12d Model

Getting Started
for
Design

Version 9

May 2009

12d Model 9 Getting Started for Design Manual

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Disclaimer

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

No warranty of fitness for a particular purpose is offered.

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

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

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Preface

Why a 'Getting Started for Design' Manual ?

12d Model is supplied with a comprehensive on-line Reference manual which describes the function of each menu option in detail. It is a Reference manual however and makes no attempt to describe how to use 12d for production surveying and civil engineering work.

The *Getting Started for Design* manual is designed to show you how to work with the on-line help system, and then as the first section of Training, help you start to learn how to use *12d* to achieve typical civil engineering tasks. The *Getting Started for Design* manual uses examples where possible to clarify usage. It complements rather than replaces the on-line Reference manual. In general, information in the on-line Reference manual will not be duplicated here.

The *Getting Started for Design* manual is available as a printed manual and as a PDF file on the *12d Model 9 Installation DVD* and the *12d Model Training DVD*.

Training Material

The training tutorials assumes that a series of files are already on your hard disk. These tutorial files are automatically installed from the CD during installation of the *12d Model* software.

Getting Started for Surveying

There is also a *Getting Started for Surveying* which has the first seven chapters in common with the *Getting Started for Design* manual (on-line help and basic modelling) but then diverts to cover topics from the direction of a Surveyor whereas the *Getting Started for Design* manual continues on with alignment design techniques.

The *Getting Started for Surveying* manual is available as a printed manual and as a PDF file on the on the *12d Model 9 Installation DVD* and the *12d Model Training DVD*.

Using the Practise and Small Versions of 12d Model

The Practise version of *12d Model* is limited to a maximum of 5,000 points. Following the procedures as stated in the Training Manual may create projects with more than 5,000 points.

Where appropriate, the text will suggest how to vary the input for each instruction so that the example feature can be completed within the limits of the *12d Model Practise* version.

The number of points used at any time in the Practise and small versions can be displayed by the option

Projects => Check base points

The easiest way to reduce the current point count is to delete any unwanted models with

Models => Delete

The installed icon on your desktop for running the practise version of 12d with these training files is labelled ***12d 9 Practise***.

Please Note: Projects created by Practise versions of *12d Model* cannot be accessed by *Release* versions of 12d Model and vice-versa.

1   Installing 12d Model

The *12d Model 9 Installation DVD* can be used to install the *Release* and *Practise* versions of **12d Model 9**.

The *Practise* version is limited to a maximum of 5,000 points and creates projects that cannot be accessed by the *Release* versions of *12d Model* and vice-versa. However the Practise version can be used free of charge by *12d Solutions* customers and registered Practise Users.

Installing the Release Version for Sites Not Running 12d Model 8 or 12d Model 9

For a **new** installation of the **Release** version of *12d Model 9*, the user is provided with

(a)   one *12d Model* dongle

(b)   one *12d Model 9 Installation DVD*

(c)   an email with the *12d Model 9* authorization file *nodes.12d9n* attached, or a folder with the *12d Model 9* authorization file *nodes.12d9n* or *nodes.4d* in it.

Please check that you have all three items before commencing the installation.

The **notes** and **video** for a new install of the *Release* version of *12d Model 9* are on the **12d Model 9 Installation DVD** or can be downloaded from the 1*2d* web site *www.12d.com* under the *Updates* area.

Installing the Release Version for Sites Already Running 12d Model 8 or 12d Model 9

Existing *12d Model 8* or *12d Model 9* users already have a dongle and so are only provided with

(a)   one *12d Model 9 Installation DVD*

(b)   an email with the *12d Model 9* authorization file *nodes.12d9n* attached, or a folder with the *12d Model 9* authorization file *nodes.12d9n* or *nodes.4d* in it.

For existing *12d Model 8* users, your existing dongle can be used with *12d Model 9*. If *12d Model 9* is **already** running on your computer, please **uninstall** it before installing a new version of *12d Model 9*.

The **notes** and **video** for a new install of the *Release* version of *12d Model 9* are on the **12d Model 9 Installation DVD** or can be downloaded from the 1*2d* web site *www.12d.com* under the *Updates* area.

Installing the Practise Version:

To install a **Practise** version of *12d Model 9*, all that is needed is:

>   one *12d Model 9 Installation* DVD
>
>   or   *12d Model 9 Practise* downloaded from www.12d.com

The *Practise* version must be Registered with *12D Solutions* once it is installed on a computer. A new Registration is required for each computer that the Practise version is run on.

The **notes** and **video** for installing the practise version of 12d Model 9 are on the *12d Model 9 Installation DVD* or can be downloaded from the 1*2d* web site *www.12d.com* under the *12d Model 9 Practise* area.

2   Before You Begin the Training

2.1   Installing the Training Files

If you have installed Training from the *12d Model Installation DVD*, then the *Training* folder will have been automatically created for you but where the files reside on the disk depends on whether you installed the *Release* version or the *Practise* version of 12d Model.

The Training manual dialogue assumes that the working folder (i.e. shortcut) of your **12d Model 9** or **12d Model 9 Practise** icon is set to

> c:\12d\9.00   for the *Release* version of 12d Model

and

> c:\12 Model 9 Practise   for the *Practise* version of 12d Model

The training files can be place in any sub-folder on your hard disk but for convenience in this manual, it is assumed that the training files are installed in

> c:\12d\9.00\Training

All the required material is already in the **Training** folder.

2.2   12d Icons on your Desktop

It is recommended that you use the **12d Model 9** icon for the **Release** version or **12d Model 9 Practise** icon for the **Practise** version whilst initially working with this training manual. The reason for this is that the icon points directly to the folder that containing the **Training** folder.

2.3   Using the Practise Version

Remember that the **Practise** version of 12d Model is limited to a maximum of 5,000 points.

Following the procedures as stated in the Training Manual may create projects with more than 5,000 points. Where appropriate, the text will suggest how to vary the input for each instruction so that the example feature can be completed within the limits of the *12d Model Practise* version.

2.4   Overview of 12d File and Folder Structures

Before you begin using 12d, it is useful to understand how 12d uses the file and folder structure under Windows 2000, XP and Vista.

12d recognises long filenames up to 256 characters so you are not limited to the old DOS convention of 8.3 filenames.

The 12d software and its support files are installed on your hard disk, the program itself is installed into the folder c:\Program Files\12d and various subfolders below. The training data and user areas, are installed into the folder c:\12d9.00 and subfolders below.

When the software was installed, the **12d Model 9** program icon is setup to point to the folder c:\12d\9.00.

The tutorial is about designing a road and the training the files have been set up in a folder c:\12d\9.00\Training\9.00\Design\Getting Started Basic.

As each 12d Model project you work on will have different files, it is strongly recommended that you keep each project in a separate subfolder. This can be anywhere on your hard disk or network. For convenience, you may prefer to keep them all under one major folder e.g. c:\12djobs.

In the general case for production work however, if you were about to start work on a new project by the name 'Highway', you would like it to be in a new folder under say 12djobs i.e. c:\12djobs\Highway. This is simply done from within 12d Model where a folder of the same name as the project is automatically created with the project inside it.

Either numeric or alpha characters and spaces can be used in 12d Model project names so you may prefer

to use your job name as the project name. Also 12d project names are *not* case sensitive so 'Highway' is seen as the same name as 'highway'.

2.5 Why Keep Projects in Separate

12d can have more than one project within the one Windows folder. For example, projects under 'Highway' might be 'Stage 1' and 'Stage 2' or 'Fred' and 'Bill'. Each project has its own data and configuration setup which controls the number of views, which models are on display etc.

However although most internal 12d project files are kept separate another projects internal files, all *input* and *output* files, *mtf* files, *chains*, *plots* and *reports* go into the folder containing the project and are not held inside the project itself. Hence to prevent projects interfering with each other, it is best to create a separate folder and create each project in its own folder.

For example, if the Highway project has two stages, create the project *Stage 1* in the folder *Highway\Stage 1* and the project *Stage 2* in the folder *Highway\Stage 2*

Once inside 12d, from within any one project, it is possible to import any or all data from another project so there is some flexibility on a major job to move/copy survey or design data between stages if staging is used and then have multiple users perform parallel development. Model and tin sharing could later be used to subsequently assemble staged project data at the completion of a major job. Within any one project, model names must be unique so some planning is necessary if parallel development streams are subsequently to be reassembled. Models can be renamed at any time. Models are discussed in See Chapter 4.11 (on page 42).

Provided no 12d user is currently accessing a particular project, the project (and the folder containing it) can be copied, renamed, moved and deleted from within 12d.

WARNING - information inside the project itself *should not* be manipulated except from within *12d Model* since this may corrupt the project and data could be lost. For example, model names can only be renamed from within 12d Model.

If you need to manually place any files on disk for a project (e.g. survey files from a total station or CAD files to get data into 12d), it is recommended that you place them in the folder containing the project. that way all the data and the project are in the one folder.

2.6 File Backup Procedures

To ensure that you can retrieve any job or project at any time from backup procedures, it is important that a complete 'set' of files is taken whenever backup is created. To backup the files associated with the 'Highway', you would typically backup all files and sub-folders in and below

> c:\12djobs\Highway

There are configuration files used that may be used in the Highway job, that are supplied by 12D Solutions and are automatically installed from the 12d Model Installation DVD. These files are in

> c:\Program Files\12d\12dmodel\9.00\set_ups
>
> c:\Program Files\12d\12dmodel\9.00\library

There are other user configurable files that 12d may use and require to fully recreate all steps of a project. They are not supplied on the 12d Model Installation DVD. These files are typically in

> c:\12d\9.00\user
>
> c:\12d\9.00\user_lib

These folders may contain files that have been configured specifically for your site e.g. your corporate standard mapping, template and plot parameter files, your particular Total Station survey macros and any user defined macros etc. In general, such files are not project specific, however because these files are user configurable they may be changed at any time and hence particular project specific versions of them may be needed as part of the complete file set of a project.

In the above case, the folders shown are for 12d Model 9. As implied, the files in these folders will never

be changed automatically by the installation process when you reinstall a later version of 12d.

The above paths are indicative only. It is possible that folders have been setup at different places for your site. For more information on exactly where all library and user folders are located, refer to the following environment variables in Appendix A of the on-line Reference manual.

> USER_4D
> USER_LIB_4D
> SET_UPS_4D
> LIB_4D

3   12d Model Help

The 12d Help can be accessed by selecting *12d Model* on the *Help* menu item on the main 12d Model menu.

On help	Help on Microsoft's help system
12d Model	12d Model help
12d Macro Manual	12d macro programming language help
12d on the Web	links to web site www.12d.com
About 12d Model	12d Model modules authorized
Email info to 12d	email details of your 12d Model to 12D Solutions
Dongles	dongle testing panel
System Information	brings up Microsoft's System Information panel

Alternatively, individual topics for a panel or menu can be invoked by using the **F1** key or the **Help** button on any 12d Model panel.

More information on the Help system will now be given.

Contents

The **Contents** allows you to look at the overall structure of the Help and access any part of it.
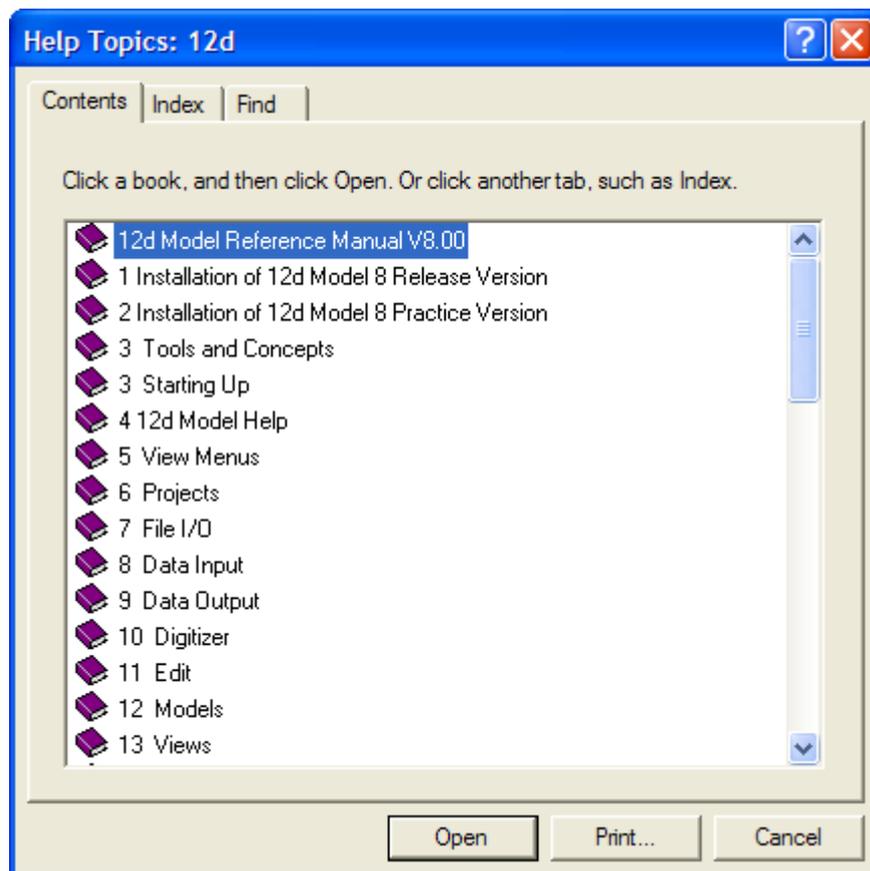
Warning - only *topics* in the Help can be accessed through the *Contents* list so any folders in the Content folders must be expanded until topics are displayed. *Topics* can be easily identified because they have a question mark beside them indicating that Help is available.

For example, double clicking on *Tools and Concepts* expands the next level of *Tools and Contents*.
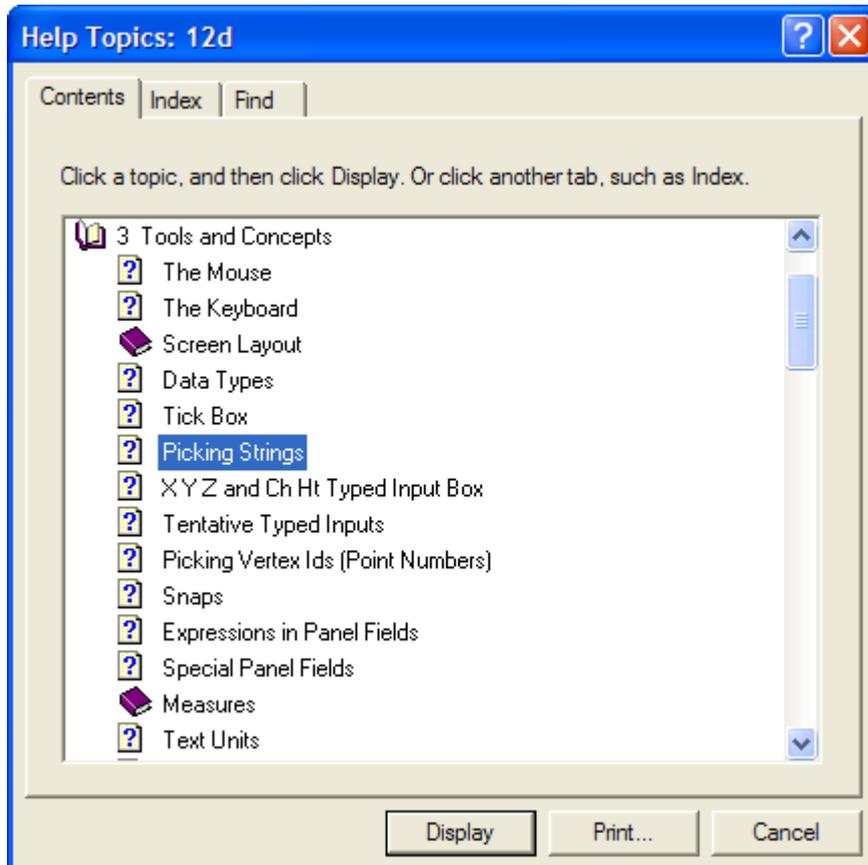
Double clicking on the topic *Picking Strings* will then display the topic.

The *Contents* then disappear leaving *Help* open at the selected topic.
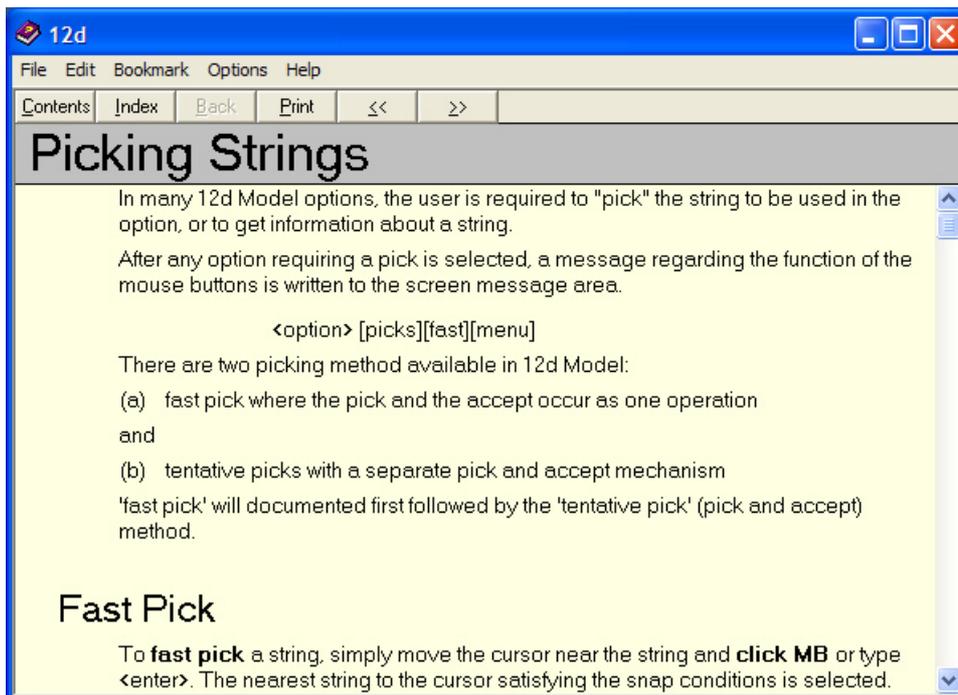
Double clicking on *Contents* on the top of the Help will bring the Contents listing back up.

Index

The *Index* option searches through all entries in the Index of the Help.

As the first few characters of the required entry are typed in, the matching index entries are displayed.
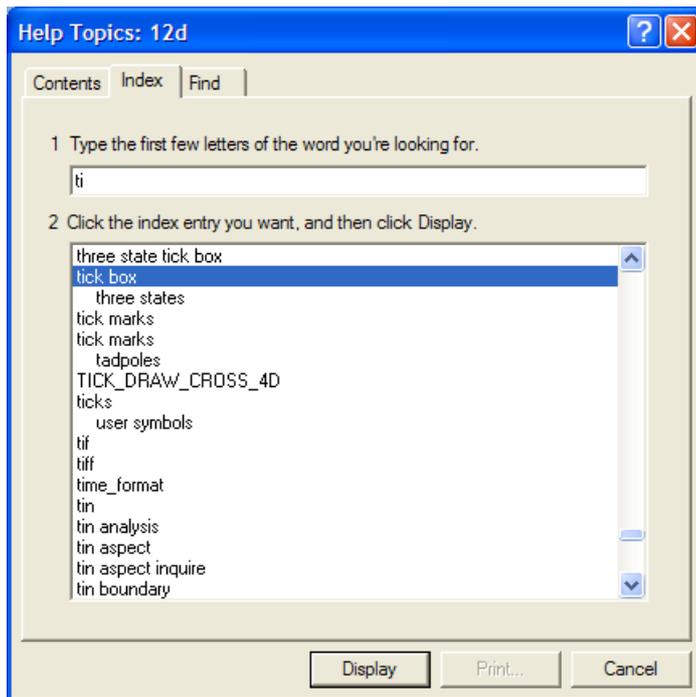
Double clicking on the displayed entries will go to the topic in the Help containing the selected index entry. If more than one topic includes the index entry, then the list of topics is displayed.

If the index has sub-indices, they can be searched by first typing in the main index followed by a comma, then a space and the first few characters of the sub-index.

Find

The most powerful searching method for the Help system is *Find*.

Simply click on the *Find* tab to search for words or phrases that may be contained in a Help topic.

If *Find* is being invoked for the first time, the **Find Setup Wizard** runs to create an index of every word in the Help.

From then on, selecting the *Find* tab goes straight to the *Find* screen.
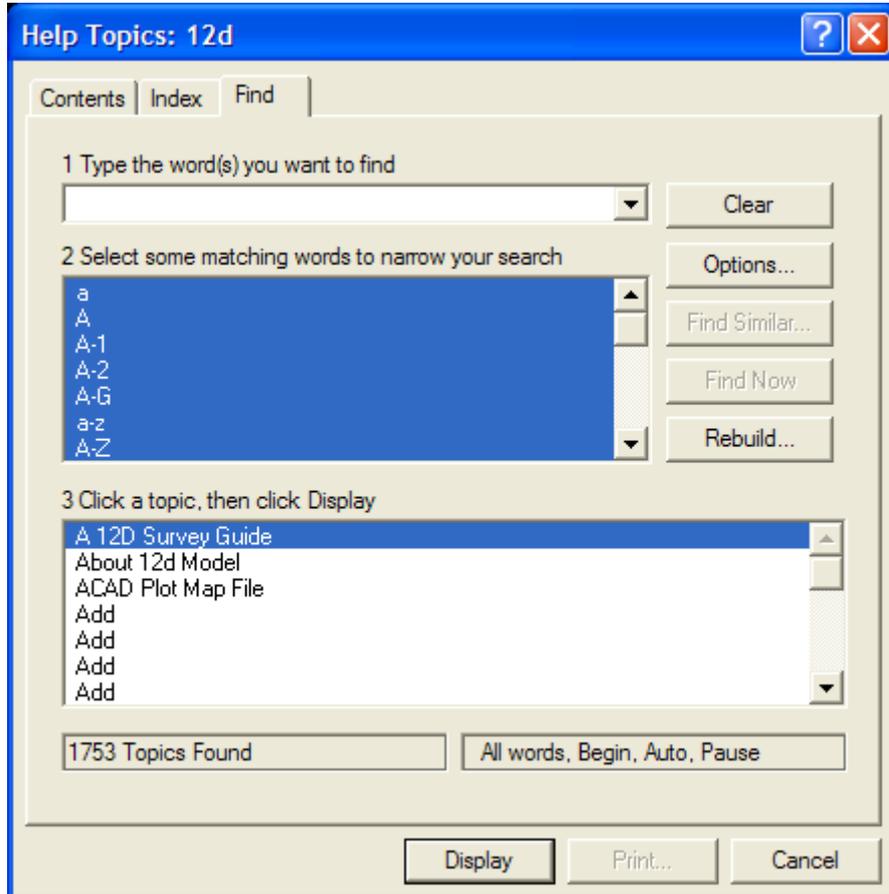
Panel Help Button

Every panel has a Help button which when selected goes to the *topic* describing that panel.

Help button to go directly to the Help topic for the panel.
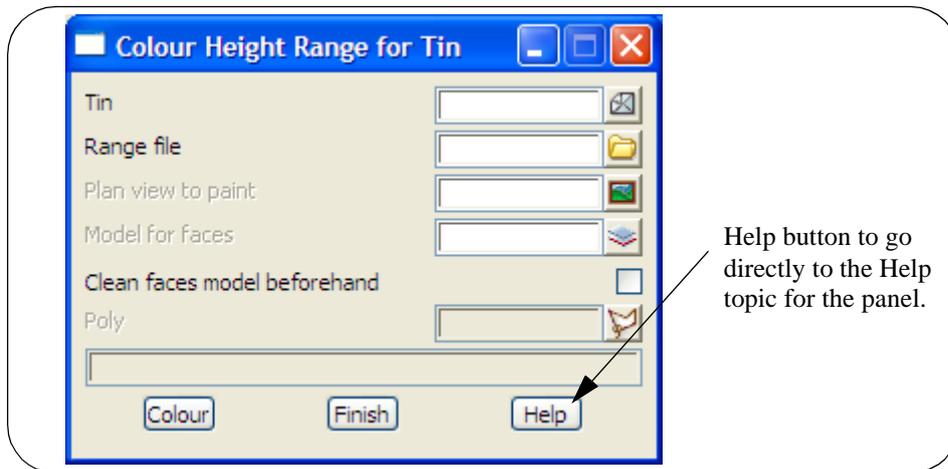
F1 Key

Another method of invoking Help is by using the F1 key as follows:

when a menu or panel is on the screen and has focus (the menu or panel title area will be highlighted), pressing F1 will bring up the help for that menu or panel.

Warning - some of the items on the *Strings* menu automatically start up a string select and change the focus from the panel to a View. This means that pressing F1 will bring up the Help for the View and not the Help for the panel.

To get Help for such a panel, click on the panel to bring the focus back to the panel before pressing F1. The top of the panel will highlight showing that it has focus.

Navigating in Help

Once at a *topic* in the Help, the << and >> buttons at the top of the Help topic will go to the previous and next Help topics respectively.

Individual Help topics can be printed by clicking **Print** at the top of the Help page.

print the
current topic   go back one topic   go to next topic
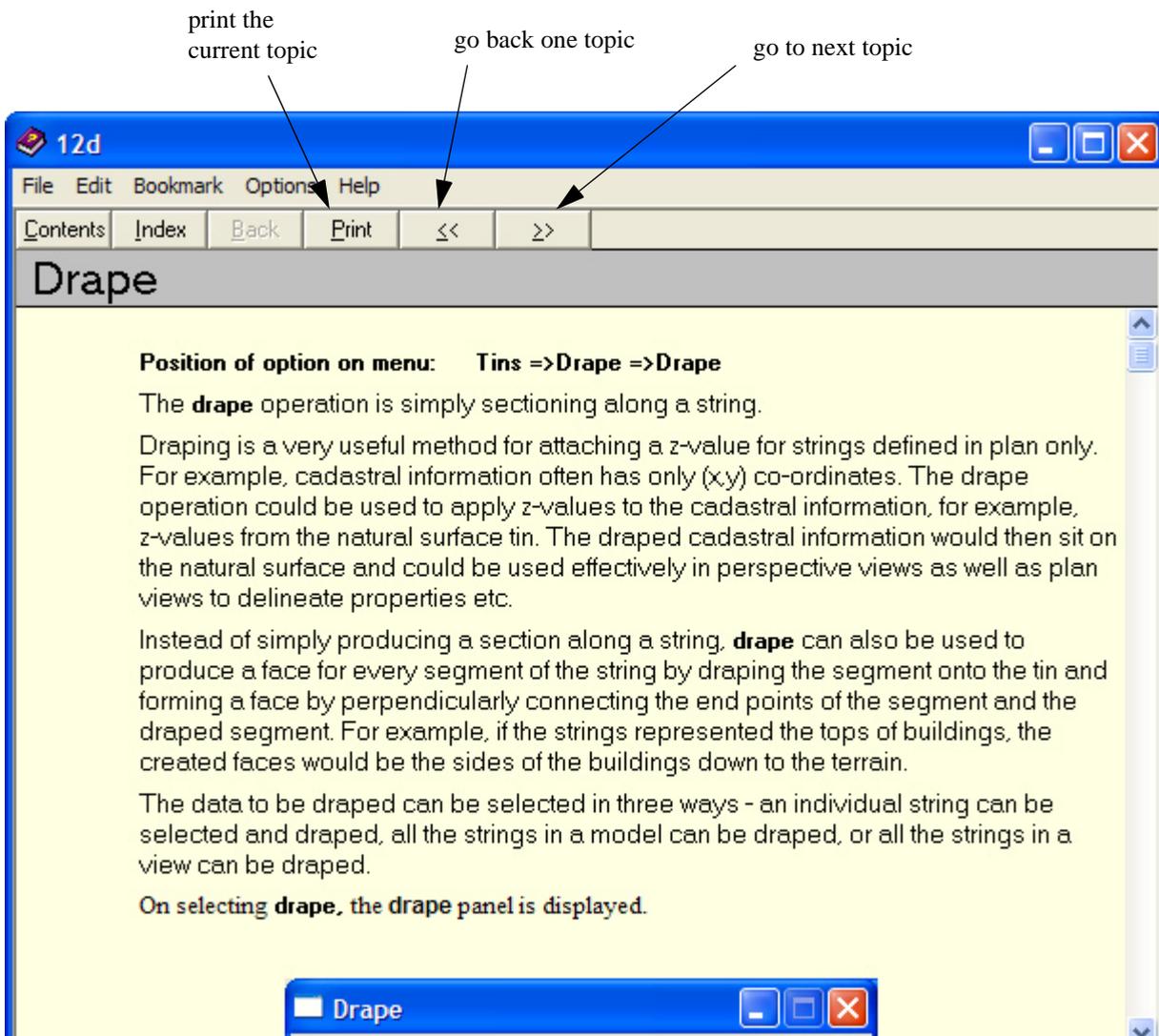
Because it is difficult to print large sections of Microsoft's Help system, a PDF file of the entire *12d Model Reference* Manual has been created and can be used to print out large sections of the manual.

The *12d Model Reference* Manual PDF file is on the *12d Model 9 Installation DVD* in the folder Documentation\Reference_Manual.

4   Basic Operations

4.1   The 'Mouse'

12d works best with a three button mouse (preferable a wheel mouse). 12d will work with a (Microsoft) two button mouse but the lack of the middle button means that you have extra mouse clicks to perform.

All 12d Documentation uses the following notation for mouse functions.

LB = left mouse button   - used for picking screen items, menus etc.

MB = middle mouse button   - used to accept the highlighted item

RB = right mouse button   - used to pop up a list of alternatives

The left button is the 'Select' button – typically used to select graphic items or text. The middle button (or wheel) is the 'Accept' button, used to confirm a selection. The right button is the 'Menu' button. It is context sensitive and often displays a list of alternatives available at that instant.

With a two button mouse you achieve this functionality by clicking the right mouse button to pop up the 'Pick Operations' menu and then clicking LB on **Accept** or by simply pressing the <Enter> key

The term 'clicking' a button means pressing it down and releasing it again. The position of the mouse is taken at the time the button is <u>released</u>. In this tutorial manual, items that are selected by a mouse click are in **bold**.

As we get more experienced, we will also introduce the term 'dragging' the mouse for some advanced 12d operations. We do this by pressing down a button and <u>whilst still holding it down,</u> moving the mouse so that the screen cursor moves. Once a definite distance has been achieved, just a millimetre or two is sufficient, release the button. 12d notes the vector you defined and can use this information to detect the direction in which you dragged the mouse.

Finally, we will use the term 'double clicking'. This is where we press the button twice in quick succession. This is often used for short-cuts.

4.2   Starting Up - The Project Selection panel

If you installed **12d Model** from the *12d Model Installation DVD*, then a **12d Model 9.0** icon will have been created on your desktop. Double clicking on this icon will take you directly into the 12d\9.00 folder.
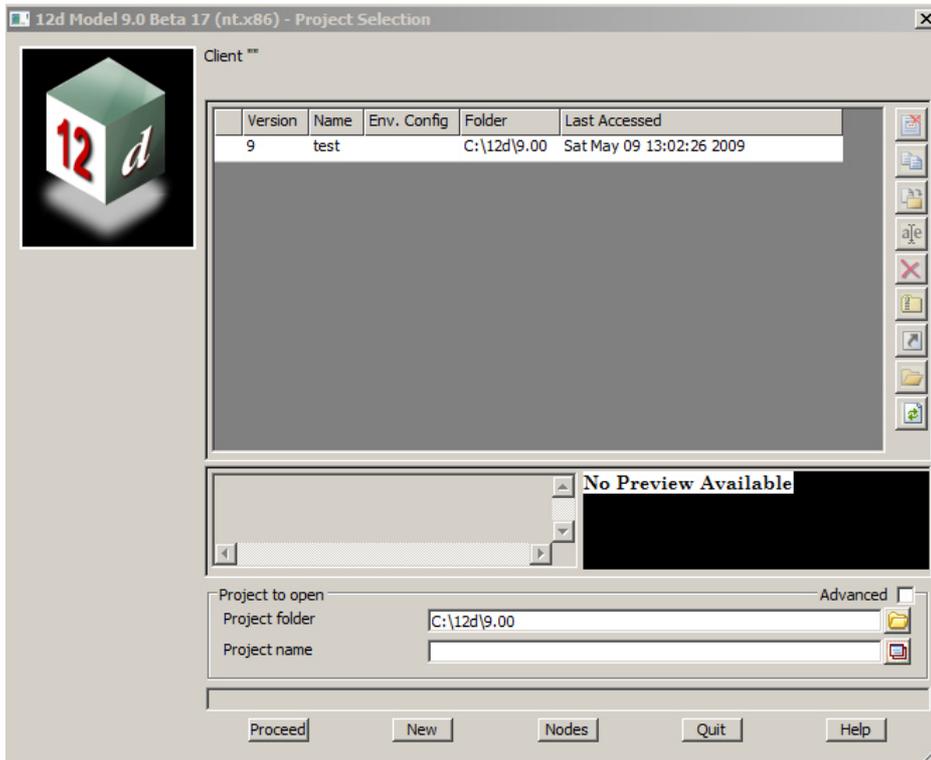
Once you are inside 12d, the Project Selection panel will appear.

To create a new project click the LB on *New* button at the bottom of the panel.

By clicking the LB on the folder icon, navigate to the folder **C:\12d\9.00\Training\design\getting started basic**

Type in the Project name 'STAGE1'

Leaving the *Create working folder* check box ticked will firstly create a new folder prior to creating the project folder. The working folder has the same name as the project
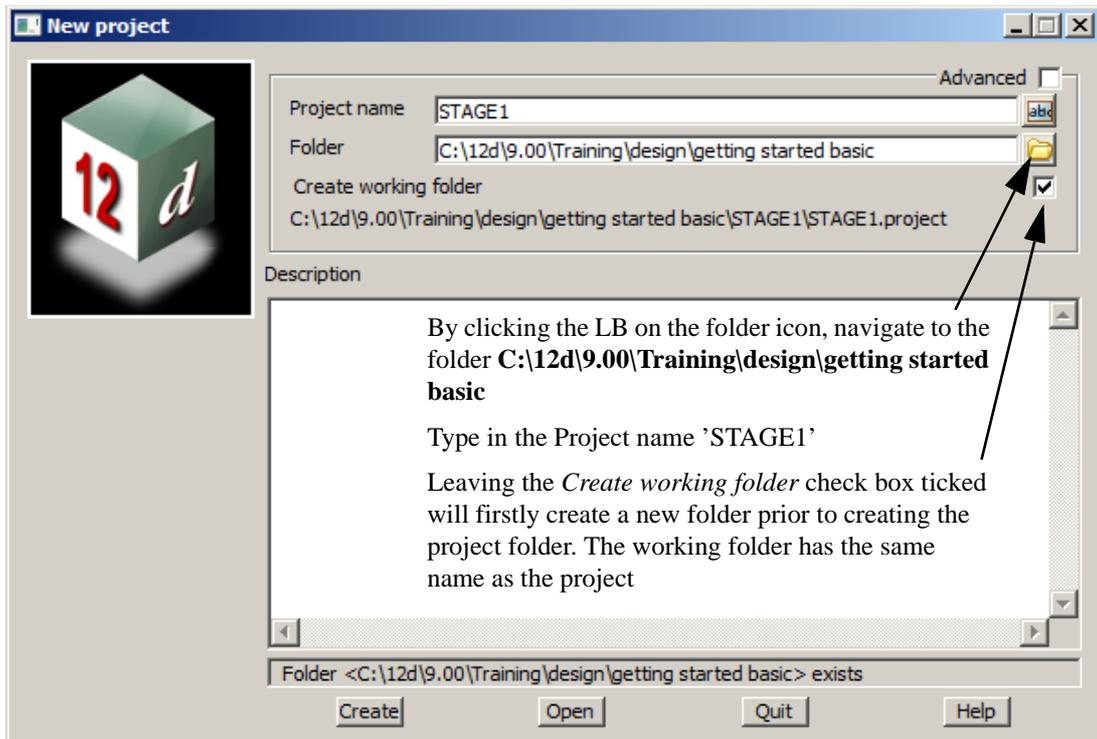
Click LB on *Create* button to create the project.

Notes:

1. It is important to select names that are meaningful to your job as you may have several projects associated with a large or complex job.

2. You only need to create a new project once. To access this project in subsequent 12d sessions, double click the LB on the project name from the pop up list. 12d will normally pop up the list automatically. If needed, you can use the   button to open the list manually.

RULES FOR ENTERING DATA INTO PANELS

Important: The cursor must be locked into the appropriate data entry field when typing data into a 12d panel. Often this will happen automatically. If you cannot see the cursor flashing in the data field in which you want to enter data, use the mouse to position the cursor anywhere over the data field and click the LB to lock the cursor into the field before typing any data. Terminate the data entry sequence by pressing the Enter key.

If you make a mistake, you can always select the erroneous entry by double clicking over it with the mouse LB. The text should then appear highlighted. As you retype it, the old entry is deleted.

When filling in data in any 12d panel, it is not essential to terminate the entry of data by pressing the 'Enter' key. You can use the 'Tab' and 'BackTab' keys to move from field to field. You can also use the mouse to jump between fields. If you do press the Enter key to terminate the entry of data into a field, 12d will immediately validate the data in that field and supply an error message if appropriate

Once a project is selected, the graphics screen will display, with the *Setup Project Details* panel open. Fill in the panel with the relevant required details

Note that you must use the LB to click between fields and cannot use the 'Enter' or 'Tab' keys

Click on *Set* to save the details and *Finish* to close the panel.
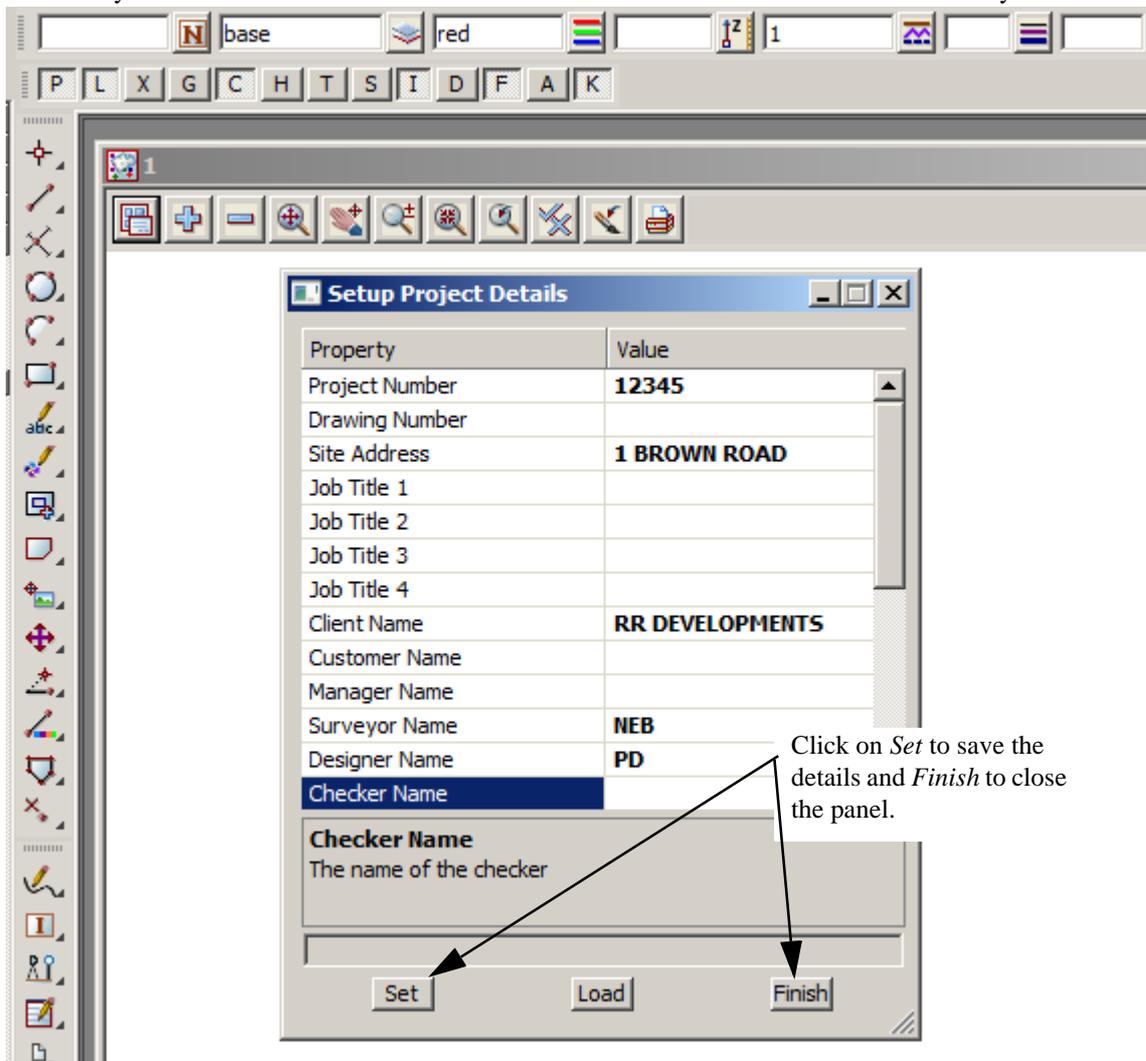
4.3   The Initial Screen Layout

The default background colour for a view is black. Black is the best colour for reducing eye strain, and for distinguishing colours displayed in the view. The names we use for the various parts of the screen are shown on the diagram below. Your screen may not appear exactly as shown as most components on the screen can be moved or turned off by user configuration options.
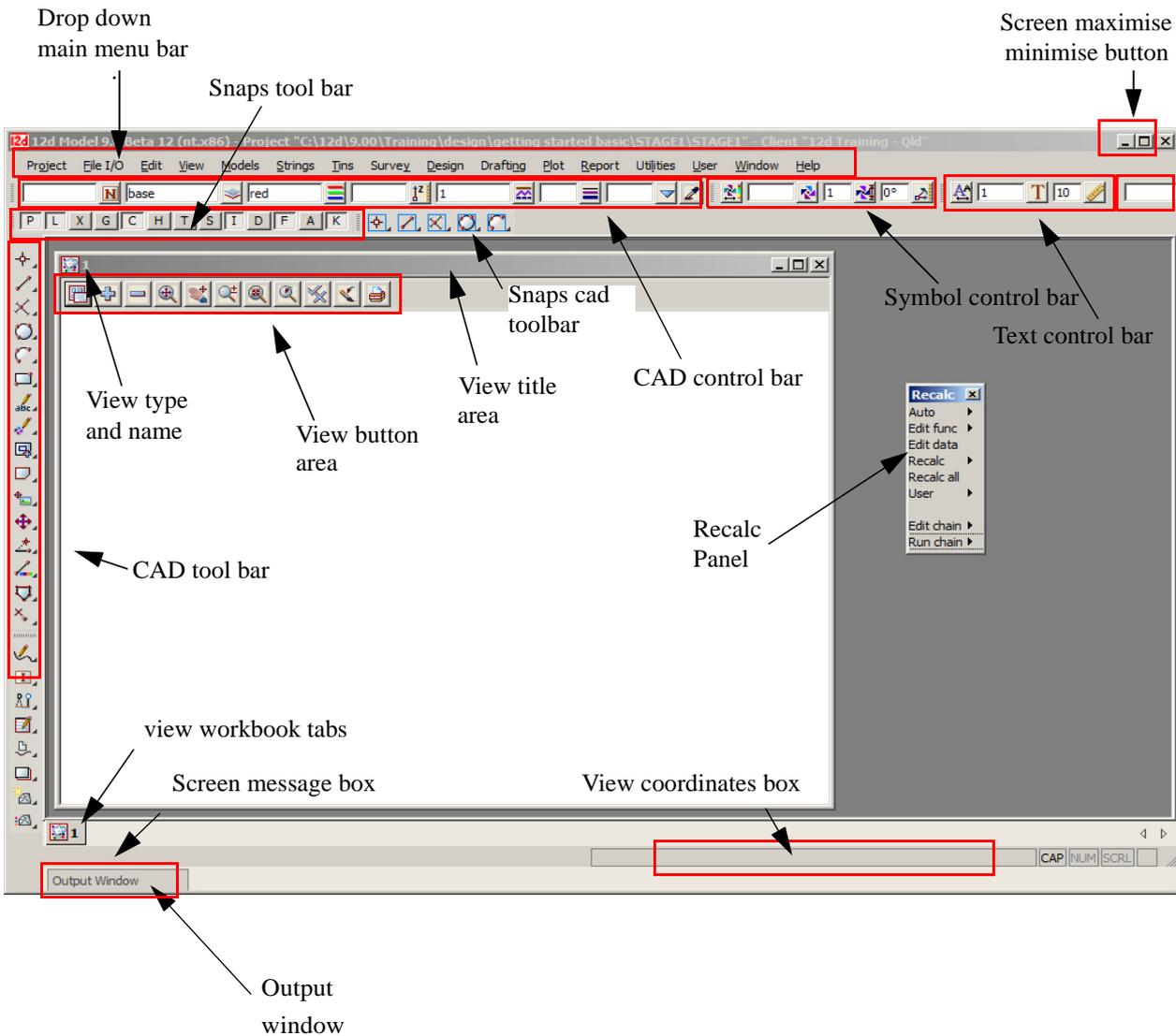
To make the *Getting Started* manuals easier to print on in-house printers, all of our illustrations have a white background colour.

Note that the View with the white background is headed 'Plan 1'. Each View in 12d is assigned to a Window. Like all Windows, they can be Minimised, Maximised or Closed.

The Plan View "1" can be maximised by clicking LB on the square button in the top right hand corner of the view menu.

Minimise

Maximise

Close
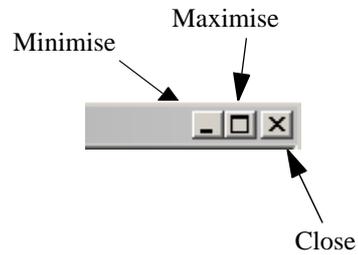
This then takes up the entire viewing area. Alternatively, you can double click LB on the plan view title area to maximise the view (The blue area to the left of the Minimise button). To reduce it back to its original size you can hit the restore icon.

Restore icon
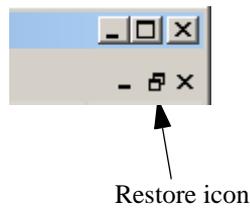
The 'Recalc' panel is used to quickly rerun design calculations and will be discussed later. We will move the panel down to the bottom left of the screen.

The view should then look as shown below.
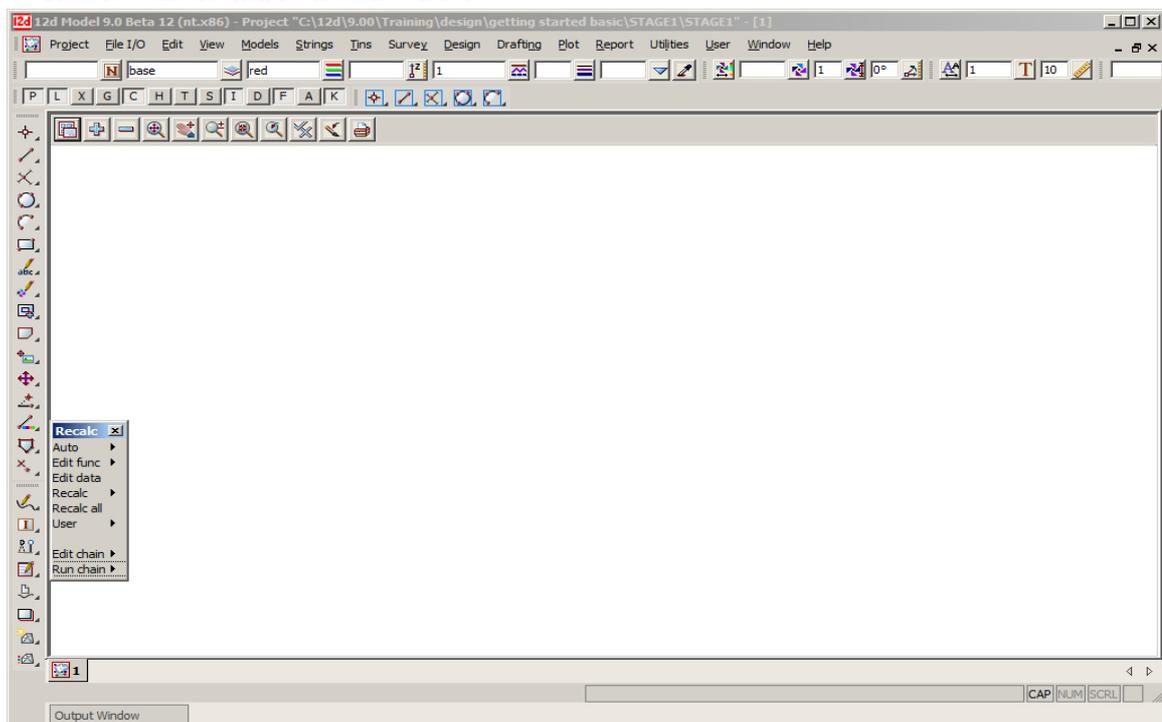
4.4   How to Find Your Way Around 12d Menus

12d options are run by a number of methods. The 'Drop Down' menu system from the bar running across the top of the screen is the main way we access 12d programs.

In addition to the 'Drop Down' Main menu system, there is a '12d Model' menu which is maintained for compatibility reasons with earlier versions of the software. This is found at **Projects=>12d Model menu**.

click on 12d Model menu
brings up the old menu
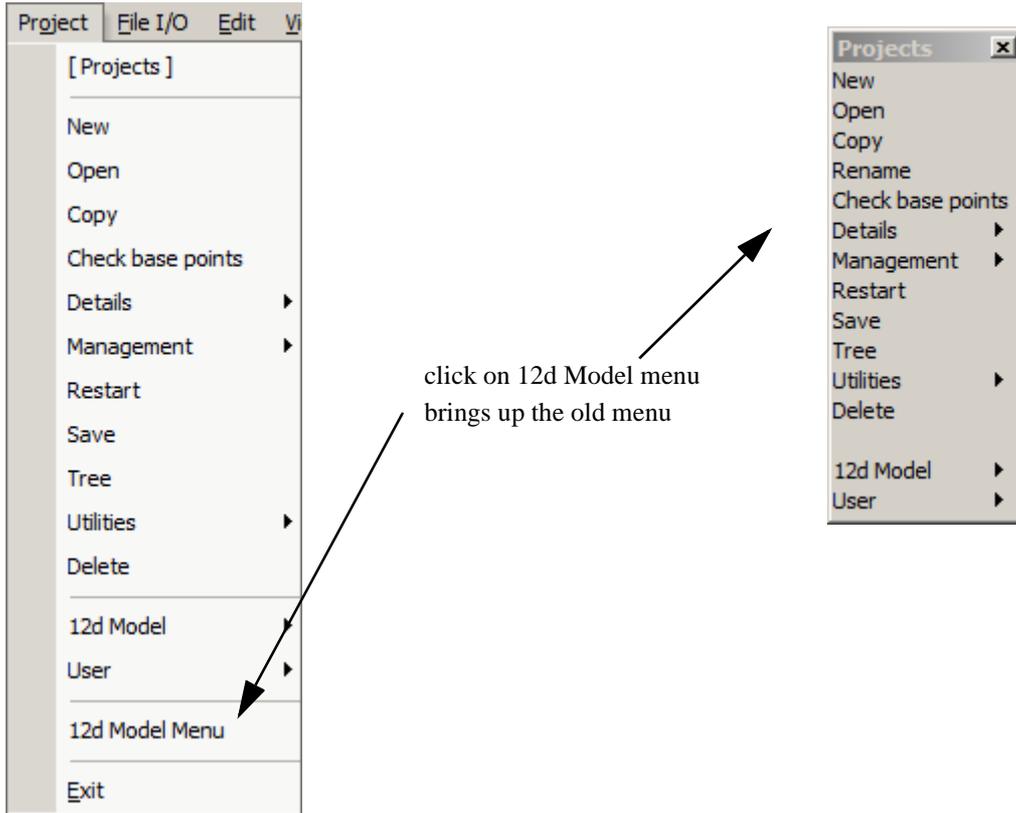
12d has a unique graphical user interface (GUI) involving hundreds of menu items. These are logically grouped by function in a 'Walk Right' and 'Tear Off' menu system. 'Walk Right' menus are menus designed such that if you move the mouse cursor right on a menu item containing a right arrow, a further menu will pop up, usually on the right hand side. 'Tear Off' menus means that a menu can be torn off it's parent menu and relocated elsewhere on the screen for clarity of operation. In general, it is possible to have multiple copies of the same 'Tear Off' menu on the screen at one time.

Notice that the order of items left-to-right on the 'Drop Down' Main menu bar is the same as the top-to-bottom order on the 'Walk Right' 12d Model menu. You can select menu items from either one of these sources – the end result is the same.

The 'Drop Down' menu bar conforms to normal Microsoft standards so it can be dragged and placed at any of the four sides of your desktop. It is probably most useable left at the top of your desktop.

The following comments apply to ALL menus. To move any menu around on the screen, you 'drag' it by **depressing** the LB in the 'blue' coloured View Title area, anywhere other than over the 'X' in the top right hand corner. With the button still depressed, move the mouse to the desired location and release the button to repin the menu. The same procedures also apply when moving panels and views. When doing this just make sure that LB is clicked in the general heading area and not on a View button.

To ease the learning and usage process, a menu description system has been adopted in this manual that describes where to look to achieve a specific function. For instance, to import an AutoCAD DXF file of point and line data into 12d, you 'Walk Right' on the 12d Model menu or from the 'Drop Down' main menu bar, through two submenus and select DWG/DXF. This instruction is documented as…

File I/O =>Data Input =>DWG/DXF/DXB

To display submenus from the 'Walk Right', you do not need to use the mouse buttons. Simply position the mouse cursor over the 12d Model menu and once 'File I/O' is highlighted, slide the mouse right over the arrow and the 'File I/O' menu will pop up. Slide further right on the 'Data Input' menu item and the 'Data Input' menu will pop up.

Your screen should appear as follows
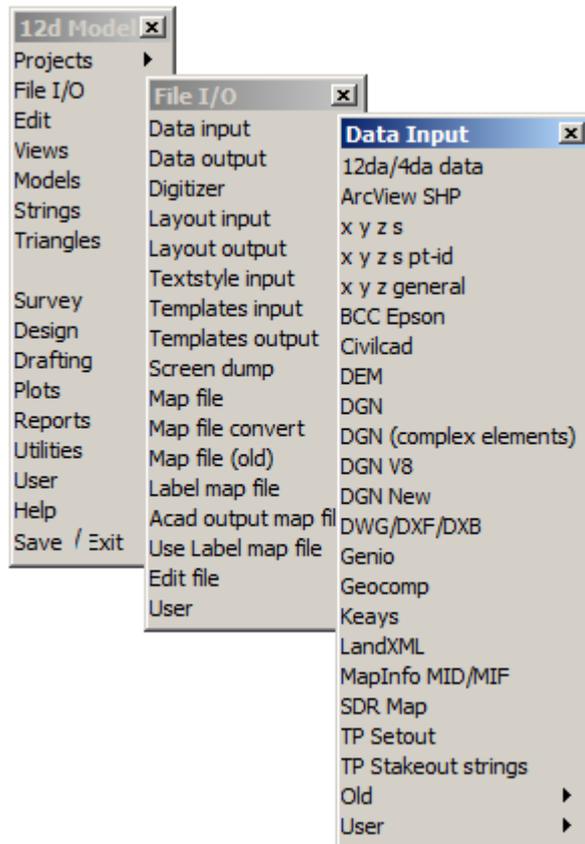
Alternatively, you can use the 'Drop Down' menu bar to get to the same point …

File I/O	Edit	View	Models	Strings	Tins	Survey	Design

[File I/O]

Data input ▶ | [Data Input]

Data output ▶ | 12da/4da data
Digitizer ▶ | ArcView SHP
Layout input ▶ | x y z s
Layout output | x y z s pt-id
Textstyle input | x y z general
Templates input | BCC Epson
Templates output ▶ | Civilcad
Screen dump | DEM
Map file | DGN
Map file convert | DGN (complex elements)
Map file (old) | DGN V8
Label map file | DGN New
Acad output map file | DWG/DXF/DXB
Use Label map file | Genio
Edit file | Geocomp
User ▶ | Keays
| LandXML
| MapInfo MID/MIF
| SDR Map
| TP Setout
| TP Stakeout strings
| Old ▶
| User ▶

To get to this same point using the pull down system, you need to click LB on [File I/O] on the 'Drop Down' menu bar and then proceed as before on the walk rights as shown below.

Regardless of which menu selection method you used, place the cursor over the words 'DWG/DXF/DXB' and click the left mouse button (LB) once. The 'Read DWG/DXF Data' panel will appear.
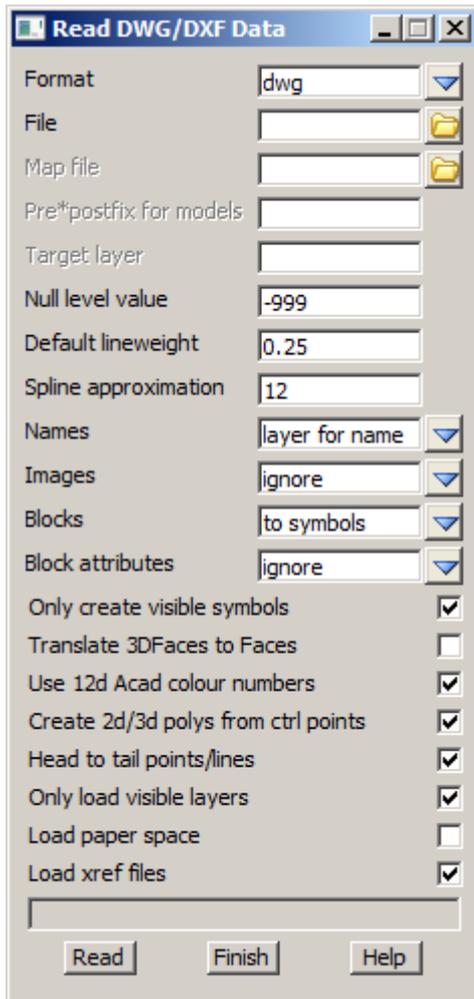
The panel is placed on the screen at the location where the mouse cursor was when LB was clicked.

Once the panel is selected, the Walk Right menu system should collapse and be removed from the screen. If you move and repin any of the menus however, they will not collapse automatically.

If a menu is in the way, you can move it as stated above. Any menu can be removed by clicking LB on the 'X' button in the top right hand corner.

You would normally now start entering data into the panel. At this time, we will not proceed further with this panel. Shut down the panel by clicking LB on the [X] in the top right hand corner or clicking LB on **Finish** at the base of the panel.

4.5 Toolbars and Controlbars

CAD Toolbar and CAD Contolbar

In 12d Model there are CAD options which are available under both the *Strings =>CAD* menu and on the *CAD Toolbar* on the left hand side of the 12d Model screen.

The **CAD** options create various elements using a number of methods. These options make use of **Tool bars** and **Control bars**. Tool bars just have icons on them but Control bars have icons and also controls such as a model box on them. The method groupings are shown on the toolbars (e.g. Points, Lines etc.).

The user can select an icon on the tool bar and a **Flyout** for all options of the grouping are displayed. This can be done by selecting the appropriate group symbol by holding down the left mouse button on the icon. This shows all the different options for that grouping in a flyout panel. Whilst still holding down the left mouse button, the user can move along the flyout toolbar to the appropriate option.
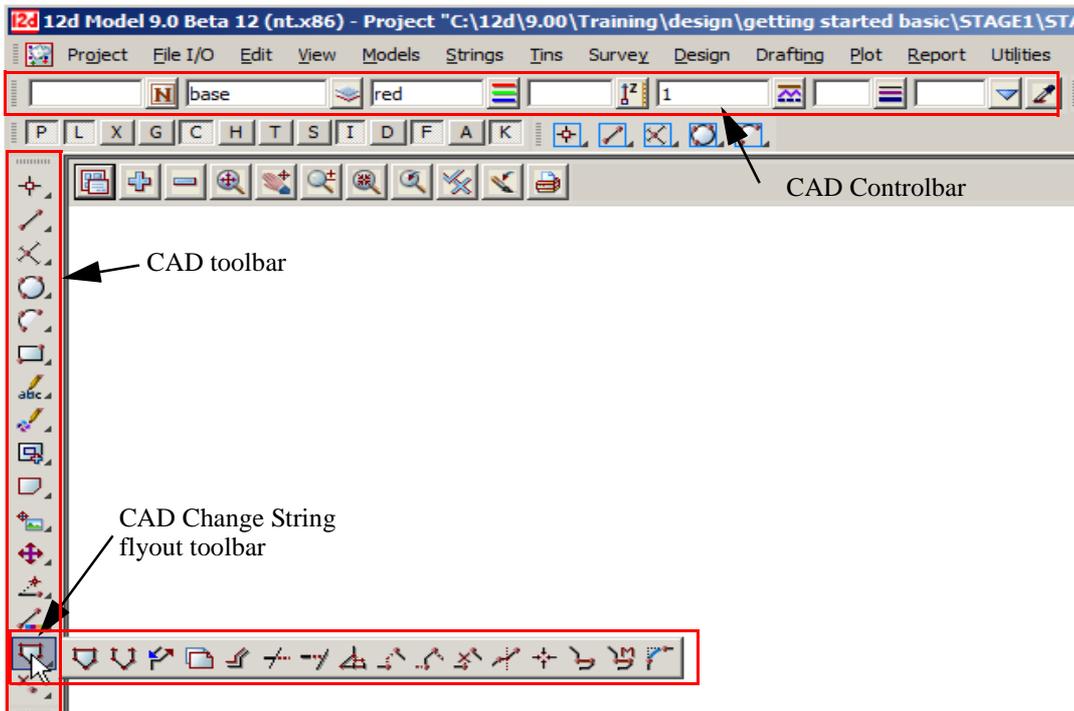
The elements created from the CAD options will have attributes as defined by the **Cad Control Bar**. This control bar is placed on the top left hand side of the screen under the main menu control bar on the creation of a project

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

Field Description	Type	Defaults	Pop-Up
[ ] N	name box		names.4d names

name of string. If a valid name already exists in names.4d, the **[N]** *button can be used to bring up a choice box of available names. On selection of a valid name, the rest of the values in the control bar will be filled out. e.g. colour, linetype etc.*

model box	base	existing models

this field can be recognised by the model icon button on the right hand side of the field. The user can select an existing model by selecting the model icon. If a new model is to be used, the user simply types the model name into the field.
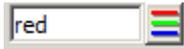
colour box	red	standard 12d colours

this field can be recognised by the colour icon button on the right hand side of the field. The user can select a 12d standard colour model by selecting the colour icon

height input	Measures menu

this field allows a height or z value to be assigned to the created elements. If a valid value exists, this value will be applied to the created element. This is regardless if the z value was specified in an XYZ box.

*If no value is specified, the level will be interpolated where possible. A value of **null** can be entered into the height field as well so that created points will be given a null height value.*

linetype box	1	valid linestyles

this field can be recognised by the linestyle icon button on the right hand side of the field. The user can select a valid linestyle by selecting the linestyle icon

weight box

this field allows the user to type in a line weight for the cad item created
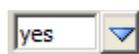
button

the Tinable field sets whether the vertices and segments are tinable (used in triangulations), not tinable (not used in triangulations) or only the vertices (points) are tinable.

button

the eye dropper allows the user to select an existing element which will define the cad control bar values.

The **CAD** options are available from the **CAD toolbar** or from the **CAD** menu under Strings.

Strings => CAD menu
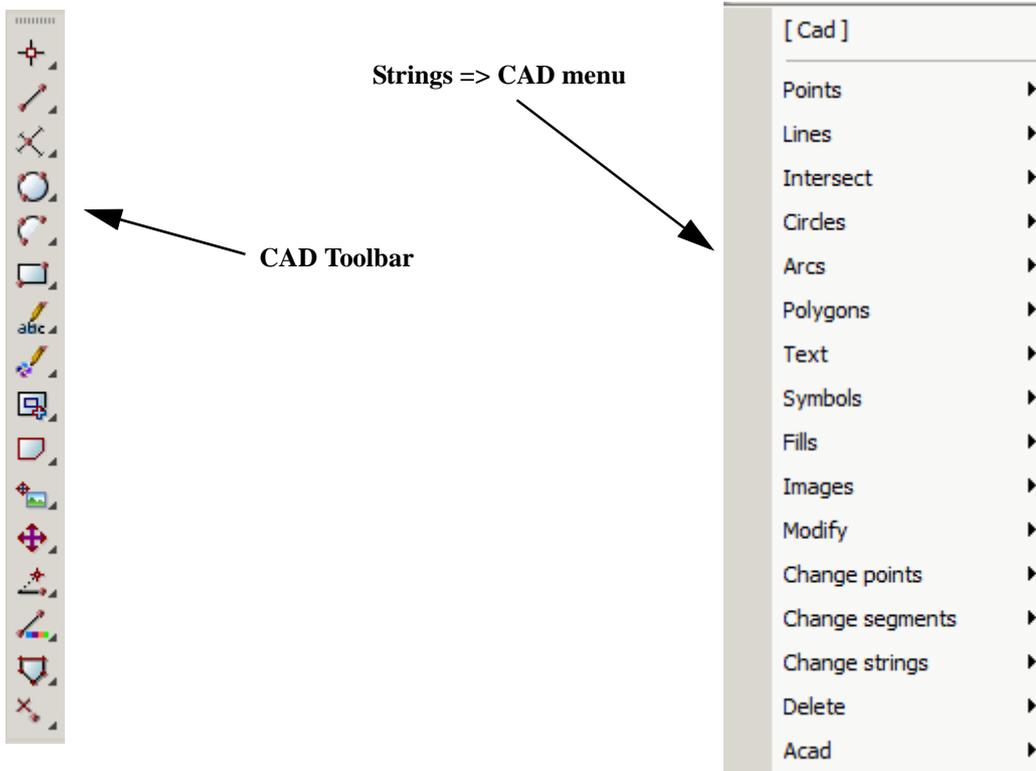
CAD Toolbar

When options are chosen from the CAD Toolbar, help messages are written to the Screen Message Box at the bottom of the 12d Model screen. Since there is no panel or menu involved with the CAD toolbar options, there is nowhere for an F1 key to function for on-line help.

Hence all the CAD options are documented under each of the walk-right menus for the

   Strings =>CAD menu.

CAD Text Toolbar and Text Controlbar

The various **Text** options are:

Text Controlbar

CAD Text Toolbar

Strings =>CAD =>Text   menu
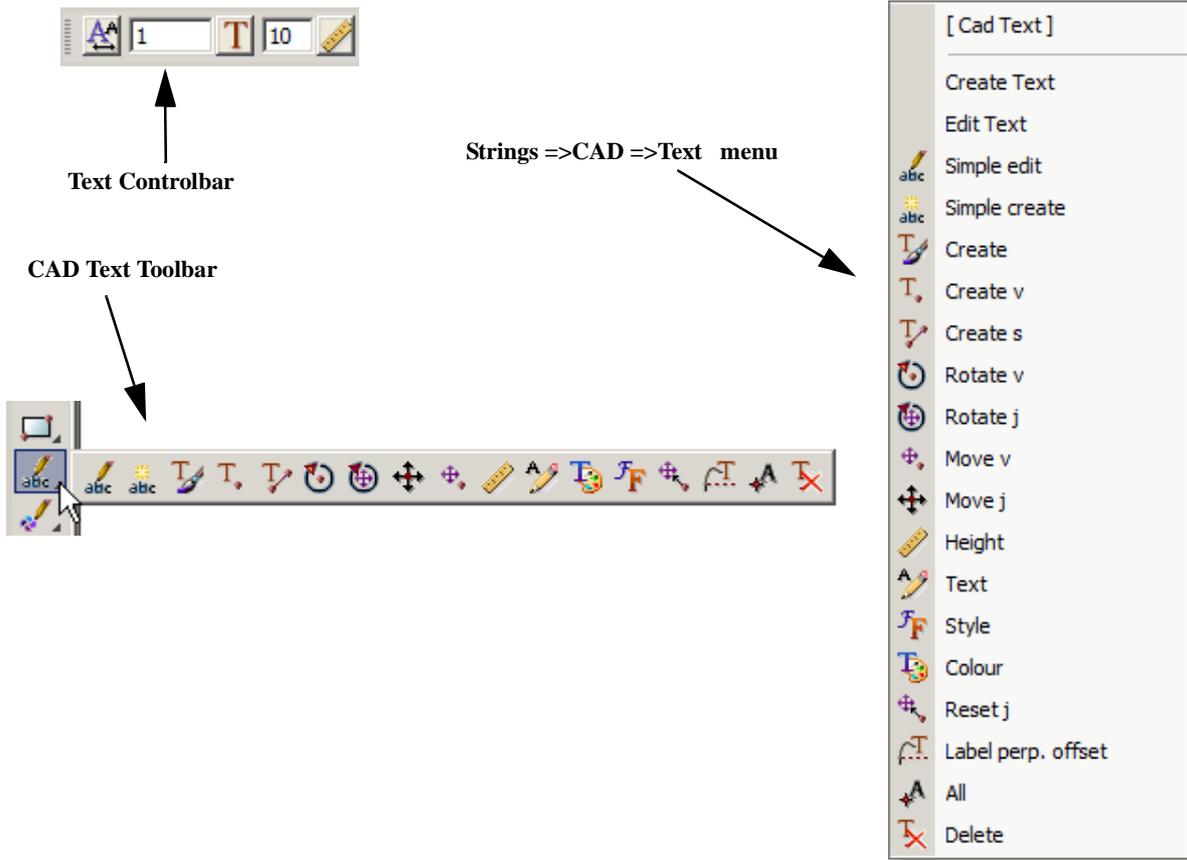
Text can occur as a text string, on vertices of a 4d string, and on vertices and segments of a super string. Each type of text has a vertex (these are displayed when Vertices are toggled on in a plan view), a justification point, a rotation, an offset and a raise value. The vertex and justification point only coincide if the offset and raise values are both zero. All text on a 4d string must have the same height, colour, angle, offset and raise. Each part of the text on a super string vertex segment can be independently modified depending on the settings for the super string.

For text options, the created elements will have attributes as defined by the **Text Control Bar**. This control bar is placed at the top right of the screen under the main menu control bar on the creation of a project

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

Field Description	Type	Defaults	Pop-Up
	Textstyle data box		

On pressing the button a list of available textdata with predefined names read from the **texstyle_names.4d** *file are displayed.*

If you require a different textsyle, the user can edit the current settings by selecting the *[Edit]*button to bring up the **textstyle data** panel. This allows for definition of textstyle, units, height offset raise etc.
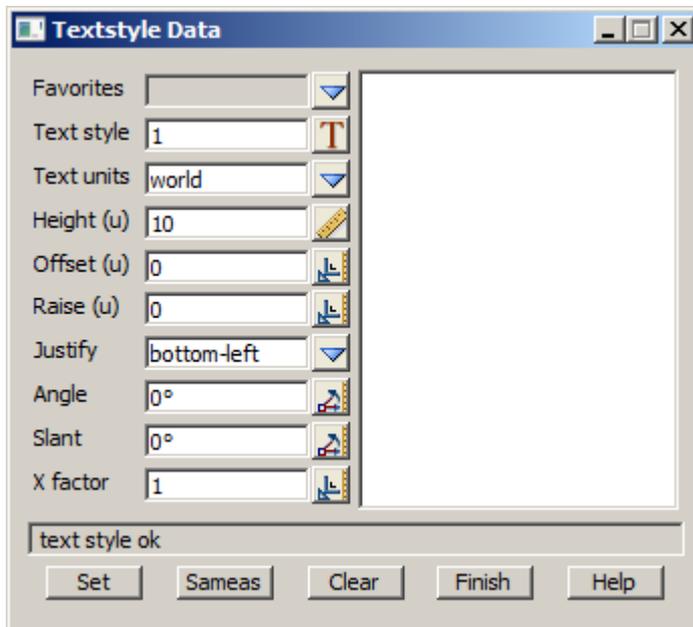
textstyle box	1	available textstyles

the user can select an existing textstyle by selecting the textstyle icon or entering a value into the input box to the left of the button.
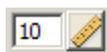
text height box	10	

the user can measure a height by selecting the text height icon or entering a value into the input box to the left of the button. The value units are defaulted to world units. This can be changed in the textstyle data box

Symbol Controlbar

The ***Symbol Controlbar*** is normally at the top right of the 12d Model screen.

Symbol Control toolbar ━━━▶

Users can define their own symbols to draw at vertices of 12d Model strings. The definition of symbols are stored in a file called symbols.4d.

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

Field Description	Type	Defaults	Pop-Up
	Symbol data box		

On pressing the *Symbol data* button a panel appears
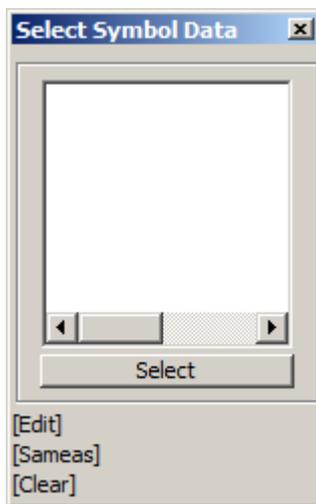
If you require a different symbol, the user can edit the current settings by selecting the [Edit] button to bring up the **Symbol Information** *panel (shown below).*
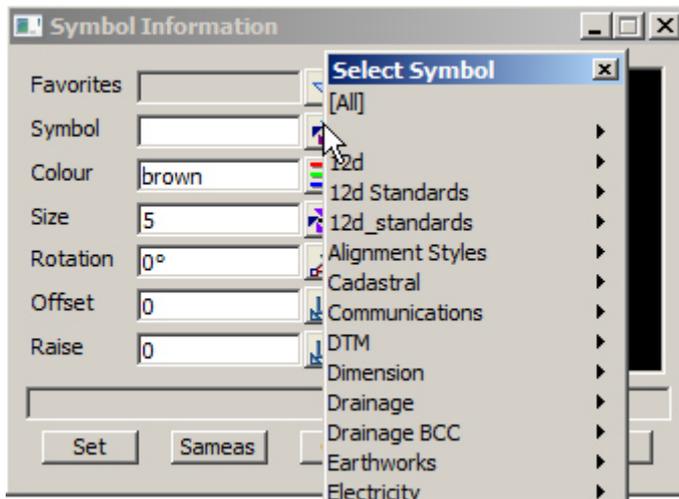
The current symbol can be selected from the Symbols list and the colour, size and rotation can be manually set

Alternatively the size and rotation (anti clockwise) can be entered manually into the boxes in the Control bar

Search Toolbar

The **Search bar** is normally at the top right of the 12d Model screen.

Users can type in words (or part) to describe the option they require and a list of menus appear when the parameters are met
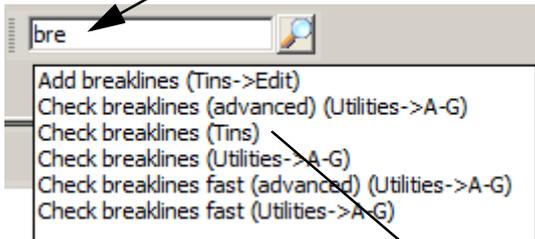
Double clicking LB on the Topic activates the menu
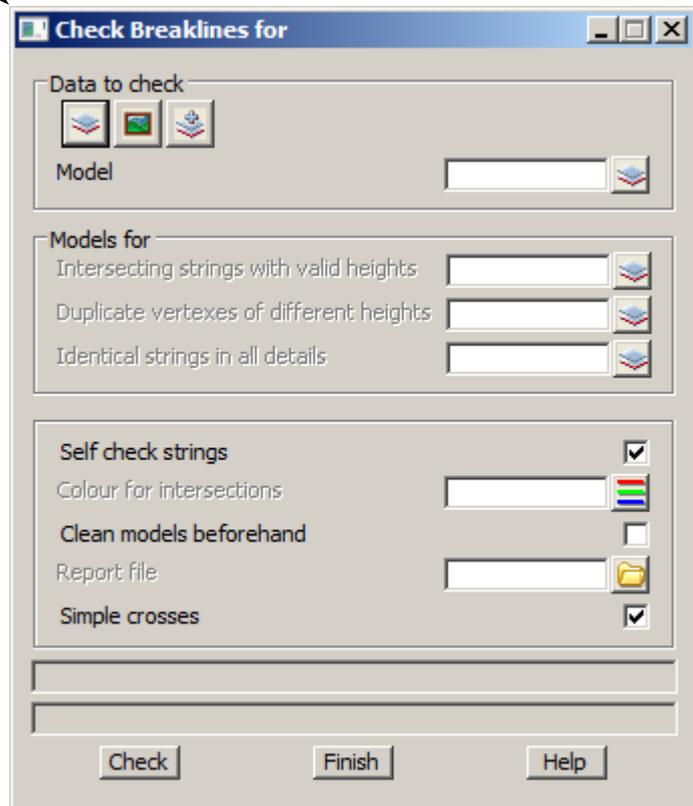
Snaps Toolbar

The *Snaps Toolbar* is normally at the top right hand corner of the 12d Model screen.

Snaps toolbar   ➤   P L X G C H T S I D F A K M

Snaps are used when picking strings - see Chapter 7.4 'Snap Settings'.

4.6 Status Bar

The Status Bar is an optional part of your desktop. It appears at the base of your desktop. The Status Bar contains the Screen Message Box and the View Coordinates Box. It is strongly recommended that you keep it turned ON.
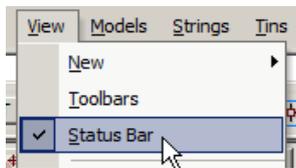
If desired, the Status Bar may be turned OFF at any time. From the **View** drop down menu bar, click LB on **View**, untick the **Status Bar** checkbox. To turn it back ON, repeat the selection but this time tick the checkbox.

4.7 Screen Message Box

The Screen Message Box contains messages that help you interact with the 12d menus. For instance, when importing a DWG/DXF/DXB file as shown previously, you have to select a file name to read. Let us investigate the messages 12d gives us to help us with this simple operation.

If the DWG/DXF/DXB Data panel is not already showing, select it again as shown previously. Click in the

'File' name entry data field. Observe that the following response appears in the Screen Message Box
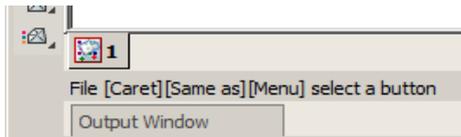
You interpret this help message as follows. 12d is asking you to supply a file name. The three sets of square brackets [ ] correspond to your response via the three mouse buttons, LB, MB and RB.

The LB message 'Caret' indicates the position of the cursor if you want to type an answer using the keyboard.

To type an answer, you must first make sure that the cursor is locked onto the field you wish to modify. The cursor must appear as a flashing vertical bar before 12d will accept any data from the keyboard. You can reposition the caret anywhere in the existing word by using the LB. You could then edit it by using the 'Backspace' key. Alternatively you can use the 'Delete' key to delete the character to the right of the cursor or the Arrow keys to move within the word. The 'Home' and 'End' keys take you to either end of the existing entry. To delete the entire entry, double click anywhere in the text to highlight it. Then press the delete key to erase the entry or just start typing to replace it.

The MB message 'Same As' indicates that you can point at any existing item on your desktop. This would not normally be used for a file name.

The RB message 'Menu' puts up a menu. At this time, no items are available. If another filename was copied to the windows clipboard then the 'Paste' would be highlighted.

Or finally, you can click LB on the folder icon to locate the required file

The Screen Message Box area changes dynamically with the position of the cursor on the screen so watch it closely for helpful messages.

4.8 View Coordinates Box

Note the location of the View Coordinates Box at the bottom right of the desktop. This box displays the X-Y coordinates of the cursor when in a Plan view and Chainage-Height when in a Section view.

4.9 The Output Window

The Output Window appears as a tab at the bottom left of the screen and flashes if there are any messages that need to be reviewed. This Window can be pinned to your desktop, but to maximise use of your desktop for 12d views etc., it is best to leave it as is. You can also convert the output window to a view, just like a 12d View.

To turn the Output Window OFF at any time, you need to access the menu bar that appears across the top of your desktop. From the Window Drop Down menu bar, click LB on **Window**, untick the **Output Window** checkbox. To turn it back ON, repeat the selection but this time tick the checkbox.

To make the Output Window appear as a normal Window on you desktop, place the cursor anywhere over the 'white' background area of the Output Window and click RB. In the pop up menu, click on the **Convert to Window** menu with the LB. The command Window will then appear somewhere on your desktop as a Window. It may be moved by clicking LB in the blue Output Window heading area, dragging the cursor to another part of your desktop and releasing the LB to pin it down.
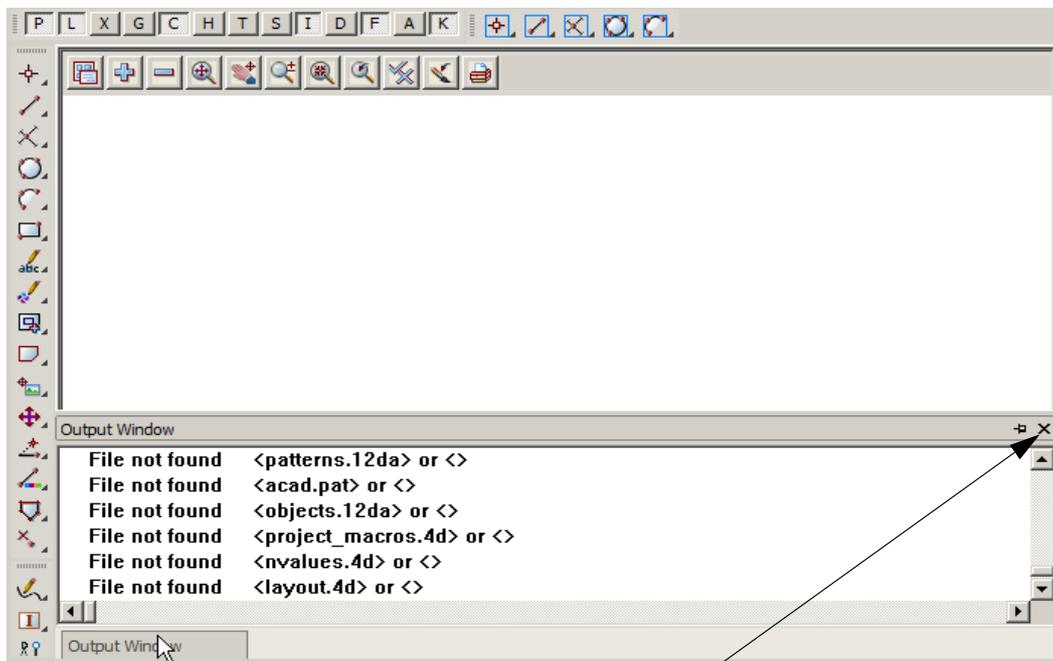
If you wish to close the "floating" Output Window just click on **x** as you would with any other view.

There are three view types available in 12d. They are Plan, Section and Perspective. It is possible to have multiple plan, section and perspective views on the desktop at one time, each showing different information. There is no limit to the number of views you may create.

Each View has a View type icon and name such as 'SURVEY' or '2' etc.

The name appears in the View Title Area. This is the blue heading at the top of each view. Just below the name is the View Button Area which contains the most common View buttons (i.e. a subset of the complete list of view options). The View buttons appears horizontally after the view name. The View Button Area appears automatically with each view as the view is created and each view type has different view buttons that reflect it's characteristics. The view name defaults to a number but can be over typed with any alphanumerics.

The view buttons on the Plan view are:
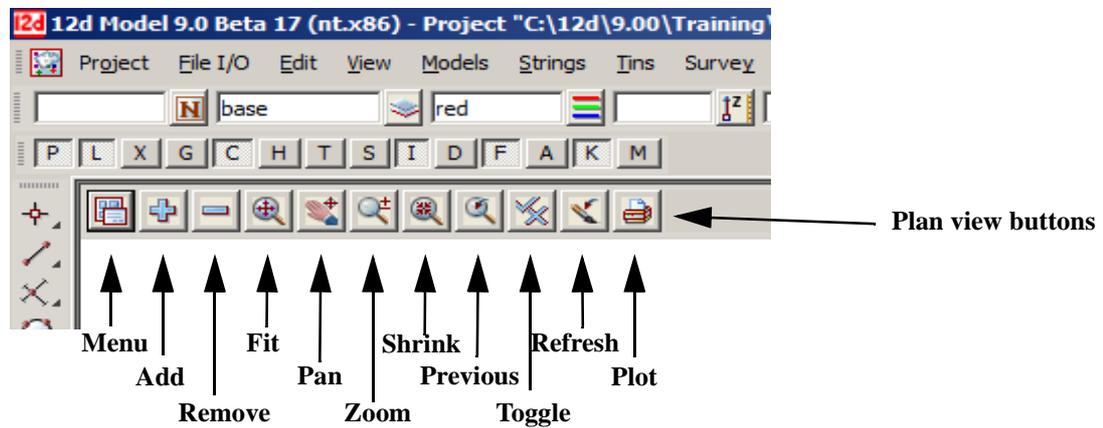
Each view also has its own menu (the view menu) which can be brought up by clicking the LB on the view button called **Menu**.

The View menus can also be brought up in another special way:

if you click the RB in the View Button Area or the View Title Area, you will also get the View menu to pop up. Clicking RB again in the View Button Area or the View Title Area will remove the view menu.

So by using the RB, view menus can be accessed even if the Menu item is not visible in the View Button Area.

The View menu contains options available for that particular view type. It is a superset of the buttons that appear on the horizontal View Button Area. If the View is made very small or moved off the right hand side of the desktop, the various buttons on the horizontal View Button Area will not be selectable as they will not be visible. In such case, you have to use the RB in the View Button Area to get access to the various View menu items.

Views may be created, resized, overlapped, moved and deleted as required. When you create a new view, 12d will automatically supply it an ascending number for reference purposes e.g. 'Section 2'. Views can overlap Menus and Panels that are already on the desktop.

Hence there are four menu systems in 12d, one for each view type (plan, section and perspective) and an overall main menu.

4.10   Basic View Operations

We will now practice some basic View operations

To create a new View, select **Views=>New=>Plan** from the main menu to create a view with the next view number.

Alternatively, you can use **Views=>Create=>Plan View.** Pick **Create** with the LB after first supplying a View name or accepting the 'number' supplied by 12d as the View name.

Once the View is on display, the following operations can be performed from the View Button Area at the 'top' of the View. To move a View to a new location on your desktop, depress the LB in the View Title Area – the 'blue' area showing the words '**Plan 1**'. Whilst you still have the mouse button depressed, drag the mouse and you will see the View move. 'Pin' the View again by releasing the LB.

Use the standard Windows features to change the size of the View. Place the cursor near any corner or midside of the existing plan view and when the drag arrows popup, depress and hold down the LB and drag the mouse to see the Window size change. Pin the new location of the corner by releasing the LB.

To delete a View just click LB on the '**X**' button in the top right hand corner of the view.
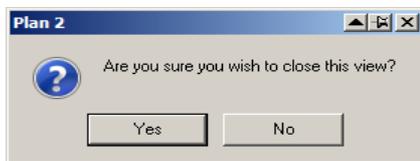
Click LB on [Yes] to confirm the action

You can also delete a view by clicking LB on the Menu button in the View Button area to popup the View menu and then click LB on **Delete**.

For the purpose of the tutorial, leave one large Plan View '1' on the desktop. We will subsequently demonstrate how the various views are linked. Information in a Plan view can also appear in Section and Perspective views for instance.

4.11   Introduction to Models

Models are a 12d concept also present in most CAD systems. It is similar for instance to the layering concept AutoCAD, or levels in Microstation. Basically each model represents a repository for data. Each point or line that is created or imported into 12d is put into a model. By turning models 'On' and 'Off', it is possible to change the amount of information that is displayed. This control is provided in each view so it is possible to have different models on display in different views.

It is important to note that the data in the various models is always permanently stored in 12d. It is a user controlled convention to only show a subset of models at any one time.

There is no limit to the number of models used in any one 12d Project.

If you want multiple copies of a certain line (i.e. string), it is possible for instance to copy the line from one model to another. The lines can then be displayed independently. If both models were on at once, the information will appear as one line instead of two since the strings are coincident. It is possible to selectively snap to and edit either line in such a case.

At any time, individual models can be **Renamed, Duplicated, Cleaned** (removes all points and lines but the name of the model is retained) or **Deleted**.

A new feature in version 9 is the **Trash Bin**. Any deleted models will be store here as a back up. Deleted models can be restored at a later time. An example of this will be shown later in the manual.

Models can be temporarily **Removed** (from selection lists) and subsequently reinstated through the **Add** function.

It is also possible to copy models between projects (See **Models=>Utilities=>Copy Project Models**). These are advanced features of 12d that we need not concern ourselves with at this time.

4.12   Introduction to Strings

12d is very much a 'strings' rather than 'points' based system. In it's simplest form, a string is a line between two points or vertices. In fact a single vertex is also a special type of string known as a 'point string'. A string may be made up of multiple straight line segments connecting many points (vertices). Strings may contain curves and arcs as well as straight lines. Strings vary in complexity from 2d (x,y and constant z value) to multidimensional (e.g. an alignment string has both horizontal and vertical geometry independently defined). In general, as well as x, y and z values, strings have properties such as string name, string type, string colour, line style, and chainage. Strings also have a 'point/line' property that can be set such that they appear as 'disconnected points' or 'connected lines'. From a design point of view, strings are much more useful than points.

4.13   Introduction to Panels

A panel is simply a means of supplying multiple answers to 12d in a concise manner. Once a panel appears on the desktop, you can use the mouse or the Tab and BackTab keys to position the cursor over any data field. Remember, when typing data from the keyboard, the cursor <u>must</u> be flashing in the data field for characters to be accepted.

When supplying data to a 12d panel, you do not need to terminate the entry of data into a field by pressing the *Enter* key. For instance, you can use the Tab and BackTab keys or the mouse to move to another field after entering data. If you do press the *Enter* key to terminate the entry of data into a field, 12d will immediately validate the data in that field and supply an error message if appropriate.

When validating supplied or previously entered data (i.e. where you do not need to <u>change</u> the data in a field), it is <u>not</u> necessary to place the cursor in the data field. Just press the *Enter* key to pass through each field in the panel in turn.

When typing data into a field, please observe that the 'Delete' key deletes a single character to the right of the cursor. The 'Backspace' key is also active. If you need to delete multiple characters, drag the LB across the characters to highlight them (or double click over a word) and press the 'Delete' key to delete them or start typing to replace them.

In general, 12d has been setup so that data can be selected from lists rather than typed from the keyboard. When entering data into a field, if there is a list of alternatives already known to 12d, pressing the LB on the icon at the end of the field will display the list.

To practice this, bring up the 'Read xyzs Data' panel - from the Main menu, click LB on

File I/O =>Data Input =>xyzs
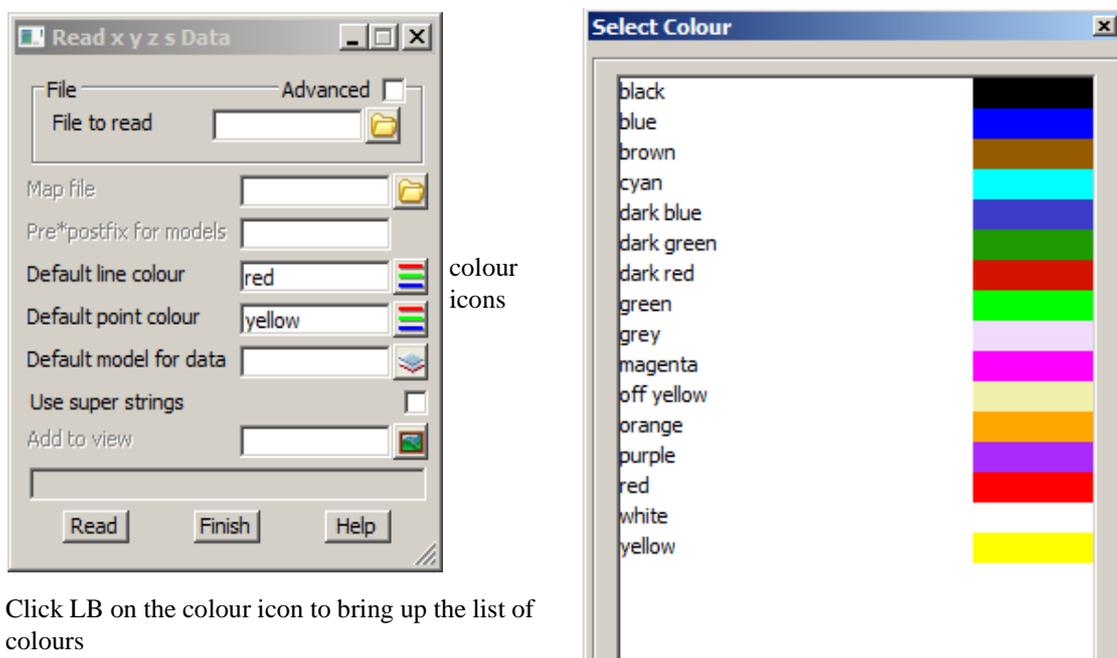
Click LB on the colour icon to bring up the list of colours

Set the 'Default line colour' in the above panel to 'dark green' by clicking LB on the colour icon (the icon to the right of the word 'red' in the fourth data field). A list of available colours will pop up. Use the mouse to click LB on 'dark green' and then process it by clicking LB on the **Select** button at the base of the panel.

Alternatives: You can double click LB on 'dark green' to short-cut this sequence. You could also have used the down arrow key to work your way down through the list to highlight the word 'dark green' and then pressed the Enter key.

In a manner similar to the colour panel field just discussed, most panel fields have a pop-up list of choices available and the list is activated by clicking on the icon at the right hand end of the panel field. Some times there will be a special icon such as the *colour* icon in the previous example or the file box icon at the end of the *File* field of the *Read DWG/DXF Data* panel.
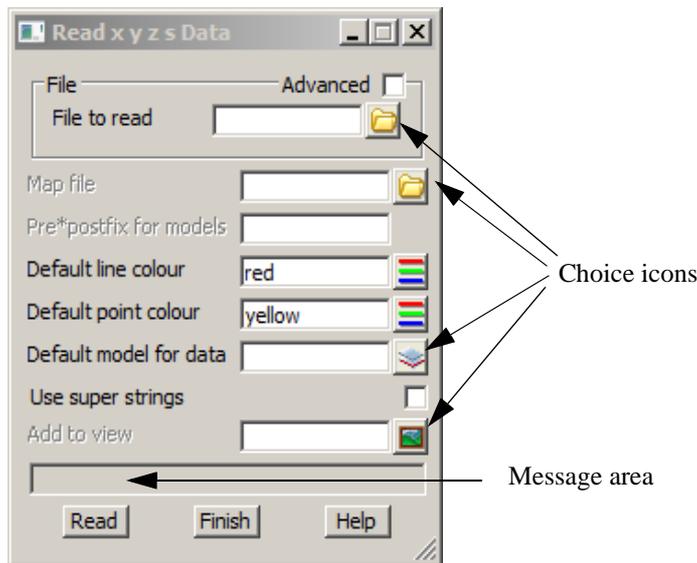
Other icons that may be used are:

file		tin		textstyle info	
model		choice		line weight	
colour		colour when none selected		view	
line style		polygon		symbol	
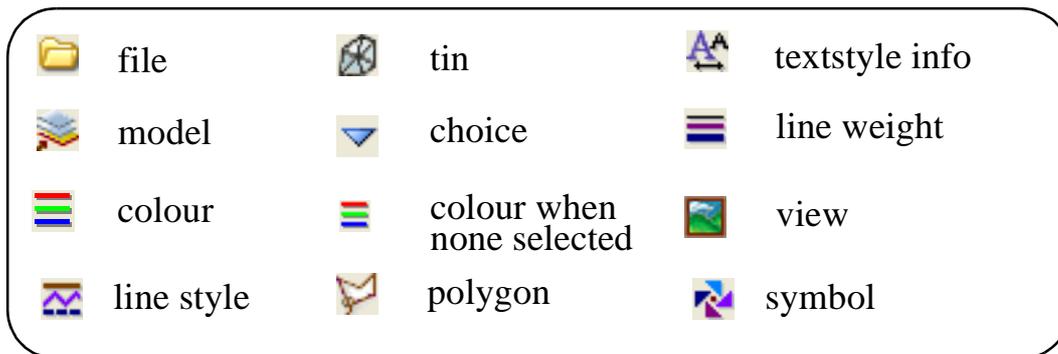
Note the message area at the base of the panel (just above the **Read** button in the *Read xyzs Data* panel). Each panel has its own message area to help you interact with 12d. If 12d does not appear to be working the way you think it should, you will often get helpful information in the Panel Message area if you make a mistake. Look in the Screen Message Box as well as it is also updated when interacting with panels.

If a panel is in the way, you can move it as stated above. Any panel can be removed (shut down) by clicking LB on the '**X**' button in the top right hand corner or by clicking on the **Finish** button.

If you want to keep a panel that is already filled in such that you can refer to it later, you may decide to temporarily minimise it by clicking LB on the '**-**' button. It can later be maximised again by clicking LB on the 'overlapping windows' button (where the '**-**' used to be).

As we don't wish to proceed further with this panel click LB on **Finish** or click LB on the '**X**' button in the top right hand corner of the panel.

5 Starting the Tutorial

Before starting your tutorial, it is assumed that your overall desktop layout is as shown at the end of Chapter 4.3, i.e. one large plan view on display called 'Plan 1'.

5.1 Importing Point Data into 12d

The easiest way to understand the use of Models and Panels is to import some data into 12d and see by example.

Point and Line data can be imported into 12d from a variety of sources. For the purposes of the tutorial, we will use the simplest of these - a simple ASCII file containing point number, x, y and z coordinates along with a code and string number.

We will begin by reading in a Points file called 'DETAIL SURVEY.csv'.

This file lies in the folder **C:\12d\9.00\Training\design\getting started basic**

```
1,42518.873,36865.368,71.833,DR,1
2,42535.232,36859.942,69.805,DR,1
3,42556.394,36847.968,69.349,DR,1
4,42572.709,36848.796,67.75,DR,1
5,42592.277,36848.967,65.879,DR,1
6,42606.098,36848.526,64.818,DR,1
7,42612.6,36847.949,64.739,DR,1
8,42410.27,36954.217,72.574,DR,2
9,42419.677,36955.067,71.904,DR,2
10,42433.789,36954.863,70.552,DR,2
11,42446.673,36955.149,69.777,DR,2
12,42460.181,36955.284,68.955,DR,2
13,42474.806,36955.092,68.24,DR,2
```

The format is one point per line containing a point number, x, y and z coordinate, string name and string number all separated by commas.

To read in the file, click LB on **File I/O =>Data Input =>x y z general** from the Main menu.
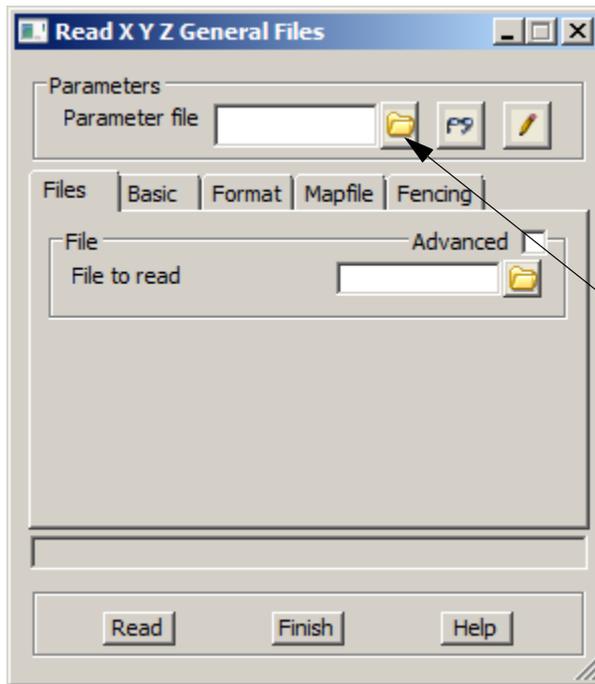
12d gives you the ability to fill in this panel once and then save the setup to a parameter file. This allows you, on subsequent occasions, to call up the parameter file and then you only need select the data file to be read.

To make things easier we have already created a parameter file and stored it in **Getting Started Basic** folder.

Click on the folder icon at the end of the *Parameter file* field.
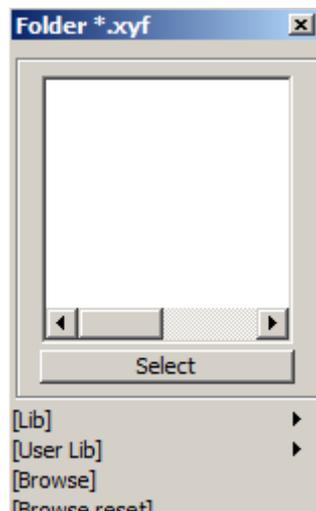
A blank folder panel will pop up, but we will browse for the parameter file

Click LB on [Browse]
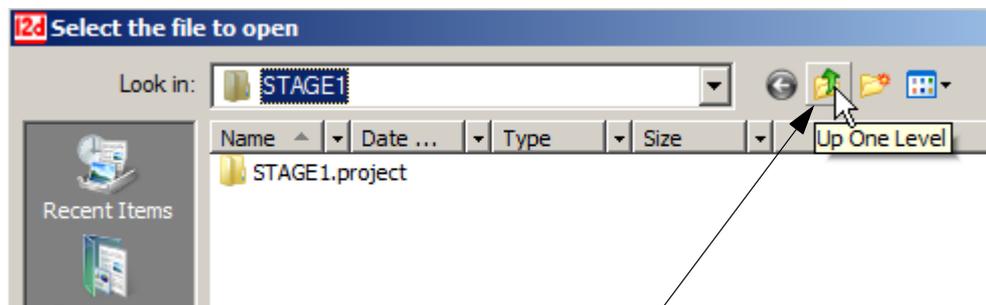
Click LB on the "Up one Level" icon to move back to the **getting started basic** folder

Note that if you have created the training project in a folder different to the one shown here then you will have to navigate to the required folder
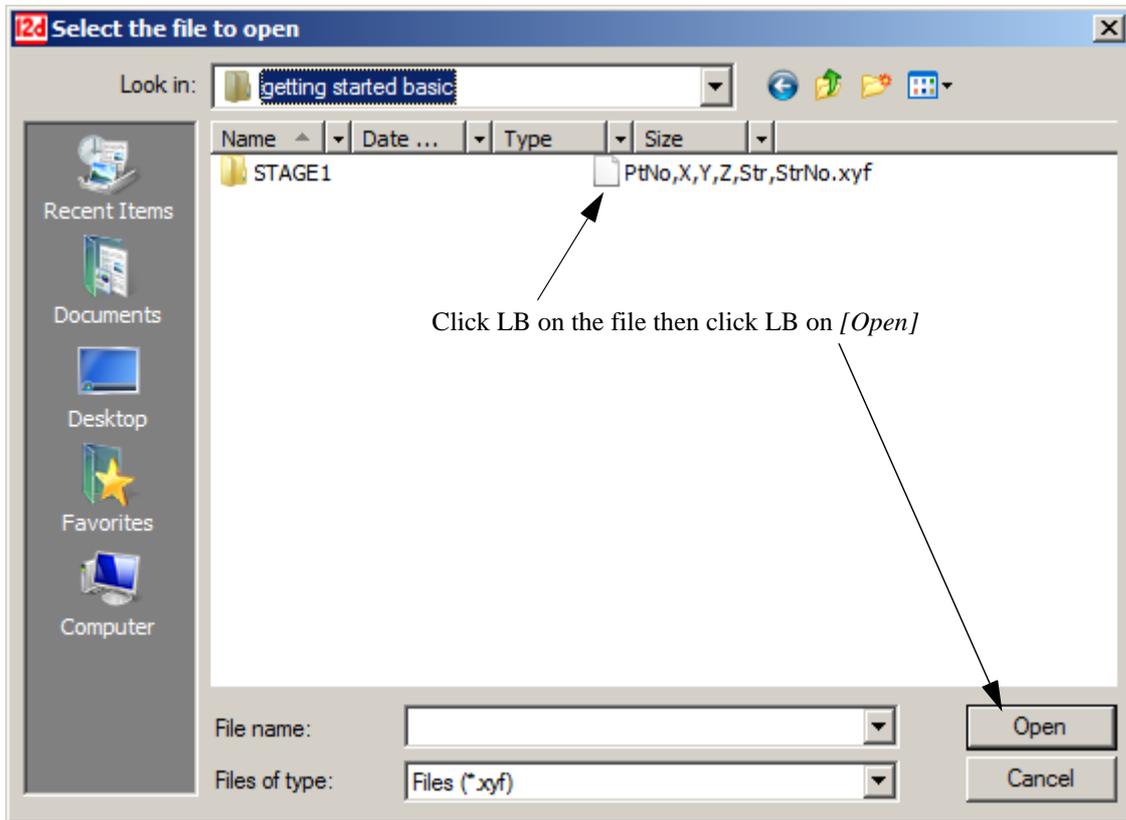
Click LB on the file then click LB on *[Open]*
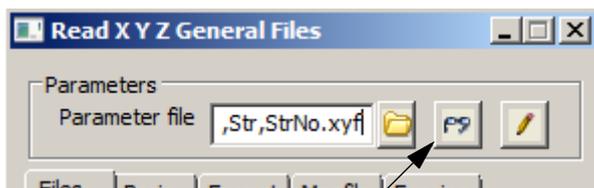
Click LB on *Read* icon to load the parameters

Select the **Files** tab
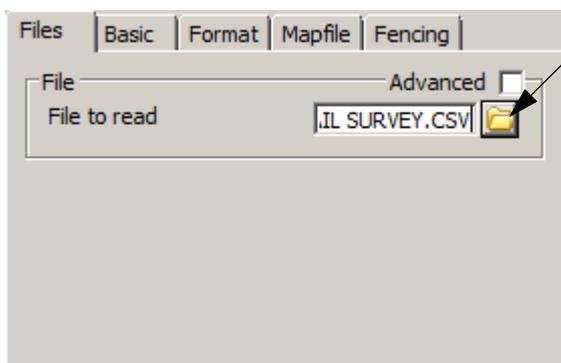
Using the folder icon browse to the same folder that held the parameter file (**C:\12d\9.00\Training\design\getting started basic**) and locate the file DETAIL SURVEY.csv.

You will have to change the *File type* display to *All files (*.*)*

Click LB on Open
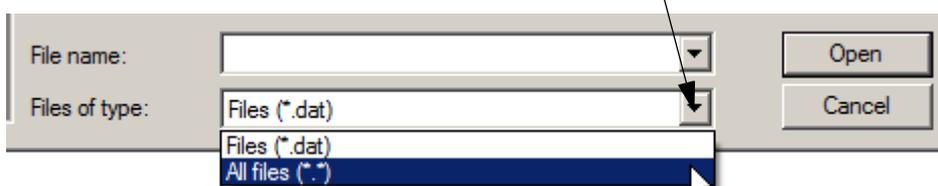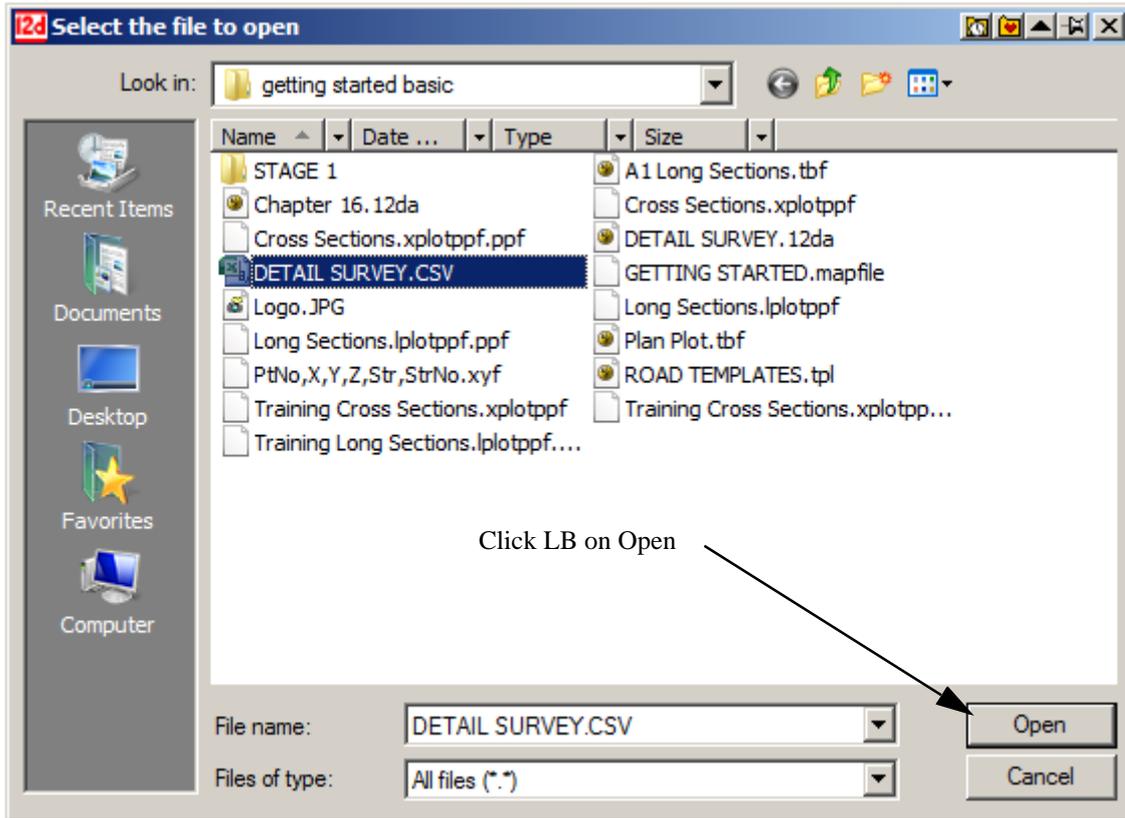
Select the **Basic** tab

The default values for the data are set up here
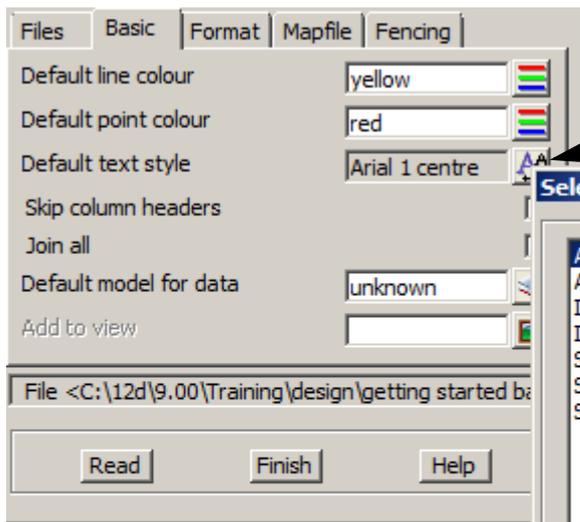
You will notice that the panel is mostly filled in from the parameter file. However, you still need to set the default text field

Select the choice icon then select any of the text style
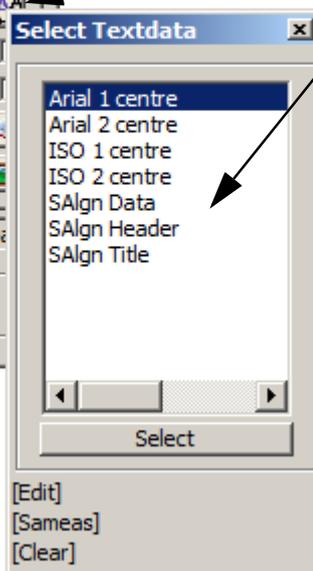
A default model is used in case the data has coding that the mapping file (See **Mapfile** tab) can not recognise.

Select the **Format** tab

The format for the file values are set up here. No
user entry is needed for this section

	Information Type	Position #		
1	point id	1		
2	x coord	2		
3	y coord	3		
4	z coord	4		
5	string name	5		
6	string number	6		

	Attribute Mode	Name	Type	Position #
1				
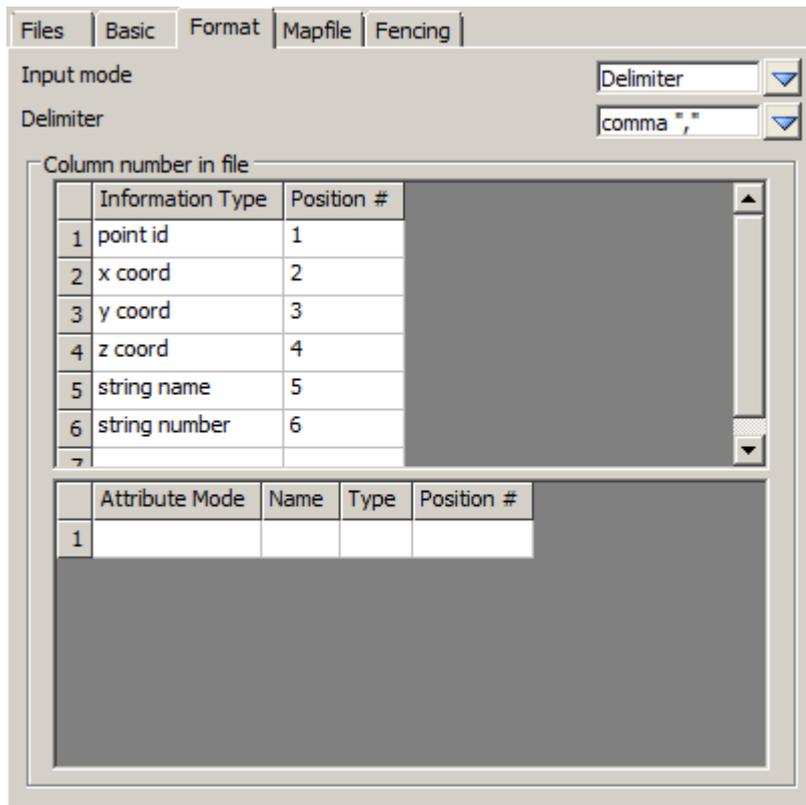
Select the **Mapfile** tab

A user defined mapping file uses the code found in the data file to set the
parameters for the strings including the model name, linestyle, colour and more.
The map file GETTING STARTED.mapfile was read from the folder
C:\12d\9.00\Training\design\getting started basic

A model prefix "**survey** " (note that there is a space after the word *survey*) is
used to group the survey models together after the map file has set the model
names. This will help keep the survey data separate from the design. Using
lower case for the word will send the models to the bottom of the listing

Open the map file

Select the folder icon then select
[Open]

ΓARTED.mapfile

survey

Folder *.mapfile *.mf

GETTING STARTED.mapfile

Select

[Lib]   ▶
[User Lib]   ▶
[Browse]
[Browse reset]
[Open]
[Open with]

Map File Create/Edit

Map file C:\12d\9.00\Tra   Read   Write

⊟·· Map File
  ···· Header
  ···· Basic
  ⊞·· Fills
  ···· Symbols
  ···· Tinable
  ···· Vertex Text Data
  ···· Segment Text Data
  ···· Pipes
  ···· Boundaries
  ⊞·· Visualization

Finish   Help
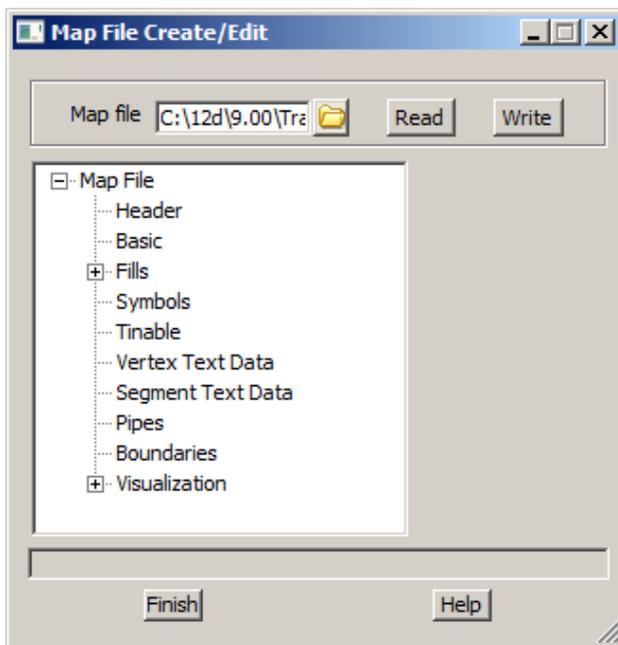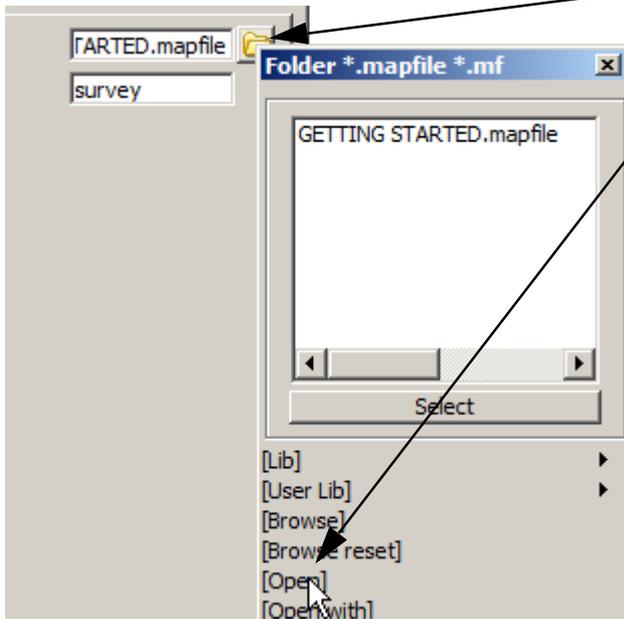
A branch structure is used to access
the tabs within the map file

The Basic tab is shown below which
sets the model, colour and more

⊟·· Map File
  ···· Header
  ···· Basic
  ⊞·· Fills
  ···· Symbols
  ···· Tinable
  ···· Vertex Text Data
  ···· Segment Text Data
  ···· Pipes
  ···· Boundaries
  ⊞·· Visualization

	Key	Att Key	Name	Model	Colour	Point Line
1	BB			TOPO BANK BOTTOM	orange	line
2	CG			TOPO CHANGE GRADE	orange	line
3	CR			ROAD CROWN	white	line
4	DR			TOPO DRAIN CL	cyan	line
5	DTMBDY			TOPO TIN BDY	red	line
6	ES			ROAD PAVEMENT EDGE	white	line
7	SEC			SEWER PIPE	brown	line
8	SL			TOPO SURFACE LEVEL	orange	point
9	STN			SURVEY STN	red	line

Click LB on *[Finish]* to exit the mapping file
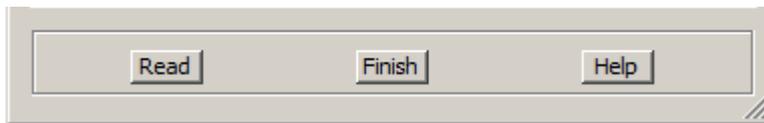
Click LB on Read to import the data file

Click LB on the Add models to view icon to display the survey models
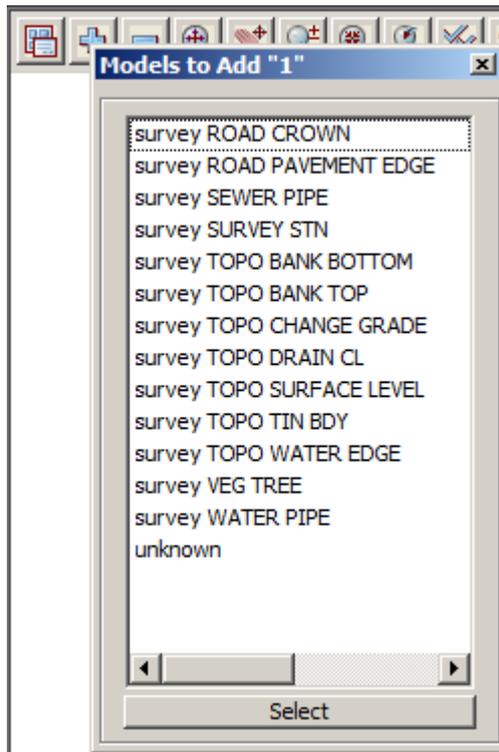
The models are listed

Select all model

Click LB on *[Select]*
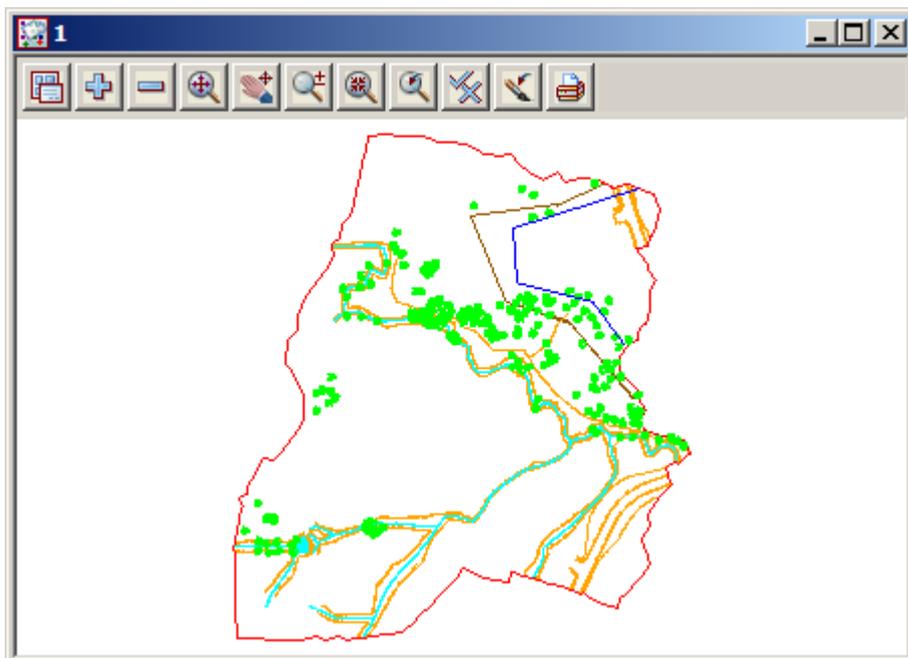
5.2   Plan View Operations

Now that we have some data, we can begin to look at some more of the Plan view features of 12d.

Menu

Bring up the Plan view Menu.

Adding/removing models

In the Plan View Button Area, you will observe a '+' and '-'. This is a shorthand technique for turning models on and off.

Click on the '-' sign button with LB. A list of available models to remove from the view pops up. Pick 'survey VEG TREE' and click LB on 'Select'. You will observe the tree symbols in model 'survey VEG TREE' are removed from the view. The '+' works in a similar way to add models to the View. Practice adding and removing models from the view with the + and -. Remember, the models are not being deleted with the '-', merely removed from the current View. Turn back on the tree model 'survey VEG TREE'.

Fit

After multiple pans and zooms, you sometimes wish to return to a point where all of your data appears in the view. This is equivalent to an AutoCAD Zoom-Extents. Click on Fit with LB to see all of your data.

Dynamic Pan

This facility allows you to move the centre of the view but retain the current zoom factor. Click on Pan with LB. You then press down LB on a point in the View and then drag the mouse. The data in the view will move with the mouse until LB is released.

Zoom

Select Zoom (to Zoom In) from the Plan View Button area with LB. Click LB on two diagonal points of a rectangle and then click LB once anywhere in the plan view. The information will appear enlarged based on the size of the rectangle.

MB Wheel Zoom

If your mouse has a wheel as part of the middle button, then it can be used to dynamically zoom in or out. Simply click LB in the plan view at the point you want to zoom about and then roll the wheel forward to zoom in and backwards to zoom out.

Shrink

This is equivalent to Zoom Out. It works just like Zoom but in reverse.

Previous

If you click LB on Previous, the view will appear as it was prior to the Zoom. 12d always keeps the details

of the previous view setting available so that you can return to it quickly. Only one level of previous view settings is kept.

Toggle

There are multiple items under the Toggle Pop Up menu. At this time, we will try only one of them. Select **Grid** with the LB. A rectangular grid should appear. If you click LB on **Toggle =>Grid** again, the Grid will be removed from the display.

The appearance of the grid can be changed by clicking LB on the Menu button in the View Button Area and click LB on **Settings =>Grid.** You can change any of the settings in the panel. Try changing the grid spacing from 100 to 10 in both x and y directions and click LB on **Set.** You will notice that the Grid can be turned on and off from either the panel settings or the **Toggle =>Grid** switch. Click LB on **Finish** to terminate the panel.

Refresh

All the information on the view will be redrawn. This can also be achieved by clicking MB anywhere in the *View Title Area* or anywhere in the *View Button Area* except over the '+' or '-' buttons.

Plot

Bring up the Plan view Plot Menu.

5.3   Birds-Eye Views and 'Throwing' Between Views

We saw in Chapter 4.10 'Basic View Operations' how to create a new View. To introduce some new concepts in 12d, we need a second small Plan view on the desktop. Firstly resize your existing 'Plan 1' view to take up around 2/3 of the left hand side of your desktop.

From the main menu, click LB on **Views=>New=>Plan** and place a small view about 50mm square in the top right hand corner of your desktop. This will create View 'Plan 2'. See Chapter 4.10 for full details on how to create and resize Views.

Note that when creating a View using **Views=>Create=>Plan View**, 12d pops up the 'New Plan View' panel. The View Name field will already have a 'number' in it supplied by 12d. 12d will always supply you a View number that is not currently in use. If you want, you can overtype the number suggested by 12d provided the number you type does not <u>currently</u> exist. If it was created earlier and has since been deleted, it is OK to reuse the view name.

In the View 'Plan 2', use the '+' sign button to turn on all of the models. From the 'Plan 2' View Button area, click LB on **Zoom** and click a point in the lower left corner of the View 'Plan 2'. Before selecting the second point of the Zoom rectangle, move the cursor into the other View i.e. 'Plan 1'.
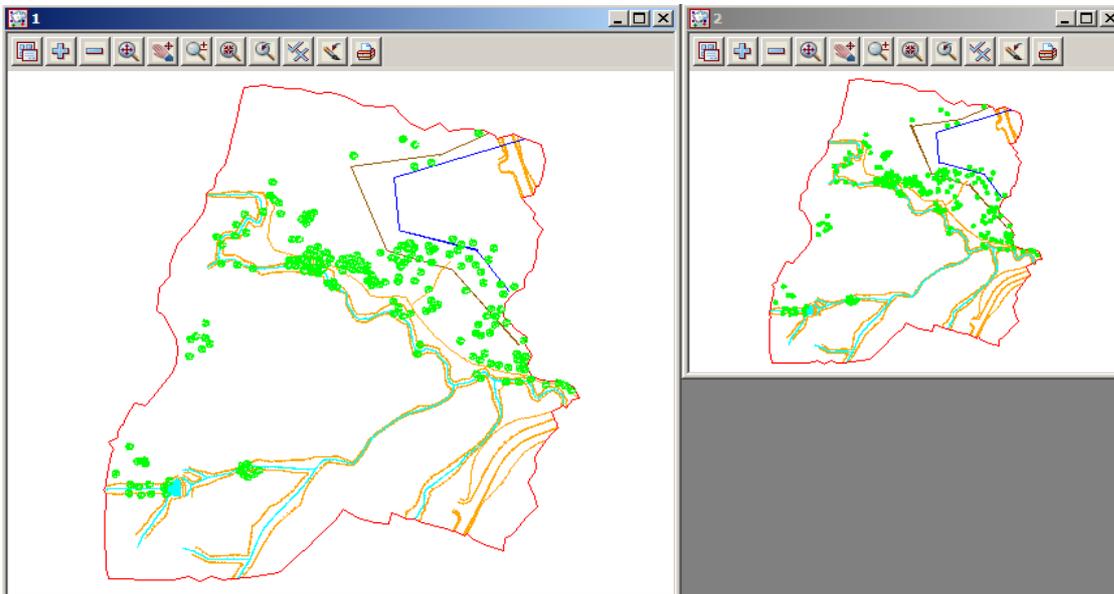
Select the second point of the Zoom rectangle in either View. After selecting the second point of the Zoom rectangle, you will notice the following prompt in the View Message Box
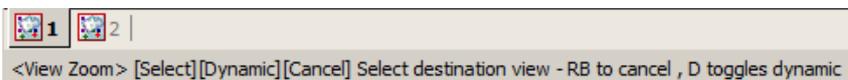
12d is prompting you to select the View you want 'zoomed'. Click LB in View 'Plan 1'. The zooming will then take effect in View 'Plan 1'.
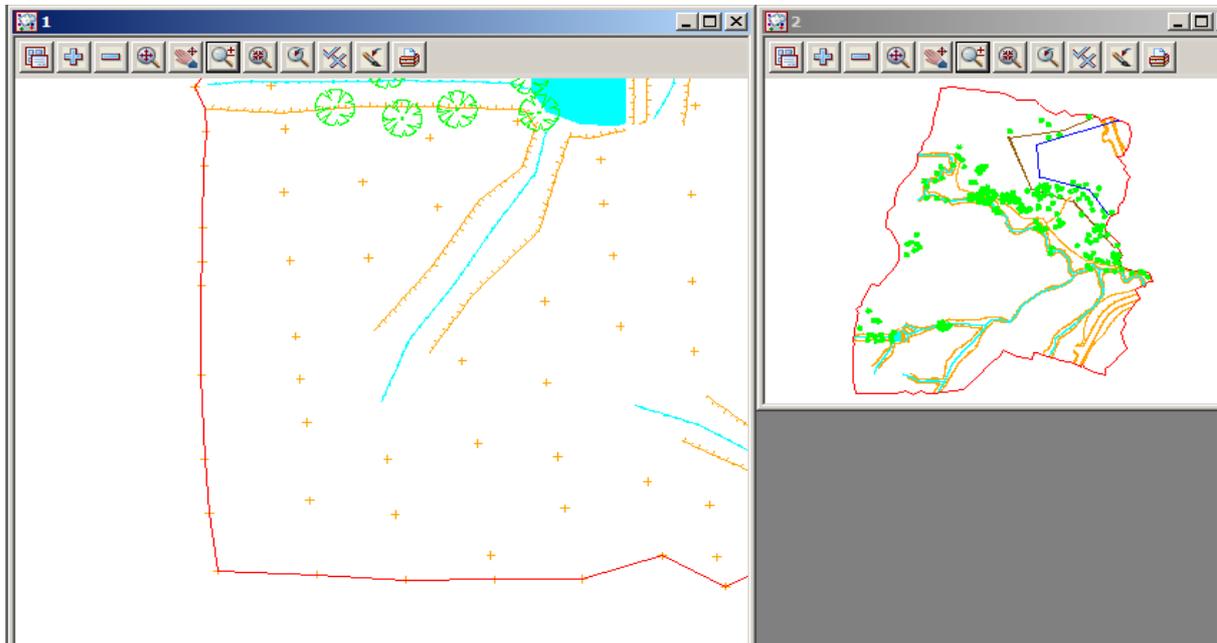
Notice that using this technique, it is possible to achieve a birds-eye effect where the smaller View displays the complete model whilst the larger 'working' view is zoomed to an extent where it displays only the detail that you are currently working on. You would typically do all of your zooming in View 'Plan 2' but have the detail updated in View 'Plan 1'. You could even do this with different models turned on. In the birds-eye view, you would typically only turn on sufficient detail to enable you to zoom on known features.

It is suggested you practice zooming and throwing between Views as this is a powerful concept in 12d and you should feel comfortable at using it.

After completing this exercise, delete View 'Plan 2' as it is no longer needed. You will now see a second way to delete a View. Click LB in the View Menu button in the View Button Area of 'Plan 2' and select **Delete** and **Yes** to confirm the deletion. The Delete View menu can also be brought up by clicking LB on the Menu button in the View Button Area of the View you wish to delete and select **Delete** and **Yes** to confirm the deletion.

It is suggested that you maximise 'Plan 1'.

5.4   Deleting a Model

As we now wish to look at an alternative (and preferred) way of importing data into 12d, we will delete the existing models as they will be recreated in the following option.

From the Main menu, click with LB on **Models=>Delete=>Delete all models**
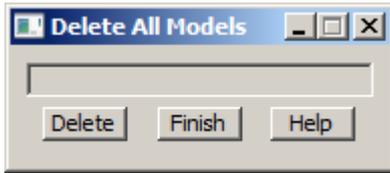
Click LB on **Delete**

Click LB on **Yes** to confirm
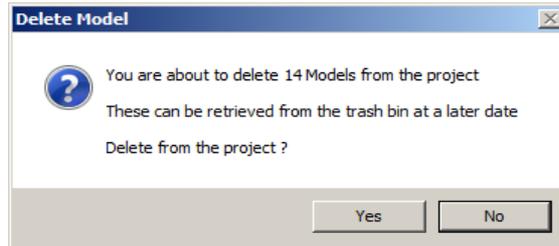
When models are deleted they are sent to the **Trash Bin** in case they need to be restored at a later stage.

A trash bin icon appears at the bottom right of the 12d screen
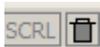
To access the deleted models double click LB on the icon or select **Project =>Management =>Trash Bin**

	Type	Name	Deleted By	Time	Select	Restore As
1	model	base	Noel	20/03/2009 11:55		
2	model	survey ROAD CROWN	Noel	20/03/2009 17:24		
3	model	survey ROAD PAVEMENT EDGE	Noel	20/03/2009 17:24		
4	model	survey SEWER PIPE	Noel	20/03/2009 17:24		
5	model	survey SURVEY STN	Noel	20/03/2009 17:24		
6	model	survey TOPO BANK BOTTOM	Noel	20/03/2009 17:24		
7	model	survey TOPO BANK TOP	Noel	20/03/2009 17:24		
8	model	survey TOPO CHANGE GRADE	Noel	20/03/2009 17:24		
9	model	survey TOPO DRAIN CL	Noel	20/03/2009 17:24		
10	model	survey TOPO SURFACE LEVEL	Noel	20/03/2009 17:24		
11	model	survey TOPO TIN BDY	Noel	20/03/2009 17:24		
12	model	survey TOPO WATER EDGE	Noel	20/03/2009 17:24		
13	model	survey VEG TREE	Noel	20/03/2009 17:24		
14	model	survey WATER PIPE	Noel	20/03/2009 17:24		
15	model	unknown	Noel	20/03/2009 17:24		
16						

To restore a model click LB next to the model under the **Select** column then click LB on **[Restore]**
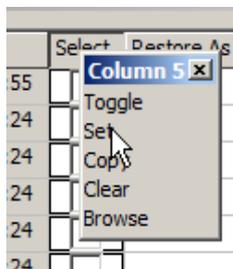
To delete all models in the trash bin (like emptying the Windows Recycle Bin) highlight all of the models by clicking LB then RB over the top of the select column. Click LB on **Set** to highlight the models and click LB on **[Delete]**
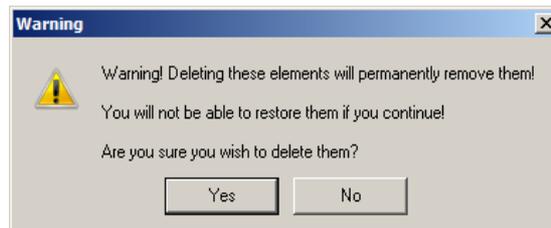
Click LB on [Yes] to confirm deleting the models

5.5   Redraw - Fixing up a Modified or Erroneous View

Whenever data is removed from a View e.g. turning off the display of a model, the view does not automatically get refreshed. 12d typically removes a model by overdrawing the information using the background colour, usually 'black'. This operation can leave the view looking speckled and unclear.

You can force the view to refresh by clicking LB on the Refresh button, or click MB in the View Button Area anywhere other than over the '+' or '-' view buttons. The whole View will be repainted instantly to display the corrected information.

It is also possible that some of the menus may at times become corrupted. Windows is a very complex multitasking environment and the menus are stored in memory which is being updated continuously. If you ever get parts of your desktop that don't look correct, you can force your entire desktop (all menus, views etc.) to be refreshed by typing Control-R at any time. Alternatively you can refresh just any one Menu by clicking MB in the menu title area.

5.6   View Tabs

There is a tab for each view on a bar just above the Status Bar at the bottom of your desktop. If you have the Output Window in the default position (the tab at the bottom left of your desktop), the tabs bar is displayed just above the Output Window.

The *View Tab* has the icon for the view type and then the view name beside it.
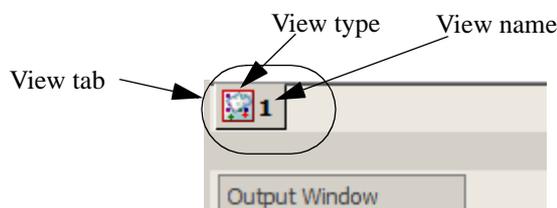
Each tab corresponds to a 12d View.

To bring a 12d view to the top of all other views and to set the view as your active view, just click LB on the appropriate View Tab, or LB in the view title area of the view.

Note that when a view is active, the View title highlights in blue.

5.7 Saving a Project

The changes to the Project you are working on are currently only stored in memory. To make the changes permanent and update your files on disk you need to Save the Project. This can be done at any time by clicking LB on **Save** from the Projects Menu (**Project =>Save**).

12d will occasionally pop up a panel reminding you 'Do you want to save the project?
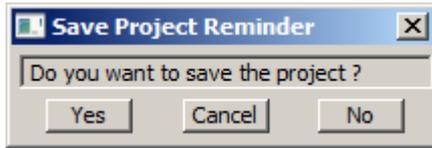
Click on **Yes** with LB to force a Save to occur.

The timing at which this message appears is set from the Main menu in **Project =>Management =>Defaults**. See the data field 'Save Interval (min)' under the 'System Settings' tab.

The default is every 15 minutes. You can set the time interval to zero to turn this feature off altogether.

If you ever crash out of 12d due to a power failure for instance, any changes since your last **Save** operation will be lost.

5.8 Exit

To terminate a 12d session, click LB on **Exit** from the Project menu (**Project =>Exit)**. If you try to Exit 12d after changes have been made to your Project, 12d will remind you of the changes by prompting you for a further **Save** operation.

5.9 Restarting 12d with an Existing Project

When you restart 12d and return to an existing project, the appearance of the desktop will be just as you last left it. The number of Views, appearance of all models and user defined parameters are redisplayed using the settings that are stored with the Project data.

The next time you start 12d, the project **STAGE 1** will appear in the previous projects list.

Double clicking LB on **STAGE 1** in the list and you will be taken into the project **STAGE 1**.
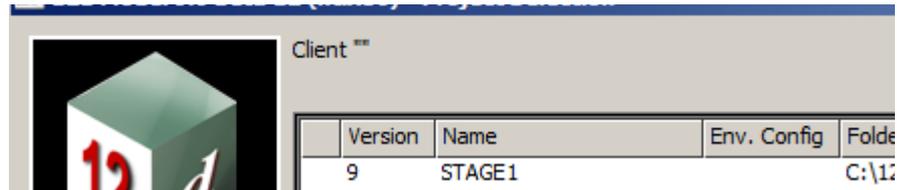
Alternatively, if you navigate to the folder containing the project **STAGE 1**, you will automatically get a pop up list of all available projects in that folder to select from.

Click LB on **STAGE 1** to highlight it and then click LB on the **Select** button. Alternatively, you can double click on **STAGE 1** to bypass the Select button.

If you have trouble restarting 12d, remember you called this Project **STAGE 1**. See Chapter 4.2 to remind yourself how to start 12d.

6   Basic Modelling

6.1   Alternative data entry

We will now repeat the process of importing data into 12d but this time we will use a 12d ascii file.

This option is the more common way of transferring data from Surveyor to Designer when both parties use 12d. The ascii format will often include all of the strings with the correct model, colour and other properties so that no mapping is required. Also a tin (triangulation) can be included in this file format so that the Designer has no need to create a new tin from the survey data. In this instance we will assume the coding is correct but the models are different so that mapping is required. Also a tin is not included.

We will import the file 'DETAIL SURVEY.12da'. To read in the file, click LB on **File I/O=>Data Input=>12da/4da data** from the Main menu.
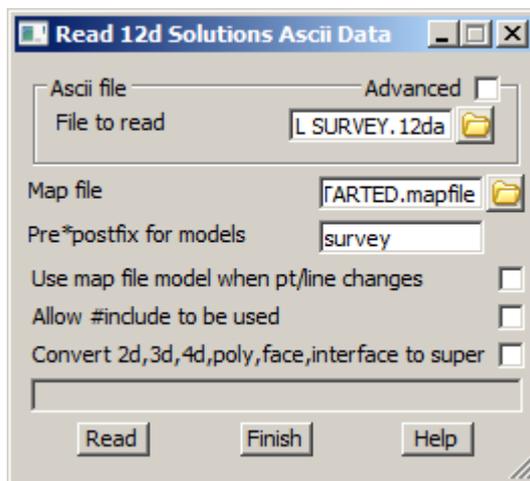
Click LB on the File folder icon then browse back up to the folder **C:\12d\9.00\Training\design\getting started basic**

Click LB on the file **DETAIL SURVEY.12da**

Click LB on [Open] to select the file

Select the map file icon and again browse to the folder **C:\12d\9.00\Training\design\getting started basic**

and select the file **GETTING STARTED.mapfile**

A model prefix 'survey ' is again typed in to group the survey models away from the future design models.

Click on **Read** to read the data into 12d Model.

Turn on all of the models
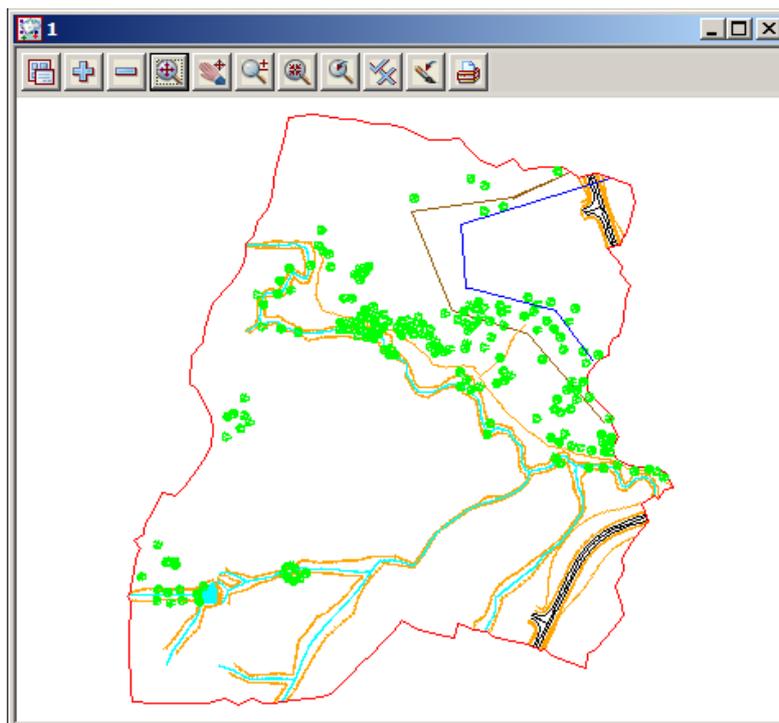
6.2 Saving model listing to a file for future use

We will now perform a function that is only meaningful later on when we are manipulating TINs. First we need to click on the 'Plan 1' view tab such that Plan View 1 is now our focus. The heading in view 'Plan 1' should appear coloured bright blue and it should be to the forefront.

The current thirteen models on the view are exactly the models that are used to create the 'natural surface' tin. We will now see how to record these models in a form that can be used in the future to restore those same models to another view.

From the Main menu click LB on **View=>Models Save/Restore**
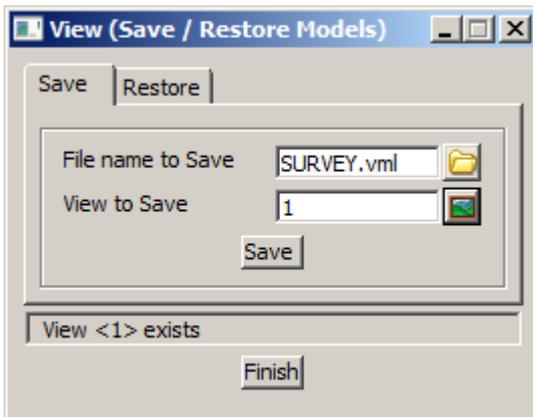
Type in the file name **SURVEY**. Pressing [Enter] will add the extension **.vml**

Click LB on the view icon then select view **1**

Click LB on **Save**

Click LB on **Finish** to exit the panel

This file can be read at any future time by use of the Restore option. This will add the same models to a view which need not necessarily be plan view '1'.

6.3   Triangulation

We will now use this point and line information to create a 3d surface or TIN (Triangulated Irregular Network). One of the concepts in 12d is that a TIN can be created from a single model, a single view (and all the models on that view are used) or a model list. In general, you will use Views to create models since you can control which models are on display in a View. <u>It is important to understand that when creating a TIN from a View, only those models on display in the View will be used in creating the TIN and only then if they are set to be tinable in the map file.</u> For instance, if you were forming a TIN to represent the natural surface, you could leave turned ON any models that represented underground surfaces prior to creating the TIN, because in the mapping file they would be set to be non tinable.

When using a mapping file to read in data, strings can be flagged as being tinable (Breaklines) or non-tinable. Only tinable strings are used in the triangulation. Breaklines are used to pick up the topographical features accurately. When forming triangles, 12d ensures that every breakline has the sides of one or more triangles along the entire breakline i.e. triangles <u>never </u>cross breaklines (unless the breaklines themselves cross).

In this exercise we are assuming that the survey strings have been checked for errors (See Getting started for Surveying manual)
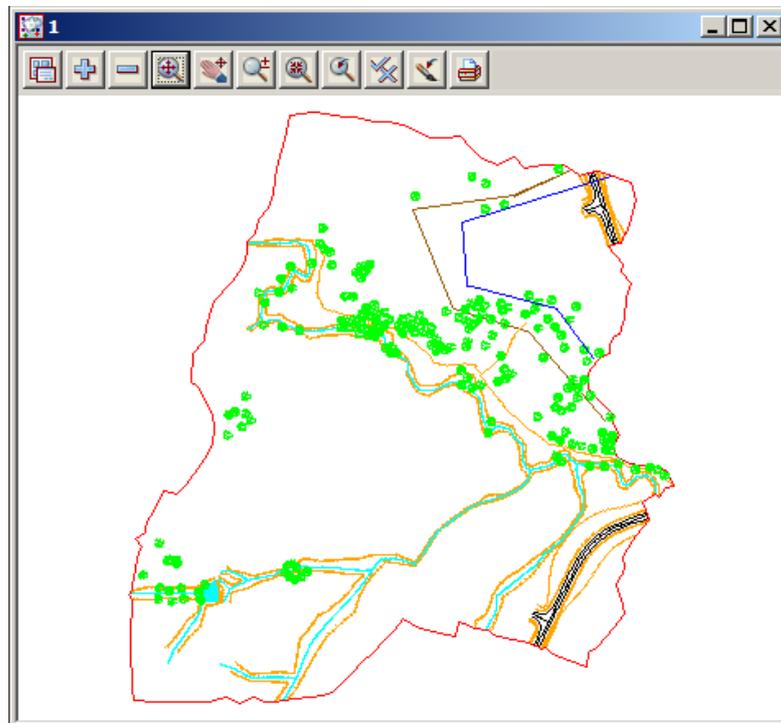
For the purposes of the ongoing tutorial, please ensure that all models in view 'Plan 1' are on display prior to creating the TIN. 'Plan 1' should look as shown above. Note that the points do not display when zoomed out.

From the Main menu, click LB on **Tins=>Create=>Triangulate data**
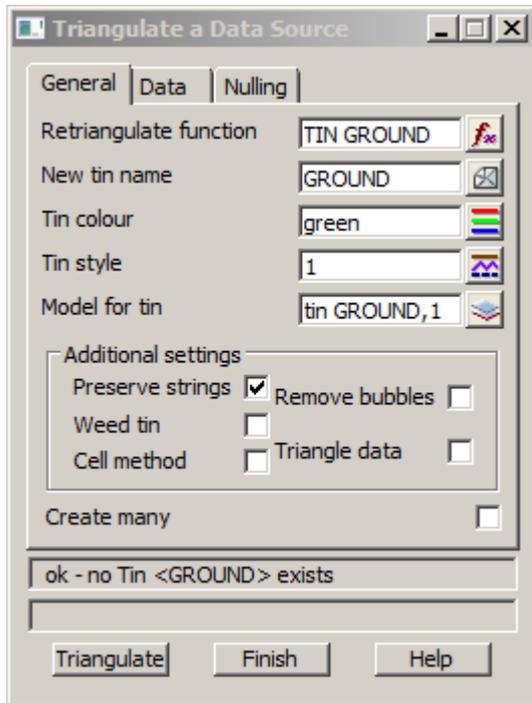
Fill in the first tab of the panel as shown.

The **Retriangulate function** option is used to construct a function which, when recalculated, will run a retriangulation on the tin. Place the cursor in the data field with the LB and type in '**TIN GROUND**'

Each TIN requires a name. Position the cursor in the **New tin name** field and type in '**GROUND**'. If you press the Enter key, this name will also be used to fill in the **Model for tin** field but with the prefix 'tin ' (see panel). The TIN name is subsequently used to refer to this specific TIN.

Position the cursor in the 'Model for Tin' field and type in the suffix '**,1**' after the name so that the model is displayed as the TIN is created. It is permissible to overtype this name but this is not recommended.
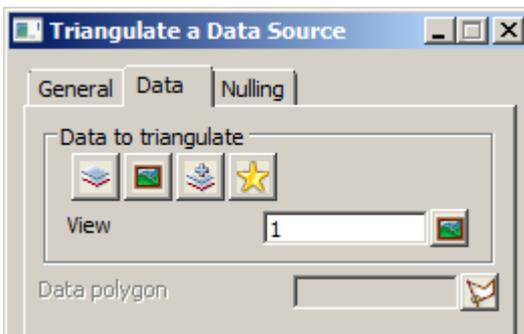
Click on the **Data** tab.

As we wish to triangulate all the data in plan view "1" and leave the tinabitily to determine which data to use, click LB on the view icon. Select '1' from the list.
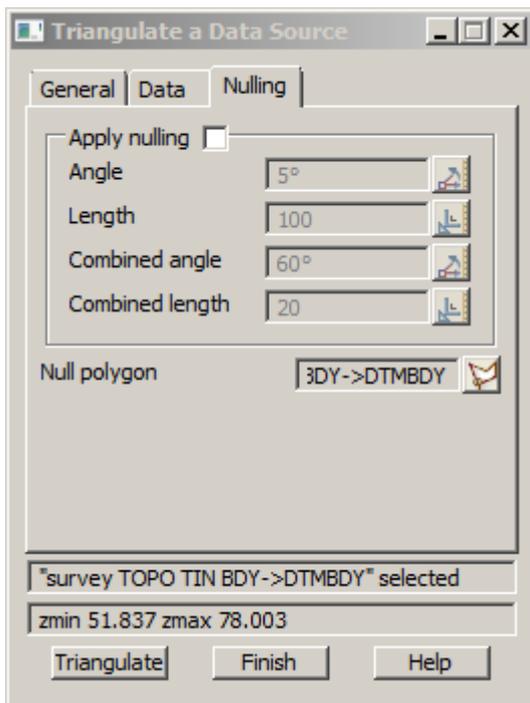
Click on the **Nulling** tab.

Click on the *Apply Nulling* check mark.

There are two options here, you can either set the parameters to null the external triangles or you can use a polygon to null all triangles outside this polygon. The **DTMBDY** string will be used as the boundary for the tin. Click LB on the **Null polygon** string icon then click LB on the **DTMBDY** string followed by clicking middle button (MB) to accept the string.

Click LB on **Triangulate** to create the TIN. There will be a short delay and then your TIN will be created and displayed as shown in the next picture.

Click LB on **Finish** to terminate the panel.
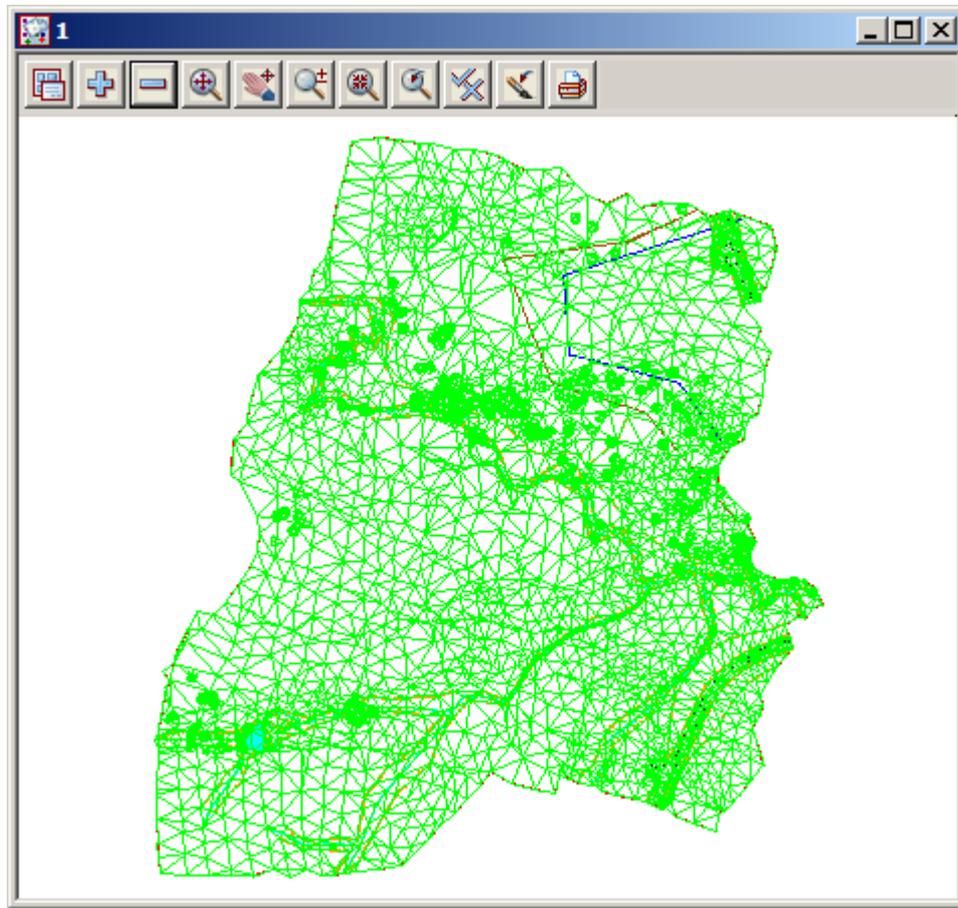
Note that the TIN is clipped at the selected null polygon ensuring only the surveyed data is included. Now that we have a TIN we can display the TIN data in a variety of ways

6.4   Tin inquire.

From the Main menu, click LB on **Tins=>Inquire** and the Tin Inquire panel pops up.
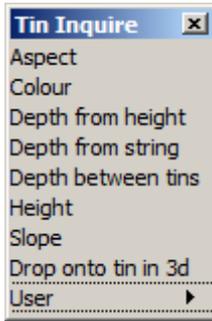
Click LB in the menu title area (where it says Tin Inquire), move the menu and Pin it with the LB. This operation is necessary to stop the menu from collapsing after the first menu pick.

Click LB on **Aspect**, and the Tin Aspect Inquire panel will pop up.
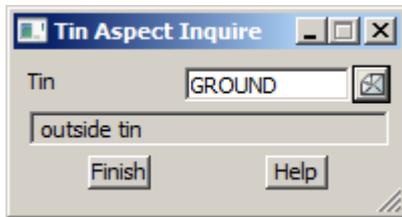
Move the cursor over the *Tin* icon button at right end of the 'Tin' field and use the LB to pop up a list of Tins. Double click LB on **GROUND**. Then click LB in the menu title area (where it says Tin Aspect Inquire), move the panel to a clear area of your screen and pin it with the LB. Do <u>not</u> Click on the Finish button in the panel.
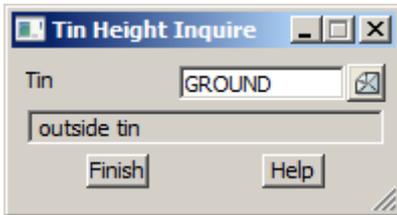
Repeat this procedure with both the **Height** and **Slope** menu items.
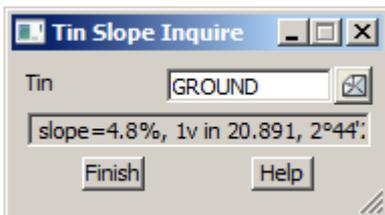
Once all three panels are on the screen, move the cursor anywhere over the TIN and observe what happens. When the cursor is positioned over any one triangle, the three point coordinates of the triangle are being used to linearly interpolate 'on the fly' to calculate the exact x,y,z coordinates of the cursor. Also the aspect and slope of the triangle is shown in the respective panels.
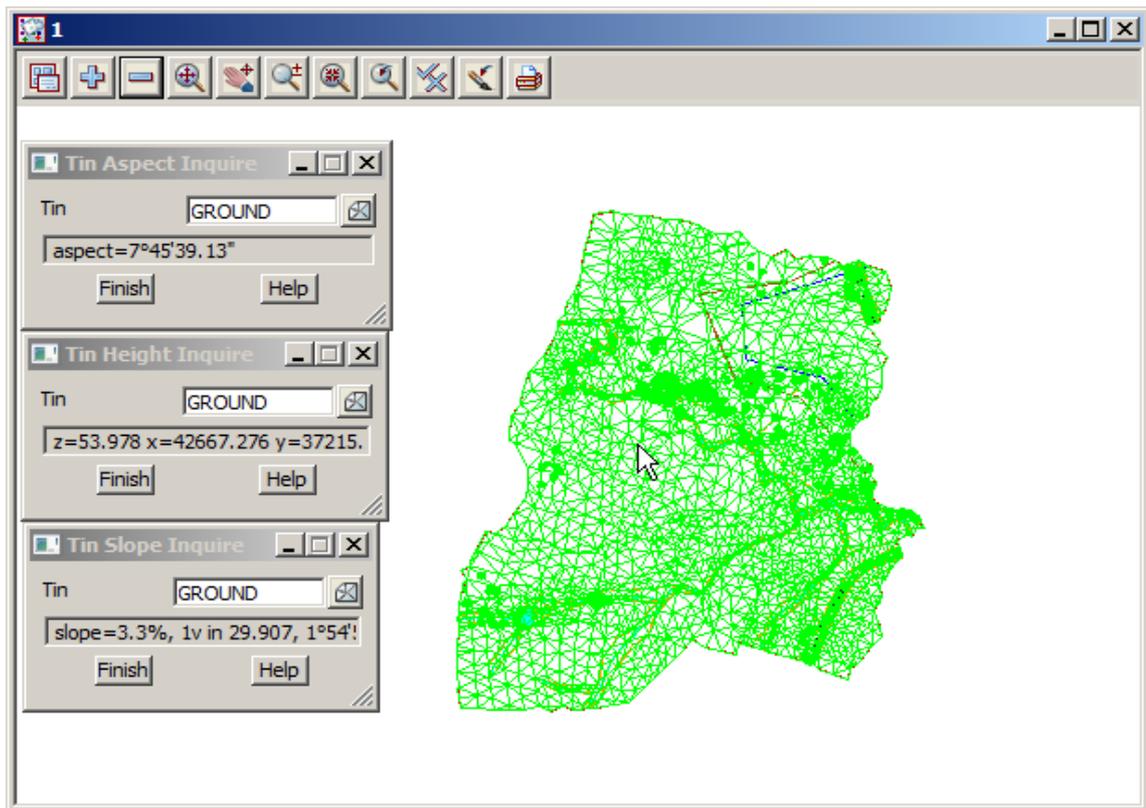
Click LB on **Finish** on all three panels to put them away. Also click LB on **'X'** on the Tin Inquire menu to shut it down.

We will now look at the various ways information in TINs can be viewed.

6.5   'Fast' Contours

We now want to remove all of the models from the View except 'tin GROUND'. From the View menu (in the View Button area), click LB on the '**-**' sign to pop up the Models to Remove panel.
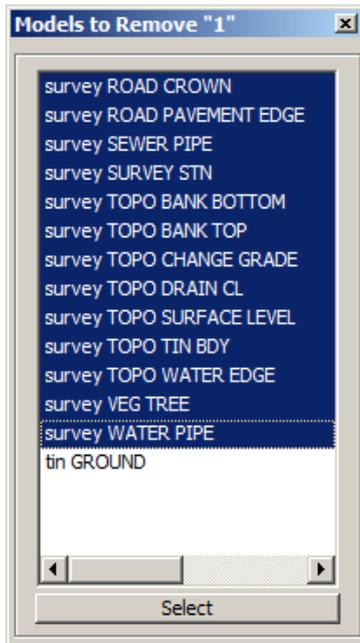
Click LB in the panel title area (over the words Models to Remove), move the panel and repin it with LB so that it doesn't collapse after each selection.

Now click the LB on the first survey model. Drag the mouse down the list to highlight all the survey models and click on 'Select'. Alternatively, you could double click LB on each model in turn *except* 'tin GROUND'. Click LB on '**X**' to shut down the panel.
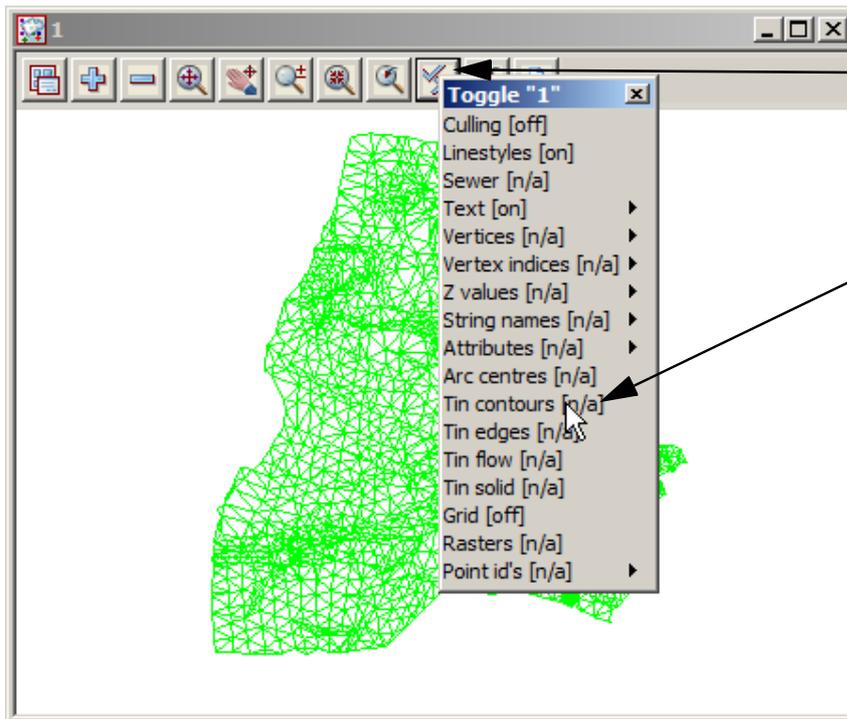
Now from the View buttons, click LB on the **Toggle** button to bring up the Toggle menu.

Then click LB on **Tin contours**. You should see the following red and green contour lines appear.
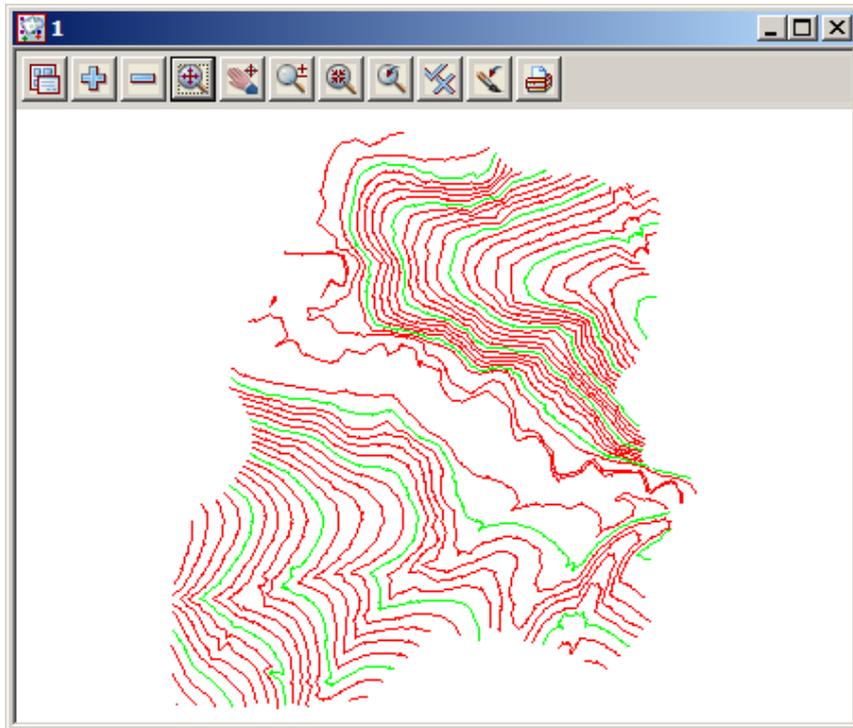
 If you click **Toggle=>Tin contours** again, the View will revert to the 'green triangle' display.

The appearance of the contours can be changed by clicking LB on the Menu button in the View Button Area. Click LB on **Settings=>Tins=>Contours** and the following panel will pop up.
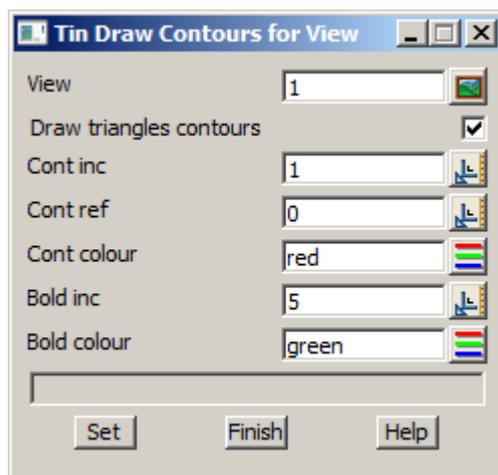
You can change any of the settings in the panel including colour. Click LB on the colour icon at the right end of the contour colour field to see a popup list of available colours. Select one by double clicking LB.

Try changing the contour increment (spacing) from 1 to 5 and the bold increment from 5 to 25. Click LB on **Set** to activate the changes**.** You will notice that the 'Fast' contours can be turned on and off from either the 'Draw triangles contours' tick box setting in the panel or the **Toggle=>Tin Contours** switch.

At the completion of experimenting it is suggested that you put the settings back to their default values (as above) at this time.

Click LB on **Finish** to terminate the panel. Your new settings will remain in effect indefinitely until changed.

6.6   'Fast' Flow Arrows

It is recommended that you turn on the drainage models for this exercise. From the View menu (in the View Button area), click LB on the '+' sign button and double click LB on 'survey TOPO BANK BOTTOM', 'survey TOPO BANK TOP' and 'survey TOPO DRAIN CL'. Make sure that the 'tin GROUND' model is also still turned on. The easiest way to confirm this is click LB on the '**-**' sign button in the View Button Area and look at the list of the models that <u>could</u> be turned off. Click LB on the **'X'** button to terminate the list.

Now from the View menu, click LB on **Toggle=>Tin contours** then **Toggle=>Tin edges**. The purpose of this is to outline each triangle. Then click LB on **Toggle=>Tin flow**. You should now see an arrow appear at the centre of each triangle representing the direction of water flow.

Try zooming in on a section of the model for a closer look. When you have finished zooming, click on **Fit** to again fill the View window.
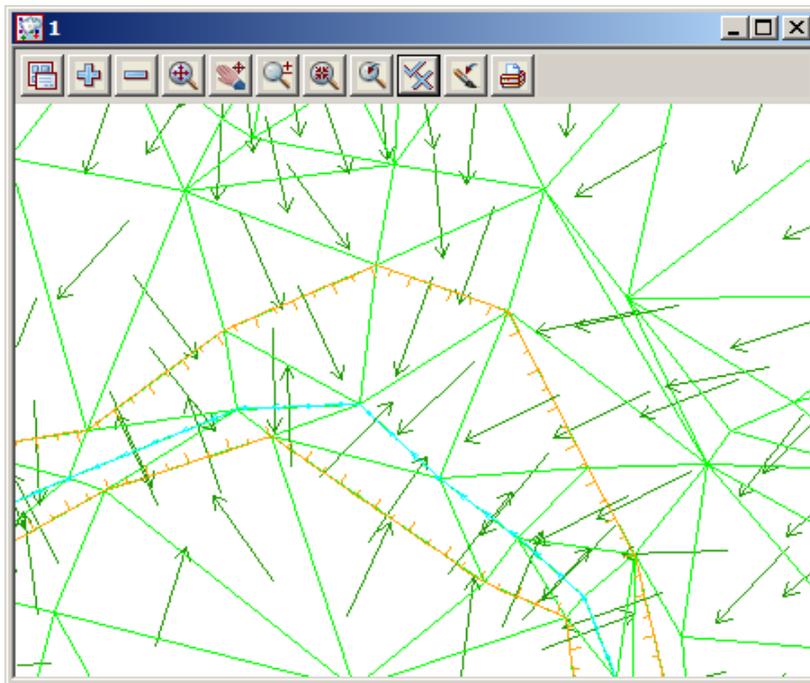
The appearance of the flow arrows can be changed by clicking LB on the Menu button in the View Button Area. Click LB on **Settings=>Tins=>Flow Arrows** and the following panel will pop up.
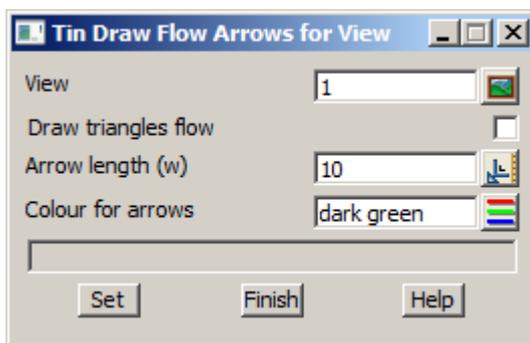
You can change the size of the arrow heads and their colour. Click LB on the colour icon for the 'Colour for arrows' field to popup a list of available colours. Select one by double clicking LB.

Try changing the arrow length from 10 to 5 world coordinates (in this case metres).

Click LB on **Set** to activate the changes**.** You will notice that the Flow arrows can be turned on and off from either the 'Draw triangles flow' tick box setting in the panel or the **Toggle=>Tin Flow** switch.

Click LB on **Finish** to terminate the panel. Your new settings will remain in effect indefinitely until changed (for this project only).

Click both **Toggle=>Tin edges** and **Toggle=>Tin flow** again and the View will revert to the 'green triangle' display.

6.7   Perspective View

We will now look at the perspective view facilities in 12d to examine the surface we created above.

Create a new perspective view. Click LB on **Views=>New=>Perspective OpenGL** from the Main menu and a new view pops up. Alternatively by selecting **Views=>Create=>Perspective OpenGL view** from the Main menu, a panel pops up.
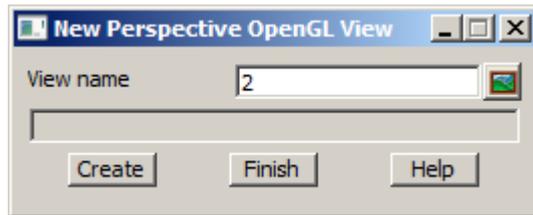
If necessary, put the cursor in the View name field, backspace over the existing entry (or use the Delete key) and type '2'.

Click LB on **Create.**

Note the new view is created immediately and is placed over the top of your existing windows.

You should use the standard windows features to 'Tile' the views. Click in the view title area for plan view '1' then select **Windows=>Tile Vertical**
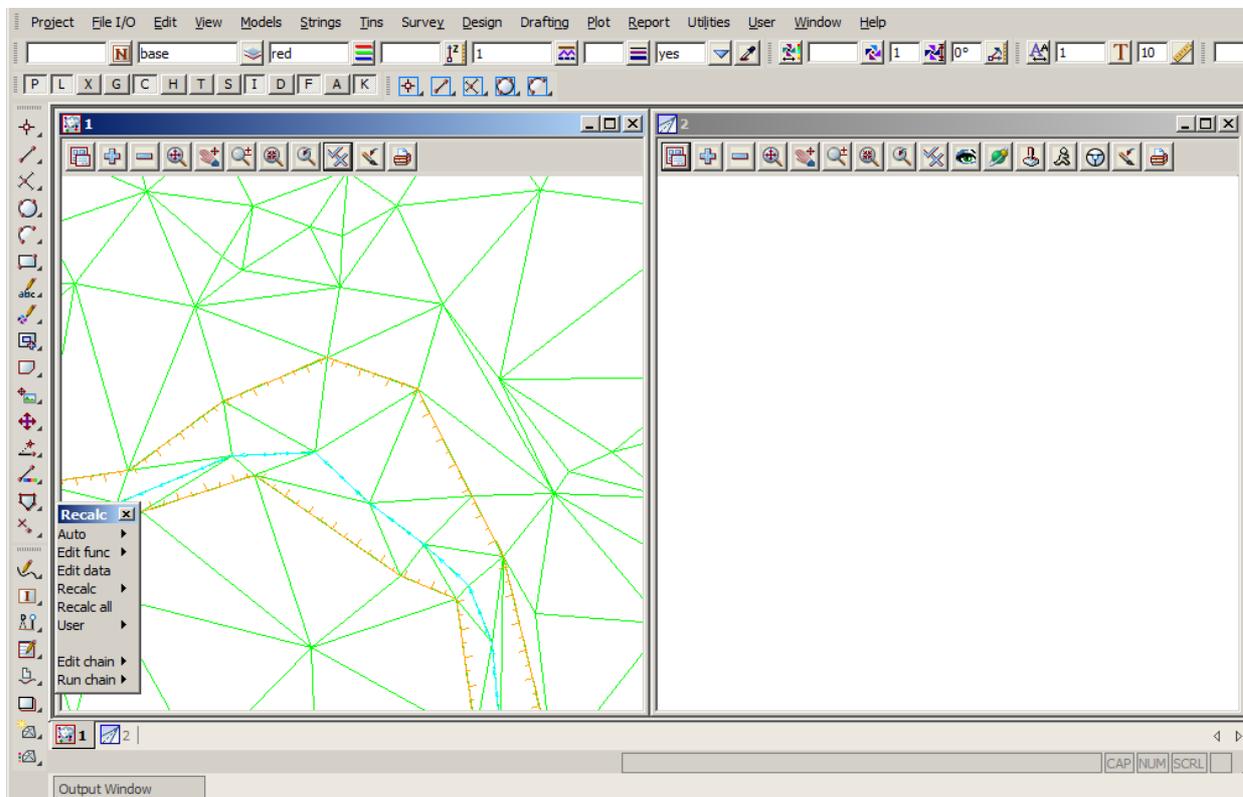
Your overall screen layout should now look something like this.

The view buttons on the Perspective view are:
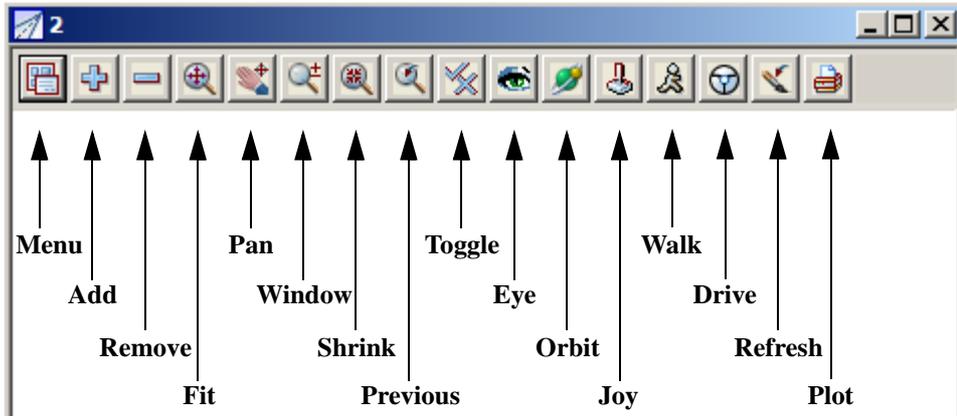
We now need to add the TIN to the perspective view. In the View Button Area of Perspective OpenGL 2, click LB on the **'+'** sign button and double click LB on **tin GROUND.** Click LB on the **Fit** icon. Your Perspective view should now look as follows
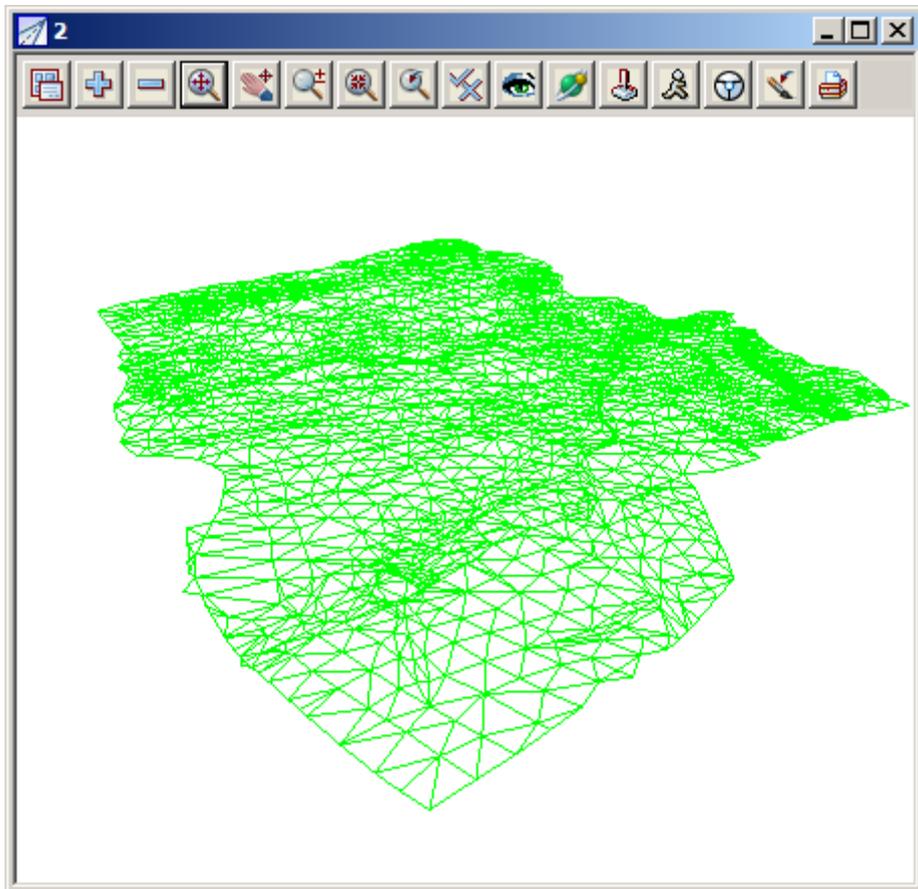
6.8   Joy Panel

The Joy (short for Joystick) provides a quick way of orientating your eye in relation to your data when manipulating a Perspective view.

The Joy panel is accessed from the View Buttons Area. Click LB on the *Joy* button in the View Button Area of 'Perspective OpenGL 2' and the **Joy View** panel appears.
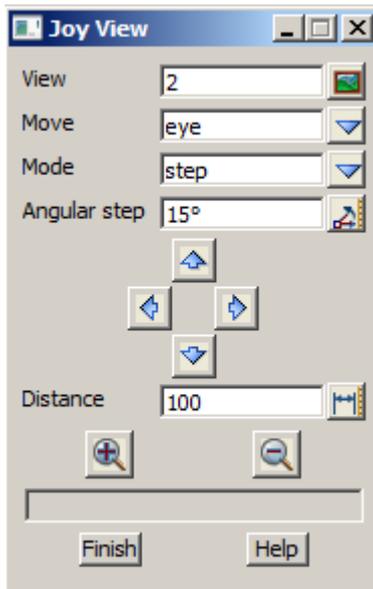
Try clicking LB on **In** and **Out** icons

and observe what is happening. You eye is moving inwards or outwards from the data.

Also try **Up, Down, Left** and **Right**. icons
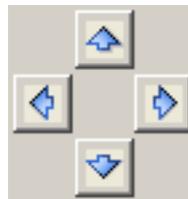
If you get lost or zoom in too far, you can always start again by clicking LB on **Fit** in the View Button Area.

The angular step between each up or down step defaults to 15 degrees. You can change this if you want smaller increments by entering a new value in the Angular Step field.

Similarly, the Distance changed on each In/Out movement defaults to 100 (metres in our case as all data is in metres).

The easiest way to reset a view so that you can see all of the data is to click LB on **Fit** from the View Button Area.

6.9   Orbit Panel

The Orbit is another way to orient your eye in relation to your data when manipulating a Perspective view.

The Orbit panel is accessed from the View Buttons Area. Click LB on the *Orbit* button in the View Button Area of 'Perspective OpenGL 2' and the **Orbit** panel appears.

With the 'Orbit' radio button selected use the LB to rotate the image in the perspective view.

You can use the middle button wheel at the same time to zoom in and out in the perspective view

If you get lost or zoom in too far, you can always start again by clicking LB on **Fit** in the View Button Area.

The easiest way to reset a view so that you can see all of the data is to click LB on **Fit** from the View Button Area.

6.10   'Fast' Meshes in Perspective view

We will now see how to quickly display the TIN in mesh form.

From the Perspective View menu, click LB on **Toggle=>Tin mesh**. You should see a coarse rectangular grid of red and green mesh lines appear.
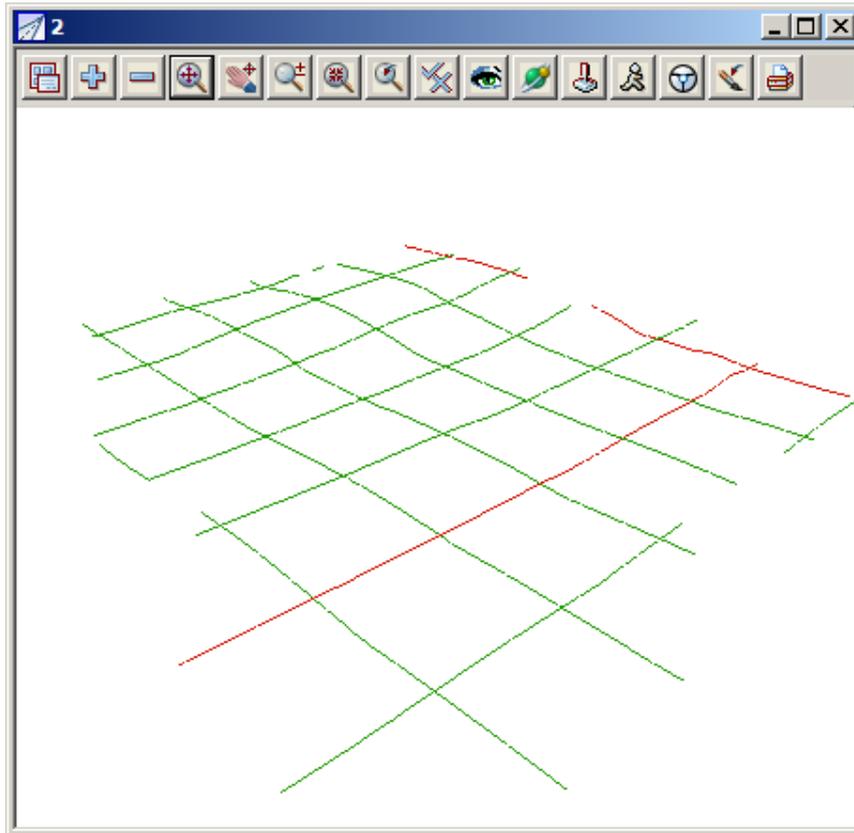
The appearance of the mesh can be improved by reducing the mesh spacing. Click LB on the Menu button in the View Button Area of the 'Perspective OpenGL 2' view and then click LB on **Settings=> Tins=>Mesh.** The following panel will pop up.
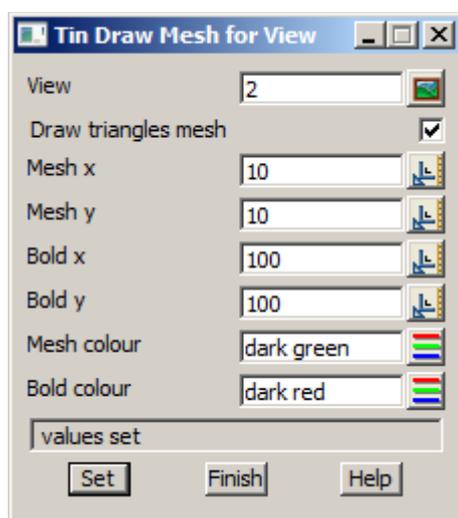
Change the settings to those shown in the panel. Change the mesh spacing from 100 to 10 in both x and y directions and bold x and y spacing from 1000 to 100. Click LB on **Set** to activate the settings.

You will notice that the Mesh can be turned ON and OFF from either the 'Draw triangles mesh' tick box in the panel or from the View menu via the **Toggle=>Tin Mesh** switch.

Click LB on **Finish** to terminate the Mesh settings panel.
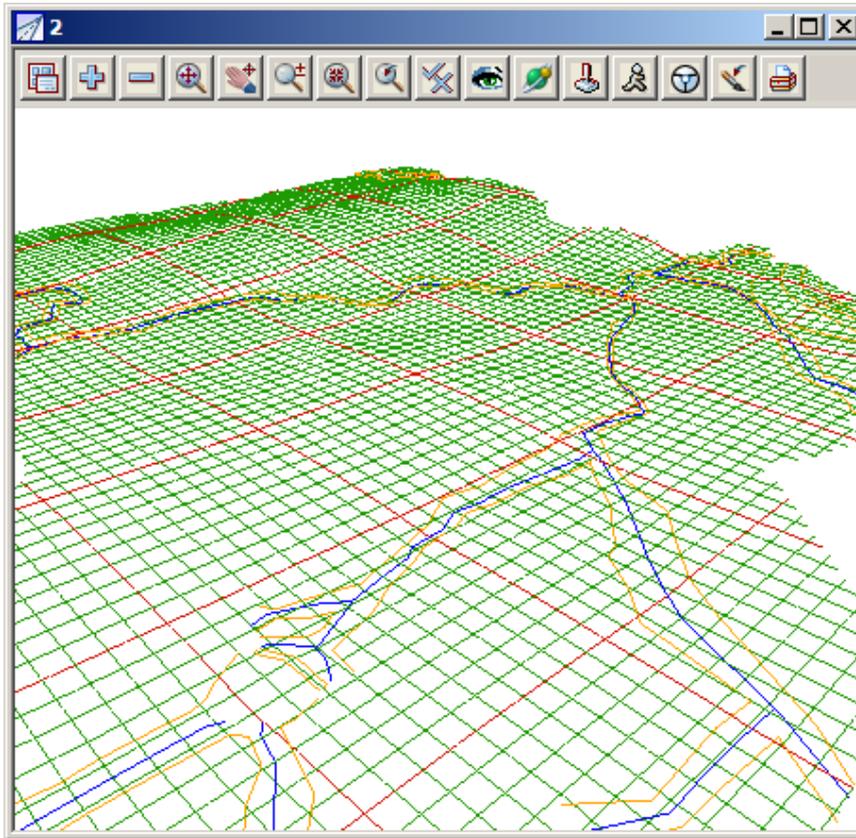
The effect of the creeks superimposed on the TIN (shown above) is created by turning on the Drainage models. Click LB on the '+' sign button in the View Button Area and double click LB on 'survey TOPO BANK BOTTOM', 'survey TOPO BANK TOP' and 'survey TOPO DRAIN CL'.

Note that 12d always displays the models in the order that they are turned on with the '+' and '-' buttons. Thus to get the effect of survey DRAIN CL (and any other models) superimposed on your TIN, you first turn all models off, then turn the TIN on first and then any other models to be superimposed last. Note that clicking LB on the Menu button in the View Button Area for 'Perspective OpenGL 2' and selecting **Models=>Remove all models** is a fast way to turn all models off.

The above perspective view orientation will stay as set indefinitely unless changed by further Joy or equivalent perspective view operations.

Toggle off the tin mesh from the View menu via the **Toggle=>Tin Mesh** switch.

6.11   Contours in Perspective Views

Sometimes it is useful to display contours in perspective views. You do this from the Toggle button. Simply click LB on **Toggle=>Tin Contours** as before.
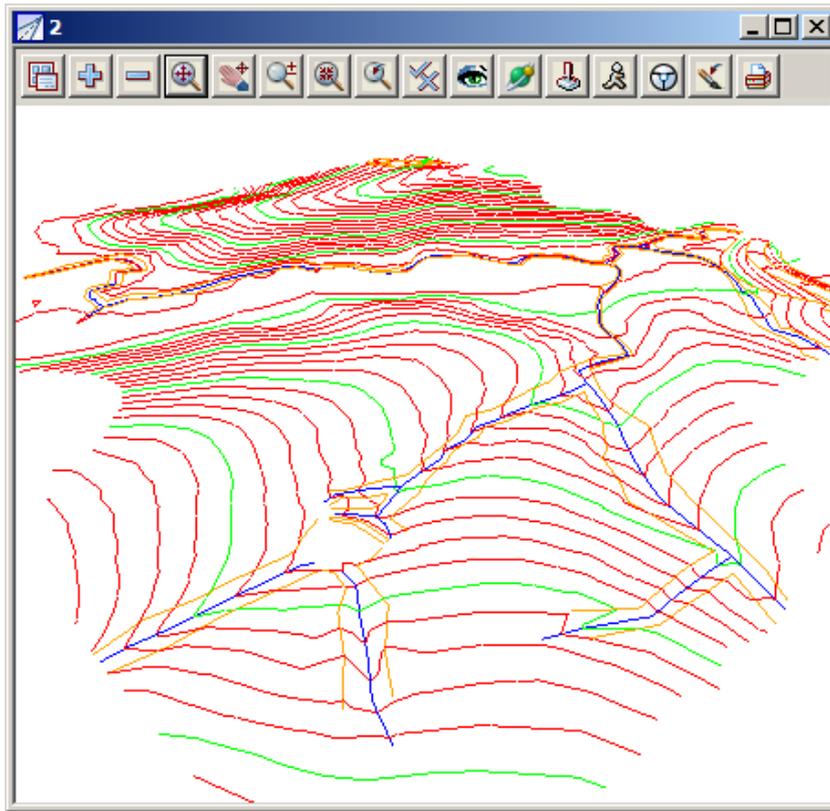
The contour spacing and colours of the Perspective view can be changed just as we did before in the Plan view. This time however you would click LB on the Menu button in the View Button Area of the 'Perspective Open GL 2' view. As before then click LB on **Settings=>Tins=>Contours.** See Chapter 6.5 for more details.

Click **Toggle=>Tin contours** again to revert to the 'green triangles' display.

6.12   Shaded Views

It is also useful to view a perspective as a colour shaded view. 12d has the ability to define up to 10,000 colours and use these to create a flat shaded view. During the shade, 12d will find and use the 'colours.12d' file supplied with the tutorial. The angle that each triangle makes with the sun (a point light source at infinity) is used to click LB on a different shade of green. The angle of the Sun can be varied but 45 degrees (the default) gives the maximum contrast.

To quickly shade all the TINs on the perspective view, simply click LB on **Toggle=>Shade**.
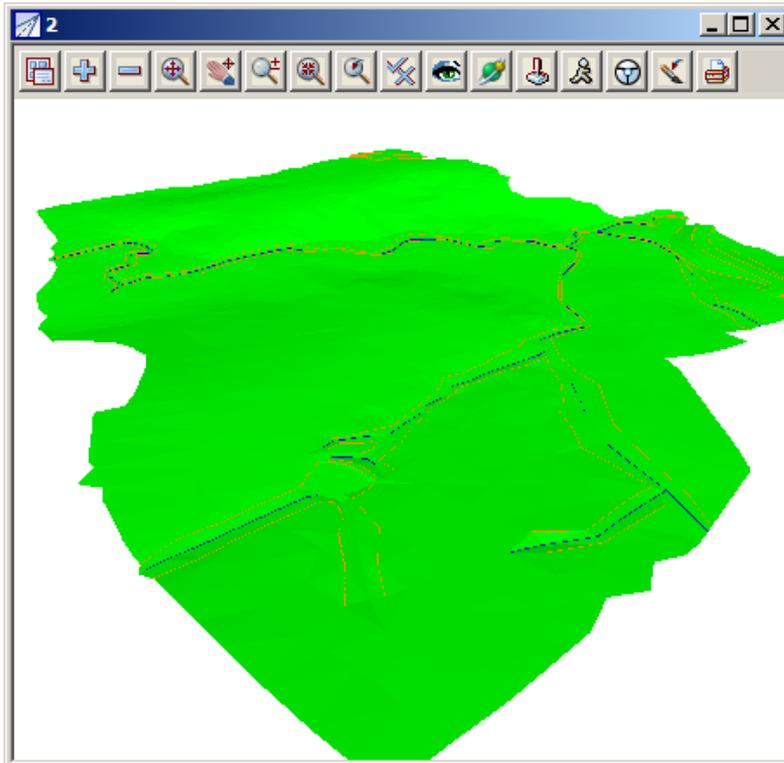
To access the Shade View panel to modify the shade settings, click LB on the Menu button in the View Button Area of 'Perspective OpenGL 2 and then click LB on **Settings=>Shade.**
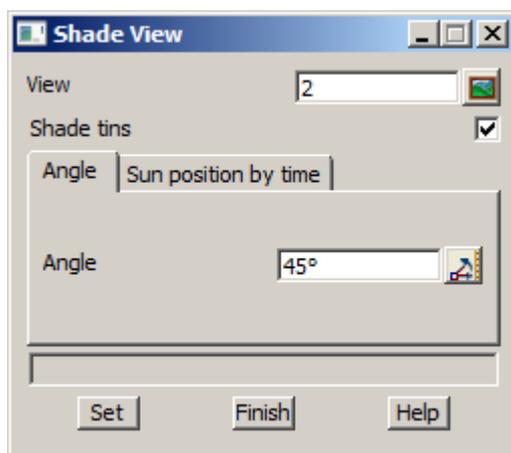
Clicking LB in the 'Shade tins' field tick box will toggle on and off the shading. A tick indicates the shade is activated.

Click LB on Set to create the shaded view. All TINs in the view will be shaded using the faces in order furthest to nearest the viewer. This has the effect of removing faces that are hidden from view.

Click LB on **Finish** to terminate the panel.

Now every time the view is refreshed or the view changed, the shaded view will reappear.

To get back to a 'green triangles' rather than a shaded view, click LB on **Toggle=>Shade** to toggle the shade off.

7   String Picking Concepts

We will now investigate picking concepts and how the mouse is used to interact with 12d when pointing to and selecting items on your screen. Initially, do all picking (i.e. mouse clicking) with the LB. This uses the 12d Model Tentative pick. Later we will look at Fast picking using MB.

In plan view '1' turn on all the models except the triangulation (tin GROUND).

Zoom in to the left dam. Your overall screen layout including the 'Plan 1' view should now look as shown below.
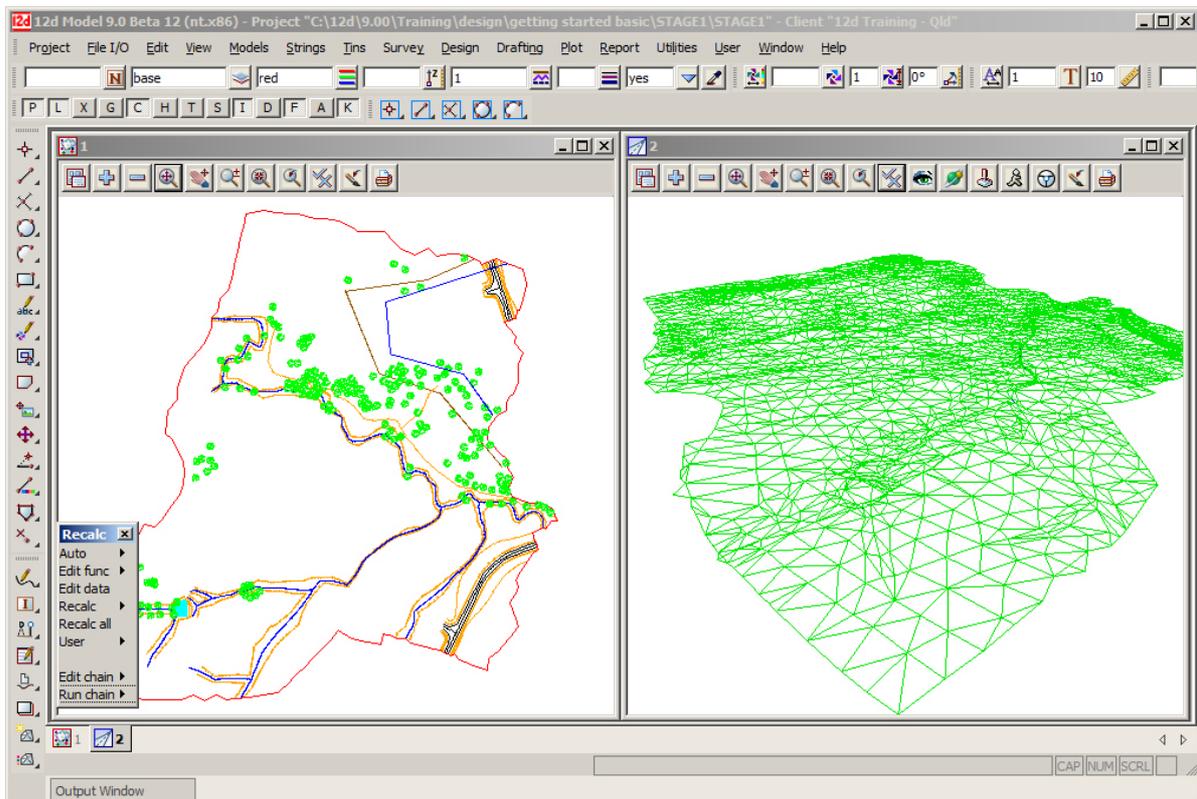
Whilst the 'string picking' concepts are used throughout 12d, especially during construction of design features where we want to connect into existing geometry, we will learn about them by example through the relatively simple 'String Inquire' feature.

7.1 String Inquire

String Inquire is used to inquire and view the details of a typical line (i.e. string) that is already present in the View. From the Main menu, click LB on **Strings=>Inquire** to bring up the following panel.
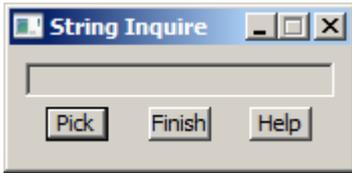
Click LB on **Pick** and then move the cursor anywhere over one of the bank strings and click LB.

NOTE: the *String Inquire* panel can also be brought up by pressing the F2 key. This has been defined in the standard 12d Model function key short cuts (userkeys.4d).
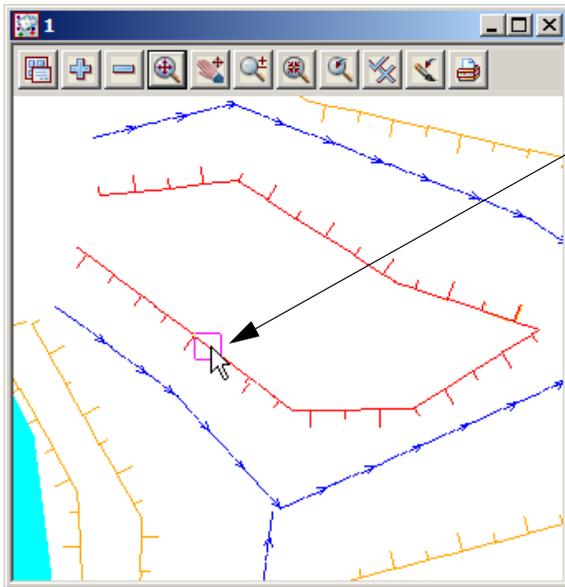
If you placed the cursor over a line:

If your Snap settings are still set to their default values, you should see the line go white (shown here as red) and a yellow (shown magenta) square box appear at the last location of your cursor when you clicked LB.
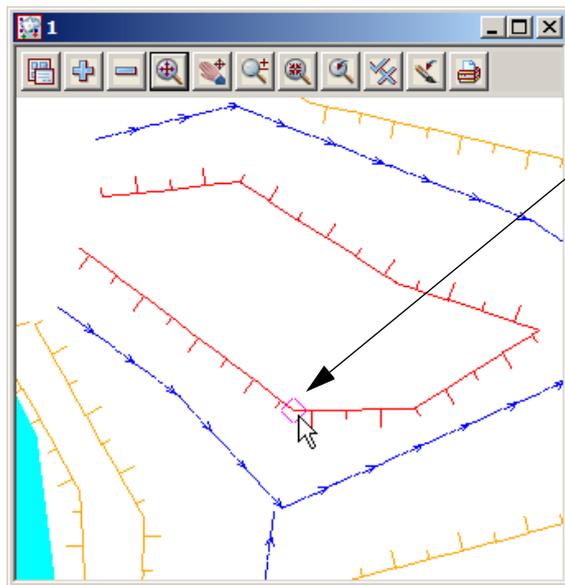
If you placed the cursor over a point connecting the line segments:

If you happened to snap to a point on the line rather than the line itself, you will see the line go white (shown red) and a yellow (shown magenta) diamond appear at the last location of the cursor when you clicked LB.

In either case, an Information panel will pop up as shown at right (provided the Info tickbox is set ON - see Chapter 7.4 'Snap Settings'). It advises such information as the name of the Model which contains the selected string (survey TOPO BANK TOP), the string name (TBR), the type of string (Super). The colour, line style and number of points in the line are also returned along with it's length.

The x and y coordinates are those of the cursor at the time of the string 'pick'.

In this case the panel shows that the string was accessed via a 'Line snap'.

If you haven't moved the cursor very far and now pick with the LB again, you will notice that the Information panel changes, the string goes back to its original orange colour and the cursor is now replaced with a yellow (shown magenta) circle.
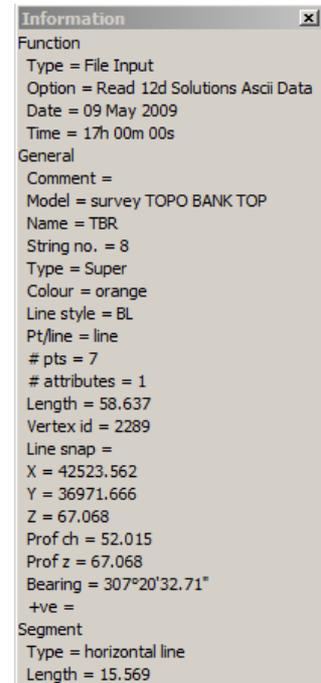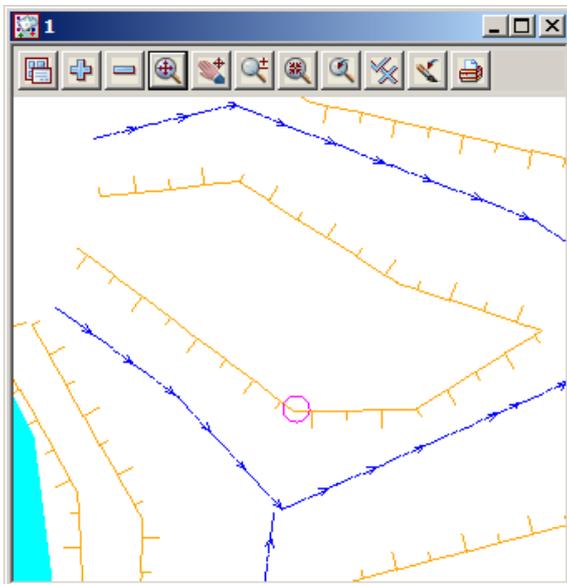
This sequence may seem strange at first. What has happened is that the first pick located a string within snapping distance of the cursor so the string 'highlighted' in yellow and the Information panel for this string popped up. The pick location showed a diamond to indicate that a 'snap to the nearest point' had occurred. 12d is in effect asking you 'Is this the string you want?'. To reject the currently highlighted string, <u>without</u> moving your mouse, simply pick with LB again.

The second pick couldn't find any more strings to snap to (adjacent strings were outside snapping distance) and so no more information panels popped up. Instead, a circle showed at the pick location to indicate that a 'snap to the cursor' location had occurred i.e. the only thing that 12d could find at the pick location was the cursor.

The above sequence will only happen this way if the snap settings are in their default setting i.e. points, line and cursor ON. See below for more about snap settings.

Now if you try to click LB again on the same string, you will only get the yellow circle indicating a cursor snap. This happens even if you try to pick it multiple times.

<u>The reason for this is that 12d only ever gives you one chance to snap to a string in any one picking sequence. Any strings already rejected during the pick sequence will be ignored.</u> The purpose of this behaviour is so that if there are (say) three lines one on top of the other, it is possible to sequentially snap to each one in turn by looking at the Information panel details as you perform each LB mouse click. <u>The fact that we could only snap to one string confirms that there is only one string present at this location.</u>

A quick method of restarting a pick sequence when a string is highlighted, is to move the mouse (i.e. cursor) a short distance from the last pick point. All strings can then be picked again. The next section shows how the mouse buttons can also be used to restart a pick sequence.

To terminate the String Inquire i.e. this pick sequence, click LB on **Finish** in the String Inquire panel.

7.2 Use of Mouse Buttons and Enter Key when using Tentative Picking

The three mouse buttons and the Enter key all have a function when picking strings. Those functions are

LB - Left Button	Select the nearest string
MB - Middle button	Accept the current 'highlighted' string. This will also terminate the current pick sequence.
RB - Right button	Bring up the Pick Ops menu
Enter key	Accept the current 'highlighted' string. This will also terminate the current pick sequence. This is the same as MB and is very useful if you only have a two-button mouse (not advisable).

7.3 Pick Operations Menu via the Right Mouse Button

We will now focus on the use of the RB. Repeat the above picking sequence but now after getting the yellow square cursor (i.e. picking the string), click the RB and the Pick Ops menu will pop up
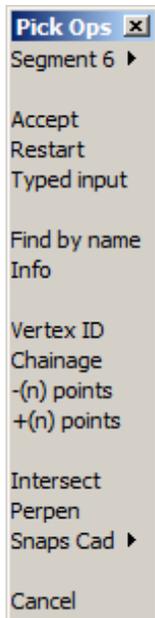
Click with LB on **Restart**. This resets the pick sequence to start over as if the previous pick sequence had never occurred.

If you now try to click on the string with LB, you will notice that the string can now be picked again with the LB. The lesson here is that if you ever get confused during a picking sequence, the safest way to get operational again is to bring up the Pick Ops menu, select **Restart** and start over from the beginning.

The **Accept** menu item needs special mention. During a picking sequence, once you have located the string you are after, you normally terminate the sequence by clicking the MB. This accepts the current string and terminates the pick sequence.

The **Accept** menu item has the same function as clicking the MB during the pick sequence i.e. it is used to indicate to 12d that the string found is the one that you wanted. If you are using a 2-button mouse, this is another way around the lack of the middle button (using the Enter key for accepting was described in the previous section). You can accept a string by using the RB to bring up the Pick Ops menu and click LB on **Accept**. If you have a 3-button mouse, it is easier to use the MB to accept the string directly.

The **Info** menu item also has a special function. The Information panel that pops up when a string highlights is displayed temporarily. If you move the mouse cursor out of the panel, the information panel will disappear. This occurs even of you don't click any mouse buttons. The **Info** menu item is used to pop up the Information panel (again) of the currently highlighted string.

The **Cancel** menu item is used to terminate many of the operations that are recursive. For instance when creating a string, 12d assumes that it will involve multiple line segments so it stays in create mode after each segment is placed. After the last point on the string is placed, use the RB to pop up the Pick Ops menu and click LB on **Cancel** to terminate the creation.

7.4   Snap Settings

In the context of String Inquire, the snap settings are used to selectively choose from 12d data sets when inquiring on existing items. The snap settings can be toggled on and off from the snaps toolbar.

Snaps toolbar
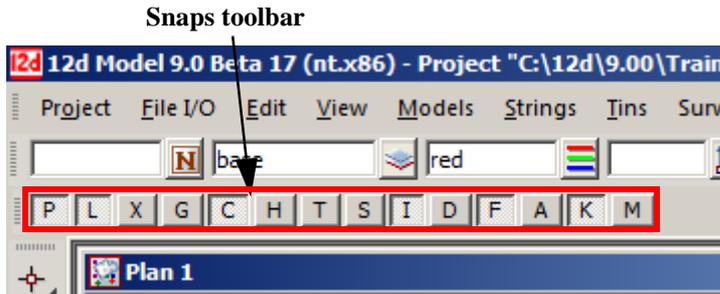
The snap settings can also be set from the Snaps menu under **Utilities** on the Main menu. Click with LB on **[Snaps Ops]** to pin up the Snaps Ops menu

You can select either *Snaps* or *Snaps (Vert)*.

As you use 12d you need to access the snap settings frequently, so it is convenient to leave the snaps menu on display at all times. To minimise menu clutter, the Snaps toolbar and Snaps (Vertical) are merely abbreviated forms of the full Snaps menu. They take up less room on your screen and hence are useful to the experienced user.

Snaps toolbar

Point	P
Line	L
Te**x**t	X
Grid	G
Cursor	C
Height	H
Vertical snaps toolbar Tin	T
Segment	S
Info	I
Data tip	D
Fast pick	F
Fast **a**ccept	A
Fast snaps cad accept	K
Lists all strings within snap tolerance	M

At any one time each snap setting is toggled either ON or OFF. For the Snaps toolbar and the Vertical snaps menu, the snap setting is ON when the button is depressed or appears clear and OFF when the button appears raised or blue. The settings shown are the default settings when starting 12d.

If you are new to 12d, it is easiest to use the full snaps menu until you get used to the abbreviations in the Snaps toolbar.

From the Main menu, click with LB on **Utilities=>Snaps=>Snaps**. Move the Snaps menu to the bottom left corner of your screen to get it out of the way.

On the Snaps menu, at any one time each snap setting is toggled either ON or OFF. If a tick appears, the snap setting is toggled ON. The settings shown are the default settings when starting 12d.
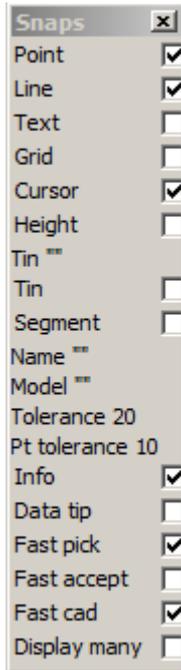
At this stage we will focus on 4 of the first 5 boxes: Point, Line, Grid and Cursor. Upon a successful snap, each snap type returns a unique appearance.

Point Snap - diamond
Snaps to the nearest point or end of line

Line Snap - square
Snaps to the nearest line

Grid Snap - circle
Snaps to the nearest grid intersection point

Cursor Snap – circle
Snaps to the mouse cursor (x,y) position. This is used when drawing freehand.

To change a snap setting, click LB in the snap setting box or on the text describing the snap (e.g. P). The setting will toggle ON or OFF.

As shown above, it is possible to have multiple snap settings on simultaneously. For instance, if you want to be able to select a line on either 'the line' or it's 'end points', you need both Point and Line snap ON.

You can generally leave Cursor snap ON. Most times, if all other snaps fail or are not set, you want the mouse cursor position returned. This is useful when freehanding into 12d strings that are not connected to existing features e.g. the centreline of a new road. If you don't have Cursor Snap ON, you will get a 'Failed Snap' error message whenever all other snap settings fail.

Near the bottom of the Snaps menu is an 'Information' tickbox labelled **Info**. If this box is NOT ticked, the Information panel will NOT pop up as each string is selected.

Above the 'Information' tickbox is the menu item **Pt tolerance 10**. This figure indicates the current point snap tolerance setting is 10. To change the snap setting, click on **Pt tolerance 10** with LB and the following panel pops up
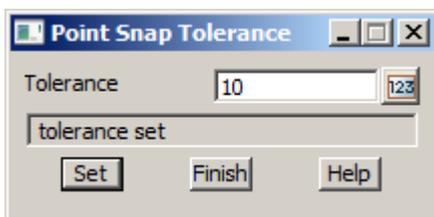
The point snap tolerance is measured in screen pixels. In 1024 resolution, a point snap tolerance of 10 represents about one hundredth of your screen width. If point snap is set, then the closest vertex within this distance of the cursor will be selected.

To change the tolerance, lock the cursor in the *Tolerance* field by highlighting (double clicking on) the existing text, press the Delete key and type a new Tolerance value. Click LB on **Set** to activate the new setting. Click on **Finish** to terminate the panel.

Similarly for the **Tolerance** menu item - click on **Tolerance** and the *Snap Tolerance* panel pops up

NOTE - When *Point* snap is set on, any vertex of a string within the point snap tolerance box around the cursor when LB is clicked, is considered for selection ***before any other type of snap is considered***. Centres of circles, centres of arcs and arc end points are considered to be vertices.

When *Line* snap is set on, the cursor only needs to be within the snap tolerance distance of any visible segment of a string when LB is clicked, and that string is considered for selection. Also arcs and circles are considered for selection.

Point Snap Box and Snap Box
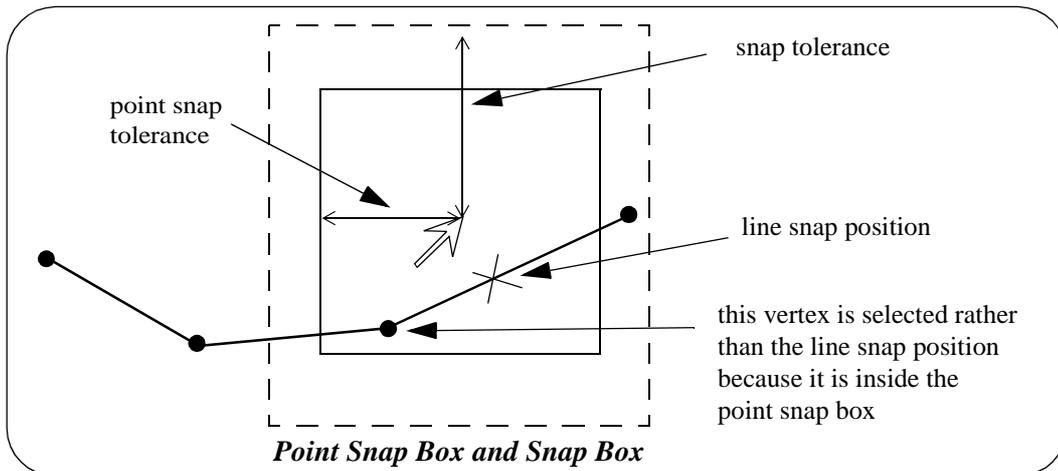
In the area between the point snap box and the snap box, vertices and line snap positions are treated equally and the closest one to the cursor is selected.

To practice this further, do a **Fit** on your current View. Pick a feature in the view where lots of lines meet and without moving the mouse, do a series of 'String Inquires' by repeated use of the LB and observe how 12d will snap to adjacent items near to the mouse cursor. Note the cursor shapes returned that indicate that sometimes you are getting a 'Point snap' and sometimes a 'Line snap'.

Remember points are just a special type of string.

7.5   Models and Snap Settings

Whilst it may appear obvious, it is important to remember that you can only snap to data that is currently on display. Models that are currently turned off will not participate in the selection process during snapping. If you find that you are snapping to unwanted items, consider turning off models that are irrelevant to your current operations

7.6   Fast Picking

To **Fast pick** a string, simply move the cursor near the string and **click MB** or type <enter>. The nearest string to the cursor satisfying the snap conditions is selected.

Hence using **MB** alone replaces a LB followed by an MB.

7.7 Modifying the String Highlighting Colour

12d has various default parameters for the display of data including the string highlighting colour. This is the colour a string is changed to whilst it is selected.

The default highlight colour is *white* but this is not be very useful if you want to draw strings in white, or if you use a white background colour. In either case, it is important to change the highlight colour to a colour other than the white.

To check the highlight colour for the project, we select from the main menu **Project => Management => Defaults** and the **Defaults** panel pops up.
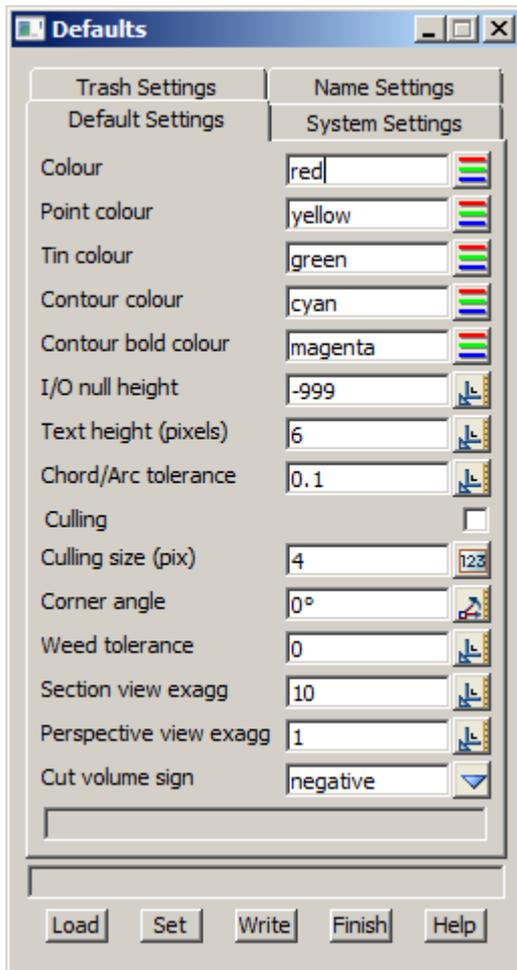
From this panel, the user can change various parameters for this project that 12d uses for calculations, display and data handling.

To change the default highlight colour, select the *Systems Settings* tab by clicking LB on the 'Systems Settings' tab.

The following panel should appear:
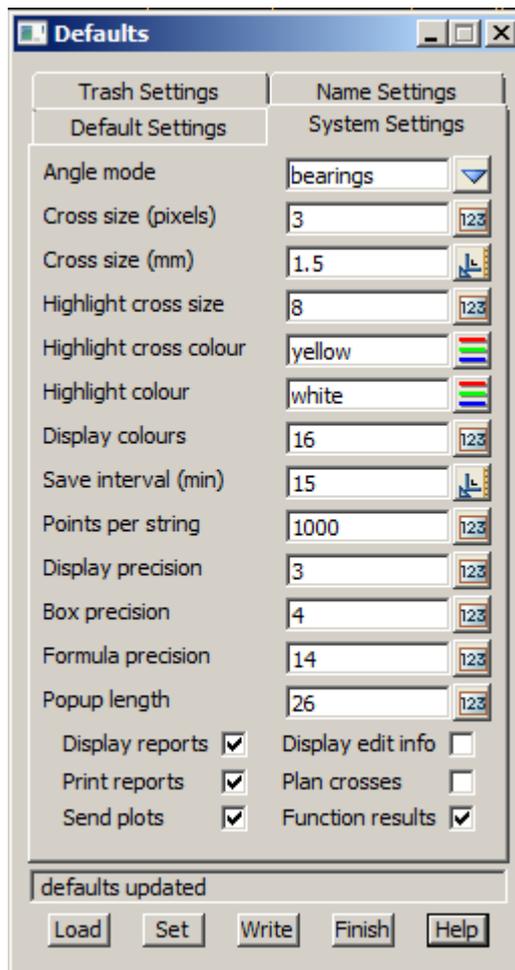
Note that the Highlight colour is set to white.

To change this, LB click on the colour icon adjacent to the Highlight colour input box and select another colour such as cyan from the colour choice box. Then press **Select** on the colour choice box panel. Colours can more quickly be selected from the choice box by double clicking LB on the desired colour - the Select button is not required.

To set the current values for the defaults press the **Set** button.

NOTE: When a new project is created, the values in the **Defaults** panel are loaded from the set-ups file *defaults.4d* which 12d Model looks for on start up in the standard 12d location (for more information on the search order, see Appendix J 'Set Ups' in the on-line Reference manual). For an existing project, all the values in the **Defaults** panel are saved with the project so if any have been changed in the project after the project was first created, then the defaults for the project will differ from those in the *defaults.4d* file.

If you wish to keep the current defaults for a project to use as the initial defaults for future new projects, you can save the file **defaults.4d** to a suitable location by clicking on the **Write** button to bring up the **Write Setup File "defaults.4d"** panel.
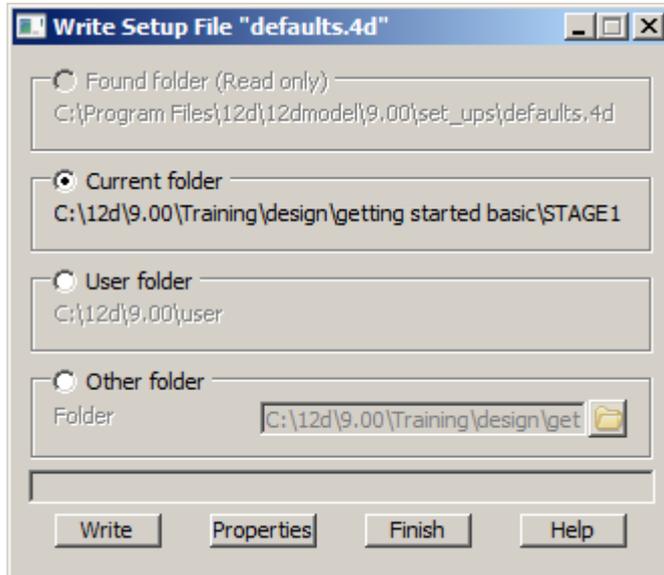
Specify where you wish the *defaults.4d* file to be saved and then click on **Write**.

In this example select the Current folder. If you wanted the changes to apply to any new project you create then you would save the changes to the **'User folder'** as shown above

Click on **Finish** to close the **Save Setup File** panel, and then **Finish** on the **Defaults** panel.

8   Creating Strings with CAD

We will now investigate creating strings using the CAD options. We will create points (one point strings), a 2 point line (single segment string) and a line string (multiple segments in the string).

First we will create a new plan view to work in.

From the main menu, click LB on **Views=>New=>Plan**. This will create View 'Plan 3'.

Maximise the view by clicking on the *Maximise* icon on the top right hand corner of the view or by double clicking on the plan view title area.

Minimise   Maximise

Close
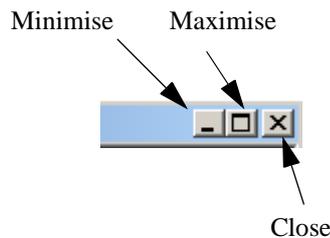
8.1   Creating Points

The CAD options to create points, lines etc. can be done by using the main menu system or by the use of the CAD **toolbar**, which is displayed on the left of the screen at start-up. Regardless of the method used to activate the CAD commands, the CAD **controlbar** as outlined on in Chapter 4.5 will be used to define the characteristics of the created elements. We will change the values in the **controlbar** as follows.

name   *colour*   *linestyle*   *tinability*

model   *height*   *weight*   *same as*
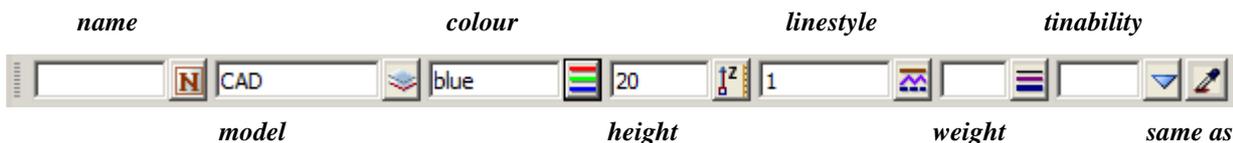
Click LB in the model field and type in 'CAD'. Click LB on the colour icon and choose the colour *blue* from the choice box by double clicking on *blue* in the pop-up list of colours. Enter '20' into the height box and leave the linestyle type as 1.

To create a point string (i.e. one vertex string) we will use the CAD **toolbar** flyout. Pick the points section of the toolbar by clicking LB over the create point symbol and keep LB depressed.
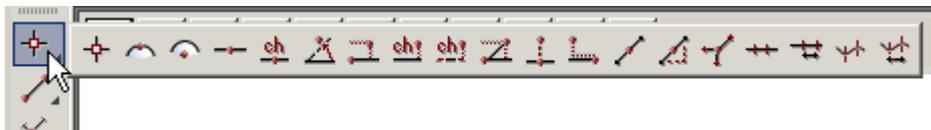
The points **flyout** menu is displayed which has all the options in the points section of the CAD creation tools. This is displayed as a horizontal bar consisting of all the icons that make up all the options in the points section of the CAD tools. Whilst holding down LB move the cursor over each of the icons and the **tooltip** function tells what each of the options does.

To select an option, keep the LB depressed until the cursor is placed over the specific option you want and then release the LB. We will select the **'Create Point'** option which is the first icon in the **flyout**.
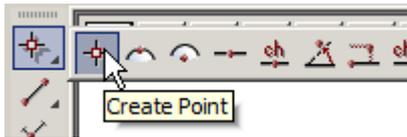
On selecting the **Create Point** option, or any other CAD option, the user is prompted for the relevant data in the screen message box located on the bottom left hand corner of the 12d Model application window
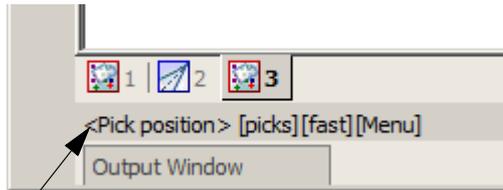
Message area

The user can select a position with the mouse and on accepting that point (Middle mouse button or enter) the point is created at the selected position. The model, colour, height etc. are defined in the **Cad Controlbar**.

The snap mode will influence the mouse selection. For example if cursor snap is on, the user can choose a position not yet defined. If point snap is on and the selection snaps to an existing point, the option will place another point at that location. Ensure that the cursor snap is activated in the snaps **toolbar**. Click LB at a position roughly in the middle of the view.
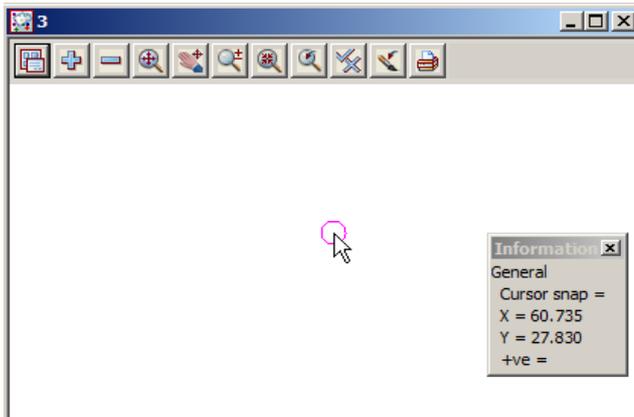
Click MB. The point is then created with the model 'CAD' being added to the view automatically.
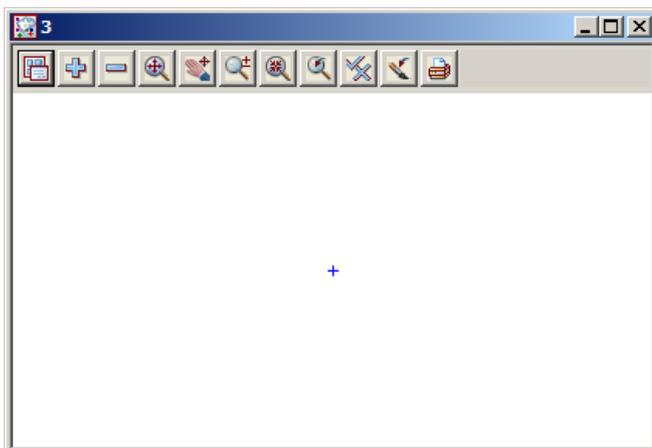
To see the height of the point we must toggle on the Z values. To do this click LB on the toggle button on the view menu to bring up the toggle menu. Then click LB on the 'Z values [n/a]' position. Don't walk right on the arrow near this position. This is to specify individual models to turn the Z values on or off. By clicking LB on the Toggle menu, you turn on (or off) all Z values in that view for all models.
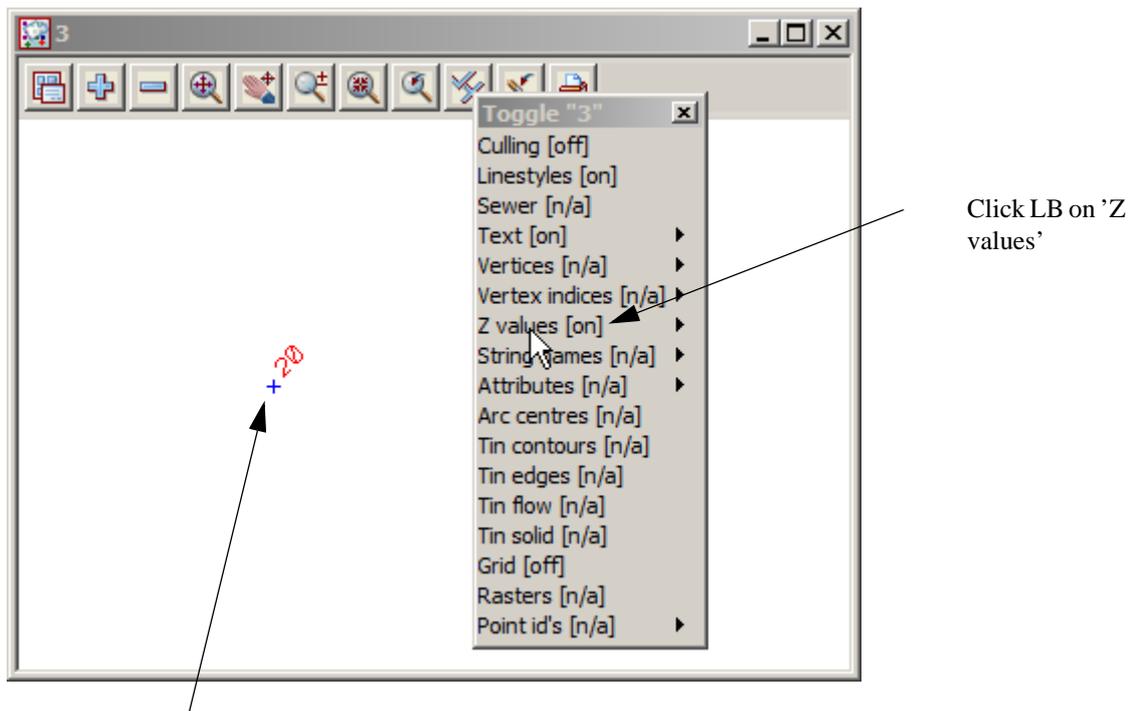
Click LB on 'Z values'

The Z value is then shown near the point that we created.

The default colour for the height text is yellow. To change the colour of the height text so it is clearer we can click LB on the menu icon from the view menu to bring up the plan view menu. From that menu we can click LB on **Settings=>Z values=>Single** to bring up the **Z values For Plan View** panel. From this panel, select the colour icon and then select the colour red by double clicking LB on the red colour. It should like as shown below:
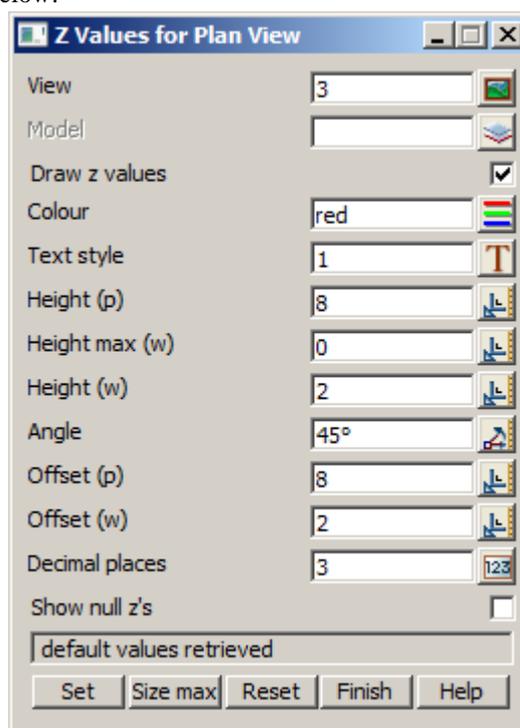
Then press **Set** on the panel to set that colour. Finally press **Finish** to close the panel.

The change is made only for view 3. Any other points added to the view will now have their height text shown in the red colour.

There are various ways of selecting a position when creating a point. Specification of a position can also be done by the direct input of the xyz coordinate of the point by pressing the space bar to bring up the enter XYZ panel or by typing of the value to bring up the XYZ panel. The user then enters the X, Y and Z value into the box separated by a space. e.g. 200 150 40. As we have already set a Z value in the CAD **controlbar,** you only have to specify a X and Y value into the box. **NOTE:** The Z value will default to the value entered into the CAD **controlbar** whether or not it is specified in the XYZ box. If no height value exists in the CAD **controlbar** or the XYZ box, then a value will be interpolated if possible, otherwise a 0 value will be assigned.

We will again create a point by using the CAD **toolbar**.

Firstly, change the Z value in the CAD **controlbar** to '50'. Then repeat the steps outlined above to choose the Create Point option. Instead of selecting a point with the mouse we will type in the coordinate values. To pop up the XYZ box, press the spacebar. Then type into the box, 200 100 and then press the enter key. We did not have to specify a Z value in XYZ box as it was already defined in the CAD **controlbar**. **NOTE:** A space must be placed between the X and Y values.
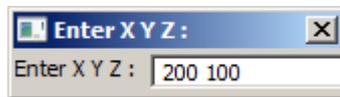
A new point is created. Click LB on the Fit icon on the view menu to fit the data in the view.

It should now look like as shown below:
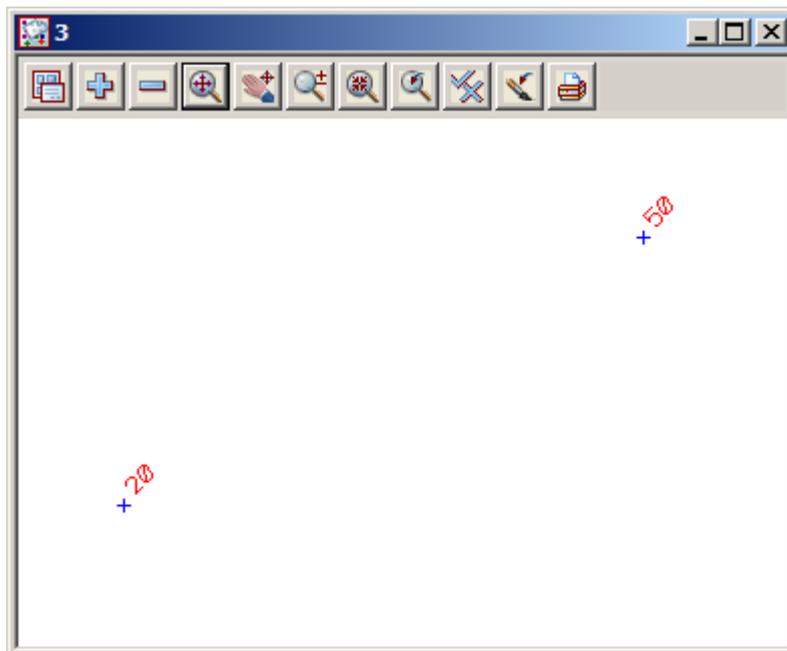
8.2   Creating Two Point Lines

We will now create a simple one segment line. To do this we will use the CAD **toolbar** flyout. Pick the lines section of the toolbar by clicking LB over the create line symbol and keep LB depressed.

Lines section
of CAD toolbar
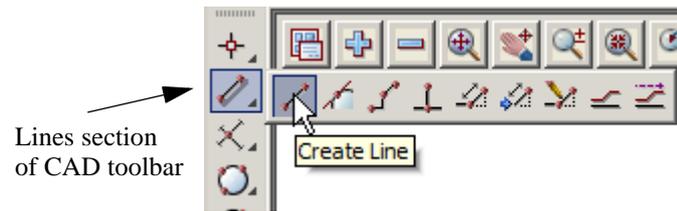
The lines **flyout** menu is displayed which has all the options in the lines section of the CAD creation tool. Select the **'Create Line'** option which is the first icon in the **flyout**.

On selecting the **Create Line** option, the user is prompted for the relevant data in the screen message box located on the bottom left hand corner of the 12d Model application window
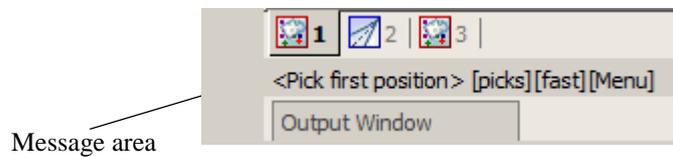
Message area

We will pick a position with the mouse to define the start of the line. Pick a position with LB about halfway between the two existing points and then MB to accept. After accepting the start point, the user is told in the message area to pick the end of the line. You will also notice when you move the mouse around that a line is drawn 'rubber banding' to the cursor position. We now select a point going south east to define the end of the string with LB and MB to accept. The created string will be shown given the parameters given in the CAD **controlbar** at the time of construction.
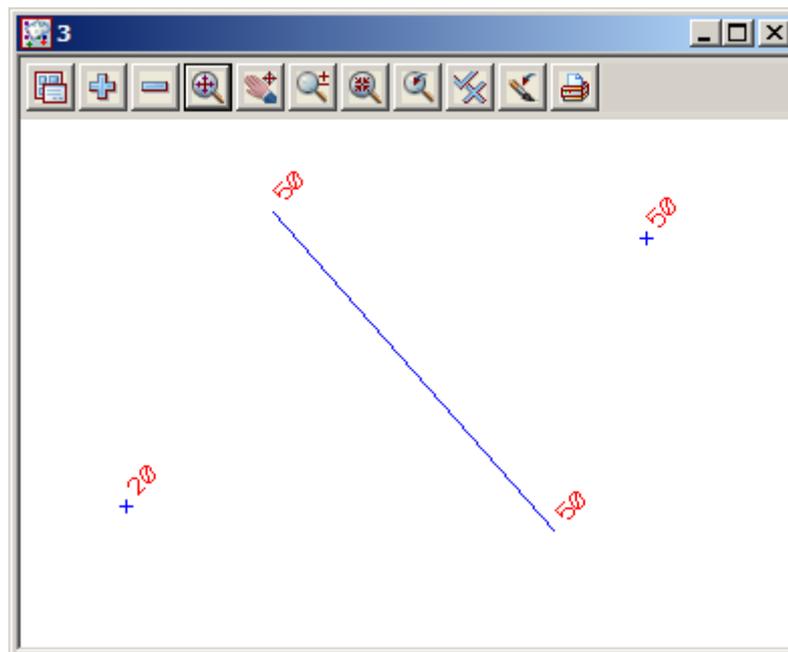
8.3 Creating Line Strings

We will now create a multi-segment string. To do this, we will use the CAD menu from the main menu system rather than from the CAD toolbar

From the main menu, click LB on **Strings=>CAD=>Lines=>Line string**. The **Create Line String** option will now be running. **NOTE:** These options have no panel assigned to them.

The same option can be started from the CAD toolbar as we did for the **Create Line** option except we choose the **Create Line String** icon from the flyout.

On selecting the **Create Line String** the user is prompted for the relevant data in the screen message box located on the bottom left hand corner of the 12d Model application window

Message area

We will pick a position with the mouse to define the start of the line. Pick a position with LB any where on the view and accept with MB. Then move the cursor to a new position and pick and accept a second point. Pick and accept a third point and so on. To finish the string simply press the Esc Key on the keyboard or alternatively RB and then select cancel from the **Pick Ops** menu. The string will be created using the parameters given in the CAD **controlbar** at the time of construction.
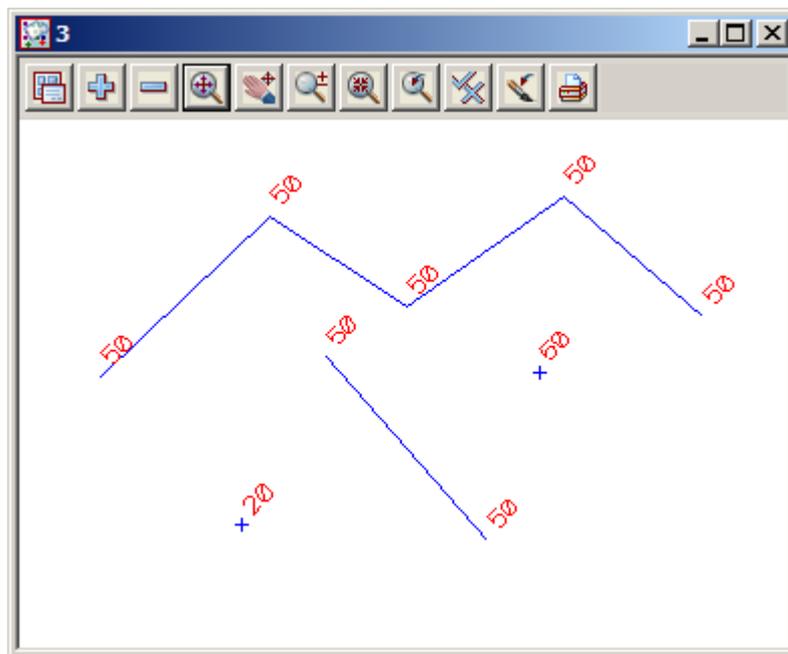
This has given a small introduction to the use of the CAD options. For a more detailed explanation of these tools see Chapter 14 'Strings' in the on-line reference manual and follow the links to the CAD options.

We will now finish this section by deleting the current view. As the view is maximised, select **View =>Delete** and select view '3'. Alternatively, we could have restored the view and click LB on the '**X**' icon at the top right of the view. This should then leave two views, Plan 1 and Perspective 2. If either Plan 1 or Perspective 2 are left maximised, select the restore button on the top right hand side of that view to leave two views as at the start of this chapter.

Clear the value for the default height in the Cad Controlbar. Leaving the height there may create problems when creating strings at a later stage. Also change the default model to one of the existing survey models

as deleting the current model is not recommended.

Finally, we will delete the CAD model. To do this we click LB on the *delete model* option from the main menu **Models=>Delete=>Delete a Model**. This brings up the **Delete Model** panel

.
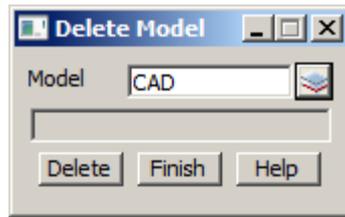
Select the model icon with LB and then double click LB on 'CAD'. Then click on the **Delete** button, and answer yes to any warnings (after reading them). This then deletes the model from the project.

9 Basic Road Design - Centreline String Creation and Editing

We will now begin our first Road Design with 12d. Before we can begin, we need to review other techniques for getting data into 12d.

By use of the Snap settings, we have seen how to snap to existing points and lines. This is useful when inserting strings into your model that must exactly join other strings already present. There are times however when we wish to place a feature in the model <u>exactly</u> by absolute or relative coordinate entry. We do this by typed input.

9.1 Typed Input

In general, whenever 12d is prompting you for a cursor pick in a Plan view, you have the option of either

> Clicking LB with the mouse to return the x and y coordinates OR
>
> Typing the x, y (and maybe z) coordinates

To enter typed coordinates, you simply start typing, or click RB and select **Typed Input** from the pop up list. A 'Typed Input' panel will pop up as you begin typing.

If you wanted to enter the coordinates of the point (100,200,50.5) you would type
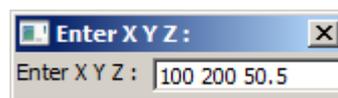
Just separate the values with a space between each item. Terminate the entry of data from the keyboard by pressing the Enter key. If you only supply two values and press Enter, 12d will assign a Z coordinate of zero.

If you ever accidentally touch a key when performing cursor input via the mouse, the 'Typed Input' panel will pop up. To remove it so that you can revert to cursor input, backspace over any digits that appear in the input window until the field is clear and press the Enter key. The panel will disappear.

Whilst there are also other ways of entering typed input e.g. by bearing-distance, relative xyz increments etc. we will not pursue these at this time.

9.2 Using a Grid to Assist in Coordinate Entry

It is possible to turn on a grid and with the appropriate grid snap setting, snap to only the grid points when entering points and strings.

Before attempting to investigate the grid capability, let us clean up our display.

From the View 'Plan 1', click LB on the Menu button in the View Button area (or click RB in the View Button Area) and the View menu will pop up. Click LB on **Models=>Remove All Models**. In the View Button Area, click LB on the '+' sign button and select all **survey** models.

Now let us set our grid settings so that they are suitable for grid snap purposes. From the 'Plan 1' view, click LB on the Menu button in the View Button Area to pop up the View menu.Click LB on **Settings=>Grid** and the following panel pops up

.
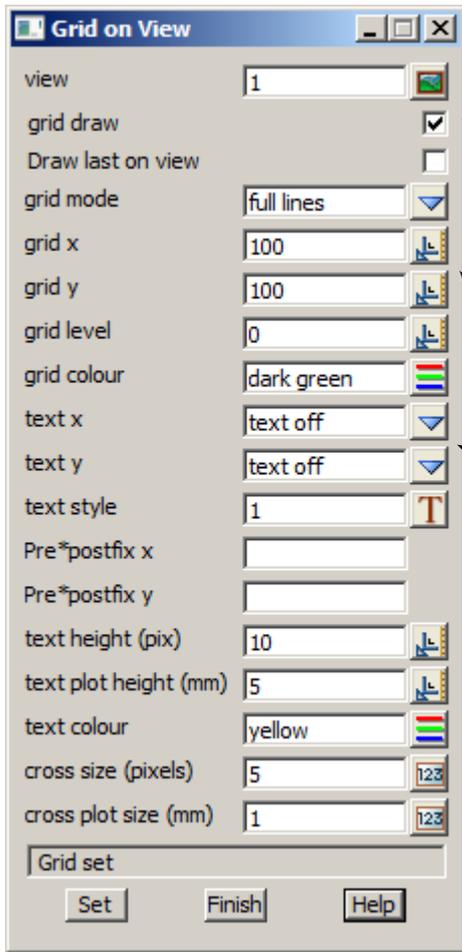
Tick on the *grid draw* box

Place the cursor on the choice button for the 'grid mode' field and click LB. You can set your grid to either '*full lines*', '*crosses*', '*marks*' or '*marks and crosses*'. Click LB on **full lines**.

Note the grid x setting. You can change this setting by placing the cursor into the *grid x* field, press the Backspace key (or the Delete key and typing the required number). Repeat this with the *grid y* field.

Place the cursor on the choice button for the *text x* field and click LB. Click LB on **text off**. Repeat this with the *text y* field.

The other settings can be left as is.

Click LB on **Set** to activate the change.

Snaps Toolbar

Snaps Menu
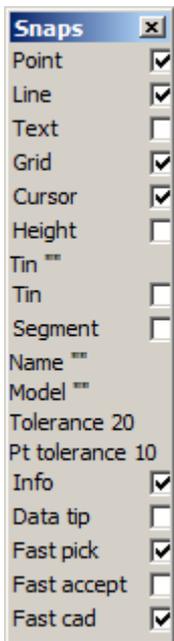
Toggle Grid snap on

To ensure that you snap to the grid, you need to set **Grid** snap ON. When creating new strings you would probably want Point and Line snap OFF so that you don't inadvertently snap to features in the view.

Any of the Snaps menus or toolbar can be used to toggle Grid snap on

If you want to use the Snaps menu and it is not already on display, click LB on **Utilities=>Snaps=>Snaps** from the Main menu.

If the grid is not already on display, in the View Button Area of 'Plan 1', click LB on **Toggle=>Grid** to turn on the grid. The 'Plan 1' view will refresh as follows
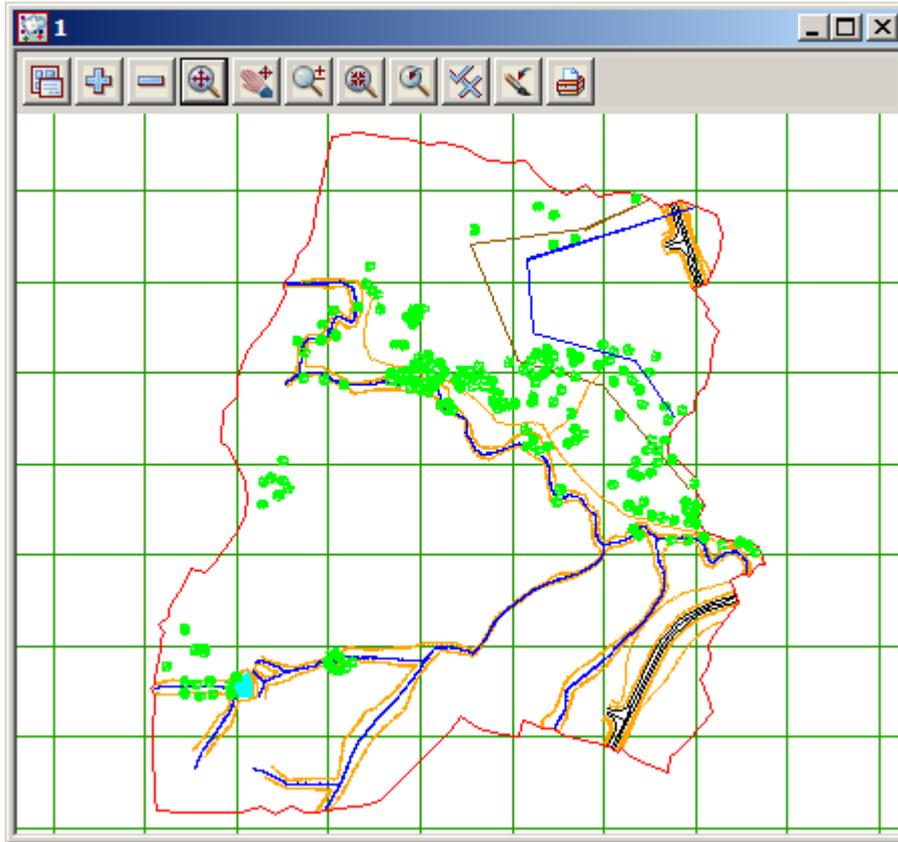
If we were now to start creating strings, with each menu pick we would snap to a grid intersection. The purpose of introducing this here is to show you how to use the grid.

We will not use the grid at this time however as it is more important that you learn how to freehand in string data and use typed input.

You can turn the grid off by clicking LB on **Toggle=>Grid** or unticking the 'grid draw' tick box in the grid settings panel. Click LB on **Finish** to terminate the grid settings panel.

Also from the Snap Settings menu, turn Grid Snaps OFF.

9.3   Horizontal Geometry (HG) Edit

From the Snap Settings menu, turn all Snaps OFF except *Point, Line, Cursor, Information, Fast pick and Fast snaps cad accept*.

In View 'Plan 1', click LB on **Fit.** Your view should look as follows
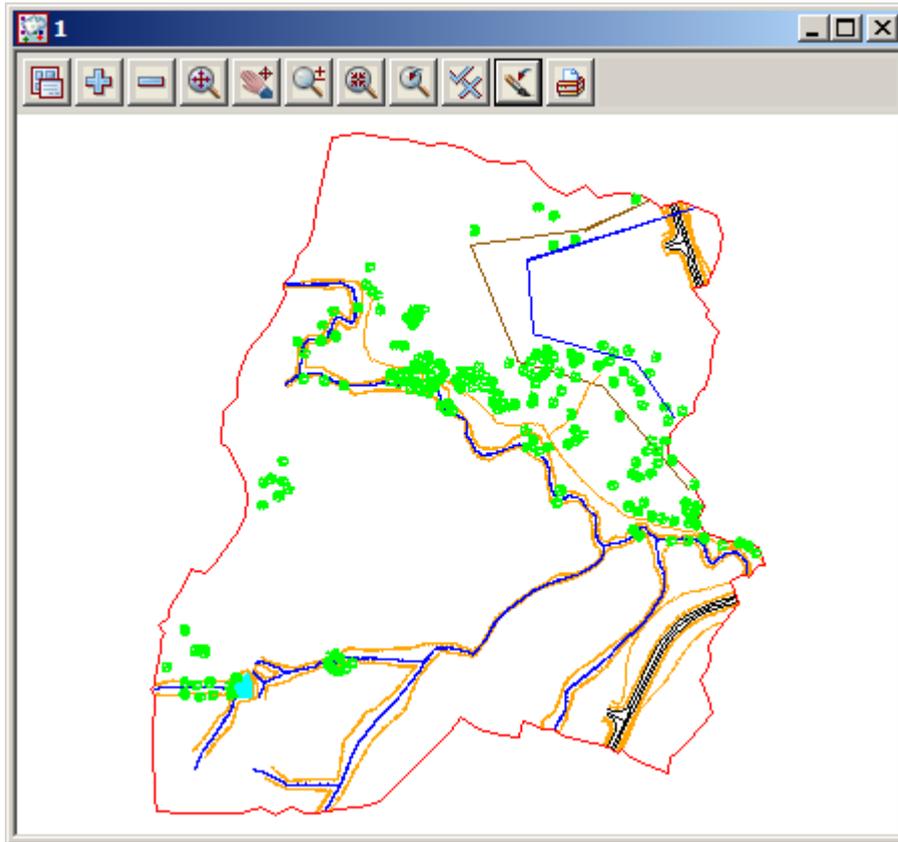
We will now bring up the Super Alignment panel and look at some of the features prior to creating the alignment

From the Main menu, click LB on **Strings=> Create=> Super Alignment =>Super Alignment**. The *Create Super Alignment* panel will appear

Click on the **General** tab

The General tab deals with the basic features of the alignment appearance. The super alignment is given a name and model along with other standard features such as colour, linestyle and weight.
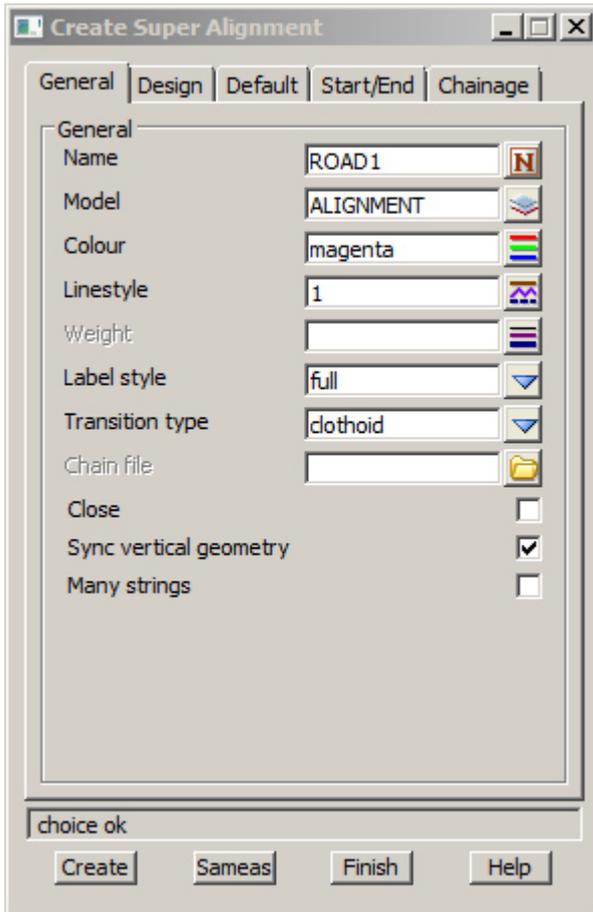
The labelling of the chainages and symbology used along the alignment can also be selected here with a list of standard and user defined label styles available.

The alignment be set to *closed* so the horizontal and vertical geometry automatically close between the start and end.

Syncing the vertical geometry to the horizontal geometry means that the vertical geometry will attempt to resolve itself for minor changes in the horizontal geometry

If multiple alignments are to be created consecutively then the *Many strings* check box can be ticked. This would return the user back to the *Create Super alignment* panel on the completion of each alignment

Fill out the panel as shown.

These settings tell 12d that our new road centreline is to be called **ROAD1** and it is to be placed in a new model called **ALIGNMENT**.

Select the **full** label style and tick **Sync vertical geometry**

We will next briefly look at the **Design** tab.

Click on the **Design** tab

The Design tab permits the user to take into account a design speed when creating the horizontal and vertical geometry. Predefined values from the Design table will automate the radii of the horizontal and vertical curves. Widening and super elevation are also calculated and automatically applied to selected strings on the fixed part of the templates
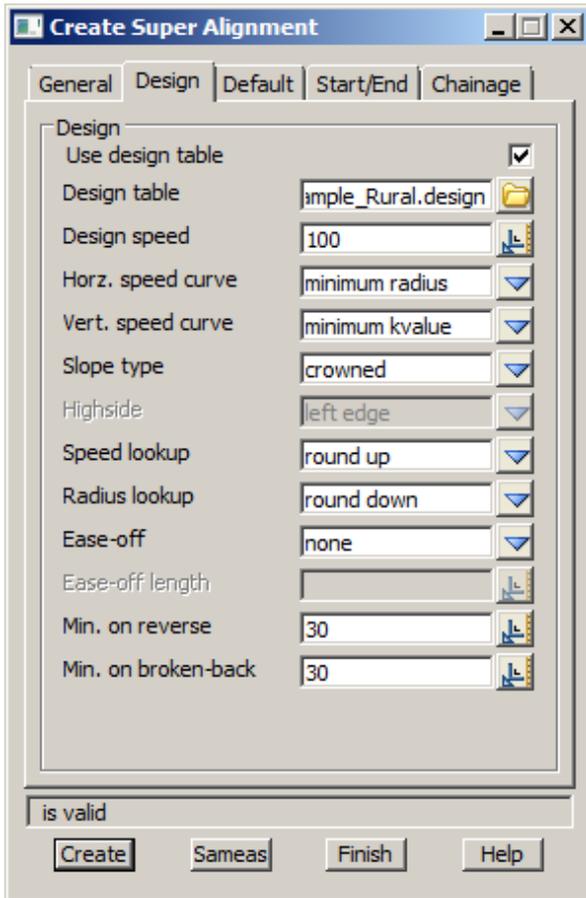
Although the panel is filled in as shown here, we will not use a Design table for our road.

So the *Use design table* tick box should be ticked off so that a Design table is no used (see example below)
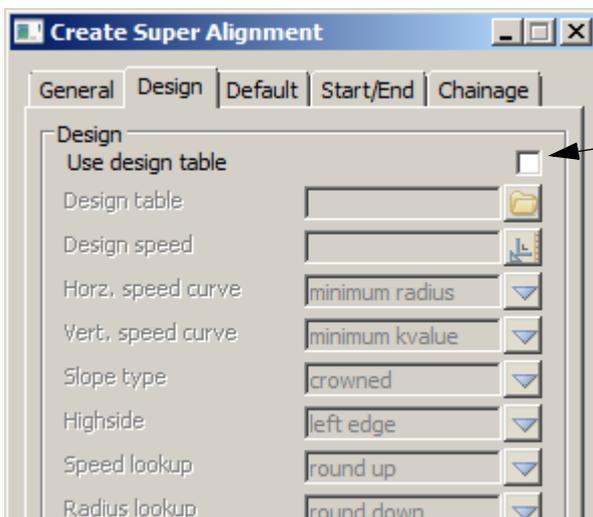
Tick off the *Use design table* tick box so that a Design table is no used

Click on the **Default** tab

The initial curve types for the Horizontal and Vertical geometry are shown in the section
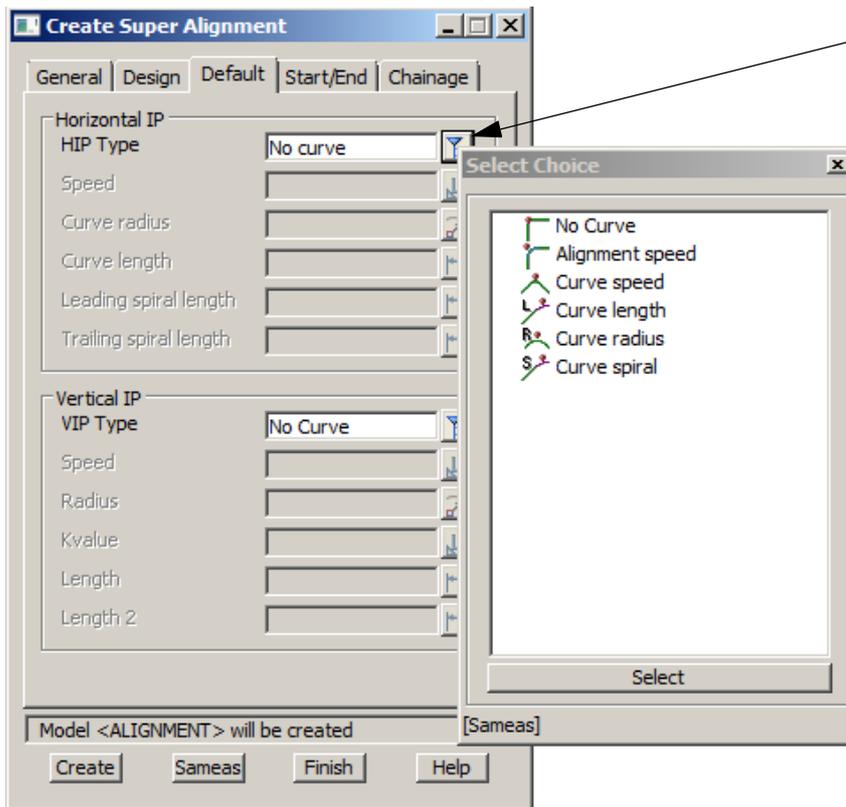
To change the type of curve the choice icon can be clicked and a list of available curve types are displayed

Values can then be entered based on the type selected.

If Curve radius was selected the *Curve radius* field would be highlighted for user input (see example below)

We will leave both of the types as **No curve** as shown in the example
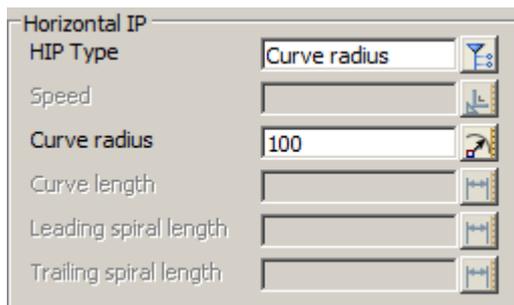
Click on the **Start/End** tab

The Start/End tab defines where the usable horizontal and vertical geometry starts and ends for the super alignment. Note that the super alignment can have more horizontal and vertical geometry than is actually used.
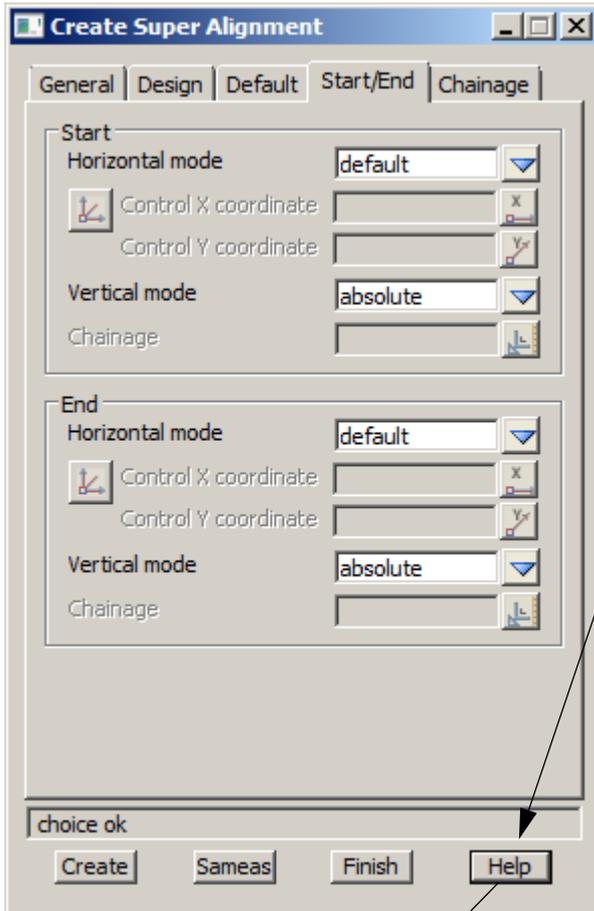
The start and end modes defines how the beginning of the horizontal and vertical geometry will be shown. It is like a visual trimming of the string

Detailed descriptions of the options in the panel are available by clicking on the [Help] button
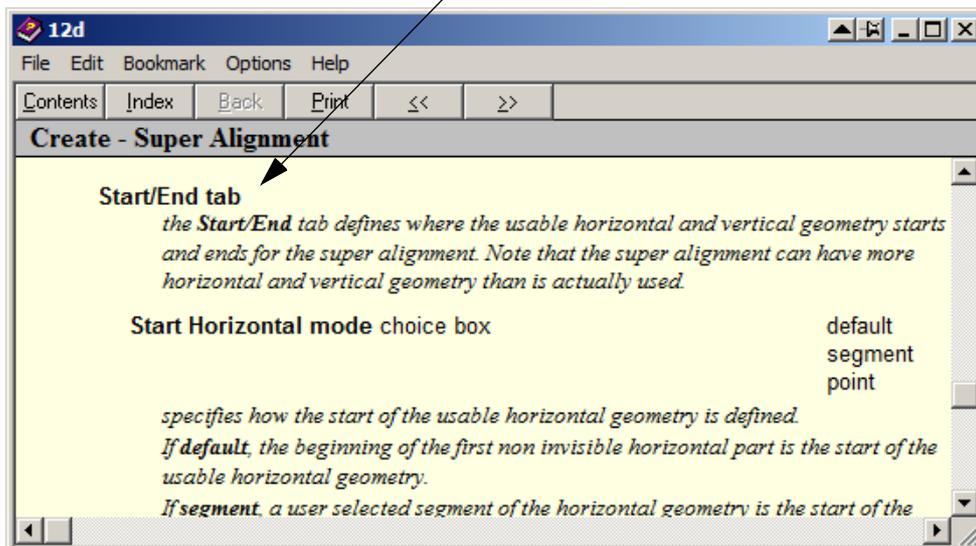
Click on the **Chainage** tab

The Chainage tab defines the properties of the chainages and chainage text on the string.
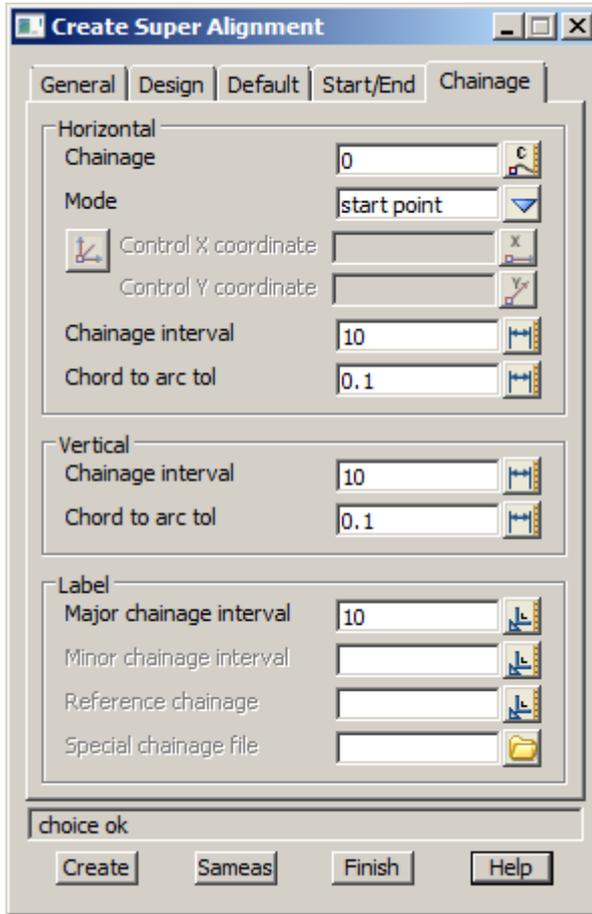
The Horizontal section nominates the start value for the chainages and how the start chainage is calculated

The Horizontal and Vertical chainage interval is used for a sample interval which can be used if triangulating the alignment string. As a general preference the design strings created from the apply many are used in the tin instead of the alignment string

The interval is also used to create vertices on the string when exporting to another string type

The Chord to arc tolerance adds additional chainages where the perpendicular distance between the arc and a chord drawn between the points exceeds the input value

The chainage labelling can have both major and minor intervals.

A reference chainage is entered when the start chainage is not an even value (e.g. 3400.54). Putting in a value of 0 will set the chainages in terms of 0 for 10 metre spacing. So the chainages would be 3500.54....3510...3520 and so on.

Click on [Create]

It is suggested that you move the *super alignment editor,* the **Edit SA** menu (or **Edit SA** toolbar) to the top right of your screen to get it out of the way when creating your new centreline. To move the Edit SA menu, press LB somewhere over the words **'Edit SA ALIGNMENT.....'** to pick up the menu, move the cursor and pin the menu down by releasing LB.

We will initially define the horizontal alignment of the road in the View 'Plan 1'. We need to tell 12d that we are defining Horizontal Intersection Points (HIPs).

To select options from the Edit SA menu hold down the left button over the relevant icon (Add/Remove IPs) on the toolbar to activate a drop down menu.

To select options from the editor panel hold down the left button over the relevant icon (Add/Remove IPs) on the toolbar to activate a drop down menu.
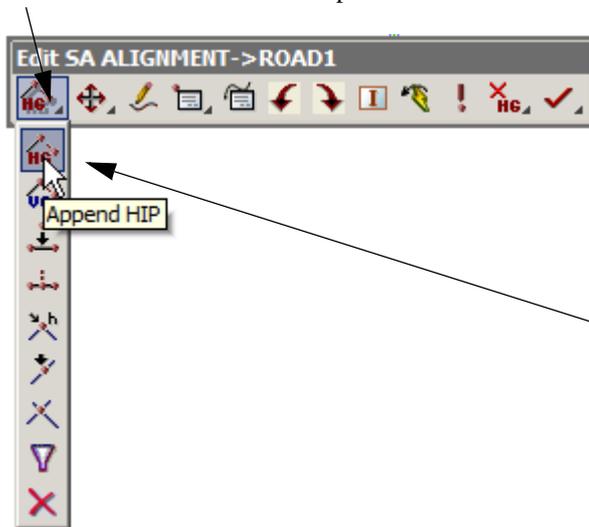
Click LB on the relevant icon. The data tip displays for a few seconds which is used to select the required option

Click LB on **Append HIP**

12d is waiting for you to select the starting point of your road. You can choose to either (1) select an existing point (2) enter coordinates exactly or (3) freehand in the points

Zoom in to the top intersection and click LB on the intersection of the road crown
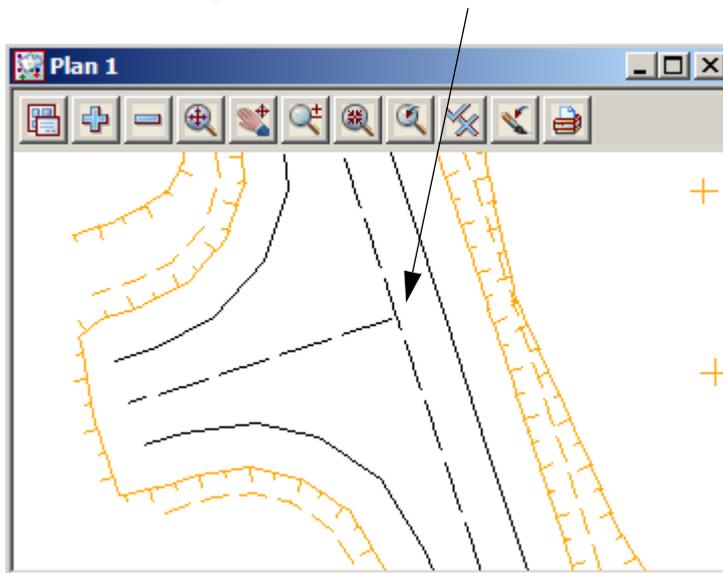
Type the X and Y coordinate in turn for the next two IP points:
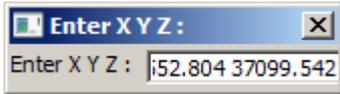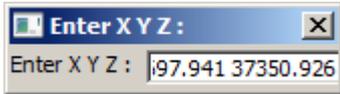
<table>
<tr><td></td><td>**IP 2**</td><td>**IP 3**</td></tr>
<tr><td></td><td>X = **42697.941**</td><td>X = **42552.804**</td></tr>
<tr><td></td><td>Y = **37350.926**</td><td>Y = **37099.542**</td></tr>
<tr><td></td><td>Press [Enter]</td><td>Press [Enter]</td></tr>
</table>

Enter X Y Z:
Enter X Y Z: |97.941 37350.926

Enter X Y Z:
Enter X Y Z: |52.804 37099.542

TERMINATING THE "RUBBER BAND"

The last IP point intersects back onto the existing road at the south east of plan 1.
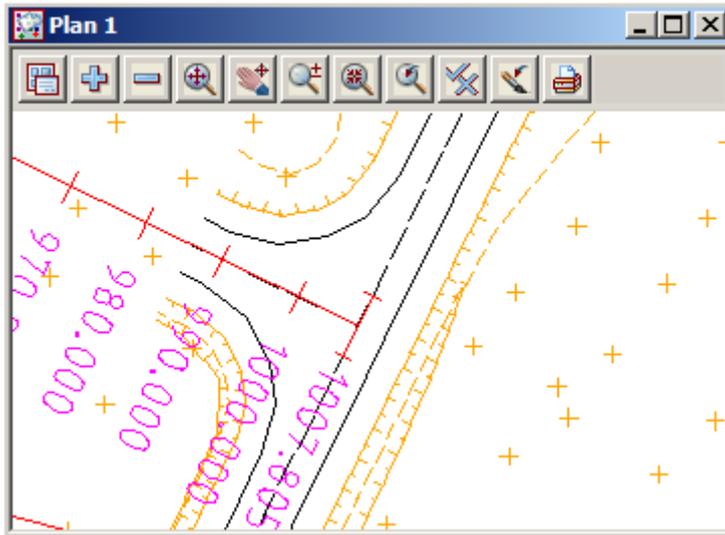
Click on the intersection and accept the position. After the fourth HIP is defined, it will remain rubber banded to the cursor.

Pressing the *Esc* key (<Esc>) terminates the String creation process and removes the rubber band. Your centreline should now comprise of four points connected by three segments.

Your view should now look as shown below.
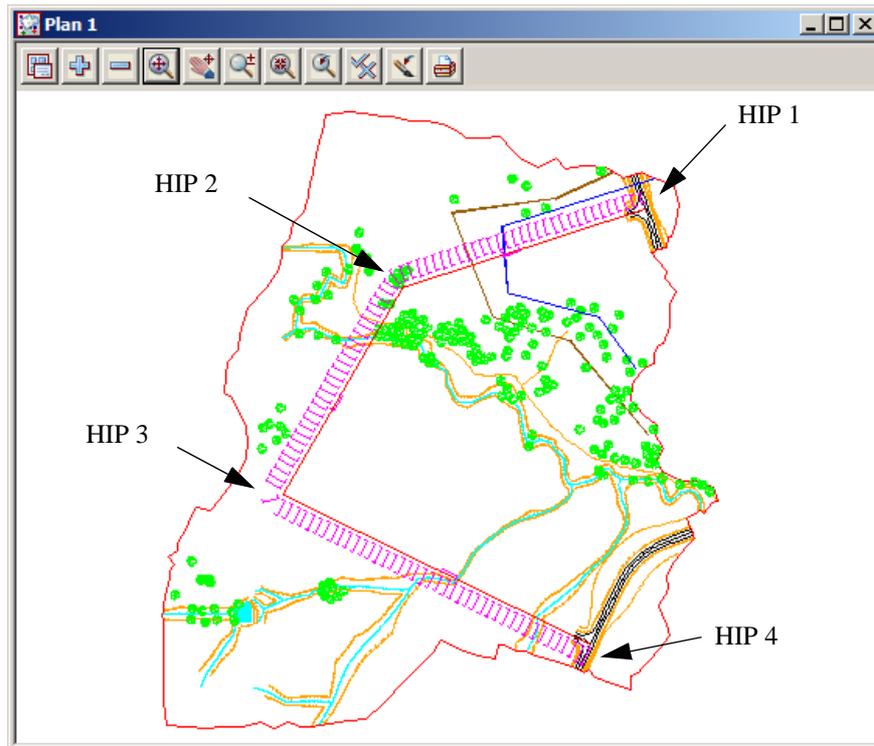
Don't put the Edit SA menu away yet as we will need it further. Just leave it in the view. Remember this menu is referring explicitly to the Alignment we are currently creating - 'ROAD1 => ALIGNMENT'.

To make the road alignment easier to see, we will turn off all the survey models except the 'survey ROAD CROWN', 'survey ROAD PAVEMENT EDGE' and 'survey TOPO TIN BDY'.
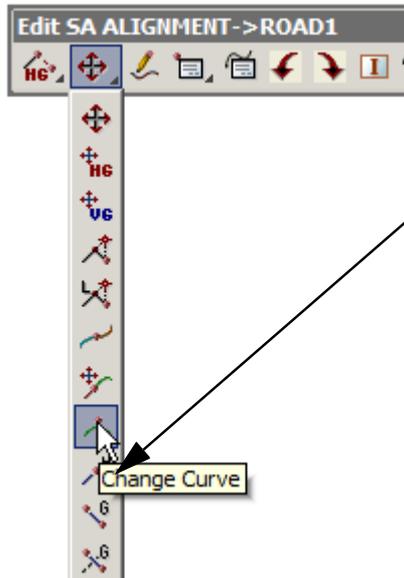
We will now put in some horizontal curves between the HIPs. We will insert a curve of radius 200 at HIP 2 and a curve of radius 100 at HIP 3.

From the Edit SA menu, click LB on **Move/ Edit** icon then select **Change Curve**

The Screen Message Box area advises

<Pick IP to change curve info>[picks][Fast][Menu]

Click with LB in the vicinity of HIP 2. The point will highlight and the Screen Message box advises

<Select point to change radius>[picks][accepts][Menu]"ALIGNMENT->ROAD1"

12d is asking you to confirm that this is the HIP where you wish to insert the radius. Click the MB to accept the highlighted point.

A panel will pop up prompting 'Radius'. The cursor should already be locked into the data field.
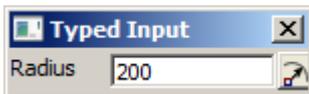
Type 200 and then press the Enter key

Observe that a horizontal curve of radius 200 is now inserted and the tangent points have symbols and chainages with user defined prefixing e.g. TC for Tangent Curve.
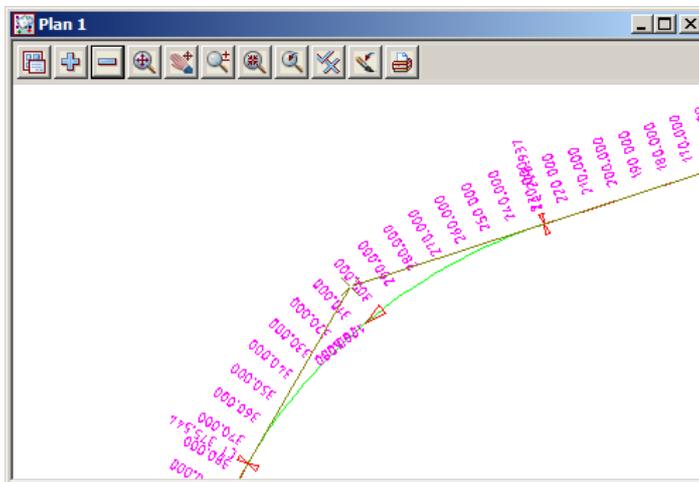
The insertion of curves is setup to handle multiple insertions. If you now position the cursor in the vicinity of HIP 3 and click with the LB, accept with MB, type 100 for the new radius and press Enter, a further radius will be inserted.

To terminate the radius insertion process, press the *<Esc>* key (or click RB to pop up the Pick Ops menu and click LB on **Cancel**).

Your plan view should now look as follows.
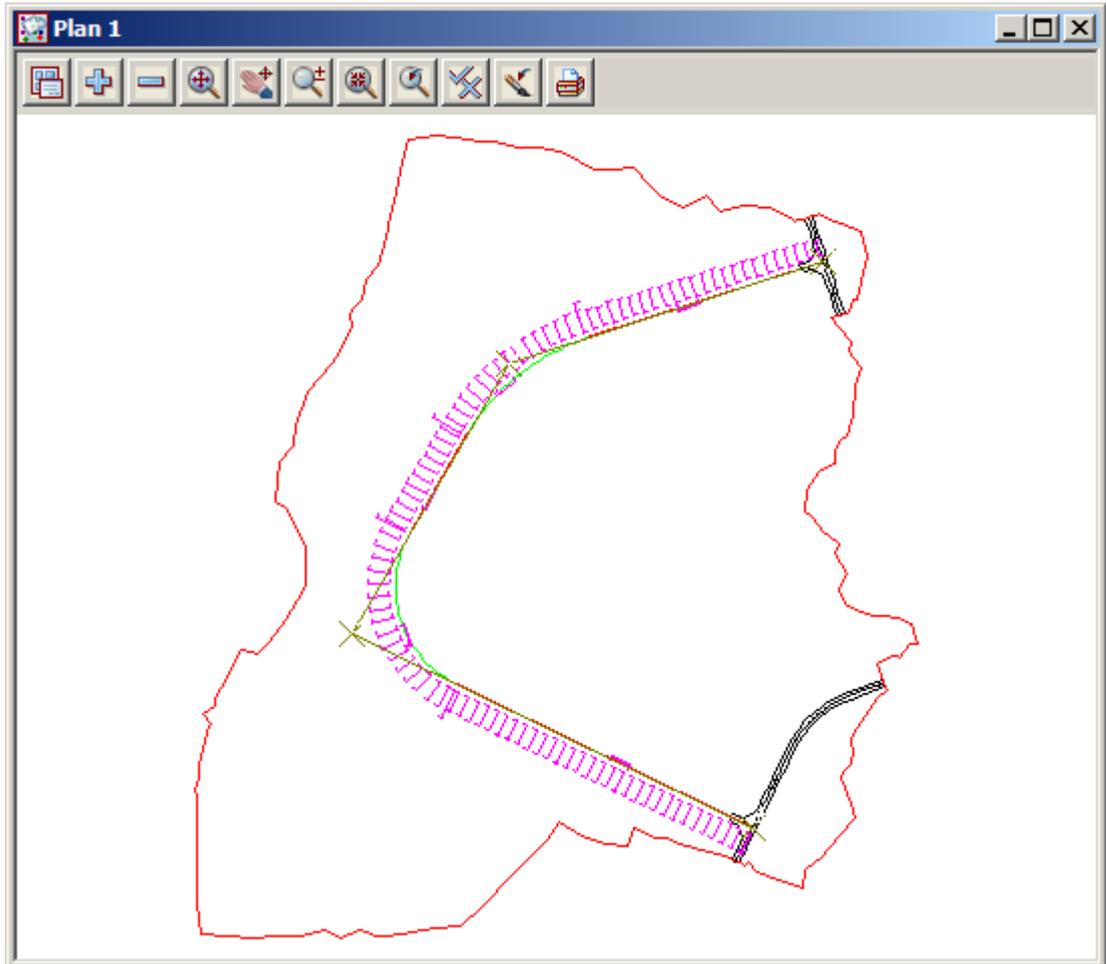
A feature of 12d at this time is the Information panel. This supplies you information about your string geometry. From the Edit SA menu, click LB on **Info** to pop up the Information Panel.
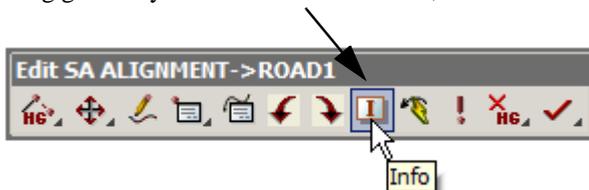
If necessary, move the panel away from your road centreline.
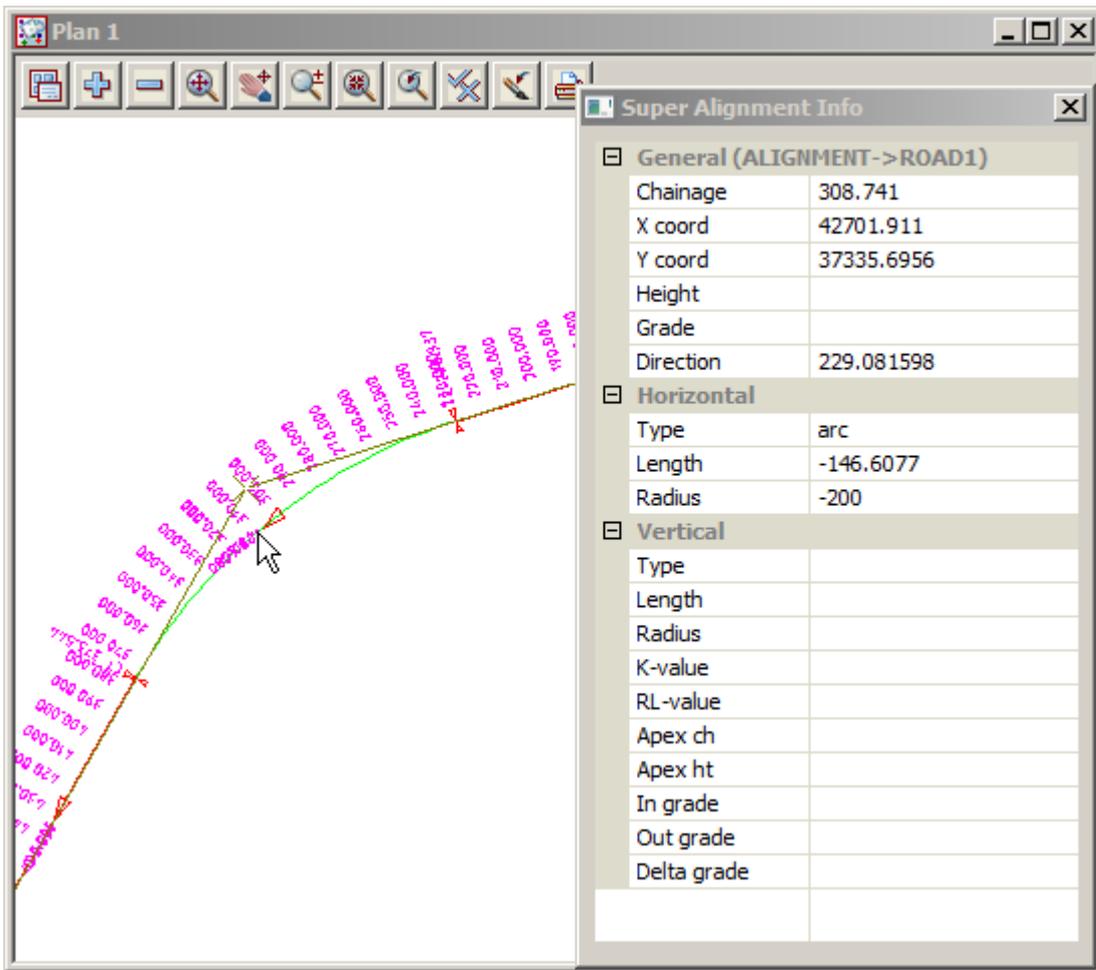
Move your cursor along the new road and you will see the information in the panel continuously changing. The panel shown above was created by pointing at HIP 2. It gives you the coordinates of the cursor at the road centreline along with the instantaneous direction, arc length and radius.

Click LB on [x] to close the panel

9.4   Section Views

To complete our new road, we now need to define its vertical geometry. To do this we first need to create a new section view.

From the Main menu, click LB on **Views=>Create=>Section view**.
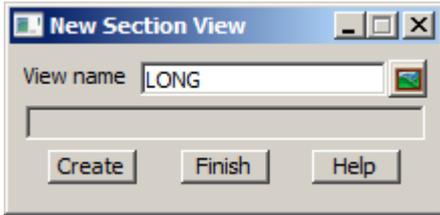
When the panel appears, highlight the current entry in the view name field by double clicking the LB, and type 'LONG' for Long Section. Click LB on **Create** to create the view.

The new view will pop up as a window overlaying your other 12d windows. Firstly, minimise the perspective view '2'. Then click LB on the plan view title area and select **Windows=>Tile Vertical**

The view buttons on the Section view are:
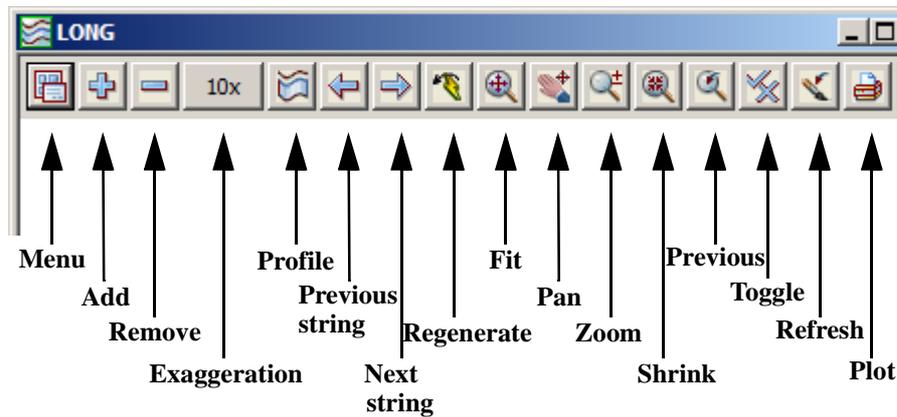
The first Model to turn on in a section view is always the TIN. The reason for this is to establish the vertical geometry in the section view. Remember we gave the TIN a name called 'GROUND' and we placed it in a model called **tin GROUND**. Turn this model ON by clicking LB on the '+' sign in the View Button Area of 'Section LONG'. The screen will still appear blank at this stage.

A section view always has the chainage of the selected string as its horizontal axis and the height of the string as its vertical axis. We need to tell 12d that we wish to construct a section view along our new road centreline **ROAD1**. We do this by selecting a string to profile as shown below. 12d then does a section through the TIN i.e. using the x and y coordinates of the selected string, it calculates z values from the TIN. 12d then uses the z values (heights) from the TIN and the string's chainage to construct the Section view.

For advanced users: If multiple TINs are present, any TINs in models added to the view are also sectioned as the string is profiled. Also the section view has a 'corridor width' so any other strings crossing the corridor will also appear provided their various models are turned on.

Information ×

General
 Model = ALIGNMENT
 Name = ROAD1
 Type = Super_Alignment
 Colour = magenta
 Line style = 1
 Pt/line = line
 # pts = 6
 Length = 950.454
 Locks = Write (1)
 Line snap =
 X = 42721.891
 Y = 37350.897
 Prof ch = 283.619
 Bearing = 236°20'04.80"
 +ve =
Segment
 Type = horizontal arc
 Length = 146.608
 Radius = -200
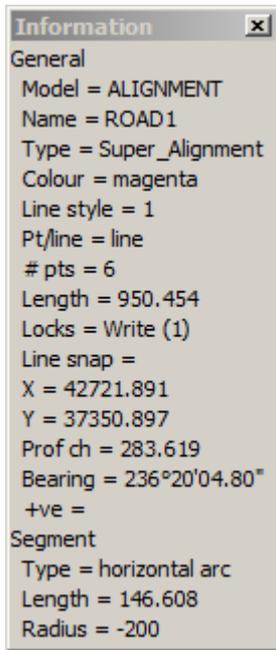
From the 'Section LONG' View Button Area, click LB on **Profile** icon

The Screen message Box advises

<Profile>[picks][][Menu]

12d is asking you which string you wish to profile. In the view 'Plan 1', click with LB on the road centreline string. Provided your snap settings have at least 'line snap' ON, the string will highlight and the Information panel will display (see left).

Hints on the use of the Information Panel:

If you move the cursor outside of the Information panel after it has popped up, the Information panel will disappear. To get it back again, click RB whilst the string is still highlighted to put up the Pick ops menu. Click LB on **Info** and the Information panel will redisplay.

Sometimes the Information panel appears to 'get in the way' of your picking process.

At any time it can be toggled off to get it out of the way for the duration of a set of pick operations. You do this by unticking the 'Info' or 'I' tick box on the Snaps menu.

Alternatively, if you leave it turned on, moving the cursor out of the panel is the easiest way of removing it after each pick. At any time, the Information panel can be moved out of the way permanently in the normal manner. See Chapter 4.4 for more information on moving menus and panels.

Once the Information panel is moved, subsequent uses of the panel will pop up at the new location during this selection set only. Now back to profiling.

Use the name and model in the Information panel to confirm that you indeed have highlighted the correct string. The Screen Message Box advises

<Profile>[picks][accepts][Menu]"ALIGNMENT->ROAD1"

Click MB to accept the highlighted string. The section view will now be refreshed and will contain a green line corresponding to where your new road centreline cuts the TIN as defined in model **tin GROUND**

Your Section LONG view should now look as follows
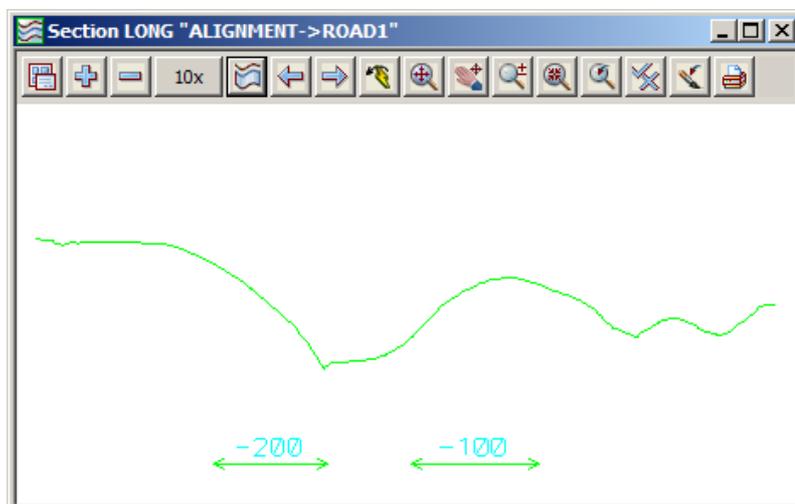
The figures of 200 and 100 in the view correspond to the radii of the two horizontal curves defined along the centreline. The arrows show the extents of the curves in the section view.

When we defined the string in the Plan view, we defined it in order starting near the top of the view and proceeded towards the bottom so by default, this is the direction of increasing chainage along the string. The negative sign in the radius indicates that a curve goes to the 'left' when going along the string in the direction of increasing chainage. Positive curves go to the 'right'.

We will now observe some of the advanced features of 12d.

When the cursor is in the 'Plan 1' view you will notice that the View Coordinates Box at the bottom of the desktop shows the x and y coordinates of the cursor.

When the cursor is placed in the 'LONG' section view, the View Coordinates Box displays the chainage (ch) and height (ht) of the profiled string. The chainage has defaulted to start at zero at HIP 1, our starting point when we defined our road centreline.

If you place the cursor in the 'LONG' section view and move the cursor backward and forward laterally via the mouse, you will see a yellow cross moving along the centreline in the plan view '1'. 12d recognises that the same string is appearing in both views and links the information in the views accordingly. The yellow cross is positioned in the plan view '1' based on the chainage (i.e. the position of the cursor laterally) along the string in the 'LONG' section view.

Toggle "LONG" ☒
Grades [n/a]
HG [on]
VG [on]
1x
2x
5x
10x
20x
Exaggeration
Grid [off]
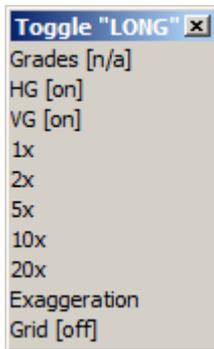
Section Views default to a vertical exaggeration of 10 to 1. You can change the exaggeration at any time by clicking on the 'View exaggeration' icon and selecting the required exaggeration.

If you require an exaggeration other than those listed, you can click on **Exaggeration** from the list and type in the required value.

From the View Button Area, click LB on **Fit** to fill the view at the new scale. Your overall screen should now appear as follows
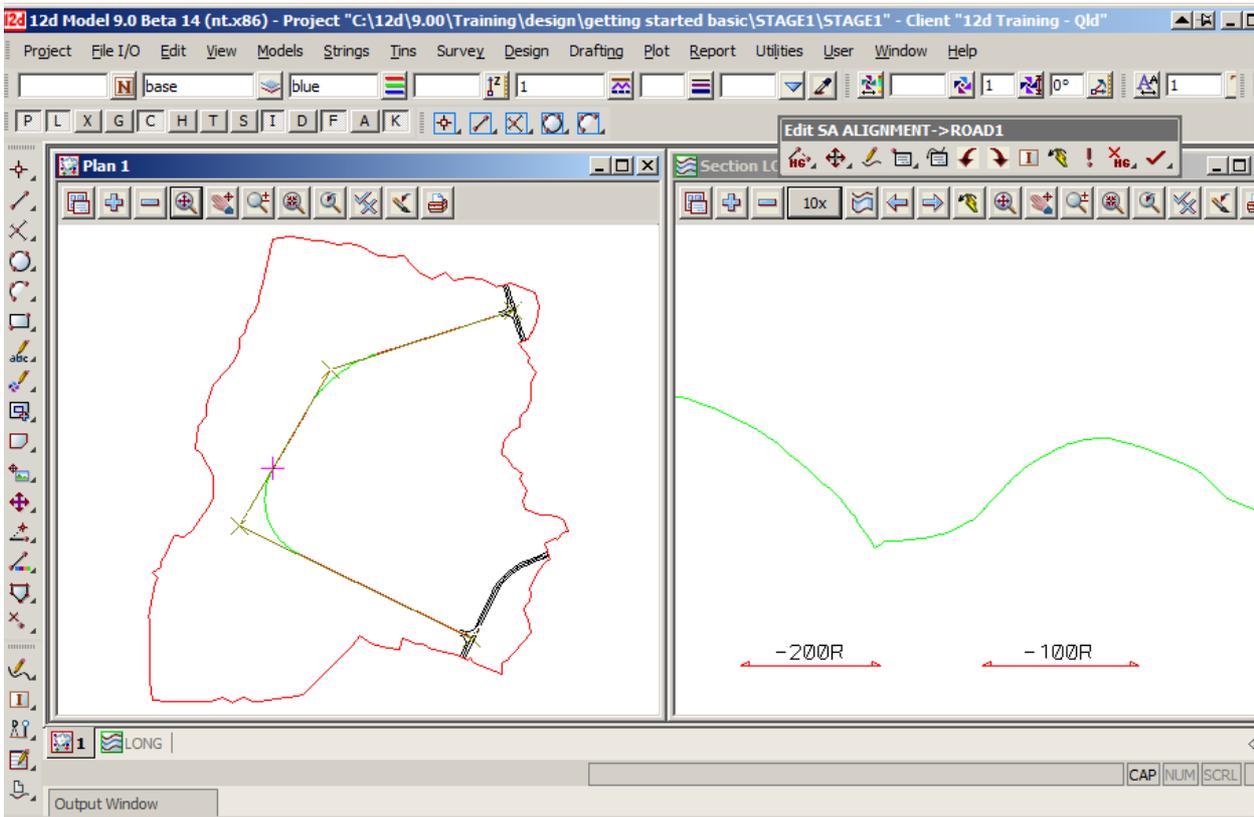
9.5   Vertical Geometry (VG) Edit

We will now define our road's vertical geometry. We do this by defining Vertical Intersection Points (VIPs) and then placing vertical curves between the VIPs. As before, the alignment editor for our road centreline is still active.

To ensure that the complete road centreline, as defined in the Plan view, is also defined in elevation, and matches neatly with the existing roads, then we also need to turn on the '**survey ROAD CROWN**' model in the section view.

From the Edit SA menu, click LB on **Add/Remove IPs=>Append VIP**.
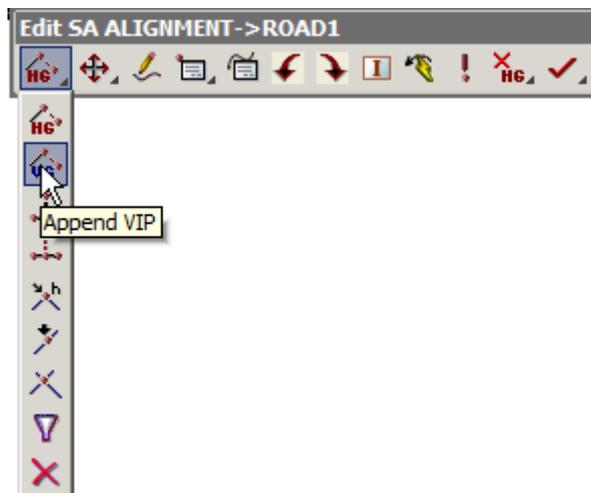
12d is asking you where you want to place the first VIP. Select and accept the intersection point in the '**survey ROAD CROWN**' model at the start of the profile. Your first pick will not necessarily be the ROAD CROWN so be sure to cycle through the picks until you have the right point. The line will rubber band from the previously placed VIP. Now select and accept the end of the existing road in the '**survey ROAD CROWN**' model. We have now placed two IP points which exactly match the existing road at the start of our design.

We will now add in two more IP points before tying into the existing road at the end of our design in a similar fashion.
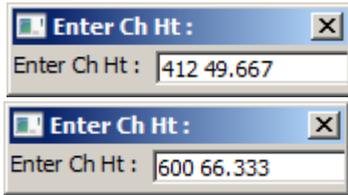
Type the chainage and level in turn for the next two IP points, the same as we did with the X and Y coordinates of the HIP's:

IP 3 Ch = 412 RL = 49.667
Press [Enter]

IP 4 Ch = 600 Rl = 66.333
Press [Enter]

Tie the last two IP points into the existing road at the end of the design in the same manner as we did previously with the start of the design.

After the sixth point is placed, press <Esc> to terminate the rubber band (or click RB to pop up the Pick Ups menu and click LB on **Cancel**). Click LB on the *Refresh* button in the View Button Area to refresh the view.

As the VIPs were placed, 12d has annotated the view showing the grades defined.
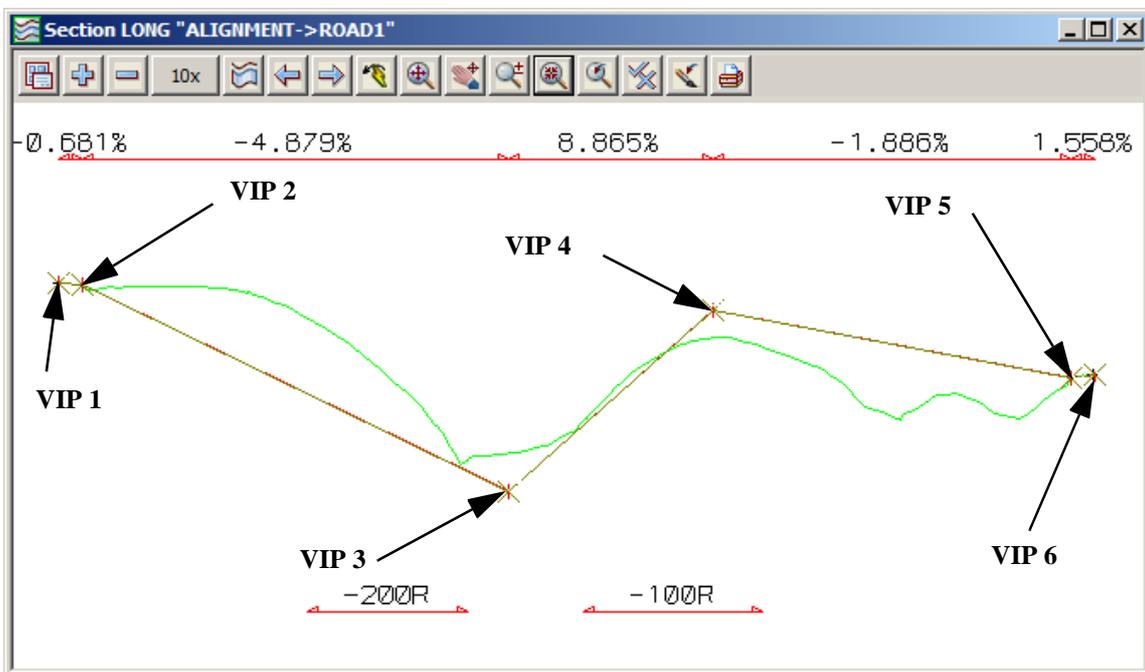
12d has many facilities to accurately place vertical geometry including typed input of grades and chainages. We are now going to insert a new IP point on the same grade as VIP 2 but 40 m from the intersection to allow us enough room to place a vertical curve. To do this we click on **Add/Remove IPs =>Insert VIP Grade**.

As we wish to extend the grade from VIP 1 through VIP 2 our starting VIP # will be 2.
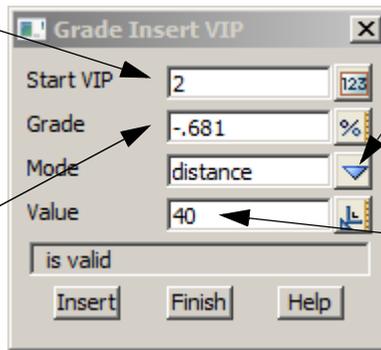
The Mode will be 'distance' as we want the new VIP to be 40m from the end of the existing road to allow enough room to add a vertical curve.

The grade will be the grade between VIP 1 and VIP 2 which we can read from the section view as -0.681

The distance as stated above will be 40m

Click LB on **Insert** then **Finish**

Your view should now have an extra VIP as shown below
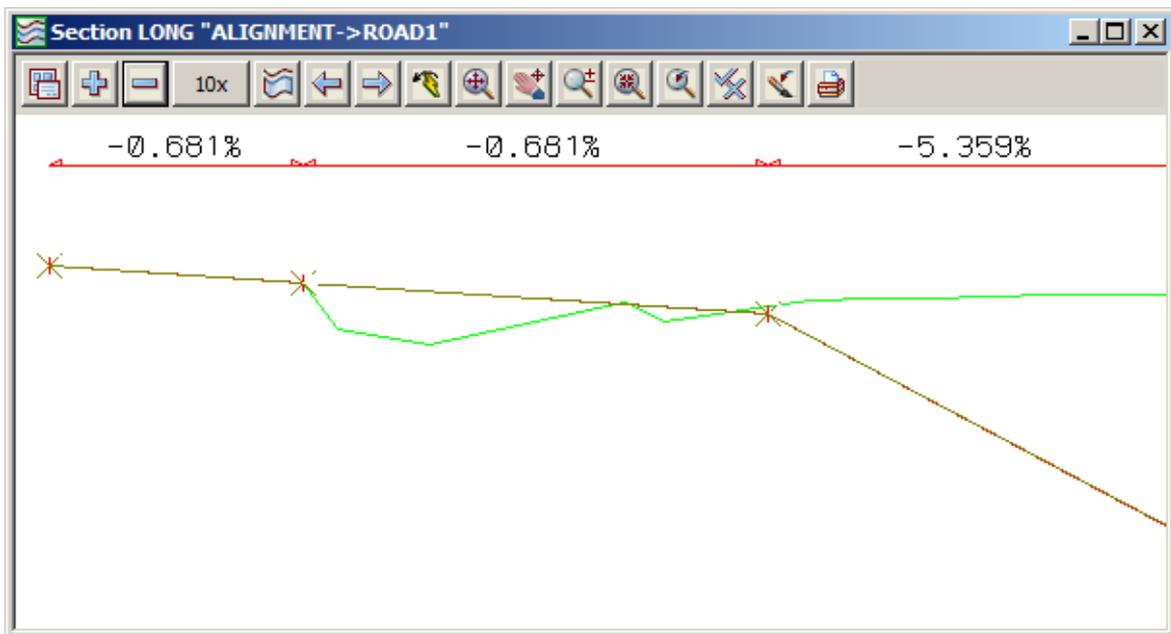
We will now insert another VIP to once again allow enough room to insert a vertical curve before finishing on the existing road at the end of our design. This time we will intersect two grades from existing VIP points. Click on **Add/Remove IPs =>Intersect VIP Grades.**
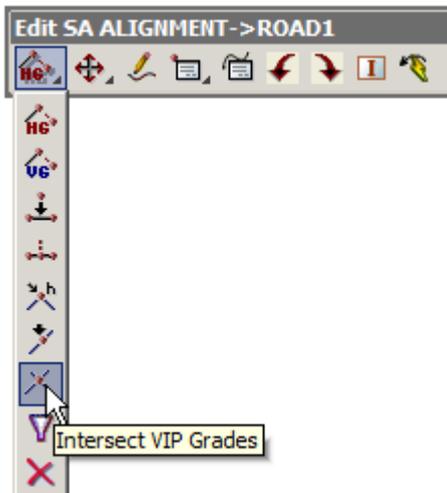
This time we will be starting from VIP 5

The second grade is calculated from **VIP6**

The mode will be **grade** for manual entry of the grade
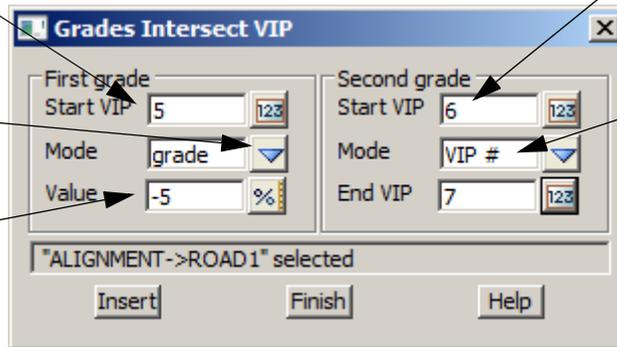
The mode will be **VIP#** so the grade will be calculated between the nominated VIP points

Type in the value **-5**

The end VIP is **7**

Click LB on **Insert** then **Finish**

Your view should now have an extra VIP as shown below
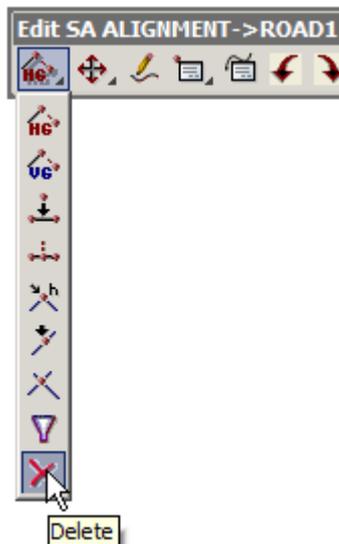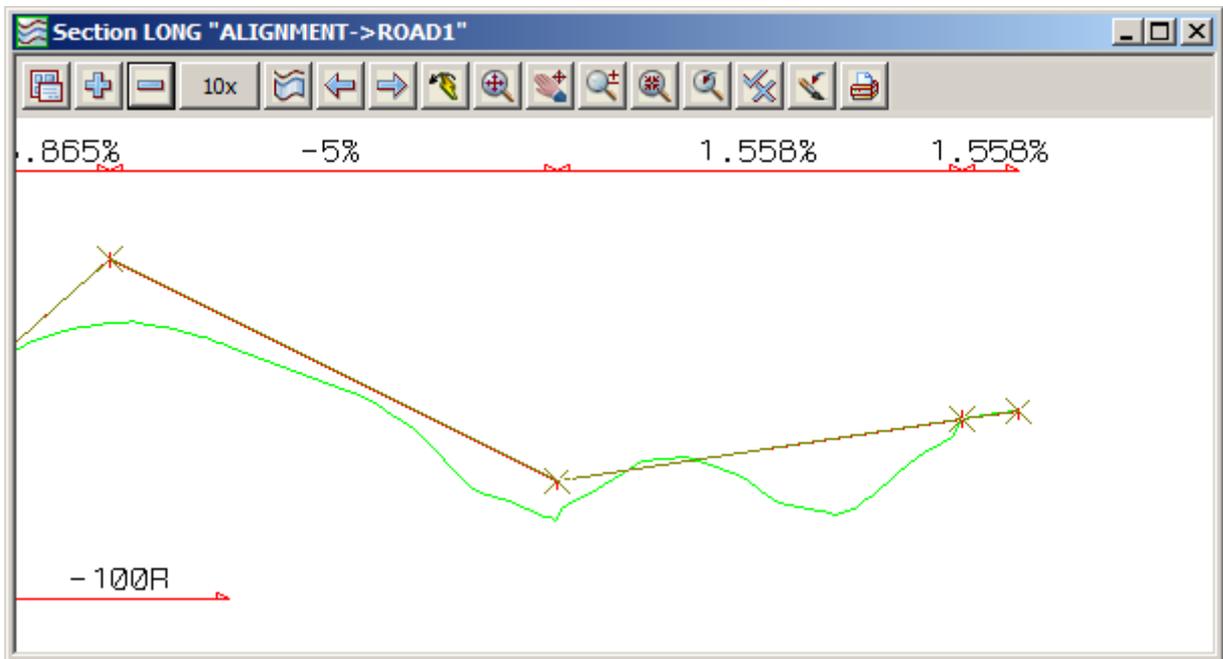
As we have inserted two new VIP's on the same grade as existing VIP's we end up with redundant VIP's which can now be deleted. Click on **Delete** and select and accept VIP 2.

12d will renumber the remaining VIP's and hence the second point to be deleted will be VIP 6.

We will now place some vertical curves in the design. We will use parabolas to define the vertical curves and place them via their length.
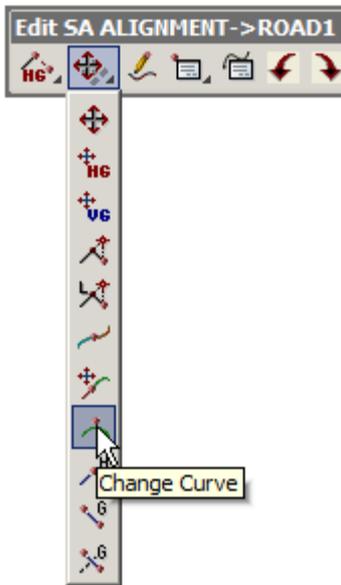
From the Alignment Edit menu, click LB on **Move/Edit** icon then select **Change Curve**

Click with LB on VIP 2 and confirm it with MB. A panel will pop up prompting 'Length'.
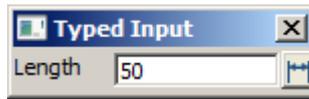
Position the cursor in the data field then type **50** and then press the Enter key.

Observe that a vertical parabola of length 50 is now inserted. The VIP is now marked with a red cross.

The insertion of vertical parabolas is setup to handle multiple insertions. If you now point in the vicinity of VIP 3 and click with the LB, accept with MB, type 150 for the new length and press Enter, a further parabola will be inserted.

You can insert the remaining parabolas in the same fashion with VIP 4 having a length of 200m and VIP 5 a length of 100m.

To terminate the parabola insertion process, press the Esc key or click RB to pop up the Pick Ops menu and click LB on **Cancel**. Click LB on the Refresh button in the View Button Area to refresh the view and revise the annotation.

Your 'Section LONG' view should now look as follows.
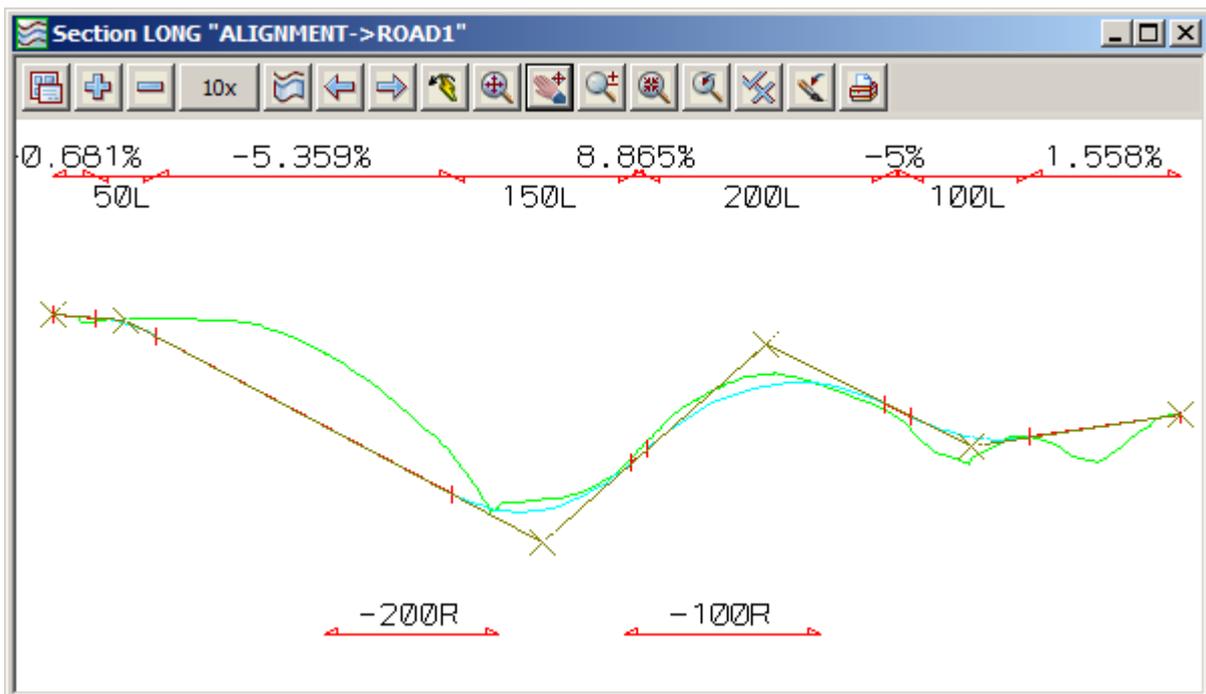
Note that the extent of the Vertical curves is annotated on the Section view.

We can now use the Information panel to show the details of our vertical geometry. From the Alignment Edit menu, click LB on **Info** to pop up the Information Panel.

Move the cursor in the Section View along the Road centreline string. The data in the Information panel changes dynamically as the cursor is moved. A new feature to version 9 is the dynamic box that travels along the vertical alignment displaying the chainage, height and grade
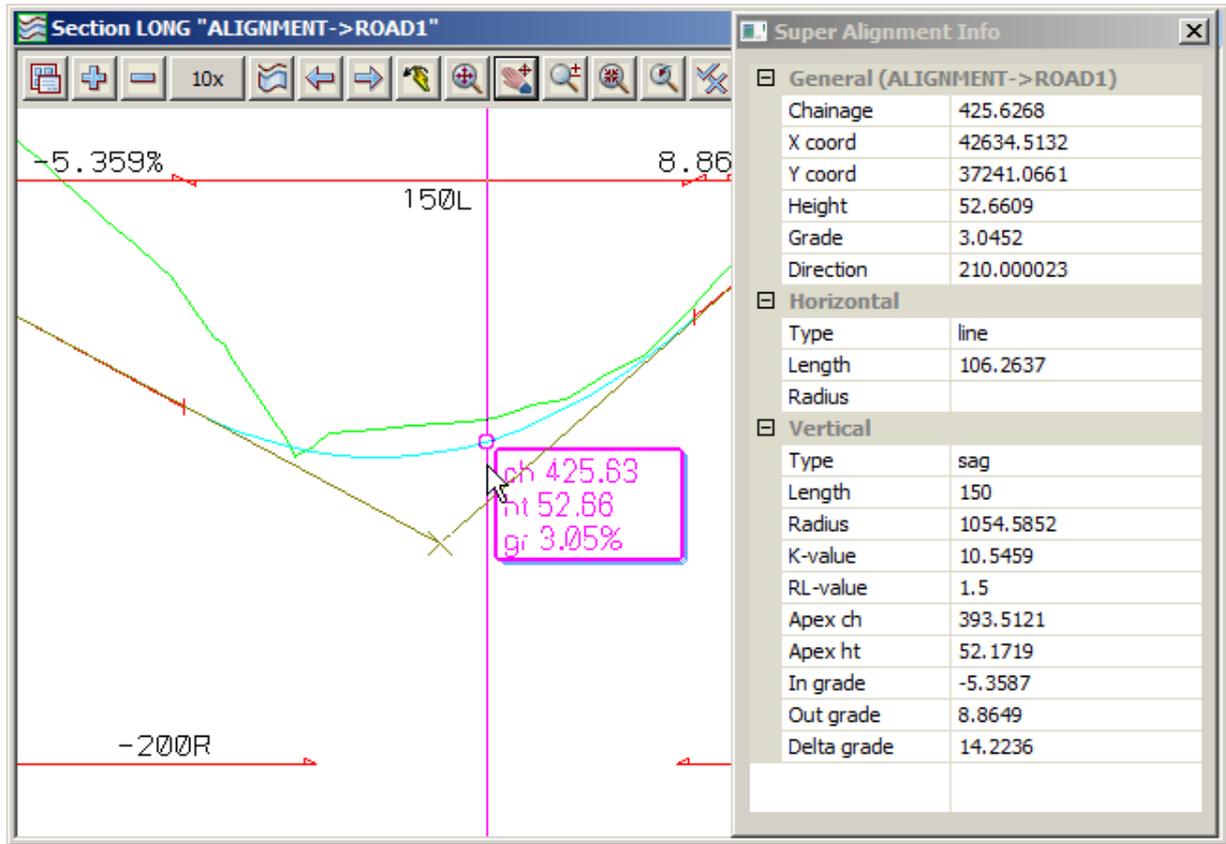
This panel results from placing the cursor near VIP 3.

We have now finished defining our horizontal and vertical geometry and wish to exit from the alignment editor. To do so, click LB on the *Finish* icon or press LB on the *Finish* icon and select *Finish* from the drop down toolbar.
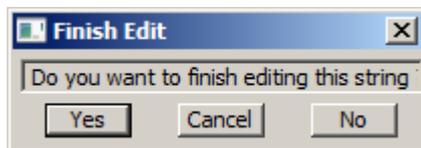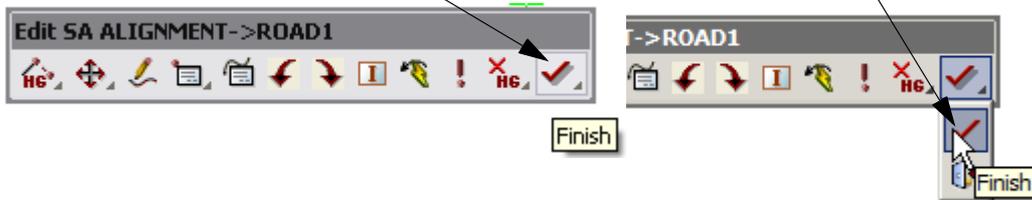
Click LB on **[Yes]** to confirm

WARNING: Do **not** select *Quit* from the alignment editor. *Quit* will throw away all the changes made to the string since the alignment editor was started.

NOTE: We don't have to exit from the alignment editor for the string **ROAD1**. We could simply leave the Edit SA menu on the screen and return to it later.

9.6   Editing an Existing String

Now that we have left the alignment editor, we need to know how to go back into the editor to make future modifications to the alignment string. In fact, what we now do applies to editing any existing string, not just an alignment string.

To edit an existing string, simply click LB on the option **Strings =>Editor** which brings up the **Edit String** panel. Now pick and accept the string you want to edit, in this case, the string **ROAD1**. The appropriate editor for the selected string will then be started.
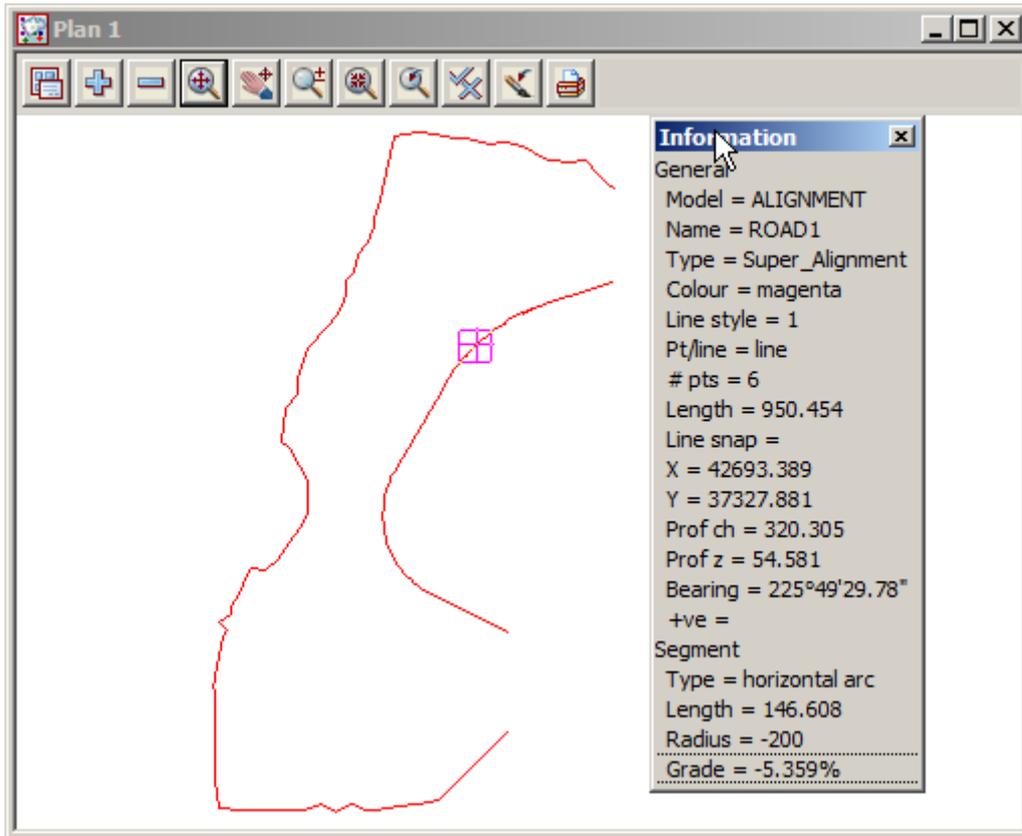
The Edit SA panel will then reopen and you can modify the alignment as necessary.

10 Road Templates

The road design is calculated by passing a template along the alignment. The interface between the new template and the existing terrain will also be calculated.

This is the simplest way that 12d can perform a road design.

12d has the concept of a basic road template. Templates are always defined for half of the road. When used on the left, the template is applied on the left hand side of the road. When used on the right, the template is applied to the right hand side of the road.

Each template has various parts to it. There is a fixed part that is always used in applying the template. Then there is a Cut/Fill part that is variable. As many links in this part are used as is necessary to reach the intersection with the natural surface. If after using all of the Cut/Fill links, the road profile still has not intersected with the surface, a final Cut/Fill slope is used to try to calculate the intersection. All parts of the template are optional.

10.1 Creation of Basic Templates

Template creation is a mechanical process of filling widths and slopes into panels. Template data is stored in files. A typical use of templates files is to store standard templates as required by a particular road authority. These can then be read in and modified to suit each particular job as required - quicker than starting from scratch each time.

For the purpose of the tutorial, we will use an existing template to save time. Previously stored template values will be read in from file 'ROAD TEMPLATES.tpl'. This is one of the files supplied on the tutorial disk.

From the Main menu, click LB on **File I/O=>Templates input**. The Read Templates panel pops up.
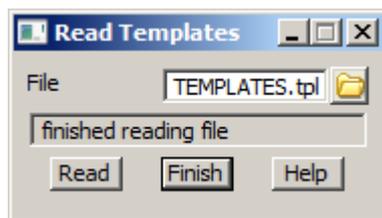
Place the cursor on the folder icon for the 'File' field and click LB to pop up a list of template files. Navigate to the folder **C:\12d\9.00\Training\design\getting started basic**

then double click LB on **ROAD TEMPLATES.tpl**. Click LB on **Read** to read in the template file. Click LB on **Finish** to terminate the panel.

Our Template file contains a number of templates. Initially we will look at the templates called **FULL LEFT** and **FULL RIGHT**. The various parts of the template just read in will now be displayed. These are just arbitrary names that have been assigned to these particular templates. There can be many templates in just one file, and in general any template can be applied either side of the centreline. In this case we will use the convention to have 'left' and 'right' suffixes *l* and *r* in the names and to use these templates on the left and right respectively.

An alternative to creating a left and right template is discussed in Chapter 10.3.

We will now investigate template **FULL LEFT**.

From the Main menu, click LB on **Design=>Templates=>Create/edit**.
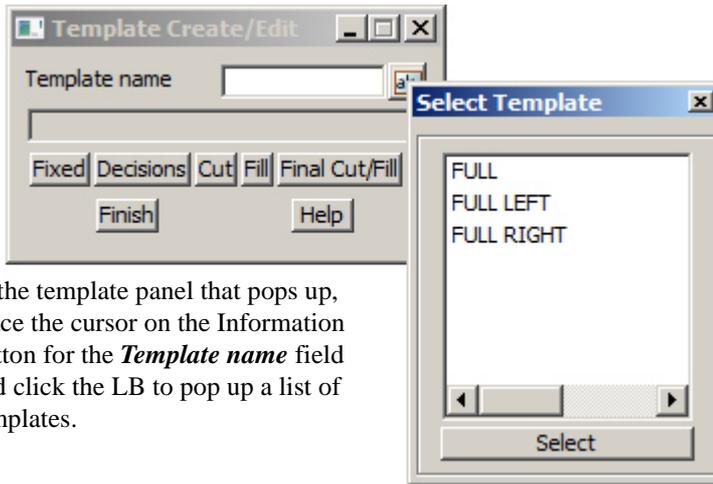
Double click LB on **FULL LEFT**

In the template panel that pops up, place the cursor on the Information button for the *Template name* field and click the LB to pop up a list of templates.

Each template has up to five parts. We will only use **Fixed**, **Cut** and **Final Cut/Fill**. This means that in a fill situation, the final fill batter will join onto the fixed part of the road template since we are not defining a variable fill template. If a template panel contains blank fields, 12d will ignore such fields in its processing of the various template parts.

Fixed Part of Template

From the Template Create/Edit panel, click LB on **Fixed** and the fixed template panel pops up.

	Width	Height	XFall %	Name	Colour
1	3.5		-3	lokl	cyan
2	0.45	-0.04		iokl	dark blue
3	0.04	0.15		tokl	blue
4	0.11		0	bokl	green
5	4.16		2.5	bofpl	dark green

valid colour
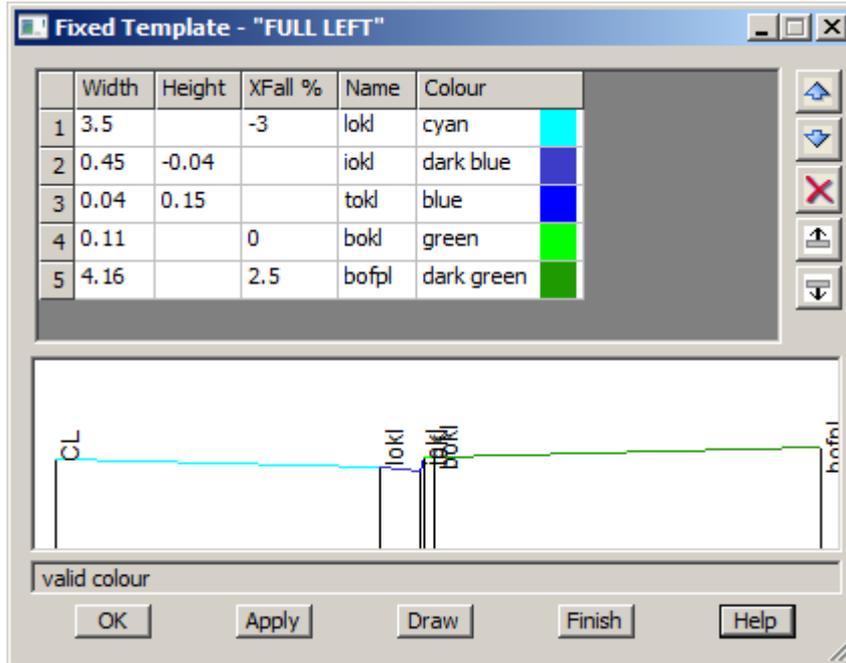
A large number of links can be defined. We will use just five.

Note that each link in the 'left' template has been assigned a suffix 'l'.

The template defines a carriage way width of 3.5 metres at -3% crossfall to the kerb line *lokl*. This is followed by a kerb and channel, *iokl*, *tokl* and *bokl* and then out to the back of the footpath *bofpl*. The sign convention is +ve is up and -ve is down. Each width defines a link from the previous link so the order is important i.e. links are defined relative to one another, not from the template centreline. As you will see

later, this is one of the features that makes 12d so powerful - the ability to use string handling to automatically perform total road redesign after any geometry or template link changes.

These template link values could now be changed. At completion click LB on **Apply** to test out any changes. Click LB on **OK** to implement and terminate the panel.

Variable Part of Template

Note that the links in the 'variable' part of the template connect onto the 'fixed' part i.e. the first variable link follows immediately after and connects to the last fixed link. The fixed part always appears so it is normal to put kerbing etc. in the fixed part.

The variable 'cut' part only appears if the fixed part of the template ends in a 'cut' region. Thus it is normal to put benching in the variable part of the template when battering is required.

Similar rules apply to the variable 'fill' part of the template.

Variable Cut Template

From the Template Create/Edit panel, click LB on **Cut** and the Variable 'cut' template panel pops up.
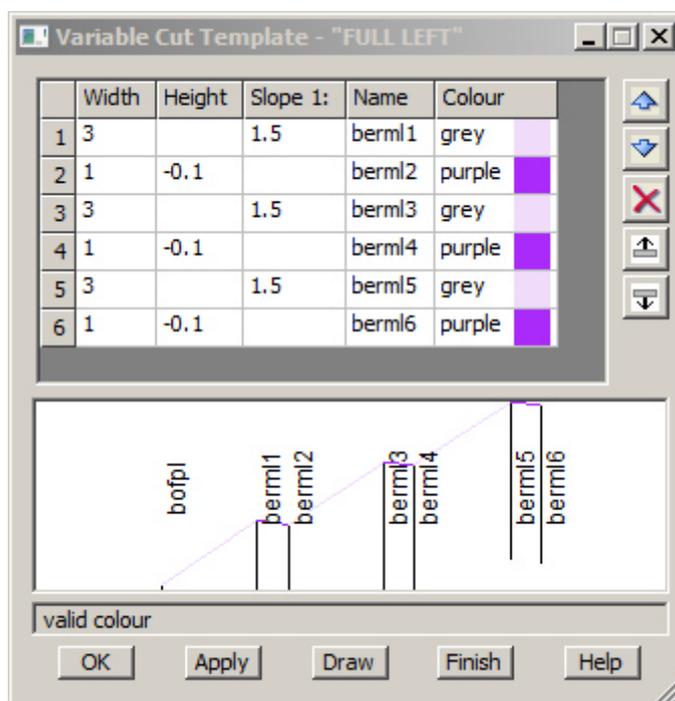
Again a large number of links can be defined here. We will use six to define our batter slopes. Slopes are defined by giving a horizontal width x where the slope is 1 vertical in x horizontal.

The sign convention for slope in a cut template is +ve is upwards

Unique names are given for each link in the template. Note the *l* suffix in each link name

These values could now be changed. At completion click LB on **Draw** to preview the template. Click LB on **Apply** to test out any changes. Click LB on **OK** to implement any changes or **Finish** to terminate the panel.

Variable Fill Template

Whilst we are not using one here, this section is included to define the rules of usage.

By leaving the panel blank, 12d understands that the variable fill template feature is not to be used.

The sign convention for slope in a Fill template is +ve is downwards

Final Cut/Fill Template

From the Template Create/Edit panel, click LB on **Final Cut/Fill** and the Final Cut/Fill template panel pops up

.

Final Cut/Fill Template - "FULL LEFT"
Final cut slope 1v in	1
Final fill slope 1v in	2
Maximum slope width	100
Final name	intl
OK	Apply	Finish	Help
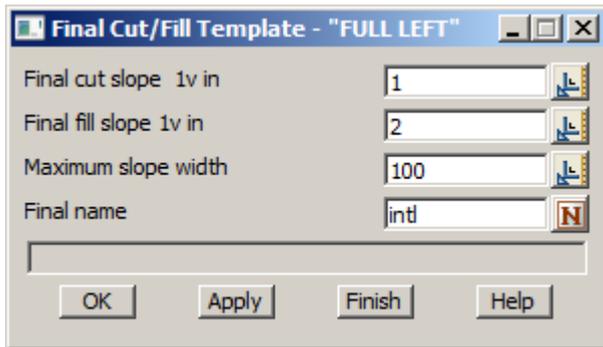
After the variable part of the template, 12d will use the final cut and fill slopes defined to calculate the intersection with the natural surface. This only occurs if the variable part hasn't yet reached the natural surface. 12d will examine a corridor up to 100 metres from the previous link to achieve this. An interface string named 'intl' will be placed on the TIN at the intersection. Again note the suffix *l*

These values could now be changed. At completion click LB on **Apply** to test out any changes. Click LB on **OK** to implement any changes and terminate the panel.

In the Template Create/Edit panel, click LB on **Finish** to terminate the panel.

Note that apart from the suffix l or r, the **FULL RIGHT** template is identical to **FULL LEFT**.

Fixed Template - "FULL RIGHT"

	Width	Height	XFall %	Name	Colour	
1	3.5		-3	lokr	cyan	(cyan)
2	0.45	-0.04		iokr	dark blue	(dark blue)
3	0.04	0.15		tokr	blue	(blue)
4	0.11		0	bokr	green	(green)
5	4.16		2.5	bofpr	dark green	(dark green)

valid colour

| OK | Apply | Draw | Finish | Help |
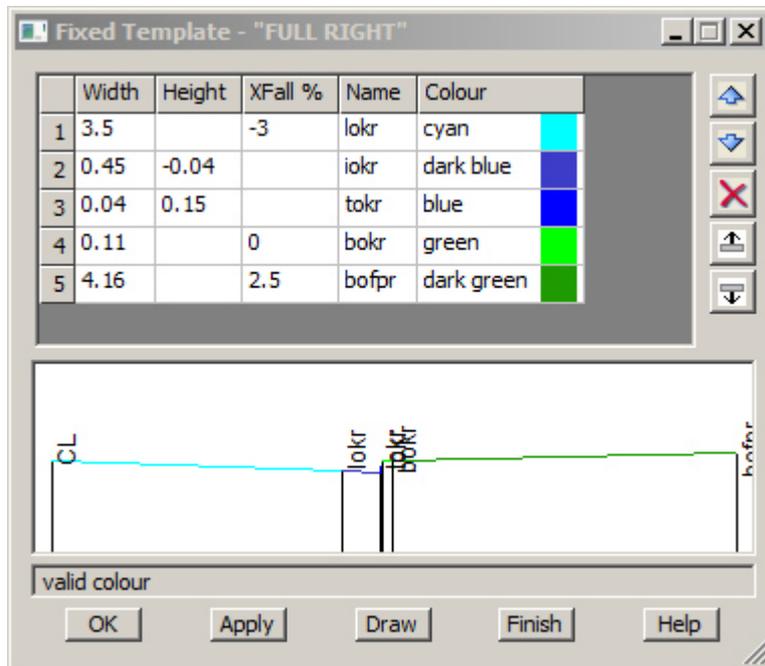
The links in the left and right templates are identical except that links in the **FULL LEFT** template have a suffix of 'l' and those on the **FULL RIGHT** template have a suffix of 'r'.

This ensures that links on either side of the centreline have unique names – essential for string modifiers and applying boxing as we shall see later
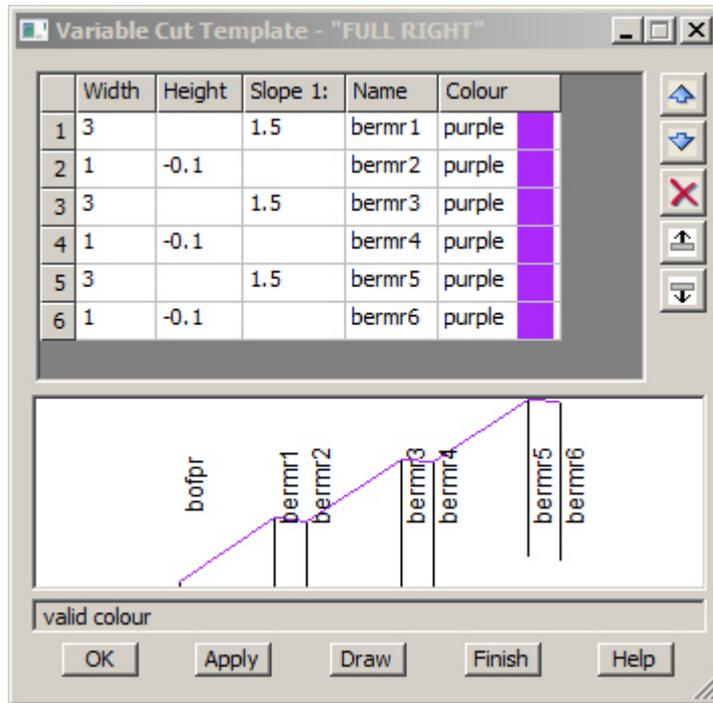
Variable Cuts for right side have suffix 'r'.
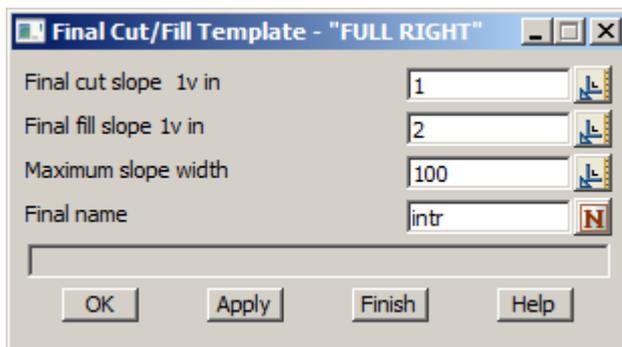
The interface name **intr** has suffix 'r'.

10.2   Applying Templates

Before we apply the template to the road centreline, let us rearrange our views so that we can see what is happening more clearly.
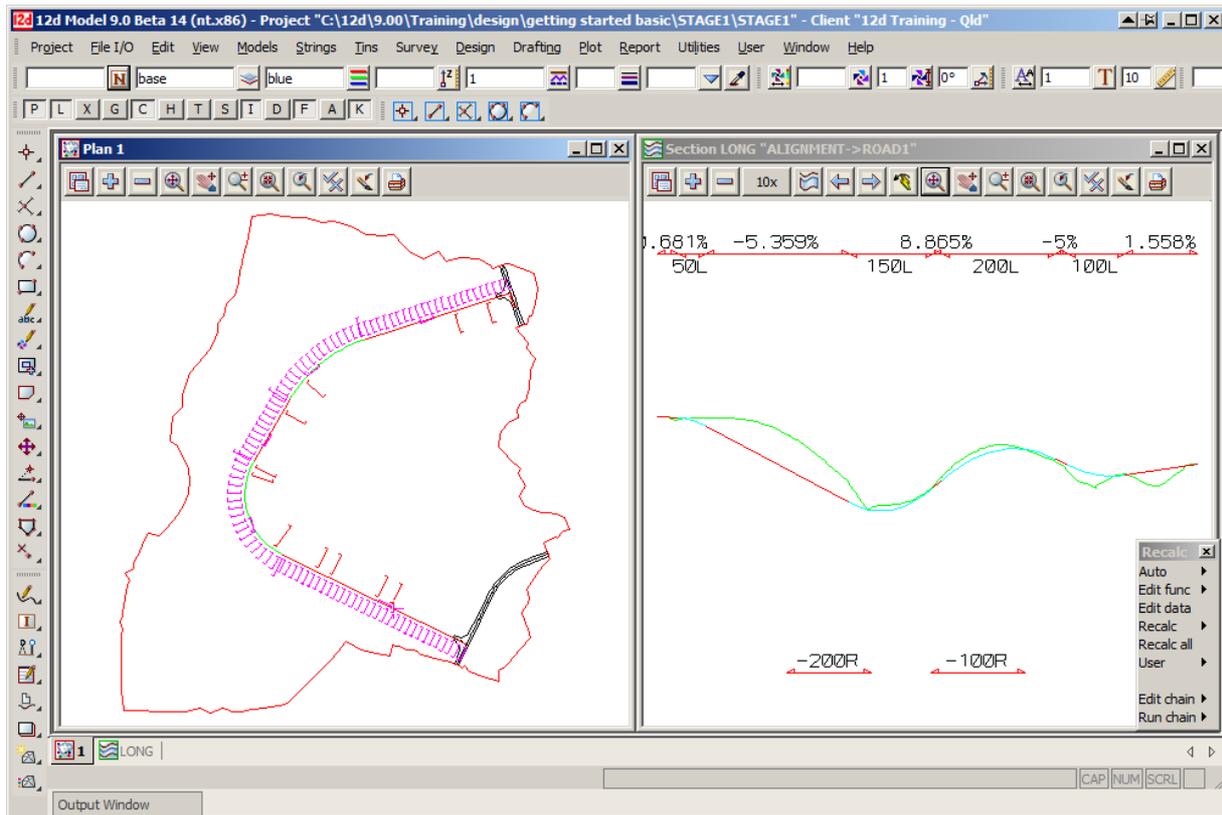
The design can be applied in two ways.

The simplest way is to create an **Apply function** which uses the templates for the length of the alignment without any modifications such as widening or superelevation. This is also useful for users who don't have the *Alignment* module.

The other more typical way for most design applications is to create an 'MTF' file (Many Template File) which allocates and allows modifications of templates. This is then processed using the **Apply Many Function**.

IMPORTANT NOTE:
The *Apply Many Function* requires the *Alignment* module. The *Apply Many Function* is not in the *Getting Started for Design* manual but is covered in the non-Introductory Design courses.

We will now create an **Apply** function to apply the template to the road centreline.

From the Main menu, click LB on **Design=>Apply=>Apply**.

The **Apply Template Function** panel pops up.
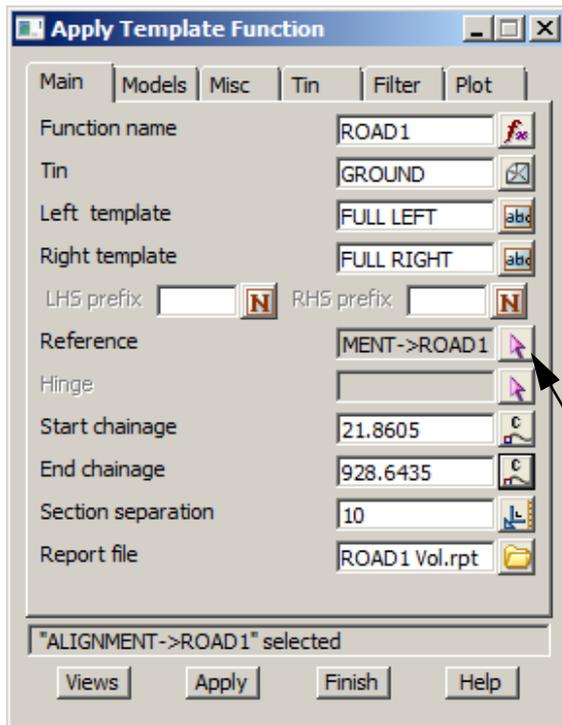
Fill in the panel as shown.

A function name is needed so that the process of applying this particular template to this piece of centreline can be referred to later in any redesign. In the 'Function name' field, type **ROAD1** and then press **Enter**. On the *Models* tab the Model names will be automatically filled in after you press **Enter.** This is based on the function name. In the 'Tin' field, click LB on the tin icon to pop up a list of available TINs. Double click LB on **GROUND**

In the Left and Right template fields, click LB on [abc] button to pop up a list of templates. Double click LB on **FULL LEFT** and **FULL RIGHT** respectively.

Select the Reference pick icon then click LB then MB on the alignment string in the plan view

As we already have existing road at the start and end of our design we do not want to start and end the template at the beginning or end of the alignment string. Type in the chainages shown to ensure the design matches up with the existing road surface.
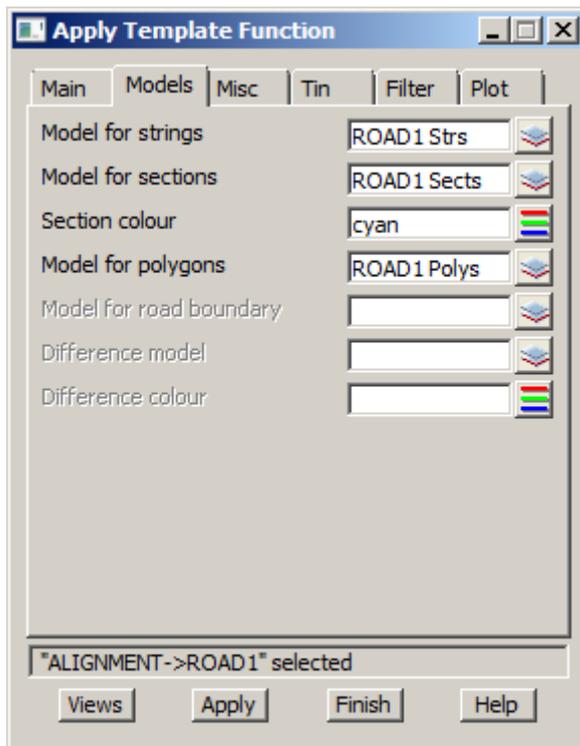
NOTE FOR PRACTISE VERSION:
The default 'Section separation' is 10 metres but for the **Practise Version** use a *Section separation* of *20* and an *End chainage* of *400*. This will keep the number of points under 5,000.

Click on the *Models* tab and note that the model names are already filled in. If they are not go back to the *Main* tab and press **Enter** after the 'Function name'.

The other tabs we don't need to worry about at this stage.

Note: If desired, use the shorthand suffix notation of **,1** after each model name to force View 1 to be updated automatically as the template is applied. If this is not done, the strings and sections will still be updated but will not be on view. In such case they can be turned ON manually from the View Button area with the '+' sign button after the template is applied.

Explanatory Note: 12d permits the chainage of a road to be defined by a string called the Reference string. The template is always applied at right angles to the Reference string. To cater for complex projects, the centreline of the template is not necessarily located on the Reference string. Another string called the Hinge string is used for this purpose. The Hinge string and the Reference string do not necessarily coincide.

In simple projects such as our new road, the Reference string and the Hinge string coincide. By default, 12d assumes the Hinge string defaults to the Reference string so we do not need to click the Hinge button in this case.

When the panel is complete, apply the template by clicking LB on **Apply**

There is now a short delay whilst 12d performs the calculation. The message box at the base of the panel will advise the current chainage as the template is applied. As the calculation completes, the view 1 will be updated with the new road strings and cross sections.

The panel message box now displays the cut, fill and balance volumes resulting from the application of the template. The default convention is negative for cut and positive for fill. Interpret these as follows

c -35297.554 f 7087.292 b -28210.262
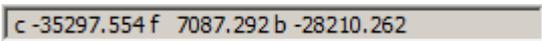
c   -35297- cubic meters of cut

f   7087- cubic metres of fill

b   -28210- balance in cubic metres showing surplus of cut over fill

Clearly we have too much cut at this stage. We will subsequently improve the design to minimise this.

Click LB on **Finish** to terminate the panel.

10.3   Alternative template creation

12d can use just the one template for both sides of the road. The templates would be set up with no suffix after the link names

From the Main menu, click LB on **Design=>Templates=>Create/edit**

Type in the template name **FULL**.
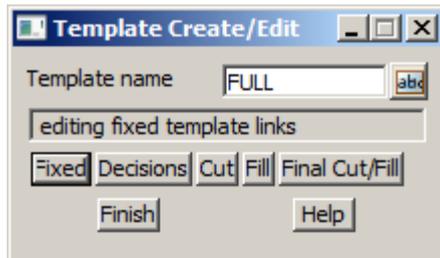
Select **Fixed**
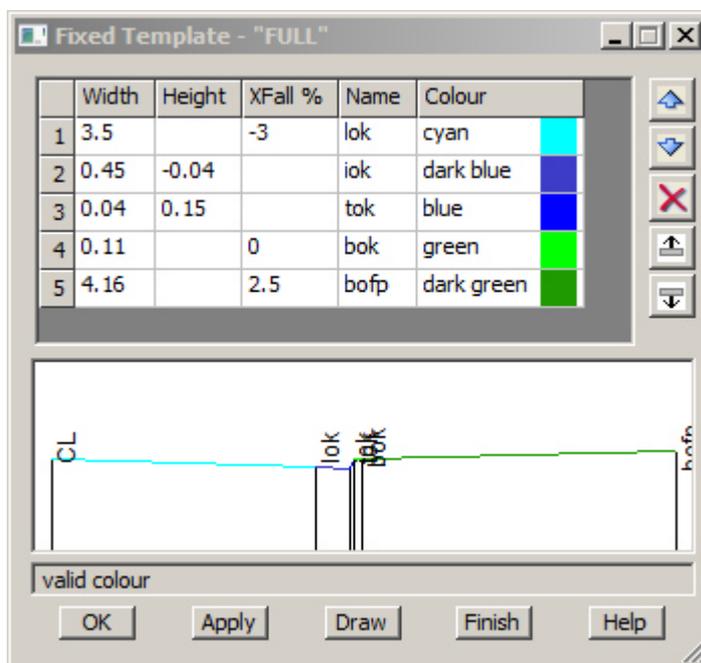
Here the values are shown in the table without an *l* or *r* suffix

Select **Draw**

Select **OK** to implement any changes and finish panel

	Width	Height	XFall %	Name	Colour	
1	3.5		-3	lok	cyan	
2	0.45	-0.04		iok	dark blue	
3	0.04	0.15		tok	blue	
4	0.11		0	bok	green	
5	4.16		2.5	bofp	dark green	

	Width	Height	Slope 1:	Name	Colour	
1	3		1.5	berm1	grey	
2	1	-0.1		berm2	purple	
3	3		1.5	berm3	grey	
4	1	-0.1		berm4	purple	
5	3		1.5	berm5	grey	
6	1	-0.1		berm6	purple	
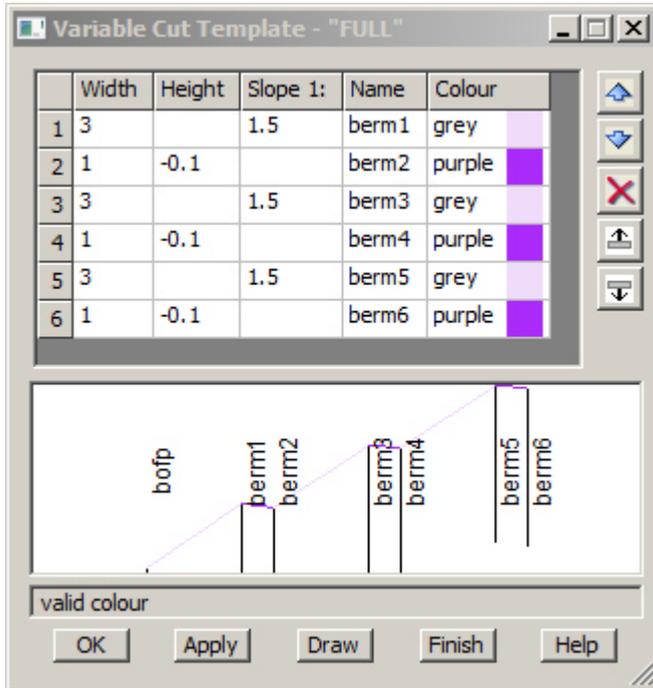
Select **Cut**

Again the panel appears similar to the Full left but without the suffix *l* or *r*

Select **Draw**

Select **OK** to implement any changes and finish panel

Final Cut/Fill Template - "FULL"

Final cut slope 1v in	1
Final fill slope 1v in	2
Maximum slope width	100
Final name	int
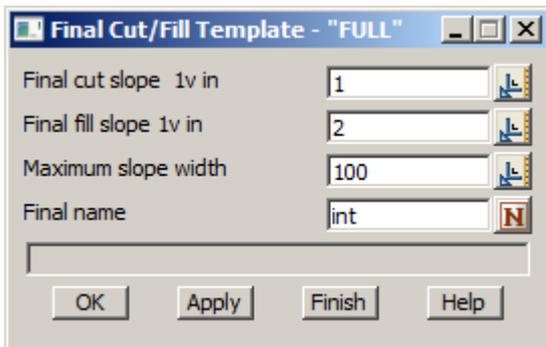
Select **Final Cut/Fill**

One template is defined

Note no suffix *l* or *r*

Select **OK** to implement any changes and finish panel

From the Main menu, click LB on **Design=>Apply=>Apply**. The **Apply Template Function** panel pops up.
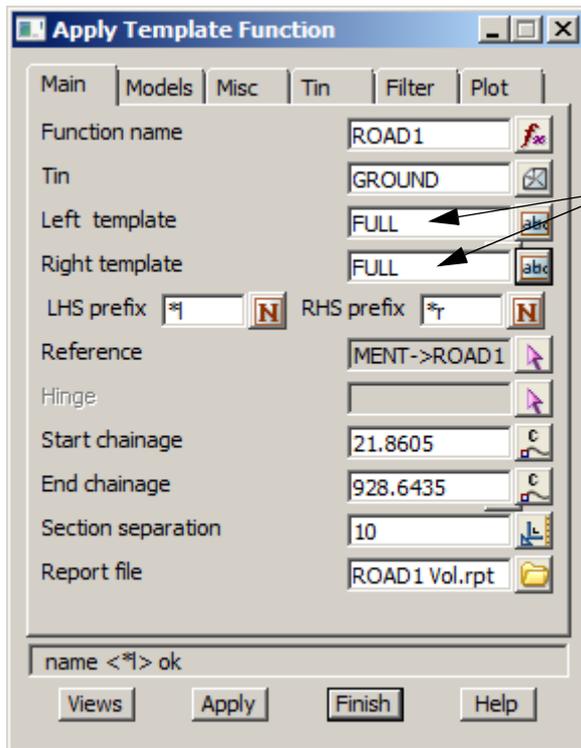
The panel is filled in the same as shown in chapter 10.2 with the exception of the 'left' and 'right' template names which are both **FULL**

The prefixes need to be added. For the entry of the 'LHS prefix' ***l** and the 'RHS prefix' ***r.**

Note that these will actual be suffixes of **l** and r

NOTE FOR PRACTISE VERSION:
The default 'Section separation' is 10 metres but for the **Practise Version** use a *Section separation* of *20* and an *End chainage* of *400*. This will keep the number of points under 5,000.

This action will suffix all road string names with **l** for the left side strings and **r** for the right side strings

The advantage of this method is the reduction in number of templates created.

The advantage of the previous system is the ability to pick strings from the view to match names which is useful when modifying templates and boxing

Each method has its own merits and the user can adopt either system with the same end results

11 Viewing and Assessing the Design

Turn off all models except '**survey ROAD CROWN**' and '**survey ROAD PAVEMENT EDGE**' in the perspective view.

We can now turn on the new design models **ROAD 1 Strs** and **ROAD 1 Sects** in the plan and perspective views. The centreline model **ALIGNMENT** should be turned off in the plan view and turned on in the perspective view

Set the screen up as per the example below

.
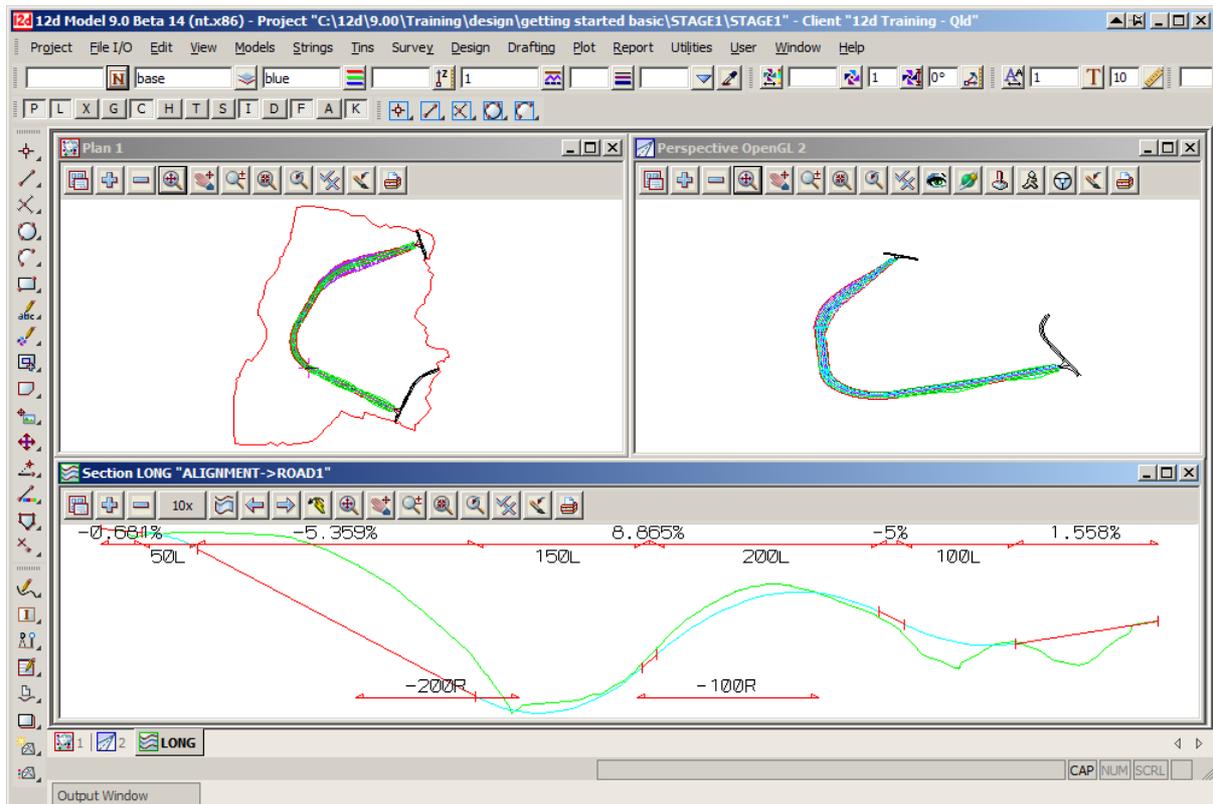
To begin assessing the design, click LB on **Zoom** in the 'Plan 1' view as shown below

Fit   Pan   Zoom
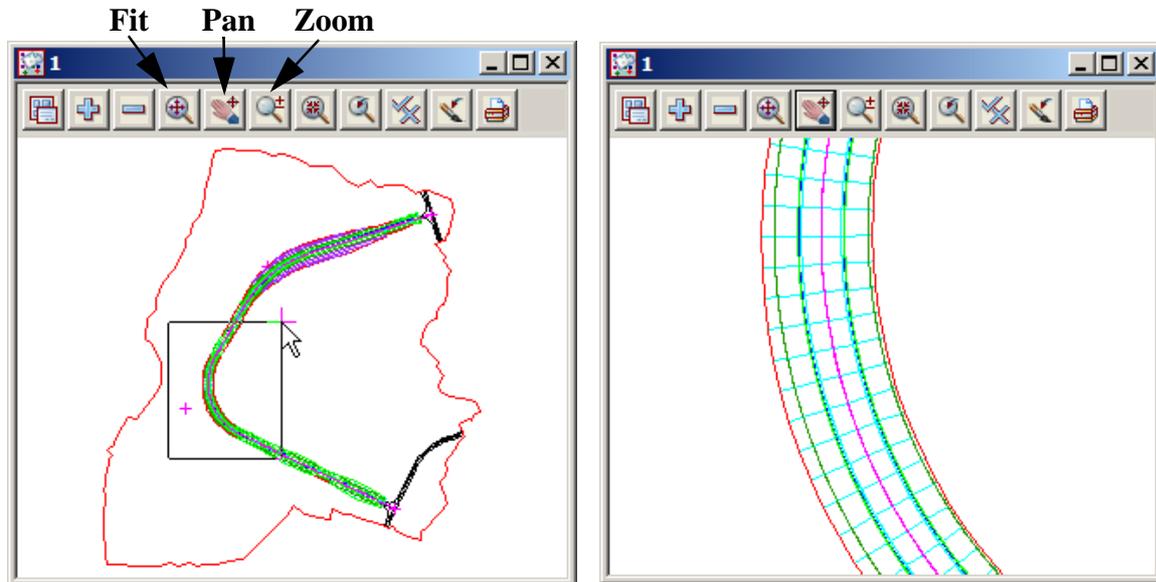
Note that the interface strings between the road template and the existing terrain are coloured red in cut areas and green in areas of fill. This can be confirmed by placing the cursor in the Section 'LONG' view and moving the cursor backwards and forwards across the view (to change the chainage of the cursor). Observe the corresponding movement of the yellow cross in both the 'Plan 1' view and the 'Perspective OpenGL 2' view.

Also note the various coloured strings that have been inserted in 'Plan 1'. From the main menu, click LB on **Strings =>Inquire** and inquire on the various strings in 'Plan 1'. Make sure that your Point and Line snaps are set ON. Place the cursor in an area near the road, click LB repeatedly and observe what happens. With each click a new string is selected. As the information panel pops up each time, note the various string names and the fact that each one now has a profile chainage (prof ch) and profile Z coordinate (prof z). These are now three dimensional strings and can be observed in the 'Perspective OpenGL 2' view.

You will observe that the cross sections are also strings with their own unique names that are used when referring to cross sectional views. For instance 'design 130' refers to the section string at chainage 130.0

Whilst the View is zoomed try panning along the road to assess the interaction of the template with the existing terrain. From the 'Plan 1' View Button Area, click LB on the **Pan** button. Position the cursor on the centreline of the road near one edge of the view and press LB down. Drag the cursor across the view and the image will pan with the cursor until LB is released. Keep positioning the cursor on the road centreline each time and clicking LB down and move down the road whilst in the zoomed state. Press the <Esc> key or RB to cancel **Pan**.

11.1   Perspective View Operations

In Chapter 6.8 we saw how the Orbit panel could be used to orientate your eye in relation to your data in a perspective view. We will now use this facility again to observe our design.

The Orbit panel is accessed by clicking LB on **Orbit** in the View Button Area of 'Perspective Open GL 2'.

If necessary, move the panel away from the perspective view so that all of 'Perspective Open GL 2' is in view. Make sure that models 'ROAD 1 Strs', 'ROAD 1 Sects' and the 'survey ROAD CROWN and survey ROAD PAVEMENT EDGE' are turned on.

Try clicking LB in the perspective view and using the mouse wheel rotate the image and zoom in and out to get a view of the intersection at the end of the design
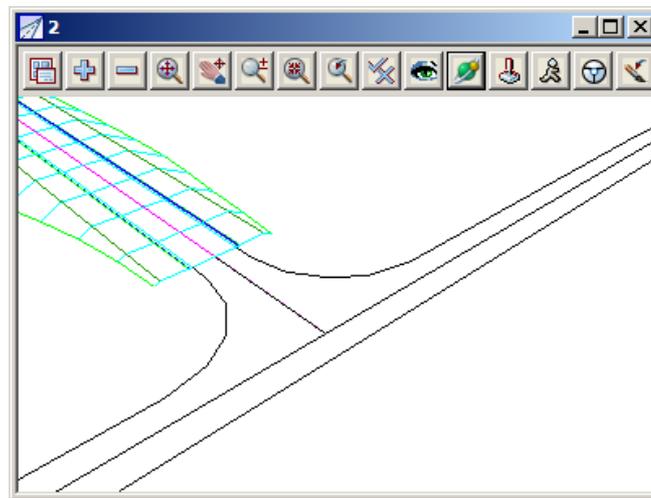
You will notice that this facility gives you a good feel for the design you have created. You will see perspective views similar to that shown above.

11.2   String Drive

String Drive allows you to nominate a string and a speed with which to drive down the road and 12d will automate the process. We will drive down the centre of the road with our eye height 10.0 metres above the road.
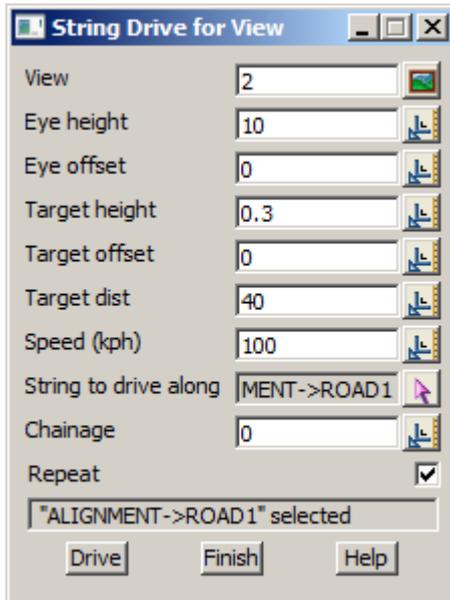
The string drive facility is accessed from the Perspective view. In the View Button Area of 'Perspective OpenGL 2', click LB on the Drive button and the String Drive panel will pop up.

Set the 'Eye height' to 10 metres. The default values for the other items are OK. Note that the speed is set for 100 kph.

To repeat the drive once the end of the string is reached tick on the 'Repeat' check box

Click LB on the **String to drive along** icon and then click LB on the centreline of the road. The easiest way to do this is to pick it from the 'Section LONG' view. Click MB to confirm the selected string.

Click LB on **Drive** to begin the string drive process. The image in 'Perspective Open GL 2' will now change to that at chainage zero, looking down the centreline.

The image will repaint automatically multiple times as the drive proceeds. Each image will be calculated such that the viewer appears to be travelling down the road at 100 kph. The following are two typical images.
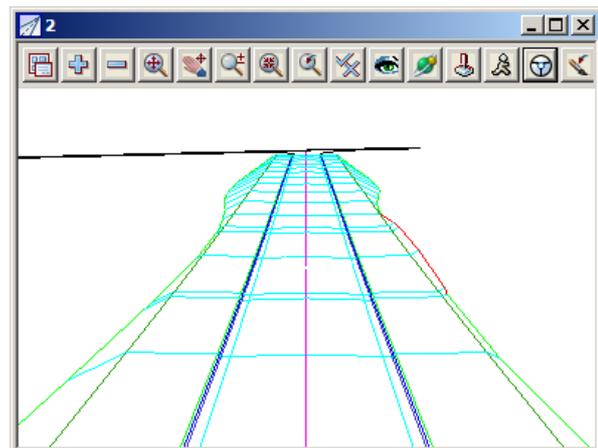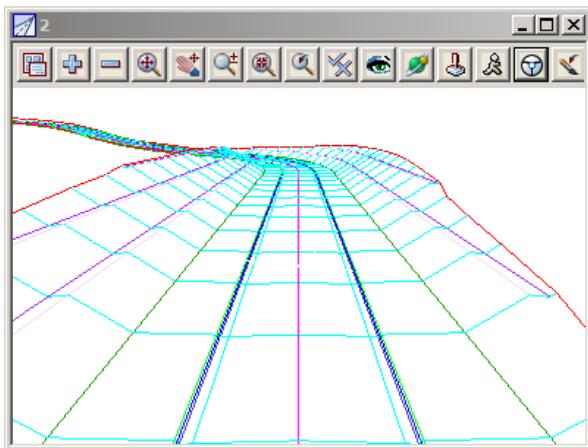
Observe the green cross on the centreline in both these views. This represents the 'target' point which in our case is 40 metres distant. This is also present in all other views. Observe its location in the 'Section LONG' view. The 'eye point' is shown with a red cross and the 'target point' with a green cross. These points move as the drive progresses.

You can stop the drive at any time by pressing the ESC (Escape) key. To resume the drive click LB on **Drive**.

Once the drive has finished, you can replay it again by resetting the chainage to 0 (or any legitimate value along the road) and clicking LB on **Drive** again. Note that both the eye and target points must be on the

string at all times for the **Drive** to work.

It is possible to enter negative values for both the 'Target distance' and 'Speed'. A negative 'Target distance' (-40) is equivalent to 'looking out the back window of the truck as you drive down the road'. Set the chainage to 40 to start.

Similarly, a negative 'Speed' (-100) can be used to drive back up the road in the opposite direction (i.e. in the direction of decreasing chainage). To do this you need to set the 'Chainage' to somewhere near the end of the road (say 870) before you start the drive and also set the 'Target distance' to -40.

Click LB on **Finish** to terminate the string drive.

11.3   Defining a New Perspective View using Eye and Target points

Sometimes it is desirable to locate your perspective view exactly. For example, you wish to locate your eye at a particular point and look in a particular direction.

To do this, click LB on the **Eye** button in the View Button Area of 'Perspective Open GL 2' and the Perspective View panel pops up.
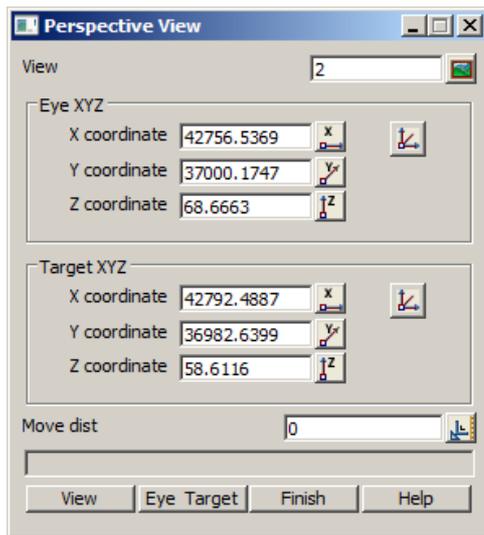
Ignore the current values in the panel. They are left over from our string drive.

Click LB on **Eye Target**. 12d asks you to locate your first point on the view line. Make sure that your Point and Line snaps are ON.
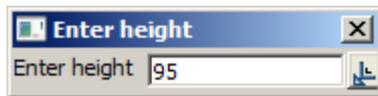
In 'Plan 1' click LB on **Fit** to fill the view. Select the first point by clicking LB on the intersection of the existing road at the end of our design. Confirm the point with MB.

When the height panel pops up backspace over the existing height and over write the value with **95** [Enter] since we wish to look down slightly on the design.
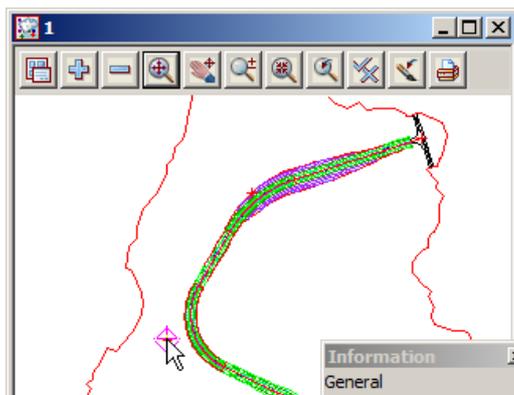
12d then prompts you for the second point on the view line. Click LB approximately in the centre of the road as shown. Confirm with MB. This time when the 'Enter height' panel pops up, just press the Enter key to accept the value.

Now we could zoom in for a closer look along this view line.
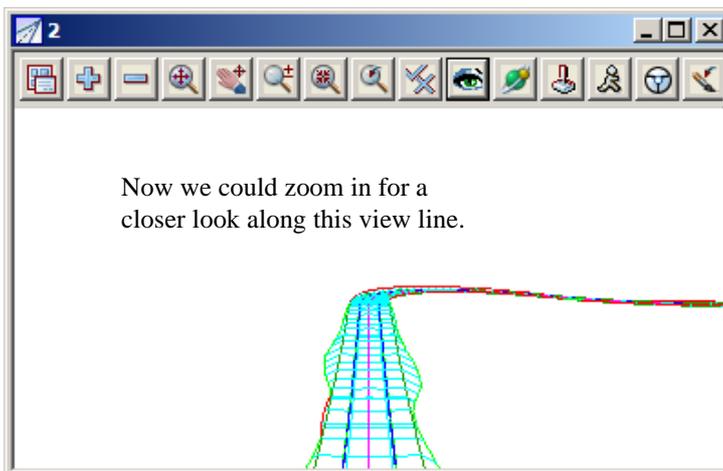
Your 'Perspective Open GL 2' should now look as shown here.
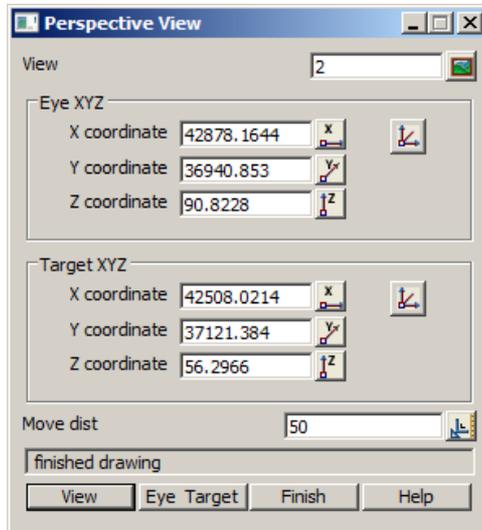
In the Perspective View panel, lock the cursor in the Move distance field by double clicking the existing entry with the LB and type 50.

Now every time that you click LB on **View**, the view will be advanced 50 metres along the view line. If you zoom in five times you will see a view like the one below.
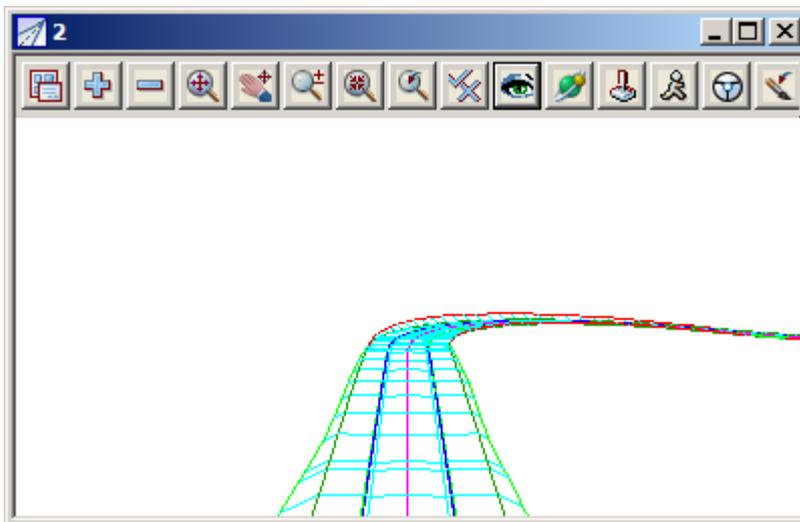
Clearly this facility gives you the opportunity to orientate your eye point accurately in any perspective view.

Click LB on **Finish** to terminate the panel.

That completes a brief look at some of the facilities in 12d that can be used to verify your design parameters visually using perspectives. We will now look at more traditional ways of displaying design data - long sections and cross sections

12   Design Long Sections

12.1   Section Profiles

We will now focus on the sectioning facilities available in 12d. As we already have our Section LONG view displaying our road centreline, there are also many other ways in which information can be viewed.

In subsequent operations we will be picking strings. To help make this easier from our Plan 1 view we need to zoom it as before. **Zoom** in on the area shown so that each string is visible in the Plan view.
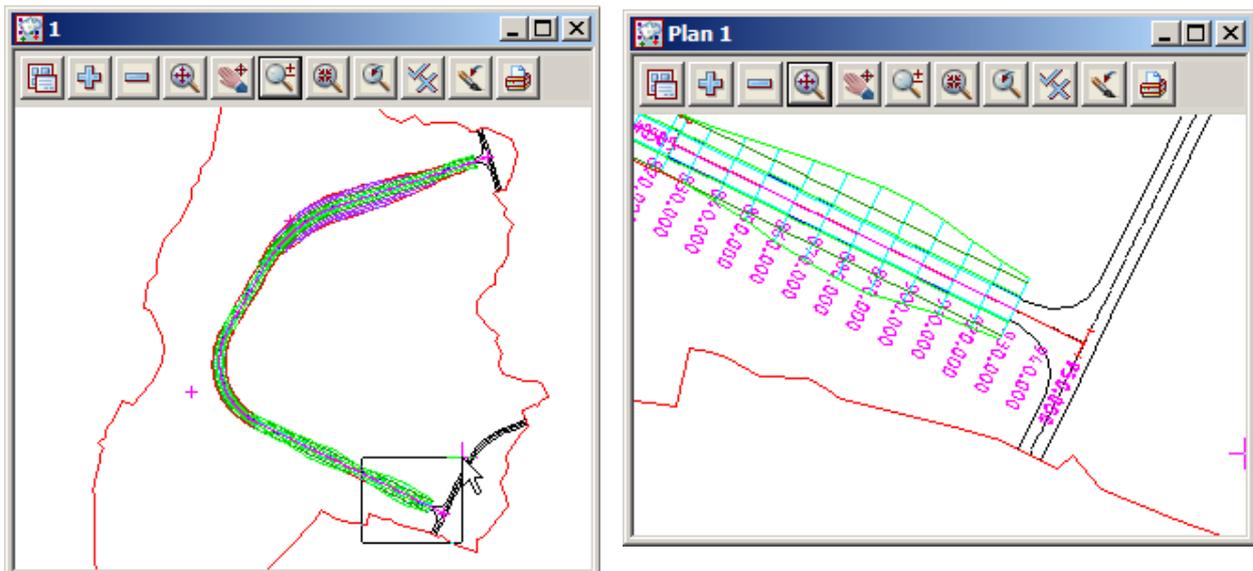
We will now section a series of strings that were created during our road design.

In the Section LONG View Button Area, click LB on the Menu button to bring up the View menu. Walk right on **Profile=>Many strings**.

(Note: This option can also be selected by clicking RB on the *Profile* button to bring up the Profiling menu. Click LB on **Many strings**.)

The Screen Message Box advises

<Profile>[picks][][Menu]

12d is asking you which string you wish to profile. In the zoomed Plan 1 view, click with LB on the cyan string just above the magenta centreline. The string should highlight and the Information panel will display (see right). Click MB to confirm the string selected.
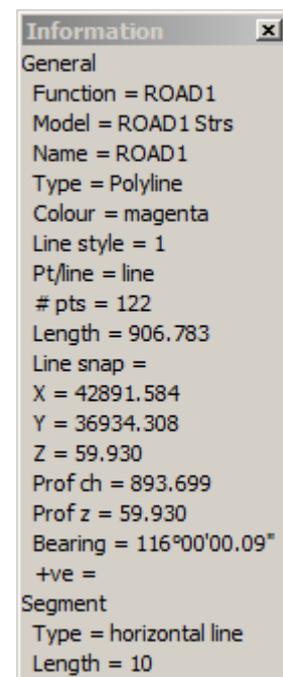
The string will now appear in the Section LONG view.
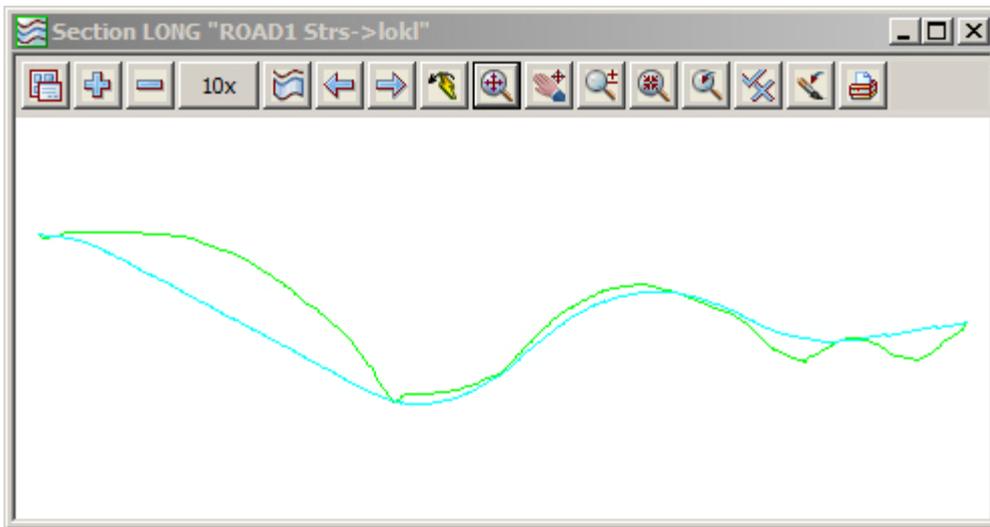
The Screen Message Box is immediately prompting you for another string.

                                                   <Profile>[picks][][Menu]

In the 'Plan 1' view click LB on the *intr* interface string between the road formation and the existing terrain. This is the red-green string (shown highlighted below). Click MB to confirm the selected string.
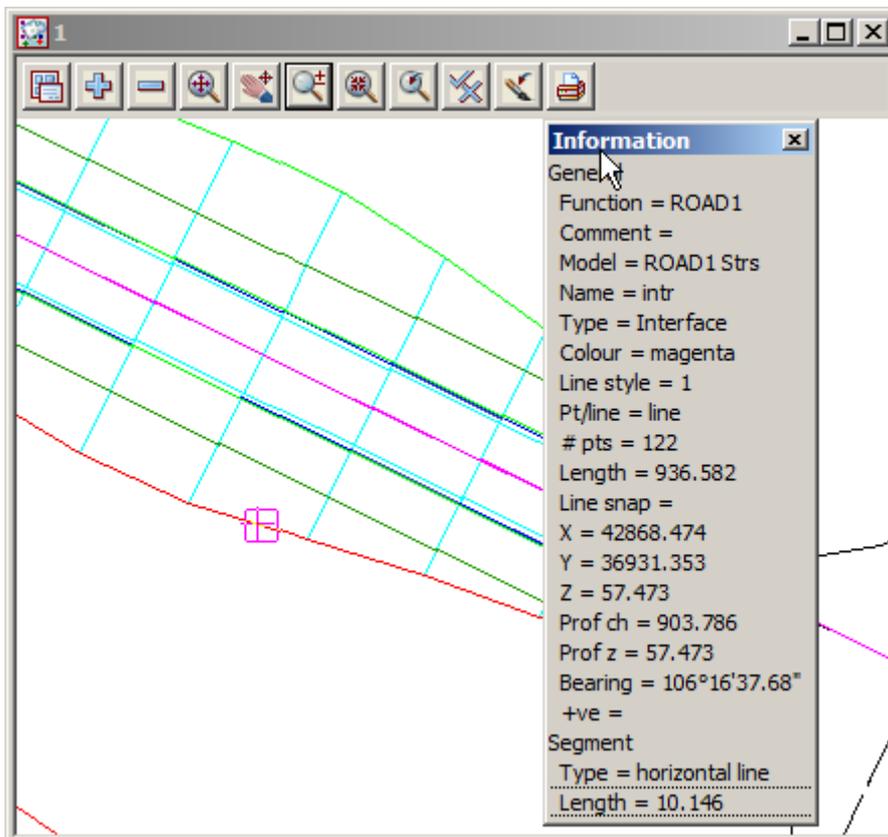
The Section LONG view will refresh as below.
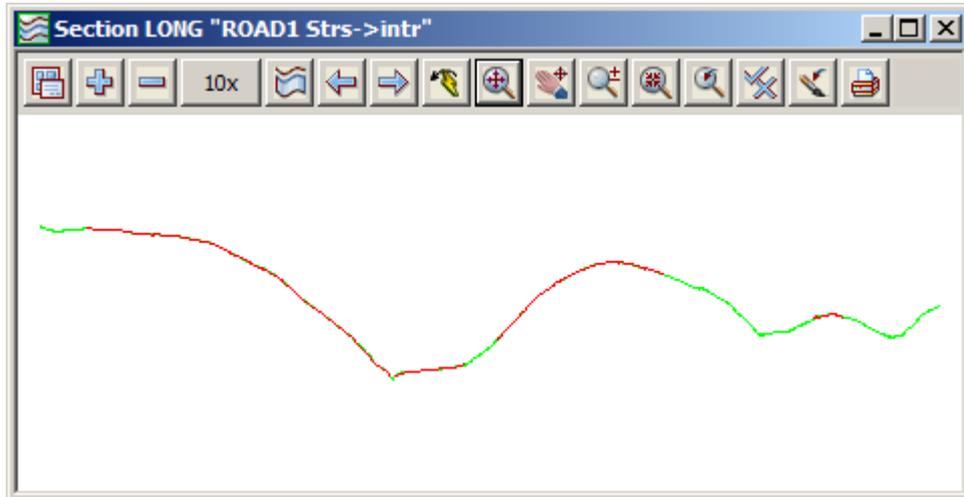
With this technique you can rapidly look at the profiles of any string in the view.

To terminate the **Profile=>Many strings** feature, press the <Esc> key or click RB whilst the cursor is anywhere in the Section LONG view to bring up the *Pick Ops* menu and click LB on **Cancel.**

Whilst the various strings have been profiled, clearly they are being scaled to fit the size of the Section view. To begin to get a feel for the scale of these strings, we can turn on a grid.

Firstly, let us make sure our grid settings are suitable. From the Section LONG view, click LB on the Menu button in the View Button Area to pop up the View menu. Click LB on **Settings=>Grid** and the following panel pops up
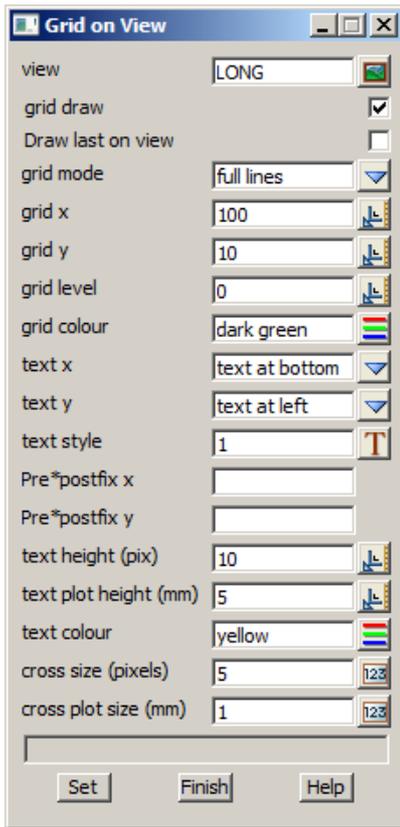
Click LB on the 'grid draw' field to tick the tick box. This activates the grid.

Note the grid y setting. If it is set to 100, move the cursor into the grid y field by clicking with the LB at the right end of the '100', press the Backspace key followed by Enter (or double click with LB anywhere on the 100 and type 10 and Enter).

Click LB on **Set** to activate the change.

Click LB on **Finish** to terminate the panel.

Note that you can turn the grid on with the above tick box or alternatively in the View Button Area of Section LONG, you could have clicked LB on **Toggle=>Grid**

The Section LONG view will refresh as follows
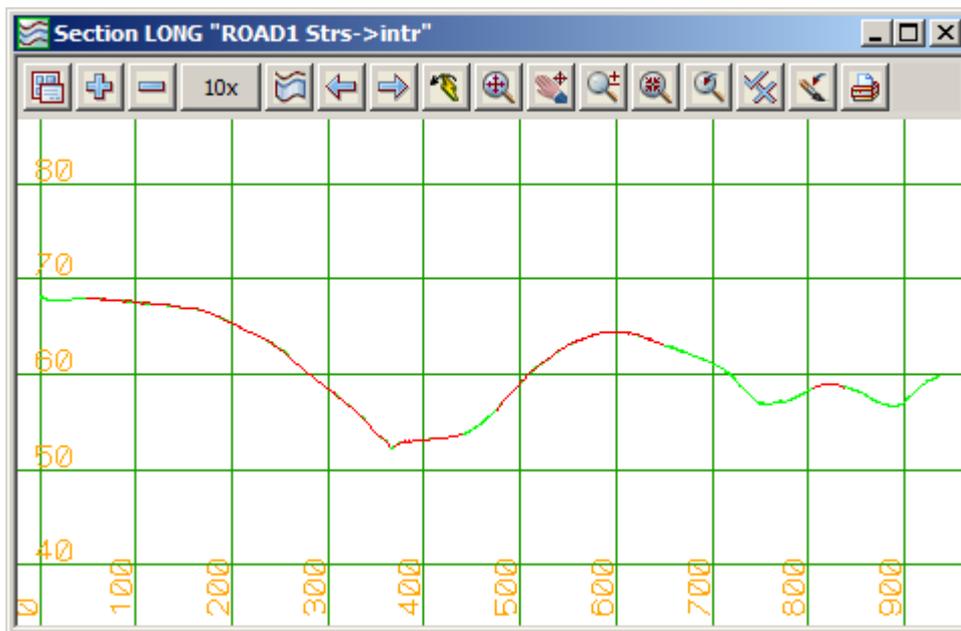
Depending upon what other information you wanted to display or create in this sectional view, the vertical scale may be too great. There are a variety of ways of changing the vertical scale.

The default vertical scale uses an exaggeration of 10 to 1. This can readily be changed by clicking LB on

Toggle from the View Button Area to pop up the Toggle menu.
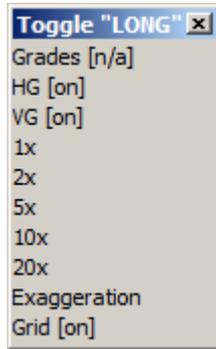
Click LB on **5x** to change the vertical exaggeration 5 to 1. In the View Button Area, click LB on **Fit** to fill the view.
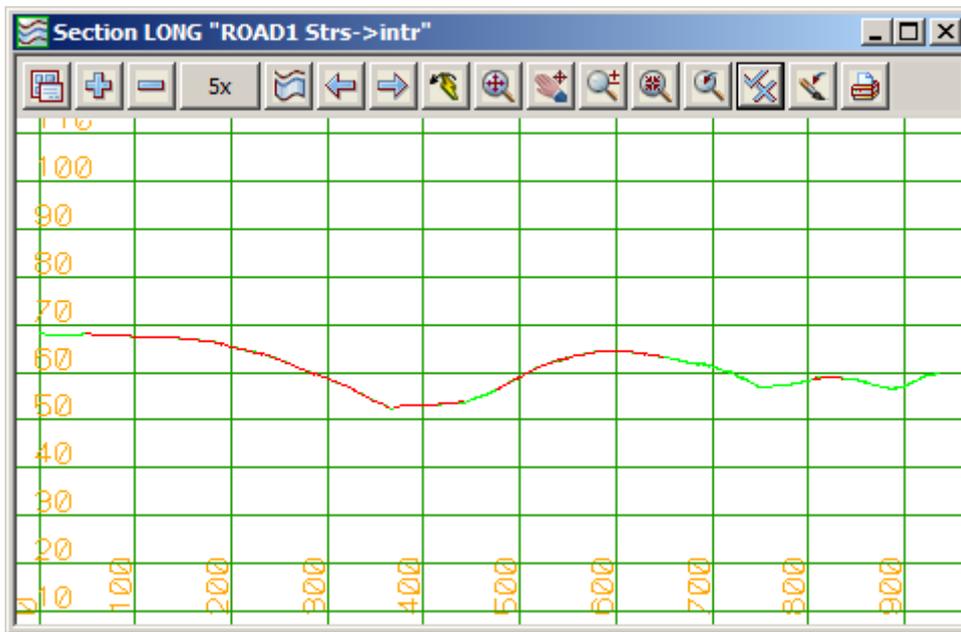
13   Design Cross Sections

12d has many facilities for displaying and plotting design cross sections. We will look at one of these called Model profiles. This name is derived from the fact that when we passed the template down our road, we created and stored our cross sections in a model. Model profile allows us to display this data by profiling the cross sections one at a time.

We now need a Section view in which to display the cross sections. As we still need our existing 'Section LONG' view for our long sections, we will create another Section view.

From the Main menu, click LB on **Views=>Create=>Section view**. When the 'New Section View' panel appears, place the cursor in the View name field, press the Delete key and type 'CROSS'. Click LB on **Create** to create a view which will now be referred to as 'Section CROSS'.

As before, you need to drag the border to resize the view. Stretch the Section view out so that it is approximately the same size as the 'Section LONG' view we created earlier. Click and hold LB over the name 'Section CROSS' and drag the view to the bottom right of your desktop as shown below. Pin it by releasing the LB. The View will initially be blank as no models are turned on.

Make sure that Point and Line snaps are set ON. Your overall desktop layout should now look something like this.
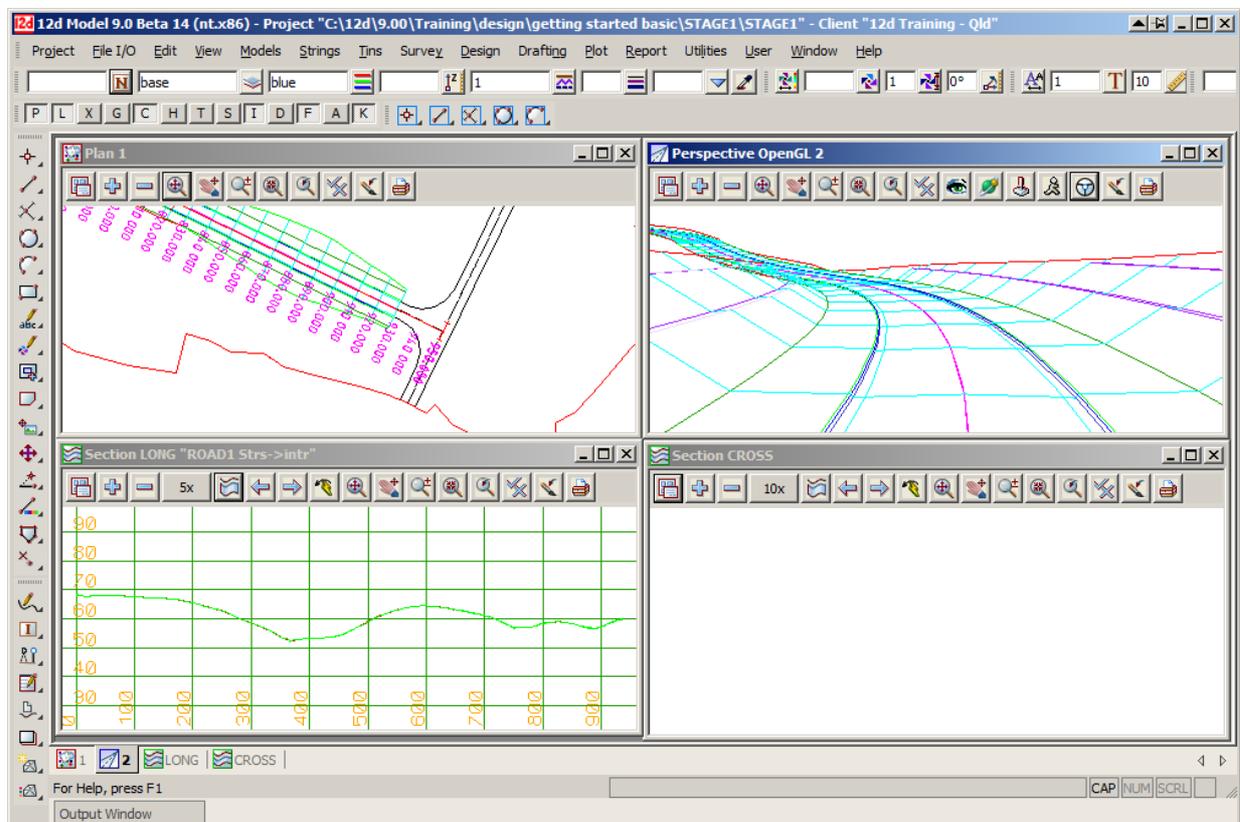
13.1   Model Profiles

In the 'Section CROSS' View Button Area, click LB on the Menu button to put up the View menu. Click LB on **Profile=>Model strings**. The Profile Model panel will display.

If necessary, move the panel away from your 'Section CROSS' view so that it does not obstruct the view.
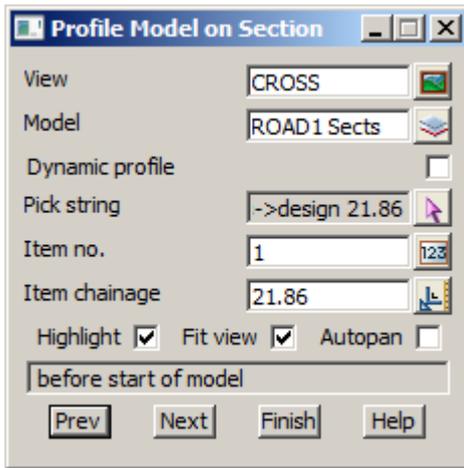
Place the cursor on the *model* icon for the Model field and click LB. A list of available models will pop up. Double click LB on **ROAD1 Sects.**

Now click LB on Next and observe the 'Section CROSS' view. The first design cross section will now be on display and highlighted white (shown red in the example below).

Your 'Section CROSS' view will look as follows
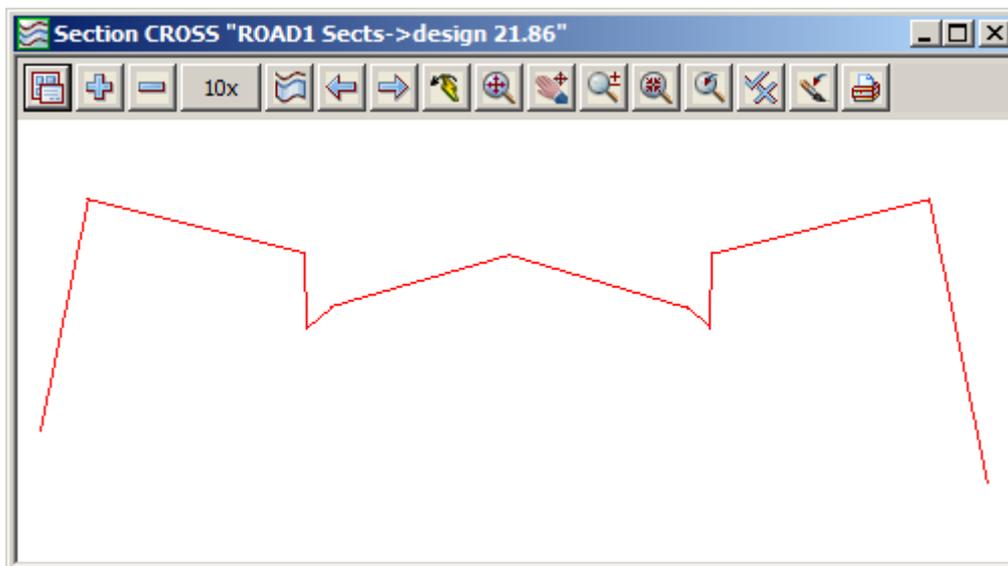
This is the cross section through your road at chainage 21.861 (the first section along our design).

Now each time you click LB on **Next**, the next cross section along the road will be displayed. Try doing this a few times and observe what happens. Observe that the view is refreshed each time so that the cross section fully fills the window.

Try clicking LB on the Highlight tick box to turn highlighting OFF. You will notice that the cross section string displays its normal colour (cyan) rather than the highlighted colour. If you refresh your 'Section CROSS' view, the string will temporarily display red even if highlighting is ON.

The **Item no.** field in the Profile Model panel just gives the item number in the model of the profiled string. It will increment/decrement as the Next and Previous buttons are selected.

The **Item chainage** field in the Profile Model panel displays the current chainage and allows the input of a chainage from typed entry. Type in 100 [Enter] and the section moves to chainage 100. Select [Prev] to return to the section at chainage 21.86

A new feature for Version 9 is the ability to link the section view to the plan view by ticking on **Dynamic profile.**
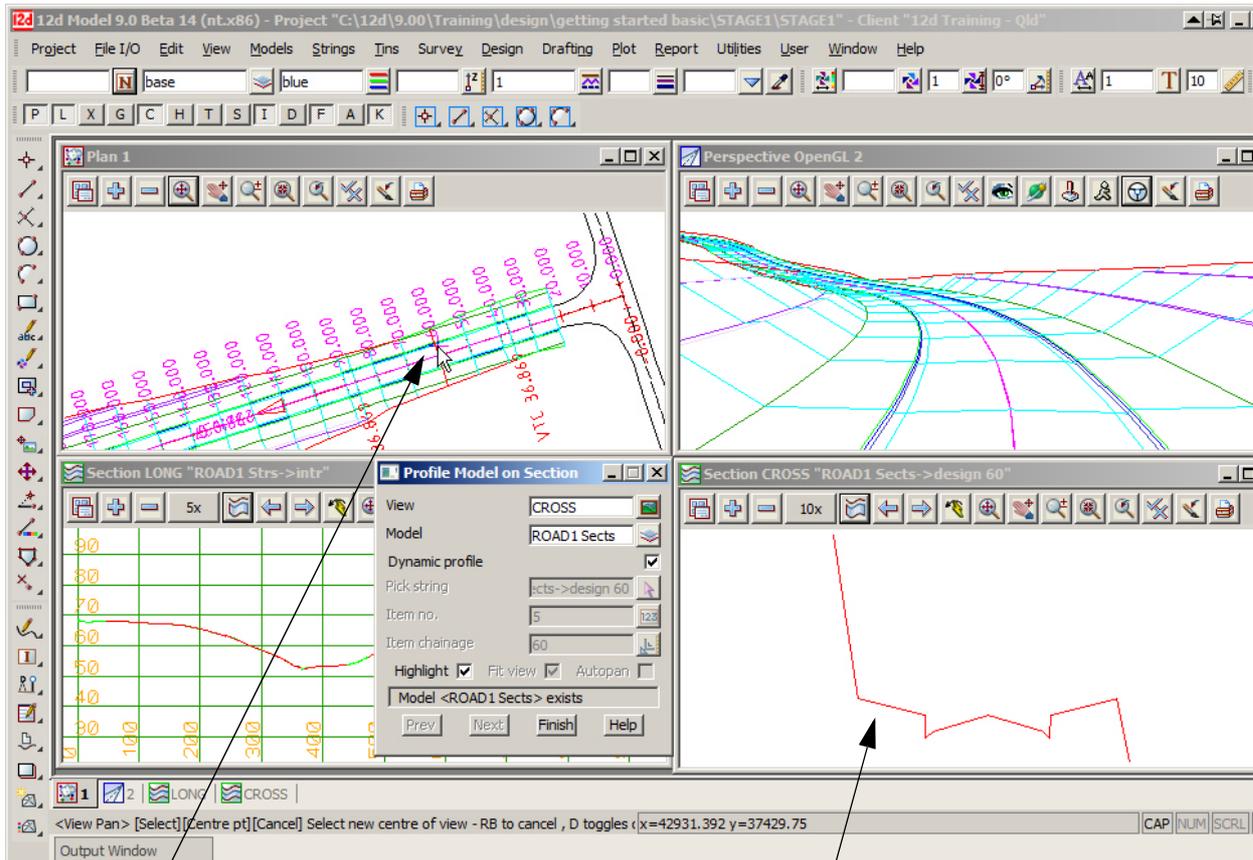
Move your cursor along the alignment string in view Plan 1 and the section will dynamically update

As we asked for cross sections at 10 metre intervals when we generated the road, that is the increment that will be used. There will also be additional cross sections at tangent points etc.

We will now improve the legibility of our view. From the View Button Area of 'Section CROSS', click LB on **Toggle**. Move and pin the menu to one side so that it stays visible.
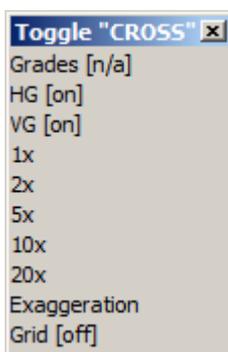
Click LB on **Grid** to turn the grid on. The spacing of the grid will default to 100 in both x and y directions. Set the grid x spacing to 5 and the y spacing to 2 metre. (See the previous (Chapter 12.1) in 'Section Profiles' for how to access and change your grid settings).

Click LB on **2x** to change your vertical exaggeration to 2 to 1.

Click LB on **Grades** to annotate the section.

From the View Button Area of 'Section CROSS', click LB on the **'+'** sign button and turn on model **tin GROUND**. This will display the natural surface (the green string) on the cross section. The cross section string is cyan.

Your view should now look as follows
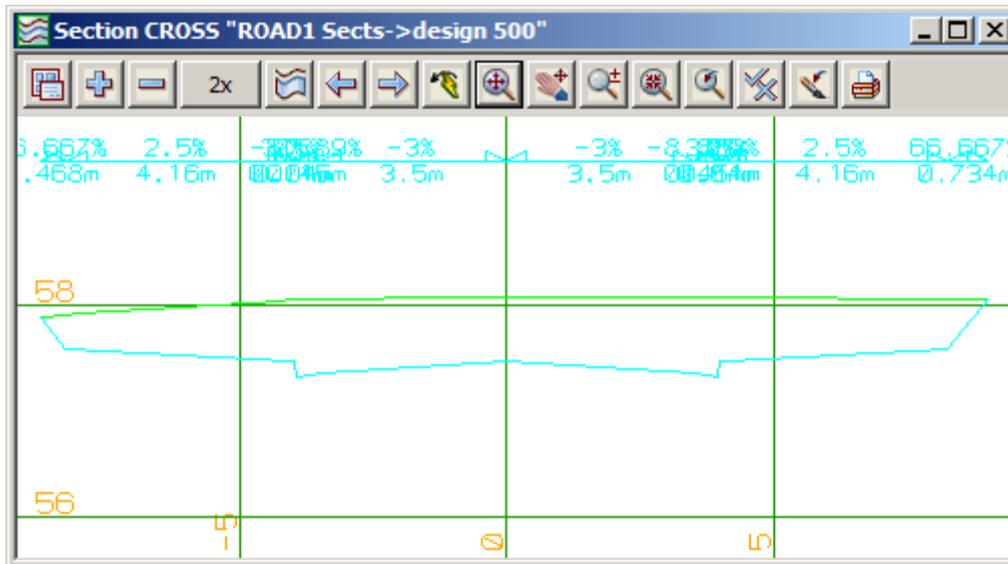
Zoom in on the text area to see it more clearly. When finished click LB on **Fit** to return to the normal scale.

From the 'Profile Model on Section CROSS' panel, try clicking LB on **Next** multiple times and observe your road sections.

If preferred, you can 'untick' the **Fit View** tick box in the Profile Model panel and the scale will remain as set as you go from section to section. This can be useful when you have the grid turned on. If your sections are on a longitudinal slope, the sections may 'walk' off the view as you go from section to section. Normally you will want the **Fit View** tick box turned on so leave it that way when finished.

Note that the various views are still linked. To see this properly, you will need to turn off unnecessary models in your 'Plan 1' view. In the View Button Area of 'Plan 1', click LB on '-' and click LB on **ROAD 1 Strs.**

Put the cursor back in your 'Section CROSS' view and move the cursor backwards and forwards laterally. You will see a red cross in the plan view moving along the section string of the section you are currently viewing in 'Section CROSS'.

Another way of selecting the model of strings and the first string to profile for the *Profile Model on Section* panel is to actually pick the string. This is what the **Pick** button is for on the panel. To try it, in the Profile Model panel click LB on **Pick**. Then move the cursor to the Perspective OpenGL 2 view and click LB on any one of the cyan cross section strings. Click MB to accept the string chosen. The 'Section CROSS' view will refresh with the chosen cross section and the model containing the selected string is written to the **Model** field on the panel.

You can combine **Prev** and **Next** commands with **Pick**s to move around your sections.

Click LB on **Finish** to terminate the Profile Model panel.

13.2   Quick Model Profile for the Section View

There is also a quick method for profiling model strings.

If a string is profiled using the standard **Profile** button in the View Button Area, the model containing the profiled string is automatically recorded.

Clicking LB on the **Previous String** and the **Next String** buttons in the View Button Area of the section view then profiles the previous/next string in the model in the same away as the *Prev* and *Next* buttons on the *Profile Model on Section* panel. The profile sections are automatically fitted to the section view but are not highlighted.

Profile string   Previous string   Next string
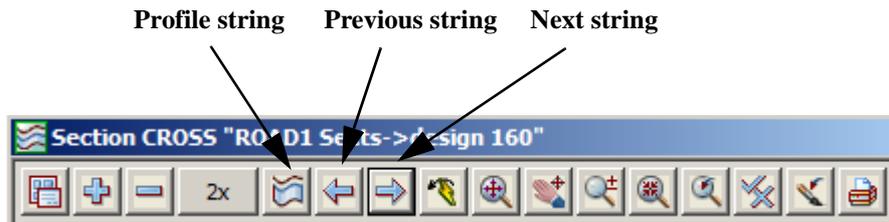
13.3   Extend the Profile in the Section View

It is possible to see more of your natural surface than is currently on display. To see how this works we will extend our view 5 metres on the left and 5 metres on the right.

In the 'Section CROSS' View Button Area, click LB on the Menu button to bring up the View menu. Click LB on **Settings=>Extend**. The Section Profile Extend panel will pop up.
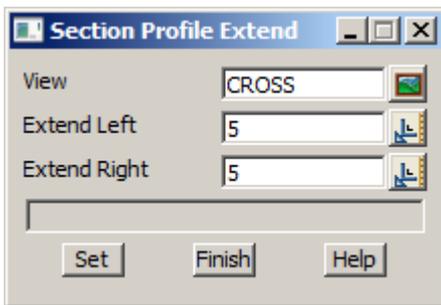
Place the cursor in the Extend Left field and type 5 and press the <Enter> key. Then type 5 for the right extension.

Click LB on **Set** to activate the settings. Click LB on **Finish** to terminate the panel.

To see the new settings in action click LB on **Fit** in the View Button Area. As shown below, the view now extends beyond the extremes of the road profile. This can be useful in checking how the new design encroaches on other existing constraints. Remember that it is possible to turn on <u>any</u> other models in this view and 12d will show where the strings in these models cross this particular section. We will investigate this further in the next Chapter.
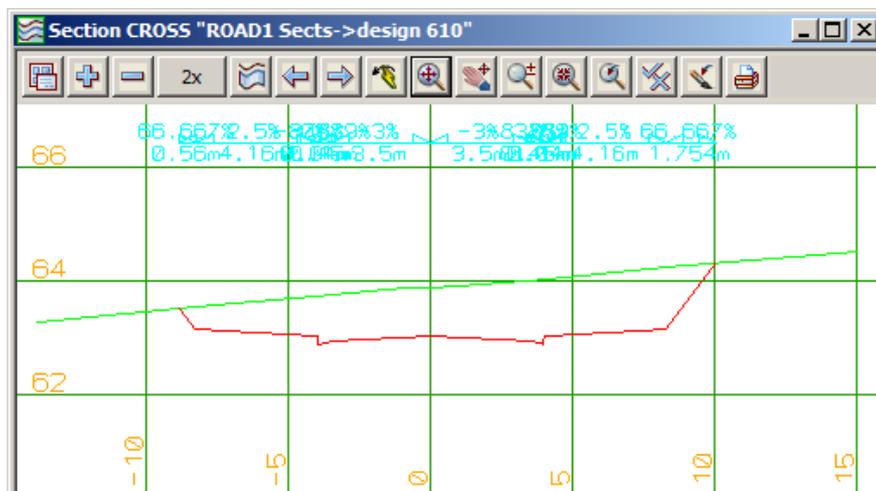
14   Services Interference

12d provides facilities that permit you to check for interference between existing constraints such as underground services and your new road design. Any underground pipes or cabling for instance can be included as strings in your overall terrain model. It is then possible to check the clearances in any of the 12d views.

14.1   Addition of Services to the Terrain

Most of the breaklines and points that we imported at the start of our design were on the natural surface, however there was also some underground features, namely two strings that represent a 250 mm water pipe and a 225mm diameter underground sewer.

These strings are mapped as super strings with an associated diameter when we import them into 12d, however they could be converted to pipe strings inside 12d.
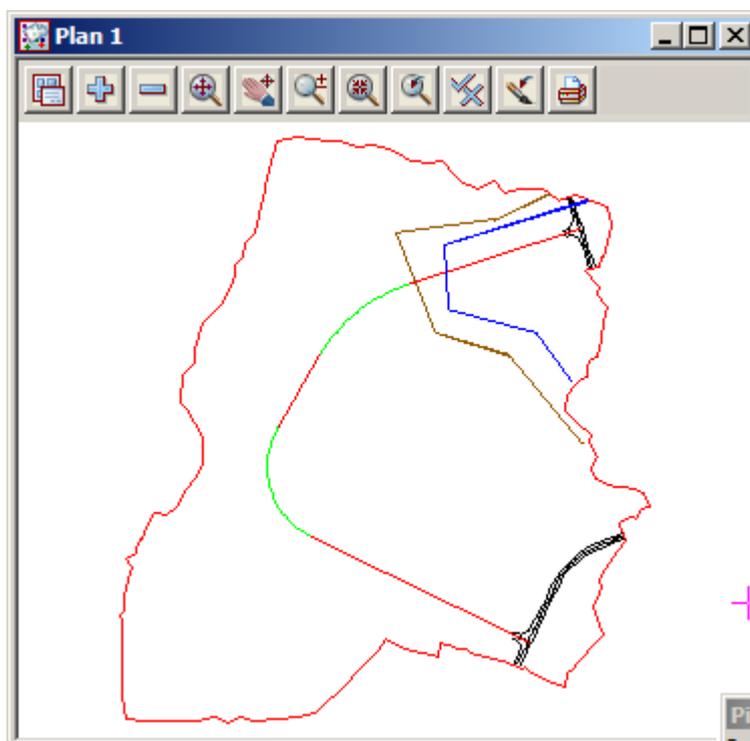
In view Plan 1, turn on the models 'ALIGNMENT', 'survey SEWER PIPE' and 'survey WATER PIPE'. Turn off the road strings and sections model 'ROAD 1 Sects' and 'ROAD 1 Strs'.

The blue line is the 250 mm water pipe and the brown line is the 225mm sewer.

To check the diameter of each string go to **Strings =>Inquire** and select one of the pipe string segments. The information panel pops up, but it gives us no information about the diameter. To see the diameter information, click the RB anywhere on the screen. Walk right on the **Segment** menu and the diameter of the string is shown.

You can click on this or any of the other options to make changes to the string properties.
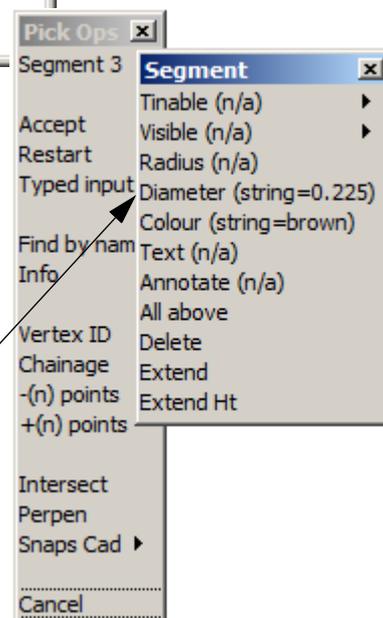
14.2   Profiling the Services

It is possible to get a quick picture of the services just imported by profiling them as we saw earlier.

From the View Button Area in 'Section LONG' click LB on **Profile**. Put the cursor over the blue pipe string in the 'Plan 1' view and click LB. Then click MB to accept the highlighted string. Your 'Section LONG' view will appear as follows.
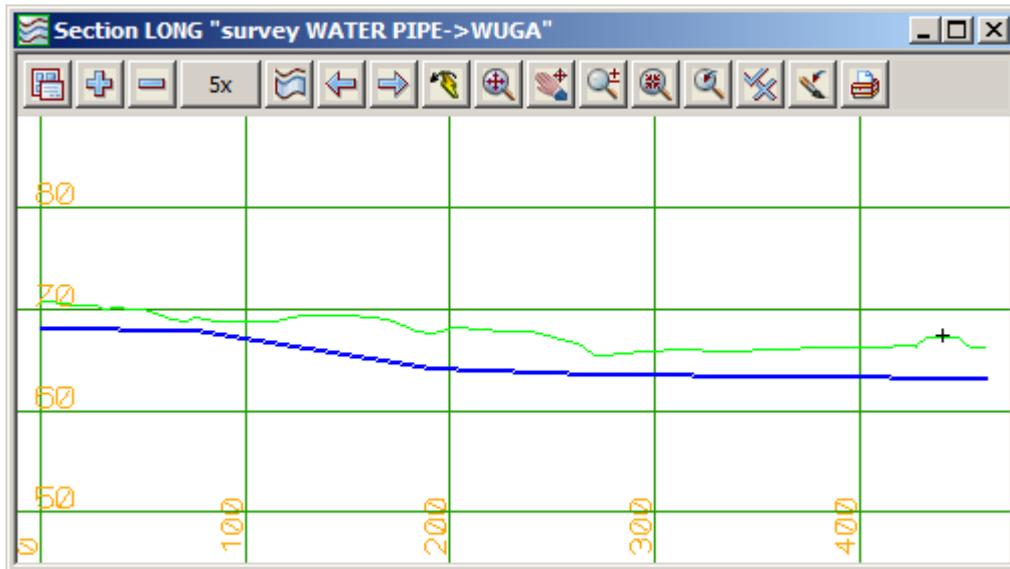
This is a longitudinal section through the pipe showing the depth below natural surface. If we turn on the design strings, ROAD 1 Strs, in the section view, we can instantly see that we have a problem.
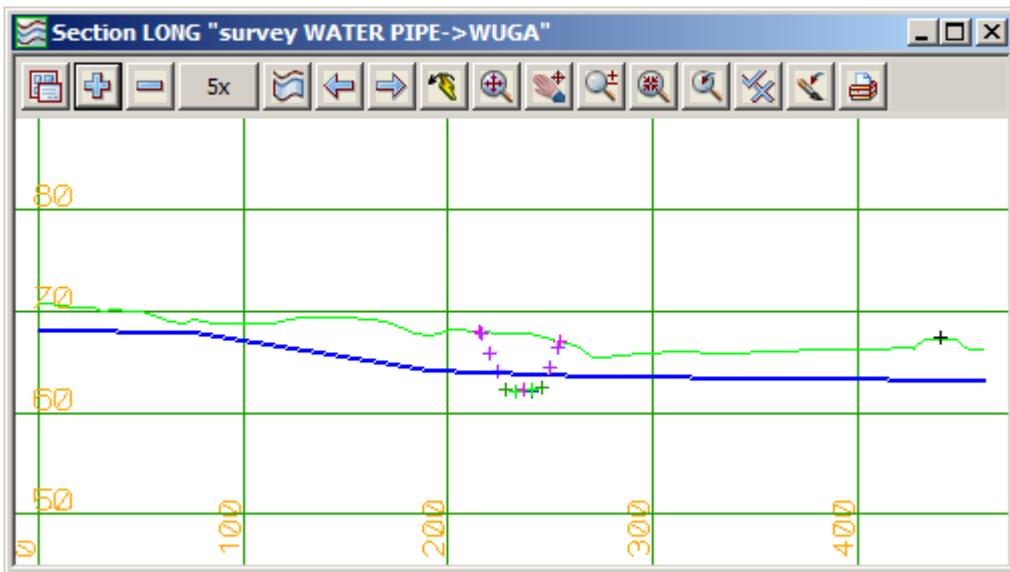
The points on the screen represent the design strings at right angles to the profiled water pipe and hence we can see that the water pipe is above the road design.

14.3   View Services in Cross Section

We will now look at our underground services in cross section in the 'Section CROSS' view.

First we need to modify our 'Plan 1' view to make it more usable. Click LB on the **'+'** sign button in 'Plan 1' and turn on **ROAD 1 Sects**. Then Zoom in on 'Plan 1' view so that we can pick cross section strings in the vicinity of where the underground services cross our new road. **Zoom** in on the area shown. You will notice that the pipe strings now appear as two parallel lines i.e. they have a diameter in Plan.
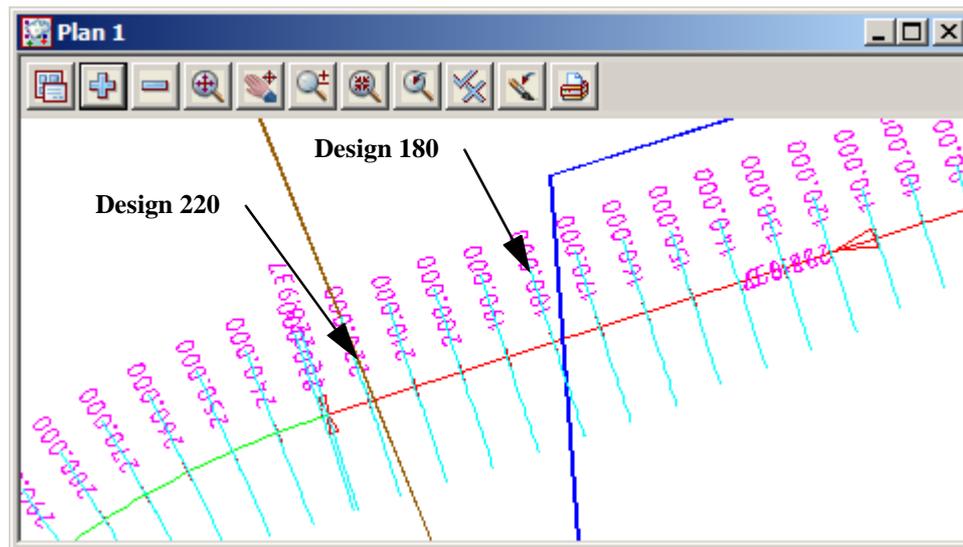
Now we need to set up 'Section CROSS' to display the appropriate cross section.

In the View Button Area of 'Section CROSS', click LB on **Profile** and point to the cross section string in the 'Plan 1' view that is <u>closest to where the cyan string crosses the road centreline</u>. This is section **design 180.** Look for the name 'design 180' in the pop up Information panel (shown at right). Click MB to accept the highlighted string. The 'Section CROSS' view will be refreshed with the new profiled cross section.

Now turn on the models **survey SEWER PIPE** and **survey WATER PIPE** You should now see a small cyan dot on the view at level 64. This is where the 100 mm water pipe crosses the section.
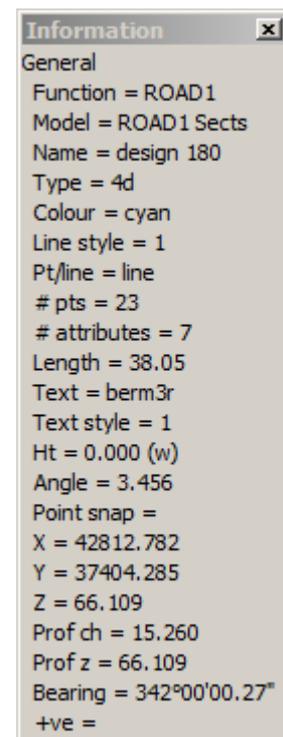
Your 'Section CROSS' view should now look as follows:
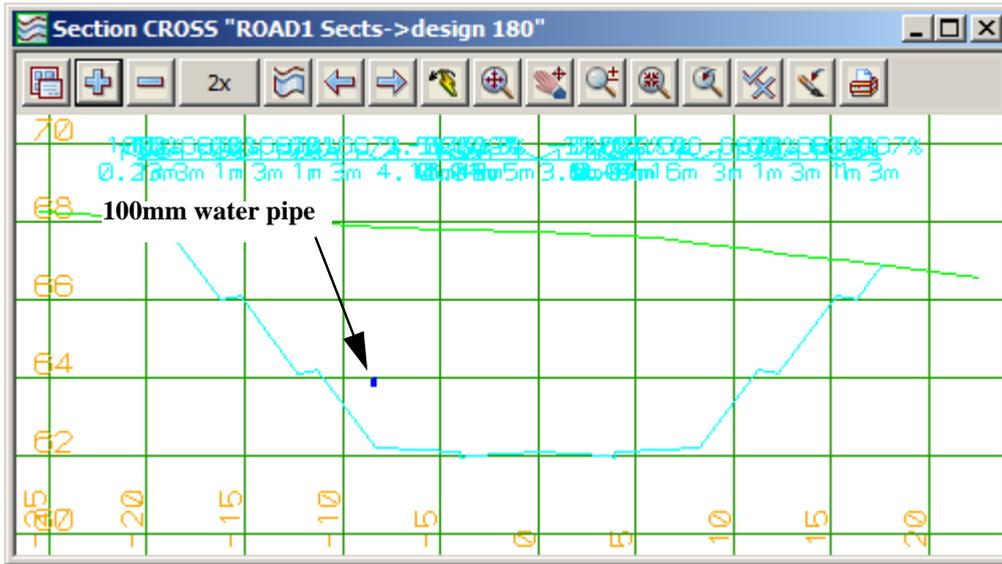
Zooming in closer the pipe is shown
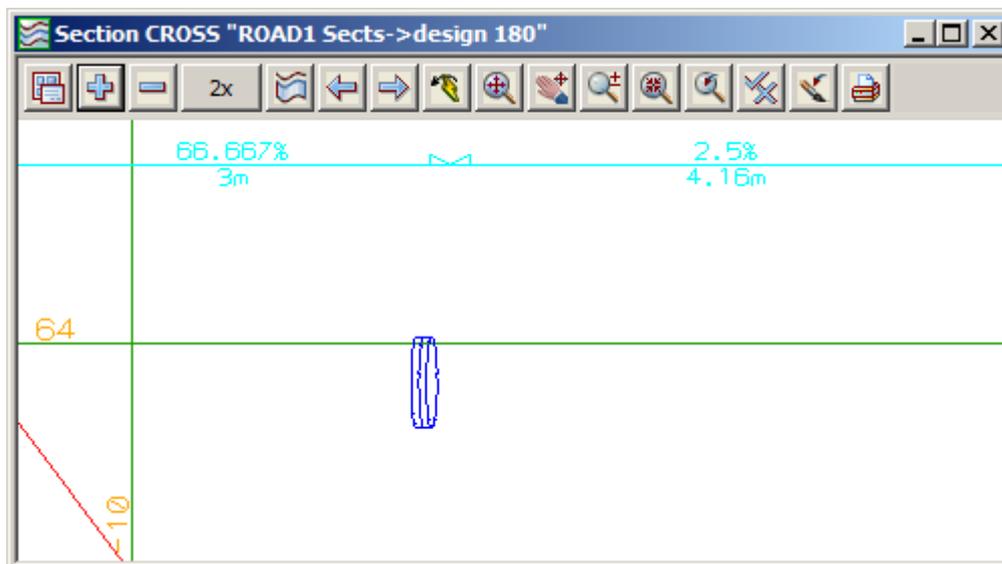
14.4 Viewing Interference with Services in Long Section

We can also check for interference in the long section. The invert of kerb string is the lowest point in the fixed portion of our road cross section. We will now profile this string and look where the services appear in our long section to check for interference. Turn on the model 'ROAD 1 Strs' in plan view 1.

From the View Button Area in 'Section LONG' click LB on **Profile**. Put the cursor over the dark blue 'iokr' string in the 'Plan 1' view and click LB. Unless you zoom right in, you may need to press the LB several times to cycle through the selections until you get the 'iokr' string. Remember to keep looking in the info panel to ensure you have the correct string, then click MB to accept the highlighted string.

In the same section view, click LB on the '+' sign button and add the models **survey SEWER PIPE** and **survey WATER PIPE** to your view. You should see some orange and cyan dots added to the section view as it refreshes.

Your overall screen should now look something like
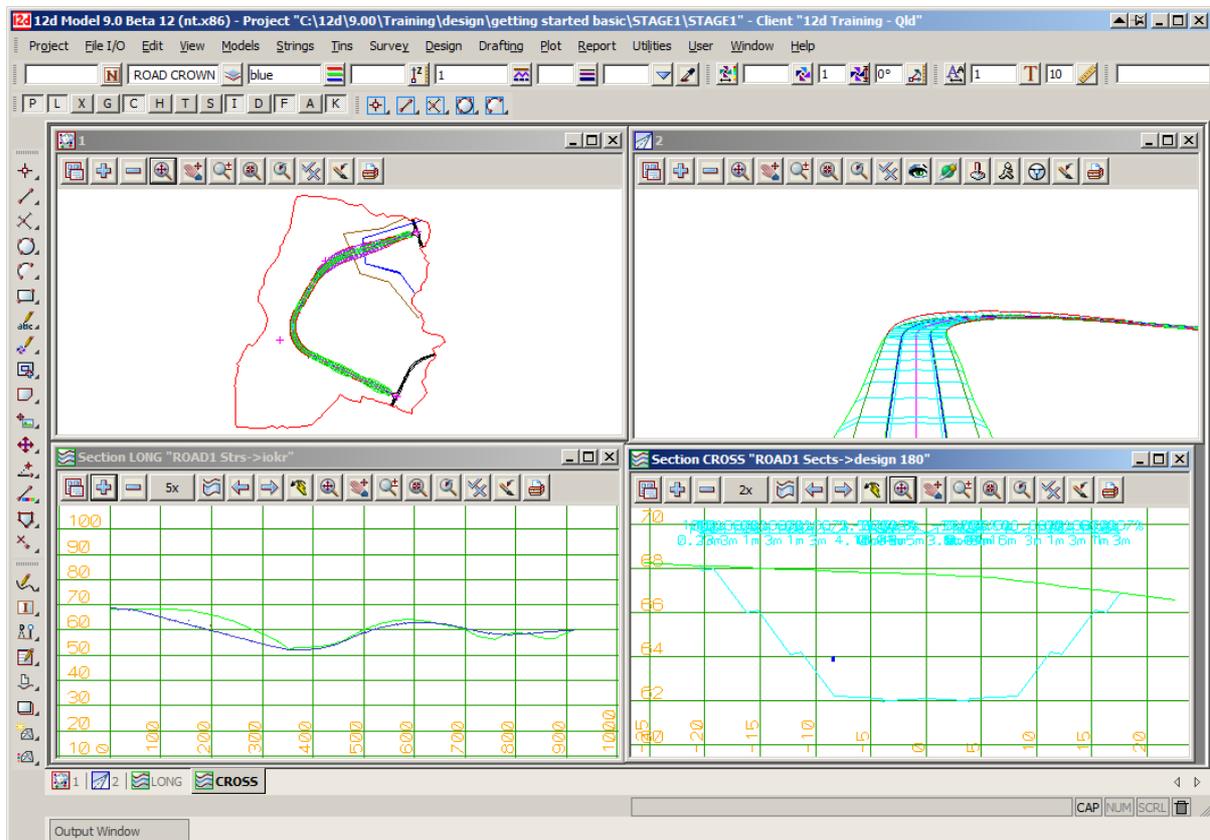
To see how the services appear in long section, zoom in on that area as shown below.
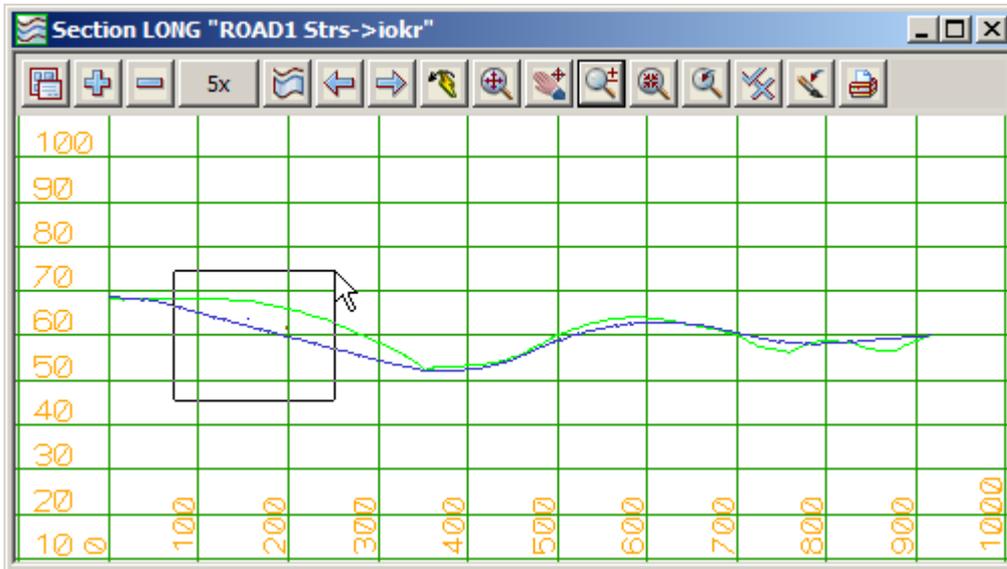
First note that the 'pipes' appear in the section views. The reason that they appear as ovals and not circles is that we have a vertical exaggeration of 5 to 1 set on the view.
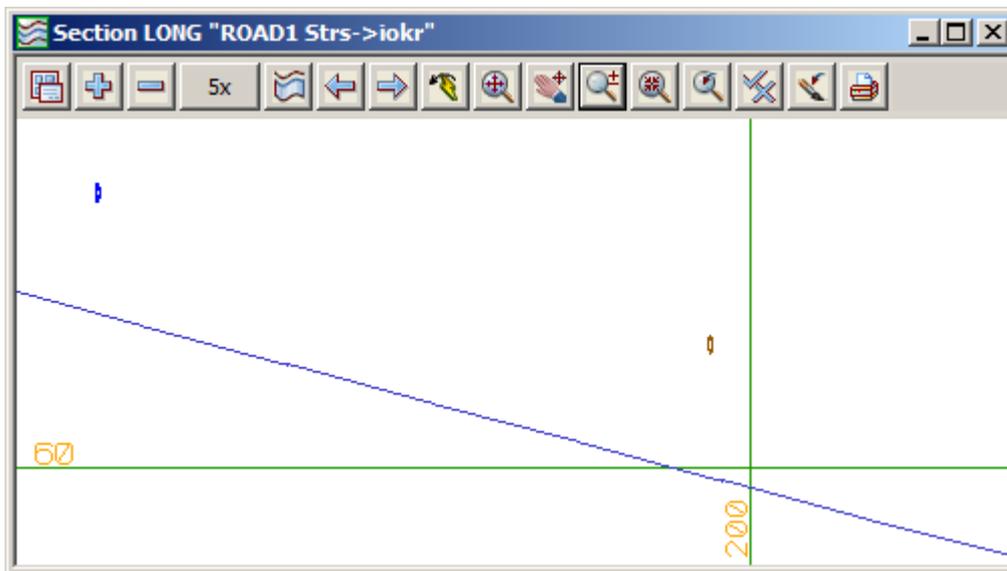
14.5   Setting Corridors

Rather than seeing just a 'thin slice' where the pipe crosses the section, 12d has the concept of setting a corridor width along a profiled string. Then whenever you profile a string in a section view, everything that appears within the corridor width will be included in the view. We will set a corridor width of 20 metres either side of the string being profiled to see this more clearly.

In the 'Section LONG' View Button Area, click LB on the Menu button to pop up the View menu. Click LB on **Settings=>Corridor** and the Section Corridor panel will pop up.

Double click the LB in the Width Left field and type 20. Press the Tab key to go down a field and type 20 for the Width Right. This has now defined a corridor 40 metres wide.
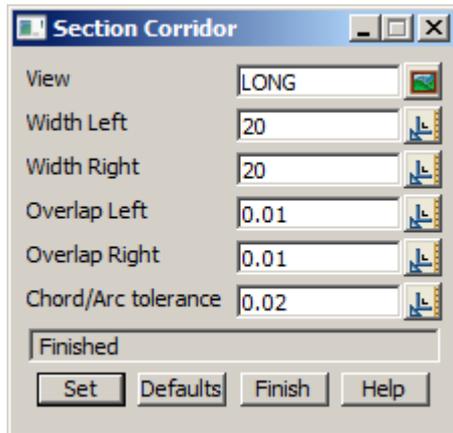
Click LB on **Set** and the view will be updated. Click LB on **Finish** to terminate the panel.

The 'Section LONG' view should now look as follows.
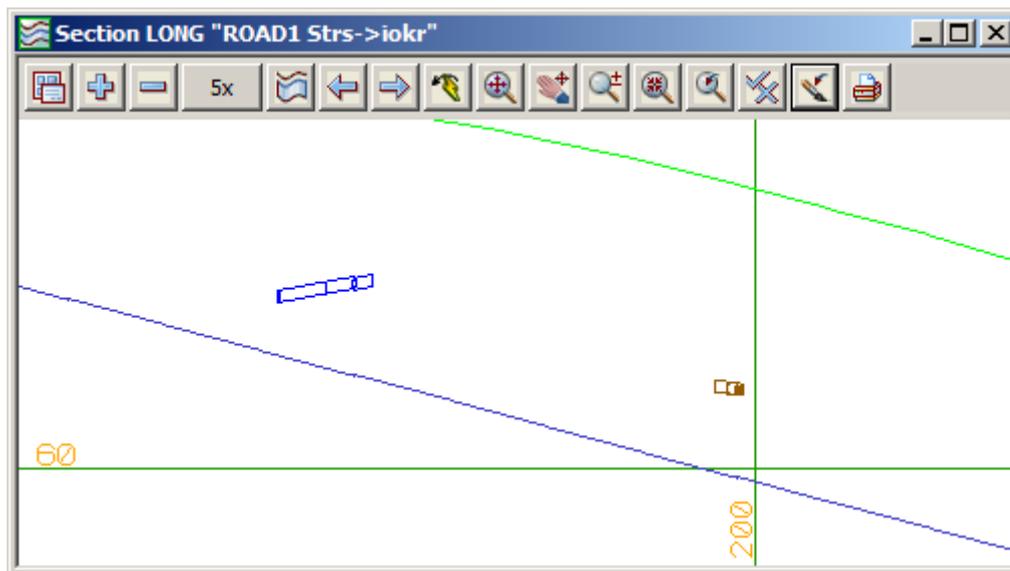
Whilst it may not appear obvious, the blue string now appears in the view as a tube. This is because much of the pipe appears in the 40 metre corridor is shown in the view. Sections are shown on the pipe corresponding to where the various cross section batter strings project onto the pipe. Try **Zooming** in on the pipe for a closer view. Click **Fit** when finished Zooming.

Remember that once a corridor for a view is set, it continues to remain set until changed, regardless of which strings are subsequently profiled.

15   Modification of Design Parameters

We will now perform a typical redesign operation and see how efficiently 12d handles such tasks. We will modify the vertical geometry of our road centreline to pass over rather than through our services. To do this we first need to rearrange the information on display in our views.

Minimise all views except 'Plan 1' and 'Section LONG' then tile them vertically. In the 'Plan 1' view, ensure that the **ROAD 1 Sects and Strs** are turned on. In 'Section LONG' reset the corridor to the default values

Ensure that the alignment string is profiled and that the **survey SEWER PIPE** and **survey WATER PIPE** models are **turned on.**

Your overall screen layout should now look something like this
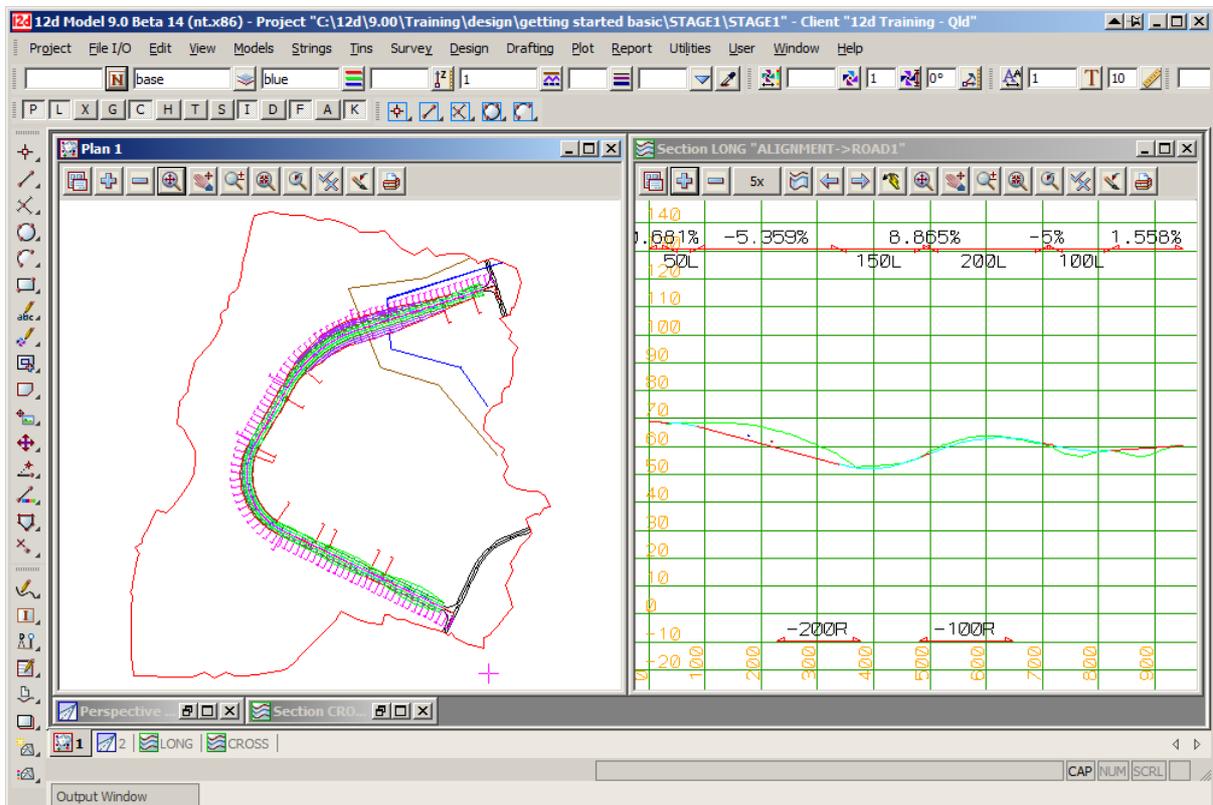
If the Edit SA menu is not on display you need to reactivate it. Remember at any one time this menu is only active with one alignment. The alignment we are editing here is called **ROAD1**. If the Edit SA menu is already on display you can skip this next step. To get the Edit SA menu on display and active with our road centreline, move to the Main menu, click LB on **Strings=>Editor** or press function key 6 (F6).

The Edit String panel will then pop up asking you to select the string to be edited. In the 'Plan 1' view, click LB on the magenta string corresponding to our road centreline. The string will highlight and the Information panel will pop up. Click MB to accept the highlighted string and the Edit SA menu will pop up. Move the Edit SA menu to the lower left area by clicking and holding LB over the words **Edit SA**, moving the cursor and pinning it down by releasing the LB.

15.1   Modify Vertical Geometry

We are now ready to begin modifying the road geometry. We will raise the level of the road in the vicinity of the pipes by inserting a new VIP into the alignment.
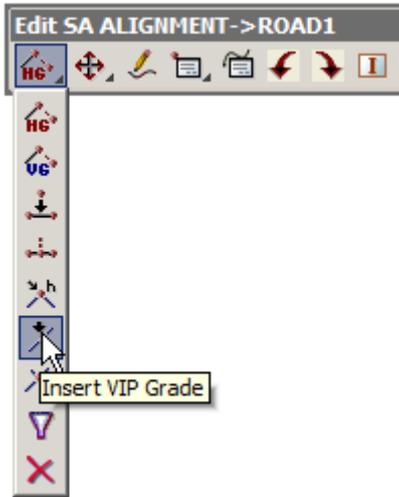
From the Edit SA menu click LB on **Add/ Remove IPs =>Insert VIP Grade**.
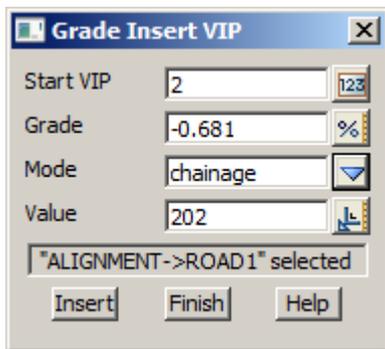
Fill in the panel as shown

We will insert a new VIP on the same grade as VIP1 to VIP 2 and at a chainage of 202.

Click on **Insert** then **Finish** once you have filled in the panel.

The 'Section LONG' view should now look as follows
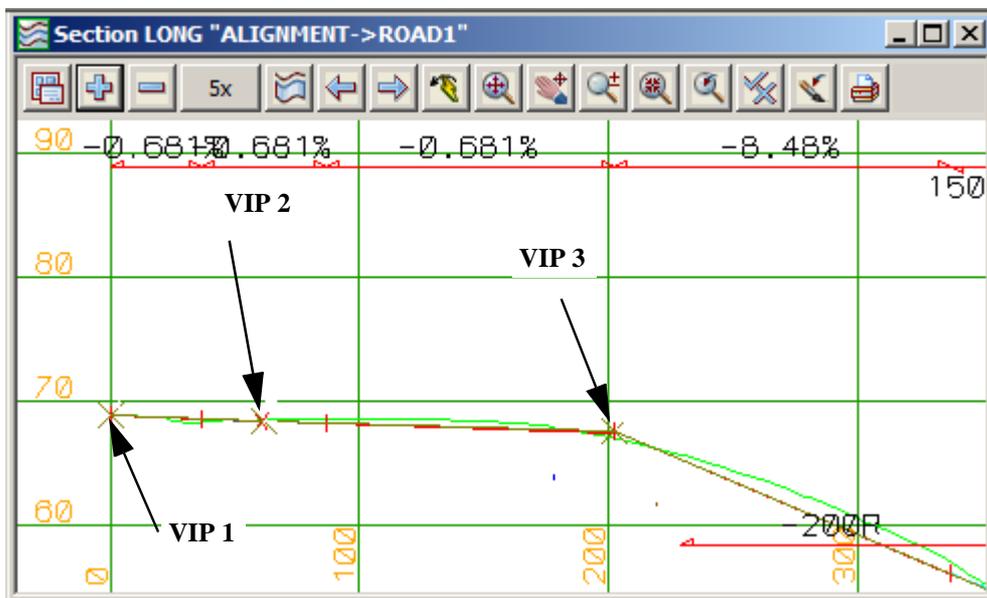
We will now insert a curve at this new VIP 3.
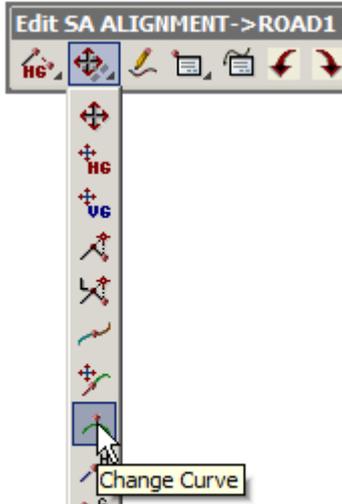
From the Edit SA menu press LB on the **Move/Edit** icon then select **Change Curve**.

Point to VIP 3 and click LB and confirm it with MB. A panel will pop up prompting 'New length'. Type in the value shown.
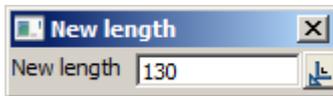
Press the Enter key to terminate data entry. A vertical curve will appear in the view. Click LB on **Fit** to ensure that all information in the view is updated.
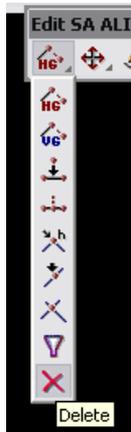
As VIP 2 is on grade between VIP 1 and VIP 3 it is not needed and hence we can delete it from the section view. Press LB on the **Add/ Remove IPs** icon and select **Delete** from the toolbar, and then select VIP 2.

The 'Section LONG' view should now look as follows
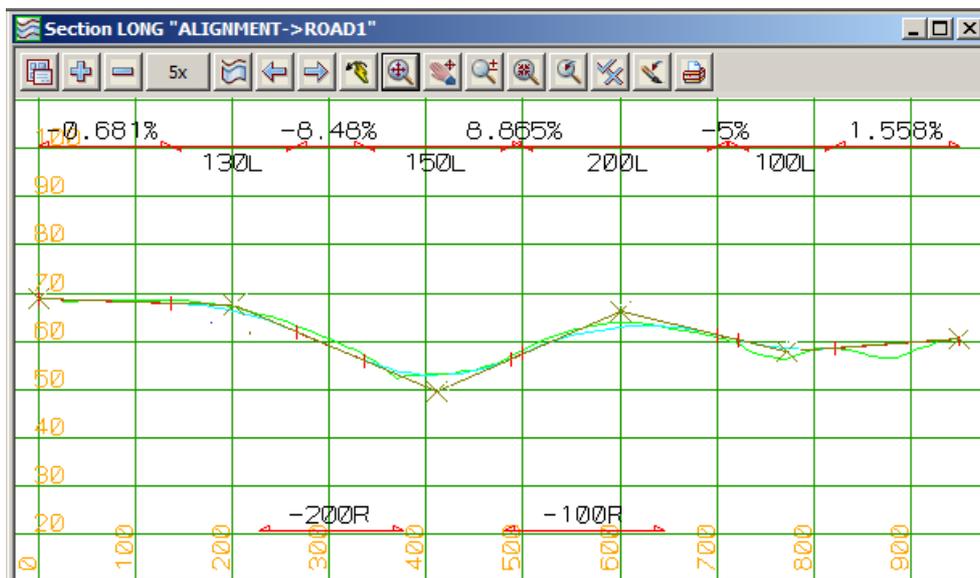
15.2 Recalc after Modifying Vertical Geometry

We will investigate one of the most powerful features of 12d. You will remember that earlier we defined a template to be passed down our road centreline. When we filled in the template panel we gave the template function a name - we called it 'ROAD1'. The purpose of that name will now be shown.

We can now refer to the template function by name and get it to reprocess the series of steps it needed to calculate the road geometry from a single menu click!

From the main menu, click LB on **Utilities=>Recalc=>Recalc=>ROAD1.** You can also walk right on **Recalc** in the *Recalc* Panel and select the function 'ROAD1'.

You will notice that 12d goes into a heavy compute operation. After a few seconds, the various plan and perspective views are all updated and now display the redesigned road. At the end of the calculation, the Apply Template panel will pop up
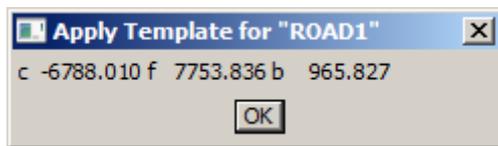
12d advises you of the new cut and fill volumes associated with this recalculation.

Click LB on **OK** to remove the panel.

If we now repeated any of the operations we did earlier such as the 'string drive' down the road or the profiling of sections, we would be looking at the revised data. It is strongly suggested you try this in your own time to convince yourself that all of the data have in fact changed!

During a recalc, you will notice that the view 'Section CROSS' has gone blank. This is intentional as the data that was displayed became obsolete. If you want to see the new data, simply repeat the steps we did earlier to profile any of the cross section strings. Note that the views only go blank when you place the cursor in the view. This is a reminder that the data on display was obsolete and can no longer be displayed (depending upon the changes you made prior to the recalc, the strings being profiled may no longer exist!).

It is worth noting that if we had used multiple templates and restricted each template application by chainage to only part of the road, we may have needed multiple template functions to achieve our full road design. This is more typical of what happens in a real world situation. In such case, it is possible to process all template application functions in sequence with a single menu click.

You would do this from the Main menu by clicking LB on **Utilities=>Recalc=>Recalc all** or click on **Recalc all** in the *Recalc* Panel.

Important: Each time you perform a recalc, all of the string data that is calculated by 12d is automatically deleted and replaced by new data. This is unlike most other processes in 12d where if you repeat an operation such as importing a string or creating a string manually, you end up with multiple copies of coincident strings.

We saw above how we can modify vertical geometry and get 12d to automatically recalculate our revised road design. We can also change the horizontal geometry and get 12d to update our section view. We will now perform a series of more complex changes that are typical of the redesign steps required in a real world situation

15.3   Modifying a Vertical curve by Moving the Tangent Points

We will now look at how we can pick up points with the cursor and use the mouse to visually place curves. First **Zoom** in on the area shown in the example below.
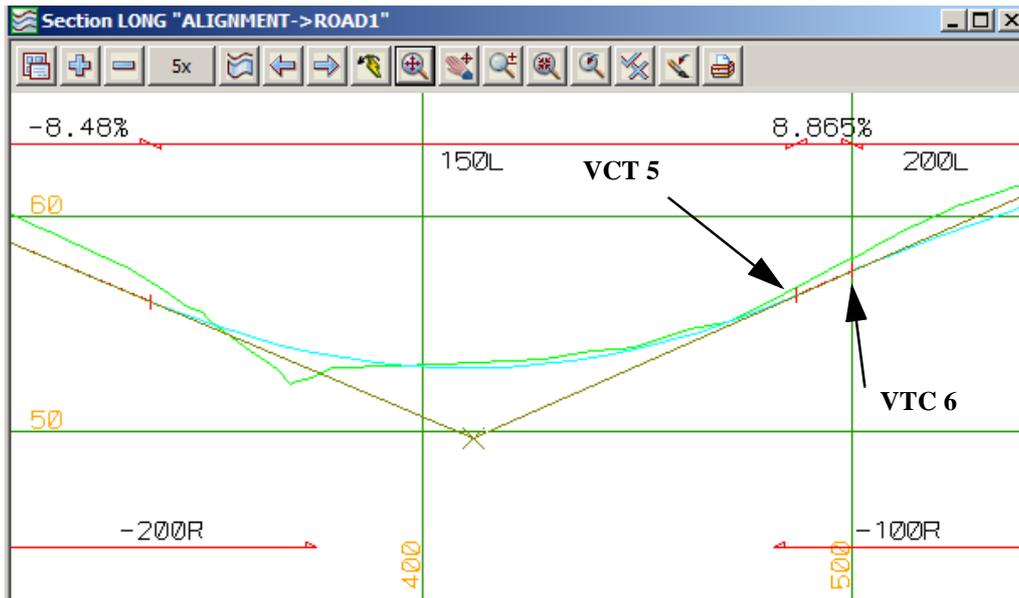
VCT 5
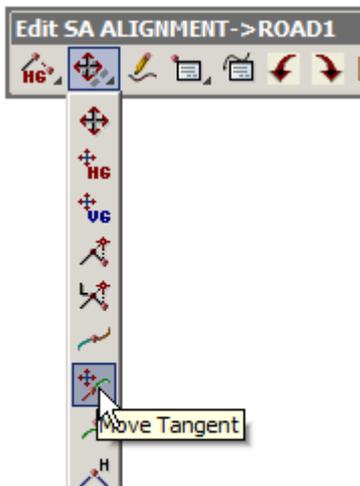
From the Edit SA menu click LB on **Move/Edit =>Move Tangent.** Place the cursor on point VCT 5 (Vertical Curve to Tangent point) as shown above and click LB. Click MB to confirm the selection. Then move the cursor to the left and right and observe what happens. Through excessive movement of the cursor it is possible to create a vertical curve that interferes with its adjoining vertical curve. Whilst 12d will permit you to make such a change, the template function will not proceed when you attempt to create the road. To ensure that the template function can work, it is essential that your vertical geometry is meaningful.

Move the cursor to the right slightly to minimise the length of tangent between adjoining curves i.e. minimise the distance from VCT 5 to VTC 6 (Vertical Tangent to Curve point). Pin the tangent point down by clicking LB. Click LB on **Fit** to fill the view.

Alternatively to get the tangent point to exactly match the chainage of VTC 6 use the Tangent Wizard option
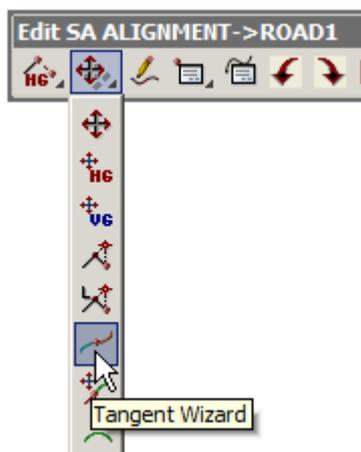
Click LB on **Move/Edit =>Tangent Wizard.**
Click on IP 3

The curve length will change so that the two tangent points are at the same chainage
View 'Section LONG' should now look similar to this

After practising moving TP's with the mouse, you should reset your VC length back to 150 metres. Click LB on **Move/Edit** =>**Change Curve** from the Edit SA menu, click LB on the VIP you just modified and MB to confirm the selection.

Type '150' and press Enter. Click LB on **Fit** to refresh the view.

15.4   Changing template widths and introducing a Table Drain

The following steps are designed to show you how to modify template values and how to introduce new links in a template. We will make a copy of your existing templates and then edit the copies to make the template changes. This way your original templates are left unchanged should you need them again

PERFORMING TEMPLATE CHANGES MANUALLY

From the main menu, click LB on **Design=>Templates=>Copy** and the Template Copy panel will pop up.
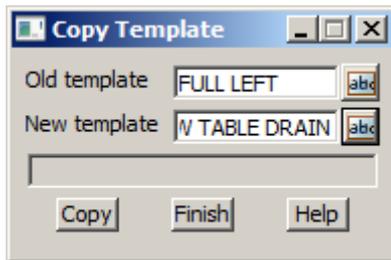
In the Copy Template panel, click on the **Old template** icon and select the **FULL LEFT** template.

In the New template name field type the name '**FULL LEFT W TABLE DRAIN**'. Click LB on **Copy**.

Repeat the process and copy **FULL RIGHT** to '**FULL RIGHT W TABLE DRAIN**'. Click LB on **Finish** to terminate the Copy Template panel.

From the main menu, click LB on **Design=>Templates=>Create/Edit** and the Template panel will pop up.
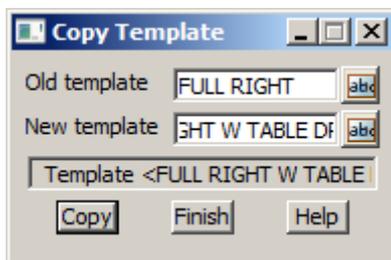
In the template panel that pops up, click on the icon and select the **FULL LEFT W TABLE DRAIN** template.
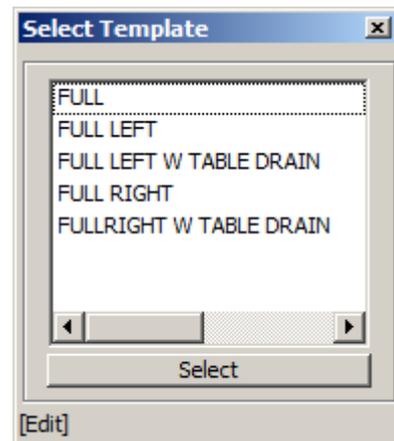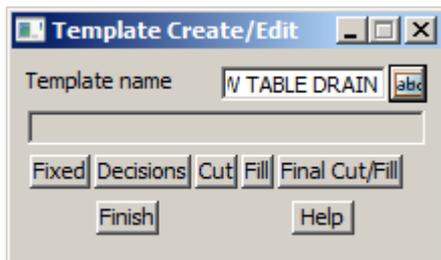
We will confine our changes to the fixed part of the template. Click LB on **Fixed.**

The Fixed Template panel pops up. The panel displays the template links we used earlier in the tutorial.

	Width	Height	XFall %	Name	Colour	
1	3.5		-3	lokl	cyan	
2	0.45	-0.04		iokl	dark blue	
3	0.04	0.15		tokl	blue	
4	0.11		0	bokl	green	
5	3.5		2.5	bofpl	dark green	
6	2	-1		iodl	blue	
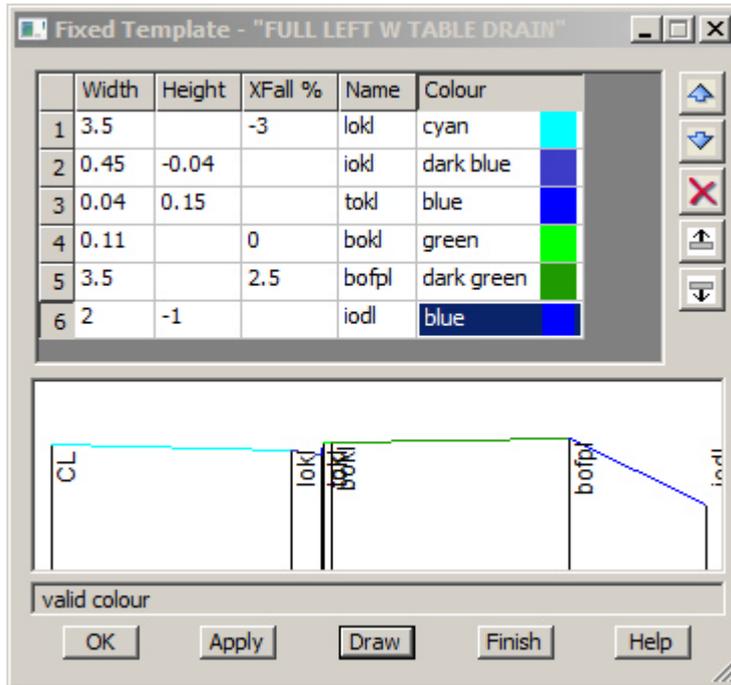
Position the cursor over the 'Width' entry on line 5 and click LB to lock the cursor into the field. decrease the footpath width from 4.16 to **3.5** metres.

Press on the Enter key 5 times so that a new line appears in the template.

Type in the details for the table drain string as shown in the example

Click LB on [Draw] to update the diagram

Select [OK] to exit the panel

Repeat for the fixed part of the FULL RIGHT W TABLE DRAIN template (shown below)

	Width	Height	XFall %	Name	Colour	
1	3.5		-3	lokr	cyan	
2	0.45	-0.04		iokr	dark blue	
3	0.04	0.15		tokr	blue	
4	0.11		0	bokr	green	
5	3.5		2.5	bofpr	dark green	
6	2	-1		iodr	blue	
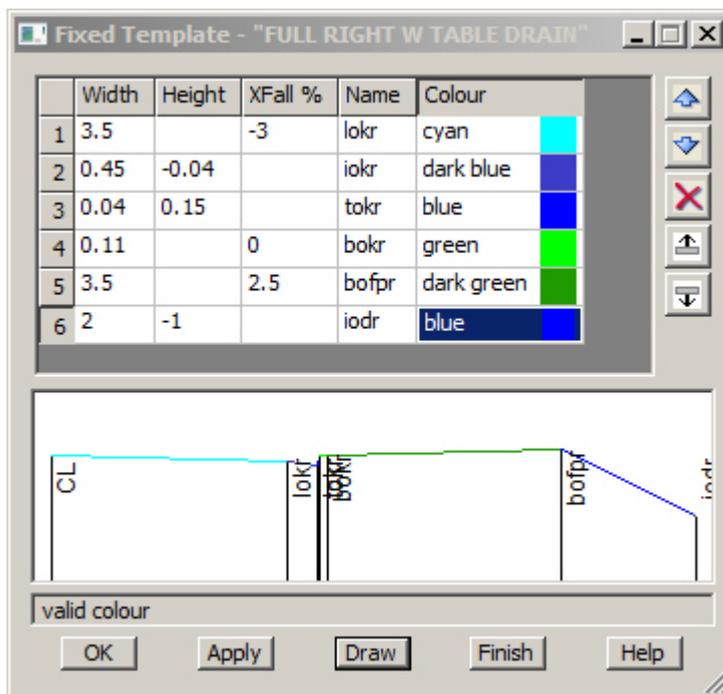
That completes the changes to our templates. Select [OK] to exit the panel

Click on **Finish** to close the *Template Create/Edit* panel.

15.5   Recalc after Modifying the Template and Other Geometry Changes

Clearly we have now made significant design changes to the template and to the vertical geometry of the road centreline. We need to get 12d to update the views to reflect these changes. Regardless of how complex the changes are, all we have to do normally to perform a complete redesign is run the recalc function.

Since we have changed the names of our templates however, we must make minor edits to our apply function to point to the new templates.

Before recalculating the changes, turn on the **ROAD 1 Sects and Strs** models in 'Plan 1' view.

From the main menu, click LB on **Utilities =>Recalc =>Edit func =>ROAD 1**

The Apply Templates panel will pop up with the values in each field already filled in. 12d remembers the values you entered earlier. You can now make any required changes.
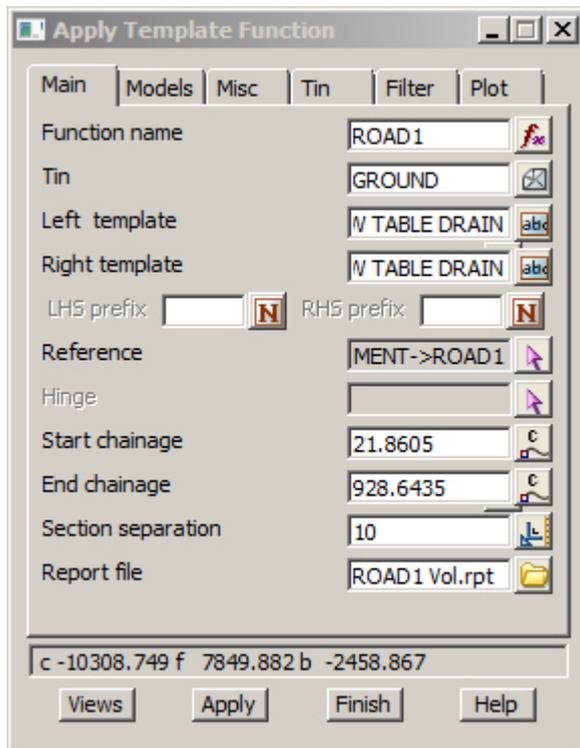
In the 'Left template' field select the **FULL LEFT W TABLE DRAIN** template.

In the 'Right template' select the **FULL RIGHT W TABLE DRAIN** template

When complete, reapply the function with the new templates by clicking LB on **Apply** then **Finish**

This time the cut and fill volumes are smaller and more closely balanced.

Note that in the views Section CROSS and Perspective OpenGL 2 you will now see the open channel v drain running through the areas of cut. In the areas of fill, the drain will blend into the final fill slope.

At the end of the calculation, the revised cut, fill and balance volumes appear in the message line.

Your overall screen layout should now look as follows
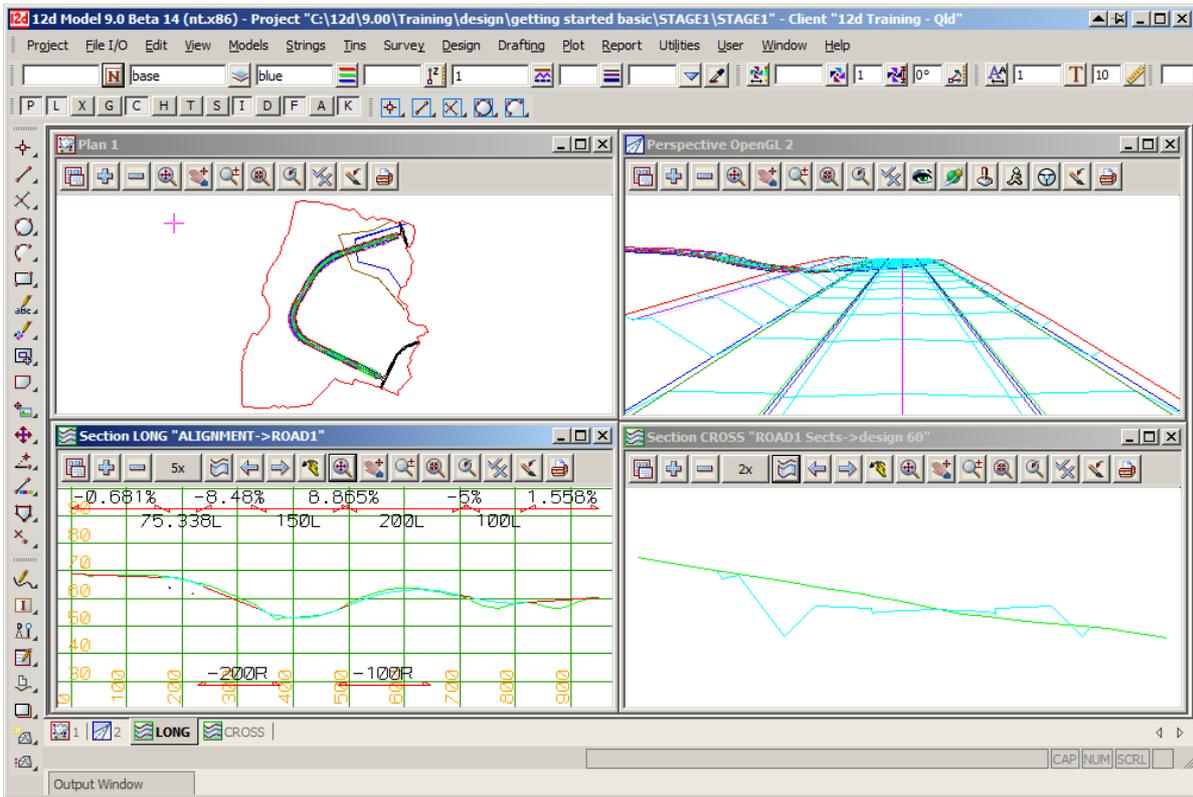
Now profile the invert of kerb string to confirm that the road now lies above the services.

From the View Button Area of 'Section LONG', click LB on **Profile** and LB on the **iokr** string from 'Plan 1' view. You may have to zoom to pick the right string

Clearly the road now lies above the services.

Finally click LB on **Finish** icon in the Edit SA panel. Click LB on 'Yes' to confirm

16   Using 12d on Typical Projects Involving Volume Calcs

16.1   General Cut and Fill Calculations

12d has many features that enable accurate cut and fill calculations to be performed. The easiest way to manipulate data for volume calculations is via surfaces (i.e. TINs). For instance, a simple way to calculate the cut and fill volumes on an earthworks project is to create a TIN of the natural surface and a TIN of the finished design surface and get 12d to calculate the volume between the TINs.

We will now demonstrate how to do this with a practical example - designing a pad footing for a commercial building.

16.2   Pad Footing Design Prerequisites

Note that if you are jumping to this Chapter of the Training manual rather than working through it sequentially, the only prerequisite for this Chapter is that the tin 'GROUND' must already exist. This TIN was created in Chapter 6.3. All other data related to Pad Footing design is created from scratch.

Alternatively, you can import the 12da ascii file **Chapter 16.12da** which contains all the models, strings and tins created to date.

16.3   Pad footing Design using the Interface Function

The Interface function is the simplest form of geometry construction within 12d Model. Generally, it is applicable whenever the batter lines are at a constant slope from top to bottom (no benching) and the constant slope applies in all directions (i.e. a constant batter slope at right angles to the alignment string).

Instead of using a super alignment for our pad footing we will use a super string. The benefits of the super string lies in the creation using bearing and distance input and the ability to translate and rotate the string. The properties for the string will be predefined in the cad control bar

We will generate this string in order A,B,C,…H. The reason we do not start at a corner r is so that we can insert curves at the corner IPs later. Curves can only fit between adjacent tangents.

Also to avoid confusion when snapping to the start and end points, we will leave a small gap of 0.001m between points H and A.

Set up the Cad control bar

Type in the name **FOOTING EDGE**

Type in the model **BUILDING PAD**

Select colour **red**

Set the linestyle to **1**

We will use a traverse option to create the footing string. This option is available from the Cad toolbar

 Clicking LB on **Cad Lines =>Traverse**

The bottom left of the screen prompts for the start position of the traverse line

Type in the start point coordinate **E42570 N36970 then press [Enter]**
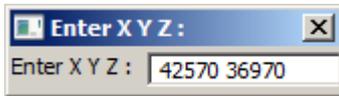
A rubber band line appears from the start point and the new prompt at the bottom left of the screen is for the bearing input

Type in bearing value of **90 then press [Enter]**
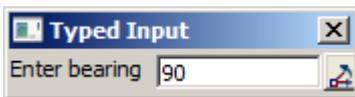
The bottom left of the screen prompts for the distance

Type in distance value of **40 then press [Enter]**
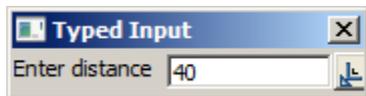
The bearing of the second line is at right angle to the first line so we can use a shortcut to add or subtract 90° to the previous value

Press [Space] to retrieve the previous bearing
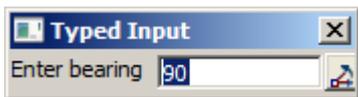
Press [Pg Up] key to add 90°
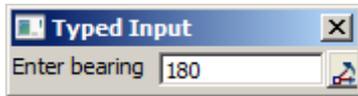
Press [Enter]

Type in the distance for the second line **15** [Enter]
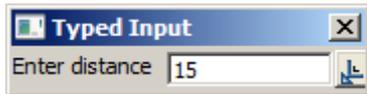
For the third line the bearing is to again increased by 90°
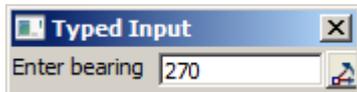
then proceed with the other dimensions as shown below
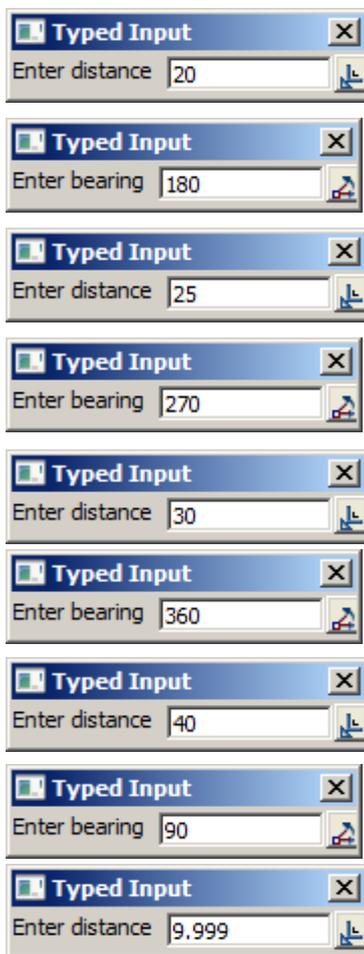
After the last line is entered, press <Esc> to terminate the creation process (or click RB to pop up the 'Pick Ops' menu and click LB on **Cancel**).

To see the string you just created zoom in on the pad footing area as shown below.
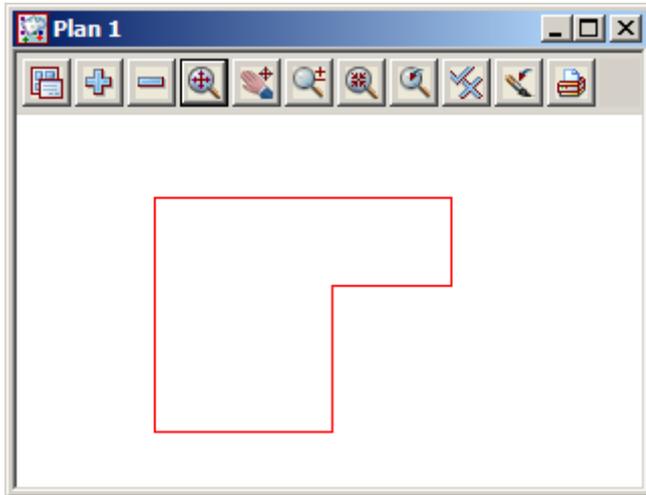
We will now insert small radii fillets at each corner of the super string to ensure smooth curves between tangents. This will ensure that the finished earthworks have a satisfactory appearance.

From the Cad toolbar select option **Cad String =>String Join Fillet**

String Join Fillet
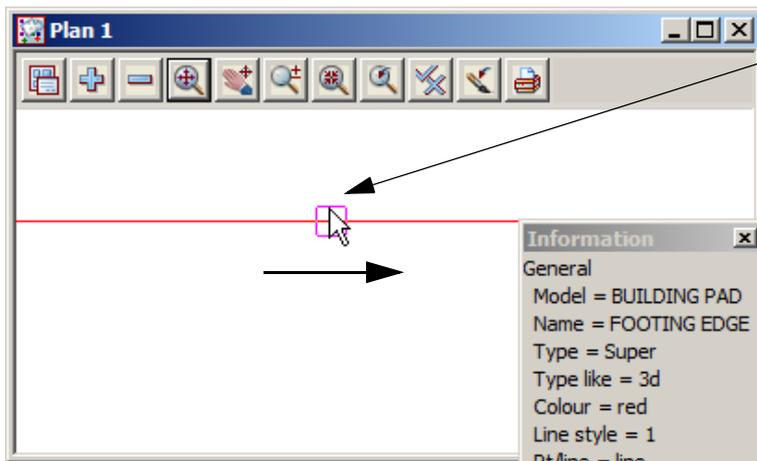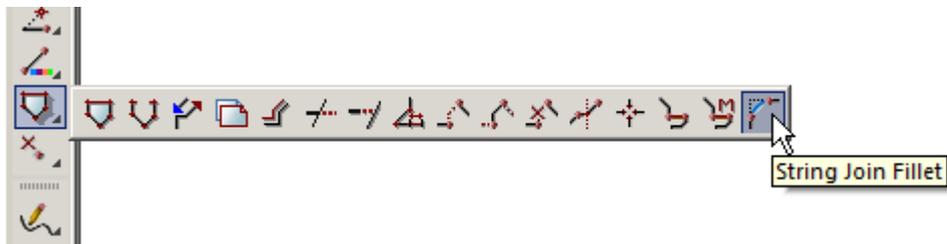
We need to pick along the first line we created with direction towards the corner. This is done by holding down the left button while moving a small distance along the line. Release the left button and then click MB to accept

Information
General
Model = BUILDING PAD
Name = FOOTING EDGE
Type = Super
Type like = 3d
Colour = red
Line style = 1
Pt/line = line
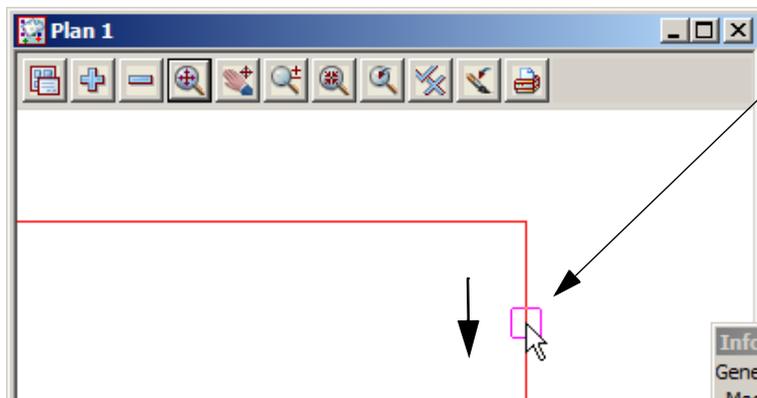
We next pick along the second line we created with direction away from the corner.
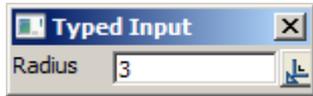
Type in the radius value **3** [Enter]. Note that if the curve is to go to the left then a **<u>negative</u>** radius is required. If a mistake is made, simply repick the segments and type in the correct radius

Repeat this for each of the corners so that the pad looks like the example below
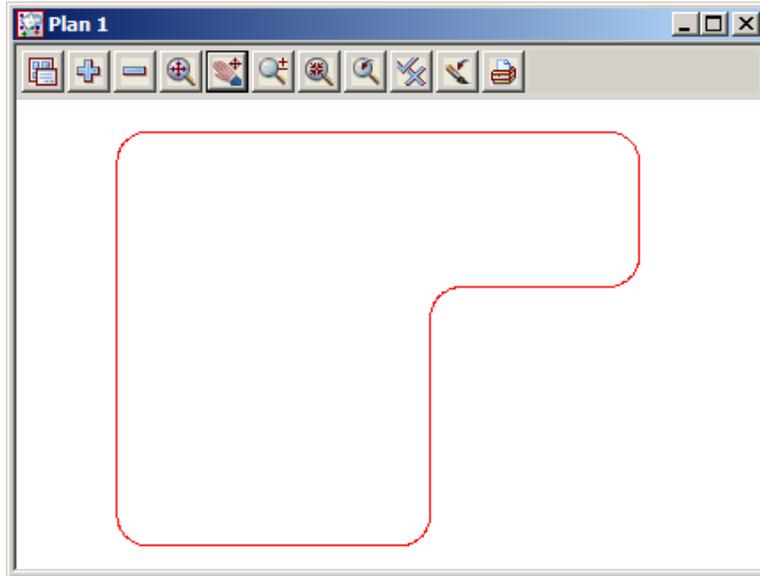
We now need to define the height of the pad. Firstly we need to get an idea of an approximate Z value to be used for our pad footing elevation

From the main menu click LB on **Tins=>Inquire=>Height**
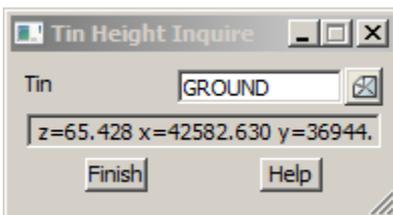
Click RB in the 'Tin' field and click LB on **GROUND** from the pop up list.
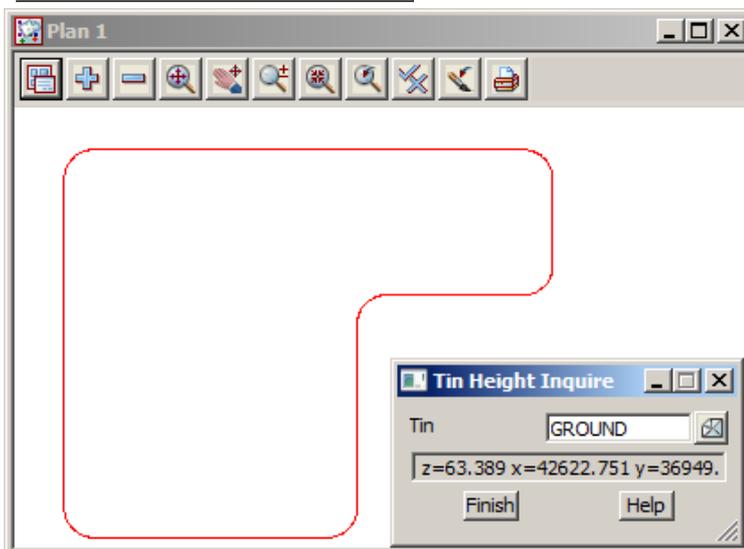
Now place the cursor in the 'Plan 1' view inside the pad footing and note that the Z values on the tin range from about 63 to 67.

To roughly balance cut and fill let us make an initial guess to set the pad footing at height Z=64.

Click LB on **Finish** to terminate the Tin Height Inquire panel.

The simplest way to change the height of a super string is through the String Inquire option.

Click LB on String =>Inquire then click LB on one of the string vertices

Click RB to open the Pick Ops panel

Walk right on **Vertex** then click LB on **Height**

Change **Height mode** to **entire string**

Type in the height **65**

Click LB on **OK**

Toggle on the Z values
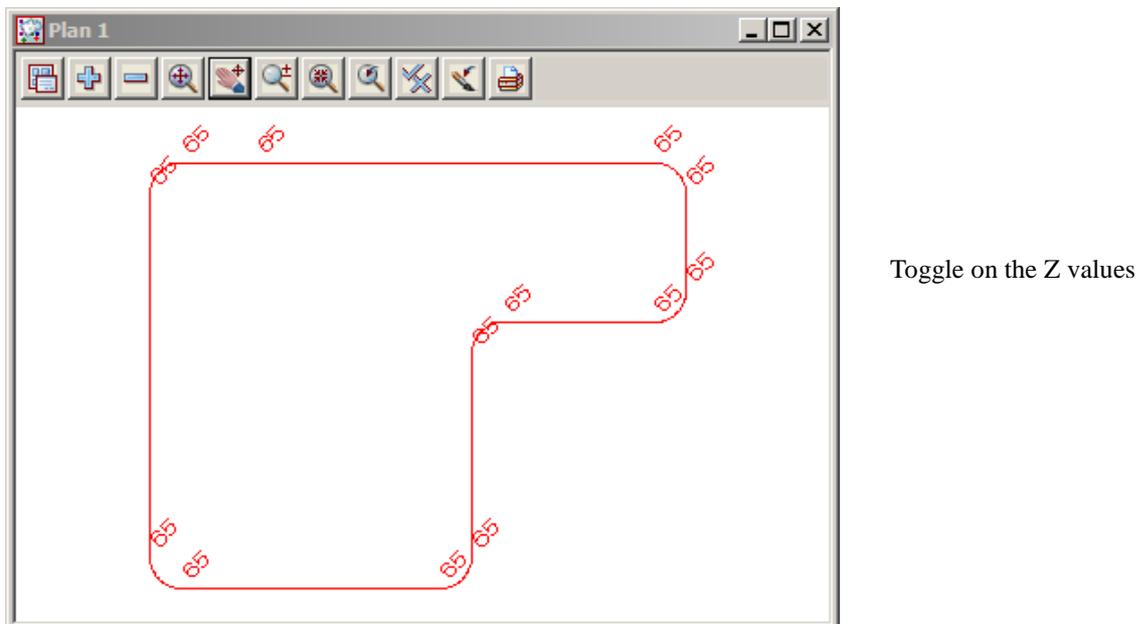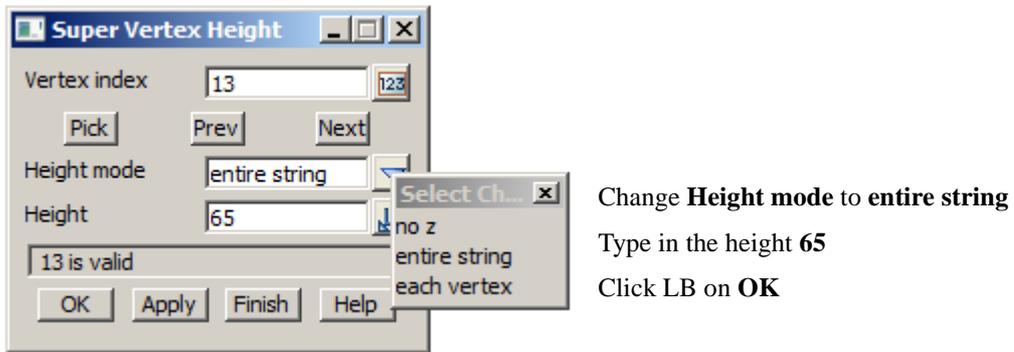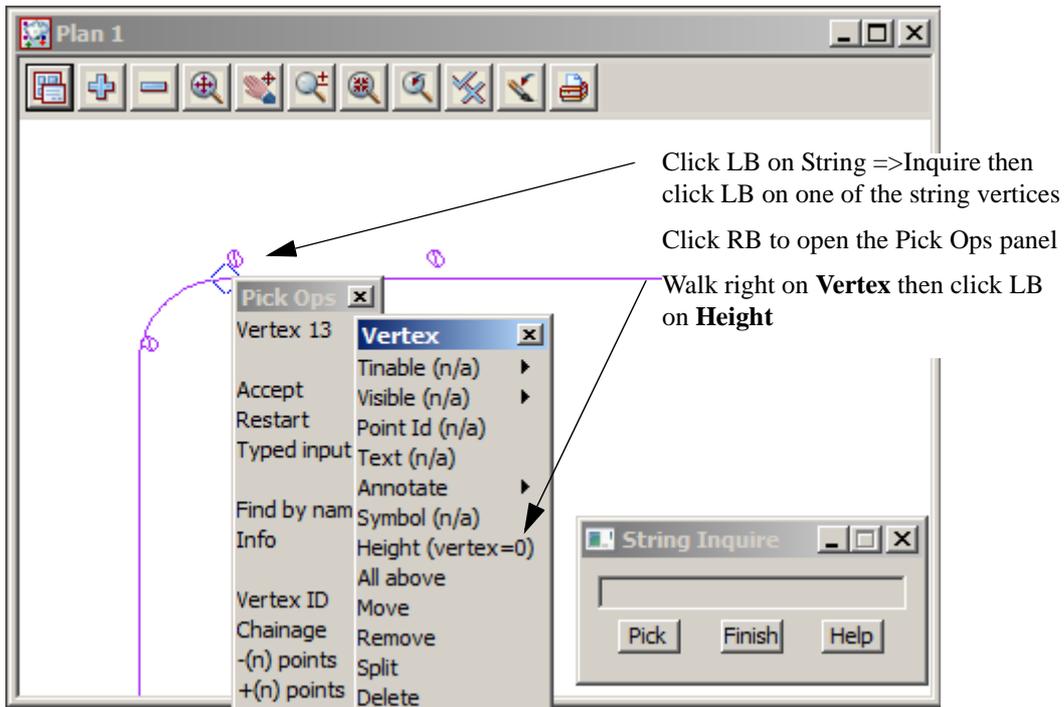
We now need to select a Section view for the purpose of displaying our pad footing string in profile. We will use our 'Section LONG' view. From the View menu of 'Section LONG', click LB on Profile and then click LB on the red string in Plan 1 corresponding to our pad footing outline. Click MB to accept the highlighted string

.
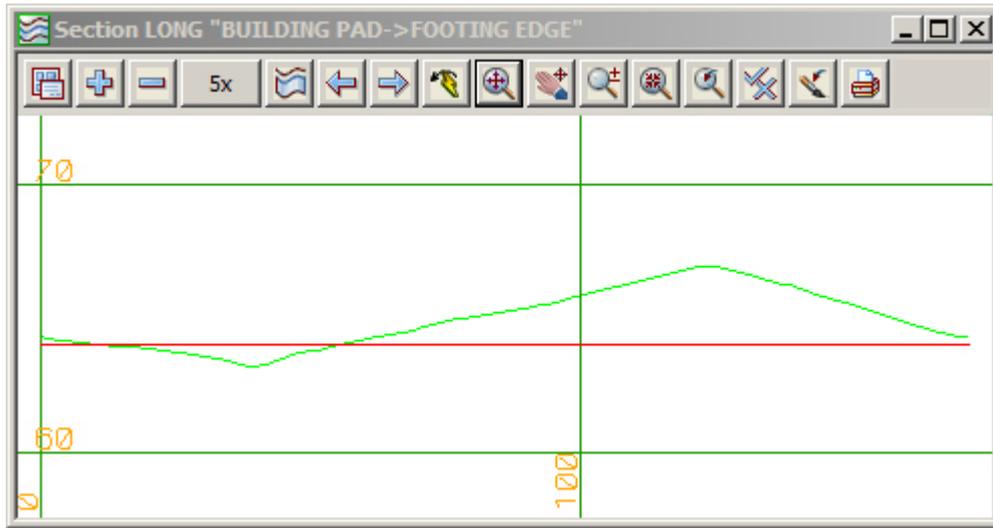
Note that the 'Plan 1' and 'Section LONG' views are now linked. If you move the cursor left-right in the 'Section LONG' view the corresponding position in the 'Plan 1' view is marked with a yellow cross.

Also observe the View Coordinates Box at the bottom of the screen. When the cursor is in the 'Section LONG' view, the message box shows chainage and height (e.g. ch=72.541 ht=64.929).

Refresh the 'Section LONG' view by clicking MB in the View Button Area. You should now see a red horizontal line on your Section view.

You should already have your grid lines turned on to assist in the evaluation of your decision making. However we need to change the vertical spacing to get a better idea of the vertical geometry.

Set the vertical spacing to 1

Your 'Section LONG' view should now look as follows. The red line corresponds to your 'footing edge' string.
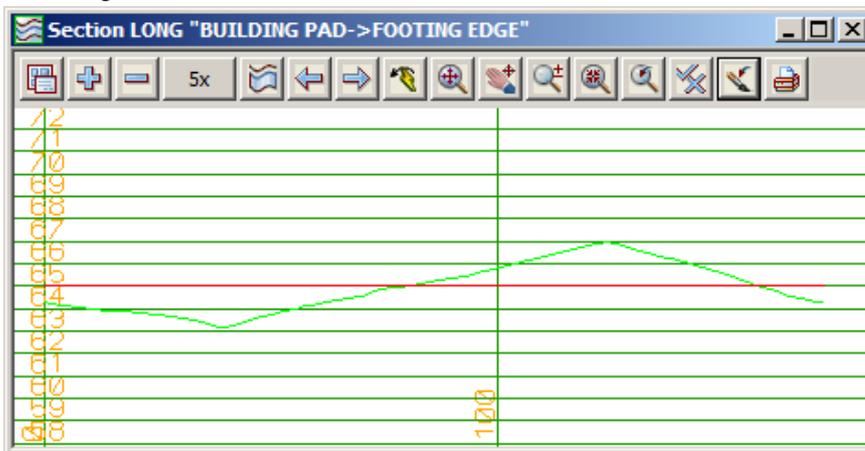
To see how the pad footing aligns with the natural surface, click LB on the '+' sign button in the 'Plan 1' view and double click LB on **tin GROUND**. From the View menu for 'Plan 1', click LB on **Toggle=>Tin contours**. Your view should now look as follows
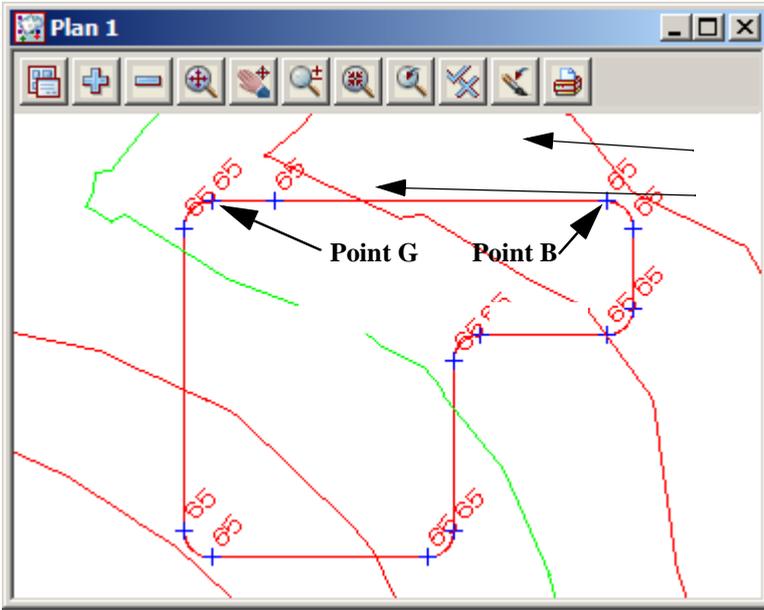
Let us assume that it is important to have side BG aligned as closely as possible with the natural surface contours.

To achieve this we will rotate our pad footing clockwise by 40 degrees about point B (top right corner) so that side BG is close to parallel with the natural surface contours in the vicinity of point B.

From the main menu, click LB on **Utilities=>H-Z=>Rotate.**
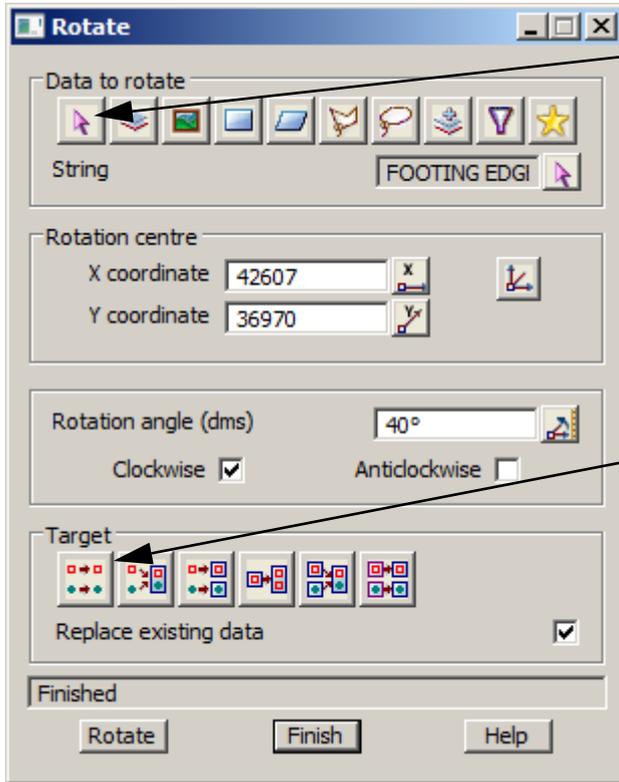
Click LB on the string data source icon then select the **BULDING PAD** string from the view.

Click LB on the **Rotation Centre** icon and select point B

Type in the rotation angle to **40** degrees clockwise

Click on the **Replace existing data** target icon

Click LB on **Rotate** to activate the rotation.

Click LB on **Finish** to terminate the panel.

Your 'FOOTING EDGE' string should now appear rotated.

To centralise the pad footing in the 'Plan 1' view, click LB on **Pan** and press down LB in the centre of the building pad and drag it to the centre of the view. Release LB and press <Esc> to terminate the Pan.

Your revised 'Plan 1' view should look as follows
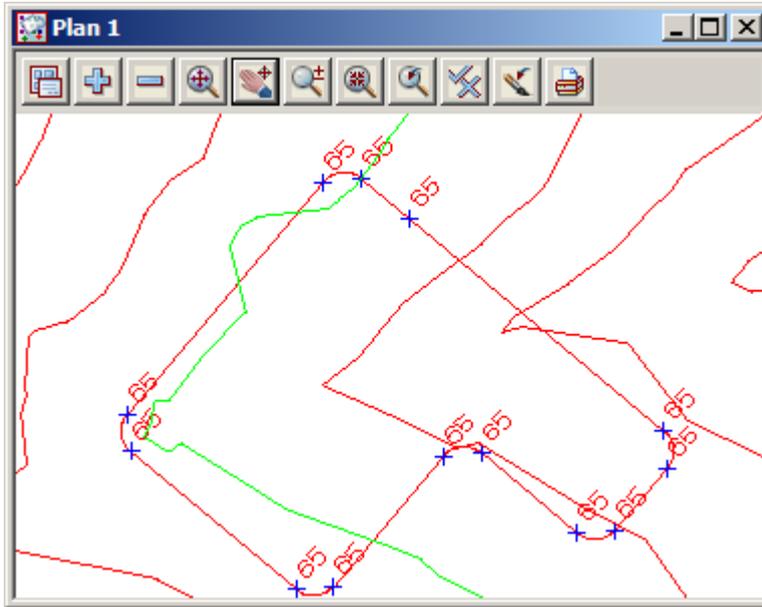
We will now translate the FOOTING EDGE string +20m in the X direction and -30m in the Y direction to get our pad footing away from the valley and more onto the ridge of the natural surface contours.

From the Main menu, click LB on **Utilities=>H-Z=>Translate**. The Translate Model panel will appear.

We could select the string as the Data Source in the Translate panel as we did in the Rotate example but this time we'll use the model Data Source to demonstrate how it works.
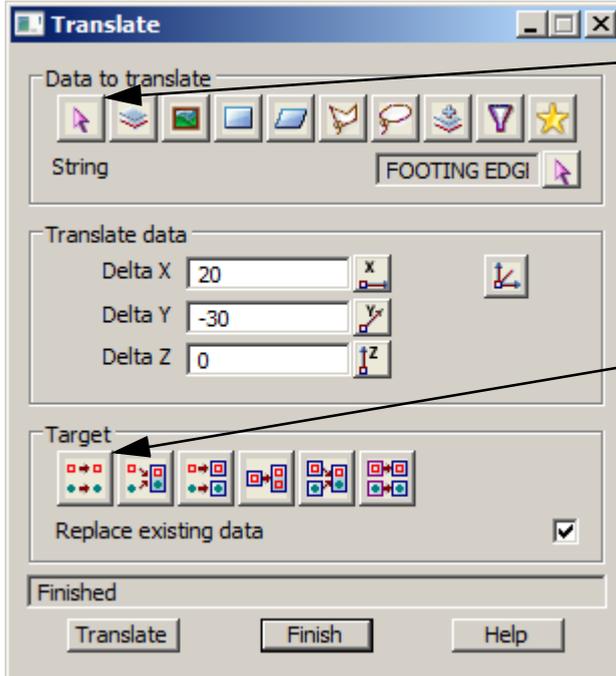
Click LB on the String data source icon. Pick and accept the footing edge string.

Type in the 'Delta X' of **20**

Type in the 'Delta Y' of **-30**

Type in the 'Delta Z' of **0**

Click on the **Replace existing data** target icon

Click LB on **Translate** to activate the settings.

Click LB on **Finish** to terminate the panel.

Your 'FOOTING EDGE' string should now have moved downwards and to the right.

To centralise the pad footing in the 'Plan 1' view, click LB on **Pan** and depress LB in the centre of the

building pad and then drag the image to the middle of the screen. Release LB Click LB.
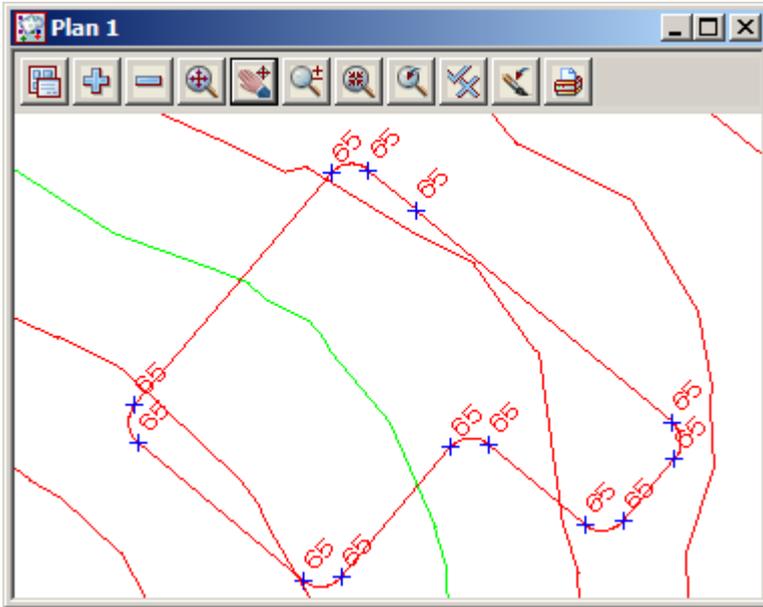
After Regenerating the long section your 'Section LONG' view should now look as follows.
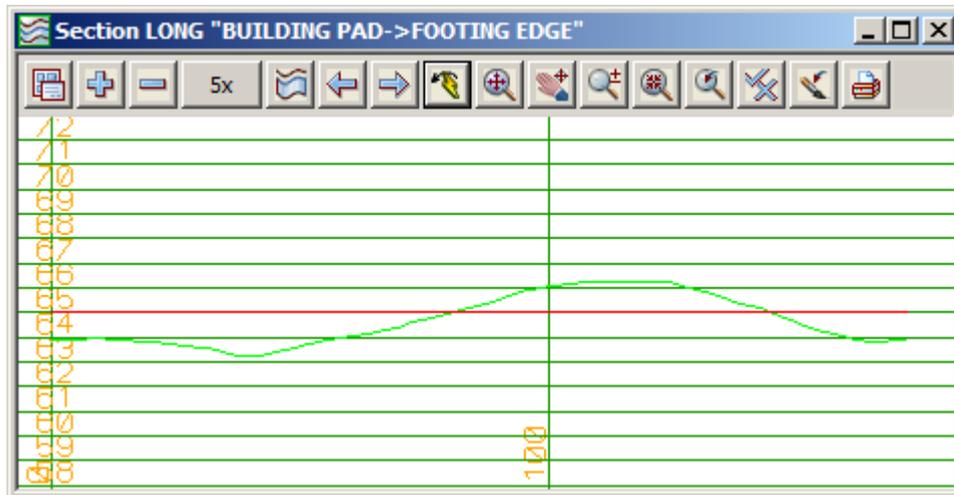
We can now have our first trial run to see how well our pad footing fits in with the existing natural surface.

From the Main menu, click LB on **Design=>Apply=>Interface**

The Interface Function panel appears.
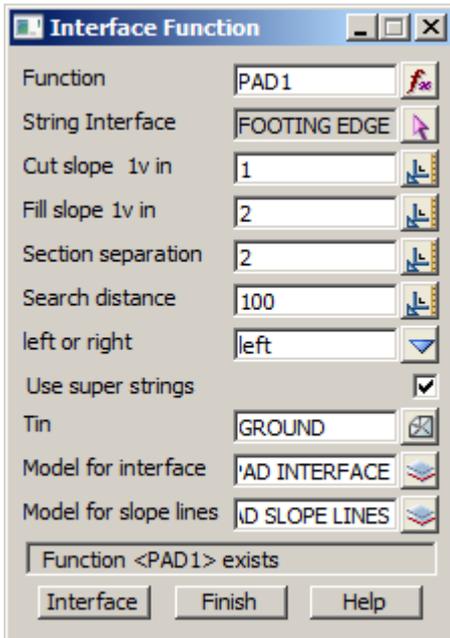
We need to give our interface function a name so that we can refer to it later. Type in the name **PAD1**.

Select the pad string as the 'String Interface'

The default 'Section separation' is 10 metres. Set this to 2 metres.

As our pad 'FOOTING EDGE' string has been generated in a clockwise manner (from starting point A to B to C etc.), we are looking to calculate the intersection of our batter lines with the **GROUND** tin on the **left** of the string (left as we proceed in a positive direction along the string. Positive direction is always in the direction of increasing chainage).

Click LB on the 'Tin' button and double click LB on **GROUND** from the popup list.

Finally supply the name **PAD INTERFACE** to the "Model for interface' field. The interface string corresponding to where our batter lines meet the **GROUND** tin are placed in model **PAD INTERFACE**. (Optional) Slope lines are placed in model **PAD SLOPE LINES**.

To cause the interface string to be calculated click LB on **Interface**. After a short delay, the panel message box advises 'finished interface'. Click LB on **Finish** to terminate the panel.
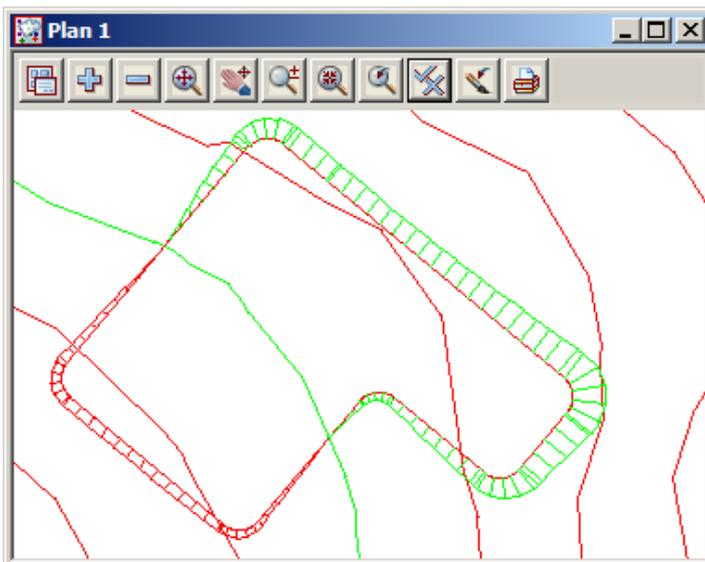
You will not see any immediate change in your 'Plan 1' view until you turn on the appropriate models that have been created by the interface function.

To see the interface that has been calculated, click LB on the '+' sign button in the 'Plan 1' view to pop up a list of models. Double click LB on models **PAD INTERFACE** and **PAD SLOPE LINES.**

Toggle off the Z values

We will now observe a very powerful design feature of 12d Model. We will make some major changes to our pad footing and see how quickly 12d can redo its calculations with a minimum of effort.

First, we will change the shape of our pad string. Remember that we rotated our pad footing 40 degrees. We will now change point D by moving it 10m towards point C. Because of the rotation, line D-C is at a bearing of 130 degrees.

We need to set the corner radii of the corner point to be moved and the next corner point (the curve will no longer be tangential) back to 0 before moving the corner point.
Turn off the models **PAD INTERFACE** and **PAD SLOPE LINES**

From the Cad toolbar select option **Cad String =>String Join Fillet**
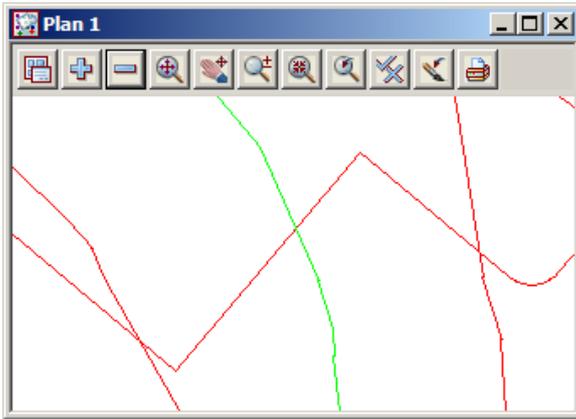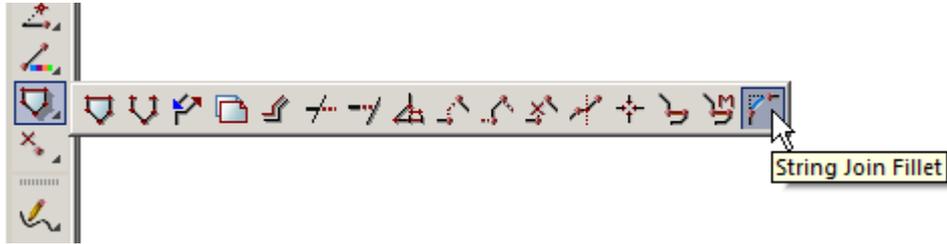
Re-pick the strings each side of the corner points as shown previously and type in the value **0** in the prompt
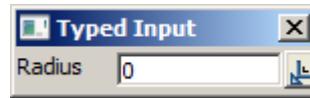
The corner point can now be moved (extended) back towards the last tangent point

From the Cad toolbar select option **Cad Vertex =>Extend point by length**
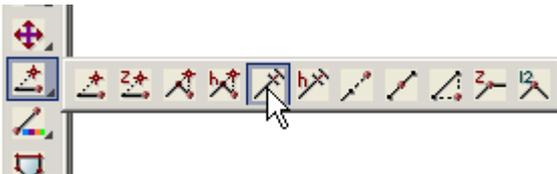
Click LB just to the right of the corner point (on the string) and click MB to accept.
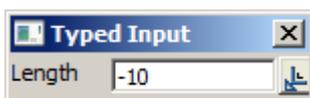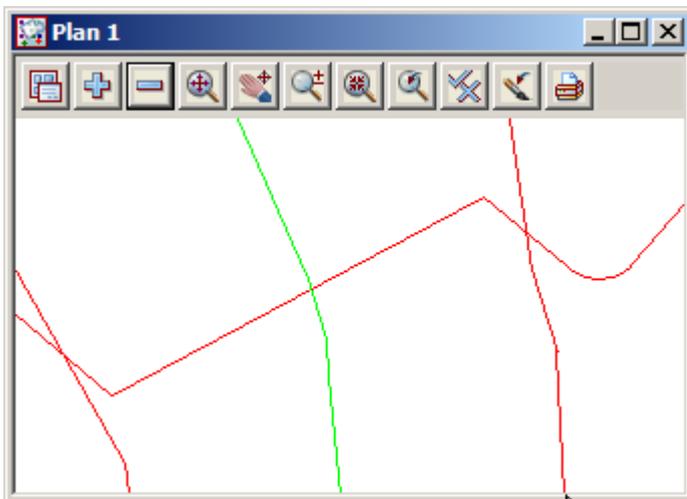
Type in -**10** [Enter] to reduce the line length by 10 metres

The radii now have to be redone as shown earlier back to **3** metres
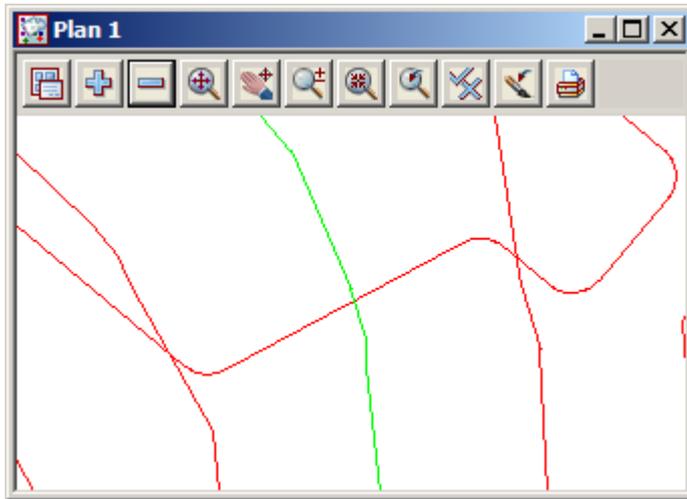
The Interface function can now be recalculated by selecting **Utilities => Recalc => Recalc => PAD1.**

12d will now recalc the pad interface using the same properties set in the **Interface Function** panel previously.

Turn back on the Pad models to see the results
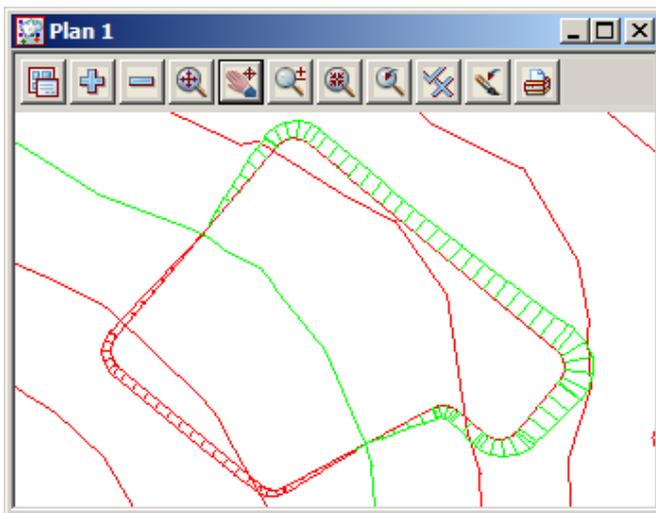
To update your 'Section LONG' view again to reflect the revised geometry all you need do is click LB on the **Regen icon.** Your 'Section LONG' view should now look as follows.
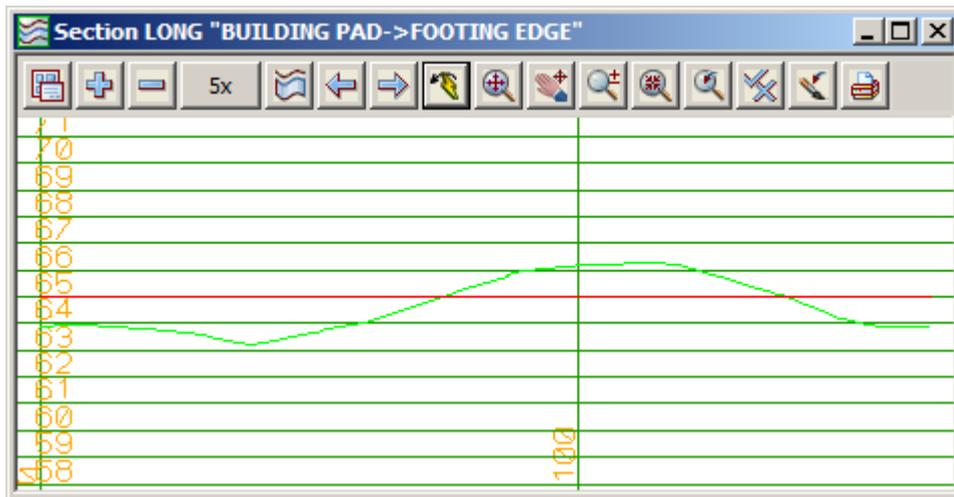
By reference to the 'Plan 1' view, it is apparent that our first guess at Z=65 for our footing is a little too high. Let us now lower this to say Z=64.5 to increase our cut and reduce our fill at the site. To do this, we only need do the following.

We can use the Translate option as before using **Utilities =>H-Z =>Translate**
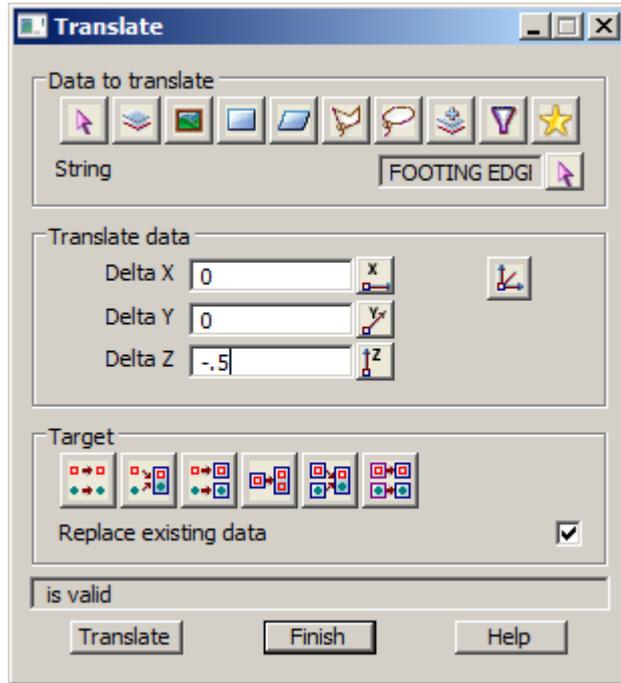
or from the Main menu, click LB on **Strings=>Strings Edit=>Translate**
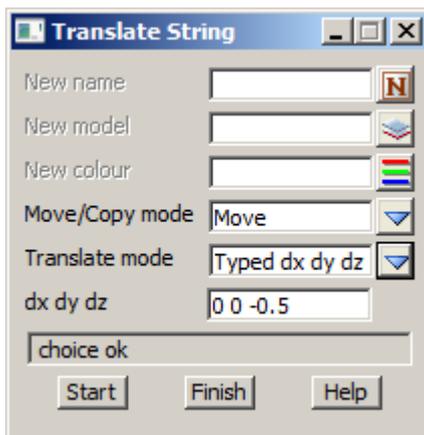
The Translate String panel appears.

Click LB in the 'Move/Copy mode' choice icon and click LB on **Move**.

Place the cursor in the 'Translate mode' field and click LB on the choice icon to popup a list of modes. Click LB on **Typed dx dy dz**.

Place the cursor in the 'x y z' field and type **0 0   -0.5**

Click LB on **Start**.

Place the cursor over the FOOTING EDGE string and select it with LB. Confirm the selection with MB. The entire string is now translated to be at height Z=64.5.

To update your 'Section LONG' view again to reflect the revised geometry all you need do is click LB on **Regen.** Your 'Section LONG' view should now look as follows.
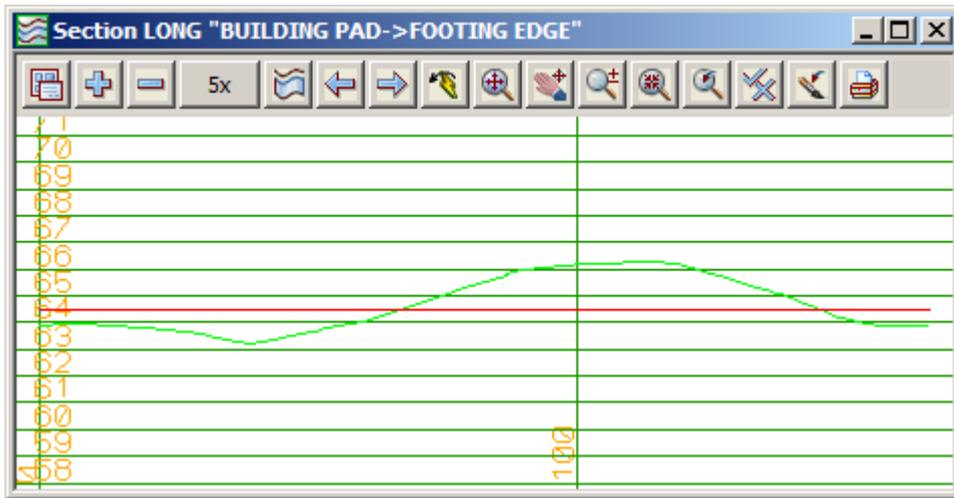
To recalculate our interface string (again), we reapply our interface function as before. Rerun the function **PAD1** from the Recalc menu (see **Utilities =>Recalc**)
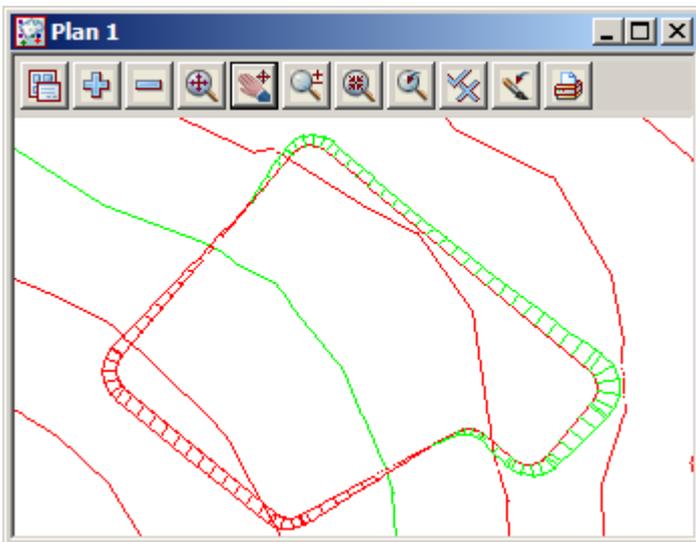
You should now see your 'Plan 1' view updated as shown at left.

Note that the area of cut (red) is now increased and the area of fill (green) is reduced.

16.4   Volume Calculations from Surfaces Created with the Interface Function.

Now that we have batter, pad and interface strings, it is a simple matter to create a TIN of our finished design surface and perform volume calculations.

16.5   Creating a TIN of the Finished Quick Pad Footing Surface

To ensure that only the correct strings are used in the creation of our finished TIN, the first step is to turn OFF all models and then selectively turn ON the appropriate pad footing strings and sections models.

The fastest way to do this is to click LB on the *Menu* button in the View Button Area of the 'Plan 1' view to popup the View menu and click LB on **Models=>Remove all models**. Then place the cursor over the '+' sign button in the 'Plan 1' view and double click LB on **BUILDING PAD**, **PAD INTERFACE** and **PAD SLOPE LINES**.

Since these are the only models on display in View 'Plan 1', we can confidently build our TIN by triangulating the view.

From the main menu, click LB on **Tins=>Create=>Triangulate data**
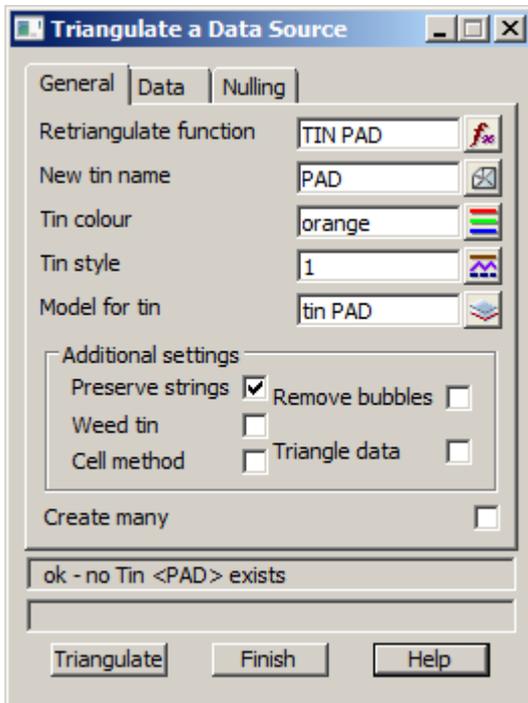
Give the triangulation the function name **TIN PAD**

Position the cursor in the 'New tin name' field and type in 'PAD' and press the Enter key. This name will also be used to fill in the 'Model for tin' field but with the prefix 'tin '.

Click LB on the colour icon and select 'orange'.

Click on the **Data** tab and set the 'Data to triangulate' to View **1**.

Click on the **Nulling** tab. To ensure that the pad TIN is restricted to within the bounds of the interface string defining where our pad footing intercepts the natural surface, click LB on the 'Null polygon' button and select with LB the red-green closed 'interface string' surrounding the pad footing.

Information

General
Function = PAD 1
Model = PAD INTERFACE
Name = interface
Type = Super
Type like = Interface
Colour = red
Line style = 1
Pt/line = line
# pts = 109
Length = 178.692
Line snap =
X = 42579.448
Y = 36928.035
Z = 66.160
Prof ch = 107.247
Prof z = 66.160
Bearing = 308°37'18.06"
+ve =
Segment
Type = horizontal line
Length = 2.001

Make sure that the string you select has the correct string name 'interface' and is of type 'interface' as shown in the panel at left. If necessary, keep clicking LB until you get this string. Once you have it, click MB to confirm the selection.

Then click LB on **Triangulate** to create the TIN.

To display the TIN, click LB on the '+' sign button in the 'Plan 1' view and double click LB on **tin PAD** from the pop up list.

The TIN on the view will currently be displayed with contours and not triangles

To see the triangles, click on the toggle icon and turn off 'Tin contours'.

The finished TIN should appear as shown below.

Note that by using the 'Null polygon' feature, any triangles that might have formed outside the interface polygon have been 'nulled' (effectively removed) from the TIN. Whilst such triangles may or may not exist, they are of no consequence to the user. Only those triangles on display will participate in any subsequent TIN or volume calculations.
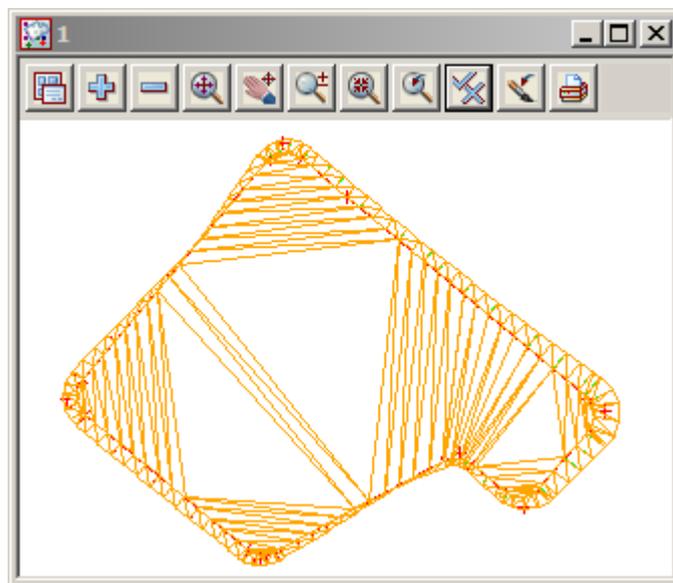
16.6   Volume Calculations Between Surfaces

Now that as we now have two tins, 'GROUND' and 'PAD', we can get 12d to calculate the volume between the TIN surfaces. 12d provides two methods of calculating such volumes:

End Area: Here parallel sections are taken at a constant user defined angle from the X axis (angles are measured anticlockwise from the X axis) with sections a user defined distance apart. When calculating end area volumes, the quality of the answer is highly dependant on the values chosen for the angle of the sections and the distance between sections.

Exact: In this method exact volumes are calculated by summing the volumes of the various 'prisms' between the triangulated surfaces. This method is 'exact' in that it is as accurate as the TINs themselves. Depending upon the overlap between 'triangles' in each TIN, each triangle may be split up into multiple prisms. All prisms are accounted for hence the term 'exact'.

We will use both methods and compare any differences.

16.7   End Area Volume Calculations

To enable string selection to be easier, first turn off PAD tin. Click LB on the '-' sign button in the 'Plan 1' view and double click LB on **tin PAD** from the pop up list.

To calculate volumes between TINs using end areas, from the Main menu, click LB on **Design=>Volumes=>End Area=>Tin to tin**
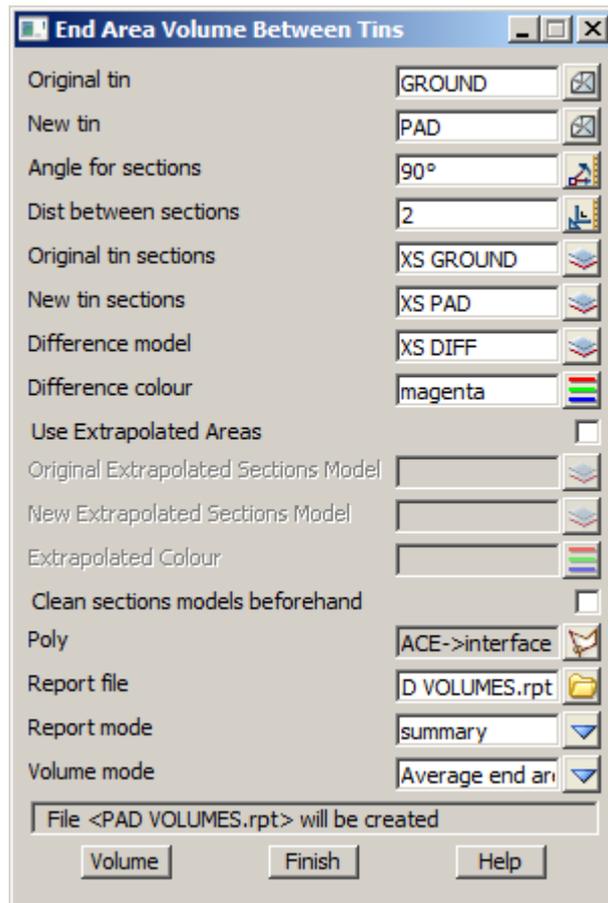
Fill the panel in as shown. Place the cursor on the tin icon for the 'Original tin' field and click LB to popup a list of the available TINs. Double click LB on **GROUND**. Repeat the process for 'New tin' and set it to **PAD**

Leave the angle for sections at 90 degrees. This will make the sections at 90 degrees to the X axis i.e. parallel to the Y axis.

Set the 'Distance between sections' to 2m as this is a relatively small site.

Enter three new model names - **XS GROUND**, **XS PAD** and **XS DIFF** for 'Original','New' and 'Difference' sections respectively. The cross sections corresponding to each of these profiles will then be stored. Entering a name in the 'Difference model' causes a series of sections to be created that correspond to the difference between the Original and Final cross sections. Note that all these model fields are optional.

Set the Difference colour to **magenta**.

Tick the checkbox to clean out the section models before running the option

A closed polygon can be defined to restrict the extents within which the calculations will be performed. If a string is selected that is not closed then the first and last points of the string are automatically joined to form a closed polygon.

We can use the 'interface polygon' for this purpose i.e.use the string which is the intersection of the pad footing with the existing ground. Click LB on the **Poly** icon then select the string icon. Select the red-green interface polygon in the 'Plan 1' view with LB. Confirm the selection with MB.

By entering a name in the 'Report file' field, a report can be created showing the details of the end area volumes. Enter **PAD VOLUMES** and press return. The suffix **.rpt** is appended by 12d. Set the report mode to **summary** as we don't need to see the volumes for each section. This would only be used if an alignment is used for the section creation.

Click LB on **Volume** to cause the end area volumes to be calculated.

If a name is entered in the 'Report file' field, 12d will immediately jump to the Editor and display the report. A sample report is shown on the following page. Click LB on **File=>Exit** to terminate the Editor and return to 12d.

Note that once the calculation is finished, the Cut, Fill and Balance volumes are displayed in the Panel's message line.

Click LB on **Finish** to terminate the panel.

NOTE: We used a polygon for the End Area volumes but a polygon does not have to be used. If no polygon is used then the volume calculations are restricted to the regions where both TINS exist.

```
PAD VOLUMES.rpt - Notepad
File   Edit   Format   View   Help

Project:        STAGE 1
User:           Noel
Organization:   12d Training - Qld
Report File:    PAD VOLUMES.rpt


------------------------- BEGIN TIN-TIN VOLUME REPORT -------------------------
  surface to surface volume report - (with plan polygon "PAD INTERFACE->interface")

     original tin GROUND
     new tin       PAD
     separation    2.000
     angle         90°00'00"
     method        Average end area
     extrapolated no

     cut volumes and areas are negative
     fill volumes and areas are positive



  total plan area              1852.806

  total cut                    -848.956
  total fill                    358.783
  balance                      -490.173
  ie excess of cut over fill    490.173


------------------------- END TIN-TIN VOLUME REPORT -------------------------
```

It is possible to view the sections that were calculated during the end area calculations.
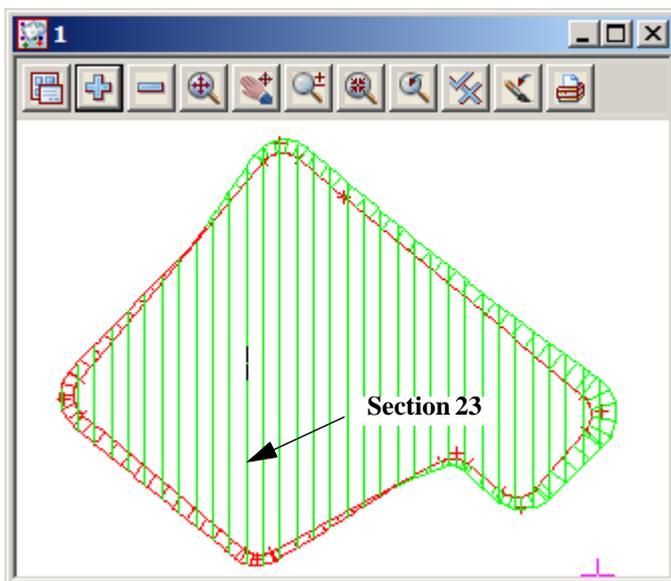
From the View Button Area of the 'Plan 1' view, click LB on the '+' sign button and turn on model **XS GROUND.**

Note that the various cross section strings display in green.

We can now profile any of these cross section strings. We will use view 'Section CROSS' for this purpose.

From the View Button Area for the 'Section CROSS' view, click LB on **Profile** and then click LB on section '23' as shown. Click MB to confirm the selection.

Toggle off the grades and set the vertical exaggeration to 5

The following view shows the profile of cross section no '23'.

In this view the **XS PAD** model has also been turned on. Hence the section shows both the **original sections** (from tin 'GROUND') and **final sections** (from tin 'PAD'). The area between these two strings is a typical section used in the end area calculations. Note that it has both cut and fill.
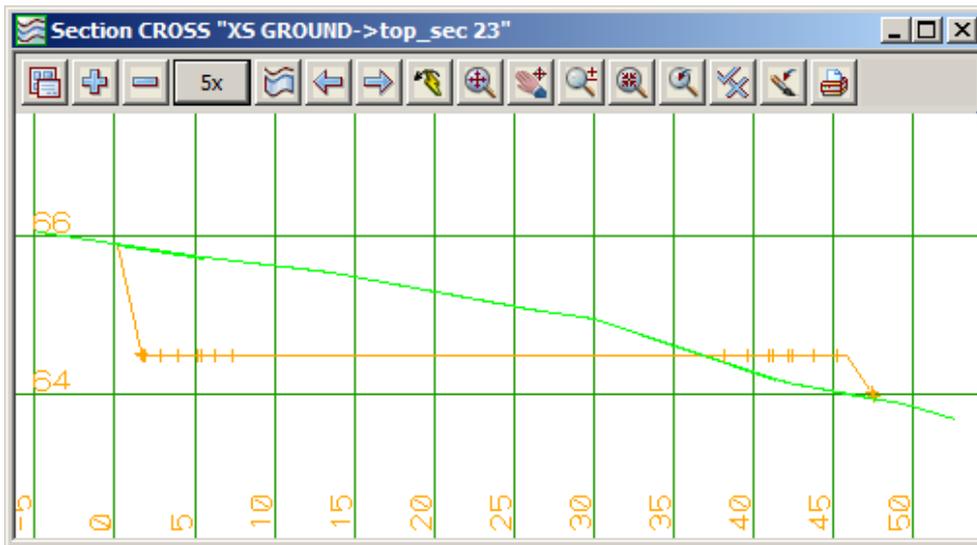
This section will now be used to demonstrate what the difference model is. Observe the typical Z values.

Place the cursor in view 'Section CROSS' and note the chainage and height values displayed. The Z values shown are the real world values. At any one chainage across the section it is possible to subtract the Z value of the 'PAD' TIN from the Z value of the 'GROUND' TIN. If the resulting Z difference was plotted on the same section, a view as shown below results. This is the 'difference model' of sections.

The following view was created by turning on model **XS DIFF** in the 'Plan 1' view and profiling the **difference sections** string at section '23' from the 'Section CROSS' view. Note that when doing this it is best to turn off all models in the view 'Section CROSS'. Click LB on **Fit** to fill the view.
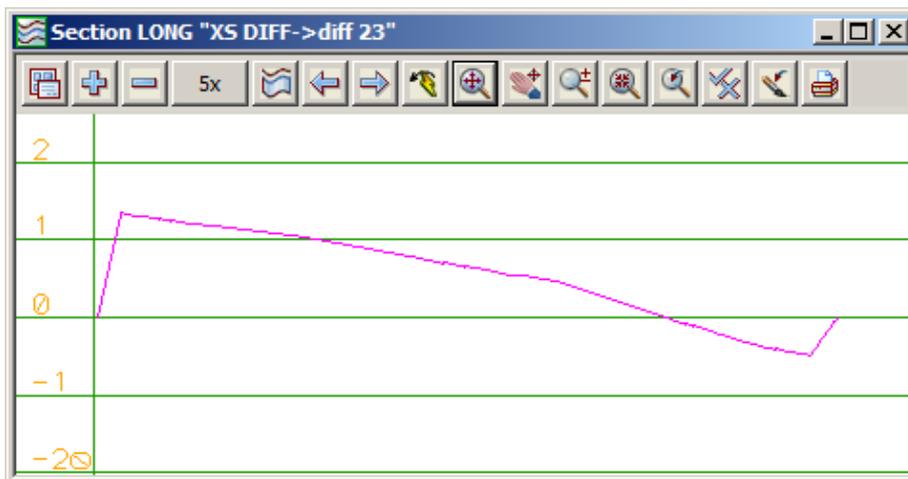
Note that the grid now displays the difference model Z values. If you now place the cursor in the 'Section CROSS' view and observe the typical chainage and height values displayed in the XYZ message bar, the values are centred around Z=0. Thus in a Section view it is not meaningful or possible to display the model of **difference sections** together with either the **original sections** or **final sections** models.

The 'difference model' is a cross section schematic where a positive Z ordinate represents cut and a negative Z ordinate represents fill. The datum for change from cut to fill is at Z=0.

16.8   Exact Volume Calculations

Now go back to the 'Plan 1' view and turn off the model **XS DIFF**.

The only models that should be turned on in the 'Plan 1' view are **BUILDING PAD**, **PAD SLOPE LINES** and **PAD INTERFACE**. Click LB on **Fit** to fill the view.

To calculate exact volumes between TINs, from the Main menu, click LB on
Design=>Volumes=>Exact=>Tin to tin
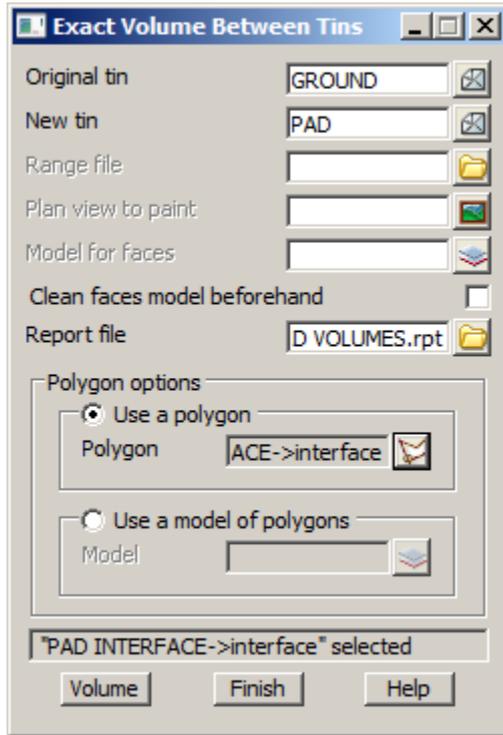
Fill the panel in as shown. Place the cursor on the tin icon for the 'Original tin' field and click LB to popup a list of the available TINs. Double click LB on **GROUND**. Repeat the process for 'New tin' and set it to **PAD**.

By entering a name in the 'Report file' field, a report can be created showing the details of the end area calculations. Select the previously created report file PAD VOLUMES.rpt so that we can append the volumes to the bottom of the report.

Click LB on the **Poly** icon and then select String icon. Select the red-green interface polygon in the 'Plan 1' view with LB. Confirm the selection with MB.

Click LB on **Volume** to initiate the calculation.
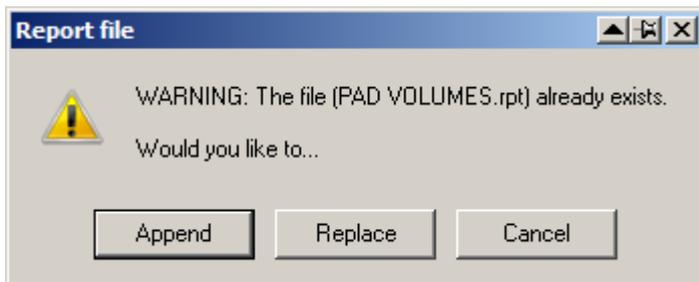
Click LB on [Append] to add to the bottom of the previous report file

The report will be calculated and immediately display. The following is a typical report

```
PAD VOLUMES.rpt - Notepad                                      ▲ ⊞ _ □ ✕

File  Edit  Format  View  Help

Project:      STAGE 1                                              ▲
User:         Noel
Organization: 12d Training - Qld
Report File:  PAD VOLUMES.rpt
#


  ------------------------- BEGIN TIN-TIN VOLUME REPORT -------------------------
---

  surface to surface volume report - (with plan polygon "PAD INTERFACE->interface")

     original tin GROUND
     new tin      PAD
     separation   2.000
     angle        90°00'00"
     method       Average end area
     extrapolated no

     cut volumes and areas are negative
     fill volumes and areas are positive



  total plan area                  1852.806

  total cut                        -848.956
  total fill                        358.783
  balance                          -490.173
  ie excess of cut over fill        490.173


  ------------------------- END TIN-TIN VOLUME REPORT --------------------------
Project:      STAGE 1
User:         Noel
Organization: 12d Training - Qld
Report File:  PAD VOLUMES.rpt

  Volumes from tin "GROUND" to tin "PAD" - (with plan polygon "interface")

     cut volumes are negative
     fill volumes are positive


  Total cut                        -849.509
  Total fill                        359.334
  Total balance                    -490.176
  ie excess of cut over fill        490.176

  Polygon plan area = 1852.806                                     ▼
```

Note the cut, fill and balance volumes display at the base of the panel.

Click LB on **Finish** to terminate the panel.

We used a polygon for the exact volumes but like the End Area volumes, a polygon does not have to be used. If no polygon is used then the volume calculations are restricted to the regions where both TINS exist.

16.9   Displaying 'depths' of Cut and Fill using Colour Shading

If the above exact volumes calculation is repeated but this time the panel is filled in as shown, it is possible to get the plan view to shade in with different colours corresponding to different depths of cut and fill. Set the TIN fields as shown
.
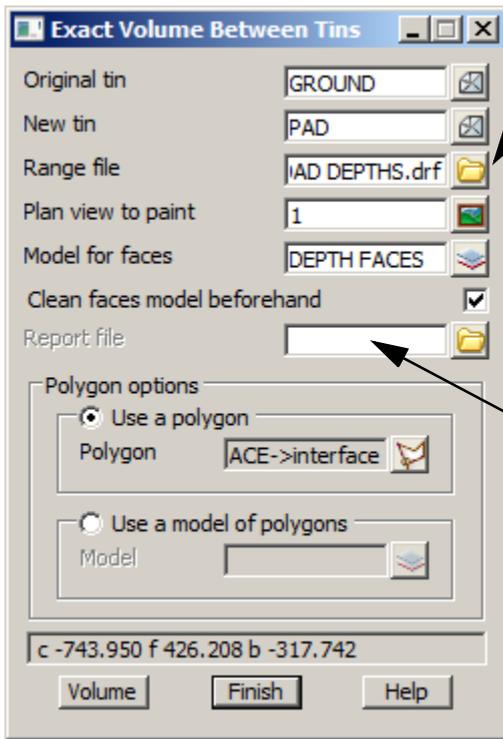
Place the cursor on the **folder** icon for the 'Range file' field and click LB to pop up a list of range files. Navigate to the folder **C:\12d\9.00\Training\design\getting started basic** then double click LB on **ROAD DEPTHS.drf**.

The 'Plan view to paint' should be set to **1**

Enter the new model name **DEPTH FACES** in the 'Model for faces' field.

If you are using the practice version and have limited point numbers then don't create the faces model. Simply view the data in the view

Clear the report file name

Click LB on **Volume** to recalculate the volumes.

Now as the volumes are calculated, the 'Plan 1' view will have its various faces coloured in.

The red area displays cut and the green area displays fill. The darker shades show areas of greatest cut and fill.
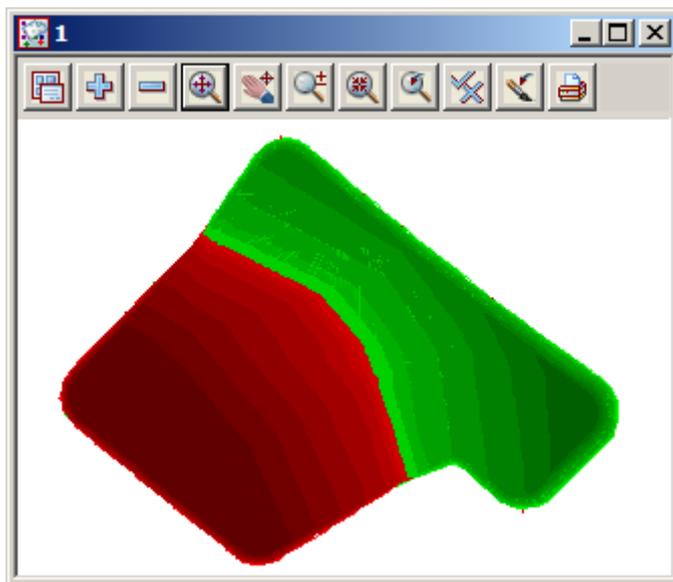
If you refresh the view you will notice that the shaded image disappears and the view reverts to whatever models you had turned on prior to performing the volume calculation.

As required, you can turn on model **DEPTH FACES** where you now have a permanent copy of the shaded faces. This model can be manipulated just like any other model in 12d.

This image can be exported or plotted as desired. When the data is transferred to AutoCAD, Microstation or another rendering package, the face data will be retained and hence can be manipulated further if required.

The quality of the finished image is a function of the number of ranges specified in the **ROAD DEPTHS.drf** file. Each range has a colour associated with it. This file is a normal ASCII file and can be edited with a text editor or from within 12d Model using the Depth Range File panel.

If you place the cursor near the name **ROAD DEPTHS.drf**, in the 'Exact Volumes Between Tins' panel, click LB on the *folder* icon to pop up the list of names again and then select **[Open],** the Depth Range File panel will pop up with the file displayed ready for editing.

Depth Range File			

Range file `C:\12d\9.00\Tra` Read Write

	From	To	Colour	Comment
1	-90	-10	red 032	
2	-10	-6	red 040	
3	-6	-4	red 048	
4	-4	-2	red 064	
5	-2	-1	red 096	
6	-1	-0.8	red 112	
7	-0.8	-0.6	red 128	
8	-0.6	-0.4	red 144	
9	-0.4	-0.2	red 160	
10	-0.2	-0.1	red 176	
11	-0.1	-0.05	red 192	
12	-0.05	0	red 208	
13	0	0.5	green 208	
14	0.5	0.1	green 192	
15	0.1	0.2	green 176	
16	0.2	0.4	green 160	
17	0.4	0.6	green 144	
18	0.6	0.8	green 128	
19	0.8	1	green 112	
20	1	2	green 096	
21	2	4	green 064	
22	4	6	green 048	
23	6	10	green 040	
24	10	90	green 032	
25				

ok

Finish   Help

The "From' field is the 'starting depth' and the 'To' field is the 'finishing depth'.

Cut depths are negative.

If any modifications are made, then the file must be written out by clicking LB on the **Write** button.

The file can also be edited in the system text editor. If you place the cursor near the name **ROAD DEPTHS.drf**, in the 'Exact Volumes Between Tins' panel, click LB on the *folder* icon to pop up the list of names again and then select **[Edit file],** the 12d text editor will pop up with the file displayed ready for editing.

```
ROAD DEPTHS.drf - Notepad

File   Edit   Format   View   Help

-90      -10       "red 032"
-10      -6        "red 040"
-6       -4        "red 048"
-4       -2        "red 064"
-2       -1        "red 096"
-1       -0.8      "red 112"
-0.8     -0.6      "red 128"
-0.6     -0.4      "red 144"
-0.4     -0.2      "red 160"
-0.2     -0.1      "red 176"
-0.1     -0.05     "red 192"
-0.05    0         "red 208"
0        0.5       "green 208"
0.5      0.1       "green 192"
0.1      0.2       "green 176"
0.2      0.4       "green 160"
0.4      0.6       "green 144"
0.6      0.8       "green 128"
0.8      1         "green 112"
1        2         "green 096"
2        4         "green 064"
4        6         "green 048"
6        10        "green 040"
10       90        "green 032"
```
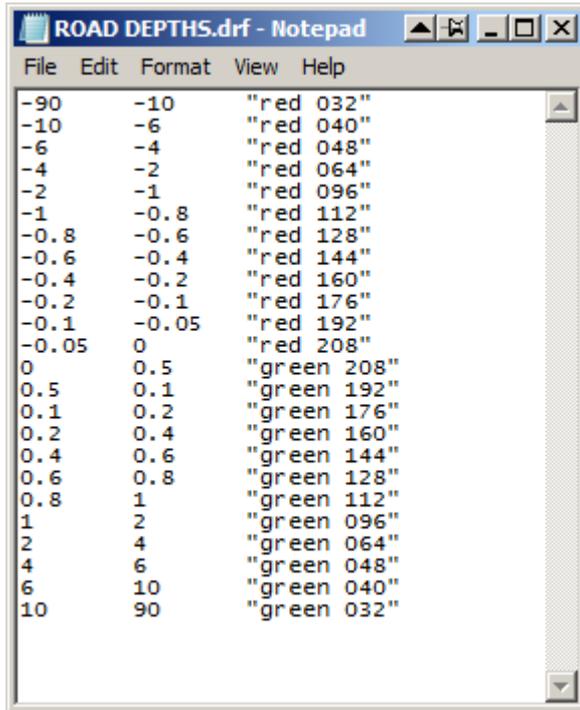
The format is 'starting depth', 'finishing depth', 'colour'. Cut depths are negative. Any colour can be used. For a full list of the colours available, see the **colours.4d** file. This file also is user definable. Terminate the edit session by shutting the Window **[X]** or choosing **File=>Exit** from the pull down menu. then click 'finish' to terminate the panel.

Important Notes:

1. If a depth range file is used then the reported volumes only use the values specified in the depth range file. So if the depth range file does not cover the entire range for the two tins, then the reported volumes will not equal the total volumes between the two tins.

2. The depth faces do not have to be created. The plan view will still be coloured as the volumes are calculated but the colours will disappear when any part of the view is refreshed.

3. **For the practise and smaller versions of 12d Model, the faces will need to be deleted before saving the project.**

16.10   Displaying 'depth contours' of Cut and Fill

To ensure that we can see the depth contours clearly after they are created, begin by turning OFF all models. Click LB on the Menu button in the View Button Area of the 'Plan 1' view to pop up the View menu and click LB on **Models=>Remove all models**.

To calculate depth contours between the TINs, from the Main menu, click LB on
Tins=>Contour=>Depth contours
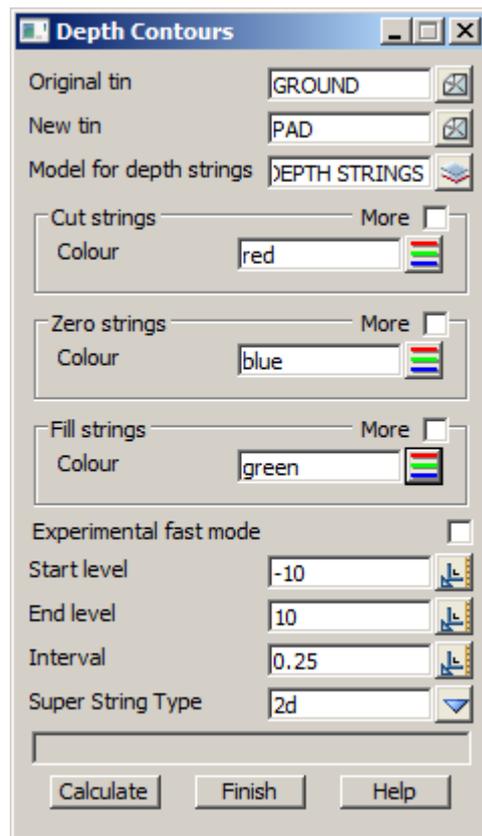
Fill the panel in as shown. Click LB on the tin icon for the 'Original tin' field to popup a list of the available TINs. Double click LB on **GROUND**. Repeat the process for 'New tin' and set it to **PAD**.

Use the colour icon to pop up a list of colours and select the colours as shown. These colours are recommended since they are consistent with the depth ranges used above.

Set the contour interval to 0.25m

Click LB on **Calculate** to produce the depth contours. Click LB on **Finish** to terminate the panel.
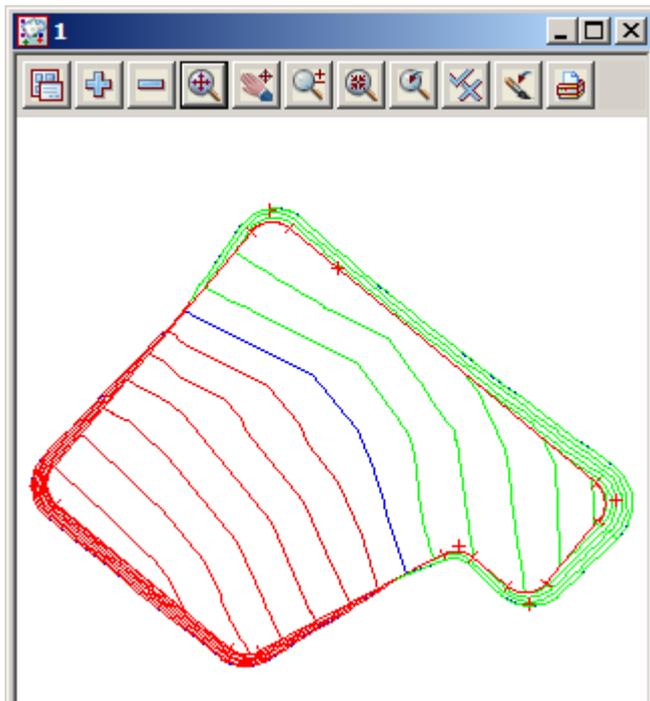
To see the contours, from the View Button Area of the 'Plan 1' view, click LB on the '+' add model button and turn on models **DEPTH STRINGS**, **BUILDING PAD** and **PAD INTERFACE**

These contours are valid 2d strings just like any other contours created by 12d Model and hence can be used further by 12d, plotted or exported to a CAD system as required.

16.11   Comparison of 'End Area' verses 'Exact' Volume Calculations

In the above models, the end area calculation for balance of volumes was 490.173 m3 verses 490.176 m3 for the exact calculation, a negligible difference.

On a large site, you may notice a significant discrepancy between your answers from both these methods. Clearly, the end area calculations are the more important if you have to allow for mass haul considerations. In such case, try performing your end area calculations with a smaller 'distance between sections'. Also try to orientate your sections at right angles to the major direction of cut/fill movement. These steps will minimise errors inherent in the end area method.

Finally it is possible to perform end area calculations such that all sections are at right angles to an arbitrary string, just as you would with template generated sections in normal road design. See **Design=>Volumes=>End Area=>String Tin to tin** for how to do this.

16.12   Sign Conventions for Cut and Fill

The entire tutorial on volume calculations so far has been performed assuming the convention that <u>Cut volumes are negative</u>. This is a user definable convention however. If preferred, Cut volumes can be made positive.
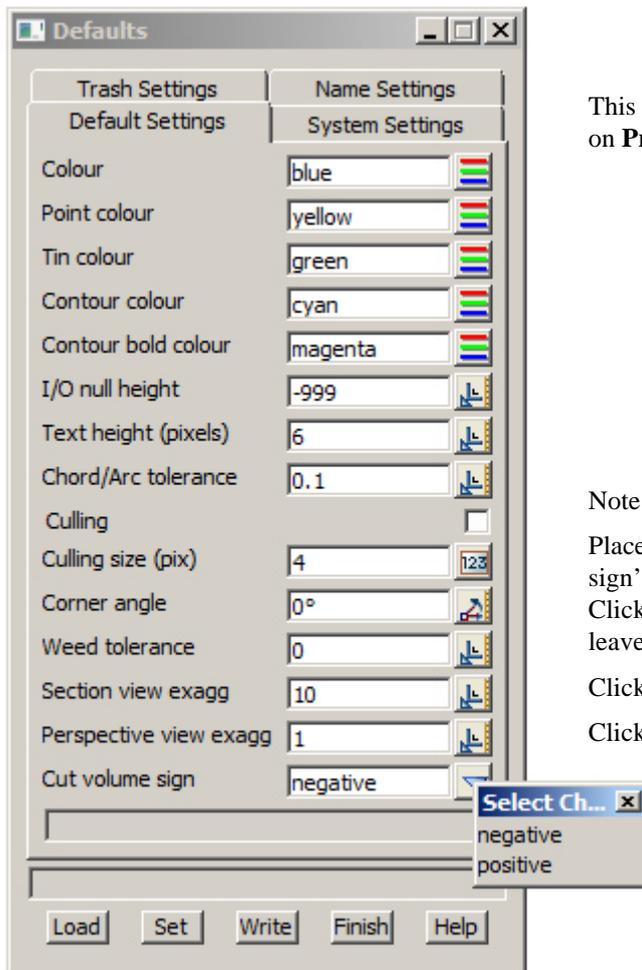
This convention is set from the Main menu. Click LB on **Project => Management => Defaults**

Note the field near the bottom of the panel.

Place the cursor on the *choice* icon for the 'Cut volume sign' field and click LB to pop up a list of alternatives. Click LB on either **positive** or **negative**. At this time, leave the value negative.

Click LB on **Set** to activate any changes.

Click LB on **Finish** to terminate the panel.

16.13   Traps to be Wary of When Designing Footings

1. Treatment at corners when radii are NOT being used

The example above used a fillet radius at each corner point on the 'footing edge' string. If you don't use a radius at each corner point then the interface string created during the template application will, by default, not generate any extra points at the change in direction.
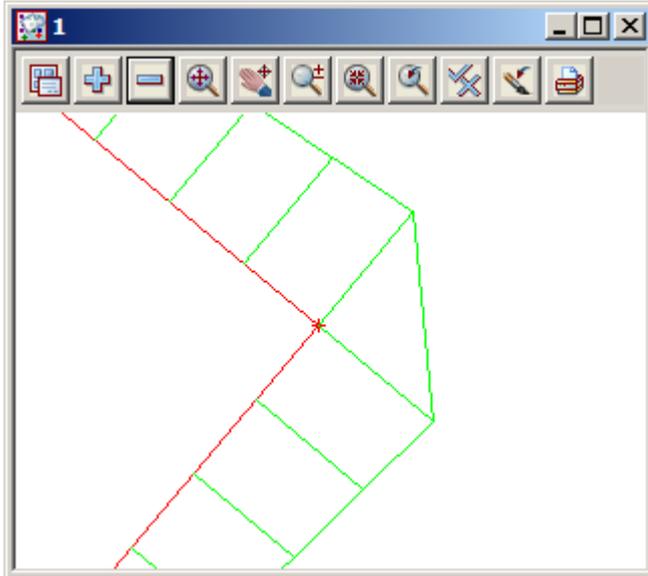
This causes the following effect at a corner point (section strings are shown).

This situation can be changed by specifying a 'corner angle'. If say a corner angle of 15 degrees is used, you will get 6 facets at a right angular change in direction rather than 1.

The corner angle value is set from the main menu by clicking LB on **Project => Management => Defaults (Default Settings tab).** See fifth item from the bottom of the panel.

Change the 'Corner angle' to 15 degrees as shown. It normally defaults to zero.

If the Interface was recalced, the corner would now appear as below
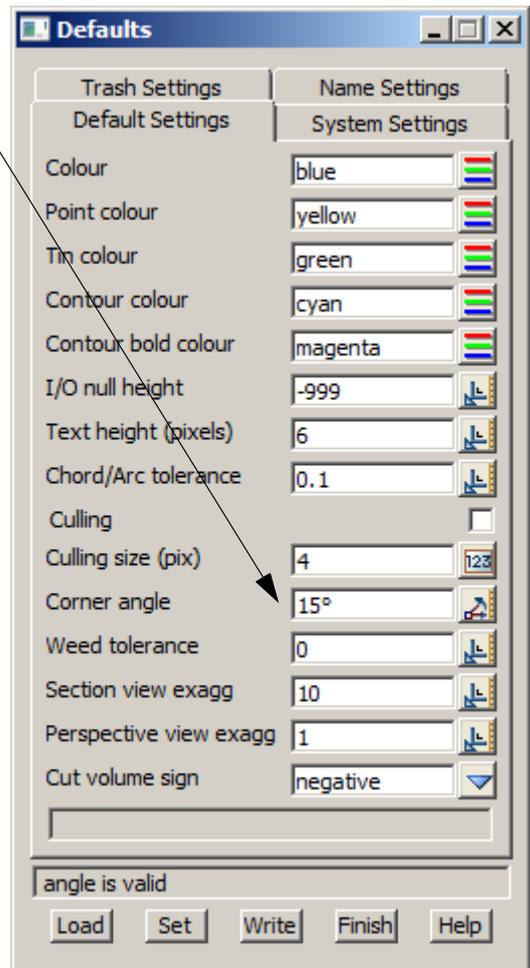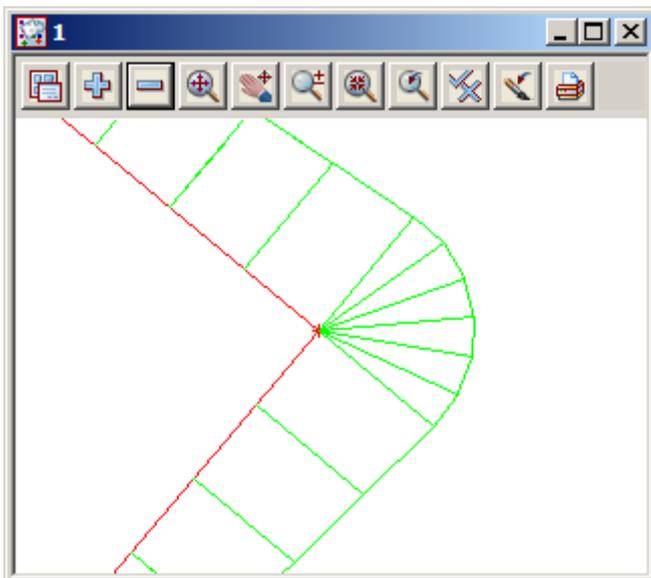
2. Internal angles
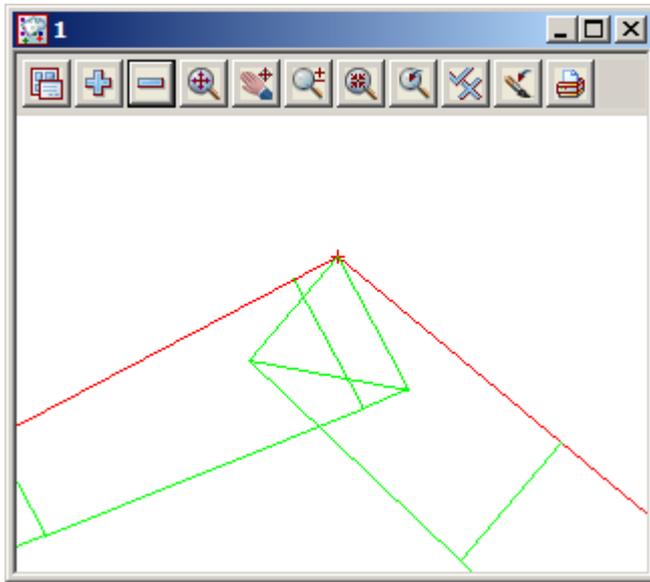
When a pad string suffers excessive changes in direction such as when the internal angle gets to be less than 90 degrees, it is sometimes possible to get the situation where batters 'cross' over one another.

Observe the shape of the interface string - beware of this effect. If you calculate volumes from such strings, you will clearly get erroneous answers.

The solution to this problem is to choose appropriate batter slopes and return angles such that this does not happen.

Alternatively, before you create your TIN you may have to edit the offending strings and take out the overlapping portions and also delete the incorrect sections.

17   Plotting

17.1   Overview

This chapter is arranged so that relevant sections appear in blocks for easy reference.

The layout of this chapter is as follows:

>   Chapter 17.10 relates to long section plotting.

>   Chapter 17.11 relates to cross section plotting.

>   Chapter 17.12 relates to plan plotting using plot frames.

>   For user convenience, each plotting section is self contained (requiring some duplication).

The data used for the plotting has been built up by working through the Getting Started manual. If you have not worked through the Getting Started Manual to this point then, you can import the 12d Ascii file **Chapter 17.12da**, which will bring you up to this point. This is in the folder **C:\12d\9.00\Training\design\getting started basic**

17.2   Triangulating the Road

In order to calculate the volumes and display the quantities in the long section plots we need to create a surface of the road.
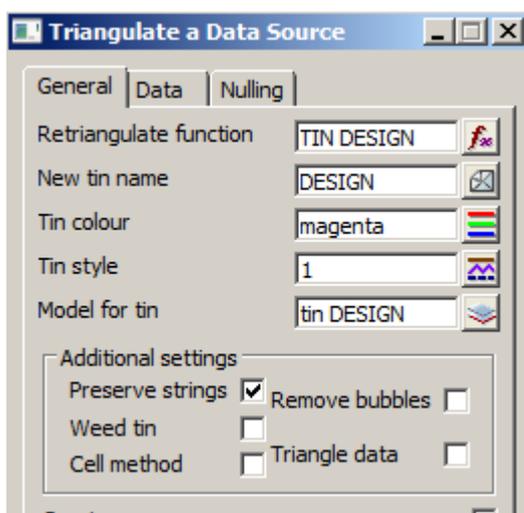
Create the TIN 'DESIGN' for the road by turning all the models off the view Plan 1 and adding just the **ROAD 1 Sects** and **Strs** models.

Create the TIN **DESIGN** using *Tins=>Create=>Triangulate data* with data source *View* and view Plan 1. When you create the road design using the Apply function, 12d also creates a number of polygons that capture the various elements.

You could use the polygon that encases the road as your 'Null polygon' or alternatively you can set the 'Length' field to 1m and 12d will null out all the triangles outside the interface strings.
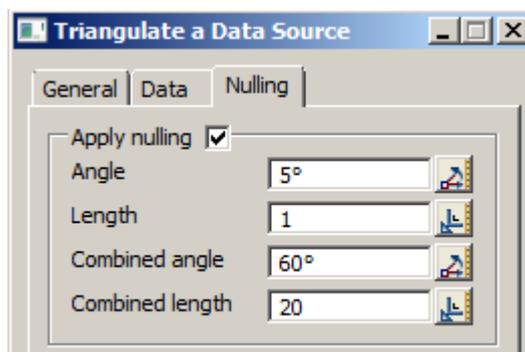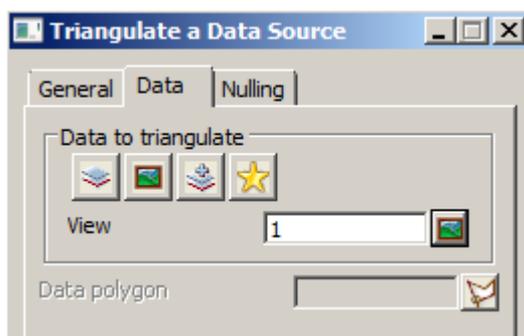
PRACTISE VERSION: To keep the number of points below 5,000, the road data has been created with sections at a 50m interval rather than 5m. This means that the pictures are not exactly as they appear in the manual when running with the Practise version.

17.3   Plot devices

12d can generate plots to various devices. Firstly, it supports a full interface to Windows so it can create plots on any device that is supported by Microsoft Windows.
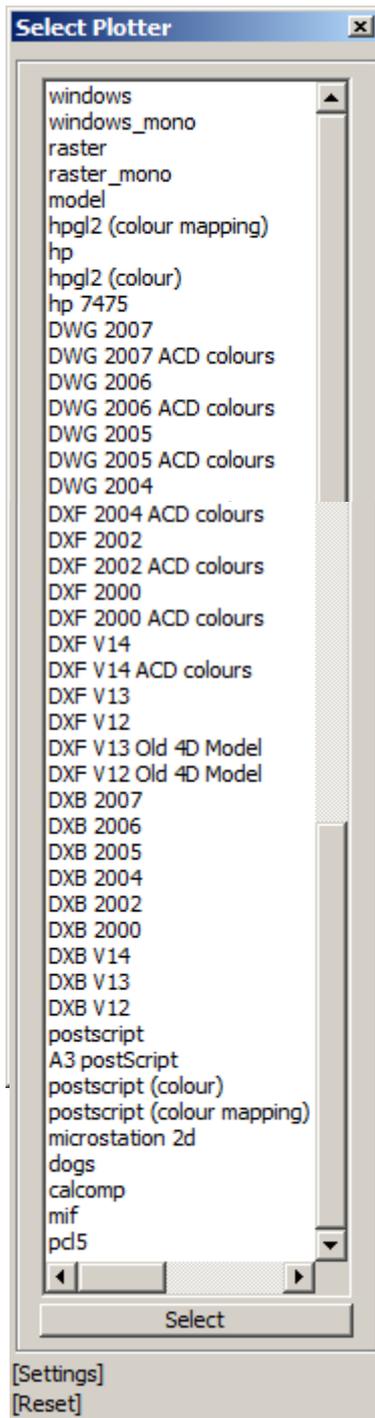
12d also supports various popular plotting devices in their native format so it can plot directly to Hewlett Packard pen, inkjet and laserjet printers/plotters. 12d supports Postscript, HPGL2 and PCL5 plotters directly and plotters that emulate these devices.

We also talk about the concept of 'plotting to CAD' where we treat CAD as just another plot device. This process generates a native CAD file which can subsequently be read in by your CAD system, manipulated further if required and then plotted from your CAD system. We can plot to AutoCAD (DWG, DXF or DXB) or Microstation (DGN).

The list on the left shows the standard 'plotter types' available for 12d users.

When selecting a device type to plot to, the popup list of 'plotter types' available is customisable so the list can include line items such as 'Mary's inkjet – 2nd floor'. You could remove line items or plotter types that are irrelevant to your organisation.

When transferring your 12d data to CAD, the list can also have multiple line items that further customise the transfer. For instance, when you pick 'DXF 2007' (the default transfer mechanism), data is transferred to AutoCAD such that colour numbers are maintained. As colour 2 in 12d is green but colour 2 in AutoCAD is yellow for instance, you will see colour changes when you transfer data to AutoCAD without customisation.

One of the line options typically implemented is 'DXF 2007 ACD colours' so that green in 12d stays as green when transferred to AutoCAD, etc.

Another line item might be 'DXF 2007 Check plot' so that all colours in 12d transfer to AutoCAD with one colour (for one pen).

Another line item could be 'DXF 2007 Customised transfer'. This is where you decide that red lines in 12d such as cross sections are always to become green lines in AutoCAD because your current CAD standard is that green lines always plots as a 0.25 pen and you want your cross sections to always appear 0.25 wide.

Finally, we also talk about 'plotting to a model' so one of the plot device types is 'model'. This is a technique for previewing a plot. See Chapter 17.6 below for more information on 'Previewing plots'.

All of this customisation of the available 'plotter types' is implemented via the **plotters.4d** file which is documented in the 12d Reference manual in Appendix N, 'Plotters and Plotting'.

17.4   General Plotting Issues

Plot parameters:

The appearance of finished plots is user definable. There are a large number of plot parameters that govern what is included on the plot and how it appears. Plots are created from plot parameter files (known as ppf files). Each parameter has a default value so that even if you perform a plot without supplying a ppf, you will still get a plot. Part of the customisation of 12d is deciding which parameters you require to achieve your drawing standard. Once the standard is achieved you will find that you can use the same ppf files from job to job with minimal or no changes. One advantage of this approach is that regardless of the skills of the operator, a common presentation standard of plotted documentation is achieved.

The training data gives you samples of typical ppf's to achieve common engineering standards for plan, long and cross section plots. It is recommended that users new to 12d take a copy of these and use them as a starting point for their own customisation.

Text:

Whilst some plotting in 12d is (What you see is what you get), 12d will in general adopt final sizes for text that are different from what you see on your screen. Text that is just large enough to be read on your screen would be much too large when plotted on say an A1 sheet. Thus all text on the screen has a default size and probably a different default size when plotted to a device. The size of plotted text is typically set in a ppf file as discussed above. Once this is set for a particular users corporate standard and sheet size, it rarely needs changing so is largely transparent to the user.

For screen text that has no plot parameter equivalent defining it's plotted size, there is an overall governing parameter that relates screen text to plotted text. This parameter is set from **Plot => Plotting Setup => Pixels to mm**. You can set this as you require. The default value is 0.5. This means that screen text that is say 10 pixels high will plot at 5 mm high.

Text that is created in paper units don't require any editing prior to plotting. To ensure the text appears at the same size as the proposed plot we change the Plot scale to the required value to match the final plot

To set the plot scale select the Menu icon in the relevant view and then select **Settings=>Plotting scale**
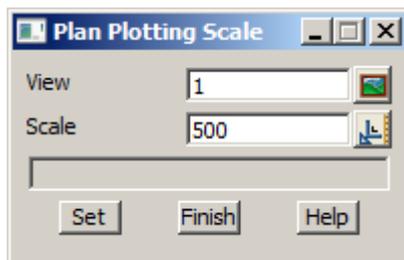
Type in the plot scale required

When plotting direct from 12d to a plot device such as an inkjet printer, it is possible to map 12d colours to pen (line thickness) size.

Fonts:

12d supports most AutoCAD .shp files as well as Windows True Type fonts. The standard install supplies you with sufficient fonts to get started – typically ISO, ISOEQ, GOTHIC, HELV, HELVL, MONO, ITALICC, SCRIPT, ROMANC and ROMANS. See files **textstyl.4d** and **fonts.4d** for more information.

Plot files and queues:

In general, whenever 12d creates a finished plot file for a hard copy device, it will only place the file in the local working folder (one level up from the .project folder). The exception to this is when plotting to the Microsoft Windows interface. In such case Windows takes over the control of the file and sends it to the device automatically.

Thus in general, plot files are not automatically submitted to any plot queue. It is the users responsibility to then place the plot in an appropriate queue, decide when it will be plotted, decide on the number of copies etc.

It is possible to have Windows run a background batch file that will automatically place any plot files in a plot queue.

Similarly, when the plot device is a CAD system, the CAD file will be written to the local working folder. After writing the CAD file, the user can then issues an Alt-Tab command to transfer Windows control from 12d to their CAD system, and then opens the file.

17.5   Windows Based Plotting

In the list of 'plotter types' shown above, there is **windows** and **windows_mono**. These devices interface directly with Microsoft Windows (version 98 onwards). This allows you to plot direct to any Windows device on the network. All plot queue issues are handled direct by Windows. The plot file is deleted at the end of the plot.

17.6   Previewing Plots

To save wasting paper, we strongly recommend that all plots be previewed before sending them to their final device.

We do this by writing the plot file to a model which is stored in the normal 12d database just like any other string data. As plot files are simple 2d files in an X-Y plane, such data is readily displayed in any plan view. We can then preview the plot in any Plan view by turning on the model of plotted data. The units used for plot files in 12d are the industry standard units for plotting - millimetres. For this reason it is important that you turn all other models off when previewing plot files. If you don't, your plot may well be mixed in with real world coordinate data. This will make the plot appear very small and probably in the extreme lower left corner of your screen, near the origin.

It is possible to do a 'plot of a plot'. This is sometimes useful when you want to make minor changes to (say) a long section plot, maybe add some new text. Remember that all plots are in millimetres so that if you add text to such a plot, you do it at full size. Create text 5 high if you want it to plot at 5 mm on the finished sheet.

After doing such changes, you then click LB on **Plot=>Plot** from the View Title Area. In the Scale 1: field, type in 1000. This will keep your second plot in millimetres. If you then preview the second plot, you should see the final plot with the changes implemented. To then reissue the final plot, simply change the Plotter type to the desired device and reclick the **Plot** button.

If after doing a plot, you decide that you need to change something and redo the plot, it is important that you clean out the old plot before you reissue the plot command again. The reason for this is that 12d just treats plot data like any other data in the database. Plots can be cleaned by simply ticking the relevant check box at the time of creating the plot. See Chapter 17.11.2 and Chapter 17.12.4 for managing previewed plots for cross and plan plots respectively.

17.7   Overview of Plotting

We will look at six of the many types of plots available.

1. Quick Plan plots

2. Quick Section plots

3. Quick Perspective plots

4. Sheets of Long Sections

5. Sheets of Cross Sections

6. Sheets of Plan plot frames

Each of these plot types will now be discussed in detail.

Apart from these six plot types, there are also others such as Drainage plots, Sewer plots and Pipeline plots which will not be discussed in this Chapter.

To preview our plots in 12d Model we need a Plan view that is not displaying any data. Before continuing, create a new one with the name PREVIEW using **View=>Create=>Plan view**.

We will use view PREVIEW for the purpose of previewing plots.

17.8   Quick plots

The key purpose of this type of plot is for occasions where the scale of the plot is less important than the contents. For example, if you needed to table a drawing at a meeting showing a certain detail, all that is needed is that you get the detail up on your screen and zoom in on it until you see the extents of your area of interest. You then create a plot and you will get exactly what you saw on the screen.

17.8.1 Quick Plan Plots

In 12d Model 9 there are now two ways to create a quick plot. The original quick plot option remains along with a new option (Quick Sheet Plot) that allows the use of a dynamic sheet size

Quick Plot

Before we start we need to get some standard data up on display.

Ensure that in View 'Plan 1' just the models shown below are in the view:
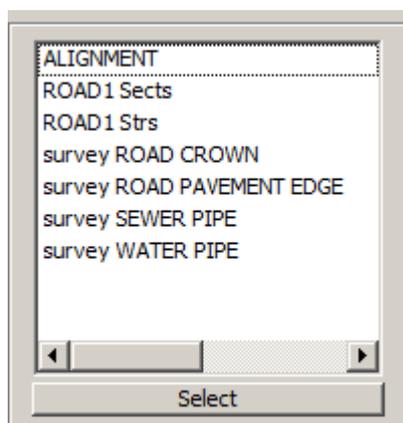
Your 'Plan 1' view should look as shown below.
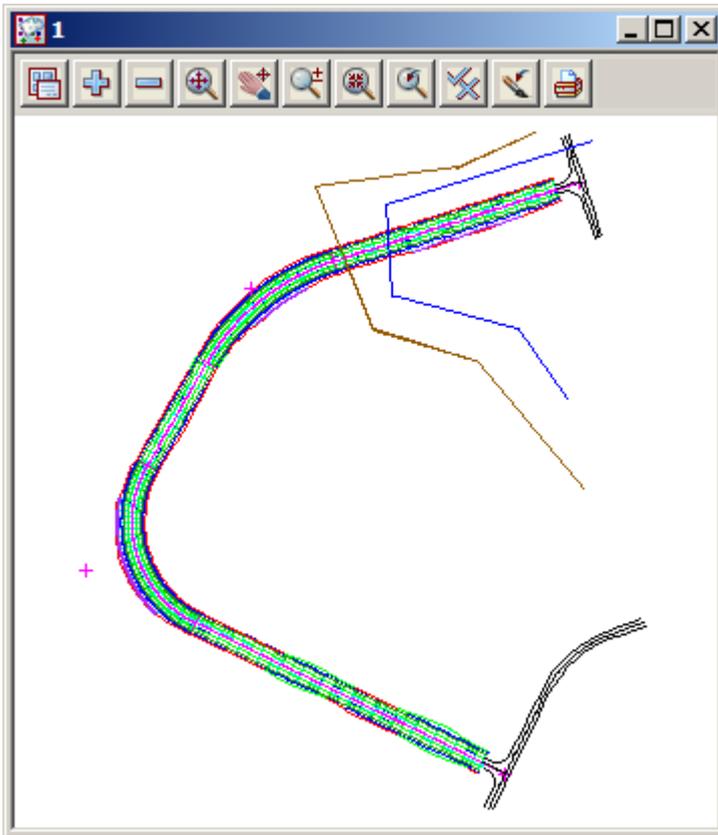
Zoom in on the lower intersection area

We will now plot the zoomed data on display in View 'Plan 1'.
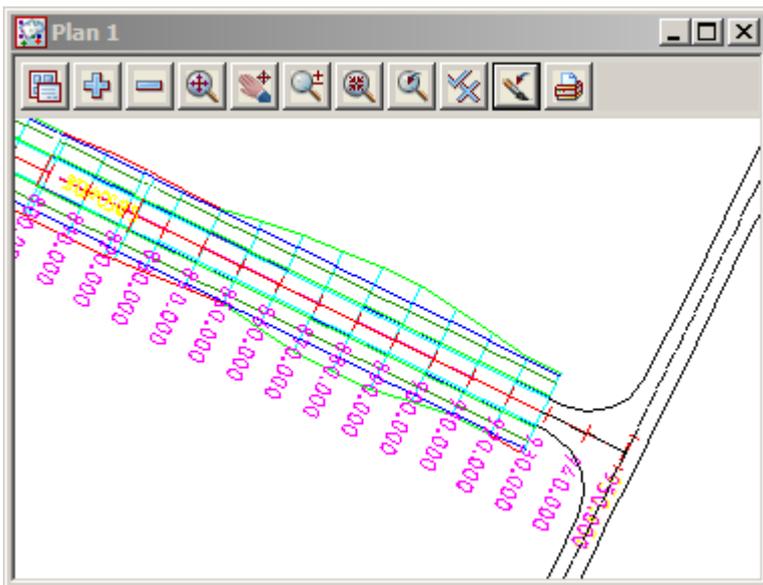
If you want the finished plot to assume the general shape of say, an A1 sheet, drag the edges of your view until the height/width ratio of the screen resembles the sheet i.e. wider than it is high.

From the View Button Area for View 'Plan 1', click LB on the printer icon in the view buttons area and select **Quick Plot**.
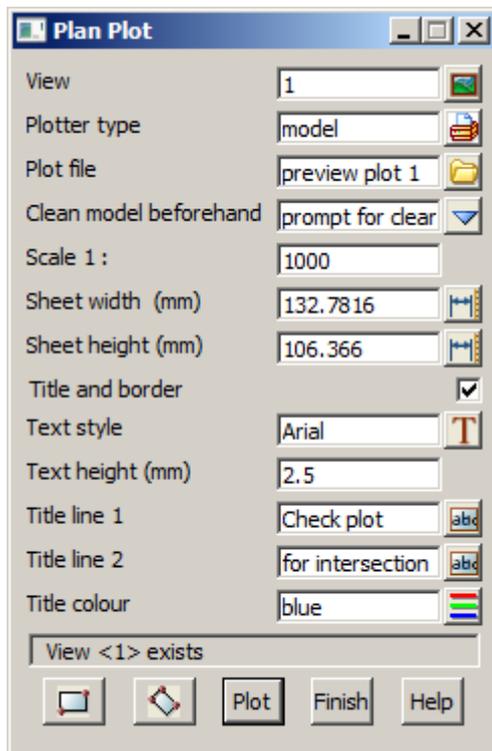
Fill in the panel as shown. Make sure that the plotter type is **model** so that we can preview the plot.

Type in **preview plot 1** for the model name

Select **prompt for clean** as clean model mode

In the scale field, type 1000 and press the Enter key. The aspect ratio of the 'Plan 1' view will determine the sheet **width** and **height** returned. It is possible to type in any one of these three numbers and 12d will calculate the other two. For instance to fill an A1 sheet where you are not interested in the scale of the plot, type in a width of 841. The easiest method is to use the rectangle option at the bottom of the panel to draw a rectangle around the data. Try to keep the proportions as close to a sheet of paper as possible.

By default, a simple title and border are created. Leave the box ticked and type in two lines of text as shown. These lines will appear at the bottom left of the plot, in the title box area.

Click LB on the **Plot** button.

Now go to View 'Plan Preview' and use the '+' sign to turn on model **preview quick plot**.
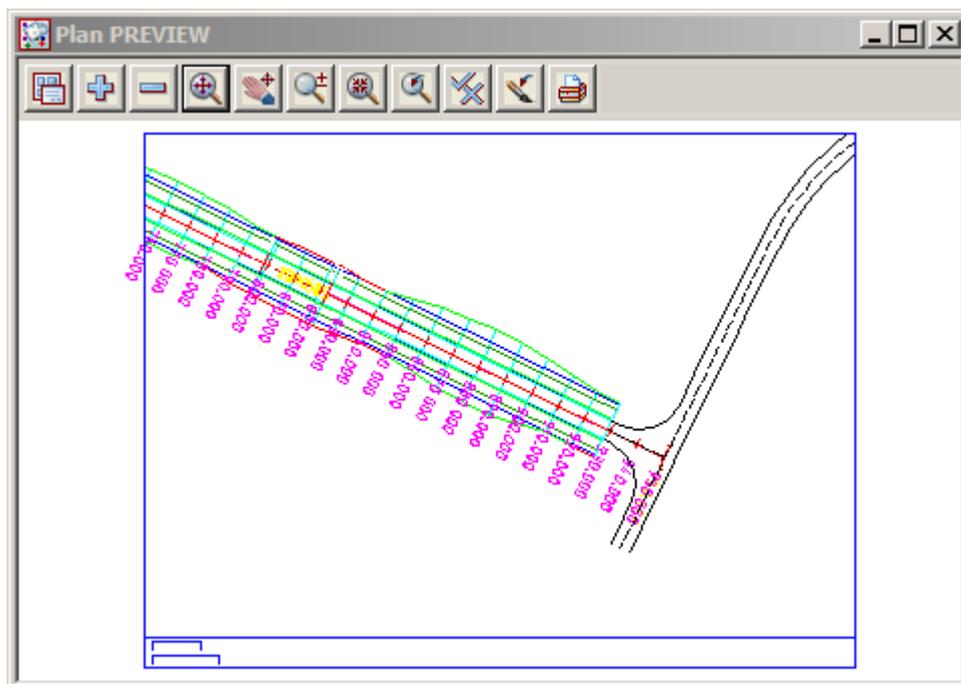
Your finished plot should look as shown above.

Firstly, ensure your POINT snap is ON. If you do a string inquire (F2) on the cyan string at the bottom left corner of the plot, observe the X and Y coordinates returned. The bottom left corner of the plot is at the origin X=5 and Y=5. The plot has automatically added a 5 unit margin inside the Sheet width values

The point to note is that the plots are in <u>millimetre units</u> but when they are plotted to a model to preview and work with inside 12d Model, the plot data has been multiplied by 1000.0. Hence the 10mm title block was of size 10 units in the plan view, not 0.010 as you would first think.

Quick sheet Plot

Return to the Plan 1 view but zoom out a bit from the previous settings
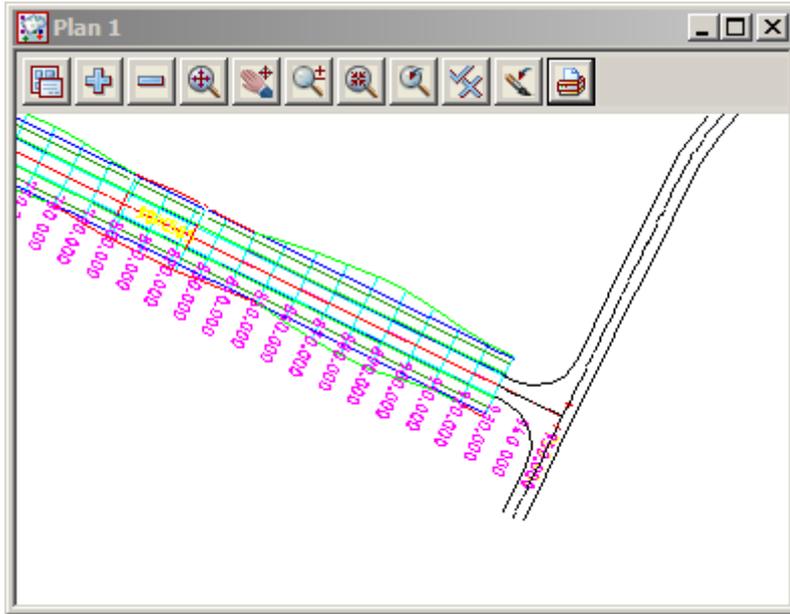
From the View Button Area for View 'Plan 1', click LB on the printer icon in the view buttons area and select
Quick Sheet Plot
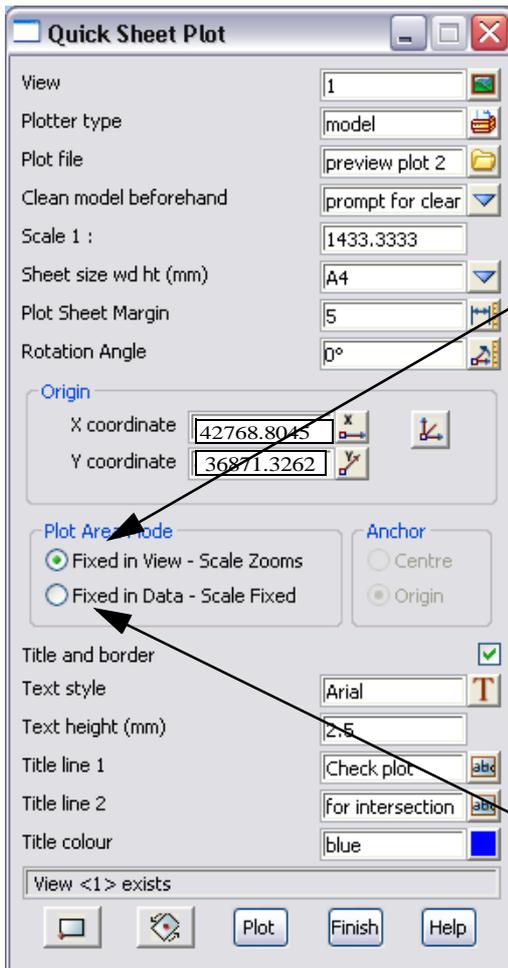
.

Fill in the panel as shown. Make sure that the plotter type is **model** so that we can preview the plot.

Type in **preview plot 2** for the model name

Select **prompt for clean** as clean model mode

There are two types of methods of controlling the box representing the sheet to be plotted. The first is *Fixed in View*

Using this option the view can be zoomed in or out and the plot frame size stays linked to the view edge
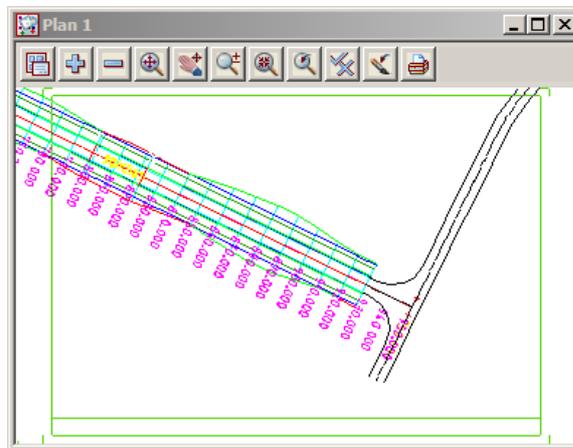
For *Fixed in Data*, the plot frame keeps its size relative to the data when zooming and panning.

We will select Fixed in Data.
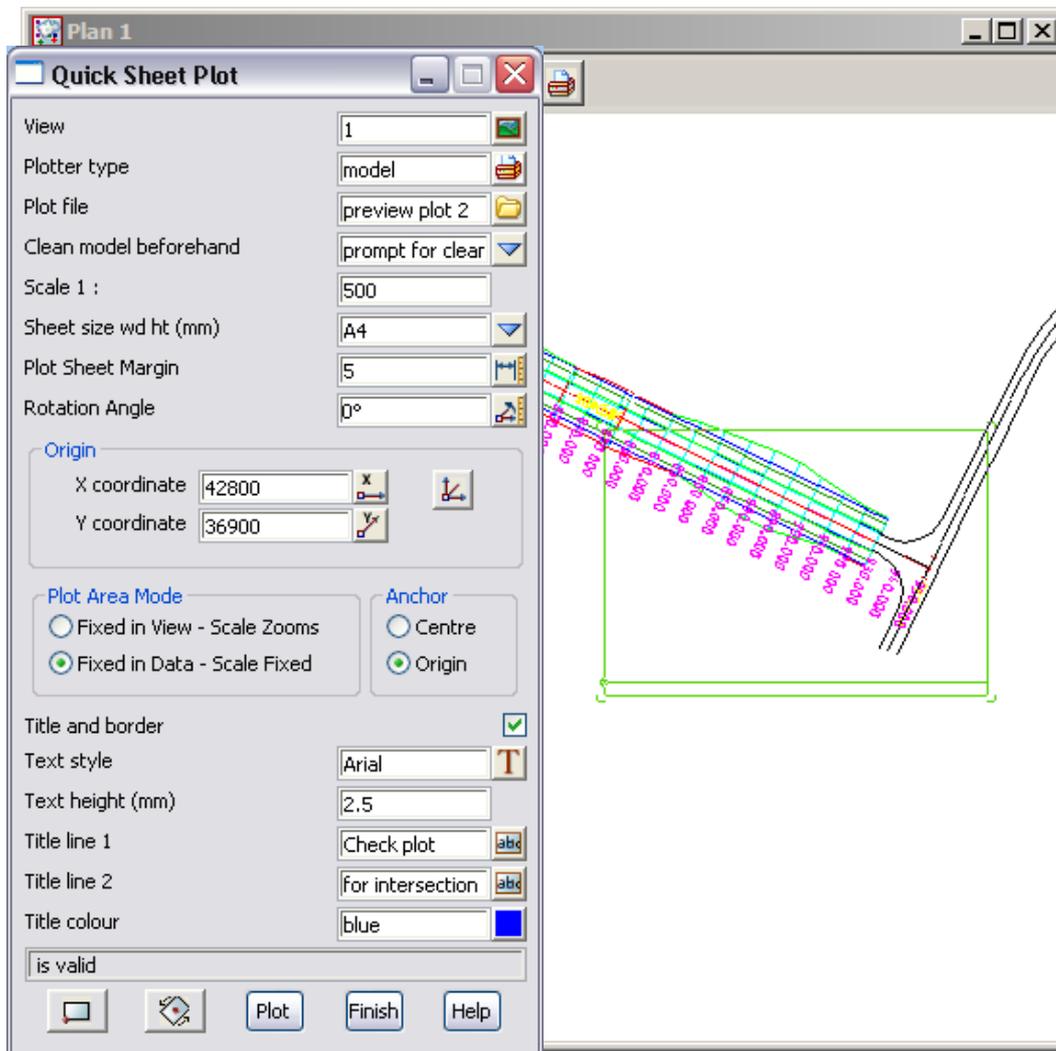
The panel above uses a scale of **1:500**, and **A4** sheet size and a bottom left origin of **E42800 N36900**

In view **PREVIEW** turn off the previous preview model and turn on **preview plot 2**

Your finished plot should look the same as shown below.
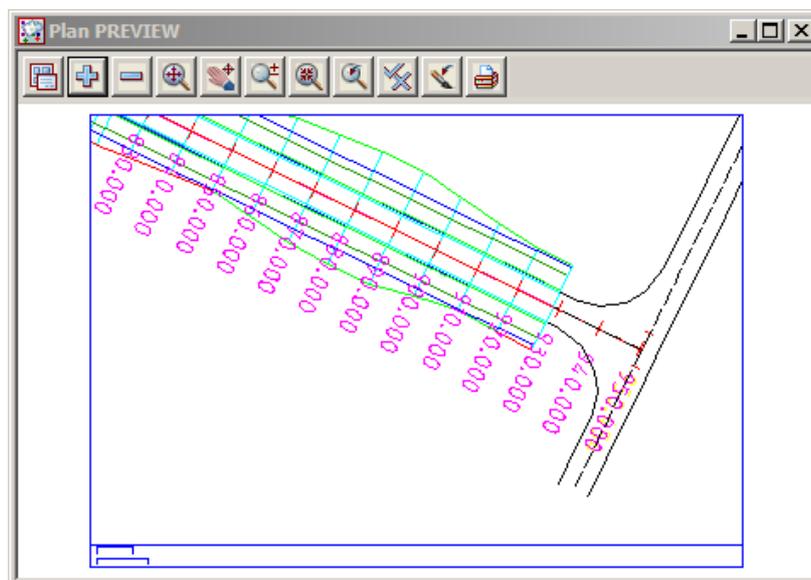
17.8.2 Quick Section Plots

This is very similar to the Quick Plan plot we have just finished.

We will investigate this facility by profiling our 'ROAD1' centreline string in view 'Section LONG'. From the View Title Area of view 'Section LONG', click LB on the **Profile** button and select the magenta centreline string on display in view 'Plan 1'. Make sure you select the alignment string. It can often be easier to pick the IP points rather than the string itself.

If you turn on the tin GROUND model along with the pipes, **survey SEWER PIPE** and **survey WATER PIPE** and ensure that your grid is still toggled on, then your section view should be as shown below.

Set the corridor back to the values defined in chapter 14.5

Zoom in on the portion of the profile where the services cross under the road.
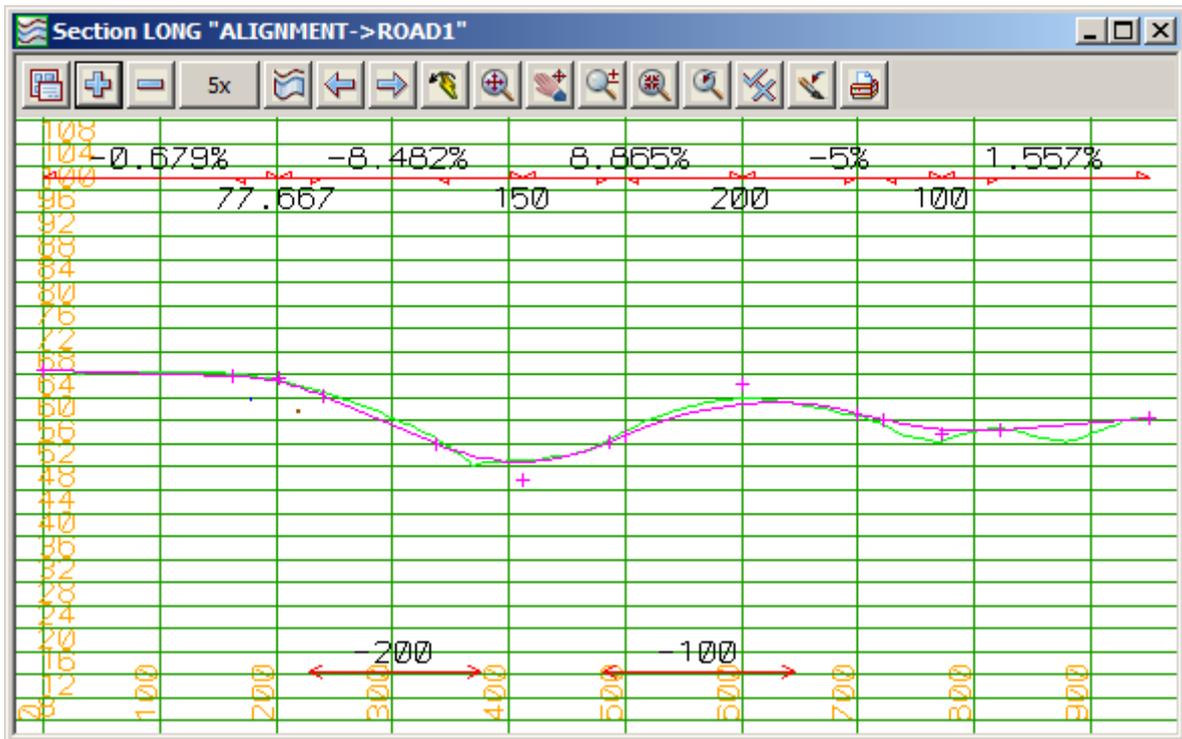
You should now see the following. Note the services under the road. Also note that even though we asked for the vertical grid to be 1 m apart, the grid will only display in full at this separation when the view is uncluttered. If 12d thinks the view will be too cluttered when you are Zoomed out, it will only display some of the requested grid lines as seen above.
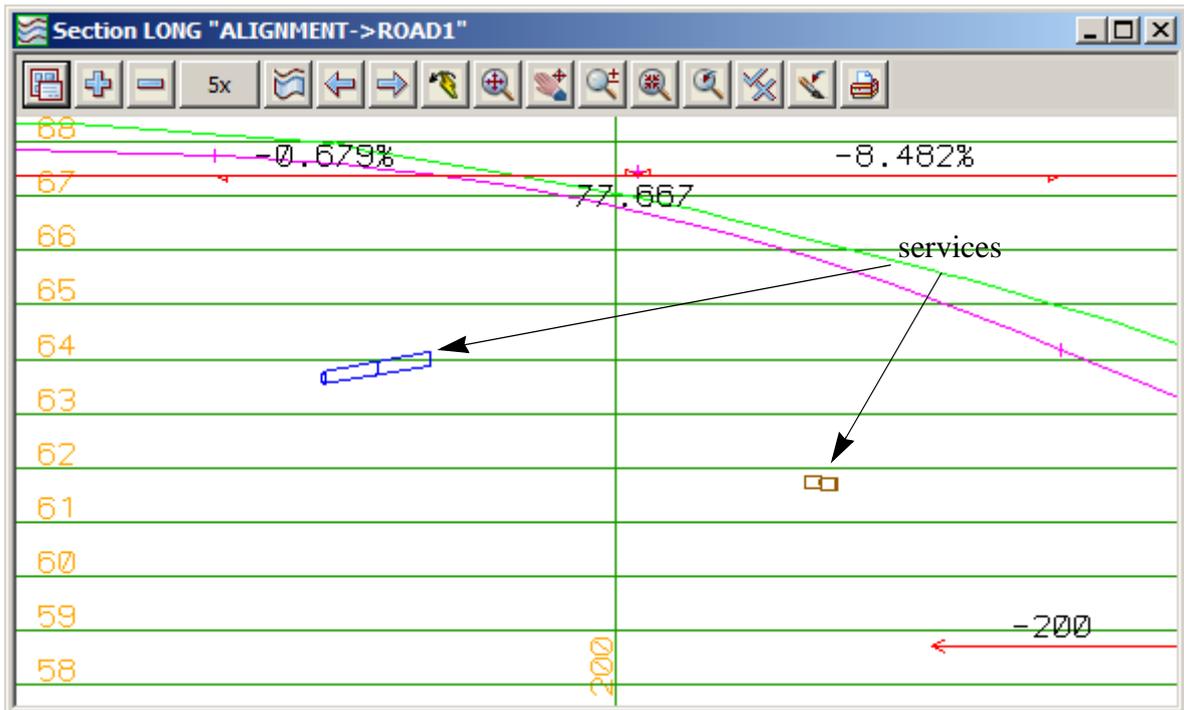
From the View Title Area of view 'Section LONG', click LB on **Menu=>Settings=>Geom annot**
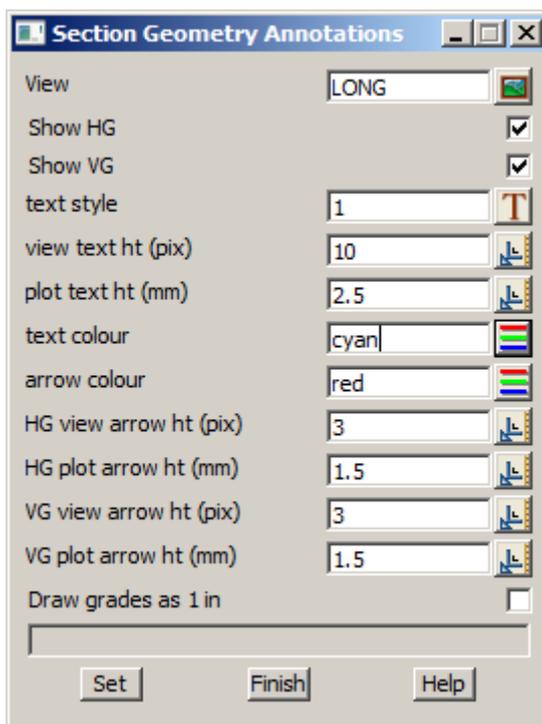
Note that you can set the screen text height in pixels independently of how the same text will appear in height on the finished plot.

Click LB on **Set** and **Finish**.

We will now create the Section view plot. From the View Button Area for View 'Section LONG', click LB on **Plot=>Plot**

Fill in the panel as shown. Make sure that the plotter type is **model** so that we can preview the plot.
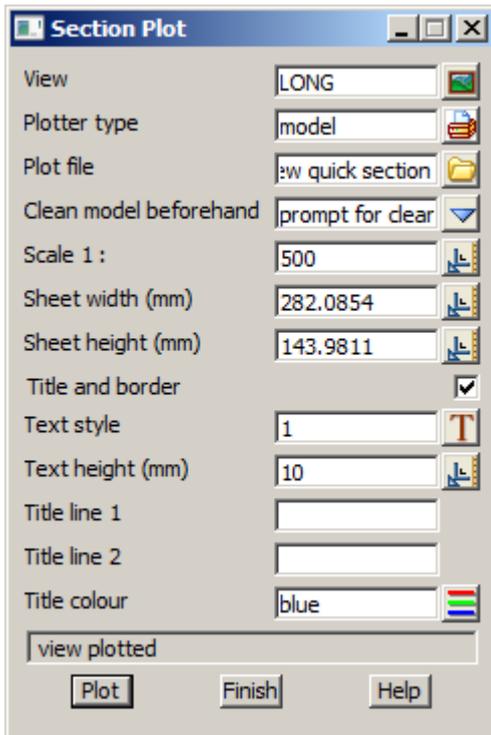
Fill in the panel as shown. Make sure that the plotter type is **model** so that we can preview the plot.

Type in **preview quick section** for the model name

Select **prompt for clean** as clean model mode

In the scale field, type 500 and press the Enter key. The aspect ratio of the 'Section LONG' view will determine the sheet **width** and **height** returned. It is possible to type in any one of these three numbers and 12d will calculate the other two. For instance to fill an A1 sheet where you are not interested in the scale of the plot, type in a width of 841.

By default, a simple title and border are created. Leave the box ticked. This time leave the Title lines blank.

We can set the textstyle to ISO to get the title text to appear with that font.

Click LB on the **Plot** button.

Now go to View 'PREVIEW' and use the '-' sign to turn OFF model **preview plot 2** and then turn ON model **preview quick section**.
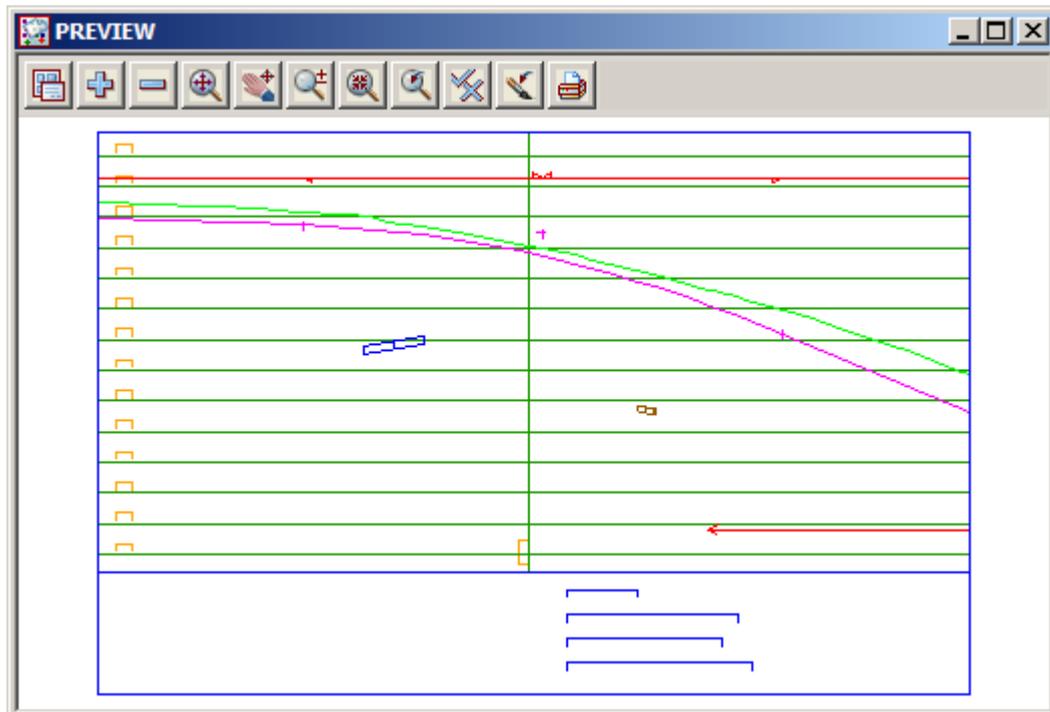
Note that, in general, the plotted text may have a different height to that in the Section view.

If the plot is satisfactory, the user can send the plot to a device. Simply select an appropriate device from the plotter icon and then Click LB on the **Plot** button.
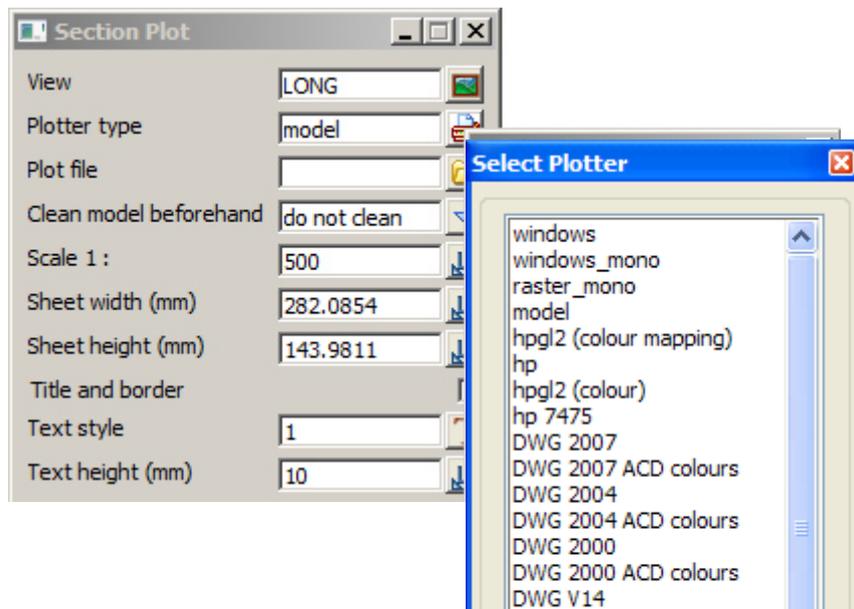
17.8.3   Quick Perspective OpenGL 2

This is very similar to the Plan and Section plots above. The **Orbit, Joystick**, **String Drive** or **String Walk** options can be used together with the **Zoom** options to establish the extents of what you can see. To get a plot of this is very similar to the above except with regard to the plot size. The plot size can only be established by trial and error.

To start off, just use any of the above tools to get some data on display in your 'Perspective OpenGL 2' view. In our case we turned on tin 'DESIGN' after doing a String Drive. Let us assume that this is the data we wish to plot

.
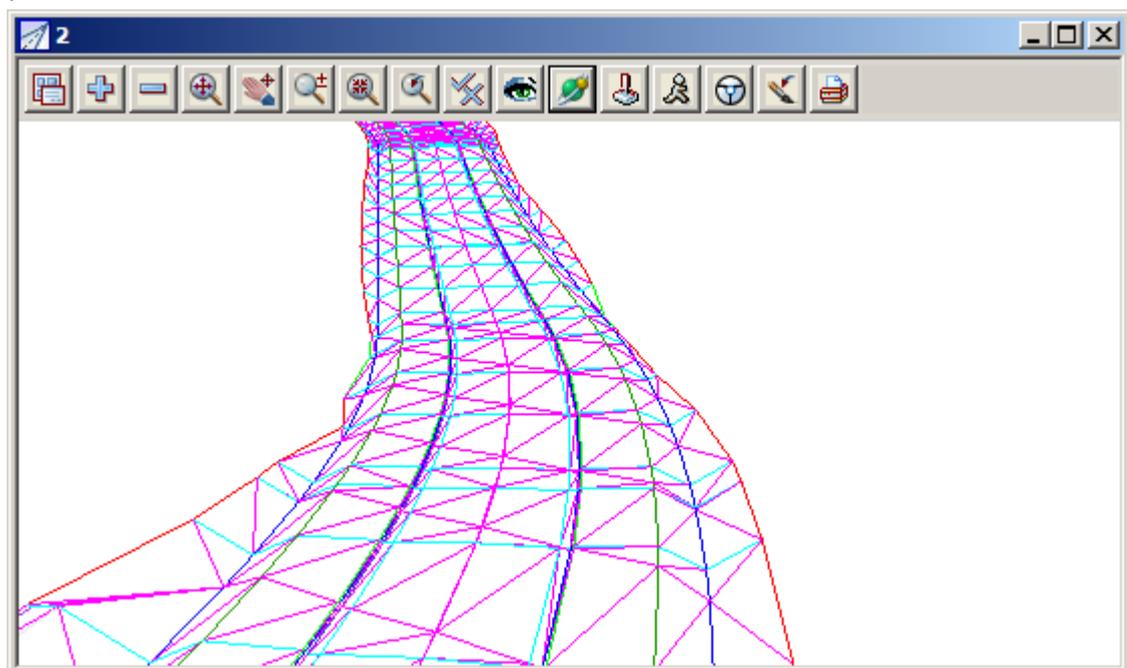
Click LB on **Plot=>Plot** from the View Button Area of View 'Perspective OpenGL 2'.
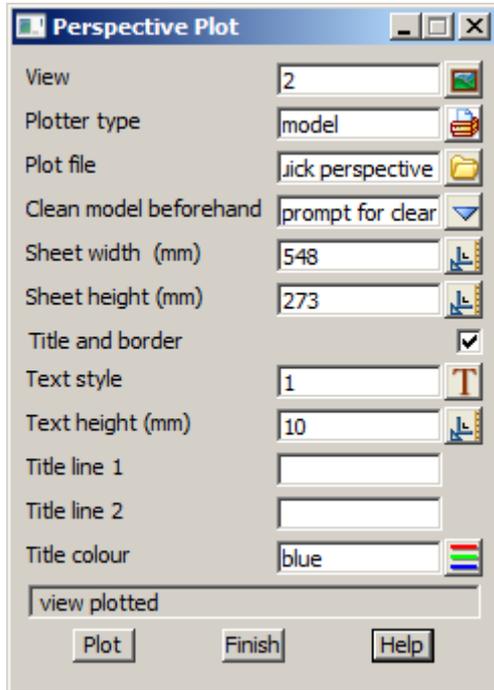
In the 'Plot file' field, type in **preview quick perspective**.

Select **prompt for clear** as clean model mode

Note that the sheet width and height are already returned.

If your plot is too large, you need to reduce the physical width and height of your 'Perspective OpenGL 2' Window to make the plot smaller. Drag the margins of the view as appropriate.

After you have changed the size of the view, place the cursor in the 'View' field (after the 2) and press the Enter key. The sheet size will be updated.

Click LB on the **Plot** button to generate the plot.

Now go to View 'PREVIEW' and turn OFF model **preview quick section** and turn ON model **preview quick perspective**. Your previewed plot should look as follows.
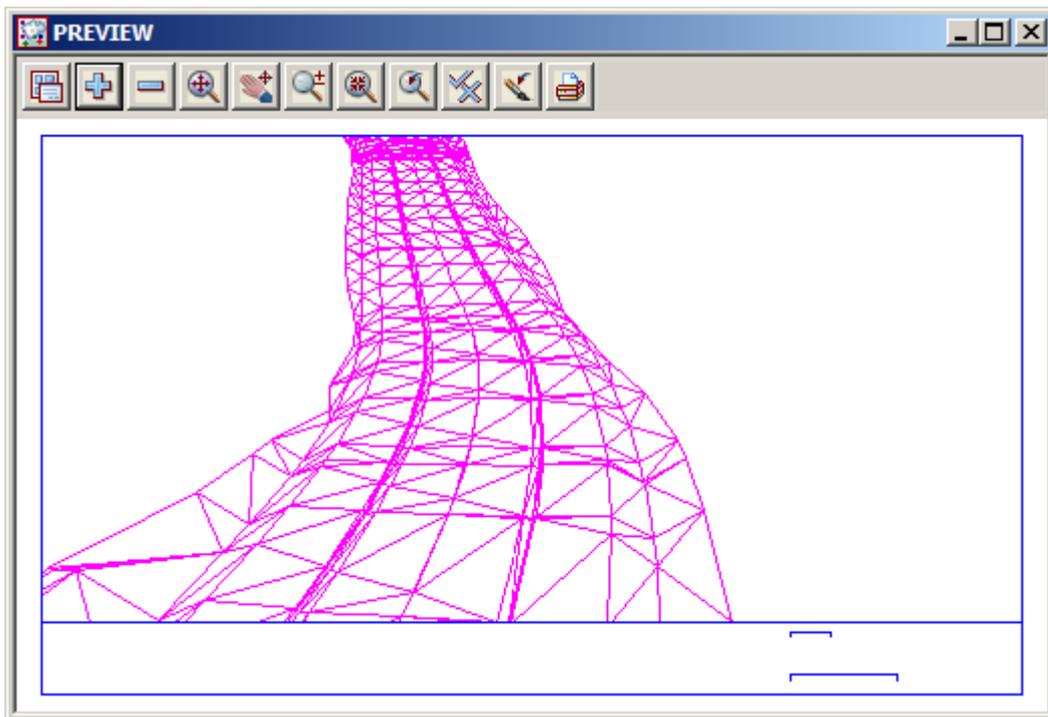
In view 'Perspective OpenGL 2' **Toggle=>Shade**. Your view should now look as shown.
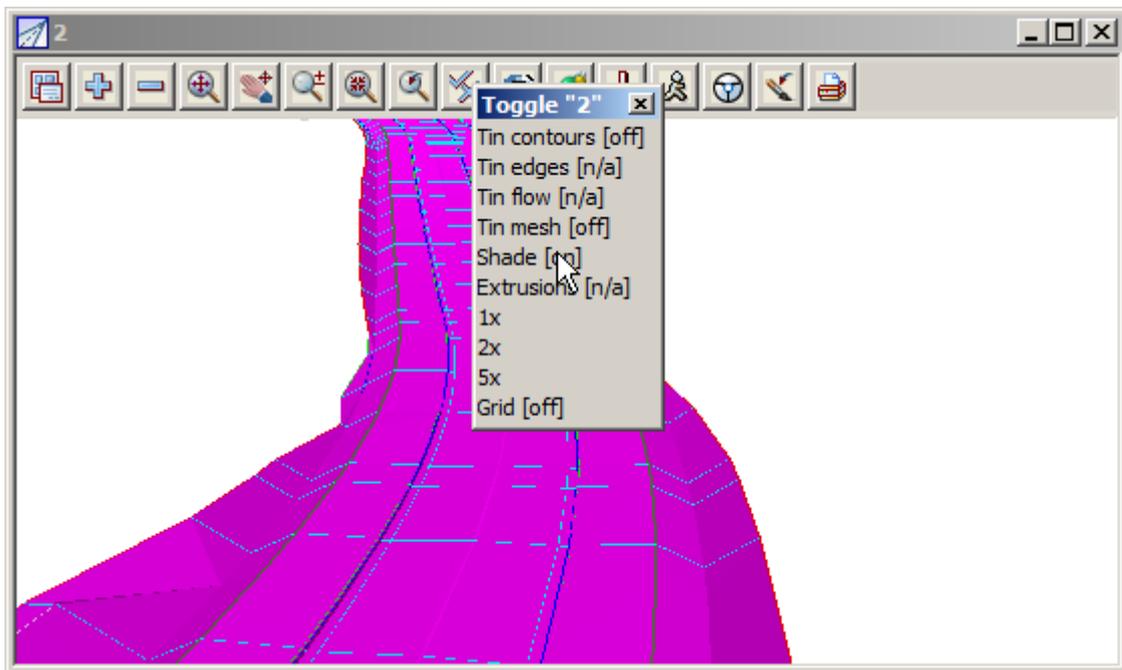
If the plot was repeated, shading will now appear in the finished plot. In view 'Perspective OpenGL 2', use **Toggle=>Shade** again to toggle it OFF when finished.

If the plot is satisfactory, the user can send the plot to a device. Simply select an appropriate device from the plotter icon and then Click LB on the **Plot** button.
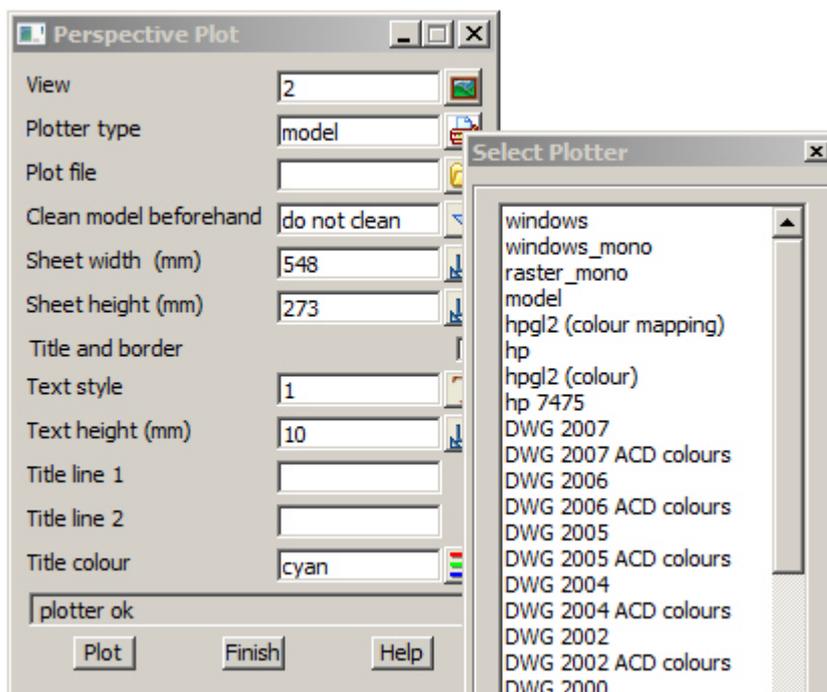
17.8.4   Quick Hidden Line Perspective

This is very similar to the Perspective plot above. This facility just allows you to create a hidden line perspective plot of any information that sits on the selected TIN.

From the View Button Area of View 'Perspective OpenGL 2', click LB on **Menu=>Settings=>Hide**.
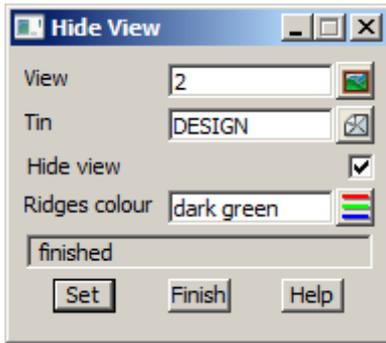
Select TIN **DESIGN** and tick the 'Hide view' tick box.

Click LB on **Set** and **Finish**.
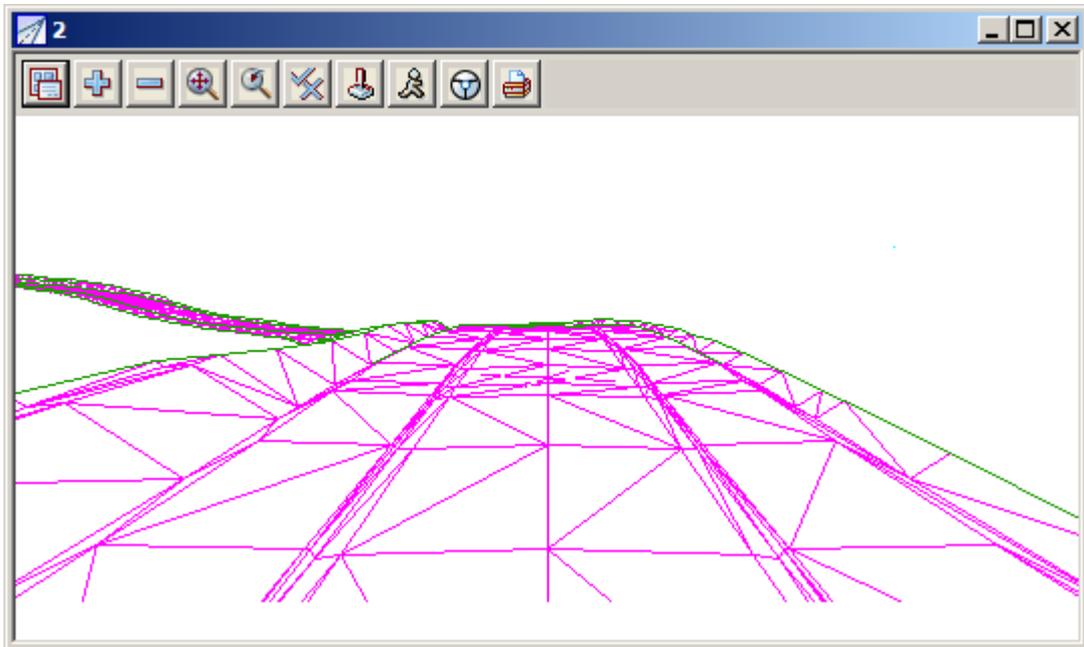
Click LB on **Plot=>Plot** from the View Button Area of View '2' and repeat the process explained above to generate the plot. Instead of name **preview quick perspective** use **preview quick hide** as the name of the model.

Now go to View PREVIEW and turn OFF model **preview quick perspective** and turn ON model **preview quick hide**. Your previewed plot should look as follows.
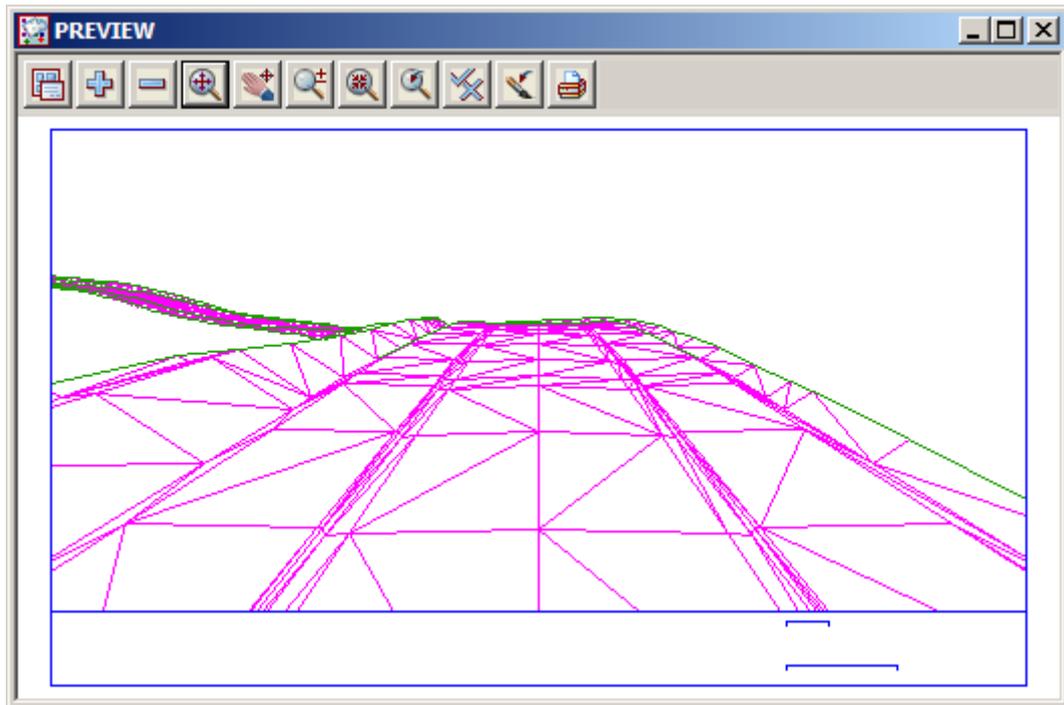
17.9 Plotting Using Plot Parameters

Often a higher quality plot is required than what the plots already described can produce.

This is especially true for long sections and cross section plots where many pages of plots are required and the layout includes large amounts of additional information such as the labelling of chainages, heights, depths, alignment geometry and services.

In early versions of 12d Model, the way more complex plots could be produced was controlled using text files called plot parameter files (ppf's for short).

PPF's consist of a large number of parameters and values which gives the user tremendous flexibility on the way the plots look but the disadvantage was that the PPF's could only be created and modified using a text editor.

Since the release of 12d Model V6.0, interactive PPF editors were introduced to allow the user to create and modify the plot parameters without needing a text editor.

This made the use of plot parameters more accessible to all users.

The interactive PPF editors store and edit information in a binary format which can't be read by a text editor.

17.10 Plotting sheets of Long sections

First you need a Section view. We will use view Section LONG to illustrate the plotting of long sections that involve multiple sheets.

In your chosen view you need to profile the Alignment string that you wish to plot. Make sure that view Section LONG has the ROAD1 string profiled.

Also make sure that the vertical exaggeration of view Section LONG is set to [2].

In the View Title Area of view Section LONG, click LB on **Toggle=>Grid** to turn the grid OFF.

To run the 'Long Section Plot PPF Editor' either click LB on the Printer icon in view Section LONG
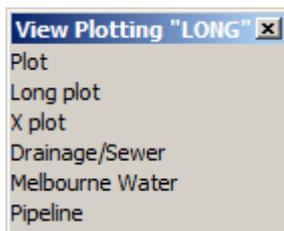
   Select **Long plot**

Or by clicking LB on the Main menu option **Plot=>Plot and PPF editors=>Long Sections**. If this method is chosen then the *Section view* number is not be automatically filled in and must be given by the user.
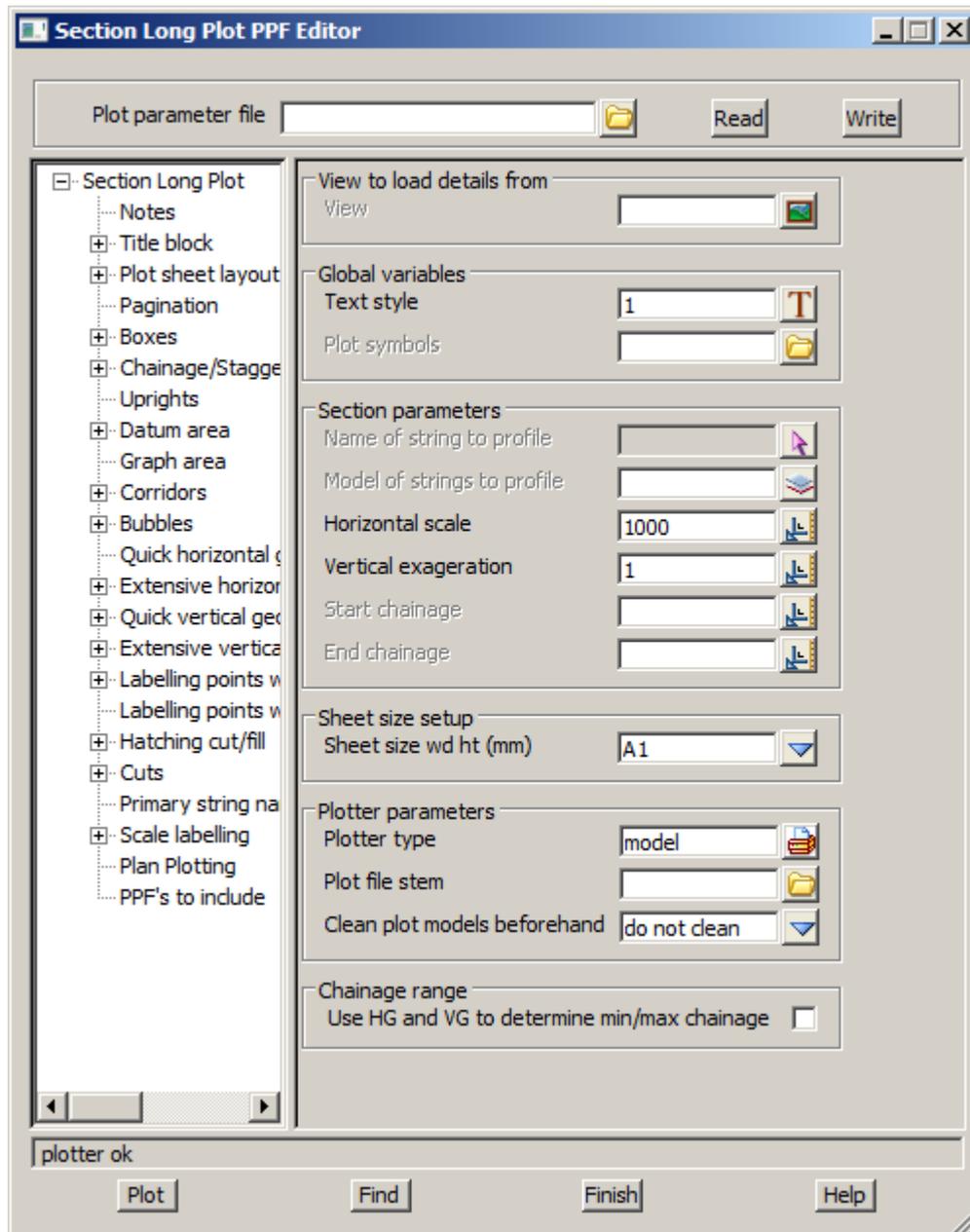
In the Plot parameter file box click LB on the folder icon to bring up the choice box
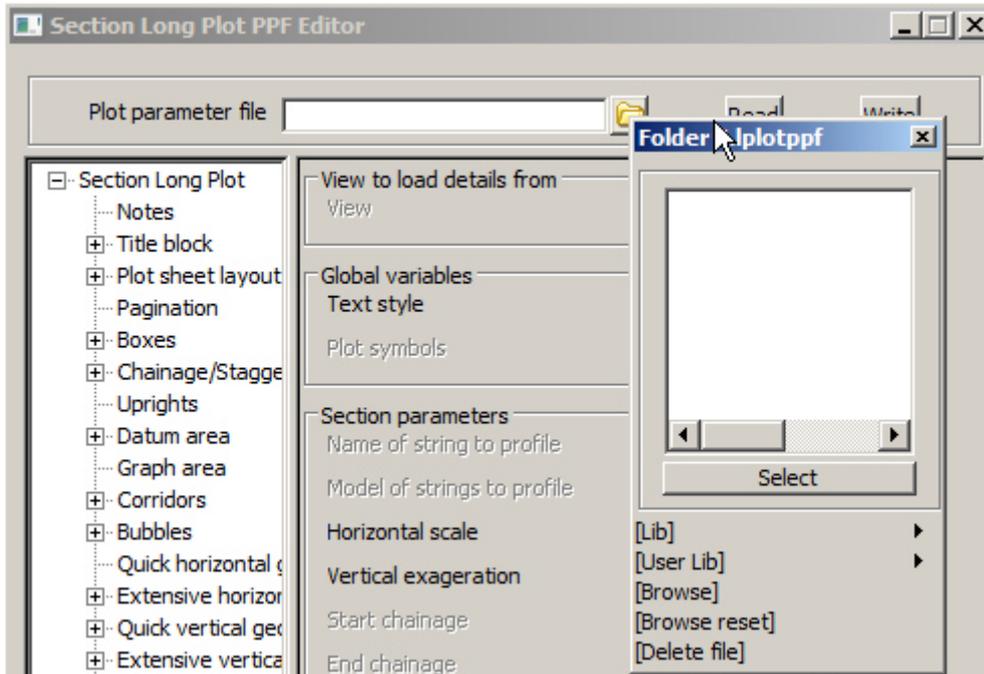
Browse to the folder **C:\12d\9.00\Training\design\getting started basic** and select the file **Long section.lplotppf**. Click LB on **[Read]**
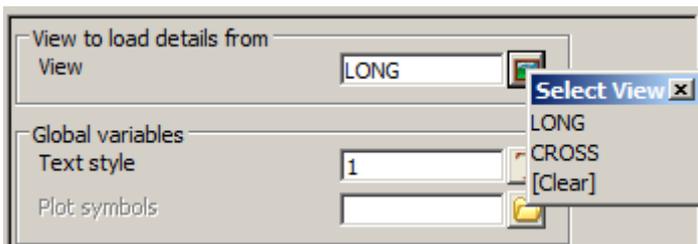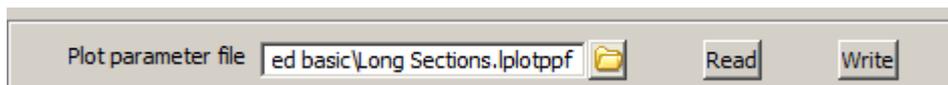
Select the section view from which the plot is to be generated from by LB click on the view icon button adjacent to the **View to load details from** box near the top of the panel. Select view **LONG**.

Note: If a value is typed then the user must then press the enter key to accept the view
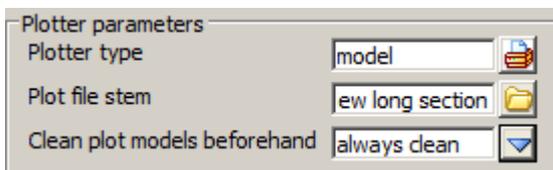
Type in the preview model name **preview long section**

Change clean mode to **always clean** to delete the previous plot mode

The parameters can be edited by moving through the various levels of the PPF editor by using the tree structure shown on the left of the panel. The tree structure can be expanded by LB click on a + symbol (node) to show underlying levels which may consist of various other nodes. To shrink underlying levels, LB click on the **-** symbol.

We will have a look at a few of the parameters available

Notes

LB click on **Notes**
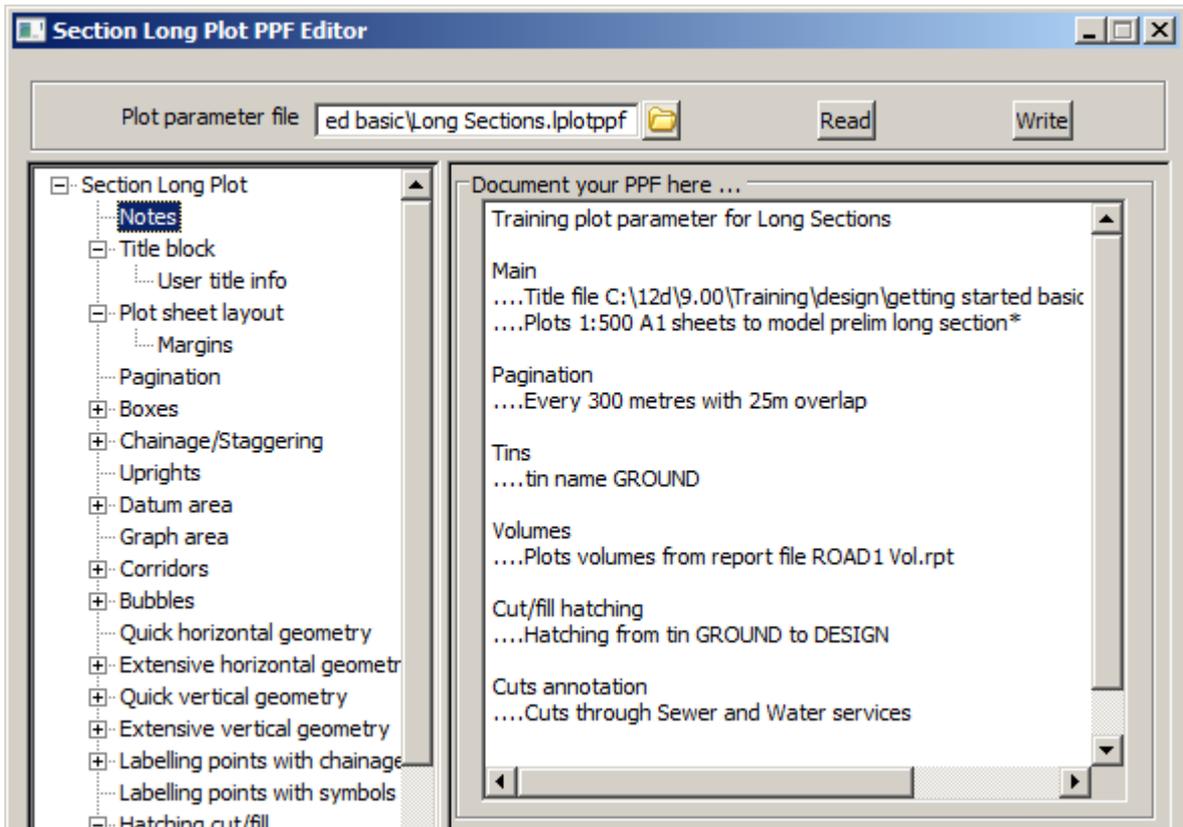
Notes can be entered to keep a record of the settings used in the PPF file. Here the notes have headings that match those in the **PPF Editor Find Parameters** panel.

Pagination

To go to say the pagination simply click LB on [Find] at the bottom of the PPF editor panel

Double click LB on **Pagination** from the choice list and the ppf editor panel navigates straight to that panel
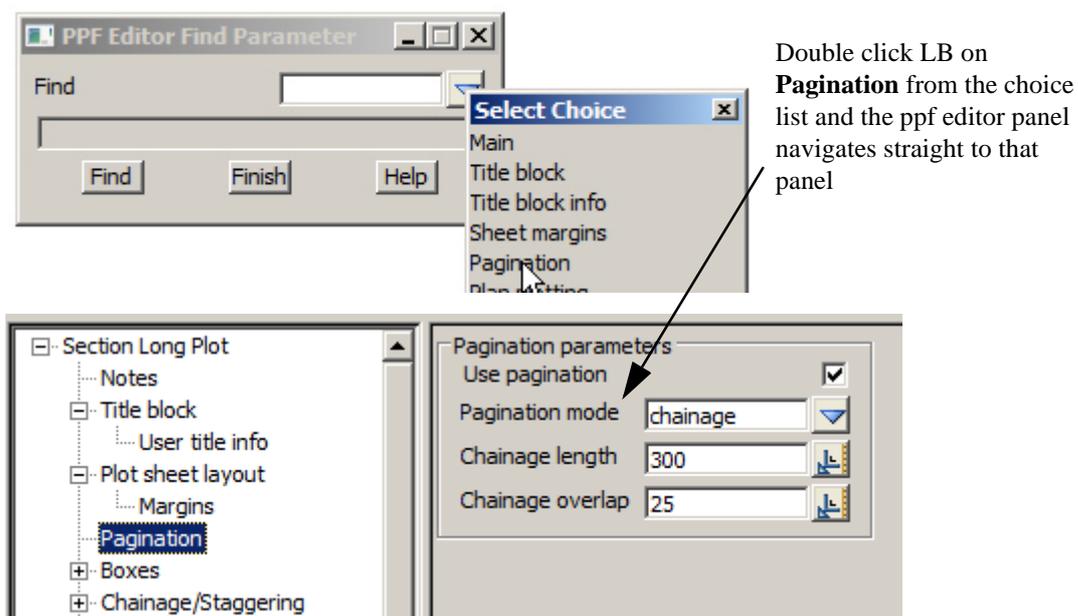
Title Info

LB click on the **Title block** node (+ symbol) to expand to the **User title info** level. Once expanded, the user can go from one level to another by simply LB click on the level they require (i.e. the text heading of the level). Going from level to level you we see the relevant parameters for that level. The **User title info** level should be selected which will look as follows.
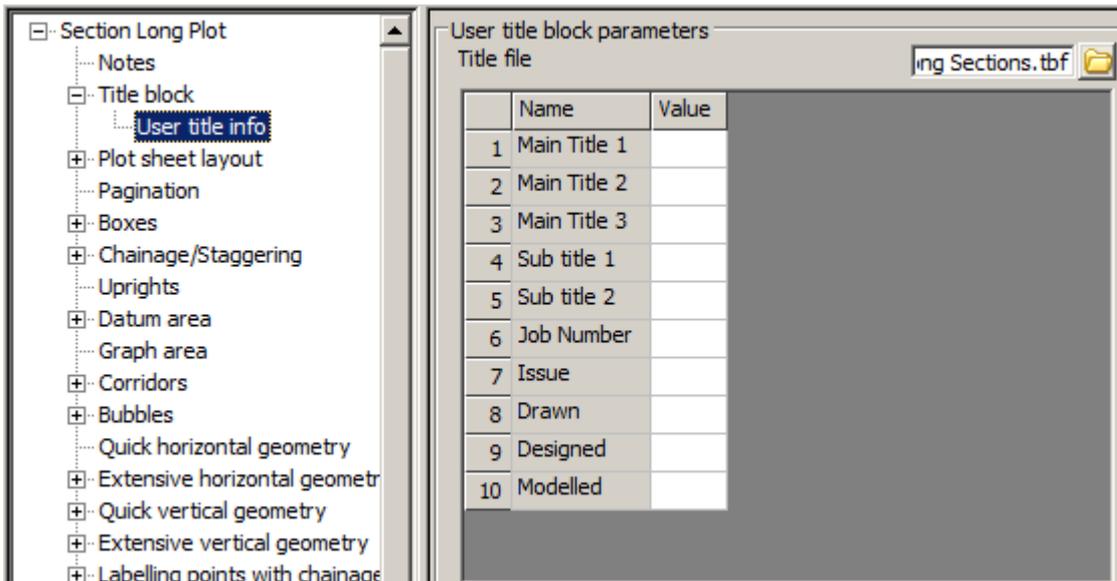
The parameters on the right of the panel include the user title block parameters. The title file given in the ppf file has been read into the grid with the names of the title user text shown in the name column, and the value column shown blank. If valid values are entered into the grid, they will be automatically substituted into the title block at the time of plotting.

This panel can be resized by moving the mouse to the extremities of the panel and whilst holding down the LB near the edge, moving the outline to the required size just like resizing any view. Resize the panel in both the horizontal and vertical so that it takes up most of the screen. **Note** Like any panel it can be minimised by using the standard windows minimise button.

We will enter a few values into the grid to show how the user text will be substituted into the title box at the time of plotting. LB click in the value filed adjacent to the **Main Title 1** name field, then type some data. As the default size for the column has been set to the width of the column heading, it will be necessary to resize the column to see all of the typed text. To do this, move the cursor over the vertical dividing line of the grid, near the right hand end of the 'Value' column heading. You will see a resizing arrow appear. Double click LB whilst this arrow appears and the column will be resized to show all the text.
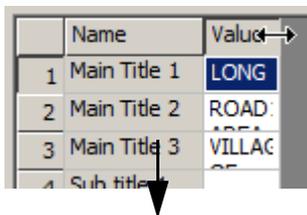
Double click LB when the resizing arrow appears.
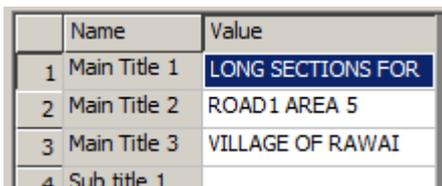
The column is resized to the width of largest value in the column

Complete the rest of the grid as follows:

	Name	Value
1	Main Title 1	LONG SECTIONS FOR
2	Main Title 2	ROAD1 AREA 5
3	Main Title 3	VILLAGE OF RAWAI
4	Sub title 1	
5	Sub title 2	
6	Job Number	SUVA-001
7	Issue	A
8	Drawn	NEB
9	Designed	PRD
10	Modelled	NEB

Note that all the value fields do not have to be filled out.

At any stage of the editing process, the user can write a binary PPF file that can be read into a panel at a later time. This is helpful if you want to close the **Long plot and PPF editor** panel but want to save the changes.

Click LB on the Plot parameter folder icon then select Browse to open the folder STAGE 1
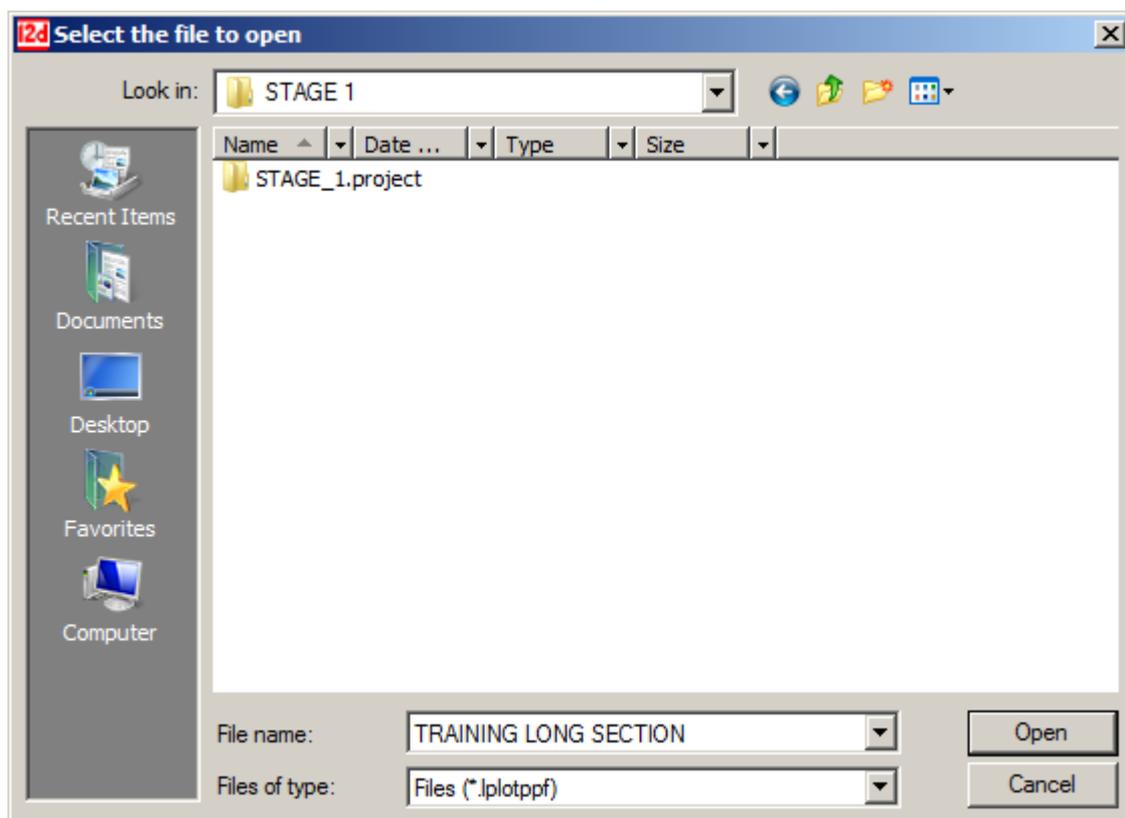
Type in TRAINING LONG SECTION then click LB on [Open]

Press the **Write** button at the top of the panel.

To read an existing PPF file, the user can choose the file from the Plot Parameter File box, then press the **Read** button. This loads any existing parameters into the grid.

Plan plotting

To add a Plan plot to the top of the Long Section click on 'Plan Plotting' near the bottom of the main listing
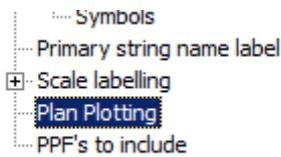
Click LB on **Plan Plotting**

Select view icon then select view **1**

Plot to preview

Now select **Plot** to create the plot models.

12d will realise that it needs four sheets to complete the job. The supplied plot file name was **preview long section**. Since Pagination was turned ON, 12d will create sheets **preview long section 1, preview long section 2........**. As we plotted to a Model, we will get models **preview long section 1, preview long section 2........** etc. If we plotted to DXF, we would get files **preview long section 1.dxf, preview long section2.dxf........** etc.

In view Plan PREVIEW, turn OFF model **preview quick hide** and turn on model **preview long section 1**. Your first sheet should appear as shown below. **Zoom** in on the area where the services appear.
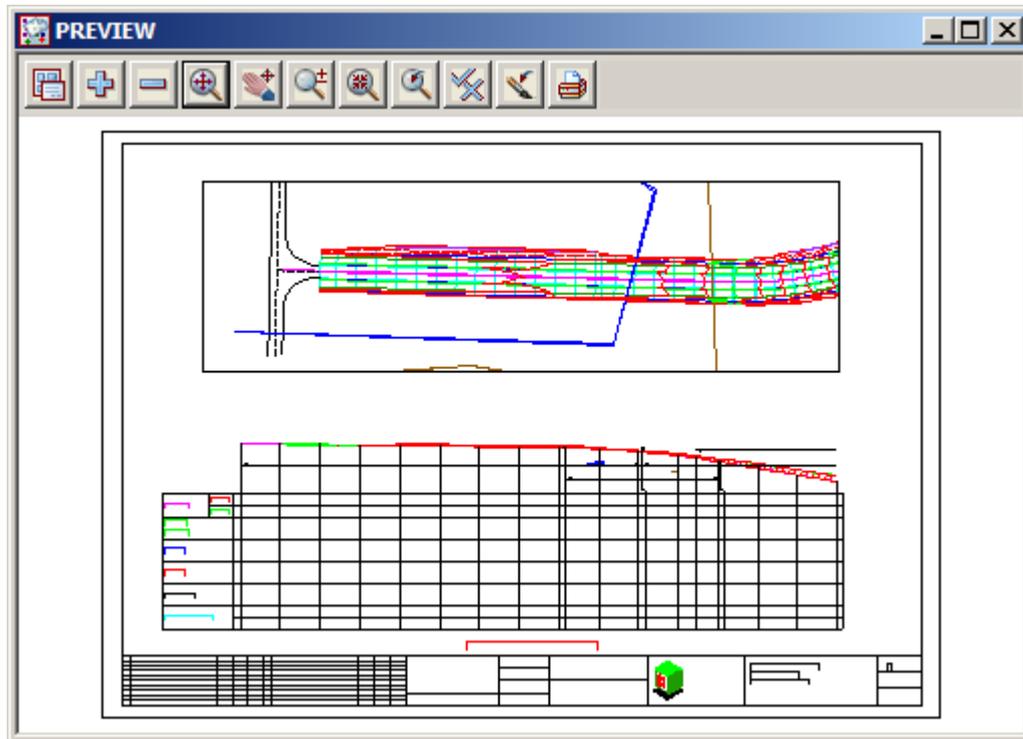
Cuts
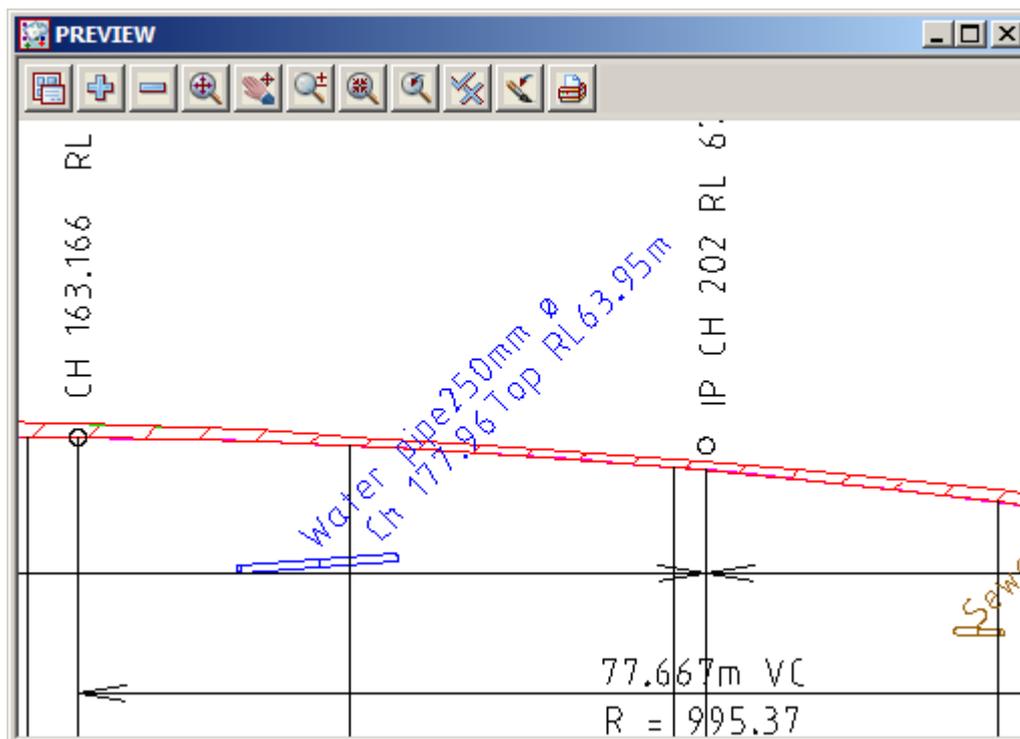
Note that 12d has automatically worked out where these services cross under the road centreline and drawn the pipe to scale (the pipes appear sections, because we have a wide corridor set for view Section LONG), and annotated each pipe. All of this happens automatically by turning on the appropriate models of

services in view Section LONG. The ppfs recognise reserved names assigned to the services.

In view Plan PREVIEW, turn OFF model **preview long section 1** and turn ON model **preview long section 2**. Your second sheet should appear as shown below.

Zoom in on the low point of the road as shown above.
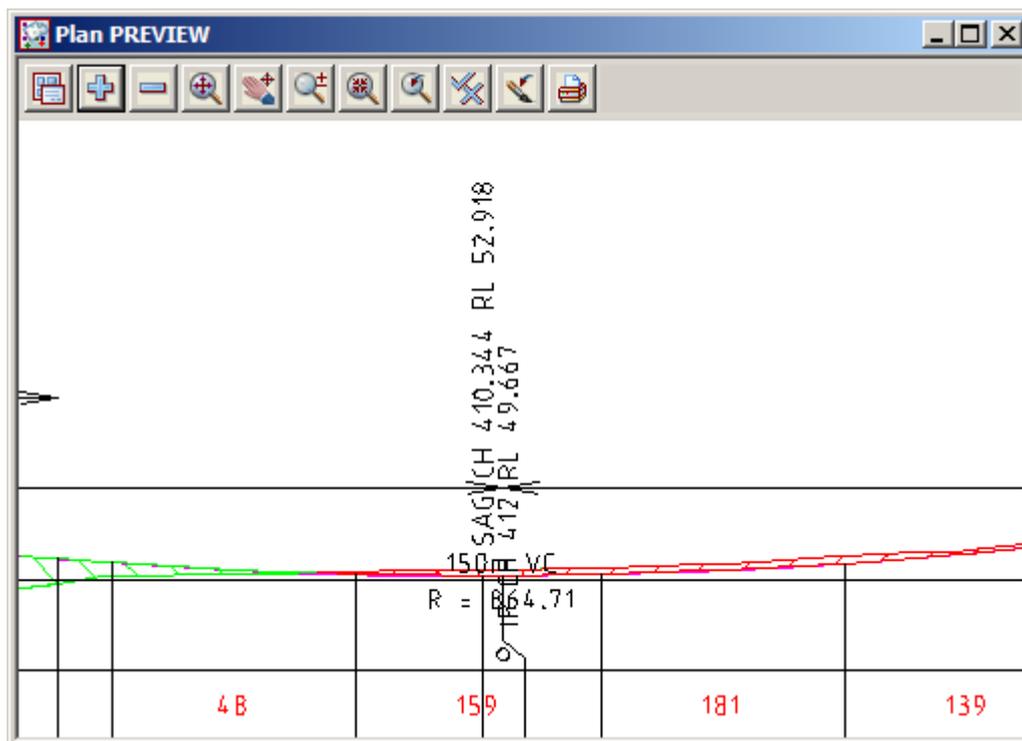
Note the sag point has been annotated automatically. Also note the labels in the boxes area and the Horizontal and Vertical geometry annotation. All of this is completely user definable.

If you **Pan** around to the centre of the Title block, you will notice that 12d has automatically calculated and inserted text showing the chainage range appearing on each sheet. It has also substituted the user text values entered into the **Long Plot and PPF editor** panel into the appropriate places in the title block.

In general, the text in the Title block is entered in a panel once per project. It can be entered for long-section plots and reused for cross-section and plan plots.

If you Pan to the right-hand end of the title block, you will observe that 12d has inserted such items as Drawing numbers (which automatically increment with each sheet), Job numbers, Company Logos and Plot date.

All of this has happened automatically during the generation of the plot.
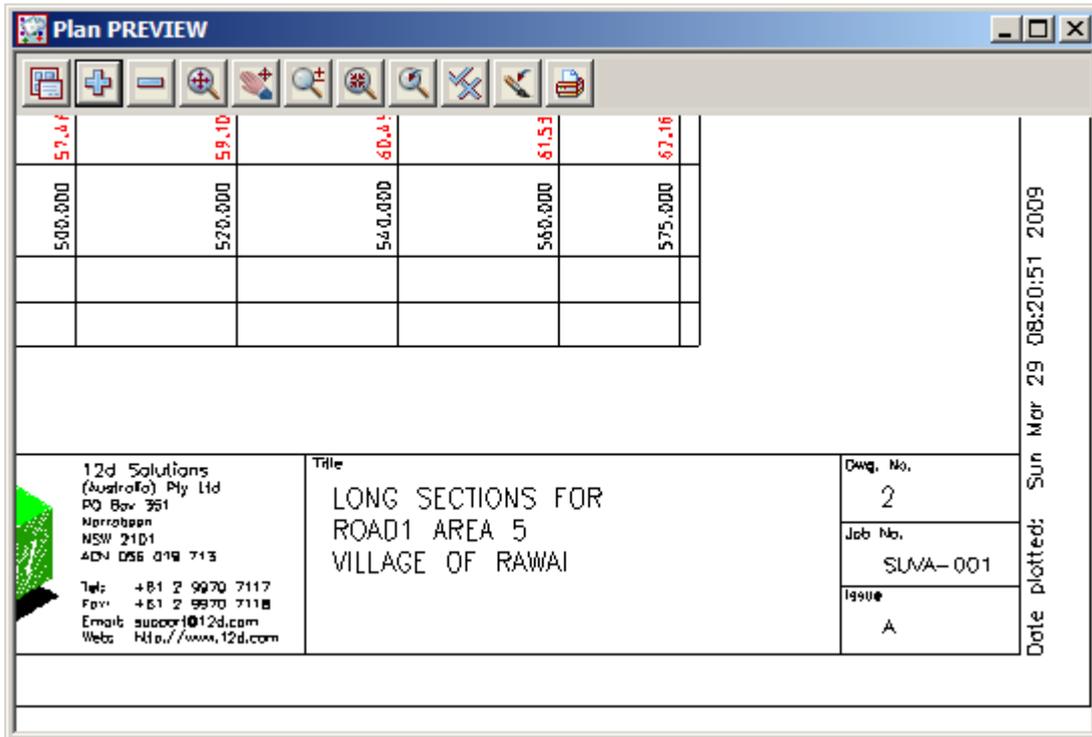
You are now in a position to make changes to your plot parameters and repeat the plot.

If the plot is satisfactory, the user can send the plot to a device. Simply select an appropriate device from the plotter icon and then Click LB on the **Plot** button.
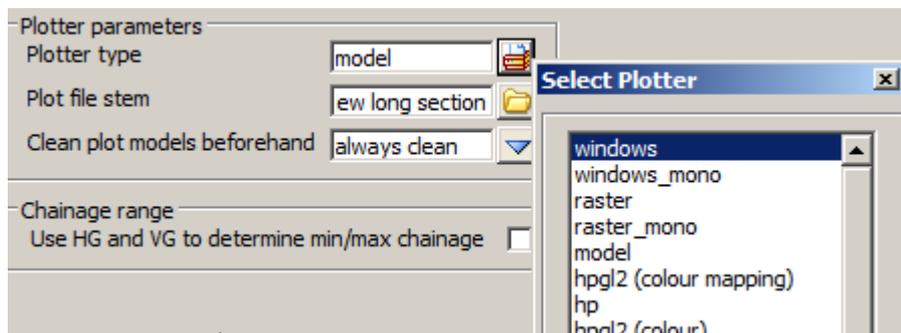
17.10.1 Automatic Labelling of Crossing Services on Long Sections

In the above plots you will notice that services appeared on the long section wherever the services were in the road corridor and labelled when the services crossed the profiled string, in our case the road centreline. We will now look at what plot parameters caused this labelling to happen. With the plot parameter files supplied with the training data, the following models contain the services.

survey SEWER PIPE
survey WATER PIPE

This is a user defined convention only. You can have any names you like for this purpose.

When 12d creates a long section plot, it will search for any strings in the above models. Masks (optionally using wild cards) can be used in the match on the string name so that only certain strings in the model are recognised.

To view the parameters that control the plotting of crossing services, go to the **cuts** section of the **Long Plot and PPF editor**) or *Find* Cuts Annotation:

The top level of the cuts section defines multiple sets of model/mask combinations.
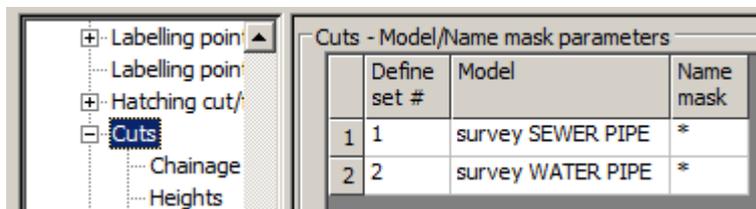
The user can select a whole model or certain strings from that model by specifying a mask. In this example, any strings from the **survey SEWER PIPE** model and **survey WATER PIPE** will be included in the **cuts** plotting.

The levels under the cuts section relate to the chainage, height, label and symbol information that is to be placed on the plot.

Cuts - Chainage parameters

	Use set #	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-te	Post-t	Justification	Decimals
1	1	above cut string height value	8	2	45	brown	3.5	ISO	Ch		bottom-left	-2
2	2	above cut string height value	8	2	45	blue	3.5	ISO	Ch		bottom-left	-2

Cuts - Height parameters

	Use set #	Mode	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Pos	Justification	Decimals
1	1	use height of cut point	above cut string height value	23	17.5	45	brown	3.5	ISO	Invert RL	m	bottom-left	-2
2	2	use height of cut point	above cut string height value	23	17.5	45	blue	3.5	ISO	Top RL	m	bottom-left	-2

Cuts - Diameter parameters

	Use set #	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Post-text	Justification	Factor	Decimal:
1	1	above cut string height value	0	1	45	brown	3.5	ISO	Sewer pipe	mm ø	bottom-left	1000	0
2	2	above cut string height value	0	1	45	blue	3.5	ISO	Water pipe	mm ø	bottom-left	1000	0

The resulting plot can be seen back in Chapter 17.10 Cuts.

17.11   Plotting Sheets of Cross Sections

In your view 'Section CROSS', profile any valid cross section from the model of cross sections called **ROAD 1 Sects**. From the View Title Area for view 'Section CROSS', click LB on the **Profile** button and click LB on any cyan cross section string you can see in any view. Confirm the selection with MB.

Also make sure that the vertical exaggeration of view 'Section CROSS' is set to **[2]**. The large range of cut and fill in the training data files will reduce the number of sections per sheet if you have the vertical exaggeration set any larger than 2.

To run the 'Section X Plot PPF Editor', from the View Button Area for View 'Section CROSS' click LB on Printer Icon and select **'X plot'**
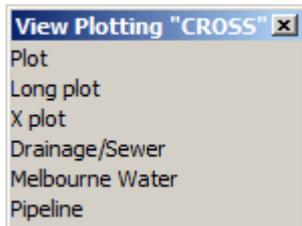
Select **x plot**

Alternatively you can click on option **Plot =>Plot and PPF editors =>Cross Sections**.
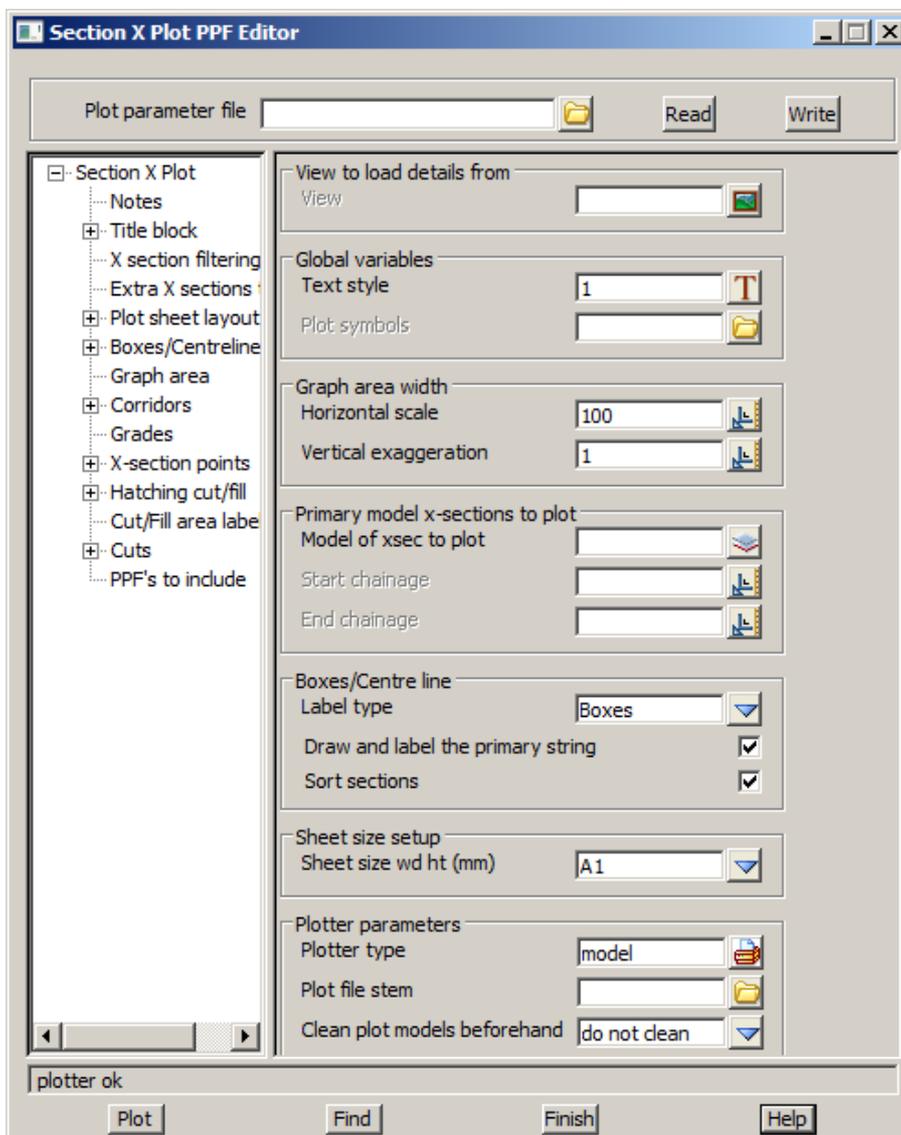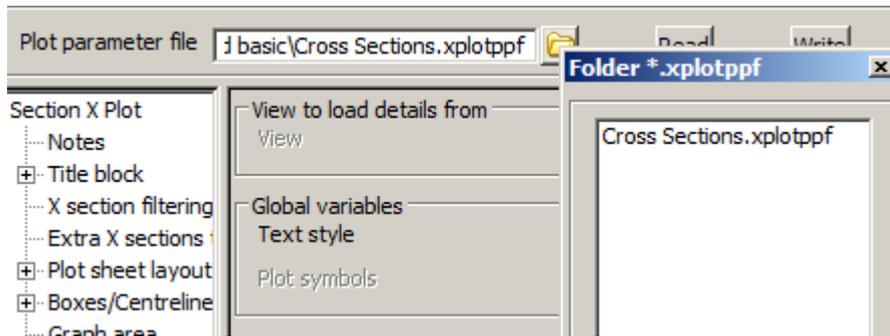
In the **Plot parameter file** box located at the top of the panel, LB click on the folder icon to bring up the folder choice box.

Browse to the folder **C:\12d\9.00\Training\design\getting started basic** and select the file **Cross section.lplotppf**. Click LB on **[Read]**

Select the section view from which the plot is to be generated from by LB click on the view icon button adjacent to the **View to load details from** box near the top of the panel. Select view **XS**. **Note:** If a value is typed then the user must then press the enter key to accept the view.

Go to the **User title info** level by navigating the tree control as described previously. The level should be selected which will look as follows.
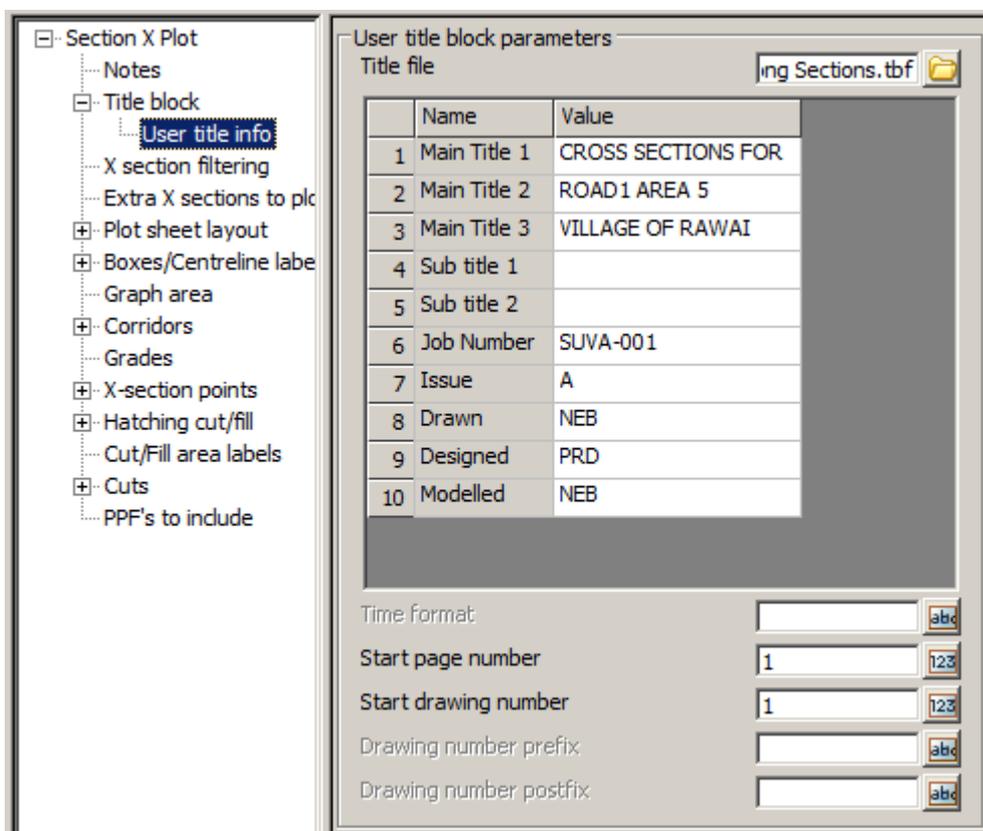
Text can be entered in the same way as the Long section plotting (Chapter 17.10 Title Info)

At any stage of the editing process, the user can write a binary PPF file that can be read into a panel at a later time. This is helpful if you want to close the **Long plot and PPF editor** panel but want to save the changes. Simply type a new file name into the Plot Parameter File box at the top of the **Long plot and PPF editor** and press the enter key.
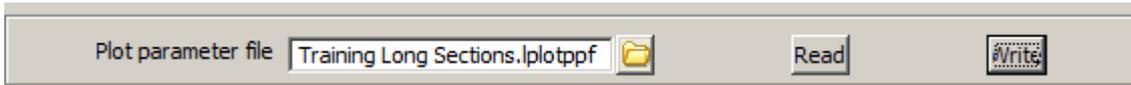
This assigns the relevant file extension. Then press the **Write** button at the top of the panel.

To read an existing PPF file, the user can choose the file from the Plot Parameter File box, then press the **Read** button. This loads any existing parameters into the grid.

Prior to plotting
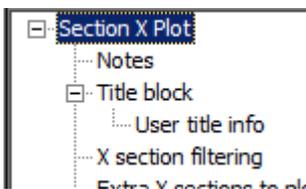
 Return to 'Section X Plot' part of the panel
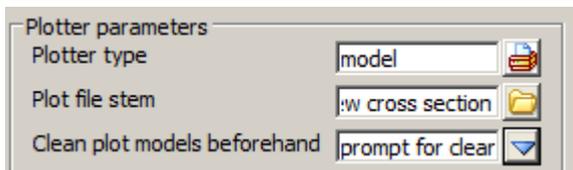
 Select **prompt for clean** as the choice for 'Clean models before hand'. This gives the user the option to clean at the time of creating the plot

To generate a plot simply press the **Plot** button at the bottom of the panel.

Select **Yes** to confirm cleaning any existing plot models

12d will realise that it needs multiple sheets to complete the job. We supplied the plot file stem **preview cross section**. 12d will automatically create as many sheets as it needs to in the sequence. As we plotted to a model, we will get models **preview cross section 1, preview cross section 2** etc. If we plotted to DXF, we would get files **preview cross section 1.dxf, preview cross section 2.dxf** etc.

In view Plan PREVIEW, turn OFF all models then turn on the model **preview cross section 1.** You'll notice round objects below the road as shown below.
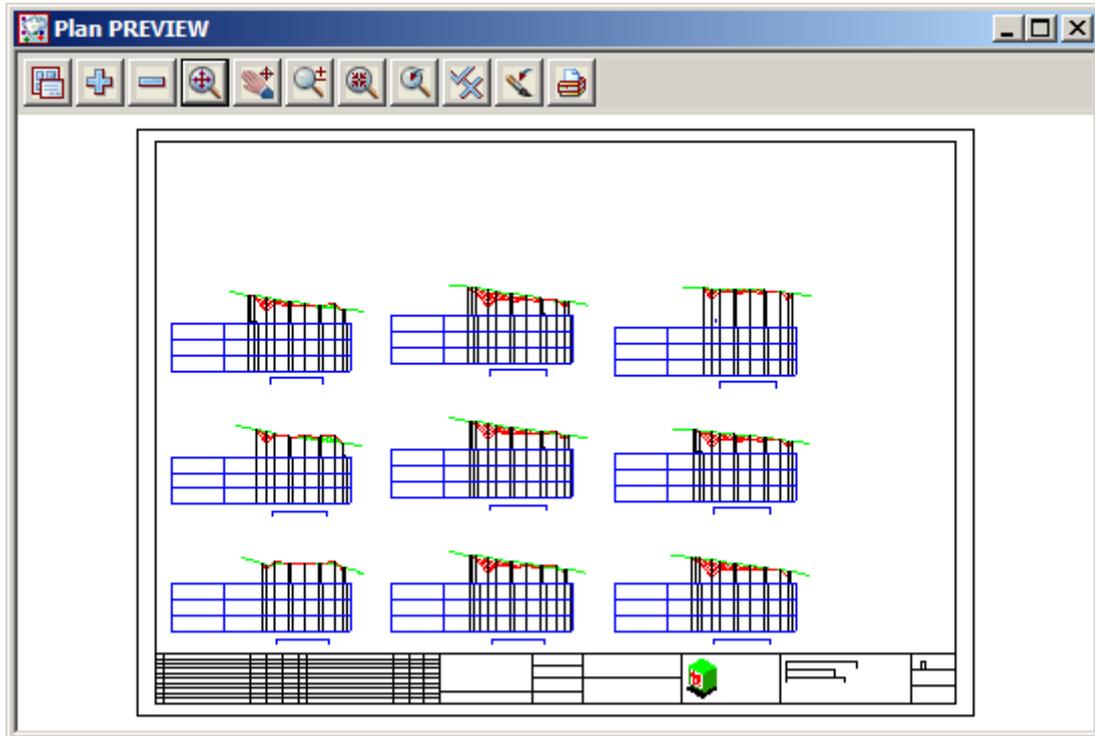
Zoom in on the top cross section in the third column.

Note the annotation in the boxes area. This is all user definable via plot parameters. Note the water string being labelled automatically where it crosses the road cross section.
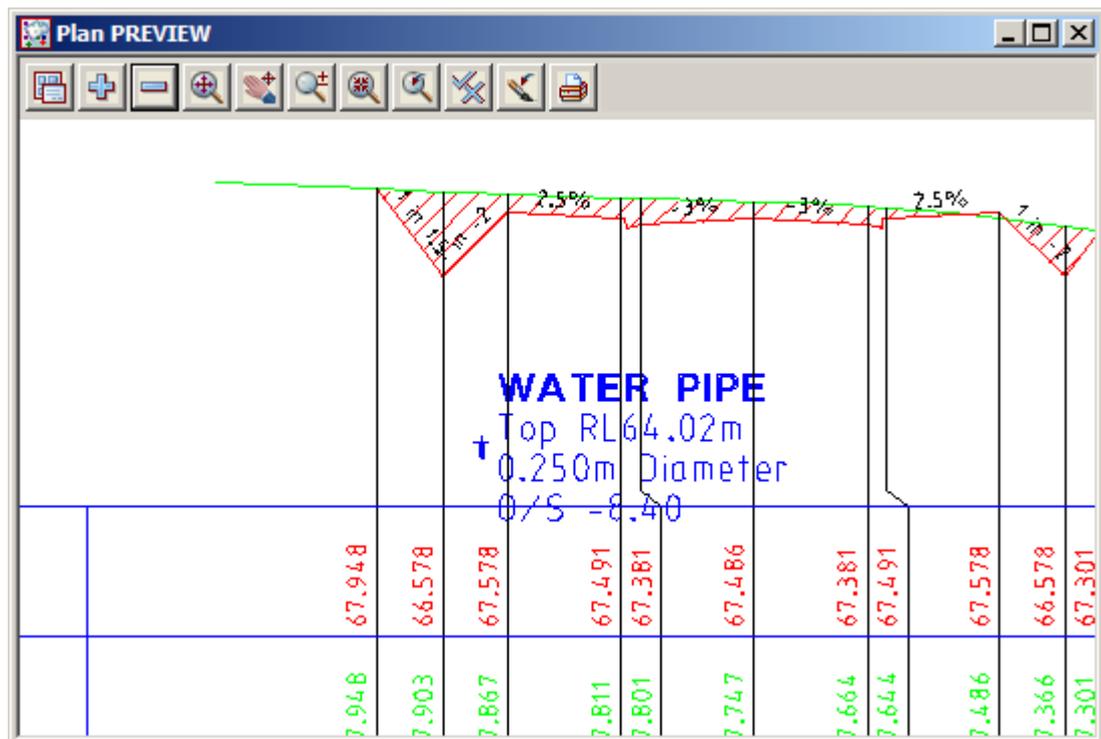
You will notice that 12d starts each sheet by assembling cross sections in the bottom left corner and working upwards. When it can no longer fit more sections in that 'column', it will move to the right and, starting at the bottom of the sheet, work upwards again. When it fills a sheet, it will automatically go to the next sheet. All cross sections are presented in increasing chainage order.

Now **Zoom** in on the road surface at the same x section and note the labelling of the grades.
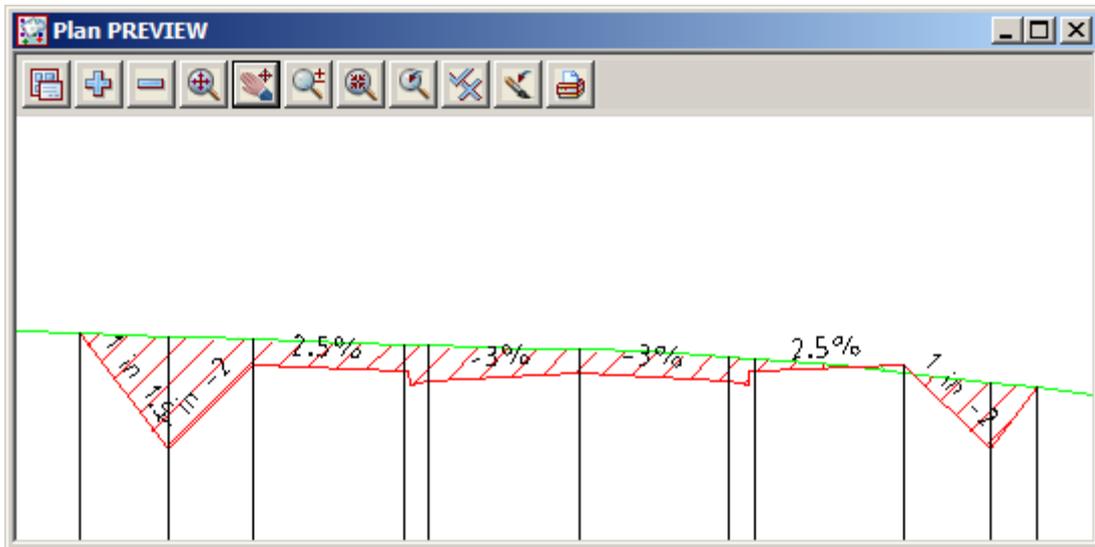
Finally, **Zoom** in at the base of the sheet and observe the Title block text

12d knew that it could only fit a certain chainage range of cross sections on the sheet and so it automatically included the start and end chainages for the sheet in the title block.

The other sheets will contain similar sections.

17.11.1 Extending the Natural Surface Beyond the Cross Section

Note that 12d uses the extend concepts when plotting.

When plotting cross sections, 12d uses some of the parameters of the Section View where the cross section is being profiled. For instance the vertical exaggeration of the 'Section CROSS' view determines the vertical scale of the finished plot.

View 'Section CROSS' has an extend parameter that determines the extent of what you see on the screen. This parameter is however <u>not</u> used for plotting. The amount of the extend required in final plots is set separately in the **PPF Editor** panel under **Plot sheet layout**
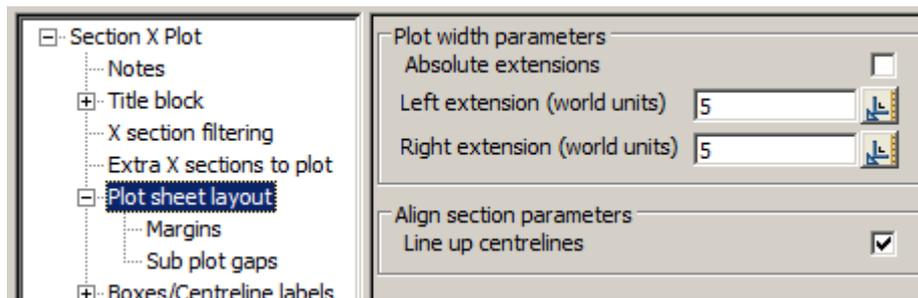
If you were to set the LHS extension to 30 m, you get the following type of cross section plot.
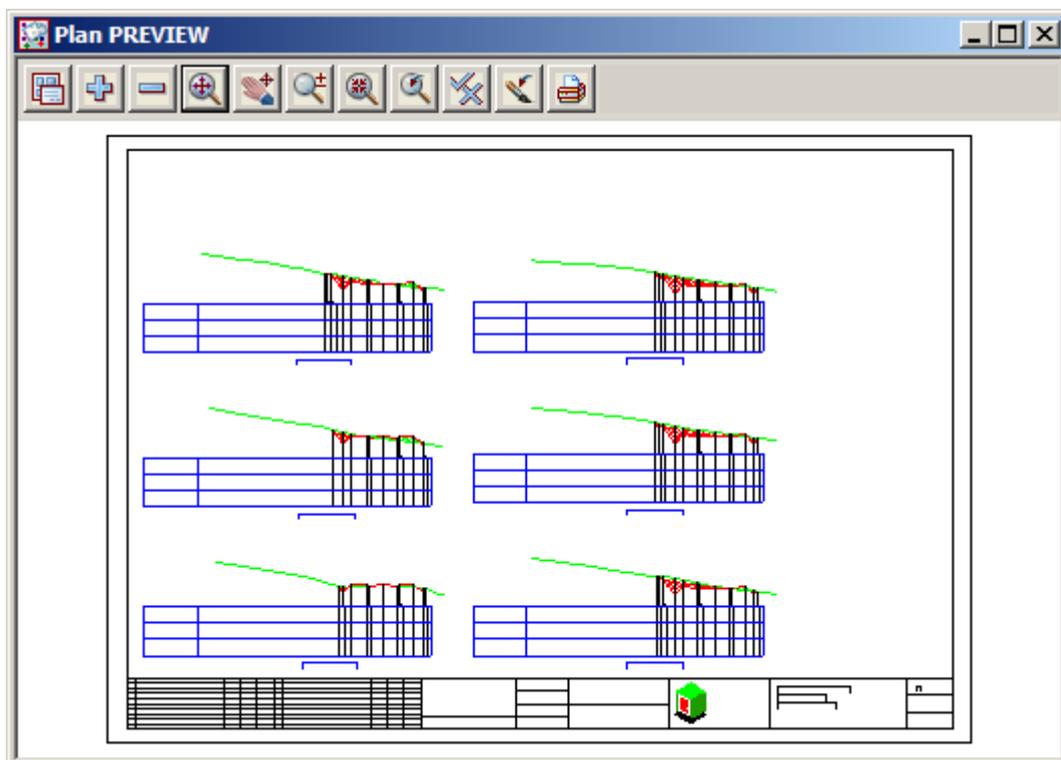
This technique can be useful at times, particularly at locating services away from the cross section

17.11.2 Previewing Cross section and Managing Cross Section Plot Files

To preview a plot, just turn on the model containing the previewed plot in view Plan PREVIEW. It is highly likely that you will need to change some of your plot parameters and repeat the plot and preview process several times before your plots are as you want them.

You can make changes to your plot parameters and repeat the plot as many times as necessary.

Once the plot is satisfactory, the user can send the plot to a device. Simply select an appropriate device from the plotter icon and then Click LB on the **Plot** button.
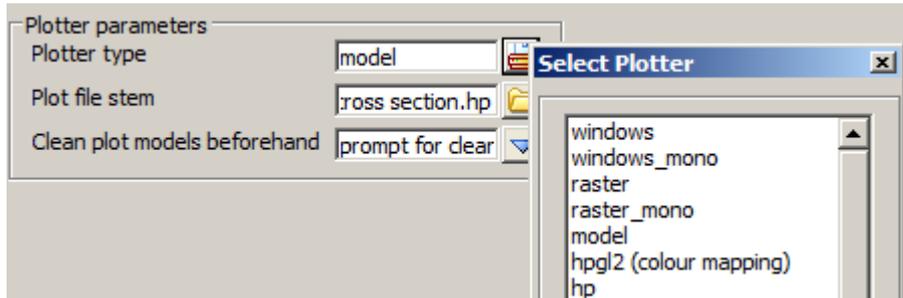
17.11.3 Automatic Labelling of Crossing Services on Cross Sections

The "Automatic Labelling of Crossing Services on Long Sections" on page 227 also applies to automatic labelling of crossing services on Cross sections in an identical manner. Examples of this are seen in the above Cross section plots.

With the plot parameter files supplied with the training data, the following models are used for services.

> survey SEWER PIPE
> survey WATER PIPE

This is a user defined convention only. You can use any names you like for this purpose.

When 12d creates a cross section plot, it will search for any strings in the above models. Masks (optionally using wild cards) can be used in the match on the string name so that only certain strings in the model are recognised.

To view the parameters that control the service plotting, go to the **cuts** section of the **X Plot and PPF editor**):
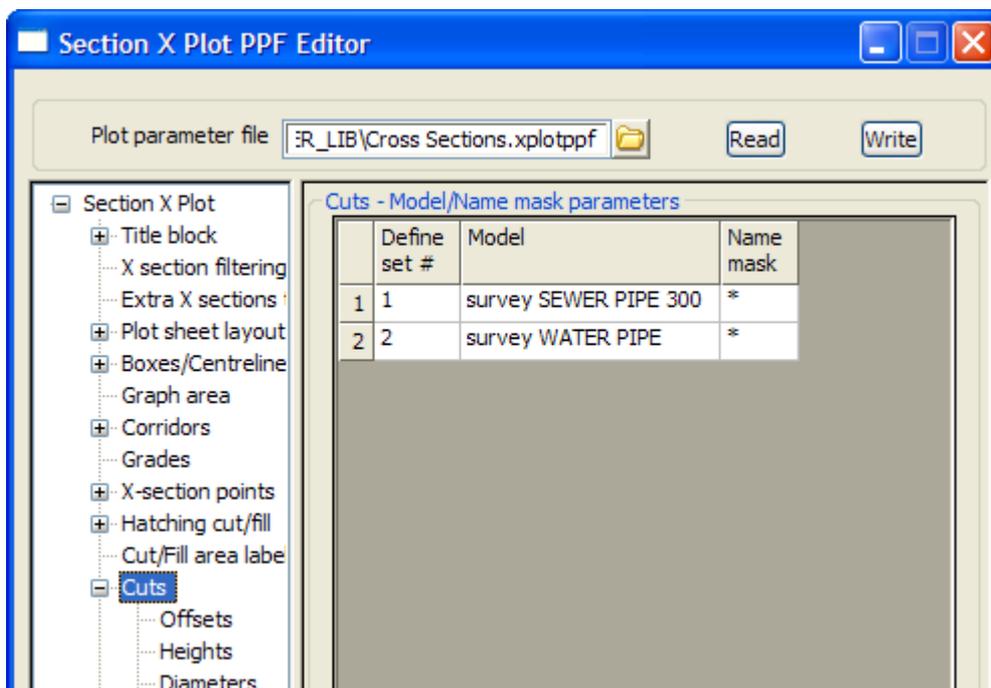
The levels under the cuts section relate to the offsets, height, label and symbol information that is to be placed on the plot.

Cuts - Offset parameters

	Use set #	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Post-text	Justification	Decimals
1	1	at cut string height	2	-10	0	orange	3.5	ISO	O/S		bottom-left	-2
2	2	at cut string height	2	-10	0	blue	3.5	ISO	O/S		bottom-left	-2

Cuts - Height parameters

	Use set #	Mode	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Post-text	Justification	Decimals
1	1	use height of cut point	at cut string height	2	0	0	orange	3.5	ISO	Invert RL	m	bottom-left	-2
2	2	use height of cut point	at cut string height	2	0	0	blue	3.5	ISO	Invert RL	m	bottom-left	-2

Cuts - Diameter parameters

	Use set #	Position	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Post-text	Justification	Factor	Decimals
1	1	at cut string height	2	-5	0	orange	3.5	ISO		m Diameter	bottom-left	1	-3
2	2	at cut string height	2	-5	0	blue	3.5	ISO		m Diameter	bottom-left	1	-3

Cuts - Label parameters

	Use set #	Position	Mode	Attr	X (mm)	Y (mm)	Angle (dms)	Colour	Size (mm)	Textstyle	Pre-text	Post-text	Justification	Factor	De
1	1	at cut string height	do not include cut string name		2	5	0	orange	3.5	HELV	SEWER PIPE		bottom-left		
2	2	at cut string height	do not include cut string name		2	5	0	blue	3.5	HELV	WATER PIPE		bottom-left		

In our case, view Section CROSS contains the model of sections we want to plot. If we turn on the above service models in view Section CROSS, the finished plot will also include the actual pipe strings as well. If you have a Vertical Exaggeration on the view other than 1, the pipe will appear as an ellipse rather than a circle.

17.12   Plan Plotting Using Plot Frames

Plot frames are a set of tools within 12d that permit a series of plan plots to be readily generated and regenerated as required. The plot frames are superimposed over data in that view and the various frames 'plotted'. All plots are clipped to size by the plot frames and will contain only the data that is on display in the plan view being processed. The user decides to plot one or more frames individually or plot a complete set.

We now need to assemble the data we want to plot in a view. We will use view 'Plan 1' for this purpose. Make sure that the following models are turned on in view 'Plan 1'.
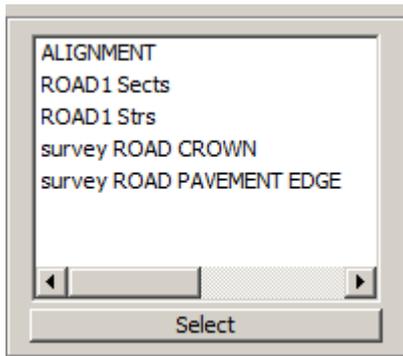
Your view 'Plan 1' should look as follows.
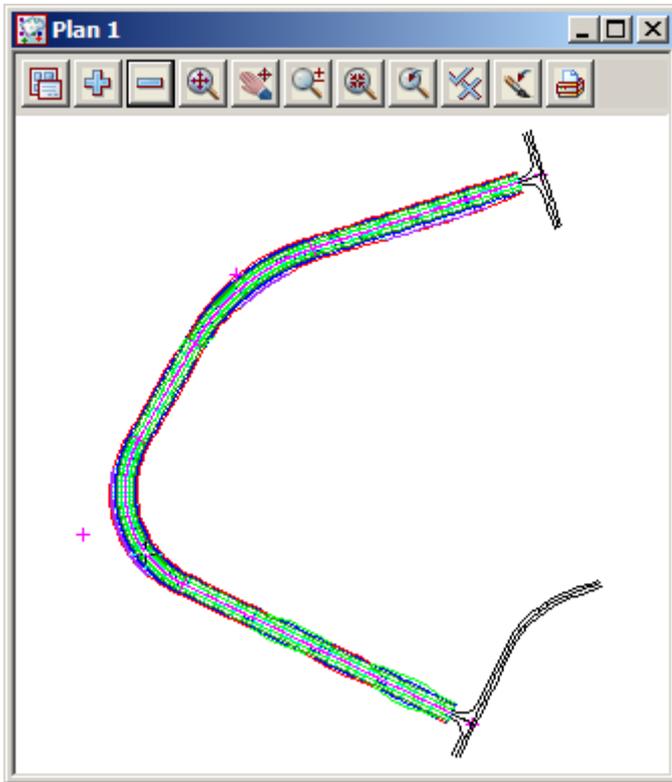
We want to create plot frames that encompass the various roads in the view. We will probably need more than one plot frame. In our case, each plot frame will represent an A1 sheet.

17.12.1 Creating Plot Frames

We will create our first plot frame.

User defined plot frames can be placed over the data in the view. These frames show both the sheet size and plot area borders.

From the 'Plot Frames' menu **Plot =>Plot frames=>Create**
Navigate to the folder **C:\12d\9.00\Training\design\getting started basic** and choose the title file **Plan Plot.tbf** and the panel will be filled out as follows:

Click LB on the Origin icon

Select a point in the bottom left of the view as shown by the magenta circle.

Confirm the selection with MB. The X and Y coordinates should appear in the field.
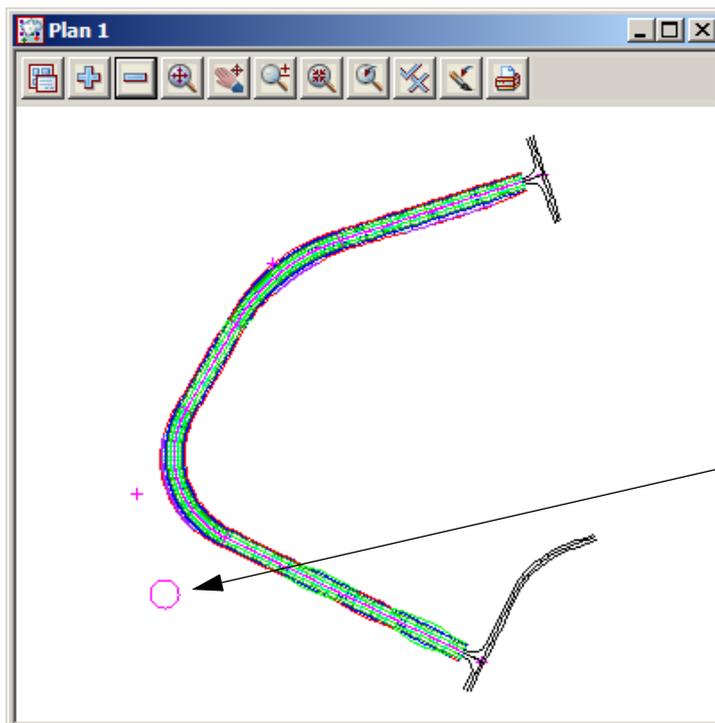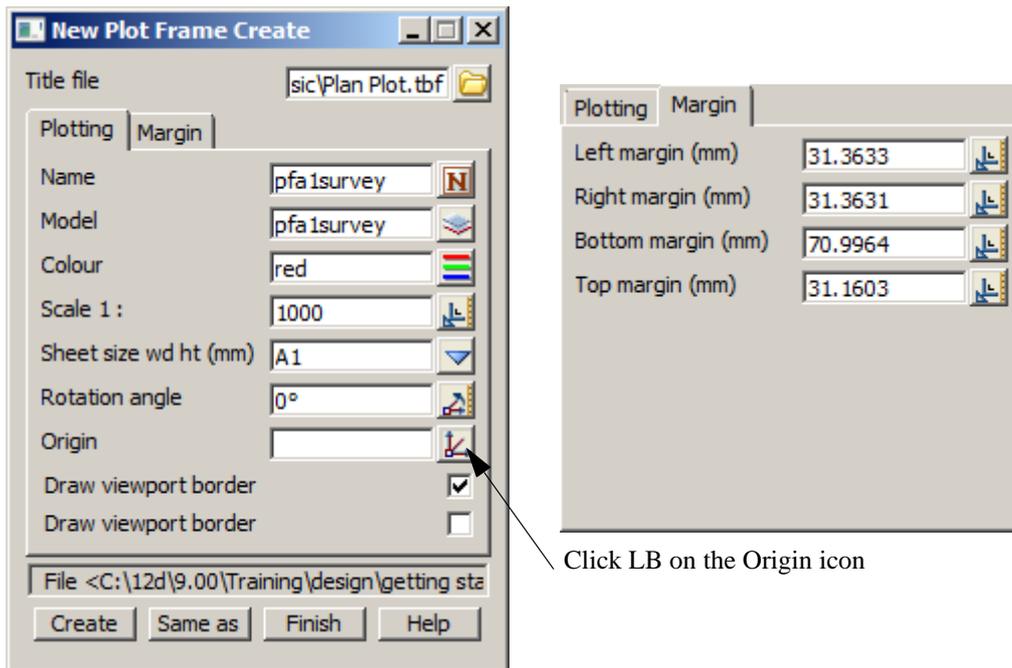
Then select the **Create** button.

12d will transform the panel into the 'New Plot Frame Edit' panel (so that you only get one chance at creating that plot frame). It can be edited later if there is an error.
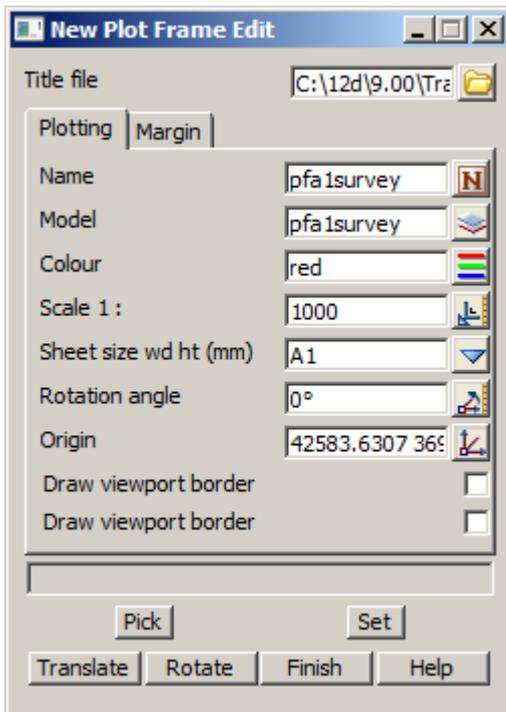
You will notice that the Edit panel is very similar to the Create panel.

To see our plot frame, you need to use the '+' in the 'Plan 1' view to turn on model **pfa1survey**. Do a **Fit** on the view.
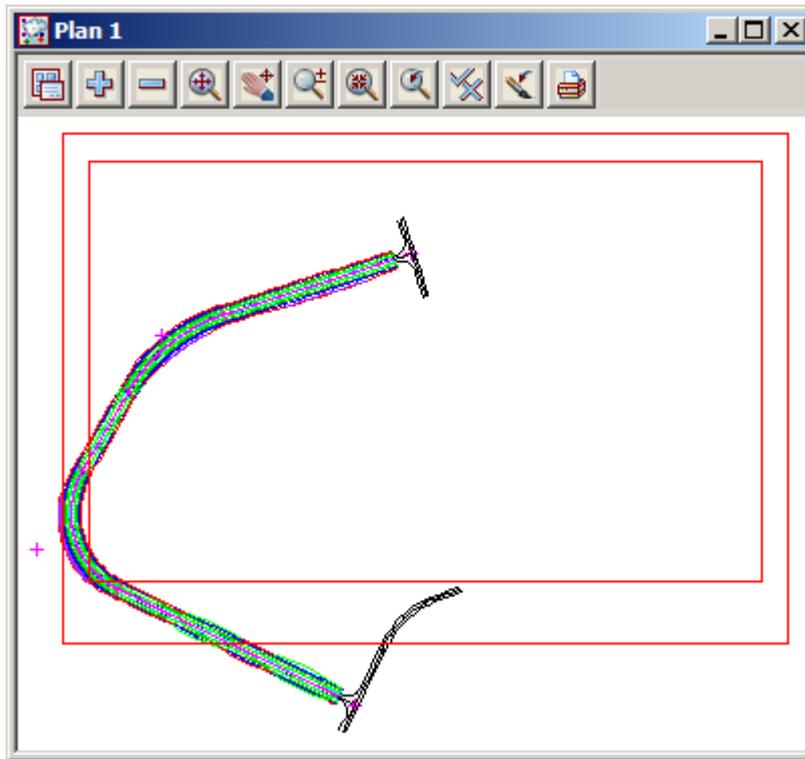
Clearly our first guess at the scale is incorrect. We need to scale down our plot frame.

In the 'New Plot Frame Edit' panel, opposite the 'Scale 1:' field, change the 1000 to **500** and click LB on the **Set** button.
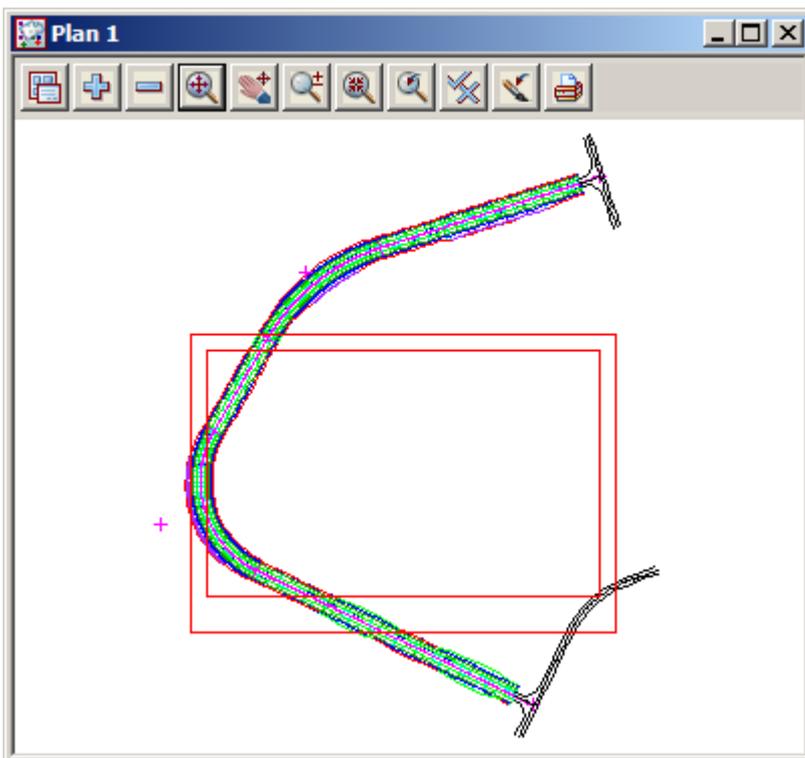
Click LB on **Fit** to fill the view.

In the 'Plot Frame Edit' panel, click LB on **Rotate**. Move the cursor into the 'Plan 1' view and notice that you can rotate the plot frame about it's insertion point. When you have the cursor positioned appropriately,

click LB and MB to confirm the selection.

Similarly, click LB on the **Translate** button and move the plot frame in view 'Plan 1'. You will notice that the rotation angle is maintained as you move the cursor. When you have the cursor positioned appropriately, click LB and MB to confirm the selection.

The final position of your plot frame pf1 should look as shown below.
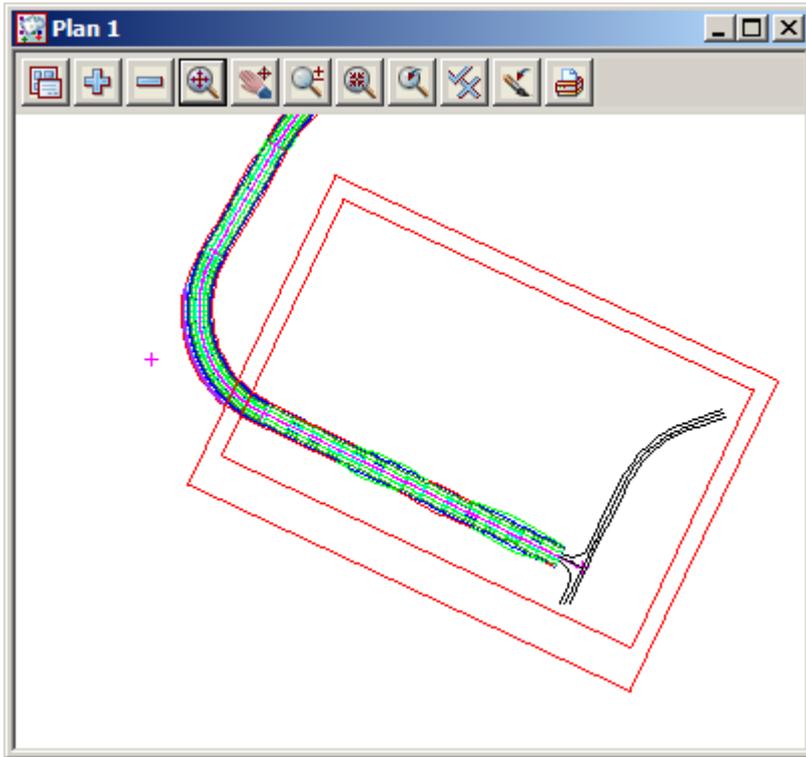
You are trying to arrange the sheet to maximise the amount of information shown on it i.e. minimise the number of sheets.
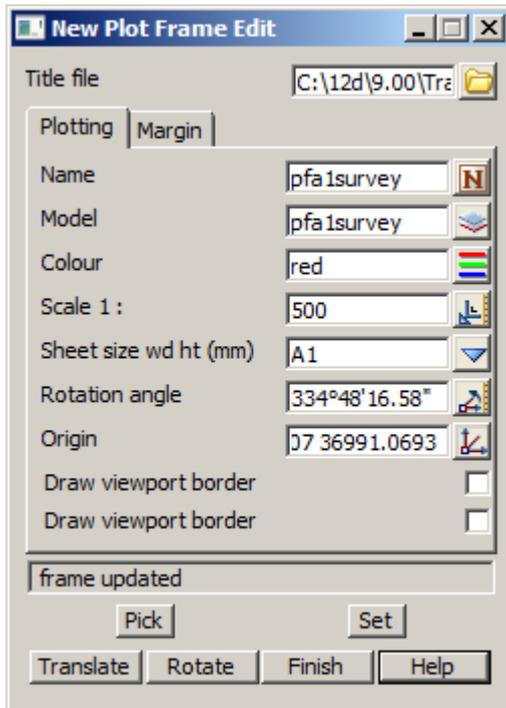
Notice that the rotation angle and origin now have non-zero values.

That finishes the development of our first plot frame.

Click LB on **Set** and **Finish**.

Click LB on **Plot =>Plot frames=>Create** again.
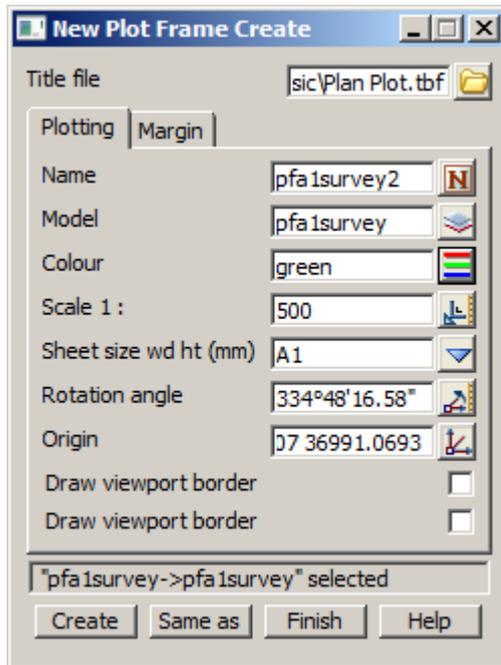
The panel will initially come up blank.

Click LB on the **Same as** button, position the cursor near any one of the corners of the *pfa1survey* plot frame and click LB to select it. When it highlights, click MB to confirm the selection.

Change pfa1survey to **pfa1survey2**

Change the Colour from red to **green**

Click LB on the **Create** button.

12d will transform the panel into the 'Plot Frame Edit' panel
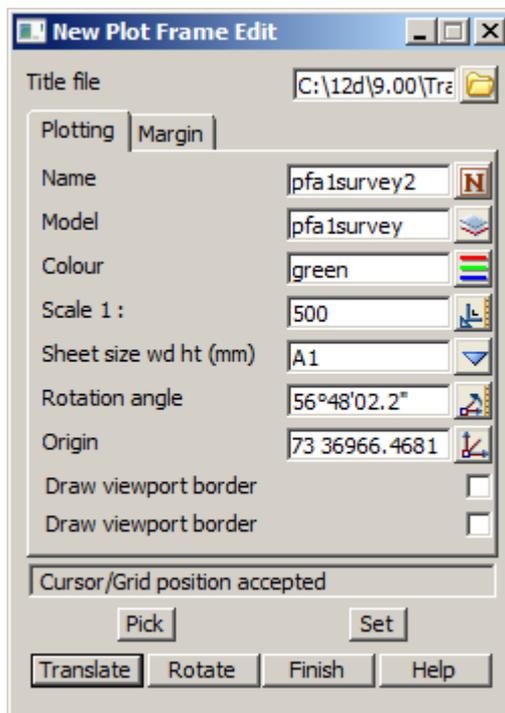
As before, click LB on **Rotate**. Move the cursor into the 'Plan 1' view and rotate the plot frame about it's insertion point. When you have the cursor positioned appropriately, click LB and MB to confirm the selection.

Then click LB on the **Translate** button and move the plot frame in view 'Plan 1'. You will notice that the rotation angle is maintained as you move the cursor. When you have the cursor positioned appropriately, click LB and MB to confirm the selection.

Click LB on **Set** and **Finish**.

Repeat for the third plot frame
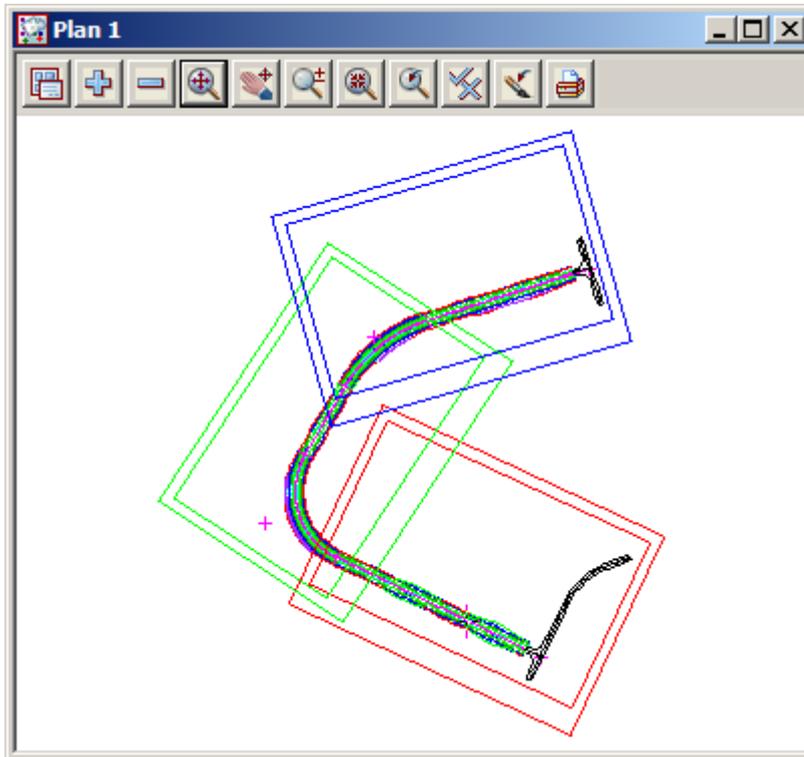
The finished position of your plot frames should look as shown.

17.12.2 Using the Plot Frame Editor

If you ever want to make changes to one of your plot frames and the panel is not currently on display, you can use the Plot Frame editor to do this.

Click LB on **Plot =>Plot frames=>Editor**

Position the cursor near any one of the corners of the plot frame you wish to edit and click LB to select it. When it highlights, click MB to confirm the selection. The 'Plot Frame Edit' panel will appear as seen earlier.

To shut down the 'New Plot Frame Edit' panel click LB on **Finish**.

17.12.3Create Plot using Plot Frame PPF Editor

Plotting using the plot frame ppf editor can be started using the plan view plotting icon

LB click on plotting icon

This brings up the **View Plotting** panel

LB click on Plot frames
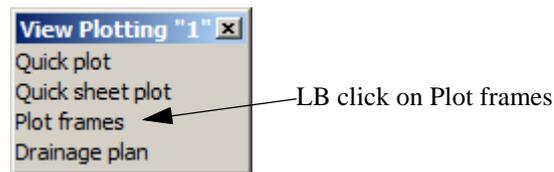
This then brings up the **Plot frame PPF Editor** panel.
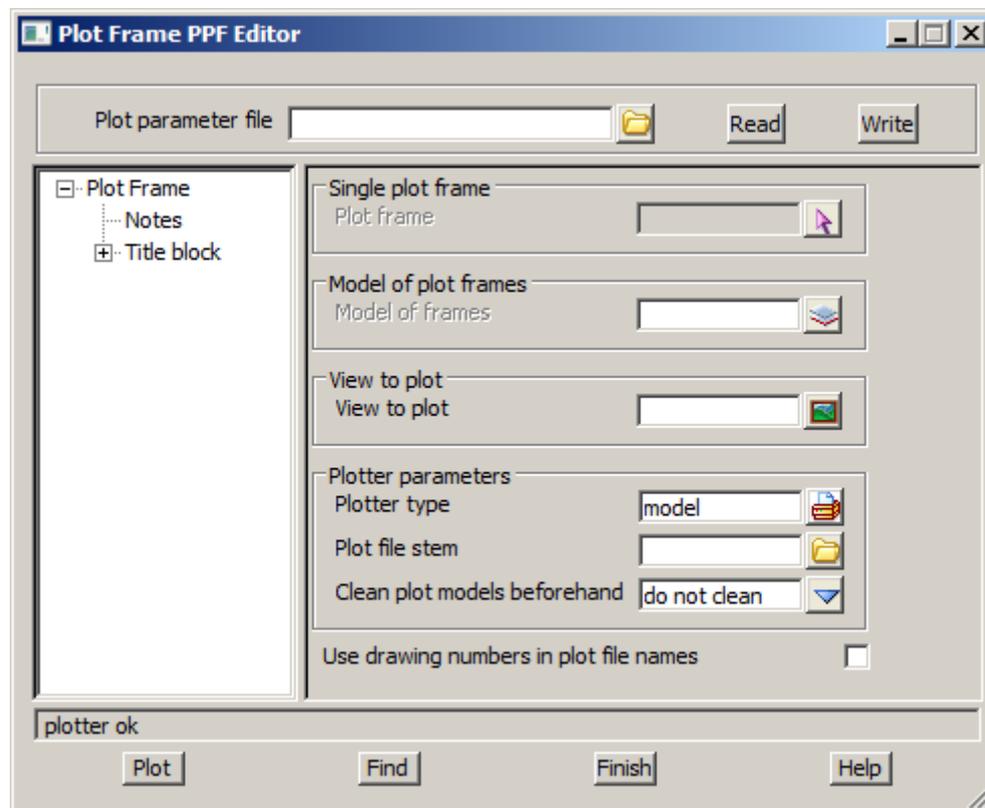
This panel has a tree structure, much like the Windows explorer type functionality. The + symbol near the *Plot Frame* text in the left of the panel indicates that there are levels below. To access lower levels, simply LB click on the + symbol to expand the tree. Expand the tree so there are no more + symbols and every level is shown.
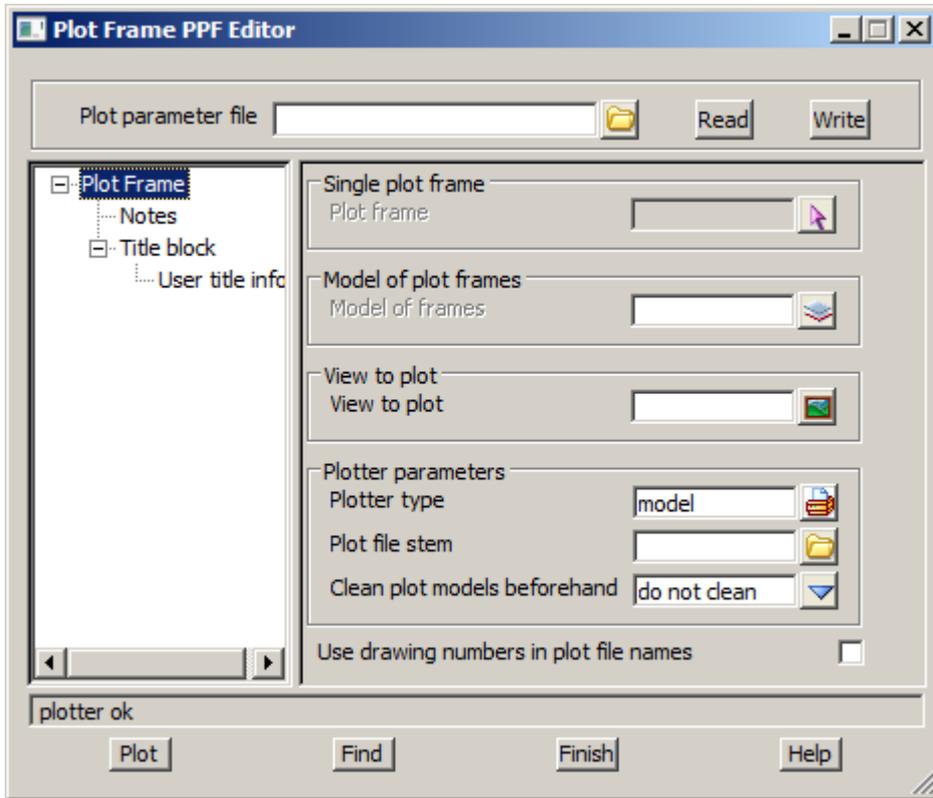
To go from one level to another, simply LB click on the text headings on the tree structure. Click LB on the *Plot Frame* level. Fill in the fields to the right of the tree using the relevant icon buttons where possible e.g. select the model **pfa1survey** from the model choice box. The fields should look as follows:
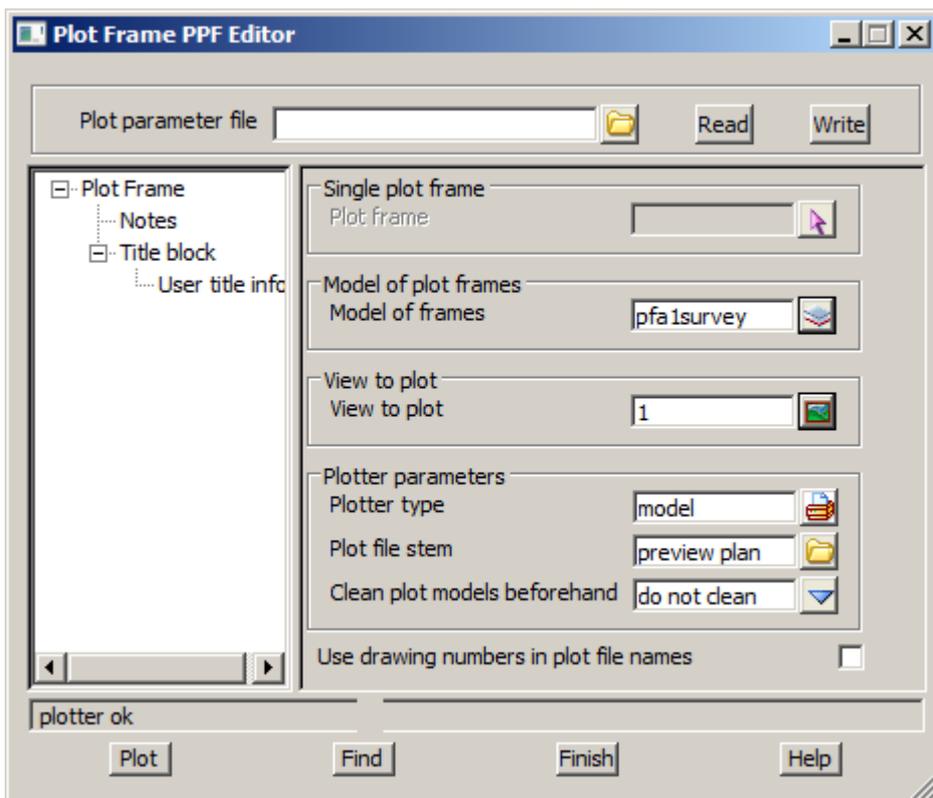
The plotter type to select is model, as we want to inspect the plot before sending it to the actual plotter.

In our example, we want to plot more than one Plot frame so we have chosen the Model of plot frames method. If we wanted to plot a single plot frame, we can select the frame using the Single plot frame selection tool.

Type in **preview plan** as the plot file stem. The plot stem specified will form the prefix for the plot name. This is important for plotting of a number of plot frames. For this example we have 3 plot frames so the 3 plot files produced will be "preview plan 1", "preview plan 2" and "preview plan 3".

Click LB on the *Title block* heading. Tick the *Use title file* checkbox as follows. This specifies that a Title file will be used for the plotting.
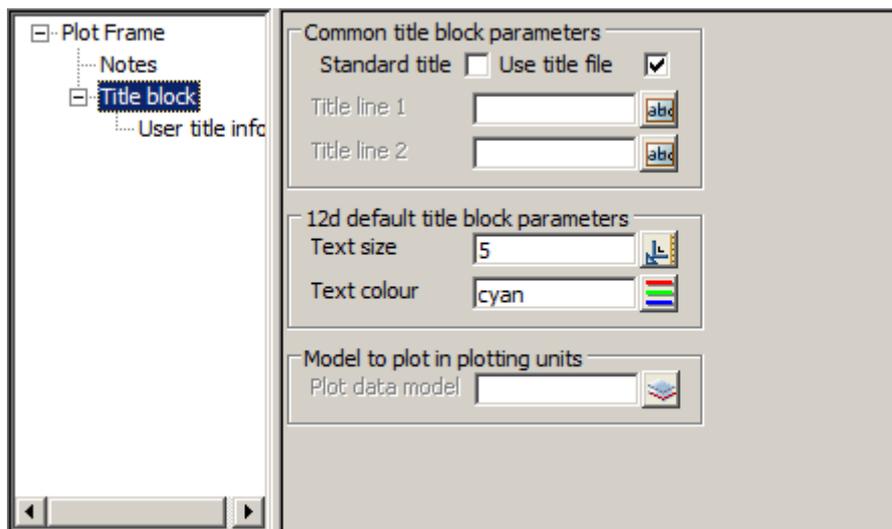
Click LB on the *User title info* heading and select the title file **Plan Plot.tbf** from the folder **C:\12d\9.00\Training\design\getting started basic**.
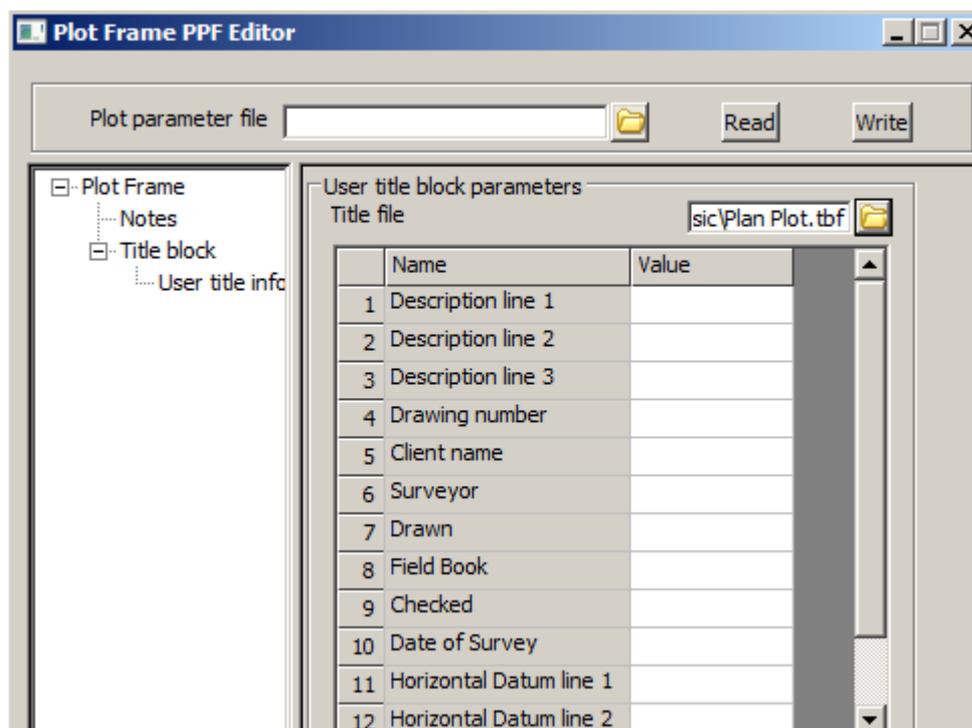
Once selected, a valid title file will populate the grid with user defined title file aliases. These are prompts for title box text and once filled out, will be substituted into the title block. Fill out the value part of the grid as follows. Fill out the form to suit your requirements.
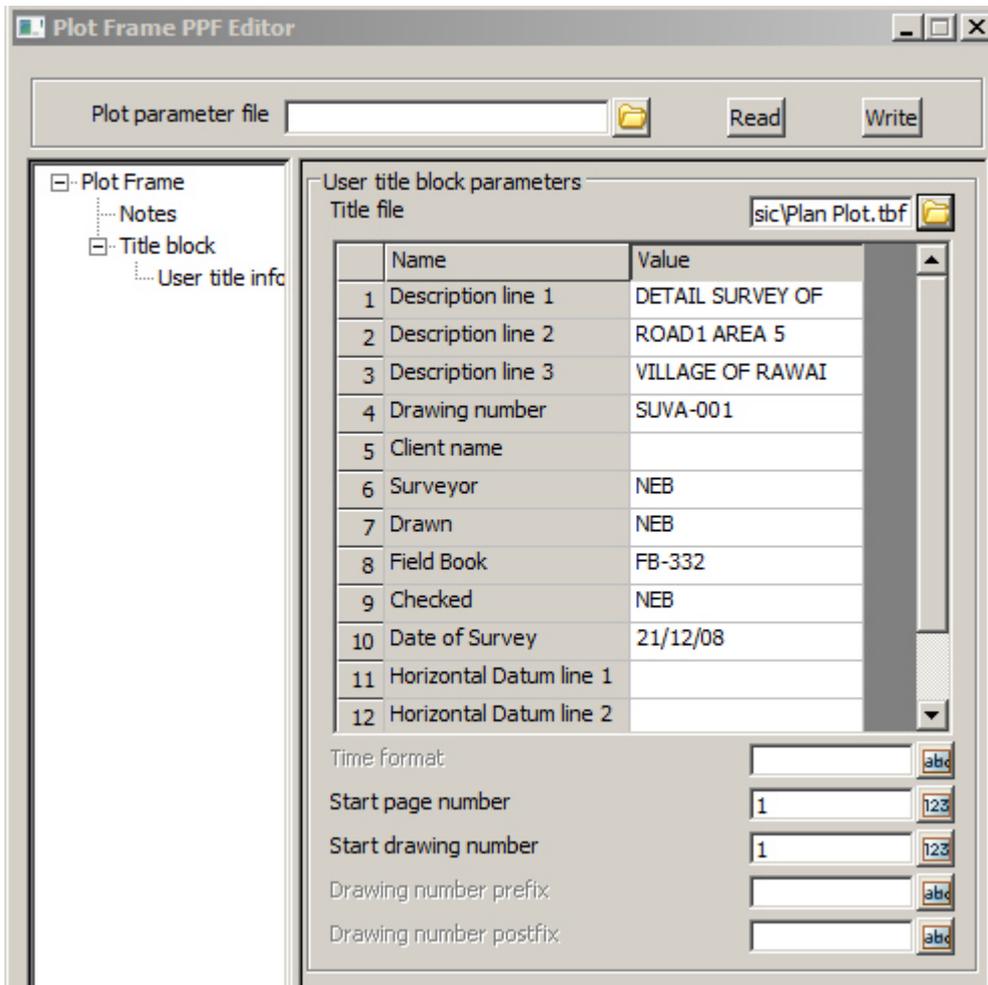
This panel can be resized by moving the mouse to the extremities of the panel and whilst holding down the LB near the edge, moving the outline to the required size just like resizing any view. Resize the panel in both the horizontal and vertical so that it takes up most of the screen. **Note** Like any panel it can be minimised by using the standard windows minimise button.

Note that all the value fields do not have to be filled out.

At any stage of the editing process, the user can write a binary PPF file that can be read into a panel at a later time. This is helpful if you want to close the **Plot frame PPF Editor** panel but want to save the changes. Simply type a file name into the Plot Parameter File box at the top of the **Plot frame PPF Editor** and press the enter key. This assigns the relevant file extension. Then press the **Write** button at the top of the panel.

To read an existing PPF file, the user can choose the file from the Plot Parameter File box, then press the **Read** button. This loads any existing parameters into the grid.

Prior to plotting

Return to 'Plot frame' part of the panel
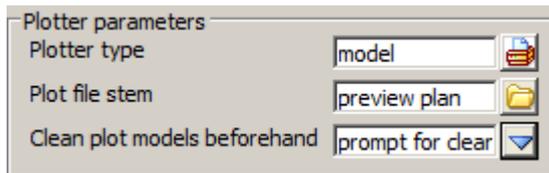
Select **prompt for clean** as the choice for 'Clean models before hand'. This gives the user the option to clean at the time of creating the plot

To generate a plot, press the **Plot** button at the bottom of the panel followed by pressing **Yes** to confirm cleaning the plot models.

In view Plan PREVIEW, turn OFF all models then turn on the model **preview plan 1**.
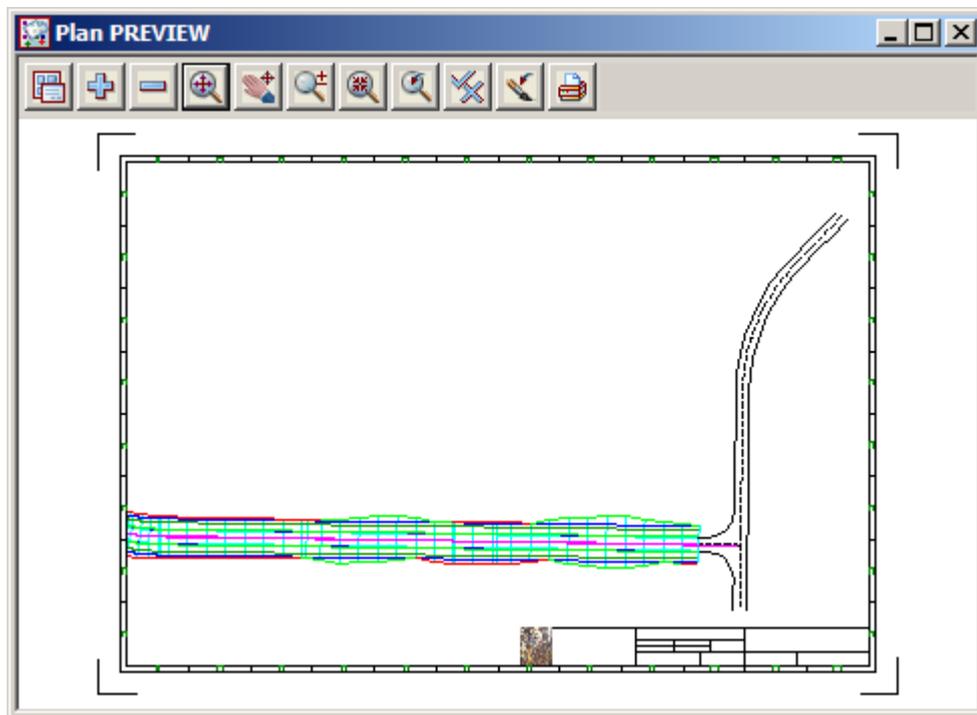
17.12.4 Previewing Plan plots and Managing Plan Plot Files

To preview a plot, just turn on the model containing the previewed plot in view Plan PREVIEW e.g **preview plan 1**. It is highly likely that you will need to change some of your plot parameters and repeat the plot and preview process several times before your plots are as you want them.

You are now in a position to make changes to your plot parameters and repeat the plot(s).

When you are happy with the plot, you can change the plotter option in the Plot Frame PPf editor to the desired plotter. Double click on the appropriate plotter to select.
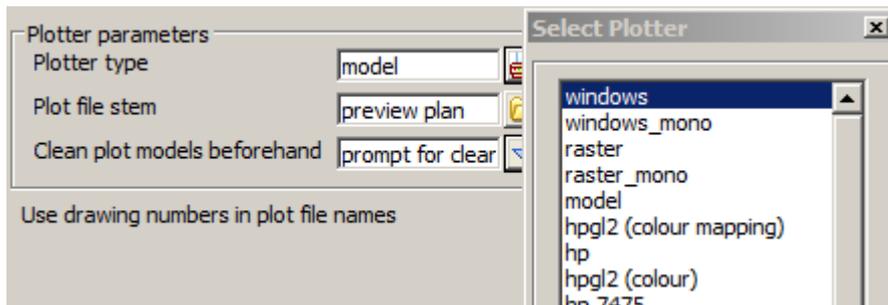
Selection of the *windows* plotter option will utilise the current printers/plotter set up in windows.

Press the plot button to send the plot file to the selected device.

17.12.5 Saving PPF files for use with other projects

For a particular company or organisation, various styles/specifications may have to be consistent for all plots. If a standard PPF is created for a company this can be saved to the **User_lib** directory for easy access for any project. Then for more specific changes, such as the user text (that is substituted into a title file) the new value can be entered and a PPF saved again. e.g. The designers name may be changed and the PPF saved with a filename "designers_name" for example.

At any stage of the editing process, the user can write a binary PPF file that can be read into a panel at a later time. This is helpful if you want to close the panel but want to save the changes. Simply type a file name into the Plot Parameter File box at the top of the editor and press the enter key. This assigns the relevant file extension. Then press the **Write** button at the top of the panel. The write process will by default put the file produced into the current project folder

.

If the user wants to save it to a **User_Lib** directory for example, they must click on **[User_lib]** to open that folder
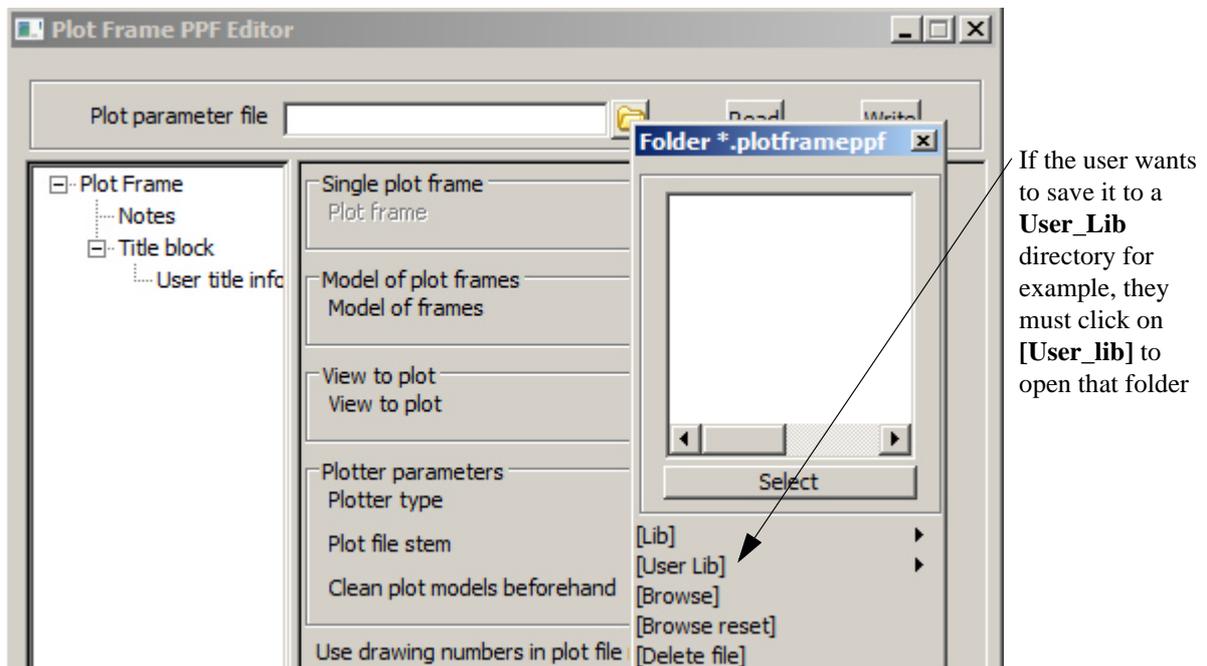
Type in the file name **Plan plot**

Select **Open**

The file name is placed in the 'Plot parameter file' text box.

Select **Write** to save the file