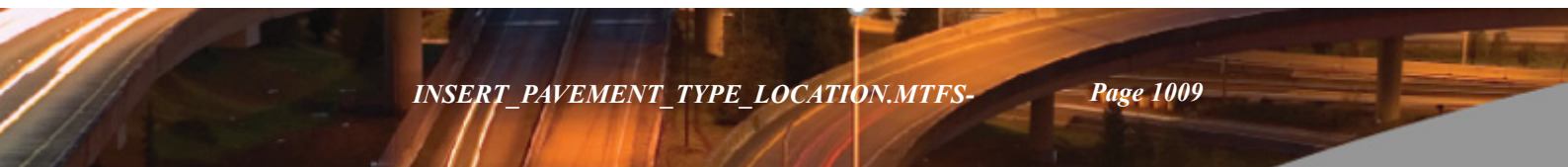


**NOTE:** The snippet is placed using the mode "Use model strings"

This enables the user to simply draw strings to define pavement locations

Field Description	Type	Defaults	Pop-Up
<b>Pavement type location name (refer info)</b>	input box		
<i>Link name that refers to the pavement type.</i>			
<b>Pavement type location layer (refer info)</b>	layer box		
<i>Layer for the links.</i>			
<b>Colour</b>	colour box	red	available colours
<i>Colour of polygon and or trimesh chosen below.</i>			
<b>Location model (refer info)</b>	model box		available models
<i>Model for polygon and or trimesh chosen below. It is optional so if not used, then no polygon or trimesh will be created.</i>			
<b>Location element type</b>	colour box	Polygon	
<i>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.).</i>			
<b>Offset</b>	real box	2	
<i>Will be used for the polygon width (measured from the reference).</i>			
<b>Height offset from reference</b>	real box	1	
<i>Position height above the reference string.</i>			

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...

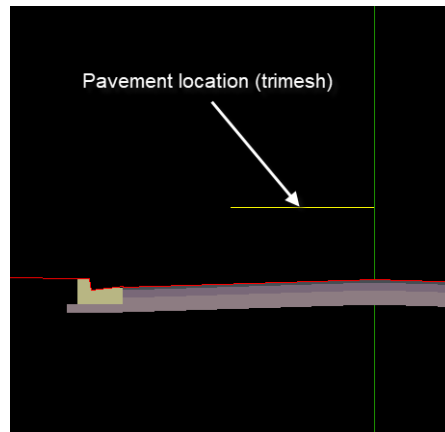
Chainages	
Alias	
Start chainage	
Mode	Start (ref)
Extension ref	
End chainage	
Mode	End (ref)
Extension ref	
Interval	
Pavement type	PT01
Kerb type	SA
Pavement extent	Full
Trimesh suffix (Ref Name -> refer info)	All Chars
Trimesh suffix (Descriptor -> refer Info)	A
Start link mode	Reference
Start Link	
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 pavement 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)	<b>PT01</b>
Pavement type location(s) layer (refer Info)	<b>Pavement Location</b>
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

Now documented in the V15 reference manual

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

Now documented in the [V15 reference manual](#)

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
<b>Existing MTF</b> <i>The existing MTF file.</i>	file box		*.mtf files
<b>Proposed Seed</b> <i>New name for the seed file.</i>	file box		*.mtf_seed files

### Buttons at Bottom

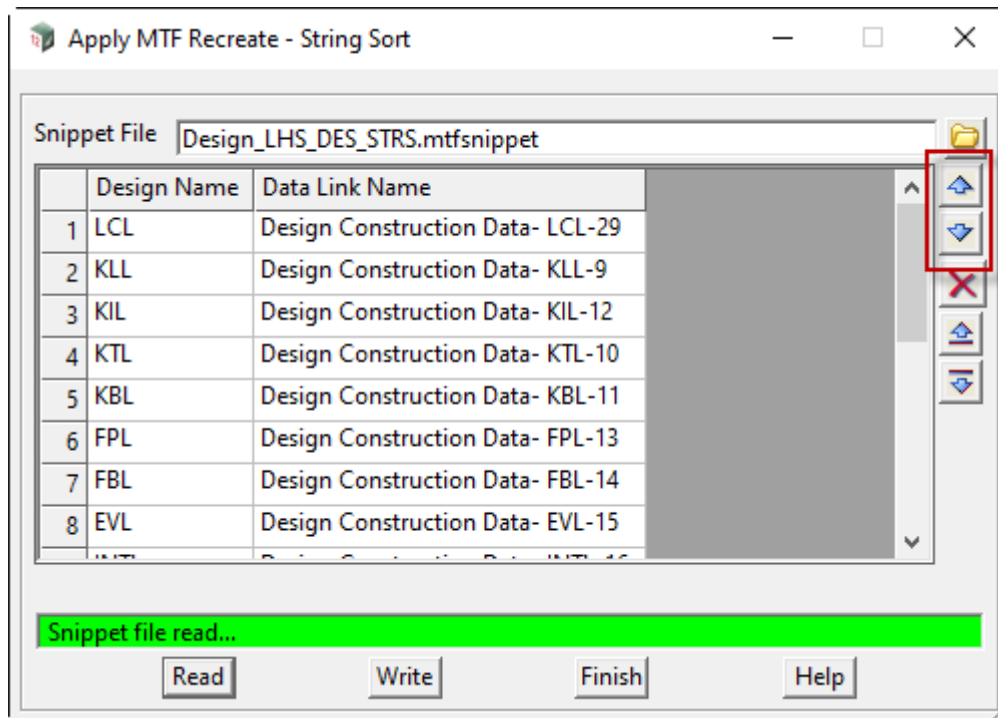
**Write** button  
*Write file (copies existing mtf to an mtf\_seed file).*

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

Now documented in the V15 reference manual



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.

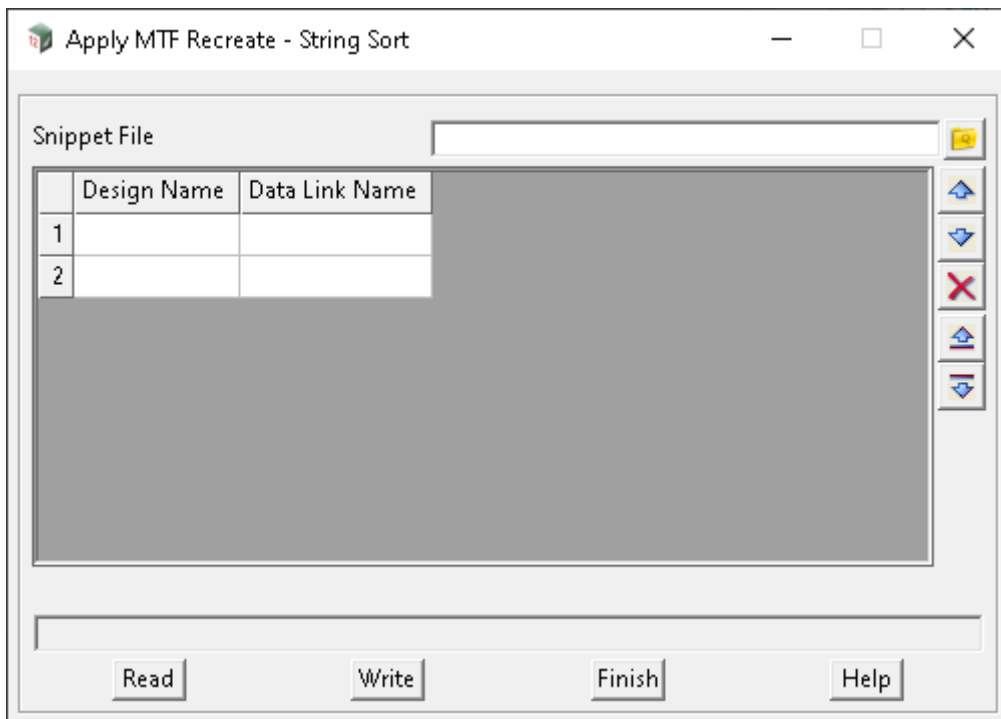
An effort is made to sort the strings into their position relative to the reference alignment. In some circumstances this automated process may fall short.

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
<b>Snippet file</b>	file box		*.mtfsnippet
<i>Snippet file created using the Apply MTF Recreate.</i>			
<b>Grid</b>	selections		
<i>Lines read from the file, which can be moved up or down via the arrows highlighted.</i>			

### 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

Now documented in the V15 reference manual

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.

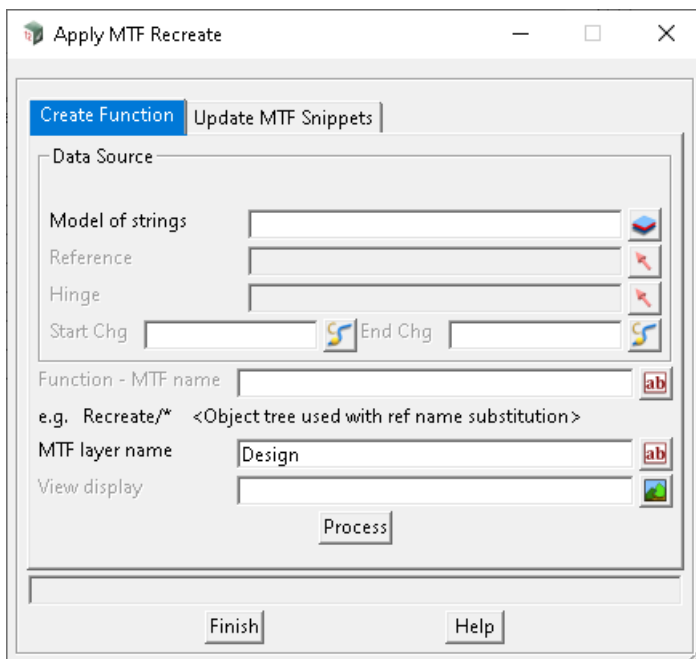
**Note:** Remove any data from the Model of strings that does not run longitudinally along the reference string (road centreline).

**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
<b>Create Function tab</b>			
<b>Model of strings</b>	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 [18.3 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 [18.3 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**

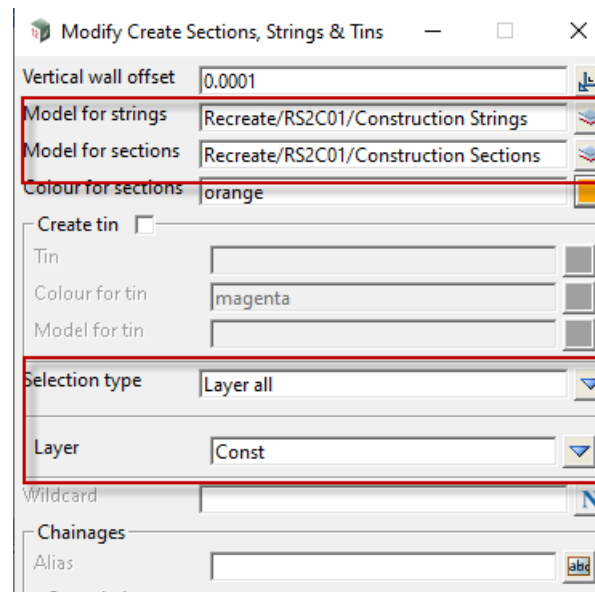
**Recreate/RS01 Construction Strings**

**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, str & tins

e.g.



*This layer would also have to be 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:*

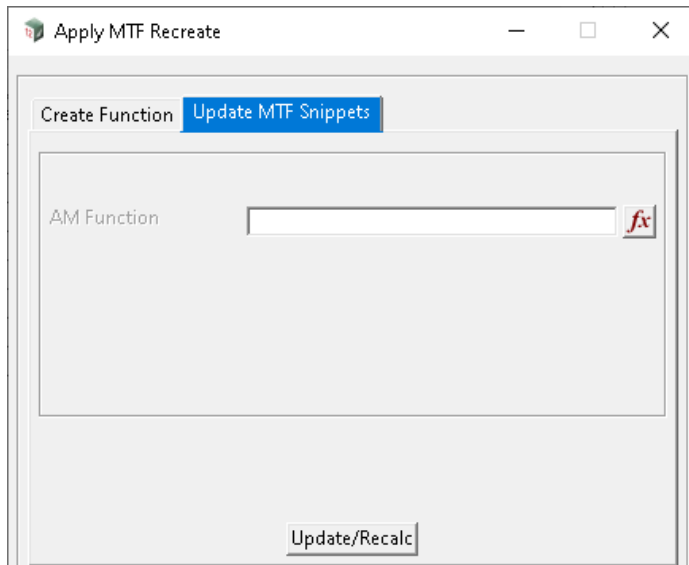
*RS01 Construction Data (a copy of the original model of strings)*

*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

Now documented in the V15 reference manual

(c) `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 if the message has no token, it will be 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!"

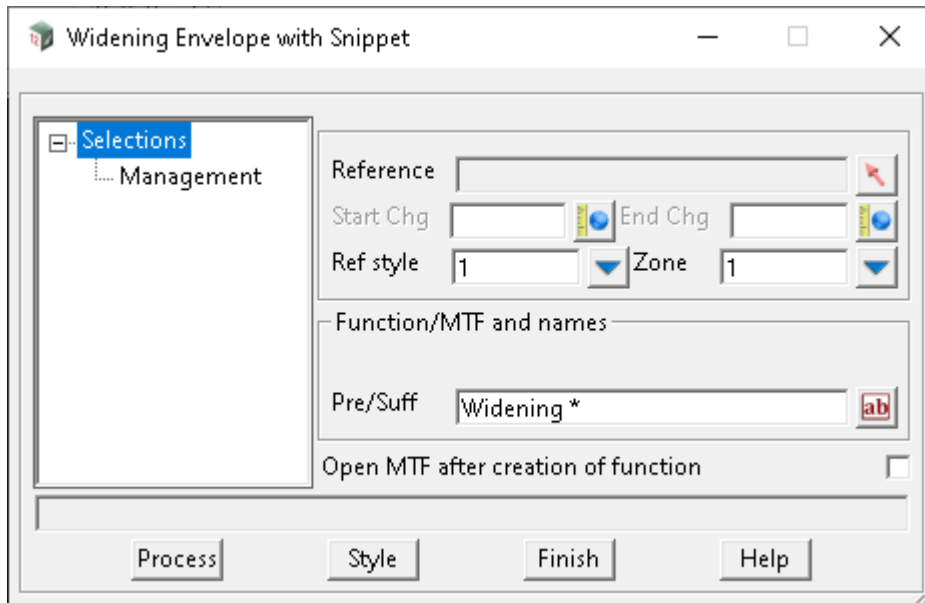
Continue to [16.20 Road Widening - with Snippet](#) or go back to [16.19 Debugging Snippets](#) or [16 Design](#).

# 16.20 Road Widening - with Snippet

Position of option on menu: Design =>Roads =>More =>Road widening (with snippet)

Now documented in the V15 reference manual

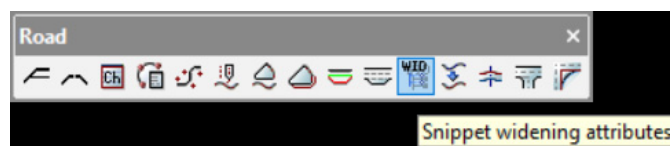
Selecting Road widening (with snippet) brings up the Widening Envelope with Snippet panel.



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

Field Description	Type	Defaults	Pop-Up
<b>Reference</b> <i>Select super alignment.</i>	string select		
<b>Start Chg</b> <i>Optional start chainage.</i>	real box		
<b>End Chg</b> <i>Optional end chainage.</i>	real box		
<b>Ref style</b> <i>Reference styles can be created and set under "Style".</i>	choice box	1	1-10
<b>Zone</b> <i>Zones are part of the Ref style</i>	choice box	1	1-10

*Note: Refer toolbar menu, see 9.2.28 Road Toolbar.*





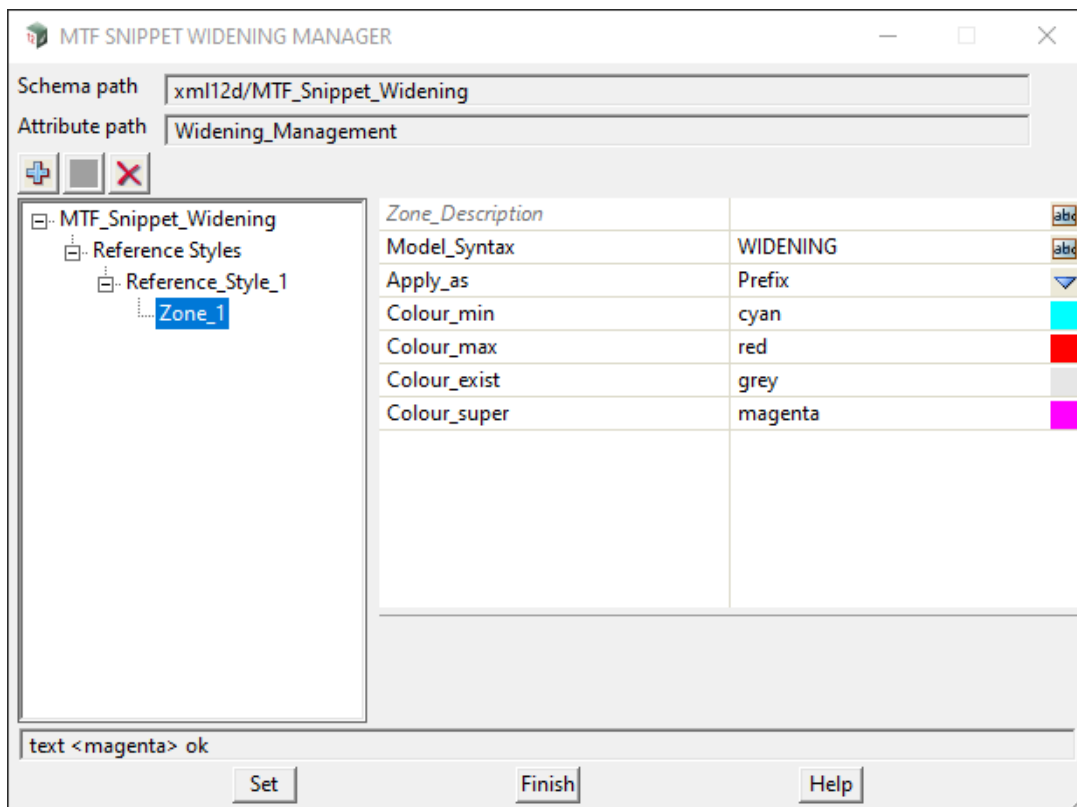
**Pre/Suff**                      input box                      Widening \*  
*Function/MTF uses this name plus the name of the reference alignment.*


**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.*

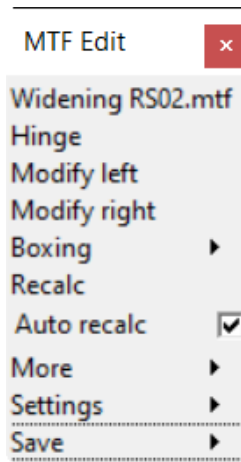
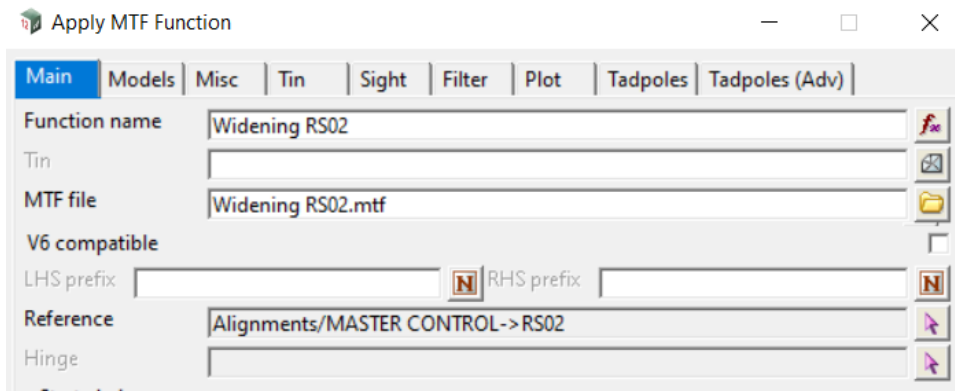


 Selecting the add button above allows you to add other Reference styles and Zones. (10 maximum for each).

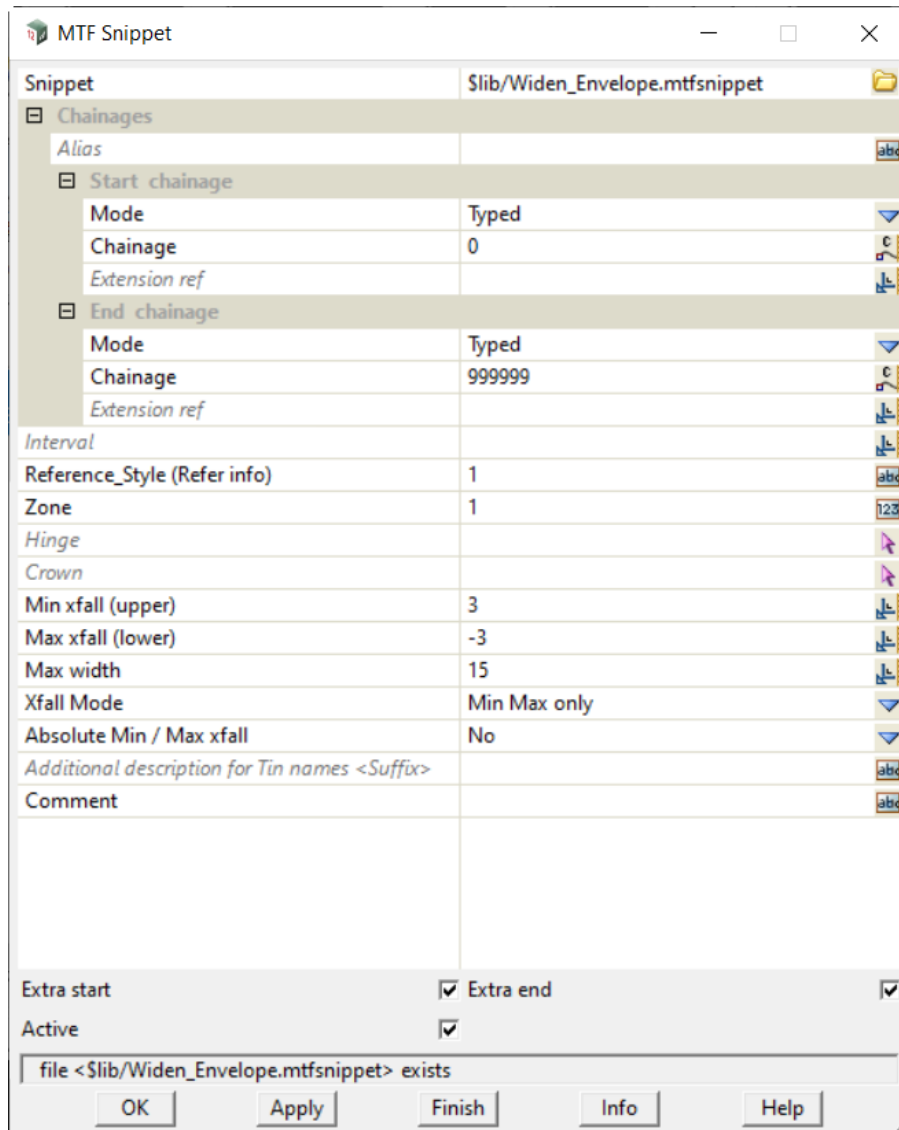
*For more information see 19.11.12.5.1. Road Widening Manager.*



## Xfall envelope selections



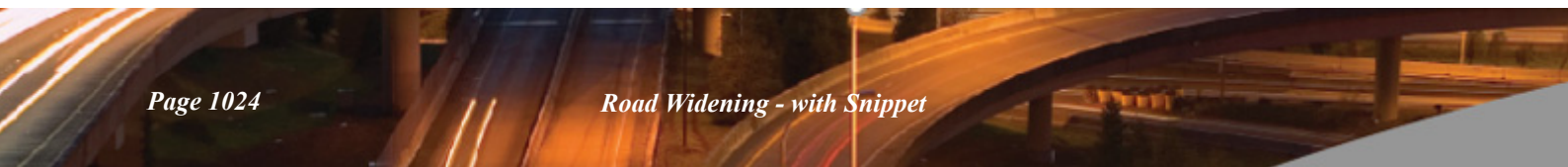
The snippet below comes from the “**Modify left**” in the MTF created.

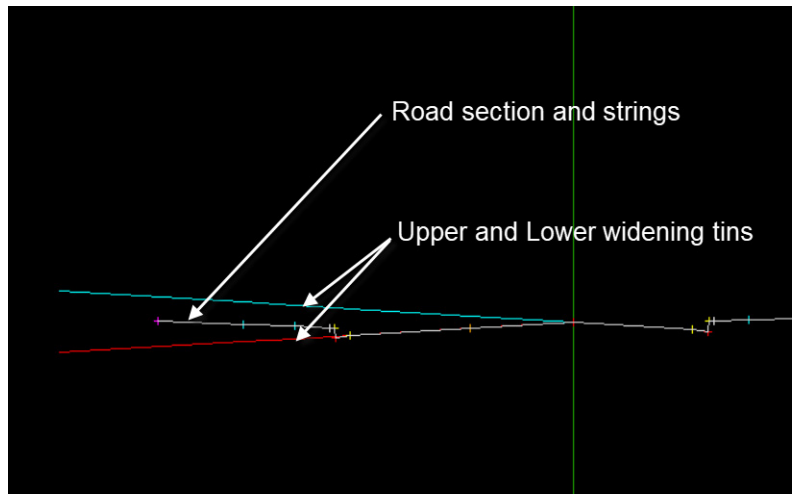


The snippet below comes from the first run when the function/MTF is created. It uses the Upper and Lower xfalls, positioned at the reference string.

**Xfall mode (Min Max only)**

*Refer section view **below**, showing the profiled design road section and the two widening tins.*

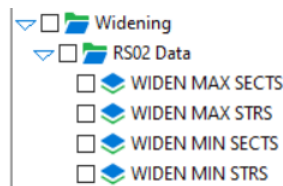




Default model for tins as per below:



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.

Snippet	Slib/Widen_Envelope.mtfsnippet
Chainages	
Alias	
Start chainage	
Mode	Typed
Chainage	0
Extension ref	
End chainage	
Mode	Typed
Chainage	999999
Extension ref	
Interval	
Reference_Style (Refer info)	1
Zone	1
Hinge	Apply/Strings/RS02-> CEL
Crown	
Min xfall (upper)	3
Max xfall (lower)	-3
Max width	15
Xfall Mode	Extend Existing
Absolute Min / Max xfall	No
Additional description for Tin names <Suffix>	
Comment	

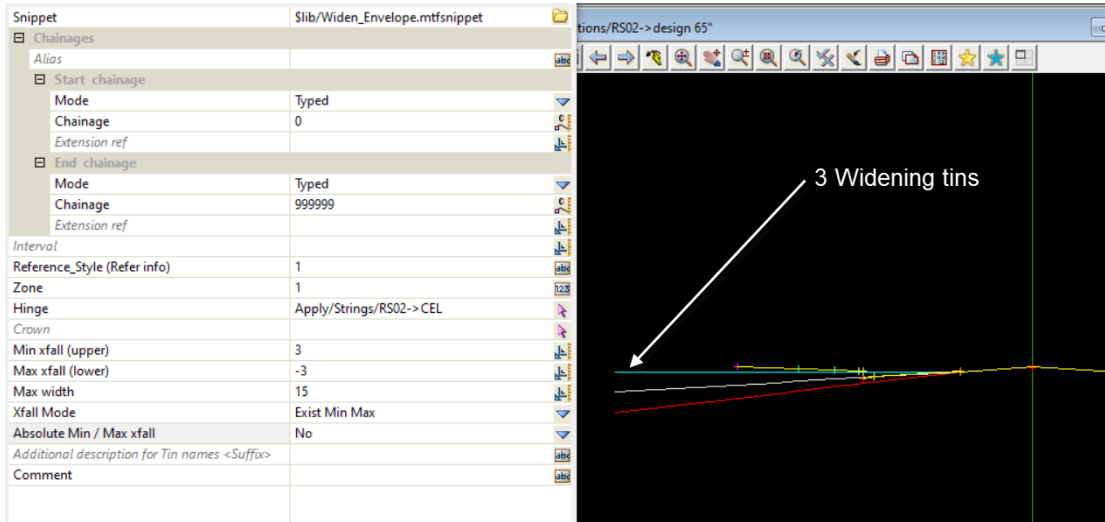
The screenshot shows a software interface with a toolbar at the top and a main view area. The main view area displays a road cross-section with a yellow line representing the widening tin. A vertical green line is also visible. The interface includes various icons for navigation and editing.

### 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")

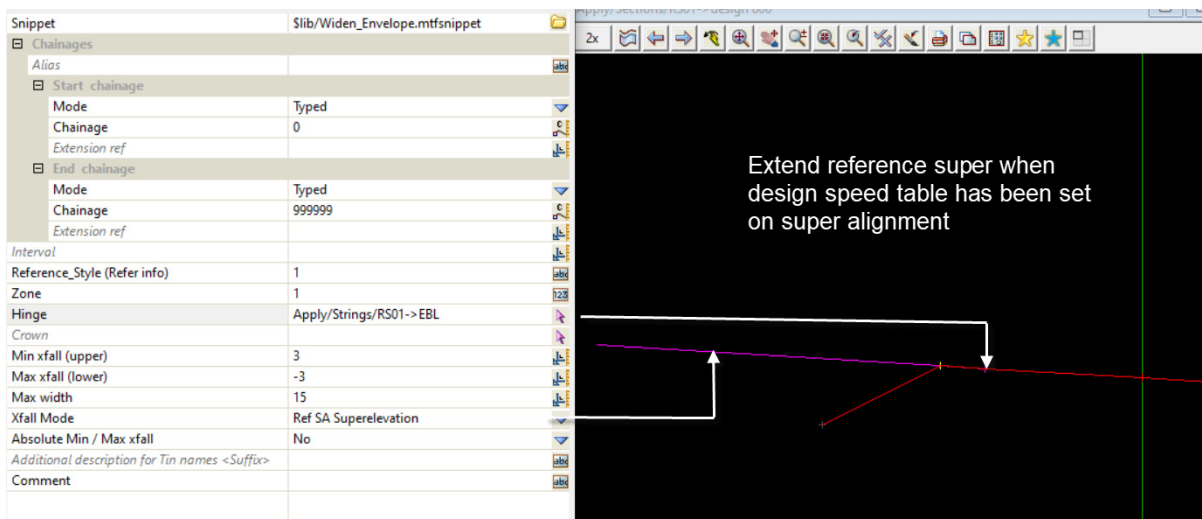
Refer section view **below**, showing the profiled design road section and the 3 widening tins.



### 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.

Snippet	Slib/Widen_Envelope.mtfsnippet
Chainages	
Alias	
Start chainage	
Mode	Typed
Chainage	0
Extension ref	
End chainage	
Mode	Typed
Chainage	999999
Extension ref	
Interval	
Reference_Style (Refer info)	1
Zone	1
Hinge	Apply/Strings/RS01->EBL
Crown	
Min xfall (upper)	3
Max xfall (lower)	-3
Max width	15
Xfall Mode	Super Min Max
Absolute Min / Max xfall	No
Additional description for Tin names <Suffix>	
Comment	

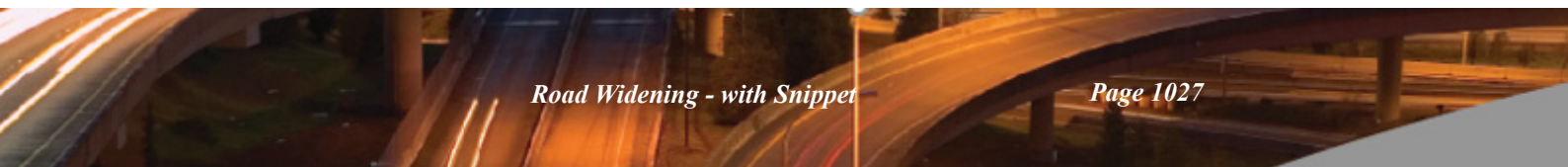
**Crown and Hinge selection**

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.

Snippet	Slib/Widen_Envelope.mtfsnippet
Chainages	
Alias	
Start chainage	
Mode	Typed
Chainage	0
Extension ref	
End chainage	
Mode	Typed
Chainage	999999
Extension ref	
Interval	
Reference_Style (Refer info)	1
Zone	1
Hinge	Apply/Strings/RS01->EBR
Crown	Apply/Strings/RS01->RS01
Min xfall (upper)	3
Max xfall (lower)	-3
Max width	15
Xfall Mode	Exist Min Max
Absolute Min / Max xfall	No
Additional description for Tin names <Suffix>	
Comment	

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"

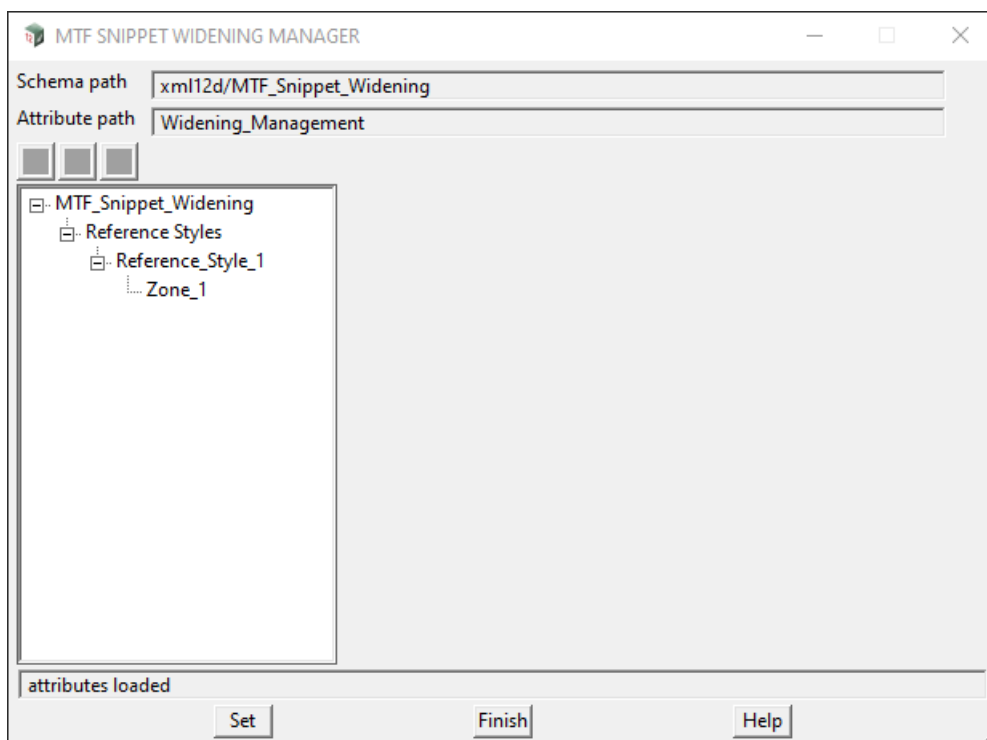
There are up to ten reference styles and each style consists of a possible further ten zones.

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.

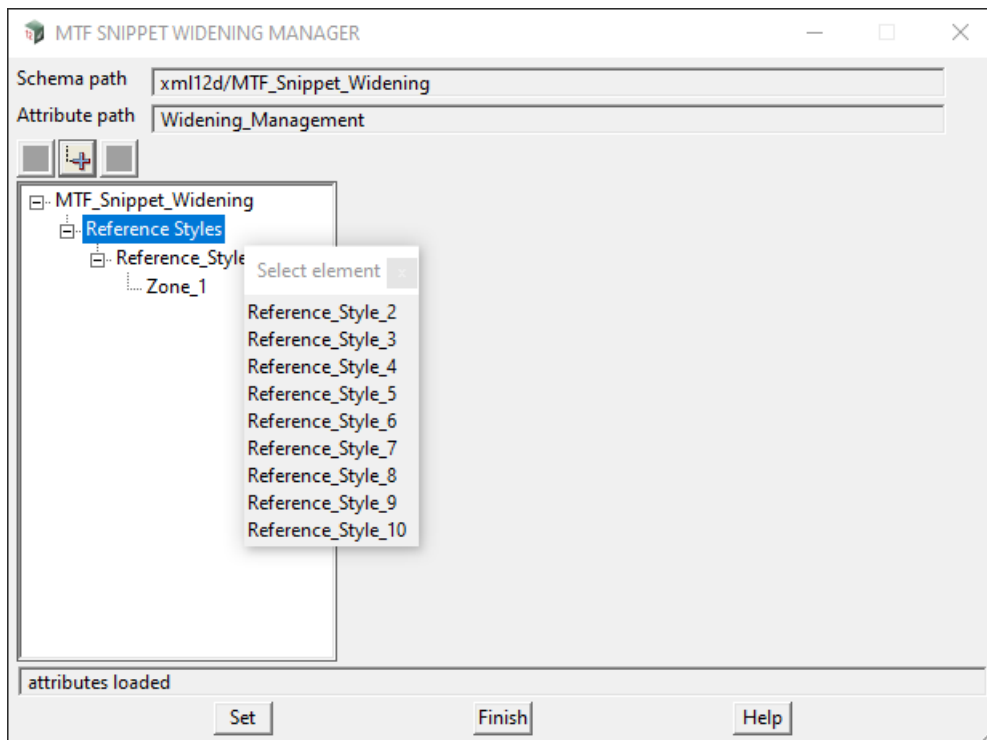


The fields and buttons used in this panel have the following functions:

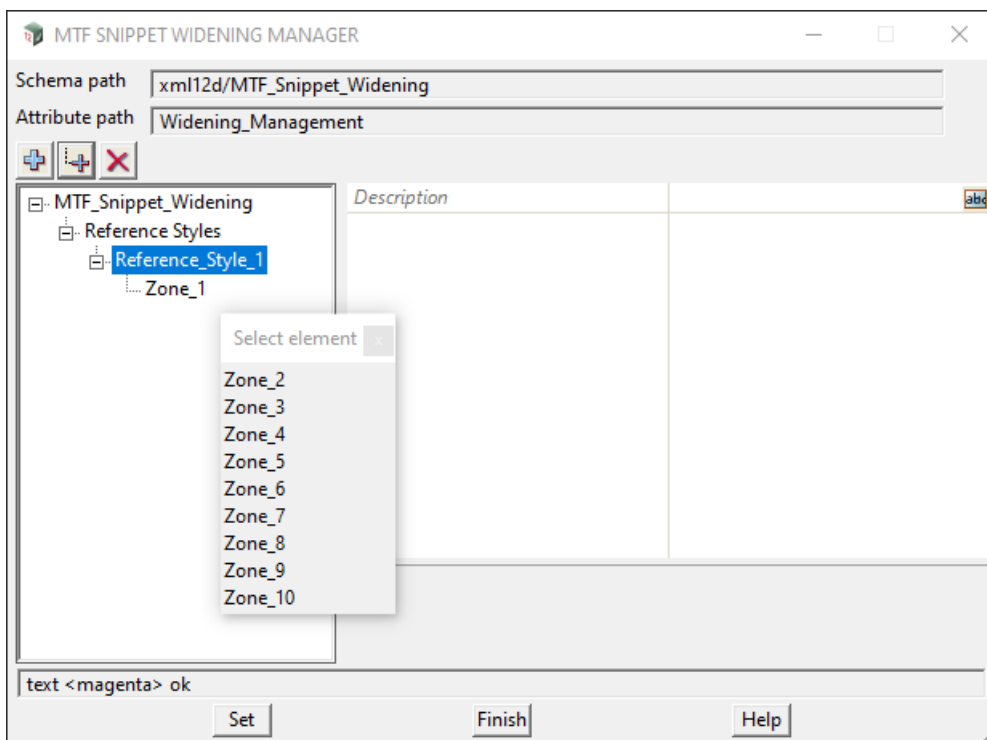
Field Description	Type	Defaults	Pop-Up
<b>Reference Styles</b>	file box		*.12dpm files

*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**.*



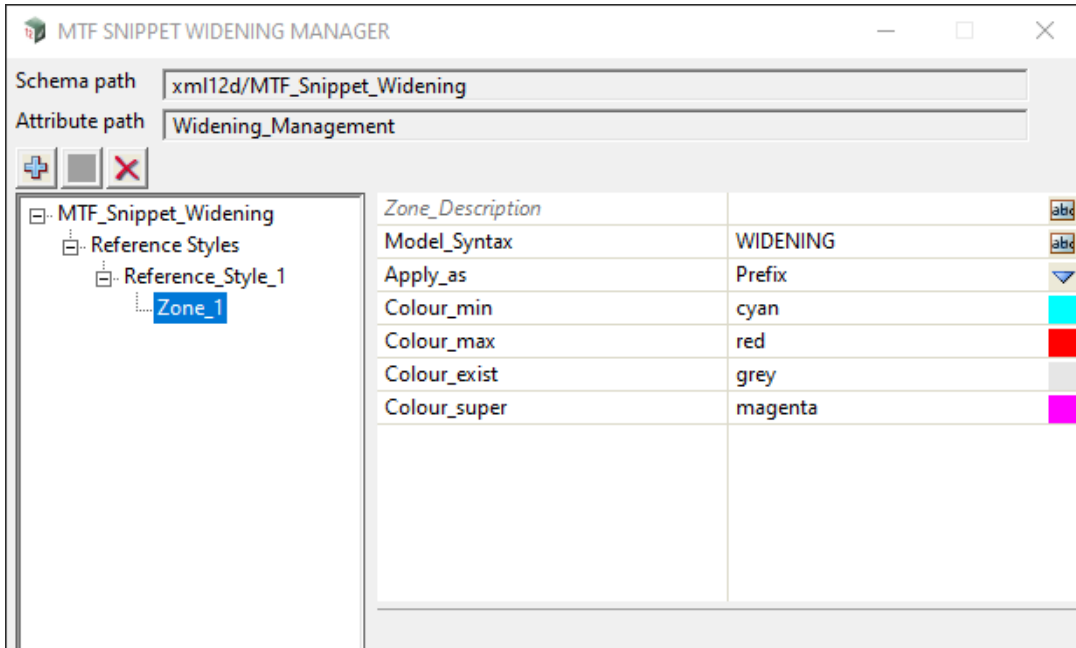


When the new **Reference\_Style\_n** is highlighted, the Add child icon + appears and clicking on the + activates a drop down menu with the new Zone number to be added.





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\_syntax + 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](#).

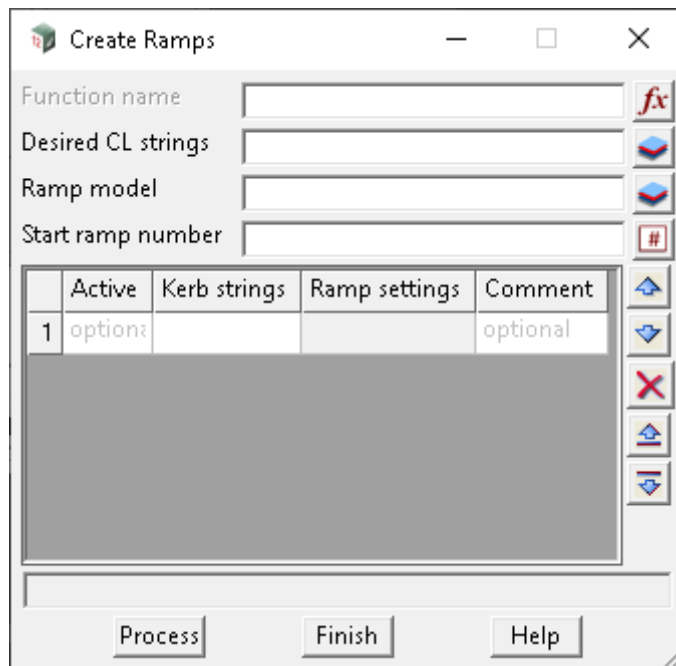
# 16.21 Create Ramps and Driveways

**Position of option on menu:** Design =>Roads =>Create ramps/driveways

Now documented in the V15 reference manual

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
<b>Function name</b>	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.*

<b>Desired CL Strings</b>	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.*

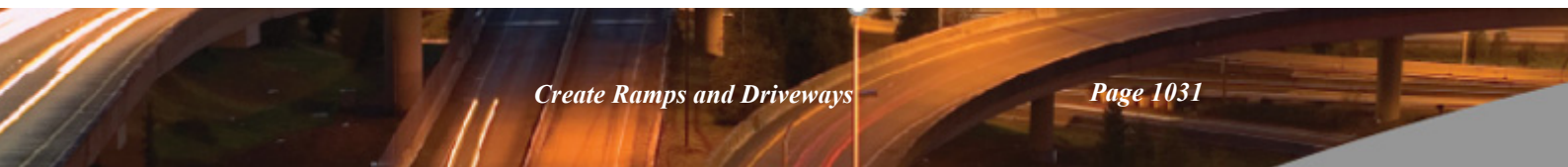
<b>Ramp Model</b>	model box		available models
-------------------	-----------	--	------------------

*Model name required into which the newly created ramp strings will be produced.*

<b>Start ramp number</b>	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

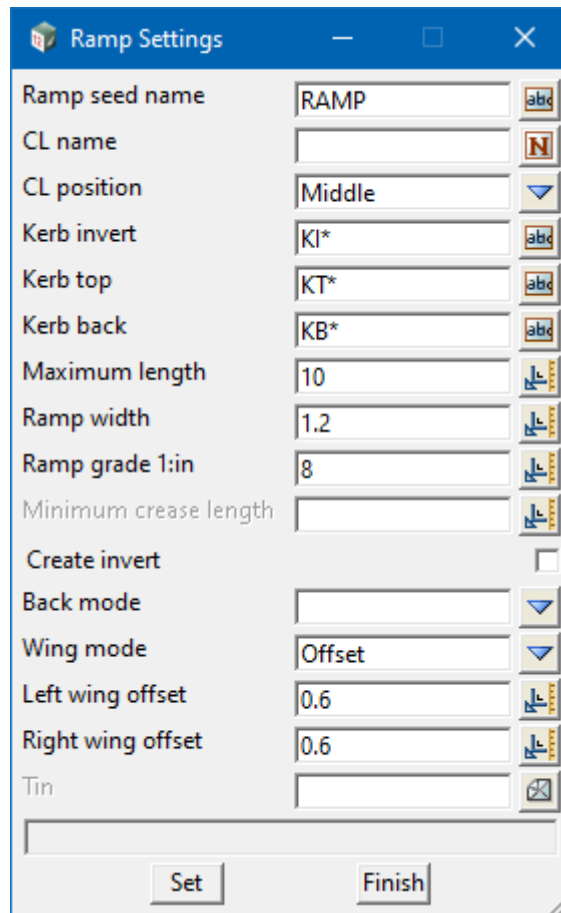
*Once selected, the values provided above in the panel are calculated and any new ramp strings are generated into the "Ramp model".*

**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
<b>Ramp seed name</b>	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.*

<b>CL name</b>	name box		
----------------	----------	--	--

*The string name selected to build the ramp from. This string is uniquely named within the "Desired CL strings" model provided above.*

<b>CL position</b>	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.*

<b>Kerb invert</b>	text box	KI*	
--------------------	----------	-----	--

*String name to be placed on the created ramp string at the time of processing.*

<b>Kerb top</b>	text box	KT*	
-----------------	----------	-----	--

*String name to be placed on the created ramp string at the time of processing.*

<b>Kerb back</b>	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

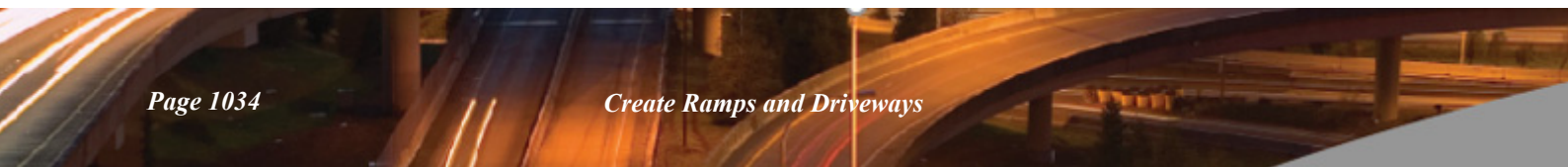
If **blank**, then calculation of the ramp grade is used to determine the length of the ramp produced.

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 Computers

Position of option on menu: Design =>Roads =>More =>Kret convert to computers

Now documented in the V15 reference manual

Selecting Kret convert to computers, displays the **Computer Kreturn & Culdesac Create** panel on the screen



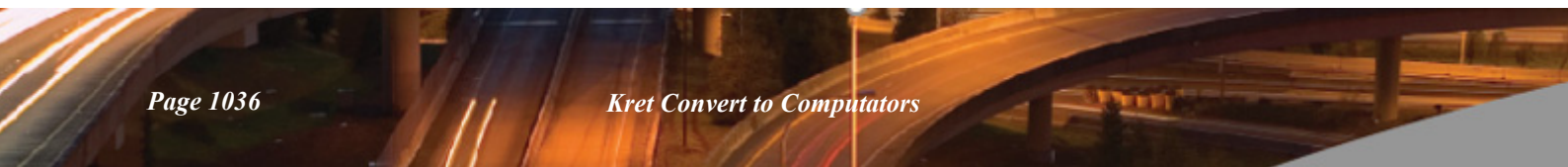
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Select App</b>	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.*



<b>OFF</b>	real box	3.5	
<b>%</b>	real box	-3	
<b>Select Dep</b>	button		
<i>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.</i>			
<b>OFF</b>	real box	3.5	
<b>%</b>	real box	-3	
<b>Kret Radius</b>	choice box	Kret Radius	Kret Radius, Kret String, Culdesac
<i>Radius of new super alignment to be created for the kerb return (enter value below choice field).</i>			
<i>Note: The radius value should be a positive value for either a new left or right kerb return arc being designed.</i>			
<b>Kret String</b>	choice box		
<i>Requires an existing string to be selected, from which the radius value is obtained.</i>			
<i>Example: Layout strings are super strings only from a cad process with the correct radius you require for your new kerb return alignment.</i>			
<b>Culdesac</b>	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.*

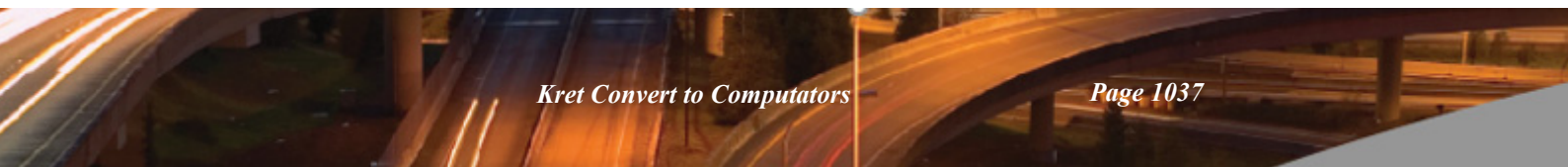
**Left and Right side parameters**

**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

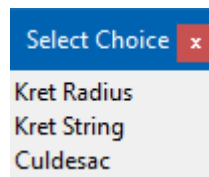
*Radius to use to be tangential to the radius of the cul-de-sac bulb.*



**%** 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** options have their own Help system which is brought up by clicking on **Help** on the **Track menu**, or clicking **Help** on each of the **Track panels**.

Now documented in the V15 reference manual

The Track walk-right menu is

Track	See
Calculate centreline	<a href="#">16.23.1 Calculate Centreline</a>
Calculate slew	<a href="#">16.23.4 Calculate Slew</a>
Calculate cant	<a href="#">16.23.5 Calculate Cant</a>
Section to snippet	<a href="#">16.23.6 Section to Snippet</a>
Turnouts ▶	<a href="#">16.23.2 Track Turnouts</a>
Copy VC	<a href="#">16.23.3 Copy VC</a>
Light rail stop distance	<a href="#">16.23.7 Light Rail Stopping Distance</a>
Structure gauge	<a href="#">16.23.8 Structure Gauge Panel</a>
Label ▶	<a href="#">16.23.10 Track Label</a>
Equality from Chainage	
Chainage from Equality	
Old ▶	<a href="#">16.23.9 Track Old</a>

## 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 [16.23.4 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.

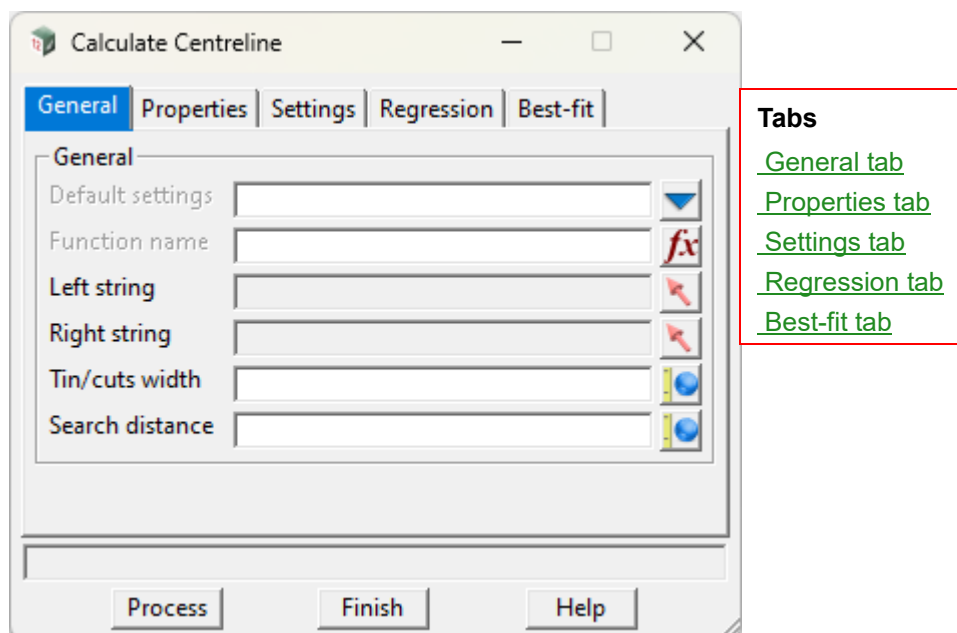
These elements can each generate a centreline with text at each vertex, a tin, a trimesh or cut strings.

The cut strings generated can be used as [26.7.4.25 Cuts - Long Section](#) cut strings inside the [26.7.4 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 [26.7.4.8.8 Boxes - Offset String Titles/Heights/Depths](#) and tins [26.7.4.8.7 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.



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.*

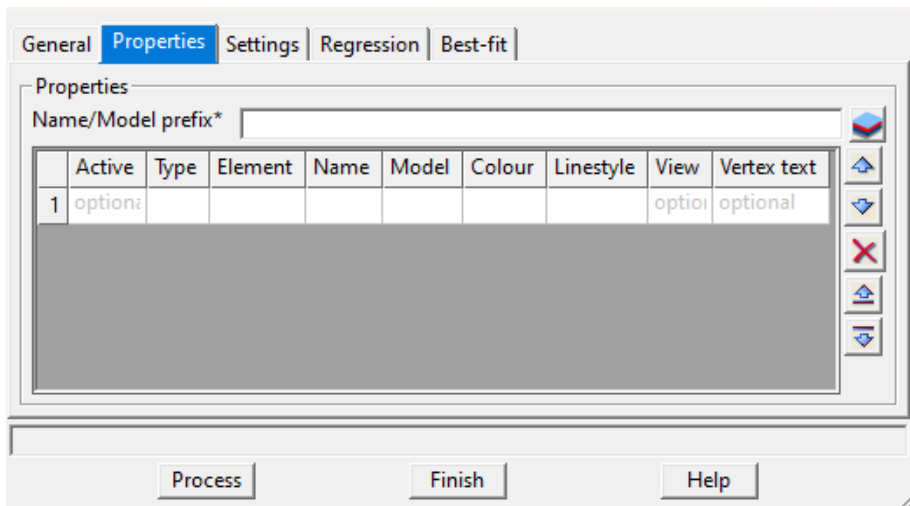
**Left string** string select  
*Left string to calculate the centreline from.*

**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

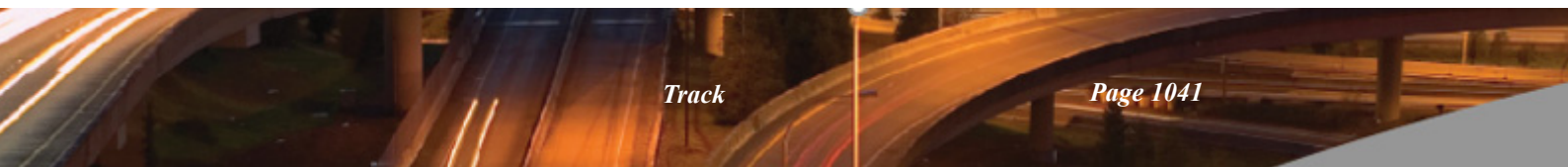


- Tabs**
- [General tab](#)
  - [Properties tab](#)
  - [Settings tab](#)
  - [Regression tab](#)
  - [Best-fit tab](#)

### 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.*

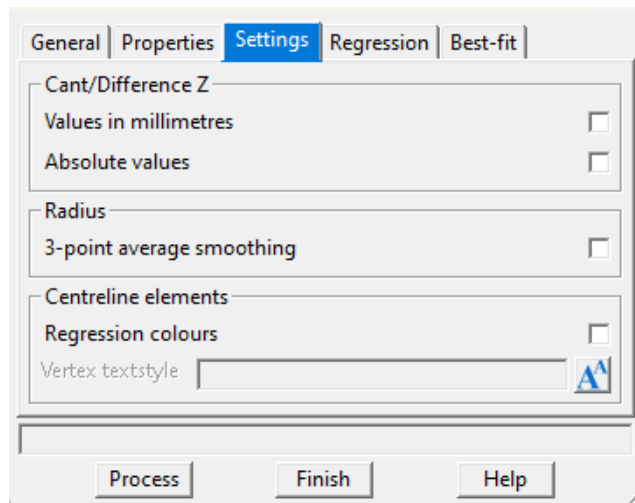




<b>Type</b>	choice box	
	<i>The type of element to be generated. There are the following options: Lowest string, average height, highest string, left string, right string, radius, cant/difference z, width2D, width3D, Xfall grade %, Slope 1v in h, Regression and Regression spiral .</i>	
	<i><b>Lowest string:</b> An element with the lowest string height applied to the z-coordinate.</i>	
	<i><b>Average height:</b> An element with the average height of both strings applied to the z-coordinate.</i>	
	<i><b>Highest string:</b> An element with the highest string height applied to the z-coordinate.</i>	
	<i><b>Left string:</b> An element with the left string height applied to the z-coordinate.</i>	
	<i><b>Right string:</b> An element with the right string height applied to the z-coordinate.</i>	
	<i><b>Radius:</b> An element with a 3-point radius applied to the z-coordinate. This value is affected by settings in the <b>Cant/Radius</b> tab.</i>	
	<i><b>Cant/Difference Z:</b> 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 <b>Cant/Radius</b> tab.</i>	
	<i><b>Width2D:</b> An element with the 2D distance between the left and right string points applied to the z-coordinate.</i>	
	<i><b>Width3D:</b> An element with the 3D distance between the left and right string points applied to the z-coordinate.</i>	
	<i><b>Xfall grade %:</b> The xfall or grade measured in % between the left and right string.</i>	
	<i><b>Slope 1v in h:</b> The slope or gradient measured in 1v in h between the left and right string.</i>	
	<i><b>Regression:</b> 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.</i>	
	<i><b>Regression spiral:</b> 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 <b>Spiral tolerance</b>.</i>	
<b>Element</b>	choice box	
	<i>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.</i>	
<b>Name</b>	custom name box	available names
	<i>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 <b>Name/Model prefix</b> * field.</i>	
<b>Model</b>	custom model box	available models
	<i>Model name of the generated element. An asterisk can be used to exchange the text entered in the <b>Name/Model prefix</b> * field.</i>	
<b>Colour</b>	colour box	available colours
	<i>Colour to be applied to the generated element.</i>	
<b>Linestyle</b>	linestyle box	
	<i>Linestyle to be applied to the generated element.</i>	
<b>View</b>	view box	available views
	<i>View for the generated element to be added to. If the view does not exist, a view will be created.</i>	

**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****Tabs**

- [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.

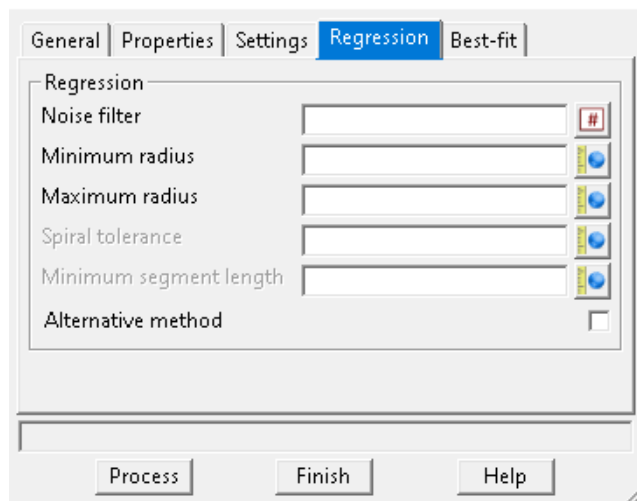
**Centreline elements****Regression colours** tick box not ticked

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



### Tabs

[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.*

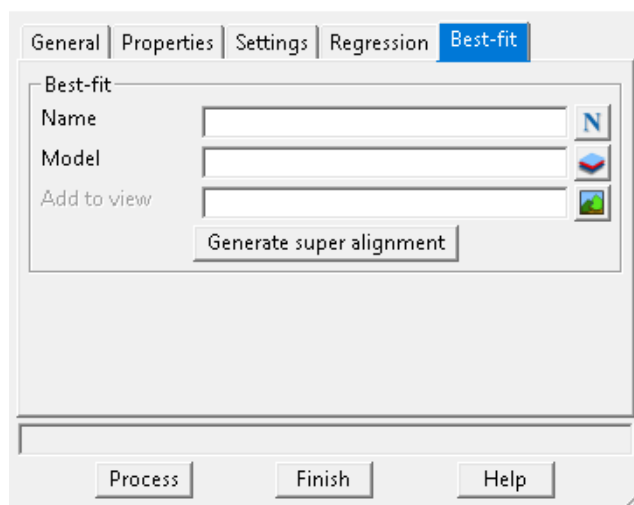
**Minimum segment length** real box

*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



### Tabs

- [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 Track Turnouts](#) or go back to [16.23.1 Calculate Centreline](#) or [16.23 Track](#).

## 16.23.2 Track Turnouts

**Position of menu:** Design =>Track =>Turnouts

The Track Turnouts walk-right menu is

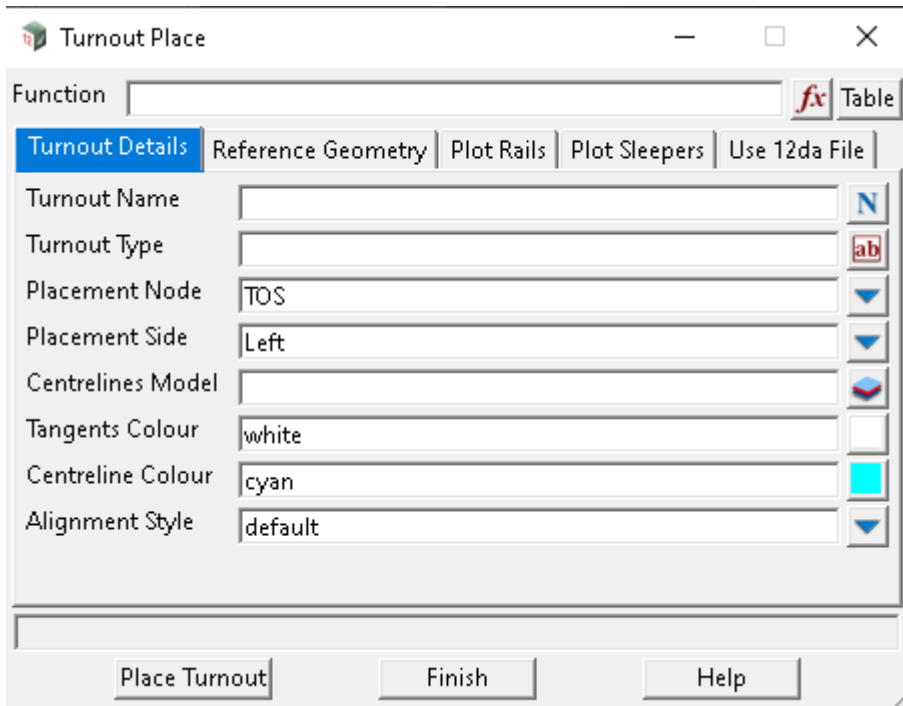
Track Turnouts 	See
Place	<a href="#">16.23.2.1 Turnout Place</a>
Create/Edit	<a href="#">16.23.2.2 Turnouts Create/ Edit</a>
Read	<a href="#">16.23.2.3 Read Turnouts</a>
Write	<a href="#">16.23.2.4 Write Turnouts File</a>

### 16.23.2.1 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.



- Tabs**
- [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
<b>Function</b>	function box		all function

*The name of the function.*

<b>Table</b>	button
--------------	--------

*The table displays a panel containing a grid box of all **Turnout Place** functions where a function can be selected and loaded.*

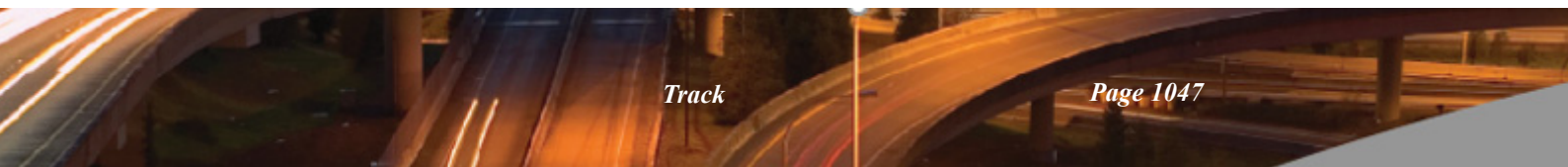
#### Turnout Details Tab

<b>Turnout Name</b>	name box	available names
---------------------	----------	-----------------

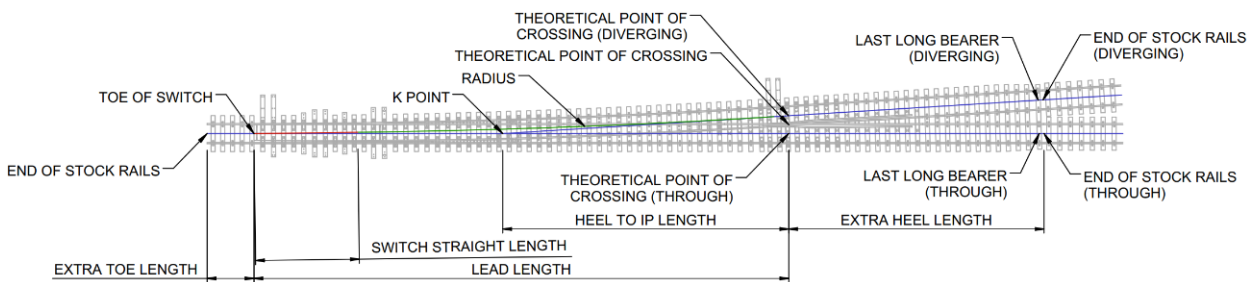
*The name of the turnout to be placed.*

<b>Turnout Type</b>	custom box	all turnouts
---------------------	------------	--------------

*Selecting the Turnout Type button opens a panel and a list of turnout types that have either been imported by [16.23.2.3 Read Turnouts](#) or created in [16.23.2.2 Turnouts Create/ Edit](#).*







<b>Placement Node</b>	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.

<b>Centreline Model</b>	model box		available models
-------------------------	-----------	--	------------------

The name of the model that the centrelines will be generated onto.

<b>Tangents Colour</b>	colour box	white	available colours
------------------------	------------	-------	-------------------

The colour that the tangents elements will be coloured.

<b>Centreline Colour</b>	colour box	cyan	available colours
--------------------------	------------	------	-------------------

The colour that the centreline elements will be coloured.

<b>Alignment Style</b>	style box	default	alignment styles
------------------------	-----------	---------	------------------

The alignment style applied to the super alignment that is generated for the diverging track.

## Reference Geometry Tab

Turnout Details	<b>Reference Geometry</b>	Plot Rails	Plot Sleepers	Use 12da File
Reference Type	vertex/segment #			
Reference String				
Direction	Normal			
Vertex Index				
Chainage Offset				
Lateral Offset				
Height Offset				
Rotation Angle				
Absolute rotation angle				<input type="checkbox"/>

### Tabs

- [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

*The 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.*

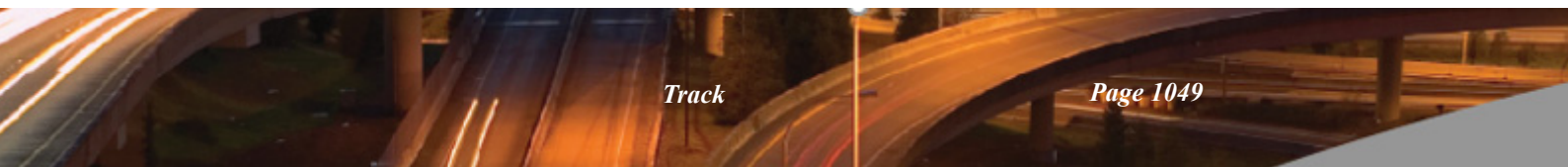
**Tag Name**                      tag box                      all tags

*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

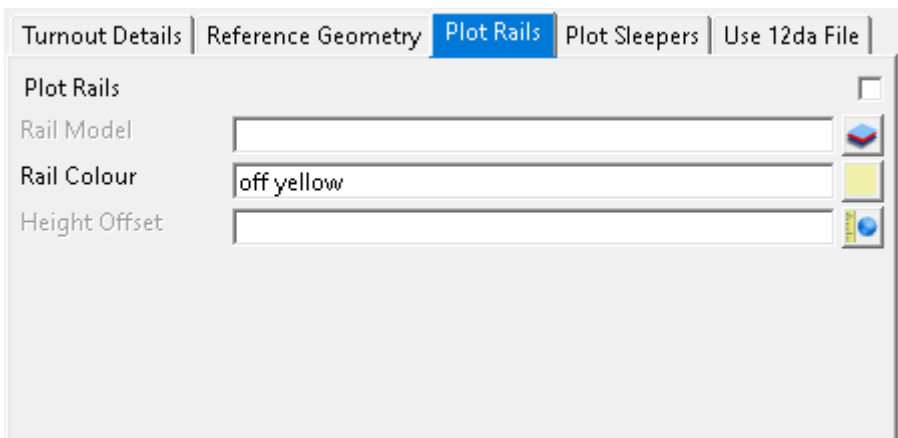
For the final turnout rotation angle, the value of **Rotation Angle** is added to the rotation of the turnout of the **Reference String**.

**Absolute rotation angle** tick box not ticked

If **ticked**, the turnout rotation angle will be set by the **Rotation Angle**.

If **unticked**, the **Rotation Angle** value will be added relative to the **Reference String** angle.

### Plots Rail Tab



**Tabs**

- [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  
*The name of the model that the rails will be generated onto.*
- Rail Colour**                      colour box                      off yellow                      available colours  
*The colour that the rails will be coloured.*
- Height Offset**                      real box                        
*The vertical offset distance that the rails will be generated.*

### Plots Sleepers Tab

- Tabs**
- [Turnout Details Tab](#)
  - [Reference Geometry Tab](#)
  - [Plots Rail Tab](#)
  - [Plots Sleepers Tab](#)
  - [Use 12da File Tab](#)

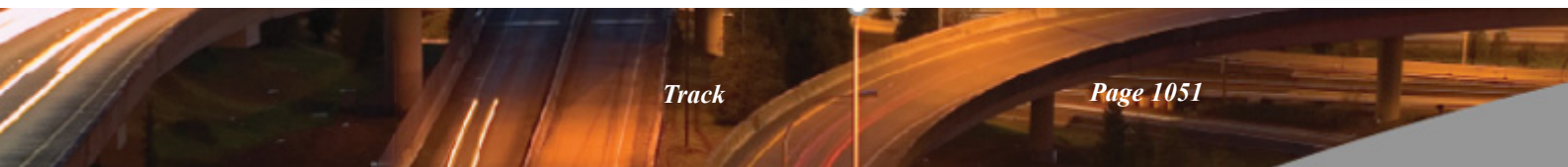
- Plot Sleepers**                      tick box                      not ticked  
*If ticked, sleepers will be generated for the turnout.*
- Sleeper Model**                      model box                      available models  
*The name of the model that the sleepers will be generated onto.*
- Sleeper Colour**                      colour box                      brown                      available colours  
*The colour that the sleepers will be coloured.*

### Use 12da File Tab

- Tabs**
- [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  
*The name of the model that the 12da elements will be generated onto. **Note: This feature has not been implemented yet.***

Continue to [16.23.2.2 Turnouts Create/ Edit](#).

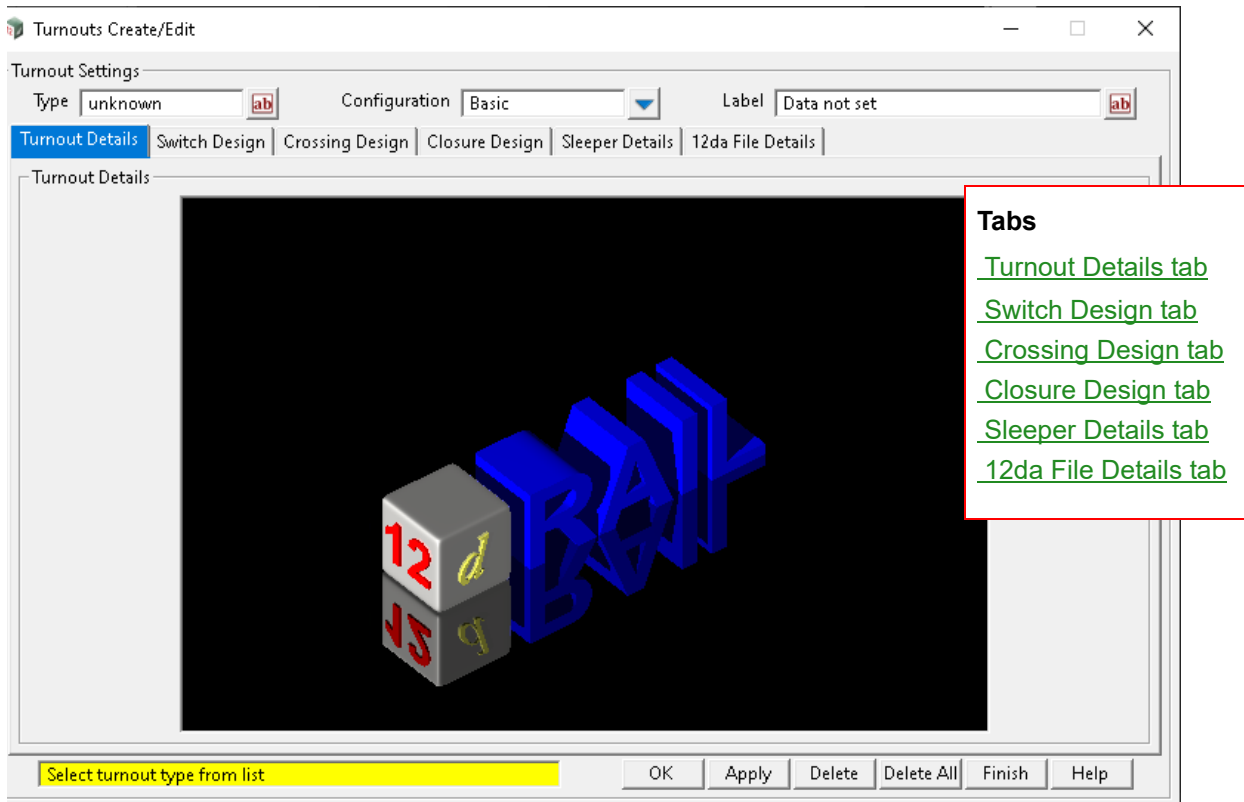


### 16.23.2.2 Turnouts Create/ Edit

**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 [16.23.2.1 Turnout Place](#).

Selecting Create/Edit displays the **Turnout Create/Edit** panel.



### 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:*



The **Select** button: Selecting a turnout type and then clicking the **Select** button loads that turnout type.

The **Sameas** button: Selecting an element of a turnout that has previously been placed with [16.23.2.1 Turnout Place](#) loads that turnout type.

The **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.

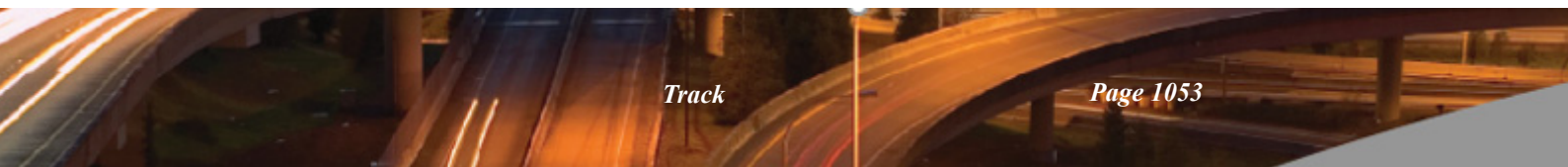
**From library file**: Note: This feature has not been implemented yet.

**Label** custom box

A label that is displayed as the turnout heading at the top of the Turnout Details window.

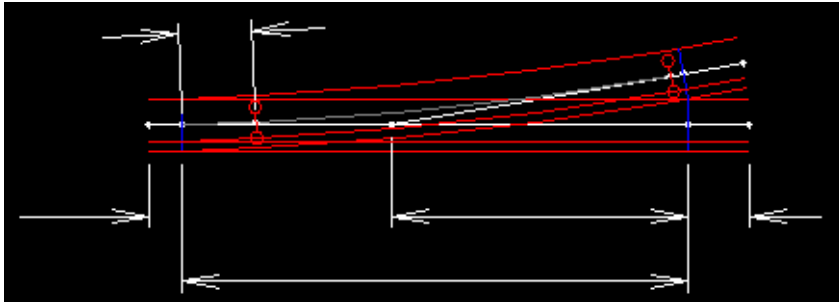
### Types of Dual Gauge Configurations

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

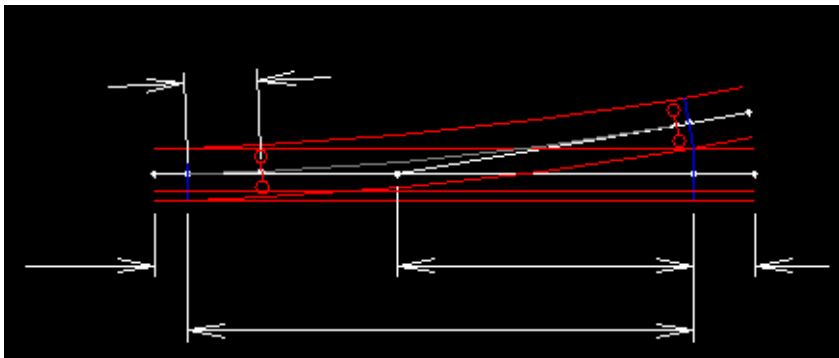




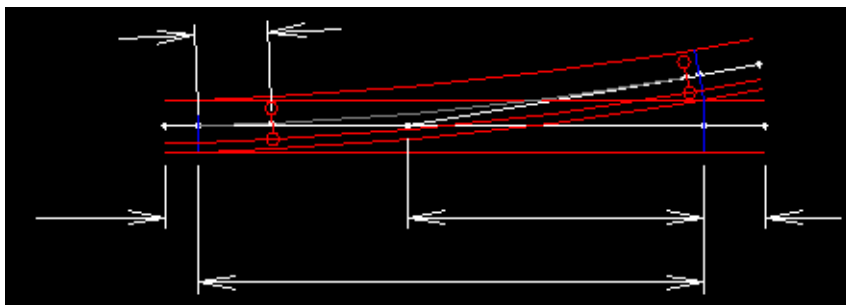
**Dual\_Gauge\_A:** Common rail on the diverging side. Both tracks are dual gauge.



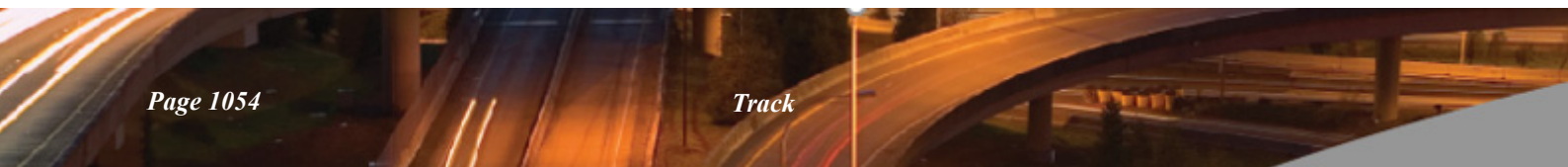
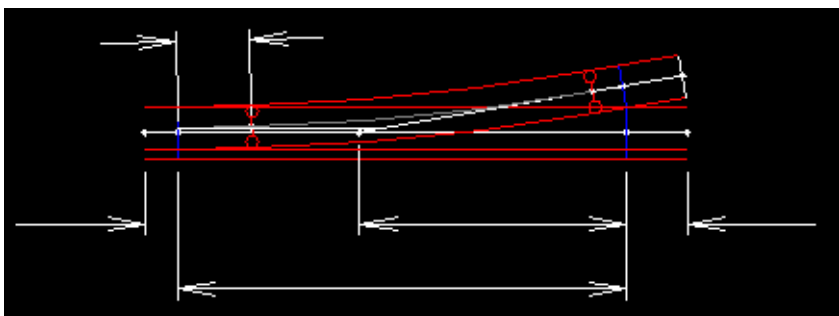
**Dual\_Gauge\_B:** Common rail on the diverging side. Through track is dual gauge. Diverging track is wider gauge.



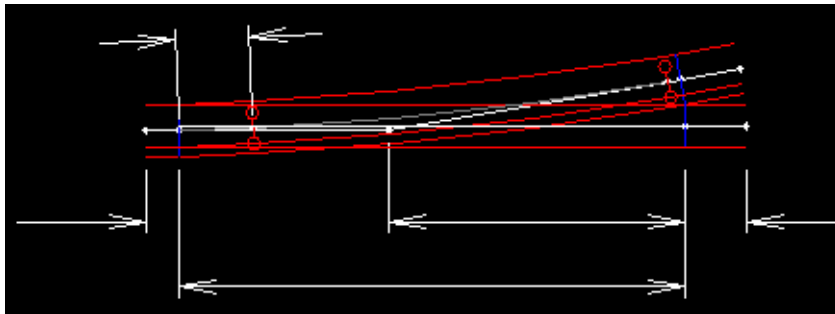
**Dual\_Gauge\_C:** Common rail on the diverging side. Through track is wider gauge. Diverging track is dual gauge.



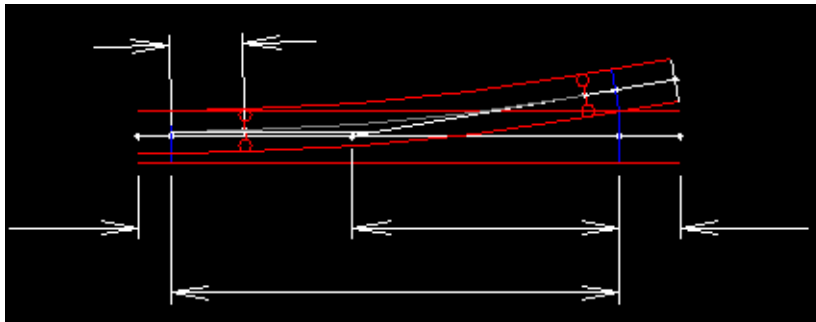
**Dual\_Gauge\_D:** Common rail on the diverging side. Through track is dual gauge. Diverging track is narrower gauge.



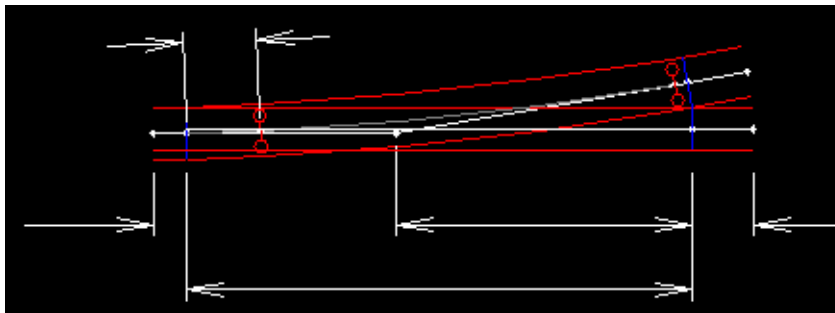
**Dual\_Gauge\_E:** Common rail on the diverging side. Through track is narrower gauge. Diverging track is dual gauge.



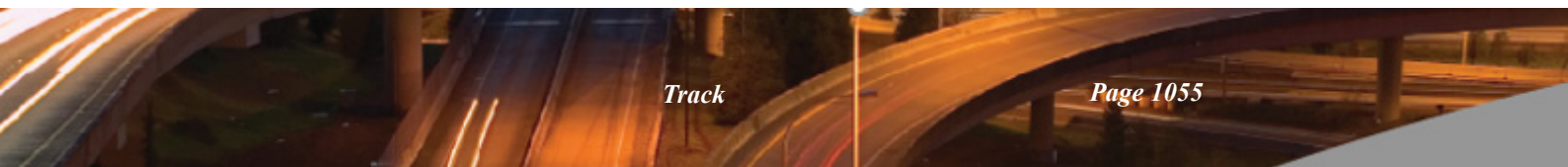
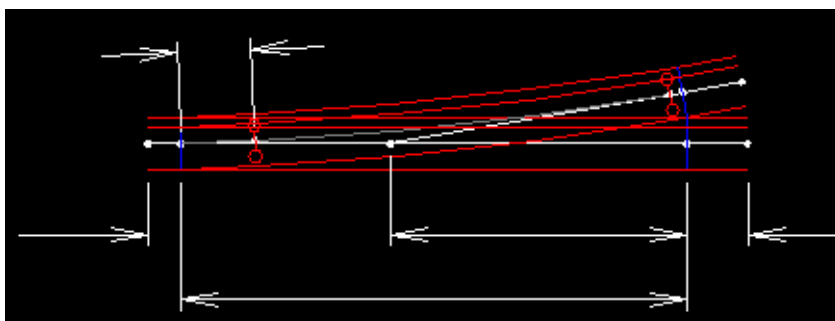
**Dual\_Gauge\_F:** Common rail on the diverging side. Through track is wider gauge. Diverging track is narrower gauge.



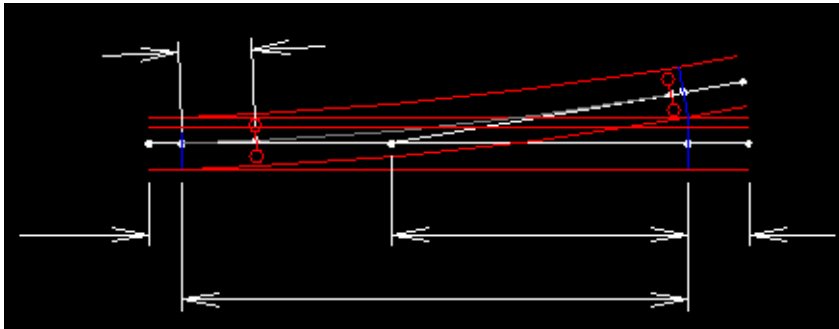
**Dual\_Gauge\_G:** Common rail on the diverging side. Through track is narrower gauge. Diverging track is wider gauge.



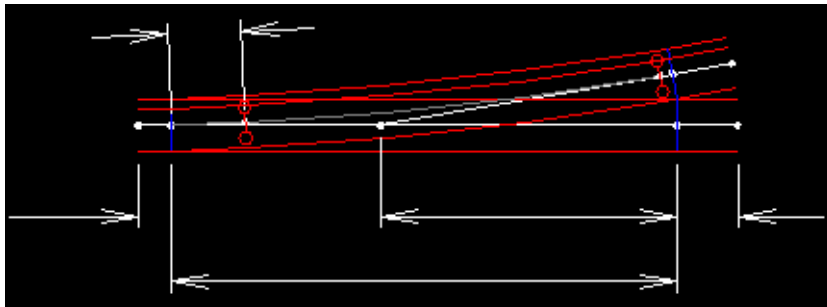
**Dual\_Gauge\_H:** Common rail on the through side. Both tracks are dual gauge.



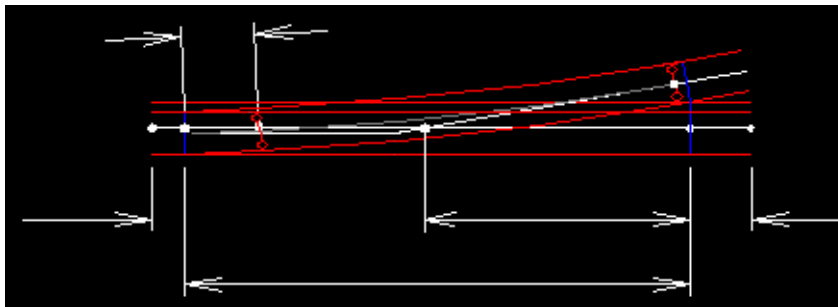
**Dual\_Gauge\_I:** Common rail on the through side. Through track is dual gauge. Diverging track is wider gauge.



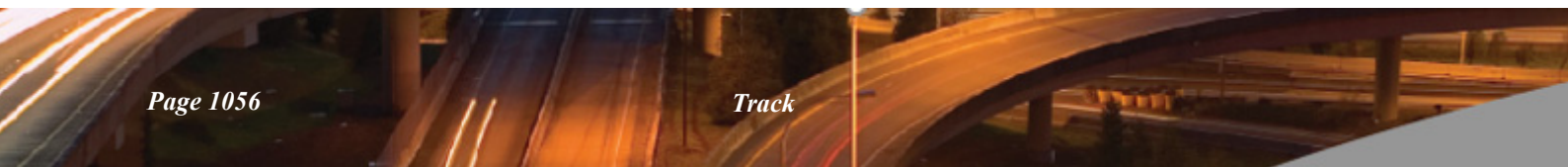
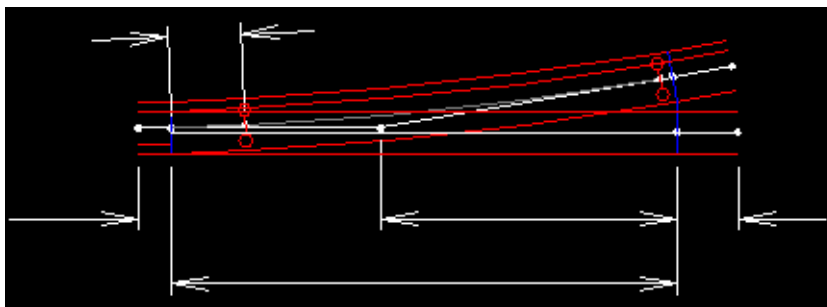
**Dual\_Gauge\_J:** Common rail on the through side. Through track is wider gauge. Diverging track is dual gauge.



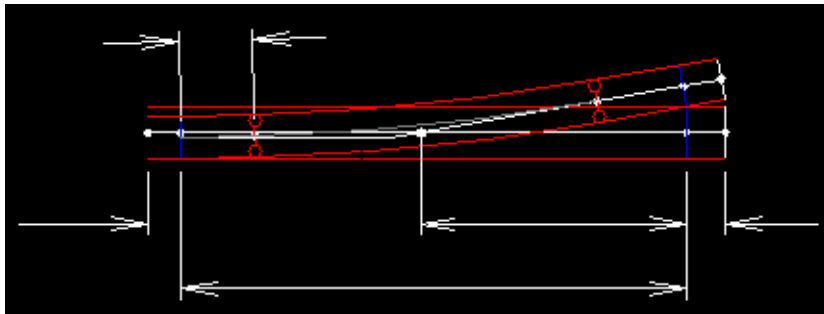
**Dual\_Gauge\_K:** Common rail on the through side. Through track is dual gauge. Diverging track is narrower gauge.



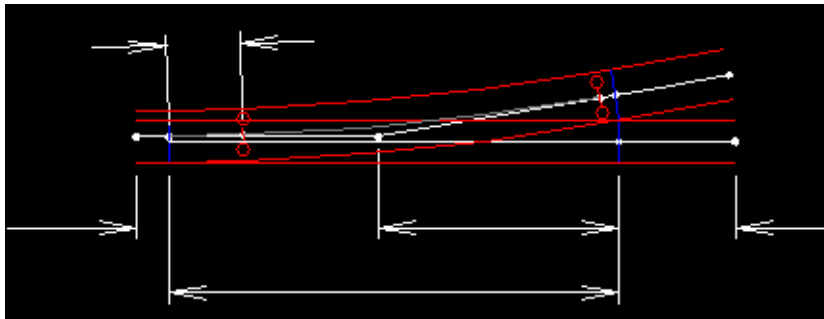
**Dual\_Gauge\_L:** Common rail on the through side. Through track is narrower gauge. Diverging track is dual gauge.



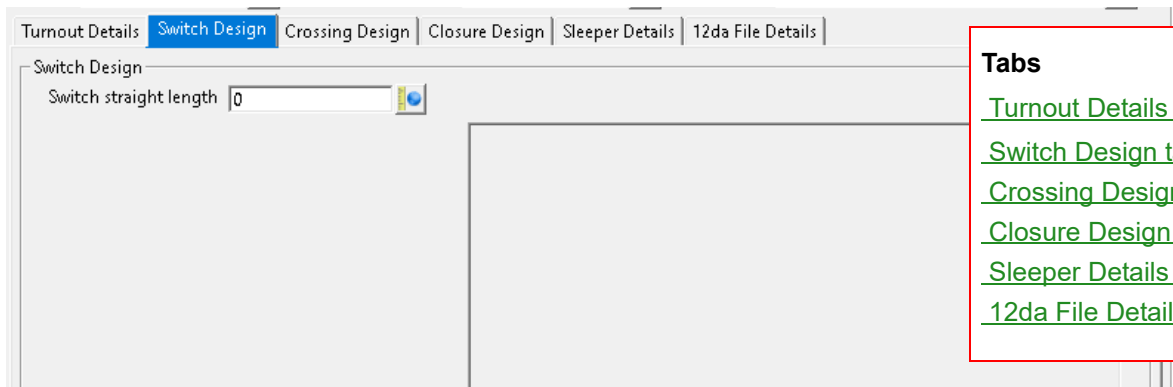
**Dual\_Gauge\_M:** Common rail on the through side. Through track is wider gauge. Diverging track is narrower gauge.



**Dual\_Gauge\_N:** Common rail on the through side. Through track is narrower gauge. Diverging track is wider gauge.



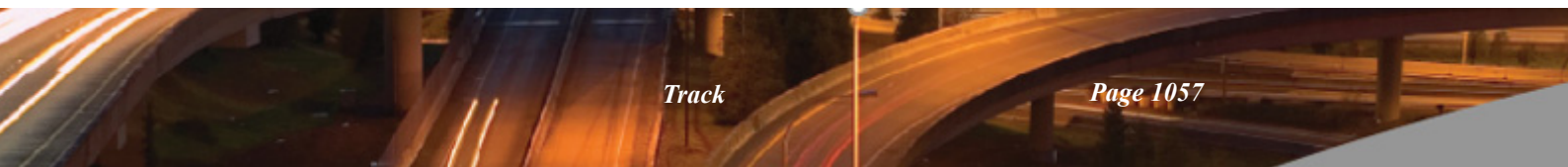
### Switch Design tab

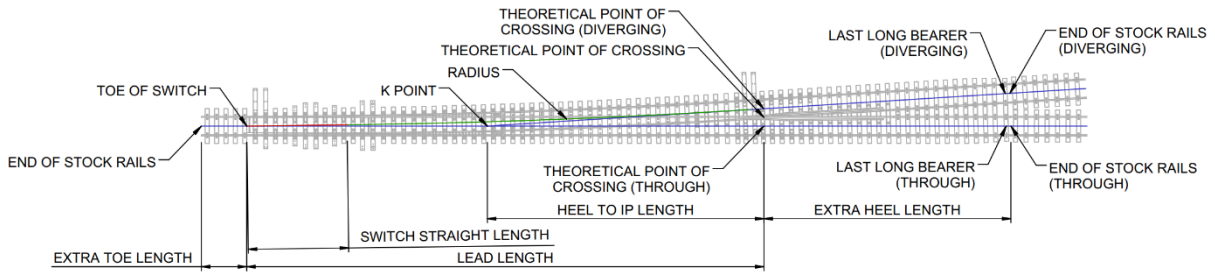


**Switch straight length**    real box    0

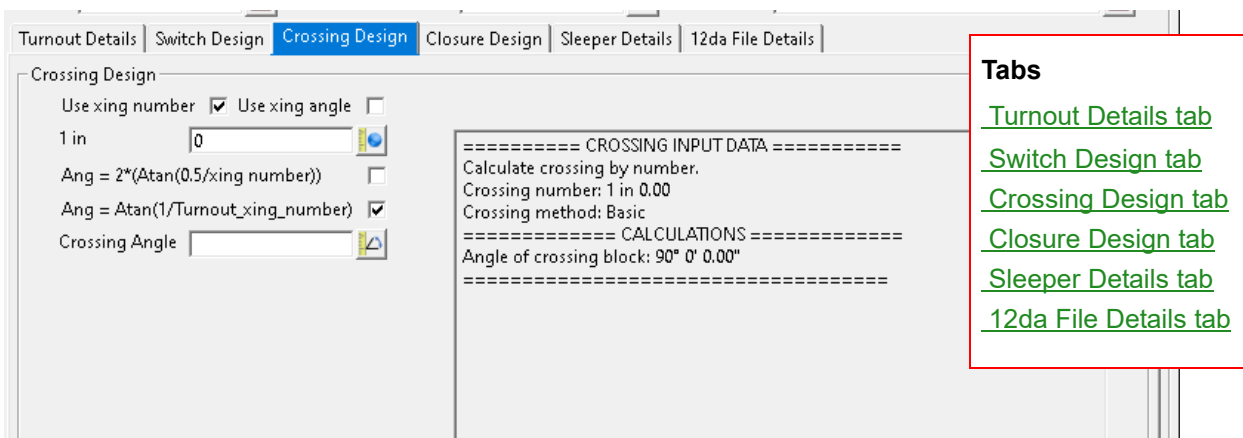
If **Configuration** field is set to **Catchpoint**: The length of the straight part of the switch rail.

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



- Tabs**
- [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

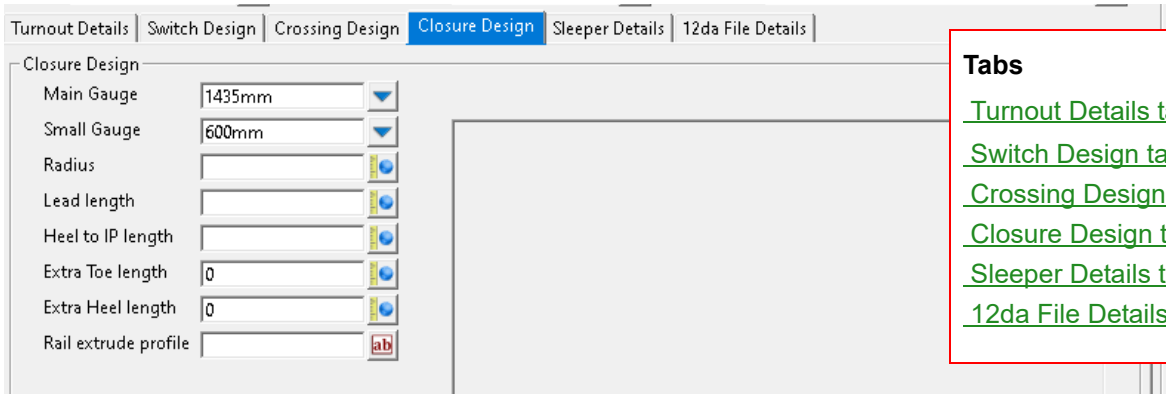
*Value of the turnout crossing angle as a ratio 1 in x.*
- Ang = 2\*(Atan(0.5/xing number))**    tick box                        **not ticked**

*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.*

## Closure Design tab



**Main Gauge**                      choice box                      1435mm                      all gauges

*The 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

*The radius of the centreline of the turnout leg.*

**Lead length**                      real box

*The 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

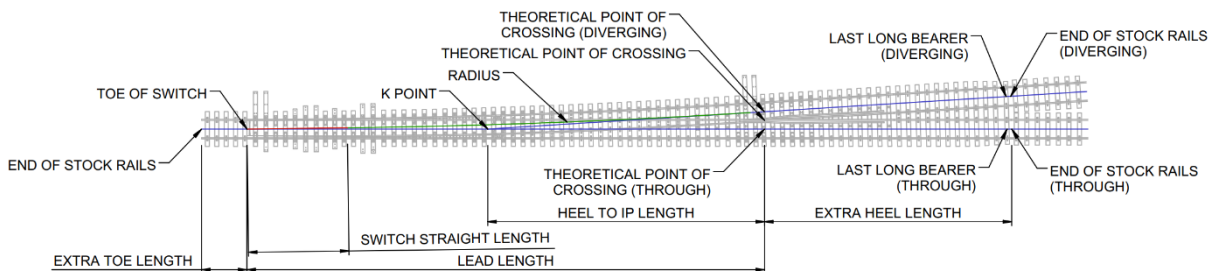
*The distance from the Toe of the Switch to front end of the rails at the toe of the turnout. This is also the distance between the Front End and the TOS nodes.*

**Extra Heel length**                      real box                      0

*The distance from the Theoretical Point of Crossing to the back end of the turnout rails.*

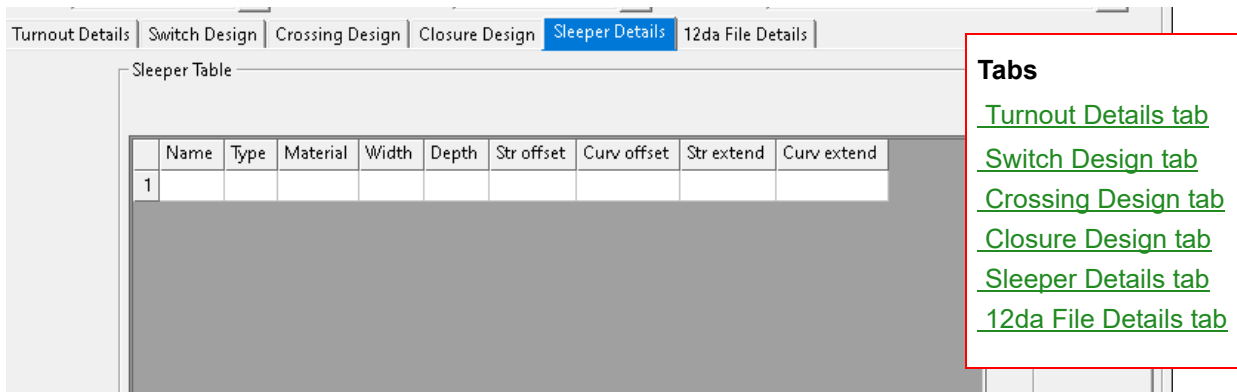
**Rail extrude profile**                      custom box                      all profiles

*A rail profile can be selected to generate three-dimensional rails that can be displayed in perspective views. To create a rail profile refer to [16.23.9.2.2 Rail Profiles Create/Edit](#).*



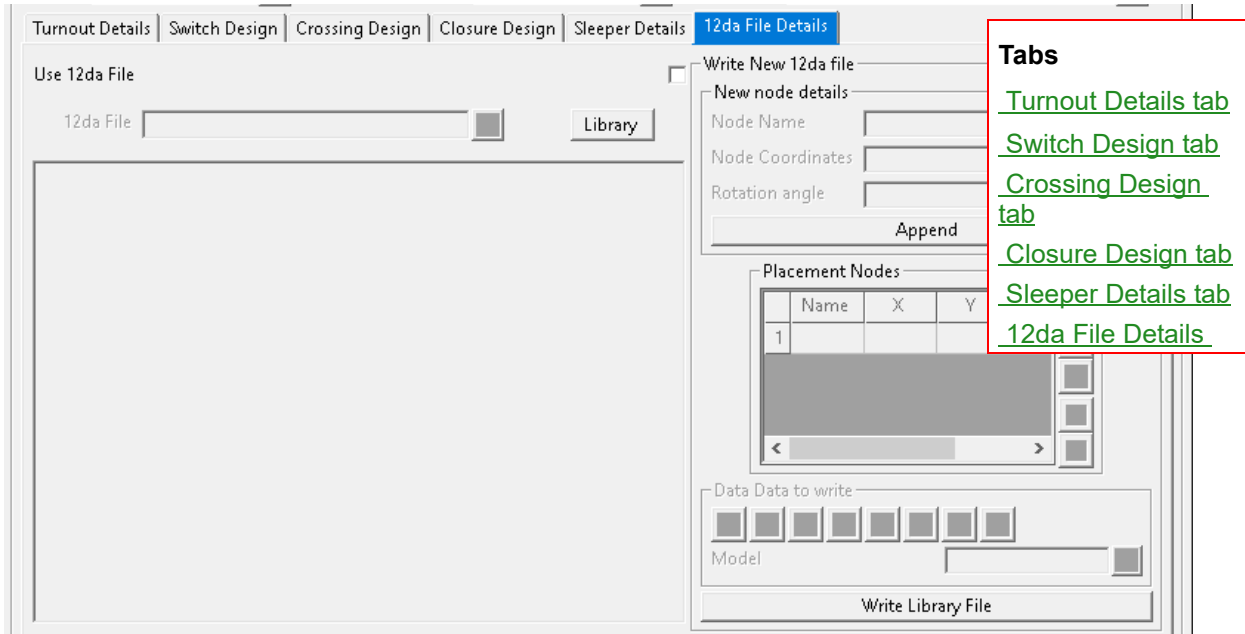


## Sleeper Details tab



- Name** name box available names  
*The name for the sleeper element.*
- Type** text box  
*The type of sleeper.*
- Material** choice box  
*The sleeper material. The material field contains the following choices: Timber, Concrete and Steel.*
- Width** real box  
*The width of the sleeper.*
- Depth** real box  
*The depth of the sleeper.*
- Str offset** real box  
*The longitudinal distance between the Toe of Switch (TOS) and the centre of the sleeper on the through side.*
- Curv offset** real box  
*The longitudinal distance between the Toe of Switch (TOS) and the centre of the sleeper on the diverging side.*
- Str extend** real box  
*The offset distance from the running rail to the end of sleeper on the through side.*
- Curv extend** real box  
*The 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

*The placement node name.*

**Node Coordinates**                      xyz box

*The location of the placement node.*

**Rotation angle**                              angle box

*The angle of the placement node.*

**Append**                                      angle box

*Adds the fields from the **New node details** to the **Placement Nodes** table.*

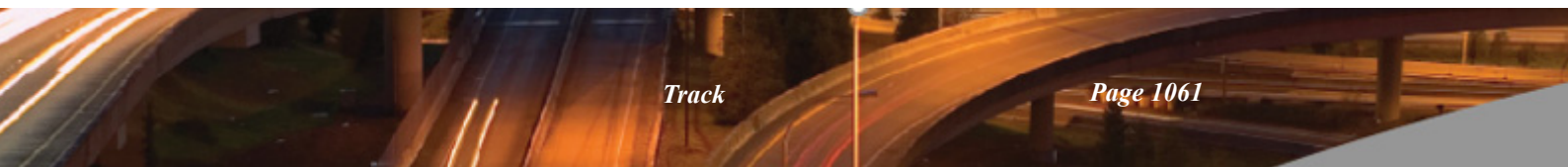
**Data to write**                              source box

*Data selection type.*

**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 [16.23.2.3 Read Turnouts](#).



### 16.23.2.3 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 [16.23.2.2 Turnouts Create/ Edit](#), can be placed with [16.23.2.1 Turnout Place](#) and turnouts exported to a file with [16.23.2.4 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
<b>Turnout file</b>	file box		*.turnouts
<i>Name of the file to read in the <b>Turnout Types</b>.</i>			

#### Buttons at Bottom

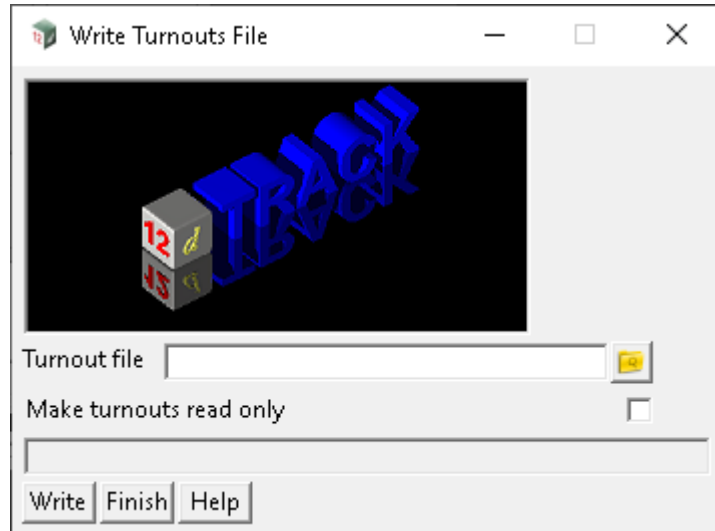
- Read** button  
*Reads the \*.turnouts file and imports the Turnout Types.*
- Continue to [16.23.2.4 Write Turnouts File](#).

### 16.23.2.4 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
<b>Turnout file</b>	file box		*.turnouts

*Name of the file to write out the **Turnout Types**.*

<b>Make turnouts read only</b>	tick box	not ticked
--------------------------------	----------	------------

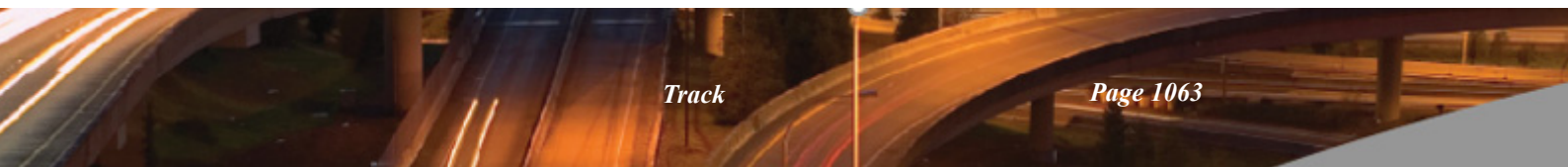
*If **ticked**, adds a read-only attribute to the entry in the **Turnouts file** which restricts modification when that **Turnout Type** has been imported.*

#### Buttons at Bottom

<b>Write</b>	button
--------------	--------

*Writes the \*.turnouts file.*

Continue to [16.23.3 Copy VC](#) or go back to [16.23.2 Track Turnouts](#) or [16.23 Track](#).

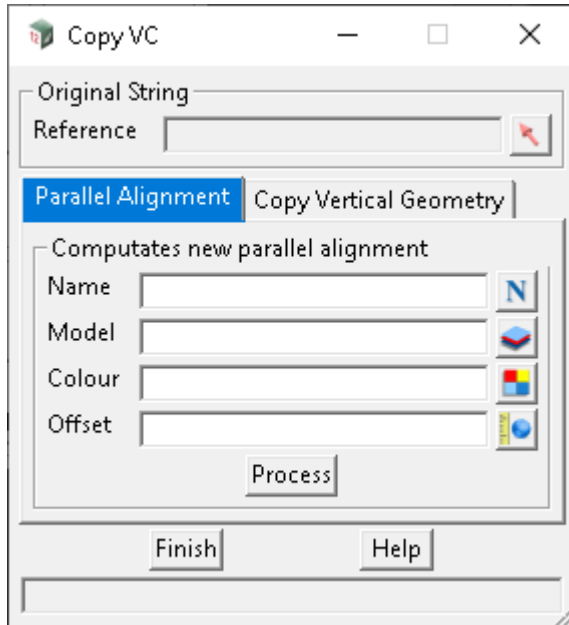


### 16.23.3 Copy VC

**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** Super Alignment to a **New String** Super Alignment.

Selecting Copy VC displays the **Copy VC** panel.



**Tabs**  
[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

##### Computates new parallel alignment

<b>Name</b>	name box		available names
-------------	----------	--	-----------------

*Name of the new alignment.*

<b>Model</b>	model box		available models
--------------	-----------	--	------------------

*Model of the new alignment.*

<b>Colour</b>	colour box	white	available colour
---------------	------------	-------	------------------

*Colour of the new alignment.*

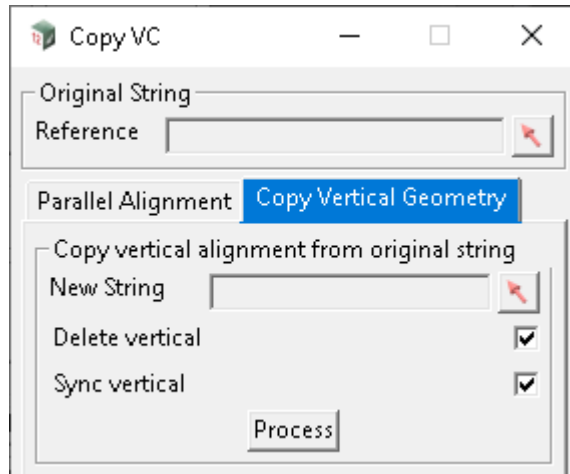
<b>Offset</b>	real box		
---------------	----------	--	--

*The offset distance that the new string will be paralleled from the **Reference** string.*

**Process** button

*Runs the function.*

## Copy Vertical Geometry Tab



### Tabs

[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 [16.23.4 Calculate Slew](#) or go back to [16.23.3 Copy VC](#) or [16.23 Track](#).



## 16.23.4 Calculate Slew

**Position of menu:** Design => Track => Calculate slew

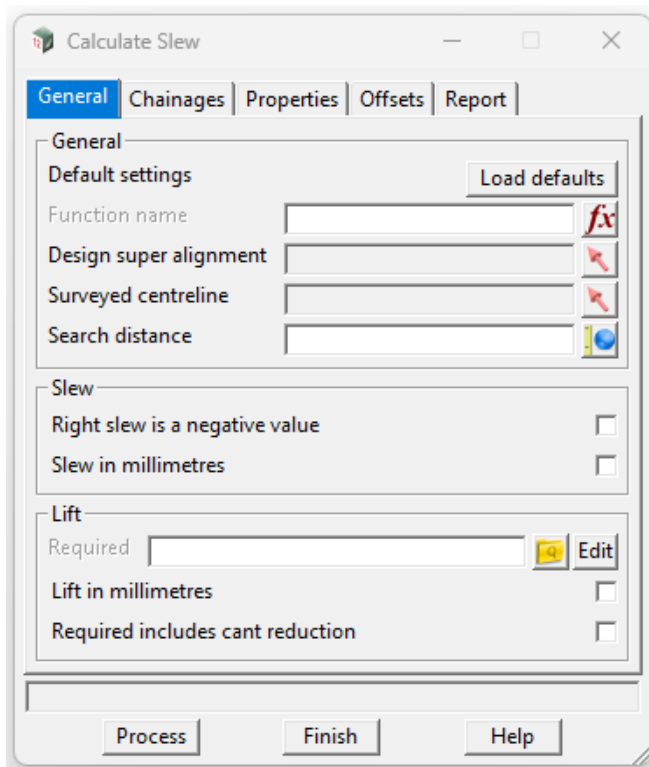
The **Calculate slew** panel calculates measurements of horizontal slew offset, lifting/lowering vertical offsets, lift required, and level required. A centreline, tin, trimesh, and cut strings can be generated for each element type. The rail slew calculations are made between a **Surveyed centreline** (which can be generated in [18.14.1 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.



### Tabs

- [General 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

<b>Process</b>	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 [18.14.1 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

*A 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 [16.23.4.1 Lift Required](#).*

**Lift in millimetres** tick box not ticked

*If **ticked**, lift values will be in millimetres.*

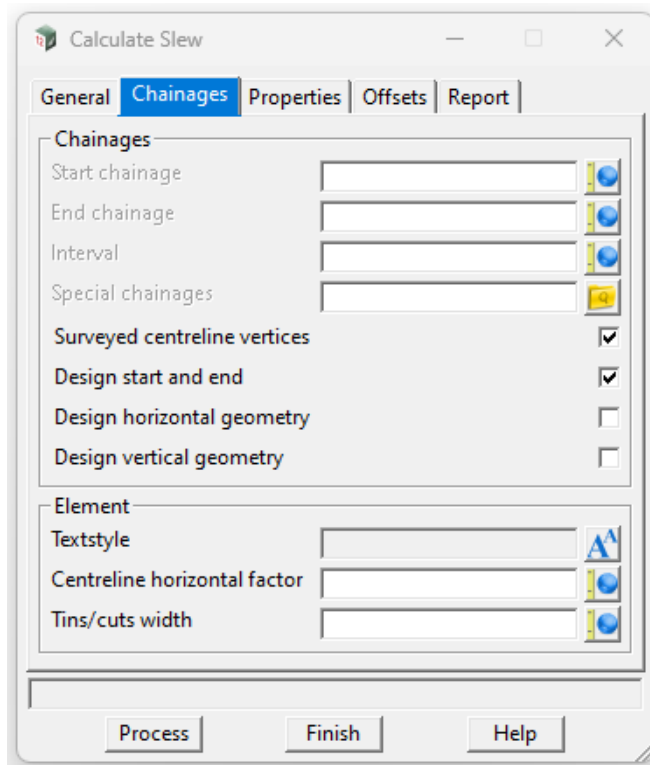
*If **not ticked**, lift values will be in metres.*

**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.*

## Chainage tab



### Tabs

- [General 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

*The distance between rail slew measurements. This is optional.*

**Special chainages**                  file box                                      \*.spc files

*A 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**.*

### Element

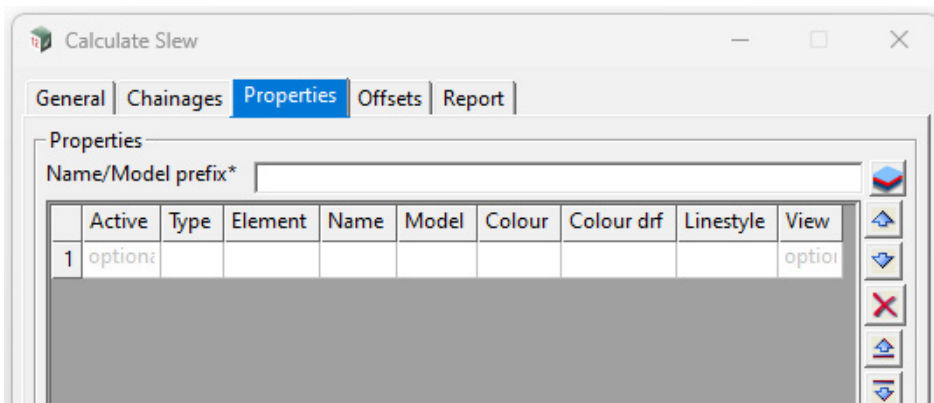
**Textstyle**                              textstyle box                              Select Textdata

*Text style applied to vertex text on generated centreline elements.*

**Centreline horizontal factor**    real box  
*Horizontal factor applied to the generated centreline elements.*

**Tins/cutes width**            real box  
*Width of generated tins, trimeshes and cuts elements.*

## Properties tab



- Tabs**
- [General tab](#)
  - [Chainage tab](#)
  - [Properties tab](#)
  - [Offsets tab](#)
  - [Report tab](#)

**Name/Model prefix\***            model box                                    available models  
*The 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** 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: **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.*

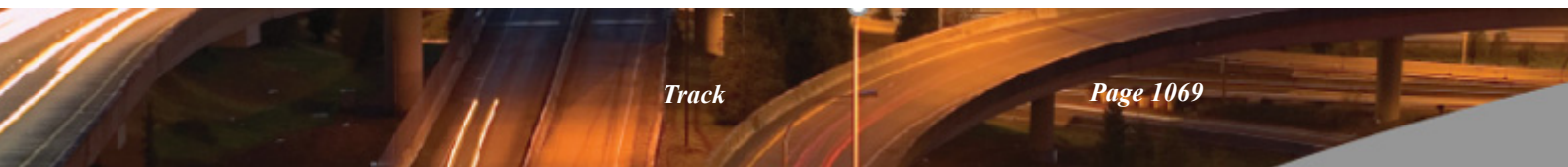
***Level required:** An element with the height that is required for the **Design super alignment** applied to the z-coordinate. This calculation is based on the slew amount and corresponding lift required specified in the CSV file referenced in the **Required** field in the **Slew/Lift** tab.*

***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.*

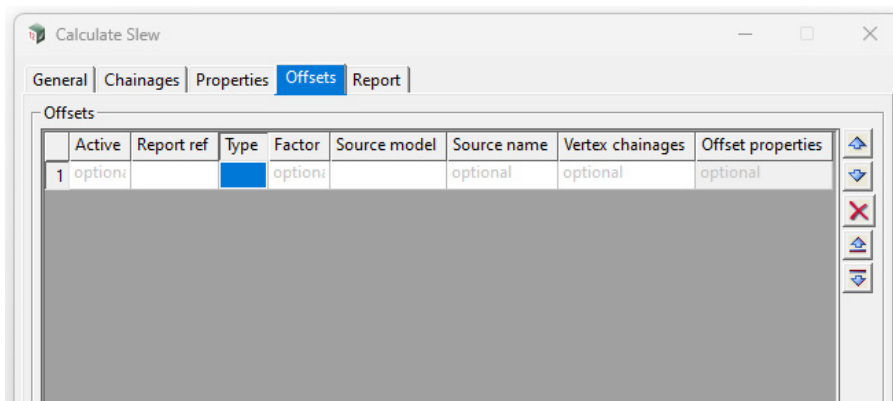
**Element**                                    choice box

*The 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.*



<b>Name</b>	custom name box	available names
	<i>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 <b>Name/Model prefix</b> * field.</i>	
<b>Model</b>	custom model box	available models
	<i>Model of the generated element. An asterisk can be used to exchange the text entered in the <b>Name/Model prefix</b> * field.</i>	
<b>Colour</b>	colour box	available colours
	<i>Colour to be applied to the generated element.</i>	
<b>Colour drf</b>	file box	available drf files
	<i>A <a href="#">7.11.5 Depth Range File</a> 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.</i>	
<b>Linestyle</b>	linestyle box	available linestyles
	<i>Linestyle to be applied to the generated element.</i>	
<b>View</b>	view box	available views
	<i>View for the generated element to be added to. If the view does not exist, a view will be created.</i>	

## Offsets tab



### Tabs

- [General tab](#)
- [Chainage tab](#)
- [Properties tab](#)
- [Offsets tab](#)
- [Report tab](#)

<b>Active</b>	choice box
	<i>If no, the row will not be calculated. This is optional.</i>
<b>Report ref</b>	input box
	<i>The name of the xml node to be generated containing offset calculations that are referenced in the <b>Stylesheet</b> xslt file located in the <b>Report</b> tab. An identical name in the <b>Report ref</b> and <b>Stylesheet</b> 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.</i>
<b>Type</b>	choice box
	<i>The type of offset calculation. There are the following options:</i>
	<i><b>Horizontal:</b> A horizontal distance between the <b>Design super alignment</b> and the source model.</i>
	<i><b>Vertical:</b> A vertical distance between the <b>Design super alignment</b> and the source model.</i>
	<i><b>Vertex attributes:</b> Vertex attributes contained in the source model are exported to the report. Attributes need to be added as fields in the <b>Stylesheet</b> and are in the format <b>Report ref</b>, underscore followed by vertex attribute name e.g. reportref_attributename.</i>



**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

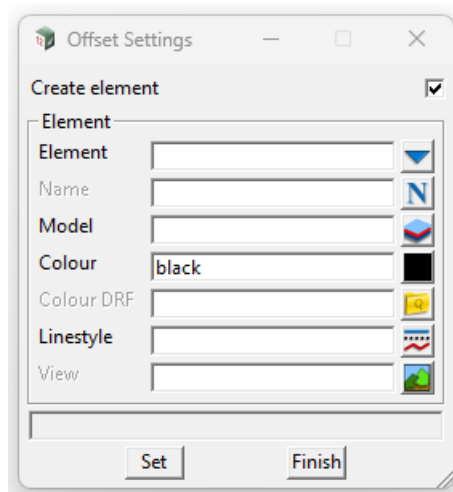
If Negation is selected, then offset values will be multiplied by negative 1. This is optional.

**Source name** name box

The 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

The 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.

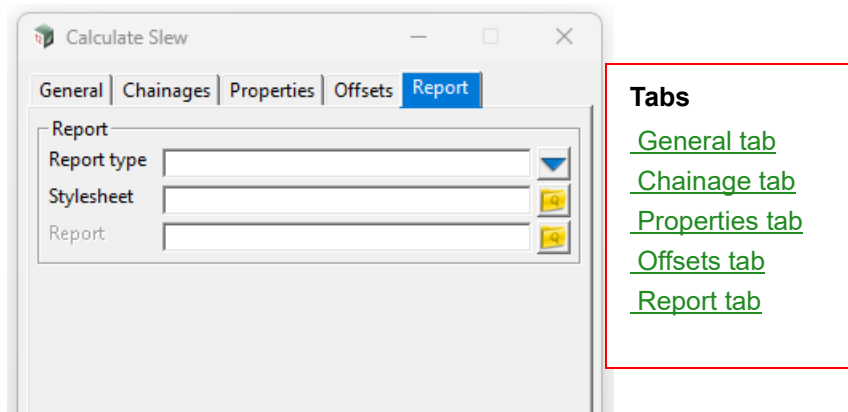
**Model** model box available models

Model name of the generated element. An asterisk can be used to exchange the text entered in the **Name/Model prefix \*** field.



<b>Colour</b>	colour box	available colours
<i>Colour to be applied to the generated element.</i>		
<b>Colour drf</b>	file box	available drf files
<i>A <a href="#">7.11.5 Depth Range File</a> 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.</i>		
<b>Linestyle</b>	linestyle box	available linestyles
<i>Linestyle to be applied to the generated element.</i>		
<b>View</b>	view box	available views
<i>View for the generated element to be added to. If the view does not exist, a view will be created.</i>		

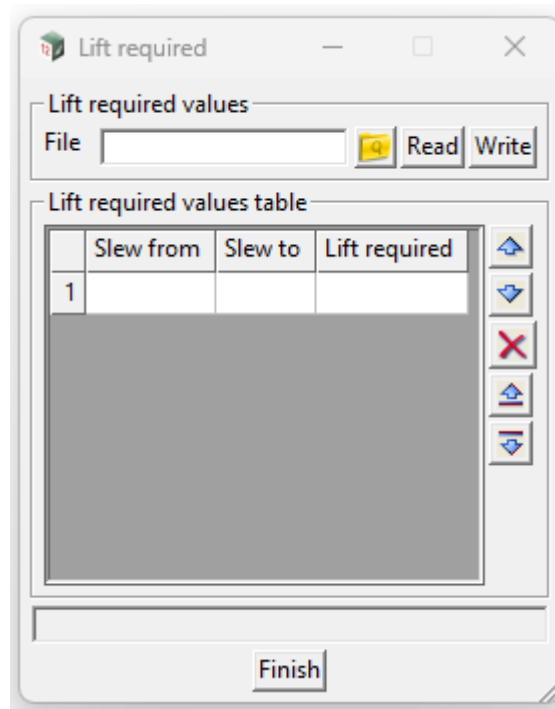
## Report tab



<b>Report type</b>	choice box	csv/html/xml
<i>The type of report to be generated. A choice of csv, html or xml can be selected for the report type.</i>		
<b>Stylesheet</b>	file box	
<i>The 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.</i>		
<b>Report</b>	file box	*.html files
<i>Filename of the report to be generated.</i>		

Continue to [16.23.4.1 Lift Required](#) or return to [18.14 Track](#).

### 16.23.4.1 Lift Required



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

Field Description	Type	Defaults	Pop-Up
<b>File</b>	file box		all *.12dslr files

*A 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

*The amount of slew value from that the lift required value will be applied.*

**Slew to** real box

*The amount of slew value to that the lift required value will be applied.*

**Lift required** real box

*The amount of lift required that is applied within the slew from and slew to.*

Continue to [16.23.5 Calculate Cant](#) or go back to [16.23.4 Calculate Slew](#) or [16.23 Track](#).

## 16.23.5 Calculate Cant

**Position of option on menu:** Design =>Track =>Calculate cant

Now documented in the [V15 reference manual](#)

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.

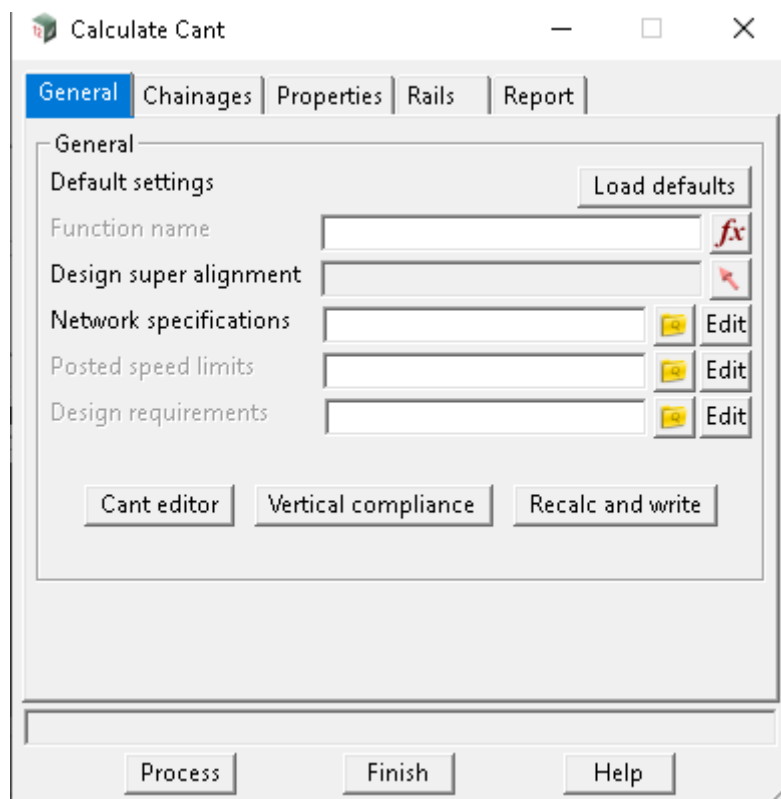
The **Properties** tab offers a range of output types and elements suitable for visualization in both plan and section views, as well as for plotting purposes. These outputs include centerlines, tins, trimeshes, and cut strings for each type.

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) or Hypertext Markup Language (HTML) file.

String attributes are generated for the **Design super alignment** when **Recalc and Write** or **Write** is selected.

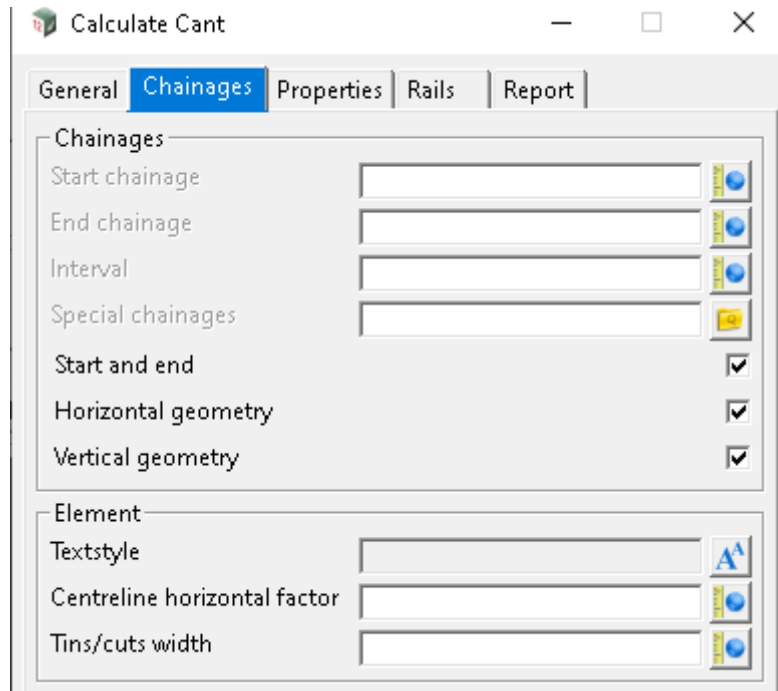
Selecting **Calculate cant** displays the **Calculate Cant** panel.



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

Field Description	Type	Defaults	Pop-Up
<b>General</b>			
<b>Load defaults</b>	button		
<i>Various fields will be populated with default values.</i>			
<b>Function name</b>	function box		all functions
<i>Name of the Calculate cant function.</i>			
<b>Design super alignment</b>	string select		
<i>String for the design centreline.</i>			
<b>Network specifications</b>	file box		available files
<i>A network specifications file. This file is created within the calculate cant panel. See <a href="#">16.23.5.1 Network Specifications</a>.</i>			
<b>Posted speed limits</b>	file box		available files
<i>A posted speed limits file. This file is created within the calculate cant panel. See <a href="#">16.23.5.2 Posted Speed Limits</a>.</i>			
<b>Design requirements</b>	file box		available files
<i>A design requirements file. This file is created within the calculate cant panel. See <a href="#">16.23.5.3 Design Requirements</a>.</i>			
<b>Cant editor</b>	button		
<i>Opens the cant editor panel. See <a href="#">16.23.5.4 Cant Editor</a>.</i>			
<b>Vertical compliance</b>	button		
<i>Opens the vertical compliance panel.</i>			
<b>Recalculate all</b>	button		
<i>Runs cant, and horizontal and vertical geometry calculations and writes the values to string attributes on the <b>Design super alignment</b>. This button exhibits identical functionality to the <b>Recalculate all</b> button within the <b>Cant editor</b>.</i>			

## Chainages tab



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Chainages

**Start chainage** real box

The **Design super alignment** chainage for elements and report values to be calculated from. This is optional.

**End chainage** real box

The **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.

**Horizontal geometry** tick box ticked

The **Design super alignment** horizontal geometry chainages are included for elements and report values.

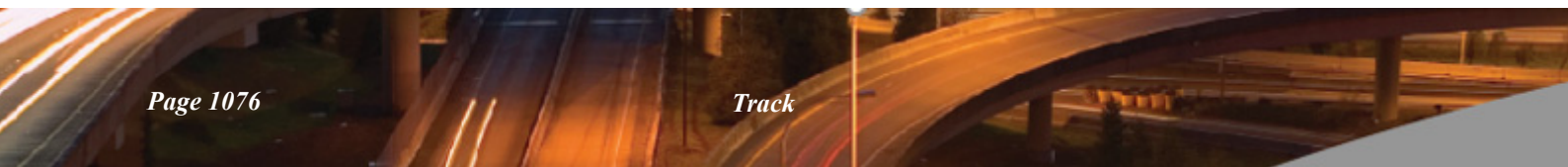
**Vertical geometry** tick box ticked

The **Design super alignment** vertical geometry chainages are included for elements and report values.

**Start and end** tick box ticked

The start and end chainages of the **Design super alignment** are included for elements and report values.

### Element



**Textstyle** text\_style box selected Textdata

*The text style applied to vertex text on generated centreline elements.*

**Centreline horizontal factor** real box

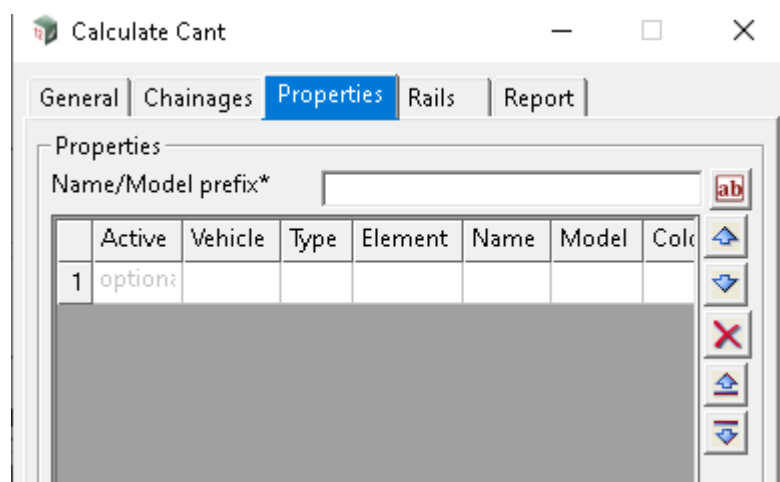
*The horizontal factor applied to the generated centreline elements.*

**Tins/cuts width** real box

*The width of generated tins, trimeshes and cuts elements.*

## 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.*



### Properties

**Name/Model/prefix\*** model box available models

*The 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 is selected, then the row will not be processed. This is optional.*

**Vehicle** custom panel

*The 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

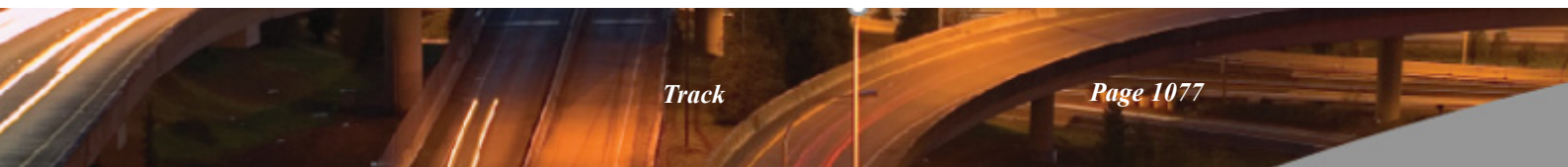
*A list of available types. The types are categorised under the headings of cant, horizontal, speed, and vertical.*

**Element** choice box

*The 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

*The 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

*The 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

*The colour to be applied to the generated element.*
- HRF**                                      file box                                      available hrf files

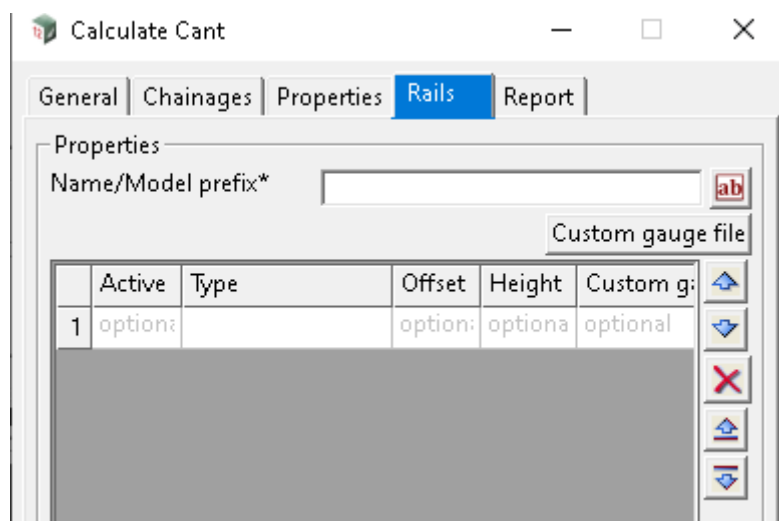
*A [7.11.7 Height Range File](#) to change the colour of each line segment and vertex text of centreline elements. The height range file is in the format: from value, to value, colour name. This is optional.*
- Linestyle**                                      linestyle box                                      available linestyles

*The linestyle to be applied to the generated element.*
- View**                                      view box                                      available views

*The 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.



### Properties

- Name/Model/prefix\***                      model box                                      available models

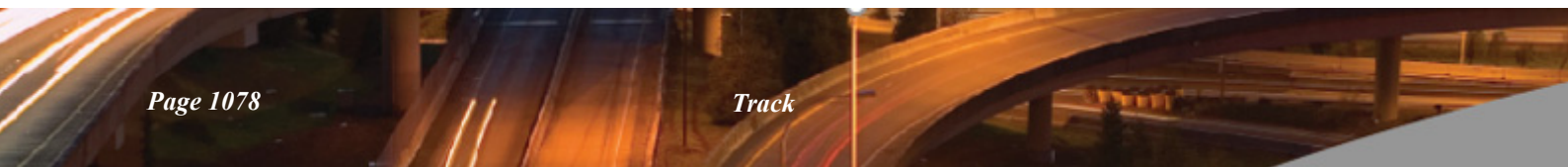
*The name entered will be exchanged with any asterisk located in the Name or Model fields of the rails GridCtrl box. The default is a prefix for the model names and tins.*
- Active**                                      choice box

*If no is selected, 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 [16.23.5.6 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

*A custom gauge file to enable gauge widening through curves.*

**Name** custom name box available names

*The 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

*The 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

*The colour to be applied to the generated element.*

**Linestyle** linestyle box available linestyles

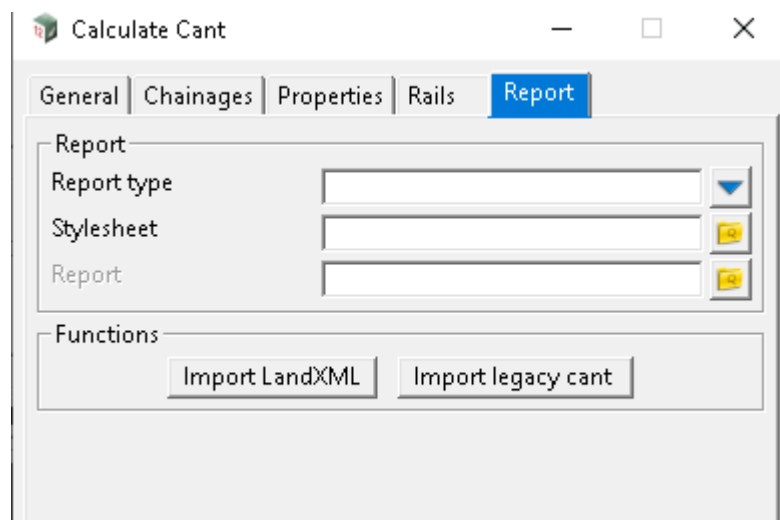
*The linestyle to be applied to the generated element.*

**View** view box available views

*The view for the generated element to be added to. If the view does not exist, a view will be created.*

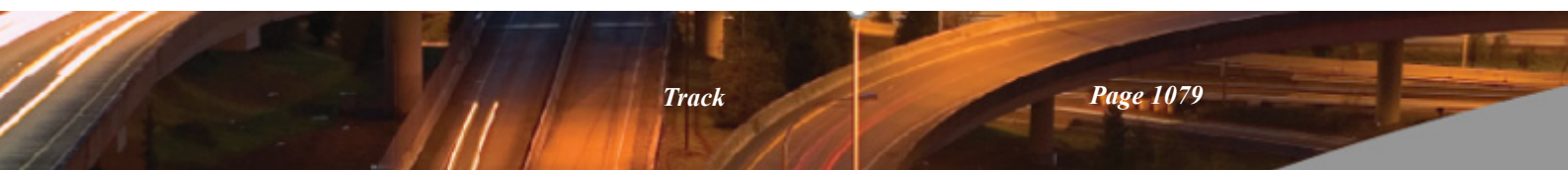
### Report tab

*A report can be generated as a Comma-Separated-Values (CSV) or Hypertext Markup Language (HTML) file.*



**Report**

**Report type** choice box csv/html



*The type of report to be generated. A choice of csv, html or xml can be selected for the report type.*

**Stylesheet** file box

*The 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.*

**Report** file box available \*.html files

*The 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 [7.4.17.1 Read LandXML](#). Identical to the **Import LandXML** button located in the **Cant Editor**.*

**Import legacy cant** button

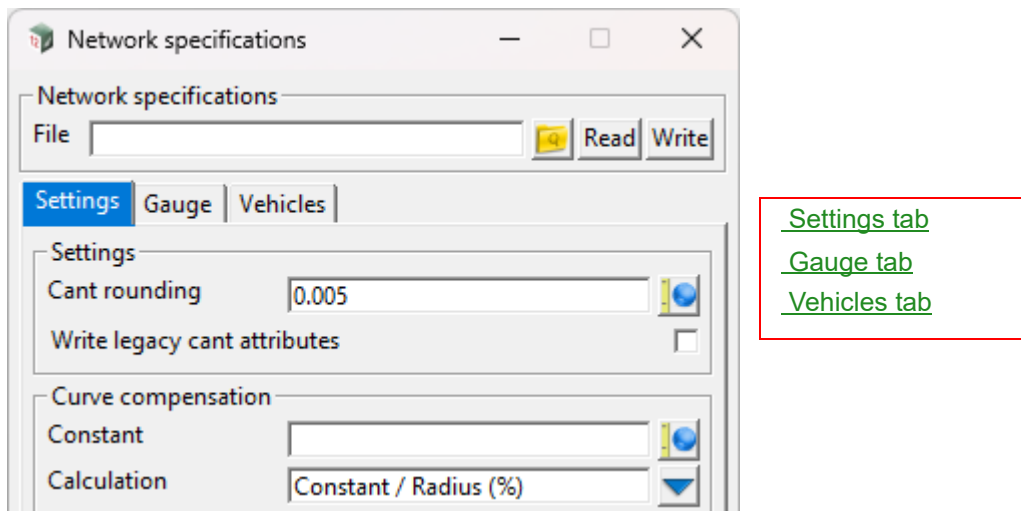
*Imports chainages, **Applied cant** and **Design speed** values from a **Design super alignment** that had cant values previously calculated using the older **Cant panel**. Identical to the **Import legacy cant** button located in the **Cant Editor**.*

### 16.23.5.1 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.

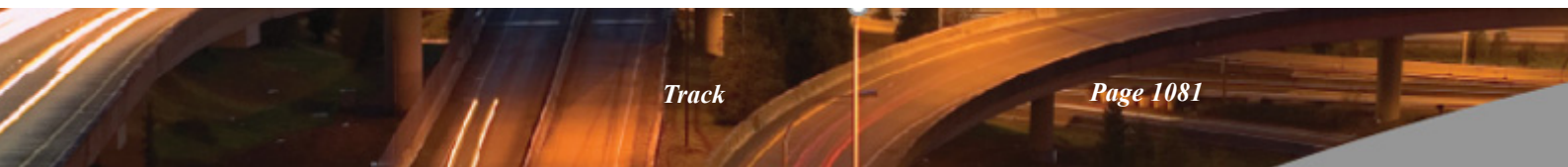
The vehicle data section is configured to calculate equilibrium and applied cant values, based on rail gauge and constants. It provides the capability to add multiple vehicles, which can be employed to assess various speeds and gauges against design requirements.

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.



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

Field Description	Type	Defaults	Pop-Up
<b>Settings tab</b>			
<b>Network specifications</b>			
<b>File</b>	file box		available files
<i>The filename for the network specifications.</i>			
<b>Read</b>	button		
<i>Reads the network specifications <b>File</b> and populates the network specifications panel.</i>			
<b>Write</b>	button		
<i>Writes the values in the network specifications panel to the network specifications <b>File</b>.</i>			
<b>Settings</b>			
<b>Cant rounding</b>	real box	0.005	
<i>The rounding value applied to cant calculations (the value is in metres).</i>			
<b>Write legacy cant attributes</b>	tick box	not ticked	
<i>If <b>ticked</b>, legacy RAIL_Classes cant attributes equivalent to the older cant panel are additionally applied to the <b>Design super alignment</b> for legacy purposes.</i>			
<b>Curve compensation</b>			
<b>Constant</b>	real box		



The constant value applied to curve compensation calculations.

$$\text{Curve compensated grade (1v:h)} = \text{Constant} * \text{Radius}$$

$$\text{Curve compensated grade (\%)} = \text{Actual gradient} + \text{Constant} / \text{Radius} \%$$

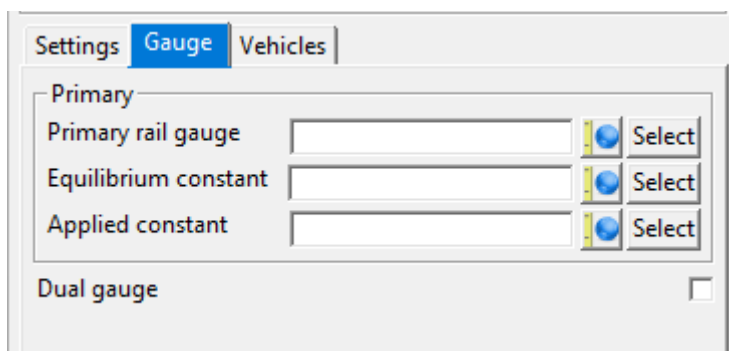
**Calculation**                      choice box                      Constant / Radius (%)

The calculation used to apply curve compensation.

$$\text{Curve compensated grade (\%)} = \text{Actual gradient} + \text{Constant} / \text{Radius} \%$$

$$\text{Curve compensated grade (1v:h)} = \text{Constant} * \text{Radius}$$

## 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

*The equilibrium constant applied to the primary vehicle.*

**Select**                                      button

*Opens a panel containing the equilibrium constant and applied constant calculations.*

**Applied constant**                              button

*The 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

*The rail gauge of the secondary vehicle.*

**Select**                                      button

*Opens a list of common rail gauges.*

**Equilibrium constant**                      real box

*The equilibrium constant applied to the secondary vehicle.*

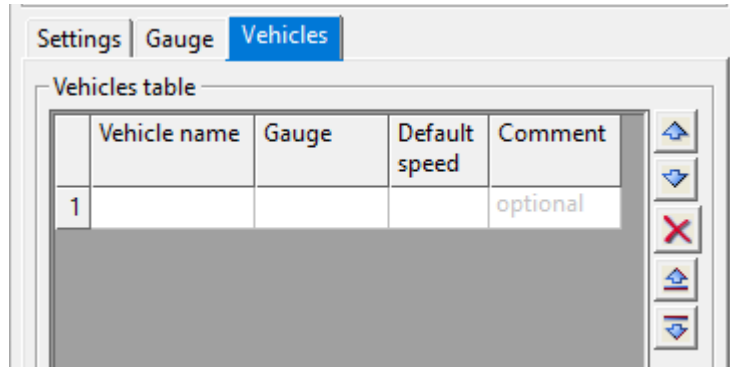
**Applied constant** button

*The applied constant applied to the secondary vehicle.*

**Common rail location** choice box Left Left, Right

*The 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

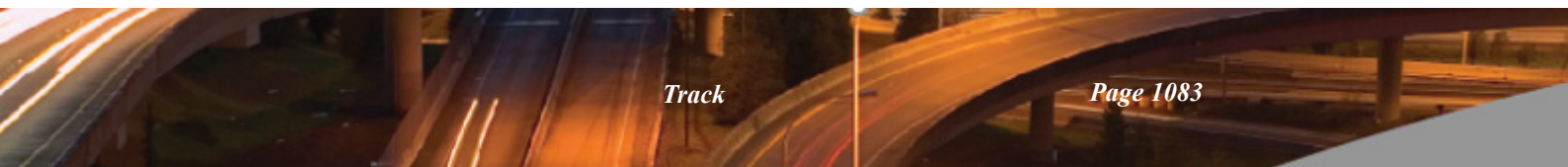
*Gauge of the vehicle. The two options are primary and secondary. These options relate to the primary or secondary rail gauge values that have been set in the **Gauge** tab.*

**Default speed** real box

*The default speed applied to the vehicle if a posted speed limits value does not exist at any chainage along the **Design super alignment**.*

**Comment** input box

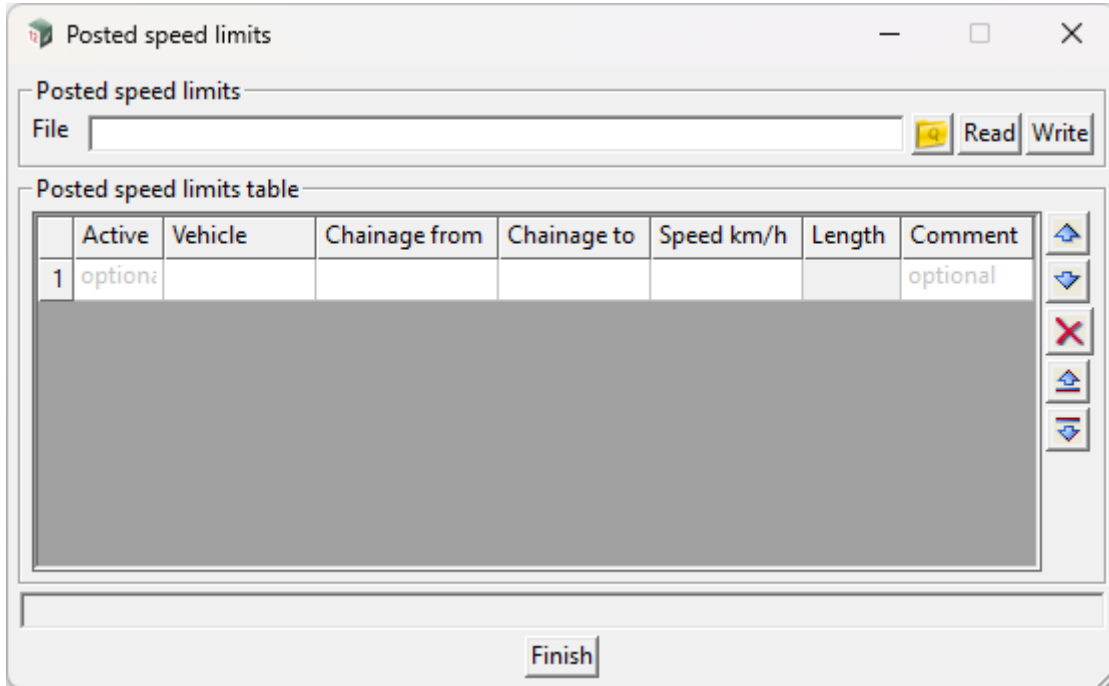
*An optional comment for the vehicle.*





### 16.23.5.2 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

<b>File</b>	file box		available files
-------------	----------	--	-----------------

*Filename for the posted speed limits.*

<b>Read</b>	button		
-------------	--------	--	--

*Reads the posted speed limits **File** and populates the posted speed limits panel.*

<b>Write</b>	button		
--------------	--------	--	--

*Writes the values in the posted speed limits panel to the posted speed limits **File**.*

#### Posted speed limits table

<b>Active</b>	choice box		Yes, No
---------------	------------	--	---------

*If no is selected, then the row will not be included. This is optional.*

<b>Vehicle</b>	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.*

<b>Chainage from</b>	real box		
----------------------	----------	--	--

*The **Design super alignment** chainage for the speed limit to be applied from.*

**Chainage to** real box

*The **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

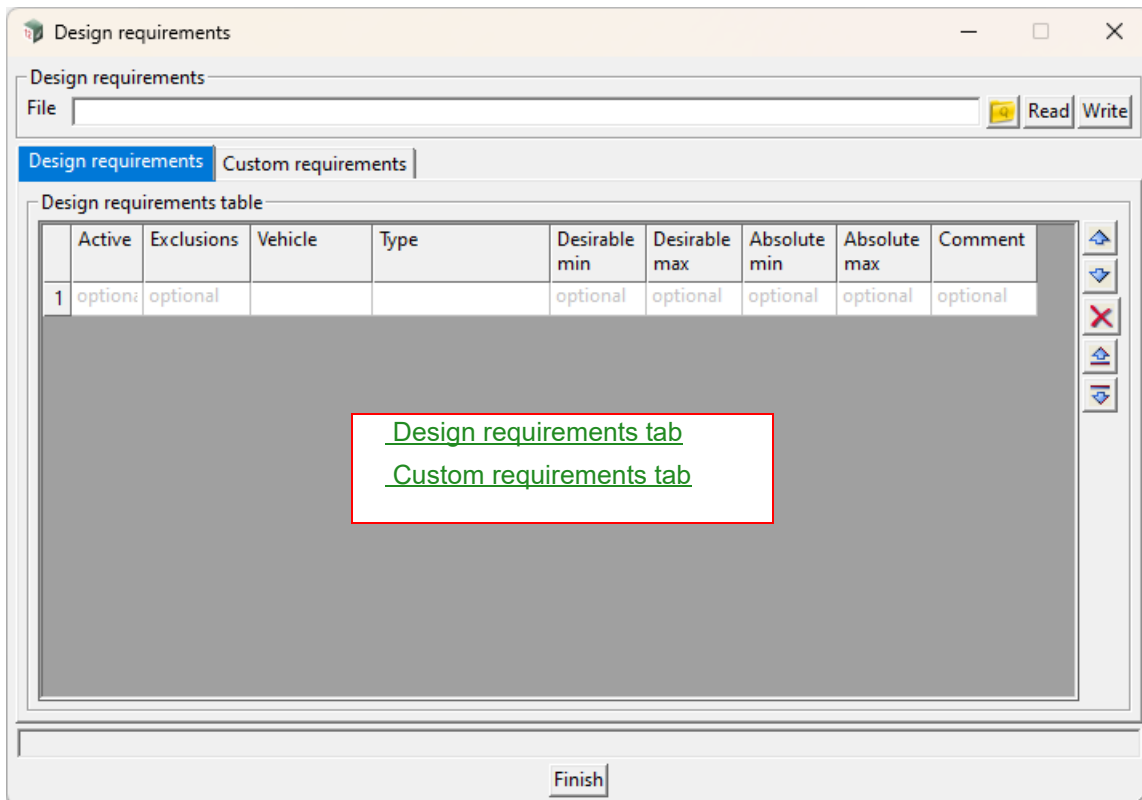
*The length of the speed limit section. This is for information and is read-only.*

**Comment** input box

*An optional comment.*

### 16.23.5.3 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
<b>File</b>	file box		available files

*Filename for the design requirements.*

<b>Read</b>	button
-------------	--------

*Reads the design requirements **File** and populates the posted speed limits panel.*

<b>Write</b>	button
--------------	--------

*Writes the values in the design requirements panel to the design requirements **File**.*

#### Design requirements table

<b>Active</b>	choice box	Yes, No
---------------	------------	---------

*If no is selected, then the row will not be included. This is optional.*

<b>Exclusions</b>	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

The 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

The 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.

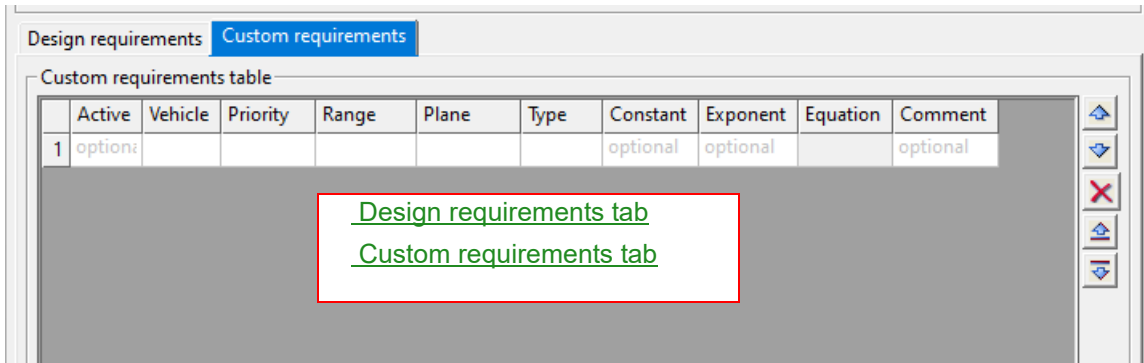
**Absolute max** real box

The 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** input 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

*The 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

*The constant multiplied by the speed (V). This is optional.*

**Exponent** input box

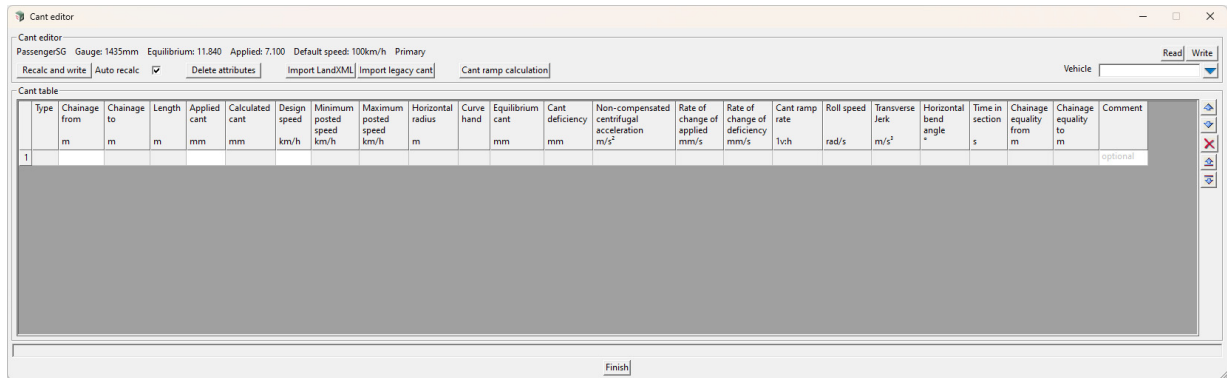
*The exponent of the speed (V). This is optional.*

**Comment** input box

*An optional comment.*

### 16.23.5.4 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 [7.4.17.1 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

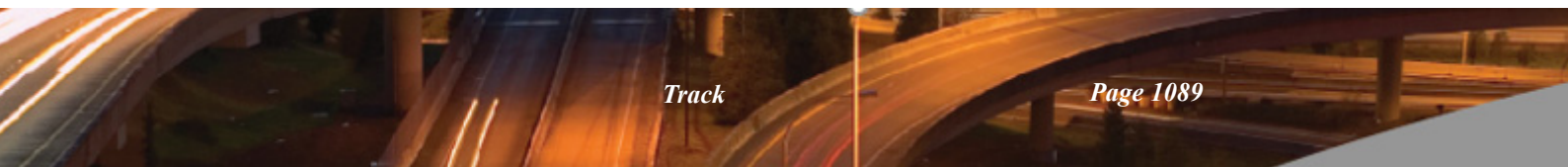
*Opens a panel that calculates cant **Ramp length**, **Previous chainage** and **Next chainage** based on a **Cant ramp 1v:h**, **Applied cant** and **Chainage** value.*

**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

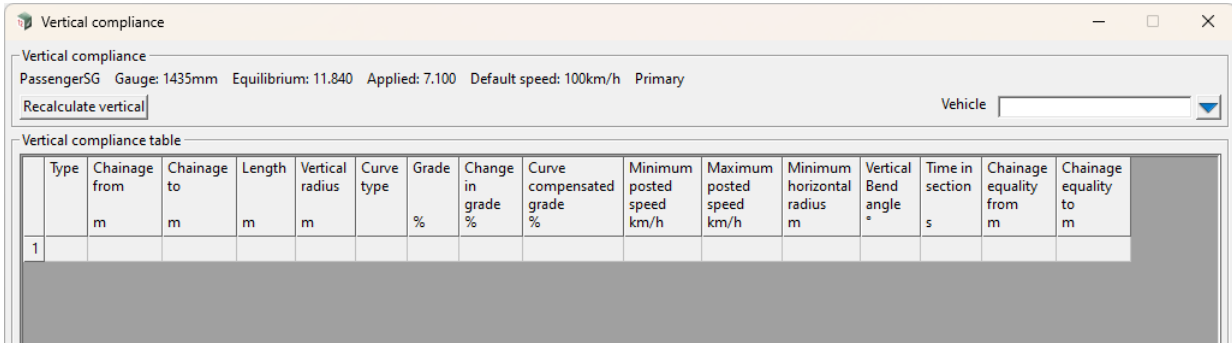
<b>Type:</b>	Specifies the horizontal segment type - either Tangent (straight), Transition (spiral), or Curve (arc).
<b>Chainage from and to:</b>	Defines the chainage range for the horizontal segment. The Chainage From value is editable.
<b>Length:</b>	Indicates the length of the horizontal segment.
<b>Applied cant:</b>	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.
<b>Calculated cant:</b>	The cant value is calculated from the Design speed, Horizontal radius and Applied constant value specified in the Network specifications.
<b>Design speed, Minimum posted speed, &amp; Maximum posted speed:</b>	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.
<b>Horizontal radius:</b>	A positive value for right-hand curves and a negative radius value for left-hand curves.
<b>Curve hand</b>	Specifies whether the curve is right-hand or left-hand
<b>Equilibrium cant:</b>	The equilibrium cant value is calculated from the Design speed, Horizontal radius and Equilibrium constant value specified in the Network specifications.
<b>Cant deficiency:</b>	The difference between the Applied cant and the Equilibrium cant. Cant excess is represented as a negative Cant deficiency value.
<b>Non-compensated centrifugal acceleration:</b>	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.
<b>Rate of change of applied:</b>	The rate of change of applied cant over time, based on the Applied cant, Design speed and transition Length.
<b>Rate of change of deficiency:</b>	The rate of change of cant deficiency over time based on the Cant deficiency, Design speed and transition Length.
<b>Cant ramp rate:</b>	The cant gradient, based on the Applied cant, and transition Length.
<b>Roll speed:</b>	A calculation based on the Applied cant, transition Length, Design speed, and Rail gauge specified in the Network specifications.
<b>Transverse jerk:</b>	A calculation based on Non-compensated centrifugal acceleration, transition Length, and Design speed.
<b>Horizontal bend angle:</b>	The angle of deflection between consecutive Tangent segments.
<b>Time in section:</b>	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 setup in the [11.3.11.4.4.5A - 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.*

### 16.23.5.5 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.*

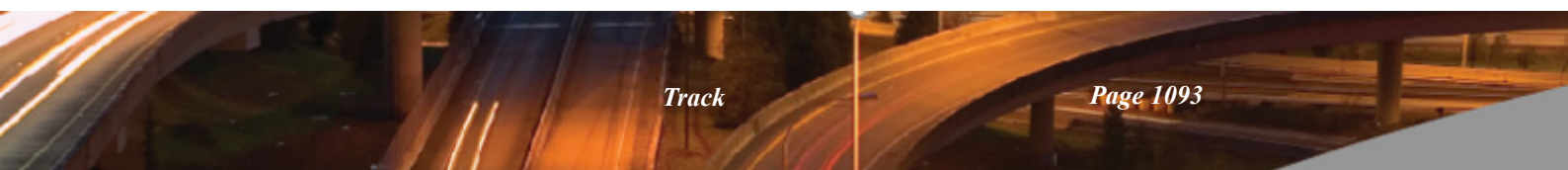
**Vehicle**                      choice box

*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

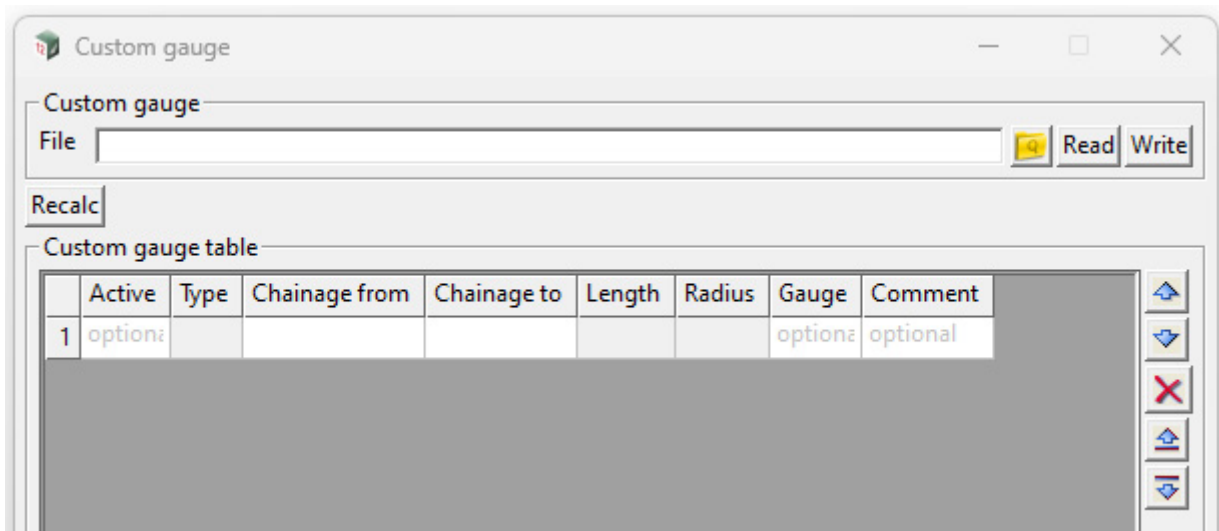
- Type:*                      *The vertical segment type. Tangent (straight), and Curve (arc).*
- Chainage from and to:*                      *The chainage range for the vertical segment.*
- Length:*                      *The length of the vertical segment.*
- Vertical radius:*                      *The 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.*

<i>Minimum horizontal radius:</i>	<i>The minimum horizontal radius through the vertical segment.</i>
<i>Vertical bend angle:</i>	<i>The angle of deflection between consecutive Tangent segments.</i>
<i>Time in section:</i>	<i>The duration of time within the section, determined by the Length and Maximum posted speed.</i>
<i>Chainage equality from and to:</i>	<i>The equivalent chainage equality if chainage equalities have been enabled and are set up in the <a href="#">11.3.11.4.4 SA- Chainage Equalities Editor</a>. Chainage equality names should use the equivalent numerical chainage value without alphabetic prefixes or suffixes as this is used in the chainage equality calculation.</i>



### 16.23.5.6 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

<b>File</b>	file box	available files
-------------	----------	-----------------

*Specifies the custom gauge file.*

<b>Read</b>	button
-------------	--------

*Reads the custom gauge file and updates the custom gauge table grid.*

<b>Write</b>	button
--------------	--------

*Writes the custom gauge file.*

<b>Recalc</b>	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

<b>Active</b>	choice box
---------------	------------

*If no is selected, then the row will not be processed. This is optional.*

<b>Type</b>	input box
-------------	-----------

*The type (Tangent, Transition, or Curve) of section. This is read-only.*

<b>Chainage from</b>	real box
----------------------	----------

*The starting chainage for the section.*

<b>Chainage to</b>	real box
--------------------	----------

*The ending chainage for the section.*

<b>Length</b>	real box
---------------	----------

*The length of the section. This is read-only.*

**Radius** real box

*The radius of the section. This is read-only.*

**Gauge** real box

*The custom rail gauge to be applied between **From m** and **To m**.*

**Comment** input box

*An optional comment.*

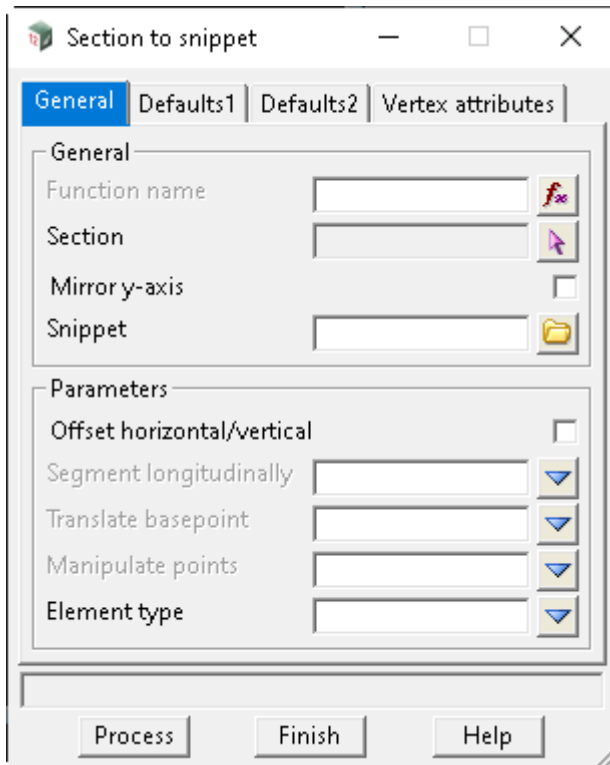
Continue to [16.23.6 Section to Snippet](#) or go back to [16.23.5 Calculate Cant](#) or [16.23 Track](#).



## 16.23.6 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. This 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 [18.14.3 Calculate Cant](#) panel should be selected for the **left grade** and **right grade** strings.



### Tabs

- [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

<b>Function name</b>	function box		all functions
----------------------	--------------	--	---------------

*Name of the function. This is optional.*

<b>Section</b>	select box		
----------------	------------	--	--

*String for the section to generate the data for the snippet.*

<b>Minor y-axis</b>	tick box	not ticked	
---------------------	----------	------------	--

*Mirrors the section about the y-axis. This should be ticked for sections drawn on the left side.*

<b>Snippet</b>	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.*

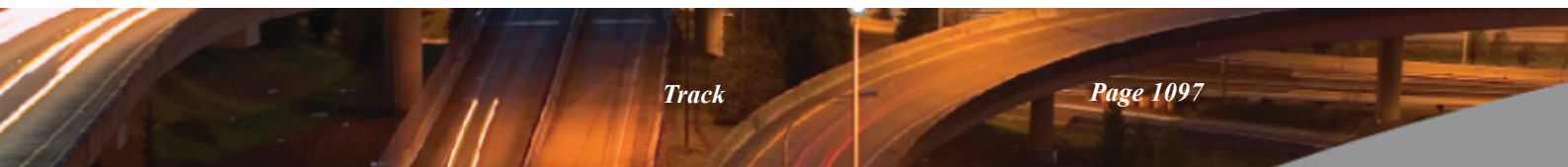
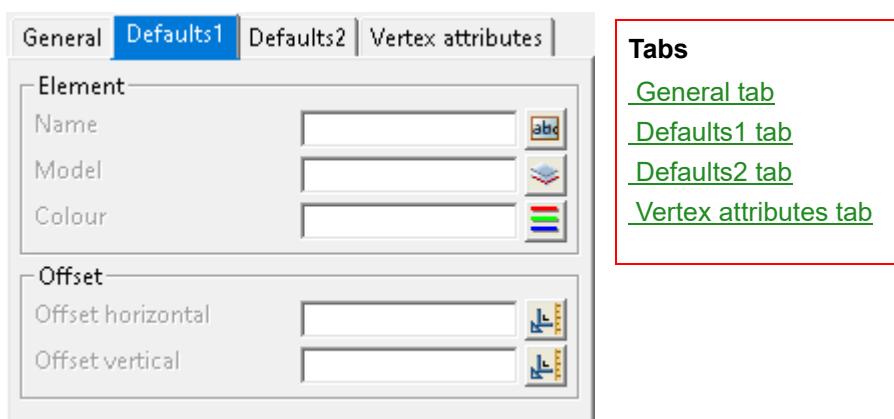
*If **All points on grade**, the Section is rotated to align with the named grade produced from the left grade and right grade strings. Suggested usage: rails and sleepers.*

*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

*The type of element to be generated. Choices include strings, tin or trimesh.*

### Defaults1 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.*

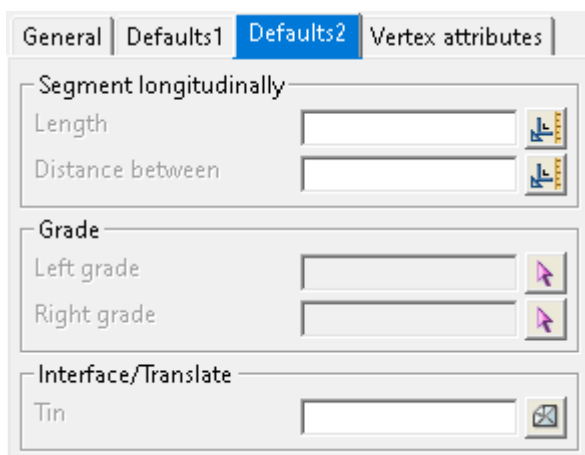
*If specified, this overrides the **Offset horizontal** parameter. If not specified, the **Offset horizontal** parameter will be optional. This is optional.*

**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**



**Links**

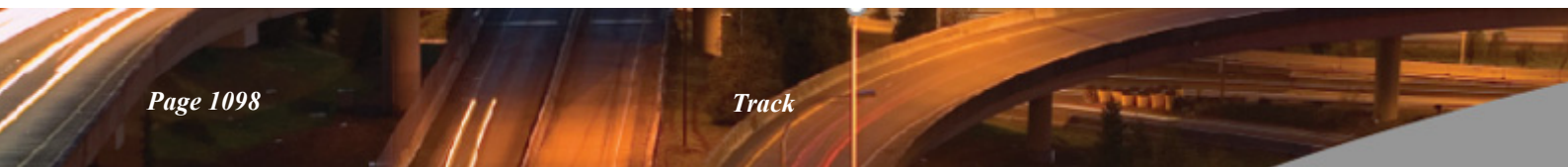
- [General tab](#)
- [Defaults1 tab](#)
- [Defaults2 tab](#)
- [Vertex attributes tab](#)

**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.

### Tabs

- [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 [16.23.7 Light Rail Stopping Distance](#) or go back to [16.23.6 Section to Snippet](#) or [16.23 Track](#).

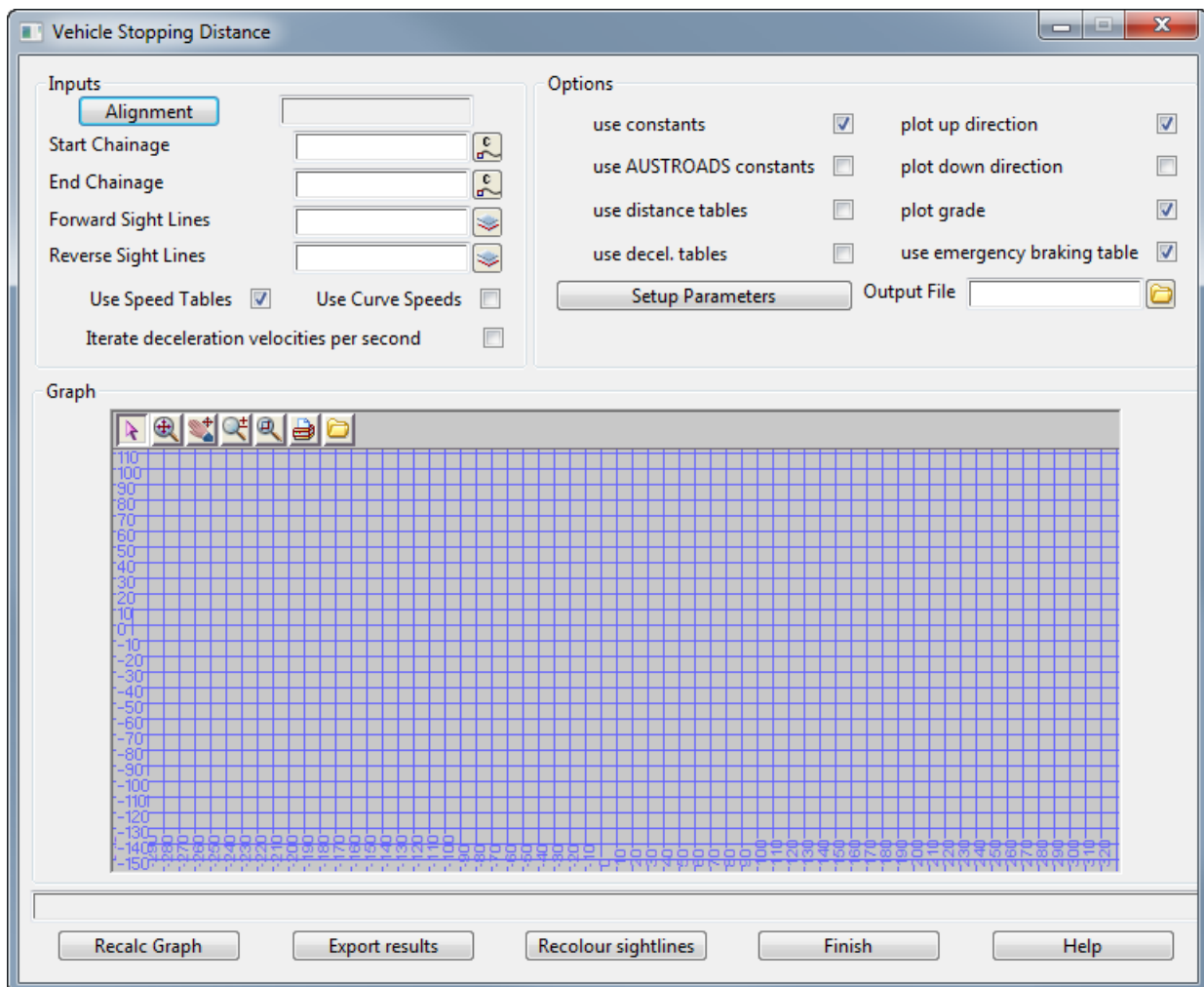


## 16.23.7 Light Rail Stopping Distance

**Position of menu:** Design => Track => Light rail stop distance

The Light rail stop distance panel is used to calculate the sight distance, normal stopping distance and emergency stopping distance of light rail. The prerequisites to running Light rail stop distance include to have created Forward Direction and Reverse Direction Sight Lines in either 19.13.8 Sight Distance - Tin Only or 19.13.1 Sight Distance Enhanced, and applying speeds in [16.23.6 Section to Snippet](#) to the **Alignment** string.

Selecting **Light rail stop distance** displays the **Vehicle Stopping Distance** panel.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Inputs

<b>Alignment</b>	button		
------------------	--------	--	--

*String to be used for calculating the stopping distance. The **Alignment** string would typically be the design alignment centreline.*

<b>Start Chainage</b>	real box		
-----------------------	----------	--	--

*Start chainage on the **Alignment** string for calculating stopping distance from. This is automatically populated with the **Alignment** string start chainage when selected.*



- End Chainage** real box  
*End chainage on the **Alignment** string for calculating stopping distance to. This is automatically populated with the **Alignment** string end chainage when selected.*
- Forward Sight Lines** model box available models  
*Model containing the calculated sightlines strings in the **forward** direction generated in either 19.12.8 Sight Distance - Tin Only or 19.13.1 Sight Distance Enhanced.*
- Reverse Sight Lines** model box available models  
*Model containing the calculated sightlines strings in the **reverse** direction generated in either 19.12.8 Sight Distance - Tin Only or 19.13.1 Sight Distance Enhanced.*
- Use Speed Tables** tick box  ticked  
*If **ticked**, the calculations are based on the **Alignment Speed Sections** table with **Alignment Speed (V)**, **km/hr** default speed used where no speed section is defined. This is attached to the **Alignment**, which is set up in the **DEFAULTS** tab of [16.23.6 Section to Snippet](#).*
- Use Curve Speeds** tick box  not ticked  
*If **ticked**, the calculations are based on the speed assigned to each Cant Station of the **Alignment**, which is set up in the **CANT DESIGN** tab of [16.23.6 Section to Snippet](#).*
- Iterate deceleration velocities per second** tick box  not ticked  
*If **ticked**, the normal stopping distance and emergency stopping distance are dynamically calculated every second during vehicle deceleration.*
- Options**
- use constants** tick box  ticked  
*If **ticked**, the calculations are based on the constants set up in the **Setup Parameters** button.*
- use AUSTRROADS constants** tick box  not ticked  
*If **ticked**, the calculations are based on the Austroads constants.*
- use distance tables** tick box  not ticked  
*If **ticked**, the calculations are based on a distance values table dialogue panel, which appears when the **Alignment** button is clicked.*
- use decel. tables** tick box  not ticked  
*If **ticked**, the calculations are based on a deceleration values table dialogue panel, which appears when the **Alignment** button is clicked.*
- Setup Parameters** button  
*opens a panel containing constant parameters which include **Overspeed value (km/hr)**, **Reaction time (s)**, **Normal Deceleration (m/s<sup>2</sup>)**, **Normal Change per % (-ve) grade**, **Emergency Deceleration (m/s<sup>2</sup>)**, and **Emergency Change per % (-ve) grade**. These parameters are used in the calculations and will only appear when the **use constants** tick box is **ticked**.*
- plot up direction** tick box  ticked  
*Displays the **Graph** using values of the **Alignment** in the up direction (increasing chainage).*
- plot down direction** tick box  not ticked  
*displays the **Graph** using values of the **Alignment** in the down direction (decreasing chainage).*
- plot grade** tick box  ticked  
*Displays the grade in the **Graph**. This is named **grade(%)\*10** in the **Legend**.*
- use emergency braking table** tick box  ticked  
*Displays the emergency stopping distance in the **Graph**. This is named **emerg sight dist** in the **Legend**.*

**Output File** file box all \*.csv files

*Filename for \*.csv file output of vehicle stopping distance calculations. The **Recalc Graph** and then **Export results** buttons must be clicked to export the file.*

## Graph

**Pick** button

*Sets the graph box to pick mode. A right-click will display the running values at any chainage that the mouse hovers over. A left-click will apply the brake from the chainage hovered over when clicked. In apply brake mode a black line will appear in the **Graph** showing deceleration. Left clicking will also write out the calculations to the Output Window.*

**Fit** button

*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

*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

*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 X scale factor and moving the mouse down and up will reduce or increase the Y scale factor.*

**Window** button

*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.*

**Plot** button

*Plots the graph to a specified model at a specified scale.*

**Export results (in graph)** button

*Exports the calculations to a file specified in the **Output File** file box. **Recalc Graph** should be clicked before exporting the results.*

## Buttons at Bottom

**Recalc graph** button

*Recalculates the vehicle stopping distances. This should be run before displaying the graph and before the **Export results** button is clicked.*

**Export results** button

*Exports the calculations to a file specified in the **Output File** file box. **Recalc Graph** should be clicked before exporting the results.*

**Recolour sightlines** button

*Changes the colour of the sight lines in **Forward Sight Lines** and **Reverse Sight Lines** models to green, and changes the colour of the sight lines that fail to red.*

Continue to [16.23.8 Structure Gauge Panel](#) or go back to [16.23.7 Light Rail Stopping Distance](#) or [16.23 Track](#).

## 16.23.8 Structure Gauge Panel

**Position of option on menu:** Design =>Track =>Plot=>Plot Structure Gauge

The Plot Structure Gauge panel creates a structure clearance envelope along a **Reference** string. The prerequisites to running **Plot Structure Gauge** are applying the cant in the [16.23.6 Section to Snippet](#) 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 **Plot Structure Gauge** displays the **Structure Gauge** panel.

The screenshot shows the 'Structure Gauge Panel' window. At the top, there are three tabs: 'Output' (selected), 'Vehicle Data', and 'Structure Gauge'. Below the tabs, there are several input fields and checkboxes. The 'Output' tab contains fields for Name, Vehicle Model, Sections Model, Trimesh Model, and Strings Model, each with a corresponding icon. There are also checkboxes for 'Store calcs as attributes' and 'Use greatest of average cant of bogies', and a color selection field. Below these are fields for 'Start Chainage', 'End Chainage', 'Height Offset', and 'Vehicle Type'. A red box highlights a 'Tabs' section with the following links: [Output tab](#), [Vehicle Data tab](#), [Structure Gauge tab](#), and [Read/Write Data tab](#). At the bottom of the panel, there are three buttons: 'Recalc Function', 'Finish', and 'Help'.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Plot Structure Gauge Function

<b>Function</b>	function box		available functions
-----------------	--------------	--	---------------------

*Name of the function.*

<b>Reference</b>	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 [16.23.6 Section to Snippet](#) must be applied to the **Reference** string before running the plot structure gauge panel*

<b>Interval</b>	real box		
-----------------	----------	--	--

*Chainage increment between sections and vertices on strings.*

### Buttons at Bottom

<b>Recalc Function</b>	button		
------------------------	--------	--	--

*Creates/updates the **Function** and generates the elements for the models defined in the **Output** tab.*

### Output tab

<b>Name</b>	name box		available names
-------------	----------	--	-----------------

*Name stem for the structure gauge generated strings.*

<b>Vehicle Model</b>	model box		available models
----------------------	-----------	--	------------------

*Name of the 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.*

<b>Sections Model</b>	model box		available models
-----------------------	-----------	--	------------------

*Name of the 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.*

<b>Trimesh Model</b>	model box		available models
----------------------	-----------	--	------------------

*Name of the 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.*

<b>Strings Model</b>	model box		available models
----------------------	-----------	--	------------------

*Name of the 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.*

<b>Store Calcs as attributes</b>	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.*

<b>Use greatest of average cant of bogies</b>	tick box	not ticked	
---	----------	------------	--

*If **ticked**, the greatest average cant of bogies is used.*

<b>Colour</b>	colour box		available colours
---------------	------------	--	-------------------

*The colour for the strings/trimesh generated on the **Sections Model**, **Trimesh Model** and **Strings Model**.*

<b>Start Chainage</b>	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.

**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.

**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



### 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

The 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

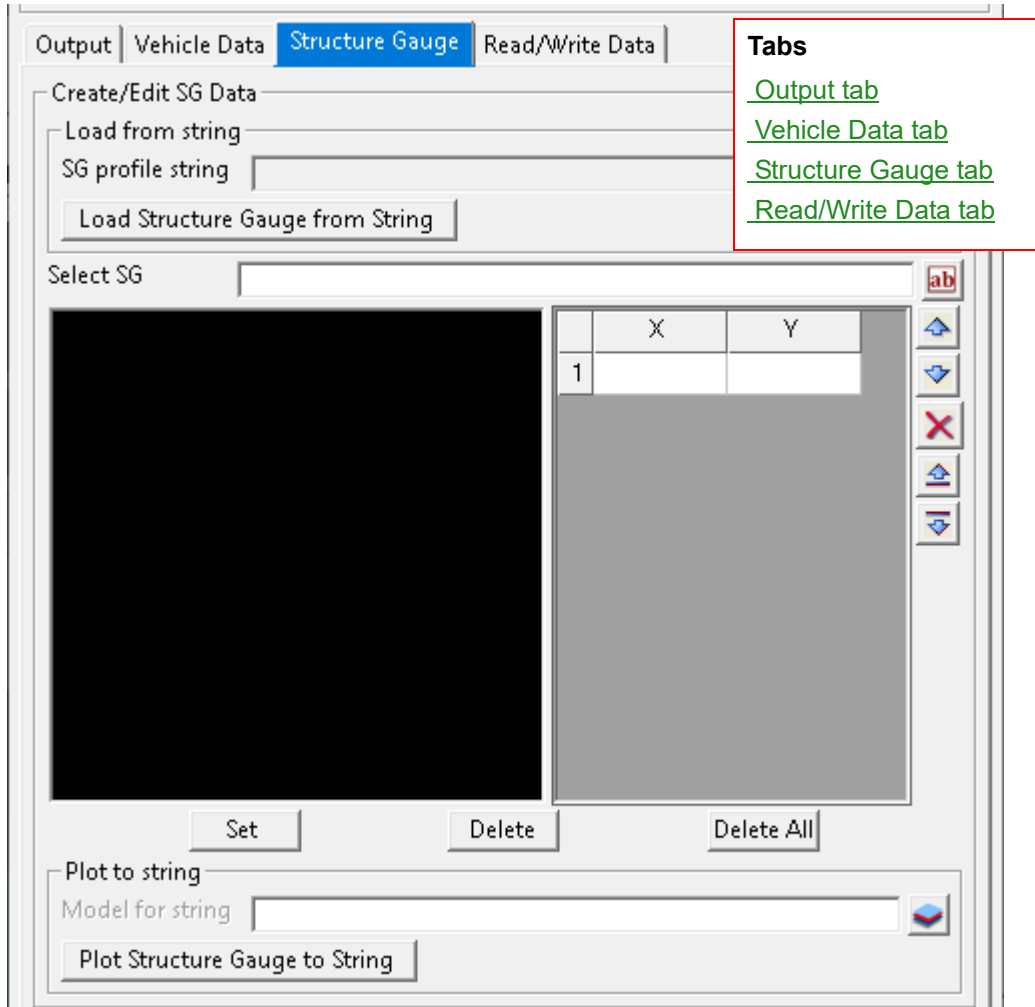
Deletes the vehicle specified in the **Select Vehicle** field.

**Delete All** button

Deletes all vehicles stored in the vehicle library.



## Structure Gauge tab



### 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

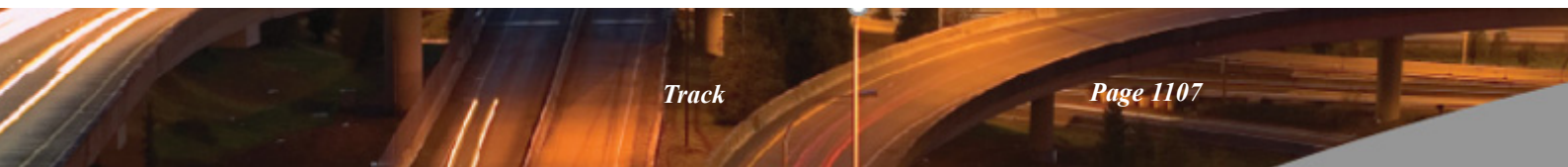
*This option sets the graph box to pick mode. When in this mode the message area will display the X and Y coordinates as the mouse hovers over a location in the graph.*

**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


Name of the 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

Output | Vehicle Data | Structure Gauge | **Read/Write Data**

Read Structure Gauges from File  
 Structure Gauge file  

Write Structure Gauges to File  
 Structure Gauge file    
 Make SG read only

Read Vehicle Details from File  
 Vehicle details file  

Write Vehicle Details to File  
 Vehicle details file    
 Make details read only

**Tabs**  
[Output tab](#)  
[Vehicle Data tab](#)  
[Structure Gauge tab](#)  
[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

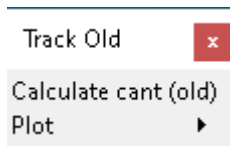
*Exports vehicle details to the \*.profiles file specified in the **Vehicle details file** field. These vehicle details are entries stored in the **Select Vehicle** list in the **Vehicle Data** tab.*

**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.*

Continue to [16.23.9 Track Old](#) or go back to [16.23.8 Structure Gauge Panel](#) or [16.23 Track](#).

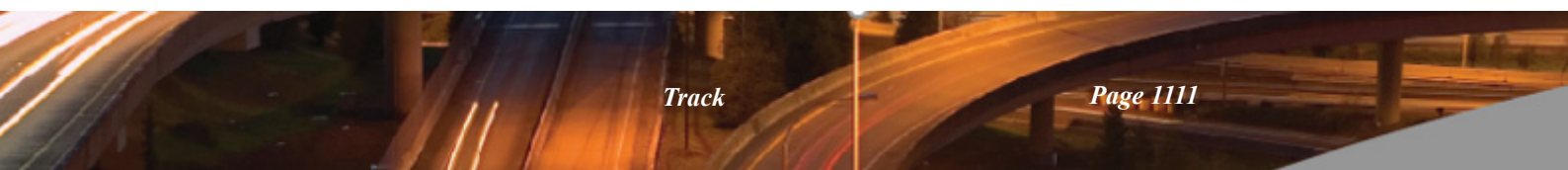
## 16.23.9 Track Old



See

[16.23.9.1 Calculate Cant \(Old\)](#)

[16.23.9.2 Track Plot](#)



### 16.23.9.1 Calculate Cant (Old)

**Position of menu:** Design =>Track =>Old =>Calculate Cant (old)

The Calculate Cant panel is used to calculate cants along a design **Rail CL Alignment**. The **DESIGN LIMITS** tab features user-defined constants to check if any of the design element values exceed these limits. In the **CANT GRAPH** tab, a table and graph are displayed. The table highlights values that exceed the design limits and the graph allows visualisation of the design element values and an option to plot this graph into a model. The **DEFAULTS** tab allows speed overrides for specified chainages and cant overrides for curves that meet a specified speed and radius. The **OUTPUTS** tab allows for: the **Cant Stations** to be exported to a stationing report file or a spreadsheet; an alignment setout to be exported; an MTF to be created.

#### Abbreviations used

**Ca:** Applied cant in mm

**Cd/Def:** Cant deficiency in mm

**Ce:** Equilibrium cant in mm

**Lateral Accel/ACC:** Lateral acceleration in  $m/s^2$

**R:** Radius of the curve in m

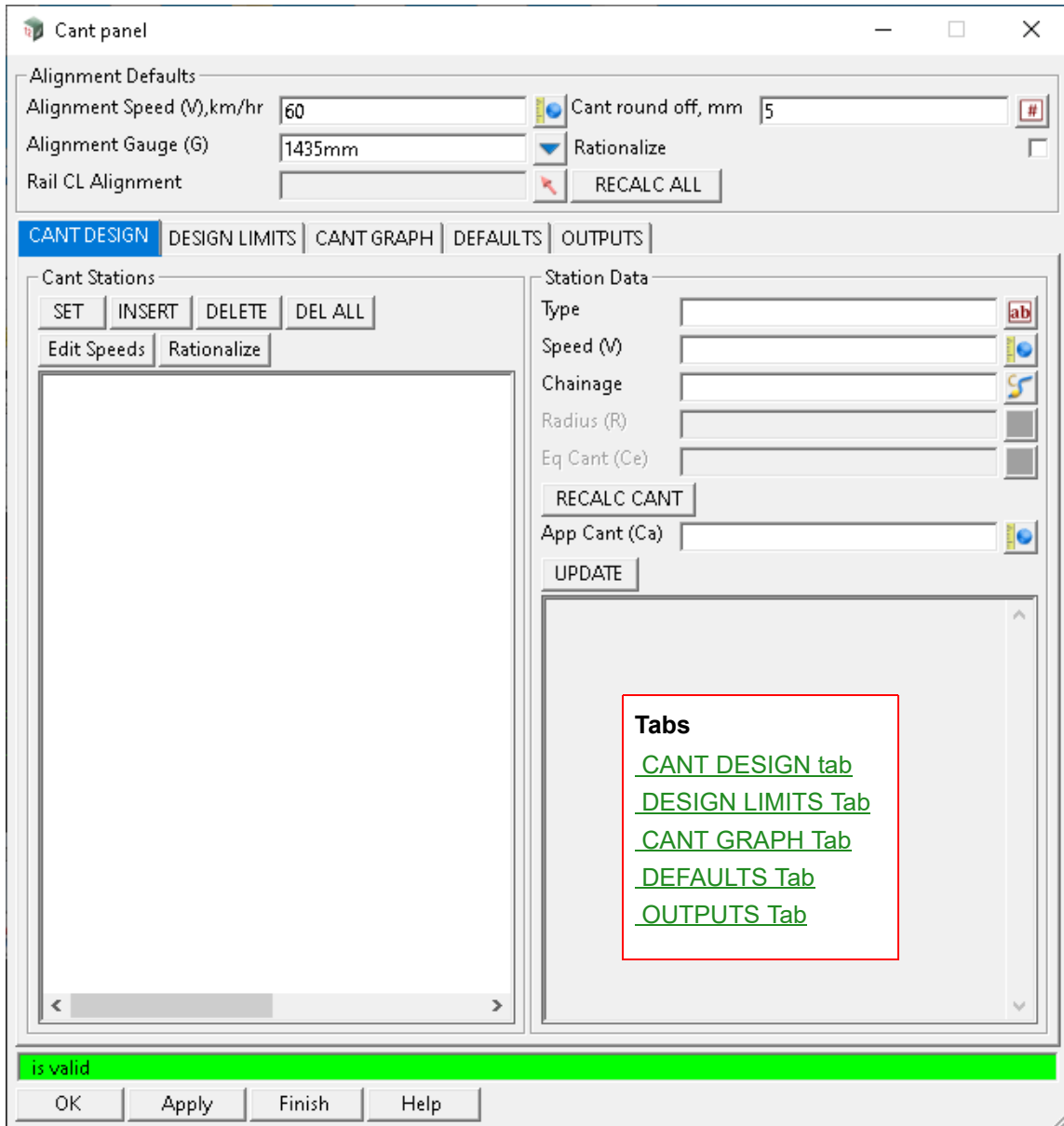
**ROCC:** Rate of change of cant in mm/s or 1v in ?h

**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

Selecting **Calculate Cant** displays the **Cant** panel.



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

Field Description	Type	Defaults	Pop-Up
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**Alignment Defaults**

<b>Alignment Speed (V), km/hr</b>	real box	60	
-----------------------------------	----------	----	--

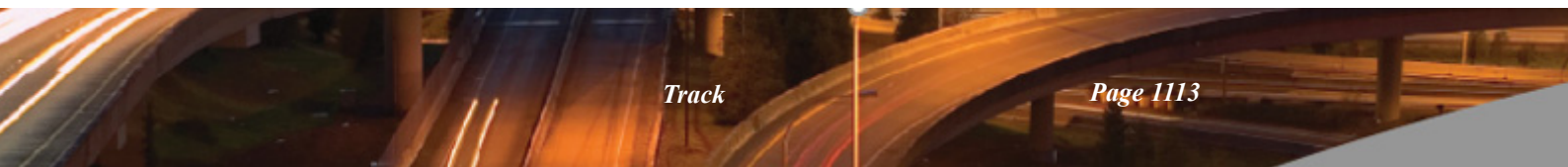
*Default speed of the design alignment. When a **Rail CL Alignment** is initially selected, or the **RECALC ALL** button is clicked, all segments will use the speed entered to calculate the cant for that segment.*

<b>Alignment Gauge (G)</b>	choice box	1435mm	available rail gauges
----------------------------	------------	--------	-----------------------

*Rail gauge of the section. The gauge is the distance between the running rails.*

<b>Rail CL Alignment</b>	string select		
--------------------------	---------------	--	--

*Design rail centreline.*





- Cant round off, mm**      integer box      5  
*Rounding to the nearest multiple in millimetres for cant values to be applied.*
- Rationalize**      tick box      not ticked  
*Deletes duplicate entries in the **Cant Stations** list.*
- RECALC ALL**      button  
*Calculates all cants using the default **Alignment Speed (V)**.*

### Buttons at Bottom

- OK**      button  
*Saves all editable fields in the **Cant** panel and then closes the panel.*
- Apply**      button  
*Saves all editable fields in the **Cant** panel.*

## CANT DESIGN tab

### Cant Stations

- SET**      button  
*Updates the **Cant Station**. This sets the **Speed (V)**, **Chainage** and **App Cant (Ca)** fields and should be run after the **RECALC CANT** button has been clicked to save the **Cant Station**.*
- INSERT**      button  
*Inserts a **Cant Station** with values matching the **Cant Station** currently selected.*
- DELETE**      button  
*Deletes a selected **Cant Station**.*
- DEL ALL**      button  
*Deletes all **Cant Stations**.*
- Edit Speeds**      button  
*Displays a dialogue panel where a speed can be applied between a start and end chainage.*
- Rationalize**      button  
*Deletes duplicate entries in the **Cant Stations** list.*

### Station Data

- Type**      custom box  
*Description or name of the **Cant Station**.*
- Speed (V)**      real box  
*Speed of the **Cant Station** section.*
- Chainage**      chainage box  
*Start chainage of the **Cant Station** section.*
- Radius (R)**  
*Radius of the **Cant Station** section. This is automatically set based on the chainage of the **Rail CL Alignment** after the **RECALC CANT** button is pressed.*
- Eq Cant (Ce)**  
*Equilibrium cant. This is automatically calculated after the **RECALC CANT** button is pressed.*
- RECALC CANT**      button  
*Recalculates the **Station Data** fields. This populates the **Radius (R)** field based on the **Chainage** entered along the **Rail CL Alignment**, and calculates the **Eq Cant (Ce)** and **App Cant (Ca)**.*

Note: **RECALC CANT** will not save the **Cant Station**. **SET** or **UPDATE** needs to be clicked after the **RECALC CANT** button has been run to save the **Cant Station**.

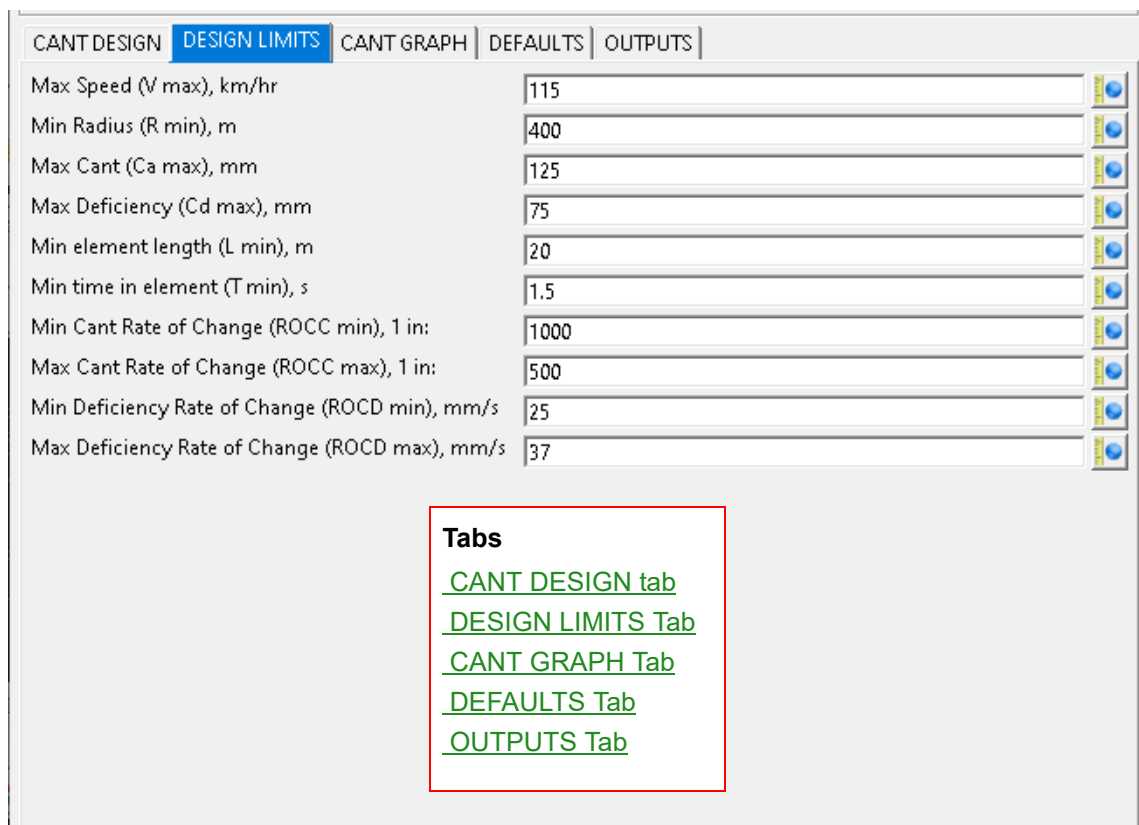
**App Cant (Ca)** real box

Applied cant. This is automatically calculated after the **RECALC CANT** button is pressed.

**Update** button

Updates the **Cant Station**. This sets the **Speed (V)**, **Chainage** and **App Cant (Ca)** fields and should be run after the **RECALC CANT** button has been clicked to save the **Cant Station**.

## DESIGN LIMITS Tab



Parameter	Value	Button
Max Speed (V max), km/hr	115	RECALC CANT
Min Radius (R min), m	400	RECALC CANT
Max Cant (Ca max), mm	125	RECALC CANT
Max Deficiency (Cd max), mm	75	RECALC CANT
Min element length (L min), m	20	RECALC CANT
Min time in element (T min), s	1.5	RECALC CANT
Min Cant Rate of Change (ROCC min), 1 in:	1000	RECALC CANT
Max Cant Rate of Change (ROCC max), 1 in:	500	RECALC CANT
Min Deficiency Rate of Change (ROCD min), mm/s	25	RECALC CANT
Max Deficiency Rate of Change (ROCD max), mm/s	37	RECALC CANT

**Tabs**

- [CANT DESIGN tab](#)
- [DESIGN LIMITS Tab](#)
- [CANT GRAPH Tab](#)
- [DEFAULTS Tab](#)
- [OUTPUTS Tab](#)

**Max Speed (V max), km/hr** real box 115

Maximum speed in kilometres per hour allowable.

**Min Radius (R min), m** real box 400

Minimum radius in metres allowable.

**Max Cant (Ca max), mm** real box 125

Maximum cant in millimetres allowable.

**Max Deficiency (Cd max), mm** real box 75

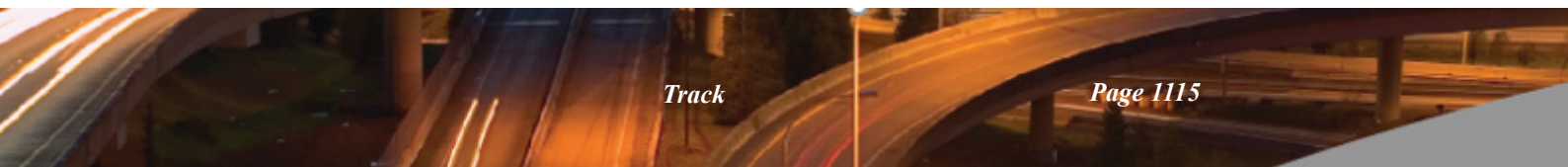
Maximum cant deficiency in millimetres allowable.

**Min element length (L min), m** real box 20

Minimum element length in metres allowable.

**Min time in element (T min), s** real box 1.5

Minimum time in curve or tangent element in seconds allowable.



**Min Cant Rate of Change (ROCC min), 1 in:** real box 1000  
*Minimum rate of change of cant in 1v in ?h allowable.*

**Max Cant Rate of Change (ROCC max), 1 in:** real box 500  
*Maximum rate of change of cant in 1v in ?h allowable.*

**Min Deficiency Rate of Change (ROCD min), mm/s** real box 1000  
*Minimum rate of change of cant deficiency in millimetres per second allowable.*

**Max Deficiency Rate of Change (ROCD max), mm/s** real box 500  
*Maximum rate of change of cant deficiency in millimetres per second allowable.*

### CANT GRAPH Tab

**Alignment Defaults**  
 Alignment Speed (V), km/hr: 60  
 Alignment Gauge (G): 1435mm  
 Rail CL Alignment: design alignment Element M  
 Cant round off, mm: 5  
 Rationalize:   
 RECALC ALL

**CANT DESIGN | DESIGN LIMITS | CANT GRAPH | DEFAULTS | OUTPUTS**

**Cant Diagram**

Chainage	Radius	Speed	Ce	Ca	Def	Type
1 0.000	0.000	60.0	0.0	0.0	0.0	line start
L:172.781	T:10.37	ROCC: 0.0mm/s	ROCC: 0.0mm/s	ROCD: 0.0mm/s		
2 172.781	0.000	60.0	0.0	0.0	0.0	line end
L:75.000	T:4.50	ROCC:lin-2500.0	-6.7mm/s	ROCD:lin-3942.6	-4.2mm/s	
3 247.781	-868.000	60.0	-49.0	-30.0	-19.0	arc start
L:287.836	T:17.27	ROCC: 0.0mm/s	ROCC: 0.0mm/s	ROCD: 0.0mm/s		
4 535.617	-868.000	60.0	-49.0	-30.0	-19.0	arc end
L:75.000	T:4.50	ROCC:lin2500.0	6.7mm/s	ROCD:lin3942.6	4.2mm/s	
5 610.617	0.000	60.0	0.0	0.0	0.0	line start
L:19.471	T:1.17	ROCC: 0.0mm/s	ROCC: 0.0mm/s	ROCD: 0.0mm/s		
6 630.088	0.000	60.0	0.0	0.0	0.0	line end
L:85.000	T:5.10	ROCC:lin2833.3	5.9mm/s	ROCD:lin4801.2	3.5mm/s	
7 715.088	892.000	60.0	30.0		17.7	arc start

**Constants**  
 Keo = 11.820  
 Ksc = 7.100

**Legend**  
 Eq Cant  
 App Cant  
 Cant Def  
 Roc Def  
 Curve Speed

**Buttons:** Pick, Fit

**Pick** button

*Sets the graph box to pick mode. When in this mode the graph box will display the X (chainage) and Y value as the mouse hovers over a location in the graph.*

**Fit** button

*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

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

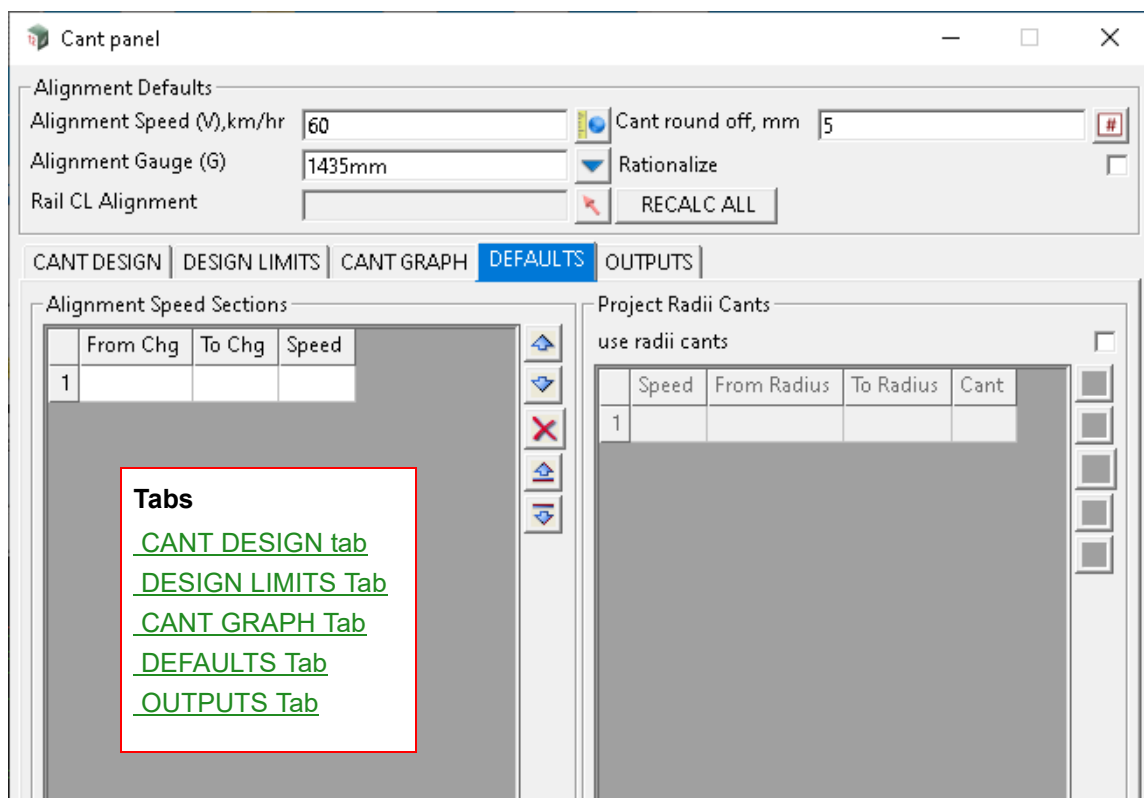
Sets the graph box to zoom mode. Click once to commence zooming, then move the mouse and click a second time to stop zooming. Moving the mouse left and right will reduce and increase the X scale factor and moving the mouse down and up will reduce or increase the Y scale factor.

**Window** button

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.

**Plot** button

Plots the graph to a specified model at a specified scale.

**DEFAULTS Tab****Alignment Speed Sections****From Chg** real box

From chainage; to set a speed override between two chainages.

**To Chg** real box

To chainage; to set a speed override between two chainages.

**Speed** real box

A speed override to apply between two chainages. Once the **From Chg**, **To Chg** and **Speed** fields have been entered, then the **Apply** and **RECALC ALL** buttons have been clicked, this will override the default **Alignment Speed (V)**, km/hr for the **Cant Stations** within those chainages.

**Project Radii Cants**

**use radii cants**                      tick box                      not ticked

*If **ticked**, then a cant override can be applied to any curve that meets a **Speed** and a radius range. This will also function in conjunction with **Alignment Speed Sections**.*

**Speed**                                      real box

*A speed condition to apply a cant override if the curve tested meets that speed.*

**From Radius**                          real box

*A lower radius range condition to apply a cant override if the curve tested meets that radius. A positive radius value should be entered.*

**To Radius**                              real box

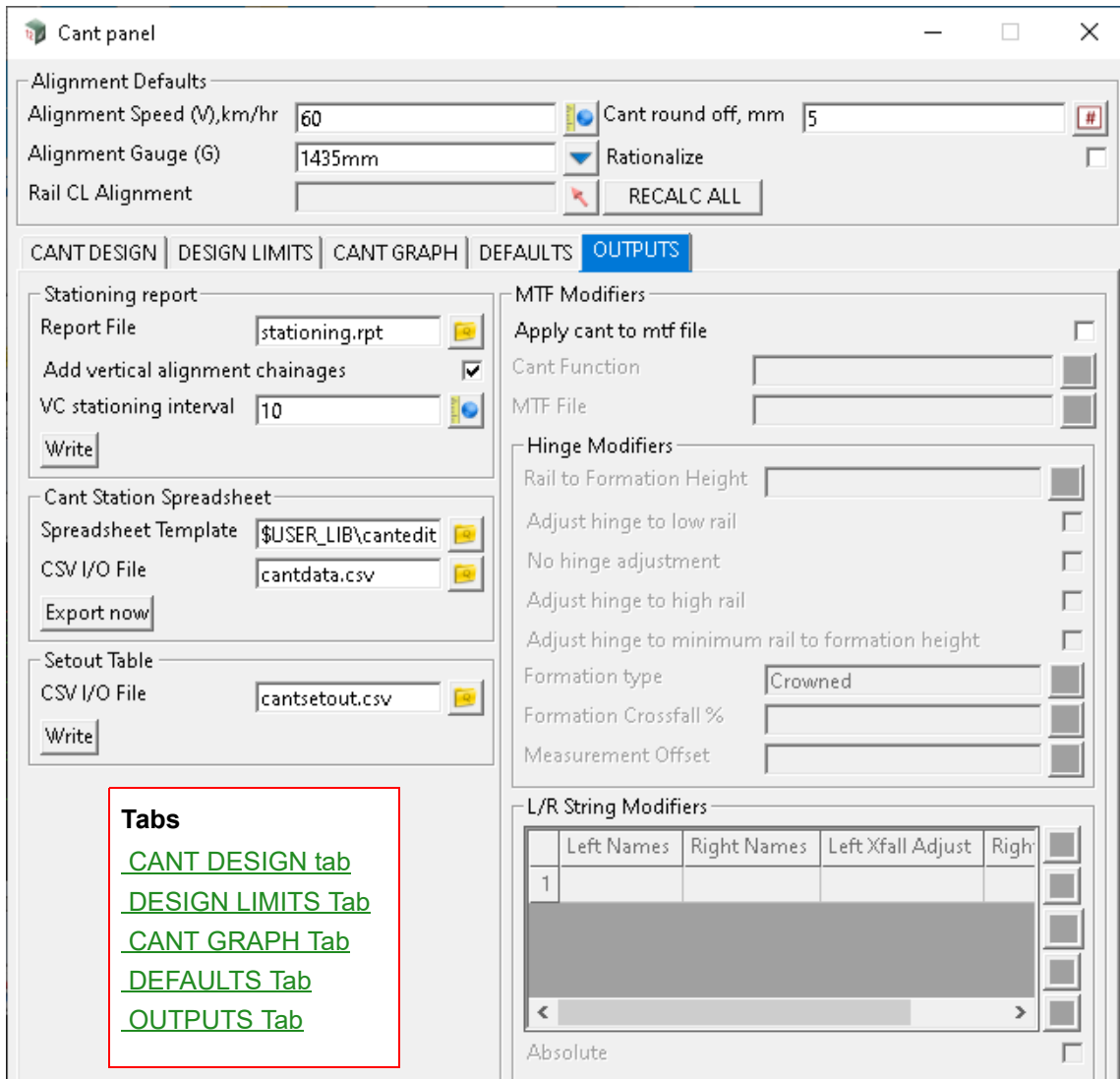
*An upper radius range condition to apply a cant override if the curve tested meets that radius. A positive radius value should be entered.*

**Cant**                                        real box

*A cant override to apply if the **Speed** and radius range conditions are met. Once the **Speed**, **From Radius**, and **To Radius** fields have been entered, then the **Apply** and **RECALC ALL** buttons have been clicked, this will override the **App Cant (Ca)** for the **Cant Stations** meeting those conditions. A positive cant value should be entered unless negative superelevation is desired.*



## OUTPUTS Tab



**Tabs**

- [CANT DESIGN tab](#)
- [DESIGN LIMITS Tab](#)
- [CANT GRAPH Tab](#)
- [DEFAULTS Tab](#)
- [OUTPUTS Tab](#)

### Stationing report

**Report File**                      file box                      stationing.rpt                      all \*.rpt files

*Name of the rpt file to export Cant Stations.*

**Add vertical alignment chainages**    tick box    ticked

*If **ticked**, vertical alignment Point of Vertical Curve (PVC) and Point of Vertical Tangency (PVT) chainages will be added to the **Report File**.*

**VC stationing interval**              real box                      10

*Includes additional stations through vertical curves at specified increments in the **Report File**.*

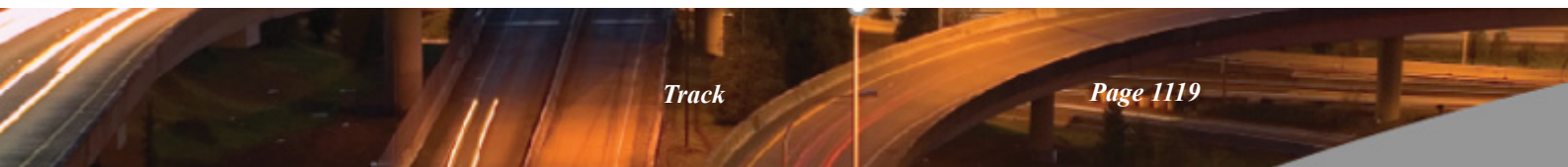
**Write**                                      button

*Exports the Stationing **Report File** containing **Cant Stations** and additional stations through vertical curves if specified.*

### Cant Station Spreadsheet

**Spreadsheet Template**              file box                                      all \*.xls files

*Name of the XLS template file that is copied and renamed to the name stem entered in the **CSV I/O File** field with an \*.xls extension.*





**CSV I/O File** file box cantsetout.csv all \*.csv files  
*Name of the CSV output file to be created.*

**Export now** button  
*Exports the **Cant Station Spreadsheet Template** and **CSV I/O File**. The \*.csv file exported can be imported into the \*.xls file created.*

**Setout Table**

**CSV I/O File** file box cantsetout.csv all \*.csv files  
*Name of the CSV output file to be created.*

**Write** button  
*Exports the Setout Table **CSV I/O File**.*

**MTF Modifiers**

**Apply cant to mtf file** tick box not ticked  
*If **ticked**, creates an **MTF File**.*

**Cant Function** function box  
*Name of the MTF **Cant Function**.*

**MTF File** file box all \*.mtf files  
*Name of the MTF file to be created.*

**Hinge Modifiers**

**Rail to Formation Height** real box  
*Vertical offset from top of rail to top of formation. The value entered should be positive.*

**Adjust hinge to low rail** tick box not ticked  
*Adds hinge adjustments to the **MTF File** based on the low rail.*

**No hinge adjustment** tick box not ticked  
*No hinge adjustments are added to the **MTF File**.*

**Adjust hinge to high rail** tick box not ticked  
*Adds hinge adjustments to the **MTF File** based on the high rail.*

**Adjust hinge to minimum rail to formation height** tick box not ticked  
*Allows for the **Formation Type**, **Formation Crossfall**, % and **Measurement Offset** fields to be populated.*

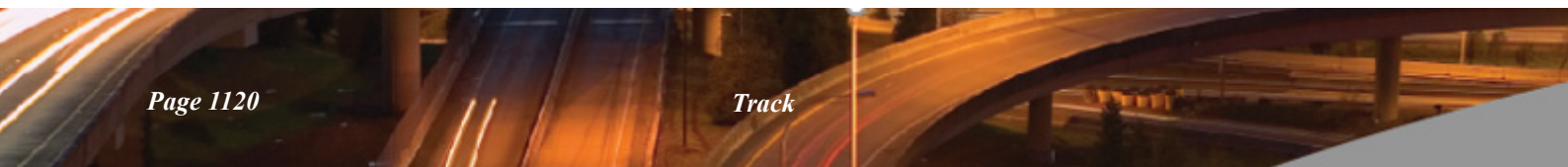
**Formation type** choice box Crowned  
*A choice of Crowned or Projected formation types can be chosen.*

**Formation Crossfall %** real box  
*When used in conjunction with a **Measurement Offset**, this affects the hinge height based on a crossfall and offset.*

**Measurement Offset** real box  
*When used in conjunction with a **Formation Crossfall %**, this affects the hinge height based on a crossfall and offset.*

**L/R String Modifiers**

**Left Names** name field  
*Adds Left MTF modifiers to the **MTF File** adjusting the link name matching the name specified in the **Left Names** field and the start and end xfall matching the **Left Xfall Adjust** field.*



**Right Names** name field

*Adds Right MTF modifiers to the **MTF File** adjusting the link name matching the name specified in the **Right Names** field and the start and end xfall matching the **Right Xfall Adjust** field.*

**Left Xfall Adjust** real field

*Adds Left MTF modifiers to the **MTF File** adjusting the link name matching the name specified in the **Left Names** field and the start and end xfall matching the **Left Xfall Adjust** field.*

**Right Xfall Adjust** real field

*Adds Right MTF modifiers to the **MTF File** adjusting the link name matching the name specified in the **Right Names** field and the start and end xfall matching the **Right Xfall Adjust** field.*

**Absolute** tick box not ticked

*If **ticked**, the xfall is set to the values given in the **Left/Right Xfall Adjust** fields.*

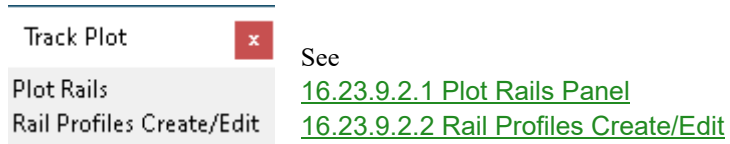
*If **not ticked**, the values given in the **Left/Right Xfall Adjust** fields are added to the existing xfall.*

Continue to [16.23.9.2 Track Plot](#) or go back to [16.23.9.1 Calculate Cant \(Old\)](#), [16.23.9 Track Old](#) or [16.23 Track](#).

### 16.23.9.2 Track Plot

Position of menu: Design =>Track =>Old =>Plot

The Track Plot walk-right menu is



See

[16.23.9.2.1 Plot Rails Panel](#)

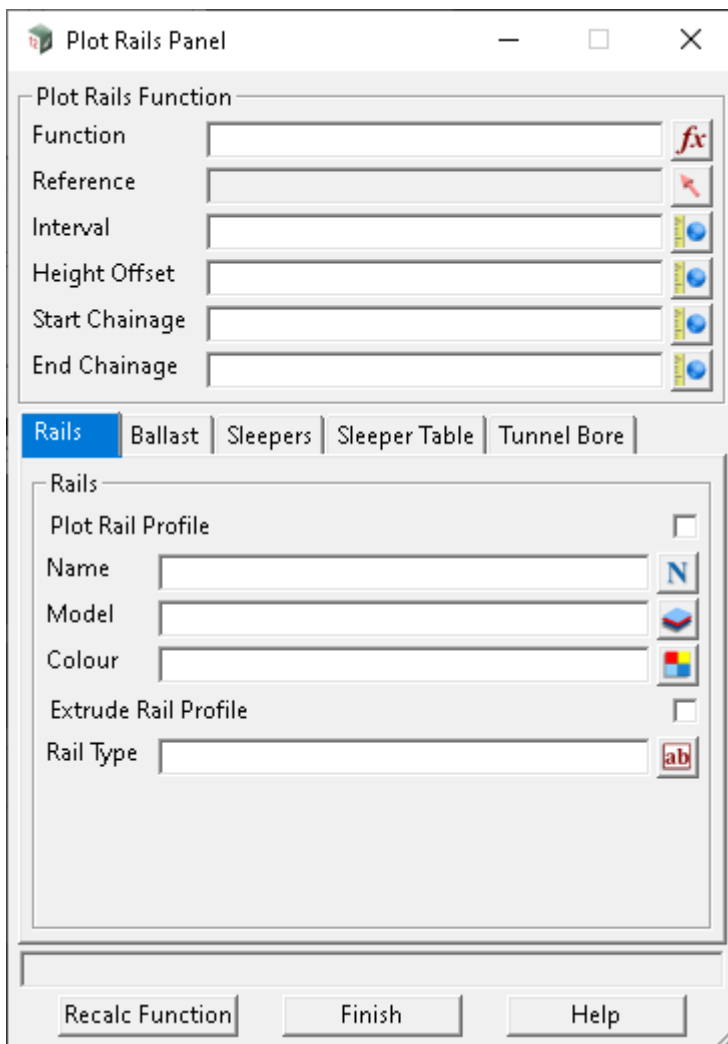
[16.23.9.2.2 Rail Profiles Create/Edit](#)

### 16.23.9.2.1 Plot Rails Panel

**Position of option on menu:** Design =>Track =>Old =>Plot =>Plot Rails

The Plot Rails panel creates rails, ballast, sleepers, and tunnel bore strings. The prerequisites to running **Plot Rails** are applying the cant in the [16.23.6 Section to Snippet](#) panel to the **Reference** string and to create a **Rail Type** in [16.23.9.2.2 Rail Profiles Create/Edit](#) if **Extrude Rail Profile** is selected. Plotting rails and sleepers generates Super Strings of each element that display as line strings in plan and section views, and that display as 3D elements in the perspective view. Plotting ballast generates sections and Super Strings for the ballast shoulder and ballast toe that interfaces a **Formation Tin**. Plotting tunnel bore generates a cylinder along the alignment that can be viewed in the plan, section and perspective views.

Selecting **Plot Rails** displays the Plot Rails **Place** panel.

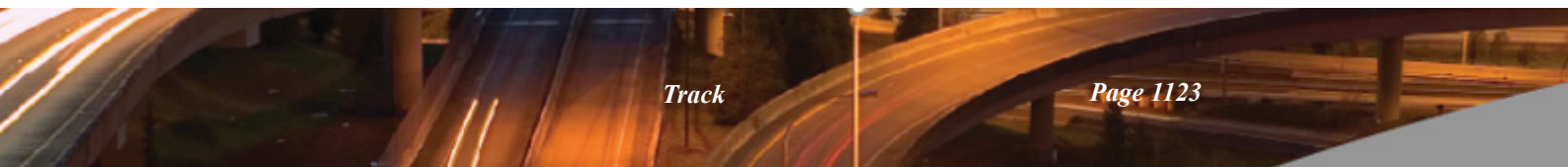


**Tabs**

- [Rails tab](#)
- [Ballast tab](#)
- [Sleepers tab](#)
- [Sleeper Table tab](#)
- [Tunnel Bore tab](#)

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

Field Description	Type	Defaults	Pop-Up
<b>Plot Rails Function</b>			
<b>Function</b>	function box		available functions
<i>Name of the function.</i>			



- Reference** string select available functions  
*Reference* string that all rail, ballast, sleepers and tunnel bore strings generated are based on. The *Reference* string would typically be the design alignment centreline. Cant values defined in [16.23.6 Section to Snippet](#) must be applied to the *Reference* string before running the plot rails panel.
- Interval** real box  
 Chainage increment between sections and vertices on strings.
- Height Offset** real box  
 Vertical distance above/below the reference string to generate all rail, ballast, sleepers and tunnel bore strings.
- Start Chainage** real box  
 The *Reference* string start chainage for generating strings from. This is automatically populated with the *Reference* string start chainage when selected.
- End Chainage** real box  
 The *Reference* string end chainage for generating strings up to. This is automatically populated with the *Reference* string end chainage when selected.

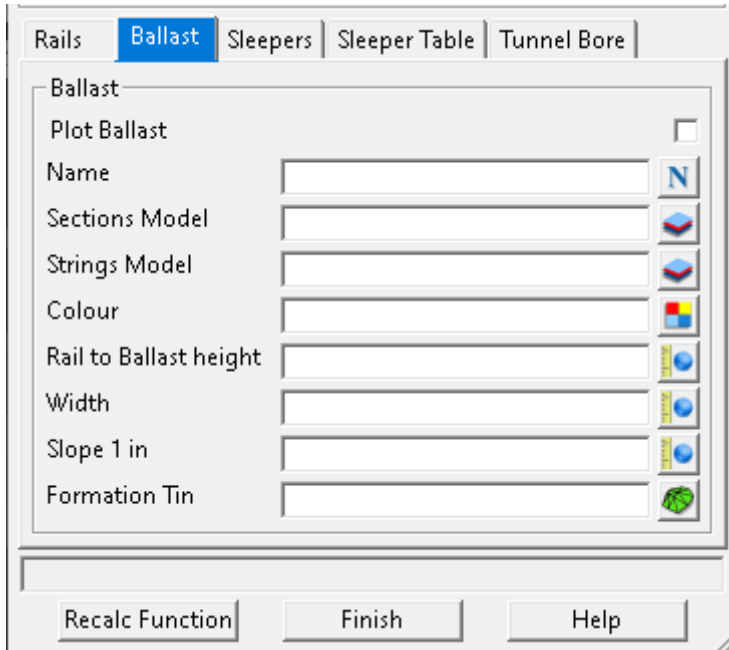
## Buttons at Bottom

- Recalc Function** real box  
 Creates/updates the *Function* and generates the strings.

## Rails tab

- Plot Rail Profiles** tick box not ticked  
 If *ticked*, rail strings are generated.
- Name** name box available names  
 Name prefix of the rail string generated. This name is suffixed by \* left and \* right.
- Model** model box available models  
 Name of the model for the rail strings to be generated onto.
- Colour** colour box available colours  
 The colour for the rail strings.
- Extrude Rail Profile** tick box not ticked  
 If *ticked*, rail strings in the perspective view will be generated with the rail profile specified in the *Rail Type* field.
- Rail Type** custom box available profiles  
 The rail profile type to be applied to the rail strings that can be viewed in a perspective view.

## Ballast tab



### Tabs

- [Rails tab](#)
- [Ballast tab](#)
- [Sleepers tab](#)
- [Sleeper Table tab](#)
- [Tunnel Bore tab](#)

### Ballast

**Plot Ballast**                      tick box                      not ticked

*If **ticked**, ballast strings and sections are generated.*

**Name**                                      name box                                      available names

*Name prefix of the ballast strings and sections generated. This name is suffixed by the chainage for sections, \* l and \* r for the ballast shoulders, and \* intl and \* intr for the ballast toes.*

**Sections Model**                      model box                                      available models

*Name of the model for the ballast sections to be generated onto.*

**Strings Model**                      model box                                      available models

*Name of the model for the ballast strings to be generated onto.*

**Colour**                                      colour box                                      available colours

*The colour for the ballast sections and strings.*

**Rail to Ballat height**                      real box

*Vertical offset from top of rail to top of ballast. The value entered should be negative.*

**Width**                                      real box

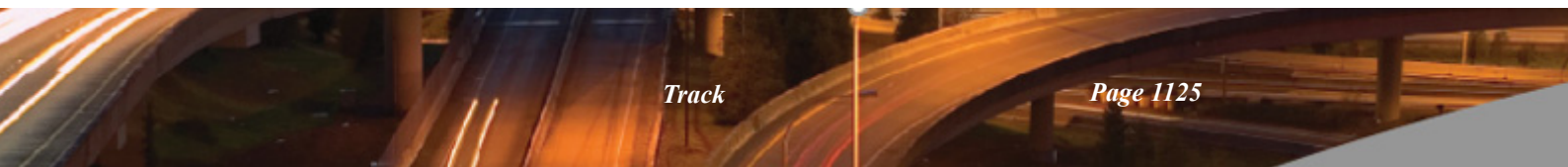
*The cross-sectional top width of the ballast; the width between ballast shoulders.*

**Slope 1 in**                                      real box

*The ballast batter side slope measured as **1** vertical **in** x horizontal. The slope at which the ballast shoulder meets the formation at the ballast toe. The value entered should be positive.*

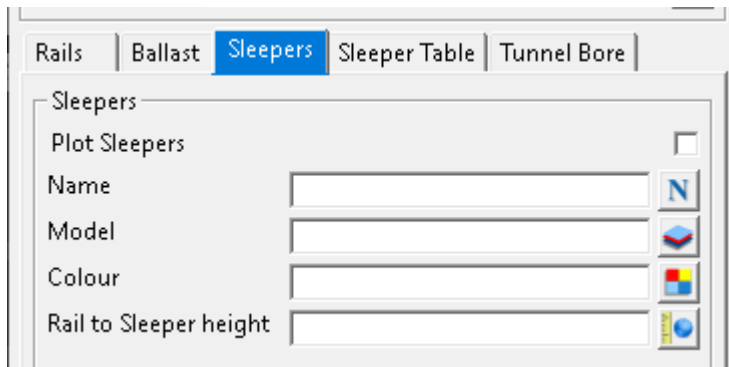
**Formation Tin**                                      tin box

*The rail formation tin for which the ballast toe interfaces.*





## Sleepers tab



### Tabs

- [Rails tab](#)
- [Ballast tab](#)
- [Sleepers tab](#)
- [Sleeper Table tab](#)
- [Tunnel Bore tab](#)

### Sleepers

**Plot Sleepers**                      tick box                      not ticked

*If ticked, sleeper strings are generated. Values in the **Sleeper Table** tab need to also be defined before sleeper strings are generated,*

**Name**                                      name box                                      available names

*Name prefix of the sleeper strings generated. This name is suffixed by the chainage of the sleeper.*

**Model**                                      model box                                      available models

*Name of the model for the sleeper strings to be generated onto.*

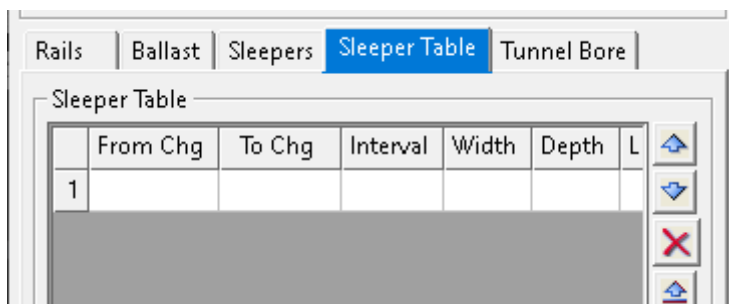
**Colour**                                      colour box                                      available colours

*The colour for the sleeper strings.*

**Rail to Sleeper height**              real box

*Vertical offset from top of rail to top of sleeper. The value entered should be negative.*

## Sleeper Table tab



### Tabs

- [Rails tab](#)
- [Ballast tab](#)
- [Sleepers tab](#)
- [Sleeper Table tab](#)
- [Tunnel Bore tab](#)

### Sleeper Table

**From Chg**                                      real box

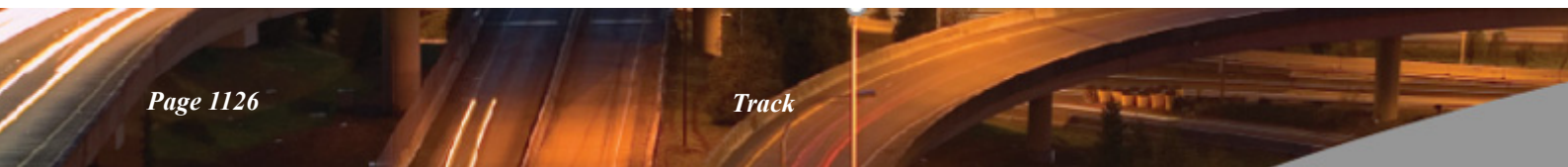
*Start chainage for the sleepers to be generated from.*

**To Chg**                                      real box

*End chainage for the sleepers to be generated to.*

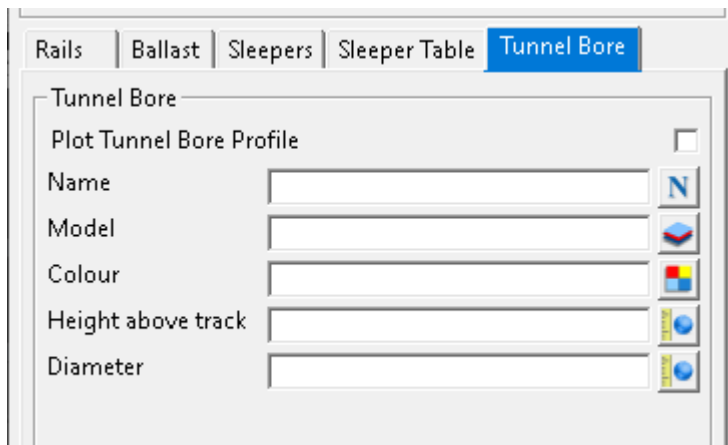
**Interval**                                      real box

*The spacing between sleeper centres.*



- Width** real box  
*The plan width of the sleeper.*
- Depth** real box  
*The plan depth of the sleeper.*
- Length** real box  
*The plan length of the sleeper.*

### Tunnel Bore tab

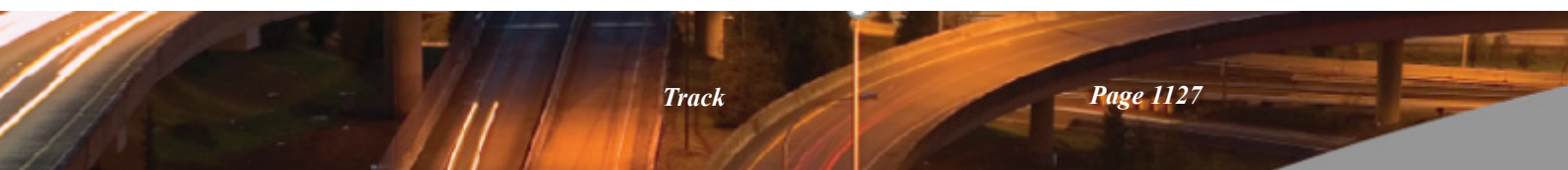


- Tabs**
- [Rails tab](#)
  - [Ballast tab](#)
  - [Sleepers tab](#)
  - [Sleeper Table tab](#)
  - [Tunnel Bore tab](#)

### Tunnel Bore

- Plot Tunnel Bore Profile** tick box not ticked  
*If ticked, tunnel bore strings are generated.*
- Name** name box available names  
*Name for the tunnel bore strings.*
- Model** model box available models  
*Name of the model for the tunnel bore strings to be generated onto.*
- Colour** colour box available colours  
*The colour for the tunnel bore strings.*
- Height above track** real box  
*Vertical offset from top of rail to the cross-sectional centre of the tunnel bore cylinder.*
- Diameter** real box  
*The cross-sectional radius of the tunnel bore.*
- Start Chainage** real box  
*The **Reference** string start chainage for generating strings from. This is automatically populated with the **Reference** string start chainage when selected.*
- End Chainage** real box  
*The **Reference** string end chainage for generating strings up to. This is automatically populated with the **Reference** string end chainage when selected.*

Continue to [16.23.9.2.2 Rail Profiles Create/Edit](#) or go back to [16.23.9.2 Track Plot](#) or [16.23.9 Track Old](#).

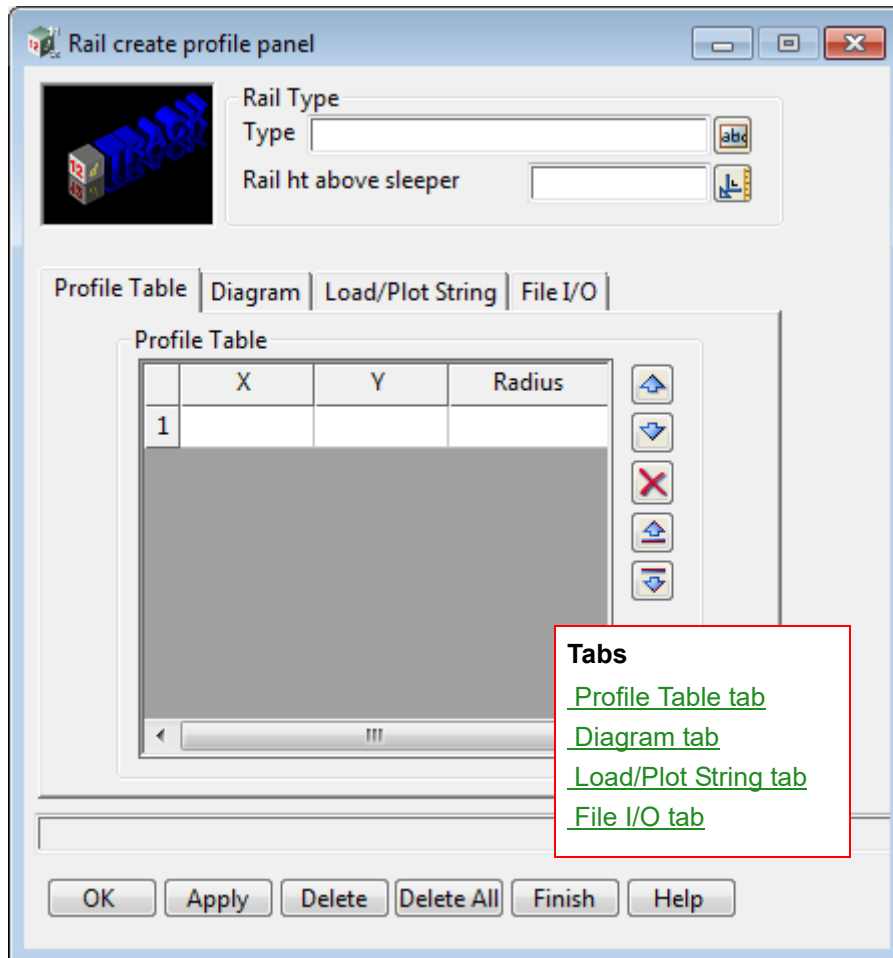


### 16.23.9.2.2 Rail Profiles Create/Edit

Position of option on menu: Design =>Track =>Old =>Plot =>Rail Profiles Create/Edit

The Rail Profiles Create/Edit creates a library of **Rail Type** rail profiles that can be imported from a file and exported to a file. Rail profiles are typically created by selecting a string in a model. Rail profiles can be used in [16.23.9.2.1 Plot Rails Panel](#) to generate Super Strings of design rails that display as line strings in plan and section views, and display as rail profiles in perspective views.

Selecting Rail Profiles Create/Edit displays the **Rail create profile panel**.

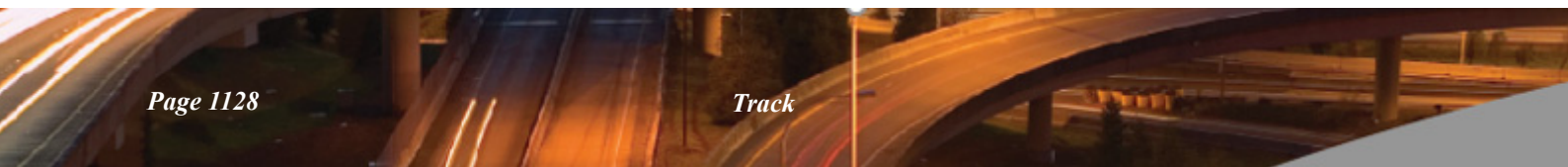


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Rail Type</b>			
<b>Type</b>	custom box		available rail profiles
<i>Name of the <b>Rail Type</b> rail profile.</i>			
<b>Rail ht above sleeper</b>	real box		
<i>Height from the top of sleeper to the top of rail.</i>			

#### Buttons at Bottom

<b>OK</b>	button
<i>Creates/updates the rail profile <b>Type</b> and closes the panel.</i>	

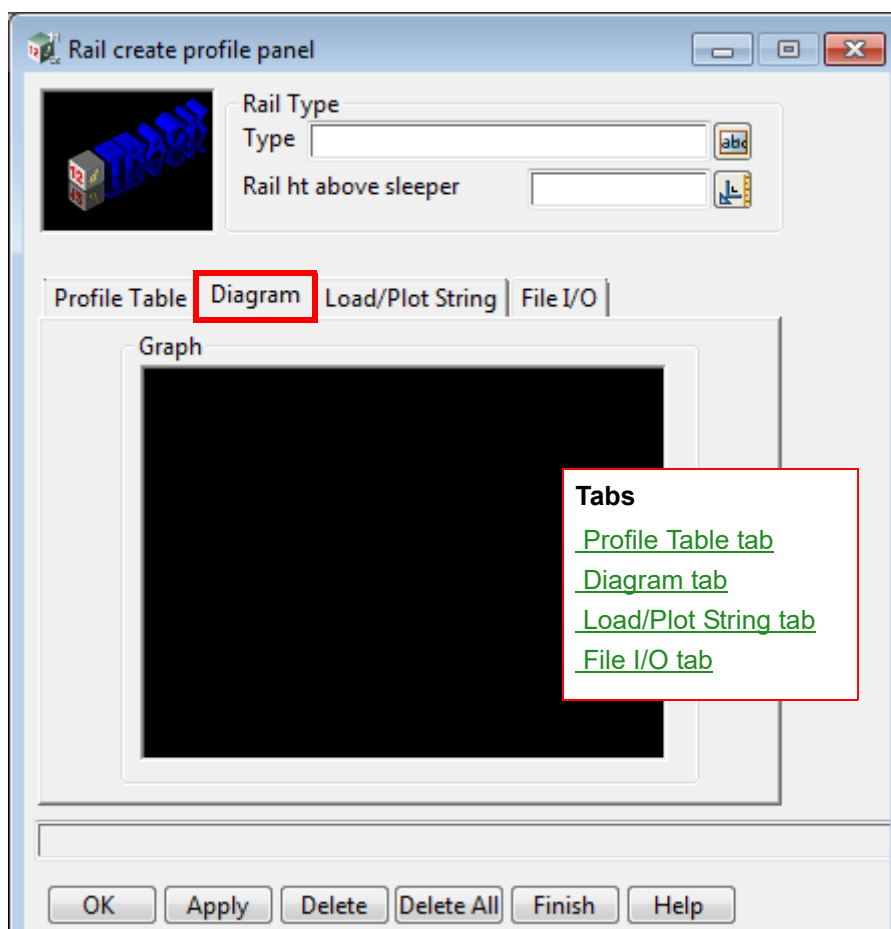


- Apply** button  
*Creates/updates the rail profile **Type**.*
- Delete** button  
*Deletes the currently selected rail profile **Type**.*
- Delete All** button  
*Deletes all rail profiles stored in the Rail **Type** library.*

## Profile Table tab

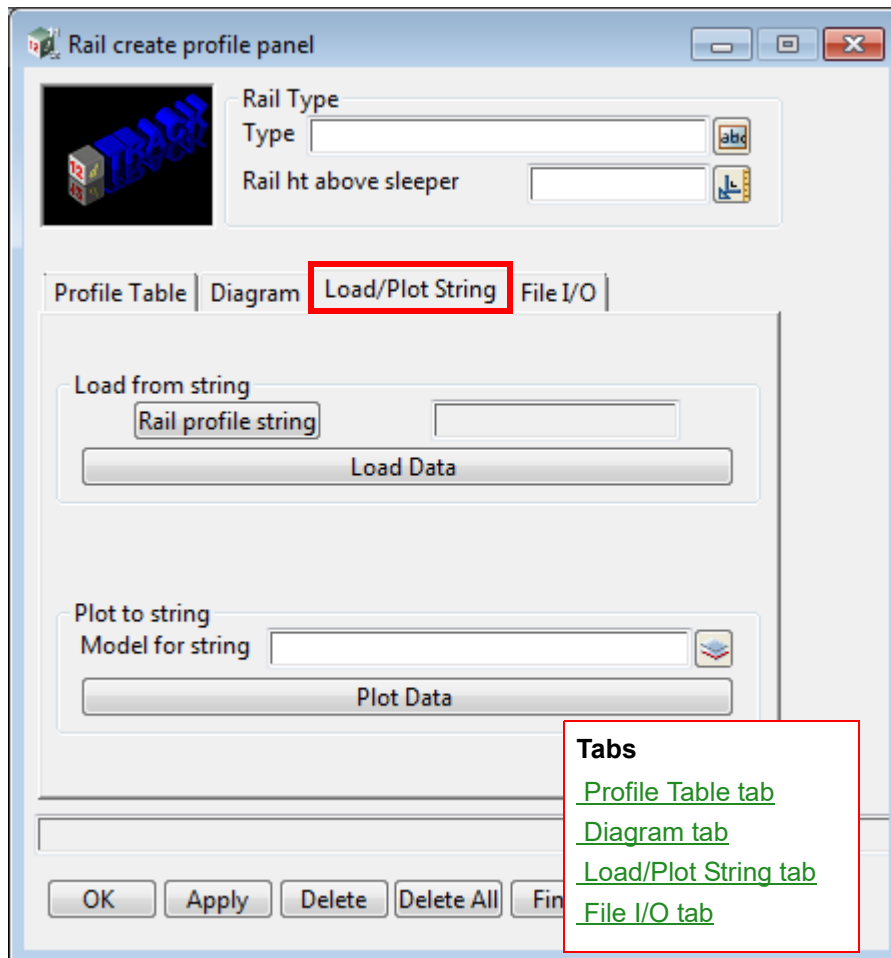
- X** real box  
*X coordinates for the rail profile vertices.*
- Y** real box  
*Y coordinates for the rail profile vertices.*
- Radius** real box  
*Radius of each rail profile segment.*

## Diagram tab



- Graph** graph  
*Graph of the **Rail Type**. Holding left-click pans, a middle-click fits view, and holding right-click zooms in/out.*

## Load/Plot String tab

**Load from string**

**Rail profile string**                      string select

*String selection to choose an element to create a **Rail Type**.*

**Load Data**                                      button

*Once a string has been selected, clicking the **Load Data** button populates the **Profile Table** and the **Diagram** graph.*

**Plot to string**

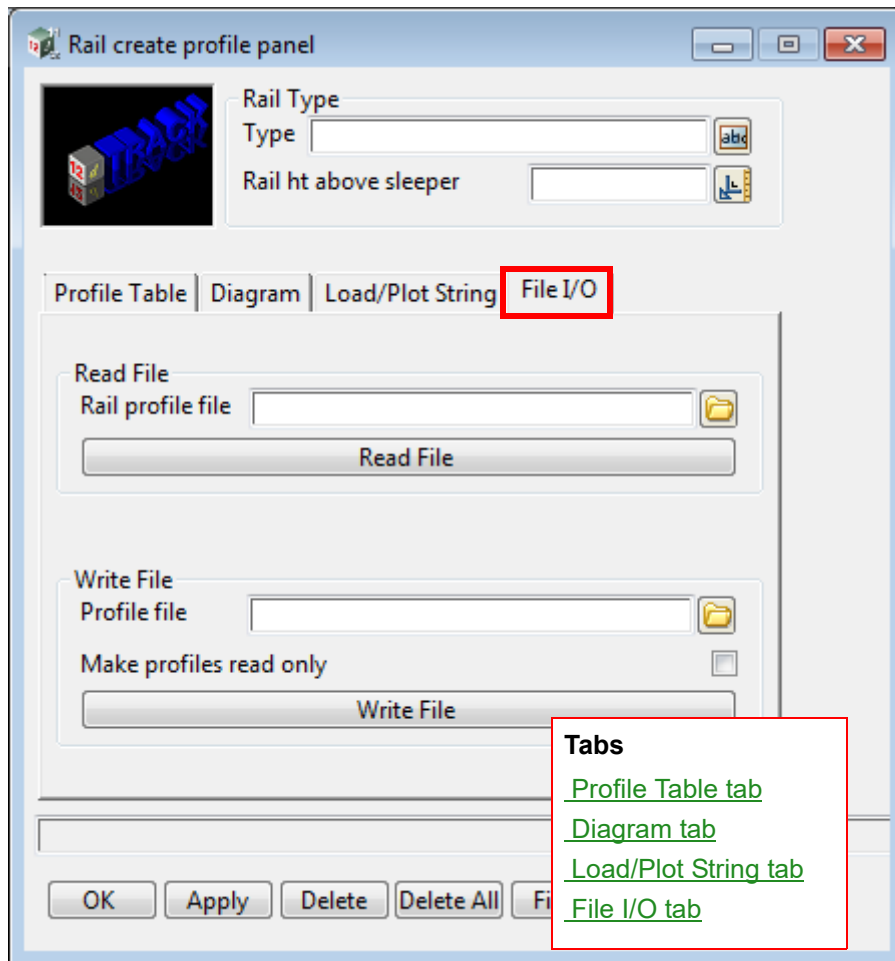
**Model for string**                      model box                                      available models

*Model for the **Rail Type** to be drawn.*

**Plot Data**                                      button

*Once a rail profile has been added to the **Rail Type** library, **Plot Data** will draw that profile onto the model selected in **Model for string**.*

## File I/O tab

**Read File**

**Rail profile file**                      File box                                      \*.profiles files

*File to read rail profiles from.*

**Read File**                                      button

*Imports all rail profiles stored in the **Rail profile file** into the **Rail Type** library.*

**Write File**

**Profile file**                                      file box

*File to write rail profiles to.*

**Make profiles read only**      tick box                                      not ticked

*Adds a read-only attribute to the entry in the **Profile file** which restricts modification of **Rail ht above sleeper** and the **Profile Table** when that **Rail Type** has been imported.*

**Write File**                                      button

*Exports all profiles in the **Rail Type** library.*


Continue to [16.23.10 Track Label](#) or go back to [16.23.9.2 Track Plot](#) or [16.23.9 Track Old](#).



## 16.23.10 Track Label

**Position of menu:** Design =>Track =>Label

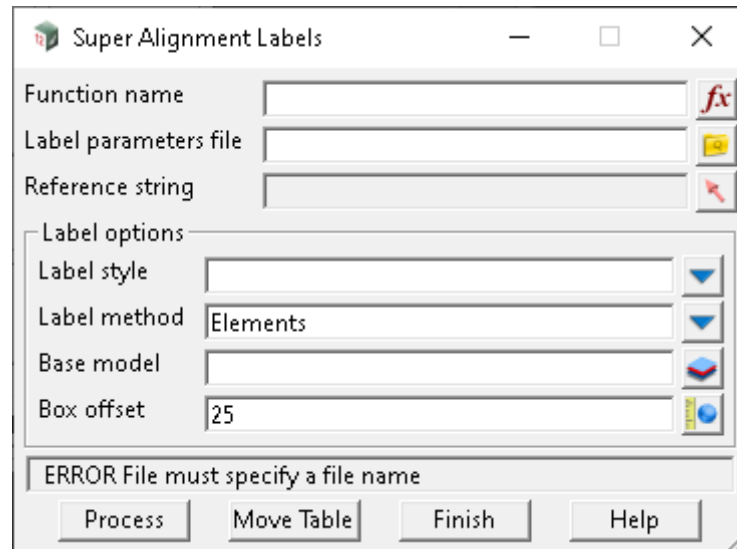
The Track Label walk-right menu is

Track Label		See
Label Alignment		<a href="#">16.23.10.1 Label Alignment</a>
Label Alignment Defaults		<a href="#">16.23.10.2 Label Alignment Defaults</a>

### 16.23.10.1 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 prerequisites to running **Label Alignment** are applying the cant in the [16.23.6 Section to Snippet](#) panel to the **Reference string**.



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

Field Description	Type	Defaults	Pop-Up
<b>Function name</b>	function box		available functions

*Name of the function to store the panel settings.*

<b>Label parameters file</b>	file box		all *.lpf files
------------------------------	----------	--	-----------------

*Name of the label parameters file that Label styles are stored in. This is a file created in the [16.23.10.2 Label Alignment Defaults](#) panel.*

<b>Reference string</b>	string select		
-------------------------	---------------	--	--

*Reference string for the labels to be created. This is typically the design alignment centreline.*

#### Label Options

<b>Label Style</b>	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 [16.23.10.2 Label Alignment Defaults](#) panel.*

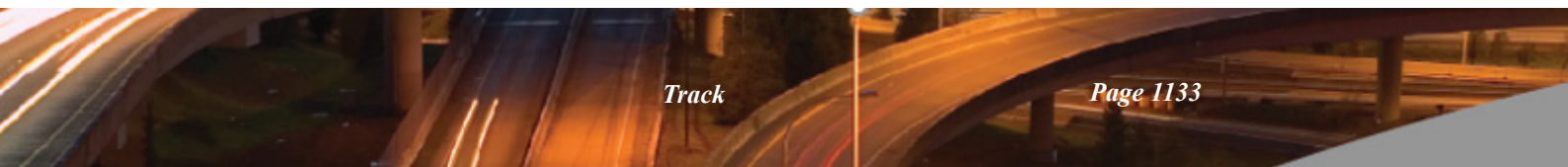
<b>Label Method</b>	choice box	Elements	label methods
---------------------	------------	----------	---------------

*Choice of labelling method between the labelling of Elements or IPs and Tangents.*

<b>Base Mode</b>	model box		available models
------------------	-----------	--	------------------

*If **Label Style - Use model suffix** in [16.23.10.2 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 [16.23.10.2 Label Alignment Defaults](#). These are **Elements Model Suffix**, **Stationing Model Suffix** and **Tables Model Suffix**.*

*If **Label Style - Use model suffix** in [16.23.10.2 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

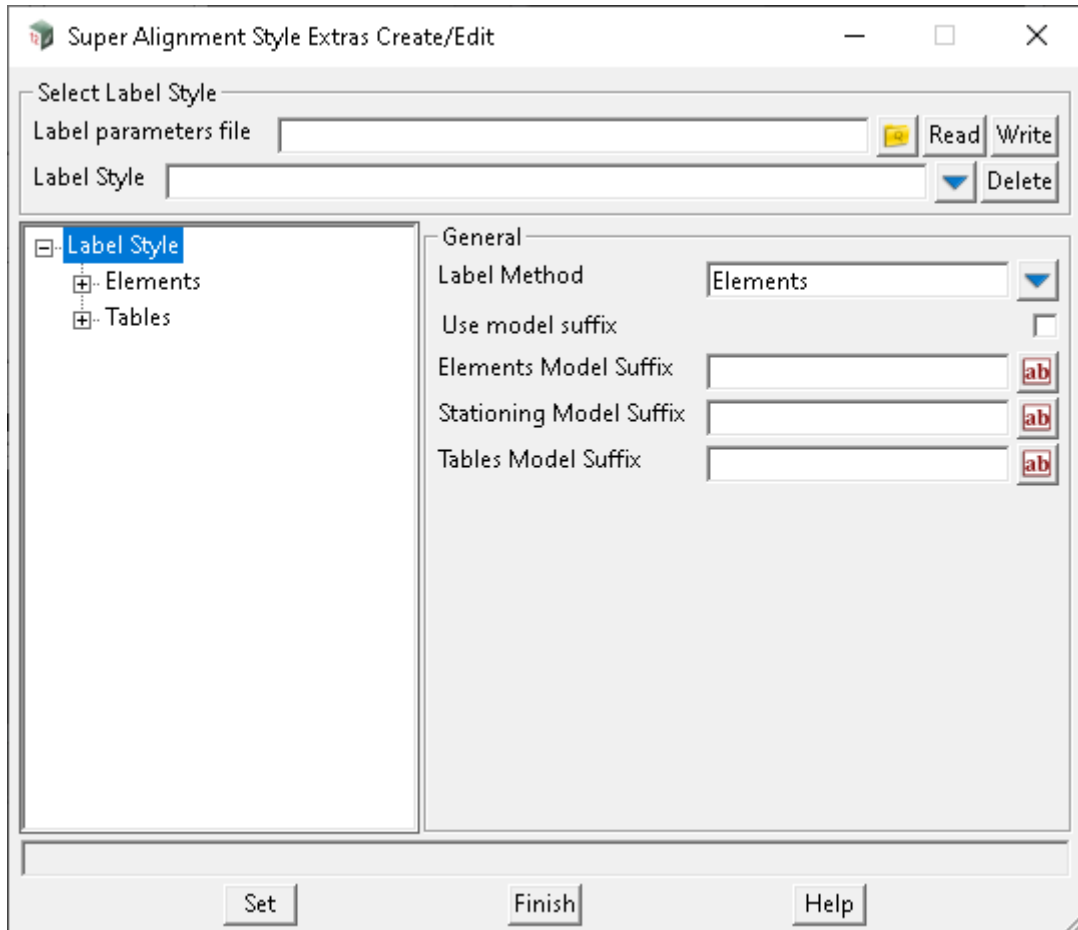
*Once tables have been generated, clicking on the **Move Table** button and then clicking on an element from one of these tables allows that table to be moved to another location. The **Maintain Existing Table Position** tick box is automatically ticked when a table has been moved to ensure that it doesn't revert to the default location when the **Process** button has been clicked.*

Continue to [16.23.10.2 Label Alignment Defaults](#).

### 16.23.10.2 Label Alignment Defaults

**Position of option on menu:** Design =>Track =>Label=>Label Alignment Defaults

**Label Styles** in the [16.23.10.1 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
<b>Select Label Style</b>			
<b>Label parameters file</b>	file box		all *.lpf files
<i>Name of the parameter file that will store the <b>Label Style</b> definitions.</i>			
<b>Read</b>	button		
<i>When selected, the panel will be populated with values contained in the Label parameters file.</i>			
<b>Write</b>	button		
<i>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 <a href="#">16.23.10.1 Label Alignment</a> panel for label style changes to take effect.</i>			
<b>Label Style</b>	choice box	DEFAULT	all label styles
<i>List of <b>Label Styles</b>. A <b>Label Style</b> can be selected or [new] can be selected which will open a panel to create a new <b>Label Style</b>.</i>			

**Delete** button

*Deletes the currently selected **Label Style**.*

### General

**Label Method** choice box all label methods

*Intended **Label Method** of [16.23.10.1 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 [16.23.10.1 Label Alignment](#).*

**Elements Model Suffix** custom box labels

*When **Elements** has been selected in the **Label Method** field specified in [16.23.10.1 Label Alignment](#), elements are generated on a model prefixed with the **Base Model** field from [16.23.10.1 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 [16.23.10.1 Label Alignment](#), elements are generated on a model prefixed with the **Base Model** field from [16.23.10.1 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 [16.23.10.1 Label Alignment](#), elements are generated on a model prefixed with the **Base Model** field from [16.23.10.1 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](#)

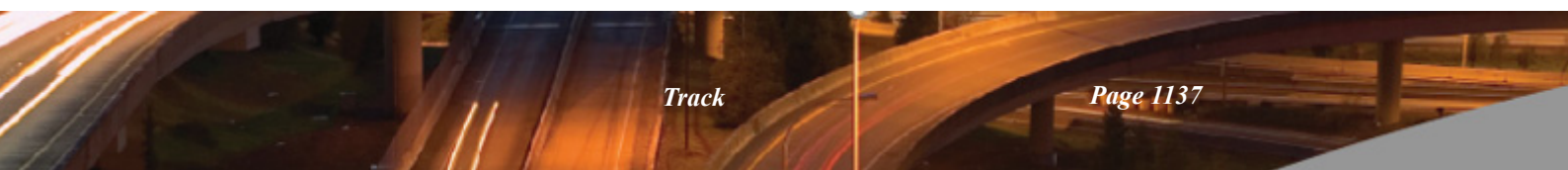
See [Segments](#)

See [Tangents](#)

**Tables**

See [Borders & Lines](#)

See [IP Tables](#)



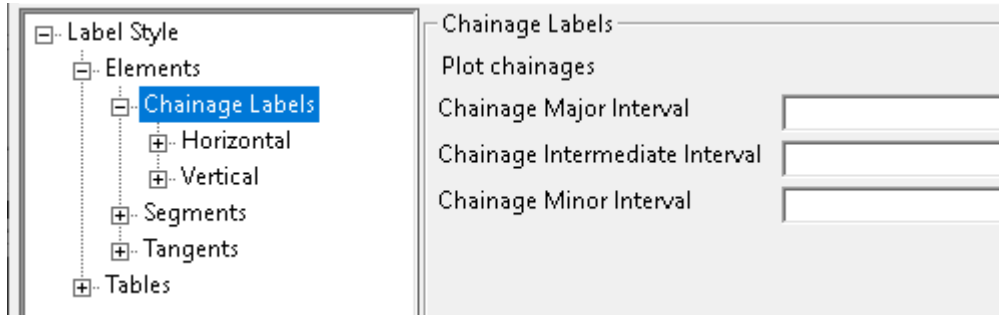


## Chainage Labels

See [Horizontal](#)

See [Vertical](#)

### 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**.*

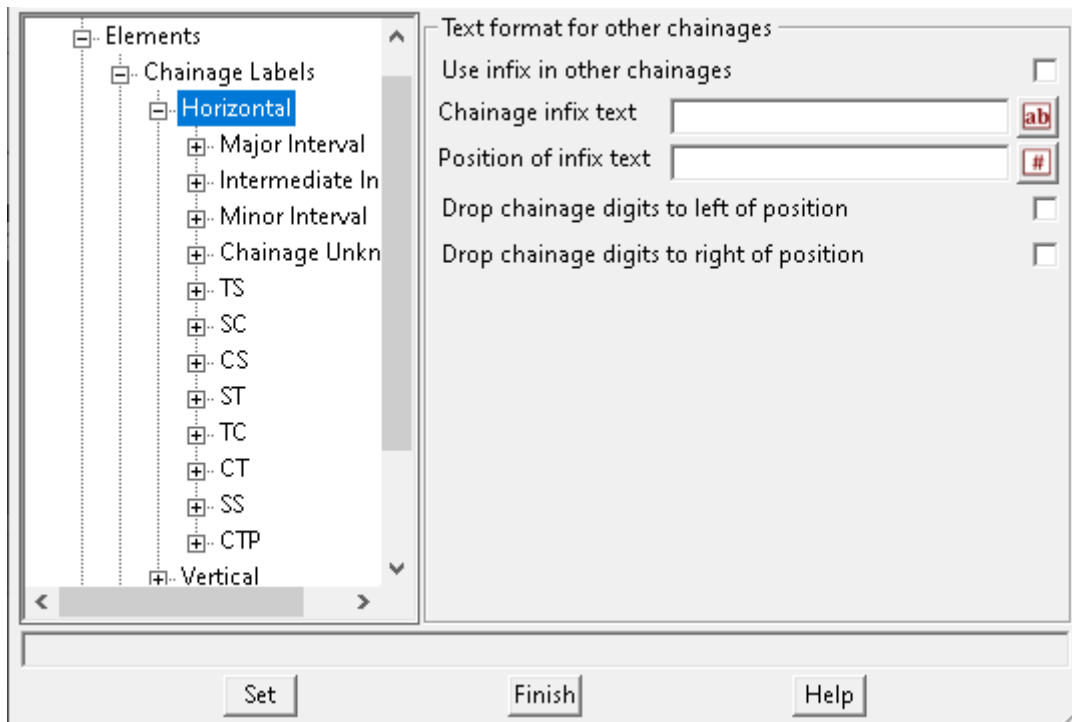
**Chainage Minor Interval**    real box                      20

*Chainage increment for minor chainages to be generated along the **Reference String**.*

## Horizontal

- See [Horizontal >Major Interval](#)
- See [Horizontal - Intermediate Interval](#)
- See [Horizontal >Minor Interval](#)
- See [Horizontal >Special Chainages](#)
- See [Horizontal >Kpost Equality](#)
- See [Horizontal >Internal Equality](#)
- See [Horizontal >Chainage Unknown](#)
- See [Horizontal >TS](#)
- See [Horizontal >SC](#)
- See [Horizontal >CS](#)
- See [Horizontal >ST](#)
- See [Horizontal >TC](#)
- See [Horizontal >CT](#)
- See [Horizontal >SS](#)
- See [Horizontal >CTP](#)

## Horizontal



### Horizontal

#### Text format for major chainages

**Use infix in major chainages**    tick box    not ticked

*If ticked, Major chainage infix text is infix to major chainages.*

**Major chainage infix text**    text box

*Text to be infix to the major 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.*

#### Text format for intermediate chainages

**Use infix in intermediate chainages**    tick box    not ticked

*If ticked, Intermediate chainage infix text is infix to intermediate chainages.*

**Intermediate chainage infix text**    custom box

*Text to be infix to the intermediate chainages.*

**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 **Intermediate 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 **Intermediate 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.

**Text format for minor chainages****Use infix in intermediate chainages**    tick box    not ticked

If **ticked**, **Minor chainage infix text** is infix to minor chainages.

**Intermediate chainage infix text**    custom box

Text to be infix to the minor chainages.

**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 **Minor 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 **Minor 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.

**Text format for other chainages****Use infix in intermediate chainages**    tick box    not ticked

If **ticked**, **Other chainage infix text** is infix to all other chainages.

**Intermediate chainage infix text**    custom box

Text to be infix 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**.

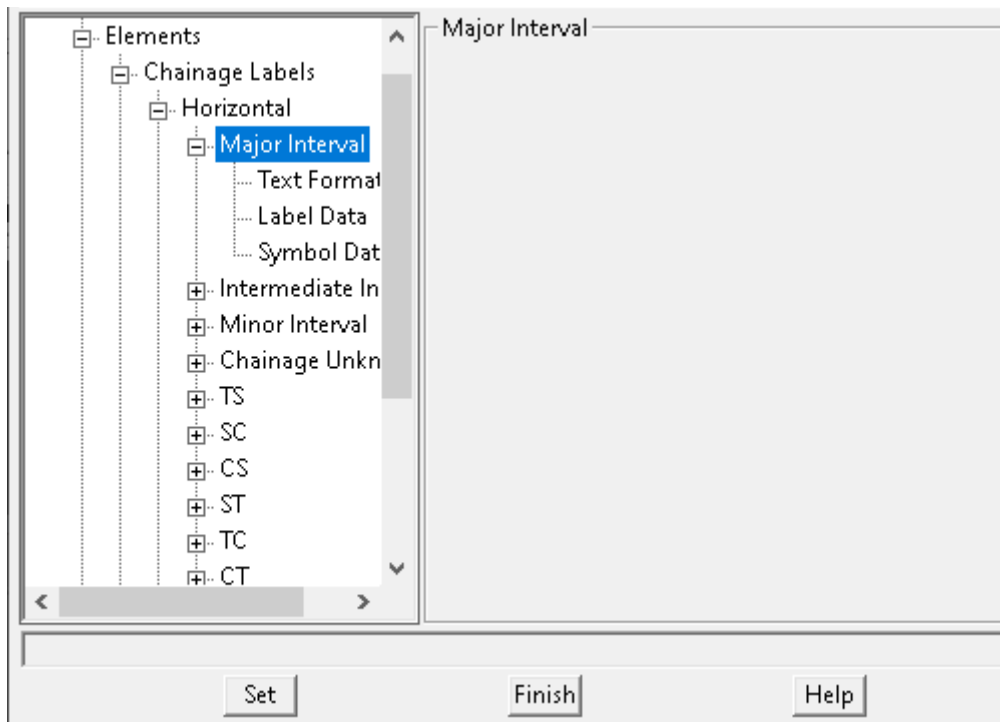
**Drop chainage digits to left of position**    tick box    not ticked

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.

## Horizontal &gt;Major Interval

**Major Interval****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** text style box all styles

*Text style for the properties of the chainage labels.*

**Decimal Places** integer box 0

*The 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.*

**Symbol Data:- major\_interval\_symbol**

**Use** tick box  not ticked

*If ticked, it will create a symbol at every major interval on the **Reference String**.*

**Symbol Style** symbol box CIRCLE

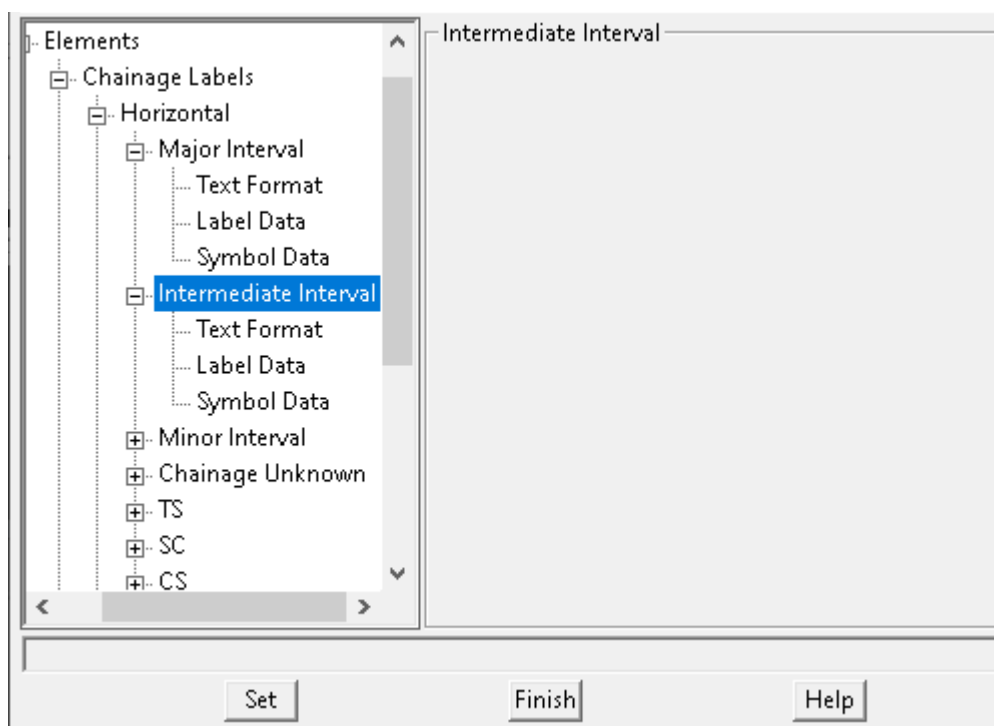
*Name of the symbol to place at every major interval on the **Reference String**.*

**Colour** colour box orange

*Colour of the symbol.*

<b>Size</b>	real box	5
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

## Horizontal - Intermediate Interval



### Intermediate Interval

#### Label Data:- chainage\_intermediate\_interval

<b>Use</b>	tick box	ticked
<i>If ticked, intermediate chainage labels will be displayed at the increment specified in <b>Chainage Labels</b>.</i>		
<b>Text Style</b>	text style box	all styles
<i>Text style for the properties of the chainage labels.</i>		
<b>Decimal Places</b>	integer box	0
<i>The number of decimal places for the chainage labels.</i>		
<b>Orient Text</b>	tick box	ticked
<i>If ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>		
<i>If not ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>		



**Text Prefix \* Suffix**      text box      INT \*

*Text to add to the prefix or suffix of the chainage value. The asterisk \* denotes where the chainage value will be placed.*

**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**      symbol box      PLine

*Name of the symbol to place at every intermediate interval 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**.*

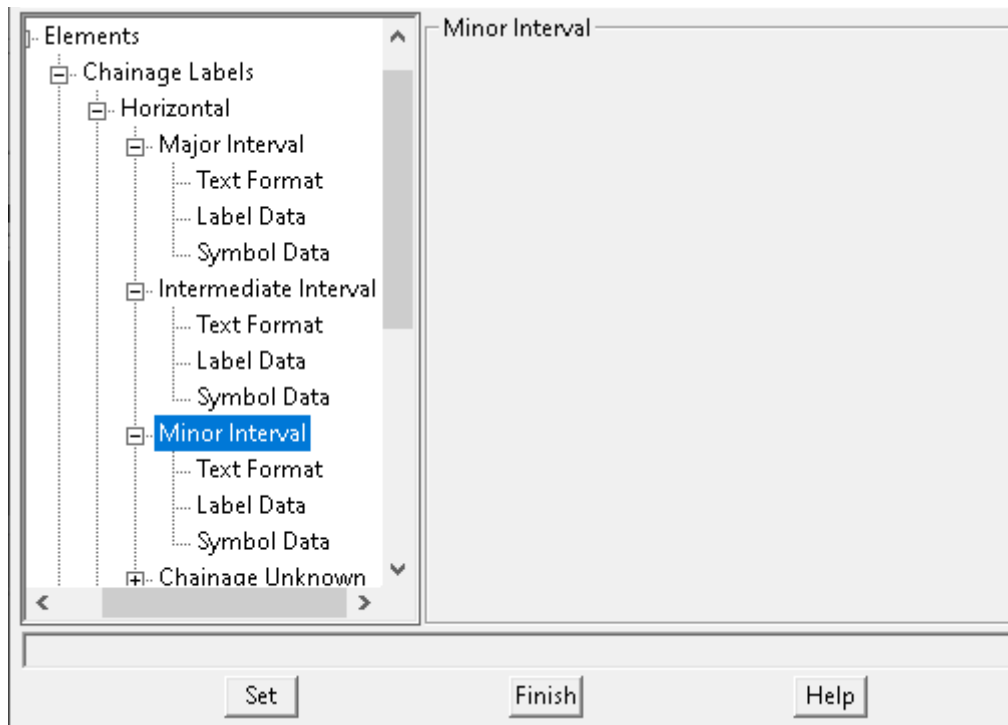
**shift**      real box      0

*Distance shifted to the left/right on the X plane.*

**Raise**      real box      0

*Distance raised/lowered on the Y plane.*

## Horizontal >Minor Interval



### Minor Interval

#### 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**  text style box  all styles

*Text style for the properties of the chainage labels.*

**Decimal Places**  integer box  0

*The 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  MIN\*

*Text to add to the prefix or suffix of the chainage value. The asterisk \* denotes where the chainage value will be placed.*

#### 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**  symbol box  PLine

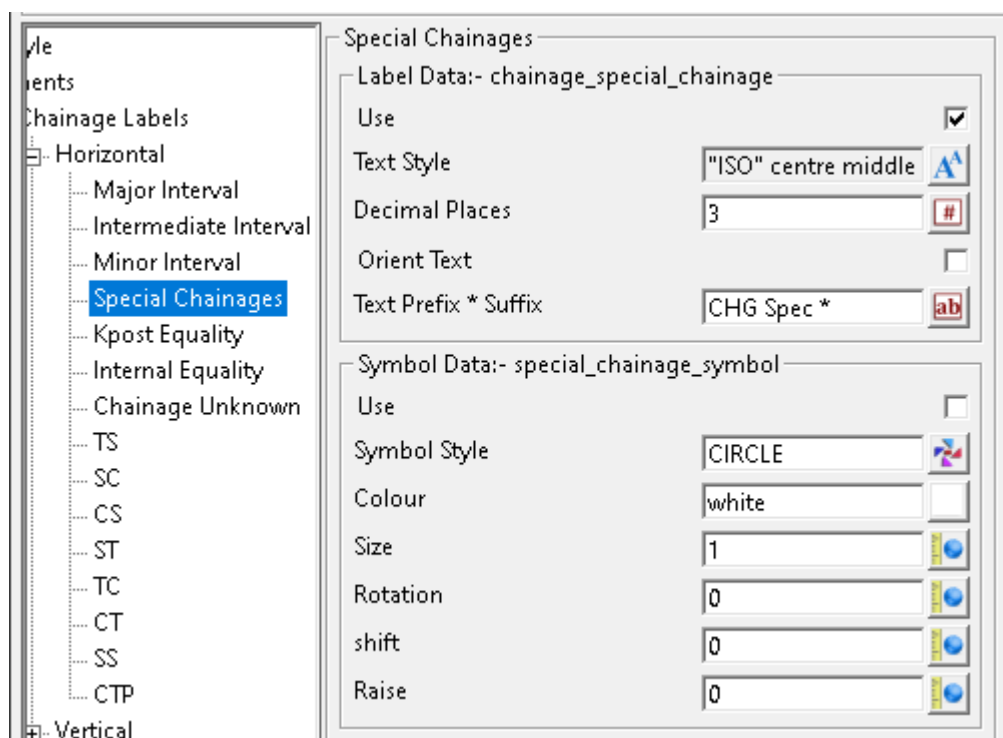
*Name of the symbol to place at every minor interval on the **Reference String**.*

**Colour**  colour box  white  all colours

*Colour of the symbol.*

<b>Size</b>	real box	0.5
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

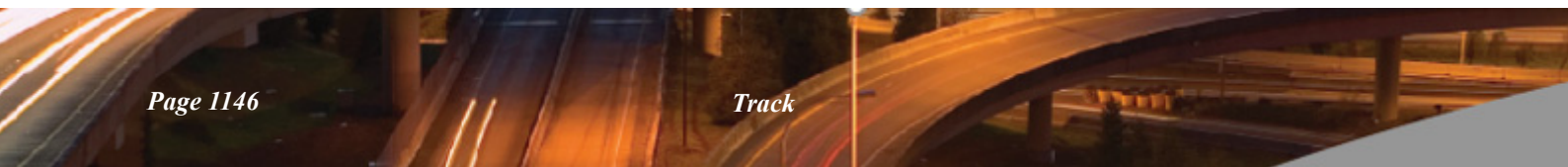
### Horizontal >Special Chainages



#### Special Chainages

##### Label Data:- chainage\_special\_chainage

<b>Use</b>	tick box	ticked
<i>If ticked, special chainage labels will be generated. Note: This feature has not been implemented yet.</i>		
<b>Text Style</b>	text style box	all styles
<i>Text style for the properties of the special chainage labels.</i>		
<b>Decimal Places</b>	integer box	3
<i>The number of decimal places for the special chainage labels.</i>		
<b>Orient Text</b>	tick box	ticked
<i>If ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>		
<i>If not ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>		



**Text Prefix \* Suffix**      text box      CHG Spec\*  
*Text to add to the prefix or suffix of the chainage value. The asterisk \* denotes where the special chainage value will be placed.*

**Symbol Data:- special\_chainage\_symbol**

**Use**      tick box      not ticked  
*If ticked, it will create a symbol at every special chainage on the **Reference String**.*

**Symbol Style**      symbol box      CIRCLE  
*Name of the symbol to place at every special chainage on the **Reference String**.*

**Colour**      colour box      white      available colours  
*Colour of the symbol.*

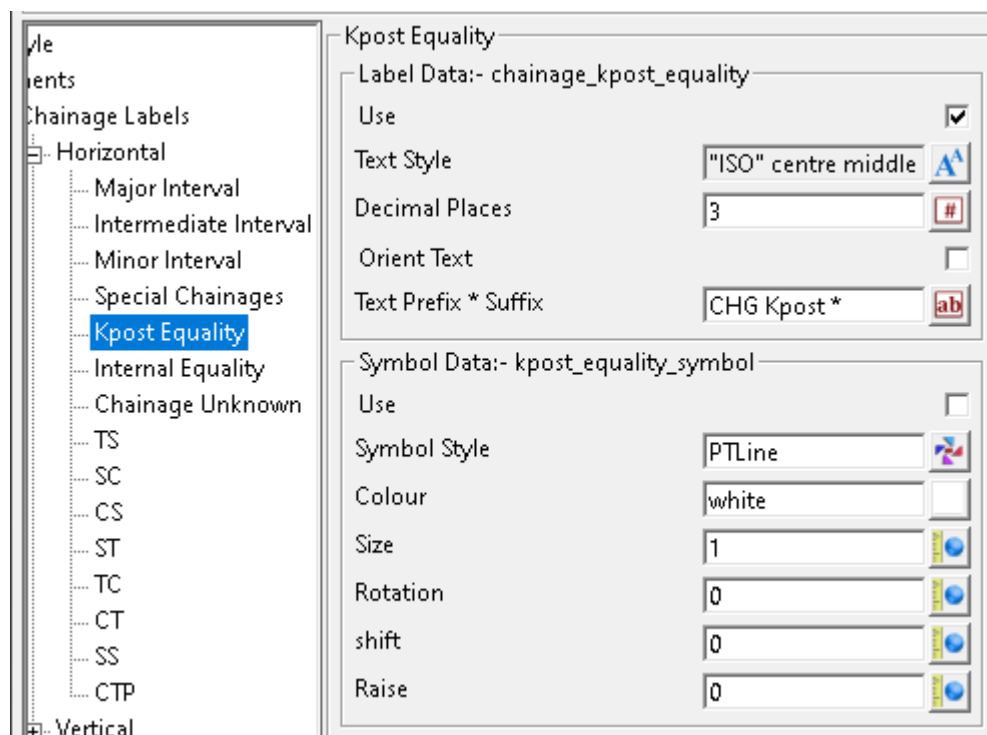
**Size**      real box      1  
*Size of the symbol.*

**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.*

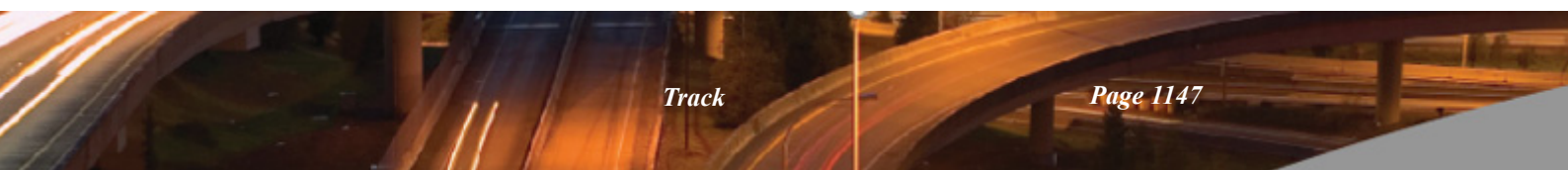
**Raise**      real box      0  
*Distance raised/lowered on the Y plane.*

**Horizontal >Kpost Equality**



**Kpost Equality**

**Label Data:- chainage\_kpost\_equality**



**Use** tick box                      ticked  
*If ticked, Kpost Equality 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 Kpost chainage labels.*

**Decimal Places** integer box                      3  
*The number of decimal places for the Kpost 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                      CHG Kpost\*  
*Text to add to the prefix or suffix of the chainage value. The asterisk \* denotes where the Kpost chainage value will be placed.*

**Symbol Data:- kpost\_equality\_symbol**

**Use** tick box                      not ticked  
*If ticked, it will create a symbol at every Kpost chainage on the **Reference String**.*

**Symbol Style** symbol box                      PtLine  
*Name of the symbol to place at every Kpost chainage on the **Reference String**.*

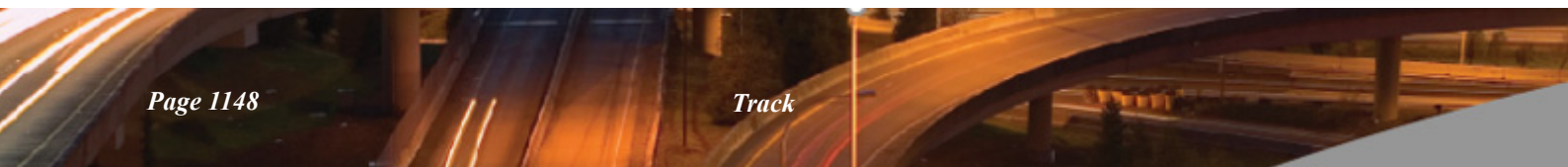
**Colour** colour box                      white                      available colours  
*Colour of the symbol.*

**Size** real box                      1  
*Size of the symbol.*

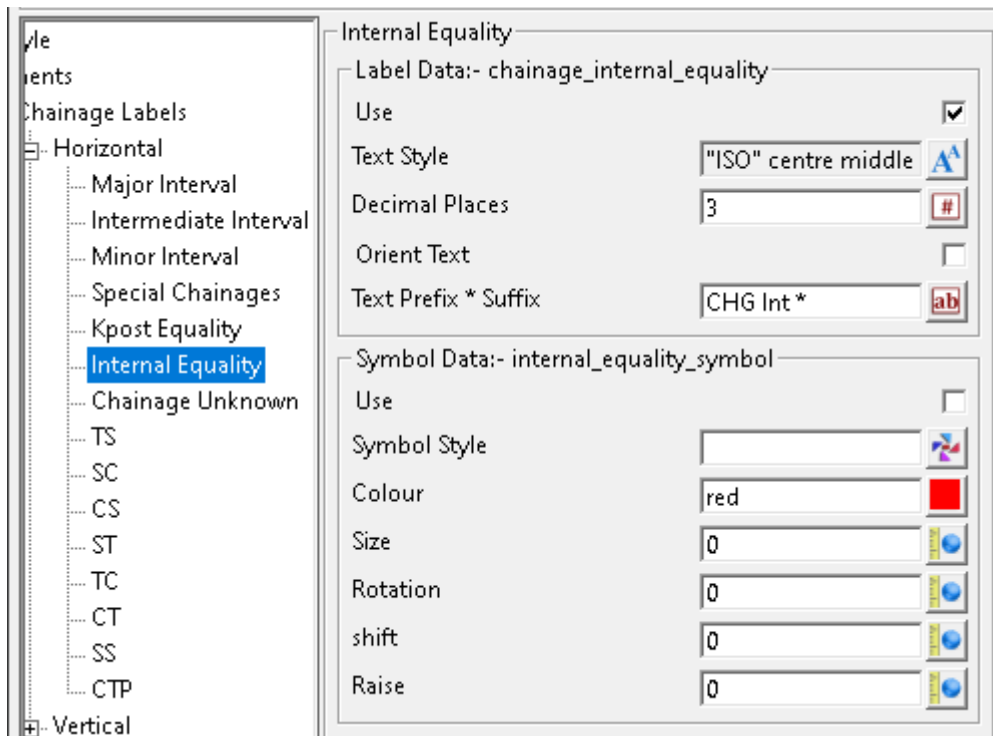
**Rotation** real box                      0  
*Rotation of the symbol. The rotation angle is affected by **Orient Text**.*

**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.*



## Horizontal >Internal Equality



### Internal Equality

#### Label Data:- chainage\_internal\_equality

**Use** tick box  ticked

*If ticked, Internal Equality labels will be generated. Note: This feature has not been implemented yet.*

**Text Style** text style box "ISO" centre middle all styles

*Text style for the properties of the internal chainage labels.*

**Decimal Places** integer box 3

*The number of decimal places for the internal 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 CHG Int\*

*Text to add to the prefix or suffix of the chainage value. The asterisk \* denotes where the internal chainage value will be placed.*

#### Symbol Data:- internal\_equality\_symbol

**Use** tick box  not ticked

*If ticked, it will create a symbol at every Kpost chainage on the Reference String.*

**Symbol Style** symbol box

*Name of the symbol to place at every internal chainage on the Reference String.*

**Colour** colour box red available colours

*Colour of the symbol.*



<b>Size</b>	real box	0
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

## Horizontal >Chainage Unknown



### 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

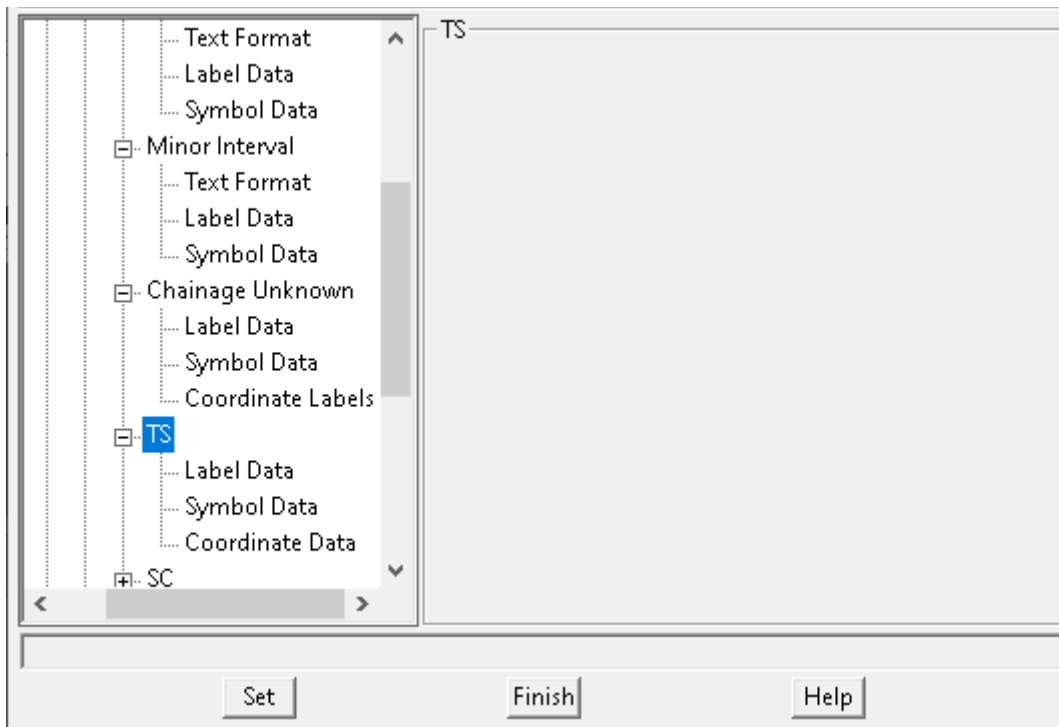
*If ticked, the **Text Style Angle** and symbol **Rotation** will be relative to the **Reference String**.*

*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

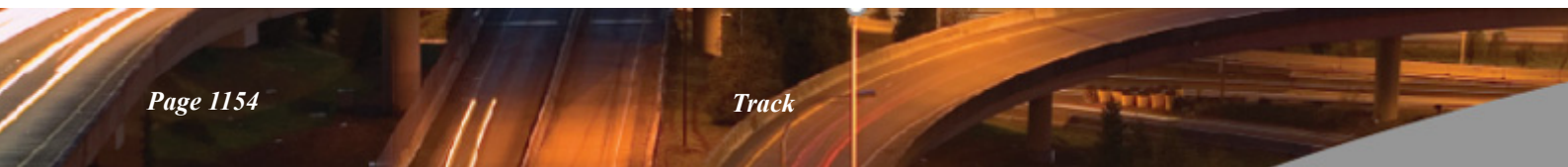
**Use**  tick box  not ticked

*If ticked, it will create a symbol at every chainage on the **Reference String**. Note: This feature has not been implemented yet.*

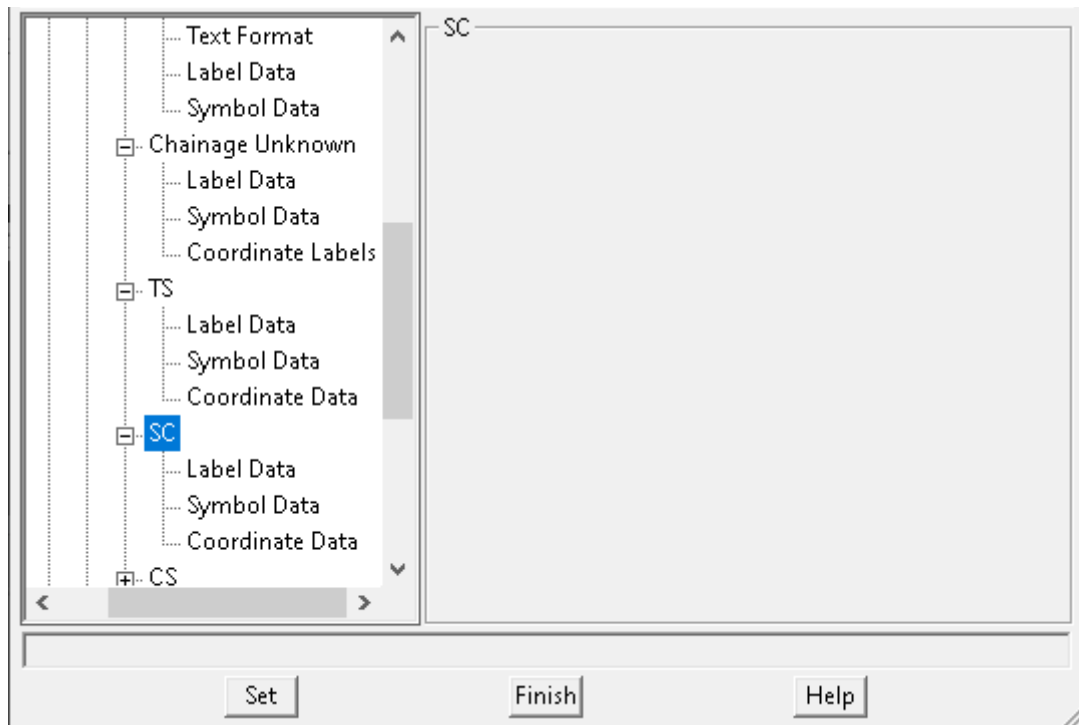
**Symbol Style**  symbol box  PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_tangent_spiral</b>			
<b>Use</b>	tick box	ticked	
<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			



## Horizontal &gt;SC



## SC

## Label Data:- chainage\_spiral\_curve

**Use** tick box

*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

*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

*If ticked, it will create a symbol at every chainage on the **Reference String**. Note: This feature has not been implemented yet.*

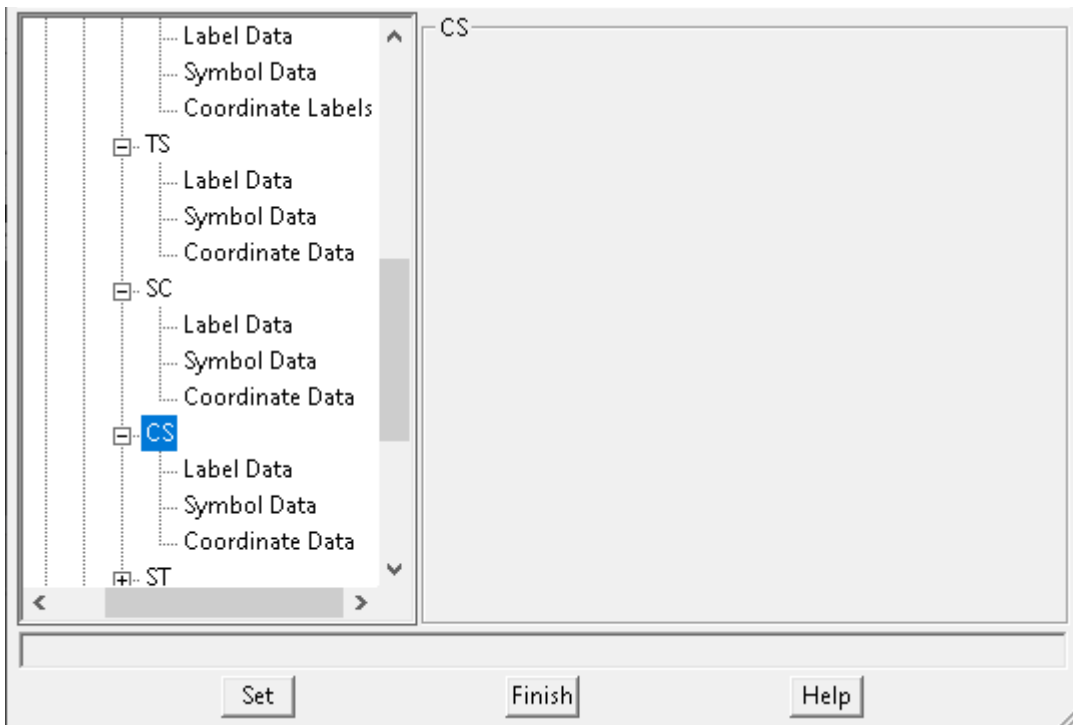
**Symbol Style** symbol box PButterfly

*Name of the symbol to place at every chainage on the **Reference String**.*



<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_spiral_curve</b>			
<b>Use</b>	tick box	ticked	
<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			

## 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

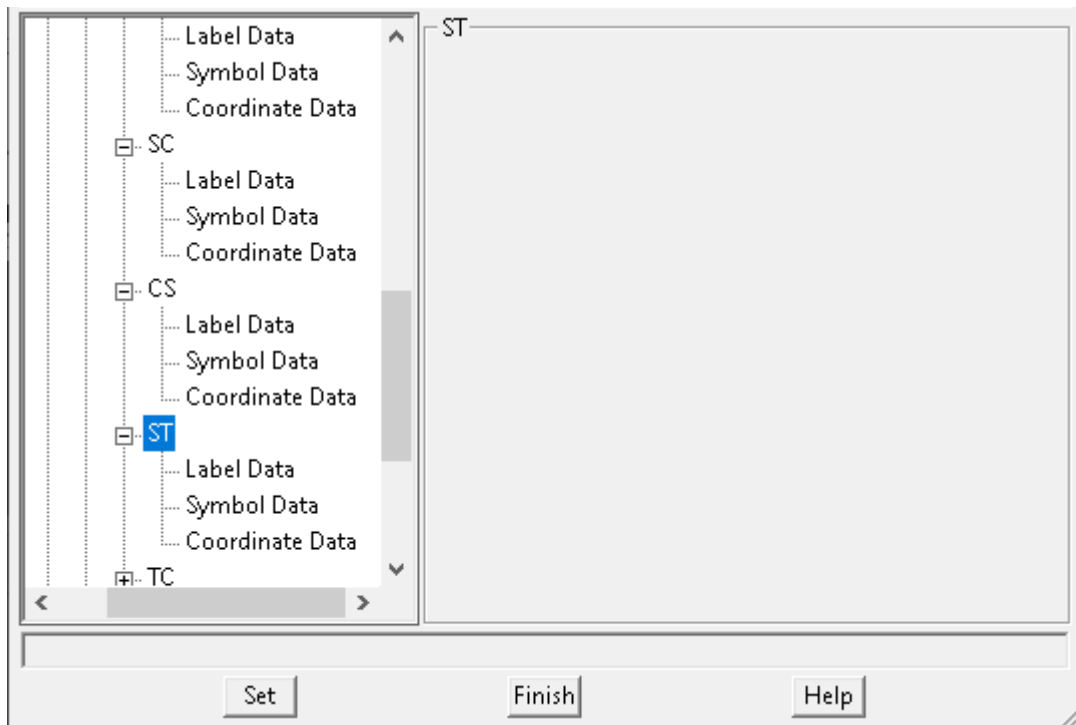
*Name of the symbol to place at every chainage on the **Reference String**.*

**Colour**  colour box  red  available colours

*Colour of the symbol.*

<b>Size</b>	real box	1	
	<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0	
	<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0	
	<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0	
	<i>Distance raised/lowered on the Y plane.</i>		
<b>Coordinate_Labels:- coord_curve_spiral</b>			
<b>Use</b>	tick box	ticked	
	<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>		
<b>Text Style</b>	text style box		all styles
	<i>Text style for the properties of the coordinate labels of the locations.</i>		
<b>Decimal Places</b>	integer box	3	
	<i>The number of decimal places for the coordinate labels of the locations.</i>		
<b>Orient Text</b>	tick box	not ticked	
	<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>		
	<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>		
<b>Text Prefix * Suffix</b>	text box	E *;N *	
	<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>		

## Horizontal &gt;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

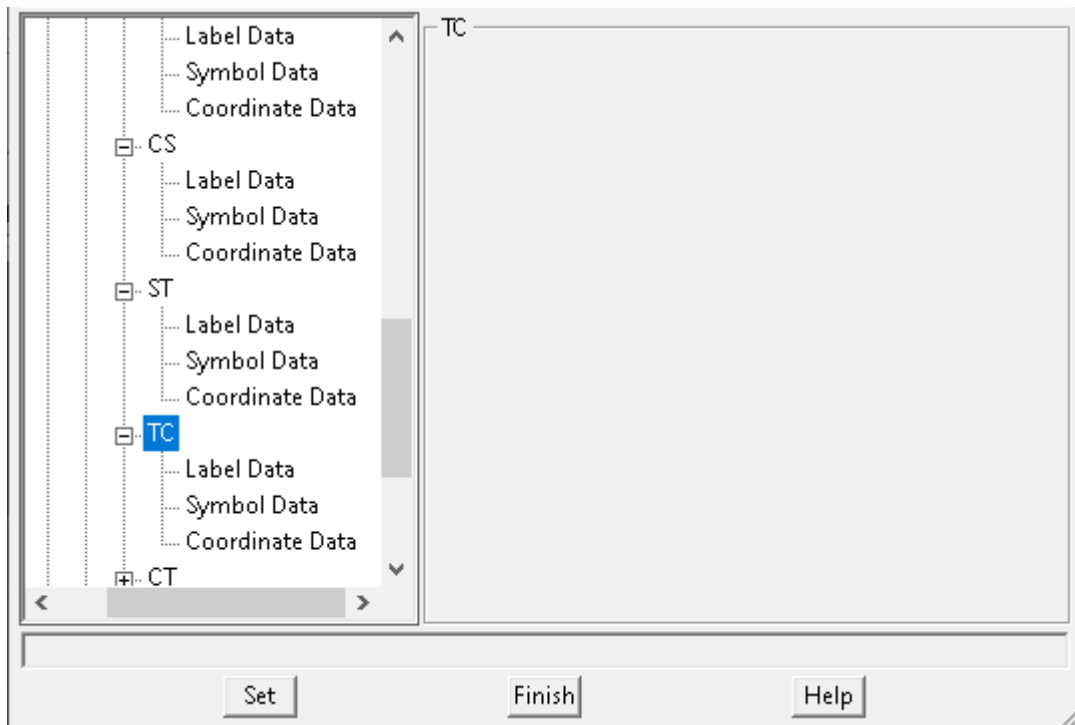
*Name of the symbol to place at every chainage on the **Reference String**.*

**Colour**  colour box  red  available colours

*Colour of the symbol.*

<b>Size</b>	real box	1	
	<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0	
	<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0	
	<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0	
	<i>Distance raised/lowered on the Y plane.</i>		
<b>Coordinate_Labels:- coord_spiral_tangent</b>			
<b>Use</b>	tick box	ticked	
	<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>		
<b>Text Style</b>	text style box		all styles
	<i>Text style for the properties of the coordinate labels of the locations.</i>		
<b>Decimal Places</b>	integer box	3	
	<i>The number of decimal places for the coordinate labels of the locations.</i>		
<b>Orient Text</b>	tick box	not ticked	
	<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>		
	<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>		
<b>Text Prefix * Suffix</b>	text box	E *;N *	
	<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>		

## 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.*

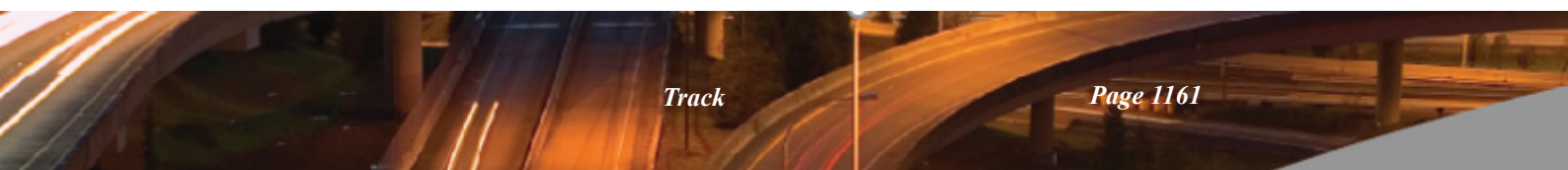
#### Symbol Data:- tangent\_curve\_symbol

**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.*

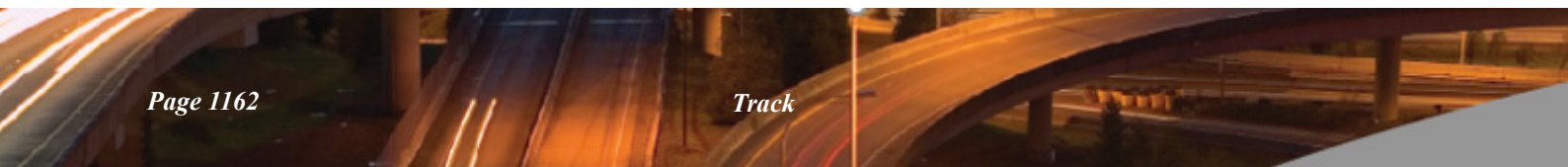
**Symbol Style**  symbol box  PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

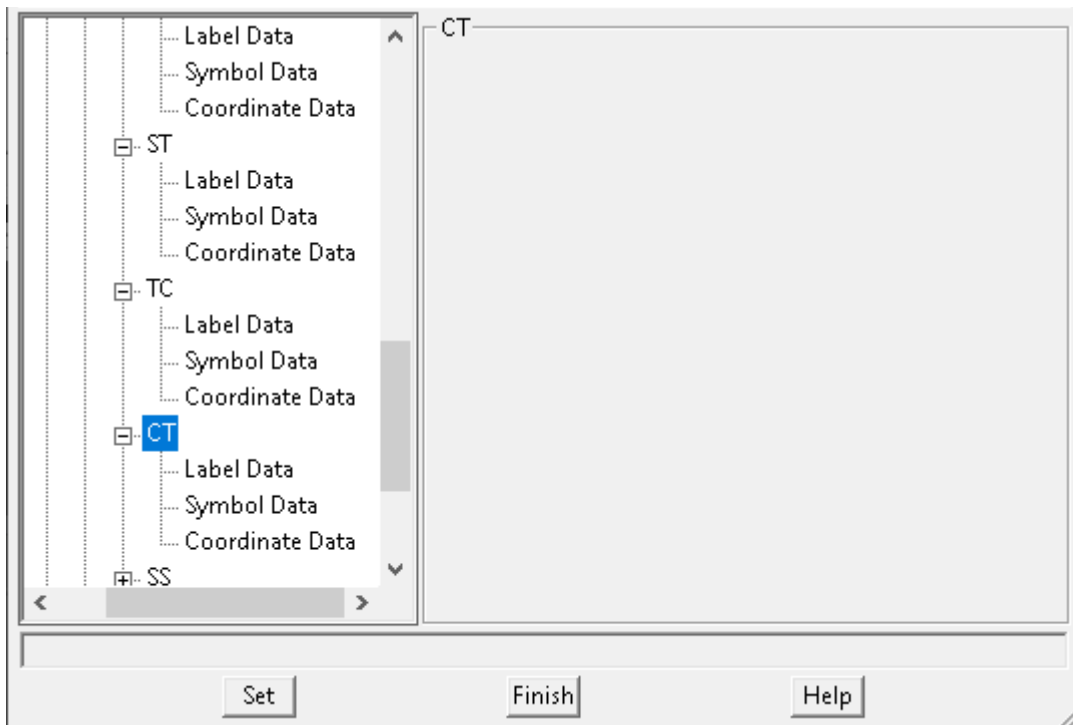




<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_tangent_curve</b>			
<b>Use</b>	tick box	ticked	
<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			



## 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 [3.10.3 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

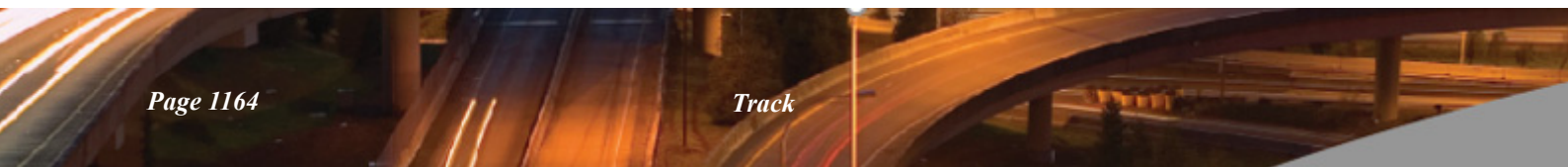
**Use**  tick box  not ticked

*If ticked, it will create a symbol at every chainage on the **Reference String**. Note: This feature has not been implemented yet.*

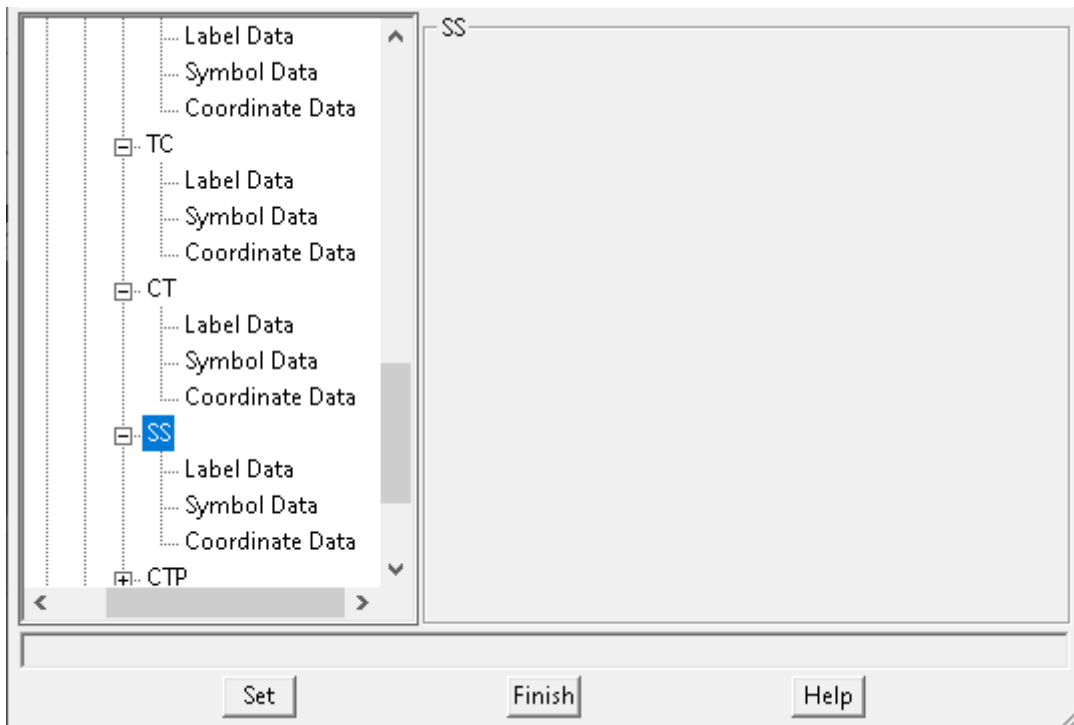
**Symbol Style**  symbol box  PDumbbell

*Name of the symbol to place at every chainage on the **Reference String**.*

<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_curve_tangent</b>			
<b>Use</b>	tick box	ticked	
<i>If <b>ticked</b>, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If <b>ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If <b>not ticked</b>, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			



## 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

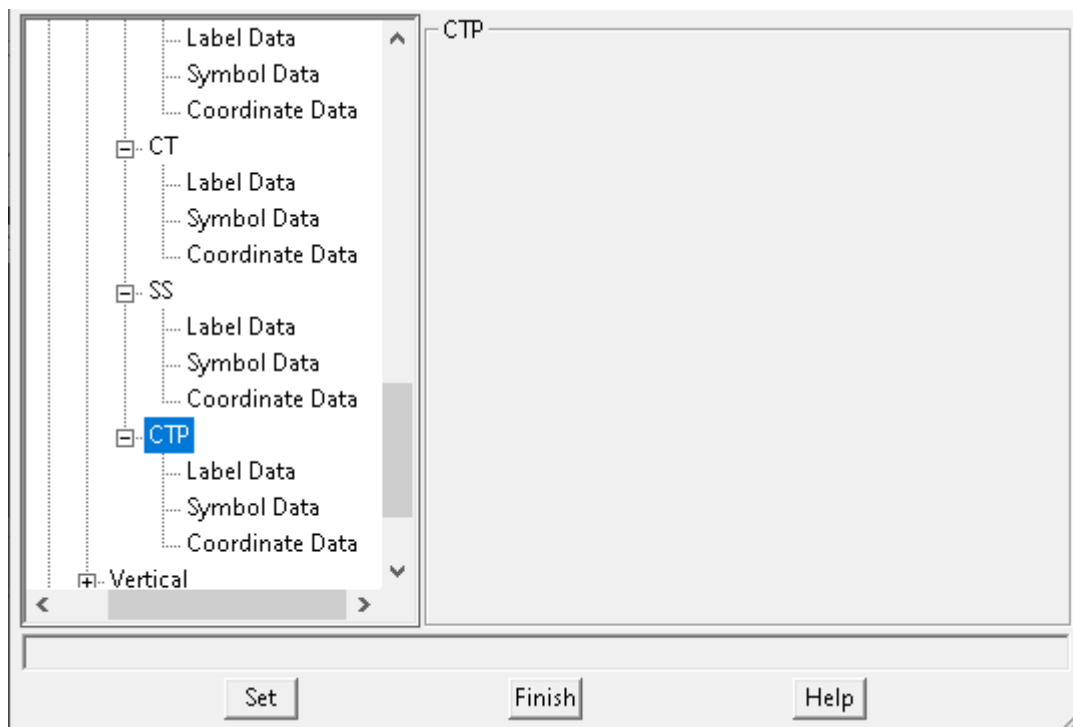
*If ticked, it will create a symbol at every chainage on the Reference String. Note: This feature has not been implemented yet.*

**Symbol Style**  symbol box  PDumbbell

*Name of the symbol to place at every chainage on the Reference String.*

<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_spiral_spiral</b>			
<b>Use</b>	tick box	not ticked	
<i>If ticked, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If not ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			

## Horizontal &gt;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

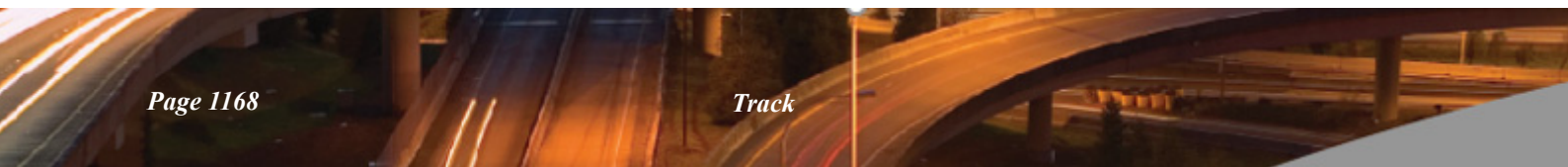
*If ticked, it will create a symbol at every chainage on the Reference String. Note: This feature has not been implemented yet.*

**Symbol Style**  symbol box  PDumbbell

*Name of the symbol to place at every chainage on the Reference String.*



<b>Colour</b>	colour box	red	available colours
<i>Colour of the symbol.</i>			
<b>Size</b>	real box	1	
<i>Size of the symbol.</i>			
<b>Rotation</b>	real box	0	
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>			
<b>shift</b>	real box	0	
<i>Distance shifted to the left/right on the X plane.</i>			
<b>Raise</b>	real box	0	
<i>Distance raised/lowered on the Y plane.</i>			
<b>Coordinate_Labels:- coord_commom_tangent</b>			
<b>Use</b>	tick box	not ticked	
<i>If ticked, coordinate labels of the locations will be generated. <b>Note: This feature has not been implemented yet.</b></i>			
<b>Text Style</b>	text style box		all styles
<i>Text style for the properties of the coordinate labels of the locations.</i>			
<b>Decimal Places</b>	integer box	3	
<i>The number of decimal places for the coordinate labels of the locations.</i>			
<b>Orient Text</b>	tick box	not ticked	
<i>If ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the <b>Reference String</b>.</i>			
<i>If not ticked, the <b>Text Style Angle</b> and symbol <b>Rotation</b> will be relative to the world.</i>			
<b>Text Prefix * Suffix</b>	text box	E *;N *	
<i>Text to add to the prefix or suffix of the coordinate value. The asterisk * denotes where the coordinate labels of value will be placed.</i>			



## Vertical

See [Vertical >Unknown](#)

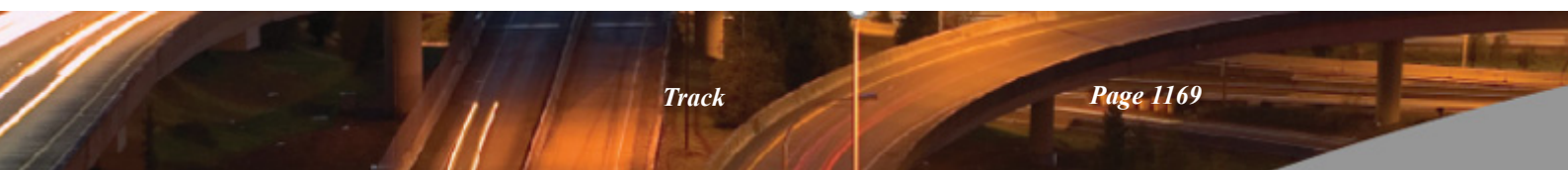
See [Vertical >TC](#)

See [Vertical >CT](#)

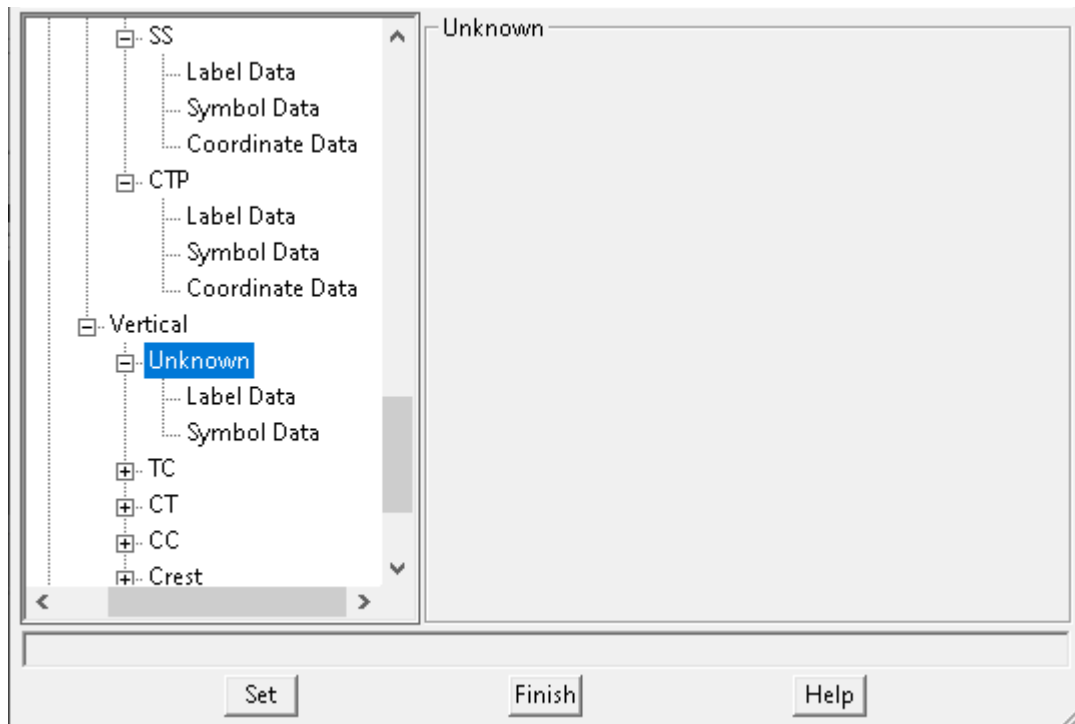
See [Vertical >CC](#)

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

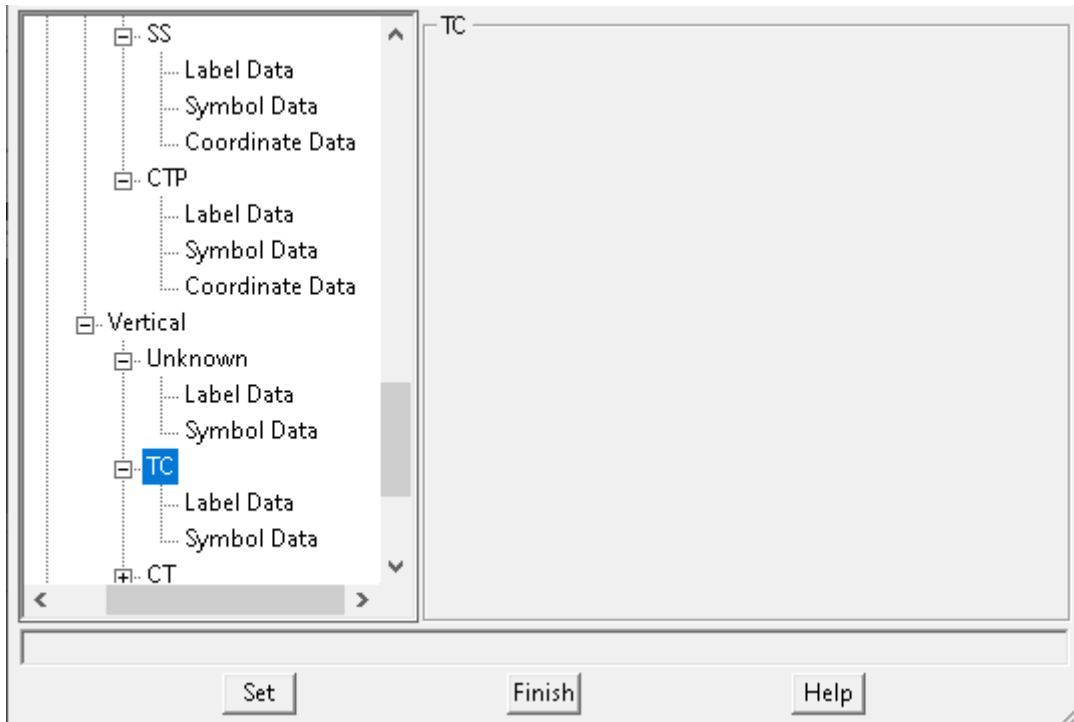
*Name of the symbol to place at every chainage on the **Reference String**.*

**Colour** colour box white available colours

*Colour of the symbol.*

<b>Size</b>	real box	1
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

## 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**.*

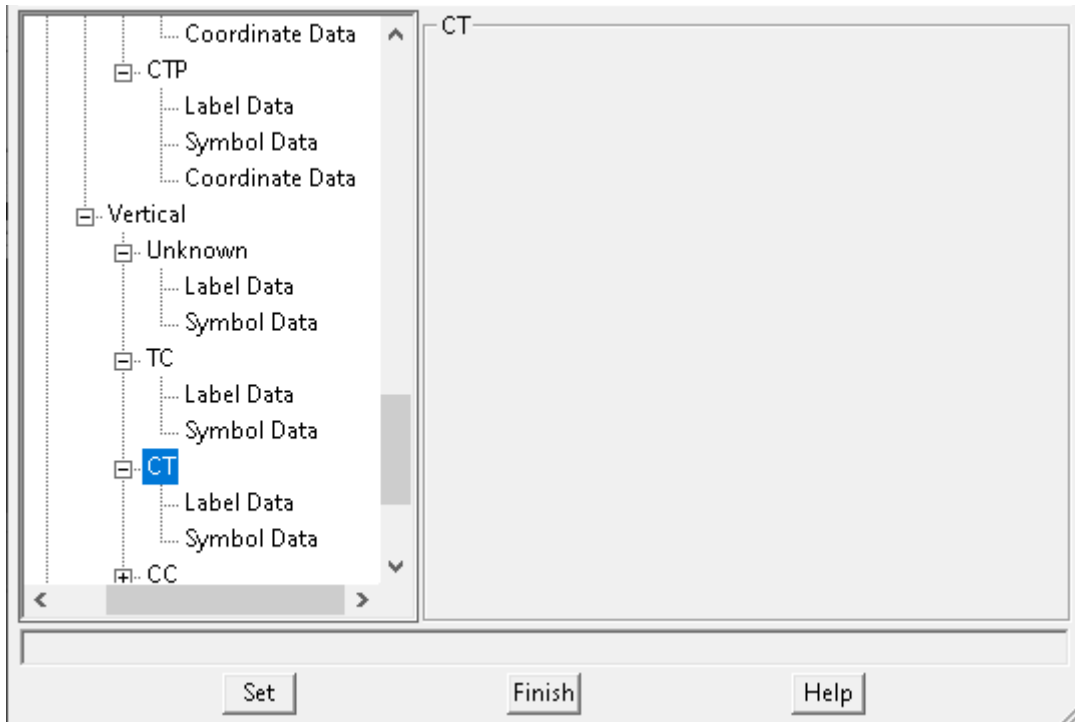
**Colour** colour box white available colours

*Colour of the symbol.*

<b>Size</b>	real box	1
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		



## 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

*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

*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

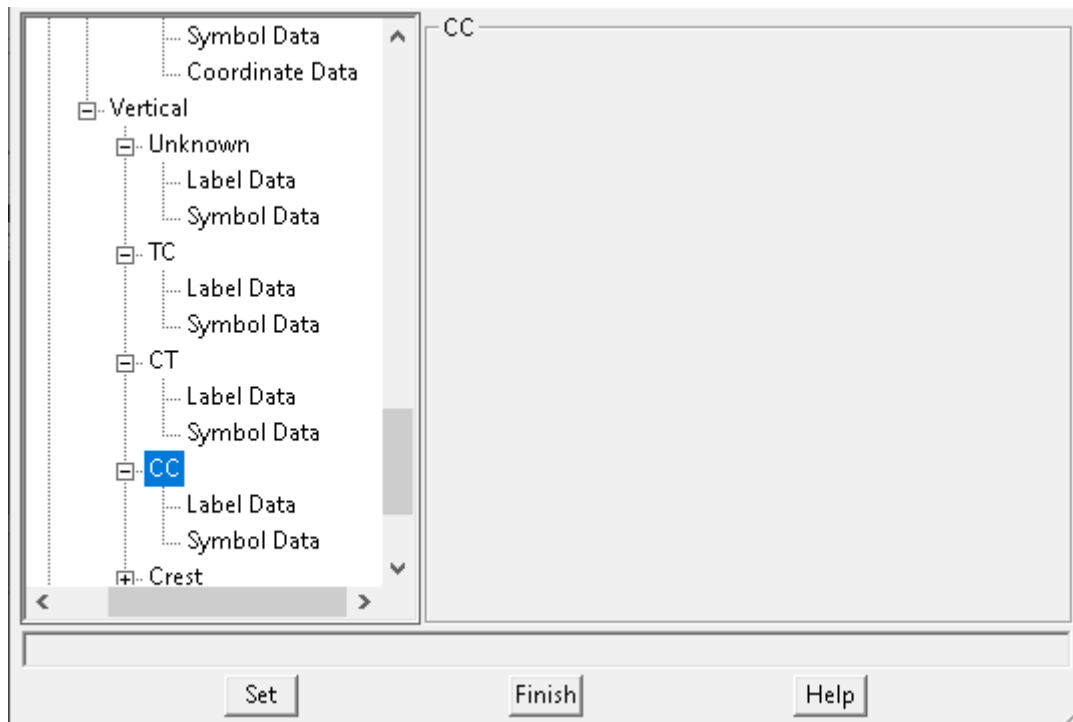
*Name of the symbol to place at every chainage on the **Reference String**.*

**Colour** colour box  **available colours**

*Colour of the symbol.*

<b>Size</b>	real box	1
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

## 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 [3.10.3 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**

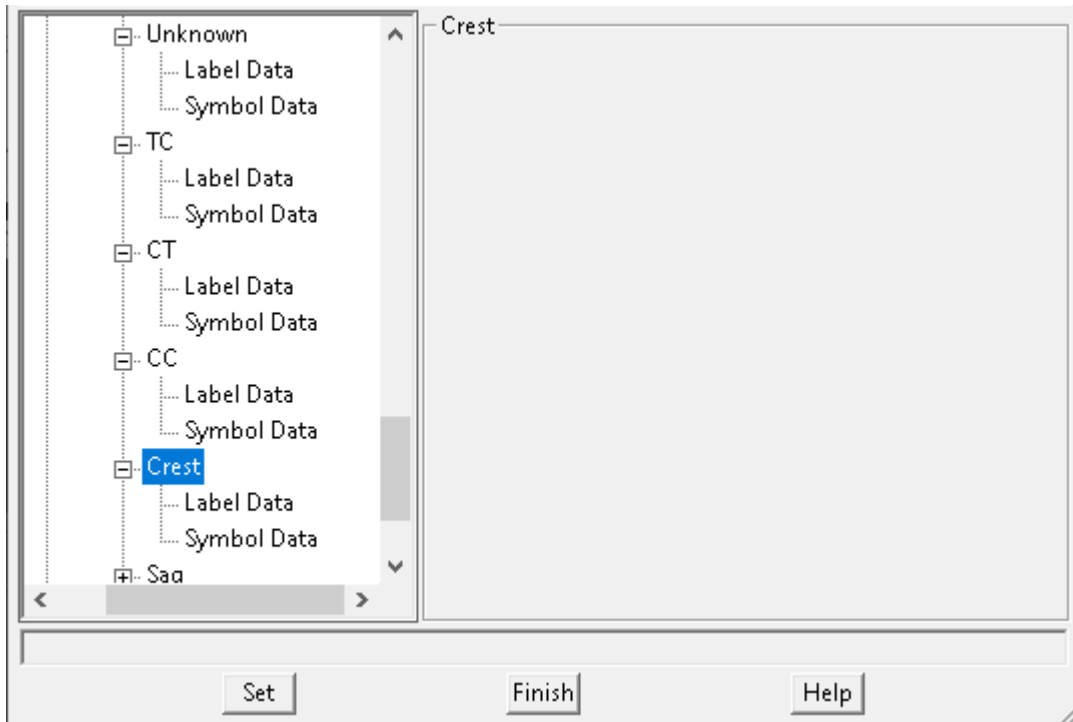
*Name of the symbol to place at every chainage on the **Reference String**.*

**Colour** colour box  **white** **available colours**

*Colour of the symbol.*

<b>Size</b>	real box	1
<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0
<i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>		
<b>shift</b>	real box	0
<i>Distance shifted to the left/right on the X plane.</i>		
<b>Raise</b>	real box	0
<i>Distance raised/lowered on the Y plane.</i>		

## 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 [3.10.3 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**.*

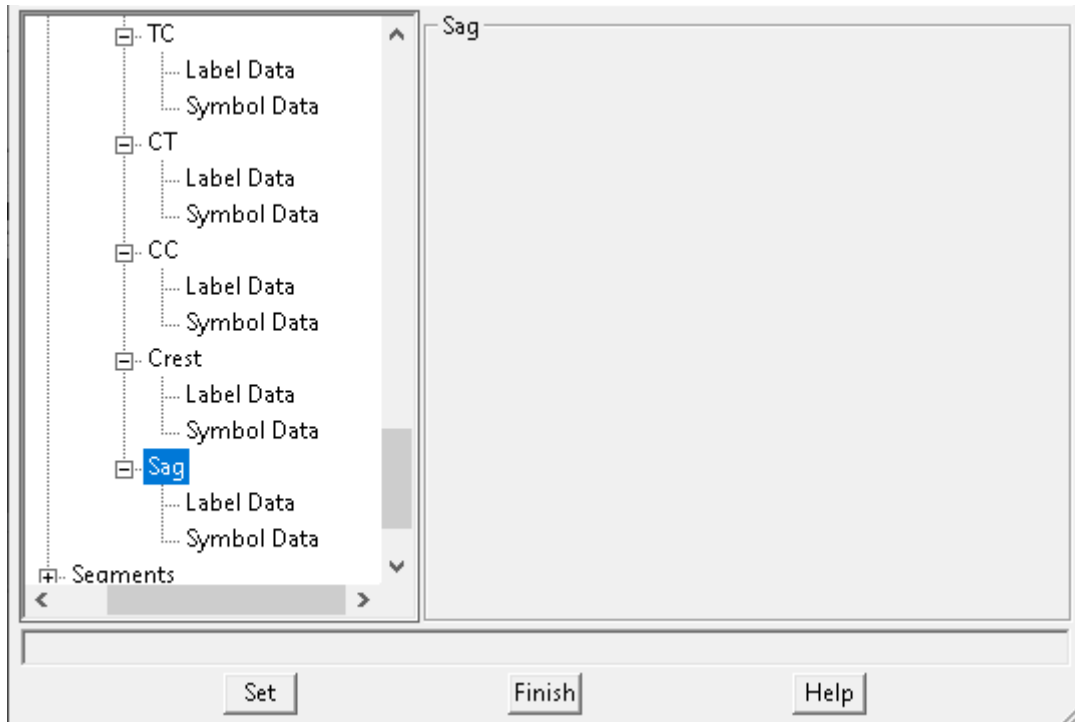
**Symbol Style**  symbol box  CIRCLE

*Name of the symbol to place at every chainage on the **Reference String**.*

<b>Colour</b> <i>Colour of the symbol.</i>	colour box	white	available colours
<b>Size</b> <i>Size of the symbol.</i>	real box	1	
<b>Rotation</b> <i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>	real box	0	
<b>shift</b> <i>Distance shifted to the left/right on the X plane.</i>	real box	0	
<b>Raise</b> <i>Distance raised/lowered on the Y plane.</i>	real box	0	



## 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 [3.10.3 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

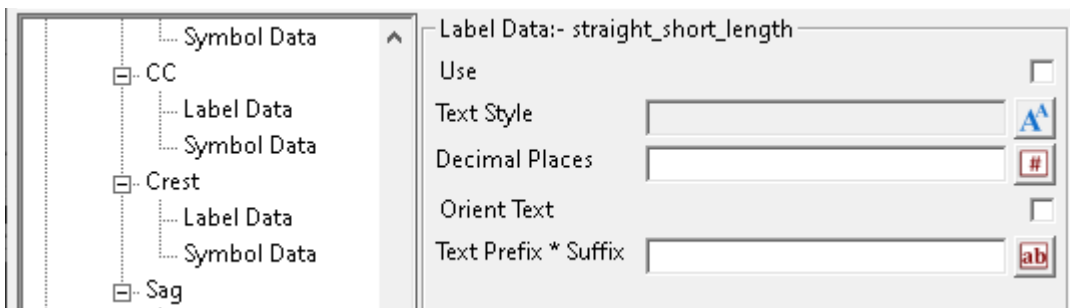
*Name of the symbol to place at every chainage on the **Reference String**.*

<b>Colour</b> <i>Colour of the symbol.</i>	colour box	white	available colours
<b>Size</b> <i>Size of the symbol.</i>	real box	1	
<b>Rotation</b> <i>Rotation of the symbol. The rotation angle is affected by <b>Orient Text</b>.</i>	real box	0	
<b>shift</b> <i>Distance shifted to the left/right on the X plane.</i>	real box	0	
<b>Raise</b> <i>Distance raised/lowered on the Y plane.</i>	real box	0	

## 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*

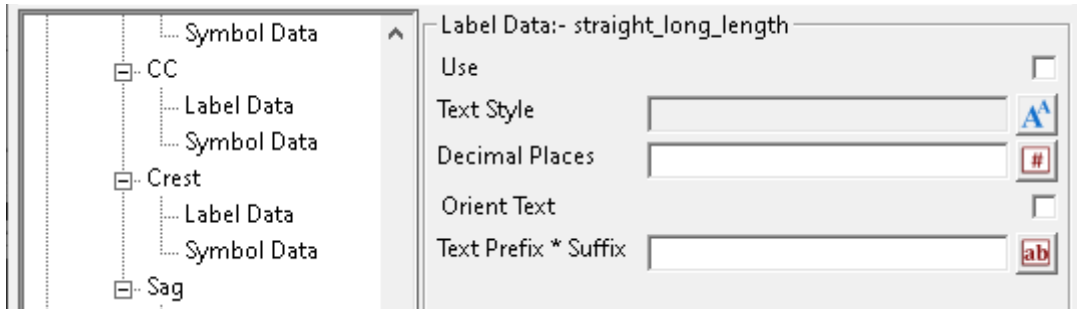
**Text Style** text style box   
*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*

**Decimal Places** custom box   
*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.*

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 [3.10.3 Textstyle](#).*

**Decimal Places** custom box 3

*The number of decimal places for the value labels.*

**Orient Text** tick box  **not ticked**

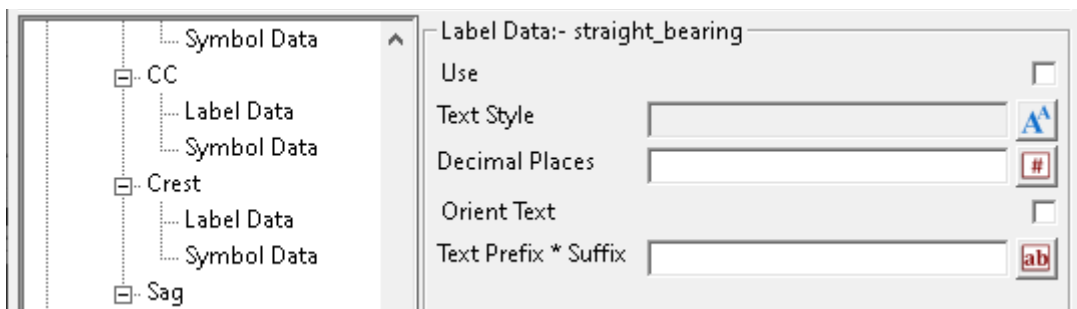
*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*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 [3.10.3 Textstyle](#).*

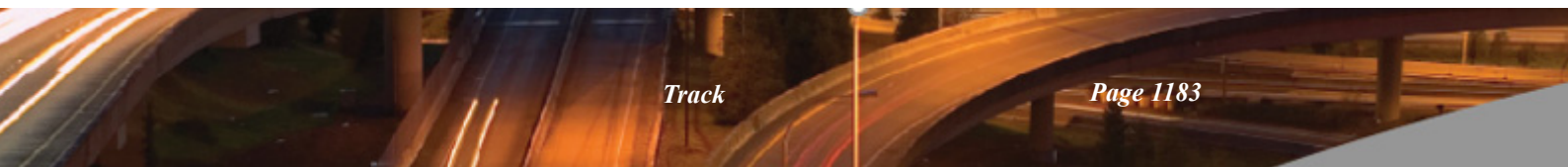
**Decimal Places** custom box 3

*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**.*

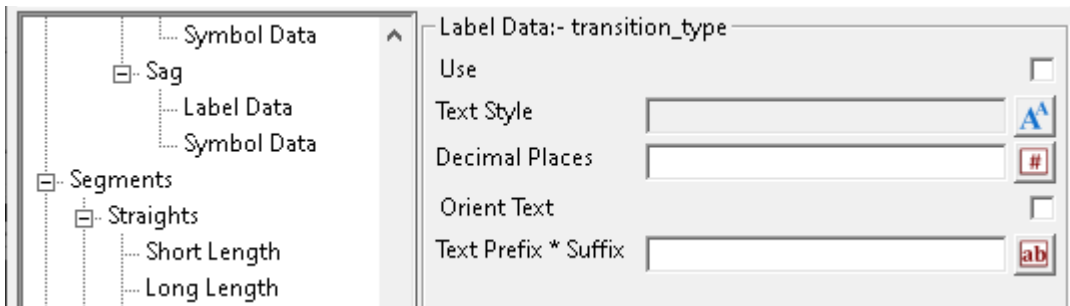
*If **not ticked**, the **Text Style Angle** will be relative to the world.*



**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 [3.10.3 Textstyle](#).*

**Decimal Places**      custom box      3

*The number of decimal places for the value labels.*

**Orient Text**      tick box       not ticked

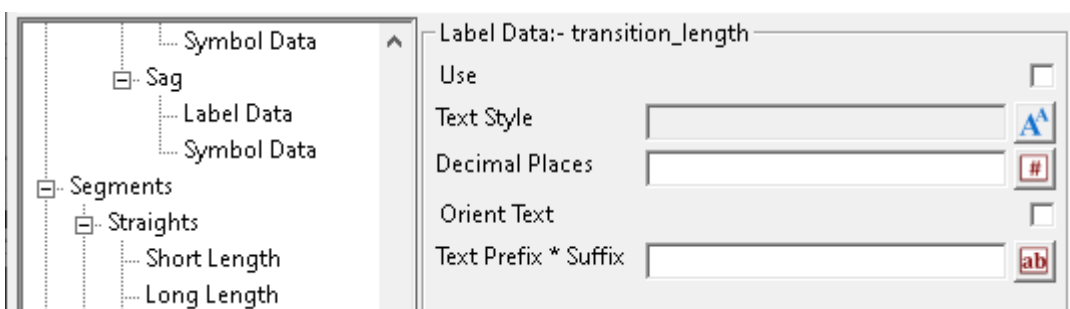
*If ticked, the Text Style Angle will be relative to the Reference String.*

*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

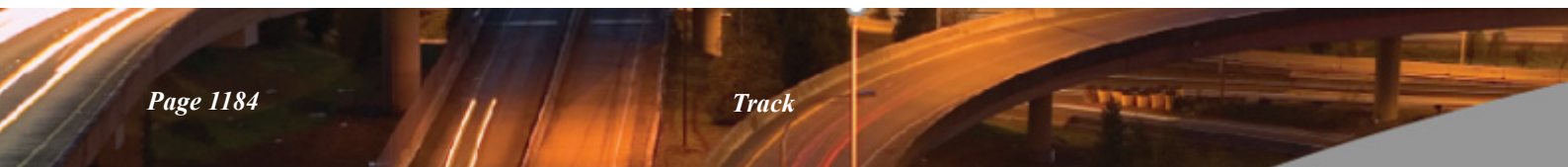
*If ticked, transition length labels will be generated*

**Text Style**      text style box      all styles

*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*

**Decimal Places**      custom box      3

*The number of decimal places for the value labels.*



**Orient Text**                      tick box                      not ticked

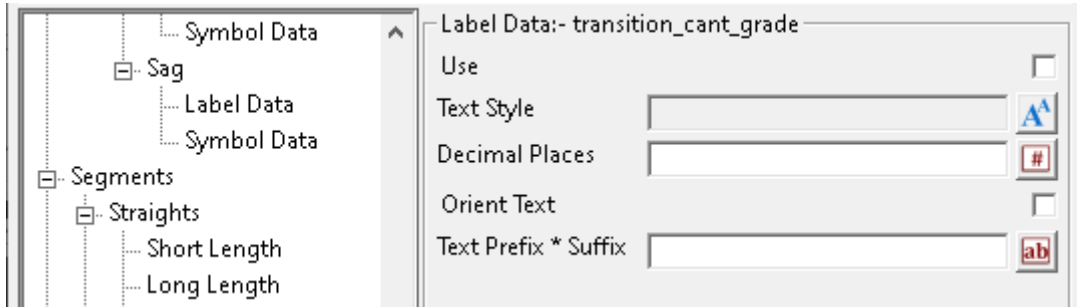
*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*

*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 [3.10.3 Textstyle](#).*

**Decimal Places**                                      custom box                                      3

*The number of decimal places for the value labels.*

**Orient Text**                                      tick box                                      not ticked

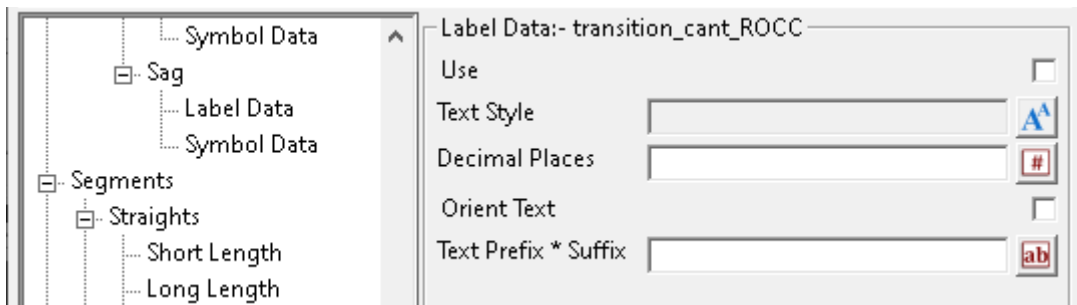
*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*

*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.*

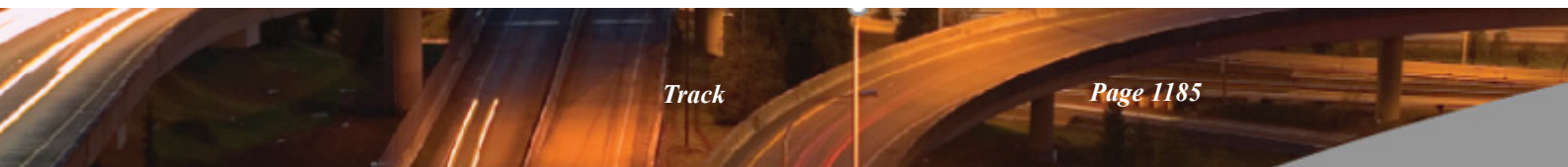
**Transitions>Cant ROCC**



**Label Data:- transition\_cant\_ROCC**

**Use**                                      tick box                                      ticked

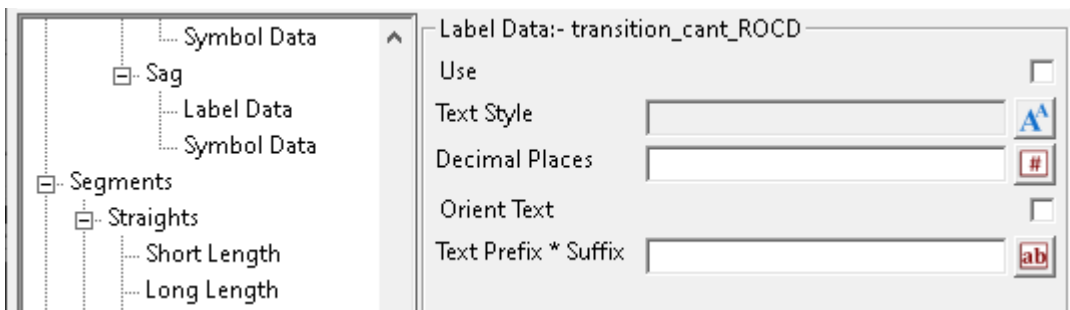
*If ticked, transition rate of change of cant (ROCC) labels will be generated.*





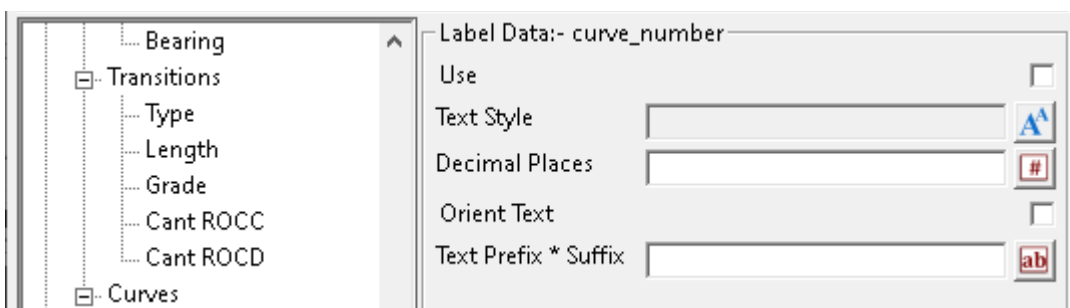
- Text Style**                      text style box                      all styles  
*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*
- Decimal Places**                      custom box                      3  
*The number of decimal places 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.*

**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 [3.10.3 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 [3.10.3 Textstyle](#).*

**Decimal Places** custom box 3

*The number of decimal places for the value labels.*

**Orient Text** tick box  not ticked

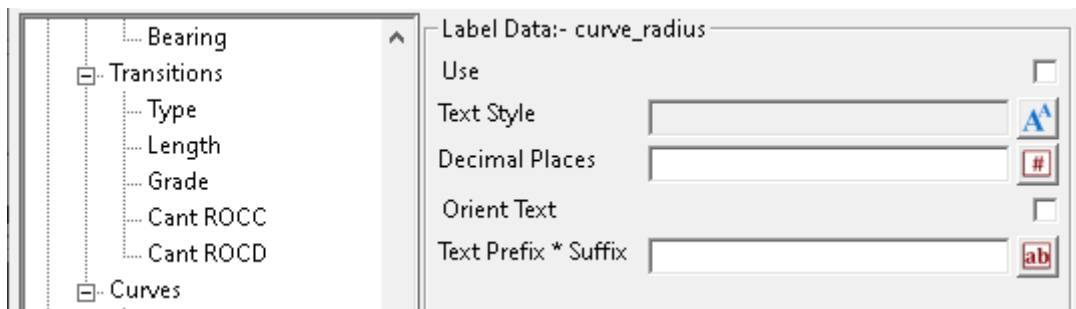
*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*

*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 [3.10.3 Textstyle](#).*

**Decimal Places** custom box 3

*The number of decimal places for the value labels.*

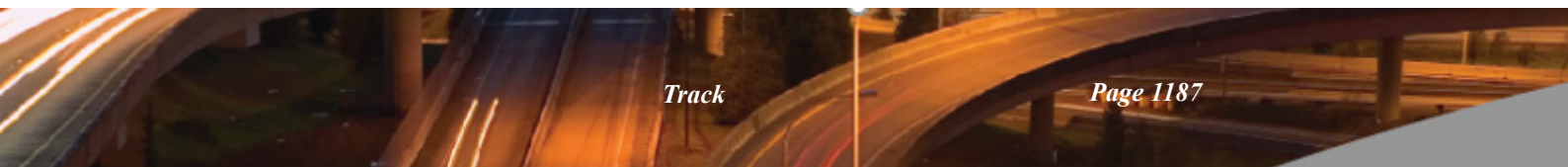
**Orient Text** tick box  not ticked

*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*

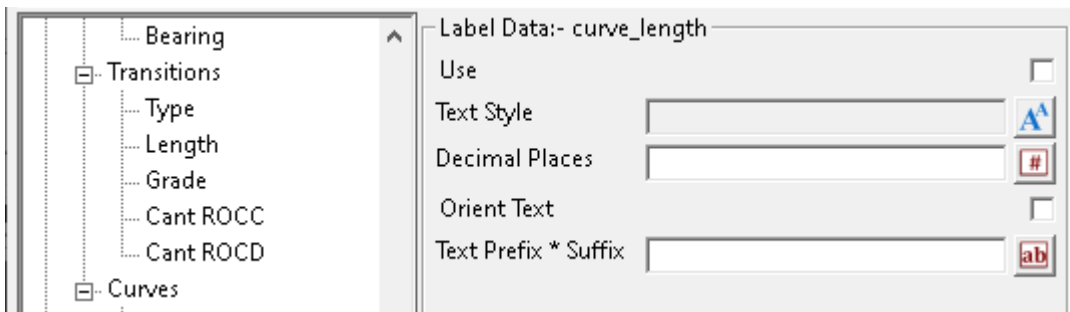
*If not ticked, the **Text Style Angle** will be relative to the world.*

**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 [3.10.3 Textstyle](#).*

**Decimal Places** custom box  **3**

*The number of decimal places for the value labels.*

**Orient Text** tick box  **not ticked**

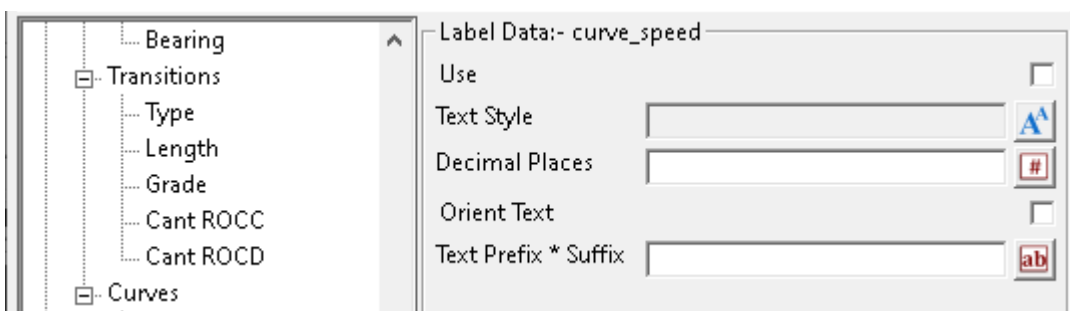
*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*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  **not 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 [3.10.3 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**

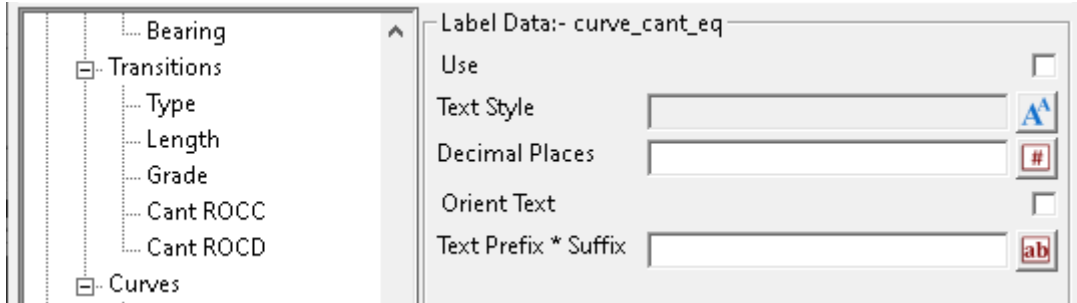
*If **ticked**, the **Text Style Angle** will be relative to the **Reference String**.*

*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 [3.10.3 Textstyle](#).*

**Decimal Places**      custom box      3

*The number of decimal places for the value labels.*

**Orient Text**      tick box       not ticked

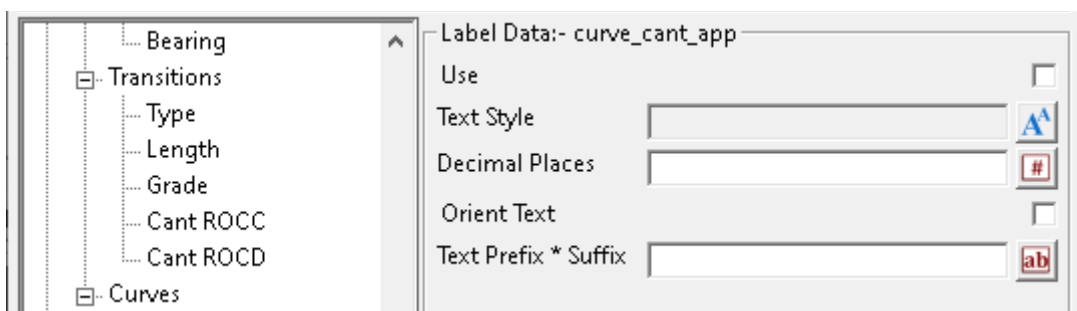
*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*

*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

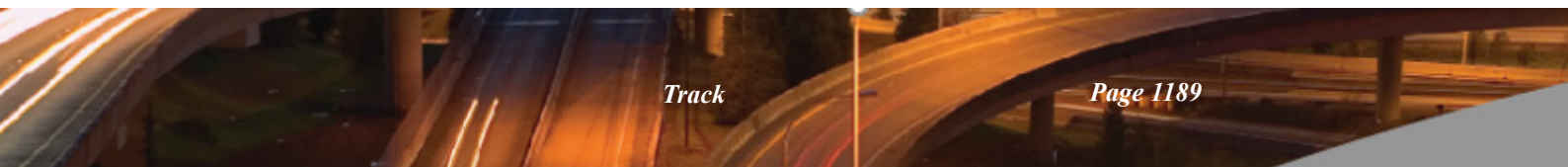
*If ticked, applied cant labels will be generated.*

**Text Style**      text style box      all styles

*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*

**Decimal Places**      custom box      3

*The number of decimal places for the value labels.*



**Orient Text**                      tick box                      not ticked

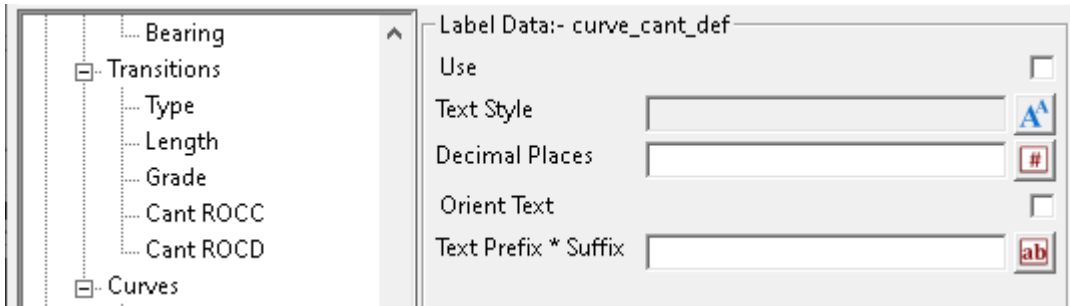
*If ticked, the Text Style Angle will be relative to the Reference String.*

*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 [3.10.3 Textstyle](#).*

**Decimal Places**                                      custom box                                      3

*The number of decimal places for the value labels.*

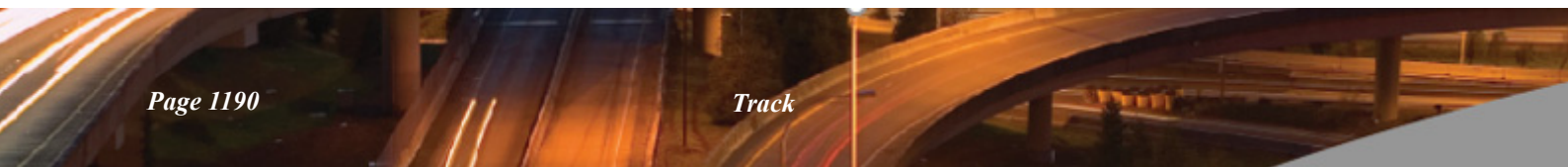
**Orient Text**                                      tick box                                      not ticked

*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.*

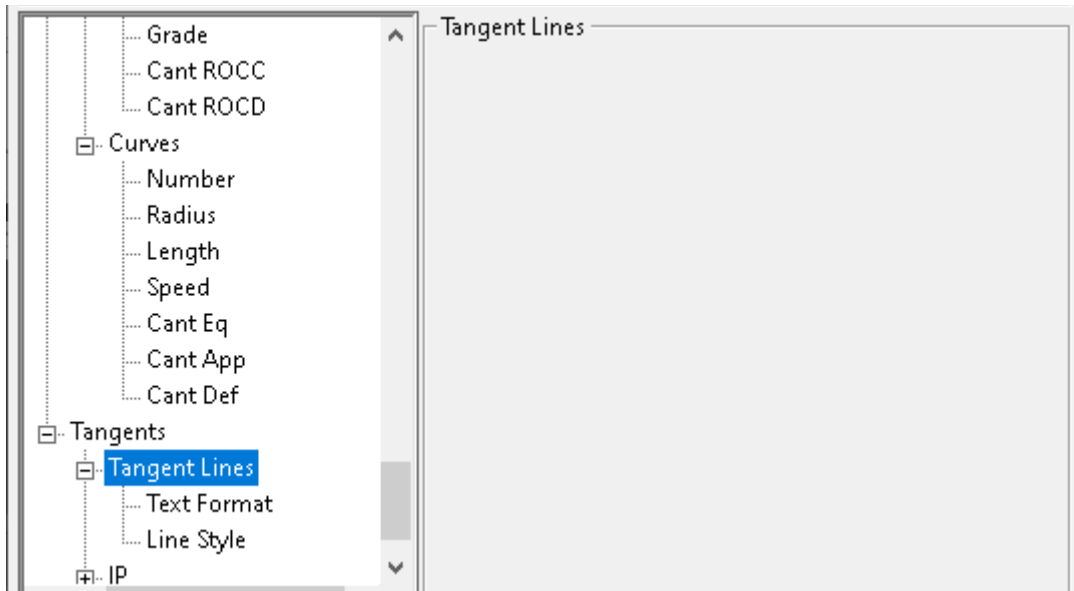


**Tangents**

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 [3.10.3 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

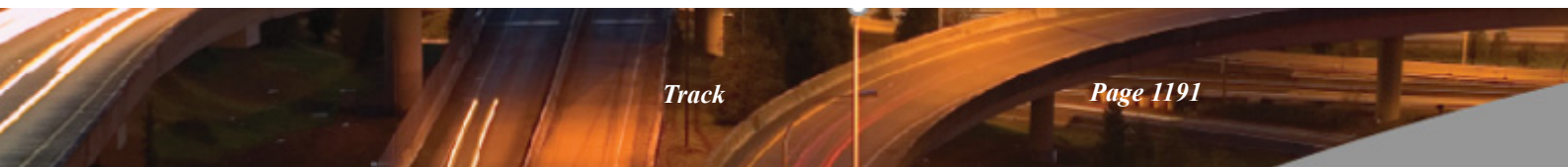
*Line style for the tangent lines. For information on linestyles refer to [44.1 Line Styles](#).*

**Colour** colour box magenta available colours

*Colour of the tangent lines.*

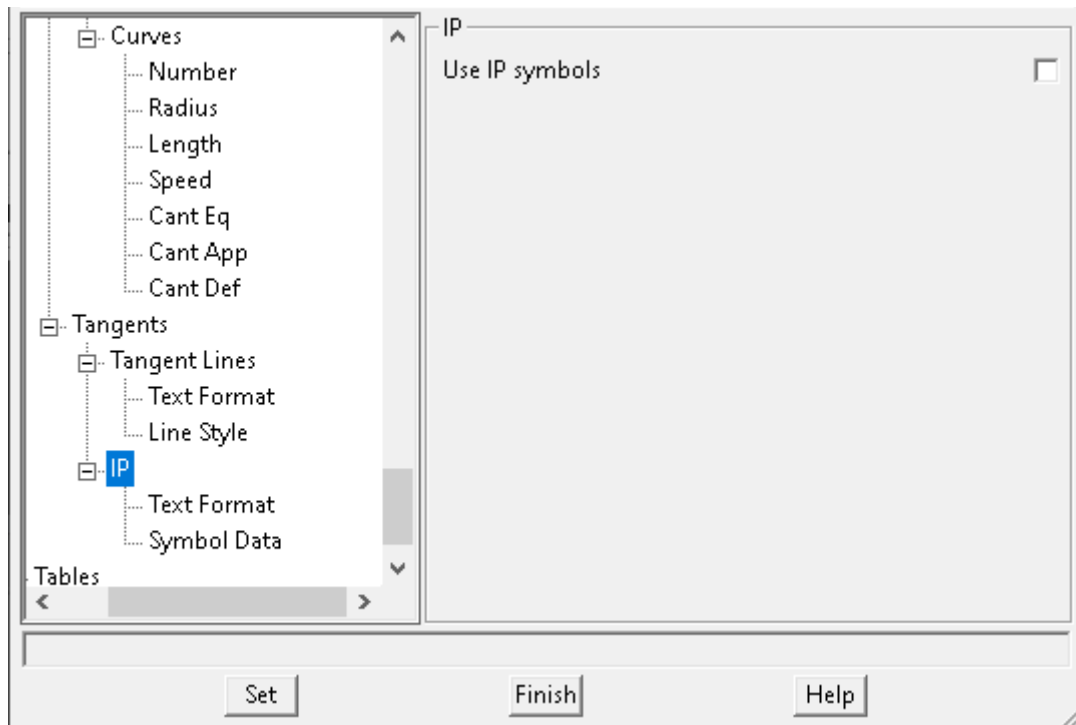
**Weight** custom box 0

*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 [3.10.3 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.*

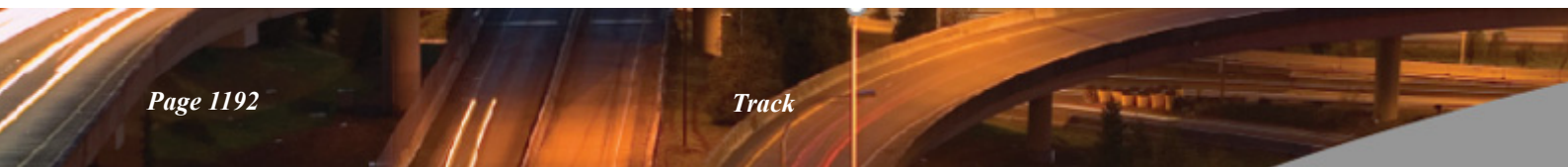
**Text Prefix \* Suffix**                      custom box                      custom box                      ip\_easting \*  
*Text to add to the prefix or suffix of the value. The asterisk \* denotes where the value will be placed.*

**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 [3.10.3 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.*

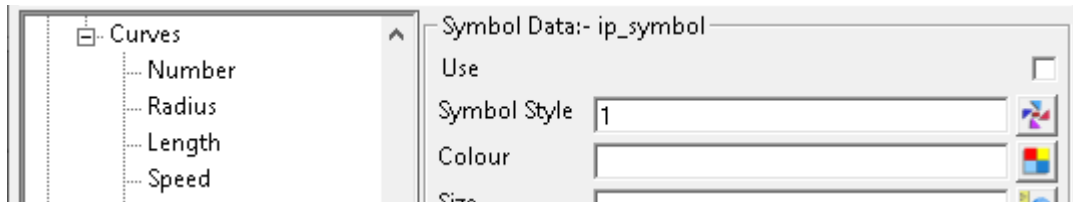
**Raise**                                    real box                      0

*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.*

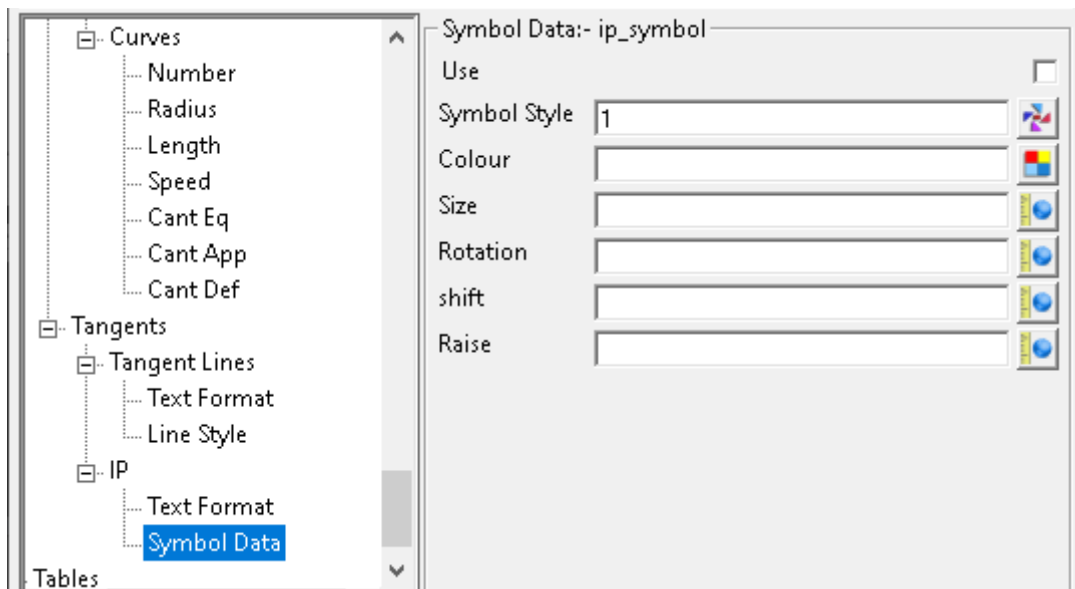
*If not ticked, the boxes will be relative to the world. Note: This feature has not been implemented yet.*

**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

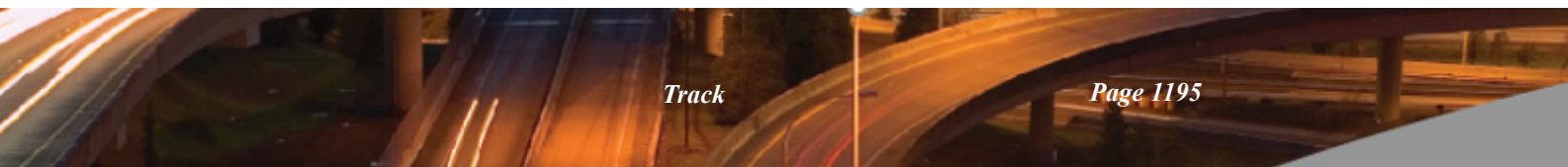
*Colour to be applied to the box border shadow.*

**Weight** custom box 2

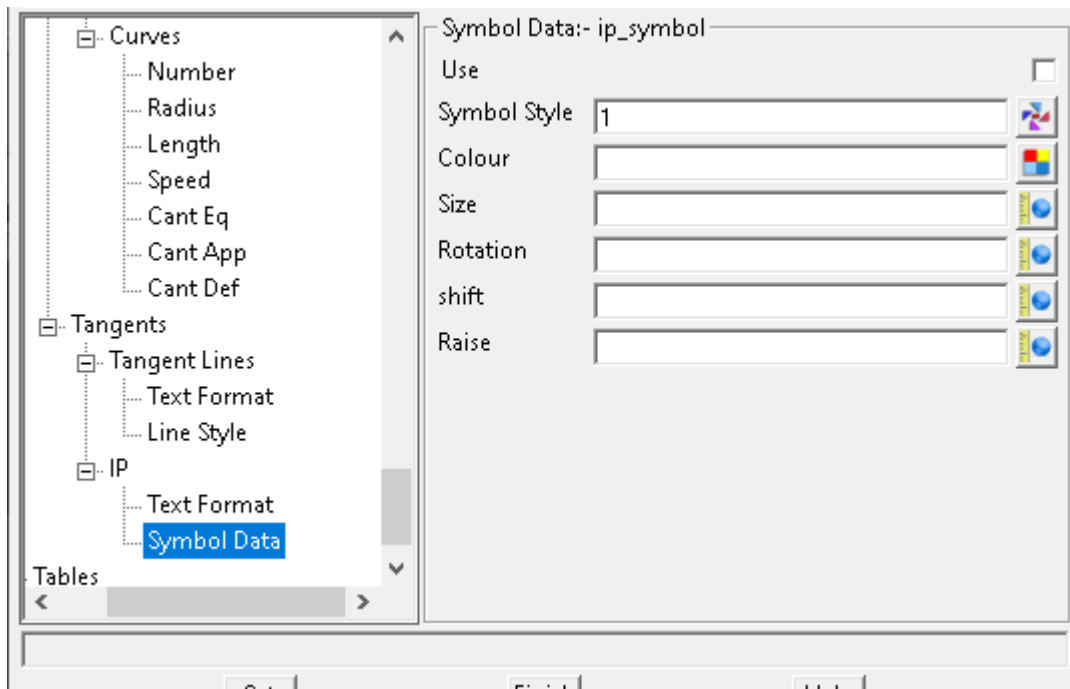
*Weight to be applied to the box border shadow.*

**Shadow width** real box 0

*Width of the box border shadow.*



Tables>Leaders



**Leaders**

**Linestyle:- ip\_table\_leader**

<b>Use</b>	tick box	not ticked	
	<i>If ticked, leaders will be generated. Note: This feature has not been implemented yet.</i>		
<b>Linestyle</b>	linestyle box	1	available styles
	<i>Name of the linestyle to be applied to the leaders.</i>		
<b>Colour</b>	colour box	red	available colours
	<i>Colour to be applied to the leaders.</i>		
<b>Weight</b>	custom box	2	
	<i>Weight to be applied to the leaders.</i>		

**Linestyle:- ip\_table\_leader\_arrow**

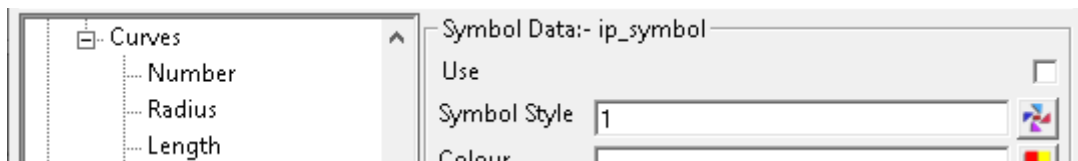
<b>Use</b>	tick box	not ticked	
	<i>If ticked, leader arrows will be generated. Note: This feature has not been implemented yet.</i>		
<b>Symbol style</b>	symbol box	CIRCLE	
	<i>Name of the symbol to use as the leader arrow.</i>		
<b>Colour</b>	colour box	white	available colours
	<i>Colour of the symbol.</i>		
<b>Size</b>	real box	1	
	<i>Size of the symbol.</i>		
<b>Rotation</b>	real box	0	
	<i>Rotation of the symbol.</i>		
<b>Shift</b>	real box	0	
	<i>Distance shifted to the left/right on the X plane.</i>		

**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](#)

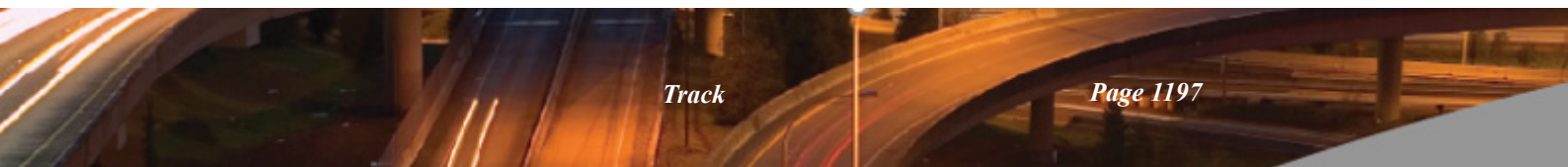
**IP Tables**



**Text format for table chainages**

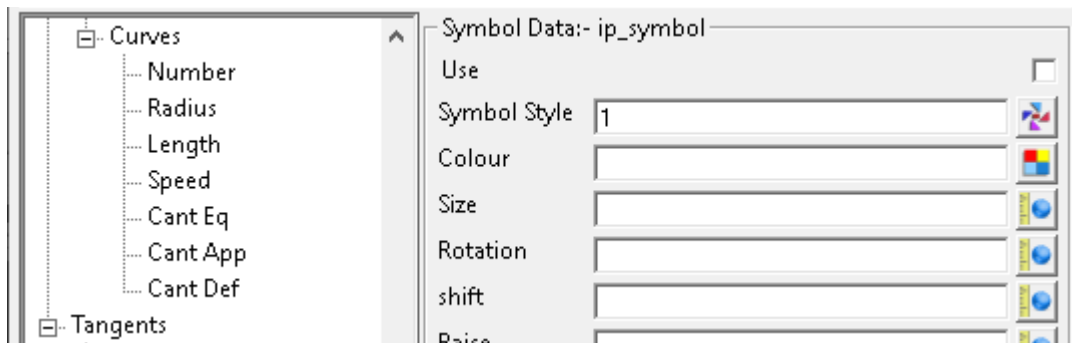
**Box Offset** real box  
 ??.

**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 [3.10.3 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.*

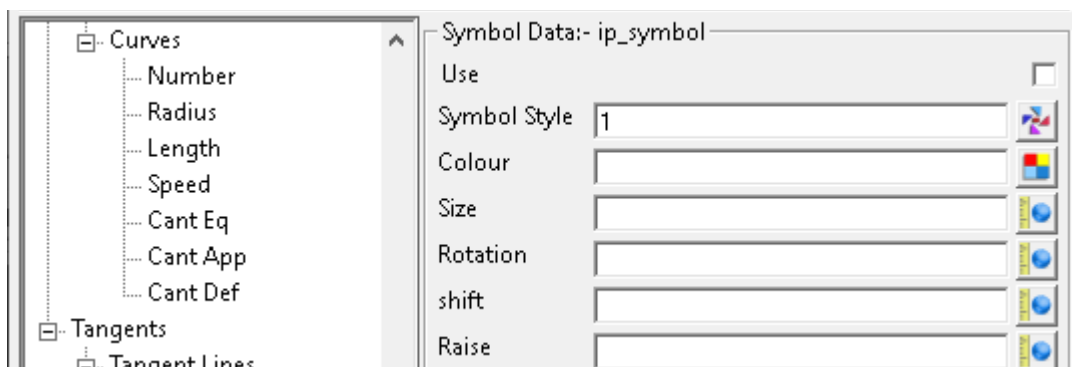
**Text Prefix \* Suffix** custom box custom box ip\_table\_curve\_number = \*

*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 [3.10.3 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.*

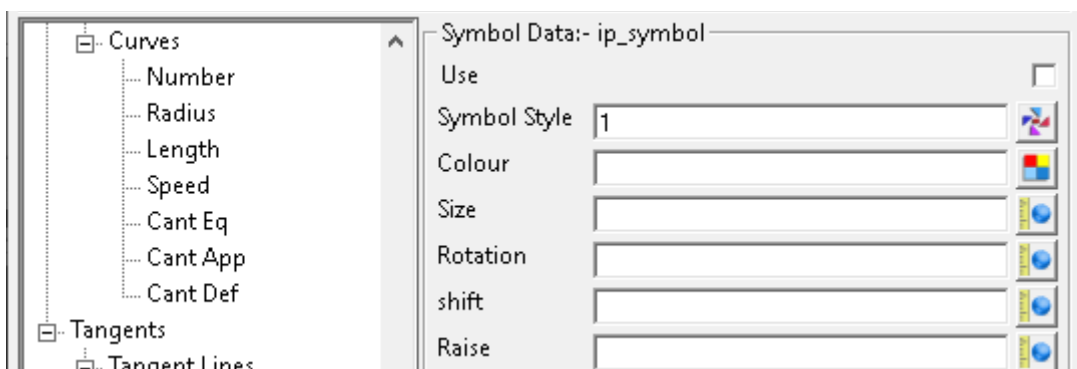
**Text Prefix \* Suffix**                      custom box

*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 [3.10.3 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**.*

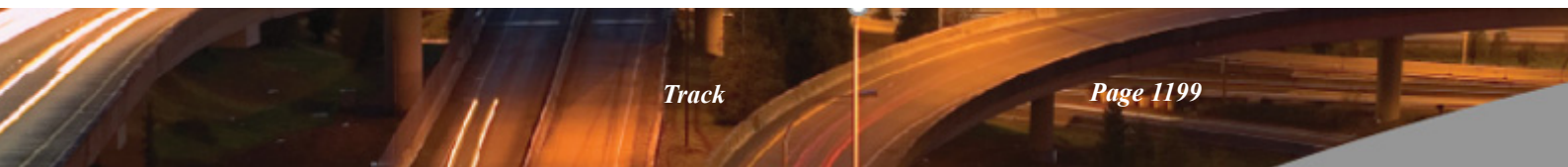
*If not ticked, the **Text Style Angle** will be relative to the world.*

**Text Prefix \* Suffix**                              custom box

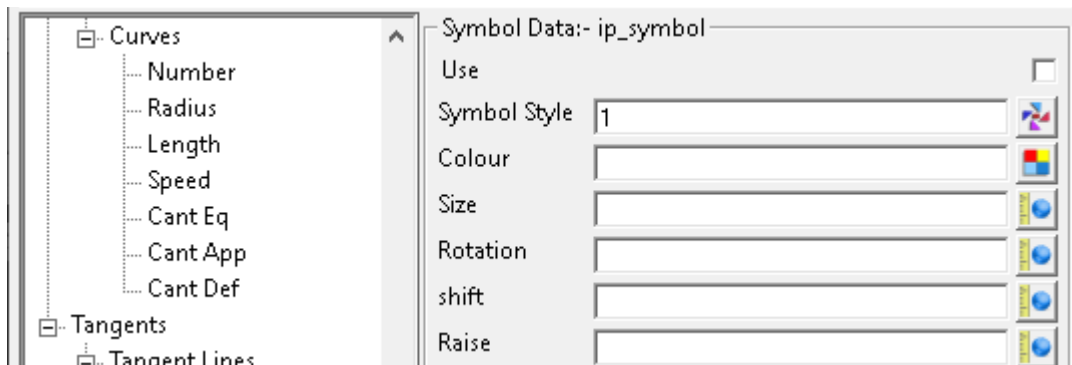
*Text to add to the prefix or suffix of the value. The asterisk \* denotes where the value will be placed.*

**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 [3.10.3 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.*

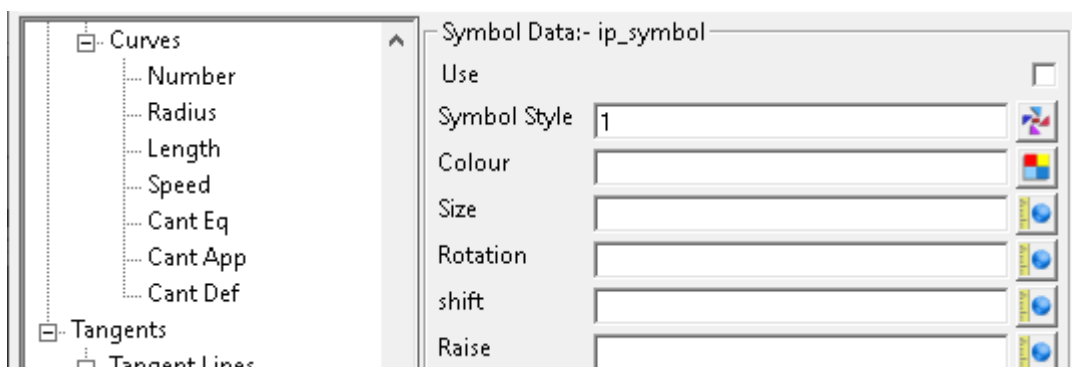
**Text Prefix \* Suffix** custom box **ip\_table\_curve\_easting \* m**

*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



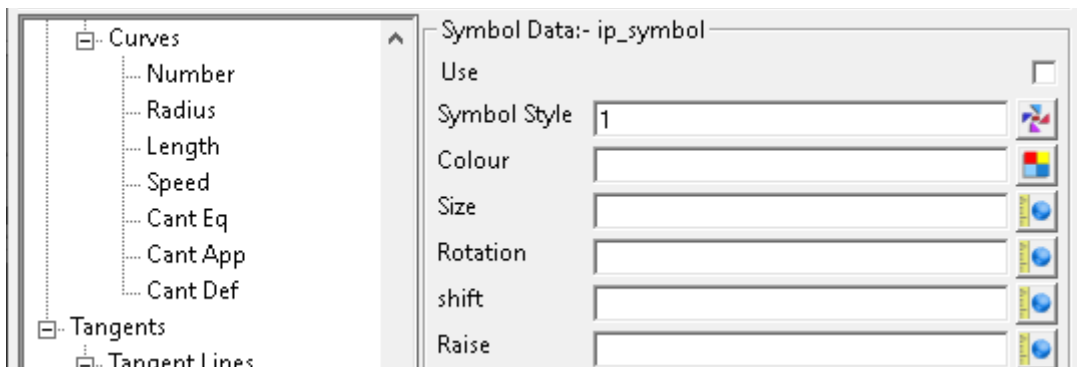
**Label Data:- ip\_table\_curve\_northing**

**Use** tick box  **ticked**

*If ticked, curve intersection point northing coordinate labels will be created when Label Method has been set to IPs, Tangents.*

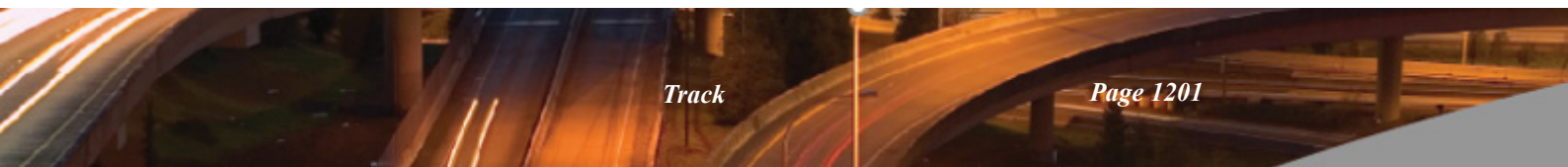
- Text Style**                      text style box                      all styles  
*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*
- Decimal Places**                      custom box                      3  
*The number of decimal places 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**

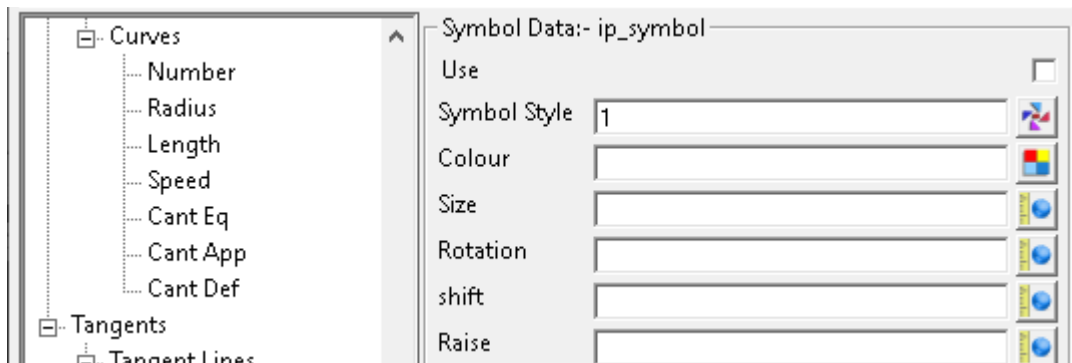


**Label Data:- ip\_table\_curve\_deflection**

- 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 [3.10.3 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 [3.10.3 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.*

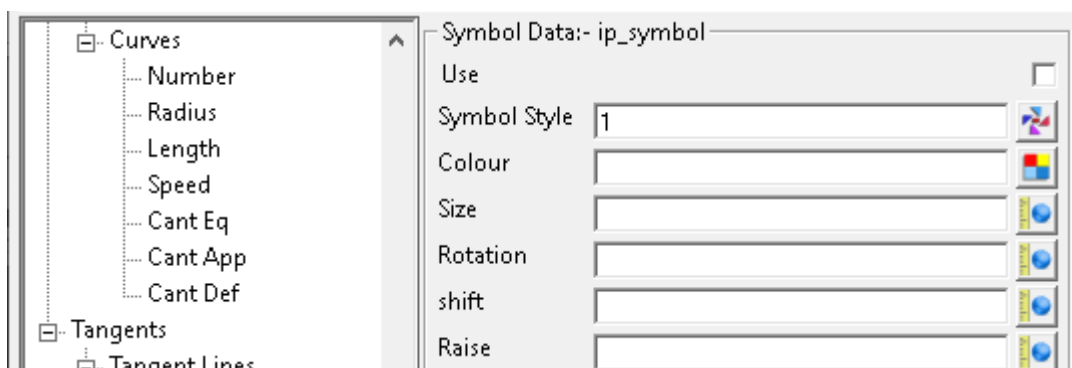
**Text Prefix \* Suffix** custom box **ip\_table\_curve\_tangent = \* m**

*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**

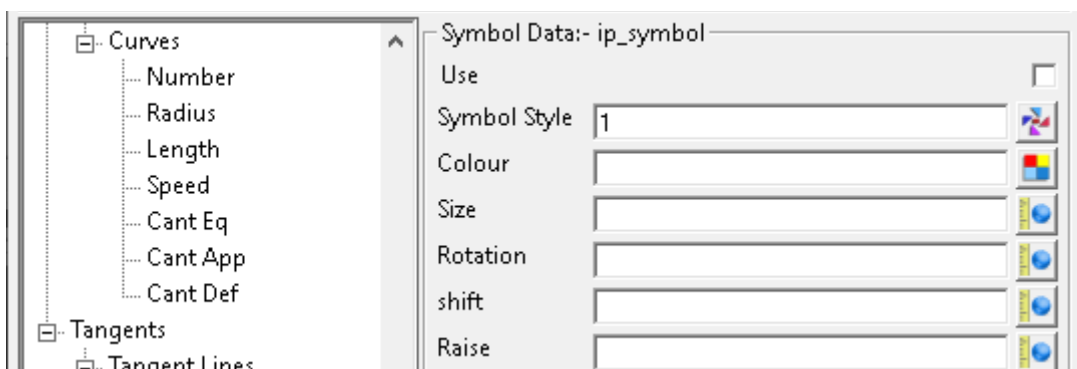
*If **ticked**, tangent 1 labels will be created when **Label Method** has been set to IPs, Tangents. **Note: This feature has not been implemented yet.***

**Text Style** text style box **all styles**

*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*

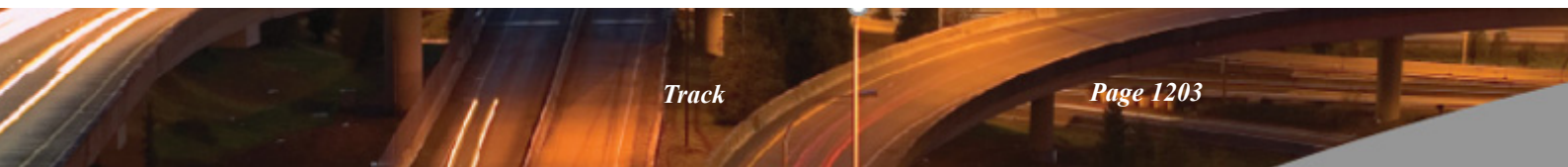
- Decimal Places**                      custom box                      3  
*The number of decimal places for the value labels.*
- Orient Text**                              tick box                              not ticked  
*If ticked, the **Text Style Angle** will be relative to the **Reference String**.*  
*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**



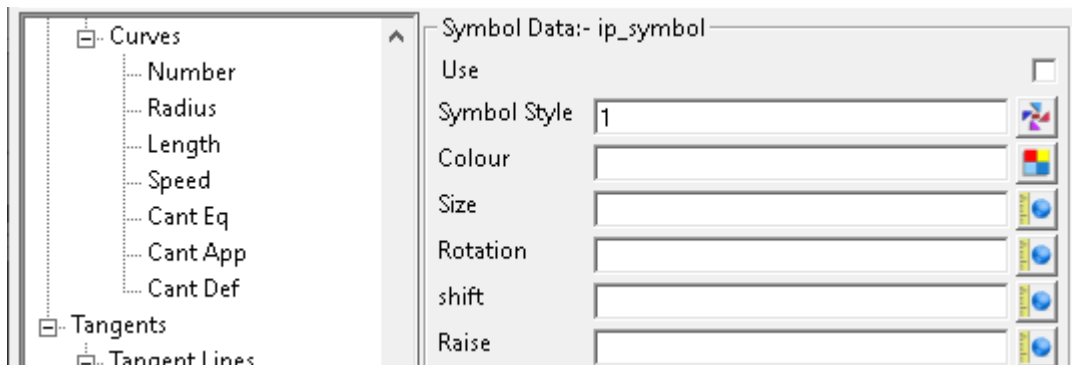
**Label Data:- ip\_table\_curve\_tangent2**

- 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 [3.10.3 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 [3.10.3 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.*

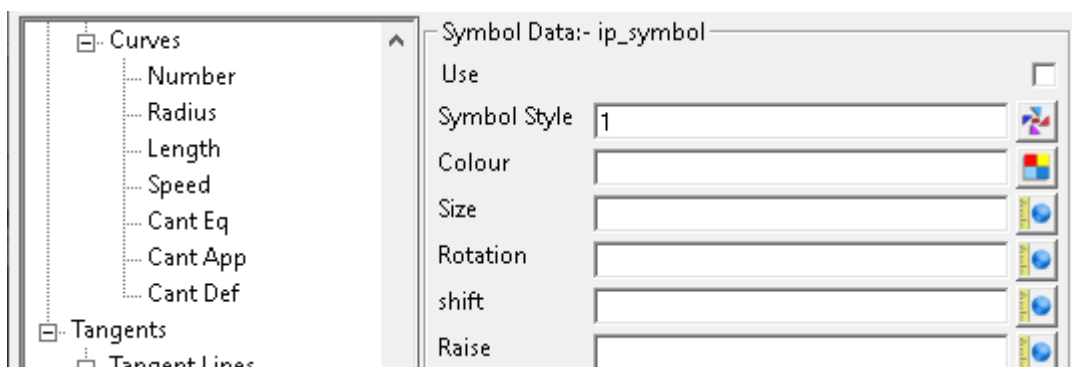
**Text Prefix \* Suffix** custom box ip\_table\_curve\_short\_tangent1 =

*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



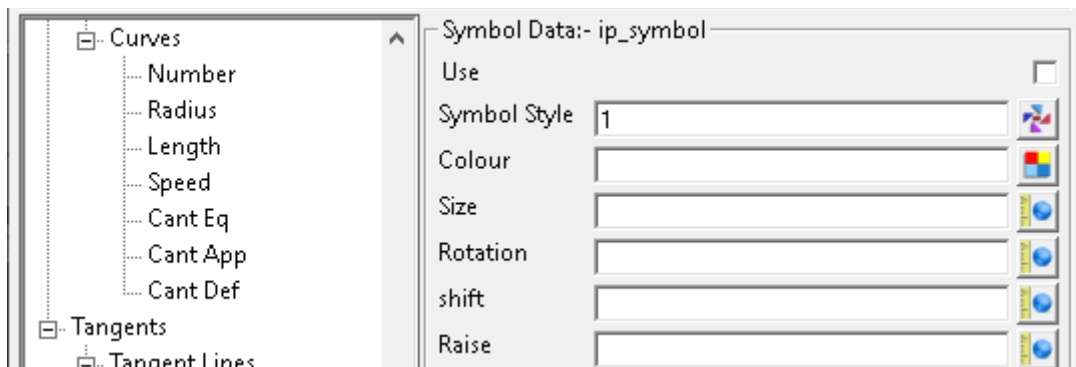
**Label Data:- ip\_table\_curve\_short\_tangent2**

**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.*

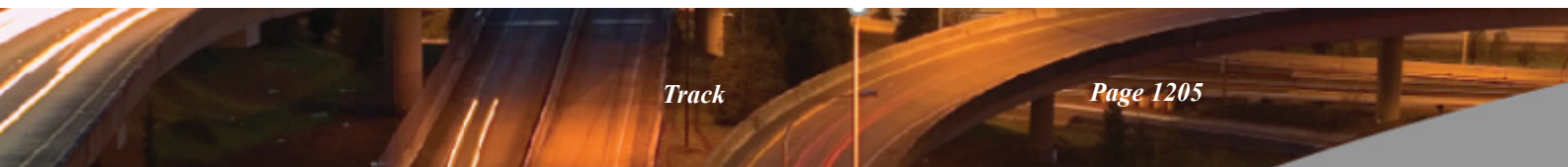
- Text Style**                      text style box                      all styles  
*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*
- Decimal Places**                      custom box                      3  
*The number of decimal places 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**

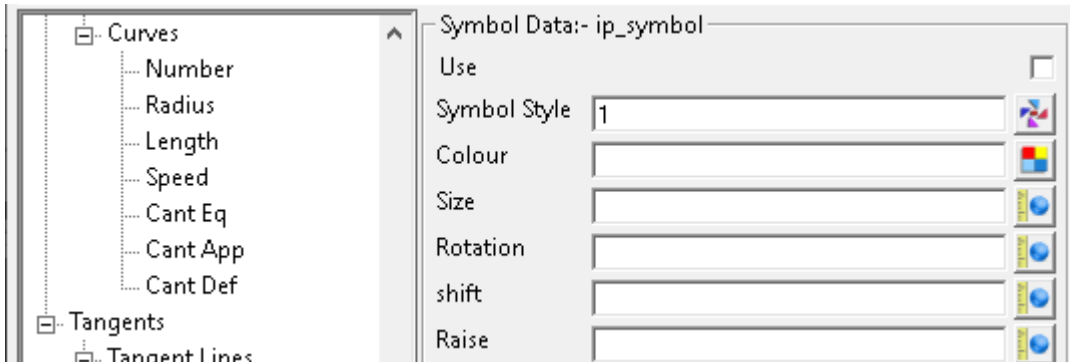


**Label Data:- ip\_table\_curve\_shift1**

- 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 [3.10.3 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 [3.10.3 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.*

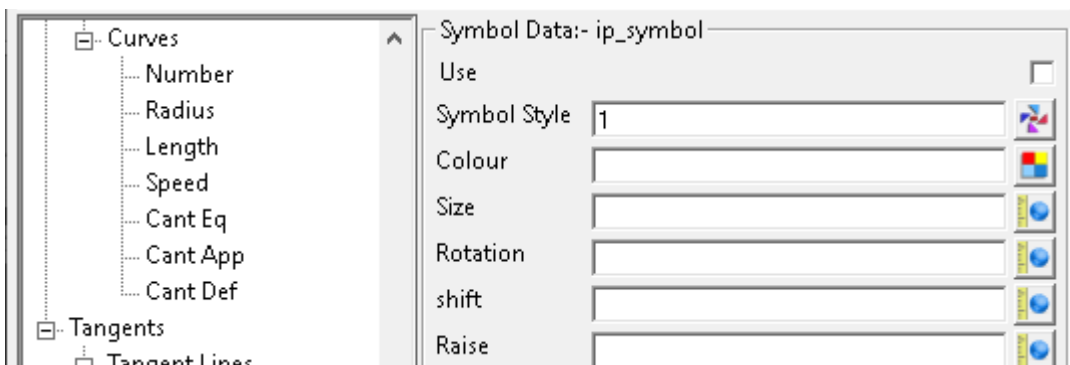
**Text Prefix \* Suffix** custom box ip\_table\_curve\_shift2 =

*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



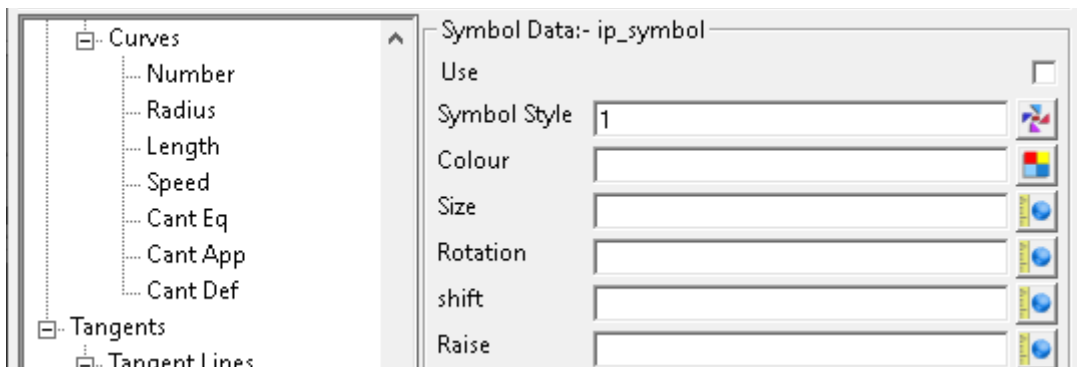
**Label Data:- ip\_table\_curve\_shift2**

**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.***

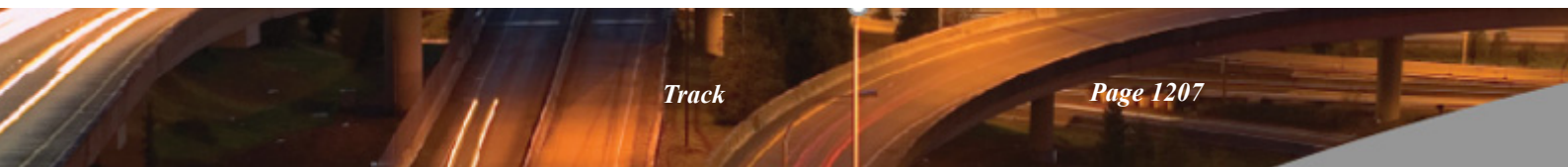
- Text Style**                      text style box                      all styles  
*Text style for the properties of the value labels. For information on textstyles refer to [3.10.3 Textstyle](#).*
- Decimal Places**                      custom box                      3  
*The number of decimal places 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**

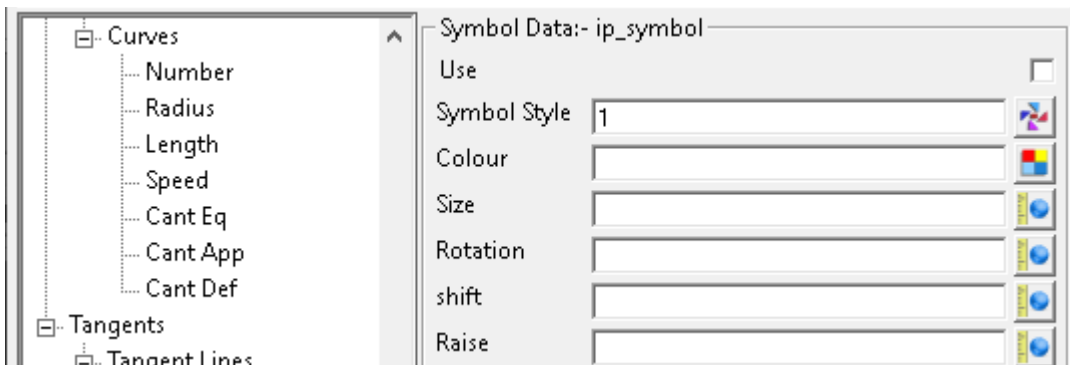


**Label Data:- ip\_table\_curve\_cant\_eq**

- 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 [3.10.3 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 [3.10.3 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.*

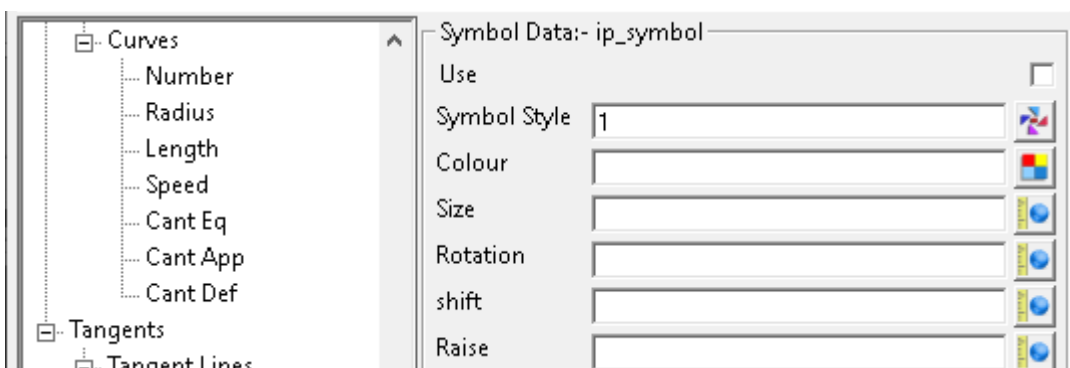
**Text Prefix \* Suffix** custom box

*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 [3.10.3 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 [16.24 Fixed Link - To String](#) or go back to [16.23.10 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.

Layer	Design	▼
Link(s)		↕
Modifier type	Width (Xfall held)	▼
Select string		↖
Side to search	Current side	▼
Use intersection	Closest to CL	▼
Stop short		↖
[-] Chainages		
Alias		abc
[-] Start chainage		
Mode	Start (ref)	▼
Extension ref		↖
[-] End chainage		
Mode	End (ref)	▼
Extension ref		↖
Interval		↖
Comment		abc
Active		<input checked="" type="checkbox"/>

OK | Apply | Finish | Help

**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.*

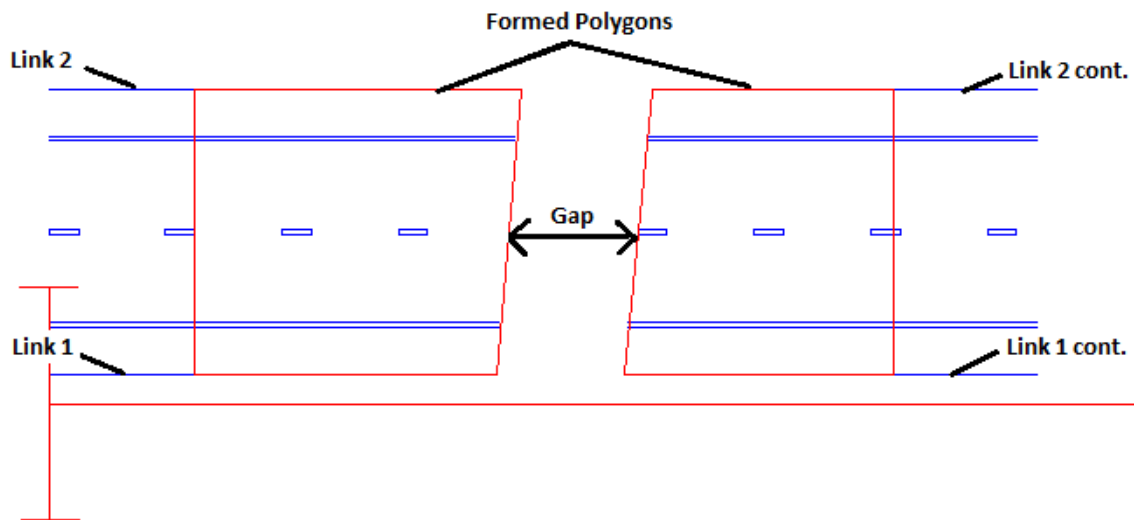
Continue to [16.25 Create Polygon](#) or go back to [16.24 Fixed Link - To String](#).

## 16.25 Create Polygon

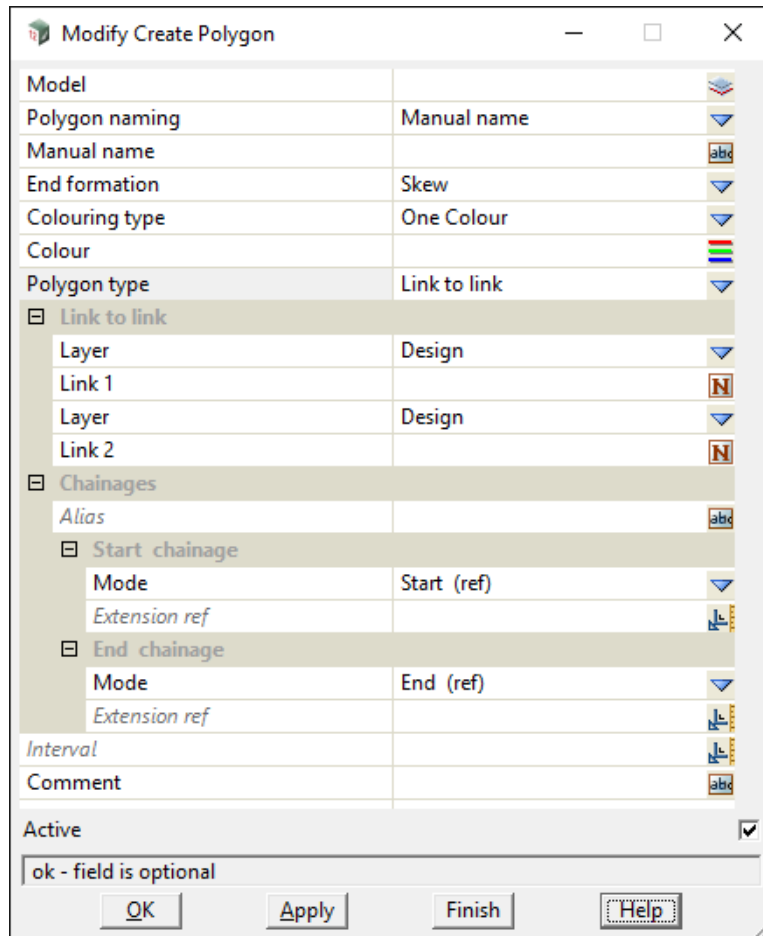
The **Polygon** option creates one or more closed strings between two given links. This option also provides the ability to customise the polygon naming, colouring and end formation type.

**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
<b>Model</b>	model box		available models
<b>Polygon naming</b>	choice box	Manual name	Manual name InnerLink-UserText-OuterLink OuterLink-UserText-InnerLink

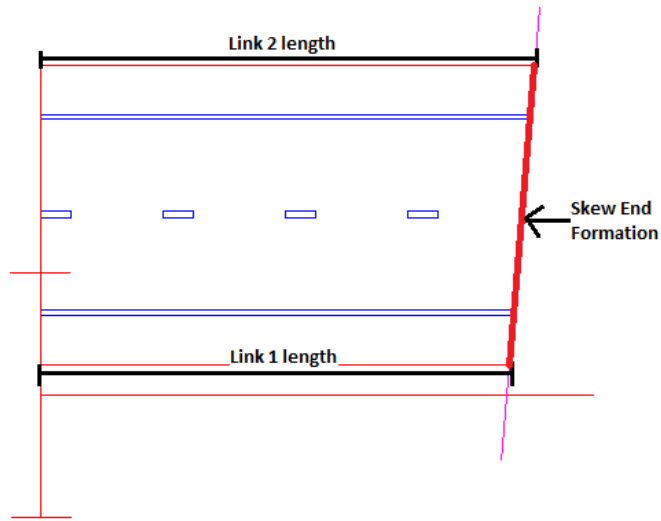
*The model for the polygon/s that are created by this modifier:*

*The naming convention for the polygon/s that are created by this modifier:*

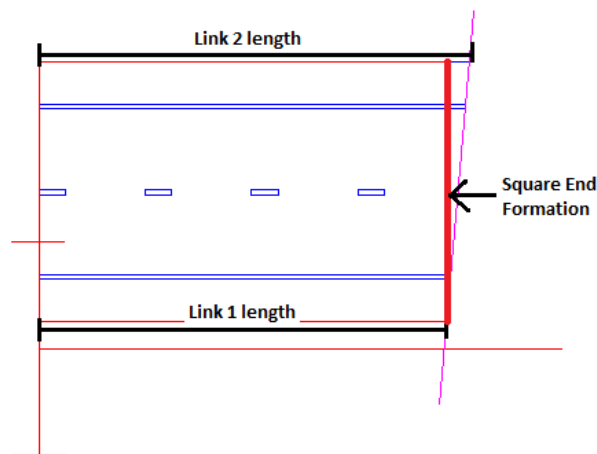
For more information, see [16.25.1 Polygon Naming](#).

<b>End formation</b>	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.



<b>Colouring type</b>	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](#).

<b>Polygon type</b>	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.*

Polygon naming	Manual name
Manual name	abc

### 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.*

Polygon naming	InnerLink-UserText-OuterLink
UserText	abc

### 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.*

Polygon naming	OuterLink-UserText-InnerLink
UserText	abc

### 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.*

Colouring type	One Colour	▼
Colour		■

### 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.*

Colouring type	Inner Link Colour	▼
----------------	-------------------	---

### 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.*

Colouring type	Outer Link Colour	▼
----------------	-------------------	---

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.

Polygon type	Link to link	▼
[-] Link to link		
Layer	Design	▼
Link 1		N
Layer	Design	▼
Link 2		N

**Layer** choice box available Layers  
 The layer containing **Link 1**. For information on Layers, see 20.1.1.2 MTF Links and Layers.

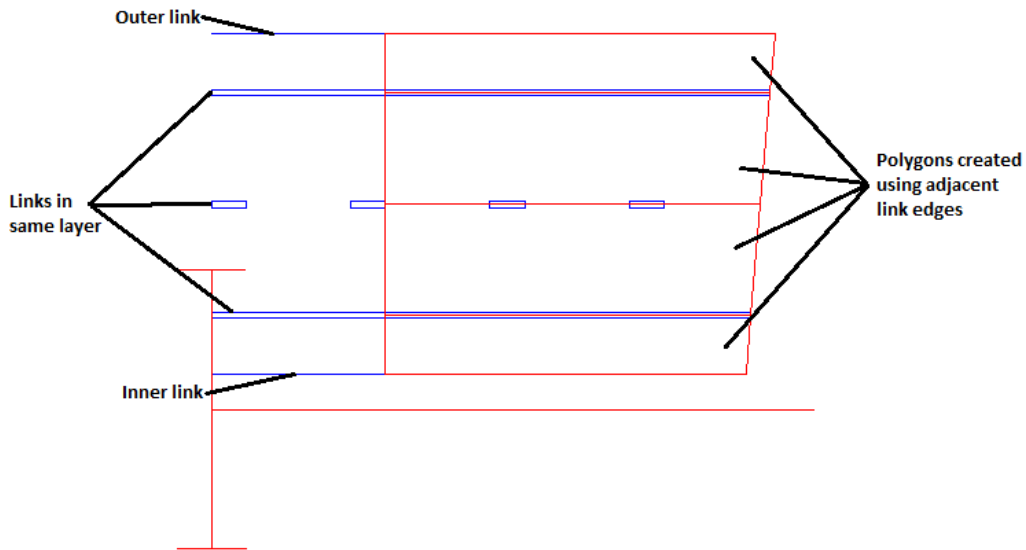
**Link 1** text box  
 The name of the link that will be used to form the one of the edges of the polygon.

**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.



Polygon type	All links between 2 links	▼
☐ All links between 2 links		
Layer	Design	▼
Inner link		N
Outer link		N

**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.*

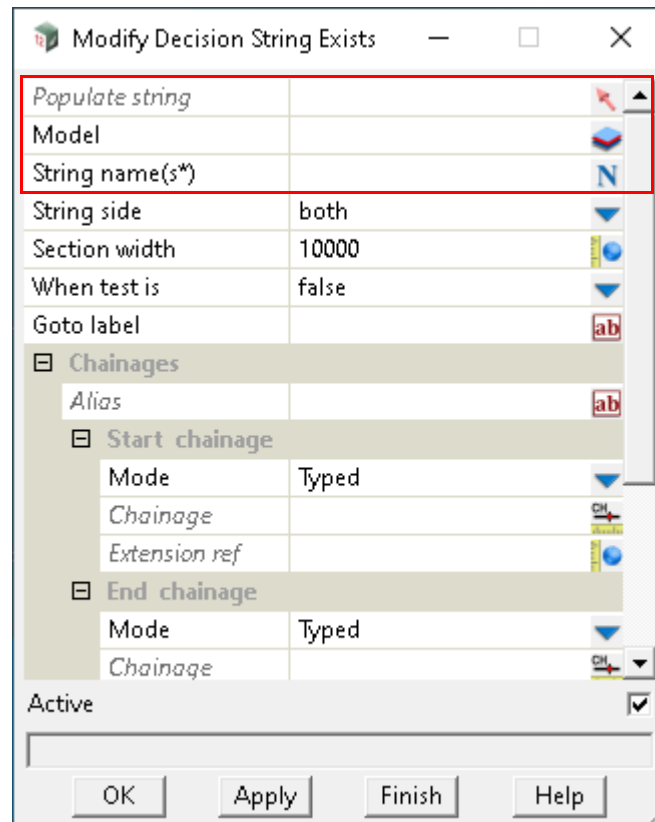
Continue to [16.26 Fixed Decisions - String Exists](#) or go back to [16.25 Create Polygon](#).

## 16.26 Fixed Decisions - String Exists

Now documented in the V15 reference manual

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
-------	-------------	------	---------	--------

<b>Populate string</b>		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.*

<b>Model</b>		model box		available models
--------------	--	-----------	--	------------------

*Model of the string(s) to be tested.*

<b>String name (s)</b>		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

Now documented in the V15 reference manual

See [16.27.1 Common token types](#)

See [16.27.2 Fixed Link Modifiers](#)

See [16.27.3 Interval](#)

See [16.27.4 MTF Create](#)

See [16.27.5 Miscellaneous](#)

See [16.27.6 Snippet](#)

See [16.27.7 Text File Only Modifiers](#)

### 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

- See [16.27.2.1 Fixed - Insert](#)
- See [16.27.2.2 Fixed - Modify](#)
- See [16.27.2.3 Fixed - Decisions](#)
- See [16.27.2.4 Fixed - Boxing](#)
- See [16.27.2.5 Fixed - Remove](#)
- See [16.27.2.6 Fixed - Trim](#)
- See [16.27.2.7 Fixed - Miscellaneous](#)

### 16.27.2.1 Fixed - Insert

- See [16.27.2.1.1 Common types](#)
- See [16.27.2.1.2 Insert a Fixed Link](#)
- See [16.27.2.1.3 Insert a Fixed Link Absolute](#)
- See [16.27.2.1.4 Insert a Fixed Link at a String](#)
- See [16.27.2.1.5 Insert Xfall Point](#)
- See [16.27.2.1.6 Insert Around Arc](#)
- See [16.27.2.1.7 Fixed Link - Insert Xfall Intersect](#)
- See [16.27.2.1.8 Insert Fixed Links from a Template](#)
- See [16.27.2.1.9 Insert Full Template](#)
- See [16.27.2.1.10 Insert Kerb Ramp](#)

#### 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\_centrelines" / (2)"to\_ramp\_centrelines"

- (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 Cubic for 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 20.2.2.2.2.5 Pos -> for more information.

Xfall, see 20.2.2.2.3.5 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 20.2.2.2.1.3 Pos -> Width for more information.

Height, see 20.2.2.2.2.3 Pos -> Height for more information.

Xfall, see 20.2.2.2.3.3 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 20.2.2.2.1.6 <-Pos for more information.

Height, see 20.2.2.2.2.6 <-Pos for more information.

Xfall, see 20.2.2.2.3.6 <-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 20.2.2.2.1.4 Width ->Pos for more information.

Height, see 20.2.2.2.2.4 Height ->Pos for more information.

Xfall, see 20.2.2.2.3.4 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 20.2.2.2.1.7 Pos->Pos: for more information.

Height, see 20.2.2.2.2.7 Pos->Pos: for more information.

Xfall, see 20.2.2.2.3.7 Pos->Pos: for more information.

Slope, N/A

All, see 20.2.2.2.5.1 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 20.2.2.2.3 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 Fixed - 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.

See 20.2.2.2.3.5.1.5 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 a line 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 Decisions - 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 prorated 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 20.2.2.4.1 Chainage 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

- See [16.27.4.1 Common Types](#)
- See [16.27.4.2 Create Shapes](#)
- See [16.27.4.3 Create Shapes \(Extrude\)](#)
- See [16.27.4.4 Create Shapes \(2 layers\)](#)
- See [16.27.4.5 Create Strings](#)
- See [16.27.4.6 Create Tins](#)
- See [16.27.4.7 Create Sections, Strings and Tins](#)
- See [16.27.4.8 Create Polygon](#)
- See [16.27.4.9 String Properties](#)
- See [16.27.4.10 Attribute Links](#)
- See [16.27.4.11 Attribute Shapes](#)

### 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.

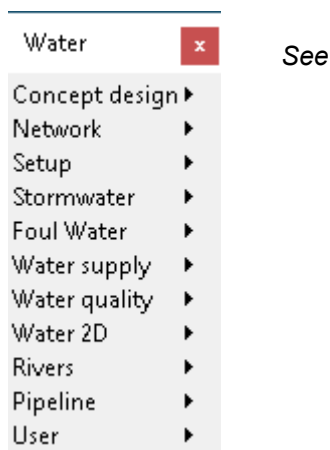
See 20.6.14.1 Defining Link Variables for more information.

Continue to [17 Water](#) or go back to [16.27 MTF Modifiers File Format](#).



# 17 Water

There has been changes to the **Water** chapter in the **12d Model Reference manual**.  
In **V15** the **Water** menu has been totally rearranged.



- See [17.1 Stormwater Design](#)
- See [17.2 Concept Water Supply \(CWS\)](#)
- See [17.3 Quick Water Network \(QWN\)](#)
- See [17.4 Water Log Line \(wll\) Messages](#)
- See [17.5 Property Controls And House Connections](#)
- See [17.6 Foul Water Tools](#)
- See [17.7 AR&R Pre-Burst](#)
- See [17.8 Drainage.4d File Editor](#)
- See [17.9 Adjust Node Locations](#)
- See [17.10 Create drainage.4d from Model](#)
- See [17.11 Create Drainage from Points and Line](#)
- See [17.12 Convert Water to Super Strings](#)
- See [17.13 Convert to XML drainage.4d](#)
- See [17.14 TUFLOW Source String Utility](#)
- See [17.15 ESTRY Culverts](#)
- See [17.16 Xsection Interpolation](#)
- See [17.17 Stormwater](#)
- See [17.18 Aquaplaning Risk Assessment](#)
- See [17.19 Catchments From Strings](#)
- See [17.20 Hydrographs from Peaks](#)
- See [17.21 Stormwater Inlet Capacities](#)
- See [17.22 Capture Curve Viewer](#)

- See [17.23 Triangulate Grate Levels](#)
- See [17.25 2D Quick Analysis](#)
- See [17.26 TUFLOW TMO TIN Settings](#)
- See [17.27 DNE Analysis >Flood Extents Tab](#)

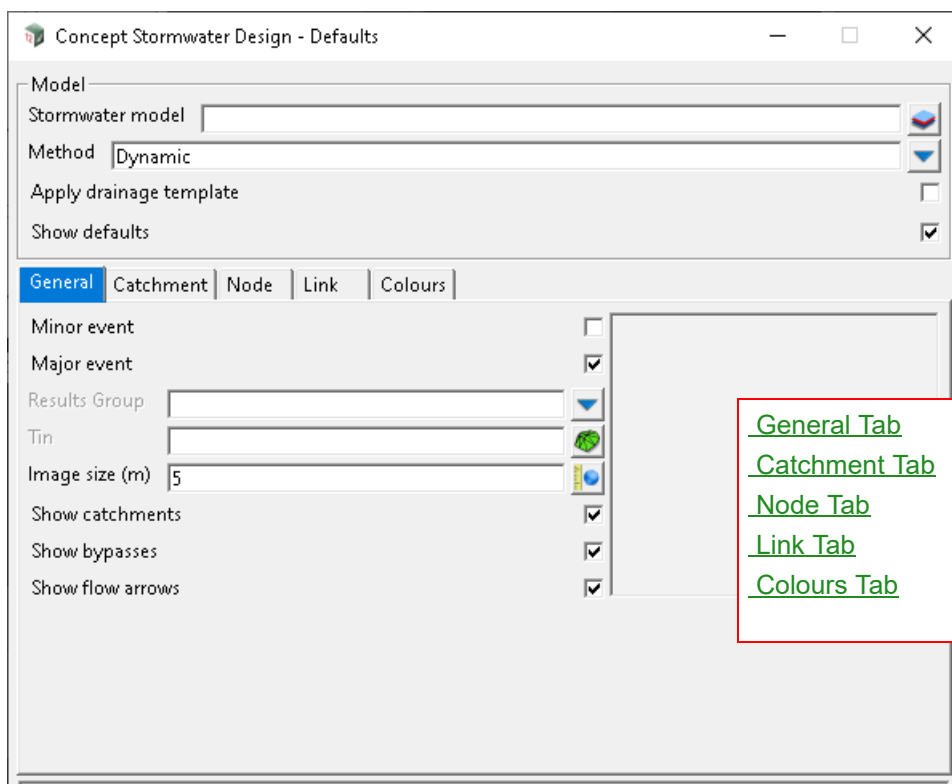
## 17.1 Stormwater Design

**Position of menu:** Water =>Concept design =>Stormwater design

Now documented in the V15 reference manual

This option provides a simplified interface for creation and editing of stormwater models for 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 WNE will still be required to set items such as that for your network.

Selecting **Stormwater design** displays the **Concept Stormwater Design - Defaults** panel.



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 drainage 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 panel will either hide or show additional options.

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

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

### Buttons at Bottom

<b>Set</b>	button
------------	--------

*Sets the defaults and opens the CSD main panel.*

**Finish** button

*Abandons any changes made in the panel and exits the panel.*

### 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

*The 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

*The 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

#### Catchment

**Area (Ha.)** real box 1  
*Default catchment area to be adopted for new catchments.*

**Impervious %** real box 50  
*The impervious proportion of the total catchment area, as a percentage.*

**Hydrology File** file box \$LIB\UTOPIA 1987.12dhydro  
*Hydrology file to be used for the analysis.*

**Graph type** choice box Rainfall/Runoff  
 Rainfall/Runoff, Runoff, Rainfall, Losses, Excess Rainfall  
*Default graph type to use for catchment results display.*

#### Hydrology

*Note: Widgets in this group will change based on choices made in the Hydrology and Infiltration choice boxes.*

**Hydrology** choice box ILSAX 2  
 ILSAX 2, Laurenson, NZ SCS Curves, EPA SWMM, SCS Method

*The hydrology method to be adopted for dynamic analysis (dynamic only).*

**Infiltration** choice box Horton  
 Horton, Initial and continuing SCS Curves, Green Ampt

*The infiltration method to be adopted for dynamic analysis (dynamic only). The available methods are dependent on the selected hydrology. Options are:*

*Hortons (ILSAX 2, EPA SWMM)*

*Initial and continuing (Laurenson)*

*SCS Curves (EPA SWMM, NZ SCS Curves, SCS Method)*

*Green Ampt (EPA SWMM)*

**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

*The Antecedent Moisture Condition (AMC) to be used for minor event analysis (only available for dynamic ILSAX2 Hydrology).*

**Width** real box 1000

*The catchment width in metres (only available for dynamic EPA SWMM).*

**Slope (%)** real box 1

*The catchment slope in % (only available for dynamic EPA SWMM).*

### Pervious

*Note: Widgets 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 Direct\*Fy

*The runoff coefficient method for rational analysis (rational only).*

**1hr-10yr intensity** real box 10

*Rainfall intensity for the 10-year ARI (rational only).*

**Impv C (minor)** real box 0

*The impervious C for a minor event (rational only).*

**Impv C (major)** real box 0

*The impervious C for a major event (rational only).*

**C maximum** real box 0

*The maximum C value for rational analysis (rational only).*

### Pervious

**Tc (minor)** real box 10

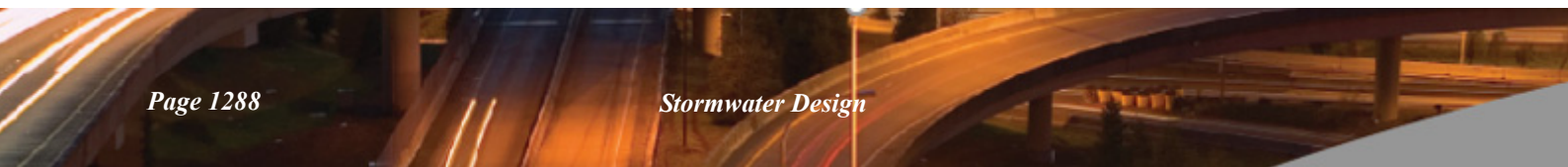
*Time of concentration to be used for the **pervious** portion of the catchment in the minor event analysis (only available for ILSAX2, NZ SCS and SCS Method)*

**Tc (major)** real box 10

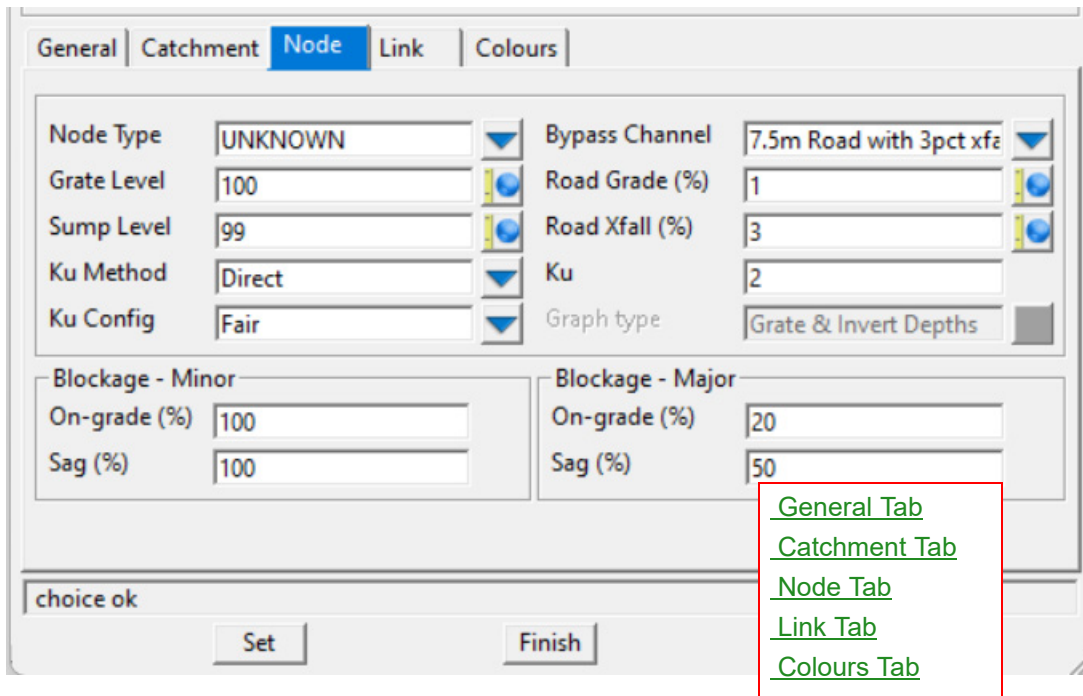
*Time of concentration to be used for the **pervious** portion of the catchment in the major event analysis (only available for ILSAX2, NZ SCS and SCS Method)*



<b>Slope (%)</b>	real box	1
<i>Average slope of the <b>pervious</b> portion of the catchment (only available for Laurenson and EPA SWMM).</i>		
<b>Retardance</b>	real box	0.025
<i>Resistance to runoff of the <b>pervious</b> portion of the catchment (only available for Laurenson and EPA SWMM).</i>		
<b>Storage</b>	real box	5
<i>The amount of catchment storage (ponding) to be applied to the <b>pervious</b> portion of the catchment following the start of runoff (dynamic only).</i>		
<b>Loss</b>	choice box	
<i>Infiltration losses to be applied to the <b>pervious</b> 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.</i>		
<b>Impervious</b>		
<b>Tc (minor)</b>	real box	5
<i>Time of concentration to be used for the <b>impervious</b> portion of the catchment in the minor event analysis (only available for Horton and SCS Curves).</i>		
<b>Tc (major)</b>	real box	5
<i>Time of concentration to be used for the <b>impervious</b> portion of the catchment in the major event analysis (only available for Horton and SCS Curves).</i>		
<b>Slope (%)</b>	real box	1
<i>Average slope of the <b>impervious</b> portion of the catchment (only available for Laurenson and EPA SWMM).</i>		
<b>Retardance</b>	real box	0.025
<i>The resistance to runoff of the <b>impervious</b> portion of the catchment (only available for Laurenson and EPA SWMM).</i>		
<b>Storage</b>	real box	1
<i>The amount of catchment storage (ponding) to be applied to the <b>impervious</b> portion of the catchment following the start of runoff (dynamic only).</i>		
<b>Loss</b>	choice box	
<i>The infiltration losses to be applied to the <b>impervious</b> 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).</i>		



### Node Tab



**Node Type** choice box

*Default node type to be used for creation of new nodes (types list from drainage.4d).*

**Grate Level** real box 100

*Default grate level to adopt for creation of new nodes.*

**Sump Level** real box 99

*Default sump level to adopt for creation of new nodes.*

**Ku Method** choice box Direct

*Default Ku Method to adopt for creation of new nodes.*

**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.*

**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

*Default channel shape to adopt for creation of new bypass channels.*

**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.*

**Ku** real box 2

*Default Ku value to adopt for creation of new nodes. Only available for a Ku Method of Direct.*

<b>Graph type</b>	real box	Grate & Invert Depths
-------------------	----------	-----------------------

*Default graph type to use for node results display.*

#### **Blockage - Minor**

<b>On- grade (%)</b>	real box	100
----------------------	----------	-----

*Blockage to be applied to on-grade nodes in the minor event, as a percentage.*

<b>Sag (%)</b>	real box	100
----------------	----------	-----

*Blockage to be applied to sag nodes in the minor event, as a percentage.*

#### **Blockage - Major**

<b>On- grade (%)</b>	real box	20
----------------------	----------	----

*Blockage to be applied to on-grade nodes in the major event, as a percentage.*

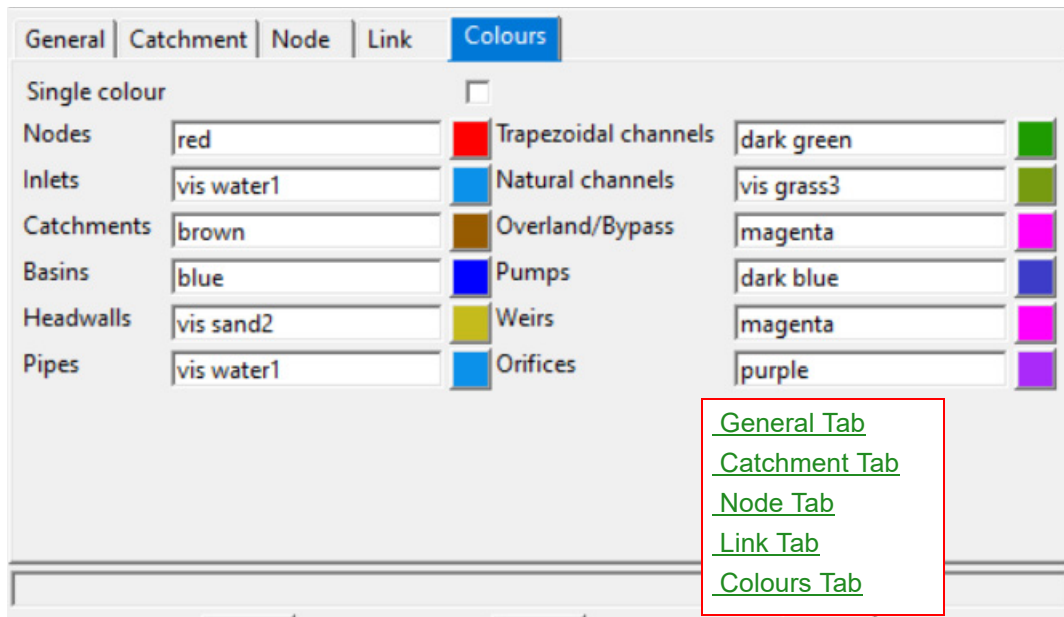
<b>Sag (%)</b>	real box	50
----------------	----------	----

*Blockage to be applied to sag nodes in the major event, as a percentage.*

## Link Tab

<b>Link Type</b>	choice box	RCP
<i>Default link type to be used for creation of new links (types list from drainage.4d).</i>		
<b>Diameter</b>	real box	0.375
<i>Default diameter to be used for creation of new links.</i>		
<b>Manning's n</b>	real box	0.013
<i>Default roughness to be used for creation of new links.</i>		
<b>US sump offset (m)</b>	real box	0
<i>Default link upstream invert offset value from the node sump for creation of new links.</i>		
<b>DS sump offset (m)</b>	real box	0.05
<i>Default link downstream invert offset value from the node sump for creation of new links.</i>		
<b>Inlet blockage (%)</b>	integer box	0
<i>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.</i>		
<b>Sediment depth (m)</b>	real box	0
<i>Default depth of sediment in the link.</i>		
<i>NOTE: This is applied to the full link length, not just the inlet, and consequently affects available link volume.</i>		
<b>Weir coeff.</b>	real box	1.7
<i>Default coefficient to be used for Weir links.</i>		
<b>Orifice coeff.</b>	real box	0.7
<i>Default coefficient to be used for Orifice links.</i>		
<b>Graph type</b>	choice box	All Link Results
<i>Default graph type to use for link results display.</i>		

### Colours Tab



<b>Single colour</b>	tick box	not ticked
<i>Allows a single colour to be used for the entire network.</i>		
<b>Nodes</b>	colour box	red
<i>Default colour for nodes with no grate inflow.</i>		
<b>Inlets</b>	colour box	vis water1
<i>Default colour for nodes with grate inflow.</i>		
<b>Catchments</b>	colour box	brown
<i>Default colour for catchment type nodes (no grate capture and no outlet link).</i>		
<b>Basins</b>	colour box	blue
<i>Default colour for basin type nodes (have a basin curve).</i>		
<b>Headwalls</b>	colour box	vis sand2
<i>Default colour for headwall type nodes.</i>		
<b>Pipes</b>	colour box	vis water1
<i>Default colour for pipe type links.</i>		
<b>Trapezoidal channels</b>	colour box	dark green
<i>Default colour for trapezoidal channel type links.</i>		
<b>Natural channels</b>	colour box	vis grass3
<i>Default colour for natural channel type links.</i>		
<b>Overland/Bypass</b>	colour box	magenta
<i>Default colour for bypass channels / overland flow routes.</i>		
<b>Pumps</b>	colour box	dark blue
<i>Default colour for pump type links (have a pump hydraulic function).</i>		
<b>Weirs</b>	colour box	magenta

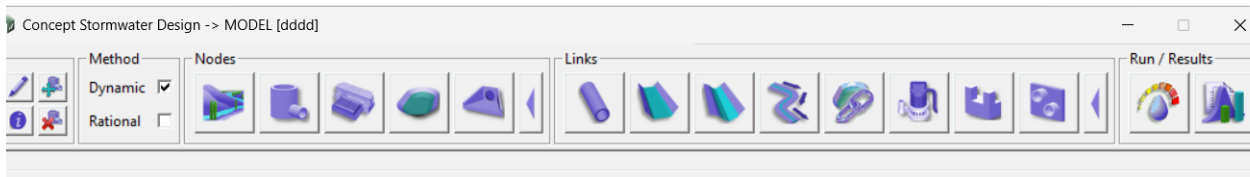
*Default colour for weir type links (have a weir hydraulic function).*

**Orifices**                      colour box                      purple

*Default colour for orifice type links (have an orifice hydraulic function).*



## Main Panel





















The main CSD panel is broken into four (4) distinct areas:

1. Tools
2. Method
3. Nodes
4. Links
5. Run / Results

All buttons have a left and right click functionality defined for them. 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] 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 Catchment button on the left side of the Nodes area will display:

**<Catchment> [create] [] [edit]**

which indicates that a left mouse click will create a new catchment node, middle mouse click will do nothing and a right mouse click will allow editing of an existing catchment node. The panel may also be enlarged/reduced in size by clicking the see more/see less buttons. The buttons on the panel are described below:

Image	Left Button Click	Middle Button Click	Right Button Click	Pop-Up
	Edit Object	Edit Node	Edit Link	
	Object Info		Defaults	
	Move node			
	Delete		Delete node + links	
<b>NODES</b>				
	Create catchment node		Edit Catchment	
	Create node (no capture)		Edit Node	
	Create inlet node		Edit Node	
	See less/see more nodes			
<b>NODES (expanded)</b>				
	Create basin node		Edit Node	
	Create headwall node		Edit Node	
<b>LINKS</b>				
	Create pipe link		Edit Link	
	Create trapezoidal channel link		Edit Link	
	See less/see more links			
<b>LINKS (expanded)</b>				
	Create natural channel link		Edit Link	
	Create bypass channel link		Edit Link	
	Create pump link		Edit Link	
	Create weir link		Edit Link	
	Create orifice link		Edit Link	

Creating any of the objects will prompt for the location for the new object and requires selection. Editing any of the object also prompts for the object to be edited and once selected, will open

either the Edit Catchment, Edit Node or Edit Links panel based on the object type selected.

The **Edit Node**, **Edit Link** and **Edit Catchment** panels are described below.

See [Edit node](#)

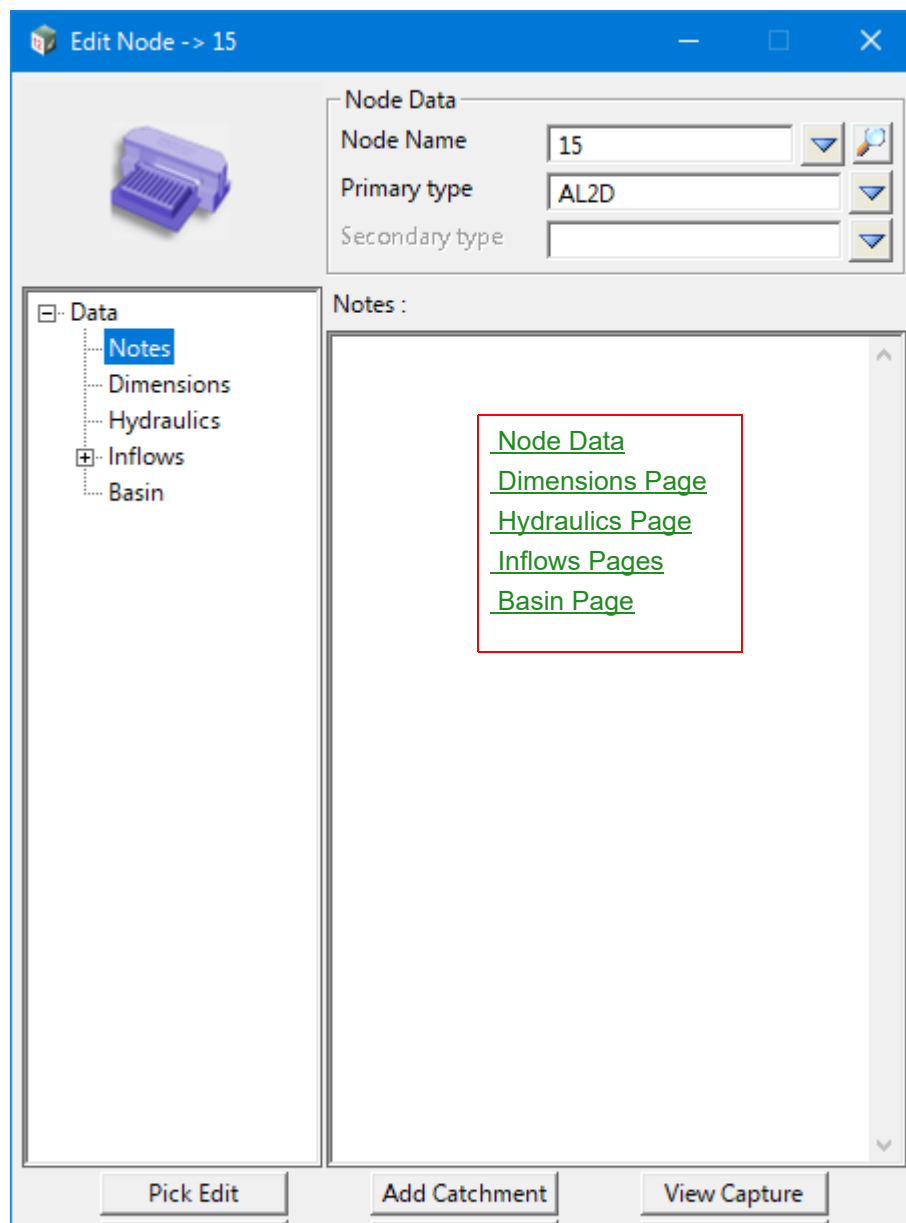
See [Edit Link](#)

See [17.1.1 Catchment Parameters Panel](#)

### Edit node

Selecting a node to edit opens the Edit Node panel. The top section is relevant to the node base parameters while the lower section is dependent on the page selected in the tree on the left.

The panel widgets are described below.



### 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.

**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.

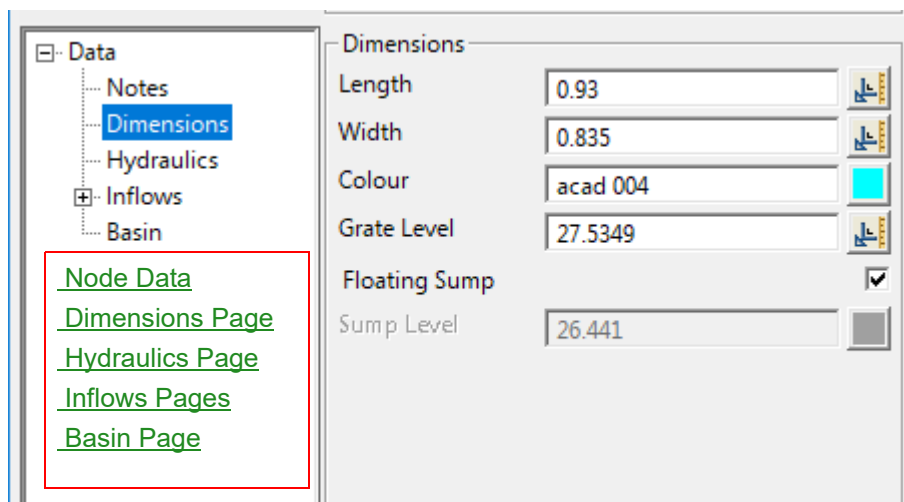
**Primary type**                      choice box

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).

**Dimensions Page**



**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.*

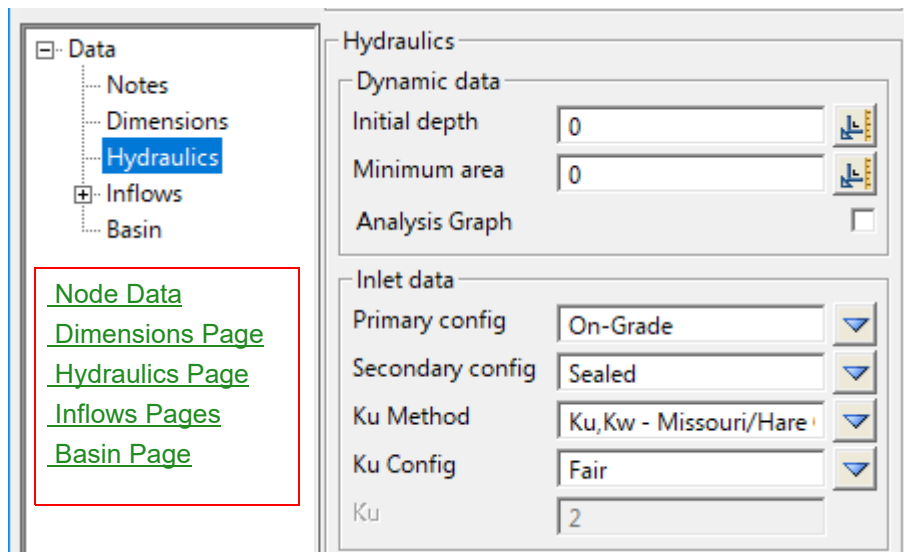
**Floating Sump** tick box

*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.*

**Hydraulics Page**



**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

*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 [21.3.4.4.2.2.1.2 Ku - Node Pressure Losses](#) for further details.*

**Ku Config** choice box

Configuration to adopt for Ku chart selection. Refer to Section [21.3.4.4.2.2.1.2 Ku - Node Pressure Losses](#) for further details.

**Ku** real box

Manually set ku value. Only available for a Ku Method of "Direct".

**Inflows Pages**

Inflows to a node fall into two typical categories:

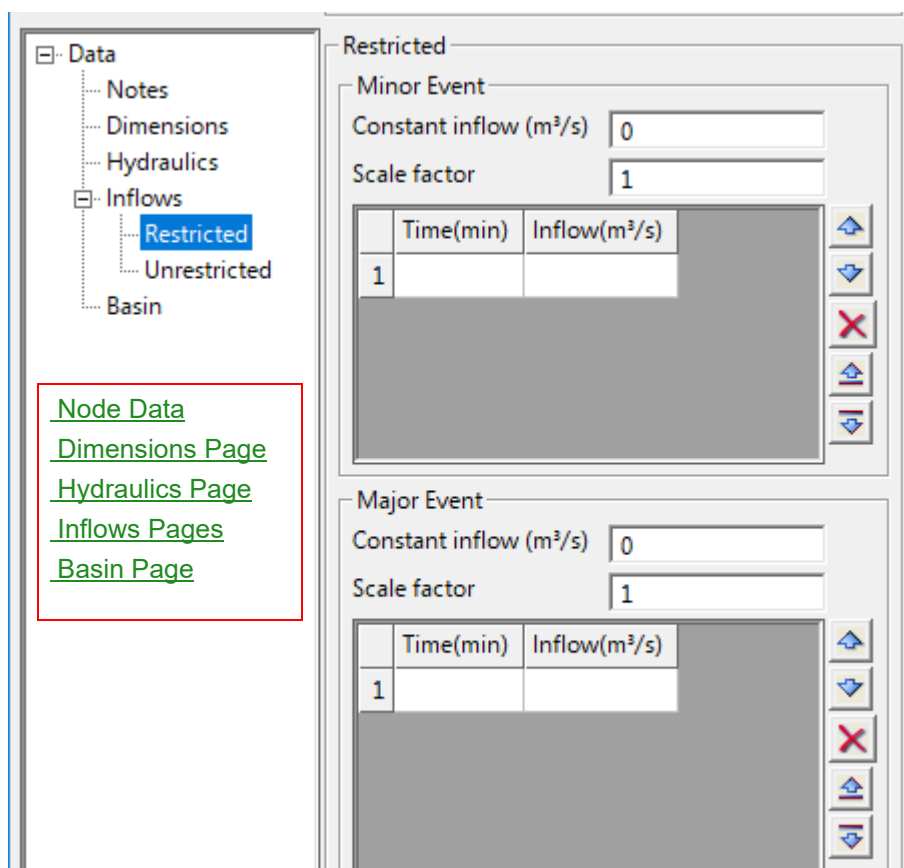
Restricted

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.



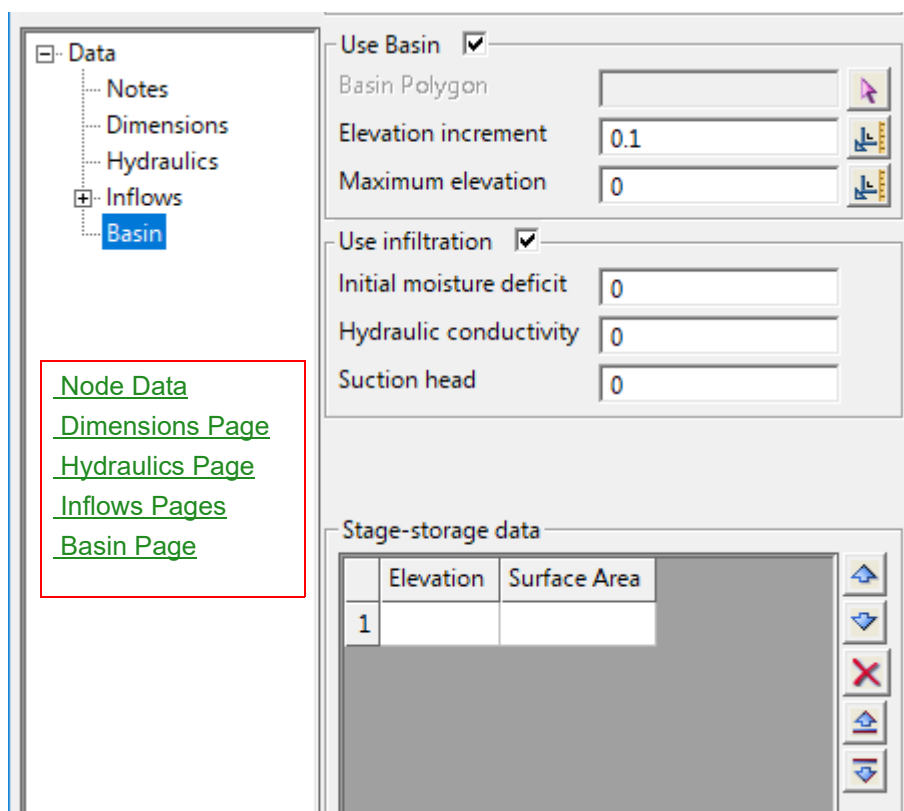


**Scale factor** real box  
*Scale factor to be applied to the inflows (constant or varied).*

**Time (min) / Inflow(m3/s)** real box  
*Grid for input of an inflow hydrograph.*

**Basin Page**

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 page 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 page.



- [Node Data](#)
- [Dimensions Page](#)
- [Hydraulics Page](#)
- [Inflows Pages](#)
- [Basin Page](#)

**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

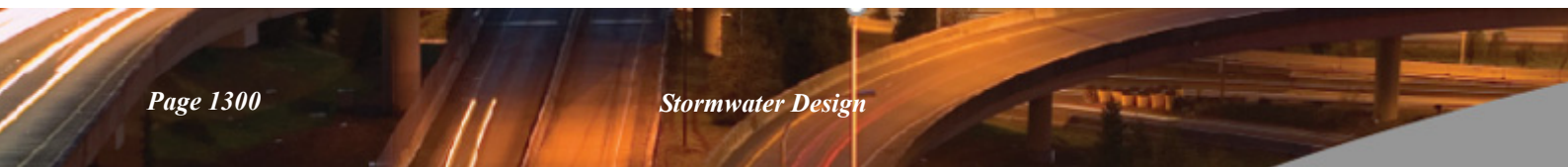
*Not currently implemented - for future development. Allows selection of a polygon to use for creation of a depth-area curve for basin storage.*

**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

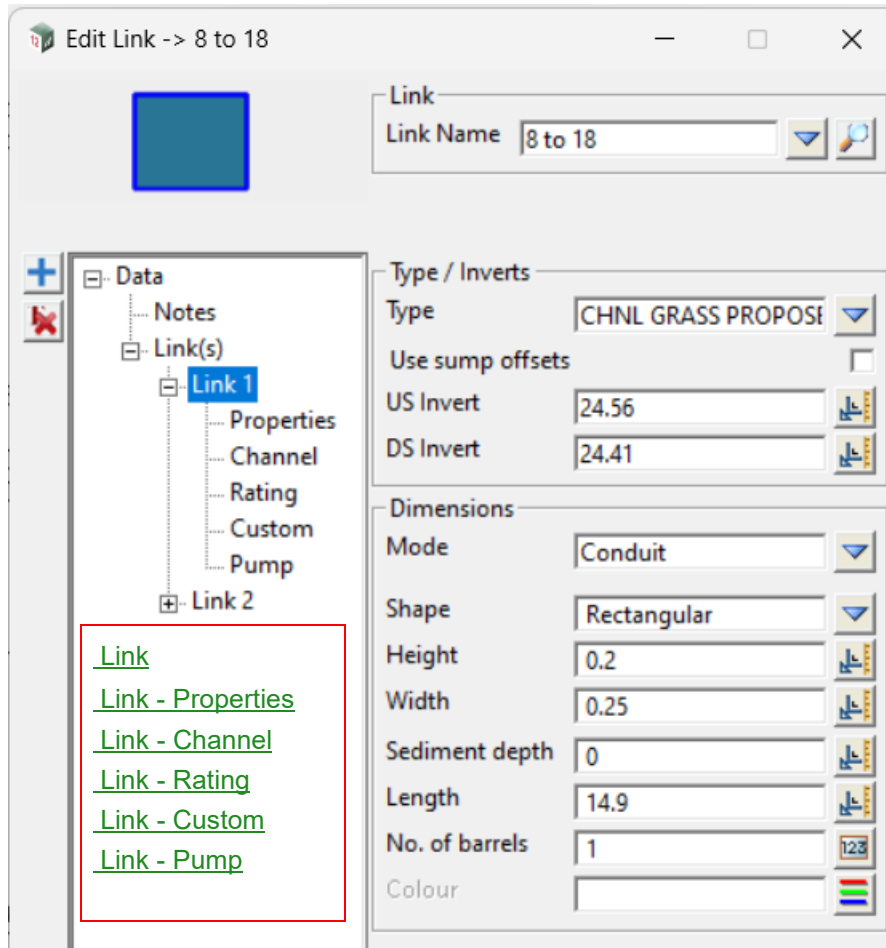
*Saturated hydraulic conductivity, measured in mm per hour. Represents the ease that water can travel through the soil whilst it is saturated. Tends to be high for sandy soils but low for compact clays. Used in the Green-Ampt infiltration calculations.*

**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.*

### Edit Link

Selecting a link to edit opens the Edit Link panel. 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 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.



The panel widgets are described below.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### 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.*

## Link

**Link Name** choice box purple

*Allows selection of a link to edit.*



icon

search for link

*Allows for searching a link by name.*

## 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:

<i>Circular</i>	<i>Rectangular</i>	<i>Trapezoidal</i>
<i>Channel</i>	<i>Egg</i>	<i>Horseshoe</i>
<i>Gothic</i>	<i>Catenary</i>	<i>Semi circular</i>
<i>Triangular</i>	<i>Parabolic</i>	<i>Horiz ellipse</i>
<i>Vert ellipse</i>	<i>Arch</i>	<i>Rect open</i>
<i>Rect triangular</i>	<i>Rect round</i>	
<i>Basket handle</i>	<i>Mod basket handle</i>	
<i>Power</i>	<i>Custom</i>	

**Orifice mode choices are:**

*Circular*

*Rectangular*

**Weir mode choices are:**

*Rectangular*

*Trapezoidal*

*Triangular*

**Height** real box

??.

**Width** real box

??.

**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.*

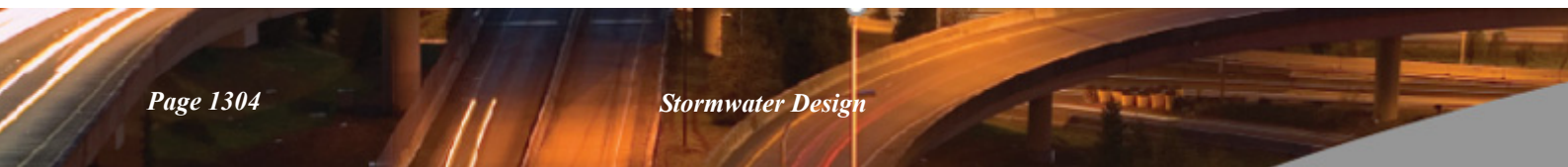
**No. of barrels** integer box 1

*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 Widgets (Note: All dimensions are in metres u.n.o.)

Shape	Widgets available	Description
Circular	Diameter	Link diameter
Rectangular	Height	Link height
	Width	Link width
Trapezoidal	Maximum height	Maximum height of the trapezoidal link
	Base width	The bottom width of the trapezoidal link
	Top width	The top width of the trapezoidal link
Channel	Maximum height	Displays the height of the link set in the Channel tab
	Maximum width	Displays the maximum width of the link set in the Channel tab
	Top width	Displays the width at the top of the channel set in the Channel tab
	Section shape	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	Maximum height of the link
	Top width	Width of the top of the triangle
Parabolic	Maximum height	Maximum height of the link
	Top width	Width of the top of the parabola
Horiz ellipse	Maximum height	Maximum height of the link
	Maximum width	Maximum width of the link
Vert ellipse	Maximum height	Maximum height of the link
	Maximum width	Maximum width of the link
Arch	Maximum height	Maximum height of the link
	Maximum width	Maximum width of the link
Rect open	Maximum height	Maximum height of the link
	Width	Width of the link
Rect triangular	Maximum height	Overall height of the link. Should be greater than the triangle height.
	Triangle height	Height of the triangular bottom of the shape
	Top width	Width of the rectangular top of the shape
Rect round	Maximum height	Overall height of the link. Should be greater than the bottom radius.
	Bottom radius	Radius of the circular bottom of the shape
	Top width	Width of the rectangular top of the shape
Basket handle	Maximum height	Maximum height of the link
Mod basket handle	Maximum height	Overall height of the link. Should be greater than the top radius.
	Top radius	Radius of the circular top of the shape
	Bottom width	Width of the rectangular bottom of the shape
Power	Maximum height	Overall height of the link
	Power	Exponent of the curve
	Top width	Width of the top of the curve
Custom	Relies on the custom dimensions provided on the Custom tree page	



The table below shows how the widgets change for Weir mode

### Weir Mode Widgets

Shape	Widgets available	Description
Rectangular	Maximum height	Maximum height of the weir
	Maximum width	Maximum width of the weir
Trapezoidal	Maximum height	Maximum height of the trapezoidal weir
	Width	The bottom width of the trapezoidal weir
	Top width	The top width of the trapezoidal weir
Triangular	Maximum height	Maximum height of the triangular weir
	Top width	Top width of the triangular weir

The table below shows how the widgets change for other Link hydraulic modes

### Other Mode Widgets

**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. Relies on data input on the Pump tree page	Diameter of attached rising main
Rating Curve	Depth discharge	Relies on data input on the Rating tree page	
	Head discharge	Relies on data input on the Rating tree page	

### Link - Properties

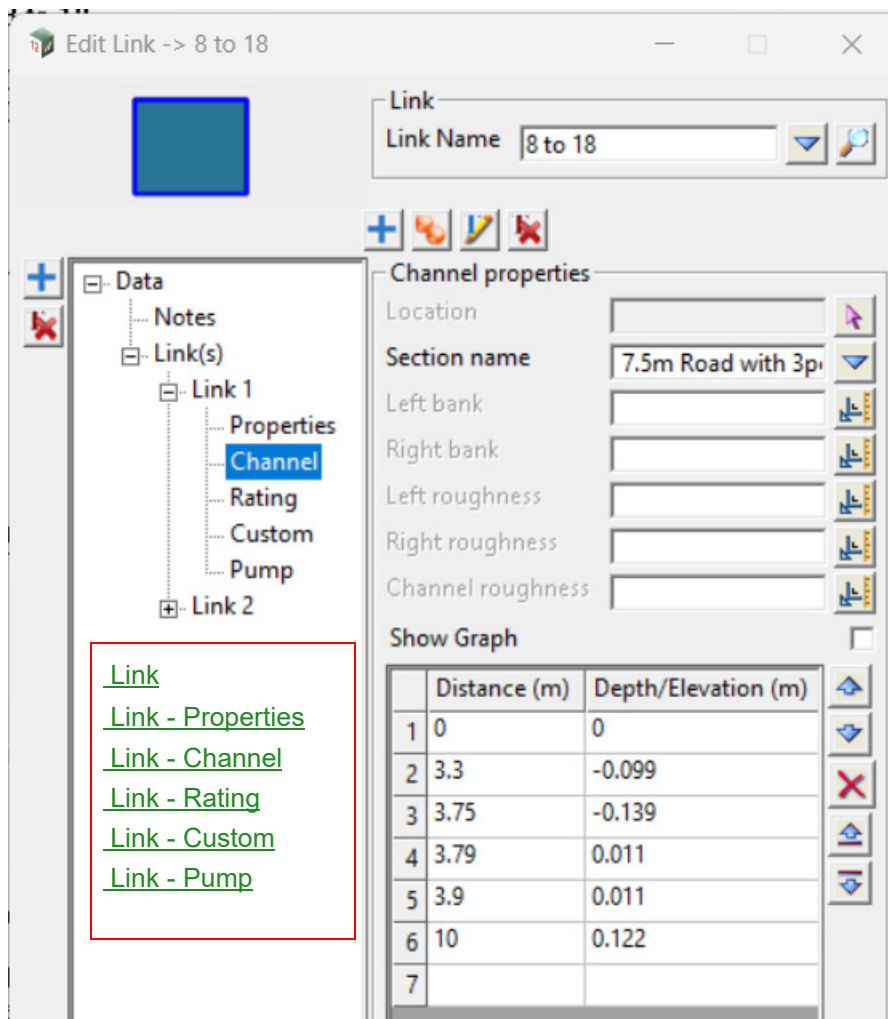
The link properties page is dynamic, in that the widgets appearing on the page are related to the hydraulic mode selected on the main page of the selected link. The table below summarises the displayed widgets for each mode.

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

### 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 page is where the data is set for this.

The widgets on the Channel page are described below.



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.*

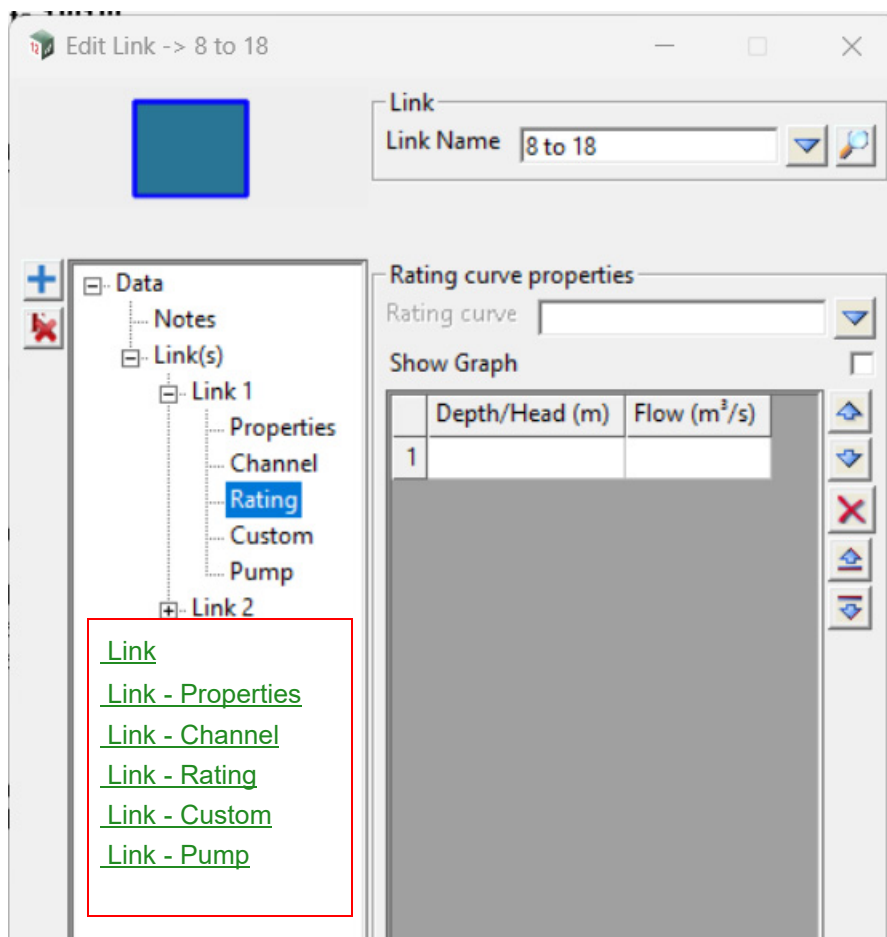
**Distance/Depth/Elevation** Grid box

*For defining the channel profile.*

## 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.*

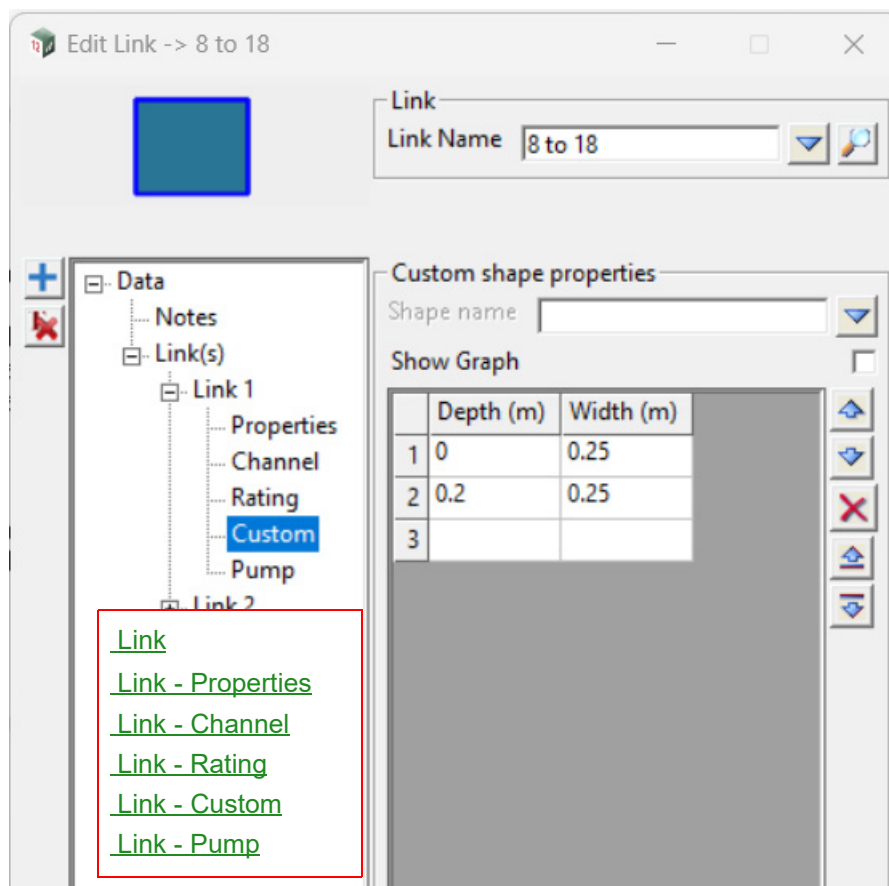
**Depth/Head/Flow** grid box

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.

**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.

**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.

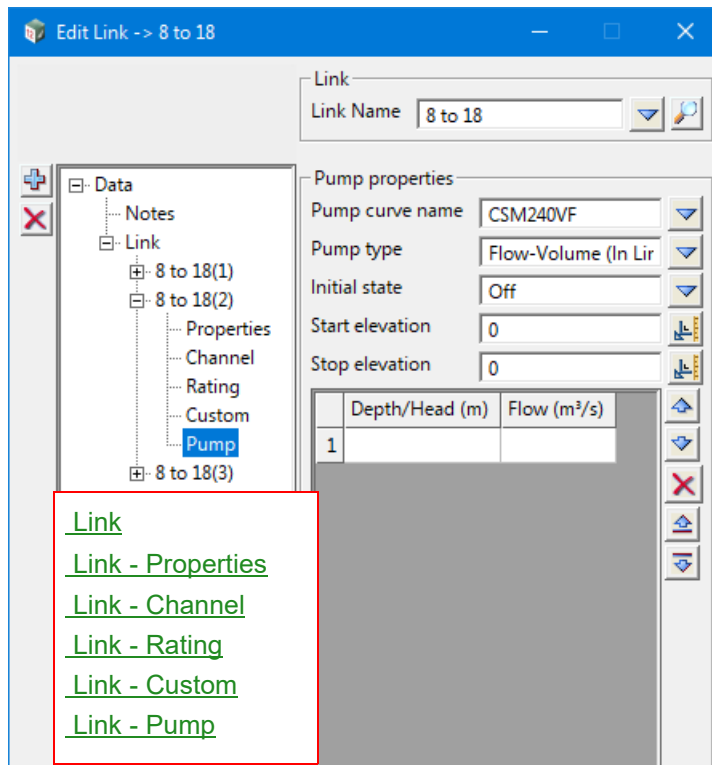
**Depth/Width** grid box

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.

**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 widgets on the Pump page 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 [21.3.4.4.5.1 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.*

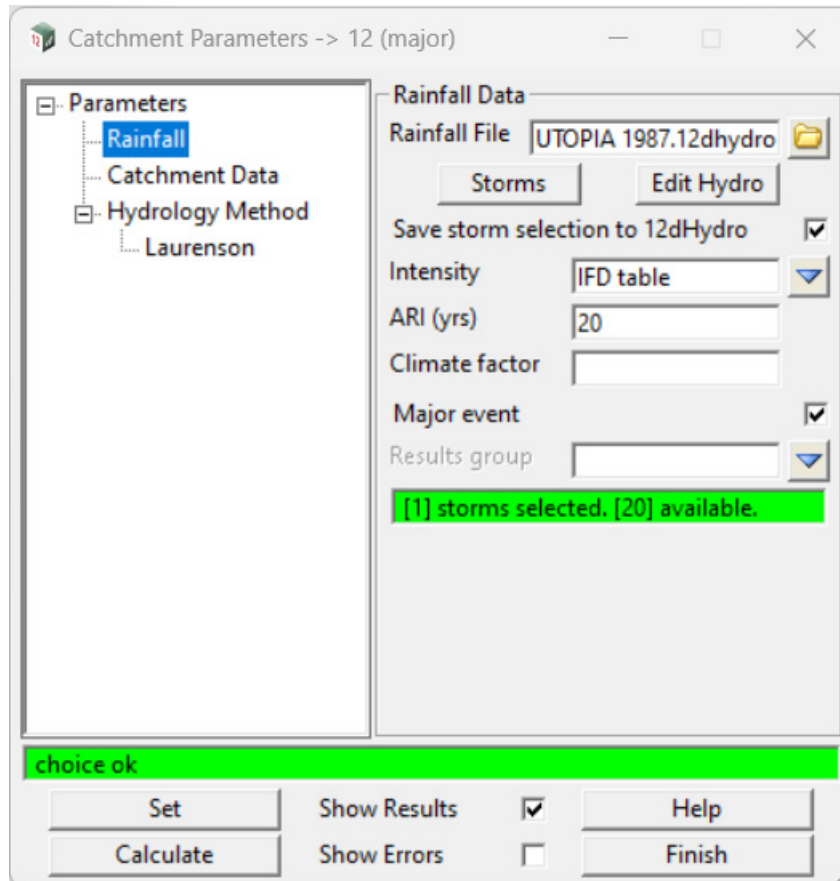
**Depth/Head/Flow** grid box

*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.*



## 17.1.1 Catchment Parameters Panel

Editing a catchment opens the Catchment Parameters panel. Various catchment and hydrology data can be set by selecting the relevant pages on the Tree displayed on the left side of the panel.



The widgets on the **Rainfall** tree page are described below.

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Rainfall Data

<b>Rainfall File</b>	File box	UTOPIA 1987.12hydro	
----------------------	----------	---------------------	--

*Hydro file to use for analysis. See [21.5.1 Hydro File Editor](#).*

<b>Storms</b>	button		Select Storms panel
---------------	--------	--	---------------------

*Storm temporal patterns, found in the hydro file, can be selected for analysis.*

<b>Edit Hydro</b>	button		Edit Hydro panel
-------------------	--------	--	------------------

*Edit the specified hydro file.*

<b>Save storm selection to 12dHydro</b>	tick box	ticked	
---	----------	--------	--

*Save the selected storm data to the specified hydro file.*

<b>Intensity</b>	choice box		
------------------	------------	--	--

*Rainfall intensity method to be used for analysis. Possible options, dependent on data in the hydro file, are:*

IFD Table

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

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 Water Network Editor (WNE). Typing a new name into the choice box will create a new item in the list of available results groups.

#### 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

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

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.

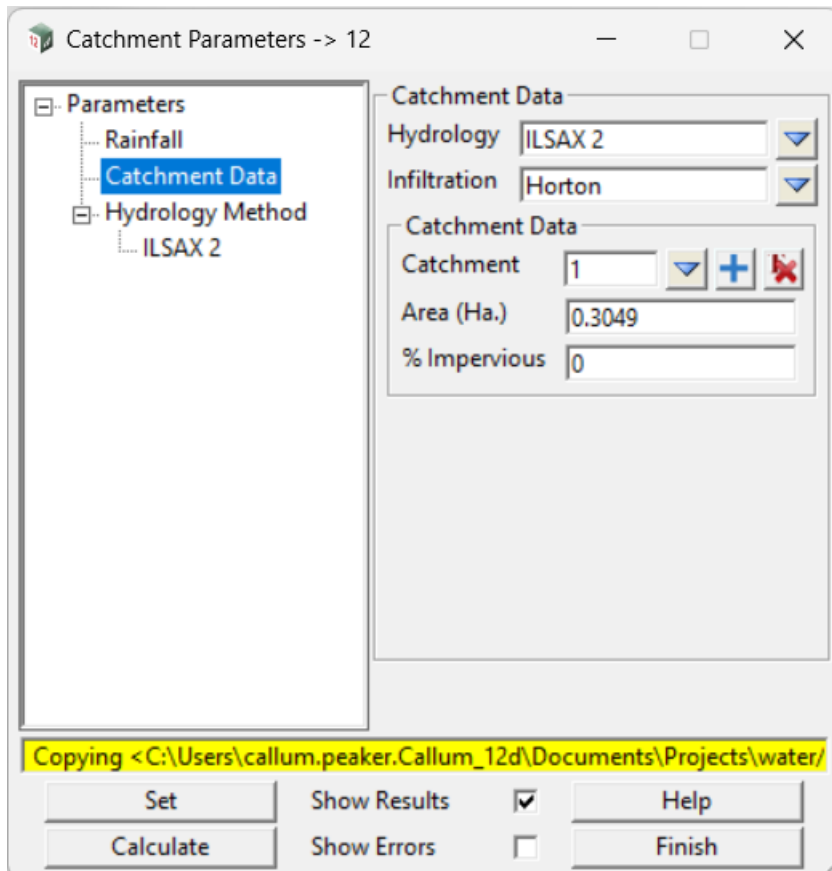
**Help** button

Opens the reference manual.

**Finish** button

Finishes the Catchment Parameters panel.

## Catchment Data



The widgets on the **Catchment Data** tree page are described below.

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

### Catchment Data

<b>Hydrology</b>	choice box	ILSAX2	
------------------	------------	--------	--

*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 [Hydrology Method](#).*

<b>Infiltration</b>	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 [Hydrology Method](#).*

<b>Catchment</b>	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.*

<b>Area (Ha.)</b>	real box		
-------------------	----------	--	--

*Catchment area in hectares.*

**% Impervious**                      real box

*Percentage of the current catchment which is impervious.*

### **Hydrology Method**

See [Hydrology Method - ILSAX 2](#)

See [Hydrology Method - Laurenson](#)

See [Hydrology Method - NZ SCS](#)

See [Hydrology Method - EPA SWMM \(Horton Infiltration\)](#)

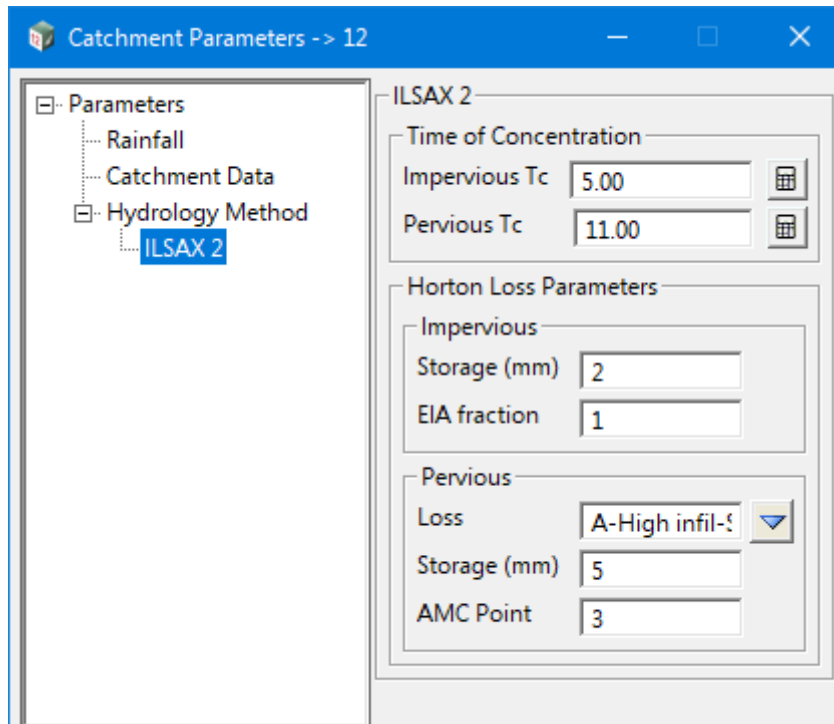
See [Hydrology Method - EPA SWMM \(SCS Curves\)](#)

See [Hydrology Method - EPA SWMM \(Green-Ampt\)](#)

See [Hydrology Method - Rational](#)

## Hydrology Method - ILSAX 2

The widgets on the Hydrology Method pages depend on the hydrology method and Infiltration method selected on the **Catchment Data** page.



The widget on the **ILSAX 2** tree page (currently only allows Horton's losses), 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).*



icon

*Opens the Tc Calculator panel for calculation of Time of Concentration. See [17.1.1.1 Time of Concentration Builder](#).*

**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.*

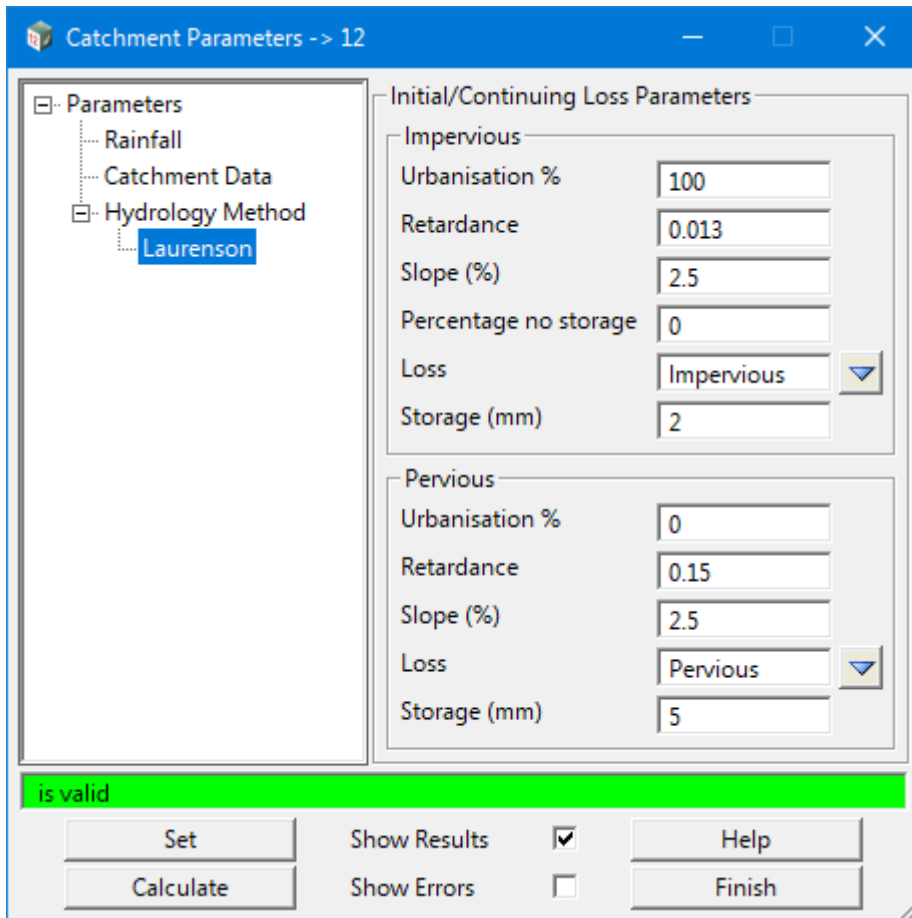
**Pervious Storage (mm)**    Real box

*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.*

### Hydrology Method - Laurenson



The widgets on the **Laurenson** tree page (currently only allows Initial/Continuing 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.*

## Hydrology Method - NZ SCS

The widgets on the **NZ SCS** tree page (only allows SCS Curve losses), 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 [17.1.1.1 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**

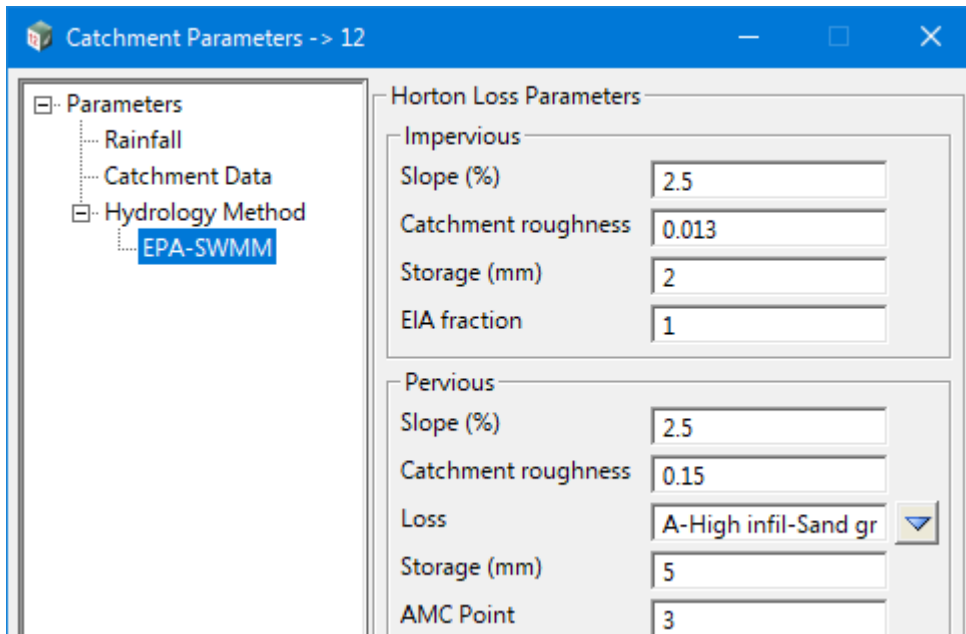
**Loss** choice box

*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).*

## Hydrology Method - EPA SWMM (Horton Infiltration)



The widgets on the **EPA SWMM** tree page when the Infiltration method is set to **Horton**, 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 (Horton's infiltration loss) as defined in the 12dhydro file.*

**Storage (mm)**                real box

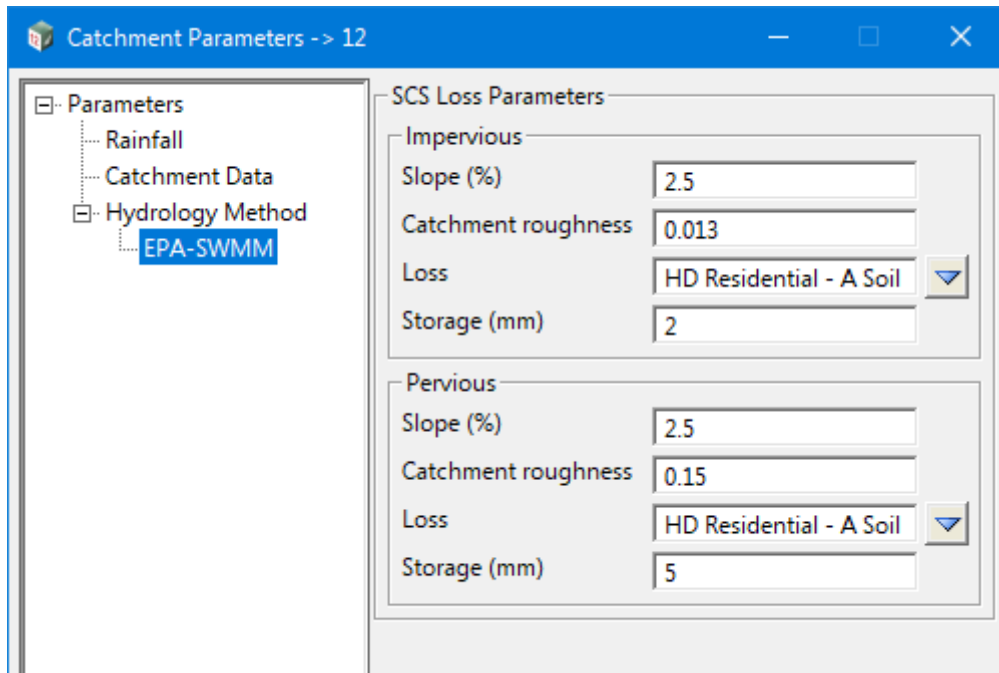
*Initial storage depth over the pervious catchment (mm of rainfall).*

**AMC Point**                      real box

*Antecedent Moisture Condition for the catchment, prior to the storm burst. Defines the starting point*

on the Horton's curve.

**Hydrology Method - EPA SWMM (SCS Curves)**



**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

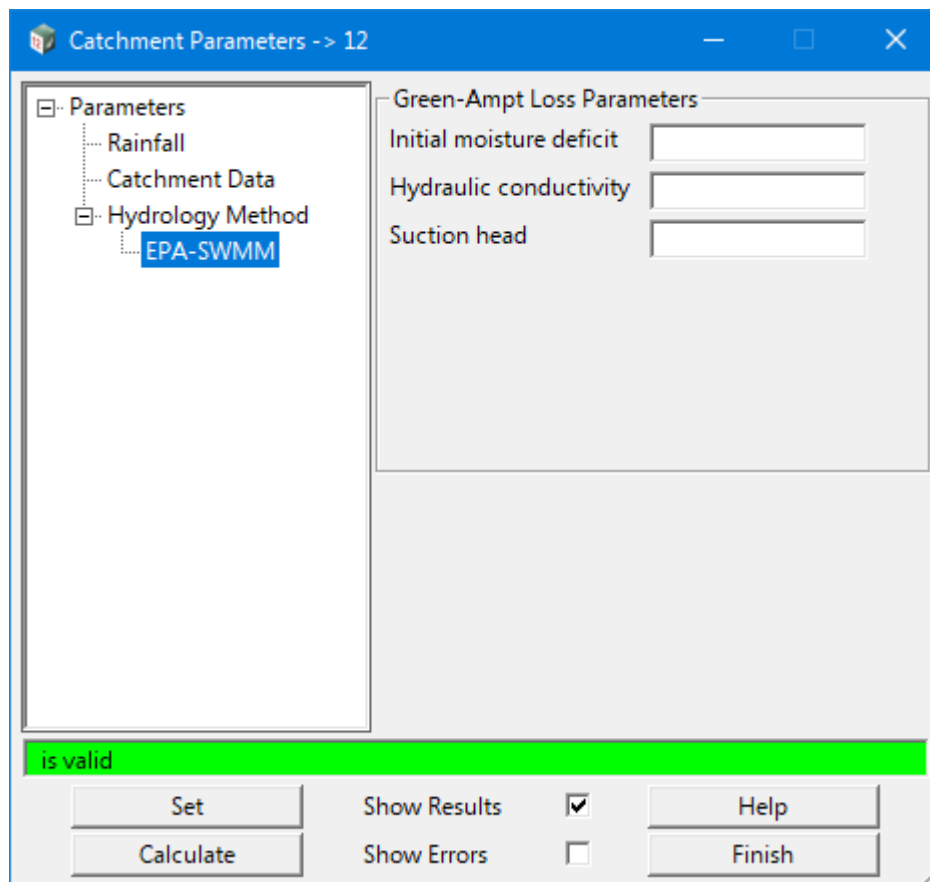
*Loss type for the impervious catchment (SCS Curve) as defined in the 12dhydro file.*

**Storage (mm)** real box

*Initial storage depth over the pervious catchment (mm of rainfall).*

**Hydrology Method - EPA SWMM (Green-Ampt)**





The widgets on the **EPA SWMM** tree page when the Infiltration method is set to **Green-Ampt**, 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.*

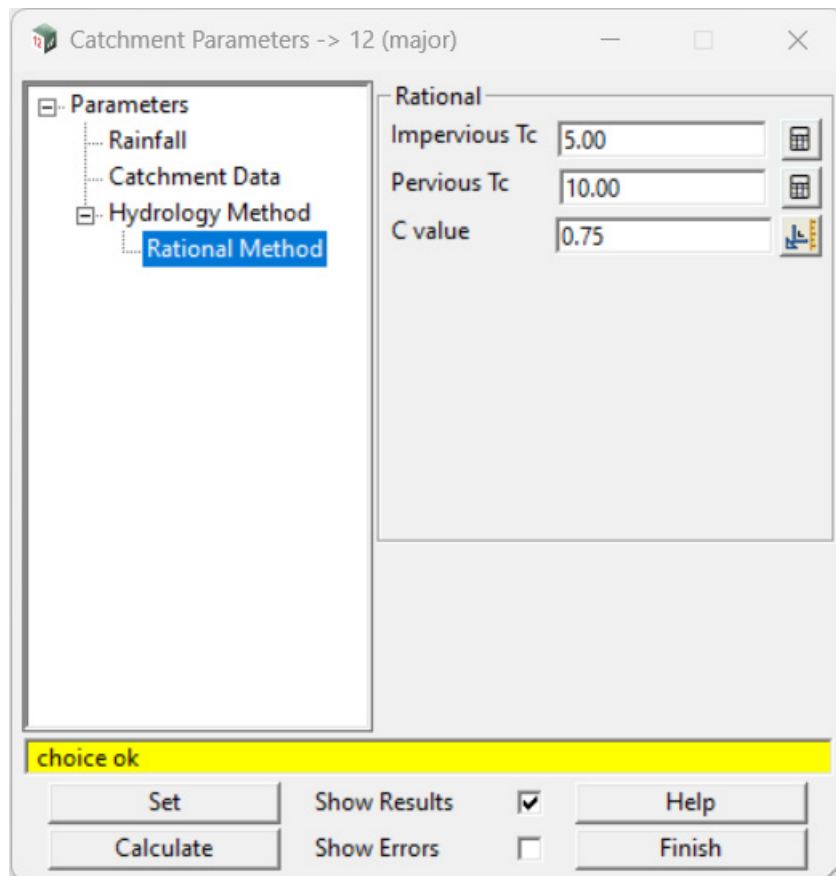
**Hydraulic conductivity**      real box

*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.*

## Hydrology Method - Rational



The widgets on the **Rational** tree page 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.*



### 17.1.1.1 Time of Concentration 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:

See [Methods - Direct](#)

See [Methods - Friend Equation](#)

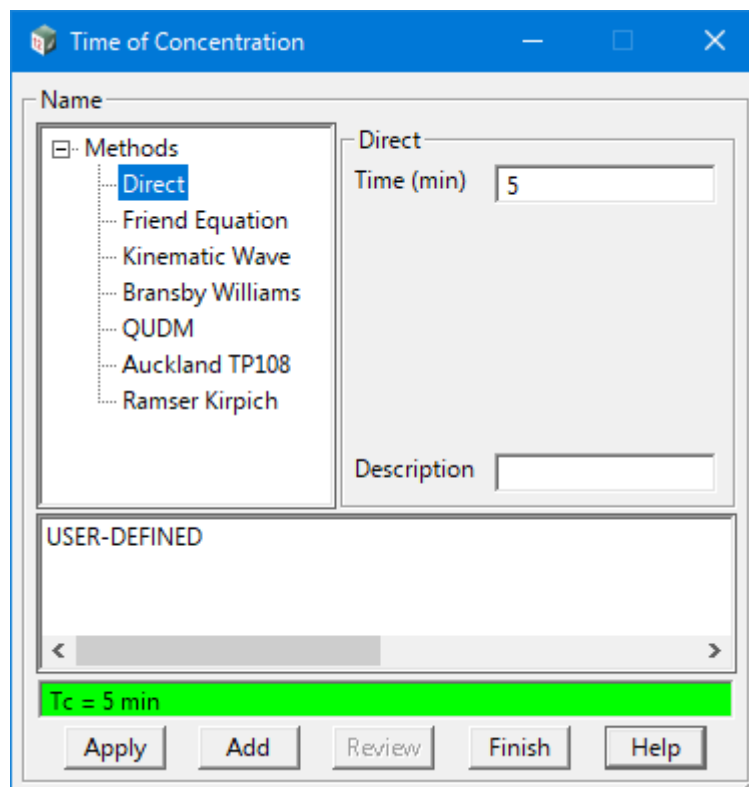
See [Methods - Kinematic wave](#)

See [Methods - Bransby Williams](#)

See [Methods - QUDM](#)

See [Methods - Auckland TP108](#)

See [Methods - Ramser Kirpich](#)



Field Description	Type	Defaults	Pop-Up
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#### 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 for the times of concentration that have been added. See [17.1.1.2 Review Tc Components](#).*

**Finish** Button  
Returns to the Catchment Parameters panel.

**Help** Button  
Opens up the reference manual.

### Methods - 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).

### Methods - Friend Equation

The screenshot shows the 'Time of Concentration' dialog box. On the left, a tree view under 'Methods' has 'Friend Equation' selected. The right side contains input fields for 'Flow length (m)' (100), 'Slope (%)' (1), and 'Roughness n\*' (0.013). Below these is a 'Description' field containing 'Carpark sheet flow'. A text area at the bottom provides details for the 'FRIEND EQUATION' method, including a note that it is commonly preferred for overland flow. A green bar at the bottom of the dialog displays 'Total Tc = 17.91 min'. At the very bottom are buttons for 'Apply', 'Add', 'Review', 'Finish', and 'Help'.

**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.

## Methods - Kinematic wave

The screenshot shows the 'Time of Concentration' dialog box with the following details:

- Name:** Kinematic Wave
- Methods List:** Direct, Friend Equation, **Kinematic Wave**, Bransby Williams, QUDM, Auckland TP108, Ramser Kirpich
- Flow length (m):** 100
- Slope (%):** 1
- Intensity (mm/hr):** 115
- Roughness n\*:** 0.013
- Description:** (empty text box)
- Equation:** KINEMATIC WAVE EQUATION  
For overland sheet flow time  
Note: Best applied to large paved areas
- Result:** Tc = 4.85 min (highlighted in green)
- Buttons:** Apply, Add, Review, Finish, Help

**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.*

## Methods - Bransby Williams

**Name**

Methods

- Direct
- Friend Equation
- Kinematic Wave
- Bransby Williams**
- QUDM
- Auckland TP108
- Ramser Kirpich

Bransby Williams

Flow length (m)

EA-Slope (%)

Catch Area (ha)

Description

BRANSBY-WILLIAMS EQUATION  
Note: Commonly adopted for rural catchments  
(due to ease of use)

**Tc = 5.8 min**

Apply Add Review Finish Help

**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.*

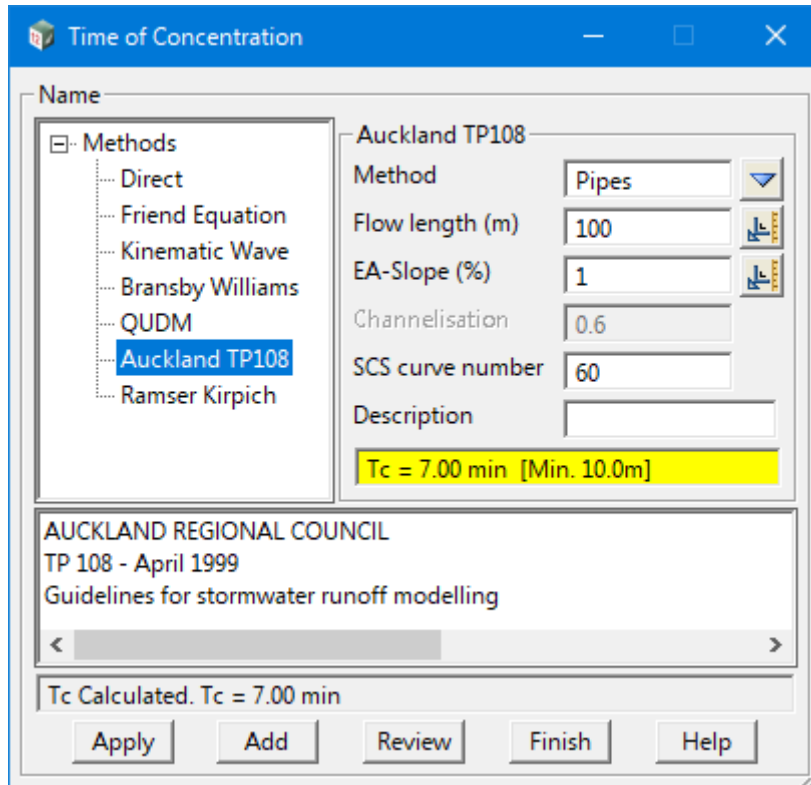


Length of the channel (m). Only available for a Method of **Channel Formula**.

**Description** input box

Optional description of what the time of concentration component represents.

**Methods - 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.

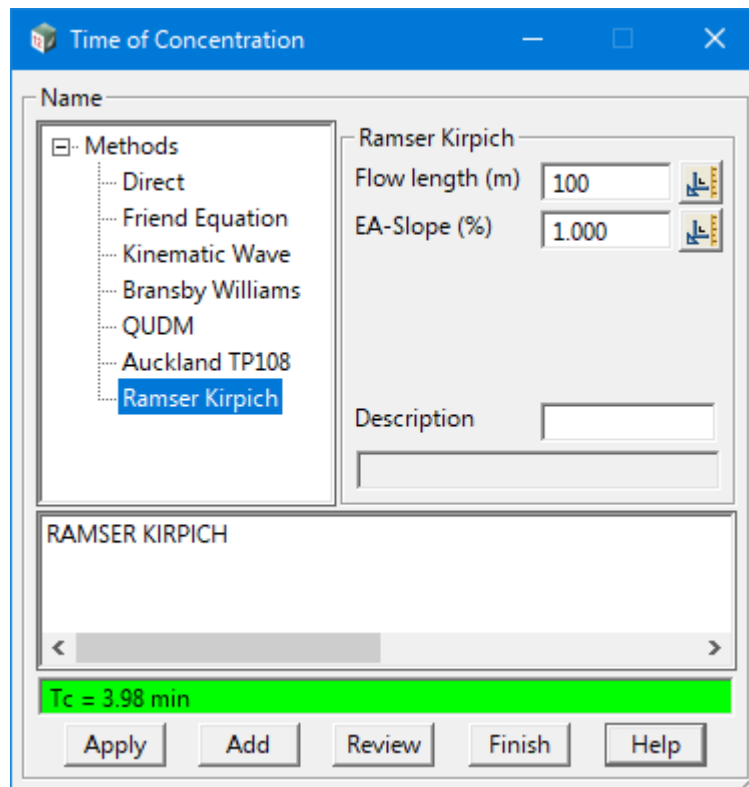
**Description** input box

Optional description of what the time of concentration component represents.





## Methods - Ramser Kirpich



The screenshot shows the 'Time of Concentration' dialog box. On the left, a tree view under 'Methods' lists: Direct, Friend Equation, Kinematic Wave, Bransby Williams, QUDM, Auckland TP108, and Ramser Kirpich (highlighted). On the right, the 'Ramser Kirpich' method is selected, showing 'Flow length (m)' as 100 and 'EA-Slope (%)' as 1.000. A 'Description' field is empty. Below the input fields, a text box contains 'RAMSER KIRPICH'. At the bottom, a green bar displays 'Tc = 3.98 min'. Buttons for 'Apply', 'Add', 'Review', 'Finish', and 'Help' are at the bottom.

**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 [17.1.1.2 Review Tc Components](#) or return to [21.2.1 Stormwater Design](#) or [21.2 Water Concept Design](#).

### 17.1.1.2 Review Tc Components

Reviewing the components of the Tc calculated can be done with the Review panel. Each of the component times of concentration will be displayed. 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.

It is possible to change the Methods on this panel as well. Updating a method will change 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.

Method	Length	Slope	Area	Intensity	Roughness	Curve No.	QUDM Type	Tc	Description
1 Direct	0	0	0	0	0	0		5	Roof to road
2 Friend Equation	100	1	0	0	0.013	0		6.46	Carpark area
3 QUDM Std Inlet Times	0	2.5	0	0	0	0		15	Road to pit

Total Tc = 26.46 min

Update Finish Help

Field Description	Type	Defaults	Pop-Up
<b>Buttons at Bottom</b>			

#### Update

button

*Updates the model with the data populated in the grid.*

#### Finish

button

*Finishes the panel.*

#### Help

button

*Opens the reference manual.*

Continue to [17.2 Concept Water Supply \(CWS\)](#) or go back to [17 Water](#).

## 17.2 Concept Water Supply (CWS)

**Position of option on menu:** Water =>Water supply =>Concept water supply

Water =>Concept design =>Water supply design

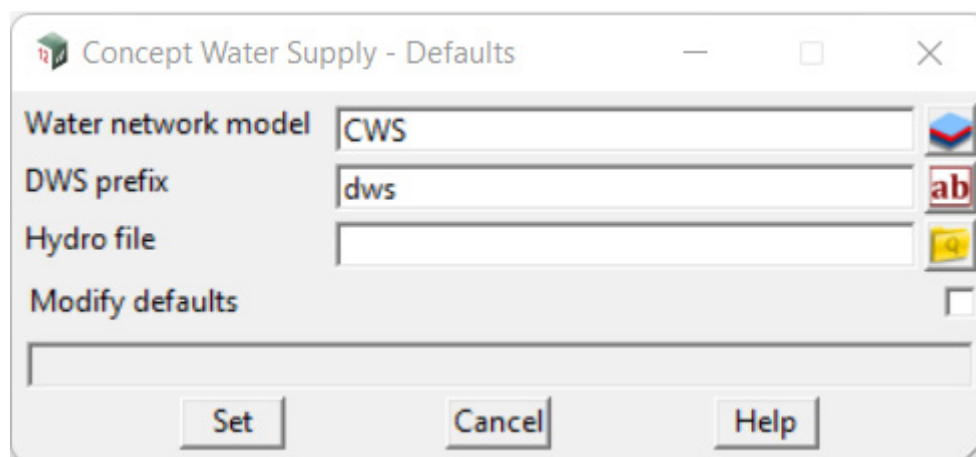
Now documented in the V15 reference manual

**Note:** this is not a comprehensive overview of 12d's Dynamic Water Supply module capabilities - for more information, please consult section [19.8 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
<b>Water Network Model</b>	model box	Project settings	available models
<i>The model used to draw all drainage data in CWS.</i>			
<b>DWS prefix</b>	input box		
<i>The root folder path for Dynamic Water Supply attributes.</i>			
<b>Hydro file</b>	file box		*.12dhydro files
<i>The project hydro file location.</i>			
<b>Modify defaults</b>	tick box	not ticked	
<i>If <b>ticked</b>, expands to reveal all settings in the panel.</i>			

### Buttons at Bottom

**Set** button  
*Accept the defaults and return to the main panel.*

**Cancel** button  
*Close the panel and cancel the macro.*

**Help**

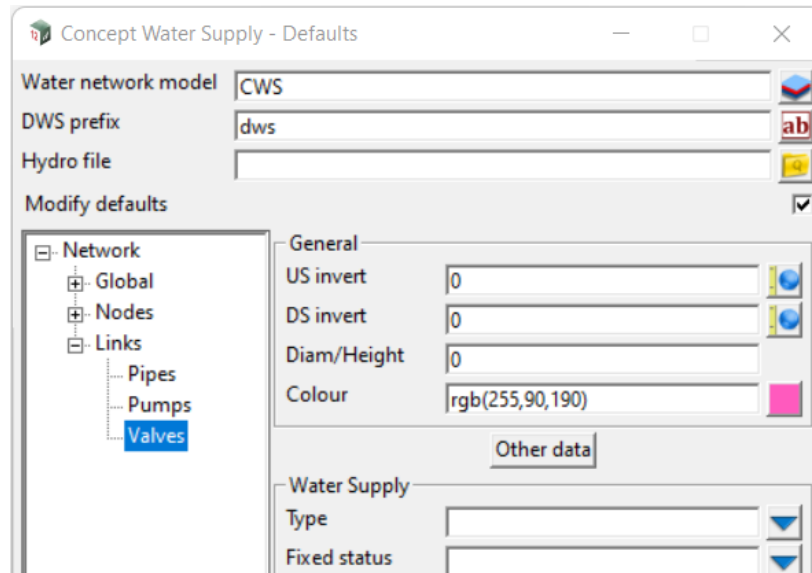
button

12d reference manual

Access this document in the help manual.

Tickling the 'Modify defaults' tick box will expand the panel, presenting a tree box with additional pages.

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](#)

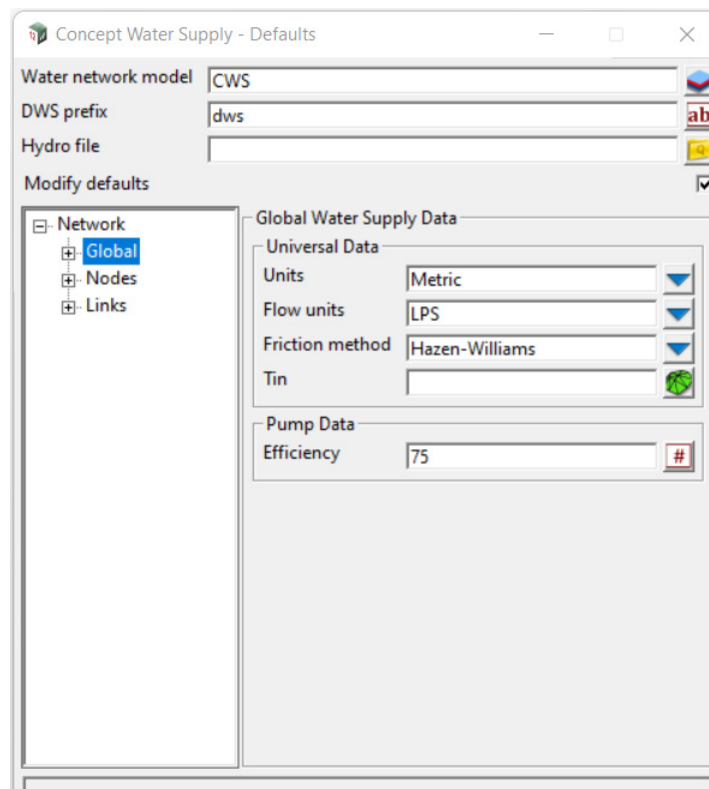
See [Controls page](#)

See [Patterns page](#)

See [Curves page](#)

See [Quality page](#)

See [Display page](#)



### Global Water Supply Data

#### Universal Data

**Units**                                      choice box                      Metric                      Metric, US

*The default measurement system for the project.*

**Flow units**                                      choice box                      LPS                      LPS, LPM, MLD, CMH, CMD

*The default flow rate system for the project.*

**Friction method**                                      choice box                      Hazen-Williams                      Hazen-Williams, Darcy-Weisbach, Chezy-Manning

*The default friction calculation method.*

**Tin**    tin box

*The 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.*

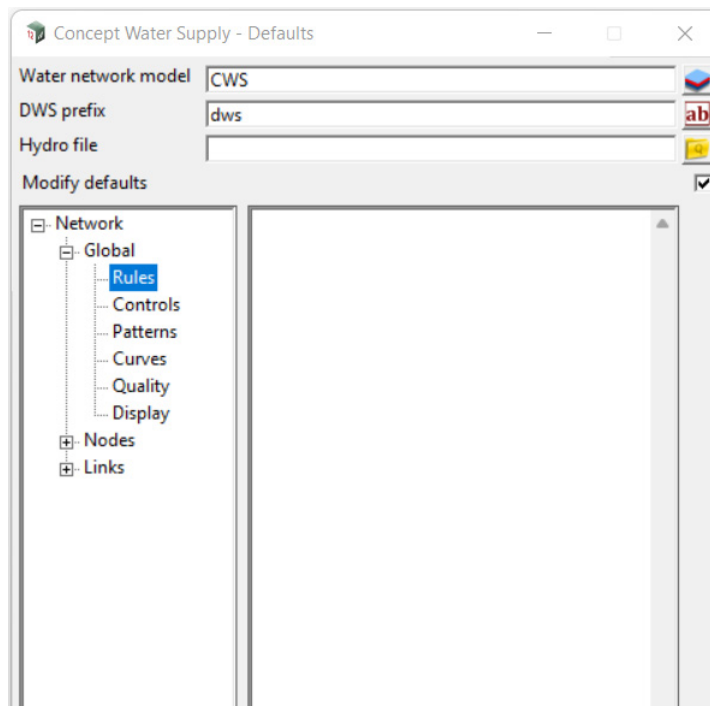
**Pump data**

**Efficiency** integer box

*The 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

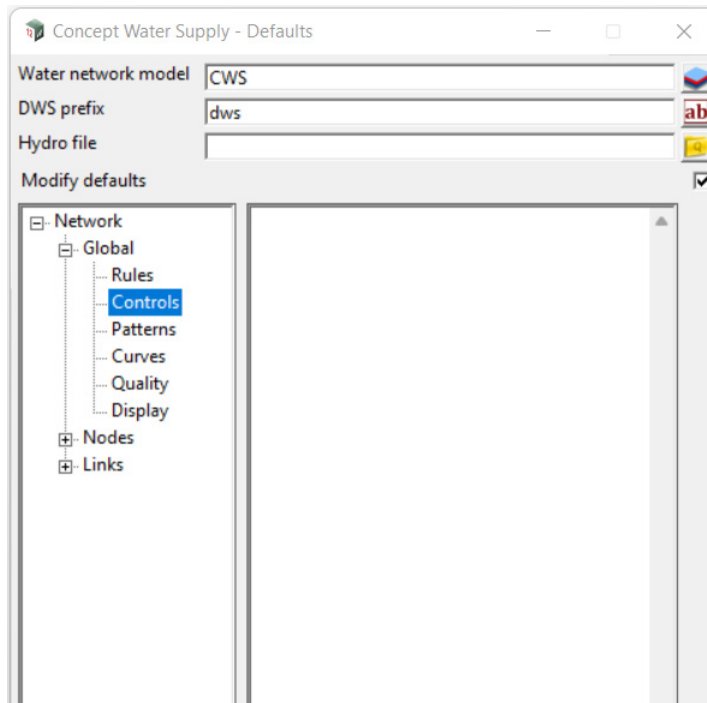
*Opens the DWS rule builder.*





## 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.

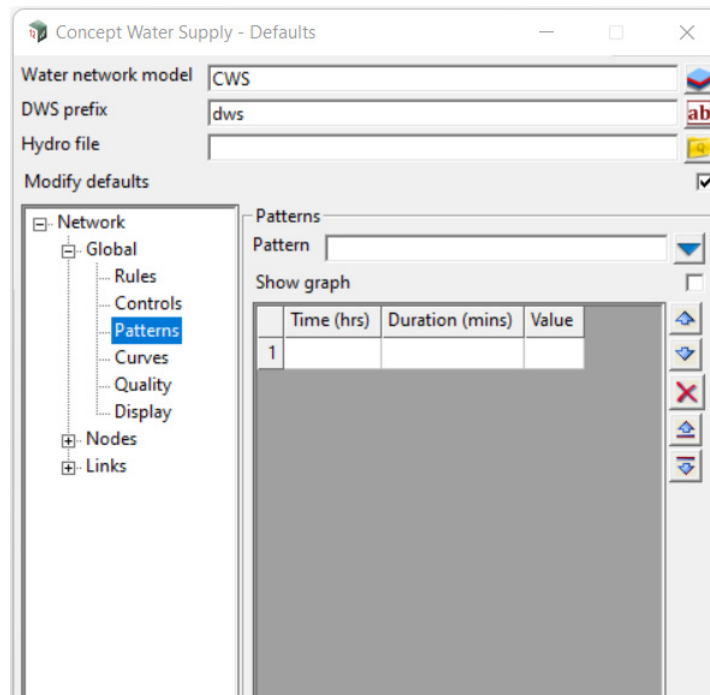


**Control builder**                      button

*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

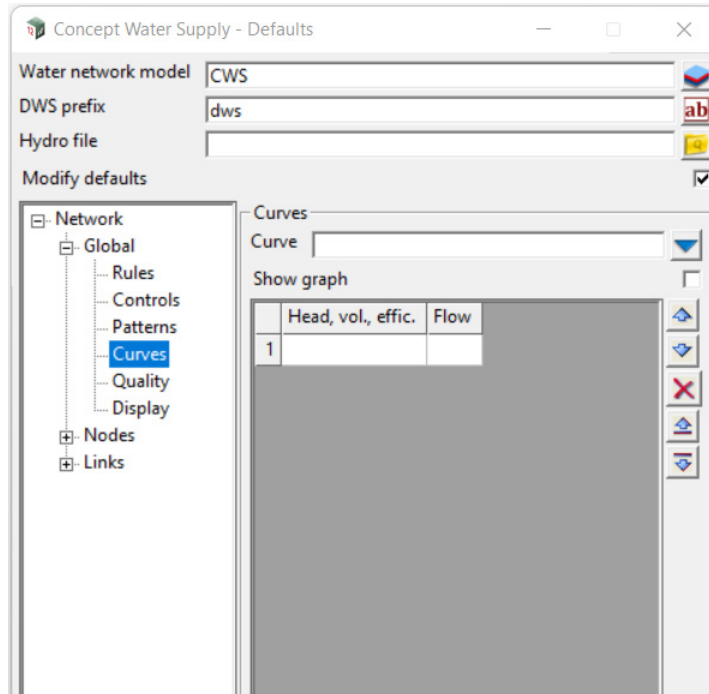
Display the graph associated with the selected pattern.

**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.

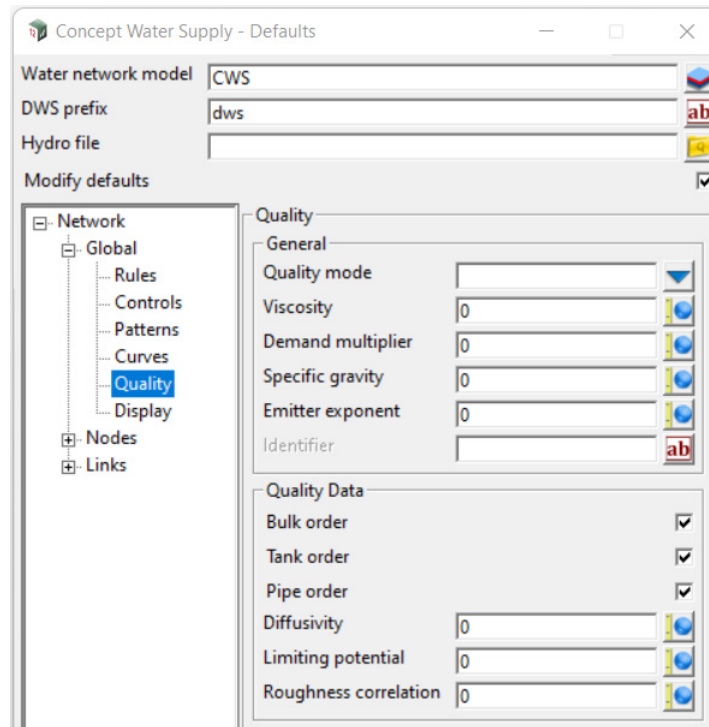
**Show graph** tick box not ticked

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

*The default mode for modelling water quality.*

**Viscosity**                      real box                      0

*The default kinematic viscosity.*

**Demand multiplier**                      real box                      0

*The 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

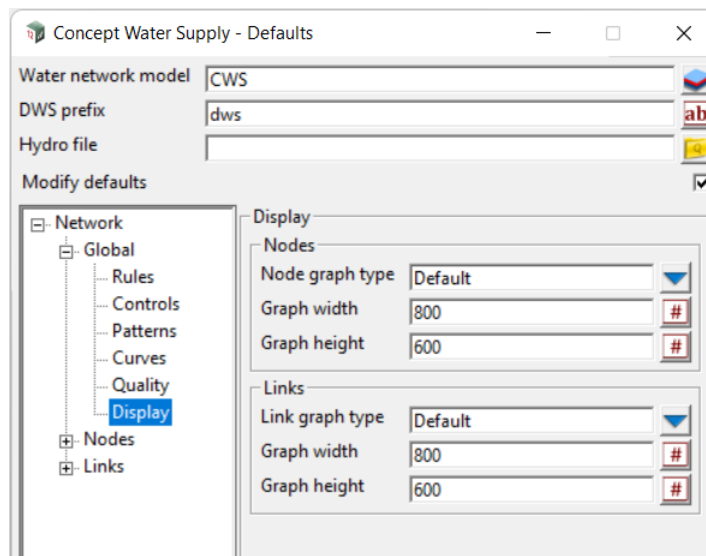
*The kinetic reaction order in the tank reaction equation.*

**Pipe order**                      tick box                      ticked

*The kinetic reaction order in the pipe reaction equation.*

<b>Diffusivity</b>	real box	0	<i>The molecular diffusivity of the chemical being modelled.</i>
<b>Limiting potential</b>	real box	0	<i>The limiting potential of reaction rates.</i>
<b>Roughness correlation</b>	real box	0	<i>The relation between reaction coefficients and specified Head loss equation.</i>

**Display page**



**Nodes**

<b>Node graph type</b>	choice box	Default	Default, Demand, Elevation, Pressure, Quality, Dynamic Plan, All Node
------------------------	------------	---------	---

**Results**

*The default graph type for nodes.*

<b>Graph width</b>	integer box	800	<i>The default node graph width.</i>
--------------------	-------------	-----	--------------------------------------

<b>Graph height</b>	integer box	600	<i>The default node graph height.</i>
---------------------	-------------	-----	---------------------------------------

**Links**

<b>Link graph type</b>	choice box	Default	<i>The default link graph type.</i>
------------------------	------------	---------	-------------------------------------

<b>Graph width</b>	integer box	800	<i>The default link graph width.</i>
--------------------	-------------	-----	--------------------------------------

<b>Graph height</b>	integer box	600	<i>The default link graph height.</i>
---------------------	-------------	-----	---------------------------------------

**Nodes**

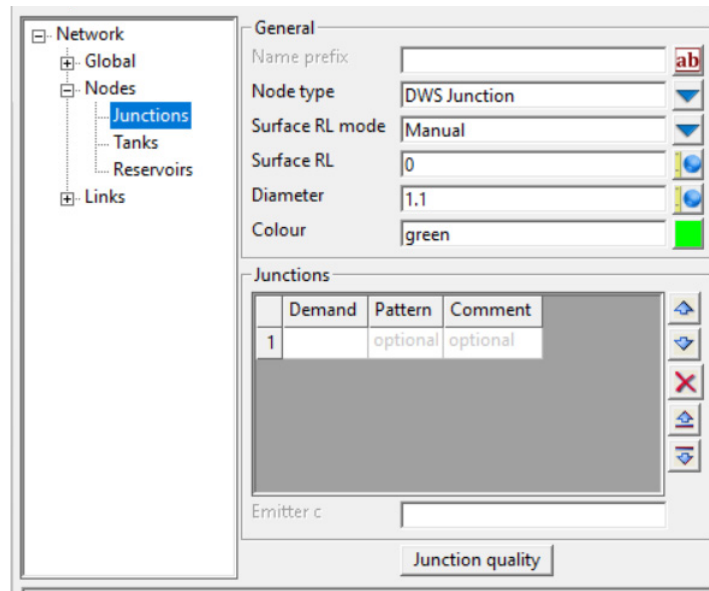
The **Junctions page**, **Tanks page** and **Reservoirs page** are described below.

See [Junctions Page](#)

See [Tanks Page](#)

See [Reservoirs Page](#)

**Junctions Page**



**General**

- Name prefix**                      input box

*The default prefix for node naming (i.e. T1, T2...).*
- Node type**                      choice box              DWS Junction

*The default drainage pit type for junction nodes.*
- Surface RL mode**              choice box              Manual

*The default mode for calculating surface reduced levels.*
- Surface RL**                      real box                  0

*The default RL value (only valid if the mode is 'manual').*
- Diameter**                      real box                  1.1

*The default junction diameter.*
- Colour**                          colour box              green                      available colours

*The default junction diameter.*
- Junctions**                      grid box

*The default junction demand patterns.*
- Emitter c**                      real box

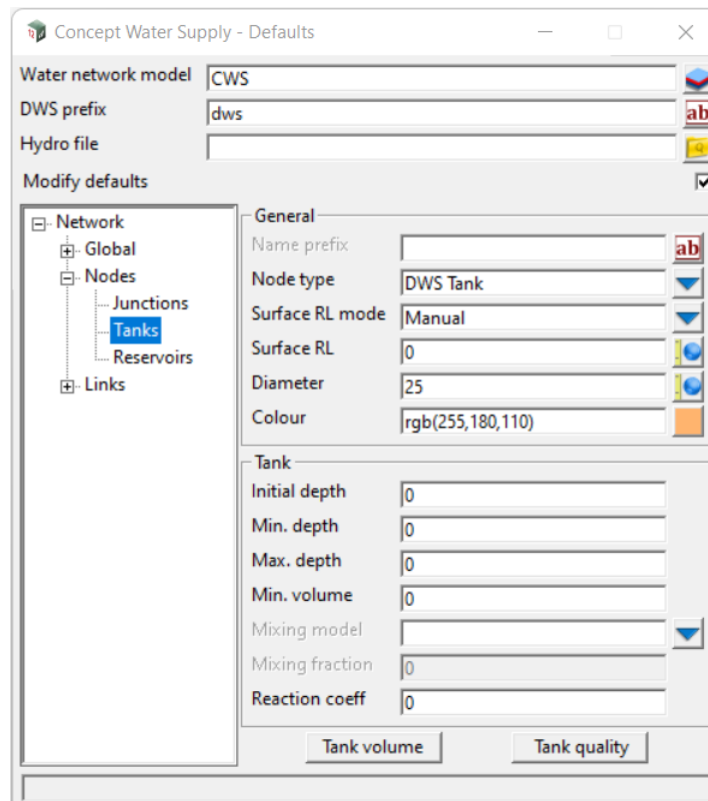
*The default junction emitter coefficient.*
- Junctions quality**              button                      Quality panel

*Opens the default quality panel for Junctions. See [17.2.1 Junction/Tank/Reservoir Quality Panel](#).*





## Tanks Page



### General

**Name prefix** input box

*The default prefix for node naming (i.e. T1, T2...).*

**Node type** choice box DWS Tank

*The default drainage pit type for tank nodes.*

**Surface RL mode** choice box Manual

*The default mode for calculating surface reduced levels.*

**Surface RL** real box 0

*The default RL value (only valid if the mode is 'manual').*

**Diameter** real box 25

*The default tank diameter.*

**Colour** colour box rgb(255,180,110) available colours

*The default tank diameter.*

### Tank

**Initial depth** real box 0

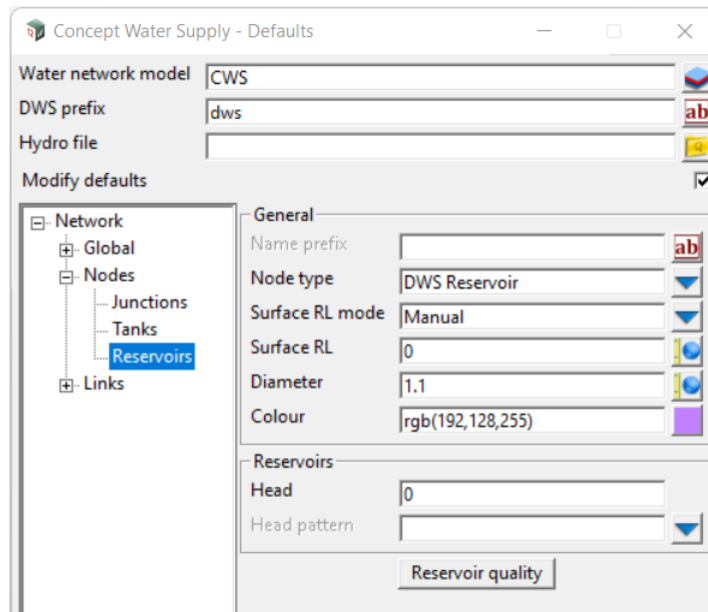
*The default tank initial depth.*

**Min. depth** real box 0

*The default tank minimum depth.*

<b>Max. depth</b>	real box	0	
<i>The default tank maximum depth.</i>			
<b>Min. volume</b>	real box	0	
<i>The default tank minimum volume.</i>			
<b>Mixing model</b>	choice box		
<i>The default tank mixing model.</i>			
<b>Mixing fraction</b>	real box	0	
<i>The default tank mixing fraction.</i>			
<b>Reaction Coeff</b>	real box	0	
<i>The default tank reaction coefficient.</i>			
<b>Tank volume</b>	button		Tank Volume
<i>Opens the tank volume panel. See <a href="#">17.2.2 Tank Volume Panel</a>.</i>			
<b>Tank quality</b>	button		Quality Panel
<i>Opens the default quality panel for Tanks. See <a href="#">17.2.1 Junction/Tank/Reservoir Quality Panel</a>.</i>			

## Reservoirs Page



### General

**Name prefix**                      input box

*The default prefix for node naming (i.e. T1, T2...).*

**Node type**                      choice box                      DWS Reservoir

*The default drainage pit type for reservoirs nodes.*

**Surface RL mode**              choice box                      Manual

*The default mode for calculating surface reduced levels.*

**Surface RL**                      real box                          0

*The default RL value (only valid if the mode is 'manual').*

**Diameter**                      real box                          1.1

*The default reservoir diameter.*

**Colour**                          colour box                      rgb(192,128,255)    available colours

*The default reservoir diameter.*

### Reservoirs

**Head**                              real box

*The default reservoir head flow.*

**Head pattern**                  choice box

*The default reservoir head pattern.*

**Reservoir quality**              button                                      Quality panel

*Opens the default quality panel for Reservoirs. See [17.2.1 Junction/Tank/Reservoir Quality Panel](#).*

## Links

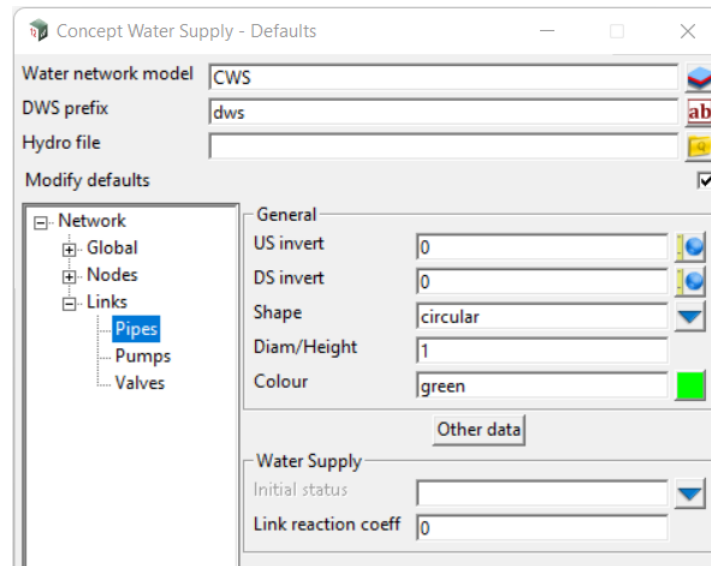
The **Pipes page**, **Pumps page** and **Valves page** are described below.

See [Pipes page](#)

See [Pumps page](#)

See [Valves page](#)

## Pipes page



### General

**US invert** real box 0

*The default pipe upstream invert level.*

**DS invert** real box 0

*The default pipe downstream invert level.*

**Shape** choice box Circular

*The default pipe shape.*

**Diam/Height** real box 1

*The default pipe diameter.*

**Colour** colour box green

*The default pipe colour.*

**Other data** button Link data

*Opens additional link data defaults.*

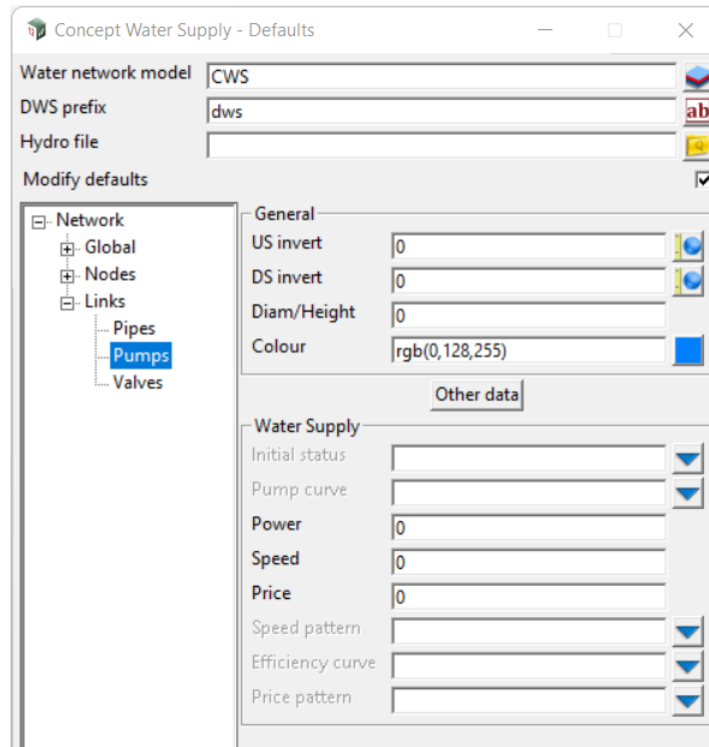
**Initial status** choice box

*The default initial pipe status.*

**Link reaction coeff** real box 0

*The default link reaction coefficient.*

## Pumps page



### General

<b>US invert</b>	real box	0	
<i>The default pump upstream invert level.</i>			
<b>DS invert</b>	real box	0	
<i>The default pump downstream invert level.</i>			
<b>Diam/Height</b>	real box	1	
<i>The default pump diameter.</i>			
<b>Colour</b>	colour box	rgb(0,128,255)	
<i>The default pump colour.</i>			
<b>Other data</b>	button		Link data
<i>Opens additional link data defaults.</i>			

### Water supply

<b>Initial status</b>	choice box	
<i>The default initial pump status.</i>		
<b>Pump curve</b>	choice box	
<i>The default pump curve (populated by hydro file data).</i>		
<b>Power</b>	real box	0
<i>The default pump power.</i>		
<b>Speed</b>	real box	0
<i>The default pump speed.</i>		

**Price** real box 0

*The default pump price.*

**Speed pattern** choice box

*The default pump speed pattern.*

**Efficiency curve** choice box

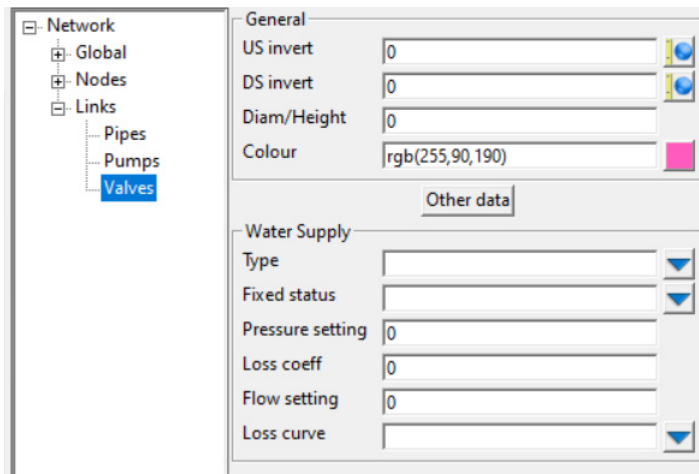
*The default pump efficiency curve.*

**Price pattern** choice box

*The default pump price pattern.*



### Valves page



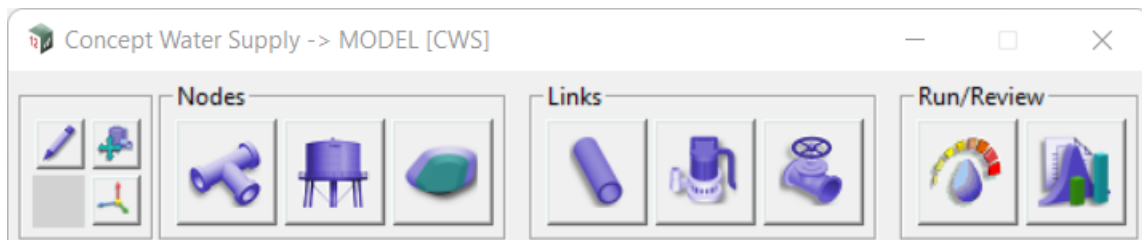
#### General

<b>US invert</b>	real box	0	
<i>The default valve upstream invert level.</i>			
<b>DS invert</b>	real box	0	
<i>The default valve downstream invert level.</i>			
<b>Diam/Height</b>	real box	1	
<i>The default valve diameter.</i>			
<b>Colour</b>	colour box	rgb(255,90,190)	
<i>The default valve colour.</i>			
<b>Other data</b>	button		Link data
<i>Opens additional link data defaults.</i>			

#### Water supply

<b>Type</b>	choice box	Pressure breaker
<i>The default water supply valve type.</i>		
<b>Fixed status</b>	choice box	Open
<i>The default valve fixed status.</i>		
<b>Pressure setting</b>	real box	0
<i>The default pressure setting (only applicable for pressure valves).</i>		
<b>Loss Coeff</b>	real box	0
<i>The default loss coefficient (only applicable for throttle control valves).</i>		
<b>Flow setting</b>	real box	0
<i>The default flow setting (only applicable for flow control valves).</i>		
<b>Loss curve</b>	choice box	
<i>The default loss curve (only applicable for general purpose valves).</i>		

### 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	DefaultsPanel	Edit Link	
	Move Node			
	Grid Snapping	Snapping Options	Ortho snapping	
<b>NODES</b>				
	Create junction node		Edit Node	
	Create tank node		Edit Node	
	Create reservoir node		Edit Node	
<b>LINKS</b>				
	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](#)

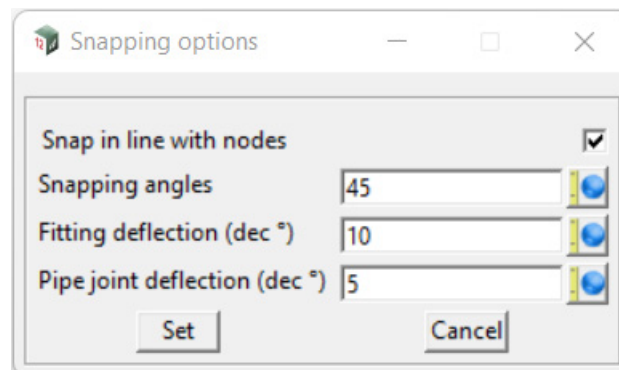
See [Pipes Page](#)

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
-------------------	------	----------	--------

<b>Snap in line with nodes</b>	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.*

<b>Snapping angles</b>	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).*

<b>Fitting deflection</b>	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.*

<b>Pipe joint deflection</b>	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

<b>Set</b>	button
------------	--------

*Accept and return to the defaults panel.*

**Cancel** button

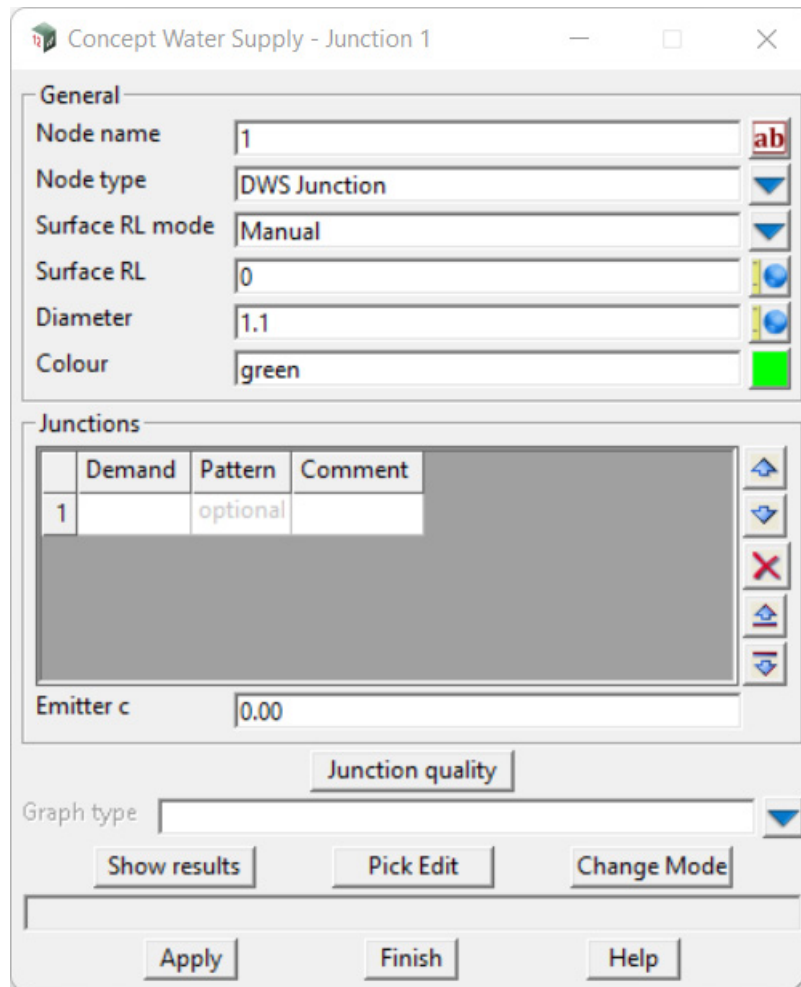
*Closes the panel.*

**Help** button

12d reference manual

*Access this document in the help manual.*

### Edit Junction Panel



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Node name</b>	input box		
------------------	-----------	--	--

*The name of the currently selected node.*

<b>Node type</b>	choice box		
------------------	------------	--	--

*The type of the currently selected node.*

<b>Surface RL Mode</b>	choice box		
------------------------	------------	--	--

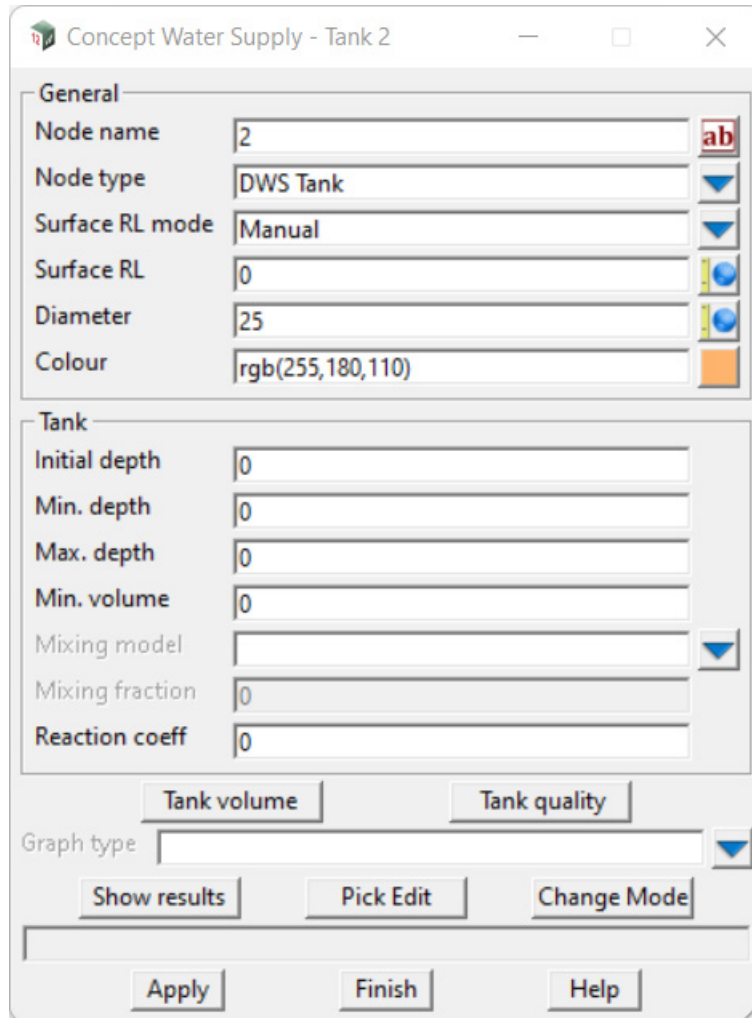
*The mode for calculating surface reduced levels.*

<b>Surface RL</b>	real box		
-------------------	----------	--	--

*The RL value (only valid if the mode is 'manual').*

<b>Diameter</b>	real box	
	<i>The diameter of the currently selected node.</i>	
<b>Colour</b>	colour box	available colours
	<i>The colour of the currently selected node.</i>	
<b>Junctions</b>		
<b>Junctions</b>	grid box	
	<i>The demand pattern for the currently selected node.</i>	
<b>Emitter c</b>	real box	
	<i>The emitter coefficient for the currently selected node.</i>	
<b>Junctions quality</b>	button	Quality panel
	<i>Opens the default quality panel for Junctions. See <a href="#">17.2.1 Junction/Tank/Reservoir Quality Panel</a>.</i>	
<b>Graph type</b>	choice box	
	<i>Specifies the graph type for showing node results.</i>	
<b>Show results</b>	button	Node graph
	<i>Display the specified graph for the currently selected node.</i>	
<b>Pick edit</b>	button	
	<i>Select a different node.</i>	
<b>Change mode</b>	button	Change mode panel
	<i>Change the mode (junction/tank/reservoir) of the currently selected node. See <a href="#">17.2.3 Change Mode:Nodes Panel</a>.</i>	
	<i>See 21.8.3.3.1 Node Graph Type Results.</i>	

Tanks Page



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

**General**

<b>Name name</b>	input box		
<i>The name of the currently selected node.</i>			
<b>Node type</b>	choice box		
<i>The type of the current tank.</i>			
<b>Surface RL mode</b>	choice box	Manual	
<i>The mode for calculating surface reduced levels.</i>			
<b>Surface RL</b>	real box	0	
<i>The RL value (only valid if the mode is 'manual').</i>			
<b>Diameter</b>	real box	25	
<i>The diameter of the current tank.</i>			
<b>Colour</b>	colour box	rgb(225,180,110)	available colours

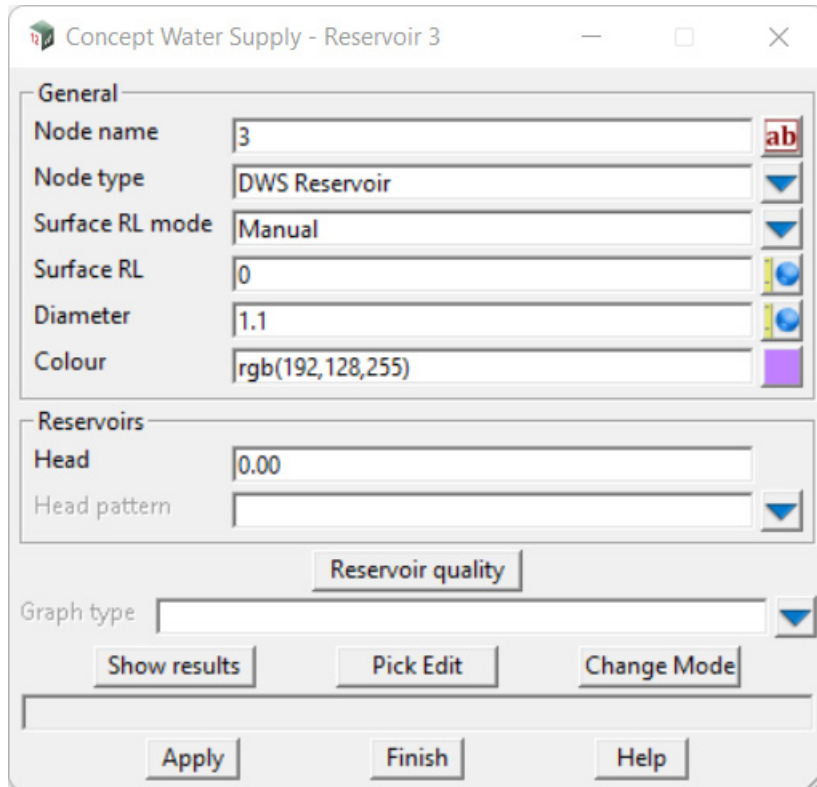


*The colour of the current tank.*

## Tank

<b>Initial depth</b>	real box	0	
	<i>The initial depth of the current tank.</i>		
<b>Min. depth</b>	real box	0	
	<i>The minimum depth of the current tank.</i>		
<b>Max. depth</b>	real box	0	
	<i>The maximum depth of the current tank.</i>		
<b>Min. volume</b>	real box	0	
	<i>The minimum volume of the current tank.</i>		
<b>Mixing model</b>	choice box	2Comp	
	<i>The mixing model of the current tank.</i>		
<b>Mixing fraction</b>	real box	0	
	<i>The mixing fraction of the current tank.</i>		
<b>Reaction Coeff</b>	real box	0	
	<i>The reaction coefficient of the current tank.</i>		
<b>Tank volume</b>	button		Tank Volume
	<i>Opens the tank volume panel. See <a href="#">17.2.2 Tank Volume Panel</a>.</i>		
<b>Tank quality</b>	button		Quality Panel
	<i>Opens the quality panel for the currently selected tank. See <a href="#">17.2.1 Junction/Tank/Reservoir Quality Panel</a>.</i>		
<b>Graph type</b>	choice box		
	<i>Specifies the graph type for showing node results.</i>		
<b>Show results</b>	button		Node graph
	<i>Display the specified graph for the currently selected node.</i>		
<b>Pick edit</b>	button		
	<i>Select a different node.</i>		
<b>Change mode</b>	button		Change mode panel
	<i>Change the mode (junction/tank/reservoir) of the currently selected node. See <a href="#">17.2.3 Change Mode:Nodes Panel</a>.</i>		
	<i>See 21.8.3.3.1 Node Graph Type Results.</i>		

## Reservoirs Page



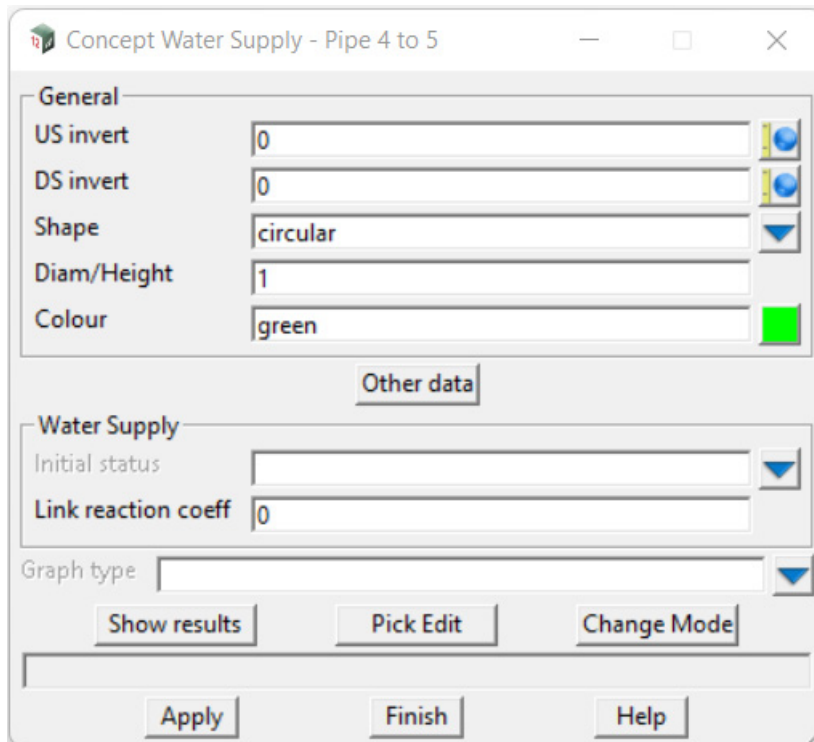
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>General</b>			
<b>Node name</b>	input box		
<i>The name of the current reservoir.</i>			
<b>Node type</b>	choice box	DWS Reservoir	
<i>The type of the current reservoir.</i>			
<b>Surface RL mode</b>	choice box	Manual	
<i>The mode for calculating surface reduced levels.</i>			
<b>Surface RL</b>	real box	0	
<i>The RL value (only valid if the mode is 'manual').</i>			
<b>Diameter</b>	real box	1.1	
<i>The diameter of the current reservoir.</i>			
<b>Colour</b>	colour box	rgb(192,128,255)	available colours
<i>The colour of the current reservoir.</i>			
<b>Reservoirs</b>			
<b>Head</b>	real box		
<i>The head flow of the current reservoir.</i>			

<b>Head pattern</b>	choice box	
<i>The head pattern of the current reservoir.</i>		
<b>Reservoir quality</b>	button	Quality panel
<i>Opens the quality panel for the currently selected reservoir. See <a href="#">17.2.1 Junction/Tank/Reservoir Quality Panel</a>.</i>		
<b>Graph type</b>	choice box	
<i>Specifies the graph type for showing node results.</i>		
<b>Show results</b>	button	Node graph
<i>Display the specified graph for the currently selected node.</i>		
<b>Pick edit</b>	button	
<i>Select a different node.</i>		
<b>Change mode</b>	button	Change mode panel
<i>Change the mode (junction/tank/reservoir) of the currently selected node. See <a href="#">17.2.3 Change Mode:Nodes Panel</a>.</i>		

*See 21.8.3.3.1 Node Graph Type Results.*

Pipes Page



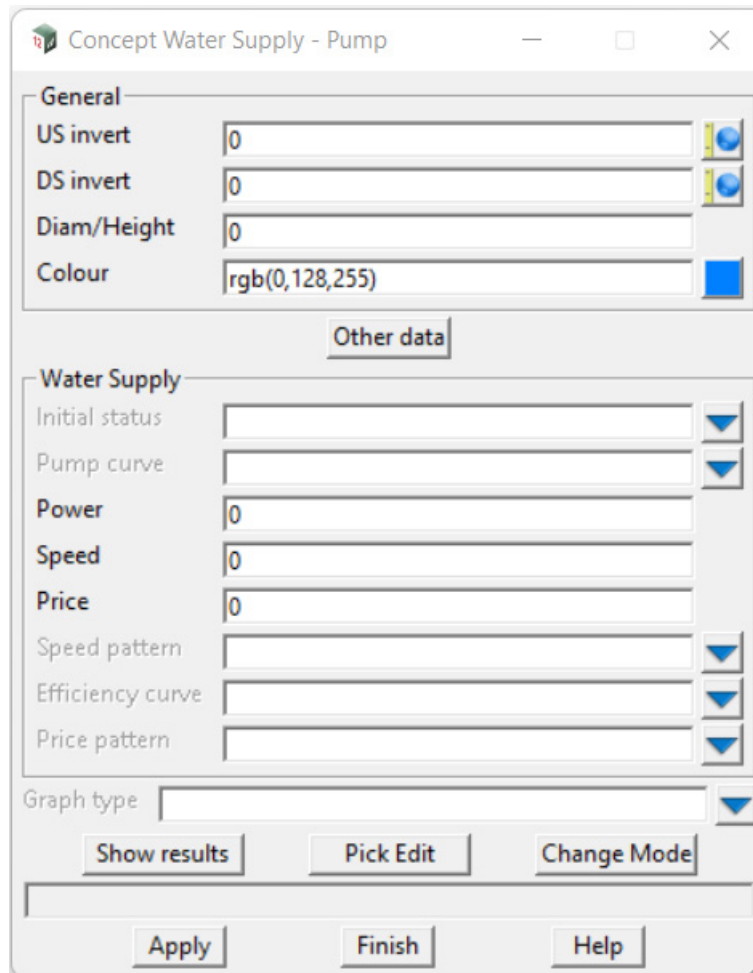
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>General</b>			
<b>US invert</b> <i>The pipe upstream invert level.</i>	real box	0	
<b>DS invert</b> <i>The pipe downstream invert level.</i>	real box	0	
<b>Shape</b> <i>The pipe shape.</i>	choice box	Circular	
<b>Diam/Height</b> <i>The pipe diameter.</i>	real box	1	
<b>Colour</b> <i>The pipe colour.</i>	colour box	green	
<b>Other data</b> <i>Opens additional link data.</i>	button		Link data
<b>Initial status</b> <i>The initial pipe status.</i>	choice box		
<b>Link reaction coeff</b> <i>The pipe reaction coefficient.</i>	real box	0	



<b>Graph type</b>	choice box	
<i>Specifies the graph type for showing link results.</i>		
<b>Show results</b>	button	Link graph
<i>Display the specified graph for the currently selected link.</i>		
<b>Pick edit</b>	button	
<i>Select a different link.</i>		
<b>Change mode</b>	button	Change link panel
<i>Change the mode (pipe/pump/valve) of the currently selected link. See <a href="#">17.2.4 Change Mode:Links Panel</a>.</i>		
<i>See 21.8.3.3.1 Node Graph Type Results.</i>		

Pumps Page



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

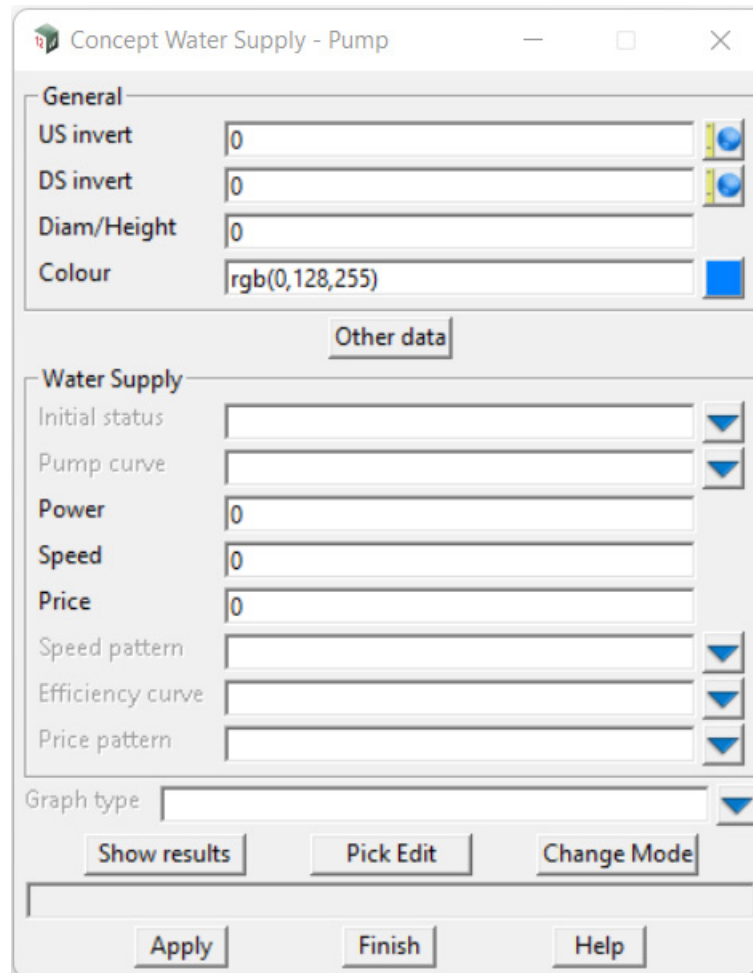
Field Description	Type	Defaults	Pop-Up
<b>General</b>			
<b>US invert</b> <i>The pump upstream invert level.</i>	real box	0	
<b>DS invert</b> <i>The pump downstream invert level.</i>	real box	0	
<b>Diam/Height</b> <i>The pump diameter.</i>	real box	1	
<b>Colour</b> <i>The pump colour.</i>	colour box	rgb(0,128,255)	
<b>Other data</b> <i>Opens additional link data.</i>	button		Link data
<b>Water supply</b>			





<b>Initial status</b>	choice box	
<i>The initial pump status.</i>		
<b>Pump curve</b>	choice box	
<i>The pump curve.</i>		
<b>Power</b>	real box	0
<i>The pump power.</i>		
<b>Speed</b>	real box	0
<i>The pump speed.</i>		
<b>Price</b>	real box	0
<i>The pump price.</i>		
<b>Speed pattern</b>	choice box	
<i>The pump speed pattern.</i>		
<b>Efficiency curve</b>	choice box	
<i>The pump efficiency curve.</i>		
<b>Price pattern</b>	choice box	
<i>The pump price pattern.</i>		
<b>Graph type</b>	choice box	
<i>Specifies the graph type for showing link results.</i>		
<b>Show results</b>	button	Link graph
<i>Display the specified graph for the currently selected link.</i>		
<b>Pick edit</b>	button	
<i>Select a different link.</i>		
<b>Change mode</b>	button	Change link panel
<i>Change the mode (pipe/pump/valve) of the currently selected link. See <a href="#">17.2.4 Change Mode:Links Panel</a>.</i>		
<i>See 21.8.3.3.2 Link Graph Type Results.</i>		

### Valves Page



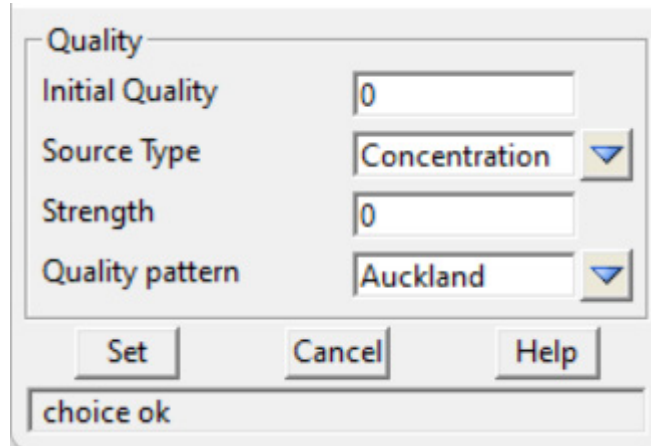
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>General</b>			
<b>US invert</b> <i>The valve upstream invert level.</i>	real box	0	
<b>DS invert</b> <i>The valve downstream invert level.</i>	real box	0	
<b>Diam/Height</b> <i>The valve diameter.</i>	real box	1	
<b>Colour</b> <i>The valve colour.</i>	colour box	rgb(255,90,190)	
<b>Other data</b> <i>Opens additional link data defaults.</i>	button		Link data
<b>Water supply</b>			

<b>Type</b>	choice box	Pressure breaker
	<i>The default water supply valve type.</i>	
<b>Fixed status</b>	choice box	Open
	<i>The valve fixed status.</i>	
<b>Pressure setting</b>	real box	0
	<i>The pressure setting (only applicable for pressure valves).</i>	
<b>Loss Coeff</b>	real box	0
	<i>The loss coefficient (only applicable for throttle control valves).</i>	
<b>Flow setting</b>	real box	0
	<i>The flow setting (only applicable for flow control valves).</i>	
<b>Loss curve</b>	choice box	
	<i>The loss curve (only applicable for general purpose valves).</i>	
<b>Graph type</b>	choice box	
	<i>Specifies the graph type for showing link results.</i>	
<b>Show results</b>	button	Link graph
	<i>Display the specified graph for the currently selected link.</i>	
<b>Pick edit</b>	button	
	<i>Select a different link.</i>	
<b>Change mode</b>	button	Change link panel
	<i>Change the mode (pipe/pump/valve) of the currently selected link. See <a href="#">17.2.4 Change Mode:Links Panel</a>.</i>	
	<i>See 21.8.3.3.2 Link Graph Type Results.</i>	
	<i>Continue to <a href="#">17.2.1 Junction/Tank/Reservoir Quality Panel</a> or go back to <a href="#">17.2 Concept Water Supply (CWS)</a> or <a href="#">17 Water</a>.</i>	

## 17.2.1 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 screenshot shows a dialog box titled "Quality". It contains four input fields: "Initial Quality" with a text box containing "0", "Source Type" with a dropdown menu showing "Concentration", "Strength" with a text box containing "0", and "Quality pattern" with a dropdown menu showing "Auckland". At the bottom of the dialog are three buttons: "Set", "Cancel", and "Help". Below the buttons is a status bar with the text "choice ok".

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

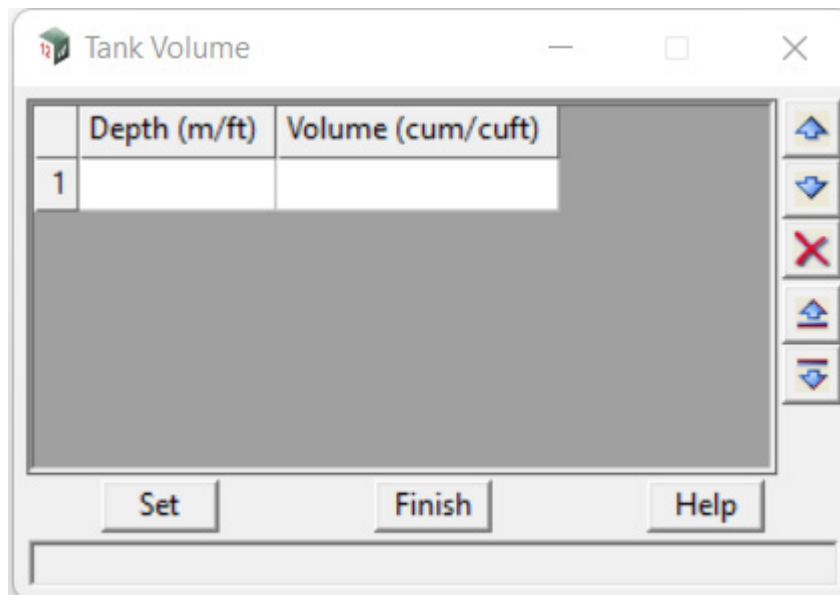
Field Description	Type	Defaults	Pop-Up
<b>Initial Quality</b> <i>The default initial quality for selected pit type.</i>	real box	0	
<b>Source type</b> <i>The default source type for selected pit type.</i>	choice box		
<b>Strength</b> <i>The default source strength for selected pit type.</i>	real box	0	
<b>Quality pattern</b> <i>The default source pattern for selected pit type.</i>	choice box		

### Buttons at Bottom

<b>Set</b> <i>Accept and return to the defaults panel.</i>	button	
<b>Cancel</b> <i>Closes the panel.</i>	button	
<b>Help</b> <i>Access this document in the help manual.</i>	button	12d reference manual

Continue to [17.2.2 Tank Volume Panel](#) or go back to [17.2 Concept Water Supply \(CWS\)](#) or [17 Water](#).

## 17.2.2 Tank Volume Panel



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

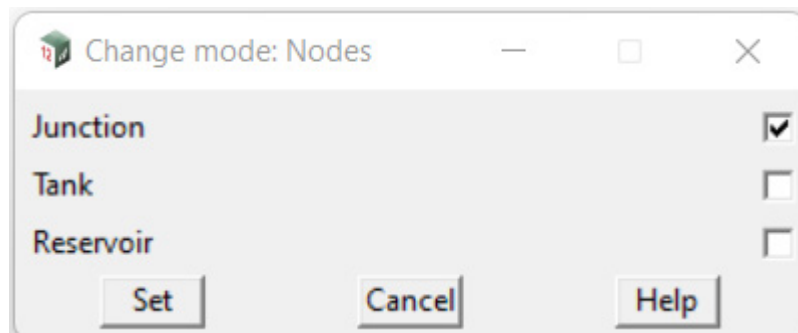
Field Description	Type	Defaults	Pop-Up
<b>Grid box</b>	grid box		
<i>Allows the user to specify tank volume parameters.</i>			

### Buttons at Bottom

<b>Set</b>	button		
<i>Accept and return to the defaults panel.</i>			
<b>Cancel</b>	button		
<i>Closes the panel.</i>			
<b>Help</b>	button		12d reference manual
<i>Access this document in the help manual.</i>			

Continue to [17.2.3 Change Mode:Nodes Panel](#) or go back to [17.2 Concept Water Supply \(CWS\)](#) or [17 Water](#).

## 17.2.3 Change Mode:Nodes Panel



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Junction</b>	tick box		
-----------------	----------	--	--

*Select junction as the new mode.*

<b>Tank</b>	tick box		
-------------	----------	--	--

*Select tank as the new mode.*

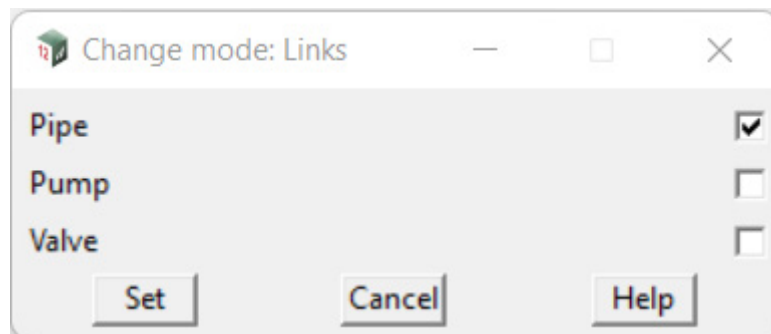
<b>Reservoir</b>	tick box		
------------------	----------	--	--

*Select reservoir as the new mode.*

Continue to [17.2.4 Change Mode:Links Panel](#) or go back to [17.2 Concept Water Supply \(CWS\)](#) or [17 Water](#).



## 17.2.4 Change Mode:Links Panel



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

Field Description	Type	Defaults	Pop-Up
<b>Pipe</b> <i>Select pipe as the new mode.</i>	tick box		
<b>Pump</b> <i>Select pump as the new mode.</i>	tick box		
<b>Valve</b> <i>Select valve as the new mode.</i>	tick box		

Continue to [17.2.5 Results Panel](#) or go back to [17.2 Concept Water Supply \(CWS\)](#) or [17 Water](#).

## 17.2.5 Results Panel

See 21.8.3.3 DWS Results.

Continue to [17.3 Quick Water Network \(QWN\)](#) or go back to [17.2 Concept Water Supply \(CWS\)](#) or [17 Water](#).

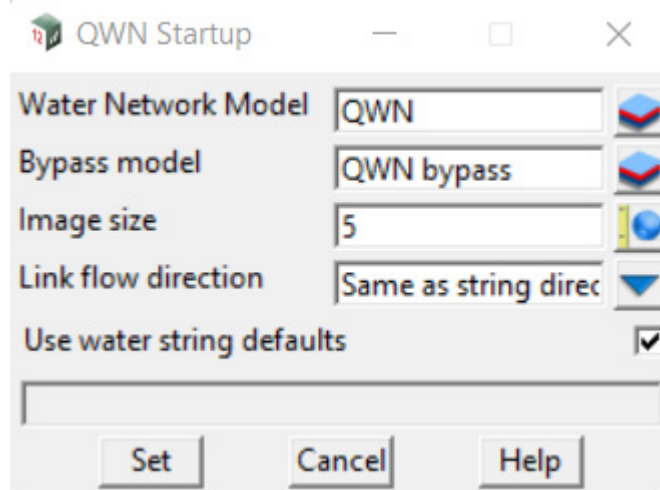
# 17.3 Quick Water Network (QWN)

**Position of menu:** Water =>Water network =>Quick water network

Now documented in the V15 reference manual

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 drainage 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
<b>Water Network Model</b> <i>Model used to draw all data in QWN.</i>	model box		available models
<b>Bypass model</b> <i>Defines the model to be set for a major event.</i>	model box	Selected	available models
<b>Image size</b> <i>Set the size (m) of the node images in the overlay.</i>	real box	5	
<b>Tin</b> <i>The tin for the specified model.</i>	tin box		
<b>Image size (m)</b> <i>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.</i>	tin box		
<b>Link flow direction</b> <i>Display catchment images for nodes.</i>	choice box	Same as string direction	opposite string direction, same as string direction
<b>FS Tin</b> <i>Select the finished surface tin for the drainage model.</i>	tin box		

**Use water string defaults** tick box            ticked

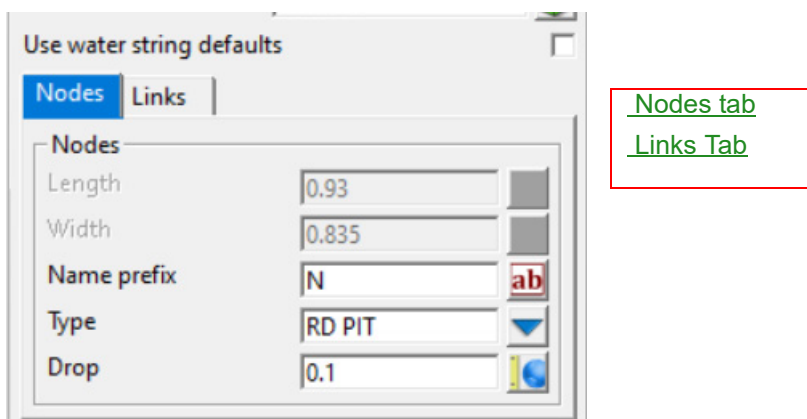
*Expands the panel to include options for specifying drainage defaults.*

*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**

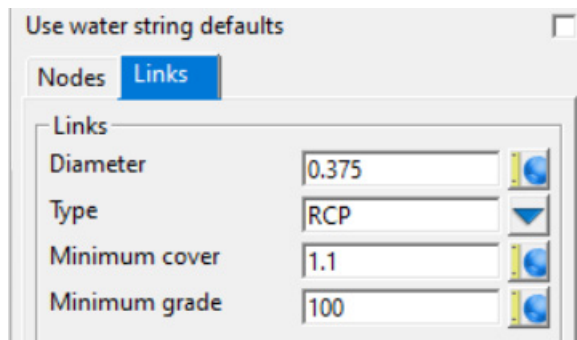


**Nodes**

- |   |            |                                       |
|---|------------|---------------------------------------|
| <b>Diameter/length</b>  | real box   | Drainage defaults OR drainage.4d over |
| <i>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).</i> |            |                                       |
| <b>Width</b>  | real box   | Drainage defaults OR drainage.4d over |
| <i>Default pit width used when creating new nodes (depending on type, can be locked by drainage.4d)</i>   |            |                                       |
| <b>Name prefix</b>  | input box  | Drainage defaults                     |
| <i>Default name prefix assigned when creating new nodes (i.e. N1, N2...).</i>   |            |                                       |
| <b>Type</b>   | choice box | Drainage defaults                     |
| <i>Default node type used when creating new nodes (types list from drainage.4d). See <a href="#">20.1.4.1.6 Node Type</a>.</i>  |            |                                       |
| <b>Drop</b>   | real box   | Drainage defaults                     |
| <i>Default maximum node drop between links - only available if a FS tin is selected.</i>  |            |                                       |



## Links Tab



[Nodes tab](#)

[Links Tab](#)

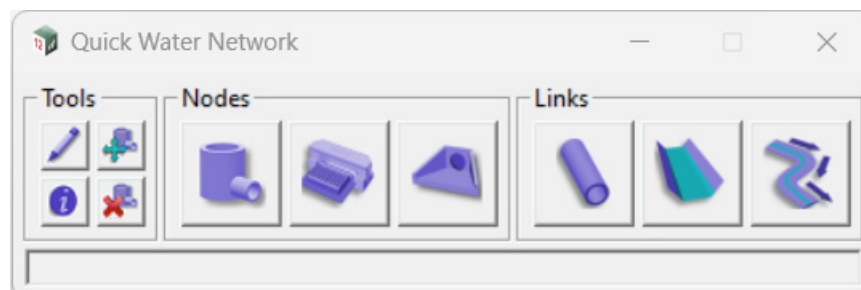
### Links

<b>Diameter</b>	real box	Drainage defaults
<i>Default pipe diameter used when creating new links.</i>		
<b>Type</b>	choice box	Drainage defaults
<i>Default pipe type for new links.</i>		
<b>Minimum cover</b>	real box	Drainage defaults
<i>The minimum cover for new links - only available when a FS tin is selected.</i>		
<b>Minimum grade</b>	real box	Drainage defaults
<i>The minimum grade for new links - only available when a FS tin is selected.</i>		

### Buttons at Bottom

<b>Set</b>	button	
<i>Accept the defaults and return to the main panel.</i>		
<b>Cancel</b>	button	
<i>Close the panel and cancel the macro.</i>		
<b>Help</b>	button	12d Reference Manual
<i>Access this document in the reference manual.</i>		

### 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	
<b>NODES</b>				
	Create node		Edit Node	
	Create inlet node		Edit Node	
	Create headwall node		Edit Node	
<b>LINKS</b>				
	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](#)

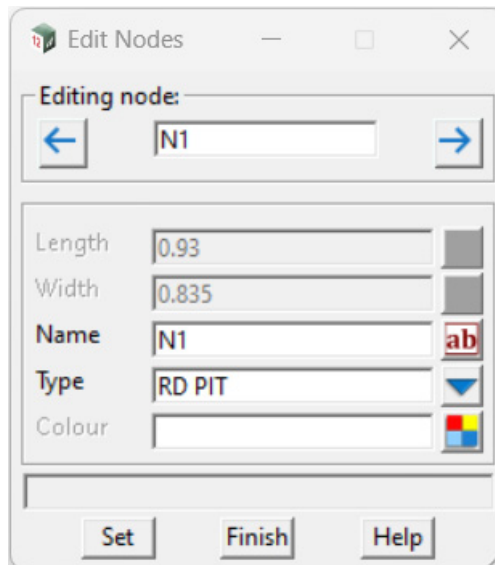
[Edit Link Panel](#)

[QWN 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 drainage 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 drainage string.



button

Select the next node vertex in the current drainage 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

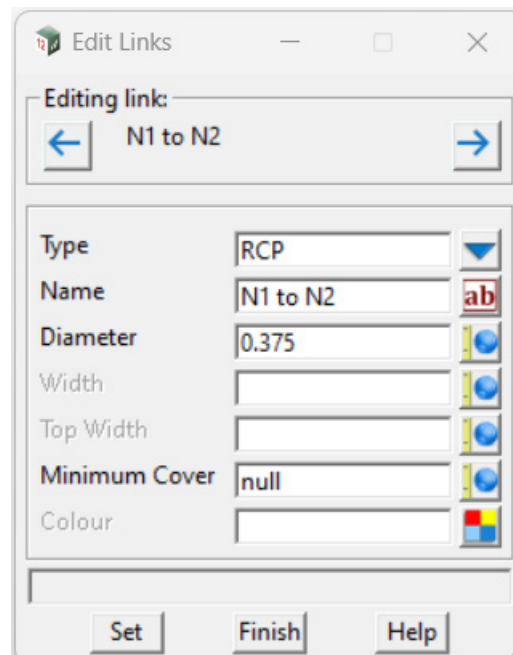
Set the string colour of the currently selected node.



## 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).

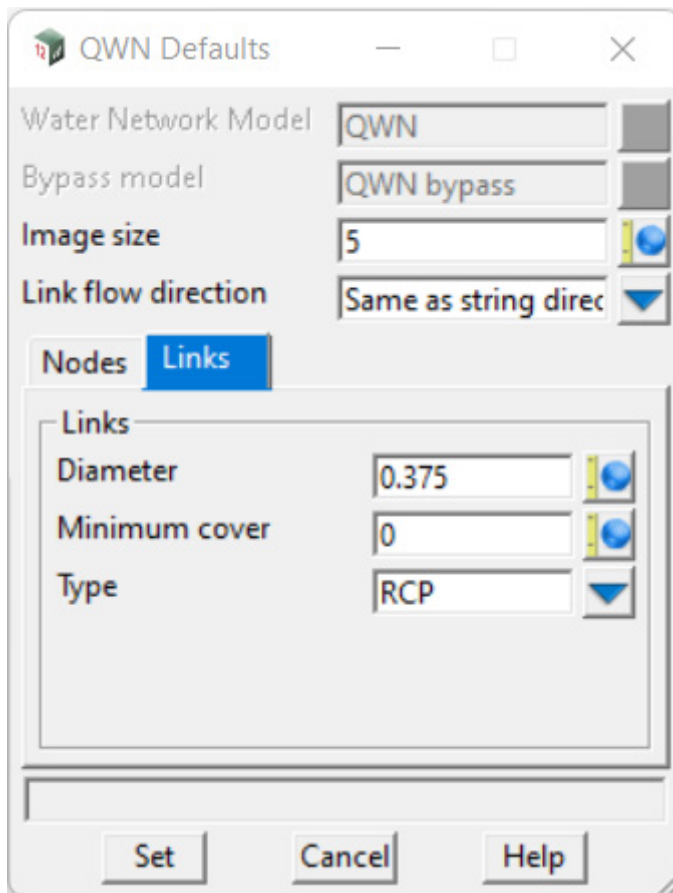
Note that at present, the drainage.4d overwrites do not affect the boxes in this panel but **will** affect what properties can ultimately be set (depending on pipe type selected). For a comprehensive list of predefined pipe dimensions and properties, please consult Water -> Water Setup -> Edit drainage.4d.



<b>Type</b>	choice box	Selected link type	
	<i>Set the type of the currently selected link.</i>		
<b>Name</b>	input box	Link name	
	<i>Set the name of the currently selected link.</i>		
<b>Diameter/height</b>	real box	Current link diameter	
	<i>Set the diameter of the currently selected link (used for height if a width/top width is specified).</i>		
<b>Width</b>	real box	Current link width	
	<i>Set the width of the currently selected link.</i>		
<b>Top Width</b>	real box	Current link top width	
	<i>Set the trapezoidal top width of the currently selected link.</i>		
<b>Minimum cover</b>	real box	Current link cover	
	<i>Set the cover of the currently selected link.</i>		
<b>Colour</b>	colour box	Current link colour	available colours
	<i>Set the string colour of the currently selected link.</i>		

### QWN 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
<b>Water Network Model</b>	model box	CAD ControlBar Input	available models
<i>Model used to draw all drainage data in QWN.</i>			
<b>Bypass model</b>	model box	Auto populated	available models
<i>Model used to draw all bypass strings.</i>			
<b>Image size</b>	real box	5	
<i>Set the size (m) of pit images in the overlay.</i>			
<b>Link flow direction</b>	choice box	Same as string direction	opposite string direction
			same as string direction
<i>Set the default flow direction for newly created drainage strings.</i>			

### 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)*
- 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  
*The default node type used when creating new nodes (types list from drainage.4d).*

### Links Tab

[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.*



## 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 [17.4 Water Log Line \(wll\) Messages](#) or go back to [17.3 Quick Water Network \(QWN\)](#) or [17 Water](#).

## 17.4 Water Log Line (wll) Messages

Now documented in the V15 reference manual

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 [17.5 Property Controls And House Connections](#) or go back to [17.4 Water Log Line \(wll\) Messages](#) or [17 Water](#).

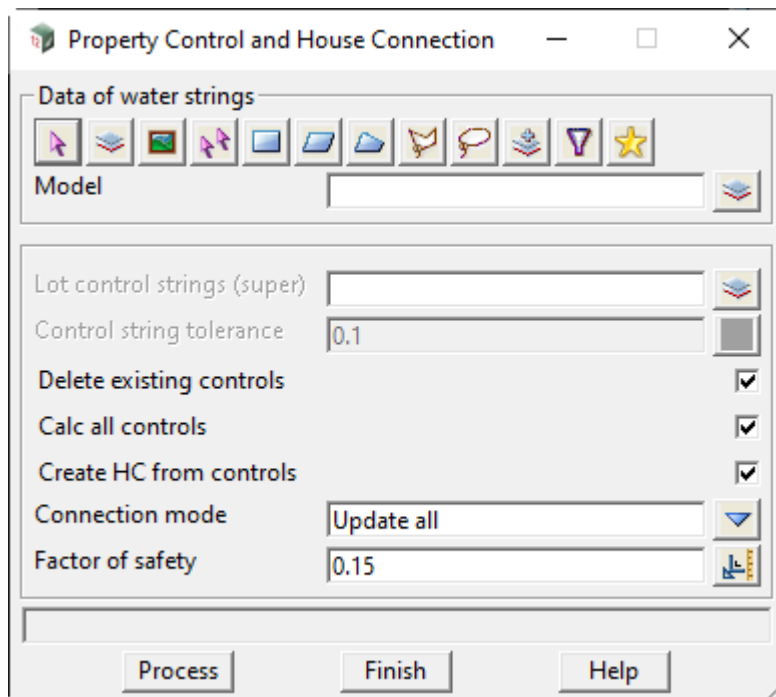
## 17.5 Property Controls And House Connections

**Position of menu:** Water =>Foul water tools =>Controls/house connections

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data source of water strings</b>	data source		
-------------------------------------	-------------	--	--

*Data selection type.*

<b>Control strings (super)</b>	model box		
--------------------------------	-----------	--	--

*OPTIONAL - The model including all controls to connect to water strings (must have type super).*

<b>Control string tolerance</b>	input number	0.1	
---------------------------------	--------------	-----	--

*OPTIONAL - The tolerant distance from controls to water string. This field is required if Lot control string is used.*

<b>Delete existing controls</b>	tick box	ticked	
---------------------------------	----------	--------	--

*If **ticked**, existing controls beforehand is deleted.*

<b>Calc all controls</b>	tick box	ticked	
--------------------------	----------	--------	--

*If **ticked**, property controls is created.*

<b>Create house connection from controls</b>	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 Foul Water Tools](#) or go back to [17.5 Property Controls And House Connections](#) or [17 Water](#).

## 17.6 Foul Water Tools

Position of menu: Water =>Foul Water



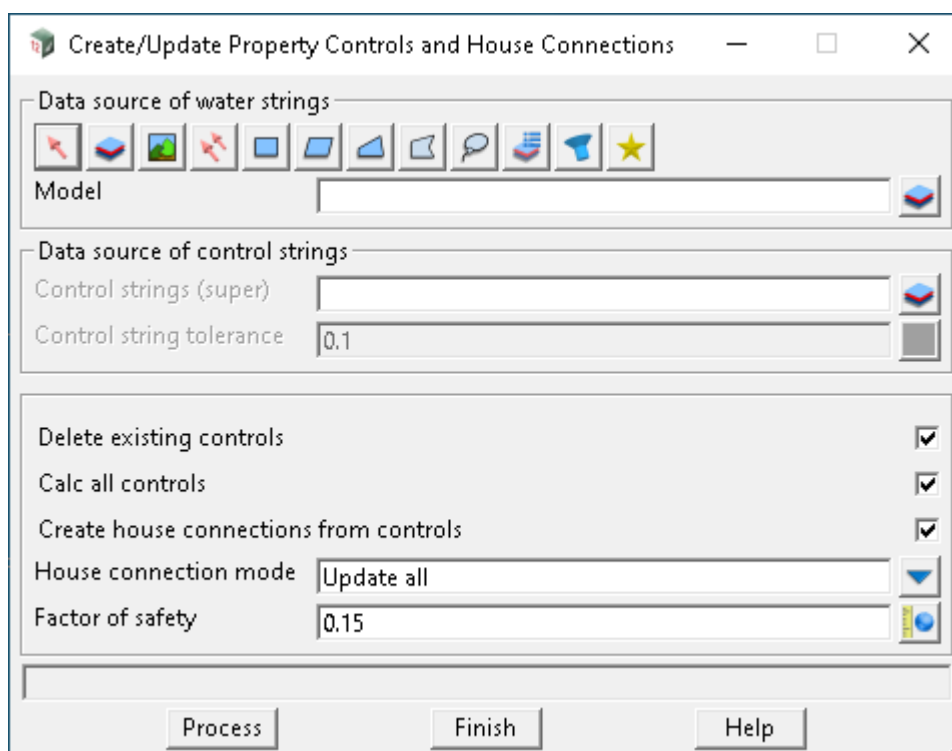
### 17.6.1 Controls/house Connections

Position of menu: Water =>Foul water tools =>Controls/house connections

Now documented in the V15 reference manual

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.

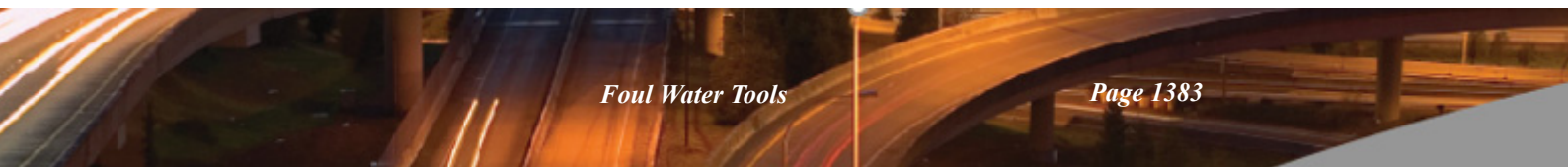


The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Data source of water strings</b>	data source		
<i>Data selection type.</i>			
<b>Control strings (super)</b>	model box		
<i>OPTIONAL - The model including all controls to connect to water strings (must have type super).</i>			
<b>Control string tolerance</b>	input number	0.1	
<i>OPTIONAL - The tolerant distance from controls to water string. This field is required if Lot control string is used.</i>			
<b>Delete existing controls</b>	tick box	ticked	
<i>If <b>ticked</b>, existing controls beforehand is deleted.</i>			
<b>Calc all controls</b>	tick box	ticked	
<i>If <b>ticked</b>, property controls is created.</i>			
<b>Create house connection from controls</b>	tick box	ticked	
<i>If <b>ticked</b>, a house connection is created (connection from water string to property control).</i>			
<b>House connection mode</b>	choice box	Update all	Removing existing first Update new Update all
<i>If <b>remove existing first</b>, all the existing connections are deleted before new ones are created from the controls.</i>			
<i>If <b>update new</b>, connections are only created from controls with names different from any existing connection.</i>			
<i>If <b>update all</b>, connections are created from all controls.</i>			
<b>Factor of safety</b>	input number	0.15	
<i>The connection height for the control is adjusted by this depth from the control connection depth.</i>			

**Buttons at Bottom**

<b>Process</b>	button
<i>Calculate controls and/or create house connections.</i>	
Continue to <a href="#">17.7 AR&amp;R Pre-Burst</a> or go back to <a href="#">17.6 Foul Water Tools</a> or <a href="#">17 Water</a> .	





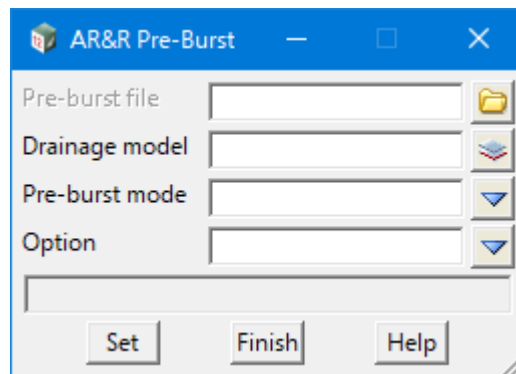
# 17.7 AR&R Pre-Burst

**Position of menu:** Water =>Stormwater =>Dynamic analysis =>ARR 2019 preburst

Now documented in the V15 reference manual

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
<b>Pre-burst file</b>	file box		*.txt files
<i>An AR&amp;R pre-burst txt file downloaded from the AR&amp;R Datahub <a href="https://data.arr-software.org/">https://data.arr-software.org/</a></i>			
<b>Drainage model</b>	model box		available models
<i>The drainage model to set/modify pre-burst parameters for.</i>			
<b>Pre-burst model</b>	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 [17.8 Drainage.4d File Editor](#) or go back to [17.7 AR&R Pre-Burst](#) or [17 Water](#).

## 17.8 Drainage.4d File Editor

**Position of menu:** Water =>Setup =>Edit drainage.4d

Now documented in the V15 reference manual

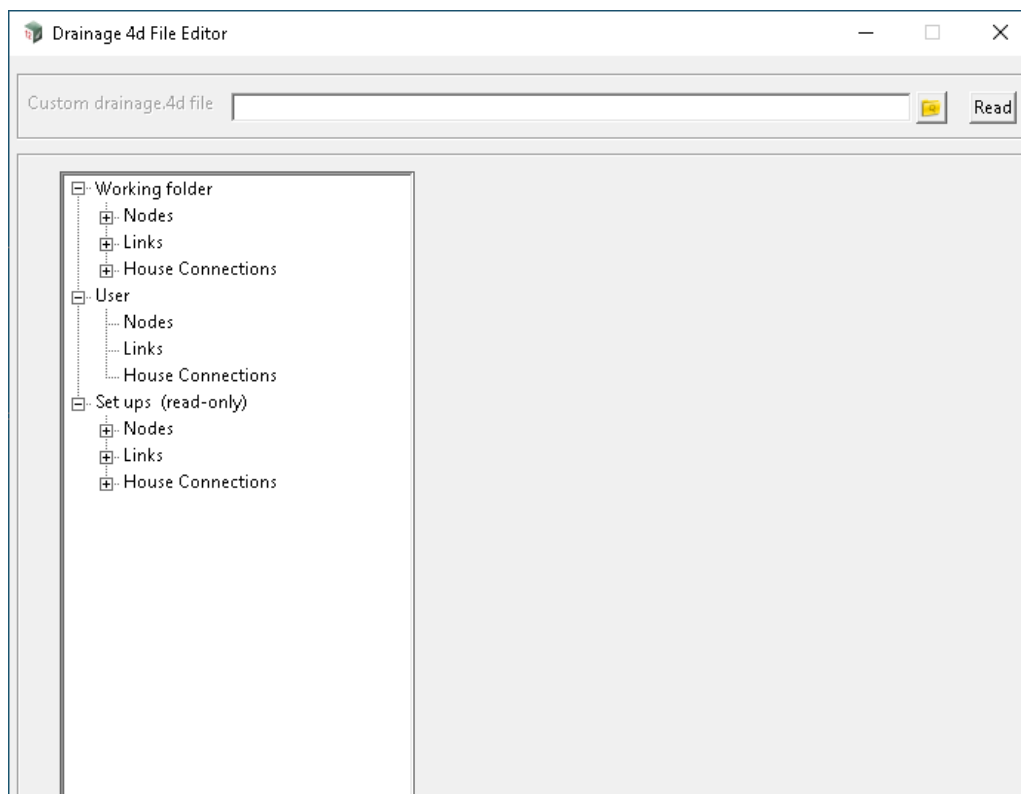
This option edits the XML version of drainage.4d.

For information about where how to find and create drainage.4d (xml) files, see 13.8 Style XML Files.

When the "**Drainage.4d File Editor**" started, standard drainage.4d files from current, user and set\_ups folders are loaded under "Working folder", "User" and "Set ups" nodes. "User" and "Set ups" are marked as "read-only" if the drainage.4d file is found under the user or set\_ups folder.

The panel consists of 4 parts.

Selecting **Edit drainage.4d** brings up the **Drainage.4d File Editor** panel.



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

Field Description	Type	Defaults	Pop-Up
<b>Custom drainage.4d file</b>	file box		dialogue box

*Custom file which users would like to modify.*

**The tree control on the left hand side and the details on the right hand side.**

*Each root node is equivalent to a drainage.4d file. When selecting a root node or a sub node from the tree box, there will be dynamic icons on the left hand side of the tree control to indicate which actions the users can perform on the current node. On the right hand side of the tree, all the details of the current node are shown.*

*There are three branches on each of the root node. They are water nodes, water links and house*

connections.

### Buttons at bottom

**Set** button

*To set the current details of the node.*

**Write** button

*To save the current drainage.4d file.*

*Note: The file being save is the one being chosen in the tree control on the left to be edited.*

### Command buttons on the left hand side

**Add** button

*Add a new node.*

**Copy** button

*Copy the current node with all of its child nodes to the clipboard.*

**Paste** button

*Paste the data stored in the clipboard. The operation is allowed when clipboard data is compatible with the currently selected node.*

**Delete** button

*Delete the current node and all of its child nodes.*

**Move to top** button

*Move the current node to the top of the branch.*

**Move up** button

*Move the current node one place up.*

**Move down** button

*Move the current node one place down.*

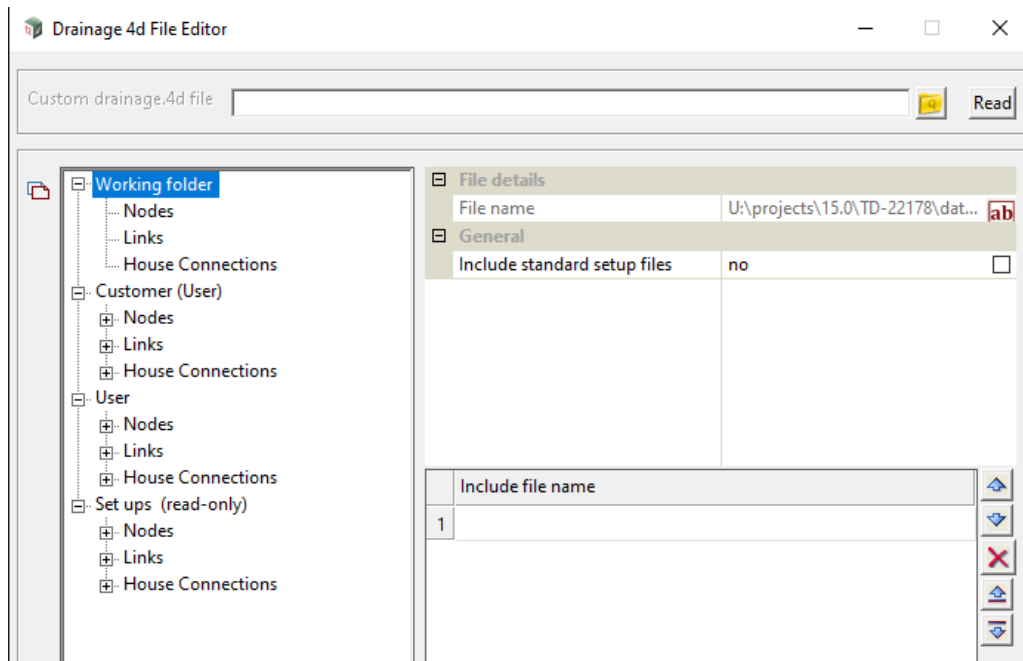
**Move to bottom** button

*Move the current node to the bottom of the branch.*

### Special usages:

#### Adding include files to drainage.4d file

*A drainage.4d file can include more Nodes, Links and House connection from different drainage file by having them included in the setting.*



**Include standard setup files**    tick box    not ticked

*If **ticked**, drainage.4d files from Customer, User and Setup folder will be included into the currently edited file.*

**Include file name**    file box

*A custom drainage file (which doesn't have to be named drainage.4d) can also be included.*

#### Edit a custom drainage file:

*A custom drainage file is shown as "**read-only**" when being included. Use "**Custom drainage.4d file**" file box on the top to edit and save the custom drainage file. Reload the system drainage.4d file, which has the custom drainage file as an include file, to show the actual changes in the system drainage.4d file.*

Continue to [17.9 Adjust Node Locations](#) or go back to [17.8 Drainage.4d File Editor](#) or [17. Water](#).

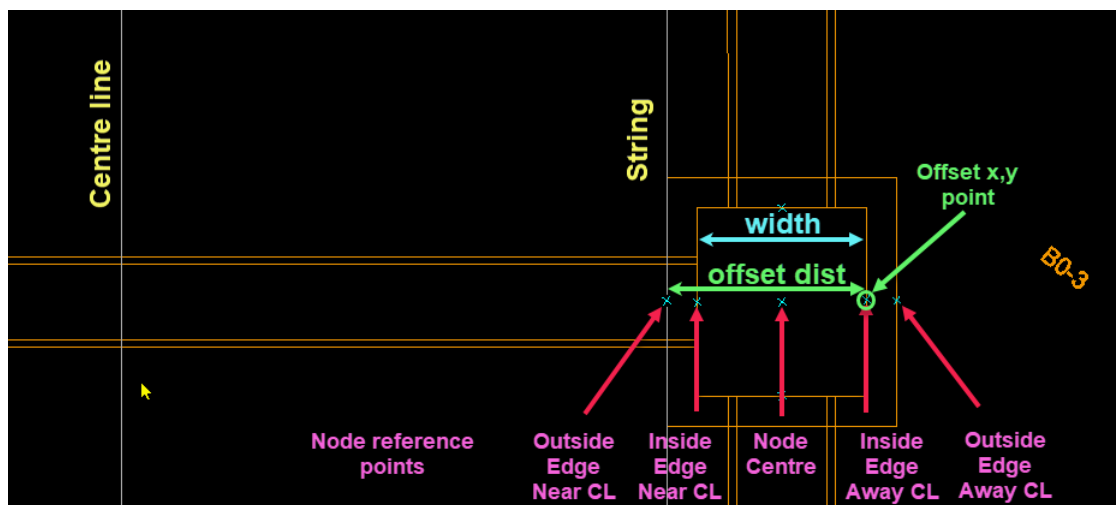
## 17.9 Adjust Node Locations

**Position of option on menu:** Water =>Water Network =>Plan edits =>Adjust Pit Locations

Now documented in the V15 reference manual

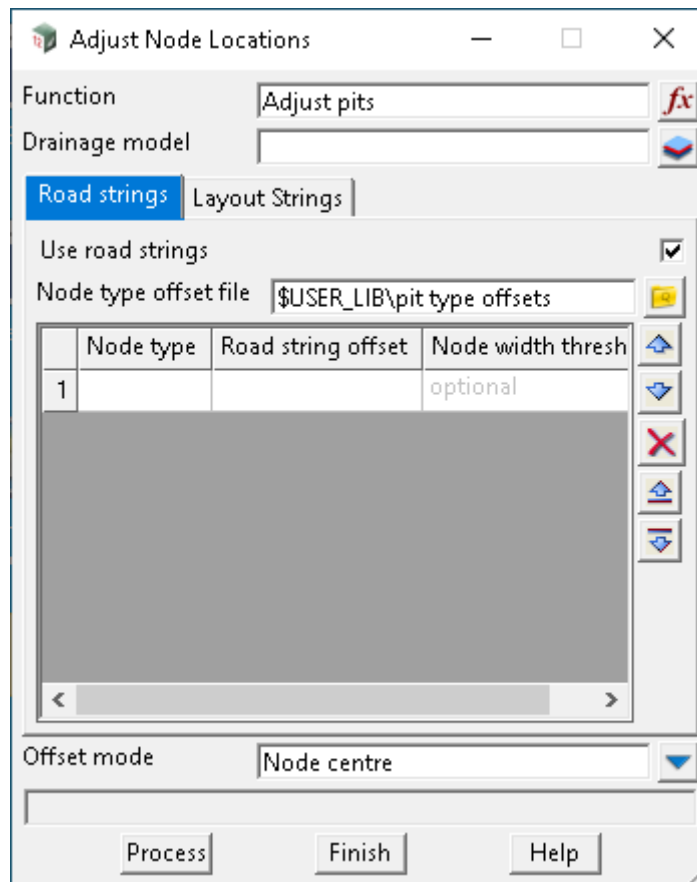
### Key Points

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





**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.*

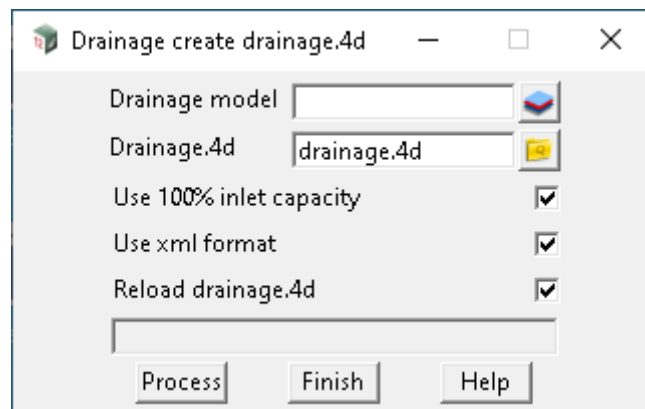
Continue to [17.10 Create drainage.4d from Model](#) or go back to [17.9 Adjust Node Locations](#) or [17 Water](#).

## 17.10 Create drainage.4d from Model

**Position of option on menu:** Water =>Water setup =>Create drainage.4d from model

Now documented in the V15 reference manual

The Drainage create drainage.4d panel has been updated.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Drainage model</b>	model box		
-----------------------	-----------	--	--

*Water strings in the model will be scanned for node and link types (not house connections).*

<b>Drainage.4d</b>	file box		*.4d
--------------------	----------	--	------

*File to be created. xml format does not support Append.*

<b>Use 100% inlet capacity</b>	tick box	ticked	
--------------------------------	----------	--------	--

*Nodes in the drainage.4d file be created with 100% inlet capacity set in the inlet equation.*

<b>Use XML format</b>	tick box	ticked	
-----------------------	----------	--------	--

*If ticked, the file created will be in the V14 xml format. Append is not supported.*

<b>Reload drainage4d</b>	tick box	ticked	
--------------------------	----------	--------	--

*If ticked, the drainage.4d file will be loaded (12d Model restart is not required). Any open panels with node and link type boxes will need to be closed and re opened.*

Continue to [17.11 Create Drainage from Points and Line](#) or go back to [17.10 Create drainage.4d from Model](#) or [17 Water](#).

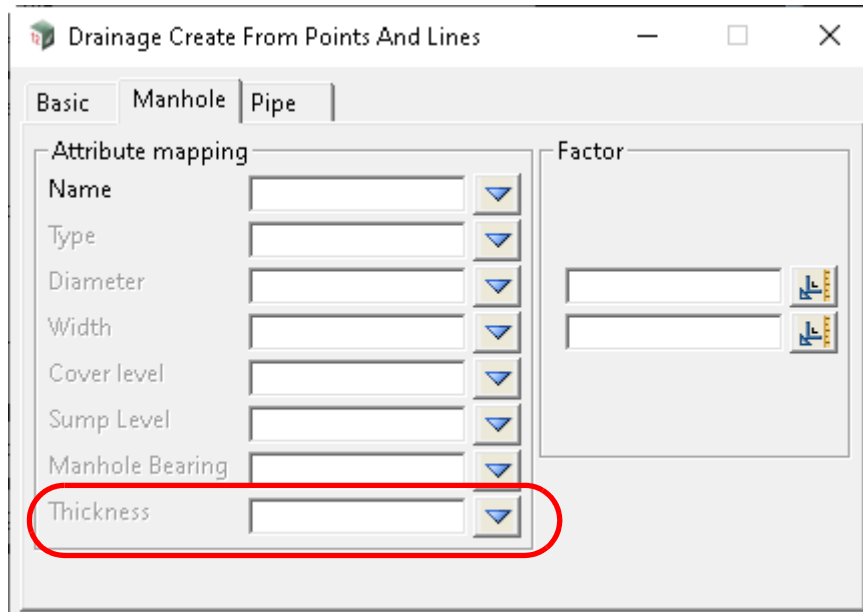
## 17.11 Create Drainage from Points and Line

**Position of option on menu:** Water =>Water network =>Create =>Create from pts and lines

Now documented in the V15 reference manual

This is the **Drainage Create from Pts and Lines** with a thickness added for manholes and pipes.

This will be extended to all the thicknesses before the release.



Continue to [17.12 Convert Water to Super Strings](#) or go back to [17.11 Create Drainage from Points and Line](#) or [17 Water](#).

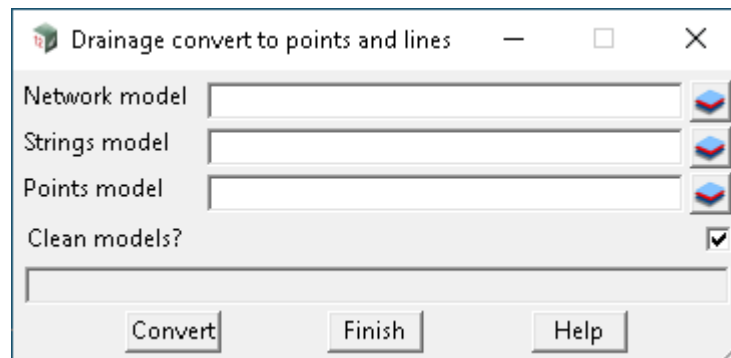
## 17.12 Convert Water to Super Strings

**Position of option on menu:** Water =>Water network =>Convert =>Convert to super

Now documented in the V15 reference manual

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
<b>Water string inputs</b>			
<b>Water model</b>	model box		available models
<i>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.</i>			
<b>String name mask(s) for inclusion</b>	text box		
<i>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.</i>			
<b>String name mask(s) for exclusion</b>	text box		
<i>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.</i>			
<b>Node type mask(s) for exclusion</b>	text box		
<i>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.</i>			
<b>Link type mask(s) for exclusion</b>	text box		
<i>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.</i>			
<b>Link line options</b>			
<b>Link line justification</b>	choice box	invert	obvert, centre, invert
<i>The vertical justification of the link line Super string components.</i>			

**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.*

**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 [17.13 Convert to XML drainage.4d](#) or go back to [17.12 Convert Water to Super Strings](#) or [17 Water](#).

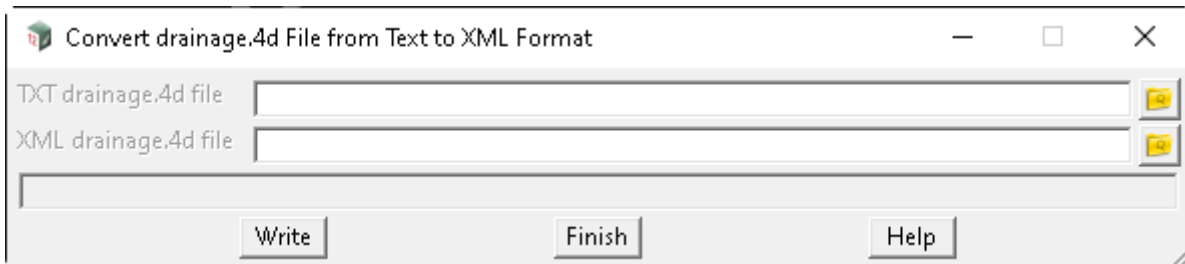


## 17.13 Convert to XML drainage.4d

**Position of option on menu:** Water =>Network =>Old =>Convert drainage.4d from text to XML

Now documented in the V15 reference manual

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
<b>TXT drainage.4d file</b> <i>An old existing drainage.4d file, so not any XML based file.</i>	file box		all *.4d
<b>XML drainage.4d file</b> <i>A new drainage.4d file which will be in the XML format.</i> <i>Note: these boxes should not be the same file.</i>	file box		all *.4d

### Buttons at Bottom

**Write** button  
*If clicked, writes out the drainage.4d file.*

Continue to [17.14 TUFLOW Source String Utility](#) or go back to [17.13 Convert to XML drainage.4d](#) or [17 Water](#).

# 17.14 TUFLOW Source String Utility

**Position of option on menu:** Water =>Water 2D =>Water 2D tools => TUFLOW source string utility

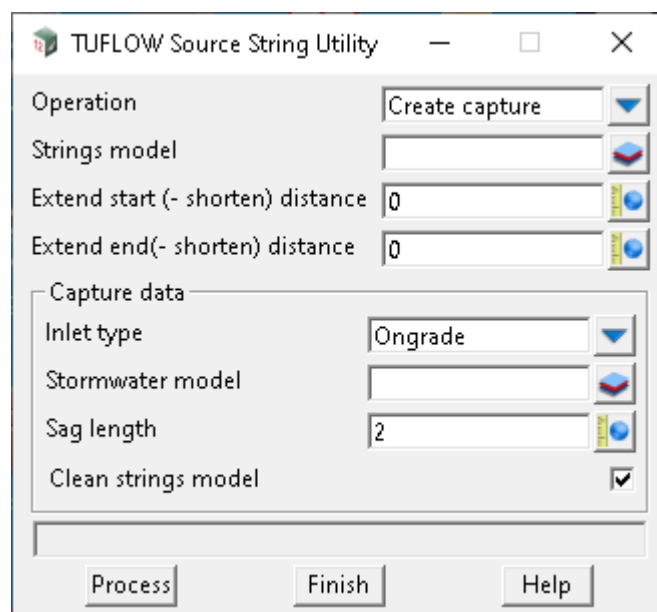
Now documented in the V15 reference manual

This panel creates or modifies strings that are used to select the 2d cells that:

- Inlet hydrographs are applied to.

- Inlet capture flow from.

On selecting the TUFLOW source string utility option, the TUFLOW Source String Utility panel is displayed.



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

Field Description	Type	Defaults	Pop-Up
<b>Operation</b>	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).*

<b>Strings model</b>	model box	available models
----------------------	-----------	------------------

*Model for new strings for **Create Capture** and existing strings for **Adjust Catchments**.*

<b>Extend start (- shorten) distance</b>	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.*

<b>Extend end (- shorten) distance</b>	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 model** 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.

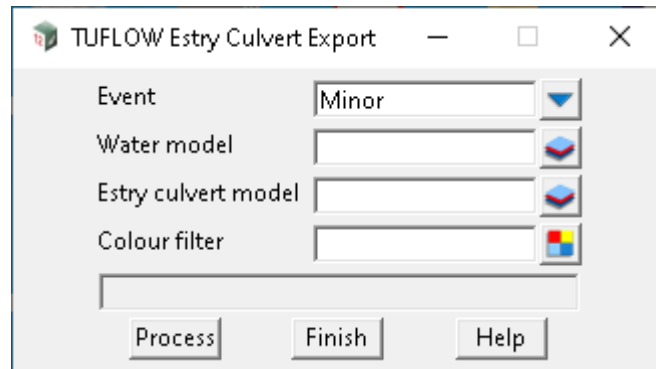
Continue to [17.15 ESTRY Culverts](#) or go back to [17.14 TUFLOW Source String Utility](#) or [17. Water](#).

# 17.15 ESTRY Culverts

**Position of option on menu:** Water =>Water 2D =>Water 2D tools => ESTRY culverts

Now documented in the V15 reference manual

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
<b>Event</b>	choice box	Minor	Minor, Major
<i>Appended to attributes where indicated. For more information on ESTRY attributes see <a href="#">ESTRY Attributes</a>.</i>			
<b>Water model</b>	model box		available models
<i>Source model for water strings.</i>			
<b>Estry culvert model</b>	model box		available models
<i>Super strings with ESTRY attributes, elevations and pipe/culvert size will be created. The model is not cleaned first.</i>			
<i>See ESTRY Attributes below for details of the attributes created. The size dimensions and elevations on the resulting super string are for visualisation only.</i>			
<b>Colour filter</b>	colour box		available colours
<i>Only links matching this colour will be exported. String colour is checked when no link colour is specified.</i>			

### Buttons at Bottom

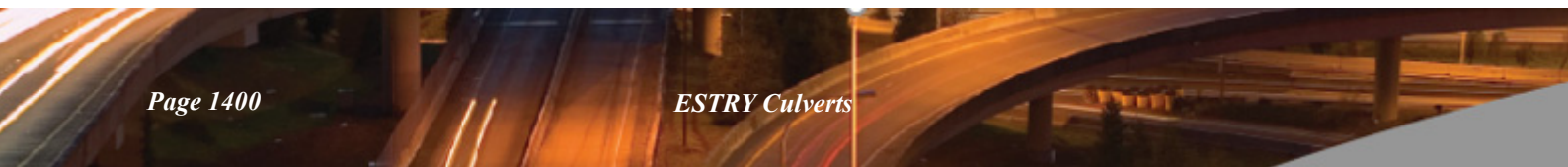
<b>Process</b>	button
<i>Process the option.</i>	

### 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	



TUFLOW\_String\_Editor\_Panel

TUFLOW string: 12da culvert estry->

Purpose: Defined in model attributes

Main database file: [Empty]

String database file: [Empty]

Label textstyle: "1" left bottom yellow 10 0 1

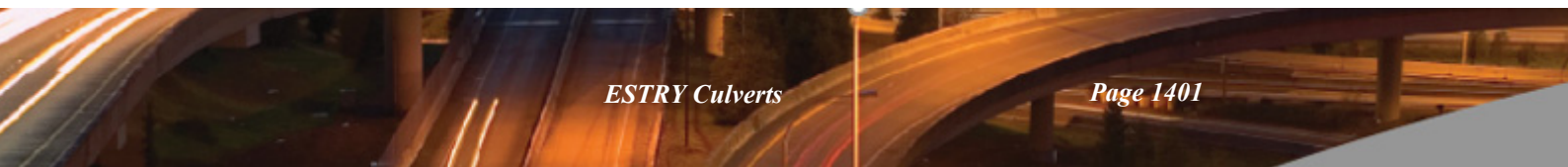
TufLOW Data

	Name	Data
1	ID	1 to 2
2	Type	C
3	Ignore	
4	UCS	
5	Len_or_ANA	10
6	n_nF_Cd	0.013
7	US_Invert	98.35
8	DS_Invert	98.3
9	Form_Loss	0
10	pBlockage	0
11	Inlet_Type	
12	Conn_1D_2D	
13	Conn_No	0
14	Width_or_Dia	0.9
15	Height_or_WF	0
16	Number_of	1
17	HConF_or_WC	0.6
18	WConF_or_WEx	0.9
19	EntryC_or_WSa	0.5
20	ExitC_or_WSb	1

Model purpose and defaults updated and string attributes saved

Buttons: Set, Update model purpose, Finish, Help

Continue to [17.16 Xsection Interpolation](#) or go back to [17.15 ESTRY Culverts](#) or [17 Water](#).



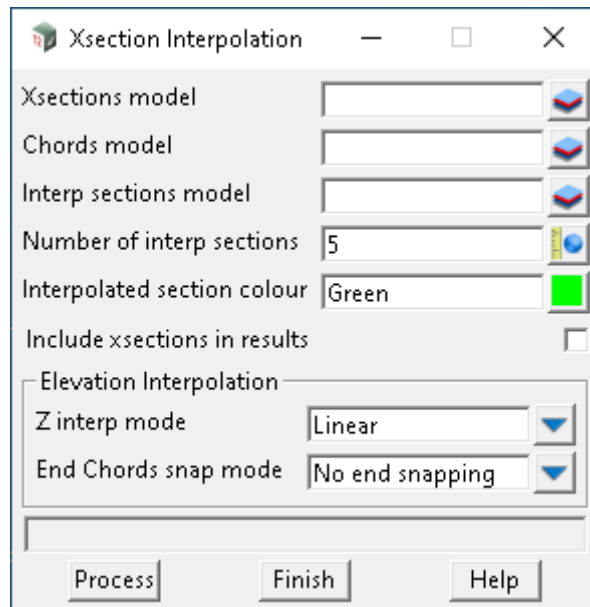


# 17.16 Xsection Interpolation

**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.

On selecting the **Xsection interpolation** option, the **Xsection Interpolation** panel is displayed.



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

Field Description	Type	Defaults	Pop-Up
<b>Xsections model</b> <i>Existing super string cross sections with elevations.</i> <i>The strings must start at the same chord (low chainage chord).</i> <i>The strings must all end at the same chord (high chainage chord) that is different to the starting chord.</i> <i>The xsections must not intersect.</i>	model box		available models
<b>Chords model</b> <i>Existing super strings that intersect every xsection and never intersect each other.</i> <i>The chord that intersects the start of the xsections in called the <b>low chainage chord</b>.</i> <i>The chord that intersects the end of the xsections in called the <b>high chainage chord</b>.</i> <i>All other chords are called internal chords.</i> <i>The must be a low chainage chord and a high chainage chord. Internal chords are optional.</i> <i>See Zinterp and snap modes below to check if elevations are required for the low and/or high chainage chords.</i> <i>The chords must all start at the same xsection (starting xsection).</i>	model box		available models

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 [17.17 Stormwater](#) or go back to [17.16 Xsection Interpolation](#) or [17 Water](#).

## 17.17 Stormwater

The names of the options **Drainage rainfall editor** and **Create rainfall file** on the **Stormwater** menu has been changed to **Hydro file editor** and **Create hydro file** respectively.

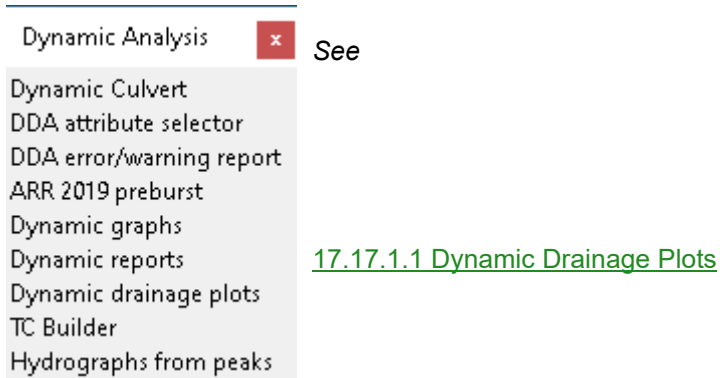
Stormwater 	See
Network editor	
Plan edits 	
Hydro file Editor	
Create Hydro File	
Downhill strings	
Utility string editor	
Dynamic analysis 	<a href="#">17.17.1 Dynamic Analysis</a>
Raindrop	
Aquaplaning risk	
Catchments from Strings	<a href="#">17.19 Catchments From Strings</a>
Split catchment	
TC Builder	<a href="#">17.20 Hydrographs from Peaks</a>
Inlet capacity curves	<a href="#">17.21 Stormwater Inlet Capacities</a>
Capture curve viewer	<a href="#">17.22 Capture Curve Viewer</a>
Create culvert	
Create culvert headwalls	

## 17.17.1 Dynamic Analysis

**Position of menu:** Water =>Stormwater =>Dynamic analysis

Now documented in the V15 reference manual

The **Dynamic Analysis** walk-right menu containing these options is:



The screenshot shows a software menu titled "Dynamic Analysis" with a red close button (x) to its right. Below the title, a list of options is displayed in a light gray background. The options are: Dynamic Culvert, DDA attribute selector, DDA error/warning report, ARR 2019 preburst, Dynamic graphs, Dynamic reports, Dynamic drainage plots, TC Builder, and Hydrographs from peaks. To the right of the menu, the word "See" is followed by a green underlined link: [17.17.1.1 Dynamic Drainage Plots](#).

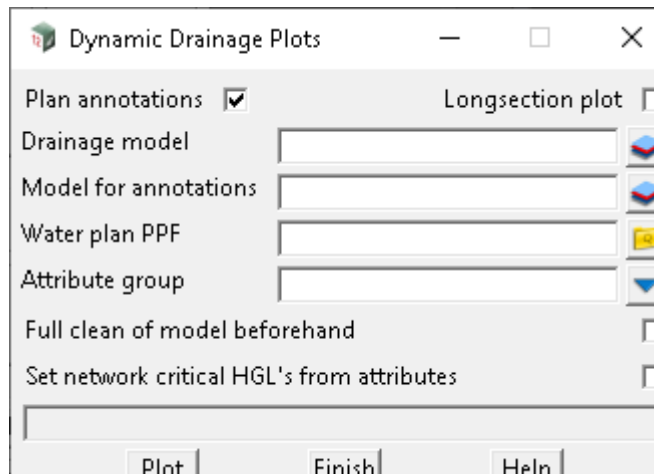
### 17.17.1.1 Dynamic Drainage Plots

**Position of option on menu:** Water => Stormwater =>Dynamic Analysis =>Dynamic drainage plots

Now documented in the V15 reference manual

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
<b>Drainage model</b>	model box		available models
<i>The drainage model to reference for results data.</i>			
<b>Water PPF</b>	file box	Previous drainplanppf name used for the model (if any)	
<i>PPF file to use for the plots (drainplanppf or drainppf).</i>			
<b>Model for annotations</b>	model box		available models
<i>Model to use for the drainplanppf outputs.</i>			
<i>Note: only visible when a drainplanppf file has been chosen in <b>Water PPF</b>.</i>			
<b>Plot model stem</b>	input box	Previous	
<i>The model stem to use for long-section plots.</i>			
<i>Note: only visible when a drainppf file has been chosen in <b>Water PPF</b>.</i>			
<b>Attribute group</b>	choice box		
<i>Allows selection of an analysis attribute group to use for the plots. This will override any analysis attribute pathing that exists in the currently selected ppf file to point at the attributes in the chosen group.</i>			
<b>Full clean of model beforehand</b>	tick box	not ticked	
<i>Allows for a full clean to be carried out when plotting. If not selected, a smart-clean will occur.</i>			
<i>Note: Only visible when a drainplanppf has been selected in <b>Water PPF</b>.</i>			
<b>Clean model(s) beforehand</b>	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 [17.18 Aquaplaning Risk Assessment](#) or go back to [17.17 Stormwater](#) or [17. Water](#).

## 17.18 Aquaplaning Risk Assessment

**Position of option on menu:** Water => Stormwater => Aquaplaning risk

Now documented in the [V15 reference manual](#)

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:

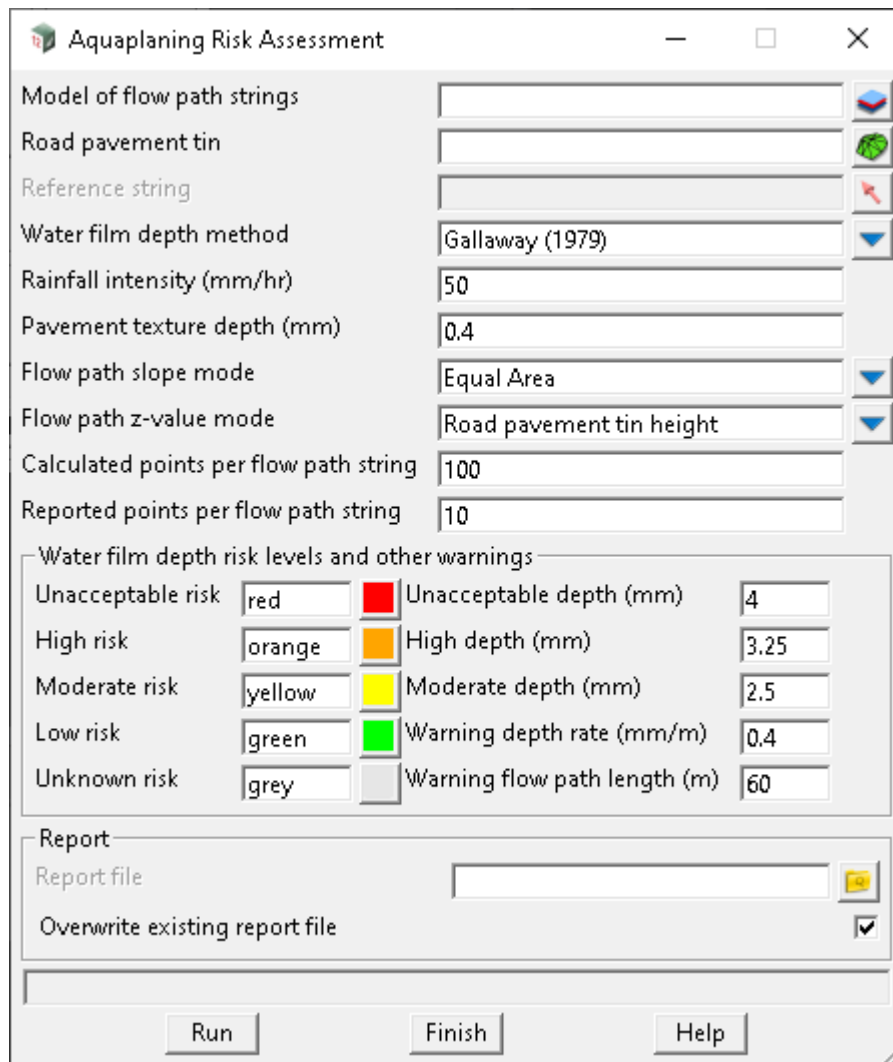
Gallaway Equation (1979)	Road Research Laboratory UK (1968)
$d = \frac{0.103 T^{0.11} L^{0.43} I^{0.59}}{S^{0.42}} - T$	$d = \frac{0.119 L^{0.5} I^{0.5}}{S^{0.2}}$
<p>d = water film depth above top of pavement texture (mm)            L = length of flow path (m)            S = slope of the flow path (%)            T = average pavement texture depth (mm)            I = rainfall intensity (mm/hr)</p>	

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
<b>Model of flow path strings</b>	model box		available models
<i>All Super strings in this model will be analysed and updated with results.</i>			
<b>Road pavement tin</b>	tin box		available tins
<i>Used to define the vertical profile of each flow path string.</i>			
<b>Reference string</b>	string select		
<i>Used to locate, identify, rename and sort the flow path strings (optional).</i>			
<b>Water film depth method</b>	choice box		Gallaway(1979)
<i>Determines which equation to use to estimate the water film depths.</i>			
<b>Rainfall intensity (mm/hr)</b>	input	50	
<i>For aquaplaning checks, typically 50 mm/hr, or the 5 minute intensity for the 1 or 2 year ARI.</i>			
<b>Pavement texture depth (mm)</b>	real box	0.4	
<i>Average texture depths can range from about 0.2 to 4 mm for different pavement materials. Only</i>			

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

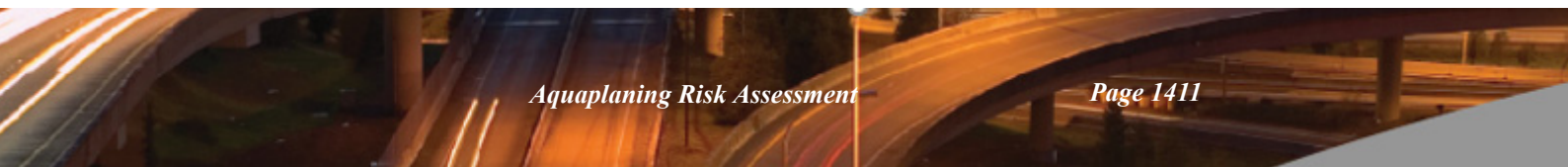
*Warn if  $\frac{\text{water film depth}}{\text{flow path length}}$  is excessive (optional).*

**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

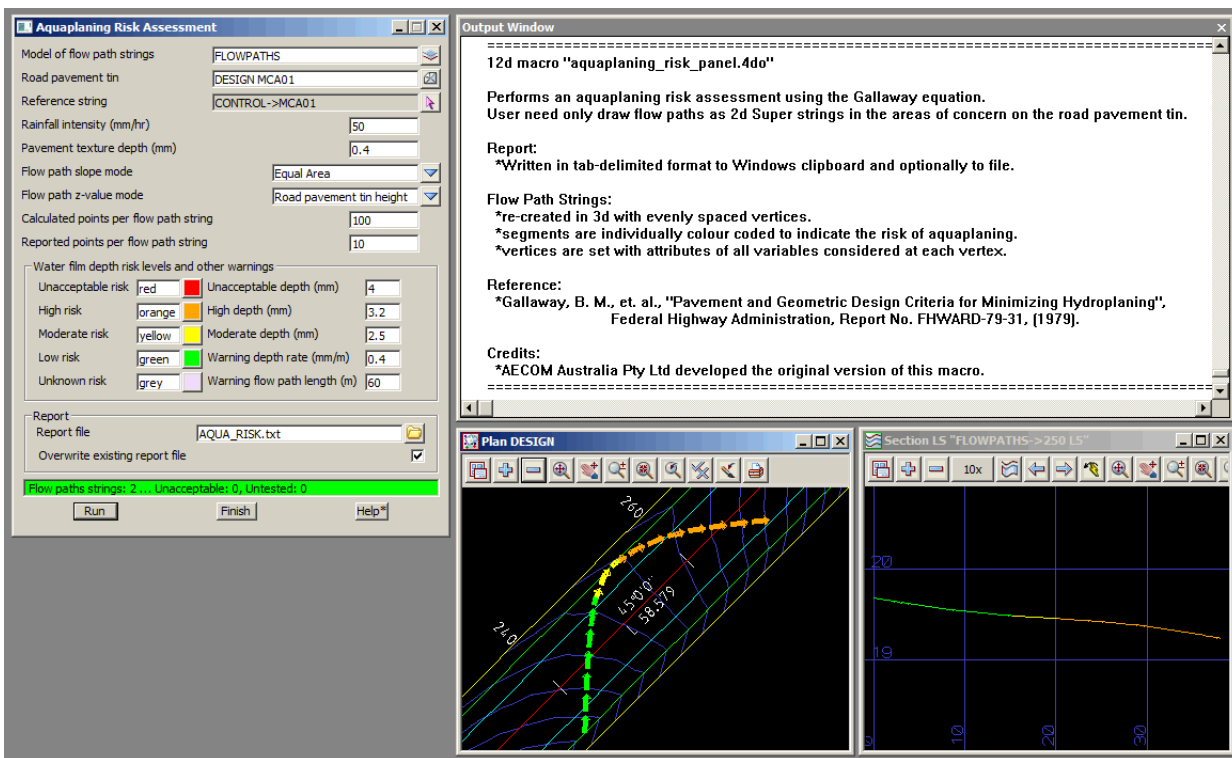
Removes the panel from the screen.

**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:

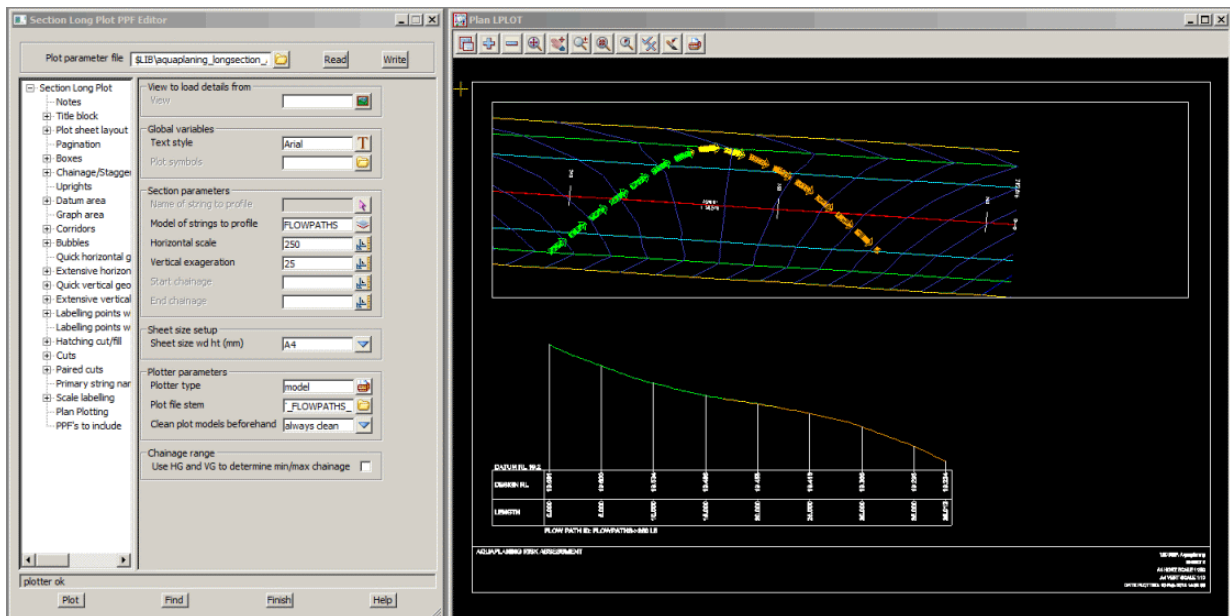
MODEL OF FLOW PATHS: FLOWPATHS  
 ROAD PAVEMENT TIN: DESIGN MCA01  
 REFERENCE STRING: CONTROL->MCA01  
 RAINFALL INTENSITY (mm/hr): 50.0  
 PAVEMENT TEXTURE DEPTH (mm): 0.4  
 FLOW PATH SLOPE: EQUAL-AREA SLOPE

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 [17.19 Catchments From Strings](#) or go back to [17.18 Aquaplaning Risk Assessment](#) or [17 Water](#).



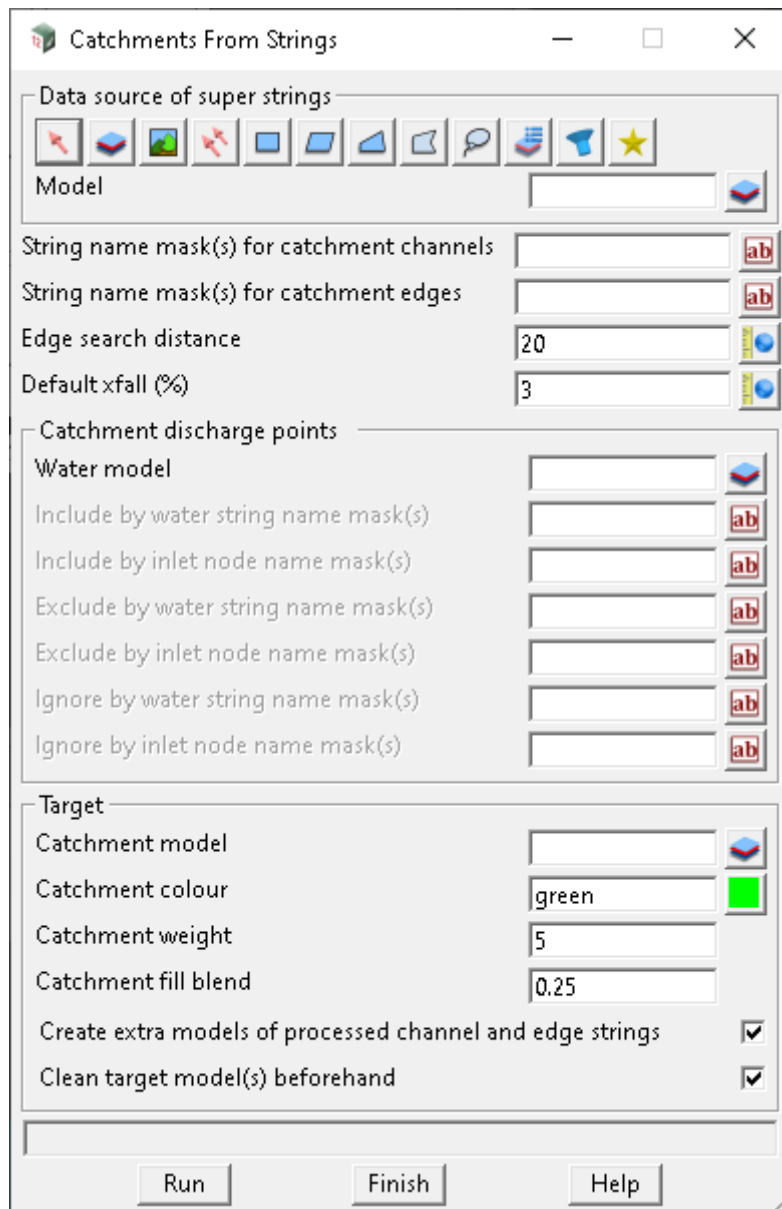
# 17.19 Catchments From Strings

**Position of option on menu:** Water =>Stormwater =>Catchments from Strings

Now documented in the V15 reference manual

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 the **Catchment from strings** option, the **Catchment From 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 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.

**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

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

Whether to clean the target 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 [17.20 Hydrographs from Peaks](#) or go back to [17.19 Catchments From Strings](#) or [17 Water](#).

## 17.20 Hydrographs from Peaks

**Position of option on menu:** Water =>Stormwater =>Hydrographs from peaks

Now documented in the V15 reference manual

The choice box **Rational results attribute group** has been added to the **Create hydrographs from peaks** panel.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

**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.*

Continue to [17.21 Stormwater Inlet Capacities](#) or go back to [17.20 Hydrographs from Peaks](#) or [17 Water](#).

## 17.21 Stormwater Inlet Capacities

Now documented in the V15 reference manual

**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.

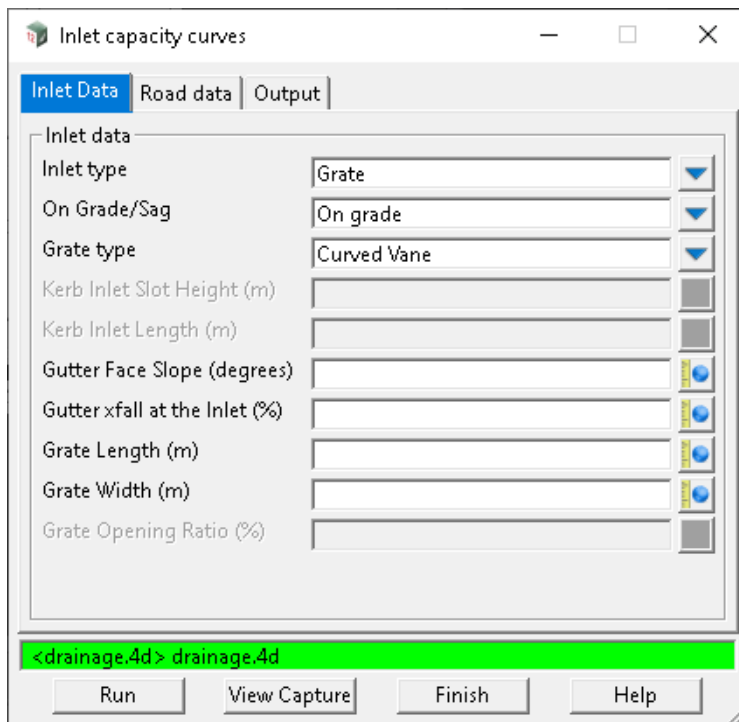
### Inlet Capacity option

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.

Fields in the panel will become disabled when they are not needed for the inlet calculations selected.

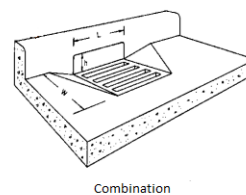
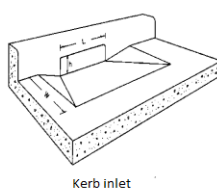
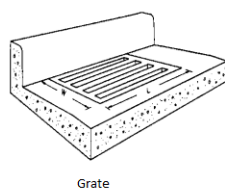
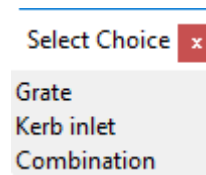
Selecting **Inlet capacity** brings up the **Inlet Curves** panel.



[Inlet data tab](#)  
[Road data tab](#)  
[Output tab](#)

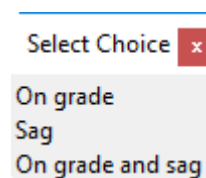
The fields and buttons used in this panel have the following functions:

Field Description	Type	Defaults	Pop-Up
<b>Inlet data tab</b>			
<b>Inlet type</b>	choice box		



Depending on the inlet type selected some boxes may be disabled.

<b>On Grade/Sag</b>	choice box
---------------------	------------



Depending on the On-grade or Sag type selected some boxes may be disabled.

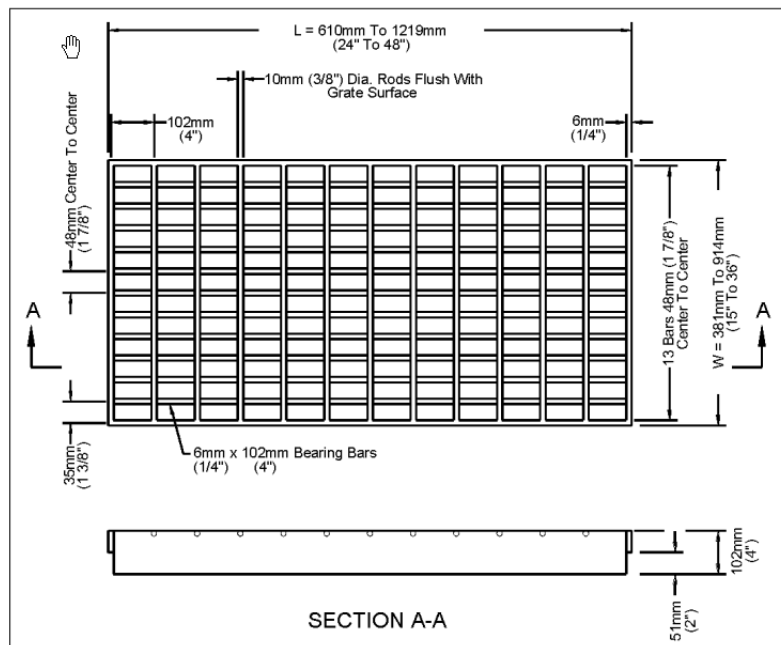


Grate type choice box



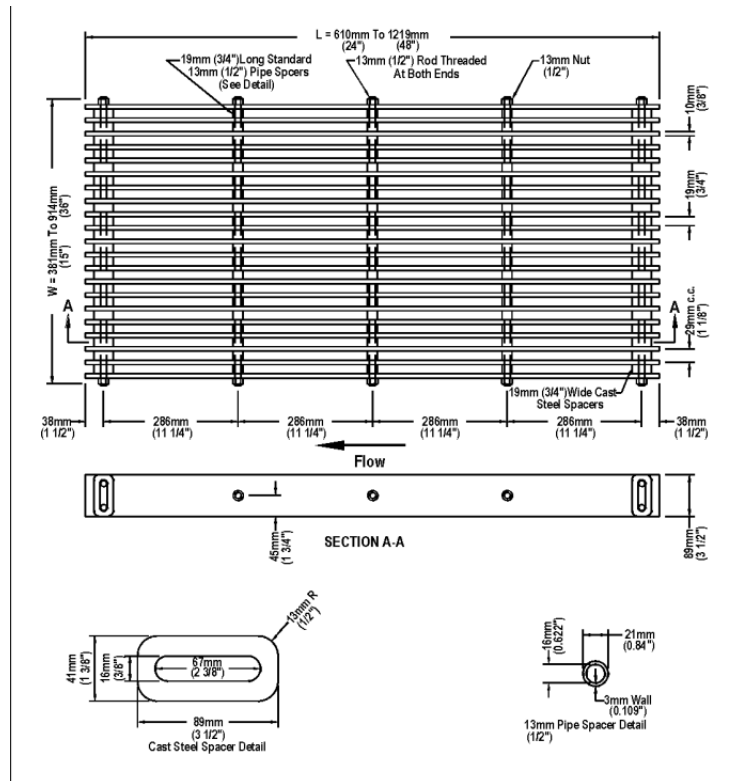
**Bar P50** - Parallel bar grate with bar spacing 48 mm (1-7/8 in) on centre (Original Imperial name was Bar P-1-7/8).

**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).

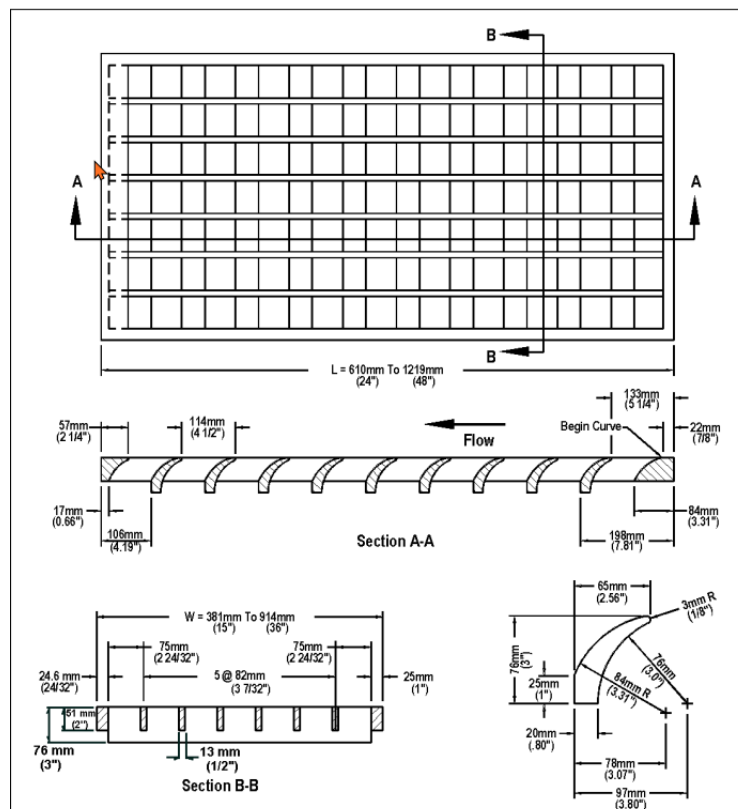


**Bar P50 and Bar P50 - 100** grate (P50 is this grate without 10mm (3/8") transverse rods).

**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)

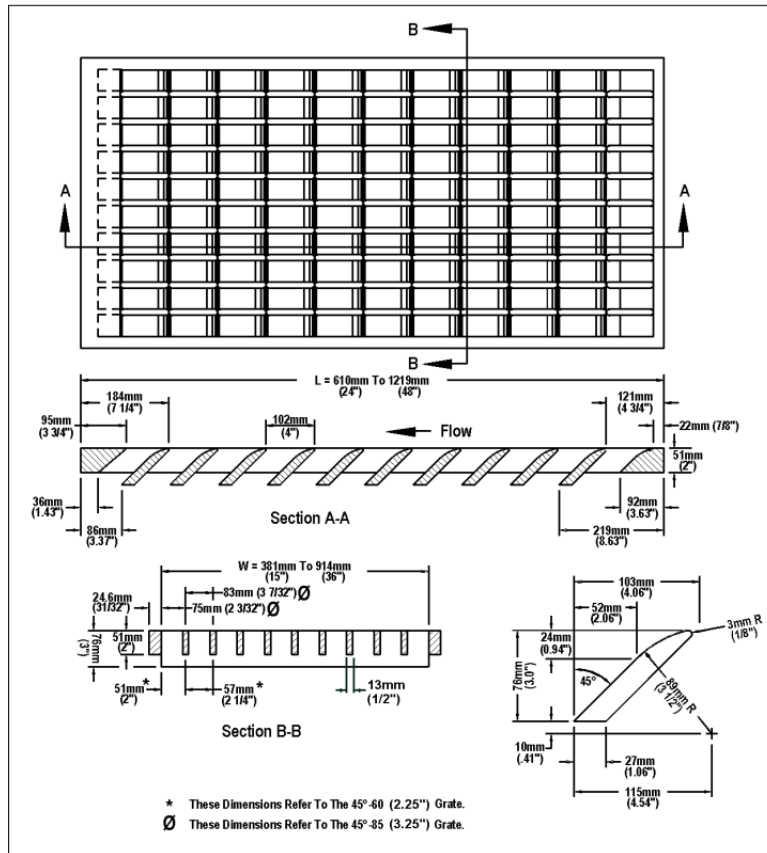


**Curved Vane** - Curved vane grate with 83 mm (3-1/4 in) longitudinal bar and 108 mm (4-1/4 in) transverse bar spacing on centre (Original Imperial name was Vane Grate).



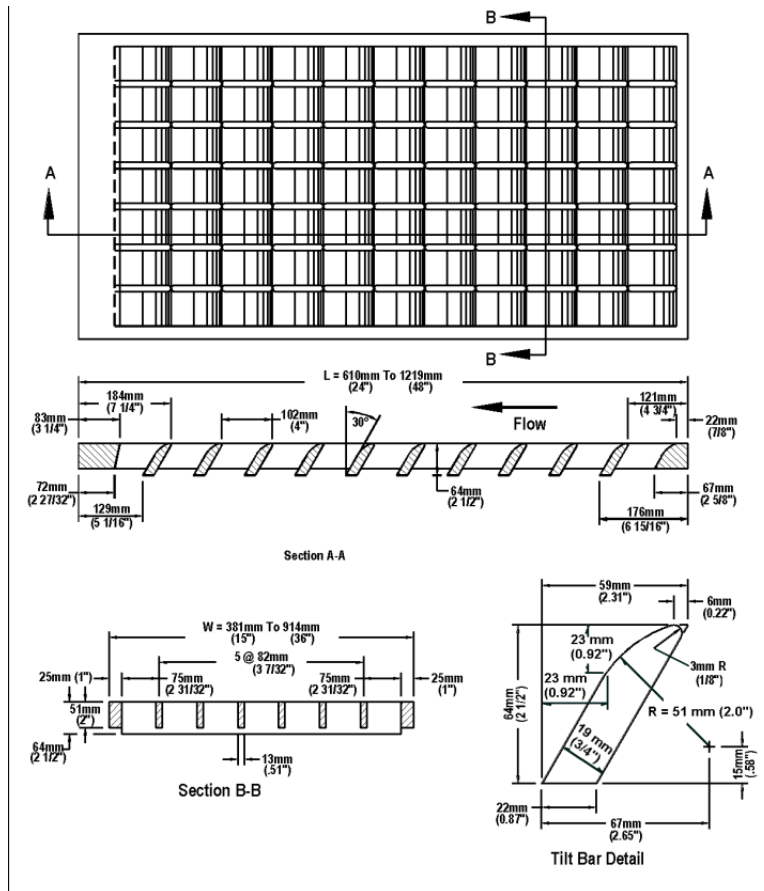
**45°- 85 Tilt Bar** - 45° Tilt-bar grate with 83 mm (3-1/4 in) longitudinal bar and 102 mm (4 in) transverse bar spacing on centre.

transverse bar spacing on centre (Original Imperial name was 45° Tilt-bar).

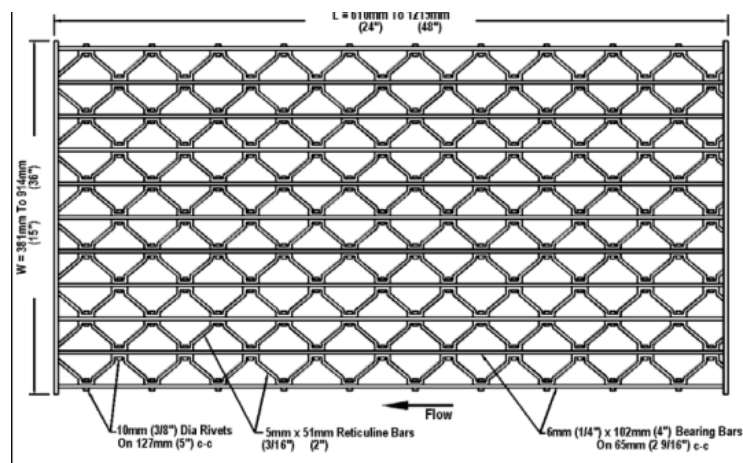


45°- 60 (2.25") and 45°- 85 (3.25") Tilt-bar grates (45°- 60 not supported).

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).



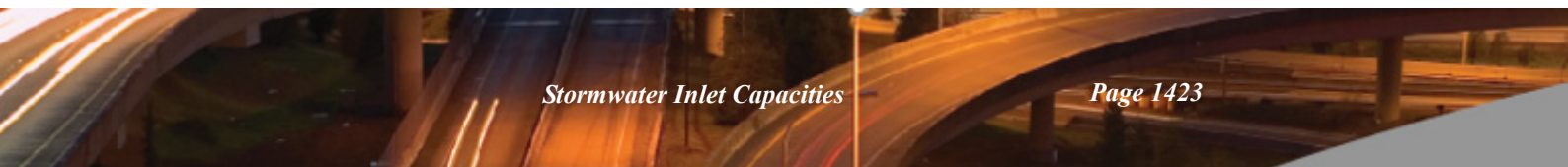
*Reticuline* - "Honeycomb" pattern of lateral bars and longitudinal bearing bars (Original Imperial name was Reticuline).



**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).*

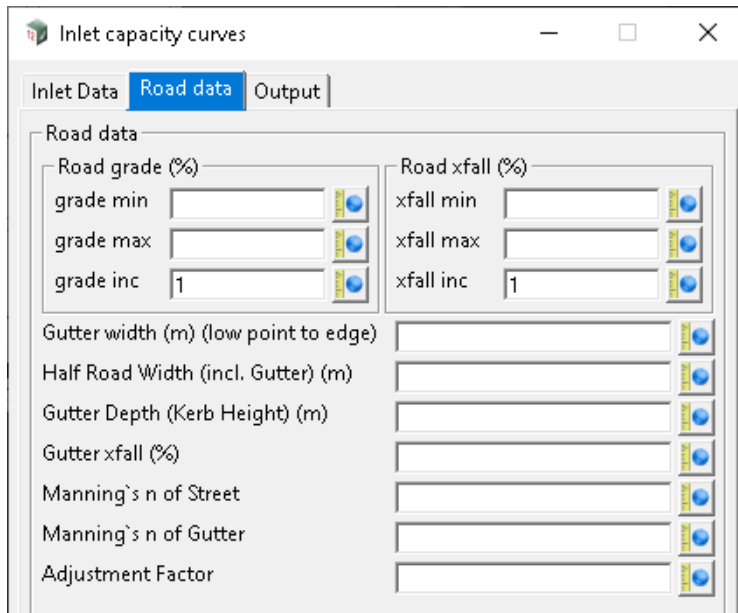
**Grate opening ratio (%)**    real box

*Ratio of 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 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

*The flattest longitudinal grade for which a curve will be created.*



**grade max** real box

*The Steepest longitudinal grade for which a curve will be created.*

**grade inc** real box

*The 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

*The flattest road crossfall for which a curve will be created.*

**xfall max** real box

*The steepest road crossfall for which a curve will be created.*

**xfall inc** real box

*The 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

*The distance from the low point of the gutter to the top of the kerb.*

**Gutter xfall (%)** real box

*The grade of the gutter from the low point of the gutter to the gutter lip.*

**Gutter face slope (deg)** real box

*The vertical angle of the face of the kerb.*

**Manning's n of Street** real box

*The roughness of the roadway (excluding the gutter) expressed in terms of Manning's n.*

**Manning's n of Gutter** real box

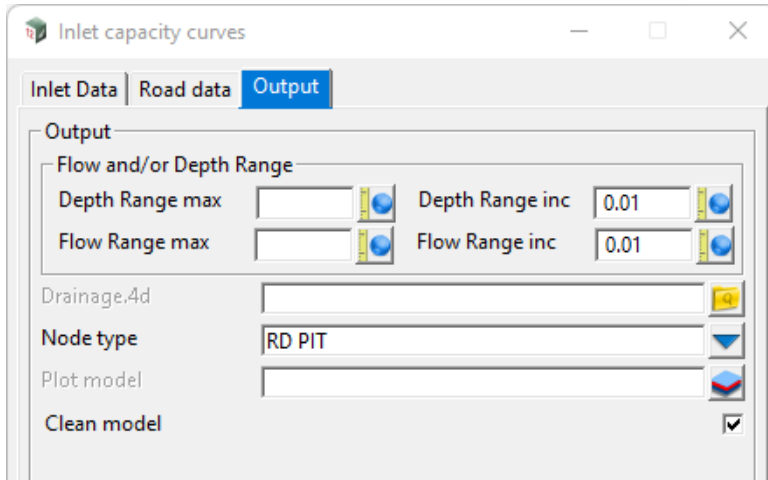
*The roughness of the kerb and gutter expressed in terms of Manning's n.*

**Adjustment Factor** real box

*A 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

*The maximum depth that will be used in the creation of a sag curve (curves always start at 0).*

**Depth Range inc**                      real box                      .01

*The depth increment used to determine the maximum number of points in the sag curve.*

**Flow Range max (m3/s)**              real box

*The 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

*The flow increment that will be used in the creation of the on-grade curves.*

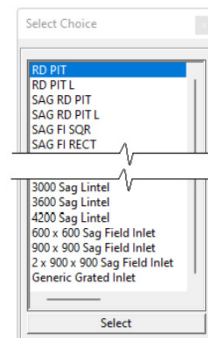
**Drainage.4d**                              file box

*This is the 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 will 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.*



# 17.22 Capture Curve Viewer

Now documented in the V15 reference manual

- Position of option on menu: Setup => Capture curve viewer (Water theme)
- Water => Stormwater => Capture curve viewer
- Water => Water setup => Capture curve viewer

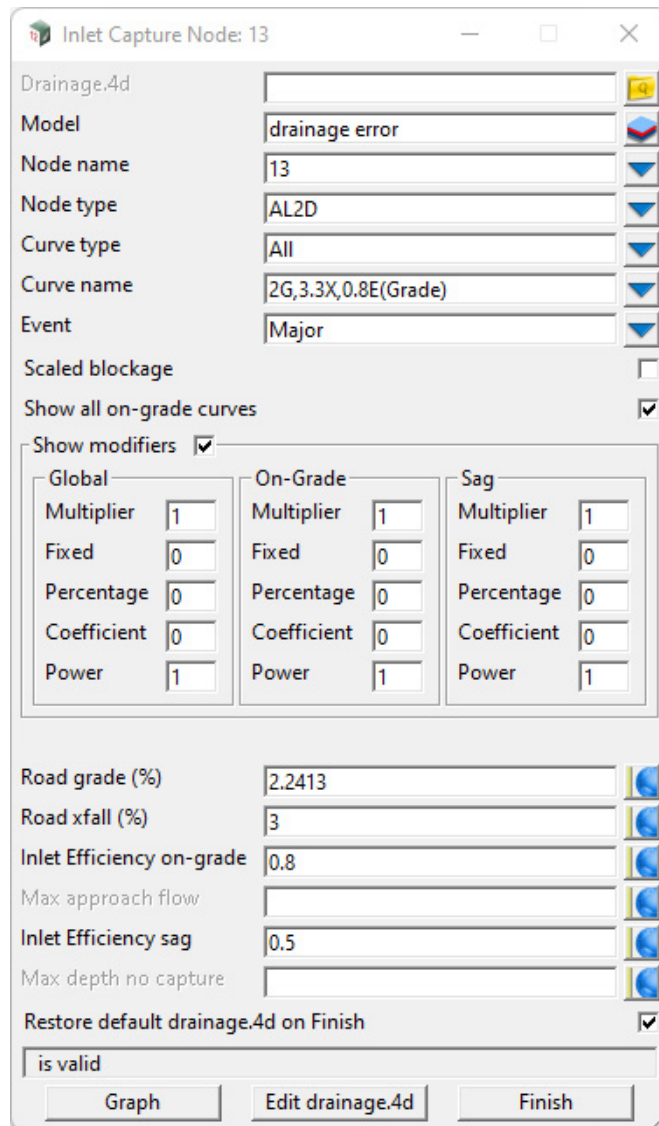
Background: Stormwater Inlet Capacity (pit capture) - 12d Model

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
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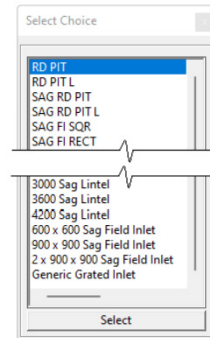
<b>Drainage.4d</b>	file box		*.4d files
--------------------	----------	--	------------

*The name of the drainage.4d file currently being interrogated. If blank the currently loaded drainage.4d file will be used.*

<b>Model</b>	model box		available models
--------------	-----------	--	------------------

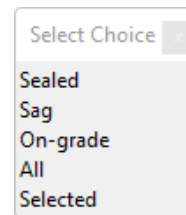
*The name of the stormwater model. If blank the road grade, crossfall and efficiency will not be loaded from the stormwater model and used in the calculation of captured flow.*

<b>Node name</b>	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.*

<b>Curve type</b>	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.*

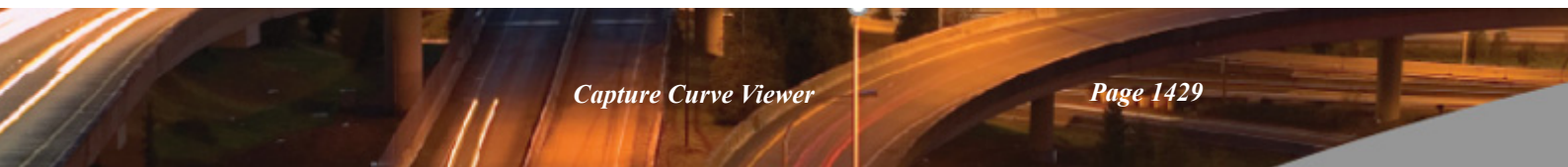
**Sealed** - will display results only for sealed node types.

**Sag** - will display results only for the sag curve.

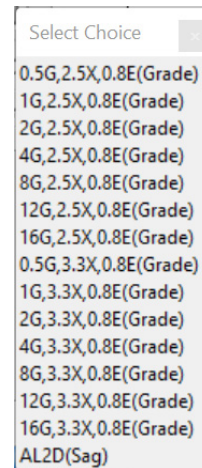
**On-grade** - will display only results for the on-grade curves with the curve representing the road grade and crossfall shown with a bold line-style.

**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

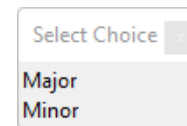


Select Choice

- 0.5G,2.5X,0.8E(Grade)
- 1G,2.5X,0.8E(Grade)
- 2G,2.5X,0.8E(Grade)
- 4G,2.5X,0.8E(Grade)
- 8G,2.5X,0.8E(Grade)
- 12G,2.5X,0.8E(Grade)
- 16G,2.5X,0.8E(Grade)
- 0.5G,3.3X,0.8E(Grade)
- 1G,3.3X,0.8E(Grade)
- 2G,3.3X,0.8E(Grade)
- 4G,3.3X,0.8E(Grade)
- 8G,3.3X,0.8E(Grade)
- 12G,3.3X,0.8E(Grade)
- 16G,3.3X,0.8E(Grade)
- AL2D(Sag)

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



Select Choice

- Major
- Minor

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 enabled 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.

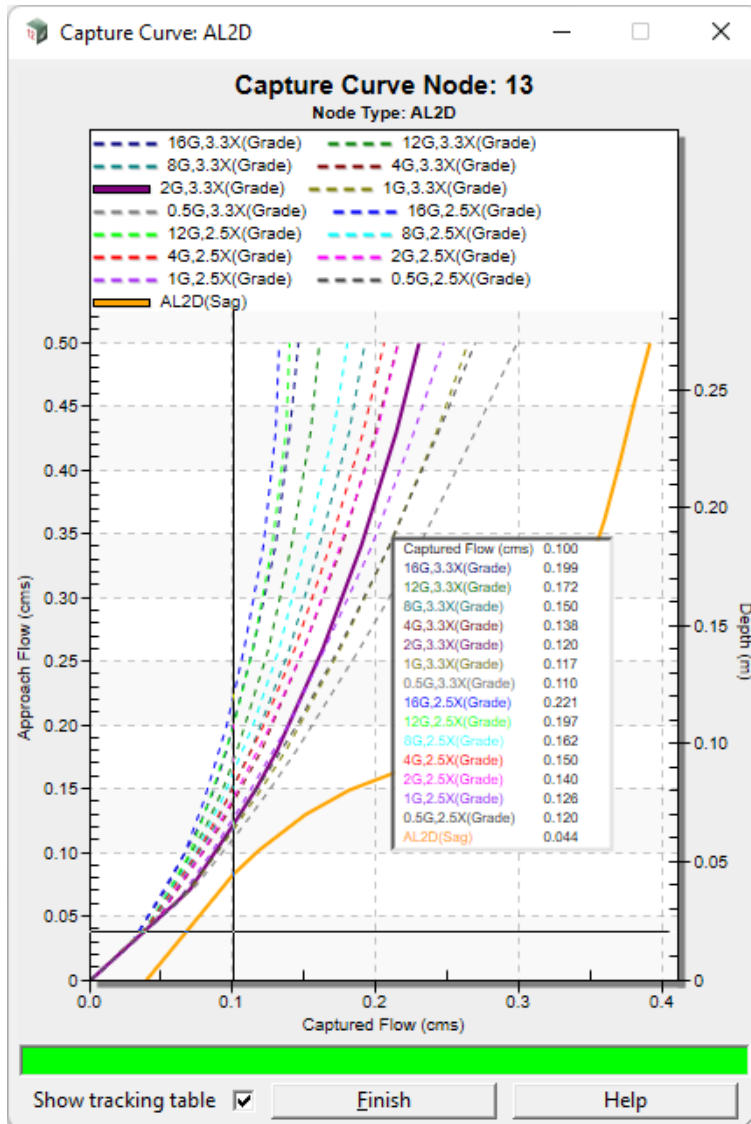




- Coefficient** real box  
*This is the coefficient used in a power equation for on-grade inlets.*
- Power** real box  
*This is the exponent used in a power equation for on-grade inlets.*
- Road Grade (%)** real box  
*The longitudinal grade at the selected node. The on-grade curve corresponding to this grade is shown with a bold line-type.*
- Road xfall (%)** real box  
*The 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  
*The 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  
*The 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      
*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 [17.22.1 Graph Panel](#).*
- Edit drainage.4d** button  
*Open the Drainage.4 File Editor.*
- Finish** button  
*Close the panel.*



## 17.22.1 Graph Panel



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

Field Description	Type	Defaults	Pop-Up
<b>Show tracking table</b>	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.*

<b>Finish</b>	button
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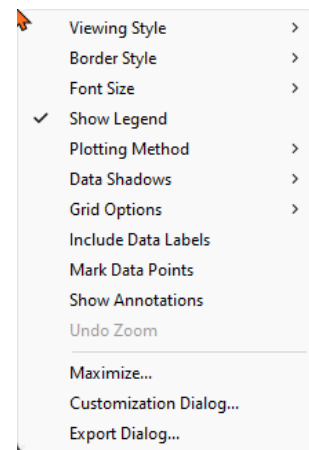
*Closes this panel. The panel can be re-opened by clicking the Graph button on the main panel.*

<b>Help</b>	button
-------------	--------

*Opens this help file.*

RB

Mouse



*There are numerous display options available and the modeller is encouraged to experiment.*

Continue to [17.23 Triangulate Grate Levels](#) or go back to [17.22 Capture Curve Viewer](#) or [17 Water](#).

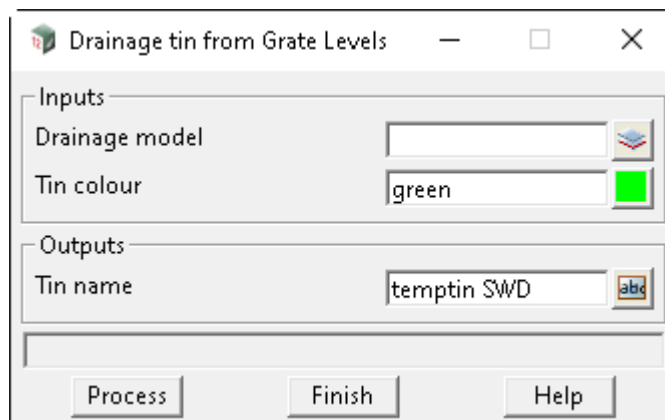
## 17.23 Triangulate Grate Levels

**Position of option on menu:** Water =>Water network =>Tools =>Triangulate grate levels

Now documented in the V15 reference manual

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
<b>Inputs</b>			
<b>Drainage model</b> <i>Drainage model to create a tin.</i>	model box		available models
<b>Tin colour</b> <i>Colour for the created tin.</i>	colour box	green	available colours
<b>Outputs</b>			
<b>Tin name</b> <i>Name for the created tin.</i>	text box	temptin SWD	
<b>Buttons at Bottom</b>			
<b>Process</b> <i>Creates the Tin.</i>	button		

Continue to [17.24 Water Real Attributes to Null](#) or go back to [17.23 Triangulate Grate Levels](#) or [17 Water](#).

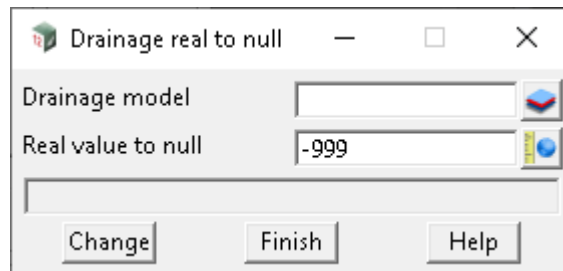
## 17.24 Water Real Attributes to Null

**Position of option on menu:** Water =>Water network =>Tools =>Water real attributes to null

Now documented in the [V15 reference manual](#)

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
<b>Drainage model</b>	model box		available models

*The drainage model to check real attribute values for.*

<b>Real value to null</b>	real box	-999	
---------------------------	----------	------	--

*Real value to substitute with Null, wherever it occurs (node / link / string attributes).*

Continue to [17.25 2D Quick Analysis](#) or go back to [17.24 Water Real Attributes to Null](#) or [17 Water](#).

## 17.25 2D Quick Analysis

**Position of option on menu:** Water =>Water 2D =>2D quick analysis

Now documented in the V15 reference manual

This option was previously known as **Roadflow** in Version 14.

On selecting the **2D quick analysis** option, the **2D Quick Analysis** panel is displayed.

2D Quick Analysis

Base data | Optional data | Log law | Results

Grid Inputs

Tuflow grid extent

Cell Size

SGS frequency

Rainfall (mm/in per hr)

Mannings n

Ground tin

New TUFLOW grid tin model

Boundary Channels Input

Boundary channel depth

Boundary energy slope(%) 2

Analysis Input

Units Metric

Duration (hrs)

Output time inc (sec)

Mapping depth cutoff

Folder

Format Mid/mif

Processor GPU

Run Read Results Result Controls Finish Help

Continue to [17.26 TUFLOW TMO TIN Settings](#) or go back to [17.25 2D Quick Analysis](#) or [17. Water](#).

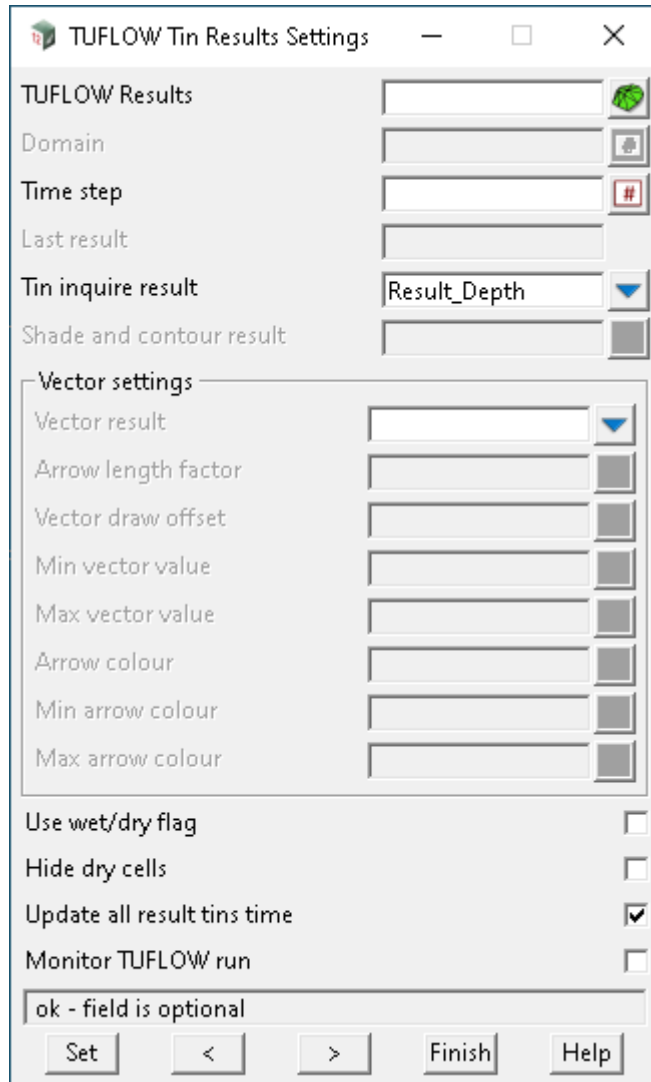
# 17.26 TUFLOW TMO TIN Settings

**Position of option on menu:** Water =>Water 2D =>2D result settings

This section of documentation is a work in progress and will be updated in subsequent releases.

Now documented in the V15 reference manual

On selecting the TMO tin settings option, the TUFLOW Tin Results Settings panel is displayed.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>TUFLOW Results</b>	tin box		
<i>A list of all grid tins in the project will be listed.</i>			
<i>Note: In future releases only grid tins with TUFLOW results will be displayed.</i>			

<b>Domain</b>	number box		
<i>Currently 12d Model only supports domain 0.</i>			





**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 [17.27 DNE Analysis >Flood Extents Tab](#) or go back to [17.26 TUFLOW TMO TIN Settings](#) or [17 Water](#).

## 17.27 DNE Analysis >Flood Extents Tab

### 17.27.1 Calculations of Flooded Width

Now documented in the V15 reference manual

4. For the 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.

Continue to [18 Dynamic Water Supply](#) or go back to [17.27 DNE Analysis >Flood Extents Tab](#) or [17 Water](#).

# 18 Dynamic Water Supply

There has been changes to the **Dynamic Water Supply** chapter in the **12d Model Reference manual**.

See [18.1 Dynamic Water Supply - Rule Builder](#)

See [18.2 Dynamic Water Supply - Control Builder](#)

## 18.1 Dynamic Water Supply - Rule Builder

Now documented in the V15 reference manual

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:**

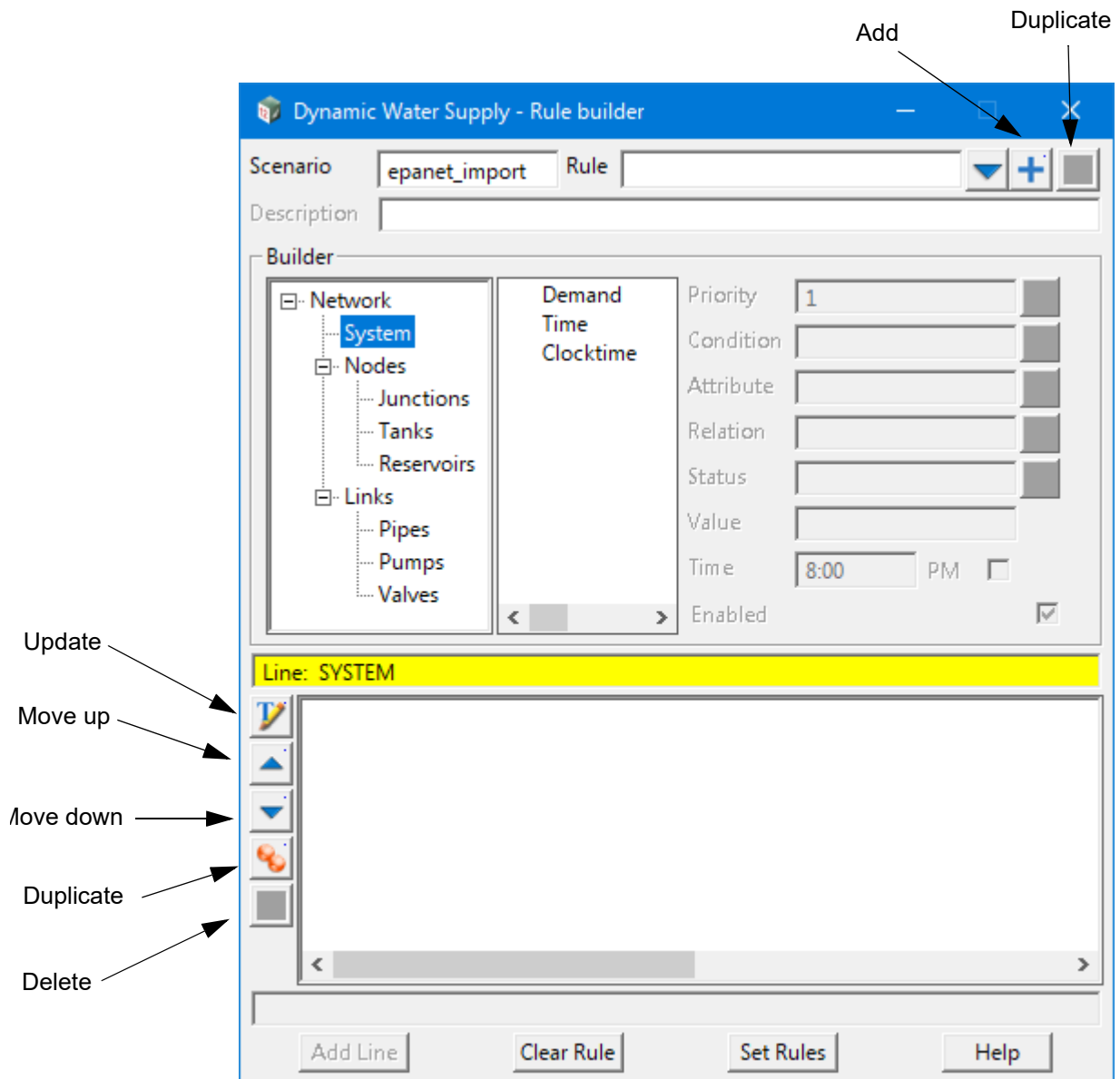
A condition clause in a Rule-Based Control takes the form of:

<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.





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

Field Description	Type	Defaults	Pop-Up
<b>Scenario</b>	input box		
<i>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.</i>			
<b>Rule</b>	choice box		
<i>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.</i>			
<b>Add Rule</b>	button		
<i>Prompts the user for a name and then creates a new rule with the name.</i>			
<b>Duplicate Rule</b>	button		
<i>Prompts the user for a new name and then duplicates the currently selected rule with the new name.</i>			
<b>Description</b>	input box		
<i>An optional description can be provided for the currently selected rule.</i>			
<b>Priority</b>	choice box		
<i>&lt;Not currently used - future development&gt;</i>			
<b>Condition</b>	choice box		
<i>Rule condition clause (Eg, IF, AND, OR, THEN, ELSE).</i>			
<b>Attribute</b>	choice box		
<i>An attribute belonging to the condition clause. The attributes available depend on the object type related to the rule line that is being written.</i>			
<i>For Node-type objects (Node, Junction, Reservoir) the following attributes can be used:</i>			
<i>DEMAND</i>			
<i>HEAD</i>			
<i>PRESSURE</i>			
<i>For Tanks the following attributes can be used:</i>			
<i>LEVEL</i>			
<i>FILLTIME (hours needed to fill a tank)</i>			
<i>DRAINTIME (hours needed to empty a tank)</i>			
<i>For Link-type objects (Pumps, Valves, Pipes) the following attributes can be used:</i>			
<i>FLOW</i>			
<i>STATUS</i>			
<i>SETTING (pump speed or valve setting)</i>			
<i>For a System object, the following attributes can be used:</i>			
<i>DEMAND (total system demand)</i>			
<i>TIME (hours from the start of simulation - decimal)</i>			
<i>CLOCKTIME (12-hour clock time with AM or PM appended)</i>			

**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 [18.2 Dynamic Water Supply - Control Builder](#) or go back to [18.1 Dynamic Water Supply - Rule Builder](#) or [18 Dynamic Water Supply](#).

## 18.2 Dynamic Water Supply - Control Builder

Now documented in the V15 reference manual

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

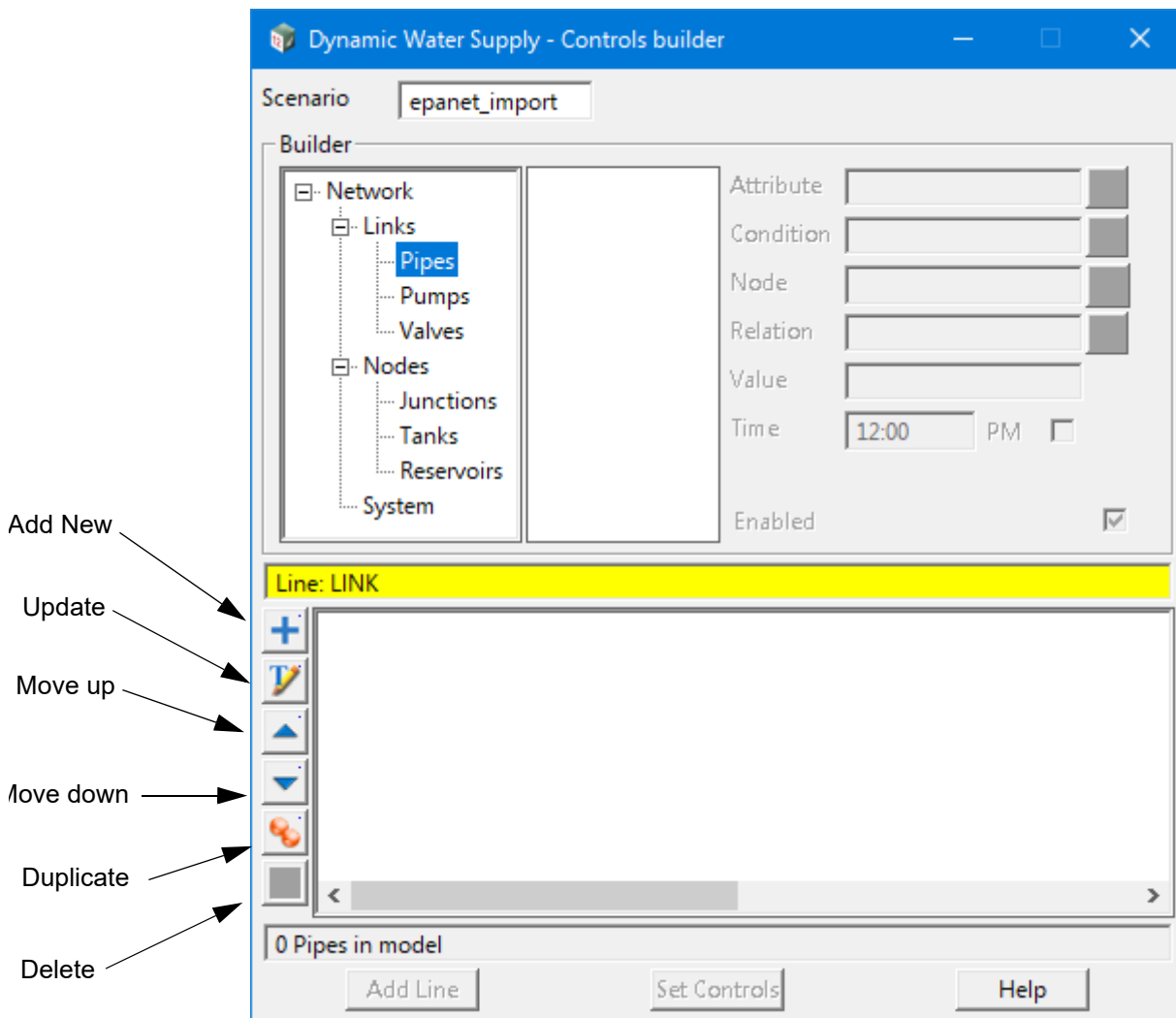
linkID	=	a link ID label
status	=	OPEN or CLOSED, a pump speed setting, or a control valve setting
nodeID	=	a node ID label
value	=	a pressure for a junction or a water level for a tank
time	=	a time since the start of the simulation in decimal hours
clocktime	=	a 12-hour clock time (hours:minutes)

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.



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

<b>Scenario</b>	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.*

<b>Add Rule</b>	button		
-----------------	--------	--	--

*Prompts the user for a name and then creates a new rule with the name.*

<b>Attribute</b>	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

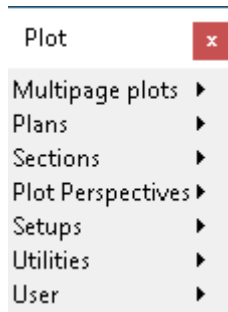
*Adds the line being built, into the current set of model controls. Not available until the line syntax has been correctly built.*

**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.*

# 19 Plot

In **V14** the menu was called **Plots** and in **V15** this has been renamed **Plot** and has been totally rearranged.



See

[19.1 Multipage Plots](#)

# 19.1 Multipage Plots

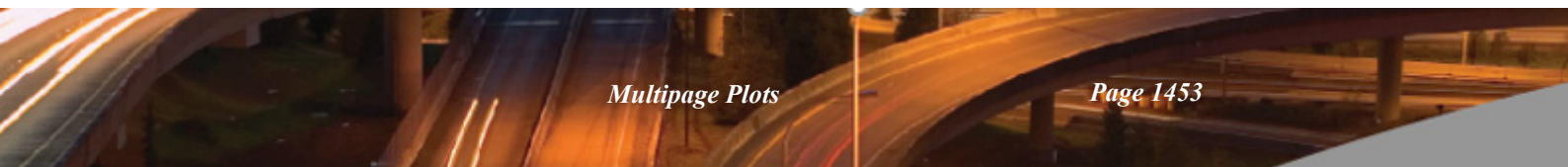
Position of menu: Plot => Multipage plots





## 19.1.1 Multipage Plot Create

**Position of option on menu:** Plot => Multipage plot => Creates



### 19.1.1.1 Icons and Fields for the Book

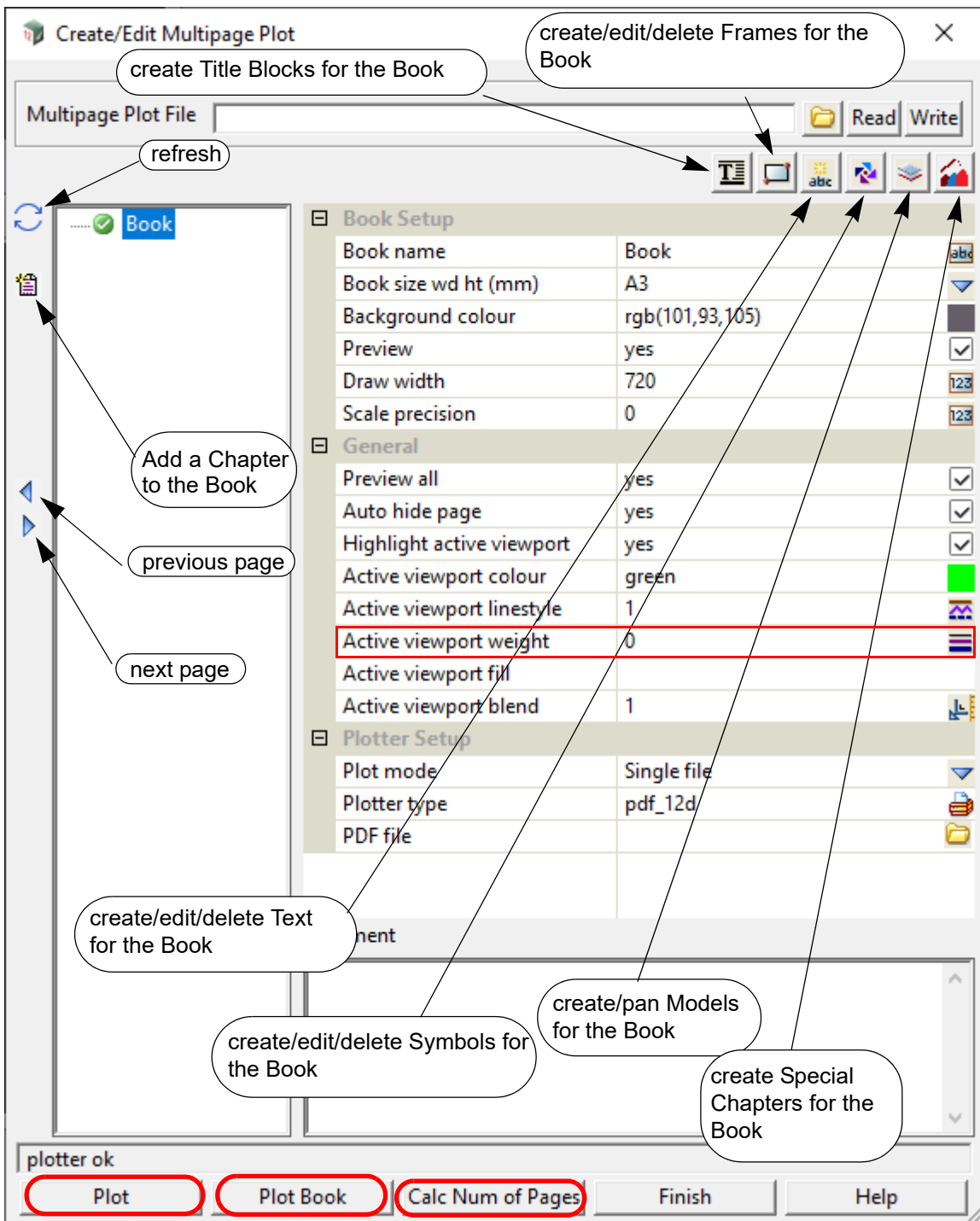
The option "Active" has been **deleted** from under the Book Setup tab on the *Create/Edit Multipage Plot* panel.

**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.*





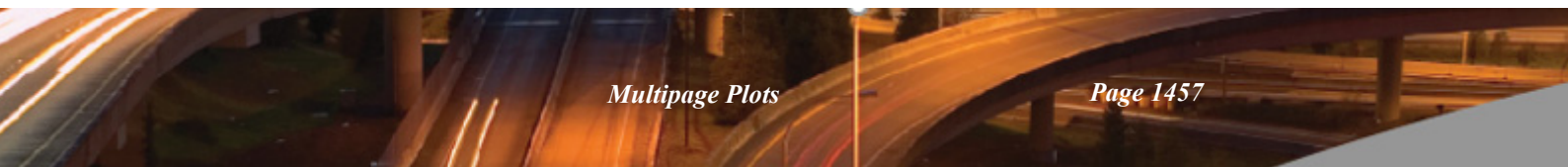
## 19.1.2 Multipage Plot Edit

**Position of option on menu: Plot =>Multipage plots =>Edit**



## 19.1.3 Multipage Plot Delete

**Position on menu:** Plot => Multipage plots => Delete



## 19.1.4 Create/Edit Multipage Plot

See

[19.1.1.1 Icons and Fields for the Book](#)

[19.1.4.1 Node Diagram Frame](#)

[19.1.4.2 MPS Text \\$variables](#)

[19.1.4.3 Node Diagram Chapter](#)

[19.1.4.4 \\$variables](#)

### 19.1.4.1 Node Diagram Frame

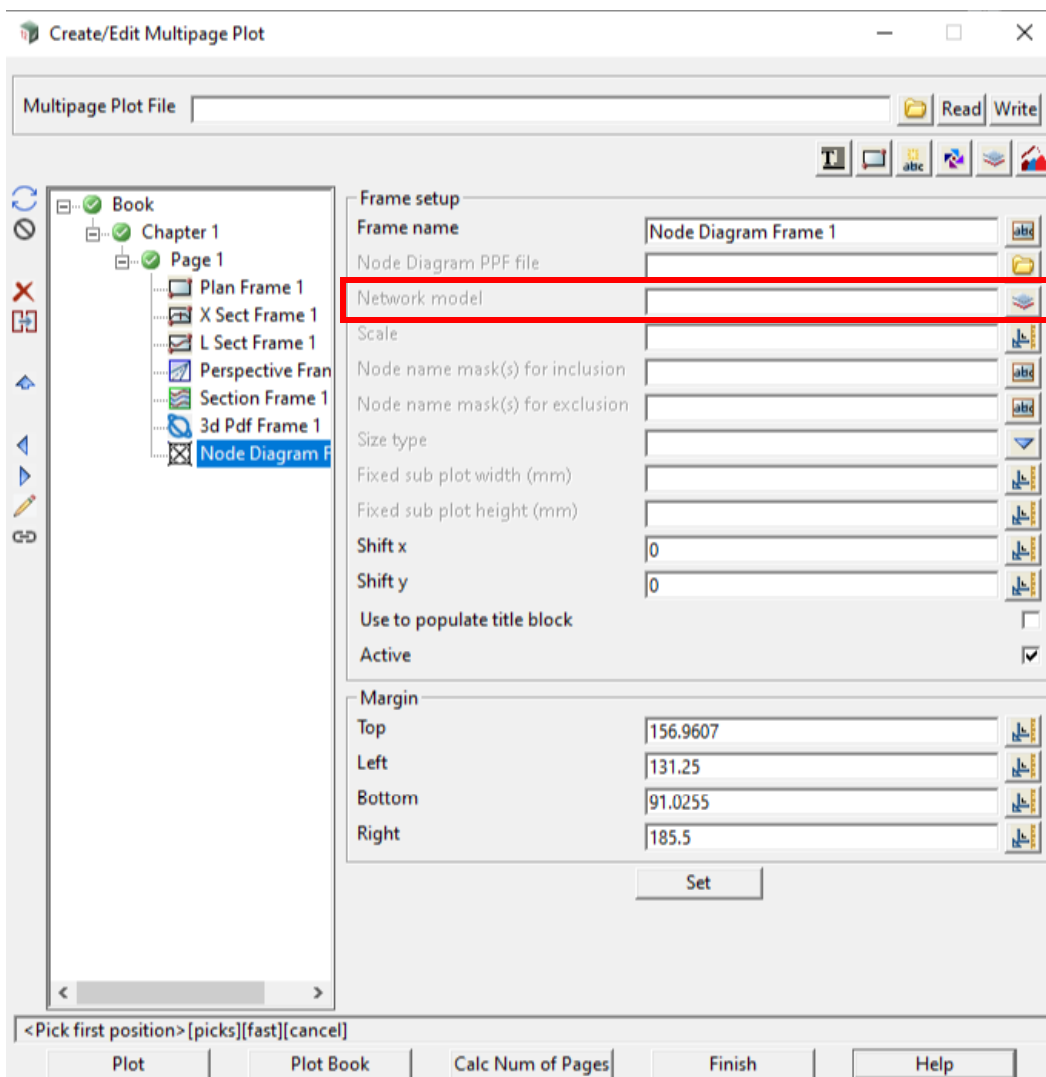
**Network Model** has been added under Frame Setup menu on the **Create/Edit Multipage Plot** panel.

**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.*



#### 19.1.4.2 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.

### 19.1.4.3 Node Diagram Chapter

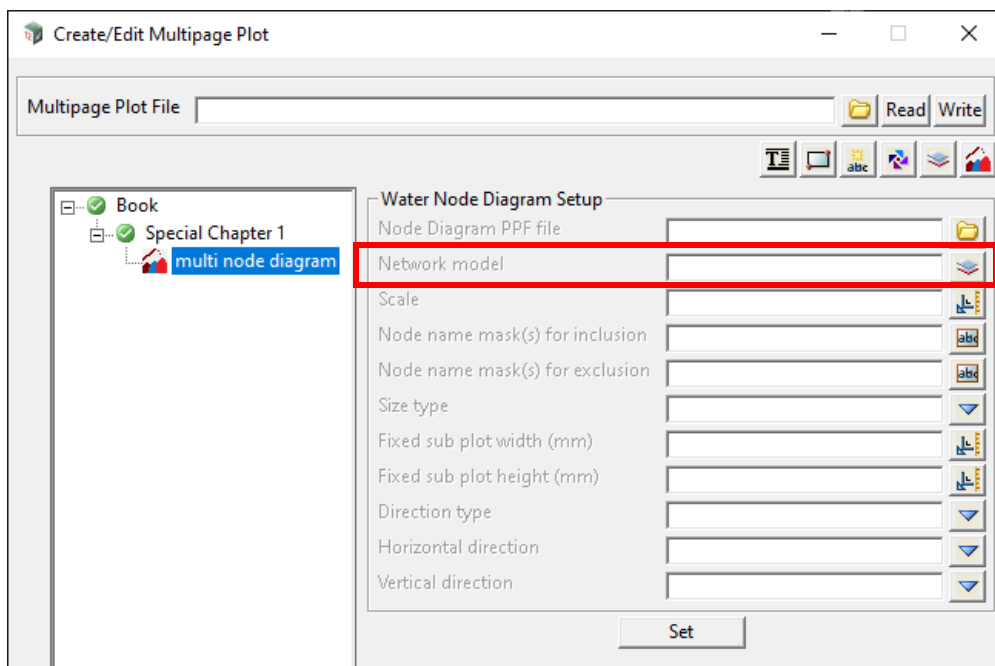
**Network Model** has been added under Water Node Diagram Setup tab on the **Create/Edit Multipage Plot** panel.

**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.*





### 19.1.4.4 \$variables

#### 19.1.4.4.1 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).

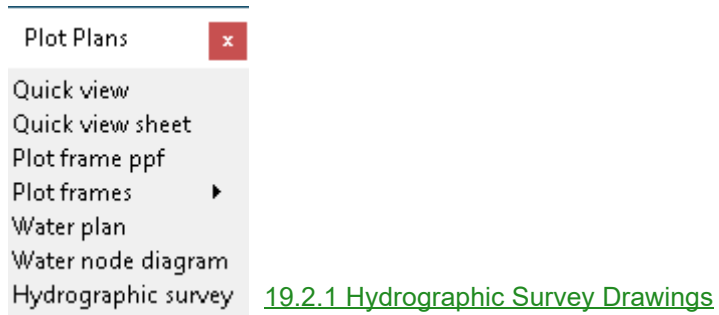
The \$variables **\$vertical\_exaggeration**, **\$scale** and **\$frame** only make sense when they are used as a **Text Frame** and not just straight Text.

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										

## 19.2 Plans

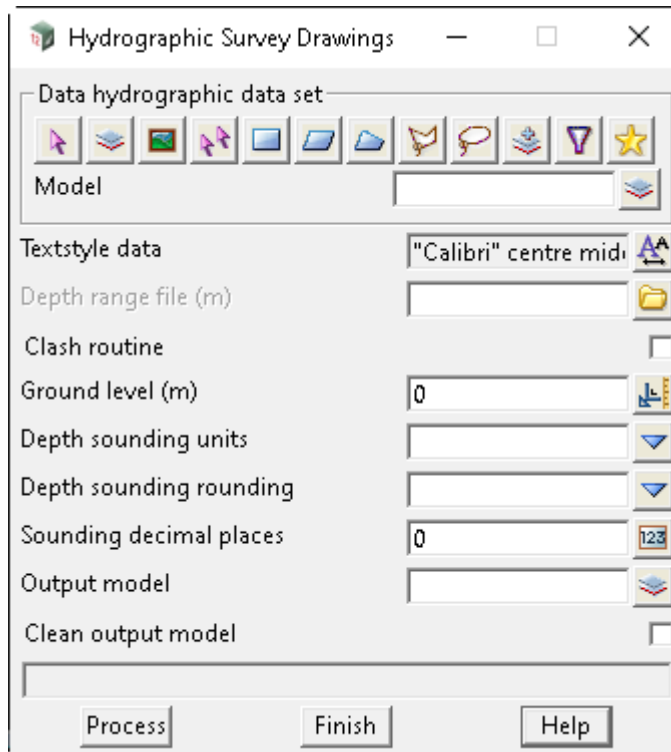
Position of menu: Plot =>Plans



## 19.2.1 Hydrographic Survey Drawings

This panel takes an input dataset of points which will be converted to an output of depth soundings.

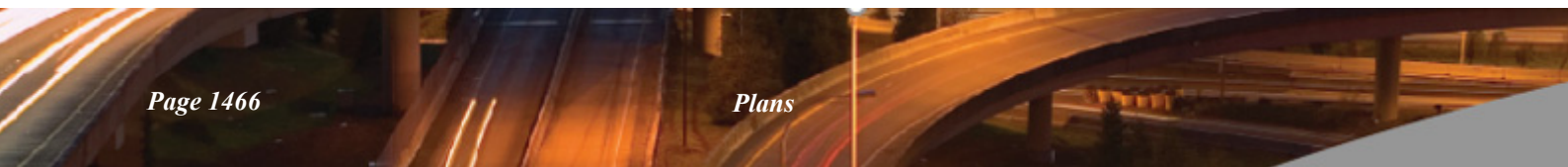
Selecting **Hydrographic survey** brings up the **Hydrographic survey drawings** panel.



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

Field Description	Type	Defaults	Pop-Up
<b>Hydrographic data set</b> <i>data set containing points to create depth soundings from. Find more info <a href="#">3.25.3 Data Source</a>.</i>	source box	mode	
<b>Selected data source</b> <i>source of data to process.</i>	input	Model	
<b>Textstyle data</b> <i>contains the parameters for defining the visual representation of the depth soundings.</i>	textstyle data box	"Calibri" centre middle white 20 0.268 0.75	textstyle info panel
<b>Depth range file</b> <i>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 <a href="#">17.11.5 Depth Range File</a>.</i>	file box	*drf	file directory
<b>Clash routine</b> <i>if <b>ticked</b>, outputted depth soundings will not overlap each other.</i>	tick box	not ticked	
<b>Ground level</b> <i>determines the height in metres that the depth soundings are measure relative to.</i>	real box	0	measures menu

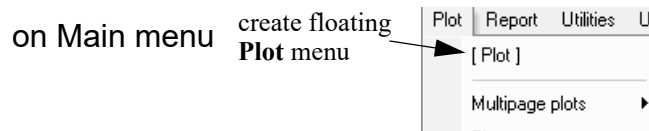




# 20 Plot

**Position of menu:** It is on the main menu as **Plot**

The **Plot** menu is



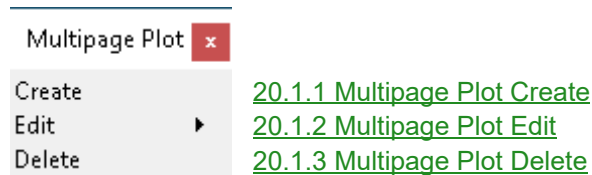
## Main Plot menu and floating Plot menu

Plot	See
Multipage plots ▶	<a href="#">20.1 Multipage Plots (MPS)</a>
Plans ▶	<a href="#">26.2 Plans</a>
Sections ▶	<a href="#">26.3 Sections</a>
Plot Perspectives ▶	<a href="#">26.4 Plot Perspectives</a>
Setups ▶	<a href="#">26.5 Plotting Setups</a>
Utilities ▶	<a href="#">26.6 Plot Utilities</a>
User ▶	User Plot menu



## 20.1 Multipage Plots (MPS)

Position of option on menu: Plot => Multipage plots



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.

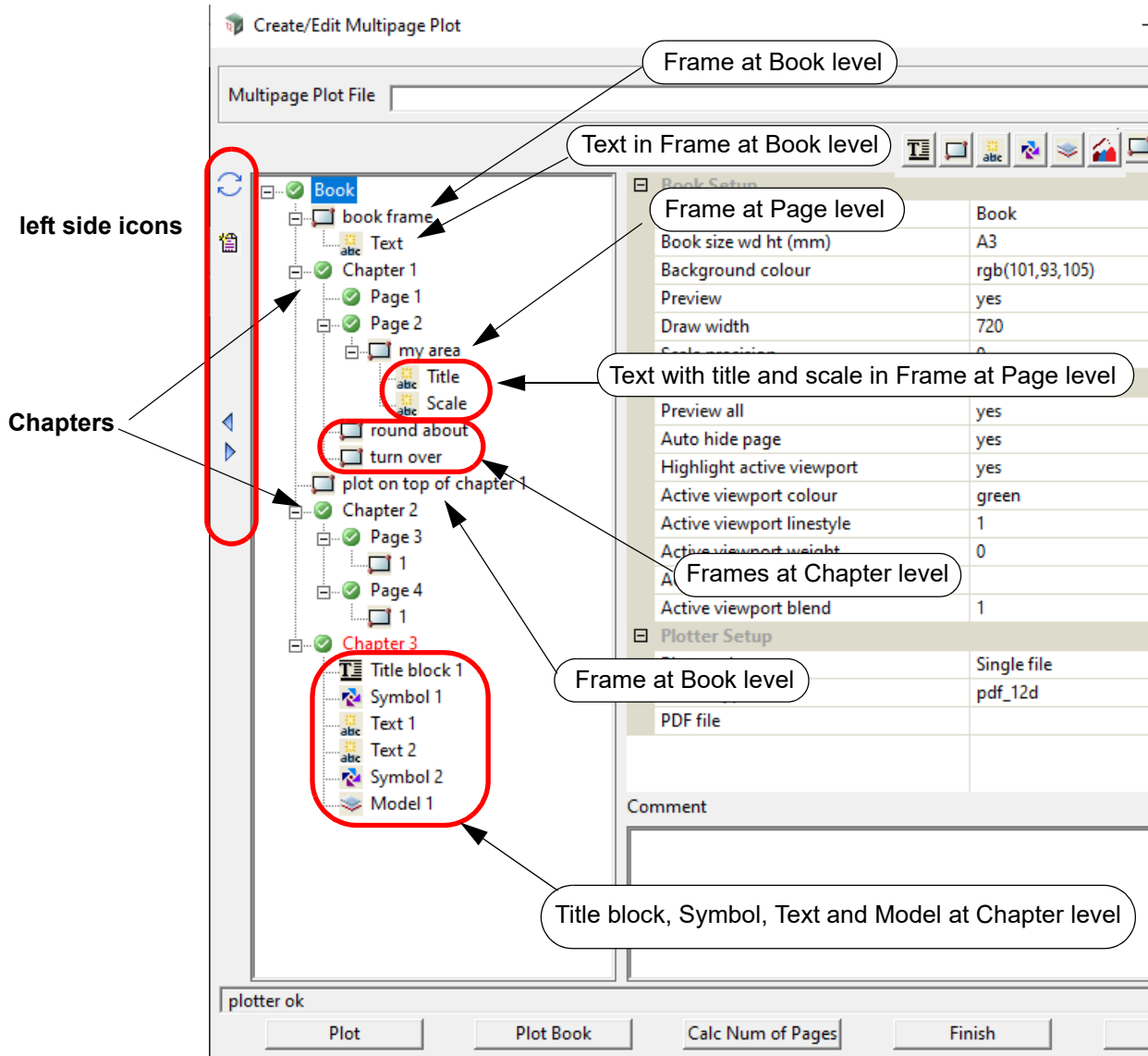
There are also **Special Chapters** that hold all the pages generated by a PPF file (eg. **X-Section**, **Long Section**, **Water Long Section** and **Water Node Diagram PPFs**). **Plot Frames** also have a **Special Chapter** that operates without a PPF.

These Chapters cannot have any additional Pages added to them. For more information on these **Special Chapters**, see [20.1.4.11 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:



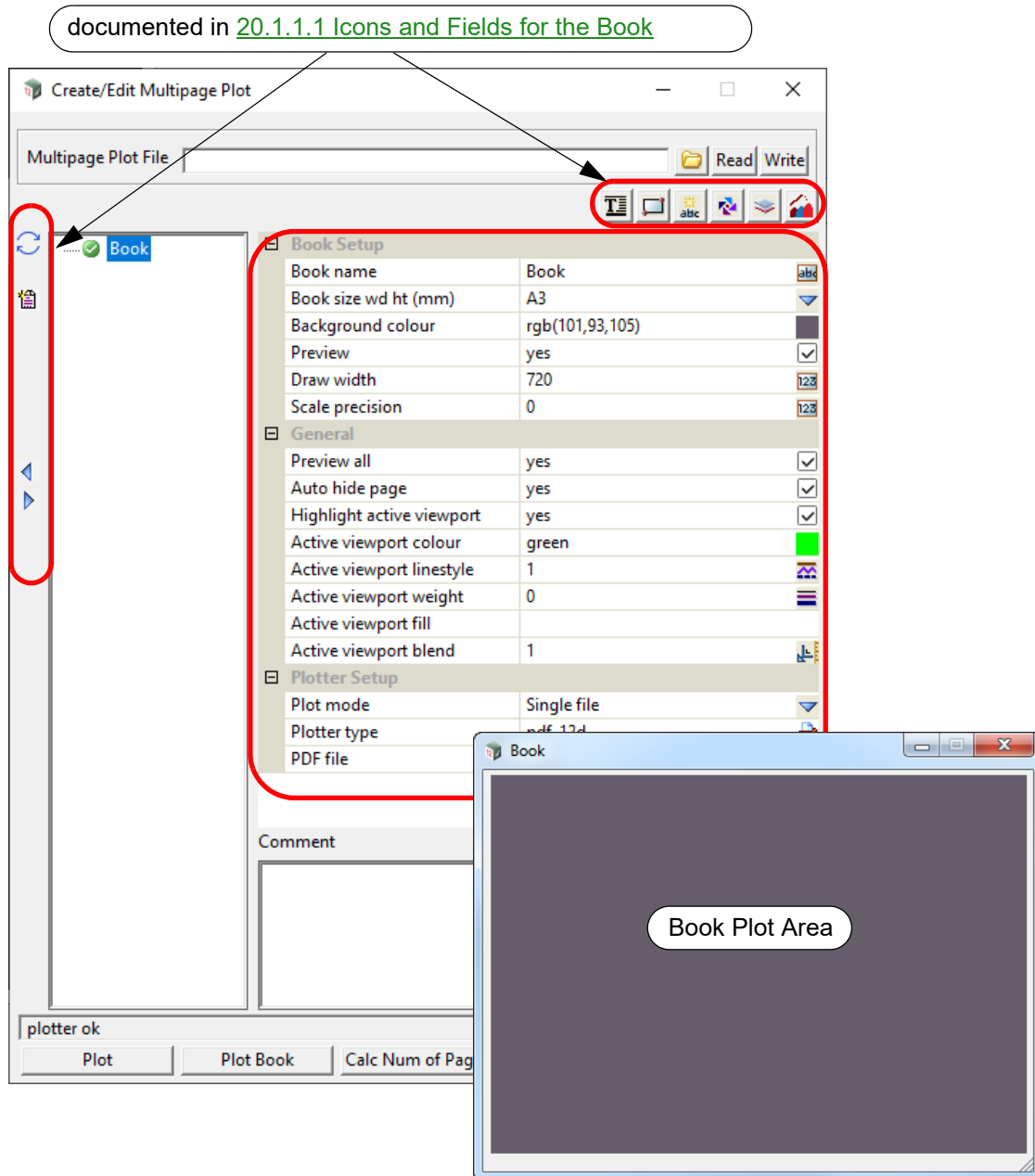
and the complete documentation is given in [20.1.4 Create/Edit Multipage Plot](#).

## 20.1.1 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.

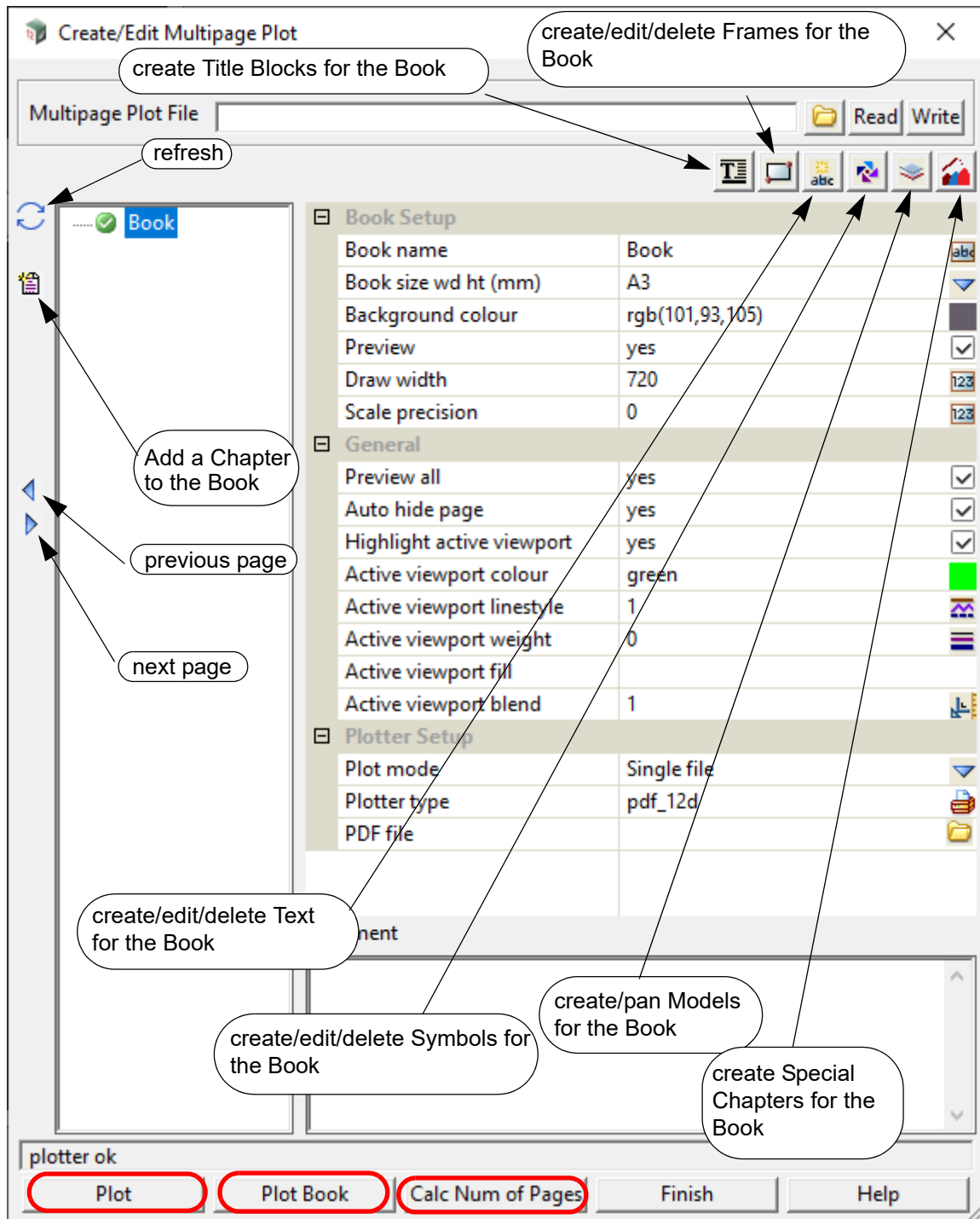
**Books** can contain **Chapters** which in turn contain the **Pages** that make up the Multipage plot.

**Chapters** and **Pages** are described in [20.1.4.1 Chapter](#). and [20.1.4.2 Page](#).

**Books** are also the only **Node** that can contain a **Special Chapter**, which is described in [20.1.4.11 Special Chapter](#).

All the icons and fields for the **Book Node** are documented in [20.1.1.1 Icons and Fields for the Book](#).

### 20.1.1.1 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
<b>Multipage Plot File</b>	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 [20.1.4.3 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 [20.1.4.1 Chapter](#)

### Icons on the Top Right

The icons are described in [20.1.4.4 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 [20.1.4.7.6.2 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 [20.1.4 Create/Edit Multipage Plot](#).

Continue to [20.1.2 Multipage Plot Edit](#) or return to [20.1 Multipage Plots \(MPS\)](#).

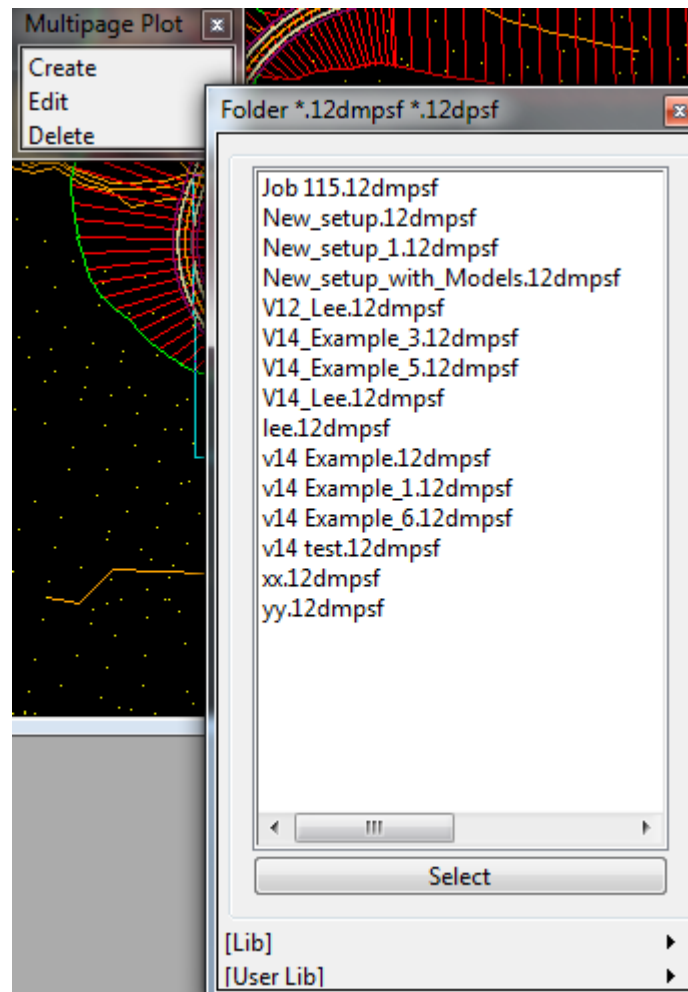
## 20.1.2 Multipage Plot Edit

**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.

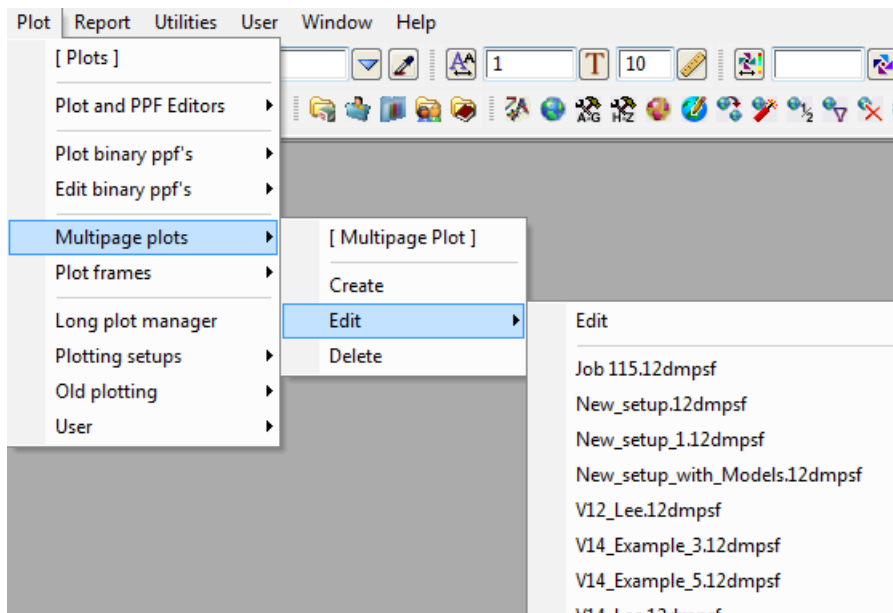
The list produced shows all the multipage plot sheet files (\*.12dmprsf) in the **working folder**. It also has options to produce lists for the **[Lib]**, **[User Lib]** and any **[Customer Lib]** folders.



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 [20.1.4 Create/Edit Multipage Plot](#).

(2) Walking right on **Edit** when the **Multipage Plot** panel is NOT pinned.

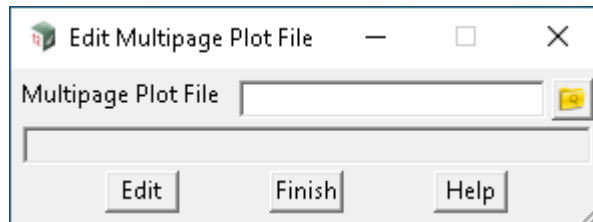
The walk right list produced shows all the multipage plot sheet files (\*.12dmprsf) in the **working folder** only.



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 [20.1.4 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
<b>Multipage Plot File</b>	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 [20.1.4 Create/Edit Multipage Plot](#).*

**Note:** **Edit** can also read in **V11 Plot Sheet Files** (\*.12dpsf).

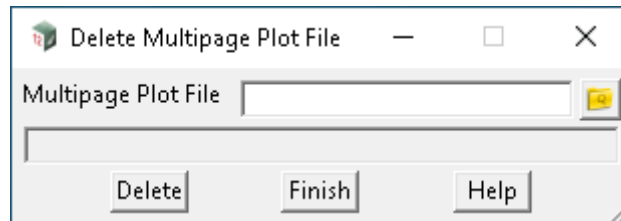
Continue to [20.1.3 Multipage Plot Delete](#) or return to [20.1 Multipage Plots \(MPS\)](#).

## 20.1.3 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
<b>Multipage Plot File</b>	file box		*.12dmprsf 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 [20.1.4 Create/Edit Multipage Plot](#) or return to [20.1 Multipage Plots \(MPS\)](#).

## 20.1.4 Create/Edit Multipage Plot

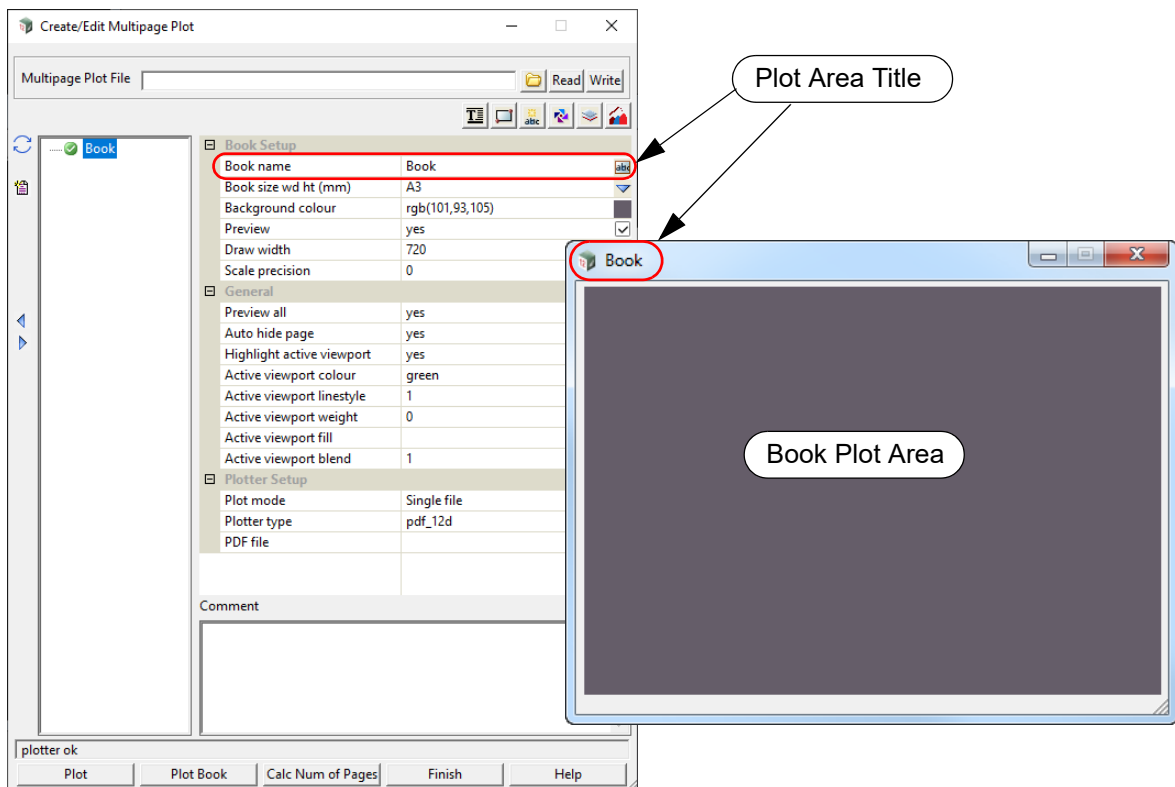
The **Create/Edit Multipage Plot** panel allows for the complete customisation of all the Nodes in the MPS tree and their Plot Areas. How the Nodes and Plot Areas are set up will determine everything about the produced pdf file.

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.

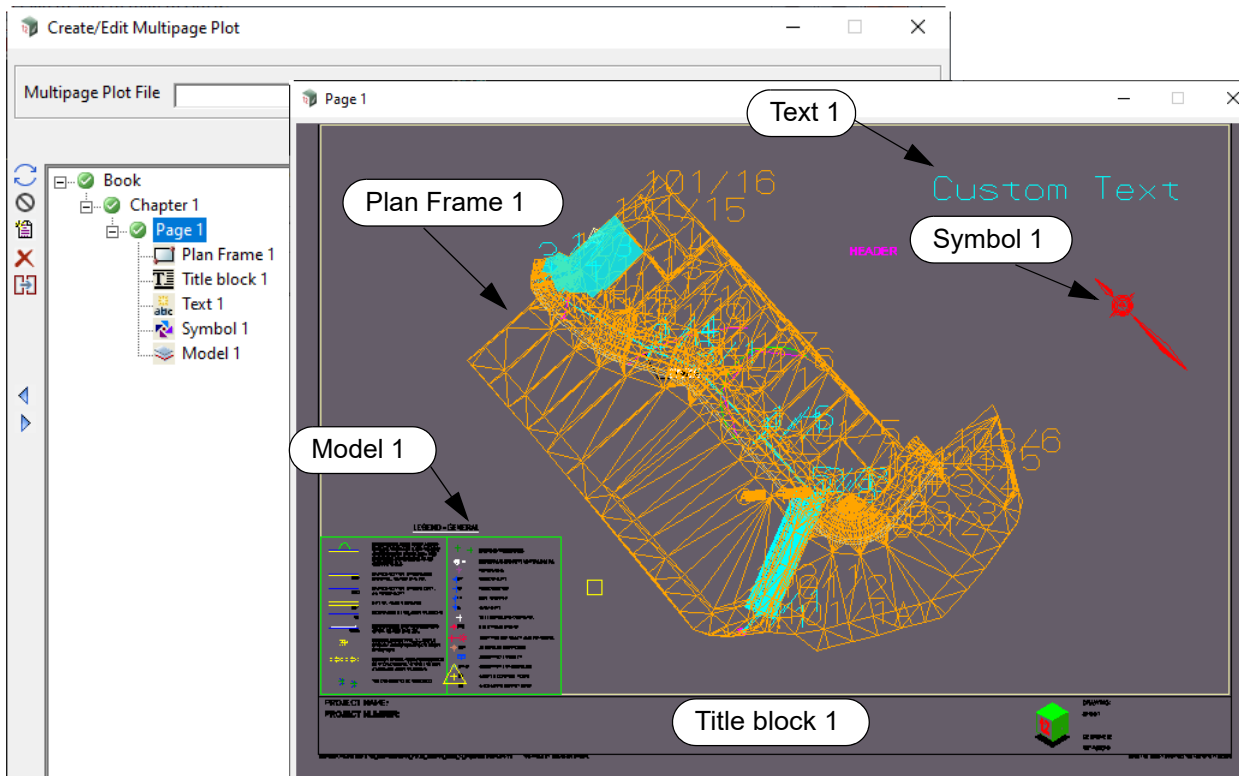
This is often referred to as the Preview window but beware, it is not intended to show exactly what the plotted page looks like. For that, press the **Plot** button.

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

[20.1.4.1 Chapter](#)

[20.1.4.2 Page](#)

[20.1.4.3 Icons on the Left Side](#)

[20.1.4.6 Title Block](#)

[20.1.4.7 Frame](#)

[20.1.4.8 Text Icon for Use on a Book, Chapter, Page or Frame Node](#)

[20.1.4.9 Symbol Icon for Use on a Book, Chapter, Page or Frame Node](#)

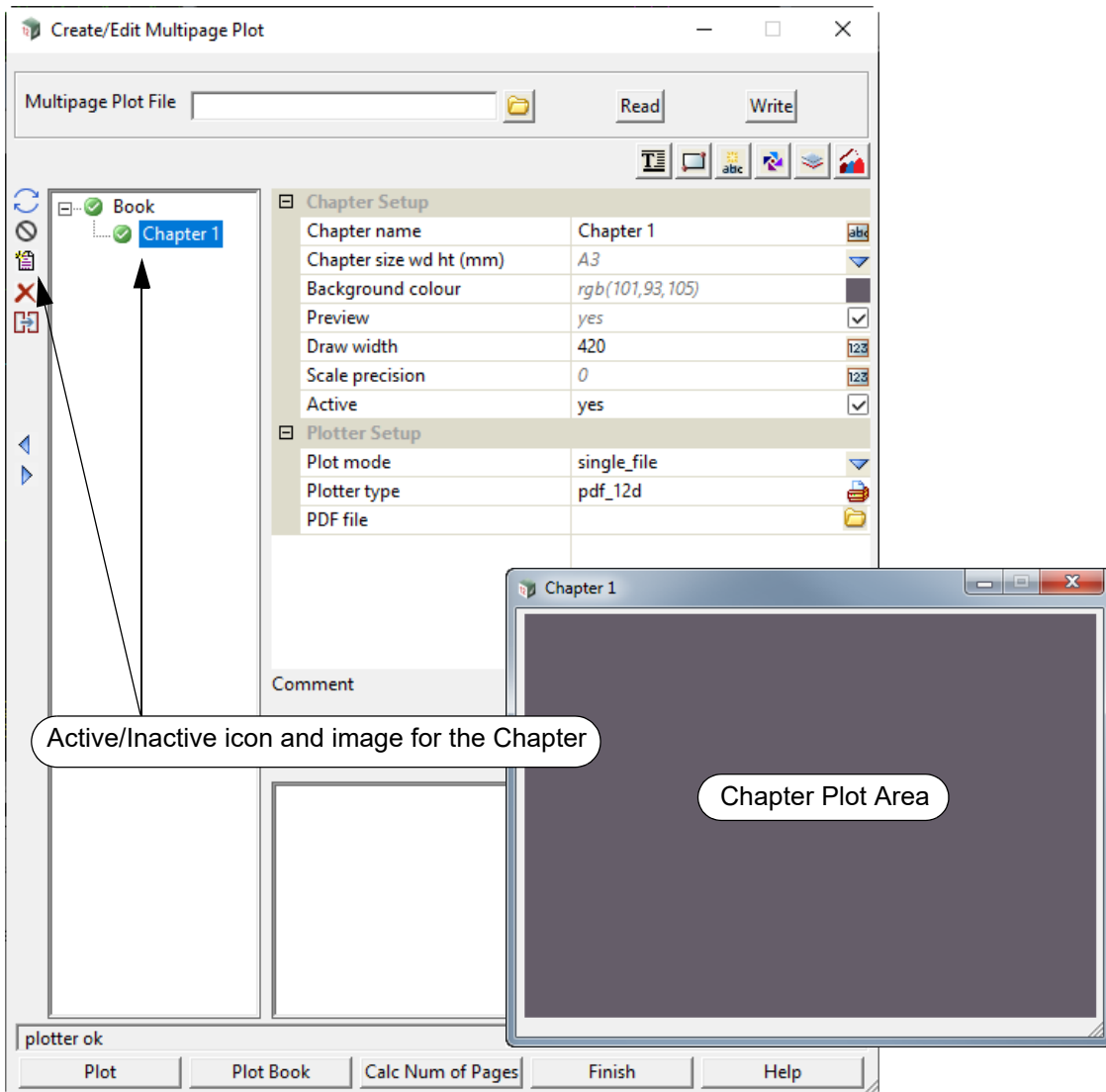
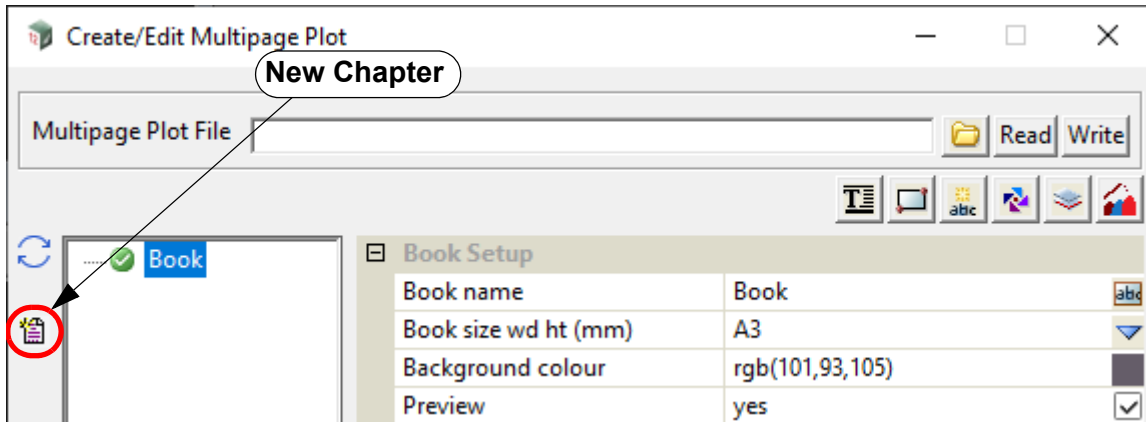
[20.1.4.10 Model Icon for Use on a Book, Chapter or Page](#)

[20.1.4.11 Special Chapter](#)



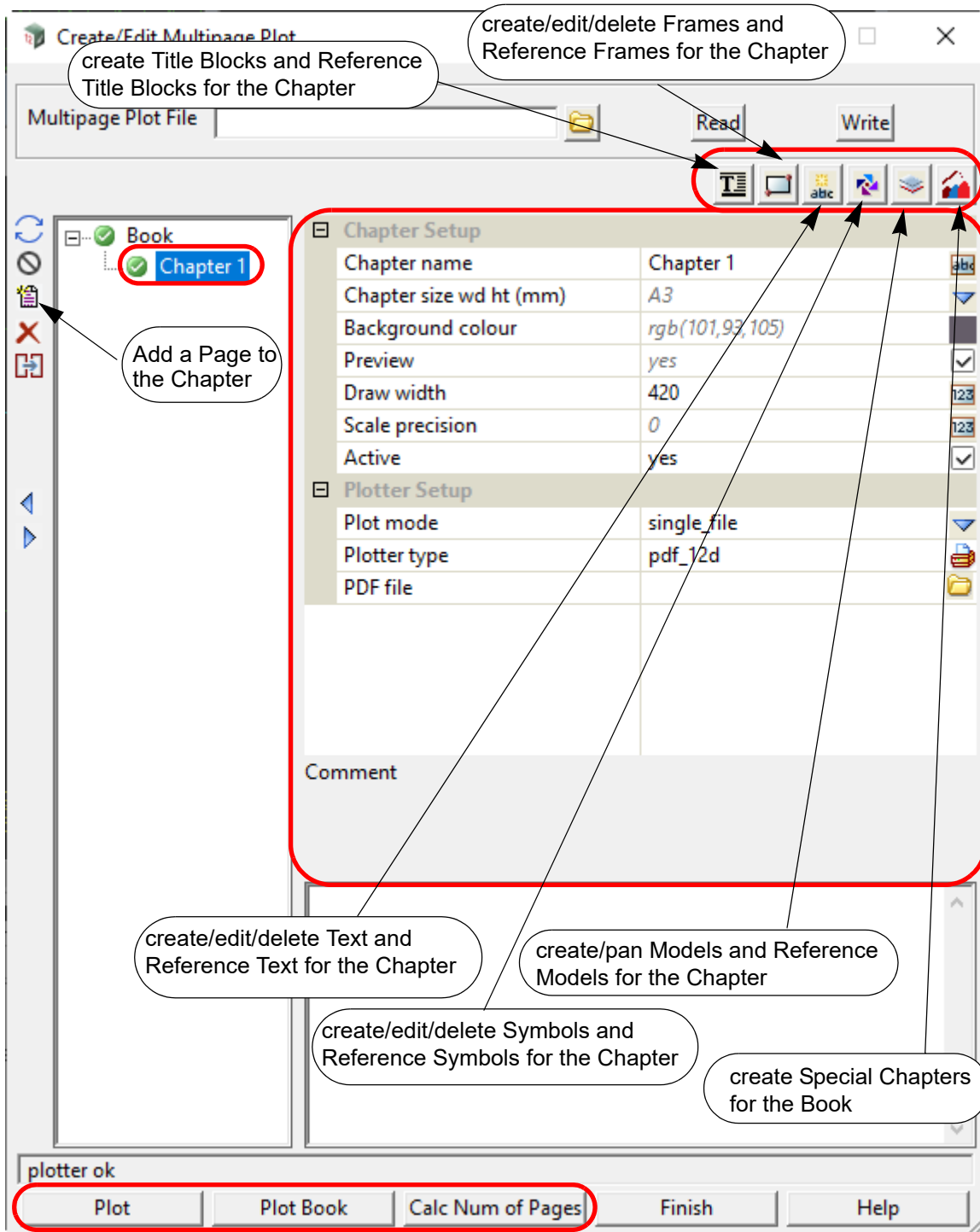
### 20.1.4.1 Chapter

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 [20.1.4.1.1 Icons and Fields for a Chapter](#).

### 20.1.4.1.1 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 [20.1.4.3 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 [20.1.4.2 Page](#).

## Icons on the Top Right

The icons are described in [20.1.4.4 Icons on the Top Right](#).

## Inherited Fields \*

Fields that support inheritance will be marked by a \* symbol next to their **Field Description**.

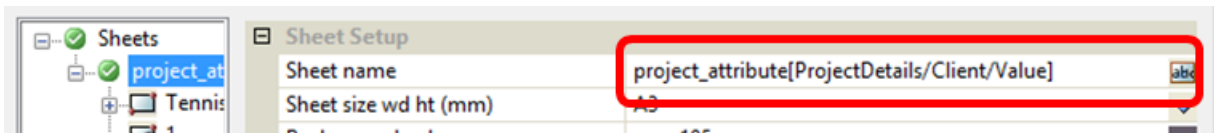
For more information on **Inherited Fields** see, [20.1.4.5 Inherited Fields \\*](#).

## 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

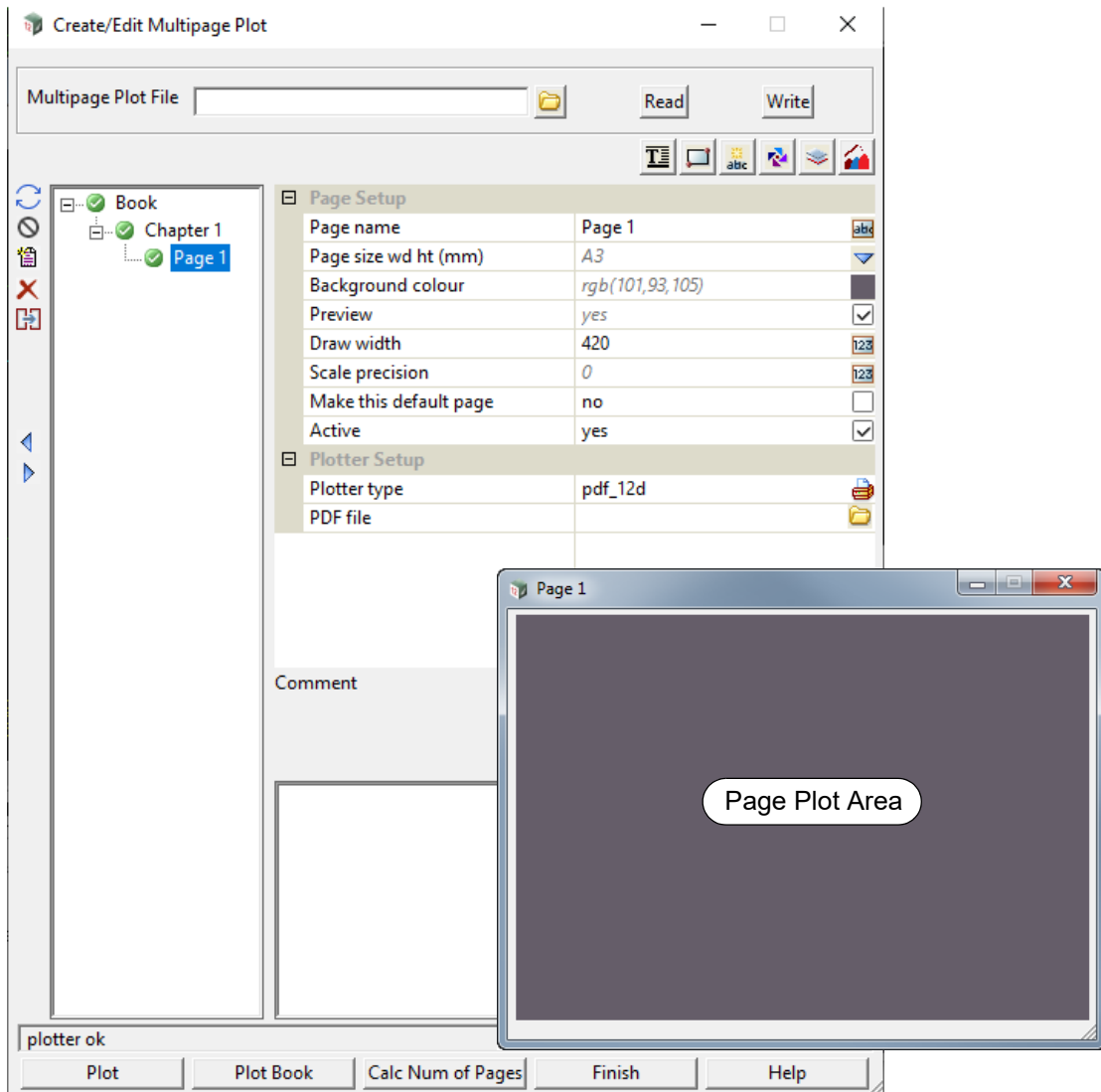
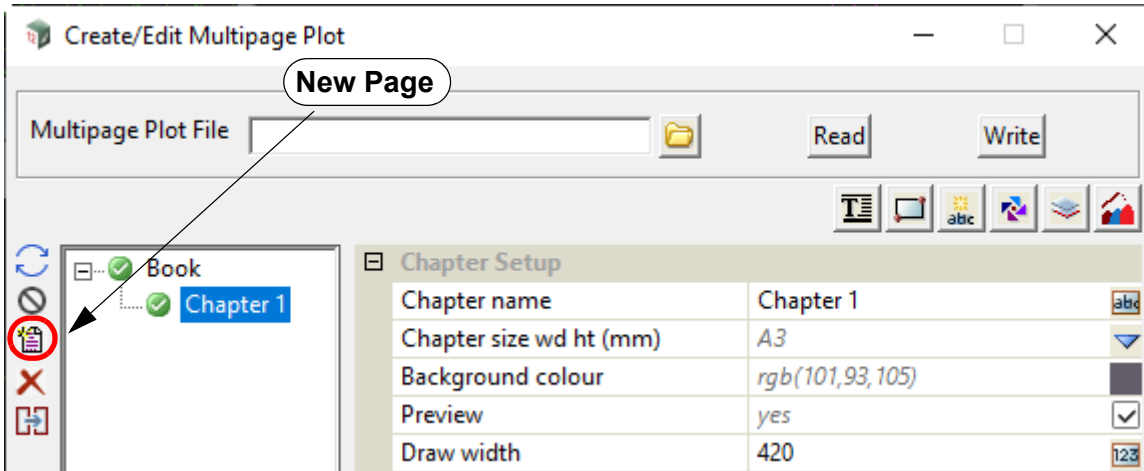
Plot the whole MPS tree from the **Book** Node down. Uses the **Plotter Setup** of the **Book** Node.

## Important Note

If the **Chapter** is *inactive* then nothing in the Chapter will plot.

### 20.1.4.2 Page

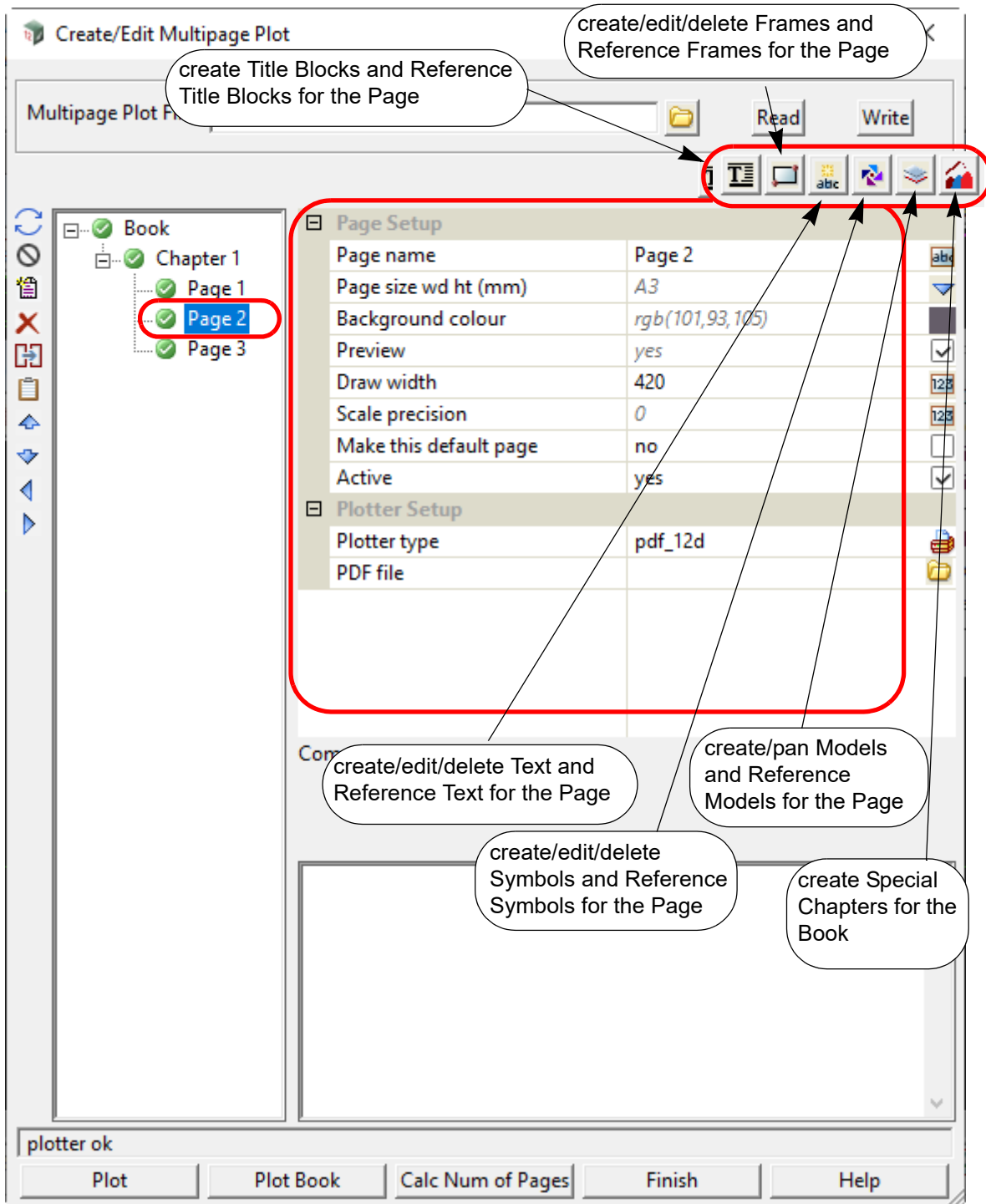
When a **Chapter Node** is selected and the **New Page**  is clicked, a new **Page Node** is created.



All the icons and fields for a **Page Node** are documented in [20.1.4.2.1 Icons and Fields for a Page](#).



### 20.1.4.2.1 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 [20.1.4.3 Icons on the Left Side](#).

The icon that is special for a Page is:

	<b>New Page</b>	icon
---	-----------------	------



create a new **Page Node** for the **Chapter** that the currently selected **Page Node** is a Subnode of. See [20.1.4.2 Page](#).

## Icons on the Top Right

The icons are described in [20.1.4.4 Icons on the Top Right](#).

## Inherited Fields \*

Fields that support inheritance will be marked by a \* symbol next to their **Field Description**.

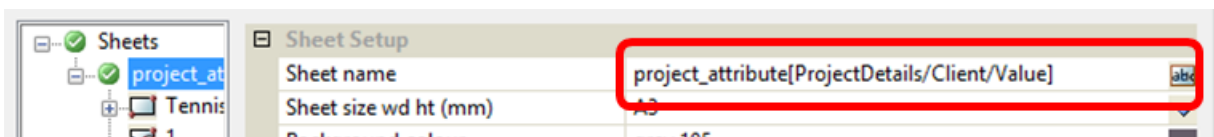
For more information on **Inherited Fields** see, [20.1.4.5 Inherited Fields \\*](#).

## 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.

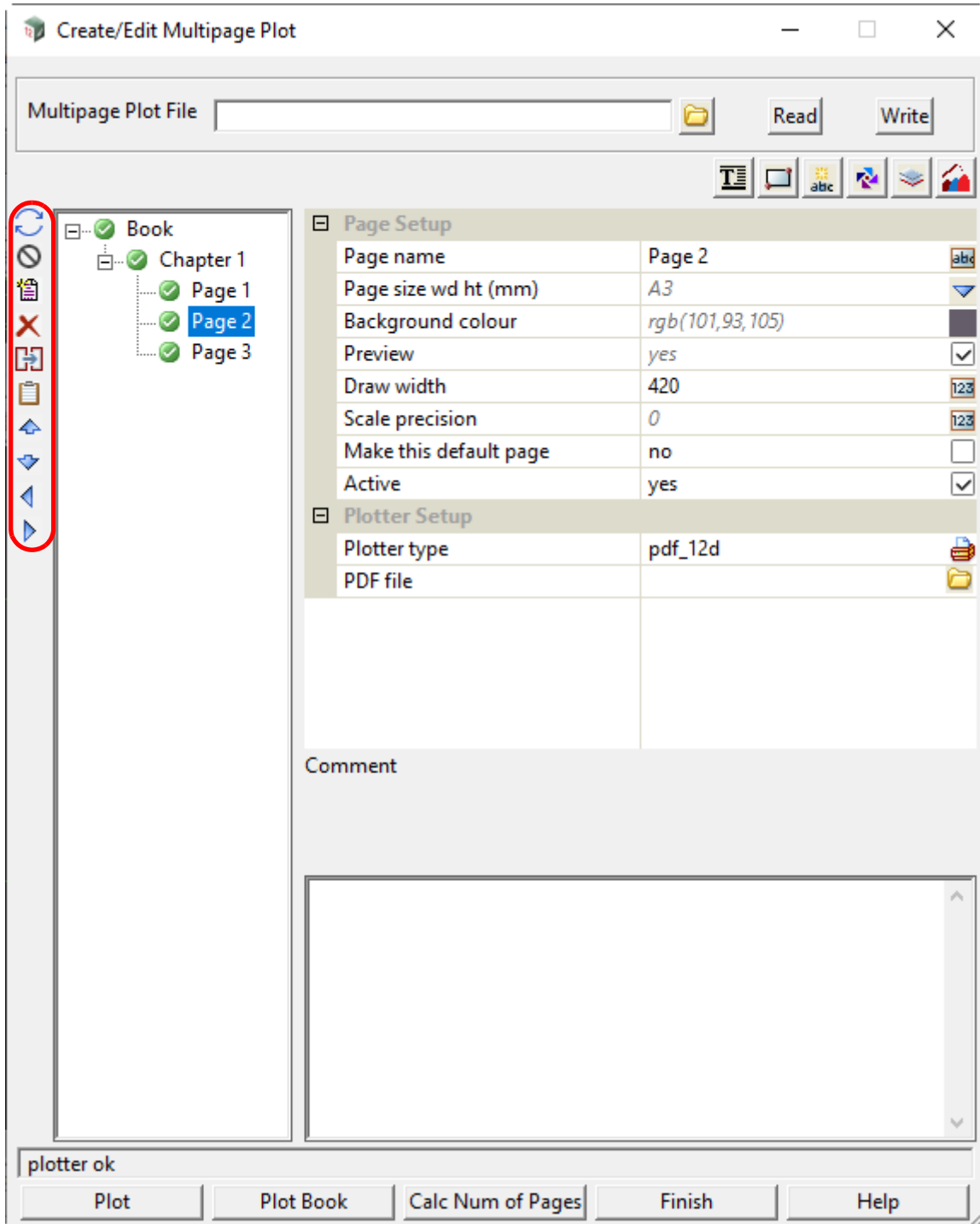
**Plot Book**      button

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.


### 20.1.4.3 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.

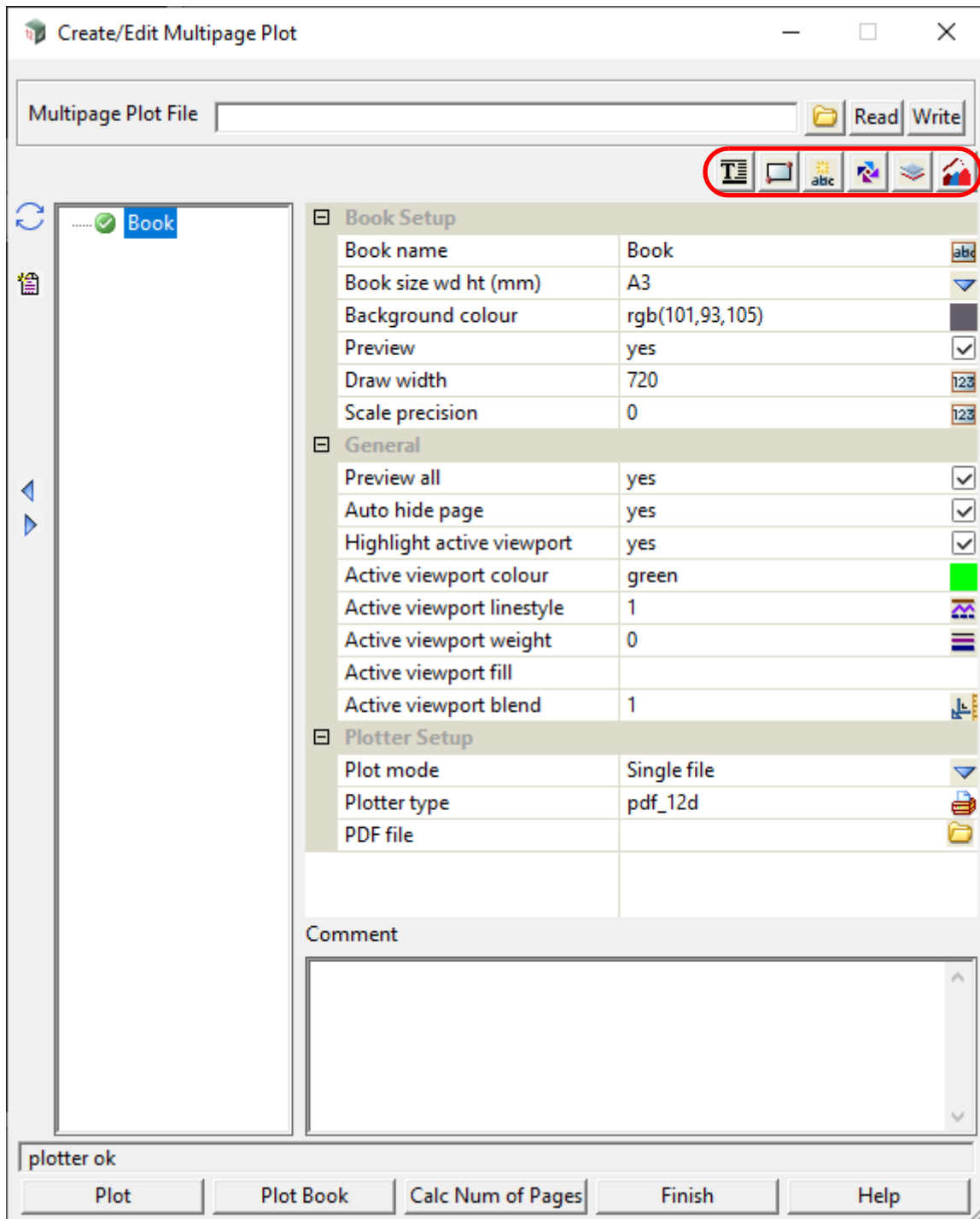
 **Pan** icon

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**.*

### 20.1.4.4 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 [20.1.4.6 Title Block](#).

 **Frame** icon

Create/edit/delete **Frames** and **Reference Frames** for the currently selected node. For more detailed



information, see [20.1.4.7 Frame](#).

 **Text** icon

Create/edit/delete **Text** and **Reference Text** for the currently selected node. For more detailed information, see [20.1.4.8 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 [20.1.4.9 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 [20.1.4.10 Model Icon for Use on a Book, Chapter or Page](#).

 **Special Chapter** icon

Create **Special Chapters** for the Book. For more detailed information, see [20.1.4.11 Special Chapter](#).

#### 20.1.4.5 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**.

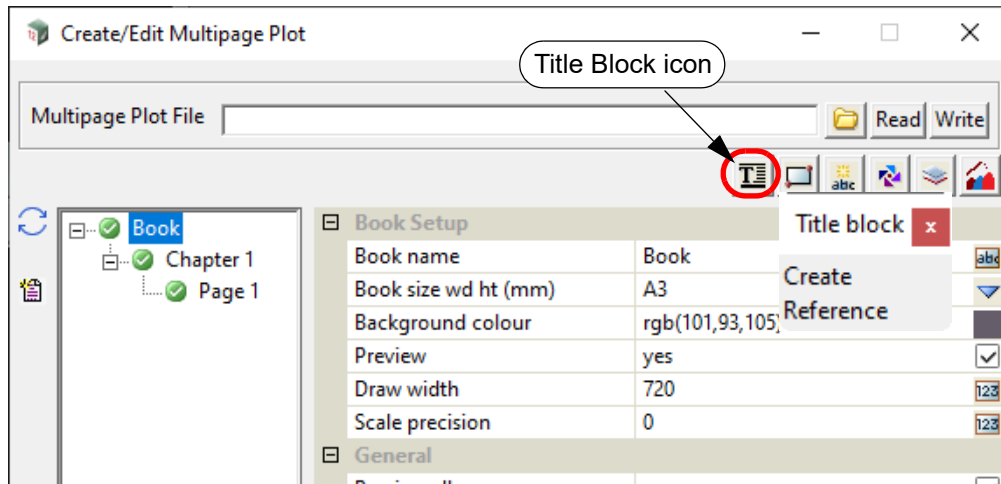
**Reference Nodes** inherit values from the **Node** that they reference.

### 20.1.4.6 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 [20.1.4.6.1.1 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 [20.1.4.6.1.2 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**.

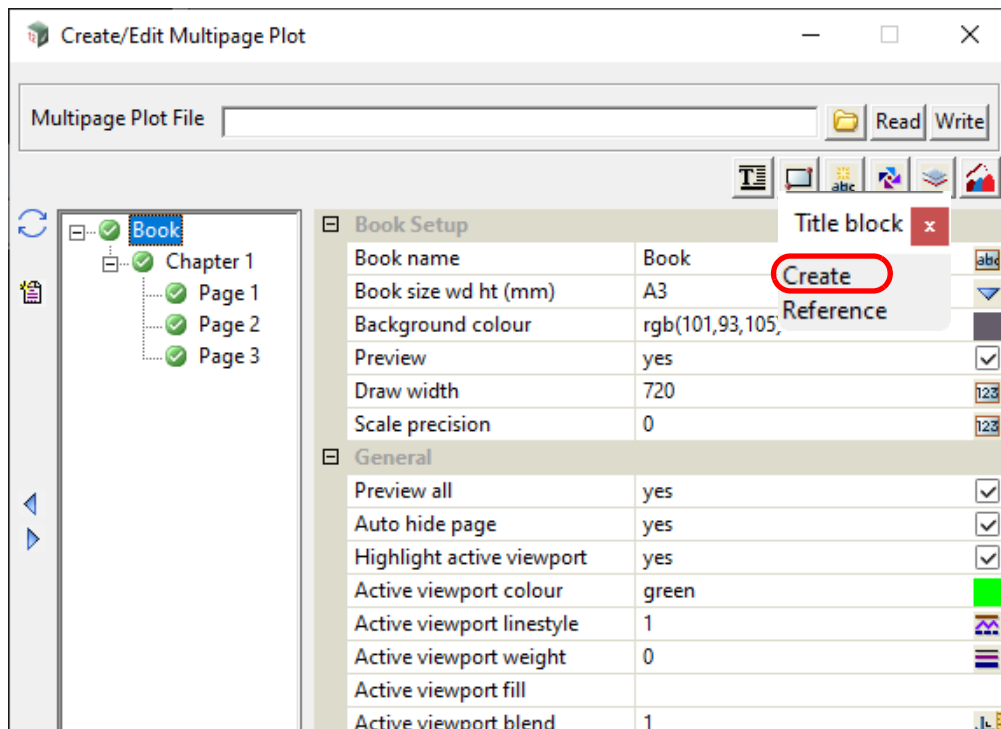
### 20.1.4.6.1 Creating Title Blocks

#### 20.1.4.6.1.1 Creating a Title Block Node

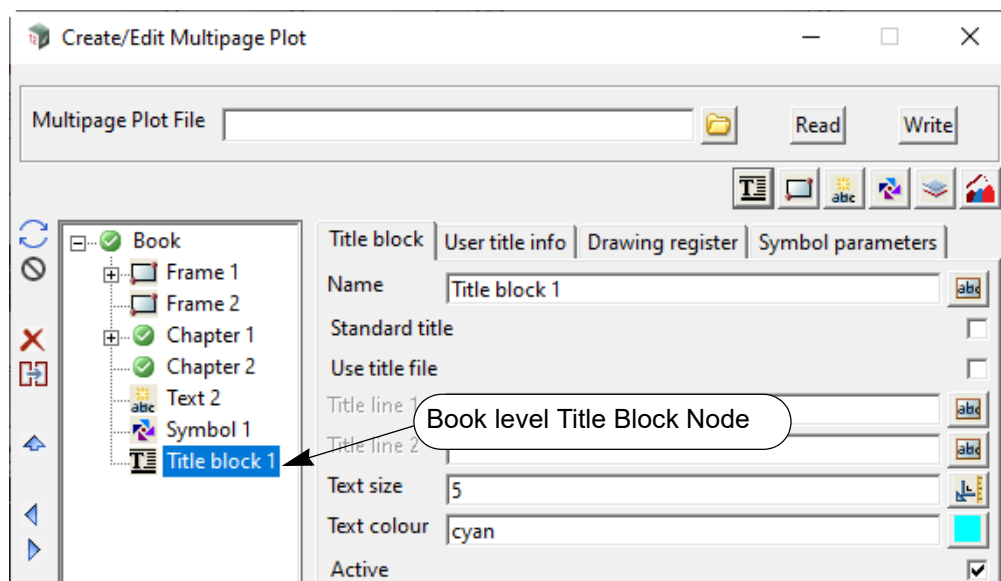
The process for creating a **Title Block** Node at the **Book** level will be described in detail here. The same process can also be used to create a **Title Block** Node at the Chapter, Special **Chapter** or **Page** level.

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.

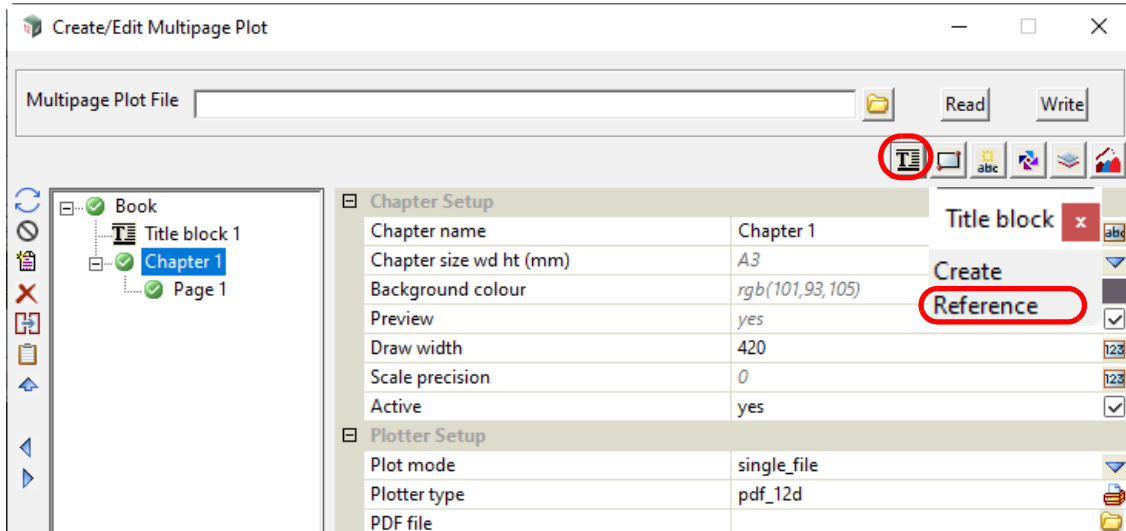


### 20.1.4.6.1.2 Creating a Reference Title Block Node

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).

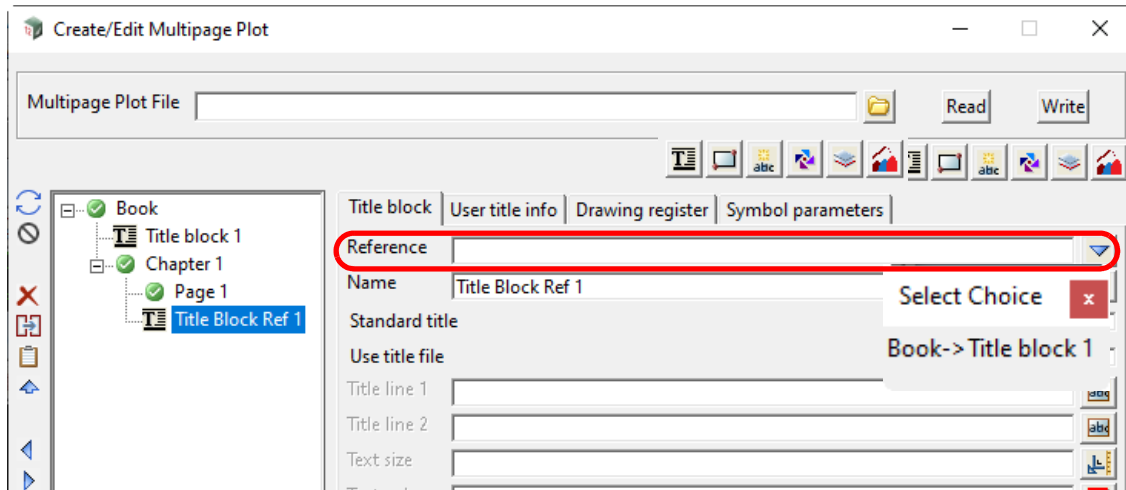
Clicking the **Title Block** icon at the top right of the Editor panel will bring up the **Title Block** menu.



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.

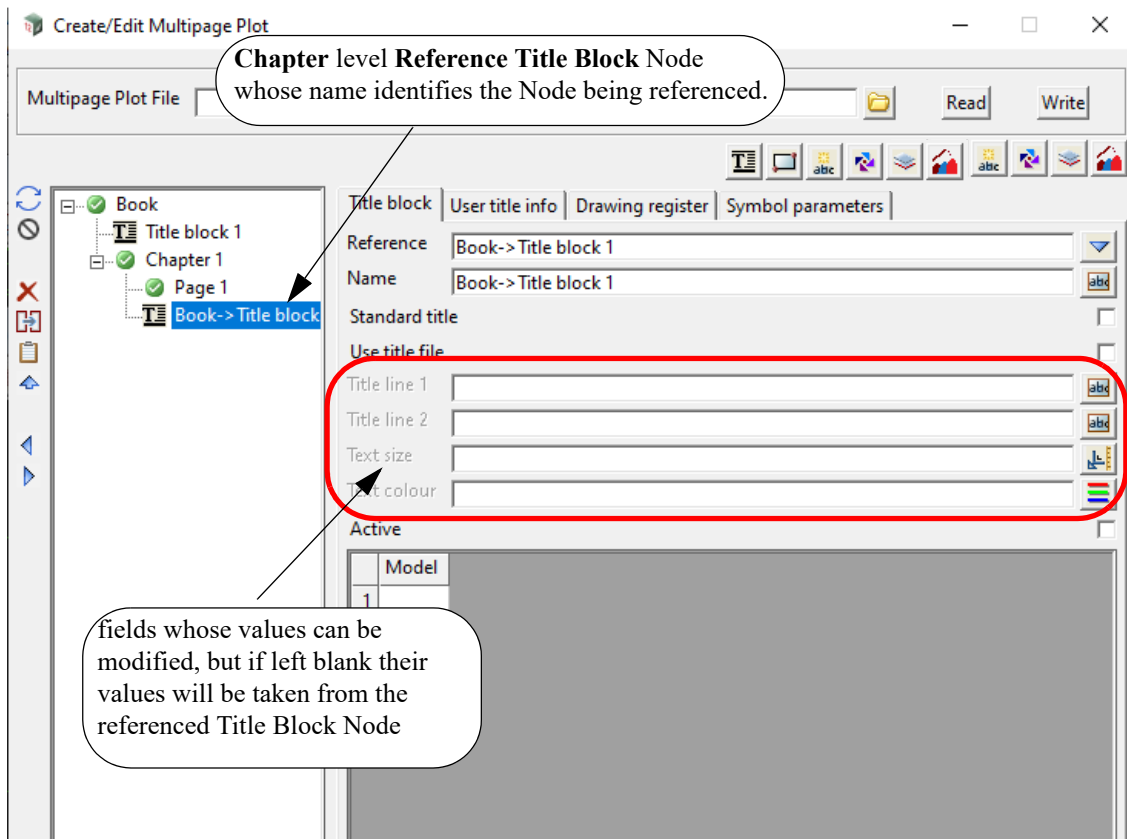


The drop-down list of the **Reference** field will show all of the existing **Title Block Nodes** that the **Reference Title Block Node** could reference. Only Nodes from higher levels of the tree can be referenced so in this **Chapter** case the list will only contain **Title Block Nodes** from **Book** 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.



### 20.1.4.6.2 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 [20.1.4.3 Icons on the Left Side](#).*

#### Icons on the Top Right

*The icons are described in [20.1.4.4 Icons on the Top Right](#).*

#### Buttons at the Bottom of each Tab

<b>Set</b>	button
------------	--------

*Must be pressed for any new field values in any of the tabs to take effect.*

#### Title Block Tab

<b>Reference</b>	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.*

<b>Name</b>	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.*

<b>Standard title</b>	tick box	not ticked
-----------------------	----------	------------

*If **ticked**, a standard 12d title block will be used.*

<b>Use title file</b>	tick box	not ticked
-----------------------	----------	------------

*If **ticked**, a user defined title file will be used.*

<b>Title line 1</b>	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.*

<b>Title line 2</b>	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.*

<b>Text size</b>	measure box	5
------------------	-------------	---

*If **Standard title** is **ticked**, then this is the text size of title text.*

<b>Text colour</b>	colour box	cyan	available colours
--------------------	------------	------	-------------------

*If **Standard title** is **ticked**, then this is the colour of title text.*

<b>Active</b>	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.*

<b>Grid of models</b>	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 [26.7.2.7.1.1.1 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 [26.7.2.7.2.7 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.*

### 20.1.4.6.3 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.

eg. 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 [26.7.2.7.2.9 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:

[20.1.4.7.6 Plan Frame](#)

[20.1.4.7.7 X Section Frame](#)

[20.1.4.7.8 Long Section Frame](#)

[20.1.4.7.9 Perspective Frame](#)

[20.1.4.7.10 Section Frame](#)

[20.1.4.7.11 3d PDF Frame](#)

[20.1.4.7.12 Node Diagram Frame](#)

#### 20.1.4.6.3.1 \$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.

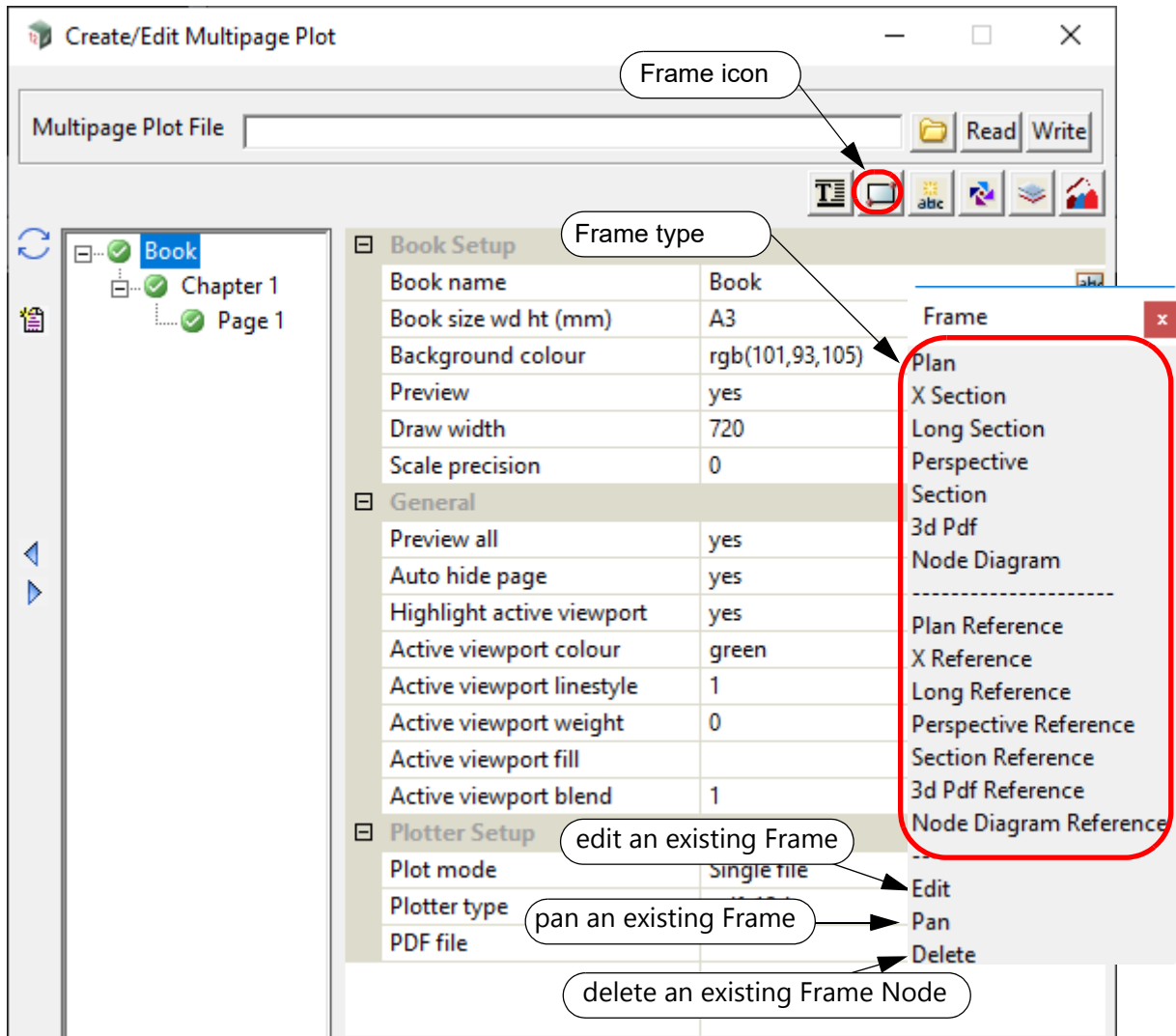
#### 20.1.4.6.3.2 \$scale/\$horizontal\_scale/\$vertical\_exaggeration

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 [20.1.4.8.2 Creating Frame Text](#) and [20.1.4.8.6 MPS Text \\$variables](#).

### 20.1.4.7 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

[20.1.4.7.1 Creating Frames for a Book](#)

[20.1.4.7.2 Creating Frames in a Chapter](#)

[20.1.4.7.3 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. eg. 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 [20.1.4.7.13 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. eg. 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. eg. 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.



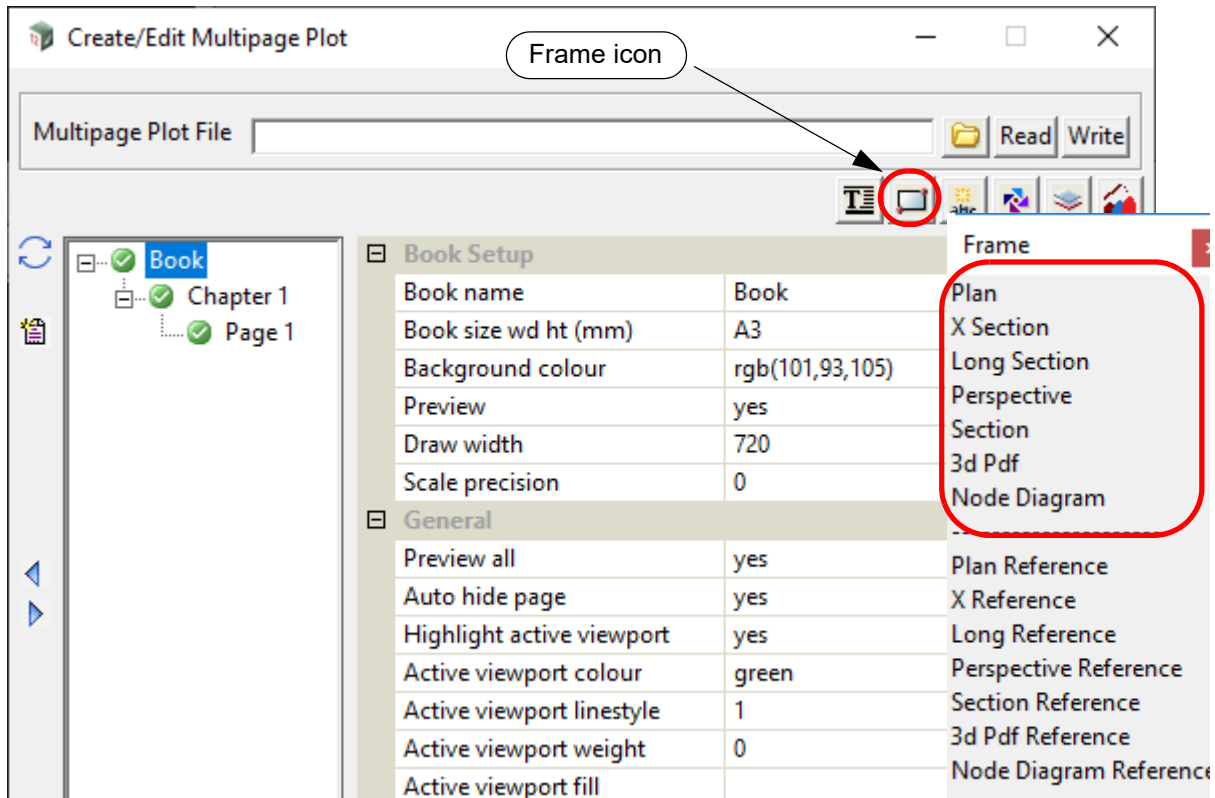
## 20.1.4.7.1 Creating Frames for a Book

### [20.1.4.7.1.1 Frames for a Book](#)

### [20.1.4.7.1.2 No Reference Frames for a Book](#)

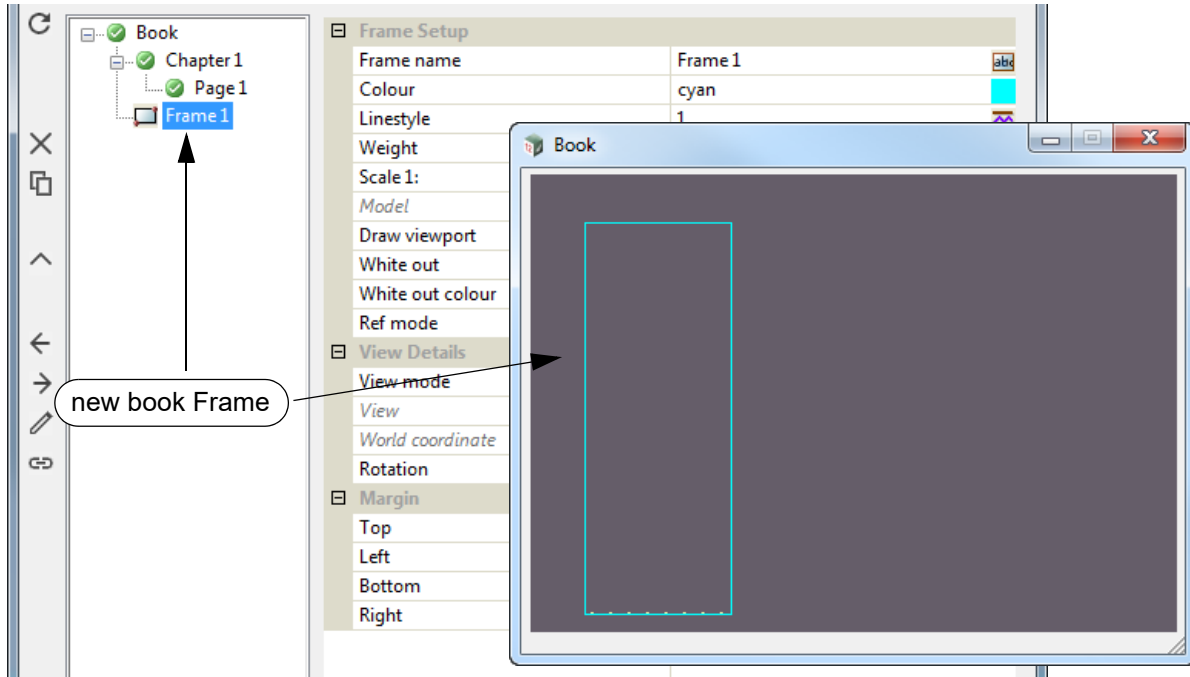
#### 20.1.4.7.1.1 Frames for a Book

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**.

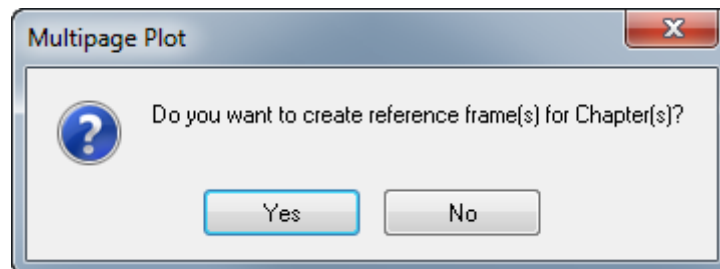


The user then creates a new **Book Frame** by drawing the rectangle representing the Frame in the **Book Plot Area**.

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**.

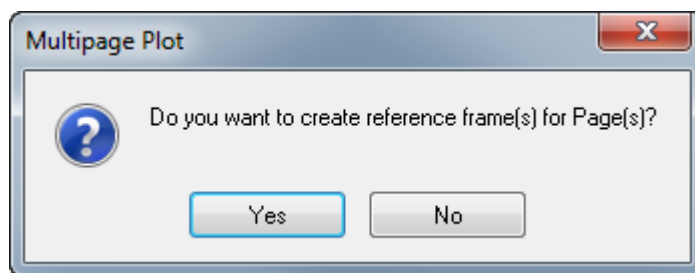
The name of the **Reference Chapter Frame** in each Chapter will be "Book ->Frame n"

**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 [20.1.4.7.14 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**.

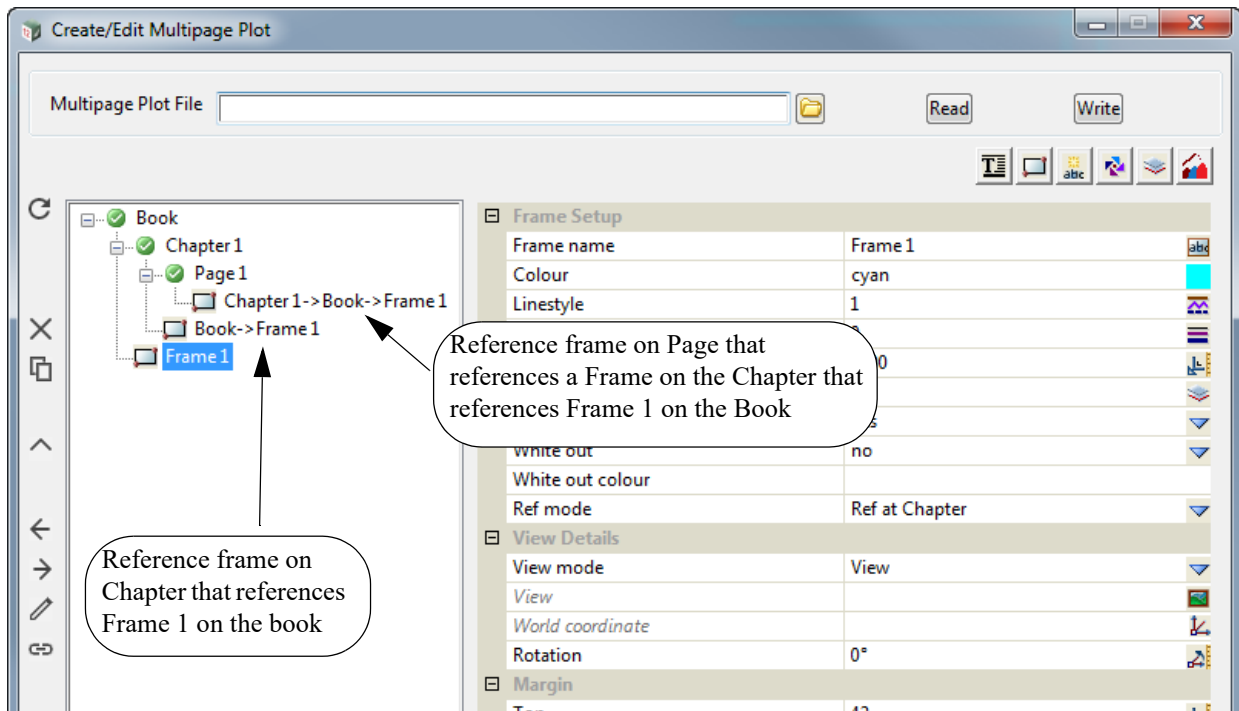
**Note:**

If the **Book Frame** is **Referenced** in a **Page** and 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**.



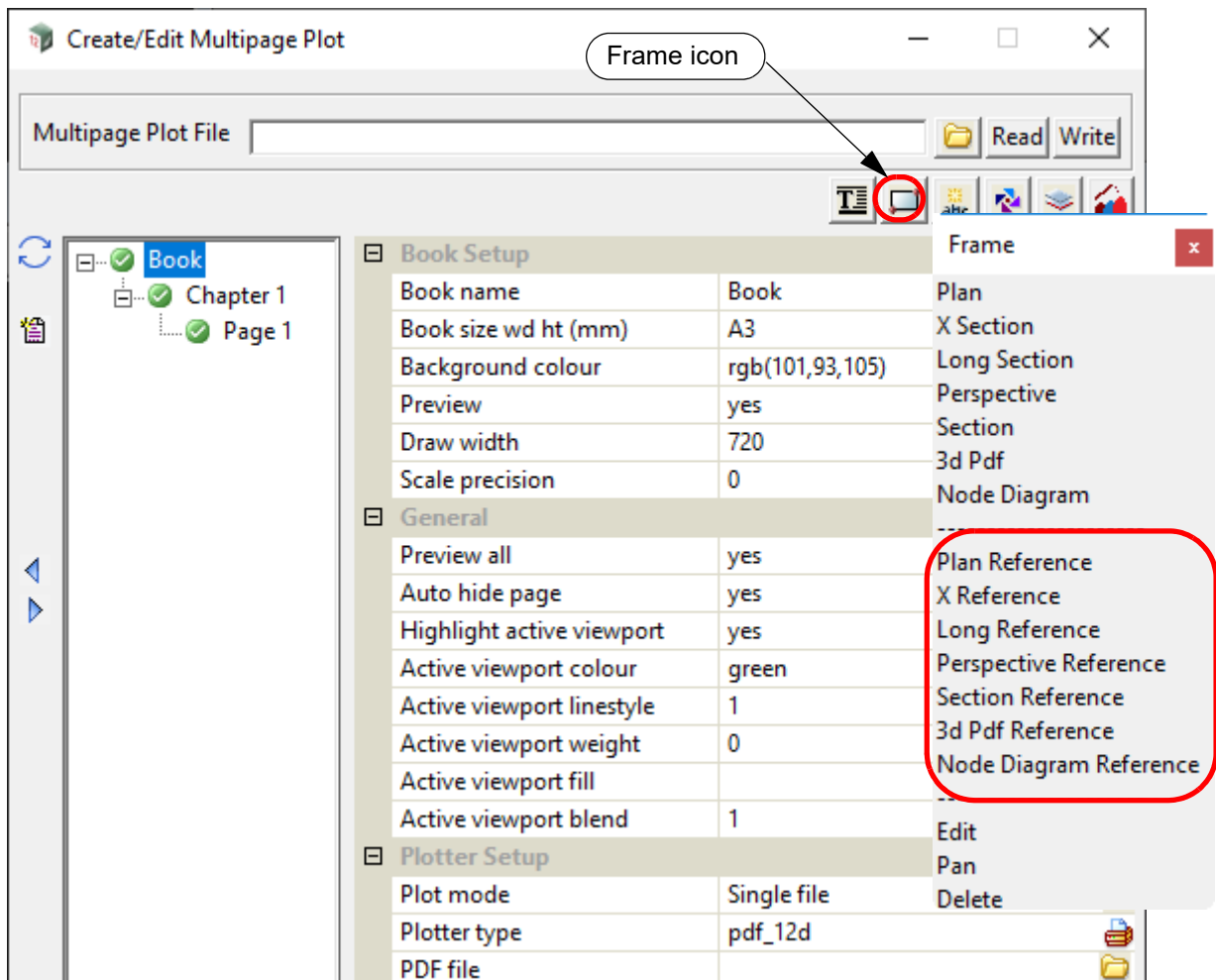
For the description on creating and editing Frames, see [20.1.4.7.5 Common Information About Frames](#).

### Important Notes

1. The order of the items in the Tree is important as it is the drawing order. See [20.1.4.7.4 Plotting Order of Frame Nodes](#).
2. **Book Frame** names have to be unique within the **Book**.

#### 20.1.4.7.1.2 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.

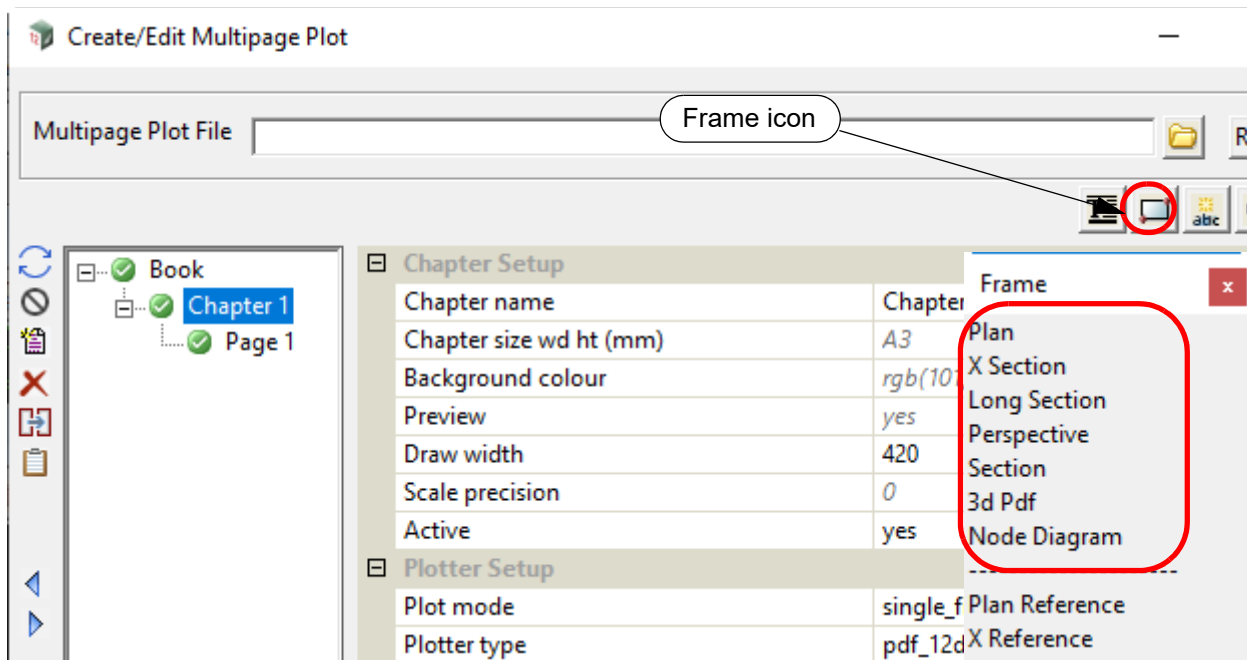
### 20.1.4.7.2 Creating Frames in a Chapter

#### [20.1.4.7.2.1 Frames for a Chapter](#)

#### [20.1.4.7.2.2 Reference Frames for a Chapter](#)

#### 20.1.4.7.2.1 Frames for a Chapter

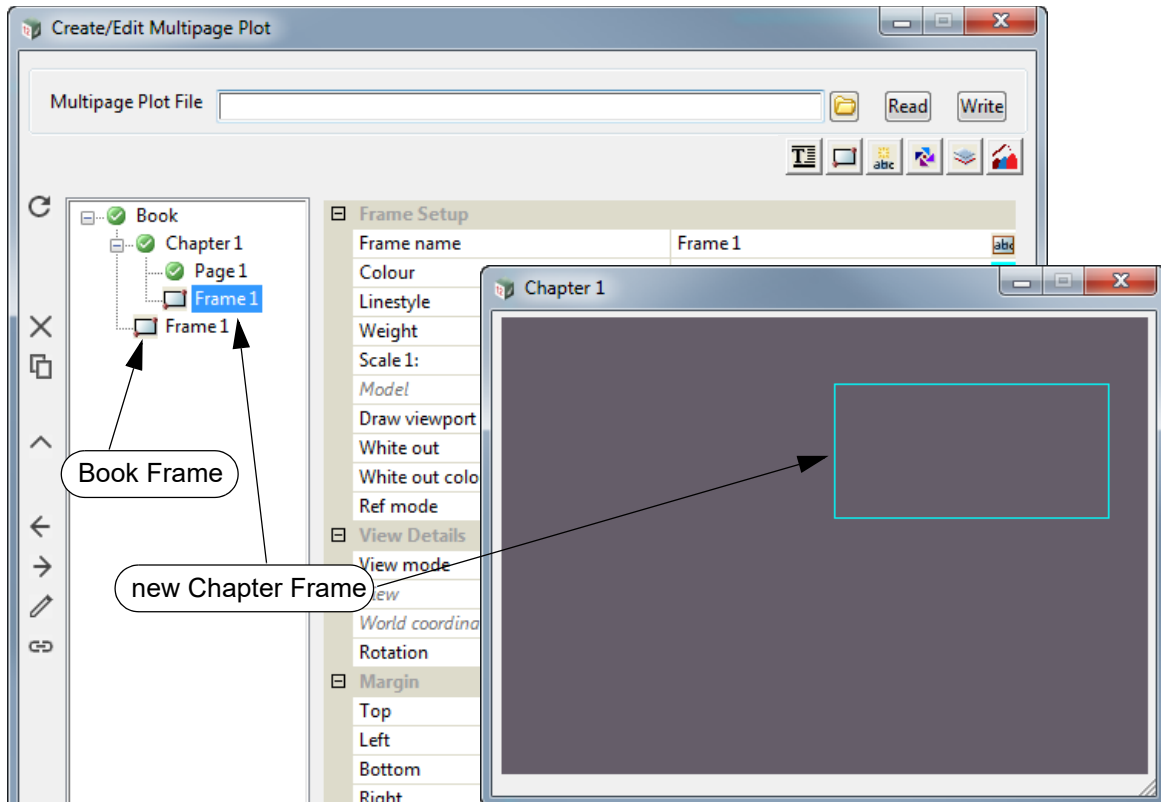
To create a **Frame** for a **Chapter**, click on the **Chapter** to display the **Chapter Plot Area** and then click on the **Frame** icon and select either **Plan**, **X Section**, **Long Section**, **Perspective**, **Section** or **Pdf 3d**.



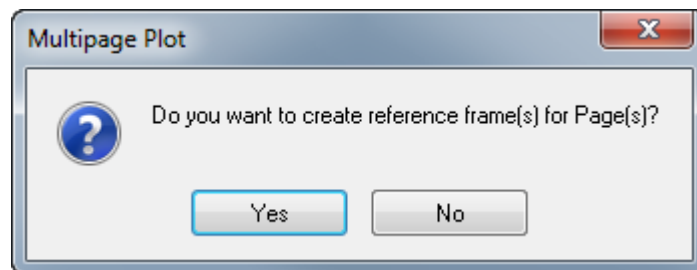
The user then creates a new **Chapter Frame** in the **Chapter Plot Area**.

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**.

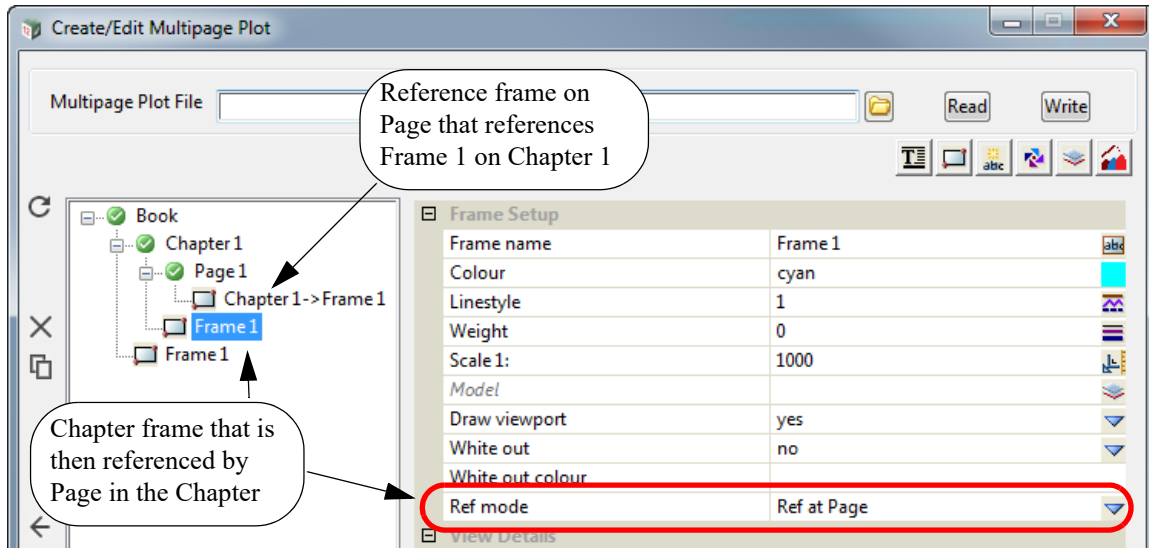
Then for each **Page** in the **Chapter**, a **Page Frame** is created for each **Page** (a **Reference Page Frame**) and each **Page Frame** references back to the **Chapter Frame**.

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**.

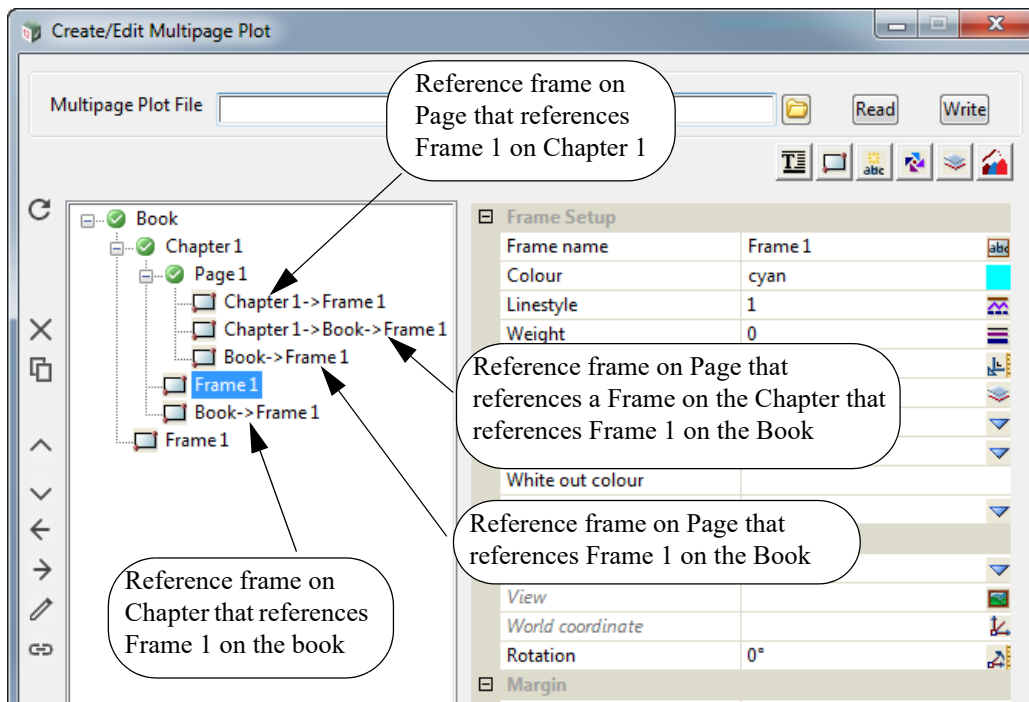
- (b) If **No** is selected, then no **Page Frames** referencing back to the **Chapter Frame** are created.

**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.



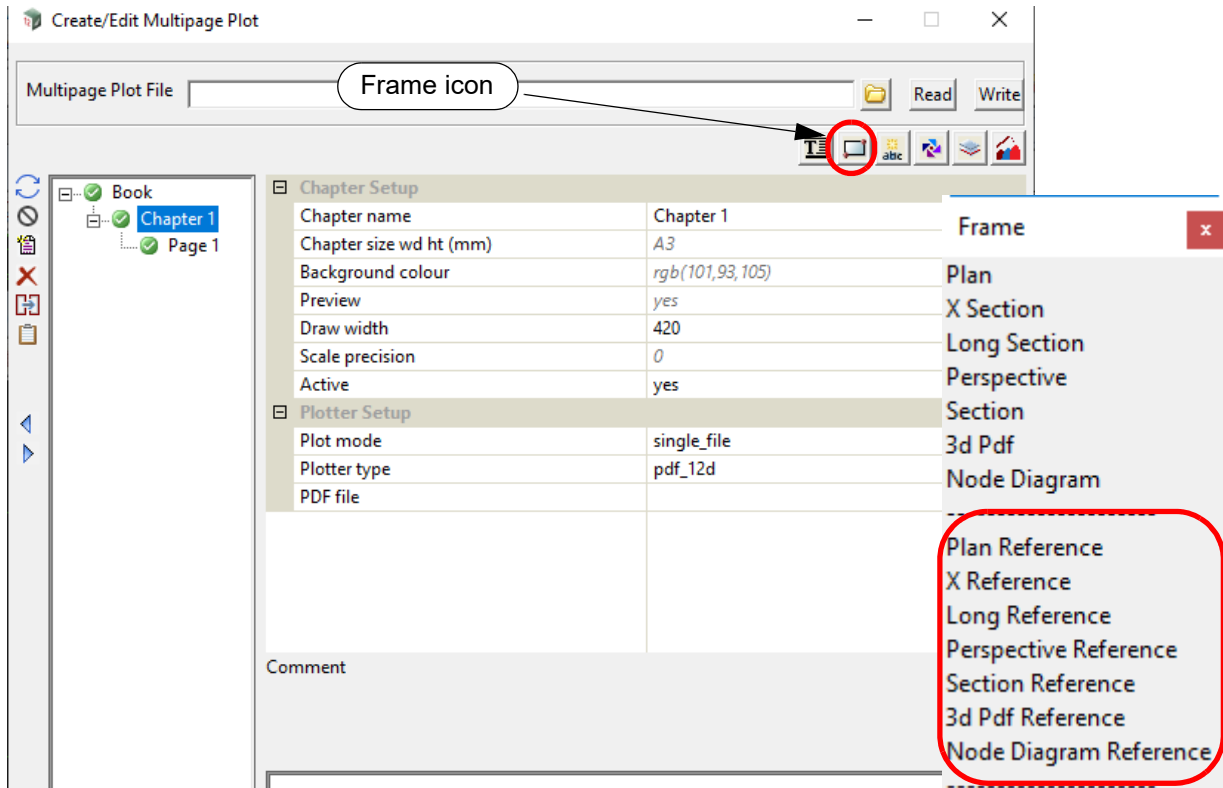
For the description on creating and editing Frames, see [20.1.4.7.5 Common Information About Frames](#)

### Important Notes

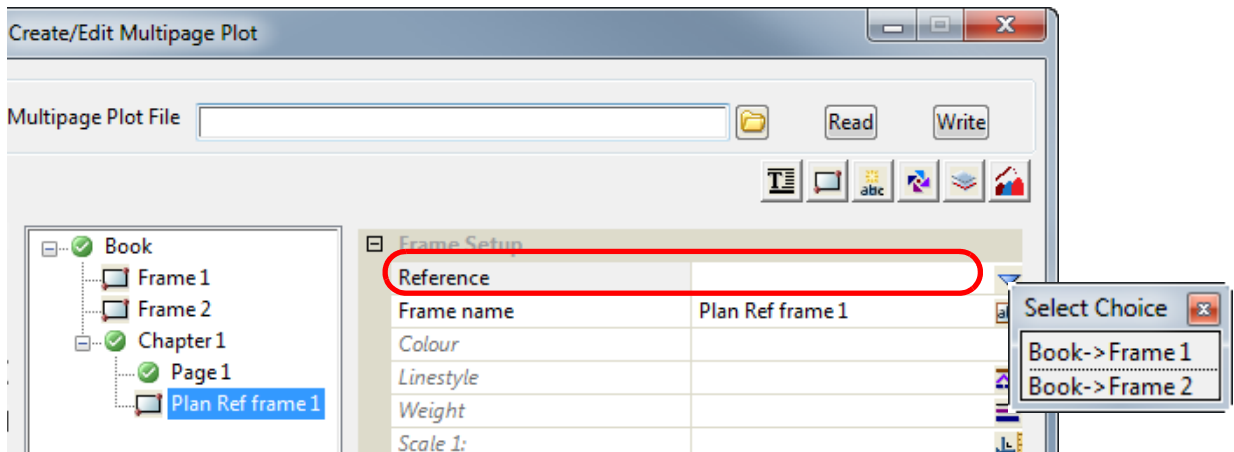
1. The order of the items in the Tree is important as it is the drawing order. See [20.1.4.7.4 Plotting Order of Frame Nodes](#).
2. **Chapter Frame** names have to be unique within a **Chapter**.

### 20.1.4.7.2.2 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**.

The screenshot shows a software interface with a tree view on the left, a properties panel in the middle, and a plot window on the right.

- Tree View:** Shows a hierarchy: Book (checked) > Frame 1 > Chapter 1 (checked) > Page 1 > Book->Frame 1 (selected).
- Properties Panel:** Shows 'Frame Setup' with 'Reference' and 'Frame name' both set to 'Book->Frame 1'. Below are sections for 'View Details' and 'Margin'.
- Plot Window:** Titled 'Chapter 1', showing a dark plot area with a dashed cyan rectangle and a solid cyan rectangle.

**Annotations:**

- A callout bubble points to the 'Reference' and 'Frame name' fields in the properties panel, stating: "Chapter Frame now referencing Book ->Frame 1".
- Another callout bubble points to the 'Book->Frame 1' item in the tree view, stating: "by default the values for the Chapter Reference Frame are taken from the Frame it is referencing. i.e. Book ->Frame 1".



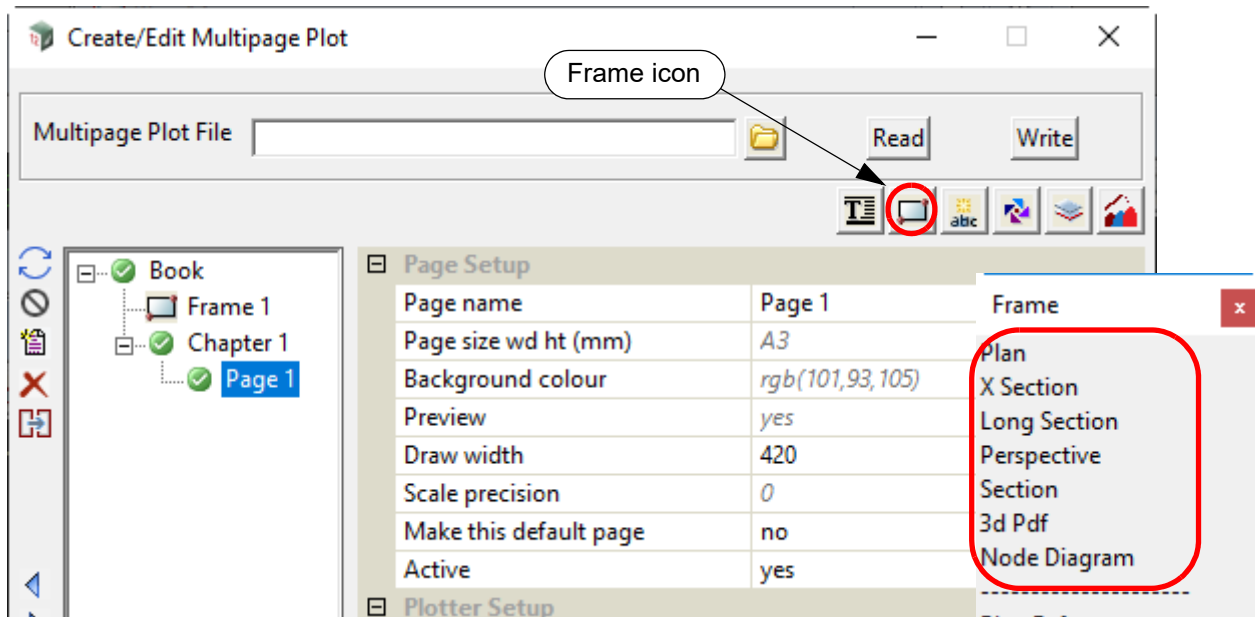
### 20.1.4.7.3 Creating Frames on a Page

#### [20.1.4.7.3.1 Frames for a Page](#)

#### [20.1.4.7.3.2 Reference Frames for a Page](#)

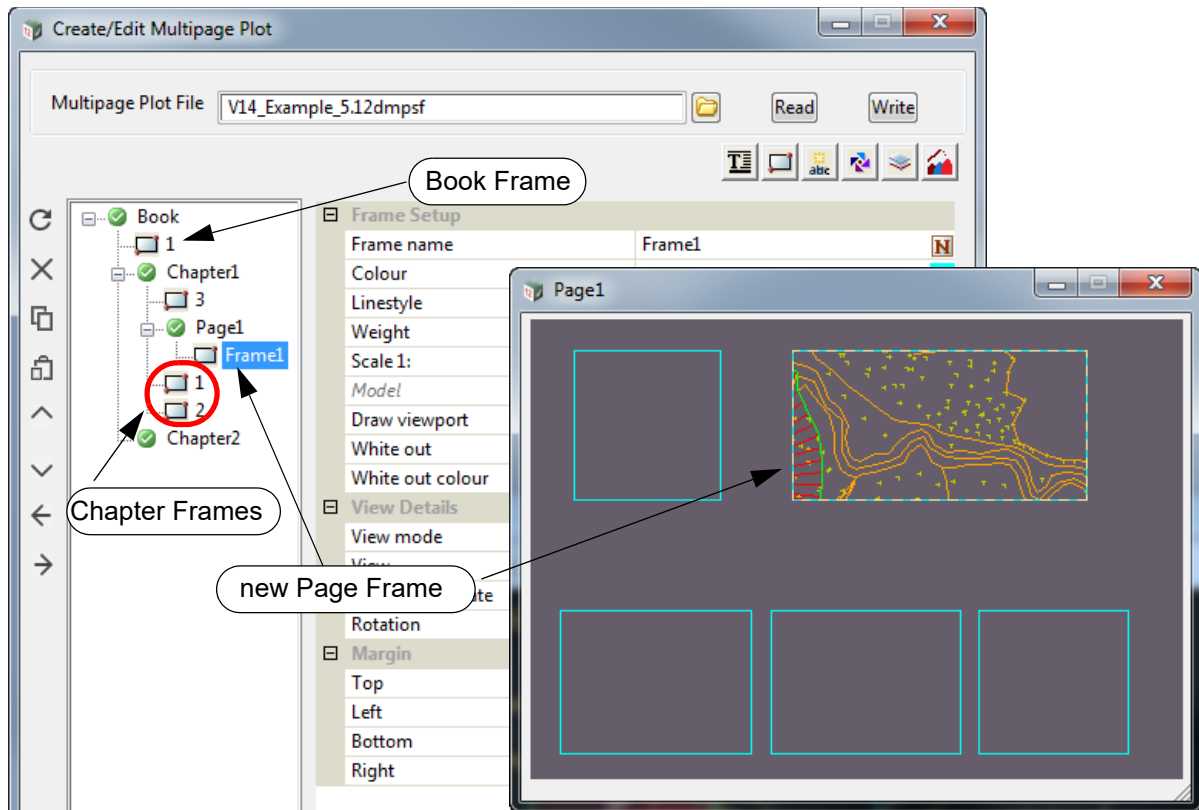
#### 20.1.4.7.3.1 Frames for a Page

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 [20.1.4.7.5 Common Information About Frames](#).

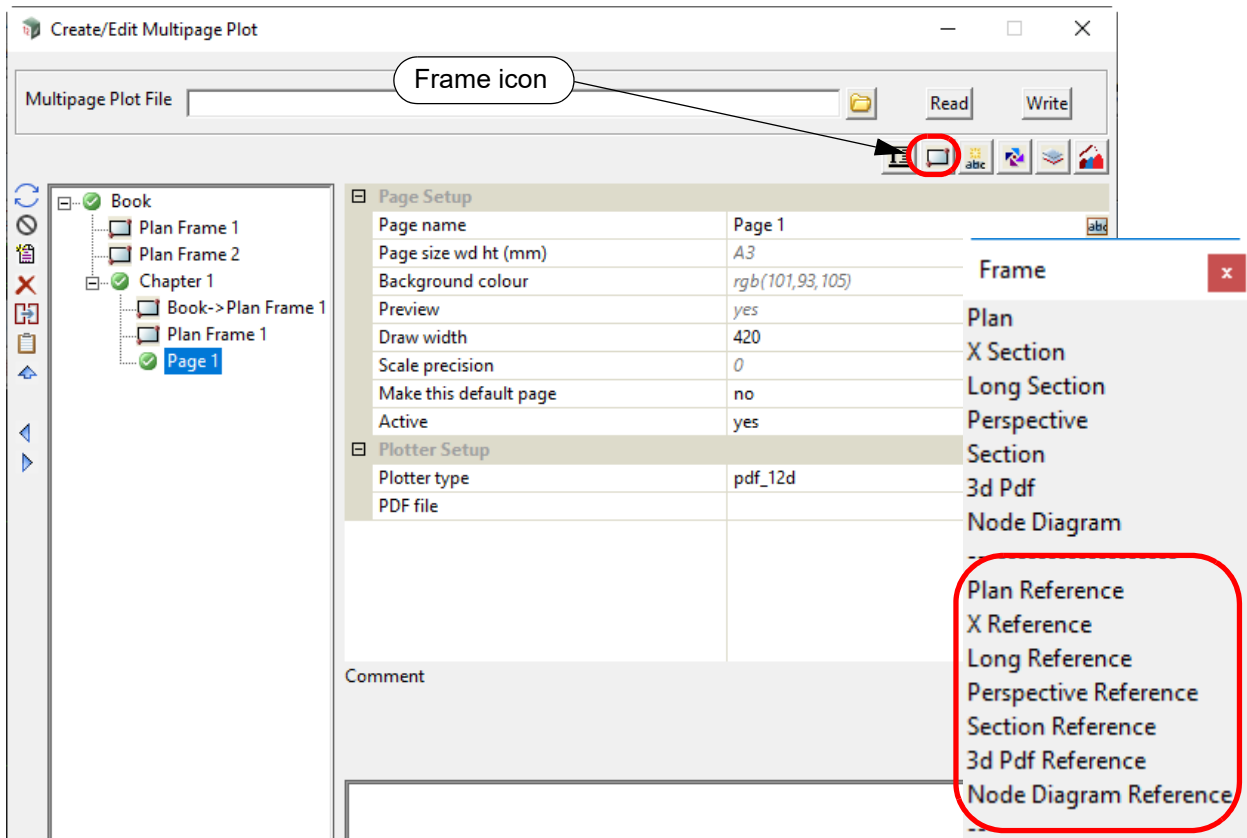
### Important Notes

1. The order of the items in the Tree is important as it determines the drawing order in each page of the plot. See [20.1.4.7.4 Plotting Order of Frame Nodes](#).
2. **Page Frame** names have to be unique within the same **Page**.

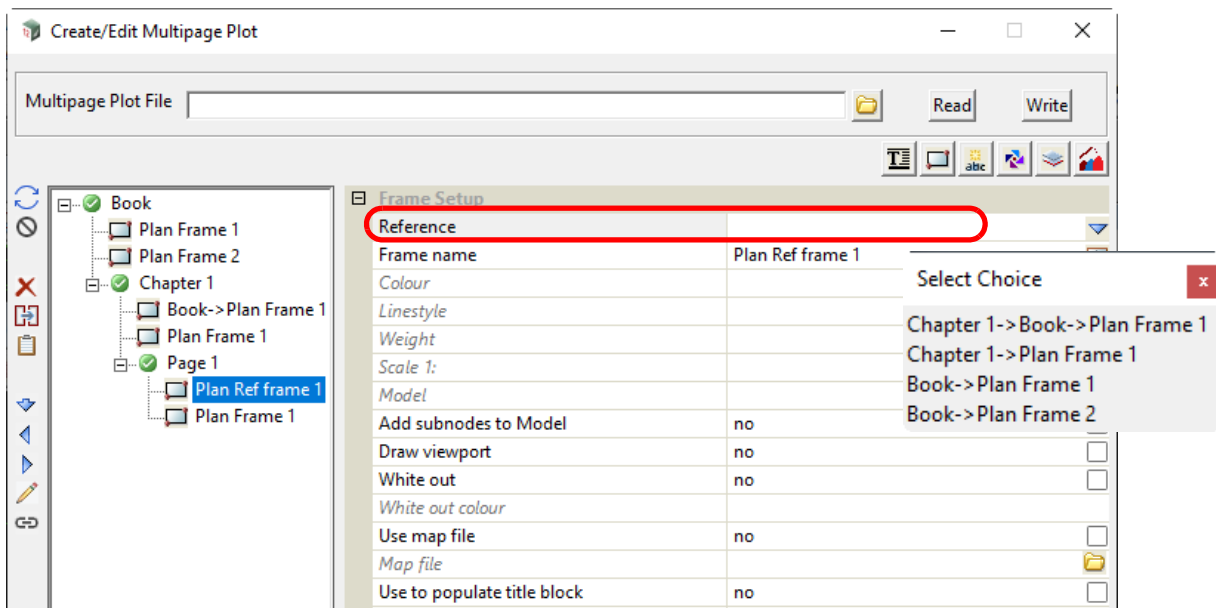


### 20.1.4.7.3.2 Reference Frames for a Page

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**.

The screenshot shows a software interface with three main components:

- Tree View:** A hierarchical tree structure on the left. The 'Book->Frame 2' node is selected and highlighted in blue.
- Frame Setup Table:** A table on the right with the following content:

Property	Value
Reference	Book->Frame 2
Frame name	Book->Frame 2
Colour	
Linestyle	
Weight	
Scale 1:	
Model	
Draw view	
White out	
White out	
View Det	
View mod	
View	
World cook	
Rotation	
Margin	
Top	
Left	
Bottom	
Right	
- Page 1 Window:** A window titled 'Page 1' showing a dark grey background with three rectangular frames. Two are solid blue outlines, and one at the bottom is a dashed blue outline. Arrows point from the 'Book->Frame 2' node in the tree and the 'Reference' and 'Frame name' cells in the table to these frames.

Callout boxes provide additional context:

- A callout pointing to the 'Book->Frame 2' node in the tree: "by default the values for the Page Reference Frame are taken from the Frame it is referencing. i.e. Book ->Frame 2"
- A callout pointing to the 'Reference' and 'Frame name' cells in the table: "Page Frame now referencing Book ->Frame 2"

#### 20.1.4.7.4 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 [20.1.4.10.5 Examples of Model Nodes](#).

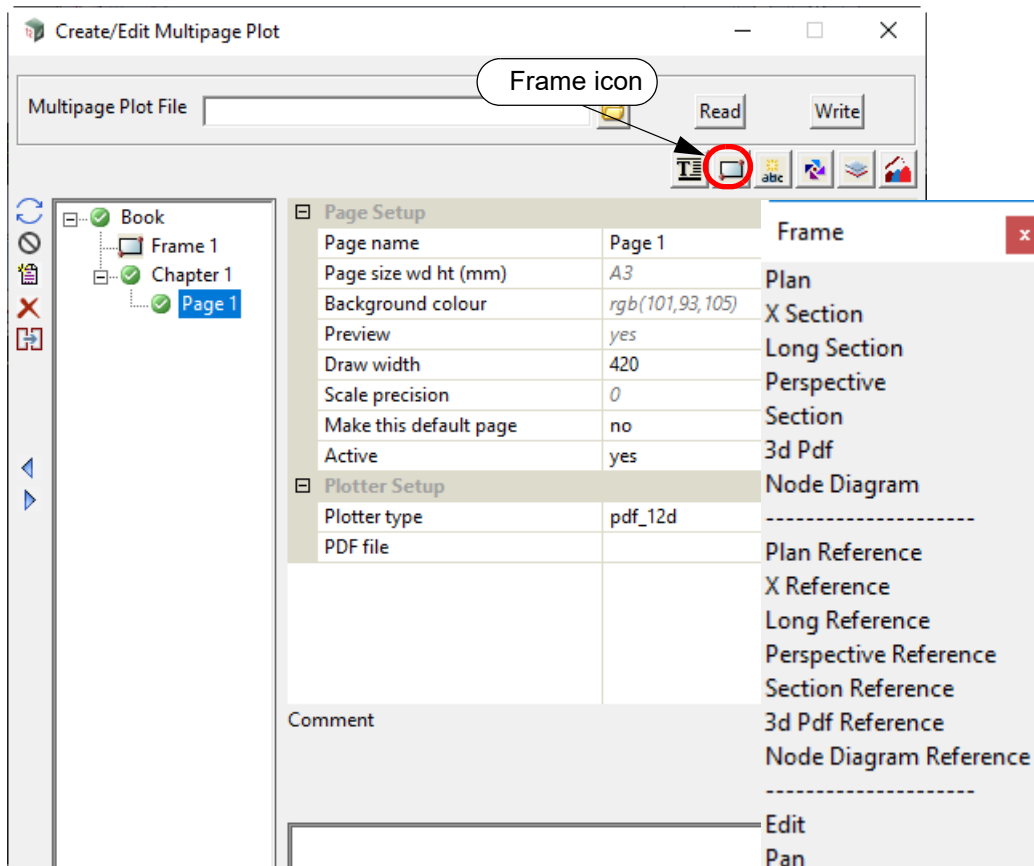
All the **Chapter Frame nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Frame node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Frame** is plotted before that **Page** is plotted.

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 [20.1.4.10.5 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.

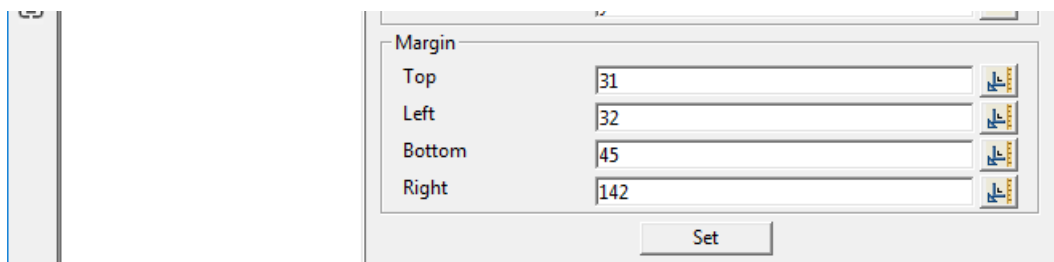
### 20.1.4.7.5 Common Information About Frames

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, [20.1.4.5 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 [20.1.4.7.14 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 [20.1.4.7.13 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 [20.1.4.7.6 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 [20.1.4.7.7 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 [20.1.4.7.8 Long Section Frame](#).

The **Perspective frame** is for drawing the image that is displayed on a Perspective View. See [20.1.4.7.9 Perspective Frame](#).

The **Section frame** is for drawing the image that is displayed on a Section View. See [20.1.4.7.10 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 [20.1.4.7.11 3d PDF Frame](#).

The **Node diagram** is for creating a structure node diagram for the node of a water string. See [20.1.4.7.12 Node Diagram Frame](#).



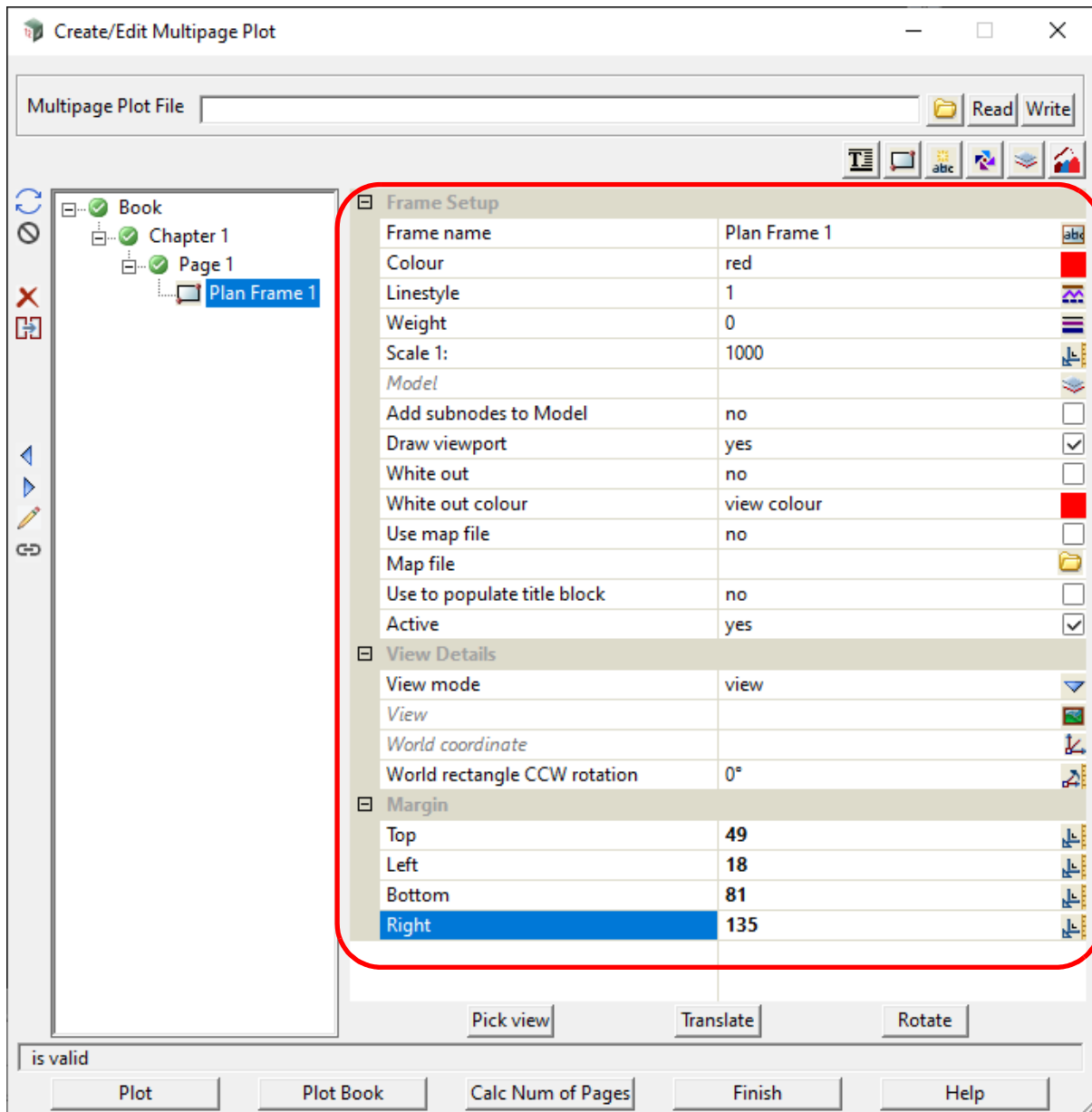
### 20.1.4.7.6 Plan Frame

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
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#### 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, [20.1.4.5 Inherited Fields](#) \*.*

## Frame Setup

<b>Frame name</b>	text box	Plan Frame n	
	<i>Name for this Plan frame. The default name is <b>Plan Frame n</b> where <b>n</b> is the first number to make the name "Plan Frame n" unique for <b>this</b> node (Book, Chapter or Page) in the tree. The name must be unique amongst all the frames on this node.</i>		
<b>Colour*</b>	colour box	red	available colours
	<i>Colour for the border of the Plan Frame that is drawn when <b>Draw viewport</b> is <b>ticked</b>.</i>		
<b>Linestyle*</b>	linestyle box	1	available linestyles
	<i>Linestyle for the border of the Plan Frame that is drawn when <b>Draw viewport</b> is <b>ticked</b>.</i>		
<b>Weight*</b>	weight box	0	
	<i>Weight for the border of the Plan Frame that is drawn when <b>Draw viewport</b> is <b>ticked</b>.</i>		
<b>Scale 1:*</b>	measure box	1000	
	<i>Scale of the drawing in the plan frame is 1:value. The size of the <b>Plan Frame</b> drawn on the Plot Area (which is in millimetres) and the <b>Scale 1:</b> value determines the width and height <b>in world units</b> of the World rectangle that is to be plotted to the plan frame.</i>		
<b>Model*</b>	model box		
	<i>If <b>not blank</b>, when this Multipage plot is being edited, a string of the World rectangle for the plan frame is added to this model. If <b>blank</b>, no string of the World rectangle for the plan frame is created. <b>Note:</b> 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.</i>		
<b>Add subnodes to Model*</b>	tick box	not ticked	
	<i>If <b>ticked</b>, then any Text or Symbol Subnodes that this Plan Frame has will also be added to the <b>Model</b> specified above. If <b>not ticked</b>, then the Subnodes will not be added to the <b>Model</b>.</i>		
<b>Draw viewport*</b>	tick box	ticked	
	<i>If <b>ticked</b>, the border of the Plan Frame is drawn on the plot. If <b>not ticked</b>, the border of the Plan Frame is <b>NOT</b> drawn on the plot.</i>		
<b>White out*</b>	tick box	not ticked	
	<i>If <b>ticked</b>, the Plan Frame is drawn on the plot and the frame area is first drawn in the <b>White out colour</b>.</i>		
<b>White out colour*</b>	colour box	view colour	available colours
	<i>Colour to be used for the white out if <b>White out</b> is <b>ticked</b>.</i>		
<b>Use map file*</b>	tick box	not ticked	
	<i>If <b>ticked</b>, the <b>Map file</b> given is applied to all the data to be drawn in the Plan Frame. If <b>not ticked</b>, the <b>Map file</b> is not used.</i>		
<b>Map file*</b>	Map file box		available Map files
	<i>Map file to use if <b>Use Map file</b> is <b>ticked</b>.</i>		
	<i><b>Note:</b> <b>Map file</b> does not support some of the more complex 12d objects (Rasters, Point Clouds, etc.) and</i>		

may result in unexpected or incomplete output when used on these objects.

#### Use to populate title block

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. ie. 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 result in the field being **un-ticked** on the first Frame Node of that Page.

For more information, see [20.1.4.6.3 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

[.20.1.4.7.6.1.1 Plan Frame - View Details - View mode - View](#)

[20.1.4.7.6.1.2 Plan Frame - - View Details - View mode - View Favourite](#)

### 20.1.4.7.6.1 Plan Frame - View Details - View mode - View

**View mode** can be either **view** or **view\_favourite**.

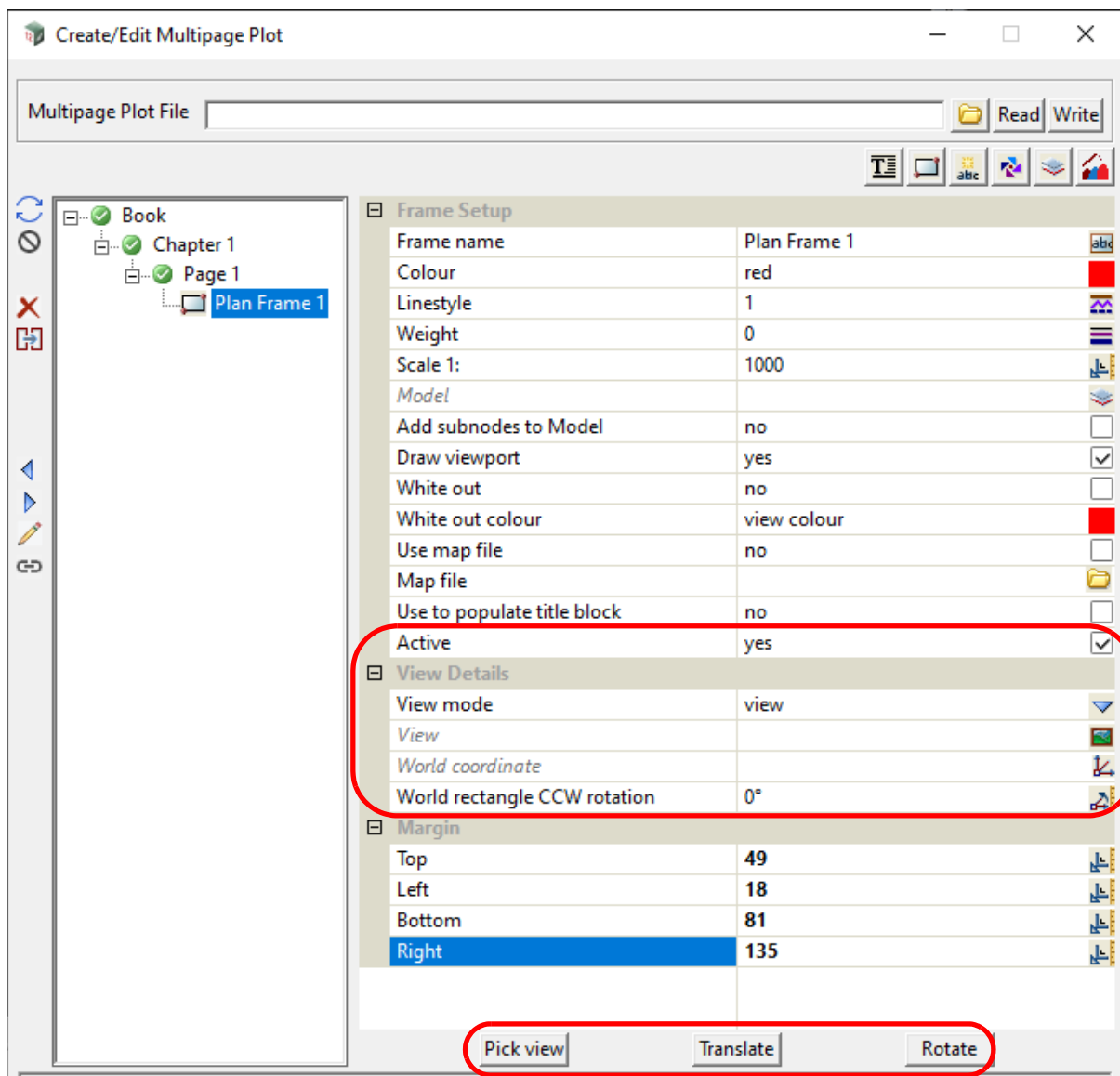
For **view**, the information for what is displayed in the Frame is taken from a View that the user selects. See [20.1.4.7.6.1.1 Plan Frame - View Details - View mode - View](#)

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 [20.1.4.7.6.1.2 Plan Frame - View Details - View mode - View Favourite](#).

#### 20.1.4.7.6.1.1 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 World 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
<b>View Details</b>			
<b>View mode*</b> <i>When View.</i>	choice box	View	View, View favourites
<b>View*</b>	view box		available views
<i>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 <b>Create/Edit Multipage Plot</b> panel is open.</i>			
<b>World coordinate*</b>	xyz pick box	1	measures
<i>World coordinate for the centre of the World rectangle. If a new <b>World coordinate</b> is entered or selected, that becomes the new centre of the World rectangle.</i>			
<b>World rectangle CCW Rotation*</b>	angle box	0	angle measures
<i>Angle of rotation of the World rectangle measured in the counter clockwise direction from the positive x-axis. If a new <b>Rotation</b> is entered, it becomes the rotation of the <b>World rectangle</b>.</i>			

## Margins

The margins give the size of the Frame in the Plot Area. See [Margins in 20.1.4.7.5 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.*

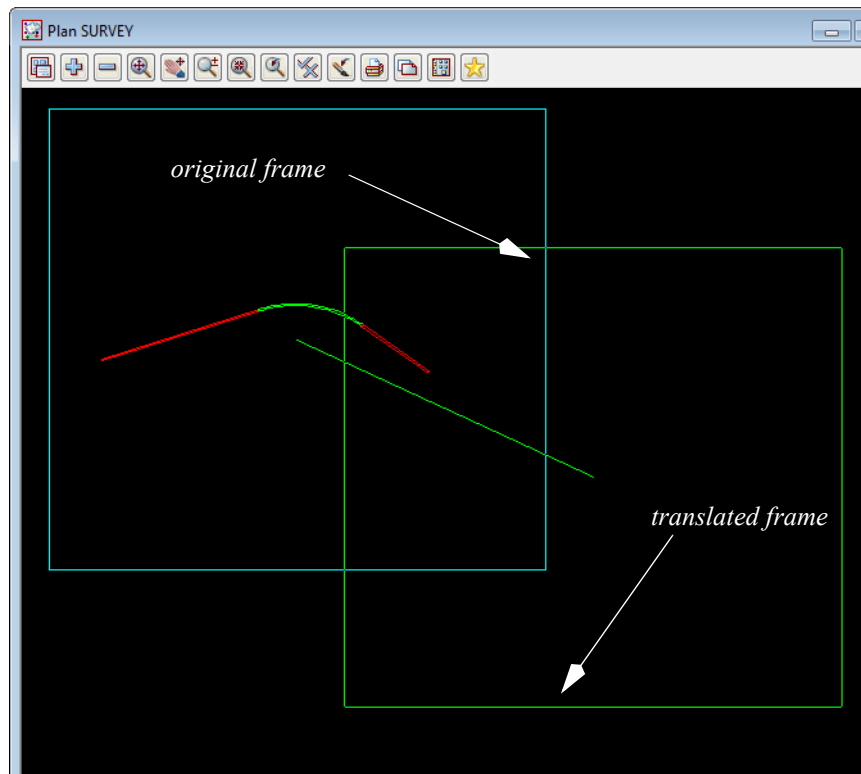
*If there is a value in the **Rotation** field then it is maintained and used for the World rectangle.*

**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.*

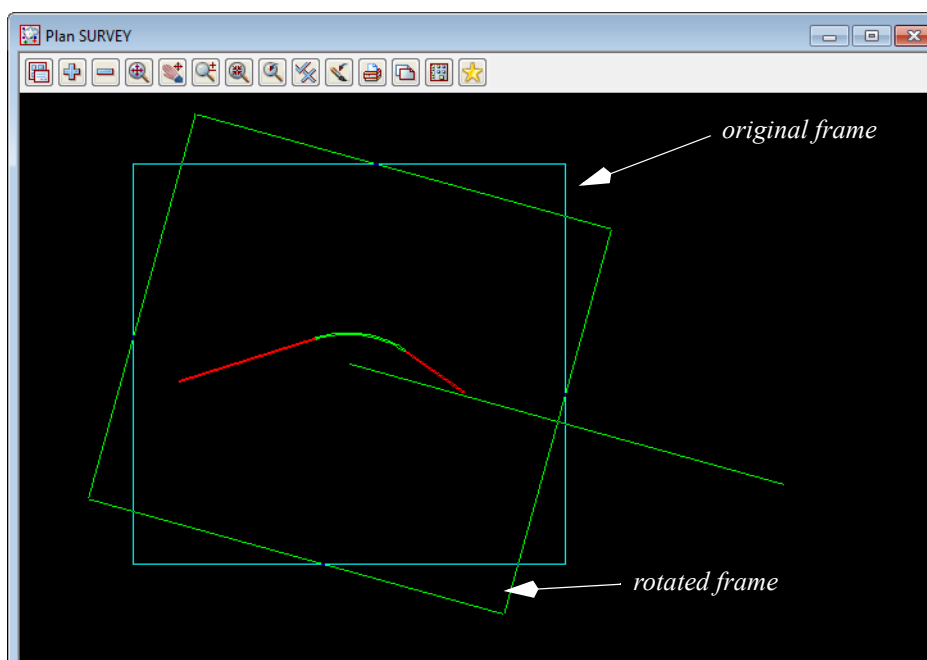




### Rotate button

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.





### 20.1.4.7.6.1.2 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

Frame Setup	
Frame name	Plan Frame 1
Colour	red
Linestyle	1
Weight	0
Scale 1:	1000
<i>Model</i>	
Add subframe to Model	yes
Draw viewport	yes
White out	no
White out colour	
Use map file?	no
Map file	
Active	yes
View Details	
View mode	view_favourites
Plan view favourite	rotated_view_30.12dvfplan
Coordinate mode	from_favourite
World coordinate	256305.6674 7411542.7542
Rotation mode	from_favourite
World rectangle CCW rotation	330°
Margin	
Top	34
Left	18
Bottom	114
Right	157

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).

Viewport	
Minimum x	255417.5692
Maximum x	257193.7657
Minimum y	7410965.5559
Maximum y	7412119.9525
Rotate angle	30°

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

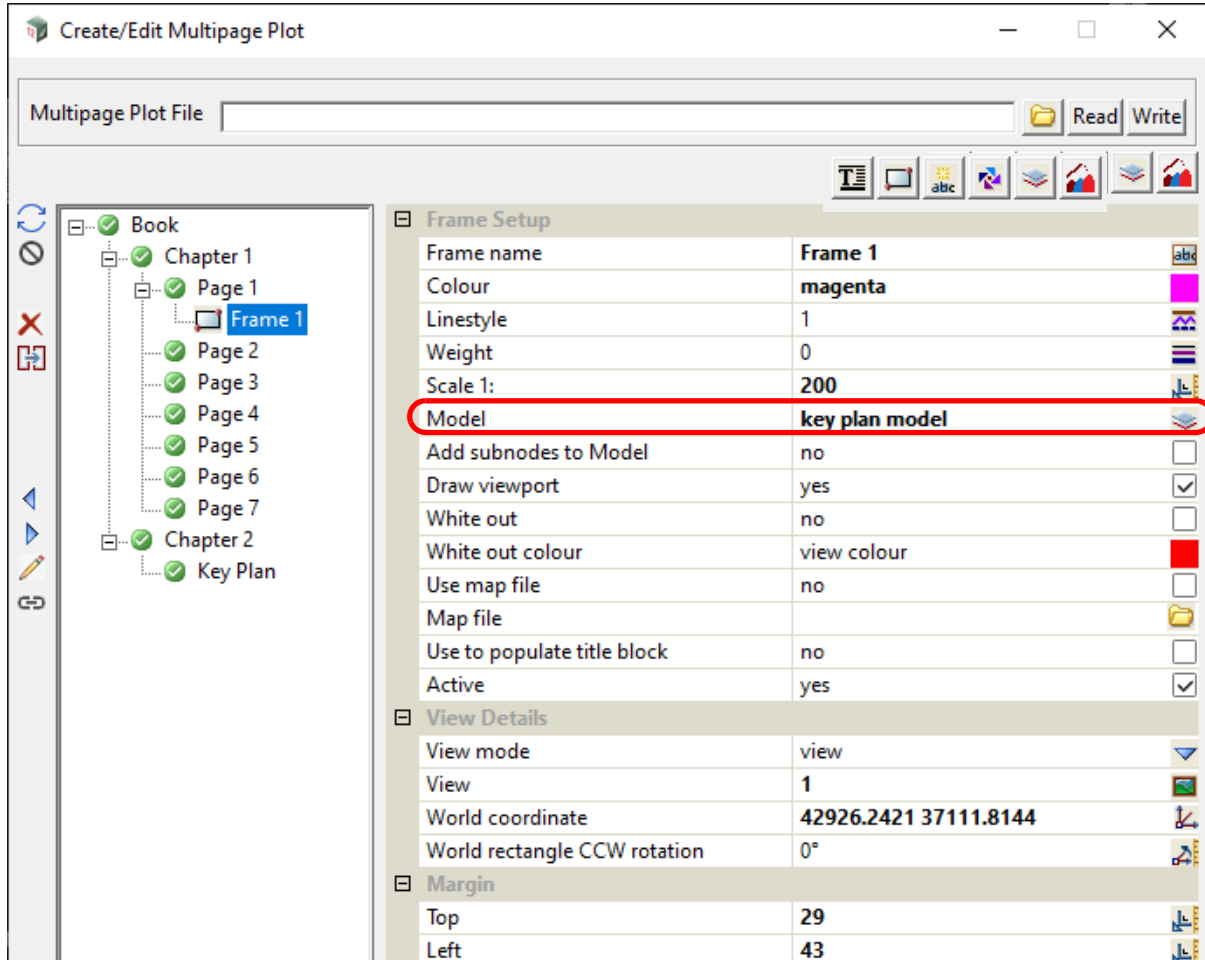
modified and the new value becomes the rotation of the World rectangle.

The fields and buttons used in this section of the panel when **View mode** is set to **View favourites** have the following functions.

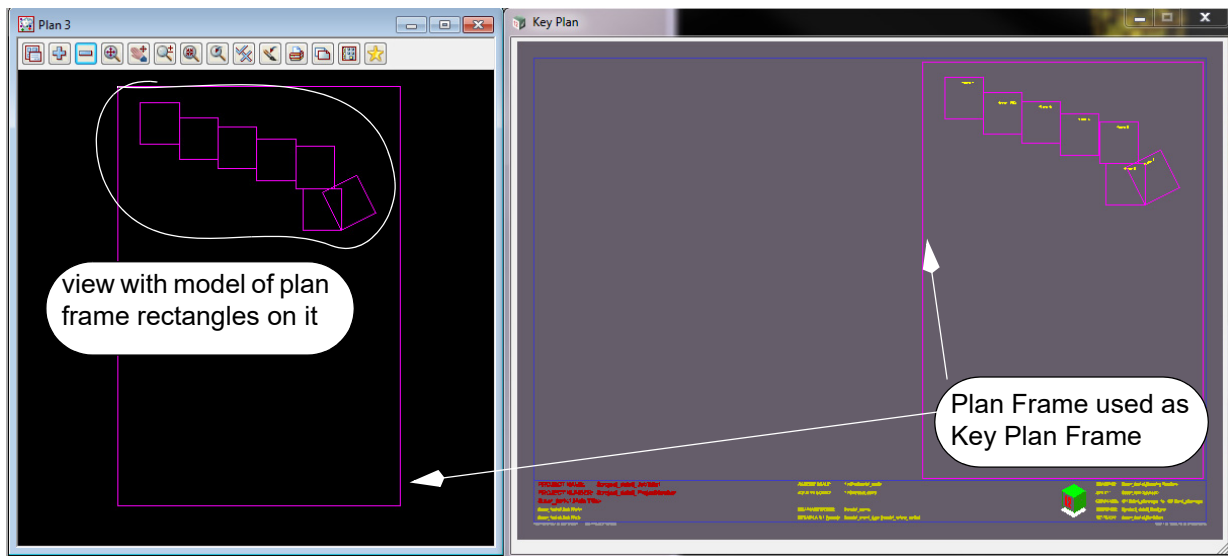
Field Description	Type	Defaults	Pop-Up
<b>View Details</b>			
<b>View mode*</b> <i>Set to <code>view_favourites</code>.</i>	choice box	View	view, view_favourites
<b>Plan view favourite*</b> <i>View that the World rectangle will take its information from for the plot. An outline of the World rectangle is displayed on the View whilst the <b>Create/Edit Multipage Plot</b> panel is open.</i>	plan view favourite box		
<b>Coordinate mode*</b> <i>If <code>from_favourite</code>, 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 <b>World coordinate</b> field. When <code>from_favourite</code>, the value in <b>World coordinate</b> can not be modified. If <code>from_frame</code>, the world coordinate is taken from the <b>World coordinate</b> field. When <code>from_frame</code>, the value in <b>World coordinate</b> CAN be modified.</i>	choice box		from_favourite, from_frame
<b>World coordinate*</b> <i>World coordinate for the centre of the World rectangle. If <b>Coordinate mode</b> is changed to <code>from_frame</code> and a new <b>World coordinate</b> is entered or selected, the new value becomes the new centre of the World rectangle.</i>	xyz pick box	1	measures
<b>Rotation mode*</b> <i>If <code>from_favourite</code>, the <b>World rectangle CCW rotation</b> field is set as the negative of the <b>Rotate angle</b> given in the <b>Viewport</b> section of the Plan view favourite. This is necessary so that the plot is identical to that given by the Plan view favourite. When <code>from_favourite</code>, the value in <b>World rectangle CCW rotation</b> can not be modified. If <code>from_frame</code>, the rotation angle is taken from the <b>World rectangle CCW rotation</b> field. When <code>from_frame</code>, the value in <b>World rectangle CCW rotation</b> CAN be modified.</i>	choice box		from_favourite, from_frame
<b>World rectangle CCW rotation*</b> <i>Angle of rotation of the World rectangle measured in the counter clockwise direction from the positive x-axis. If <b>Rotation mode</b> is changed to <code>from_frame</code> and a new <b>World rectangle CCW rotation</b> is entered, that new value becomes the rotation of the World rectangle.</i>	angle box	0	angle measures

### 20.1.4.7.6.2 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 (eg 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.

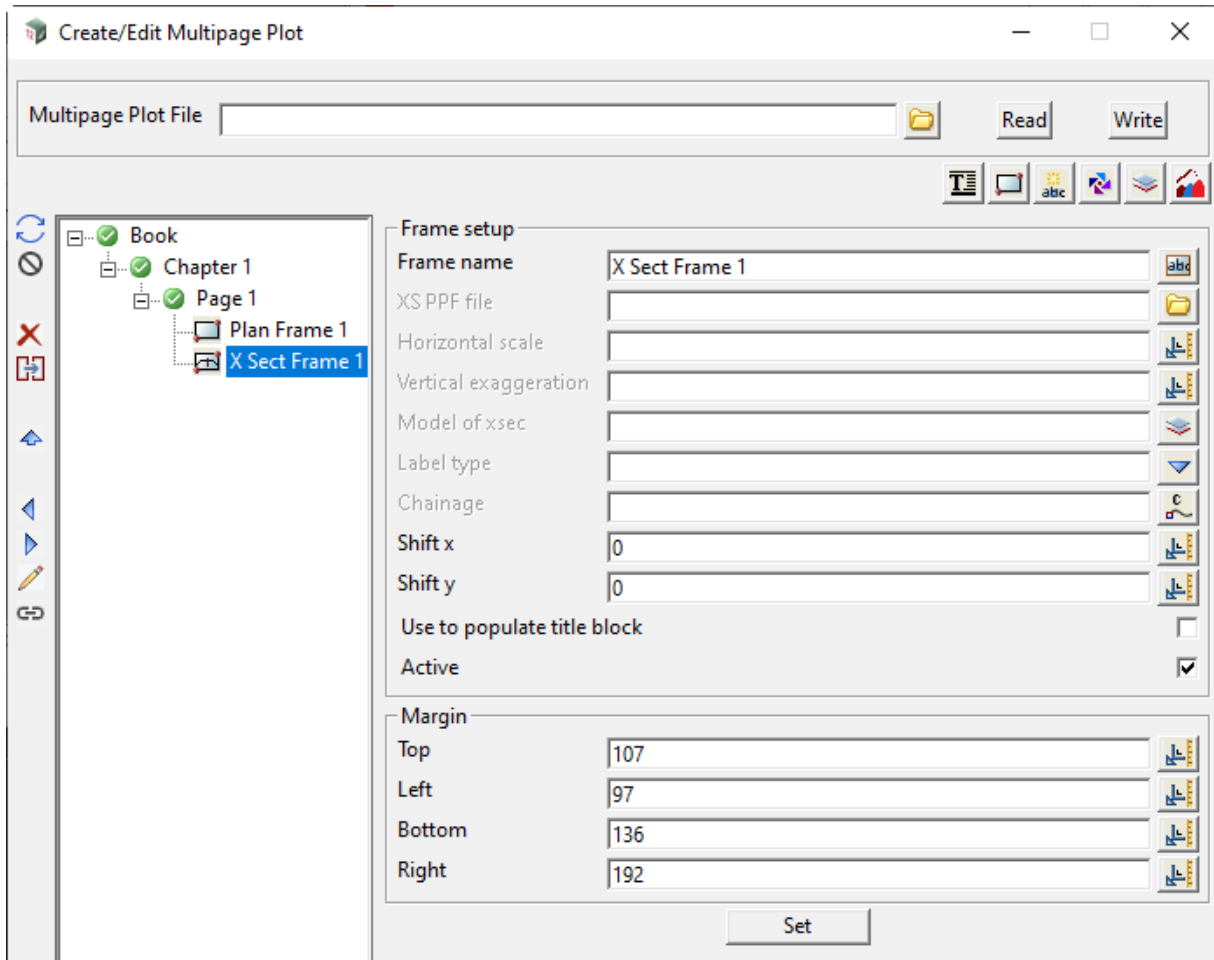


Now whenever a Plan Frame is placed on the same **Sheet** as a Key Plan Frame that contains the



### 20.1.4.7.7 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

<b>Frame name</b>	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.*

<b>XS PPF file</b>	x section ppf box		available x section ppfs
--------------------	-------------------	--	--------------------------

*Selected PPF file that contains all the information for drawing a cross section plot.*

<b>Horizontal scale</b>	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.*

<b>Vertical exaggeration</b>	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. ie. 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 result in the field being **un-ticked** on the first Frame Node of that Page.

For more information, see [20.1.4.6.3 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

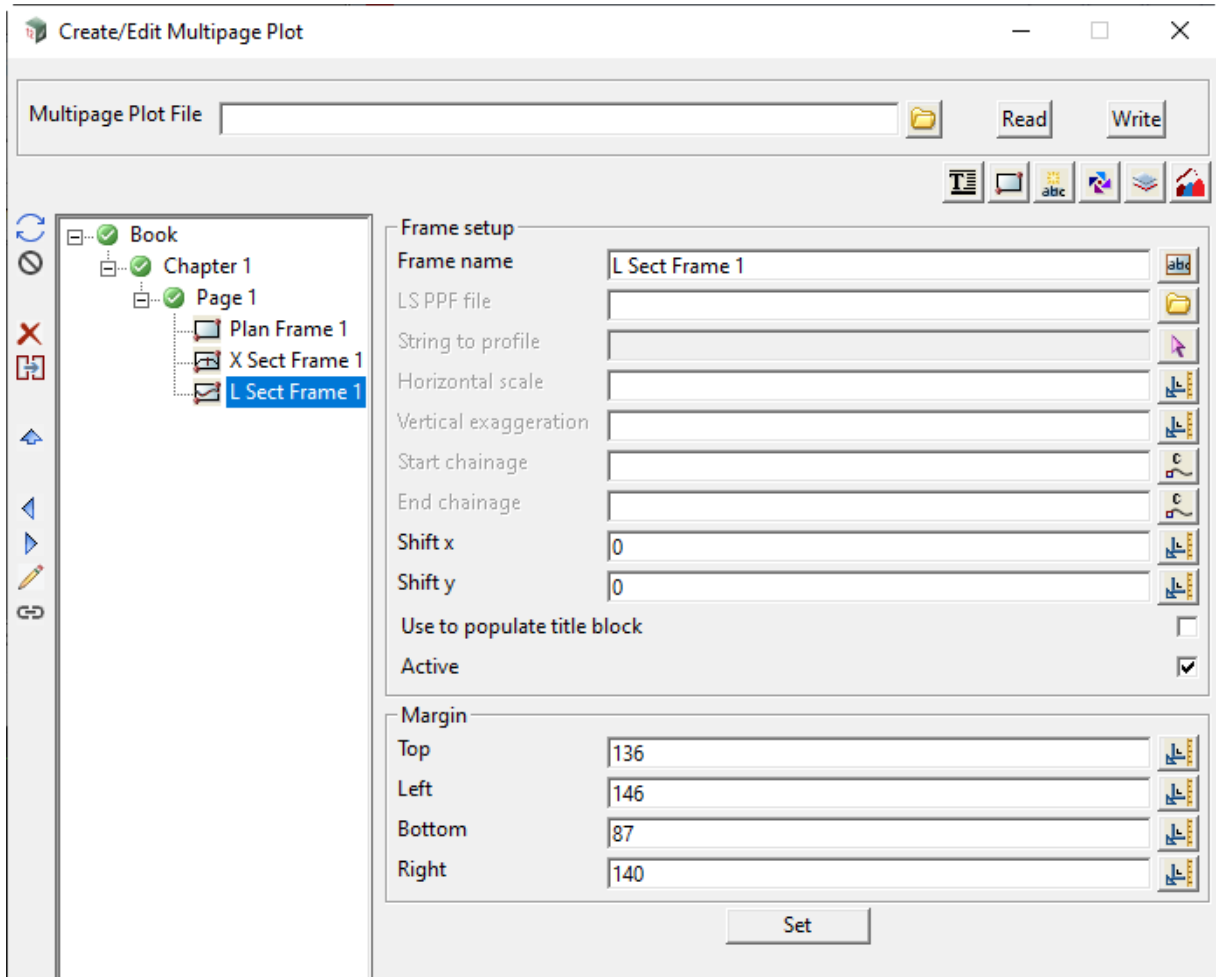
The margins give the size of the Frame in the Plot Area. See [Margins in 20.1.4.7.5 Common Information About Frames](#).

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.



### 20.1.4.7.8 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

<b>Frame Name</b>	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.*

<b>LS PPF file</b>	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.*

<b>String to profile</b>	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. ie. 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 result in the field being **un-ticked** on the first Frame Node of that Page.

For more information, see [20.1.4.6.3 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

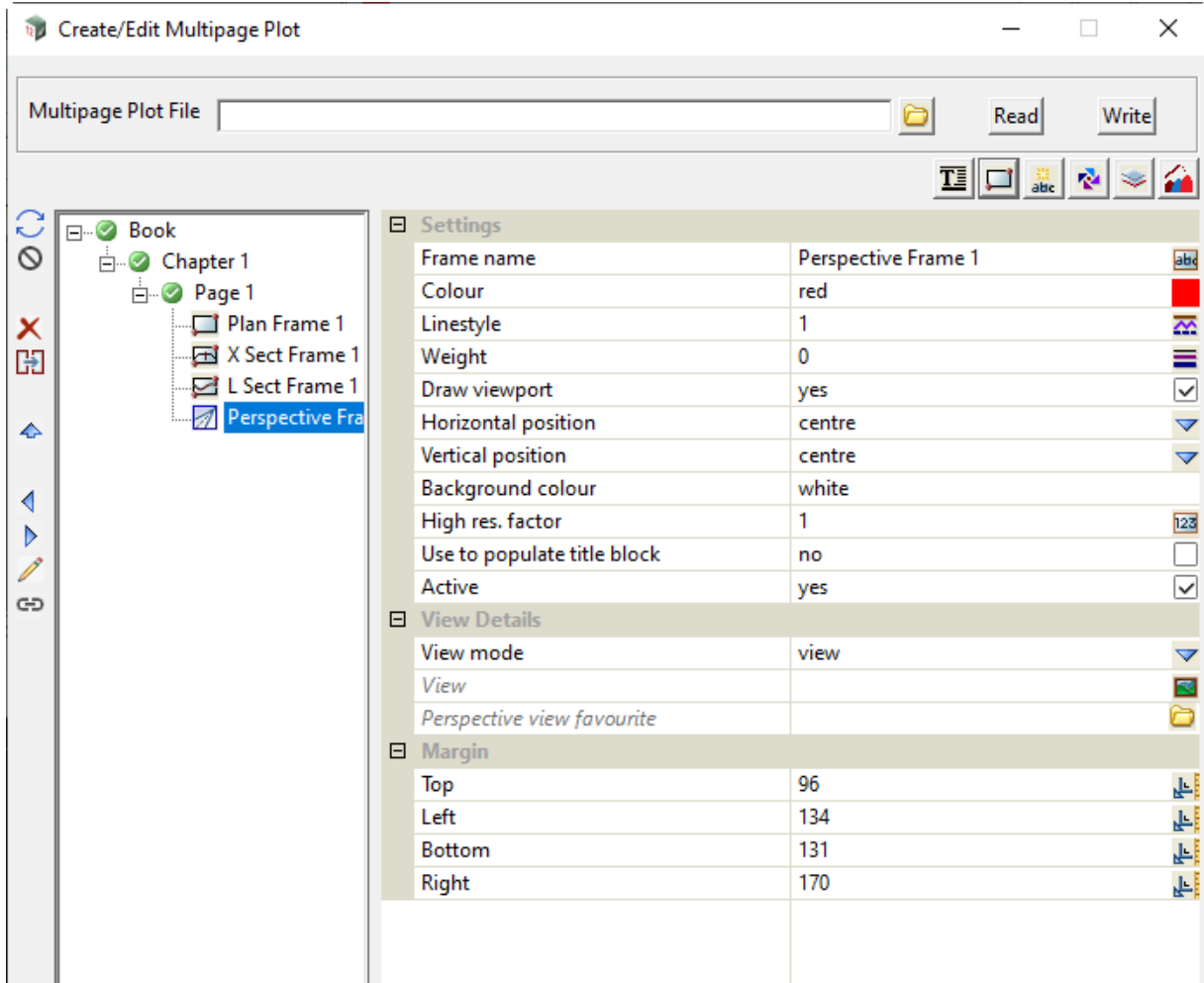
The margins give the size of the Frame in the Plot Area. See [Margins](#) in [20.1.4.7.5 Common Information About Frames](#).

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.

### 20.1.4.7.9 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 Frame** fields have inheritance support.*

*For more information on **Inherited Fields** see, [20.1.4.5 Inherited Fields \\*](#).*

**Frame Setup**

<b>Frame name</b>	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. ie. 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 [20.1.4.6.3 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*.

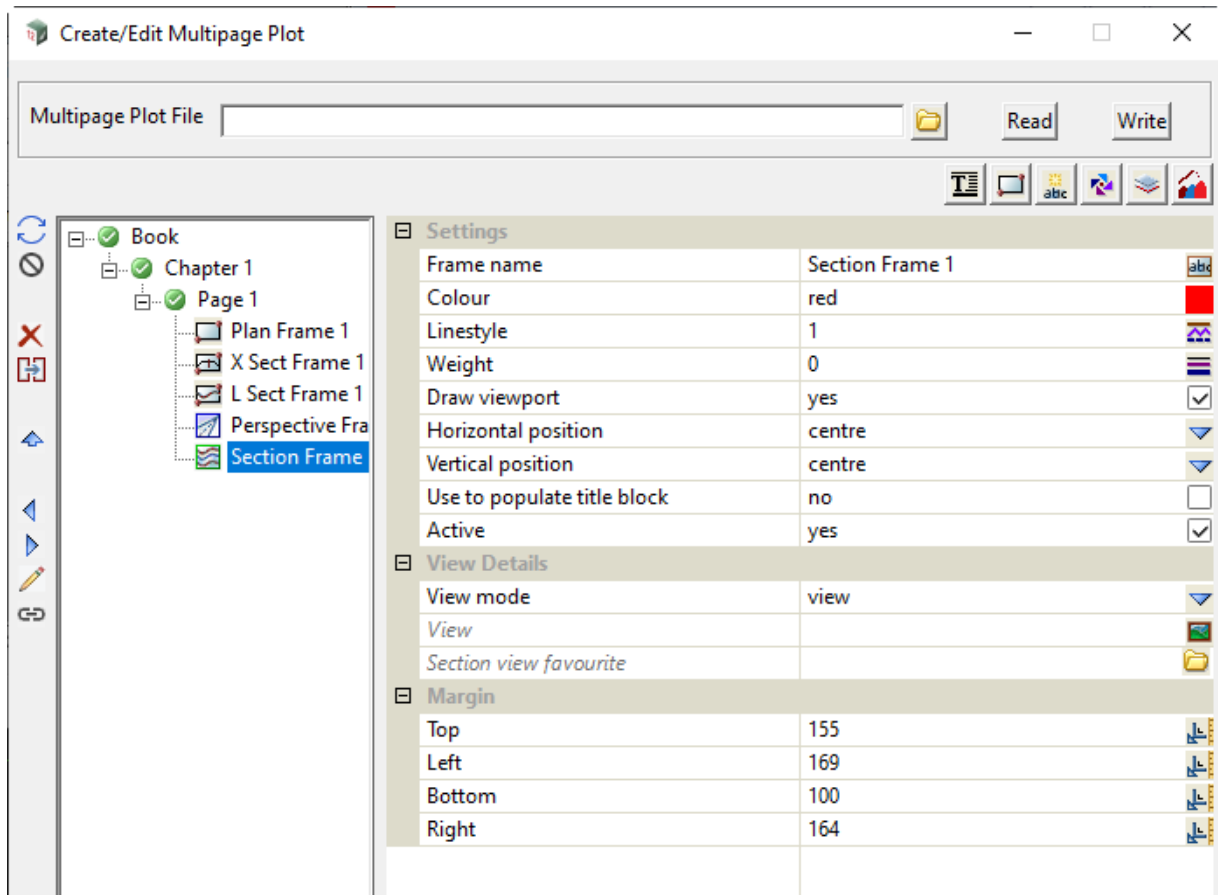
## Margins

The margins give the size of the *Frame* in the *Plot Area*. See [Margins](#) in [20.1.4.7.5 Common Information About Frames](#).



### 20.1.4.7.10 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
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#### 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, [20.1.4.5 Inherited Fields \\*](#).*

#### Frame Setup

<b>Frame name</b>	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.*

<b>Colour*</b>	colour box	red	available colours
----------------	------------	-----	-------------------

*Colour for the border of the Section Frame that is drawn when **Draw viewport** is ticked.*

<b>Linstyle*</b>	linestyle box	1	available linestyles
------------------	---------------	---	----------------------

*Linstyle 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. ie. 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 [20.1.4.6.3 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

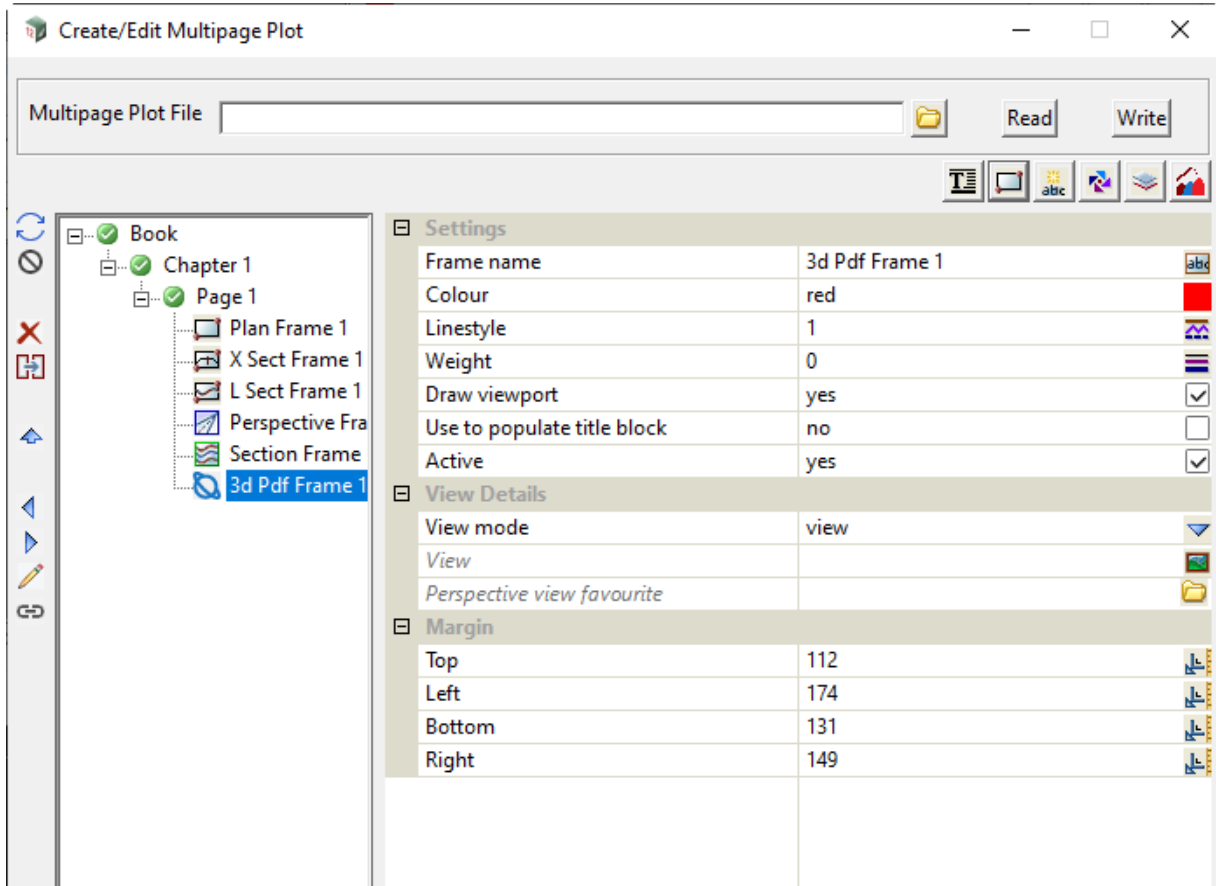
*Section view favourite that is used to define all the information that will be displayed in the plot of the Section Frame.*

## **Margins**

*The margins give the size of the Frame in the Plot Area. See [Margins](#) in [20.1.4.7.5 Common Information About Frames](#).*

### 20.1.4.7.11 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, [20.1.4.5 Inherited Fields \\*](#).*

#### Frame Setup

<b>Frame name</b>	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.*

<b>Colour*</b>	colour box	red	available colours
----------------	------------	-----	-------------------

*Colour for the border of the 3d Pdf that is drawn when **Draw viewport** is **ticked**.*

<b>Linestyle*</b>	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. ie. 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 result in the field being **un-ticked** on the first Frame Node of that Page.

For more information, see [20.1.4.6.3 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

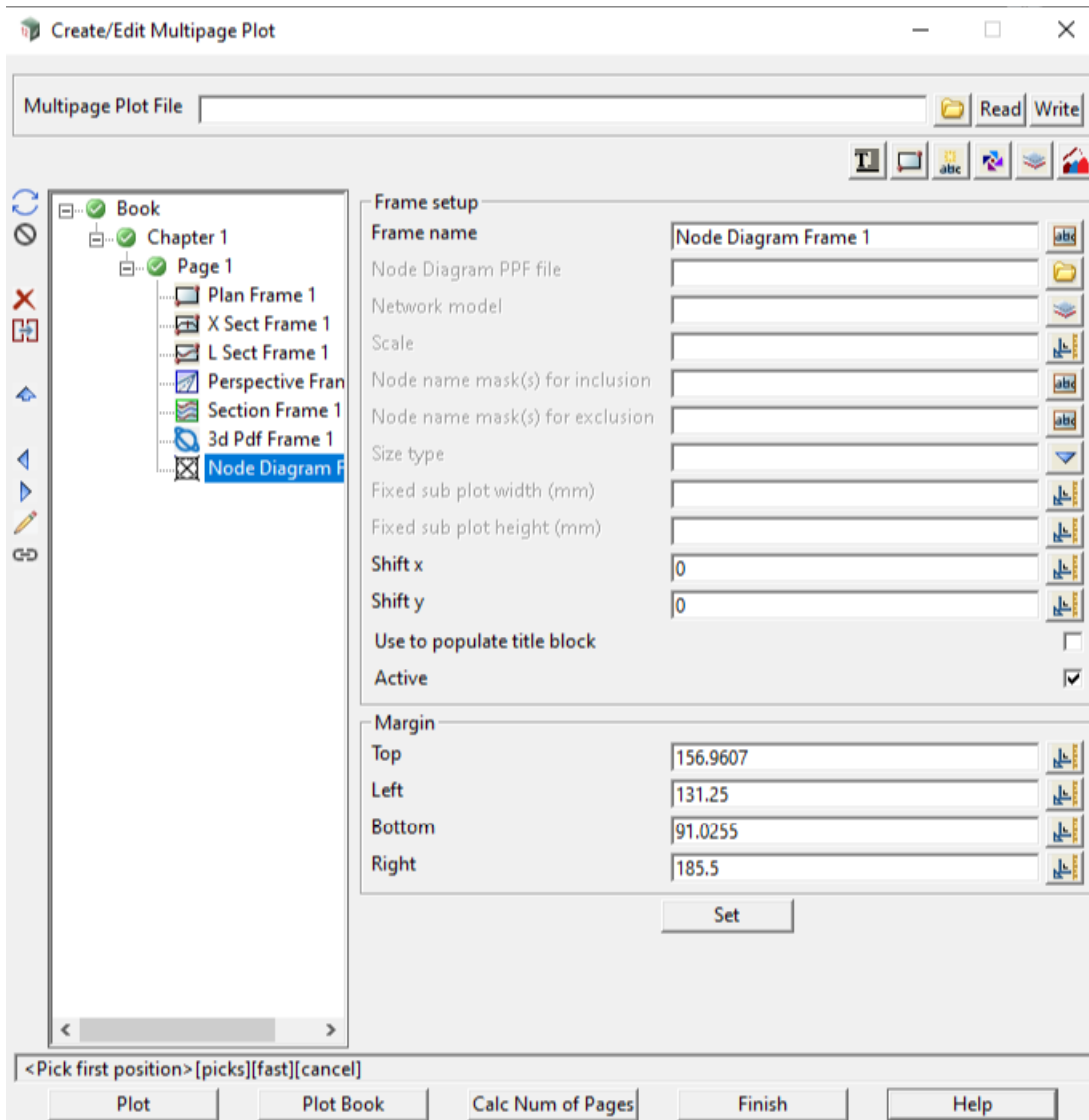
Perspective view favourite that is used to define all the information that will be displayed in the plot of the Pdf 3d Frame.

## Margins

The margins give the size of the Frame in the Plot Area. See [Margins in 20.1.4.7.5 Common Information About Frames](#).

### 20.1.4.7.12 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

<b>Frame name</b>	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.*

<b>Node diagram PPF file</b>	node diagram ppf box		available node diagram ppfs
------------------------------	----------------------	--	-----------------------------

*Selected PPF file that contains all the information for drawing a node diagram plot.*

<b>Network model</b>	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 [26.7.2.1 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 [26.7.2.1 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. ie. 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 result in the field being **un-ticked** on the first Frame Node of that Page.

For more information, see [20.1.4.6.3 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.*

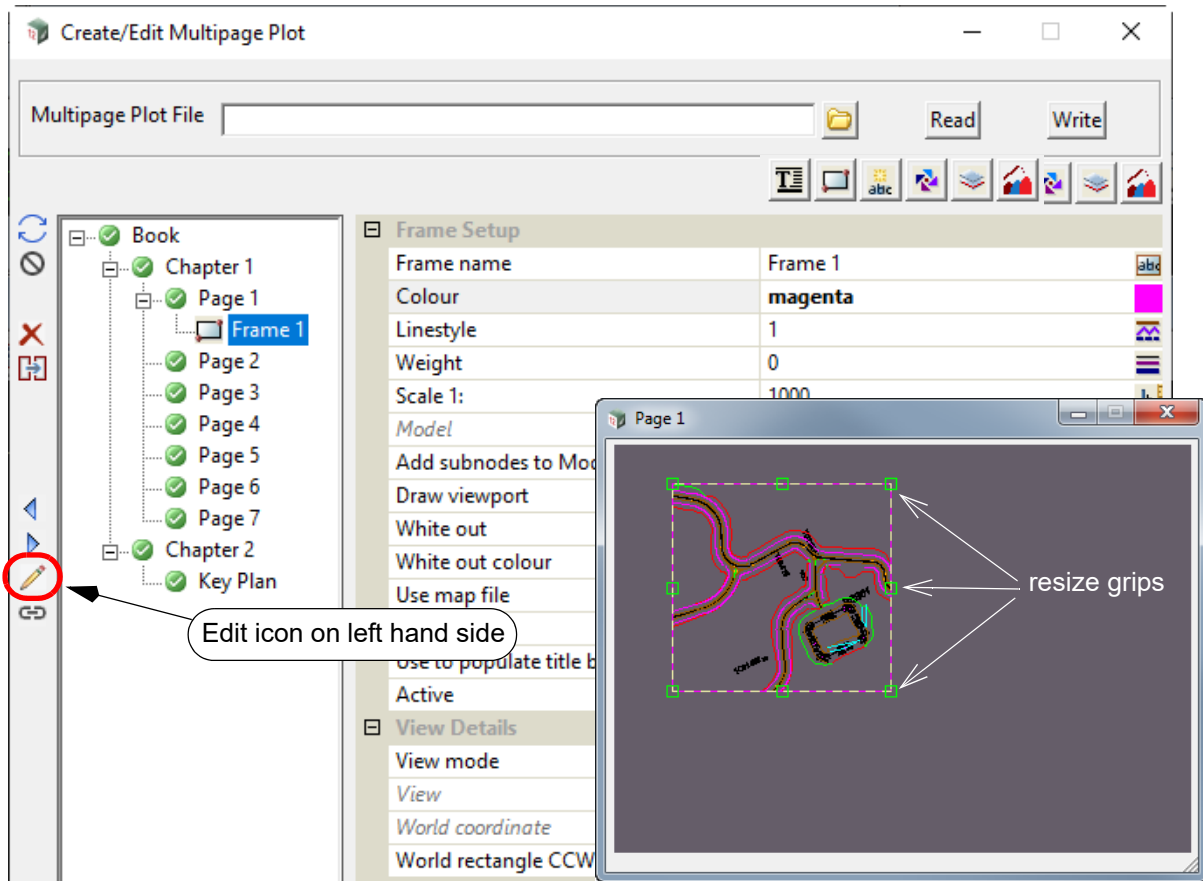
## **Margins**

*The margins give the size of the Frame in the Plot Area. See [Margins](#) in [20.1.4.7.5 Common Information About Frames](#).*

### 20.1.4.7.13 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 hand side **Edit** icon.

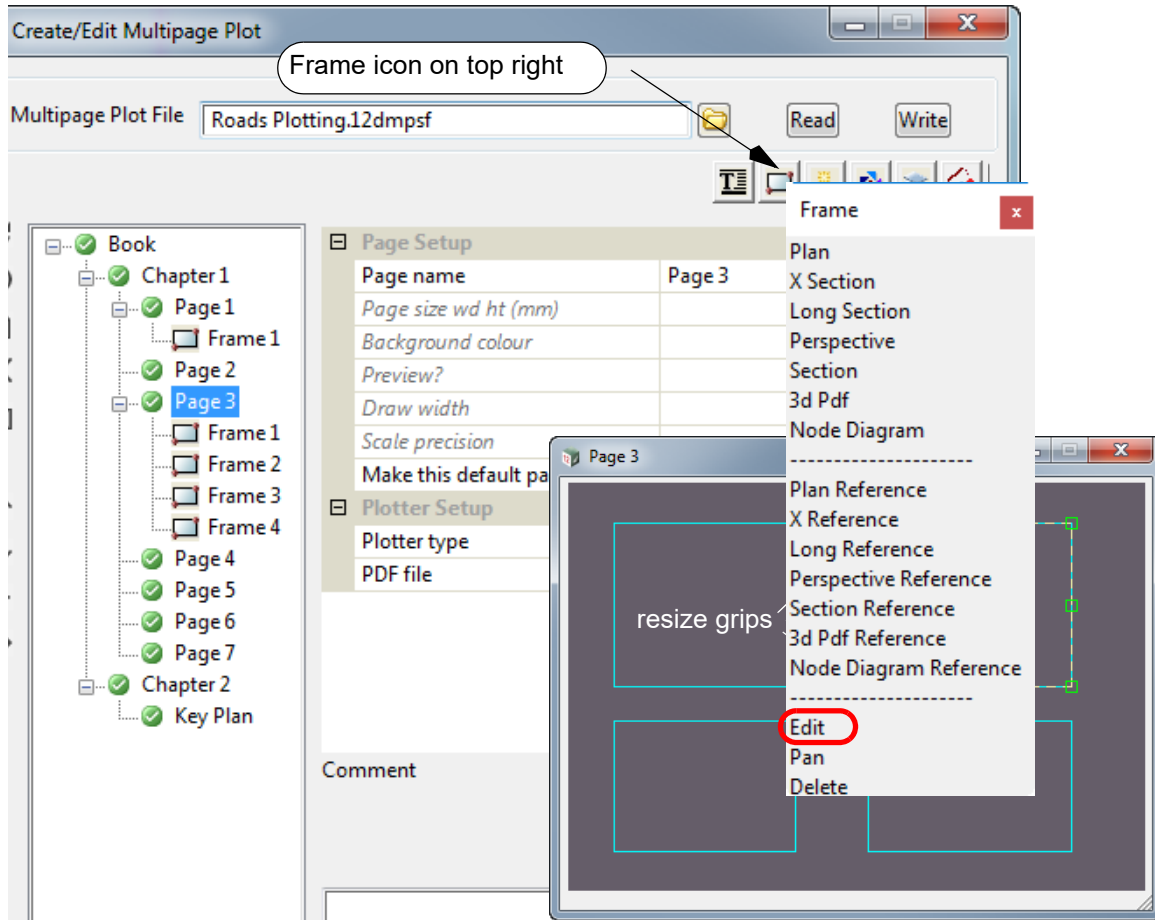


The frame is then highlighted in the Plot Area and resize grips displayed.

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.

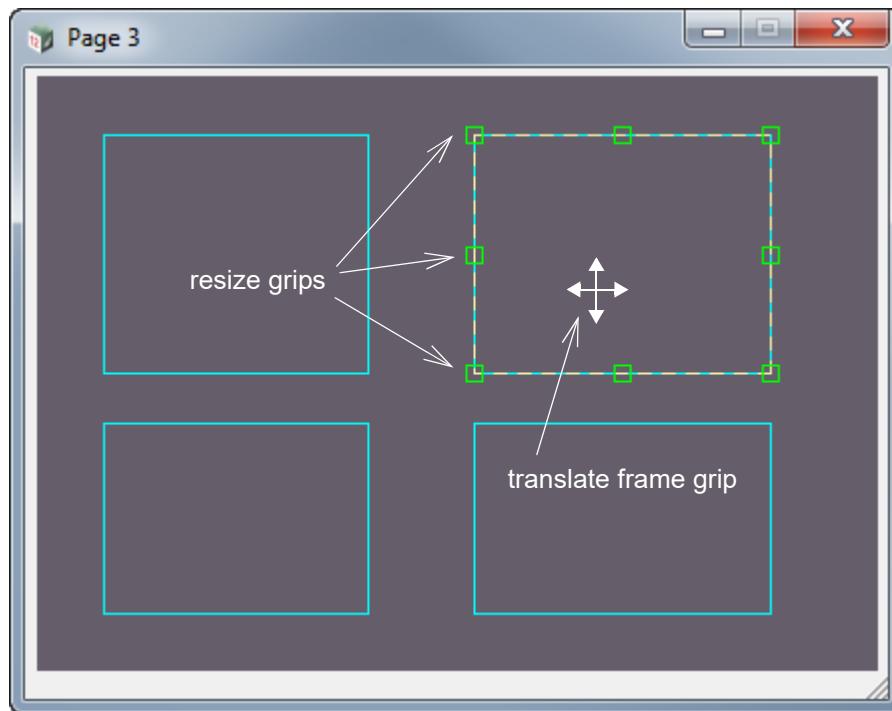
The Frame to Edit is then selected from the Plot Area by clicking LB **anywhere inside** the Frame **but don't accept it with MB**.



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.

### 20.1.4.7.14 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.

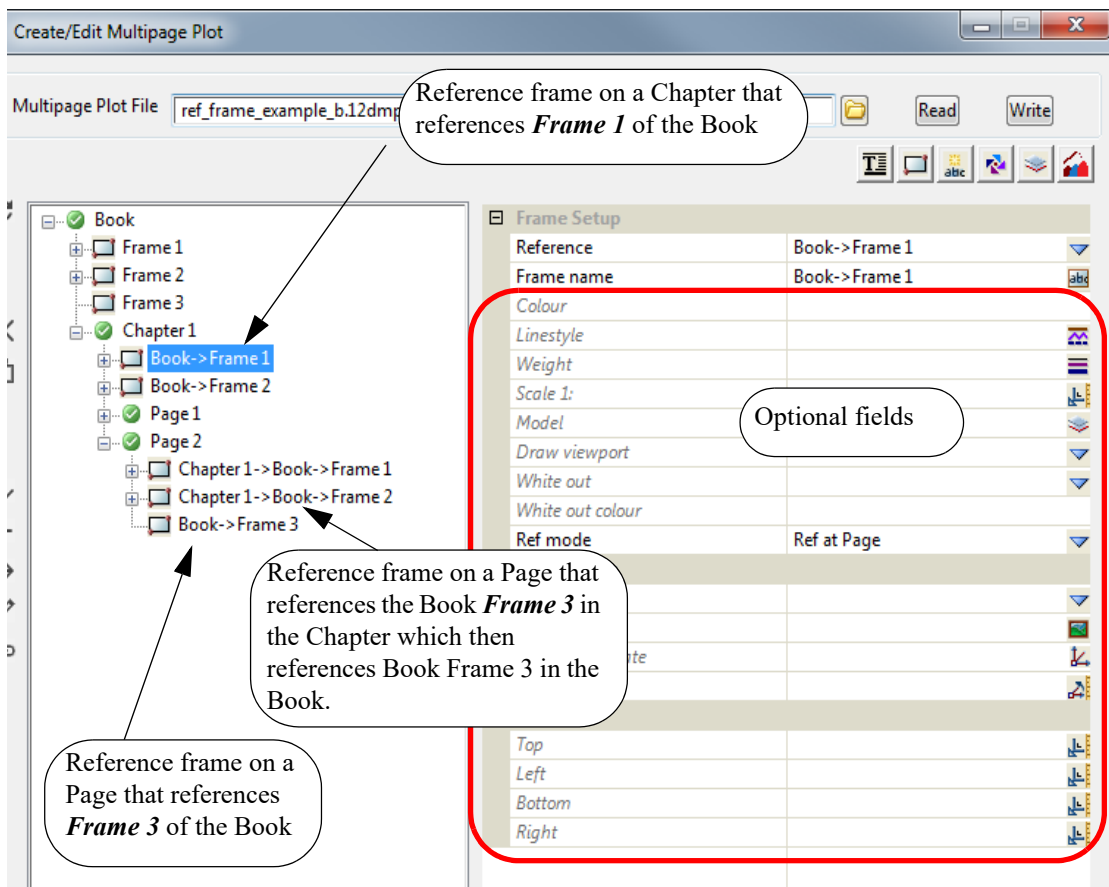
This has been documented in [20.1.4.7.2.2 Reference Frames for a Chapter](#) and [20.1.4.7.3.2 Reference Frames for a Page](#).

- (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 [20.1.4.7.1.1 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 [20.1.4.7.2.1 Frames for a Chapter](#).



The fields used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Reference</b>	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**

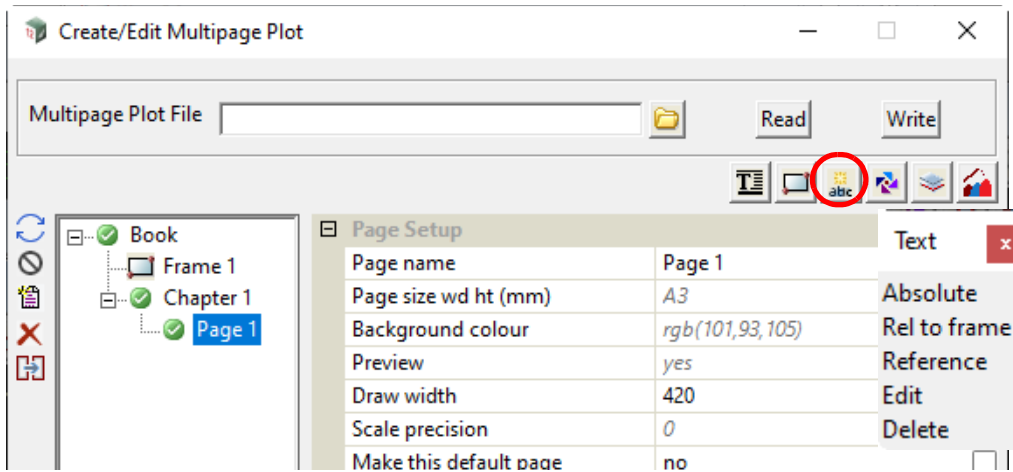
*the rest of the fields in the panel are optional and if blank, the values are taken from the referenced Frame.*

See [20.1.5 Example Using Reference Frames](#).



### 20.1.4.8 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 [20.1.4.8.1 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.

See [20.1.4.8.2.1 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**.

See [20.1.4.8.2 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 [20.1.4.8.1 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.

See [20.1.4.8.2.1 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**.

See [20.1.4.8.2 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 [20.1.4.8.1 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.

See [20.1.4.8.2.1 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**.

See [20.1.4.8.2 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 [20.1.4.8.3 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**.

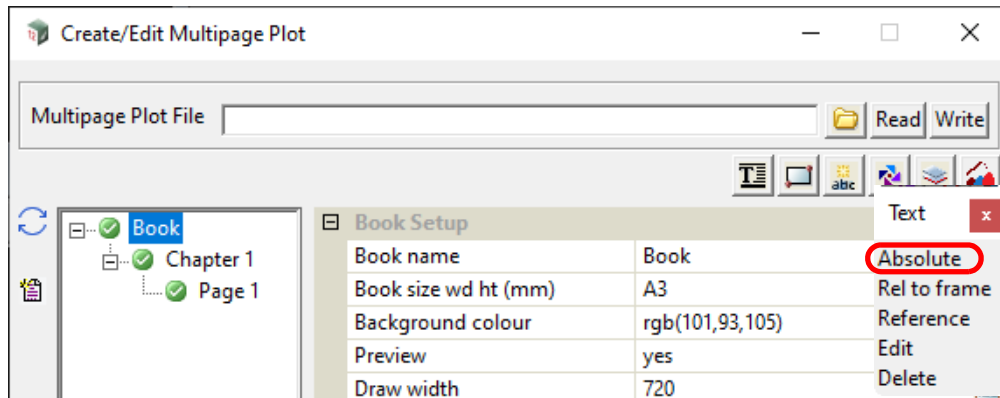
For a **Chapter**, the names of the **Chapter Text nodes** and the **Chapter Frame Text nodes** for that **Chapter** must be unique amongst all the **Chapter Text nodes** AND the **Chapter Frame Text nodes** for that **Chapter**.

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**.

### 20.1.4.8.1 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

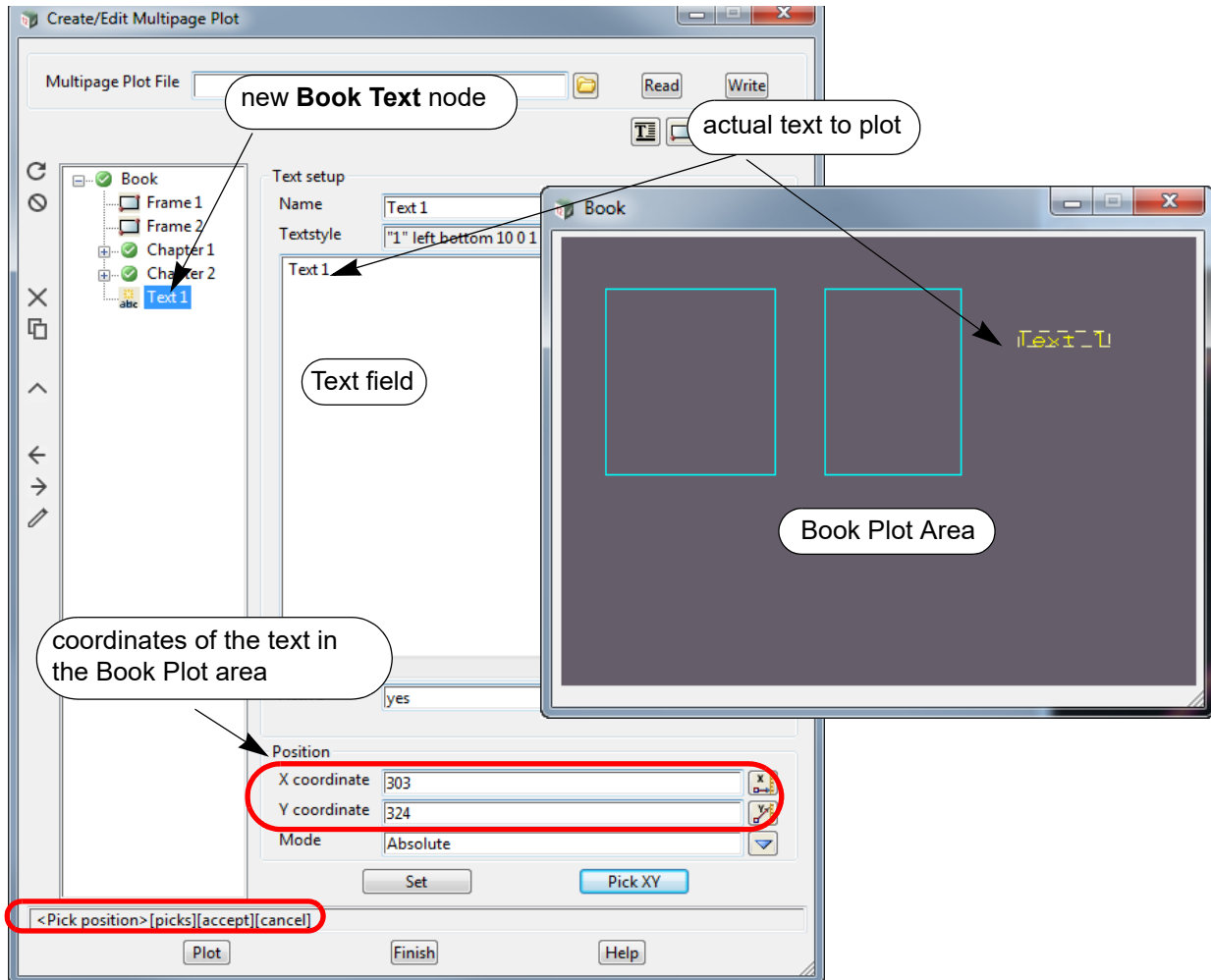


A position in the **Book Plot Area** for the text is then selected.

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 [20.1.4.8.4 Icons and Fields for Text and Frame Text Nodes](#).

### 20.1.4.8.2 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 [20.1.4.8.2.1 Creating Frame Text by Highlighting the Frame Node](#).

2. Picking a **Frame** from the **Plot Area**.

See [20.1.4.8.2.2 Creating Frame Text by Picking a Frame from the Plot Area](#).



### 20.1.4.8.2.1 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 replaced by **Chapter** or **Page**.

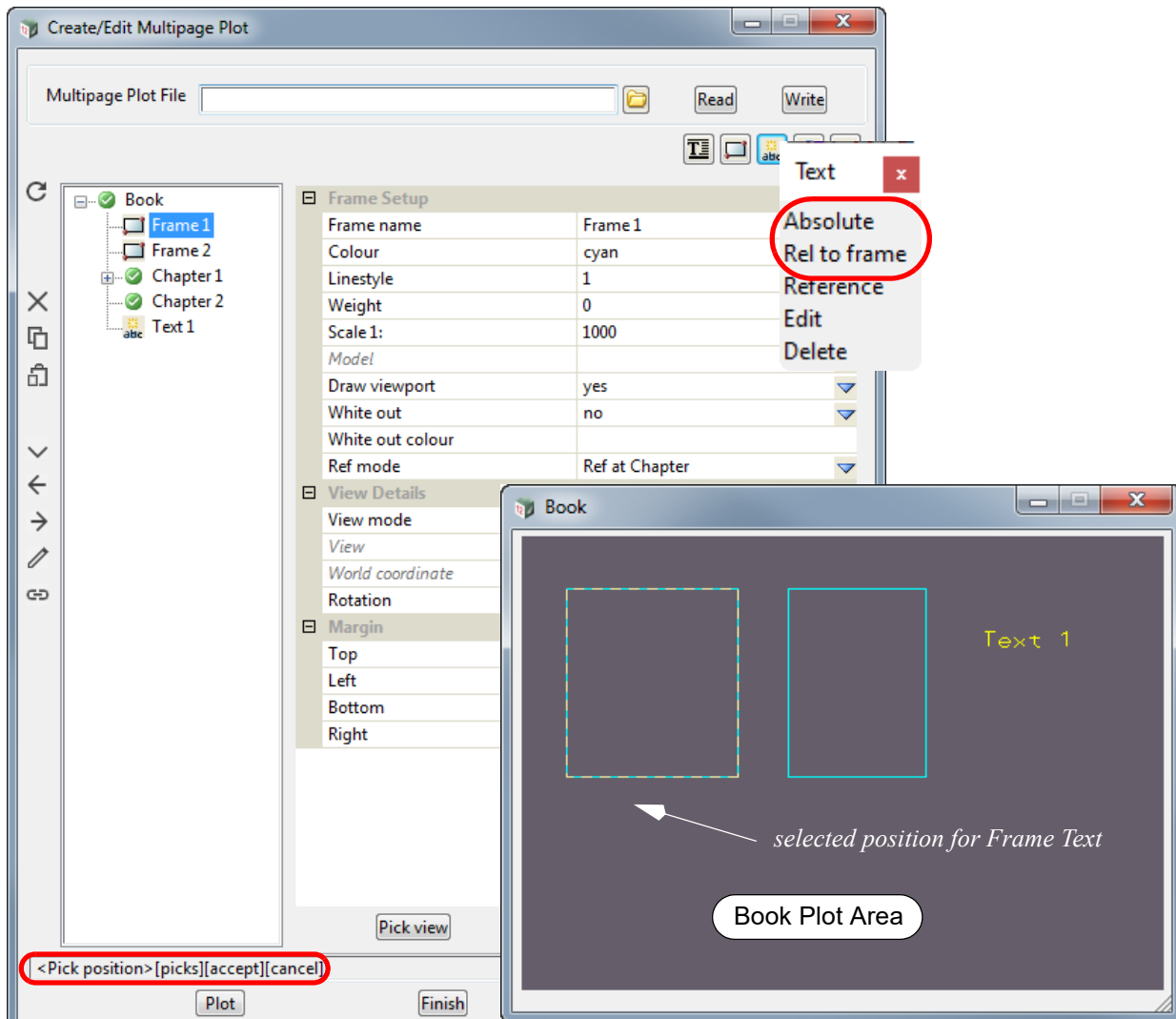
To create **Frame Text** using the **Frame node**, click on and highlight the **Book Frame node**, **Chapter Frame node** or **Page Frame node** to add **Frame Text** to.

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 **Frame Text** is selected in the **Plot Area**.

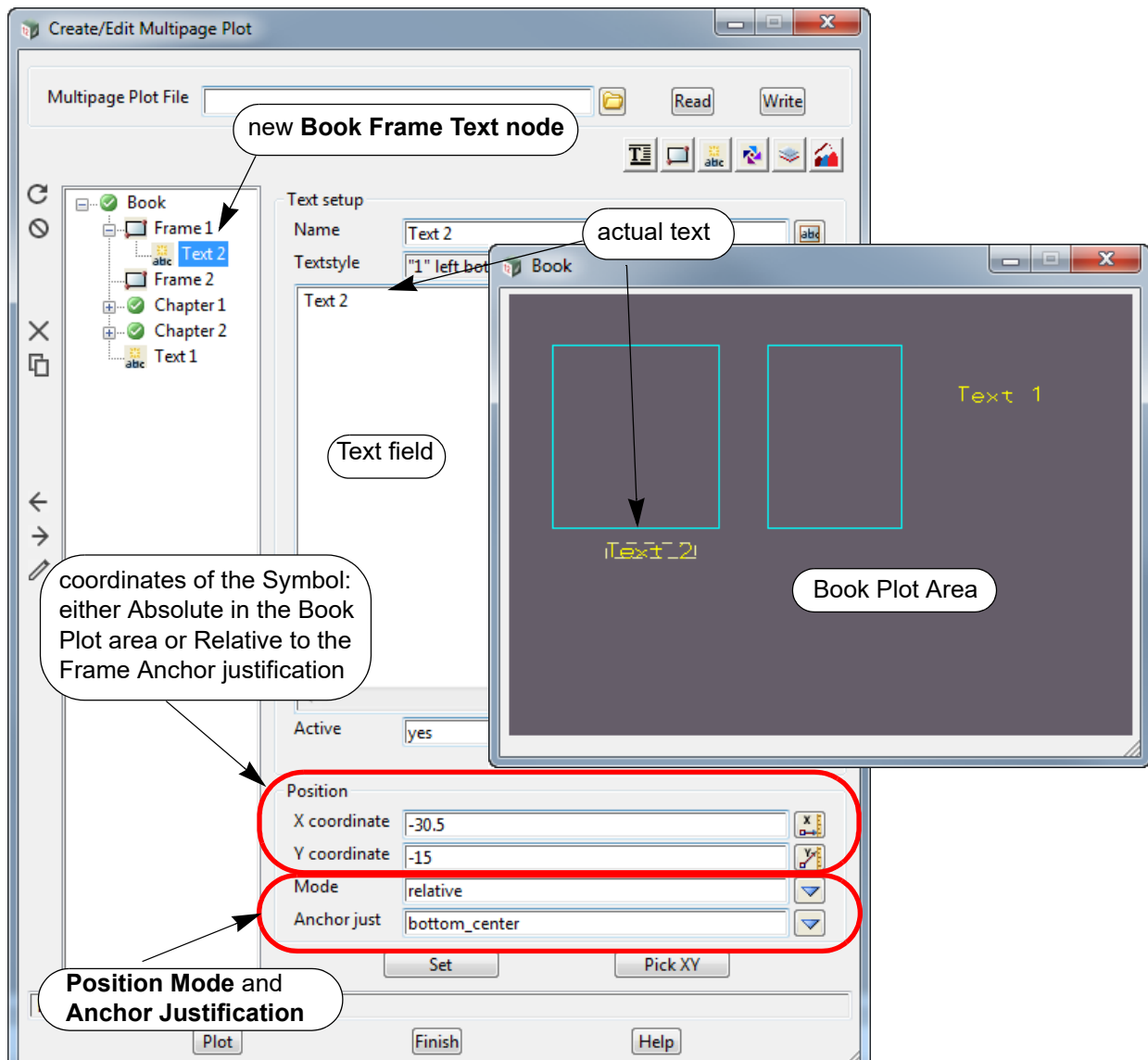


Once the text position is selected, a **Book Frame Text node** is automatically added at the bottom of the **Book Frame** with the default name **Text n** where **n** is the next integer that makes the **Book Frame Text node** name unique amongst all the **Book Text nodes** AND the **Book Frame Text 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 [20.1.4.8.4 Icons and Fields for Text and Frame Text Nodes](#).

### 20.1.4.8.2.2 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**.

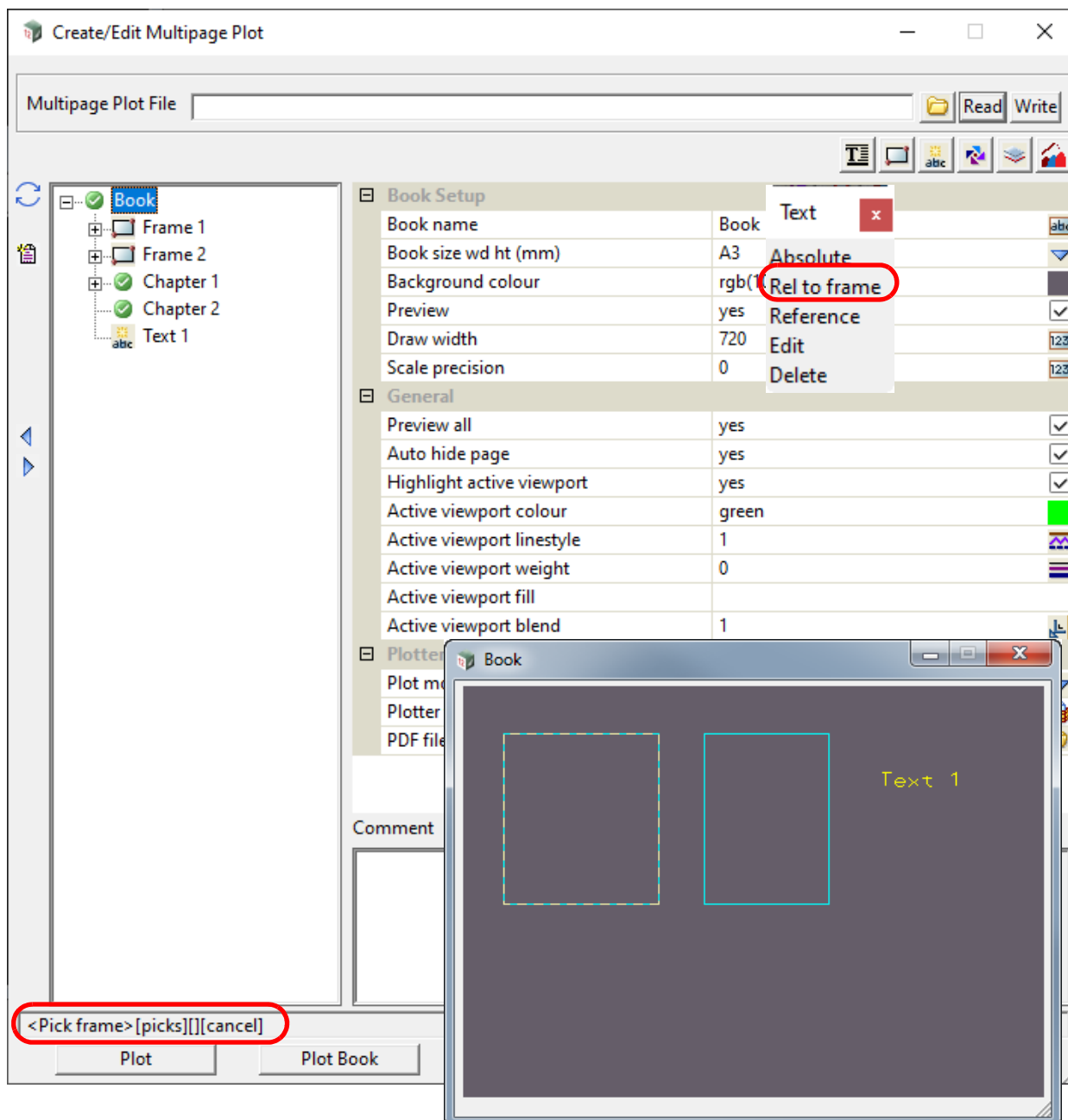
The process is similar to that for **Book**, **Chapter** or **Page Text** except **Rel to frame** must be selected from the **Text** menu.

(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.

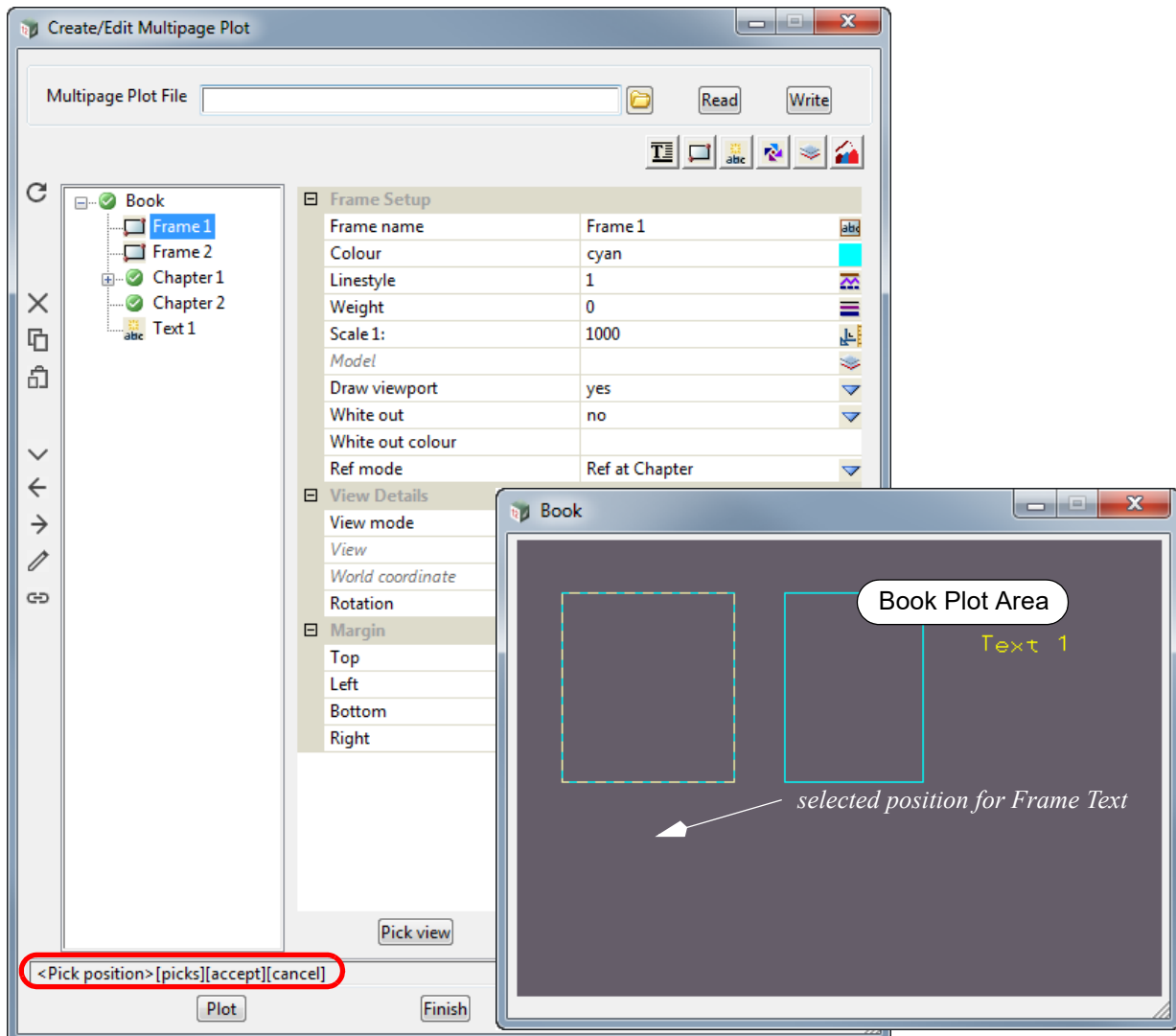
The user is then asked to pick a **Frame** from the **Plot Area**.



When the **Frame** is **selected**, the **Frame** is highlighted in the **Plot Area** and the **Frame node**

highlighted in the tree.

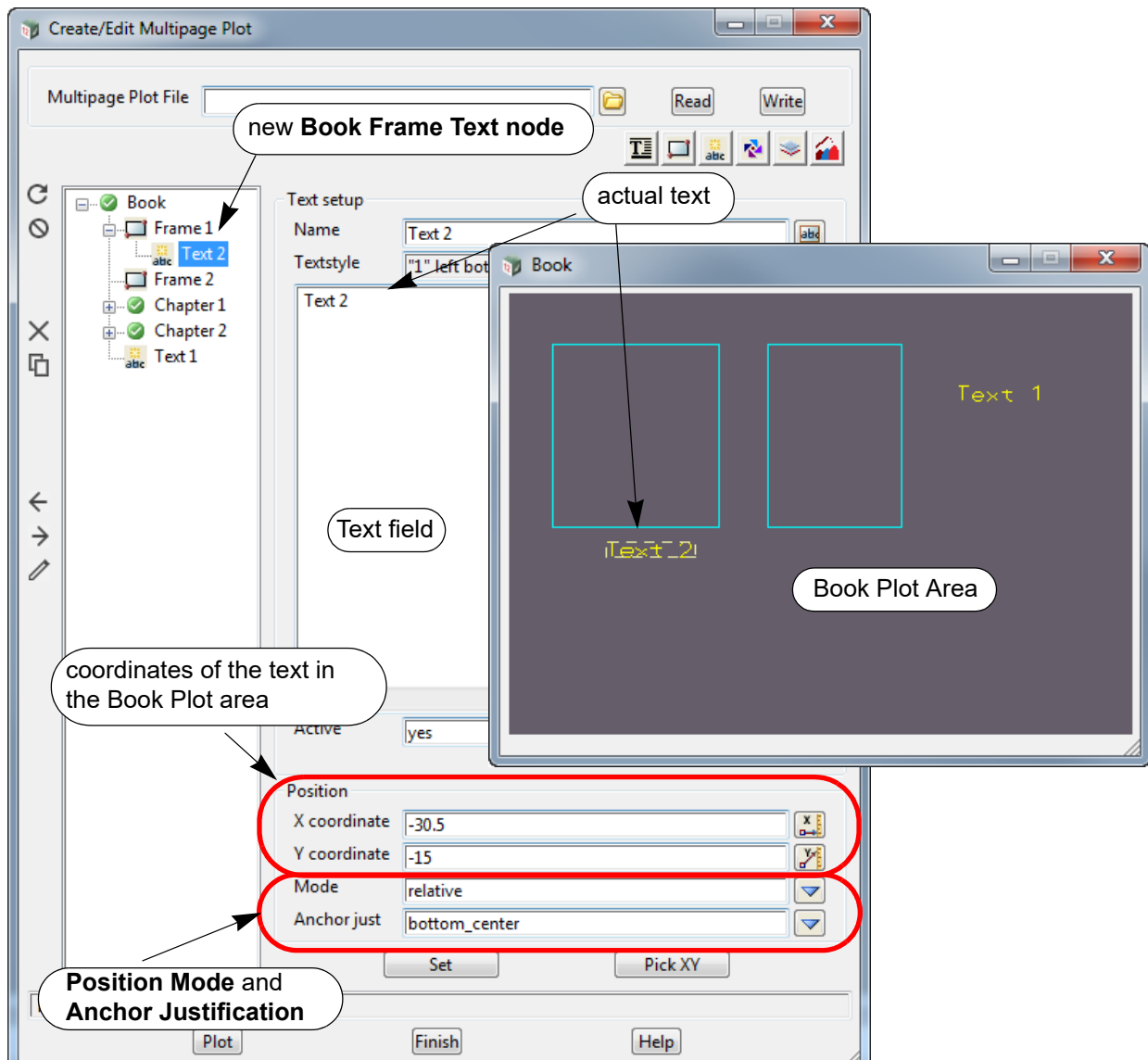
The position for the **Fame Text** is then selected in the **Plot Area**.



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 [20.1.4.8.4 Icons and Fields for Text and Frame Text Nodes](#).



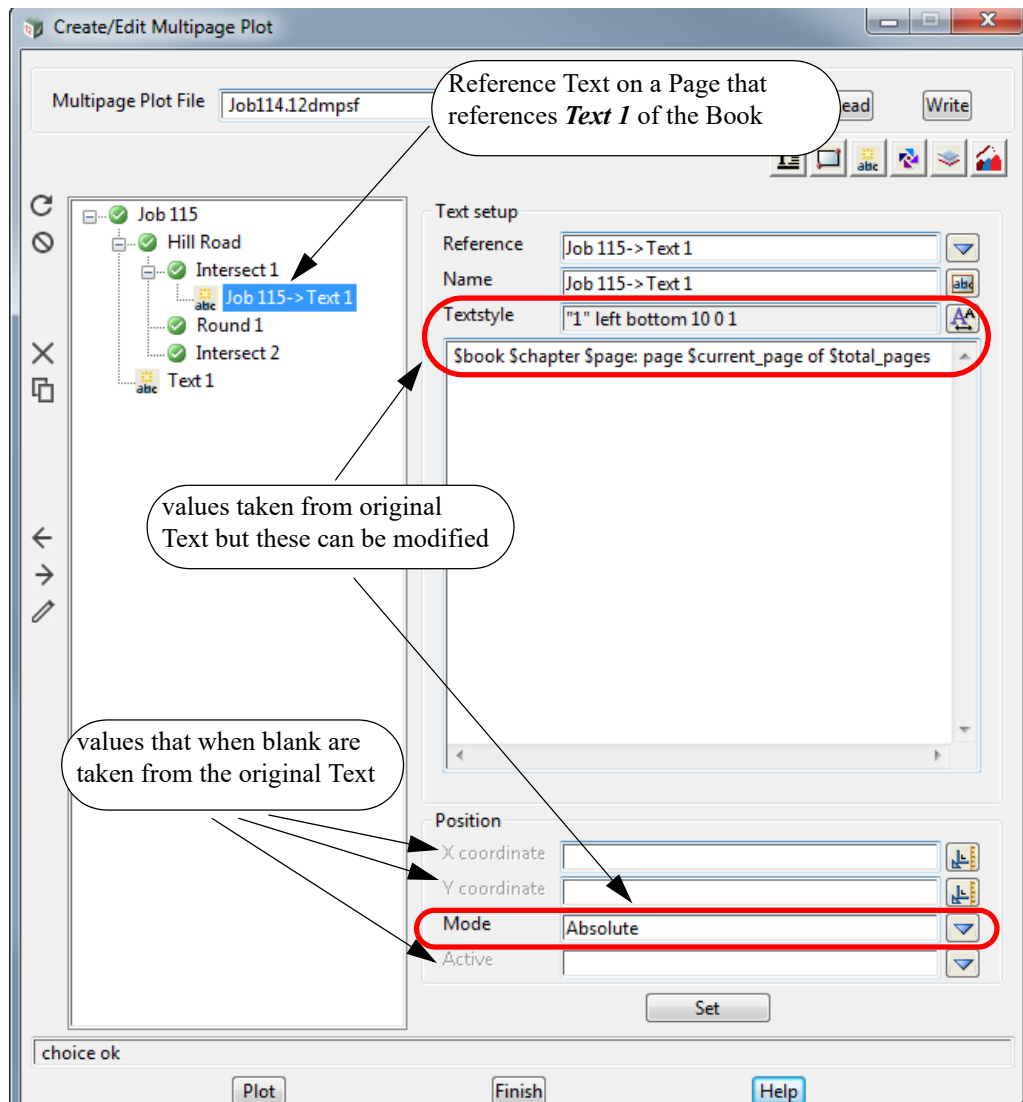
### 20.1.4.8.3 Reference Text

**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**.



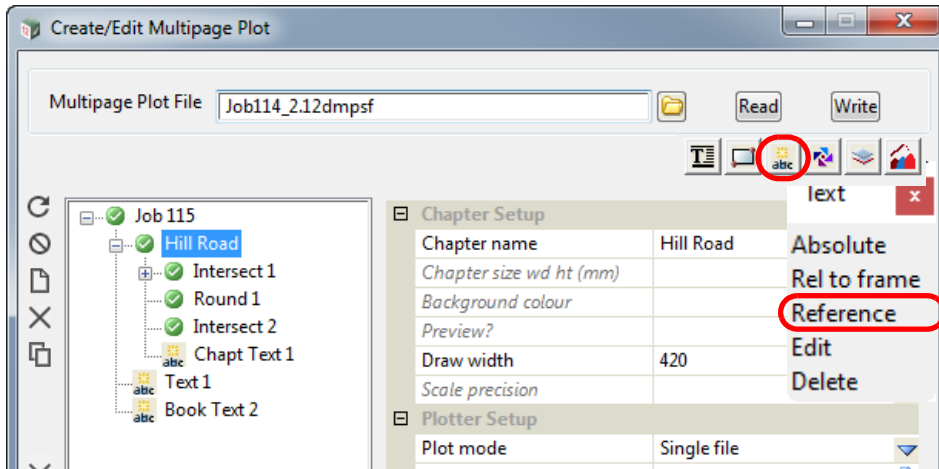
**Reference Text** can be created in six ways:

- Chapter Reference Text.** See [20.1.4.8.3.1 Creating Chapter Reference Text](#)
- Chapter Frame Reference Text** See [20.1.4.8.3.2 Creating Chapter Frame Reference Text.](#)

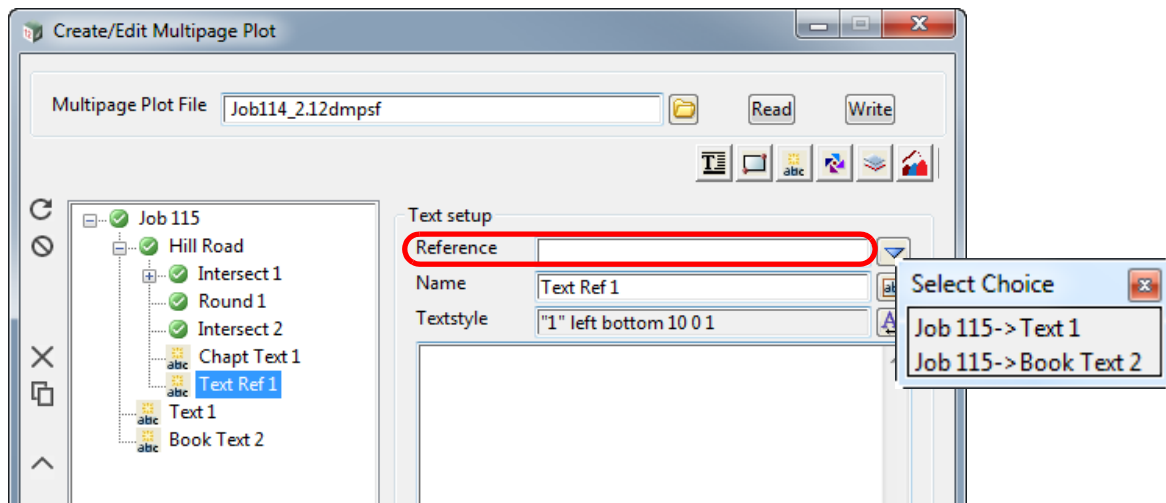
- (c) **Chapter Reference Frame Reference Text** See [20.1.4.8.3.3 Creating Chapter Reference Frame Reference Text](#).
- (d) **Page Reference Text**. See [20.1.4.8.3.4 Creating Page Reference Text](#).
- (e) **Page Frame Reference Text**. See [20.1.4.8.3.5 Creating Page Frame Reference Text](#).
- (f) **Page Reference Frame Reference Text**. See [20.1.4.8.3.6 Creating Page Reference Frame Reference Text](#).

### 20.1.4.8.3.1 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.

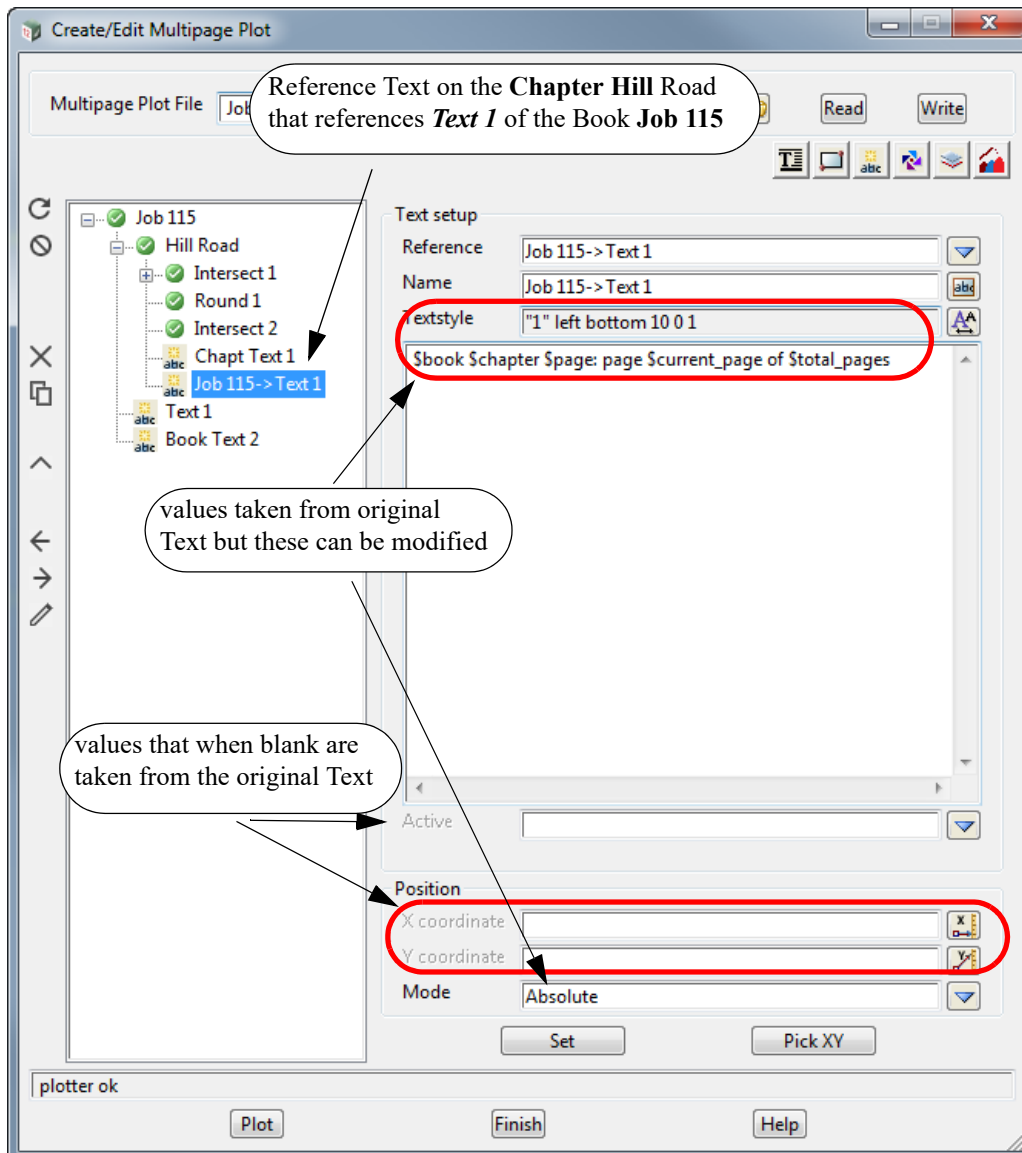


A new **Chapter Reference Text** is created but it has a blank **Reference** Field.



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

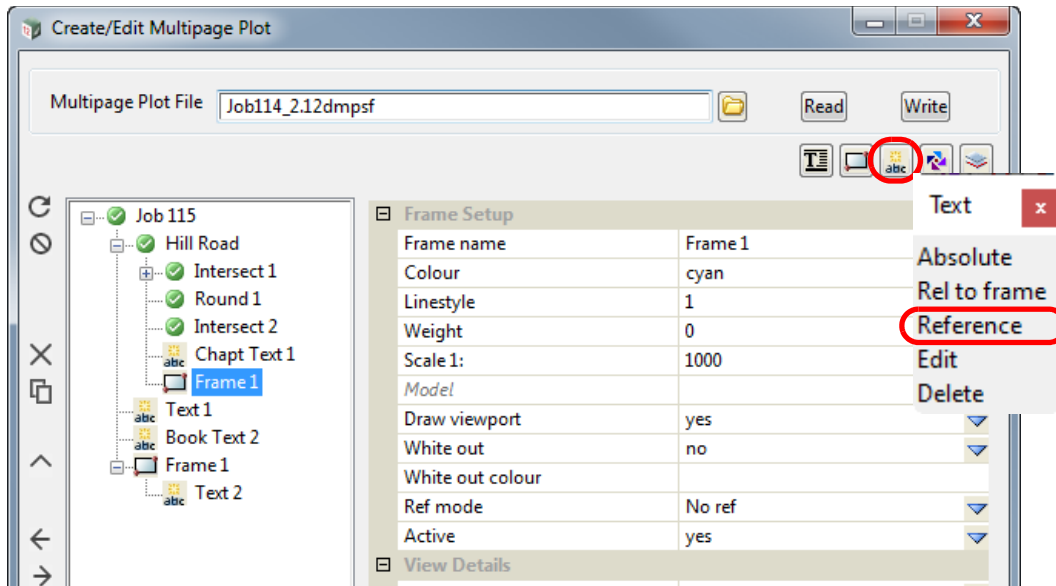
If you don't want to display **Book Text**, **Chapter Text** or **Chapter Reference Text** for a particular **Page**, then for that page, create a **Reference Text** that references the appropriate Book Text, Chapter Text or Chapter Reference Text, and set the **Active** field to **No**.

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**.

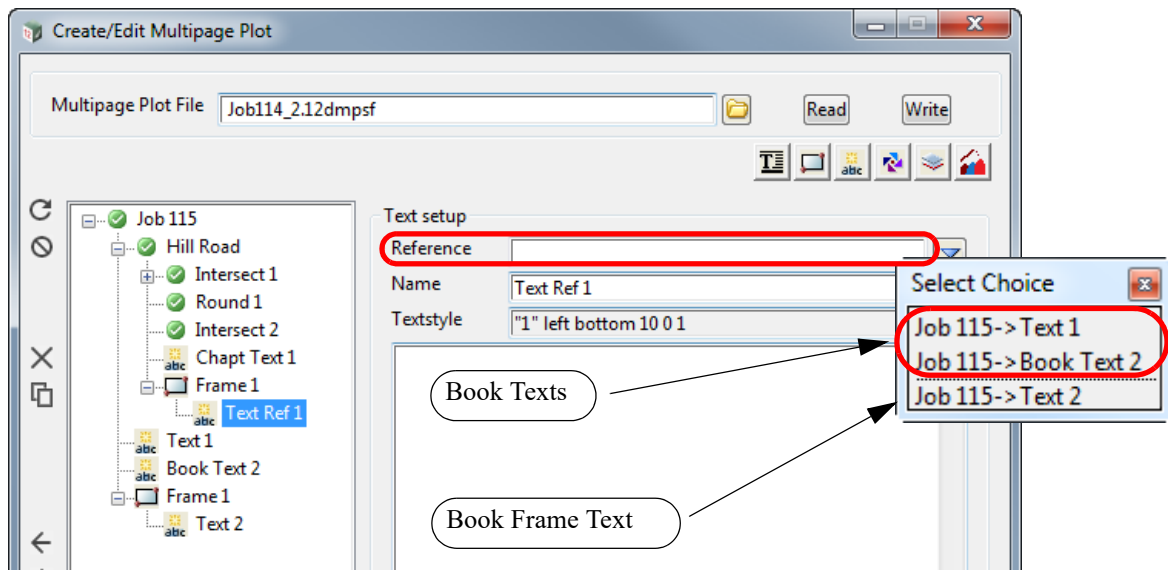
Similarly if a **Book Text** has been set to **Inactive** (i.e. OFF) then it can be displayed for a particular chapter by creating a **Chapter Reference Text** for that chapter and reference appropriate **Book Text**, and in the **Chapter Reference Text** fields, set the **Active** field to **Yes**.

### 20.1.4.8.3.2 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.



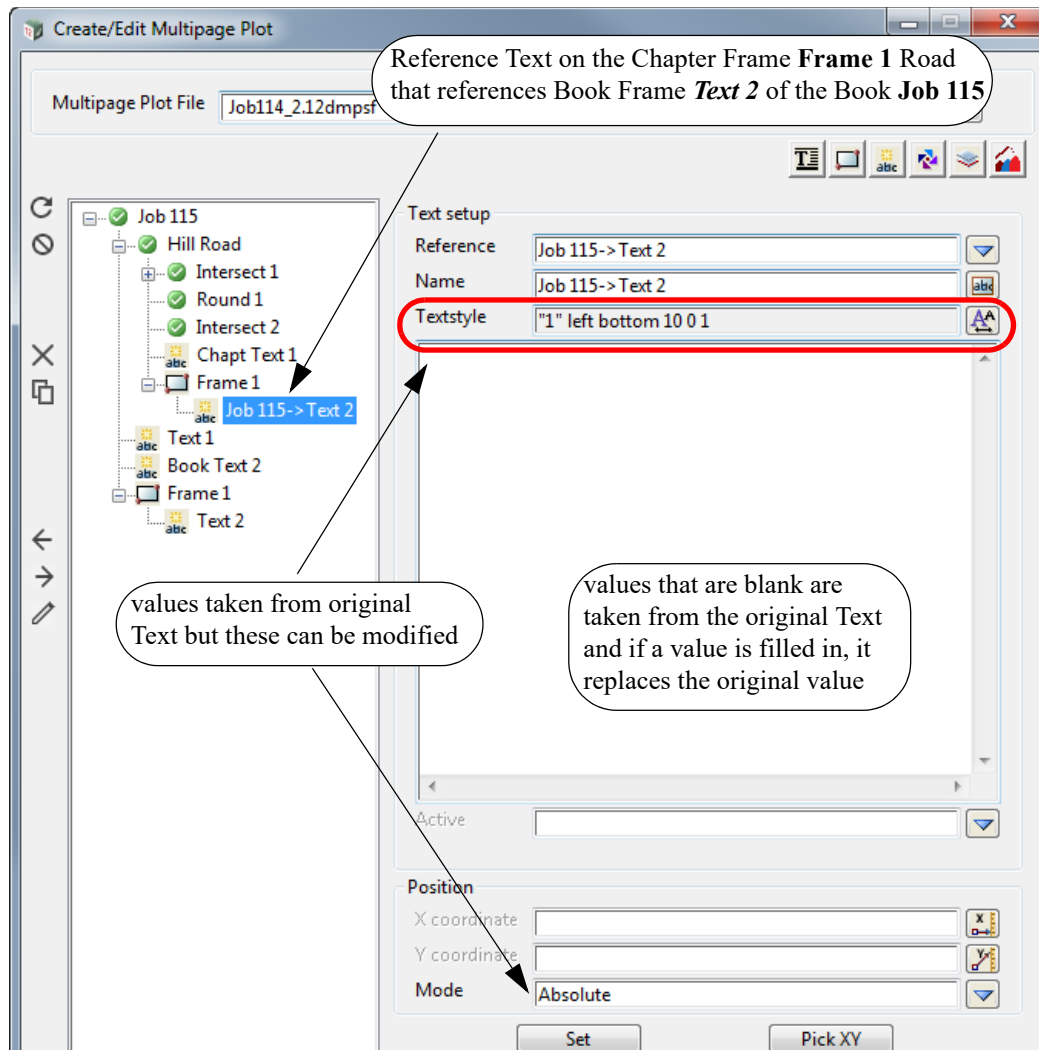
A new **Chapter Frame Reference Text** is created but it has a blank **Reference** Field.



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 **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**.

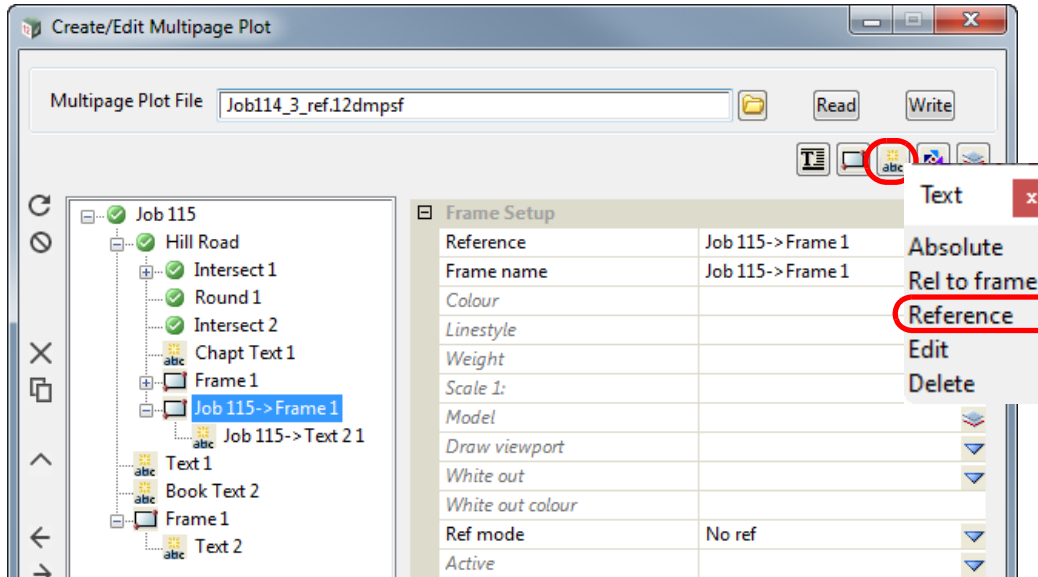


### 20.1.4.8.3.3 Creating Chapter Reference Frame Reference Text

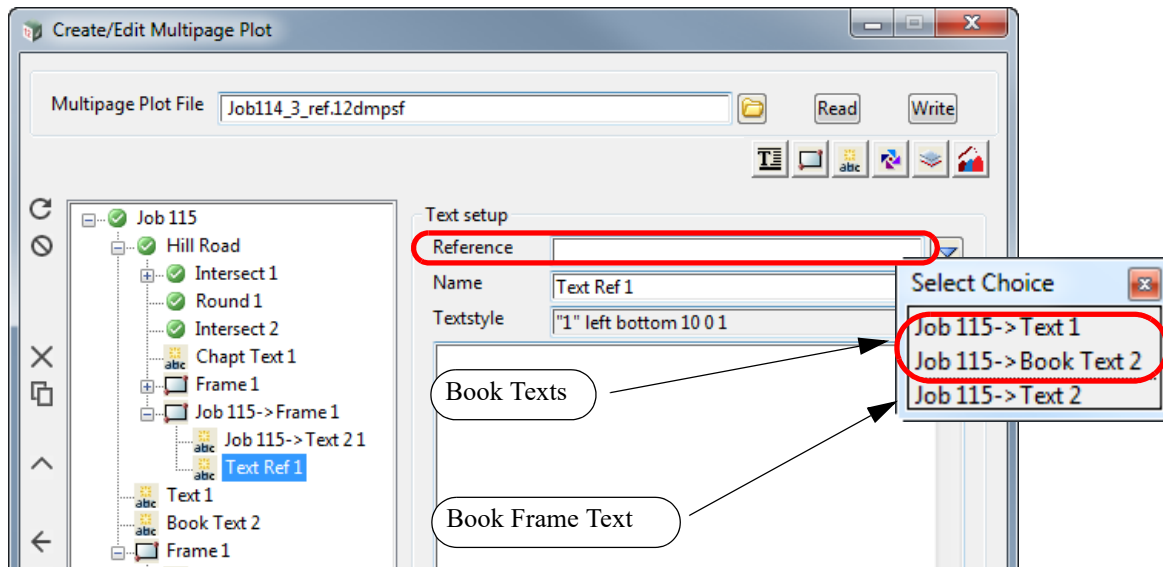
#### Important Note

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.

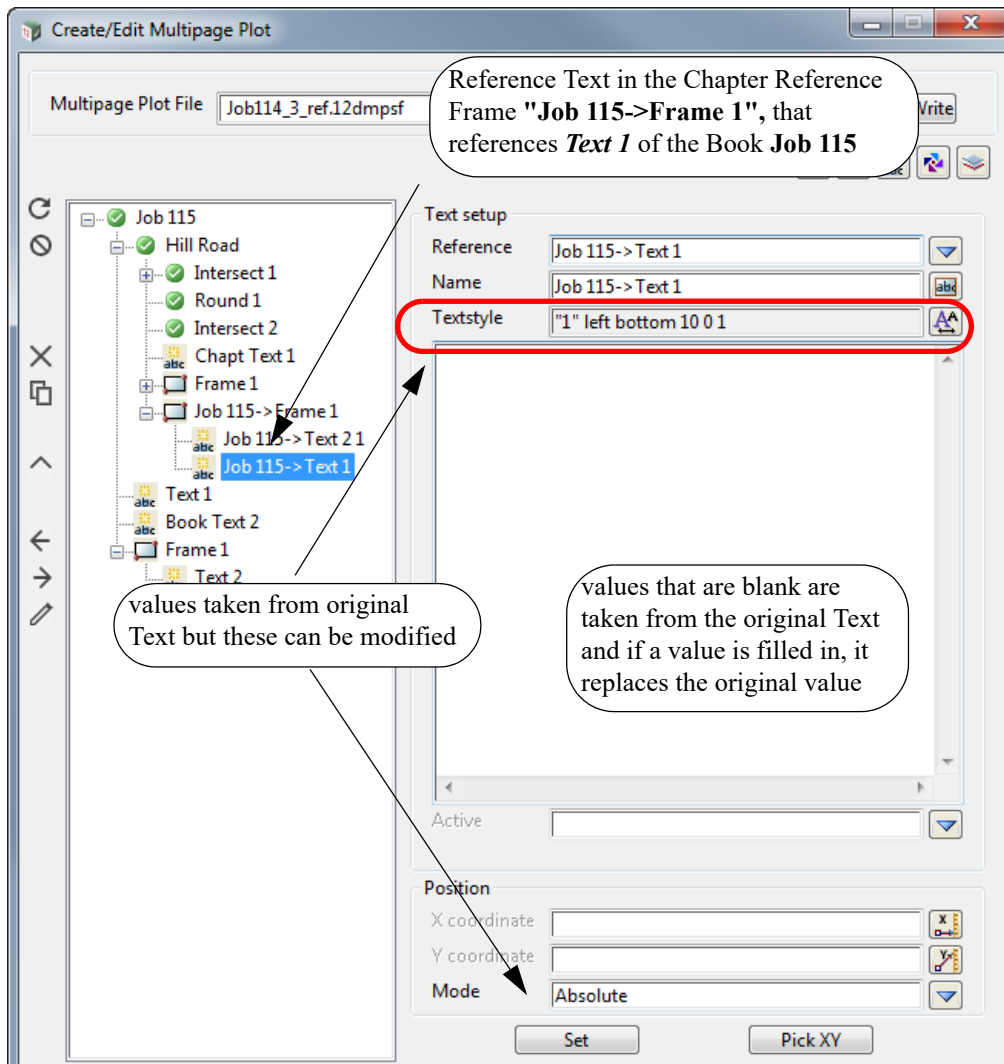


A new **Chapter Reference Frame Reference Text** is created but it has a blank **Reference** Field.



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.



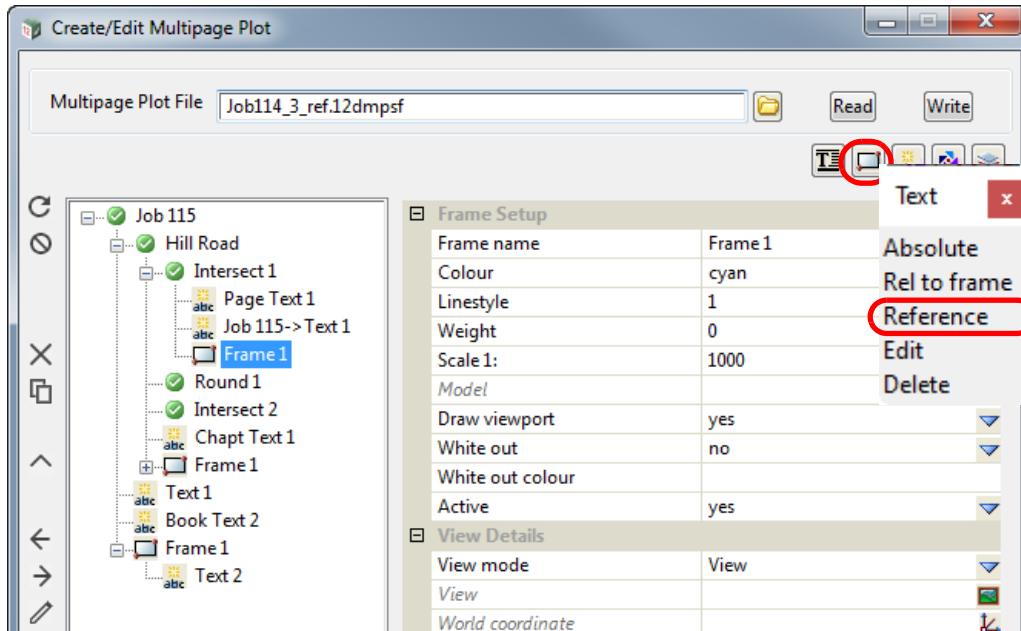
If the **Chapter Reference Frame Reference Text** references a **Book Text** or **Book Frame Text**, any blank fields in the **Text Setup** take their values from the original **Text** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Reference Frame Reference Text**.

### Important Notes

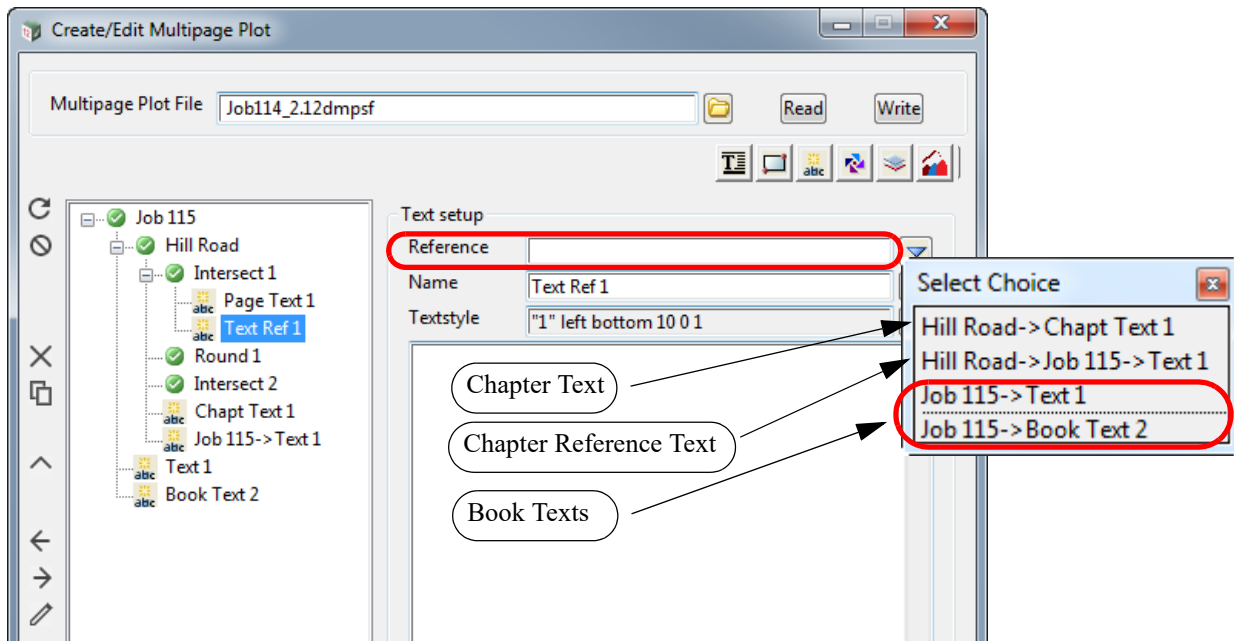
1. Please note that the **Chapter Reference Frame Reference Text** and the **Chapter Frame Reference Text** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame**.
2. The only way to tell if a **Text** references a **Book Text** or a **Book Frame Text** is that their names have to be unique at the **Book** level.

### 20.1.4.8.3.4 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.

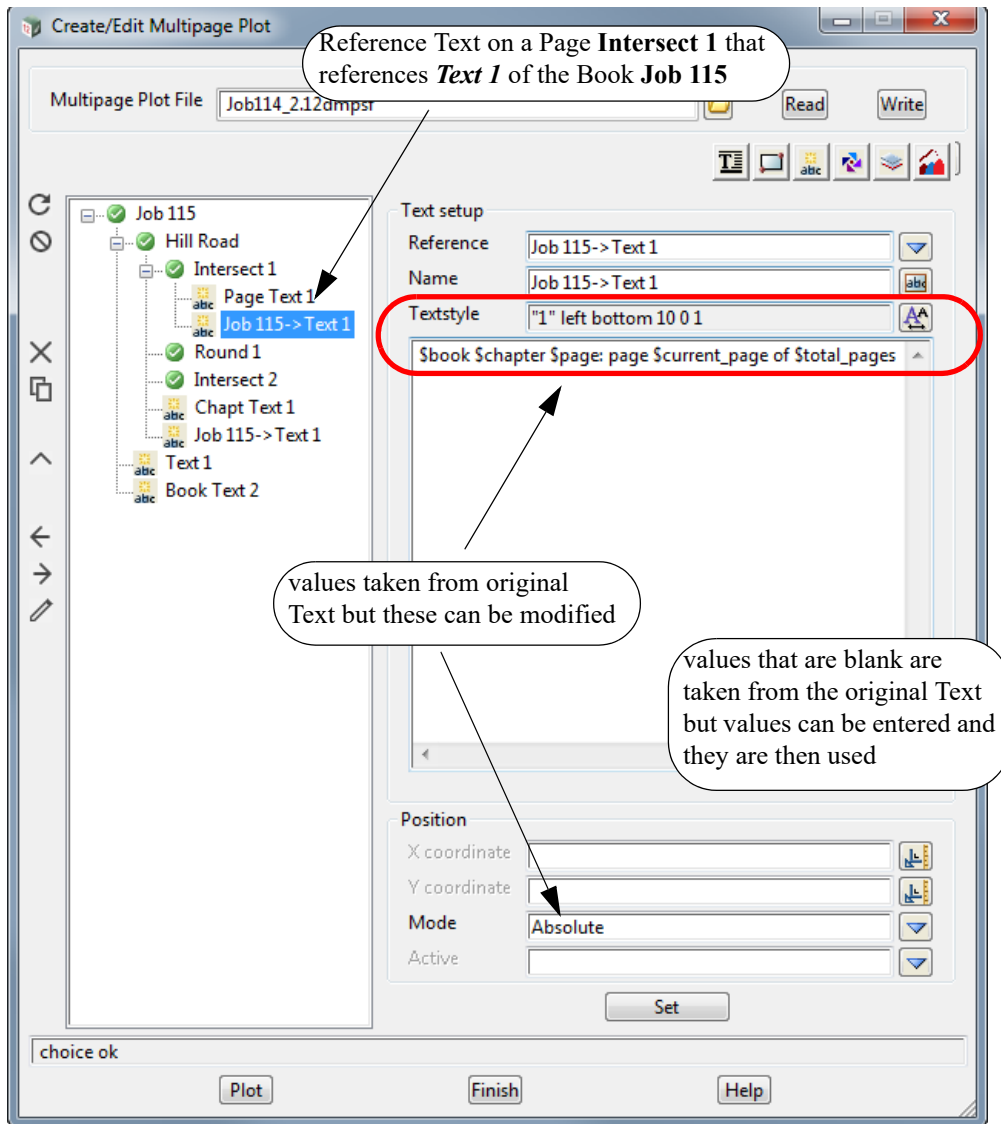


A new **Page Reference Text** is created but it has a blank **Reference** Field.



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

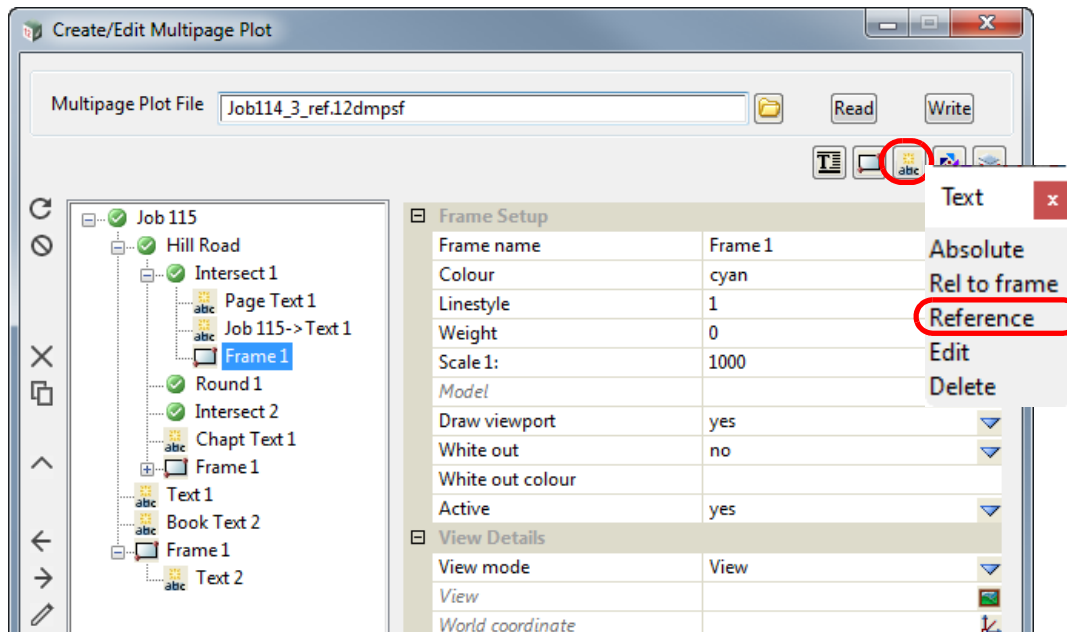
in the **Page Reference Text** fields, set the **Active** field to **No**.

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**.

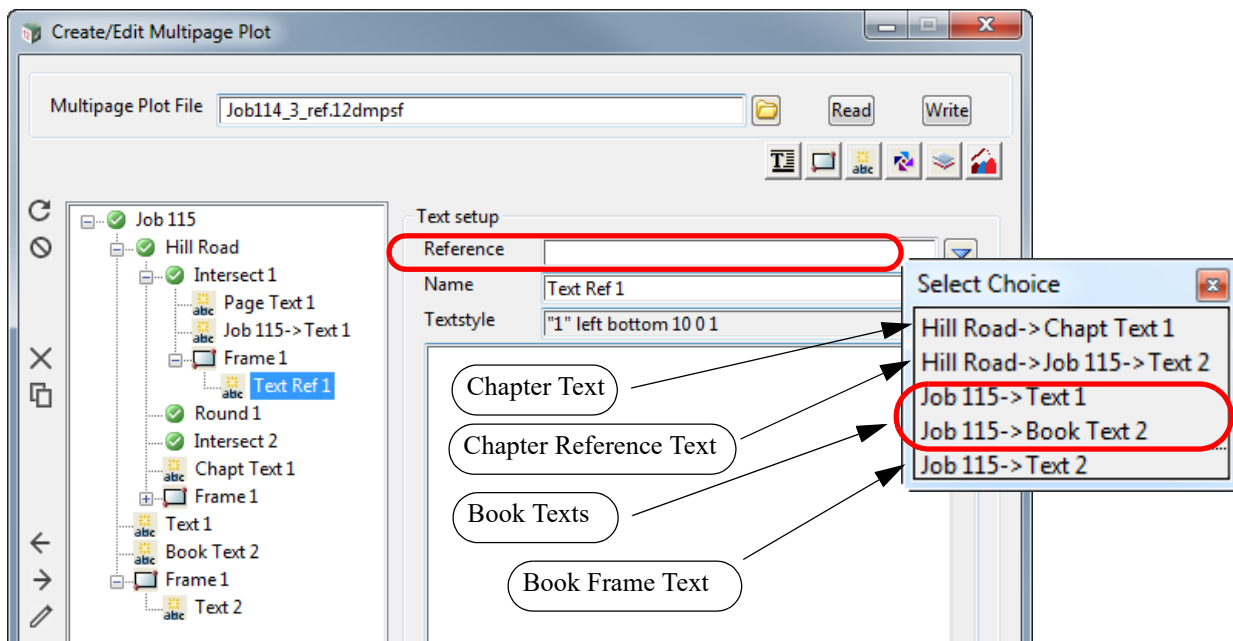


### 20.1.4.8.3.5 Creating Page Frame Reference Text

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.



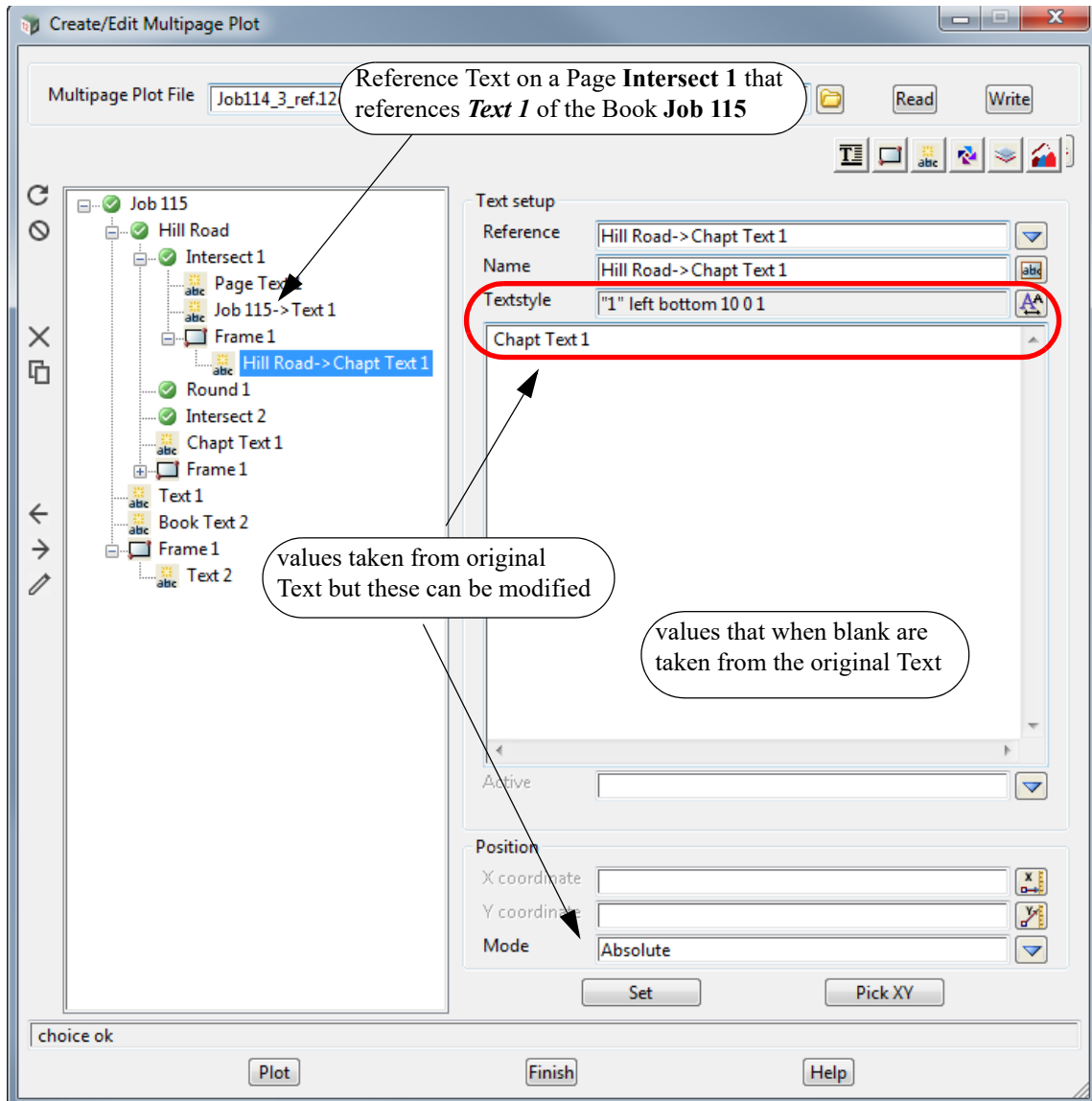
A new **Page Frame Reference Text** is created but it has a blank **Reference** Field.



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**.

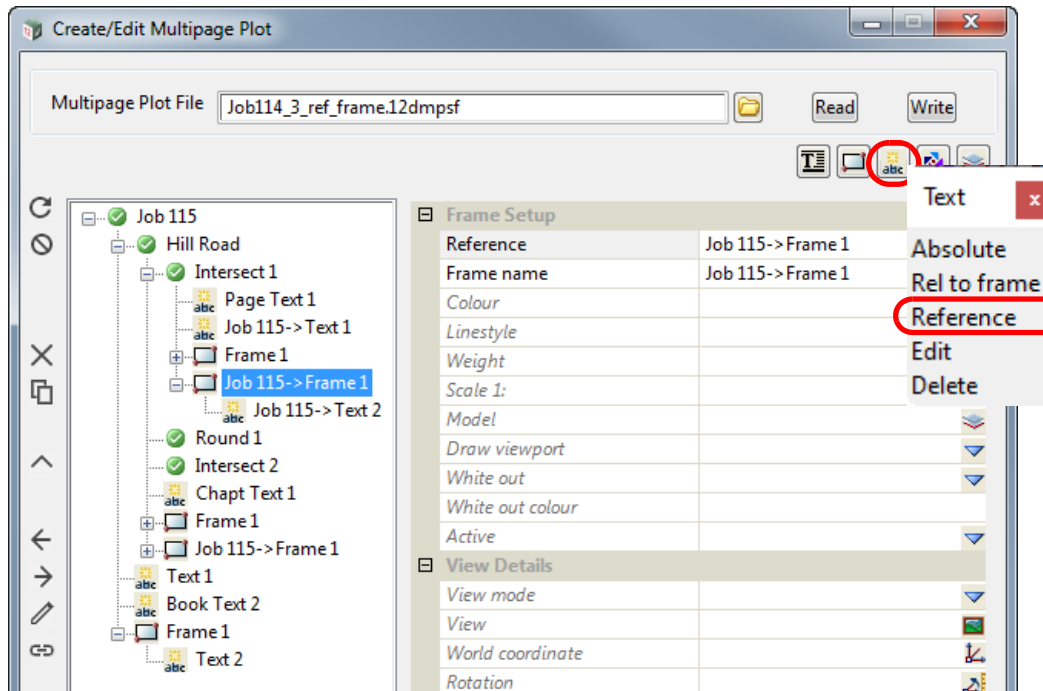
4. If you don't want to display **Chapter Frame Text** for a particular page, then for that page, create a **Page Reference Frame** that references the **Chapter Frame** that contains the **Chapter Frame Text**. This new **Page Reference Frame** will also include a **Page Reference Frame Reference Text** 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 **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 **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 **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**.

### 20.1.4.8.3.6 Creating Page Reference Frame Reference Text

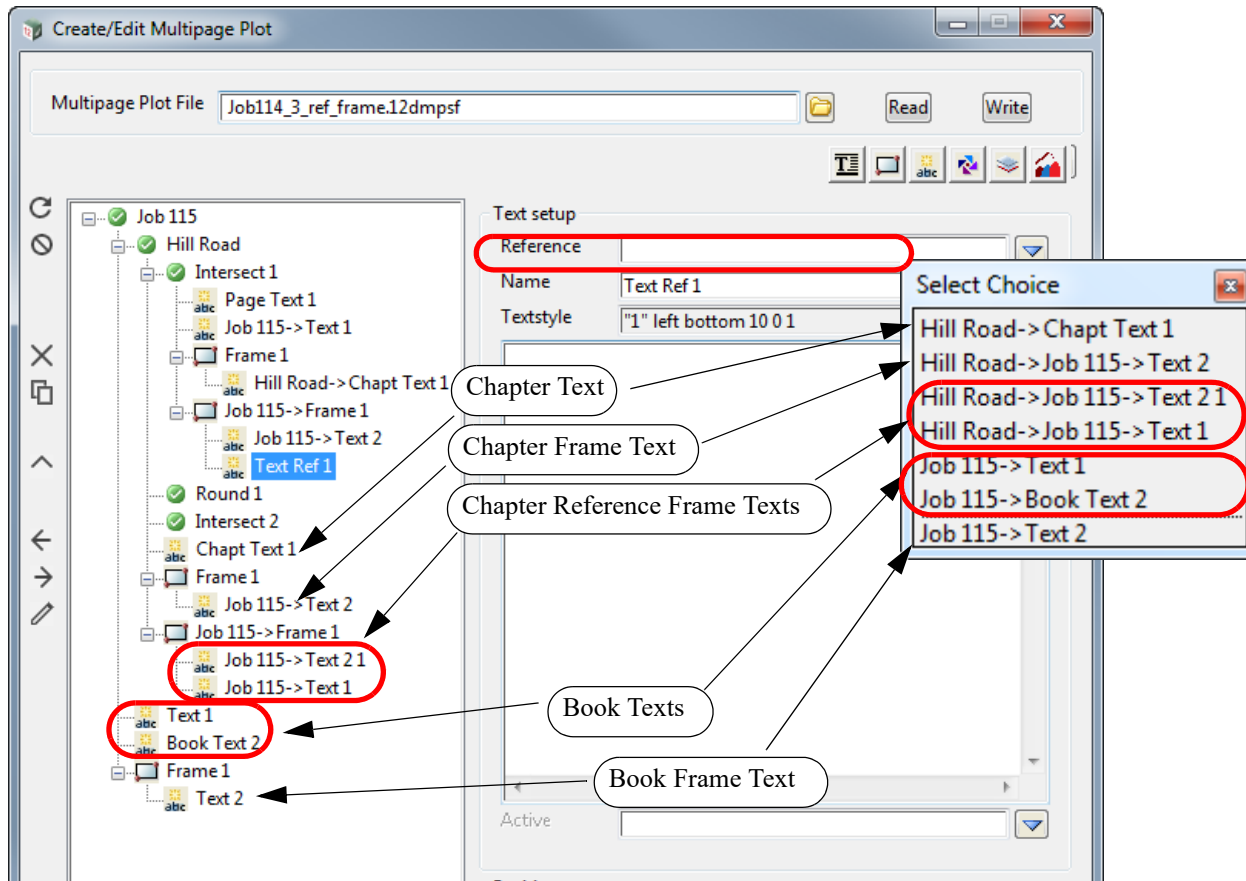
#### Important Note

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.

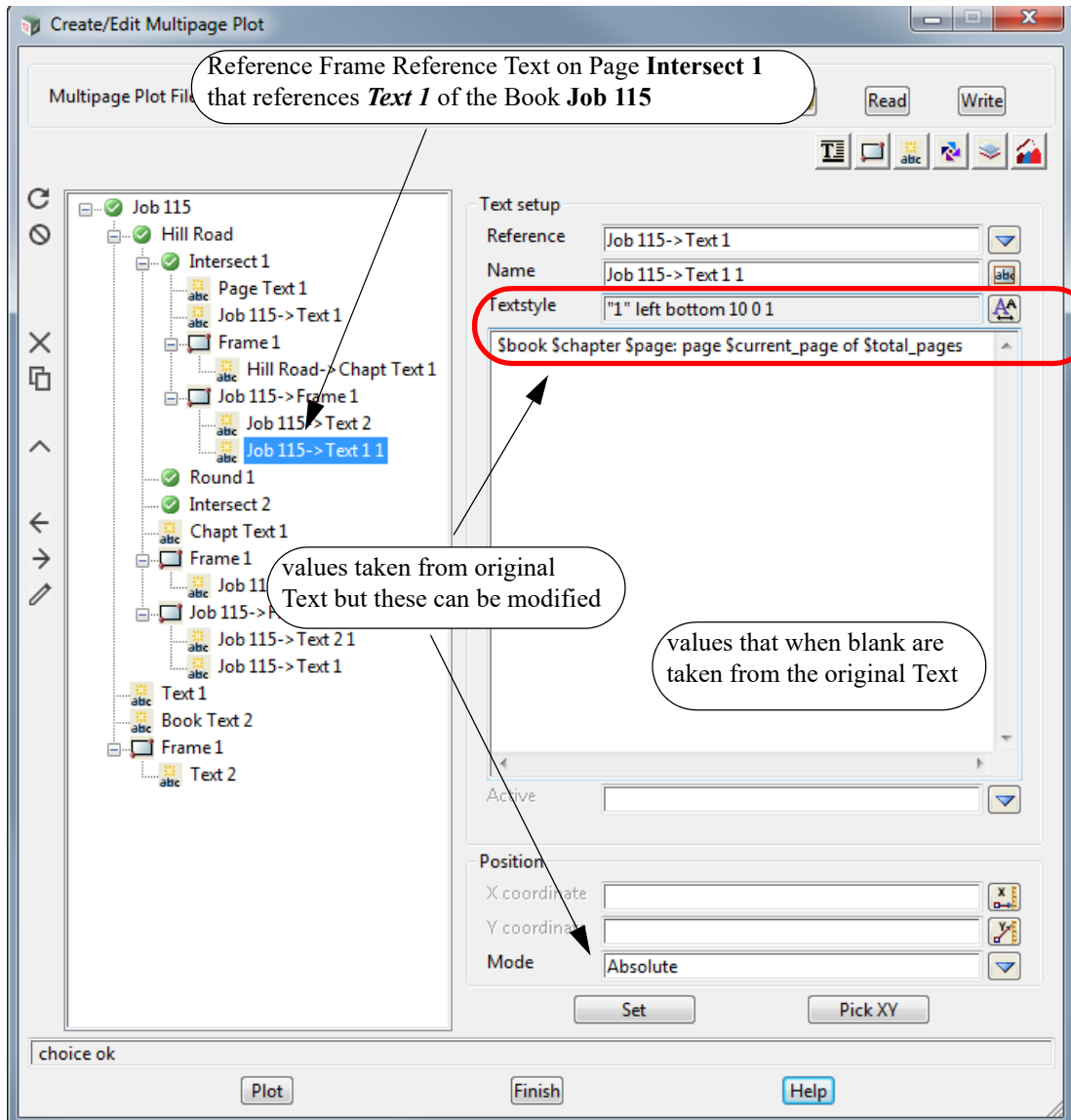


A new **Page Reference Frame Reference Text** is created but it has a blank **Reference** Field.



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** 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.



#### 20.1.4.8.4 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 [20.1.4.3 Icons on the Left Side](#).*

#### Text Setup

<b>Text name</b>	text box		
------------------	----------	--	--

*name of the Text node.*

<b>Textstyle</b>	textdata box		available textdata
------------------	--------------	--	--------------------

*Textstyle data to use for the text.*

<b>Text Area</b>	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 [20.1.4.8.6 MPS Text \\$variables](#)).*

*Note: if changes are made then the Set button must be pressed for the changes to take effect.*

<b>Active</b>	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

<b>X/Y coordinate</b>	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.*

<b>Mode</b>	choice box		Absolute, Relative
-------------	------------	--	--------------------

*If **Absolute**, the text is positioned in millimetre coordinates in the Plot Area.*

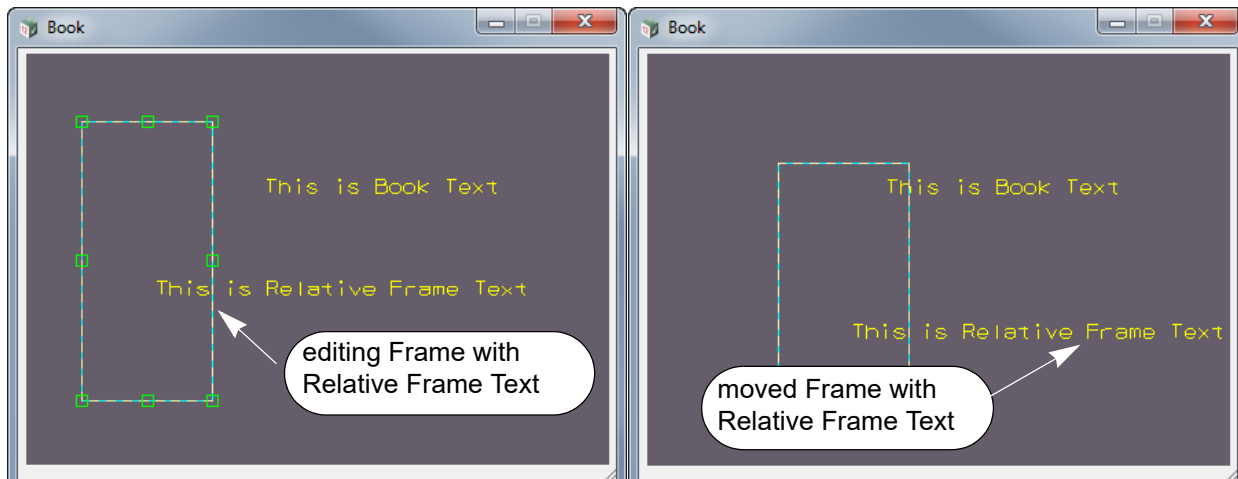
*If it is **Frame Text** and the Frame the Text is on is moved, the Text does not move with the Frame.*

*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.*

#### 20.1.4.8.5 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.

### 20.1.4.8.6 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 (ie. There is a next page). If this IS the last page in the plot (ie. 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 (ie. There is a previous page). If this IS the first page in the plot (ie. 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. (eg. 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 [26.7.2.7.2.7 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 [26.7.2.7.2.1.3 Project Attributes](#).
- (s) **\$synergy\_attribute<synergy\_attribute\_path>** which at plot time is replaced with the

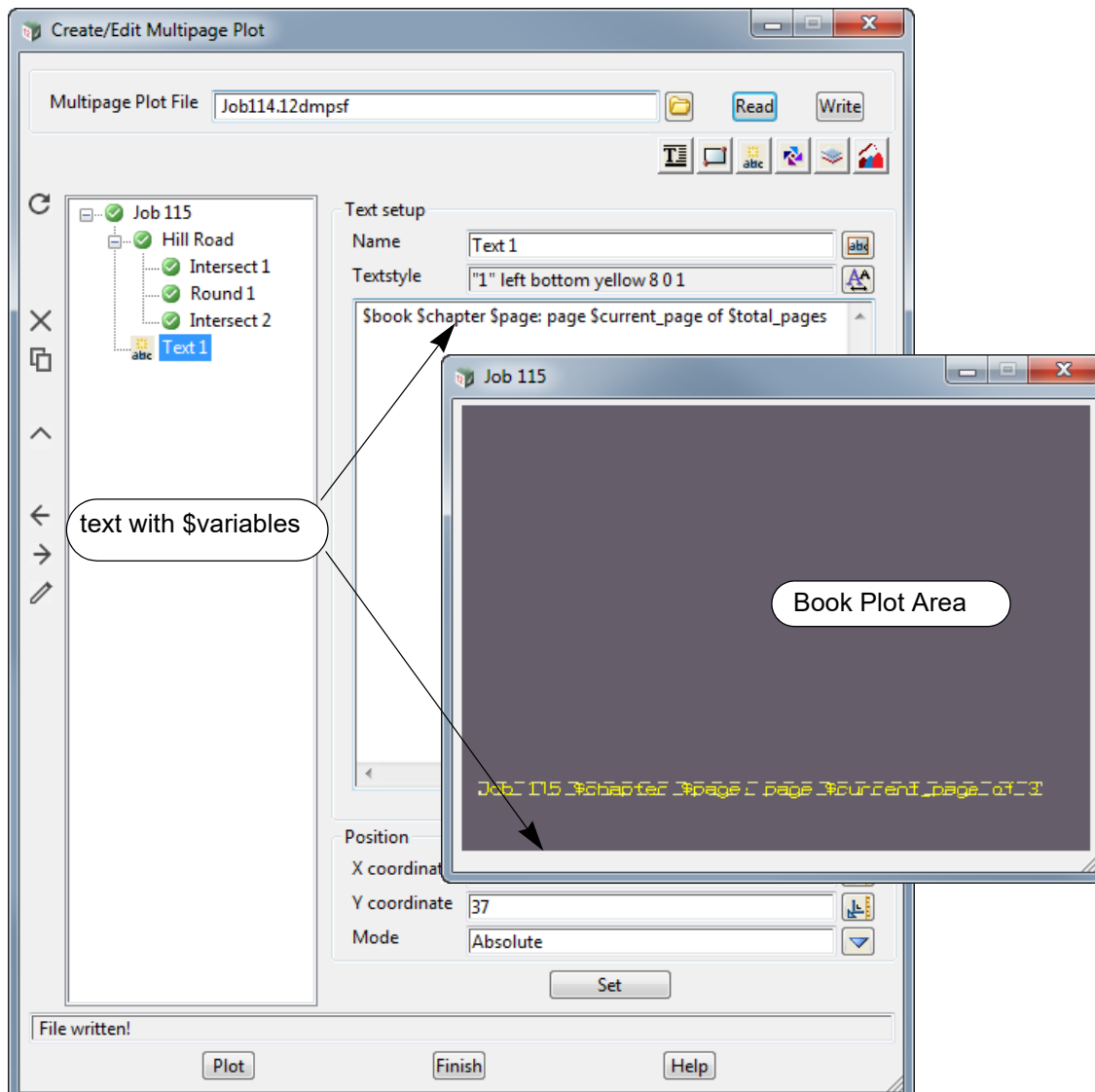
**synergy\_attribute** specified by **synergy\_attribute\_path**. For example - Text Frame Text - "Job name: \$synergy\_attribute<Job\_Number>" will be written out as the text "Job name: " followed by the text in the 12d Synergy attribute Job\_Number.

- (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).

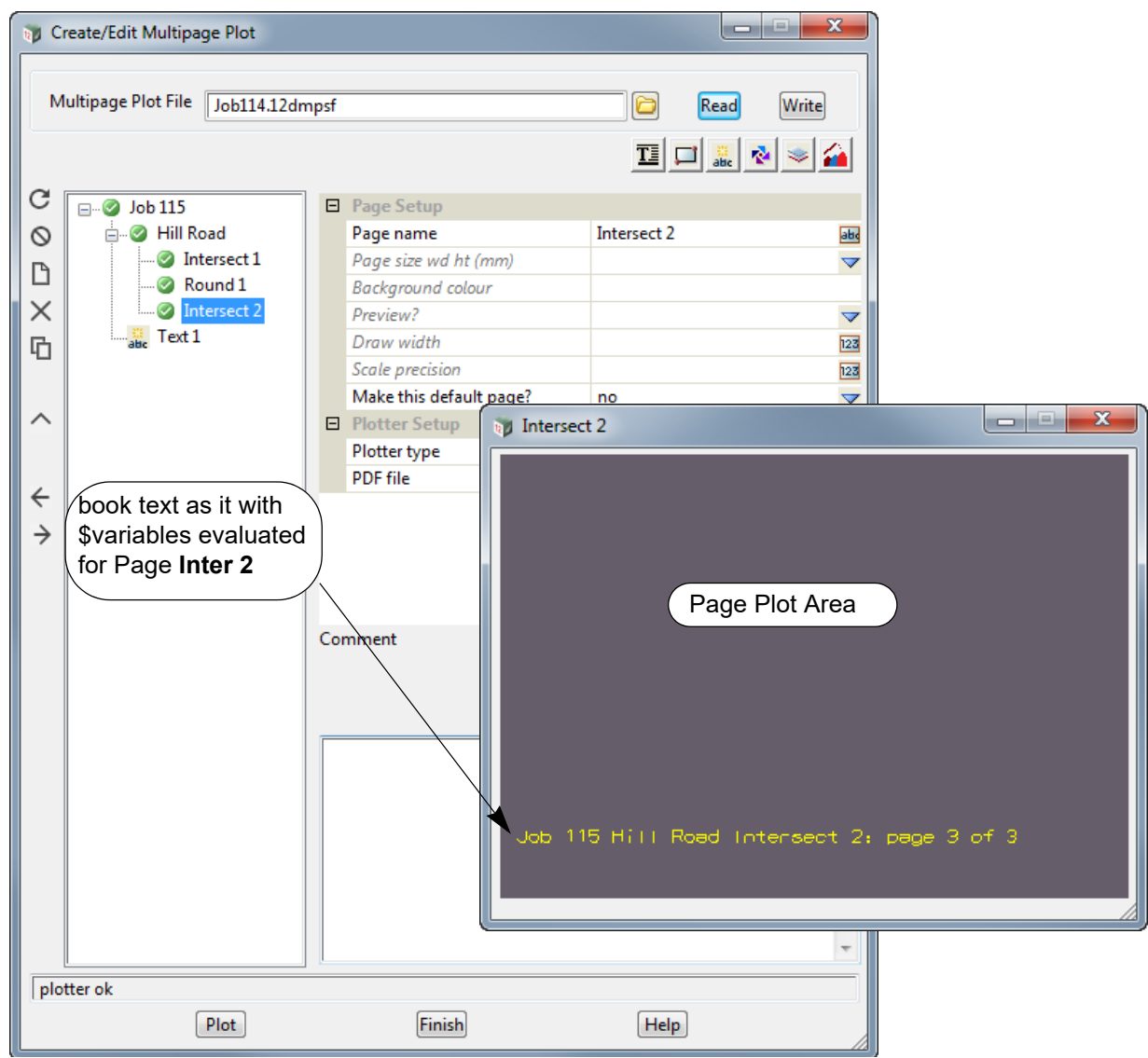
And for **Frame Text** there are also some special \$variables that at plot time, are substituted by values from the Frame. They are

- (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".

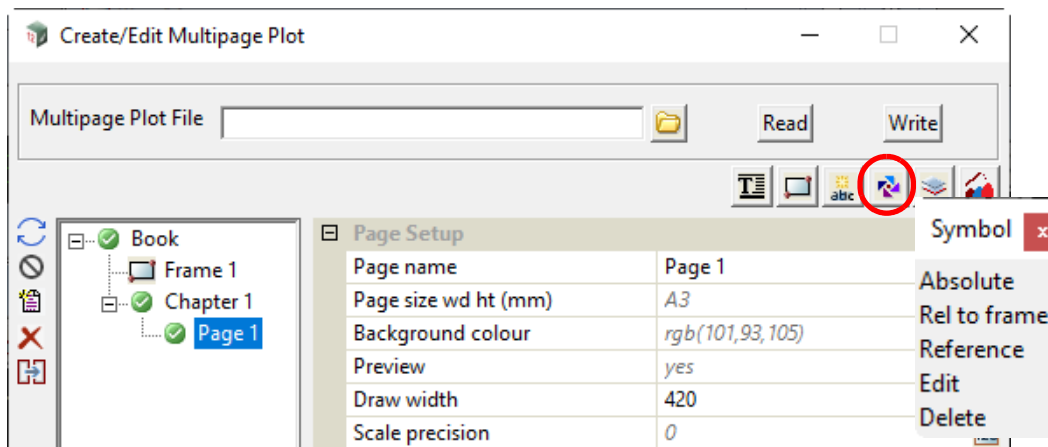


And on **Page "Intersect 2"**, this would be evaluated as:



### 20.1.4.9 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 [20.1.4.9.1 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 [20.1.4.9.2.1 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 [20.1.4.9.2 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 [20.1.4.9.1 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.

See [20.1.4.9.2.1 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 [20.1.4.9.2 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 [20.1.4.9.1 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 [20.1.4.9.2.1 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 [20.1.4.9.2 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 [20.1.4.10 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**.

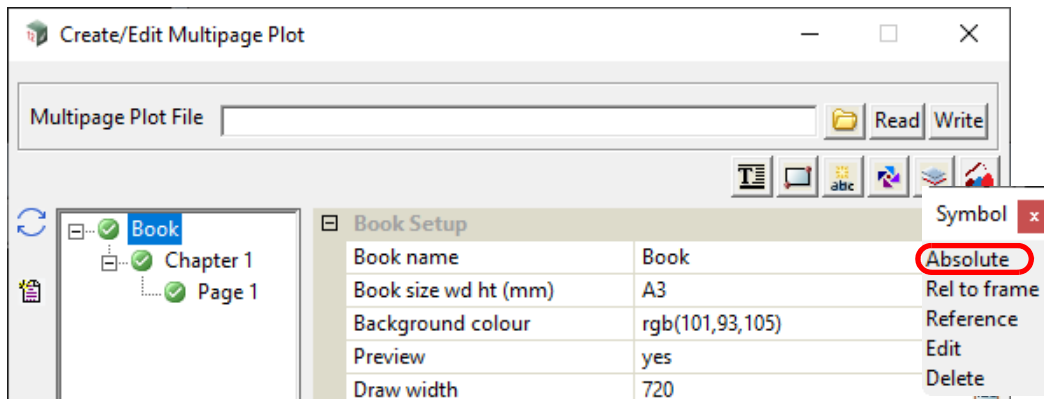
For a **Chapter**, the names of the **Chapter Symbol nodes** and the **Chapter Frame Symbol nodes** for **that Chapter** must be unique amongst all the **Chapter Symbol nodes** AND the **Chapter Frame Symbol nodes** for that **Chapter**.

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**.

### 20.1.4.9.1 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 replaced 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

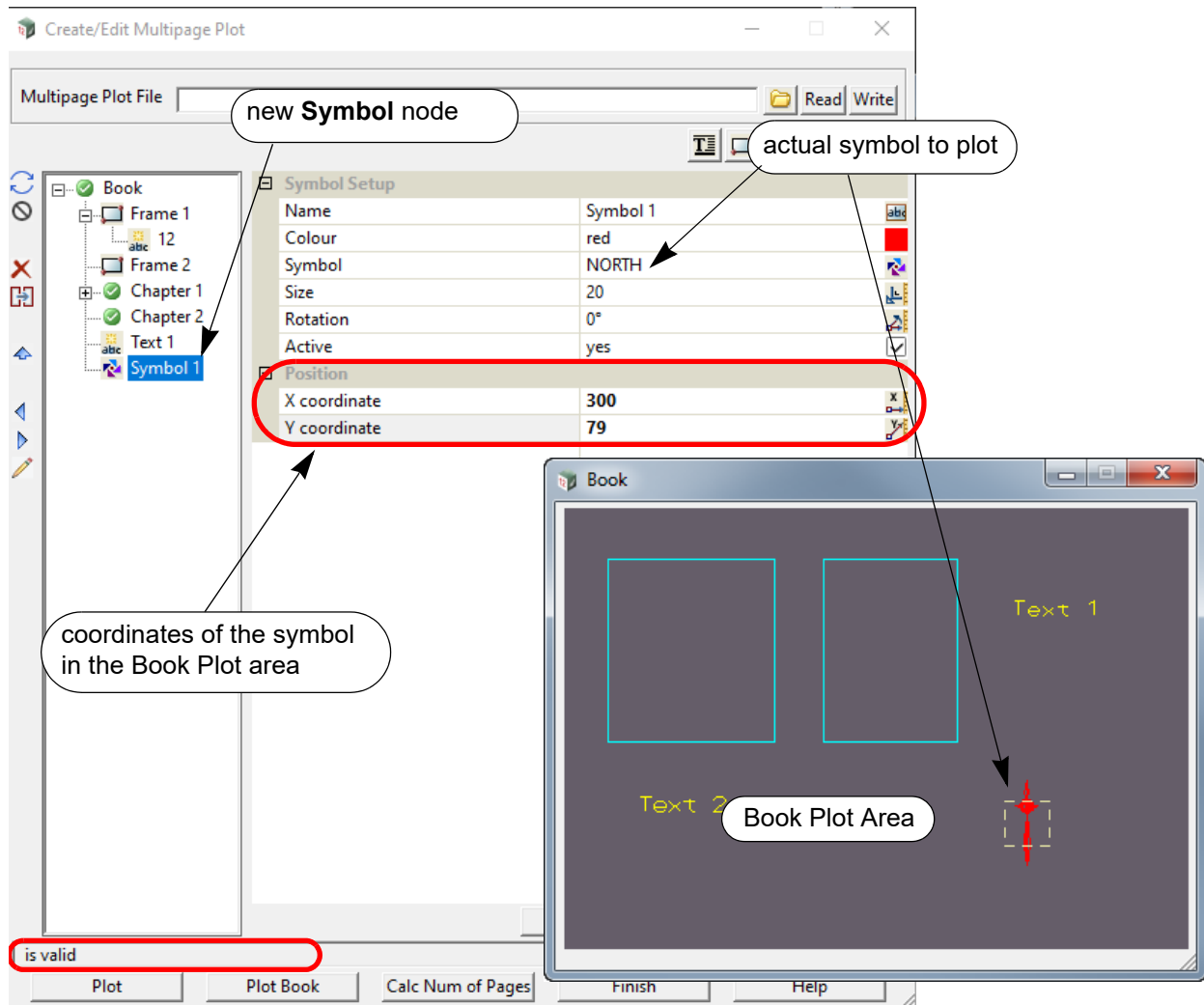


A position in the **Book Plot Area** for the symbol is then selected.

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 [20.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes](#).

### 20.1.4.9.2 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 [20.1.4.9.2.1 Creating a Symbol by Highlighting the Frame Node](#).

2. Picking a **Frame** from the **Plot Area**.

See [20.1.4.9.2.2 Creating a Frame Symbol by Picking a Frame from a Plot Area](#).

### 20.1.4.9.2.1 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**.

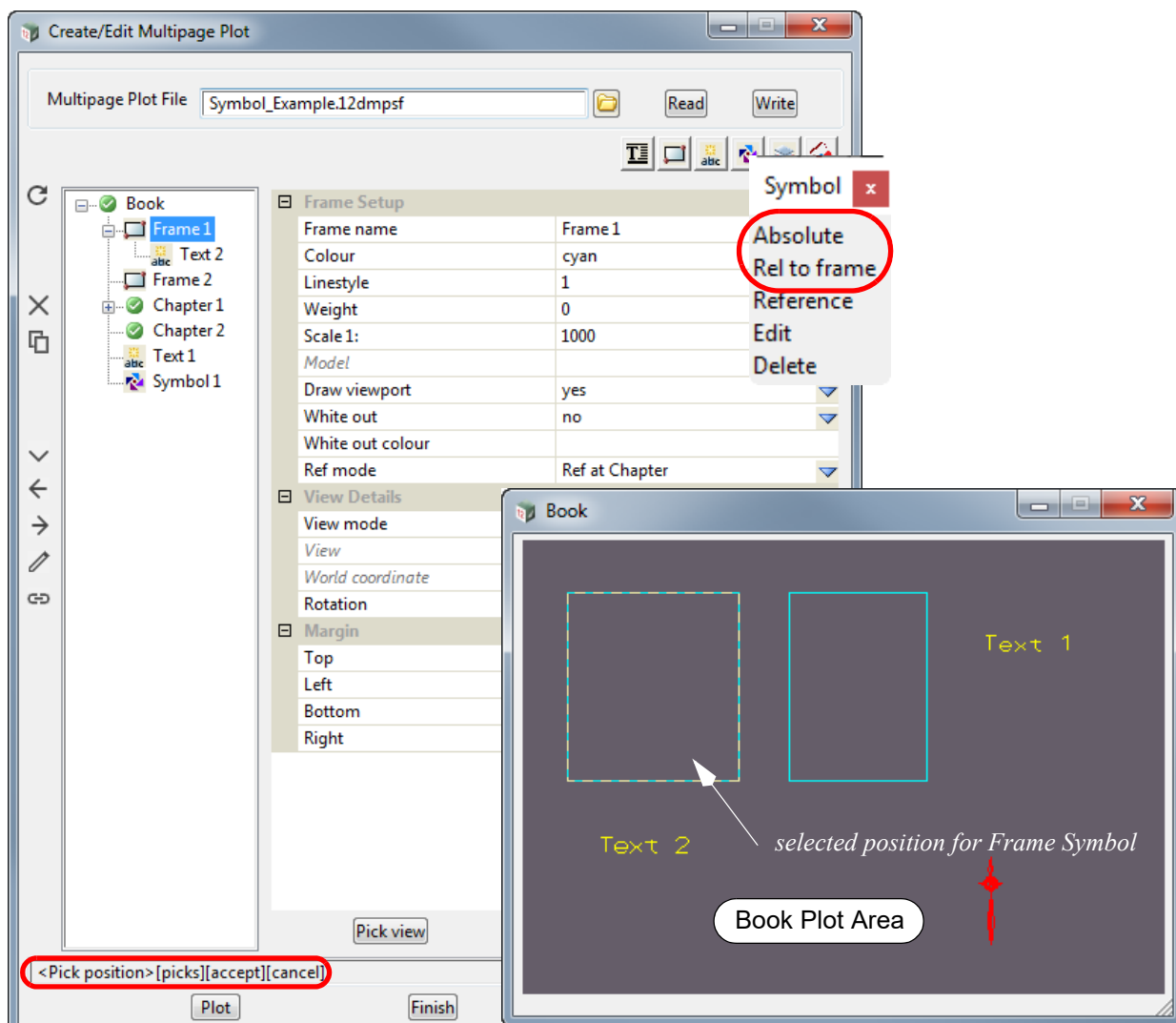
To create a **Frame Symbol** using the **Frame node**, click on and highlight the **Book Frame node**, **Chapter Frame node** or **Page Frame node** to add a **Frame Symbol** to.

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**.

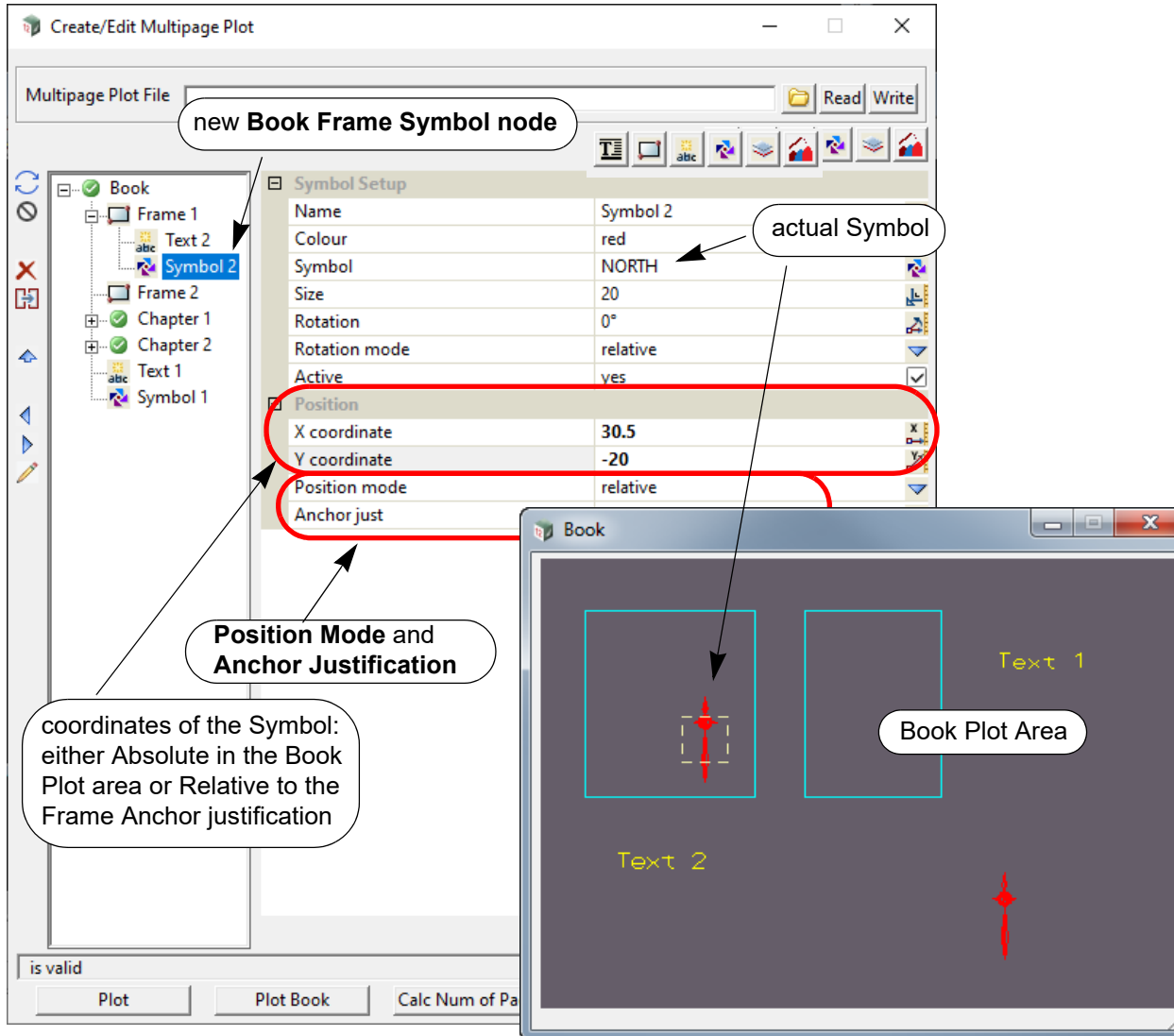


Once the Symbol position is selected, a **Book Frame Symbol** node is automatically added at the bottom of the **Book Frame** with the default node name **Symbol n** where **n** is the next integer that makes the **Book Symbol** node name unique amongst all the **Book Symbol** nodes AND **Book Frame 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 [20.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes](#).

### 20.1.4.9.2.2 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**.

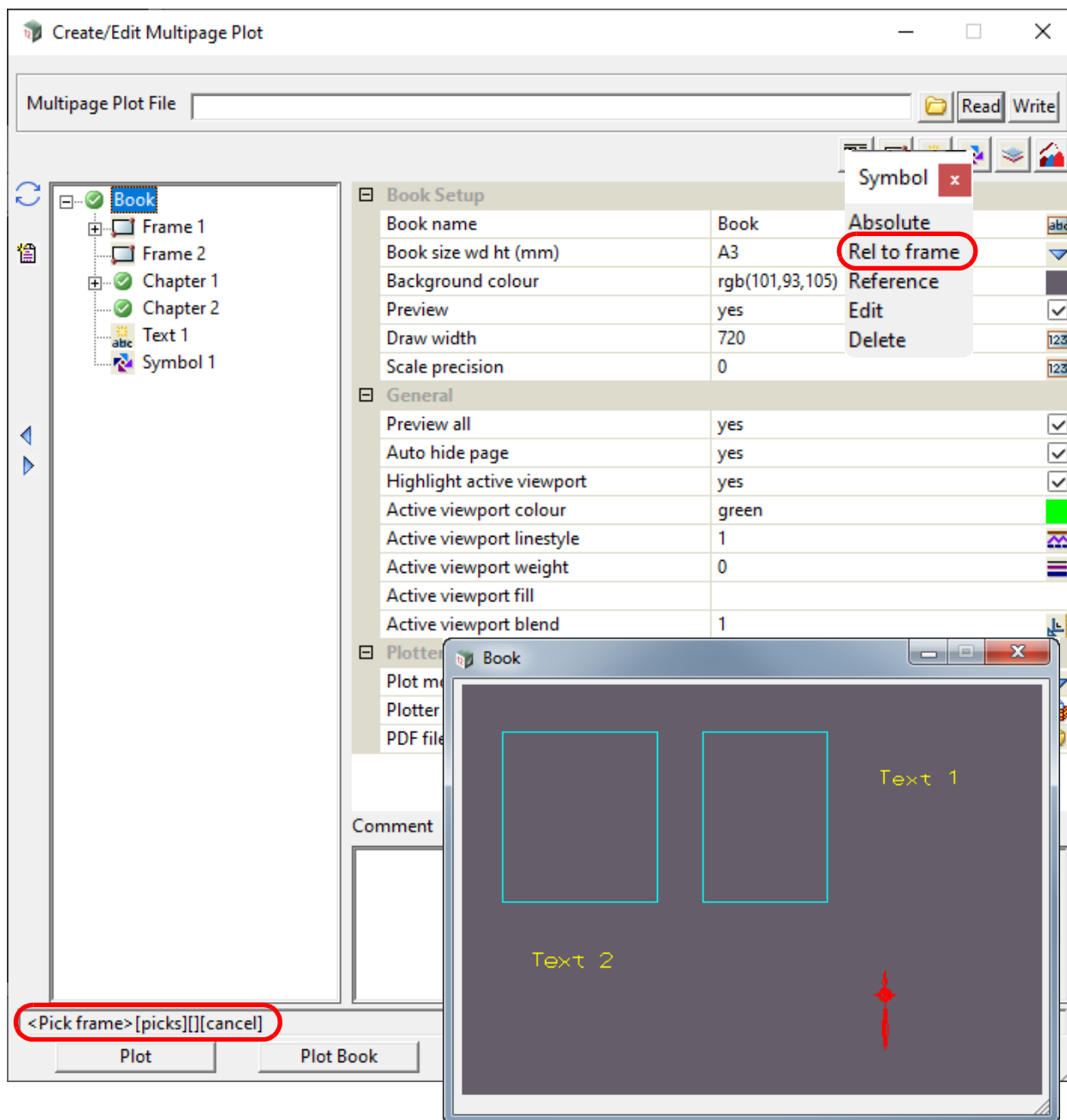
The process is similar to that for a **Book**, **Chapter** or **Page Symbol** except **Rel to frame** must be selected from the **Symbol** menu.

(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.

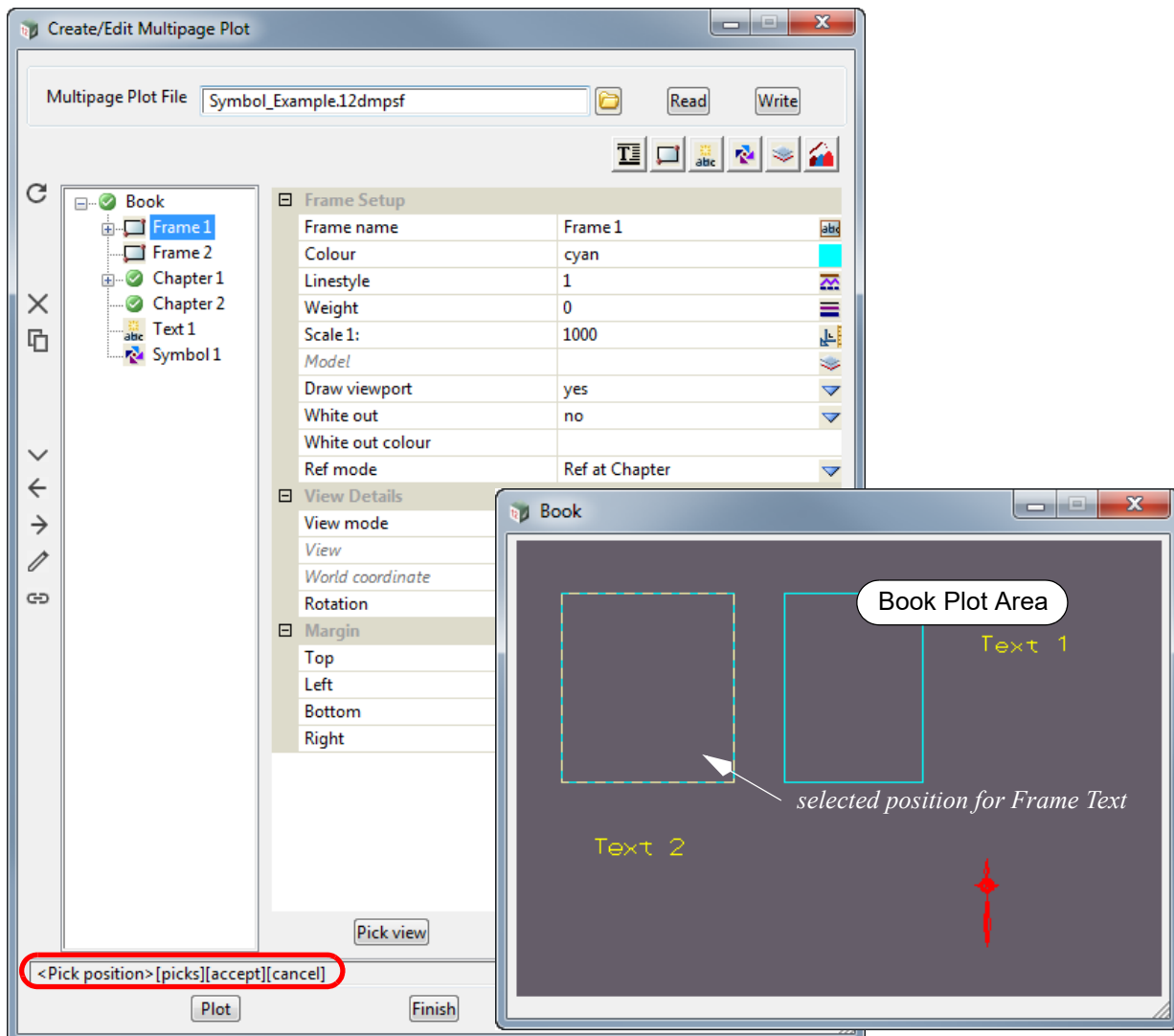
The user is then asked to pick a **Frame** from the **Plot Area**.



When the **Frame** is **selected**, the **Frame** is highlighted in the **Plot Area** and the **Frame node**

highlighted in the tree.

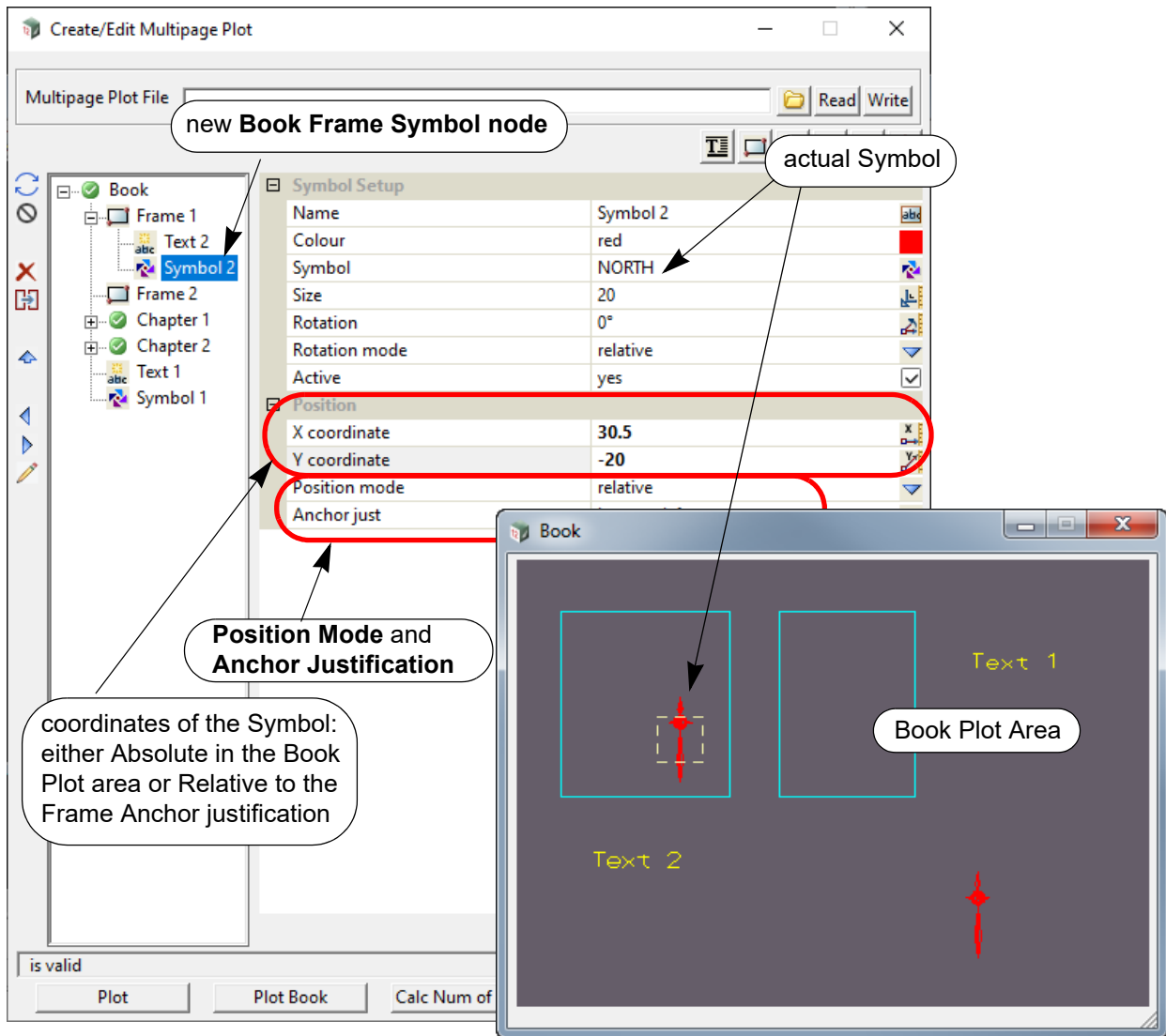
The position for the **Book Frame Symbol** is then selected in the **Plot Area**.



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 [20.1.4.9.4 Icons and Fields for Symbol and Frame Symbol Nodes](#).



### 20.1.4.9.3 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**.

Reference Symbol on a Page **Page 1** that references **Symbol 1** of the Book **Book**

Multipage Plot File: Symbol\_Ref

Symbol Setup

Reference	Book->Symbol 1
Name	Book->Symbol 1
Colour	red
Symbol	4dNORTH
Size	0
Rotation	0°
Rotation mode	Absolute
Active	
Position	
X coordinate	
Y coordinate	
Position mode	Absolute

values taken from original Symbol but can be modified

values that are blank are taken from the original Symbol but new values can be entered

Pick XY

choice ok

Plot Finish Help

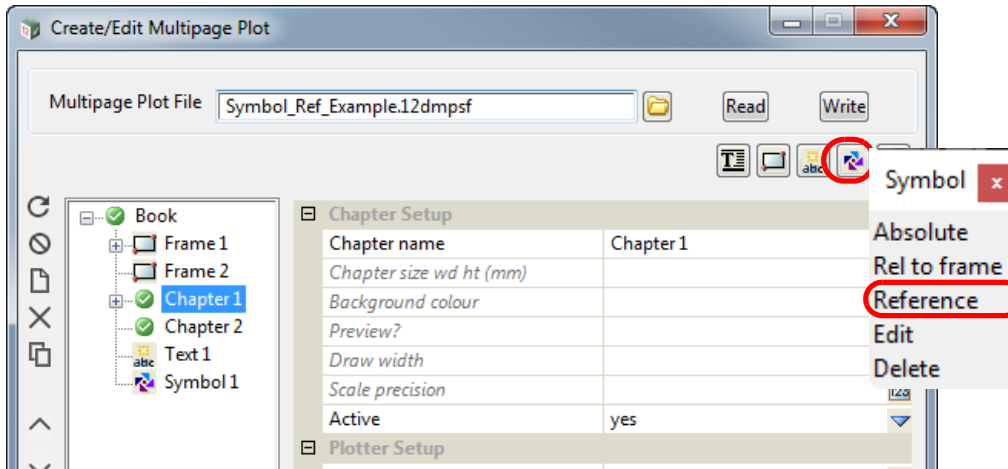
A **Reference Symbol** can be is created in six ways:



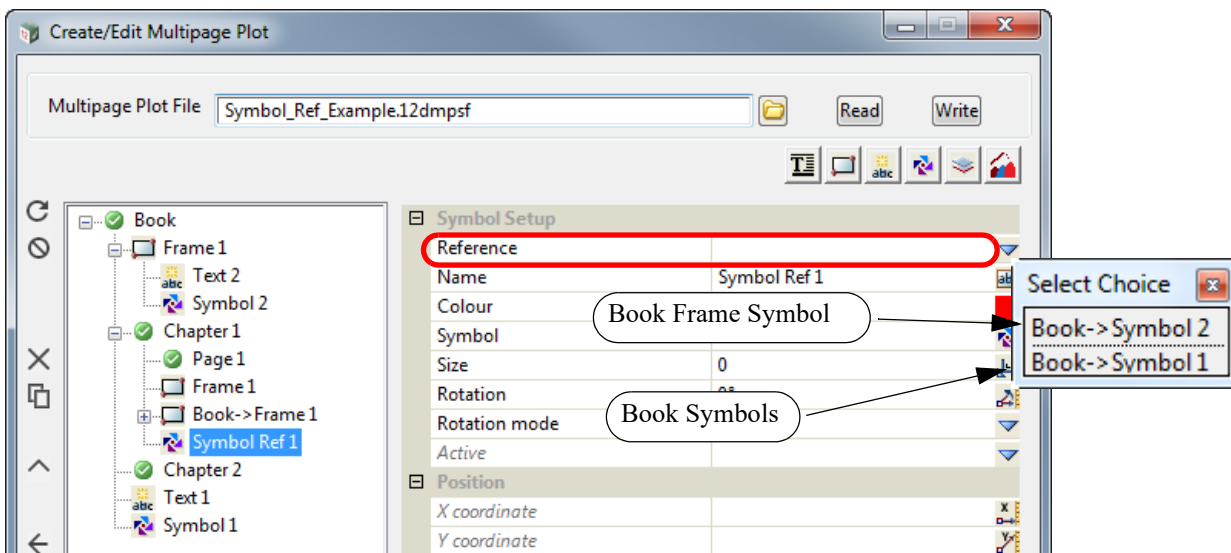
- (a) **Chapter Reference Symbol.** See [20.1.4.9.3.1 Creating Chapter Reference Symbol.](#)
- (b) **Chapter Frame Reference Symbol** See [20.1.4.9.3.2 Creating Chapter Frame Reference Symbol.](#)
- (c) **Chapter Reference Frame Reference Symbol** See [20.1.4.9.3.3 Creating Chapter Reference Frame Reference Symbol.](#)
- (d) **Page Reference Symbol.** See [20.1.4.9.3.4 Creating a Page Reference Symbol.](#)
- (e) **Page Frame Reference Symbol.** See [20.1.4.9.3.5 Creating Page Frame Reference Symbol.](#)
- (f) **Page Reference Frame Reference Symbol.** See [20.1.4.9.3.6 Creating Page Reference Frame Reference Symbol.](#)

### 20.1.4.9.3.1 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.

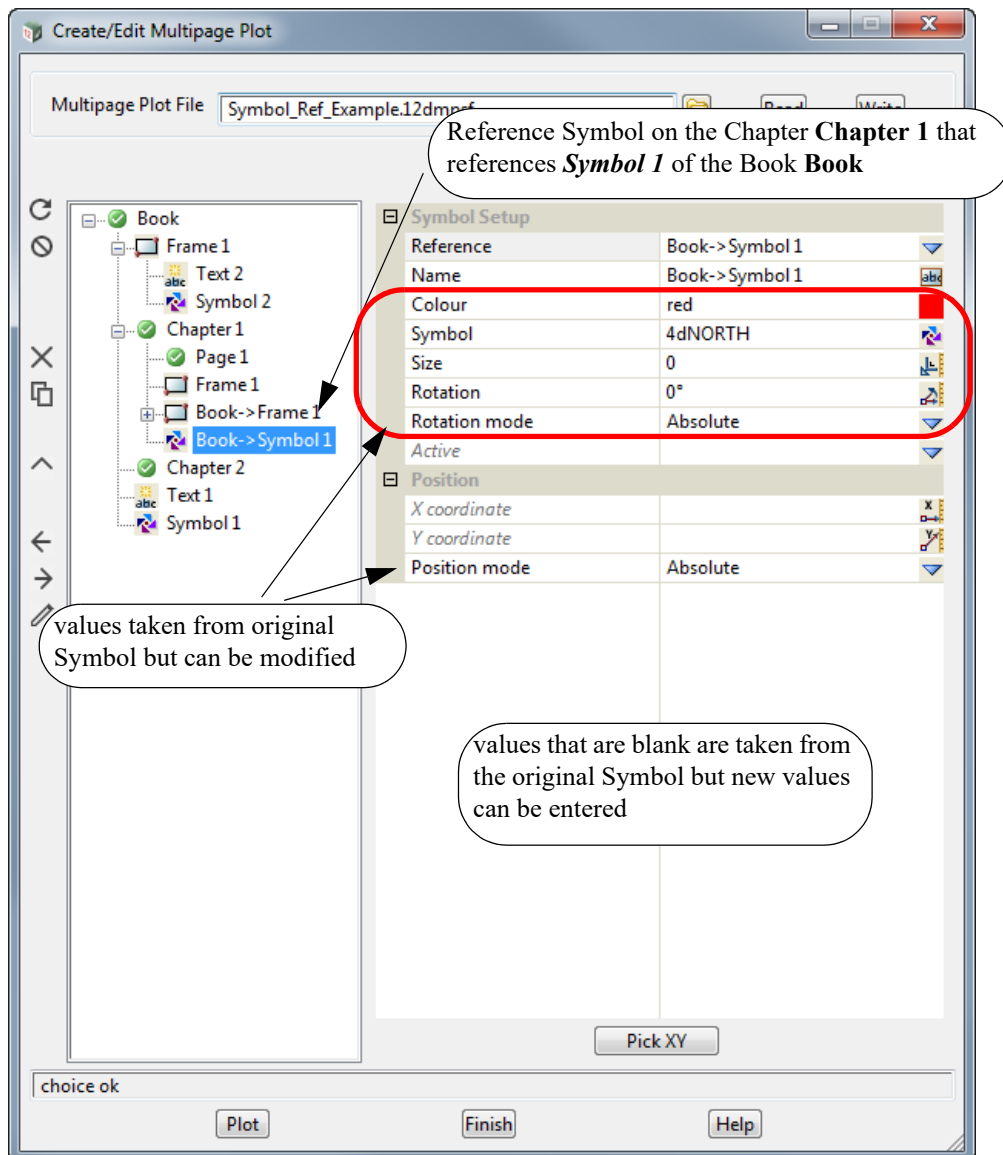


A new **Chapter Reference Symbol** is created but it has a blank **Reference** Field.



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**.

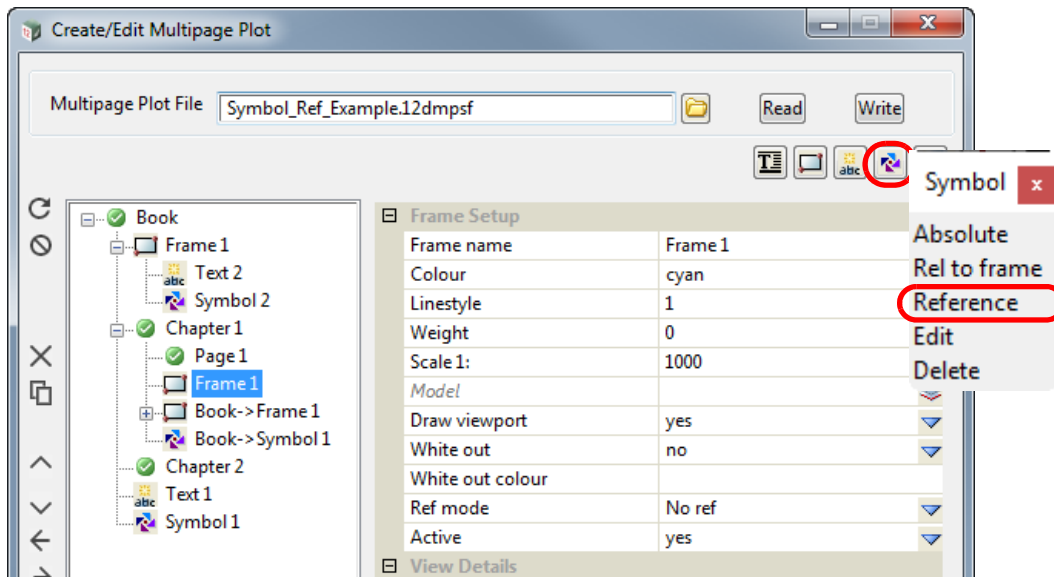
### Important Notes

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**.

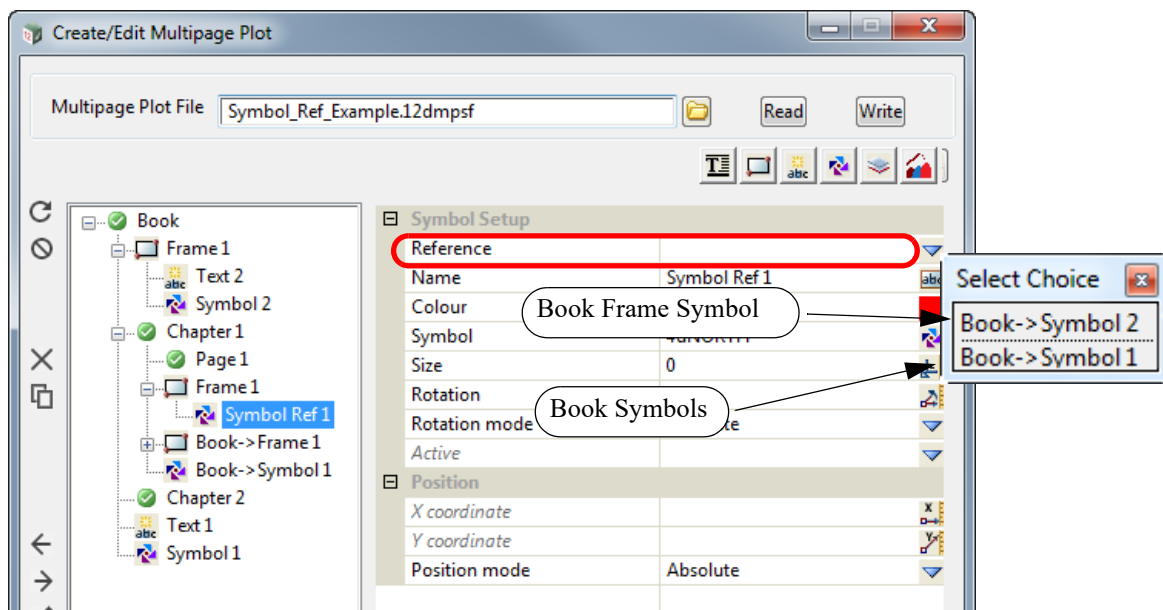
4. If a **Book Frame Symbol** has been set to *Inactive* (i.e. OFF) then it can be **displayed** for a **particular** chapter by creating a **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a **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**.

### 20.1.4.9.3.2 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.

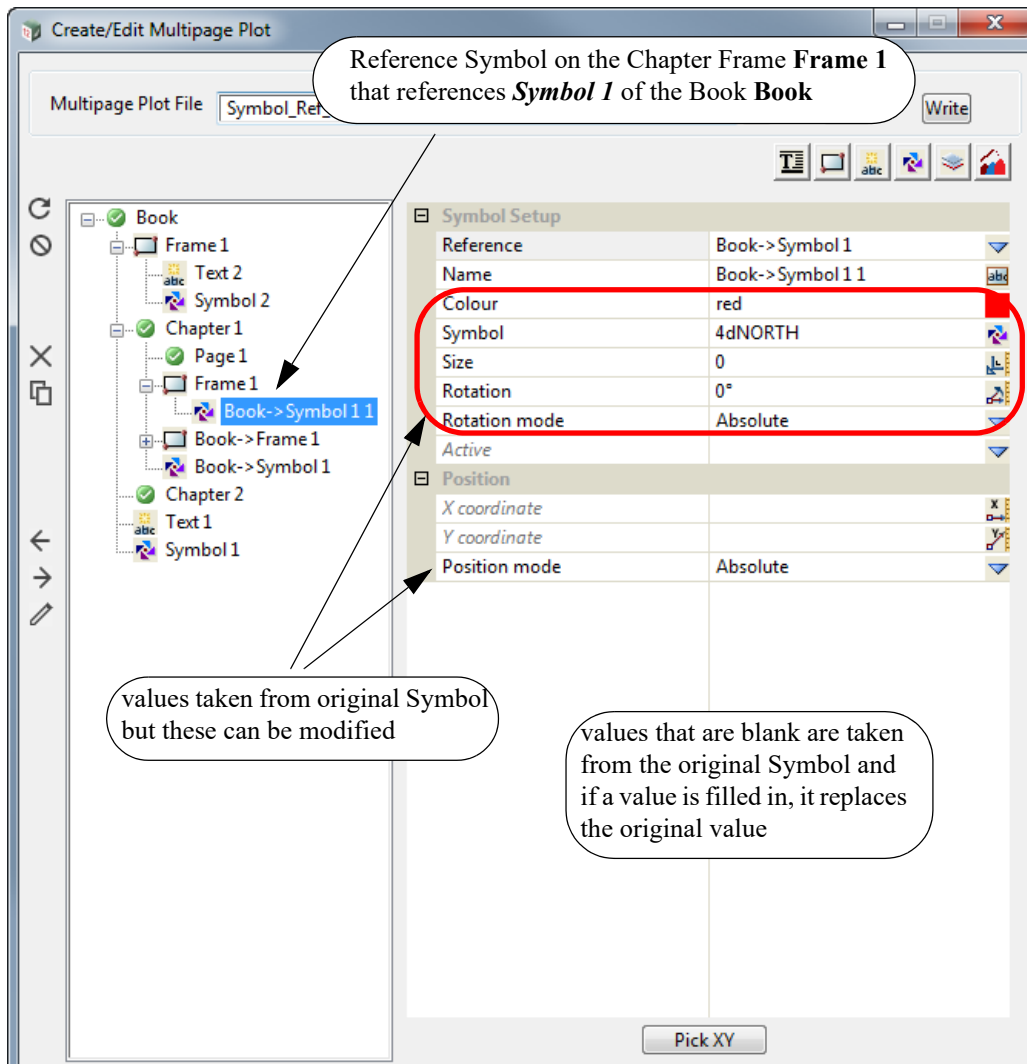


A new **Chapter Frame Reference Symbol** is created but it has a blank **Reference** Field.



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 **Chapter Reference Frame** that references the **Book Frame** that contains the **Book Frame Symbol**. This new **Chapter Reference Frame** will also include a



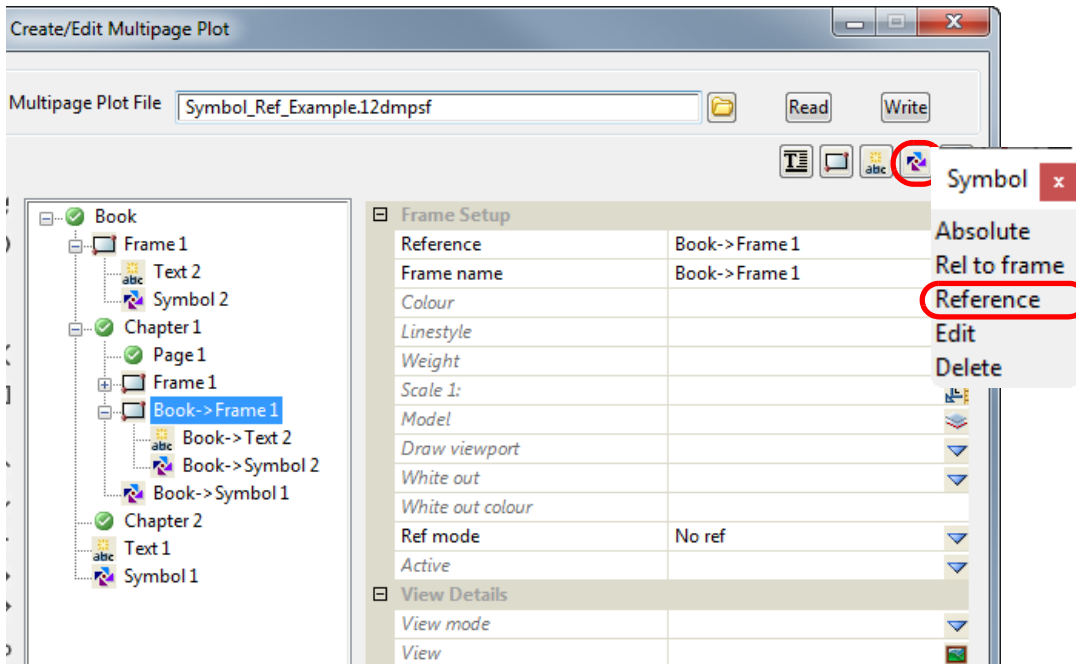
**Chapter Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Chapter Reference Frame Reference Symbol** fields, set the **Active** field to **Yes**.

### 20.1.4.9.3.3 Creating Chapter Reference Frame Reference Symbol

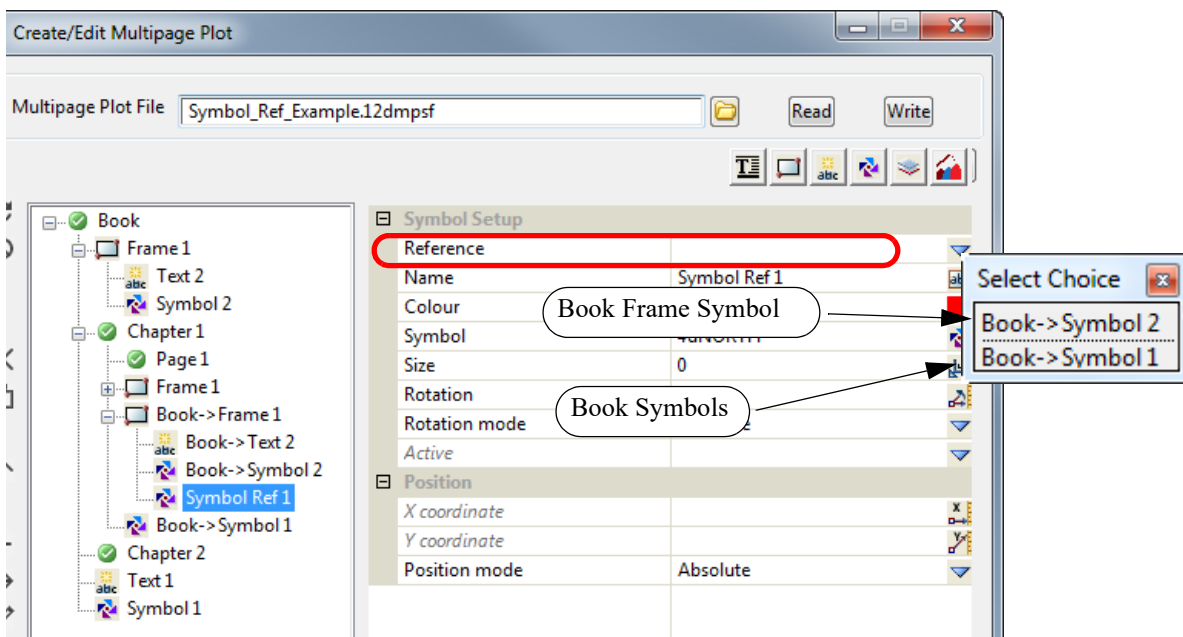
#### Important Note

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.



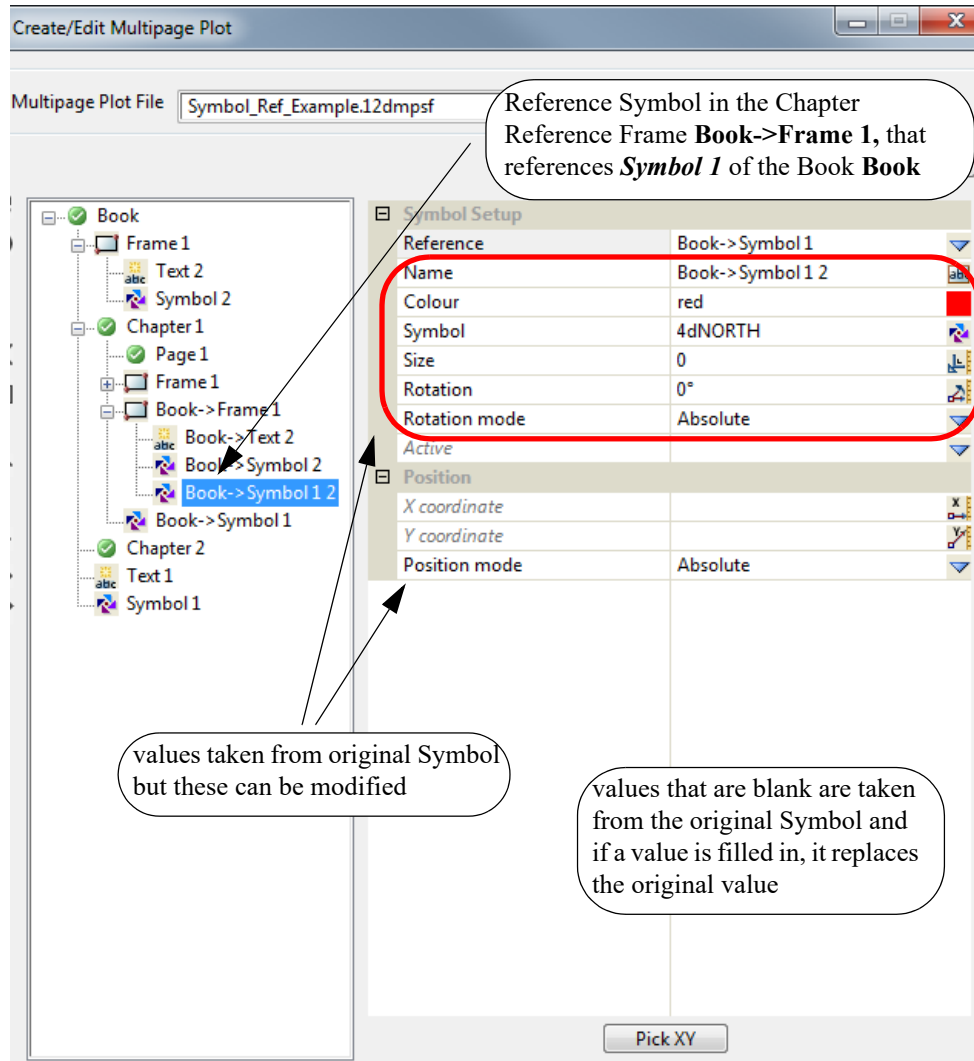
A new **Chapter Reference Frame Reference Symbol** is created but it has a blank **Reference** Field.



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.



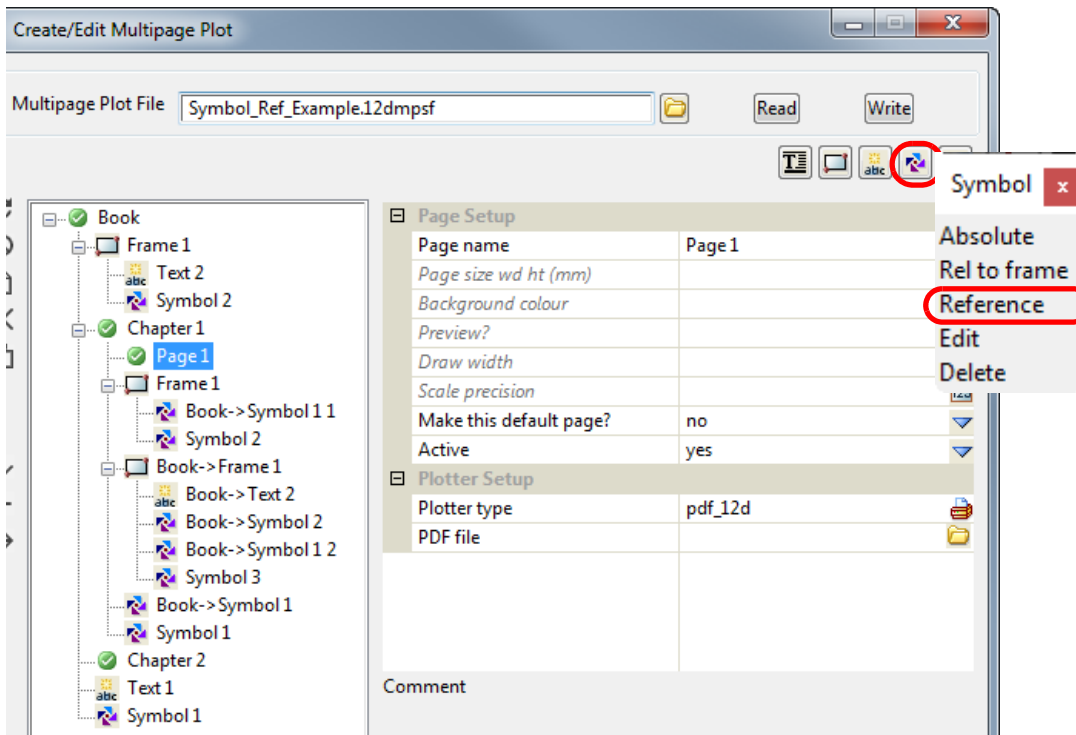
If the **Chapter Reference Frame Reference Symbol** references a **Book Symbol** or **Book Frame Symbol**, any blank fields in the **Symbol Setup** take their values from the original **Symbol** being referenced. Any of the blank values can be changed and the changed values will be used for the **Chapter Reference Frame Reference Symbol**.

### Important Notes

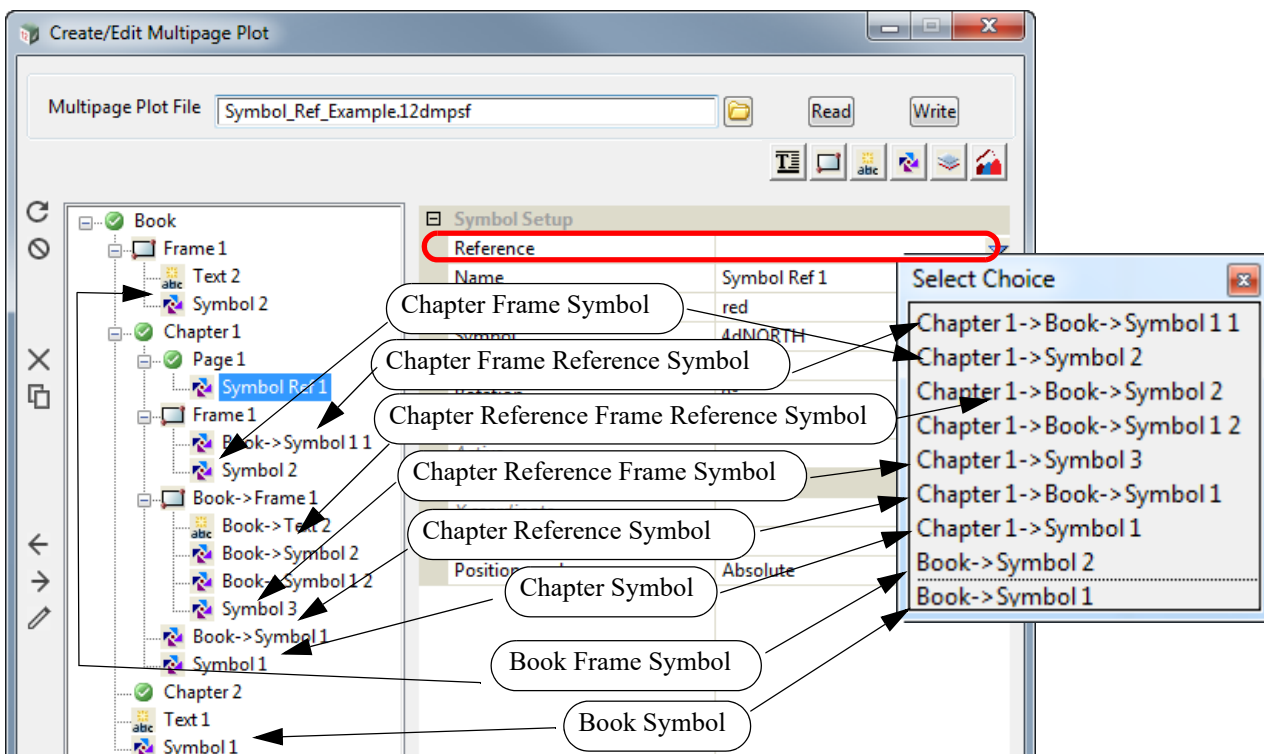
1. Please note that the **Chapter Reference Frame Reference Symbol** and the **Chapter Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Chapter Reference Frame** and the other in a **Chapter Frame**.
2. The only way to tell if a **Symbol** references a **Book Symbol** or a **Book Frame Symbol** is that their names have to be unique at the **Book** level.

### 20.1.4.9.3.4 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.



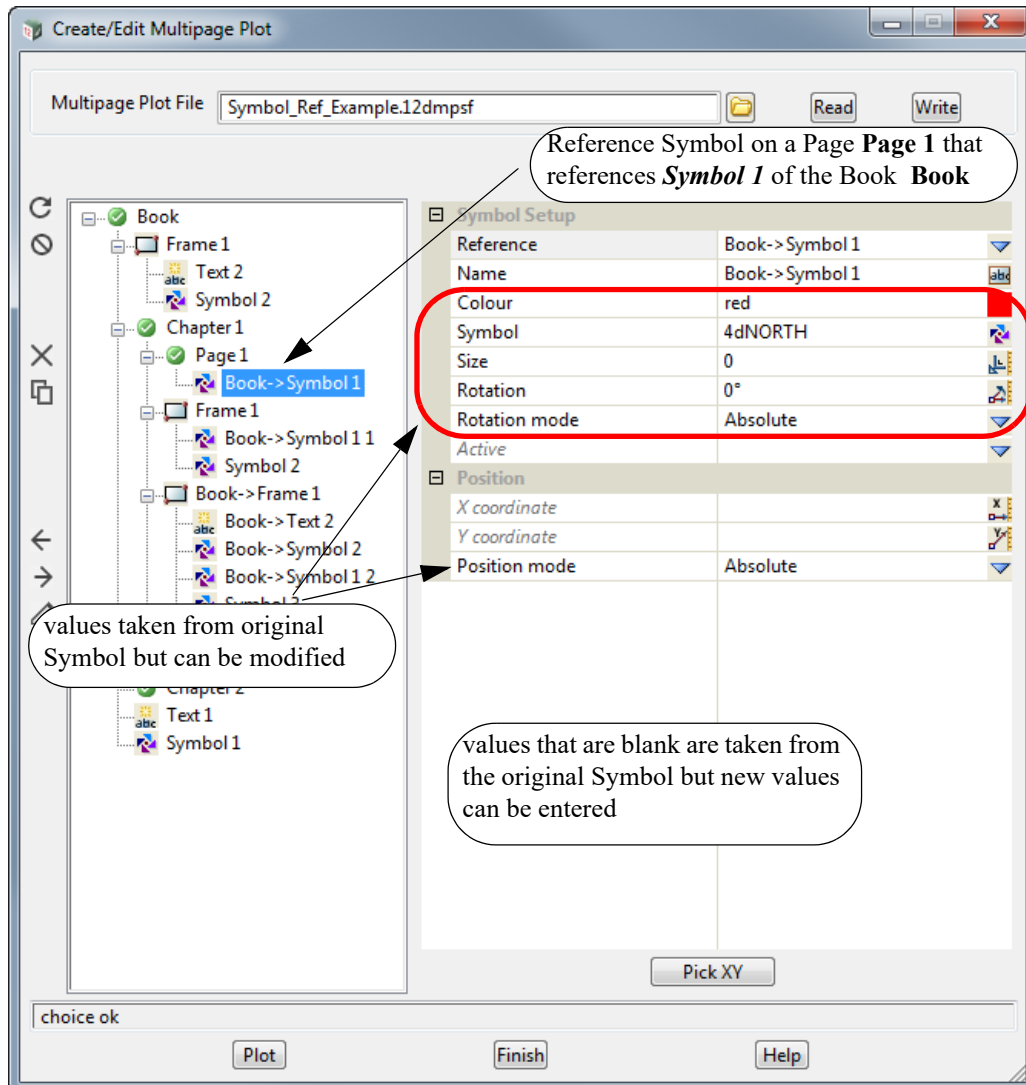
A new **Page Reference Symbol** is created but it has a blank **Reference** Field.



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**.

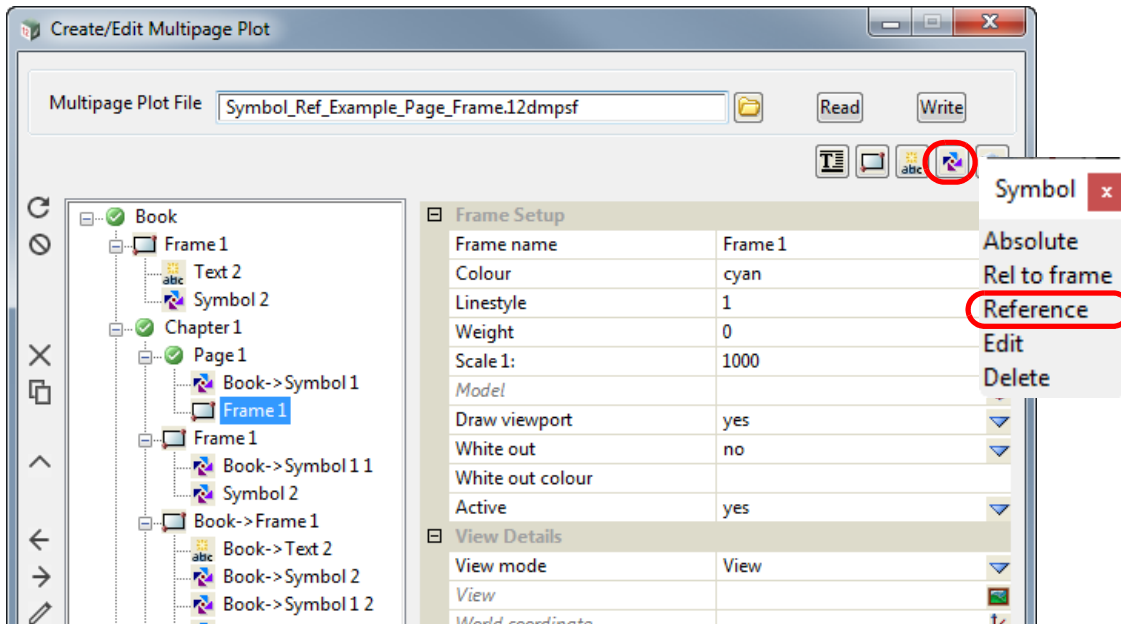


3. If you don't want to display **Chapter Reference Symbol** for a particular page, then for that page, create a **Page Reference Symbol** which references the appropriate **Chapter Reference Symbol**, and in the **Page Reference Symbol** fields, set the **Active** field to **No**.
4. If a **Book Symbol** 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**.

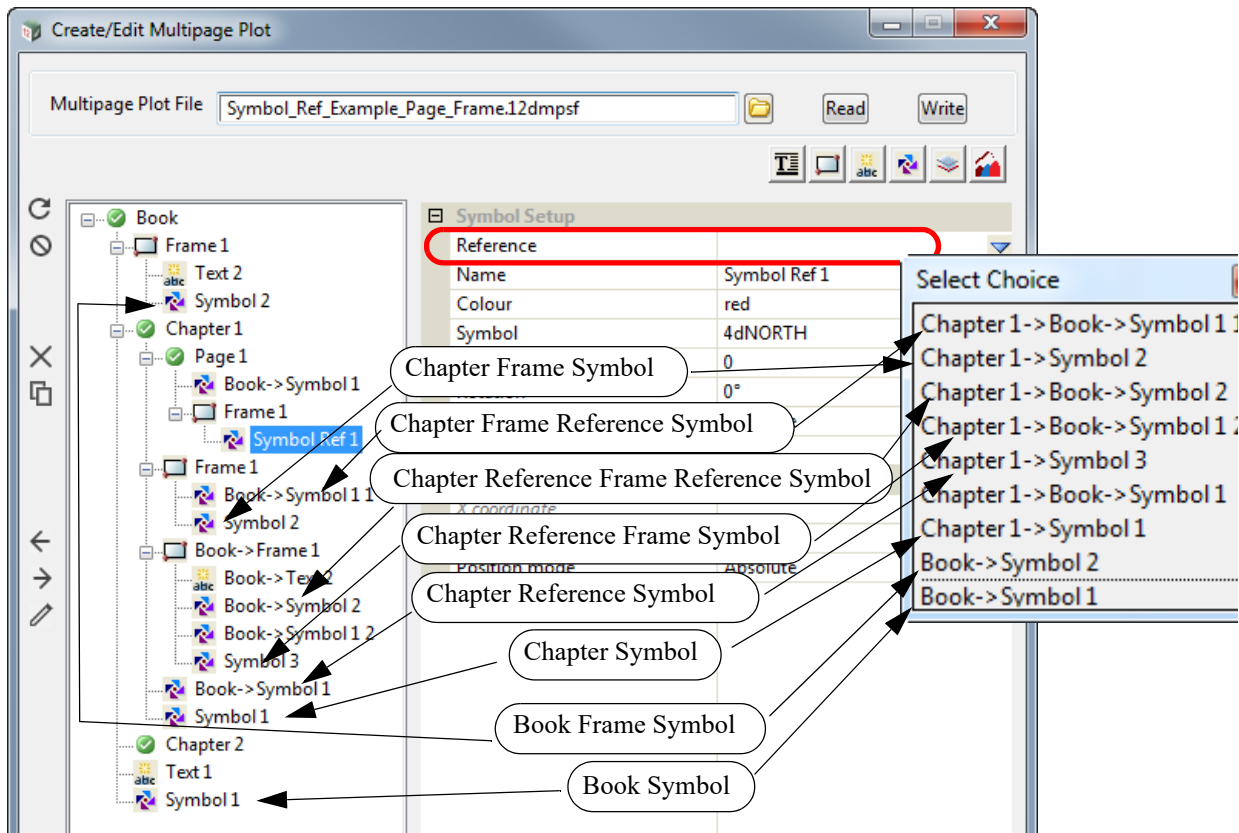


### 20.1.4.9.3.5 Creating Page Frame Reference Symbol

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.

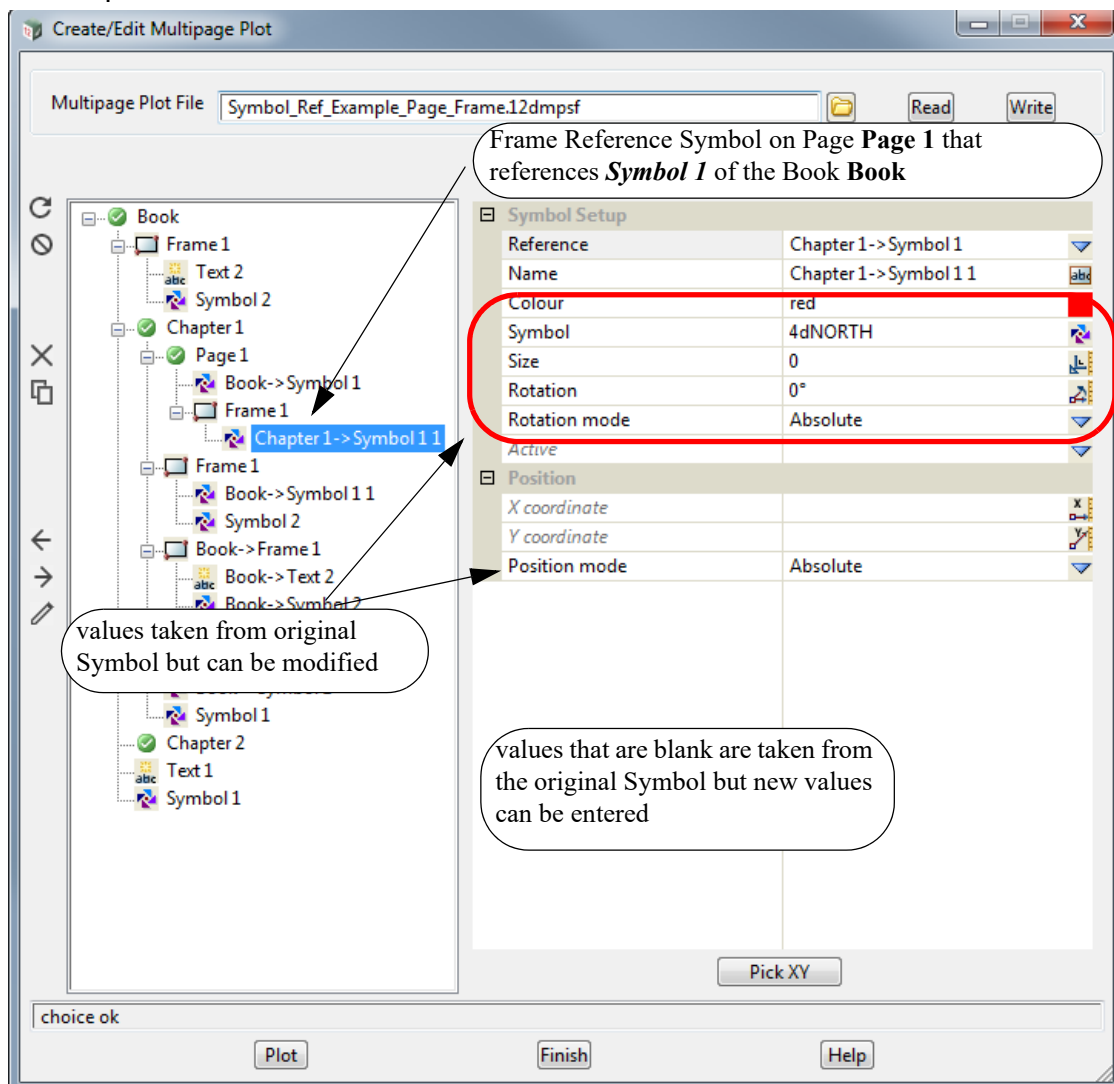


A new **Page Frame Reference Symbol** is created but it has a blank **Reference** Field.



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 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 Frame 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**

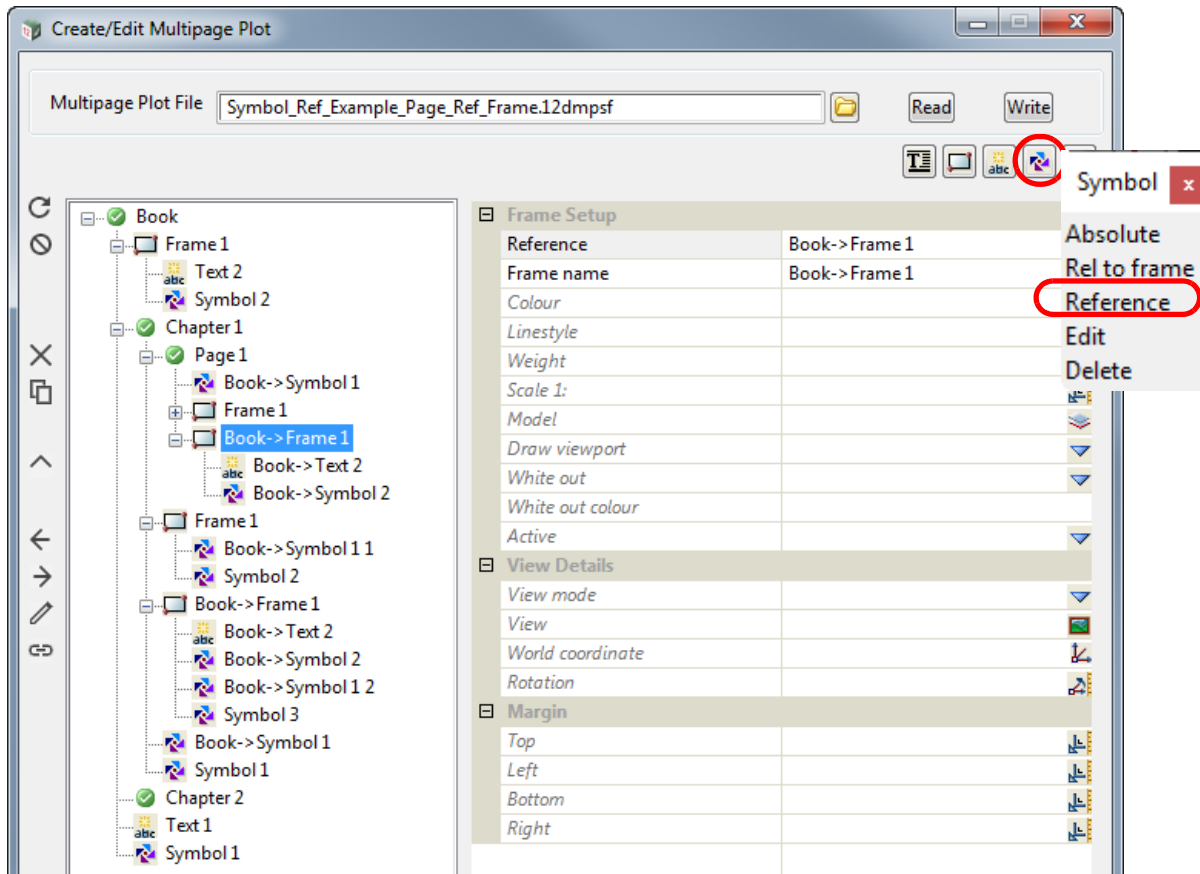
- Symbol.** This new **Page Reference Frame** will also include a **Page Reference Frame Reference Symbol** that references the appropriate **Book Frame Symbol**. And in the **Page Reference Frame Reference Symbol** fields, set the **Active** field to **No**.
- If you don't want to display **Chapter 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**.
  - 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**.
  - 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**.
  - 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 **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**.
  - 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 **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**.
  - 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 **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**.

### 20.1.4.9.3.6 Creating Page Reference Frame Reference Symbol

#### Important Note

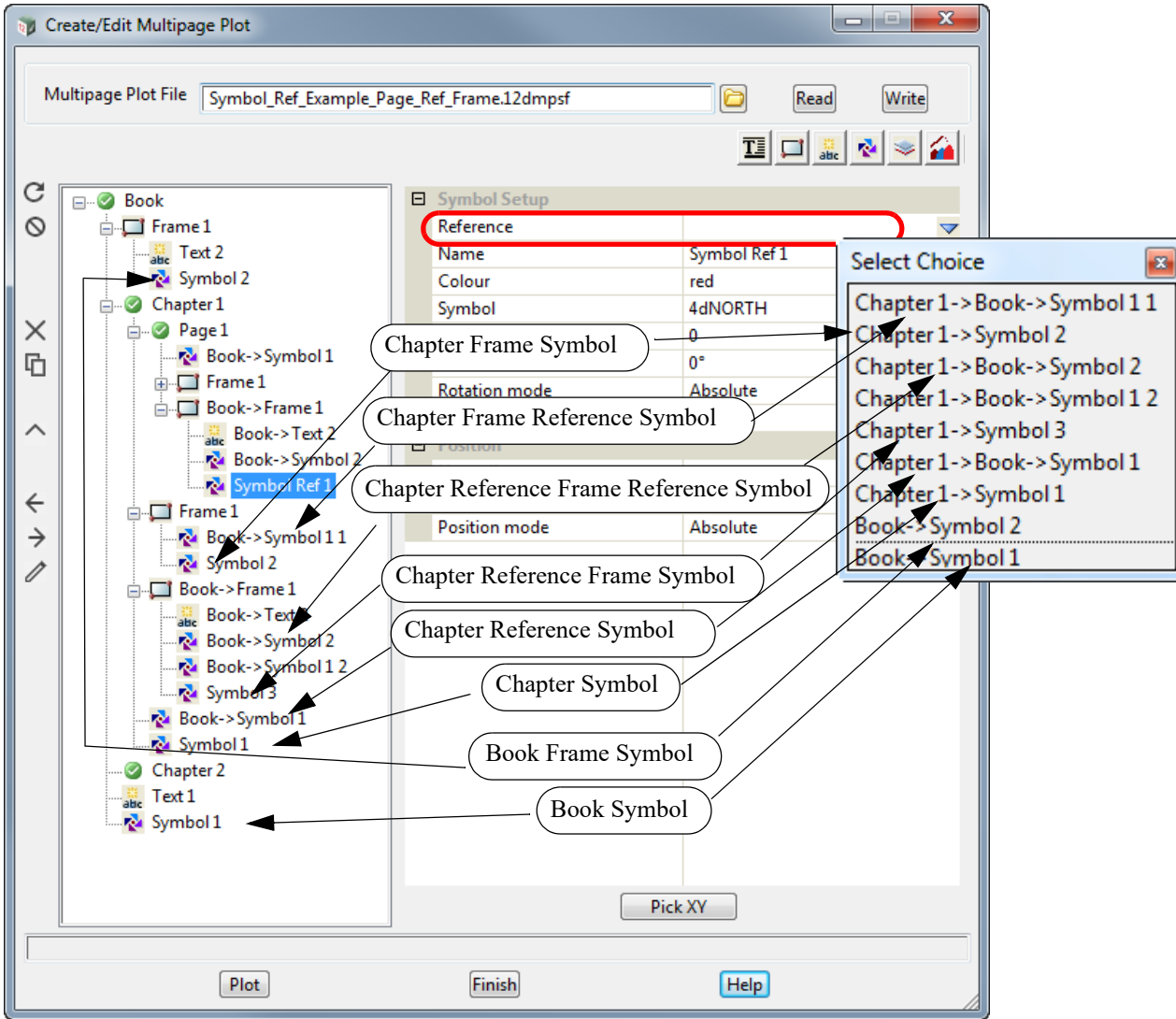
Please note that the **Page Reference Frame Reference Symbol** and a **Page Frame Reference Symbol** are virtually identical and the only difference is that one is in a **Page Reference Frame** and the other in a **Page Frame**.

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.



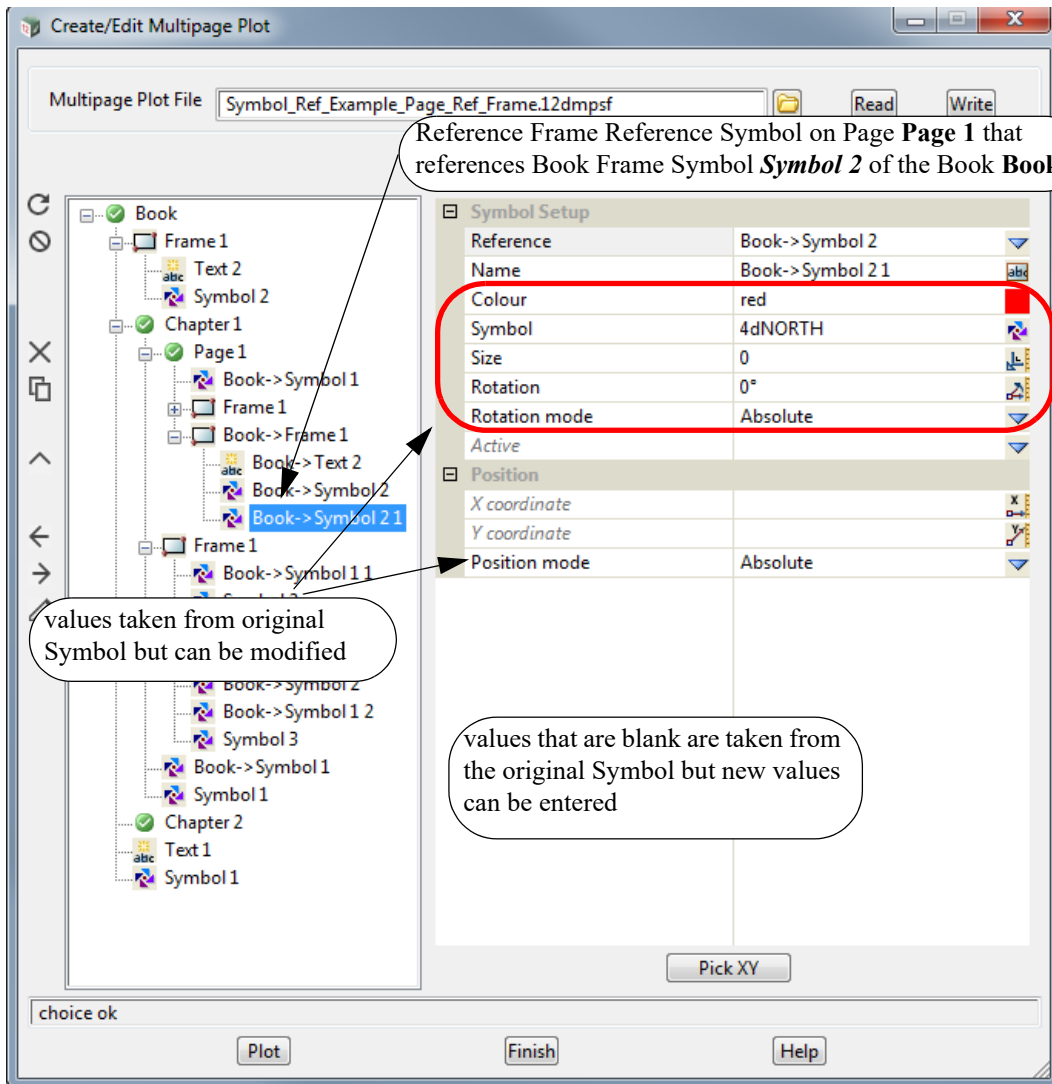
A new **Page Reference Frame Reference Symbol** is created but it has a blank **Reference** Field.





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.



### 20.1.4.9.4 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 [20.1.4.3 Icons on the Left Side](#).

#### Inherited Fields \*

Fields that support inheritance will be marked by a \* symbol next to their **Field Description**.

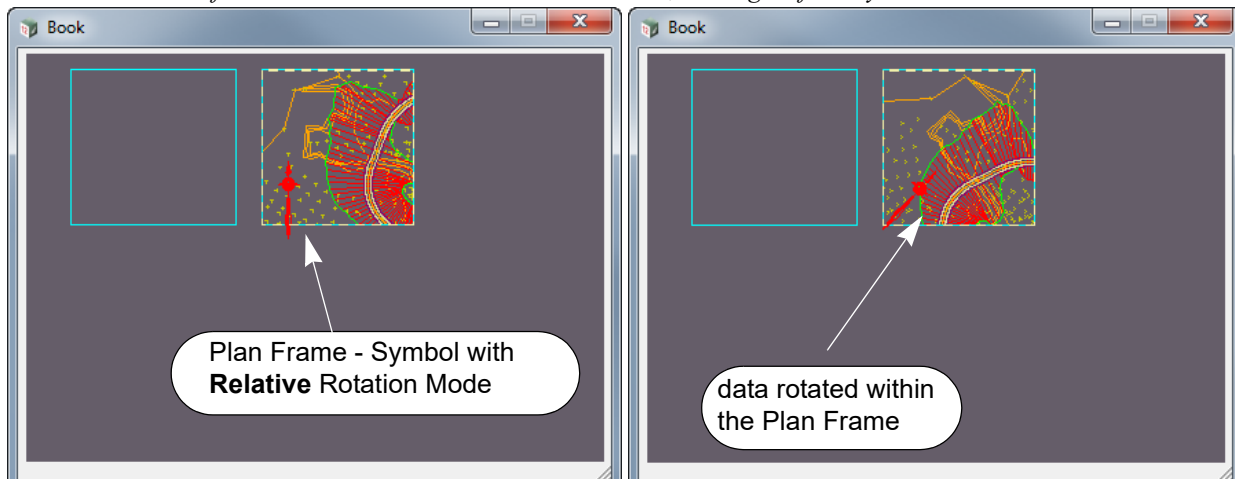
**Note:** Only **Reference Symbol** fields have inheritance support.

For more information on **Inherited Fields** see, [20.1.4.5 Inherited Fields \\*](#).

#### Symbol Setup

Name	text box	Symbol n	
<i>Name of this Symbol Node. The default is <b>Symbol n</b> where <b>n</b> is the first number (integer from zero) to make the Symbol Name unique amongst all Symbol Nodes in the tree.</i>			
<b>Colour*</b>	colour box	red	available colours
<i>Colour for the Symbol.</i>			
<b>Symbol*</b>	symbol box	NORTH	available symbols
<i>Symbol to use.</i>			
<b>Size*</b>	real box	20	
<i>Size of the Symbol.</i>			
<b>Rotation*</b>	angle box	0	
<i>Rotation angle of the Symbol.</i>			
<b>Rotation Mode*</b>	choice box	absolute	absolute, relative
<i>If <b>absolute</b>, the rotation angle of the Symbol is fixed and is defined by the value of <b>Rotation</b>.</i>			
<i>If <b>relative</b>, the rotation angle of the Symbol will match the rotation of the data within the parent Frame Node.</i>			
<b>Note:</b> 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

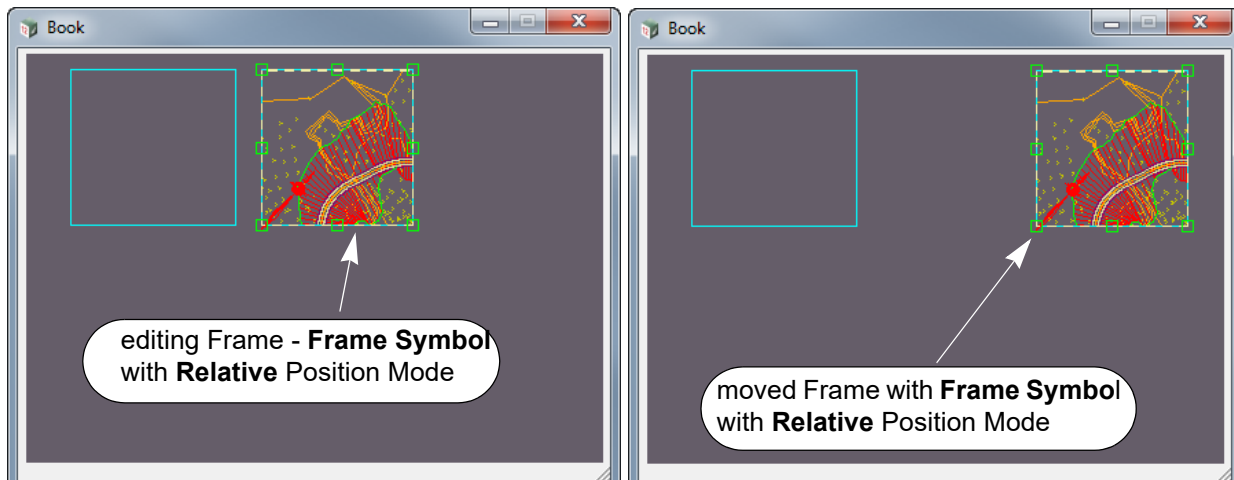
If **Absolute**, the Symbol is positioned in millimetre coordinates in the Plot Area.

If it is a **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.

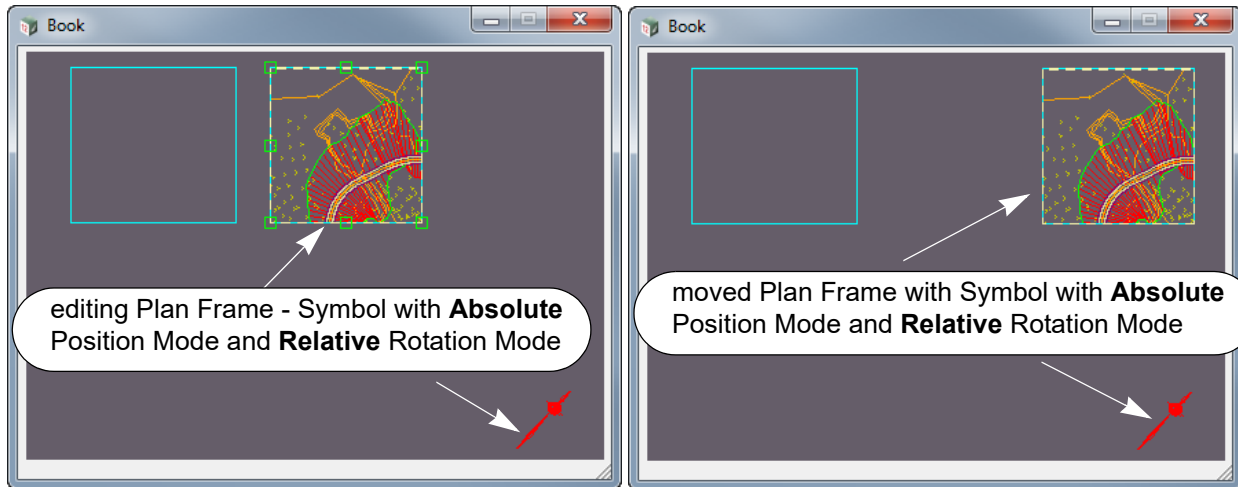
### Important Notes

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**.

#### 20.1.4.9.5 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.

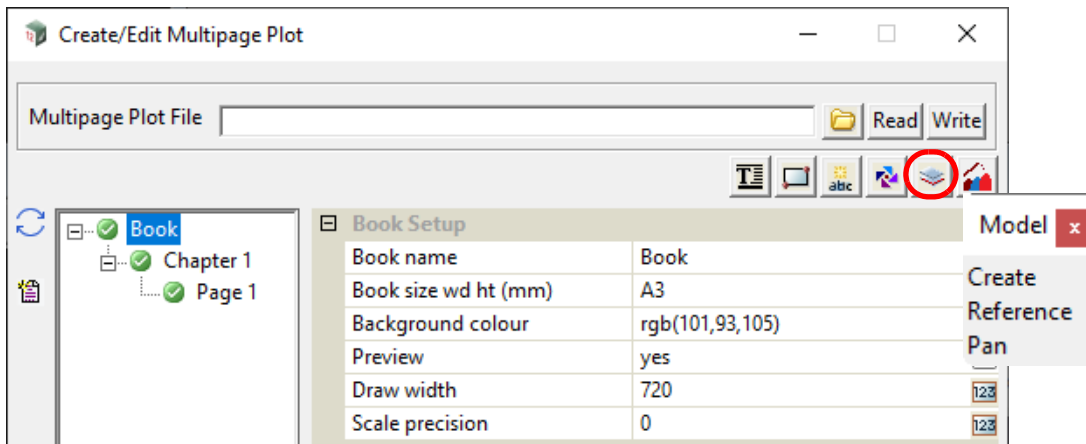
All the **Chapter Symbol nodes** are plotted on each **Page** in the **Chapter** but if the **Chapter Symbol node** appears in the tree before a **Page** in the **Chapter** then the **Chapter Symbol** is plotted before that **Page** is plotted.

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.

### 20.1.4.10 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 [20.1.4.10.1 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 [20.1.4.10.4 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**.

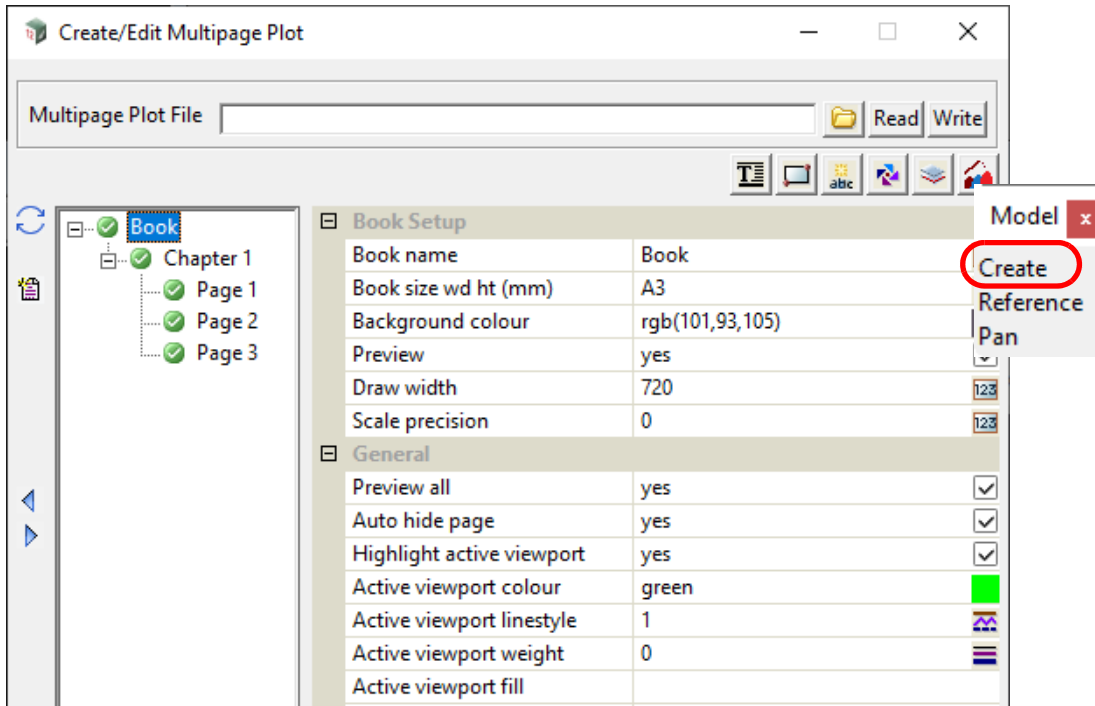
Similarly for a **Page**, the names of the **Page Model nodes** must be unique amongst all the **Page Model nodes** for that **Page**.



### 20.1.4.10.1 Creating a Model Node at the Book, Chapter or Page Level

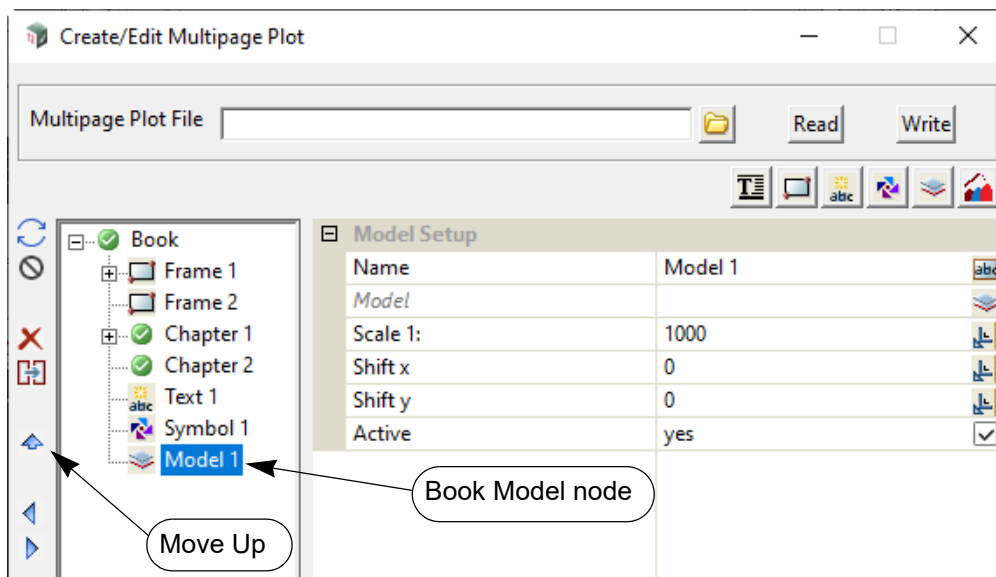
The process for creating a **Book Model** will be described in detail but the steps are identical for **Chapter** and **Page** except that the word **Book** in the description is replaced by **Chapter** or **Page**.

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.



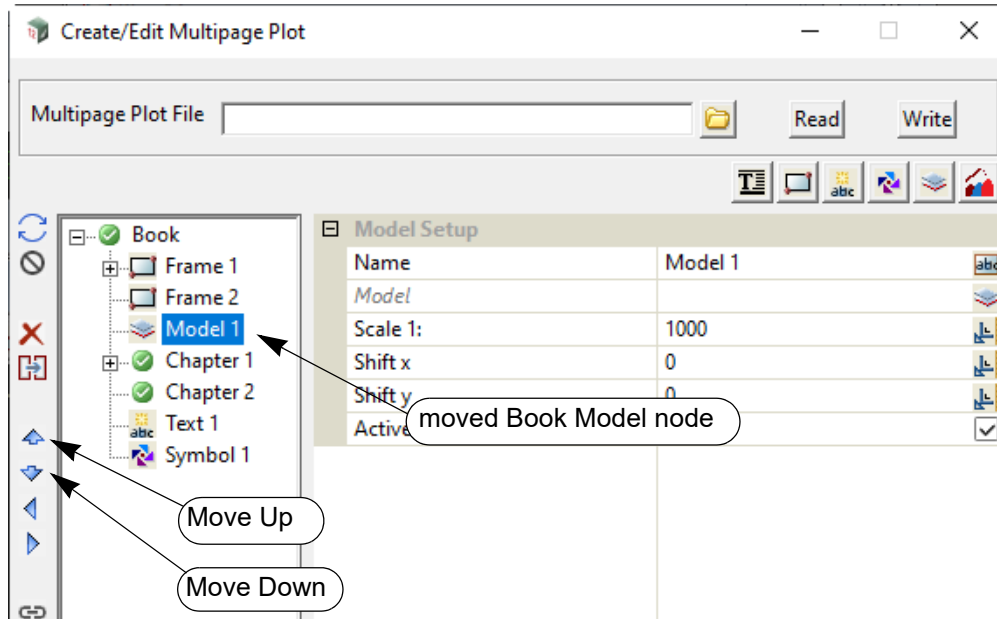
A **Book Model node** is automatically added at the bottom of the **Book** with the default name **Model n** where **n** is the next integer that makes the **Book Model node** name unique amongst all the **Book Model nodes**.

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**.



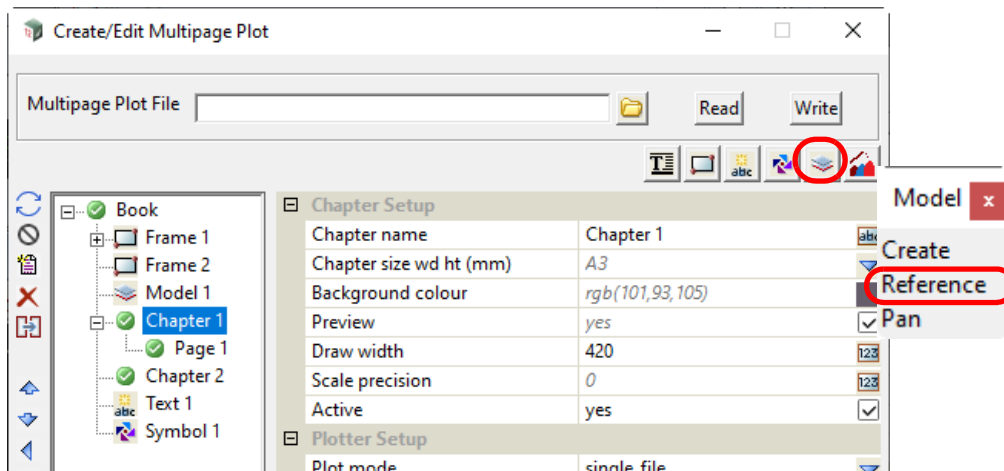


Once a **Model node** is created, it can be moved **Up** and **Down** at that level by using **Up** and **Down** on the left hand side.

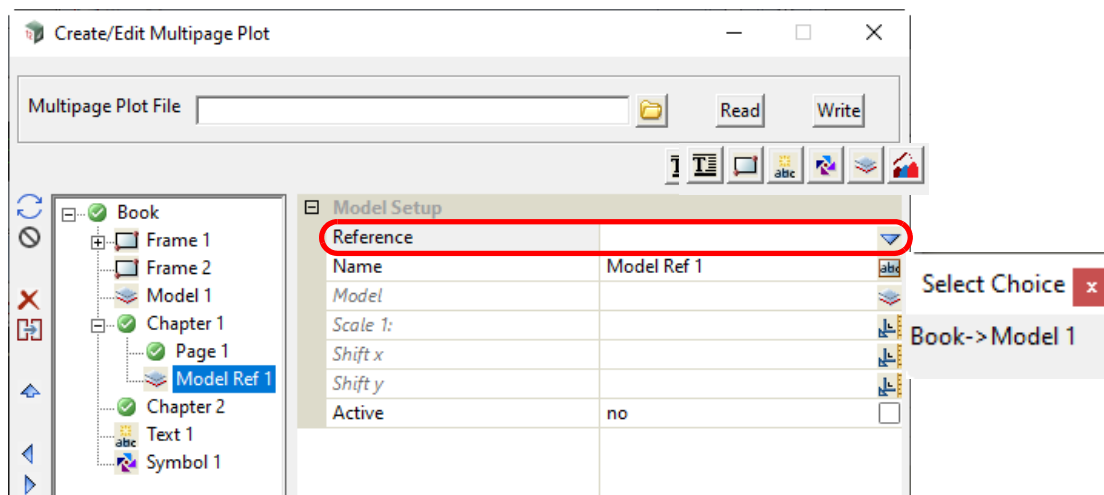


### 20.1.4.10.1.1 Chapter Reference Model

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.

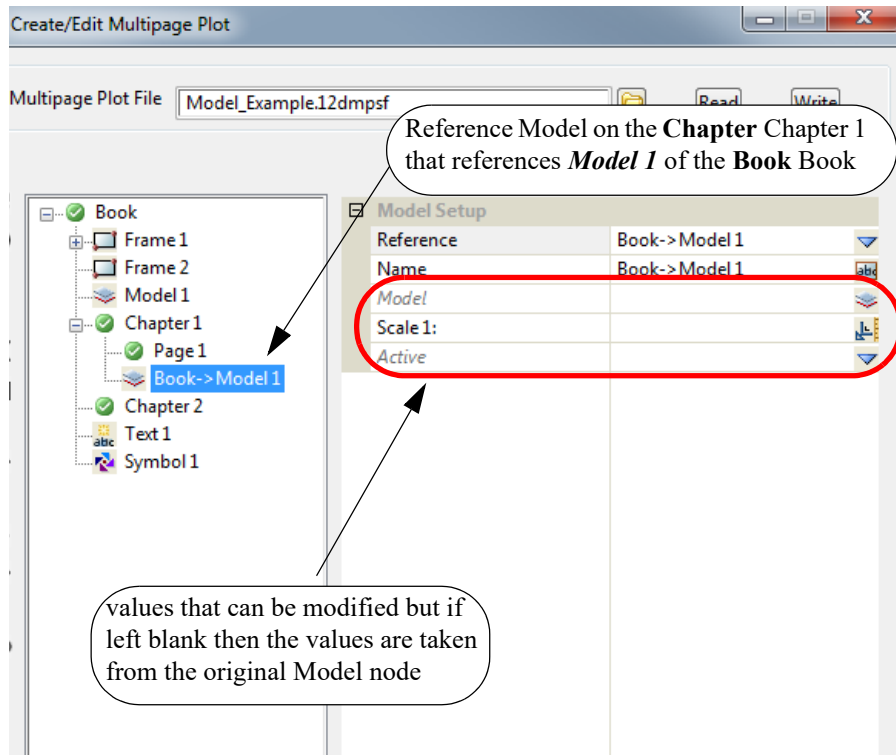


A new **Chapter Reference Model** node is created but it has a blank **Reference** Field.



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**.

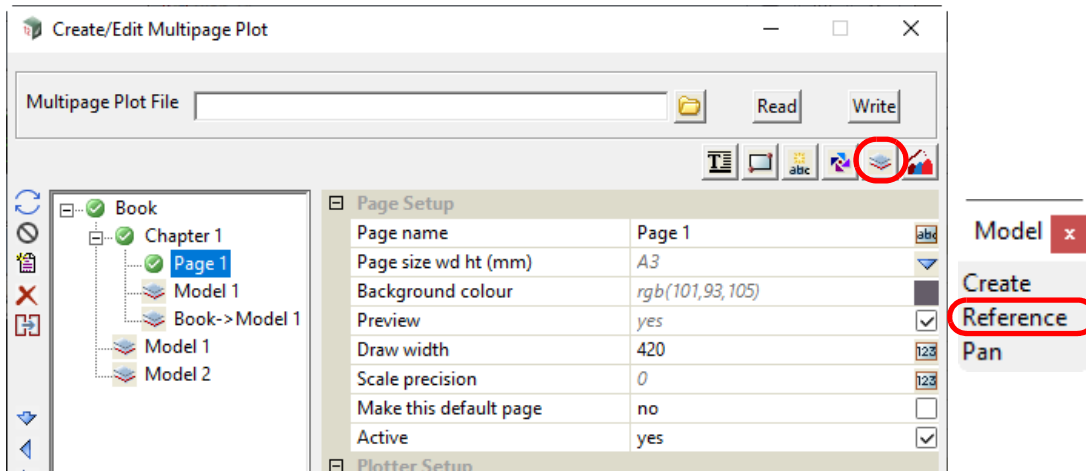
#### Important Note

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**.

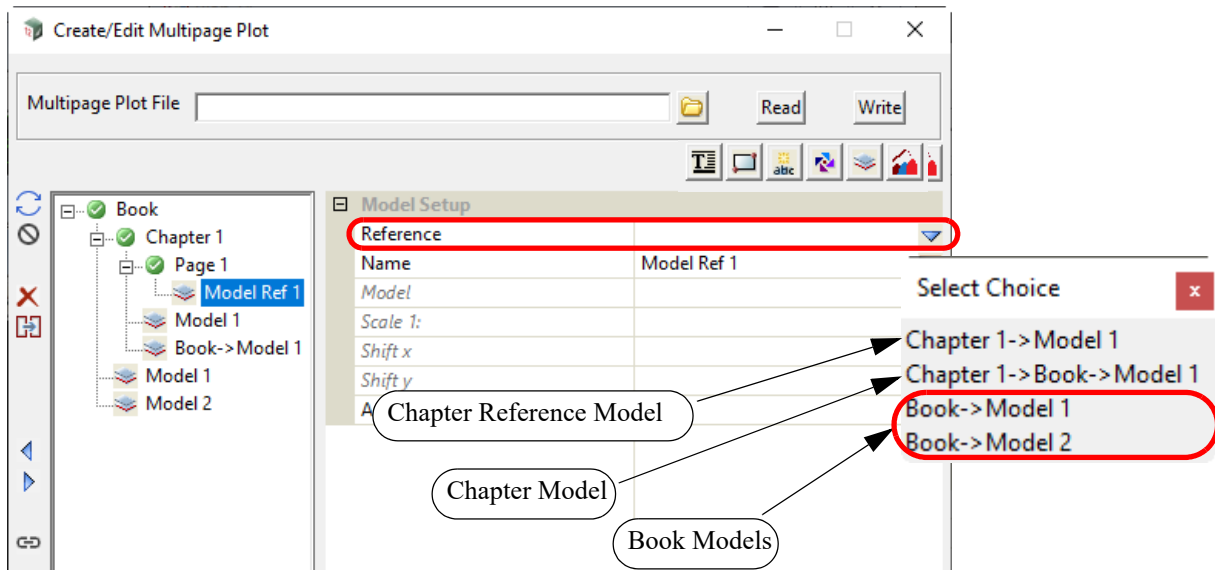
Similarly if a **Book Model** has been set to **Inactive** (i.e. OFF) then it can be displayed for a particular chapter by creating a **Chapter Reference Model** for that chapter and referencing the appropriate **Book Model**, and in the **Chapter Reference Model** fields, set the **Active** field to **Yes**.

### 20.1.4.10.1.2 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.

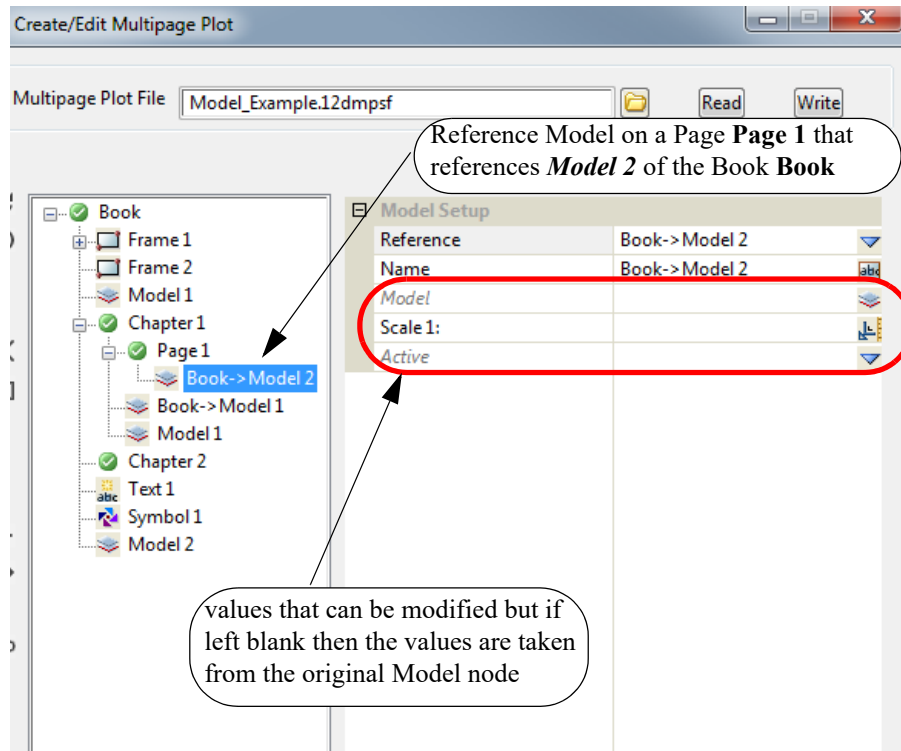


A new **Page Reference Model** is created but it has a blank **Reference** Field.



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**.

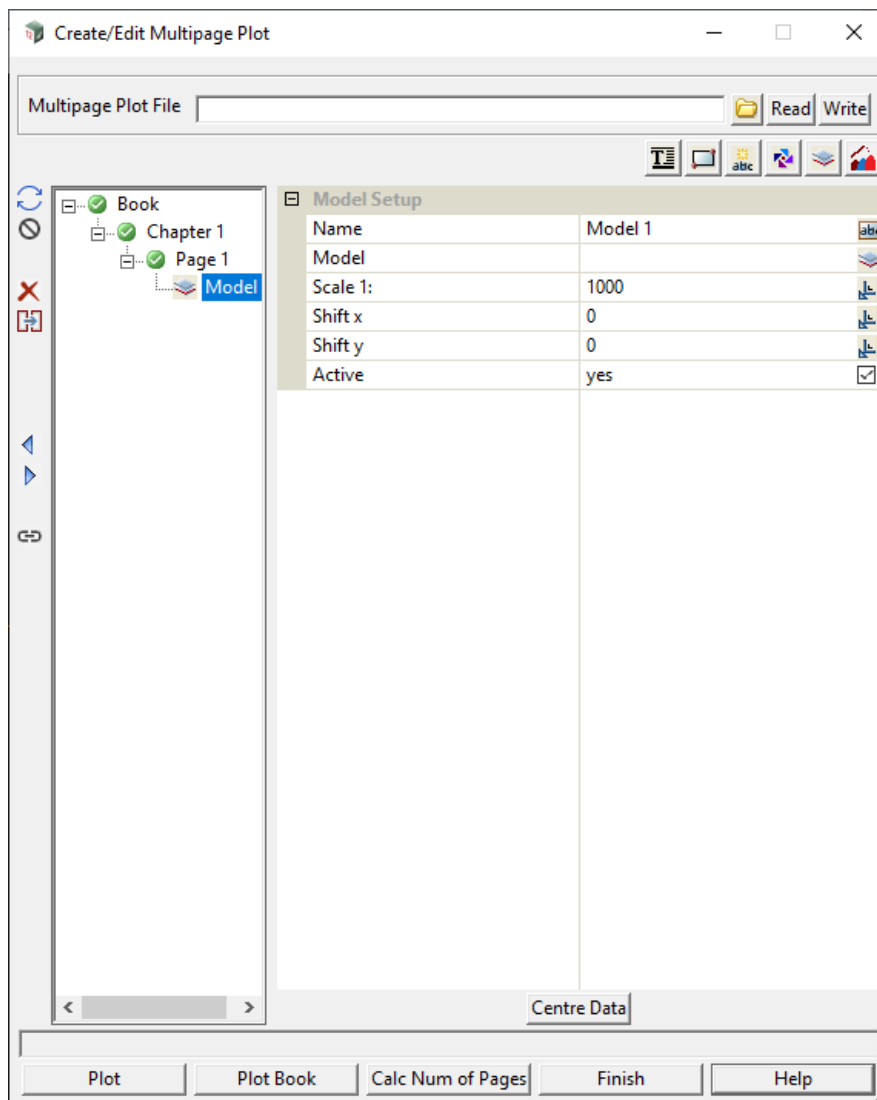
If the **Page Reference Model** references a **Chapter Reference Model** then the fields in the Page Reference Model override the fields in the **Chapter Reference Model** which in turn override the fields in the original **Book Model**.

#### 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**.

### 20.1.4.10.2 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 [20.1.4.3 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, [20.1.4.5 Inherited Fields \\*](#).

#### Model Setup

<b>Name</b>	text box	
	<i>Name of the Model node.</i>	
<b>Model*</b>	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.*

### 20.1.4.10.3 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 [20.1.4.10.5 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 [20.1.4.10.5 Examples of Model Nodes](#).

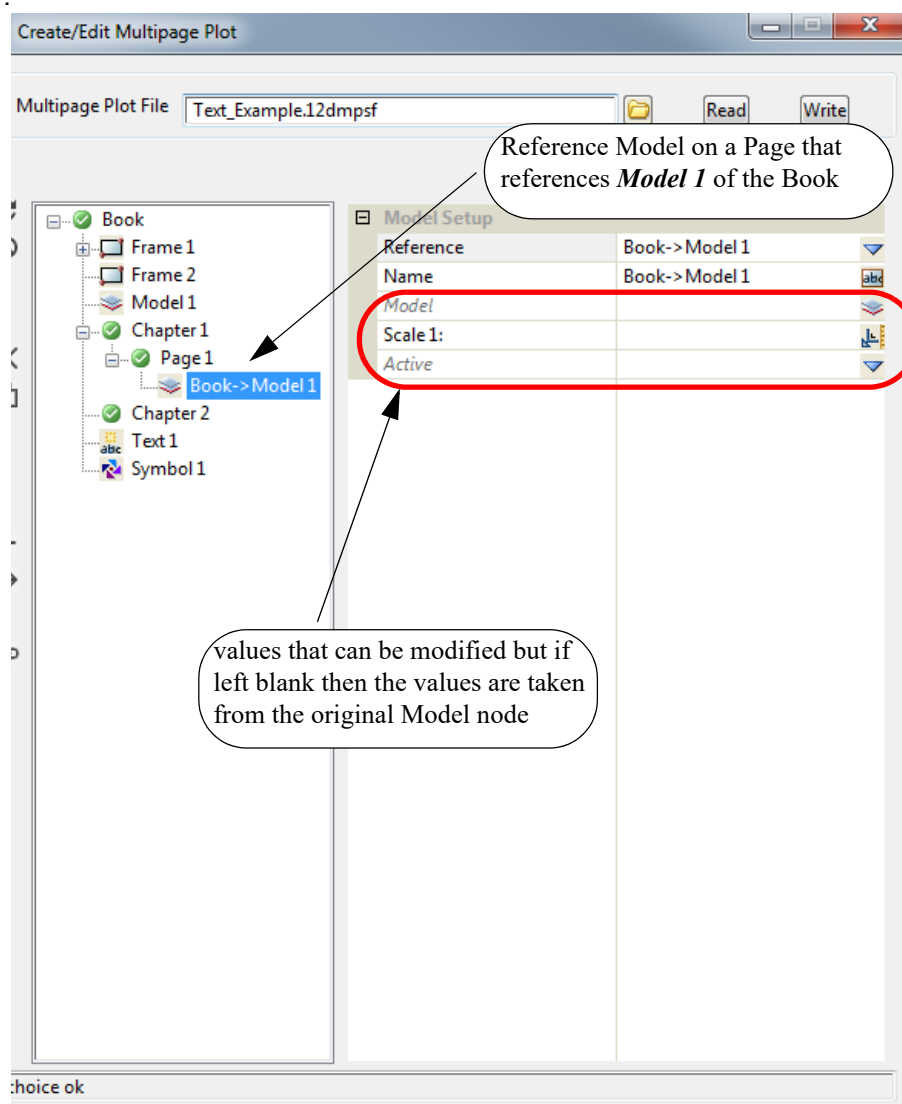
Finally for a **Page node**, the order of the plotting is in the order of the items in the **Page** subtree.

#### 20.1.4.10.4 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**.

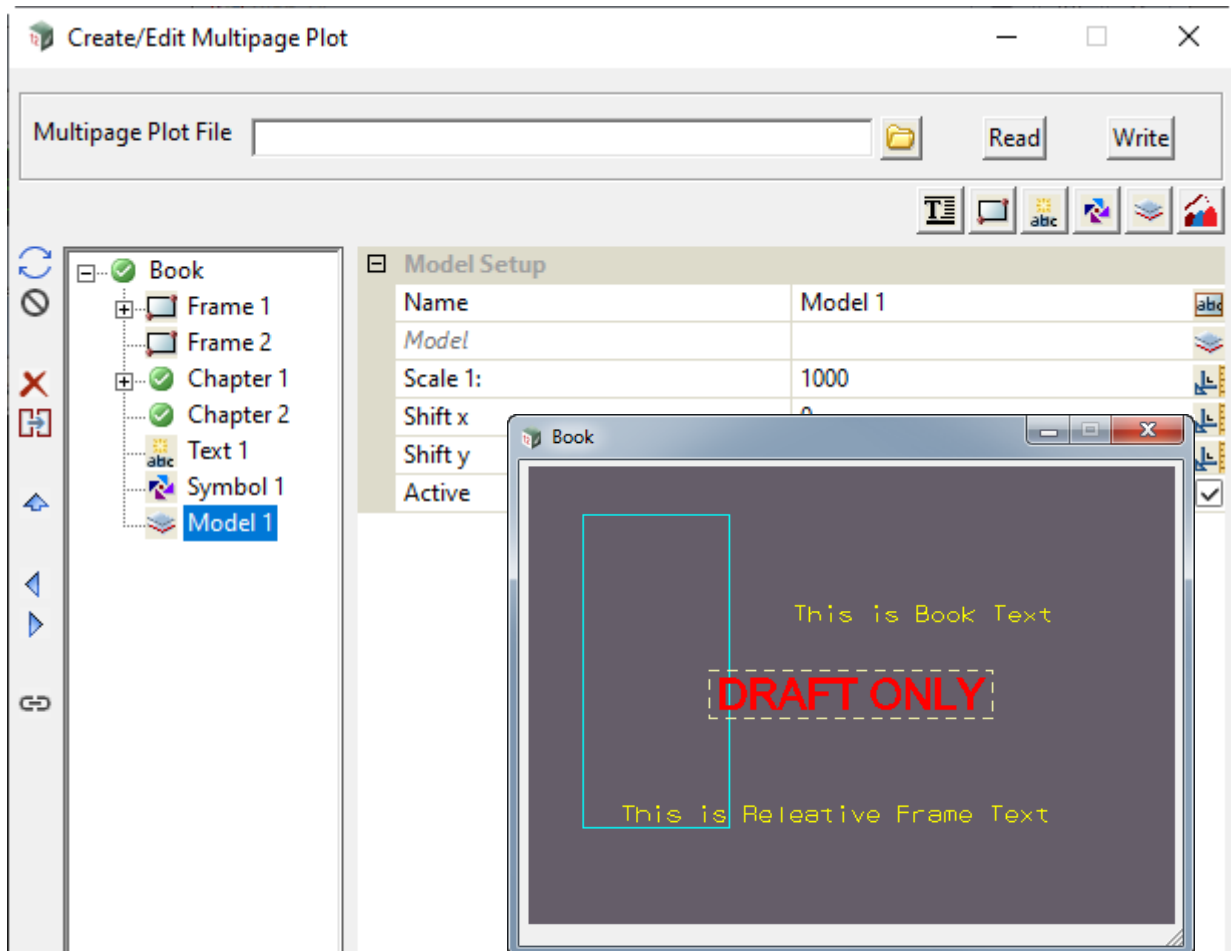
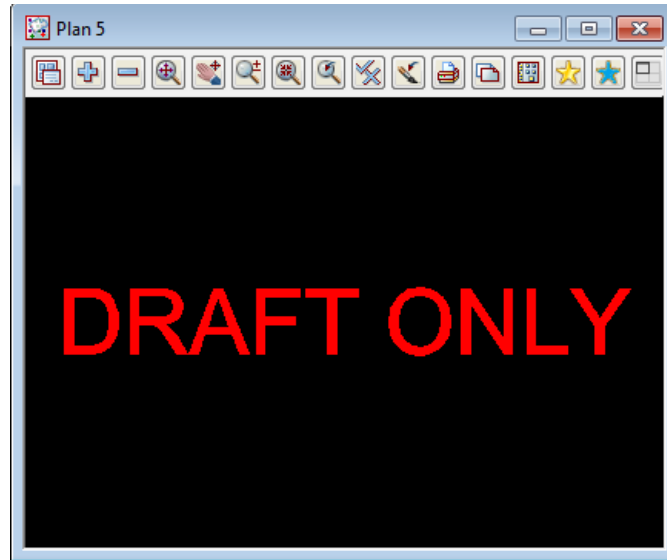


A **Reference Model** can be is created in two ways:

- Chapter Reference Model.** See [20.1.4.10.1.1 Chapter Reference Model](#).
- Page Reference Model.** See [20.1.4.10.1.2 Page Reference Model](#).

### 20.1.4.10.5 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.



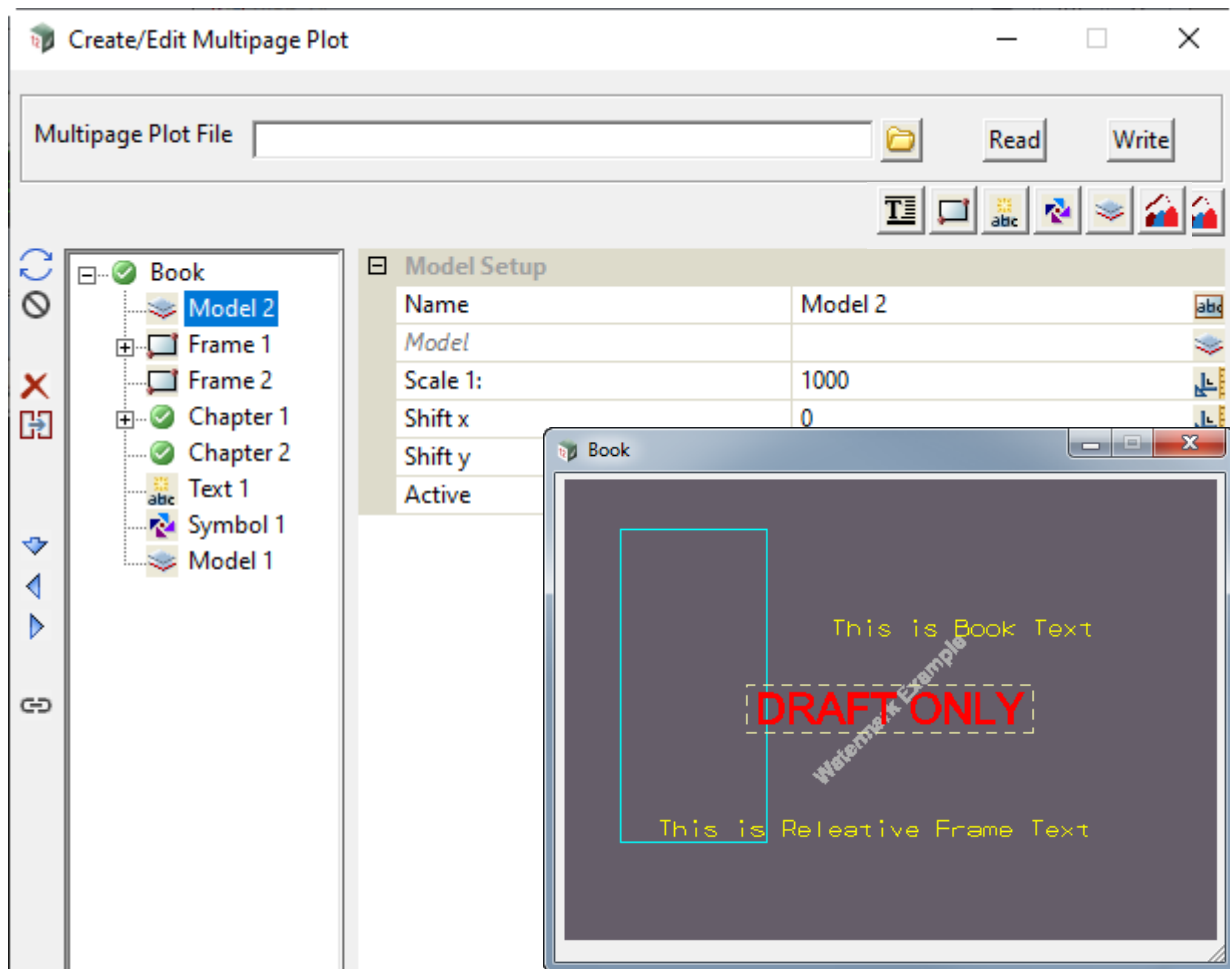
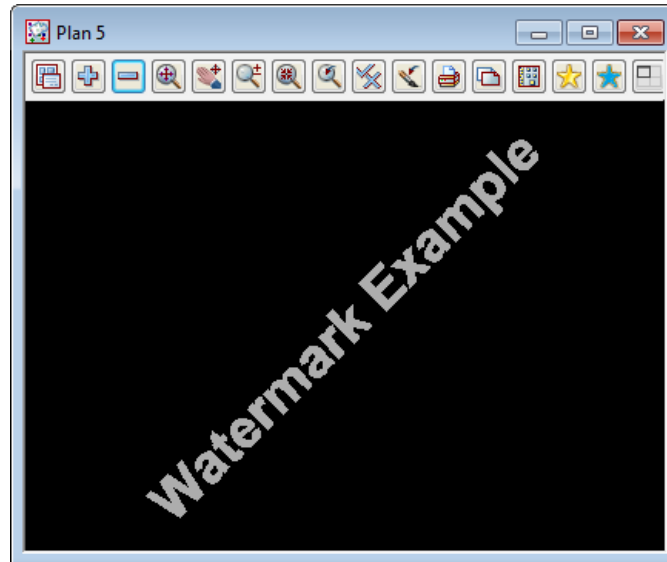
Although all the **Models** at **Book** level will be plotted on each **Page**, the order of the **Model node** in the tree is still very important.

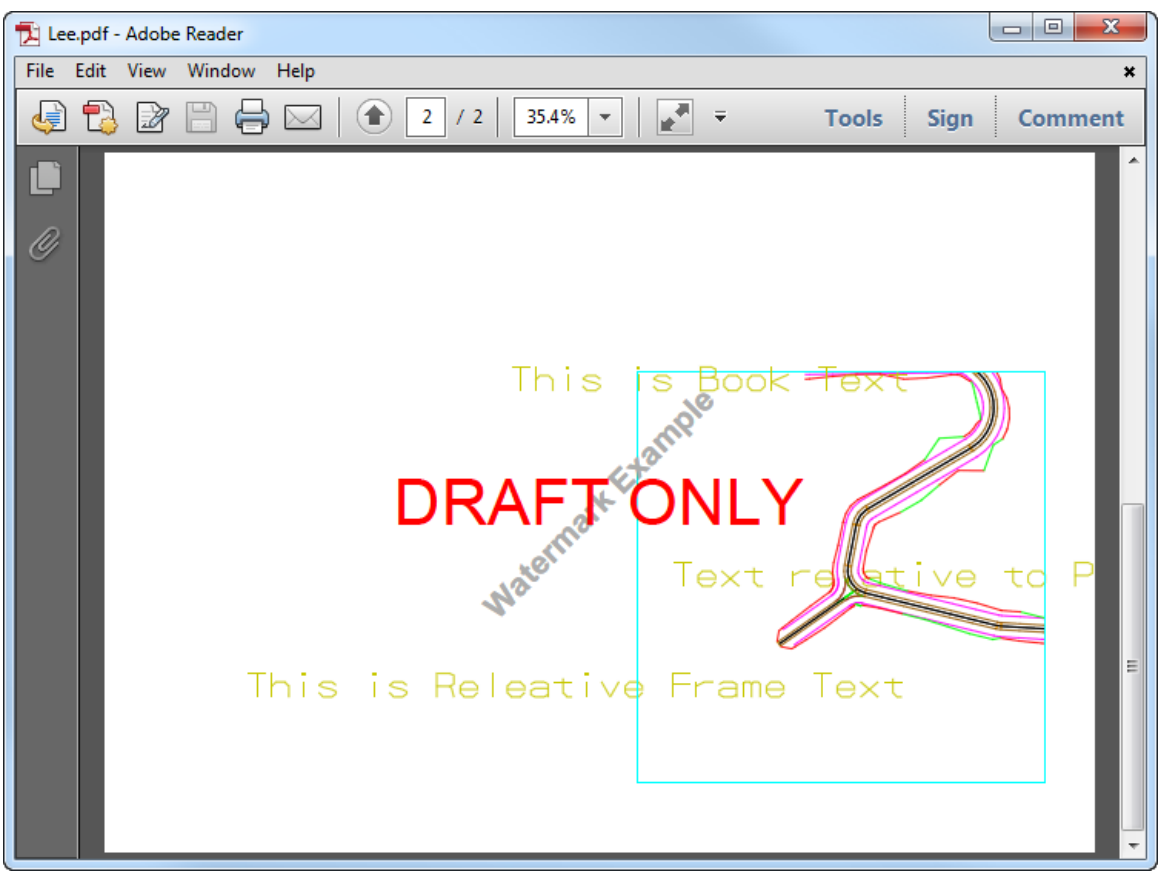
In the example just given, the **Model node** is at the bottom of the tree and so the words *Draft Only*

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.





### 20.1.4.11 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 [20.1.4.11.2 X-Section Chapter](#)

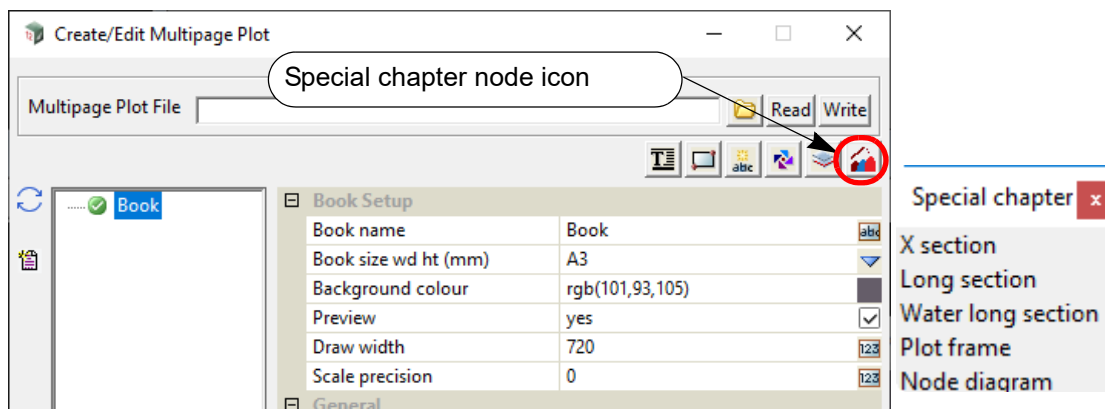
Long Section [20.1.4.11.3 Long Section Chapter](#)

Water Long Section [20.1.4.11.4 Water Long Section Chapter](#)

Plot Frame [20.1.4.11.5 Plot Frame Chapter](#)

Water Node Diagram [20.1.4.11.6 Node Diagram Chapter](#)

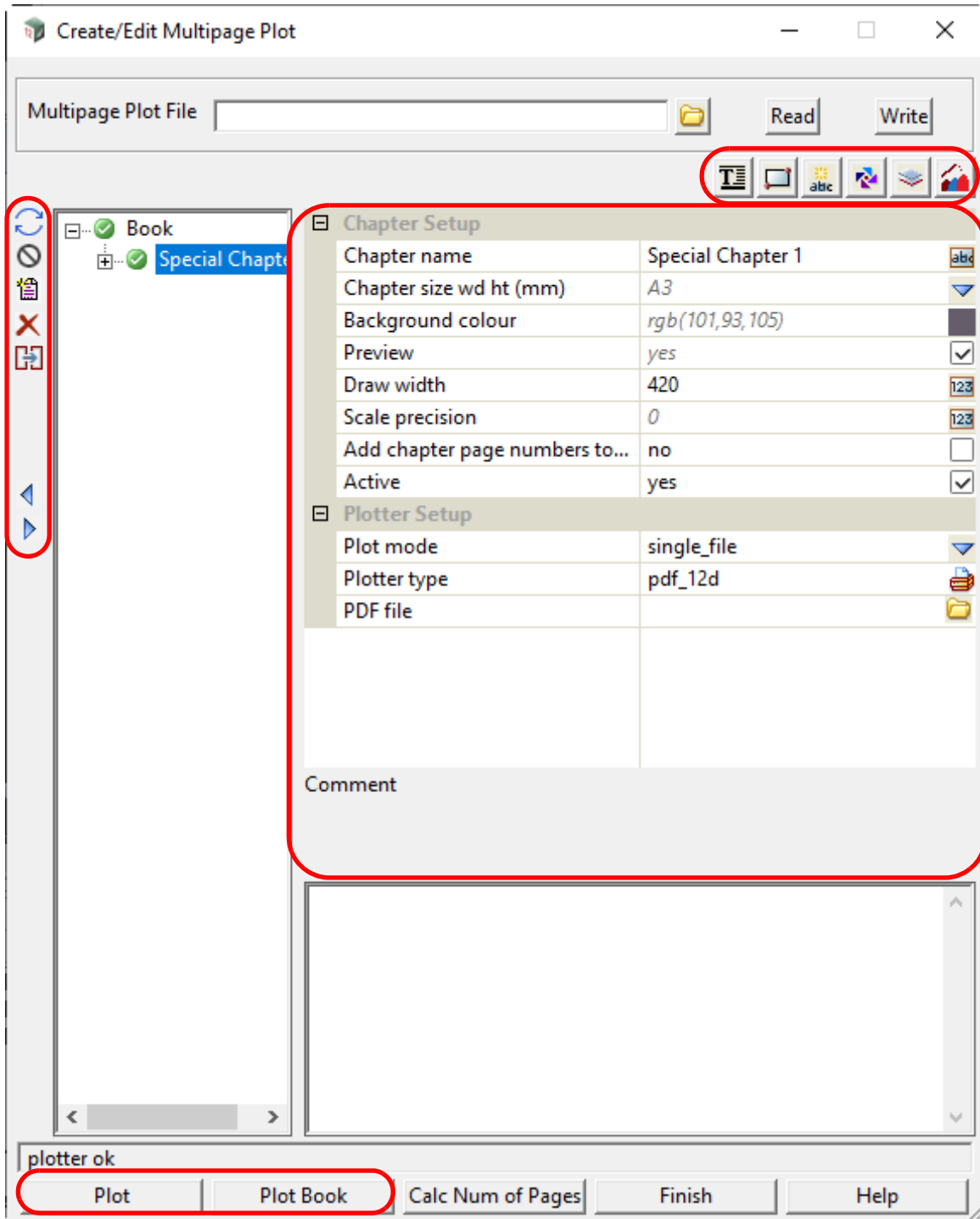
Special Chapters are created using the Special Chapter Node Icon.



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.



### 20.1.4.11.1 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 [20.1.4.3 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 [20.1.4.1 Chapter](#).

### Icons on Right Side

The icons are described in [20.1.4.4 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, [20.1.4.5 Inherited Fields \\*](#).

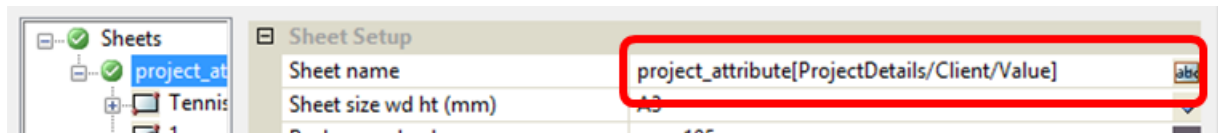
### Special Chapter Setup

**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.*

*eg. 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

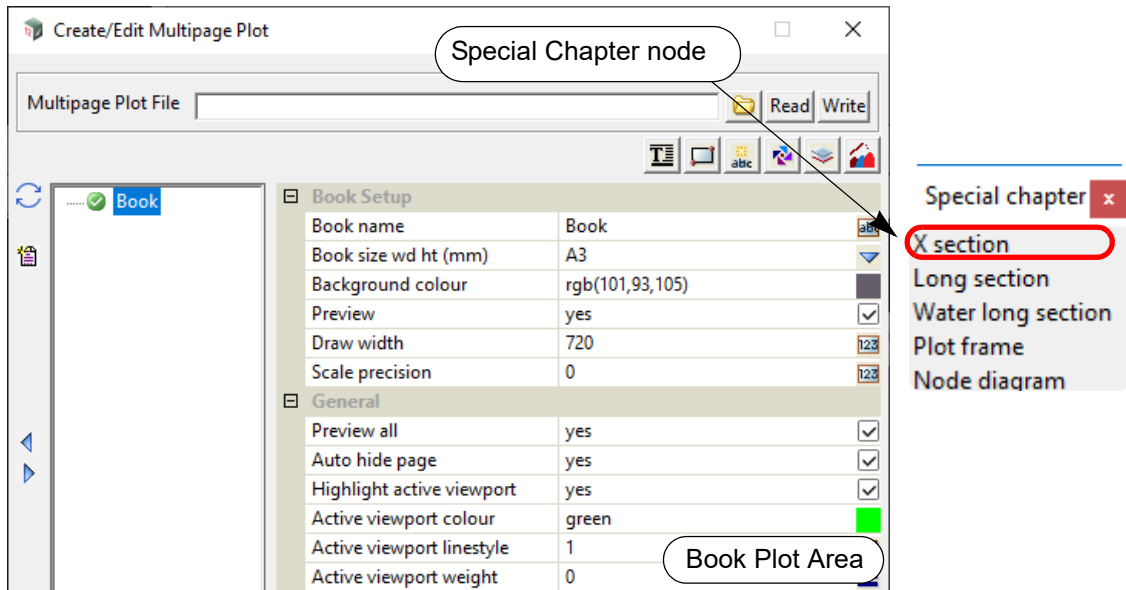
*Triggers plotting from the Book Node regardless of the currently highlighted node. The **Plotter Setup** from the Book Node is used for the plot.*

## Important Notes

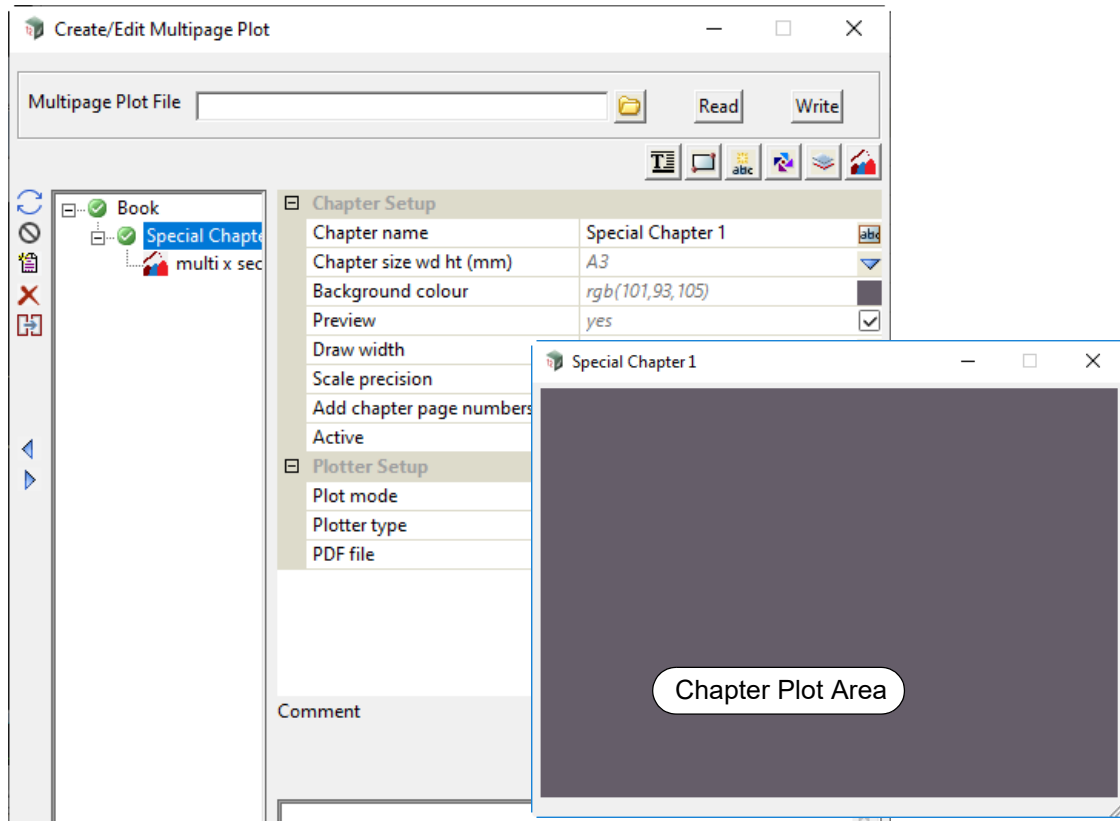
*If the Special Chapter is inactive then nothing in the Special Chapter will plot.*

*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.*

### 20.1.4.11.2 X-Section Chapter

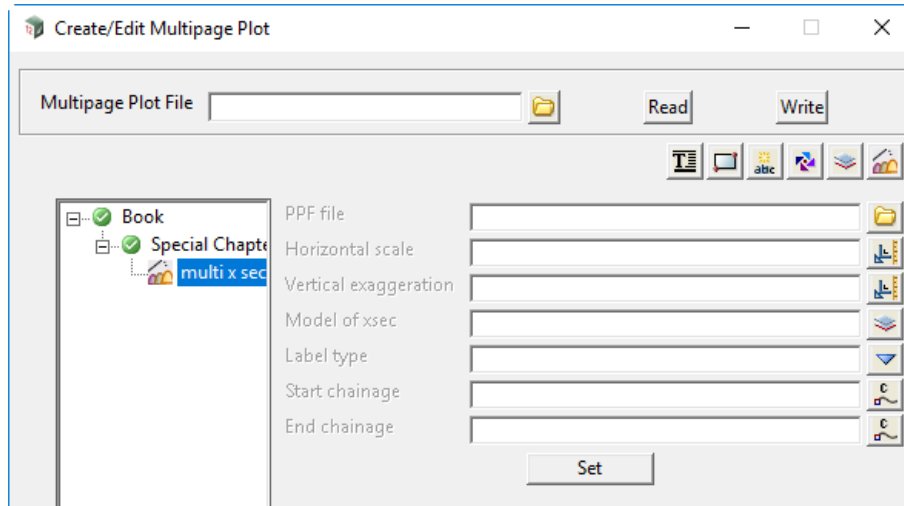


Clicking on the **Special Chapter node >X-Section** option creates a X-sections Chapter with a subnode called **multi x-sections**.



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.*

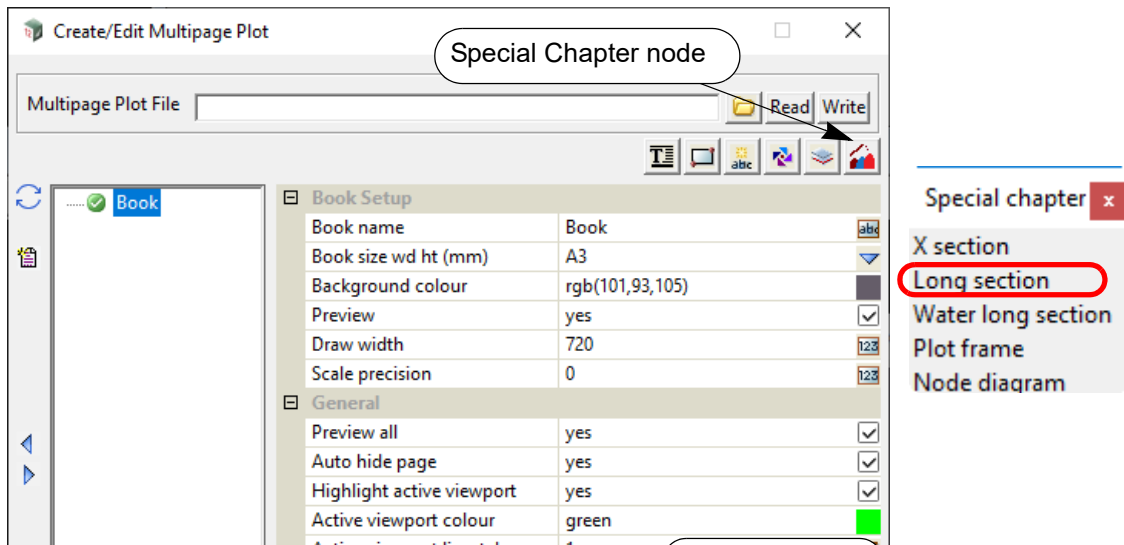


#### 20.1.4.11.2.1 Notes on Using the X-Section Chapter

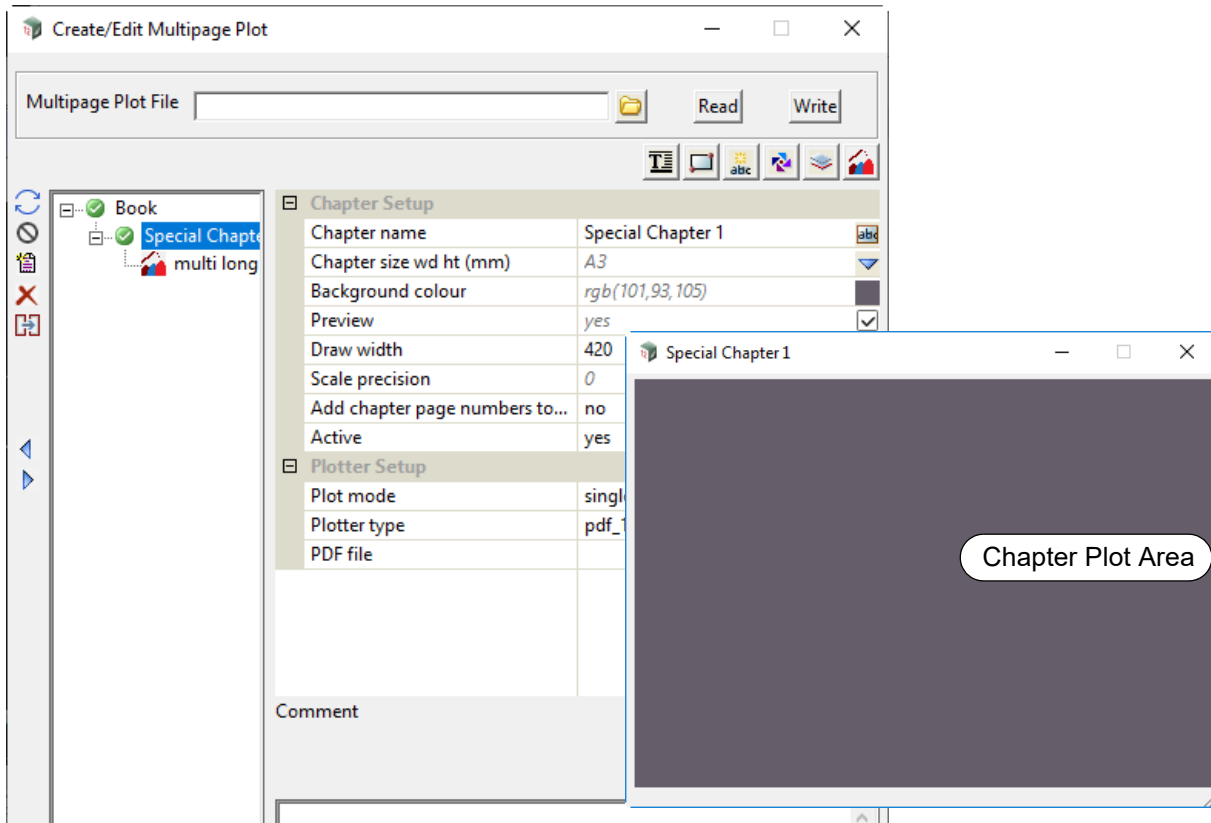
1. No other pages can be added to the X-Section Chapter and the drawing of the x-sections on each page is determined by the information in the X-Plot PPF file.
2. The *Title Block* in the X-Plot PPF is NOT used.
3. If they are not blank, the *Start and End Chainages* in the PPF are NOT used and are replaced 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 [20.1.4.8.6 MPS Text \\$variables](#).

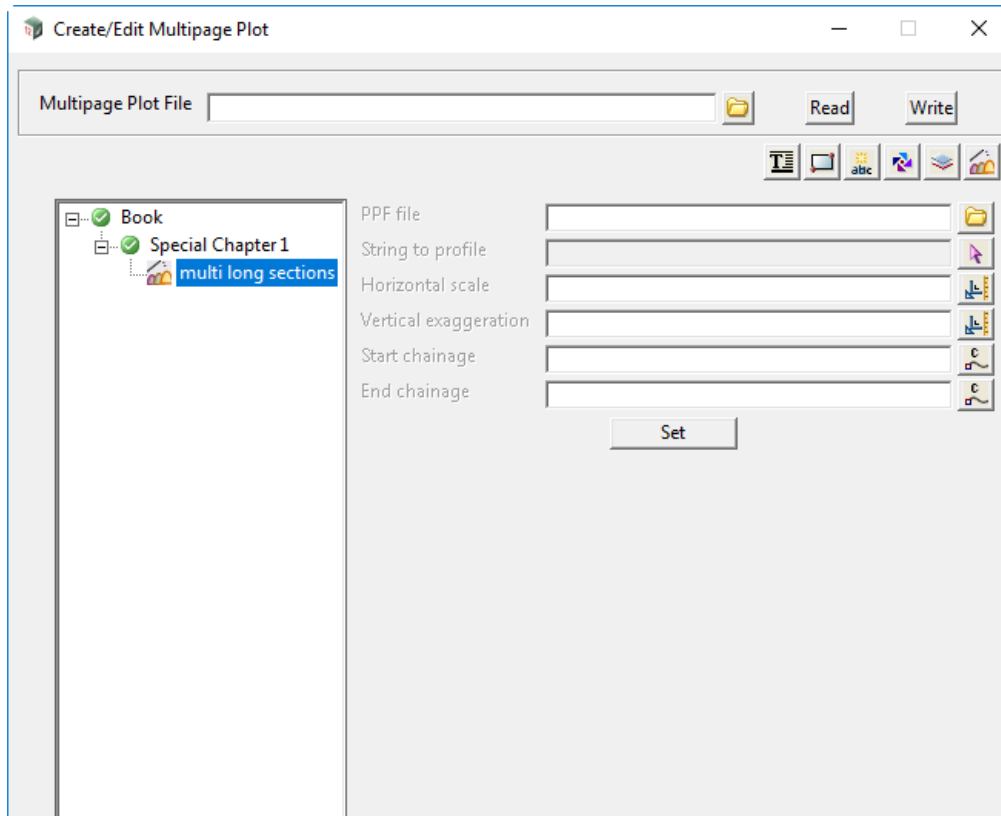
### 20.1.4.11.3 Long Section Chapter



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.

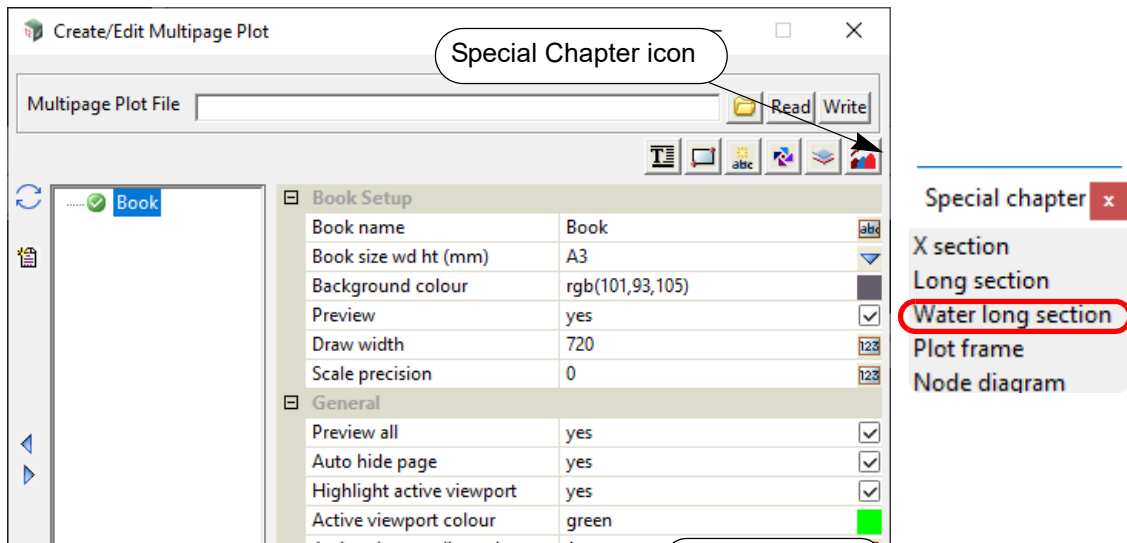
Note that a **Write** needs to be done to update the Multipage plots file.

### 20.1.4.11.3.1 Notes on Using the Long Section Chapter

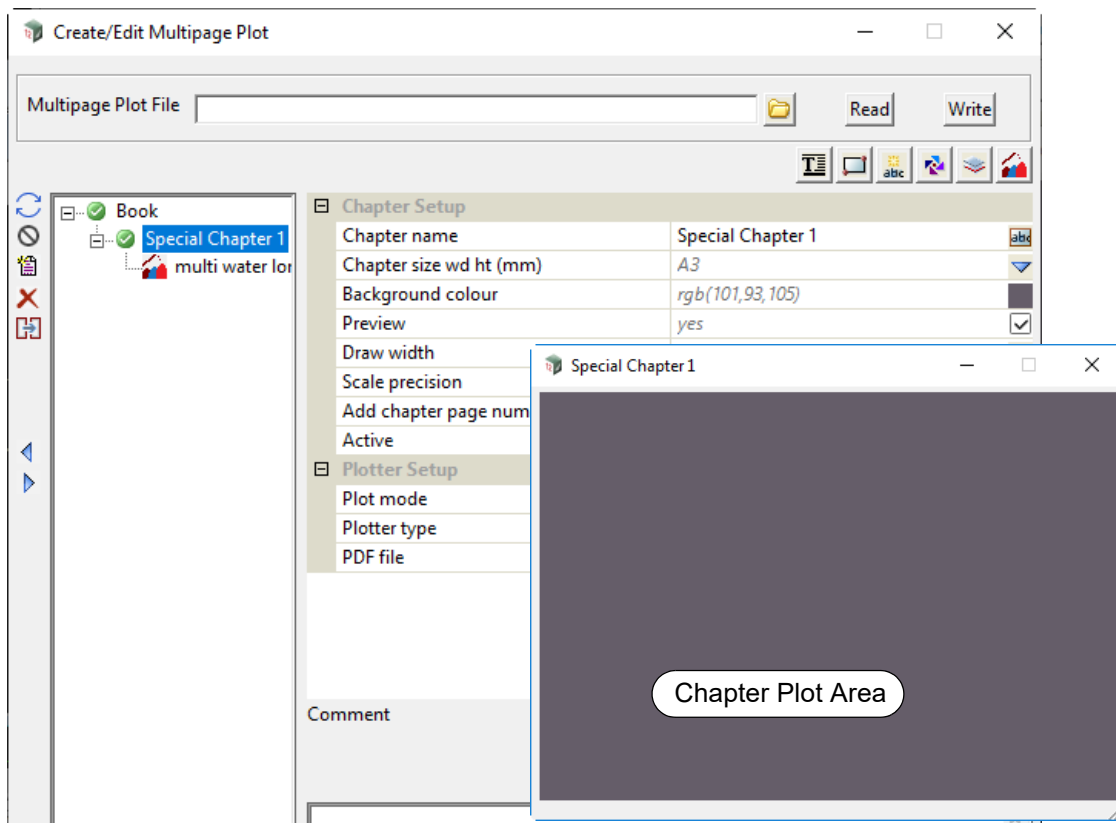
1. No other pages can be added to the Long Section Chapter and the drawing of the long section of the primary string on each page is determined by the information in the Long Plot PPF file.
2. The *Title Block* in the Long Plot PPF is NOT used.
3. If they are not blank, the *Start and End Chainages* 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 [20.1.4.8.6 MPS Text \\$variables](#).

### 20.1.4.11.4 Water Long Section Chapter

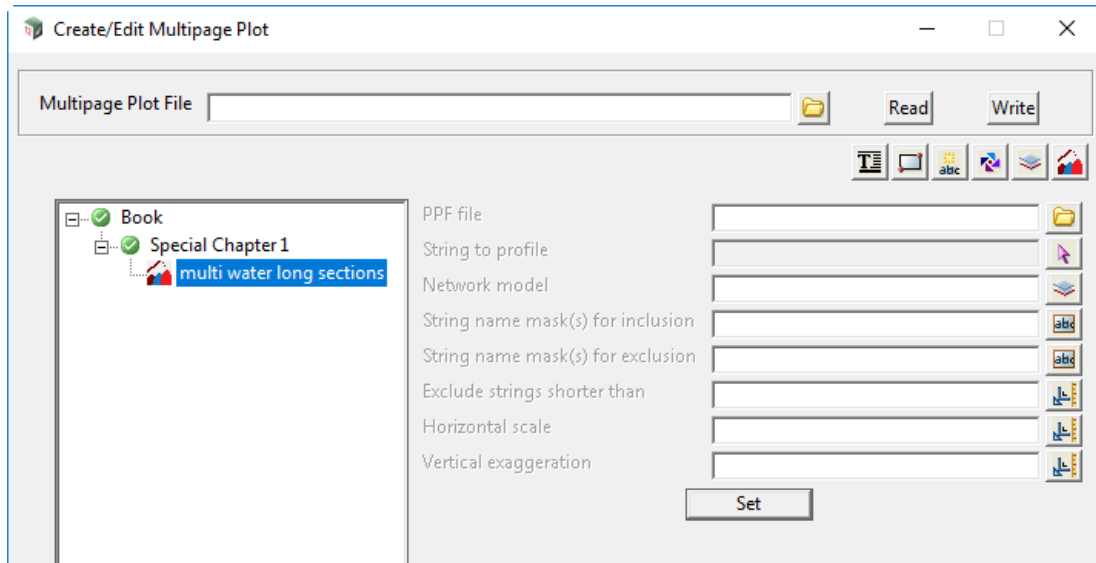


Clicking on the **Special Chapter >Water long section** option creates a Water Long section Chapter with a subnode called **multi water long sections**.



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 [26.7.2.1 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 [26.7.2.1 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.*

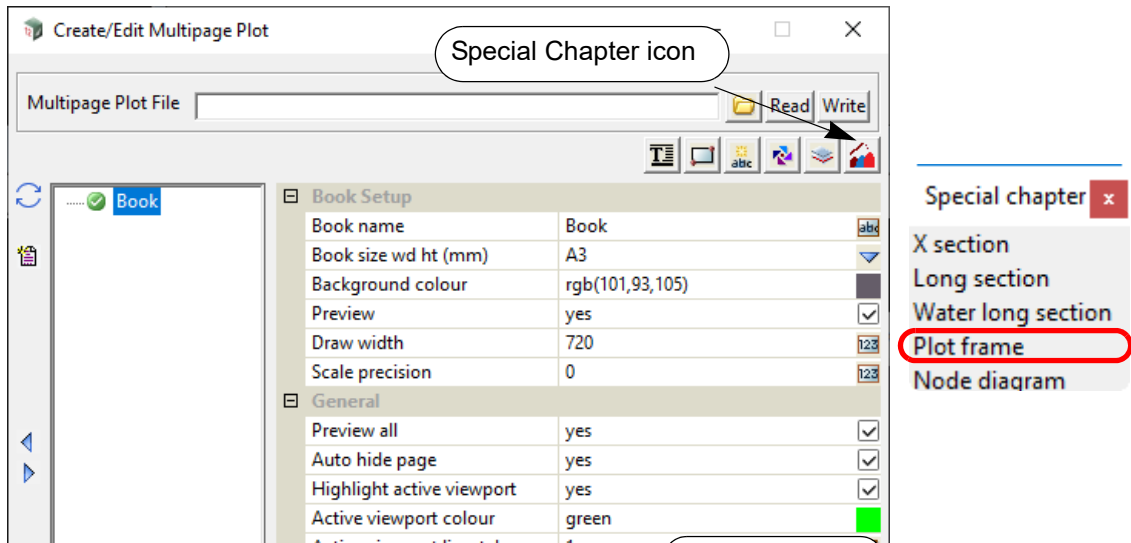
*Note that a **Write** needs to be done to update the Multipage plots file.*

#### **20.1.4.11.4.1 Notes on Using the Water Long Section Chapter**

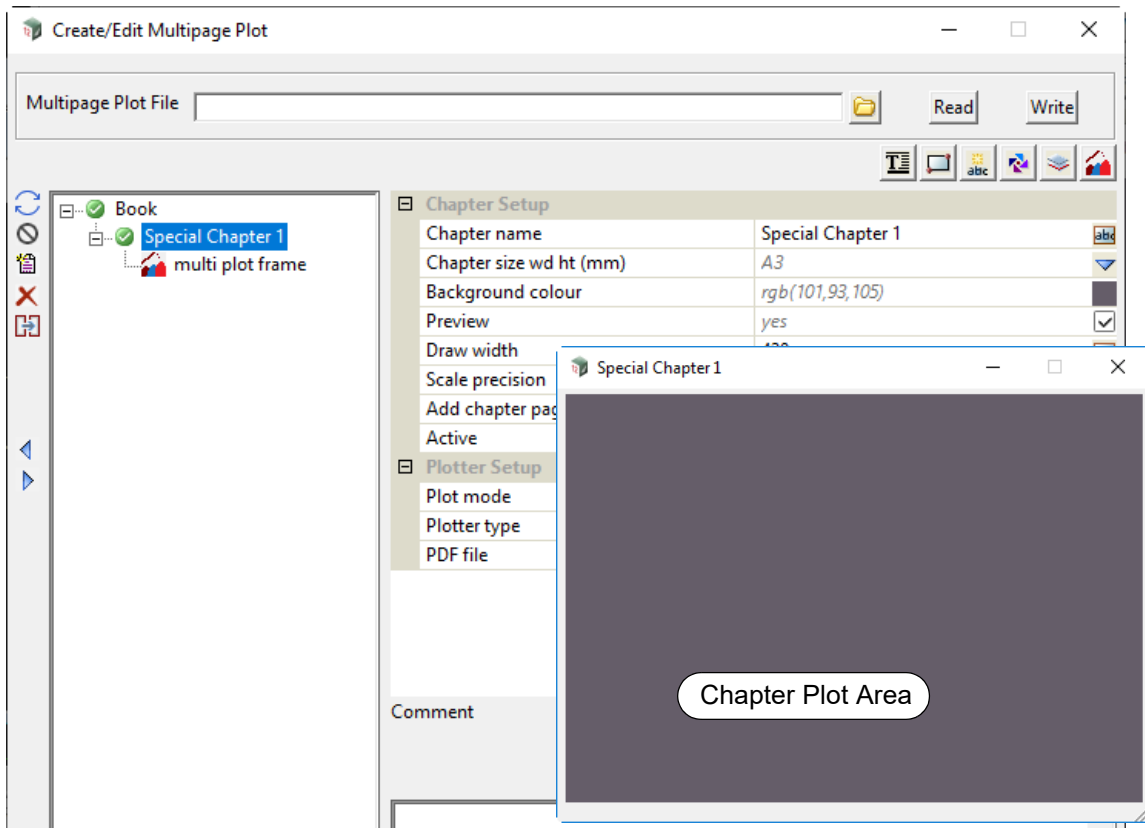
1. No other pages can be added to the Water Long Section Chapter and the drawing of the water long sections on each page is determined by the information in the Water Long Plot PPF file.
2. The *Title Block* in the Water Long Plot PPF is NOT used.
3. Title Blocks, Frames, Text, Symbols and Models can 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 [20.1.4.8.6 MPS Text \\$variables](#).

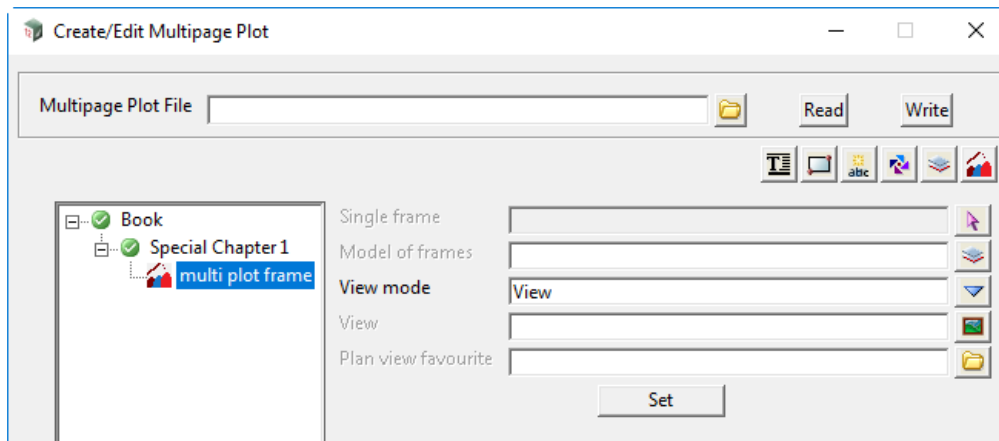
### 20.1.4.11.5 Plot Frame Chapter



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.*

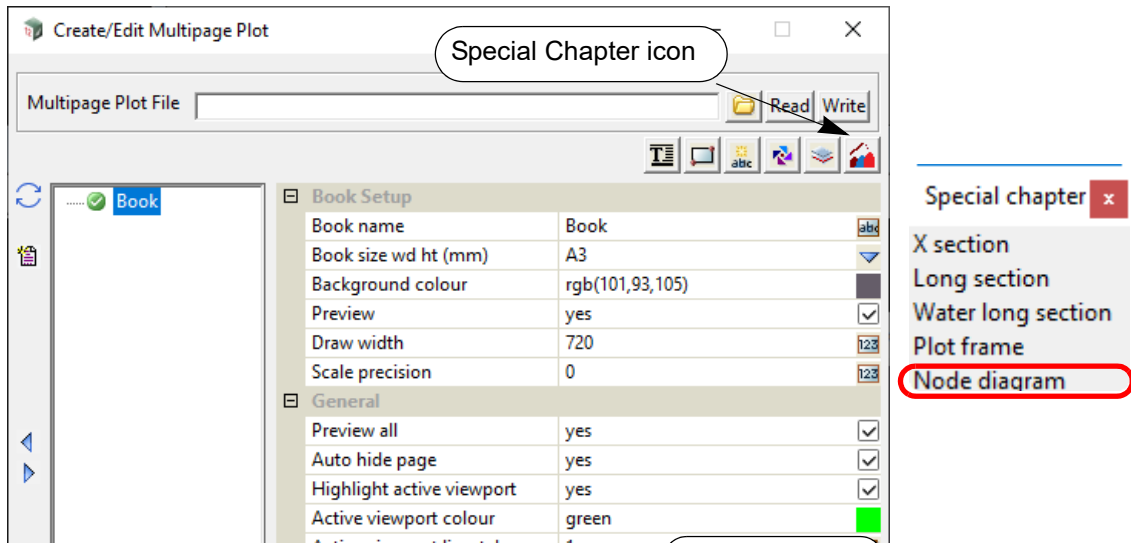
*Note that a **Write** needs to be done to update the Multipage plots file.*

#### 20.1.4.11.5.1 Notes on Using the Plot Frames Chapter

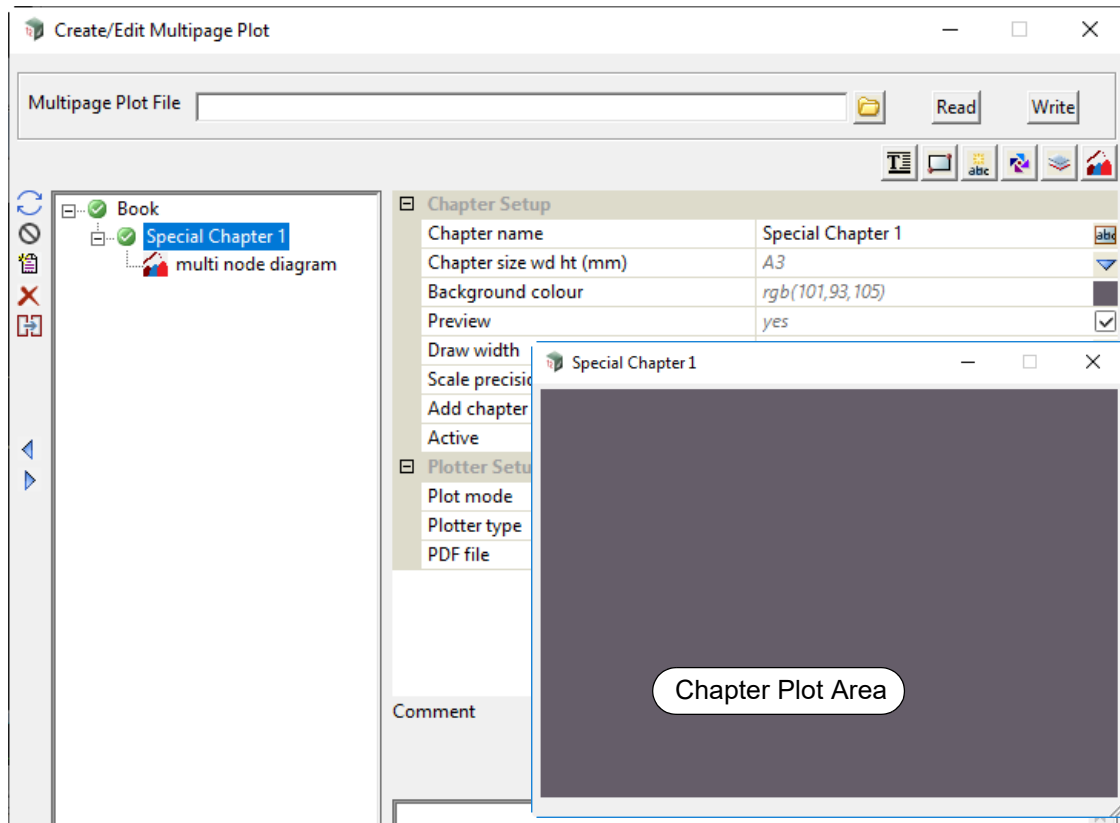
1. No other pages can be added to the Plot Frames Chapter and the drawing of the plot frame on each page is determined by the information in the Plot Frame PPF file.
2. The *Title Block* in the Plot Frame PPF is NOT used.
3. Title Blocks, Frames, Text, Symbols and Models can be added to the Plot Frame 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 [20.1.4.8.6 MPS Text \\$variables](#).

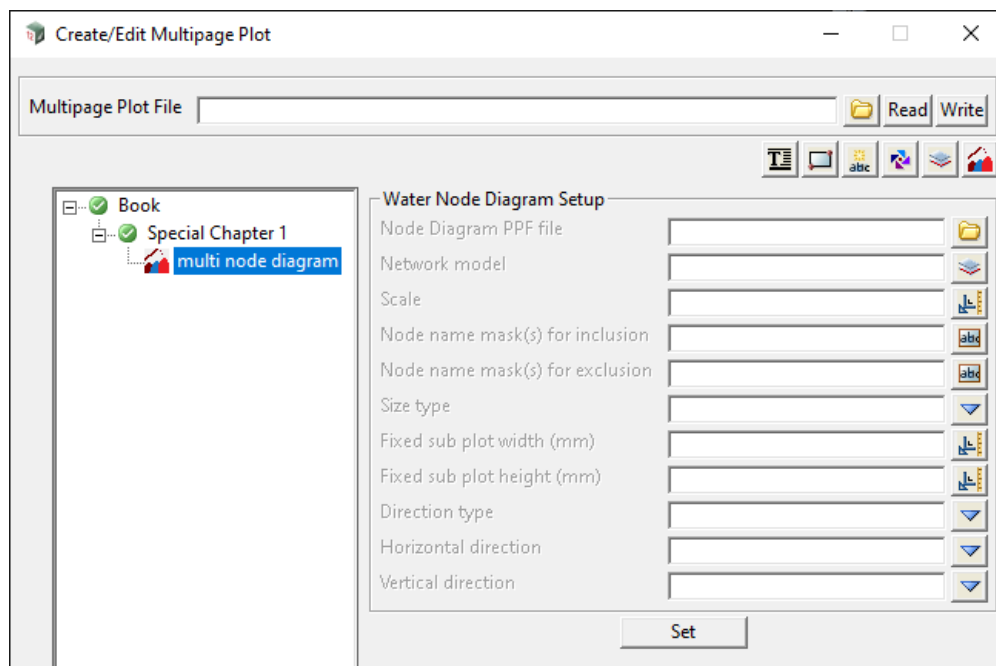
### 20.1.4.11.6 Node Diagram Chapter



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 [26.7.2.1 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 [26.7.2.1 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.*



<b>Sub plot height in mm</b>	real box
<i>Height of the imaginary box to draw each node diagram in.</i>	
<b>Sub plot direction</b>	choice box
<i>If <b>by column</b>, then the plotted node diagrams are arranged into columns.</i>	
<i>If <b>by row</b>, then the plotted node diagrams are arranged into rows.</i>	
<b>Horizontal direction</b>	choice box
<i>If <b>left to right</b>, the node diagrams in a row start on the left and move to the right.</i>	
<i>If <b>right to left</b>, the node diagrams in a row start on the right and move to the left.</i>	
<b>Vertical direction</b>	choice box
<i>If <b>top to bottom</b>, the node diagrams in a column start at the top and go down to the bottom.</i>	
<i>If <b>bottom to top</b>, the node diagrams in a column start at the bottom and go up to the top.</i>	
<b>Set</b>	button
<i>Update and use the values in the fields.</i>	
<i>Note that a <b>Write</b> needs to be done to update the Multipage plots file.</i>	

#### 20.1.4.11.6.1 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.

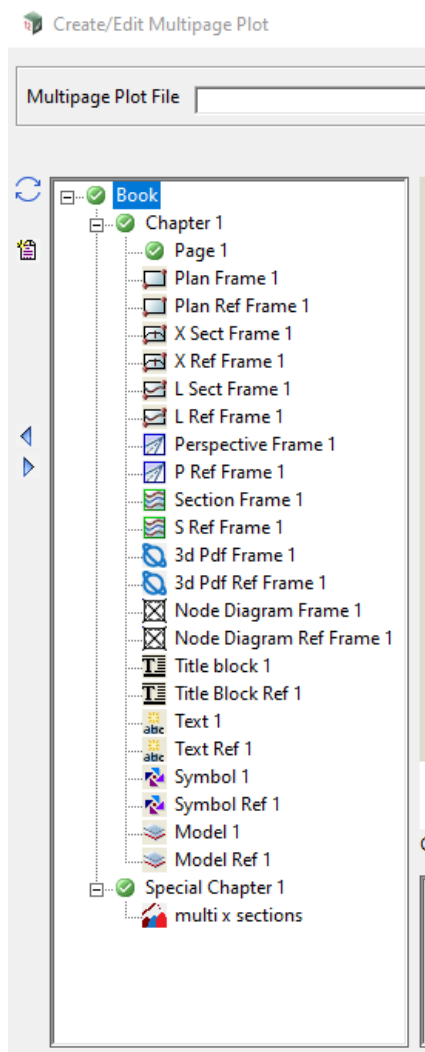
For information on the special text \$variables for MPS, see [20.1.4.8.6 MPS Text \\$variables](#).

### 20.1.4.12 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:

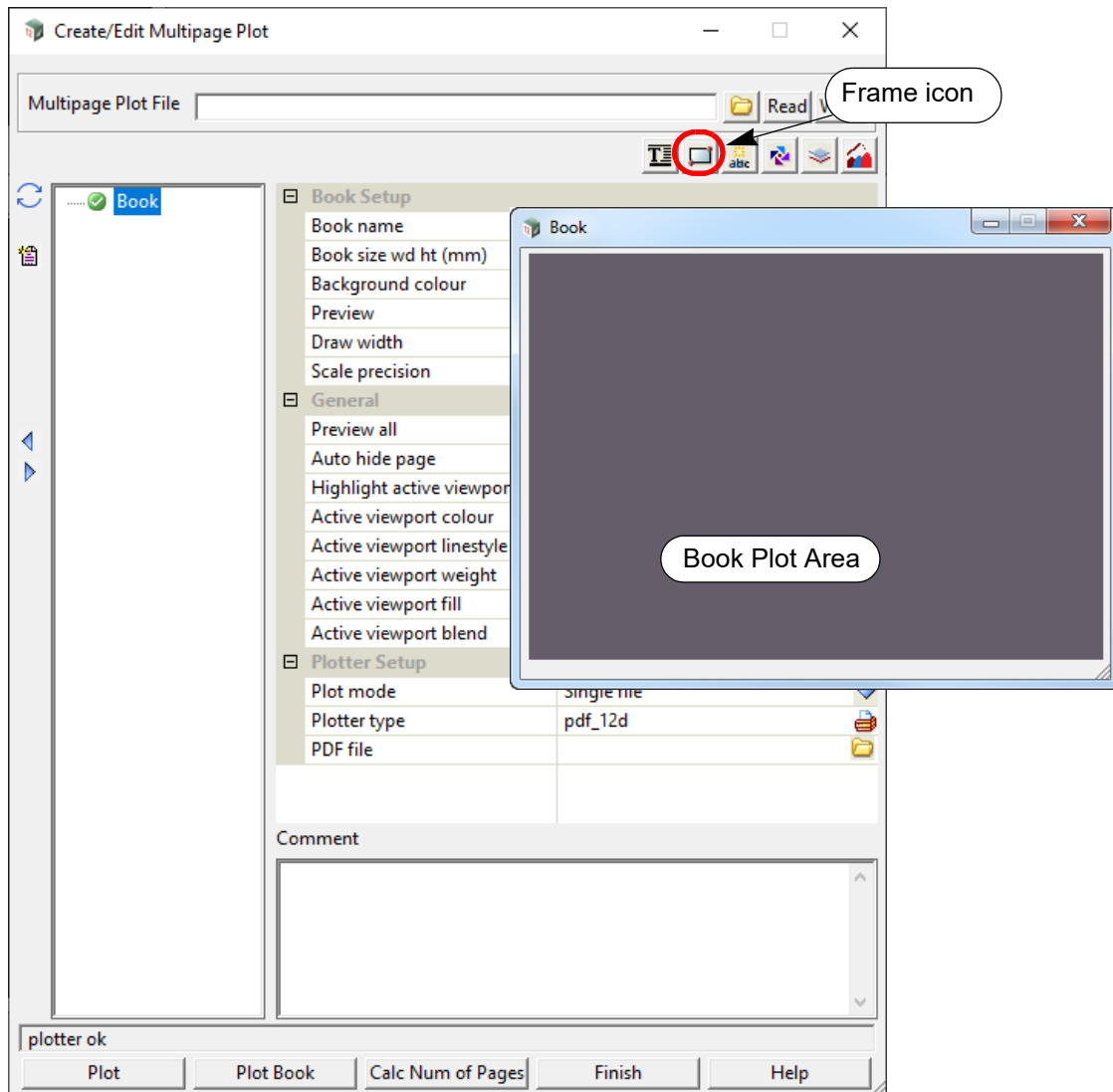
- Book Node
- Chapter Node
- Special Chapter Node\*
- Page Node
- Special Chapter Multi Node
- Plan Frame Node
- Plan Frame Reference Node
- X Section Frame Node
- X Section Frame Reference Node
- Long Section Frame Node
- Long Section Frame Reference Node
- Perspective Frame Node
- Perspective Frame 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.

## 20.1.5 Example Using Reference Frames

### 20.1.5.1 Creating Frames That Can Be Referenced

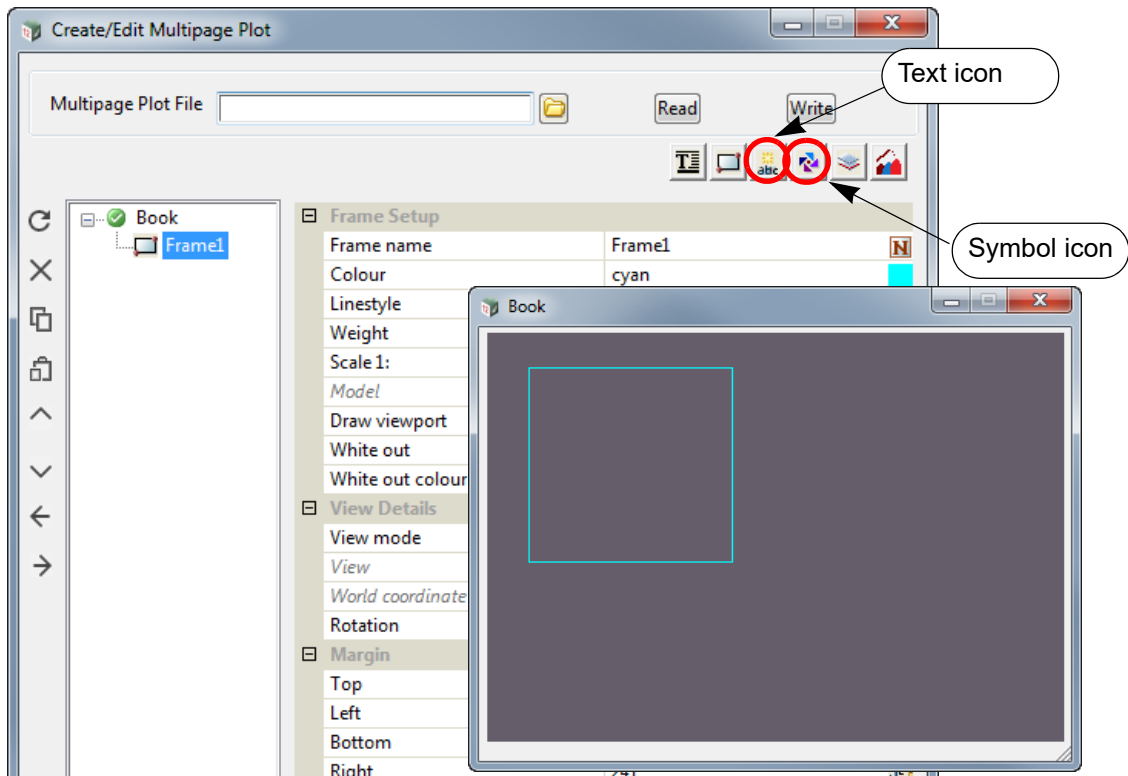
Click on the option **Plots =>Multipage Plots =>Create** to create a new **Multipage Plot Tree** with just the **Book** node and a **Book Plot Area**.



Click on the **Frame** icon and select **Plan** and then create a **Book Frame** on the left hand side of the **Book Plot Area**.

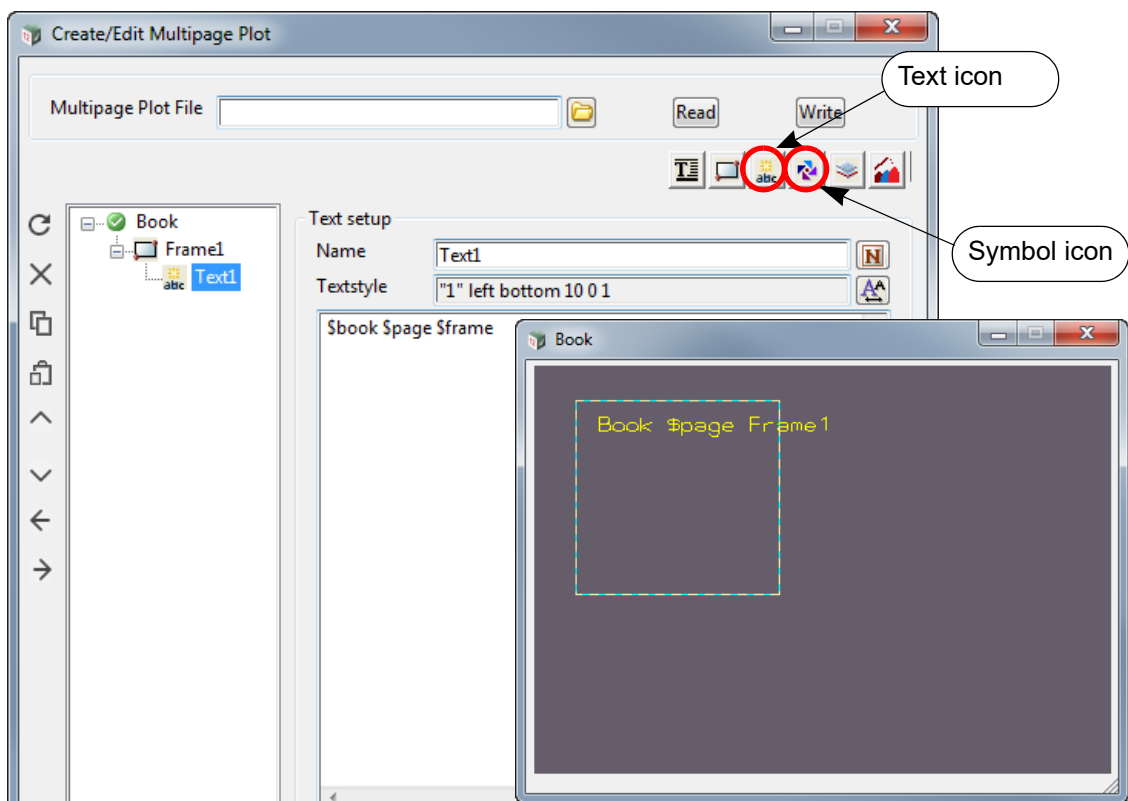
Say **Yes** to "Do you want to create reference frame(s) for Chapter(s)?"

Say **Yes** to "Do you want to create reference frame(s) for Pages(s)?"



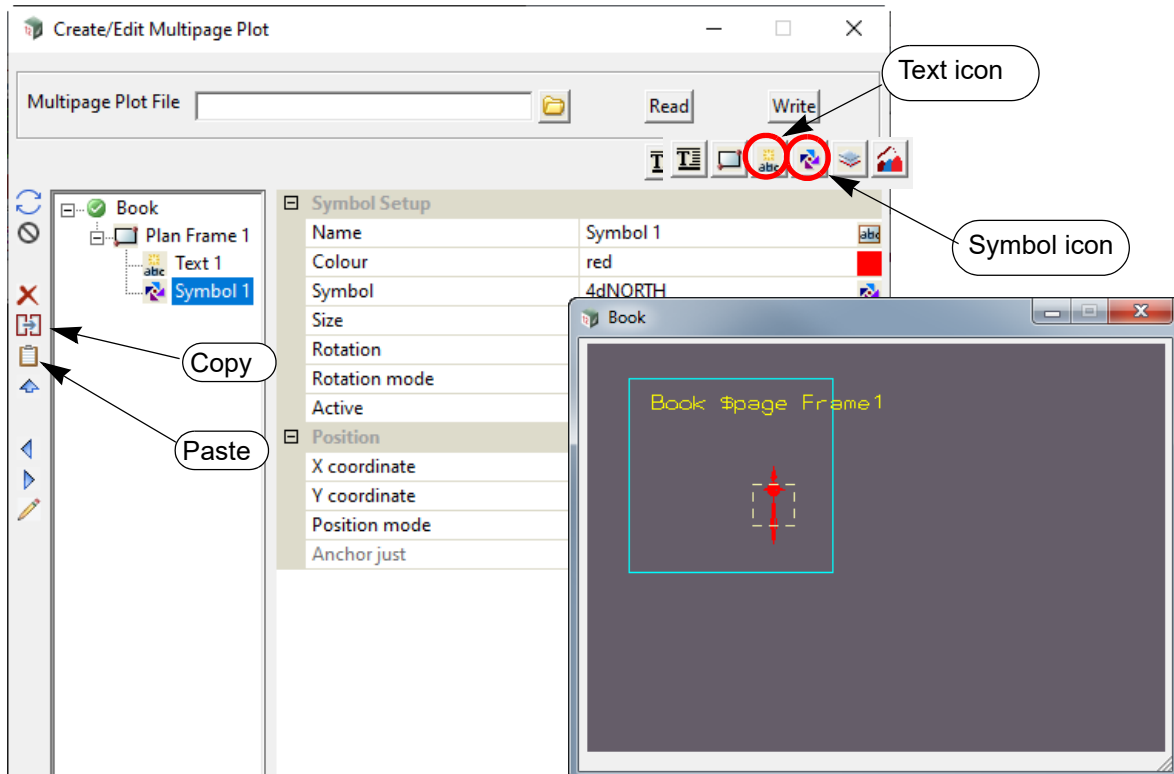
Highlight the *Frame 1* node and click on the **Text** icon, select **Rel to frame** and then place **Text** at the top of the **Book Frame Frame1**.

Click on the *Text 1* node and replace the text with "\$book \$page \$frame" and click on the **Set** button.



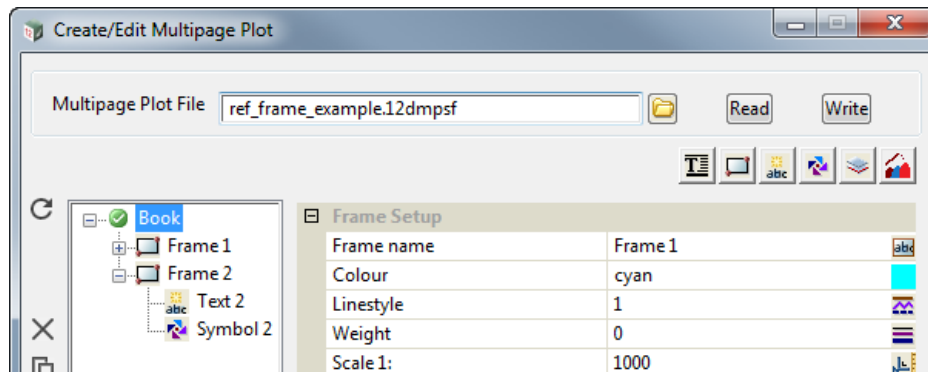
Highlight the *Frame 1* node and click on the **Symbol** icon, select **Rel to frame** and then place a

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**.

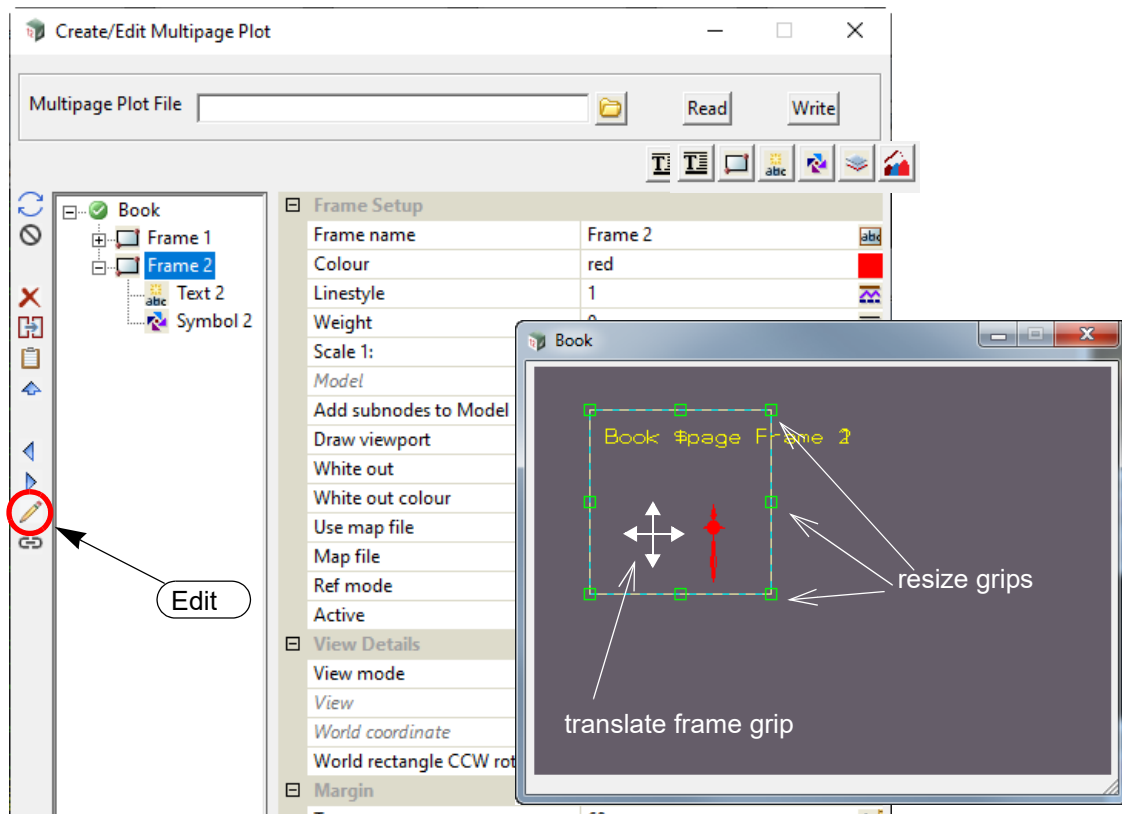
Now highlight the *Frame 1* node and click on the **Copy** icon and then the **Paste** icon. A new Frame is created at the bottom of the Books and the **Book** node is automatically highlighted.



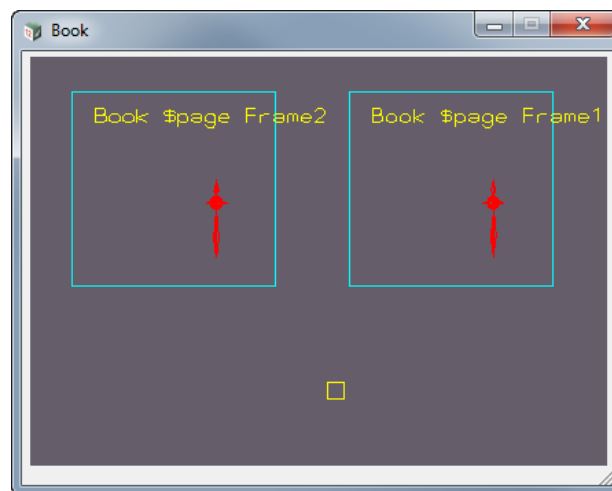
The copied frame is on top of the original frame so we will move one of the Frames by using the Frame Edit command which can be done in two ways:

(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.

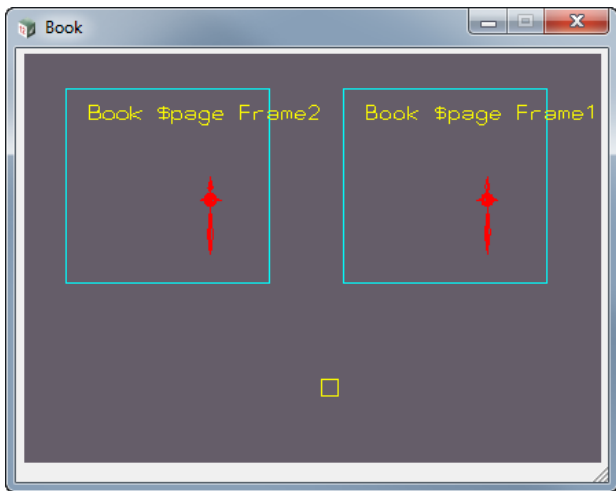
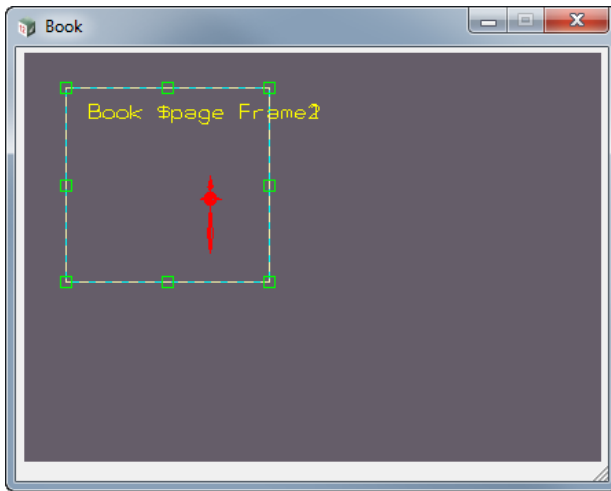
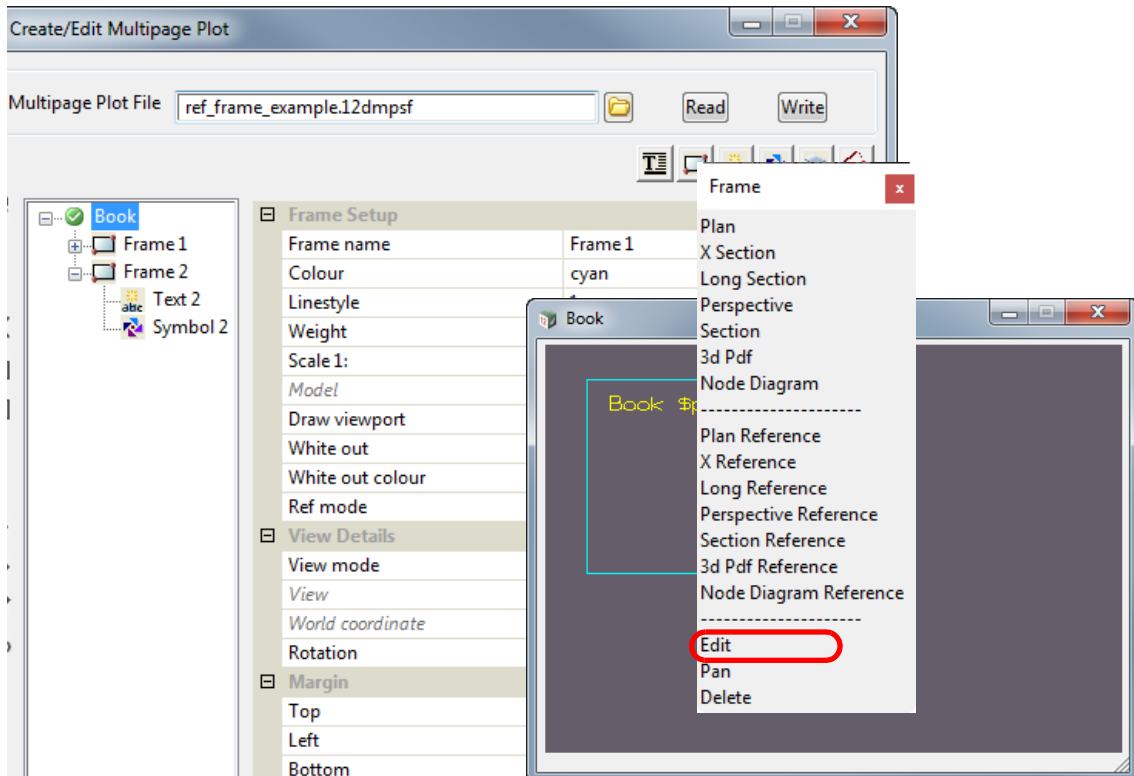


(b) Selecting the Frame from the Book Plot Area

With **Book** highlighted, click on the **Frame** icon and select **Edit** from the **Frame** menu.

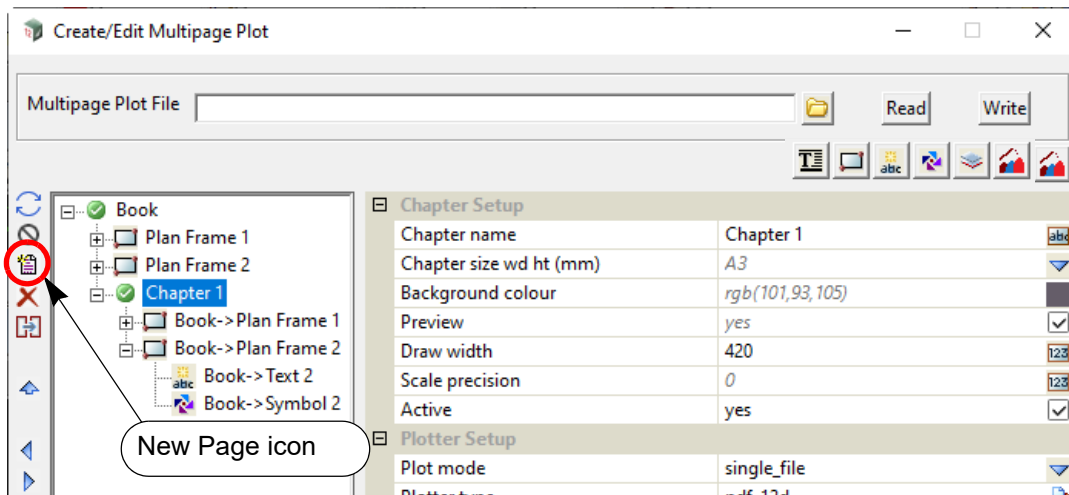
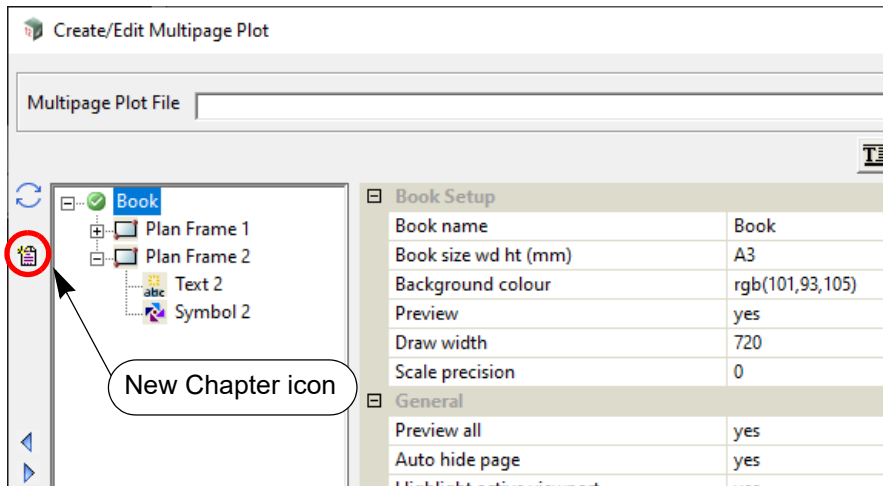
Then click LB only on one of the Frames in the **Book Plot Area** and then move it to the right hand side of the **Book Plot Area**.



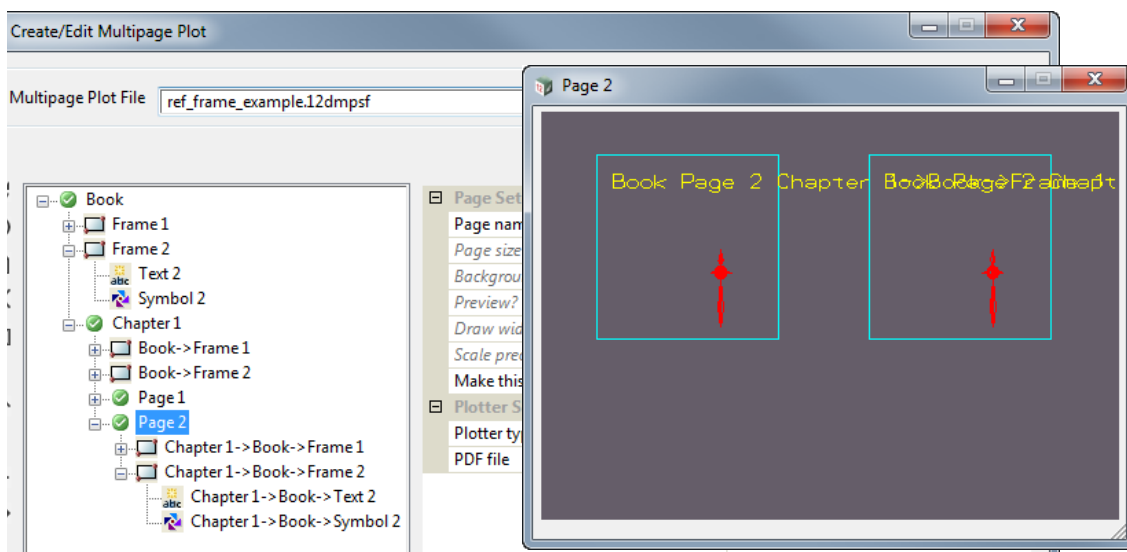


### 20.1.5.2 Automatic Reference Frame Creation

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**:

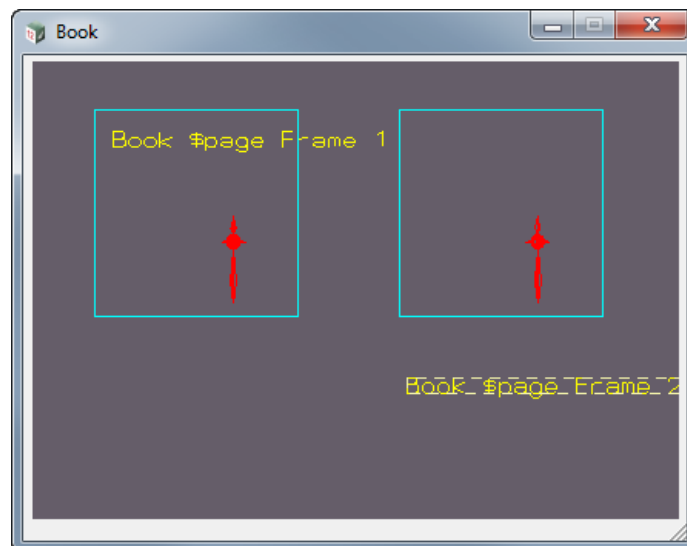
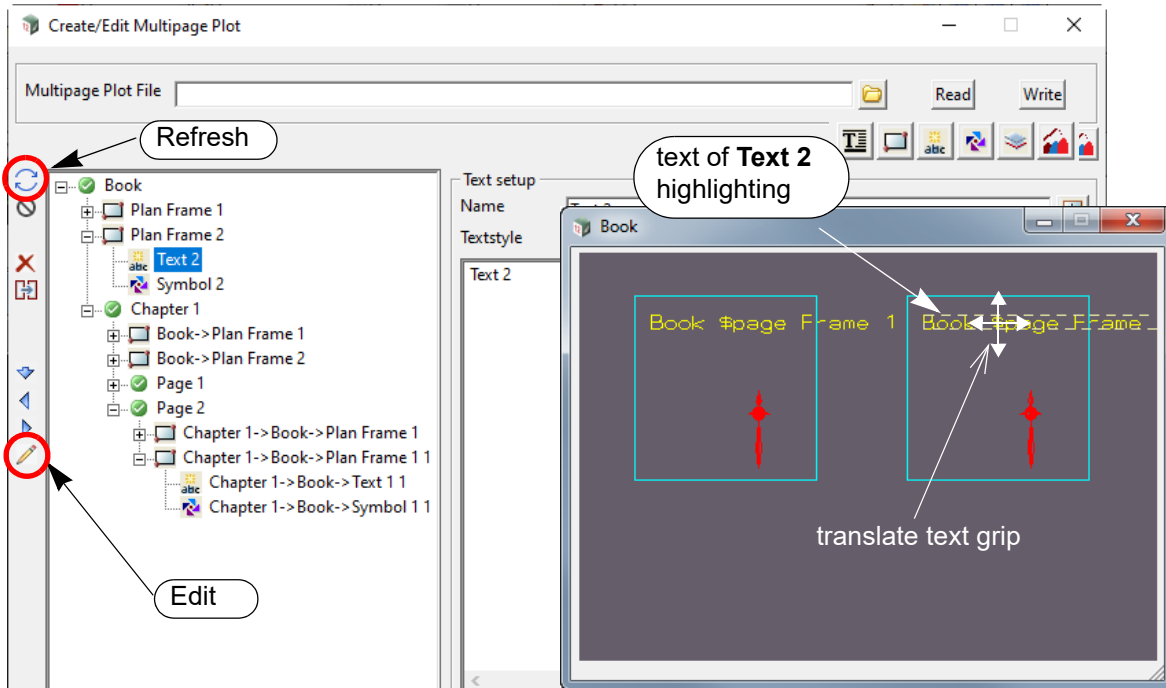


Click on the **Write** button to save the MPS file.

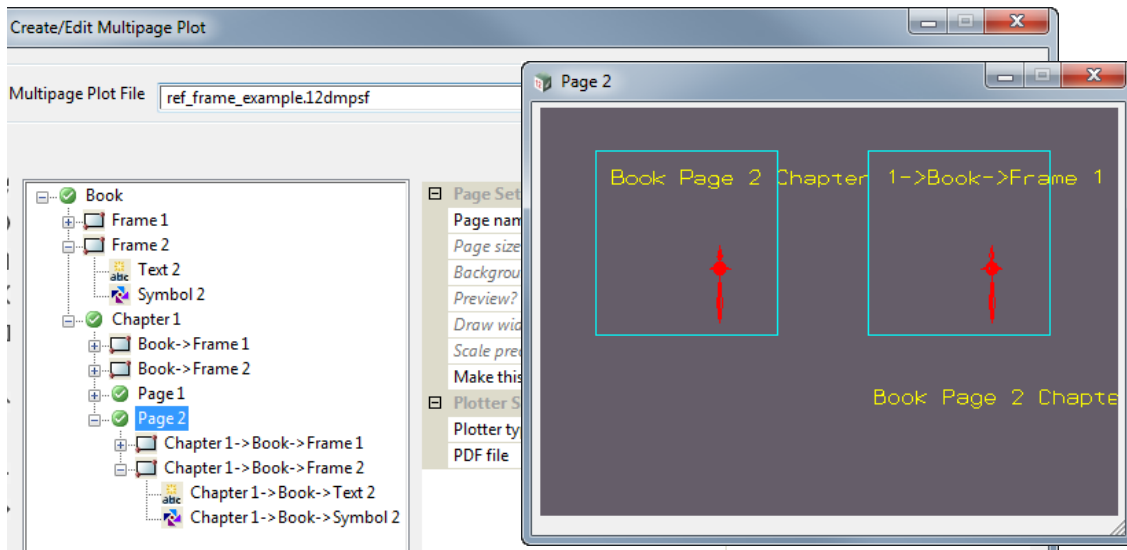
You'll notice the Text from the left hand frame is overwriting the Text in the right hand frame so we need to move it and we'll do that on the original **Book Frame Frame 2**.

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**.

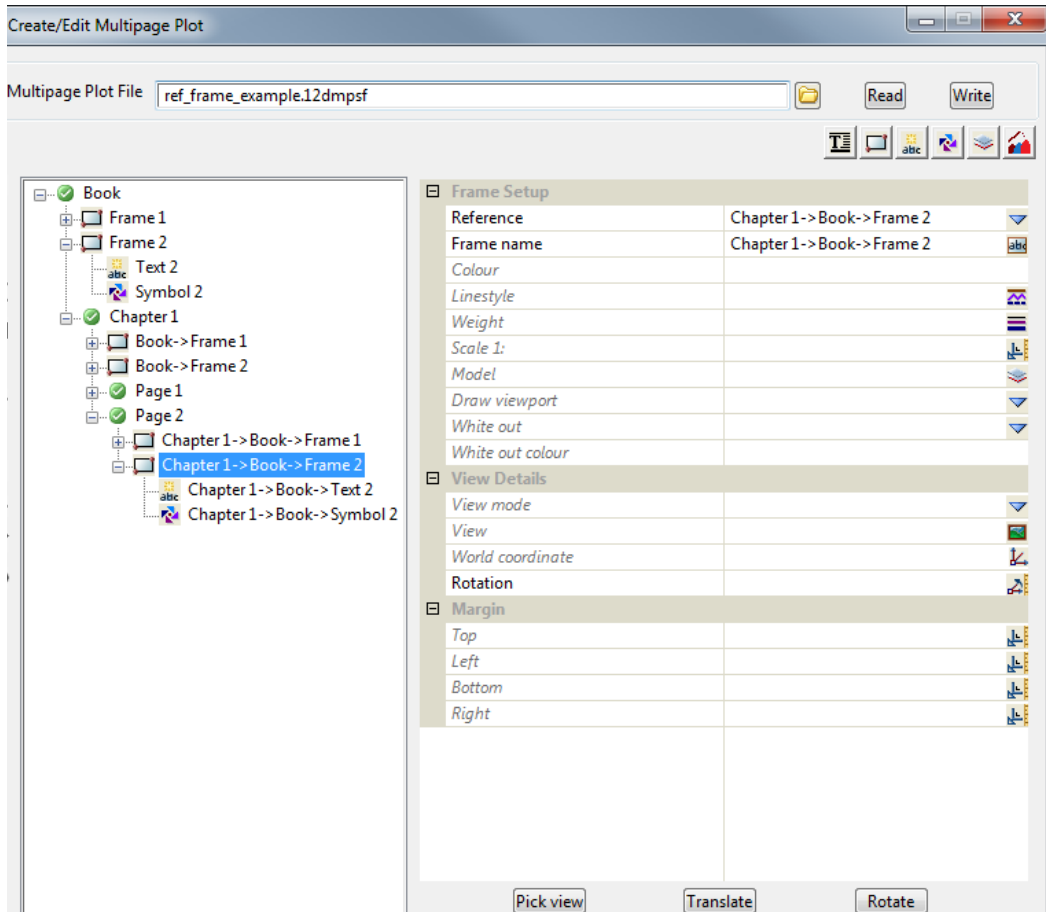
Next click LB down on the text to be moved to see the translate text grip and then move the text to the bottom of the right hand Frame and release LB.

### 20.1.5.3 Reference Frame Fields

We'll now work with these Reference Frames to give an idea of how Reference Frames can be used.

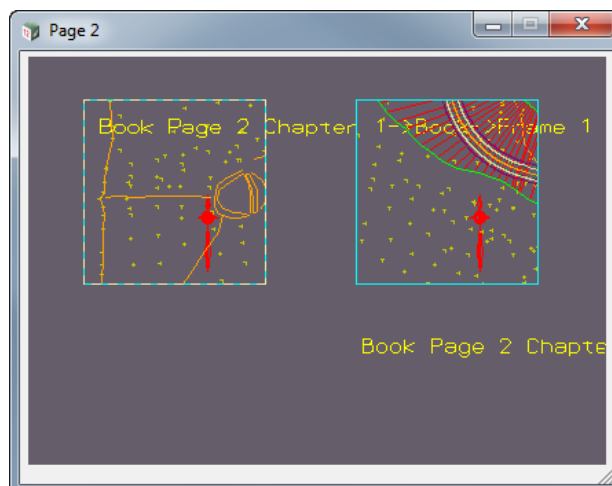
Highlight the **Reference Frame** *Chapter 1 ->Book ->Frame 2* under the **Page** node *Page 2*.

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**.



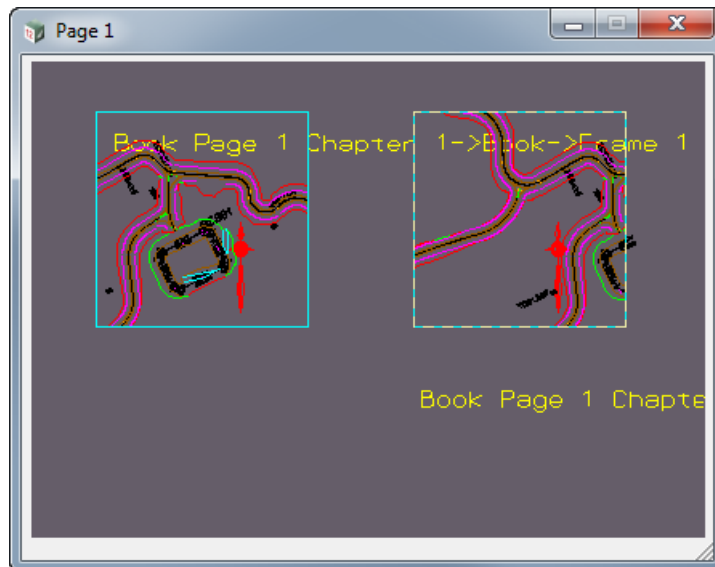
Click on **Pick View** and click in a view to get the data to draw in the Frame.

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.



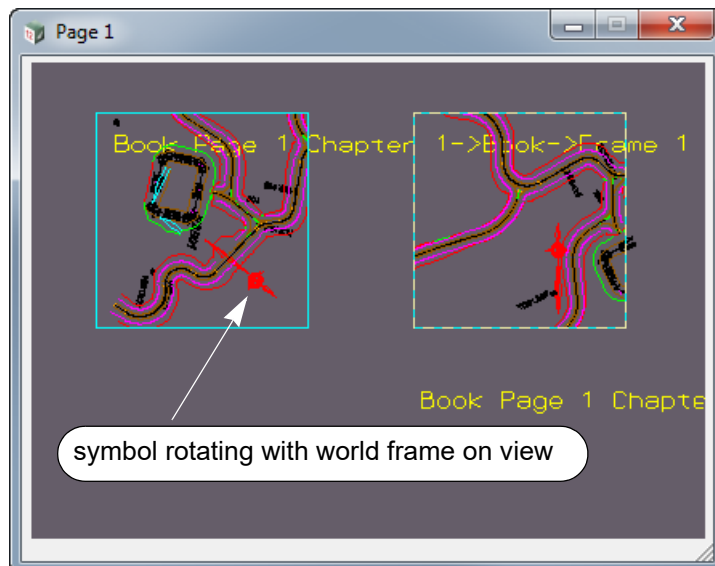
Now highlight the **Page Reference Frame** *Chapter 1 ->Book ->Frame 1* under the **Page** node *Page1* and again pick the *Pick view* button and select a View.

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.



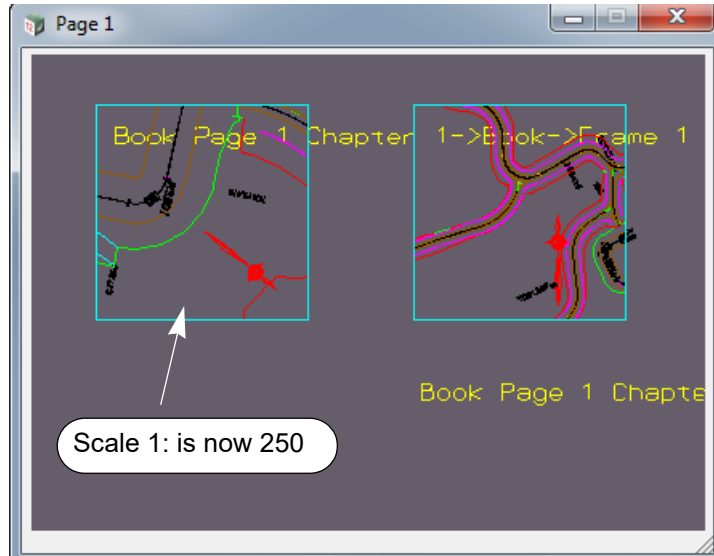


### 20.1.5.4 Changing Fields on the Original Frames

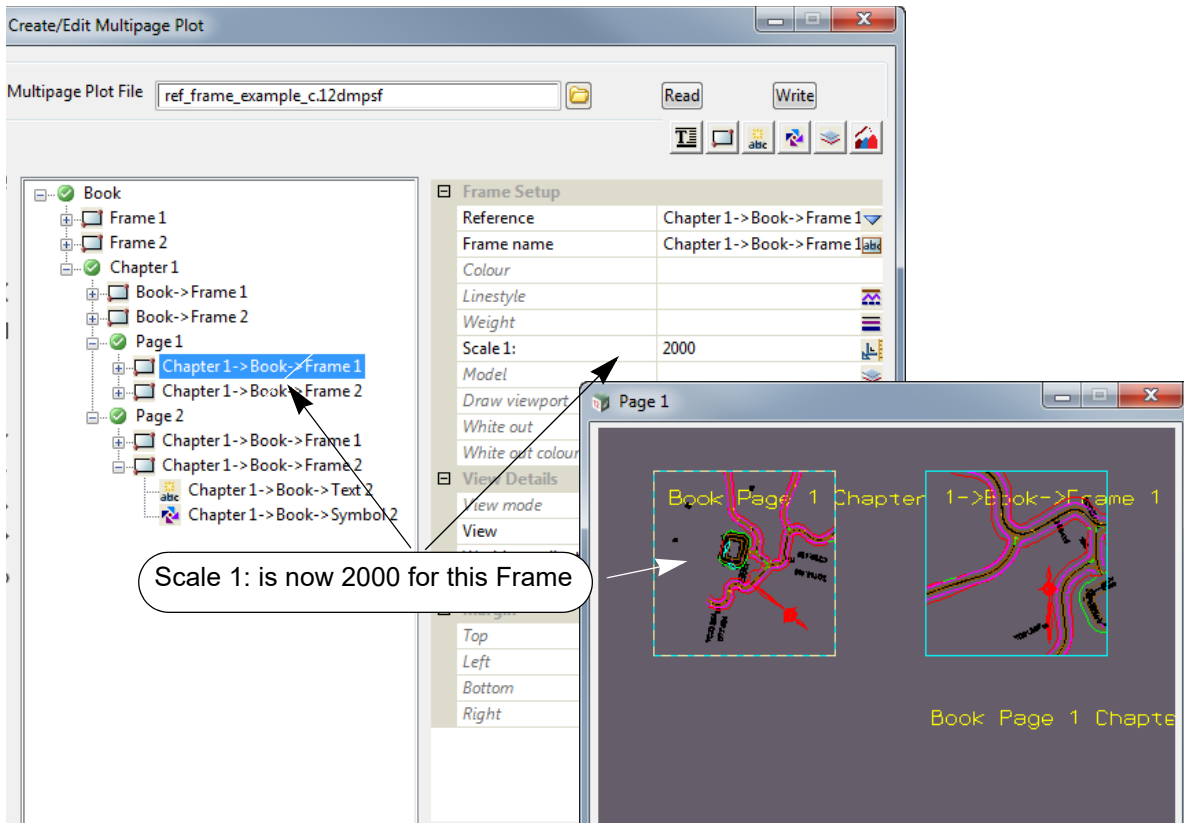
If you click on the **Frame 1** node at the **Book** level you will see that **Scale 1:** is *1000* and so it is for the frames on *Page 1* and *Page 2* that both reference **Book Frame1**.

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.

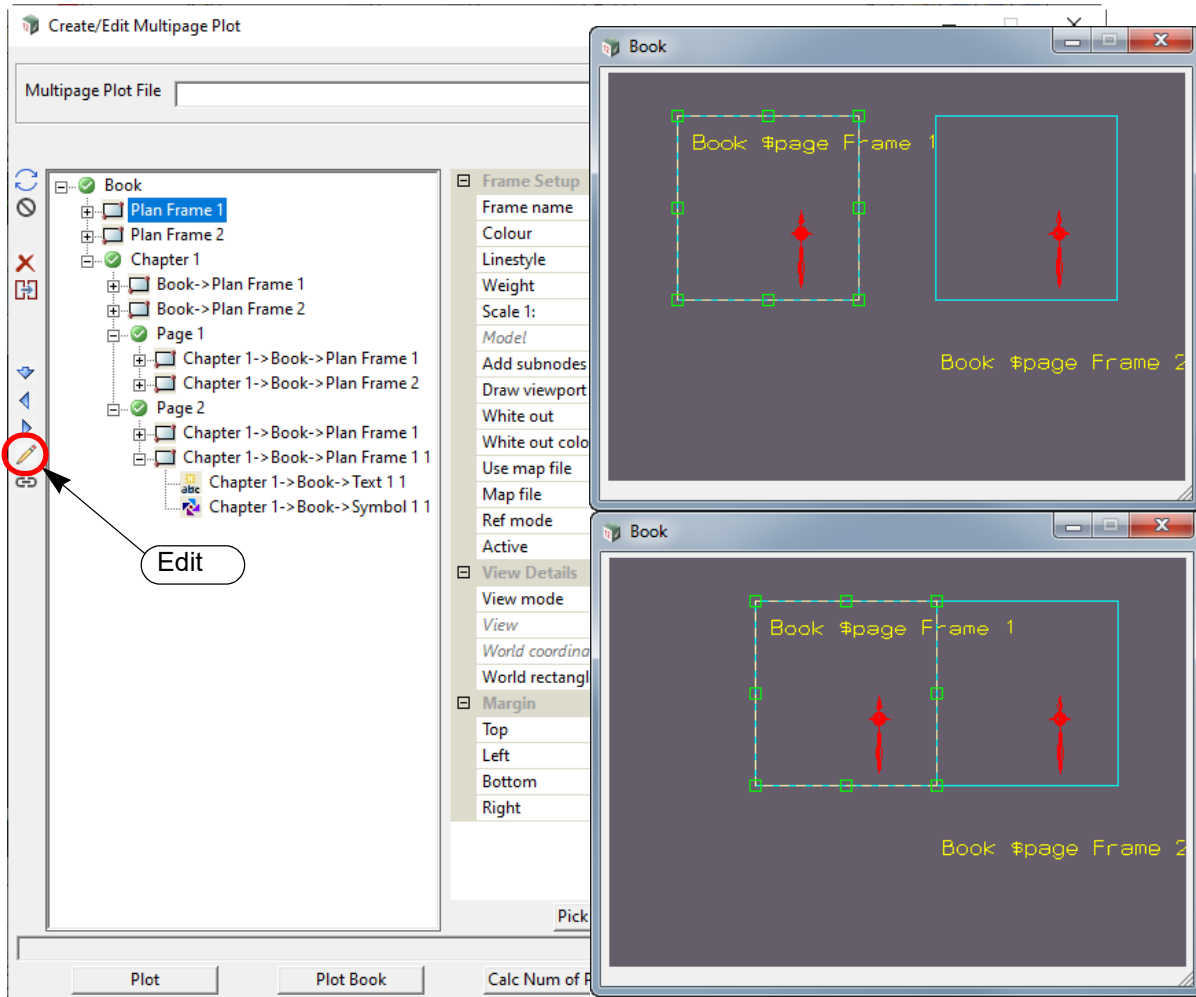


Even though **Book Frame 1** has **Scale 1:** to *250*, you can give a **Page Reference Frame** that references it a different scale by simply clicking that **Frame** node and where the field **Scale 1:** was blank, enter *2000*. Because the field is no longer blank, the scale for that particular Frame is no longer inherited from the original frame and will be *2000*.



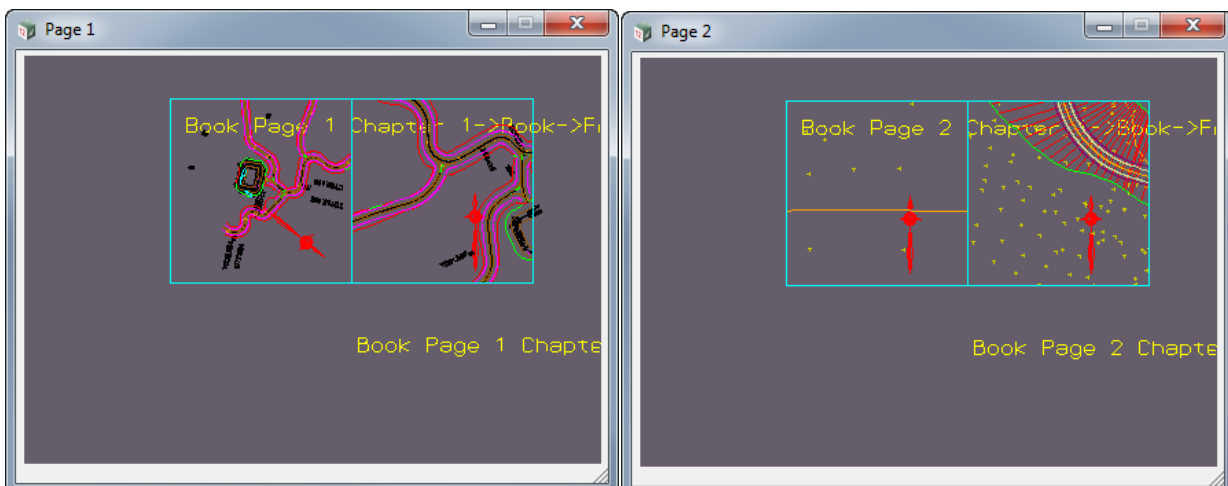
### 20.1.5.5 Moving an Original Frame

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**.

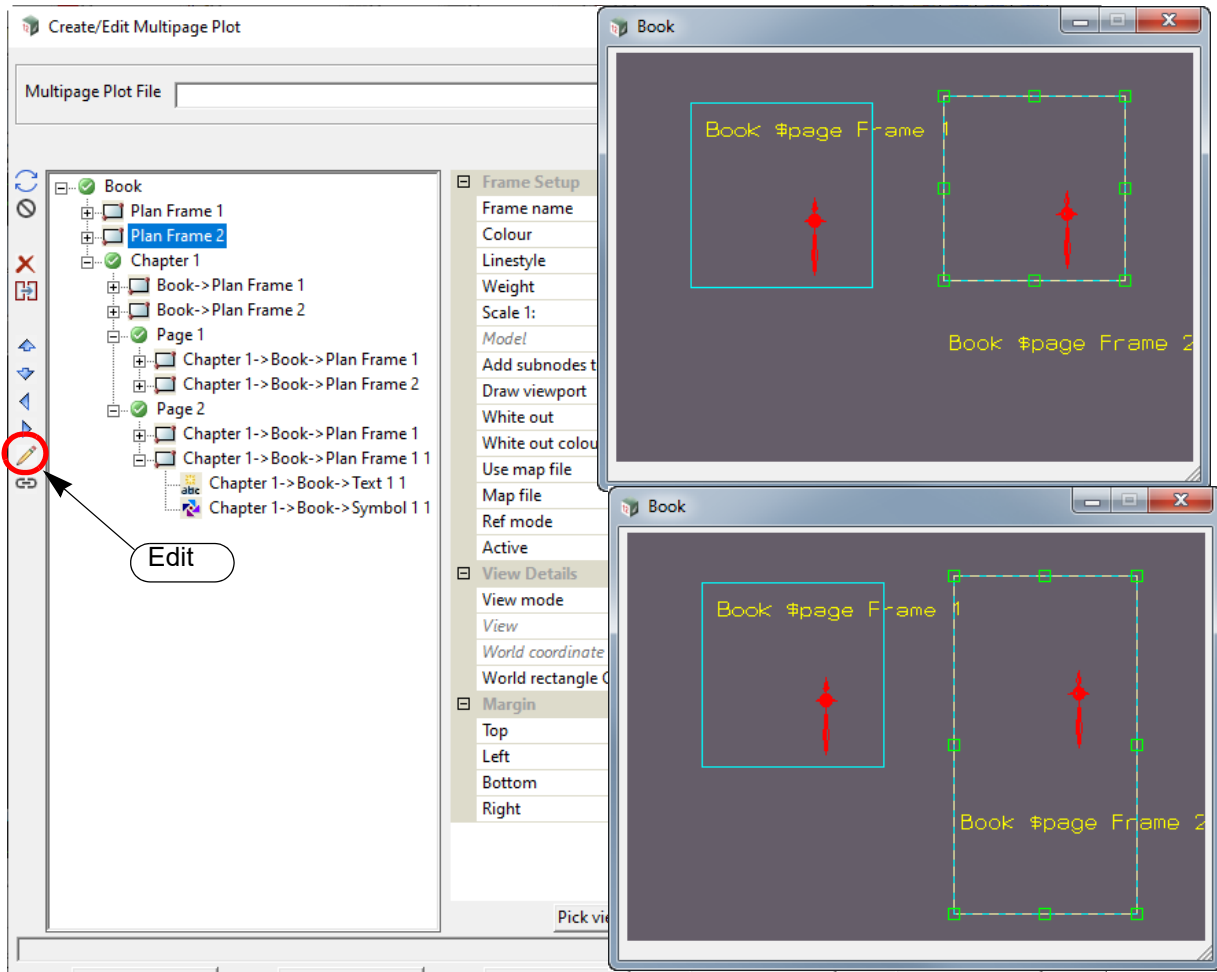
Then click on the **Page 1** and **Page 2** nodes again and you'll see that **all** the Reference Frames that reference **Book Frame 1** have moved.



Now move the **Book** Frame back to where it was, highlight **Book** and click on **Refresh**.

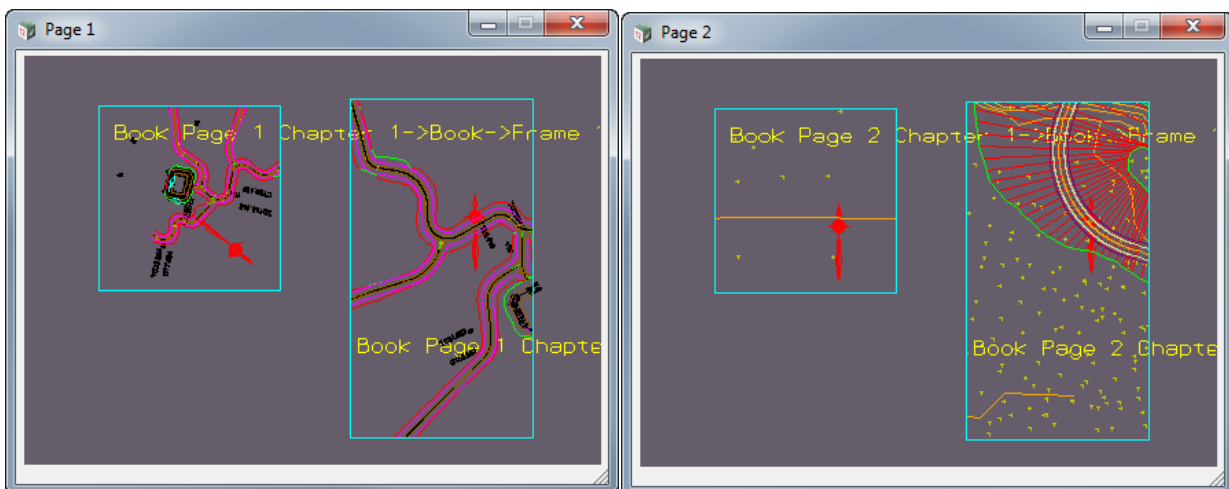
### 20.1.5.6 Resizing an Original Frame

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.

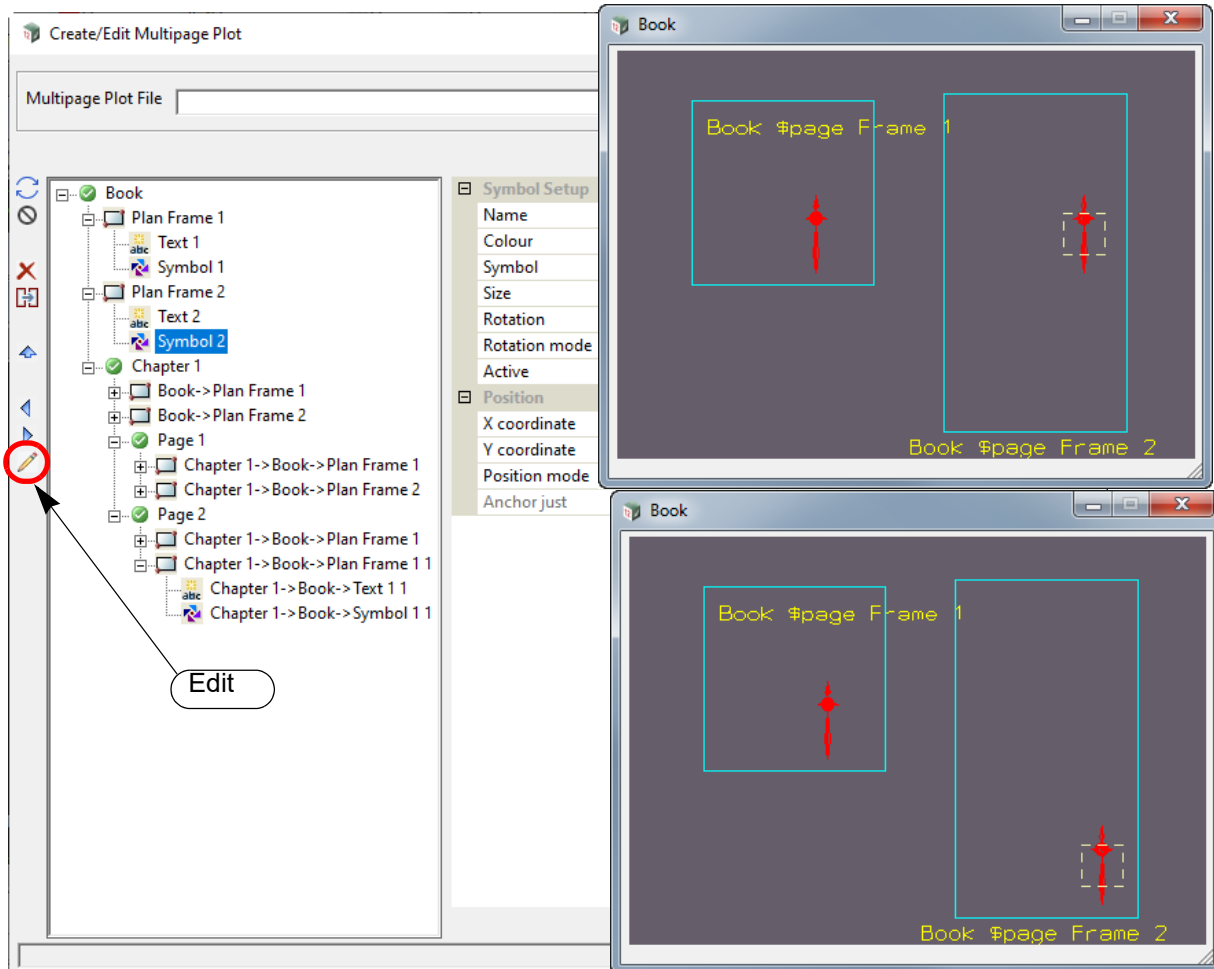


### 20.1.5.7 Moving an Original Text and Original Symbol

Go back and expand **Frame 2**, click on the **Text 2** node, then **Edit** and move the Text to the bottom of the Frame.

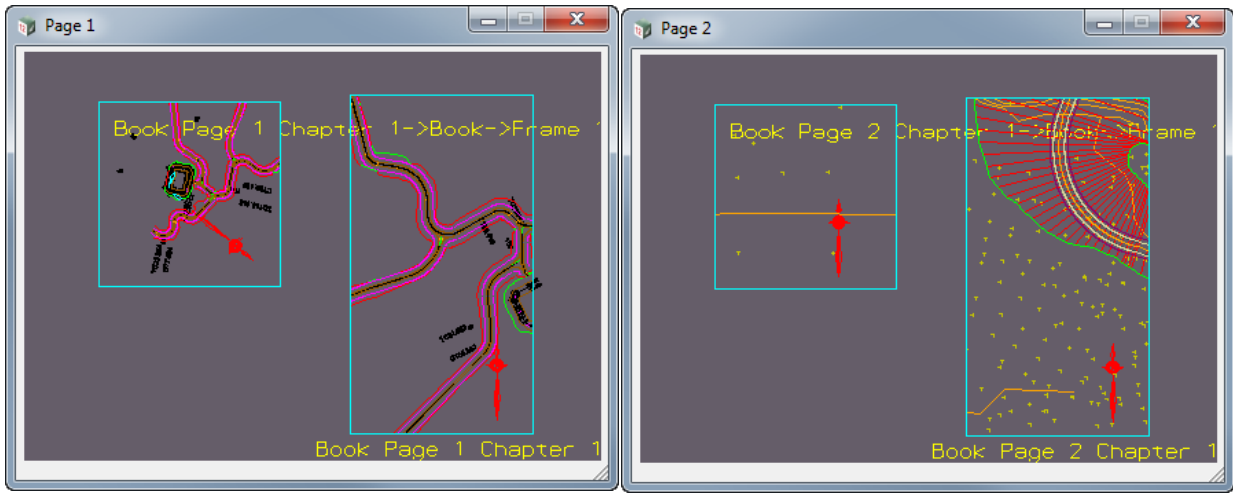
Or to do the same thing where the text is selected in the Book Page Area: Highlight the **Book** node, click on the **Text** icon, select **Edit** from the **Text** menu and then click LB down on the Text on the right hand side and move it to the bottom of the Frame.

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**.

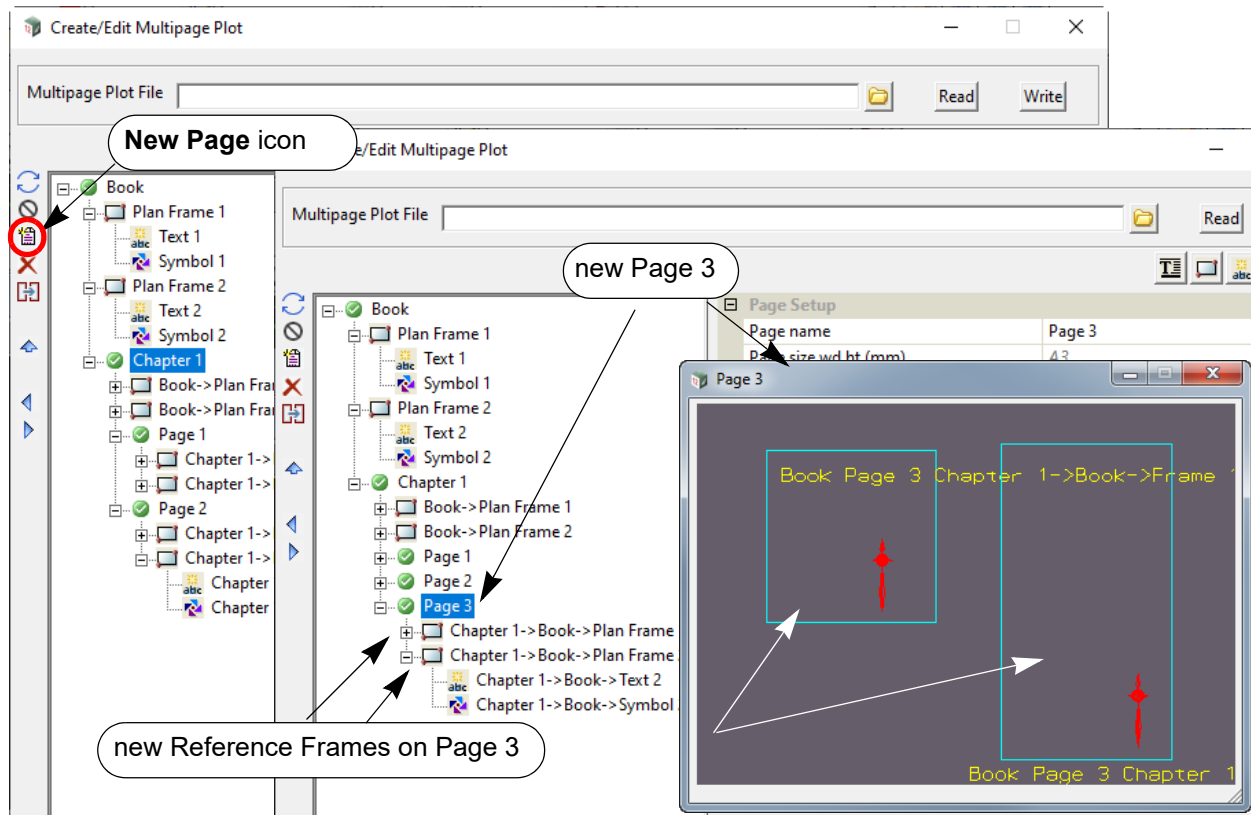
Then click on the **Page1** and **Page2** nodes again and you'll see that **all** the Reference Frames that reference **Book Frame1** have the Text and Symbol moved.





### 20.1.5.8 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**.



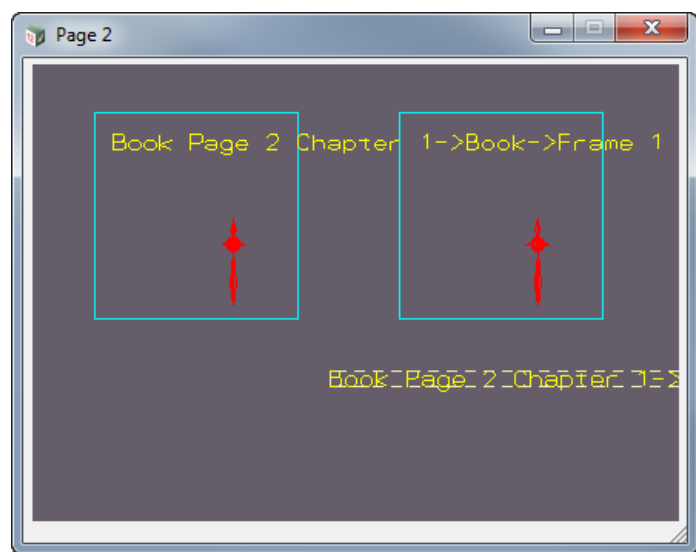
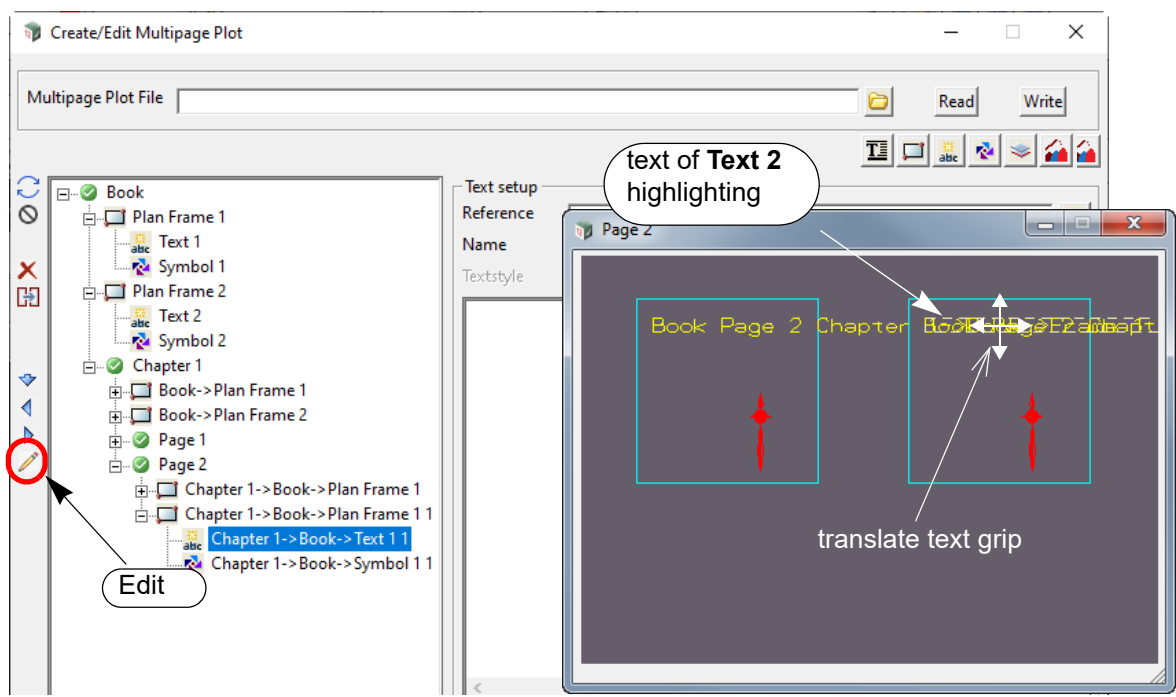
The new node **Page Page3** is added to the bottom of **Chapter Chapter1** and for each **Book Frame** that has the field **Ref mode** set to **Ref on Chapter and Page** or **Ref on Page**, a **Reference Frame** is automatically added to **Page Page3**.

#### 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.

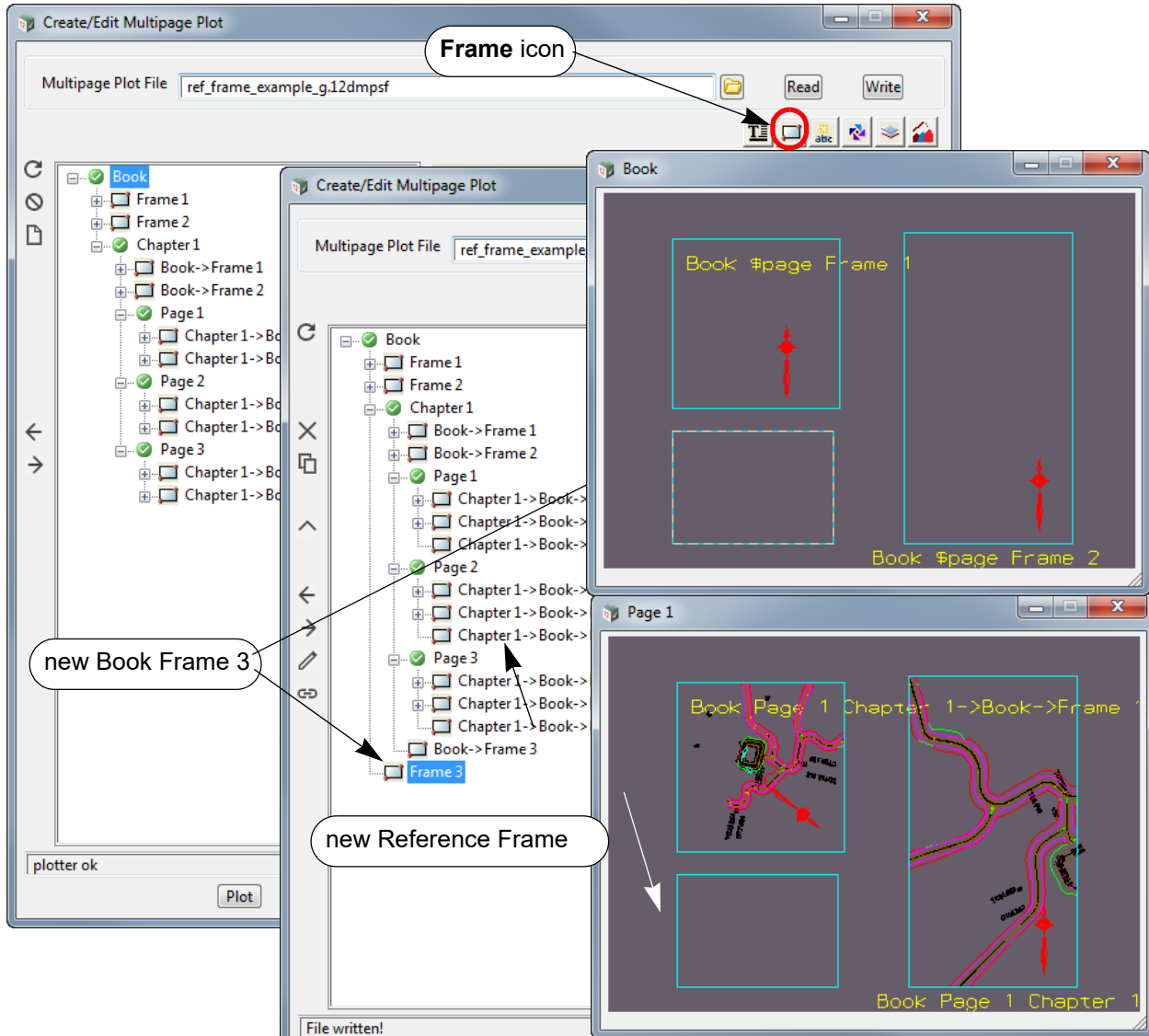
To do so, click on the **Text 2 node** under **Page 2**. The text for **Text 2** then highlights in the Page 2 Plot Area and if the cursor is moved over the highlight text then the translate text grip is displayed.

Hold down LB and move the text to the bottom of the right hand Frame.



### 20.1.5.9 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)?".



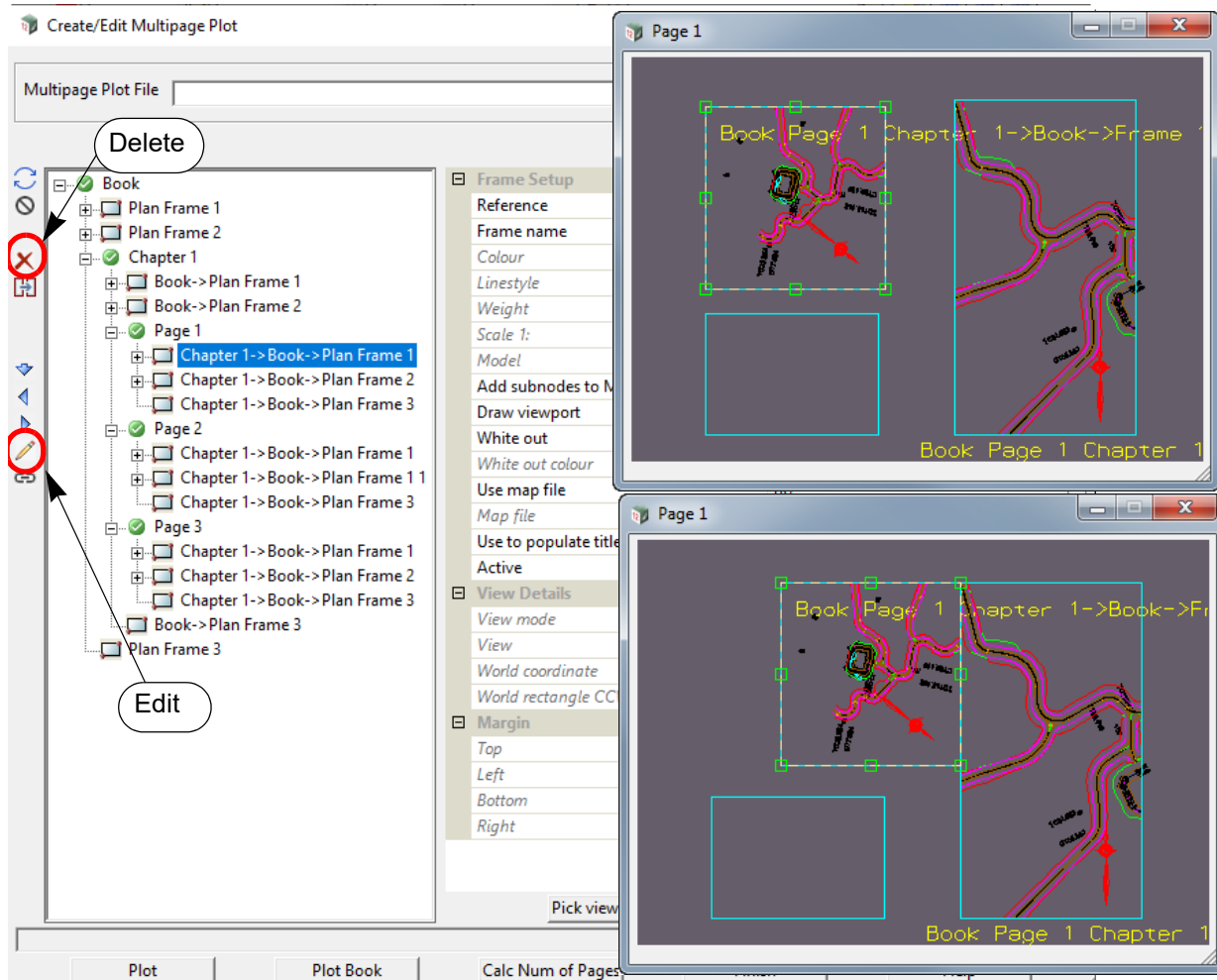
The new **Frame** node *Frame 3* is added to the bottom of the **Book** and because **Yes** was answered to the questions about creating reference frames for the Chapters and Pages, a **Reference Frame** is automatically added to each **Chapter** and each **Page** in the **Book**.

#### Notes

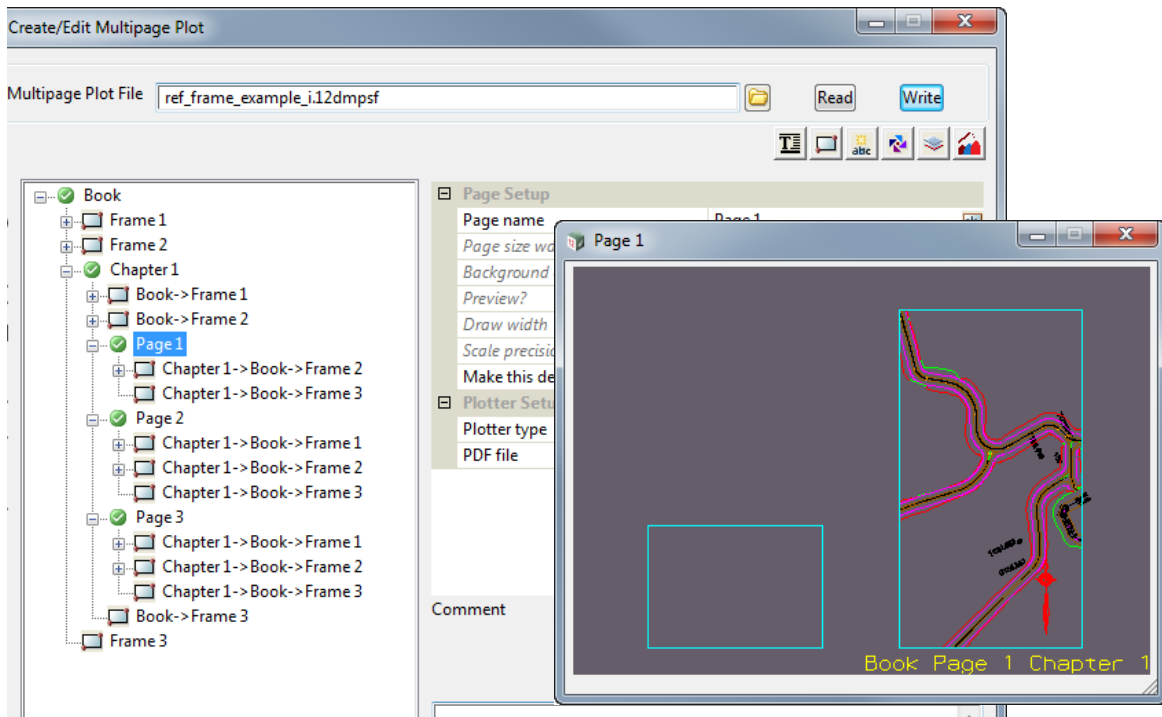
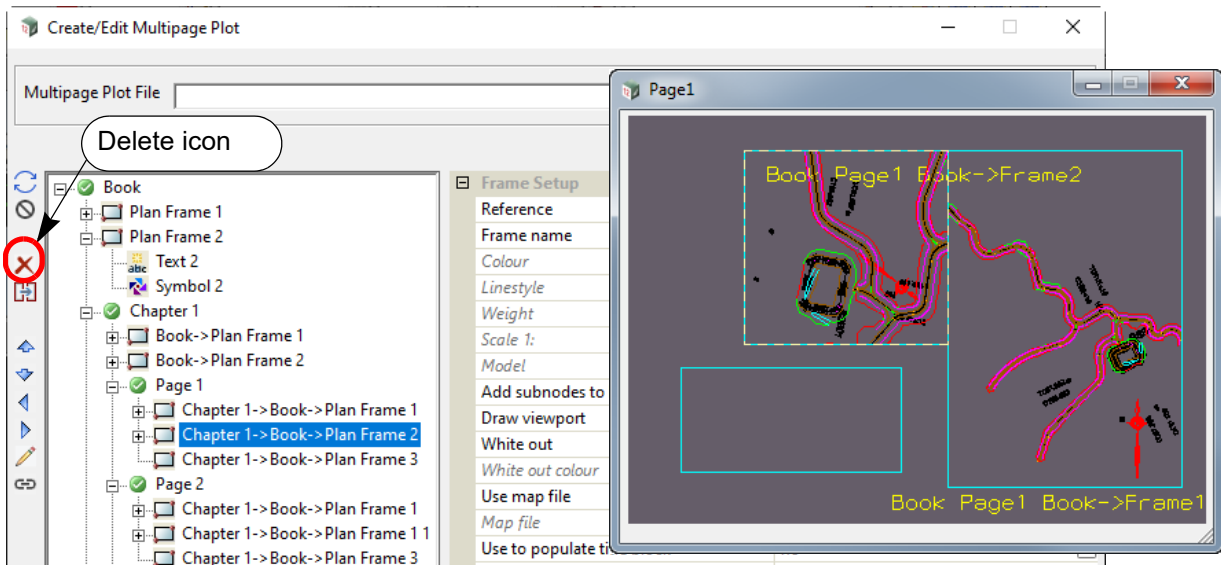
1. If when *Book Frame 3* was created, **Yes** was answered to "Do you want to create reference frame(s) for Chapter(s)?" and **No** to "Do you want to create reference frame(s) for Pages(s)?", then only the **Chapter Reference Frames** would be created.
2. If when *Book Frame 3* was created, **No** 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.

### 20.1.5.10 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.

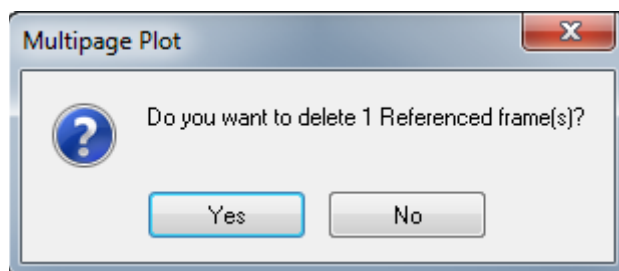


You can delete a **Reference Frame** by highlighting the **Reference Frame** node and clicking on the **Delete** on the left hand side.



**Important Note:**

If you delete an original Frame that has been referenced by other Frames, the Yes-No panel pops up.

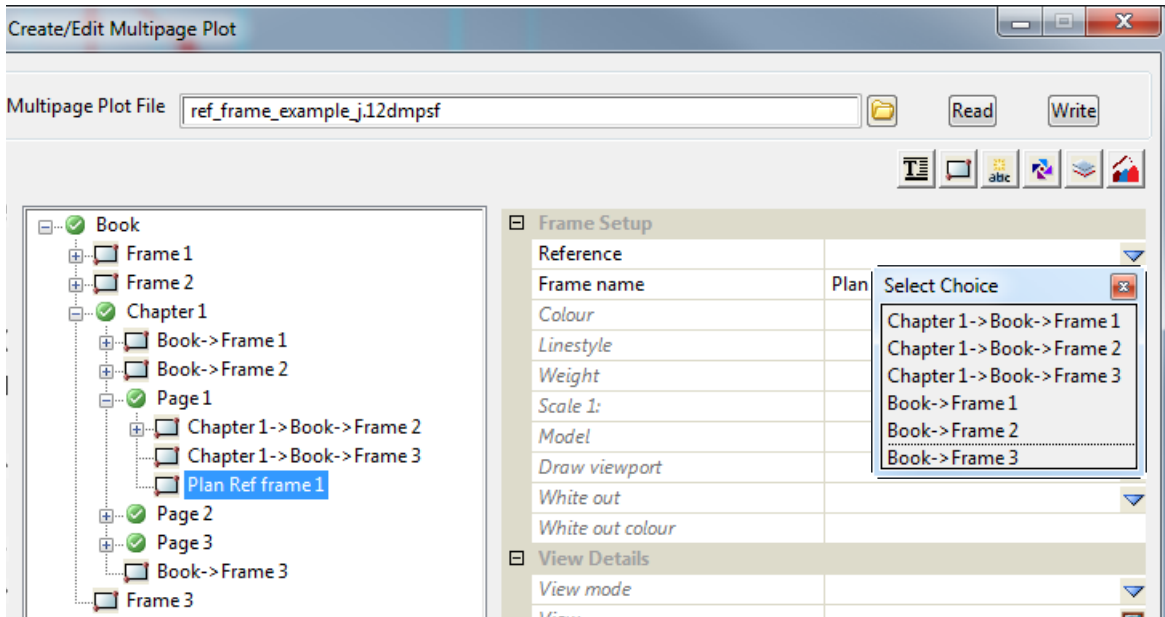


If you answer **Yes**, then the Frame and all the Frames that reference that Frame will be deleted. If you answer **No**, then the Frame is deleted and the Frames that reference it are left.

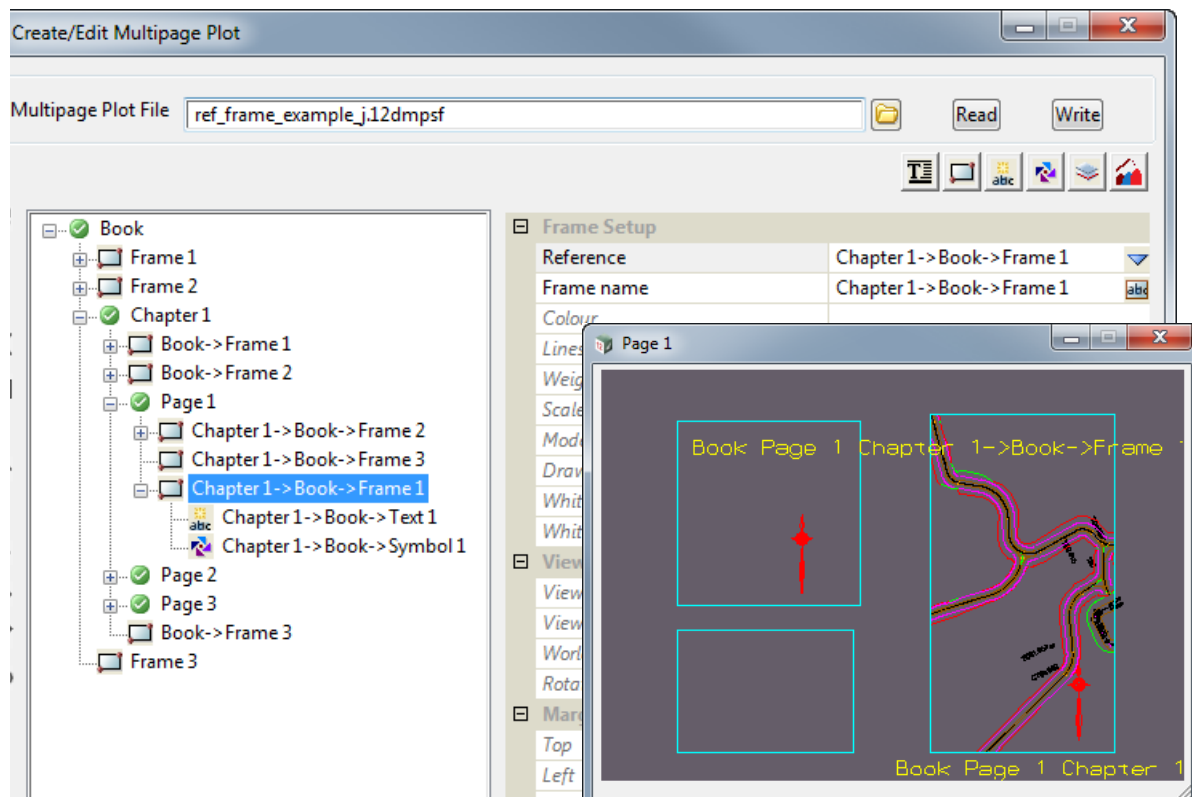


To add a Reference Frame to a Page, first click on the **Page** node, then the **Frame** icon and select **Plan Reference**, **X Reference** or **Long Reference**.

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**.

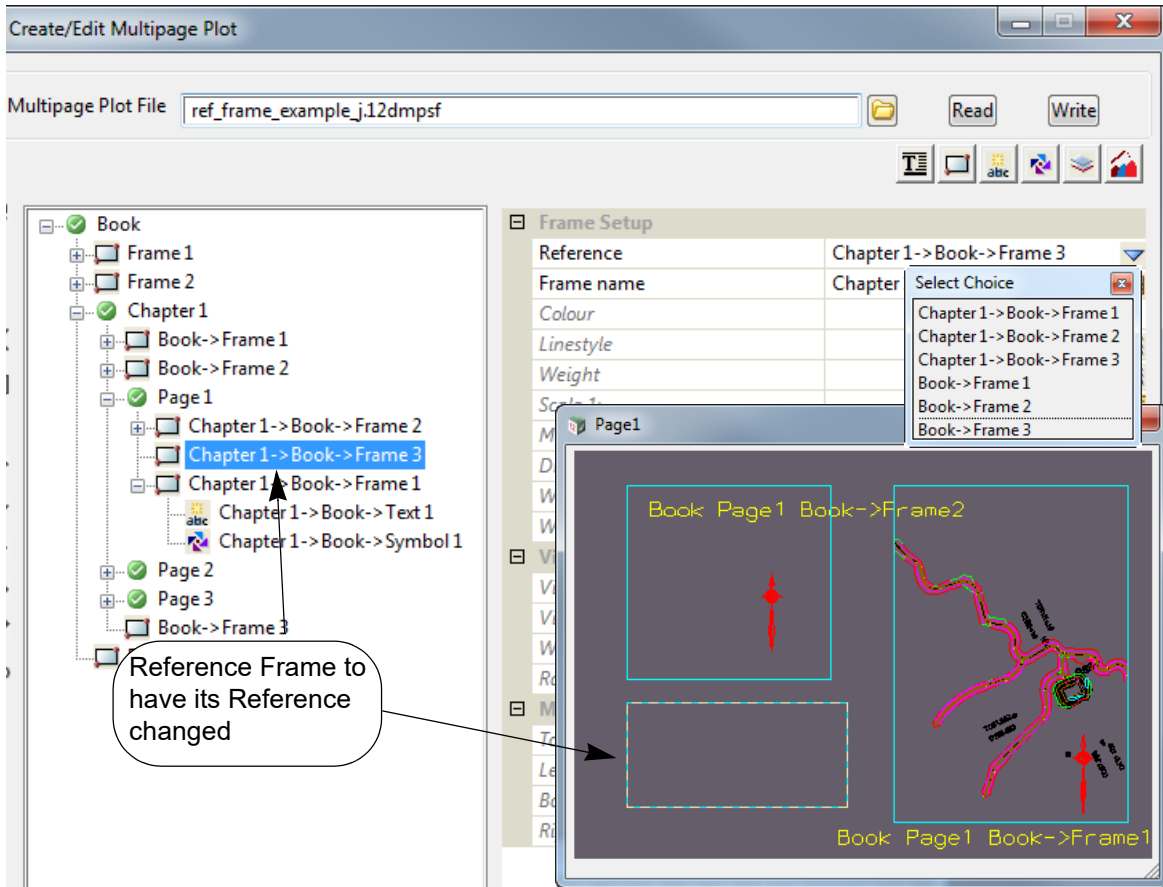


The **Frame Setup**, **View Details** etc can then modified for the Reference Frame as required.

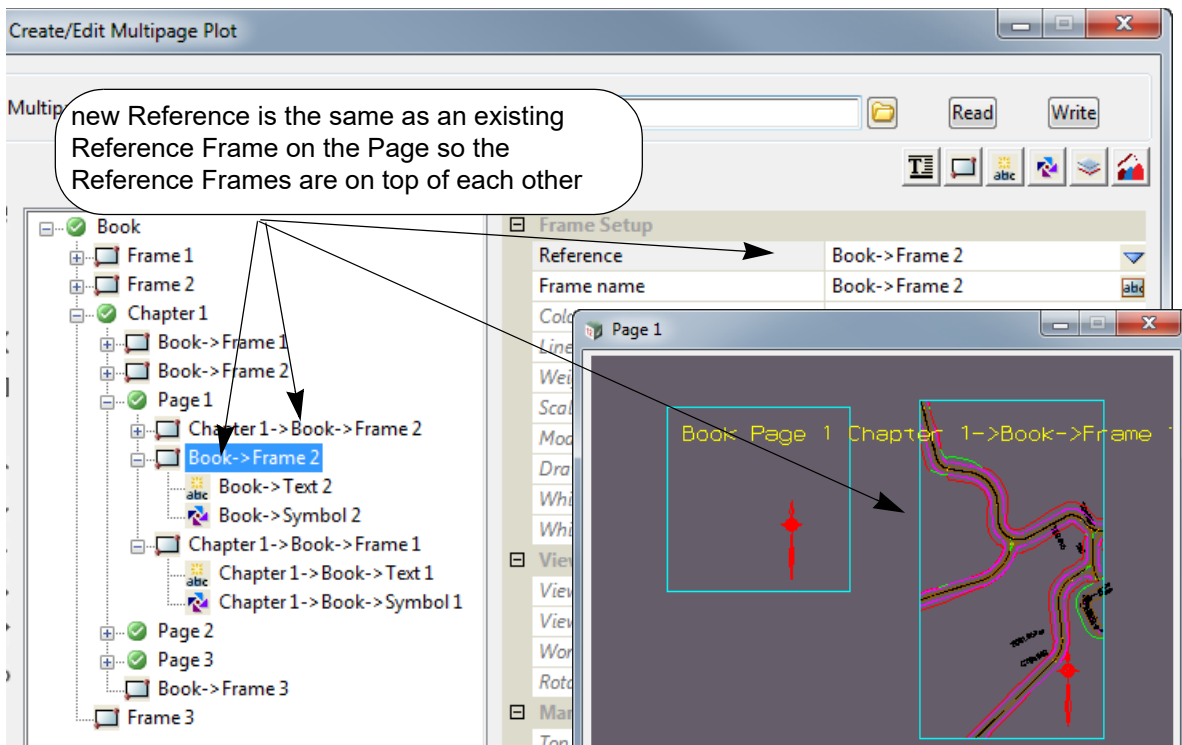
For more information on adding a **Reference Frame** to a **Chapter** or **Page**, see [20.1.4.7.2.2 Reference Frames for a Chapter](#) or [20.1.4.7.3.2 Reference Frames for a Page](#).



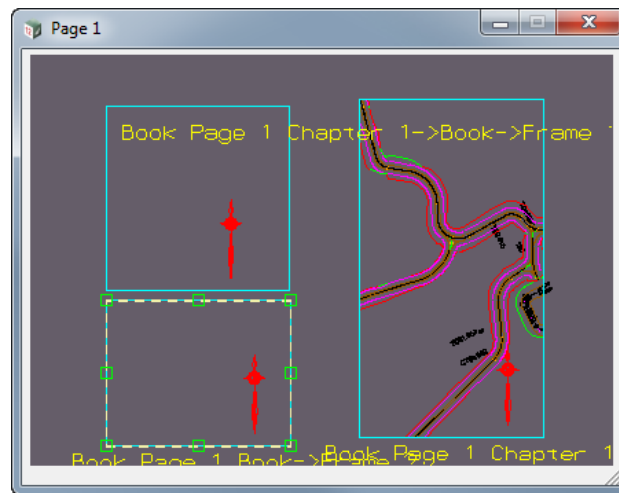
Finally the **Frame** that a **Reference Frame** references can be changed by clicking on the **Reference Frame** node and selecting another **Frame** in the **Reference** field.



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 [26.2 Plans](#) or return to [20.1 Multipage Plots \(MPS\)](#).



# 21 PPF Editors

There has been changes to the **PPF Editors** chapter in the **12d Model Reference manual**.

See [21.1 General Information on PPF Editors](#)

See [21.2 Fields and Nodes Common to PPF Editors](#)

See [21.3 Water Node Diagram PPF](#)

See [21.4 Long Section Plot PPF Editor](#)

See [21.5 Plot to Models - Long Section](#)



## 21.1 General Information on PPF Editors

[21.1 General Information on PPF Editors](#)

[21.2 Fields and Nodes Common to PPF Editors](#)

[21.3 Water Node Diagram PPF](#)

[21.4 Long Section Plot PPF Editor](#)

## 21.2 Fields and Nodes Common to PPF Editors

Now documented in the V15 reference manual

### 21.2.1 Title Blocks

#### 21.2.1.1 Title Block Variables

##### 21.2.1.1.1 Plot Details

###### 21.2.1.1.1.1 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*

###### 21.2.1.1.1.2 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*



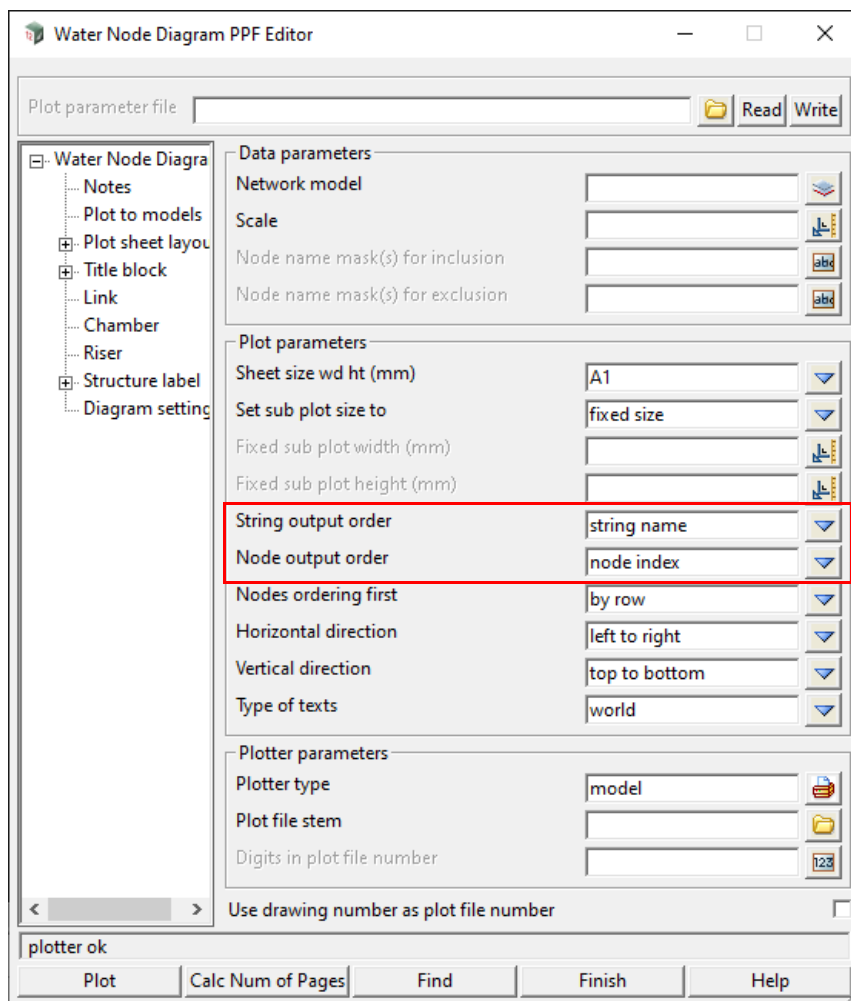
# 21.3 Water Node Diagram PPF

Position of option on menu: Plot =>Plot and PPF Editors =>Water node diagram

## 21.3.1 Water Node Diagram - Front Page

Now documented in the V15 reference manual

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.

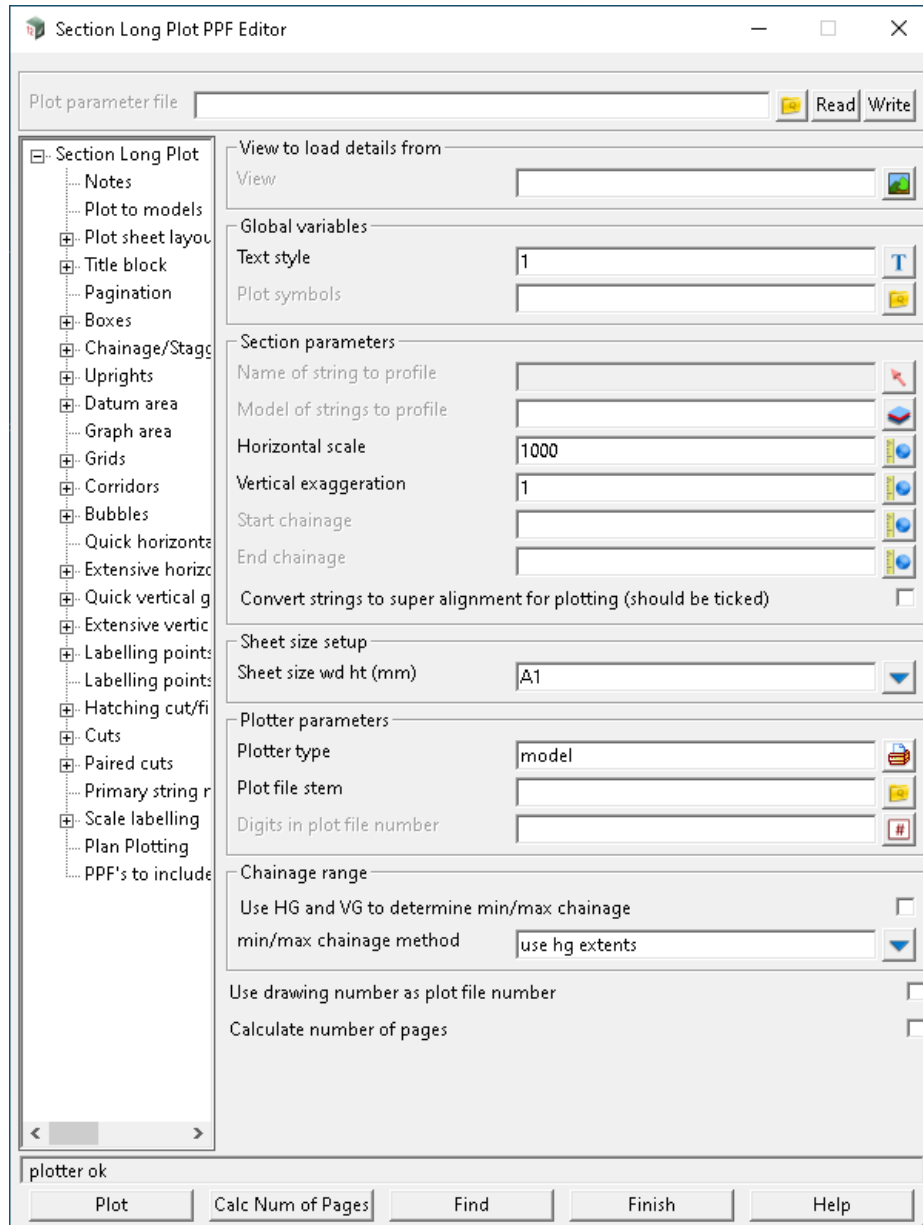
Field Description	Type	Defaults	Pop-Up
<b>String output order</b>	choice box	string name	string name, upstream to downstream, downstream to upstream

*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.*



# 21.4 Long Section Plot PPF Editor



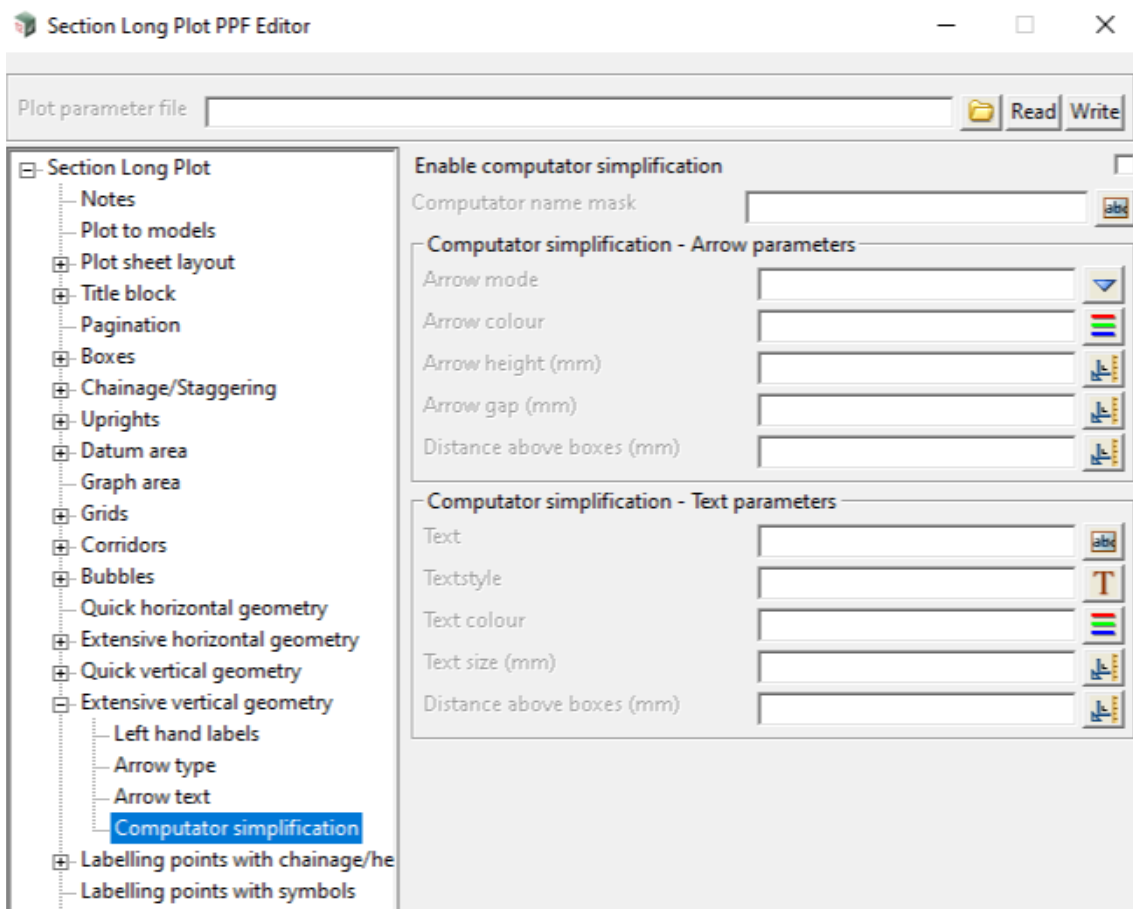
## 21.4.1 Extensive Vertical Geometry - Long Section

### 21.4.1.1 Extensive Vertical Geometry - Computator simplification

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Enable computator simplification</b>	tick box	not ticked	
---	----------	------------	--

*If ticked, computator simplification will be performed.*

*if not ticked, then computator simplification will not be performed.*

<b>Computator name mask</b>	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

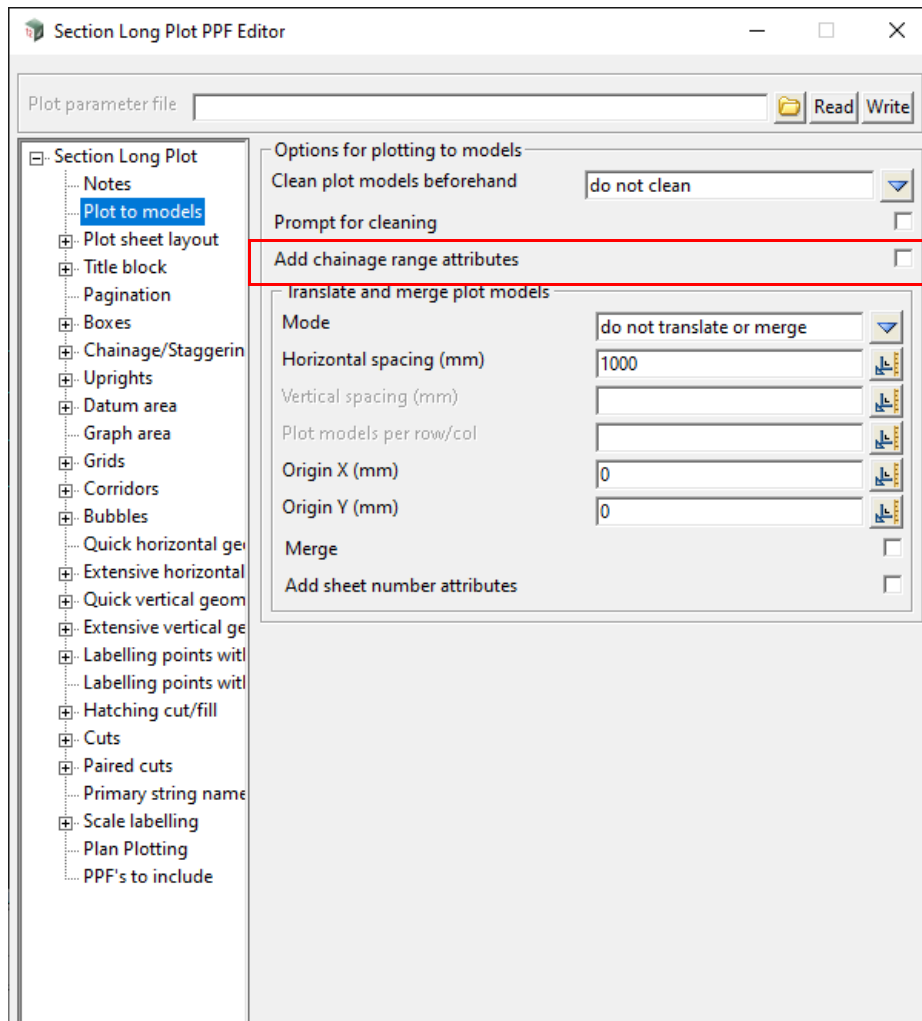
The distance above (or below) the top of the boxes that the **Text** should be drawn. Can be positive or negative.

# 21.5 Plot to Models - Long Section

Now documented in the V15 reference manual

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
-------	-------	----------------	------	--------

<b>Add chainage range attributes</b>	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.*



# 22 Utilities

There has been changes to the **Utilities** chapter in the **12d Model Reference manual**.

See

- [22.1 MetaConnex](#)
- [22.2 Attributes Favourites](#)
- [22.3 Conduit Banks from Attributes](#)
- [22.4 Model from Attribute](#)
- [22.5 Classify with Attributes](#)
- [22.6 Convert Chain to Macro](#)
- [22.7 Change Super Strings Closed](#)
- [22.8 Real Attributes to Null](#)
- [22.9 Regular Cuts Through Strings](#)
- [22.10 Delete empty text attributes](#)

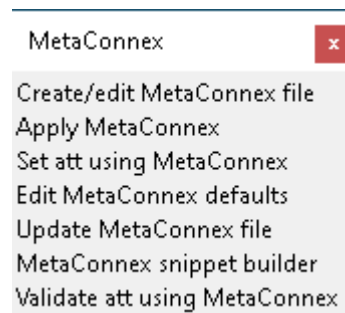
## 22.1 MetaConnex

**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 [22.2 Attributes Favourites](#) or return to [22 Utilities](#).

## 22.2 Attributes Favourites

Position of option on menu: Utilities =>Attributes =>Favourites

Attributes favourites 	See
Rules	<a href="#">22.2.1 Attribute Rules</a>
Check attributes	<a href="#">22.2.2 Attributes Query</a>
Attributes table	<a href="#">22.2.3 Attributes Table</a>

## 22.2.1 Attribute Rules

**Position of option on menu:** Utilities =>Attributes =>Favourites =>Rules

Now documented in the V15 reference manual

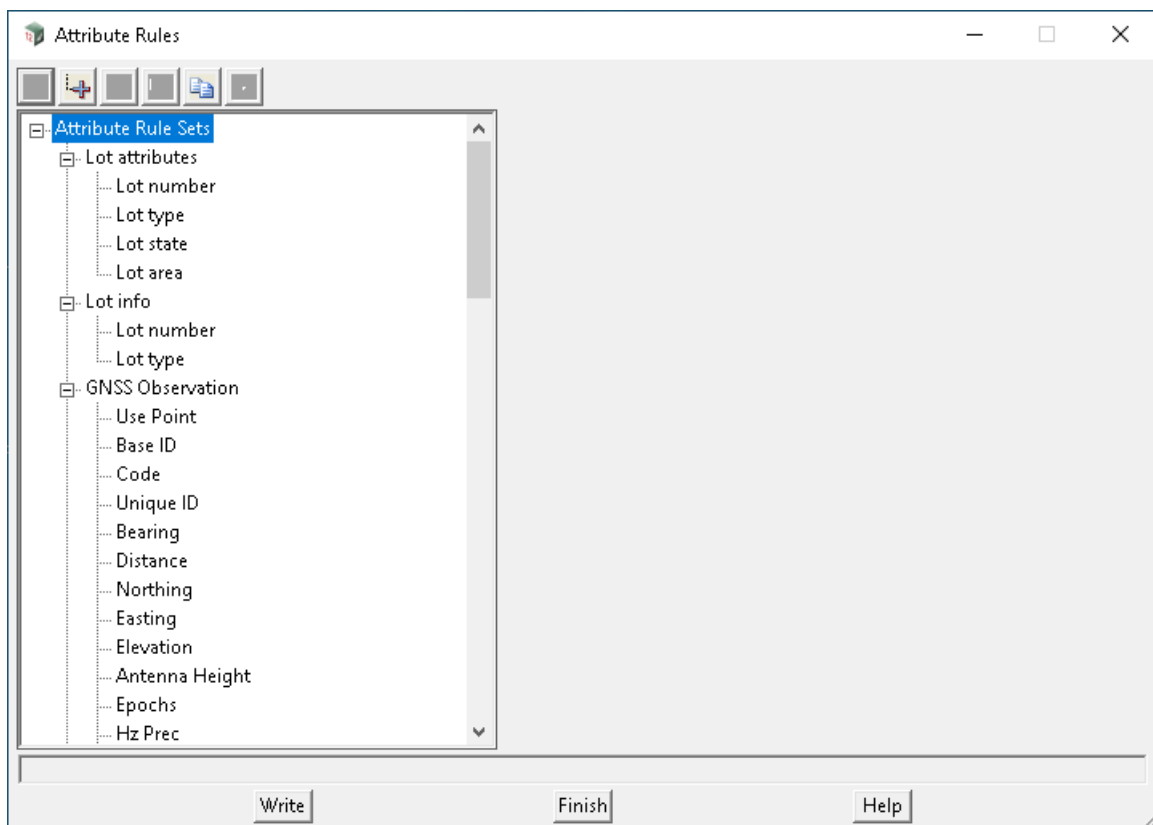
The **Attribute Rules** define what a set of rules (conditions) for element attributes. They are used in the panels **Attributes Table** and **Attributes Query**.

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

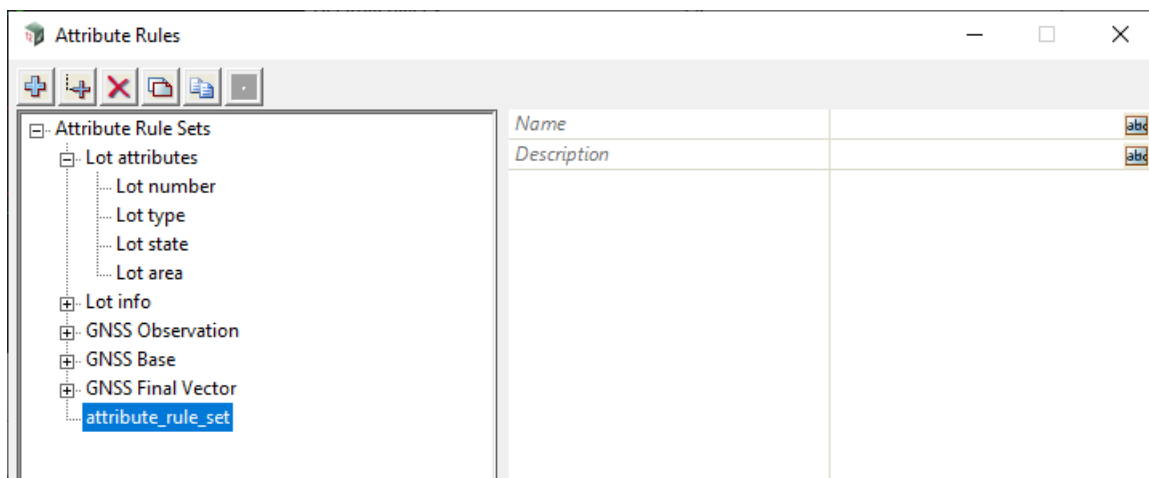
**Attribute Rule Set** must have a unique name. One **Attribute Rule Set** is selected in the **Attributes Table**

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
<b>Name</b>	<i>Name of the rule set. This must be unique within the sets of rules.</i>	text box		
<b>Description</b>	<i>Description of the rule set.</i>	text box		

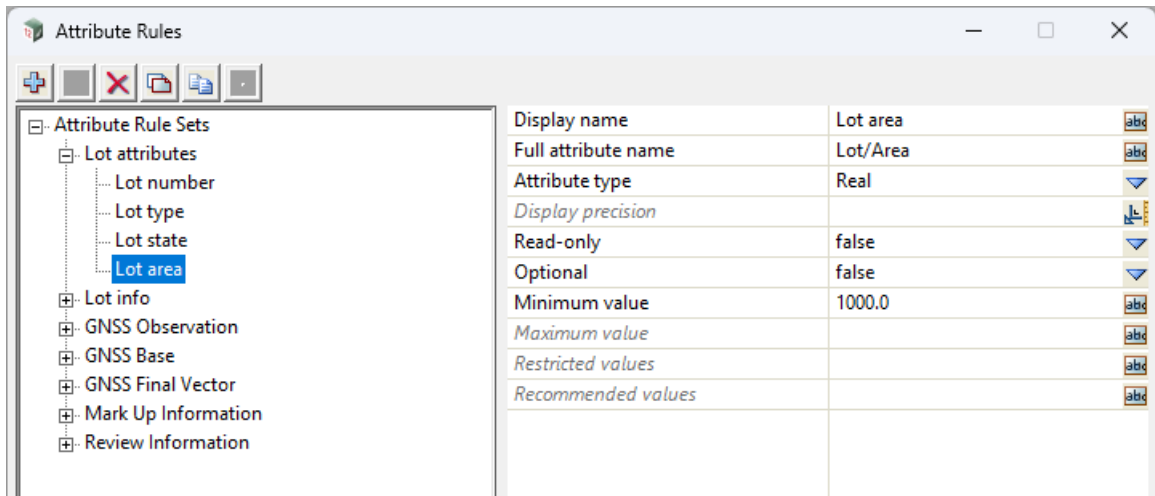
### (b) Rules in an Attribute Rule Set

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.

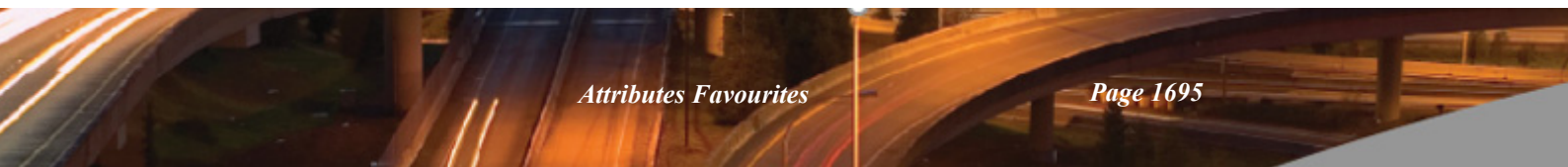
A new *Rule* with the dummy name **attribute\_rule** is then created and a new name must be entered in the **Name** field on the right hand side of the tree. The **Description** is optional.



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
<b>Display name</b> <i>Name of the rule.</i>	text box		
<b>Full attribute name</b> <i>Full attribute name this rule will be applied upon.</i>	text box		
<b>Attribute type</b> <i>If not blank, the rule check for matching type of attribute.</i>	choice box		
<b>Display precision</b> <i>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).</i>	long box		
<b>Read-only</b> <i>Allow the attribute being edited or not.</i>	yes/no box	false	
<b>Optional</b> <i>If yes, the attribute can be omitted, otherwise, a valid value must be provided.</i>	yes/no box	false	
<b>Minimum value</b> <i>If not blank, attribute value must not be less than the specified value.</i>	double box	1000.0	
<b>Maximum value</b> <i>If not blank, attribute value must not be greater than the specified value.</i>	double box		
<b>Restricted value</b> <i>If not blank, attribute value must be one of the values from the list.</i>	choice box		
<b>Recommended value</b> <i>If not blank, attribute value should be one of the values from the list.</i>	choice box		

Continue to [22.2.2 Attributes Query](#) or return to [22.2 Attributes Favourites](#).





## 22.2.2 Attributes Query

**Position of option on menu:** Utilities =>Attributes =>Favourites =>Check attributes

Now documented in the V15 reference manual

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.

	Attribute alias	Data type	Data value
1	Start Point	Integer	174
2	End Point	Integer	166
3	From Name	Text	RN 7
4	To Name	Text	RN 114 DP 499604
5	GVR Bearing	Text	300°23'24.08"
6	GVR Distance	Real	82.840
7	Plan Bearing	Text	300°23'30"
8	Plan Distance	Real	82.840
9	Selection	Text	
10	Notes	Text	
11	Plan	Text	DP 12345
12	Bearing Difference	Text	0°00'05.92"
13	Distance Difference	Real	-0.000

attributes loaded

Select Query Finish Help

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

Field Description	Type	Defaults	Pop-Up
<b>Rule set</b> <i>Name of the rule set being used for the query.</i>	choice box		List of rule sets available
<b>Attribute type</b> <i>Type of attributes being queried.</i>	choice box	element	element, segment, vertex

#### Grid area

<b>Grid</b> <i>There are 4 columns on the grid. The first column is <b>colour</b> 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.</i>	grid box		
---	----------	--	--

#### Buttons on the right-hand side of the Grid

<b>First</b> <i>Go to the first element (of the model) or first segment/vertex (of the element).</i>	button		
<b>Prev</b> <i>Go to the previous element or previous segment/vertex.</i>	button		
<b>Next</b> <i>Go to the next element or the next segment/vertex.</i>	button		
<b>Last</b> <i>Go to the last element (of the model) or last segment/vertex (of the element).</i>	button		

#### Buttons at Bottom

<b>Select</b> <i>Select the element or segment/vertex to query the attributes defined in the selected rule set.</i>	button		
<b>Query</b> <i>Refresh the attributes information to reflect the latest changes.</i>	button		

Continue to [22.2.3 Attributes Table](#) or return to [22.2 Attributes Favourites](#).

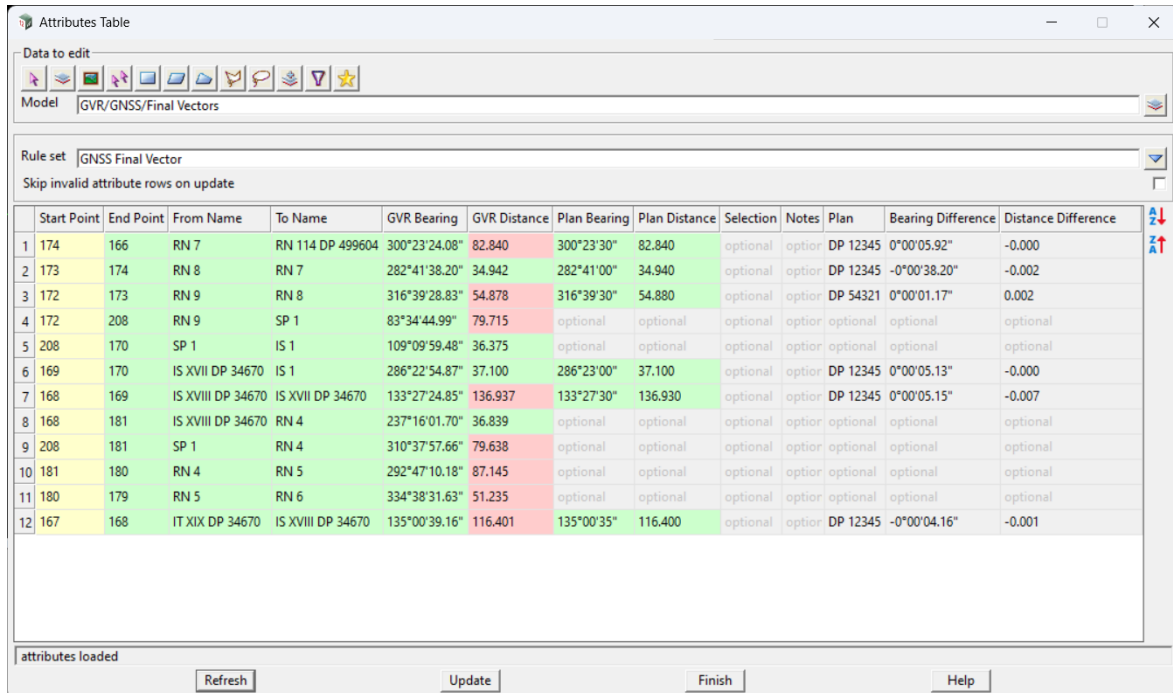
## 22.2.3 Attributes Table

**Position of option on menu:** Utilities =>Attributes =>Favourites =>Attributes table

Now documented in the V15 reference manual

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.



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

Field Description	Type	Defaults	Pop-Up
<b>Data to edit</b>	source box		
<i>Data selection type - for a full description go to <a href="#">3.25.3 Data Source</a>.</i>			
<b>Rule set</b>	choice box		List of rule sets available
<i>Name of the rule set being used for the query.</i>			
<b>Skip invalid attribute rows on update</b>	tick box	not ticked	
<i>If <b>ticked</b>, invalid attribute data row will be ignored (i.e. the underline element attributes won't be updated)</i>			
<i>If <b>not ticked</b>, all attribute data rows will be checked and nothing will be updated unless all rows passed the test</i>			

### Grid area

Grid	grid box
<i>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.</i>	

**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 [22.3 Conduit Banks from Attributes](#) or return to [22.2 Attributes Favourites](#).

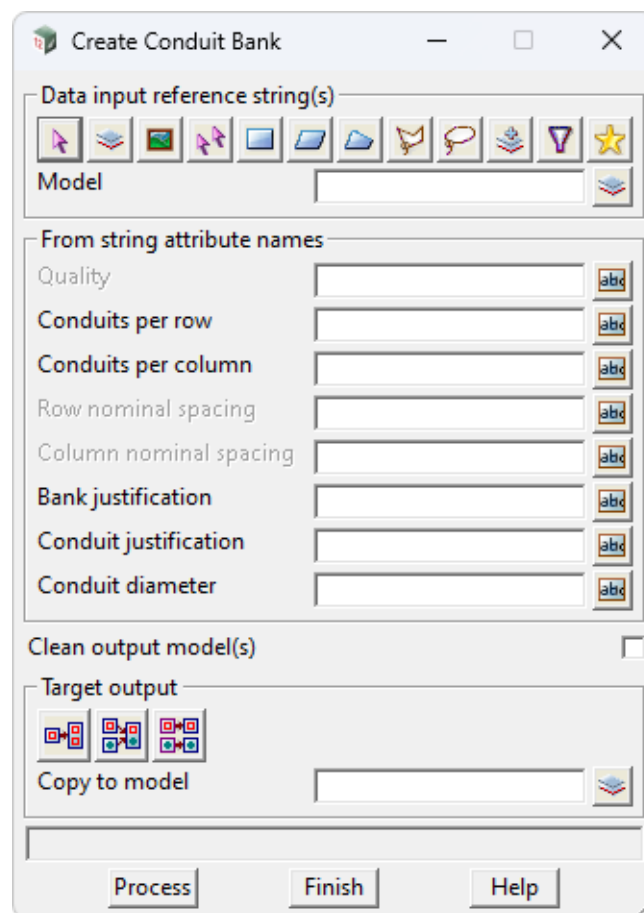
## 22.3 Conduit Banks from Attributes

**Position of option on menu:** Utilities =>Attributes =>Conduit banks from attributes

Now documented in the V15 reference manual

This option allows a user to enter the names of string attributes that will be used to create conduit banks around the reference strings that the string attributes came from.

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
-------	-------------	------	----------	--------

<b>Data input reference string(S)</b>	data source			
---------------------------------------	-------------	--	--	--

*The super string(s) to create the conduits relative to.*

*For a full description go to [3.25.3 Data Source](#).*

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

<b>Quality</b>	input box			
----------------	-----------	--	--	--

*The name of the attribute that contains the conduit quality.*

<b>Conduits per row</b>	input box			
-------------------------	-----------	--	--	--

*The name of the attribute that contains the number of conduits for each row.*

**Conduits per column**      input box

*The name of the attribute that contains the number of conduits for each column.*

**Row nominal spacing**      input box

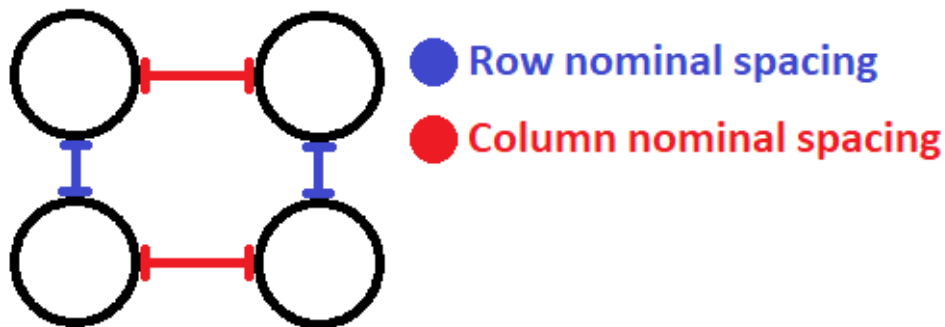
*The name of the attribute that contains the distance between each row of conduits.*

*If blank, a default value of 0.05 is used.*

**Column nominal spacing**      input box

*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**      input box

*The name of the text attribute that contains the justification value of "top", "centre" or "bottom" that is used to justify the conduit bank relative to the entire conduit bank for a given input reference string.*

**Conduit justification**      input box

*The name of the text attribute that contains the justification value of "top", "centre" or "bottom" that is used to justify the conduit bank relative to a single conduit for a given input reference string.*





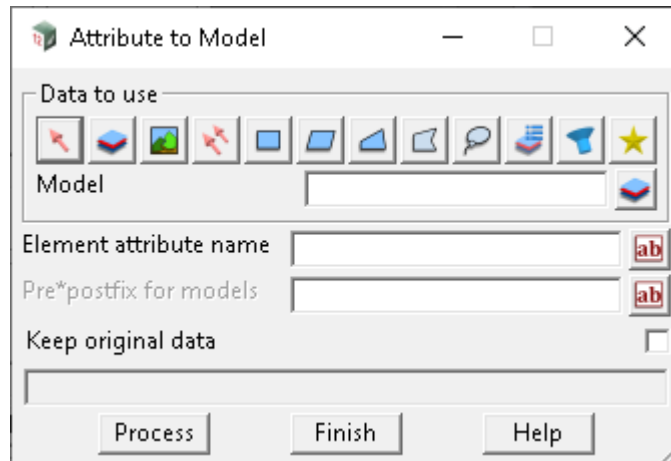
## 22.4 Model from Attribute

**Position of option on menu:** Utilities =>Attributes =>Model from attribute

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data to translate</b>	data source		
--------------------------	-------------	--	--

*Data selection type.*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Data source for data to have an attribute value used as a model name.*

<b>String attribute name</b>	text box		
------------------------------	----------	--	--

*The name of the attribute whose value is to be used as the model for the element.*

<b>Pre*postfix for model</b>	text box		
------------------------------	----------	--	--

*The model name given by the attribute is pre\*postfixed by this text.*

<b>Keep original data</b>	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

<b>Process</b>	button
----------------	--------

*When Process is pressed, the selected data is copied/moved to the model given by the attribute value.*

## 22.5 Classify with Attributes

Classify with attributes ×

Classify closed  
Classify conduits  
Classify super alignments  
Classify super string fills  
Classify symbols

*See*

[22.5.1 Set String Closed Attribute](#)

[22.5.2 Classify Super String Fills](#)

## 22.5.1 Set String Closed Attribute

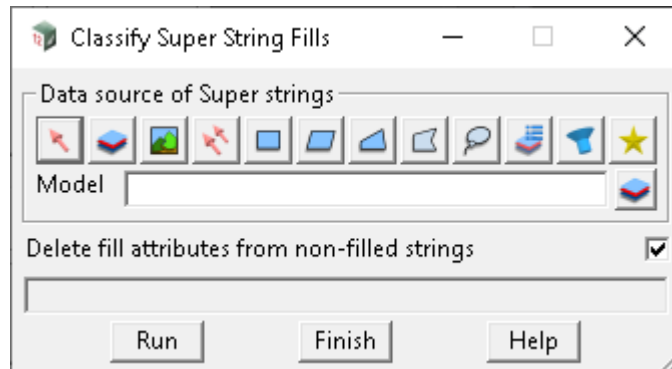
**Position of option on menu:** Utilities =>A-G =>Classify with attributes =>Classify closed

**Position of option on menu:** Utilities =>Attributes =>Classify with attributes =>Classify closed

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data to Attribute</b>	data source		
--------------------------	-------------	--	--

*Data selection type.*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be processed.*

### Buttons at Bottom

<b>Run</b>	button
------------	--------

*Runs the option.*

## 22.5.2 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

Now documented in the V15 reference manual

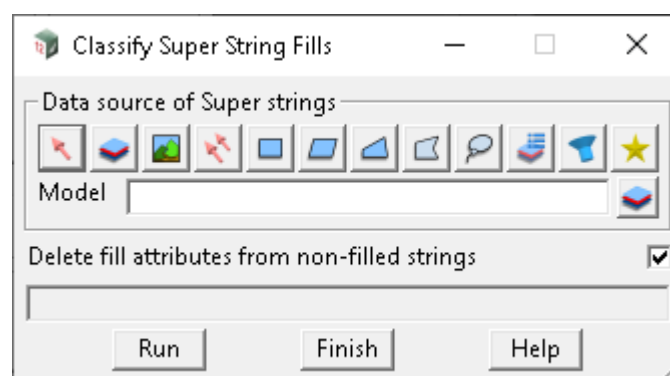
This option sets attributes on **Super** strings with solid fill.

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
-------------------	------	----------	--------

<b>Data source of Super strings</b>	data source		
-------------------------------------	-------------	--	--

*Data selection type.*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be processed*

<b>Delete fill attributes from non-filled strings</b>	tick box	ticked	
---	----------	--------	--

*Whether to delete the above mentioned string attributes (if present) from strings without fill.*

### Buttons at Bottom

<b>Run</b>	button
------------	--------

*Runs the option.*

## 22.6 Convert Chain to Macro

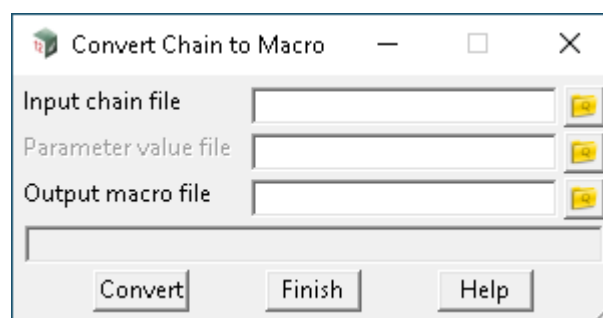
**Position of option on menu:** Utilities =>Chains =>Convert chain to macro

Now documented in the V15 reference manual

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
<b>Input chain file</b> <i>Name of the chain to convert to a macro.</i>	file box		available *.chain, *.rcn files
<b>Parameter value file</b> <i>Parameter file to use with the chain.</i>	file box		available *.pvf files
<b>Output macro file</b> <i>Name of the macro file for the converted chain.</i>	file box		available *.4dm

### Buttons at Bottom

<b>Convert</b> <i>Convert chain to a macro.</i>	button
--	--------



## 22.7 Change Super Strings Closed

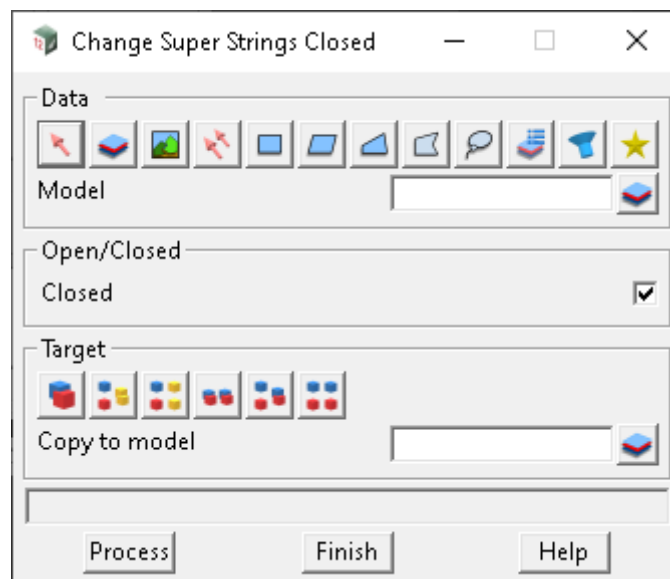
**Position of option on menu:** Utilities =>Super strings =>Close/open super strings

**Position of option on menu:** Utilities =>A-G =>Close

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data</b>	data source		
-------------	-------------	--	--

*Data selection type.*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be processed.*

<b>Closed</b>	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.*

<b>Target info</b>	input		
--------------------	-------	--	--

*Extra information required for the target.*

**Buttons at Bottom**

<b>Process</b>	button		
----------------	--------	--	--

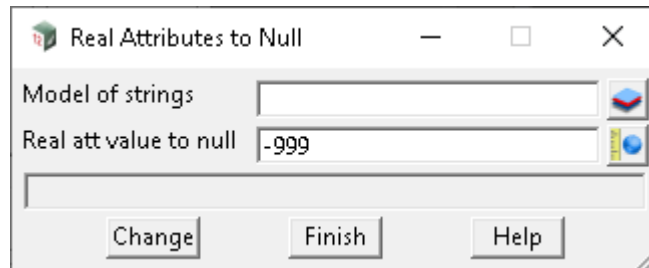
*When pressed, the strings are processed to be opened/closed.*

## 22.8 Real Attributes to Null

**Position of option on menu:** Utilities =>Attributes =>Real attributes to null

Now documented in the V15 reference manual

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
<b>Model of strings</b>	model box		available models
<i>The model to check real attribute values for.</i>			
<b>Real att value to null</b>	real box	-999	
<i>Real value to substitute with Null, wherever it occurs (vertex / segment / string attributes).</i>			

## 22.9 Regular Cuts Through Strings

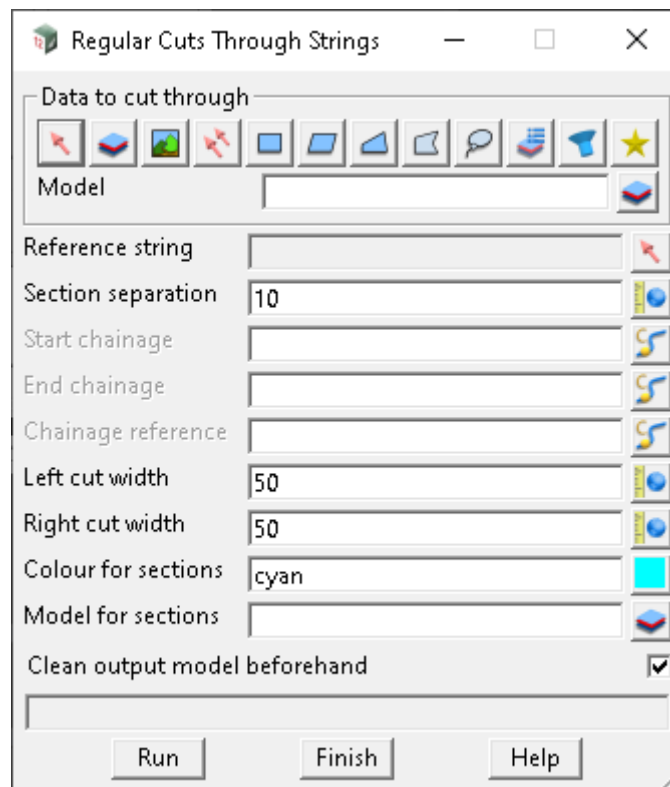
**Position of option on menu:** Utilities =>A-G =>Cuts =>by centreline (regular)

Design =>X-sections =>Cuts =>X-section from regular cuts thru strings

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data to cut through</b>	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 [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be processed.*

<b>Reference string</b>	select box		
-------------------------	------------	--	--

*The string from which the regular chainages are defined. The x-section strings will be normal to the reference string.*

<b>Section separation</b>	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

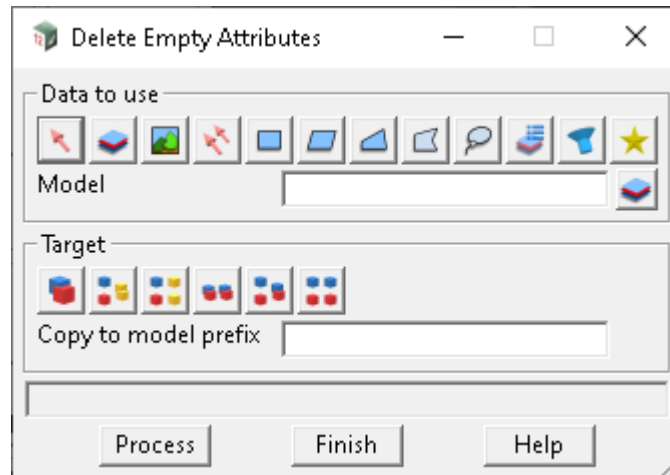
*Launches the 12d help for the option.*

## 22.10 Delete empty text attributes

**Position of option on menu:** Utilities =>Attributes =>Delete empty text attributes

Now documented in the V15 reference manual

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
-------------------	------	----------	--------

<b>Data to use</b>	data source		
--------------------	-------------	--	--

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Selected data source</b>	input	Model	
-----------------------------	-------	-------	--

*Source of data to be used.*

<b>Target type</b>			
--------------------	--	--	--

*Data selection type - for a full description go to [3.25.3 Data Source](#).*

<b>Target info</b>	input		
--------------------	-------	--	--

*Extra information required for the target.*

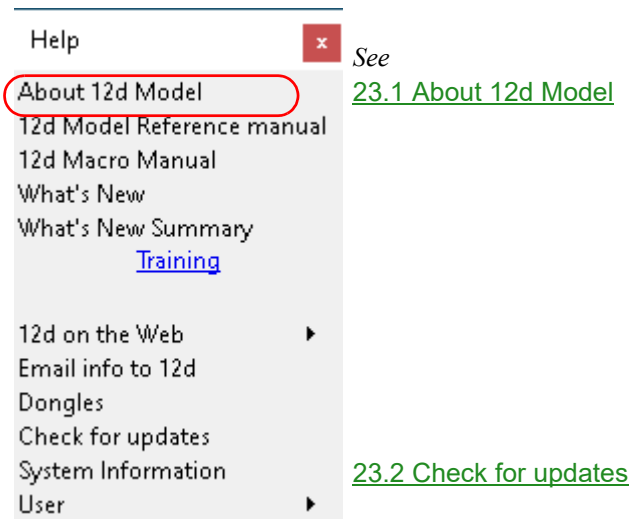
**Buttons at Bottom**

<b>Process</b>	button		
----------------	--------	--	--

*Run the process.*

# 23 Help

There has been changes to the **Help** chapter in the **12d Model Reference manual**.



## 23.1 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.

## 23.2 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.



# 24 Setting Up

There has been changes to the **Setting Up** chapter in the **12d Model Reference manual**.

## 24.1 Environment Variables

### 24.1.1 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 existence 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 existence 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.



# 25 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 Pickup** option (**12d Pickup**) and also the background information required when **12d Pickup** is not being used to produce the survey data on a survey instrument.

For **non-12d Pickup** users, the chapter [44 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

[25.1 An Overview of Surveying and Reduction](#)

[25.2 Survey Reduction in 12d Model](#)

[25.3 Field Coding for 12d Model](#)

[25.4 Field Data Commands](#)

[25.5 Field Data Commands and 12d Field File Opcodes](#)

Continue to [25.2 Survey Reduction in 12d Model](#).

## 25.1 An Overview of Surveying and Reduction

See

[25.1.1 Collecting Survey Data in the Field](#)

[25.1.2 What is Survey Reduction?](#)

### 25.1.1 Collecting Survey Data in the Field

**Total Stations (TPS)** and **GNSS** (GPS, Glonass etc) instruments are used to collect information in the field.

See

[25.1.1.1 Total Stations - TPS](#)

[25.1.1.2 GNSS \(GPS, Glonass etc\)](#)

### 25.1.1.1 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?

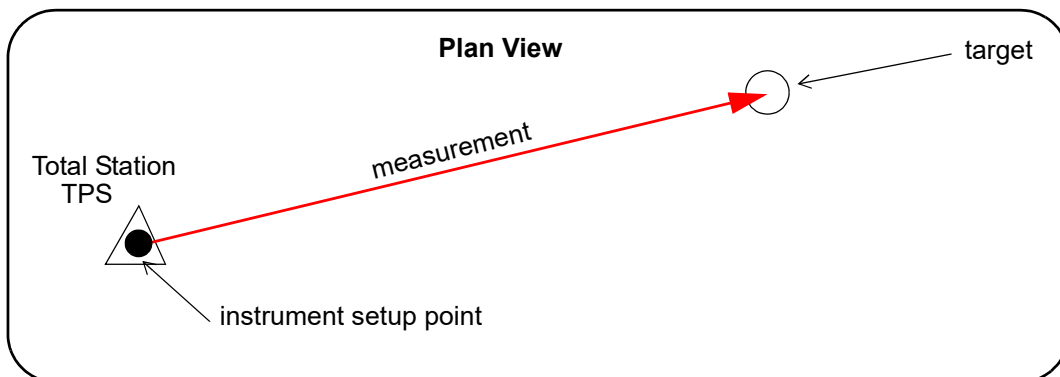
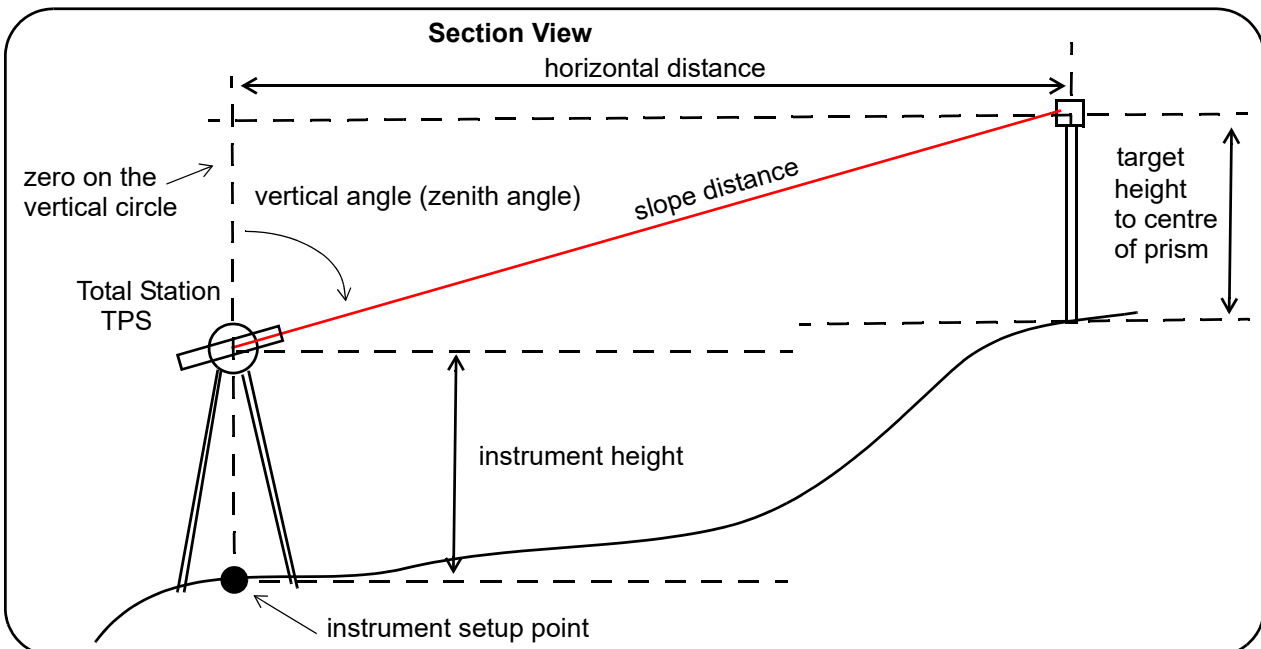
A TPS is set up over a point whose coordinates are known (or will be known) - the **instrument setup point**.

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 from 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**.

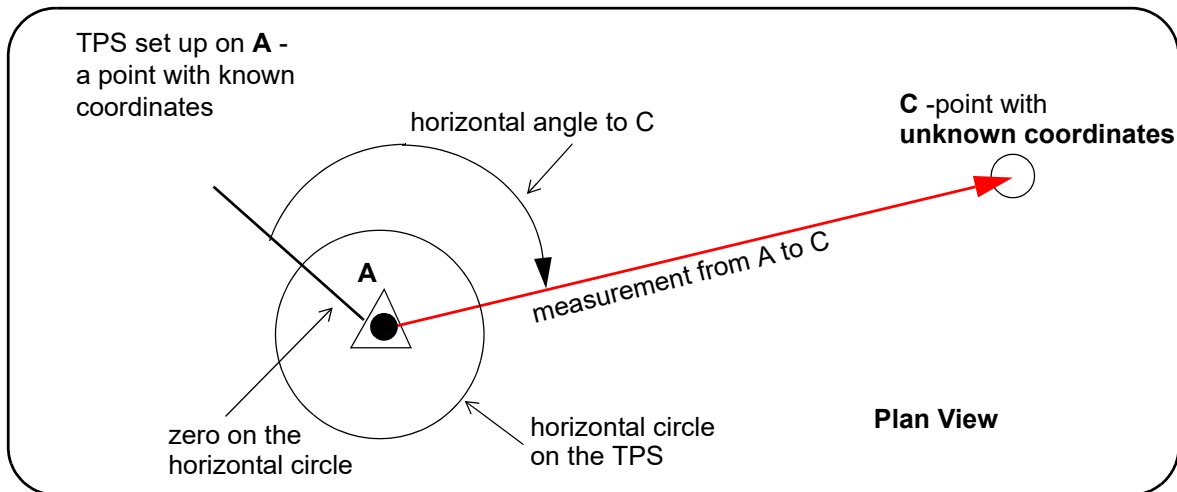
The distance from the centre of the prism to the ground is the **target height**.

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**.





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 know, 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.

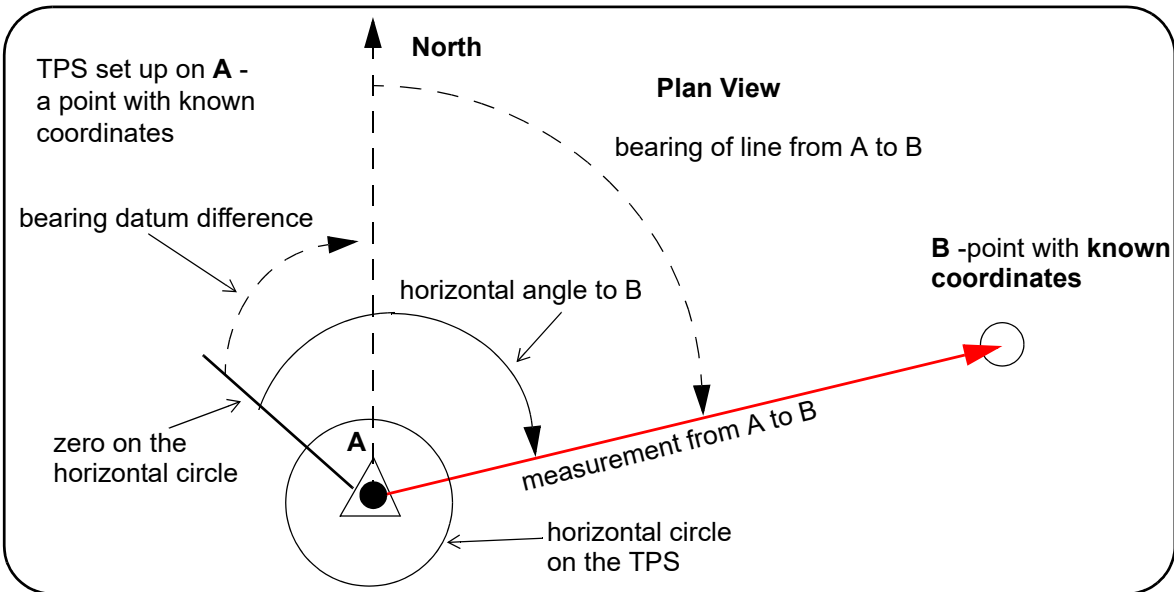
But the most common method used is much easier and only requires that from the same instrument set up, you can make a measurement to another point, **B**, whose (x,y) coordinates are known.

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.

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,

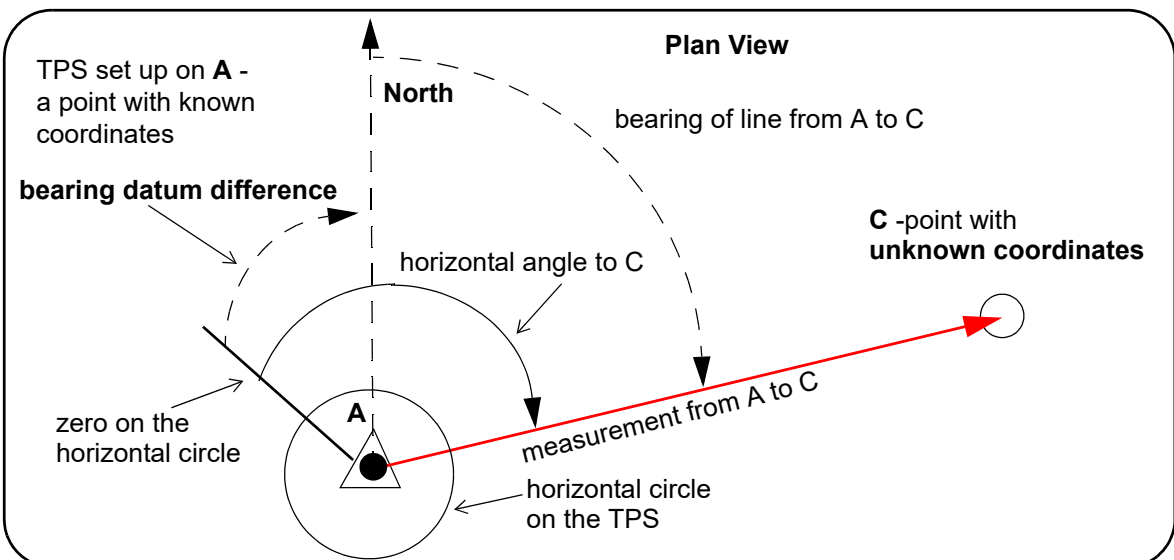
$$\text{Bearing datum difference} = (\text{horizontal angle of B observed from A}) - (\text{bearing of line AB})$$

Because both the bearing of the line AB and the horizontal angle for B are both known quantities, the **bearing datum distance is a known value.**

### How is the bearing dataum 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.

$$(\text{bearing of line AC}) = (\text{horizontal angle of C observed from A}) - \text{Bearing datum difference}$$



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 to get an actual bearing, the coordinates for the known points need to be map coordinates, or at least truncated map coordinates.

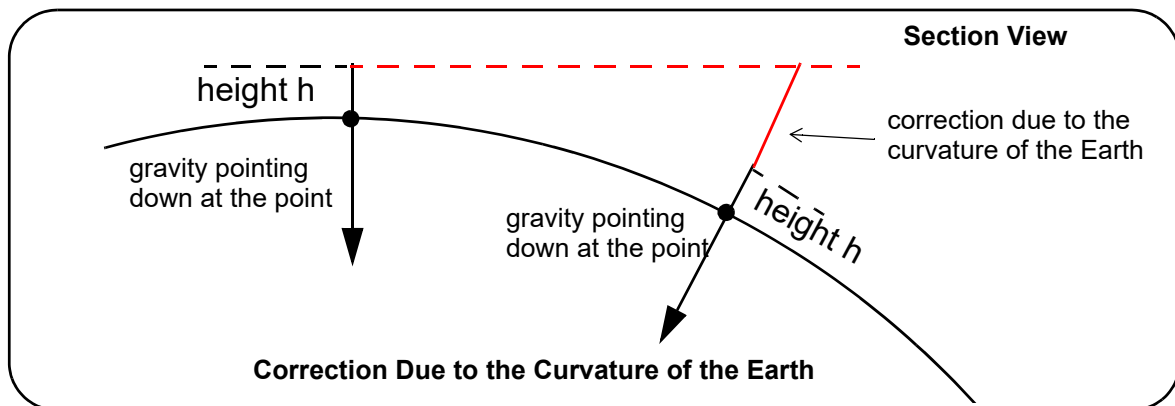
Then there is the fact that there are three Norths uses in Surveying. See [27.4.3 True North, Grid North and Magnetic North](#).

### 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 [25.1.1.2 GNSS \(GPS, Glonass etc\)](#) or return to [25.1.1 Collecting Survey Data in the Field](#) or [25.1 An Overview of Surveying and Reduction](#).

### 25.1.1.2 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 produce 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 [27 Geodetics Summary](#).

Continue to [25.1.2 What is Survey Reduction?](#) or return to [25.1 An Overview of Surveying and Reduction](#) or [25 12d Survey Guide](#).

## 25.1.2 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**.

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 **Survey Data Reduction Function (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.

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** created using the **12d Field File** as its initial input.

So in both cases, it is a **12d Model Survey Data Reduction Function (SDR Function)** that does the survey reduction to produce strings. See [25.1.2 What is Survey Reduction?](#).

### 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 [25.5 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 [25.2 Survey Reduction in 12d Model](#) or return to [25 12d Survey Guide](#).



## 25.2 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 [25.3 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 [25.2.1 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 [25.2.2 A Non 12d Field File is Received](#).

### Important Note

The **SDR 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 [25.5 Field Data Commands and 12d Field File Opcodes](#).

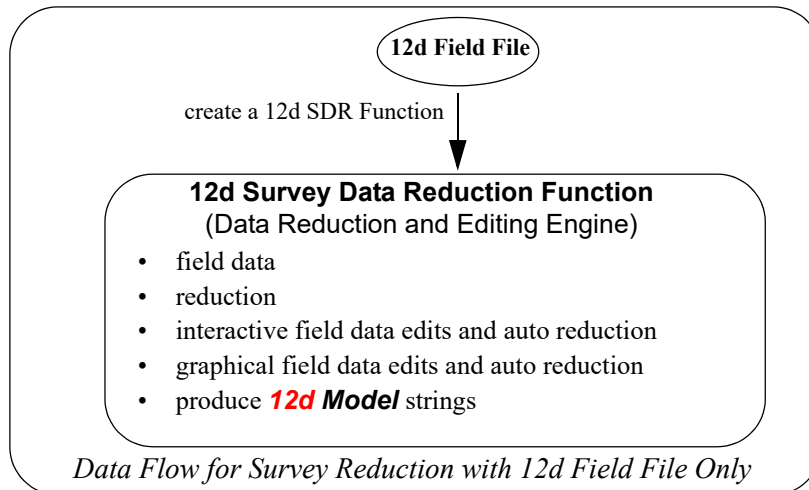
Continue to [25.2.1 12d Field File and No Survey Data Reduction Function](#) or return to [25 12d Survey Guide](#).

## 25.2.1 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 Create 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:



### Note

To understand survey coding in **12d Field File**, the following information is required:

- 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 [25.3 Field Coding for 12d Model](#)
- There are template field coding concepts used in **12d Model** that are common to all instruments. These are described in [25.3.10 Field Templates](#)
- There are shape field coding concepts used in **12d Model** that are common to all instruments. These are described in [25.3.11 Shape Field Coding](#)
- There are traverse field coding concepts used in **12d Model** that are common to all instruments. These are described in [25.3.12 Traverse Coding](#)

Continue to [25.2.2 A Non 12d Field File is Received](#) or return to [25.2 Survey Reduction in 12d Model](#) or [25 12d Survey Guide](#).

## 25.2.2 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**.

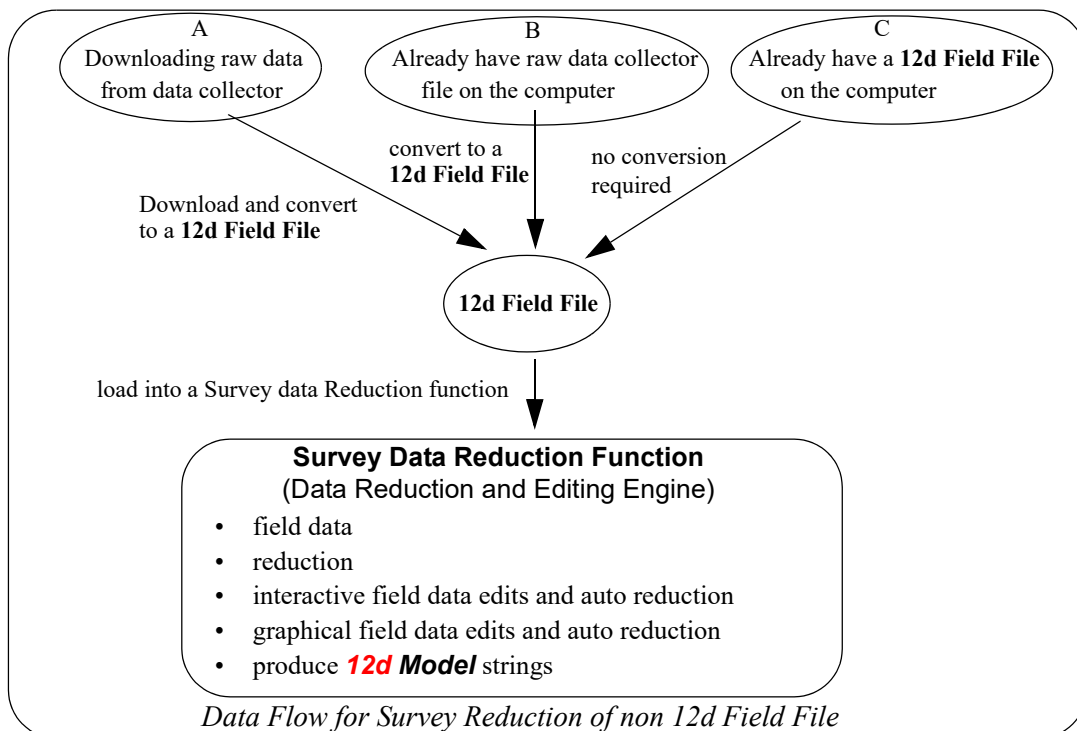
In some circumstances, not all steps are necessary.

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:



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 [44.1 Data Collector Definitions](#).

Continue to [25.2.3 Using Data Collectors](#) or return to [25.2 Survey Reduction in 12d Model](#) or [25 12d Survey Guide](#).

## 25.2.3 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, want 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 [25.3 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 [25.3.10 Field Templates](#)
- (c) Also shape field coding concepts used in **12d Model** that are common to all instruments. These are described in [25.3.11 Shape Field Coding](#)
- (d) And traverse field coding concepts used in **12d Model** that are common to all instruments. These are described in [25.3.12 Traverse Coding](#)
- (e) For Leica instruments, the coding methods are different from most other types. These are described in [44.3 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 [44.2 Field Coding for Non Leica Instruments](#)

Continue to [25.3 Field Coding for 12d Model](#) or return to [25 12d Survey Guide](#).

## 25.3 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 Pickup** stores the **feature codes, string number etc** as **field data commands (commands)** is well defined in [25.4 Field Data Commands](#) but unfortunately there is no industry standard for doing so on other survey instruments and data collectors.

For **non-12d Pickup** users, **12d Model** needs to convert the raw data files from the different survey instruments and data recorders with different coding conventions, into a **12d Field File** before being 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

- [25.3.1 Stringing in the Field.](#)
- [25.3.2 Offsets.](#)
- [25.3.3 Start New String.](#)
- [25.3.4 Close String.](#)
- [25.3.5 Squashed Rectangle - Parallelogram.](#)
- [25.3.6 Rectangle by 2 Points.](#)
- [25.3.7 Feature String.](#)
- [25.3.8 Joining Strings](#)
- [25.3.9 Arcs Through Points](#)
- [25.3.10 Field Templates](#)
- [25.3.11 Shape Field Coding](#)
- [25.3.12 Traverse Coding](#)

Continue to [25.3.1 Stringing in the Field](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).



## 25.3.1 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.

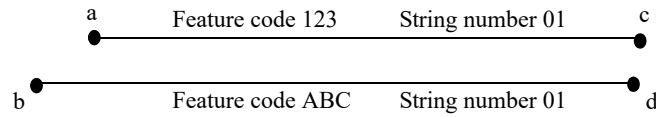
### Important Note

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:

- [25.3.2 Offsets](#)
- [25.3.3 Start New String](#)
- [25.3.4 Close String](#)
- [25.3.5 Squashed Rectangle - Parallelogram](#)
- [25.3.6 Rectangle by 2 Points](#)
- [25.3.7 Feature String](#)
- [25.3.4 Close String](#)
- [25.3.8 Joining Strings](#)
- [25.3.9 Arcs Through Points](#)
- [25.3.10 Field Templates](#)
- [25.3.11 Shape Field Coding](#)
- [25.3.12 Traverse Coding](#)

Continue to [25.3.2 Offsets](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

## 25.3.2 Offsets

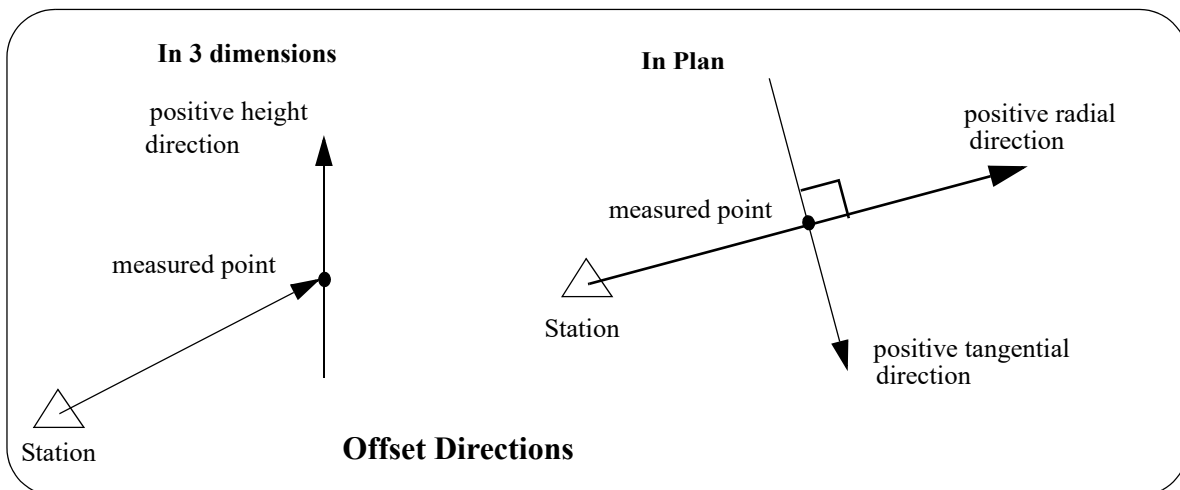
It is not always possible to measure a point directly but it may be possible to measure a point nearby and then measure an offset to adjust the measured point by and so produce the coordinates of the required point.

The three offsets that are allowed as field data commands:

**Height** - 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** - 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** - 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.



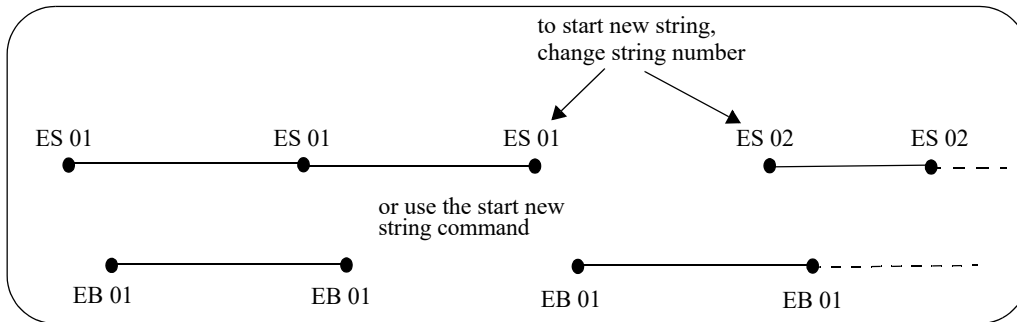
Continue to [25.3.3 Start New String](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

### 25.3.3 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.

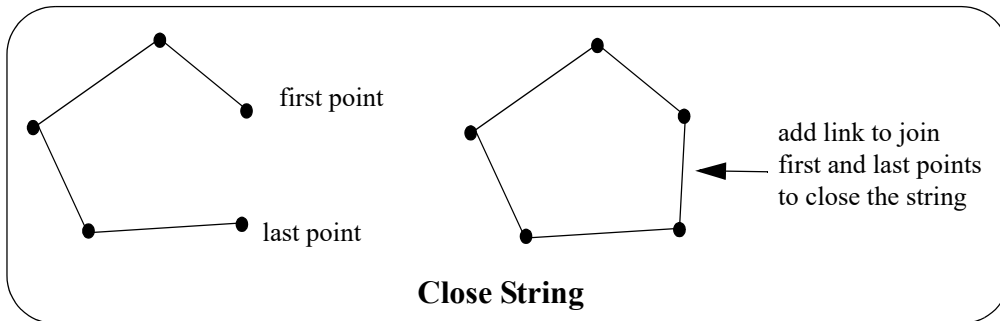


Continue to [25.3.4 Close String](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

### 25.3.4 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.

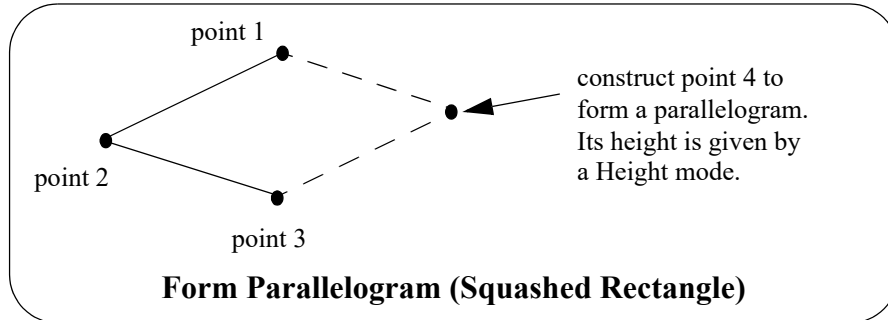


Continue to [25.3.5 Squashed Rectangle - Parallelogram](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

### 25.3.5 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**.

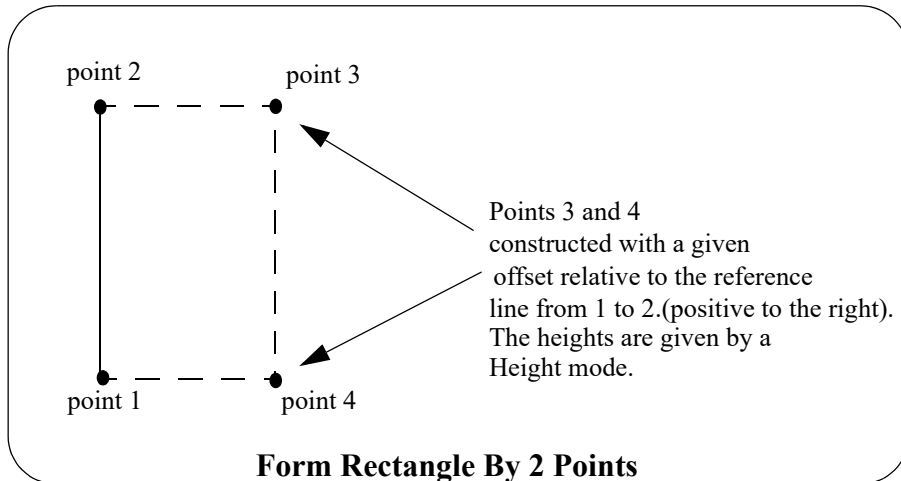


Continue to [25.3.6 Rectangle by 2 Points](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

### 25.3.6 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**.



Continue to [25.3.7 Feature String](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).



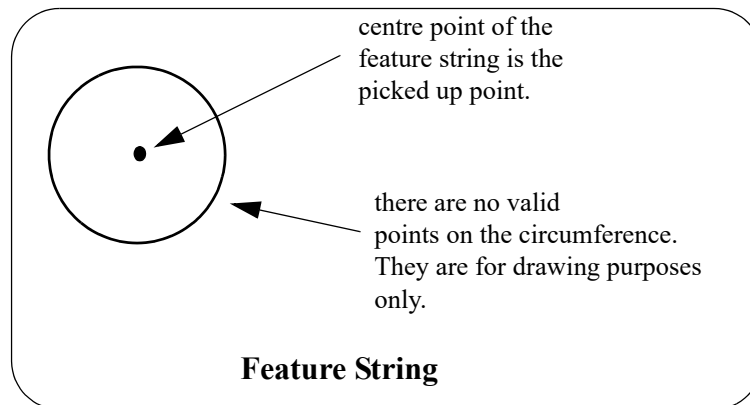
## 25.3.7 Feature String

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.



Continue to [25.3.8 Joining Strings](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

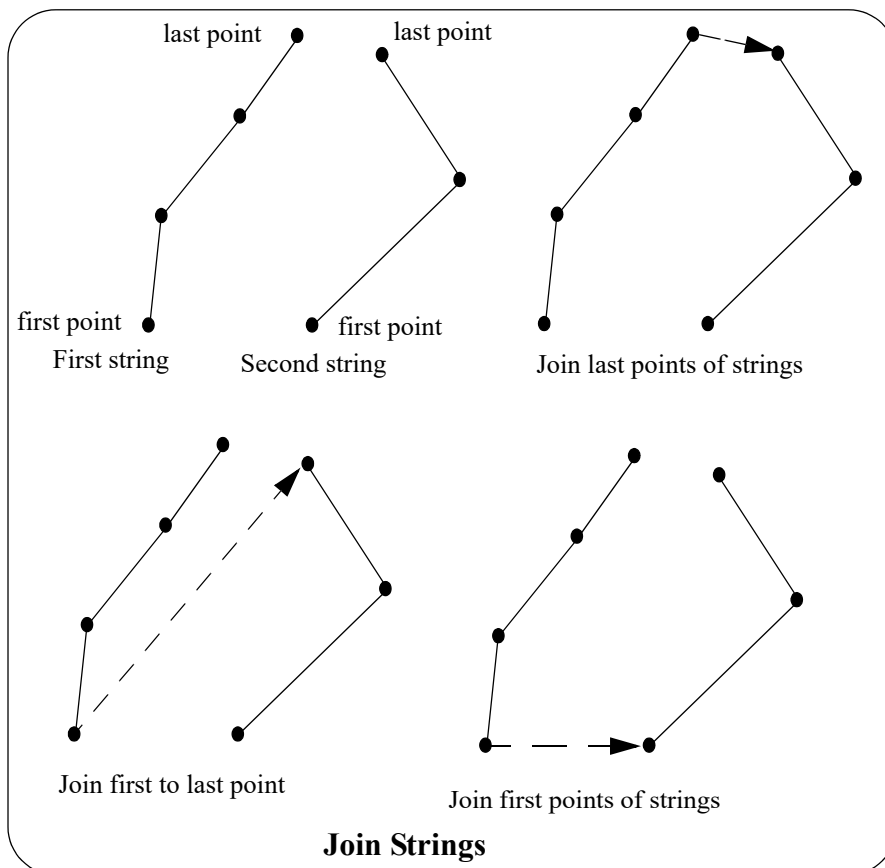
## 25.3.8 Joining Strings

There are three commands for joining two strings together.

**Join last points of strings** - 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** - 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** - 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.



Continue to [25.3.9 Arcs Through Points](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

## 25.3.9 Arcs Through Points

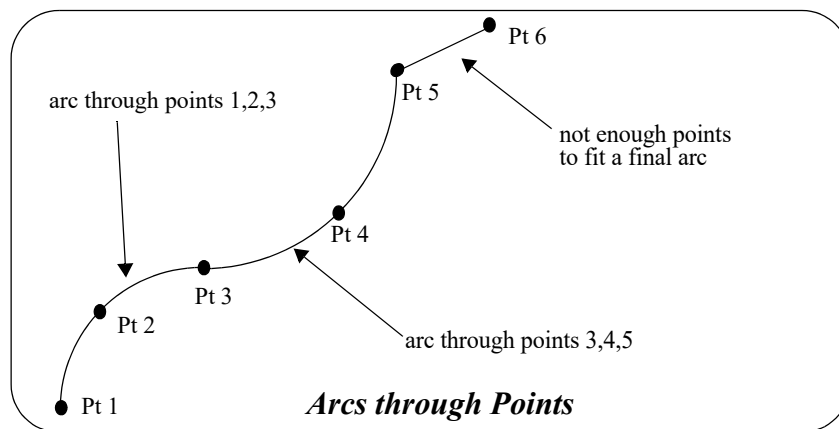
There are a number of commands to fit arcs through sequences of three or more points. Note that this is an **arc** in **plan**, with different z-values at each of the three points. The z-values are linearly interpolated around the arc between the points.

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 arc commands to

- (a) fit an arc through the next three points
- (b) fit an arc through the previous three points.
- (c) fit arcs to sets of three points until stopped.

The first two cases need no explanation but in the final case, a arc is fitted to the first three points, and then another arc to points 3, 4 and 5 and then an arc through 5,6 and 7 and so on. 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.



Continue to [25.3.10 Field Templates](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

### 25.3.10 Field Templates

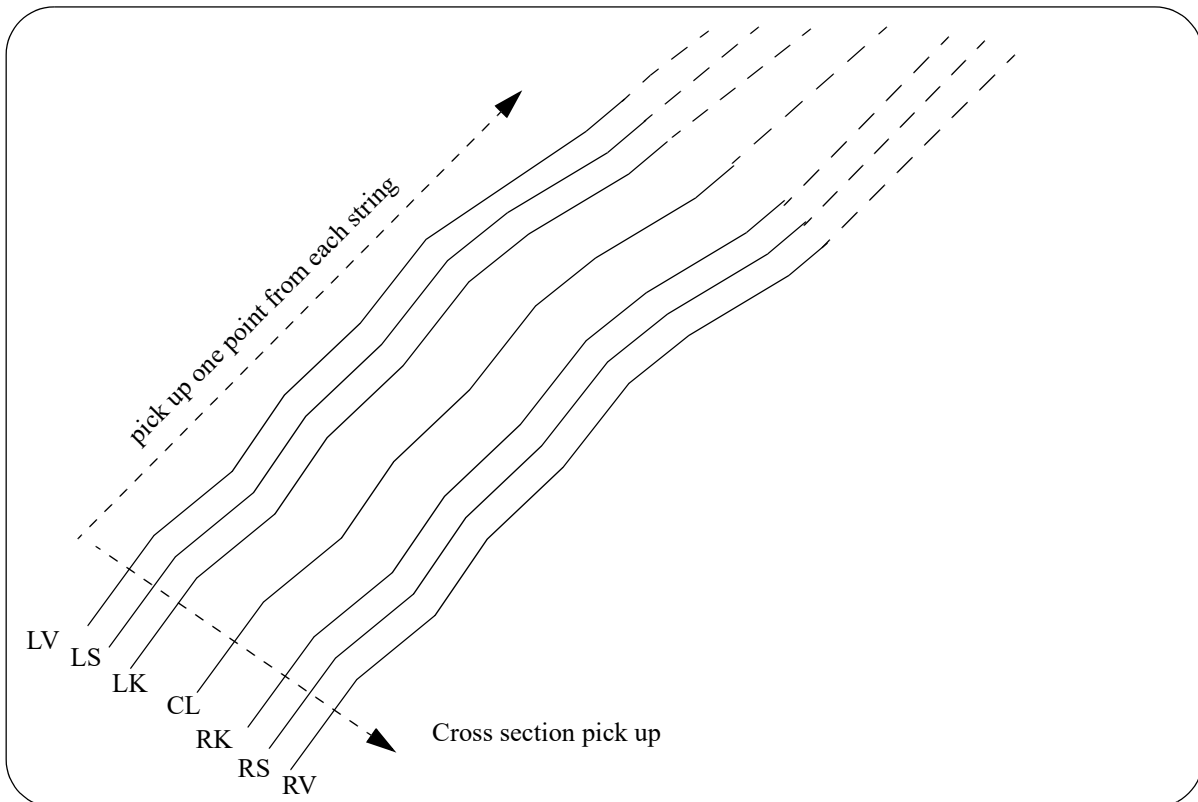
If a series of points are being picked up along the one string then the **feature code** and **string number** only need to be entered once since the **default** is for a measurement to use the **last feature code and string number** if no new ones are given.

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.

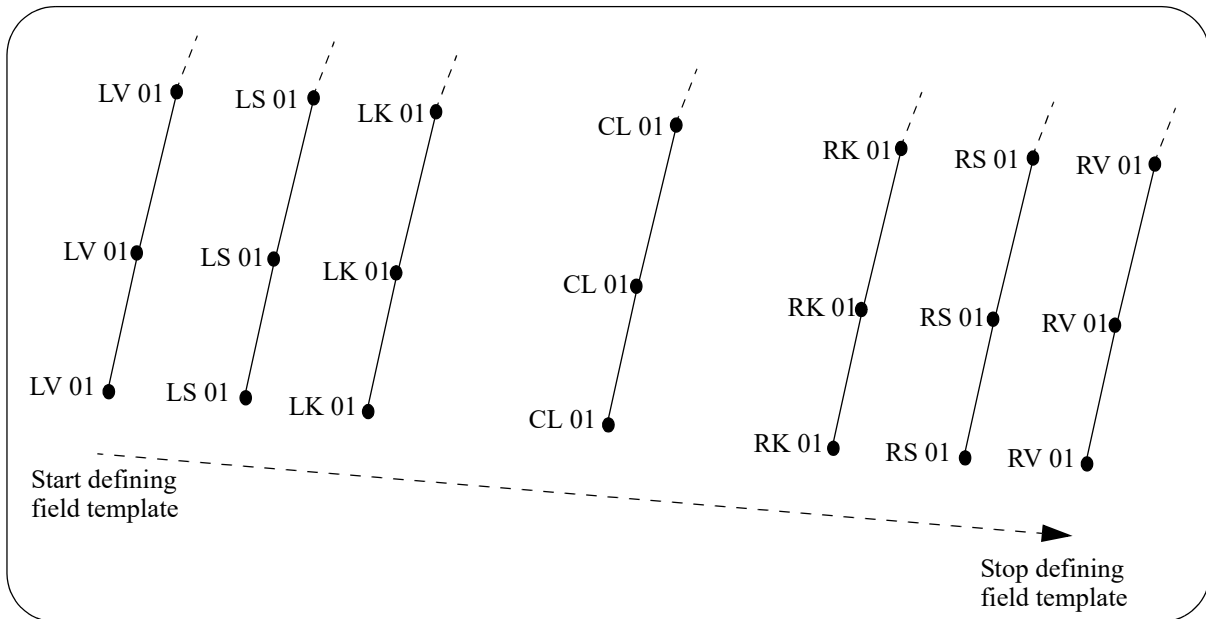
In the diagram below, this means picking up one point from each of the strings LV, LS, LK, CL, RK, RS, RV and then moving onto the next cross section rather than picking up all of LV and then all of LS and so on.

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 **string 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:

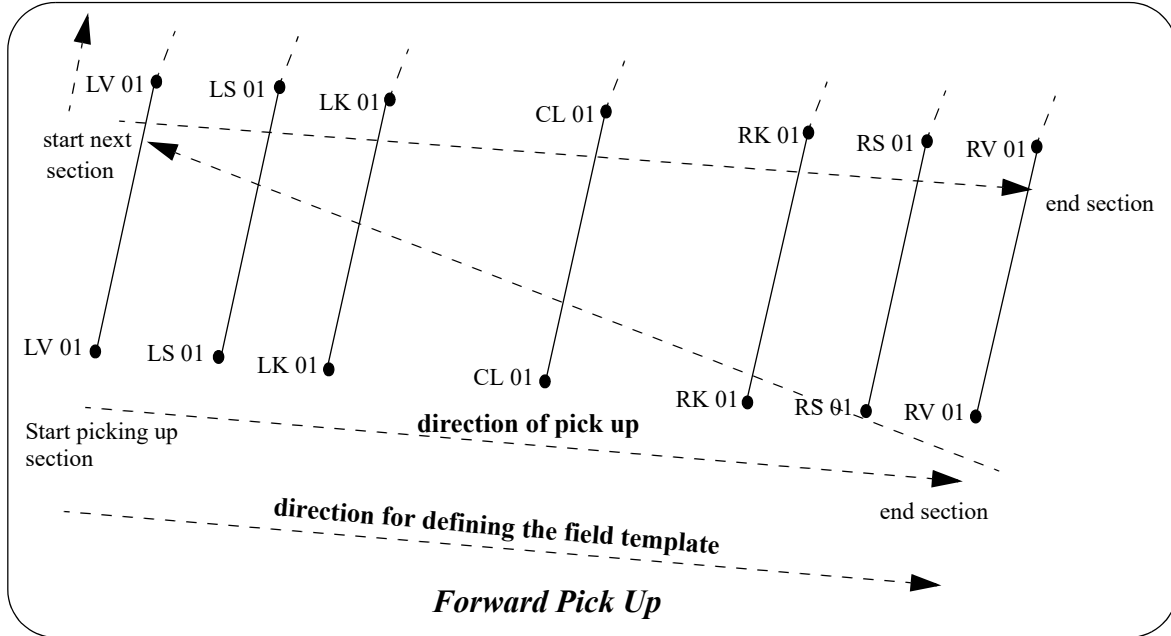
- in the same order as the codes are defined in the field template (forward direction).
- in the opposite order to how the codes are defined in the field template (reverse direction).
- in an alternating same and opposite order that the codes are defined in field template (zig-zag)

These three modes of usage of a field template will be described in the following sections.

Continue to [25.3.10.1 Forward Direction](#).

### 25.3.10.1 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.

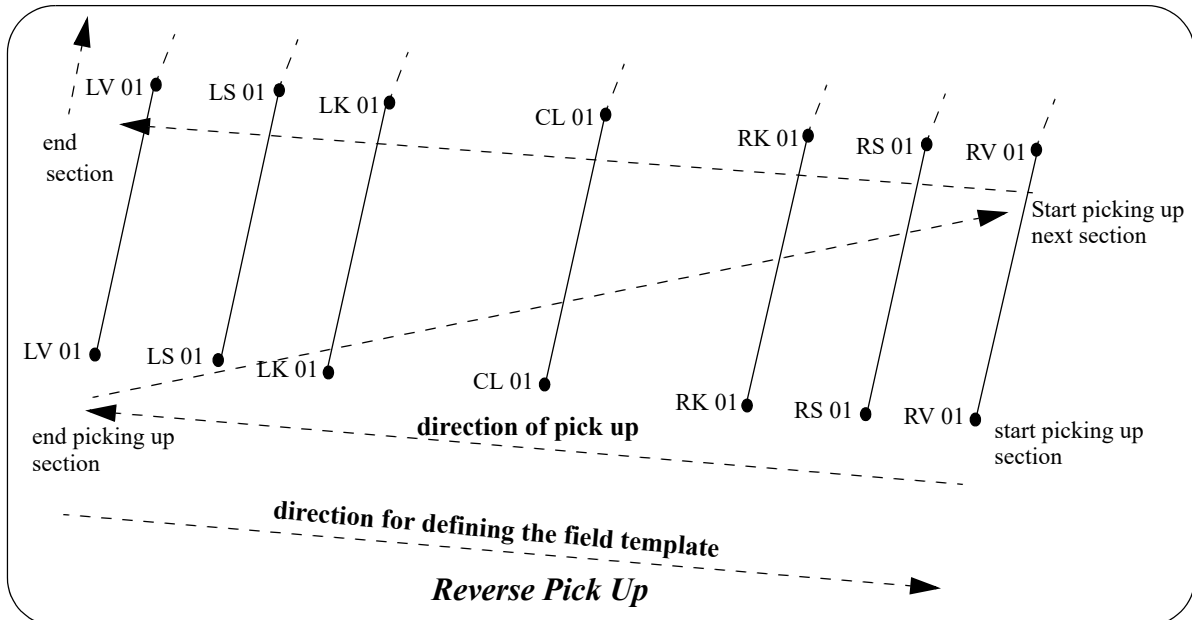


Continue to [25.3.10.2 Reverse Template Direction](#).



### 25.3.10.2 Reverse Template Direction

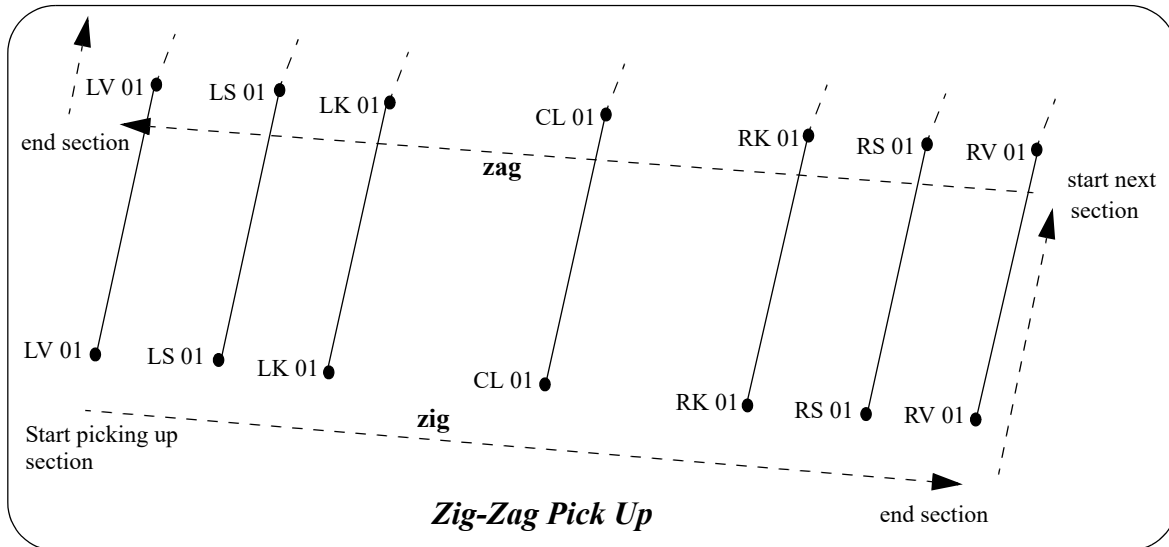
If the field template is used in the *reverse* direction, then the feature codes and string numbers are used in the reverse order to what they were defined to be in the field template. That is the feature codes and string numbers start at the *end* of the field template definition and are used in the 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 [25.3.10.3 Zig-Zag](#).

### 25.3.10.3 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*.

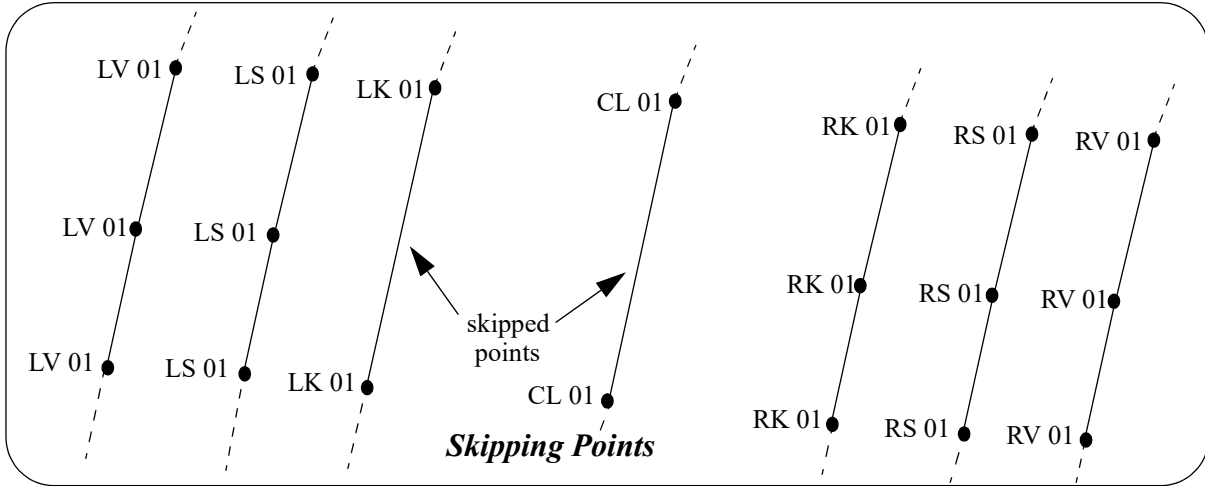
Hence if a field template is used in the zig-zag mode, it can be used as either:

- a zig-zag field template starting on the zig
- a zig-zag field template starting on the zag.

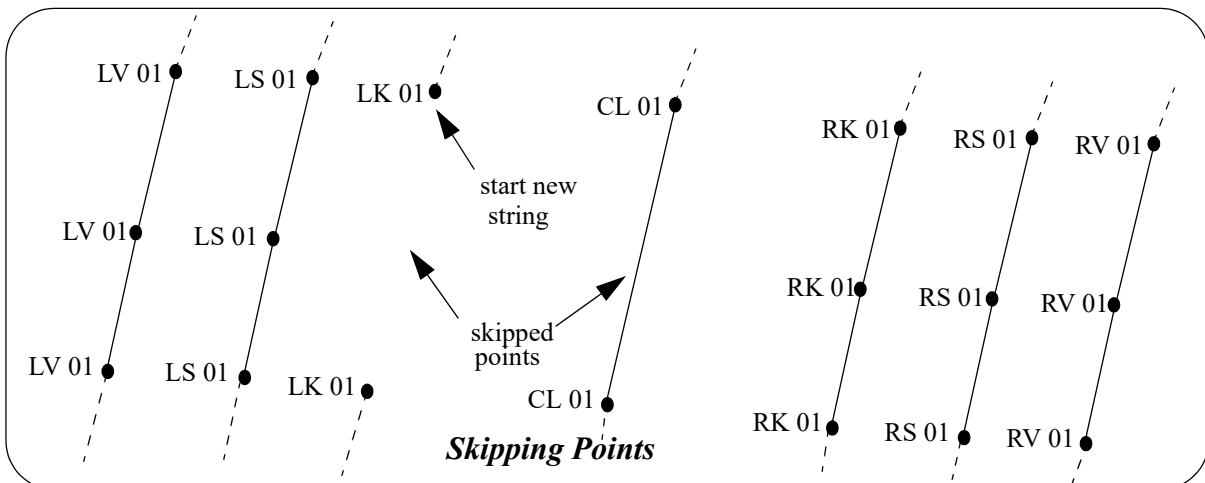
Continue to [25.3.10.4 Skipping Field Template Points](#).

### 25.3.10.4 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 [25.3.10.5 Insert Template Points or Insert Multiple Codes.](#)

### 25.3.10.5 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.

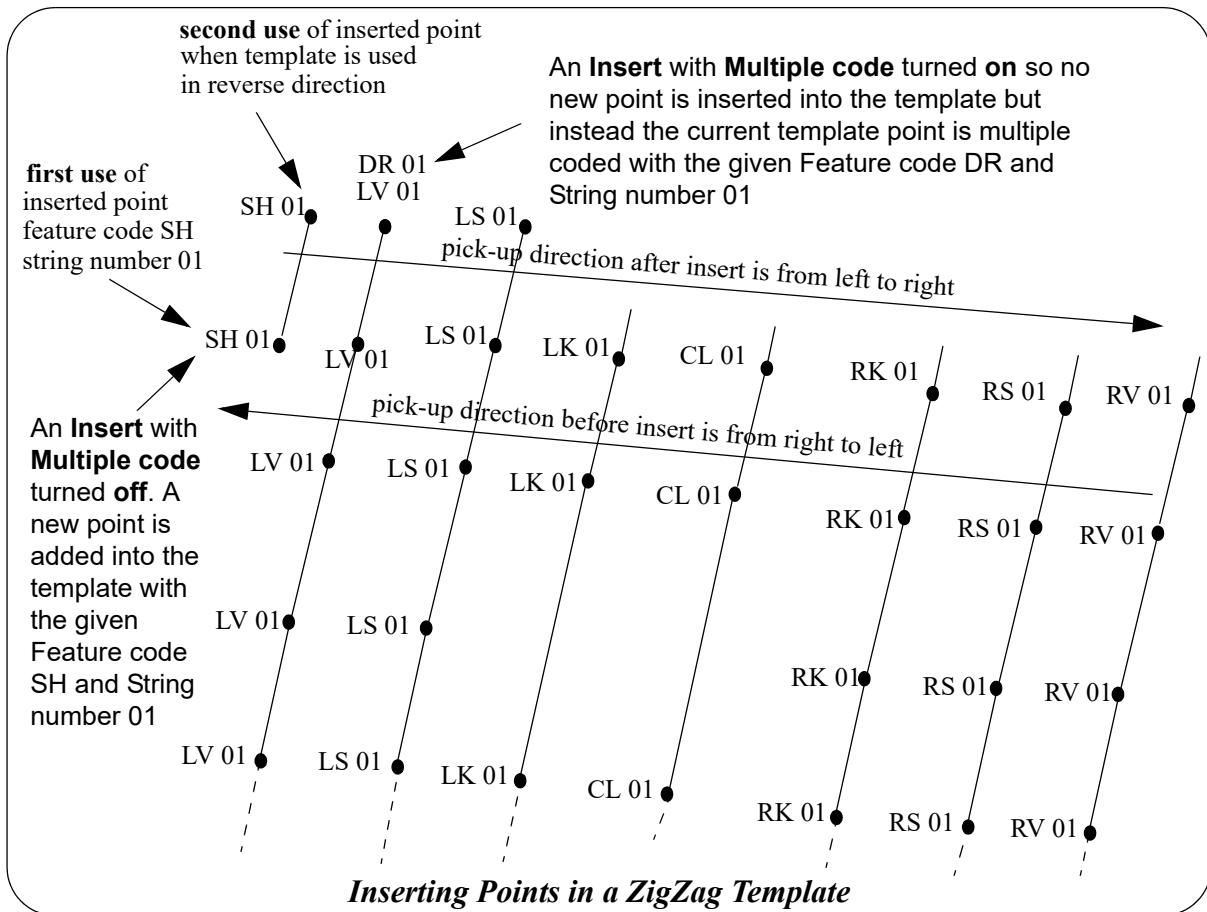
If ticked on in the insert panel, or if the flag given in the offset code is 1, the point will be added to the current series of points in the template being picked up.

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 pick-up 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.

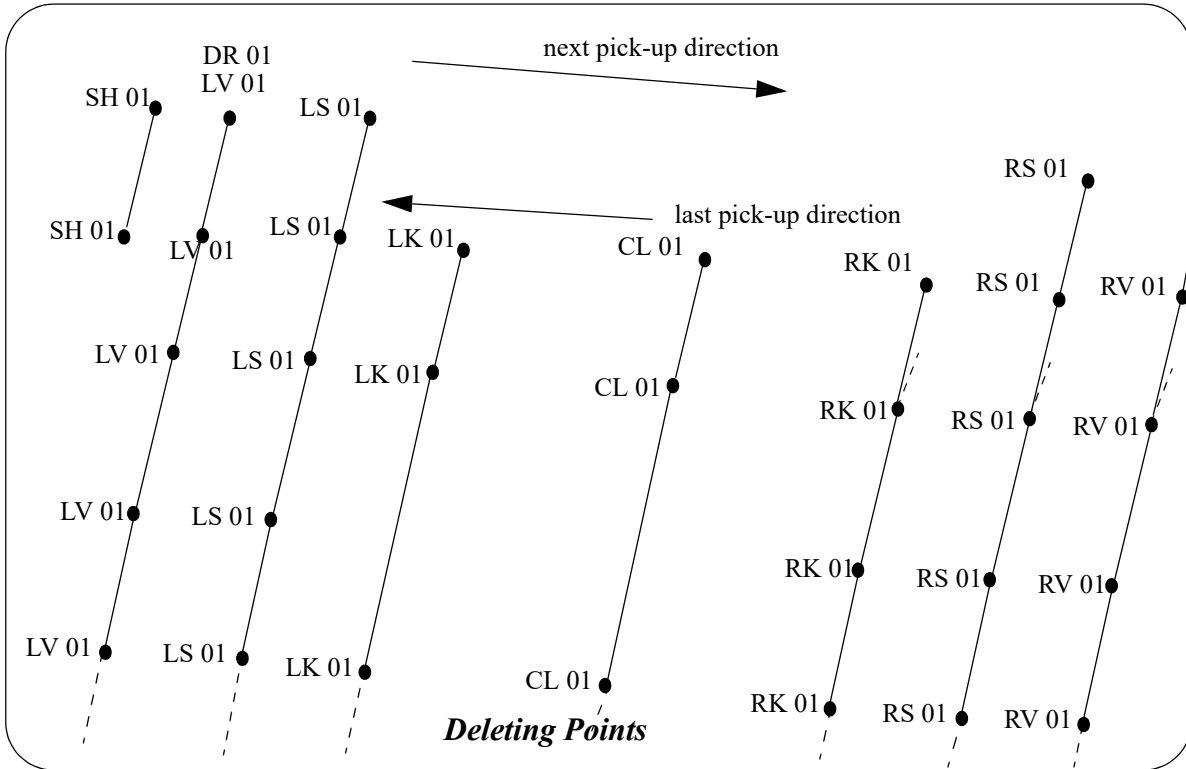


Continue to [25.3.10.6 Delete Template Points.](#)

### 25.3.10.6 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 [25.3.11 Shape Field Coding](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

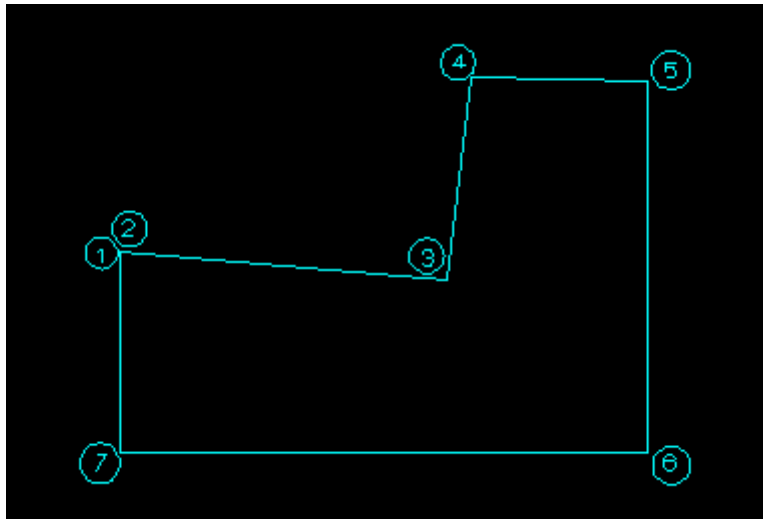
### 25.3.11 Shape Field Coding

If an object of a standard section is to be picked up such as a length of kerb, a shape can be defined and extruded/paralleled along a single pick-up string related to that shape.

For example, a kerb shape can be defined by observing all points on a typical section of the kerb and assigned a shape name. Then when picking up the length of kerb, only one reference string to the shape (defined when recording the shape) has to be picked up e.g. lip of kerb. On reduction, **12d Model** can extrude or parallel the shape such that the strings/shape of the kerb are produced for the entire kerb pick-up.

Normally if each measurement is from a different string e.g. back of kerb, lip kerb etc., 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 *shape field coding*.

Basically, a **12d Model shape** consists of observing a number of points on a given section of an object. The shape can be given a unique name or have no name at all.



For example, a shape can be defined by observations shown in order above

1- being the reference point, 2- 7 being the shape points. In this case, the 1st point of the shape pick-up coincides with the reference point.

To define a **12d Model shape**, there is a command to *start and end the recording* of the shape. The *feature codes* and *string numbers* for the next series of measurements until the *stop recording* command is given, are stored in the final shape.

As the shape is defined, other field codes can be used in conjunction such as offset. In this example an observation may be made at 5 for the position of 6 using a vertical offset. 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.

The next step is to pick up the entire length of the kerb at the reference string position using the same *feature code* and *string number* used for the reference string in the shape pick-up. In this example the lip of kerb.

Once completed, the shape can be extruded or paralleled using the extrude or parallel commands. The parallel command will create a number of strings according to the number of points on the shape. The extrude will create a super string with a shape defined like a pipe string.

Continue to [25.3.12 Traverse Coding](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).



## 25.3.12 Traverse Coding

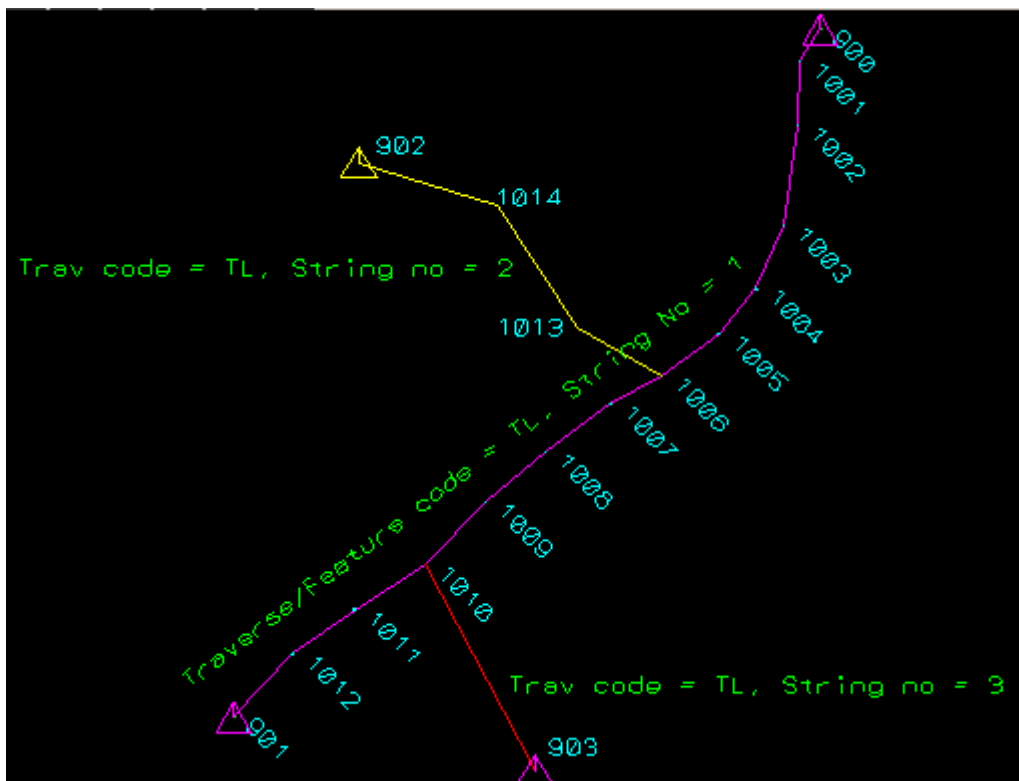
If a traverse is undertaken as part of a survey, a traverse code and string number can be coded so that **12d Model** can extract the traverse information. The specific traverse code can be supplied in the survey reduction panel under the traverse tab. An example is shown below:

Traverse	Geodetics	Others
Do traverse calcs		<input checked="" type="checkbox"/>
Traverse code	TL	+
Adjust method		▼
Network model	traverse string	☰

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.

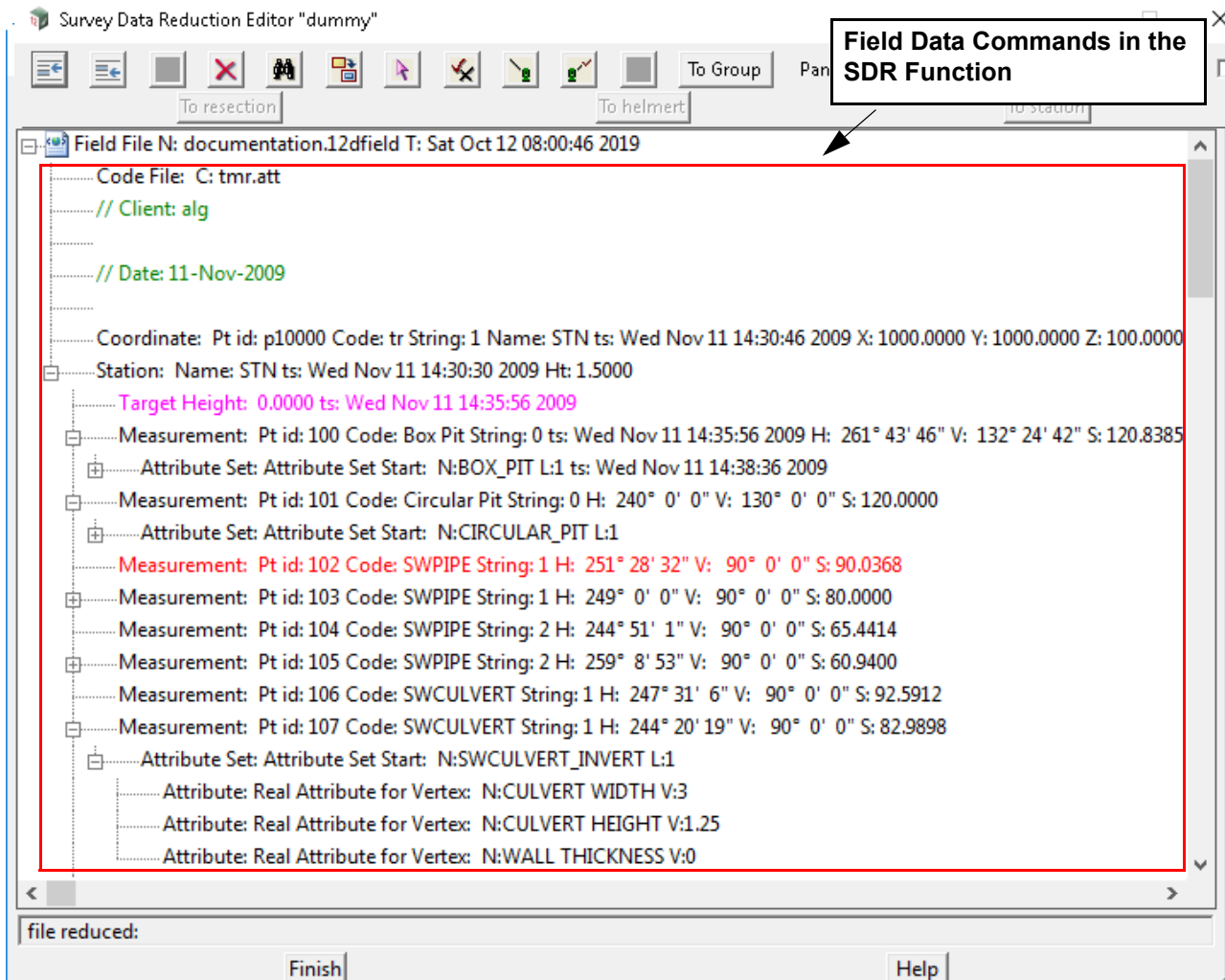


Continue to [25.4 Field Data Commands](#) or return to [25.3 Field Coding for 12d Model](#) or [25 12d Survey Guide](#).

## 25.4 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 [25.4.1 Common Information for Field Data Command Panels](#) and the field data commands themselves in [25.4.2 List of Field Data Commands](#).

## 25.4.1 Common Information for Field Data Command Panels

See

[25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#)

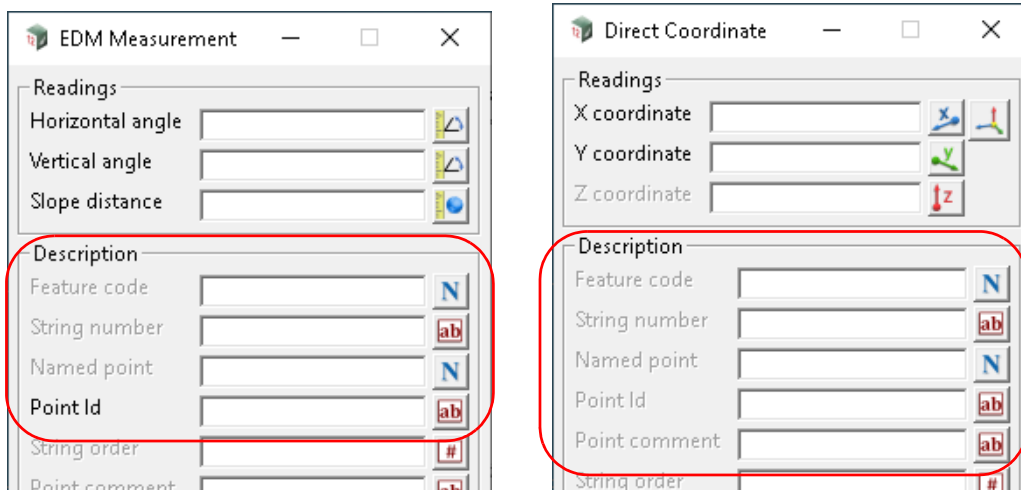
[25.4.1.2 Searching for Coordinates, Points and Strings](#)

[25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#)

### 25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New 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**.

In this case, the measurement point becomes the vertex of a super string during the **Feature code-String number** processing.

For details of the super string vertex for a standard measurement, see [25.4.1.1.1 Standard Measurement](#)

#### 2. Named measurement

If the field **Named point** in the panel is **not blank**, or when working with a **112d 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 **SDR Function** 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 [25.4.1.1.2 Named Measurement](#)

### 25.4.1.1.1 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 [25.3.1 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 [25.4.1.1.1 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 [25.4.1.1.1 Standard Measurement](#).*

**String order**

???



### 25.4.1.1.2 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**.

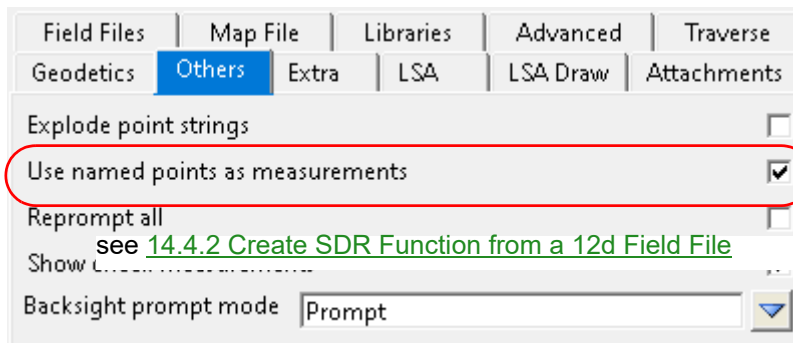
When reduction occurs for a named measure, the (x,y,z) coordinates are calculated for the measurement point and:

- a **one vertex super string** of name **Feature code (feature\_code)** is created and mapped using the Map File
- the **vertex text** of the vertex is the **station prefix** followed by the **Named point (point\_name)**.
- 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.
- 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 **SDR Function** being used.



then a **separate standard measurement** is **also created** using the fields **Feature code (feature\_code)**, **String number (string\_number)**, **Point id (point\_id)**, **Point Comment (point\_comment)** and **String order (string\_order)**.

The **Feature code** and **String number** are for the separate standard measurement that can be processed to produce stringed data (see [25.3.1 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 [25.4.1.1.1 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 [25.4.1.1.1 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 [25.4.1.1.1 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 [25.4.1.1.1 Standard Measurement](#).

### Point comment

*point\_comment.*

For a named measurement, the **point\_comment** is used as the vertex text of the super string.

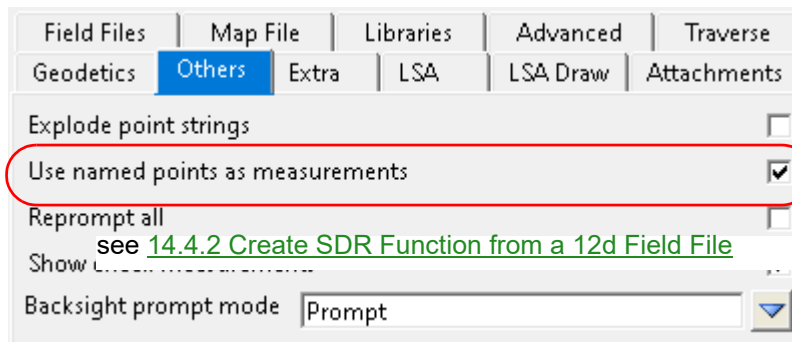
If a standard measurement is also being created, then the **point\_comment** is the **vertex text** of this super string. See [25.4.1.1.1 Standard Measurement](#).

### String order

???

### 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 **SDR Function** being used.



### 25.4.1.2 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 [25.4.1.2.1 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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

### 25.4.1.2.1 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 [25.5 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 summary of the **12d Field File Opcodes**, see [26.8 12d Survey Opcode Summary](#)

For the full description of the **12d Field File Opcodes**, see [26.7 Full Description of 12d Survey Opcodes](#).

Continue to [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#) or return to [25.4 Field Data Commands](#).

### 25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#) or return to [25.4 Field Data Commands](#).

### 25.4.1.3 Time surveyed, Comment and 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.*

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 [25.4.2 List of Field Data Commands](#) or return to [25.4 Field Data Commands](#).



## 25.4.2 List of Field Data Commands

The list of Field Data Commands field commands in the pop-up from **Insert** or **Batch Add** are:

Select Choice

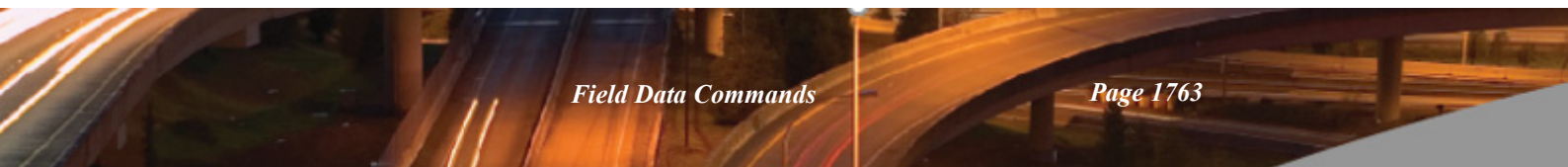
	See
Arc fitting end (opcode 62)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc fitting start (opcode 61)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc through last 3 points (opcode 17)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc through next 3 points (opcode 60)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Attachment (opcode 126)	<a href="#">25.4.2.2 Attachment (opcode 126)</a>
Attribute for next segment (Measurement) (opcode 120)	<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
Attribute for next segment (integer) (opcode 74)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for next segment (real) (opcode 75)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for next segment (text) (opcode 76)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for previous segment (Measurement) (opcode 121)	<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
Attribute for previous segment (integer) (opcode 77)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for previous segment (real) (opcode 78)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for previous segment (text) (opcode 79)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for string (Measurement) (opcode 120)	<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
Attribute for string (integer) (opcode 68)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for string (real) (opcode 69)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for string (text) (opcode 70)	<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
Attribute for vertex (Measurement) (opcode 121)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for vertex (integer) (opcode 71)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for vertex (real) (opcode 72)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for vertex (text) (opcode 73)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute set end (opcode 125)	<a href="#">25.4.2.5 Attribute Set (opcodes 124 and 125)</a>
Attribute set start (opcode 124)	<a href="#">25.4.2.5 Attribute Set (opcodes 124 and 125)</a>
Backsight (opcode 4)	<a href="#">25.4.2.6 Backsight (opcode 4)</a>
Backsight reference (opcode 50)	<a href="#">25.4.2.7 Backsight Reference (opcode 50)</a>
Building end (opcode 111)	<a href="#">25.4.2.8 Buildings (opcodes 110, 111)</a>
Building start (opcode 110)	<a href="#">25.4.2.8 Buildings (opcodes 110, 111)</a>
Check coordinate (opcode 14)	<a href="#">25.4.2.9 Check Coordinate (opcode 14)</a>
Check measurement (opcode 6)	<a href="#">25.4.2.10 Check Measurement (opcode 6)</a>
Circle feature (opcode 18)	<a href="#">25.4.2.11 Circle Feature (opcode 18)</a>
Code file (opcode 119)	<a href="#">25.4.2.12 Code File (opcode 119)</a>

Select Choice

	See
Comment (opcode -2)	<a href="#">25.4.2.13 Comment (opcode -2)</a>
Coordinate (opcode 2)	<a href="#">25.4.2.14 Coordinate (opcode 2)</a>
Delta height (opcode 28)	<a href="#">25.4.2.15 Height Or Depth Comment (opcode 28)</a>
Description (opcode 1)	<a href="#">25.4.2.16 Job Data (opcode 1)</a>
Distance correction (opcode 127)	<a href="#">25.4.2.17 Distance correction (opcode 127)</a>
Distances (opcode 49)	<a href="#">25.4.2.18 Distances (opcode 49)</a>
Error (opcode -1)	<a href="#">25.4.2.19 Error (opcode -1)</a>
File end (opcode 99)	<a href="#">25.4.2.20 End File (opcode 99)</a>
GPS Coordinate (opcode 140)	<a href="#">25.4.2.21 GNSS Coordinate (opcode 140)</a>
GPS Offset Coordinate (opcode 145)	<a href="#">25.4.2.22 GNSS Offset Correction (opcode 145)</a>
Group (opcode -3)	<a href="#">25.4.2.23 Helmert Start (opcode 138)</a>
Helmert end (opcode 139)	<a href="#">25.4.2.24 Helmert End (opcode 139)</a>
Helmert start (opcode 138)	<a href="#">25.4.2.25 Group (opcode -3)</a>
Horizontal Distance PPM Correction (opcode 131)	<a href="#">25.4.2.26 PPM Correction (opcode 131)</a>
Invisible next segment (opcode 108)	<a href="#">25.4.2.27 Invisibility (opcodes 107, 108, 109)</a>
Invisible point (opcode 109)	<a href="#">25.4.2.27 Invisibility (opcodes 107, 108, 109)</a>
Invisible previous segment (opcode 107)	<a href="#">25.4.2.27 Invisibility (opcodes 107, 108, 109)</a>
Join first points of strings (opcode 23)	<a href="#">25.4.2.28 Strings Join (opcodes 21 to 24)</a>
Join first to last point of strings (opcode 22)	<a href="#">25.4.2.28 Strings Join (opcodes 21 to 24)</a>
Join last points of strings (opcode 21)	<a href="#">25.4.2.28 Strings Join (opcodes 21 to 24)</a>
Join last to first point of strings (opcode 24)	<a href="#">25.4.2.28 Strings Join (opcodes 21 to 24)</a>
Measurement EDM (opcode 7)	<a href="#">25.4.2.29 EDM Measurement (opcode 7)</a>
Measurement EDM HT (opcode 11)	<a href="#">25.4.2.30 EDM Measurement (HA,HD,HT) (opcode 11)</a>
Measurement EDM VD (opcode 12)	<a href="#">25.4.2.31 EDM Measurement (HA,HD,Diff HT) (opcode 12)</a>
Measurement Stadia (opcode 10)	<a href="#">25.4.2.32 Stadia Measurement (opcode 10)</a>
Midpoint of 2 Points (opcode 146)	<a href="#">25.4.2.33 Midpoint of Two Points (opcode 146)</a>
Midpoint of 3 Points (opcode 147)	<a href="#">25.4.2.34 Centre of Arc Through Three Points (opcode 147)</a>
Multiple coding (opcode 16)	<a href="#">25.4.2.35 Multiple Coding (opcode 16)</a>
New instrument (opcode 3)	<a href="#">25.4.2.36 New Instrument Setup - Station (opcode 3)</a>
Non tinal next segment (opcode 38)	<a href="#">25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</a>
Non tinal point (opcode 40)	<a href="#">25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</a>

< [ ]

Select



## Select Choice

	See
Non tinable previous segment (opcode 39)	<a href="#">25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</a>
Non tinable string (opcode 141)	<a href="#">25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</a>
Note (opcode 29)	<a href="#">25.4.2.38 Note (opcode 29)</a>
Offset height (opcode 44)	<a href="#">25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</a>
Offset radial (opcode 42)	<a href="#">25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</a>
Offset tangential (opcode 43)	<a href="#">25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</a>
Order String Automatically (opcode 101)	<a href="#">25.4.2.40 Order String Automatically (opcode 101)</a>
Pipe axial (opcode 81)	<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
Pipe invert (opcode 80)	<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
Pipe obvert (opcode 82)	<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
Remove height (opcode 30)	<a href="#">25.4.2.42 Remove Height (opcode 30)</a>
Remove point (opcode 31)	<a href="#">25.4.2.43 Remove (Delete) Point (opcode 31)</a>
Remove string (opcode 144)	<a href="#">25.4.2.44 Remove (Delete) String (opcode 144)</a>
Resection end (opcode 129)	<a href="#">25.4.2.46 Resection End (opcode 129)</a>
Resection start (opcode 128)	<a href="#">25.4.2.45 Resection Start (opcode 128)</a>
Shape end (opcode 84)	<a href="#">25.4.2.47 Shaping (opcodes 83 to 86)</a>
Shape extrude (opcode 86)	<a href="#">25.4.2.47 Shaping (opcodes 83 to 86)</a>
Shape parallel (opcode 85)	<a href="#">25.4.2.47 Shaping (opcodes 83 to 86)</a>
Shape record (opcode 83)	<a href="#">25.4.2.47 Shaping (opcodes 83 to 86)</a>
Slope Distance Scale factor (opcode 9)	<a href="#">25.4.2.48 Slope Distance Scale Factor (opcode 9)</a>
String close (opcode 20)	<a href="#">25.4.2.49 String Close (opcode 20)</a>
String end (opcode 48)	<a href="#">25.4.2.50 String End (opcode 48)</a>
String rectangle (opcode 45)	<a href="#">25.4.2.51 String (Squashed) Rectangle (opcode 45)</a>
String rectangle by 2 points (opcode 37)	<a href="#">25.4.2.52 String Rectangle by 2 Points (opcode 37)</a>
String reverse (opcode 19)	<a href="#">25.4.2.53 String Reverse (opcode 19)</a>
String start (opcode 47)	<a href="#">25.4.2.54 String Start (opcode 47)</a>
String tinable (opcode 46)	<a href="#">25.4.2.55 String Tinable - Breakline String (opcode 46)</a>
String type 2d (opcode 92)	<a href="#">25.4.2.56 String Type (opcodes 92, 93, 94)</a>
String type 3d (opcode 93)	<a href="#">25.4.2.56 String Type (opcodes 92, 93, 94)</a>
String type 4d (opcode 94)	<a href="#">25.4.2.56 String Type (opcodes 92, 93, 94)</a>
String type culvert (opcode 96)	<a href="#">25.4.2.57 Culvert (opcode 96)</a>
	See
String type pipe (opcode 95)	<a href="#">25.4.2.58 Pipe Diameter (opcode 95)</a>
Target height (opcode 5)	<a href="#">25.4.2.59 Target Height (opcode 5)</a>
Template change (opcode 59)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template continue (opcode 54)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template delete (opcode 57)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template end (opcode 52)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template insert (opcode 58)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template pause (opcode 53)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template record (opcode 55)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template skip (opcode 56)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Template start (opcode 51)	<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
Text (opcode 41)	<a href="#">25.4.2.61 Additional Text For Point (opcode 41)</a>
Units (opcode 100)	<a href="#">25.4.2.62 Units (opcode 100)</a>
Vertical circle correction (opcode 15)	<a href="#">25.4.2.63 Vertical Circle Correction (opcode 15)</a>

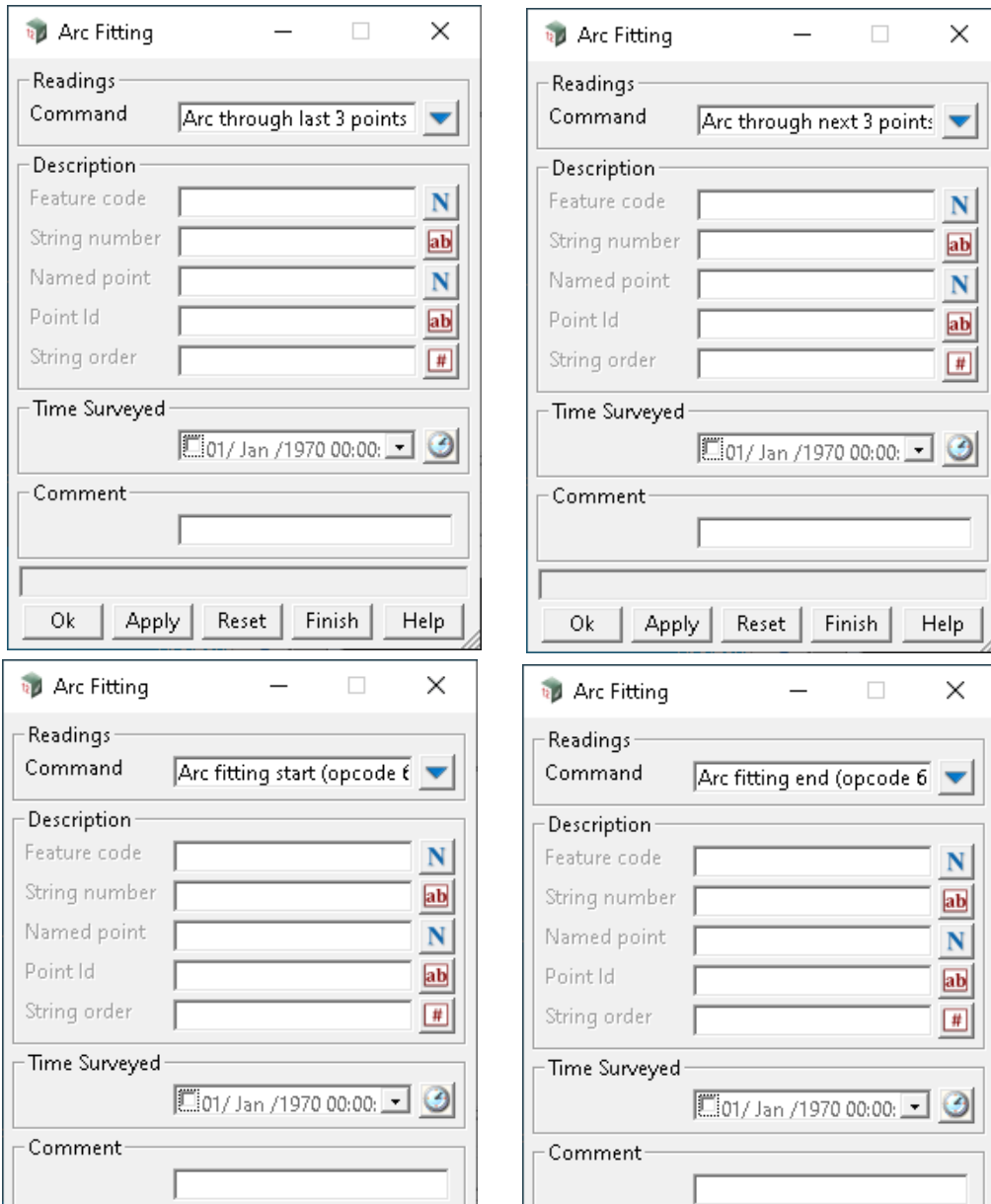
For a summary of the field file opcodes see the section [26.8 12d Survey Opcode Summary](#).

The documentation for each of the Field Data Commands in the pop-up list will now be given.

### 25.4.2.1 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 [25.3.9 Arcs Through Points](#) in [25 12d Survey Guide](#).



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

Field Description	Type	Defaults	Pop-Up
<b>Readings</b>			
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**

the **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**

the **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**

the **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*

*the 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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

**Named point**

*not used*

**String order**

???

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.2 Attachment \(opcode 126\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.3 Measurement Attributes \(opcodes 120 to 123\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#)

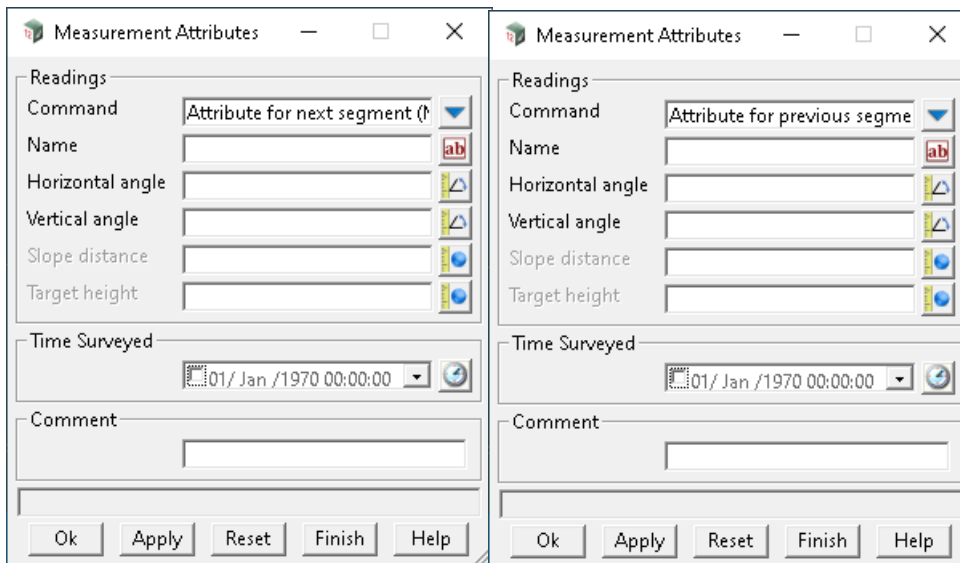
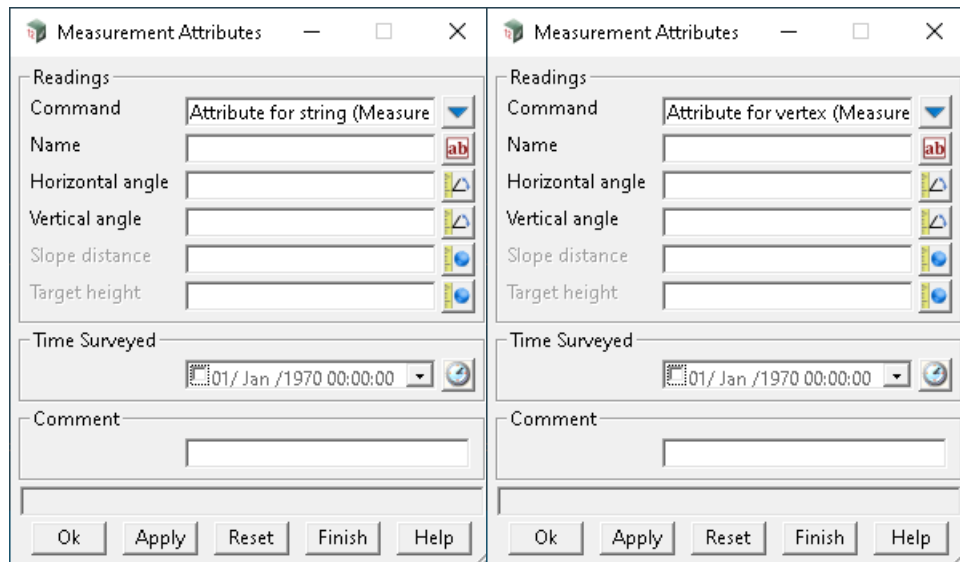
### 25.4.2.3 Measurement Attributes (opcodes 120 to 123)

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
<b>Readings</b>			
<b>Command</b>	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)	
		<i>for string (measurement)</i> add the measurement attributes to the current string.	
		<i>for vertex (measurement)</i> add the measurement attributes to the current vertex (current measurement point).	
		<i>for next segment (measurement)</i> add the measurement attributes to the next segment from the current measurement point.	
		<i>for previous segment (measurement)</i> 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

*the horizontal angle to use to calculate a point.*

### Vertical angle

*the vertical angle to use to calculate a point.*

### Slope distance

*the slope distance to use to calculate a point.*

### Target height

*the target height to use to calculate a point.*

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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	<b>Horizontal angle</b> in radians
name_prefix va	<b>Vertical angle</b> in radians
name_prefix sd	<b>Slope distance</b> in radians
name_prefix t	<b>Target height</b>

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 [25.4.2.4 Attributes \(opcodes 68 to79\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

#### 25.4.2.4 Attributes (opcodes 68 to 79)

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.

The screenshot shows the 'Attributes' dialog box with the following fields:

- Readings:** Command: Attribute for string (integer) (integer) (dropdown), Name: (text input), Value: (text input)
- Time Surveyed:** 01/ Jan /1970 00:00:00 (calendar icon)
- Comment:** (text input)
- Buttons:** Ok, Apply, Reset, Finish, Help

The screenshot shows the 'Attributes' dialog box with the following fields:

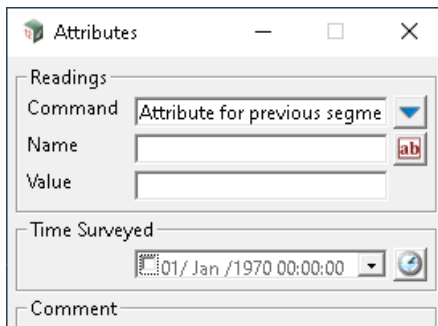
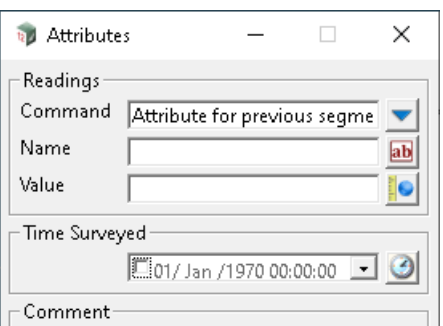
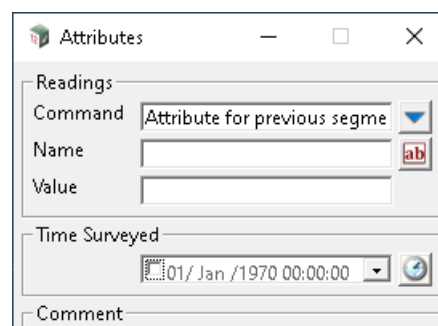
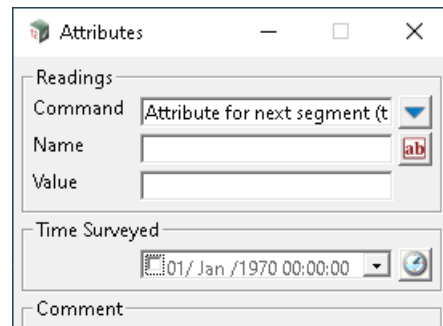
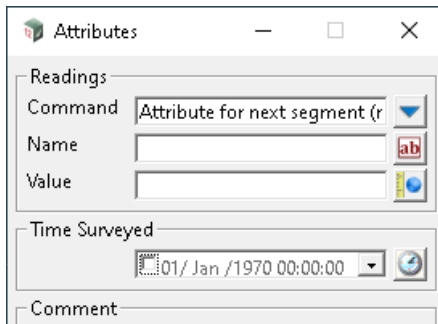
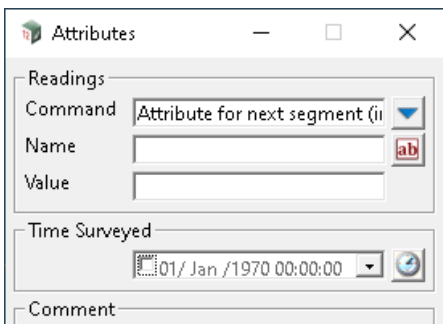
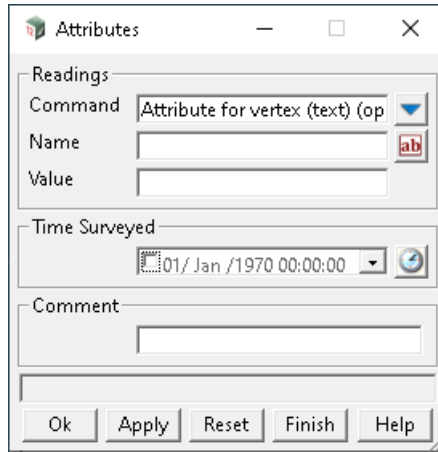
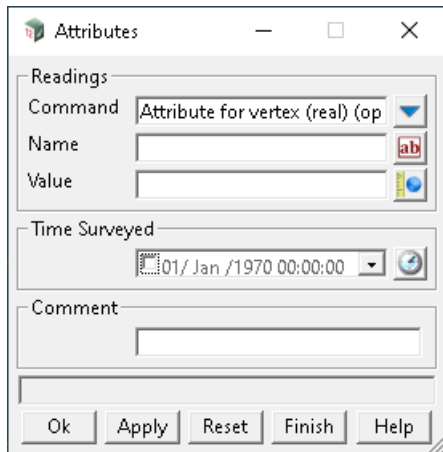
- Readings:** Command: Attribute for string (real) (real) (dropdown), Name: (text input), Value: (text input)
- Time Surveyed:** 01/ Jan /1970 00:00:00 (calendar icon)
- Comment:** (text input)
- Buttons:** Ok, Apply, Reset, Finish, Help

The screenshot shows the 'Attributes' dialog box with the following fields:

- Readings:** Command: Attribute for string (text) (text) (dropdown), Name: (text input), Value: (text input)
- Time Surveyed:** 01/ Jan /1970 00:00:00 (calendar icon)
- Comment:** (text input)
- Buttons:** Ok, Apply, Reset, Finish, Help

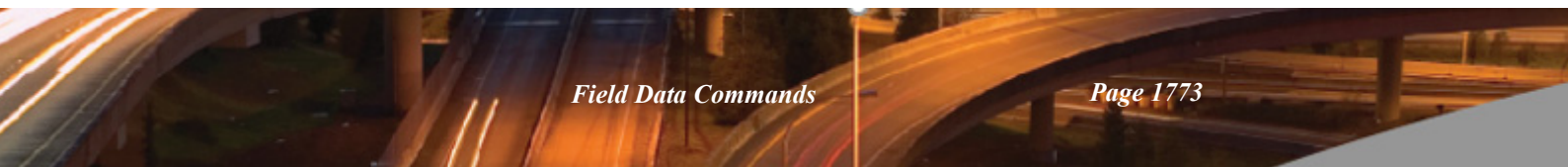
The screenshot shows the 'Attributes' dialog box with the following fields:

- Readings:** Command: Attribute for vertex (integer) (integer) (dropdown), Name: (text input), Value: (text input)
- Time Surveyed:** 01/ Jan /1970 00:00:00 (calendar icon)
- Comment:** (text input)
- Buttons:** Ok, Apply, Reset, Finish, Help



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

Field Description	Type	Defaults	Pop-Up
<b>Readings</b>			
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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.5 Attribute Set \(opcodes 124 and 125\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)

### 25.4.2.5 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
<b>Data</b>			
<b>Command</b>	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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.6 Backsight \(opcode 4\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.12d Survey Guide](#).

### 25.4.2.6 Backsight (opcode 4)

The **Backsight** option tags the measurement as a backsight measurement.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Readings

##### Horizontal angle

*the horizontal angle to the backsight in dd.mmss format.*

##### Vertical angle

*the 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

*the 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 [25.4.1.2.1 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.

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

For the description on how the field data command is stored in a **12d 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](#)

## When Backsight Point is Found for a Backsight Command

If the **Backsight prompt mode** is set to **Prompt** in the **SDR Function** and the Backsight point is found, the **Bearing Datum Difference** panel is displayed:

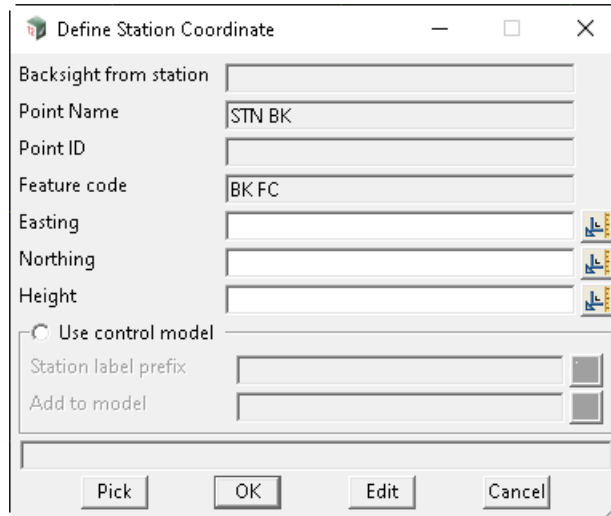
	Observed	Calculated	Observed - Calculated	Corrected	Corrected - Calculated
Easting	398.915	400.000	-1.085	398.915	-1.085
Northing	399.457	400.000	-0.543	399.457	-0.543
Height	6.713	7.000	-0.287	6.713	-0.287
Bearing	63° 0' 0"	63° 26' 6"	- 0° 26' 6"	63° 26' 6"	0° 0' 0"
Distance	446.000	447.214	-1.214	446.000	-1.214

No point is created.

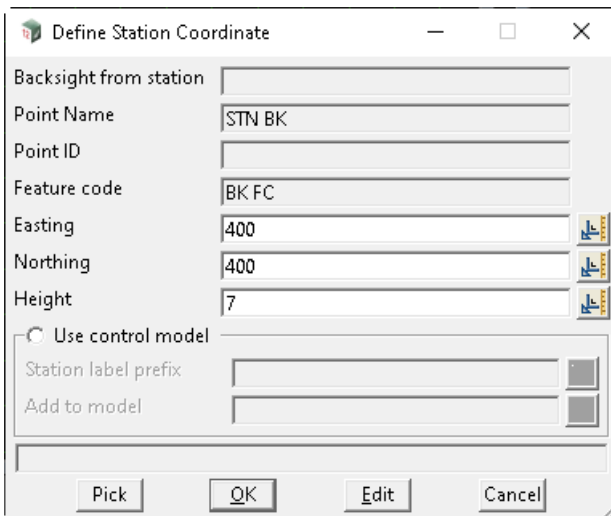
For information on the **Bearing Data Difference** panel, see [14.4.3.3 Bearing Datum Difference](#).

### When Backsight Point is Not Found for a Backsight Command

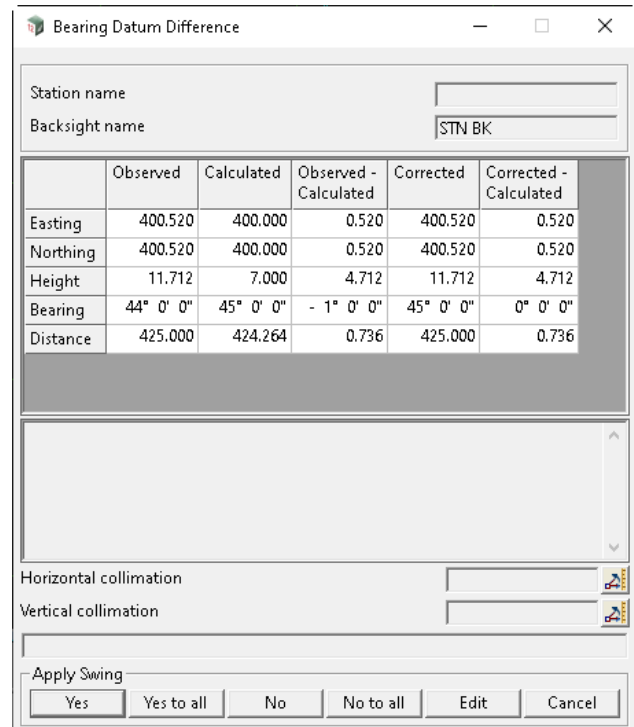
If the **Backsight point** can't be found, the **Define Station Coordinate** panel is displayed (see [14.4.3.1 Define Station Coordinate for Unknown Points](#)):



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.

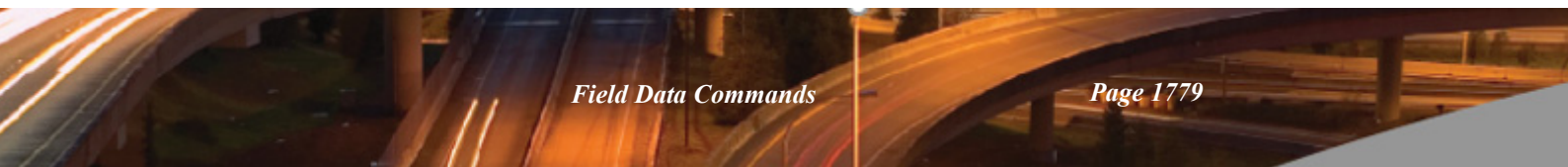


When **OK** is pressed, the **Bearing Datum Difference** panel is displayed (see [14.4.3.3 Bearing Datum Difference](#)).



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 [25.4.2.64 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 [25.4.2.7 Backsight Reference \(opcode 50\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.7 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.*

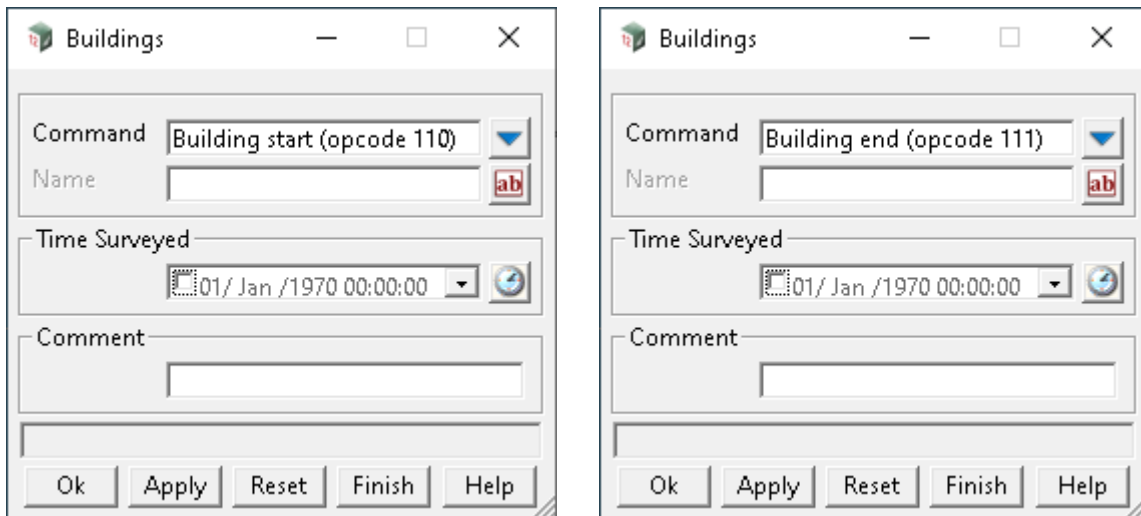
**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

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 [25.4.2.8 Buildings \(opcodes 110, 111\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.8 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
<b>Command</b>	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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.9 Check Coordinate \(opcode 14\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.9 Check Coordinate (opcode 14)

The **Check Coordinate** option tags the measurement as a **check coordinate** measurement.

That is, it is a measurement to a known point and so the difference between the measurement point and the known point can be calculated and reported.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Readings

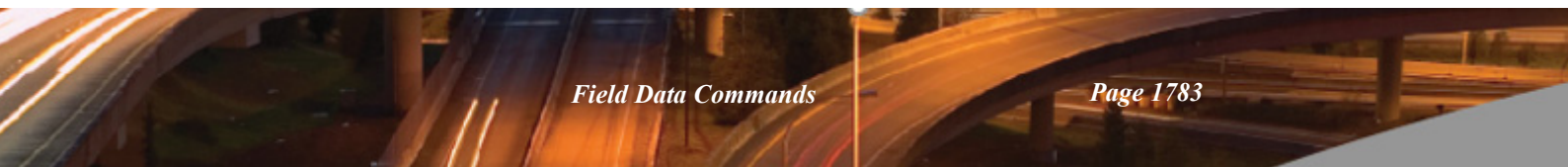
##### X/Y/Z coordinate

*The X/Y/Z of the measurement to the check point.*

<b>GPS check</b>	tick box	ticked
------------------	----------	--------

*If **ticked**, the active GPS Offset Correction values with 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 Point is Not Found for the Check Coordinate 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 [25.4.1.2.1 Searching for the Coordinates of Special Points](#)

### Point id

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

???

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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](#).

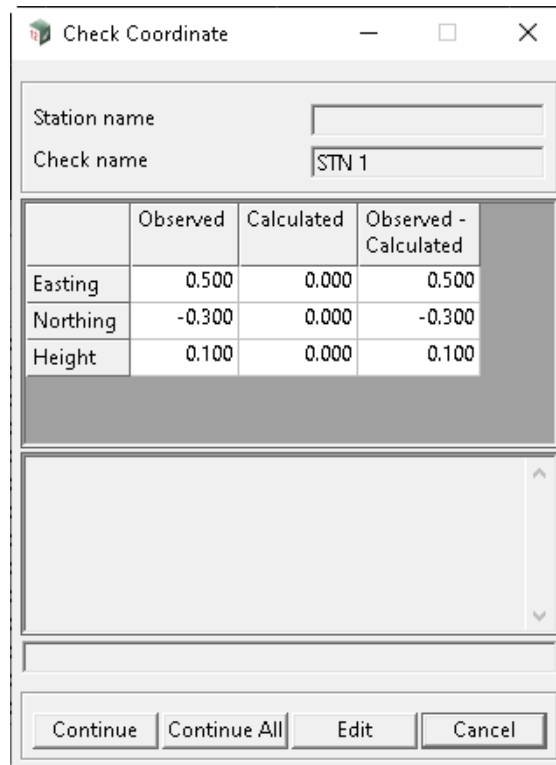
### See

[When Check Point is Found for the Check Coordinate Command](#)

[When Check Point is Not Found for the Check Coordinate Command](#)

## When Check Point is Found for the Check Coordinate Command

If **Show check measurements** is *ticked* in the **SDR Function** then for each check coordinate measurement, the **Check Coordinate Difference** panel is displayed:



The screenshot shows a dialog box titled "Check Coordinate" with a close button (X) in the top right corner. Below the title bar, there are two input fields: "Station name" (empty) and "Check name" (containing "STN 1"). Below these fields is a table with four columns: "Observed", "Calculated", and "Observed - Calculated". The table has three rows: "Easting", "Northing", and "Height". Below the table is a large empty text area with a vertical scrollbar on the right. At the bottom of the dialog box are four buttons: "Continue", "Continue All", "Edit", and "Cancel".

	Observed	Calculated	Observed - Calculated
Easting	0.500	0.000	0.500
Northing	-0.300	0.000	-0.300
Height	0.100	0.000	0.100

For information on the **Check Coordinate Difference** panel, see [14.4.3.5 Check Coordinate Difference](#).

No point is created.



## When Check 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 [14.4.3.2 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 [14.4.3.4 Check Measurement Difference](#)).

	Observed	Calculated	Observed - Calculated
Easting	401.000	400.000	1.000
Northing	199.000	200.000	-1.000
Height	10.000	10.000	0.000

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 [25.4.2.64 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 [25.4.2.10 Check Measurement \(opcode 6\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.10 Check Measurement (opcode 6)

The **Check Measurement** option tags the measurement as a **check measurement**.

That is, it is a measurement to a known point and so the difference between the measurement point and the known point can be calculated and reported.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Readings

##### Horizontal angle

*The horizontal angle of the measurement to the check point in dd.mmss format.*

##### Vertical angle

*the 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

The 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 [25.4.1.2.1 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

???

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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](#)

## When Check Point is Found for the Check Measurement Command

If **Show check measurements** is *ticked* in the **SDR Function** then for each check measurement, the **Check Measurement Difference** panel is displayed:

Check Measurement

Station name:

Check name:

	Observed	Calculated	Observed - Calculated
Easting	100.947	100.000	0.947
Northing	100.947	100.000	0.947
Height	10.079	10.000	0.079
Bearing	45° 0' 0"	45° 0' 0"	- 0° 0' 0"
Distance		141.421	

No distance was measured on this check measurement.  
We assume the correct distance so that we get a measure of the accuracy of the check.

Continue Continue All Edit Cancel

For information on the **Check Measurement Difference** panel, see [14.4.3.4 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 [14.4.3.1 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 [14.4.3.4 Check Measurement Difference](#)).

	Observed	Calculated	Observed - Calculated
Easting	-200.750	-200.000	-0.750
Northing	-97.624	-100.000	2.376
Height	6.709	10.000	-3.291
Bearing	214° 0' 0"	213° 41' 24"	0° 18' 36"
Distance	359.000	360.555	-1.555

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 **SDR Function**:

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 [25.4.2.64 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 [25.4.2.11 Circle Feature \(opcode 18\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.11 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 [25.3.7 Feature String](#).

That is, the current measurement point is the centre of the feature string.

See [25.3.7 Feature String](#) in [25 12d Survey Guide](#).

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Radius

*the 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.12 Code File \(opcode 119\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.4 Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.12 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**

*the name of the 12d Field File.*

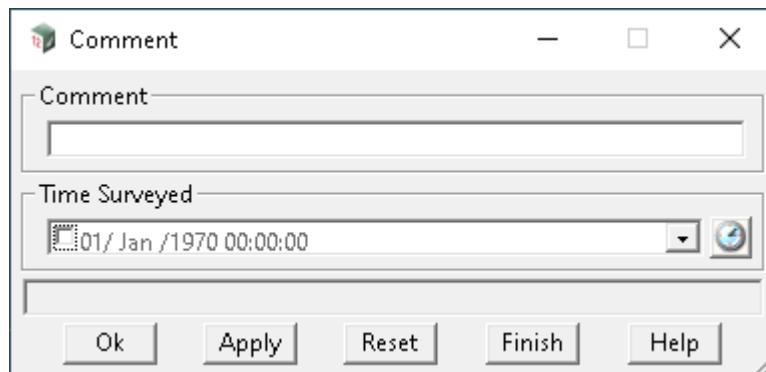
**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

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 [25.4.2.13 Comment \(opcode -2\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.4 Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.13 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** field is added as a comment in the 12d Field File.*

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.14 Coordinate \(opcode 2\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.4 Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.14 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  
*the x coordinate for the point.*

**Y coordinate** double box  
*the y coordinate for the point.*

**Z coordinate** double box  
*the z coordinate for the point.*

#### Description - used for the new point or points

**Feature code, String number, Named point, Point id, Point comment and String order** are used to define values for the new point. See [25.4.1.1 Feature Code, String Number, Named Point.](#)

[Point Id, Point Comment and String Order for a New Measured Point.](#)

### Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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.](#)

Continue to [25.4.2.15 Height Or Depth Comment \(opcode 28\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)



### 25.4.2.15 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
<b>Value</b>	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

*the **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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

##### Named point

*not used*

##### String order

???

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.16 Job Data \(opcode 1\)](#) or return to [25.4.2 List of Field Data Commands 25 12d Survey Guide](#).

### 25.4.2.16 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.17 Distance correction \(opcode 127\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.17 Distance correction (opcode 127)

This section of documentation is a work in progress and will be updated in subsequent releases.

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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.18 Distances \(opcode 49\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.12d Survey Guide.](#)

### 25.4.2.18 Distances (opcode 49)

This section of documentation is a work in progress and will be updated in subsequent releases.

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 [25.4.1.2.1 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 [25.4.1.2.1 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

*????*

#### Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.19 Error \(opcode -1\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.19 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.20 End File \(opcode 99\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.12d Survey Guide](#)

### 25.4.2.20 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
<b>Time surveyed, Comment, OK, Apply, Reset, Finish, Help</b>			See <a href="#">25.4.1.3 Time surveyed, Comment and Bottom Panel buttons</a> .

For the description on how the field data command is stored in a **12d Field File**, see [99 file\\_end Terminate processing](#).

Continue to [25.4.2.21 GNSS Coordinate \(opcode 140\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.21 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 [25.4.2.22 GNSS Offset Correction \(opcode 145\)](#))

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Readings

- |   |            |  |  |
|---|------------|--|--|
| <b>X coordinate</b>   | double box |  |  |
| <i>the x coordinate value of the nominated point.</i>                                   |            |  |  |
| <b>Y coordinate</b>   | double box |  |  |
| <i>the y coordinate value of the nominated point.</i>                                   |            |  |  |
| <b>Z coordinate</b>   | double box |  |  |
| <i>the z coordinate value of the nominated point.</i>                                   |            |  |  |
| <i>The antenna height is not subtracted.</i>  |            |  |  |
| <i>The reduced Z coordinate is calculated by subtracting the current target height.</i> |            |  |  |

#### 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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point.](#)

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.22 GNSS Offset Correction \(opcode 145\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.22 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 following 140 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
-------------------	------	----------	--------

<b>X Offset</b>	double box		
-----------------	------------	--	--

*the x offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.*

<b>Y Offset</b>	double box		
-----------------	------------	--	--

*the y offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.*

<b>Z Offset</b>	double box		
-----------------	------------	--	--

*the z offset value is applied to subsequent GPS coordinate measurements until another 145 is encountered.*

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons.](#)

Continue to [25.4.2.23 Helmert Start \(opcode 138\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.23 Helmert Start (opcode 138)

This option is under development.

The screenshot shows a dialog box titled "Helmert" with the following fields and controls:

- Readings:** Instrument ht (text field)
- Description:** Feature code (text field, icon: N), String number (text field, icon: ab), Setup point (text field, icon: N), Point Id (text field, icon: ab), Point comment (text field, icon: ab), String order (text field, icon: #)
- Position:** Easting (text field, icon: N), Northing (text field, icon: N), Height (text field, icon: N), Accuracy (text field, value: Unknown)
- Time Surveyed:** Date and time selector (value: 01/ Jan /1970 00:00, icon: refresh)
- Comment:** Text area
- Buttons:** Ok, Apply, Reset, Finish, Help

**OK, Apply, Reset, Finish, Help** See the description for the panel buttons in the section [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#)

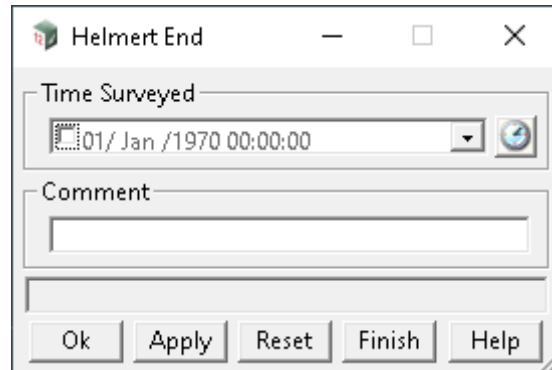
For the description on how the field data command is stored in a **12d Field File**, see [138 helmert Helmert start](#).

Continue to [25.4.2.24 Helmert End \(opcode 139\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.24 Helmert End (opcode 139)

This option is under development.



**OK, Apply, Reset, Finish, Help** See the description for the panel buttons in the section [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.25 Group \(opcode -3\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.25 Group (opcode -3)

This section of documentation is a work in progress and will be updated in subsequent releases.

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

**Group name**

???

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.26 PPM Correction \(opcode 131\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.26 PPM Correction (opcode 131)

This section of documentation is a work in progress and will be updated in subsequent releases.

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

Field Description	Type	Defaults	Pop-Up
<b>Correction</b>	real box		
???			

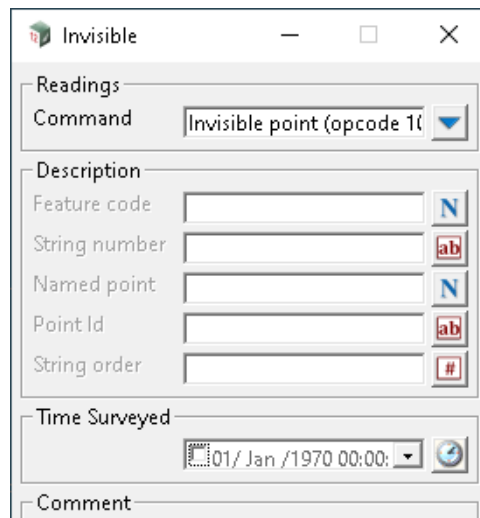
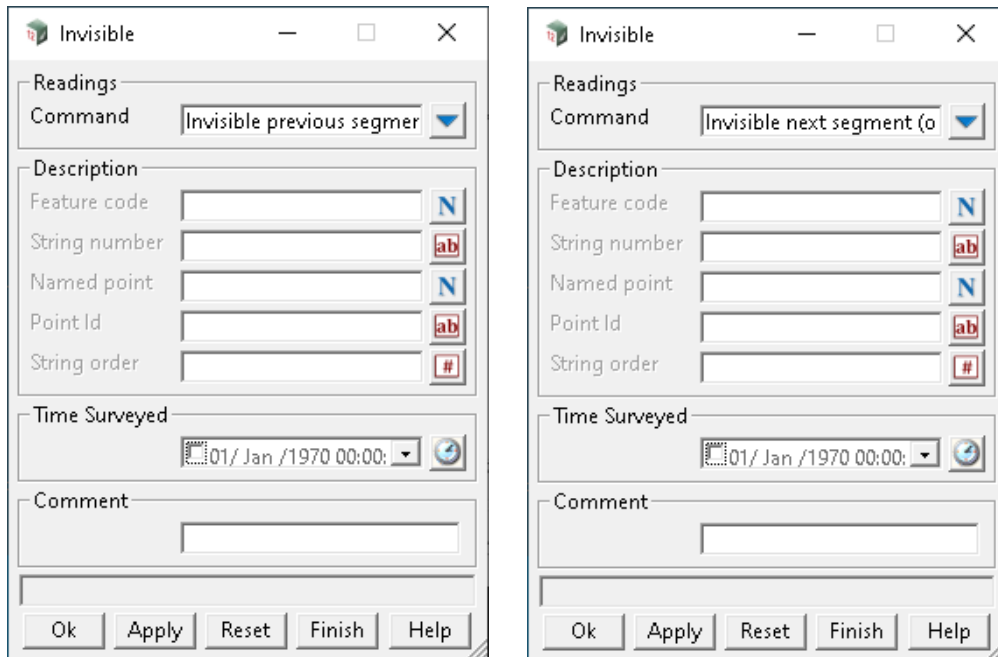
**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

For the description on how the field data command is stored in a **12d Field File**, see [131 ppm\\_correction PPM correction](#).

Continue to [25.4.2.27 Invisibility \(opcodes 107, 108, 109\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.27 Invisibility (opcodes 107, 108, 109)

The *Invisibility* option make segments or vertices invisible.



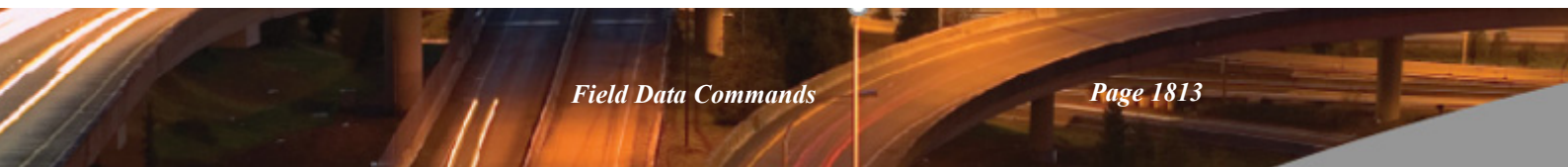
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Readings</b>			
<b>Command</b>	choice box		Invisible previous segment (opcode 107) Invisible next segment (opcode 108) Invisible point (opcode 109)

**for Invisible previous segment**

*the 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.28 Strings Join \(opcodes 21 to 24\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.28 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 [25.3.8 Joining Strings](#) in Appendix [25 12d Survey Guide](#).

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

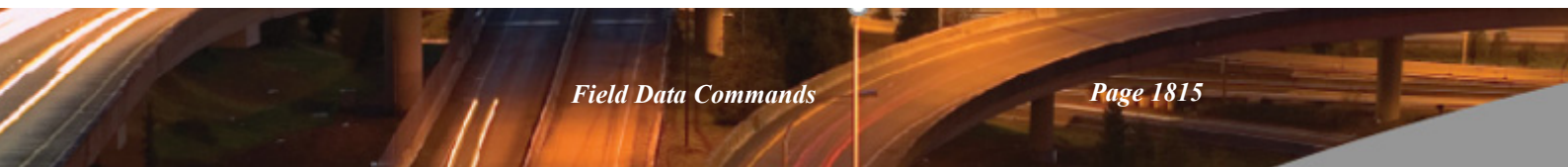
Field Description	Type	Defaults	Pop-Up
<b>Readings</b>			
<b>Command</b>	choice box	Join last points of strings (opcode 21) Join first to last point of strings (opcode 22) Join first points of strings (opcode 23) Join last to first point of strings (opcode 24)	

**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

*the feature code of the strings to be joined*

#### String number 1

*the string number of the first string*

#### String number 2

*the string number of the second string*

### Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.29 EDM Measurement \(opcode 7\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.29 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

*the horizontal angle to the measured point in dd.mmss format.*

##### Vertical angle

*the 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

*the 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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.30 EDM Measurement \(HA,HD,HT\) \(opcode 11\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#)

### 25.4.2.30 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

*the horizontal angle to the measured point in dd.mmss format.*

##### Horizontal distance

*the reduced horizontal distance to the measured point.*

##### Height

*the 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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.31 EDM Measurement \(HA,HD,Diff HT\) \(opcode 12\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.31 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

*the horizontal angle to the measured point in dd.mmss format.*

##### Horizontal distance

*the reduced horizontal distance to the measured point.*

##### Vertical distance

*the 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 [25.4.1.1 Feature Code](#).



[String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point.](#)

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.32 Stadia Measurement \(opcode 10\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)

### 25.4.2.32 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

*the horizontal angle to the measured point in dd.mmss format.*

##### Vertical angle

*the vertical angle to the measured point in dd.mmss format.*

##### Top

*the top hair reading.*

##### Middle

*the middle hair reading.*

##### Bottom

*the bottom hair reading.*

## 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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

## Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.33 Midpoint of Two Points \(opcode 146\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.33 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, Point comment and String order** are used to define values for the new point created by the measurement. See [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

#### Named point

???

#### String order

???

## 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 determined 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 determined 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 determined 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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

**Named point**

???

**String order**

???

## Rest of the Fields and Buttons

**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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.34 Centre of Arc Through Three Points \(opcode 147\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.34 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 screenshot shows a dialog box titled "Midpoint by 3 Points". It is divided into several sections:

- Midpoint coding:** Contains input fields for Feature code, String number, Named point, Point Id, Point comment, and String order. Each field has a button to its right: 'N' for Feature code, 'ab' for String number, 'N' for Named point, 'ab' for Point Id, 'ab' for Point comment, and '#' for String order.
- Description:** Contains identical input fields and buttons as the Midpoint coding section.
- Height mode:** A dropdown menu.
- Keep points:** A checkbox.
- Time Surveyed:** A date and time selector showing "01/ Jan /1970 00:00:C" with a refresh icon.
- Comment:** A text input field.

At the bottom of the dialog are five buttons: "Ok", "Apply", "Reset", "Finish", and "Help".

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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

#### Named point

???

#### String order

???



## 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 determined 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 determined 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 determined 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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

### Named point

???

### String order

???

## Rest of the Fields and Buttons

**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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.35 Multiple Coding \(opcode 16\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.35 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 [25.4.1.1 Feature Code, String Number, Named Point, Point Id, Point Comment and String Order for a New Measured Point](#).

#### Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.36 New Instrument Setup - Station \(opcode 3\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.36 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 [26.6 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

*the 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 [25.4.1.2.1 Searching for the Coordinates of Special Points](#)*

**Point id**

*Point id.*

*if **not blank**, the point id is used for searching.*

**Point comment**

*Not used.*

**String order**

*??*

**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 [25.4.1.3 Time surveyed, Comment and 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 [14.4.3.1 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 **SDR Function**:

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 [25.4.2.64 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 [25.4.2.37 Non Tinability \(opcodes 38, 39, 40, 141\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)

The **Non-Tinable** option sets selected vertices and/or segments to be non-tinable (not tinable).

Non-Tinable dialog box showing the 'Non tinable next segmen' command. The 'Readings' section includes a Command dropdown, and the 'Description' section includes fields for Feature code, String number, Named point, Point Id, and String order, each with a corresponding icon (N, ab, N, ab, #). The 'Time Surveyed' section has a date/time selector and a refresh button. The 'Comment' section has a text input field. Buttons at the bottom include Ok, Apply, Reset, Finish, and Help.

Non-Tinable dialog box showing the 'Non tinable previous segm' command. The 'Readings' section includes a Command dropdown, and the 'Description' section includes fields for Feature code, String number, Named point, Point Id, and String order, each with a corresponding icon (N, ab, N, ab, #). The 'Time Surveyed' section has a date/time selector and a refresh button. The 'Comment' section has a text input field. Buttons at the bottom include Ok, Apply, Reset, Finish, and Help.

Non-Tinable dialog box showing the 'Non tinable point (opcod' command. The 'Readings' section includes a Command dropdown, and the 'Description' section includes fields for Feature code, String number, Named point, Point Id, and String order, each with a corresponding icon (N, ab, N, ab, #). The 'Time Surveyed' section has a date/time selector and a refresh button. The 'Comment' section has a text input field. Buttons at the bottom include Ok, Apply, Reset, Finish, and Help.

Non-Tinable dialog box showing the 'Non tinable string (opcod' command. The 'Readings' section includes a Command dropdown, and the 'Description' section includes fields for Feature code, String number, Named point, Point Id, and String order, each with a corresponding icon (N, ab, N, ab, #). The 'Time Surveyed' section has a date/time selector and a refresh button. The 'Comment' section has a text input field. Buttons at the bottom include Ok, Apply, Reset, Finish, and Help.

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

Field Description	Type	Defaults	Pop-Up
<b>Readings</b>			
<b>Command</b>	choice box		Non tinable previous segment (opcode 39) Non tinable next segment (opcode 38) Non tinable point (opcode 40)
<b>for Non tinable previous segment</b>			

*the **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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.38 Note \(opcode 29\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.38 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 [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

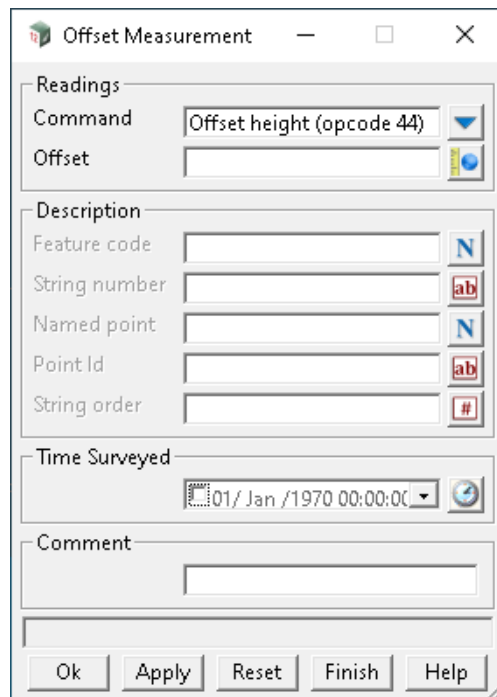
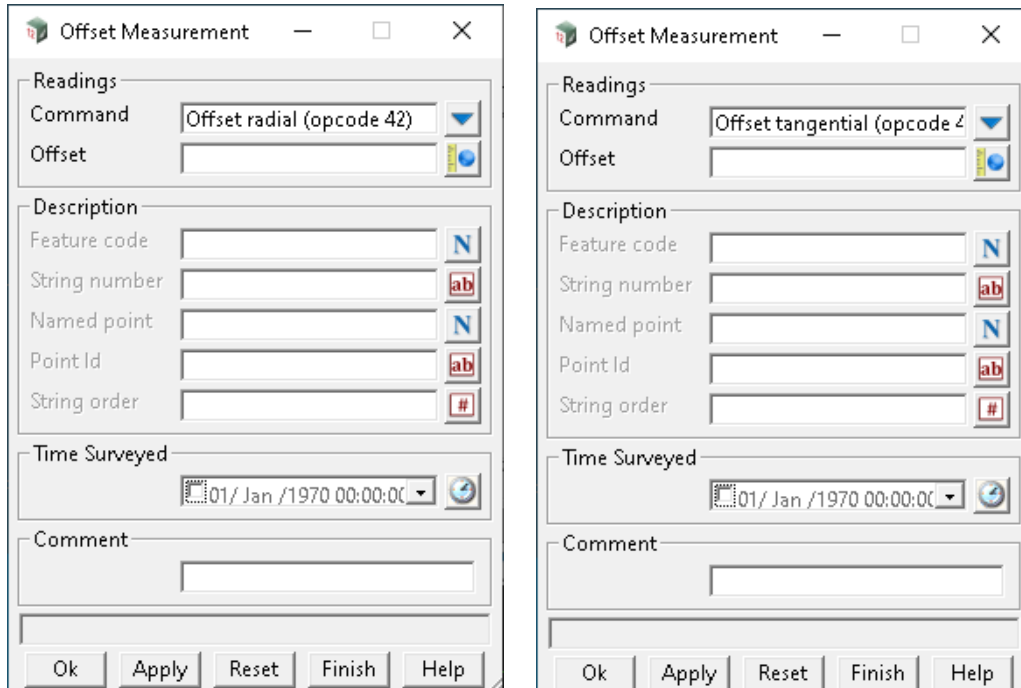
For the description on how the field data command is stored in a **12d Field File**, see [29 memo Note or memo](#).

Continue to [25.4.2.39 Offset Measurement \(opcodes 42, 43, 44\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#)

### 25.4.2.39 Offset Measurement (opcodes 42, 43, 44)

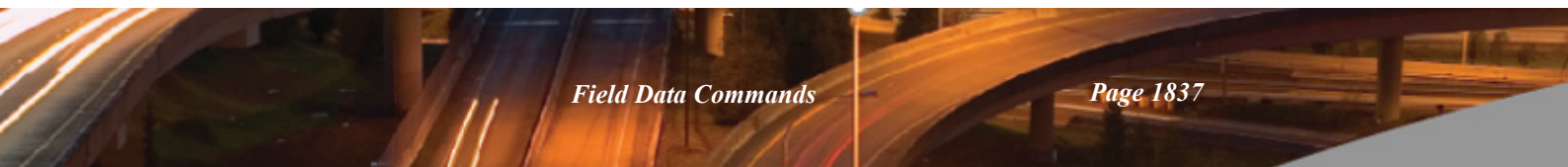
It is not always possible to measure a point directly but it may be possible to measure a point nearby and then measure offsets to adjust the measured point by to produce the coordinates of the required point.

For a full description and diagrams, see [25.3.2 Offsets](#) in Appendix [25 12d Survey Guide](#).



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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------



## Readings

<b>Command</b>	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 [25.3.2 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 [25.3.2 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 [25.3.2 Offsets](#)

## Description - used for finding an existing point

the **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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons.](#)

For the description on how the field data command is stored in a **12d Field File**, see

<a href="#">42</a>	<a href="#">offset_measurement_radial</a>	<a href="#">Add a radial offset.</a>
<a href="#">43</a>	<a href="#">offset_measurement_tangential</a>	<a href="#">Add a tangential offset.</a>
<a href="#">44</a>	<a href="#">offset_measurement_height</a>	<a href="#">Add a height offset.</a>

Continue to [25.4.2.40 Order String Automatically \(opcode 101\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)

#### 25.4.2.40 Order String Automatically (opcode 101)

The **Order string automatically** option does not bring up a panel and straight away creates an Order record.

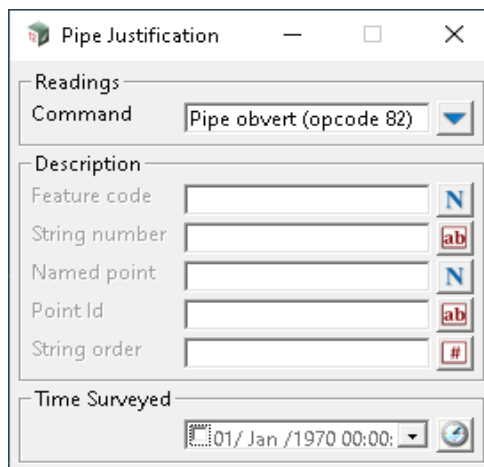
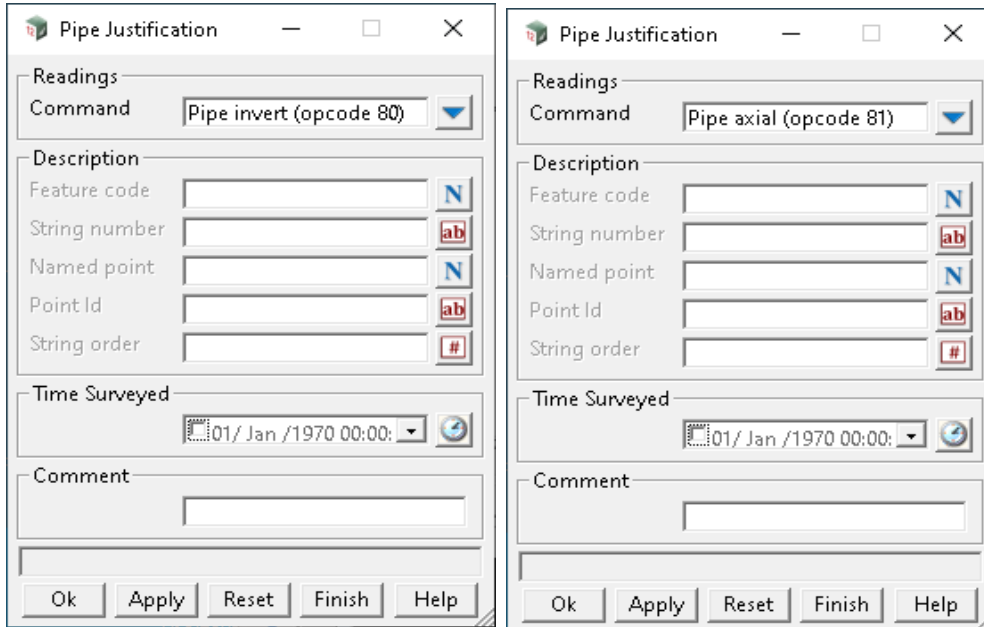
For the description on how the field data command is stored in a **12d Field File**, see [\\_101 auto\\_order Order strings automatically.](#)

Continue to [25.4.2.41 Pipe Justification \(opcodes 80, 81, 82\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.41 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
<b>Readings</b>			
<b>Command</b>	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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.42 Remove Height \(opcode 30\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.42 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.43 Remove \(Delete\) Point \(opcode 31\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.43 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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

#### Named point

*Not used.*

#### String order

???

#### Rest of the Fields and Buttons

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.44 Remove \(Delete\) String \(opcode 144\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.44 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.45 Resection Start \(opcode 128\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.45 Resection Start (opcode 128)

The **Resection** option is under development.

The screenshot shows a dialog box titled "Resection" with the following fields and controls:

- Readings:** Instrument ht (text field with a globe icon).
- Description:** Feature code (text field with 'N' icon), String number (text field with 'ab' icon), Setup point (text field with 'N' icon), Point Id (text field with 'ab' icon), Point comment (text field with 'ab' icon), String order (text field with '#' icon).
- Position:** Easting (text field with globe icon), Northing (text field with globe icon), Height (text field with globe icon), Accuracy (text field with 'Unknown' value).
- Time Surveyed:** Date and time field showing '01/ Jan /1970 00:00' with a globe icon.
- Comment:** A large text area for entering a comment.
- Buttons:** Ok, Apply, Reset, Finish, Help.

**OK, Apply, Reset, Finish, Help** See the description for the panel buttons in the section [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#)

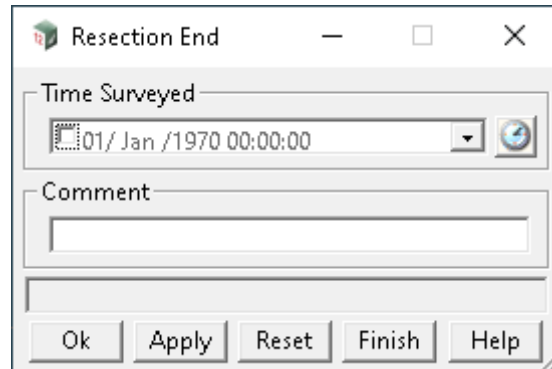
For the description on how the field data command is stored in a **12d Field File**, see [128 resection Start a resection](#).

Continue to [25.4.2.46 Resection End \(opcode 129\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).



### 25.4.2.46 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 [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#)

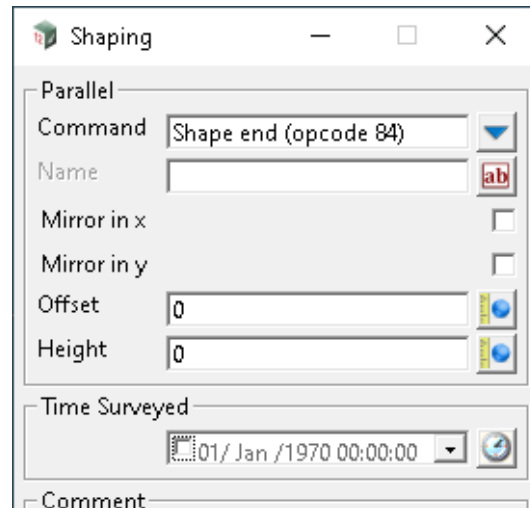
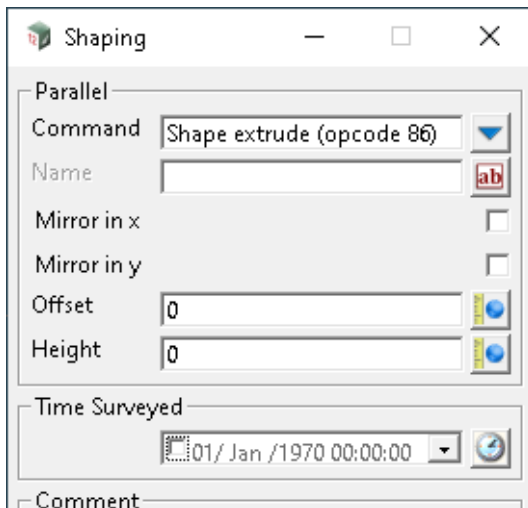
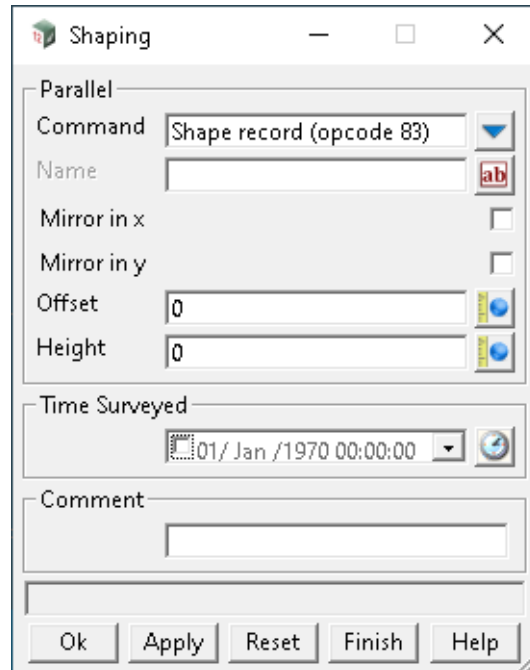
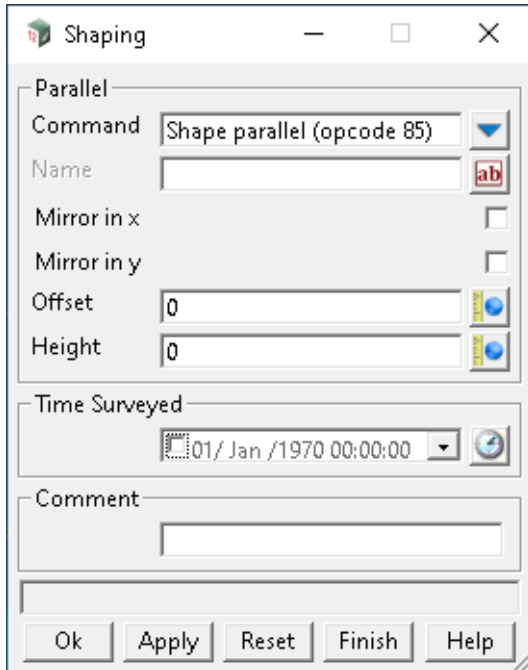
For the description on how the field data command is stored in a **12d Field File**, see [129 resection\\_end End the resection.](#)

Continue to [25.4.2.47 Shaping \(opcodes 83 to 86\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.47 Shaping (opcodes 83 to 86)

The **Shaping** option defines a shape and extrudes it down a string.

For a full description and diagrams, see [25.3.11 Shape Field Coding](#) in chapter [25 12d Survey Guide](#)



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

Field Description	Type	Defaults	Pop-Up
<b>Parallel</b>			
<b>Command</b>	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 specified super string.*

**for Shape parallel**

*parallel the current shape along the specified super 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 [3.24.2 Chord-to-Arc Tolerance](#)*

**Name**

*the name of the shape.*

**Mirror in x****Mirror in y****Offset****Height****Rest of the Fields and Buttons**

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.48 Slope Distance Scale Factor \(opcode 9\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.48 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

*the 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 [25.4.1.3 Time surveyed, Comment and 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](#).

Continue to [25.4.2.49 String Close \(opcode 20\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.49 String Close (opcode 20)

The **String Close** option closes the selected string.

For a full description and diagrams, see [25.3.4 Close String](#) in [25 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.50 String End \(opcode 48\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.50 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.51 String \(Squashed\) Rectangle \(opcode 45\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.51 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 [25.3.5 Squashed Rectangle - Parallelogram](#) in [25 12d Survey Guide](#).

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Readings

<b>Height mode</b>	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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.52 String Rectangle by 2 Points \(opcode 37\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#)

### 25.4.2.52 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 [25.3.6 Rectangle by 2 Points](#) in [25 12d Survey Guide](#).

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

Field	Description	Type	Defaults	Pop-Up
-------	-------------	------	----------	--------

#### Readings

<b>Offset</b>		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.*

<b>Height mode</b>		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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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, for 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 [25.4.2.53 String Reverse \(opcode 19\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.53 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.54 String Start \(opcode 47\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)



### 25.4.2.54 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 [25.3.3 Start New String](#) in [25 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.55 String Tinable - Breakline String \(opcode 46\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#)

### 25.4.2.55 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
<b>Readings</b>			
<b>Breakline mode</b>	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 [25.4.1.2.2 Feature Code, String Number, Point Id for Finding Standard Points or Strings](#)

#### Named point

???

**String order**

???

**Rest of the Fields and Buttons**

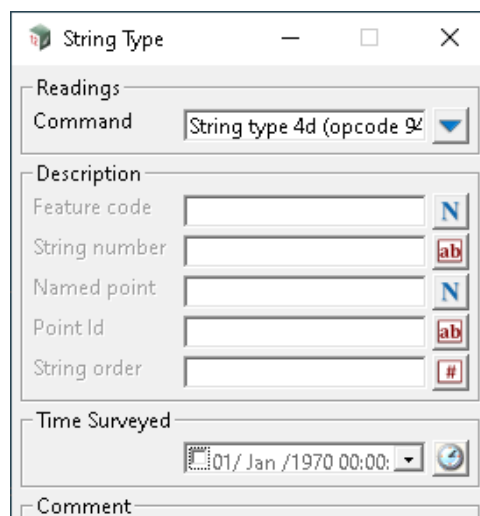
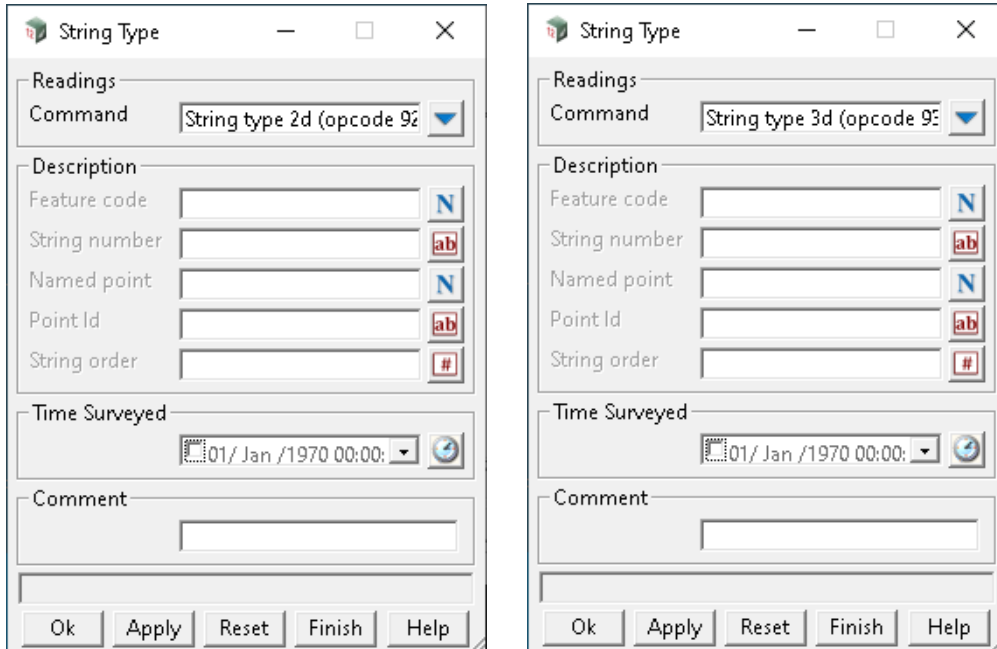
**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and Bottom Panel buttons](#).

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 [25.4.2.56 String Type \(opcodes 92, 93, 94\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.56 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
<b>Readings</b>			
<b>Command</b>	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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.57 Culvert \(opcode 96\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25.12d Survey Guide](#).



### 25.4.2.57 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

*the width of the culvert*

##### Height

*the 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.58 Pipe Diameter \(opcode 95\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.58 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

*the 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 [25.4.1.2.2 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.59 Target Height \(opcode 5\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.59 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.60 Templating \(opcodes 51 to 59\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)

### 25.4.2.60 Templating (opcodes 51 to 59)

The **Templating** option records and uses field templates when picking up strings.

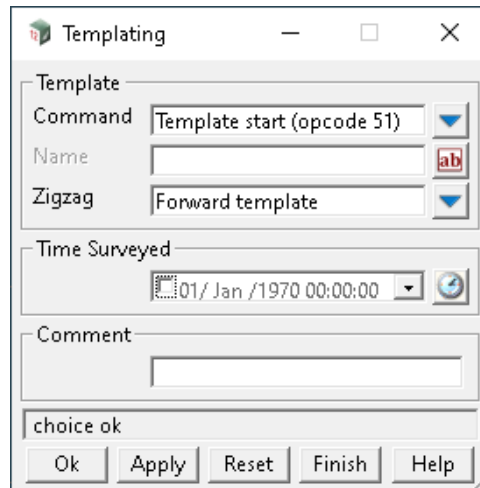
For a full description and diagrams, see [25.3.10 Field Templates](#) in [25 12d Survey Guide](#).

For <i>Template start (opcode 51)</i> , go to	<a href="#">Template start</a>
<i>Template end (opcode 52)</i>	<a href="#">Template end</a>
<i>Template pause (opcode 53)</i>	<a href="#">Template pause</a>
<i>Template continue (opcode 54)</i>	<a href="#">Template continue</a>
<i>Template record (opcode 55)</i>	<a href="#">Template record</a>
<i>Template skip (opcode 56)</i>	<a href="#">Template skip</a>
Template insert (opcode 58)	<a href="#">Template insert</a>
Template delete (opcode 57)	<a href="#">Template delete</a>
<i>Template change (opcode 59)</i>	<a href="#">Template change</a>

#### Template start

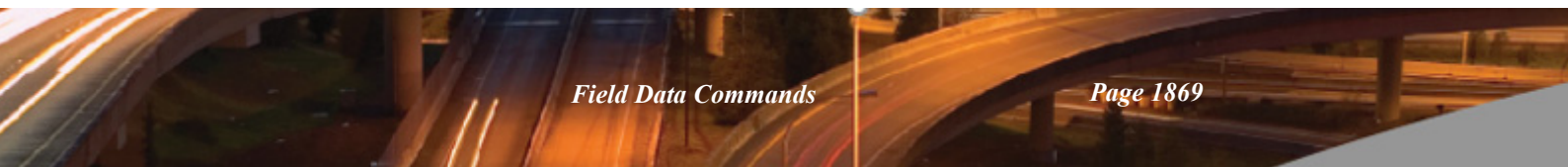
Selecting *Template start (opcode 51)* brings up the **Templating** panel with the *Command* field set to *Template start (opcode 51)*

*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
<b>Command</b>		Template start	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)
<b>Name</b>	Text box		
	Name of the field template to use. If <i>Name</i> is blank, the default field template is used.		
<b>Zigzag</b>	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 [25.3.10.1 Forward Direction](#) in Appendix [25 12d Survey Guide](#)

**reverse template**, then the field template is used as a *reverse* template. See [25.3.10.2 Reverse Template Direction](#) in Appendix [25 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 [25.3.10.3 Zig-Zag](#) in Appendix [25 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 [25.3.10.3 Zig-Zag](#) in Appendix [25 12d Survey Guide](#).

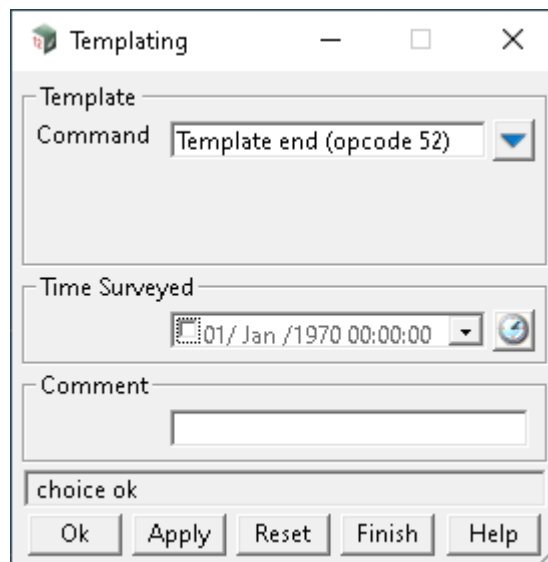
If *zigzag* is **blank**, or anything other than **forward**, **reverse**, or **start on zag** then the field template is used as a zig-zag template starting on a **zig**.

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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
<b>Command</b>		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 [25.4.1.3 Time surveyed, Comment and 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.

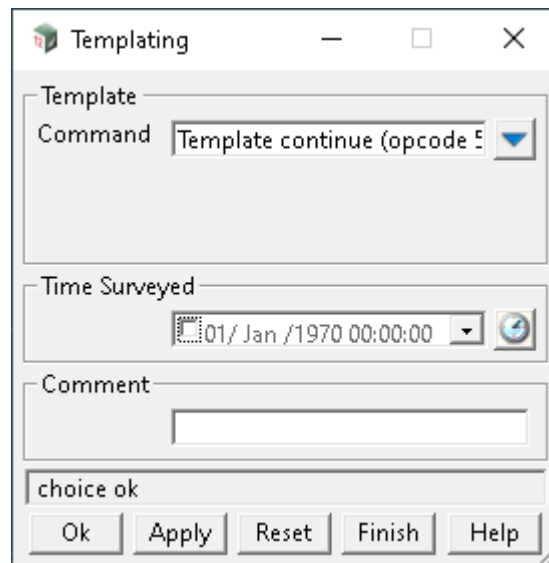
The fields and buttons used in this panel have the following functions.

Field Description	Type	Defaults	Pop-Up
<b>Command</b>		Template pause	Template start (opcode 51) Template end (opcode 52) Template pause (opcode 53) Template continue (opcode 54) Template record (opcode 55)
<b>Time surveyed, Comment, OK, Apply, Reset, Finish, Help</b>			See <a href="#">25.4.1.3 Time surveyed, Comment and Bottom Panel buttons</a> .

### 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
<b>Command</b>		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 [25.4.1.3 Time surveyed, Comment and 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
<b>Command</b>		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 [25.4.1.3 Time surveyed, Comment and 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 [25.3.10.4 Skipping Field Template Points](#) in Appendix [25 12d Survey Guide](#)

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

Field Description	Type	Defaults	Pop-Up
-------------------	------	----------	--------

#### Points to skip

*the 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 [25.4.1.3 Time surveyed, Comment and 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 [25.3.10.5 Insert Template Points or Insert Multiple Codes](#) in Appendix [25 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 ticked off (the default), a new point is inserted into the template with the Feature code and String number given in the panel.*

*If ticked on, 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 on, 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 [25.4.1.3 Time surveyed, Comment and 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 [25.3.10.6 Delete Template Points](#) in Appendix [25 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 use the updated template definition.*

**Time surveyed, Comment, OK, Apply, Reset, Finish, Help** See [25.4.1.3 Time surveyed, Comment and 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 [25.4.1.3 Time surveyed.](#)

[Comment and Bottom Panel buttons.](#)

Continue to [25.4.2.61 Additional Text For Point \(opcode 41\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.61 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 [25.4.1.3 Time surveyed, Comment and 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 [25.4.2.62 Units \(opcode 100\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

### 25.4.2.62 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
<b>Angle</b> <i>if degrees, angles are given in decimal degrees.</i> <i>Warning: gons and mills are not implemented and even through chosen, decimal degrees is still used.</i>	choice box		degrees, gons, mills
<b>Distance</b> <i>if metres, distance is given in metres.</i> <i>Warning: feet is not implemented and even through chosen, metres is still used.</i>	choice box		metres, feet
<b>Pressure</b> <i>if millimetres, pressure is given in millimetres.</i> <i>Warning: inches and millibars are not implemented and even through chosen, millimetres is still used.</i>	choice box		millimetres, inches, millibars
<b>Temperature</b> <i>if celsius, temperatures are given in celsius.</i> <i>Warning: fahrenheit is not implemented and even through chosen, celsius is still used.</i>	choice box		celsius, fahrenheit
<b>Time surveyed, Comment, OK, Apply, Reset, Finish, Help</b>			See <a href="#">25.4.1.3 Time surveyed, Comment and Bottom Panel buttons.</a>

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 [25.4.2.63 Vertical Circle Correction \(opcode 15\)](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide.](#)

### 25.4.2.63 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 [25.4.1.3 Time surveyed, Comment and 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 [26 12d Field File Format](#) or return to [25.4.2 List of Field Data Commands](#) or [25 12d Survey Guide](#).

#### 25.4.2.64 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:



## 25.5 Field Data Commands and 12d Field File Opcodes

When picking up data in the field, **12d Pickup** creates **field data commands** in the **SDR Function**.

However at any time, the field data in the **SDR Function** can be written out as a **12d Field File** where the information is stored as **opcodes** and the opcode's associated data.

So to make this work effectively, there is a one-to-one relationship between the **field data commands** and the **opcodes**. That is, for each **field data command** there is one **opcode**, and vice-versa.

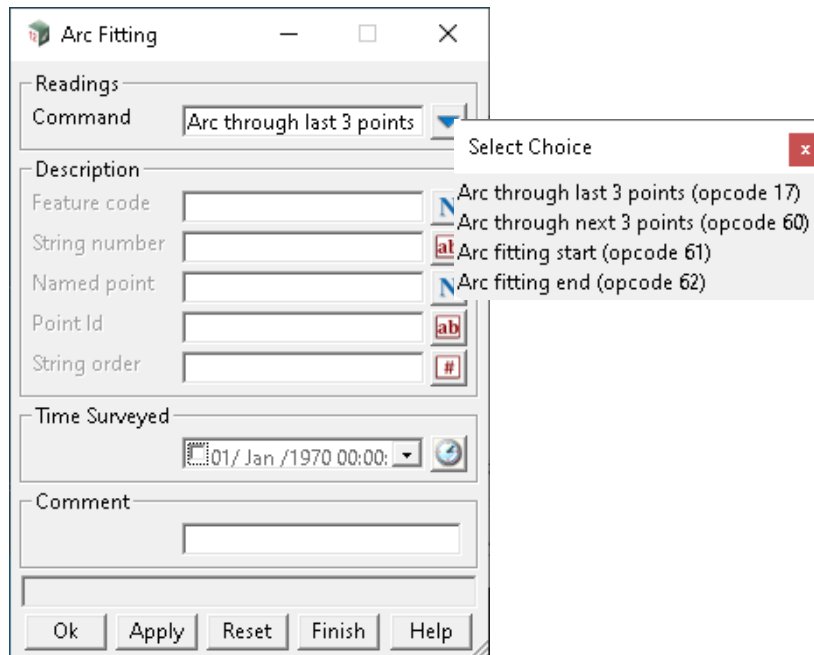
This relationship can be seen in the pop-up for the list of field data commands where each choice has its equivalent **opcode number** as part of the text.

Select Choice

	See
Arc fitting end (opcode 62)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc fitting start (opcode 61)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc through last 3 points (opcode 17)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Arc through next 3 points (opcode 60)	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
Attachment (opcode 126)	<a href="#">25.4.2.2 Attachment (opcode 126)</a>
Attribute for next segment (Measurement) (opcode 120)	<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
Attribute for next segment (integer) (opcode 74)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for next segment (real) (opcode 75)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
Attribute for next segment (text) (opcode 76)	<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>

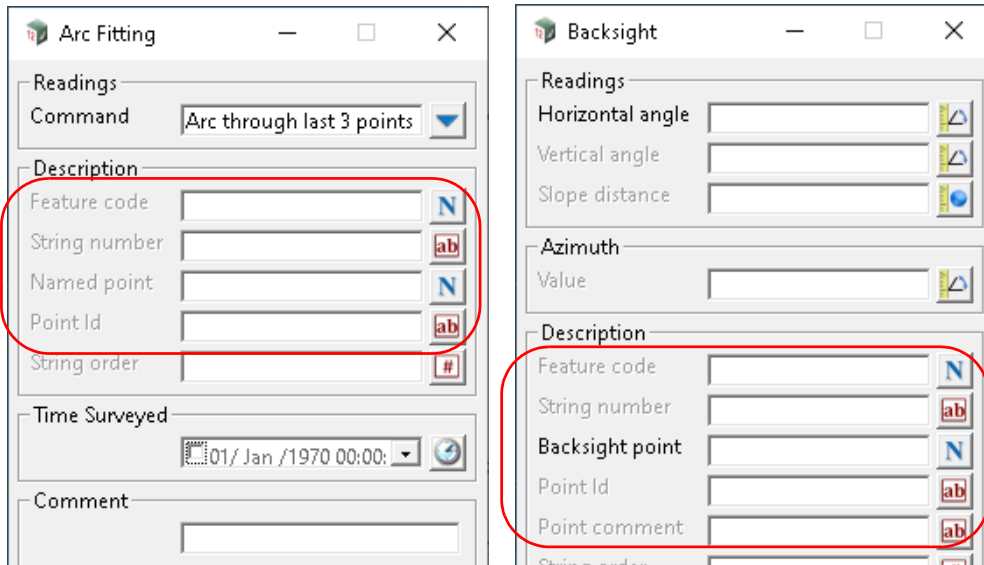
However, many of the opcodes can be grouped together and this fact is used in the panels in the **SDR Editor**.

For example, although there are four different opcodes and field data commands for **Arc Fitting**, in the **SDR Editor** they all bring up the same panel, **Arc Fitting**, and the pop-up of choices for the **Command** field is restricted to the opcodes for arc fitting.



Another major difference between the display of field data commands and opcode is that the fields on the panel can have different text describing them but in the structure of the opcode record, the names of the fields are fixed and how they are used is determined by the opcode itself.

For example, in the **Arc Fitting** panel, there are the fields **Feature code**, **String number**, **Named point** and **Point id** and in the **Backsight** panel, there are the fields **Feature code**, **String number**, **Backsight point**, **Point id** and **Point comment**.



In the **12d Field File**, these fields are collectively referred to 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.

In the **field data command** panel, the field **Feature code** is written out to the opcode field **feature\_code**, **String number** to **string\_number**, **Point id** to **point\_id** and **Point comment** to **point\_comment**.

However the name of the field that is written out to **point\_name** will vary.

For example, in the panel **Arc Fitting**, **Named point** is written out to **point\_id** but in the **Backsight** panel, it is **Backsight point**.

## 25.6 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*.



# 26 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

[26.1 Structure of the 12dfield File](#)

[26.2 Structure of the fld File](#)

[26.3 Point Description](#)

[26.4 Keyword Blocks in the 12dfield File](#)

[26.5 Measurements and Named Measurements](#)

[26.6 Searching for Special Coordinates](#)

[26.7 Full Description of 12d Survey Opcodes](#)

[26.8 12d Survey Opcode Summary](#)



## 26.1 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 ([26.1.1 One 12dfield file](#))
- or
- (b) internally the **12d field** file consists of a number of separate **12d field** files ([26.1.2 More Than One 12dfield File](#)).

### 26.1.1 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>
```

## 26.1.2 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>
  </field12>
</xml12d>
```

Continue to [26.3 Point Description](#).

## 26.2 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 [26.3 Point Description](#).

## 26.3 Point Description

**Feature codes** and **string numbers** are entered by the surveyor whilst surveying in the field and entered by the surveyor into **12d Pickup**, or if **12d Pickup** is not being used, the instrument or a separate data collector external to the instrument.

For convenience, **data collector** will be used to refer to data stored on the instrument itself, or in a data collector that is external to the instrument.

The **point ids** are usually automatically created by **12d Pickup**, or the data collector, but sometimes will be entered by the surveyor.

Other information can also be entered by the surveyor but the extra information must end up in the **12d Field File** for it to be used by **12d Model**.

For **non-12d Pickup** users, how any of the information is entered in the field depends on the data recorder and the coding convention used and the user can set up a **Data Collector Definition** in **12d Model** for the information to be converted correctly into a **12d Field File**. In the **12d Model Reference Manual**, see [44.1 Data Collector Definitions](#).

In most records of a **12d Field File**, a **feature code**, **string number**, **point id**, **point name** and **point comment** (also called **point text**) are present and stored together, either as sequential lines in the **12dfield** file, or on the same line separated by tabs in the **fld** file.

- (a) The **feature code** and **string number** are for stringing points together, described in the **12d Model Reference Manual** in [25.3.1 Stringing in the Field](#).
- (b) 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** can be **alphanumeric**.  
During reduction, the **point id** is stored as the **point id** for the vertex of the super string that the measurement point is part of.
- (c) The **point name** is used to store the name of a **station** or **special named point**, and is supplied by the surveyor with certain opcodes. It is also used by some opcodes to create a **named point** that can be searched for by other opcodes. See [26.5 Measurements and Named Measurements](#).
- (d) The **point comment** or **point text** is stored as **vertex text** for that vertex of the super string.

For simplicity in describing the **12d Field File**, the **feature code**, **string number**, **point id**, **point name** and **point comment** are grouped together and called the **point description**.

Hence the **point description** consists of the following pieces of information:

- feature code (string name)
- string number
- point id
- point name
- point comment or point text

In the **12dfield** file, the **point description** is denoted by **<point\_description>** and is actually 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 five items in <point\_description> file is not important as each item is easily identified.

In the *fld* file, the **feature code**, **string number**, **point id**, **point name** and **point text** must be given in this 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** will be five items of information separated by tabs.:

feature code	string number	point id	point name	point comment
abc	01	1002	STN 4	freddie

The order of the five items in the *fld* file record is **critical** and each is separated by a <Tab>.

So, in summary, the **point description** is shorthand for **five** pieces of information

## 26.4 Keyword Blocks in the *12dfield* File

There are many regularly used blocks of information in *12dfield* that will be identified and documented by 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>](#)

and the format for time, [time\\_text](#).

Finally there are [<point\\_description>](#) and [\[<op\\_code\\_properties>\]](#) which are not actual keyword blocks but are shorthand for a group 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>
  <a href="#">units_block</a>
  <a href="#">application_block</a>
</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 [26.7 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\_text

**time\_text** is a string of characters in the W3C time format.

YYYY-MM-DDThh:mm:ssZ      see [40.3.8 W3C Time Format](#).

For example, 2015-09-28T06:42:45Z

### <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 of 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 **id** keyword block is:

```
<comment>comment_text</comment>
```

where **comment\_text** is a string of characters.

**<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 [26.3 Point Description](#).

This is:

```

<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 [26.5 Measurements and Named Measurements](#).



## 26.5 Measurements and Named Measurements

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)
- (b) EDM measurement VD (HA,HD,VD + point\_description)
- (c) EDM measurement HT (HA,HD,HT, + point\_description)
- (d) three hair stadia measurement
- (e) directly entered coordinate
- (f) GNSS coordinate

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*.

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 as the **current string**.

If a **point\_name exists** in the **point description** for any of the measurements, then it is called a **named measurement** and a one point super string of name **point\_name** is created and if it is used, mapped using the Map File.

The **vertex text** for the one point super string is the **station prefix followed by point\_name**.

The **point\_name** is added to an internal list of named points for searching for coordinates.

For a **named measurement**, an ordinary measurement point can also be created but whether this occurs depends on a tick in a field in the **12d Model SDR Function**.

Continue to [26.6 Searching for Special Coordinates](#).

## 26.6 Searching for Special Coordinates

When setting up the instrument on a point, measuring to a backsight, doing a check measurement or 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 used for the reduction of further measurements.

To save confusion in this section, **Name** and **Id** are used for values of **point\_name** and **point\_id** that are being searched for.

Given the **Name** and/or **Id**, a point is found by searching in the following order:

**First search the Control model (if it exists) in 12d Model:**

1. **Name** amongst **Vertex ids**

A search in **12d Model** 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 in **12d Model** 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 in **12d Model** 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) in 12d Model:**

4. **Name** amongst **Vertex ids**

A search in **12d Model** 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 in **12d Model** 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 in the SDR Function in 12d Model, next search the already entered Directly Entered Coordinates (DECs) in the 12d Field File. A DEC has a point\_name and point\_id**

6. **Name** amongst **point\_names**

A search is made of previously entered **directly entered coordinates** in the field file for a DEC whose **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** in the field file for a DEC whose **point\_id** is the same as **Name**. If a DEC is found, its (x,y,z) coordinates are used.

8. **Id** amongst **point\_ids**

A search is made of previously entered **directly entered coordinates** in the field file for a DEC whose **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 field file: a measurement has a point\_name and point\_id**

9. **Name** amongst **point\_names**

A search is made of **previous measurements** in the field file for a measurement whose **point\_name** is the **same as Name**. If a measurement is found, its (x,y,z) coordinates are used.

10. **Name** amongst **point\_ids**

A search is made of **previous measurements** in the field file for a measurement whose **point id** is the **same as Name**. If a measurement is found, its (x,y,z) coordinates are used.

11. **id** amongst **point\_ids**

A search is made of **previous measurements** in the field file for a measurement whose **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, 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.

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 summary of the **12d Field File Opcodes**, see [26.8 12d Survey Opcode Summary](#)

For the full description of the **12d Field File Opcodes**, see [26.7 Full Description of 12d Survey Opcodes](#).

**Note**

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 id**, by **12d Pickup** 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.

## 26.7 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 [26.8 12d Survey Opcode Summary](#).

Numeric Opcode	Text Opcode	Short Description of Opcode
-3	<b>group</b> <group> <name>Group_name</name> [<op_code_properties>] </group> -3 Group_name	<b>Group</b>
-2	<b>comment</b> <comment> <data>Comment_text</data> [<op_code_properties>] </comment> -2 Comment_text	<b>Insert a comment</b>
-1	<b>error</b> <error> <data>Error_value</data> [<op_code_properties>] </error> -1 Error_value	<b>Add text to information for an error</b>
1	<b>job_data</b> <job_data> <description>description_text</description> [<op_code_properties>]	<b>Job Information</b>

</job\_data>

01 block1 block2 block3 block4 where each block can be up to 10 characters.

Job header information.

The field\_data command panel in the SDR Editor is documented in [25.4.2.16 Job Data \(opcode 1\)](#)

## 2 coordinate Directly entered coordinate measurement

<coordinate>

<XYZ>

<point\_description>

[<op\_code\_properties>]

</coordinate>

02 Point\_description X Y Z

A measurement point is created with the feature code and string number from the point\_description and given (x, y,z) coordinates. No reduction is needed.

The point\_number 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 LJG) 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 [25.4.2.14 Coordinate \(opcode 2\)](#)

## 3 station New instrument setup on a point

<station>

<height>instrument\_height</height>

<point\_description>

[<op\_code\_properties>]

</station>

03 Point\_description instrument\_height

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 [25.4.2.36 New Instrument Setup - Station \(opcode 3\)](#)

## 4 backsight Measurement to backsight

<backsight>

<horizontal\_angle>horizontal\_circle</horizontal\_angle>

<vertical\_angle><vertical\_circle</vertical\_angle>

<slope\_distance><slope\_distance\_value</slope\_distance>

<azimuth><azimuth\_value</azimuth>

<point\_description>

[<op\_code\_properties>]

</backsight>

04 Point\_description horizontal\_circle vertical\_circle slope\_distance\_value azimuth\_value

Measurement to a backsight whose name is given in the point\_name section of the point\_description.



If the *Display panel for backsights* field in the **Survey Data Reduction Function** panel is **ticked**, 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 [25.4.2.6 Backsight \(opcode 4\)](#)

#### 5 **target\_height** **New target height**

```
<target_height>
  <height>Target_height</height>
  <point_description>
  [<op_code_properties>]
</target_height>
```

05 Target\_height

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 [25.4.2.59 Target Height \(opcode 5\)](#)

#### 6 **check\_measurement** **Check measurement**

```
<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>
```

06 Point\_description horizontal\_circle vertical\_circle slope\_distance\_value

A check measurement is made to the station given in the *point\_name* section of the *point\_description*. A one point super string (with name *point\_name*) at the measured point is created 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 [25.4.2.10 Check Measurement \(opcode 6\)](#)

#### 7 **edm\_tachy\_measurement** **Measurement - HA, VA, SD**

```
<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>
```

07 Point\_description horizontal\_circle vertical\_circle slope\_distance\_value

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\_number* and *text* 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 [25.4.2.29 EDM Measurement \(opcode 7\)](#)

**8 not yet used**

**9 scale\_factor Slope distance scale factor for subsequent distances**

```
<scale_factor>
  <factor>Scale_factor</factor>
  [op\_code\_properties]
</scale_factor>
```

09 Scale\_factor

Scale factor to apply to subsequent slope distances.

The field data command panel in the SDR Editor is documented in [25.4.2.48 Slope Distance Scale Factor \(opcode 9\)](#)

**10 stadia\_measurement Three hair stadia measurement**

```
<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>
```

10 Point\_description horizontal\_circle vertical\_circle bottom\_value bottom\_value top\_value

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\_number* and *text* 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 [25.4.2.32 Stadia Measurement \(opcode 10\)](#)

**11 edm\_tachy\_measurement\_ht Measurement - HA, HD, Height**

```
<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>

11 *Point\_description horizontal\_circle horizontal\_distance\_value height\_value*

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\_number* and *text* 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 [25.4.2.30 EDM Measurement \(HA,HD,HT\) \(opcode 11\)](#)

## 12 edm\_tachy\_measurement\_vd Measurement - HA, HD, Height difference (VD)

<edm\_tachy\_measurement\_vd>

<horizontal\_angle>*horizontal\_angle\_value*</horizontal\_angle>

<horizontal\_distance>*horizontal\_distance\_value*</horizontal\_distance>

<vertical\_distance>*height\_difference*</vertical\_distance>

[<point\\_description>](#)

[\[<op\\_code\\_properties>\]](#)

</edm\_tachy\_measurement\_vd>

11 *Point\_description horizontal\_circle horizontal\_distance height\_difference*

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\_number* and *text* 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 [25.4.2.31 EDM Measurement \(HA,HD,Diff HT\) \(opcode 12\)](#).

## 13 not yet used

## 14 check\_coordinate Check Coordinates

<check\_coordinate>

[<XYZ>](#)

[<point\\_description>](#)

[\[<op\\_code\\_properties>\]](#)

</check\_coordinate>

14 *Point\_description X Y Z*

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 [25.4.2.9 Check Coordinate \(opcode 14\)](#)

## 15 vertical\_circle Vertical circle correction

<vertical\_circle>

<correction>*vertical\_circle\_in\_decimal\_degrees*</correction>

[\[<op\\_code\\_properties>\]](#)

</vertical\_circle>

09 *Vertical\_circle\_in\_decimal\_degrees*

The *vertical\_circle\_in\_decimal\_degrees* is **subtracted** from the vertical circle value in any measurements. The units for *vertical\_circle\_in\_decimal\_degrees* is decimal degrees.

The field data command panel in the SDR Editor is documented in [25.4.2.63 Vertical Circle Correction \(opcode 15\)](#)

## 16 **multiple\_coding** **Multiply coded point**

<multiple\_coding>

[<point\\_description>](#)

[\[<op\\_code\\_properties>\]](#)

</multiple\_coding>

16 *Point\_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\_number* and *text* 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 [25.4.2.35 Multiple Coding \(opcode 16\)](#)

## 17 **arc\_fitting\_last\_3\_points** **Arc through previous three points**

<arc\_fitting\_last\_3\_points>

[\[<point\\_description>\]](#)

[\[<op\\_code\\_properties>\]](#)

</arc\_fitting\_last\_3\_points>

17 [*Point\_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 *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 *Point\_number* 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 [25.3.9 Arcs Through Points](#).

The field data command panel in the SDR Editor is documented in [25.4.2.1 Arc Fitting \(opcodes 17, 60, 61, 62\)](#)

## 18 **feature** **Circle Feature**

<feature>

```
<radius>Radius_value</radius>
  [<op_code_properties>]
</feature>
```

18 Radius\_value

Creates a feature string with the given *Radius\_value* and centred on the current measurement point.

See [25.3.7 Feature String](#)

The field data command panel in the SDR Editor is documented in [25.4.2.11 Circle Feature \(opcode 18\)](#)

## 19 reverse\_string Reverse string

```
<reverse_string>
  [<point_description>]
  [<op_code_properties>]
</reverse_string>
```

19 [*Point\_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 [25.4.2.53 String Reverse \(opcode 19\)](#)

## 20 close\_string Close string

```
<close_string>
  [<point_description>]
  [<op_code_properties>]
</close_string>
```

20 [*Point\_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.

If the *point id* from the *point\_description* exists, then the string containing that point id will be closed.

See [25.3.4 Close String](#)

The field data command panel in the SDR Editor is documented in [25.4.2.49 String Close \(opcode 20\)](#)

## 21 join\_strings\_last\_to\_last Join last points of strings

```
<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>
```

21 Feature\_code string\_number\_1 string\_number\_2

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 [25.3.8 Joining Strings](#)

The field data command panel in the SDR Editor is documented in [25.4.2.28 Strings Join \(opcodes 21 to 24\)](#)

## 22 **join\_strings\_first\_to\_last** **Join first to last point of strings**

```
<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>
```

22 *Feature\_code string\_number\_1 string\_number\_2*

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 [25.3.8 Joining Strings](#)

The field data command panel in the SDR Editor is documented in [25.4.2.28 Strings Join \(opcodes 21 to 24\)](#)

## 23 **join\_strings\_first\_to\_first** **Join first points of strings**

```
<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>
```

23 *Feature code string number\_1 string number\_2*

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 [25.3.8 Joining Strings](#)

The field data command panel in the SDR Editor is documented in [25.4.2.28 Strings Join \(opcodes 21 to 24\)](#)

## 24 **join\_strings\_last\_to\_first** **Join last to first point of strings**

```
<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>
```

24 *Feature\_code string\_number\_1 string\_number\_2*

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 [25.3.8 Joining Strings](#)

The field data command panel in the SDR Editor is documented in [25.4.2.28 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**

<height\_or\_depth>

<value>Text</value>

[<point\_description>]

[<op\_code\_properties>]

</height\_or\_depth>

28 [Point\_description] Text

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 [25.4.2.15 Height Or Depth Comment \(opcode 28\)](#)

29 **memo** **Note or memo**

<memo>

<data>Text</data>

[<op\_code\_properties>]

</memo>

29 Text

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 [25.4.2.38 Note \(opcode 29\)](#)

30 **remove\_height** **Remove height from a point - that is make it a null height**

<remove\_height>

[<point\_description>]

[<op\_code\_properties>]

</remove\_height>

30 [Point\_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.

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 [25.4.2.42 Remove Height \(opcode 30\)](#)

**31 remove\_point Delete point**

```
<remove_point>
  [<point_description>]
  [<op_code_properties>]
</remove_point>
```

30 [Point\_description]

The field data command panel in the SDR Editor is documented in [25.4.2.43 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**

```
<rectangle_2>
  <offset>offset_in_metres</offset>
  [<point_description>]
  [<op_code_properties>]
</rectangle_2>
```

37 [Point\_description] offset\_in\_metres

The rectangle is defined by two points (reference side) and a 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.

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 [25.3.6 Rectangle by 2 Points](#)

The field data command panel in the SDR Editor is documented in [25.4.2.52 String Rectangle by 2 Points \(opcode 37\)](#)

**38 non\_tinable\_next\_segment Make the next segment non-tinable**

```
<non_tinable_next_segment>
```

```
[<point_description>]
[<op_code_properties>]
</non_tinable_next_segment>
```

38 [Point\_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 [25.4.2.37 Non Tinability \(opcodes 38, 39, 40, 141\)](#)

### 39 non\_tinable\_previous\_segment                      Make the previous segment non-tinable

```
<non_tinable_previous_segment>
[<point_description>]
[<op_code_properties>]
</non_tinable_previous_segment>
```

39 [Point\_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 [25.4.2.37 Non Tinability \(opcodes 38, 39, 40, 141\)](#)

### 40 non\_tinable\_vertex                                      Make a point non-tinable

```
<non_tinable_vertex>
[<point_description>]
[<op_code_properties>]
</non_tinable_vertex>
```

40 [Point\_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 [25.4.2.37 Non Tinability \(opcodes 38, 39, 40, 141\)](#)

**41 additional\_text Add additional text to the current measurement point**

```
<additional_text>
  <text>Text</text>
  <point_description>
  [<op_code_properties>]
</additional_text>
```

41 Text

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 [25.4.2.61 Additional Text For Point \(opcode 41\)](#)

**42 offset\_measurement\_radial Add a radial offset**

```
<offset_measurement_radial>
  <offset>Radial_offset_in_metres</offset>
  [<point_description>]
  [<op_code_properties>]
</offset_measurement_radial>
```

42 [*Point\_description*] *Radial\_offset\_in\_metres*

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 [25.3.2 Offsets](#)

The field data command panel in the SDR Editor is documented in [25.4.2.39 Offset Measurement \(opcodes 42, 43, 44\)](#)

**43 offset\_measurement\_tangential Add a tangential offset**

```
<offset_measurement_tangential>
  <offset>Tangential_offset_in_metres</offset>
  [<point_description>]
  [<op_code_properties>]
</offset_measurement_tangential>
```

43 [*Point\_description*] *Tangential\_offset\_in\_metres*

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 [25.3.2 Offsets](#)

The field data command panel in the SDR Editor is documented in [25.4.2.39 Offset Measurement \(opcodes 42, 43, 44\)](#)

#### 44 **offset\_measurement\_height** **Add a height offset**

```
<offset_measurement_height>
  <offset>Height_offset_in_metres</offset>
  [<point\_description>]
  [<op\_code\_properties>]
</offset_measurement_height>
```

44 [*Point\_description*] *Height\_offset\_in\_metres*

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 [25.3.2 Offsets](#)

The field data command panel in the SDR Editor is documented in [25.4.2.39 Offset Measurement \(opcodes 42, 43, 44\)](#)

#### 45 **rectangle** **Make a parallelogram from the last three measurement points**

```
<rectangle>
  [<point\_description>]
  [<op\_code\_properties>]
</rectangle>
```

45 [*Point\_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 [25.3.5 Squashed Rectangle - Parallelogram](#)

The field data command panel in the SDR Editor is documented in [25.4.2.51 String \(Squashed\) Rectangle \(opcode 45\)](#)

46 **breakline** **Make the string a breakline or not**

```
<breakline>
  [<mode>mode_value</mode>]
  [<point_description>]
  [<op_code_properties>]
</breakline>
```

46 [Point\_description] [mode\_value]

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 [25.4.2.55 String Tinable - Breakline String \(opcode 46\)](#)

47 **new\_string** **Start a new string**

```
<new_string>
  [<point_description>]
  [<op_code_properties>]
</new_string>
```

47 [Point\_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 [25.3.3 Start New String](#)

The field data command panel in the SDR Editor is documented in [25.4.2.54 String Start \(opcode 47\)](#)

48 **end\_string** **End a string**

```
<end_string>
  [<point_description>]
  [<op_code_properties>]
```



</end\_string>

48 [Point\_description]

If no *Point\_description* exists, 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\_number* 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 [25.4.2.50 String End \(opcode 48\)](#)

#### 49 distances Distances

<distances>

<data>distance\_value</data>

<point\_description>

[<op\_code\_properties>]

</distances>

49 ?????

The field data command panel in the SDR Editor is documented in [25.4.2.18 Distances \(opcode 49\)](#)

#### 50 backsight\_reference Specify bearing to correct for true north - used as bearing datum difference

<backsight\_reference>

<angle\_difference>bearing\_in\_decimal\_degrees</angle\_difference>

<point\_description>

[<op\_code\_properties>]

</backsight\_reference>

50 Point\_description bearing\_in\_decimal\_degrees

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 [25.4.2.7 Backsight Reference \(opcode 50\)](#)

#### 51 template\_start Start using an existing field template

<template\_start>

<name>Template\_name</name>

<zigzag\_mode>zig\_zag\_mode</zigzag\_mode>

[<op\_code\_properties>]

</template\_start>

51 Template\_name zig\_zag\_mode

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 [25.3.10 Field Templates](#)

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

**52    `template_end`                                    Finish using a field template or finish recording a field template**

`<template_end>`

[\[<op\\_code\\_properties>\]](#)

`</template_end>`

52

Stops using the current field template or stops recording a field template.

See [25.3.10 Field Templates](#)

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

**53    `template_pause`                                    Pause the current field template until opcode 54 or finish template 52**

`<template_pause>`

[\[<op\\_code\\_properties>\]](#)

`</template_pause>`

53

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 [25.3.10 Field Templates](#)

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

**54    `template_continue`                                    Continue the current field template**

`<template_continue>`

[\[<op\\_code\\_properties>\]](#)

`</template_continue>`

54

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 [25.3.10 Field Templates](#)

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

**55    `template_record`                                    Start recording a field template**

`<template_record>`

  [<name>*Template\_name*</name>]

[\[<op\\_code\\_properties>\]](#)

`</template_record>`

55    [*Template\_name*]

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 [25.3.10 Field Templates](#)

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

- 56    `template_skip`                    Skip picking up one or more points from a field template**
- ```
<template_skip>
  [<point_count>num_skipped_points</point_count>]
  [<op_code_properties>]
</template_skip>
```
- 56 [num\_skipped\_points]
- 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 [25.3.10.4 Skipping Field Template Points](#)
- The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)
- 57    `template_delete`                Delete points from a field template - after the measurement of last point**
- ```
<template_delete>
  [<point_count>num_points_to_delete</point_count>]
  [<op_code_properties>]
</template_delete>
```
- 57 [num\_points\_to\_delete]
- 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 [25.3.10 Field Templates](#)
- The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)
- 58    `template_insert`                Insert points when using a field template - after the measurement of last point**
- ```
<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>
```
- 58 *Feature\_code String\_number Multiple\_code\_flag Insert\_special\_flag*
- 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 [25.3.10.5 Insert Template Points or Insert Multiple Codes](#)
- The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)
- 59    `template_change`                Change points in a field template**
- ```
<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>
59 [Point_description] String_number Point_value Count_value

```

The field data command panel in the SDR Editor is documented in [25.4.2.60 Templating \(opcodes 51 to 59\)](#)

**60 arc\_fitting\_next\_3\_points Arc through next three points**

```

<arc_fitting_next_3_points>
  [<point_description>]
  [<op_code_properties>]
</arc_fitting_next_3_points>

```

60 [Point\_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 [25.3.9 Arcs Through Points](#)

The field data command panel in the SDR Editor is documented in [25.4.2.1 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**

```

<arc_fitting_start>
  [<point_description>]
  [<op_code_properties>]
</arc_fitting_start>

```

61 [Point\_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 [25.3.9 Arcs Through Points](#)

The field data command panel in the SDR Editor is documented in [25.4.2.1 Arc Fitting \(opcodes 17, 60, 61, 62\)](#)

**62 arc\_fitting\_end** **End the arcs begun by a 61 command**

```
<arc_fitting_end>
  [<point\_description>]
  [<op\_code\_properties>]
</arc_fitting_end>
```

62 [*Point\_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 [25.3.9 Arcs Through Points](#)

The field data command panel in the SDR Editor is documented in [25.4.2.1 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 the current 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**

```
<integer_attribute_string>
  <name>Name</name>
  <value>Integer</value>
  [<op\_code\_properties>]
</integer_attribute_string>
```

68 Name Integer

Add an user defined integer attribute to the current string.

The field data command panel in the SDR Editor is documented in [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 69 real\_attribute\_string**                    **Add a user defined real attribute to the current string**

```
<real_attribute_string>
  <name>Name</name>
  <value>Real</value>
  [<op\_code\_properties>]
</real_attribute_string>
```

69 Name Real

Add a real user defined attribute to the current string.

The field data command panel in the SDR Editor is documented in [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 70 text\_attribute\_string**                    **Add a user defined text attribute to the current string**

```
<text_attribute_string>
  <name>Name</name>
  <value>Text</value>
  [<op\_code\_properties>]
</text_attribute_string>
```

70 Name Text

Add a text user defined attribute to the current string.

The field data command panel in the SDR Editor is documented in [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 71 integer\_attribute\_vertex**                    **Add a user defined integer attribute to the current point**

```
<integer_attribute_vertex>
  <name>Name</name>
  <value>Integer</value>
  [<op\_code\_properties>]
</integer_attribute_vertex>
```

71 Name Integer

Add an integer user defined attribute to the current measurement point.

The field data command panel in the SDR Editor is documented in [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 72 real\_attribute\_vertex**                    **Add a user defined real attribute to the current point**

```
<real_attribute_vertex>
```



```

<name>Name</name>
<value>Real</value>
  [op_code_properties]
</real_attribute_vertex>

```

72 Name Real

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 [25.4.2.4 Attributes \(opcodes 68 to 79\)](#)

**73 text\_attribute\_vertex Add a user defined text attribute to the current point**

```

<text_attribute_vertex>
  <name>Name</name>
  <value>Text</value>
  [op_code_properties]
</text_attribute_vertex>

```

73 Name Text

Add a text user defined attribute to the current measurement point.

The field data command panel in the SDR Editor is documented in [25.4.2.4 Attributes \(opcodes 68 to 79\)](#)

**74 integer\_attribute\_next\_segment Add a user defined integer attribute to the next segment**

```

<integer_attribute_next_segment>
  <name>Name</name>
  <value>Integer</value>
  [op_code_properties]
</integer_attribute_next_segment>

```

74 Name Integer

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 [25.4.2.4 Attributes \(opcodes 68 to 79\)](#)

**75 real\_attribute\_next\_segment Add a user defined real attribute to the next segment**

```

<real_attribute_next_segment>
  <name>Name</name>
  <value>Real</value>
  [op_code_properties]
</real_attribute_next_segment>

```

75 Name Real

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 [25.4.2.4 Attributes \(opcodes 68 to 79\)](#)

**76 text\_attribute\_next\_segment Add a user defined text attribute to the next segment**

```

<text_attribute_next_segment>
  <name>Name</name>
  <value>Text</value>
  [op_code_properties]
</text_attribute_next_segment>

```

76 Name Text

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 [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 77 **integer\_attribute\_previous\_segment** Add a user defined integer attribute to the previous segment  
**<integer\_attribute\_previous\_segment>**

<name>Name</name>

<value>Integer</value>

[\[<op\\_code\\_properties>\]](#)

**</integer\_attribute\_previous\_segment>**

77 Name Integer

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 [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 78 **real\_attribute\_previous\_segment** Add a user defined real attribute for the previous segment  
**<real\_attribute\_previous\_segment>**

<name>Name</name>

<value>Real</value>

[\[<op\\_code\\_properties>\]](#)

**</real\_attribute\_previous\_segment>**

78 Name Real

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 [25.4.2.4 Attributes \(opcodes 68 to79\)](#)

- 79 **text\_attribute\_previous\_segment** Add a user defined text attribute to the previous segment  
**<text\_attribute\_previous\_segment>**

<name>Name</name>

<value>Text</value>

[\[<op\\_code\\_properties>\]](#)

**</text\_attribute\_previous\_segment>**

79 Name Text

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 [25.4.2.4 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)  
**<pipe\_justification\_invert>**

[\[<point\\_description>\]](#)

[\[<op\\_code\\_properties>\]](#)

**</pipe\_justification\_invert>**

80 [Point\_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 [25.4.2.41 Pipe Justification \(opcodes 80, 81, 82\)](#)

- 81 pipe\_justification\_axial** **Pipe or culvert axial point (centre of the pipe or culvert)**  
**<pipe\_justification\_axial>**  
 [ <point\_description> ]  
 [ <op\_code\_properties> ]  
**</pipe\_justification\_axial>**

81 [Point\_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 [25.4.2.41 Pipe Justification \(opcodes 80, 81, 82\)](#)

- 82 pipe\_justification\_obvert** **Pipe or culvert obvert point (top of the pipe or culvert)**  
**<pipe\_justification\_obvert>**  
 [ <point\_description> ]  
 [ <op\_code\_properties> ]  
**</pipe\_justification\_obvert>**

82 [Point\_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 [25.4.2.41 Pipe Justification \(opcodes 80, 81, 82\)](#)

- 83 shape\_record** **Start recording a shape - before the measurement**  
**<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>
```

83 [*Shape\_name*] *Mirror\_x\_status* *Mirror\_y\_status* *Offset\_value* *Height\_value*

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 [25.3.11 Shape Field Coding](#)

The field data command panel in the SDR Editor is documented in [25.4.2.47 Shaping \(opcodes 83 to 86\)](#)

#### 84 **shape\_end**            **Finish using a shape definition or finish recording a shape - after the measurement**

```
<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>
```

84 [*Shape\_name*] *Mirror\_x\_status* *Mirror\_y\_status* *Offset\_value* *Height\_value*

Stops using the current shape or stops recording a shape.

See [25.3.11 Shape Field Coding](#)

The field data command panel in the SDR Editor is documented in [25.4.2.47 Shaping \(opcodes 83 to 86\)](#)

#### 85 **shape\_parallel**            **Parallel an existing shape**

```
<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>
```

85 [*Shape\_name*] *Mirror\_x\_status* *Mirror\_y\_status* *Offset\_value* *Height\_value*

Takes all the points on the defined shape of *Shape\_name* and parallels them the entire length of the string. Once paralleled, a number of strings are created.

If *Feature\_code* and *String\_number* exist, the last string with the same *feature code* and *string number* has the shape applied to the entire length of the string.

If *Point\_number* exists, then the string containing that point id has the shape applied to the entire length of the string.

See [25.3.11 Shape Field Coding](#)

The field data command panel in the SDR Editor is documented in [25.4.2.47 Shaping \(opcodes 83 to 86\)](#)

#### 86 **shape\_extrude**            **Extrude an existing shape**

```
<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>
```

86 [*Shape\_name*] *Mirror\_x\_status* *Mirror\_y\_status* *Offset\_value* *Height\_value*

Takes the defined shape of *Shape\_name* and extrudes it along the entire length of the string. Once extruded, only one string is created which contains all the shape information.

If *Feature\_code* and *String\_number* exist, the last string with the same *feature code* and *string number* has the shape applied to the entire length of the string.

If *Point\_number* exists, then the string containing that point id has the shape applied to the entire length of the string.

See [25.3.11 Shape Field Coding](#)

The field data command panel in the SDR Editor is documented in [25.4.2.47 Shaping \(opcodes 83 to 86\)](#)

87	<b>shape_parallel_start</b>	<b>not yet documented</b>
88	<b>shape_extrude_start</b>	<b>not yet documented</b>
89	<b>not yet used</b>	
90	<b>not yet used</b>	
91	<b>not yet used</b>	
92	<b>string_type_2d</b>	<b>Remove all z-values for a string (i.e. make all z-values null)</b>

```
<string_type_2d>
[<point_description>]
[<op_code_properties>]
</string_type_2d>
```

92 [*Point\_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 [25.4.2.56 String Type \(opcodes 92, 93, 94\)](#)

93	<b>string_type_3d</b>	<b>The string can have different z-values for each vertex</b>
----	-----------------------	---

```
<string_type_3d>
[<point_description>]
[<op_code_properties>]
</string_type_3d>
```

93 [*Point\_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 [25.4.2.56 String Type \(opcodes 92, 93, 94\)](#)

94 **string\_type\_4d**      **Use name library file/ Map File for vertex text on the string - name mapping**

```
<string_type_4d>
  <point_description>
  [<op_code_properties>]
</string_type_4d>
```

94 [*Point\_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 [25.4.2.56 String Type \(opcodes 92, 93, 94\)](#)

95 **pipe\_diameter**      **Diameter for a super string pipe**

```
<pipe_diameter>
  <diameter>pipe_diameter</diameter>
  [<point_description>]
  [<op_code_properties>]
</pipe_diameter>
```

95 [*Point\_description*]    *diameter*



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 [25.4.2.58 Pipe Diameter \(opcode 95\)](#)

## 96 culvert width and height for a culvert super string

```
<culvert>
  <width>culvert_width</width>
  <height>culvert_height</height>
  <point_description>
  [<op_code_properties>]
</culvert>
```

96 [*Point\_description*] width height

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 [25.4.2.57 Culvert \(opcode 96\)](#)

## 97 not yet used

## 98 not yet used

## 99 file\_end Terminate processing

```
<file_end>
  [<op_code_properties>]
</file_end>
99
```

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 [25.4.2.20 End File \(opcode 99\)](#)

## 100 units Units used in the 12d Field File

```
<units>
  <angle>angle_unit</angle>
```



```

<distance>metres</distance>
<pressure>millimetres</pressure>
<temperature>celsius</temperature>
  [<op\_code\_properties>]
</units>
100 angle_unit distance_unit pressure_unit temperature_unit

```

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 [25.4.2.62 Units \(opcode 100\)](#)

**101 auto\_order Order strings automatically**

```

<auto_order>
  [<point\_description>]
  [<op\_code\_properties>]
</auto_order>

```

```
101 [Point_description]
```

The field data command panel in the SDR Editor is documented in????

**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**

```

<invisible_previous_segment>
  [<point\_description>]
  [<op\_code\_properties>]
</invisible_previous_segment>

```

```
107 [Point_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 [25.4.2.27 Invisibility \(opcodes 107, 108, 109\)](#)

**108 invisible\_next\_segment Make next segment invisible - after measurement for first point of segment**

```

<invisible_next_segment>
  [<point\_description>]

```

[\[<op\\_code\\_properties>\]](#)

</invisible\_next\_segment>

108 [Point\_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\_number* 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 [25.4.2.27 Invisibility \(opcodes 107, 108, 109\)](#)

#### 109 invisible\_vertex **Make a point invisible - after the measurement**

<invisible\_vertex>

[\[<point\\_description>\]](#)

[\[<op\\_code\\_properties>\]](#)

</invisible\_vertex>

109 [Point\_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\_number* exists, then the point with that point id is set to invisible.

The field data command panel in the SDR Editor is documented in [25.4.2.27 Invisibility \(opcodes 107, 108, 109\)](#)

#### 110 building\_face **Start recording buildings face observations - before the measurements**

<building\_face>

[<name>Building\_name</name>]

[\[<op\\_code\\_properties>\]](#)

</building\_face>

110 [Building\_name]

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 [25.4.2.8 Buildings \(opcodes 110, 111\)](#)

#### 111 building\_face\_end **End recording building face observations**

<building\_face\_end>

[<name>Building\_name</name>]

[\[<op\\_code\\_properties>\]](#)

</building\_face\_end>

111 [Building\_name]

If no *Building\_name* exists, 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 [25.4.2.8 Buildings \(opcodes 110, 111\)](#)

**112 set\_collection Start set collection observations - before the measurements**

```
<set_collection>
  [op_code_properties]
</set_collection>
```

112

The field data command panel in the SDR Editor is documented in???

**113 set\_collection\_end End set collection observations**

```
<set_collection_end>
  [op_code_properties]
</set_collection_end>
```

113

The field data command panel in the SDR Editor is documented in???

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**

```
<code_file>
  <name>file_name</name>
  [op_code_properties]
</code_file>
```

119 file\_name

file\_name is the name of this *12d Field File*.

The field data command panel in the SDR Editor is documented in [25.4.2.12 Code File \(opcode 119\)](#)

**120 measure\_attribute\_string Attribute for string (measurement)**

```
<measure_attribute_string>
  <name>Attribute_name</name>
  <horizontal_angle>horizontal_angle_value</horizontal_angle>
  <vertical_angle><vertical_angle_value</vertical_angle>
  <slope_distance><slope_distance_value</slope_distance>
  <target_height><slope_distance_value</target_height>
  [op_code_properties]
</measure_attribute_string>
```

This opcode does not exist in the *fld* file.

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 [25.4.2.3 Measurement Attributes \(opcodes 120 to 123\)](#)

**121 measure\_attribute\_vertex            Attribute for vertex (measurement)**

```
<measure_attribute_vertex>
  <name>Attribute_name>
  <horizontal_angle>horizontal_angle_value</horizontal_angle>
  <vertical_angle><vertical_angle_value</vertical_angle>
  <slope_distance><slope_distance_value</slope_distance>
  <target_height><slope_distance_value</target_height>
  [op\_code\_properties]
</measure_attribute_vertex>
```

*This opcode does not exist in the fld file.*

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 [25.4.2.3 Measurement Attributes \(opcodes 120 to 123\)](#)

**122 measure\_attribute\_next\_segment            Attribute for next segment (measurement)**

```
<measure_attribute_next_segment>
  <name>Attribute_name>
  <horizontal_angle>horizontal_angle_value</horizontal_angle>
  <vertical_angle><vertical_angle_value</vertical_angle>
  <slope_distance><slope_distance_value</slope_distance>
  <target_height><slope_distance_value</target_height>
  [op\_code\_properties]
</measure_attribute_next_segment>
```

*This opcode does not exist in the fld file.*

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 [25.4.2.3 Measurement Attributes \(opcodes 120 to 123\)](#)

**123 measure\_attribute\_previous\_segment Attribute for previous segment (measurement)**

```

<measure_attribute_previous_segment>
  <name>Attribute_name</name>
  <horizontal_angle>horizontal_angle_value</horizontal_angle>
  <vertical_angle><vertical_angle_value</vertical_angle>
  <slope_distance><slope_distance_value</slope_distance>
  <target_height><slope_distance_value</target_height>
  [op\_code\_properties]
</measure_attribute_previous_segment>

```

*This opcode does not exist in the fld file.*

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 [25.4.2.3 Measurement Attributes \(opcodes 120 to 123\)](#)

**124 attribute\_set Start an attribute group**

```

<attribute_set>
  <name>Attribute_group_name</name>
  <level>Attribute_group_level</level>
  [op\_code\_properties]
</attribute_set>

```

*This opcode does not exist in the fld file.*

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 [25.4.2.5 Attribute Set \(opcodes 124 and 125\)](#)

**125 attribute\_set\_end End the current attribute group**

```

<attribute_set_end>
  [op\_code\_properties]
</attribute_set_end>

```

*This opcode does not exist in the fld file.*

End the current attribute group.

The field data command panel in the SDR Editor is documented in [25.4.2.5 Attribute Set \(opcodes 124 and 125\)](#)

**126 attachment Attach a file**

```

<attachment>
  <name>file_name</name>
  [op\_code\_properties]

```



</attachment>

126 *file\_name*

The file *file\_name* is attached to the current measurement point.

The field data command panel in the SDR Editor is documented in [25.4.2.2 Attachment \(opcode 126\)](#)

**127 measurement\_offset                      Distance correction**

<measurement\_offset>

<correction>*correction\_vaue*</correction>

[\[<op\\_code\\_properties>\]](#)

</measurement\_offset>

127 *correction\_vaue*

The field data command panel in the SDR Editor is documented in [25.4.2.17 Distance correction \(opcode 127\)](#)

**128 resection                                      Start a resection**

<resection>

<height>*height\_value*</height>

[<point\\_description>](#)

[\[<op\\_code\\_properties>\]](#)

</resection>

128 *height\_value*

The field data command panel in the SDR Editor is documented in [25.4.2.45 Resection Start \(opcode 128\)](#)

**129 resection\_end                                      End the resection**

<resection\_end>

[\[<op\\_code\\_properties>\]](#)

</resection\_end>

129

The field data command panel in the SDR Editor is documented in [25.4.2.46 Resection End \(opcode 129\)](#)

**130 field\_file                                      12d Model internal use only**

<field\_file>

<name>*file\_name*</name>

[\[<op\\_code\\_properties>\]](#)

</field\_file>

*This opcode does not exist in the fld file.*

*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**

<ppm\_correction>

<value>*PPM\_correction*</value>

[\[<op\\_code\\_properties>\]](#)

</ppm\_correction>

131 *PPM\_correction*

The field data command panel in the SDR Editor is documented in [25.4.2.26 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**

```
<helmert>
  <height>height_value</height>
  <point_description>
  [<op_code_properties>]
</helmert>
```

138 height\_value

The field data command panel in the SDR Editor is documented in [25.4.2.23 Helmert Start \(opcode 138\)](#)

139 **helmert\_end** **End the Helmert**

```
<helmert_end>
  [<op_code_properties>]
</helmert_end>
```

139 ?????

The field data command panel in the SDR Editor is documented in [25.4.2.24 Helmert End \(opcode 139\)](#)

140 **gps\_coordinate** **GNSS coordinate measurement**

```
<gps_coordinate>
  <XYZ>
  <point_description>
  [<op_code_properties>]
</gps_coordinate>
```

*This opcode does not exist in the fld file.*

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\_number* 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 [25.4.2.21 GNSS Coordinate \(opcode 140\)](#)

141 **non\_tinable\_string** **Make a string non-tinable**

```
<non_tinable_string>
  <point_description>
  [<op_code_properties>]
</non_tinable_string>
```

*This opcode does not exist in the fld file.*

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 [25.4.2.37 Non Tinability \(opcodes 38, 39, 40, 141\)](#).

142 **offset\_measurement\_next\_segment**      **not yet implemented**

143 **offset\_measurement\_previous\_segment**      **not yet implemented**

144 **remove\_string**      **Delete a string**

```
<remove_string>
  <point_description>
  [<op_code_properties>]
</remove_string>
```

*This opcode does not exist in the fld file.*

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 [25.4.2.44 Remove \(Delete\) String \(opcode 144\)](#)

145 **gps\_offset**      **GNSS Offset correction**

```
<gps_offset>
  <xoffset>Xoffset_vaue</xoffset>
  <yoffset>Yoffset_vaue</yoffset>
  <zoffset>Zoffset_vaue</zoffset>
  <point_description>
  [<op_code_properties>]
</gps_offset>
```

*This opcode does not exist in the fld file.*

The *Xoffset\_vaue*, *Yoffset\_vaue*, *Zoffset\_vaue* is **added** to GNSS (x, y,z) coordinate in the following 140 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 [25.4.2.22 GNSS Offset Correction \(opcode 145\)](#)

146 **midpoint\_2** Create midpoint of two points

```

<midpoint_2>
  <keep_points>keep_point_value</keep_points>
  <coding>
    <point_description>
  </coding>
  <point_description>
  [<op_code_properties>]
</midpoint_2>

```

*This opcode does not exist in the fld file.*

The field data command panel in the SDR Editor is documented in [25.4.2.33 Midpoint of Two Points \(opcode 146\)](#)

147 **midpoint\_3** Create centre of arc that goes through three points

```

<midpoint_3>
  <keep_points>keep_point_value</keep_points>
  <coding>
    <point_description>
  </coding>
  <point_description>
  [<op_code_properties>]
</midpoint_3>

```

*This opcode does not exist in the fld file.*

The field data command panel in the SDR Editor is documented in [25.4.2.34 Centre of Arc Through Three Points \(opcode 147\)](#)

**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 [26.8 12d Survey Opcode Summary](#)

## 26.8 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			
-3	group	Group	<a href="#">25.4.2.25 Group (opcode -3)</a>
-2	comment	Insert a comment	<a href="#">25.4.2.13 Comment (opcode -2)</a>
-1	error	Add text to information for an error	<a href="#">25.4.2.19 Error (opcode -1)</a>
1	job_data	Job Information	<a href="#">25.4.2.16 Job Data (opcode 1)</a>
2	coordinate	Directly entered coordinate measurement	<a href="#">25.4.2.14 Coordinate (opcode 2)</a>
3	station	New instrument setup on a point	<a href="#">25.4.2.36 New Instrument Setup - Station (opcode 3)</a>
4	backsight	Measurement to backsight	<a href="#">25.4.2.6 Backsight (opcode 4)</a>
5	target_height	New target height	<a href="#">25.4.2.59 Target Height (opcode 5)</a>
6	check_measurement	Check measurement	<a href="#">25.4.2.59 Target Height (opcode 5)</a>
7	edm_tachy_measurement	Measurement - HA, VA, SD	<a href="#">25.4.2.58 Pipe Diameter (opcode 95)</a>
8	not yet used		
9	scale_factor	Slope distance scale factor for subsequent distances	<a href="#">25.4.2.48 Slope Distance Scale Factor (opcode 9)</a>
10	stadia_measurement	Three hair stadia measurement	<a href="#">25.4.2.32 Stadia Measurement (opcode 10)</a>
11	edm_tachy_measurement_ht	Measurement - HA, HD, Height	<a href="#">25.4.2.30 EDM Measurement (HA,HD,HT) (opcode 11)</a>
12	edm_tachy_measurement_vd	Measurement - HA, HD, Height difference (VD)	<a href="#">25.4.2.31 EDM Measurement (HA,HD,Diff HT) (opcode 12)</a>
13	not yet used		
14	check_coordinate	Check Coordinates	<a href="#">25.4.2.9 Check Coordinate (opcode 14)</a>
15	vertical_circle	Vertical circle correction	<a href="#">25.4.2.63 Vertical Circle Correction (opcode 15)</a>
16	multiple_coding	Multiply coded point	<a href="#">25.4.2.35 Multiple Coding (opcode 16)</a>
17	arc_fitting_last_3_points	Arc through previous three points	<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
18	feature	Circle Feature	<a href="#">25.4.2.11 Circle Feature (opcode 18)</a>
19	reverse_string	Reverse string	

<u>20</u>	<u>close_string</u>	<u>Close string</u>	<u>25.4.2.53 String Reverse (opcode 19)</u>
<u>21</u>	<u>join_strings_last_to_last</u>	<u>Join last points of strings</u>	<u>25.4.2.28 Strings Join (opcodes 21 to 24)</u>
<u>22</u>	<u>join_strings_first_to_last</u>	<u>Join first to last point of strings</u>	<u>25.4.2.28 Strings Join (opcodes 21 to 24)</u>
<u>23</u>	<u>join_strings_first_to_first</u>	<u>Join first points of strings</u>	<u>25.4.2.28 Strings Join (opcodes 21 to 24)</u>
<u>24</u>	<u>join_strings_last_to_first</u>	<u>Join last to first point of strings</u>	<u>25.4.2.28 Strings Join (opcodes 21 to 24)</u>
<u>25</u>	<u>not yet used</u>		
<u>26</u>	<u>not yet used</u>		
<u>25</u>	<u>not yet used</u>		
<u>28</u>	<u>height_or_depth</u>	<u>Add text to the string name - for delta height</u>	<u>25.4.2.15 Height Or Depth Comment (opcode 28)</u>
<u>29</u>	<u>memo</u>	<u>Note or memo</u>	<u>25.4.2.38 Note (opcode 29)</u>
<u>30</u>	<u>remove_height</u>	<u>Remove height from a point - that is make it a null height</u>	<u>25.4.2.42 Remove Height (opcode 30)</u>
<u>31</u>	<u>remove_point</u>	<u>Delete point</u>	<u>25.4.2.43 Remove (Delete) Point (opcode 31)</u>
<u>32</u>	<u>not yet used</u>		
<u>33</u>	<u>not yet used</u>		
<u>34</u>	<u>not yet used</u>		
<u>35</u>	<u>not yet used</u>		
<u>36</u>	<u>not yet used</u>		
<u>37</u>	<u>rectangle_2</u>	<u>Rectangle by two points</u>	<u>25.4.2.52 String Rectangle by 2 Points (opcode 37)</u>
<u>38</u>	<u>non_tinable_next_segment</u>	<u>Make the next segment non-tinable</u>	<u>25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</u>
<u>39</u>	<u>non_tinable_previous_segment</u>	<u>Make the previous segment non-tinable</u>	<u>25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</u>
<u>40</u>	<u>non_tinable_vertex</u>	<u>Make a point non-tinable</u>	<u>25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</u>
<u>41</u>	<u>additional_text</u>	<u>Add additional text to the current measurement point</u>	<u>25.4.2.61 Additional Text For Point (opcode 41)</u>
<u>42</u>	<u>offset_measurement_radial</u>	<u>Add a radial offset</u>	<u>25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</u>
<u>43</u>	<u>offset_measurement_tangential</u>	<u>Add a tangential offset</u>	<u>25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</u>
<u>44</u>	<u>offset_measurement_height</u>	<u>Add a height offset</u>	<u>25.4.2.39 Offset Measurement (opcodes 42, 43, 44)</u>
<u>45</u>	<u>rectangle</u>	<u>Make a parallelogram from the last three measurement points</u>	<u>25.4.2.51 String (Squashed) Rectangle (opcode 45)</u>
<u>46</u>	<u>breakline</u>	<u>Make the string a breakline or not</u>	<u>25.4.2.55 String Tinable - Breakline String (opcode 46)</u>
<u>47</u>	<u>new_string</u>	<u>Start a new string</u>	<u>25.4.2.54 String Start (opcode 47)</u>
<u>48</u>	<u>end_string</u>	<u>End a string</u>	<u>25.4.2.50 String End (opcode 48)</u>
<u>49</u>	<u>distances</u>	<u>Distances</u>	<u>25.4.2.18 Distances (opcode 49)</u>
<u>50</u>	<u>backsight_reference</u>	<u>Specify bearing to correct for true north - used as bearing datum difference</u>	<u>25.4.2.7 Backsight Reference (opcode 50)</u>
<u>51</u>	<u>template_start</u>	<u>Start using an existing field template</u>	<u>25.4.2.60 Templating (opcodes 51 to 59)</u>
<u>52</u>	<u>template_end</u>	<u>Finish using a field template or finish recording a field template</u>	



		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>53</u>	<u>template_pause</u>	<u>Pause the current field template until opcode 54 or finish template 52</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>54</u>	<u>template_continue</u>	<u>Continue the current field template</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>55</u>	<u>template_record</u>	<u>Start recording a field template</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>56</u>	<u>template_skip</u>	<u>Skip picking up one or more points from a field template</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>57</u>	<u>template_delete</u>	<u>Delete points from a field template - after the measurement of last point</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>58</u>	<u>template_insert</u>	<u>Insert points when using a field template - after the measurement of last point</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>59</u>	<u>template_change</u>	<u>Change points in a field template</u>
		<a href="#">25.4.2.60 Templating (opcodes 51 to 59)</a>
<u>60</u>	<u>arc_fitting_next_3_points</u>	<u>Arc through next three points</u>
		<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
<u>61</u>	<u>arc_fitting_start</u>	<u>Start of arc through sets of three points until end of string, or a 62 occurs</u>
		<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
<u>62</u>	<u>arc_fitting_end</u>	<u>End the arcs begun by a 61 command</u>
		<a href="#">25.4.2.1 Arc Fitting (opcodes 17, 60, 61, 62)</a>
<u>63</u>	<u>not yet used</u>	
<u>64</u>	<u>not yet used</u>	
<u>65</u>	<u>not yet used</u>	
<u>66</u>	<u>not yet used</u>	
<u>67</u>	<u>not yet used</u>	
<u>68</u>	<u>integer_attribute_string</u>	<u>Add a user defined integer attribute to the current string</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>69</u>	<u>real_attribute_string</u>	<u>Add a user defined real attribute to the current string</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>70</u>	<u>text_attribute_string</u>	<u>Add a user defined text attribute to the current string</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>71</u>	<u>integer_attribute_vertex</u>	<u>Add a user defined integer attribute to the current point</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>72</u>	<u>real_attribute_vertex</u>	<u>Add a user defined real attribute to the current point</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>73</u>	<u>text_attribute_vertex</u>	<u>Add a user defined text attribute to the current point</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>74</u>	<u>integer_attribute_next_segment</u>	<u>Add a user defined integer attribute to the next segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>75</u>	<u>real_attribute_next_segment</u>	<u>Add a user defined real attribute to the next segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>76</u>	<u>text_attribute_next_segment</u>	<u>Add a user defined text attribute to the next segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>77</u>	<u>integer_attribute_previous_segment</u>	<u>Add a user defined integer attribute to the previous segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>78</u>	<u>real_attribute_previous_segment</u>	<u>Add a user defined real attribute for the previous segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>79</u>	<u>text_attribute_previous_segment</u>	<u>Add a user defined text attribute to the previous segment</u>
		<a href="#">25.4.2.4 Attributes (opcodes 68 to 79)</a>
<u>80</u>	<u>pipe_justification_invert</u>	<u>Pipe or culvert invert point (bottom of the pipe or culvert)</u>
		<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
<u>81</u>	<u>pipe_justification_axial</u>	<u>Pipe or culvert axial point (centre of the pipe or culvert)</u>
		<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
<u>82</u>	<u>pipe_justification_obvert</u>	<u>Pipe or culvert obvert point (top of the pipe or culvert)</u>
		<a href="#">25.4.2.41 Pipe Justification (opcodes 80, 81, 82)</a>
<u>83</u>	<u>shape_record</u>	<u>Start recording a shape - before the measurement</u>
		<a href="#">25.4.2.47 Shaping (opcodes 83 to 86)</a>



<u>84</u>	<u>shape_end</u>	<u>Finish using a shape definition or finish recording a shape - after the measurement</u>	<u>25.4.2.47 Shaping (opcodes 83 to 86)</u>
<u>85</u>	<u>shape_parallel</u>	<u>Parallel an existing shape</u>	<u>25.4.2.47 Shaping (opcodes 83 to 86)</u>
<u>86</u>	<u>shape_extrude</u>	<u>Extrude an existing shape</u>	<u>25.4.2.47 Shaping (opcodes 83 to 86)</u>
<u>87</u>	<u>shape_parallel_start</u>	<u>not yet documented</u>	
<u>88</u>	<u>shape_extrude_start</u>	<u>not yet documented</u>	
<u>89</u>	<u>not yet used</u>		
<u>90</u>	<u>not yet used</u>		
<u>91</u>	<u>not yet used</u>		
<u>92</u>	<u>string_type_2d</u>	<u>Remove all z-values for a string (i.e. make all z-values null)</u>	<u>25.4.2.56 String Type (opcodes 92, 93, 94)</u>
<u>93</u>	<u>string_type_3d</u>	<u>The string can have different z-values for each vertex</u>	<u>25.4.2.56 String Type (opcodes 92, 93, 94)</u>
<u>94</u>	<u>string_type_4d</u>	<u>Use name library file/ Map File for vertex text on the string - name mapping</u>	<u>25.4.2.56 String Type (opcodes 92, 93, 94)</u>
<u>95</u>	<u>pipe_diameter</u>	<u>Diameter for a super string pipe</u>	<u>25.4.2.58 Pipe Diameter (opcode 95)</u>
<u>96</u>	<u>culvert</u>	<u>width and height for a culvert super string</u>	<u>25.4.2.57 Culvert (opcode 96)</u>
<u>97</u>	<u>not yet used</u>		
<u>98</u>	<u>not yet used</u>		
<u>99</u>	<u>file_end</u>	<u>Terminate processing</u>	<u>25.4.2.20 End File (opcode 99)</u>
<u>100</u>	<u>units</u>	<u>Units used in the 12d Field File</u>	<u>25.4.2.62 Units (opcode 100)</u>
<u>101</u>	<u>auto_order</u>	<u>Order strings automatically</u>	<u>25.4.2.40 Order String Automatically (opcode 101)</u>
<u>102</u>	<u>not yet used</u>		
<u>103</u>	<u>not yet used</u>		
<u>104</u>	<u>not yet used</u>		
<u>105</u>	<u>not yet used</u>		
<u>106</u>	<u>not yet used</u>		
<u>107</u>	<u>invisible_previous_segmet</u>	<u>Make the previous segment invisible - after the measurement</u>	<u>25.4.2.27 Invisibility (opcodes 107, 108, 109)</u>
<u>108</u>	<u>invisible_next_segment</u>	<u>Make next segment invisible - after measurement for first point of segment</u>	<u>25.4.2.27 Invisibility (opcodes 107, 108, 109)</u>
<u>109</u>	<u>invisible_vertex</u>	<u>Make a point invisible - after the measurement</u>	<u>25.4.2.27 Invisibility (opcodes 107, 108, 109)</u>
<u>110</u>	<u>building_face</u>	<u>Start recording buildings face observations - before the measurements</u>	<u>25.4.2.8 Buildings (opcodes 110, 111)</u>
<u>111</u>	<u>building_face_end</u>	<u>End recording building face observations</u>	<u>25.4.2.8 Buildings (opcodes 110, 111)</u>
<u>112</u>	<u>set_collection</u>	<u>Start set collection observations - before the measurements</u>	
<u>113</u>	<u>set_collection_end</u>	<u>End set collection observations</u>	
<u>114</u>	<u>not yet used</u>		
<u>115</u>	<u>not yet used</u>		
<u>116</u>	<u>not yet used</u>		
<u>117</u>	<u>not yet used</u>		
<u>118</u>	<u>not yet used</u>		
<u>119</u>	<u>code_file</u>	<u>Name of this 12d Field File</u>	<u>25.4.2.12 Code File (opcode 119)</u>
<u>120</u>	<u>measure_attribute_string</u>	<u>Attribute for string (measurement)</u>	<u>25.4.2.3 Measurement Attributes (opcodes 120 to 123)</u>
<u>121</u>	<u>measure_attribute_vertex</u>	<u>Attribute for vertex (measurement)</u>	

		<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
<a href="#">122</a>	<a href="#">measure_attribute_next_segment</a>	Attribute for next segment (measurement)
		<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
<a href="#">123</a>	<a href="#">measure_attribute_previous_segment</a>	Attribute for previous segment (measurement)
		<a href="#">25.4.2.3 Measurement Attributes (opcodes 120 to 123)</a>
<a href="#">124</a>	<a href="#">attribute_set</a>	Start an attribute group
		<a href="#">25.4.2.5 Attribute Set (opcodes 124 and 125)</a>
<a href="#">125</a>	<a href="#">attribute_set_end</a>	End the current attribute group
		<a href="#">25.4.2.5 Attribute Set (opcodes 124 and 125)</a>
<a href="#">126</a>	<a href="#">attachment</a>	Attach a file
		<a href="#">25.4.2.2 Attachment (opcode 126)</a>
<a href="#">127</a>	<a href="#">measurement_offset</a>	Distance correction
		<a href="#">25.4.2.17 Distance correction (opcode 127)</a>
<a href="#">128</a>	<a href="#">resection</a>	Start a resection
		<a href="#">25.4.2.45 Resection Start (opcode 128)</a>
<a href="#">129</a>	<a href="#">resection_end</a>	End the resection
		<a href="#">25.4.2.46 Resection End (opcode 129)</a>
<a href="#">130</a>	<a href="#">field_file</a>	12d Model internal use only
<a href="#">131</a>	<a href="#">ppm_correction</a>	PPM correction
		<a href="#">25.4.2.26 PPM Correction (opcode 131)</a>
<a href="#">132</a>	<a href="#">not yet used</a>	
<a href="#">133</a>	<a href="#">not yet used</a>	
<a href="#">134</a>	<a href="#">not yet used</a>	
<a href="#">135</a>	<a href="#">not yet used</a>	
<a href="#">136</a>	<a href="#">not yet used</a>	
<a href="#">137</a>	<a href="#">not yet used</a>	
<a href="#">138</a>	<a href="#">helmert</a>	Helmert start
<a href="#">139</a>	<a href="#">helmert_end</a>	End the Helmert
<a href="#">140</a>	<a href="#">gps_coordinate</a>	GNSS coordinate measurement
		<a href="#">25.4.2.21 GNSS Coordinate (opcode 140)</a>
<a href="#">141</a>	<a href="#">non_tinable_string</a>	Make a string non-tinable
		<a href="#">25.4.2.37 Non Tinability (opcodes 38, 39, 40, 141)</a>
<a href="#">142</a>	<a href="#">offset_measurement_next_segment</a>	not yet implemented
<a href="#">143</a>	<a href="#">offset_measurement_previous_segment</a>	not yet implemented
<a href="#">144</a>	<a href="#">remove_string</a>	Delete a string
		<a href="#">25.4.2.44 Remove (Delete) String (opcode 144)</a>
<a href="#">145</a>	<a href="#">gps_offset</a>	GNSS Offset correction
		<a href="#">25.4.2.22 GNSS Offset Correction (opcode 145)</a>
<a href="#">146</a>	<a href="#">midpoint_2</a>	Create midpoint of two points
		<a href="#">25.4.2.33 Midpoint of Two Points (opcode 146)</a>
<a href="#">147</a>	<a href="#">midpoint_3</a>	Create centre of arc that goes through three points
		<a href="#">25.4.2.34 Centre of Arc Through Three Points (opcode 147)</a>

For the full description of the **12d Field File Opcodes**, see [26.7 Full Description of 12d Survey Opcodes](#)

### 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 [44.2 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 [44.2.4 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.

# 27 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

[27.1 Shape Of The Earth](#)

[27.2 Horizontal and Vertical Datums](#)

[27.3 Coordinate Systems for the Earth](#)

[27.4 Norths, Azimuths and Bearings](#)

[27.5 Distances](#)

[27.6 Calculating Distances and Scale Factors](#)

[27.7 Defining a Projection in 12d Model](#)

[27.8 Coordinate Conversions and Transformations](#)

## 27.1 Shape Of The Earth

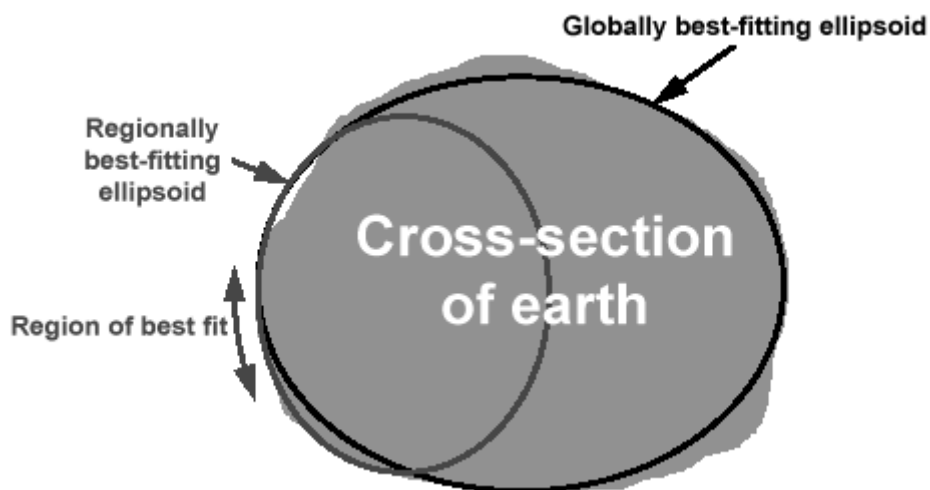
The determination of the Earth's shape is a science known as **Geodesy**.

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 [27.1.1 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 [27.2.2 Geoid](#).

However due to the undulations of the earths density and surface, an exact mathematical model of the geoid is not currently available.

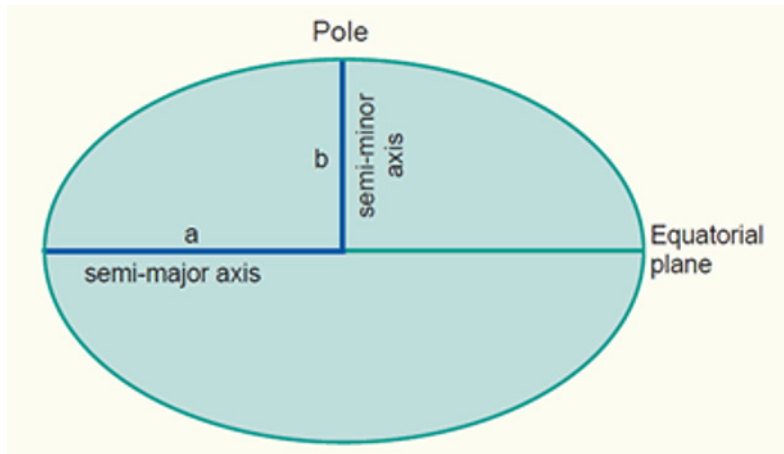
So to understand how the shape of the Earth is mathematically modelled, one must know how an ellipsoid is defined for the Earth, and then the relationship between the defined ellipsoid and the geoid.

Continue to [27.1.1 Ellipsoid](#) or return to [27 Geodetics Summary](#).

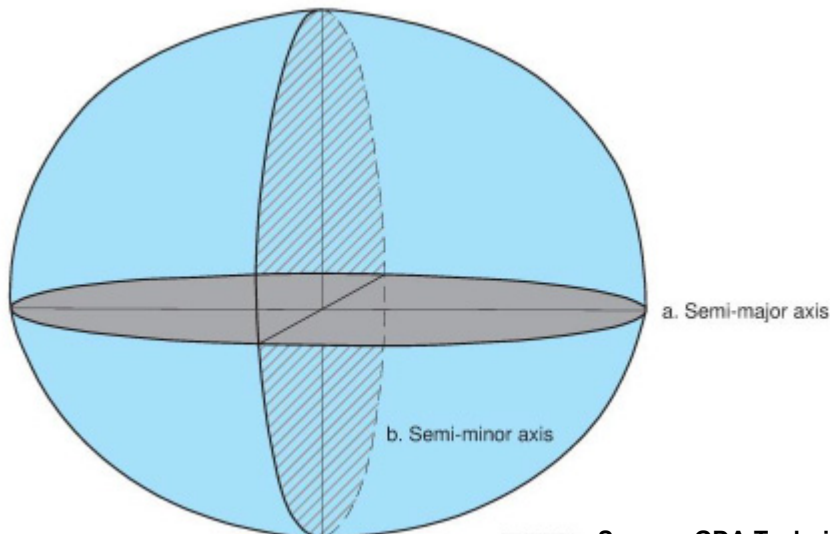
## 27.1.1 Ellipsoid

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 is obtained by rotating the 2D ellipse about its **semi-minor axis (polar axis)** through 360 degrees.



14-8134-4 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

$$\text{flattening} = f = (a - b) / a$$

or

the reciprocal of the flattening  $1/f$ .

So given the **semi-major axis (a)** and the **flattening (f)** or the **inverse flattening (reciprocal flattening  $rf = 1/f$ )**, the semi-minor axis (b) is given by:

$$b = a (1-f) = b(rf - 1)/rf \text{ where } rf = 1/f$$



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 [27.1.1.1 Mass Centred Ellipsoid](#).

Continue to [27.1.1.1 Mass Centred Ellipsoid](#) or return to [27 Geodetics Summary](#).

### 27.1.1.1 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 [27.2.1 Geodetic or Horizontal Datum](#).

Continue to [27.2 Horizontal and Vertical Datums](#) or return to [27.1 Shape Of The Earth](#) or [27 Geodetics Summary](#).

## 27.2 Horizontal and Vertical Datums

See

[27.2.1 Geodetic or Horizontal Datum](#)

[27.2.2 Geoid](#)

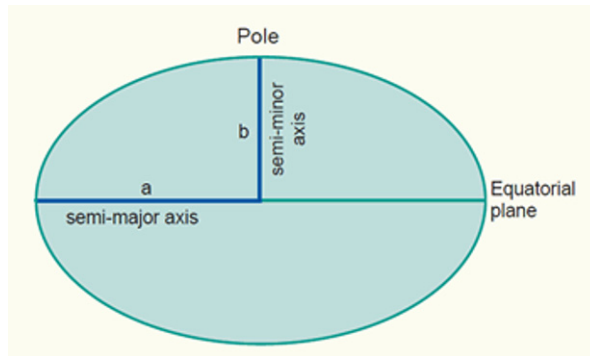
[27.2.3 Geoids and N Values](#)

[27.2.4 Vertical Datum](#)

## 27.2.1 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 [27.1.1 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 in 1994, and GDA2020 is where Australia is in 2020. See [27.8.2.3.2 Transforming Between MGA94 and MGA2020](#).

Continue to [27.2.2 Geoid](#) or return to [27.1 Shape Of The Earth](#) or [27 Geodetics Summary](#).



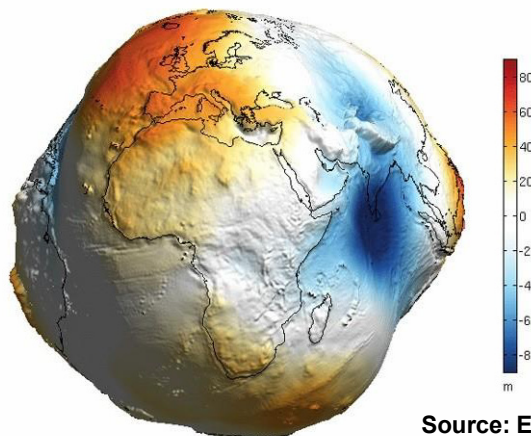
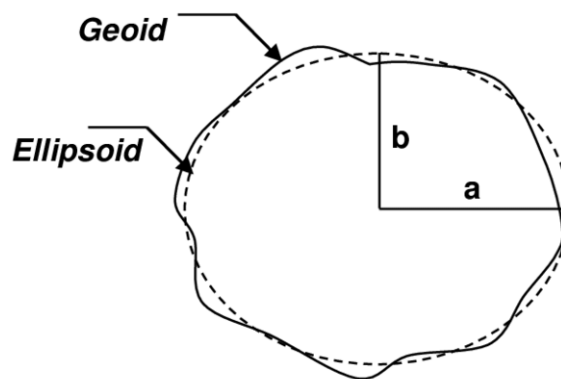
## 27.2.2 Geoid

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**.



Source: European Space Agency

### The Earth Potato - exaggerated difference between Geoid and the Ellipsoid

For more information on the Geoid, see [27.2.3 Geoids and N Values](#).



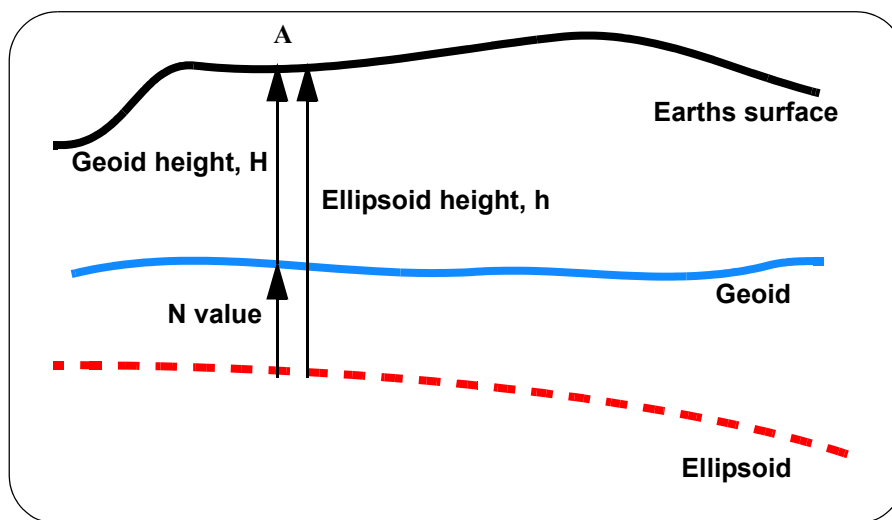
## 27.2.3 Geoids and N Values

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:

$$\mathbf{N \text{ value} = \text{Ellipsoid Height} - \text{Geoid height}}$$

$$\mathbf{N = h - H}$$

or

$$\mathbf{\text{Ellipsoid height} = \text{Geoid height} + \text{N value}}$$

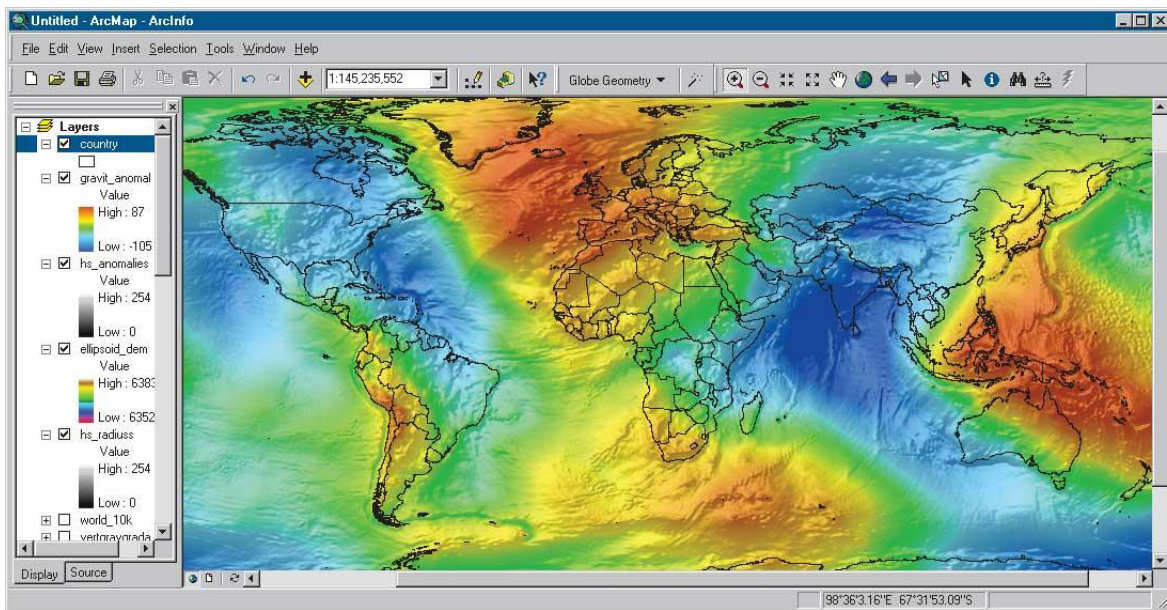
$$\mathbf{h = H + N}$$

or

$$\mathbf{\text{Geoid height} = \text{Orthometric height} = \text{Ellipsoid height} - \text{N value}}$$

$$\mathbf{H = h - N}$$

**N values** can be positive or negative.



### Distance between the Geoid and the Ellipsoid GRS80

Even though there is a 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 **Ausgeoid98** 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 [27.2.4 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 [27.2.4.1 Height Datum and Geoid Models](#).

(f) a Geotiff file representing a grid of N values

A grid of N values at regular coordinate points is 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 [27.2.4 Vertical Datum](#) or return to [27.2 Horizontal and Vertical Datums](#) or [27 Geodetics Summary](#).

## 27.2.4 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**.

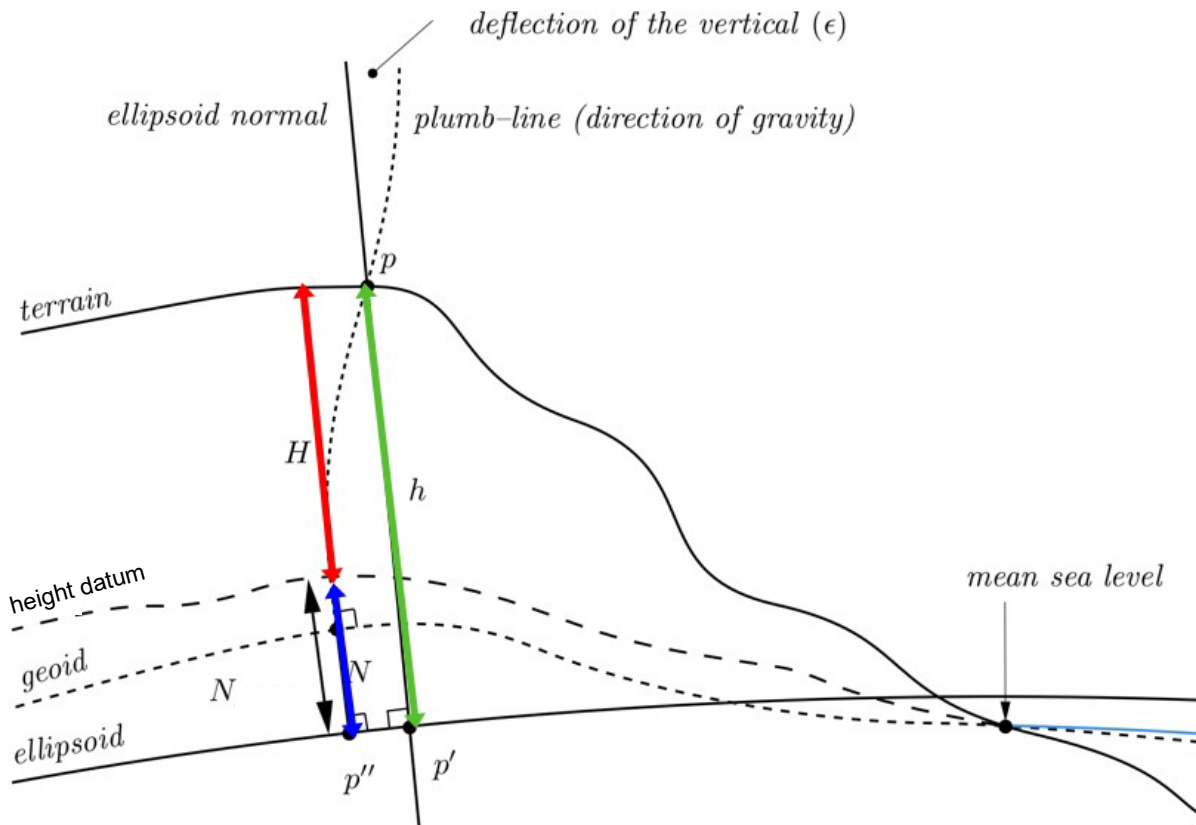
However the universal Geoid is not normally accurate enough to use everywhere. Consequently local models of the geoid are often still in use today.

For examples of the height datums currently in use in Australia, continue to [27.2.4.1 Height Datum and Geoid Models](#).

### 27.2.4.1 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

[27.2.4.1.1 Australian Height Datum \(AHD\)](#)

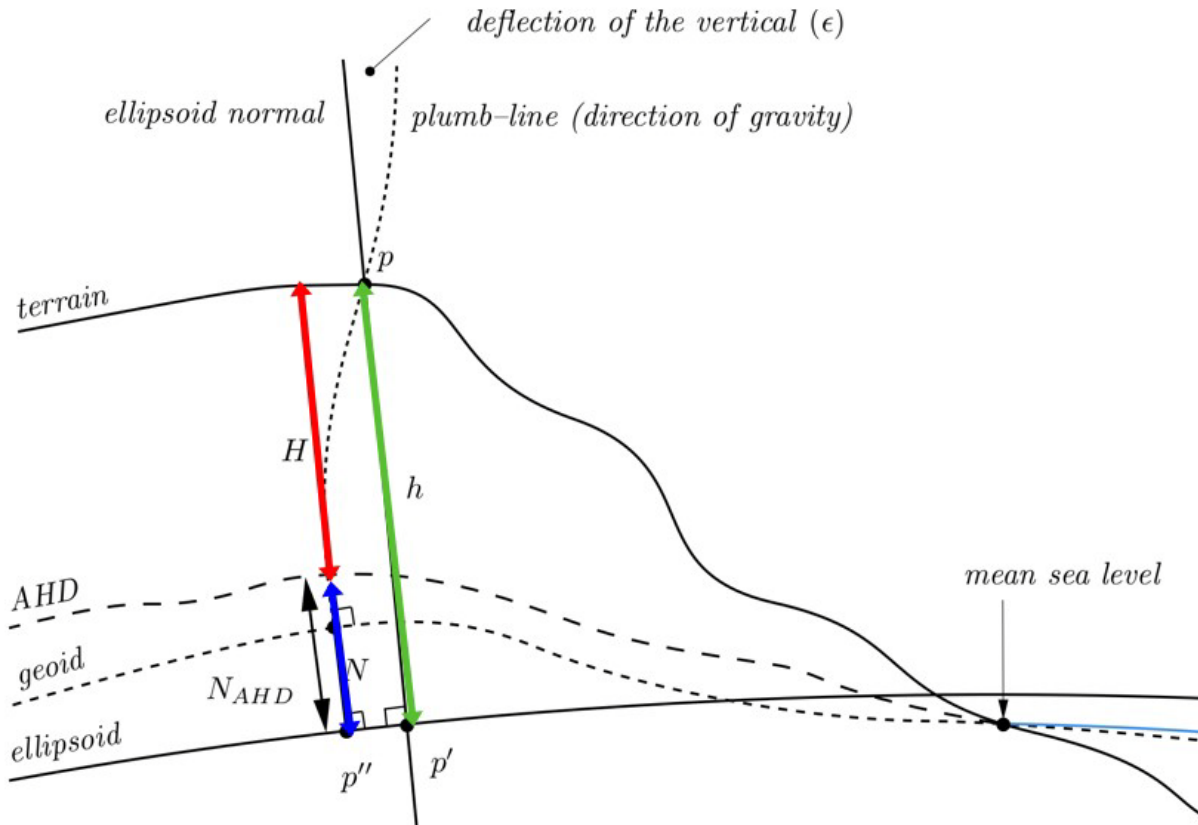
[27.2.4.1.2 AUSGeoid09](#)

[27.2.4.1.3 AUSGeoid2020](#)



### 27.2.4.1.1 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 al., 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 [27.2.4.1.2 AUSGeoid09](#) or return to [27.2.4.1 Height Datum and Geoid Models](#) or [27.2 Horizontal and Vertical Datums](#) or [27 Geodetics Summary](#).



### 27.2.4.1.2 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.

**AUSGeoid09** is available as a NTV2 (.gsb) file from <https://www.ga.gov.au/scientific-topics/positioning-navigation/australian-geospatial-reference-system/agrstooldmodels>.

#### Important Note

Only GDA94 coordinates can be used with AUSGeoid09.

Continue to [27.2.4.1.3 AUSGeoid2020](#) or return to [27.2.4.1 Height Datum and Geoid Models](#) or [27.2 Horizontal and Vertical Datums](#) or [27 Geodetics Summary](#).

### 27.2.4.1.3 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/agrstooldmodels>.

#### 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 [27.3 Coordinate Systems for the Earth](#) or return to [27.1 Shape Of The Earth](#) or [27 Geodetics Summary](#).

## 27.3 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  $\mathbf{p}$ , 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

[27.3.1 Geodetic Coordinates](#)

[27.3.3 Global XYZ Coordinates](#)

[27.3.4 Map \(Cartographic\) Projections and Map Coordinates](#)

[27.3.5 Map Coordinates are Independent of Ellipsoid Height](#)

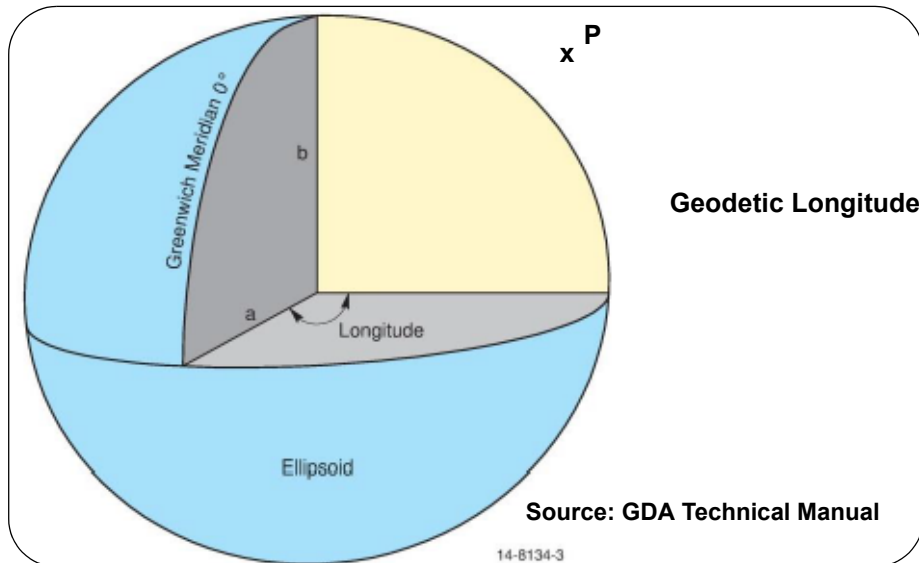
Continue to [27.3.1 Geodetic Coordinates](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).

## 27.3.1 Geodetic Coordinates

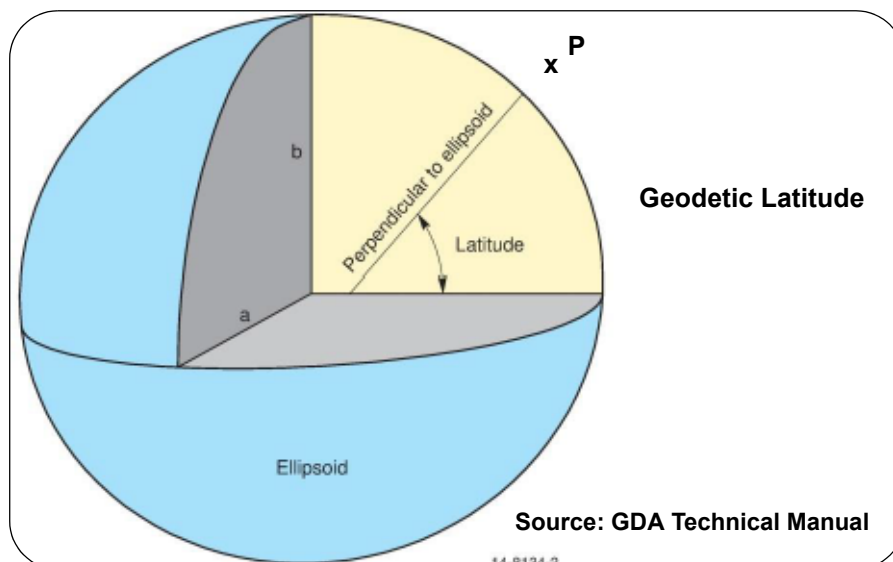
Once an ellipsoid is defined, a position **P** on the earth's surface can be described in terms of **Longitude**, **Geodetic Latitude** and **Ellipsoid height**. These are called **Geodetic Coordinates** of the point P.

To define the longitude and latitude of P, a plane is taken through the polar axis and containing P.

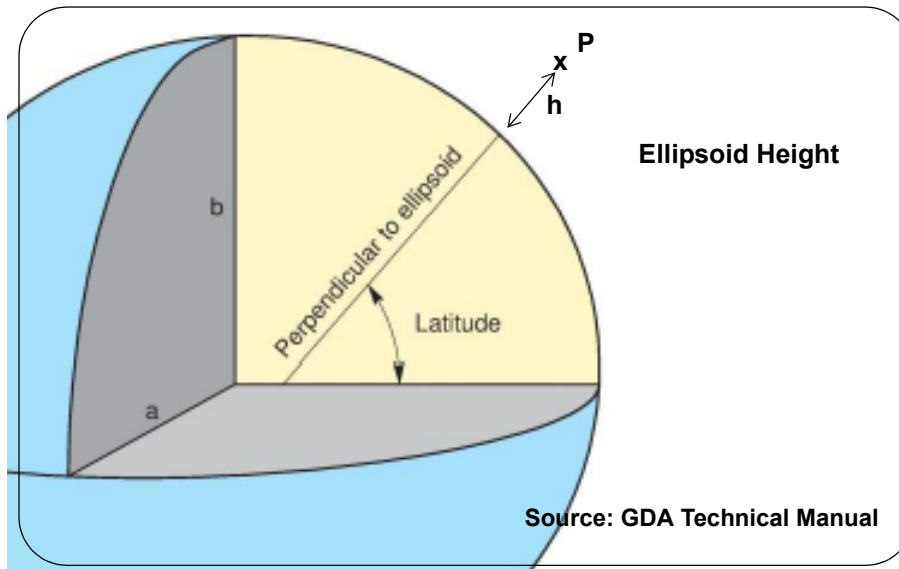
**Longitude** is an angular quantity measured **from the Greenwich meridian** to this plane. It is most commonly described in terms of degrees, minutes and seconds East or West of the Greenwich meridian.



**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 [27.3.2 Deflection of the Vertical - Three Latitudes](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).

## 27.3.2 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**.

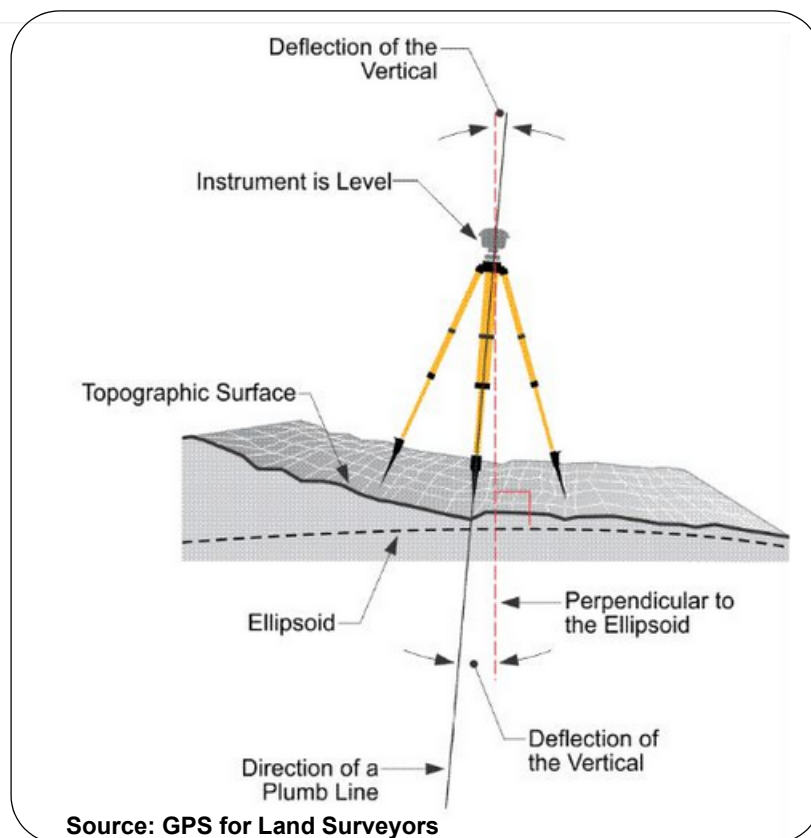
When astronomic observations are used to calculate the longitude and latitude of a point, "down" is perpendicular to the geoid and NOT perpendicular the ellipsoid and so the value obtained for latitude by astronomic observations is not the same as the geodetic latitude. The latitude derived from astronomic 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**



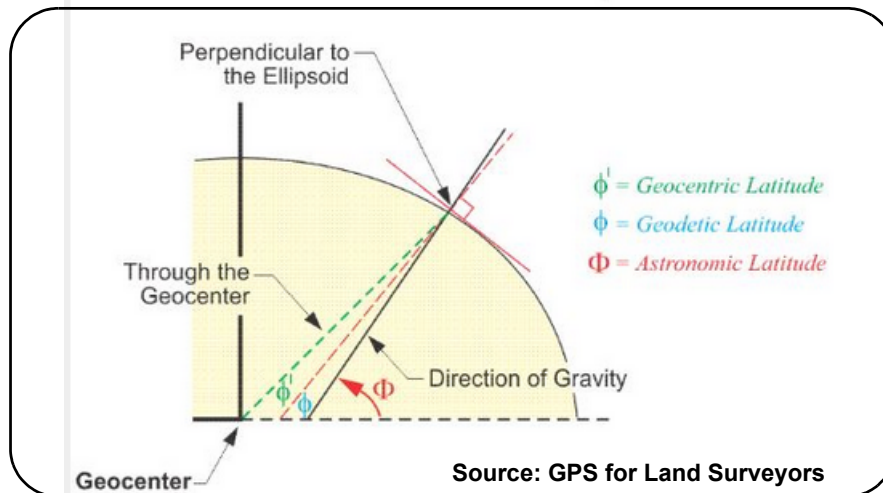
Because they are related to a particular ellipsoid, deflection of the vertical, like geoid-ellipsoid separation, will be different for different datums.

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**.



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 [27.3.3 Global XYZ Coordinates](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).



### 27.3.3 Global XYZ Coordinates

For an ellipsoid, the **Global XYZ** coordinate system is a cartesian coordinate system defined by:

- the origin is at the centre of the ellipsoid
- the Z-axis is the direction of the rotational axis of the ellipsoid of revolution.
- the X-Y plane is the equatorial plane of the ellipsoid and the origin of latitude
- 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  $(x_p, y_p, z_p)$ .

The point P has **Global XYZ coordinates**  $(x_p, y_p, z_p)$  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).

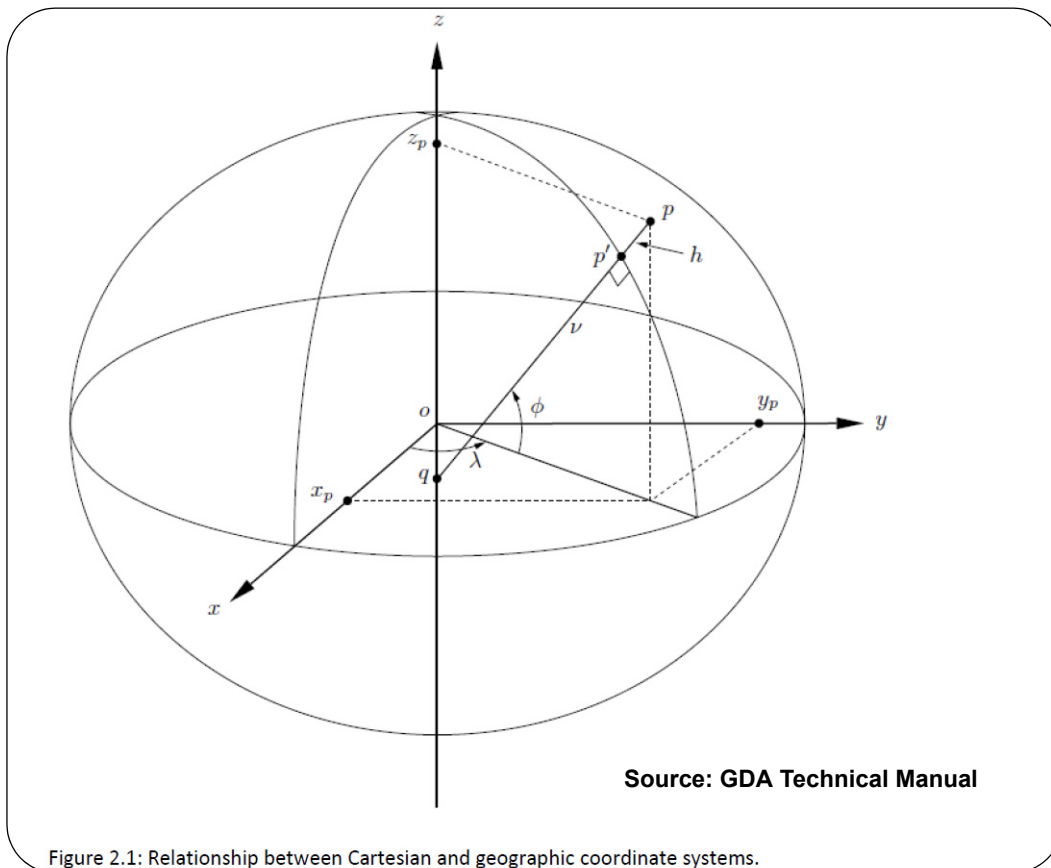


Figure 2.1: Relationship between Cartesian and geographic coordinate systems.

**Global XYZ coordinates** are also **often called** Cartesian coordinates or **Global Cartesian coordinates**.

#### Important Note

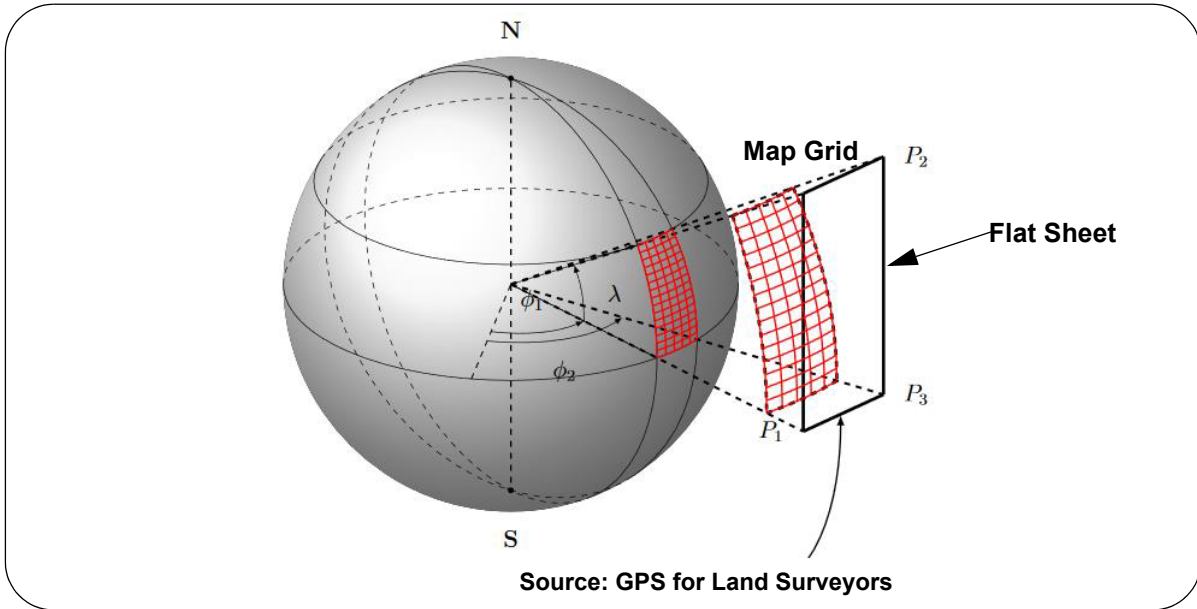
The calculations are more difficult than for the spheroid case because unlike the spheroid case, the tangent to a point on the ellipsoid does NOT go through the centre of the ellipse.

Continue to [27.3.4 Map \(Cartographic\) Projections and Map Coordinates](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).

### 27.3.4 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 earth's surface to be mathematically projected onto an imaginary developable **surface**.

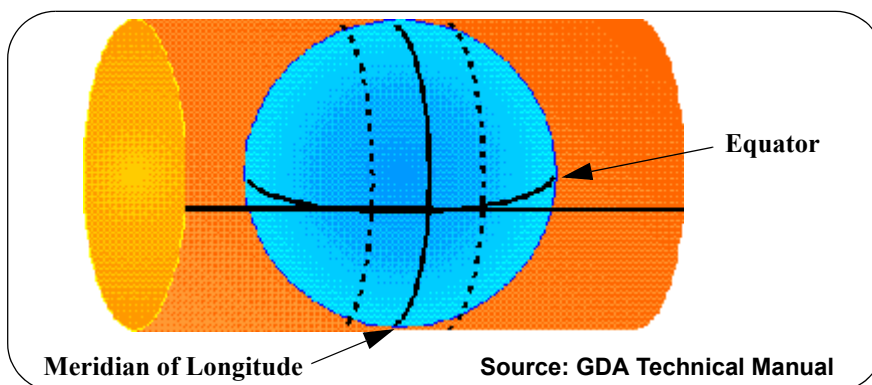
This surface can then be developed or "rolled flat" to draw the images on a flat sheet.



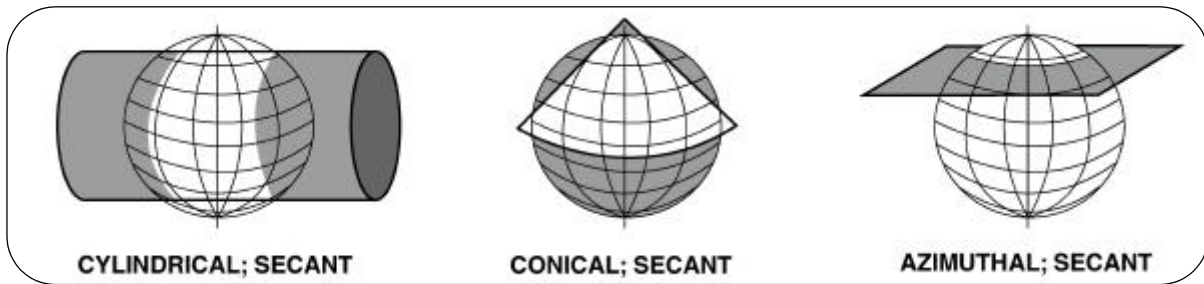
The the surface that the ellipsoid is projected onto is often a cylinder, a cone or a flat plane.



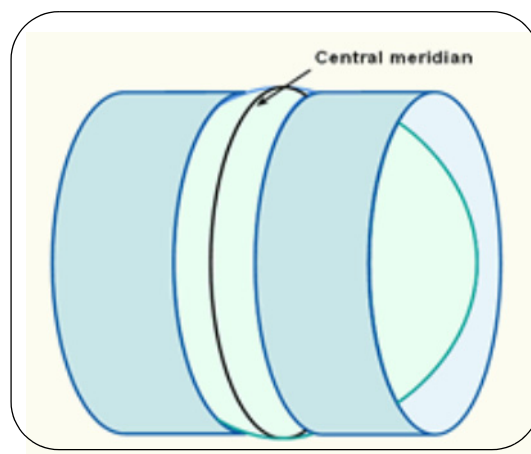
The **Transverse Mercator** system (TM) projects coordinates onto a cylinder that is tangent to the equator and the entire length of a meridian of Longitude.



In practice, the more used versions are the secant versions. That is, the cylinder, cone etc is slightly inside the ellipsoid:

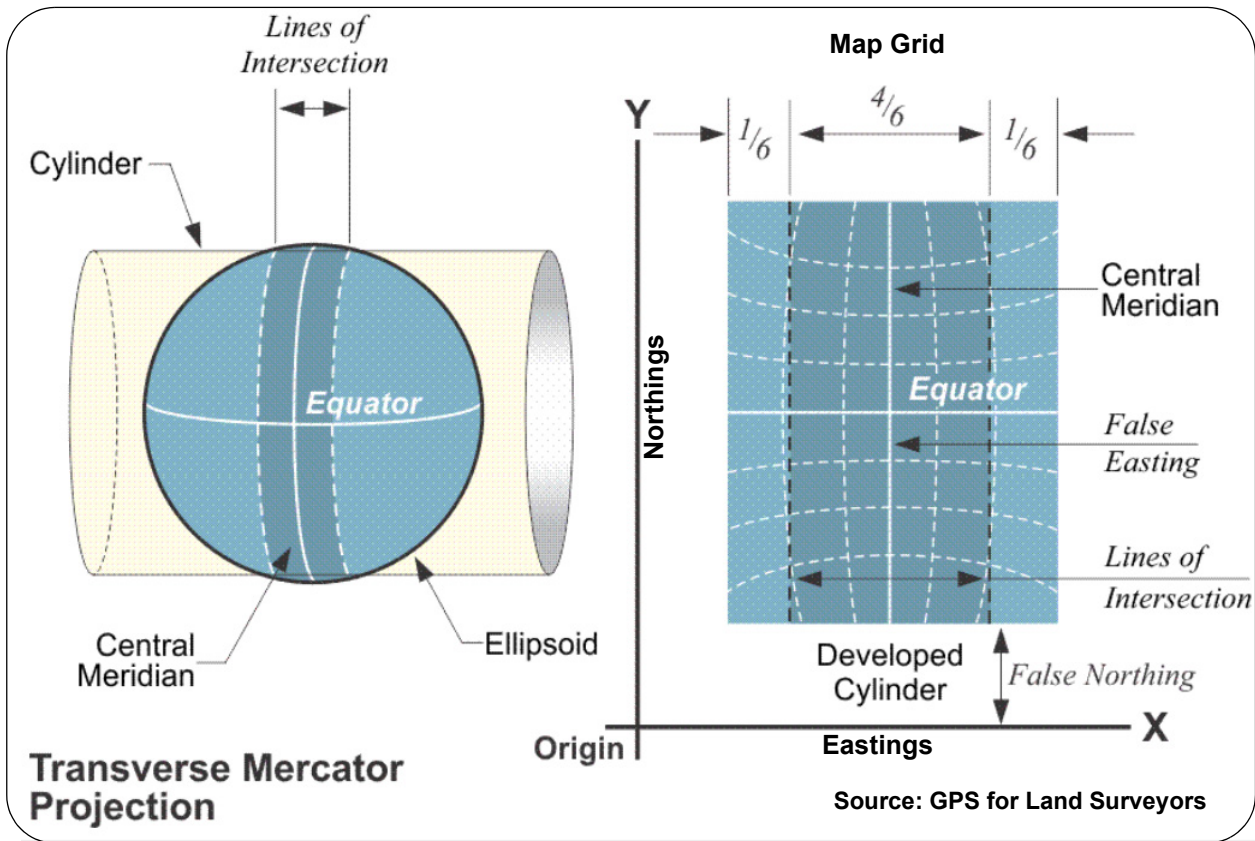


The Transverse Mercator projection used in **Universal Transverse Mercator (UTM)** is a **Secant Transverse Mercator**.



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 [27.3.4.1 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 [27.3.4.1 Map Zones](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).



### 27.3.4.1 Map Zones

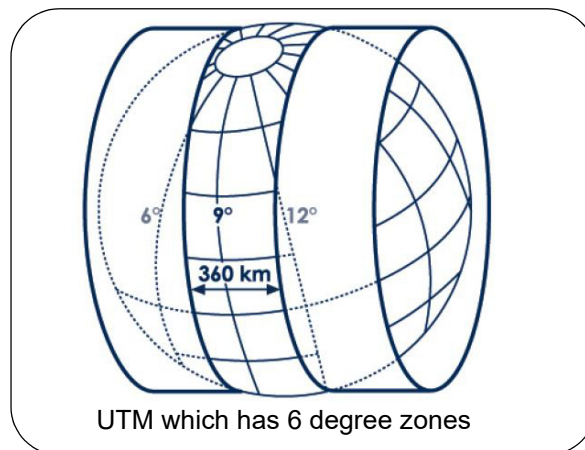
Points can not be projected from the ellipsoid onto a developable surface (flat sheet) without introducing **distortions** in the lengths of lines or the shapes of areas.

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 [27.6.4 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 extent of coverage of the earth's 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.

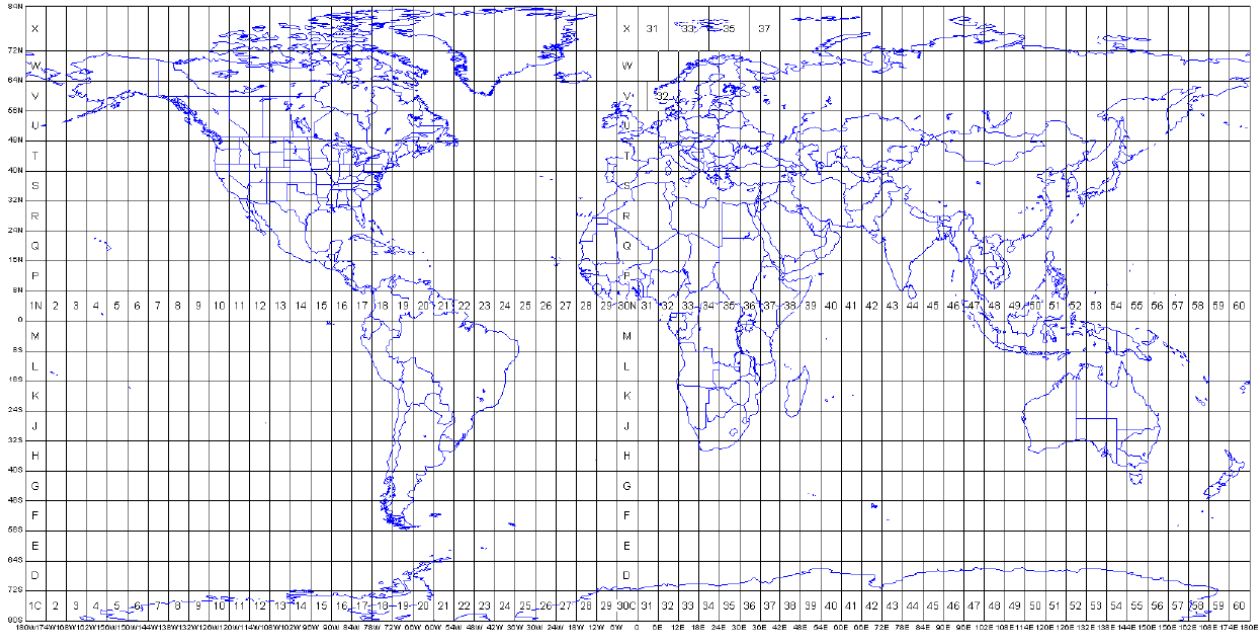
For example, the Universal Transverse projection (UTM) splits the world into **sixty** zones of **six** degree with the **central meridian** of the projection in the **middle of the zone**.



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.

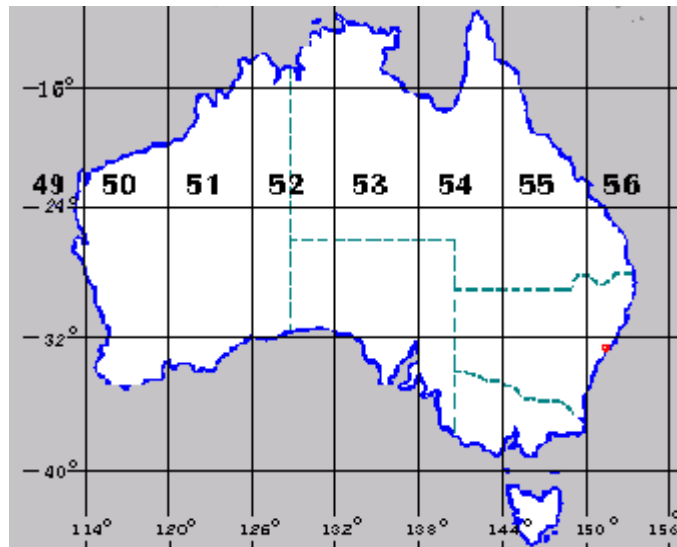
So each UTM zone has a specific central meridian and range of longitude that defines it. As such, by supplying a zone number, a number of parameters about a projection can be deduced.

**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:**

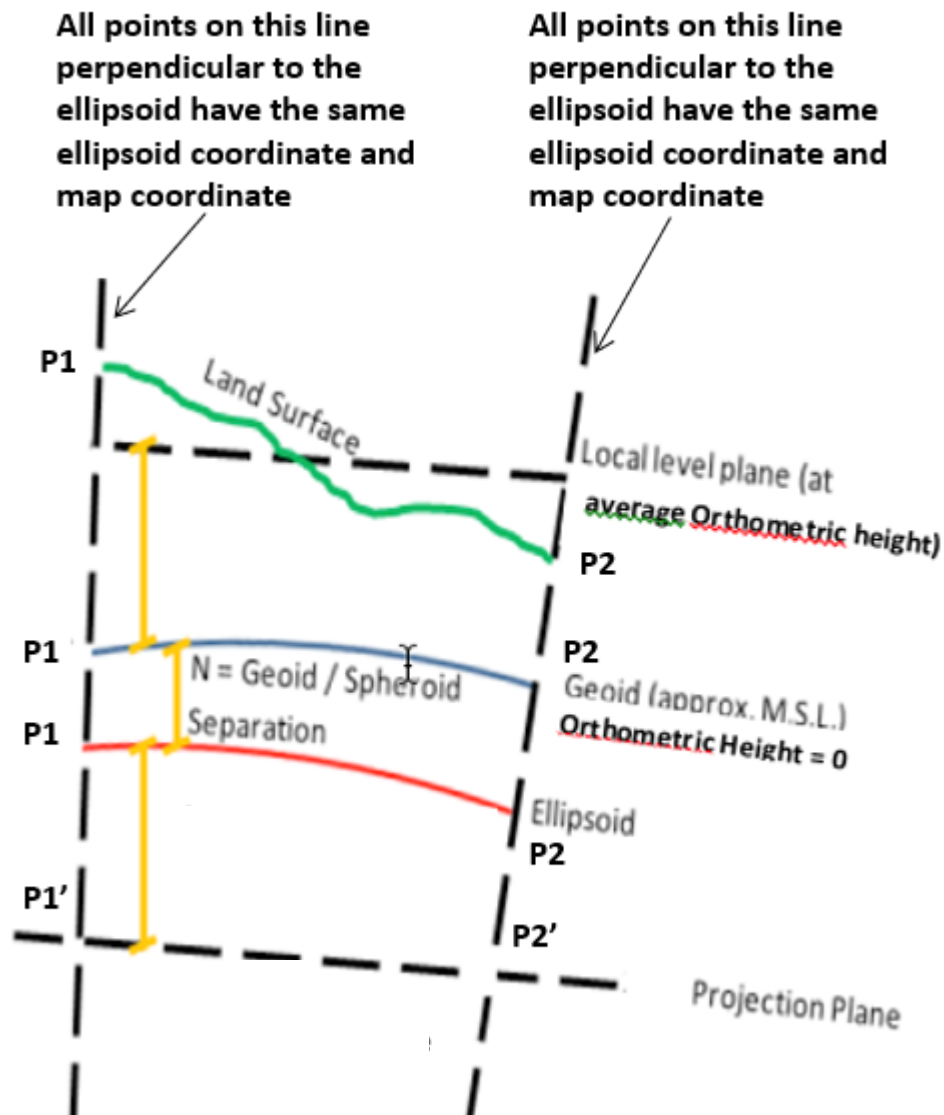
MGA94 and MGA2020 use the same map projection **BUT** MGA94 refers to the map coordinates using GDA94 which is where all the points in the world are at 1 January 1994, and MGA2020 are the map coordinates when using GDA2020 which is where the points are at 1 January 2020. See [27.8.2.3.2 Transforming Between MGA94 and MGA2020](#).

Continue to [27.3.5 Map Coordinates are Independent of Ellipsoid Height](#) or return to [27.3 Coordinate Systems for the Earth](#) or [27 Geodetics Summary](#).



### 27.3.5 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 [27.4 Norths, Azimuths and Bearings](#) or return to [27 Geodetics Summary](#).

## 27.4 Norths, Azimuths and Bearings

See

[27.4.1 Azimuth](#)

[27.4.2 Bearing](#)

[27.4.3 True North, Grid North and Magnetic North](#)

[27.4.4 Plane Bearing, Projection Bearing](#)

[27.4.5 Grid Azimuth, Australian Grid Bearing](#)

[27.4.6 Arc to Chord Correction \(t-T correction\)](#)

[27.4.7 True Azimuth and Grid Convergence](#)

### 27.4.1 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 earth's 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.

### 27.4.2 Bearing

The **12d Model** definition 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 or 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 [27.4.5 Grid Azimuth, Australian Grid Bearing](#).

The term **plane bearing** is used for the angle between two points on a map grid - see [27.4.4 Plane Bearing, Projection Bearing](#).

### 27.4.3 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.

**(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.

**(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.

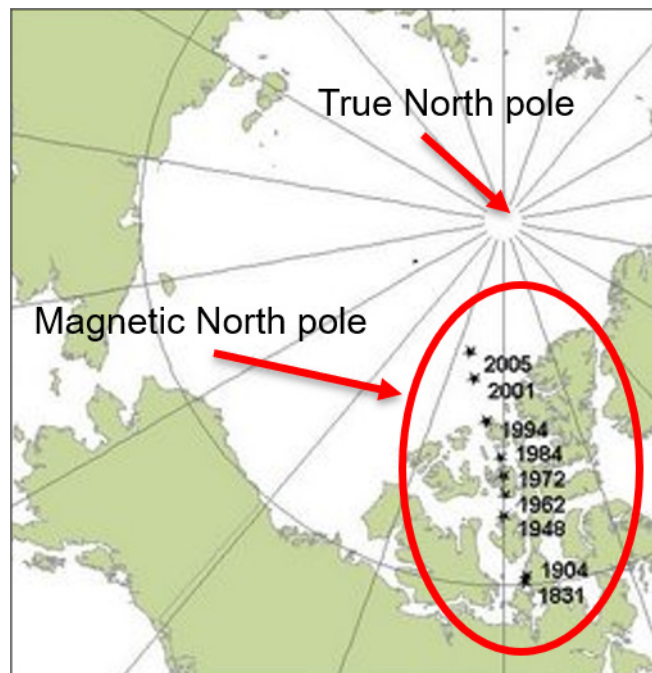
Grid north is useful because it allows the Easting grid lines on the map to be the North reference.

**(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.

### 27.4.3.1 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 [27.4.7 True Azimuth and Grid Convergence](#)).

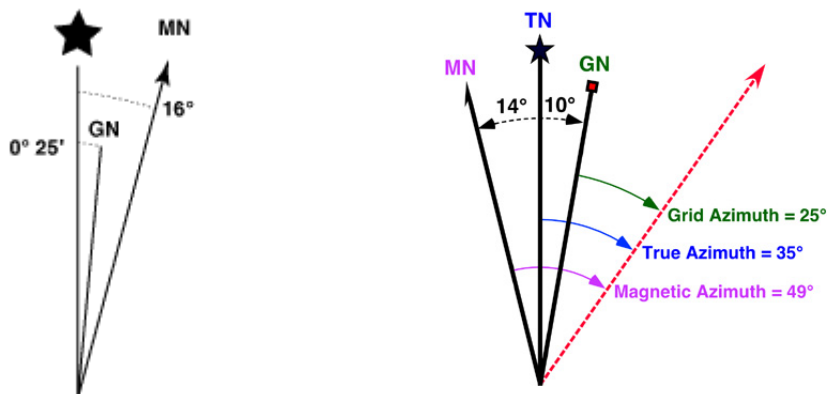
Although the value of the declination and grid convergence varies from location to location, over a small distance, the values can be considered to be constant.

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.



## 27.4.4 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.

$$\tan (\text{plane bearing}) = (N2 - N1) / (E2 - E1)$$

*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**.

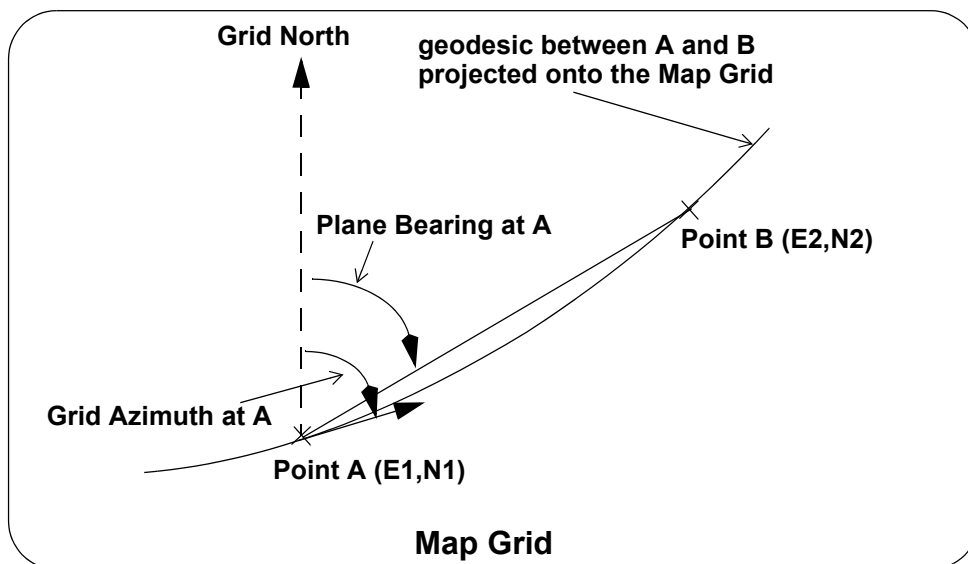
However the **Australian GDA Technical Manual** has a different definition of "**grid bearing**". So to avoid confusion, the term "grid bearing" will be avoided in this manual unless it is referred to as the **Australian grid bearing**.

Continue to [27.4.5 Grid Azimuth, Australian Grid Bearing](#) or return [27 Geodetics Summary](#).

## 27.4.5 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 [27.4.6 Arc to Chord Correction \(t-T correction\)](#) or return to [27 Geodetics Summary](#).

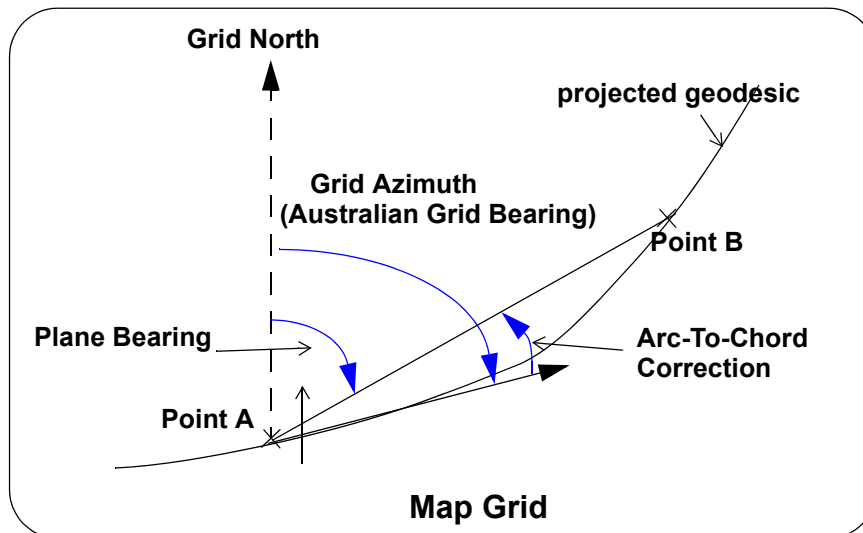


## 27.4.6 Arc to Chord Correction (t-T correction)

The *arc-to-chord* correction is the quantity to be added algebraically to a Grid Azimuth (Australian grid bearing) to obtain a Plane bearing.

$$\text{Plane Bearing} = \text{Grid Azimuth} + \text{Arc\_To\_Chord\_Correction}$$

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 [27.4.7 True Azimuth and Grid Convergence](#) or return to [27 Geodetics Summary](#).



## 27.4.7 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.

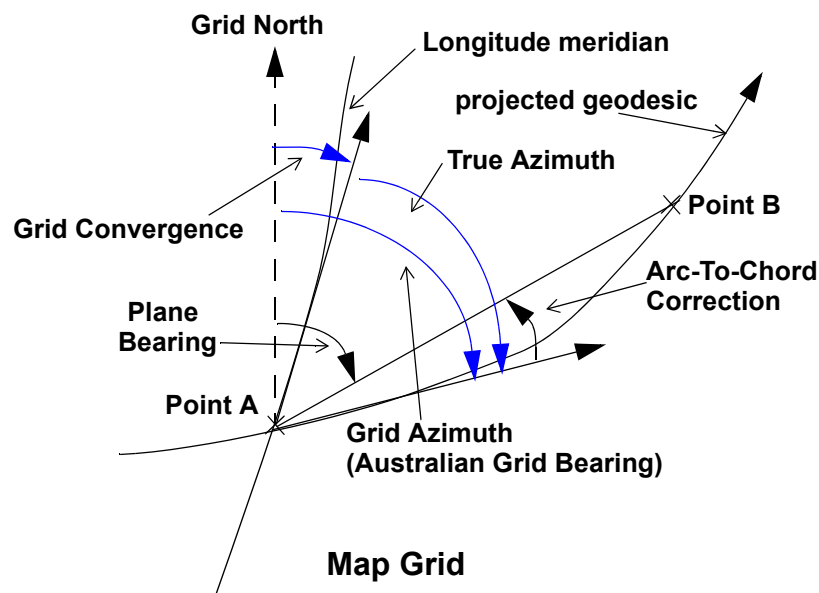
In the **Australian GDA Technical Manual** this is just called the **Azimuth**. But in this manual the term **Grid Azimuth** is used so **True Azimuth** is preferred to avoid confusion.

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.*

$$\text{Grid Azimuth} = \text{True Azimuth} + \text{Grid Convergence}$$

**Warning:** In some countries, the *Grid Convergence* has the opposite sign.



Combining

$$\text{Grid Azimuth} = \text{True Azimuth} + \text{Grid Convergence}$$

and

$$\text{Plane Bearing} = \text{Grid Azimuth} + \text{Arc\_To\_Chord\_Correction}$$

produces the equation

$$\text{Plane Bearing} = \text{True Azimuth} + \text{Grid Convergence} + \text{Arc\_To\_Chord\_Correction}$$

or

$$\text{True Azimuth} = \text{Plane Bearing} - \text{Grid Convergence} - \text{Arc\_To\_Chord\_Correction}$$

Continue to [27.5 Distances](#) or return to [27 Geodetics Summary](#).

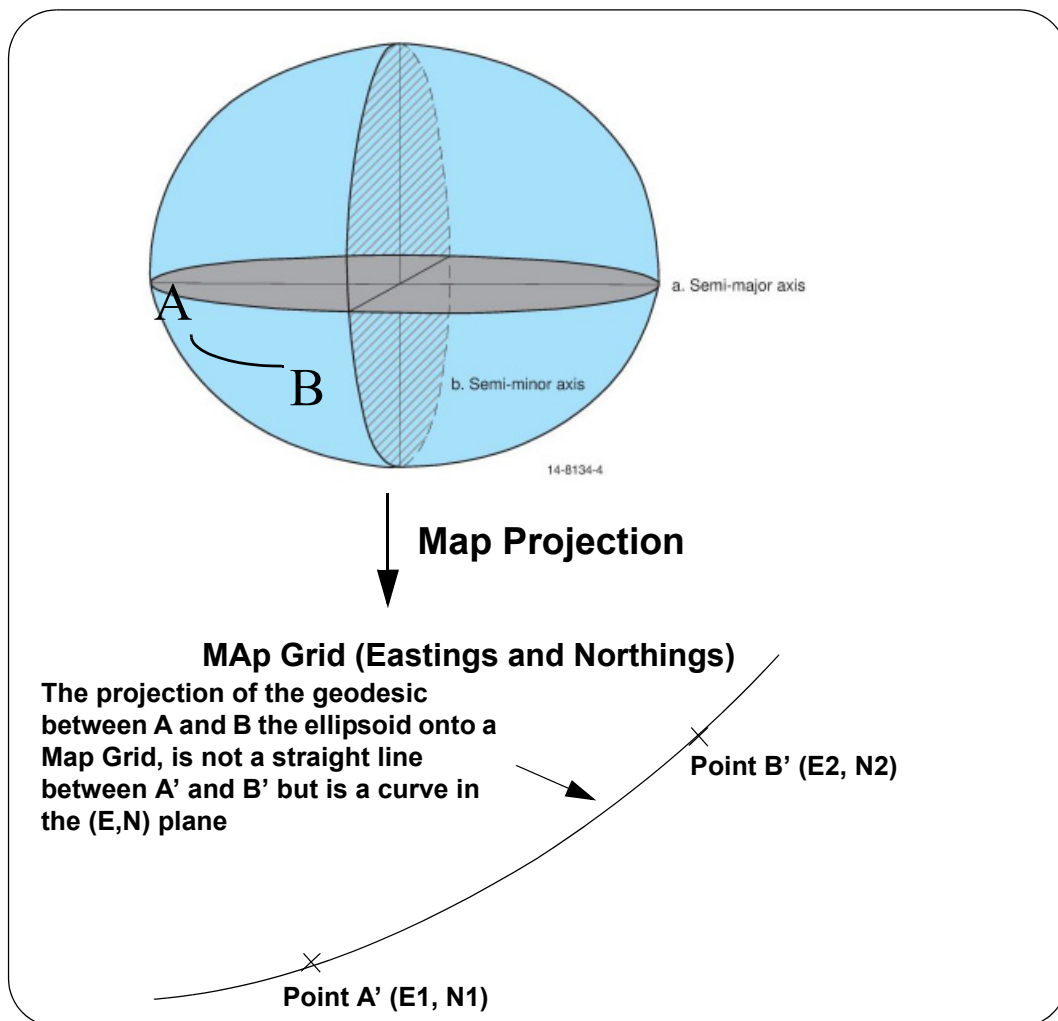
## 27.5 Distances

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

[27.5.1 Ellipsoid Distance](#)

[27.5.2 Plane or Projection Distance](#)

[27.5.3 Australian Grid Distance](#)

[27.5.4 Ground or Level Terrain Distance](#)

[27.5.5 Ellipsoid and Plane Distances are Independent of Height](#)

## 27.5.1 Ellipsoid Distance

The **ellipsoid distance** ( $s$ ) between two points **A** and **B** on an 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 [27.5.2 Plane or Projection Distance](#) or return to [27 Geodetics Summary](#).

## 27.5.2 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

$$\text{plane distance} = \text{square root } [(E2 - E1)^2 + (N2 - N1)^2]$$

**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 not be used in **12d Model**.

Given that the longitude and latitude can be uniquely calculated for the two points **A'** and **B'**, the ellipsoid distance between the two projected points **A'** and **B'** can also be calculated.

Continue to [27.5.3 Australian Grid Distance](#) or return to [27 Geodetics Summary](#).

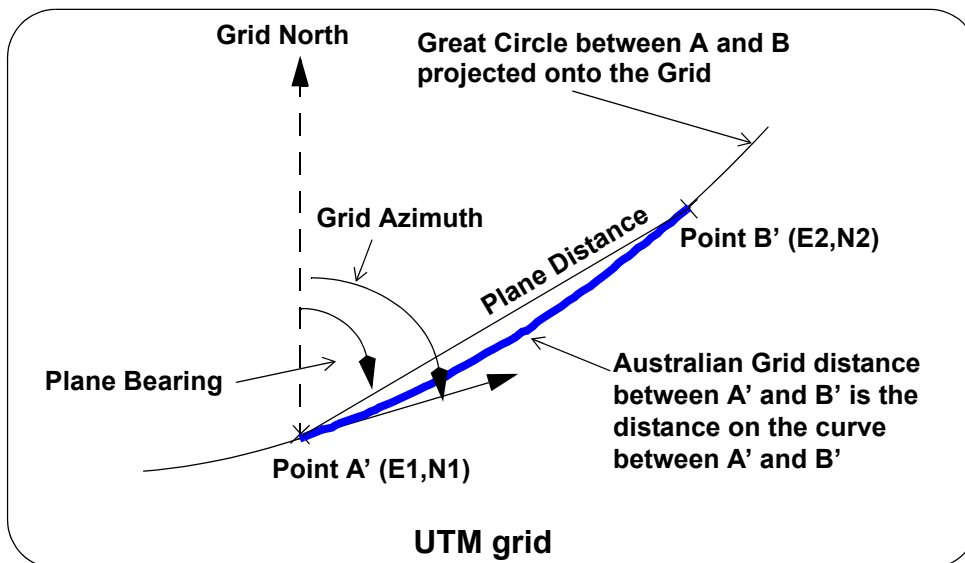
### 27.5.3 Australian Grid Distance

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.

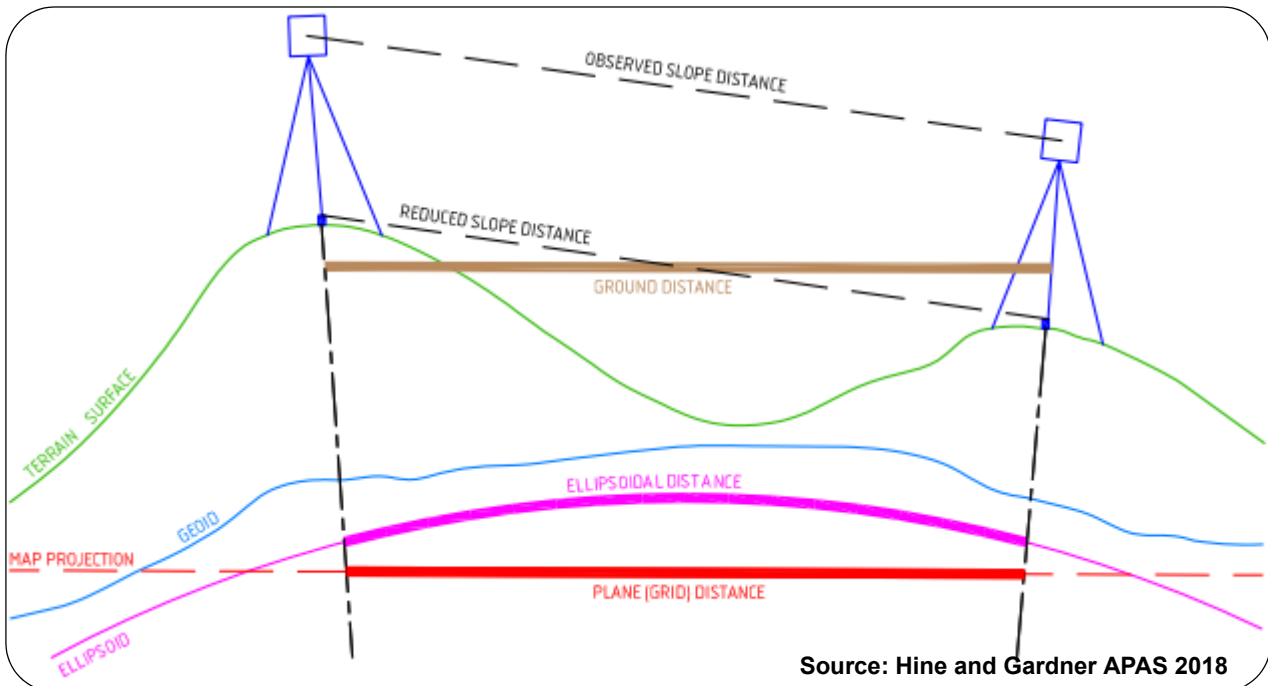
**Warning:** In some countries (e.g. New Zealand), the term *grid distance* is defined to be the **plane distance (projection distance)**. Hence to avoid confusion, the term **grid distance** will be not be used in **12d Model**. If the Australian definition is being used, then it will be written as the **Australian grid distance**.

Continue to [27.5.4 Ground or Level Terrain Distance](#) or return to [27 Geodetics Summary](#).

## 27.5.4 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.



The **ground distance** is a reduced slope distance projected onto a local horizontal plane at mean ground level.

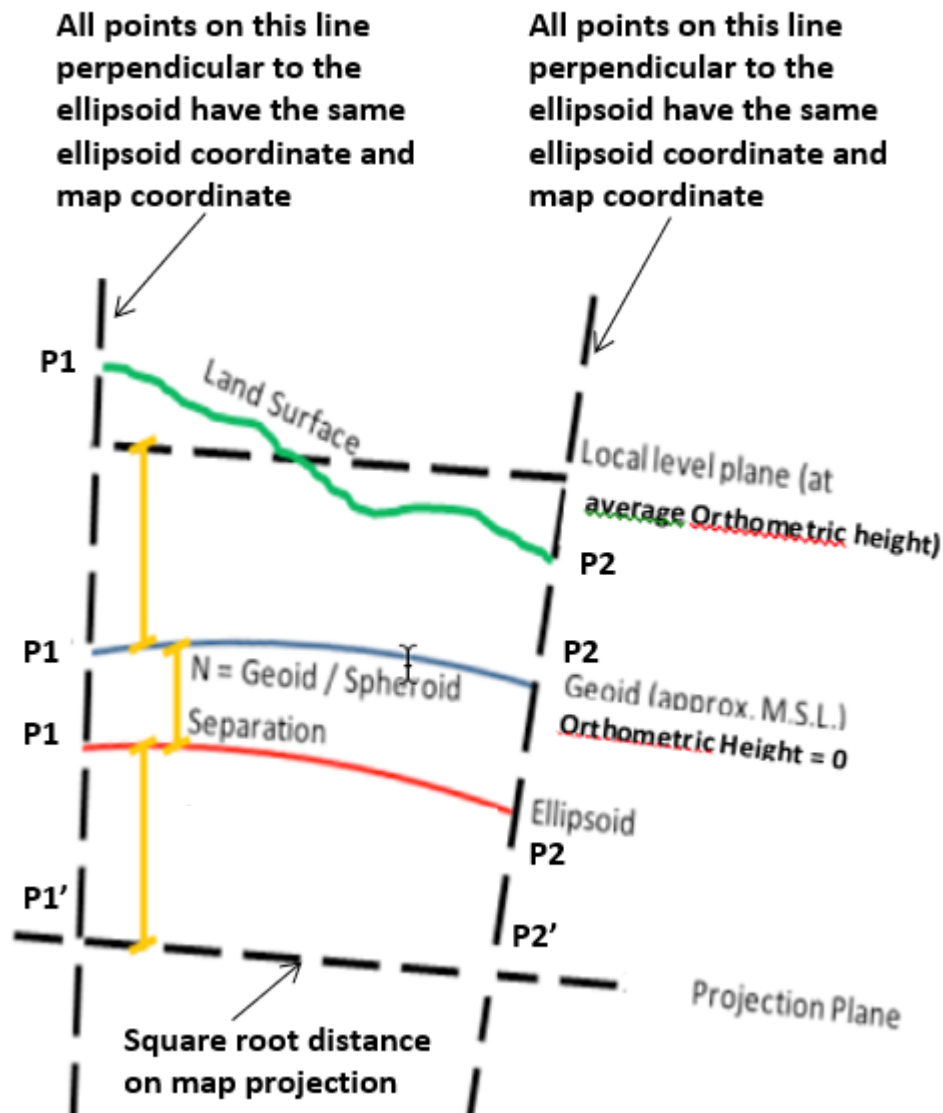
Continue to [27.5.5 Ellipsoid and Plane Distances are Independent of Height](#) or return to [27. Geodetics Summary](#).



## 27.5.5 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 [27.6 Calculating Distances and Scale Factors](#) or return to [27 Geodetics Summary](#).

## 27.6 Calculating Distances and Scale Factors

See

[27.6.1 Reduction of Measured Distances to the Ellipsoid](#)

[27.6.2 Point and Line Scale Factors](#)

[27.6.3 Point and Line Height Factor](#)

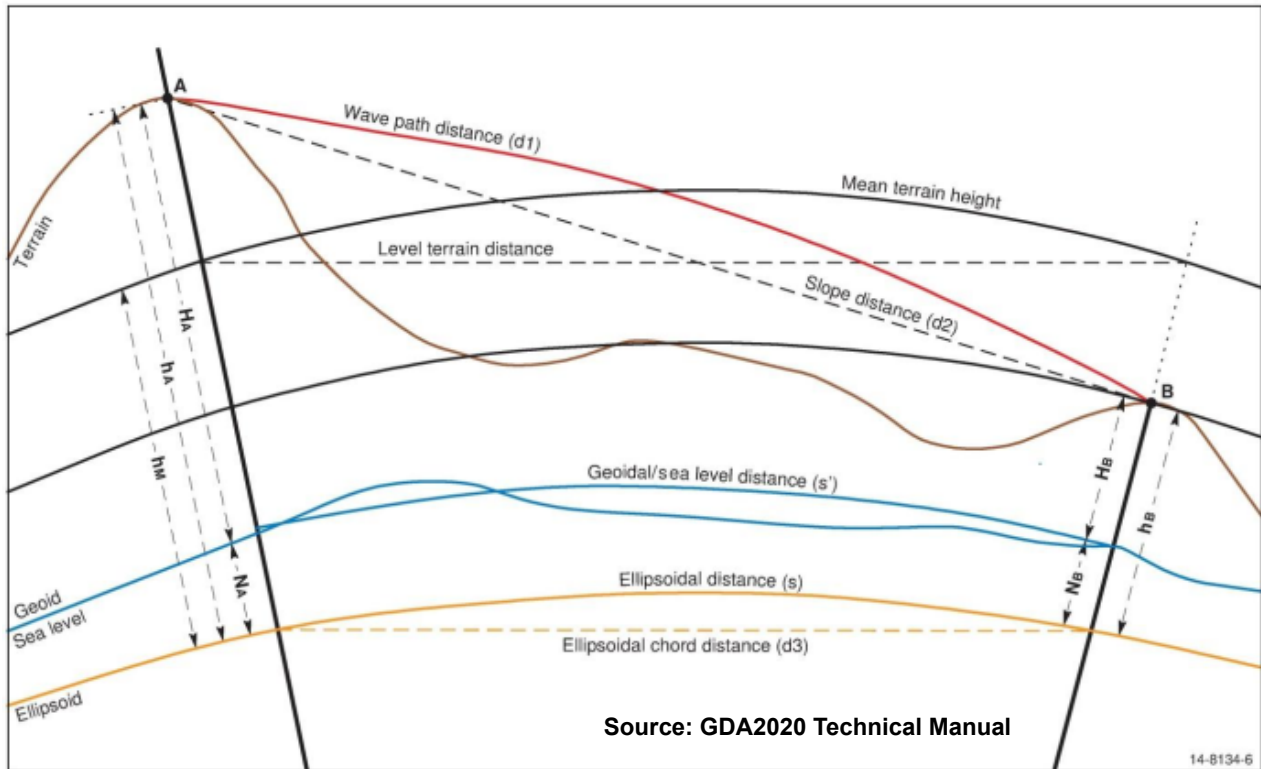
[27.6.4 Combined Scale Factor](#)

Continue to [27.6.1 Reduction of Measured Distances to the Ellipsoid](#) or return to [27 Geodetics Summary](#).

## 27.6.1 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):

$$d_3 = \sqrt{\left[ \frac{(d_2^2 - (h_A - h_B)^2)}{(1 + h_A/R_\alpha)(1 + h_B/R_\alpha)} \right]}$$

The ellipsoid chord distance **d3** can then be reduced to the ellipsoid distance **s** by

$$s = d_3 \left[ 1 + \left( \frac{d_3^2}{24R_\alpha^2} + \frac{3d_3^4}{640R_\alpha^4} + \dots \right) \right]$$

where  $R_\alpha$  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, an 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 [27.3.2 Deflection of the Vertical - Three Latitudes](#)) and a correction for this difference should be applied for the highest quality results.

Continue to [27.6.2 Point and Line Scale Factors](#) or return to [27.6 Calculating Distances and Scale Factors](#) or [27 Geodetics Summary](#).

## 27.6.2 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

[27.6.2.1 Point Scale Factor](#)

[27.6.2.2 Line Scale Factor](#)

[27.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor](#)

### 27.6.2.1 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:

$$\text{Point Scale Factor} = \text{Infinitesimal Plane Distance} / \text{Infinitesimal Ellipsoid Distance}$$

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:

$$\text{Plane Distance} = \text{Ellipsoid Distance} \times \text{Point Scale Factor},$$

or to convert a plane distance near a point to an ellipsoid distance

$$\text{Ellipsoid Distance} = \text{Plane Distance} / \text{Point Scale Factor}.$$

However the distances from the point should be fairly short.

Continue to [27.6.2.2 Line Scale Factor](#) or return to [27.6.2 Point and Line Scale Factors](#) or [27 Geodetics Summary](#).

### 27.6.2.2 Line Scale Factor

The **Line Scale Factor** is the ratio of the plane distance on a grid to a corresponding ellipsoid distance. that is:

$$\text{Line Scale Factor} = \text{Plane Distance} / \text{Ellipsoid Distance}$$

The **Line Scale Factor** can be used to convert an ellipsoid distance to a plane distance:

$$\text{Plane Distance} = \text{Ellipsoid Distance} \times \text{Line Scale Factor},$$

or to convert a plane distance to an ellipsoid distance

$$\text{Ellipsoid Distance} = \text{Plane Distance} / \text{Line Scale Factor}.$$

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 [27.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor](#) or return to [27.6.2 Point and Line Scale Factors](#) or [27 Geodetics Summary](#).

### 27.6.2.3 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

$$\text{Line Scale Factor} = (\text{Points Scale factor at A} + \text{Point Scale factor at B}) / 2$$

- (b) Use of Simpsons Rule

$$\text{Line Scale Factor} = (\text{PSF(A)} + 4 \times \text{PSF(mid-point)} + \text{PSF(B)}) / 6$$

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 [27.6.2.4 Calculating the Line Scale Factor for a UTM](#) or return to [27 Geodetics Summary](#).



### 27.6.2.4 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:

$$\text{Line Scale Factor (1 to 2)} = k_0 \left\{ 1 + \left[ \frac{(E_1'^2 + E_1'E_2' + E_2'^2)}{6r_m^2} \right] \right\} \left[ 1 + \frac{(E_1'^2 + E_1'E_2' + E_2'^2)}{36r_m^2} \right]$$

where

$$r_m^2 = \rho_m \nu_m k_0^2$$

$$\nu_m = \frac{a}{\sqrt{(1 - e^2 \sin^2 \varphi_m)}} \quad \rho_m = \frac{a(1 - e^2)}{(1 - e^2 \sin^2 \varphi_m)^{\frac{3}{2}}}$$

$$e^2 = \frac{(a^2 - b^2)}{a^2} \quad \varphi_m = \frac{\varphi_1 + \varphi_2}{2}$$

$a$  = 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

$$E_1' = E_1 - 500,000 \quad E_2' = E_2 - 500,000$$

$E_1'$  = 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**

$\varphi_1$  = latitude of point 1

$\varphi_2$  = latitude of point 2

$\varphi_m$  = mean latitude

$\nu_m$  = radius of curvature in the prime vertical at the mean latitude

$\rho_m$  = radius of curvature in the meridian at the mean latitude

Continue to [27.6.3 Point and Line Height Factor](#) or return to [27 Geodetics Summary](#).

## 27.6.3 Point and Line Height Factor

The **Height Factor** is the ratios of the ellipsoid distance to the ground distance.

$$\text{Height Factor} = \text{Ellipsoid Distance} / \text{Ground Distance}$$

Hence the **Height Scale Factor** is used to convert a ground distance to an ellipsoid distance:

$$\text{Ellipsoid Distance} = \text{Ground Distance} \times \text{Height Factor}$$

or an ellipsoid distance to a ground distance:

$$\text{Ground Distance} = \text{Ellipsoid Distance} / \text{Height Factor}$$

**Note:**

In the USA, the **Height Factor** is also called the **Elevation Factor**.

See

[27.6.3.1 Height Factor for a Point](#)

[27.6.3.2 Height Factor for a Line](#)

[27.6.3.3 Calculating Line Height Factor \(Height Scale Factor\)](#)

### 27.6.3.1 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

$$\text{Height Factor (Point)} = \text{Infinitesimal Ellipsoid Distance} / \text{Infinitesimal Ground Distance}$$

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 [27.6.3.2 Height Factor for a Line](#) or return to [27.6.3 Point and Line Height Factor](#) or [27 Geodetics Summary](#).

### 27.6.3.2 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

$$\text{Height Factor (Line)} = \text{Ellipsoid Distance} / \text{Ground Distance}$$

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 [27.6.3.3 Calculating Line Height Factor \(Height Scale Factor\)](#) or return to [27.6.3 Point and Line Height Factor](#) or [27 Geodetics Summary](#).

### 27.6.3.3 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

$$\text{Line Height Factor} = (\text{Height Factor at A} + \text{Height Factor at B}) / 2$$

- (b) Use of Simpsons Rule

$$\text{Line Height Factor} = (\text{PHF(A)} + 4x \text{PHF(mid-point)} + \text{PHF(B)}) / 6$$

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:

$$\text{Height factor (line)} = \left( 1 - \frac{h_m}{R_\alpha + h_m} \right)$$

where:

$h_1$  = ellipsoidal height of point 1

$h_2$  = ellipsoidal height of point 2

$$h_m = \text{mean ellipsoidal height} = \frac{h_1 + h_2}{2}$$

$R_\alpha$  = 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 [27.6.4 Combined Scale Factor](#) or return to [27 Geodetics Summary](#).

## 27.6.4 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.

$$\text{Combined Scale Factor} = \text{Plane Distance} / \text{Ground Distance}$$

Hence a combined scale factor can be used to convert a ground distance to a plane distance

$$\text{Plane Distance} = \text{Ground Distance} \times \text{Combined Scale Factor}$$

or a plane distance to a ground distance.

$$\text{Ground Distance} = \text{Plane Distance} / \text{Combined Scale Factor}$$

The CSF can be calculated for either a line or a point.

**Note:**

In the USA, the **Combined Scale Factor** is also called the **Grid Factor**.

See

[27.6.4.1 Combined Scale Factor - Line](#)

[27.6.4.2 Combined Scale Factor - Point](#)

[27.6.4.3 Using the CSF \(Point\) to Calculate the CSF \(Line\)](#)

[27.6.4.4 Calculating the Combined Scale Factor \(Line\)](#)

### 27.6.4.1 Combined Scale Factor - Line

The basic equation for the **CSF (line)** is:

$$\text{Combine Scale Factor (Line)} = \text{Plane Distance} / \text{Ground Distance}$$

This is also expressed as:

$$\text{Combine Scale Factor (Line)} = \text{Height Factor (line)} \times \text{Line Scale Factor}$$

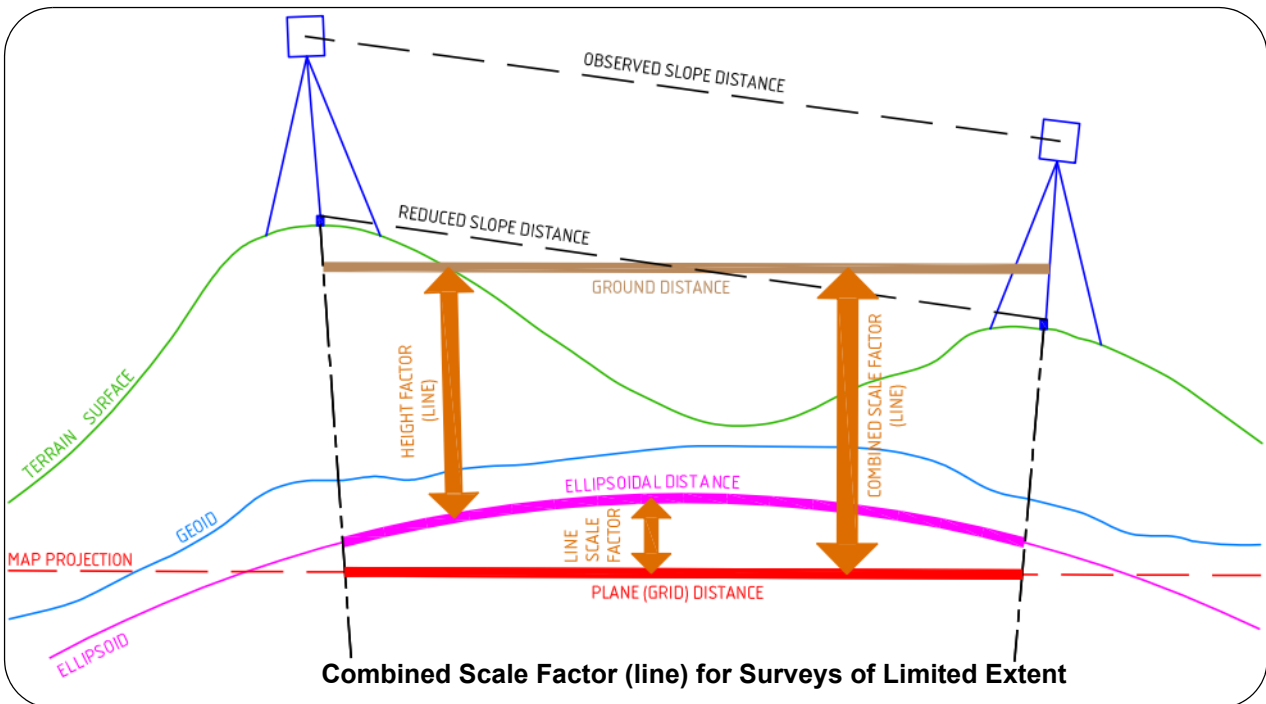
For surveys of limited extent"

- (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 [27.6.3.2 Height Factor for a Line](#).

$$\text{Height Factor (Line)} = \text{Ellipsoid Distance} / \text{Ground Distance}$$

- (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 [27.6.2.2 Line Scale Factor](#).

$$\text{Line Scale factor} = \text{Plane Distance} / \text{Ellipsoid Distance}$$



Continue to [27.6.4.2 Combined Scale Factor - Point](#) or return to [27.6.4 Combined Scale Factor](#) or [27 Geodetics Summary](#).



### 27.6.4.2 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:

$$\mathbf{CSF (Point) = Infinitesimal Plane Distance / infinitesimal Ground Distance}$$

This is also expressed as:

$$\mathbf{Combine Scale Factor (Point) = Height Factor (point) \times Point Scale Factor}$$

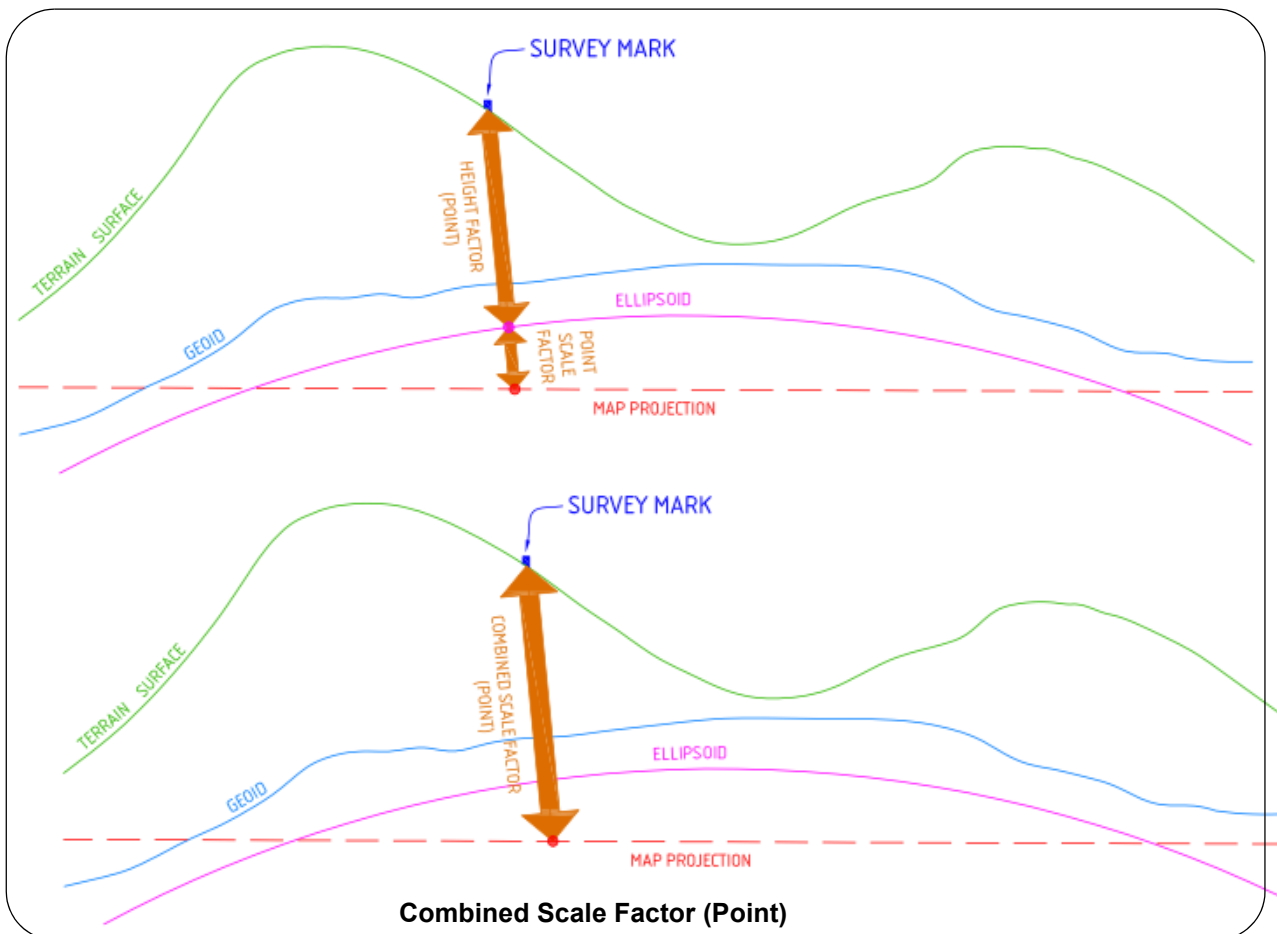
For surveys of limited extent"

- (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 [27.6.3.1 Height Factor for a Point](#).

$$\mathbf{Height Factor (Point) = Infinitesimal Ellipsoid Distance / Infinitesimal Ground Distance}$$

- (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 [27.6.2.1 Point Scale Factor](#).

$$\mathbf{Point Scale factor = Infinitesimal Plane Distance / Infinitesimal Ellipsoid Distance}$$



Continue to [27.6.4.3 Using the CSF \(Point\) to Calculate the CSF \(Line\)](#) or return to [27.6.4 Combined Scale Factor](#) or [27 Geodetics Summary](#).



### 27.6.4.3 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

$$\text{CSF}(\text{Line}) = (\text{CSF}(\text{Point}) \text{ at A} + \text{CSF}(\text{Point}) \text{ at B}) / 2$$

- (b) Use of Simpsons Rule

$$\text{CSF}(\text{Line}) = (\text{CSF}(\text{A}) + 4x \text{CSF}(\text{mid-point}) + \text{CSF}(\text{B})) / 6$$

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 [27.6.4.4 Calculating the Combined Scale Factor \(Line\)](#) or return to [27.6.4 Combined Scale Factor](#) or [27 Geodetics Summary](#).

### 27.6.4.4 Calculating the Combined Scale Factor (Line)

A surveyor can calculate a more rigorous CSF(Line) that the methods shown in the previous section [27.6.4.3 Using the CSF \(Point\) to Calculate the CSF \(Line\)](#) by:

- (a) Calculating the Height Factor (Line) using the method (c) in [27.6.3.3 Calculating Line Height Factor \(Height Scale Factor\)](#):

$$\text{Height factor (line)} = \left( 1 - \frac{h_m}{R_\alpha + h_m} \right)$$

- (b) Calculating the Line Scale Factor using the best method in [27.6.2.3 Using Point Scale Factors to Calculate the Line Scale Factor](#) or for a UTM, [27.6.2.4 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

$$\text{CSF}(\text{Line}) = \left( 1 - \frac{h_m}{R_\alpha + h_m} \right) \times k_0 \left\{ 1 + \left[ \frac{(E_1'^2 + E_1'E_2' + E_2'^2)}{6r_m^2} \right] \left[ 1 + \frac{(E_1'^2 + E_1'E_2' + E_2'^2)}{36r_m^2} \right] \right\}$$

Continue to [27.7 Defining a Projection in 12d Model](#) or return to [27.6.4 Combined Scale Factor](#) or [27.6 Calculating Distances and Scale Factors](#) or [27 Geodetics Summary](#).

## 27.7 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:

Set Project Projection	
Projection name	MGA2020 Zone 56
<b>General</b>	
Group	MGA2020
Name	MGA2020 Zone 56
Description	
EPSG code	7856
ESRI WKT	PROJCS["GDA2020_MGA_Z...
ISO code	
IFC code	
MapInfo	8, 1028, 7, 153, 0, 0.9996, 50...
<b>Map Projection</b>	
Map projection type	UTM
Description	
Projection zone	56
Projection hemisphere	south
Scale factor	0.9996
EPSG code	7856
ESRI WKT	PROJCS["GDA2020_MGA_Z...
ISO code	
IFC code	
MapInfo	
<b>Horizontal Datum</b>	
Type	GRS80
Semi-major axis	6378137
Reciprocal flattening(1/f)	298.257222101
Description	
EPSG code	
ESRI WKT	
ISO code	
IFC code	
MapInfo	
<b>Vertical Datum</b>	
Name	
Description	
N Value interpolation method	None
EPSG code	
ESRI WKT	
ISO code	
IFC code	
MapInfo	
is valid	
<input type="button" value="Set"/> <input type="button" value="Finish"/> <input type="button" value="Help"/>	

Continue to [27.8 Coordinate Conversions and Transformations](#) or return to [27 Geodetics Summary](#).

## 27.8 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 [27.2.1 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 [27.8.1 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 [27.8.2 Coordinate Transformations](#)

See

[27.8.1 Coordinate Conversions](#)

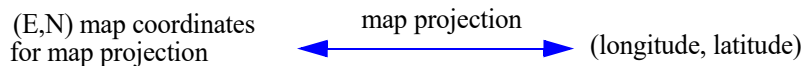
[27.8.2 Coordinate Transformations](#)

### 27.8.1 Coordinate Conversions

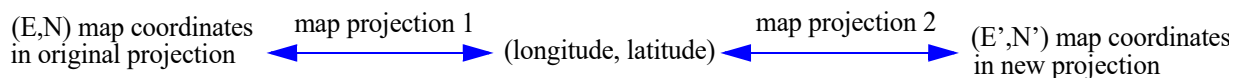
**Coordinate conversion** is a conversion of coordinates from one coordinate system to a different coordinate system referenced to the **same datum**. That is, the ellipsoid, reference frame and epoch of the Earth remains the same for the two coordinate system.

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,



The conversion between the (Eastings, Northings) coordinates for two map projections usually uses longitude and latitude as an intermediate step. That is,



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,



Continue to [27.8.2 Coordinate Transformations](#) or return to [27.8 Coordinate Conversions and Transformations](#) or [27 Geodetics Summary](#).

## 27.8.2 Coordinate Transformations

**Coordinate transformation** is a process of changing coordinates from one datum to another datum. That is, there are different datums.

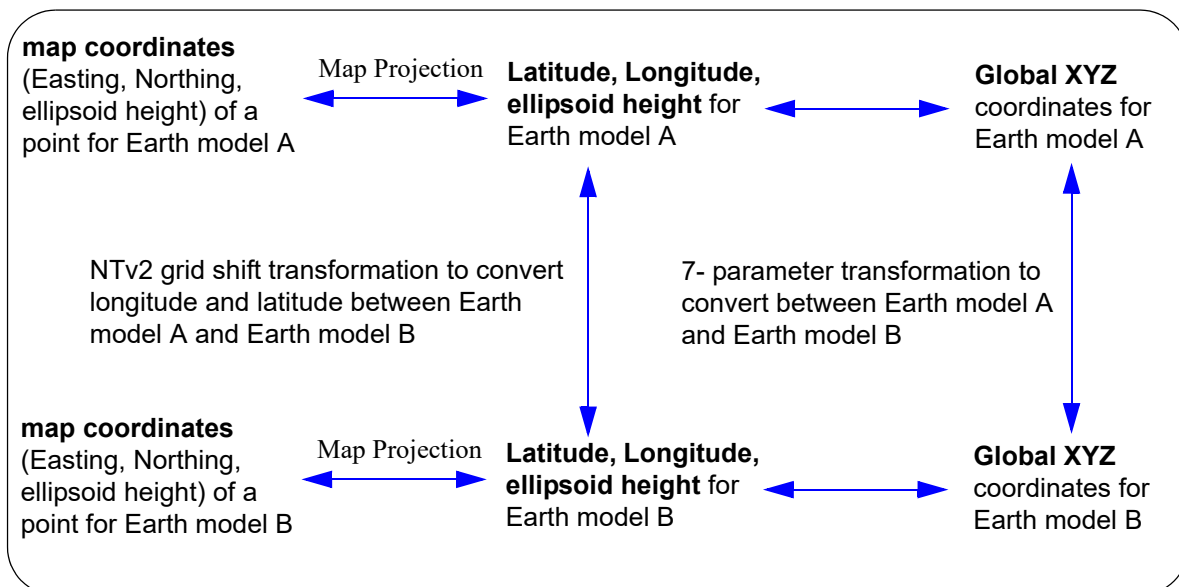
For example, transforming the longitude and latitude of a point for AGD84 to the longitude and latitude of the same point for GDA94. In this case, the ellipsoid is different for AGD66 and GDA94 as well as the Epoch.

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

[27.8.2.1 7-Parameter Similarity Transformation](#)

[27.8.2.2 NTV2 Grid Shift Transformation](#)

[27.8.2.3.2 Transforming Between MGA94 and MGA2020](#)

### 27.8.2.1 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.

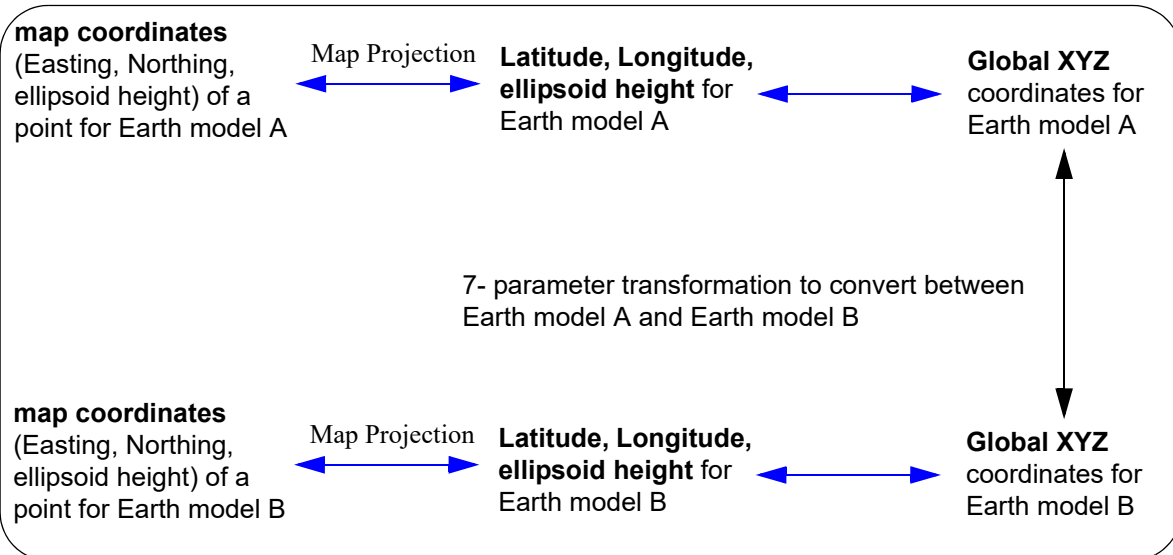
So to use a 7-parameter transformation, if the coordinates are not Global XYZ coordinates then the coordinates must first be converted to Global XYZ coordinates (using the same datum).

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.



### 27.8.2.2 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 storing the grid is the **NTv2** format (**.gsb** files).

#### Important Note

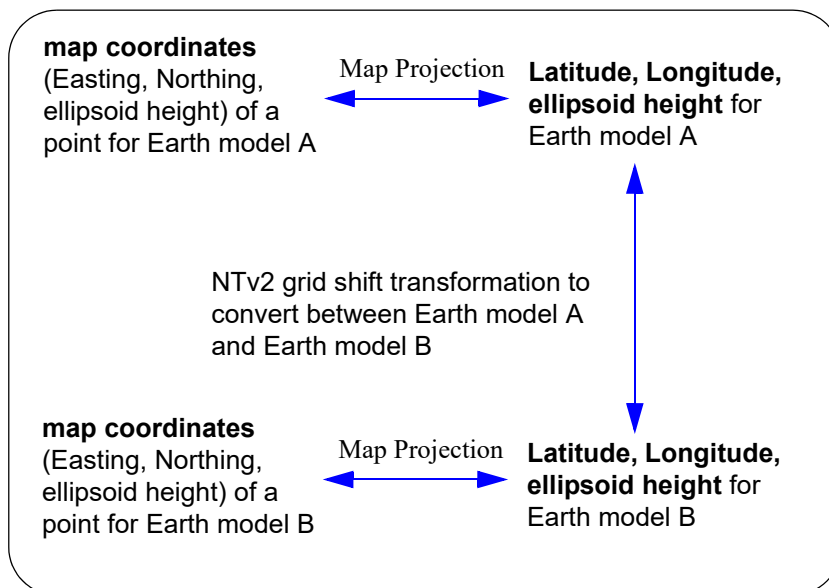
The NTV2 format does not store ellipsoid height information and therefore cannot be used to transform the height of data from one datum to another.

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.



## 27.8.2.3 Australian Coordinate Transformations

See

[27.8.2.3.1 Transforming Between AMG, ISG and MGA94](#)

[27.8.2.3.2 Transforming Between MGA94 and MGA2020](#)

[27.8.2.3.3 Transforming from AGD66 or AGD84 to MGA2020](#)

### 27.8.2.3.1 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 [27.1 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.

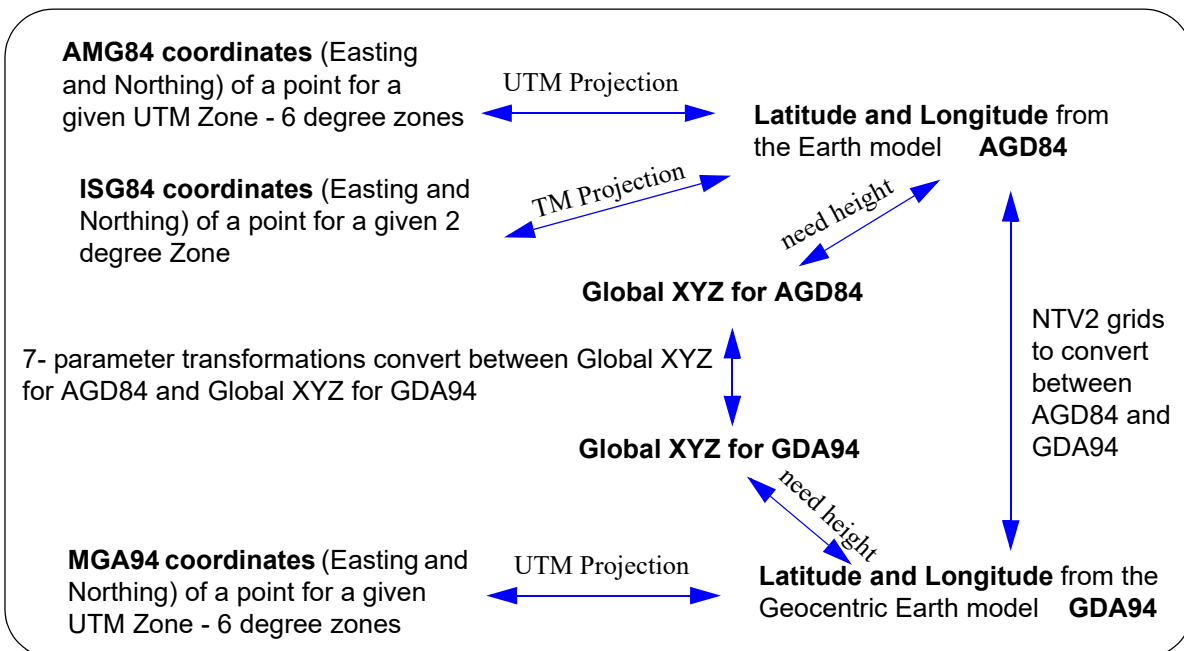
The use of UTM projections (Universal Transverse Mercator - see [27.3.4 Map \(Cartographic\) Projections and Map Coordinates](#)) and Zones still applied but because the latitude and longitude of each point has changed, the Easting and Northing for a point in a UTM zone has also changed.

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)

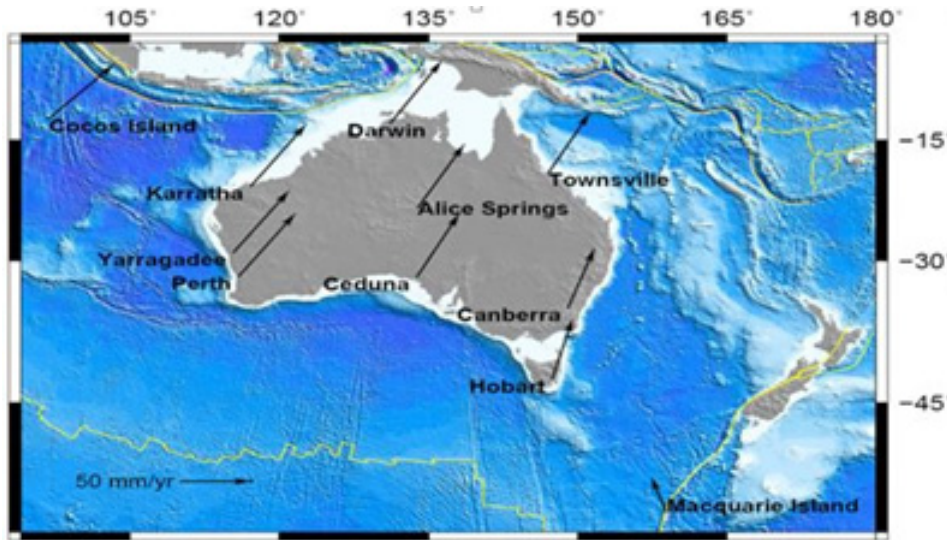
Survey =>Conversions =>Cartographic. See [14.8.1 Notes on Cartographic Conversions](#).

Continue to [27.8.2.3.2 Transforming Between MGA94 and MGA2020](#) or return to [27 Geodetics Summary](#).

### 27.8.2.3.2 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.



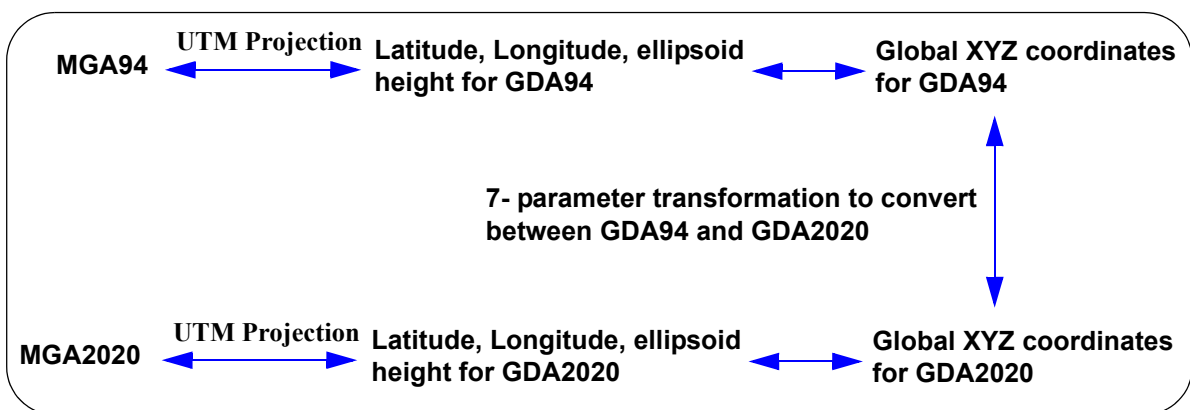
So the Australian Government decide to define a new datum which represented where the Australian Continent is at 1st January 2020.

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

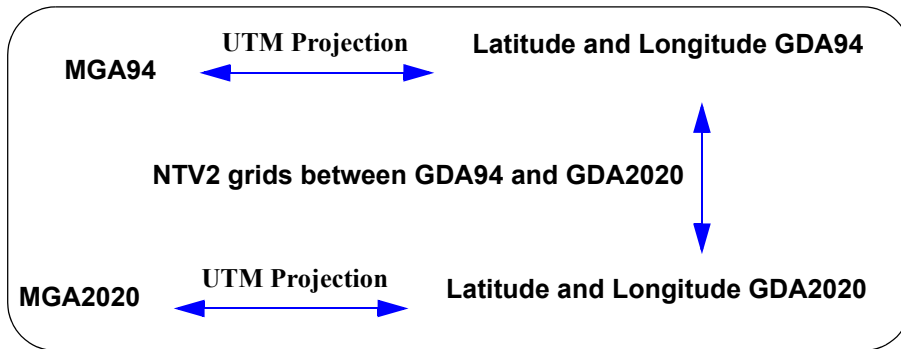
See [27.8.2.3.2.1 7-Parameter Transformation Parameters GDA94 to GDA2020](#)



or

- (b) a NTV2 grid.

See [27.8.2.3.2.2 Transformation Grids GDA94 to GDA2020](#)



**12d Model** is GDA2020 compliant for both the 7 parameter similarity transformations and NTV2 grids.



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 [27.8.2 Coordinate Transformations](#) or [27.8 Coordinate Conversions and Transformations](#) or [27 Geodetics Summary](#).



### 27.8.2.3.2.1 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 ( $1\sigma$ ). 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.



### 27.8.2.3.2.2 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.

### 27.8.2.3.3 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.



# 28 Moving to 12d Model 15

See

[28.1 Hardware Locks for 12d Model 15](#)

[28.2 Installers for Lock Drivers and 12d Model](#)

[28.3 User, User\\_Lib and env.4d for 12d Model 15](#)

[28.4 Network Hardware Locks and 12d Model](#)

## 28.1 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**.

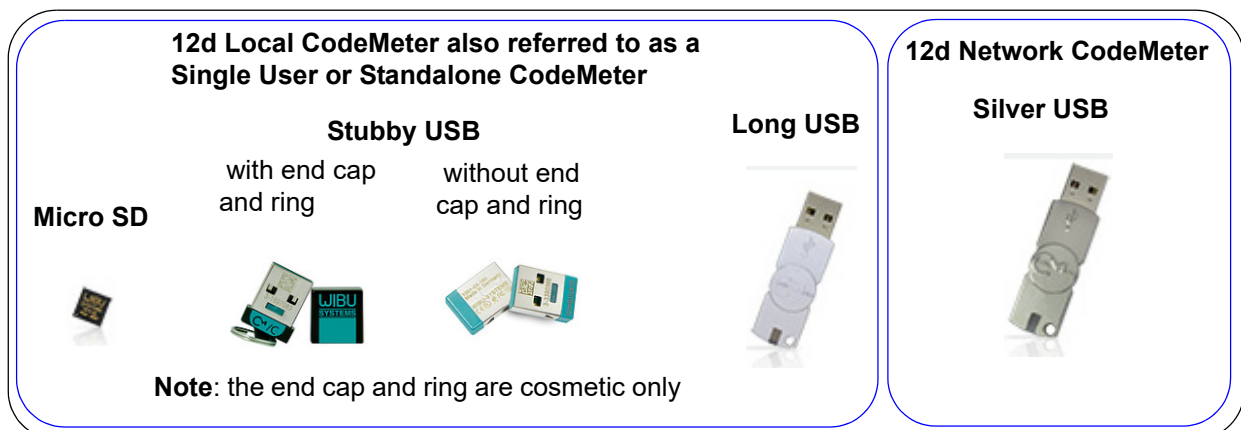
However Subscription licenses of **12d Model 15** must have **CodeMeters**.

**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.

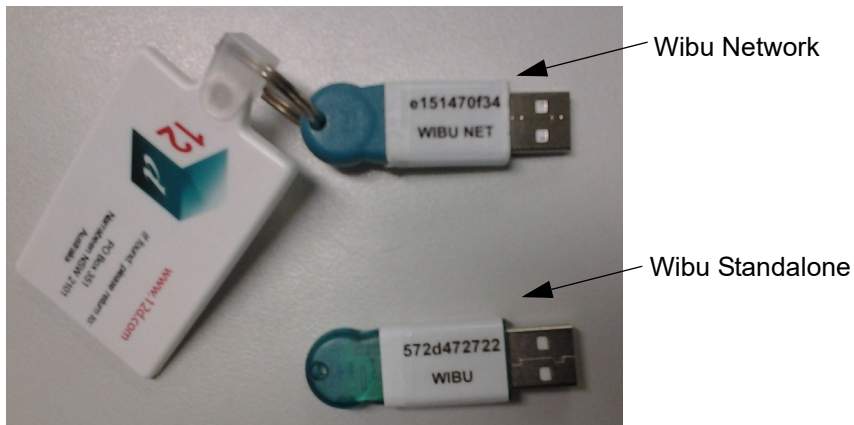
So if you move to a **CodeMeter**, you won't be able to run the **12d Model 10** and **earlier** 12d.exe's. But of course you can always open projects from those versions in the latest versions of **12d Model**.

### (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 [28.2 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 [28.2 Installers for Lock Drivers and 12d Model](#) or return to [28 Moving to 12d Model 15](#).



## 28.2 Installers for Lock Drivers and 12d Model

See

[28.2.1 Installing CodeMeter Drivers](#)

[28.2.2 Installers for 12d Model](#)

Or return to [28 Moving to 12d Model 15](#)

### 28.2.1 Installing CodeMeter Drivers

If you have no CodeMeter drivers installed, then the installer for the CodeMeter drivers can be downloaded from:

[https://12dmodel.com/Training/V15/12d\\_Model\\_15\\_Tech\\_Preview/CodeMeterRuntime\\_7\\_30a.exe](https://12dmodel.com/Training/V15/12d_Model_15_Tech_Preview/CodeMeterRuntime_7_30a.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

The screenshot shows the 'End-User License Agreement' window. The title bar reads 'CodeMeter Runtime Kit v7.30a Setup'. The window has a teal header with the title 'End-User License Agreement' and the instruction 'Please read the following license agreement carefully'. The main content area contains the following text:

WIBU-SYSTEMS AG, Karlsruhe, Germany and Wibu-Systems USA Inc., Edmonds, WA, USA  
Software License Agreement, Single Use License  
CodeMeter and WibuKey Software

PLEASE READ THIS SOFTWARE LICENSE AGREEMENT ("LICENSE") BEFORE USING THE SOFTWARE. BY USING THE SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS LICENSE. IF YOU ARE ACCESSING THE SOFTWARE ELECTRONICALLY, SIGNIFY YOUR AGREEMENT TO BE BOUND BY THE TERMS OF THIS LICENSE BY CLICKING THE "AGREE/ACCEPT" BUTTON. IF YOU DO NOT AGREE TO THE TERMS OF THIS LICENSE, RETURN THE WIBU-SYSTEMS

At the bottom, there is a checkbox labeled 'I accept the terms in the License Agreement' which is checked and circled in red. Below the checkbox are four buttons: 'Print', 'Back', 'Next' (highlighted with a blue border), and 'Cancel'.

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

The screenshot shows the 'Installation Scope' window. The title bar reads 'CodeMeter Runtime Kit v7.30a Setup'. The window has a teal header with the title 'Installation Scope' and the instruction 'Choose the installation scope and folder'. Below the header, there are two text input fields: 'User name:' with the value 'ljj' and 'Organization:' with the value 'Design Without Pain'. There are two radio button options:

- Install just for you (ljj.admin)**  
CodeMeter Runtime Kit v7.30a will be installed in a per-user folder and be available just for your user account.
- Install for all users of this machine**  
CodeMeter Runtime Kit v7.30a will be installed in a per-machine folder by default and be available for all users. You must have local Administrator privileges.

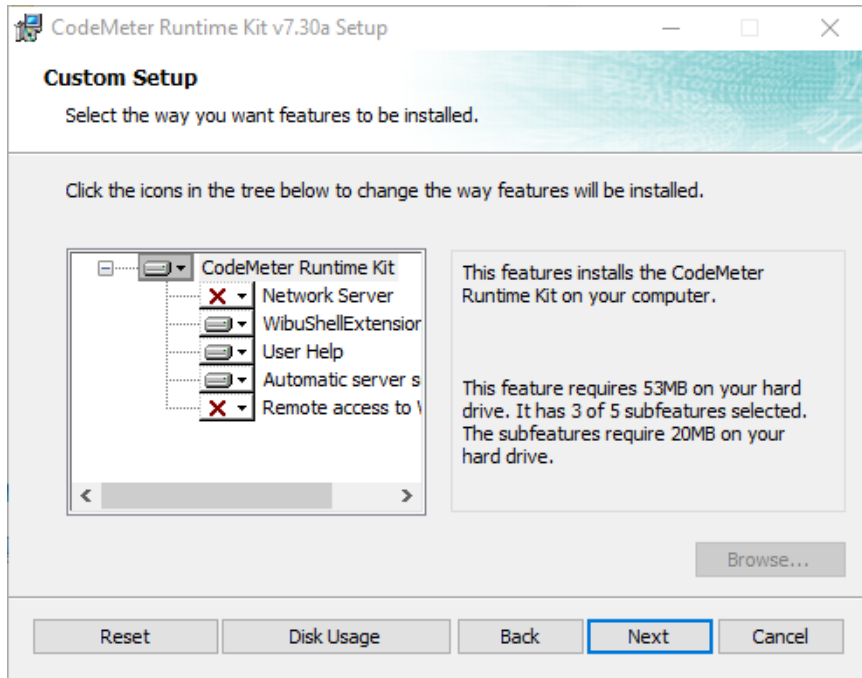
At the bottom, there are three buttons: 'Back', 'Next' (highlighted with a blue border), and 'Cancel'.

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**

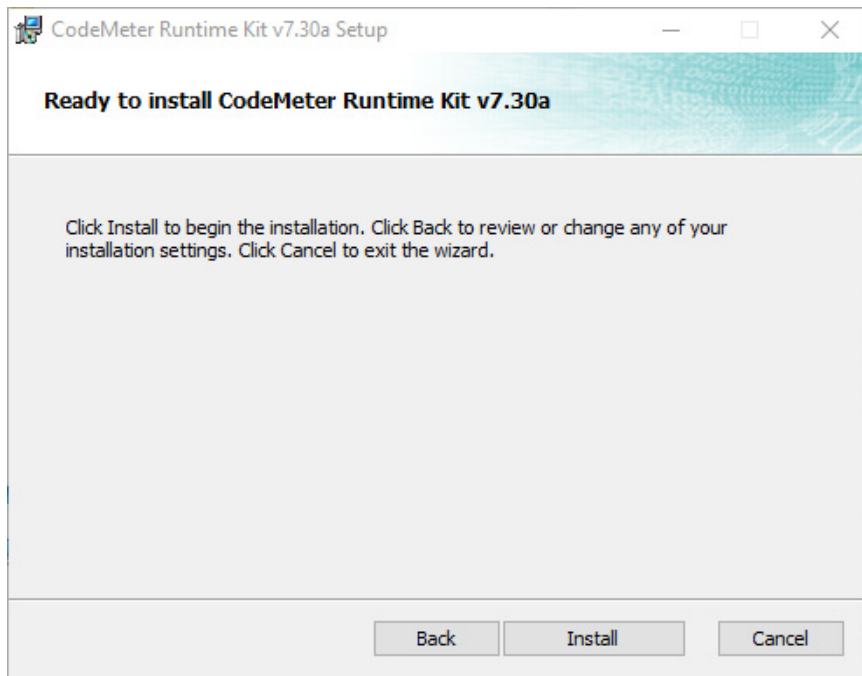
*CodeMeter Runtime Kit Setup*



Select **Next** to continue.

**Ready to Install**

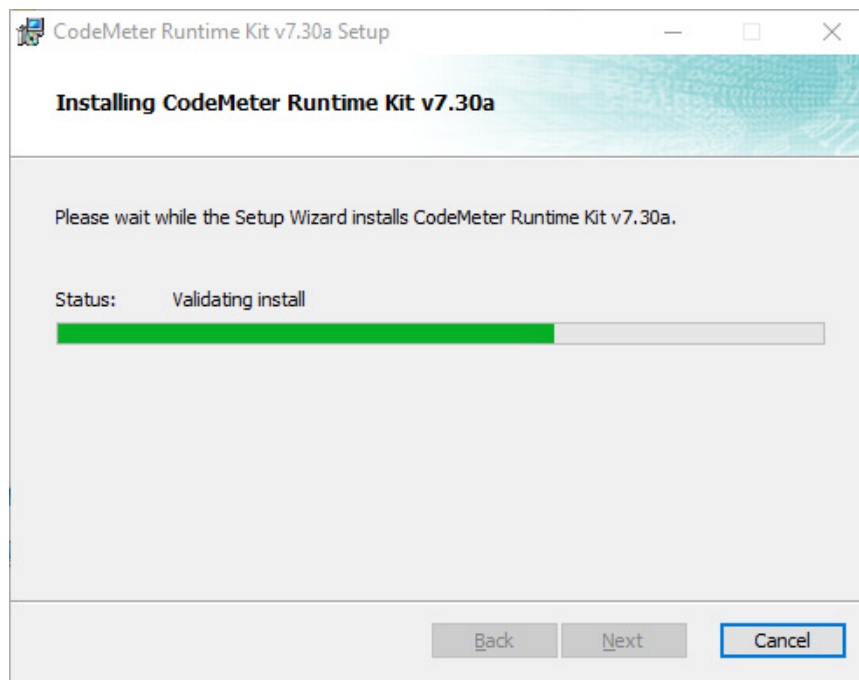
*CodeMeter Runtime Kit Setup*



Select **Install** to continue.

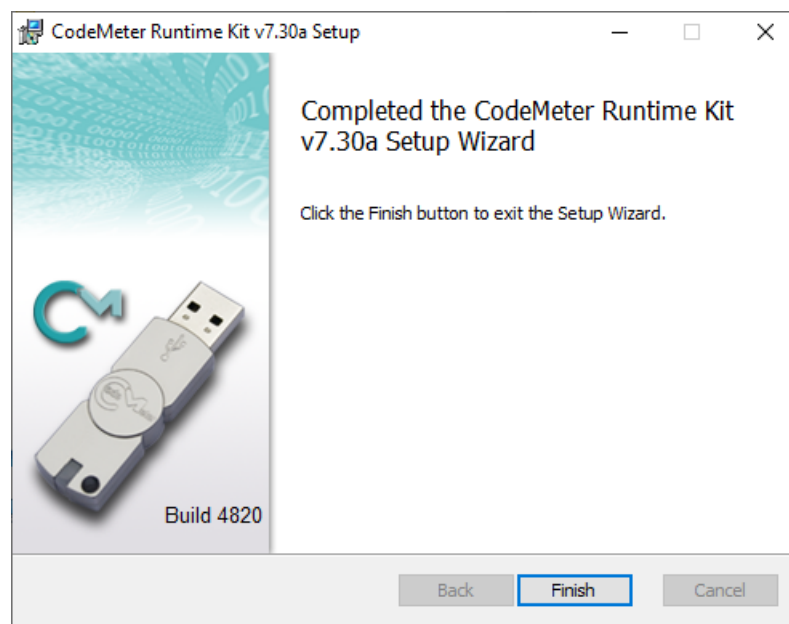
## Installing

## 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 [28.2.1 Installing CodeMeter Drivers](#).

Continue to [28.2.2 Installers for 12d Model](#) or return to [28.2 Installers for Lock Drivers and 12d Model](#).



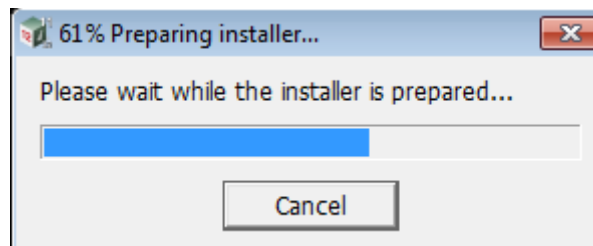
## 28.2.2 Installers for 12d Model

There are different **Installers** for installing the 64-bit or 32-bit **12d Model 15**.

1. Installer for 64-bit **12d Model** exe for Windows 10 and above.
2. Installer for 32-bit **12d Model** exe for Windows 10 and above.

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.

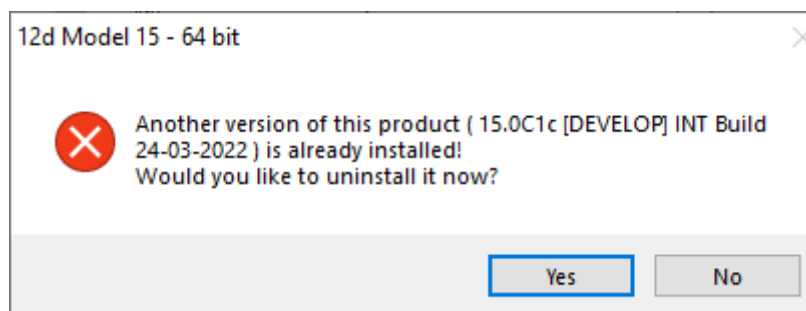


**Note** - the following screens are for the **64 bit** install but the **32 bit** install is identical except the words **64 bit** are replaced by **32 bit**.

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.

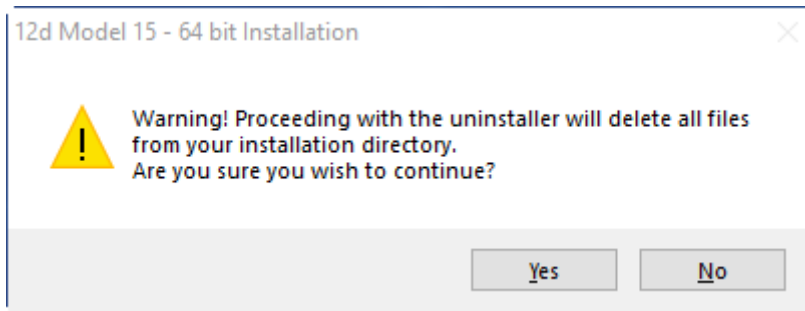
**Note:** The uninstall deletes everything in the **12d\12dmodel\15.00** folder in **Program Files** (or in Program Files (x86) for a 32-bit Install on a 64-bit O/S) so you should never modify any of those files.



Click on **Yes** to continue.

You then receive a **Warning** that the files will be deleted.





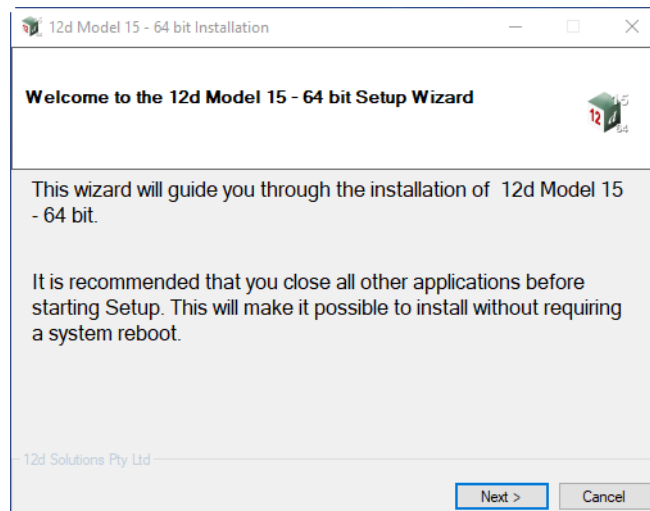
Click on **Yes** to continue.

All the files in the **12d\12dmodel\15.00** folder in **Program Files** (or in Program Files (x86) for a 32-bit Install on a 64-bit O/S) 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**

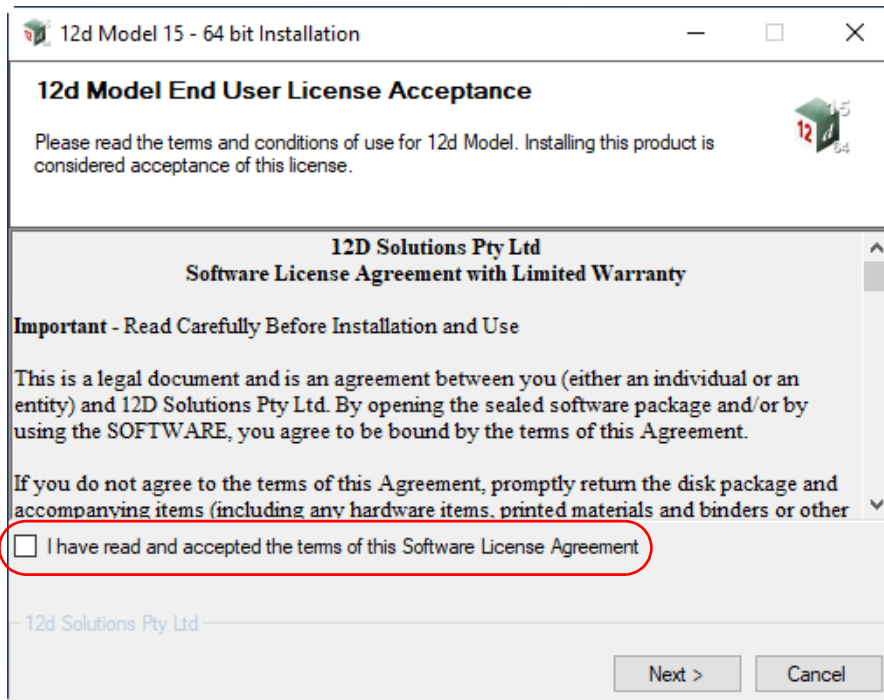
*Welcome message*



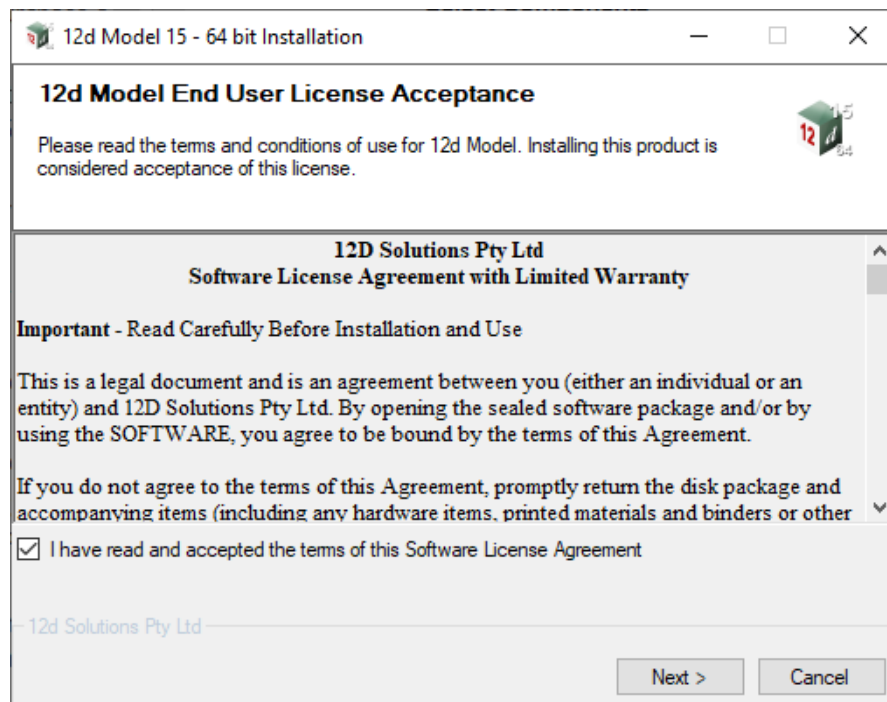
Select **Next** to continue with the installation

Software License Agreement

12d Solutions license agreement

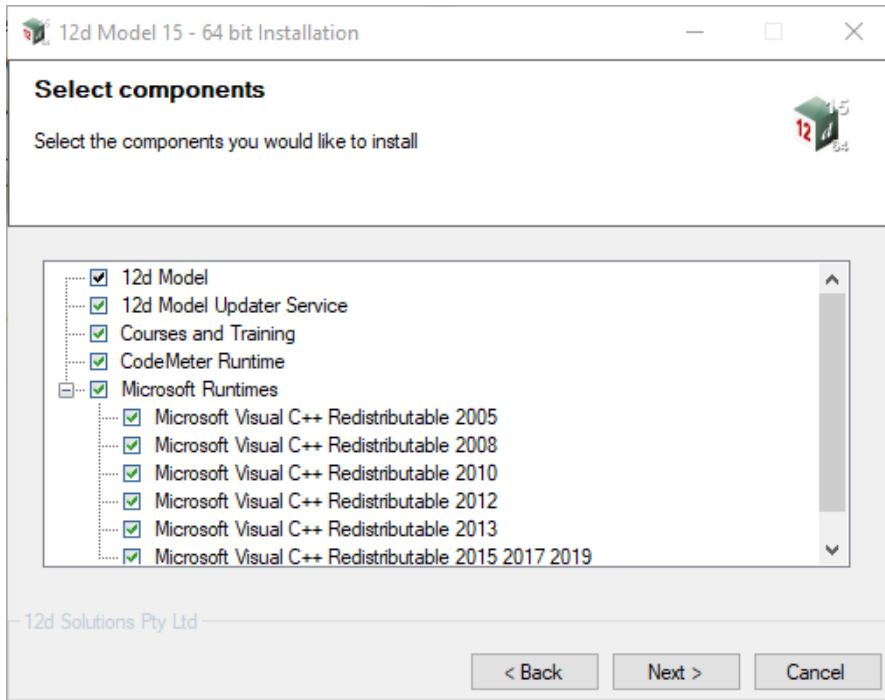


If you agree with the License conditions, **tick on *I have read and accept the terms of the Software License Agreement.***



Select **Next** to continue with the installation

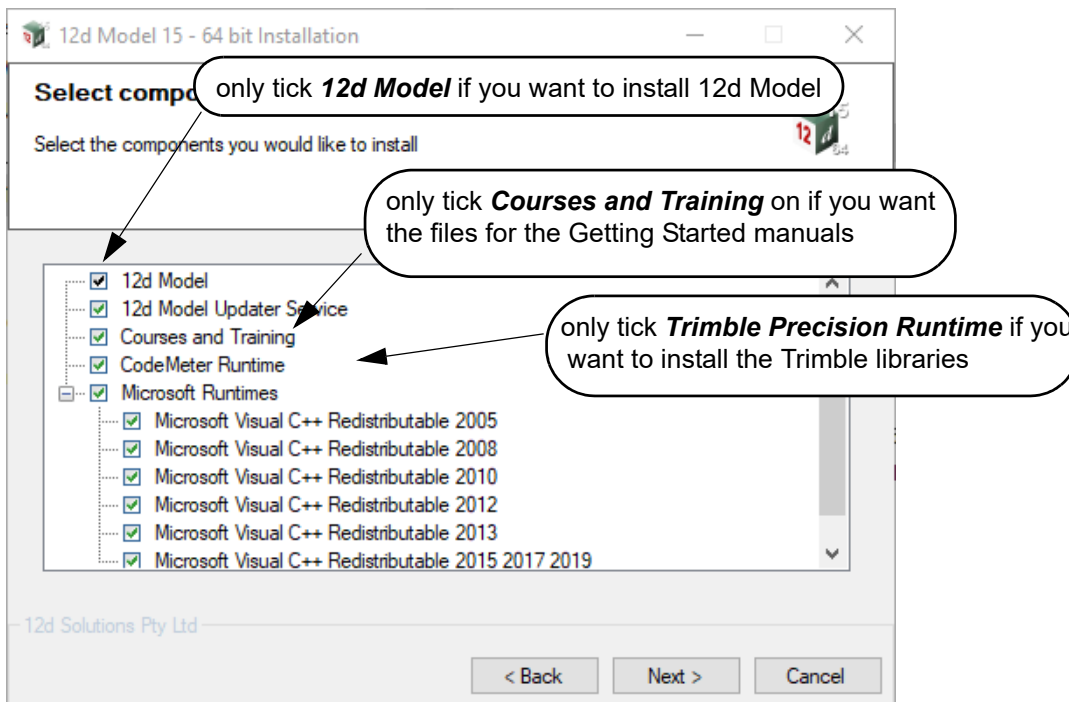
### Select Components



Tick on **12d Model** to install **12d Model**.

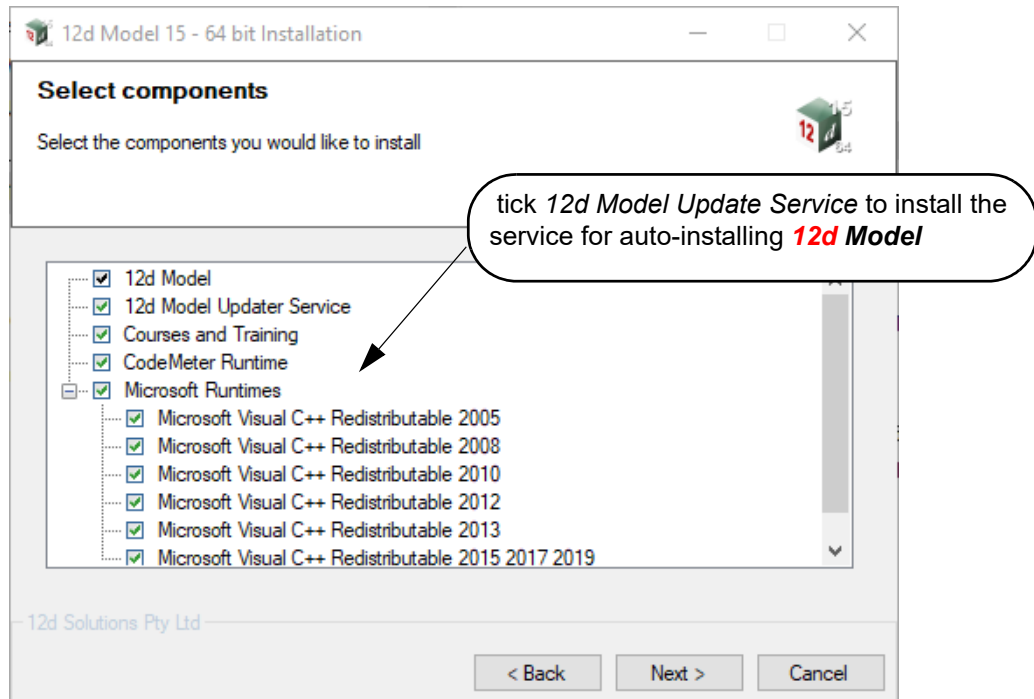
Tick on **Courses and Training** if you want to install the files for the **Getting Started** manuals.

Tick on **Trimble Precision Runtime** if you want to install the Trimble libraries.

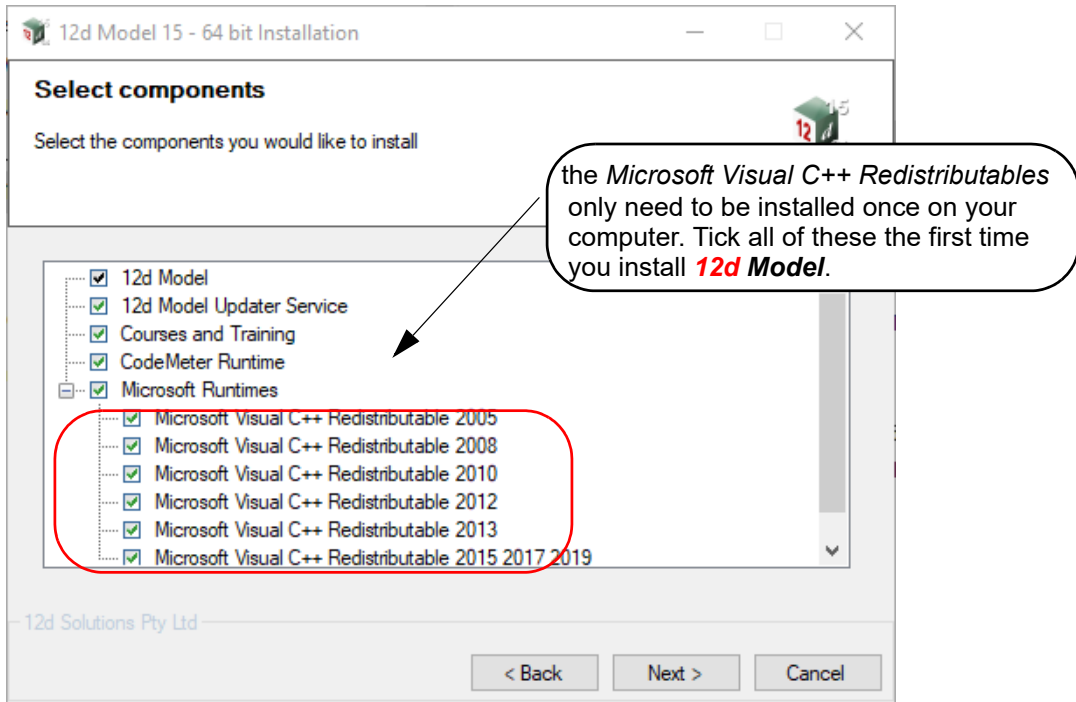


The **12d Model Updater Service** creates a **background Service** that is used to install new versions of **12d Model 15** without needing Admin privileges.

For information on setting up and using the **12d Model Updater Service**, see [2.6 AutoUpdater for 12d Model 15](#).

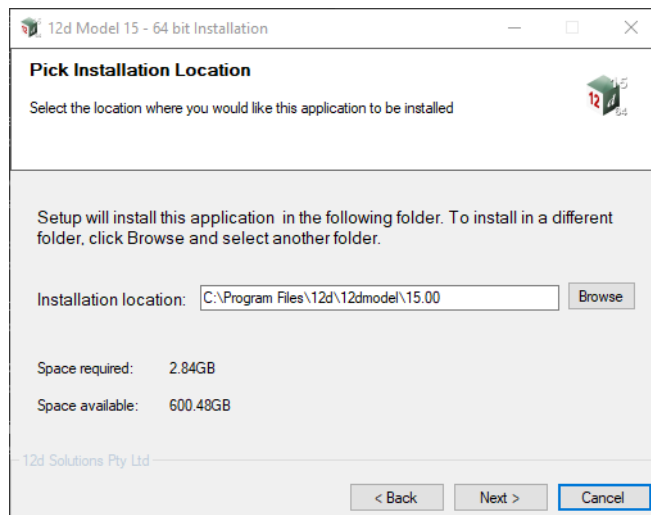


The **Microsoft Visual C++ Redistributables** only needs to be installed once on your computer. If you install **12d Model** again then you can leave them unticked.



After ticking on the required components, select **Next** to continue with the installation

### Installation Location



Continue with the default installation folder for the software:

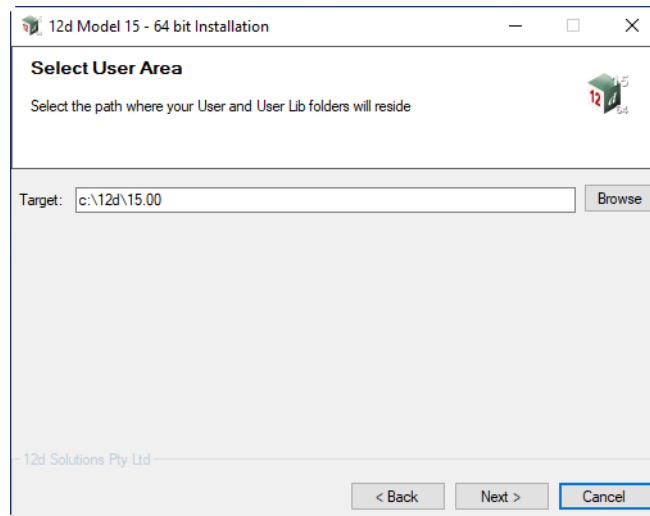
*for 64 bit version: c:\Program Files\12d\12dmodel\15.0*

*for 32 bit version: c:\Program Files (x86)\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



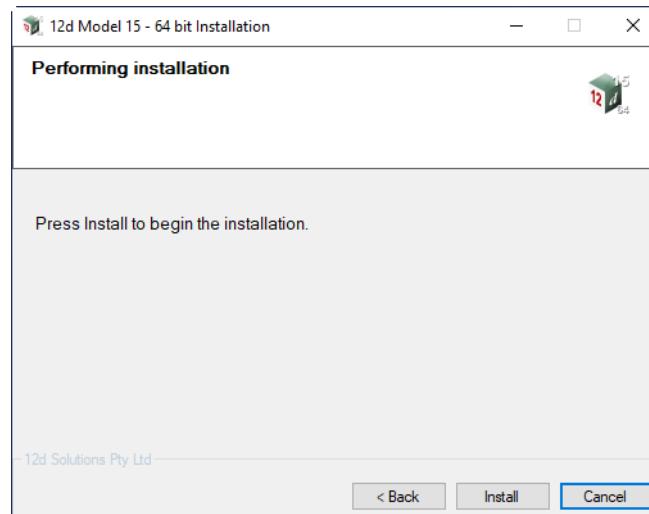
Continue with the default folder for the **User Area** for the software:

`c:\12d\15.0`

or click on **Browse** to browse to another folder for the User Area.

Select **Next** to continue with the installation

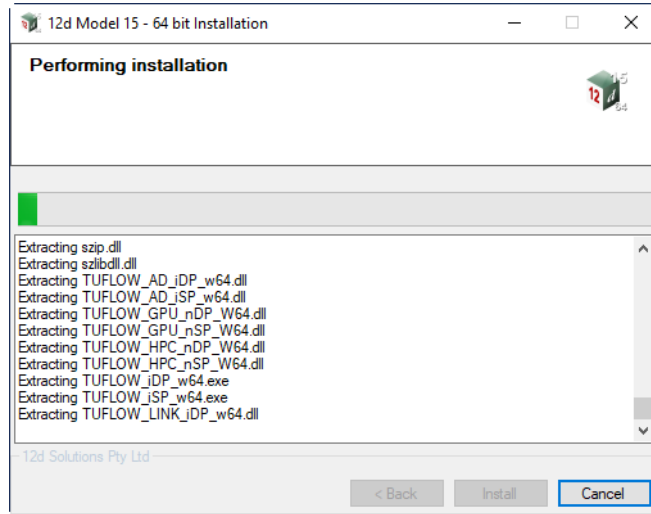
## Ready to Install



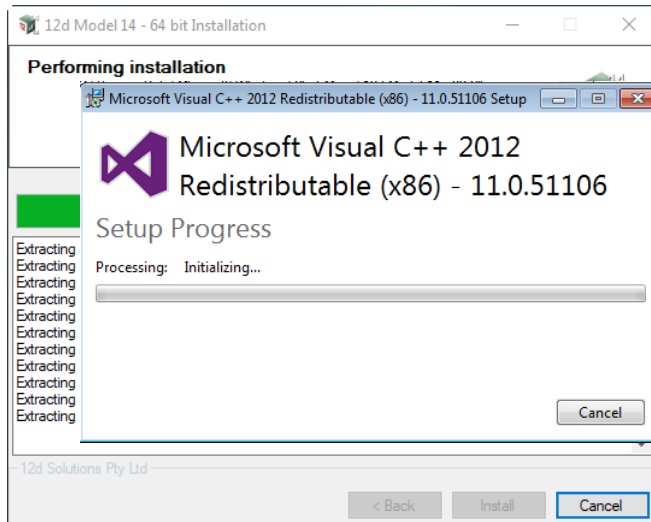
Select **Install** to begin the actual installation.



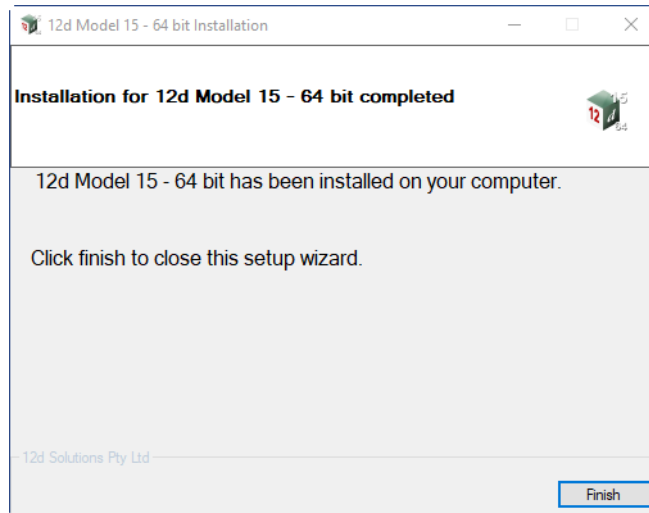
The software will be copied and installed onto the computer.



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.

**Setup Complete**

End of the installation.

Select **Finish** to complete the installation

This completes the installation of the **12d Model** software.

Continue to [28.3 User, User\\_Lib and env.4d for 12d Model 15](#) or return to [28.2 Installers for Lock Drivers and 12d Model](#).

## 28.3 User, User\_Lib and env.4d for *12d Model 15*

See

[28.3.1 User](#)

[28.3.2 User\\_Lib](#)

[28.3.3 env.4d](#)

[28.3.4 nodes.4d](#)

Or continue to [28.4 Network Hardware Locks and 12d Model](#) or return to [28 Moving to 12d Model 15](#)

### 28.3.1 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 [28.3.2 User\\_Lib](#) or return to [28.3 User, User\\_Lib and env.4d for 12d Model 15](#).

### 28.3.2 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 [28.3.3 env.4d](#) or return to [28.3 User, User\\_Lib and env.4d for 12d Model 15](#).

### 28.3.3 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 [28.3.1 User](#).

Continue to [28.3.4 nodes.4d](#) or return to [28.3 User, User\\_Lib and env.4d for 12d Model 15](#).

### 28.3.4 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 [28.4 Network Hardware Locks and 12d Model](#) or return to [28.3 User, User\\_Lib and env.4d for 12d Model 15](#) [28.3.4 nodes.4d](#) or [28 Moving to 12d Model 15](#).

## 28.4 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 [28.3.1 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 [28 Moving to 12d Model 15](#).





# 29 12d Programming Language

It is the available functions in the **12d Model Programming Language** (macros) that gives the language its power.

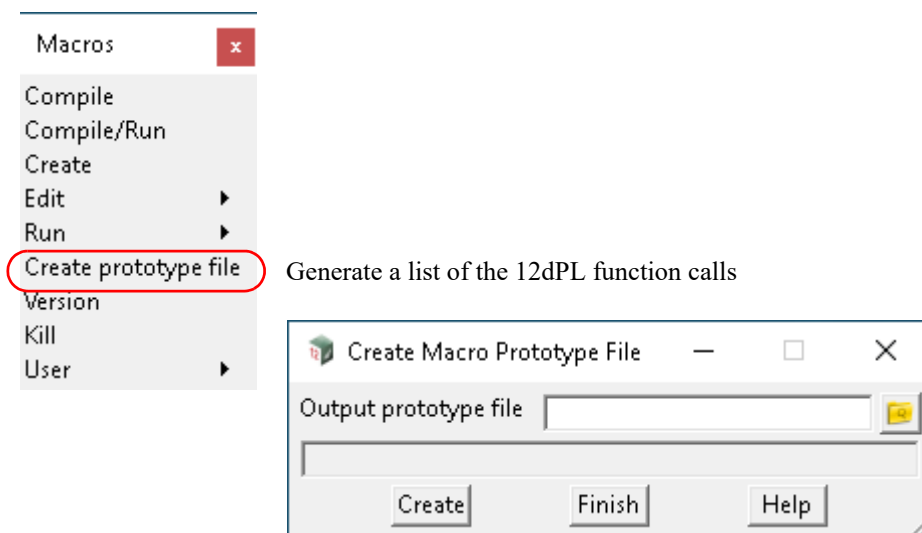
So new functions calls are added to the **12d Model Programming Language** (12dPL) with each release of **12d Model**, and often in sub-versions.

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**.

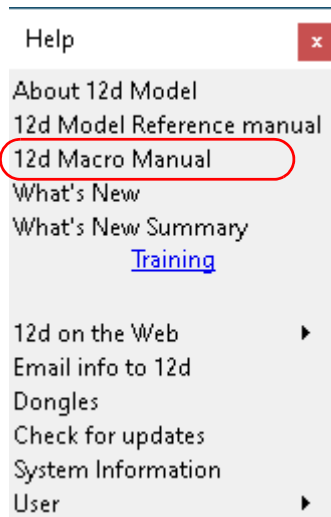
For **12d Model 15 C1e**, the highest ID is 7746

```
Integer Convert_to_polymesh(Real deflection,Integer relative_deflection,Dynamic_Element  
&trimeshes); // ID = 7746
```

So 3,983 new function calls have been added going from **12d Model 14 C2e** to **12d Model 15 C1e**.

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.



get the 12d Model Programming Language pdf