SCC Help

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1 Introduction

1.1 SCC Manual Overview

Introduction

The SCC documentation is composed of two printed manuals and a number of additional electronic resources. The two manuals are the SCC reference manual, and the SCC user guide.

SCC User Guide

The SCC user guide contains a series of step-by-step tutorials that go through many of the typical survey, modelling, mapping, volumes, and design tasks for which you are likely to use SCC. This includes, among others, tasks such as transferring data to and from many popular measuring instruments, using SCC with other packages such as MX and CAD, creating models, calculating volumes and cutting sections. All of the data used in these tutorials is available in the SCC installation folders. This manual is designed to teach you how to use SCC to accomplish most tasks, and is a good starting point for most new users, or those putting SCC to new uses.

SCC Reference Manual

The SCC reference manual contains a functional description of every menu option available in the SCC software, organised in a format that has a similar logical layout to the software itself. This manual is designed to show you how each SCC function operates, and how SCC as a whole interacts with other software on your computer. Where appropriate, this manual also includes references into the SCC user manual for more detailed examples on the use of specific options.

On-line help

In addition to the printed documentation, the user and reference manuals will also be available in the form of on-line context sensitive help from within SCC. The on-line help is likely to contain more up to date information than the printed manuals, and additionally will contain extra multi-media content such as video examples covering the use of different program options. For the very latest documentation and program updates, visit the SCC web site at www.atlascomputers.ie

Documentation Conventions

NOTES are something of special interest. They should be remembered. If not, at least they will be easy to find in the future when surrounded by a double border.

All menu and command options will be in inverted commas, with the main menu title appearing in CAPITAL LETTERS.

All actions required by you, will be indented and appear in italics.

There will be a heading at the top right of the instructions describing the aim of the exercise.

Follow these exact instructions to achieve the proper results.

An example might be:

Action Identifier Table Heading

From the Main Menu Bar, Select 'EDIT > Edit Strings > Join Strings'

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Pick the two strings from the graphic model

1.2 Installation and set-up

To install SCC, insert the CD in your CD or DVD drive and run the 'Setup' application on that drive. For example, if your CD drive is drive 'D', select Start, Run, 'D:\SETUP.EXE'. Please ensure that you have a hardware lock or network license prior to commencing with SCC installation. If you have a previous version of SCC installed, please back up all your SCC data, and uninstall the previous version prior to installing this version.

SCC requires Windows 2000, Windows XP or Windows Vista with at least 512KB of RAM and between 100MB and 500MB of available disk space depending on options installed. SCC Installation is quick and easy.

To Install/Update SCC

If you have SCC already installed on your computer, backup your existing SCC directory and any sub-directories off it.

Plug the SCC hardware lock (dongle) into the PC's printer port or USB port

Insert the CD into your CD drive and run SETUP.EXE from the root directory.

On most machines this will run automatically when you insert the CD.

The SCC image will be displayed

Select Next

Read the Welcome dialog

Select Next

Enter in the user name and organization. Select whether the software is to be used by many users or only the person whose name was entered.

Select Next

Select a destination directory for SCC. It will default to the directory C:\SCC\. To accept this directory, select Next, to chose a different directory, select Change.

Select Next

Set Typical as the Setup Type

Select Next

Select Install to accept the current installation settings.

The program is now installing.

The hardware lock driver will also install.

Select Finish

Run SCC, either by double clicking on the SCC icon or by selecting SCC from the Windows program menu.

Before performing any operations in SCC, it is important to ensure directories and external links are setup correctly. It is sufficient to set up these links once.

Directories & Files:File Structures

Setting up SCC Directories and Files:

SCC can have direct links to a text editor, CAD and/or MX. Having a link to a CAD system or MX will mean that when exporting a model, the CAD system or MX will open automatically and the drawing will be generated in that program.

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The Executable files, Projects and Temporary files directory will be filled in automatically during installation. If the default settings differ from yours ensure you change them to correspond to your specific directory structure.

The Windows WordPad is used as the default Text Editor. No path directory has to be entered in this option, simply type the word NOTEPAD. Any time any reports are edited they will be presented in the Text Editor. Having a link to a CAD system or MX will mean that when exporting an SCC model or section, to either CAD or MX, they will be automatically opened and the drawing generated in that system.

Go to 'FILE > General Options > Directories and Files' panel

Check and see that the executable files directory is correct.

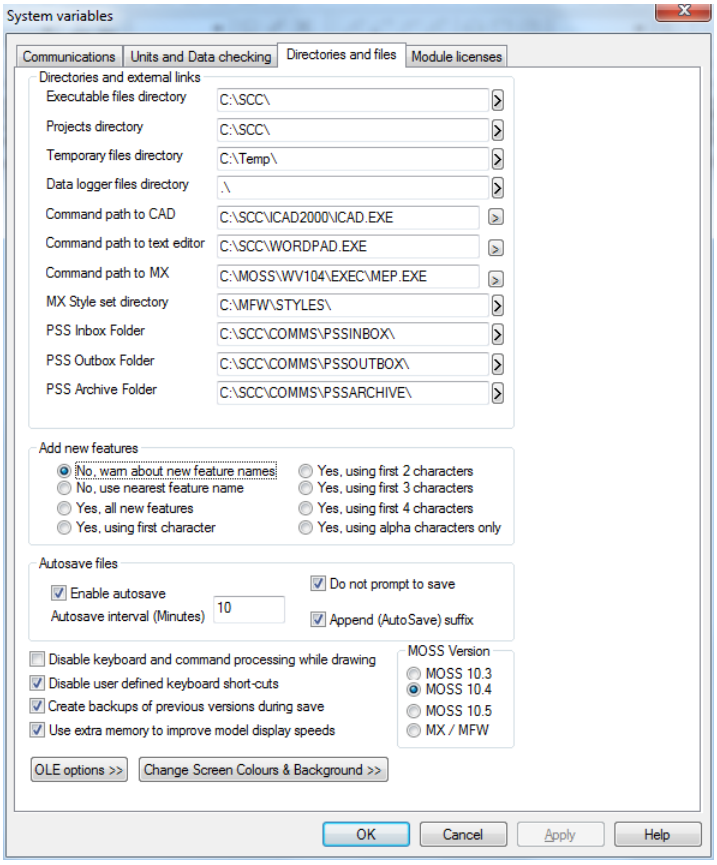
If you have installed SCC in a directory other than the default, type in the correct path to this directory.

Check and see that the projects directory is correct. This should normally be the same directory as the executable file directory.

Make sure that the temporary directory stated exists. If not create this directory.

Select the path to your CAD executable file.

Identify the text editor you wish to use for SCC generated reports.



SCC uses the Windows Wordpad as its default Text Editor. This link will be automatically set during installation. SCC generates reports for some functions it carries out, such as traverse reduction, adjustment and volume calculation. If you choose to edit/view these reports while SCC is running the selected editor will display the report.

It is also possible to change the background colour of SCC from this panel as well as the screen colours themselves as colours that are visible on a white background may be less visible on a black background.

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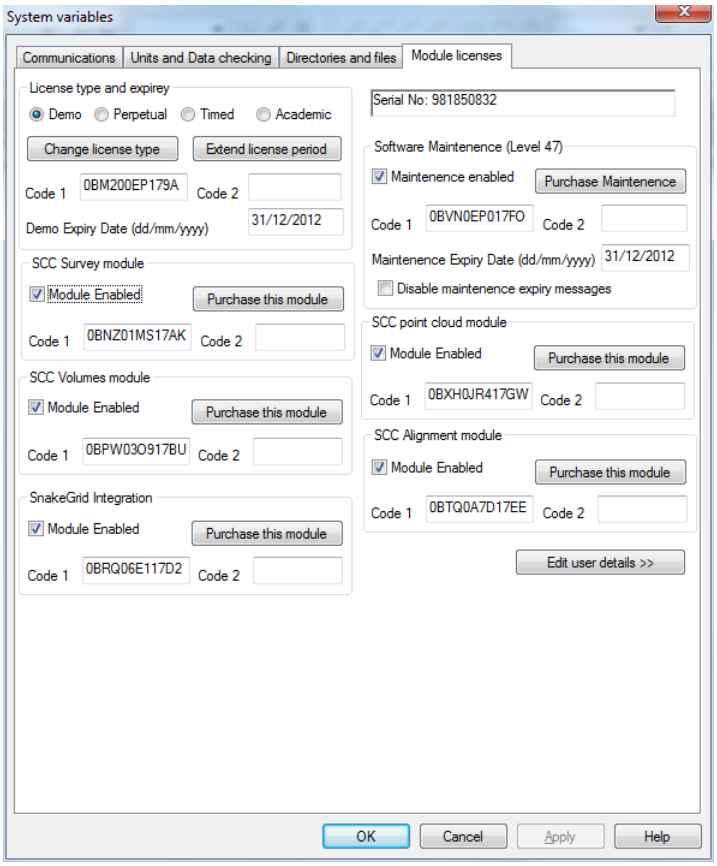
Module Licences

Maintenance codes will be specific to your dongle number and the expiry date. 10 days before your maintenance is due to expire, a reminder message will be displayed on opening the program. This message will be displayed until the maintenance has been renewed.

Go to 'FILE > General Options'

Select the 'Module Licenses' panel

Ensure you have the entered the correct maintenance code and maintenance expiry date.



To install Maintenance Codes and Expiry Date:

Go to 'FILE > General Options'

Within the 'System Variables' dialog box go to 'Module Licenses'

Enter Maintenance Code 2 and Maintenance Expiry Date

Select 'Purchase Maintenance'

A black correct symbol should appear in the box beside 'Maintenance Enabled'

Units & Data Checking

During the download procedure, SCC also range checks every field against a user definable range of values. Any exceptions are reported to the log file, and optionally to screen during the download process. The log file also includes any other potential errors relating to the input data, reduction, adjustment and subsequent analysis.

The level of detail included in the log file is also user definable, ranging from minimal to full diagnostic. When run in diagnostic mode, SCC will also log all intermediate computational results to the log file for QA purposes, such as matrix dumps in least squares analysis or

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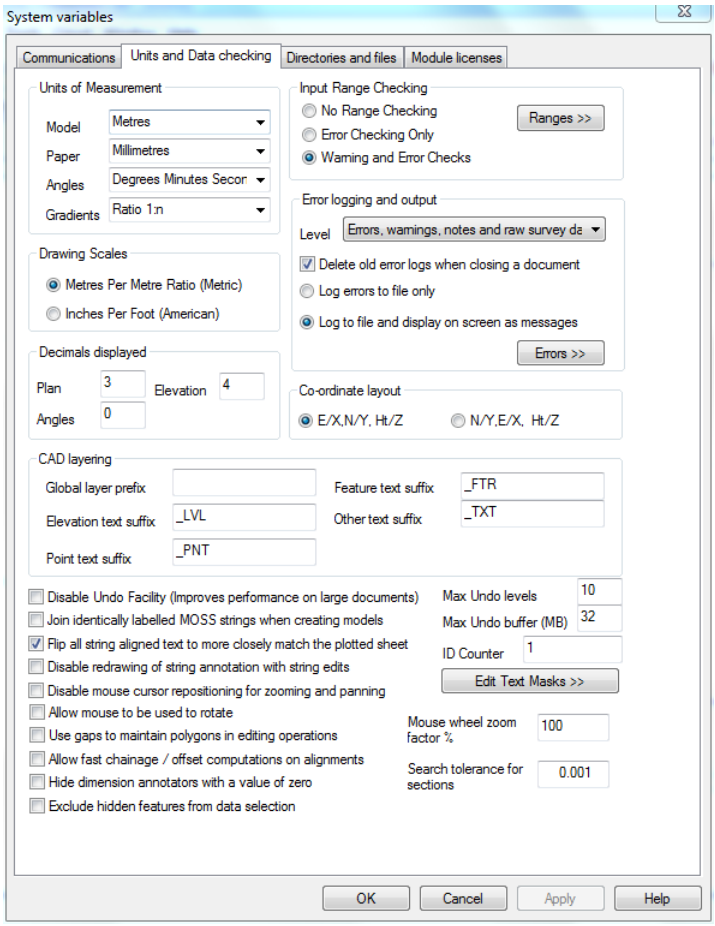
transformation, triangulation computations during modelling, etc… This can prove an invaluable tool both for support, and when attempting to track down a complex data related error or query.

Go to 'FILE > General Options > Units & Data Checking' panel

Select the type of 'Input Range Checking', 'Error Reporting Method' and 'Error Reporting Detail' options you prefer.

You may also set the 'Undo' facility in this panel but remember that the more undo levels you select, the more memory taken.



Workspaces

The workspace contains all the file, menu and toolbar settings that appear when you first open SCC. These settings can be changed for an individual or for the duration of a large project where only a number of the toolbars/menus are in use and more of the display area is needed. The workspace can be saved as default and then loaded each time SCC is opened. This option can be accessed through the FILE > Workspaces menu.

Go to 'FILE > Workspaces'

Save the workspace as ….

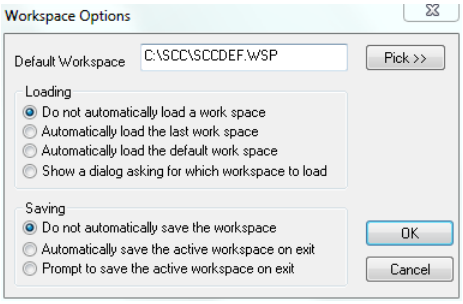
Go to 'FILE > Workspaces'

This time select 'Workspace Options'

Select the workspace file previously saved using the 'Pick' button

Set the loading option to 'Automatically load the default workspace'

Set the saving option to 'Do not automatically save the workspace'



Again, these settings can be changed to suit the individual user or working project.

1.3 32 bit & 64 bit SCC Versions

SCC now includes separate native 32 bit and 64 bit versions of SCC. The 64 bit version of SCC requires Windows 7 (64 bit) with 2GB or more of RAM. This version can work with point clouds of up to 4 billion points and TIN models of hundreds of millions of points. A point cloud of 4 billion points will take between 12gb and 20gb of RAM depending on colour and intensity scheme used. A typically large cloud of ~ 1 billion points take ~10 seconds to open and can be displayed and edited in real time on a mid range multi-core workstation. The point cloud engine has been optimised such that it can take full advantage of modern multi-core processors for most tasks, thus making it up to eight times faster than previous versions where eight core processing (e.g. Intel i7 or AMD 8350) is available. This installation of SCC installs both 32 and 64 bit versions by default. The current 64 bit version is limited insofar as it does not as yet support the geodetic grid or SnakeGrid transformations available under 32 bit.

2 Basic Concepts

This section deals with the basic concepts and terms used within SCC. It aims to explain how SCC generates maps and surfaces from observed survey data, and what mechanisms are used to transfer the information generated into other CAD and design packages such as AutoCAD, MicroStation and MX.

2.1 Data storage and user interface

Data Storage

SCC uses the Microsoft document/view architecture to store and edit all its information. A document is a file on your computer used to store one or more pieces of related information in a self contained format, that is recognisable by the Windows operating system. Examples of documents include Word documents, Excel spreadsheets, etc.. Each of these document types have corresponding disk files and are registered with the operating system for use with other programs, such as explorer.

When using SCC, all the documents relating to a given survey project, including SCC documents and other data such as CAD drawings, will be stored in a project folder. This folder is created when the 'New Project' option is selected, taking its name from the project name. The location of this folder is set-up in the 'General Options > Directories and Files' dialog, by default it will be 'C:\SCC'. When we create a new project, a new SCC project document is opened in the project folder, based on a selected project template. All data downloaded or imported, and models and sections generated in this project are stored in this new folder. While you can enter names for all documents, file extensions are controlled by SCC. As with other document based Windows software, when closing a file within SCC you will be prompted to save this file if it has been modified. If you are carrying out a lot of editing on any document, and you are not using a version control system to manage your revisions, we recommend that you regularly save your changes, given each saved version a revision based file name. For example, if you create a model called MyModel, the first time you save it you might call it MyModel01.Model. Intermediate edits might be saved as MyModel02.Model,

MyModel03.Model, etc.., and the final model saved as MyModel-Final.Model. In this way, if you make any errors during the editing process, you can always revert to a previous version. Alternatively, you can use an automated back software, such as Active Backup (www.ajcsoft.com), to do this for you.

SCC versions and updating

Please note the following with regards to SCC versions and version compatibility. The SCC version is made up of three digits; the release number, the major version, and the minor version. For example, SCC 7.4.8 is SCC release 7, version 4, sub version 8. The release number typically changes on an annual basis, when all users with a current maintenance contract are issued with new full installation CDs and supporting documentation. The major version changes when a modification is made that necessitates a file format change, that may in turn lead to backward incompatibility with previous versions. For example, SCC 7.0.0 may not be able to fully read all files created with 7.1.0. A minor version change indicates a software modification that has no bearing on file format compatibility, for example SCC 7.4.2 can read files created in 7.4.8 as all data created in SCC 7.4.x has the same file format. Therefore, for a group of SCC users wishing to ensure that they will be fully data compatible, they should all be on the same release of SCC and the same major version. Note that like most commercial software, such as AutoCAD, MS Office, etc.., all versions of SCC can always read all files created from any previous version. Compatibility issues only arise when attempting to read files created by a later version than the version in use.

XML Support

SCC also supports loading and saving of all of its document files in the industry standard XML format, in addition to its native formats. XML (extensible mark-up language) is an ASCII format widely used in Internet and database applications for the exchange and archiving of data. It has the following advantages; Data saved by SCC in XML format is both backward and forward compatible with any XML enabled version of SCC. XML is an open data format, thus SCC XML data may be translated into other formats by third party software where required. Note that XML has the disadvantages that it is much slower to save and load, and is much larger in size than native SCC binary formats. SCC XML options are available from the File / XML menus throughout the program.

User Interface

The view is the principal graphical interface to a document. Some documents have a single view, for example in Word, the view is the area on screen where you type in your text. Other programs will have multiple views, for example in Excel, you might have a single spreadsheet that contains many pages, though each page belongs to the same .XLS document. SCC documents typically have multiple views, for example in a survey data set, detail observations and reduced coordinates are presented in separate spreadsheet views. All of the views in SCC are either spread sheet views, or interactive graphical views, and have a unique name and graphical icon, displayed in a tab at the bottom of the view. The simplest way to switch between views is to left click on this tab with the mouse.

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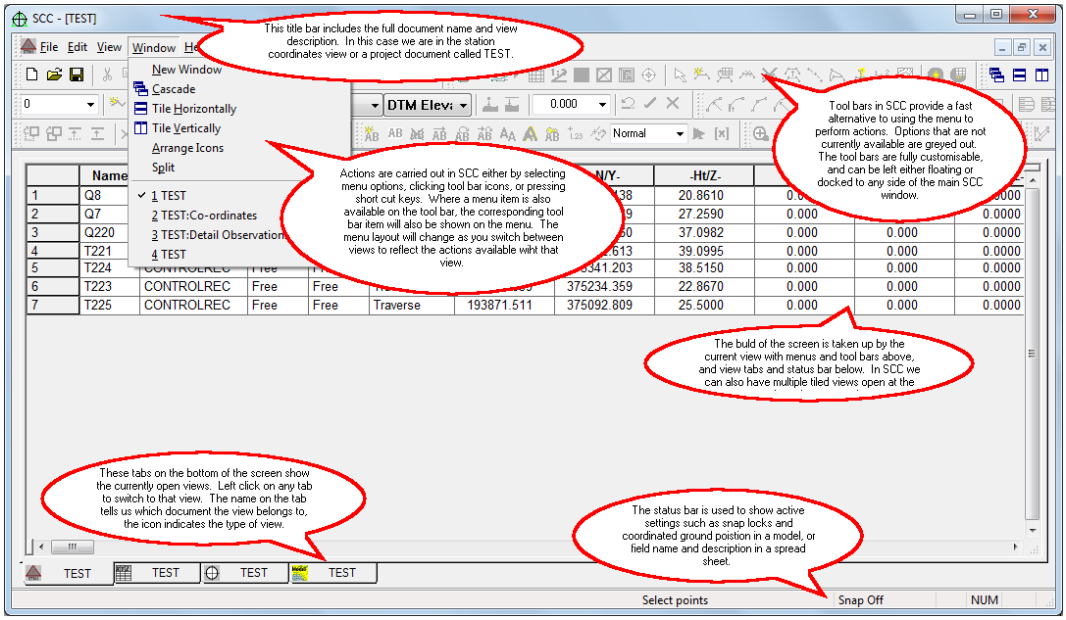

Documents

SCC creates and works with the following document types: Projects, Survey Datasets, Traverses, Models, Sections, Transformations, Alignments and Program modules. A brief description of each document is given below, along with the views available and icons used.

2.1.1 Project

A project document is used to share station coordinates between other SCC documents in the project folder, and to determine drawing and modelling conventions used. It contains four sheet views

Station coordinates, used to establish and maintain the grid system used in this project.

Feature Library, used to control naming conventions, drawing standards and modelling defaults.

Ground Type Library, used to break down different parts of the surface model into various ground types for viewing and analysis purposes.

Advanced Survey Coding, used to control how coding in the field is interpreted into features and reduction options.

In addition to this the project file stores copies of all ancillary drawing support items such as symbols, line-styles, sheet layouts, text styles, and bitmaps that are used in model and section drawing.

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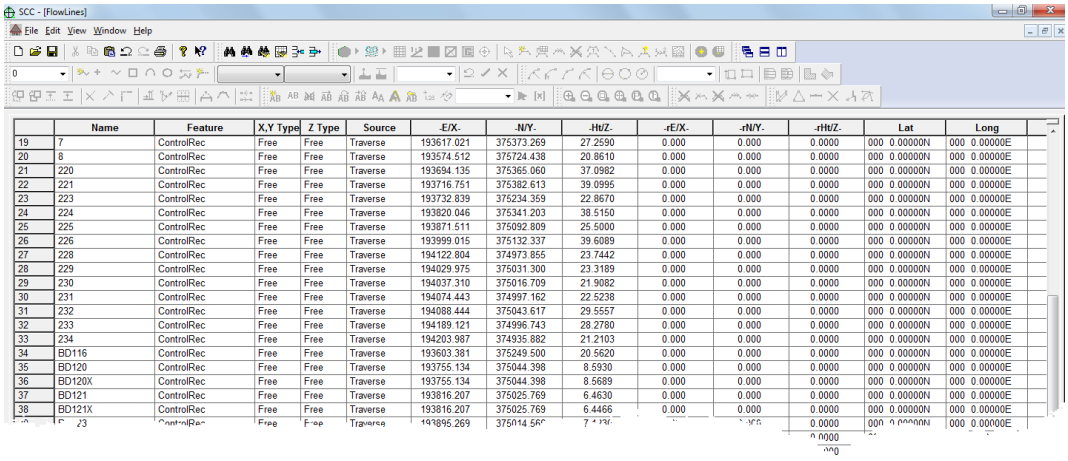
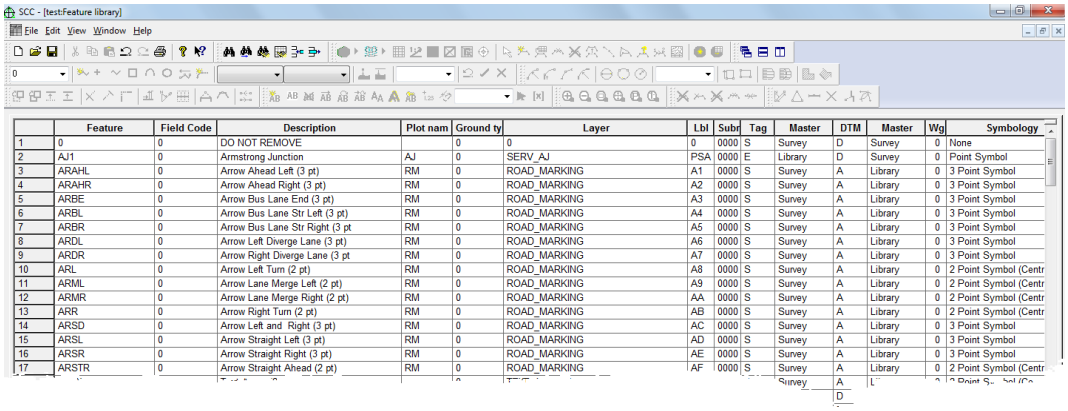


SCC - [FlowLines]

File Edit View Window Help

	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat	Long
19	7	ControlRec	Free	Free	Traverse	193617.021	375373.269	27.2590	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
20	8	ControlRec	Free	Free	Traverse	193574.512	375724.438	20.8610	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
21	220	ControlRec	Free	Free	Traverse	193694.135	375365.060	37.0982	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
22	221	ControlRec	Free	Free	Traverse	193716.751	375382.613	39.0995	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
23	223	ControlRec	Free	Free	Traverse	193732.839	375234.359	22.8670	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
24	224	ControlRec	Free	Free	Traverse	193820.046	375341.203	38.5150	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
25	225	ControlRec	Free	Free	Traverse	193871.511	375092.809	25.5000	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
26	226	ControlRec	Free	Free	Traverse	193999.015	375132.337	39.6089	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
27	228	ControlRec	Free	Free	Traverse	194122.804	374973.855	23.7442	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
28	229	ControlRec	Free	Free	Traverse	194029.975	375031.300	23.3189	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
29	230	ControlRec	Free	Free	Traverse	194037.310	375016.709	21.9082	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
30	231	ControlRec	Free	Free	Traverse	194074.443	374997.162	22.5238	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
31	232	ControlRec	Free	Free	Traverse	194088.444	375043.617	29.5557	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
32	233	ControlRec	Free	Free	Traverse	194189.121	374996.743	28.2780	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
33	234	ControlRec	Free	Free	Traverse	194203.987	374935.882	21.2103	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
34	BD116	ControlRec	Free	Free	Traverse	193603.381	375249.500	20.5620	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
35	BD120	ControlRec	Free	Free	Traverse	193755.134	375044.398	8.5930	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
36	BD120X	ControlRec	Free	Free	Traverse	193755.134	375044.398	8.5689	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
37	BD121	ControlRec	Free	Free	Traverse	193816.207	375025.769	6.4630	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
38	BD121X	ControlRec	Free	Free	Traverse	193816.207	375025.769	6.4466	0.000	0.000	0.0000	000 0.00000N	000 0.00000E

Project - Station Coordinate Sheet

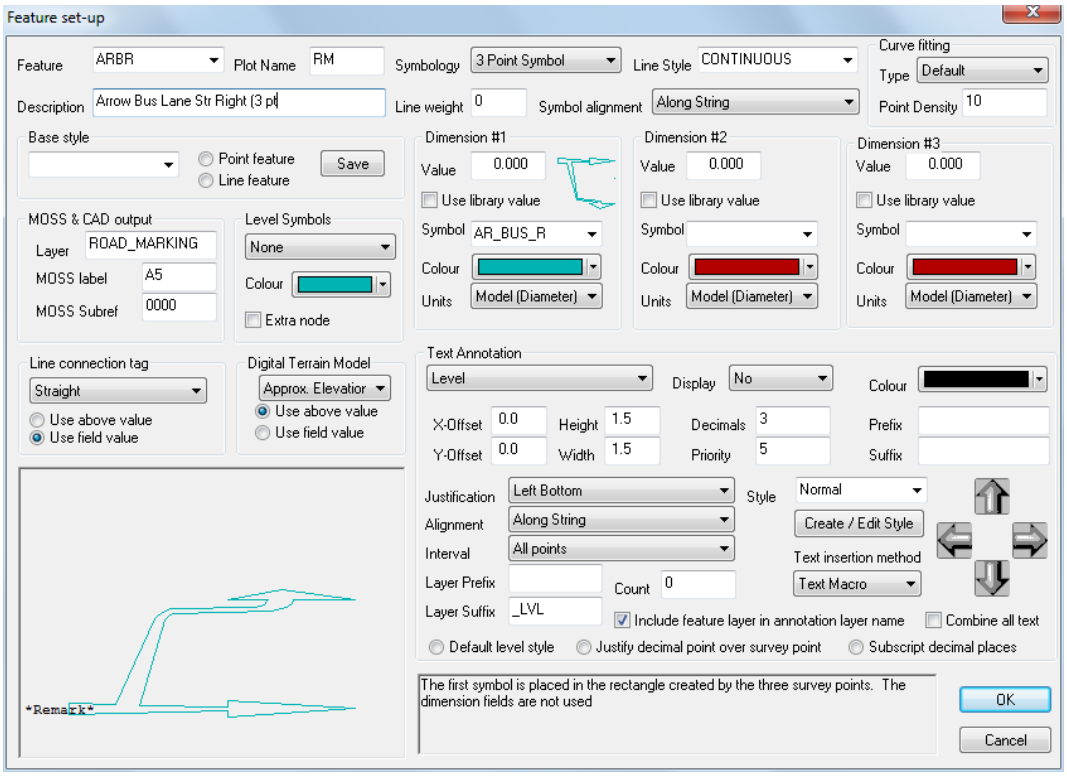


SCC - [test:Feature library]

File Edit View Window Help

	Feature	Field Code	Description	Plot nam	Ground ty	Layer	Lbl	Subr	Tag	Master	DTM	Master	Wg	Symbology
1	0	0	DO NOT REMOVE		0	0	0	0000	S	Survey	D	Survey	0	None
2	AJ1	0	Armstrong Junction	AJ	0	SERV_AJ	PSA	0000	E	Library	D	Survey	0	Point Symbol
3	ARAHL	0	Arrow Ahead Left (3 pt)	RM	0	ROAD_MARKING	A1	0000	S	Survey	A	Library	0	3 Point Symbol
4	ARAHR	0	Arrow Ahead Right (3 pt)	RM	0	ROAD_MARKING	A2	0000	S	Survey	A	Library	0	3 Point Symbol
5	ARBE	0	Arrow Bus Lane End (3 pt)	RM	0	ROAD_MARKING	A3	0000	S	Survey	A	Library	0	3 Point Symbol
6	ARBL	0	Arrow Bus Lane Str Left (3 pt)	RM	0	ROAD_MARKING	A4	0000	S	Survey	A	Library	0	3 Point Symbol
7	ARBR	0	Arrow Bus Lane Str Right (3 pt	RM	0	ROAD_MARKING	A5	0000	S	Survey	A	Library	0	3 Point Symbol
8	ARDL	0	Arrow Left Diverge Lane (3 pt)	RM	0	ROAD_MARKING	A6	0000	S	Survey	A	Library	0	3 Point Symbol
9	ARDR	0	Arrow Right Diverge Lane (3 pt	RM	0	ROAD_MARKING	A7	0000	S	Survey	A	Library	0	3 Point Symbol
10	ARL	0	Arrow Left Turn (2 pt)	RM	0	ROAD_MARKING	A8	0000	S	Survey	A	Library	0	2 Point Symbol (Centr
11	ARML	0	Arrow Lane Merge Left (2 pt)	RM	0	ROAD_MARKING	A9	0000	S	Survey	A	Library	0	2 Point Symbol (Centr
12	ARMR	0	Arrow Lane Merge Right (2 pt)	RM	0	ROAD_MARKING	AA	0000	S	Survey	A	Library	0	2 Point Symbol (Centr
13	ARR	0	Arrow Right Turn (2 pt)	RM	0	ROAD_MARKING	AB	0000	S	Survey	A	Library	0	2 Point Symbol (Centr
14	ARSD	0	Arrow Left and Right (3 pt)	RM	0	ROAD_MARKING	AC	0000	S	Survey	A	Library	0	3 Point Symbol
15	ARSL	0	Arrow Straight Left (3 pt)	RM	0	ROAD_MARKING	AD	0000	S	Survey	A	Library	0	3 Point Symbol
16	ARSR	0	Arrow Straight Right (3 pt)	RM	0	ROAD_MARKING	AE	0000	S	Survey	A	Library	0	3 Point Symbol
17	ARSTR	0	Arrow Straight Ahead (2 pt)	RM	0	ROAD_MARKING	AF	0000	S	Survey	A	Library	0	2 Point Symbol (Centr

Project - Feature Library Sheet



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See Also

Station Co-ordinates (View Menu)

Feature Library (View menu)

Ground Type Library (View Menu)

Advanced Survey Coding (View Menu)

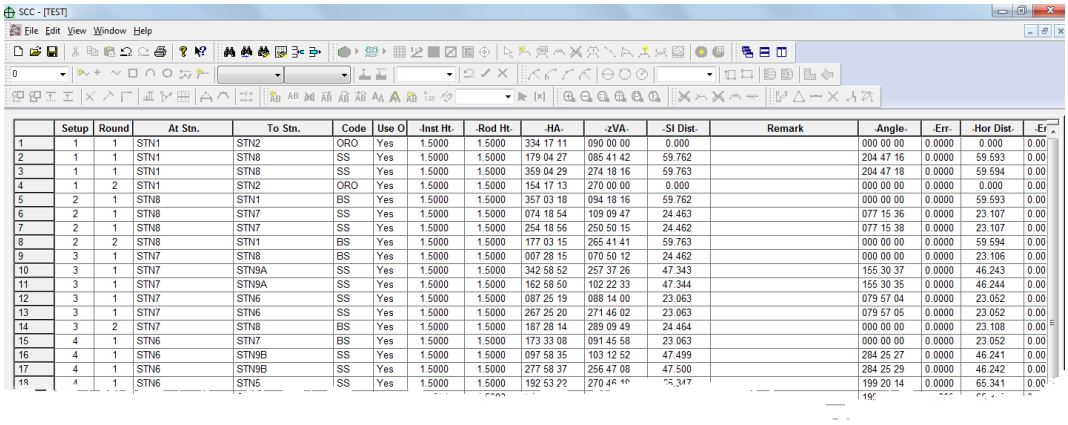
2.1.2 Traverse

The **traverse** document is used to store observations relating to traverse and network adjustments. Within the Traverse document you can reduce and edit setups, apply relevant corrections and perform adjustments. The traverse document includes three sheet views

The traverse observation view, including observed angles and distances, reduced values, and computed residuals

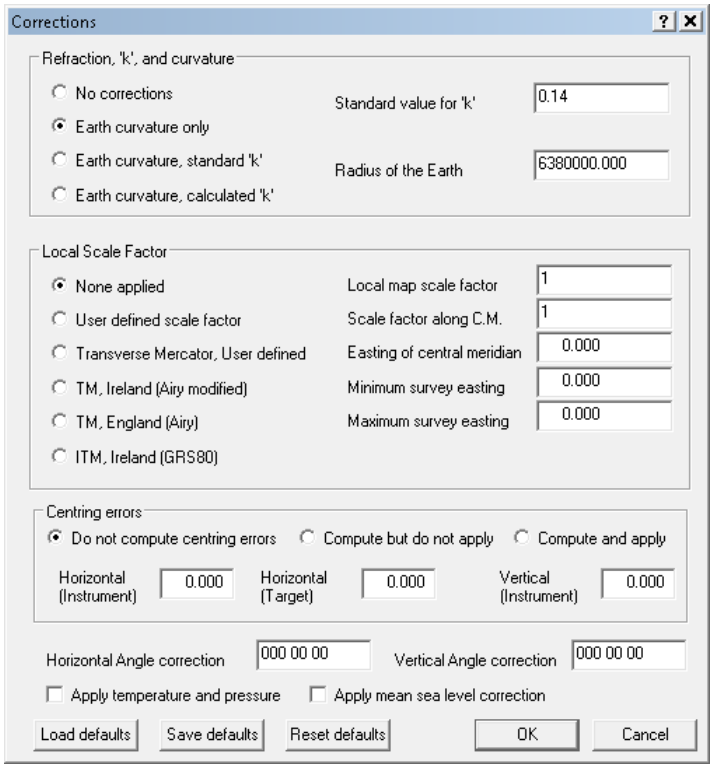
The traverse coordinates view, including provisional and adjusted station coordinates, and computed error ellipse axes

Station coordinates, a back-up of the station coordinates used in this traverse, such that the traverse document is fully self contained.

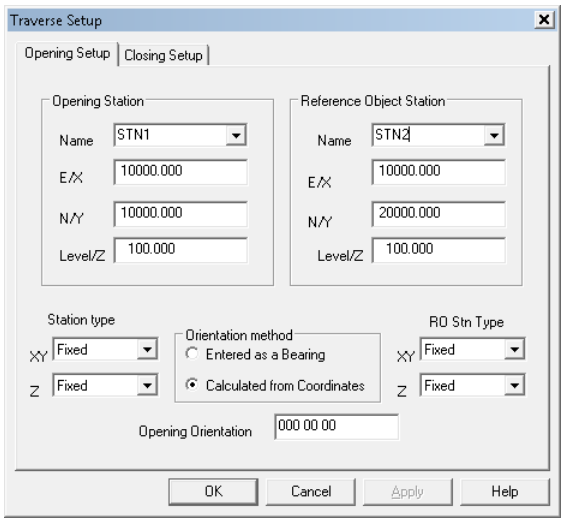


	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Remark	-Angle-	-Err-	-Hor Dist-	-Er
1	1	1	STN1	STN2	ORO	Yes	1.5000	1.5000	334 17 11	090 00 00	0.000		000 00 00	0.0000	0.000	0.00
2	1	1	STN1	STN8	SS	Yes	1.5000	1.5000	179 04 27	085 41 42	59.762		204 47 16	0.0000	59.593	0.00
3	1	1	STN1	STN8	SS	Yes	1.5000	1.5000	359 04 29	274 18 16	59.763		204 47 18	0.0000	59.594	0.00
4	1	2	STN1	STN2	ORO	Yes	1.5000	1.5000	154 17 13	270 00 00	0.000		000 00 00	0.0000	0.000	0.00
5	2	1	STN8	STN1	BS	Yes	1.5000	1.5000	357 03 18	094 18 16	59.762		000 00 00	0.0000	59.593	0.00
6	2	1	STN8	STN7	SS	Yes	1.5000	1.5000	074 18 54	109 09 47	24.463		077 15 36	0.0000	23.107	0.00
7	2	1	STN8	STN7	SS	Yes	1.5000	1.5000	254 18 56	250 50 15	24.462		077 15 38	0.0000	23.107	0.00
8	2	2	STN8	STN1	BS	Yes	1.5000	1.5000	177 03 15	265 41 41	59.763		000 00 00	0.0000	59.594	0.00
9	3	1	STN7	STN8	BS	Yes	1.5000	1.5000	007 28 15	070 50 12	24.462		000 00 00	0.0000	23.106	0.00
10	3	1	STN7	STN9A	SS	Yes	1.5000	1.5000	342 58 52	257 37 26	47.343		155 30 37	0.0000	46.243	0.00
11	3	1	STN7	STN9A	SS	Yes	1.5000	1.5000	162 58 50	102 22 33	47.344		155 30 35	0.0000	46.244	0.00
12	3	1	STN7	STN6	SS	Yes	1.5000	1.5000	087 25 19	088 14 00	23.063		079 57 04	0.0000	23.052	0.00
13	3	1	STN7	STN6	SS	Yes	1.5000	1.5000	267 25 20	271 46 02	23.063		079 57 05	0.0000	23.052	0.00
14	3	2	STN7	STN8	BS	Yes	1.5000	1.5000	187 28 14	289 09 49	24.464		000 00 00	0.0000	23.108	0.00
15	4	1	STN6	STN7	BS	Yes	1.5000	1.5000	173 33 08	091 45 58	23.063		000 00 00	0.0000	23.052	0.00
16	4	1	STN6	STN9B	SS	Yes	1.5000	1.5000	097 58 35	103 12 52	47.499		284 25 27	0.0000	46.241	0.00
17	4	1	STN6	STN9B	SS	Yes	1.5000	1.5000	277 58 37	256 47 08	47.500		284 25 29	0.0000	46.242	0.00
18	4	1	STN6	STN5	SS	Yes	1.5000	1.5000	192 53 22	270 46 16	65.347		199 20 14	0.0000	65.341	0.00

Traverse Sheet



Corrections



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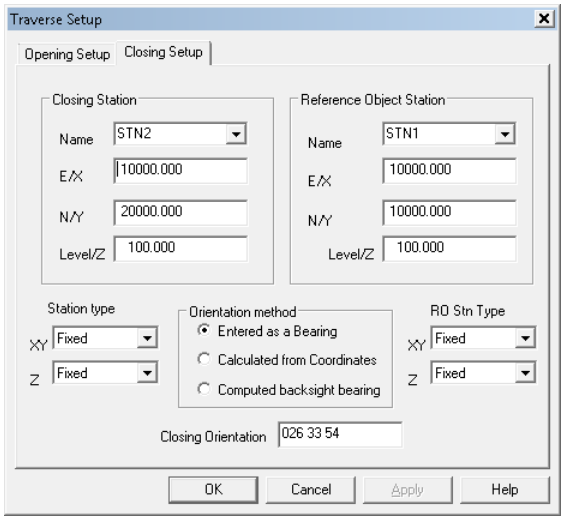


Traverse - Setup Dialogs

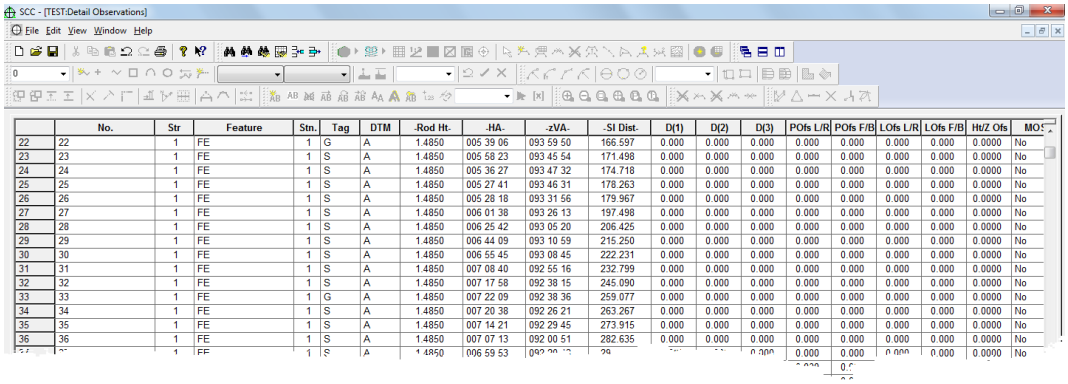
See Also

Traverse

2.1.3 Dataset

The survey document is used to store raw detail observations and reduced detail coordinates in a normalised format. Survey datasets can be created by downloading data from a survey instrument, or importing reduced data from another file. Depending on the data source, they may or may not contain any observation data. The survey document is made of the following five sheet views;

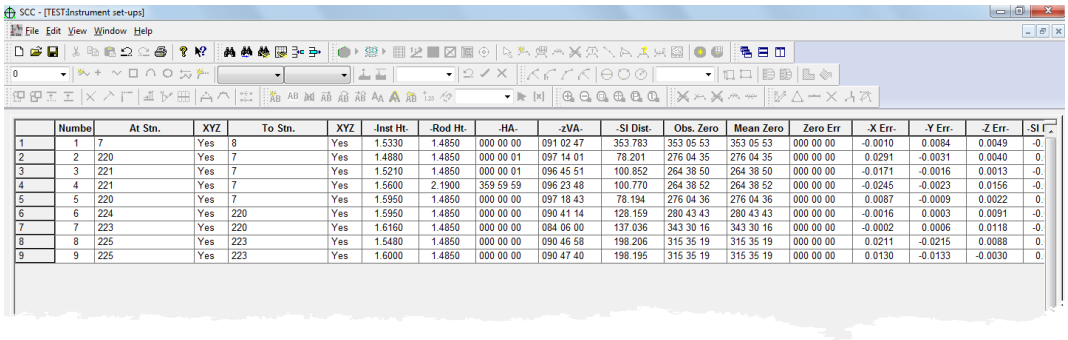
The detail observation spreadsheet contains all of the observations in any given survey. Note that these observations can be total station angles and distances, GPS latitude, longitude, height, or X, Y, Z. These different observation types may be also freely mixed in a given job. From the observation view, we can also specify various reduction parameters and defaults including corrections, mapping projections and GPS datum and transformation. Any changes made in the Detail Observation view will require the detail co-ordinates to be rebuilt in order to reflect the new changes. If the co-ordinates were not formed from a detail survey then this sheet will be blank.



	No.	Str	Feature	Stn.	Tag	DTM	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	D(1)	D(2)	D(3)	POfs L/R	POfs F/B	LOfs L/R	LOfs F/B	Ht/Z Ofs	MOS
22	22	1	FE	1	G	A	1.4850	005 39 06	093 59 50	166.597	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
23	23	1	FE	1	S	A	1.4850	005 58 23	093 45 54	171.498	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
24	24	1	FE	1	S	A	1.4850	005 36 27	093 47 32	174.718	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
25	25	1	FE	1	S	A	1.4850	005 27 41	093 46 31	178.263	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
26	26	1	FE	1	S	A	1.4850	005 28 18	093 31 56	179.967	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
27	27	1	FE	1	S	A	1.4850	006 01 38	093 26 13	197.498	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
28	28	1	FE	1	S	A	1.4850	006 25 42	093 05 20	206.425	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
29	29	1	FE	1	S	A	1.4850	006 44 09	093 10 59	215.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
30	30	1	FE	1	S	A	1.4850	006 55 45	093 08 45	222.231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
31	31	1	FE	1	S	A	1.4850	007 08 40	092 55 16	232.799	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
32	32	1	FE	1	S	A	1.4850	007 17 58	092 38 15	245.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
33	33	1	FE	1	G	A	1.4850	007 22 09	092 38 36	259.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
34	34	1	FE	1	S	A	1.4850	007 20 38	092 26 21	263.267	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
35	35	1	FE	1	S	A	1.4850	007 14 21	092 29 45	273.915	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
36	36	1	FE	1	S	A	1.4850	007 07 13	092 00 51	282.635	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No

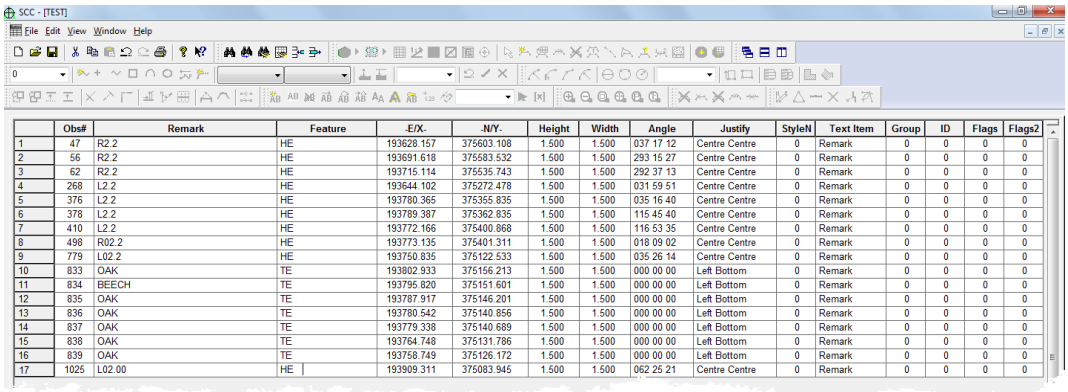
Instrument Set-ups, containing observed back-sights, used to orient the horizontal circle whenever the total station is moved. The instrument set-up sheet also contains distance and coordinate misclosures, along with other QA fields. Each instrument set-up is numbered, and each detail observation contains a corresponding

set-up number. Modifying the station set-up details will require the associated survey to be re-coordinated and the model to be rebuilt. If the co-ordinates were not formed from a detail survey then this sheet will be blank.



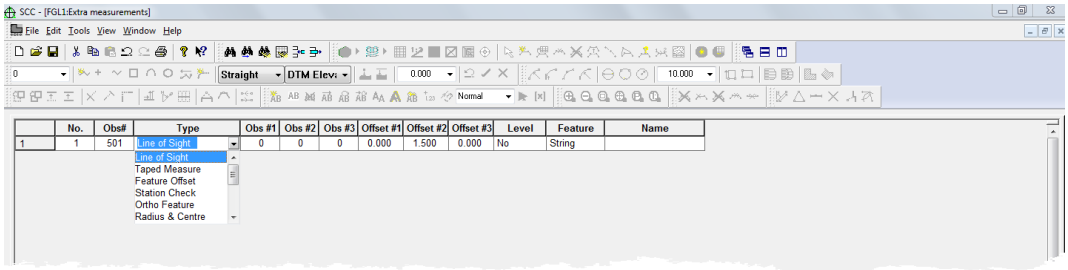
	Numbe	At Stn.	XYZ	To Stn.	XYZ	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	Obs. Zero	Mean Zero	Zero Err	-X Err-	-Y Err-	-Z Err-	-Sl
1	1	7	Yes	8	Yes	1.5330	1.4850	000 00 00	091 02 47	353.783	353 05 53	353 05 53	000 00 00	-0.0010	0.0084	0.0049	-0.
2	2	220	Yes	7	Yes	1.4880	1.4850	000 00 01	097 14 01	78.201	276 04 35	276 04 35	000 00 00	0.0291	-0.0031	0.0040	0.
3	3	221	Yes	7	Yes	1.5210	1.4850	000 00 01	096 45 51	100.852	264 38 50	264 38 50	000 00 00	-0.0171	-0.0016	0.0013	-0.
4	4	221	Yes	7	Yes	1.5600	2.1900	359 59 59	096 23 48	100.770	264 38 52	264 38 52	000 00 00	-0.0245	-0.0023	0.0156	-0.
5	5	220	Yes	7	Yes	1.5950	1.4850	000 00 00	097 18 43	78.194	276 04 36	276 04 36	000 00 00	0.0087	-0.0009	0.0022	0.
6	6	224	Yes	220	Yes	1.5950	1.4850	000 00 00	090 41 14	128.159	280 43 43	280 43 43	000 00 00	-0.0016	0.0003	0.0091	-0.
7	7	223	Yes	220	Yes	1.6160	1.4850	000 00 00	084 06 00	137.036	343 30 16	343 30 16	000 00 00	-0.0002	0.0006	0.0118	-0.
8	8	225	Yes	223	Yes	1.5480	1.4850	000 00 00	090 46 58	198.206	315 35 19	315 35 19	000 00 00	0.0211	-0.0215	0.0088	0.
9	9	225	Yes	223	Yes	1.6000	1.4850	000 00 00	090 47 40	198.195	315 35 19	315 35 19	000 00 00	0.0130	-0.0133	-0.0030	0.

Text Notes, used to store text data and placement details.



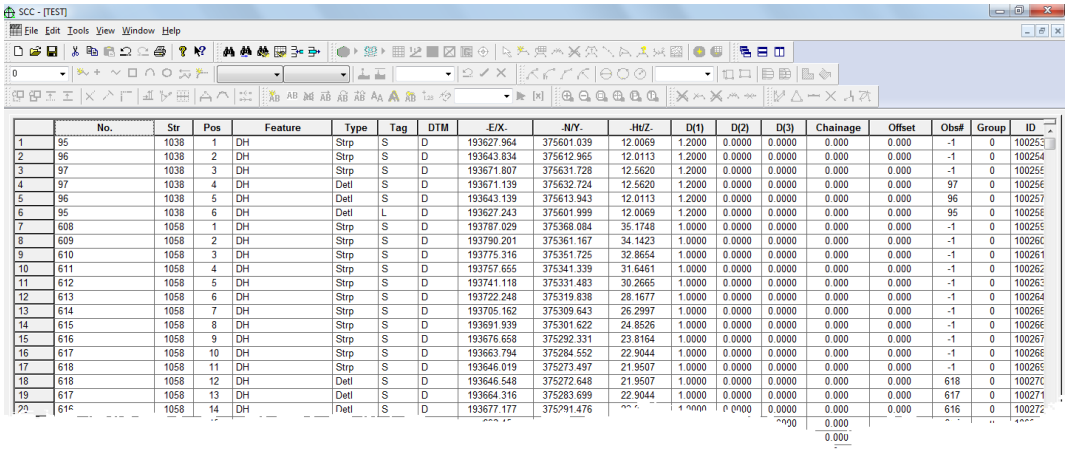
	Obs#	Remark	Feature	-E/X-	-N/Y-	Height	Width	Angle	Justify	StyleN	Text Item	Group	ID	Flags	Flags2
1	47	R2.2	HE	193628.157	375603.108	1.500	1.500	037 17 12	Centre Centre	0	Remark	0	0	0	0
2	56	R2.2	HE	193691.618	375683.532	1.500	1.500	293 15 27	Centre Centre	0	Remark	0	0	0	0
3	62	R2.2	HE	193715.114	375535.743	1.500	1.500	292 37 13	Centre Centre	0	Remark	0	0	0	0
4	268	L2.2	HE	193644.102	375272.478	1.500	1.500	031 59 51	Centre Centre	0	Remark	0	0	0	0
5	376	L2.2	HE	193780.365	375355.835	1.500	1.500	035 16 40	Centre Centre	0	Remark	0	0	0	0
6	378	L2.2	HE	193789.387	375362.835	1.500	1.500	115 45 40	Centre Centre	0	Remark	0	0	0	0
7	410	L2.2	HE	193772.166	375400.868	1.500	1.500	116 53 35	Centre Centre	0	Remark	0	0	0	0
8	498	R02.2	HE	193773.135	375401.311	1.500	1.500	018 09 02	Centre Centre	0	Remark	0	0	0	0
9	779	L02.2	HE	193750.835	375122.533	1.500	1.500	035 26 14	Centre Centre	0	Remark	0	0	0	0
10	833	OAK	TE	193802.933	375156.213	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
11	834	BEECH	TE	193795.820	375151.601	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
12	835	OAK	TE	193787.917	375146.201	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
13	836	OAK	TE	193780.542	375140.856	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
14	837	OAK	TE	193779.338	375140.689	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
15	838	OAK	TE	193764.748	375131.786	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
16	839	OAK	TE	193758.749	375126.172	1.500	1.500	000 00 00	Left Bottom	0	Remark	0	0	0	0
17	1025	L02.00	HE	193909.311	375083.945	1.500	1.500	062 25 21	Centre Centre	0	Remark	0	0	0	0

Extra Measurements, used to store measurements other than direct observations, such as tape measurements and copied strings. If the co-ordinates were not formed from a detail survey then this sheet will be blank.



	No.	Obs#	Type	Obs #1	Obs #2	Obs #3	Offset #1	Offset #2	Offset #3	Level	Feature	Name
1	1	501	Line of Sight	0	0	0	0.000	1.500	0.000	No	String	

Detail Coordinate Sheet, used to store reduced topographic coordinates, sorted alphabetically by feature name and string number. Note that the detail coordinates sheet may contain interpolated data, such as curve fit points, in addition to reduced observations or imported coordinates.



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	95	1038	1	DH	Strp	S	D	193627.964	375601.039	12.0069	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100253
2	96	1038	2	DH	Strp	S	D	193643.834	375612.965	12.0113	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100254
3	97	1038	3	DH	Strp	S	D	193671.807	375631.728	12.5620	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100255
4	97	1038	4	DH	Detl	S	D	193671.139	375632.724	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	100256
5	96	1038	5	DH	Detl	S	D	193643.139	375613.943	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	100257
6	95	1038	6	DH	Detl	L	D	193627.243	375601.999	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	100258
7	608	1058	1	DH	Strp	S	D	193787.029	375368.084	35.1748	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100259
8	609	1058	2	DH	Strp	S	D	193790.201	375361.167	34.1423	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100260
9	610	1058	3	DH	Strp	S	D	193775.316	375351.725	32.8654	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100261
10	611	1058	4	DH	Strp	S	D	193757.655	375341.339	31.6461	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100262
11	612	1058	5	DH	Strp	S	D	193741.118	375331.483	30.2665	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100263
12	613	1058	6	DH	Strp	S	D	193722.248	375319.838	28.1677	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100264
13	614	1058	7	DH	Strp	S	D	193705.162	375309.643	26.2997	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100265
14	615	1058	8	DH	Strp	S	D	193691.939	375301.622	24.8526	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100266
15	616	1058	9	DH	Strp	S	D	193676.658	375292.331	23.8164	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100267
16	617	1058	10	DH	Strp	S	D	193663.794	375284.552	22.9044	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100268
17	618	1058	11	DH	Strp	S	D	193646.019	375273.497	21.9507	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100269
18	618	1058	12	DH	Detl	S	D	193646.548	375272.648	21.9507	1.0000	0.0000	0.0000	0.000	0.000	618	0	100270
19	617	1058	13	DH	Detl	S	D	193664.316	375283.699	22.9044	1.0000	0.0000	0.0000	0.000	0.000	617	0	100271
20	616	1058	14	DH	Detl	S	D	193677.177	375291.476	[illegible]	1.0000	0.0000	0.0000	0.000	0.000	616	0	100272
													[illegible]	0.000				

Station coordinates, a back-up of the station coordinates used in this survey, such that the survey document is fully self contained. In addition to the above sheet views, the survey document also includes a copy of the downloaded survey data as a text file in its native format, such that the other spreadsheets can be reconstructed in their originally downloaded state at any time.

2.1.4 Model

Models are used to display and manipulate survey data graphically as plan drawings, in a similar manner to CAD. Models can contain a mixture of 2d and 3d information, and will typically include a triangulated surface model or TIN. The surface model is used to interpolate elevations that have not been directly observed, for analysis purposes such as contouring and volume calculation. Models can be formed either directly from coordinates sources, such as CAD or MX GENIO, or from reduced survey datasets. SCC includes an extensive range of graphic editing tools that enable simultaneous editing of the planimetry and 3d surface. In addition to graphic editing, the model may also be edited as a spread-sheet using a split screen editor. SCC models contain the following views;

Plan view, used for all graphical display and editing

Station coordinates, copied from the surveys used when creating the model. You may also cut and paste in additional unreferenced stations from the project as required.

Feature Library, copied from the project, used to control naming conventions, drawing standards and modelling defaults.

Ground Type Library, copied from the project, used to break down different parts of the surface model into various ground types for viewing and analysis purposes.

ZVI station coordinate, used for ZVI station positions in visual intrusion analysis

As with the project, the model also stores copies of all referenced symbols, line styles, text styles, bitmaps, and sheet layouts, such that it forms a fully self contained document. Additional SCC documents, including traverses, alignments, sections and even other models may also be attached to a model for graphical display purposes.

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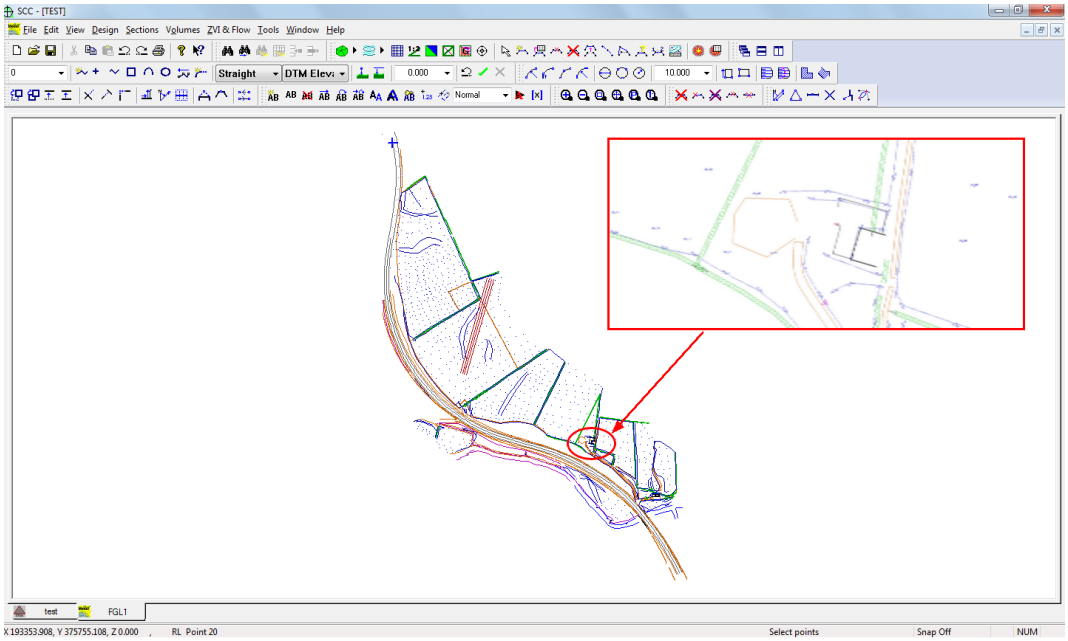
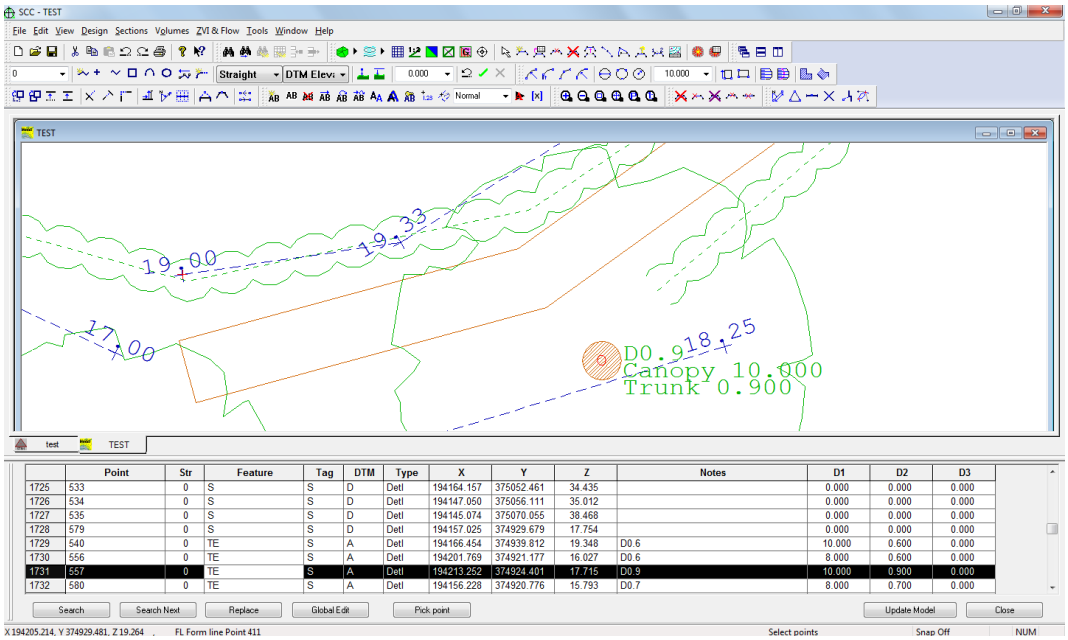


Model



	Point	Str	Feature	Tag	DTM	Type	X	Y	Z	Notes	D1	D2	D3
1725	533	0	S	S	D	Detl	194164.157	375052.461	34.435		0.000	0.000	0.000
1726	534	0	S	S	D	Detl	194147.050	375056.111	35.012		0.000	0.000	0.000
1727	535	0	S	S	D	Detl	194145.074	375070.055	38.468		0.000	0.000	0.000
1728	579	0	S	S	D	Detl	194157.025	374929.679	17.754		0.000	0.000	0.000
1729	540	0	TE	S	A	Detl	194166.454	374939.812	19.348	D0.6	10.000	0.600	0.000
1730	556	0	TE	S	A	Detl	194201.769	374921.177	16.027	D0.6	8.000	0.600	0.000
1731	557	0	TE	S	A	Detl	194213.252	374924.401	17.715	D0.9	10.000	0.900	0.000
1732	580	0	TE	S	A	Detl	194156.228	374920.776	15.793	D0.7	8.000	0.700	0.000

Model - Split View option which allows the user to browse *the dataset table whilst the cursor interactively moves to the chosen x, y, z*

See Also

Modelling

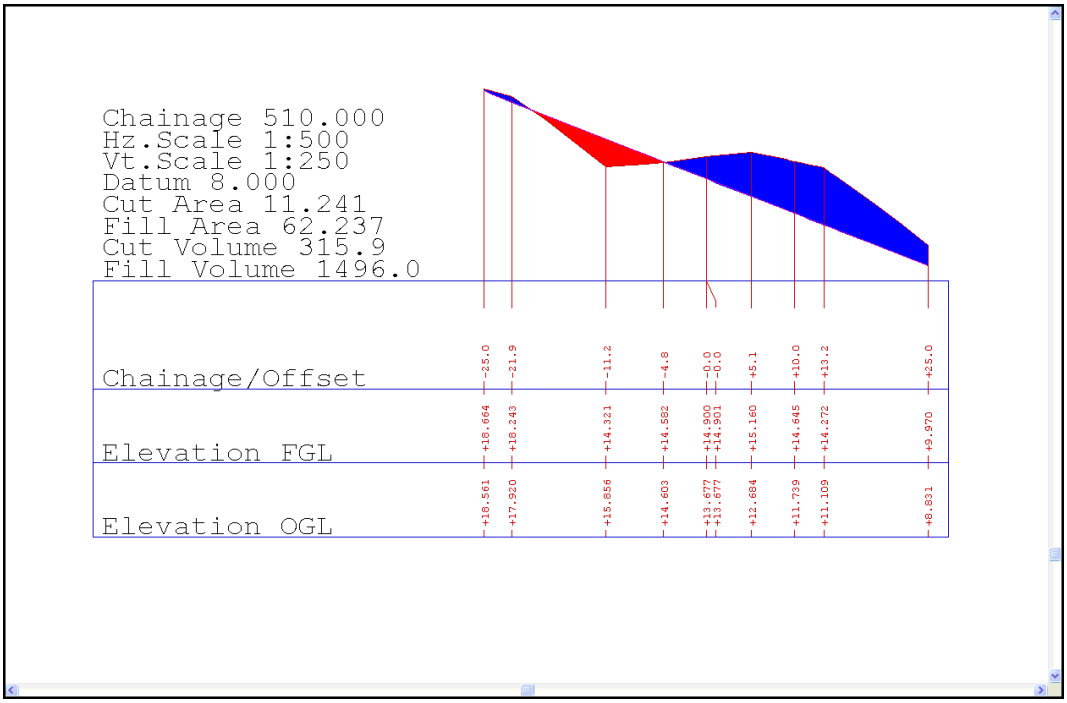
2.1.5 Section

A **section** document is used to graphically represent profiles, long sections and cross sections. Sections can either be cut from a model or generated directly from coordinate or chainage / offset data, can include any number of surfaces per section, and can be drawn to user defined standards. A section document contains the following views;

Section view, used for all graphical display and editing

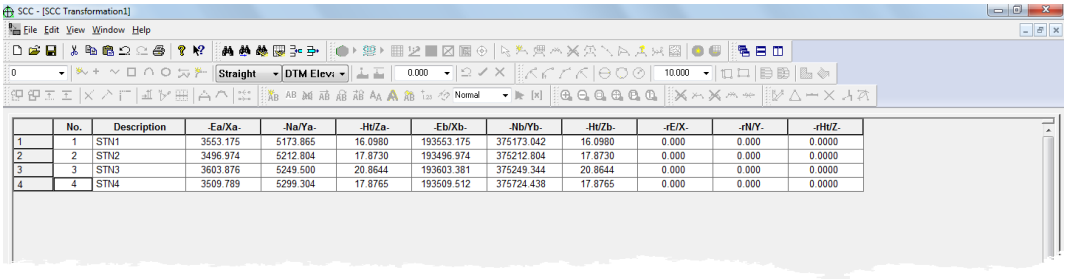
Feature Library, copied from the project, used to control naming conventions, drawing standards and modelling defaults

As with the project, the model also stores copies of all referenced symbols, line styles, text styles, bitmaps, and sheet layouts, such that it forms a fully self contained document. Section style files can also saved and loaded from section views to simplify the process of applying standard drawing styles and sheet layouts to different types of section drawings. Sections can also be attached to ground models, to show their plan position, and annotated with chainage and offset.



2.1.6 Transformation

The **transformation** document has a single spreadsheet view consisting of pairs of control co-ordinates used to move datasets between coordinate systems. SCC includes 2D affine plus level shift, 2D / 3D conformal, 2D / 3D scale free and 2D / 3D best fit (2 or more points) transformations. Furthermore, SCC supports national grid transfromations between ITM, Irish Grid, OSGB36 and ETRS89. These transformations utilise Grid Inquest software provided by Quest Geo Solutions. Transformations may be applied to project stations, reduced coordinates and models.



	No.	Description	-Ea/Xa-	-Na/Ya-	-Ht/Za-	-Eb/Xb-	-Nb/Yb-	-Ht/Zb-	-rE/X-	-rN/Y-	-rHt/Z-
1	1	STN1	3553.175	5173.865	16.0980	193553.175	375173.042	16.0980	0.000	0.000	0.0000
2	2	STN2	3496.974	5212.804	17.8730	193496.974	375212.804	17.8730	0.000	0.000	0.0000
3	3	STN3	3603.876	5249.500	20.8644	193603.381	375249.344	20.8644	0.000	0.000	0.0000
4	4	STN4	3509.789	5299.304	17.8765	193509.512	375724.438	17.8765	0.000	0.000	0.0000

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See Also

Transform Coordinates

2.1.7 Alignment

The **alignment** document stores all information relating to horizontal, vertical, and section template design data. SCC enables you to create linear and polygonal designs, using both interactive graphics and spreadsheets. Designs can include surfaces and multiple section templates for different chainage ranges. Linear designs can be created either from horizontal and vertical intersection points, or directly from entities. Designs may also be imported from MX GENIO geometry and master alignment strings, and from other design packages. The SCC alignment document contains the following views;

Horizontal intersection points

Vertical intersection points

Horizontal entities

Vertical entities

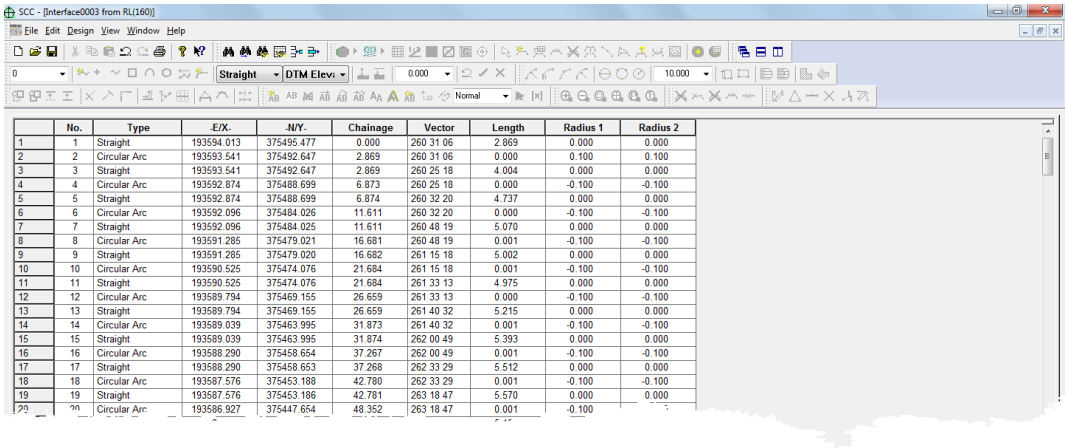
Section template points

Super-elevation nodes

Interactive section template design

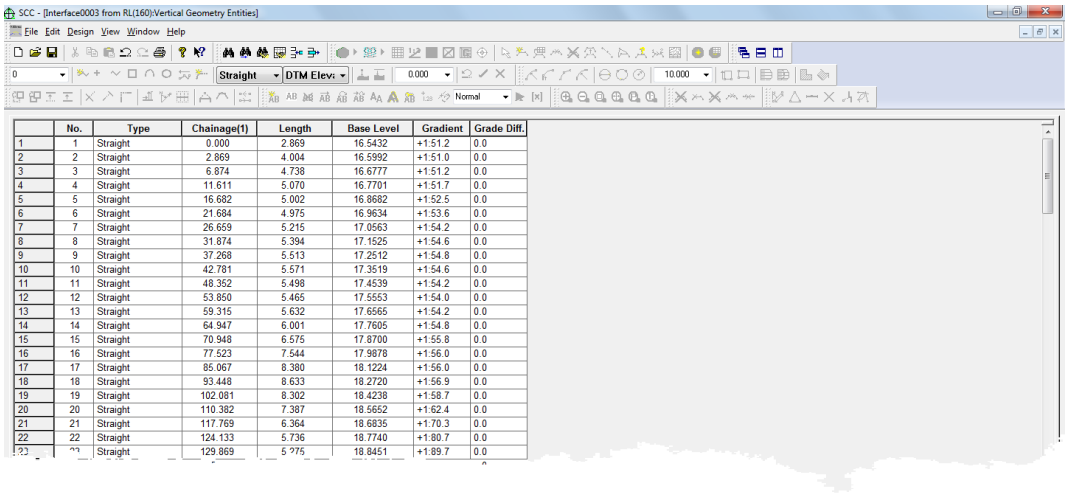
Interactive vertical design

Interactive horizontal design is carried out in plan in the model view. As with the project, the model also stores copies of all referenced symbols, line styles, text styles, bitmaps, and sheet layouts, such that it forms a fully self contained document. Alignment documents can also include attached models representing non-alignment related strings in the design, and a model for level reference.



	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Straight	193594.013	375495.477	0.000	260 31 06	2.869	0.000	0.000
2	2	Circular Arc	193593.541	375492.647	2.869	260 31 06	0.000	0.100	0.100
3	3	Straight	193593.541	375492.647	2.869	260 25 18	4.004	0.000	0.000
4	4	Circular Arc	193592.874	375488.699	6.873	260 25 18	0.000	-0.100	-0.100
5	5	Straight	193592.874	375488.699	6.874	260 32 20	4.737	0.000	0.000
6	6	Circular Arc	193592.096	375484.026	11.611	260 32 20	0.000	-0.100	-0.100
7	7	Straight	193592.096	375484.025	11.611	260 48 19	5.070	0.000	0.000
8	8	Circular Arc	193591.285	375479.021	16.681	260 48 19	0.001	-0.100	-0.100
9	9	Straight	193591.285	375479.020	16.682	261 15 18	5.002	0.000	0.000
10	10	Circular Arc	193590.525	375474.076	21.684	261 15 18	0.001	-0.100	-0.100
11	11	Straight	193590.525	375474.076	21.684	261 33 13	4.975	0.000	0.000
12	12	Circular Arc	193589.794	375469.155	26.659	261 33 13	0.000	-0.100	-0.100
13	13	Straight	193589.794	375469.155	26.659	261 40 32	5.215	0.000	0.000
14	14	Circular Arc	193589.039	375463.995	31.873	261 40 32	0.001	-0.100	-0.100
15	15	Straight	193589.039	375463.995	31.874	262 00 49	5.393	0.000	0.000
16	16	Circular Arc	193588.290	375458.654	37.267	262 00 49	0.001	-0.100	-0.100
17	17	Straight	193588.290	375458.653	37.268	262 33 29	5.512	0.000	0.000
18	18	Circular Arc	193587.576	375453.188	42.780	262 33 29	0.001	-0.100	-0.100
19	19	Straight	193587.576	375453.186	42.781	263 18 47	5.570	0.000	0.000
20	20	Circular Arc	193586.927	375447.654	48.352	263 18 47	0.001	-0.100	

Alignment - Horizontal Geometry Entities



	No.	Type	Chainage(1)	Length	Base Level	Gradient	Grade Diff.
1	1	Straight	0.000	2.869	16.5432	+1:51.2	0.0
2	2	Straight	2.869	4.004	16.5992	+1:51.0	0.0
3	3	Straight	6.874	4.738	16.6777	+1:51.2	0.0
4	4	Straight	11.611	5.070	16.7701	+1:51.7	0.0
5	5	Straight	16.682	5.002	16.8682	+1:52.5	0.0
6	6	Straight	21.684	4.975	16.9634	+1:53.6	0.0
7	7	Straight	26.659	5.215	17.0563	+1:54.2	0.0
8	8	Straight	31.874	5.394	17.1525	+1:54.6	0.0
9	9	Straight	37.268	5.513	17.2512	+1:54.8	0.0
10	10	Straight	42.781	5.571	17.3519	+1:54.6	0.0
11	11	Straight	48.352	5.498	17.4539	+1:54.2	0.0
12	12	Straight	53.850	5.465	17.5553	+1:54.0	0.0
13	13	Straight	59.315	5.632	17.6565	+1:54.2	0.0
14	14	Straight	64.947	6.001	17.7605	+1:54.8	0.0
15	15	Straight	70.948	6.575	17.8700	+1:55.8	0.0
16	16	Straight	77.523	7.544	17.9878	+1:56.0	0.0
17	17	Straight	85.067	8.380	18.1224	+1:56.0	0.0
18	18	Straight	93.448	8.633	18.2720	+1:56.9	0.0
19	19	Straight	102.081	8.302	18.4238	+1:58.7	0.0
20	20	Straight	110.382	7.387	18.5652	+1:62.4	0.0
21	21	Straight	117.769	6.364	18.6835	+1:70.3	0.0
22	22	Straight	124.133	5.736	18.7740	+1:80.7	0.0
23	23	Straight	129.869	5.275	18.8451	+1:89.7	0.0

Alignment - Vertical Geometry Entities

2.1.8 Program Module

In addition to using SCC interactively, SCC can be driven programmatically, through any scripting language that supports OLE automation or COM, such as Visual BASIC or Java Script. This may be used to automate complex or time consuming SCC user processes.

SCC program modules are edited in a script viewer that also includes a visual form designer.

2.1.9 Using SCC with Microsoft Office and other Windows Applications

Any SCC documents may be transferred to other Windows programs by cutting or copying data to the clipboard and pasting it into the target location. SCC supports standard 'Cut', ' Copy', 'Paste' 'Paste Special' and 'OLE' commands. You may also cut and paste data from other packages into SCC. SCC spreadsheets support text and Microsoft Excel clipboard formats. SCC models additionally support cut, copy and paste of graphical data between any other OLE compliant software.

Cutting or Copying Data within SCC

Spreadsheet data may be cut or copied between spreadsheets.

Highlight the cells to be cut or copied. Go to 'EDIT > Cut/Copy'.

Highlight the cell where you wish to place the data. Go to 'EDIT > Paste'.

Data within models may be selected for cutting or pasting using the Data Selection dialog.

Copying a model to a new dataset or to a new model is different than exporting models, in that, only the survey points selected are copied. Model data may also be copied to the clipboard in its native format or as a bitmap. When data is copied to the clipboard it may be pasted or inserted into any other Windows program. When copied in its native format in may be inserted into another document as an OLE object.

OLE

An object created in another application that supports OLE may be inserted into SCC. To insert objects such as Microsoft Excel worksheet objects, use the 'Insert New Object' command or the 'Paste Special' command, both found under the Edit menu.

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Similarly objects created in SCC may be input into any other Windows application. Objects are created in SCC by using the 'Copy to Clipboard' option.

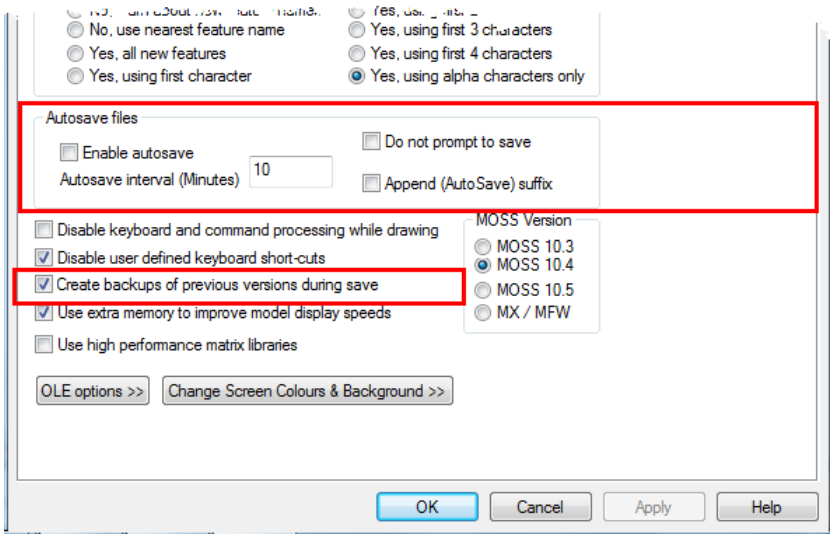
Send

Send attaches the current file to a new blank e-mail message. Select the recipient and type your message.

2.1.10 Backup Strategies

We recommend that in addition to saving your documents using a revision number based file naming convention, that you include your main SCC folder in you backup plan. Good practice is to keep any important data in at least two physical locations at any given time.

In addition, several options are available within 'FILE > General Options > Directories & Files' to allow the user to select auto save options but also to create backup files automatically.



2.2 Feature Names Conventions & The Feature Library

A feature name is the name given to one or more similar surveyed objects used to group strings and points of the same type. Examples of feature names include TREE, ROADEDGE, DITCH, WALL, MANHOLE and shortened or mnemonic versions such as TE, RE, DH, WL, MH. In SCC, a feature name can be up to eight characters long although it is common to use shorter abbreviations. In SCC, feature names are used to determine how survey data is drawn and modelled. This is controlled by the feature library, which is essentially a spreadsheet containing a large number of fields against each feature determining how it will be interpreted for modelling, mapping, and export purposes. These fields include colour, line-style, annotation defaults, symbology, MX label, and CAD layer.

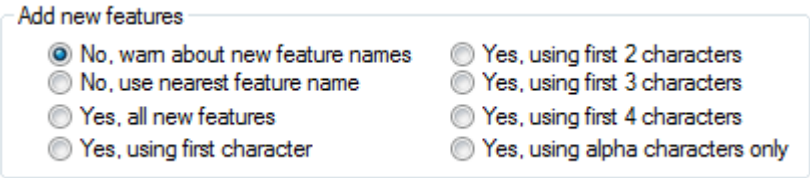
Many large organisations will have there own naming conventions, whether it be based on string labelling conventions for MX users, layer naming conventions for AutoCAD users, or both.

The feature library controls the application of a feature, layer, and string naming conventions when generating SCC models and sections, AutoCAD and Microstation drawings or MX models. The key field in the feature library is the feature name.

Most survey data collectors will include a feature name or point code field that can either be directly used as a feature name, or mapped onto a feature name using the advanced field coding sheet. When transferring data from a MX SURVEY or GENIO file, the feature may be the first few characters of the string label that define the object. For example, the SW from the MX string label SW01 might indicate the string is a sidewalk. The numeric 01 part of the label

indicates string number or occurrence of this feature in the current model. When transferring from AutoCAD or Microstation to SCC, the layer name, entity type, colour and line-style can all be used to determine the SCC feature.

In SCC, the method of matching survey features with feature names in the feature library is determined in SCC by a parameter within General Options. ('**FILE** > **General Options** > **Directories and Files**').



The variable name is 'Add new features' and its value will be one of the following;

- No, warn about new feature name
- No, use nearest feature name
- Yes, all new features
- Yes, using first character
- Yes, using first 2 characters
- Yes, using first 3 characters
- Yes, using first 4 characters
- Yes, using alpha characters only

Feature Wizard

The feature library contains a very large number of fields, approximately four hundred per feature, that allow for a very fine degree of control on how any given feature is drawn and annotated. While this allows for a very high degree of field to finish automation, it can be quite daunting to edit and maintain.

The solution to this dilemma is the 'Feature Wizard', which can be accessed using 'EDIT > Feature Wizard' from the feature library spreadsheet. This displays the dialog shown below;

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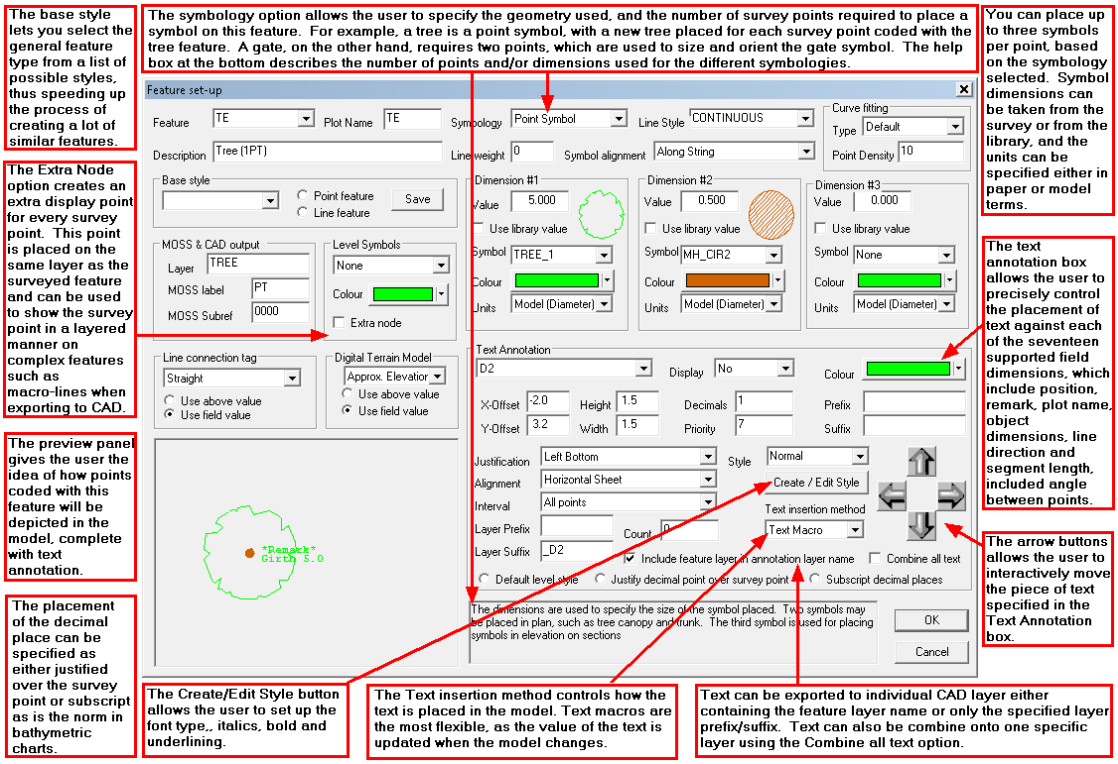

The feature wizard is an automation tool that helps you generate and maintain feature libraries with the minimum of effort. It offers the following facilities;

- All of the fields for a given feature are displayed in a single dialog, with a preview panel that shows a sample string or point for that feature, including annotation and symbology. This preview panel is updated when any field is changed.
- Feature styles may be saved and re-used. For example, if you set up a manhole with a circular symbol, and the plot name and cover level to the left of the symbol, you might save this as a man hole feature style. If you then wish to set-up a similarly drawn feature, such as a gas valve, you simply re-select the man-hole feature style, and the gas valve will inherit the man holes symbology and annotation settings.
- The feature wizard also allows you to create and edit text styles, which consist of font selection and display attributes, such as italicisation, and underlining.

See Also

General Options (File Menu)

Feature Library (View menu)

Ground Type Library (View Menu))

Developing SCC Feature Library for use with MX

2.3 Strings

In order to form a surface model and map from a survey, it is necessary to create a number of distinct geometric entities from the observed points. These include points, lines, curves, and combinations of lines and curves. In SCC, these entities are referred to as strings. An example of a string might be the edge of a road. This string would include sections of straight lines, curves and possibly gaps or discontinuities. A string can be two or three-dimensional and can have varying significance to the surface depending on how it is defined. An example of a two dimensional string might be an overhead telecommunications line which is displayed in plan for cartographic purposes. An example of a non DTM three dimensional line might be an

overhead transmission line where the conductor cable could be represented as a three dimensional line in CAD and not influence the formation of the surface model. An example of a three dimensional string might be the edge of an embankment which is fully represented as a 3 dimensional line which significantly influences the surface model formation since it delineates a characteristic fold in the physical terrain.

String Number

The string number field, available in detail coordinates view of the survey data set, indicates the instance of a given feature within a survey. All points in a survey with the same feature name and string number will be sequentially joined to form a single string. It is therefore used to distinguish multiple occurrences of the same feature. For example, if there are two distinct buildings in the survey both having the feature name BUILDING, all the points on the first BUILDING would have a string number of 1, and all the points on the second have a string number of 2. This makes it possible to survey part of Building 1 and move on to BUILDING 2. It would then be possible to subsequently come back to continue the first building by picking up the next sequential point on BUILDING 1. A string number of 0 is used to denote a point feature (unconnected point) such as a spot level, bus stop, traffic signal etc.

Tags

The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string.

DTM Code

The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated.

See Also

Feature Library (View menu)

2.4 Models

Models within SCC are formed from a variety of co-ordinate files, such as reduced survey, DXF and GENIO. A model in SCC consists of the plan drawing and the feature library. If a SCC dataset is used to create a model then the feature library from that project will be copied as the feature library for the model file. If the model is generated directly from a co-ordinate file, new features encountered will be added to the default feature library (depending on the setting defined within General Options). A model comprises of cartographic map detail formed from the strings and a surface or TIN model used to form contours. TIN stands for Triangular Irregular Network. Put simply, this means that points adjacent to one another are connected to form triangular facets. These facets can be considered as oblique planes for the express purpose of interpolating contours, profiles, cross sections, volumes, and other surface analysis tasks. Strings are paramount in the creation of TIN as they are used to form breaklines, that is, linear areas of the surface, such as banks, ditches, and walls, where there is a sharp or marked discontinuity of the terrain surface. See diagram below:

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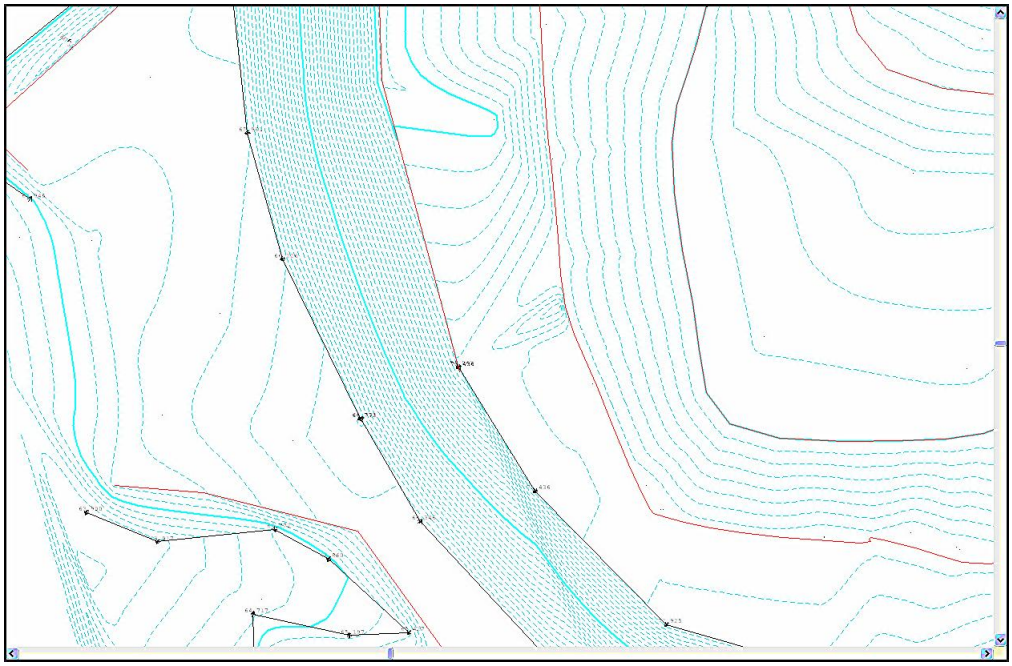
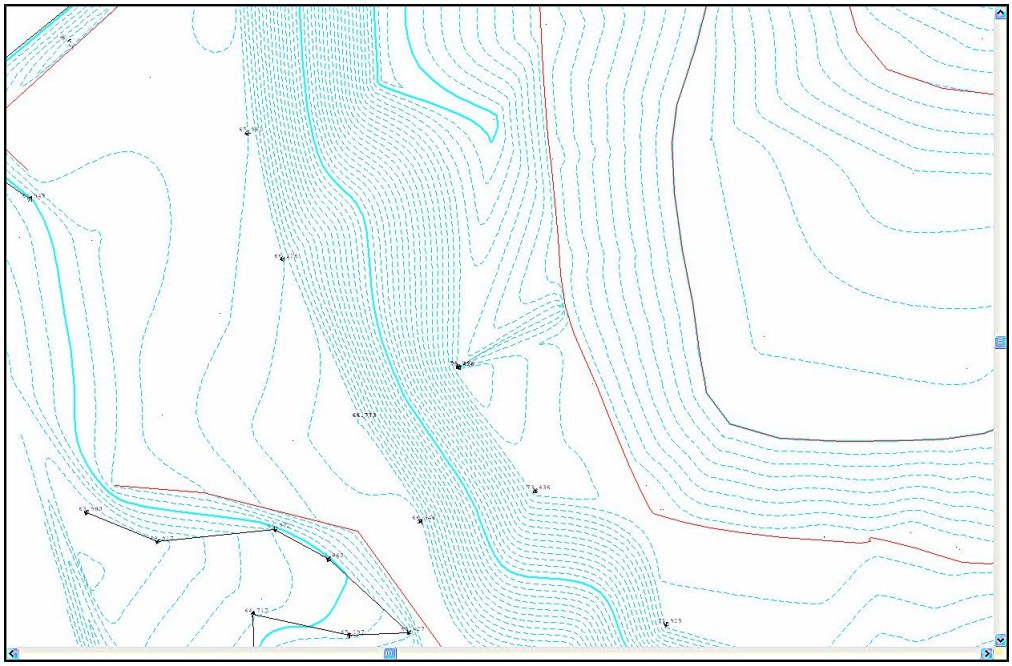


The picture below shows the effect of not creating a breakline from a string where one was required. Compare this picture to the previous one of the same model. The dataset in terms of spatial co-ordinates remains the same but the formation of the triangulation has been deformed because the correct DTM code has not been selected. The selection of sufficient point density and the delineation of the physical surface characteristics for the purposes of intended use are prime requirements during the surveying process.



Models, which were created from SCC datasets, have links back to their original co-ordinate and survey observations files. As such they may also be used to graphically query all aspects of the detail survey database. Thus recovery from measurement errors, mistakes in DTM definition, feature object dimensions etc. may be achieved interactively. Data may be combined from a variety of sources for model creation.

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2.5 Field Practice Applicable to SCC

Field Practice for Topographic Surveying

SCC models are formed from point or line string information. Point strings are discrete points such as trees and spot heights whereas line strings are connected features such as roads, walls and hedges. In order for strings to appear in the model, the surveyor must record string information when surveying. This involves recording one or more fields that tell the software the type of feature being surveyed, e.g. Wall, Tree, Road, and optionally additional geometric information to specify the string number or instance of that feature, for example, WALL 02 might be the second wall surveyed.

The coding of string information in the field is dependent on the data collector being used. Data collectors, such as PocketDTM and AutoGRAD/MSMM, include distinct feature name and string number fields. This has the advantage that points on a string do not have to appear in sequential and unbroken order within the survey. For example, we could observe points on a road in sectional format from a number of different set-up stations yet they would appear as strings in the model. This can greatly reduce the overall amount of fieldwork. Modern total stations allow a high degree of customization, allowing us to collect as many or as few fields as required.

We can also collect geometric codes that allow us to specify the geometry connecting string sections, such as straights, curves, arcs, and rectangles, dimensional information, and various offsets.

On data logging systems without explicit fields for feature code, string number, tag code, etc... we can use the advanced field coding sheet to achieve most of the same results given a single point code field. This sheet determines whether a field code represents a feature code or a control code, and what to do with numeric values within a point code. For example, we might say that KB represents a KERB feature, connected by straights, whereas KBC might be a KERB feature connected by curves. Thus KB and KBC would lie on the same string. Similarly, we can say that for KB and KBC, any numerics in the point code represent the string number, such that KB02 and KBC02 represent straight line and curved segments of KERB string 2. We can also use control codes, for example ST might be used to start a new string with the current feature. Individual observations may also have more than one code when surveyed in this manner, for example HE01 GA might represent the junction point between HEDGE string 1 and a GATE. This type of coding allows us to replicate topographic field surveying techniques used in many popular legacy systems such as SDRMap, Panterra, LandScape and NRG.

Field Practice for Traversing

SCC supports both traverse and network adjustment. As with topographic surveying, the method of collecting a traverse will vary between data loggers and instruments used. When surveying combined topographic detail and traverse data in a single job, observations with a specified feature code can be extracted into the traverse sheet for adjustment purposes.

A traverse connects chains of straight lines with measured lengths and angles. A traverse is one means of providing 2 or 3 dimensional control in which position is determined by a combination of angle and distance measurements between successive lines joining control stations. SCC allows closed and open traversing with several methods of traverse adjustment computed. The calculations will generate co-ordinates based on the error adjustment selected and it is the surveyor’s responsibility to assess the accuracy of the calculated co-ordinates.

It is always good survey practice to record more information than necessary. When observing traverse information, sight to all possible stations. If extra measurements are observed to form a network the Least Squares traverse adjustment should be carried out. This adjustment can also be computed in PocketDTM prior to using SCC.

When observing an open traverse no adjustment may be selected and provisional co-ordinates used.

Where possible ensure the RO is part of the traverse and not an external observation.

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The accuracy of the traverse is governed largely by the observation and measurement techniques applied and by the type of equipment used.

Field Practice for Setting Out

SCC allows uploading of data from co-ordinate files to a number of dataloggers. Sections, strings or contours may be uploaded to the logger.

Generally design data will be imported into SCC from MX, DOER or CAD. This data would be uploaded to the datalogger to set out positions of proposed buildings or structures.

Road alignments are usually set out in section. It is important that the stringing is correct before uploading sections for setting out. When you have created the sections you wish to set out, export the section file to a survey dataset (co-ordinate file) and upload the dataset.

The zero contour line on an isopachyte model may be set out on the ground to determine the extent of boundary between the cut and fill on the ground. The position of the cut or fill contours from the isopachyte model may be uploaded to set out the position of the excavations.

See Also

Feature Library (View menu)

Detail Observation

3 Getting Started

3.1 Creating A New Project

A new project should be created before data may be downloaded into SCC or models formed. The project file stores the co-ordinates of stations used in the surveys which are stored in the current directory.

It is important that there is only one project file open at a time.

Creating a New Project

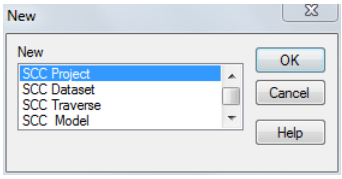
Two options are available when SCC is opened, either open an existing project or start a new project.

When using SCC for the first time, it is necessary to start a new project.

Starting the Software

Double click the SCC Icon

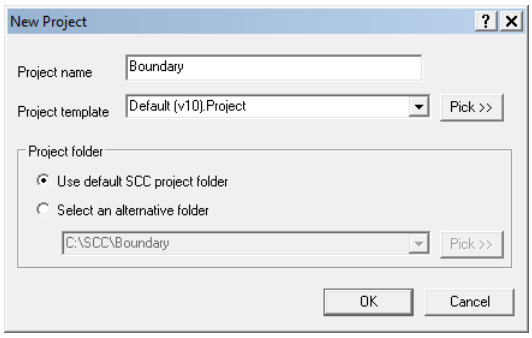
On first entry to the software, or if there is no active projects, the following dialog will be shown on screen



Select 'Cancel'

If a project is selected at this point, **no directory** will be set up for the project directory. This option will simply create a project file in the 'C:\SCC\' directory, and associated files will be placed there as well. This

will make it difficult to track project work files. Also, 'New' dialog does not give the user the option to select a Project Template (Feature Library).



Creating A Project Directory

From the Main Menu Bar, select 'FILE >New Project'

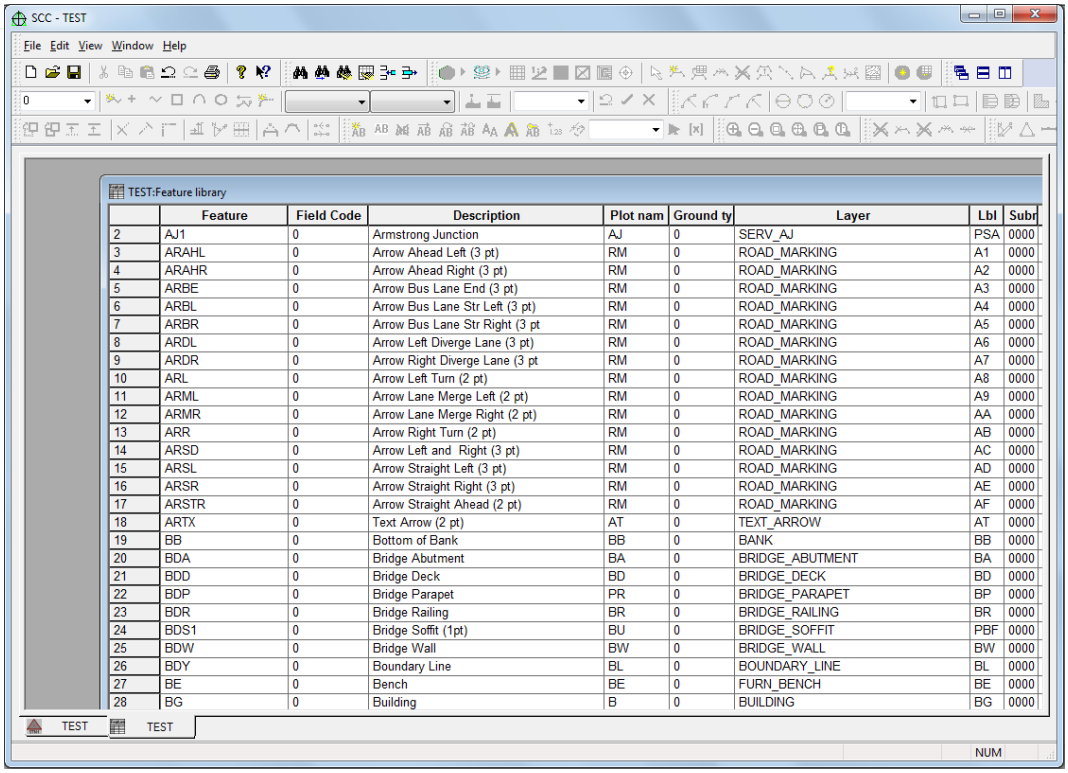
Enter in a Project/Job name

Select a Project Template from the list 'Default v7 Complex.Project'

Select 'OK'

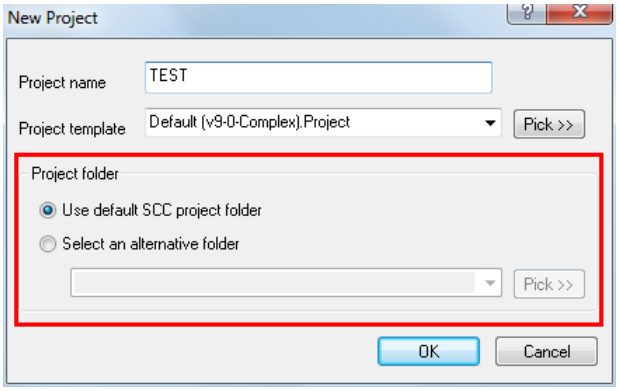
The **project template** contains all the feature coding, layering, string labelling, modelling, symbology and annotation standards that will be applied to the project.

The project itself consists of a spreadsheet containing the control stations used in the project, along with a feature library spreadsheet.



	Feature	Field Code	Description	Plot nam	Ground ty	Layer	Lbl	Subr
2	AJ1	0	Armstrong Junction	AJ	0	SERV_AJ	PSA	0000
3	ARAHL	0	Arrow Ahead Left (3 pt)	RM	0	ROAD_MARKING	A1	0000
4	ARAHR	0	Arrow Ahead Right (3 pt)	RM	0	ROAD_MARKING	A2	0000
5	ARBE	0	Arrow Bus Lane End (3 pt)	RM	0	ROAD_MARKING	A3	0000
6	ARBL	0	Arrow Bus Lane Str Left (3 pt)	RM	0	ROAD_MARKING	A4	0000
7	ARBR	0	Arrow Bus Lane Str Right (3 pt	RM	0	ROAD_MARKING	A5	0000
8	ARDL	0	Arrow Left Diverge Lane (3 pt)	RM	0	ROAD_MARKING	A6	0000
9	ARDR	0	Arrow Right Diverge Lane (3 pt	RM	0	ROAD_MARKING	A7	0000
10	ARL	0	Arrow Left Turn (2 pt)	RM	0	ROAD_MARKING	A8	0000
11	ARML	0	Arrow Lane Merge Left (2 pt)	RM	0	ROAD_MARKING	A9	0000
12	ARMR	0	Arrow Lane Merge Right (2 pt)	RM	0	ROAD_MARKING	AA	0000
13	ARR	0	Arrow Right Turn (2 pt)	RM	0	ROAD_MARKING	AB	0000
14	ARSD	0	Arrow Left and Right (3 pt)	RM	0	ROAD_MARKING	AC	0000
15	ARSL	0	Arrow Straight Left (3 pt)	RM	0	ROAD_MARKING	AD	0000
16	ARSR	0	Arrow Straight Right (3 pt)	RM	0	ROAD_MARKING	AE	0000
17	ARSTR	0	Arrow Straight Ahead (2 pt)	RM	0	ROAD_MARKING	AF	0000
18	ARTX	0	Text Arrow (2 pt)	AT	0	TEXT_ARROW	AT	0000
19	BB	0	Bottom of Bank	BB	0	BANK	BB	0000
20	BDA	0	Bridge Abutment	BA	0	BRIDGE_ABUTMENT	BA	0000
21	BDD	0	Bridge Deck	BD	0	BRIDGE_DECK	BD	0000
22	BDP	0	Bridge Parapet	PR	0	BRIDGE_PARAPET	BP	0000
23	BDR	0	Bridge Railing	BR	0	BRIDGE_RAILING	BR	0000
24	BDS1	0	Bridge Soffit (1pt)	BU	0	BRIDGE_SOFFIT	PBF	0000
25	BDW	0	Bridge Wall	BW	0	BRIDGE_WALL	BW	0000
26	BDY	0	Boundary Line	BL	0	BOUNDARY_LINE	BL	0000
27	BE	0	Bench	BE	0	FURN_BENCH	BE	0000
28	BG	0	Building	B	0	BUILDING	BG	0000

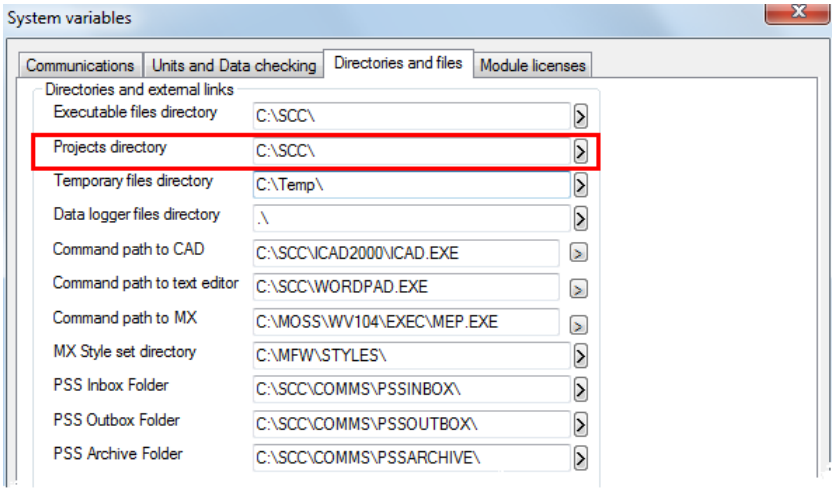
Project Folder



Use default SCC project folder

This option creates a directory under the SCC root level directory/Project Directory ('General Options > Directories and Files'), and creates a project file in that directory. The name of the new directory is taken from the project name.

For example, within the General Options the user has the Project Directory set to 'C:\SCCProjects\' as shown below:



Therefore, a new project folder will be created called Test ('C:\SCCProjects\Test\') and associated files will be downloaded/saved and exported to this directory.

Select an alternative folder

This option allows the user to specify a specific project directory different to the directory specified within the General Options in which the project file is placed.

3.2 Import & Downloading Files Into SCC

Having created the project, it is necessary either to import data into a dataset or to download traverse and detail information. SCC must be told what survey instrument/logger format to use, what type of data is being downloaded and what type of media it is being downloaded from.

For training purposes, the download process from some of the common survey instruments and logging formats are discussed.

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3.2.1 Importing Data Into SCC

SCC can import files from various other systems. All imported files are co-ordinate files and are displayed in the co-ordinate spreadsheet. Because only co-ordinate information was input it is not possible to access detail observations, instrument set-ups or extra measurements information. The following lists the import options available within SCC:

Import SCC Text File (File Menu)

Import Comma Separated file (File Menu)

Import Fixed format ASCII file (File Menu)

Import STAR*NET Co-ordinate file (File Menu)

Import MOVE3 Co-ordinate file (File Menu)

Import DWG/DXF File

Import LandXML (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import ESRI Shapefile (File Menu)

Import ASCII Wriggle Survey (File Menu)

Import Amberg GRPwin Format (File Menu)

Import Amberg AR2 Format (File Menu)

Import AutoGrad/MSMM 'As Set-Out File' (File Menu)

Import AutoGrad/MSMM Levelling File (File Menu)

Import AutoGrad/MSMM GDS Printout (File Menu)

Import DOER Husky File (File Menu)

Import MOSS GENIO File (File Menu)

Import MOSS 992 Report (File Menu)

Import MOSS 994 Report (File Menu)

Import User defined ASCII co-ordinate file

Panterra

Import Steanne MIDAS File (File Menu)

Import SDRMAP ASCII File (File Menu)

Import Eclipse Report File (File Menu)

Import ESBI Vectors File (File menu)

Import SCC for DOS Project

Landscape (File Menu)

STAR*NET and MOVE3 are traverse and network adjustment packages. If the user chooses to adjust the traverse in one of these packages, the result may be an output file containing the adjusted co-ordinates. These co-ordinates are input into the Project file.

Select 'FILE > Import' and select file type from given list.

3.2.1.1 Importing User Defined ASCII file

The following examines importing user defined '*.txt' files (extract below) into SCC. Note that in this case, coordinates are placed in the detail coordinate sheet, and no further survey reduction takes place.

```
1001,277888.8971,240915.1356,83.0006,KB,01
1002,277888.5933,240915.4912,82.6221,SH,
1003,277891.9484,240916.0136,80.2850,KB,01
1004,277889.5419,240920.9060,80.7244,KB,01
1005,277886.3506,240922.5783,79.3112,KB,01
1006,277886.2381,240922.5023,80.4776,SH,
1007,277886.2772,240922.5681,80.8412,SH,
1008,277887.8752,240920.7858,79.4522,SH,
```

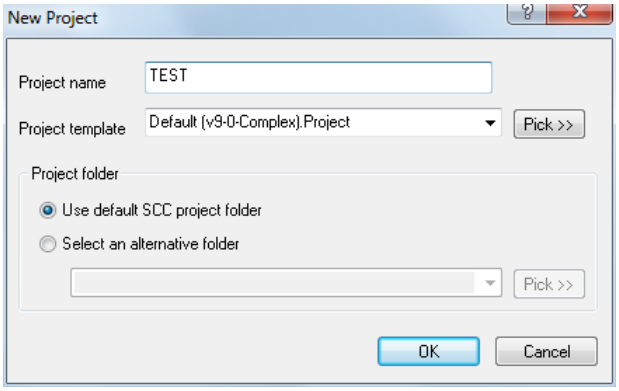
A.Creating Project

Opening Existing Project

Open SCC

Go to 'FILE > New Project'

Enter the Project Name and assign a Project Template

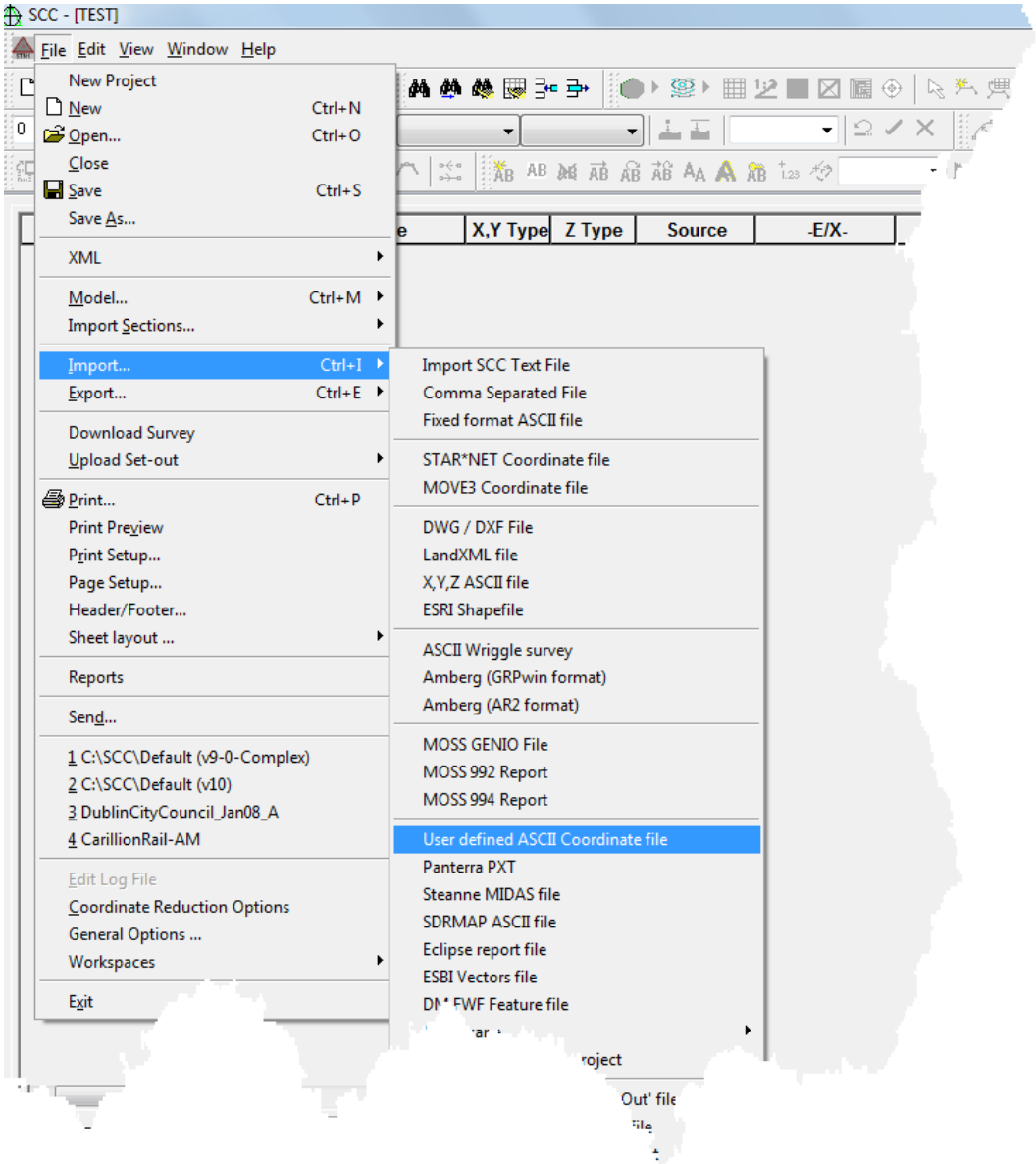


*B.Import User Defined *.txt Files*

Having opened our project, we can proceed to download our data files:

Import Sample Txt File

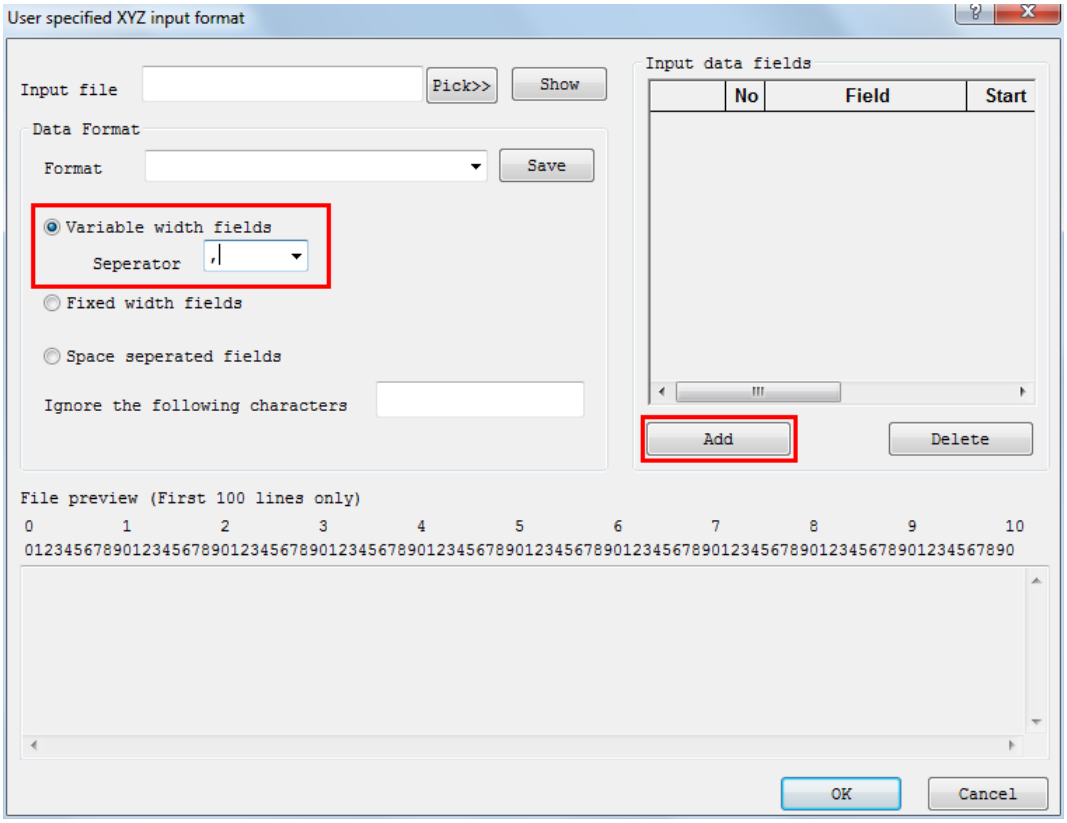
Go to 'File > Import > User Defined ASCII Coordinate File'



Within Data Format Section, enter Format Name 'TEST'

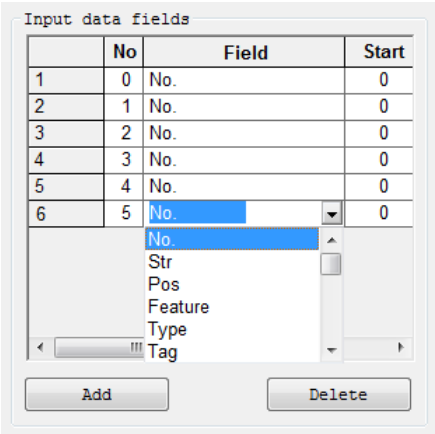
Select 'Variable Width Fields'

Enter ',' as a Separator



Within 'Input Data Fields' select 'Add'

Enter 6 Additional lines



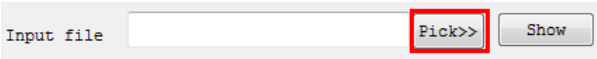
Using the Drop Down Menu within the Input Data Fields column enter the required cell values

Point No (No.), Easting (-E/X-), Northing (-N/Y-), Height (-Ht/Z-), Code (Feature), String No (Str)

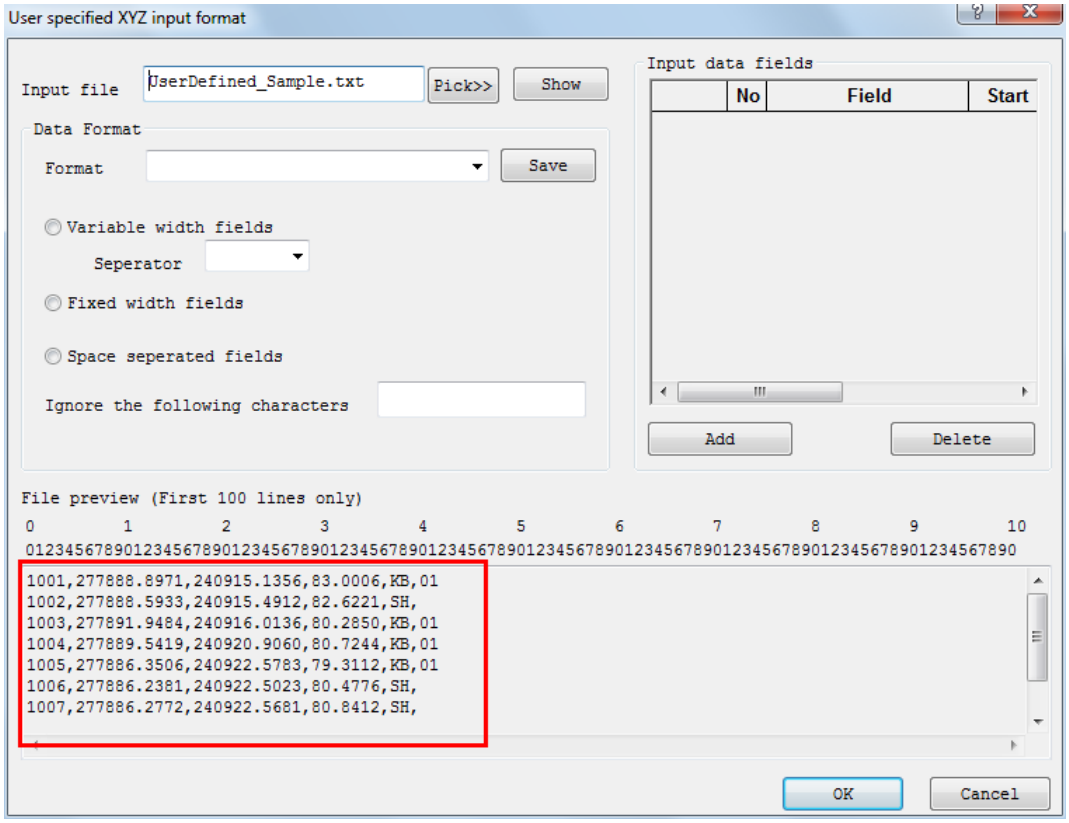
Select 'Save'

The format file 'TEST.InputFormat' can be select from the drop down menu in subsequent imports.

Select the Input File using 'Pick>>'

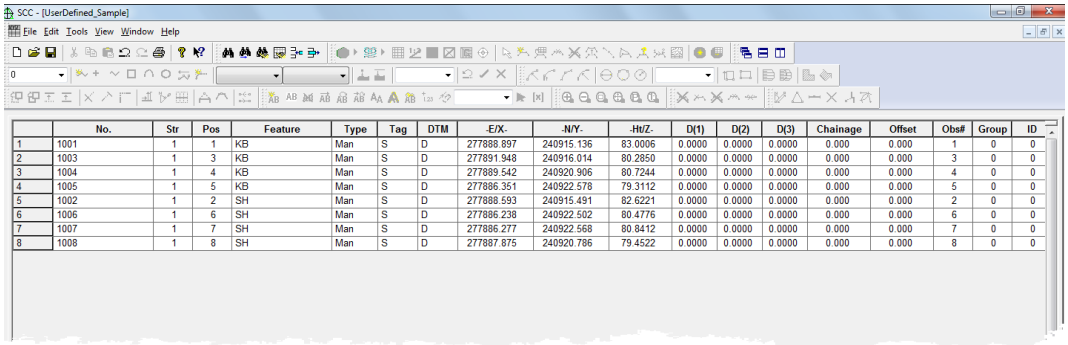


Note the File Preview



Select 'OK'

The selected file is imported to Co-ordinate Observation Sheet as follows:



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	1001	1	1	KB	Man	S	D	277888.897	240915.136	83.0006	0.0000	0.0000	0.0000	0.000	0.000	1	0	0
2	1003	1	3	KB	Man	S	D	277891.948	240916.014	80.2850	0.0000	0.0000	0.0000	0.000	0.000	3	0	0
3	1004	1	4	KB	Man	S	D	277889.542	240920.906	80.7244	0.0000	0.0000	0.0000	0.000	0.000	4	0	0
4	1005	1	5	KB	Man	S	D	277886.351	240922.578	79.3112	0.0000	0.0000	0.0000	0.000	0.000	5	0	0
5	1002	1	2	SH	Man	S	D	277888.593	240915.491	82.6221	0.0000	0.0000	0.0000	0.000	0.000	2	0	0
6	1006	1	6	SH	Man	S	D	277886.238	240922.502	80.4776	0.0000	0.0000	0.0000	0.000	0.000	6	0	0
7	1007	1	7	SH	Man	S	D	277886.277	240922.568	80.8412	0.0000	0.0000	0.0000	0.000	0.000	7	0	0
8	1008	1	8	SH	Man	S	D	277887.875	240920.786	79.4522	0.0000	0.0000	0.0000	0.000	0.000	8	0	0

3.2.1.2 Importing Models From Landscape

The following steps should be implemented when transferring model data from LandScape into SCC:

A. Export Files from Landscape

Export your model from LandScape as GENIO

'5002.crd'

Export your model from LandScape as 3DDXF

‘5002.dxf’

Export trees from LandScape using the print option

‘5002.txt’

Export stations from LandScape using the print option

‘5002.stn’

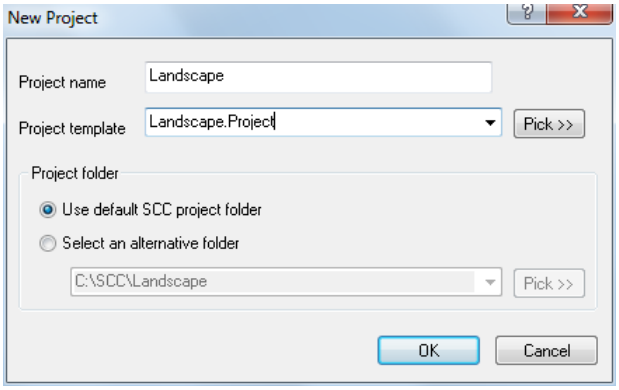
B. Setting up SCC Project

Set up Project

Open SCC

Select ‘FILE > New Project’

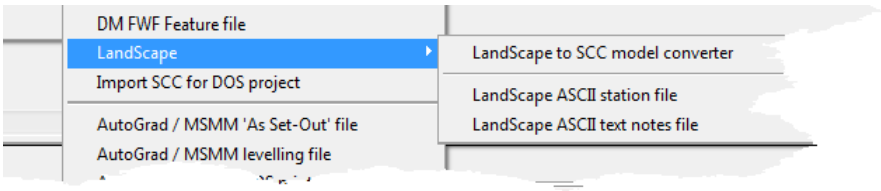
Enter the Project Name and attach the ‘LandscapeSample.Project’ template



C. Importing Files into SCC

Import .txt files

From the Project View, select 'FILE > Import > LandScape > Landscape ASCII Text Notes File'



Select ‘5002.txt’

Go to ‘FILE > Save As > Trees.Survey'

3.2.2 Downloading & Processing Traverse Data

From the 'Download Survey Data' dialog, it is possible to select the type of datalogger used (Detail Topography, Traverse, As Set Out or Levelling) and the input device being used.

Some dataloggers will not record traverse and detail information in the one file and it important to specify which type of data is being input.

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Processing Traverse Data

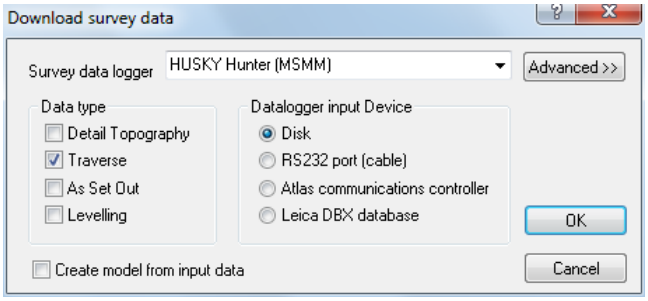
Download Raw Traverse File

Select 'FILE > Download Survey Data'

Select Survey Data Logger 'HUSKY Hunter (MSMM)'

Set the Data Type to 'Traverse'

Set Datalogger Input Device' to 'Disk

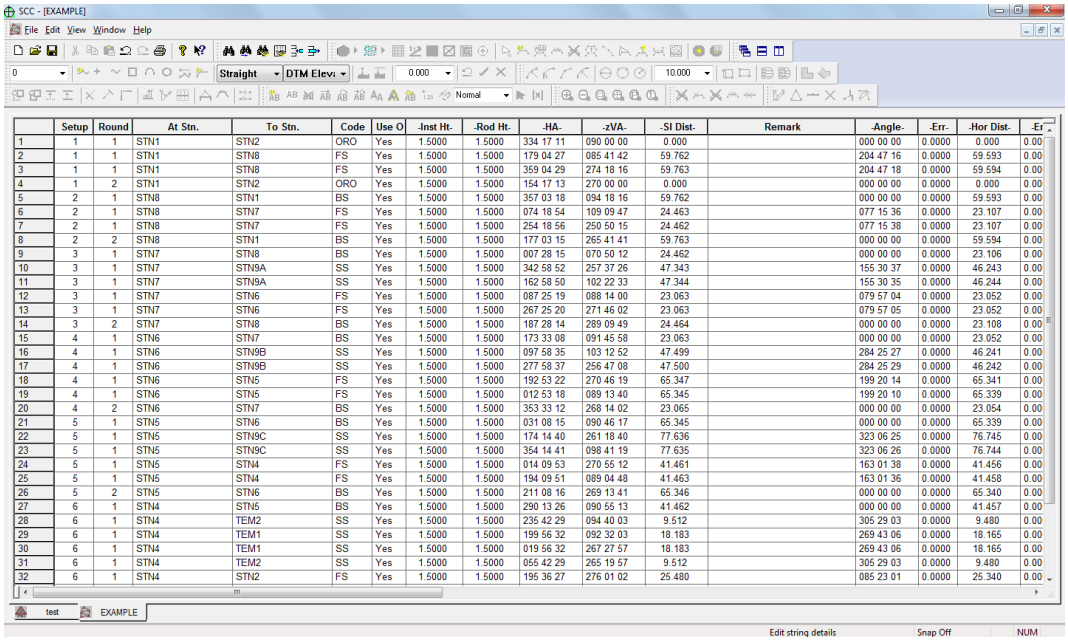


Select 'OK'

Look in the 'Tutorials' folder in the main SCC directory and highlight 'Example.G31'

Select 'Open'

The following spreadsheet is presented:



	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Remark	-Angle-	-Err-	-Hor Dist-	-Er
1	1	1	STN1	STN2	ORO	Yes	1.5000	1.5000	334 17 11	090 00 00	0.000		000 00 00	0.0000	0.000	0.00
2	1	1	STN1	STN8	FS	Yes	1.5000	1.5000	179 04 27	085 41 42	59.762		204 47 16	0.0000	59.593	0.00
3	1	1	STN1	STN8	FS	Yes	1.5000	1.5000	359 04 29	274 18 16	59.763		204 47 18	0.0000	59.594	0.00
4	1	2	STN1	STN2	ORO	Yes	1.5000	1.5000	154 17 13	270 00 00	0.000		000 00 00	0.0000	0.000	0.00
5	2	1	STN8	STN1	BS	Yes	1.5000	1.5000	357 03 18	094 18 16	59.762		000 00 00	0.0000	59.593	0.00
6	2	1	STN8	STN7	FS	Yes	1.5000	1.5000	074 18 54	109 09 47	24.463		077 15 36	0.0000	23.107	0.00
7	2	1	STN8	STN7	FS	Yes	1.5000	1.5000	254 18 56	250 50 15	24.462		077 15 38	0.0000	23.107	0.00
8	2	2	STN8	STN1	BS	Yes	1.5000	1.5000	177 03 15	265 41 41	59.763		000 00 00	0.0000	59.594	0.00
9	3	1	STN7	STN8	BS	Yes	1.5000	1.5000	007 28 15	070 50 12	24.462		000 00 00	0.0000	23.106	0.00
10	3	1	STN7	STN9A	SS	Yes	1.5000	1.5000	342 58 52	257 37 26	47.343		155 30 37	0.0000	46.243	0.00
11	3	1	STN7	STN9A	SS	Yes	1.5000	1.5000	162 58 50	102 22 33	47.344		155 30 35	0.0000	46.244	0.00
12	3	1	STN7	STN6	FS	Yes	1.5000	1.5000	087 25 19	088 14 00	23.063		079 57 04	0.0000	23.052	0.00
13	3	1	STN7	STN6	FS	Yes	1.5000	1.5000	267 25 20	271 46 02	23.063		079 57 05	0.0000	23.052	0.00
14	3	2	STN7	STN8	BS	Yes	1.5000	1.5000	187 28 14	289 09 49	24.464		000 00 00	0.0000	23.108	0.00
15	4	1	STN6	STN7	BS	Yes	1.5000	1.5000	173 33 08	091 45 58	23.063		000 00 00	0.0000	23.052	0.00
16	4	1	STN6	STN9B	SS	Yes	1.5000	1.5000	097 58 35	103 12 52	47.499		284 25 27	0.0000	46.241	0.00
17	4	1	STN6	STN9B	SS	Yes	1.5000	1.5000	277 58 37	256 47 08	47.500		284 25 29	0.0000	46.242	0.00
18	4	1	STN6	STN5	FS	Yes	1.5000	1.5000	192 53 22	270 46 19	65.347		199 20 14	0.0000	65.341	0.00
19	4	1	STN6	STN5	FS	Yes	1.5000	1.5000	012 53 18	089 13 40	65.345		199 20 10	0.0000	65.339	0.00
20	4	2	STN6	STN7	BS	Yes	1.5000	1.5000	353 33 12	268 14 02	23.065		000 00 00	0.0000	23.054	0.00
21	5	1	STN5	STN6	BS	Yes	1.5000	1.5000	031 08 15	090 46 17	65.345		000 00 00	0.0000	65.339	0.00
22	5	1	STN5	STN9C	SS	Yes	1.5000	1.5000	174 14 40	261 18 40	77.636		323 06 25	0.0000	76.745	0.00
23	5	1	STN5	STN9C	SS	Yes	1.5000	1.5000	354 14 41	098 41 19	77.635		323 06 26	0.0000	76.744	0.00
24	5	1	STN5	STN4	FS	Yes	1.5000	1.5000	014 09 53	270 55 12	41.461		163 01 38	0.0000	41.456	0.00
25	5	1	STN5	STN4	FS	Yes	1.5000	1.5000	194 09 51	089 04 48	41.463		163 01 36	0.0000	41.458	0.00
26	5	2	STN5	STN6	BS	Yes	1.5000	1.5000	211 08 16	269 13 41	65.346		000 00 00	0.0000	65.340	0.00
27	6	1	STN4	STN5	BS	Yes	1.5000	1.5000	290 13 26	090 55 13	41.462		000 00 00	0.0000	41.457	0.00
28	6	1	STN4	TEM2	SS	Yes	1.5000	1.5000	235 42 29	094 40 03	9.512		305 29 03	0.0000	9.480	0.00
29	6	1	STN4	TEM1	SS	Yes	1.5000	1.5000	199 56 32	092 32 03	18.183		269 43 06	0.0000	18.165	0.00
30	6	1	STN4	TEM1	SS	Yes	1.5000	1.5000	019 56 32	267 27 57	18.183		269 43 06	0.0000	18.165	0.00
31	6	1	STN4	TEM2	SS	Yes	1.5000	1.5000	055 42 29	265 19 57	9.512		305 29 03	0.0000	9.480	0.00
32	6	1	STN4	STN2	FS	Yes	1.5000	1.5000	195 36 27	276 01 02	25.480		085 23 01	0.0000	25.340	0.00

The traverse observation spreadsheet contains the measured traverse observations, and their reduced values such as bearing, height difference, forward measured angle. Also included on this sheet are standard errors that may be set for any given observation, residuals generated by the adjustment, and atmospherics.

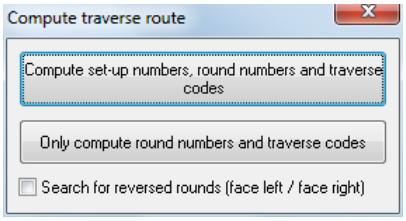
Having done this you should perform an initial 'free' least squares adjustment, in which the only constraints applied are those of the opening set-up. This checks the internal consistency of the measurements independently of any known station information, and provides us with initial station coordinates in the station coordinate spreadsheet. A significant change in the residuals produced by the free adjustment and a later constrained adjustment indicates that measurements are not consistent with the constraints (fixed control) provided. This is typically

due to incorrect application of scale factor, corrections, or poor quality of fixed control data. It can also occur where the fixed control has been generated by GPS, with and inappropriate transformation or projection selected. The traverse adjustment dialog also allows us to specify default standard errors, and an output report file name.

Traverse Adjustment

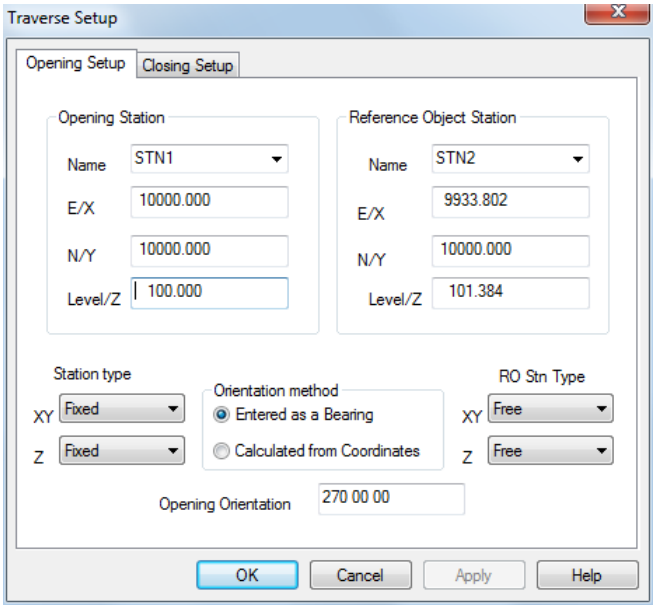
Before adjusting the traverse we can use the 'Check Traverse Route' tool from the 'FILE' menu. This function searches the traverse observation file for pairs of matched back-sight (BS) and foresight (FS) observations. It then sets the codes of these observations to form a correct route through the traverse.

Go to 'FILE' and select 'Check Traverse Route'



Select 'Only compute round numbers and traverse codes'

Then, go to 'EDIT' and select 'Setup'



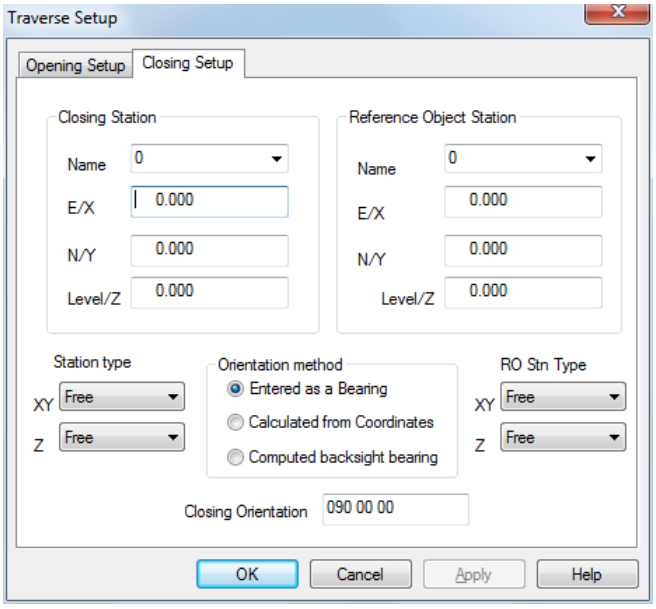
Select the Opening Station and Opening Reference Station from the pull down lists.

The Opening Station 1 should be held 'Fixed' and the Opening Reference Station should be held 'Free'

The Orientation method should be set to 'Enter As A Bearing'

Select the Closing Setup tab

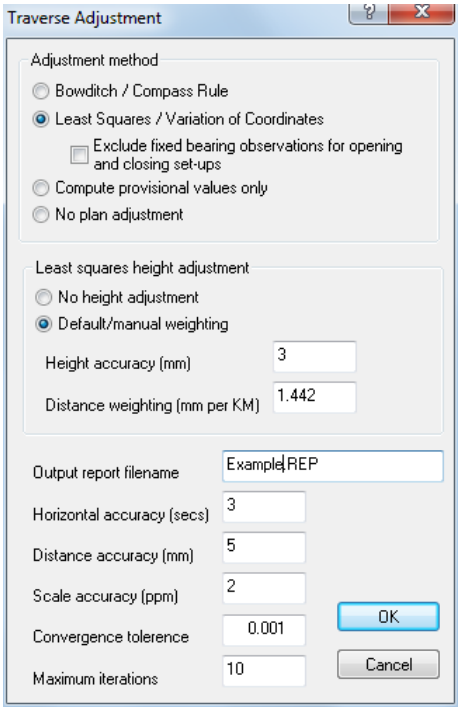
For this traverse example, the closing station and reference station should be left blank and set to 'Free'



Select 'OK'

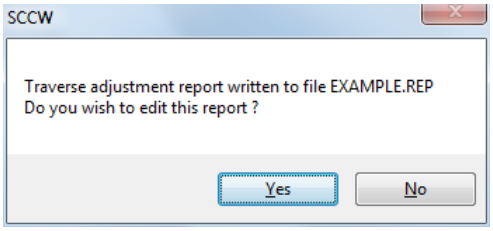
Select 'EDIT > Adjust'x

Select 'Least Squares/Variation of Coordinates' as the adjustment method

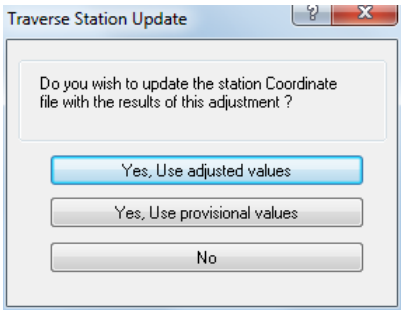


Select 'OK'

If you wish to edit the adjustment report, select 'Yes', if not, select 'No'



The option to update the station coordinates/project file with the adjusted values, provisional values or not to update



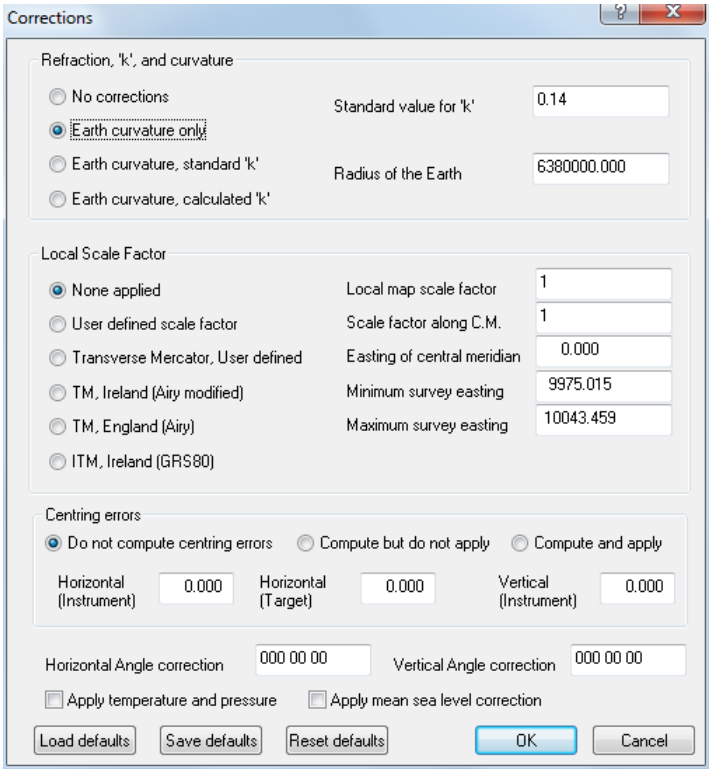
Select 'Yes, use adjusted values'

The project file should now be updated with the new adjusted station co-ordinates.

We can also configure the application of mapping scale factor, atmospheric and mean sea level corrections at this stage. This dialog can be accessed from the EDIT > Corrections menu.

Setting the Corrections

Go to 'EDIT > Corrections'



Select your option for Refraction, 'K' and curvature, the default being 'Earth curvature only'

You now have the option of adjusting the traverse again but this time holding some of the new stations fixed.

Save Files

Within the Project, select 'FILE > Save As > Test.Project'

Within the Traverse, select 'FILE > Save As > Example.Traverse'

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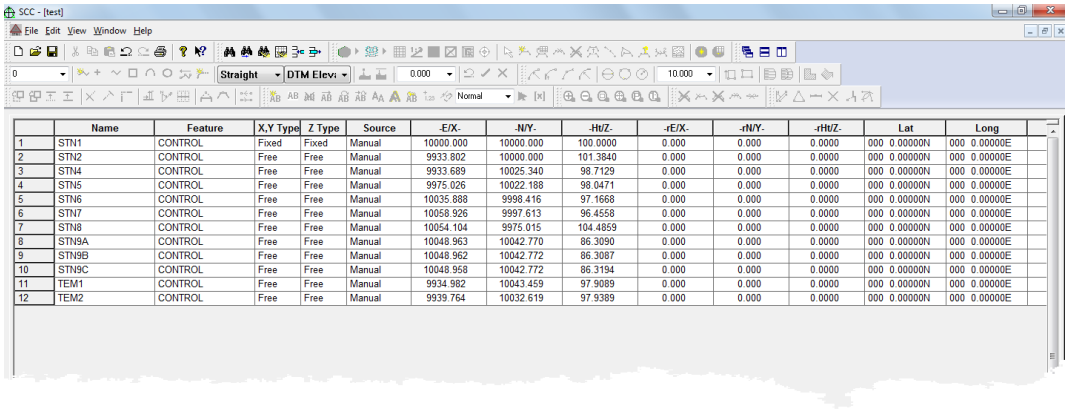
3.2.2.1 Displaying & Annotating the Traverse

After adjusting the traverse and updating the project file with the new adjusted co-ordinates, the stations can then be exported to a survey file where they can be modelled and the traverse/network file attached.

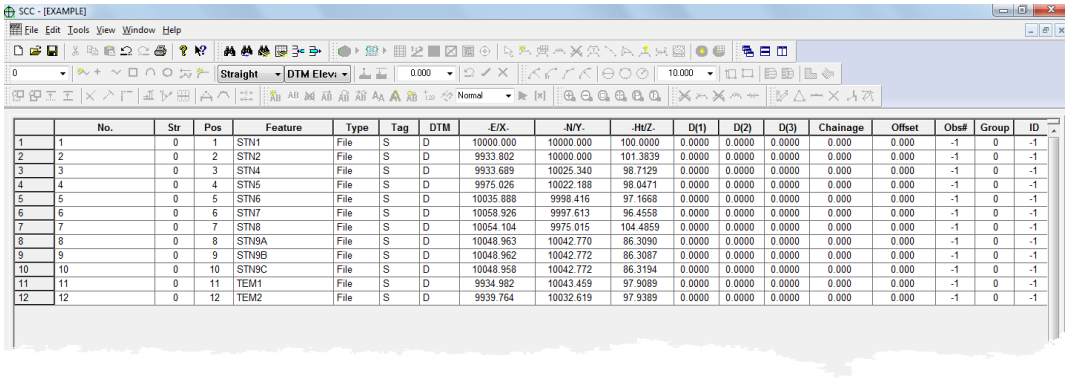


	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat	Long
1	STN1	CONTROL	Fixed	Fixed	Manual	10000.000	10000.000	100.0000	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
2	STN2	CONTROL	Free	Free	Manual	9933.802	10000.000	101.3840	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
3	STN4	CONTROL	Free	Free	Manual	9933.689	10025.340	98.7129	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
4	STN5	CONTROL	Free	Free	Manual	9975.026	10022.188	98.0471	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
5	STN6	CONTROL	Free	Free	Manual	10035.888	9998.416	97.1668	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
6	STN7	CONTROL	Free	Free	Manual	10058.926	9997.613	96.4558	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
7	STN8	CONTROL	Free	Free	Manual	10054.104	9975.015	104.4859	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
8	STN9A	CONTROL	Free	Free	Manual	10048.963	10042.770	86.3090	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
9	STN9B	CONTROL	Free	Free	Manual	10048.962	10042.772	86.3087	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
10	STN9C	CONTROL	Free	Free	Manual	10048.958	10042.772	86.3194	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
11	TEM1	CONTROL	Free	Free	Manual	9934.982	10043.459	97.9089	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
12	TEM2	CONTROL	Free	Free	Manual	9939.764	10032.619	97.9389	0.000	0.000	0.0000	000 0.00000N	000 0.00000E

Export stations to a dataset

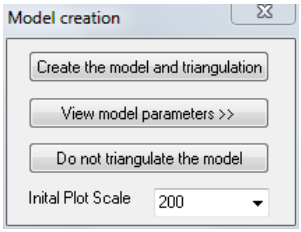
From the project file, select 'FILE > Export > Stations as dataset'

Save the dataset as 'Stations.Survey'



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	1	0	1	STN1	File	S	D	10000.000	10000.000	100.0000	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
2	2	0	2	STN2	File	S	D	9933.802	10000.000	101.3839	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
3	3	0	3	STN4	File	S	D	9933.689	10025.340	98.7129	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
4	4	0	4	STN5	File	S	D	9975.026	10022.188	98.0471	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
5	5	0	5	STN6	File	S	D	10035.888	9998.416	97.1668	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
6	6	0	6	STN7	File	S	D	10058.926	9997.613	96.4558	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
7	7	0	7	STN8	File	S	D	10054.104	9975.015	104.4859	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
8	8	0	8	STN9A	File	S	D	10048.963	10042.770	86.3090	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
9	9	0	9	STN9B	File	S	D	10048.962	10042.772	86.3087	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
10	10	0	10	STN9C	File	S	D	10048.958	10042.772	86.3194	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
11	11	0	11	TEM1	File	S	D	9934.982	10043.459	97.9089	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
12	12	0	12	TEM2	File	S	D	9939.764	10032.619	97.9389	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1

Go to 'FILE > Model > SCC Dataset > Select 'Stations.Survey'



Select 'Create the model and triangulation' and Initial Plot Scale of '1:200'

Go to 'FILE > Attach/Detach > Attach traverse file

Select saved traverse 'Example.Traverse'

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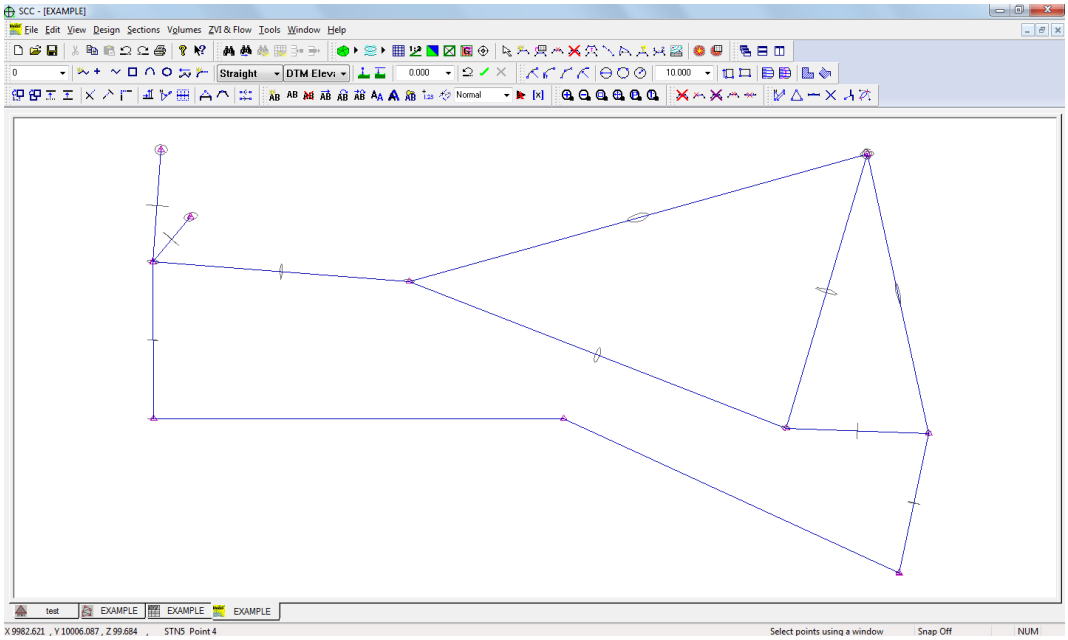
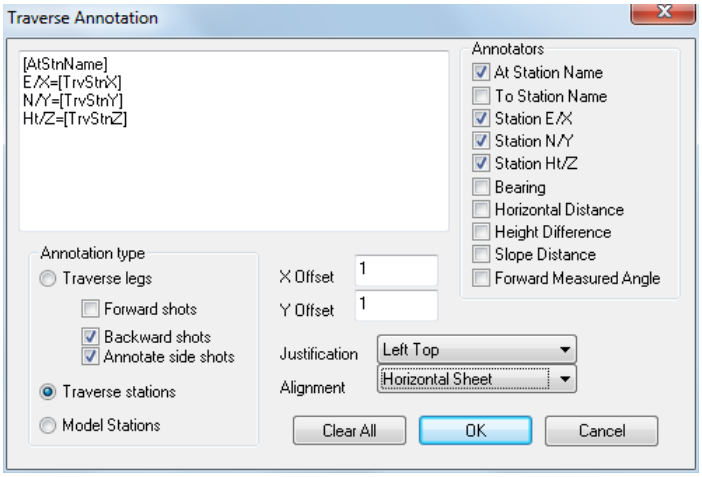


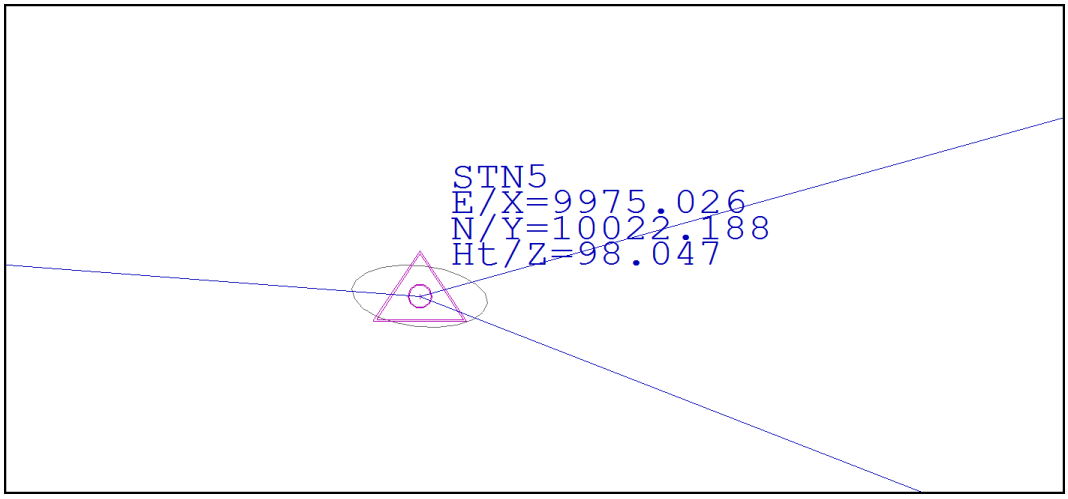
Traverse Annotation

Select 'EDIT > Text > Annotate Traverse'

Set up the following:



Select 'OK'

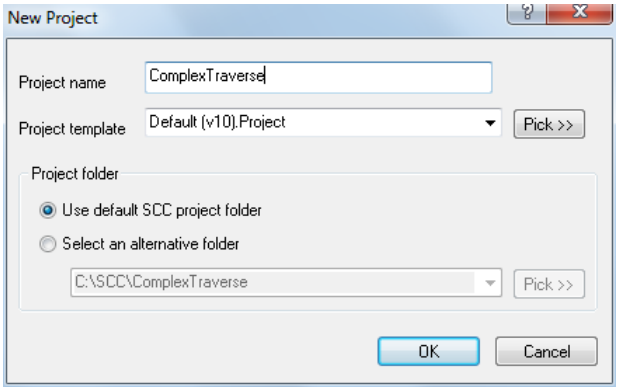


3.2.2.2 Processing A Complex Traverse

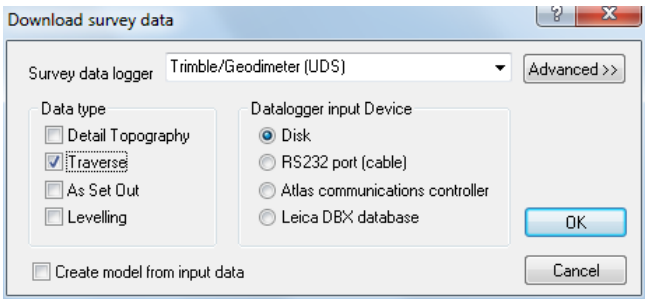
The following worked example shows how to process a complex control project in SCC that includes interlinked traverses, cross braces and additional side-shots. This includes processing the complete observation set as an unconstrained network via least squares, extracting separate traverses for Bowditch adjustment, and fixing the primary stations for constrained least squares adjustment. The steps to achieve this are given below;

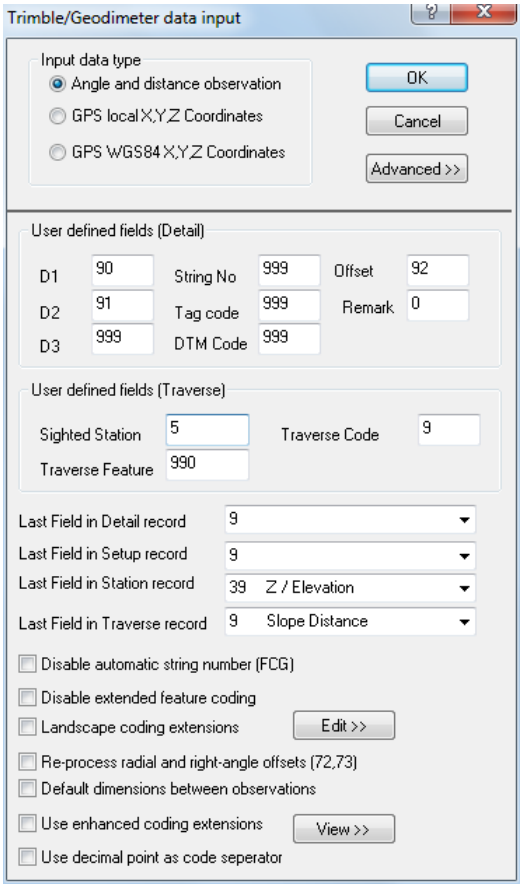
A. Project Creation & Download

Use 'FILE > New Project' to create a new project based around the default template.

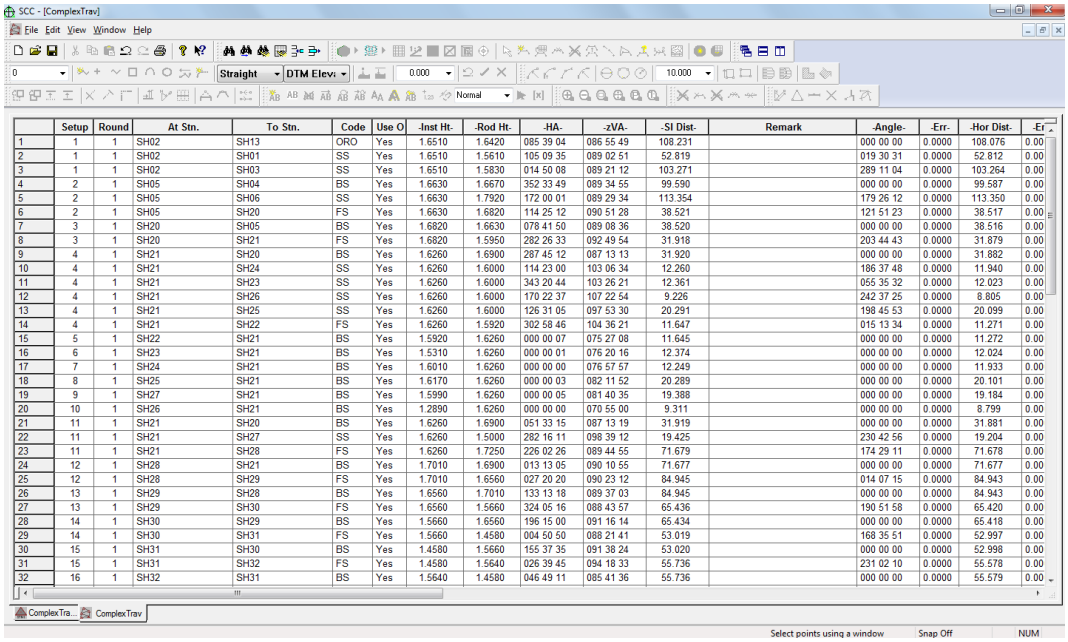


Into this project use 'FILE > Download Survey' to download the Trimble / Geodimeter UDS file, \SCC\Tutorials\ComplexTrav.DAT, using the parameters shown.





This results in the traverse spread-sheet given below;



	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Remark	-Angle-	-Err-	-Hor Dist-	-Er
1	1	1	SH02	SH13	ORO	Yes	1.6510	1.6420	085 39 04	086 55 49	108.231		000 00 00	0.0000	108.076	0.00
2	1	1	SH02	SH01	SS	Yes	1.6510	1.5610	105 09 35	089 02 51	52.819		019 30 31	0.0000	52.812	0.00
3	1	1	SH02	SH03	SS	Yes	1.6510	1.5830	014 50 08	089 21 12	103.271		289 11 04	0.0000	103.264	0.00
4	2	1	SH05	SH04	BS	Yes	1.6630	1.6670	352 33 49	089 34 55	99.590		000 00 00	0.0000	99.587	0.00
5	2	1	SH05	SH06	SS	Yes	1.6630	1.7920	172 00 01	089 29 34	113.354		179 26 12	0.0000	113.350	0.00
6	2	1	SH05	SH20	FS	Yes	1.6630	1.6820	114 25 12	090 51 28	38.521		121 51 23	0.0000	38.517	0.00
7	3	1	SH20	SH05	BS	Yes	1.6820	1.6630	078 41 50	089 08 36	38.520		000 00 00	0.0000	38.516	0.00
8	3	1	SH20	SH21	FS	Yes	1.6820	1.5950	282 26 33	092 49 54	31.918		203 44 43	0.0000	31.879	0.00
9	4	1	SH21	SH20	BS	Yes	1.6260	1.6900	287 45 12	087 13 13	31.920		000 00 00	0.0000	31.882	0.00
10	4	1	SH21	SH24	SS	Yes	1.6260	1.6000	114 23 00	103 06 34	12.260		186 37 48	0.0000	11.940	0.00
11	4	1	SH21	SH23	SS	Yes	1.6260	1.6000	343 20 44	103 26 21	12.361		055 35 32	0.0000	12.023	0.00
12	4	1	SH21	SH26	SS	Yes	1.6260	1.6000	170 22 37	107 22 54	9.226		242 37 25	0.0000	8.805	0.00
13	4	1	SH21	SH25	SS	Yes	1.6260	1.6000	126 31 05	097 53 30	20.291		198 45 53	0.0000	20.099	0.00
14	4	1	SH21	SH22	FS	Yes	1.6260	1.5920	302 58 46	104 36 21	11.647		015 13 34	0.0000	11.271	0.00
15	5	1	SH22	SH21	BS	Yes	1.5920	1.6260	000 00 07	075 27 08	11.645		000 00 00	0.0000	11.272	0.00
16	6	1	SH23	SH21	BS	Yes	1.5310	1.6260	000 00 01	076 20 16	12.374		000 00 00	0.0000	12.024	0.00
17	7	1	SH24	SH21	BS	Yes	1.6010	1.6260	000 00 00	076 57 57	12.249		000 00 00	0.0000	11.933	0.00
18	8	1	SH25	SH21	BS	Yes	1.6170	1.6260	000 00 03	082 11 52	20.289		000 00 00	0.0000	20.101	0.00
19	9	1	SH27	SH21	BS	Yes	1.5990	1.6260	000 00 05	081 40 35	19.388		000 00 00	0.0000	19.184	0.00
20	10	1	SH26	SH21	BS	Yes	1.2890	1.6260	000 00 00	070 55 00	9.311		000 00 00	0.0000	8.799	0.00
21	11	1	SH21	SH20	BS	Yes	1.6260	1.6900	051 33 15	087 13 19	31.919		000 00 00	0.0000	31.881	0.00
22	11	1	SH21	SH27	SS	Yes	1.6260	1.5000	282 16 11	098 39 12	19.425		230 42 56	0.0000	19.204	0.00
23	11	1	SH21	SH28	FS	Yes	1.6260	1.7250	226 02 26	089 44 55	71.679		174 29 11	0.0000	71.678	0.00
24	12	1	SH28	SH21	BS	Yes	1.7010	1.6900	013 13 05	090 10 55	71.677		000 00 00	0.0000	71.677	0.00
25	12	1	SH28	SH29	FS	Yes	1.7010	1.6560	027 20 20	090 23 12	84.945		014 07 15	0.0000	84.943	0.00
26	13	1	SH29	SH28	BS	Yes	1.6560	1.7010	133 13 18	089 37 03	84.945		000 00 00	0.0000	84.943	0.00
27	13	1	SH29	SH30	FS	Yes	1.6560	1.5660	324 05 16	088 43 57	65.436		190 51 58	0.0000	65.420	0.00
28	14	1	SH30	SH29	BS	Yes	1.5660	1.6560	196 15 00	091 16 14	65.434		000 00 00	0.0000	65.418	0.00
29	14	1	SH30	SH31	FS	Yes	1.5660	1.4580	004 50 50	088 21 41	53.019		168 35 51	0.0000	52.997	0.00
30	15	1	SH31	SH30	BS	Yes	1.4580	1.5660	155 37 35	091 38 24	53.020		000 00 00	0.0000	52.998	0.00
31	15	1	SH31	SH32	FS	Yes	1.4580	1.5640	026 39 45	094 18 33	55.736		231 02 10	0.0000	55.578	0.00
32	16	1	SH32	SH31	BS	Yes	1.5640	1.4580	046 49 11	085 41 36	55.736		000 00 00	0.0000	55.579	0.00

B. Adjustment of Traverse

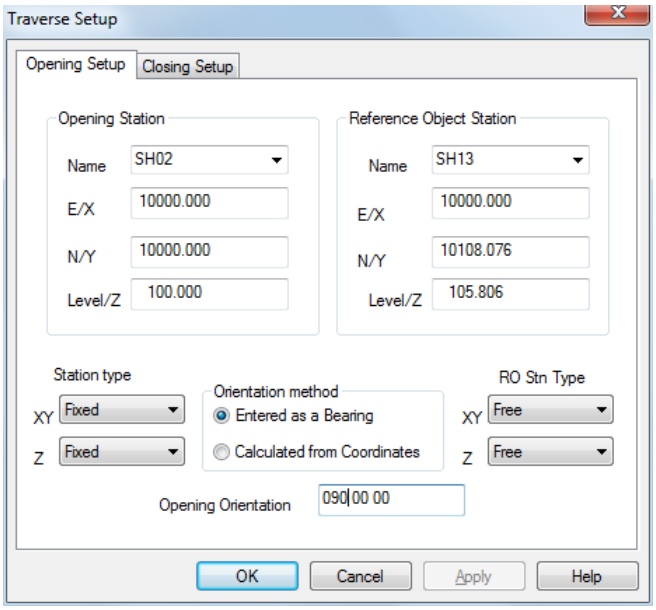
Adjust the control in its entirety, using a least squares adjustment with minimal constraints.

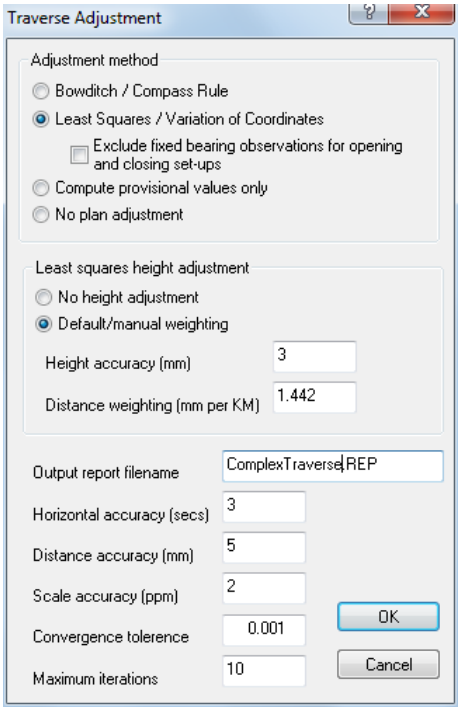
Select 'EDIT > Set-up', and enter an opening setup as shown in the dialog below.

Note that only the closing station and RO should be left 'Free'.

Select 'EDIT > Adjust' and adjust this data by least squares.

When prompted, save the adjusted values to the project station sheet.





3.2.2.3 Processing A Resection Network

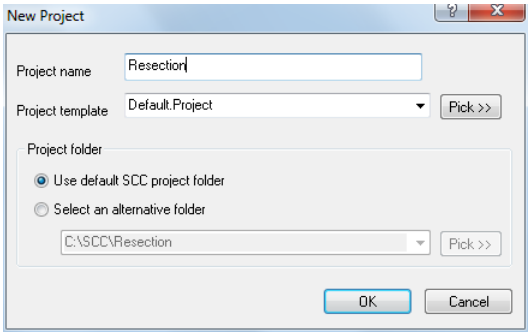
The following tutorial covers the processing of the Leica GSI control network provided in the file 'Resection-Network.GSI' (available in \SCC\Tutorials). The job consists of a large number of total station measurements from primary unknown stations to other secondary unknown stations. The network can be computed as there are enough common target points between each set-up to allow computation of provisional values of all primary stations by resection (or free-station), and secondary stations by direct trigonometry. Due to the interdependency of the stations, the computation of provisional coordinates is iterative, whereby new station

coordinates are generated with each iteration thus providing base information for successive iterations. Having computed all of the provisional station coordinates, the network can then be adjusted using a least squares variation of coordinates method, which provides the best and most consistent final station values for the observed data.

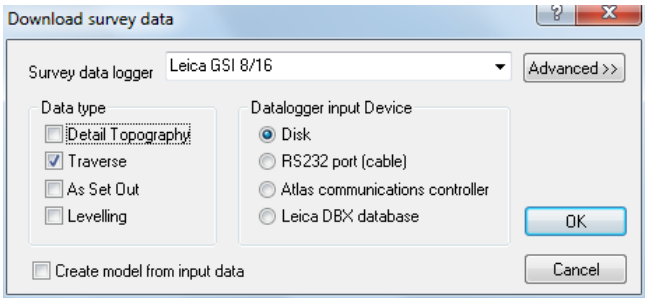
The steps taken to process this job are as follows:

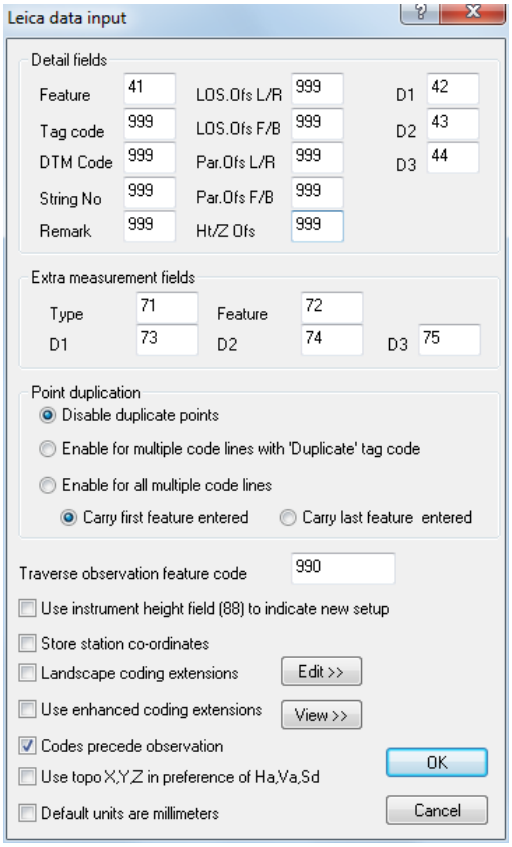
A. Project Creation & Download

Use 'FILE > New Project' to create a new project based around the default template.



Into this project use 'FILE > Download Survey' to download the 'Leica GSI 8/16', \SCC\Tutorials\Resection-Network.gsi, using the parameters shown.

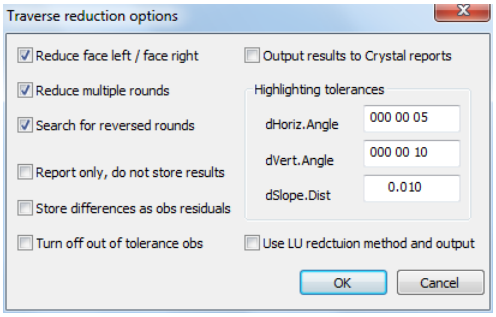




B. Traverse Reduction Processing of Traverse Data

Given the size of the job, 1076 observations to 321 stations, it is advisable to reduce the data prior to adjustment.

Select 'EDIT > Reduce' to reduce the data.



The reduction creates mean forward measured angles and distances for multiple similar observations, in this case reducing the number of input observations from 1076 to 538. The reason for doing this is primarily processing time. Many of the matrix manipulation routines in the least squares adjustment are making a number of computations based on the square of number of observations times the number of unknown stations, i.e. (1076x1076x320 = 370,488,320 for unreduced data, or 538x538x320 = 92,622,080 for reduced data). Using the reduced data also provides better initial provisional coordinates, such that fewer iterations of the transformation are required to get a final result. The net effect is that on a 1.5Ghz machine, adjusting the data without first reducing it will take about 110 minutes, whereas adjusting the reduced data takes about 7 minutes. If individual observation residuals, as opposed to residuals on averaged measurements, are required, you should not reduce the data prior to the adjustment.

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3.2.2.4 Traverse Reduction & STAR*NET Export options

Traverse Reduction options support output to Crystal reports and additional 2D or 3D STAR*NET export options.

The following details the processing of 'Z41120424TRAV1.GSI' using 'LUL1.GSIConfig' and based on the 'LUL01.Project' feature library. This assumes the following coding has been used:

```
41 = 1 Station set-up record

42 = At Stn

43 = Inst Height

44 = Rod height

45 = BS Stn
```

For example, from Z41120424TRAV1.GSI

```
410002+00000001 42....+000Z4105 43....+00001611 44....+00001520 45....+000Z4106
110004+000Z4106 21...2+35959590

22...2+08934580 31...0+00101597 81...0+02999999 82...0+05101594 83...0+00100831
51....+0000+000 87....+00001520

71....00000STN

41 = 5 Coding details

42 = Feature code

43 = D1

44 = D2

45 = D3
```

The feature code line comes after the observation, and dimensions can be a mix of mm or metres. For trees 43 is the diameter in mm, 44 is the spread in metres, 45 is the height in metres. The feature is carried until a new feature code is logged.

```
110008+00004514 21.324+03518040 22.324+07941180 31..00+00020489 51..1.-0000+034
81..00+83107925 82..00+35861779

83..00+00098576 87..10+00000000 410009+00000005 42....+00000201 43....+00000300
44....+00000010 45....+00000014

41 = 6 Offsets

42 = Line of sight offset, forward or back, in millimetres.

43 = Line of sight offset, left or right, in millimetres.
```

As with the feature code, this relates to the previous observation, for example in the line below tree at point 4514 is offset 150mm to the right of the point taken, which is half the trunk diameter in this case. These offsets apply to a single point only.

```
110008+00004514 21.324+03518040 22.324+07941180 31..00+00020489 51..1.-0000+034
81..00+83107925 82..00+35861779

83..00+00098576 87..10+00000000 410009+00000005 42....+00000201 43....+00000300
44....+00000010 45....+00000014

410010+00000006 42....+00000000 43....+00000150
```

Other field codes can be added as required.

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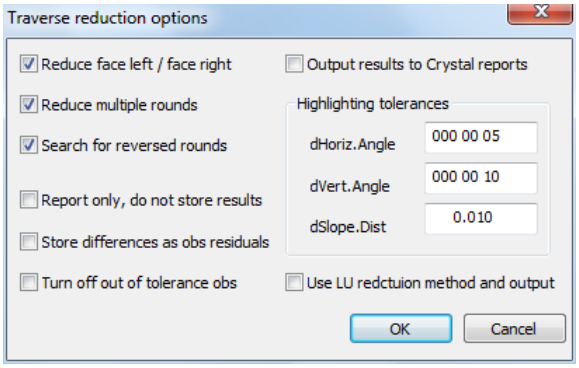
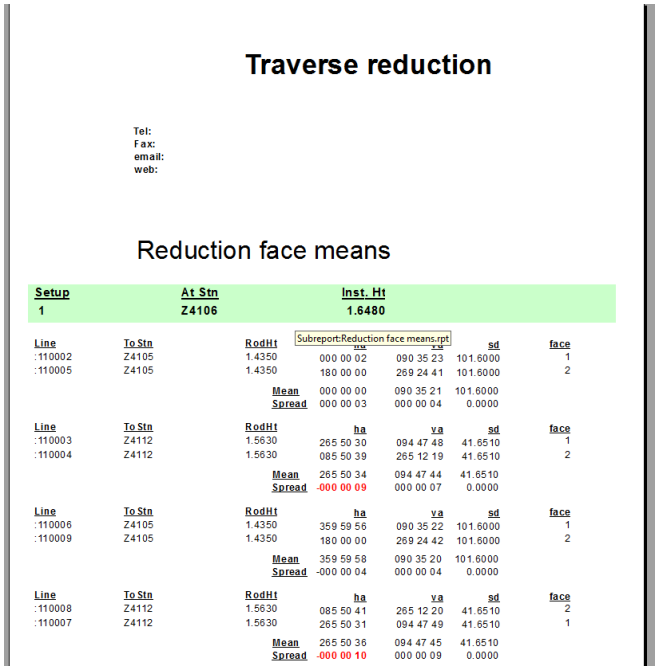
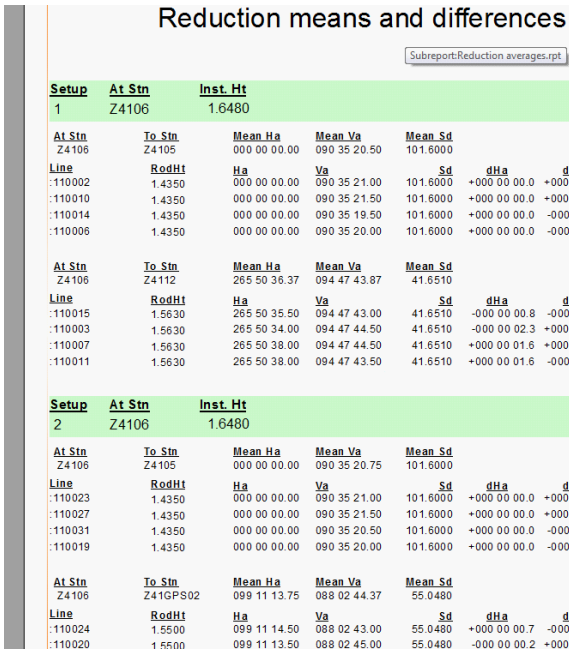


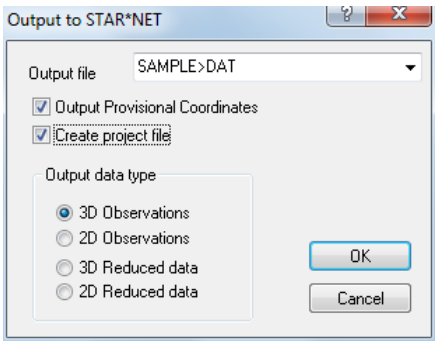
Crystal Report

Extreme variances at user defined tolerances can be highlighted within the Crystal Report. Additional crystal reports have been added to support different reduction options, specifically rounds and faces, rounds only, and faces only.





These reports can be readily customized either by Atlas or directly by the user using a copy of Crystal reports, and data can be output to a wide variety of formats such as PDF, MS Excel, MS Word, etc….



STAR*NET Export

The STAR*NET export option has been enhanced to support export to 2d or 3d, using observed format (e.g. sets of horizontal directions, see page 75 of the STAR*NET v6 reference manual), or reduced angles (included angle to backsight station). Where 3d data is selected, rod height and instrument height are included as are standard errors. The STAR*NET output now also includes an option to create a project file in addition to the DAT file.

The output allows for the inclusion of either standard errors or observation residuals as remarks. Inclusion of standard errors within the data has also been made optional.

In relation to traverse processing and adjustment in SCC ;

In the least squares adjustment Report, in the line referring to Chi squared it displayed "value exceeded lower bound(0.00)" the question was raised should this not say (1.00)?

Typically, values of 0.00 (exceeds lower bounds) and 100.00 (exceeds upper bounds) can be seen where the weighting isn't in good agreement with the data. The chi squared graph is asymptotic to the x axis, and tends towards 0 quite quickly. SCC could report this to a greater number of decimals but the difference between failing at say 0.01 and failing at 0.0001 has no real meaning in most surveys. Very small values are quite common and just indicate that the standard errors given were way too high.

A traverse is adjusted between 5 stations where 1 and 5 are fixed, 2 and 4 are new and 3 is known but free. In the report there is no differentiation in the adjusted coordinate tags between 2,3,4 . All stations are shown to be Provisional. The user would prefer 2 and 4 to be tagged provisional new and 3 to be tagged provisional free. In this way, the user would be able to look how well the expected coordinates of stations tie in with the adjusted coordinates without being confused by adjusted coordinates of truly new stations.

In SCC, the user can discriminate between stations in plan and elevation as follows;

Free

The station will not be used as input to the adjustment. This is also the value given to stations output from the adjustment.

Provisional

The station will be used as input to the adjustment, but can be freely moved by the adjustment. i.e. a provisional coordinate is the initial unadjusted value as given by the surveyor.

Constrained

The station will be used as input to the adjustment, and can be moved by the adjustment in accordance with the standard coordinate errors provided. i.e. a GPS coordinate provided as input with known accuracy.

Fixed

The station will be used as input to the adjustment, and cannot be moved by the adjustment

Note that as per the requirement above, provisional coordinates (initial values supplied)

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are already distinguished from free coordinates (initial values not supplied) in the adjustment and report.

3.2.3 Downloading & Processing Detail Topography Data

Once station coordinates have been computed, detail topography can be downloaded.

> It is important to remember that only the survey file is automatically saved on download. All other files must be saved by the user.

Sample download proceeds for specific data formats are examined as follows:

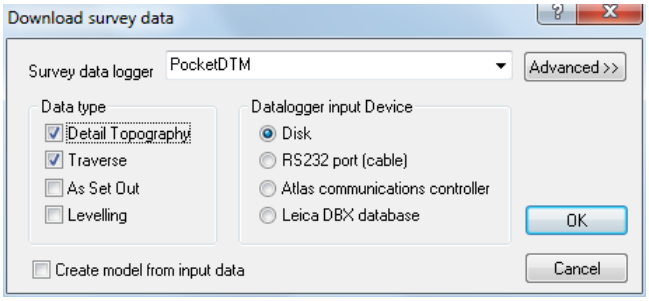
3.2.3.1 Downloading PocketDTM Data

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'PocketDTM'

Highlight 'Traverse' or 'Detail Topography' as the Data Type

Set Input Device to RS323 port (cable)

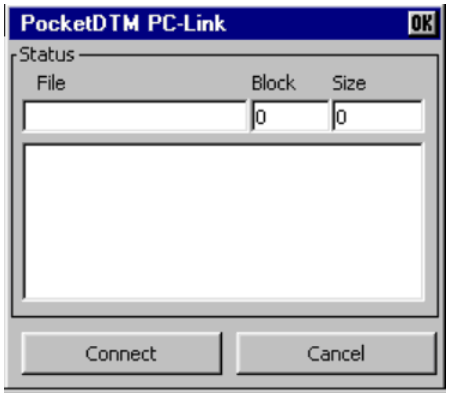


Select 'OK'

On the hand-held device, go to 'FILE'

Select 'Export to SCC'

Select 'Connect' from the dialog displayed



In SCC, a dialog displaying all available jobs will appear on screen

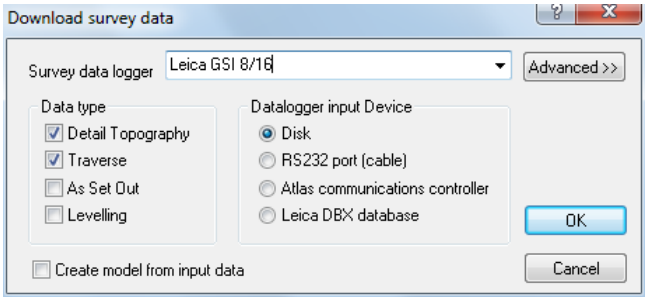
Highlight the job you wish to download

Select 'OK'

3.2.3.2 Downloading Leica Data

SCC includes a number of different Leica interfaces to support correspondingly different data collection strategies. The simplest of these is the TPS series interface which maps

user definable fields on the instrument directly onto SCC observation fields.



Downloading Leica Data

From the Main Menu Bar, select 'FILE > Download Survey Data'

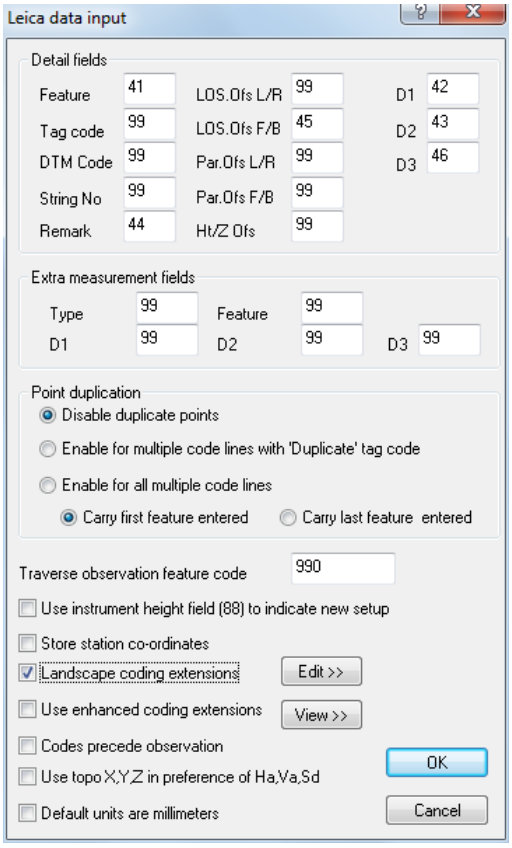
Set Survey Data Logger to 'Leica GS1 8/16'

Highlight 'Traverse' or 'Detail Topography' as the Data Type

Set Input Device to 'Dsk', 'RS323 port (cable) 'or 'Atlas communications controller' as required

Select 'OK'

Select the file you require and 'OK'

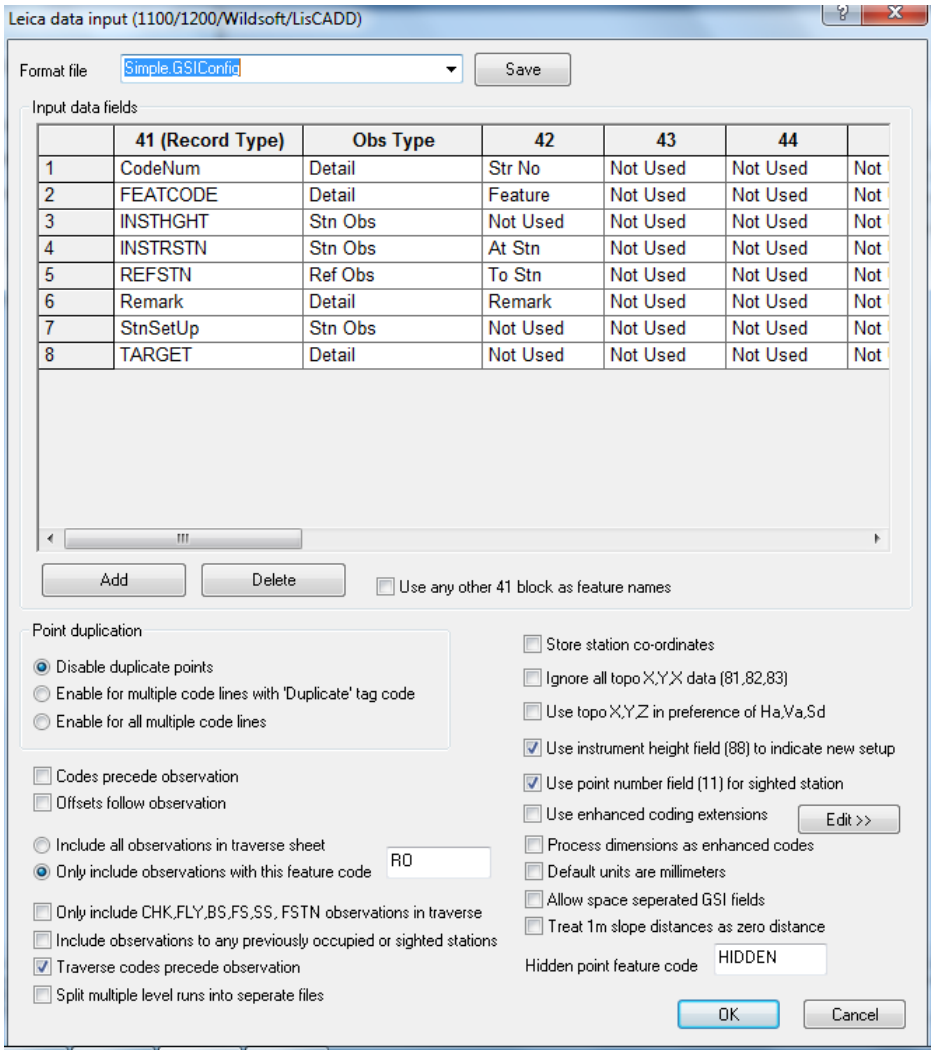


In this case, for example, field 41 on the instrument will be used to store the SCC feature name. Any SCC fields that are not being recorded in the field should be set to 99.

Note that these settings will become the defaults for all future downloads from the Leica and do not have to be entered with each download.

An alternative method is to use the LisCADD or WildSoft style coding (Leica 1100/1200

(GSI config)) which will be more familiar to LisCadd users. In this case field 41 on the instrument is always used to determine what is stored in other instrument fields. For example, in the dialog shown below, if field 41 contains the word 'FEATCODE' the feature code is expected in field 42, whereas if it contains 'Remark' a survey remark is expected in field 42.



Note that in both cases, a traverse feature code may be provided to determine that subsequent observations are to be included in the traverse spreadsheet. This is provided to facilitate combined detail topography and traverse surveys.

Leica 1200 Data Input

The following outlines the transfer of format files on to a Leica1200 system and the use of the 'SCC Sys1200.FRT' file. Download steps into SCC are noted. The use of extra measurements such as 'Line of Sight offsets, Tape Offsets, Parallel Offsets, Dimensions and Remarks are examined.

A. Files for SCC Coding on Leica TPS1200 Series instruments:

SCCSys1200.FRT	Format File (*.FRT) generated in Leica GEO Office to a System 1200 sensor
badleyt_0405_211712.xcf badleyt_0405_211712.x23	Parameter Files

badleyt_0405_211712.x06	

B. *Setting up Coding on the TPS1200:*

a)Transfer of Format Files on PC:

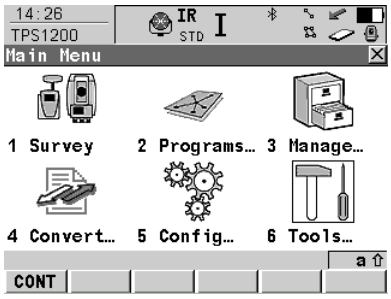
- **Copy Format Files to the Convert Directory on the Compact Flash [CF] Card**
- **Copy the *.xcf, *.x23 and *.x06 files into the Code Directory on the Compact Flash [CF] card**

Note:

The Compact Flash card must always be “Stopped” before removing it from your computer. The System 1200 sensor must always be switched off before removing the Compact Flash.

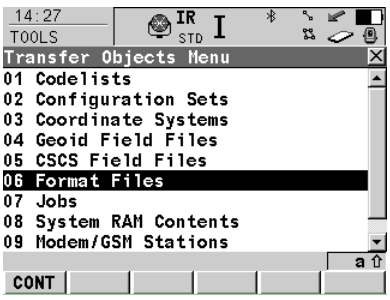
b)PC Card in the instrument – Format File:

- **Select option 6 Tools… from the Main Menu**

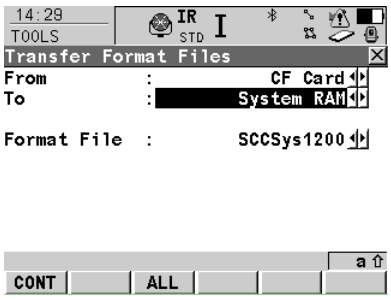


This option can be selected by pressing the number 6 key, or by navigating to 6 Tools... and pressing the Enter key, or by touching the Tools… icon when using an active touch screen

- **Select option 2 Transfer Objects… from the Tools Menu.**
- **Select option 6 Format Files from the Transfer Objects Menu**



- **Select the Format File (SCCSys1200.FRT) you wish to transfer, from the CF Card, to the SystemRAM, in the Transfer Format Files screen.**

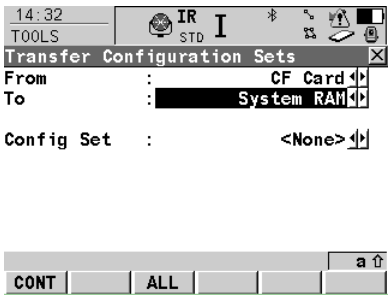


- **Select CONT [F1]**

The System 1200 sensor will return to the Main Menu once the Format File transfer is completed.

c)PC Card in the instrument – Transfer Configuration Sets:

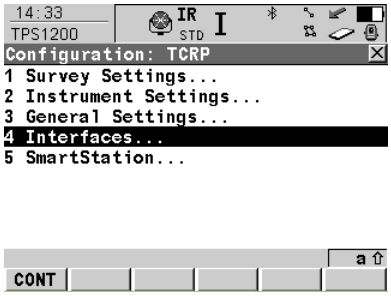
- **Select option 6 Tools… from the Main Menu**
- **Select option 2 Transfer Objects from the Tools Menu**
- **Select option 2 Configuration Sets from the Transfer Objects Menu**
- **Set up appropriately (TC, TCRP RCS etc.):**



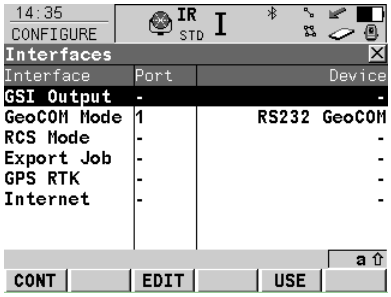
- **Select 'F3 – ALL'**

d)PC Card in the instrument – Configuration:

- **Select option 5 Configuration… from the Main Menu**
- **Select option 4 Interfaces from the Configuration: TC Menu**



- **Select GSI Output**



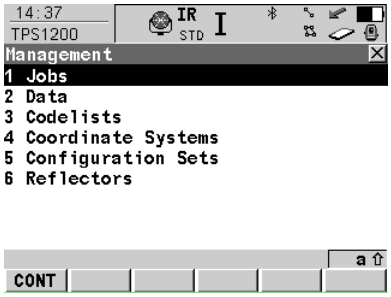
- **Select 'F1 – CONT'**

C. Setting up Survey

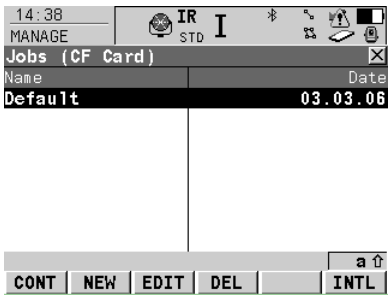
a)PC Card in the instrument – Management:

Select option 3 Management… from the Main Menu

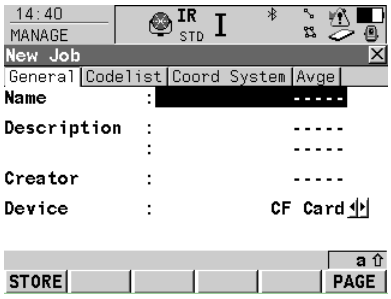
Select 1 Job from Management Menu



- **Select F2 New from Job (CF Card) Menu**

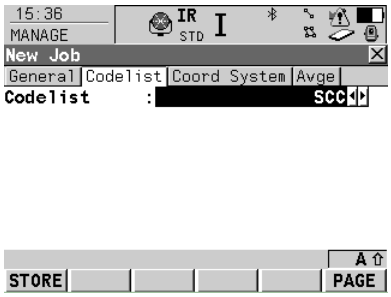


- **Within General Tab enter relevant details:**

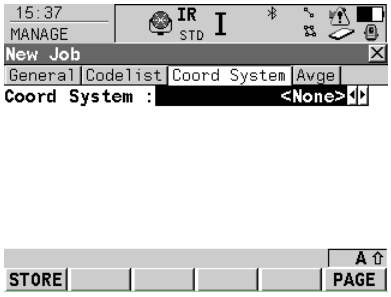


- **Tab to Codelist and ensure that the setting assigned in Step C d**

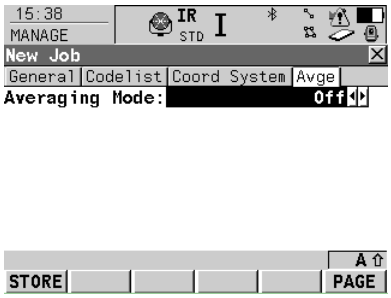
(Transfer Codelist) have been attained



- **Within Tab Coord System select None**



- **Within Avge Tab select Off**

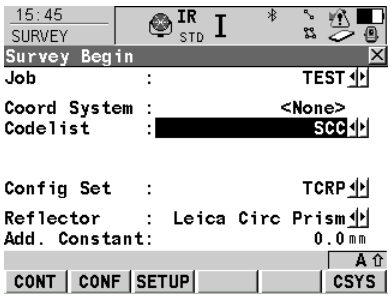


- **Select F1 Store**
- **Within Main Job Screen select F1 CONT with TEST highlighted**

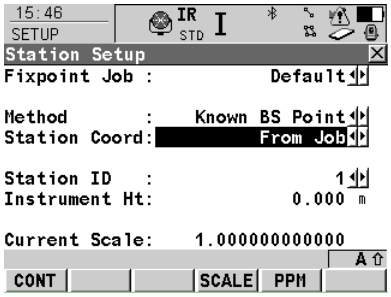
D. Setting up Stations within 1200 Series:

(Known Azimuth)

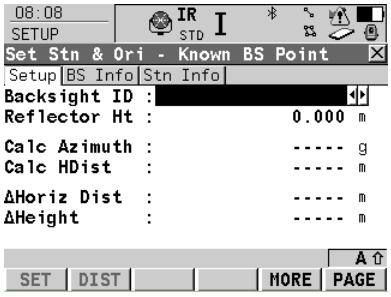
- **Select option 1 Survey… from the Main Menu**



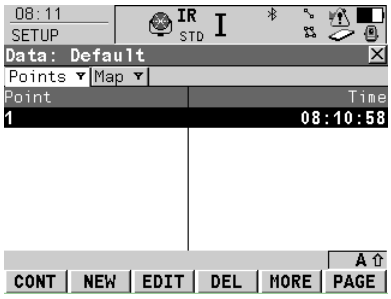
- **Set up the appropriate Reflector**
- **Set Method to Known BS**
- **Select Frm Fixpoint Job as Station Coord**



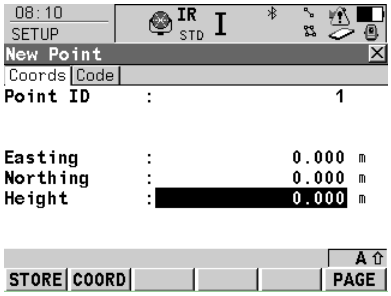
- **Select F1 CONT to access the Station Setup Panel**

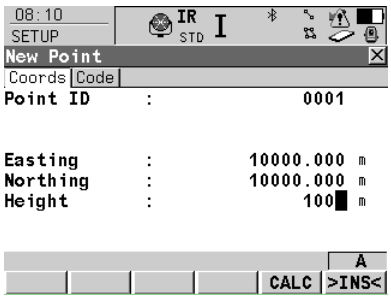


- **With Station ID highlighted select Enter (or Tap on Station ID focus)**

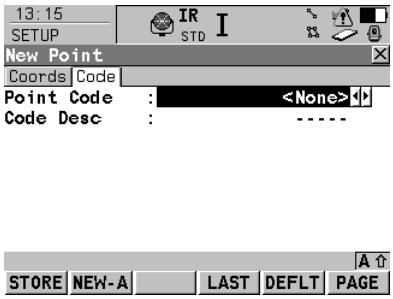


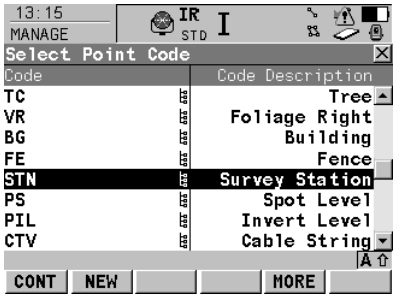
- **Select F2 NEW**
- **Enter Coords**

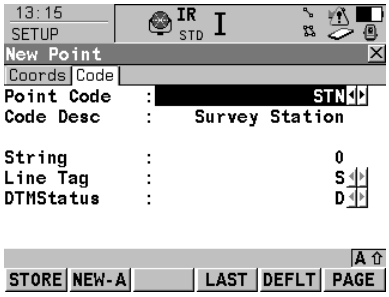




- **Within Code Tab**







- **Select F1 STORE**
- **Select F1 CONT twice to return to Select Station Dialog**
- **Select Station ID and enter Instrument Height**
- **Select F1 CONT**
- **Enter A Backsight ID and set Azmuith**

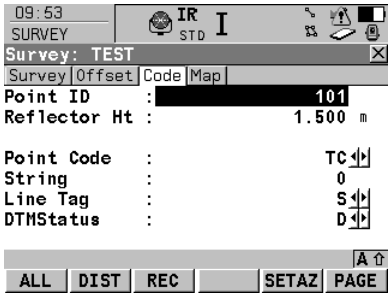
E. Surveying Detail with SCC Codelist:

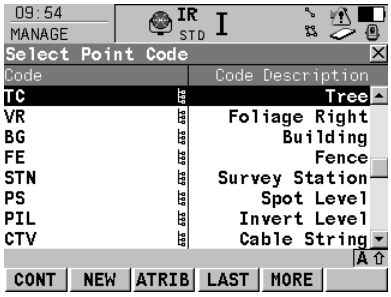
Leica TPS1200 Coding

- **After Station Set up select 1 Survey from Main Menu**
- **4 tabs are available**
- **For Example**

Go to Code tab:Enter Reflector Ht.

Assign Point Code either using arrows or double click to view Code and Code Description Dialog





- **Assign String, Line Tag and DTM Status appropriately**

Offsets are available from either the offset Tab or by within the Free Codes ‘F7’.

Extra Measurements have also been set up within the Free Codes ‘F7’.

F. SCC Settings for Leica coding using Leica TPS1200 Instruments

Open SCC and set up Project

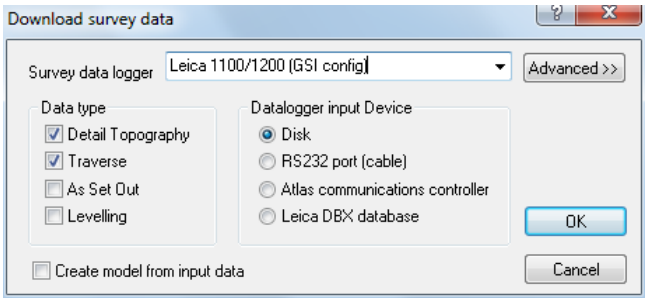
Select ‘FILE > Download Survey’

Select ‘Leica 1100/1200 (GSI Config)’ as Survey Data Logger

Select the required ‘Data Type’

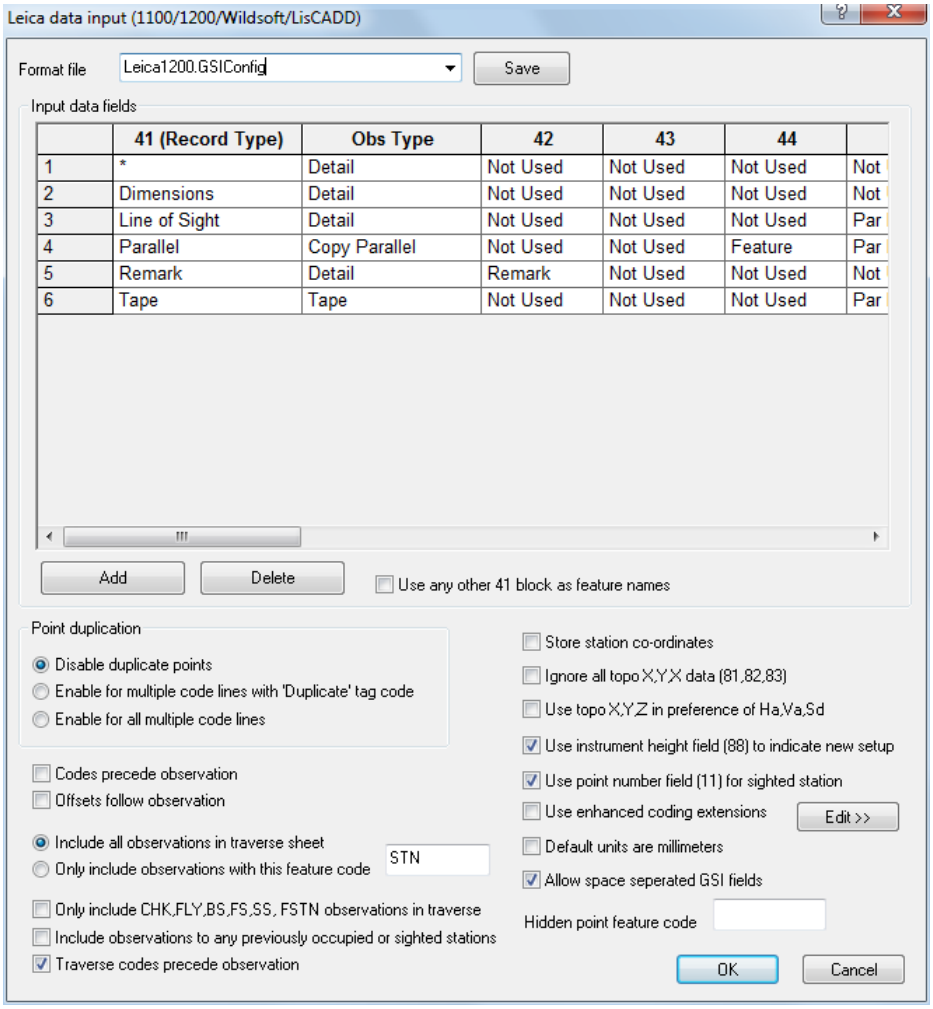
Select ‘Data logger input Device’

Select ‘OK’



Select ‘Leica1200.GSIConfig’ Format File

Set up additional settings as shown below:



Select 'OK'

Traverse Observation Feature Code

Traverse Observation Feature Code field should be filled with the user's individual code i.e. PSSA or STN etc.

If this is not filled in, no stations file will be produced.

Always include the decimal point when inputting any number so that SCC knows the units i.e. 12.0 or 0.25

G. Tag Codes

The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string. The tag codes may be entered either in numeric or alpha-numeric format.

See Also

Feature Library (View menu)

H. DTM Tag Code

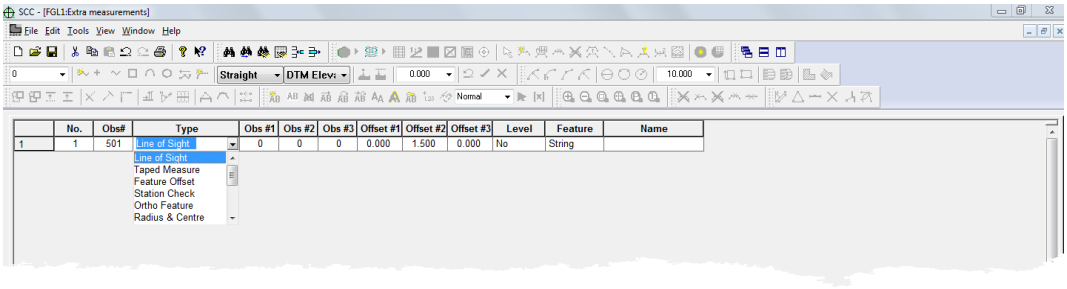
The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. The DTM codes may be entered either in numeric or alpha-numeric format

See Also

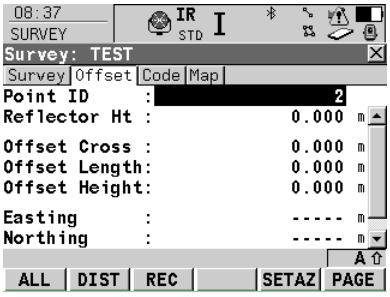
Feature Library (View menu)

I. Extra measurement fields

Extra user defined GSI fields may be used to collect extra measurement information corresponding to the SCC extra measurement sheet.



Several offsets are available as part of the main interface:

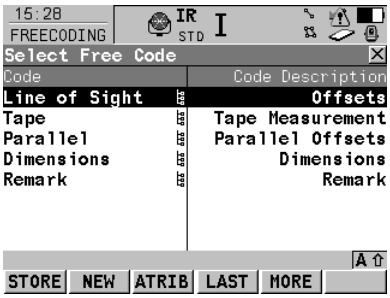


The Offsets are as follows:

Offset Cross:	Line Of Sight L/R (Radial Offset)
Offset Length:	Line Of Sight F/B (Lateral Offset)
Offset Height:	Elevation offset.

Additional Extra Measurements have been set up as part of the Free Codes (F7):

Free Code:

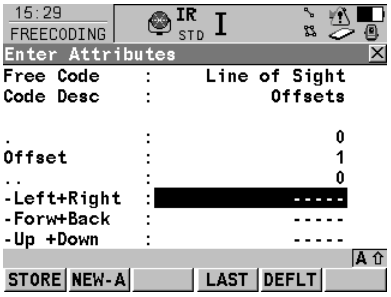


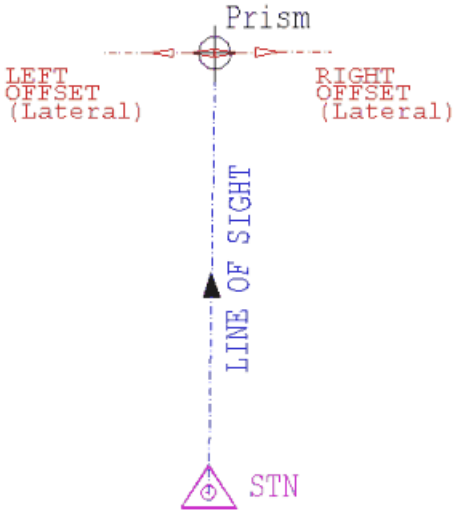
Line OF Sight

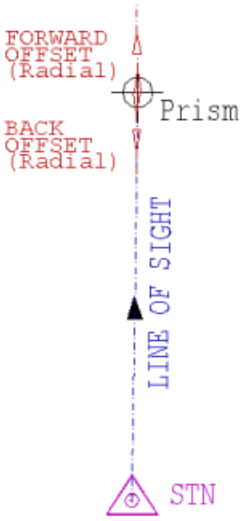
The **'-Left+Right'** offset corresponds to the distance left or right along the line of sight between the instrument and the target.

The **'–Forward+Back'** offset corresponds to the distance forward or back along the line of sight between the instrument and the target.

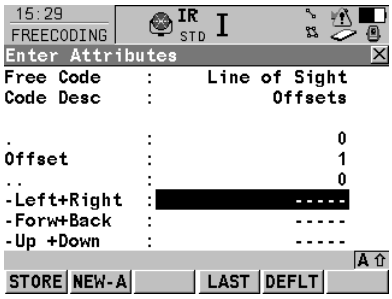
The **'–Up+Down'** offset corresponds to the elevation offset.





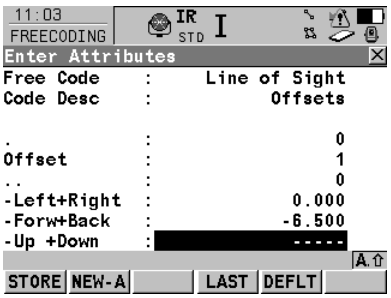


Point 101: **Line of Sight Offset to the left –3.500**



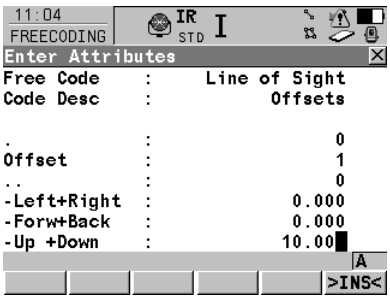
*110017+0000000000000**101** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410018+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 **45....+0000000000-3.500**
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 102: **Line of Sight Offset to the Forward -6.500**



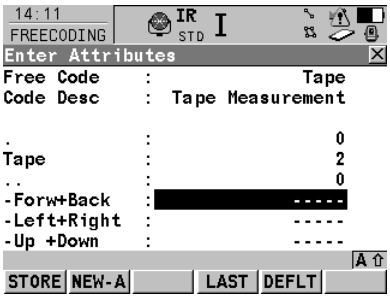
*110019+0000000000000**102** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410020+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 45....+000000000000.000
46....+0000000000-6.500 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 103: Line of Sight Offset to the Down +10.00



*110021+0000000000000**103** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410022+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 45....+000000000000.000
46....+000000000000.000 **47....+000000000010.000** 48....+0000000000000000
49....+0000000000000000

Tape

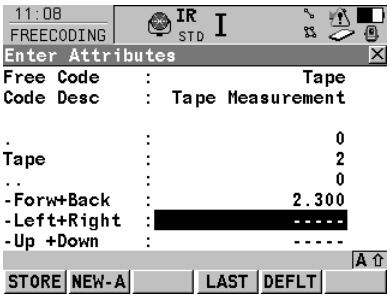


The**'–Forward+Back'** offset corresponds to the distance forward or back along the line (Baseline) connecting the last two survey points.

The **'-Left+Right'** offset corresponds to the distance left or right along the line (Baseline) connecting the last two survey points.

The **'–Up+Down'** offset corresponds to the elevation offset.

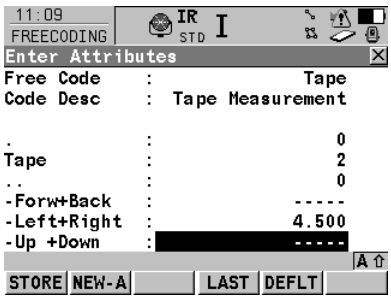
Point 201: Tape Offset to the Back +2.300



*110026+0000000000000**201** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500

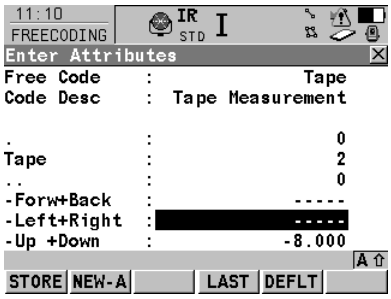
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410027+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 **45....+000000000002.300**
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 202: Tape Offset to the Right +4.500



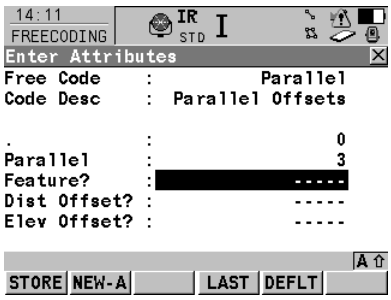
*110028+0000000000000**202** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410029+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 45....+0000000000000000
46....+000000000004.500 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 203: Tape Offset to the Up -8.000



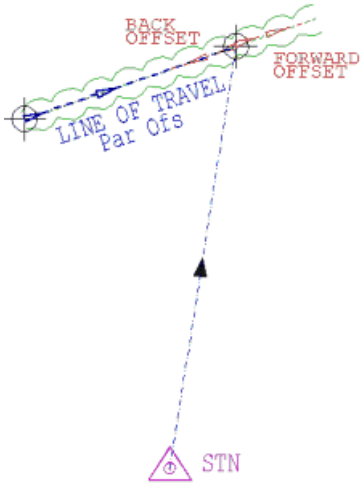
*110030+0000000000000**203** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410031+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 **47....+0000000000-8.000** 48....+0000000000000000
49....+0000000000000000

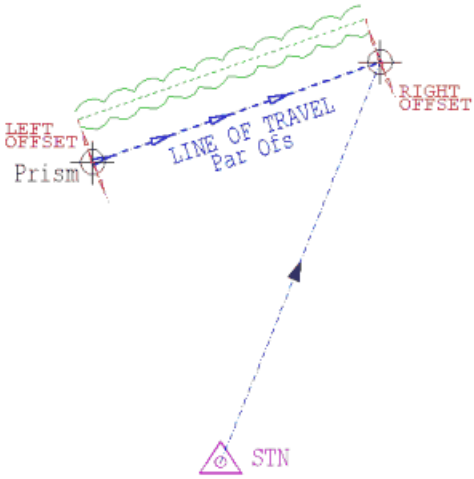
Parallel Offset



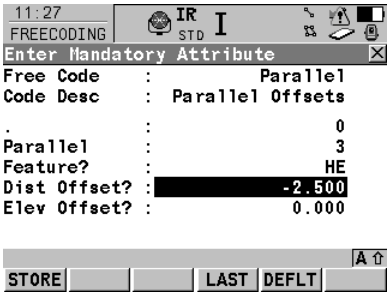
'**Dist Offset'** corresponds to the distance between the observed feature line and the generated feature line (Feature?).

'Elev Offset' corresponds to the elevation offset.



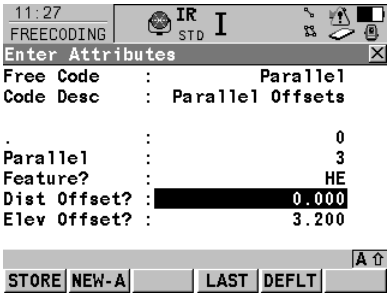


Point 302: Parallel Offset – Offsetting HE Left -2.500 from TB Feature



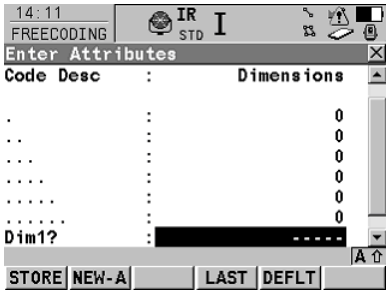
*110035+000000000000**302** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TB 72....+0000000000000056 73....+000000000000000S
74....+000000000000000D ***410036+00000000Parallel** 42....+0000000000000000
43....+0000000000000003 **44....+00000000000000HE 45....+0000000000-2.500**
46....+000000000000.000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

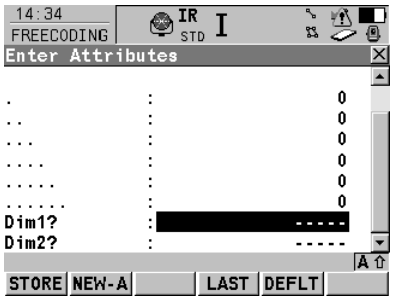
Point 302: Parallel Height Offset – Offsetting HE in Z +2.500 from TB Feature



*110037+000000000000**303** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TB 72....+0000000000000056 73....+000000000000000S
74....+000000000000000D ***410038+00000000Parallel** 42....+0000000000000000
43....+0000000000000003 **44....+00000000000000HE** 45....+000000000000.000
46....+000000000003.200 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

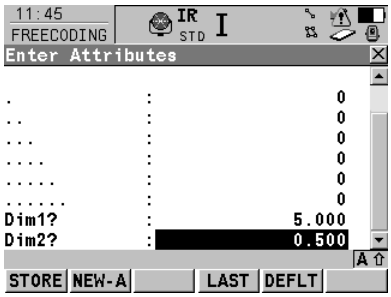
Dimension





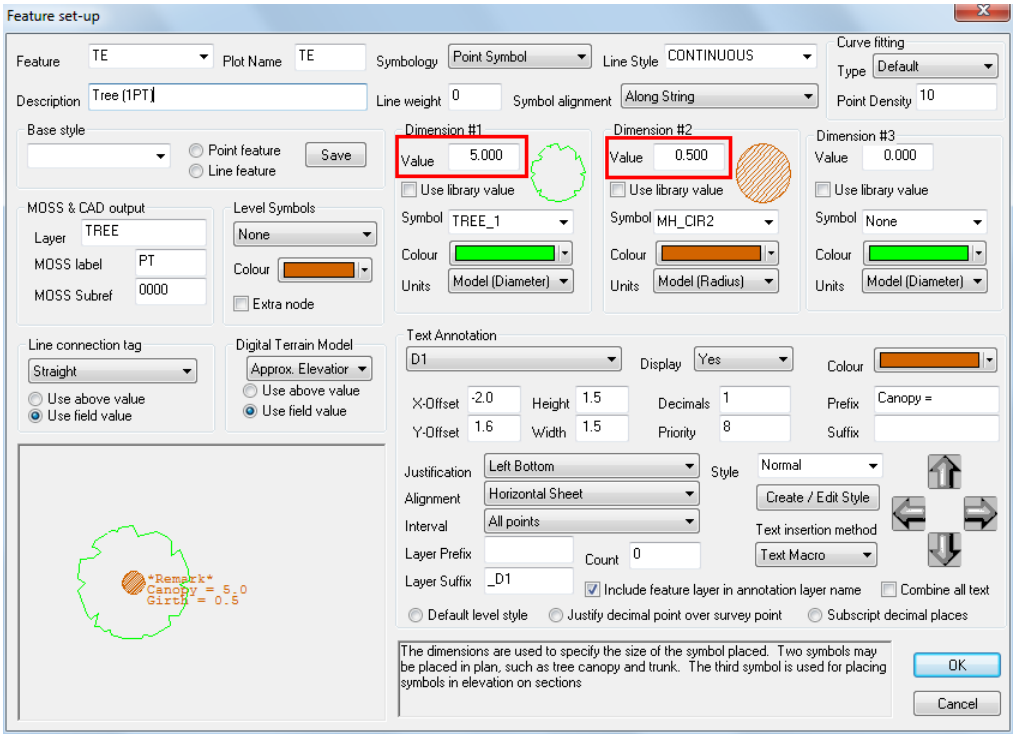
This option allows the user to manually input a Dimension 1 and Dimension 2 value.

Point 401: TC feature with assigned D1 of 5.0 and D2 of 0.500

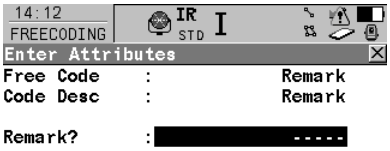


*110040+000000000000**401** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TC 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410041+000000Dimensions** 42....+0000000000000000
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 **48....+000000000005.000**
49....+000000000000.500

For example, Feature ‘Tree’ may have a Dimension 1 value denoting the Canopy size and also a Dimension 2 referring to Tree Trunk size.

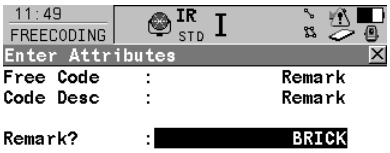


Remarks



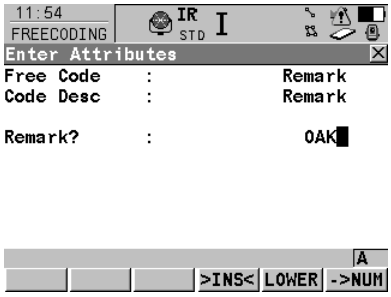
Additional annotation can be assigned to a specific point with ‘Remarks’.

Point 95: **WALL feature with assigned Remark ‘BRICK’**

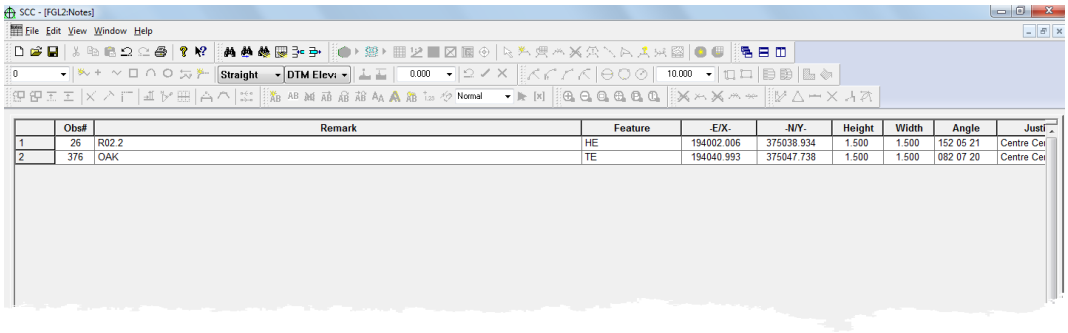


*110043+0000000000000**95** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+000000000000WALL 72....+0000000000000001 73....+000000000000000S
74....+000000000000000D ***410044+0000000000Remark 42....+00000000000BRICK**
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 376: **TC feature with assigned Remark ‘OAK’**



*110045+0000000000000**376** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TC 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410046+0000000000Remark 42....+0000000000000OAK**
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000



J. Traverse observation feature code (not specific to 1200)

An extra user defined feature code may be used to signify a control observation. This observation will be used as a reference observation in the instrument set-up sheet and as a traverse observation in the traverse sheet. This facilitates combined detail and traverse surveys using the GSI format. If this field is left blank, and tag codes are not being collected, all observations will be output to the traverse sheet. If this field is left blank and tag codes are being collected, observations with tag codes of FS, BS, and SS will be output to the traverse sheet.

K. Store Station co-ordinates (not specific to 1200)

Tick this field if you want to store station coordinates present in the input file, in fields 84 to 86, in the SCC project control file.

L. Codes precede observations (not specific to 1200)

This option controls whether a code block is associate with the preceding observation, or the following observation. For example, in the input below the code block precedes the data block

410006+000000KB 48....+0000000S 47....+0000000D 49....+00000002 110007+00000169
21.304+12359530 22.304+09515230 31...0+00003502

M. Use Topo X,Y,Z in preference to HA,Va,Sd (not specific to 1200)

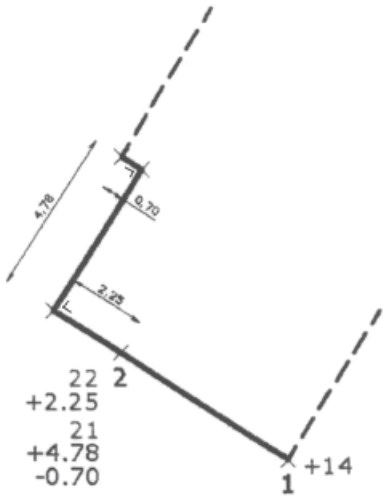
This option allows the computed X,Y,Z positions in the GSI input file to be stored in the SCC observation sheet rather than the Ha,Va,Sd values, where both occur in a single data line. This is useful if the GSI file does not include all of the survey observations, such as observed back-sights, as shown in the example below;

```
*110001+000000000000GR0A 84..10+0000000320728329
85..10+0000000376869559 86..10+0000000000099259
*110002+000000000000GR01 81..00+0000000320715339
82..00+0000000376754428 83..00+0000000000100000
```

```
*110003+000000000000GR0A 84..10+0000000320728329
85..10+0000000376869559 86..10+0000000000099259
87..10+0000000000001500 88..10+0000000000001602
79....+000000000000GR01
*110004+0000000000000066 21.324+0000000018626250
22.324+0000000008940550 31..00+0000000000115851
87..10+0000000000001500 71....+0000000000000000
72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 81..00+0000000320715334
82..00+0000000376754441 83..00+0000000000100005
*110005+0000000000000067 21.324+0000000015216010
22.324+0000000008744130 31..00+0000000000074790
87..10+0000000000001500 71....+000000000000OSC
72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 81..00+0000000320763106
 82..00+0000000376803412 83..00+0000000000102315
```

Case Study

Case 1: Tape Offset




```
*110015+000000000000001  21.324+0000000001732120  22.324+0000000008645360
31..00+0000000000030223  81..00+0000000000109092  82..00+0000000000128773
83..00+0000000000013208  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*110015+000000000000002  21.324+0000000001732120  22.324+0000000008645360
31..00+0000000000030223  81..00+0000000000109092  82..00+0000000000128773
83..00+0000000000013208  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*110016+000000000000003  21.324+0000000000927290  22.324+0000000008548510
31..00+0000000000030413  81..00+0000000000104984  82..00+0000000000129919
83..00+0000000000013720  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*410017+000000000000003  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000  45....+0000000000000000 46....+000000000002.250
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000

*410017+000000000000004  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000 45....+000000000004.760 46....  +000000000000000
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000

*410017+000000000000005  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000  45....+0000000000000000 46....-000000000000.700
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000
```

Tape Offset Pt. 3: Longitudinal Offset of +2.250

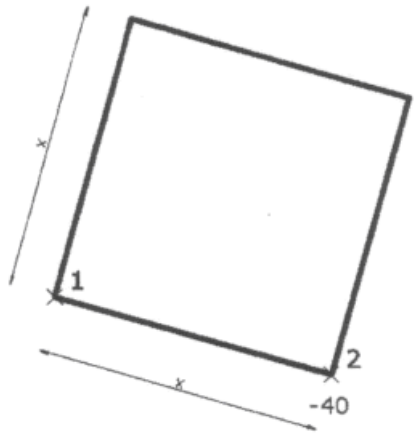
New Baseline is now Pt. 2- Pt. 3

Tape Offset Pt. 4: Lateral Offset of +4.760m (+Right)

Baseline now Pt. 3 – Pt. 4

Tape Offset Pt. 5: Lateral Offset of -0.700m (-Left)

Case 2: 2 Point Symbol OR 2 Point + Width

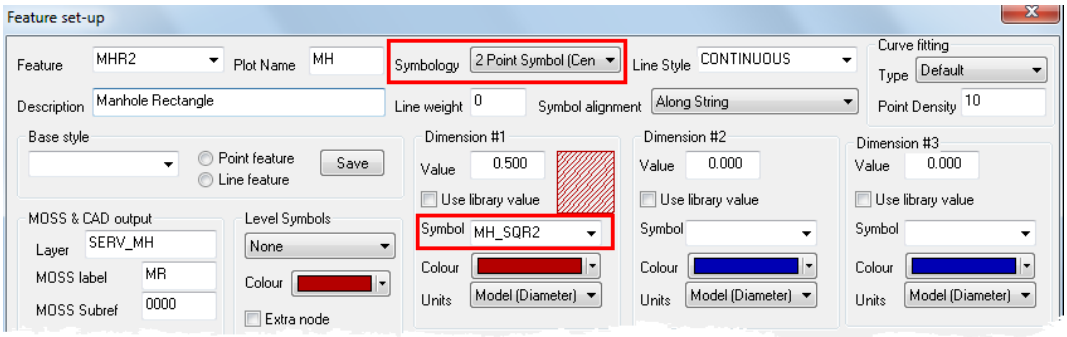


2 Point Symbol

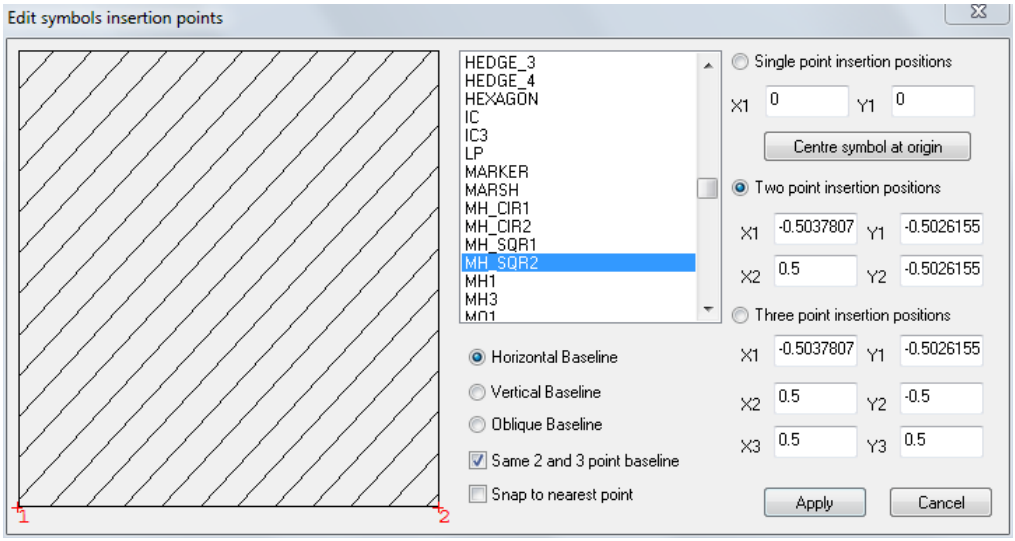
*110015+000000000000**01** 21.324+0000000001732120 22.324+0000000008645360
31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000030 73....+000000000000000S 74....+000000000000000D

*110016+000000000000**02** 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000030 73....+000000000000000S 74....+000000000000000D

Within the Project File assign '2Point Symbol (Side)' Symbology and select a Dimension 1 symbol which has side intersection points.

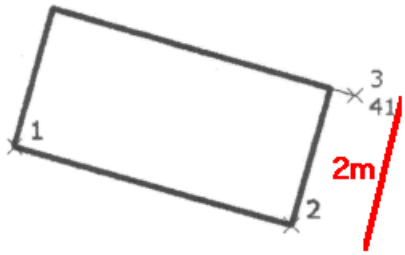


Within the Project select 'EDIT > Symbols > Edit symbols insert point'



Case 3: 2 Point + Width

Manhole / Utility Cover

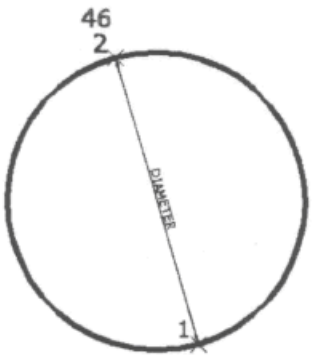


*110015+000000000000001 21.324+0000000001732120 22.324+0000000008645360
31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000020 **73....+0000000000000R2W** 74....+000000000000000D

*110016+000000000000002 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000020 **73....+0000000000000R2W** 74....+000000000000000D

***410041+000000Dimensions** 42....+0000000000000000 43....+0000000000000000
44....+0000000000000000 45....+0000000000000000 46....+0000000000000000
47....+0000000000000000 **48....+000000000002.000** 49....+0000000000000000

Case 4: 2 Point Circle



*110015+000000000000001 21.324+0000000001732120 22.324+0000000008645360

31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000BG
72....+0000000000000020 73....+00000000000000**C2** 74....+000000000000000D

*110016+000000000000002 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000BG
72....+0000000000000020 73....+00000000000000**C2** 74....+000000000000000D

3.2.3.3 Downloading Leica HexML Data

The SCC HexML interface to Leica Captivate includes supports for embedded photography within observation files and models. Model points that include embedded photos will be highlighted using an extra marker controlled by the ~OBSPIC feature. Observation photographs can be previewed and edited under the observation tag using the Query & edit functions. When exporting to AutoCAD DWG and DXF, embedded photographs are available as hyper-links attached to the survey point.

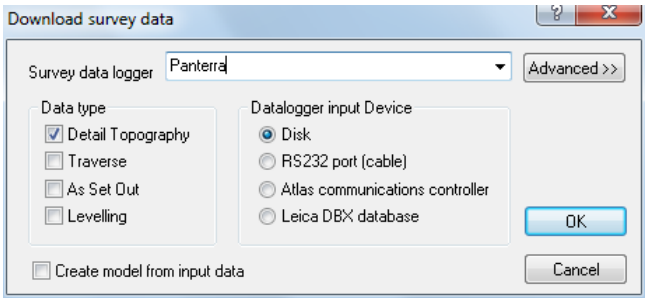
The SCC HexML interface supports advanced coding through both point codes and free codes, which can be used in conjunction with Captivate curve and arc codes. When using free codes with captivate, the free code should be entered after the observation.

3.2.3.4 Downloading Panterra Data

Downloading Panterra Husky Traverse File

Create Project

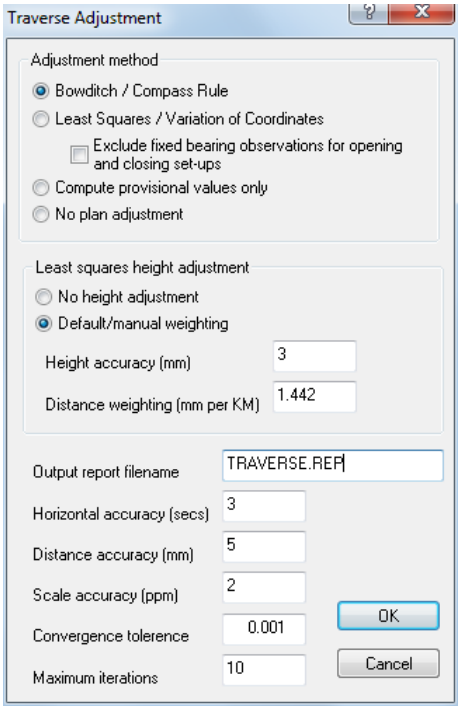
Select 'FILE > Download Survey' and complete the dialog presented as shown below.



Select the file 'Panterra.TRV' as the input file, and press 'Open' to download.

This will create a new traverse spreadsheet containing all the observations in the input file. We will adjust this traverse using a least squares adjustment, from the traverse observation sheet:

Select 'Edit > Adjust and complete the dialog as shown.



This will produce a report giving the full details of the adjustment.

3.2.3.5 Downloading Trimble Data

Trimble ACU Output

SCC support downloading files from the Trimble ACU, running Tsce software, using the SDR33 output format. These attributes can be used to describe dimensions, offsets, parallel features, and all other items available through the SCC extended coding library. We will demonstrate the use of this facility through the sample file 060228D.DAT. Note that in this file, Tsce attributes are stored in 13AT records, see extract below for an example;

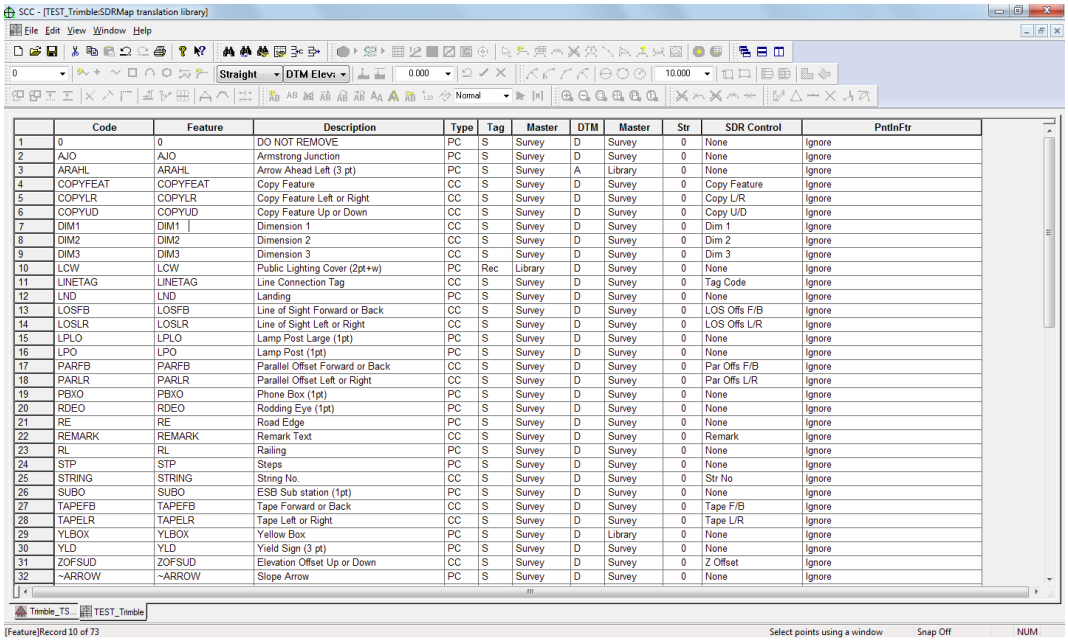
```
2NM        9020    308417.642000000231995.58500000051.33300000000001.50000000000000

07NM        9020            9021    27.900185437685727.9001854376857
03NM1.70000000000000
09F1        9020            9021    12.874430000000088.109739263113027.9001854376857STN

09F1        9020            1001    18.593340000000088.669171829746923.1694290000000BG

13ATOffset              0.30000000000000
09F1        9020            1002    17.165240000000088.759832243491514.1117367500000BG
```

To process this file in SCC, do the following;

Create a new project, based on a standard template

Select Import / View SDR translation table

Add a record for each attribute type present in the Tsce format being used. For example, for the OFFSET attribute, we add a new record with the name and code of OFFSET, type of 'Control Code with Parameter (CCP)', and SDR Control type of 'Par Ofs L/R'. This means that when SCC encounters an attribute called OFFSET, it will take the attribute value and store it in the parallel offset field in SCC. For this job, the rest of the records will be as follows;



	Code	Feature	Description	Type	Tag	Master	DTM	Master	Str	SDR Control	PntInFtr
1	0	0	DO NOT REMOVE	PC	S	Survey	D	Survey	0	None	Ignore
2	AJO	AJO	Armstrong Junction	PC	S	Survey	D	Survey	0	None	Ignore
3	ARAHL	ARAHL	Arrow Ahead Left (3 pt)	PC	S	Survey	A	Library	0	None	Ignore
4	COPYFEAT	COPYFEAT	Copy Feature	CC	S	Survey	D	Survey	0	Copy Feature	Ignore
5	COPYLR	COPYLR	Copy Feature Left or Right	CC	S	Survey	D	Survey	0	Copy L/R	Ignore
6	COPYUD	COPYUD	Copy Feature Up or Down	CC	S	Survey	D	Survey	0	Copy U/D	Ignore
7	DIM1	DIM1	Dimension 1	CC	S	Survey	D	Survey	0	Dim 1	Ignore
8	DIM2	DIM2	Dimension 2	CC	S	Survey	D	Survey	0	Dim 2	Ignore
9	DIM3	DIM3	Dimension 3	CC	S	Survey	D	Survey	0	Dim 3	Ignore
10	LCW	LCW	Public Lighting Cover (2pt+w)	PC	Rec	Library	D	Survey	0	None	Ignore
11	LINETAG	LINETAG	Line Connection Tag	CC	S	Survey	D	Survey	0	Tag Code	Ignore
12	LND	LND	Landing	PC	S	Survey	D	Survey	0	None	Ignore
13	LOSFB	LOSFB	Line of Sight Forward or Back	CC	S	Survey	D	Survey	0	LOS Offs F/B	Ignore
14	LOSLR	LOSLR	Line of Sight Left or Right	CC	S	Survey	D	Survey	0	LOS Offs L/R	Ignore
15	LPLO	LPLO	Lamp Post Large (1pt)	PC	S	Survey	D	Survey	0	None	Ignore
16	LPO	LPO	Lamp Post (1pt)	PC	S	Survey	D	Survey	0	None	Ignore
17	PARFB	PARFB	Parallel Offset Forward or Back	CC	S	Survey	D	Survey	0	Par Offs F/B	Ignore
18	PARLR	PARLR	Parallel Offset Left or Right	CC	S	Survey	D	Survey	0	Par Offs L/R	Ignore
19	PBXO	PBXO	Phone Box (1pt)	PC	S	Survey	D	Survey	0	None	Ignore
20	RDEO	RDEO	Rodding Eye (1pt)	PC	S	Survey	D	Survey	0	None	Ignore
21	RE	RE	Road Edge	PC	S	Survey	D	Survey	0	None	Ignore
22	REMARK	REMARK	Remark Text	CC	S	Survey	D	Survey	0	Remark	Ignore
23	RL	RL	Railing	PC	S	Survey	D	Survey	0	None	Ignore
24	STP	STP	Steps	PC	S	Survey	D	Survey	0	None	Ignore
25	STRING	STRING	String No.	CC	S	Survey	D	Survey	0	Str No	Ignore
26	SUBO	SUBO	ESB Sub station (1pt)	PC	S	Survey	D	Survey	0	None	Ignore
27	TAPEFB	TAPEFB	Tape Forward or Back	CC	S	Survey	D	Survey	0	Tape F/B	Ignore
28	TAPELR	TAPELR	Tape Left or Right	CC	S	Survey	D	Survey	0	Tape L/R	Ignore
29	YLBOX	YLBOX	Yellow Box	PC	S	Survey	D	Library	0	None	Ignore
30	YLD	YLD	Yield Sign (3 pt)	PC	S	Survey	D	Survey	0	None	Ignore
31	ZOFSUD	ZOFSUD	Elevation Offset Up or Down	CC	S	Survey	D	Survey	0	Z Offset	Ignore
32	~ARROW	~ARROW	Slope Arrow	PC	S	Survey	D	Survey	0	None	Ignore

Note that regular features that contain embedded string numbers should also appear in this sheet with a type of 'PC' and a PntInFtr setting of 'String'. This sheet can also be used to control default tag and DTM codes for these features.

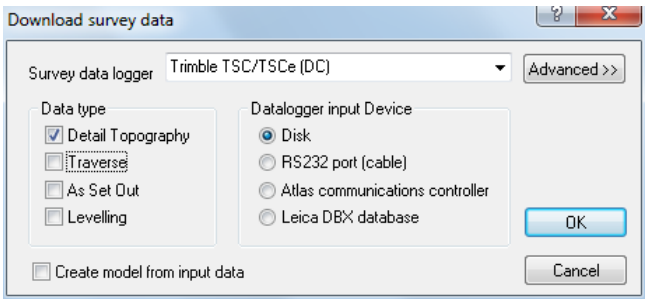
Once you have completed editing this translation table, you should save the project as a new template in the SCC folder, such that you do not have to repeat this exercise.

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Trimble TSC/TSCe (DC)'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'

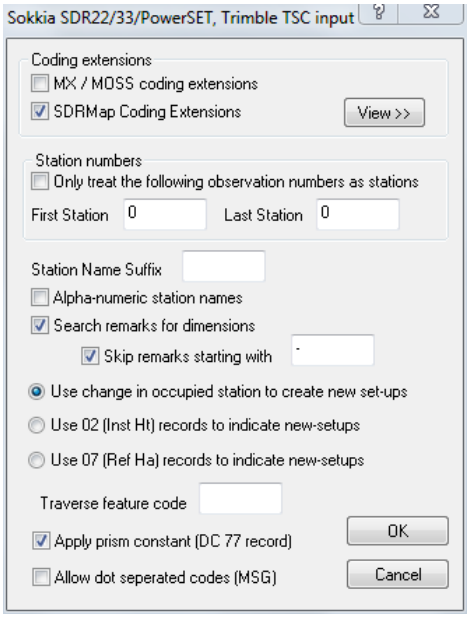


Select 'OK'

Select '060228D.Dat' from '\SCC\Tutorials' directory

Select 'Open'

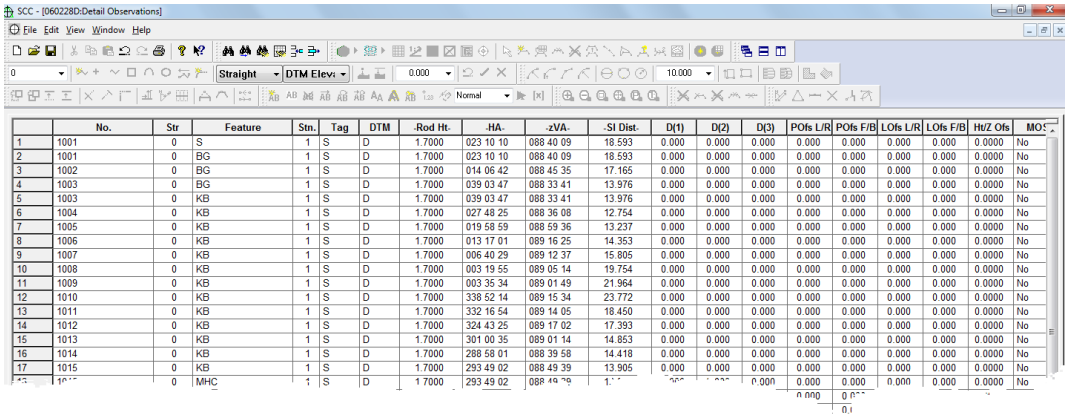
Select 'OK'



Set 'SDRMap Coding Extensions' and 'Search remarks for dimensions'

Select 'OK'

This will generate the following detail survey file;



	No.	Str	Feature	Stn.	Tag	DTM	-Rod Ht-	-HA-	-zVA-	-SI Dist-	D(1)	D(2)	D(3)	POfs L/R	POfs F/B	LOfs L/R	LOfs F/B	Ht/Z Ofs	MOS
1	1001	0	S	1	S	D	1.7000	023 10 10	088 40 09	18.593	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
2	1001	0	BG	1	S	D	1.7000	023 10 10	088 40 09	18.593	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
3	1002	0	BG	1	S	D	1.7000	014 06 42	088 45 35	17.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
4	1003	0	BG	1	S	D	1.7000	039 03 47	088 33 41	13.976	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
5	1003	0	KB	1	S	D	1.7000	039 03 47	088 33 41	13.976	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
6	1004	0	KB	1	S	D	1.7000	027 48 25	088 36 08	12.754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
7	1005	0	KB	1	S	D	1.7000	019 58 59	088 59 36	13.237	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
8	1006	0	KB	1	S	D	1.7000	013 17 01	089 16 25	14.353	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
9	1007	0	KB	1	S	D	1.7000	006 40 29	089 12 37	15.805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
10	1008	0	KB	1	S	D	1.7000	003 19 55	089 05 14	19.754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
11	1009	0	KB	1	S	D	1.7000	003 35 34	089 01 49	21.964	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
12	1010	0	KB	1	S	D	1.7000	338 52 14	089 15 34	23.772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
13	1011	0	KB	1	S	D	1.7000	332 16 54	089 14 05	18.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
14	1012	0	KB	1	S	D	1.7000	324 43 25	089 17 02	17.393	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
15	1013	0	KB	1	S	D	1.7000	301 00 35	089 01 14	14.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
16	1014	0	KB	1	S	D	1.7000	288 58 01	088 39 58	14.418	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
17	1015	0	KB	1	S	D	1.7000	293 49 02	088 49 39	13.905	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
		0	MHC	1	S	D	1.7000	293 49 02	088 49 39					0.000	0.000	0.000	0.000	0.0000	No

*.DC files from TSCE containing observations in DC formats as defined in DC10.70 or DC7.5 are also supported. Observations must be in HA,Va,Sd or X,Y,Z formats. SCC does not currently read GPS vectors, or GPS lat,long, height records from this format.

Combined Total Station & GPS Files Trimble Data

SCC supports the download of combined Total Station and GPS information contained within one complete file.

Total Station Detail

```
08PD        1853    240109.491174308230536.45323307880.5785407722807CONC2
08PD        1854    240106.941616718230533.14415286880.4446191824330CONC2
08PD        1855    240106.934895243230533.12155861780.4350418868451K2
08PD        1856    240103.591644851230535.66377808680.3671757765827K2
08PD        1857    240102.973759388230536.67287284980.3818527249702K2
08PD        1858    240102.946912372230537.66137346080.3672869395576K2
08PD        1859    240108.024260067230544.61543070080.4062528838890K2
```

GPS Data

```
09F1        S4              1871    19.485780000000086.2995339500897308.269300500000SL
```

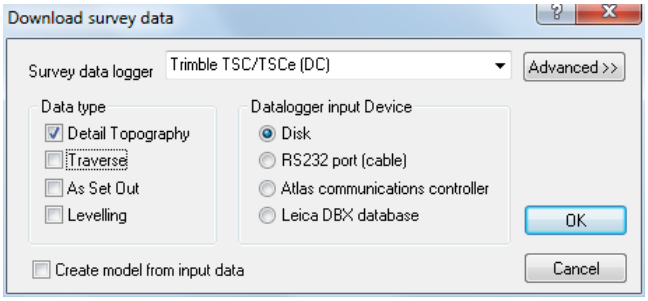
```
09F1        S4              1872    20.122220000000086.2101823251036306.161937000000HE3

13NMOFFSET HE3 2.0M LEFT
09F1        S4              1873    26.350400000000086.0417014778084314.111125500000HE3

09F1        S4              1874    36.881090000000086.4799984710826316.234896000000HE3

09F1        S4              1875    45.070550000000086.8506673231004318.345708000000HE3

09F1        S4              1876    56.991010000000087.4670758972154318.269134018868HE3

09F1        S4              1877    58.376750000000087.5556657440944316.922418000000EP

09F1        S4              1878    60.863180000000087.5235304357424318.604251600000B10

09F1        S4              1879    60.548220000000087.5381532946088326.509790400000B10
```

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'

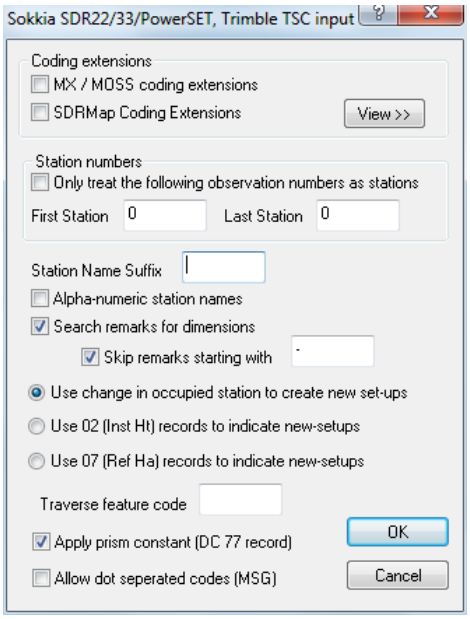


Select 'OK'

Select 'RAWsdr33dc.dc' from '\SCC\Tutorials' directory

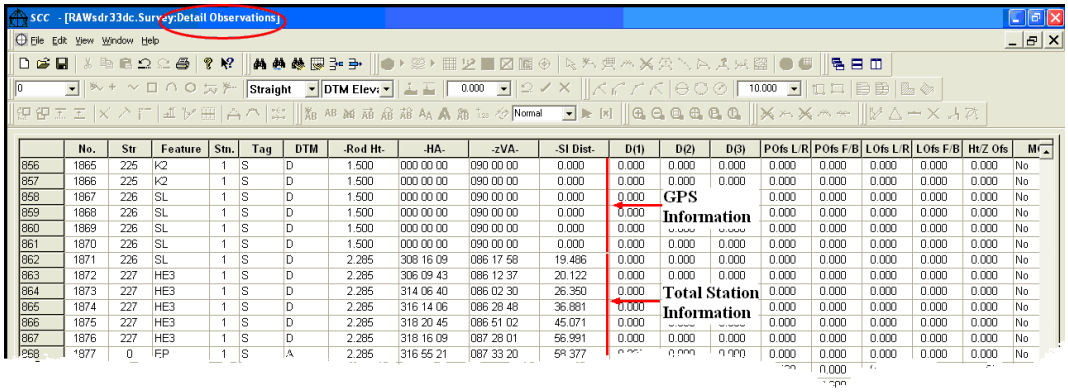
Select 'Open'

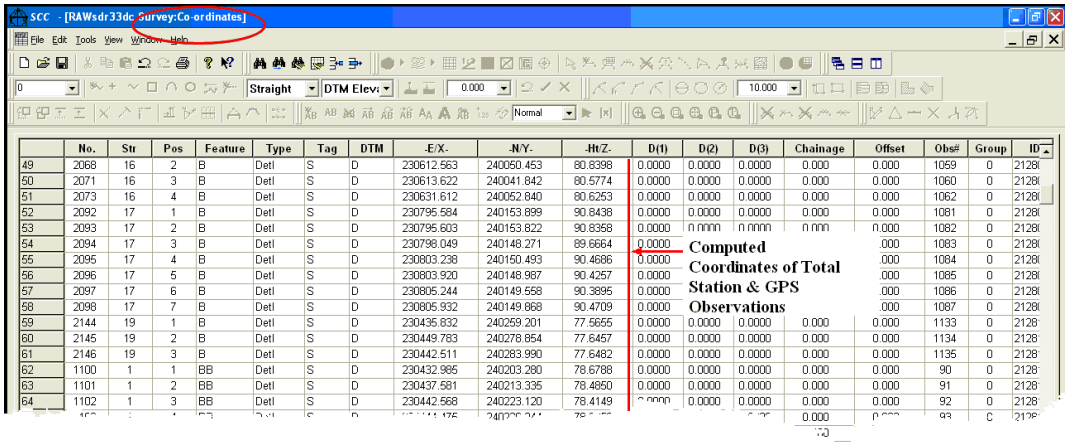
Select 'OK'



Set 'Search remarks for dimensions'

Select 'OK'





Note that the option to strip string numbers from field codes has bee selected with the 'Coordinate Reduction Options'.

Trimble DC Format

SCC also supports the direct download of DC format as follows:

```
D2NM1021.70000000000                0.14200000000000
        69FD        S22     137412.769000000253513.23000000046.1450000000000CON
   11
        E0NM        S22     1.620000000000001.000000000000001
        E1NM        S22             S21                     190.187083794199

         77NM1.500000000000002.000000000000000.00000000000000
        D9F1        S22             S21
91.250749347157591.8136377610403190.187083794199CON
50.003182501540000.001388888888890.00138888888889
        A6F1                -0.00090101528280.00846784874555
        D9F1        S22             1
90.790027562819091.9271004383258190.244880000000S
10.010181580100000.001388888888890.00138888888889
        D9F1        S22             2
90.795487574480291.9263806245318190.249560000000S
10.010181591020000.001388888888890.00138888888889
         77NM2.000000000000002.000000000000000.00000000000000
         10.010192322360000.001388888888890.00138888888889
        D9F1        S22             8001
86.761130395951992.3277570859462213.880050000000HEC1
10.010173522320000.001388888888890.00138888888889
        D9F1        S22             8002
77.753634782899292.0915956056461219.797010000000HEC1
10.010155507320000.001388888888890.00138888888889
         77NM1.500000000000002.000000000000000.00000000000000
        D9F1        S22             8003
73.815260826027192.3056179106150224.597520000000HEC1
10.010147630580000.001388888888890.00138888888889
        D9F1        S22             8004
```

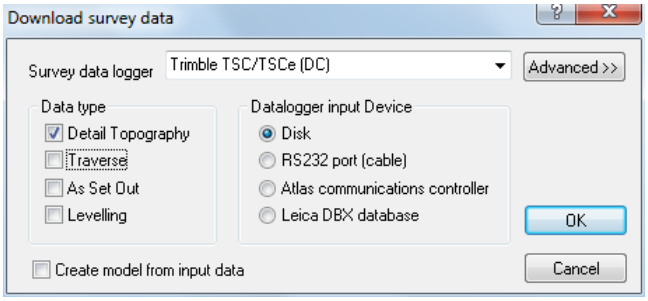
```
68.620739011095391.8354586405055234.321300000000HEC1
10.010137241520000.001388888888890.00138888888889
        D9F1        S22             8005
64.289547497628291.1620741098151249.494310000000HEC1
 10.010128579120000.001388888888890.00138888888889
```

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'

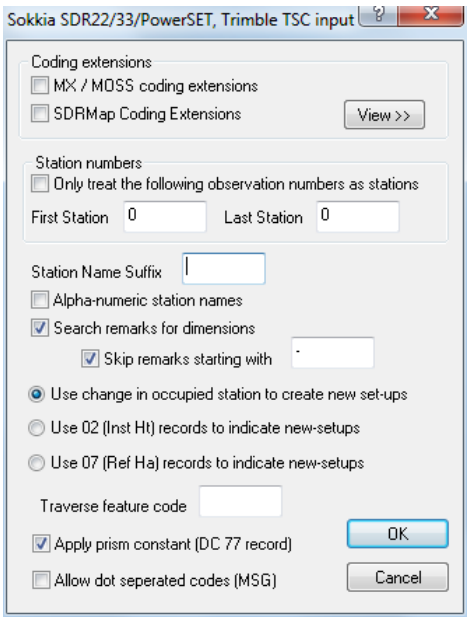


Select 'OK'

Select File

Select 'Open'

Select 'OK'



Set 'Search remarks for dimensions'

Select 'OK'

Trimble/Geodimeter UDS

SCC supports Trimble/Geodimeter format and can be processed as follows:

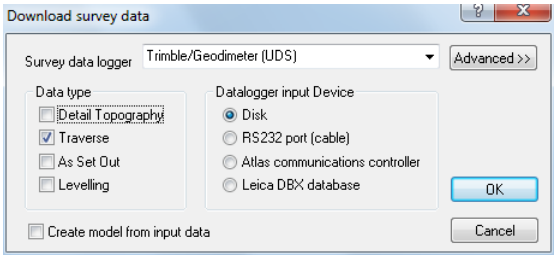
From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data Logger to 'Trimble/Geodimeter UDS'

Highlight ‘Traverse’ or ‘Detail Topography’ as the Data Type

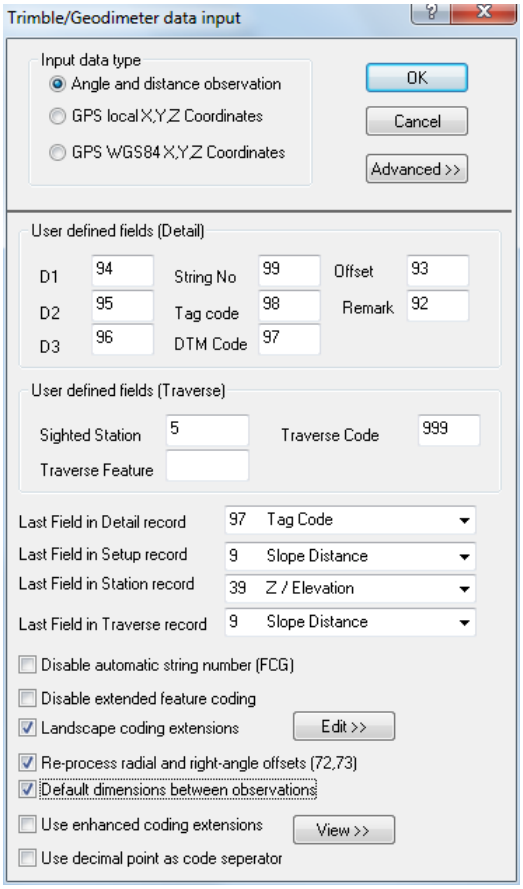
Set Input Device to 'Dsk', 'RS323 port (cable) 'or 'Atlas communications controller' as required

Select ‘OK’



Select the file you require and ‘OK’

Additional settings may be checked at this stage that relate to the field coding standards used that are particular to a given instrument. Note that these settings will become the defaults for all future downloads from the Geodimeter and do not have to be entered with each download.



Codes 90 through to 99 in the Geodimeter are user definable and may be used log extra dimensions in SCC. For existing ‘Landscape’ users, the first time we download into SCC, we will also have to set up the coding options as shown above. The LandScape coding options determine how the numeric field codes entered in the instrument will be translated into SCC tag codes, DTM codes, and ancillary measurements based on existing ‘ Landscape’ techniques.

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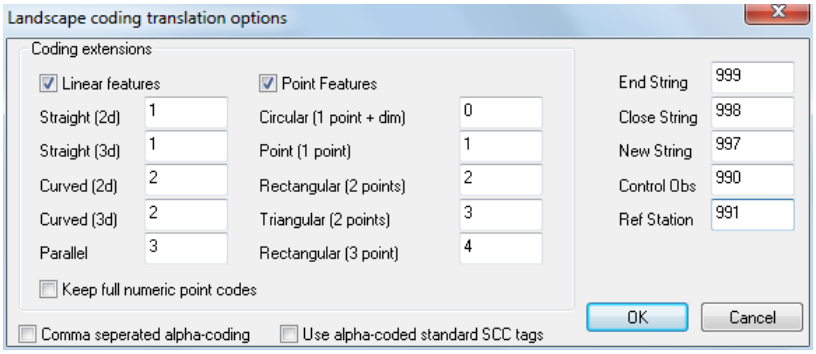


SCC lets us freely mix data from a range of different instrument manufacturers and instrument types within a given project. The LandScape processing options are currently enabled for the Geodimeter and Leica instruments.

Transferring survey data from a Geodimeter CU

Connect the Geodimeter instrument/keyboard to the PC with the appropriate cable and through the correct communications port. Enter program 54, for data transfer.

Choose from which device the data will be transferred from Internal memory (2. Imem) or Serial (3. Serial). Select internal memory (2. Imem).

Select the file type for transfer from 1. Job (file), 2. Area (file), 3. U.D.S. Choose option number 1 - Job file, and type in the job file number in which the observed data is stored.

Choose destination device for the job file from 2. Imem (internal memory) and 3. Serial (serial device - PC). Select 3 - Serial and accept or enter the correct serial parameters, which are Com=1.8.0.9600. Prepare SCC(PC) before accepting the serial parameters because once the serial parameters have been accepted then the data will be transferred.

The display on the Geodimeter/keyboard shows 'Wait' during the data transfer. When the data transfer is finished the Geodimeter/keyboard will exit from program 54 and return to program 0.

Transferring Setting Out and Control data to a Geodimeter CU

Connect the Geodimeter instrument/keyboard to the PC with the appropriate cable and through the correct communications port. Enter program 54, for data transfer.

Choose from which device the data will be transferred from Internal memory (2. Imem) or Serial (3. Serial). Select Serial (3. Serial) and accept or enter correct serial parameters, which are Com=1.8.0.9600

Select file type for the data to be saved as from 1. Job (file), 2. Area (file), 3. U.D.S. Choose option number 2 - Area file, and type in the area file number in which the data is to be stored.

The display on the Geodimeter/keyboard shows "Wait" and is now ready to receive data. Start the data transfer from SCC. When the data has been transferred the Geodimeter/keyboard will exit from program 54 and return to program 0.

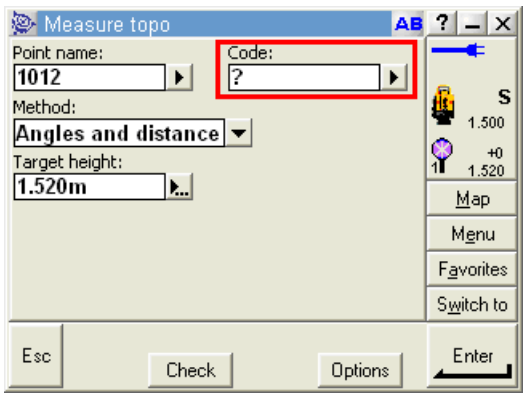
Downloading Trimble DC With Specific Attributes

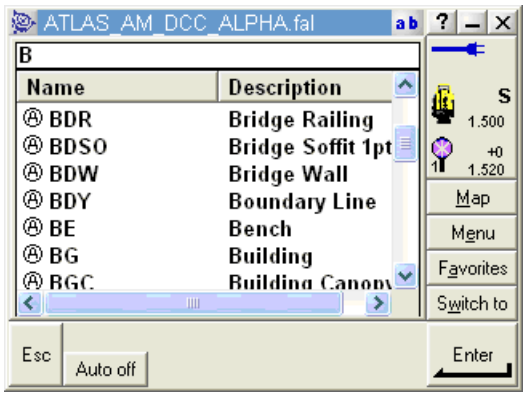
SCC support downloading files from the Trimble ACU/TCU/TSC2/TSCe, running Tsce software, using the SDR33 output format. These attributes can be used to describe dimensions, offsets, parallel features, and all other items available through the SCC extended coding library. Such attributes have been set up within the feature file 'ATLAS_AM_DCC_ALPHA.fal' and should be used in conjunction 'Trimble_TSCE_ALPHA.Project' feature library in which all features coincide.

Examination of Feature File and Raw Data

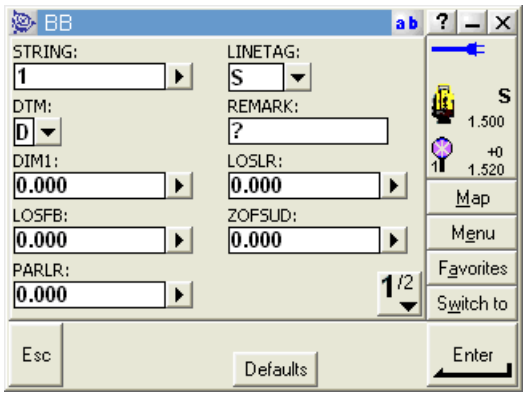
The following screenshots have been captured from Survey Pro to demonstrate the attributes set up in 'ATLAS_AM_DCC_ALPHA.fal'. Three common survey field codes have been examined 'BB' Bottom of Bank, 'SO' Spot Height and 'TO' Tree. In turn, extracts from raw survey data are displayed. Note that, Tsce attributes are stored in 13AT records.

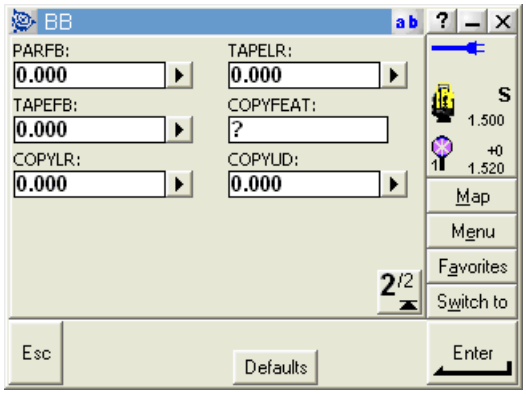
The drop down code list can be accessed within the main 'Measure Top' screen





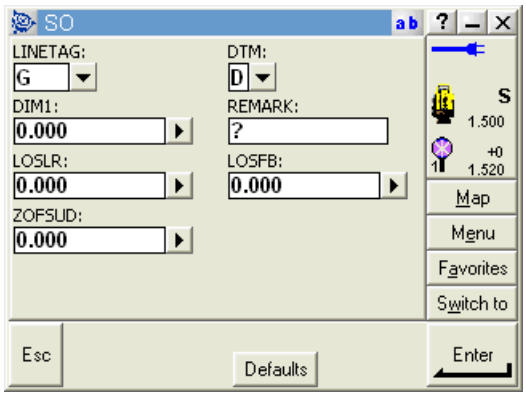
'BB' Bottom Of Bank String Feature and Attributes:





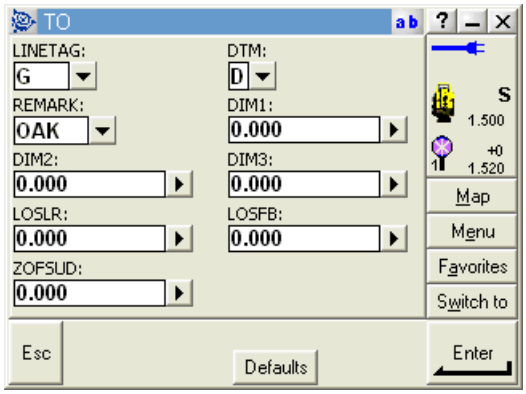

```
09F10003100034.698000090.7002777159.380833BB
13ATSTRING                1.00000000000000
13ATLINETAG               S
13ATDTM                   A

13ATREMARK
13ATDIM1                  0.00000000000000
13ATLOSLR                 0.00000000000000
13ATLOSFB                 0.00000000000000
13ATZOFSUD                0.00000000000000

13ATPARLR                 0.00000000000000
13ATPARFB                 0.00000000000000
13ATTAPELR                0.00000000000000
13ATTAPEFB                0.00000000000000
13ATCOPYFEAT
13ATCOPYLR                0.00000000000000
13ATCOPYUD                0.00000000000000
```

'SO' Spot Height Point Feature and Attributes:




```
09F10450106819.867000090.5027777255.889444SO
13ATLINETAG               G
13ATDTM                   E
13ATDIM1                  0.00000000000000
13ATREMARK
13ATLOSLR                 0.00000000000000
13ATLOSFB                 0.00000000000000
13ATZOFSUD                0.00000000000000
```

TO' Tree Point Feature and Attributes:

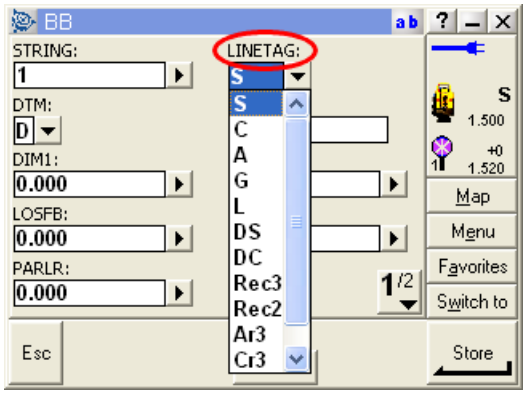



```
09F10450106738.205000090.0836111263.203611TO
13ATLINETAG                G
13ATDTM                    A
13ATREMARK                 OAK

13ATDIM1                   10.0000000000000
13ATDIM2                   0.75000000000000
13ATDIM3                   1.00000000000000
13ATLOSLR                  0.00000000000000
13ATLOSFB                  0.00000000000000
13ATZOFSUD                 0.00000000000000
```

Note:

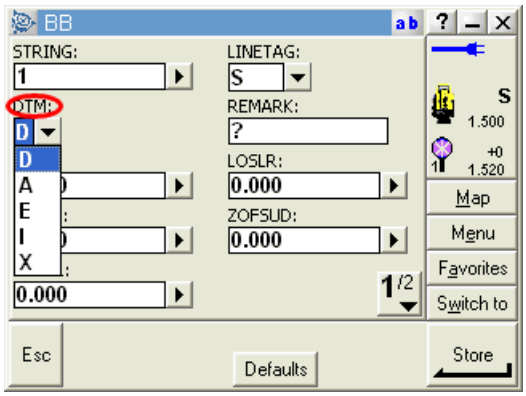
Many attributes contain drop down menus. For instance, several line connection tags (tabulated below) which determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string are included as a drop down menu.

Alpha Code	Description
S	Straight
C	Curve
A	Arc
G	Gap
L	Link Back To First Point on the String
DC	Discontinuous Curve (Non-Tangential Incoming Tangent from Straight to Curve)
DS	Discontinuous Straight (Non-Tangential Outcoming Tangent from Straight to Curve)
Ar3	Three Point Arc
Cr3	Three Point Circle
Cr2	Two Point Circle
C1R	Radius and Centre Circle
Rec3	Three Point Rectangle
Rec2	Two Point and Width Rectangle



In the same manner, common DTM (Digital Terrain Model) status code which determines the significance of the point of the surface model / digital terrain model are set up (tabulated below). As such DTM controls whether the point is 2D or 3D, whether it should be used in surface model generation and subsequent contouring and other surface analysis, and whether it lies on a string forming the model boundary.

Alpha Code	Description
D	DTM Elevation
A	Approximate Elevation (2D Point)
E	Non DTM Elevation
I	Ignore
X	DTM Elevation with text turned off on download



Processing & Download Steps:

To process a file in SCC, do the following;

Create a new project, based on 'DublinCityCouncil_Feb07_A_ALPHA.Project'

Select Import / View SDR translation table

A record for each attribute type present in the Tsce format being used. For example, for the LINETAG attribute, we add a new record with the name and code of LINETAG, type of 'Control Code with Parameter (CCP)', and SDR Control type of 'Tag Code'. This means that when SCC encounters an attribute called LINETAG, it will take the attribute value and store it in the parallel offset field in SCC. When using the feature file 'ATLAS_AM_DCC_ALPHA.fal' on the instrument, the following records should be set up;

	Code	Feature	Description	Type	Tag	Master	DTM	Master	Str	SDR Control	PntInFtr
1	COPYFEAT	COPYFEAT	Copy Feature	CC	S	Survey	D	Survey	0	Copy Feature	Ignore
2	COPYLR	COPYLR	Copy Feature Left or Right	CC	S	Survey	D	Survey	0	Copy L/R	Ignore
3	COPYUD	COPYUD	Copy Feature Up or Down	CC	S	Survey	D	Survey	0	Copy U/D	Ignore
4	DIM1	DIM1	Dimension 1	CC	S	Survey	D	Survey	0	Dim 1	Ignore
5	DIM2	DIM2	Dimension 2	CC	S	Survey	D	Survey	0	Dim 2	Ignore
6	DIM3	DIM3	Dimension 3	CC	S	Survey	D	Survey	0	Dim 3	Ignore
7	LINETAG	LINETAG	Line Connection Tag	CC	S	Survey	D	Survey	0	Tag Code	Ignore
8	LOSFB	LOSFB	Line of Sight Forward or Back	CC	S	Survey	D	Survey	0	LOS Offs F/B	Ignore
9	LOSLR	LOSLR	Line of Sight Left or Right	CC	S	Survey	D	Survey	0	LOS Offs L/R	Ignore
10	PARFB	PARFB	Parallel Offset Forward or Back	CC	S	Survey	D	Survey	0	Par Offs F/B	Ignore
11	PARLR	PARLR	Parallel Offset Left or Right	CC	S	Survey	D	Survey	0	Par Offs L/R	Ignore
12	REMARK	REMARK	Remark Text	CC	S	Survey	D	Survey	0	Remark	Ignore
13	STRING	STRING	String No.	CC	S	Survey	D	Survey	0	Str No	Ignore
14	TAPEFB	TAPEFB	Tape Forward or Back	CC	S	Survey	D	Survey	0	Tape F/B	Ignore
15	TAPELR	TAPELR	Tape Left or Right	CC	S	Survey	D	Survey	0	Tape L/R	Ignore
16	ZOFSUD	ZOFSUD	Elevation Offset Up or Down	CC	S	Survey	D	Survey	0	Z Offset	Ignore

Note:

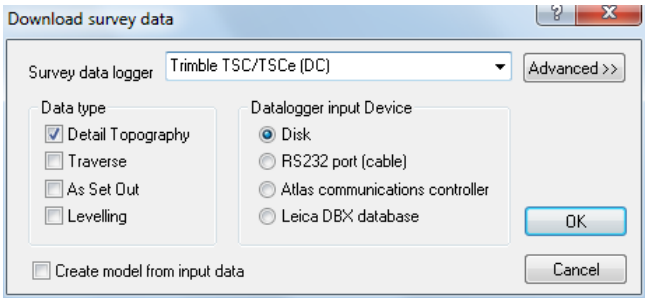
Regular features that contain embedded string numbers should also appear in this sheet with a type of ‘PC’ and a PntInFtr setting of ‘String’.

From the Main Menu Bar, select ‘FILE > Download Survey Data’

Set Survey Data logger to 'Trimble TSC/TSCe (DC)'

Highlight ‘Detail Topography’ as the Data Type

Set Input Device to 'Disk'

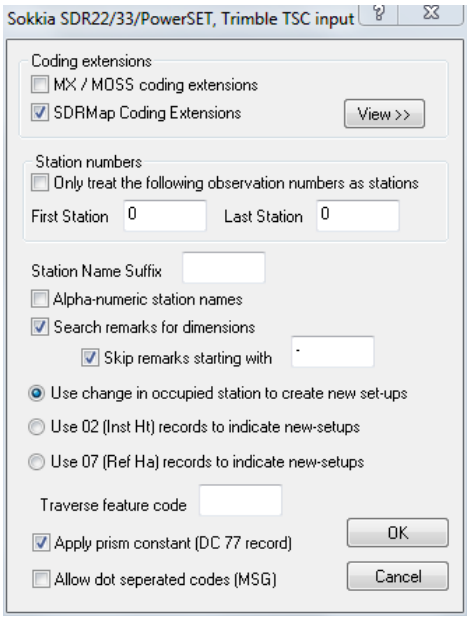


Select 'OK'

Select file

Select 'Open'

Select 'OK'



Select 'View>>' beside 'SDRMap Coding Extensions'

Extended field coding table

	Code	Feature	Description	Type	Tag	Master	DTM	Master
41	BSLD	BSLD	Bus Lane Dashed	PC	S	Survey	D	Survey
42	BSO	BSO	Bus Stop (1pt)	PC	S	Survey	D	Survey
43	BSS	BSS	Bus Shelter	PC	S	Survey	D	Survey
44	CAMO	CAMO	Camera (1pt)	PC	S	Survey	D	Survey
45	CC	CC	Channel Concrete Line	PC	S	Survey	D	Survey
46	CE	CE	Cellar (Basement)	PC	S	Survey	D	Survey
47	CL	CL	Road Centreline	PC	S	Survey	D	Survey
48	CLHO	CLHO	Coal Hole (1pt)	PC	S	Survey	D	Survey
49	CM	CM	Channel Mastic Line	PC	S	Survey	D	Survey
50	COPYFEAT	COPYFEAT	Copy Feature	CC	S	Survey	D	Survey
51	COPYLR	COPYLR	Copy Feature Left or Right	CC	S	Survey	D	Survey
52	COPYUD	COPYUD	Copy Feature Up or Down	CC	S	Survey	D	Survey
53	CUIO	CUIO	Culvert Invert (1pt)	PC	S	Survey	D	Survey
54	CUSO	CUSO	Culvert Soffit (1pt)	PC	S	Survey	D	Survey
55	CUW	CUW	Culvert Wall	PC	S	Survey	D	Survey
56	CYC	CYC	Cycleway Edge	PC	S	Survey	D	Survey
57	CYCD	CYCD	Cycleway Edge Dashed	PC	S	Survey	D	Survey
58	CYCO7	CYCO7	Cycle Logo 1.7m wide (2 pt)	PC	S	Survey	D	Survey
59	CYCOO	CYCOO	Cycle Logo 1.1m wide (2 pt)	PC	S	Survey	D	Survey
60	DH	DH	Ditch Bed Level	PC	S	Survey	D	Survey
61	DIM1	DIM1	Dimension 1	CC	S	Survey	D	Survey
62	DIM2	DIM2	Dimension 2	CC	S	Survey	D	Survey
63	DIM3	DIM3	Dimension 3	CC	S	Survey	D	Survey

Add | Delete | Delete All | Global Edit | Replace | Import codes from feature library | OK | Cancel

Note:

The default library 'Trimble_TSCE_ALPHA.Project' already contains existing field codes within the Extended field coding table. However, for a new library the user can simply use 'Import codes from library' at this stage to automatically add all feature library codes to the SDRMap table. The user can then save the project as a default library for future downloads.

Select 'OK' within the 'Extended field coding table'

Within the 'Sokkia SDR22/33/PowerSet,Trimble TSC..' dialog, select 'SDRMap Coding Extensions', 'Search remarks for dimensions' with 'Skip remarks starting with -'

Ensure that 'Use change in occupied station to create new set-ups'

Select 'OK'

The dataset will be presented.

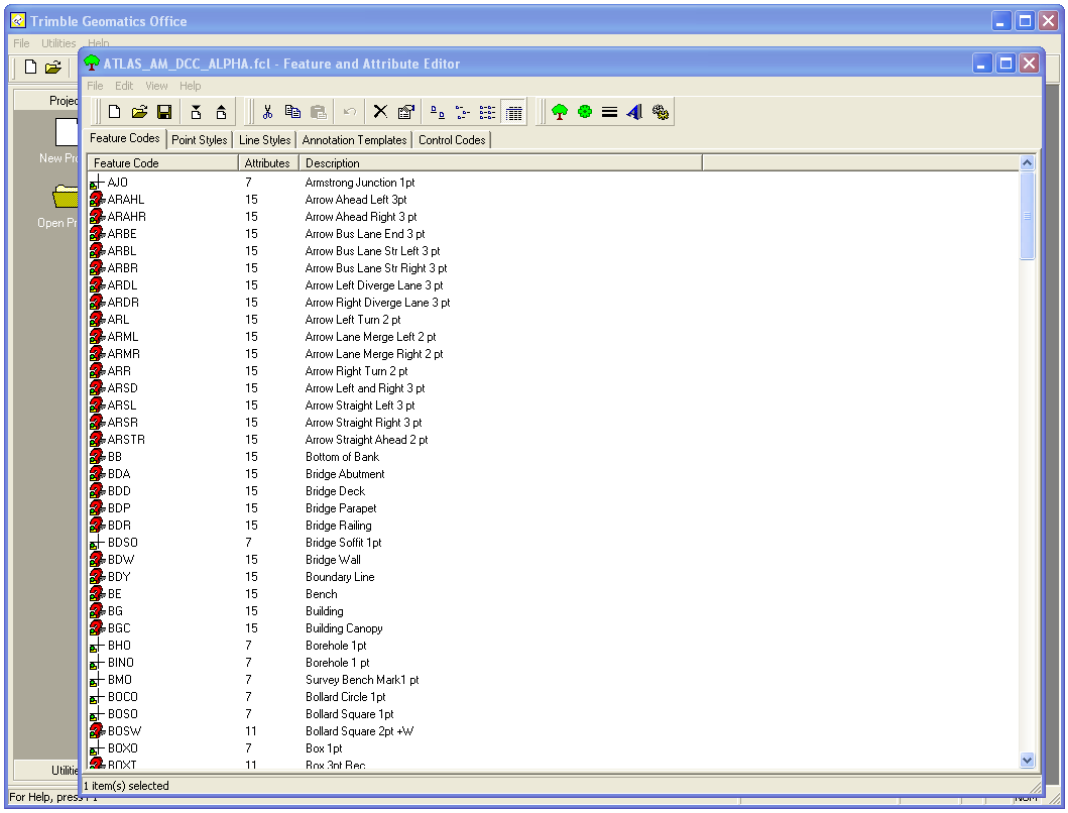
Examination Of Feature Library

The following examines the feature library 'ATLAS_AM_DCC_ALPHA.fcl' within Trimble Geomatics Office:

Open Trimble Geomatics Office Software, select 'Utilities > Feature and Attribute Editor'

Within the Feature and Attribute Editor' dialog, select 'FILE > Open'

Select 'ATLAS_AM_DCC_ALPHA.fcl'



Template Features

5 specific template features have been set up within Trimble Geomatics Office which all other features are based. As a result, the library can be quickly edited by amending or changing the 5 main features on which all other features are based.

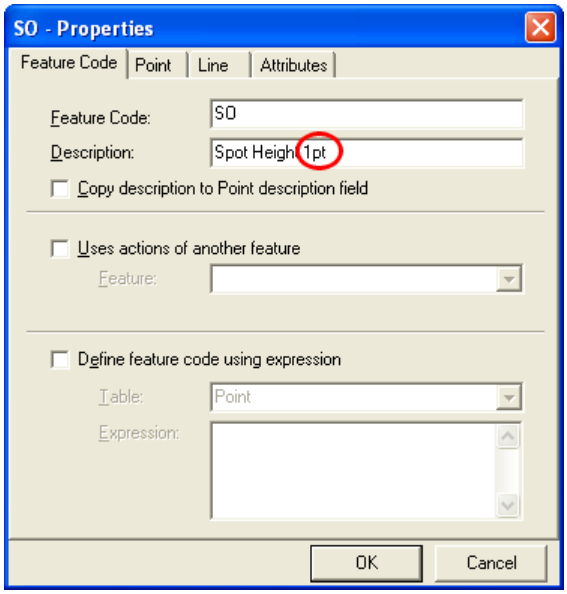
The following outlines each and details the attributes assigned:

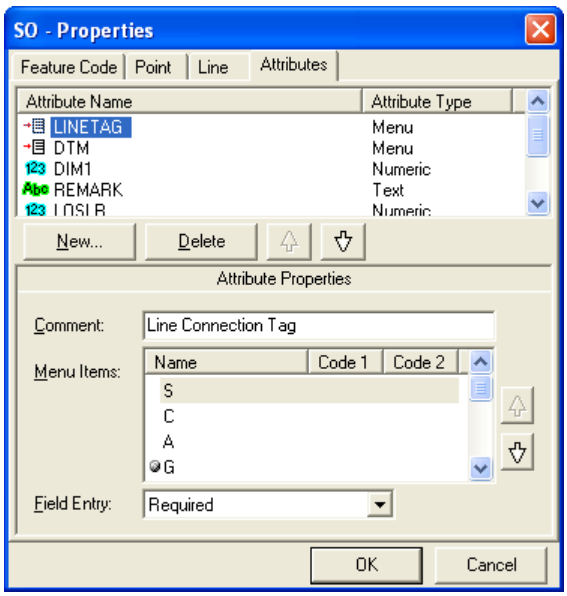
'SO' Spot Height Feature set up as a 1pt Feature:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
SO	Spot Height	LINETAG	G
		DTM	D
		DIM1	
		REMARK	
		LOSLR	
		LOSFB	
		ZOFSUD	

NOTE:

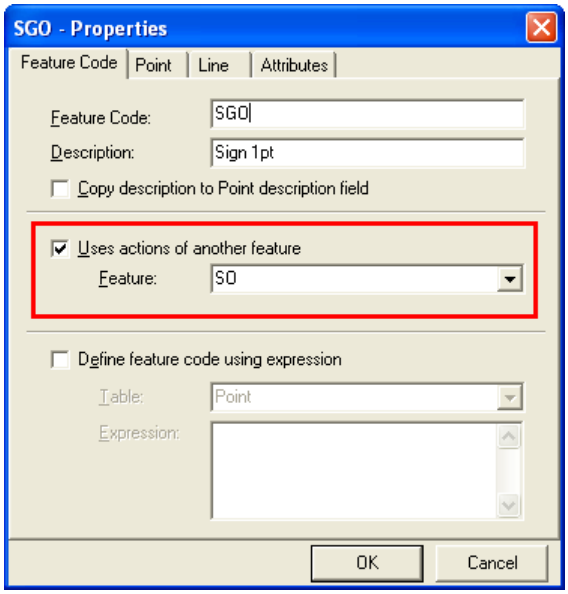
LINETAG - Line Connection Tag, DTM - DTM Status, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down



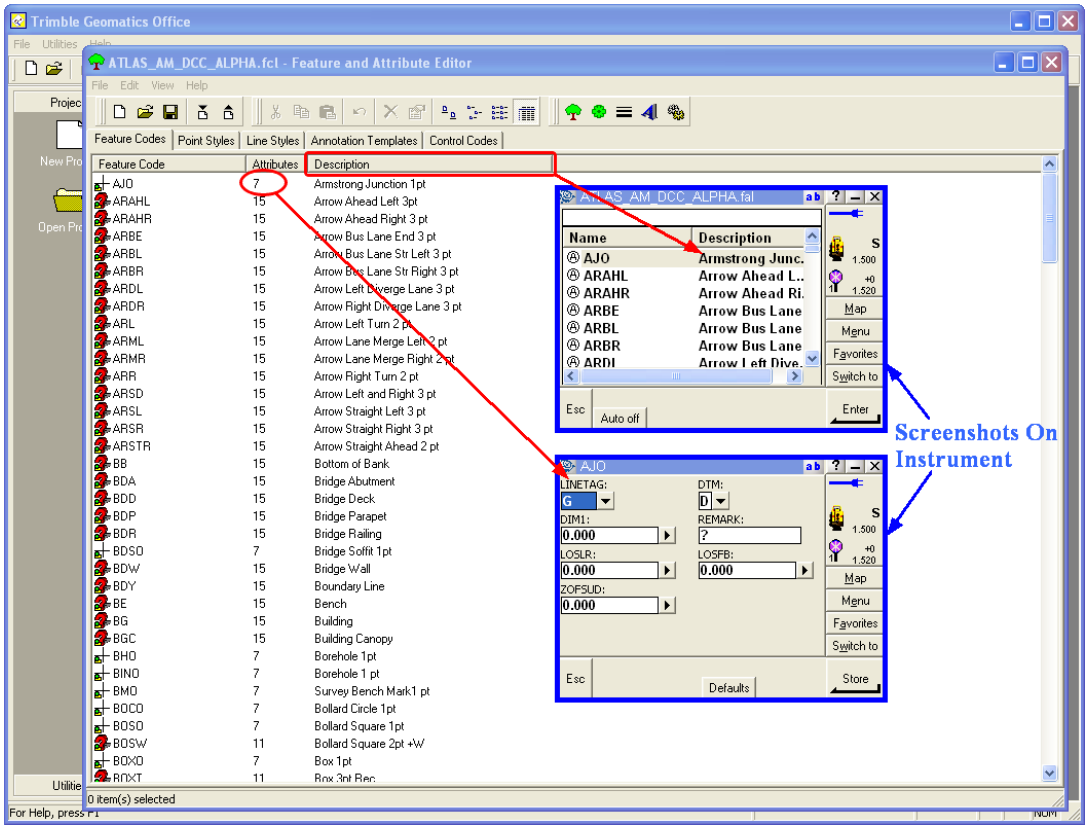


All other 1 point Features have been set up based on 'SO'.

Therefore, if you double click on a 1 point feature in the Feature and Attribute Editor or right click mouse on 1 point feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'SO'. In the example below, Sign 1 point 'SGO' uses 'SO' :



The following diagram demonstrates the relationship of the attributes within Trimble Geomatics Office 'Feature and Attribute Editor' dialog and the actually screens from the instrument showing the attribute:



To globally edit all 1 point feature the feature 'SO' can be modified.

For instance, if you do not wish to have specific attributes assigned to a 1 point feature, the feature 'SO' can be edited and in turn, all 1 point features based on 'SO' will be modified.

'KT' Kerb Top Feature set up as a String:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
KT	Kerb Top	STRING	1
		LINETAG	S
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	
		COPYFEAT	
		COPYLR	
		COPYUD	

NOTE:

STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back, COPYFEAT - Copy Feature, COPYLR - Copy Feature Left / Right Offset, COPYFB - Copy Feature Forward / Back Offset

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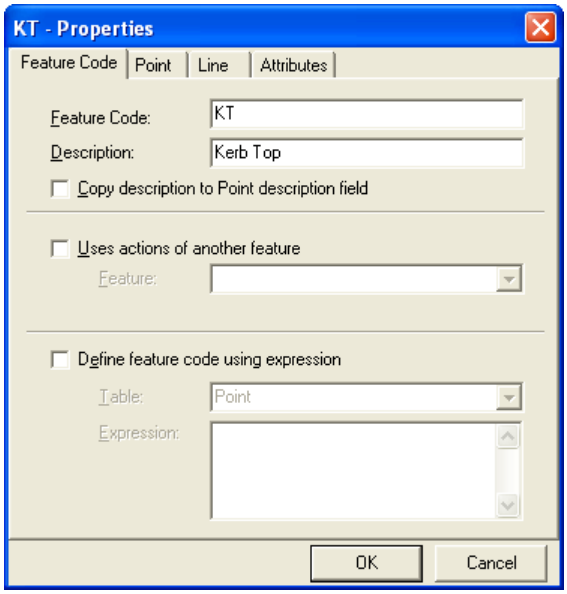
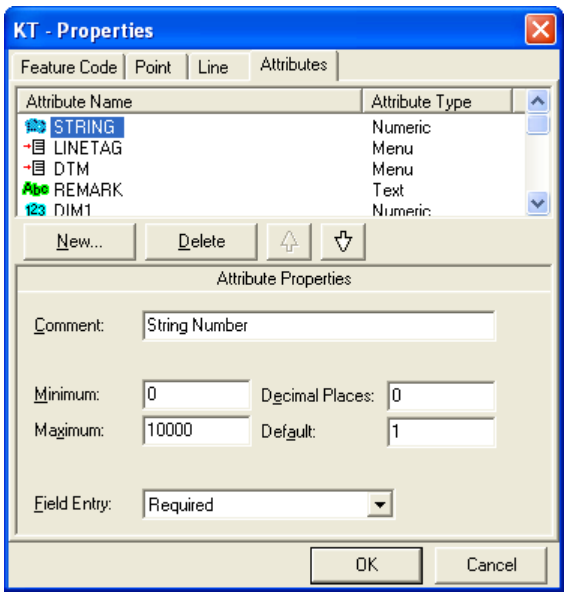
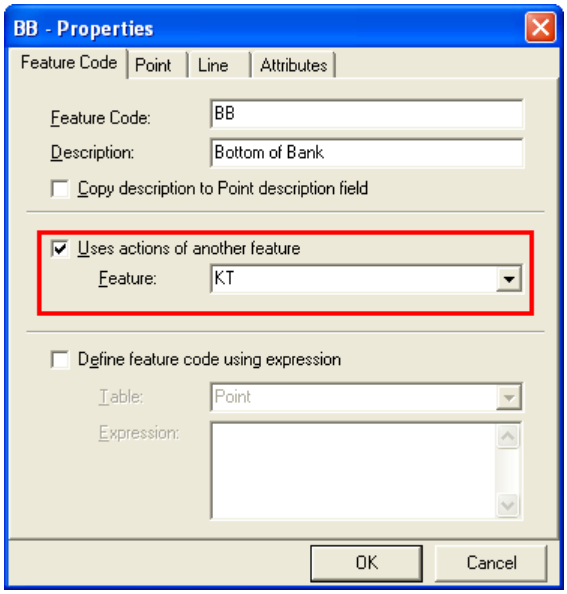


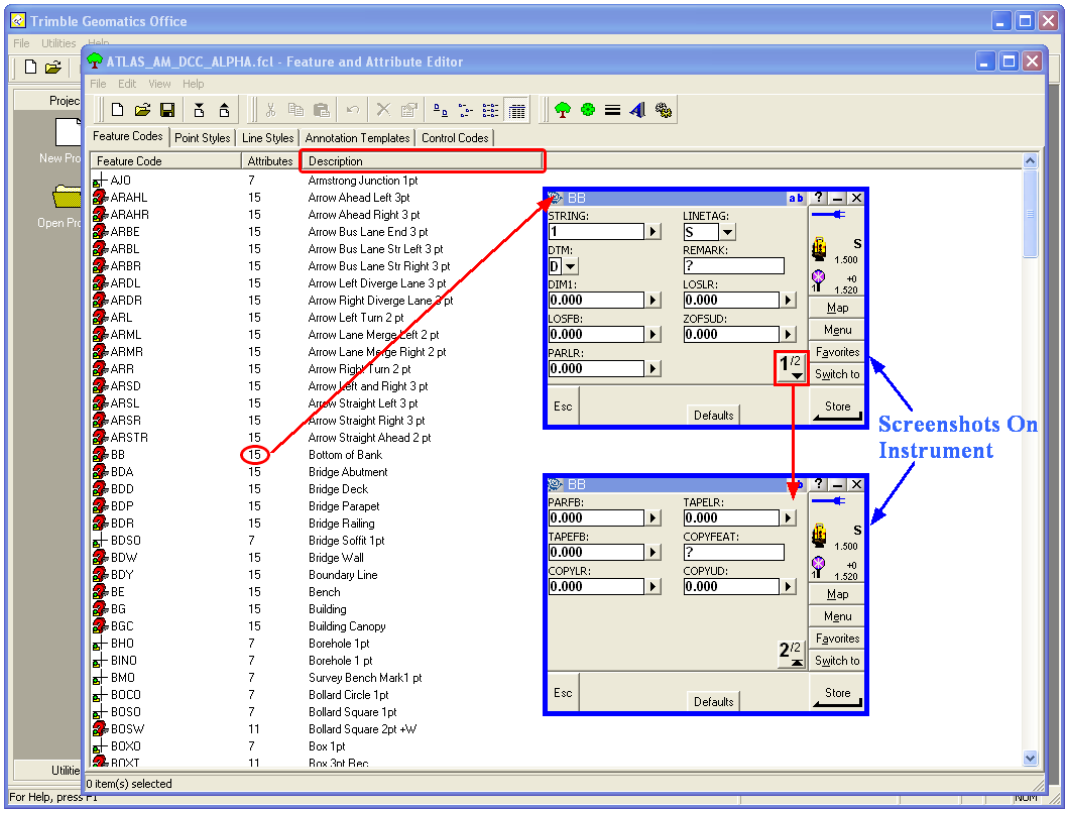


All other strings have been set up based on 'KT'.

Therefore, if you double click on a string feature in the Feature and Attribute Editor or right click mouse on string feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'KT'. In the example below, Bottom of Bank string 'BB' uses 'KT' :



The following diagram demonstrates the relationship of the attributes within Trimble Geomatics Office 'Feature and Attribute Editor' dialog and the actually screens from the instrument showing the attribute:



To globally edit all string features, the feature 'KT' can be modified.

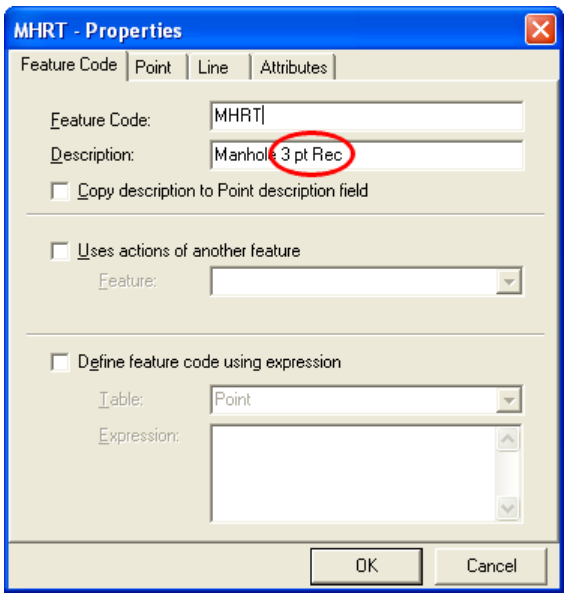
For instance, if you do not wish to have specific attributes assigned to a string, the feature 'KT' can be edited and in turn, all stings based on 'KT' will be modified.

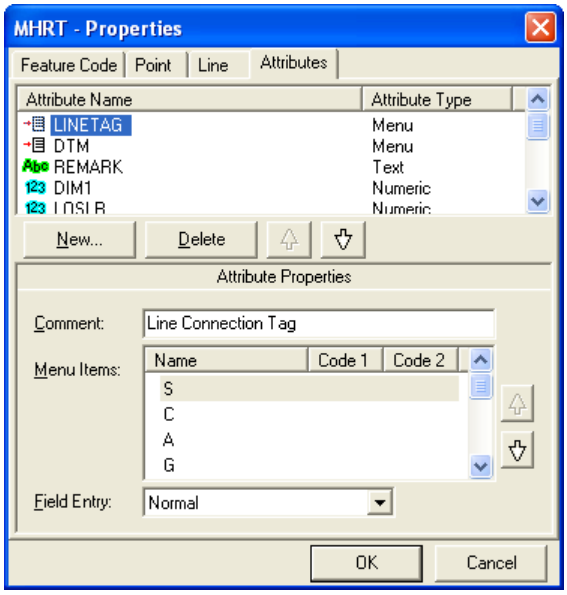
'MHRT' Manhole Feature set up as a 3 Point Rectangular:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
MHRT	Manhole 3pt Rec	LINETAG	Rec3
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

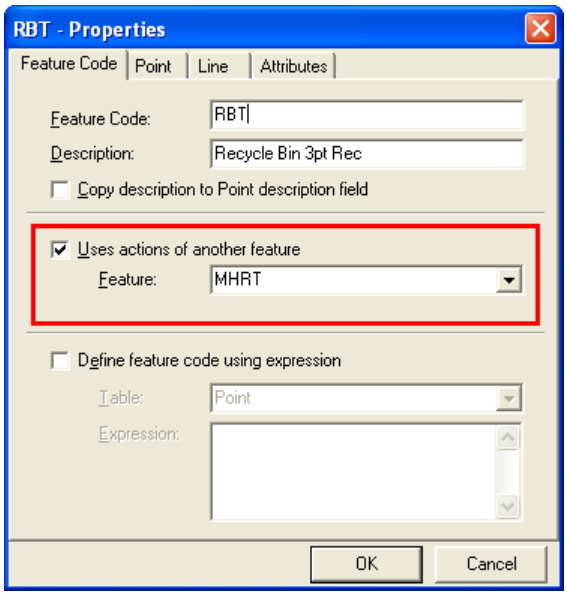
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 3 point rectangles have been set up based on 'MHRT'.

Therefore, if you double click on a 3 point rectangles feature in the Feature and Attribute Editor or right click mouse on a 3 point rectangles feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'MHRT'. In the example below, Recycle Bin 3 point rectangle 'RBT' uses 'MHRT' :



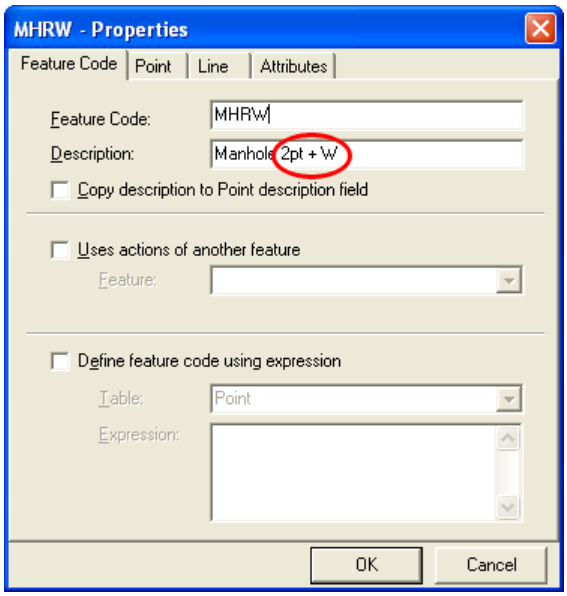
To globally edit all 3 point rectangles features, the feature 'MHRT' can be modified.

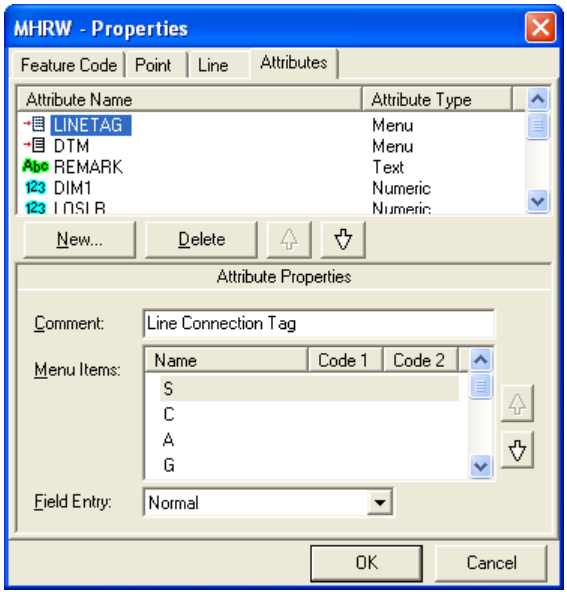
'MHRW' Manhole Feature set up as a 2 Points plus Width:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
MHRT	Manhole 3pt Rec	LINETAG	Rec2
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

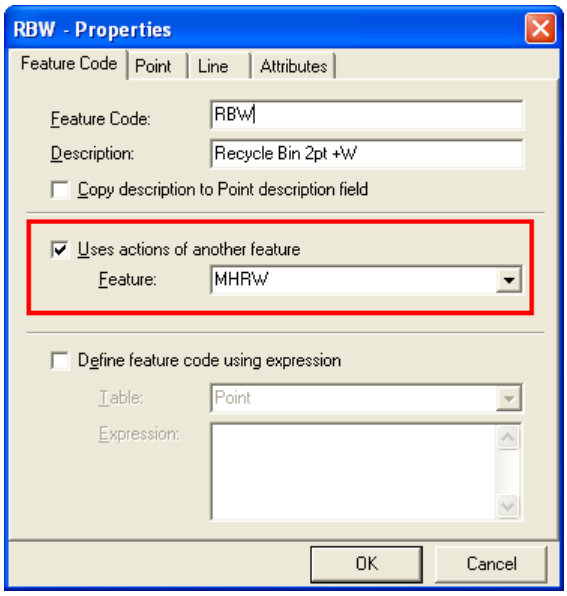
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 2 point plus width have been set up based on 'MHRW'.

Therefore, if you double click on a 2 point plus width feature in the Feature and Attribute Editor or right click mouse on 2 point plus width feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'MHRW'. In the example below, Recycle Bin 3 point rectangle 'RBW' uses 'MHRW' :



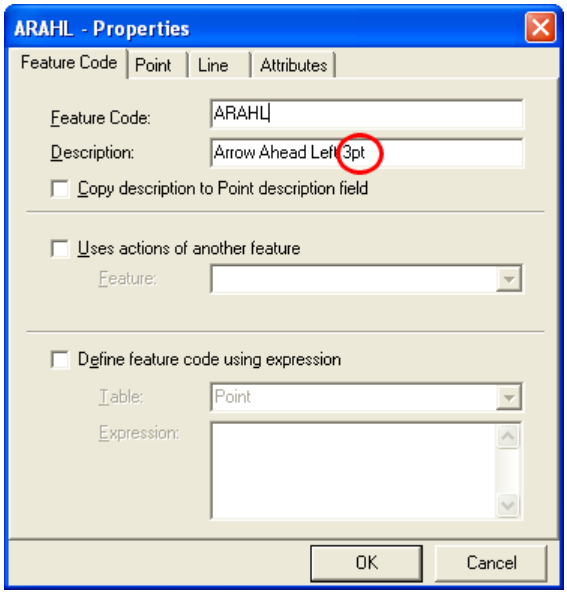
To globally edit all 2 point plus width features, the feature 'MHRW' can be modified.

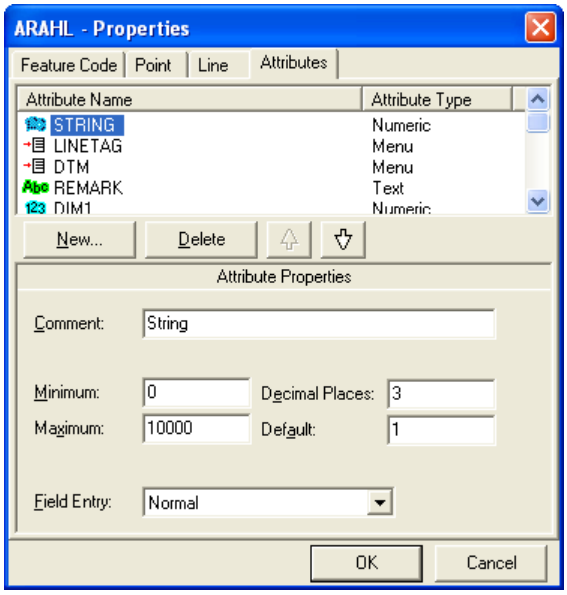
'ARAHL' Arrow Ahead Left Feature set up as a 3 Points:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
ARAHL	Arrow Ahead Left	STRING	1
		LINETAG	S
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	
		COPYFEAT	
		COPYLR	
		COPYUD	

NOTE:

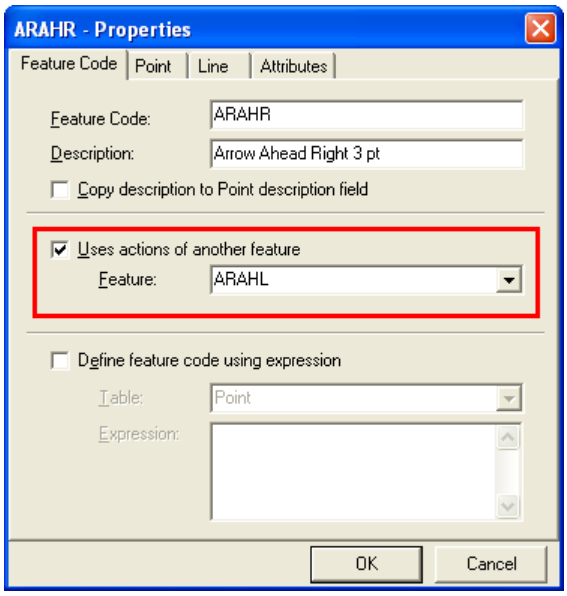
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back, COPYFEAT - Copy Feature, COPYLR - Copy Feature Left / Right Offset, COPYFB - Copy Feature Forward / Back Offset





All other 3 point features have been set up based on 'MHRW'.

Therefore, if you double click on a 3 point feature in the Feature and Attribute Editor or right click mouse on a 3 point feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'ARAHL'. In the example below, Arrow Ahead Right 3 point rectangle 'ARAHR' uses 'ARAHL :



To globally edit all 3 point features, the feature 'ARAHL' can be modified.

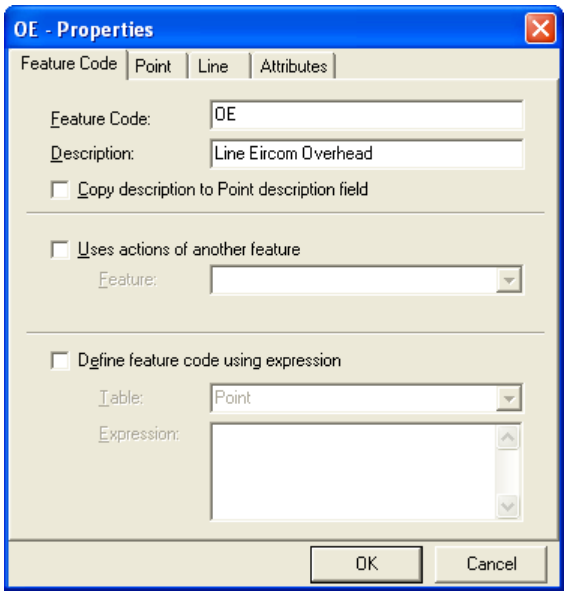
'OE' Line Eircom Overhead Feature set up as a 2D (Approx Elevation)

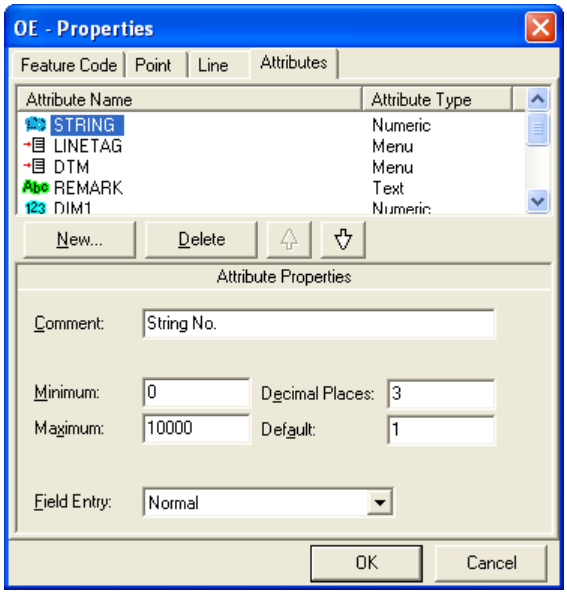
String:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
OE	Eircom Overhead	STRING	1
		LINETAG	S
		DTM	A
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

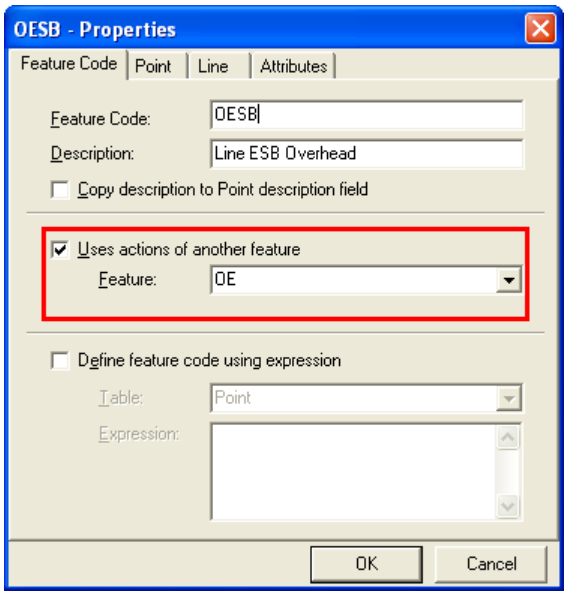
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 2D string features have been set up based on 'OE'.

Therefore, if you double click on a 2D string feature in the Feature and Attribute Editor or right click mouse on a 2D string feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'OESB'. In the example below, ESB Overhead 'OESB' uses 'OE' :



To globally edit all 2D string features, the feature 'OE' can be modified.

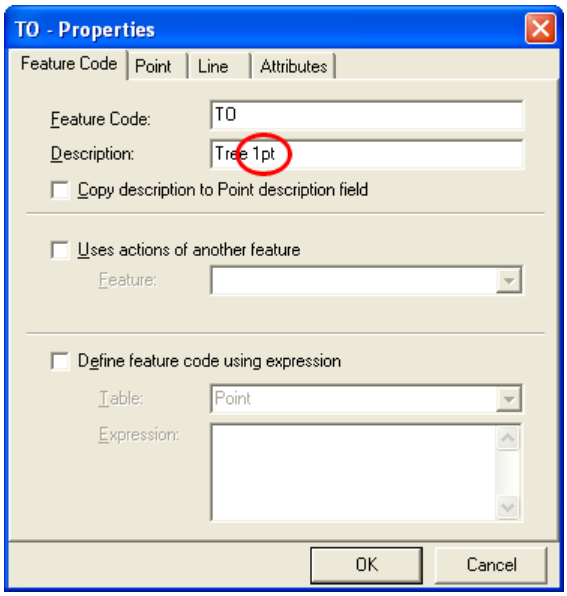
'TO' Tree Feature set up as a 2D (Approx Elevation) 1 point feature with

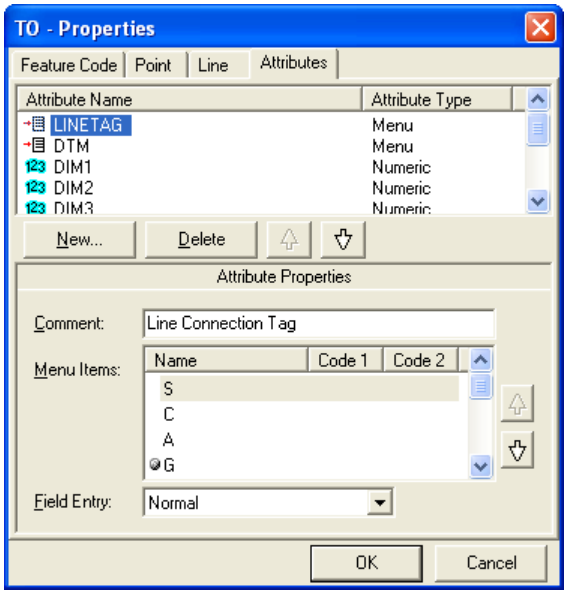
specific Dimension Attributes for Canopy and Trunk Size:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
TO	Tree	LINETAG	G
		DTM	A
		DIM1	
		DIM2	
		DIM3	
		REMARK	
		LOSLR	
		LOSFB	
		ZOFSUD	

NOTE:

LINETAG - Line Connection Tag, DTM - DTM Status, DIM1 - Dimension 1, DIM2 - Dimension 2, DIM3 - Dimension 3, REMARK - Remark / Note, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down



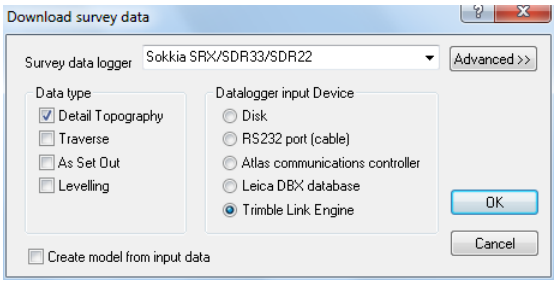


Trimble Exchange

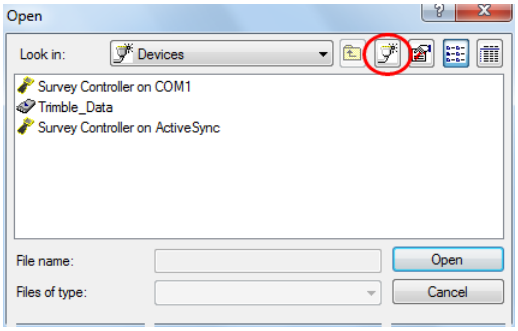
The user can download using Trimble JXL, Trimble DC, SDR33, Geodimeter UDS or GPS X,Y, Z formats using the Trimble Link Engine.

To download from using Trimble Link Engine in SCC, use the following steps;

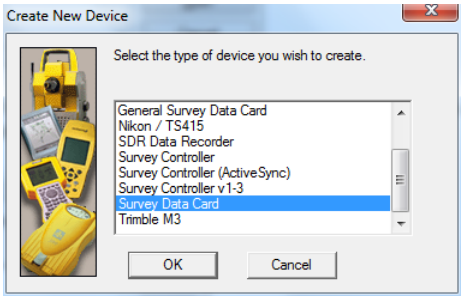
Go to 'FILE > Download survey'

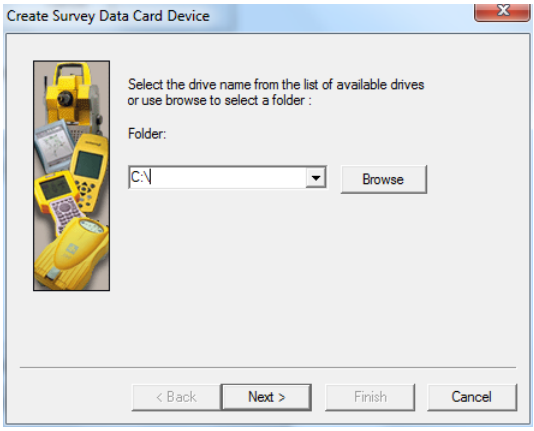


If this is the first time using TLE, and downloading from file, press the 'Create New Device' icon

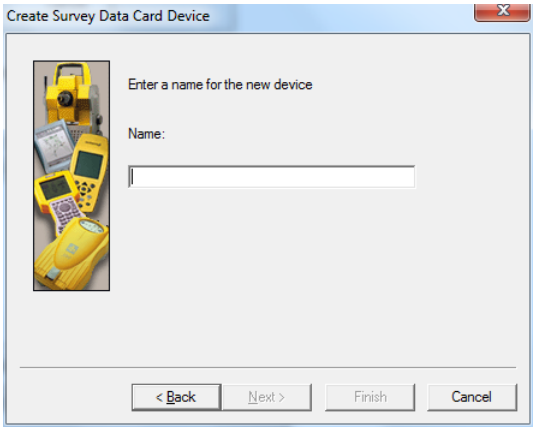


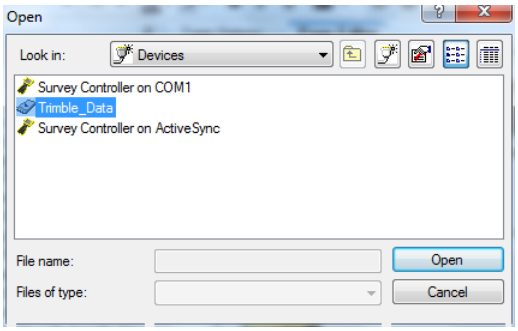
Create a Survey Data Card device for the folder containing your raw Trimble data.

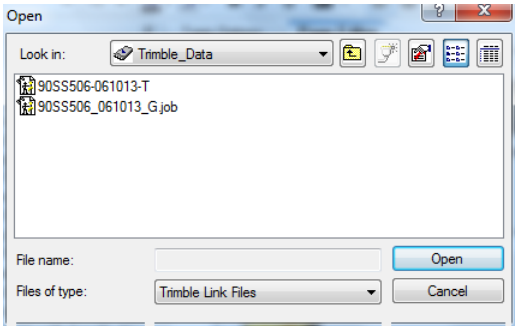




Select the device, select the job and press Open to begin downloading.

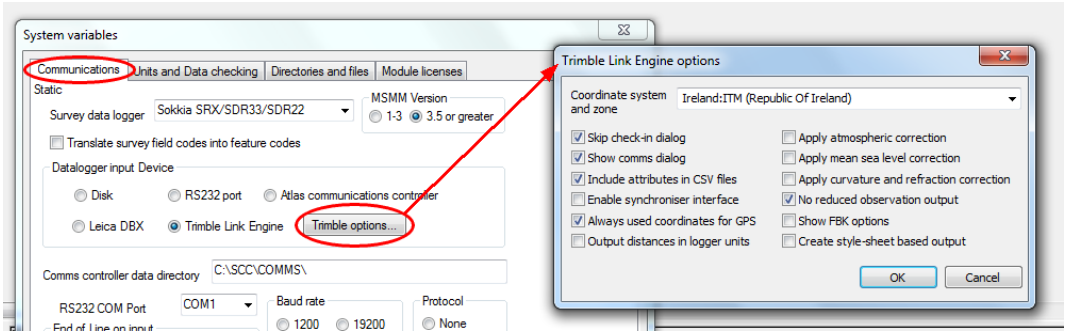






General SCC download steps can be implemented from this stage.

The TLE interface can be configured under 'FILE > General options > Communications > Trimble options'



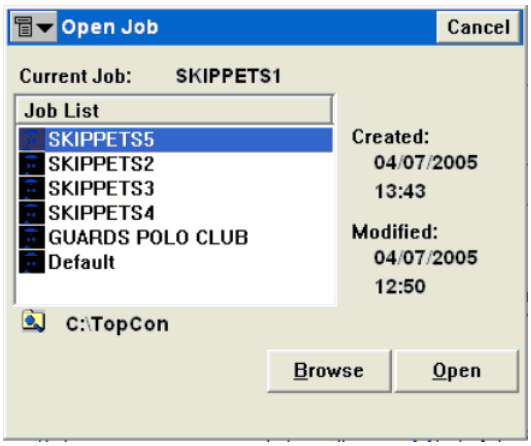
Zone may need to be changed to reduce RTK to coordinates, but most of the other defaults should be ok.

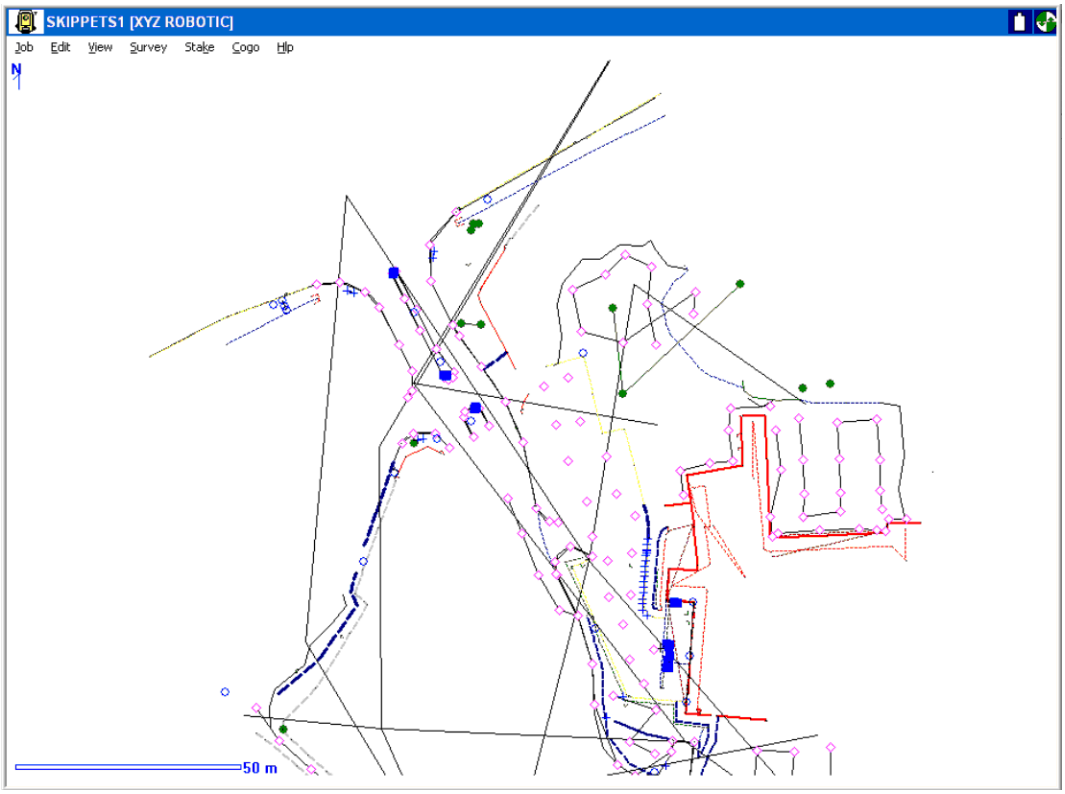
3.2.3.6 Downloading TopCon Data

This following outlines the usage of the SCC TopSurv interface using the raw TopSurv files ‘Skippets1’, ‘Skippets2’, ‘Skippets3’, ‘Skippets4’, and ‘Skippets5’, as provided via TopCon. The steps required in processing this job are as follows;

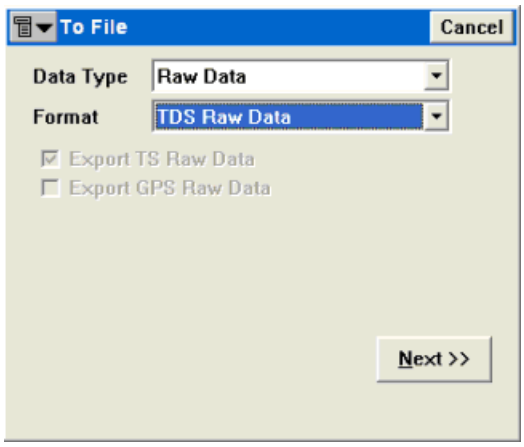
In TopSurv, open each job, and export it in both raw data and point formats.

Select Job > Open > Skippets1.Job

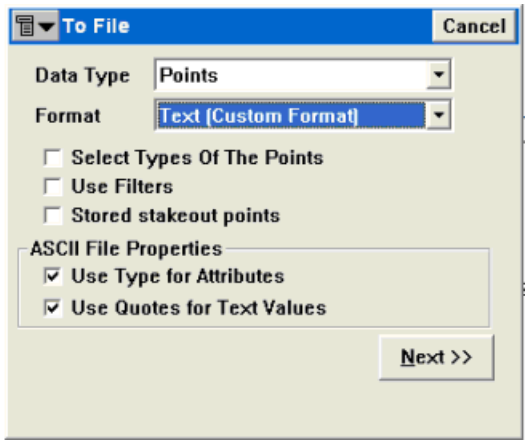


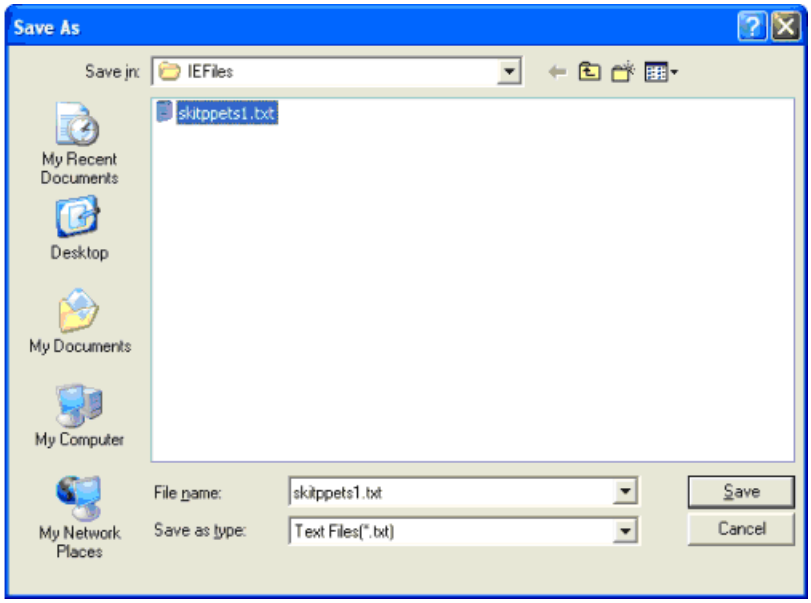


Select 'Job > Export To File > Raw Data, and select the TDS format as shown below. This will create the file Skippets1.RAW.

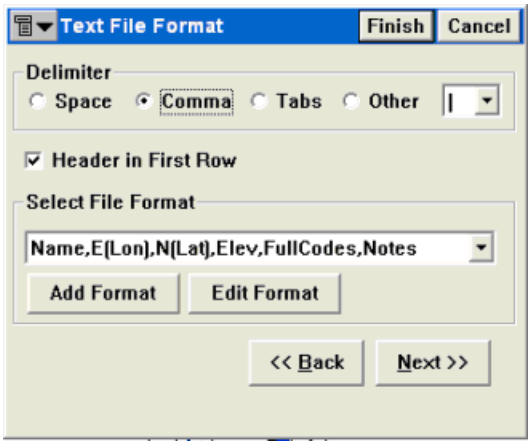


Select 'Job > Export To File > Points, and select the custom format as shown below.

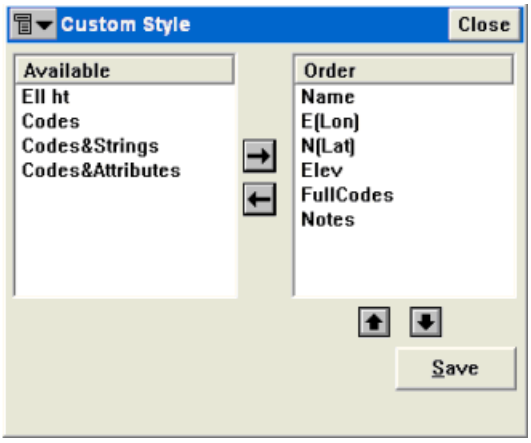


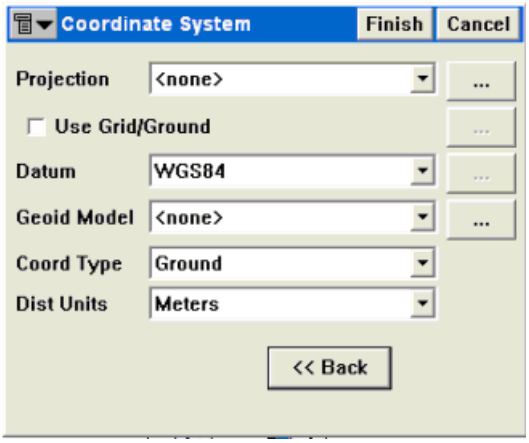


This will create the file Skippets1.txt. Use the custom format shown below.



If this is the first time you have used this option, press the Edit format button, and select the fields as shown.



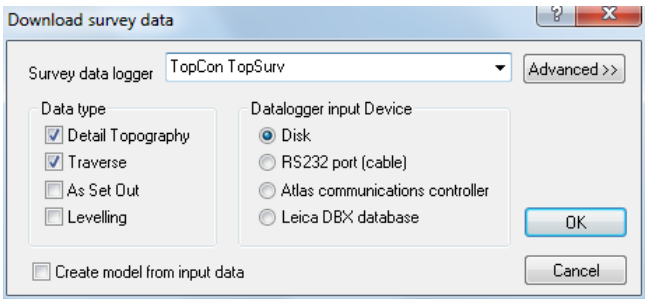


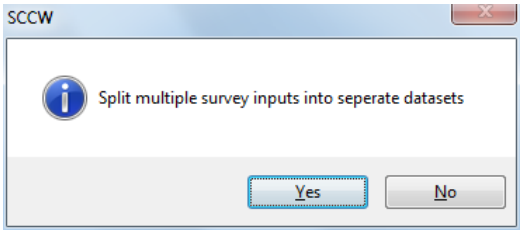
Finish the points output as shown, repeat the above steps for all five jobs, and copy all the resultant .RAW and .TXT files onto the PC running SCC.

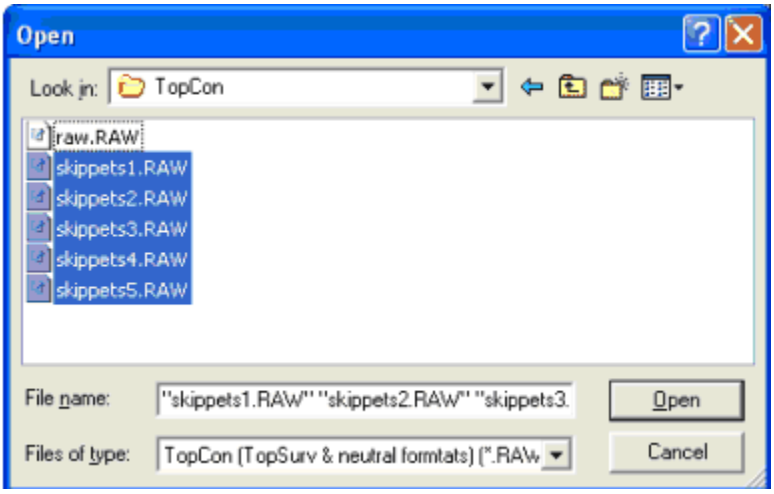
Import the TopSurv files into SCC

In SCC, select 'FILE > New project' to create a new project. The project file will be used to store all the common stations between the different jobs, and to store the feature library, which in turn controls the drawing, layering and model creation standards that will be used.

Select 'FILE > Download' to download all five jobs as shown below;





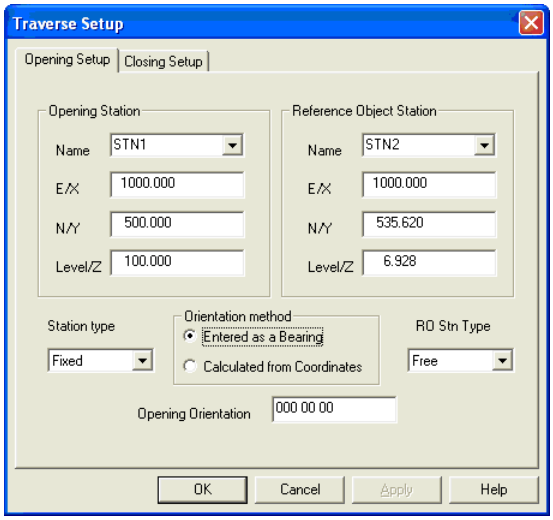


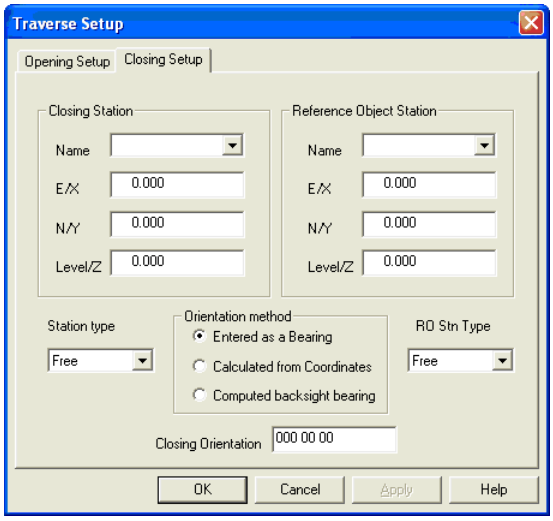
This will create ten new SCC documents, which are made up of a detail survey document and traverse document for each raw job.

Adjust The First Traverse

The traverse documents created in SCC will be used to tie the five separate detail jobs into a single, common, grid. Each survey job was carried out using common station names, but different grids. The SCC traversing routines will be used to resolve these into a common grid. This can be done either by adjusting the traverse information for each job separately, or by combining the all the raw data to form a single traverse. We will start be adjusting the first traverse in isolation.

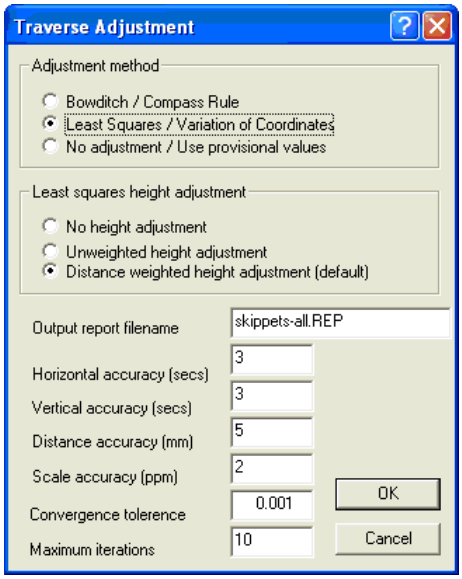
Select 'EDIT > Setup', and enter the opening and closing setups as shown.



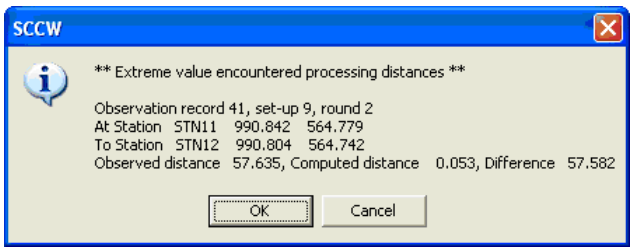


This arrangement with on fixed station and one fixed bearing provides a minimally constrained traverse network that is useful for testing the internal integrity of the measurements.

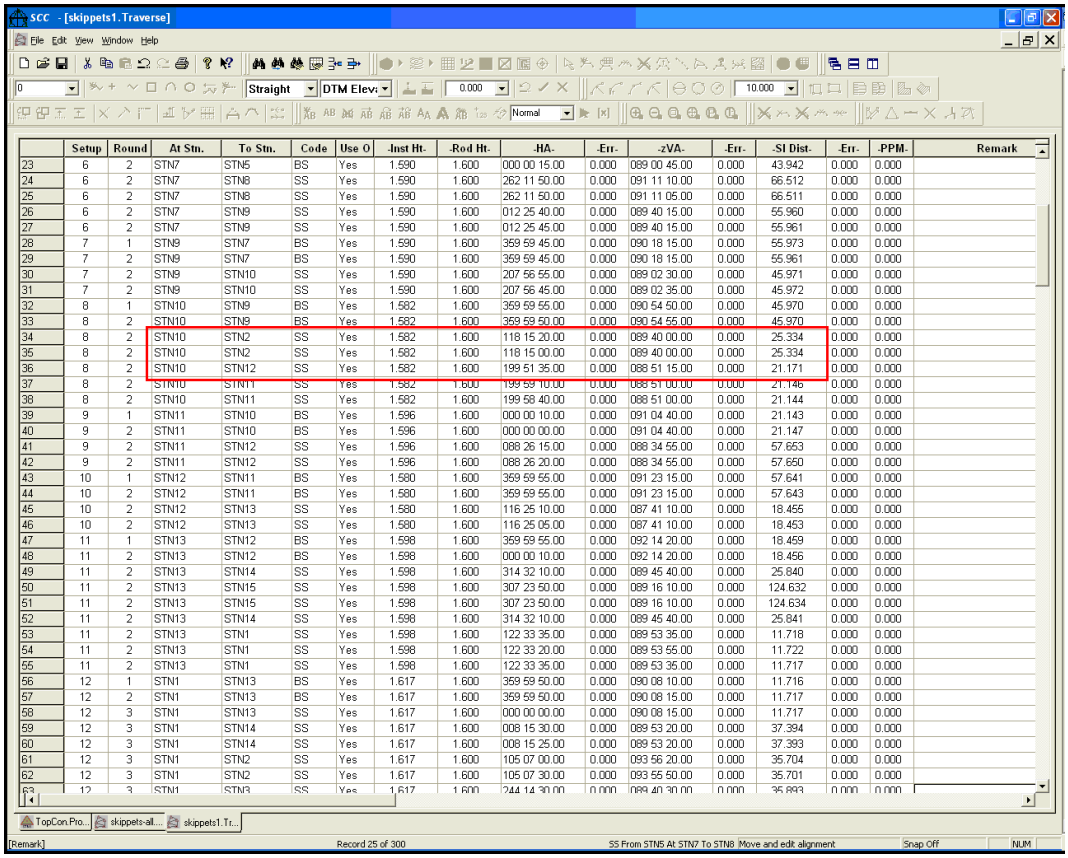
Select 'EDIT > Adjust, and adjust the traverse using a least squares method, as shown below;



The first attempt at doing this will show up a station naming error in the raw data.

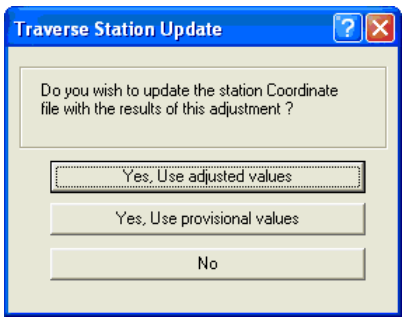


We can see that the observation at station 35, from STN10 to STN11, has a horizontal angle and distance that suggests that the sighted station is actually STN12 rather than STN11. This can be rectified by changing the 'To Stn' field to STN12, or by setting the ' Use Obs' field to 'No'.



	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-Err-	-zVA-	-Err-	-Sl Dist-	-Err-	-PPM-	Remark
23	6	2	STN7	STN5	BS	Yes	1.590	1.600	000 00 15.00	0.000	089 00 45.00	0.000	43.942	0.000	0.000	
24	6	2	STN7	STN8	SS	Yes	1.590	1.600	262 11 50.00	0.000	091 11 10.00	0.000	66.512	0.000	0.000	
25	6	2	STN7	STN8	SS	Yes	1.590	1.600	262 11 50.00	0.000	091 11 05.00	0.000	66.511	0.000	0.000	
26	6	2	STN7	STN9	SS	Yes	1.590	1.600	012 25 40.00	0.000	089 40 15.00	0.000	55.960	0.000	0.000	
27	6	2	STN7	STN9	SS	Yes	1.590	1.600	012 25 45.00	0.000	089 40 15.00	0.000	55.961	0.000	0.000	
28	7	1	STN9	STN7	BS	Yes	1.590	1.600	359 59 45.00	0.000	090 18 15.00	0.000	55.973	0.000	0.000	
29	7	2	STN9	STN7	BS	Yes	1.590	1.600	359 59 45.00	0.000	090 18 15.00	0.000	55.961	0.000	0.000	
30	7	2	STN9	STN10	SS	Yes	1.590	1.600	207 56 55.00	0.000	089 02 30.00	0.000	45.971	0.000	0.000	
31	7	2	STN9	STN10	SS	Yes	1.590	1.600	207 56 45.00	0.000	089 02 35.00	0.000	45.972	0.000	0.000	
32	8	1	STN10	STN9	BS	Yes	1.582	1.600	359 59 55.00	0.000	090 54 50.00	0.000	45.970	0.000	0.000	
33	8	2	STN10	STN9	BS	Yes	1.582	1.600	359 59 50.00	0.000	090 54 55.00	0.000	45.970	0.000	0.000	
34	8	2	STN10	STN2	SS	Yes	1.582	1.600	118 15 20.00	0.000	089 40 00.00	0.000	25.334	0.000	0.000	
35	8	2	STN10	STN2	SS	Yes	1.582	1.600	118 15 00.00	0.000	089 40 00.00	0.000	25.334	0.000	0.000	
36	8	2	STN10	STN12	SS	Yes	1.582	1.600	199 51 35.00	0.000	088 51 15.00	0.000	21.171	0.000	0.000	
37	8	2	STN10	STN11	SS	Yes	1.582	1.600	199 59 10.00	0.000	088 51 00.00	0.000	21.146	0.000	0.000	
38	8	2	STN10	STN11	SS	Yes	1.582	1.600	199 58 40.00	0.000	088 51 00.00	0.000	21.144	0.000	0.000	
39	9	1	STN11	STN10	BS	Yes	1.596	1.600	000 00 10.00	0.000	091 04 40.00	0.000	21.143	0.000	0.000	
40	9	2	STN11	STN10	BS	Yes	1.596	1.600	000 00 00.00	0.000	091 04 40.00	0.000	21.147	0.000	0.000	
41	9	2	STN11	STN12	SS	Yes	1.596	1.600	088 26 15.00	0.000	088 34 55.00	0.000	57.653	0.000	0.000	
42	9	2	STN11	STN12	SS	Yes	1.596	1.600	088 26 20.00	0.000	088 34 55.00	0.000	57.650	0.000	0.000	
43	10	1	STN12	STN11	BS	Yes	1.580	1.600	359 59 55.00	0.000	091 23 15.00	0.000	57.641	0.000	0.000	
44	10	2	STN12	STN11	BS	Yes	1.580	1.600	359 59 55.00	0.000	091 23 15.00	0.000	57.643	0.000	0.000	
45	10	2	STN12	STN13	SS	Yes	1.580	1.600	116 25 10.00	0.000	087 41 10.00	0.000	18.455	0.000	0.000	
46	10	2	STN12	STN13	SS	Yes	1.580	1.600	116 25 05.00	0.000	087 41 10.00	0.000	18.453	0.000	0.000	
47	11	1	STN13	STN12	BS	Yes	1.598	1.600	359 59 55.00	0.000	092 14 20.00	0.000	18.459	0.000	0.000	
48	11	2	STN13	STN12	BS	Yes	1.598	1.600	000 00 10.00	0.000	092 14 20.00	0.000	18.456	0.000	0.000	
49	11	2	STN13	STN14	SS	Yes	1.598	1.600	314 32 10.00	0.000	089 45 40.00	0.000	25.840	0.000	0.000	
50	11	2	STN13	STN15	SS	Yes	1.598	1.600	307 23 50.00	0.000	089 16 10.00	0.000	124.632	0.000	0.000	
51	11	2	STN13	STN15	SS	Yes	1.598	1.600	307 23 50.00	0.000	089 16 10.00	0.000	124.634	0.000	0.000	
52	11	2	STN13	STN14	SS	Yes	1.598	1.600	314 32 10.00	0.000	089 45 40.00	0.000	25.841	0.000	0.000	
53	11	2	STN13	STN1	SS	Yes	1.598	1.600	122 33 35.00	0.000	089 53 35.00	0.000	11.718	0.000	0.000	
54	11	2	STN13	STN1	SS	Yes	1.598	1.600	122 33 20.00	0.000	089 53 55.00	0.000	11.722	0.000	0.000	
55	11	2	STN13	STN1	SS	Yes	1.598	1.600	122 33 35.00	0.000	089 53 35.00	0.000	11.717	0.000	0.000	
56	12	1	STN1	STN13	BS	Yes	1.617	1.600	359 59 50.00	0.000	090 08 10.00	0.000	11.716	0.000	0.000	
57	12	2	STN1	STN13	BS	Yes	1.617	1.600	359 59 50.00	0.000	090 08 15.00	0.000	11.717	0.000	0.000	
58	12	3	STN1	STN13	SS	Yes	1.617	1.600	000 00 00.00	0.000	090 08 15.00	0.000	11.717	0.000	0.000	
59	12	3	STN1	STN14	SS	Yes	1.617	1.600	008 15 30.00	0.000	089 53 20.00	0.000	37.394	0.000	0.000	
60	12	3	STN1	STN14	SS	Yes	1.617	1.600	008 15 25.00	0.000	089 53 20.00	0.000	37.393	0.000	0.000	
61	12	3	STN1	STN2	SS	Yes	1.617	1.600	105 07 00.00	0.000	093 56 20.00	0.000	35.704	0.000	0.000	
62	12	3	STN1	STN2	SS	Yes	1.617	1.600	105 07 30.00	0.000	093 55 50.00	0.000	35.701	0.000	0.000	
63	12	3	STN1	STN3	SS	Yes	1.617	1.600	244 14 30.00	0.000	089 40 30.00	0.000	35.893	0.000	0.000	

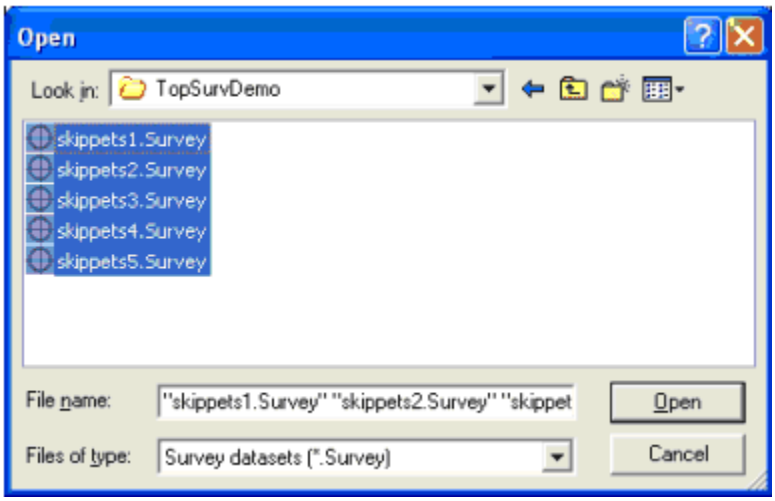
Repeating the adjustment gives us no more errors in this job, and yields the traverse report.



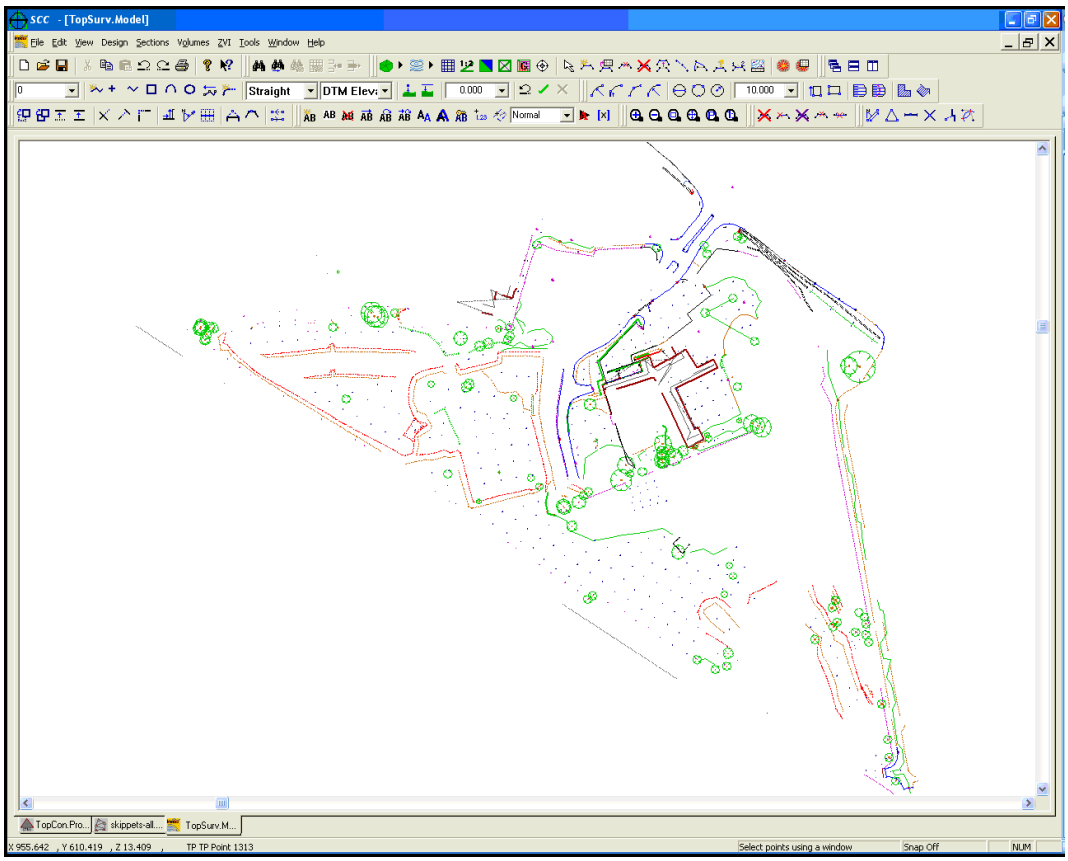
We can now store the station coordinates in the project file, and repeat the process for the remaining jobs. Another solution, which is preferable in this case, is use the option ' **Append Traverse'** to create a single traverse job, and adjust them simultaneously, again using the method described above. The final traverse file and project that includes all of the adjusted stations are attached in 'Skippets-all.traverse' and 'TopSurvDemo.project'.

Coordinate And Model The Detail Topography

Use **'FILE** > **Open'** to open all of the detail survey jobs as shown below. In each job, select 'File / Rebuild coordinates' to apply the effects of the control adjustment.



Select 'FILE >Model > SCC Survey Datasets', and again select all five jobs to create the model as shown below.



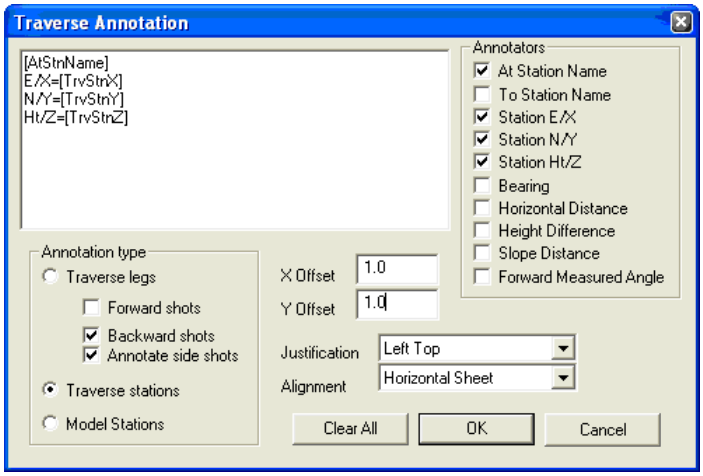
Note that SCC is interpreting the TopSurv attributes as follows in order to provide some of the reduction and drawing details;

DIAMETER.REAL= SPREAD.REAL= WIDTH.REAL=	The attributed is evaluated and stored in D1, which is in turn used for tree spreads, wall widths, etc…
GIRTH.REAL=	The attributed is evaluated and stored in D2 which is in turn used for tree spreads, etc

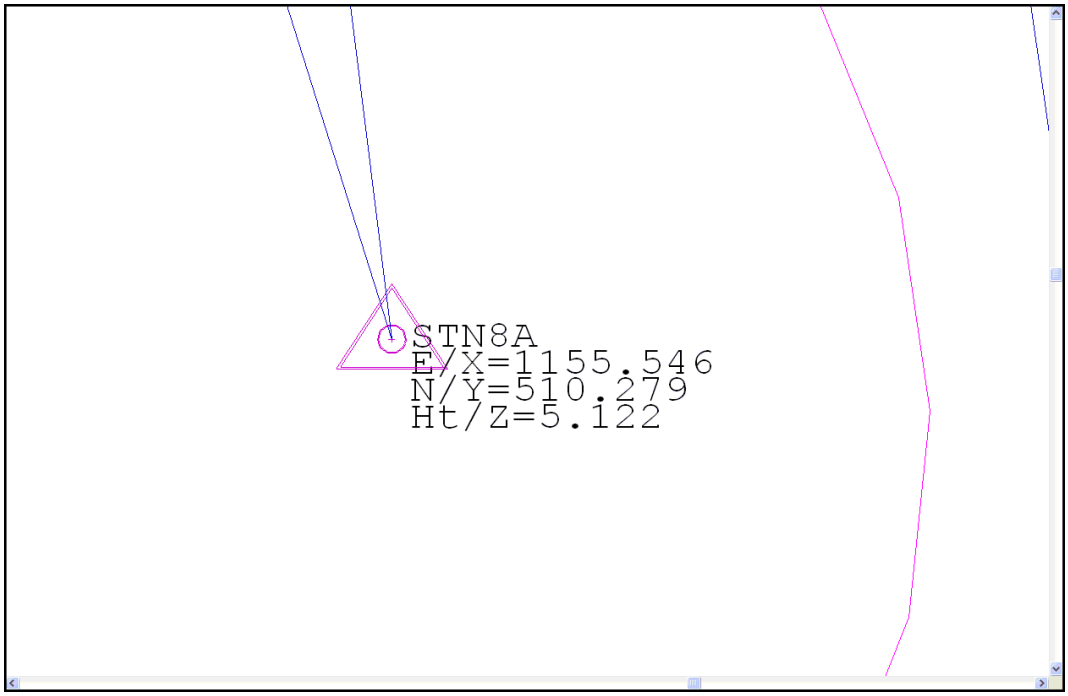
HEIGHT.REAL=	The attributed is evaluated and stored in D3
“S”	The tag code is set to straight
“C”	The tag code is set to curve
“s	The tag code is set to discontinuous straight, that is a straight that follows a curve that does not impose any tangent conditions on the curve.
“C”	The tag code is set to discontinuous curve, that is a new curve that is not tangential to the last straight or curve.
“R”	The point is assumed to be part of a three point rectangle.
&	The numeric following determine the string number. If these are not present the observation refers to a discrete point feature

Note that all other tag and dtm codes are derived from the feature library.

To annotate the traverse on the model select ‘FILE > Attach/Detach > Attach traverse’ and select ‘Skippets-all.traverse’. The select ‘EDIT > Text > Annotate Traverse’ as shown



This will result in the stations being annotated on the traverse.



3.2.3.7 Downloading Sokkia Data

SCC support downloading files using the SDR33 output format.

Extract of Sample File

```
07TP00030004305.1843910.00000000
03NM1.59000000
09F10003000490.561000090.16305550.000000000004
03NM1.50000000
09F10003100034.698000090.7002777159.380833TS01
09F10003100136.903000088.7950000165.696944TB01
09F10003100222.805000089.8027777189.280277201 TS01
09F10003100327.147000087.9900000188.787777TB01
09F10003100425.362000088.3702777191.974166PTDS
13NMP 1004 1.10 m ELM
09F10003100523.497000089.8994444247.683888TS01
09F10003100627.212000088.2977777243.250555TB01
09F10003100734.248000089.9150000271.187500TS01
09F10003100836.355000088.7963888266.240833TB01
09F10003100924.278000090.1666666283.591111PLIT
09F10003101038.033000090.3277777315.945833SK50
13NM203 SK50 SK51 0.0 -1.85
09F10003101130.238000090.2000000348.368611SK50 CS50
09F10003101229.183000090.2005555348.219444CS50
09F10003101329.090000090.1336111354.765555CS50
09F10003101430.140000090.1333333354.751388CS50 SK50
09F10003101536.737000089.807777728.3350000SK50
```

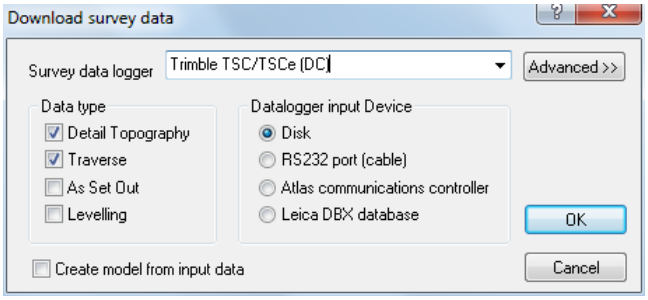
Download Steps

From the Main Menu Bar, select ‘FILE > Download Survey Data’

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight ‘Detail Topography’ as the Data Type

Set Input Device to 'Disk'

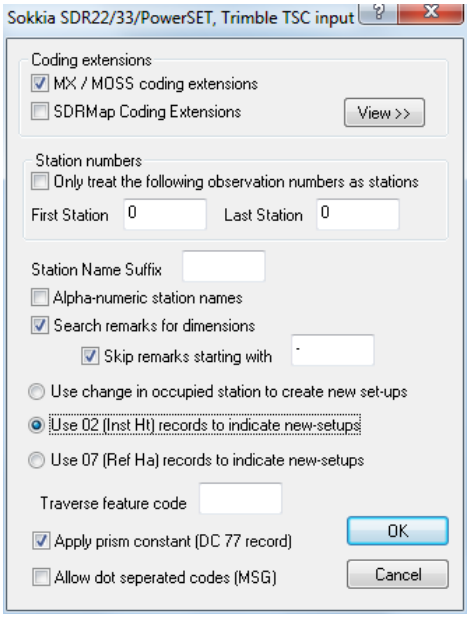


Select 'OK'

Select 'PKTOPO1.Dat' from '\SCC\Tutorials' directory

Select 'Open'

Select 'OK'



Set 'MX/MOSS coding extension' and 'Search remarks for dimensions'

Select 'OK'

See Also

Downloading Trimble DC Format Data

Downloading Sokkia SRX/SDR33/SDR22

Creating a New Project

From the Main Menu Bar, select 'FILE >New Project'

Enter in a Project/Job name 'TEST.Project'

Select a Project Template from the list 'Default v7 Complex.Project'

Select 'OK'

The **project template** contains all the feature coding, layering, string labelling, modelling, symbology and annotation standards that will be applied to the project.

The project itself consists of a spreadsheet containing the control stations used in the

project, along with a feature library spreadsheet.

Feature Library

Importing SDR Library

From the Main Menu Bar, select 'VIEW > Feature Library'

Select 'FILE > Import > SDR Map Feature Library'

Select 'FCLIB02.DAT' feature library

Modification of Library

Each feature can be modified easily within the Feature Wizard '

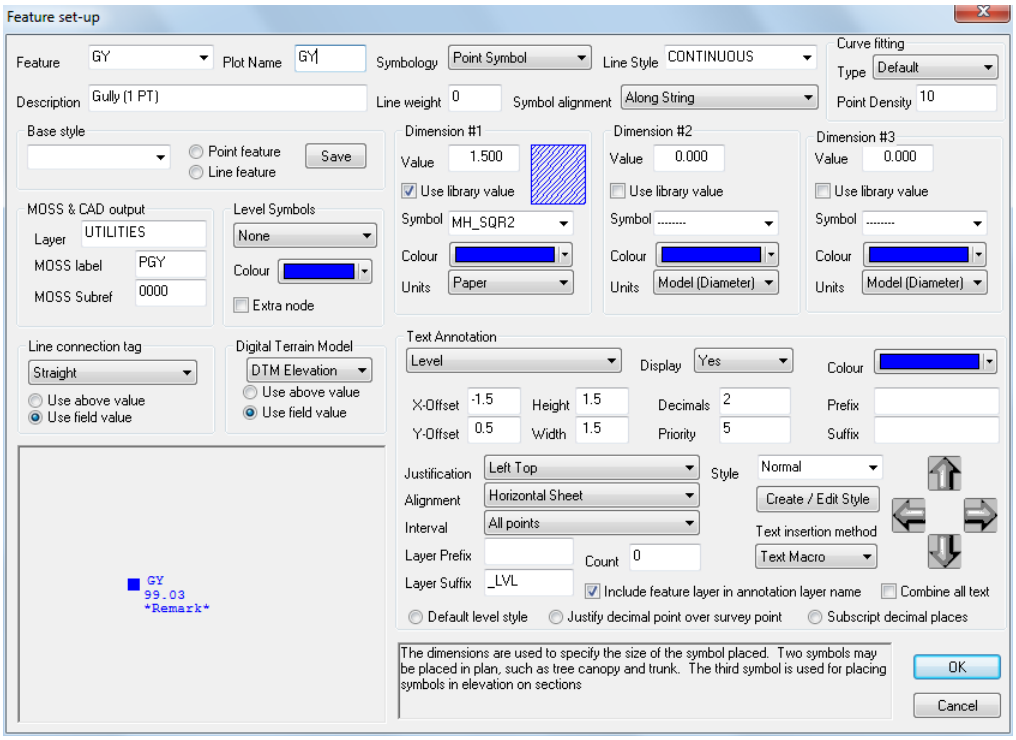
From the Main Menu Bar, select 'VIEW > Feature Library'

Select 'EDIT > Feature Wizard'

Select the feature from the drop down menu, set up the symbology, symbol, colour, text and CAD layer for instance.

For example, the feature 'GU' gully should have a symbology of 'Point Symbol' as observed as a single observation. A specific symbol can be assigned (MH_SQR1) and symbol size.

The user can also define what text to turn on and the position of such text within Text Annotation



Note: Additional Symbols can be imported from dxf/dwg

Select 'OK'

Many other features may need attention and in particular 3 point feature such as 'BT3' which should have a Line Connection Tag of 'Rec3' assigned and forced by the library ('Use above value' within the Feature Wizard)

In addition to the modification of the Feature Library Sheet, strung feature should have a starting string number assigned within the SDR Map translation library

Select 'VIEW > Advanced Survey Coding'

Go to 'LH' for example place '1' in the 'Str' column

Save Library

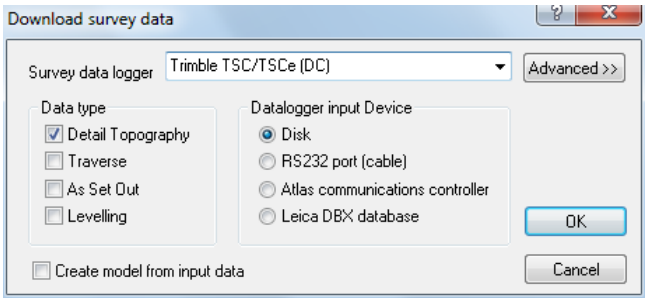
Download Steps

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'



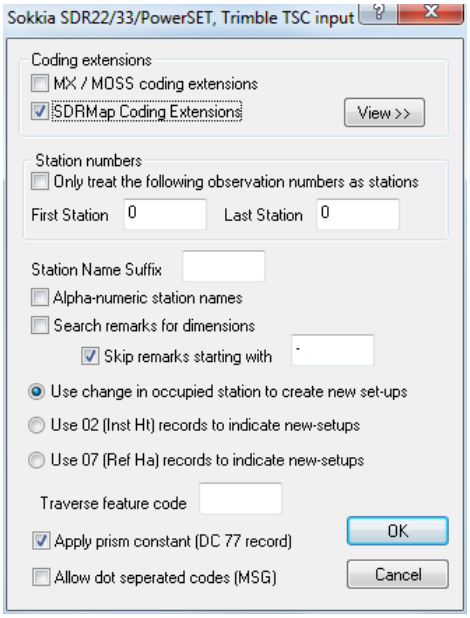
Select 'OK'

Select raw file

Select 'Open'

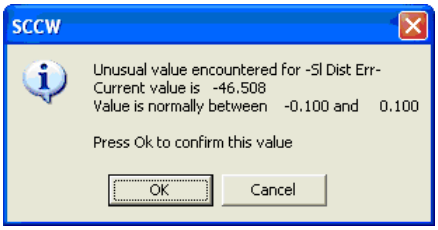
Select 'OK'

Set SDRMap Coding Extensions and 'Use change in occupied station to create new set-ups' as shown below

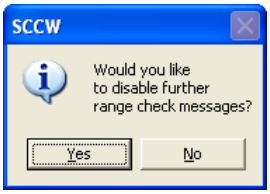


Select 'OK'

On download SCC range checks each observation, base on the settings within 'General Options > Units & Data Checking'. In this case, a spurious slope distance has been noted.



Select 'OK'



Select 'OK' to disable range checks

The log file will present any potential error which may need further investigation. Such spurious points can be eliminated by change the DTM status to 'I Ignore' within the Detail Observation Sheet and then select 'FILE > Rebuild Coordinates'

Further error check can be carried out by examining station set ups with 'VIEW > Instrument Setups'

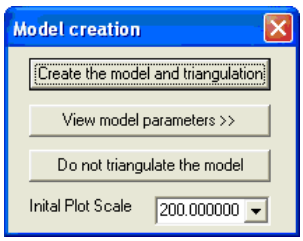
Save Dataset

Model Data

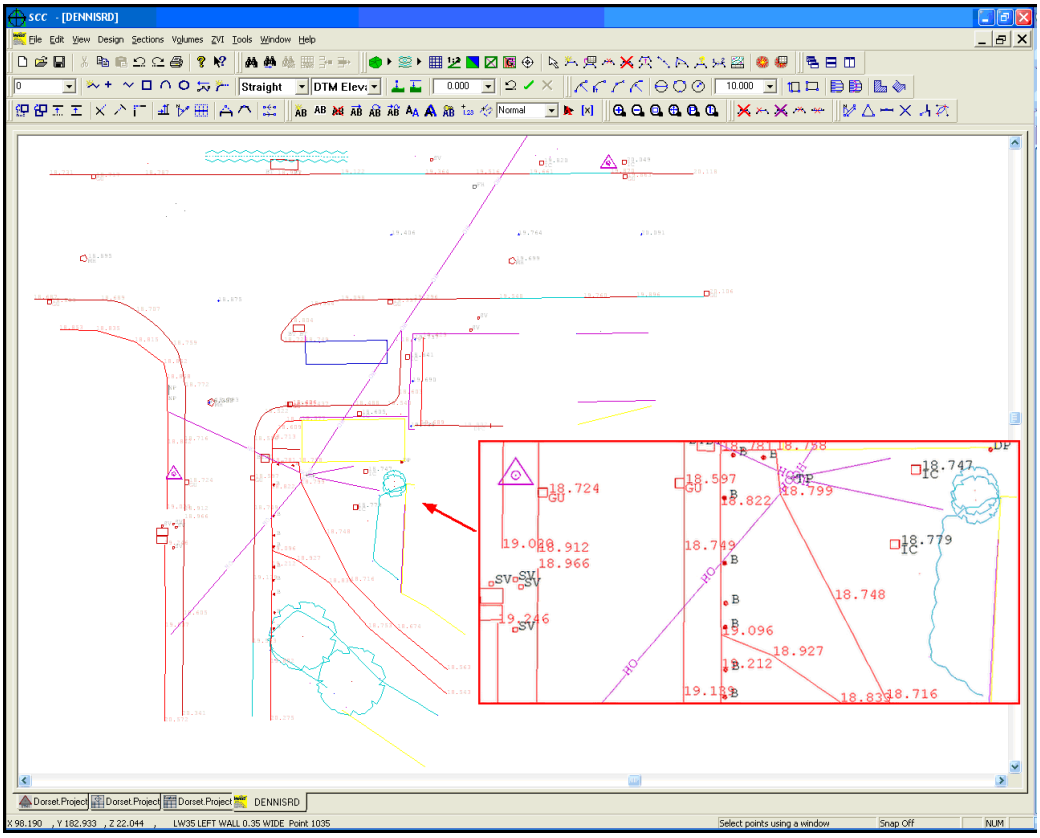
Select 'FILE > Model > SCC Dataset'

Select saved dataset

Select 'Create the model and triangulation' and set Intial Plot Scale of 200



Select 'OK' to Attributes summary dialog



3.2.3.8 Downloading MOSS Site Module Data

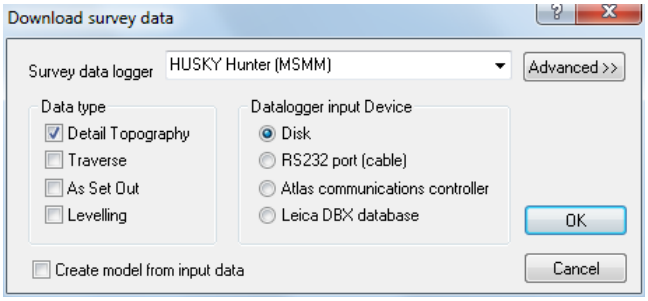
SCC supports MOSS Site Module format and can be processed as follows:

Go to 'FILE > Download Survey'

Select 'Husky Hunter (MSMM)' as the survey data logger

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Dsk', 'RS323 port (cable) 'or 'Atlas communications controller' as required



Select 'OK'

From the 'Tutorials' folder in the main SCC directory, highlight 'FGL1.G11', 'FGL2.G11' , 'FGL3.G11' and 'FGL4.G11' and 'Open'.

You will be presented with 4 SCC datasets called 'FGL1', 'FGL2', 'FGL3' and 'FGL4'.

These datasets will be automatically saved on download.

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3.2.3.9 Downloading X,Y,Z coordinates from GPS

The following examines downloading coordinate files into SCC using 'GPS XYZ' Download option. Note that in this case the coordinates are initially placed in the observation sheet, such that they can be processed by the survey reduction. This allows for curve fitting, squaring up strings, and completion of any other survey geometry.

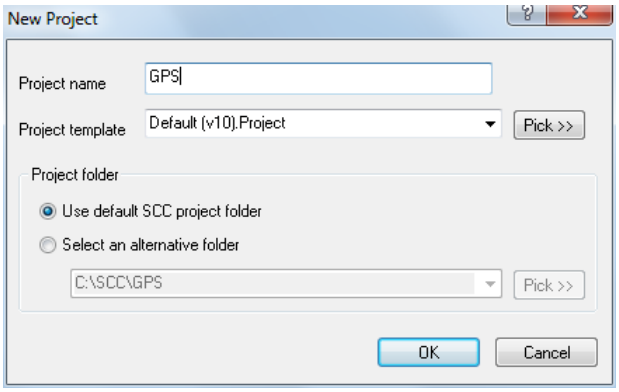
A. Setting up Project

Set up Project

Open SCC

Select 'FILE > New Project'

Enter the Project Name and attach the 'Default(v6-9 Complex).Project' template.



B. Download & Model Creation

Downloading the sample detail file

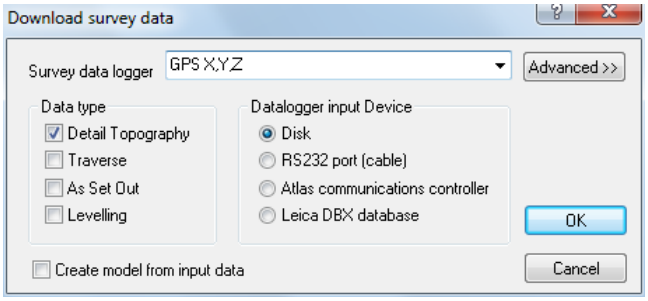
Go to 'FILE'

Select 'Download Survey'

Select 'GPS X, Y, Z' as the survey data logger

Select 'Detail Topography' as the data type and set the datalogger input device to 'disk'

Select 'OK'



Select 'GPSTEST.txt'

Extract of 'GPSTEST.txt'

```
121,936.4463,1078.9469,42.5348,WL,BRICK
122,935.3751,1076.8353,42.6115,WL,BRICK
123,932.9097,1072.0190,42.5418,WL,BRICK
124,932.2931,1070.8306,42.6371,WL,BRICK
125,931.0534,1068.3674,42.5873,WL,BRICK
126,927.4137,1062.1438,42.5386,TE,OAK
```

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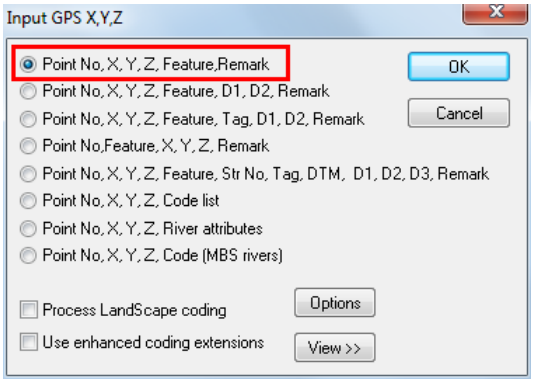
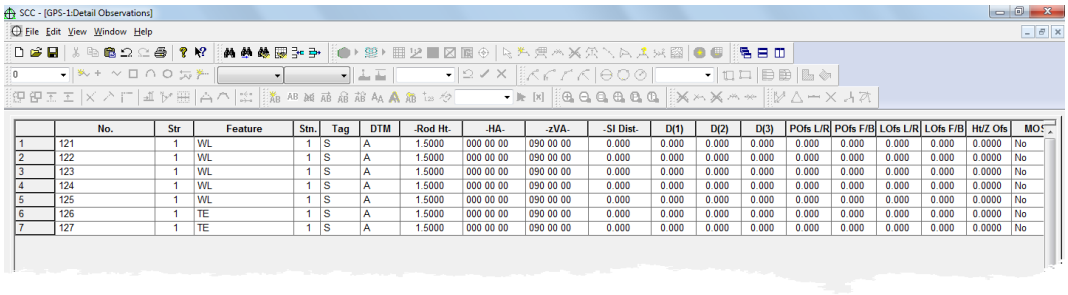
```
127,925.6250,1059.3698,42.5524,TE,ASH
```



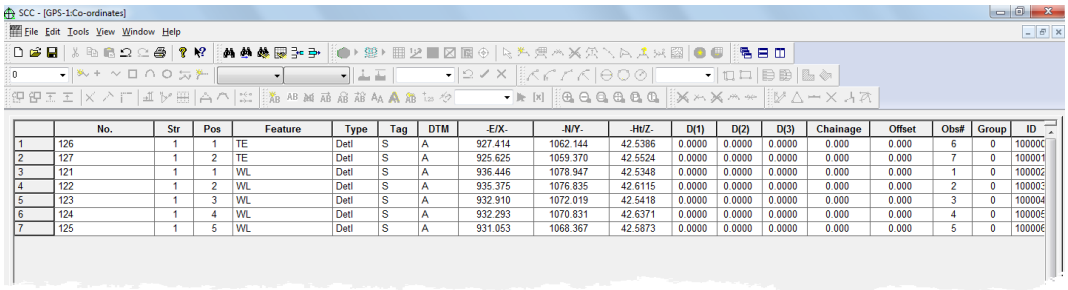
Select 'Point No., X, Y, Z, Feature, Remark

Select 'OK'

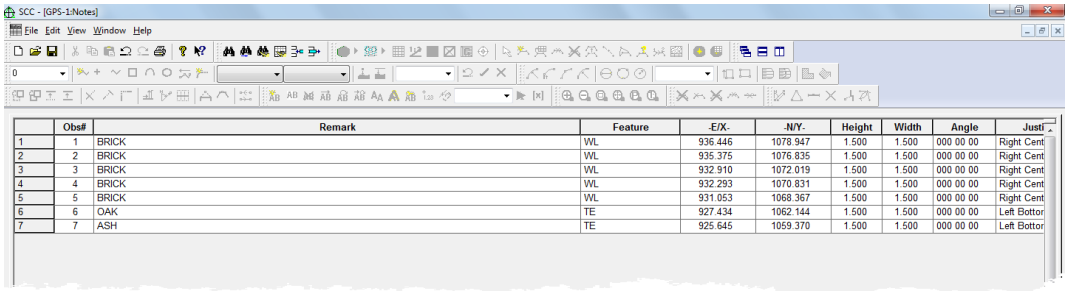
This method has the advantage of the 'Detail Observation' Sheet being available for editing.



	No.	Str	Feature	Stn.	Tag	DTM	-Rod Ht-	-HA-	-zVA-	-SI Dist-	D(1)	D(2)	D(3)	POfs L/R	POfs F/B	LOfs L/R	LOfs F/B	Ht/Z Ofs	MOS
1	121	1	WL	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
2	122	1	WL	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
3	123	1	WL	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
4	124	1	WL	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
5	125	1	WL	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
6	126	1	TE	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
7	127	1	TE	1	S	A	1.5000	000 00 00	090 00 00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	126	1	1	TE	Detl	S	A	927.414	1062.144	42.5386	0.0000	0.0000	0.0000	0.000	0.000	6	0	100000
2	127	1	2	TE	Detl	S	A	925.625	1059.370	42.5524	0.0000	0.0000	0.0000	0.000	0.000	7	0	100001
3	121	1	1	WL	Detl	S	A	936.446	1078.947	42.5348	0.0000	0.0000	0.0000	0.000	0.000	1	0	100002
4	122	1	2	WL	Detl	S	A	935.375	1076.835	42.6115	0.0000	0.0000	0.0000	0.000	0.000	2	0	100003
5	123	1	3	WL	Detl	S	A	932.910	1072.019	42.5418	0.0000	0.0000	0.0000	0.000	0.000	3	0	100004
6	124	1	4	WL	Detl	S	A	932.293	1070.831	42.6371	0.0000	0.0000	0.0000	0.000	0.000	4	0	100005
7	125	1	5	WL	Detl	S	A	931.053	1068.367	42.5873	0.0000	0.0000	0.0000	0.000	0.000	5	0	100006



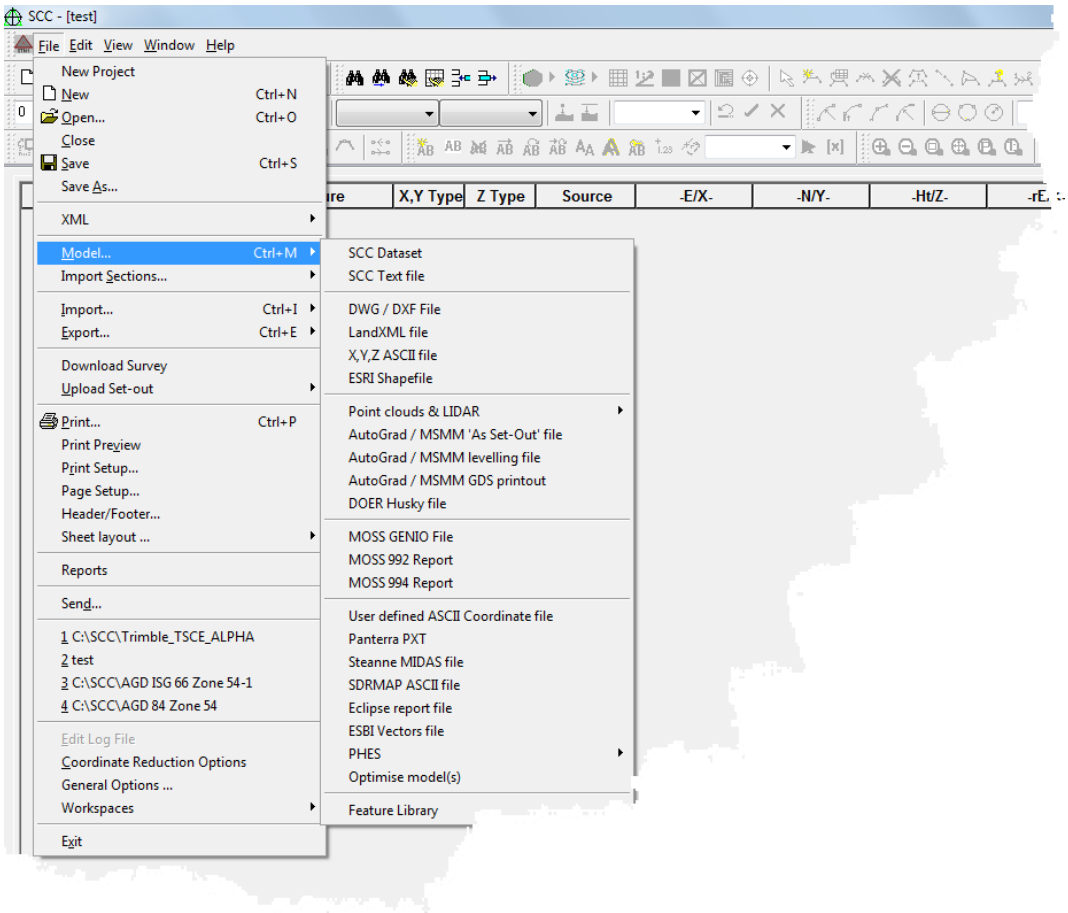
	Obs#	Remark	Feature	-E/X-	-N/Y-	Height	Width	Angle	Justi
1	1	BRICK	WL	936.446	1078.947	1.500	1.500	000 00 00	Right Cent
2	2	BRICK	WL	935.375	1076.835	1.500	1.500	000 00 00	Right Cent
3	3	BRICK	WL	932.910	1072.019	1.500	1.500	000 00 00	Right Cent
4	4	BRICK	WL	932.293	1070.831	1.500	1.500	000 00 00	Right Cent
5	5	BRICK	WL	931.053	1068.367	1.500	1.500	000 00 00	Right Cent
6	6	OAK	TE	927.434	1062.144	1.500	1.500	000 00 00	Left Bottor
7	7	ASH	TE	925.645	1059.370	1.500	1.500	000 00 00	Left Bottor

3.3 Creating A Model

A SCC model can now be generated using the survey dataset files.

3.3.1 Topographic Model Creation & Editing

A model in SCC is a visual representation of one or more surveys that includes all the annotated planimetry and a TIN surface model which in turn generates contours, slope lines, relief mapping, etc.. Note that all of the colours used within SCC, both foreground and background, are fully user definable to suit the users preference, and the media in use

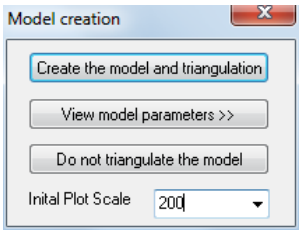


Before becoming a visual graphic representation, each model starts out as text in one form or another. The most common form of data files are SCC Datasets, DXF files, MX Genio and X,Y,Z ASCII files. These sources can be mixed and matched. SCC will keep track of where the data comes from. Your responsibility rests in choosing the right data to combine into your model.

Creating the Model

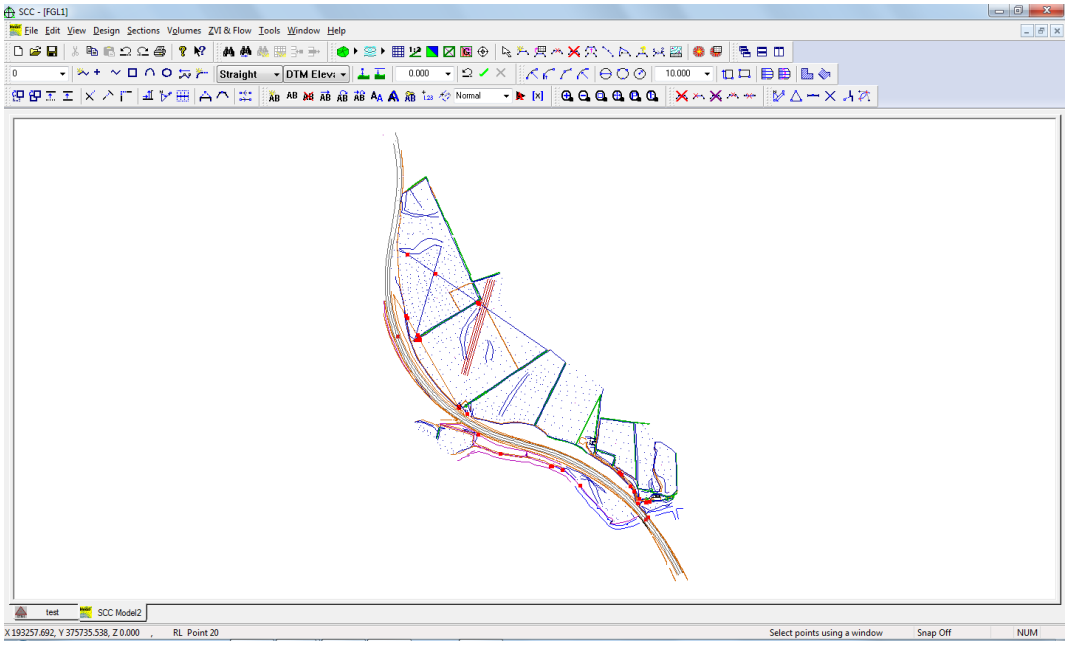
To create the model, go to 'FILE > Model > SCC Dataset > and select all 4 downloaded datasets.

Select 'Create the model and triangulation' and set Intial Plot Scale of 200



Select 'OK' to Attributes summary dialog

Your model should like the image below



3.3.2 Creating A Model from An External File

SCC can also create models from existing SCC data or directly from external files. The external co-ordinate files are files, which are imported into SCC.

3.3.2.1 Modelling A DXF File

The following examines the direct modelling of a DXF file

Select 'FILE > Model'

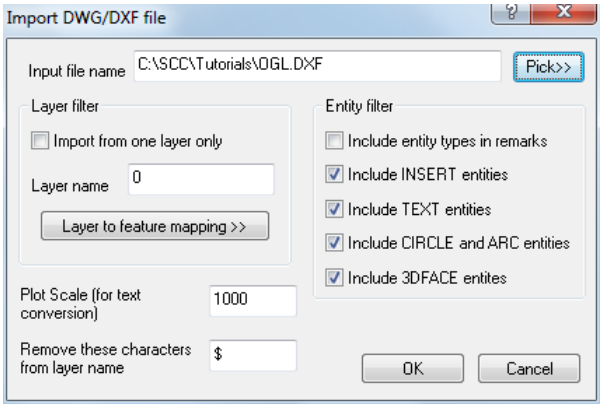
A dialog will be presented requiring the external file to be selected.

When querying the model using the Query and Edit Points (Model Edit Menu) option from the Edit menu only feature information will be available. If the file was imported, saved as a SCC dataset and then a model created feature and co-ordinate information would be available.

The option to Edit String Details under the Edit menu allows access to global editing without having to import the file.

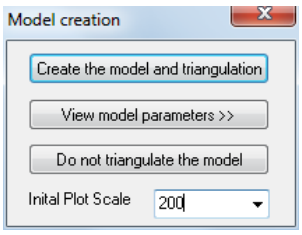
Select 'FILE > Model > DWG/DXF File'

Using the Pick button on the Import DXF file dialog, go to the \SCC\TUTORIAL\ directory and select the file OGL.



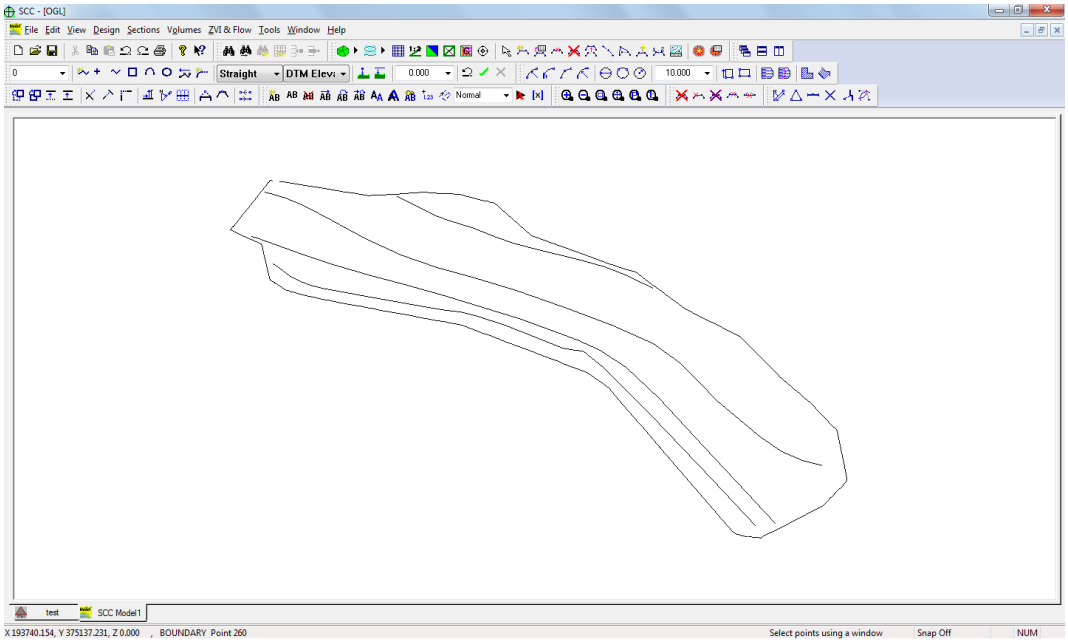
Select 'OK'

Select 'Create model and triangulation and set the Initial Plot Scale '200'



Select 'OK' for the SCCW window which summarises model attributes

The model OGL will be drawn:



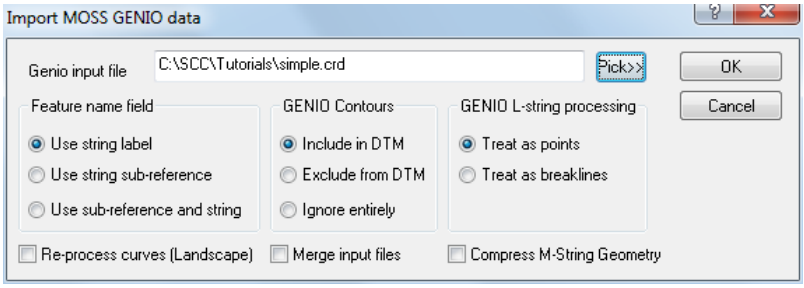
3.3.2.2 Modelling A GENIO File

The following examines the direct modelling of a GENIO file

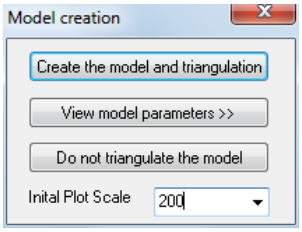
Go to 'File > Model > MX GENIO file'.

Select the file 'GROUND.CRD' from the TUTORIALS directory

Set the Feature Name field to 'Use string label', the GENIO Contours to 'Ignore' entirely and GENIO L-string processing to 'Treat as points'.

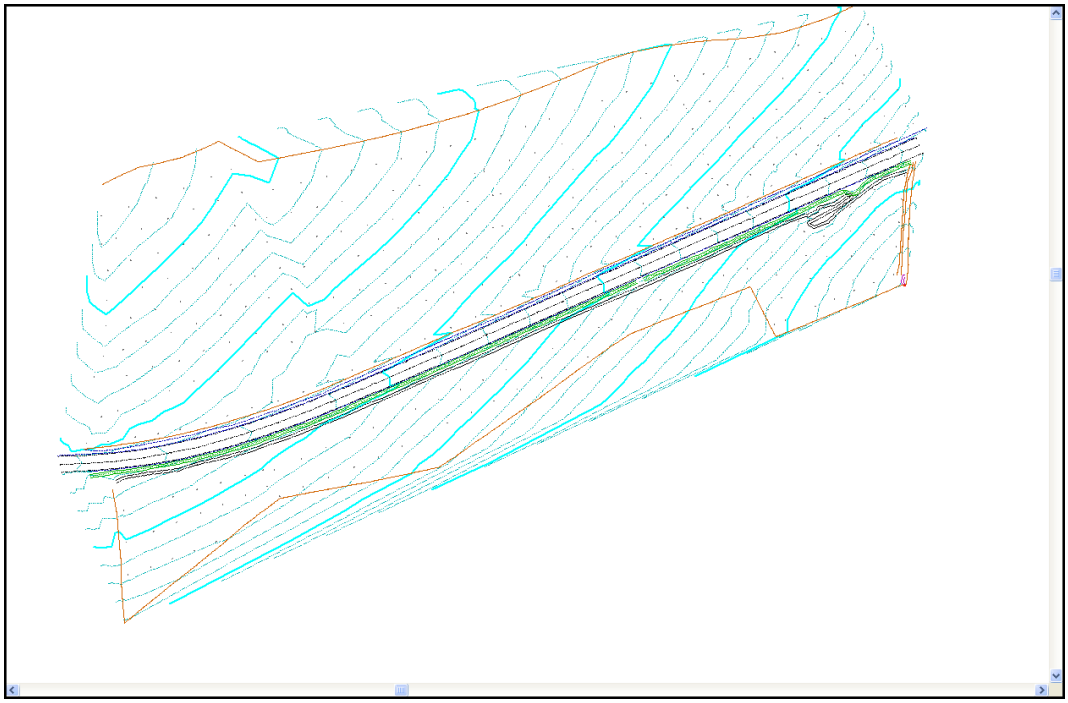


Select 'OK'



Set the Initial Plot Scale as '200'

Select 'Create the model and triangulation'



Go to 'FILE > Save'

Save the model as 'Ground.Model'

3.4 Triangle Editing

SCC supports two methods of triangulation: 'Delaunay' or '3D Nearest Neighbour'. Either of these may be selected depending on the requirements of the dataset under consideration. Generally the final model produced by either method for a given dataset will be almost identical.

Delaunay triangulation forms the set of most equilateral triangles for a set of points. As such it is deciding the final triangulation based on a purely 2 dimensional criterion and then adding elevations to form a surface. As a rule it normally gives the most even spread of

triangles, and hence interpolation results, particularly in areas where data is sparse.

3D nearest neighbour joins every point to all its nearest neighbours while not allowing any edges to cross. While not providing as even a spread of triangles as Delaunay, the triangulation is being weighted on a 3D criterion. This may often be more suitable for surfaces where strings have not been surveyed and points are being selected randomly from the surface, e.g. for bathymetric work. This is because triangle edges will form more along contours than across them, hence finding the equivalent of natural strings.

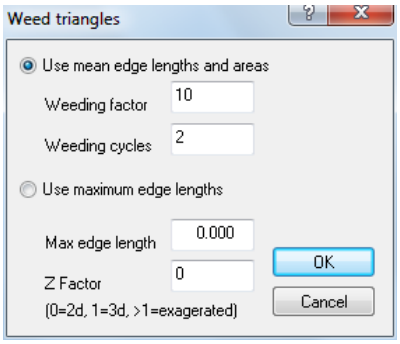
The triangulation is derived from the strings and points in the model. Therefore, all efforts should be made to edit the strings before editing the triangulation. Editing the triangulation allows further control over the final model surface and its boundaries.

Triangle Weeding

The simplest way of triangle editing is to 'Weed the Triangulation'.

Weeding Model Triangles

From the Main Menu Bar, select 'EDIT > Weed the Triangulation'



Select OK to accept the defaults 'Use mean edge lengths and areas'

The weeding factor determines how many standard deviations from the normal will be required to eliminate the triangle. A higher number will eliminate fewer triangles.

Weeding cycles determine how many times the system will run through this process.

Adding And Removing Triangles

The weeding defaults work reasonably well on most models but it is possible that some triangles may be eliminated from the interior of the model that you wish to keep. The 'A dd/Remove' option will allow you to replace any of those triangles.

Additionally, there may be triangles the weeding did not remove, that are invalid. These may be close to equilateral triangles crossing a concave area, or triangles interior to a building or other flat surface. The above option also allow you to remove any of these unwanted triangles.

By selecting 'EDIT' and then 'Add/Remove Triangles', you will activate the triangle editor. You know when this editor is active because the color of the triangles in your model will be filled in either green or blue. Triangles may be interactively selected or by using previously selected points. The invalid or removed triangles are shown in blue and the valid triangles are shown in green.

When you select this option a dialog will be displayed. This dialog allows you to control how the triangles are selected and the action you wish to apply to them.

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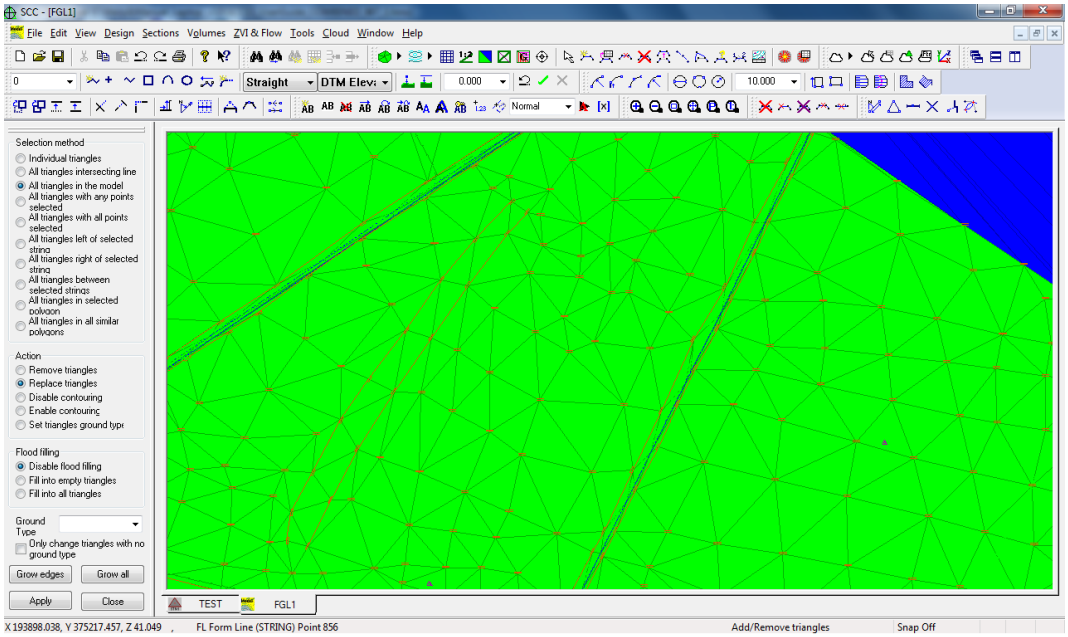


By selecting points in advance, for example all points on a road center line, it is very easy to set triangles by feature or string. In this case, selecting 'All triangles with any points selected' will usually refer to any triangle in contact with a road centre line. This will be much quicker than selecting triangles manually.

Triangle Editing

From the Main Menu Bar, select 'EDIT > Add and Remove triangles'

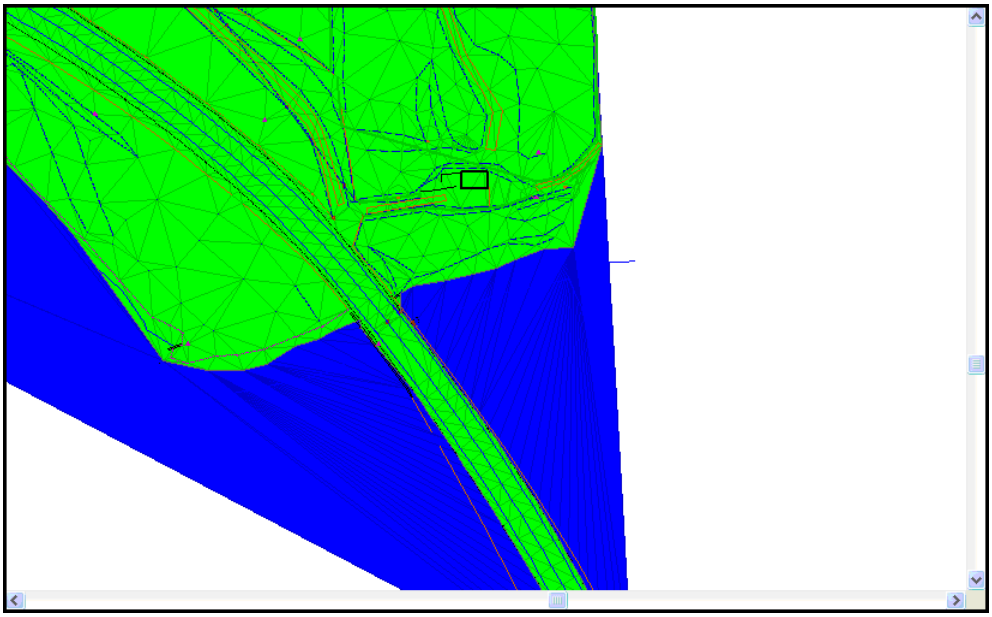
Highlight 'All triangles intersecting line'

Highlight 'Remove triangles'

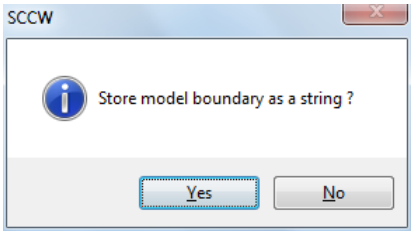
Click OK

Select the triangles shown in blue in the image below by left click mouse to start the intersecting line, move the cursor across triangle you wish to remove and then left click mouse to end intersecting line.

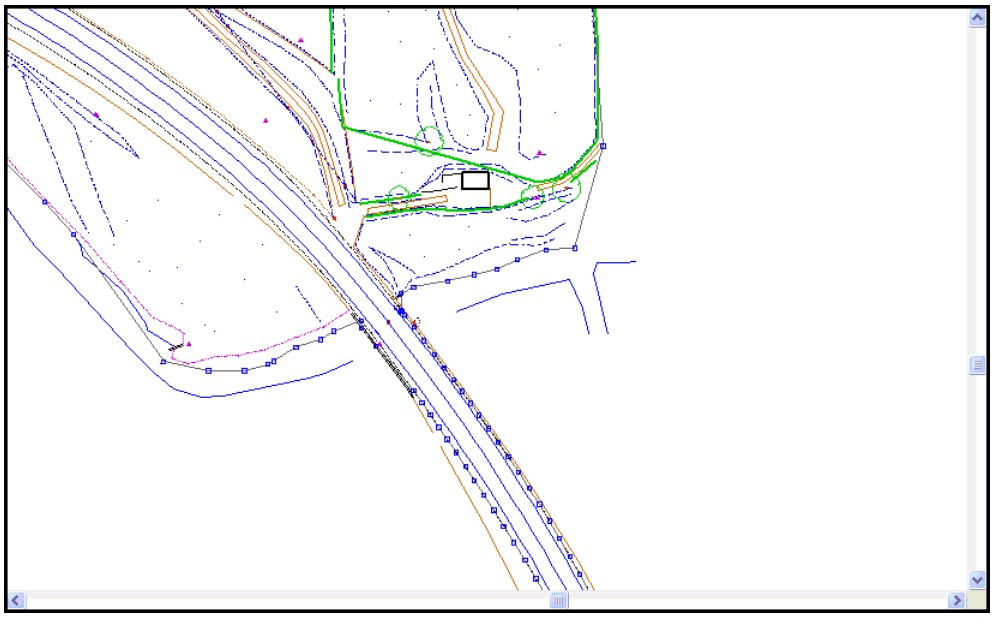
Select Close (or press ESC) when finished



SCC then gives you the option of storing the boundary you have created using the ‘ Add/Remove Triangles’ option, as a boundary string. If you say ‘Yes’ to this, a boundary string called '~BNDRY' is created and stored in your model. This is very useful especially when volume calculations may be needed.



Click 'Yes' to 'Store model boundary as a string'

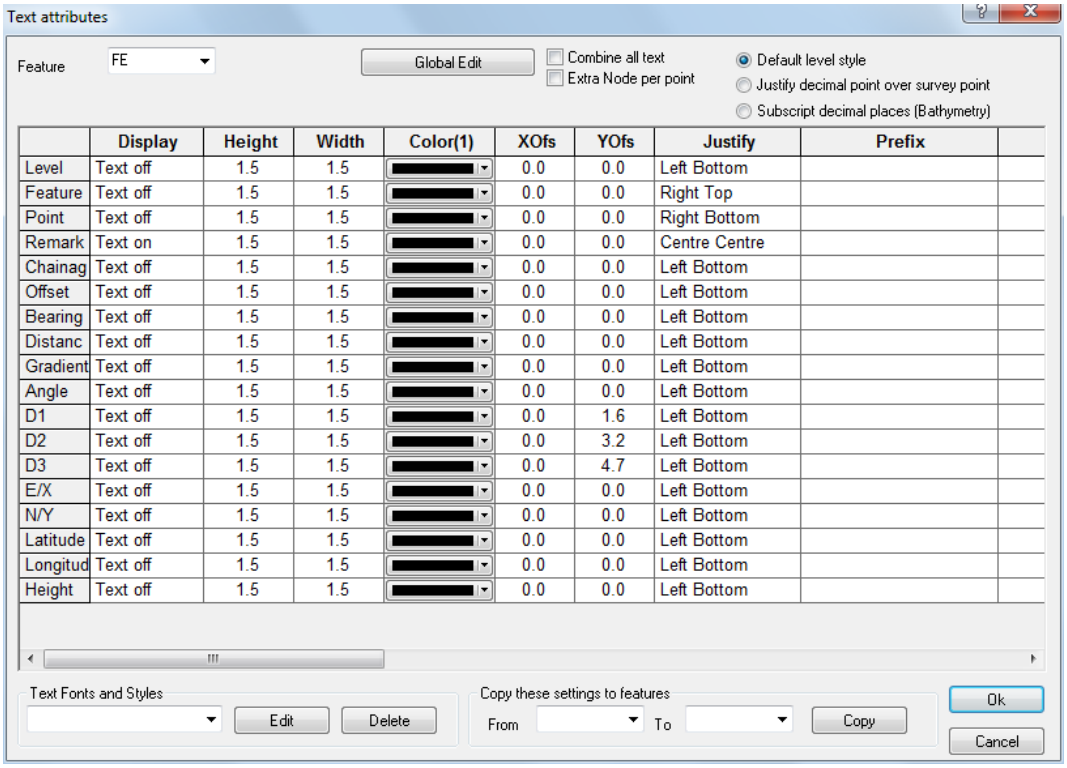


The ‘Add/Remove Triangles’ option also allows you to disable contours in a given area, but keeping the triangles active. For example, on a road, you may not want to display contours across the hard surface but will wish to generate profiles and cross sections of the road at a later stage. Removing the triangles from this area will mean that no sections can be generated at all so therefore you would use the ‘Disable contours’ option instead.

3.5 Annotation In The Model

In terms of text placement, SCC has eighteen automatically annotatable fields per point. For each of these fields it is possible to specify text size, width, position relative to the point, justification relative to the point, alignment relative to string, grid and sheet, suffix and prefix, output layer, font and style. Additionally you can specify whether to annotate all or selected points for this feature and field, and what the relative priority of this field is when automatically deleting overwriting text. This can all be set up in the feature library prior to download, thereby reducing the amount of work that needs to be done to produce the final plot.

Once in the model, these settings can be viewed through the ‘Query & Edit Points’ option from the ‘EDIT’ menu.



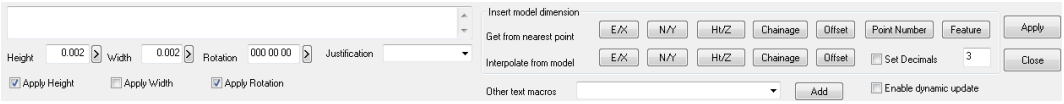
	Display	Height	Width	Color(1)	XOfs	YOfs	Justify	Prefix
Level	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Feature	Text off	1.5	1.5		0.0	0.0	Right Top	
Point	Text off	1.5	1.5		0.0	0.0	Right Bottom	
Remark	Text on	1.5	1.5		0.0	0.0	Centre Centre	
Chainag	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Offset	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Bearing	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Distanc	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Gradient	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Angle	Text off	1.5	1.5		0.0	0.0	Left Bottom	
D1	Text off	1.5	1.5		0.0	1.6	Left Bottom	
D2	Text off	1.5	1.5		0.0	3.2	Left Bottom	
D3	Text off	1.5	1.5		0.0	4.7	Left Bottom	
E/X	Text off	1.5	1.5		0.0	0.0	Left Bottom	
N/Y	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Latitude	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Longitud	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Height	Text off	1.5	1.5		0.0	0.0	Left Bottom	

However, it is recommended that any further editing of text should be done using one of the following options:

Text Node Editing

Create Text

This option allows you to add free form text and text macros to your model. Selecting it presents the 'Create / Edit Text' dialog shown below.



Type in the text you wish to add to the model. Then click on the model where you wish to insert the text. You may set the height, width, rotation and justification of the text in the dialog or interactively when the text is inserted into the model. Font information for the text will be determined by the current text style.

There is also the option of adding X,Y and Z co-ordinates (in text form) to the model using the nearest and interpolation macros available. To do this, select X,Y or Z from either 'Get from nearest point' or 'Interpolate from model' and hit the 'APPLY' button. As you move the cursor about the model, the text will be automatically updated, giving you either the interpolated co-ordinates of the point at the end of the cursor of the co-ordinates of the nearest point, depending on the option selected. Ticking the 'Enable dynamic update' option means that if at a later stage you have to move the text, it will be updated automatically to display the co-ordinates of the new position.

Edit Existing Text

This option allows you to edit existing text in the model. The option works in a similar manner to the create edit text option, but in this case you must initially select the text with the mouse, rather than entering it in the dialog.

Delete Text

This option allows you to delete existing text. Select this option and then select the text you wish to delete. To select the text, click on it with the mouse. Use the 'Data Selection Dialog' prior to selecting this option to delete a large amount of text at the same time.

Move Text

This option allows you to move existing text. Select the text by clicking on it and then moving it with the mouse to its position. Use the 'Data Selection dialog' prior to selecting this option to delete a large amount of text at the same time. Pressing the '*'key in move or rotate text changes the mode between moving and rotating the selected text item.

Rotate Text

This option allows you to rotate existing text graphically about the insertion point of the text. The insertion point of text is to the bottom left of the text. Use the 'Data Selection dialog' prior to selecting this option to rotate a large amount of text at the same time. This will give you an option to either set a fixed angle for all the selected text or add a relative rotation to that text.

Move and rotate text

This option combines the move and rotate function into one button. After selecting this option you can move text and then left click to change to rotate function.

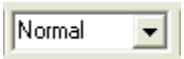
Resize Text

This option allows you to resize exiting text interactively on the screen. Use the 'Data Selection Dialog' prior to selecting this option to resize a large amount of text at the same time.

Copy Text

This option allows the user to copy text and paste the text multiply.

Text Style



The text style controls the font and effects for model text. To set the style of text nodes in the model, first use the 'Data Selection Dialog' to select the text nodes you wish to modify, then select the desired text style from the list given in this control.

Edit Text Style

This option allows you to create or edit a text style, using the standard Windows Font dialog. To create a text style, enter the name of the style and press this button. To edit an existing text style, select the name of the style and press this button. Apart from being displayed and plotted in SCC, text styles may be exported to CAD.

Unlock Text

This allows you to convert associative dimension text into literal text, in order to make it editable. Once dimensional text has been unlocked it is converted into remarks text for the purposes of the model annotation dialog. Use the 'Data Selection Dialog' prior to selecting this option to unlock a large amount of text at the same time. This option is only applicable for annotation items that have an feature library 'Insert Method' set to ' Associative Dimension'. This will typically only be the case when working with very large models.

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Show / Hide Macro Text [x]

This option shows or hides text macro details, in order to let you see how various text items have been created, and what they represent. Text macros are typically used for annotating point dimensions, such as elevation and point number. All feature library text macros will appear as '[VTX]' with any appropriate prefixed and / or suffixes. A complete list of text macros currently in use in SCC is given below

Macro Name	Description
[VTX]	Any point annotation generated by the feature library
[Name]	The file title of the current model
[Path]	The full file name and folder location of the current model
[Scale]	The plot scale
[Client]	The client name, entered in the 'Scales, titles and grids' dialog.
[Date]	The date, entered in the 'Scales, titles and grids' dialog.
[Surveyor]	The surveyor name, entered in the 'Scales, titles and grids' dialog.
[ProjectTitle]	The project title, entered in the 'Scales, titles and grids' dialog.
[Project]	The SCC project name.
[Operator]	The operator name, entered in the 'Scales, titles and grids' dialog.
[Time]	The current system date and time.
[Version]	The SCC version number
[Page]	The number of sheets in the model
[Pages]	The sheet number currently being plotted or displayed.
[ContourScale]	A graphic representing the colour contour scale for relief contours
[ModelX]	The X ordinate of the text node
[ModelY]	The Y ordinate of the text node
[ModelZ]	The Z ordinate of the text node, interpolated from the triangulation
[ModelChainage]	The chainage of the text node, interpolated from the active alignment
[ModelOffset]	The offset of the text node, interpolated from the active alignment
[NearestX]	The X ordinate of the nearest model point to the macro text node
[NearestY]	The Y ordinate of the nearest model point to the macro text node
[NearestZ]	The Z ordinate of the nearest model point to the macro text node
[NearestChainage]	The chainage, generated from the active alignment, of the

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	nearest model point to the macro text node
[NearestOffset]	The offset , generated from the active alignment, of the nearest model point to the macro text node
[NearestD1]	The first dimension of the nearest model point to the macro text node
[NearestD2]	The second dimension of the nearest model point to the macro text node
[NearestD3]	The third dimension of the nearest model point to the macro text node
[NearestPoint]	The point number of the nearest model point to the macro text node
[NearestFeature]	The feature name of the nearest model point to the macro text node
[Stn <n> Name]	The name of the <n>th station in the model, normally used for creating station schedules in sheet layouts.
[Stn <n>X]	The X ordinate of the <n>th station in the model
[Stn <n>Y]	The Y ordinate of the <n>th station in the model
[Stn <n>Z]	The Z ordinate of the <n>th station in the model
[Stn <n>]	The name X,Y and Z of the <n>th station in the model
[Ftr <n> Name]	The name of the <n>th feature in the model,normally used for creating legends in sheet layouts.
[Ftr <n> Layer]	The layer name of the <n>th feature in the model
[Ftr <n> Title]	The description of the <n>th feature in the model
[Ftr <n>]	The name, layer name and description of the <n>th feature in the model
[DrawFtr <n>]	A graphic sample of the <nth> feature in the model
[Fcode <n> Name]	The name of the feature, with feature named <n>in the model, normally used for creating fixed coded legends in sheet layouts.
[Fcode <n> Layer]	The layer name of the feature named <n>in the model
[Fcode <n> Title]	The description of the feature named <n> in the model
[Fcode <n>]	The name, layer name and description of the feature named <n> in the model
[DrawFcode <n>]	A graphic sample of the feature named <n> in the model
[Signature]	A graphic of the surveyor's signature, created by the PocketDTM ADC module. Used for signed models.

Toggle Text On/Off

This option turns on or off all the text associated with a given point and is provided as an alternative to manually deleting text, or using the delete overlapping text option.

Align Text To A String

This option aligns text to a given reference string, either interactively or by pre-selecting a number of text nodes.

Edit Text Annotation

As briefly discussed previously this option is used in conjunction with the 'Data Selection Dialog' and is extremely useful for annotating individual points and strings.

Once your model has been downloaded, all survey points will be annotated using the settings from the feature library. However, depending on the number of points in the model, some strings/points may become cluttered and illegible. Using the 'Data Selection Dialog' allows you to highlight individual points, selected strings or points in a specific area, and change the annotation settings without changing those in the feature library. The 'Edit Text Annotation' dialog also contains several annotation settings that are not contained within the main feature library.

Using The Edit Text Annotation Tool

Right click the mouse to bring up the 'Data Selection Dialog'

Select 'All points on selected string' and make sure that 'Mark all points' is selected.

Select 'OK'

Pick any point on a string by left click mouse

All points should be highlighted

Go to 'EDIT > Text > Edit Text Annotation'

Turn on or off the annotation settings as desired.

Using the 'Edit Text Annotation' option is purely a model function and does not effect the annotation settings in the feature library.

Feature Annotation

The feature annotation option is similar to the string annotation option except that it allows the user to add annotation to the model by feature rather than selected points or strings. Remember that a feature refers to all strings of the same type, such as all hedges, all walls etc. Group information set up within the feature library is also displayed within the Feature Annotation dialog. This allowing the user to modify, select and display data based on their defined group.

Viewing Feature Annotation

Select 'VIEW > Feature Annotation'

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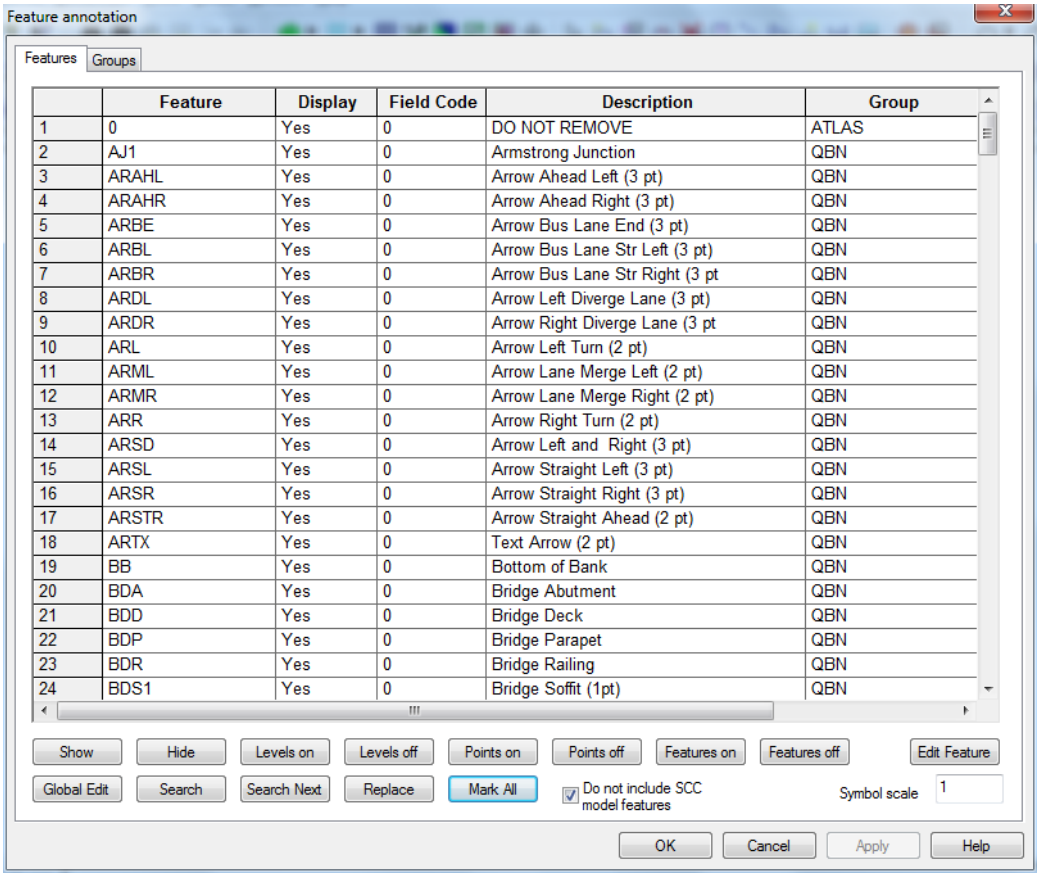
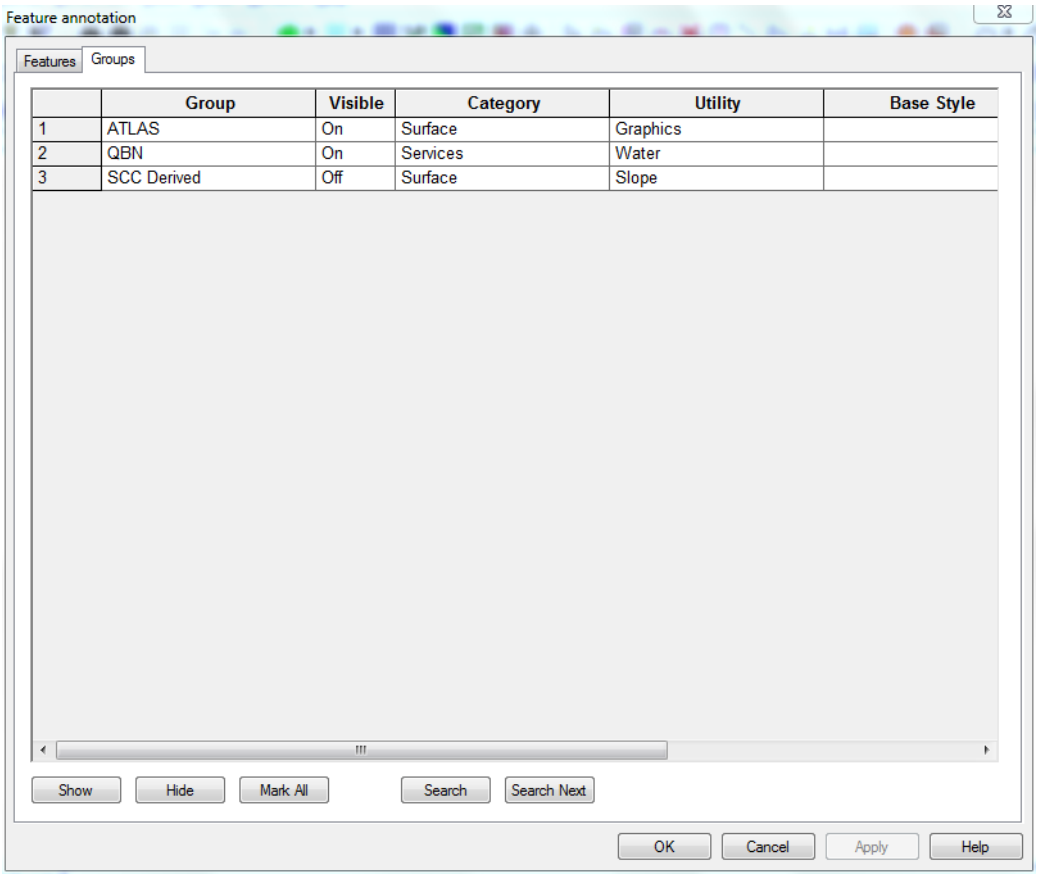


	Feature	Display	Field Code	Description	Group
1	0	Yes	0	DO NOT REMOVE	ATLAS
2	AJ1	Yes	0	Armstrong Junction	QBN
3	ARAHL	Yes	0	Arrow Ahead Left (3 pt)	QBN
4	ARAHR	Yes	0	Arrow Ahead Right (3 pt)	QBN
5	ARBE	Yes	0	Arrow Bus Lane End (3 pt)	QBN
6	ARBL	Yes	0	Arrow Bus Lane Str Left (3 pt)	QBN
7	ARBR	Yes	0	Arrow Bus Lane Str Right (3 pt	QBN
8	ARDL	Yes	0	Arrow Left Diverge Lane (3 pt)	QBN
9	ARDR	Yes	0	Arrow Right Diverge Lane (3 pt	QBN
10	ARL	Yes	0	Arrow Left Turn (2 pt)	QBN
11	ARML	Yes	0	Arrow Lane Merge Left (2 pt)	QBN
12	ARMR	Yes	0	Arrow Lane Merge Right (2 pt)	QBN
13	ARR	Yes	0	Arrow Right Turn (2 pt)	QBN
14	ARSD	Yes	0	Arrow Left and Right (3 pt)	QBN
15	ARSL	Yes	0	Arrow Straight Left (3 pt)	QBN
16	ARSR	Yes	0	Arrow Straight Right (3 pt)	QBN
17	ARSTR	Yes	0	Arrow Straight Ahead (2 pt)	QBN
18	ARTX	Yes	0	Text Arrow (2 pt)	QBN
19	BB	Yes	0	Bottom of Bank	QBN
20	BDA	Yes	0	Bridge Abutment	QBN
21	BDD	Yes	0	Bridge Deck	QBN
22	BDP	Yes	0	Bridge Parapet	QBN
23	BDR	Yes	0	Bridge Railing	QBN
24	BDS1	Yes	0	Bridge Soffit (1pt)	QBN



	Group	Visible	Category	Utility	Base Style
1	ATLAS	On	Surface	Graphics	
2	QBN	On	Services	Water	
3	SCC Derived	Off	Surface	Slope	

Note that Feature Annotation option modifies the models feature library,

and re-annotates all strings for any features that are altered. This is liable to **undo** other text editing and should be used with caution. If you have already carried out a significant amount of text editing, use 'Edit Text Annotation' instead.

Delete Overlapping Text

This option allows SCC to delete any overlapping text based on the number entered in the 'Priority' field of the text attributes in the feature library. Each piece of associated text is given a number and the higher the number, the higher the priority. Therefore, if there are two pieces of text overlapping where the point number has a priority of 3 and the elevation has a priority of 6, then, the point number will be deleted. This option can be used in conjunction with the 'Data Selection Dialog' to highlight either certain areas, features or strings.

Delete Overlapping Text Using The Data Selection Dialog

First, press the 'Escape' button. This will cancel any active editing process.

Press the right mouse button and the 'Data Selection Dialog' should appear.

Select 'All point in a window'

Select 'OK'

In the model, draw a window around the area in question.

All points within this area should be highlighted blue.

Go to 'EDIT > Text > Delete Overlapping Text'

SCC will then inform you of how many pieces of text were deleted during the process.

Any remaining text can then be interactively moved, rotated, resized, deleted or edited. Text that has been deleted can also easily be restored using the 'Annotate Strings' tool, which again works best in combination with the data selection tool.

4 The Feature Library

The feature library controls how survey spreadsheets are translated into graphical SCC models, CAD drawings, and MX models. It includes a large number of fields for each survey feature that control how it is drawn, annotated, modelled, and output. Each project in SCC should have its own feature library.

See Also

Feature Naming Conventions & The Feature Library

Feature Library (View Menu)

To set-up a new feature it is often easiest to use the feature wizard as follows;

Type the feature name and description into the boxes at the top right of the dialog.

Pick a base style that most closely matches the feature you are creating. Scrolling through the base styles is a good way of looking at how different features can be drawn.

Change the CAD layer, MX label, and any other fields as required.

To change any annotators, select the annotator in question from drop down menu, e.g. Level, and then modify the other annotation fields.

If you wish to create a number of other features with a similar look, type in a new base style and press 'Save'.

When you have finished, press OK

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Select 'File > Save' or 'File > Save As' to save the project.

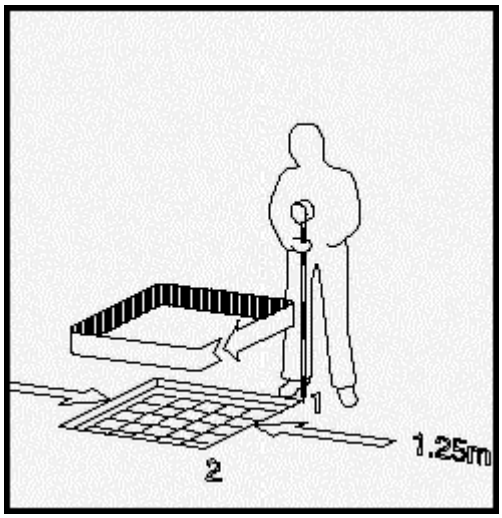
If you wish to change a field value for a large number of features, it will be quicker to do this directly in the feature library spreadsheet using the search and replace function.

4.1 Using the Feature Library

This section describes how to record specific features in the field and then set up SCC so as it will automatically draw these specific features when they are downloaded.

4.1.1 Creating Rectangles (Using the Feature Library)

The rectangle option speeds up the process of surveying rectangular features such as inspection covers, road gullies or simple buildings. The surveyor need only record two successive points while moving in a clockwise direction around the feature. The breadth of the feature must then be entered in the dimension field of the data logger.



To generate rectangles in SCC the switch Create squares and rectangles in the Co-ordinate Reduction options menu of the Detail co-ordinate file (Coordinate Reduction Options (File Menu)) must be turned on, and the symbology field for that particular feature name must be set to Rectangle in the Feature Library (Feature Library (View menu).

Note that if any feature is inadvertently surveyed in an anti-clockwise direction then the rectangle will be generated on the wrong side of the surveyed line. This can be corrected by reversing the string direction using the global editor.

See Also

Creating Strip Levels (Using the Feature Library)

Creating Trees (Using the Feature Library)

Inaccessible Linear Features

4.1.2 Creating Strip Levels (Using the Feature Library)

Surveying the centre-line of a linear feature such as a track, ditch or wall generates a strip-level. As the surveyor progresses along the centre-line the width of the feature must be entered into the dimensional field in the survey data recorder.

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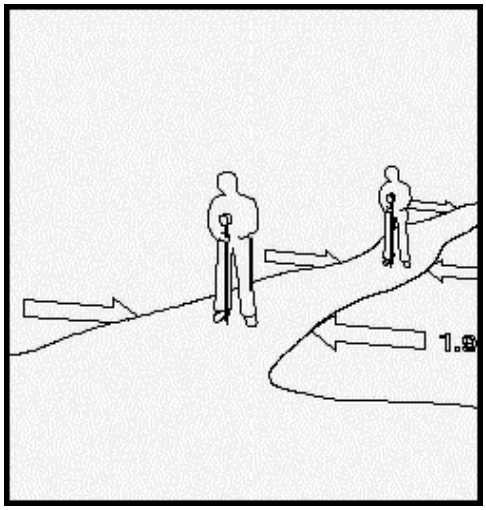
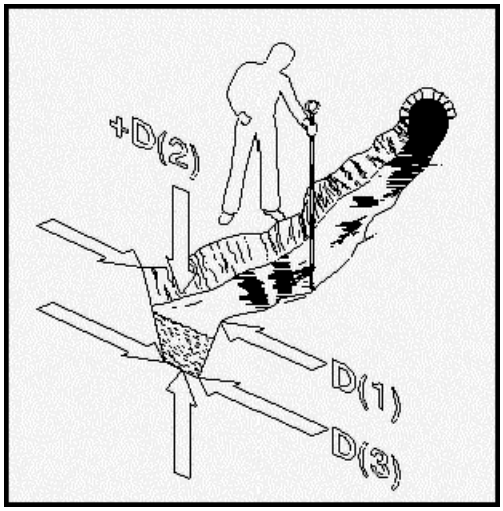


When the survey data is processed in SCC the feature will be displayed as a strip of the appropriate width. The centre-line will not be displayed. In order to have specific features treated as strip-levels the following options must be set within SCC; in the Detail Co-ordinate File menu go to co-ordinate reduction options (Coordinate Reduction Options (File Menu) and turn on the switch to Create `Strip levels', and in the Feature Library the symbology field for that particular feature name must be set to Strip level (Feature Library (View menu). Note that all instances of that feature will now be treated as a strip-level.

SCC provides the option to model three-dimensional strip-levels. Thus, features such as streams, ditches or walls may be surveyed as a series of points along the centre-line with an associated width for the top and the base; the height or depth of the feature at each surveyed point should also be recorded. In the case of a stream the rod will typically be placed on the stream bed, the strip-level dimensions should be entered into the data logger's dimensional fields as indicated in the diagram.



Note that the depth of the stream course will be positive if the rod is placed on the bed. To have all streams treated as strip-levels set the options within SCC as described above.

In the case of a wall, the dimensions should be entered into the survey data recorder dimension fields as illustrated in figure below. Note that because the top of the wall has been observed the height should be entered into the second dimensional field as a negative value. In order to have walls treated as strip-levels in the SCC model, follow the procedure described above. The second width (that is the third dimensional field) must always be less than the first width as over-hangs cannot be triangulated. If the first and second dimensions are recorded, but the third field is omitted SCC will supply a default width for the third field (the value for the first dimension will be copied into the third dimension).

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See Also

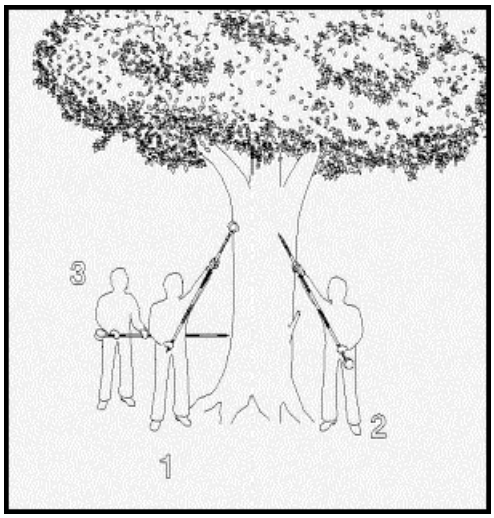
Creating Rectangles (Using the Feature Library)

Creating Trees (Using the Feature Library)

Inaccessible Linear Features

4.1.3 Creating Trees (Using the Feature Library)

SCC places two symbols for trees; one representing the canopy and the other the trunk. The process of surveying a tree is illustrated in the diagram. Generally, the reflector is first placed to the side of the trunk such that the observer can measure the distance from the instrument to the centre of the trunk. The centre-line of the trunk - relative to the instrument - is then indicated so that the instrument operator may hold the observed distance fixed whilst observing the correct horizontal angle; these are then downloaded to the data recorder as a pair. Finally, the assistant will measure the mean canopy and trunk diameters; these will be entered in the D (1) and D (2) fields of the data logger respectively. In order to have trees appear as scaled symbols in the model the following options must be set within the SCC feature library; you must enter the symbol name Tree in the Symbol field for the feature TREE and symbology field must be set to Scaled Point.



See Also

Creating Rectangles (Using the Feature Library)

Creating Strip Levels (Using the Feature Library)

Inaccessible Linear Features

4.1.4 Inaccessible Linear Features

The diagram illustrates the process of surveying an inaccessible linear feature; in this instance a wall, which is obscured by a hedge. The feature is recorded as an offset; an offset right in this example, as the wall lies to the right of the line of progress. A series of points are observed in convenient positions and the offset distance to the wall is entered into the dimensional field of the data recorder. SCC treats offsets to the right as positive and those to the left as negative. To have offsets processed you must set the Parallel feature offsets switch in the co-ordinate reduction options dialog to Apply in the X-Y Plane. This option may be found in the File menu of the Detail Observations and Detail Co-ordinate spreadsheets. The other settings within this option are used when processing building facade surveys

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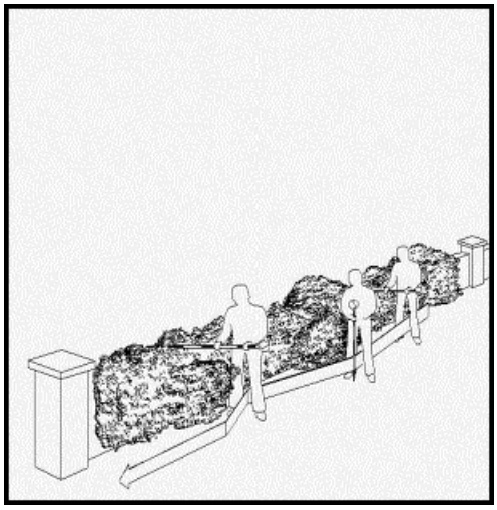


See Also

Creating Rectangles (Using the Feature Library)

Creating Strip Levels (Using the Feature Library)

Creating Trees (Using the Feature Library)

4.1.5 Developing SCC Feature Library for use with MX

The following outlines the implementation of MX coding within an SCC Feature Library. SCC's ability to create customised MX styles set and macros based on the SCC library are described. Furthermore, a systematic quality check is outlined to verify MX codes, MX styles sets and MX macros.

MX Codes

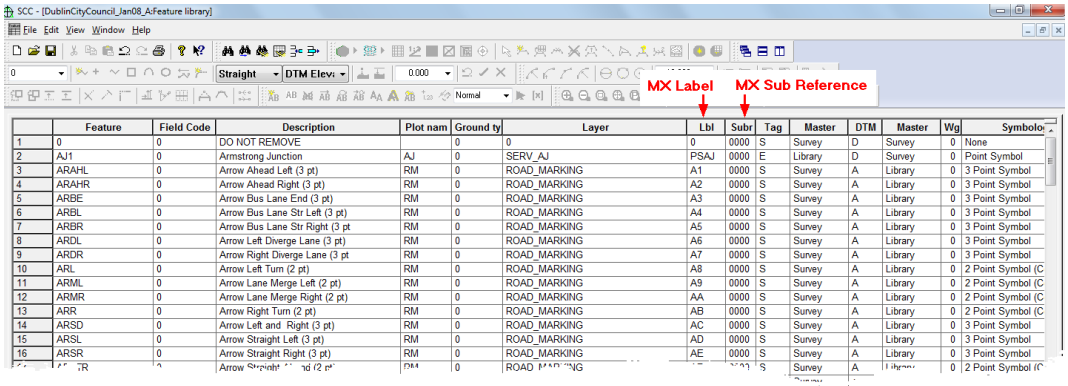
MX Codes can be entered in the feature library either directly within the Feature Library table or within the 'Feature Wizard'

Go to 'FILE > Open'

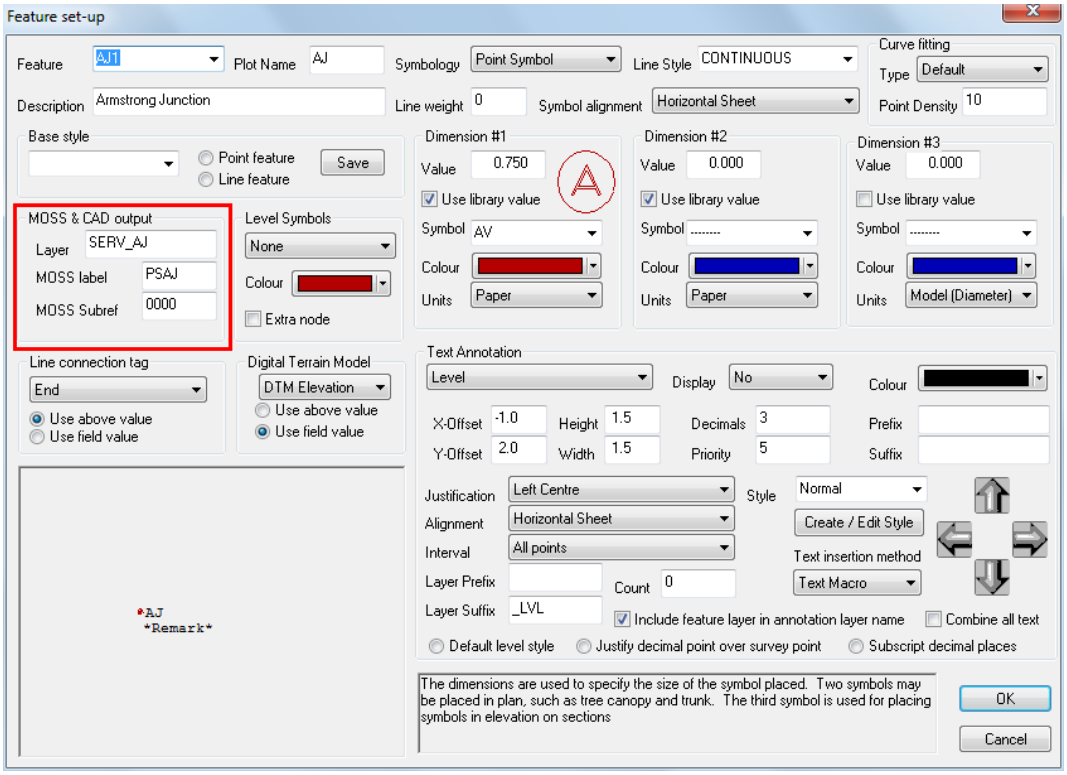
Open 'Default (v6-14 Complex). Project'

Select 'VIEW > Feature Library'

MX codes can be assigned to each feature within the Feature Library table or with the use of the Feature Wizard



	Feature	Field Code	Description	Plot nam	Ground ty	Layer	Lbl	Subr	Tag	Master	DTM	Master	Wg	Symbolo
1	0	0	DO NOT REMOVE		0	0	0	0000	S	Survey	D	Survey	0	None
2	AJ1	0	Armstrong Junction	AJ	0	SERV_AJ	PSAJ	0000	E	Library	D	Survey	0	Point Symbol
3	ARAHL	0	Arrow Ahead Left (3 pt)	RM	0	ROAD_MARKING	A1	0000	S	Survey	A	Library	0	3 Point Symbol
4	ARAHR	0	Arrow Ahead Right (3 pt)	RM	0	ROAD_MARKING	A2	0000	S	Survey	A	Library	0	3 Point Symbol
5	ARBE	0	Arrow Bus Lane End (3 pt)	RM	0	ROAD_MARKING	A3	0000	S	Survey	A	Library	0	3 Point Symbol
6	ARBL	0	Arrow Bus Lane Str Left (3 pt)	RM	0	ROAD_MARKING	A4	0000	S	Survey	A	Library	0	3 Point Symbol
7	ARBR	0	Arrow Bus Lane Str Right (3 pt	RM	0	ROAD_MARKING	A5	0000	S	Survey	A	Library	0	3 Point Symbol
8	ARDL	0	Arrow Left Diverge Lane (3 pt)	RM	0	ROAD_MARKING	A6	0000	S	Survey	A	Library	0	3 Point Symbol
9	ARDR	0	Arrow Right Diverge Lane (3 pt	RM	0	ROAD_MARKING	A7	0000	S	Survey	A	Library	0	3 Point Symbol
10	ARL	0	Arrow Left Turn (2 pt)	RM	0	ROAD_MARKING	A8	0000	S	Survey	A	Library	0	2 Point Symbol (C
11	ARML	0	Arrow Lane Merge Left (2 pt)	RM	0	ROAD_MARKING	A9	0000	S	Survey	A	Library	0	2 Point Symbol (C
12	ARMR	0	Arrow Lane Merge Right (2 pt)	RM	0	ROAD_MARKING	AA	0000	S	Survey	A	Library	0	2 Point Symbol (C
13	ARR	0	Arrow Right Turn (2 pt)	RM	0	ROAD_MARKING	AB	0000	S	Survey	A	Library	0	2 Point Symbol (C
14	ARSD	0	Arrow Left and Right (3 pt)	RM	0	ROAD_MARKING	AC	0000	S	Survey	A	Library	0	3 Point Symbol
15	ARSL	0	Arrow Straight Left (3 pt)	RM	0	ROAD_MARKING	AD	0000	S	Survey	A	Library	0	3 Point Symbol
16	ARSR	0	Arrow Straight Right (3 pt)	RM	0	ROAD_MARKING	AE	0000	S	Survey	A	Library	0	3 Point Symbol



MX Coding Convention:

Strings:

- Are individual features of a model
- Contain linked points of digital information
- Identified by a string label
- String Label consist of a maximum of four alphanumeric characters
- Strings may contain as few or as many points as you wish

String Features, for example:

- Point strings – no link at all between the points. Used for features such as trees, road signs, telegraph poles, and manhole covers etc.
- Null Levels (Z = -999.0) - Are set on strings where the elevation is not required. Any points with null levels will be ignored by any vertical analysis function such as sectioning.

String Labels:

- All strings have a four character string label
- Four alphanumeric codes are assigned for single string generation
- Coding must be unique and explicate
- Some string types require particular first character

  -M used for Master alignment strings

  -G used for Geometry strings

  -P used for point strings

Features with Varied Dimension:

When designing an SCC Feature Library for use with MX, the user must be aware that all points with a varied dimension, for example, Trees, Hedges and Walls, will produce a separate style set file which should be drawn within MX, in addition to the ground model.

Symbol Naming:

MX symbols are restricted to an 8 character name. Therefore, all symbols used with the SCC library should be limited to 8 character names before export. This may require the user to rename existing symbols.

Creation / Export of MX Style Sets

MX Not Installed on PC:

Before exporting style sets, if MX is not installed on the local PC, it is important to create the directory '\Mfw\styles' to which SCC can export the necessary files. All style sets and macros are output to '\Mfw\styles'.

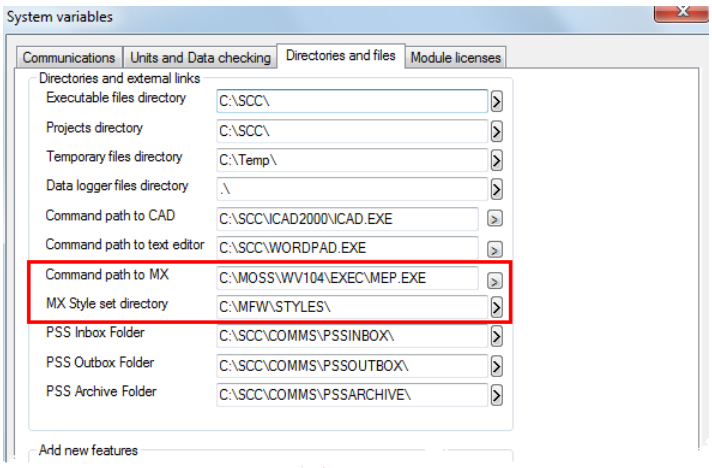
As a final step the user separates the style set files into a '\styles' folder and the macros into '\macros' folder for use within MX.

MX Installed on PC:

On the other hand, if MX is installed on the local PC, both a '\styles' folder and \macros' folder have been created during the MX installation.

The Mfw style set directory path can be defined within SCC System Variables

'FILE > General Options > Directories & Files'



Style Sets and Macro files are export to this location.

It is important that when SCC outputs the required files that no files of the same name are overwritten.

The new styles set are added to the existing MX styles sets.

The following options are available for the new macro symbols:

1. The new macro files can be placed in a new '\macros' folder replacing the existing MX '\macro' folders present from the installation. This is not often desirable as other projects may require the original macro symbols.

2. The new macros can be copied and added to the existing original '\macros' folder. However, it is important not to overwrite existing macros of the same

name. That is, some newly created macro symbols may have the same name as the original macro symbols provided on installation.

3. The existing macros folder can be renamed (e.g. '\macros_Original') and a new macro folder created and placed in the same directory. Therefore, the user has the option to use either folder. MX always uses the macros within the folder ' \macros'.

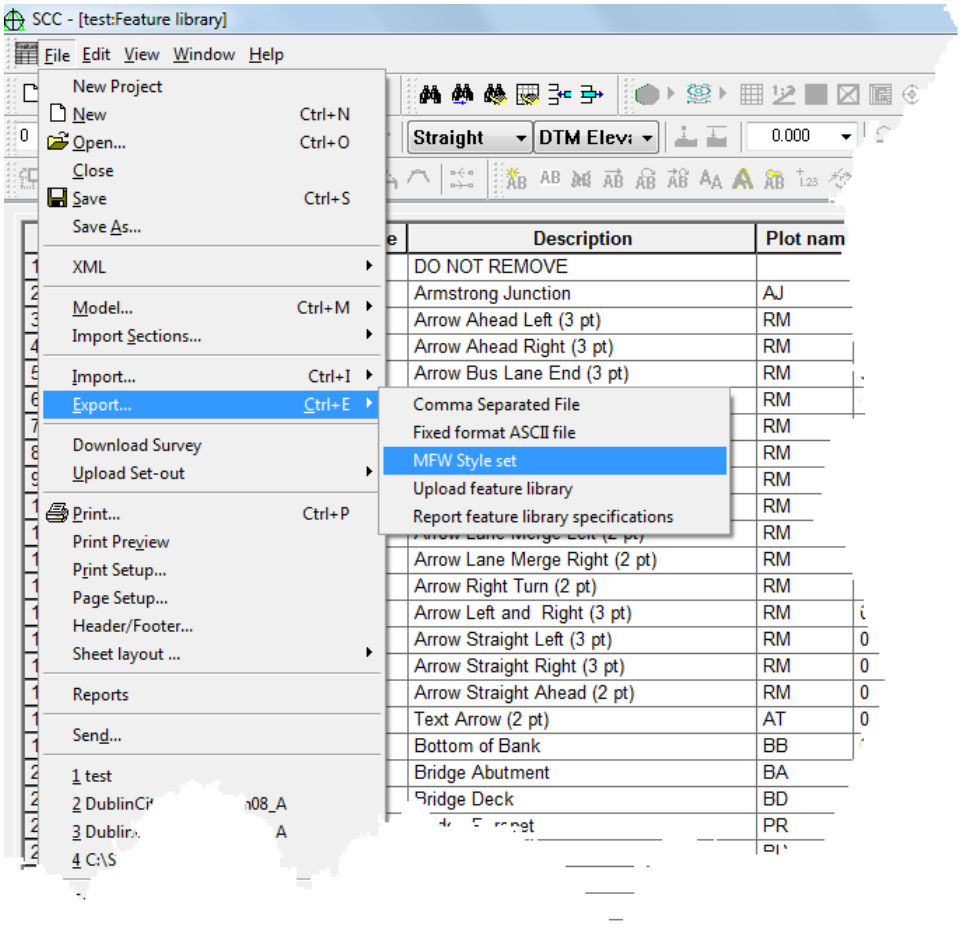
   For example, when processing a project created from 'SCC.Project' the user ensures that the macros folder created from SCC is entitled '\macros' and the original renamed to '\macros_Original'.

   On the other hand, when processing a project, which requires the original macros, the user renames the macros folder created from SCC '\macro_SCC' and ensures that the original symbols are in '\macros' folder.

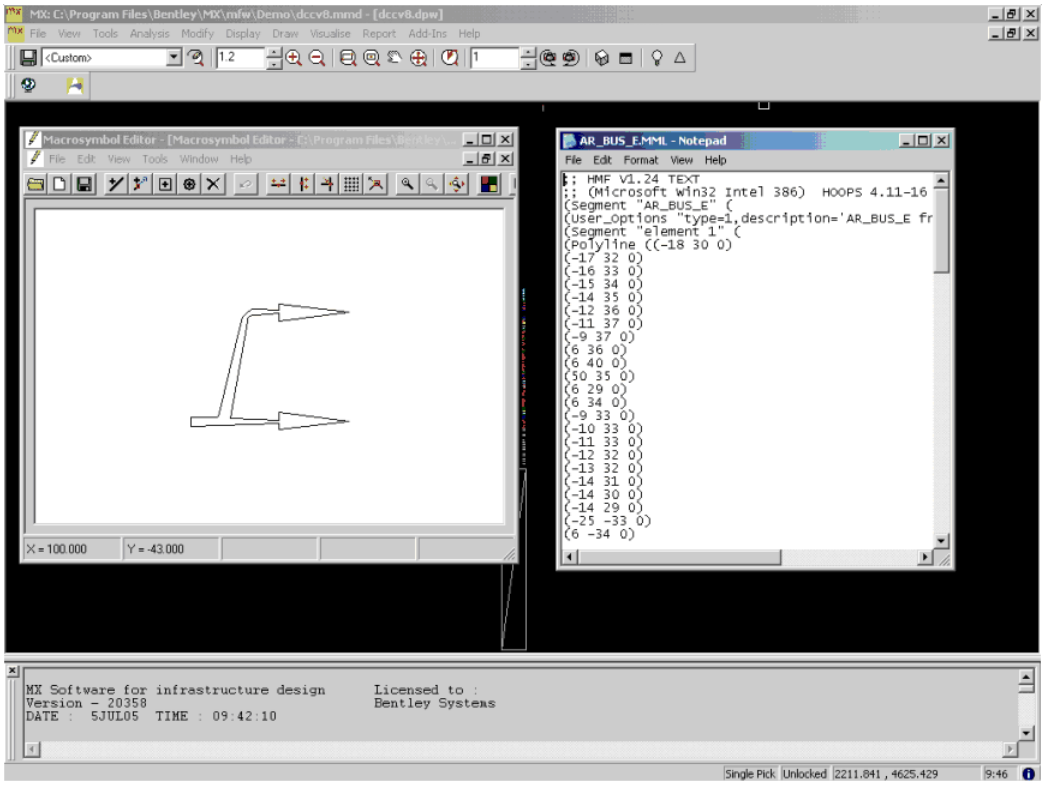
Export MX Style Sets

With the Feature Library open, select 'FILE > Export >MX style sets'

SCC creates *.PSS file, *.FNS file and the associated macros *.mml and *.mms within ' \Mfw\styles'



All newly created symbols can be viewed and edited within MX's Macrosymbol Editor



Check / Verification of MX Codes & Styles Sets

An important check to verify MX codes, Styles Sets and Macros can be can be carried out by:

- modeling the Feature Library within SCC
- creating a GENIO file of this model
- importing the GENIO into MX using the relevant styles sets and macros previously created from SCC

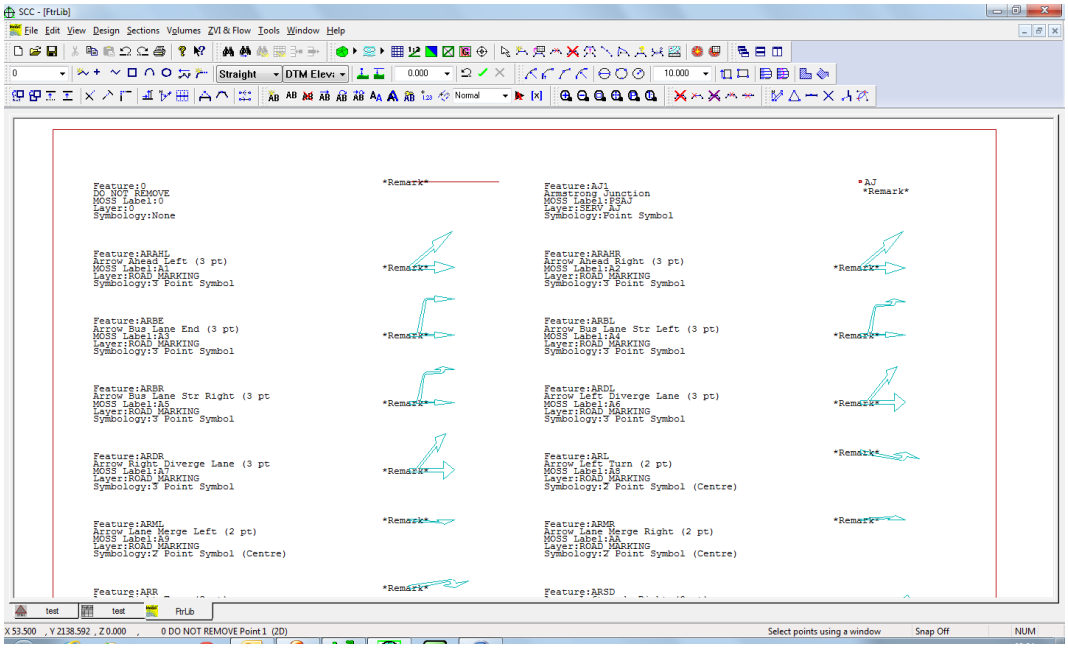
Model Feature Library

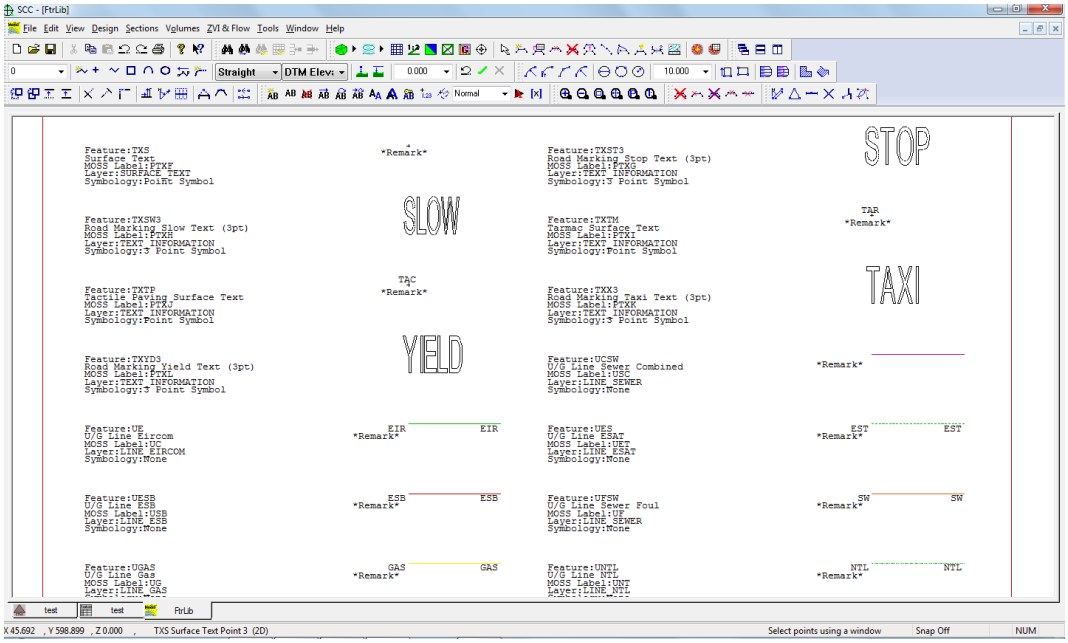
Go to ‘FILE > Open’

Open ‘Default (v6-14 Complex). Project’

Select ‘FILE > Model > Feature Library'

Select ‘OK’ to create the model





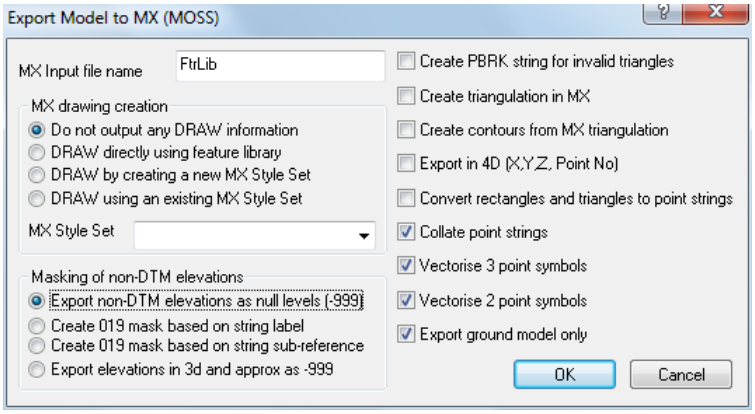
Save Model

Go to 'FILE > Save As > Default. Model'

Export Model

Select 'FILE > Export Model > MX Model'

Enter File Name and set up relevant settings:



MX

Ensure that the required styles sets and macros are in the correct MX directory.

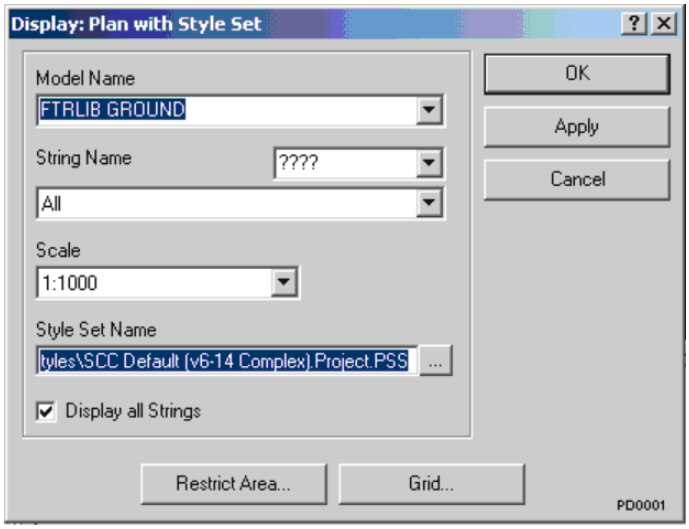
Open MX

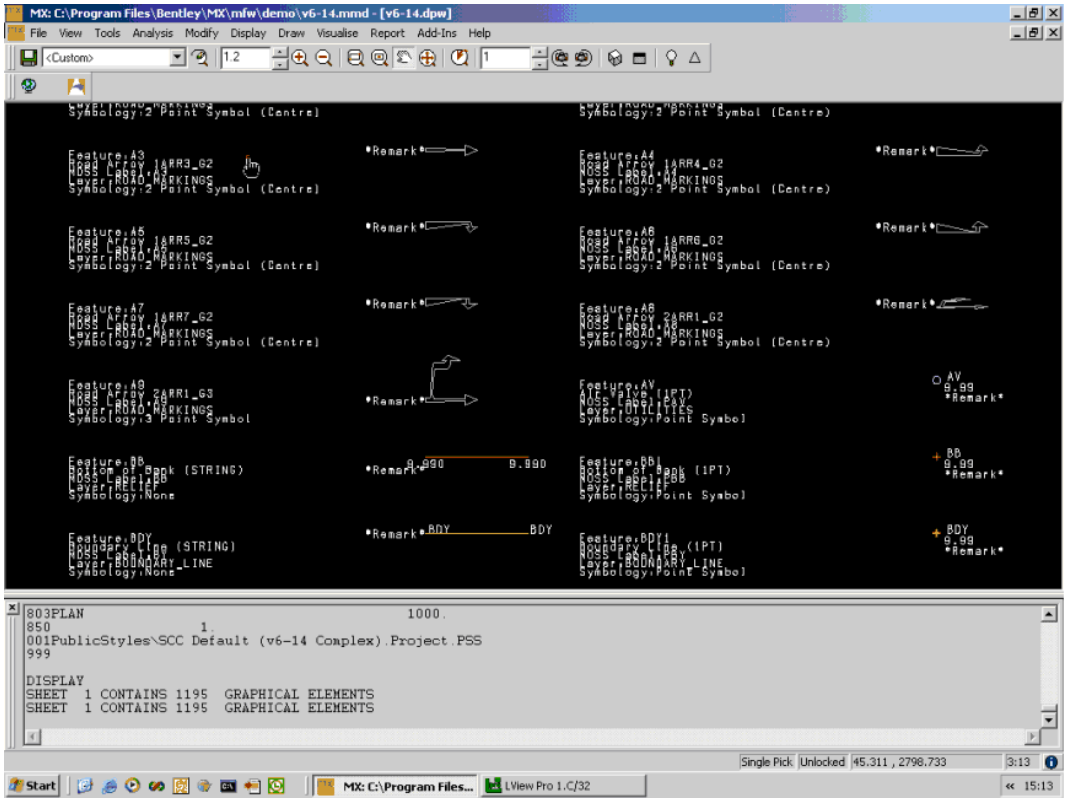
Set up New Project

Go to 'FILE > New Plan Display' and enter title

Import 'FtrLib.inp MX file

Go to 'DISPLAY > Plan with Style Set…' and set up the following:





In turn, it is necessary to draw the additional style sets for features of varied dimensions.

4.1.6 Symbol Creation & Insertion

The feature library contains all the symbols used to create model features within SCC. These symbols can be point symbols, such as trees and lampposts, or line symbols, such as hedges, fences etc. Symbols can be created in SCC and copied to the current project or imported from AutoCAD or Microstation. Symbol options are available from the edit menus in the model and project.

Importing Symbols from DXF

Symbols may be drawn in AutoCAD/Microstation, exploded and saved. Go to 'FILE > I mport Symbols from DXF' and the new symbols will be added to the current project file.

Creating New Symbols in SCC

It is just as easy to create new symbols in SCC whether the design is from a DXF file or drawn in SCC itself.

Create a New Symbol

Go to 'FILE > New >SCC model' – this creates a blank model from which to work

Create your symbol using the 'Add Strings With Cursor' option and 'Update In Model' when you are finished.

Click on the right mouse button.

Select 'All Points In Window'

Put a window around all your points

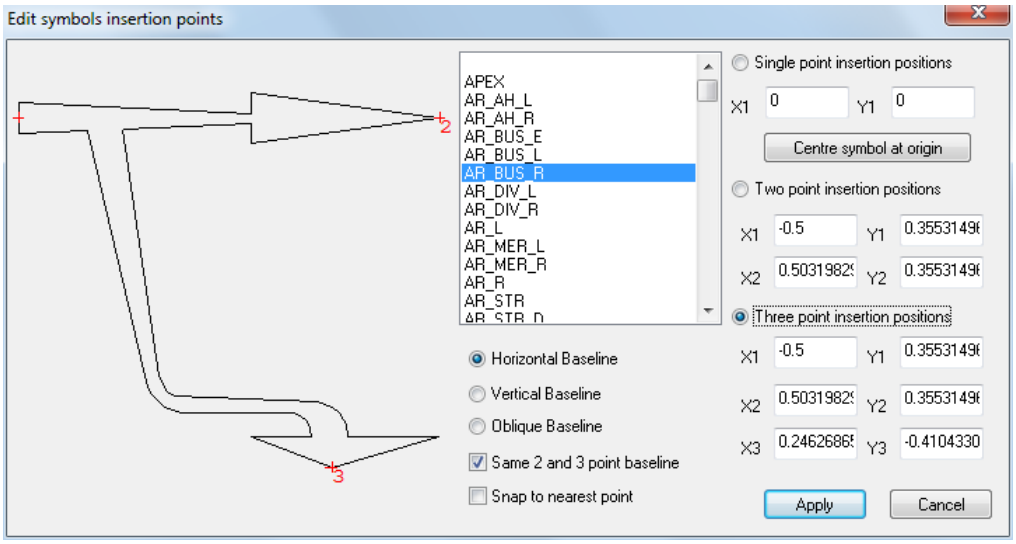
Go to 'EDIT > Symbols' and select 'Create New Symbol'

Type in a name for the symbol.

Select OK.

Setting Symbols Insertion Points

SCC Symbols may be inserted into SCC using one, two or three points. The symbol's insertion points correspond to the points observed in the field by the surveyor, when surveying the feature represented by that symbol. The symbology field in the feature library determines how the survey points are used to determine the position, size and orientation of the symbol. To edit a symbol's insertion points select 'Edit > Symbols > Edit Symbol Insertion' points. This will display the dialog shown below.



Each symbol has a separate set of insertion points for insertion by one, two and three points. When inserting symbols by three points, the third point is used to determine the orientation and lateral dimension. If the first two points lie on the same horizontal or vertical base line, the third point can be picked up on either side of that base line. Thus a turn left symbol can also be used as a turn right symbol.

Inserting Symbols Into The Model

The selected data has now been copied to the project feature library as a new symbol. This symbol can now be inserted into the model either manually or by using the 'Query & Edit points' option. All inserted symbols can be edited, rotated and scaled similar to the characteristics of freeform text.

To insert a symbol for a surveyed point, it is best to use the 'Query & Edit Points' option from the 'EDIT' menu. Changing the feature symbol using this option, will automatically update all the points in the model with the same feature.

Changing A Feature Symbol

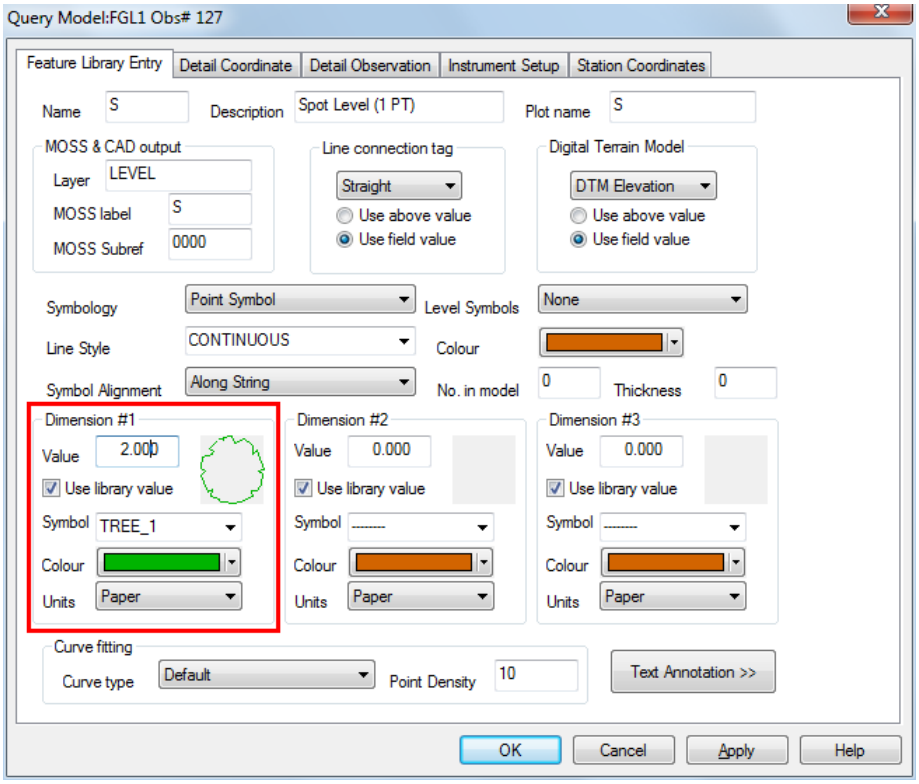
Open the model FGL

Turn off the contours ('VIEW > Contours')

Go to 'EDIT > Query & Edit Points'

Select any point with the feature code 's' i.e. Spot level

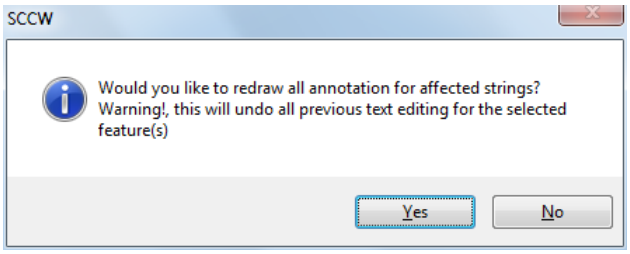
A tab menu is displayed showing all the feature library entries relating to the feature 'S'

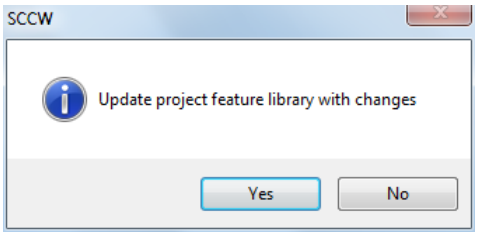


Change the symbol in the 'Dimension #1' field to display 'Tree_1' and change the value to 7.0

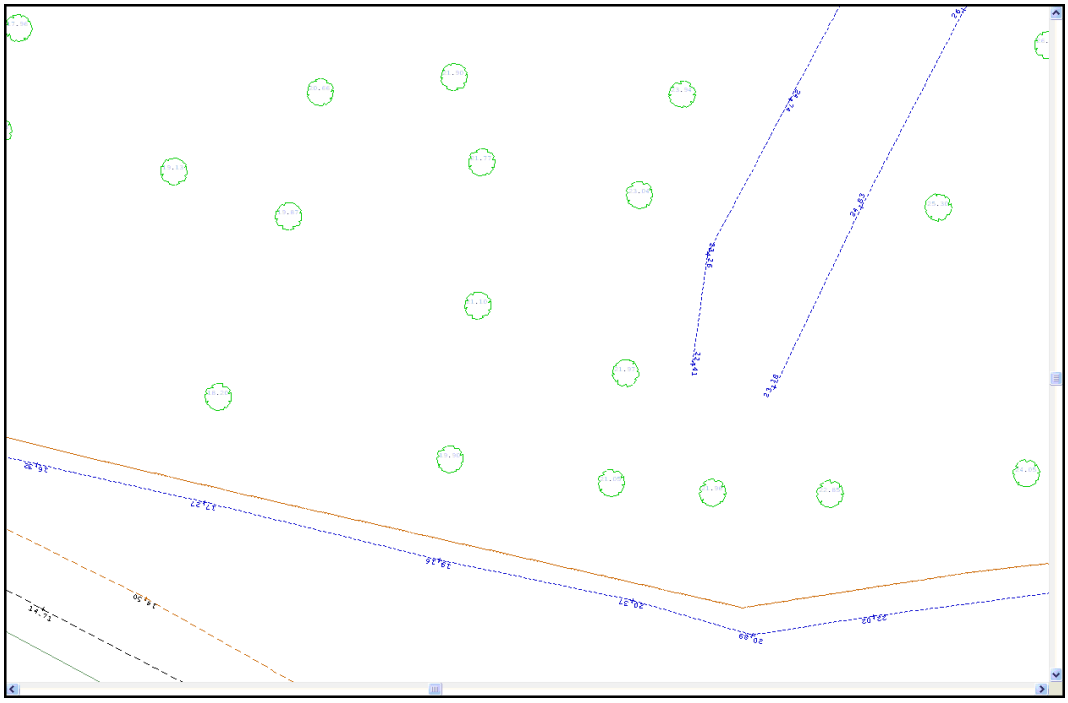
Change the colour to green and the units to Model (Diameter)

Press the 'Apply' button and OK





All the points in the model with the feature 's' will now display a tree symbol, see figure below:



4.1.6.1 Creating a Circle Symbol (Using the Feature Library)

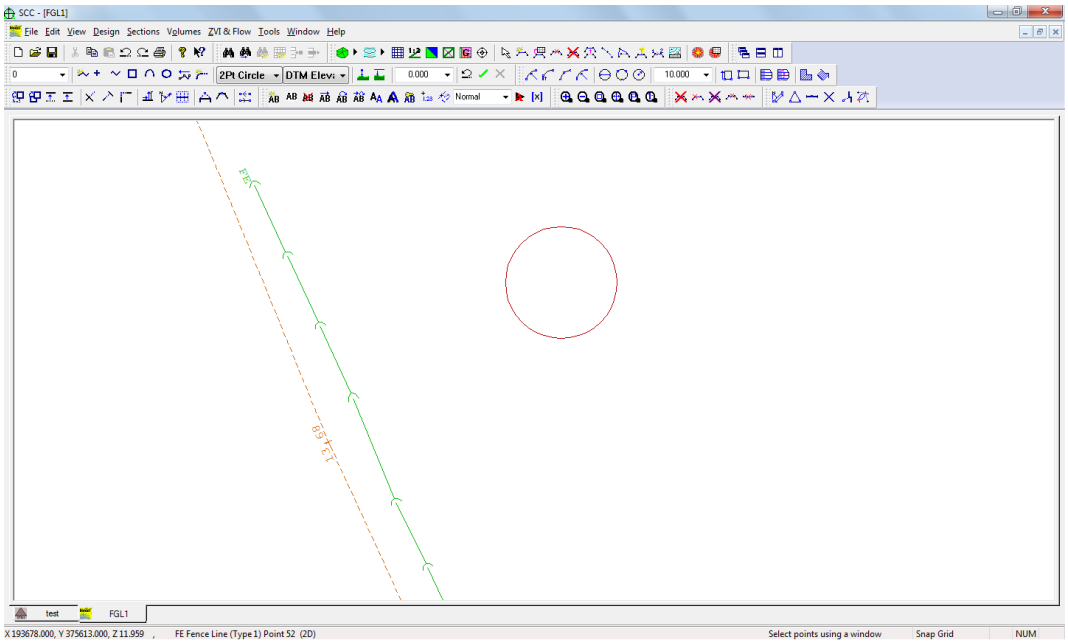
The following examines Creating Symbols From with a model:

A. Creating A Circle Symbol

Within the open model, select 'EDIT > Circles, Arcs & Rectangles.. > 2pt Circle'

Left click on model to generate first point of circle and left click again to produce second point

Right click mouse and select 'Update string in Model'



Repeat the above steps to generate inner circle

Within the open model, select 'EDIT > Circles, Arcs & Rectangles.. > 2pt Circle'

Left click on model to generate first point of circle and left click again to produce second point

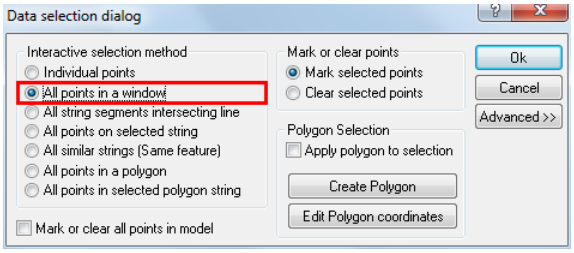
Right click mouse and select 'Update string in Model'

Highlight the Circle

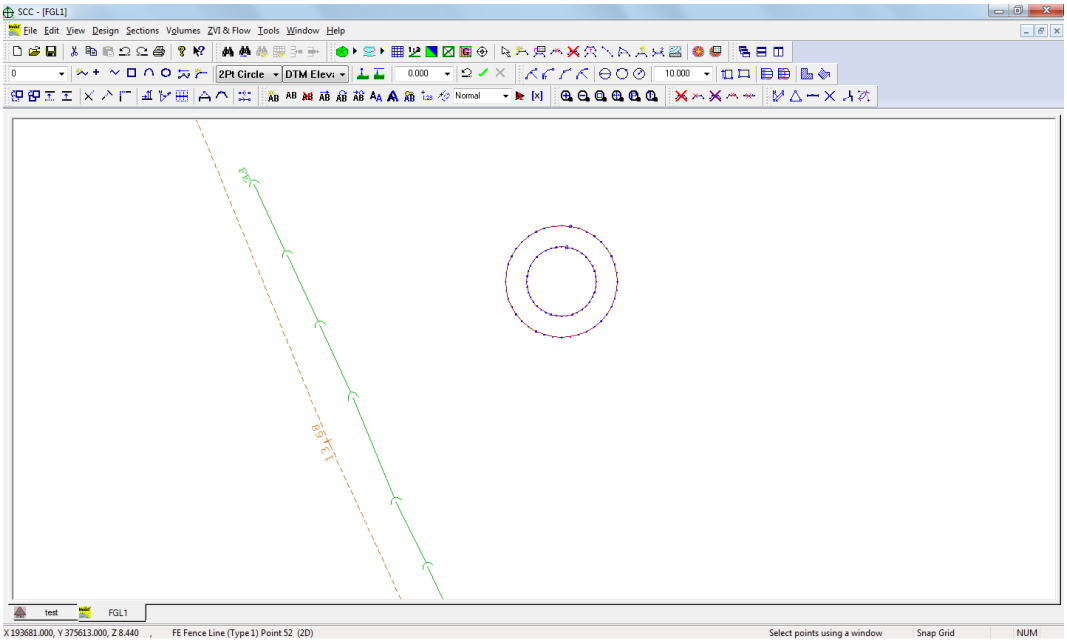
Right Click the mouse to bring up 'Data Selection Dialog'

Select 'All points in a window'

Select 'OK'



Window the symbol, highlighting all points in blue

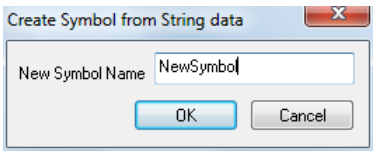


Go to 'Edit > Symbol > Create New Symbol'

Enter 'New Symbol Name'

Select 'OK'

Select 'Esc' on keyboard to unselect symbol



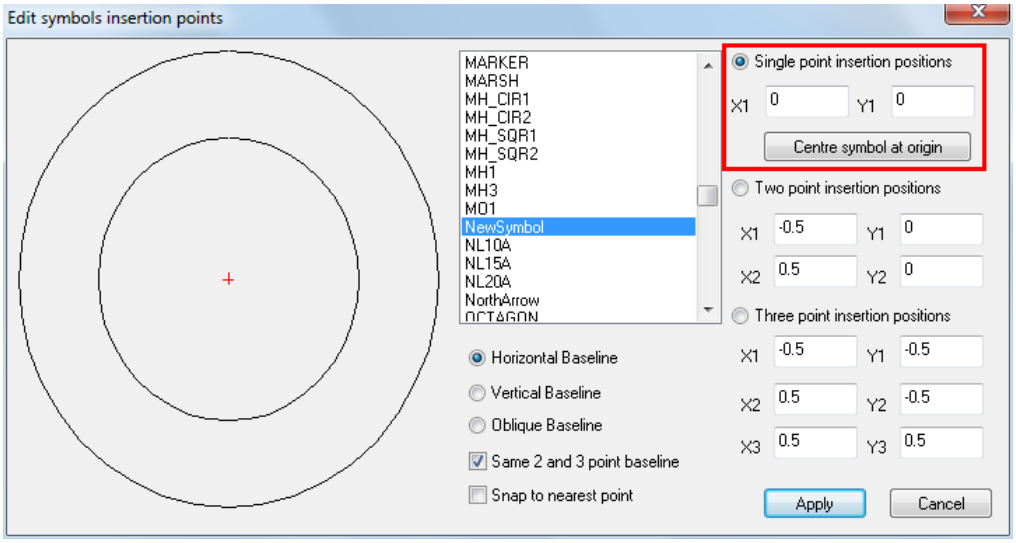
B. Setting Symbol Insertion Point

Go to 'File > Symbols > Edit Symbol insert points'

From this dialog box the insertion points can be assigned.

Select the symbol from the list

By selecting 'Single point insertion position' the centre of the symbols is defined as the insertion point depicted by a red cross



C. Applying New Symbol to Feature Within Existing Model

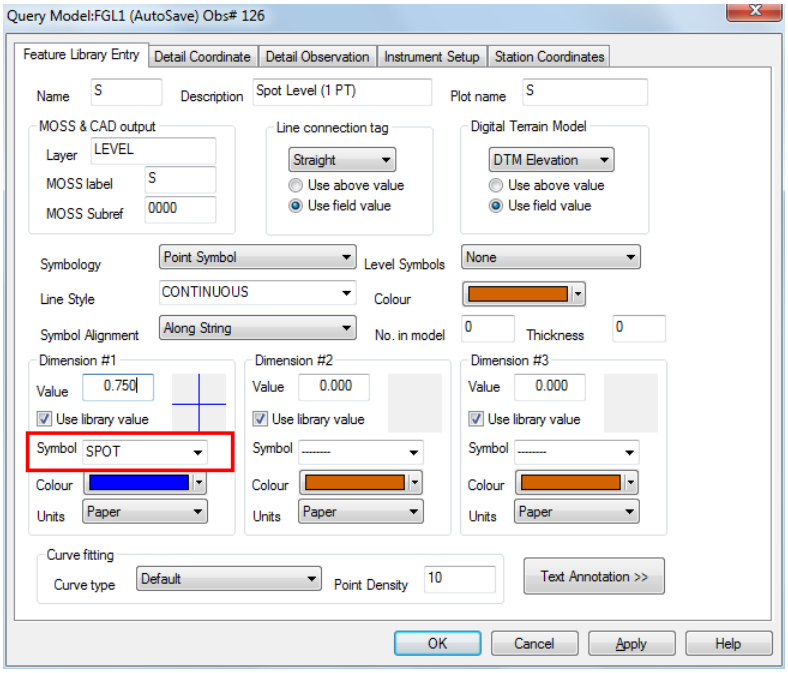
The new symbol can be applied to a feature within the existing Model as follows:

Select 'EDIT > Query & Edit Points'

Left click on Feature, for example 'S' for Spot Height

Change the Dimension 1 symbol to 'NewSymbol' available within from the drop down menu

Select 'OK'



4.1.6.2 Creating symbols from DXF or DWG (Using the Feature Library)

The following examines Creating Symbols From a Given *.dxf within SCC:

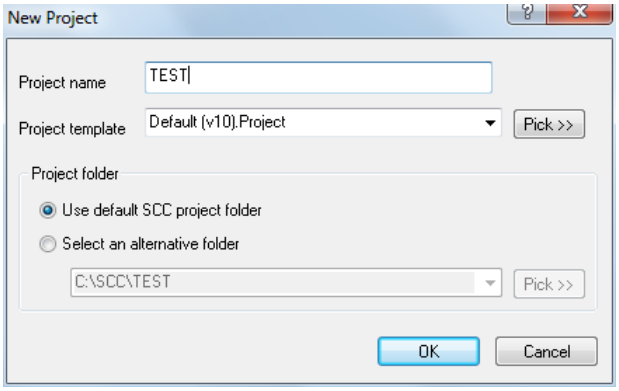
A. Creating Project

Opening Existing Project

Open SCC

Go to 'File > New Project'

Enter the Project Name and assign a Project Template



B. Import DXF File

Creating A North Symbol

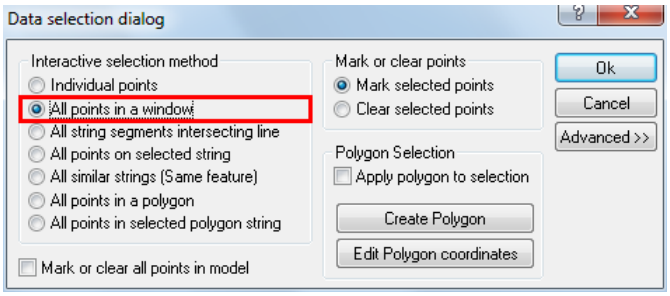
'File > Model > dxf > North.dxf'

Highlight the North Symbol

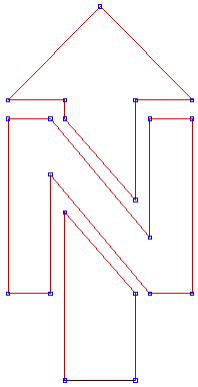
Right Click the mouse to bring up 'Data Selection Dialog'

Select 'All points in a window'

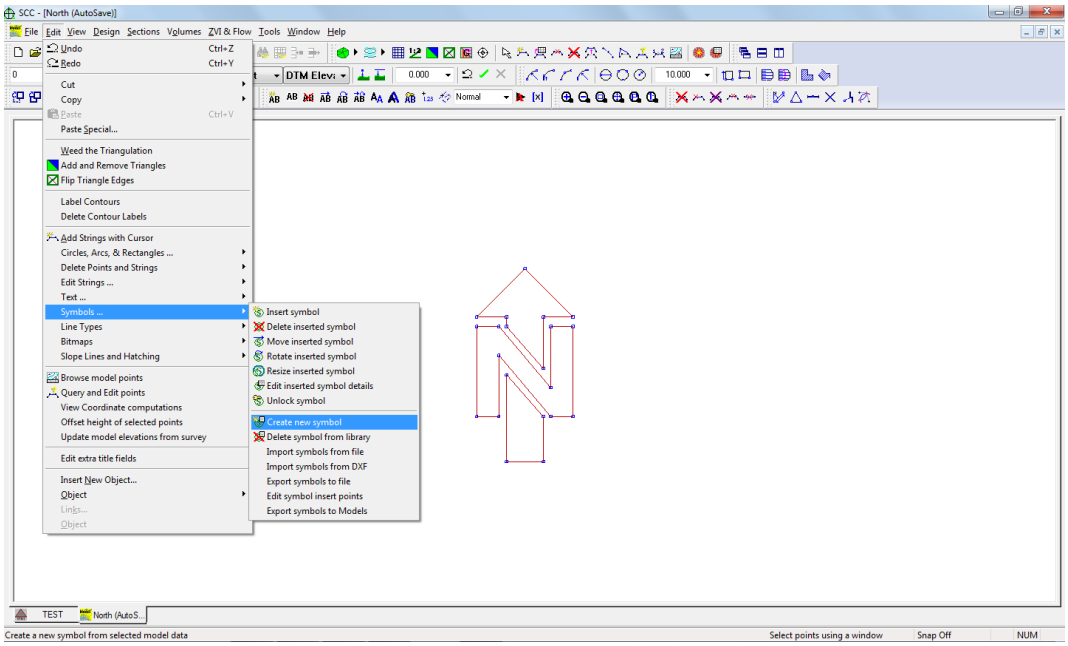
Select 'OK'



Window the symbol, highlighting all points in blue



Go to 'Edit > Symbol > Create New Symbol'

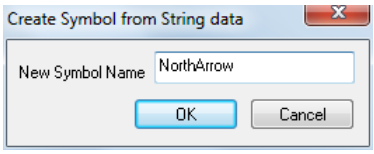


'Create Symbol From String Data' Dialog appears

Enter 'New Symbol Name'

Select 'OK'

Select 'Esc' on keyboard to unselect symbol

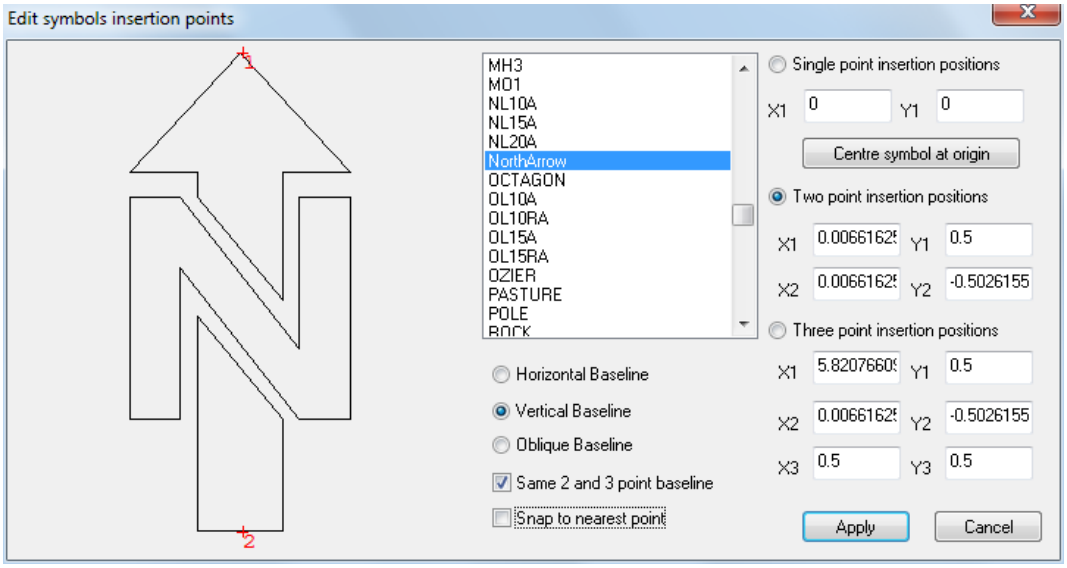


Go to 'File > Symbols > Edit Symbol insert points'

From this dialog box the insertion points can be assigned.

Select the symbol from the list

By selecting 'Two point insertion positions' the insert points can then be defined using the mouse and shown on screen as red cross



The symbol is automatically available for the existing open working project.

Select 'Edit > Symbol > Export Symbol to File' exports the symbol to the SCC directory allowing the symbol to be used in other projects

The size of the symbol can be defined in the Feature Wizard

Note 1: General Symbol Creation and Availability

a) A symbol created in a model is available to the model it was created in

b) **'Edit > Symbol > Export Symbols to File'** allows for all symbols including the newly created symbol to be output to the SCC directory and available for importing into a project

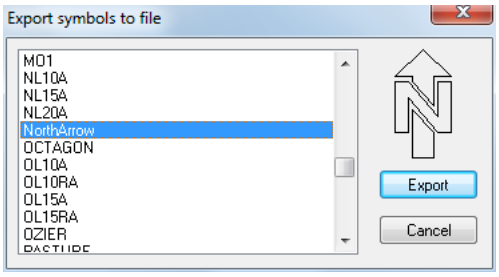
[Open the Projects Feature Library **'Edit> Symbols > Import Symbols From File']**

c) The symbols in the SCC Directory can also be imported into an existing model and subsequently used [Open Model **'Edit > Symbol > Import symbols from files'**]

It is important to note that in all 3 scenarios how the symbol is used is dependent on how the feature has been set up in the Feature Library

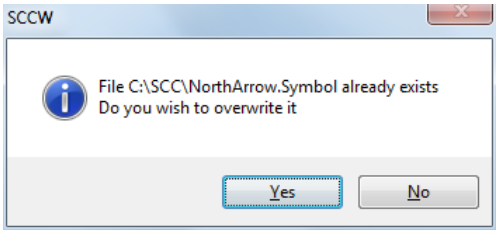
Note 2: Exporting Symbols to SCC Directory – Overwriting Facility

'Edit > Symbol > Export Symbols to File' allows for specific symbols to be selected from the dialog to be output to the SCC directory



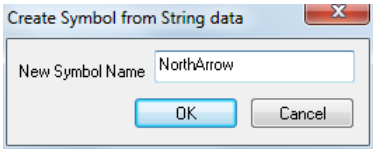
The **'Do you wish to overwrite it'** dialog box will appear for each symbol being exported.

The function of this dialog is to allow for symbols that have been edited without any name change to overwrite what already exists in SCC directory.



Note 3: Symbol Name

When creating a symbol, the 'Create Symbol From String Data' Dialog appears which allows the user to enter the new symbol name

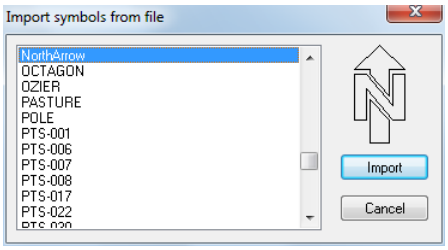


However the name entered also defines the symbols description within the *.VectorSymbol file.

SCC uses the symbol description (embedded in the file) for importing symbols.

Therefore if the user changes the file name in explorer the user will not be able to import the renamed file, as SCC will source the symbol description (embedded in the file).

For example, a symbol created and exported named NorthArrow will also have a description (embedded in the file) of NorthArrow. NorthArrow will therefore be available in the 'Import symbols from file' dialog box.



However, if in explorer NorthArrow.VectorSymbol was renamed North_1.VectorSymbol this file will still have NorthArrow as the symbol description (embedded in the file).

In turn the 'Import symbols from file' dialog box, which uses symbol descriptions (embedded in the file) will only have NorthArrow available as no North_1 description exists.

4.1.6.3 Creating Symbol and redefining baseline

The following examines Creating Symbols 'ES3' as a 2 point symbol with a define width from a Given *.dxf within SCC:

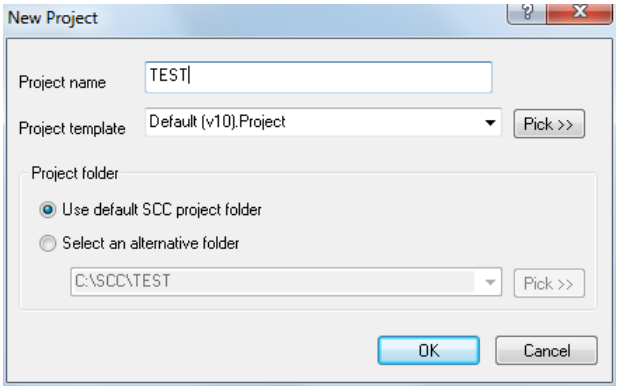
A. Creating Project

Opening Existing Project

Open SCC

Go to 'File > New Project'

Enter the Project Name and assign a Project Template



B. Explode Blocks within CAD

Before importing dxf into SCC all elements must be explodes within CAD. Then resave file.

C. Import & Edit Symbol

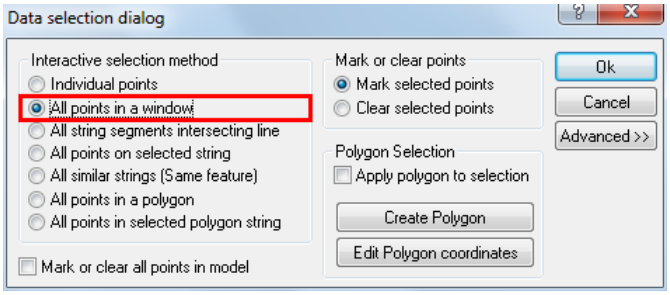
'FILE > Model > DWG/DXF > ES.dxf'

The symbol must be rotated so the insertion points are on the horizontal axis.

Right Click the mouse to bring up 'Data Selection Dialog'

Select 'All points in a window'

Select 'OK'

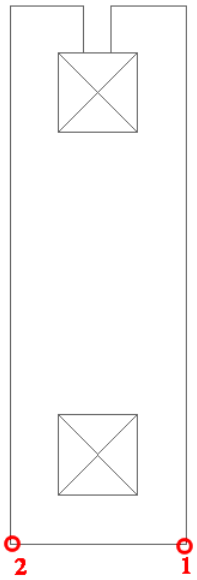


Highlight all symbol points

Go to 'EDIT > Edit Strings > Move String

Set the Rotation to '90 00 00' and Left click on base point

Select 'Apply'



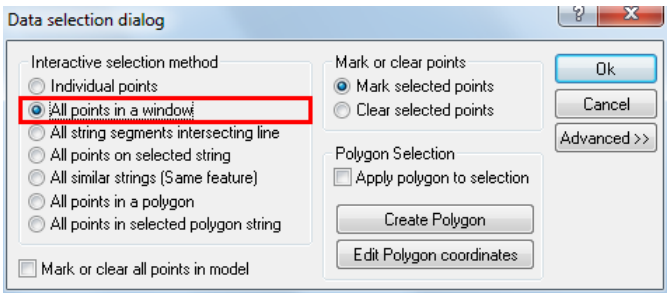
D. Creating A Symbol

Highlight the rotated Symbol

Right Click the mouse to bring up 'Data Selection Dialog'

Select 'All points in a window'

Select 'OK'



Window the symbol, highlighting all points in blue

Go to 'EDIT > Symbol > Create New Symbol'

'Create Symbol From String Data' Dialog appears

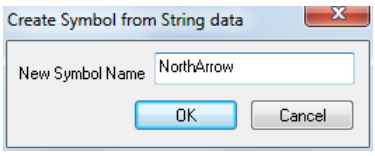
Enter 'New Symbol Name'

Select 'OK'

Select 'Esc' on keyboard to unselect symbol

Note : Symbol Name

When creating a symbol, the 'Create Symbol From String Data' Dialog appears which allows the user to enter the new symbol name



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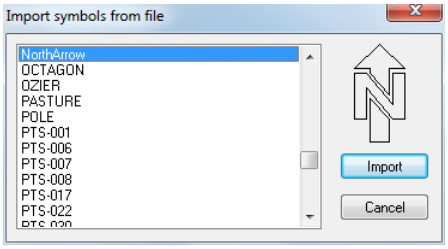
However the name entered also defines the symbols description within the *.VectorSymbol file.

SCC uses the symbol description (embedded in the file) for importing symbols.

Therefore if the user changes the file name in explorer the user will not be able to import the renamed file, as SCC will source the symbol description (embedded in the file).

For example, a symbol created and exported named NorthArrow will also have a description (embedded in the file) of NorthArrow. NorthArrow will therefore be available in the 'Import symbols from file' dialog box.

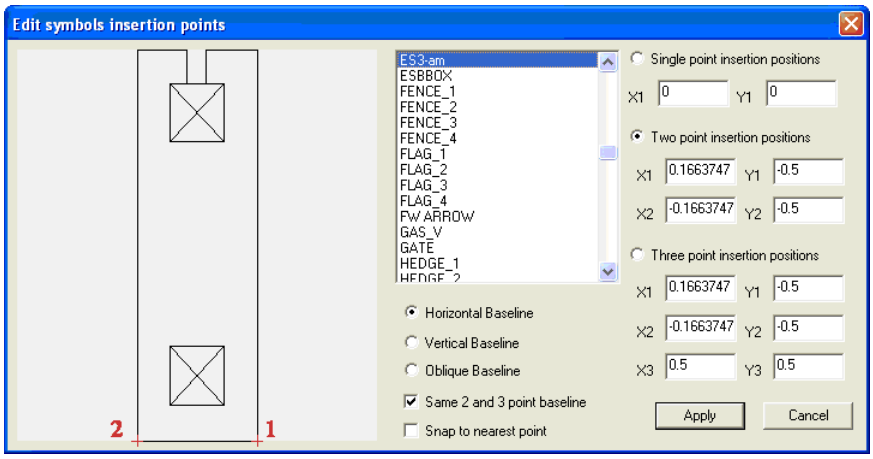


However, if in explorer NorthArrow.VectorSymbol was renamed North_1.VectorSymbol this file will still have NorthArrow as the symbol description (embedded in the file).

In turn the 'Import symbols from file' dialog box, which uses symbol descriptions (embedded in the file) will only have NorthArrow available as no North_1 description exists.

E. Define Insertion Point

Go to 'File > Symbols > Edit Symbol insert points'



From this dialog box the insertion points can be assigned.

Select the symbol from the list and select 'Two point postion', 'Horizontal Baseline' and 'Snap to nearest point'

Left click on 1st point and left click on second

Select 'Apply'

The symbol is automatically available for the existing open working project.

(If the symbol is exported and later imported into another feature library the insertion points may need to be redefined)

Note : General Symbol Creation and Availability

a) A symbol created in a model is available to the model it was created in

b) **'Edit > Symbol > Export Symbols to File'** allows for all symbols including the newly created symbol to be output to the SCC directory and available for importing into a project

[To import Open the Projects Feature Library **'Edit> Symbols > Import Symbols From File']**

c) The symbols in the SCC Directory can also be imported into an existing model and subsequently used [Open Model **'Edit > Symbol > Import symbols from files'**]

It is important to note that in all 3 scenarios how the symbol is used is dependent on how the feature has been set up in the Feature Library

F. Exporting Symbol

To allow the symbol to be used within other project the symbol can be exported to the \SCC directory

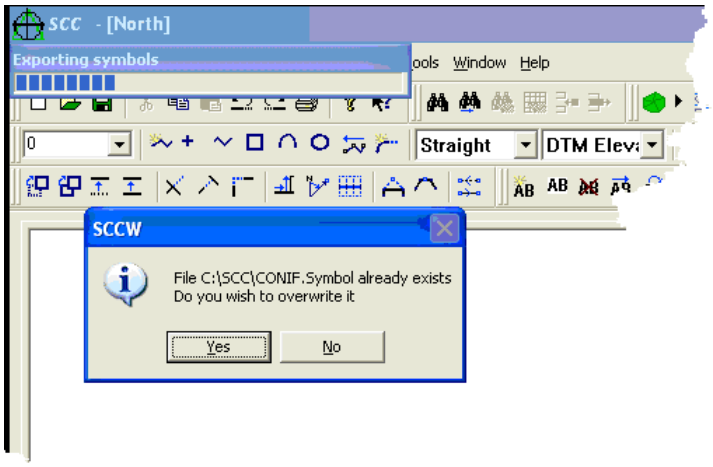
Select 'Edit > Symbol > Export Symbol to File'

Note : Exporting Symbols to SCC Directory – Overwriting Facility

'Edit > Symbol > Export Symbols to File' allows for all symbols to be output to the SCC directory

The **'Do you wish to overwrite it'** dialog box will appear for each symbol being exported.

The function of this dialog is to allow for symbols that have been edited without any name change to overwrite what already exists in SCC directory.



G. Importing Symbol into Default Library

Open default Project

Select 'VIEW > Feature Library'

'Edit> Symbols > Import Symbols From File'

Select symbol from list and select 'Import'

H. Defining 'ES3' Symbol as a 2 point symbol (centre) with fixed width

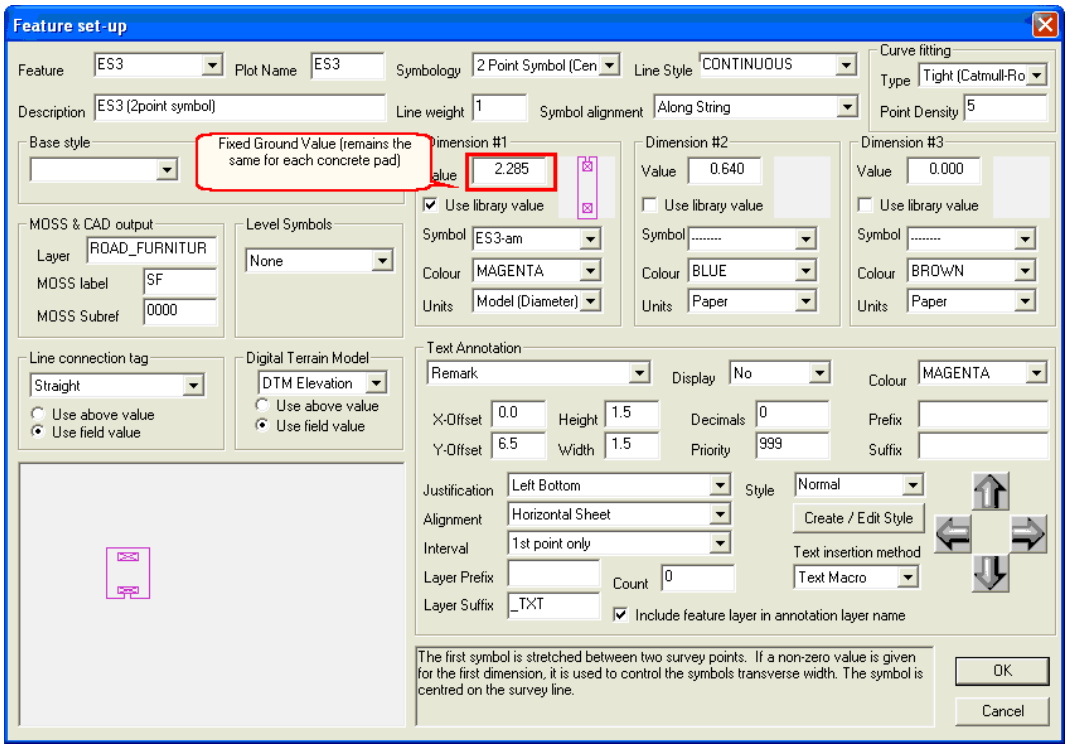
Firstly, measure and take note of the defined unchanging width (e.g. 2.285) of the structure.

With the default feature library open, insert blank new record 'EDIT > Insert Record'

Enter specific attributes for ES3 feature such as field codes, CAD layer

Then go to 'VIEW > Feature Wizard'

Drop down to 'ES3' feature and set up the following:



Set the symbology to '2 Point Symbol (Centre)

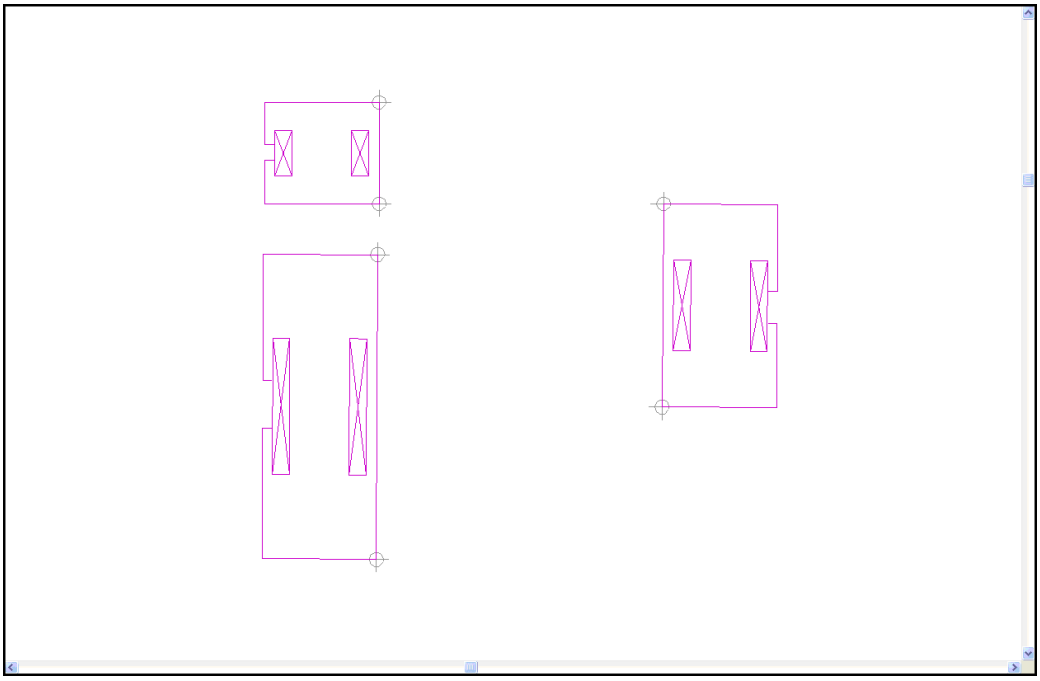
Select symbol for Dimension 1 and enter known D1 value

Select 'Use Library Value' as this value in defined and will not change

Select 'OK'

Save Project

Perform Checks



5 Editing A Model

When moving around the model, there are certain window controls you can use. These can be found under the WINDOW menu, on the model toolbar, or under specific keys on the keyboard as follows;

Esc	Quits any of the interactive editing options
Home	Zoom Extents
End	Zoom Previous
Page Up	Zoom Out
Page Down	Zoom In
Space Bar	Zoom Centre (Pan)
TAB	Pan to the next crossing breakline, next duplicate point, or next potential model error. This option will only pan to crossing breaklines and / or duplicate points if they are currently being displayed. This is controlled using `View / Triangulation options'. Other potential model errors that are detected with this option include links between 2d and 3d points, duplicate 3d points with different elevations, and polygons with less than three points. This key press is very useful when correcting survey errors interactively.
F2	Pressing this key pans to the next selected point. This option should be used in conjunction with the data selection dialog, and is very useful for finding specific points in the model. For example, to find a specific point in the model, use the advanced section of the data select dialog to highlight the point (or point range), and press F2 to pan to that point.
s	Pressing ‘s’ toggles between the available snap lock modes, including nearest point, nearest DTM point, nearest 2D point, gird position, midpoint, perpendicular (to string), perpendicular

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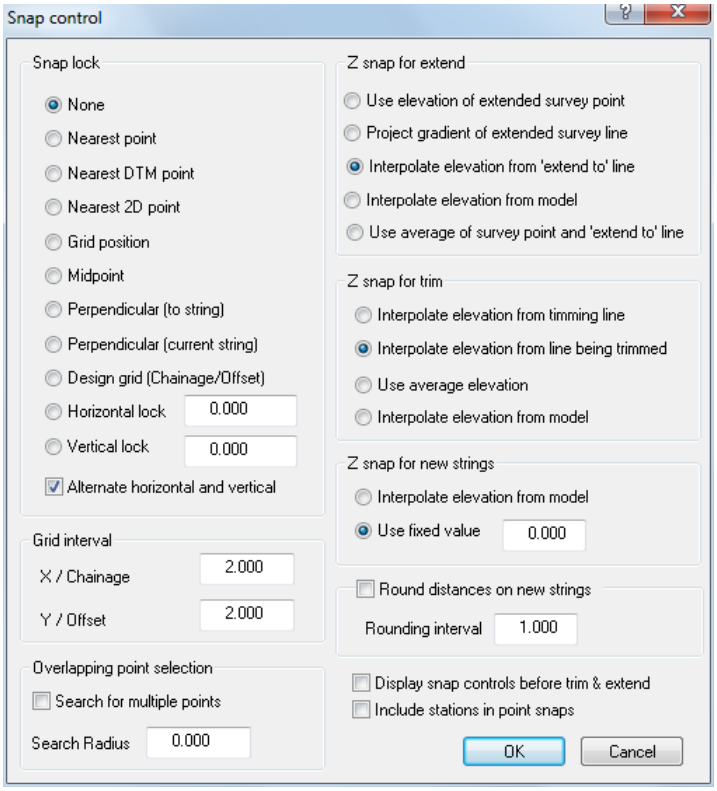
	(current string) and design grid (chainage/offset).
n	Pressing ‘n’ turns snap lock off.
g	Pressing ‘g’ enables snap to grid mode.
m	Pressing ‘m’ enables multiple point selection mode. This is useful when selecting a point, or piece of text that overlaps other items. If multiple point selection is enabled, and a position on screen is selected where there are multiple overlapping points, a dialog will be presented that allows you to select the desired point from a list of points within a specified range from the cursor.
****	Use of ‘\’ and ‘*’ keyboard shortcuts can be used to the create text function, as per other text editing functions. Note that when creating new free form text, the drop down feature list in the tool bar may be used to set the texts feature and hence colour and CAD layer.
H or V	Pressing 'H' or 'V' will snap vertically or horizontally. The base point used will be the last point on the string if you're already creating a string, or the cursor position if not, so you can extend from an existing point using snap point and then press 'H' or 'V' for subsequent points.
O	Pressing 'O' snaps perpendicular from the last two points, or horizontal if no points have been entered. The default behaviour after picking a point with snap horizontal or vertical is switch to snap perpendicular from the last two points. This can be turned on or off in the snap points dialog.
Q	Pressing 'Q' closes the string and updates the model using the Link Square tag. This creates a new point by intersecting a line at right angles from the last two points selected with another line at right angles to the first two points. Thus if you have entered three points, pressing 'Q' will square off by creating a fourth point to from a quadrilateral.
L	Pressing 'L' closes the string and updates the model using the normal Link tag. Thus if you have entered three points, pressing 'L' will give you a triangle.

You can also use the mouse wheel to zoom in and out of the current position, and to pan around the model by moving the mouse with the wheel pressed down.

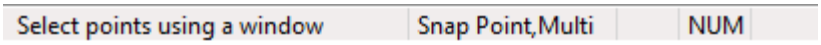
Snap Controls

The snap control option available from the 'VIEW' menu has the following options:



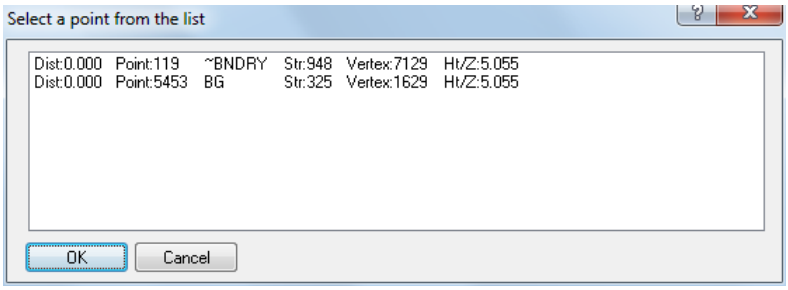
This dialog allows you to force the cursor to always lock onto a specific point or grid co-ordinate while editing the model. It is particularly useful when positioning points exactly on top of survey points, for example, when generating a boundary string.

Pressing ‘s’ on the keyboard toggles through the snap options. The current snap option is displayed on the bottom right of the status bar.



The snap control dialog is also used in the selection of overlapping points. If you highlight the ‘Enable search for multiple points’ option, a list of all points within the prescribed radius is displayed whenever you have to select a point in the editing options. This is particularly useful when querying points that overlap or join strings at the junction point of other strings.

The snap selection may be changed in the middle of a command. For example, if adding points the user snaps to grid and in the middle the user wishes to snap to a feature, the snap control can be changed to ‘Nearest point’ and allow the user to continue with the previous command, ‘adding strings with cursor’.



Pressing **‘m’** on the keyboard enables a shortcut key to ‘Enable search for multiple points’.

There are three methods of editing a model within SCC.

Point editing allows you to query a point in the model and modify any information relating to that point.

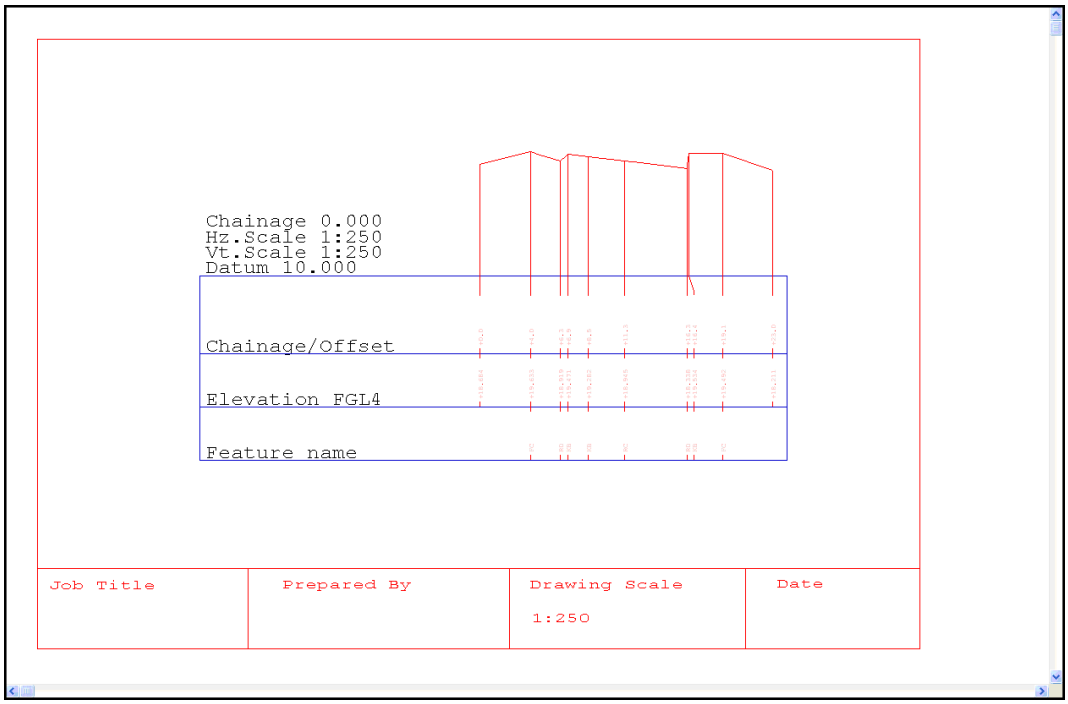
String editing allows you to identify string lines in the model. Field errors relating to connectivity can be edited here.

Triangle editing allows you to identify which triangles you will use in modelling applications.

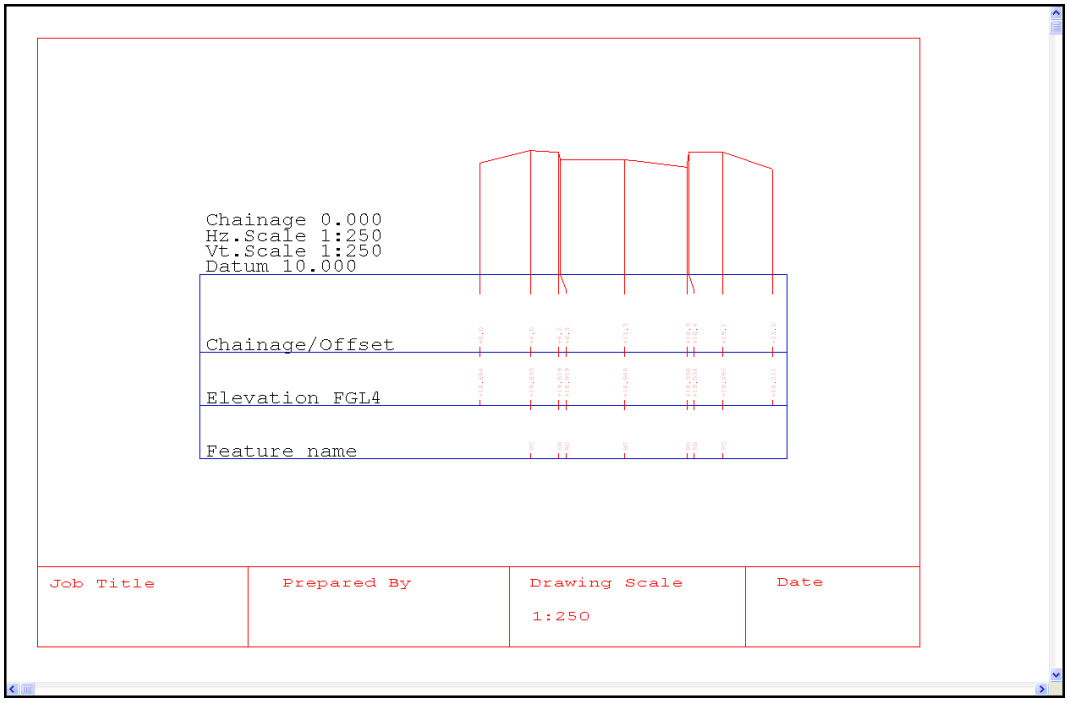
5.1 Probable Modelling Errors

SCC graphically highlights probable modelling errors such as crossing strings and duplicate points. Crossing strings are indicated by red crosses and by pressing the TAB key, the screen will be re-centred over each one, allowing them to be easily located and therefore easily resolved.

While crossing strings do not necessarily pose a problem in themselves, they are often indicative of a survey or modelling error that could have more serious implications. For example, where a kerb top and kerb channels are surveyed as two separate 3d strings. These strings are very close to one another in plan, and may actually cross in a number of places. While this makes very little difference to the plan, it has a serious effect on the 3d model as shown in the section below.



Using the ‘move points’ option to shift the offending point by a few millimetres in plan quickly resolves this problem, as shown in the second section drawing.

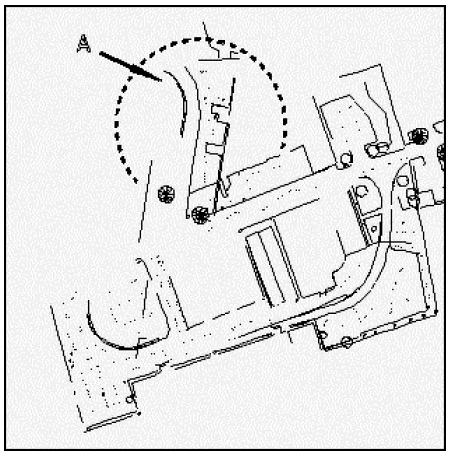


5.2 Correcting Survey Errors

In a model the most easily recognisable survey errors are crossing breaklines. Crossing breaklines are identified by the Breakline Intersection Point (~BRK_INT) feature. This is a standard SCC feature. The symbol for this feature is a red X. Look around this model there a few red Xs. When editing the model the operator should aim to remove all crossing breakline from a model. Depending on the strings and how they overlap different editing tools may be used to rectify the errors.

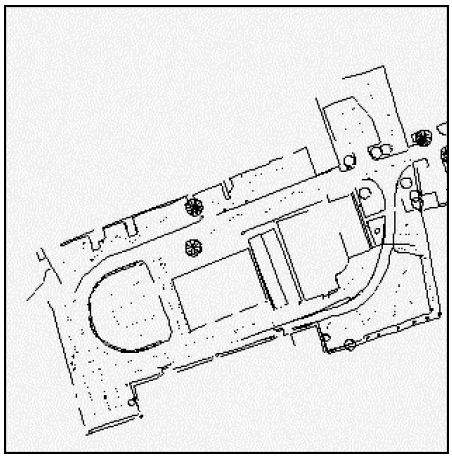
5.2.1 Control Orientation Error

On creating a SCC model, you discover that the detail enclosed at 'A' is not in its true position. Surveyed features are both shifted and rotated. An error of this nature is frequently caused by setting an incorrect reference orientation on the horizontal circle prior to observing a reference object. Incorrect traverse observation or reduction may also cause orientation errors. Surveys which involve combined traversing and detailing (as opposed to those in which the traverse is reduced before the detail survey is undertaken) are particularly susceptible to orientation problems. Establishing the cause of such errors may involve time-consuming reviews of the traverse observations and much experimentation to uncover the offending data.



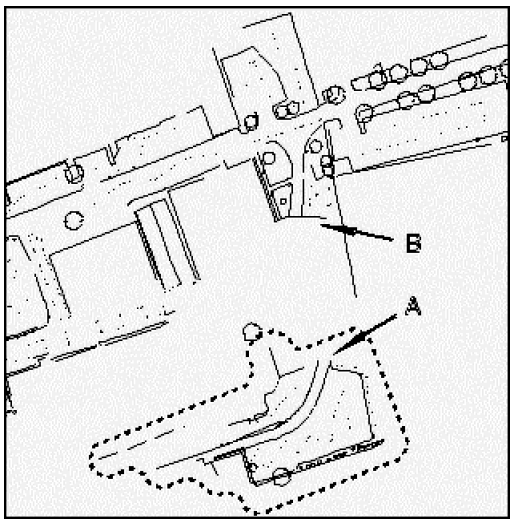
It is often possible to correct the error by editing the station set-up for the displaced area. To do

this, choose the Query and Edit points option from the Edit menu. Click on any point in the displaced area. Select the Instrument Set-up tab. Both occupied and reference station names should be correctly spelt and have a valid co-ordinate, i.e. XYZ set to 'Yes', in order for the orientation to be correct. If you have taken a full observation, including a distance, to the reference station, SCC will back compute the co-ordinates of the reference station and display the differences between those co-ordinates and the values in the station co-ordinates file. It will also compute the difference in observed and calculated horizontal distance. If the co-ordinate difference is large, but the distance difference is very small, you have a genuine orientation error. If both co-ordinate and distance differences are large, you most probably have an error in either a reference station name, or a reference station co-ordinate value. An incorrect occupied station name, or incorrect occupied station co-ordinate value would result in a control shift error.



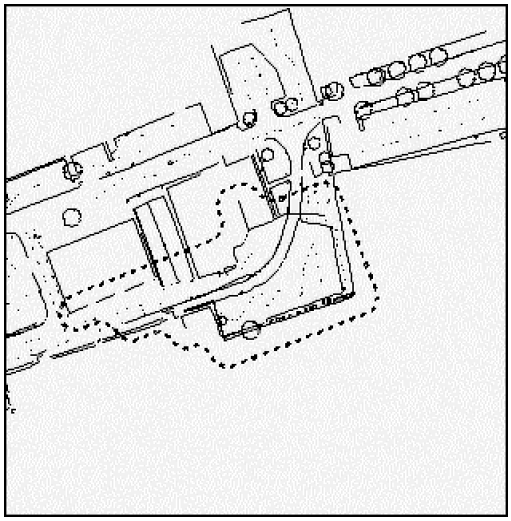
5.2.2 Control Shift In Plan

A less common form of control error involves a simple shift in station co-ordinates. Such an error occurs when, for example, one survey data set containing a particular station is loaded into a project. If, at a later stage, you add another data set, containing a station of the same name, but different co-ordinates, to that project then the co-ordinates of the first station will be over-written. As a result the detail associated with the first data set will be shifted. This may also cause orientation errors, as the same station may be used as a reference station elsewhere. Every control station name must be unique to the current SCC project. You are most likely to encounter duplicate station names on larger projects where several crews have established minor stations using names, which were chosen arbitrarily. The problem of duplicate names may also arise when more recent survey data sets are being added to older projects.



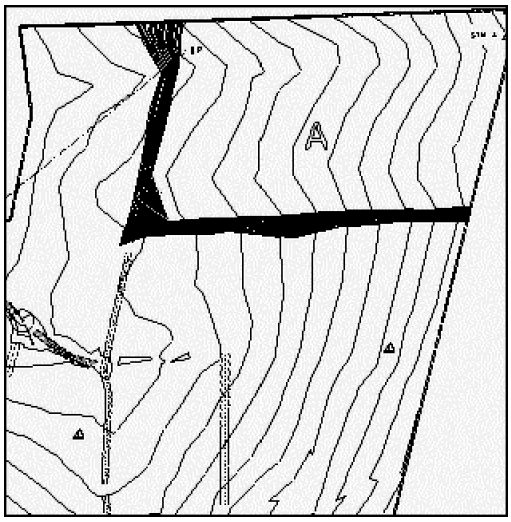
You can reduce the risk of duplicate names by establishing a station naming convention to be

used by all field crews. If you suspect that a survey data set is displaced as a result of a station having incorrect co-ordinates then you can correct the problem as follows; Choose the Query and Edit points option from the Edit menu. Use the mouse to select an element of the displaced area. Select the Station co-ordinate tab. Type in the correct easting (or X co-ordinate), northing (or Y co-ordinate) and level for the station. This will cause the survey co-ordinates and model to be regenerated. If you do have two distinct stations with the same name, it will be necessary to rename one of them. Having done this you will also have to modify any references to this station in the associated station set-up information in the relevant detail observations file(s).

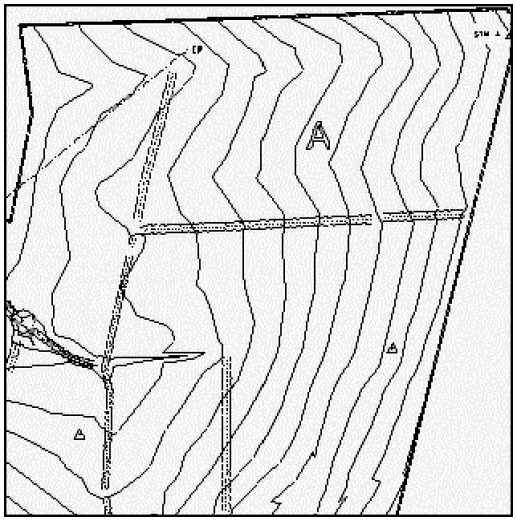


5.2.3 Control Station Datum Error

The diagram illustrates a topographic survey covering a number of fields. The field marked ‘A’ has been surveyed entirely from station A. All the surrounding fields have been surveyed from stations other than station A. On examining the diagram you will see that there is marked build-up of contours around the perimeter of field ‘A’. The general plan trend of the contours, excepting those along the boundary of field ‘A’, is correct, though the contour values will differ significantly between the two areas. The over-all planimetric detail is also correct. The steep shelf of contours suggests that there is an error in the reduced level of station A. An error of this nature may occur because the level of an existing station is over-written when a survey data set containing a station of the same name and plan co-ordinates but a different reduced level is loaded into the current project. Such an error is most liable to occur when the control station levels are first determined in relation to an arbitrary datum, but shifted at a later stage to, for example, National height datum.

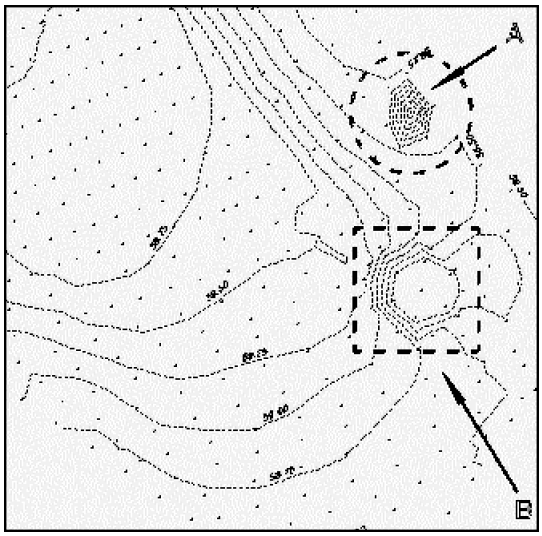


To correct this error choose the Query and Edit points option from the Edit menu. Use the mouse to select an element of the displaced area. Select the Station co-ordinate tab. Type in the correct elevation for the station. If this causes the error to occur in a different area of the model, ensure that all your stations are based around the same datum.



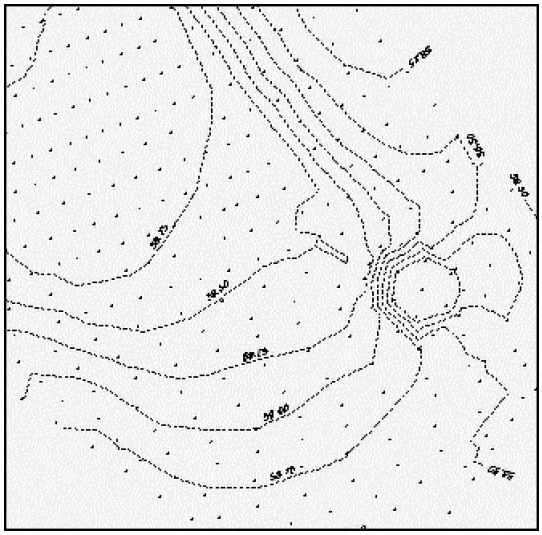
5.2.4 Surface Model Errors

Errors in the surface model may be caused by control station errors, by poor field survey techniques, or by the wrong rod height being recorded. Incorrect elevations due to wrong rod height are often difficult to see on the screen, particularly on rugged terrain. When examining the surface model for errors you may find it beneficial to set a small contour interval, (e.g. 0.1 meters rather than 1.0 meters) as this will tend to highlight anomalies in the surface model. The diagram to below shows part of a golf course survey, the area enclosed at ‘B’ is a bunker and contains a number of surveyed points of similar elevation. In contrast, the area indicated at ‘A’ contains just a single point of significantly different elevation; this suggests a rod height error, though of course such a suspicion can only be confirmed by knowledge of the terrain.

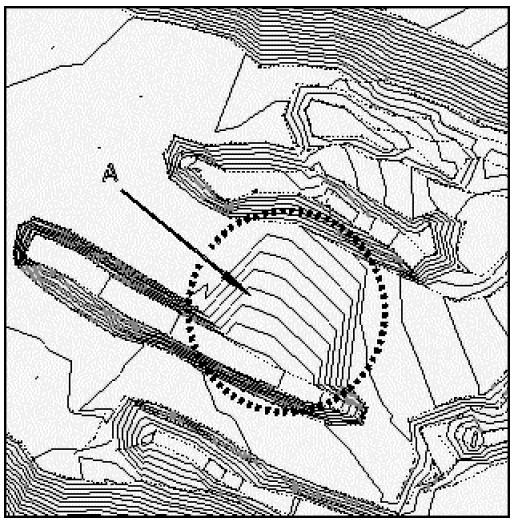


To correct a single point error of this nature choose the Query and Edit points option from the Edit menu. Using the mouse select the point to be edited. Select the Detail Observation tab. You may now remove the point from the DTM by changing the DTM switch to Approx. Elevation. Alternatively, if you know the correct rod height you may leave the point in the DTM but change the Rod Ht field to the appropriate value. Note: it is good field procedure to maintain one rod height throughout a survey. If the rod height must be altered, for example, in order to survey obscured detail then it is recommended that you increase the rod height by even increments and return the standard rod height as soon as practicable. Using standard

increments will often make it easier to identify any incorrect rod heights.



To model the ground surface correctly it is not sufficient to survey a high density of levels across the terrain. It is necessary to define the shape of the ground using both spot levels and break-lines. All three-dimensional strings are treated as break-lines (or form-lines). A breakline must be surveyed where obvious changes of grade occur on the ground. They are essential if the triangulation is to form correctly. The diagram depicts an example of a poorly surveyed surface. Because the base of the spoil-heap has not been completely enclosed by a string, severe deformation of the surface occurs in the area marked ‘A’. Note that the model depicted in the diagram consists of the same set of observations, only the string tag code has been edited within SCC from STRAIGHT to LINK. STRAIGHT would be looking to link up with the next sequential point on a feature of the same name and string number, but not having found any would terminate and leave the toe of the slope open.



Go to Edit and select Edit String Details. Select the string forming the base of the mound. Change the Tag of the last point on the string to Link. Then select Update String in Model. See the diagram for the results.

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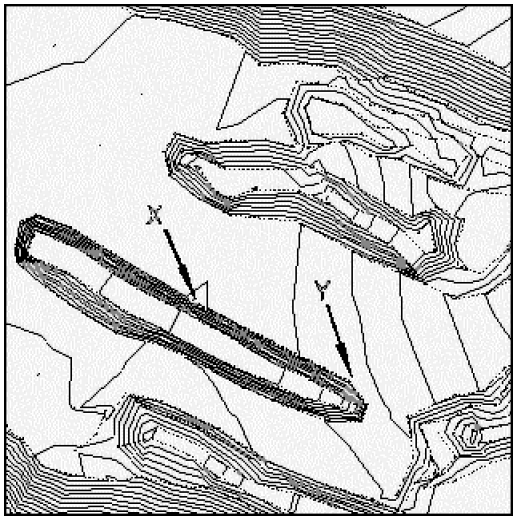
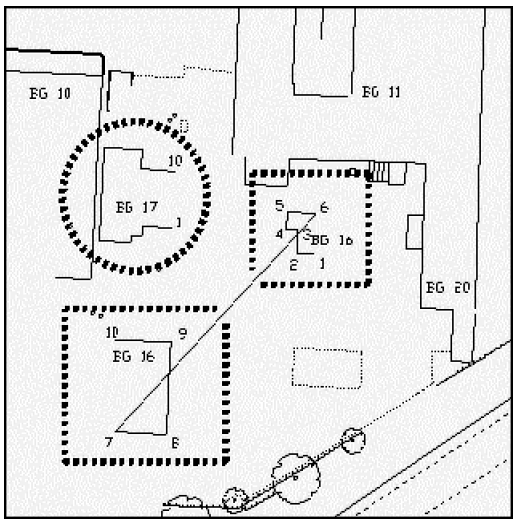


We described the function of break-lines previously. The figure below and to the right illustrates another consequence of failing to survey break-lines. A ditch or watercourse has been surveyed using three-dimensional strings to define the tops of the banks. The bed of the ditch has, however, been surveyed as a number of unstrung points. The resulting “Paternoster effect” is not merely a misrepresentation, in a cartographic sense, of the shape of the ground, but more importantly it constitutes a flawed triangulation which will cause incorrect sections and volumes to be generated and will not permit water to flow down hill.



Go to Edit and select Edit String Details. Select any point along the base of the string, which should be strung. Go to Global Edit and change the String No. from 0 to any positive number. Pick a high number just in case this feature has appeared in the model in other places.

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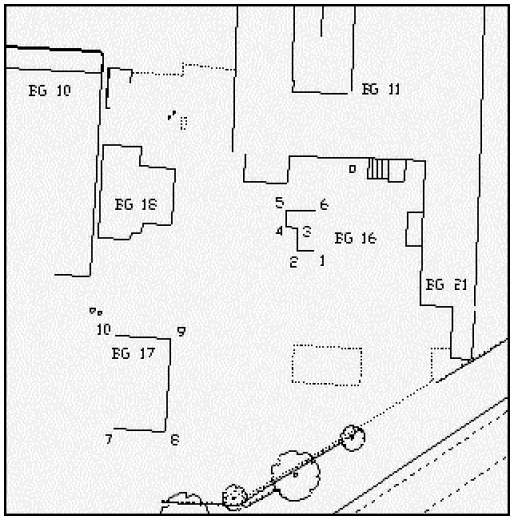
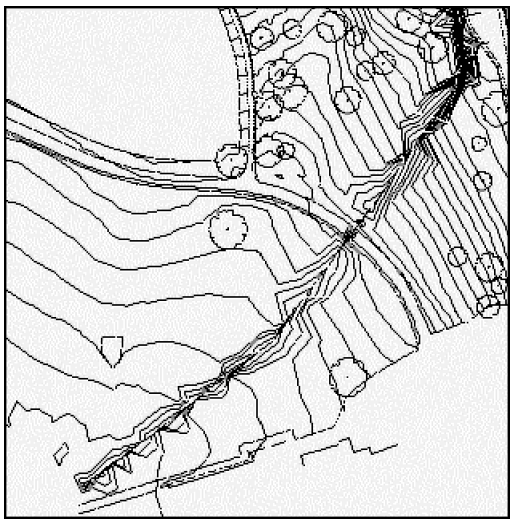


At first glance the error illustrated in the figure below might seem similar to that shown previously. In this instance however, the surveyor wrongly recording the pylons of an overhead transmission line as a three-dimensional string causes the deformation of the surface. Consequently, the overhead line is included in the triangulation. The pecked circles in figure below left indicate the pylons supporting the power-line. This error will also be encountered in localised areas when, for example, the tops of trees, lamp standards, or telecommunication masts are included in the DTM.



To correct an error of this nature you could change the DTM code of the pylon feature in the feature library. Choose the Query and Edit points option from the Edit menu. Use the mouse select the power-line. On the Feature Library Entry tab. Go to the Digital Terrain Model field. Change the value to Approx. Elevation. Then select the option to Use the above value. All over-head lines will now derive their DTM status from the feature library Master DTM tag rather than the survey file. On pressing OK the model will be regenerated and the surface will now appear as shown below.

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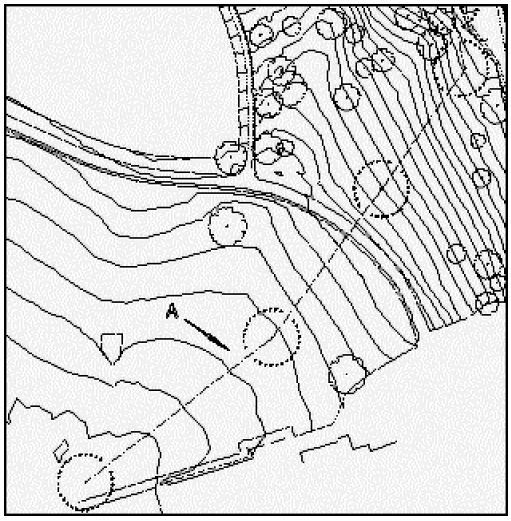
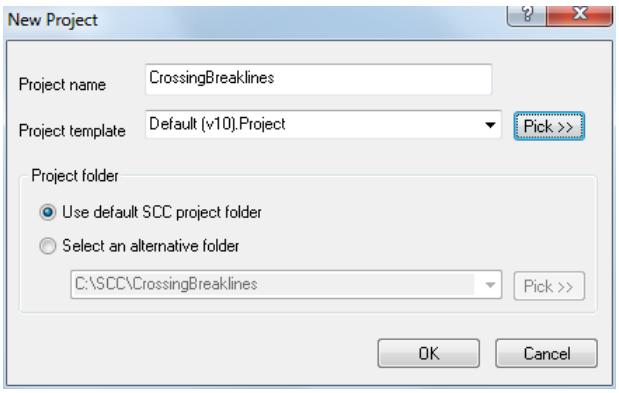


5.2.5 Determining The Height Value of Crossing Breakline

A. New Project

Select 'FILE > New Project'

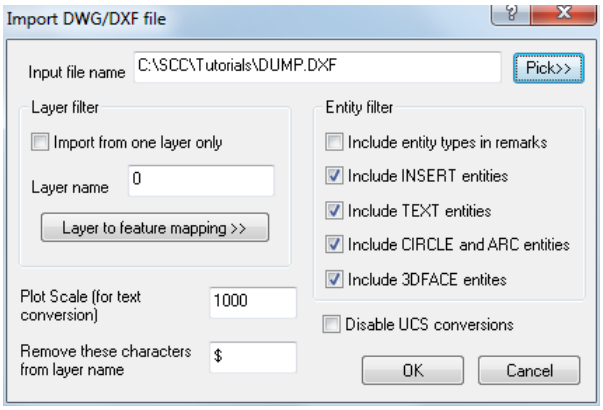
Enter Project Name 'Crossing Breaklines' and attach Project Template 'Default (v6). Project'



B. Model DXF

Select 'FILE > Model > DWG/DXF'

Using 'Pick>>' button select 'DUMP.dxf' from the SCC\Tutorials directory

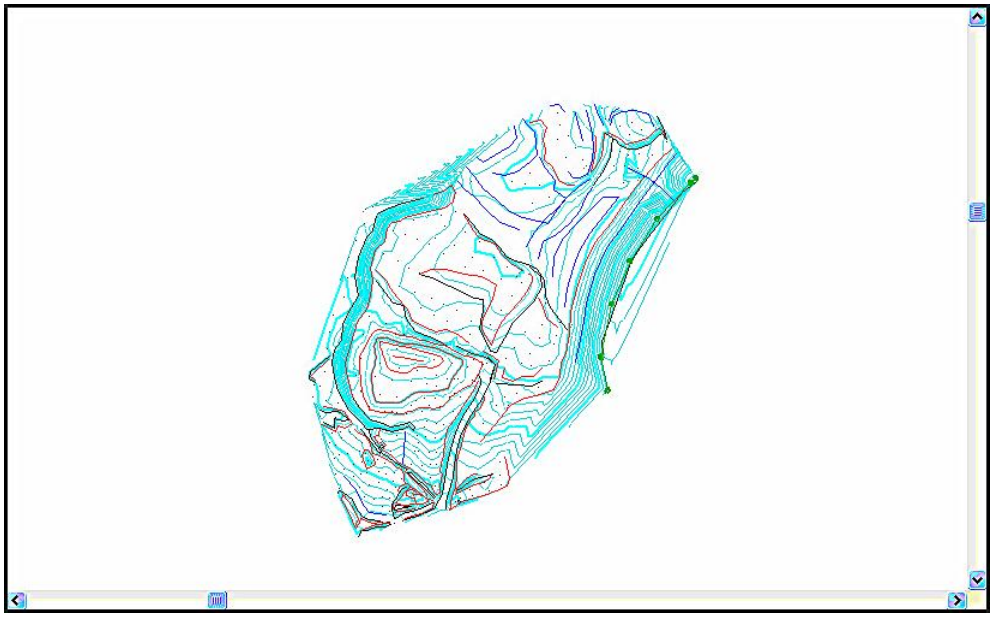


Select 'OK'

Select Initial Plot Scale of 250

Select 'Create the model and triangulation'

Select 'Ok' to Model Attributes dialog



Zoom in and then select 'WINDOW > Zoom XY' and enter 1878.360, 3275.959'

Note the drainage line running perpendicular to the top and bottom of bank. Where the drainage lines meets the bank a crossing breakline symbol is generated. What we are going to do is insert a point onto both strings at each point where they cross. The height of the new points will be taken from the height of the point interpolated.

Set the snap lock to snap point by pressing the 's' key. On the right of the status bar the current snap setting is displayed.

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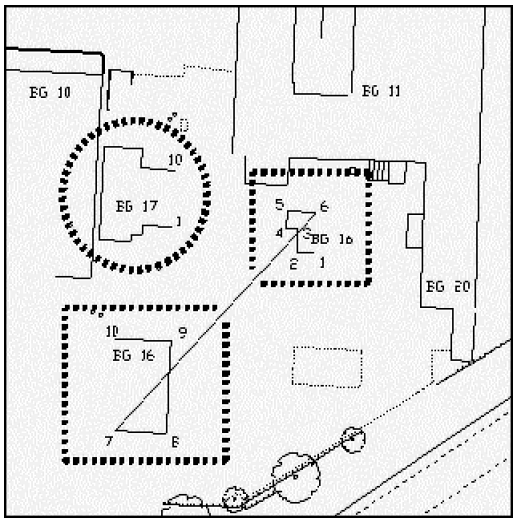
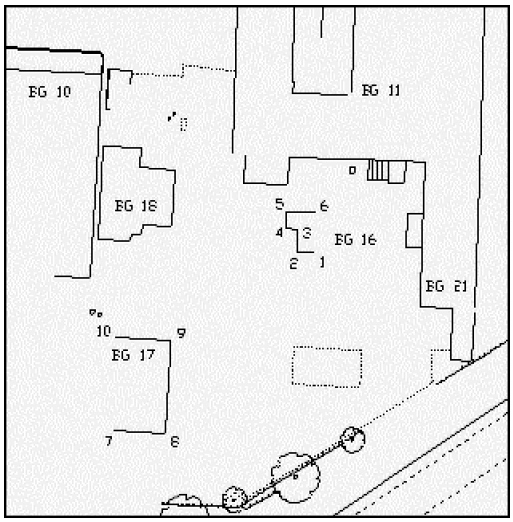
5.3 String Errors

Stringing errors are arguably the most common error encountered when processing topographic surveys. The problem is especially associated with urban areas where the sheer number of features, combined with the difficulty of gaining access to every point, militates against even the most seasoned field crew. The diagram depicts two errors. The building BG 18 (the circled area) has had all the required points surveyed. The surveyor has, however, failed to link the final point (No. 10) to the first (No. 1). In the second case, (enclosed by rectangles) two separate buildings have inadvertently been allocated the same string number.



To correct the first error we simply need to establish a link between the first and the last surveyed point. Choose the Query and Edit points option from the Edit menu. Select point number 10 on string BG 17. Click the Detail Observations tab. Then change the Tag from Straight to Link. In the second case, select point number 6 on string BG 16; once again select Edit Observation for selected point. This time change the Tag from Straight to End. Re-create the model; the model will appear as shown in the figure above. Note that because you have used the End tag SCC incremented all those strings following BG 16. You may now close both building outlines by using the Link tag as described above.



Alternatively, if you had a number of such links to remove, you could use the Break string links on the ‘Model’ menu. Remember that this option operates on co-ordinate file(s) rather than observation files. As such that all editing carried out using this option will be undone if you edit observation data and rebuild the co-ordinate file.

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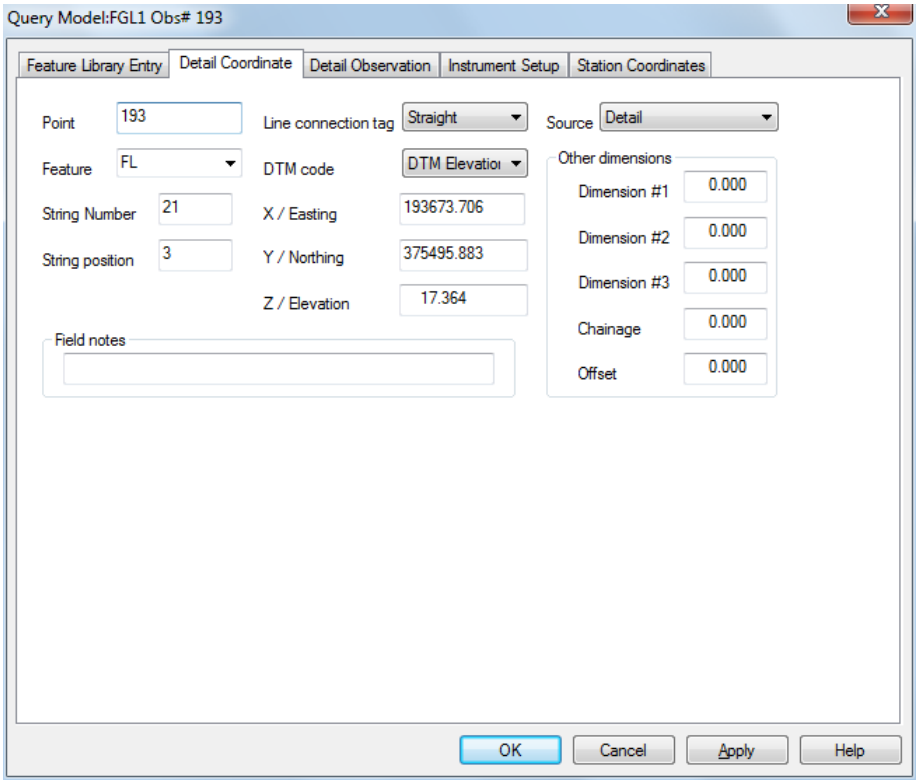
5.4 Point Editing

The 'Query and Edits points' option from the main EDIT menu allows you to select a point of interest for which a number of different detail tabs are displayed.



We have already mentioned the feature library tab and how it is used to set up or make changes to the characteristics of the point. Any changes made to the library using this tab, will present you with the option to update the project file.

The other four tabs are extracts from the survey file or SCC dataset used to create the model. The Detail Co-ordinate and Detail Observation tabs are nearly identical. The main difference relates to which dataset is being changed.

- If the **Detail Observation** tab is changed, the survey co-ordinates will be rebuilt to reflect the change.
- If the **Detail Co-ordinate** tab is changed, the detail observations are **not** affected.

A copy of the original survey file is kept so the coordinate files may be rebuilt from raw observations at any time you require them.

When querying a model that was created from multiple datasets, the dataset from which the queried point originated is displayed at the top of the dialog. In this example the queried point is taken from the 'FGL3' dataset.

Another item of particular interest is the **Instrument Setup** tab. This tab displays what station you were set up on for the point in question and also what station was backsighted to.

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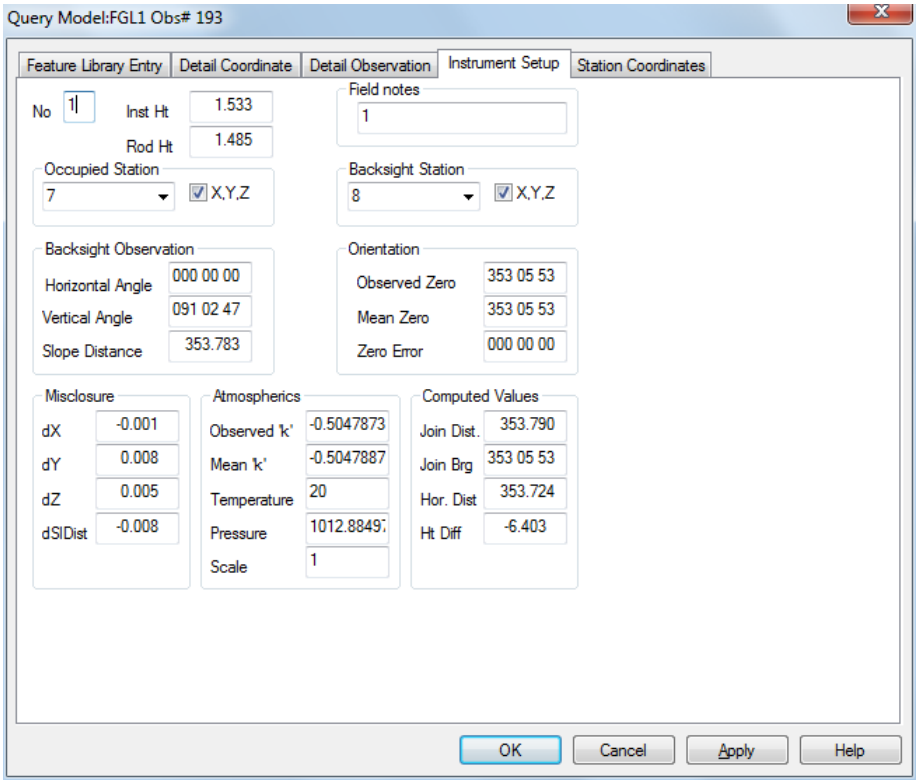


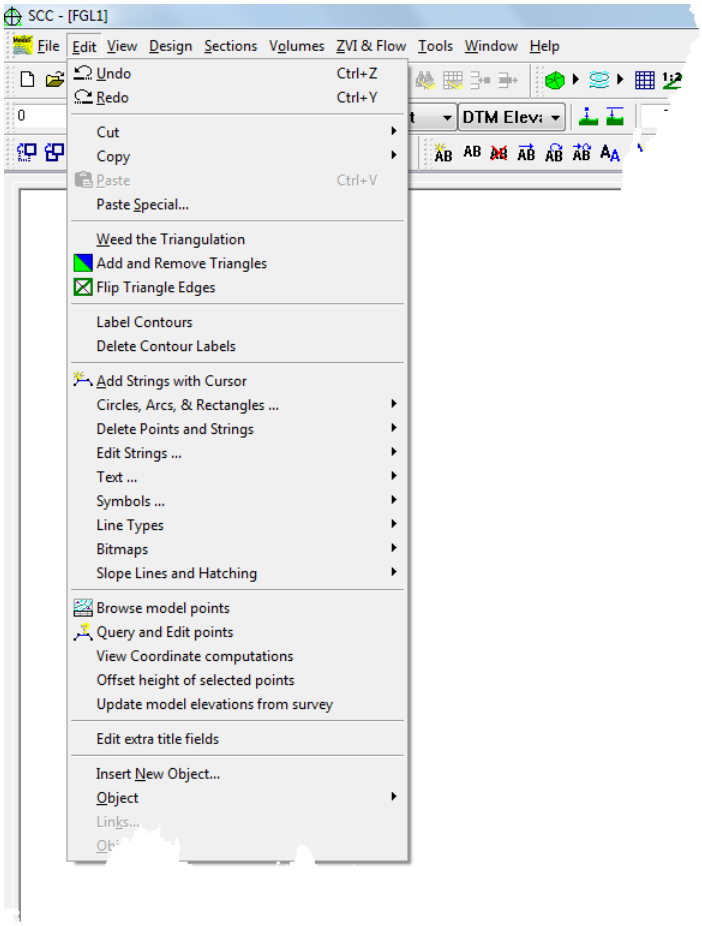
In the **Station Coordinates** menu, you can determine the position of each station that was set up upon. Sometimes the wrong station name is entered in the field, resulting in a disorientation of part of the survey. This can be easily tracked and corrected.

Editing models with the 'Query and Edit Points' option will undo any local string editing carried out on your model for the queried dataset. For this reason, it is advisable to do any query based editing prior to carrying out interactive string editing.

> As changes are made to the model using the 'Query and Edit Points' option the survey file will be automatically updated.

5.5 String Editing

SCC has an extensive set of string editing tools, similar to CAD tools, to interactively edit the model. This editing always occurs simultaneously in plan and 3d. String editing tools include trim, extend, move, copy, rotate, copy parallel, join, split, partial delete, reverse string, change geometry, change feature, and change DTM status can all be located under the main EDIT menu.



All tools work both interactively and with pre-selected data, such that they can be used to carry out a given operation on a large amount of points as a single operation. To access the ‘Data Selection Dialog’, you must press the right mouse button once when in the model.

For example, if you wished to use the ‘Delete overlapping text’ tool in a given area, you can used the ‘All points in a window’ option to select the chosen area. Likewise, if you wanted to apply the command to a particular feature code, you can use the ‘Apply String/Feature Range’ to define the points.

Data selection also works with ‘Cut’, ’Copy’ and ‘Paste’ commands, allowing you to transfer selected data between models and datasets.

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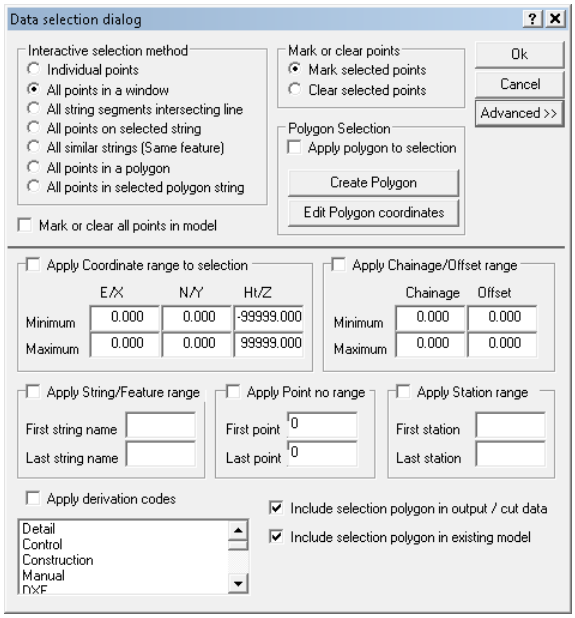


If you wished to show the string direction and point number for all points on a selected string you would do the following;

Display String Direction & Point Numbers on a String

Press Escape to clear any active editing operation

Press the right mouse button to access the'Data Selection Dialog'

Select 'All points on selected string'

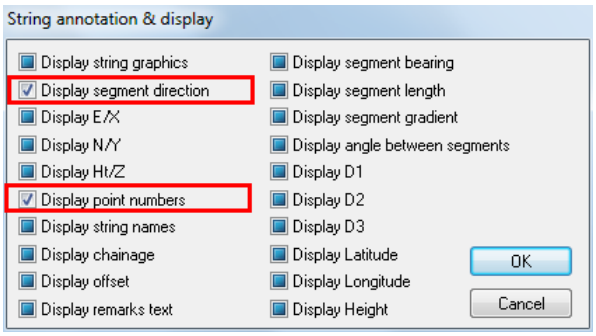
Select 'Mark selected points'

Press OK

Pick the string you wish to annotate

Go to the 'EDIT > Text > Edit Text Annotation'

Turn on 'Display point numbers' and 'Display segment direction'



'All points on selected string' will remain the default data selection method now until you change it, such that to similarly annotate subsequent strings you only have to go through the last three stages.

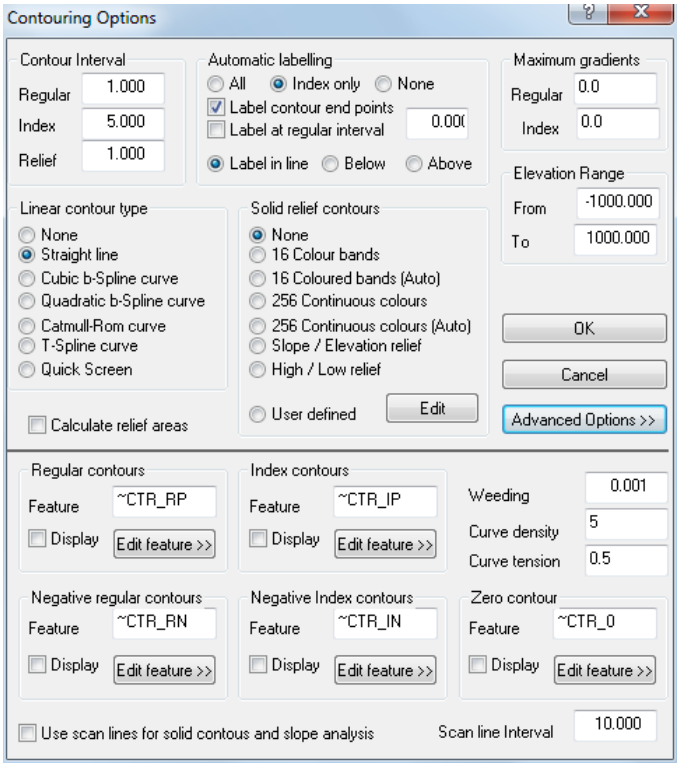
5.6 Survey Error Detection & Correction

There are various facilities available in SCC to rectify survey errors depending on how they were formed. Apart from red crosses, which highlight probable errors in your model, contours also play a part in highlighting possible height errors in the model. Selecting a small contour interval will draw your attention to any discrepancies in the survey.

Changing The Contour Interval

Activate the window FGL.model

From the toolbar, select black arrow on the contour button



Change the Regular Contour Interval to 0.5 and the Index to 2.0.

Set the Linear contour type to 'Quick Screen' and the Solid Relief Contours to 'None'.

Select 'OK'

You should immediately be able to see if there are any height discrepancies in the model.

5.7 Using SCC Editing Facilities to Rectify Survey Errors

The following examines specific editing tools to correct survey errors in the model.

5.7.1 Delete Points & Strings

At the bottom of the model along the road there are three crossing breakline symbols. The coordinates of this area are roughly 194152E and 374879N. If you look closely at this area you will see that there are four short lines running in the direction of the road. It seems that the surveyor began surveying the road with these short lines, but they were never finished. The road was surveyed using different strings. It may have been surveyed on a different day and/or by a different surveyor.

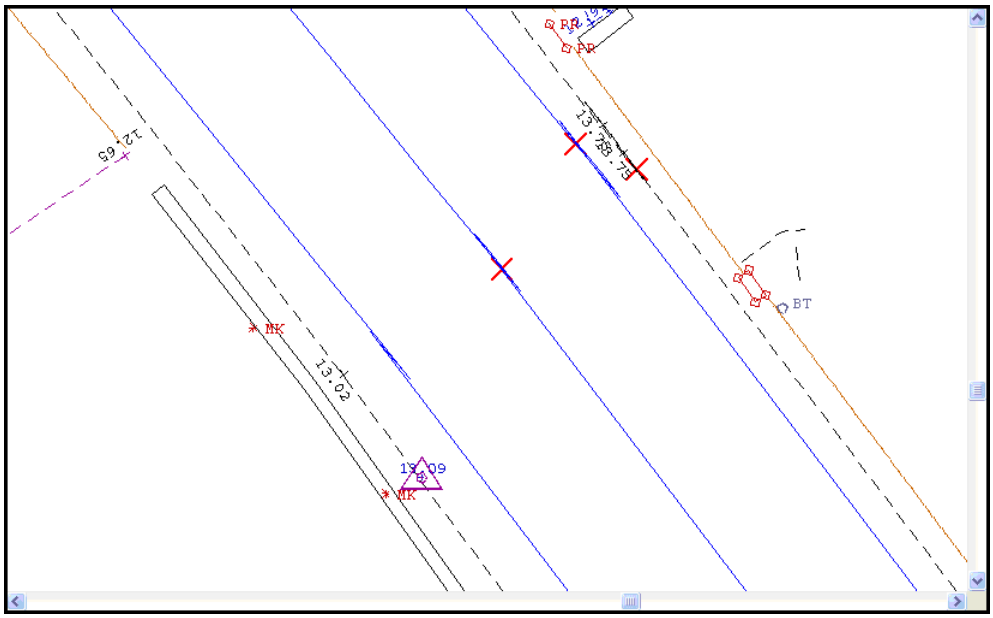
We want to delete the short intersecting lines. Select these lines by drawing a polygon around them. All points along these short lines will be selected as shown in the picture below. When the option to delete points is selected a dialog will be presented as to whether or not you want to delete the selected points. Choose Yes.

Selecting Points By Creating A Polygon

To view the Breakline Intersection Points more easily turn off the contours.

Zoom into an area where extra unnecessary points have been generated.

The co-ordinate of the top corner is 194140E, 374888N and the bottom right co-ordinate is 194166E, 374868N.



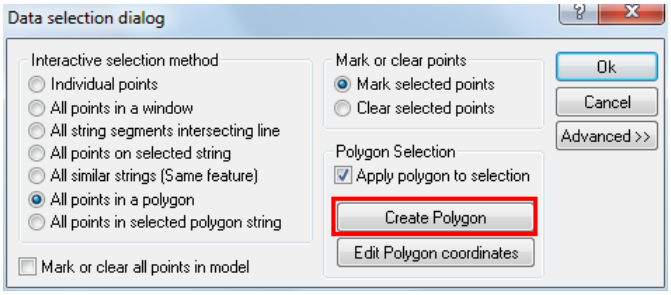
You will see that there are four short lines running in the direction of the road. It seems that the surveyor began surveying the road with these short lines, but they were never used to finish it. The road was surveyed using different strings. It may have been surveyed on a different day and/or by a different surveyor.

Left click mouse to bring up 'Data Selection Dialog'.

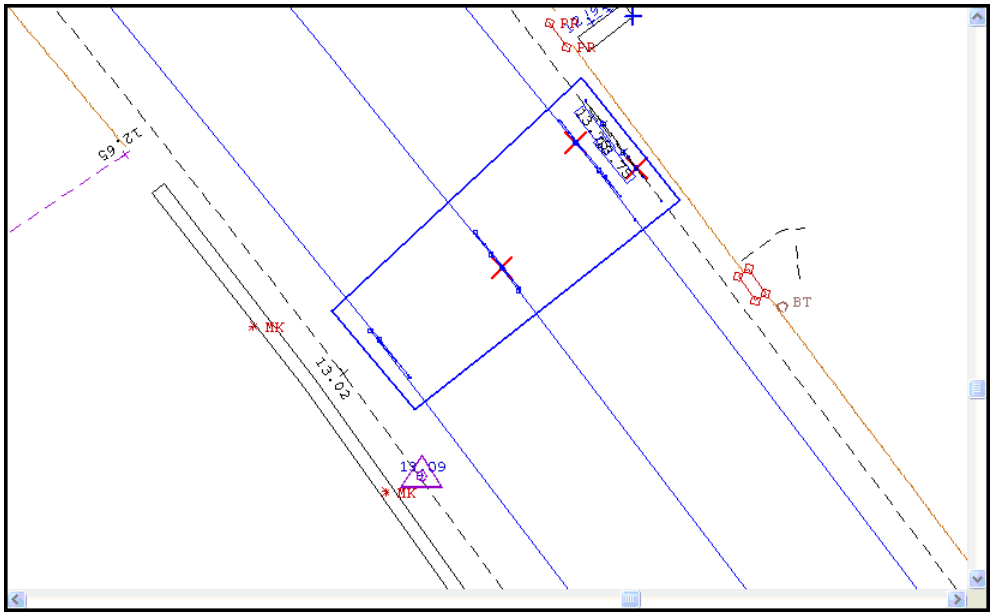
Select 'Create A Polygon'

This automatically selects 'All points in selected polygon string' and 'Mark selected points'

The option can also be used to 'Clear selected points' from an area where points have already been selected.



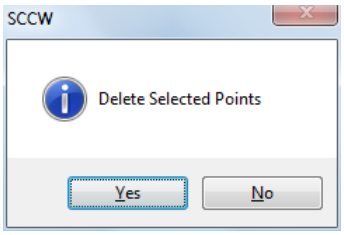
Draw a polygon around the four short lines by right clicking mouse to form 3 sides of the polygon and left clicking mouse button to close the polygon. All points along these short lines will be selected.

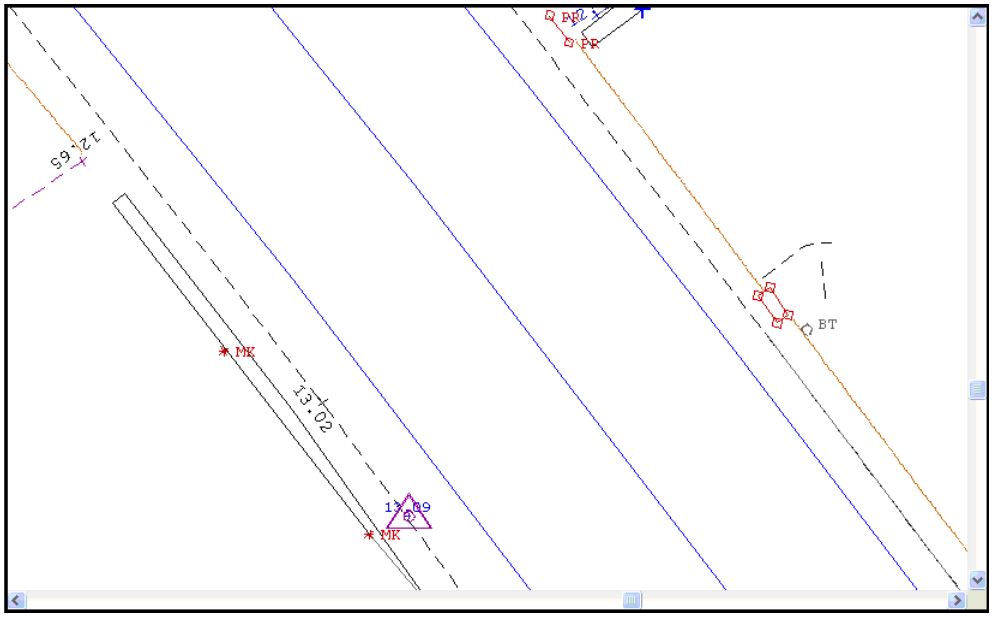


Delete Points and Strings

Go to 'EDIT > Delete Points and Strings > Delete Points'

Select 'Yes' to 'Delete Selected Points'





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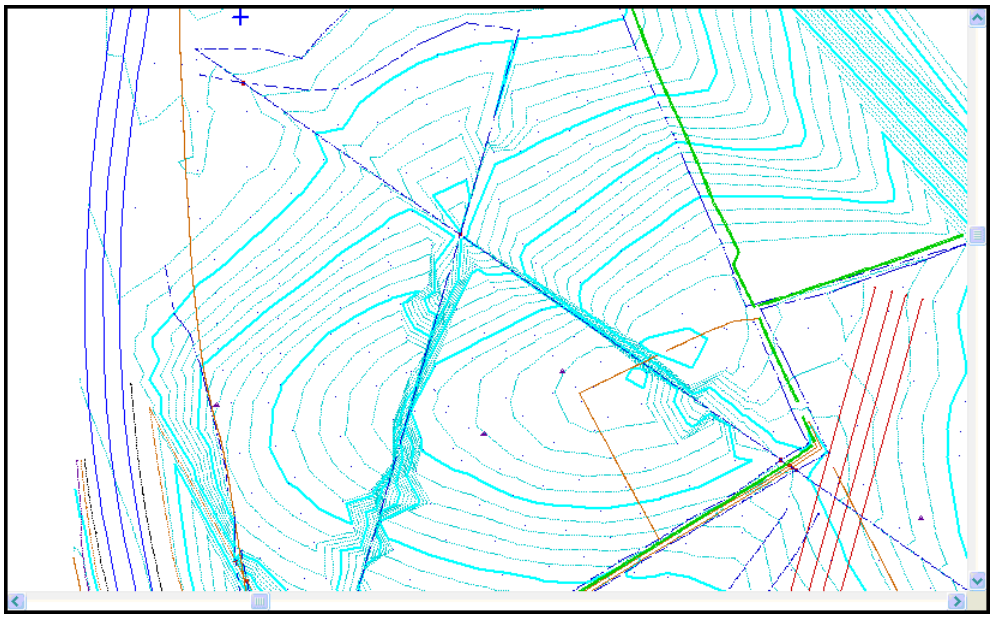
5.7.2 Breaking String Links

While the previous option allowed us to delete entire strings or points, we will often want to simply break a string into two separate parts by removing an undesired connecting link. Breaking string links may be achieved by selecting the above button or the 'Break Strings' option in the 'EDIT' > 'Delete Points & Strings' menu.

Zoom into the top left area to see the unwanted crossing strings.



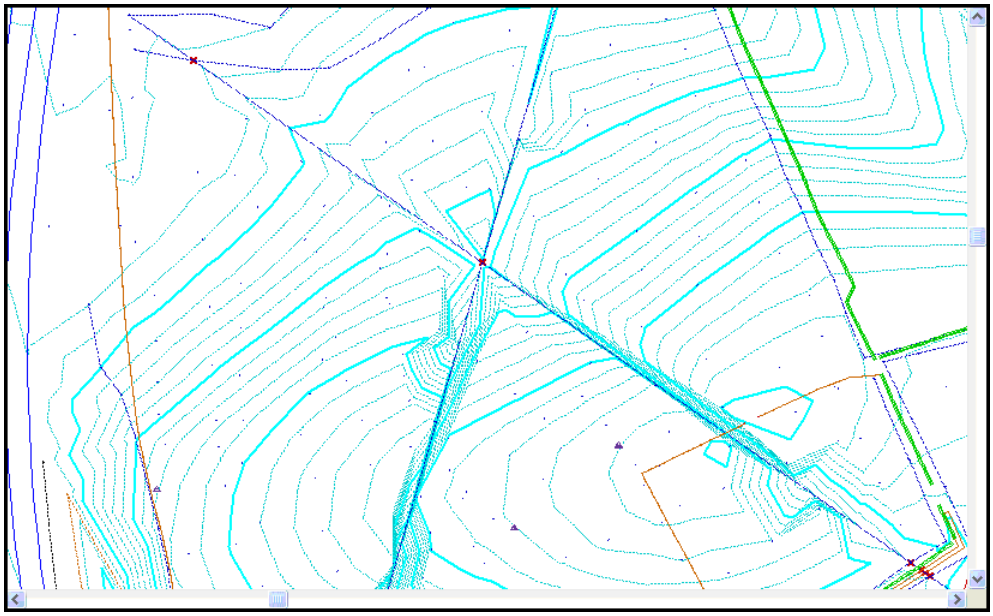
As you move the cursor on screen you will see a thick blue line that you can align to potentially unwanted string links. When this line lands on the correct link, press the left mouse button and the link will be removed. Alternatively you can use the 'Individual Points ' options from the data selection dialog to mark the end points of the unwanted link and then select the 'Break Links' option.

Breaking A String

Go to 'WINDOW > Zoom Window'

Zoom into the top of the model. There are two lines crossing.

If a segment of one of the lines were deleted, there would be no crossing breaklines.

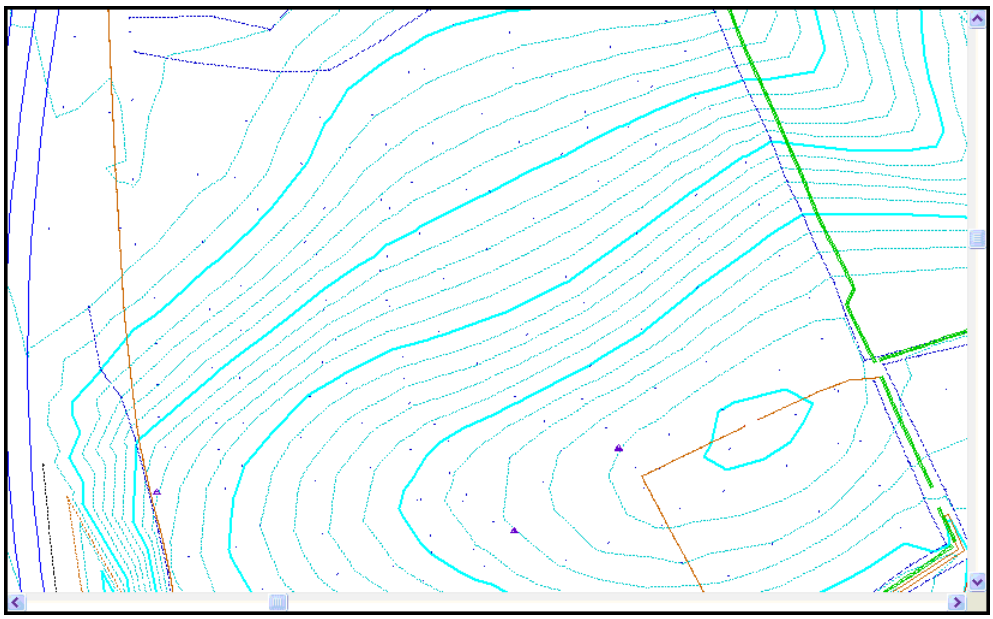


Go to 'EDIT > Delete Points & Strings > Break strings' or

Align the cursor along the string segment you wish to break and click the left mouse button.

Place cursor over line segment.

This option inserts a gap into the string. The line tag of the point at the start of the segment is changed to GAP.



Note:

To move to the next set of crossing breaklines hit the Tab key. SCC will retain the current view size and move to the nearest set of crossing breaklines. This facility saves zooming in and out of the model looking for crossing breaklines.

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5.7.3 Partial Delete

This option may be accessed from the 'Delete Points & Strings' option in the 'EDIT' menu. 'Partial Delete' allows any segment of a string to be deleted. It differs from the 'Break Links' option in that, the segment being deleted does not have to be between two surveyed points, it may be anywhere along the string.

Deleting Any Part Of A String

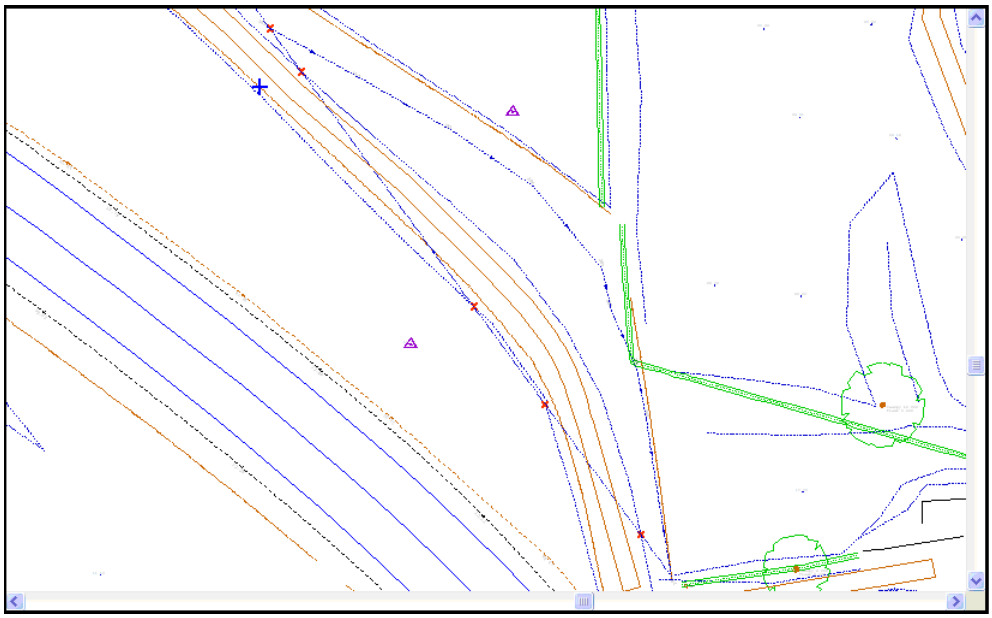
Go to 'EDIT > Delete Points and Strings > Partial Delete' or

Select the string you wish to delete – a blue bar appears perpendicular to the chosen string

Select a point on this string where you wish to delete from by left clicking mouse, and then the point you wish to delete to by left clicking mouse again.

5.7.4 Annotating Strings

In the last few examples, the string errors in the model were very easy to identify, but in many cases the error can be quite subtle and it helps to annotate the strings in order to figure out what is going on. Panning down and to the right on the model we see another area, where there are many crossing breaklines.

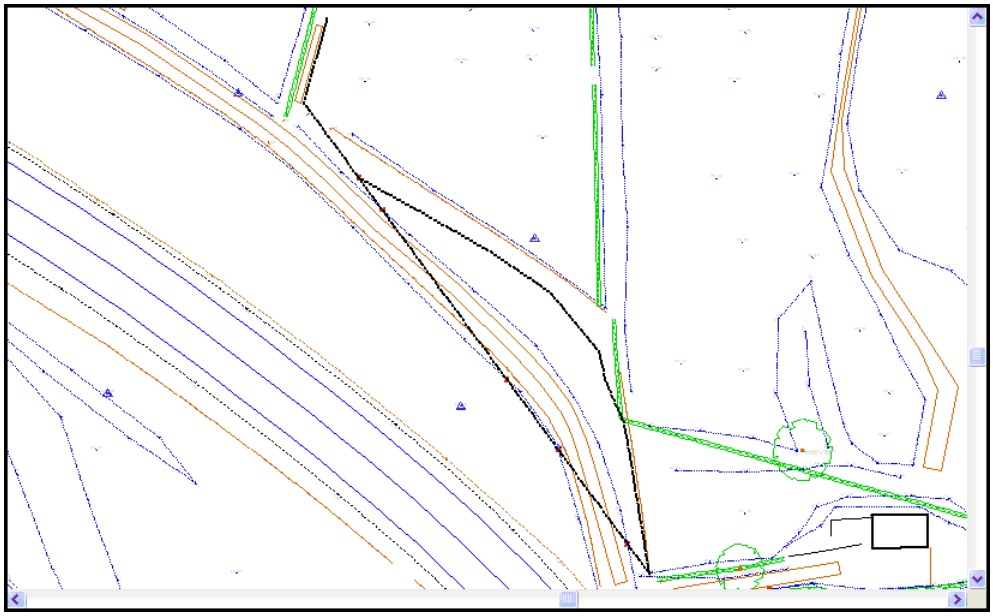


It appears to be an unwanted string link but we will do some more investigation to be sure.

Using the 'Data Selection Dialog' select the string of interest. Go to 'EDIT' and 'Edit text annotation' and display the point numbers and segment direction.

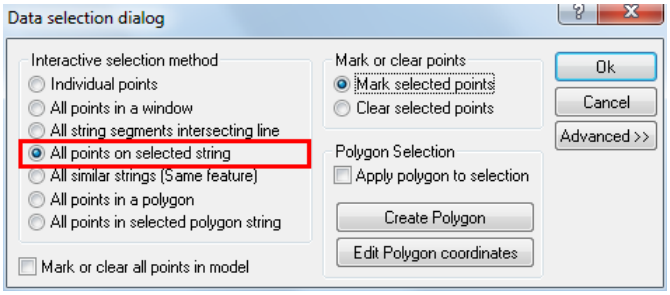
Zoom into an area at the bottom of the model where the end of one string seems to be joined to the beginning of another.

The co-ordinate of the top corner is 194054E, 374987N and the bottom right co-ordinate is 194178E, 374919N.



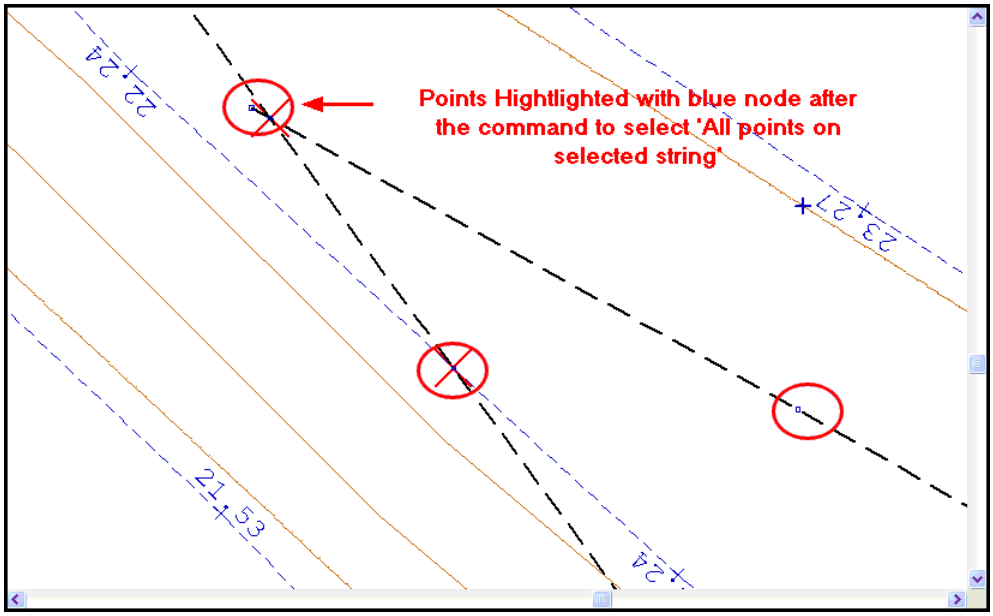
Note: The string of interest has been highlighted in the diagram.

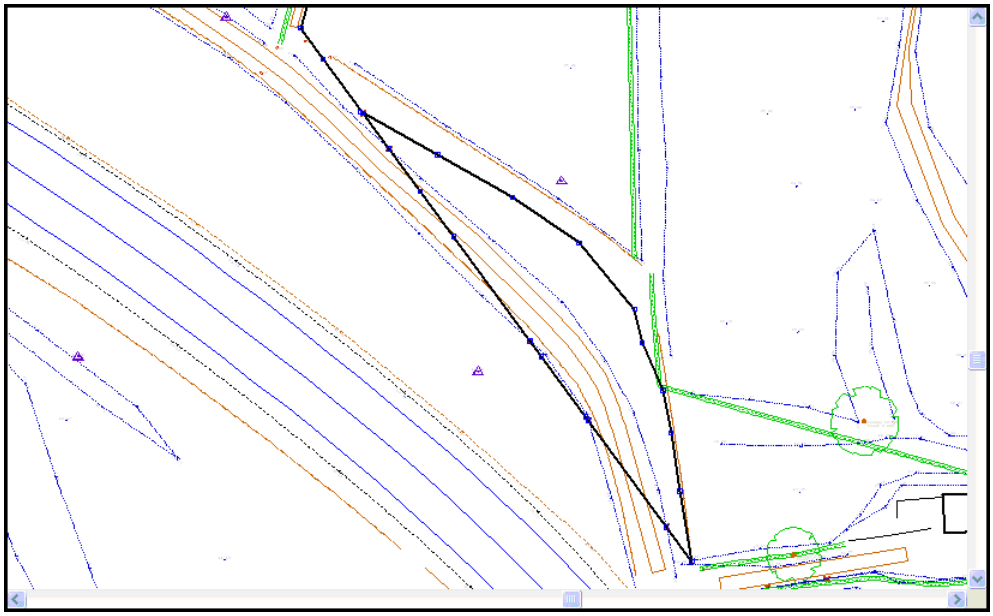
Left click mouse to bring up 'Data Selection Dialog'.



Select 'All points on selected string' and 'OK'

Left click on string, all points on the string are highlighted in blue nodes

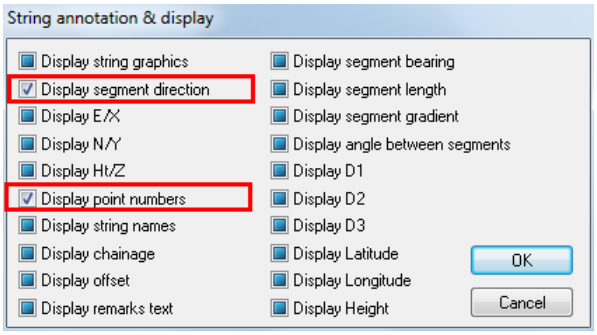




Display Point Numbers & Segment Direction

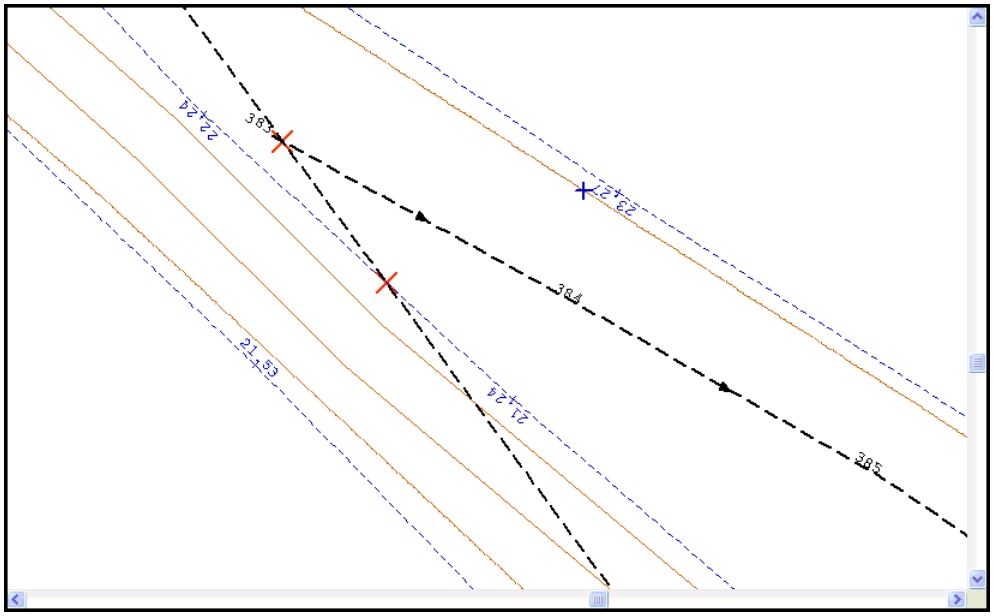
Go to 'EDIT > Text >Edit Text Annotation' or

Select 'Display Segment Direction' and 'Display point numbers'



Note that highlighting boxes in this dialog will turn the associated text on, clearing boxes will turn text off, and leaving boxes grayed out will not effect associated text at all.

Select 'OK'



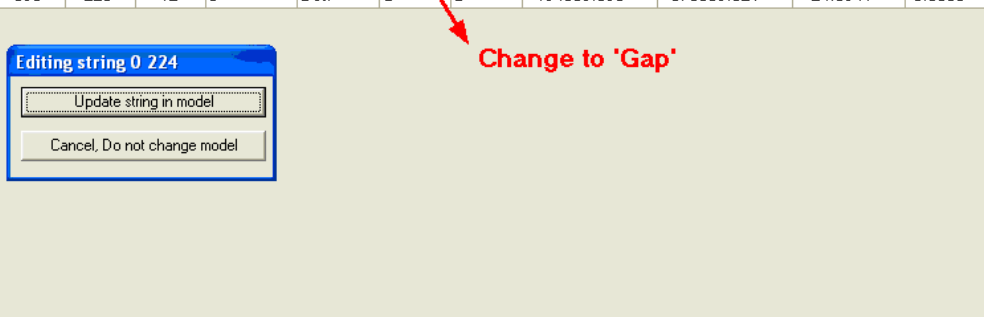
You will notice one long segment going from point number 392 to 397 over which all the crossing breaklines lie. If this segment is deleted or removed then there will be no crossing breaklines.

Go to 'EDIT > Edit String Details'

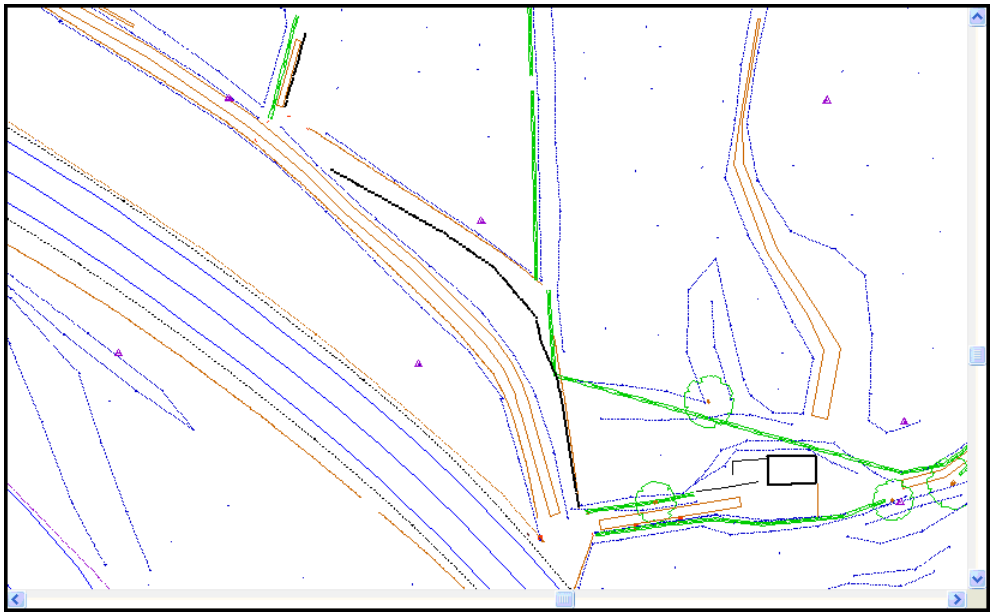
Left click on string, which will bring up a coordinate spreadsheet containing the coordinates of each point.

Change Point 392 tag code from 'Straight' to 'Gap'

	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)
1	383	225	1	0	Detl	S	D	194093.807	374983.722	22.5980	0.0000
2	384	225	2	0	Detl	S	D	194104.934	374977.670	22.8801	0.0000
3	385	225	3	0	Detl	S	D	194115.706	374971.627	23.2030	0.0000
4	386	225	4	0	Detl	S	D	194125.290	374965.156	23.1472	0.0000
5	387	225	5	0	Detl	S	D	194133.334	374955.695	23.0733	0.0000
6	388	225	6	0	Detl	S	D	194134.406	374950.942	22.5871	0.0000
7	389	225	7	0	Detl	S	D	194137.423	374944.209	21.5654	0.0000
8	390	225	8	0	Detl	S	D	194138.565	374938.211	20.6355	0.0000
9	391	225	9	0	Detl	S	D	194139.862	374929.879	17.5944	0.0000
10	392	225	10	0	Detl	S	D	194141.545	374919.938	15.1485	0.0000
11	397	225	11	0	Detl	S	D	194085.201	374995.568	23.2372	0.0000
12	398	225	12	0	Detl	S	D	194089.095	375009.321	24.5941	0.0000

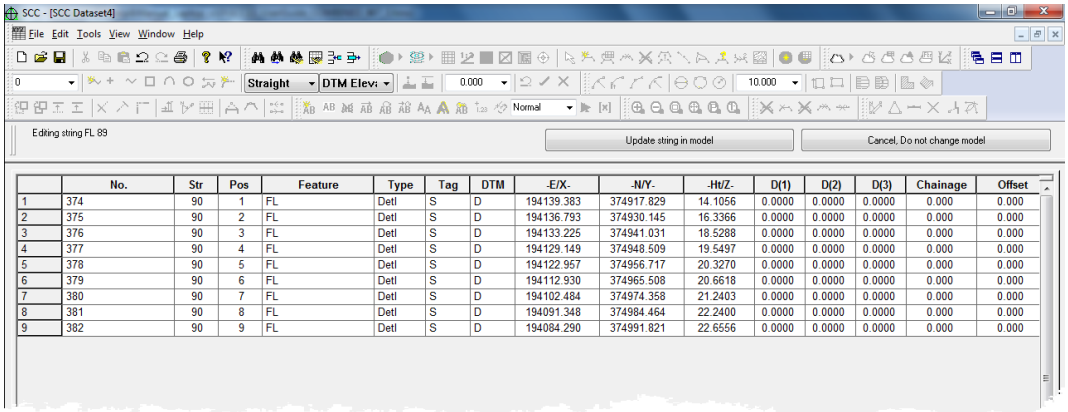


Select 'Update string in model'



5.7.5 Using The String Editor

Selecting the 'Edit String Details' option from the 'Edit Strings' menu in the model view accesses the string editor. To select a string simply press the left mouse button over any point on the string we wish to edit. A spreadsheet containing the co-ordinate details of the select string, is displayed.



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset
1	374	90	1	FL	Detl	S	D	194139.383	374917.829	14.1056	0.0000	0.0000	0.0000	0.000	0.000
2	375	90	2	FL	Detl	S	D	194136.793	374930.145	16.3366	0.0000	0.0000	0.0000	0.000	0.000
3	376	90	3	FL	Detl	S	D	194133.225	374941.031	18.5288	0.0000	0.0000	0.0000	0.000	0.000
4	377	90	4	FL	Detl	S	D	194129.149	374948.509	19.5497	0.0000	0.0000	0.0000	0.000	0.000
5	378	90	5	FL	Detl	S	D	194122.957	374956.717	20.3270	0.0000	0.0000	0.0000	0.000	0.000
6	379	90	6	FL	Detl	S	D	194112.930	374965.508	20.6618	0.0000	0.0000	0.0000	0.000	0.000
7	380	90	7	FL	Detl	S	D	194102.484	374974.358	21.2403	0.0000	0.0000	0.0000	0.000	0.000
8	381	90	8	FL	Detl	S	D	194091.348	374984.464	22.2400	0.0000	0.0000	0.0000	0.000	0.000
9	382	90	9	FL	Detl	S	D	194084.290	374991.821	22.6556	0.0000	0.0000	0.0000	0.000	0.000

Inserting A Gap In A String

Go to 'EDIT > Edit Strings > Edit String Details' or

Select the string you have just annotated

Type 'G' in the Tag field for observation number 378

Select Update string in model

The string editor is the most versatile of the editing tools and can be used to add and remove points, change the direction of parts of a string, re-label a string etc. If you can't find another way of performing a string editing operation, you will usually be able to do it in the string editor.

5.7.6 Moving Points On A String

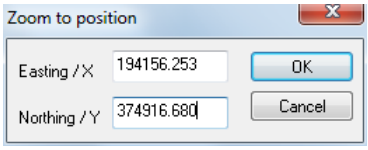
We are now going to look at a crossing breakline problem caused by two strings overlapping. Using the 'Move Points' option best solves this type of problem. First go to the area of interest.

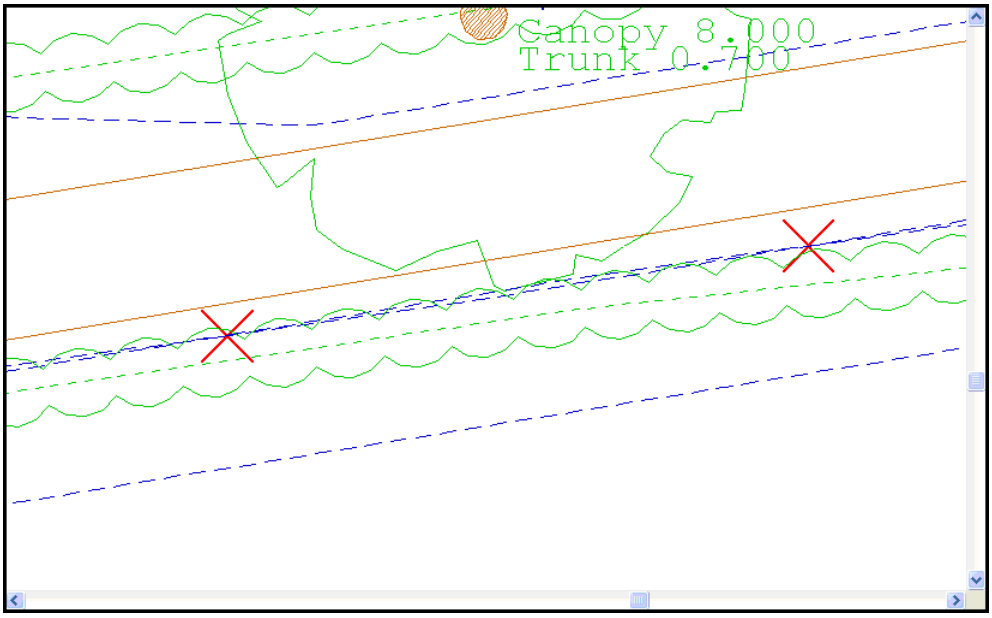
Zooming to specific coordinates

Press 'Page Down' to zoom in quite close

Select 'WINDOW > Zoom to X,Y position'

On the dialog, enter coordinates of 194156.253, 374916.680





Select the 'Move Points' option from the 'EDIT' menu to move the point on the dashed string (Point 598) to the far side of the string it crosses, hence removing the overlap and the crossing break lines.

Moving Point

Select 'EDIT > Edit Strings > Move Points' or

Left click on the dashed string (Point 598) and drag to the far side of the string it crosses, hence removing the overlap and the crossing breaklines.

The 'Move Points' option should be used in conjunction with the snap controls where the ends of two strings that meet, overlap slightly. It is better used free hand when fixing problems such as the one above, and re-aligning tops and bottoms of kerbs for example.

Below is the result of using the 'move points' option.

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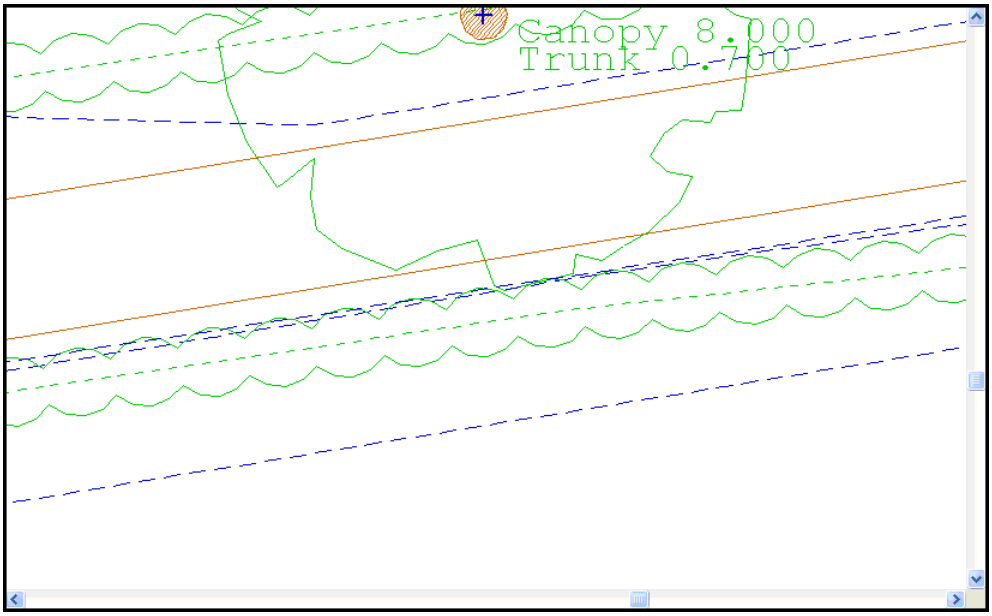
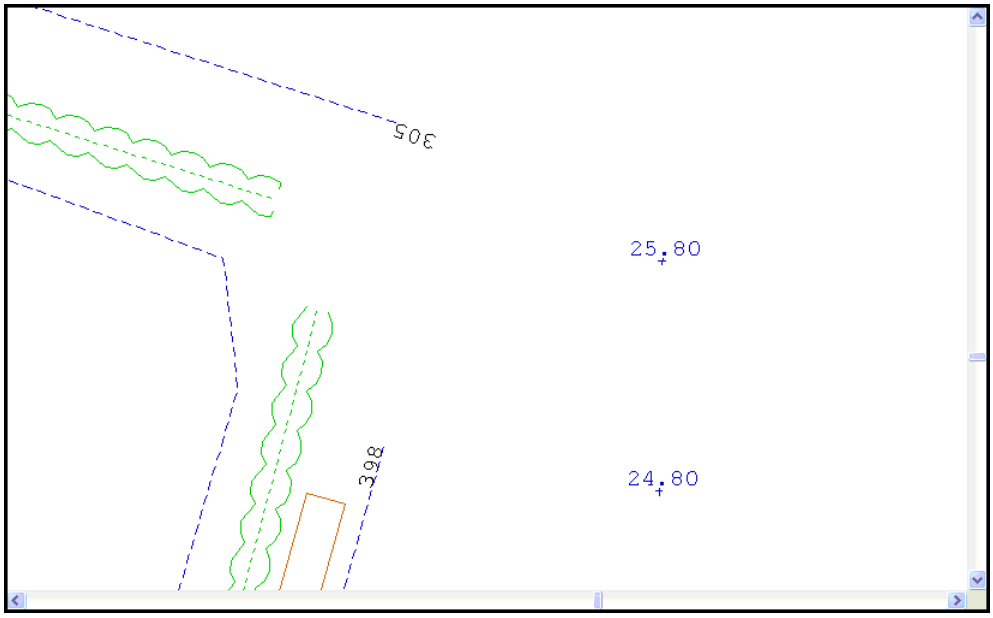


5.7.7 Extending Strings To Intersect

Apart from breaking string links there is often a requirement to join strings together. This typically occurs on larger jobs where several crews may be surveying the same string, either at different times or from different directions. This will often leave a string in many separate sections that needs to be connected.

If we zoom back up to the area where we were using the string editor we can see a few strings that may need to be joined up.



The 'Join Strings' option may be used to join two strings together with a single line. Alternatively the 'Extend to Intersect' option may be used to extend the two strings until they meet.

The 'Join Strings' option will convert the two separate strings into a single string if they both are of the same type. If they are not the same type an extra segment will be added to the end of the first string to make it meet the second string, in this case they will remain

separate strings.

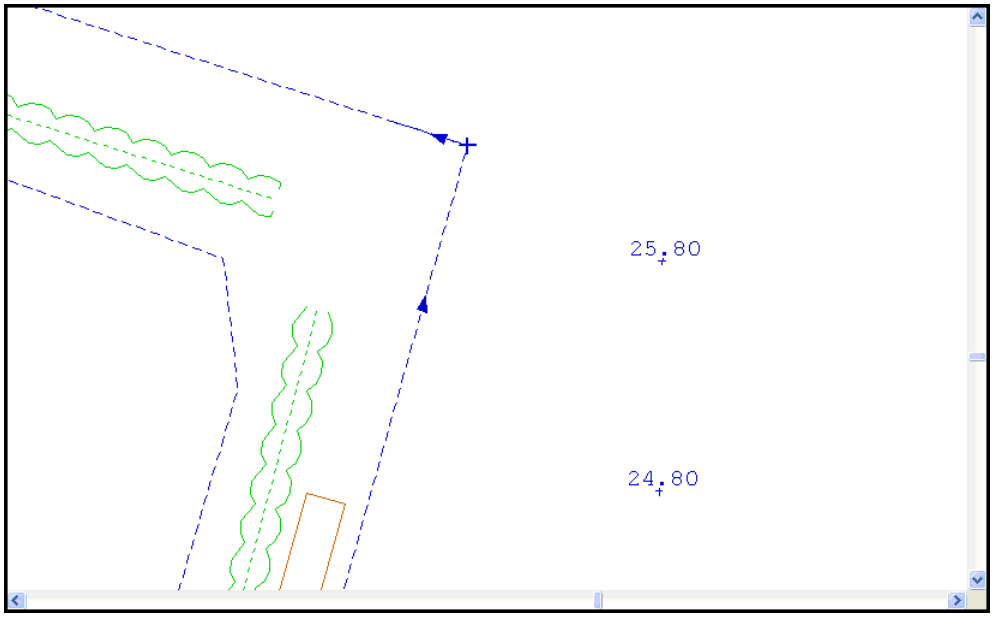
Select the 'Extend to Intersect' option from the 'Edit Strings' sub-menu and press the left button first on point 398 and then on point 305 to join up the outer fence string.

Extend Lines To Intersect

Go to 'EDIT > Edit Strings > Extend To Intersect' or

Select point 398 and then select point 305

Both lines will be extended until they intersect



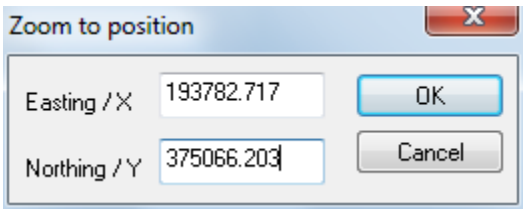
5.7.8 Trim Lines

Strings may sometimes extend further than they should. If this happens use the 'Trim' command to trim the strings back to a cutting edge.

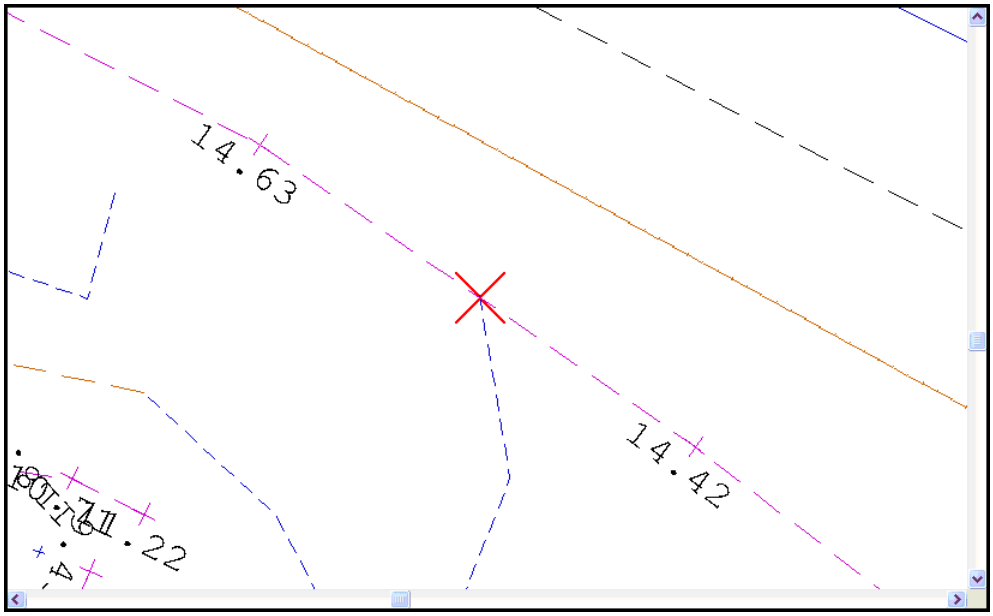
Trim A Line

Select 'WINDOW > Zoom to X,Y position'

Type in the X and Y co-ordinates 193782.717 and 375066.203 respectively



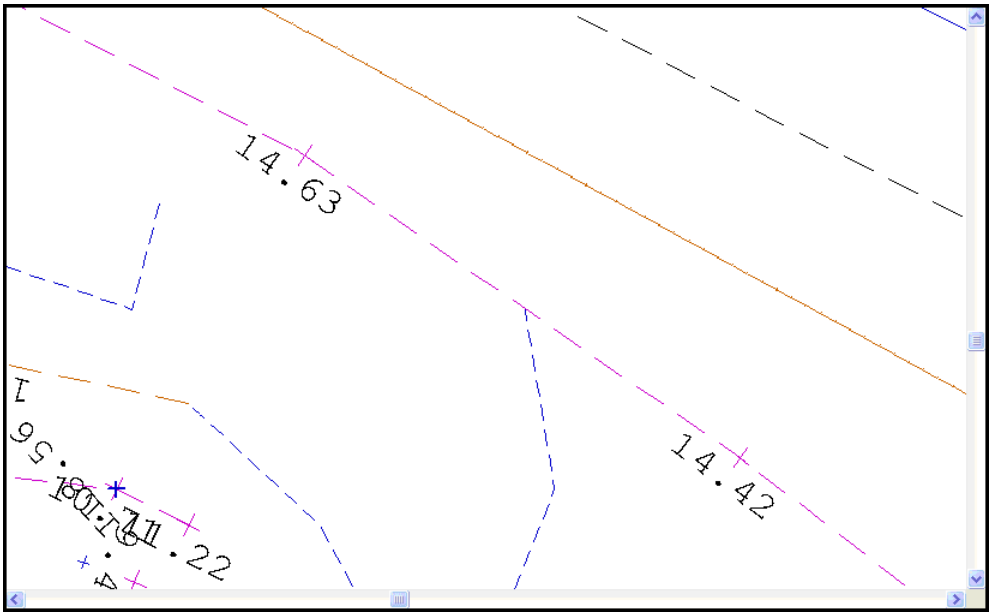
Select 'Ok'



Go to 'EDIT > Edit Strings > Trim' or

Pick 'TB' as the cutting string for trim – once selected, the cutting edge will turn to red

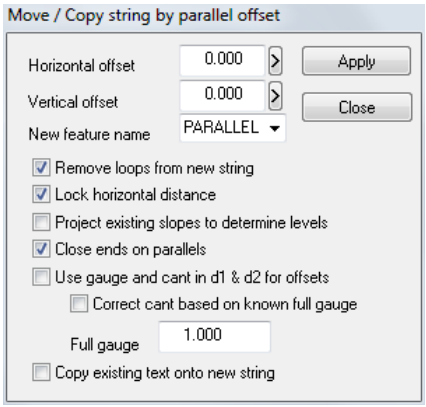
Select 'FL', as string to trim



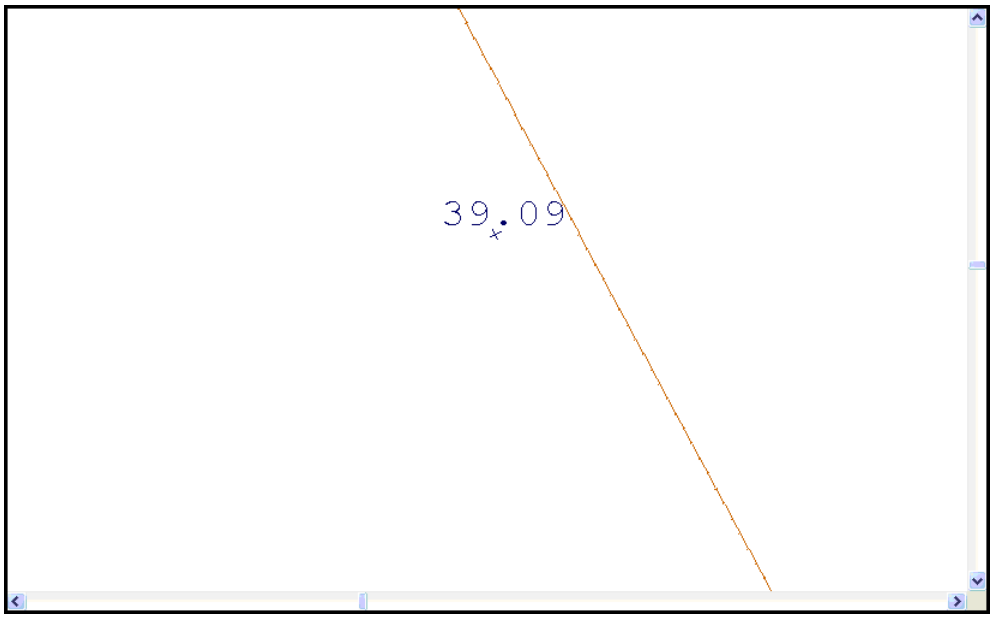
Press 'ESC' quit this command

5.7.9 Copying/Moving Strings

Copying or moving strings in the model, brings up the following dialog display.



Due to an error in the original survey, it may be necessary to offset a string a certain distance, or copy a string parallel. For example, if a hedge has been offset 2.0m to the left instead of 2.0m to the right, then, by using the above command, you can offset the hedge string 4.0m to the correct position.



Copy A String Parallel

Select 'EDIT > Edit String Details > Copy String Parallel' or

Enter the horizontal distance of 2m in the relevant box and turn on the 'Lock Horizontal Distance' and 'Remove loops from new string' options.

Using Drop Down Feature Menu select 'F' as the new feature name

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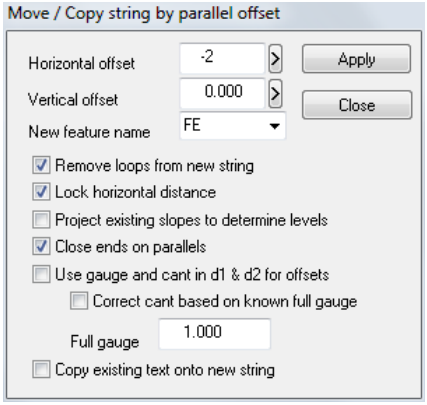
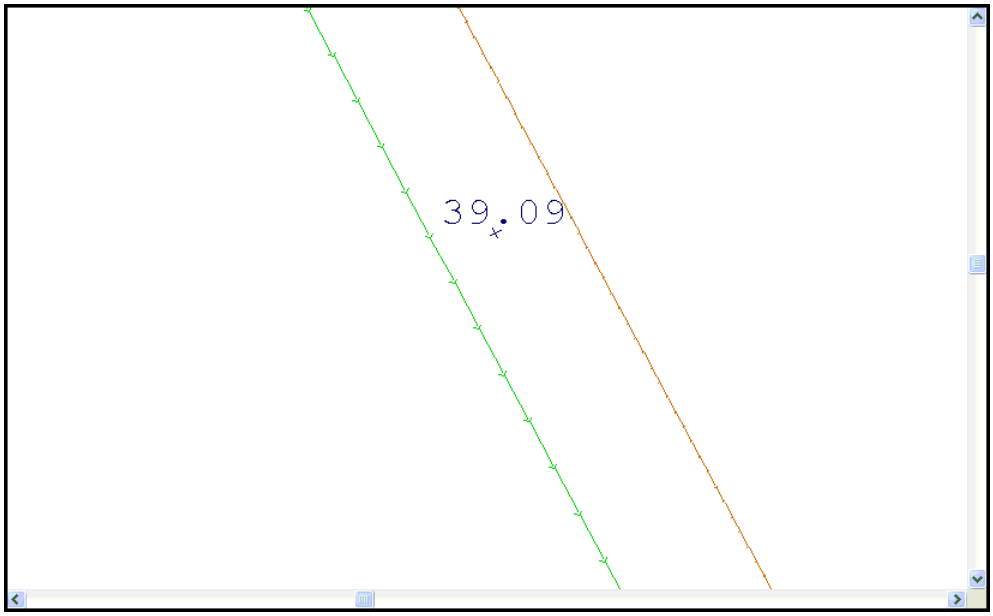


Left click on existing string and move/drag cursor in correct offset direction

Left click to place new string

Select 'Close'



A vertical offset may also be entered though the new string will assume the levels of the original string if the box is left at 0.000. If a horizontal distance is not specified and the ‘ lock horizontal distance’ box left blank, then the string selected can be moved automatically with the cursor and the distance is shown in the ‘horizontal distance’ display.

5.7.10 Adding Slope Lines To A Model

As well as adding text to the model, you may wish to add a feature such as a slope string, which indicates the slope of a selected area and the direction in which it is falling. Slope strings can be added using two methods:

- Slope lines between strings or
- Slope lines using reference string

The first method allows you to pick two strings and generates the slope lines between the two from the lowest to the highest.

The second method is more likely to be used when the two strings are more curved or jagged and in this case, the first method will not work. To add the slope strings between

strings of this nature, you need to add a reference string first. When the reference string has been added, the slope string can be drawn, by selecting, in order, the first string, the second string and finally the new reference string.

Add Slope Strings Using A Reference String

Add the reference string by selecting the icon from the toolbar. Select the icon to update the string in the model.

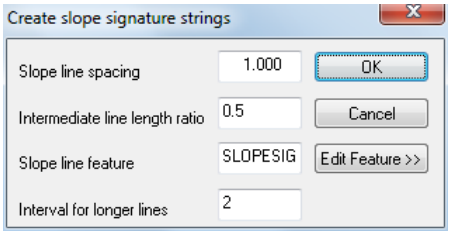
Select 'EDIT > Slope Lines & Hatching > Slope lines using reference string'

A blue cross will appear at the end of the cursor.

Select the First String and then second string by left clicking mouse on each respectively

Select the reference string

Enter in your own values



OR

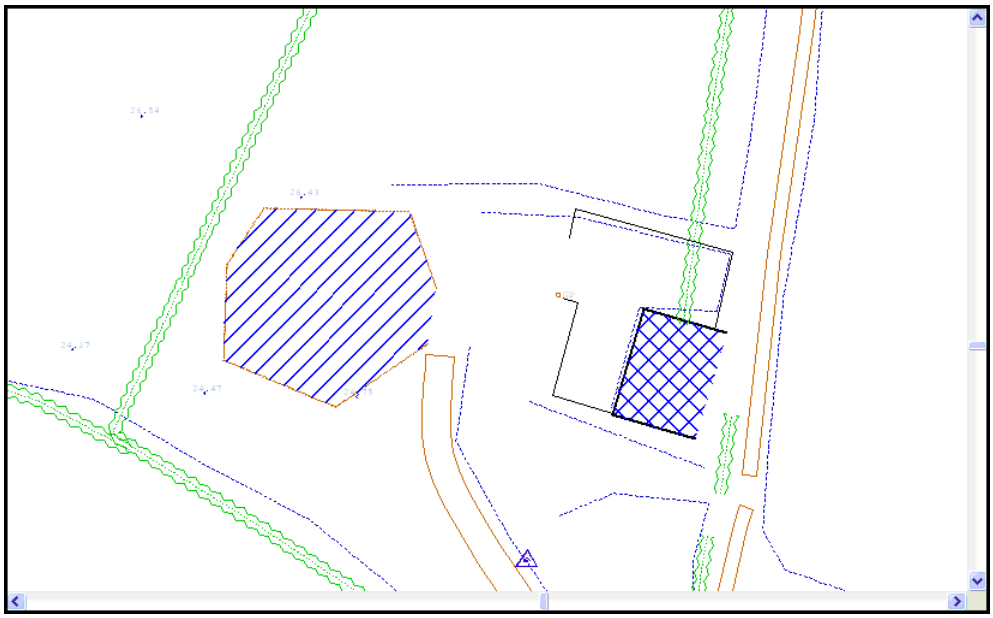
Accept the defaults

Select 'OK'

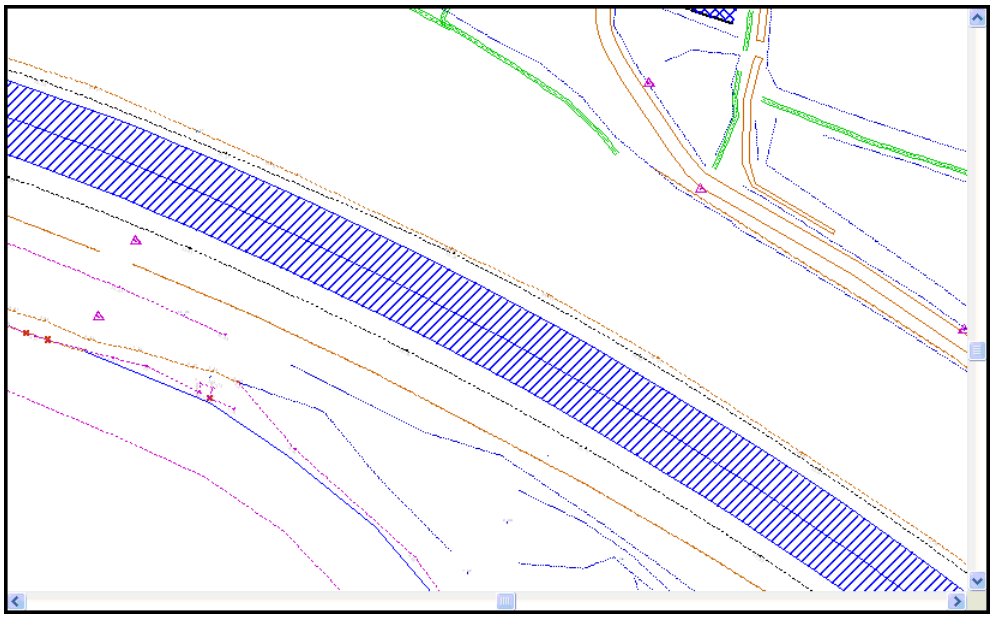
5.7.11 Adding Hatching To A Model

SCC also gives you the option to add hatching to a model. The two options available are:

- 'Hatch a polygon' assumes a closed link between the first and last points on the string regardless of whether it is displayed in the model.



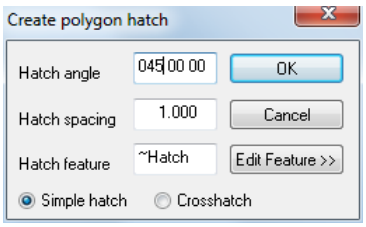
- ‘Hatch between strings’ will hatch between any two strings selected by the user. The strings must be selected prior to using this option. This can be done using the ‘Data Selection Dialog’.



Hatch A Polygon

Go to ‘EDIT > Slope lines & Hatching > Hatch a polygon’

Left click mouse on polygon you wish to hatch



Enter in the values for angle and spacing and select whether you want simple or cross hatching displayed.

Select ‘OK’

5.8 Editing Pre-selected Data

Using the data selection dialog allows various methods of point and string selection. If points have been pre-selected and then an editing option chosen, you will be asked if you wish to perform this task on the selected points.

The following editing options may be used with pre-selected:

- Move points
- Delete points and strings
- Break Strings
- Unlock Text
- 3Pts Arc
- Fillet Arc
- Arc 2Pts + Radius

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- Arc 2Pts + Tangent
- 2Pts Circle
- 3Pts Circle
- Circle, Radius + Arc
- 2Pt Rectangle
- 3Pts Rectangle

Creating A 3Pts Arc From Pre-selected Data

Open the FGL model

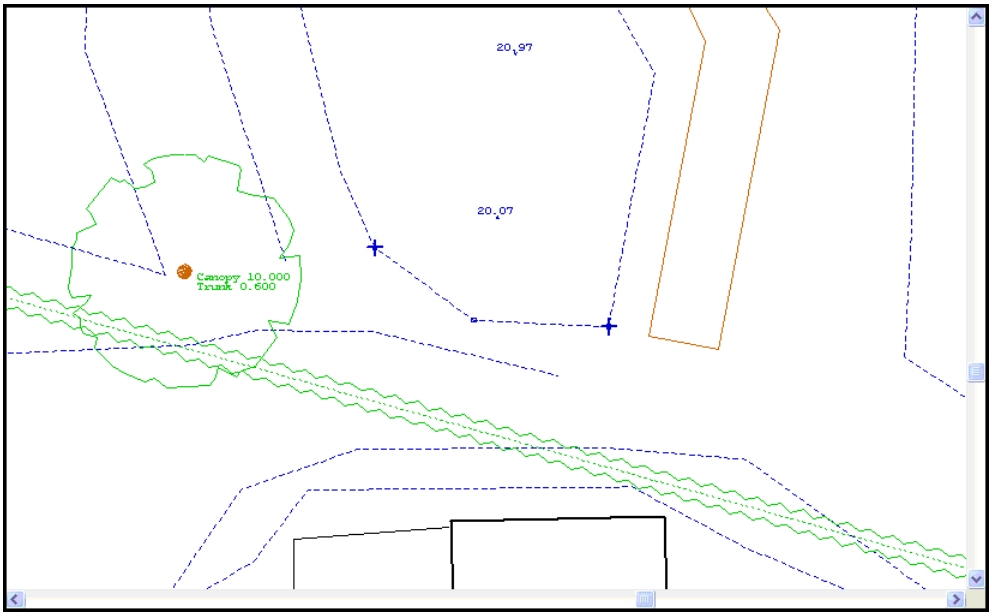
Zoom into the south east of the model as shown in the diagram below

Click the right mouse button to access the 'Data Selection Dialog'

Set the selection method to 'Individual Points'

Select OK

Select the points shown below



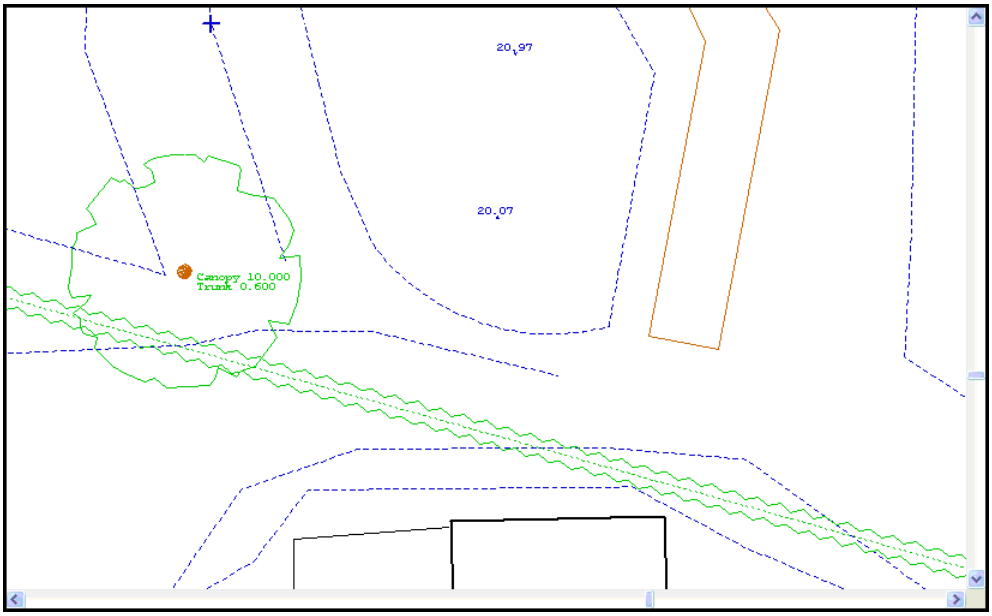
Go to the Circles, Arcs and Rectangles toolbar

Set the Change Radius/Width to 0.1

Select the third icon – Arc 3Pts

Select 'Yes' to 'Convert selected points'

The result should look as below.



5.8.1 Surveying Circular and Curved Objects

The following examines tag codes (Curve, Arc Fit & Circle Fit) assigned to man made circular structure.

One must considers that circular object on site have been designed with a specific defined radius. As the radius is unknown the surveyor must implement geometry tag codes between survey points to best represent the structure on the ground.

It is important to note that curve fitting in plan is merely a plan fit in 3D and therefore not recommended for man made structures on an incline/decline i.e. sloping ground.

In conclusion, circle fit is shown to give the best representation of man made object.

Curve / Curve Fitting Within SCC:

Extra curve points are generated in between surveyed curve points. The type of curves used is 'Splines under tension'. Curve generation parameters may be further defined by tension and point density parameters. Points used to define curves should be surveyed at even intervals apart. The number of points required for accurate delineation of a curve depends on the accuracy requirements. As a guide on tight curves on road belmouths, points for engineering accuracy requirements may be as close as 1 -2 meters - very tight curves on traffic islands may be at 0.1 to 0.2 meters centres depending on the tightness of the curve - main highway curves may be as far apart as 10 to 20 meter centres depending again on requirements.

Curve Type

The following curve-fitting algorithm can be assigned;

Default

The curve fitting settings will be the default one found in the coordinate reduction options dialog.

Catmull-Rom (Tight)

A Catmull-Rom curve will be fit through the survey points. This curve type stays very close to the survey line and has user definable tension and tangent weights.

Tspline (Circular)

A trigonometric spline curve will be fit through the survey points. This curve is suitable for more circular features that are not true circles. A T-Spline curve through an equilateral triangle will result in a circle. When collecting points on this type of curve, it helps if they are reasonably evenly spaced. Failure to do so may result in a curve that billows away from the surveyed line.

Circle fit

This option creates a best fit circle through all the points on the surveyed polgon. It is usefull when dealing with circular tanks, small roundabouts, and other man-made circular features.

Curve point density

This is the ratio of curve fit points to surveyed points. For example, a value of 10 would result in ten extra 3d curve fit points being generated for every survey point.

Curve tension

This applies to Catmull-Rom curves only, and defines the closeness of the surveyed line to the curve. The default value of 0.5 rarley needs to be changed. A value of 0 results in a straight line. A value of greater than 0.5 allows the curve to billow further from the line, (i.e. it loosens the curve).

Curve tangent weight

This applies to Catmull-Rom curves only, and defines the effect of the incoming and outgoing tangents on the curve. The default value of 1.0 rarely needs to be modified.

Coordinate Reduction Option

The Coordinate Reduction option allows the user to edit configurable parameters relevant to the generation of the detail co-ordinate information. These parameters are used when creating detail co-ordinates from the detail observation spread sheet.

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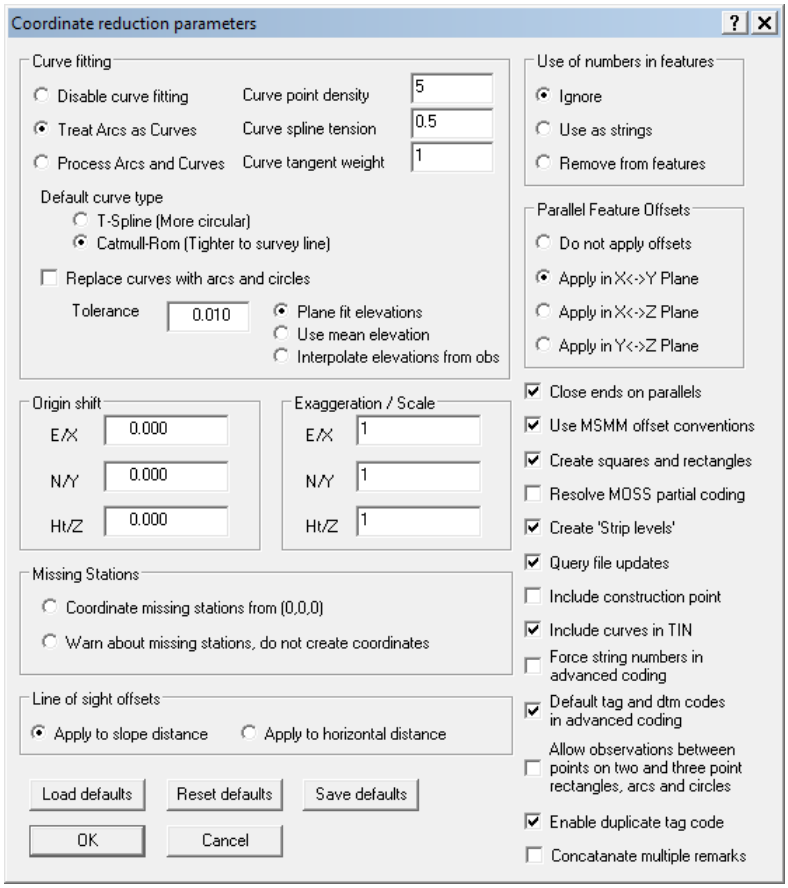
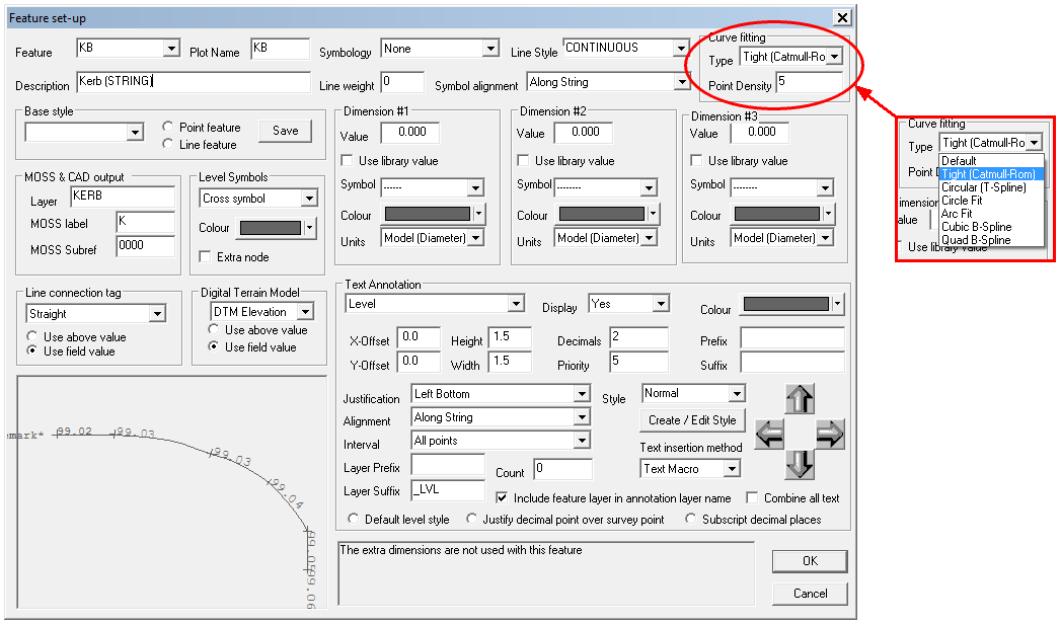


Feature Library

Also specific settings may be assigned to individual features within the Feature Library – Feature Wizard as shown below:



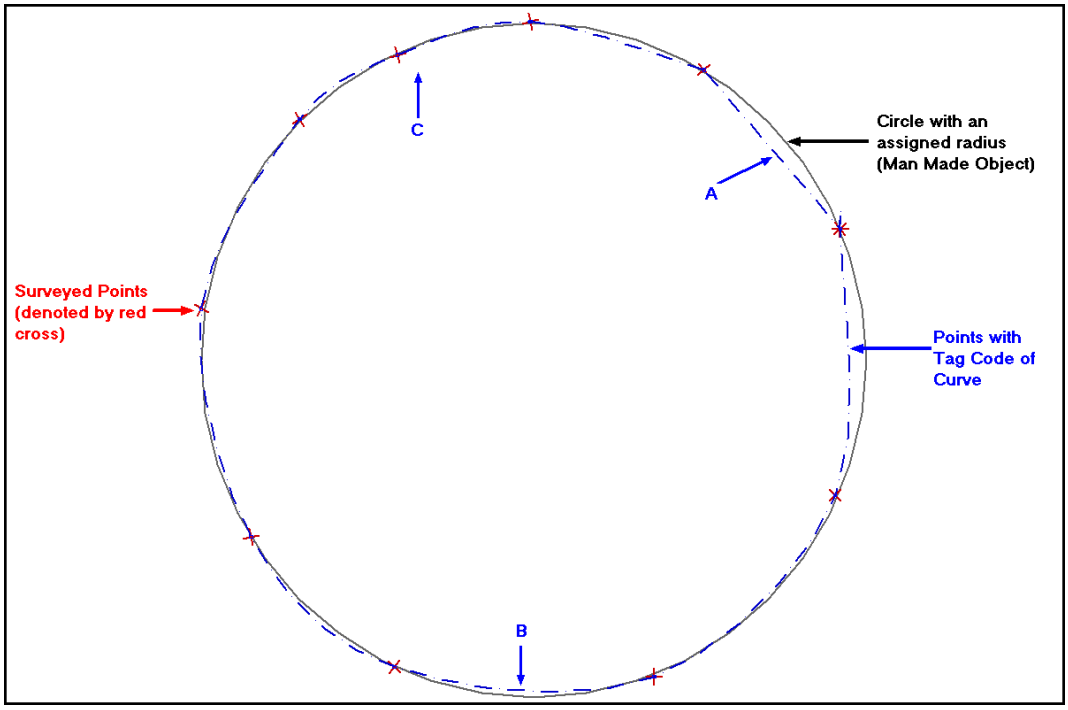
Case Study:

Consider the Man Made Object with a defined radius denoted in each scenario in red.

Ten survey points have been pick up in the field.

Scenario 1: Curve 'C' Tag Code

In the field, the surveyor has pick up 10 points and assigned the relevant 'C' tag code to each. Extra curve points are generated in between surveyed curve points.



Note the influence of the point spacing in area A and B. In area C, points have been surveyed closer together and as a result the curve is a better representation of what is on the ground.

Scenario 2: Arc Fit Tag Code

An Arc Fit Tag Code assigns a best-fit circular arc to the surveyed points.

When more than 3 points are used to generate the arc, the additional points are used only to influence the arc. That is, the arc will not intersect or pass through all points, as shown below:

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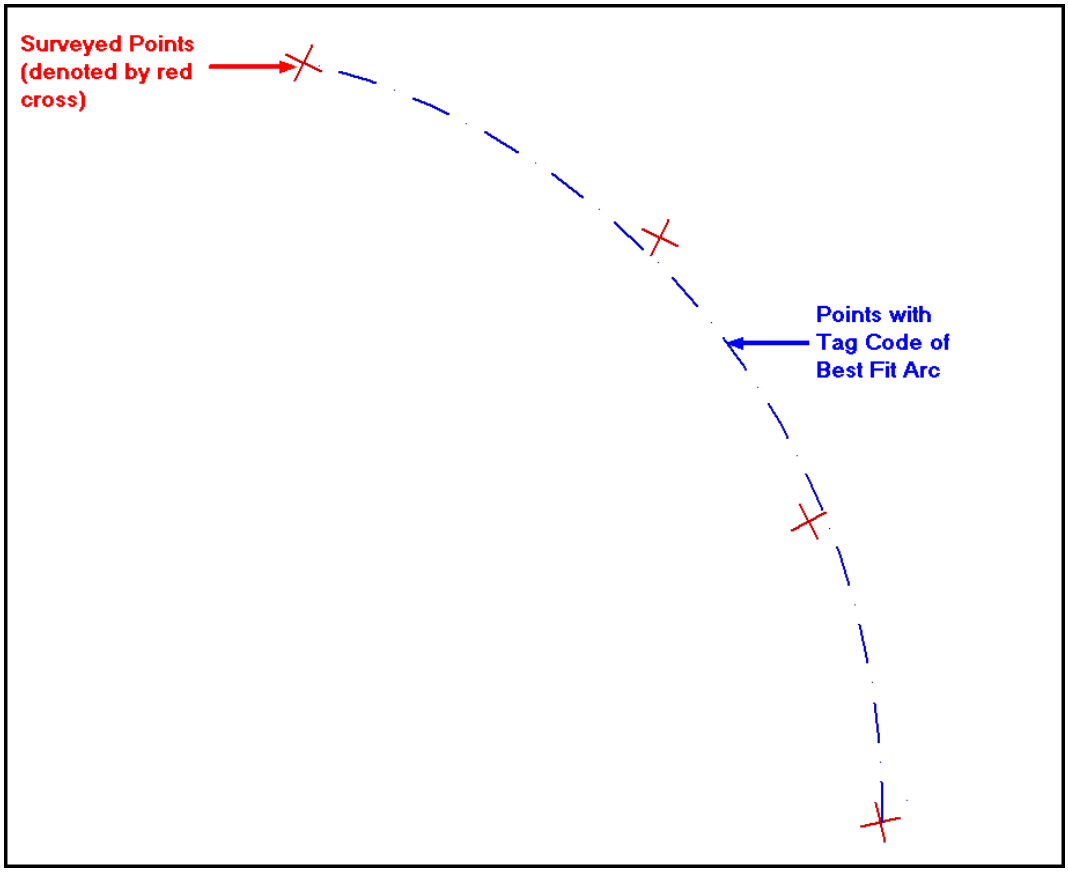
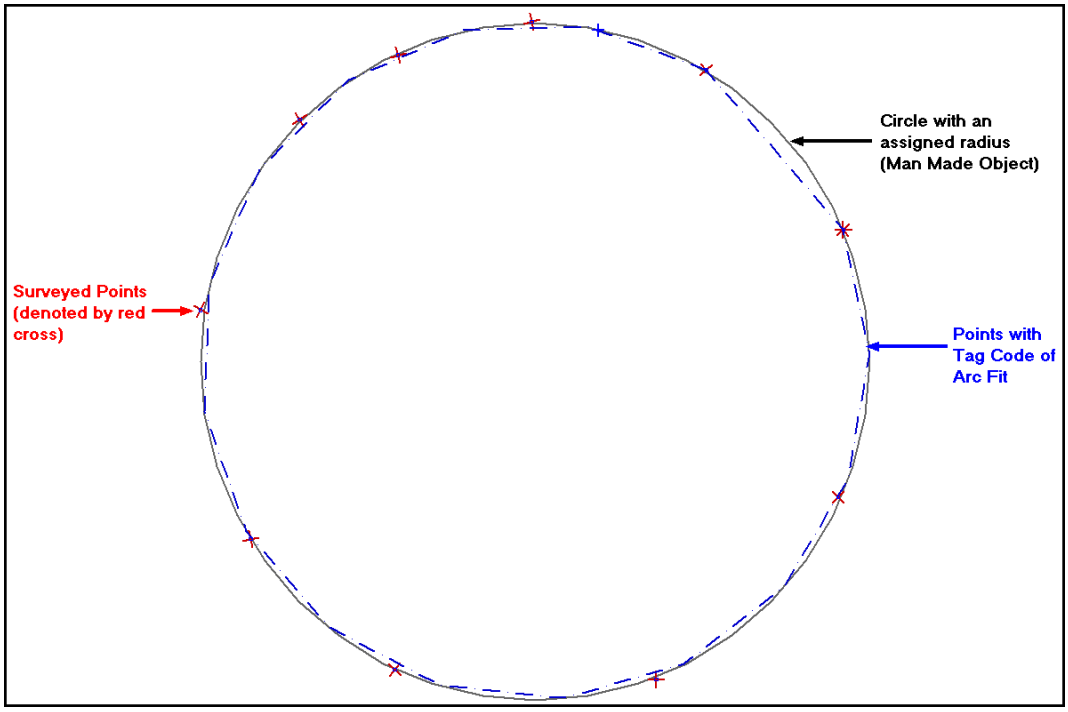


The position and spacing of survey points is important.

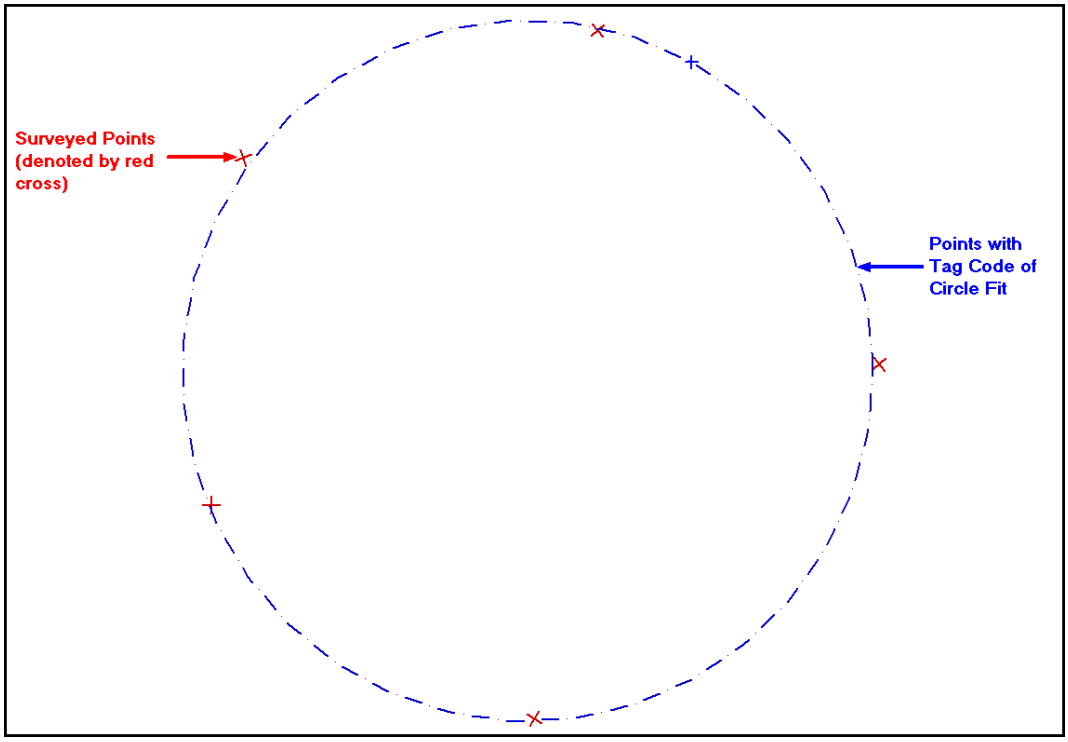


Scenario 3: Circle Fit Tag Code

This option creates a best-fit circle. It is useful when dealing with circular tanks, small roundabouts, and other man-made circular features.

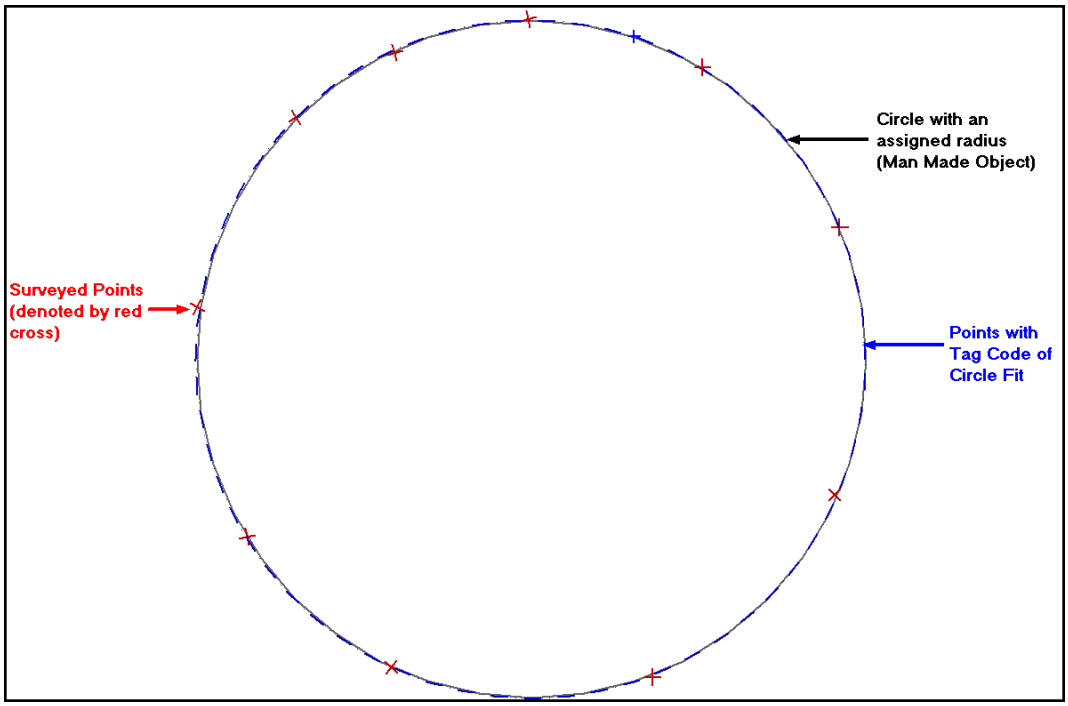
Like Arc fit, not all survey points are intersected but rather influence the position of the

circle.



When generating a circle fit use the snap point command to pick up each survey point.

As shown below, the circle fit is the best representation of the man made object.



Note:

Additional Tag Codes have been added to the tag code drop down menu and also the ‘ EDIT > Circles, Arcs, & Rectangles…’

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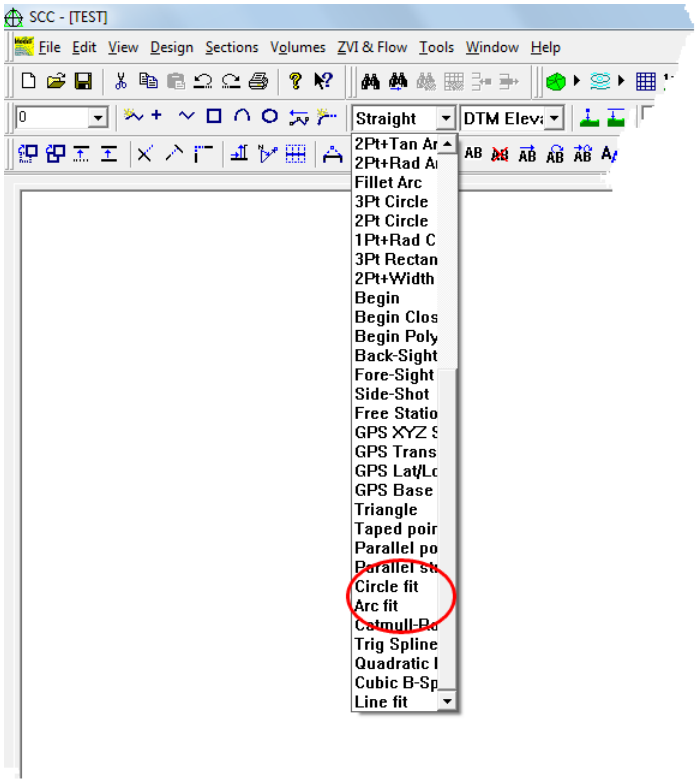
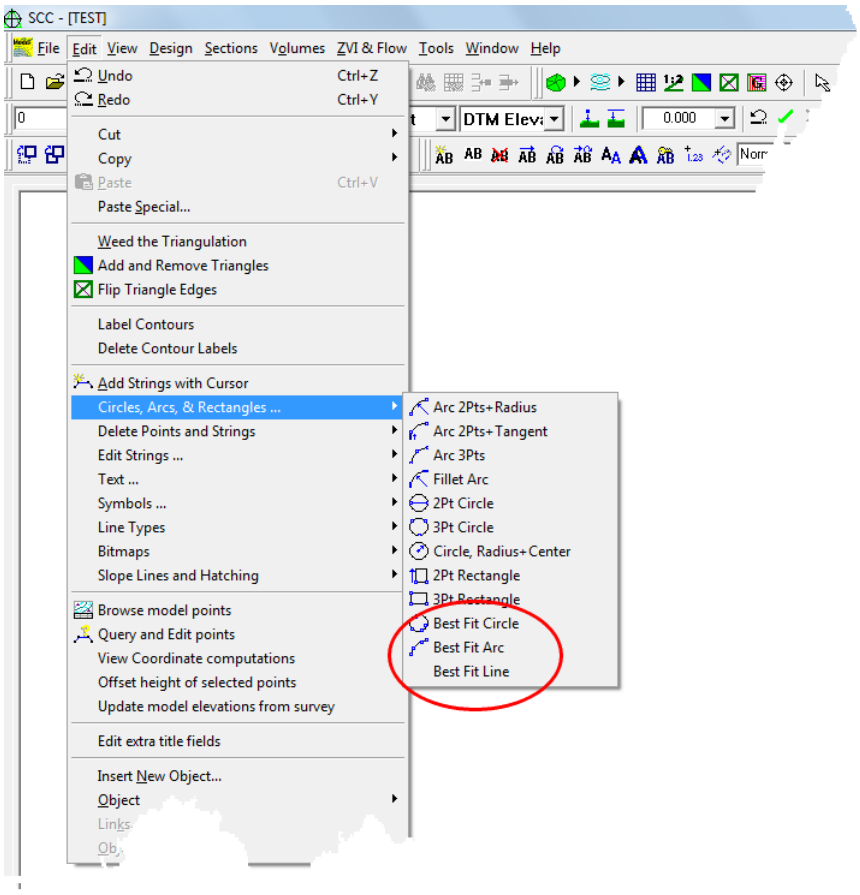

SCC - [TEST]
File Edit View Design Sections Volumes ZVI & Flow Tools Window Help
Straight
DTM Elev
2Pt+Tan Ar
2Pt+Rad Ar
Fillet Arc
3Pt Circle
2Pt Circle
1Pt+Rad C
3Pt Rectan
2Pt+Width
Begin
Begin Clos
Begin Poly
Back-Sight
Fore-Sight
Side-Shot
Free Statio
GPS XYZ S
GPS Trans
GPS Lat/Lo
GPS Base
Triangle
Taped poir
Parallel po
Parallel st
Circle fit
Arc fit
Catmull-Ro
Trig Spline
Quadratic I
Cubic B-Sp
Line fit


SCC - [TEST]
File Edit View Design Sections Volumes ZVI & Flow Tools Window Help
Undo Ctrl+Z
Redo Ctrl+Y
Cut
Copy
Paste Ctrl+V
Paste Special...
Weed the Triangulation
Add and Remove Triangles
Flip Triangle Edges
Label Contours
Delete Contour Labels
Add Strings with Cursor
Circles, Arcs, & Rectangles ...
Delete Points and Strings
Edit Strings ...
Text ...
Symbols ...
Line Types
Bitmaps
Slope Lines and Hatching
Browse model points
Query and Edit points
View Coordinate computations
Offset height of selected points
Update model elevations from survey
Edit extra title fields
Insert New Object...
Object
Arc 2Pts+Radius
Arc 2Pts+Tangent
Arc 3Pts
Fillet Arc
2Pt Circle
3Pt Circle
Circle, Radius+Center
2Pt Rectangle
3Pt Rectangle
Best Fit Circle
Best Fit Arc
Best Fit Line

6 Generation Of Boundaries

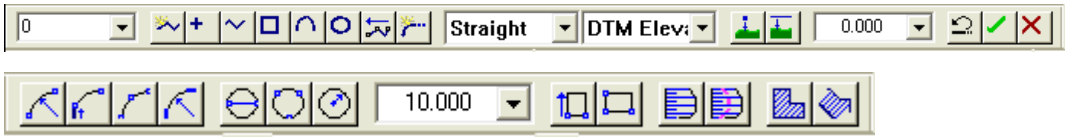
Boundaries are important for volume calculations. If the surface used in volume calculation is not clearly defined the result of the volume calculation will be ambiguous. If a boundary has not been surveyed in the field for whatever reason, one must be generated in SCC.

We have already discussed how to use the 'Add/Remove Triangles' option to create a boundary in the model.

Here we will describe how to use the 'Add String With Cursor' option to generate a new string in your model. If your model already contains strings that may form part of the surface boundary, they may be used to generate the new boundary. The most common way to generate boundary strings is to select the outmost surveyed points in the model. It is important therefore that the snap control is set to nearest point.

Adding A New String To The Model

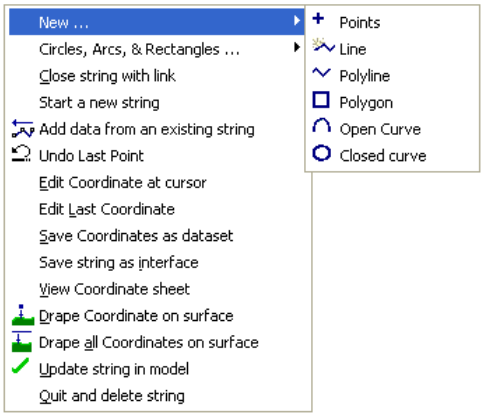
It is possible to add strings to a model using the Add Strings toolbar.



Using the field boxes above, set the feature code to 'boundary' and the tag code to ' straight. The DTM code is set to 'clip polygon' because we wish to use this string as a boundary where all contours and triangles outside of the polygon are clipped out of the DTM.

Select the 'polygon' button, to start adding points to your polygon. Click the left mouse button once for each point you wish to add, and click the 'Update String In Model' button to complete the process.

Pressing the right mouse button while adding points to the model provides you with a sub-menu containing options for setting specific information about the string being created. These options can also be found on the relevant toolbar.



A very useful technique on this menu is the option to 'Save Co-ordinates As Dataset'. This allows the new boundary co-ordinates that you have created to be saved as a separate dataset that can then be used as a boundary for multiple sub-surfaces.

Creating A Boundary String

On the 'Add Strings'toolbar, enter the feature code BNDRY in the feature box, set the tag code to 'Straight' in the tag code box and the DTM code to 'Clip Polygon' in the DTM status box.

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Go to 'EDIT > Add String with Cursor'

Click the right mouse button on the model

On the secondary menu go to 'New > Polygon'

Press 's' on the keyboard to turn the snap to '3D point'

Select the first point on the string

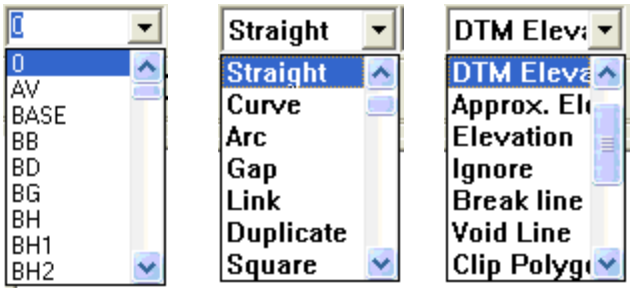
Go around the model clicking on the outer most surveyed points

When you come to the second last point click the right mouse button and select 'Update String In Model'.

Note that when creating boundary strings we should either have the snap controls set to 'S nap to Existing DTM points', or ensure that valid contouring exists inside the entire polygon. We do not have to enter elevations for points on the boundary string as these are automatically interpolated from the DTM surface.

The other buttons on the toolbar allow for creation of point strings, open and closed line strings and open and closed curves. If you are introducing a mixture of curves, gaps and other geometry into a single string, you can change the Tag code field for specific points by changing the code in the box.

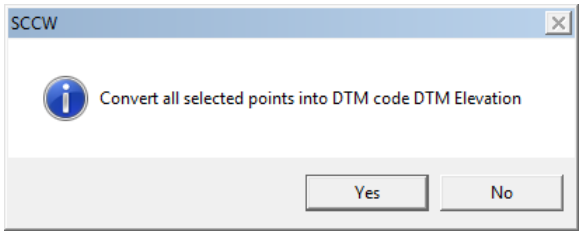
String Editing Using The List Boxes



This option is used in conjunction with the 'Add Strings from cursor' command and works very similar to 'Edit String Details'.

By selecting the relevant code from the list and entering it in the box, any new string that is drawn in the model using the 'Add Strings From Cursor' option, will have this new status.

This option also allows you to edit the status of a pre-selected string. By using the 'Data Selection Dialog' (right mouse button) and highlighting the string that you wish to change, you can then enter the new code in the DTM box and SCC will ask you whether you wish to convert all selected points to the new status.



6.1 Additional Samples of Creating A Boundary String

There are several ways of creating a boundary string within SCC. The following methods are often used

Creating A Boundary String Using Add/Remove Triangulation Options

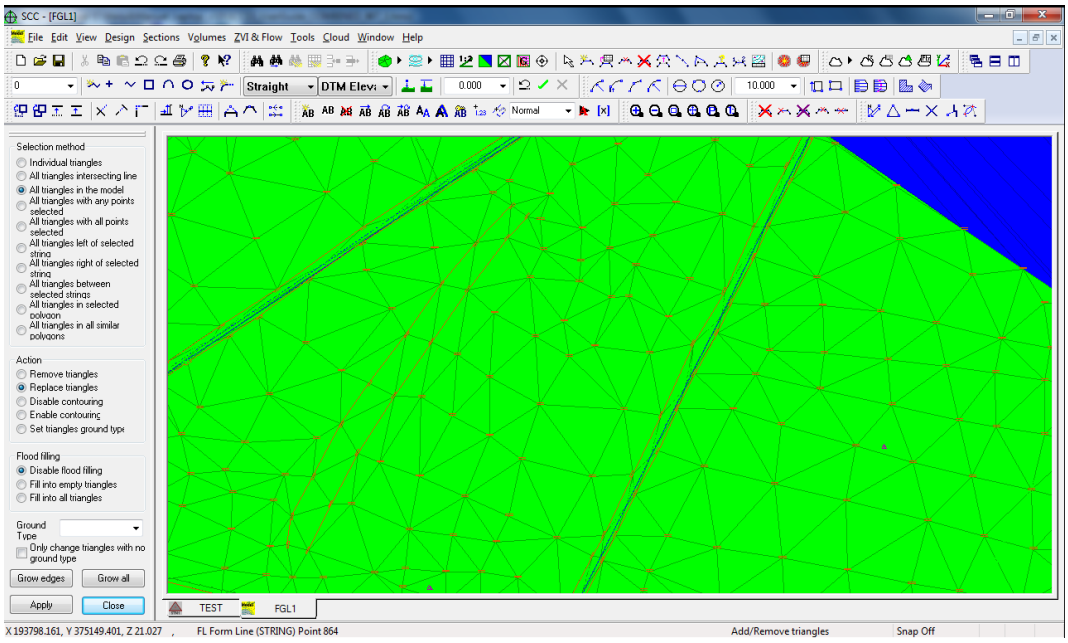
The 'Add/ Remove Triangles' option can be used to create a boundary string.

The 'Add/ Remove Triangles' option allows the user to turn on and off given triangles in the triangulation. Triangles that are turned off (passive/sterile, are indicated by being filled in blue) will not be used when computing volumes, contours, grids, sections, viewsheds etc.

Selecting this option highlights all valid and invalid triangles (valid are highlighted in green). Selecting this option presents the Add and Remove Dialog.

When the required triangles have been removed, the user is presented with the option to 'Store boundary as a string'. If 'yes' is selected a boundary string '~BNDRY' is created around all valid triangles.

Select ' EDIT > Add/ Remove Triangles'

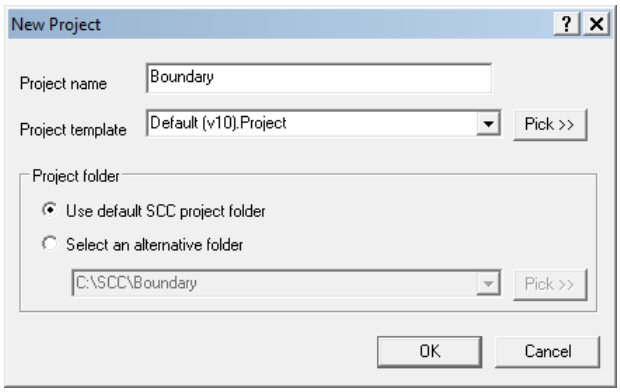


Creating A Boundary String Using 'Clip Polygon' status

Set up Project

Open a 'New Project' and attach the 'Default(v6).Project' template.

Call the project 'Boundary'.

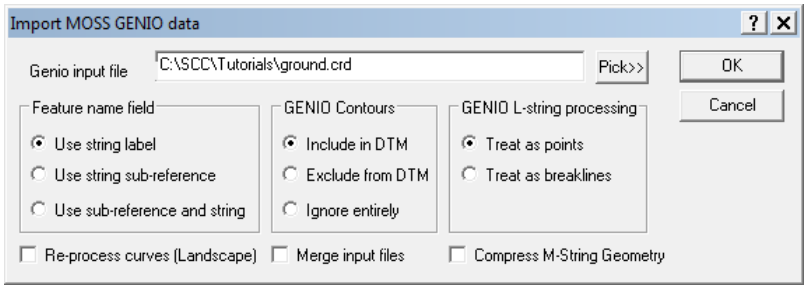


Model Data

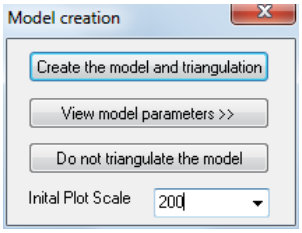
Go to ‘File > Model > MX GENIO file’.

Select the file ‘GROUND.CRD’ from the TUTORIALS directory

Set the Feature Name field to ‘Use string label’, the GENIO Contours to ‘Ignore’ entirely and GENIO L-string processing to ‘Treat as points’.

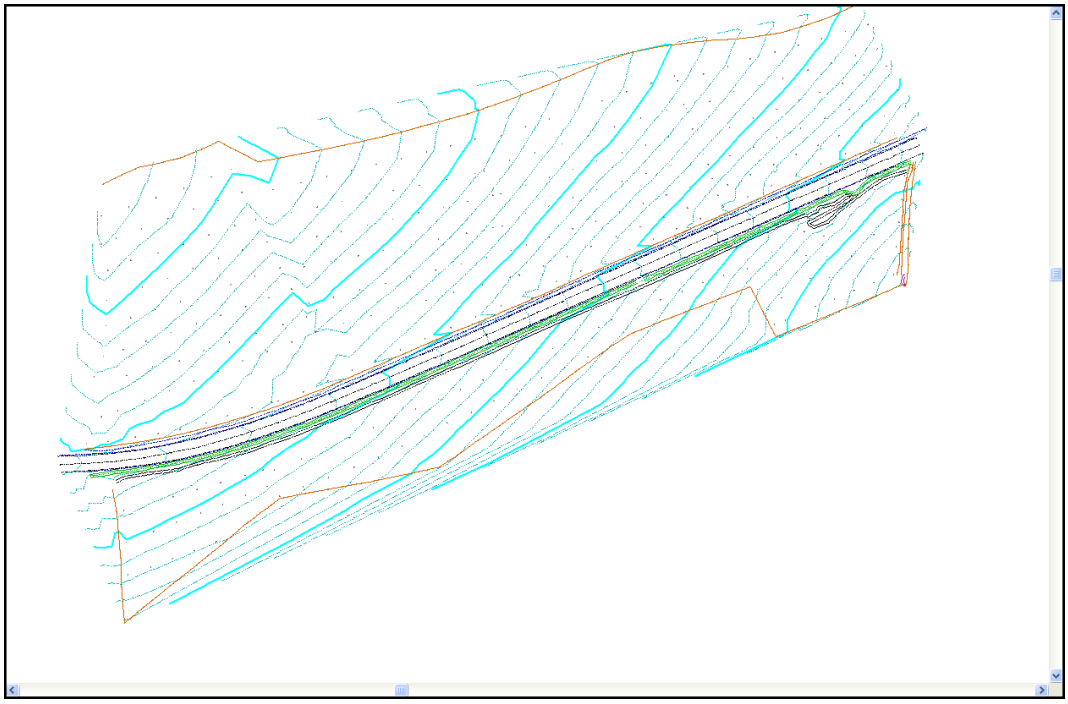


Select 'OK'



Set the Initial Plot Scale as '200'

Select 'Create the model and triangulation'

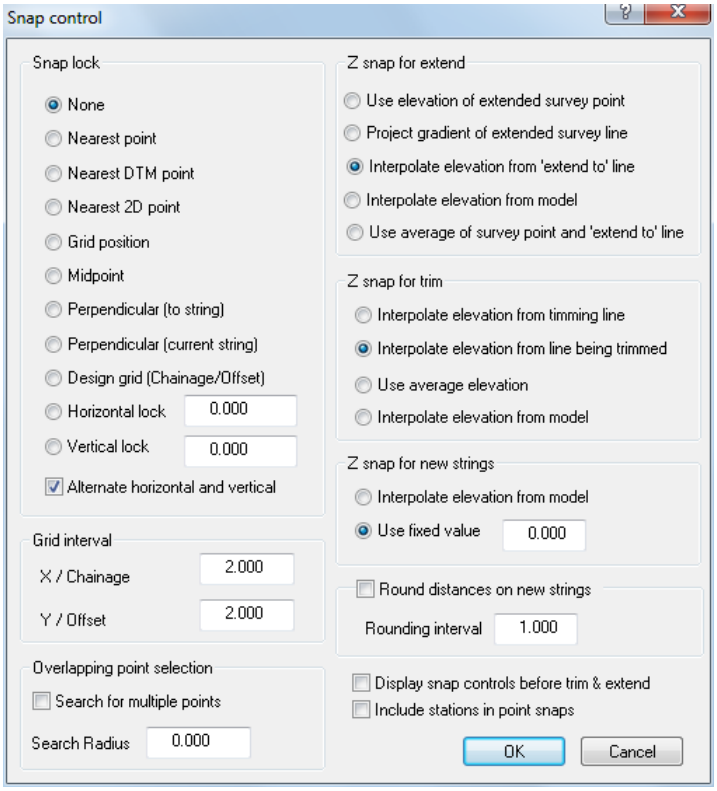


Go to ‘File > Save’

Save the model as ‘Ground.Model’

There are existing strings along the top and bottom of the model, which define two sections of the boundary.

Go to View and Snap Control . Set the snap locks to 'Nearest DTM Point'.



Alternatively, press 's' on the keyboard until 'Snap 3D Point' appears on the bottom left toolbar

Go to 'EDIT > Add new String with Cursor .

Set the String / Feature name to be BOUNDARY.

Also on this toolbar set the DTM status to 'Clip Polygon'

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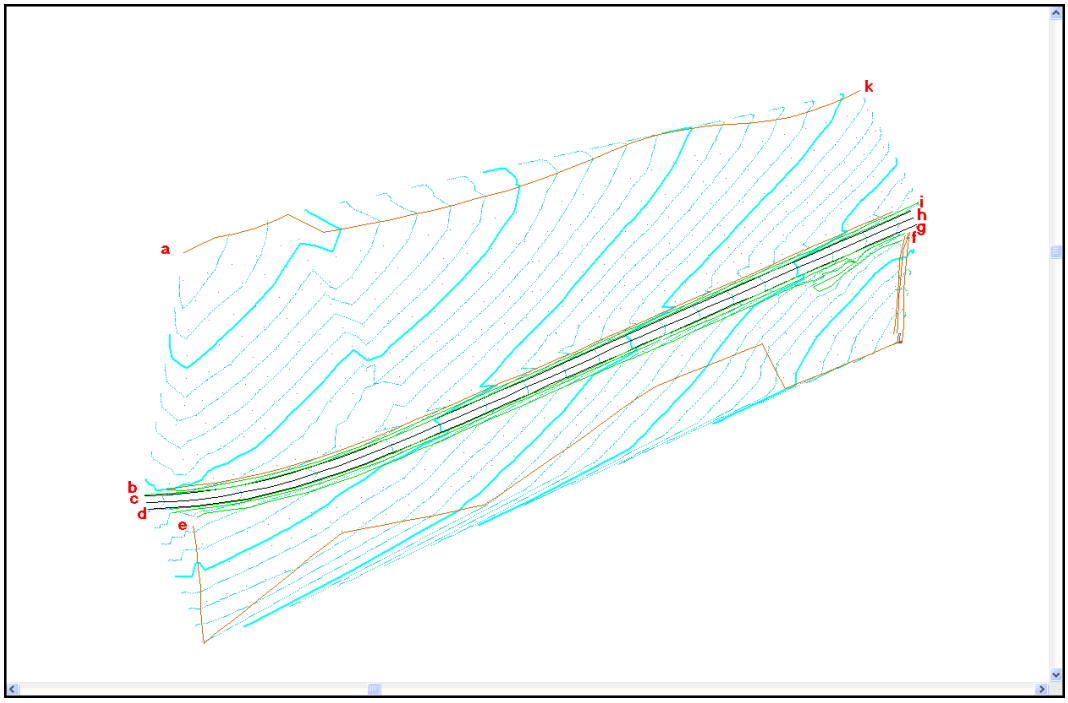

Start at the top left hand corner of the model. (point a)

Snap to the survey points along the edge of the model (points b, c and d, for instance) until the next point you wish to select is on the existing string in the model (point e).

Right click mouse and select 'Add data from an existing string'

Left click on string (point e)

And left click again (point e) to select first point on string

Turn 'Snap 3D Point' off to 'Snap Off'

Move cursor to the end of the string (point f)

Now turn 'Snap 3D Point' on

Left click on mouse to select last point on string

Continue to add points to string with the cursor (points g, h, and i)

To add the top string, right click mouse and select 'Add data from an existing string'

Left click on string (point k)

And left click again (point k) to select first point on string

Turn 'Snap 3D Point' off to 'Snap Off'

Move cursor to the end of the string (point f)

Now turn 'Snap 3D Point' on

Left click on mouse to select last point on string

When all points on the string have been selected, right click the mouse button and select Close String with Link.

Click the right mouse button again and select Update string in model. The will appear as it is below

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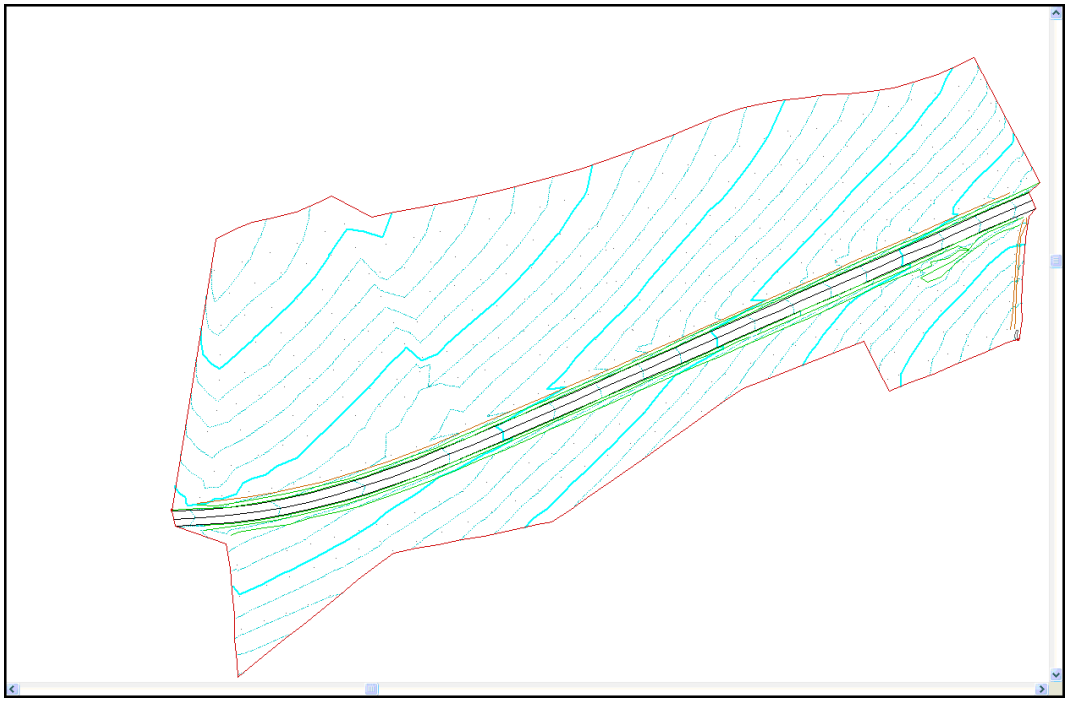

7 Import & Export From Model

SCC includes a wide range of methods for communicating with other software packages and survey devices. These comprise of general purpose data exchange methods and functions that are specifically for communication with a given package. The general purpose methods include cut & paste, full OLE (object linking and embedding) client, server and automation support and user defined ASCII import and export. The cut and paste routines support cut and paste in text format, Microsoft Excel and Access format, bitmap format, OLE object format, and internal SCC coordinate exchange format. This means that cut and paste can be freely used both internally within SCC and to transfer information between most other Windows software.

The specific functions include highly configurable bi-directional CAD and MX/MX interfaces.

7.1 Importing Additional Model Data

There may be instances where you have recorded a survey, downloaded it into SCC, created and edited the model and then you are required to take more survey information. To add this extra survey information to your existing model, you will need to download the new survey into SCC, using the original project file, save this file as a dataset (survey file) and add it to the existing model. The 'Add Strings from File' option, under the 'TOOLS' menu allows you to do this.

Data can be added to the model from files other than SCC datasets. SCC is capable of accepting additional information from DXF files, ASCII files and MX (Moss) Genio files.

Create a model using the existing survey files, FGL1, FGL2 and FGL3 and then add the Survey file FGL4 to the model.

Adding More Survey Information to an Existing Model

Go to 'FILE > Model > SCC Datasets'

Highlight the files, 'FGL1.Survey', 'FGL2.Survey' & 'FGL3.Survey'.

Select 'Create the model and Triangulation' as before

Select OK

Save the model as 'FGL123.model'

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Go to 'TOOLS > Add Strings from File > SCC datasets'

Highlight the file 'FGL4.survey'

Select Open

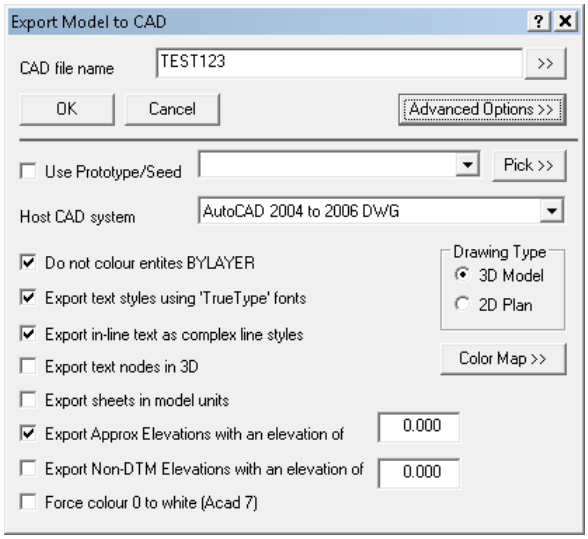
Select 'Normal Topographic Data'

Select OK

Selecting 'Normal Topographic Data' means that SCC uses the elevation/height detail from the SCC dataset you are adding. If you select '2D boundary strings', SCC will drape the X and Y co-ordinates on to the model and add the elevation/height information from the existing ground surface. This is more commonly selected when adding boundary strings.

7.2 Export Data from SCC to CAD

The CAD interface supports a wide variety of CAD packages, and where the CAD system is available on the same computer as SCC, SCC will automatically run the model into CAD. The CAD export also includes user definable colour matching for Microstation, and nearest colour palette mapping where relief mapping is in use. Note the Microstation DGN output supports alpha-numeric layer names.



The key thing to remember in exporting model data to CAD is 'what you see on screen is what will be transferred'. That includes grids, text contours and triangles, etc.The feature library is used to control MX labelling and CAD layering such that it is entirely independent of the field coding in use.

SCC will create AutoCAD line styles and text styles to match the SCC drawing with the minimum number of entities. Note that when exporting in 3d, all polylines will appear as continuous lines. This is a restriction in AutoCAD rather than SCC.

Export Model To Cad Drawing

Go to 'FILE > Export Model > Cad drawing'

Enter in a file name, this name should be no longer than 8 characters and contain no spaces

Select 'Advanced Options'

Select the host Cad system you are using

Select whether you want 2D or 3D information and other required settings

Select 'OK'

Direct links (within General Options) may be created from SCC to Windows based CAD systems such as AutoCAD 2006.

7.2.1 Using SCC Text Styles with AutoCAD

SCC version 6.7.6 and above allow the translation of TrueType font styles from SCC into AutoCAD via DXF in the Text Styles table. When dealing with TrueType fonts, one of the primary things to observe is the difference between fixed width fonts, such as Courier, and variable width fonts, which include most other supported fonts. With fixed width fonts, the width of a piece of text is determined by the text width multiplied by the number of characters. With variable width fonts, the text width, the exact characters used, and the font characteristics determine the width of the text. This potentially can lead to huge variations in overall text width, caused by changing fonts, without changing the specified width of a piece of text.

SCC minimizes the effect of this phenomenon, by calculating the average width of the most commonly encountered characters in the current font, and using this as a scaling factor when outputting text. Thus the string 0123456789.-+ at a given text size will occupy a very similar bounding rectangle for most fonts. This is shown in the 'Text.Model' found in the tutorials directory. It is important that the extents of pieces of text can be easily calculated in SCC, as they are used by a number of modules, such as the automatic deletion of overwriting text.

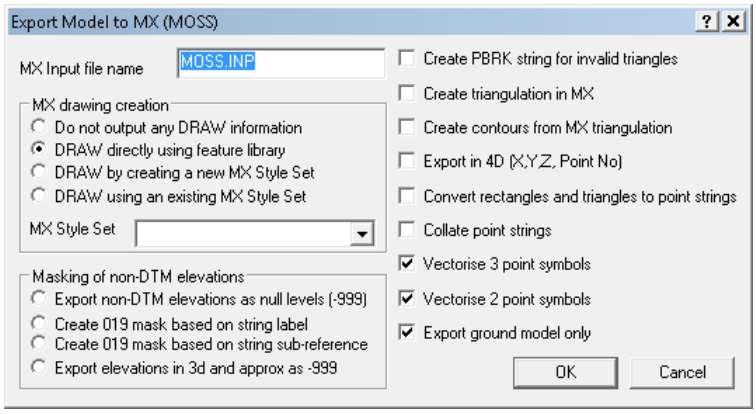
AutoCAD does not attempt to correct the text width based on the characteristics of the font used. Thus changing a piece of text from a 'Courier' or monospaced font, to a variable width font, will have a very dramatic effect on its width. While this is not a problem in itself, it can lead to output differences when plotting from SCC and CAD.

The solution to this, implemented in SCC 6.7.6, is to scale the text, using the font characteristics prior to going into CAD. While there are still some differences between the SCC and AutoCAD text, they are greatly reduced by doing this. See 'Text.DWG', also in the tutorials directory, for an example of this. The only potential pitfall in CAD, is that changing the style of the text will again change the width. As this already occurs in CAD it is not considered to be a major problem.

7.3 Export Data from SCC to MX

The MX Interface

The MX interface includes support for transfer of model, section, alignment and drawing data, using GENIO and other MX formats. Output of model data can be in 3d or 4d, where the fourth dimension is the survey point number, and includes support for non-DTM 3d data such as invert levels and overhead features. The 'Export to Moss' option can be located under the 'FILE > Export Model' menu.



Export Model To Moss Model

Go to 'FILE > Export Model > MX (Moss) Model'

Enter in a file name

Select the options 'Do not output any DRAW information', 'Export non-DTM elevations as null levels (-999) and 'Collate point strings'

Select 'OK'

The input file will be saved in your current working directory

MX String Labelling

The feature library controls the conversion of SCC survey data sets into MX models. Part of this process is the automatic allocation of MX string labels. This may be either totally automatic, or where required, full MX string labels may be coded in field.

In the feature library, the 'LBL' field is used to determine the label of any MX string generated for a given feature. For example, if coniferous tree is coded as TCONIF, the 'LBL' field might have a value of 'TC', hence point strings for this feature would be labelled PTC0 to PTCZ, and line strings coded TC00 to TCZZ.

In MX SURVEY based data collectors, the surveyor may code strings with a full four character MX string label. If the initial characters of the string label agree with the 'LBL' field of the matching feature in the feature library, the surveyed string label will be carried through. For example, say the centre line of the road being surveyed is given a feature name of CL05. SCC is set up to use the nearest matching feature in the feature library, which in this case might be CL. The feature CL also has CL set in its 'LBL' field, thus the feature name CL05 will be created as string CL05 in the MX model. If a MX SURVEY file contains a feature of less than four characters in length this is treated the same as any other feature, in MX this is referred to as a partial string label.

The characters M (Master alignment string) or G (Geometry string) should be avoided as the first character in the 'LBL' field as they denote strings of special significance in MX.

See Also

Developing SCC Feature Library for use with MX

7.4 Extracting An Elevation From A Model

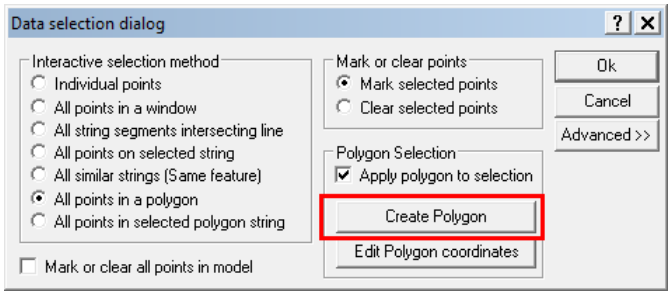
Often models, while primarily plan drawings, will contain one or more elevations, which we wish to extract into separate models. SCC provides a tool to do this, in 'Tools > Extract Elevation'. To try this out, we will first open the model 'Tutorials\Bridge.Model'.

Extract Elevation

Open 'Bridge.Model' from \SCC\Tutorials' directory

Right Click the mouse 'Data Selection Dialog'

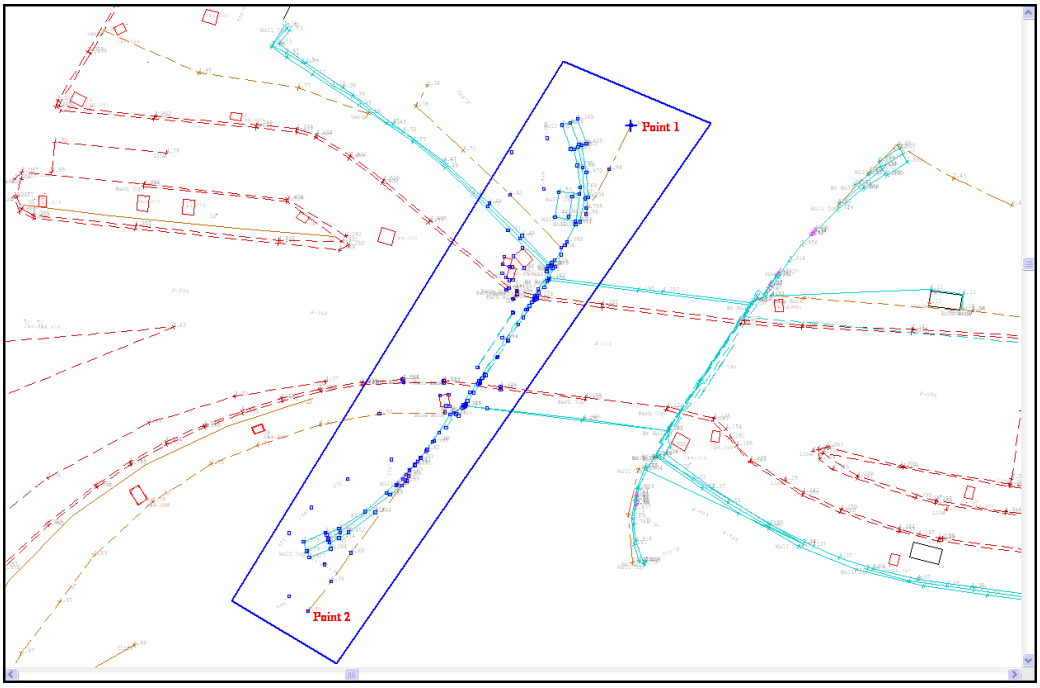
Select 'Create Polygon'



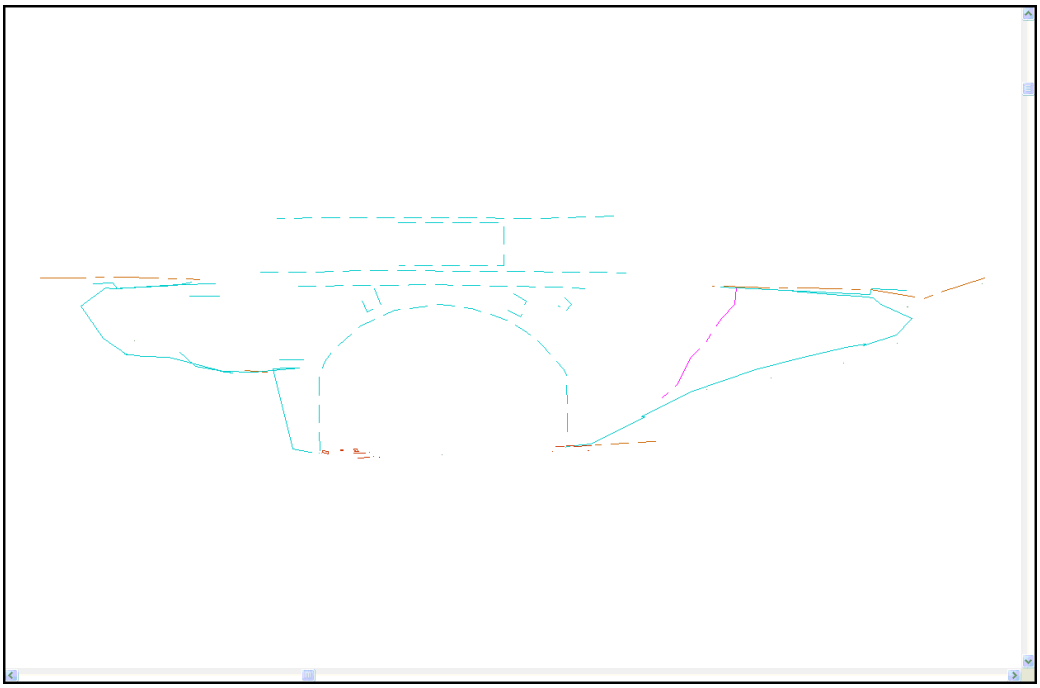
Draw a Polygon around the points that are to be included in the elevation using the left mouse button and click the right mouse button to close the polygon

From the Main Menu Bar, Select 'TOOLS > Extract Elevation'

Using 'Snap Controls' draw a line selecting the first and last points.



This line defines the base plan. The data is projected onto this base plan.



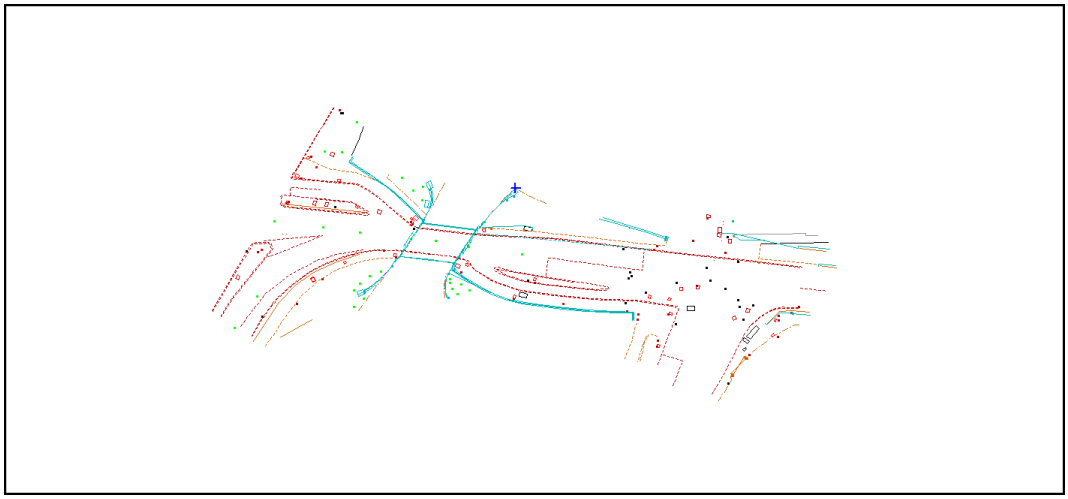
The coordinate system for the elevation model uses X, and Y to represent chainage and height resepctively, thus differences in Y in this model represent differences in height

7.5 Viewpoint

The following exercise demonstrates the use of Viewports within SCC. The sample model 'Bridge.Model' is available within the SCC tutorials directory.

Sample Model

Open 'Bridge.Model' from \SCC\Tutorials' directory

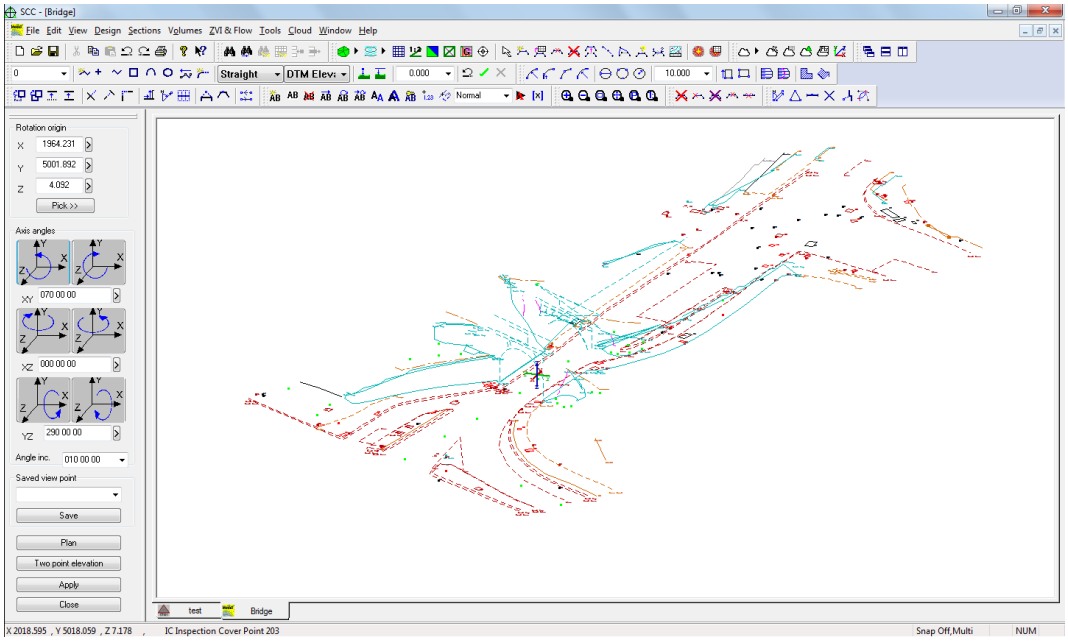


Elevation through two points

Within the model, select 'VIEW > Rotate Viewpoint'

Select 'Pick>>' button to define rotation origin and left click on model

Use Axis angle buttons 'XY', 'XZ' and 'YZ' to achieve required viewpoint



Saved view point

By selecting 'Save' button specific viewpoints can be save and then selected at a later stage from the 'Saved Viewpoint' drop down menu

Plan

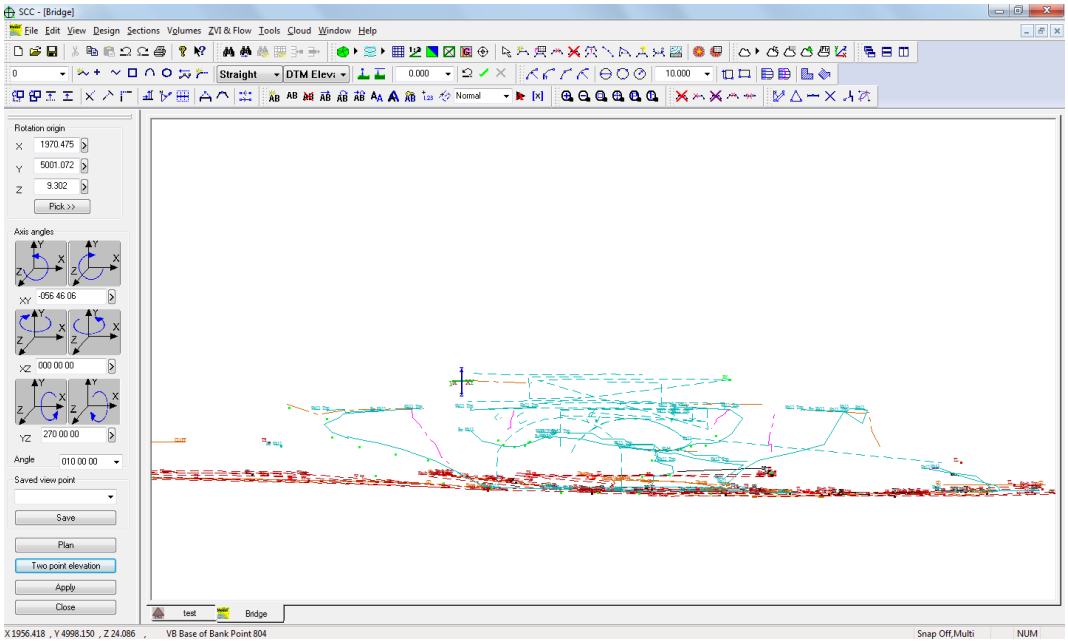
To revert to Plan, pick 'Plan' button

Rotate Viewpoint

Two point elevations can also be achieved

Select 'Two point elevation', within the model left click the mouse to define first point of the baseline and left click once again to define last point on baseline

See samples below:



8 Typical QA Procedures for Survey Models

Before delivering the model you should check the following:

There are no crossing breaklines. Crossing breaklines are identified in SCC as a red cross, and indicate that the elevation at that point in the model is either incorrect or ambiguous. They typically highlight string linkage errors, inaccurate surveying, or string naming and hence DTM coding errors.

- Strings representing single continuous features on the ground should consist of a single continuous string in the model. This can be checked using the ‘All points on string’ option with the 'Data Selection' dialog and picking any point on the string. If the string is continuous all points on it will have a selection highlight. For example, if the survey contains a road centerline, that centerline should be a single string, such that you can use it to generate long sections and cross sections for the length of the road. The same is true of boundary strings and other closed strings, where the software is dependent on the polygonal nature of the string for certain calculations.

- Strings should not contain two or more consecutive gaps. While SCC allows this, if exporting your model to MX, this will cause the GENIO file generated to fail in MX. This can be checked using the ‘Report String Details’ under the ‘TOOLS’ menu and checking the right hand side of the report for consecutive gaps. These gaps can be removed either using the string editor or the ‘Delete points’ option.

- Strings should not contain more than one closing link. Such errors will automatically be fixed by SCC and noted in the log file.

- Strings with less than 3 points should not contain a closing link. Such errors will automatically be fixed by SCC and noted in the log file.

- Point strings should not contain gaps or closing links. Such errors will automatically be fixed by SCC and noted in the log file.

- Strings, particularly road strings, should not contain duplicate points or double back on themselves. An example of what this looks like and how to rectify it is shown in the section on point deletion.

- Gaps should not be used to break up separate strings. It is a common survey mistake to end each string with a gap such that the same string label can be re-used. SCC provides an END

tag for this purpose. Using a gap means that many options such as copying and offsetting the string will not work correctly, as the option will be applied to too many points. It also means that if such a string is closed with a link, the link will probably join back the wrong point. Gaps, and MX DISC codes, should only be used to represent a gap in a given string that corresponds to an actual gap on the ground, for example a gap in a fence for a gate, or a gap in a major road for a junction with a minor road.

- String editing can be the most time consuming part of model editing. It can generally be minimized by good field practice.

Checking The Accuracy Of The DTM

Checking the accuracy of the DTM is usually very simple and involves checking there are no spurious elevations in the model and no features that have been included in the DTM that are not part of the ground surface. Checking for spurious elevations is achieved by looking for obvious anomalies in the contours. The relief contours tend to highlight such problems. Generally, if a single point or a single point on a string causes a significant change in the contours, shown as a series of circular contours around that point, the point is suspect and should be investigated further.

It is good survey practice to survey in strings rather than discrete points. While discrete points can be used to adequately describe smooth and reasonably flat surfaces, they are unsuitable for describing irregular surfaces containing significant grade changes such as embankments, spoil heaps, pits & hollows, etc. Strings are used as breaklines and as such, constrain the triangulation around irregular areas, the net effect of not using strings where they are required is that embankments, pit edges, etc. may appear to spill. Note that the only difference in survey procedure is to enter a unique non-zero string number for any string being surveyed. Not providing strings where they are required can often lead to serious volumetric errors.

Another method, applicable to road and similar surveys, is to take a series of cross sections down the center of the road and check for anomalies on the sections.

Where high accuracy is required and must be proven, the usual method is to abstract either a grid or sections from the model, get an independent crew to stake them out on the ground and compare elevations using a level. This is a time consuming job and would normally only be required where elevation accuracy is of primary importance.

QA Tools in SCC

In order to speed up the process of QA checking in a model, SCC provides an extensive range of tools to rapidly identify and correct all of the potential modelling problems outlined. Please read the topics listed below for details on these tools.

See Also

Resolve Crossing Breaklines (Model Tools Menu)

Join Adjacent Strings (Any Feature) (Model Tools Menu)

Join Adjacent Strings (Same Feature)(Model Tools Menu)

Set Preferred String Direction (Model Tools Menu)

Search for Orphan Points (Model Tools Menu)

Report Intersecting Strings (Model Tools Menu)

9 Volumetric Analysis & QA

Overview of Different Methods of Volumetric Analysis

In SCC there are 3 methods by which volumes may be calculated.

1. Cross Sectional End Areas method
2. Prismoidal / Isopachyte method
3. Grid method

All three methods of volume calculation should be performed when calculating volumes, as each method is mathematically independent of the other and hence each provides a check on the other. Differences of more than one or two percent indicate possible errors.

When calculating volumes it is important that there is a common boundary between the two surfaces, defining a common plan area over which volumes will be measured. Accurate volumes can usually not be calculated between two surfaces where a common boundary is not defined, due to the ambiguous nature of the area over which the measurement is taken. Poor boundary definitions are probably the most common cause of gross error in volume calculations.

9.1 Creating Profiles & Sections

Before volumes are calculated we will take a brief look at creating profiles and sections.

Profiles

Profiles can be taken through any number of models, using existing strings or selecting points with the cursor. In either case, a SCC section file will be created containing the profile information.

With A Cursor

To create a profile with the cursor, using the left mouse button, simply select points on the model where you want the profile to run. When you are finished with the profile and are ready to view the section, click your right mouse button. Your profile will be displayed and can be saved as a '.Section' file. If you wish, you can continue adding points to the profile by using the left mouse button again.

Using Existing Strings

Select 'Long Section From Existing String', and then in the model, select any point on the string you wish to generate a long section from. Again, your profile will be displayed automatically and can be saved appropriately.

From Coordinate Data

This option allows you to use the X, Y co-ordinates of another file to define the plan path of the profile. The elevations will be derived from your current model. The data can come in many formats, datasets, DXF and ASCII being the most common.

Cross Sections

From Existing String

For this option you will be asked to provide the left and right offset distances. You can choose to have sections taken at regular intervals, at the survey points, or both.

From Coordinate Data

This option is used where you have previously created a long section using one of the profile options under the 'SECTION' menu. After choosing this option you will select the file to generate the cross sections from and then proceed as using an existing string above.

To get some experience with sections, open the example project and the FGL model. Create a profile along the center of the length of this model and save the section file as ' FGL long.Section'.

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Opening An Existing Model

Open the Project Example.project

Go to 'FILE > Open'

Change the Files of Type to SCC Models (*.Model)

Select the model 'FGL.Model'

After opening the Example project and the FGL model:

Creating A Profile

From The Main Menu Bar, select 'SECTIONS > Long sections with cursor'

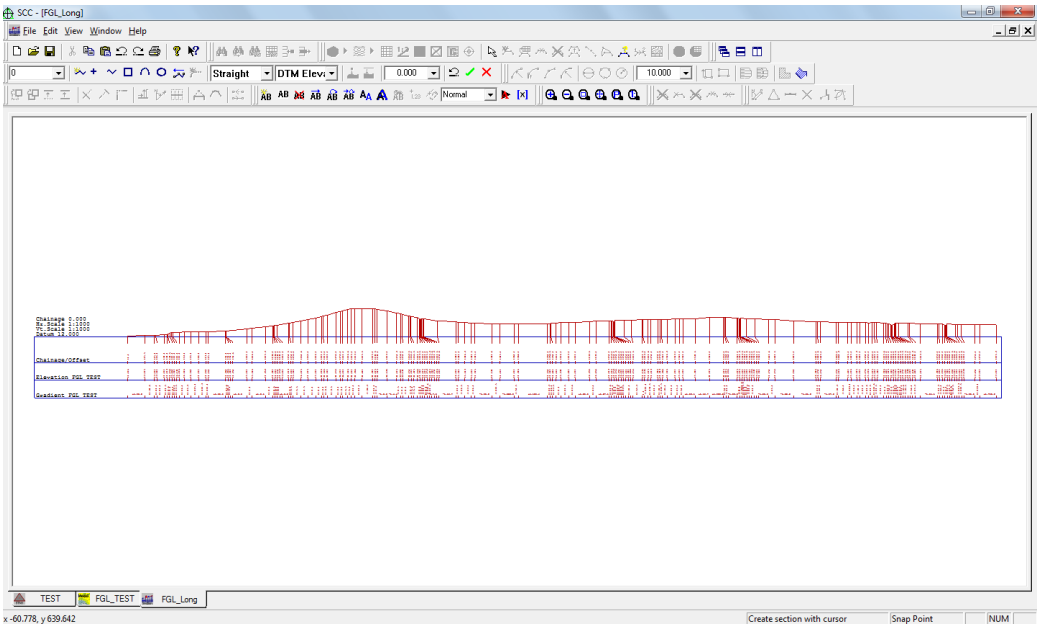
Select three or four points with the left mouse button following the center of the FGL model

When finished, click the right mouse button

View the profile

Select 'FILE > Save As' and call the file' FGL long.Section'

Go to 'FILE > Close'



Now let's create the cross sections

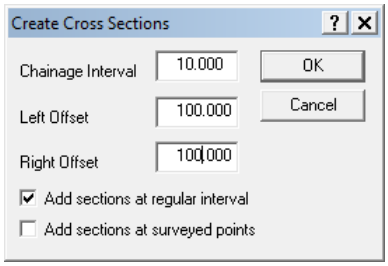
Creating Cross Sections

Select 'SECTIONS > Cross-sections from an existing string'

Set the Chainage Interval to 10

Set Offsets to 100 (should go beyond required area)

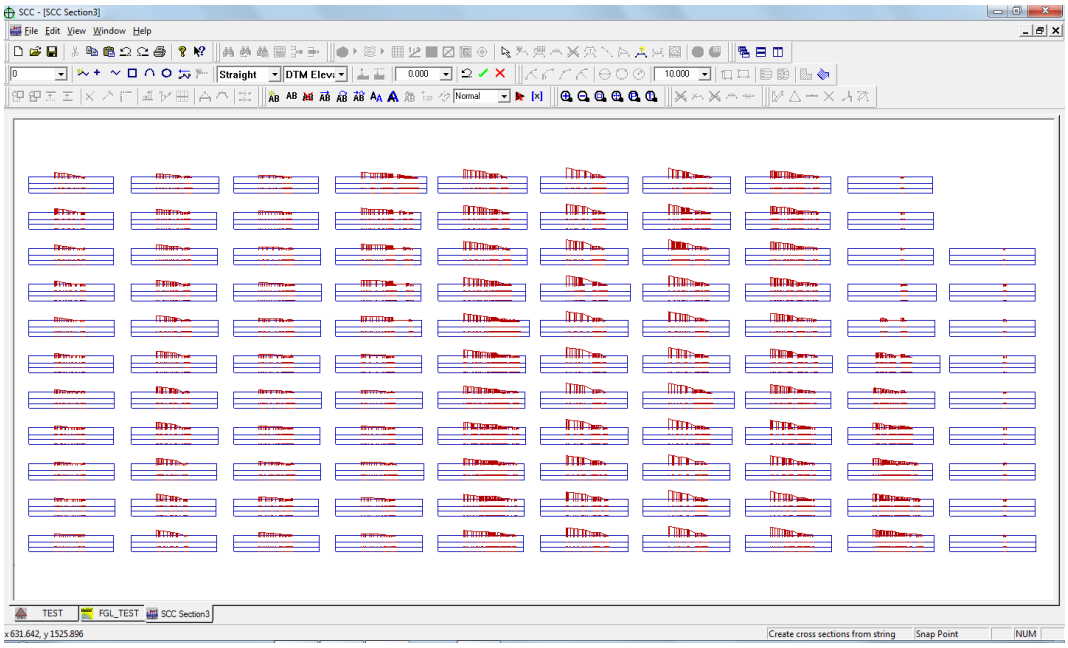
Leave the option to 'Add Sections at Regular Interval' on



Select OK

Left click on road center line string

View the cross sections



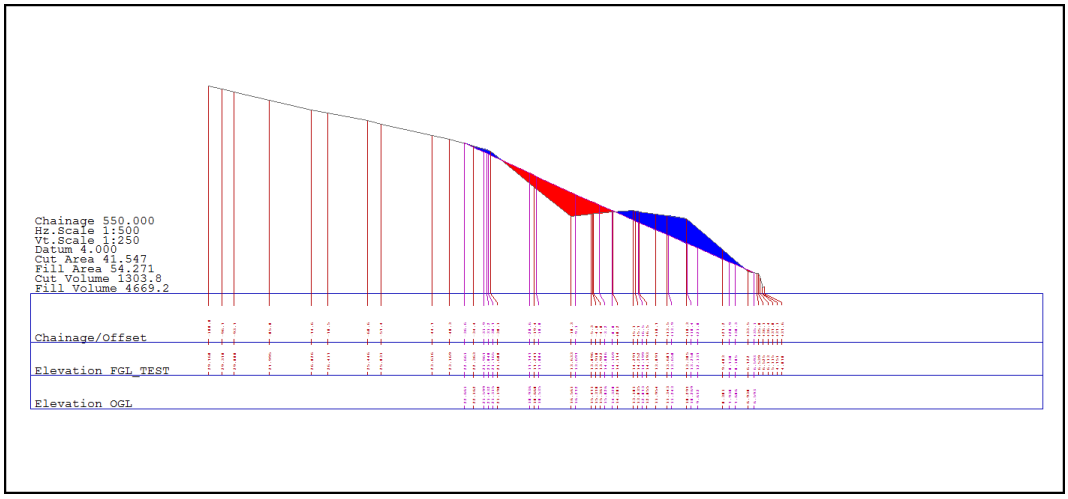
Select 'FILE > Save As' and save as FGL Cross.Section

Have the file FGL cross.section file open:

Adding a Second Surface to the Sections

Select 'EDIT > Append Surfaces'

Select OGL.Model from tutorials directory



Data from the OGL surface is now added to the FGL sections. This only occurs where the two models overlap.

> When displaying sections in SCC it is important to select a datum that is lower or equal to the lowest point of any of the models being analysed.

9.2 Calculation Of Volumes Using Different Methods

Using the models FGL and OGL we will calculate volumes using prismoidal, grid and cross sectional methods. Both these models have been previously created. However no boundary has been defined on either model. We will define a boundary on the smaller model, OGL. This model already contains a boundary string, probably surveyed in the field, however the DTM extends beyond this string (look at the contours). We need to change the DTM status of this string to 'Clip Polygon', which means that no information outside this line will be included in the DTM.

Changing the DTM status of an existing string can be done in two ways, by using the string editor (that is, ‘EDIT > Edit String Details’) or using the list boxes on the ‘Add strings with cursor ’ menu bar. The method below describes the latter.

Creating A Boundary From An Existing String

Open the model OGL

Click on the right mouse button to bring up the ‘Data Selection Dialog’

Select ‘All points on selected string’

Press OK

In the model, select a point on the outermost string (the boundary string)

Once it has been highlighted, go to the list boxes on the ‘Add Strings’ toolbar and change the code in the DTM status box to ‘Clip Polygon’.

You will be asked ‘Do you wish to convert all points to Clip polygon’, press OK

Save the model

9.3 Average End Area Method

To calculate volumes using this method, you must first create sections that contain all the surfaces being considered. The reference string can be an existing string or a profile you created using the ‘Long Section with Cursor’ option. In either case, the following procedure is the same.

1. Create section set

2. Append surface of additional models

3. Calculate volumes between surfaces of interest

Having the model FGL active:

Opening Existing Edited Models from Tutorials

Select 'FILE > Open'

Select 'FGL.Model'

Repeating the same steps, select 'FILE > Open' and select 'OGL.Model'

Both models have been triangulated correctly and the relevant boundaries formed prior to calculating volumes.

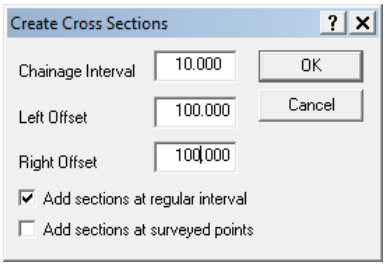
Generation of Cross Sections

Within 'FGL.Model', select 'SECTIONS > Cross Sections From An Existing String'

Set the Chainage Interval to 10

Set Offsets to 100 (should go beyond required area)

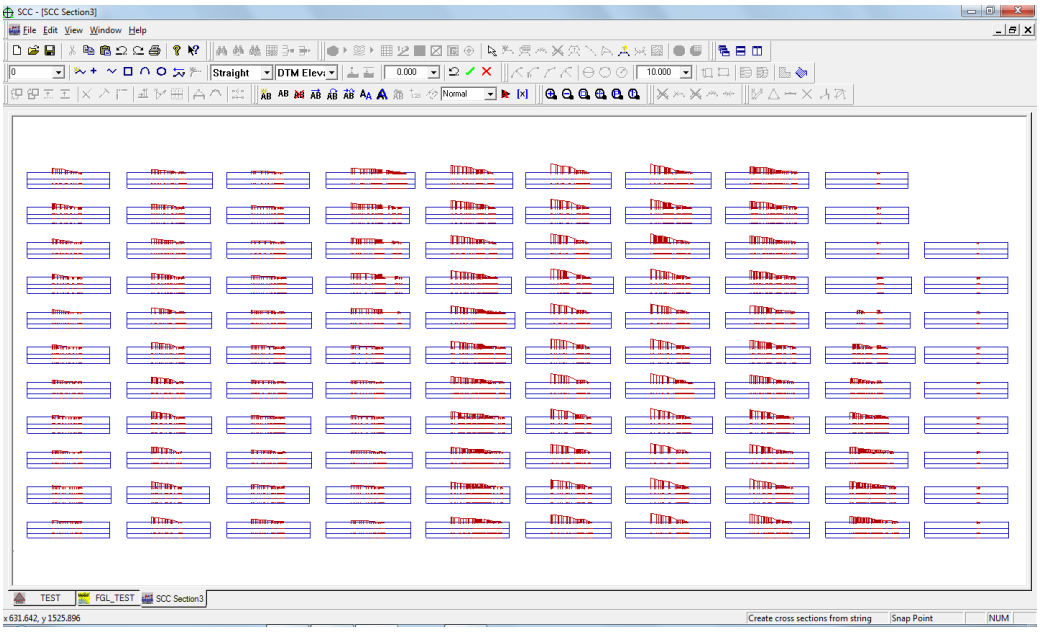
Leave the option to 'add sections at regular interval' on



Select OK

Left click on the road center line

View the cross sections



Select 'Save' and save as FGL cross.section

Append Surface

Within the Section File, select 'EDIT > Append Surface'

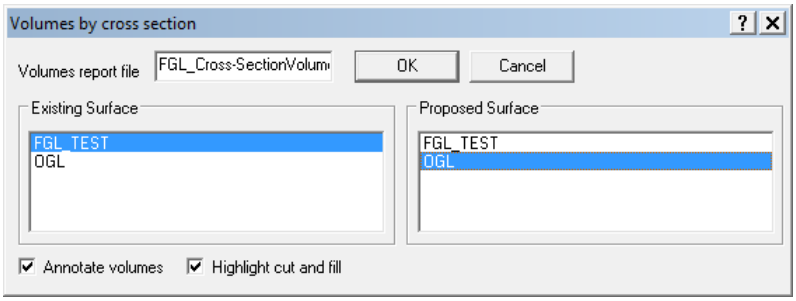
Select 'OGL.Model

End Area Volumes

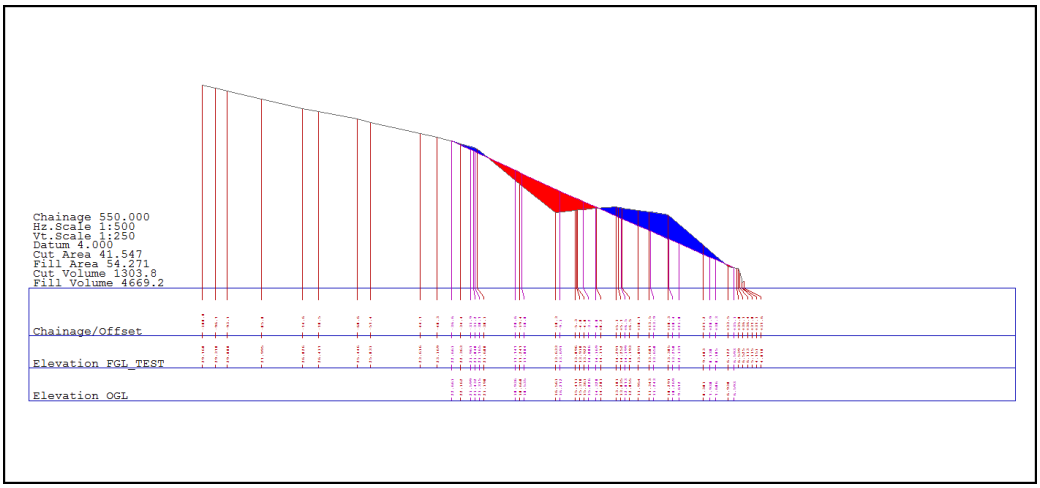
Select 'EDIT > Volumes'

Select Existing Surface and Proposed Surface

Select to 'Annotate Volumes' and to 'Highlight cut and fill'



Examine report and results



9.3.1 Exporting User Defined ASCII file From Sections

The following examines the exporting of a user-defined file from a Section file.

Case 1 considers the export of a *.txt file containing Chainage, Offset, X, Y, Z, Feature of all ground points within the Section File.

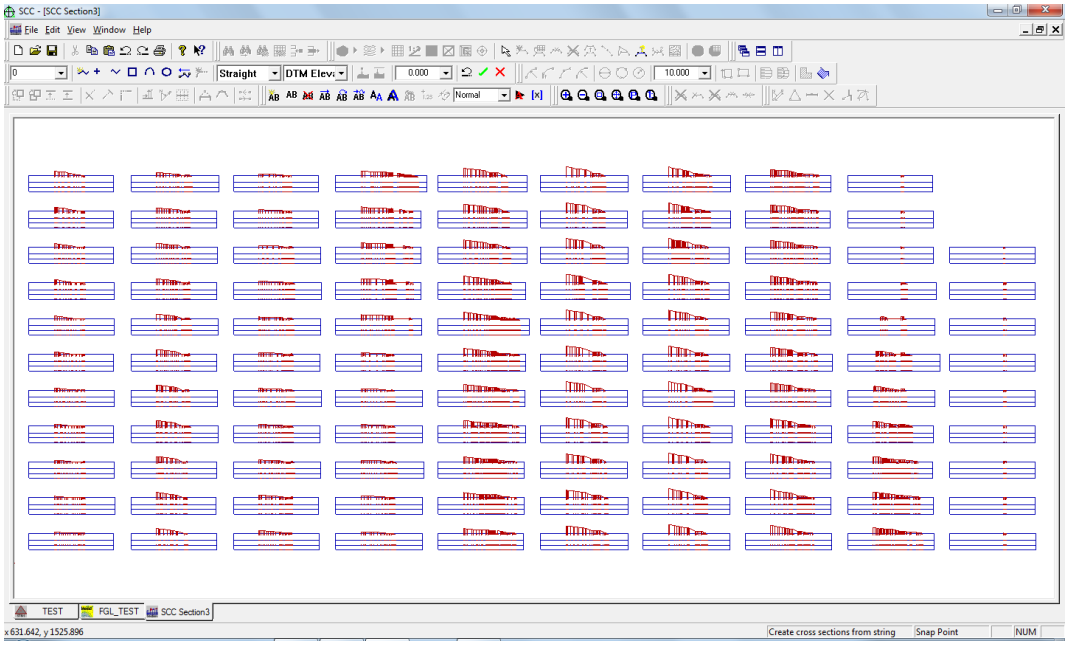
Whilst, case 2 outlines the creation of a *.txt file of Chainage, X, Y, Z, Feature of all annotated points:

Section File

Open Project File

Open Section File

In this instance, Cross Section have been generated along a string at Chainage Intervals of 10.00m .



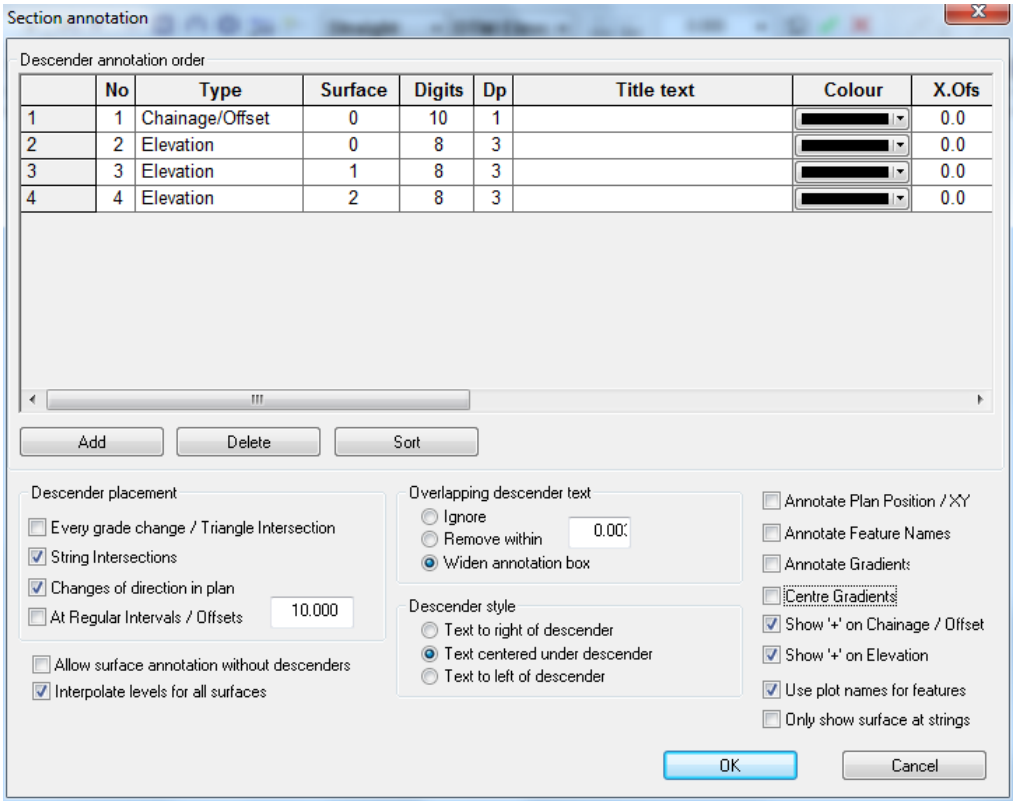
Case 1: Output Ground Points

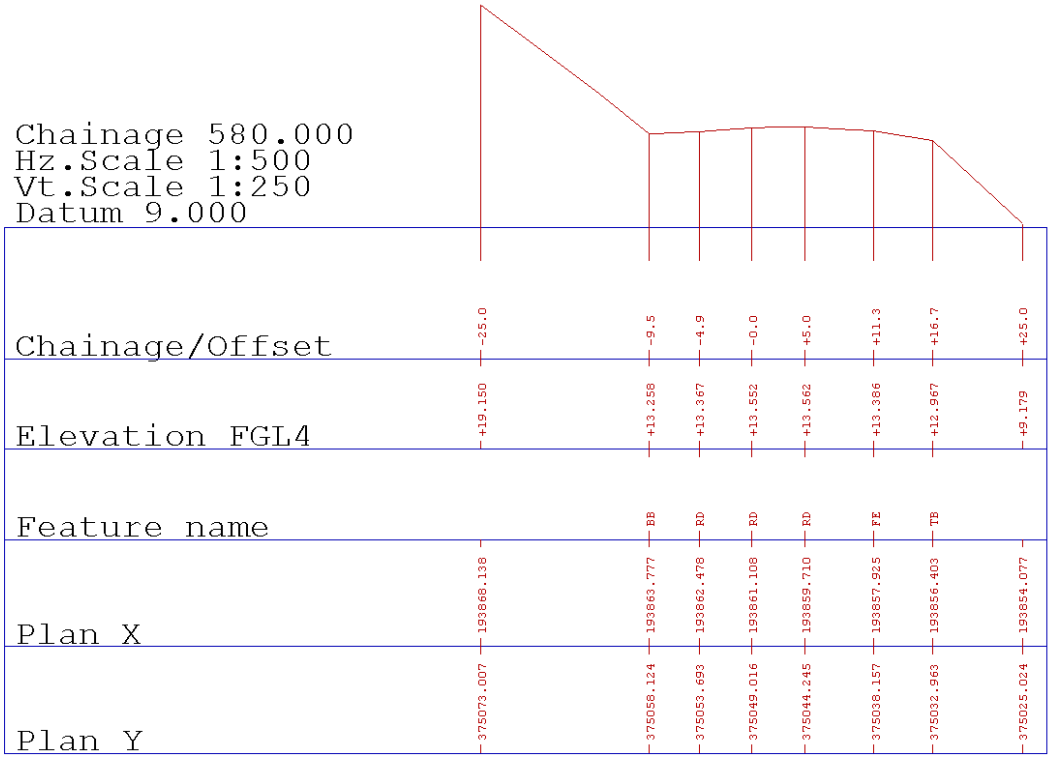
The User is required to output a *.txt file of Chainage, Offset, X, Y, Z, Feature of all ground points:

Annotation Settings:

Go to 'EDIT > Annotation Settings'

Assign the following





Exporting User Defined File

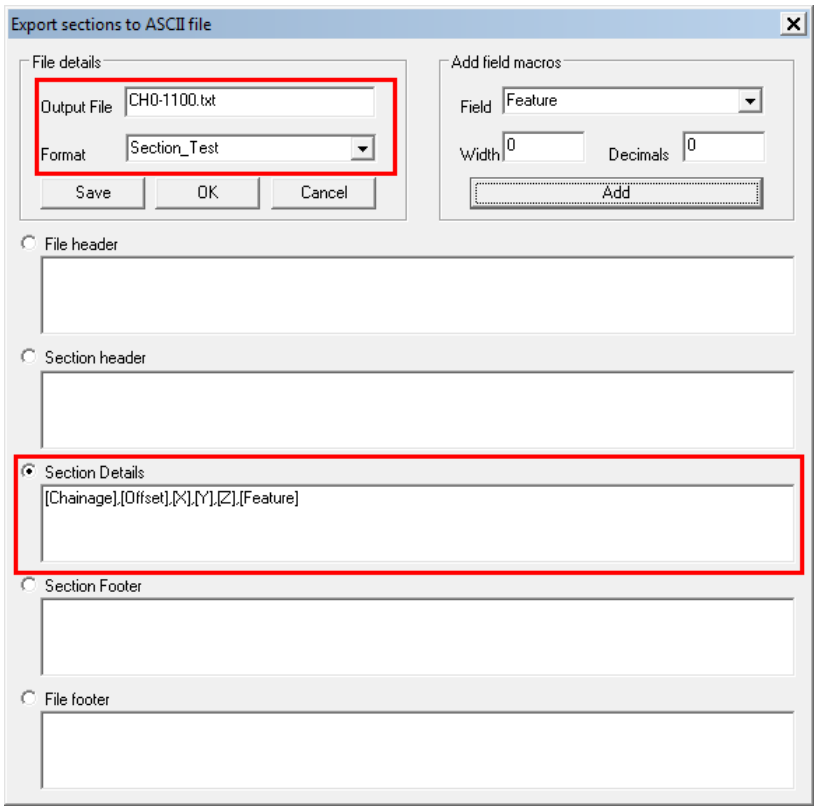
Within the Section File, select 'FILE > Export Sections > User Defined ASCII File'

Select 'Section Details' and place cursor in the box below

Select required 'Field' from drop down menu with the 'Add Field to Macros'

For example, 'Chainage' and select 'ADD'

Manually enter a comma ',' between each macro field added to construct a csv file



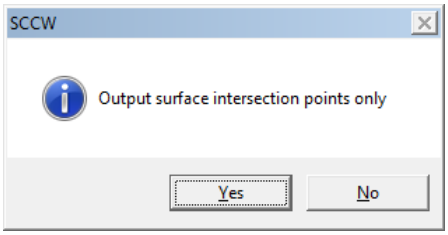
Enter a Format Name within Field Details 'Section_Test' and select 'Save'

This saves the format to allow the user to output other files using same Section Details. The Format should be available from the drop down 'Format' Menu in future.

Enter 'Output File'. 'Ch0-1100.txt'

Select 'OK'

Select 'No' to 'Output surface intersection points only'



Extract of File Shown below:

```
0.000,    -100.000,  193692.647,  375479.004,      19.584,0
0.000,     -99.014,  193691.675,  375479.167,      19.552,0
0.000,     -98.382,  193691.051,  375479.271,      19.522,0
0.000,     -94.799,  193687.517,  375479.861,      19.380,0
0.000,     -93.068,  193685.810,  375480.146,      19.296,FL
0.000,     -81.994,  193674.888,  375481.970,      18.813,0
0.000,     -73.145,  193666.159,  375483.428,      18.057,0
0.000,     -67.501,  193660.592,  375484.358,      17.606,0
0.000,     -61.539,  193654.711,  375485.340,      16.907,FL
0.000,     -52.869,  193646.160,  375486.768,      16.667,0
0.000,     -46.577,  193639.954,  375487.805,      16.385,0
0.000,     -33.948,  193627.497,  375489.885,      16.033,0
0.000,     -27.429,  193621.067,  375490.959,      15.902,0
```

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```
 0.000,     -17.478,  193611.253,  375492.598,      15.818,0
 0.000,     -14.144,  193607.964,  375493.147,      15.970,0
 0.000,     -12.891,  193606.728,  375493.354,      16.100,0
 0.000,      -9.593,  193603.475,  375493.897,      16.260,0
 0.000,      -4.925,  193598.872,  375494.666,      16.394,RL
 0.000,      -1.074,  193595.073,  375495.300,      16.517,0
 0.000,       0.000,  193594.013,  375495.477,      16.543,RL
 0.000,       1.135,  193592.894,  375495.664,      16.521,0
 0.000,       4.983,  193589.099,  375496.298,      16.471,RL
10.000,    -100.000,  193691.000,  375469.177,      20.680,0
10.000,     -92.998,  193684.094,  375470.328,      20.342,0
10.000,     -89.331,  193680.476,  375470.931,      20.131,0
10.000,     -88.681,  193679.835,  375471.037,      20.087,0
10.000,     -84.014,  193675.231,  375471.805,      19.833,0
10.000,     -79.447,  193670.727,  375472.555,      19.502,FL
10.000,     -72.407,  193663.782,  375473.713,      18.940,0
```

Note:

The user defined output from the Section Screen, is unaffected by the Annotations Settings.

For instance, if the user turns all descenders off as shown below and outputs using ‘ SectionTest.SCCOutput’ the *.txt file will remain the same.

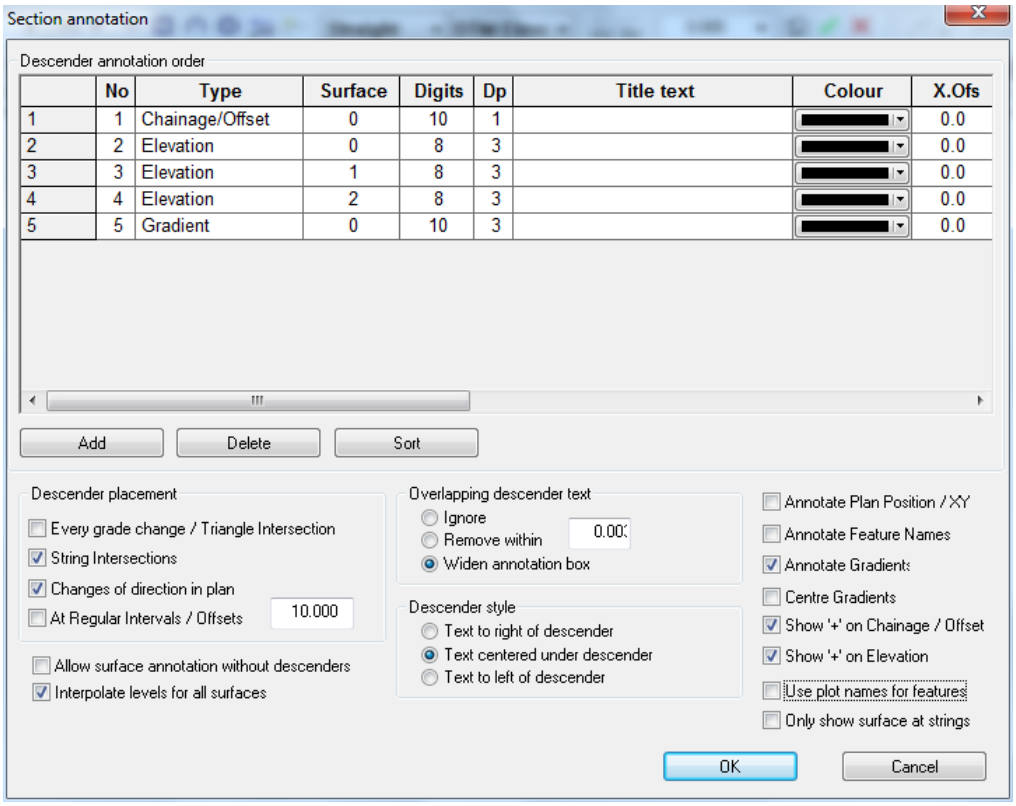
Case 2: Output Surface Points/Annotated Points

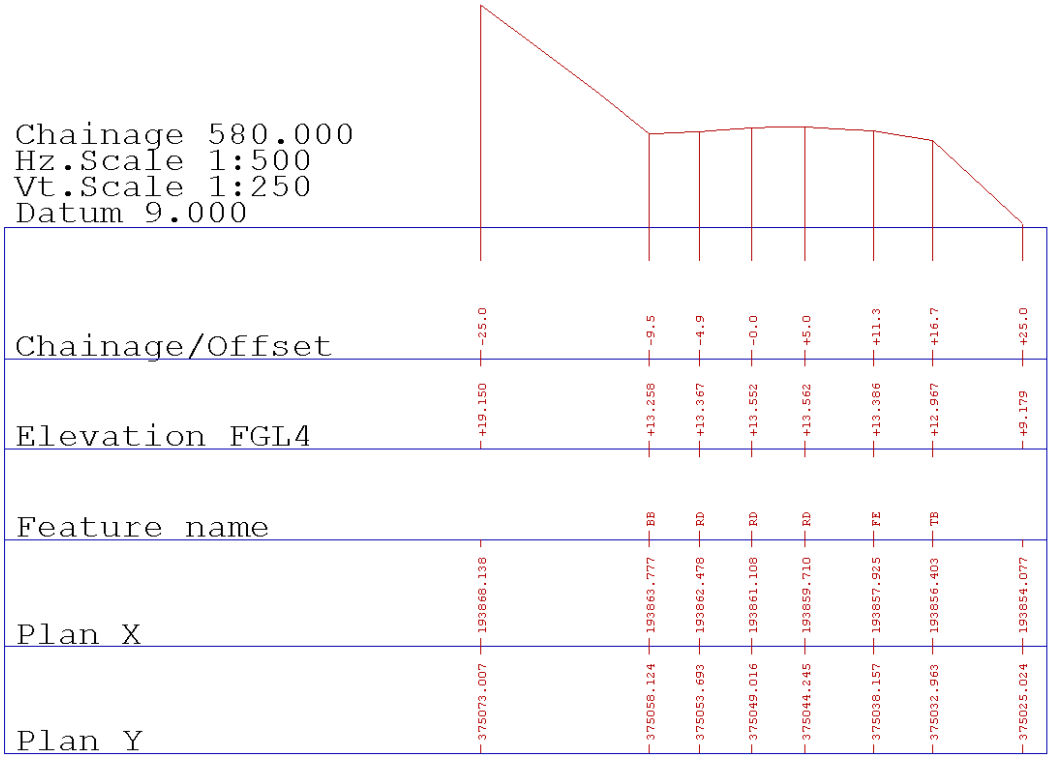
The user is required to output a *.txt file of Chainage, X, Y, Z, Feature of all annotated points:

Annotation Settings:

Go to ‘EDIT > Annotation Settings’

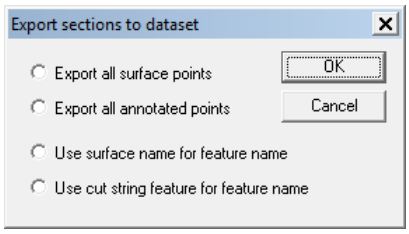
Assign the following





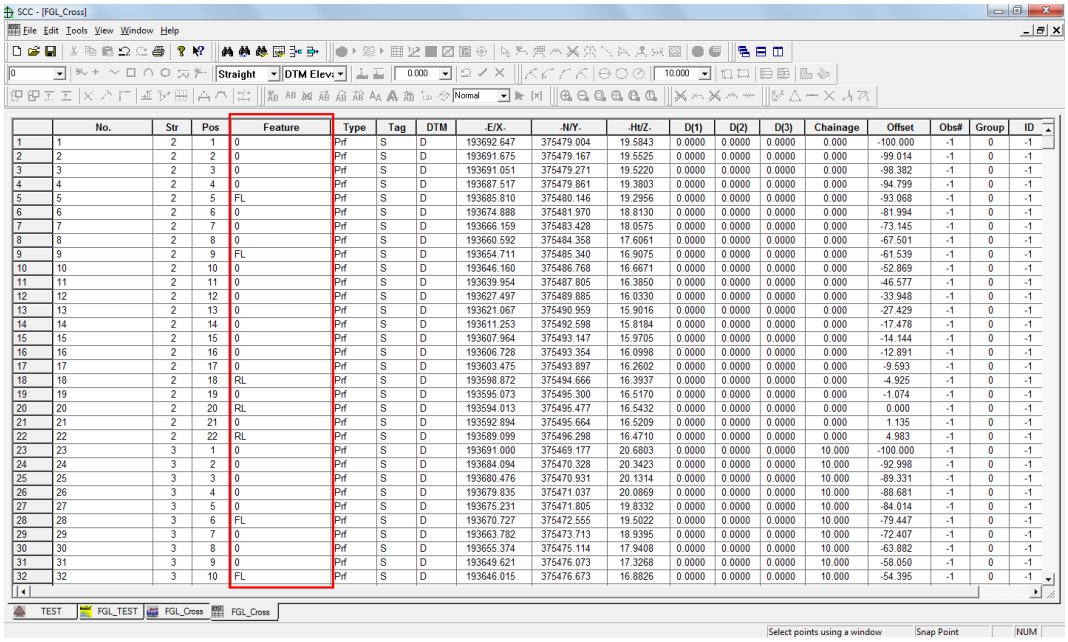
Exporting Dataset

Within the Section File, select 'FILE > Export Sections > SCC Dataset'



Select 'Export all annotated points'

Select 'OK'



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	1	2	1	0	Prf	S	D	193692.647	375479.004	19.5843	0.0000	0.0000	0.0000	0.000	-100.000	-1	0	-1
2	2	2	2	0	Prf	S	D	193691.675	375479.167	19.5525	0.0000	0.0000	0.0000	0.000	-99.014	-1	0	-1
3	3	2	3	0	Prf	S	D	193691.051	375479.271	19.5220	0.0000	0.0000	0.0000	0.000	-98.382	-1	0	-1
4	4	2	4	0	Prf	S	D	193687.517	375479.861	19.3803	0.0000	0.0000	0.0000	0.000	-94.799	-1	0	-1
5	5	2	5	FL	Prf	S	D	193685.810	375480.146	19.2956	0.0000	0.0000	0.0000	0.000	-93.068	-1	0	-1
6	6	2	6	0	Prf	S	D	193674.888	375481.970	18.8130	0.0000	0.0000	0.0000	0.000	-81.994	-1	0	-1
7	7	2	7	0	Prf	S	D	193666.159	375483.428	18.0575	0.0000	0.0000	0.0000	0.000	-73.145	-1	0	-1
8	8	2	8	0	Prf	S	D	193660.592	375484.358	17.6061	0.0000	0.0000	0.0000	0.000	-67.501	-1	0	-1
9	9	2	9	FL	Prf	S	D	193654.711	375485.340	16.9075	0.0000	0.0000	0.0000	0.000	-61.539	-1	0	-1
10	10	2	10	0	Prf	S	D	193646.160	375486.768	16.6671	0.0000	0.0000	0.0000	0.000	-52.869	-1	0	-1
11	11	2	11	0	Prf	S	D	193639.954	375487.805	16.3850	0.0000	0.0000	0.0000	0.000	-46.577	-1	0	-1
12	12	2	12	0	Prf	S	D	193627.497	375489.885	16.0330	0.0000	0.0000	0.0000	0.000	-33.948	-1	0	-1
13	13	2	13	0	Prf	S	D	193621.067	375490.959	15.9016	0.0000	0.0000	0.0000	0.000	-27.429	-1	0	-1
14	14	2	14	0	Prf	S	D	193611.253	375492.598	15.8184	0.0000	0.0000	0.0000	0.000	-17.478	-1	0	-1
15	15	2	15	0	Prf	S	D	193607.964	375493.147	15.9705	0.0000	0.0000	0.0000	0.000	-14.144	-1	0	-1
16	16	2	16	0	Prf	S	D	193606.728	375493.354	16.0998	0.0000	0.0000	0.0000	0.000	-12.891	-1	0	-1
17	17	2	17	0	Prf	S	D	193603.475	375493.897	16.2602	0.0000	0.0000	0.0000	0.000	-9.593	-1	0	-1
18	18	2	18	RL	Prf	S	D	193598.872	375494.666	16.3937	0.0000	0.0000	0.0000	0.000	-4.925	-1	0	-1
19	19	2	19	0	Prf	S	D	193595.073	375495.300	16.5170	0.0000	0.0000	0.0000	0.000	-1.074	-1	0	-1
20	20	2	20	RL	Prf	S	D	193594.013	375495.477	16.5432	0.0000	0.0000	0.0000	0.000	0.000	-1	0	-1
21	21	2	21	0	Prf	S	D	193592.894	375495.664	16.5209	0.0000	0.0000	0.0000	0.000	1.135	-1	0	-1
22	22	2	22	RL	Prf	S	D	193589.099	375496.298	16.4710	0.0000	0.0000	0.0000	0.000	4.983	-1	0	-1
23	23	3	1	0	Prf	S	D	193691.000	375469.177	20.6803	0.0000	0.0000	0.0000	10.000	-100.000	-1	0	-1
24	24	3	2	0	Prf	S	D	193684.094	375470.328	20.3423	0.0000	0.0000	0.0000	10.000	-92.998	-1	0	-1
25	25	3	3	0	Prf	S	D	193680.476	375470.931	20.1314	0.0000	0.0000	0.0000	10.000	-89.331	-1	0	-1
26	26	3	4	0	Prf	S	D	193679.835	375471.037	20.0869	0.0000	0.0000	0.0000	10.000	-88.681	-1	0	-1
27	27	3	5	0	Prf	S	D	193675.231	375471.805	19.8332	0.0000	0.0000	0.0000	10.000	-84.014	-1	0	-1
28	28	3	6	FL	Prf	S	D	193670.727	375472.555	19.5022	0.0000	0.0000	0.0000	10.000	-79.447	-1	0	-1
29	29	3	7	0	Prf	S	D	193663.782	375473.713	18.9395	0.0000	0.0000	0.0000	10.000	-72.407	-1	0	-1
30	30	3	8	0	Prf	S	D	193655.374	375475.114	17.9408	0.0000	0.0000	0.0000	10.000	-63.882	-1	0	-1
31	31	3	9	0	Prf	S	D	193649.621	375476.073	17.3268	0.0000	0.0000	0.0000	10.000	-58.050	-1	0	-1
32	32	3	10	FL	Prf	S	D	193646.015	375476.673	16.8826	0.0000	0.0000	0.0000	10.000	-54.395	-1	0	-1

Exporting User Defined File

Within the Dataset File, select 'FILE > Export > User Defined ASCII File'

Select 'SectionTest.SCCOutput' Format previously created

Enter output file name 'Ch0-1070_AnnotationPoints.txt

9.4 Prismoidal Method

The first and most accurate method of computing volumes is the Prismodial projection method.

This method involves the creation of an isopachyte or thickness model from the two surfaces under consideration. This is achieved by calculating differences in elevation from all surveyed points, and along all surveyed strings, in both models, and triangulating the result. Once the isopachyte model has been formed, prismoidal volumes are calculated by adding the volume of each triangular prism generated by projecting the isopachyte triangle to a datum of zero. Note that individual triangular prisms may contain both cut and fill with this type of measurement.

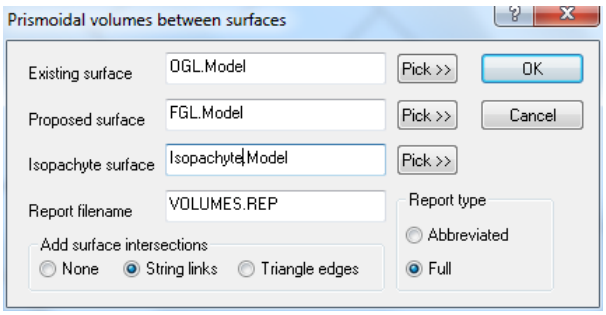
The volume calculation report generated from the volume computation shows us the plan and surface areas under consideration as well as the total cut and fill volumes. It also gives us average material depth and calculates the effect of survey elevation accuracy on the volume.

To calculate prismoidal volumes you must have a model window active.

Calculating Prismoidal Volumes

Select 'VOLUMES > Volumes between surfaces (prismoidal)'

Fill in the dialog box with the existing surface and the proposed surface

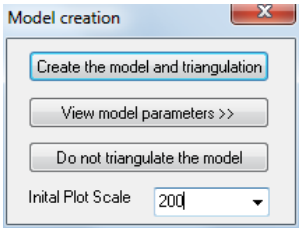


Since SCC provides the default name of VOLUMES.REP to all volume reports, you may want to use a specific file name to avoid having the data overwritten

Select 'OK'

Isopachyte Surface Model

Select 'Create the model and triangulation' and set the Inital Plot Scale as 200



Select 'OK' to the Model Attributes Dialog

Examine Report

Once we have created an isopachyte model, we can colour it according to depth of material and calculate material volumes by depth. Note that this is using an end areas method based on horizontal sections whose accuracy is dependent on the vertical interval.

9.5 Grid Method

This option is similar to the prismoidal method, except that the volumes are derived from a regular grid of rectangular prisms. Each prism is generated by calculating height differences for the four grid points that make up its vertical edges. The total volume is computed as the sum of the volumes of the individual prisms. You can use the default grid sizes, or fill in different values on the dialog box.

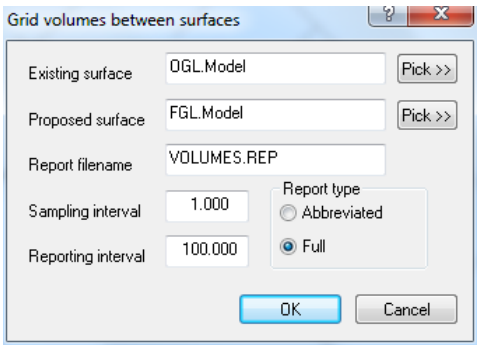
The main disadvantage of using this technique to compute your volumes is that it does not provide graphical representation of the results. It does have the advantage though that it does not require any additional memory resource to compute the volumes, other than required by the input models. This is useful when using larger models and computer resource limitations are an issue.

Volumes Calculations

Within FGL, select 'VOLUMES > Volumes between surfaces (Grid)'

Using the 'Pick>>' button select the existing and proposed surfaces

Enter report filename



9.6 Calculating Spoil Heap Volumes

Often when calculating spoil heap volumes the original ground surface is not available. Therefore, the original surface has to be estimated from the surveyed surface. The base of spoil heap or the top of a quarry site would be taken as the original ground surface.

We are going to use the model DUMP.

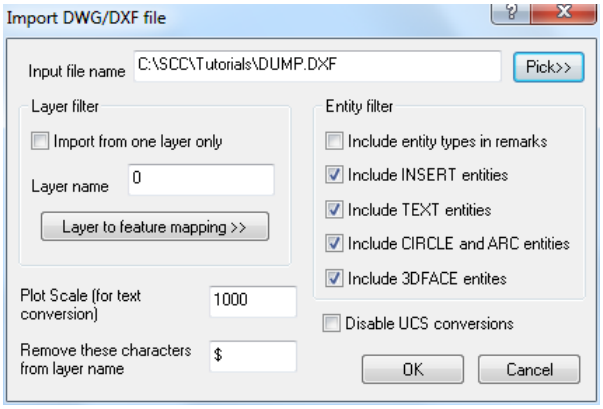
Create the model 'DUMP' from DXF file

Go to 'FILE > Model > DXF file'

Select Pick

Select the file DUMP.DXF from the directory \SCC\Tutorials

Select Open



Select OK

Select 'Create Model and Triangulation'

Select OK

Save model as DUMP.Model

There is a spoil heap in the bottom half of this model. Using the Data Selection Dialog (right click mouse), highlight all points on the base string of the spoil heap and from the DTM list box, convert the string to 'Clip Polygon'.

Creating The Boundary String

Zoom into the area of the spoil heap

Click the right mouse button to access the Data Selection Dialog

Set the selection method to 'All points on selected string'

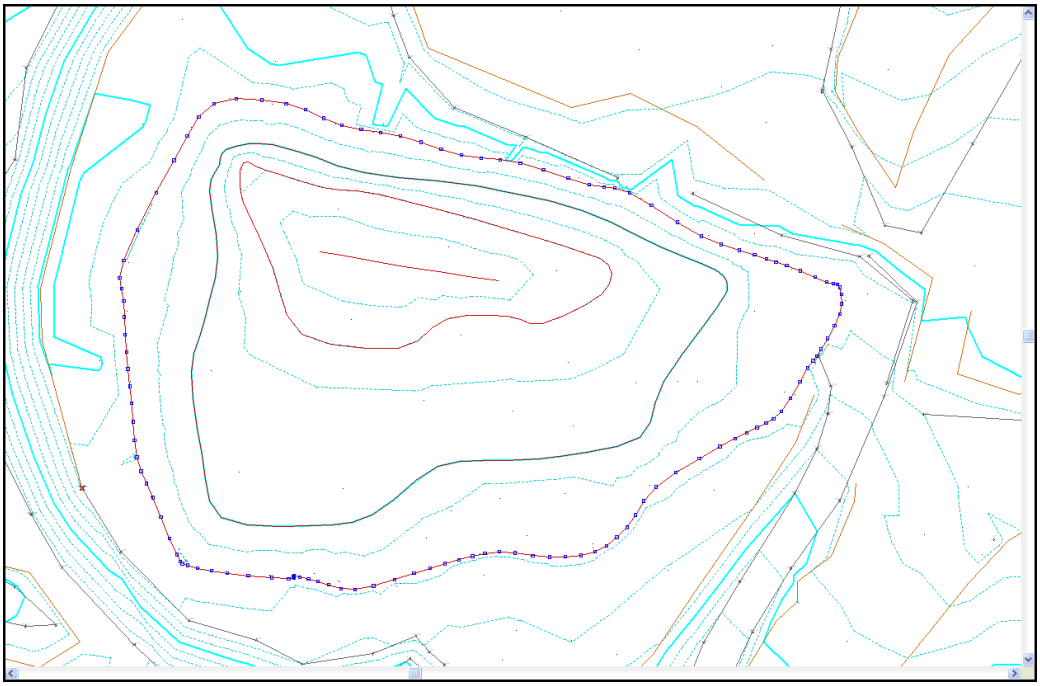
Select OK

Select the string indicating the base of the spoil heap (See image below)

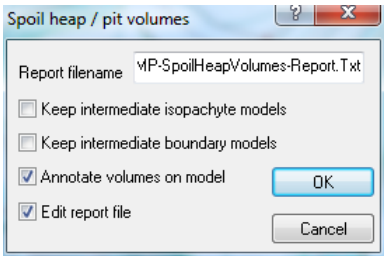
From the list boxes, select 'Clip Polygon' from the DTM status box.

Select 'Yes' to convert the string

Save the model



From the 'VOLUMES' menu, selecting the 'Volumes of Spoilheaps/Pits' option will calculate the volumes of any spoilheap or pit so long as there is a clip polygon string around it. This option also allows multiple clip polygons in the model. SCC copies the boundary string to a second model and then computes volumes between the two using the prismodial method. It does this in one step and gives you the option of keeping the intermediate boundary model, the isopachyte model and report file and whether you wish to annotate the volumes on the model.



Computing Spoil Heap Volumes

Go to 'VOLUMES > Volumes of Spoilheaps/Pits'

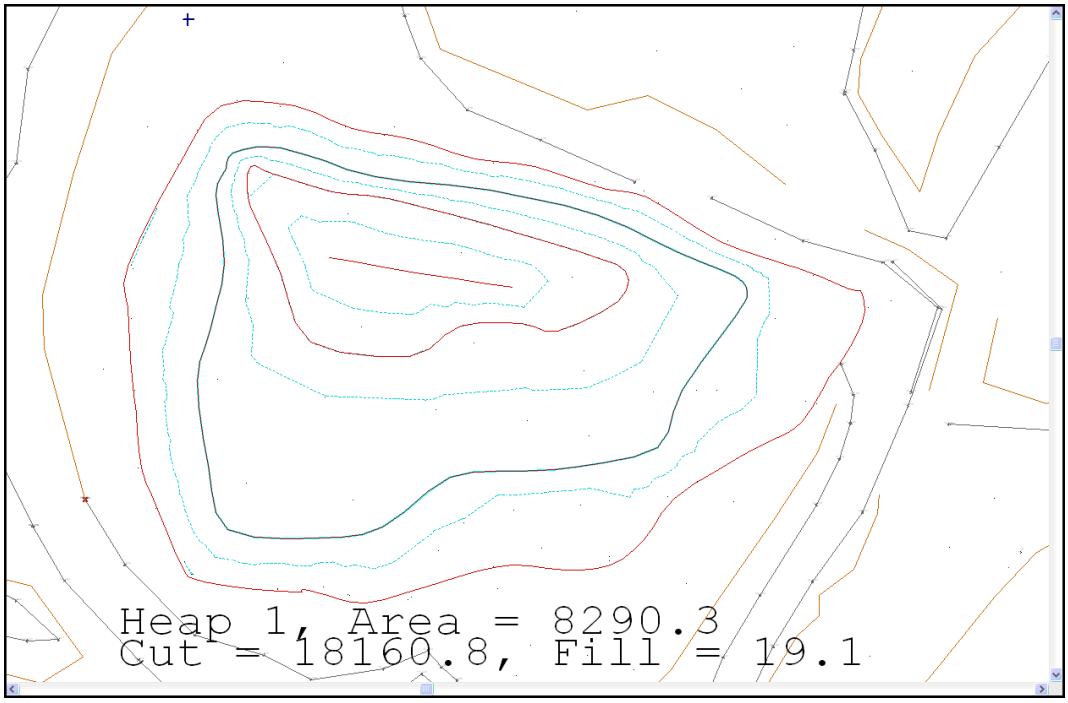
Enter in a new or accept the default report name

Select the options you require, if the options to 'Keep intermediate isopachtye models' and 'Keep intermediate boundary models' are not turned on, these two models will be stored in your current working directory regardless.

Select 'OK'

Selecting the options as shown above will present you with the following;

```
Volumetric analysis report for spoil heaps and pits (Prismoidal method)   Thu Feb 01
12:40:56 2007
Survey model DUMP
No    Cut Volume  Fill Volume  Plan Area  Surface Area
----- ----------  -----------  ---------  ------------
1        18160.8        19.1      8290.3        8424.8
SCC for Windows v7.8.22  (C) 1990 - 2005 Atlas Computers Ltd
```



9.7 Identification of Potential Errors In Volumes

Before volume calculations are carried out both models should be checked for the following points.

Define Topography Using Strings Not Entirely Discrete Points

Ensure that the models are defined using strings and not entirely of discrete points (spot elevations). While discrete points can be used to adequately describe smooth and reasonably flat surfaces, they are unsuitable for describing irregular surfaces containing significant grade changes such as embankments, spoil heaps, pits & hollows, etc. Strings are used as breaklines and as such constrain the triangulation around irregular areas, the net effect of not using strings where they are required is that embankments, pit edges, etc. may appear to spill as illustrated in the diagram below;

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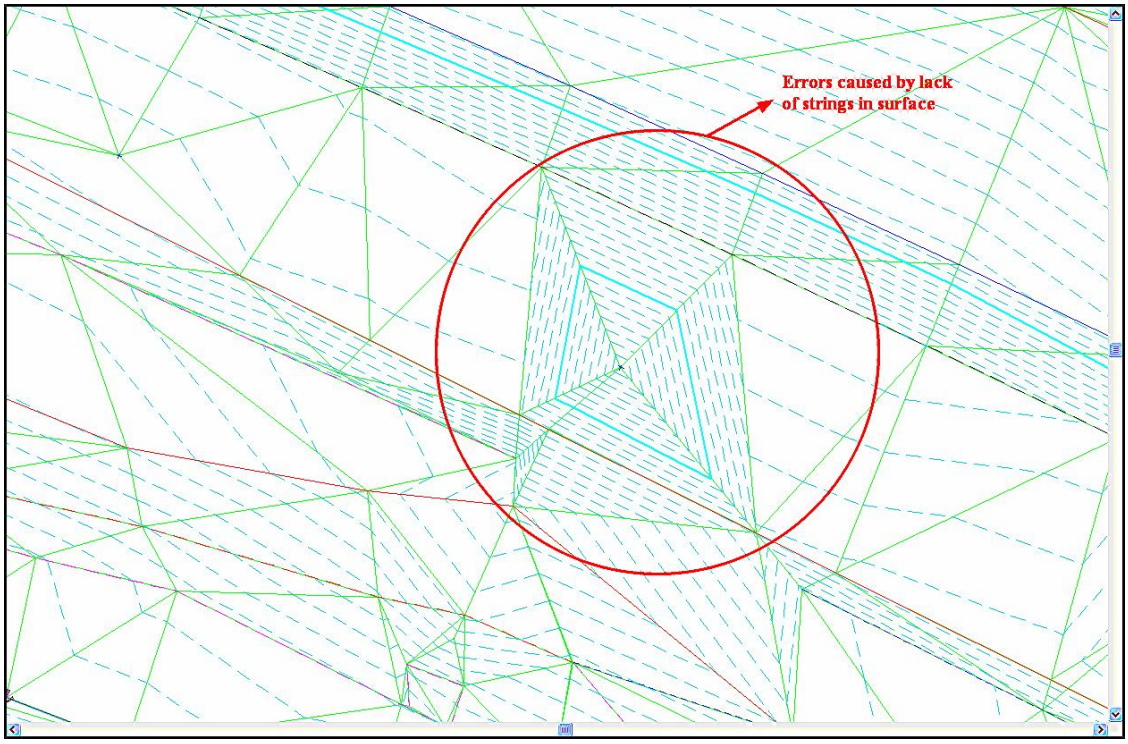
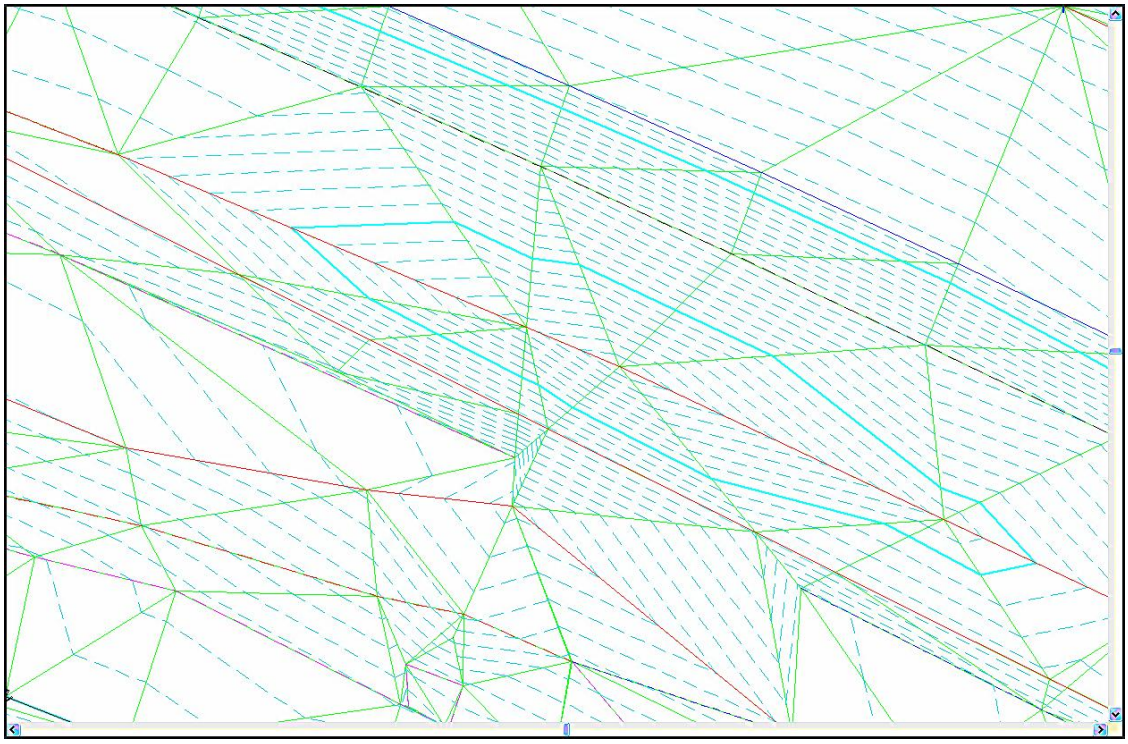


The error shown above is corrected by connecting the discrete points defining the embankment / grade change with a string to produce the results shown in the following picture.



Note that the only difference in survey procedure is to enter a unique non-zero string number for any string being surveyed. Not providing strings where they are required can often lead to serious volumetric errors.

When calculating prismoidal volume between models that contain only point information, there is an option to ‘Add Surface Intersections’ to ‘Triangle Edges’. Make sure that this is set before computing the volumes.

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Boundary

The survey model should always extend beyond the design area to facilitate side slope design, and the side slopes should be recomputed whenever the survey model is modified. For accurate volumetric analysis, a common boundary string, normally generated from the side slope intercept points, should be included in both models.

Accurate Volumes

Accurate volumes cannot be calculated between two surfaces where a common boundary is not defined. Poor boundary definitions are probably the most common cause of gross error in volume calculations. The boundary string should always have a DTM status of clip polygon and will normally take the form of an existing string line, one generated by interface design, or one added manually to the model in SCC. If a boundary is not provided, most modeling packages, including SCC, will automatically determine a boundary, using a convex hull or similar algorithm. Such boundaries rarely reflect conditions on site, as can be seen in many cases, by contours appearing outside the surveyed areas. In any case, such a boundary is ambiguous, as it is dependent on the algorithm selected by the software package rather than the judgement/ agreement of the engineers and surveyors on site. Weeding and the adding/removing of traingles may also be used to define plan areas although use of a boundary string is far superior.

Visual Verification

Both models, that is, the survey and design or OGL and FGL, should always be visually verified prior to computing volumes, as if there are any discrepancies in either model the result is liable to be a gross error in the results. To verify a model, increase the contour interval, say to 0.2m and visually check the contours. It is also wise to generate a number of profiles and cross sections, with vertical exaggeration of say 5:1, through the model to further check for anomalies.

Volume Verification

Having verified all models you may then proceed with volume calculations. When calculating volumes, it is advisable to use all three methods, i.e. prismoidal, grid and cross sectional, and compare the results. Each method is mathematically independent of the other, and hence each provides a check on the other. Differences of any greater than approx. 0.5% indicate ambiguities in either the surface or boundary conditions. Of the three methods, cross-sections are most prone to error, particularly when dealing with survey models in rough terrain. The reason for this is that cross sectional volumes assume that data along the cross section is typical of data between cross sections, which is often not the case. If you have errors in your data, cross sectional volumes are liable to magnify their effect.

Cross sectional volumes may also contain errors due to curvature. The end-areas method of calculation also assumes that cross sections being used are parallel to one another. This may not be the case where cross sections are being taken along a curved centre line, such as a road centre line. In this case, small errors can occur where there is fill on one side of the centre line and cut on the other side, or vice-versa. This is another reason to measure your volume using more than one method, prismoidal and grid volumes do not suffer from this error.

Using Cross Sections To Verify Design

In many measurements, including road and building footprint design, it is the case that the design and survey surfaces meet at the boundary string. This will normally be carried out through a process of interface design, either in SCC, or using another specific design package such as MX or DOER. If this is the case, it is necessary to check that the two models do actually meet at the boundary. The simplest way of doing this is to take a regular set of cross sections through both models and check that there are no vertical side slopes visible, as shown in the following figure.

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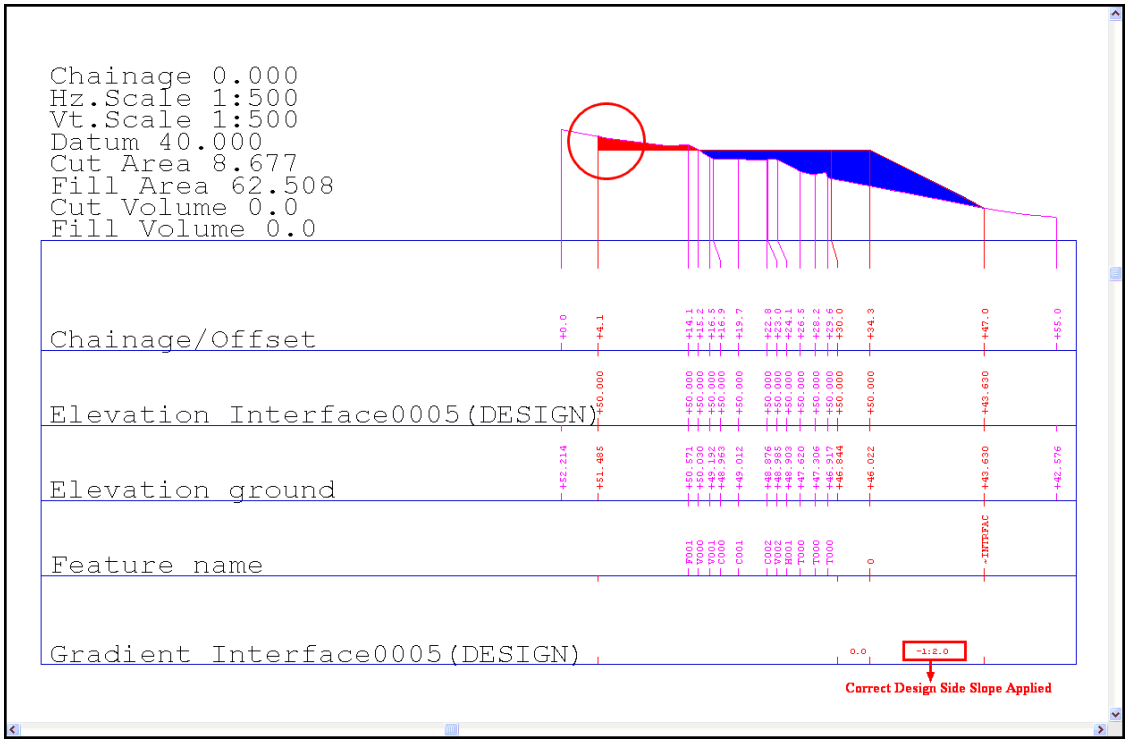


This can be caused by a number of different factors. The most common reasons are that the survey model does not cover a large enough area to accommodate the interface design, or that one or both models have been altered after the interface has been designed and the design has not been updated. In either case, the result is liable to be a gross error in the volumes.

Contours

When verifying the contours in a design model where interface strings are being employed with fixed side slopes, the contours along those side slopes should be parallel to one another. In the case of a flat building footprint, they should also be parallel to the edge of the design model. If this is not the case, there is probably an error in the interface design that will lead to errors in sections and volumes.

10 Section Editing

The following tutorials outlining briefly section editing functionality. All section editing commands will be demonstrated using sample file 'Bridge.Model' available from the tutorials directory.

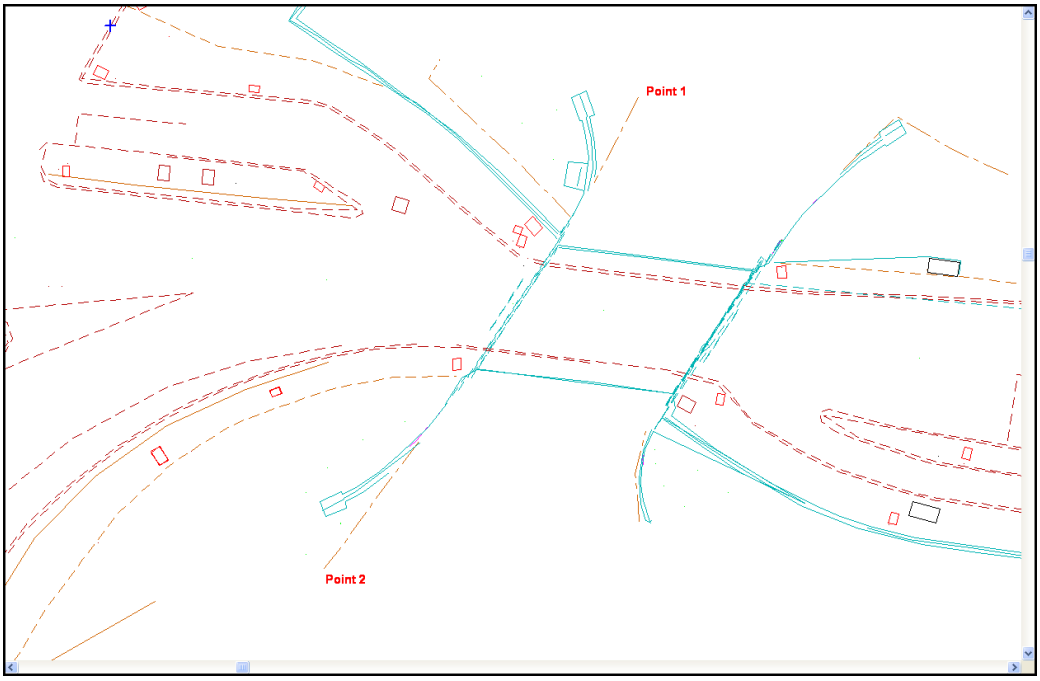
Open Model

Select 'FILE > Open' and pick 'Bridge.Model' from \SCC\Tutorials' directory

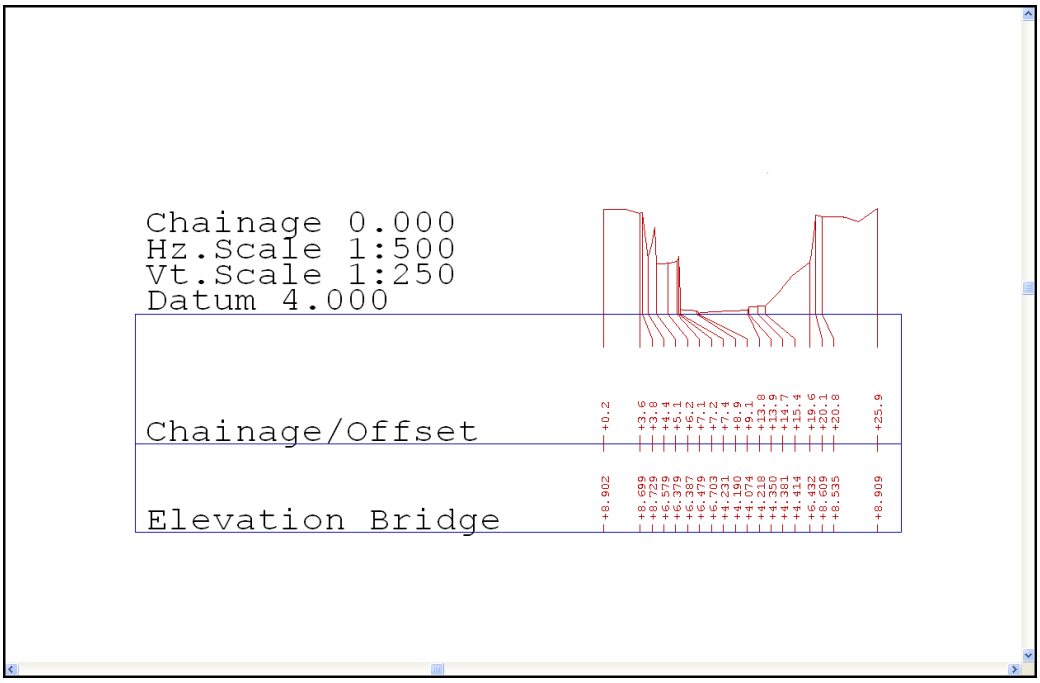
Creating A Profile

From The Main Menu Bar, select 'SECTIONS > Long sections with cursor'

Left click mouse on Point 1 and Point 2 illustrated below



Right click mouse to create Section



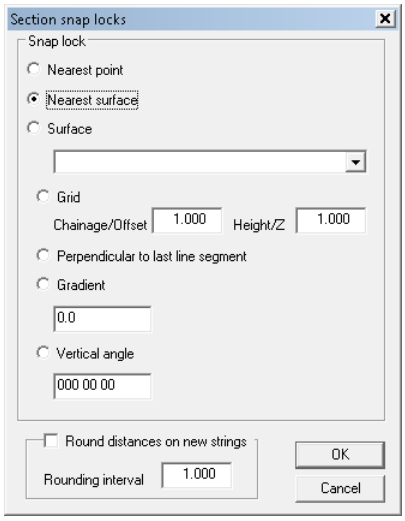
Select 'FILE > Save As > Bridge1.Section'

10.1 Section Snap Controls & Data Selection Options

Section Editing can be carried out with the use of additional Snap Controls and Data Selection Dialog:

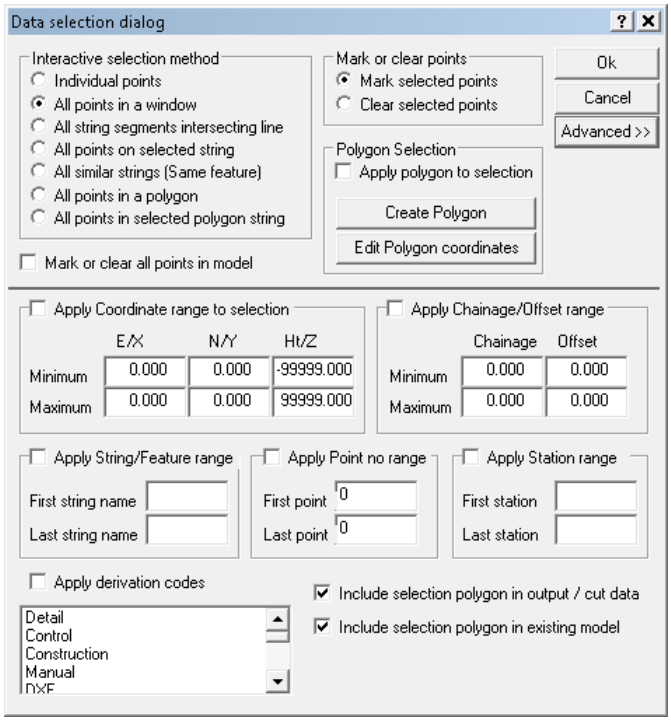
Snap Controls

The following snap controls are available:



Data Selection Dialog

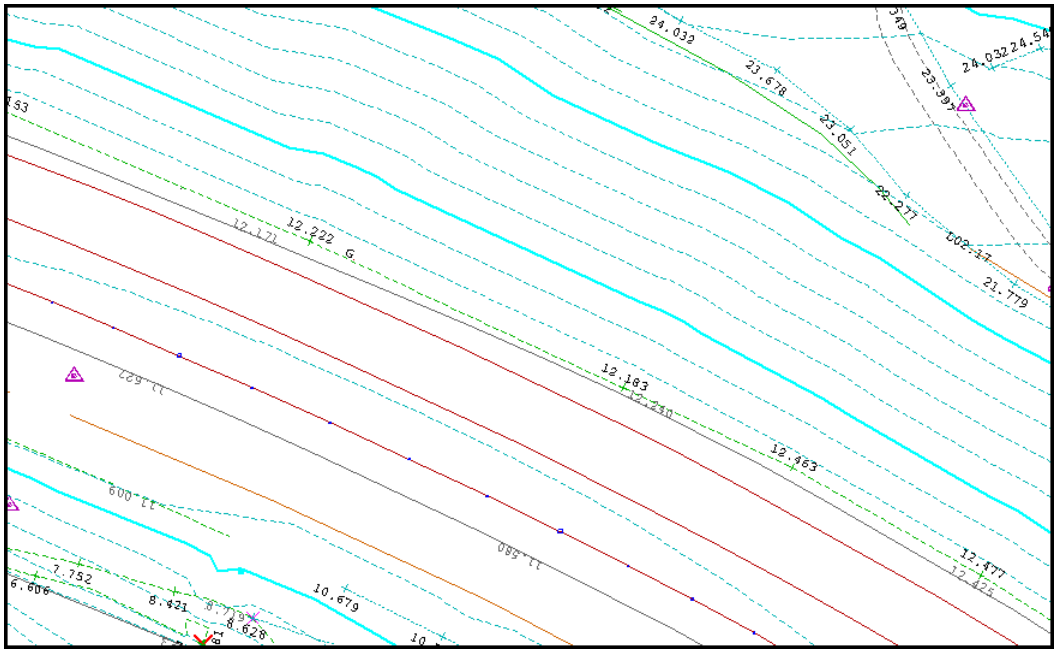
The use of the Data Selection Dialog allows the user to isolate specific data easily:



10.2 Section Editing Of Surface & Non-Surface Strings

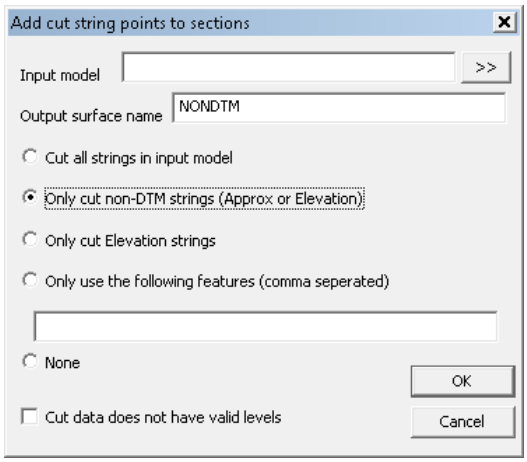
SCC supports section annotation of levels on surfaces, and cuts through strings that are not part of the DTM surface. These can be illustrated as follows;

Open the sample project 'SECTION_EDITING.Project' and '2d-sectest.Model'.



Select 'EDIT > Non-surface string cutting options' which are also available in the section.

Selecting Non-surface string cutting options shows the following dialog:



Input model is only used when the option is used from within an existing section

Output surface name is the same given to the surface annotation line within the sections

Cut all strings in the input model is only used when calling the option from an existing section, and causes all cut strings to be added to the section

Only cut Non-DTM points (Approx and Elevation) will cut all strings that are not part of the DTM surface in the input model and add the cut positions as single points to the section.

Only cut Elevation strings does the same but is restricted to strings with a DTM code of Elevation.

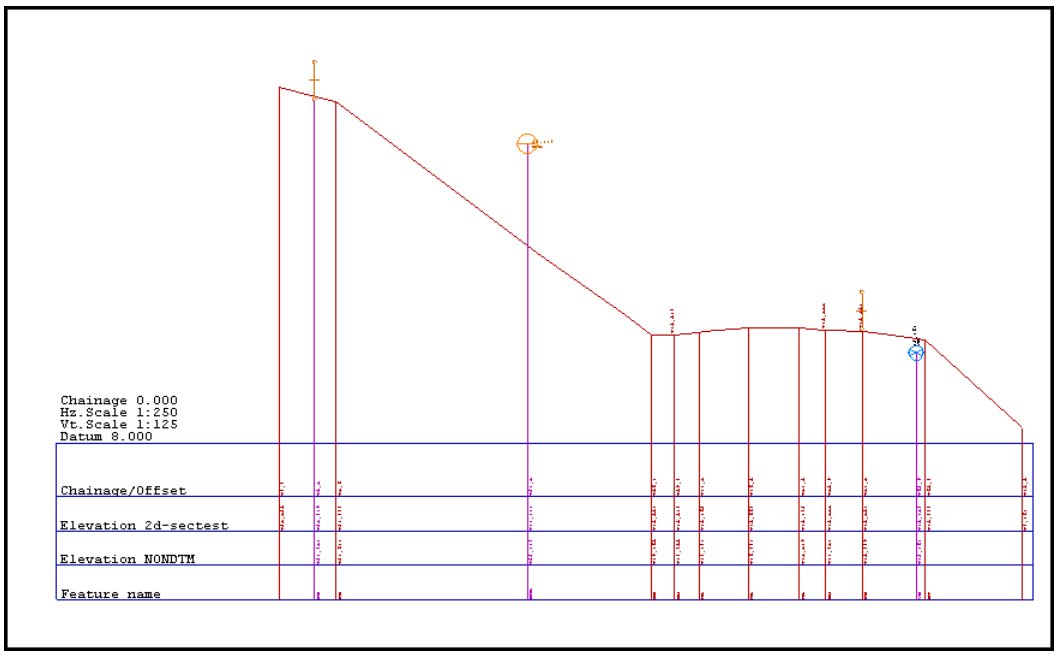
Only use the following features (comma separated) cuts all string with the nominated features. For example, a value of TB,BB,RL,RR would only cut strings with one of these feature names.

None indicates that this function will not be used when creating new section.

Cut data does not have valid levels forces the cut points output to assume the level of the sections datum.

When selected within a model, the above rules will apply to all newly cut sections created using long or cross sections, created using the cursor, existing strings, or alignments.

To demonstrate this cut a section using **'SECTION > Long sections with cursor'**, using the above values:



Note that additional symbols and annotation have automatically been added based on the feature library and section coding options being used. Where the cut feature, for example OHL has a valid dimension 3 symbol and value a symbol will be drawn in the section. Text annotation for feature and level will also used for this point in section, including text alignments, offsets, and orientation. OHL setting can be viewed using the Query and edit function from plan.

Note that the D3 Units field controls whether the symbol is placed above the cut point, e.g. for a fence, wall, etc.. or centred around the cut point, e.g. for a pipe.

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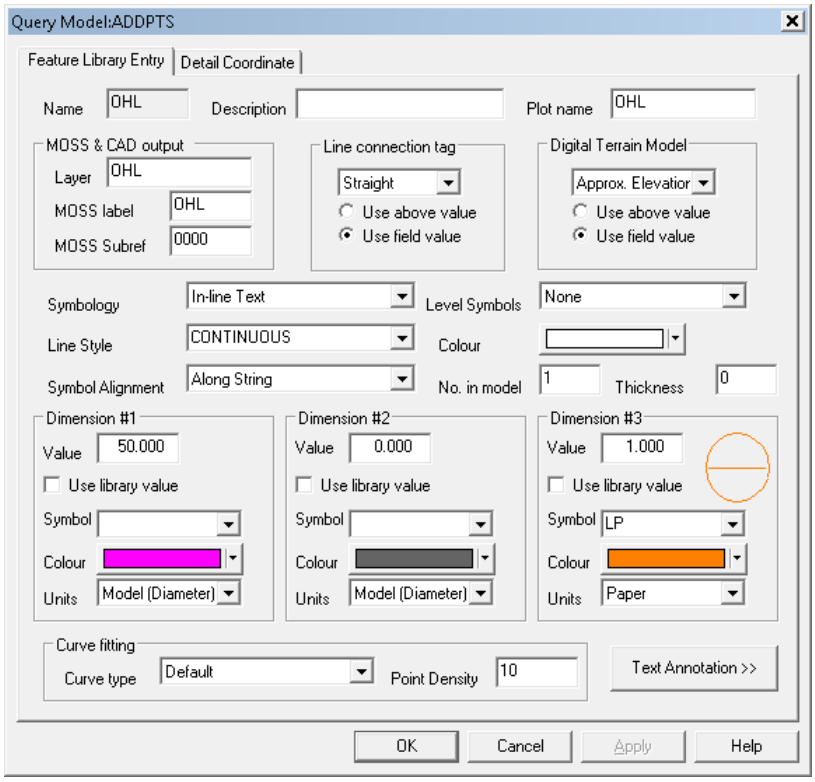
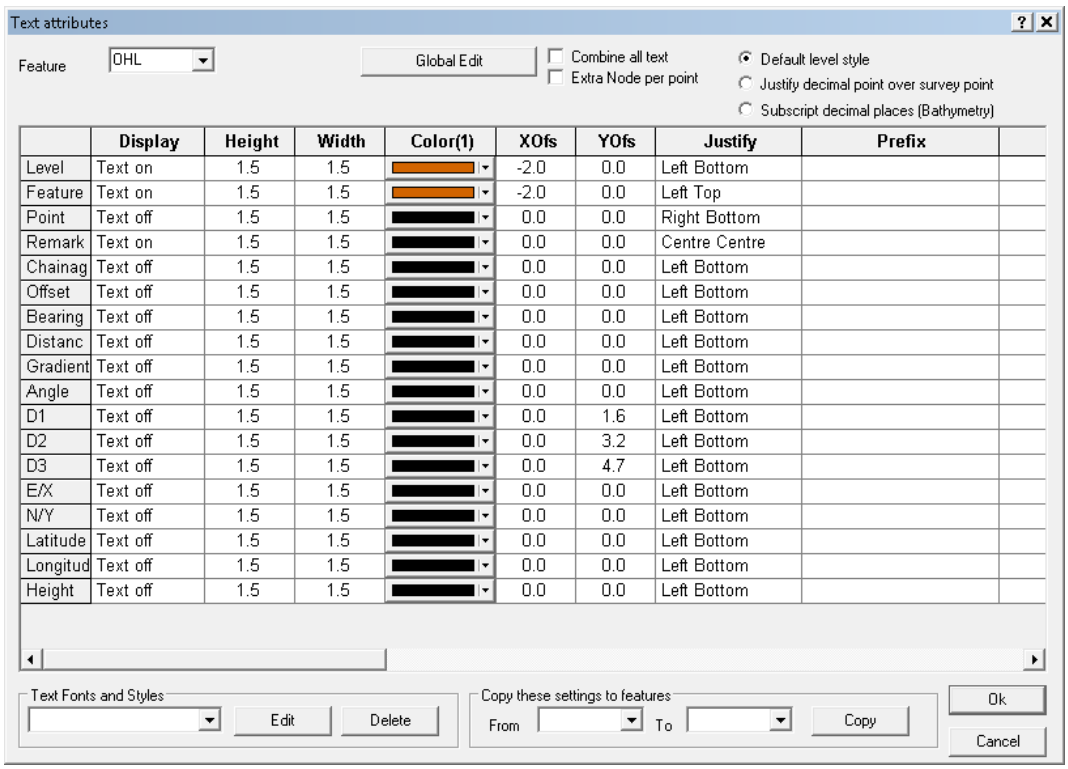




	Display	Height	Width	Color(1)	XOfs	YOfs	Justify	Prefix
Level	Text on	1.5	1.5		-2.0	0.0	Left Bottom	
Feature	Text on	1.5	1.5		-2.0	0.0	Left Top	
Point	Text off	1.5	1.5		0.0	0.0	Right Bottom	
Remark	Text on	1.5	1.5		0.0	0.0	Centre Centre	
Chainag	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Offset	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Bearing	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Distanc	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Gradient	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Angle	Text off	1.5	1.5		0.0	0.0	Left Bottom	
D1	Text off	1.5	1.5		0.0	1.6	Left Bottom	
D2	Text off	1.5	1.5		0.0	3.2	Left Bottom	
D3	Text off	1.5	1.5		0.0	4.7	Left Bottom	
E/X	Text off	1.5	1.5		0.0	0.0	Left Bottom	
N/Y	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Latitude	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Longitud	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Height	Text off	1.5	1.5		0.0	0.0	Left Bottom	

The '**SECTION** > **Edit section codes option**' allows the user to specify additional annotation options by feature. Using a value of Level on surface annotates the level of any given point on the surface in addition to the annotation boxes. A code and feature value of ~BLANK may be used for triangle cuts that do not relate to a string.

Extended field coding table

	Code	Feature	Text	Type
296	HE	HE		Level on surface
297	IL	IL		Level on surface
298	KB	KB		Level on surface
299	MK	MK		Level on surface
300	OHL	OHL		Level on surface
301	PIPE	PIPE		Level on surface
302	PR	PR		Level on surface
303	RIVER	RIVER		Level on surface
304	S	S		Level on surface
305	S901	S901		Level on surface
306	S901A	S901A		Level on surface
307	S902	S902		Level on surface
308	S903	S903		Level on surface
309	S904	S904		Level on surface
310	S905	S905		Level on surface
311	S906	S906		Level on surface
312	SC	SC		Level on surface
313	SV	SV		Level on surface
314	TE	TE		Level on surface
315	UG	UG		Level on surface
316	V	V		Level on surface
317	WL	WL		Level on surface
318	WW	WW		Level on surface

Add | Delete | Delete All | Global Edit | Replace | Import codes from feature library | OK | Cancel

This annotation can be turned off for individual points as required using the **'EDIT** > **Query and edit points'** option from within the section.

10.3 Adding Surface String & Point Data To An Existing Section

The addition of string and point data to an existing section can be examined using 'Bridge.Model' and 'Bridge1.Section'.

If you are within 'Bridge1.Section' revert to 'Bridge.Model' to copy and paste bridge detail from the model to the section file.

By changing the model view using 'EDIT > Viewports' specific bridge detail strings can be easily identified and in turn selected for insertion onto Section Profile.

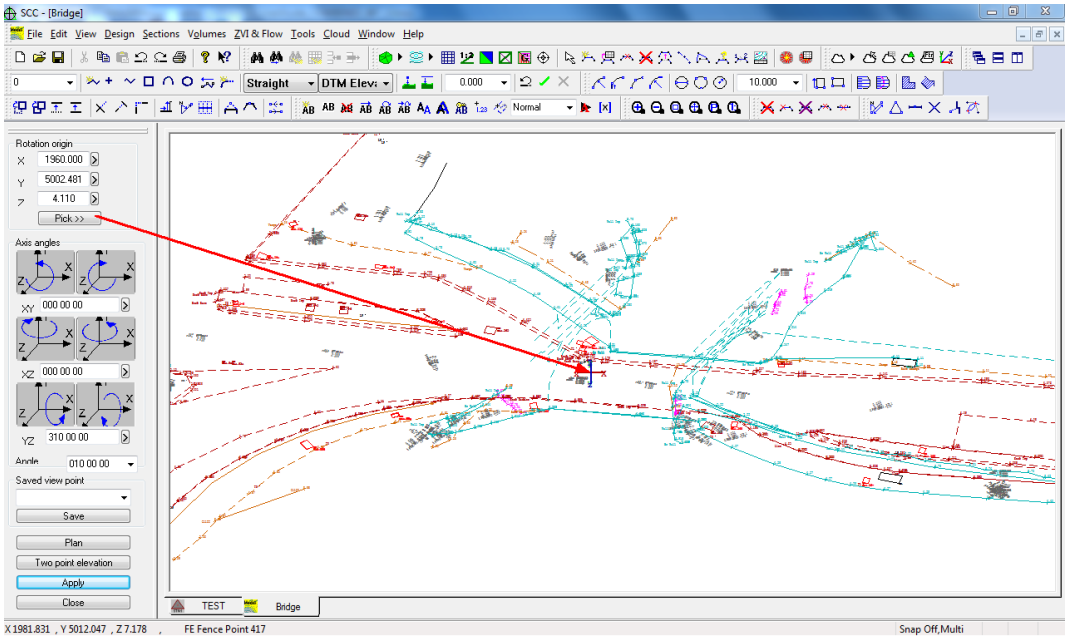
Viewport

Go to 'Bridge.Model'

Select 'VIEW > Viewports > Rotate Viewports'

Select 'Pick' from Create viewport by rotation dialog and left click on model to assign point

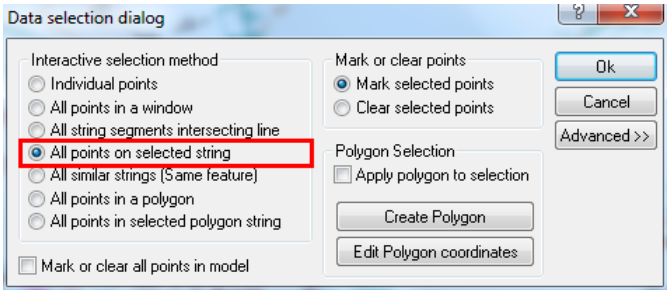
In this instance, rotate the model in the YZ axis as shown below:



Select 'Close'

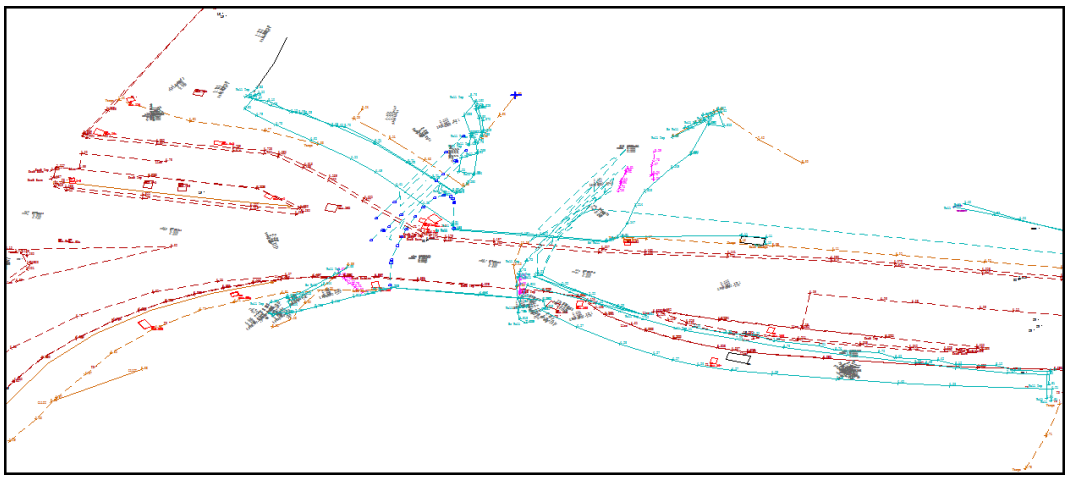
Bridge Detail

Left click mouse to bring up 'Data Selection Dialog'.



Select 'All points on selected string' and 'OK'

Left click on string of interest, all points on the string are highlighted in blue nodes



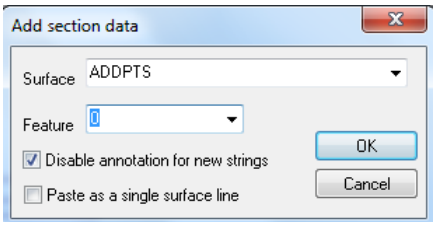
Select 'EDIT > Copy > Copy to Clipboard'

Go to Section File, select 'EDIT > Paste'

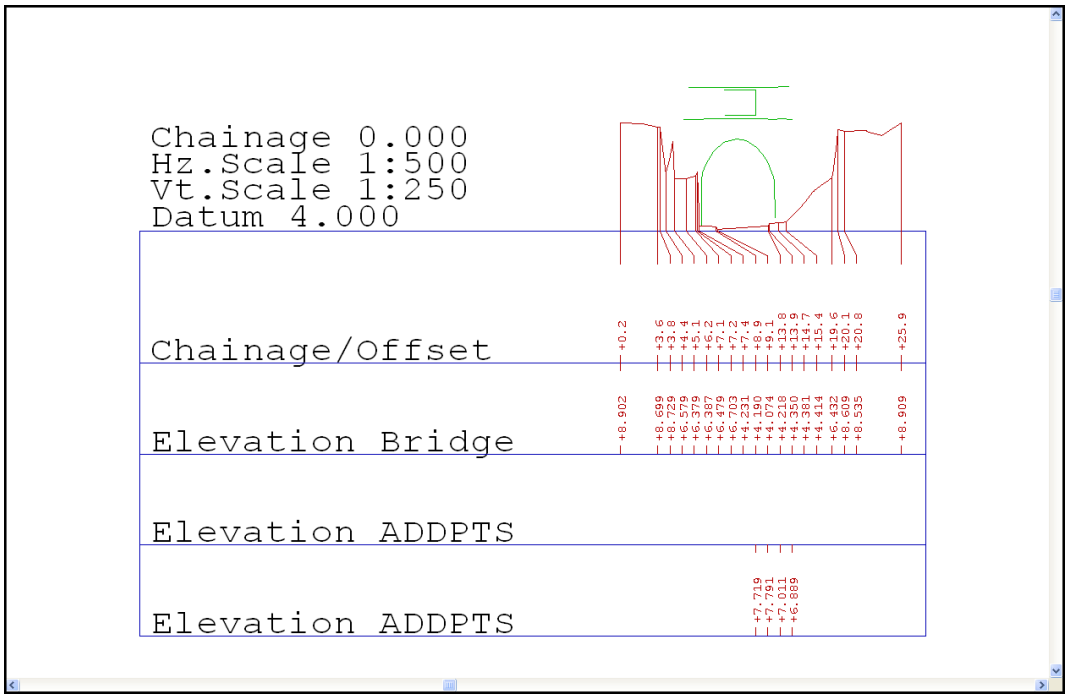
Move cursor over section which you wish to add the detail to (In this case there is only one profile) and a blue box will border the section

Left click to add the detail to this section

Within the 'Add section data' select surface 'ADDPTS', feature 'O' and 'Disable annotation for new strings'



Select 'OK'



Select 'FILE > Save As > Bridge2.Section'

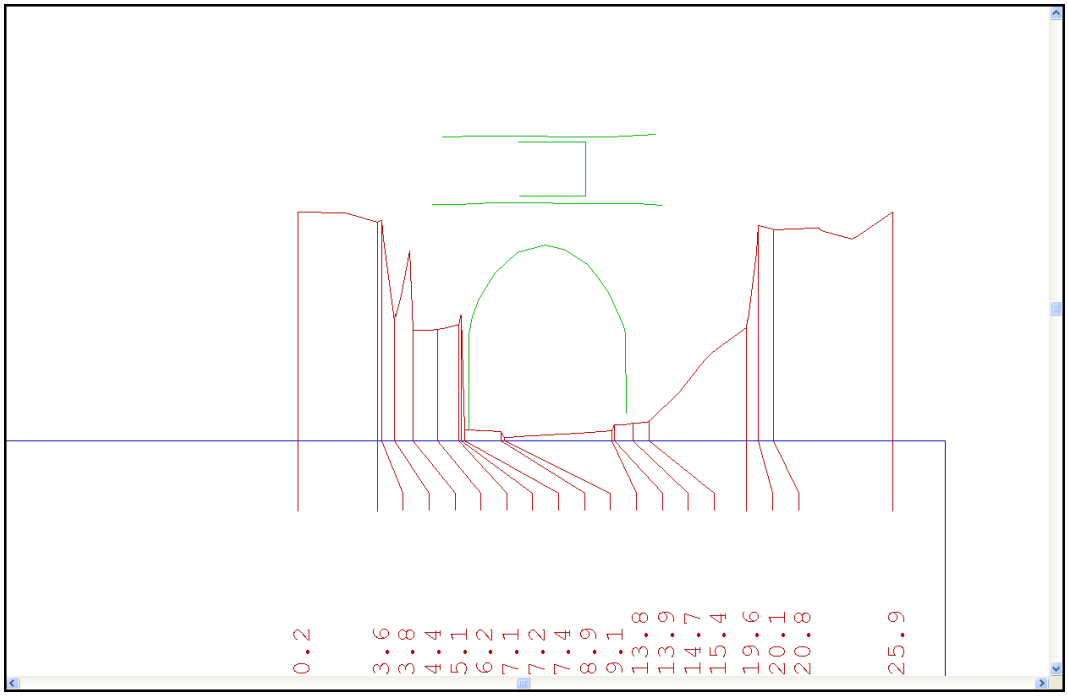
10.4 Delete Points (Section Edit Menu)

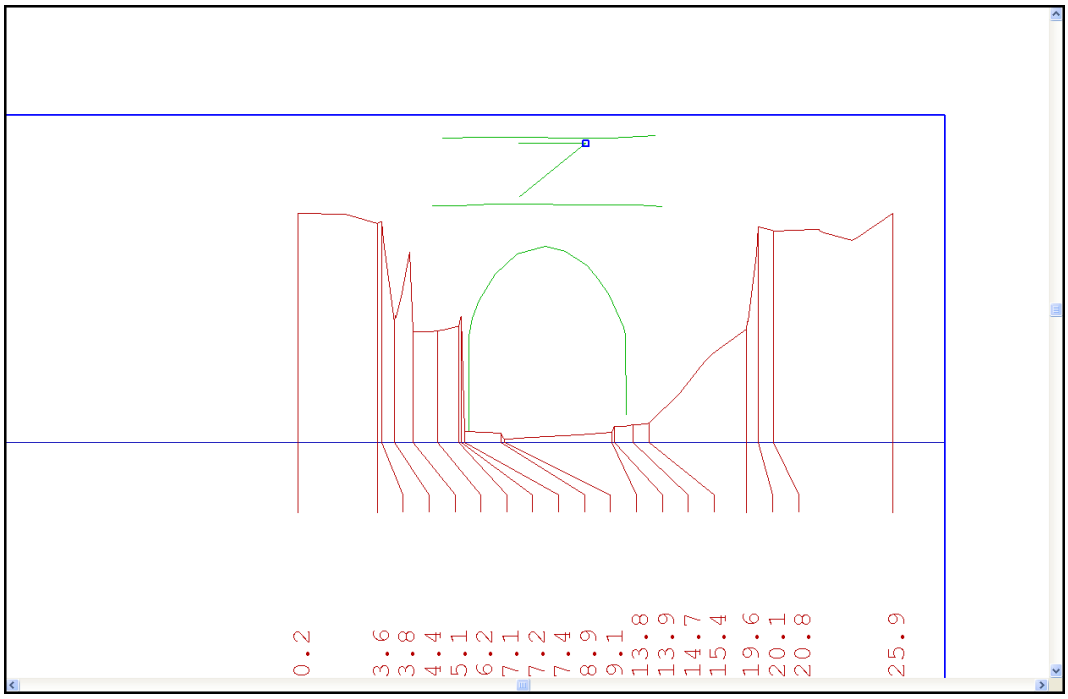
Specific delete options are available within the 'EDIT' menu'.

Delete Points

With 'Bridge2.Section', select 'EDIT > Delete Points > Delete Points'

Left click on points to delete





10.5 Move Points (Section Edit Menu)

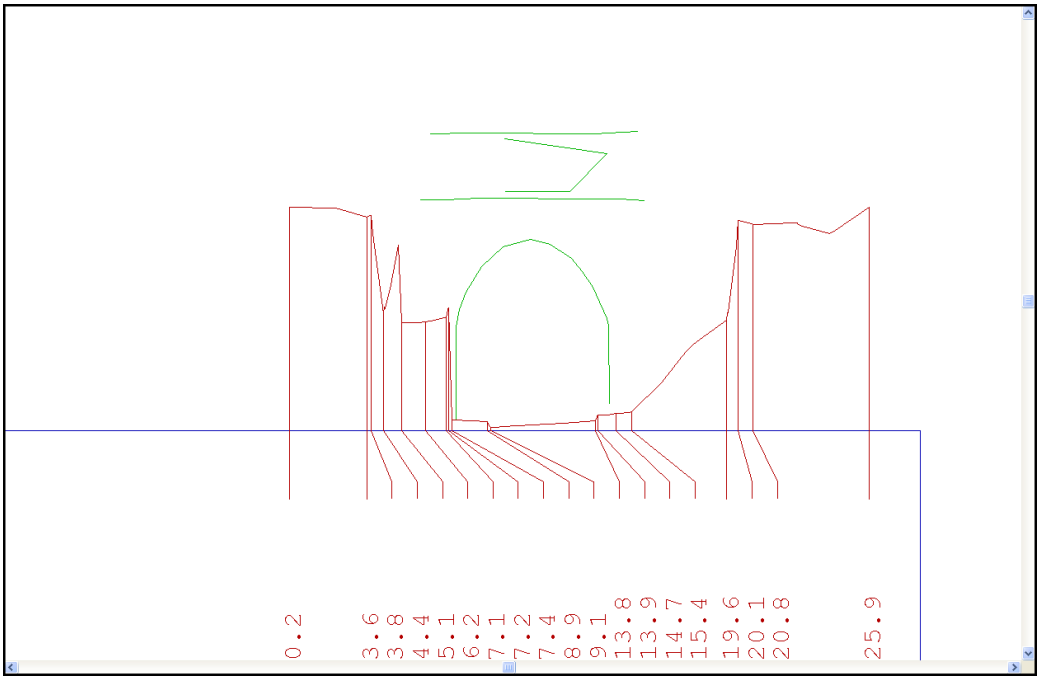
The move function is also available.

Move Points

With 'Bridge2.Section', select 'EDIT > Move Points'

Left click on points and move cursor

Left click mouse to drop/reposition points



10.6 Text (Section Edit Menu)

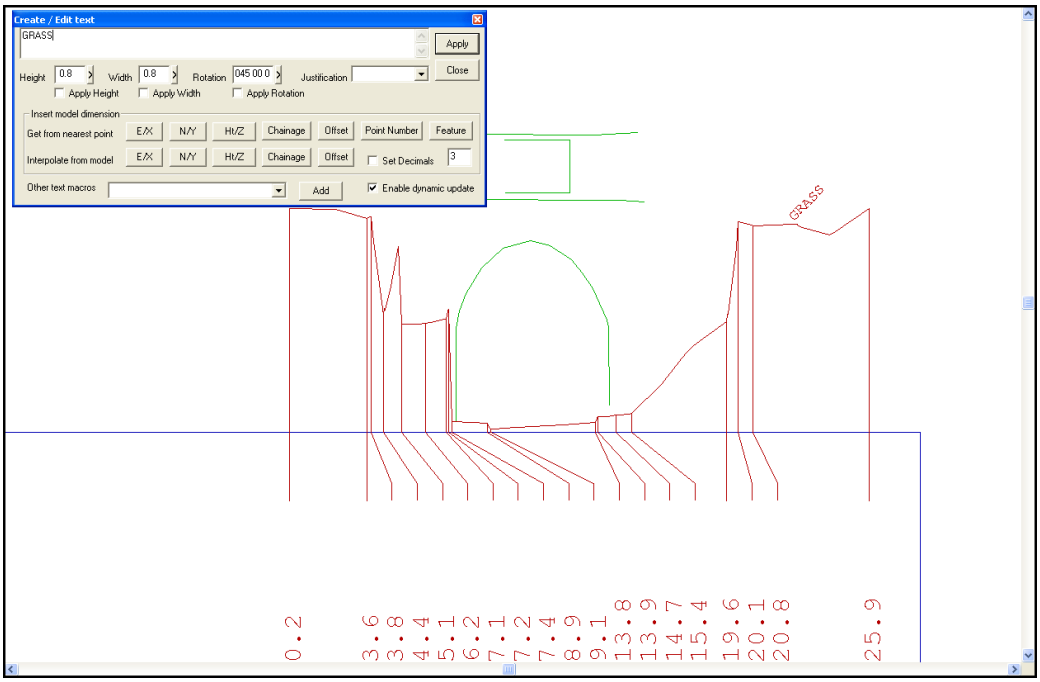
Text options available within a SCC model can also be used with the section file. The example below illustrates the use of the 'Create Text' option

Text

With 'Bridge2.Section', select 'EDIT >Text > Create Text'

Within the Create/Edit Text dialog, enter 'GRASS', set the height and width to 0.8 and Rotation to 45

Move the cursor across model and left click mouse to position text



10.7 Symbol (Section Edit Menu)

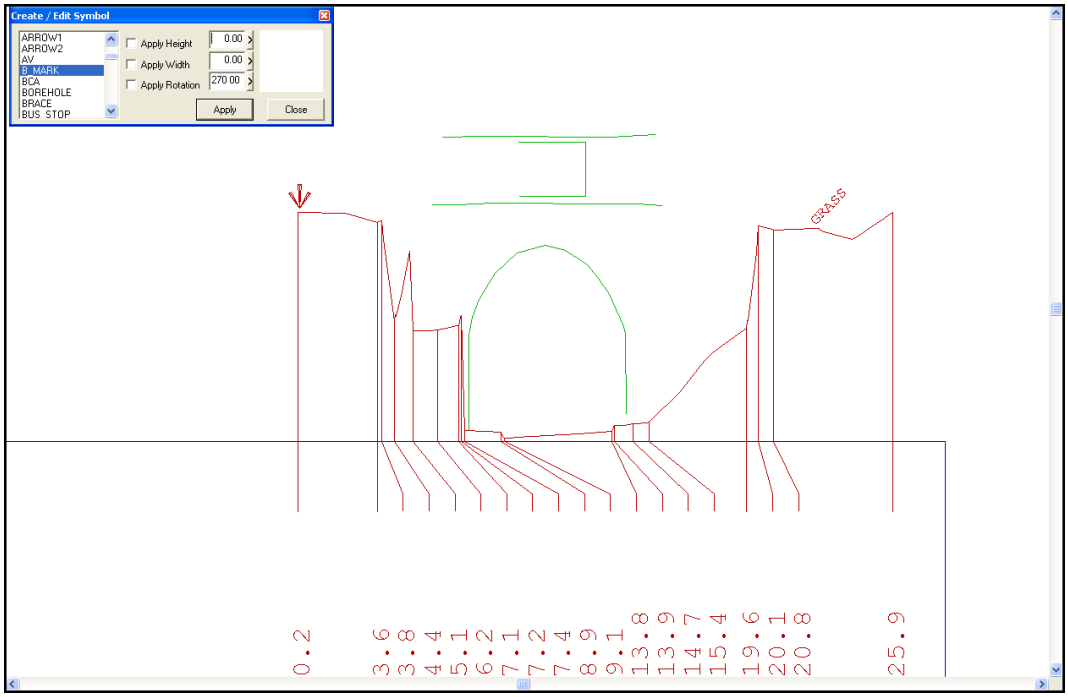
Symbol options available within a SCC model can also be used with the section file. The example below illustrates the insertion of a 'B_MARK' symbol.

Symbol

With 'Bridge2.Section', select 'EDIT >Symbol > Insert Symbol'

Select 'B_MARK' from the symbol list, set height and width to 0.02 and rotation to 270 00 00

Move the cursor across model and left click mouse to position symbol



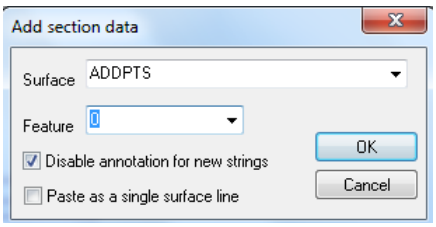
10.8 Hatching Between Strings (Section Edit Menu)

Hatching can be applied between two strings.

Creation of Construction String

Select 'EDIT > Add points'

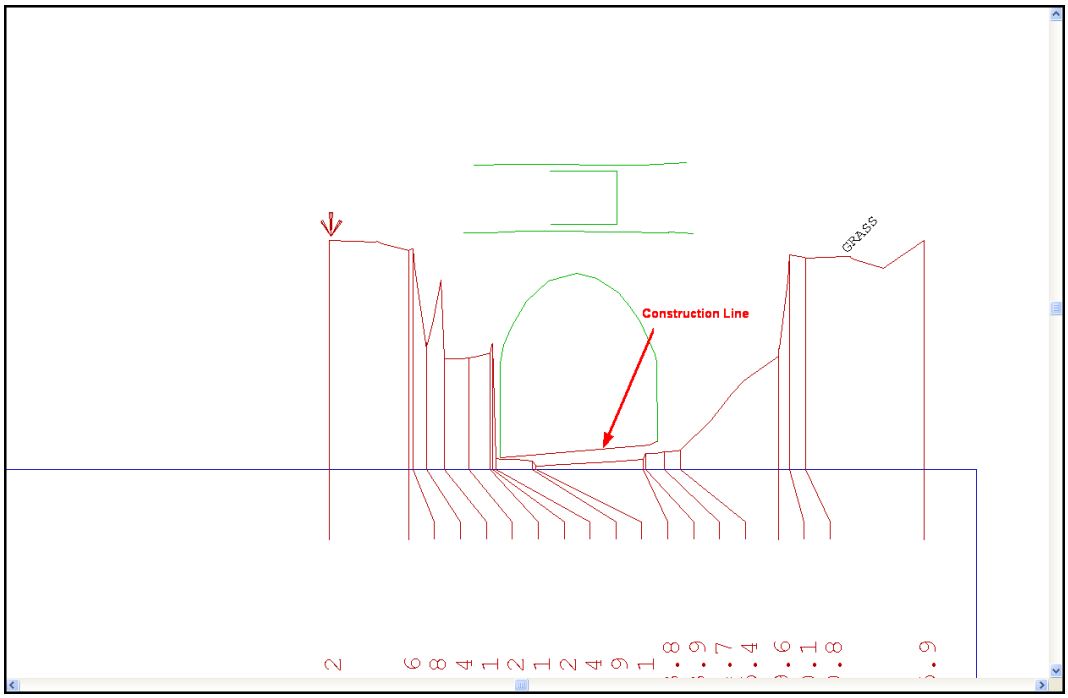
Within the 'Add section data' select surface 'ADDPTS', feature 'O' and 'Disable annotation for new strings'



Select 'OK'

Draw string as illustrated below along the base of bridge

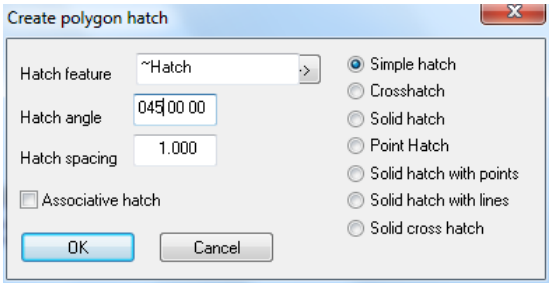
Left click mouse and select 'Update String in Model to complete



Hatching Between Strings

Select 'EDIT > Hatching between strings'

Enter 45 00 00 as the Hatch angle and set 0.2 as the Hatch spacing



Select 'OK'

Move cursor over bridge outline and left click mouse when string is highlighted in blue

Then move cursor over 'construction string' and left click mouse when string is highlighted in blue

Hatching will be applied as shown below between the two selected strings

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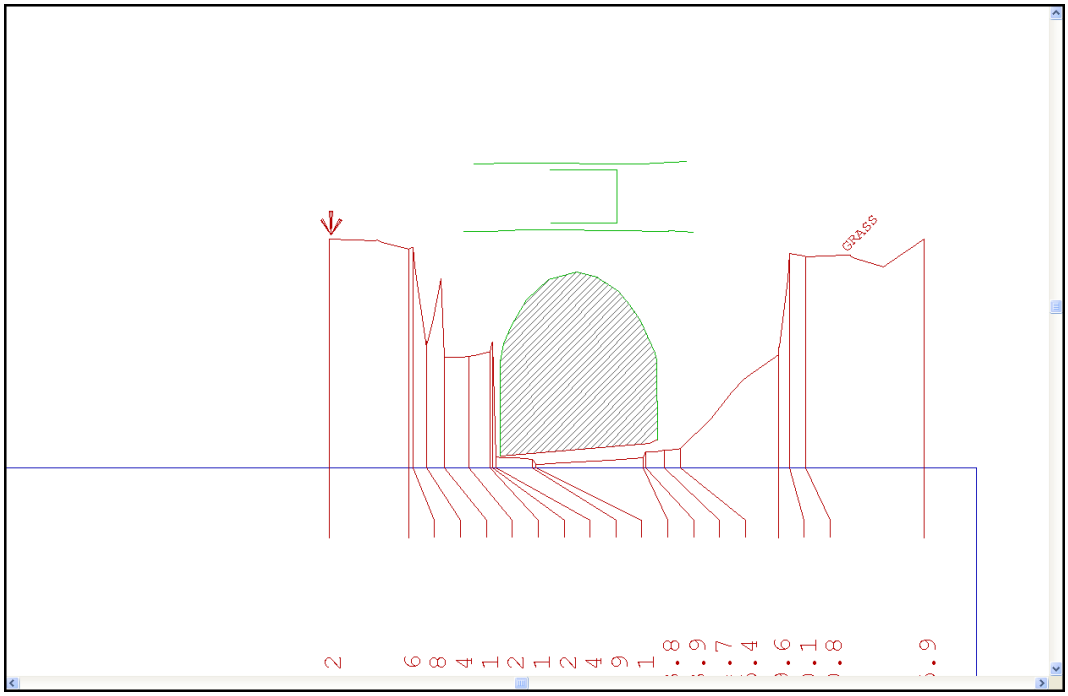
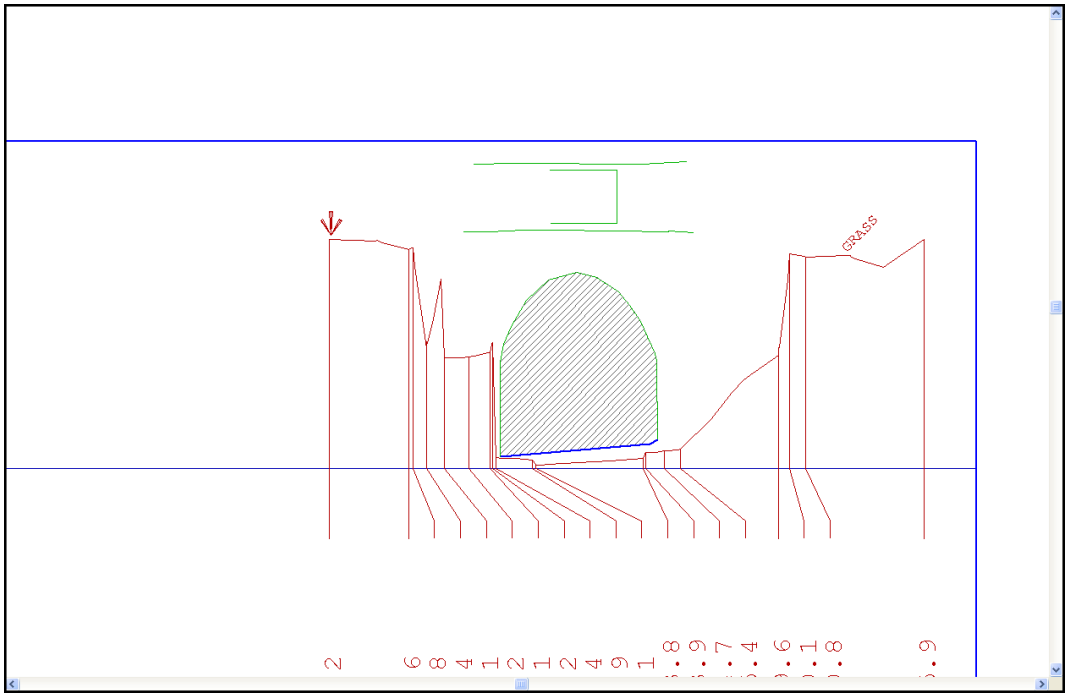


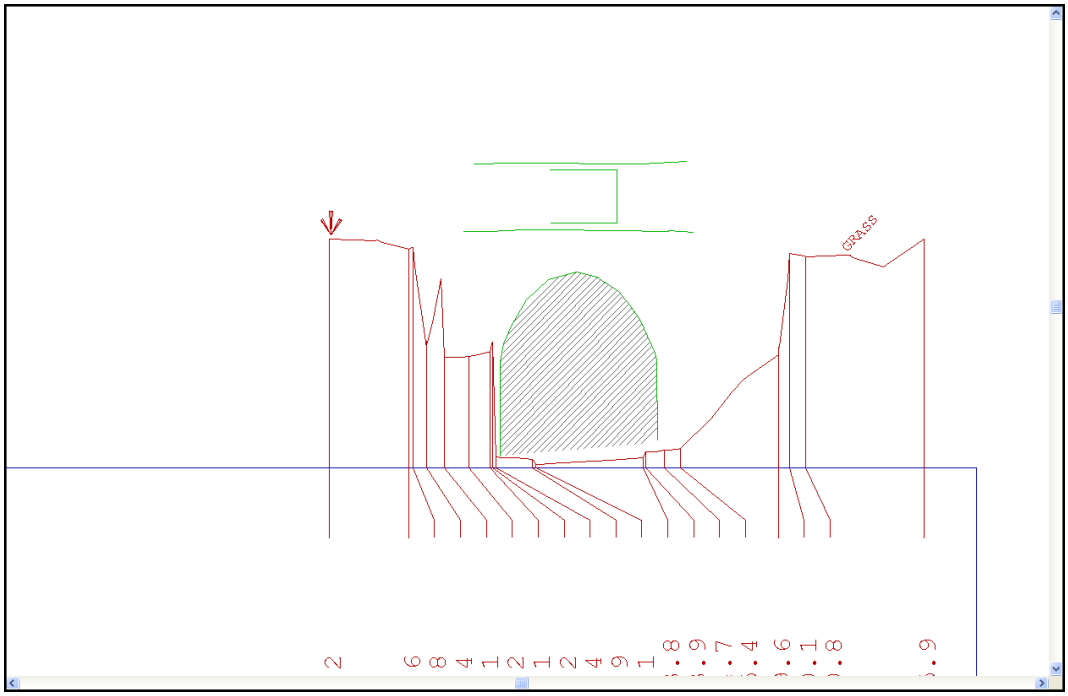
Remove String

Select 'EDIT > Delete points > Delete surface'

Move cursor over 'construction string' and left click mouse when string is highlighted in blue



The string is removed



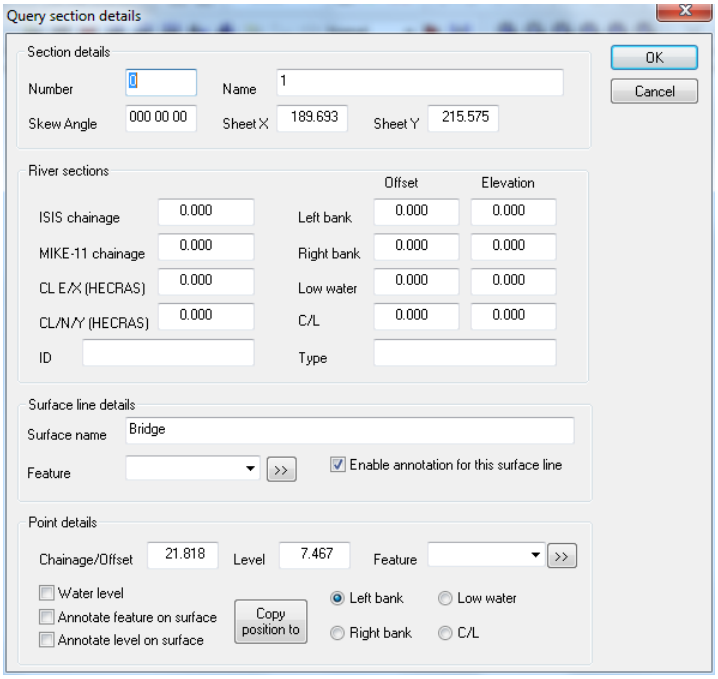
10.9 Query Points (Section Edit Menu)

Additional information can be obtain about a specific point using the Query function within the Edit menu

Query Points

With 'Bridge2.Section', select 'EDIT > Query Point'

Left click on specific point and the 'Query section detail' dialog is presented



10.10 Removal of Specific Points from Section

This tutorial is based on previously created 'FGL.Model' or you may have already created 'FGL long.Section' in which case step 1 'Creating A profile' can be skipped

Creating A Profile

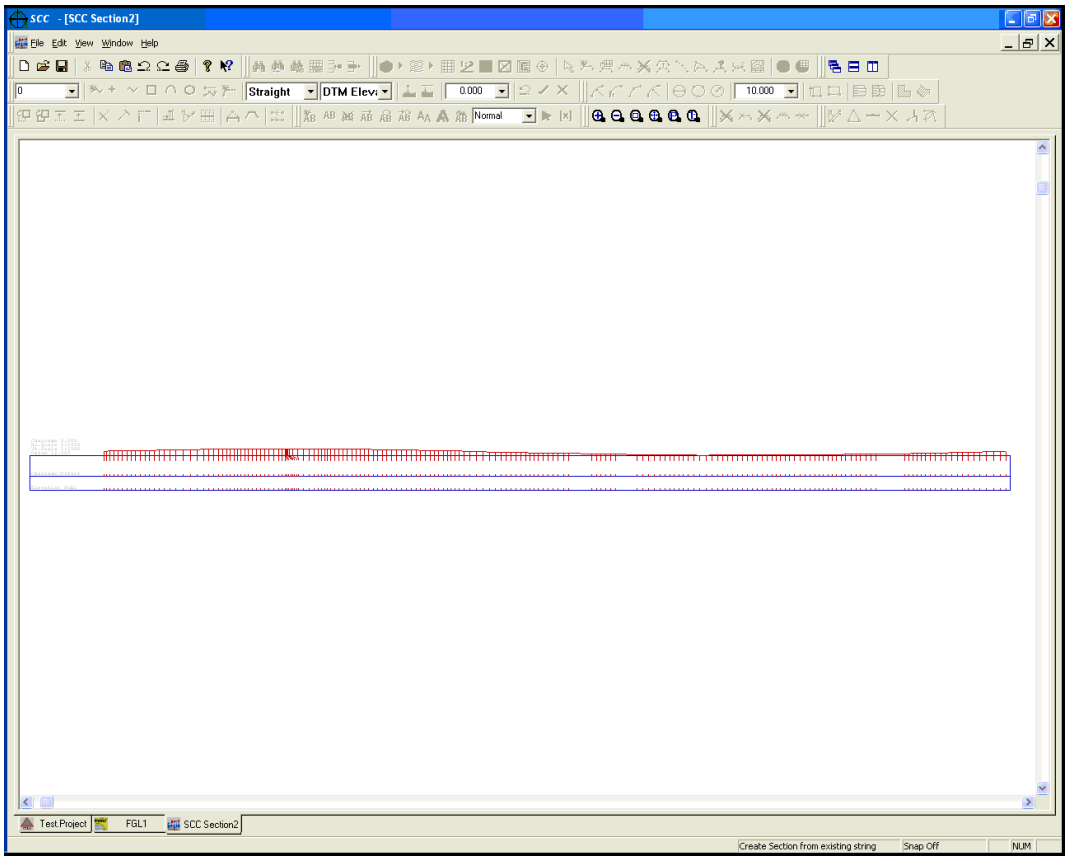
Within FGL.Model, select ‘SECTIONS > Long sections with cursor’

Select three or four points with the left mouse button following the centre of the FGL model

When finished, click the right mouse button

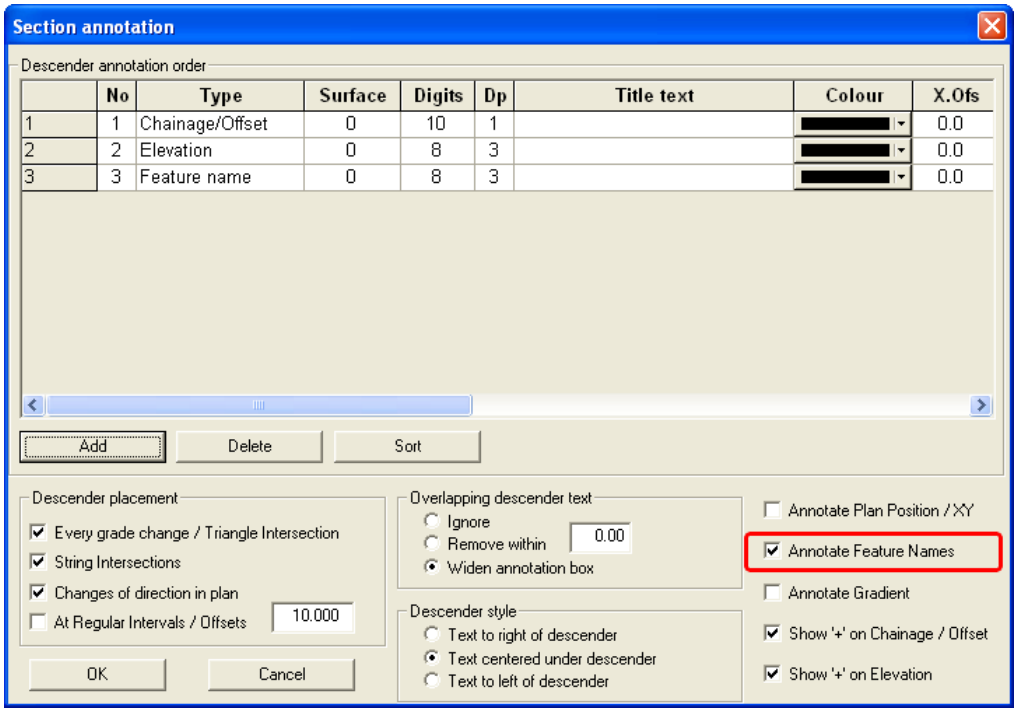
View the profile

Select ‘FILE > Save As’ and call the file' FGL long.Section'



Annotation of Section to Isolate Points belonging to 'TB' feature

Within Section File, select 'VIEW > Annotation Settings'

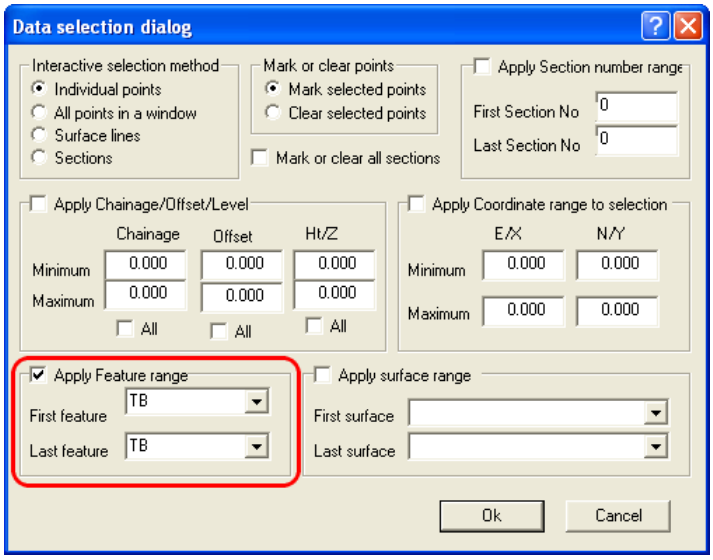


Select 'Annotate Feature Names' and press 'OK'

Deletion of 'TB' points from Section

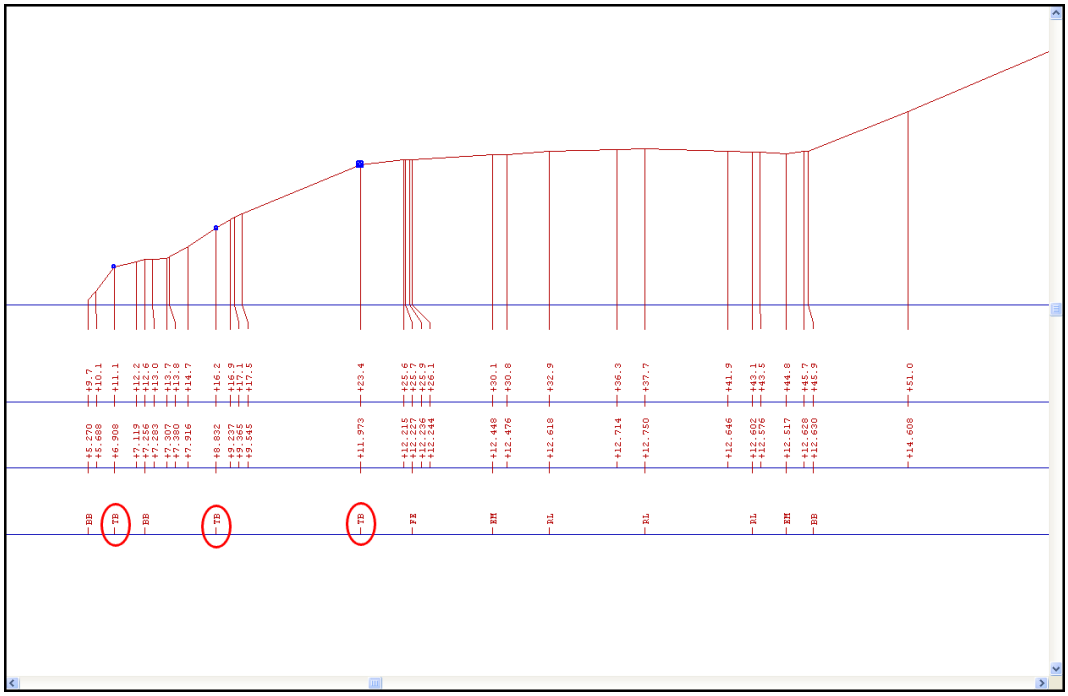
Within section, right click mouse to bring up 'Data Selection Dialog'

Enter 'TB' as the First and Last feature range



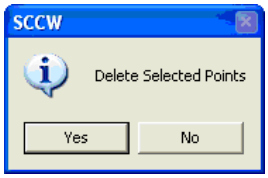
Select 'OK'

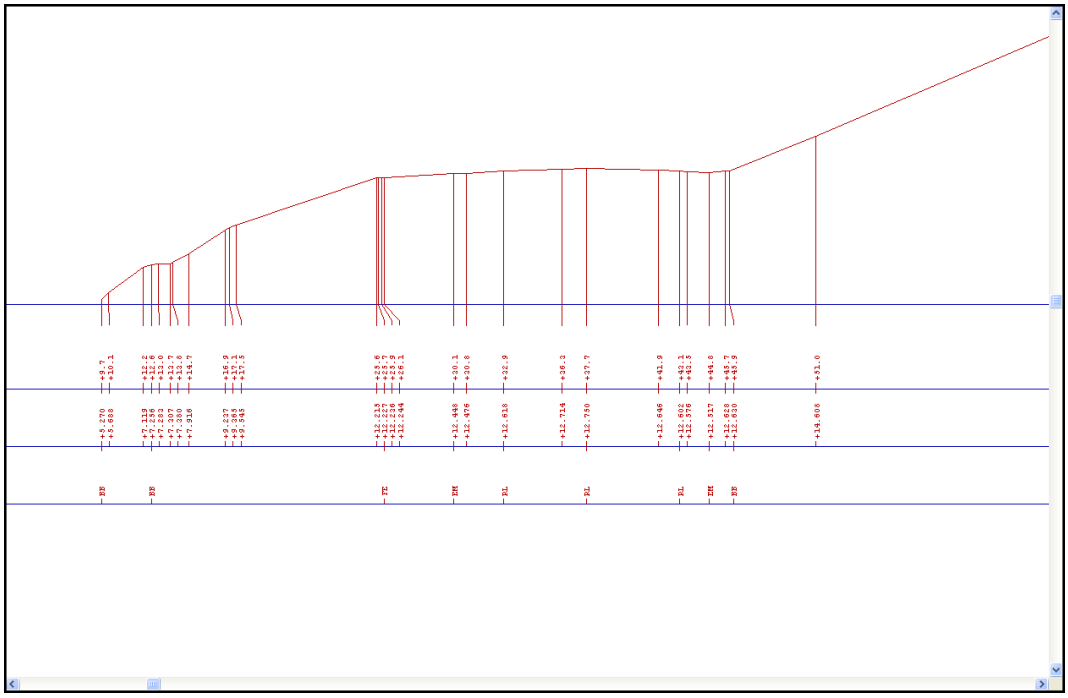
All 'TB' point on the section are highlighted as shown below:



Select 'EDIT > Delete > Delete Points'

Select 'Yes' to 'Delete selected points'



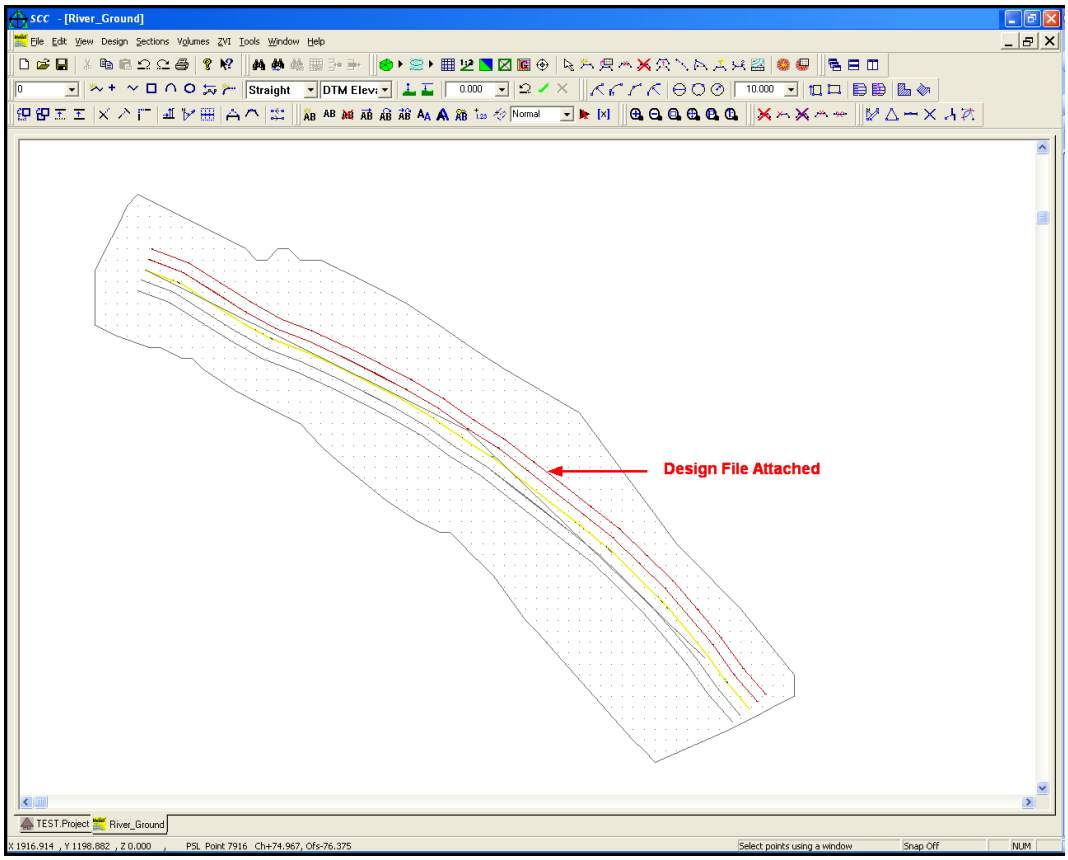


10.11 Optimised Volumes

Consider that a river trench design has been completed 'River_Trench_3.Alignment' using the existing ground model 'River_Ground.Model and required design parameter. The following tutorial outlines the generation of Cross sections from the Alignment to allow optimised volumes to be carried out. Particular attention is drawn to the optimised volumes steps.

Generation of Sections from Alignment

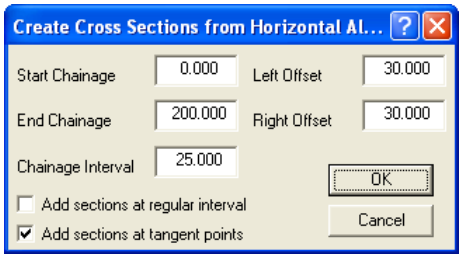
The optimisation function is base on sections generated from the alignment



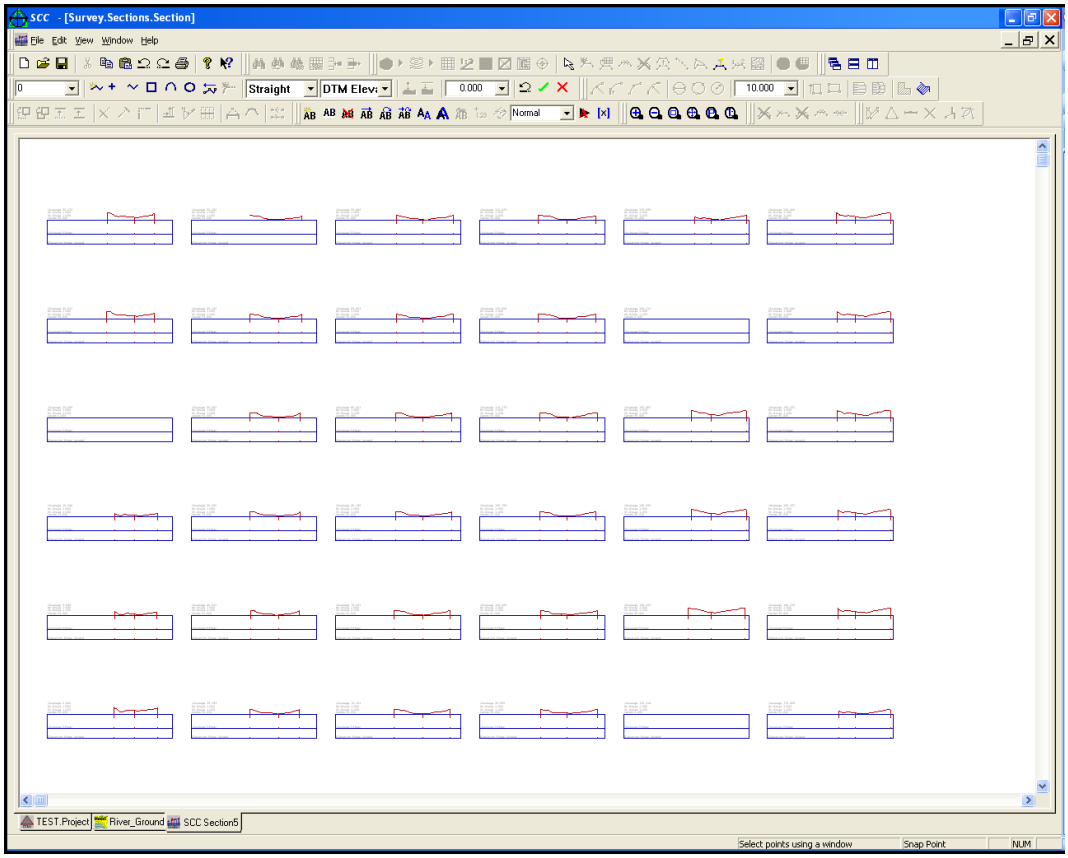
Cross Section From an Alignment

Within 'River_Ground.Model' which has the Alignment 'River_Trench_3.Alignment' attached, select 'Sections > Cross Section From an Alignment

Enter required Parameter for example below:



Select 'OK'



Select 'FILE >Save As > Survey.Sections'

Optimised Volumes:

The optimised surface calculations are carried out as follows:

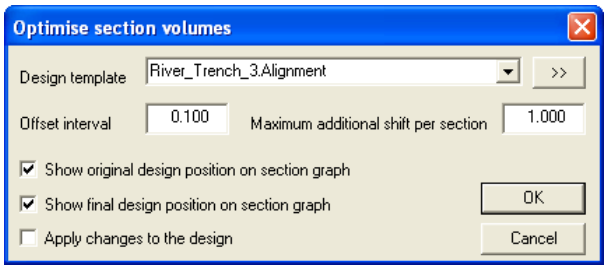
Optimised Volumes

Within the Section file, select 'EDIT > Optimise Volumes'

Using arrow button select Design Template 'River_Trench_3.Alignment' (currently attached to model)

Set the Offset Internal and Maximum additional shift per section

Select the following options also



Select 'OK'

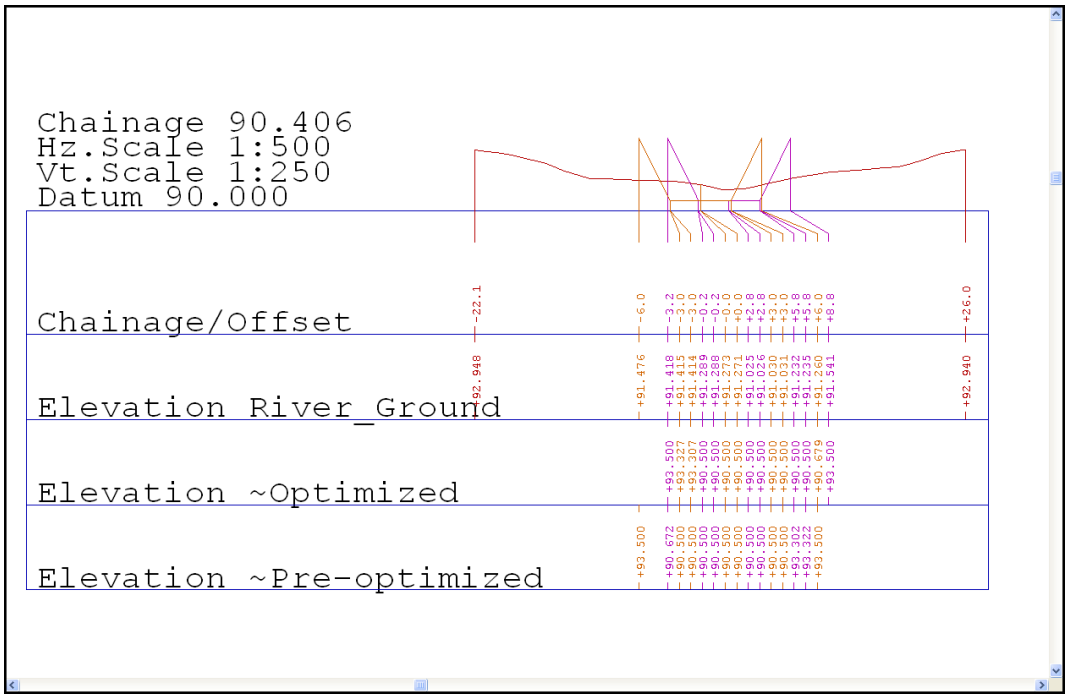
Offset Interval

Offset Interval is the value, which the design section is iteratively shifted with respect to the survey river section. The larger the offset interval value the quicker the optimisation

processes. The smaller offset interval value the slower but more accurate the optimisation process. For example, the default value is 0.1 means that the design section will be placed within 0.1m of the optimum position

Maximum Additional Shift per Section

This parameter controls the amount the design section may be shifted in position relative to the position of the previous design section. The value controls the maximum deviation of the optimised centre line from the original centre line. For example, a value of 2m would mean that the centreline position of the current design section could only deviate a maximum of 2 m from the design centreline. A large value can potential allow the optimum design centreline to zig zag across the river in order to optimise or to minimized the dredged volume. A smaller value prevents the optimum centreline from deviating sharply away from the design centreline.



Volumes Calculation & Report

The volumes are calculated as follows:

Volumes

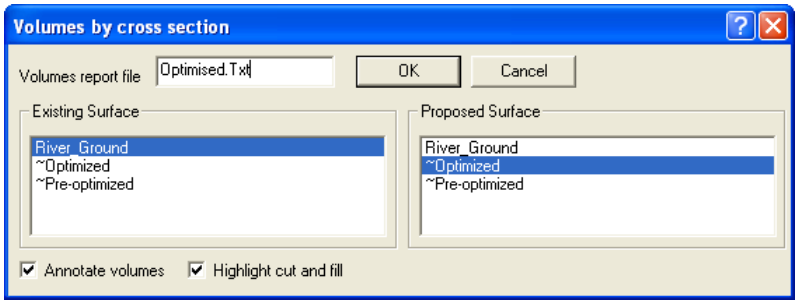
Select 'EDIT > Volumes'

Select Existing Surface 'River_Ground.Model' and Proposed Surface '~Optimized'

Select 'Annotate volumes and 'Highlight cut and fill' options

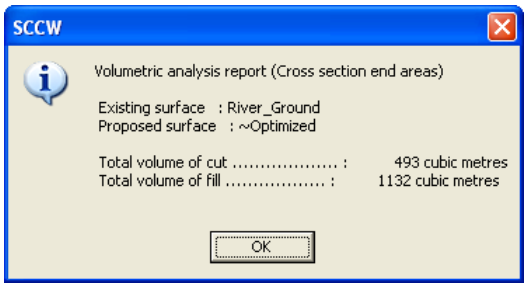
Enter relevant Volumes report file name

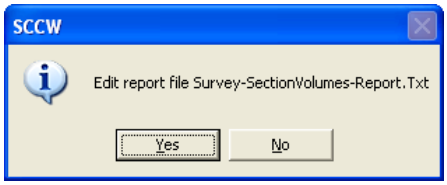
Select 'OK'



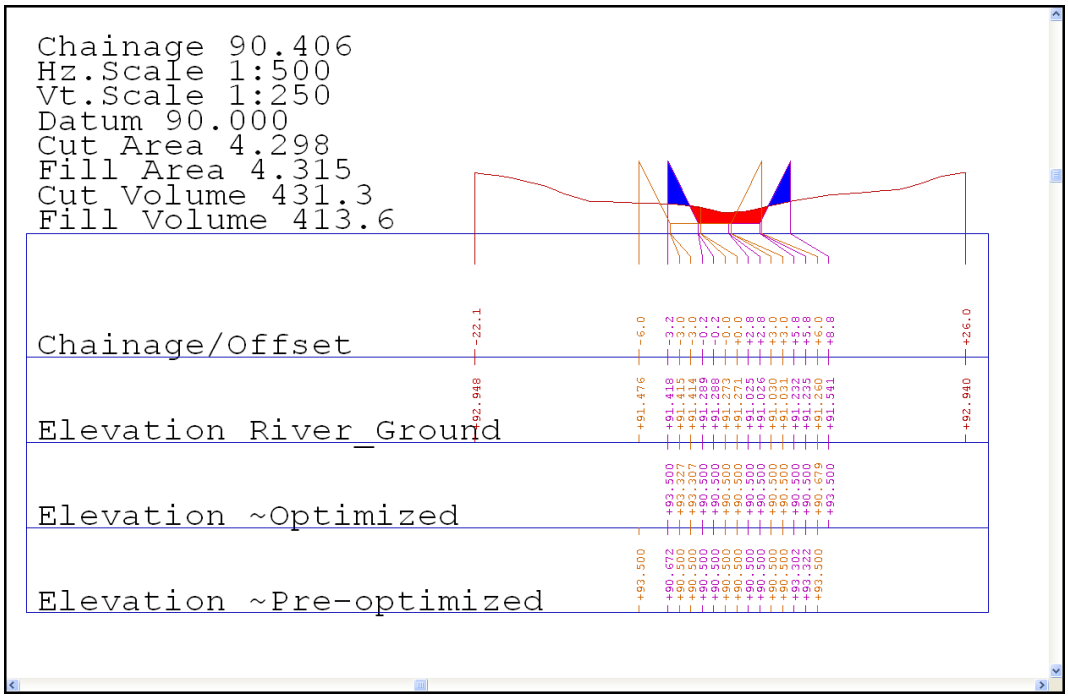
Cut and Fill Volumes are report firstly in a dialog box

The user can also view report in a text editor





The sections now show the original model surface, original design and the optimised design. Cut and Fill are highlighted as shown below:



11 Interface Design Using The Alignment Module

SCC's Alignment module allows simple and straightforward interface design.

Create a model from a MX GENIO file. Design a simple building interface which can then be moved about the model until the amount of cut and fill indicated is roughly equaled.

Creating A Model From A GENIO file

Close all open windows except the Project Window

Go to 'FILE > Model > MX GENIO file'

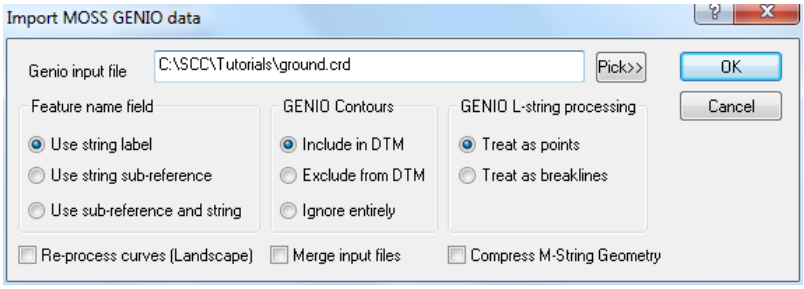
Select Pick

Go to the directory \SCC\Tutorials

Select the file 'GROUND.CRD'

Select Open

Set the GENIO L-string processing to Treat as points



Save the model as GROUND.model

Designing A Building Interface

Fill in the list boxes as required.

Enter 50.0 into the Level Control box

Go to 'EDIT > Add Strings with cursor'

Click on the right mouse button

Select 'New > Polygon'

Draw a simple building

When you are finished, click the right mouse button

Select 'Save string as interface'

Set the Fillet Radius to 0.15

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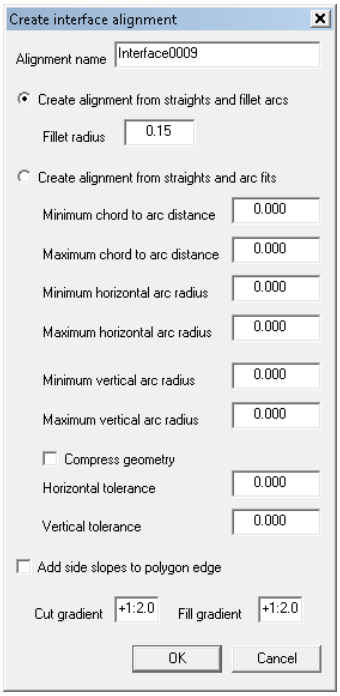
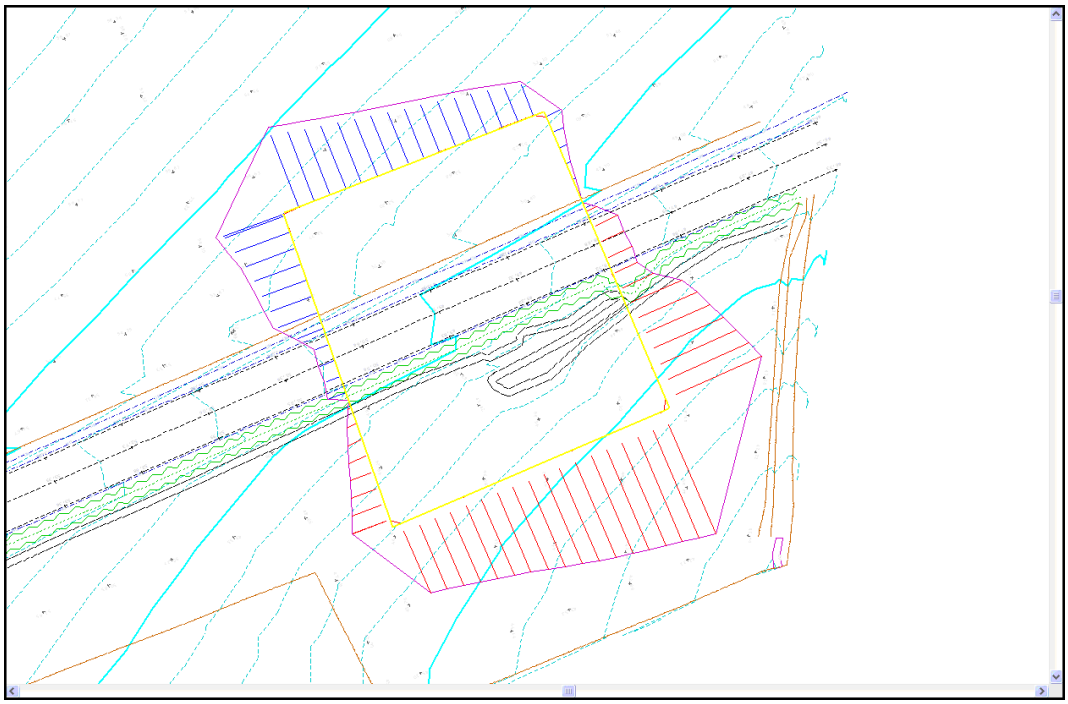


Select OK

The option Move/Edit Alignment is automatically activated and the design can be moved about the model until the correct amounts of cut and fill are indicated.

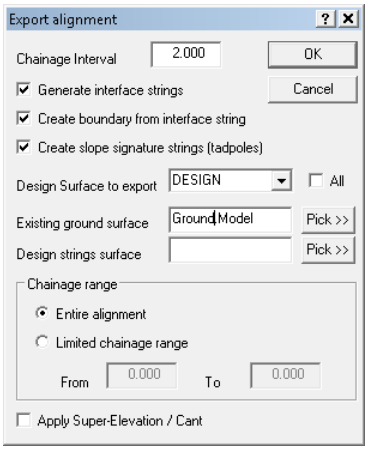


The design can then be exported to a model and used for calculating volumes as before.

Export Design To A Model

Go to the 'DESIGN > Export Design as a Model'

The dialog below will be displayed



Enter the relevant details

Select Ok to create the model

The model can be saved and volumes calculated between the design and the survey.

11.1 Simple Football Pitch Design

The following outlines designs steps with SCC to design a football football pitch (130m * 80m) with 1:2 side slopes and in turn to balance cut and fill. Specific parameters may be changes where appropriate to achieve the desired design

Open Existing Data

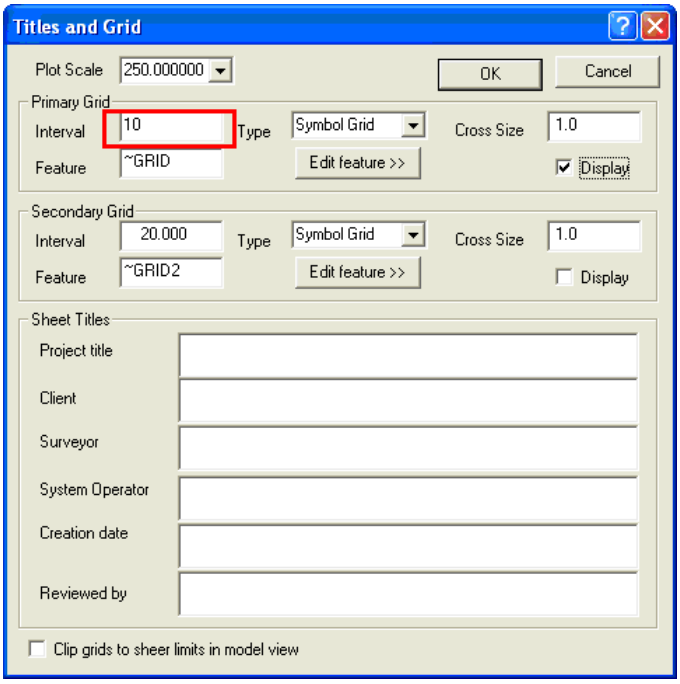
Select 'FILE > Open'

Open Project and Model

Construct Pitch

Turn On Grid as show below so that we can snap to grid points when drawing in pitch

Select 'VIEW > Titles & Grids'



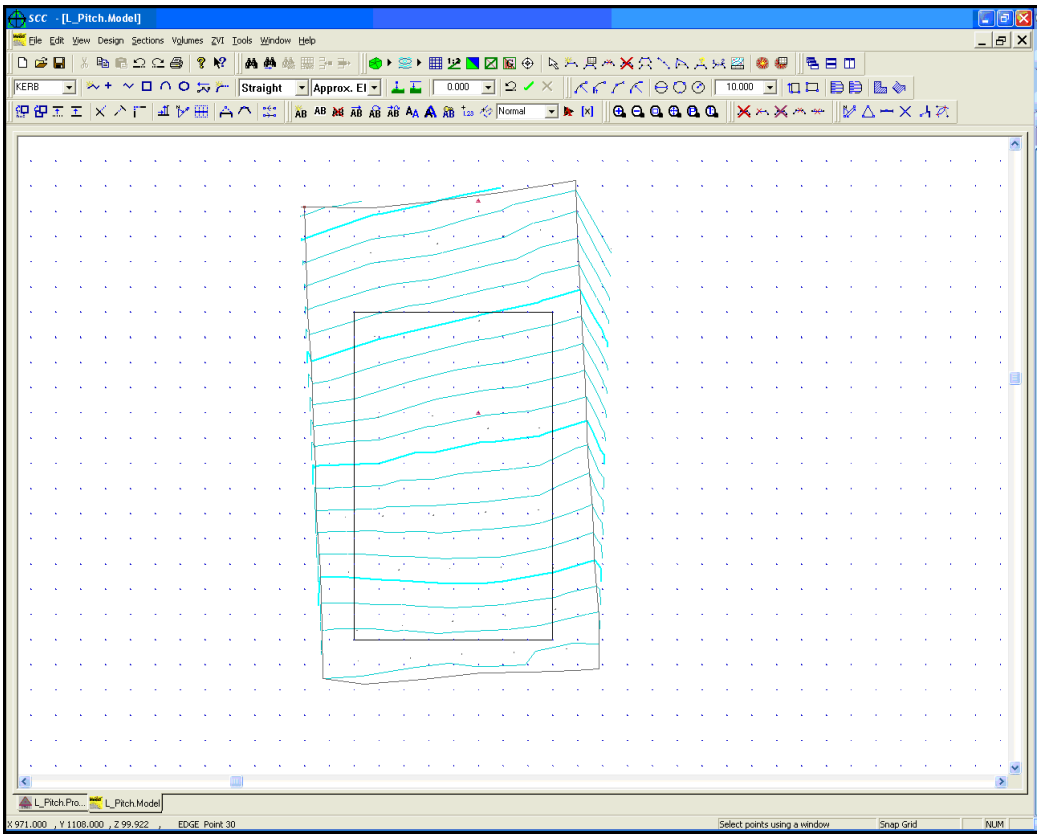
Pick feature from the drop down menu ‘KERB’ or ‘PITCH’ for example

Set the DTM status as ‘Approx Elevation’

Turn snap grid on and Left click mouse at corner points of pitch

Right Click mouse, select 'Update string in model' to end string

With the grid points turned on the user can easily set out 130m*80m



Create Alignment String

We can use the alignment module to apply side slope to the pitch boundary string

Pick feature from the drop down menu ‘KERB’ or ‘PITCH’ for example

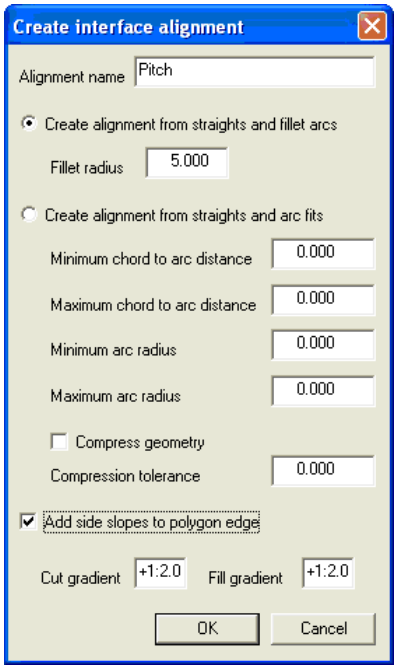
Set the DTM status as ‘DTM’

Set the elevation to 90 (In this instance, 90 is the average height)

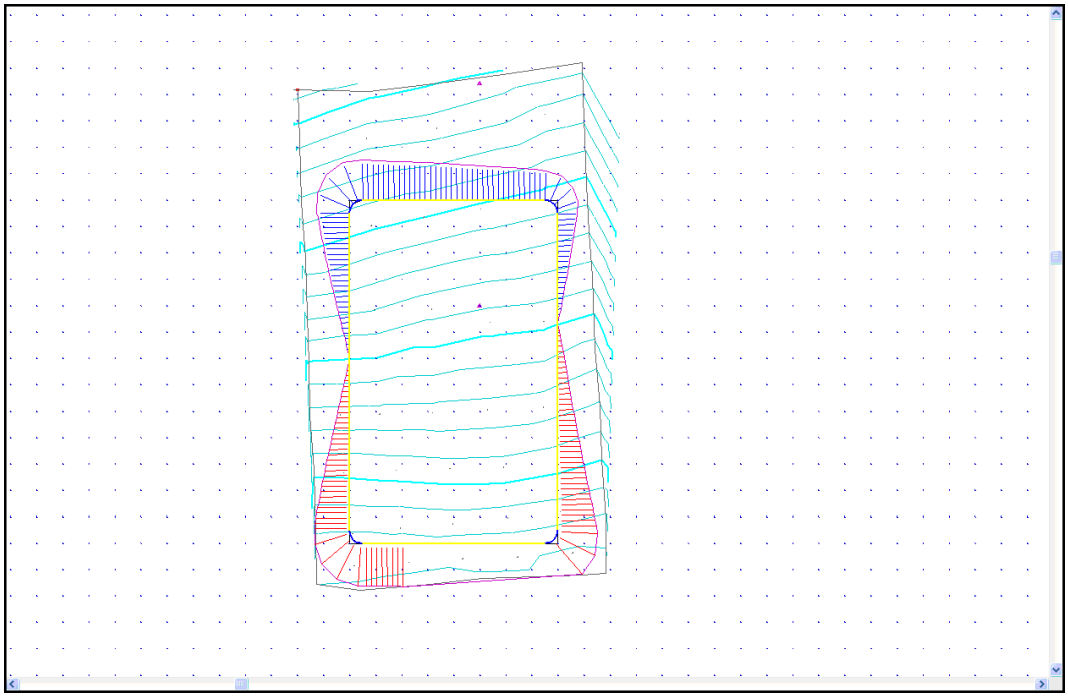
Turn snap grid on and Left click mouse at corner points of pitch

Right Click mouse, select 'Save As Interface String'

Set up the following:

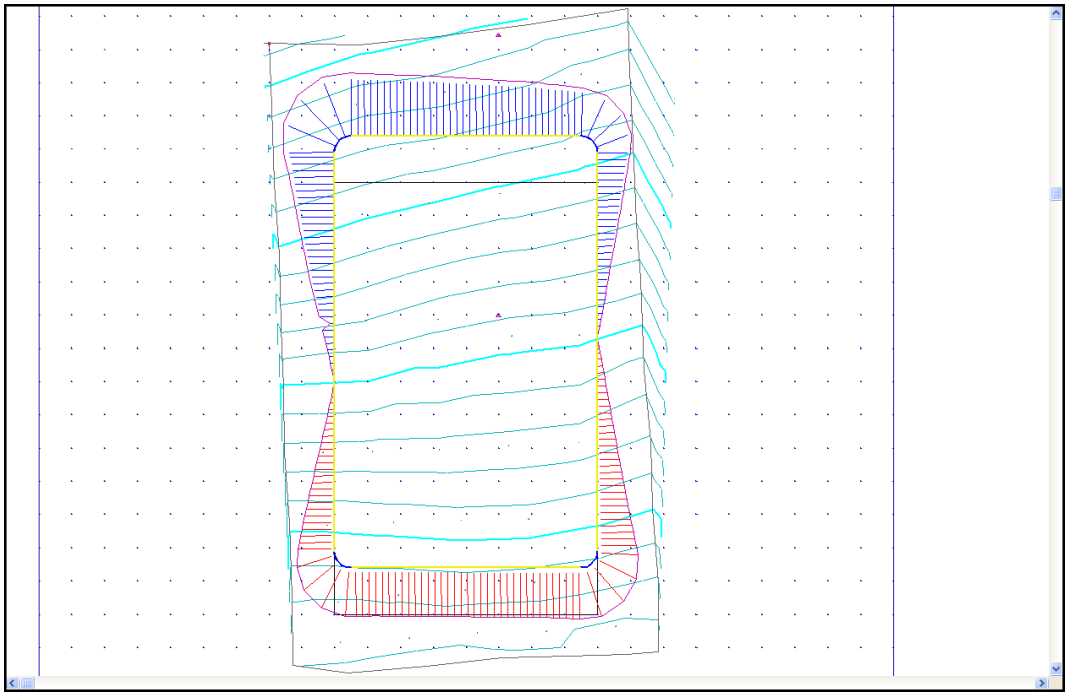


Revert to model



As can be seen in the model above, the pitch with 1:2 side slope does not currently fit (bottom side slopes not shown). We can manually move the alignment as follows:

Left click mouse on model, move cursor and a blue line will appear which will allow you to move the alignment in the line direction.



To check design parameters, select 'DESIGN > Section Template'

Turn on side slope of 1:2 for left side (String was drawn in a clockwise direction so we want the slope outside so therefore left must be selected)

Balance Cut & Fill

In order to allow the optimise cut and fill function to work the surface/model needs to be larger.

Draw in an arbitrary string around the field boundary at height of 90 for instance.

Pick feature from the drop down menu '0' for example

Set the DTM status as 'DTM' and height of '90' in the elevation box (circled in image below)

Left click mouse to place point

Right click mouse to select 'Update String in model'

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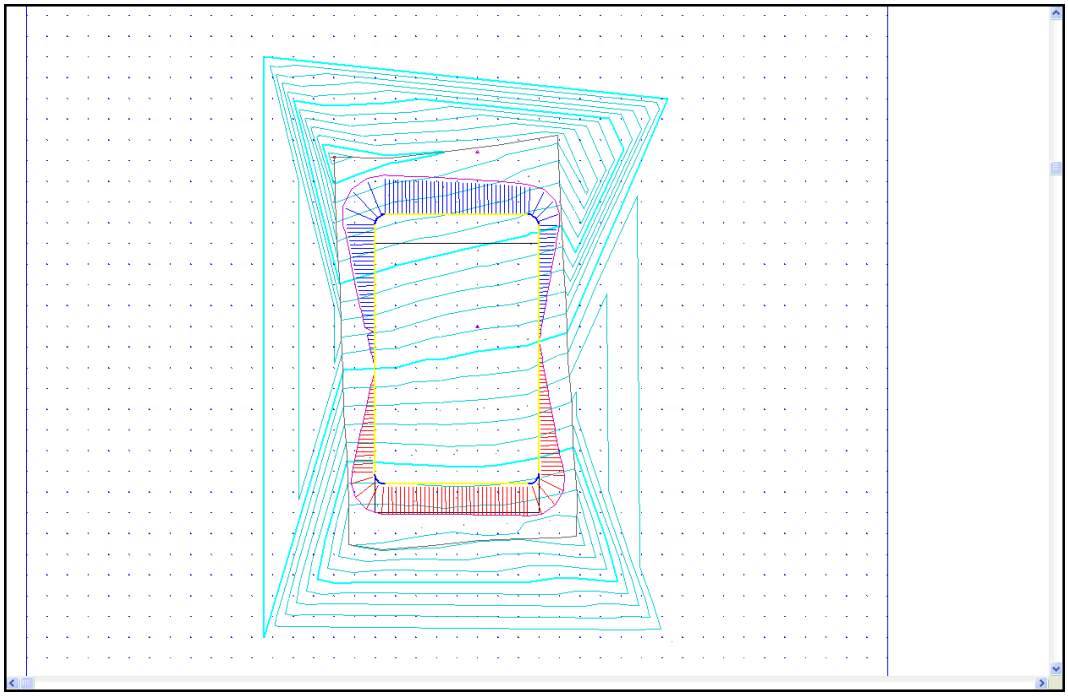
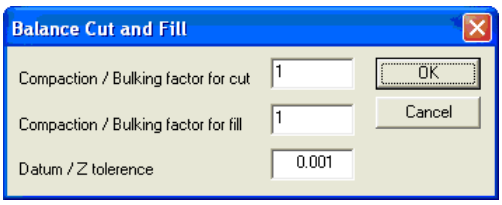


Select 'DESIGN > Balance Cut and Fill'



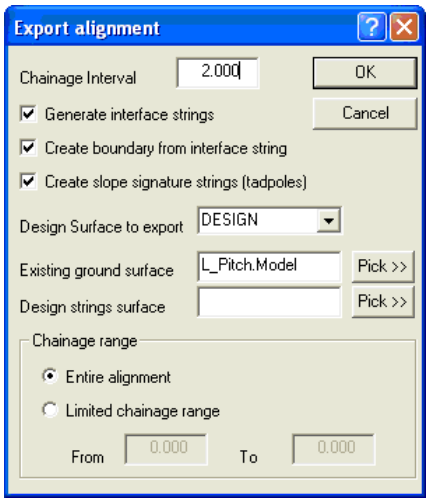
Select 'Ok' to except default 'Balance Cut and Fill' settings

Remove arbitrary string (delete points command)

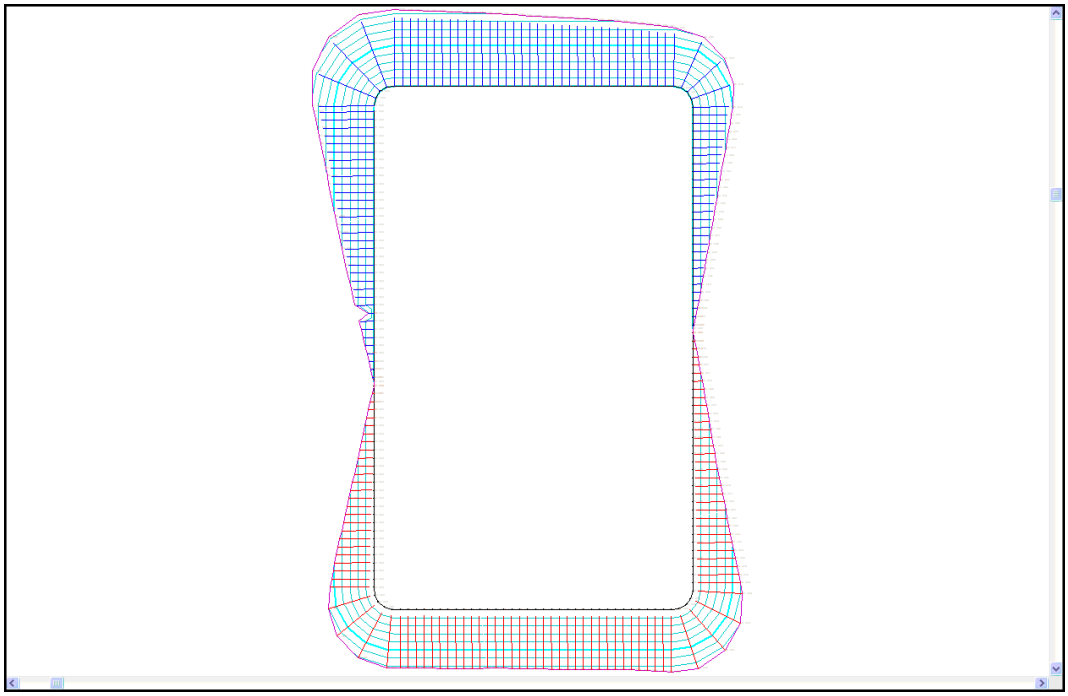
Export Design

Select 'DESIGN > Interface & Export parameters

Set up the following and ensure that original model is set as the ground surface



Select 'OK'



Sections

To verify a design generate cross sections:

Within Design Model, select 'SECTIONS > Long Section with Cursor'

Left click on first point of section and left click on last point

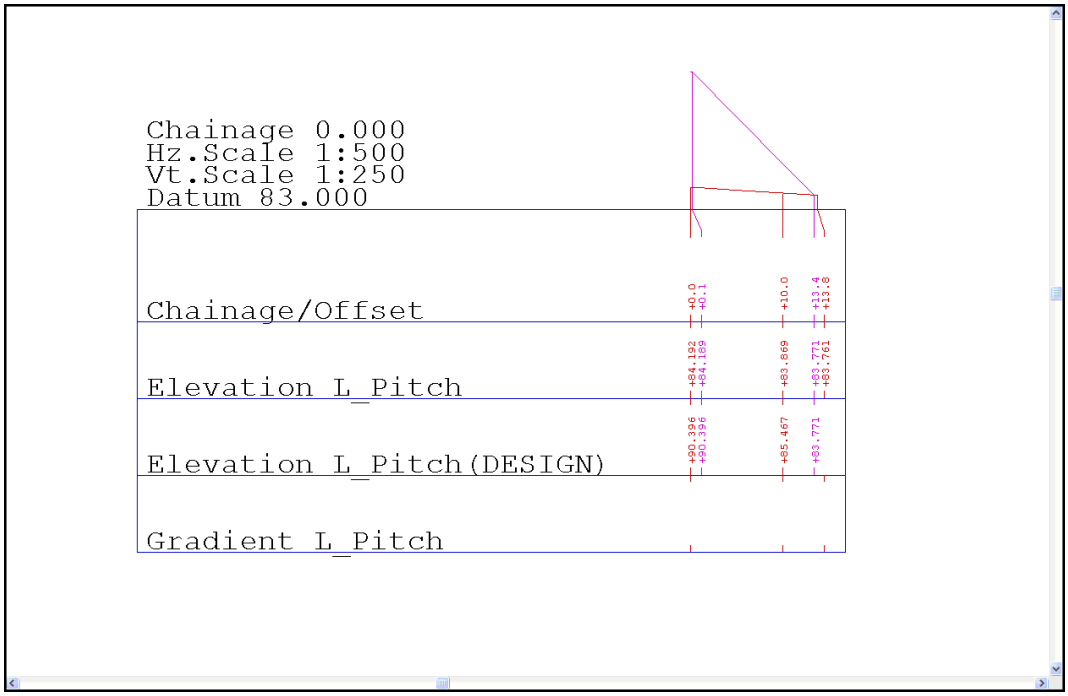
Right click to finish section

A good check is to also append the original surface:

Within the section, select 'VOLUMES > Append Surface'

Pick original surface

See sample section below:



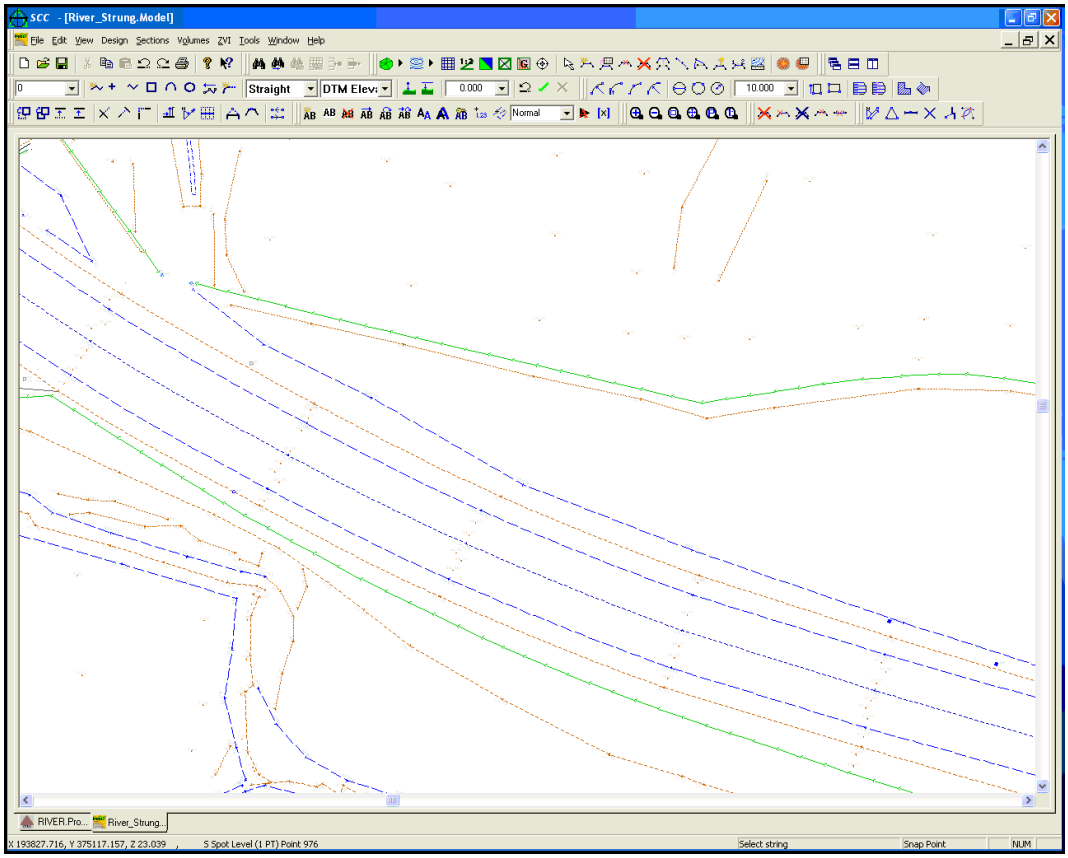
11.2 River Section: Sections From A Bandwidth

The following tutorial outlines the steps to generate River Sections from a centreline using a bandwidth.

‘Section From A Bandwidth’ method is typically used when creating river sections, where the surveyed section line is greater than the actual river width. The section is created using the surveyed elevations snapped, at right angles, onto the user-defined centreline.

Open Existing Data

Open ‘RIVER.Project’ and ‘RIVER_Strung.Model’ from '\SCC\Tutorials'

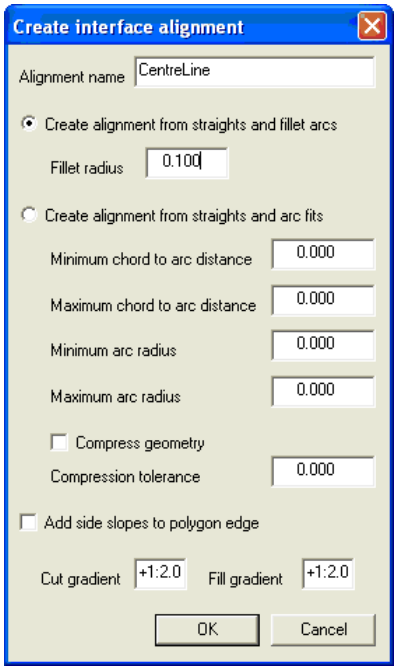


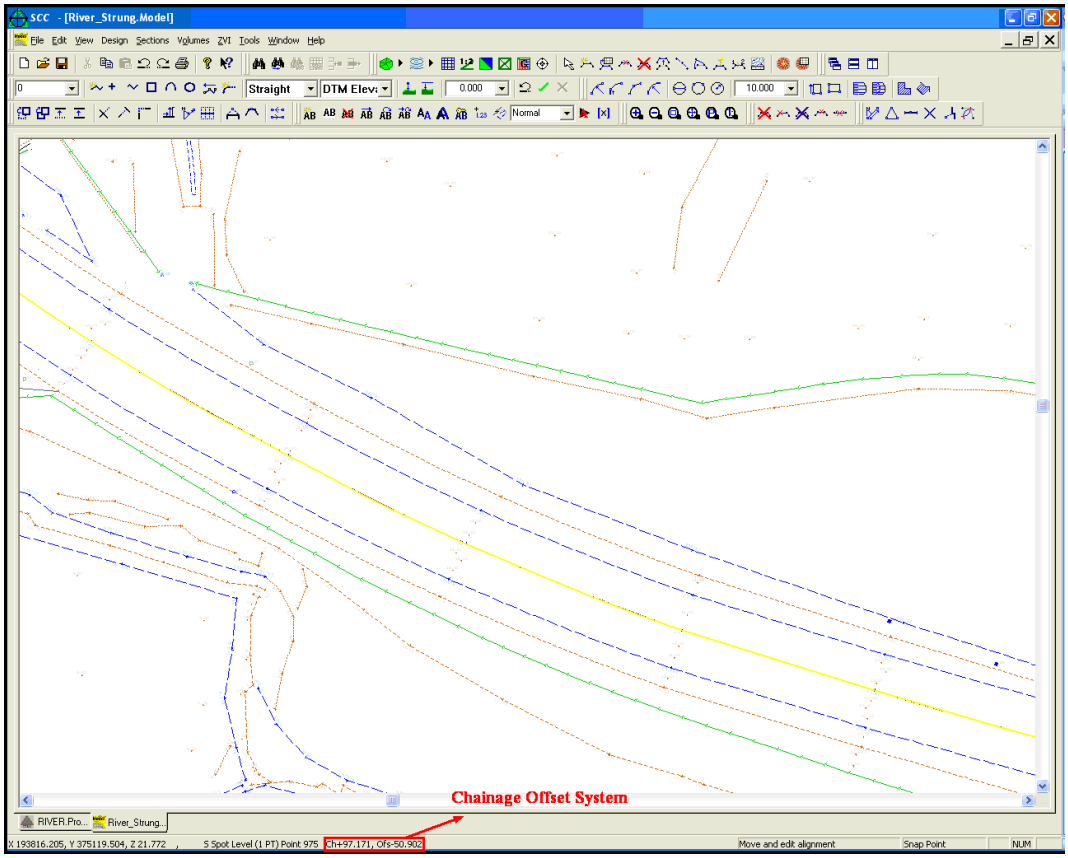
Creating Centreline Alignment

Select 'DESIGN > Create Alignment from String'

Left click on centreline of river

Enter Alignment Name



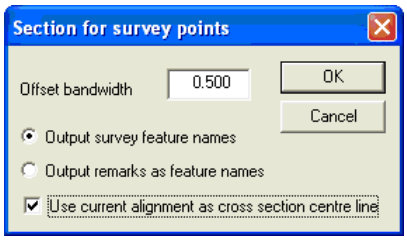


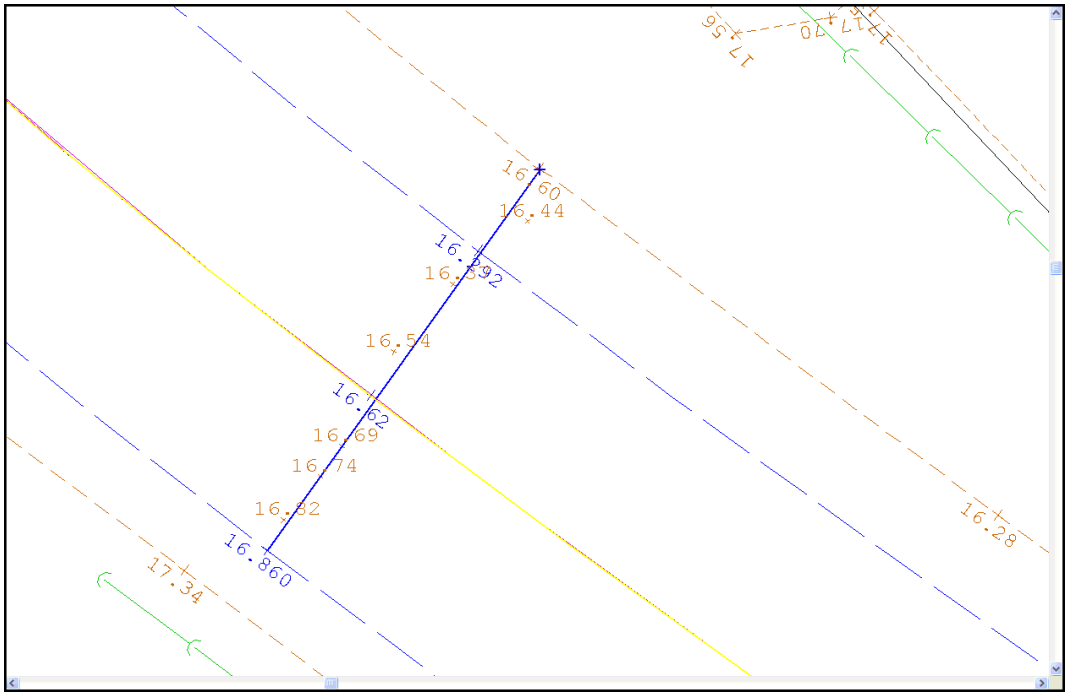
Generation of Sections

Select 'SECTIONS > Sections from a Bandwidth'

Set the desired bandwidth '0.500' for example

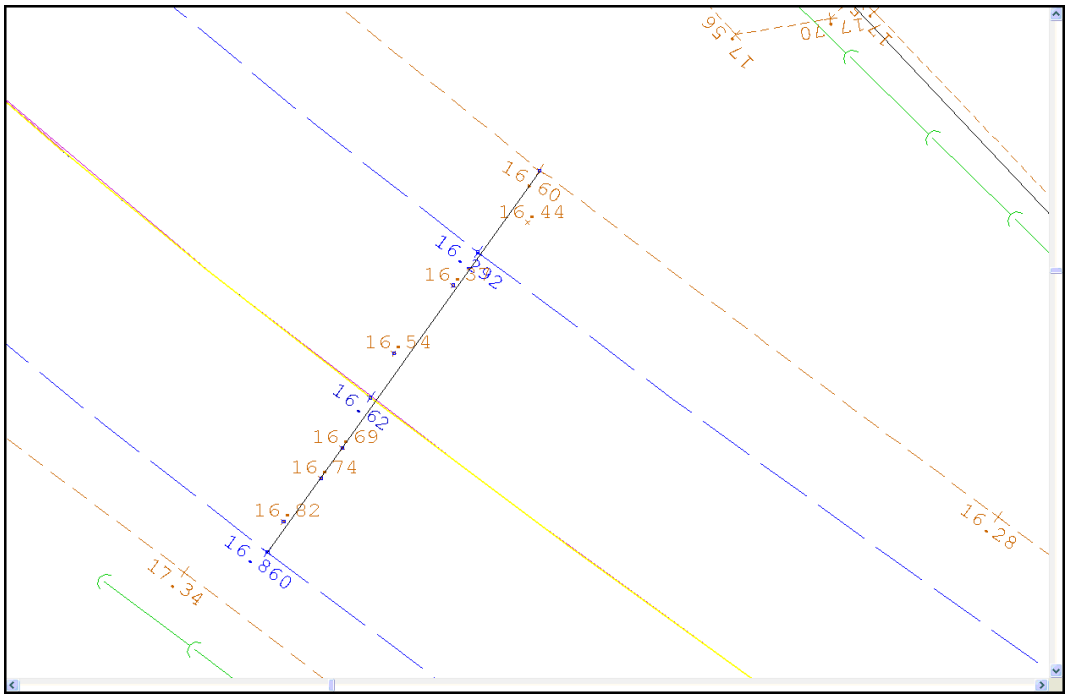
Set 'Output survey feature names' and 'Use current alignment as cross section centre line' as outlined below:

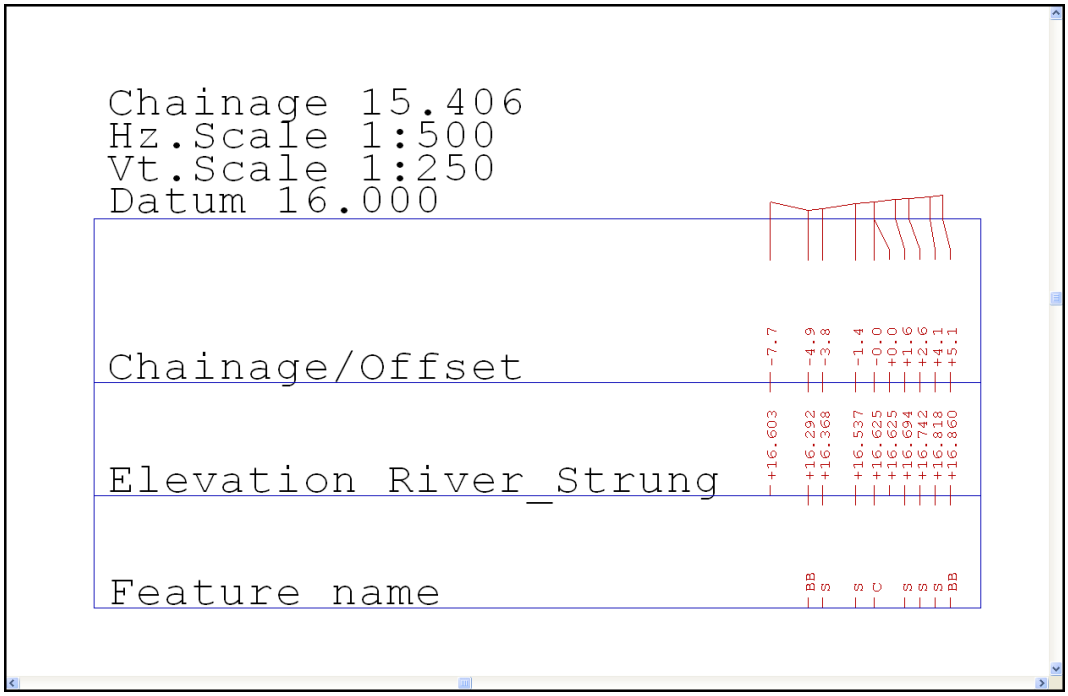




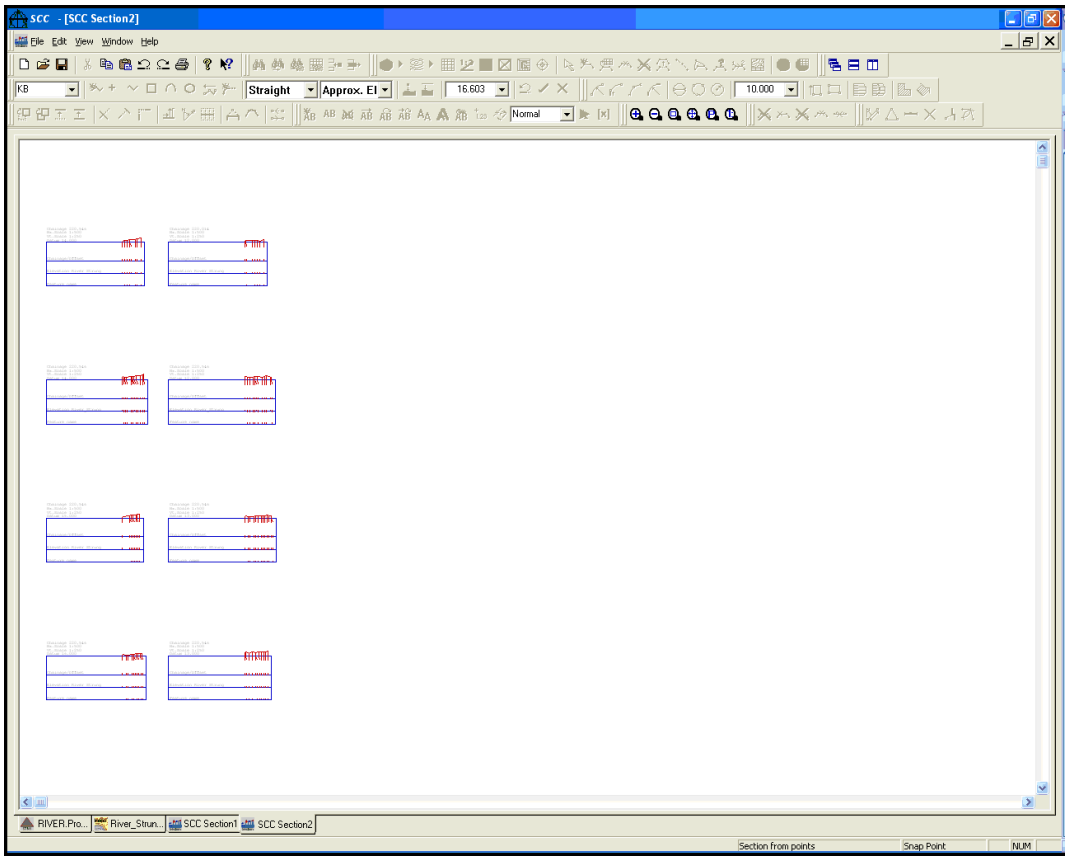
And secondly, all point within the set bandwidth are highlighted (in blue) for inclusion

Right click mouse to produce Section





By reverting to the model view without dropping the 'Sections from a bandwidth' command, that is, without selecting 'Esc', the user can move to the next cross section position and create a section.



Select 'FILE > Save As > River.Sections'

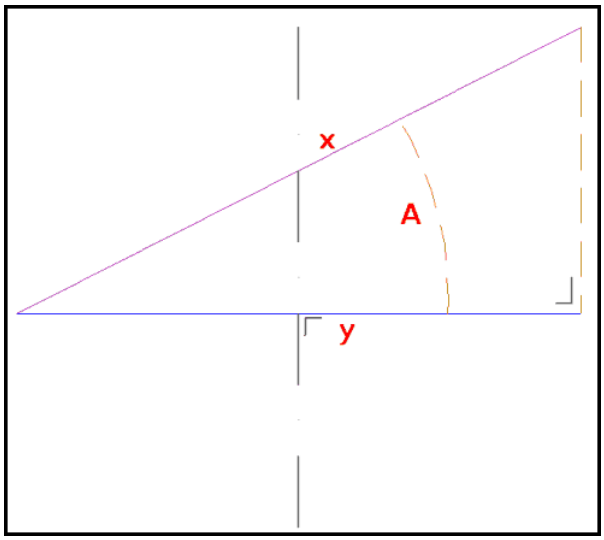
Skew Angle

Skew Angle is the angle of deviation from the normal to the centre line, that is, a skew angle of 0° implies that the cross section is at normal, right angle to the centre line.

A large skew angle means that the area of the cross section will be significantly larger than the cross section area at the river at that point.

Dividing the offsets of the cross section (the width of the cross section) by the Cosine of the skew angle may be used to normalise the cross section.

y = xCosA



Annotation of Skew Angle

Select 'View > Scales, Titles & Grids'

Select 'Add' within the 'Section Graph Titles' Area

Within the Title Column, select 'Skew Angle' from drop down menu

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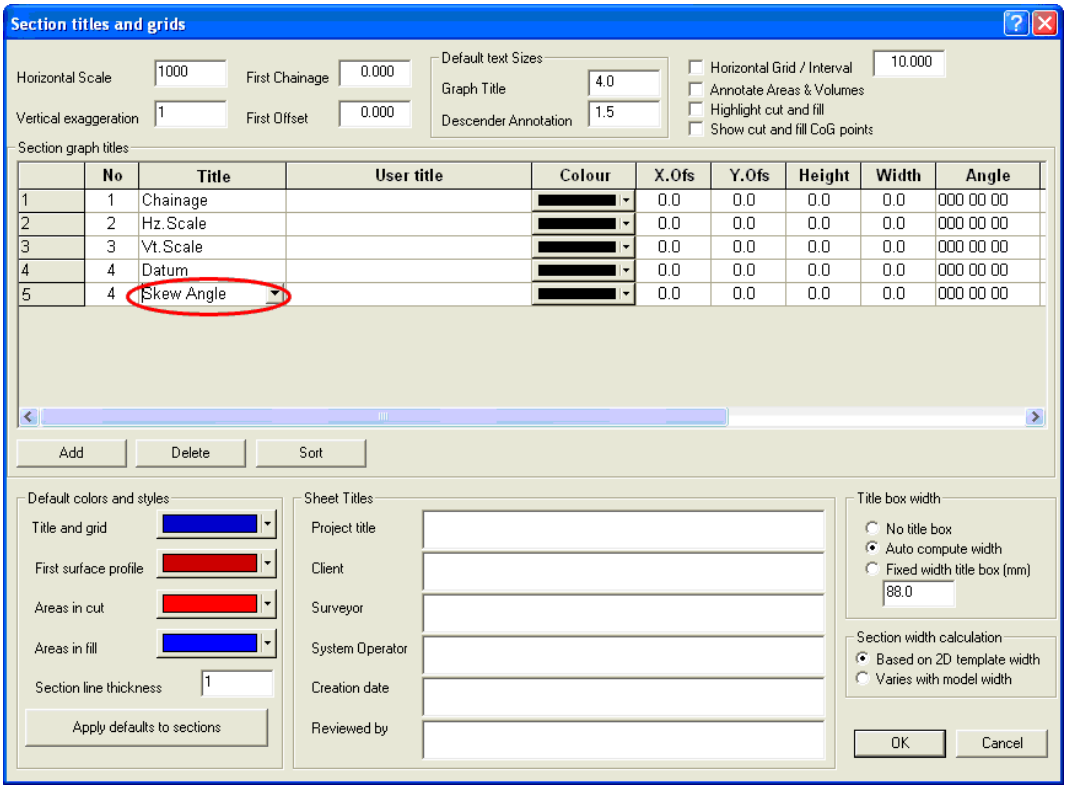
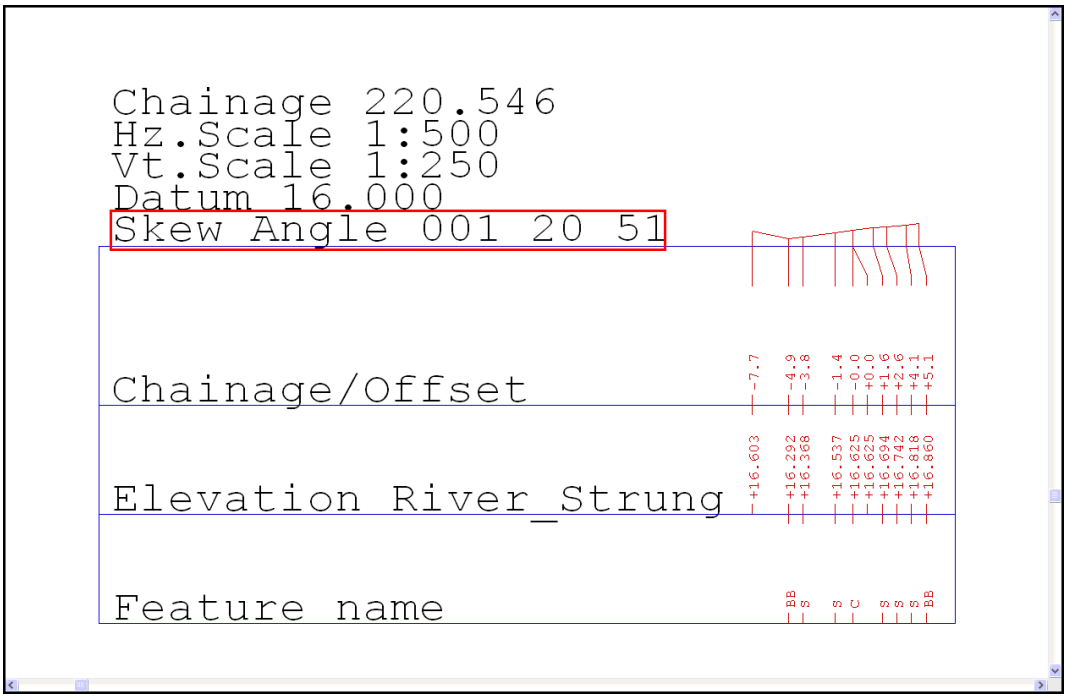
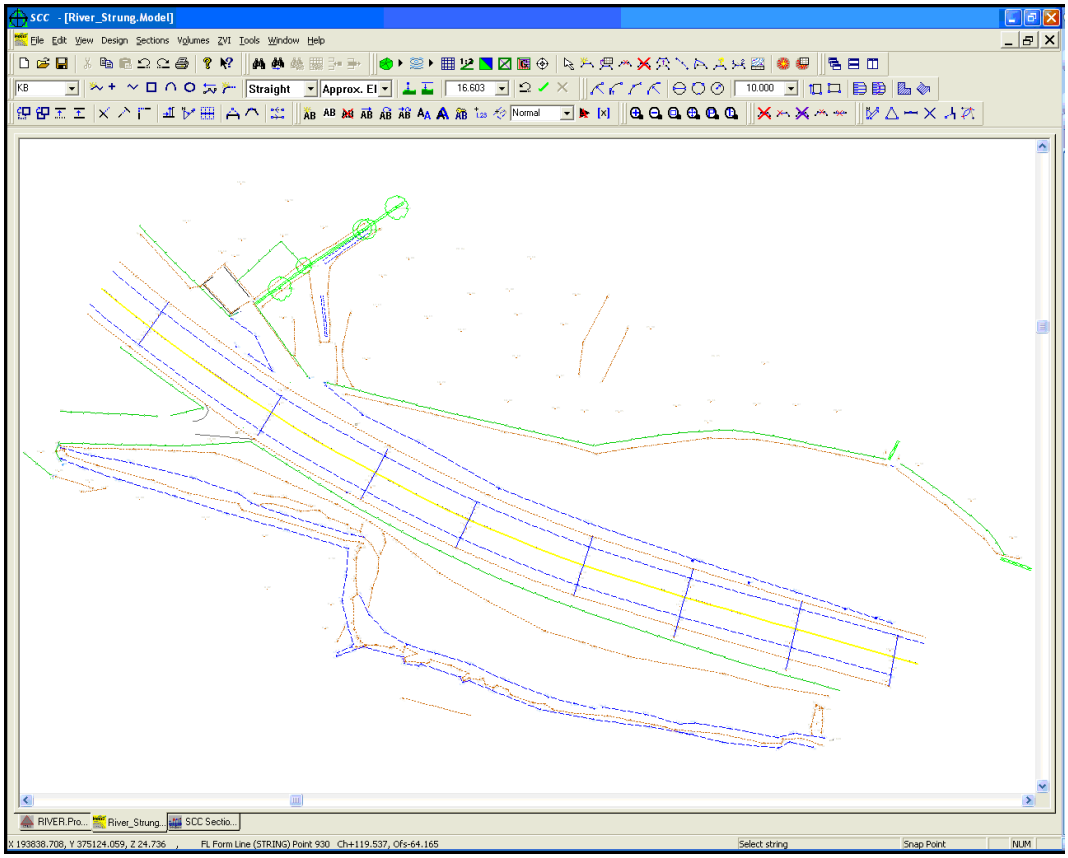




Attaching Sections

Select 'FILE > Attach/Detach > Attach Section File'

Select 'River.Sections'



12 Presentation & Archiving of Measurment Results

In order to minimise the risk of error appearing into a measurement, and also to illustrate the checks that were applied during the calculations, it is advisable to incorporate the procedures used and results obtained into a standardised form. A sample of such a form is included at the end of this section.

When presenting the results, the following items should be included:

- Measurement results / Volumetric check list
- Plan drawings of both models used
- Sample sections showing both surfaces, with cut and fill highlighted.
- Plan drawing of isopachyte model showing depth of cut and fill
- Electronic media containing any of the above where required.

In many cases, using a small A4 or A3 colour printer, is a fast and very cost effective way of producing the above. Remember that the drawings are provided to illustrate the method and accuracy of measurement and are in addition to any other survey drawings required. If the calculations have been carried out correctly, the above information is generated as a natural by-product of the measurement process and adds little or no overhead to time required. Copies of all results provided to any third parties, should be kept and filed. You never know when you might need them!

Where regular measurements are being taken over a reasonable period of time, it is some times preferable to use a database to enter any volumetric result check list details. The form given below can be easily recreated in Microsoft Access or a similar database. This greatly simplifies the retrieval of given measures and the production of summary information of measures taken to date.

Volumetric Measure Check List

SCC Project	
Measure Number	
Measure Description	
Carried Out By	
Date	
Survey Datasets Used **(Including Directory, Date and File Size)**	
Survey Model Name **(Including Directory, Date and File Size)**	
Design Datasets Used **(Including Directory, Date and File Size)**	
Other Datasets Used **(Including Directory, Date and File Size)**	
Names Of Other Models Used **(Including Directory, Date and File Size)**	

Task	**Completed**
Strings have been used to define all significant features and grade changes in all of the survey models	
The contours on each model have been visually checked at a 0.2 or smaller interval and appear to agree with conditions on the ground. There are no large humps, hollows, or embankments in the model, visible via contours, that have not been described by strings.	
Any survey data that is not consistent with ground conditions has either been corrected or removed, with enough data remaining to fully describe the ground surface.	
SCC Cross sections have been taken through all models and they appear to agree with conditions on the ground, and, the intercept lines from the design meet the ground for all sections.	
A common boundary string has been developed and included in the survey and design models and this string has been set to a Clip Polygon in SCC. There are no contours visible outside of this boundary in any of the models, and, this boundary does not affect any existing contours in any other way. Contours along design side slopes are parallel on one another.	
Volumes calculated by cross section Cut_____ Fill_____	

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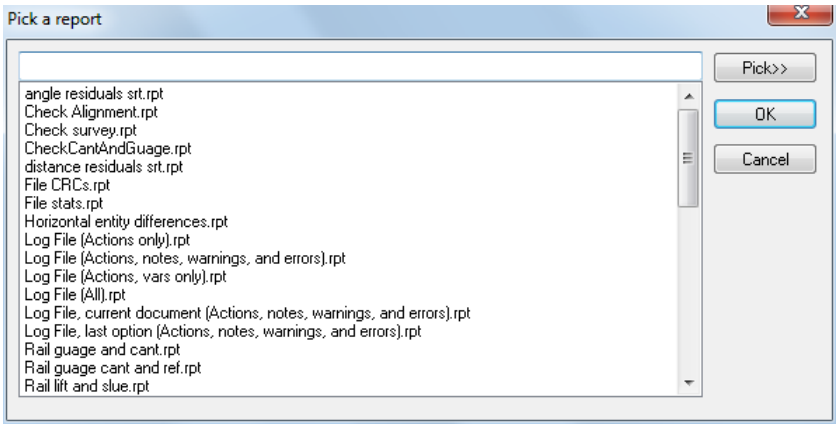
Volumes calculated by Prismoidal volumes between surfaces Cut_____ Fill_____ Isopachyte Plan Area_____ Probable error due to bad overlap _____M3 ___%	
Volumes calculated by Grid volumes between surfaces Cut_____ Fill_____	

13 Reports Within SCC

SCC produces high quality reports from all SCC documents using the industry acclaimed Crystal reports engine. These reports can include data, charts, bitmaps and other rich content, and can be output to printers, PDF, Excel, HTML and Word files.

Sample reports are available within the SCC directory. These templates can be used to regenerate project specific report data directly from SCC. The Crystal reports also have the advantages that they allow the report layout to be readily changed without affecting the content, they allow automatic highlighting of out of spec values such that they can be easily picked up by anyone reading the report, and they can be readily exported to a range of formats including Word, PDF, Excel and HTML.

Note that while creation of new report formats requires a Crystal reports license, creation, viewing, printing and export of reports is included within the SCC license. To view a report, click '**FILE** > **Reports**' and select sample report.



Extract from sample files provides can be viewed below:

Sample Feature Library Report:

Group: **Category:** Roads

Appendix A: Feature library

Feature: ARAHL Arrow Ahead Left (3 pt) 36

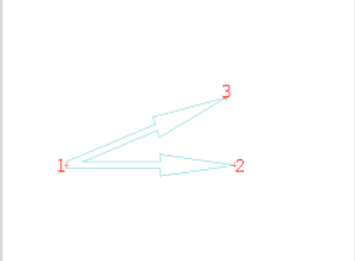
Layer: ROAD_MARKING **Linestyle:** CONTINUOUS

Colour: 3 (CYAN) **Symbology:** 3 Point Symbol

MX Label: A1 **Microstation Level:** 0

This feature is 2D and is not included in the TIN surface.

This feature is represented by the AR_AH_L symbol



Feature: ARAHR Arrow Ahead Right (3 pt) 37

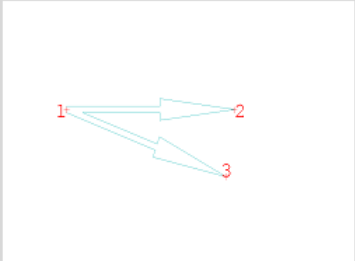
Layer: ROAD_MARKING **Linestyle:** CONTINUOUS

Colour: 3 (CYAN) **Symbology:** 3 Point Symbol

MX Label: A2 **Microstation Level:** 0

This feature is 2D and is not included in the TIN surface.

This feature is represented by the AR_AH_R symbol



Feature: ARBE Arrow Bus Lane End (3 pt) 38

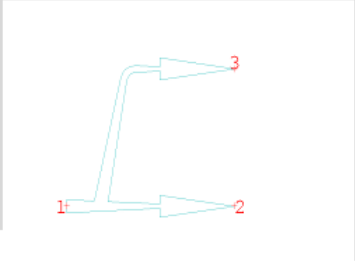
Layer: ROAD_MARKING **Linestyle:** CONTINUOUS

Colour: 3 (CYAN) **Symbology:** 3 Point Symbol

MX Label: A3 **Microstation Level:** 0

This feature is 2D and is not included in the TIN surface.

This feature is represented by the AR_BUS_E symbol



Sample Traverse Report:

Contract survey by
ABC Surveys ltd

Report file \\pe1800\Applications\Sp ATLAS
Created on 26/10/2007
By SCC for Windows v9.0.0
(C) 1990 - 2007 Atlas Computers Ltd

Traverse Report

Traverse name: qbn2.Traverse

Horizontal Grid: IG75 **Datum:** Malin Head

Horizontal adjustment method: Least squares (2D, variation of coordinates)

Vertical adjustment method: Least squares (1D, distance weighted)

Default standard errors

Horizontal angles (secs)	2
Horizontal distances (mm)	2
Horizontal scale (ppm)	1

Corrections applied

Local scale factor : Irish TM scale factor
Scale factor along CM : 1.0000350000
Easting of central meridian : 200000.000
Minimum survey easting : 303826.630
Maximum survey easting : 304037.911
Earth curvature and refraction : Curvature
Temperature and pressure : No
Mean sea level correction : No

Statistical analysis of results

Number of observations : 197
Number of unknowns : 22
Number of redundant obs : 175

Survey stations

Station: GPS1 Fixed

Coordinates:	E/X	N/Y	Ht/Z	Error ellipse	
Adjusted	303,826.6300	230,740.24	73.44	Major Axis:	0.0000
Provisional	303,826.6300	230,740.24	73.44	Minor Axis:	0.0000
Correction	0.0000	0.0000	0.0000	Angle:	000 00 00

ETRS89 Coordinates Lat 000 0.00000N Long 000 0.00000E Height 0.0000

Station: GPS2 Fixed

Coordinates
Adjusted
Provisional
Correction
ETRS89 Coordinat

Station: GPS2A

Coordinates
Adjusted
Provisional
Correction
ETRS89 Coordinat

Station: GPS3

Observations

Setup 1

At Stn	To Stn	Inst Ht	Rod Ht	Ha	Va	Sl. Dist	Hor.Dist	Ht Diff	FMA
GPS2	GPS1	1.660	1.610	000 00 00.00	090 17 33.00	151.7670	151.7900	-0.7220	000 00 00.00
GPS2	STN1	1.660	1.620	189 08 40.00	089 30 21.00	153.6070	153.6270	1.3677	189 08 40.00
GPS2	STN1	1.660	1.620	189 08 42.00	089 30 13.00	153.6070	153.6270	1.3736	189 08 42.00
GPS2	GPS1	1.660	1.610	000 00 00.00	090 17 26.00	151.7670	151.7900	-0.7168	000 00 00.00
GPS2	GPS1	1.660	1.610	000 00 00.00	090 17 26.00	151.7670	151.7900	-0.7168	000 00 00.00
GPS2	GPS1	1.660	1.610	000 00 00.00	090 17 33.00	151.7670	151.7900	-0.7220	000 00 00.00
GPS2	STN1	1.660	1.620	189 08 41.00	089 30 25.00	153.6060	153.6260	1.3647	189 08 41.00
GPS2	GPS1	1.660	1.610	000 00 00.00	090 17 33.00	151.7660	151.7890	-0.7220	000 00 00.00

Setup 2

At Stn	To Stn
STN1	GPS2
STN1	STN1A
STN1	GPS2
STN1	GPS2
STN1	STN1A
STN1	GPS2
STN1	STN1A

Setup 3

At Stn	To Stn

Reduced horizontal distances and residuals

Obs	At	To	Hor Dist	Residual	StdErr	StdRes
0	GPS2	GPS1	151.7895	0.0263	0.0022	-12.2031
1	GPS2	GPS1	151.7905	-0.0273	0.0022	12.6679
2	GPS2	STN1	153.6270	0.0026	0.0022	-1.1900
3	GPS2	STN1	153.6270	0.0026	0.0022	-1.2139
4	GPS2	GPS1	151.7905	-0.0273	0.0022	12.6801
5	GPS2	GPS1	151.7905	-0.0273	0.0022	12.6801
6	GPS2	GPS1	151.7905	-0.0273	0.0022	12.6679
7	GPS2	STN1	153.6261	0.0035	0.0022	-1.6425
8	STN1	GPS2	153.6270	0.0026	0.0022	-1.2169
9	STN1	GPS2	153.6270	0.0026	0.0022	-1.2169
10	STN1	STN1A	40.1616	0.0012	0.0020	-0.5902
11	STN1	STN1A	40.1616	0.0012	0.0020	-0.5897
12	STN1	GPS2	153.6260	0.0036	0.0022	-1.6604
13	STN1	GPS2	153.6270	0.0026	0.0022	-1.2139
14	STN1	STN1A	40.1616	0.0012	0.0020	-0.5891
15	STN1A	STN1	40.1626	0.0002	0.0020	-0.0997
16	STN1A	STN1	40.1616		0.0020	-0.5899

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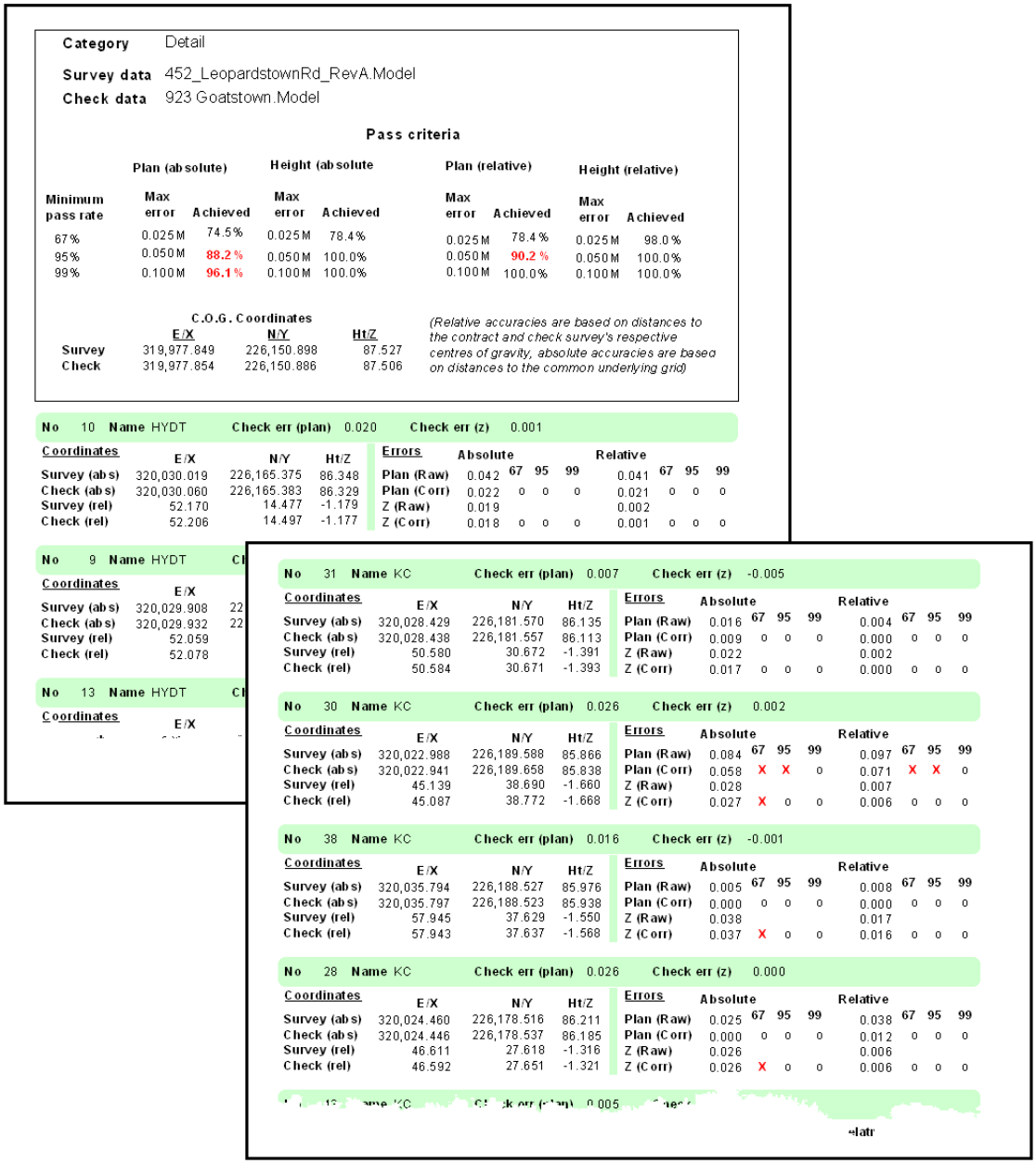
Sample Check Survey Report:



Category Detail

Survey data 452_LeopardstownRd_RevA.Model
Check data 923 Goatstown.Model

Pass criteria

Minimum pass rate	Plan (absolute) Max error	Plan (absolute) Achieved	Height (absolute) Max error	Height (absolute) Achieved	Plan (relative) Max error	Plan (relative) Achieved	Height (relative) Max error	Height (relative) Achieved
67%	0.025M	74.5%	0.025M	78.4%	0.025M	78.4%	0.025M	98.0%
95%	0.050M	88.2%	0.050M	100.0%	0.050M	90.2%	0.050M	100.0%
99%	0.100M	96.1%	0.100M	100.0%	0.100M	100.0%	0.100M	100.0%

C.O.G. Coordinates

	E/X	N/Y	Ht/Z
Survey	319,977.849	226,150.898	87.527
Check	319,977.854	226,150.886	87.506

(Relative accuracies are based on distances to the contract and check survey's respective centres of gravity, absolute accuracies are based on distances to the common underlying grid)

No 10 **Name** HYDT **Check err (plan)** 0.020 **Check err (z)** 0.001

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,030.019	226,165.375	86.348
Check (abs)	320,030.060	226,165.383	86.329
Survey (rel)	52.170	14.477	-1.179
Check (rel)	52.206	14.497	-1.177

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.042				0.041			
Plan (Corr)	0.022	0	0	0	0.021	0	0	0
Z (Raw)	0.019				0.002			
Z (Corr)	0.018	0	0	0	0.001	0	0	0

No 9 **Name** HYDT

Coordinates	E/X
Survey (abs)	320,029.908
Check (abs)	320,029.932
Survey (rel)	52.059
Check (rel)	52.078

No 13 **Name** HYDT

No 31 **Name** KC **Check err (plan)** 0.007 **Check err (z)** -0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,028.429	226,181.570	86.135
Check (abs)	320,028.438	226,181.557	86.113
Survey (rel)	50.580	30.672	-1.391
Check (rel)	50.584	30.671	-1.393

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.016				0.004			
Plan (Corr)	0.009	0	0	0	0.000	0	0	0
Z (Raw)	0.022				0.002			
Z (Corr)	0.017	0	0	0	0.000	0	0	0

No 30 **Name** KC **Check err (plan)** 0.026 **Check err (z)** 0.002

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,022.988	226,189.588	85.866
Check (abs)	320,022.941	226,189.658	85.838
Survey (rel)	45.139	38.690	-1.660
Check (rel)	45.087	38.772	-1.668

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.084				0.097			
Plan (Corr)	0.058	X	X	0	0.071	X	X	0
Z (Raw)	0.028				0.007			
Z (Corr)	0.027	X	0	0	0.006	0	0	0

No 38 **Name** KC **Check err (plan)** 0.016 **Check err (z)** -0.001

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,035.794	226,188.527	85.976
Check (abs)	320,035.797	226,188.523	85.938
Survey (rel)	57.945	37.629	-1.550
Check (rel)	57.943	37.637	-1.568

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.005				0.008			
Plan (Corr)	0.000	0	0	0	0.000	0	0	0
Z (Raw)	0.038				0.017			
Z (Corr)	0.037	X	0	0	0.016	0	0	0

No 28 **Name** KC **Check err (plan)** 0.026 **Check err (z)** 0.000

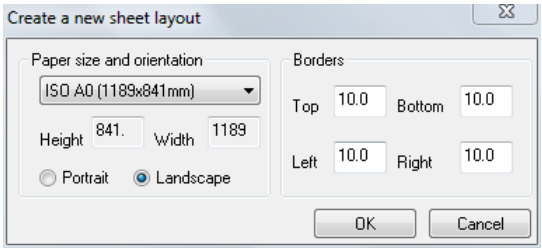
Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,024.460	226,178.516	86.211
Check (abs)	320,024.446	226,178.537	86.185
Survey (rel)	46.611	27.618	-1.316
Check (rel)	46.592	27.651	-1.321

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.025				0.038			
Plan (Corr)	0.000	0	0	0	0.012	0	0	0
Z (Raw)	0.026				0.006			
Z (Corr)	0.026	X	0	0	0.006	0	0	0

14 Plotting From SCC

There are plotting facilities in SCC for creating and editing sheet layouts. These facilities work with all Windows compatible plotters and printers, with full print preview.

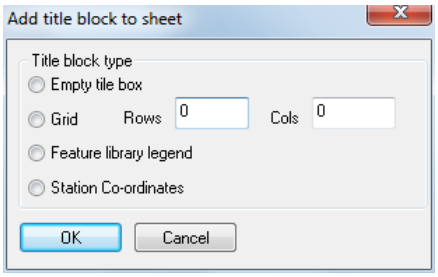
Sheet layouts can be imported from DXF or created in SCC as a model file. This file can then be added to the feature library within a project or attached to a model using the 'Attach/Detach' option under the 'FILE' menu. To create a new sheet template, go to 'FILE > Sheet Layout > Create new sheet template' and select the paper size and orientation.



Title blocks, legends and station co-ordinate boxes can be added to the template and it is then saved to the current project file.

When you have added a title block to the sheet, a dialog will be displayed. This option allows the user to add and design title blocks for a sheet template.

The box is positioned using the right mouse button; the first click should be used to position the top left corner of the data box and the second click to denote the bottom right corner of the box. When the box is drawn the following dialog is presented:



Selecting one of the options on this dialog will determine the type of data displayed. The options are as follows:

Empty Title Box

This option allows the user to add an empty rectangular box to the sheet model, which can be used for data entry, borders etc.

Grid

When selecting this option, the user also needs to enter a value for the amount of rows or columns required in the grid. The grid may be used for entering data such as 'Project Name', 'Scale' or 'Date' etc..

Feature Library Legend

To select this option the user must enter a value in the rows box. This value indicates the total amount of feature library entries the user would like to display in the legend when the sheet is inserted into the model. This works by taking each entry in the model in sequential record number and displaying the description and the linetype or symbol in the feature library legend. Features that are not used in the model, do not count.

Station Co-Ordinates

The user must also enter a value in the rows box. The value entered is the total amount of station coordinates that the user wishes to display on the sheet, where STN 1 is the first record number in the station coordinates spreadsheet.

The images below show how the station coordinate box appears both in the sheet template and in the model.

Station Co-ordinates

[Stn 1 Name]	[Stn 1 X]	[Stn 1 Y]	[Stn 1 Z]
[Stn 2 Name]	[Stn 2 X]	[Stn 2 Y]	[Stn 2 Z]
[Stn 3 Name]	[Stn 3 X]	[Stn 3 Y]	[Stn 3 Z]
[Stn 4 Name]	[Stn 4 X]	[Stn 4 Y]	[Stn 4 Z]
[Stn 5 Name]	[Stn 5 X]	[Stn 5 Y]	[Stn 5 Z]
[Stn 6 Name]	[Stn 6 X]	[Stn 6 Y]	[Stn 6 Z]
[Stn 7 Name]	[Stn 7 X]	[Stn 7 Y]	[Stn 7 Z]
[Stn 8 Name]	[Stn 8 X]	[Stn 8 Y]	[Stn 8 Z]

Station Co-ordinates

STN21	193716.751	375382.613	39.100
STN23	193732.839	375234.359	22.867
STN24	193820.046	375341.203	38.515
STN25	193871.511	375092.809	25.500
STN26	193999.015	375132.337	39.609
STN28	194122.804	374973.855	23.744
STN29	194029.975	375031.300	23.319
STN230	194037.310	375016.709	21.908
STN231	194074.443	374997.162	22.524
STN230	194088.444	375043.617	29.556
STN233	194189.121	374996.743	28.278
STN234	194203.987	374935.882	21.210
STN7	193617.021	375373.269	27.259
STN8	193574.512	375724.438	20.861
STN116	193603.381	375249.500	20.562
STN20	193755.134	375044.398	8.593
STN20X	193755.134	375044.398	8.569
STN321	193816.207	375025.769	6.463
STN21X	193816.207	375025.769	6.447

You can design the sheet template by adding your own company logo, the company feature library and legend and also additional information about stations, bench level values and location.

Below is a list of macros that can be used to create the sheet template. When the sheet is inserted into a model or section these macros will be automatically updated with the relevant job data, either from the operating system that is being used or from the data entered into the ‘Titles & Grids’ dialog.

Sheet Creation Macros

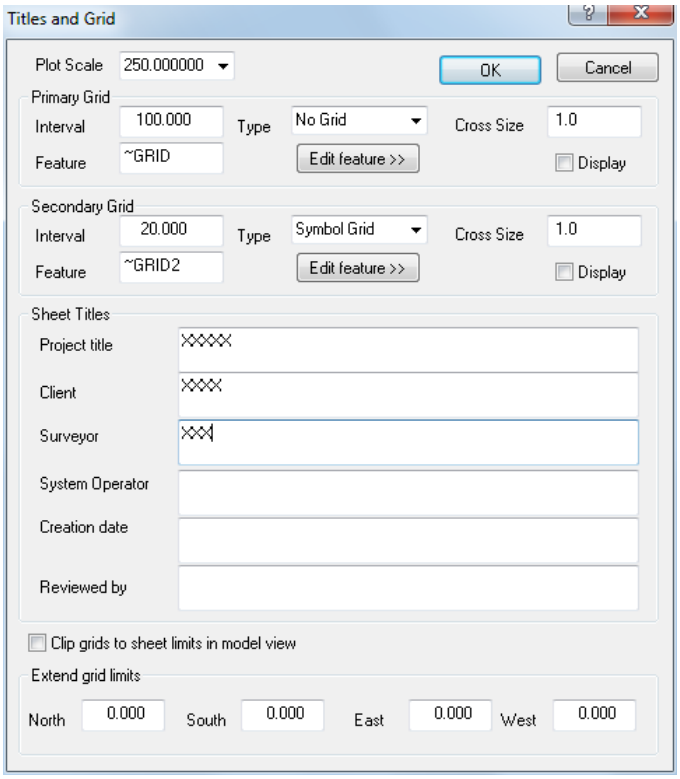
Operating System

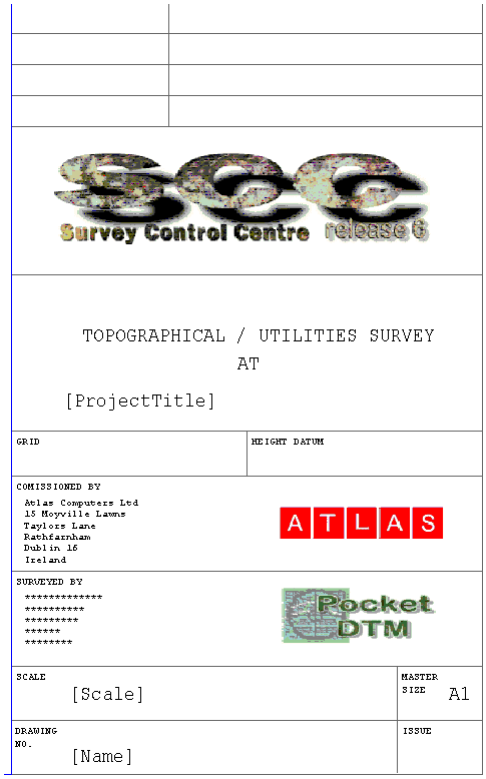
[Name}	Model / Section Name
[Path	Full Model/Section path
[Project]	Project Name
[Time]	Current time
[Version	SCC Version & Dongle Number
[Scale	Plot Scale
[Page]	Sheet Number
[Pages]	Number of Pages

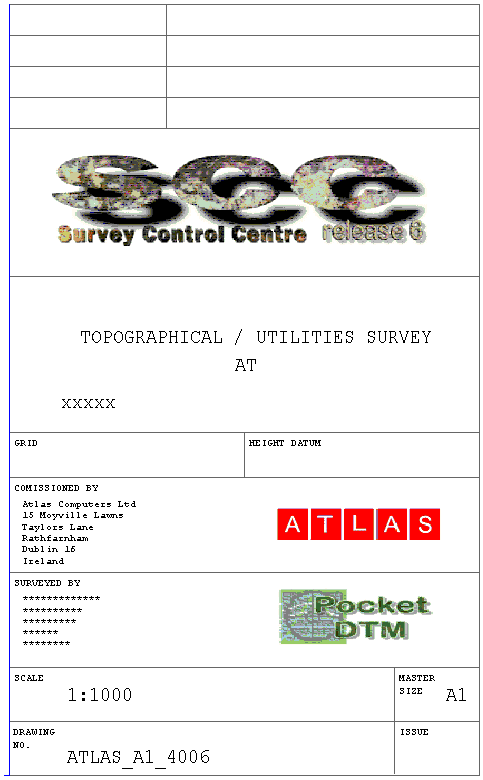
Titles & Grids Dialog

[ProjectTitle]	Job Name / Title
[Client	Client Name
[Date]	Date
[Surveyor]	Username
[Operator]	Operator

See the images below for an example of how the macros use the data entered in the 'Titles & Grids' dialog. The first grid box displays the macros typed in sheet creation. The second grid box show how the macros are used when inserted into the model.







Create A New Sheet Layout

Start with a blank screen

Go to 'FILE > Open'

Change FILES OF TYPE to 'Project'

Select 'Default.project'.

Go to 'FILE > Sheet Layout > create New Sheet Template'

Select the paper size and orientation.

Select OK

Select OK to view the model

> Remember, when creating a new sheet template, to allow enough margin space to accommodate the printer rollers on your selected printer. These may vary across printers and though the sheet size will be correct, it may stop the print process if the margin size is not large enough.

Saving The Template

To save the sheet template, go to 'FILE > Sheet Layout > Save Sheet Template'

Enter a name for your sheet (it is good to contain the size of the sheet in the name)

Select Ok

Close the model

Go into the project file

Select 'FILE > Save'

Save the project file

Inserting Sheet Into Model

Once the template has been saved to a project file, any model created with this project will store the new sheet in the feature library. This sheet can then be inserted into the model and viewed either within the model view or by print preview. Remember, to view the layout in print preview, you must have the correct sheet size selected in the print set-up!

Inserting the sheet into the model

Open the FGL. Model file

Go to 'FILE > Sheet Layout > Insert Sheet'

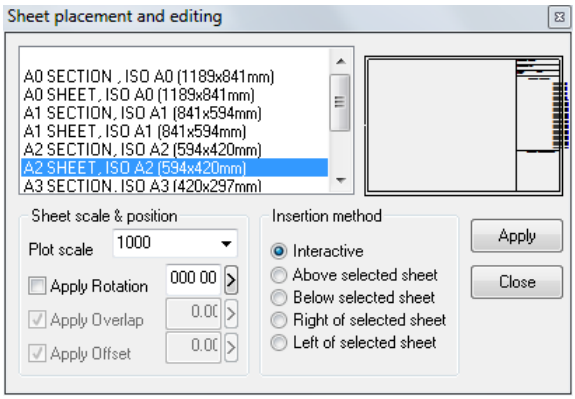
Select the sheet you wish to insert, from the list

Set the correct orientation and plot scale

Note that the plot scale effects the size of the sheet relevant to the model.

Then drag the sheet and place it over the model

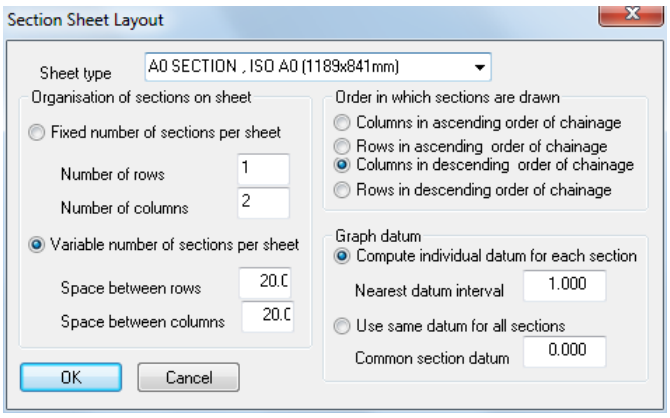
Pressing the left mouse button once will secure the sheet in position



Once the sheet is in the model, it can be rotated, moved and the plot scale changed. If there is more than one sheet in the model, it is possible to view each sheet individually by changing the view number in the control box on the Sheet Layout menu bar.

Sections

Once the sheet layouts have been saved to the feature library, these can then be used to plot sections and profiles. The method of inserting sheets into section drawings differs slightly from that of the model. Once a section has been generated, a sheet can be inserted by going to the 'VIEW' menu and selecting 'Section Sheet Layout'. You can then select the sheet of your choice and also set the way in which you sections appear on the sheet.



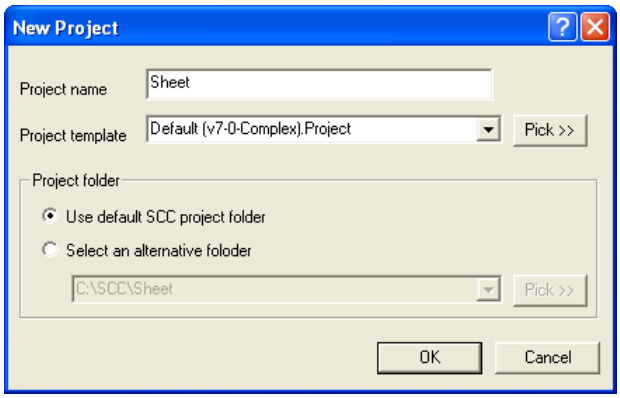
14.1 Creating Sheets in SCC

The following outlines the creation of a SCC Sheet Layout:

A.Set Up Project

Open a ‘New Project’ and attach the ‘Default(v7-0 Complex).Project’ template.

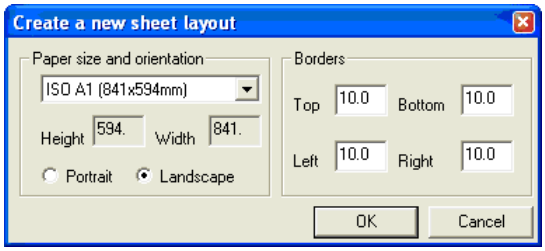
Call the project ‘Sheet’



B.Creating Sheet Layout

Go to 'FILE > Sheet Layout > Create Sheet'

A dialog is displayed with a selection of sheet sizes and orientations. Select a sheet.



A model of the selected sheet is generated. The user can add text to the title blocks, creating an individual sheet style for the company. Symbols can also be added to the models. These symbols can be created from dxf files and are especially useful for inserting north arrows or company logos. See Symbols.

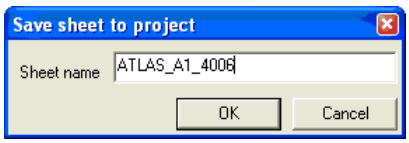
C.Save Model

Save the model 'FILE > Save As'

This means that the sheet can be edited at a later date and the previous template overwritten.

D.Save Sheet Layout

To add the template to the feature library, go to 'FILE > Sheet Layout > Save Sheet Template’ and give the template a name. This template will be automatically saved to the current project library.



E.Export Sheet & Import Sheet into Default Project

In order to make this sheet available to use within other project, it is necessary to output the sheet layout and import the file into the necessary project.

Go to 'EDIT > Sheet Layout > Export Symbols to File'

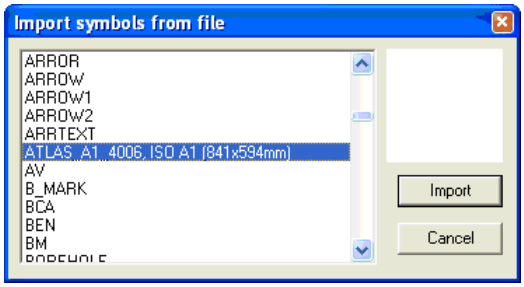
Select 'No' to 'Do you want to overwrite it'

The sheet can then be importing into the default library as follows:

Open Default Project

Select 'EDIT > Symbols > Import Symbols from File'

Select Sheet Layout to import



Select 'Import'

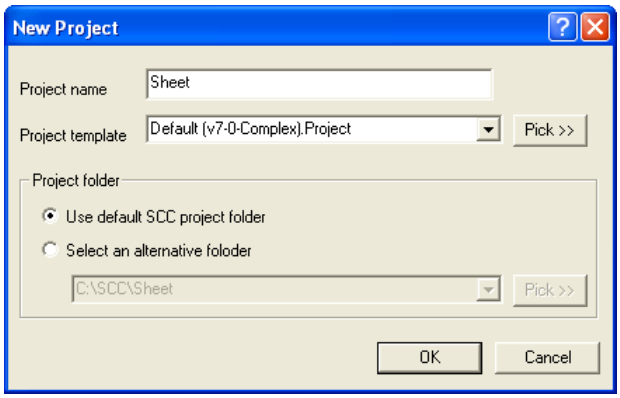
14.2 Creating a SCC Sheet Layout From a DXF/DWG file

The following outlines the creation of an SCC Sheet Layout from a given dxf file.

A.Set Up Project

Open a 'New Project' and attach the 'Default (v7-0 Complex).Project' template.

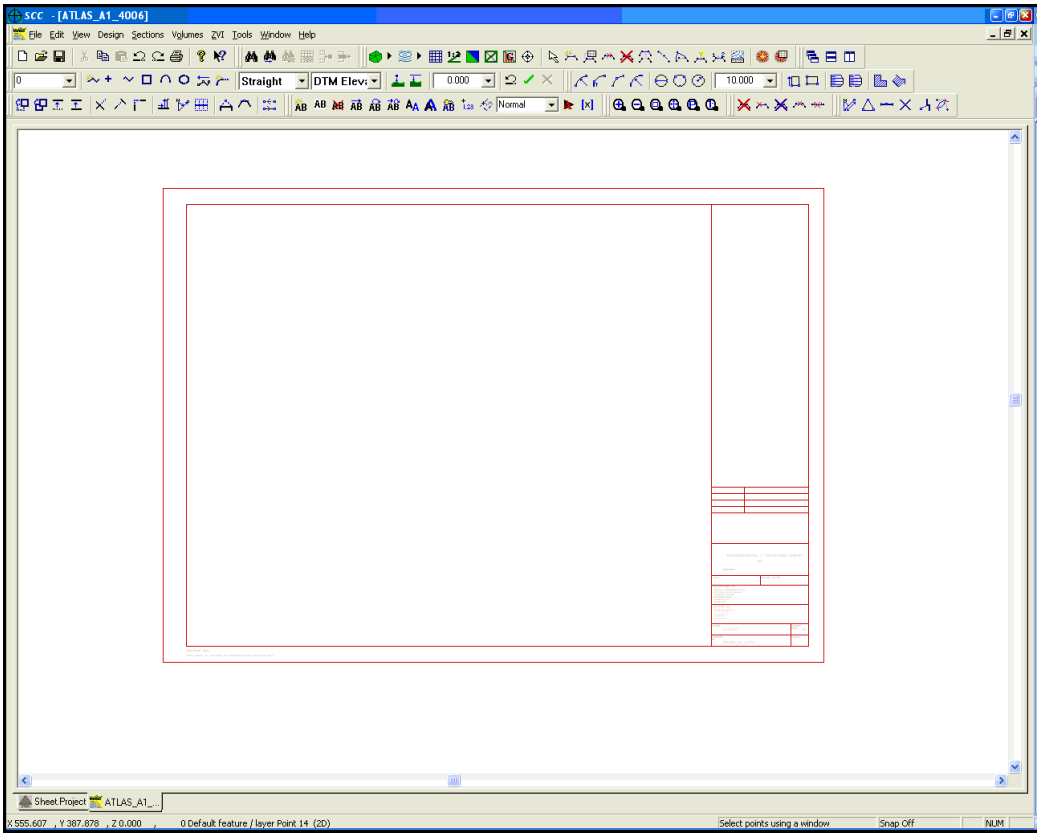
Call the project 'Sheet'



B.Model DXF Sheet

Go to 'Model > DXF file'

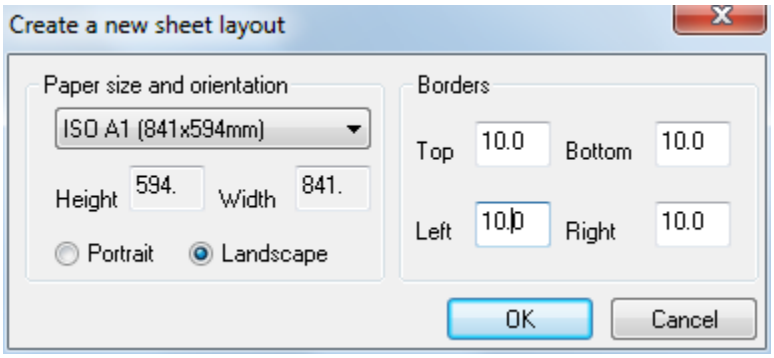
Select 'ATLAS_A1_4006.dwg'

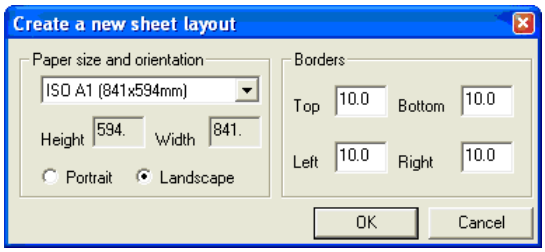


C.Creation of New Sheet Layout

Go to 'File > Sheet Layout > Create a New Sheet Layout'

Select 'ISO A1' and enter the relevant border settings as follows:





To easily identify the sheet edge and the border (clipping frame) use the 'Query and Edit' function to change the colour of each.

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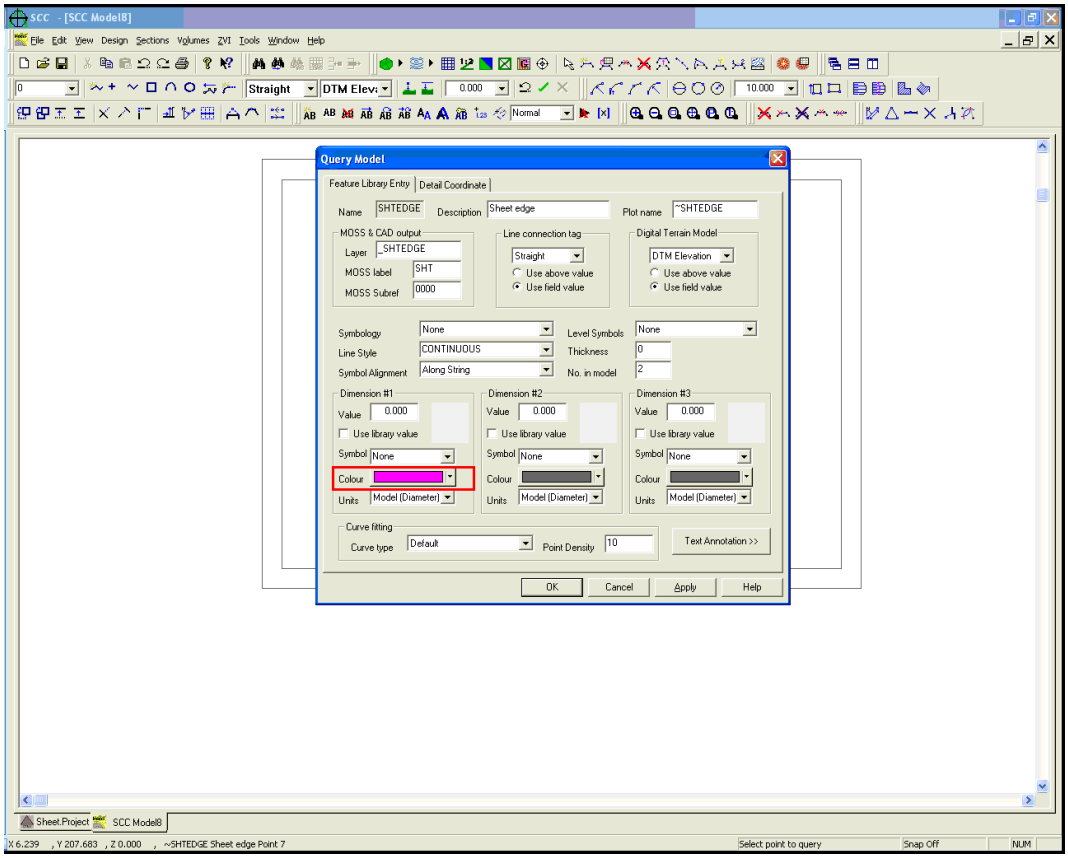
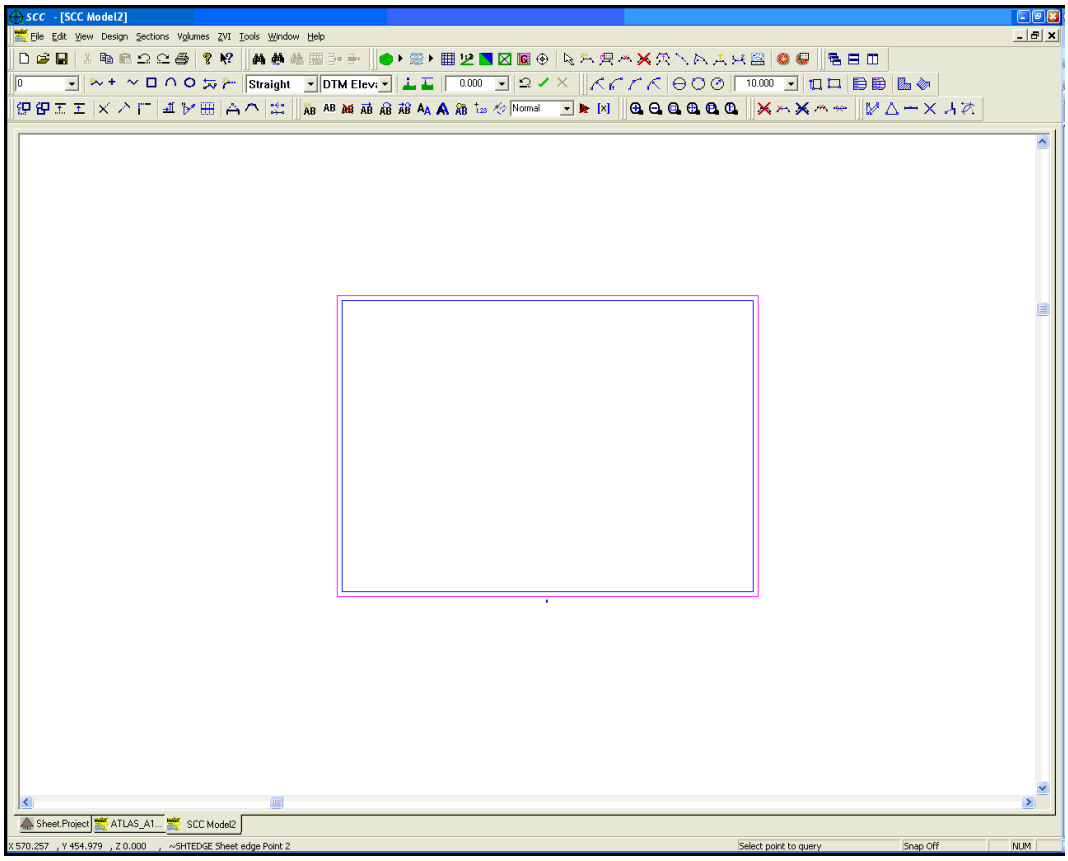
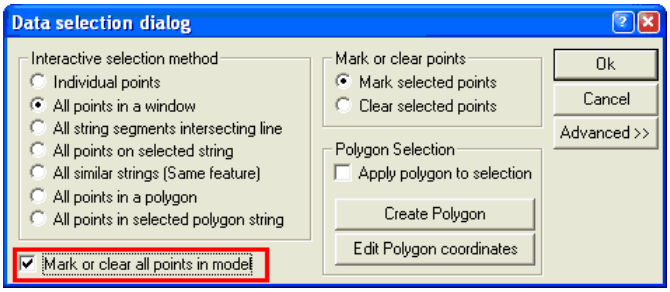




Go to 'Atlas_A4_4006.Model', right click to access 'Data Selection Dialog Box' and select ' Mark or clear all points in the model highlight all points



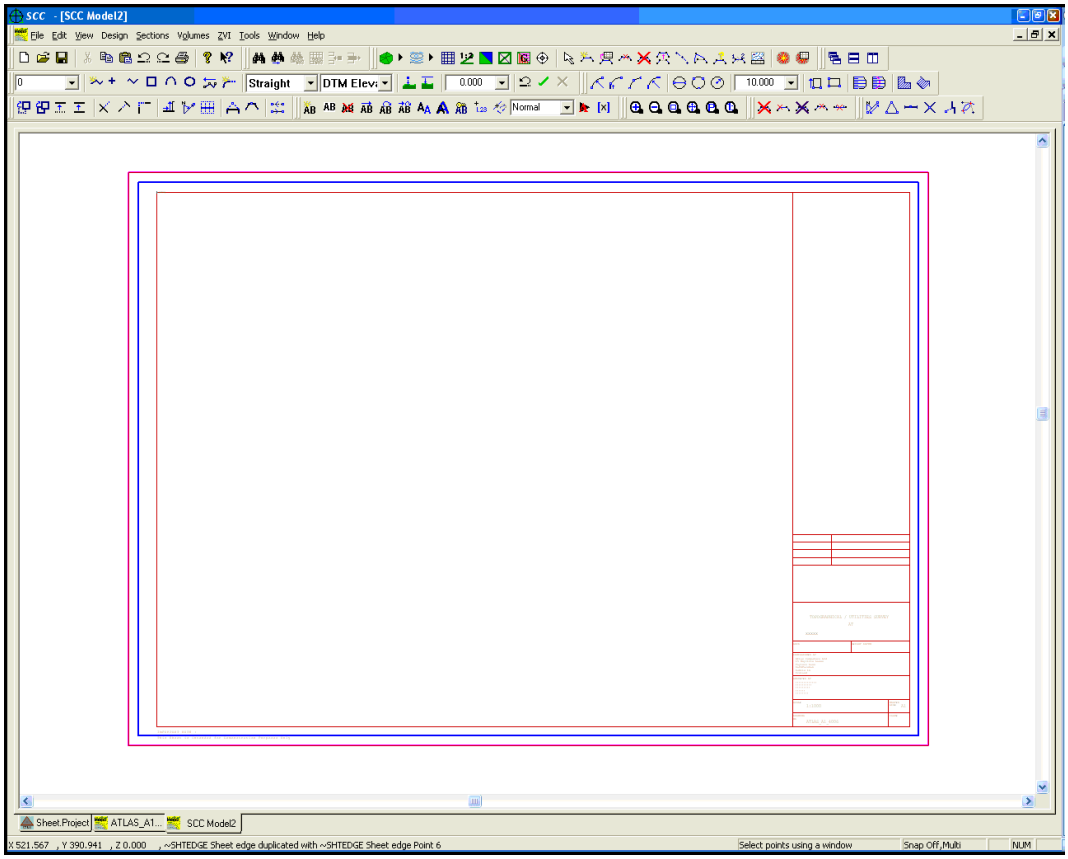
Select 'Edit > Copy to Clip Board'

Go to Sheet Layout 'ISO A1'Model and select 'Edit > Paste'

Note that the Sheet Edges coincide.

Delete the unnecessary Sheet Edge point (grey) leaving behind one Sheet Edge String (magenta)

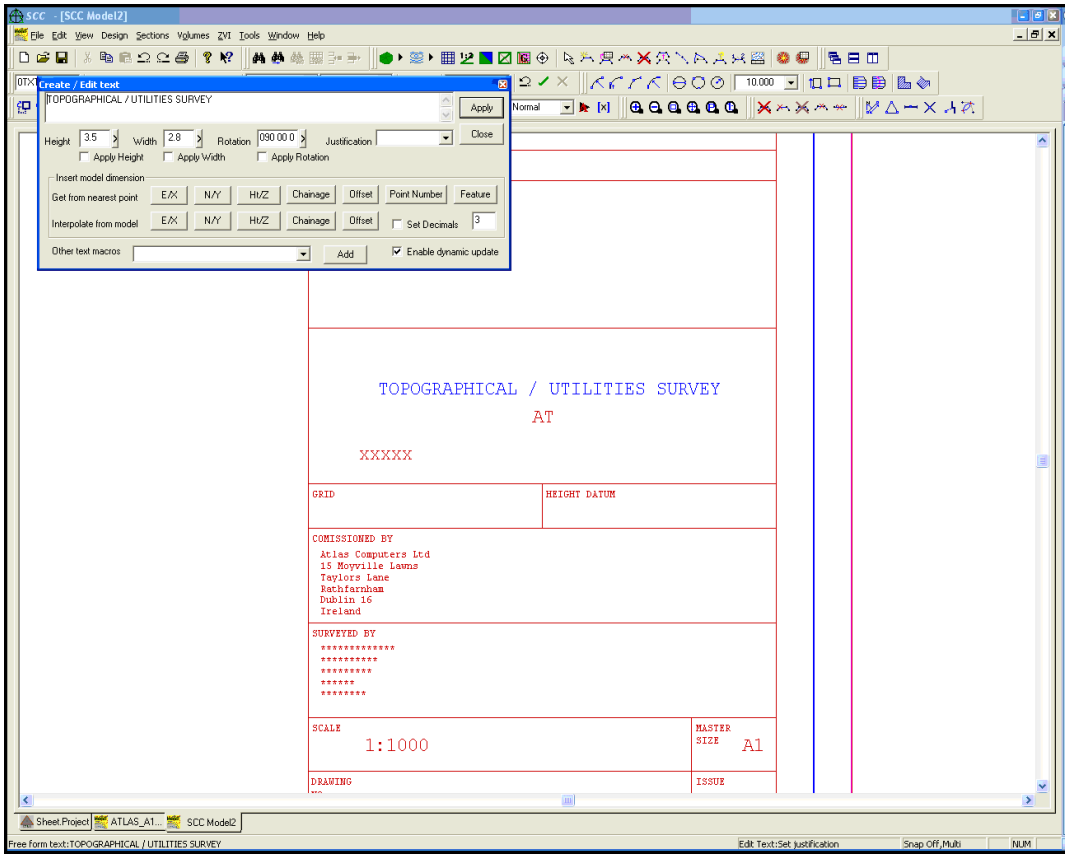
Where necessary use the string edit command, for example, Move Points, Trim, Extend



D.Adding Text & Text Macros

Text can be added to the Sheet Layout with the Text Tools

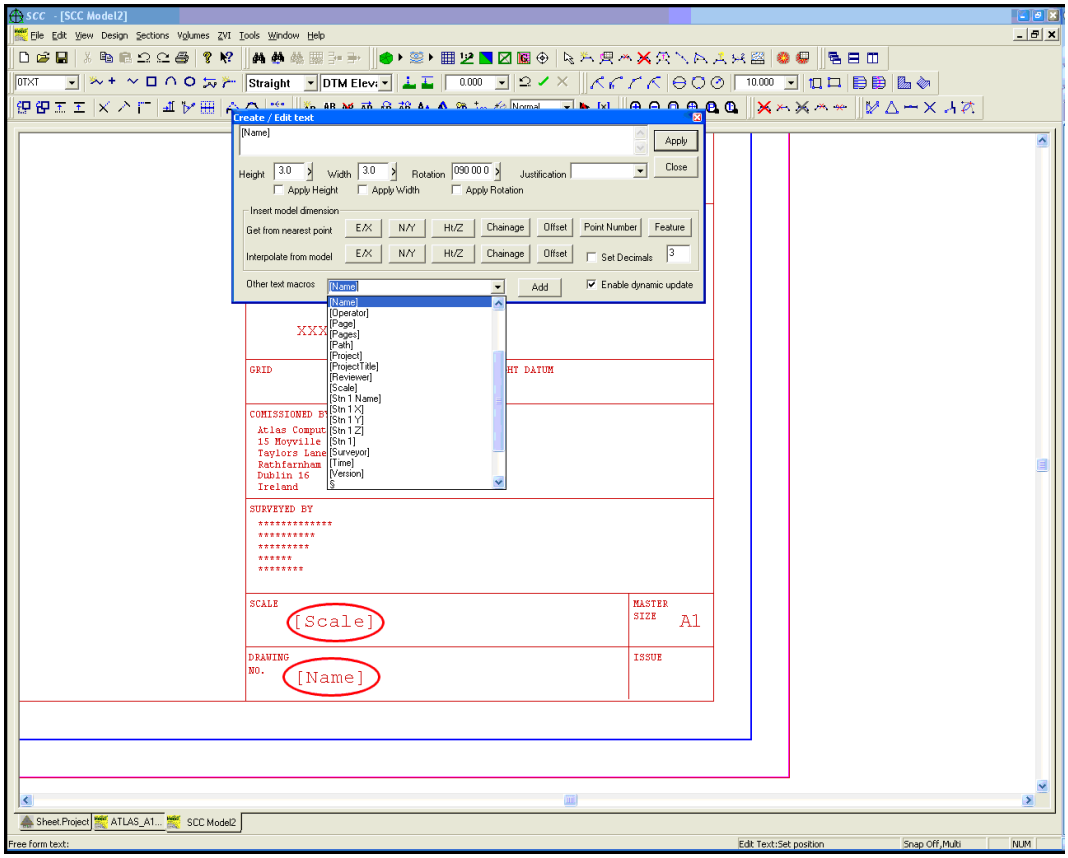
Either using the Text Toolbar or 'EDIT > Text > Add Text'



Text Macros are available within the 'Add Text' function

Select the Macro from the drop down menu

Select 'Add' and place the text in the required position



E.Bitmaps

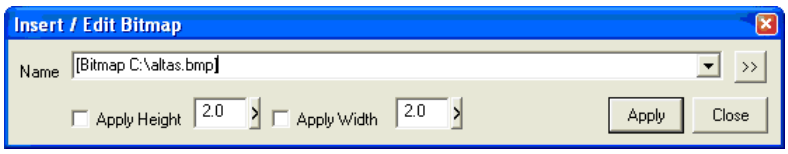
SCC bitmap option inserts a windows bitmap (.BMP) file into the model in a given location and allows you to define its size and aspect ration. This option can be used when creating sheet layouts, where bitmap information, such as company logo, are required on the sheet

.

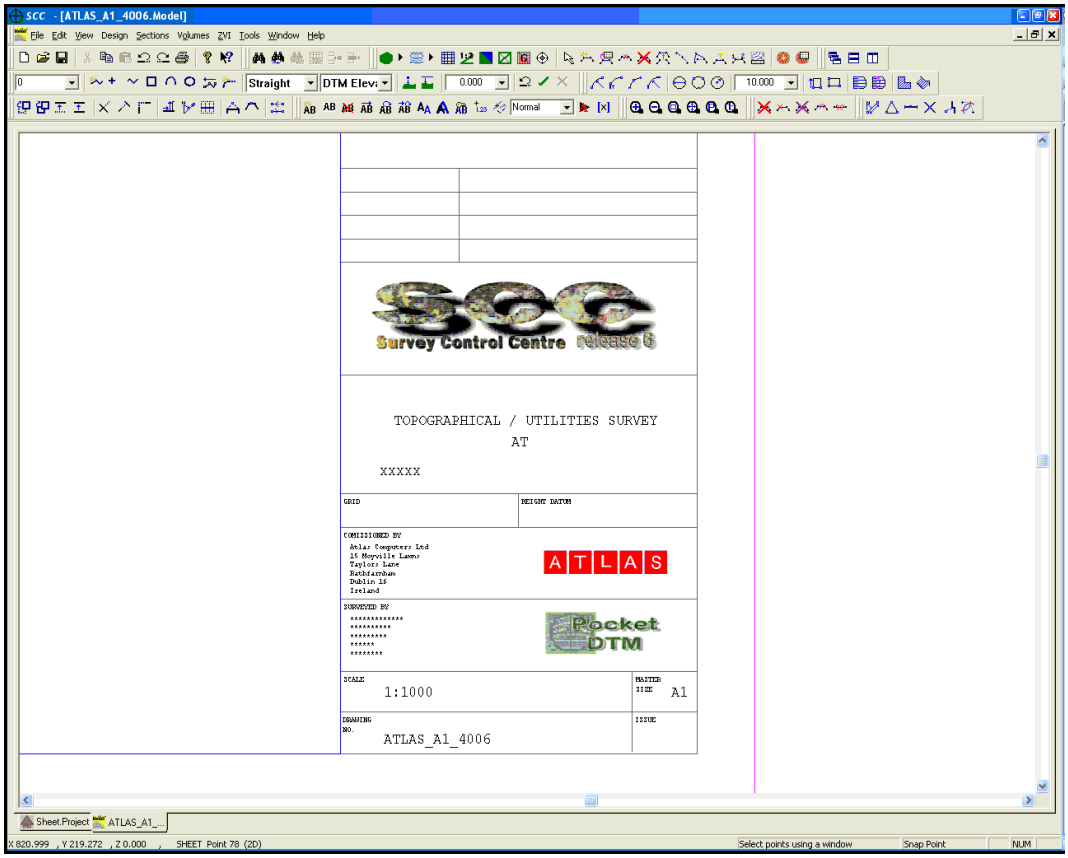
Go to 'EDIT > Bitmaps > Insert Bitmap'

Select bitmap using '>>' option

The height and width can be defined within the window or manually on screen



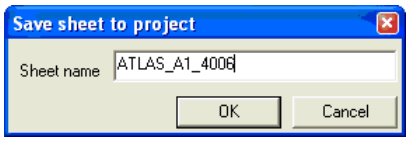
The bitmap can be resized, moved and deleted using the commands within 'EDIT > Bitmaps'



F.Save Sheet Layout

Go to 'FILE > Sheet Layout > Save Sheet Layout'

Enter Sheet Name



G.Export Sheet & Import Sheet into Default Project

In order to make this sheet available to use within other project, it is necessary to output the sheet layout and import the file into the necessary project.

Go to 'EDIT > Sheet Layout > Export Symbols to File'

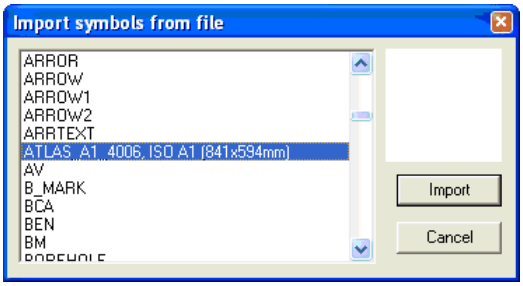
Select 'No' to 'Do you want to overwrite it'

The sheet can then be importing into the default library as follows:

Open Default Project

Select 'EDIT > Symbols > Import Symbols from File'

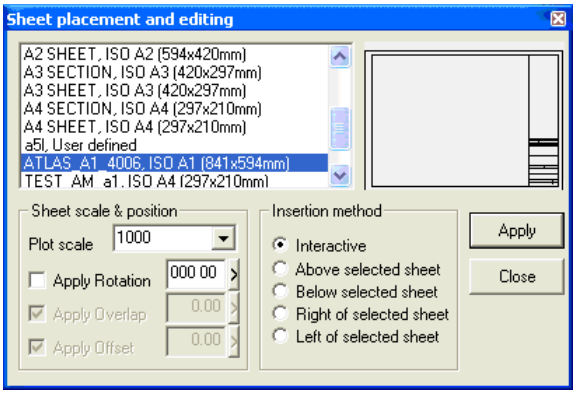
Select Sheet Layout to import



Select 'Import'

H.Inserting Sheet Layout Within A Model

Within a Model, go to 'FILE > Sheet Layout > Insert Sheet'

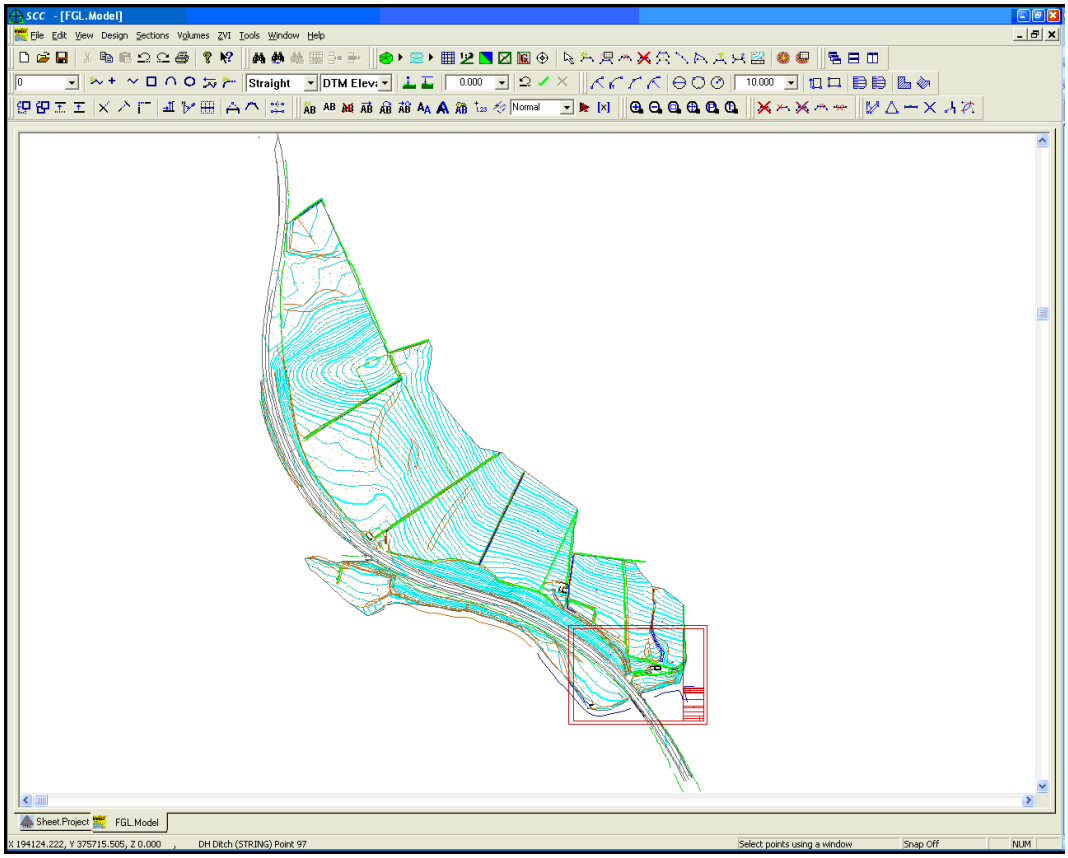


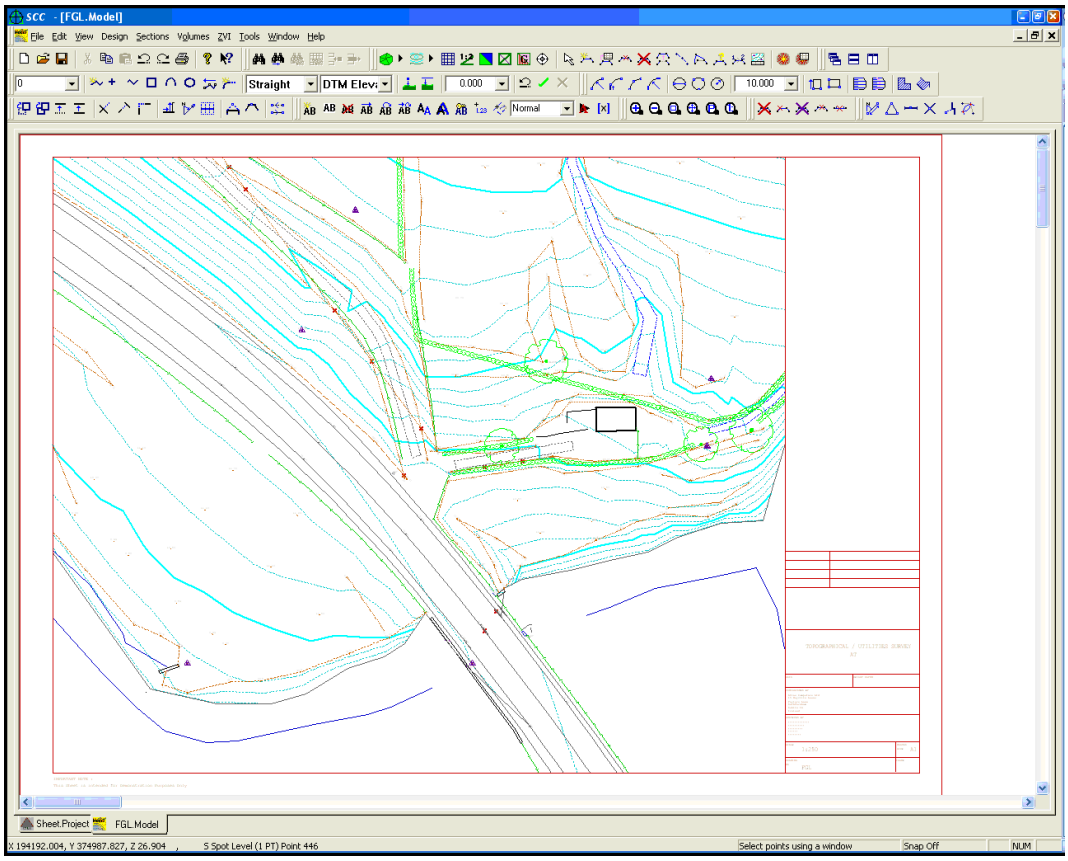
Select Sheet from list

Select Plot Scale and Insertion Method

Right click mouse to place sheet

Note: Rotation and Placement can be interactively choose on screen


SCC - [FGL.Model]
File Edit View Design Sections Volumes ZVI Tools Window Help
Straight
DTM Elev
0.000
10.000
Normal
Sheet Project
FGL Model
X 194124.222, Y 375715.505, Z 0.000
DH Ditch (STRING) Point 97
Select points using a window
Snap Off
NUM


SCC - [FGL.Model]
File Edit View Design Sections Volumes ZVI Tools Window Help
Straight
DTM Elev
0.000
10.000
Normal
Sheet Project
FGL Model
X 194192.004, Y 374987.827, Z 26.904
S Spot Level (1 PT) Point 446
Select points using a window
Snap Off
NUM

15 Transformations

SCC allows the user to create or edit a transformation from one co-ordinate system to another. The transformation editor lets the user enter any number of co-ordinates in both systems and calculates a transformation that will convert data between these systems.

It is for example possible to take a survey where the control stations have been destroyed and by surveying series of well-defined points of local detail, match up the common co-ordinates and transform the newly established stations into the old survey grid system.

Likewise, it would be possible to transform from a local or assumed grid system into the National Grid.

It is advisable to take a large number of mutual points and to have these spread over the extent of the survey. The system uses a least squares best-fit technique so that a large number of points may be used to provide the strongest transformation.

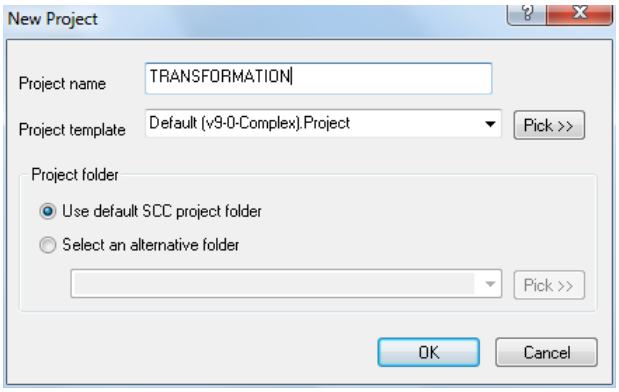
15.1 Performing A Transformation

In this specific example SCC uses an affine two-dimensional transformation with elevation datum shift. This transformation allows for rotation, translation and scaling in plan along with translation of levels.

Go into SCC.

Go to 'FILE > New Project'

Call the project Transformation Tutorial and attach the project template Default.Project.



Go to 'FILE > Open'.

Go to the directory '\SCC\Tutorials\'.

At the bottom of the Open dialog and change the Files of Type to SCC Datasets (*.Survey) by clicking the down arrow.

Select the dataset 'Square.Survey'. The Detail Co-ordinates window.

Go to 'TOOLS > Transform Co-ordinates'.

When you are creating a new transformation, just click on the New transformation option. A blank transformation spreadsheet is opened.

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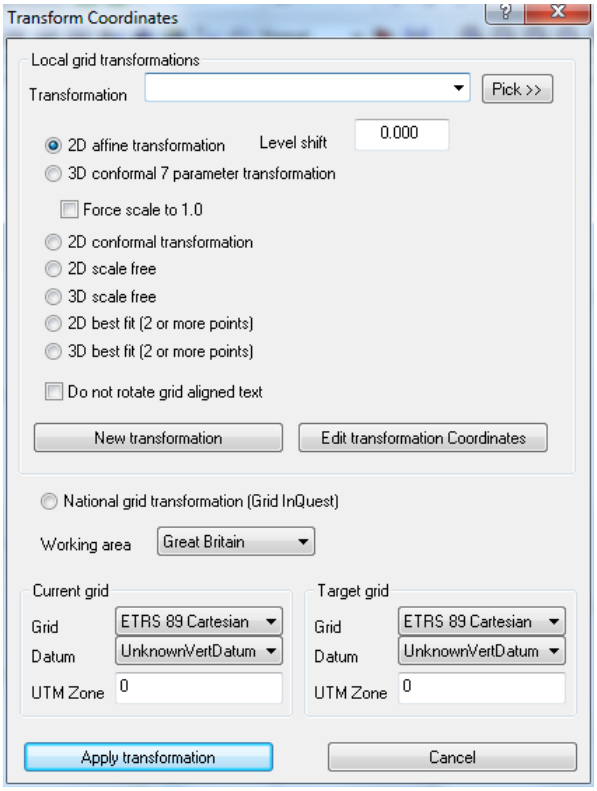
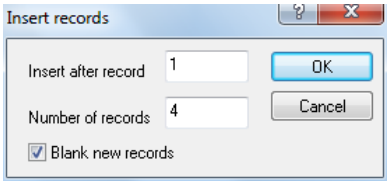


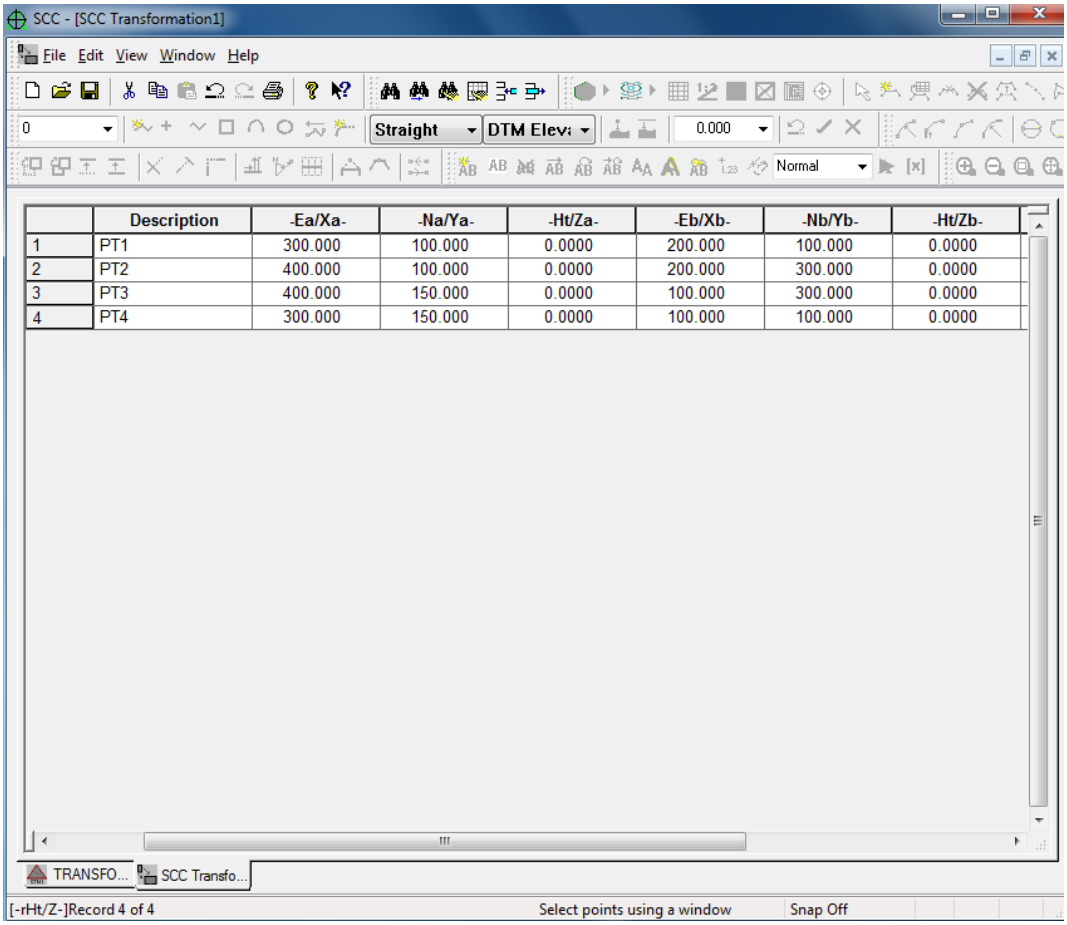
Type in the co-ordinates of the points, which you know in both grid systems.

Insert a blank record for each point known in both co-ordinate systems.

Go to 'EDIT > Insert Records'. Insert 3 new records.



Type in the co-ordinates of the points in the first grid system (Ea/Xa,Na/Ya and Ht/Za) and then their co-ordinates in the second grid system (Eb/Xb,Nb/Yb and Ht/Zb).



	Description	-Ea/Xa-	-Na/Ya-	-Ht/Za-	-Eb/Xb-	-Nb/Yb-	-Ht/Zb-
1	PT1	300.000	100.000	0.0000	200.000	100.000	0.0000
2	PT2	400.000	100.000	0.0000	200.000	300.000	0.0000
3	PT3	400.000	150.000	0.0000	100.000	300.000	0.0000
4	PT4	300.000	150.000	0.0000	100.000	100.000	0.0000

Save the Transformation as 'SQ.Transformation'.

Close the transformation spreadsheet and returned to Detail Co-ordinates window.

Go to 'TOOLS >Transform Co-ordinates'.

Pick the Transformation file 'SQ.Transformation'.

Apply the transformation.

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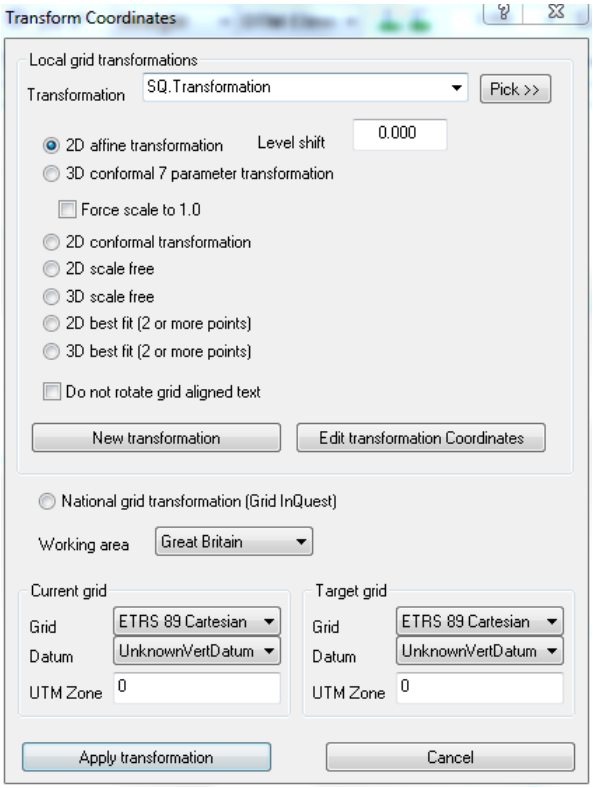
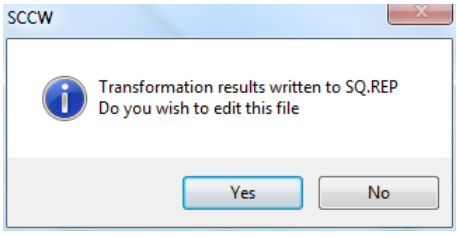


When the transformation is performed a report is generated. You will be asked whether or not you wish to view this report. Choose Yes to view the report . The following report will be presented in Wordpad (or whichever Text Editor you have specified in the Directories and Files section of the General Options.).

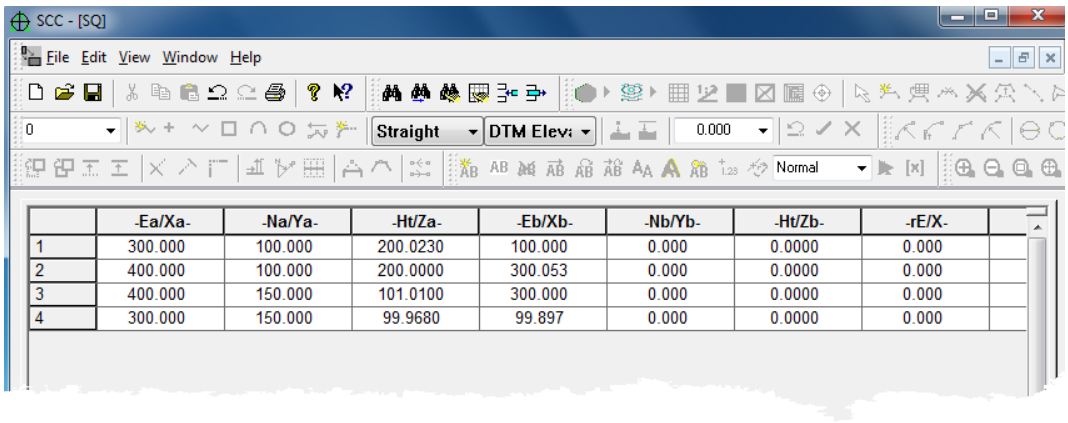


In the previous example, the points were known exactly in both co-ordinate systems therefore there were no residuals listed in the report.

```
SCC for Windows v7.8.11 (C) 1990 - 2005 Atlas Computers Ltd
   Transformation report
   Transformation name  SQ
   Date                 Wed Dec 06 09:24:02 2006
   Transformation parameters are
    a  = 0.000000
    b  = 2.000000
    c1 = 400.0000
    c2 = -500.0000
 Where  x' = ax - by + c1
        y' = bx + ay + c2
Pt   Name                E/X(a)      N/Y(a)      E/X(b)      N/Y(b)     rE/X    rN/Y
--   ----                ------      ------      ------      ------     ----    ----
0    STNA               300.000     150.000     100.000     100.000   0.0000  0.0000
0    STNB               400.000     150.000     100.000     300.000   0.0000  0.0000
0    STNC               400.000     100.000     200.000     300.000   0.0000  0.0000
0    STND               300.000     100.000     200.000     100.000   0.0000  0.0000
     Block shifting parameters
     (0,0) -> (400.00000,-500.00000)
     (0,1) -> (400.00000,-498.00000)
     (1,0) -> (398.00000,-500.00000)
     Block creation point 150.00000,200.000000
     Insertion point 0.00000,-200.000000
     Scale  = 2.00000
     Rotation = 090 00 00  (Counter Clockwise)
```

```
Typical shift applied -150.00000,-400.00000
```

In the following example the co-ordinates of the points were not known exactly in the second system. Apply the following changes to the transformation.



	-Ea/Xa-	-Na/Ya-	-Ht/Za-	-Eb/Xb-	-Nb/Yb-	-Ht/Zb-	-rE/X-
1	300.000	100.000	200.0230	100.000	0.000	0.0000	0.000
2	400.000	100.000	200.0000	300.053	0.000	0.0000	0.000
3	400.000	150.000	101.0100	300.000	0.000	0.0000	0.000
4	300.000	150.000	99.9680	99.897	0.000	0.0000	0.000

Save the transformation and then Apply it. The following transformation report is generated.

Note the residuals at each of the Easting and Northings. The residuals are differences between the given co-ordinate values for the point and the co-ordinate values calculated using the transformation parameters.

Calculating the residual at the Easting of point no.1.

```
SCC for Windows v7.8.11 (C) 1990 - 2005 Atlas Computers Ltd
   Transformation report
   Transformation name  SQ_2
   Date                 Wed Dec 06 09:33:10 2006
   Transformation parameters are
    a  = 0.003859
    b  = 1.998523
    c1 = 398.7149
    c2 = -499.9900
 Where  x' = ax - by + c1
        y' = bx + ay + c2
Pt   Name                E/X(a)      N/Y(a)      E/X(b)      N/Y(b)     rE/X    rN/Y
--   ----                ------      ------      ------      ------     ----    ----
0    STNA               300.000     150.000      99.968      99.897   0.1262   0.2489
0    STNB               400.000     150.000     101.010     300.000  -0.5299  -0.0018
0    STNC               400.000     100.000     200.000     300.005   0.4063  -0.2001
0    STND               300.000     100.000     200.023     100.000  -0.0026  -0.0471
     Block shifting parameters
     (0,0) -> (398.71486,-499.98997)
     (0,1) -> (398.71872,-497.99145)
     (1,0) -> (396.71634,-499.98611)
     Block creation point 150.25025,199.975575
     Insertion point -0.36109,-198.939574
     Scale  = 1.99853
     Rotation = 089 53 22  (Counter Clockwise)
     Typical shift applied -150.61134,-398.91515
```

Calculating the residuals of Easting of STND Point No. 4:

where x' = ax - by + c1

x'=200.023

a =0.003764

x =300.000

b =1.998714

y =100.000

c1=398.7721

x'= (0.003764 x 300.000) - (1.998714 x 100.000) + 398.7721

x'= 1.1292 - 199.8714 + 398.7721

x'= 200.0299

The difference between the computed (200.0299) and the given (200.023) answer is 0.0069, which is displayed in the transformation spreadsheet as the residual (rE/X).

15.2 Applying A Transformation

If a drawing has been exported to CAD and subsequently requires transformation a block may be made of the original drawing. The block creation, insertion, scaling and rotation values given in the report may be used to apply the transformation to a CAD drawing.

Note:

If a significant inappropriate scale, or large residual values, is generated, check your input data. If you have a large number of points in both systems, try replacing points with large residuals with other matched points that are near to those points.

15.3 Transformation Report

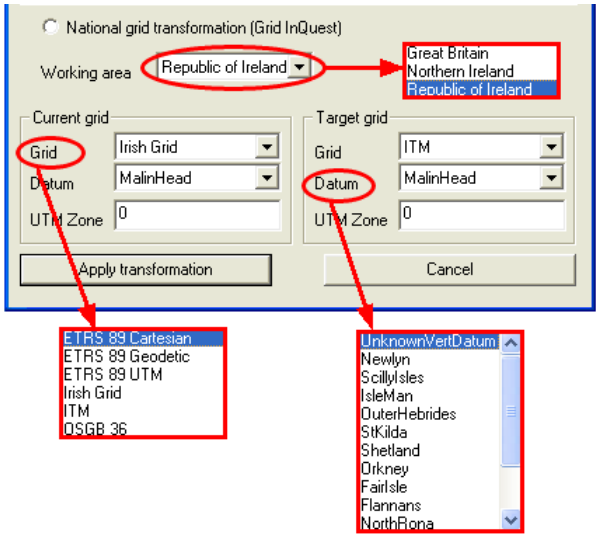
Sample Tranformation Reports:

2D Affine:

```
SCC for Windows v7.8.11 (C) 1990 - 2005 Atlas Computers Ltd
   Transformation report
   Transformation name  SQ_2
   Date                 Wed Dec 06 09:38:21 2006
   Transformation parameters are
    a  = 0.003859
    b  = 1.998523
    c1 = 398.7149
    c2 = -499.9900
 Where  x' = ax - by + c1
        y' = bx + ay + c2
Pt   Name                E/X(a)      N/Y(a)      E/X(b)      N/Y(b)     rE/X    rN/Y
--   ----                ------      ------      ------      ------     ----    ----
0    STND               300.000     100.000     200.023     100.000  -0.0026  -0.0471
0    STNC               400.000     100.000     200.000     300.005   0.4063  -0.2000
0    STNB               400.000     150.000     101.010     300.000  -0.5299  -0.0018
0    STNA               300.000     150.000      99.968      99.897   0.1262   0.2489
     Block shifting parameters
     (0,0) -> (398.71486,-499.98997)
     (0,1) -> (398.71872,-497.99145)
     (1,0) -> (396.71634,-499.98611)
     Block creation point 150.25025,199.975575
     Insertion point -0.36109,-198.939574
     Scale  = 1.99853
     Rotation = 089 53 22  (Counter Clockwise)
     Typical shift applied -150.61134,-398.91515
SCC for Windows v7.8.11  7 Parameter Transformation report
No  Station  Obs     aX          aY        aZ         bX          bY        bZ
--- -------- --- ----------- ----------- -------- ----------- ----------- --------
  0 STND       0     300.000     100.000   10.000     200.023     100.000   20.000
  1 STNC       0     400.000     100.000   10.000     200.000     300.005   25.000
  2 STNB       0     400.000     150.000   15.000     101.010     300.000   30.000
  3 STNA       0     300.000     150.000   15.000      99.968      99.897   25.000
Coordinate residuals
No  Station  Obs     dX          dY        dZ      dDist(2d)   dDist(3d)
--- -------- --- ----------- ----------- -------- ----------- -----------
  0 STND       0      0.1334      0.0846  -0.0173      0.1579      0.1589
  1 STNC       0      0.5918     -0.2313  -0.0228      0.6354      0.6358
  2 STNB       0     -0.6659     -0.1335   0.0173      0.6791      0.6793
  3 STNA       0     -0.0593      0.2802   0.0228      0.2864      0.2873
Shifts  X:399.345  Y:-499.168  Z:-5.081
Rotation X:002 49 53  Y:001 25 58  Z:089 52 30
Scale:0.50061033
```

15.4 National Grid Transformations

Support has been added for national grid transformations between ITM, Irish Grid, OSGB36 and ETRS89. These transformations utilise Grid Inquest software provided by Quest Geo Solutions.



16 Alignments

16.1 Entering & Importing Data Into An Alignment

The following briefly examines some of the features within SCC Alignment Module.

In short, SCC Alignment Modules allows for:

- the importing of alignment information from MX
- the importing of horizontal and vertical geometry information from MX
- the importing of horizontal and vertical intersection points from DOER
- the generation of intersection point information from the horizontal and vertical geometry

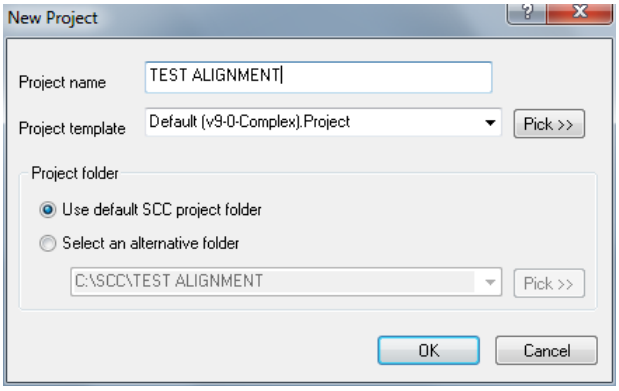
16.1.1 Getting Alignment Data From MFW into SCC

Import MX GENIO Geometry strings

Set up Project

Open a 'New Project' and attach the 'Default(v9-0-Complex).Project' template.

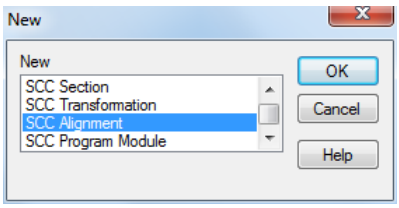
Call the project 'Test Align'.



Import MX Alignment

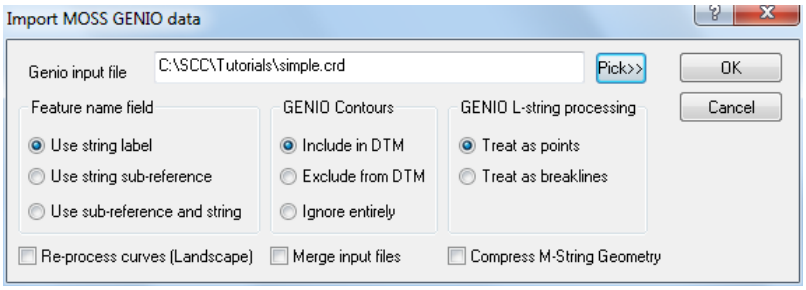
Open a blank Alignment file

Go to 'File > New > SCC Alignment'



A blank horizontal intersection sheet is opened. The alignment information is imported into this SCC alignment file.

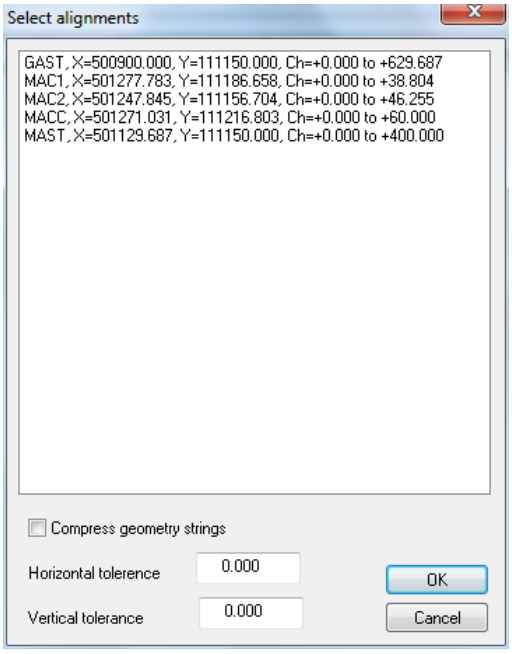
Go to 'FILE > Import > MX GENIO Geometry strings'



Go to the Tutorials directory and select the GENIO file 'SIMPLE.CRD'

This file contains horizontal and vertical geometry information.

The 'Select Alignments' dialog allows the user to select a specific alignment present in the input file



Select ' GAST' and 'OK'

The horizontal entities sheet is opened and the imported information displayed.

	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Straight	501517.000	111232.000	0.000	203 18 00	12.639	0.000	0.000
2	2	Spiral In	501505.392	111227.001	12.639	203 18 00	100.457	700.000	1000000000.000
3	3	Circular Arc	501412.225	111189.492	113.096	199 11 19	184.206	700.000	700.000
4	4	Spiral Out	501232.334	111152.402	297.302	184 06 41	100.457	700.000	1000000000.000
5	5	Straight	501131.928	111150.000	397.759	180 00 00	231.928	0.000	0.000

Go to ‘VIEW > Vertical Entities’

	No.	Type	Chainage(1)	Length	Base Level	Gradient	Grade Diff.
1	1	Straight	10.000	0.000	47.040	+1:14.3	0.0
2	2	V.Curve	10.000	76.960	47.040	+1:14.3	-1:148.8
3	3	Straight	86.960	-0.000	52.686	+1:13.0	0.0
4	4	V.Curve	86.960	148.235	52.686	+1:13.0	+1:472.2
5	5	Straight	235.195	0.000	63.902	+1:13.4	0.0
6	6	V.Curve	235.195	118.459	63.902	+1:13.4	+1:65.2
7	7	Straight	353.654	-0.000	71.831	+1:16.9	0.0
8	8	V.Curve	353.654	46.346	71.831	+1:16.9	+1:107.9
9	9	Straight	400.000	0.000	74.363	+1:20.0	0.0

Save the alignment as ‘GAST.ALIGNMENT’.

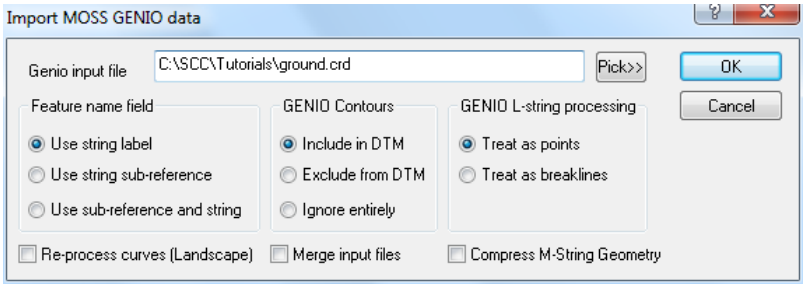
16.1.2 Attaching an Alignment To A Model

Create the MX Model

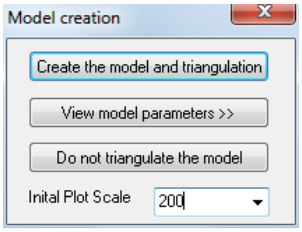
Go to ‘FILE > Model > MX GENIO file’.

Select the file ‘GROUND.CRD’ from the TUTORIALS directory

Set the Feature Name field to ‘Use string label’, the GENIO Contours to ‘Ignore’ entirely and GENIO L-string processing to ‘Treat as points’.

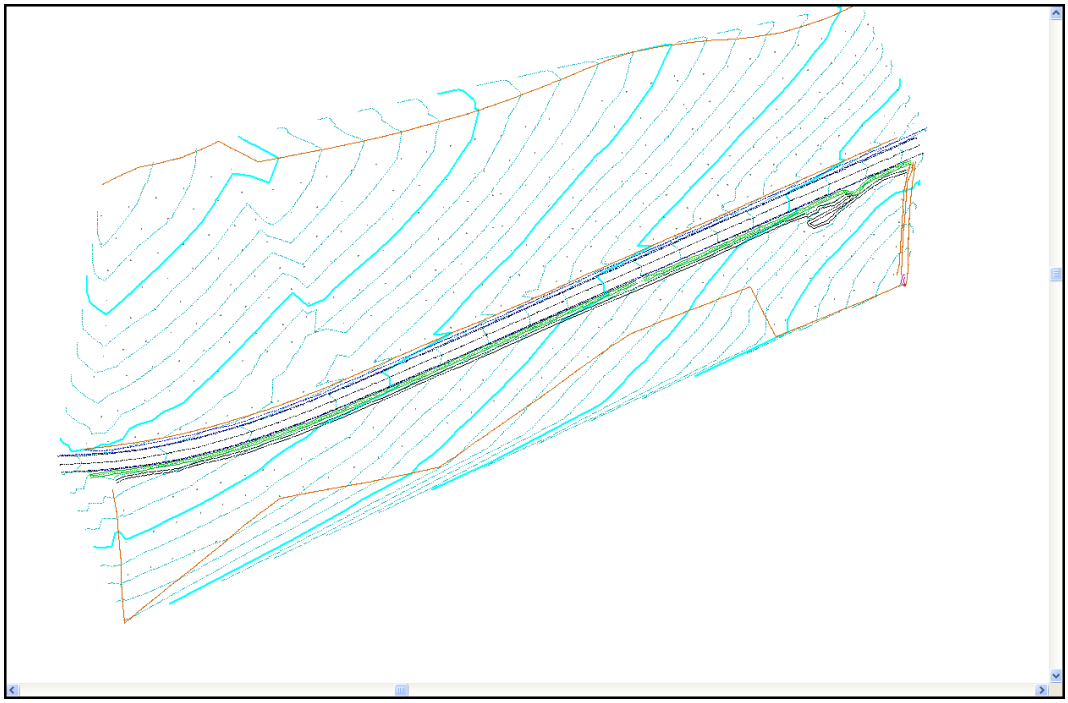


Select 'OK'



Set the Initial Plot Scale as '200'

Select 'Create the model and triangulation'



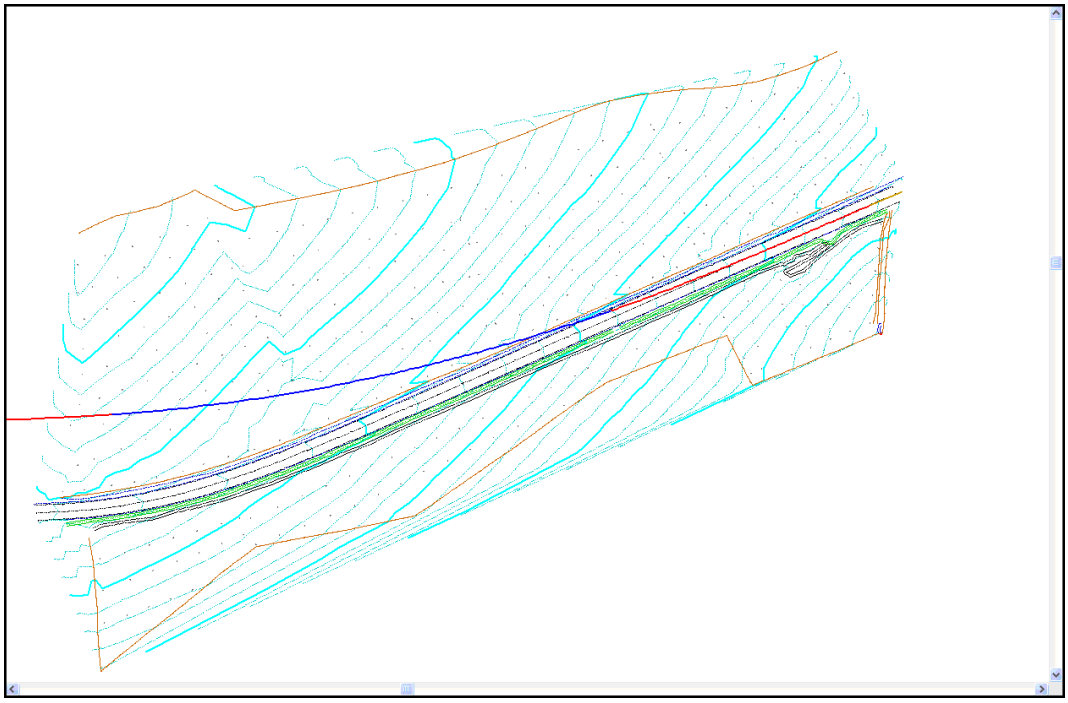
Go to 'File > Save'

Save the model as 'Ground.Model'

Attaching MX Alignment

Within the ground model, 'select 'FILE > Attach/Detach > Attach Alignment File'

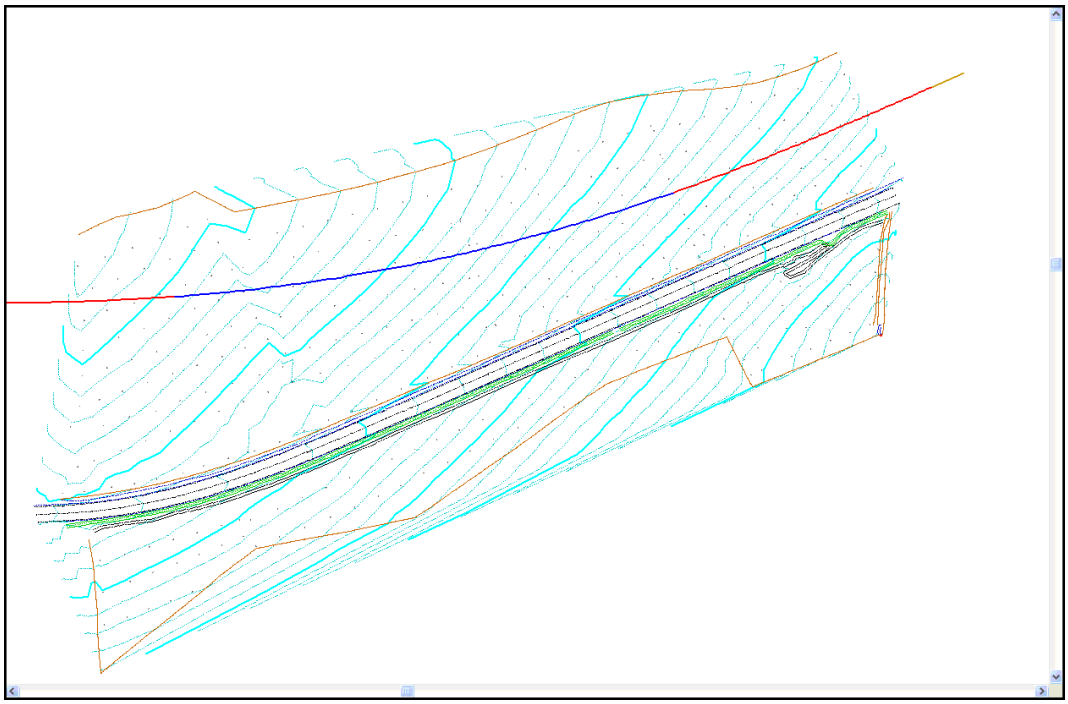
Select 'GAST.ALIGNMENT'



16.1.3 Interactively Editing The Alignment

Within 'SIMPLE.Alignment', select 'DESIGN > Move Alignment'

Click on alignment string with the left mouse button and interactively move the alignment.



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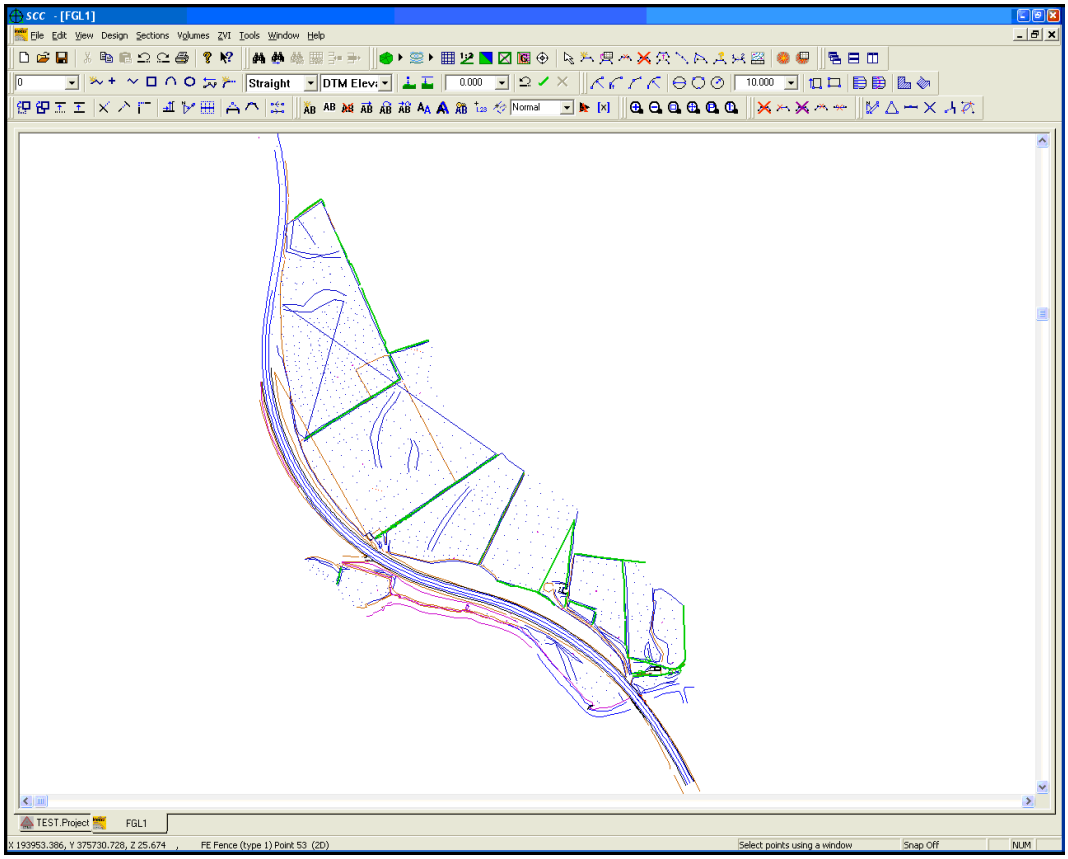
16.1.4 Typing Horizontal Intersection Points

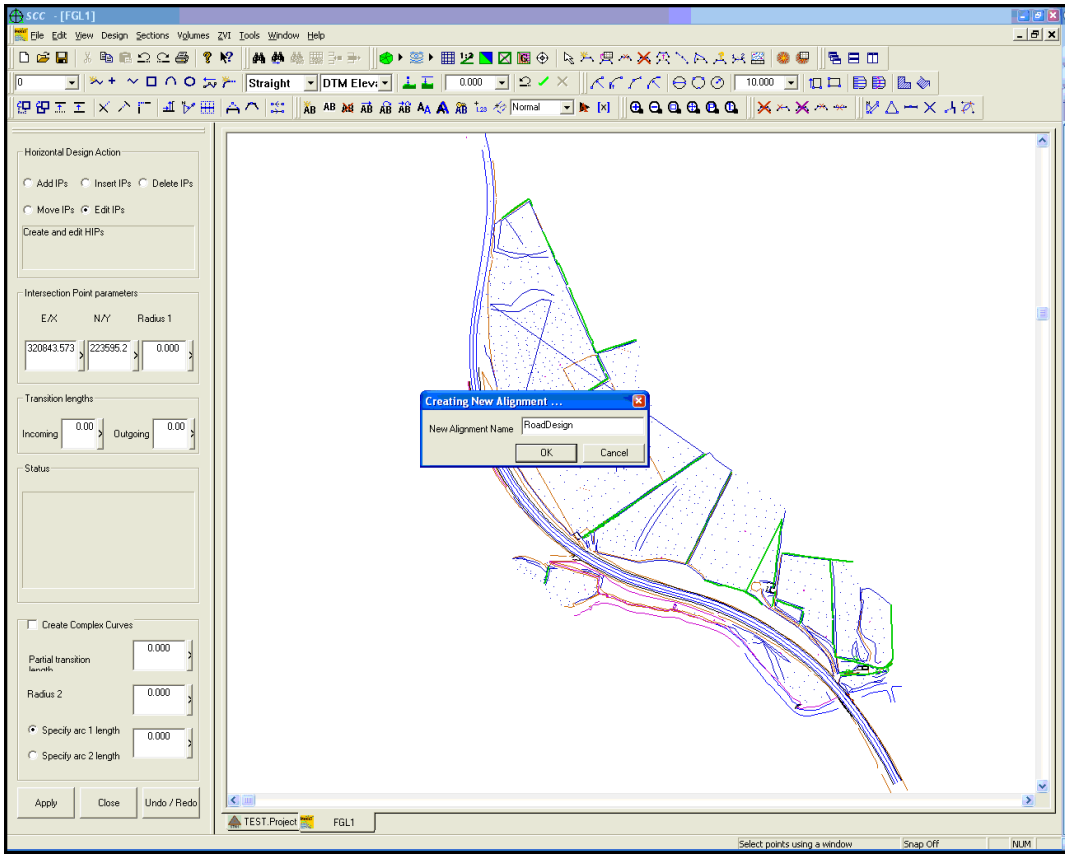
Open 'FGL.Model' from the tutorials directory.



Horizontal Intersection Points

Go to 'Design > Horizontal Alignment'

Call the new alignment 'RoadDesign.Alignment'.



The horizontal intersection point information is in a text file. This text file, 'HIPs.txt' can be found in the '\SCC\Tutorials\' directory. Open it in the text editor and print it.

Horizontal Intersection Points

Transition Lengths

E/X	N/Y	Radius 1	Incoming	Outgoing
193606.497	375687.288	0	0	0
193612.146	375437.006	400	100	100
193769.208	375136.441	300	100	100
194053.388	375030.792	0	0	0

There are 4 intersection points in this file. The Easting, Northing, and chainage of each point are defined along with the length of the radius and incoming and outgoing transitions.

Set the Horizontal Design Action to 'Add IPs'

Turn Off 'Create Complex Curves' option

Type in the information for each of the four intersection points.

(E/X value, N/Y value, Radius 1, Incoming and Outgoing Transition Lengths)

After each point is entered select 'Add HIP' at the bottom of the dialog to add the intersection point to the alignment.

Select 'Close' after last intersection point

(By pressing the tab button, the cursor will jump to each entry box in order).

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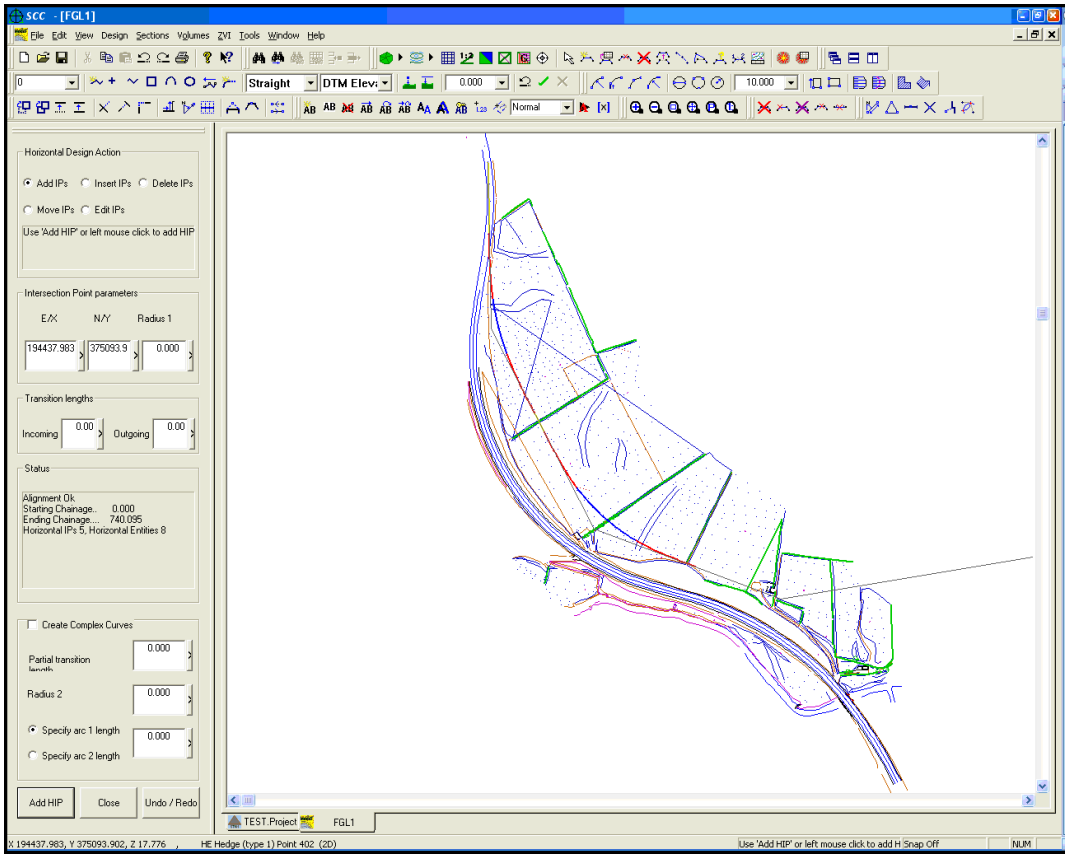


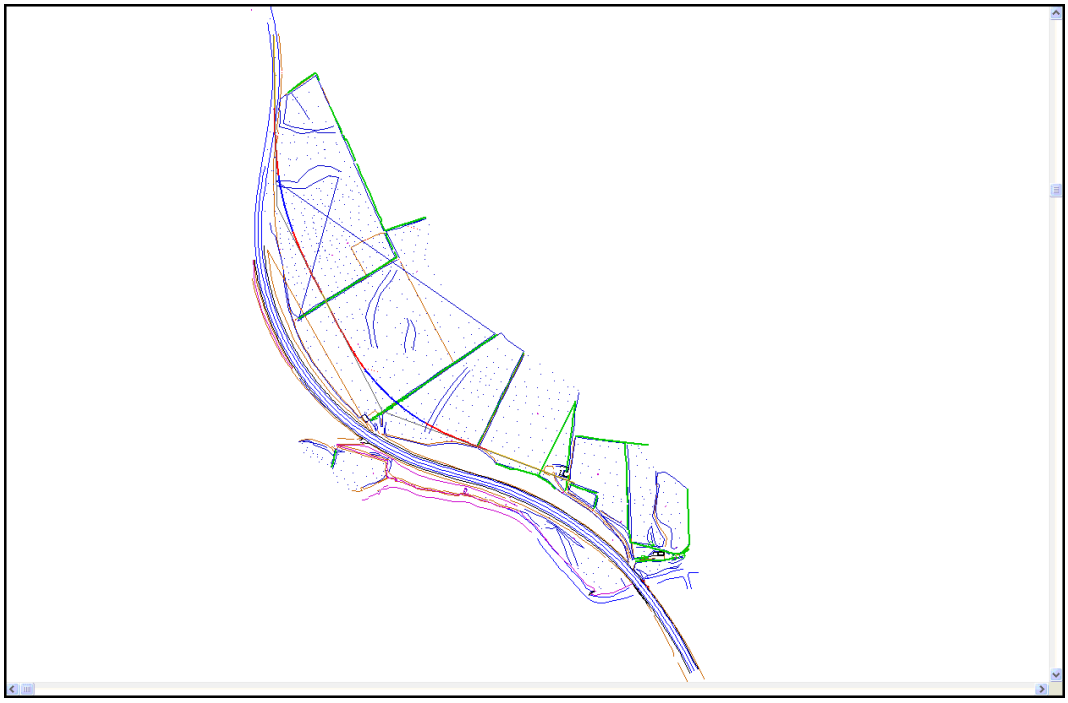
To view the horizontal intersection points,

Go to 'Design >View design sheet', then select 'Horizontal Intersection Points'.

	No.	-E/X-	-N/Y-	R1	Spiral In	Spiral Out	R2	Pivot
1	2	193606.497	375687.288	0.000	0.000	0.000	0.000	Centre
2	3	193612.146	375437.006	400.000	100.000	100.000	400.000	Centre
3	4	193769.208	375136.411	300.000	100.000	100.000	300.000	Centre
4	5	194053.388	375030.792	0.000	0.000	0.000	0.000	Centre

Save the alignment as 'RoadDesign.Alignment'

The finished horizontal alignment is shown in the diagram below.



16.1.5 Typing Vertical Intersection Points

Before creating the vertical alignment, ensure that the horizontal alignment has been created.

The vertical intersection point data can be found in the '\SCC\Tutorials' directory.

The file 'VIPs.txt' can be printed using Word or Notepad and contains all the necessary information to define a vertical alignment.

Vertical Intersection Points

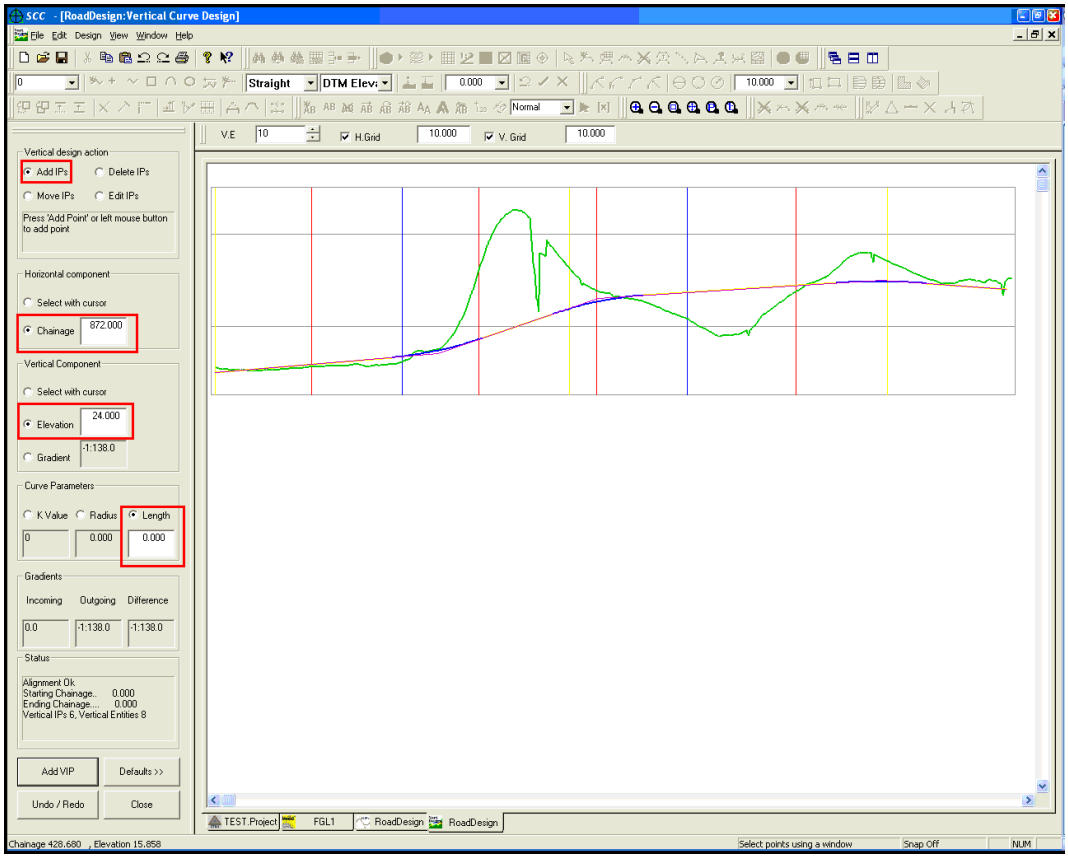
Chainage	ElevationN/Y	Length
0	15.00	0
245	17.00	100
422	23.00	100
734	25.00	100
872	24.00	0

Continuing from the Design above:

Select 'RoadDesign.Alignment' created in the earlier tutorial

From the model window, go to 'DESIGN >Vertical Alignment'

On the top menu bar set the 'V.E' or 'vertical exaggeration' to 10



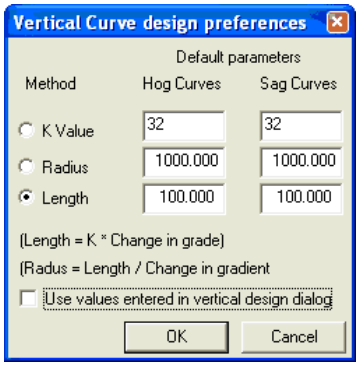
Set the 'Vertical Design Action' to 'Add IPs'

Select 'Chainage' as the 'Horizontal Component'

Select 'Elevation' as the 'Vertical Component'

Select the 'Defaults>>' option

Ensure that the method is set to 'length'



Enter '100.00' as the default values

Turn off the option to 'use values entered in vertical design dialog'

Press 'OK'

Select 'Length' as the 'Curve Parameter'.

Type in the 'Chainage', 'Elevation' of each vertical intersection point

Select 'Add VIP' at the bottom of the dialog after each vertical intersection point

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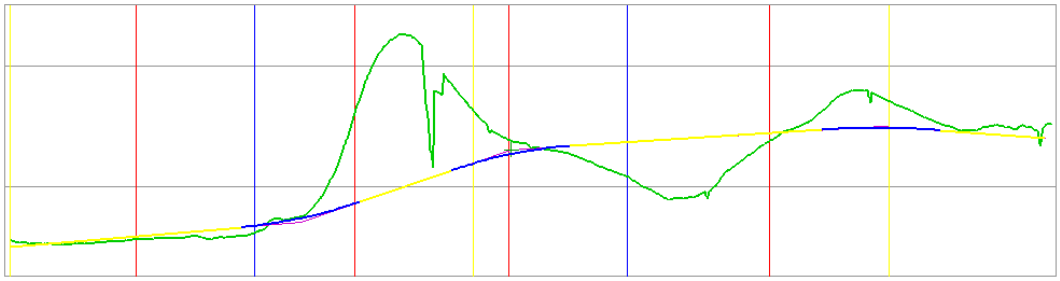
The default length value of ‘100.00’ will be used to calculate the curve parameters.

The finished vertical design is displayed in the diagram below.



16.1.6 Creating Mulit-Surface Section

Applying a Second Surface to a Section Template

Having designed a horizontal and vertical alignment and a standard section template, one can now add additional surfaces to a section template.

Open the existing section template from the model ‘Design > Section template’

Select ‘New Surface’ from bottom of the side menu bar

Set up the following surfaces:

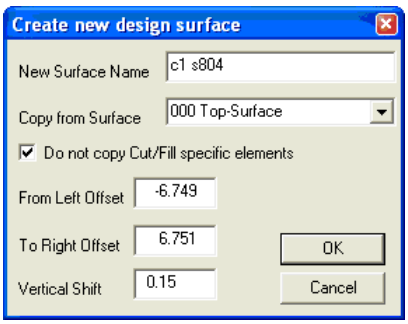
45mm Hot Rolled Asphalt Wearing Course to cl. s905
55mm Dense Bitumen Macadam Base Course to cl. s902
120mm Dense Bitument Macadam Road Base to cl. s812
150mm Minimum Granular Material Type B Sub-Base to cl 804

Within Create New Surface dialog enter surface Name ‘c1 s804’

Set ‘000 Top Surface’ as Copy from Surface

Select ‘Do not copy Cut/Fill specific elements’

Accept default ‘From Left Offset’ and ‘To Right Offset’

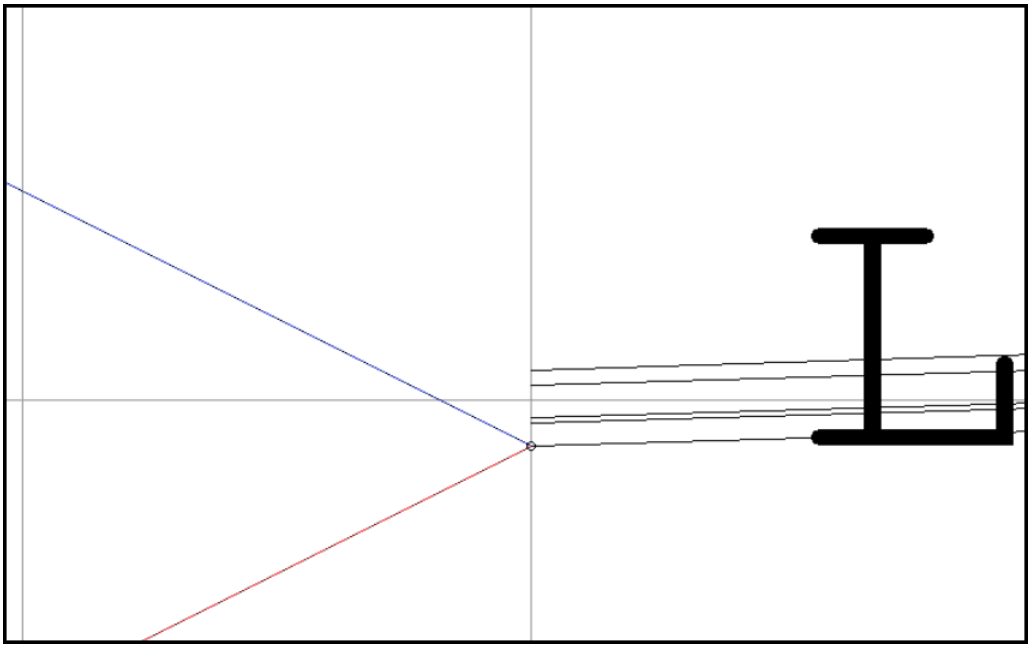


Enter the relevant ‘Vertical Shift’

Select ‘OK’

Repeat the above steps for ‘c1 s902’, ‘c1 s812’ and ‘c1 905’

Use the Zoom Functions to see the additional new surfaces.



16.2 Section Template Design On A MX Alignment

The following examines importing and modelling of MX GENIO strings into SCC. In turn allowing for the attachment of alignment data and subsequent section template design. Long Sections and Cross Sections are considered as a quality assurance means of examining the Section Template.

MX GENIO Alignment

Opening Project

Select 'FILE > Open'

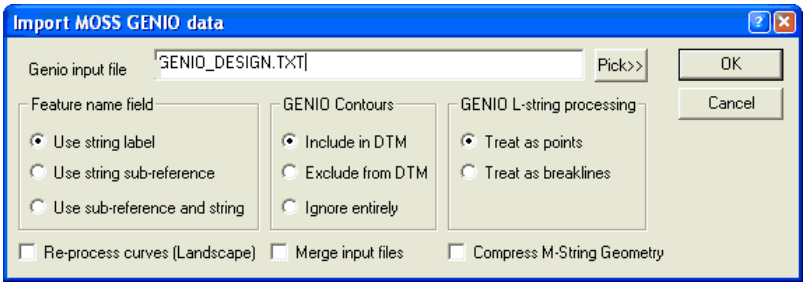
Select 'Genio-S.Project

Modeling MX GENIO File

Go to 'FILE > Model > MX GENIO file'

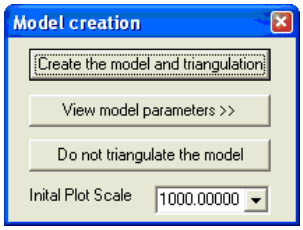
Select the file 'GENIO_DESIGN.txt'

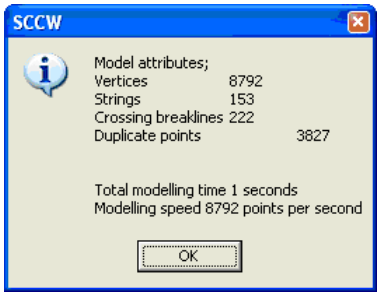
Set the Feature Name field to 'Use string label', the GENIO Contours to 'Ignore' entirely and GENIO L-string processing to 'Treat as points'.

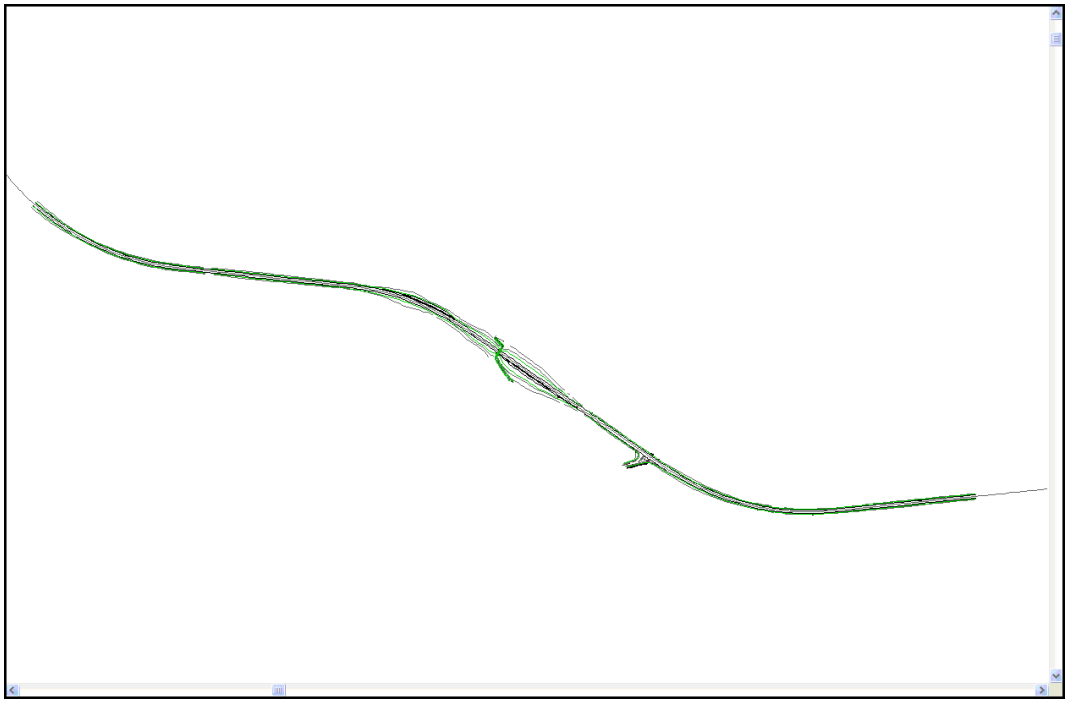


Select 'Create the model and triangulation'

Select 'OK'



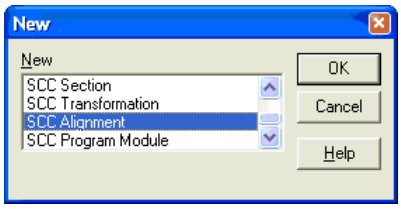




Go to 'FILE > Save As > GENIO_DESIGN.Model'

Taking MfW Geometry strings into SCC

Go to 'FILE > New > SCC Alignment'



A blank horizontal intersection sheet is opened. The alignment information is imported into this SCC alignment file.

Go to 'FILE > Import > MX GENIO Geometry strings'

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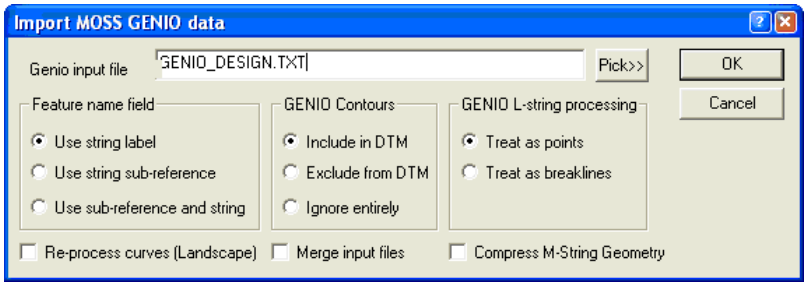
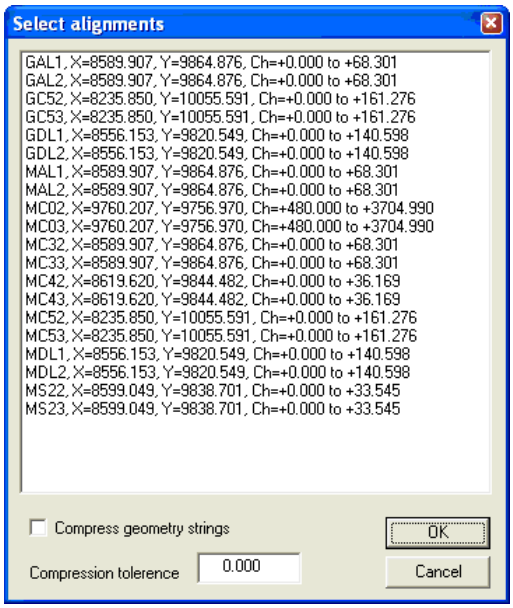


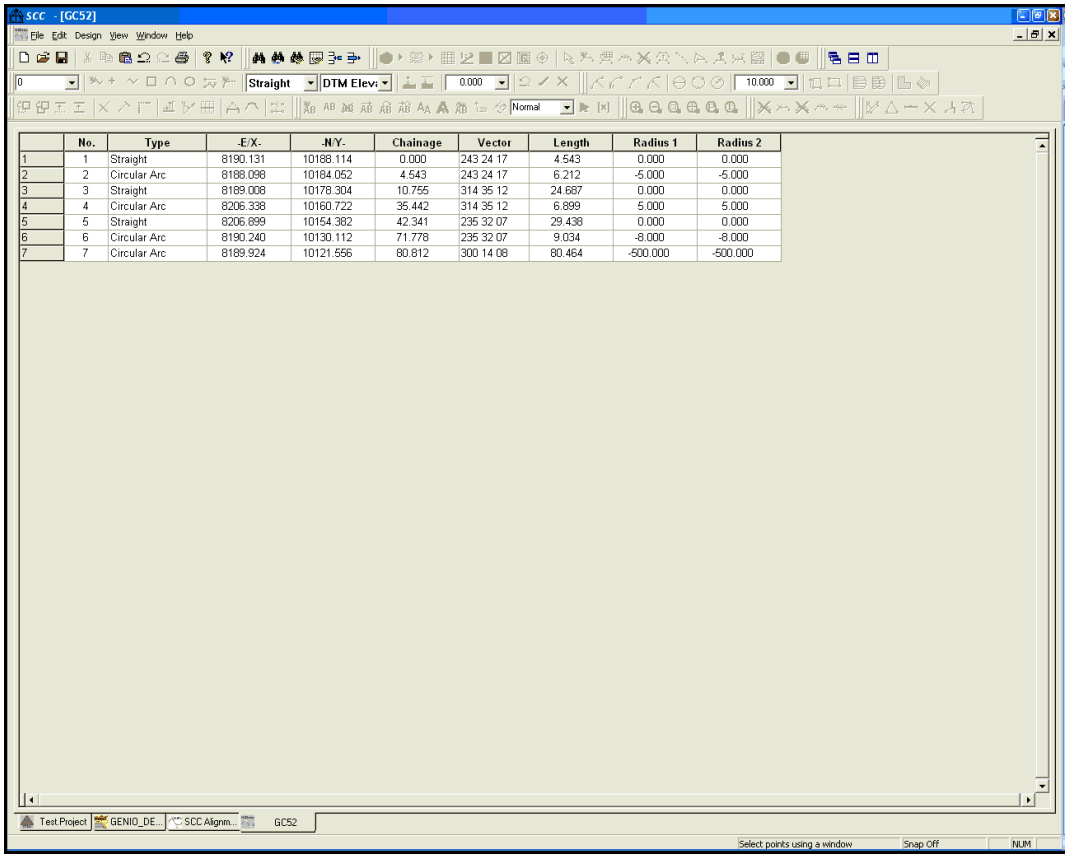
Select the file 'GENIO_DESIGN.txt'

Set the Feature Name field to 'Use string label', the GENIO Contours to 'Ignore' entirely and GENIO L-string processing to 'Treat as points'.



Select 'GC52.Alignment'

Alignment files contain horizontal and vertical geometry information. The horizontal entities sheet is opened and the imported information displayed.



	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Straight	8190.131	10188.114	0.000	243 24 17	4.543	0.000	0.000
2	2	Circular Arc	8188.098	10184.052	4.543	243 24 17	6.212	-5.000	-5.000
3	3	Straight	8189.008	10178.304	10.755	314 35 12	24.687	0.000	0.000
4	4	Circular Arc	8206.338	10160.722	35.442	314 35 12	6.899	5.000	5.000
5	5	Straight	8206.899	10154.382	42.341	235 32 07	29.438	0.000	0.000
6	6	Circular Arc	8190.240	10130.112	71.778	235 32 07	9.034	-8.000	-8.000
7	7	Circular Arc	8189.924	10121.556	80.812	300 14 08	80.464	-500.000	-500.000

Save As 'GC52.Alignment'.

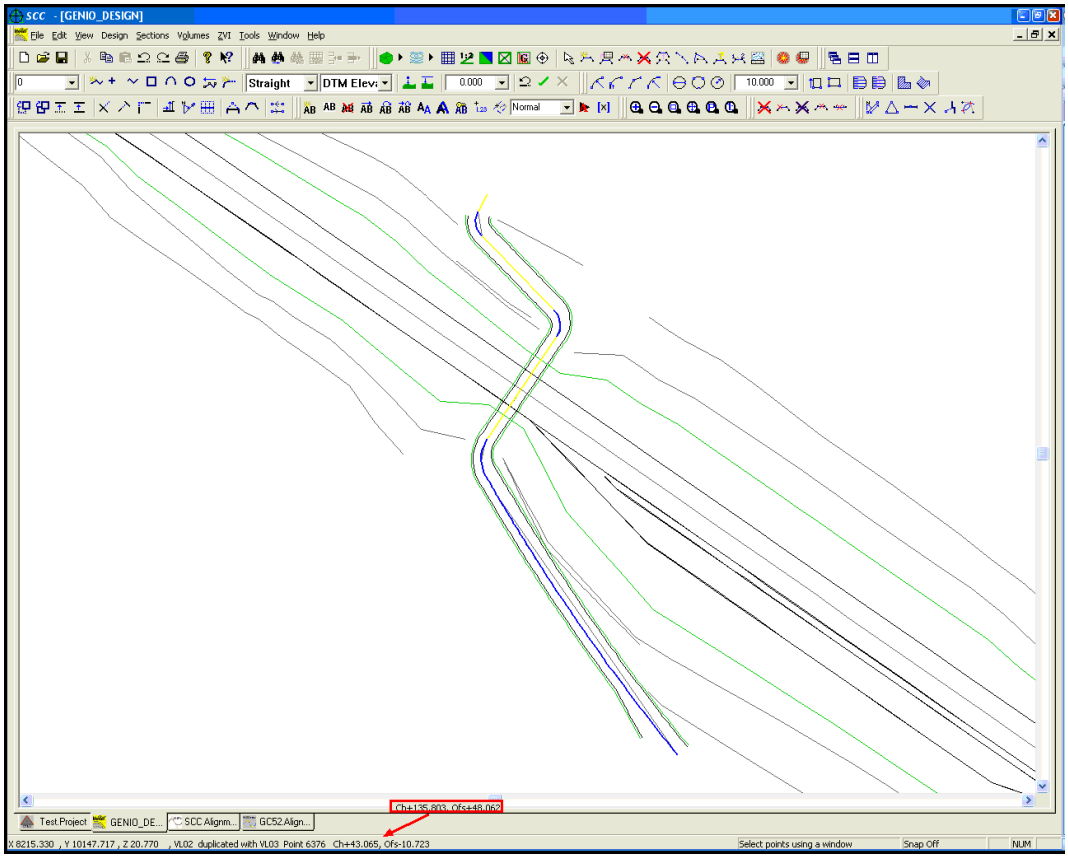
Attaching an Alignment to a Model

Go to ‘GENIO_DESIGN.Model’

Select ‘FILE > Attach/Detach > Attach an alignment file’

Select the alignment'GC52.Alignment

Note by holding the ‘Ctrl’ key allows the user to select several alignment files together

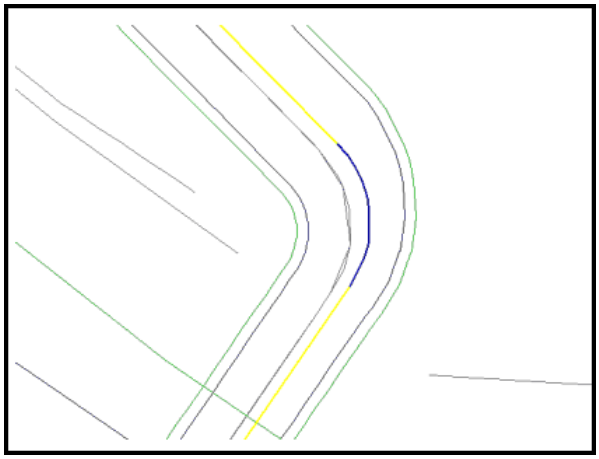


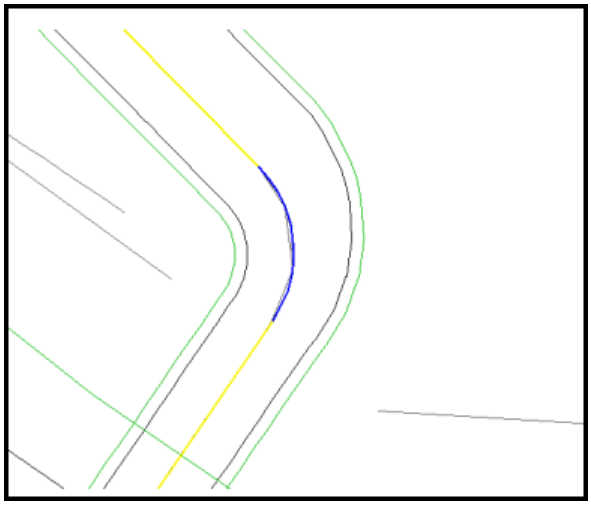
If we examine 'GC52.Alignment' note that the chainage system is available on the bottom toolbar as the cursor is moved along the alignment.

The option to Move/Edit Alignment under the 'Design Menu' is automatically activated.

Within 'GENIO_DESIGN.Model', select 'DESIGN > Move Alignment'

Click on alignment string with the left mouse button and interactively move the alignment.





Original Horizontal Entities

	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Straight	8190.131	10188.114	0.000	243 24 17	4.543	0.000	0.000
2	2	Circular Arc	8188.098	10184.052	4.543	243 24 17	6.212	-5.000	-5.000
3	3	Straight	8189.008	10178.304	10.755	314 35 12	24.687	0.000	0.000
4	4	Circular Arc	8206.338	10160.722	35.442	314 35 12	6.899	5.000	5.000
5	5	Straight	8206.899	10154.382	42.341	235 32 07	29.438	0.000	0.000
6	6	Circular Arc	8190.240	10130.112	71.778	235 32 07	9.034	-8.000	-8.000
7	7	Circular Arc	8189.924	10121.556	80.812	300 14 08	80.464	-500.000	-500.000

Automatically updated Horizontal Entities after Alignment was moved within Model

	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Straight	8190.759	10188.197	0.000	243 24 17	4.543	0.000	0.000
2	2	Circular Arc	8188.726	10184.135	4.543	243 24 17	6.212	-5.000	-5.000
3	3	Straight	8189.636	10178.387	10.755	314 35 12	24.687	0.000	0.000
4	4	Circular Arc	8206.966	10160.805	35.442	314 35 12	6.899	5.000	5.000
5	5	Straight	8207.527	10154.465	42.341	235 32 07	29.438	0.000	0.000
6	6	Circular Arc	8190.868	10130.195	71.778	235 32 07	9.034	-8.000	-8.000
7	7	Circular Arc	8190.552	10121.639	80.812	300 14 08	80.464	-500.000	-500.000

Typing in Section Template Points

The section template design for this tutorial is ‘SectionTemplate.Model’.

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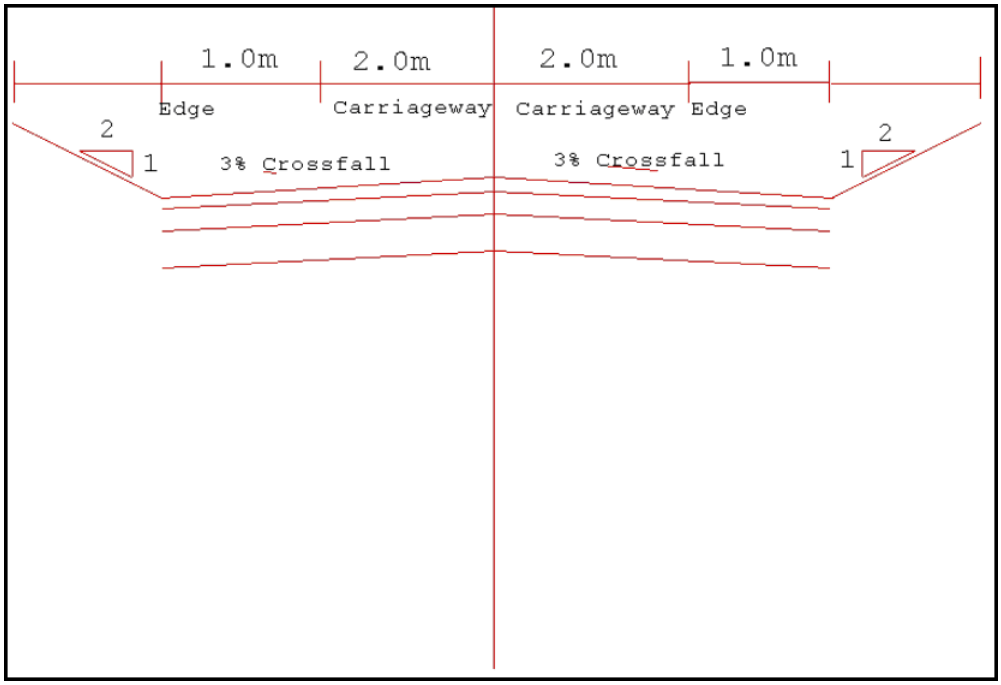


It contains the width and cross fall of each element in the template

Revert back to 'GENIO_DESIGN.Model' which has the unedited 'GC52.Alignment' attached.

Go to 'Design > Section Templates'.

Set the 'Template Design Action' to 'Add Points'.

Set Apply to 'Cut and Fill'

Set the 'Horizontal Component' to 'Width' and the 'Vertical Component' to 'Gradient'.

Set the Units of measurement for gradients to Percentage %

Ensure that the 'Unit for Gradients' is set to 'percentage %' within 'FILE >General Options > Units and Data Checking' section.

Centre Line:

Set the 'Surface' to 'TopSurface' and the Feature 'CL'

Enter a value of '0.00' for the 'horizontal and vertical component.

Leave the 'interface side slopes' turned 'off'

Select 'Add Point'

All horizontal components to the right of the centre line are positive, while all the horizontal components to the left are negative.

RHS001:

Select 'Feature > RHS001'

Set the 'width > 2.00' and the 'gradient > –3'.

'Turn on' 'Right Interface slope' and set the 'Gradient > 50%'.

Select 'Add Point'

R-EDGE:

Select ‘Feature > R-EDGE’

Set the ‘width > 1.00’ and the ‘gradient > –3’.

‘Turn on’ ‘Right Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

LHS001:

Select ‘Feature > LHS001’

Set the ‘width > -2.00’ and the ‘gradient > –3’.

‘Turn on’ ‘Right Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

L-EDGE:

Select ‘Feature > L-EDGE’

Set the ‘width > -1.00’ and the ‘gradient > –3’.

‘Turn on’ ‘Right Interface slope’ and set the ‘Gradient > 50%’.

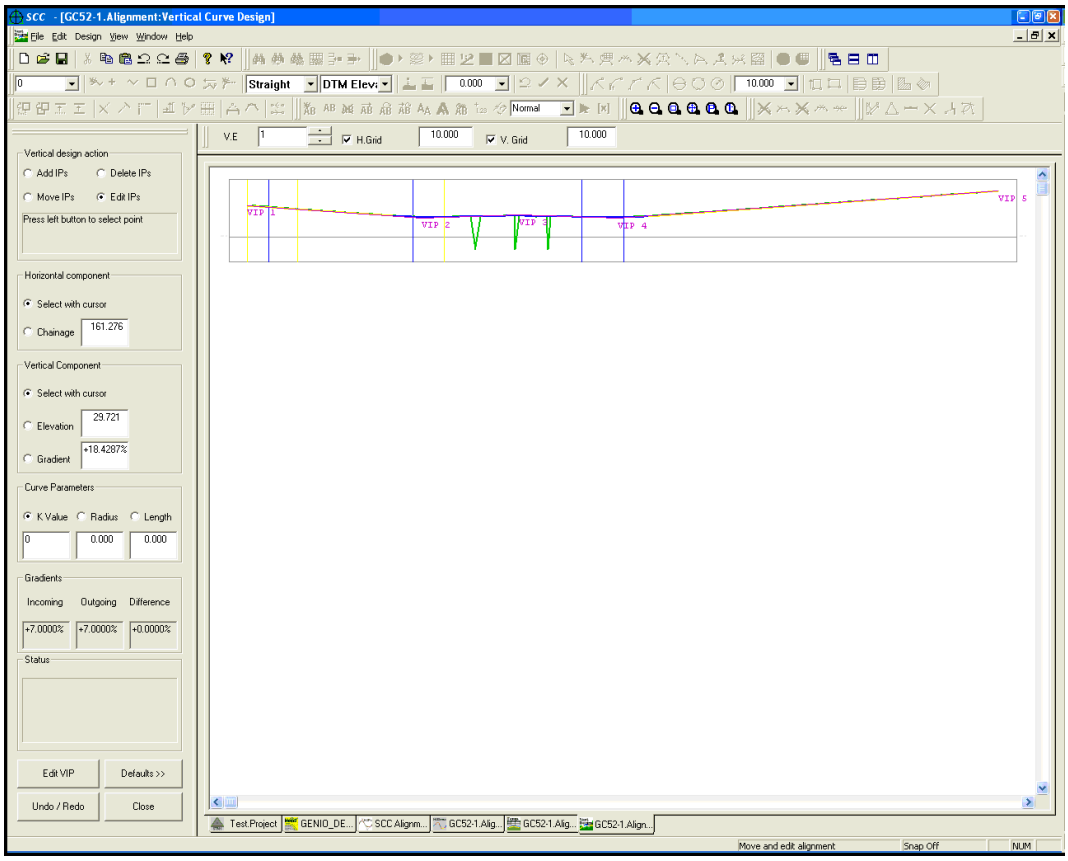
Select ‘Add Point’

The Section Template should be automatically updated within the Model ‘ GENIO_DESIGN.Model’ which has the alignment attached.

However, in this instance no such update take places. Therefore further investigation of the Vertical Alignment is necessary.

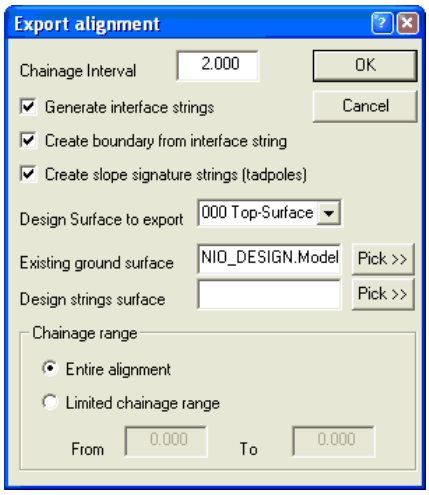
Within ‘GENIO_DESIGN.Model’ which has the ‘GC52.Alignment’ attached.

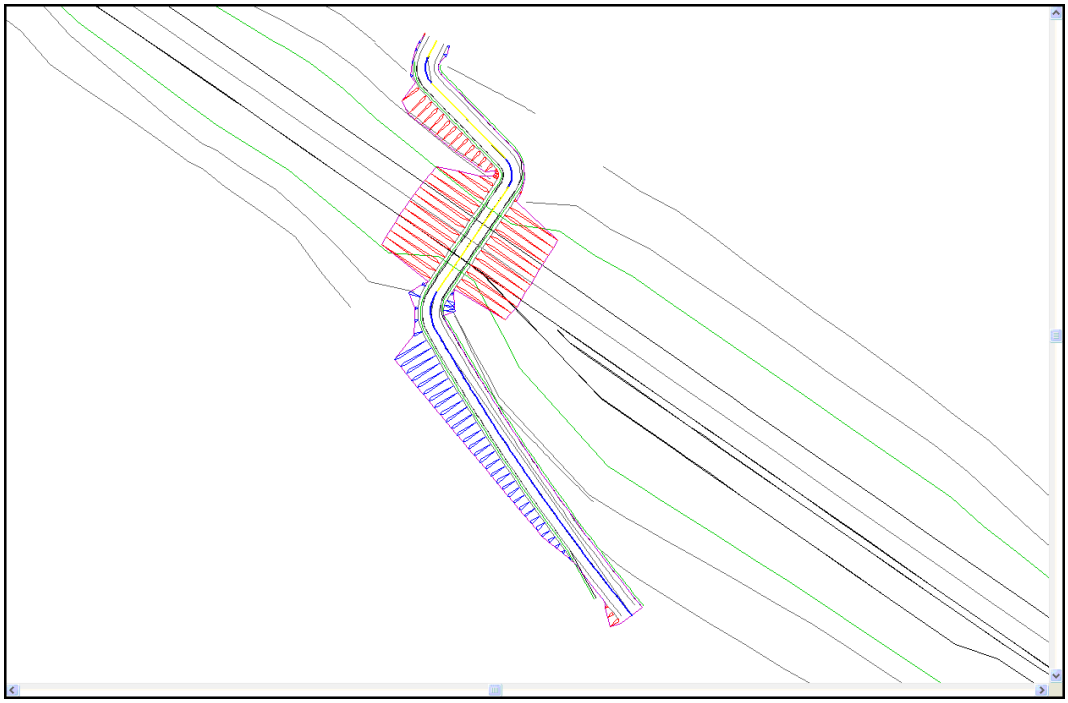
Go to ‘Design > Vertical Alignment’



Select 'DESIGN > Interface And Export Parameters…'

Set up the parameters as follows:





It is clear that one single Section Template is not satisfactory for this Road.

As the Road incorporates a Bridge Crossing it is perhaps more feasible to have a Section Template specifically for this area. In other words a section template, which does not have any side slopes.

Note also that from the contours one can deduce there is a need for string editing.

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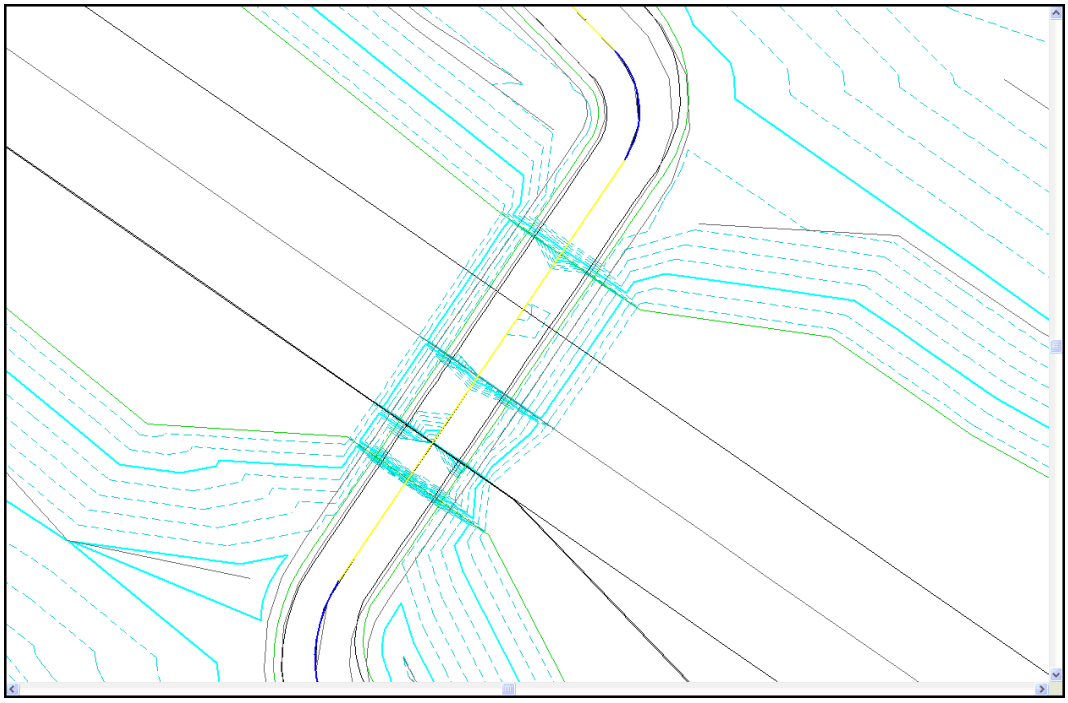


New Section Templates

Within 'GENIO_DESIGN.Model' place the cursor over the bridge edges in order to obtain Chainage Values (bottom toolbar) to begin Second and Third Section Templates

Go to 'Design > Section Templates'.

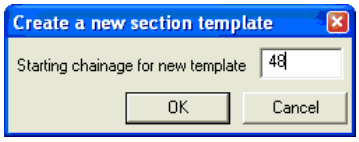
As before Set the 'Template Design Action' to 'Add Points'.

Set Apply to 'Cut and Fill'

Set the 'Horizontal Component' to 'Width' and the 'Vertical Component' to 'Gradient'.

Set the Units of measurement for gradients to Percentage %

Select 'New Surface' from the bottom left of the screen



Enter the new template starting chainage '48.00'

Unselect 'Left Interface Side Slope' and 'Right Interface Side Slope'

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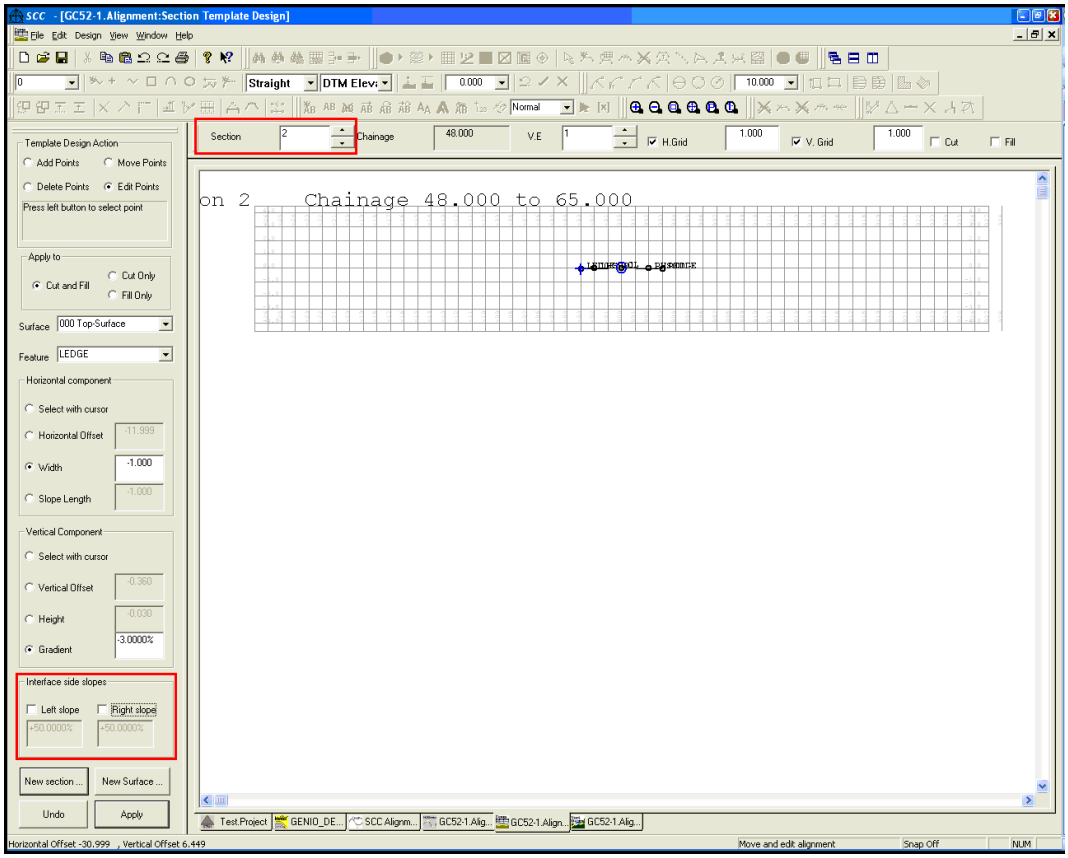
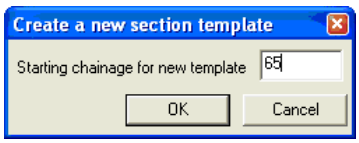
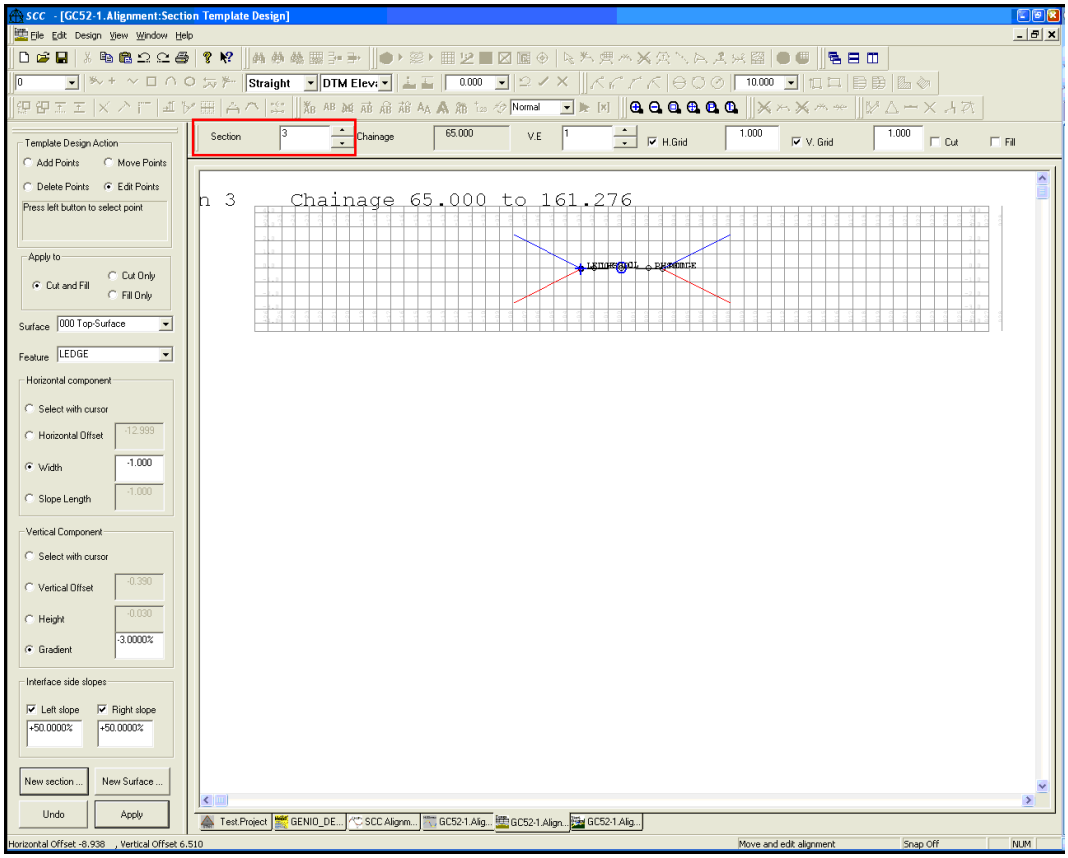


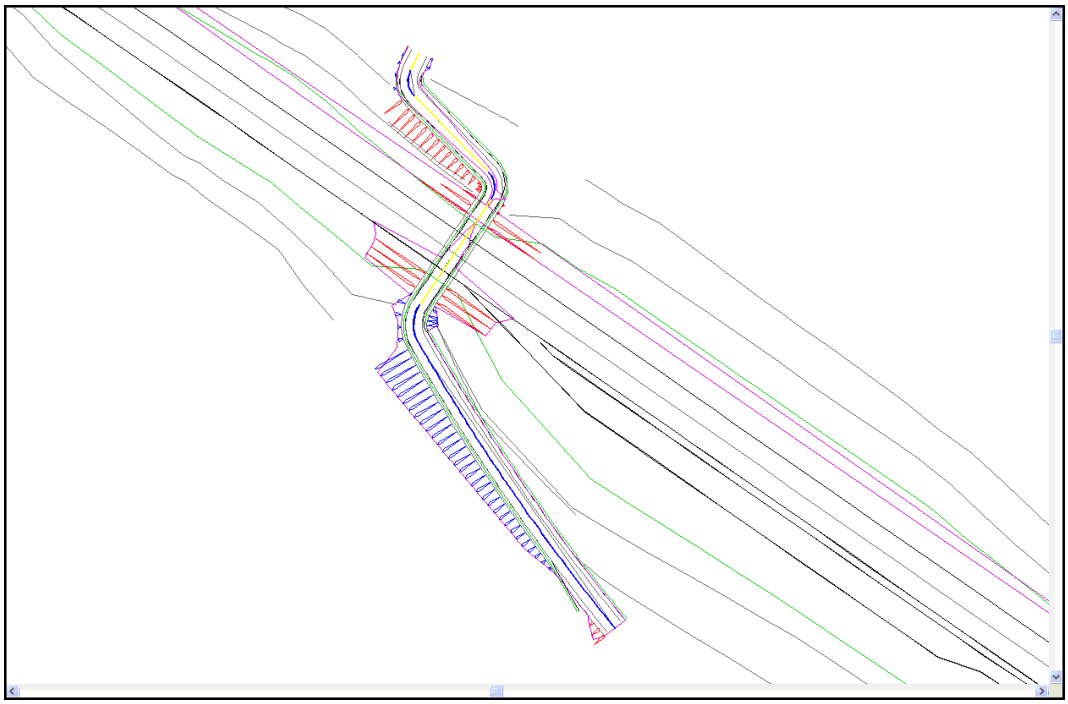
Select 'New Surface' from the bottom left of the screen



Enter the new template starting chainage '65.00'

Select 'Left Interface Side Slope' and 'Right Interface Side Slope' of 50%



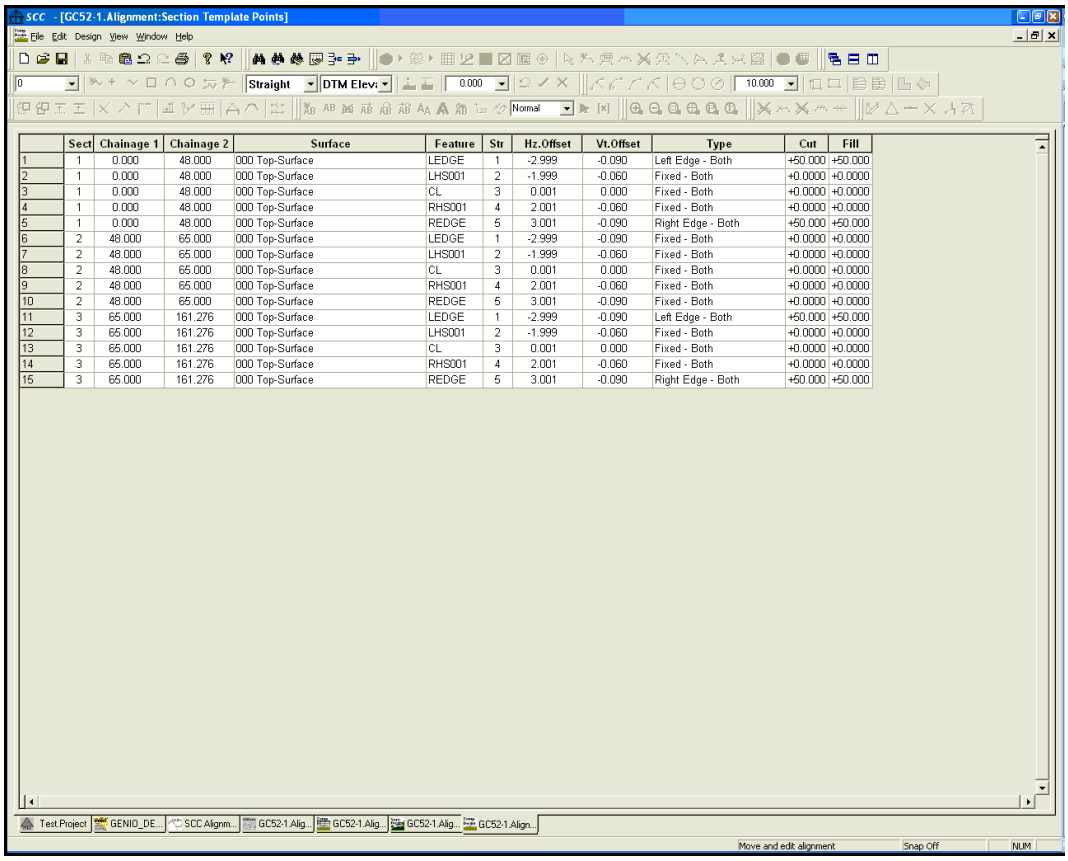


Once the section Template has been created further editing can be carried out with the Design Sheet.

For instance, editing the starting chainage of a Section Template can be carried out as follows:

Editing Section Template Points

Within 'GENIO_DESIGN.Model' select 'DESIGN > View Design Sheet > Section Template Points'



	Sect	Chainage 1	Chainage 2	Surface	Feature	Str	Hz.Offset	Vt.Offset	Type	Cut	Fill
1	1	0.000	48.000	000 Top-Surface	LEDGE	1	-2.999	-0.090	Left Edge - Both	+50.000	+50.000
2	1	0.000	48.000	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
3	1	0.000	48.000	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
4	1	0.000	48.000	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
5	1	0.000	48.000	000 Top-Surface	REDGE	5	3.001	-0.090	Right Edge - Both	+50.000	+50.000
6	2	48.000	65.000	000 Top-Surface	LEDGE	1	-2.999	-0.090	Fixed - Both	+0.0000	+0.0000
7	2	48.000	65.000	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
8	2	48.000	65.000	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
9	2	48.000	65.000	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
10	2	48.000	65.000	000 Top-Surface	REDGE	5	3.001	-0.090	Fixed - Both	+0.0000	+0.0000
11	3	65.000	161.276	000 Top-Surface	LEDGE	1	-2.999	-0.090	Left Edge - Both	+50.000	+50.000
12	3	65.000	161.276	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
13	3	65.000	161.276	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
14	3	65.000	161.276	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
15	3	65.000	161.276	000 Top-Surface	REDGE	5	3.001	-0.090	Right Edge - Both	+50.000	+50.000

Changing Section Template 2 starting point from 48.00 to 43.00:

Select 'EDIT > Replace'

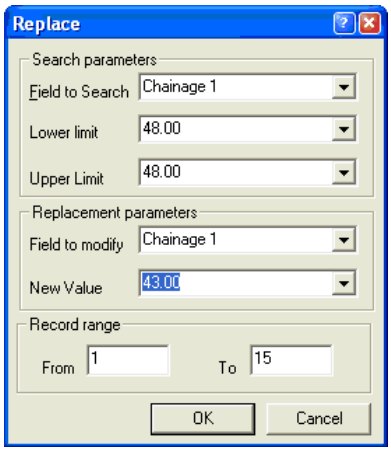
Within the Search Parameters, enter 'Field to Search' as 'Chainage 1'

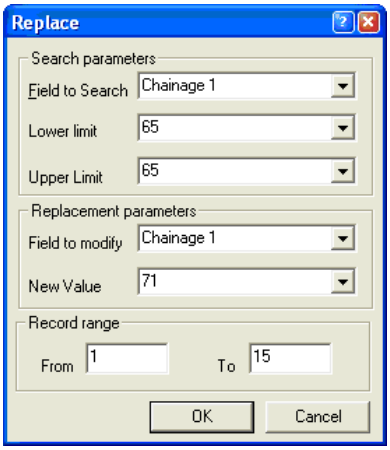
Enter existing value Lower and Upper Limit Values '48.00'

Within the 'Replacement Parameters' enter the 'Field to modify as 'Chainage 1'

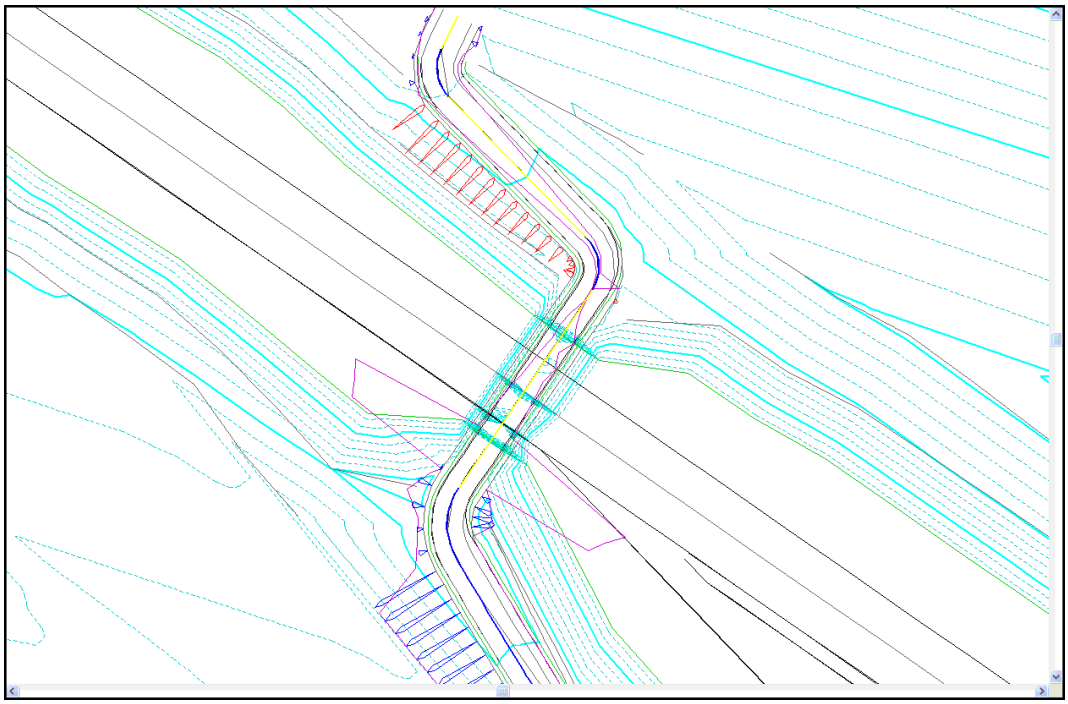
Enter 'New Value' as '43.00'4

The above commands are repeated to changing Section Template 3 starting point from 65.00 to 71.00:





	Sect	Chainage 1	Chainage 2	Surface	Feature	Str	Hz.Offset	Vt.Offset	Type	Cut	Fill
1	1	0.000	48.000	000 Top-Surface	LEDGE	1	-2.999	-0.090	Left Edge - Both	+50.000	+50.000
2	1	0.000	48.000	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
3	1	0.000	48.000	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
4	1	0.000	48.000	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
5	1	0.000	48.000	000 Top-Surface	REDGE	5	3.001	-0.090	Right Edge - Both	+50.000	+50.000
6	2	43.000	65.000	000 Top-Surface	LEDGE	1	-2.999	-0.090	Fixed - Both	+0.0000	+0.0000
7	2	43.000	65.000	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
8	2	43.000	65.000	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
9	2	43.000	65.000	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
10	2	43.000	65.000	000 Top-Surface	REDGE	5	3.001	-0.090	Fixed - Both	+0.0000	+0.0000
11	3	71.000	161.276	000 Top-Surface	LEDGE	1	-2.999	-0.090	Left Edge - Both	+50.000	+50.000
12	3	71.000	161.276	000 Top-Surface	LHS001	2	-1.999	-0.060	Fixed - Both	+0.0000	+0.0000
13	3	71.000	161.276	000 Top-Surface	CL	3	0.001	0.000	Fixed - Both	+0.0000	+0.0000
14	3	71.000	161.276	000 Top-Surface	RHS001	4	2.001	-0.060	Fixed - Both	+0.0000	+0.0000
15	3	71.000	161.276	000 Top-Surface	REDGE	5	3.001	-0.090	Right Edge - Both	+50.000	+50.000



Applying a Second Surface to a Section Template

Having a horizontal and vertical alignment and a standard section template, the user can now add additional surface to the section template.

The follow surfaces will be added to the Section Template:

45mm Hot Rolled Asphalt Wearing Course to cl. s905
55mm Dense Bitumen Macadam Base Course to cl. s902

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120mm Dense Bitument Macadam Road Base to cl. s812
150mm Minimum Granular Material Type B Sub-Base to cl 804

Revert to the 'Section Template Design'

Select 'New Surface'

Within Create New Surface dialog enter surface Name ‘c1 s804’

Set ‘000 Top Surface’ as Copy from Surface

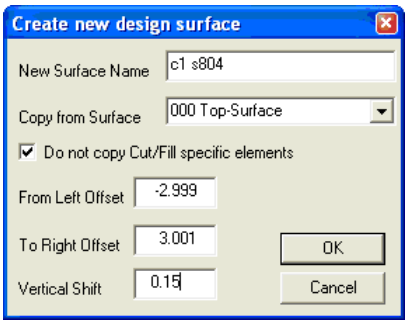
Select ‘Do not copy Cut/Fill specific elements’

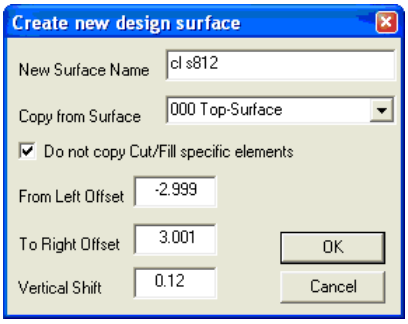
Accept default ‘From Left Offset’ and ‘To Right Offset’

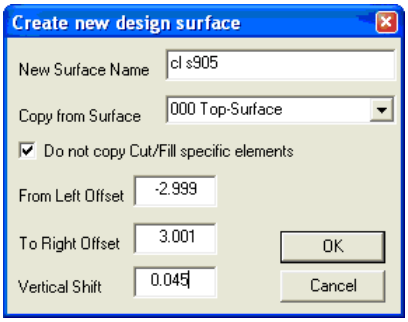
Enter the relevant ‘Vertical Shift’

Select ‘OK’

Repeat the above steps for ‘c1 s902’, ‘c1 s812’ and ‘c1 905’







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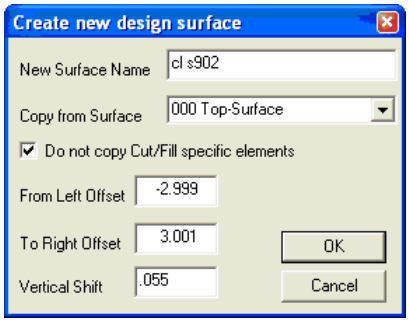
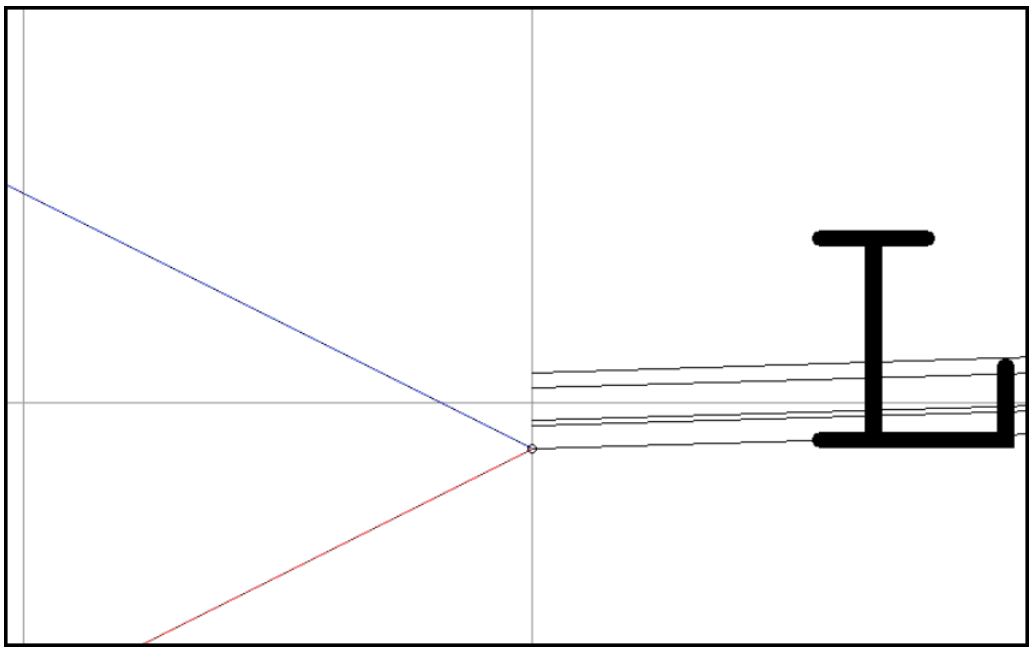


Use the Zoom Functions to see the additional new surfaces.



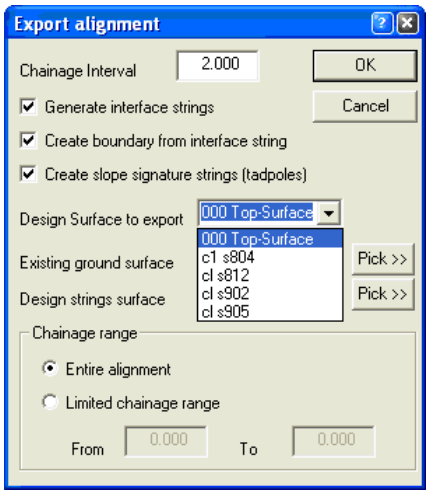
Exporting Surfaces from Section Template

Surface created within a Section Template can be export as dataset or as model.

Within 'GENIO_DESIGN.Model' which has the 'GC52.Alignment' attached.

Select 'DESIGN > Export design as model'

Set up the follow:



Set 'GENIO_DESIGN.Model' as the 'Existing Ground Surface'

Select surface from the 'Design Surface to export' Drop Down Menu

Save the Model

Repeat this step until all Surfaces are exported

'c1 804.Model', 'c1 s812.Model', 'c1s902.Model' and 'c1 s905.Model'

Sections

Sections can be used as a QA procedure when using the Section Templates.

Within 'GENIO_DESIGN.Model' which has the 'GC52.Alignment' attached.

Select 'SECTIONS > Long Section by cursor'

Left click the model to select first point of section, left click the mouse to select end point and right click mouse to finish.

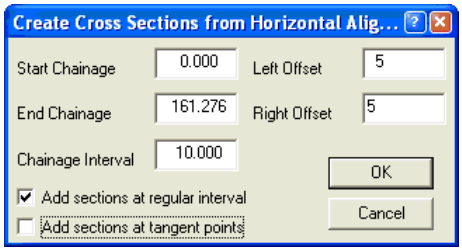
A more extensive examination of surfaces can be carried out as follows:

Cross Section From Alignment

Within 'GENIO_DESIGN.Model' which has the alignment file attached.

Select 'SECTIONS > Cross Section from An Alignment

Set up the following:



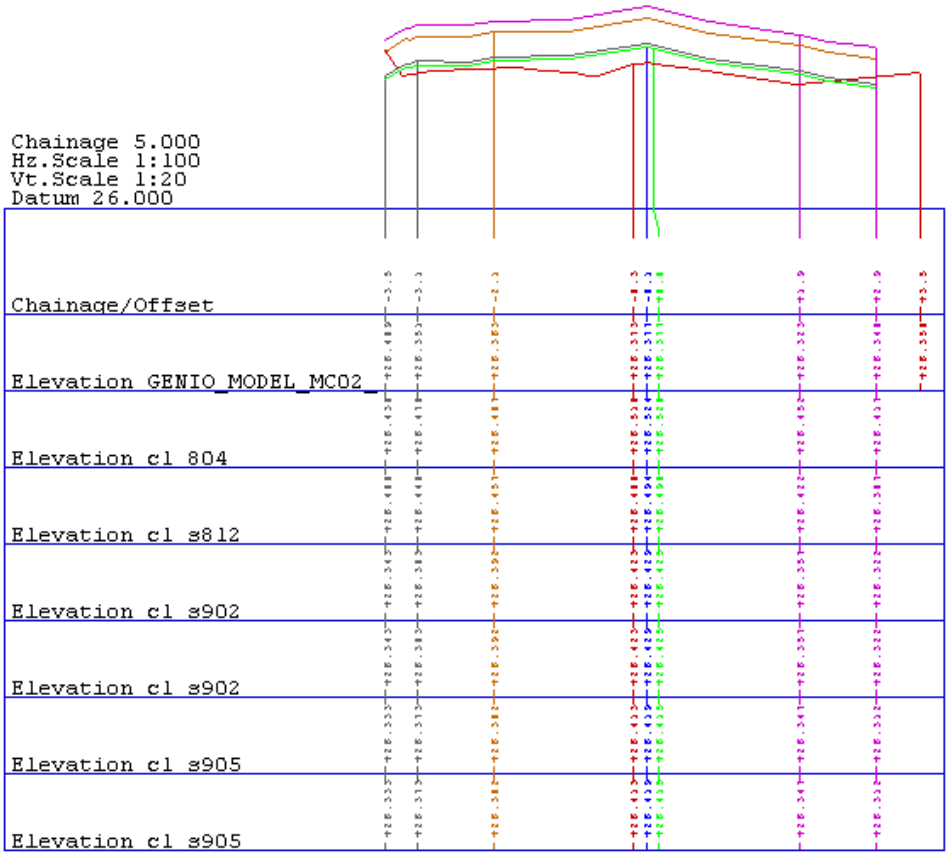
'Save As > CrossSection GC52.Section'

Please note the Section Annotation and Scale can be assigned within **'VIEW > Scale, Titles & Grids' and 'VIEW > Annotation Settings'**

Appending Surfaces to Sections

Within 'CrossSection GC52.Section' select 'EDIT > Append Surface'

Select 'c1 804.Model', 'c1 s812.Model', 'c1s902.Model' and 'c1 s905.Model' by holding ' Ctrl'



Furthermore this allows for volumes by Cross Section to be carried out:

Volumes by Cross Section

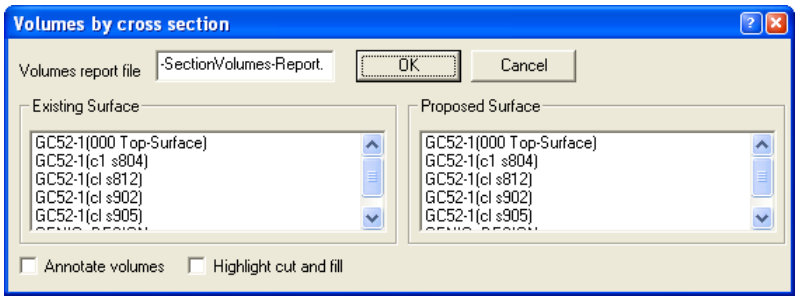
Within 'CrossSection GC52.Section' select 'EDIT > Volumes'

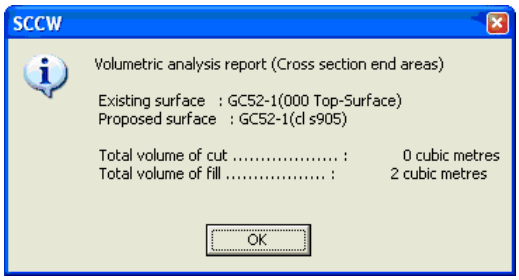
Enter a 'Volume Report File' 'c1 s902.txt'

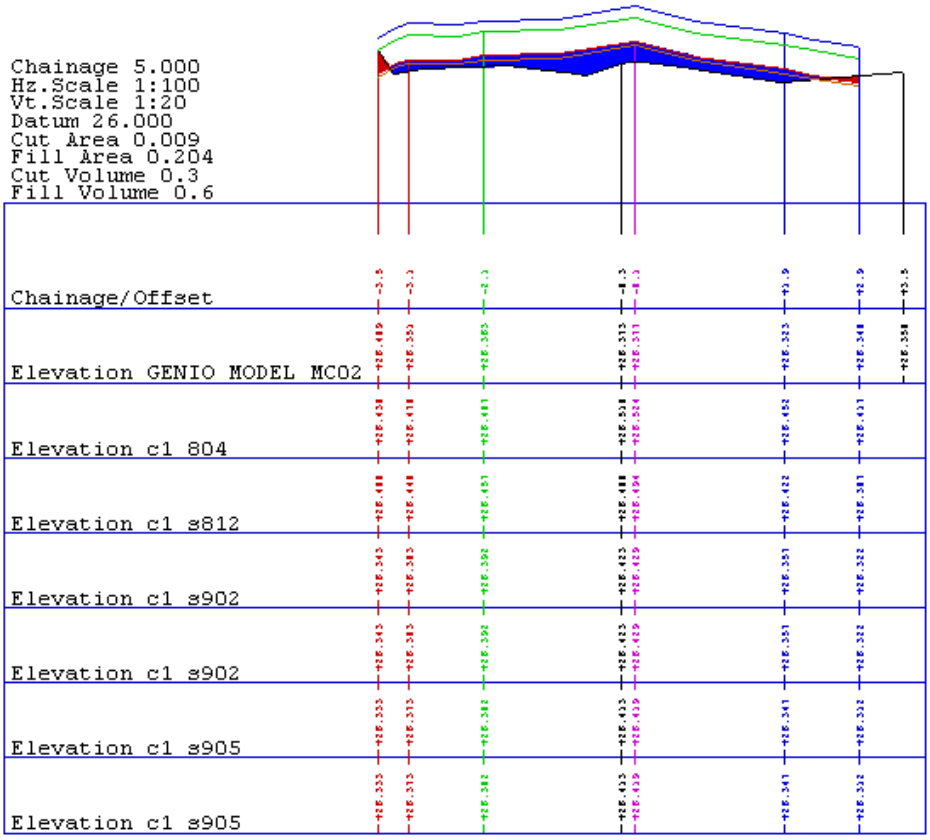
Select 'Existing Surface' 'Top Surface' and the 'Proposed Surface' 'c1 s902'

Select to 'Annotate Volumes' and 'Highlight Cut and Fill'

Select 'OK'







16.3 Getting Intersection Points from DOER

SCC can import alignment information from DOER (the Irish Department of Environment Road Design package).

16.3.1 Getting Horizontal Intersection Points from DOER

SCC imports horizontal and vertical intersection point information from DOER. Intersection point information may not be generated from geometric entities.

There is a DOER alignment file (BigRoad.A01) in the \SCC\Tutorials directory.

Exporting Alignment from DOER

Copy this file from this directory into the DOER directory.

From DOS or from a DOS window in NT open DOER.

From the Opening Menu of DOER select the first option ;1 to DESIGN/edit/PRINT alignments, ground or survey point data.

```
DOER NT
current directory =D:\DOER NT
MENU "R"        O P E N I N G     M E N U     OF     "D O E R"

Enter 1 to DESIGN/edit/PRINT alignments, ground or survey point data

      2 to PLOT alignments, ground or survey point data

      3 to design or plot a DRAINAGE network

      4 to convert DXF AutoCAD TEXT/POLYLINE files to alignments
      5 to PRINT or SETOUT alignments

      6 to setup JUNCTION levels via ROGER or setup ramp MERGE/TRIM

      7 to use HOPS to derive a vertical alignment

      8 to SORT/DUMP a datafile or ECHO all vdu/keyboard to file DOERECHO.LOG
     10 to use a Working Directory other than D:\DOER NT
     11 setup/reuse a named "Batch File" of answers to all subsequent input

     12 setup/reuse "BatchFile" DOERBAT.FIL of answers to all subsequent input

     99 to exit from DOER
     (to switch to DOS, type DOS in answer to ANY input request)
Value entered =1_
```

The Opening menu of the Design Module is opened.

Select option 2 to edit, process or print an existing alignment via menu “B”.

```
DOER NT
     99 to exit from DOER
     (to switch to DOS, type DOS in answer to ANY input request)
Value entered =1
DOER     Road Design Program              J Devlin   V11.23       22-Aug-1997
current directory =D:\DOER NT

MENU "A"       Opening menu of Design Module

Enter 1 to setup a new road alignment via menu "B"

      2 to edit, process or print an existing alignment via menu "B"

      0 or 9 to return to menu "R"

      4 to setup/edit a ground surface    model via menu "C/D"

      5 to setup/edit a ground subsurface model via menu "C/D"

      6 to copy/merge an existing alignment (copy less some/all cross section)

      8 to setup/edit/print coordinated Survey Points via menu "P"

     10 to examine the design level implications of various vertical curves

Value entered =2
```

You will be required to select an existing DOER alignment file. Select the file BigRoad.A01 from the current directory.

```
DOER NT
current directory =D:\DOER NT

MENU "A"       Opening menu of Design Module

Enter 1 to setup a new road alignment via menu "B"

      2 to edit, process or print an existing alignment via menu "B"

      0 or 9 to return to menu "R"

      4 to setup/edit a ground surface    model via menu "C/D"

      5 to setup/edit a ground subsurface model via menu "C/D"

      6 to copy/merge an existing alignment (copy less some/all cross section)

      8 to setup/edit/print coordinated Survey Points via menu "P"

     10 to examine the design level implications of various vertical curves

Value entered =2
Name of existing disk file to use
on directory D:\DOER NT
blank=>use last filename    =[bigroad.a01              ]
  *  =>go back to last menu =bigroad.a01
```

Once the alignment has been selected the Main Menu for the alignment is opened. Select option 1 to setup/edit the horizontal alignment via Menu "E".

```
DOER NT
 on directory D:\DOER NT
 blank=>use last filename    =[bigroad.a01              ]
   *  =>go back to last menu =bigroad.a01
☺←<←[2J←[H  MENU "B"                M A I N     M E N U      for alignment  bigro
ad.a01
 directory =D:\DOER NT                                <ch  1000.000 to ch  2475.278>

 Enter 1 to setup/edit the Horizontal alignment via Menu "E"

       2 to setup/edit the Vertical alignment via Menu "E"

       3 to design the alignment via menu "H"

       4 to print  alignment data via menu "I"

            5 to setup/edit the ground surface model via menu "C/D"

            7 to setup/edit the cross section templates via menu "G"

       8 to change title,frdrain,materialno,stakeinterval,2dualverts,jnsd,etc

           10 to change to a different coordinate system

       9 to return to previous menu <99 to return to opening menu>
 Value entered =1
```

Choose option 8 to write ALL horizontal alignment IP data to diskfile DOERHIP.DAT.

```
DOER NT

           10 to change to a different coordinate system

       9 to return to previous menu <99 to return to opening menu>
 Value entered =1

 MENU "Eh"
 Enter 1 to setup a new horizontal alignment
       2 to list on the vdu all horizontal points stored to date
       3 to add a new   horizontal point after an existing point
       4 to delete an existing  horizontal point
       5 to change an existing  horizontal point
       6 to replace the <E,N> coords of an IP by the coords of a Survey Point

       7 to check each curve for length/radius/angle conflicts

       8 to write   ALL horizontal alignment IP data to diskfile  DOERHIP.DAT

      10 to replace ALL horizontal alignment IP data by data from DOERHIP.DAT

      11 to output ALL Horizontal IP Coordinates to Polyline HIP.DXF

      12 to replace ALL Horiz IP Coordinates by coords in Polyline HIP.DXF
       9 to return to previous menu <99 to return to opening menu>
 Value entered =8
```

The DOER HIP file will be processed and saved in the DOER working directory. Type in 99, to return to the opening menu.

```
DOER NT
 HIP   1 processed
 HIP   2 processed
 HIP   3 processed
 HIP   4 processed
 HIP   5 processed
 HIP   6 processed
MENU "Eh"
Enter 1 to setup a new horizontal alignment
      2 to list on the vdu all horizontal points stored to date
      3 to add a new   horizontal point after an existing point
      4 to delete an existing  horizontal point
      5 to change an existing  horizontal point
      6 to replace the (E,N) coords of an IP by the coords of a Survey Point

      7 to check each curve for length/radius/angle conflicts

      8 to write   ALL horizontal alignment IP data to diskfile  DOERHIP.DAT

     10 to replace ALL horizontal alignment IP data by data from DOERHIP.DAT

     11 to output ALL Horizontal IP Coordinates to Polyline HIP.DXF

     12 to replace ALL Horiz IP Coordinates by coords in Polyline HIP.DXF
      9 to return to previous menu (99 to return to opening menu)
Value entered =99_
```

Exit from DOER by again typing in 99.

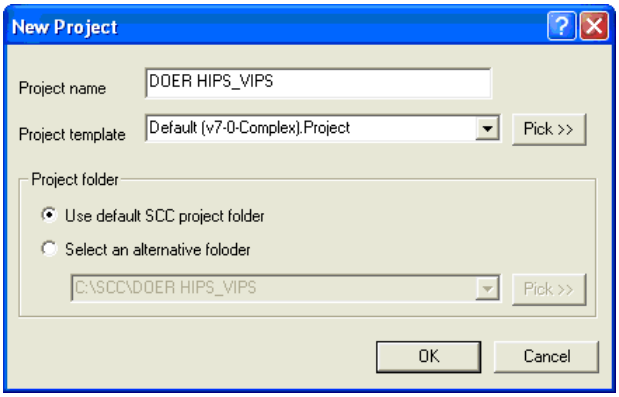
```
DOER NT
current directory =D:\DOER NT
MENU "R"        O P E N I N G     M E N U    OF    "D O E R"

Enter 1 to DESIGN/edit/PRINT alignments, ground or survey point data

      2 to PLOT alignments, ground or survey point data

      3 to design or plot a DRAINAGE network

      4 to convert DXF AutoCAD TEXT/POLYLINE files to alignments
      5 to PRINT or SETOUT alignments

      6 to setup JUNCTION levels via ROGER or setup ramp MERGE/TRIM

      7 to use HOPS to derive a vertical alignment

      8 to SORT/DUMP a datafile or ECHO all vdu/keyboard to file DOERECHO.LOG
     10 to use a Working Directory other than D:\DOER NT
     11 setup/reuse a named "Batch File" of answers to all subsequent input

     12 setup/reuse "BatchFile" DOERBAT.FIL of answers to all subsequent input

     99 to exit from DOER
     (to switch to DOS, type DOS in answer to ANY input request)
Value entered =1_
```

Importing DOER Alignment into SCC

Set up Project

Open a 'New Project' and attach the 'Default(v6).Project' template.

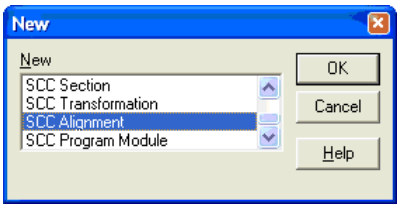
Call the project 'DOER HIPS_VIPS'.



Import DOER Alignment

Open a blank Alignment file

Go to 'FILE > New > SCC Alignment'



A blank horizontal intersection sheet is opened. The alignment information is imported into this SCC alignment file.

From the File menu, select Import DOER HIPS.

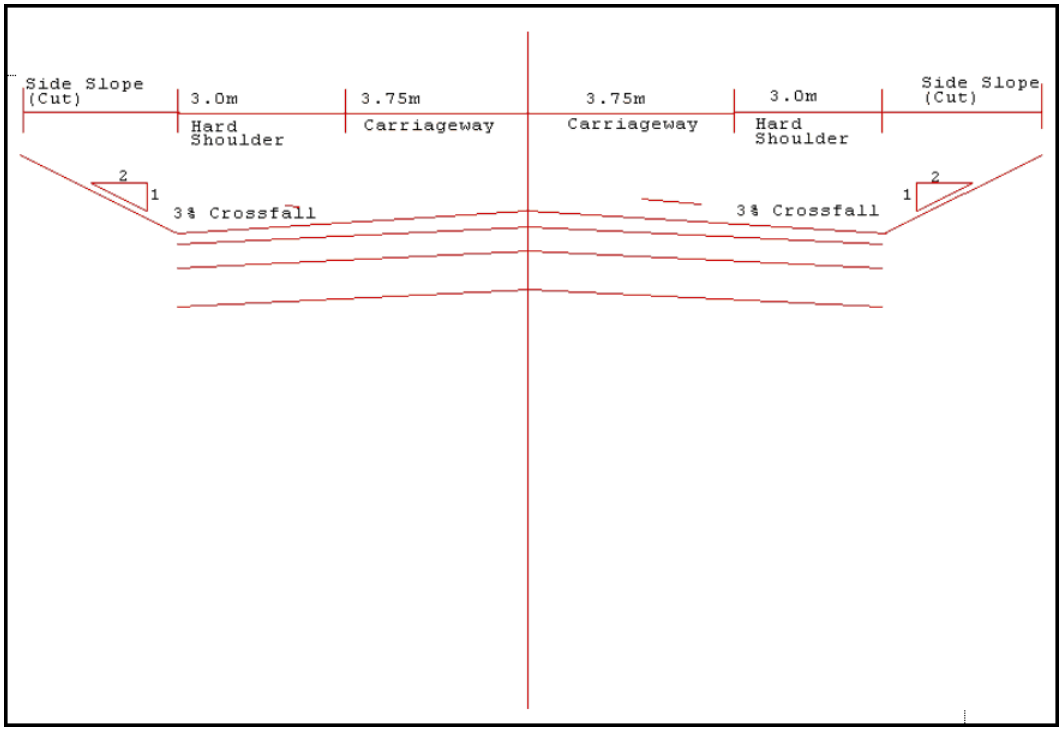
From the DOER directory select the file 'DOERHIP.dat'. The data will be downloaded directly into this spreadsheet.

16.3.2 Typing Section Template Points

Once a horizontal and vertical alignment has been created, it is then possible to design a section template.

The section template design for this tutorial may be found as a DXF file in the \SCC\Tutorials directory.

Import the *'Section Template.DXF'* file into SCC or CAD and print it.



It contains the width and crossfall of each element in the template.

Revert back to ''FGL.Model' which has the unedited 'RoadDesign.Alignment' attached.

Go to 'Design > Section Templates'.

Set the 'Template Design Action' to 'Add Points'.

Set Apply to 'Cut and Fill'

Set the ‘Horizontal Component’ to ‘Width’ and the ‘Vertical Component’ to ‘Gradient’.

Set the Units of measurement for gradients to Percentage %

Ensure that the ‘Unit for Gradients’ is set to ‘percentage %’ within ‘FILE >General Options > Units and Data Checking’ section

Centre Line:

Set the ‘Surface’ to ‘TopSurface’ and the Feature ‘CL’

Enter a value of ‘0.00’ for the ‘horizontal and vertical component.

Leave the ‘interface side slopes’ turned ‘off’

Select ‘Add Point’

All horizontal components to the right of the centre line are positive, while all the horizontal components to the left are negative.

RHS001:

Select ‘Feature > RHS001’

Set the ‘width > 3.75’ and the ‘gradient > –3’.

‘Turn on’ ‘Right Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

R-EDGE:

Select ‘Feature > R-EDGE’

Set the ‘width > 3.00’ and the ‘gradient > –3’.

‘Turn on’ ‘Right Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

LHS001:

Select ‘Feature > LHS001’

Set the ‘width > -3.75’ and the ‘gradient > –3’.

‘Turn on’ ‘Left Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

L-EDGE:

Select ‘Feature > L-EDGE’

Set the ‘width > -3.00’ and the ‘gradient > –3’.

‘Turn on’ ‘Left Interface slope’ and set the ‘Gradient > 50%’.

Select ‘Add Point’

The following Section Template has been designed.

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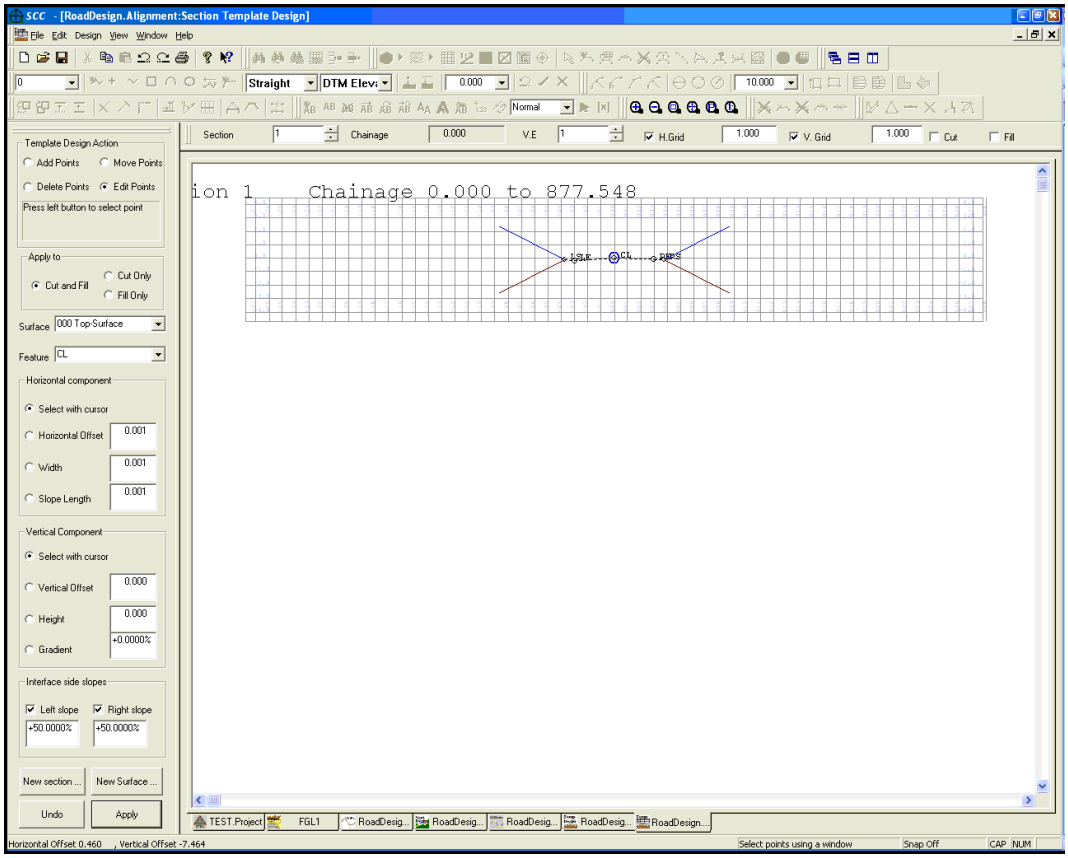
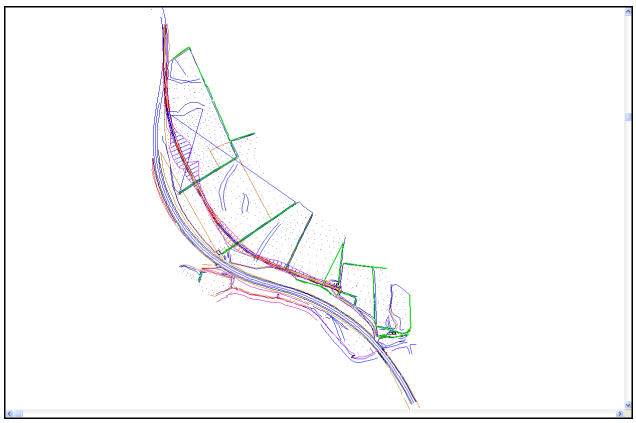
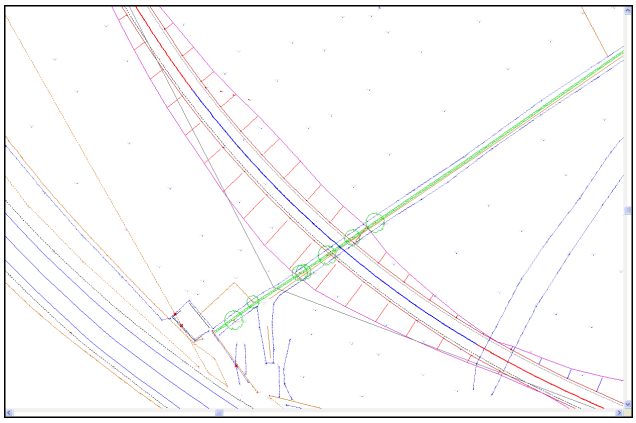


The Section Template should be automatically updated within the Model 'FGL.Model' which has the alignment attached.





16.4 Designing A Fixed Gradient Interface

The following examines the creation of a design interface with 1:3 gradient for given pond data.

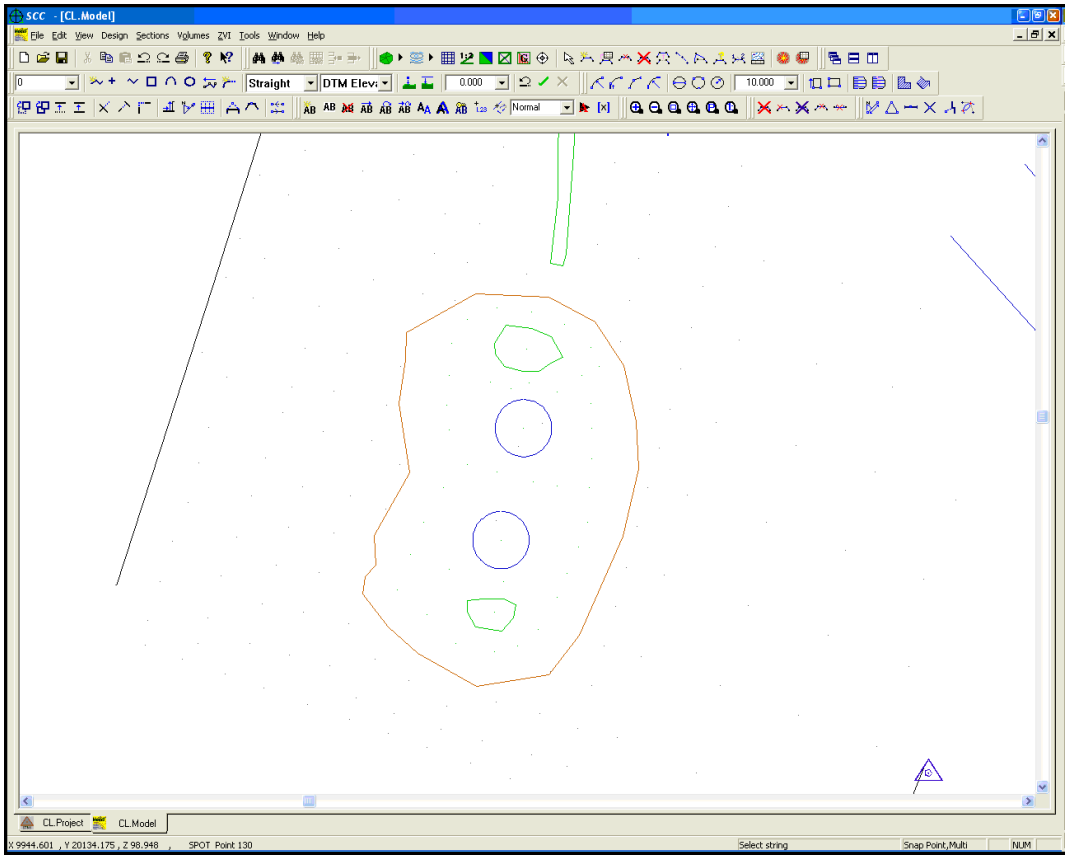
Consider that the 'CL.Model' contains the pond boundary ('WATERLINE' String) and subsequent pond islands.

A design interface is required to produce a 1:3 gradient from the water edge (boundary string) to the pond bed (96.1m).

Open Existing Files

Go to 'FILE > Open'

Open 'CL.Project' and 'CL.Model'



Create Pond Bed Model

Select 'O' from the Feature Drop Down Menu

Go to 'EDIT > Add String with Cursor'

Set the Elevation to '96.1'

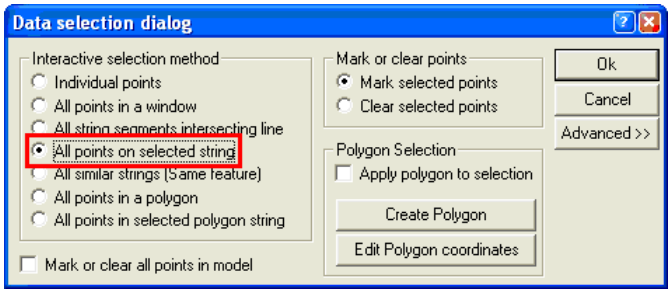
Using 'Snap Point' draw a boundary string

Right click mouse, select 'Drape Coordinates on Surface'

Right click mouse, select 'Update String in model'

Select 'Esc' to unselect command

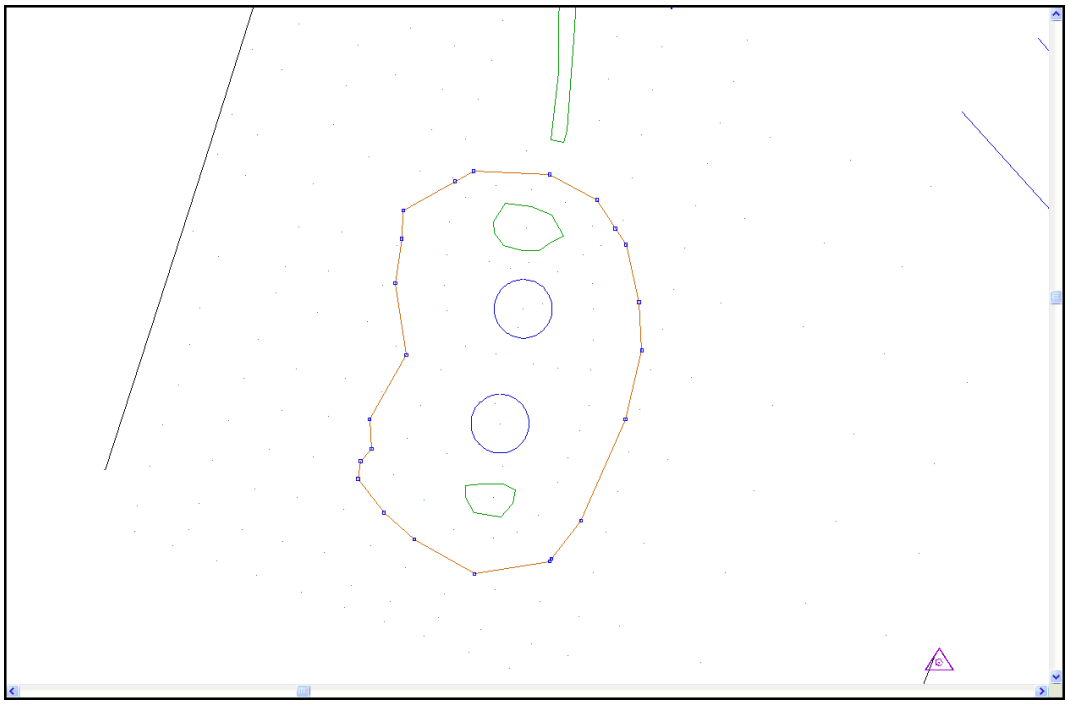
Right click mouse, to bring 'Data Selection Dialog'



Select 'All points on selected string'

Select 'OK'

Left click on newly created '0' string



Note selected points highlighted in blue, as shown above.

Go to 'EDIT > Copy > Copy to New Model'

Save Model as '96-1.Model'

This string will act as a guide boundary string

Select 'O' from the Feature Drop Down Menu

Select to draw a 'Polygon' from Toolbar

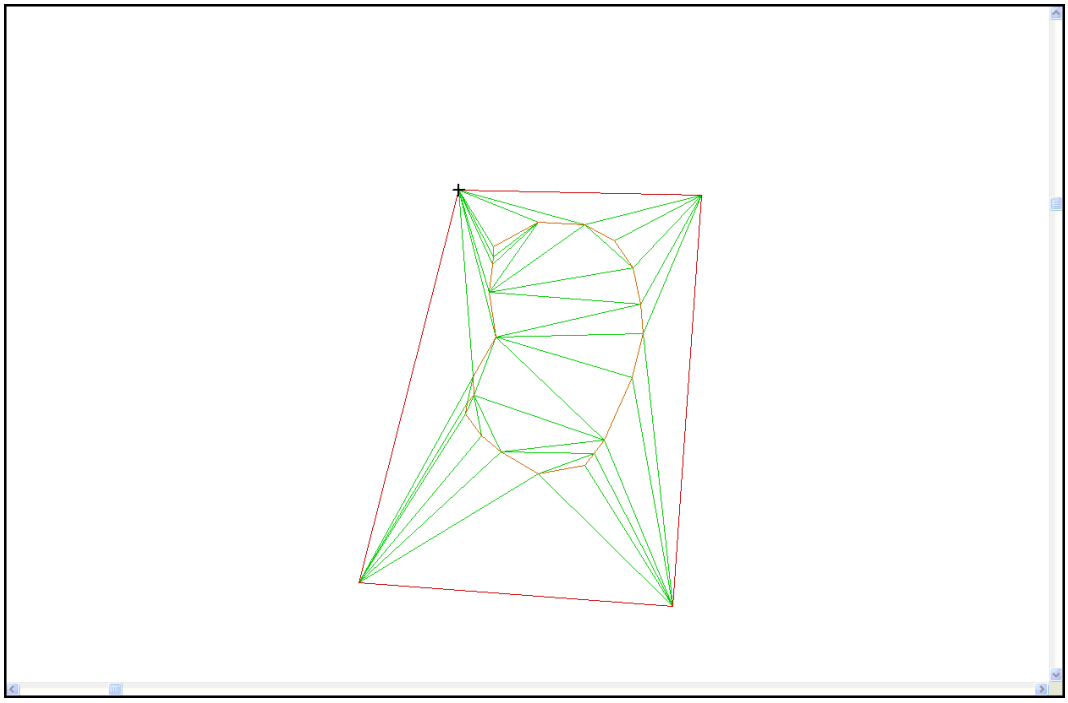
Draw a Polygon around the boundary string

Set the Elevation to '96.1'

Right click mouse, select 'Drape Coordinates on Surface'

Right click mouse, select 'Update String in model'

This creates a plan at the water level of 96.1



Save Model

Create Alignment From Pond Boundary (Waterline String)

Within 'CL.Model', go to 'DESIGN > Create Alignment from String'

Enter file name 'Interface0008' with a fillet radius of 1.000

Enter the desired gradient

Select 'OK'

Left click mouse on pond boundary 'WATERLINE' string

Save Alignment

Go to 'FILE > Attach/Detach > Edit/Detach > Detach All'

Select 'OK'

Open '96-1.Model'

Go to 'FILE > Attach/Detach > Edit/Detach > Attach Alignment File'

Select 'Interface0008.Alignment'

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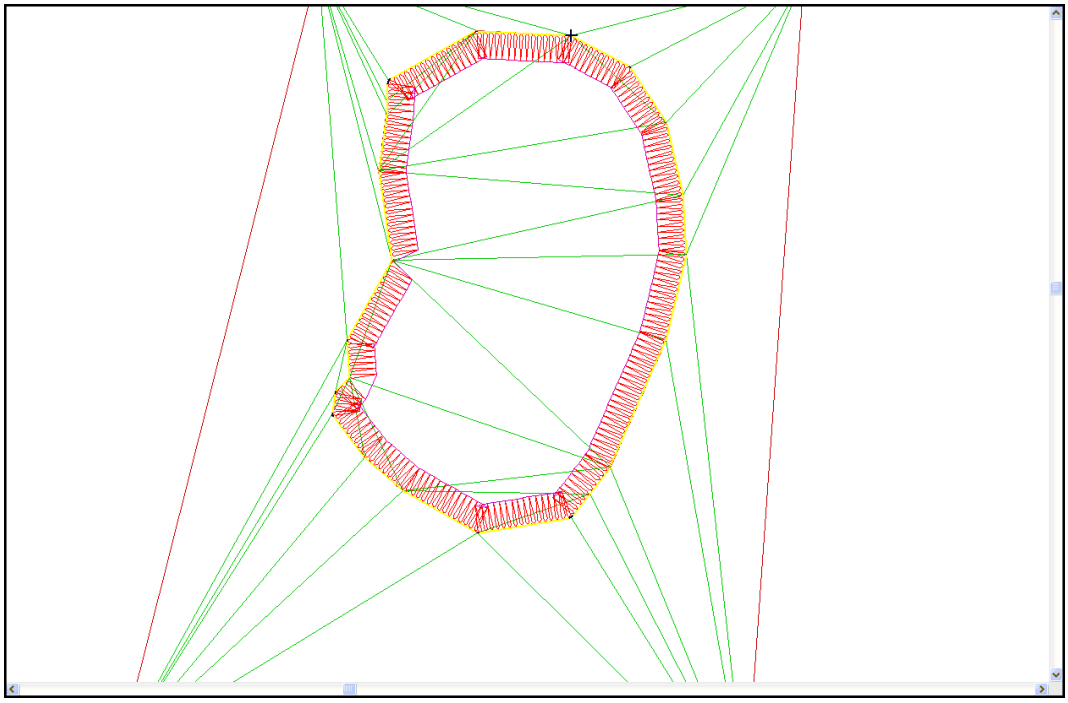


Go to 'DESIGN > Export design as model'

Select 'Chainage Interval' as 1.000

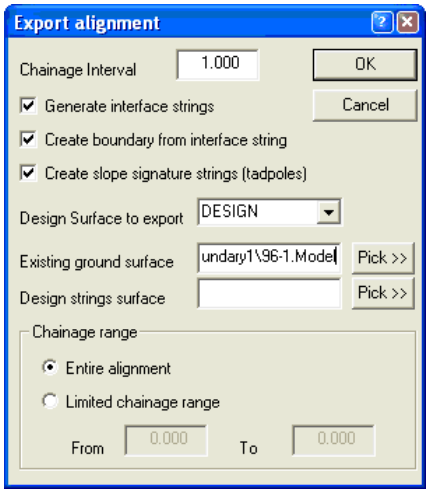
Select 'Generate interface strings', 'Create boundary from interface string' and 'Create slope signature strings (tadpoles)

Select 'Design' as the surface to export

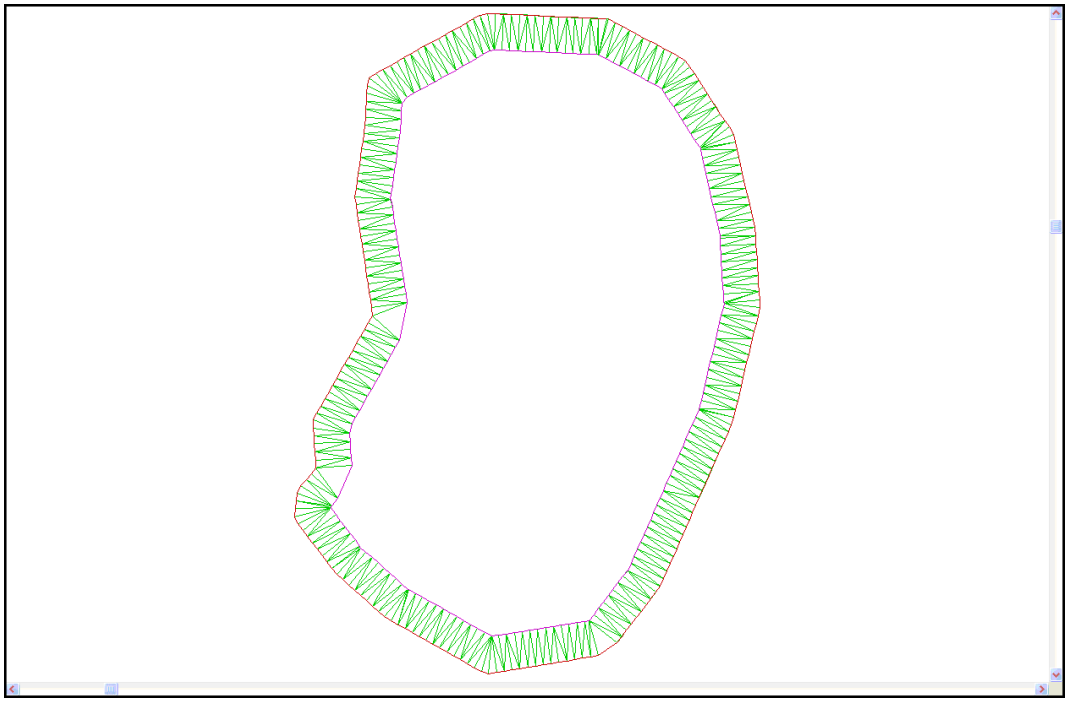
Select '96-1.Model' as the existing ground surface using 'Pick>>'

Set the 'Chainage Range' as 'Entire Alignment'

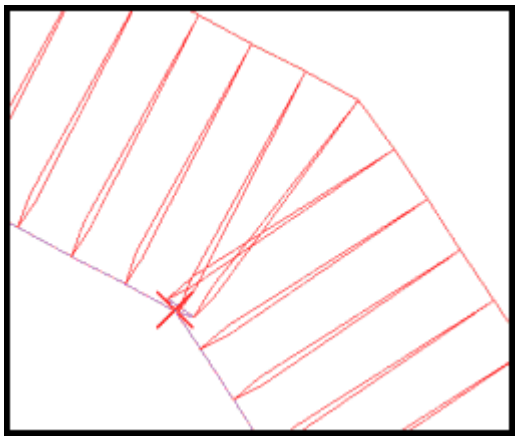
Select 'OK'



Save As 'Design.Model'



Once the design has been exported, tadpoles can be edited using 'String Edit' commands, for example, Move Points, Delete Points



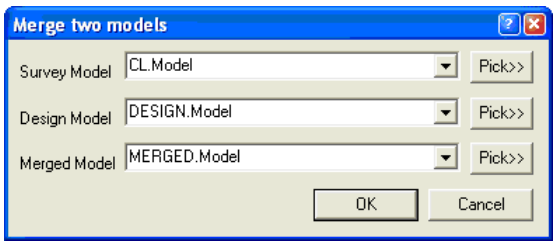
Merge Model

Open 'CL.Model'

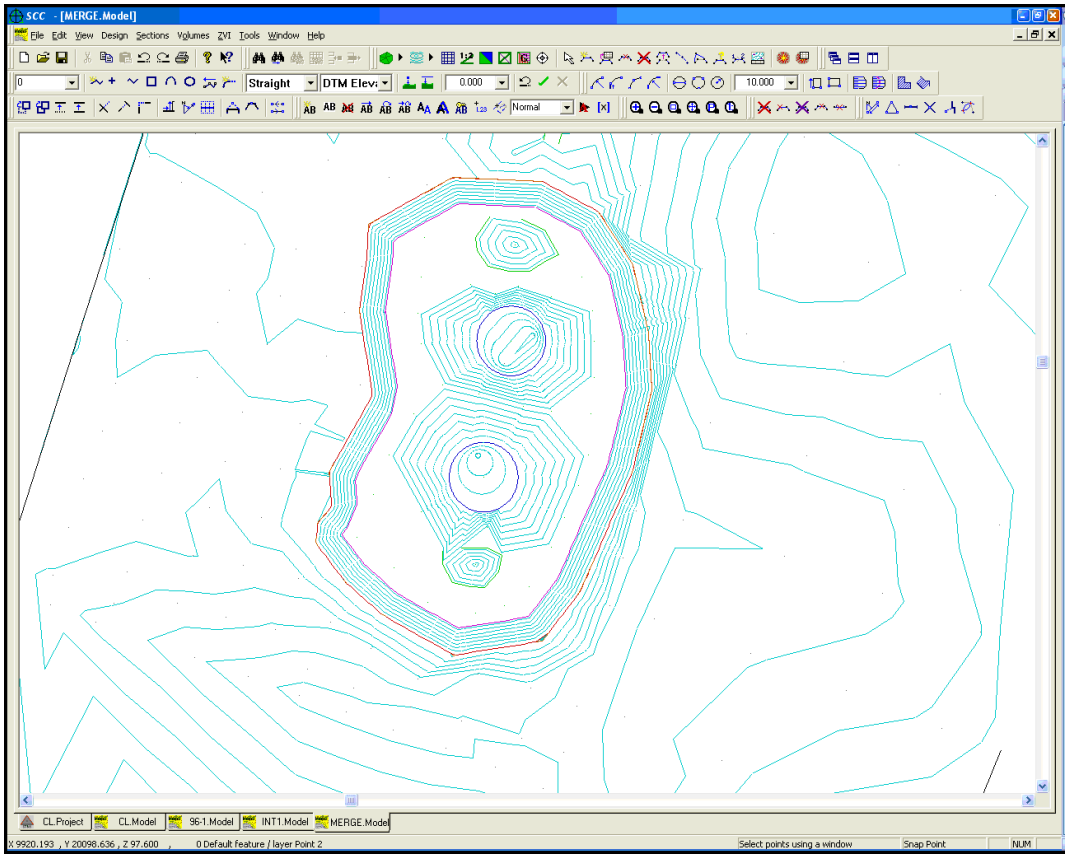
Go to 'TOOLS > Merge two model

Using 'Pick>>' select the Survey and Design Model

Enter a name for Merged Model



Select 'OK'

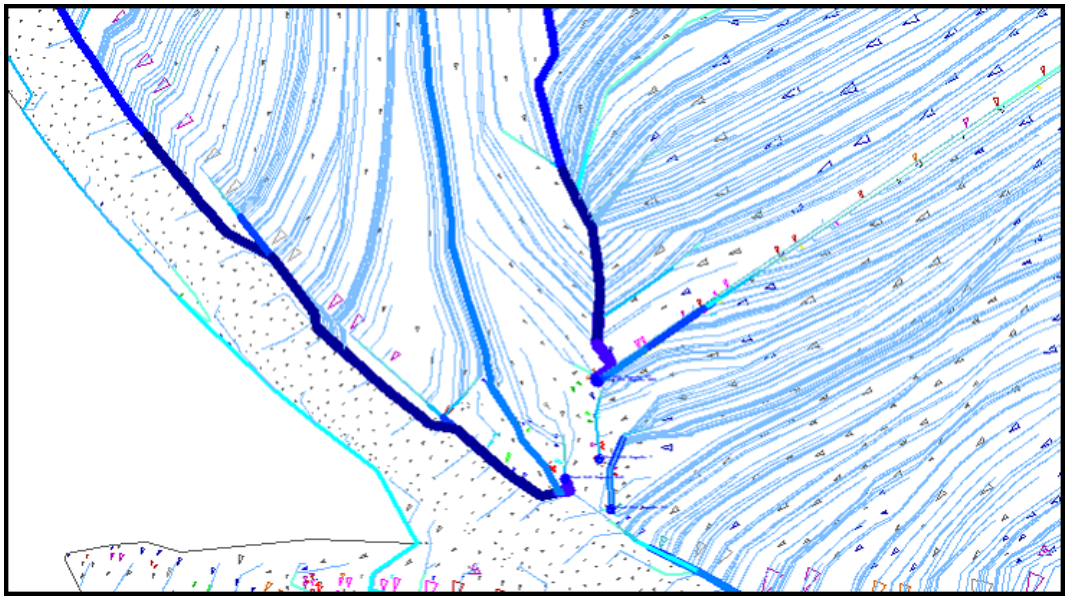


Note:

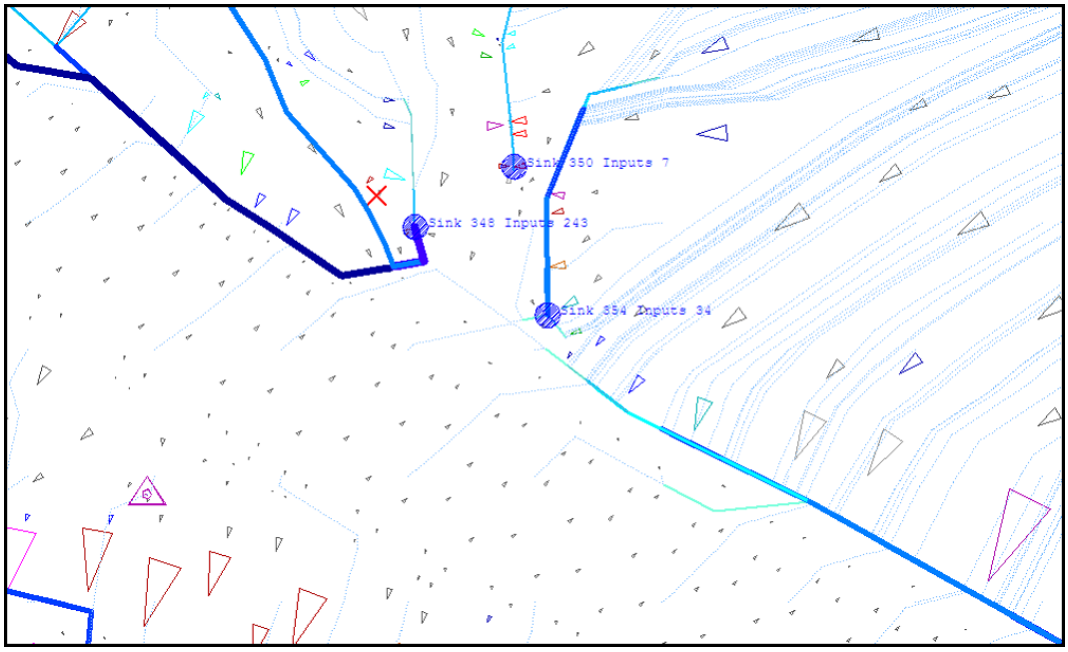
Separate Designs should be carried out for the islands in the pond, if required.

17 Flow Lines

This functionality allows the user to generate and display flow lines associate sink points from any 3d model. A flow line is a line that follows the path of steepest descent from a given source point until it either reaches a local low point or the edge of the model. Source points for flow lines can either be specified using a regular grid across the model, a coordinate file, or interactively with the cursor. In addition to generating the flow lines, SCC also identifies all the confluence points between flow lines, and counts the number of sources meeting at each junction and arriving at each sink point. This is useful for identifying natural drainage across a model and designing additional drainage. An example of flow lines based on a regular grid of source points is shown below;



Thinner lines illustrate simple flow lines connected to a source point, whereas lines of increasing thickness show the confluence of multiple flow lines culminating in a sink point. Note that in this example, slope vectors are also shown to illustrate the downhill direction.



If we zoom into a given sink point we will see it is annotated with an index and count of the number of input flow lines arrive at this sink.

Flow line functions are available from the ZVI & Flow menu, and include the following options;

Flow lines with cursor	This allows you to select flow line source points interactively with the mouse
Flow lines from grid	This creates a regular grid of flow line source points across the entire model.
Flow lines from data set	This creates flow line source points from a SCC coordinate file.

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Flow line options	This allows you to control the features used to control flow lines based on the number of incoming flow lines. It is also used to specify the grid interval used when creating flow lines from a grid, and control whether sink points are annotated.

The flow line options are as follows;

Flow grid interval	The grid interval used when creating flow line source points at a regular interval.
Compute cumulative flows	This controls whether the number of lines that pass through a given point are counted. This is required is compound flow lines are to be drawn using different features, but is slower when generating flow lines.
Local sink feature	The feature code used to draw flow line sink points.
Annotate sinks	This controls whether sink points are annotated with an index number and counter.
Minimum line count to display	Flow lines that have less than this number of input lines passing through them will not be displayed.
Minimum sink count to display	Sink points that have less than this number of input lines reaching them will not be displayed

18 River Sections

The river sections module is designed to offer efficient stream-lined processing steps for surveyed river data and provides for:

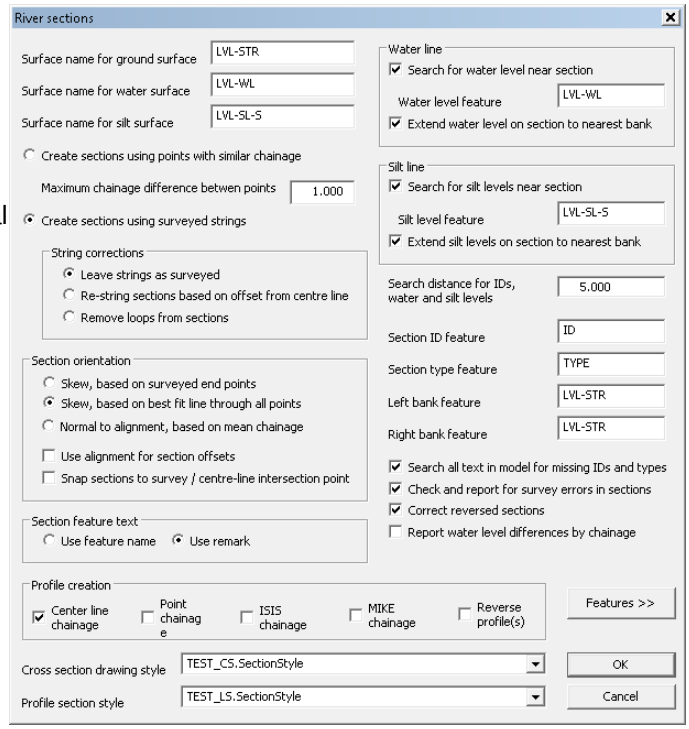
- simultaneous annotation and output of sections with offsets relative to the left most point of the section, the lowest (or highest) point on the section, and the alignment centre line.
- data output to multiple modelling systems includes ISIS, MIKE, and HECRAS without having to repeat processing of the sections

The river module functionality assumes that rivers are processed as a series of sections, which can be collected as a single string per section or as discrete feature coded points. The module has been designed around the following criteria:

Ease of Use: SCC incorporates the principles river sections settings within a single dialog in order to limit the number of processing steps required to generate each river section. The

single river section dialog allows for:

- ground, water and silt surface names to be defined easily
- sections generation either from points with similar chainage or using surveyed strings
- section orientation based on surveyed end points, best fit line through all points or normal to a defined alignment
- section feature text to be defined as feature name or remarks from the field
- section ID, left bank and right bank feature name search options
- water and silt line search options which can be used to annotation and/or display such surfaces
- options to extend water and silt line surfaces to the nearest banks automatically
- automatic surveyed section string direction correction
- quality controls, reporting and check options
- the selection of predefined cross section and profile drawing styles



Flexible:

New Section Coding Table allows the user the flexibility to implement existing coding systems currently in use in the field.

Specific remark codes used in the field can be set up to allow for the automatic generation of labels / text within the river sections.

Importantly, left bank and right bank can be included to control the extent of the automatic creation of water level and silt level surfaces on each river section.

Specific String Correction Options:

Automatic correction of string errors from the field provides time saving advantages during processing. Options allow for the removal of loops from surveyed section strings and/or to set a preferred string direction at a global level across all sections.

Simple River Centreline Definition:

An existing predefined river centreline or a new centreline reference string can be generated from which a chainage / offset system can be created easily. The reference string controls section orientation, section annotation on individual sections and within plan drawings and acts as an integral part of the required output to modelling systems.

Automatic Water and Silt Surface:

Search options provide for the extraction of water and silt levels which can be used to extrapolate water edges, silt edges and the ground profile.

Annotation of water and silt levels can be automatically set up and applied to all sections together with date and time stamp.

Global Section Text Annotation:

Section Annotation can be globally applied to all sections offering time saving advantages and limiting user errors.

Text can be customised to suit deliverables.

Simple Drawing Style Applications:

Section presentation can be customised to meet client needs and applied globally with the application of a drawing style reducing repetitive steps and ensuring continuity throughout a large project.

Advanced Quality Checks & Reporting:

Quality assurance checks provide invaluable tools to support consistent qualitative section files and subsequent exported deliverables. Search options for missing text within each section detail missing text elements whilst survey errors are reported for review and correction. Output of water levels differences by chainage offers further checks for blunders and gross errors.

Structure Display on Sections:

Surveyed structures can be easily selected from plan and attached to individual sections to meet specification using simple copy and paste tools.

Specific annotation and text can be inserted manually allowing for customisations.

Advanced Output of Sections to Multiple Modelling Systems:

Sections can be easily output to modelling systems includes ISIS, MIKE, and HECRAS in a single step.

18.1 Creating Project

A new project should be created before data may be downloaded into SCC or models formed.

From the Main Menu Bar, select ‘FILE >New Project’

Enter in a Project/Job name

Select a Project Template from the list 'River_Sections.Project'

Select ‘OK’

Note: 'River_Sections.Project' template has been set up to demonstrate the river section functionality.

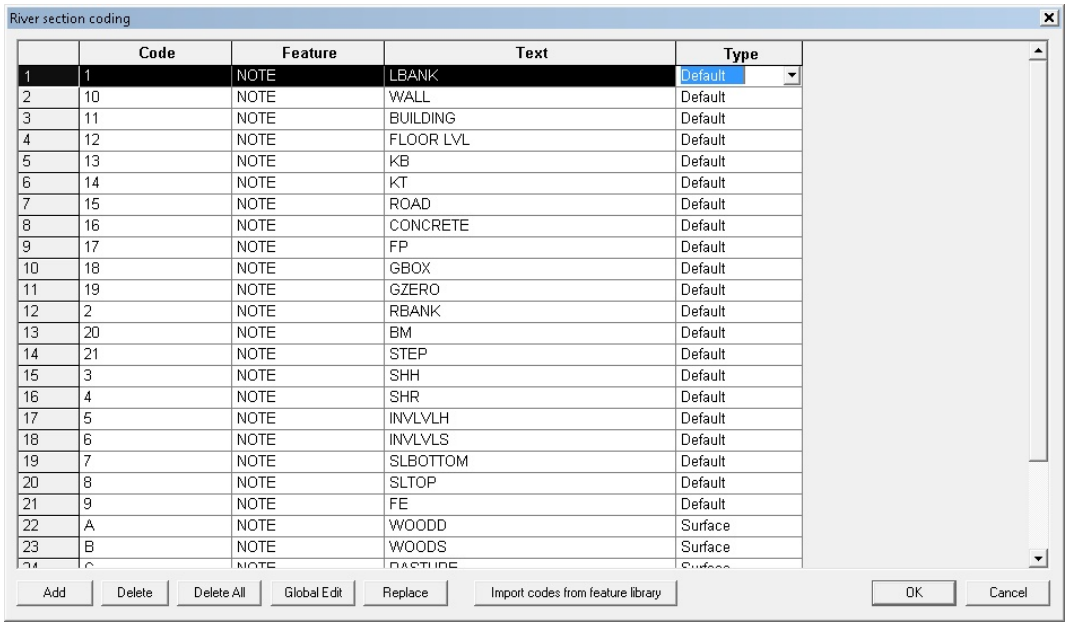
Feature Library

Select 'VIEW > Feature Library'

Specific feature codes have been set up in the library which coincide with codes used in the field.

Section Coding

From within the feature library view, select 'EDIT > Edit Section Coding'



	Code	Feature	Text	Type
1	1	NOTE	LBANK	Default
2	10	NOTE	WALL	Default
3	11	NOTE	BUILDING	Default
4	12	NOTE	FLOOR LVL	Default
5	13	NOTE	KB	Default
6	14	NOTE	KT	Default
7	15	NOTE	ROAD	Default
8	16	NOTE	CONCRETE	Default
9	17	NOTE	FP	Default
10	18	NOTE	GBOX	Default
11	19	NOTE	GZERO	Default
12	2	NOTE	RBANK	Default
13	20	NOTE	BM	Default
14	21	NOTE	STEP	Default
15	3	NOTE	SHH	Default
16	4	NOTE	SHR	Default
17	5	NOTE	INVLVLH	Default
18	6	NOTE	INVLVLS	Default
19	7	NOTE	SLBOTTOM	Default
20	8	NOTE	SLTOP	Default
21	9	NOTE	FE	Default
22	A	NOTE	WOODD	Surface
23	B	NOTE	WOODS	Surface

In this instance, specific remark codes used in the field have been set up to allow for the automatic generation of labels / text within the river sections. Importantly, left bank and right bank have been included to control the extent of the automatic creation of water level and silt level surfaces but also required for HECRAS, ISIS and MIKE formats.

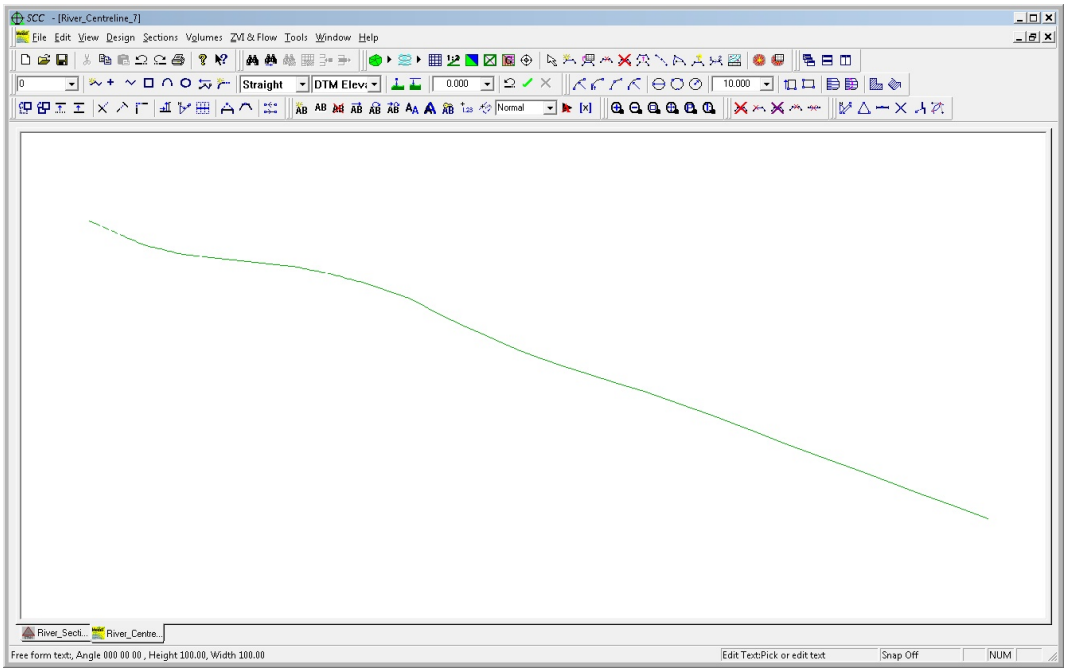
It should be noted that the 'Type' column controls the placement of text on a section / profile:

- Default - places text as a descender on the section
- Surface - places text on the surface line of the section
- Water - used to annotation the water surface within a section

18.2 Creating River Centreline Model

In order to generate the river section it is necessary to have a defined river centreline. The centreline can be generated within SCC using string creation tools or can be input from a CAD, ASCII or MX file.

Select 'FILE > Open > RiverCentreline.Model'



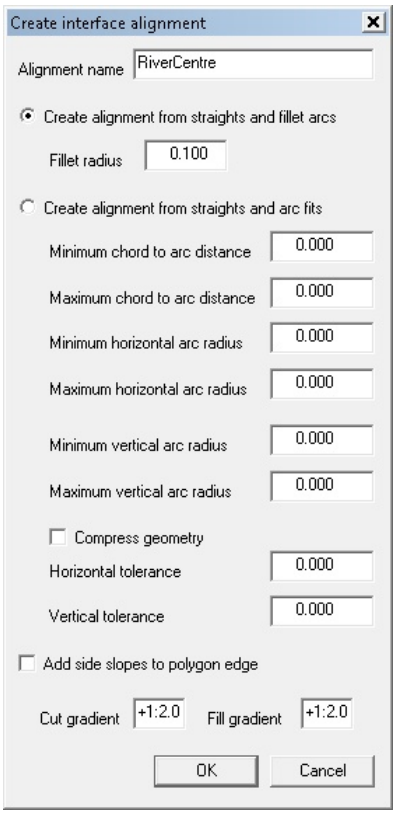
18.3 River Centreline Alignment

The river section functionality requires a horizontal alignment representing the river centre line and hence a full SCC design license. Alignments can be created as follows;

Creating Alignment from existing string

Within 'RiverCentreline.Model', select 'DESIGN > Create Alignment from existing string'

Left click on string and enter the following:



Click 'Ok'

Chainage and offset system is generated and is visible on the base toolbar on the bottom of the screen

To save alignment, select 'DESIGN > View Design Sheet > Horizontal Entities'

Select 'FILE > Save As' and enter name

'RC.Alignment' is a sample alignment file for use within this tutorial.

Creating Alignment from CAD file or MX file

Existing alignments can be imported as follows:

Imported from a design or CAD package, select 'FILE > New > SCC Alignment'

Select 'FILE > Import > MOSS GENIO geometry strings', or 'FILE > Import > Entities from DXF'

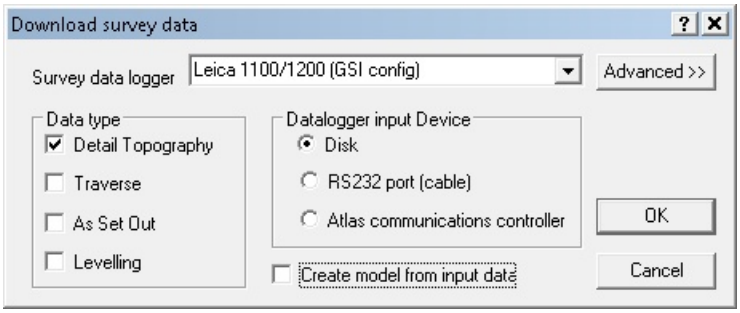
Using 'FILE > Import > LandXML'

18.4 Downloading Surveyed Section Data

Surveyed section data can be downloaded as follows:

From the Main Menu Bar, select 'FILE > Download Survey Data'

Select Survey Data Logger and download survey data as per SCC help tutorials



18.5 Examination of Dataset

The dataset should be examined to ensure attribute and text information has been downloaded correctly. For instance, checks should be carried out to ensure that specific section codes surveyed in the field have been downloaded in the Text Notes Sheet and match the codes set up within the Section Coding table, part of the Project file.

Concatenate Multiple Remarks

It should be noted that SCC can concatenate multiple remarks on the same survey point using the Concatenate multiple remarks tool. For example, observation 123 has two remarks noted as WALL and STONE within the text notes sheet. To concatenate the multiple text after download:

Select 'FILE > Coordinate Reduction Options'

Tick Concatenate Multiple Remarks and Press 'OK'

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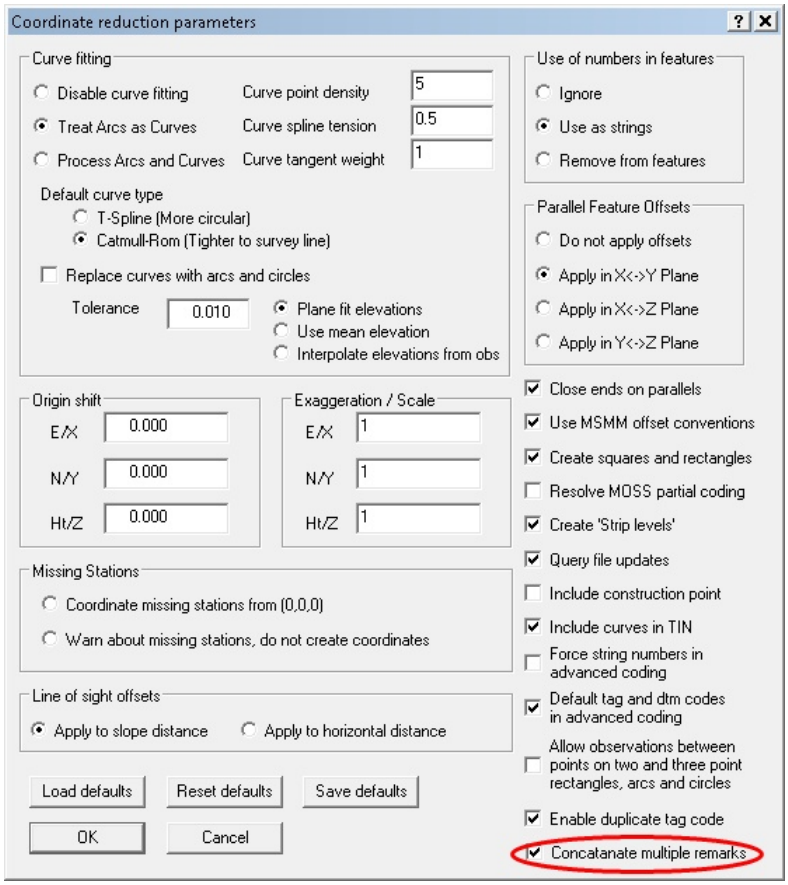


Within the dataset, select 'FILE > Rebuild Coordinates'

Multiple remarks are text concatenated as shown below:

	Obs#	Remark	Feature	-E/X-	-N/Y-	Height
1	123	WALL	SURFACE	11662.990	9724.407	1.500
2	123	STONE	SURFACE	11662.990	9724.407	1.500

	Obs#	Remark	Feature	-E/X-	-N/Y-	Height
1	123	WALL STONE	SURFACE	11662.990	9724.407	1.500

Note that the feature field on sections is limited to a total of 16 characters.

18.6 Creating Surveyed Section Data Model

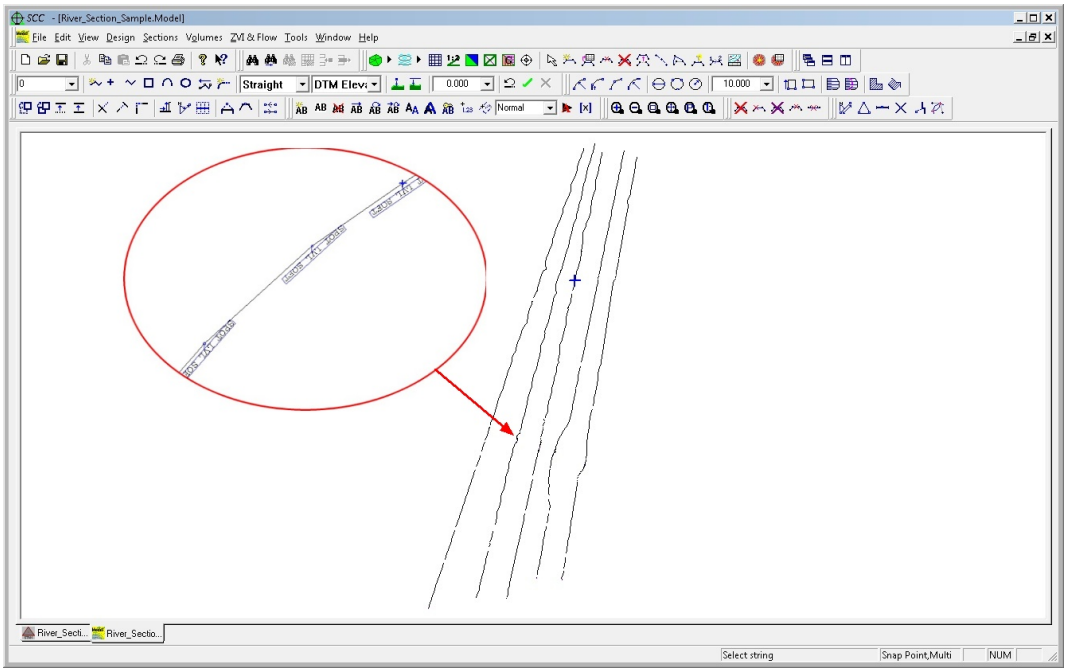
The dataset containing the surveyed sections is model as follows:

Go to 'FILE > Model > SCC Dataset'

Select 'Create the model and triangulation' and set Initial Plot Scale of 1000

Select 'FILE > Save As'

For the purpose of this tutorial open 'River_Section_Sample.Model'

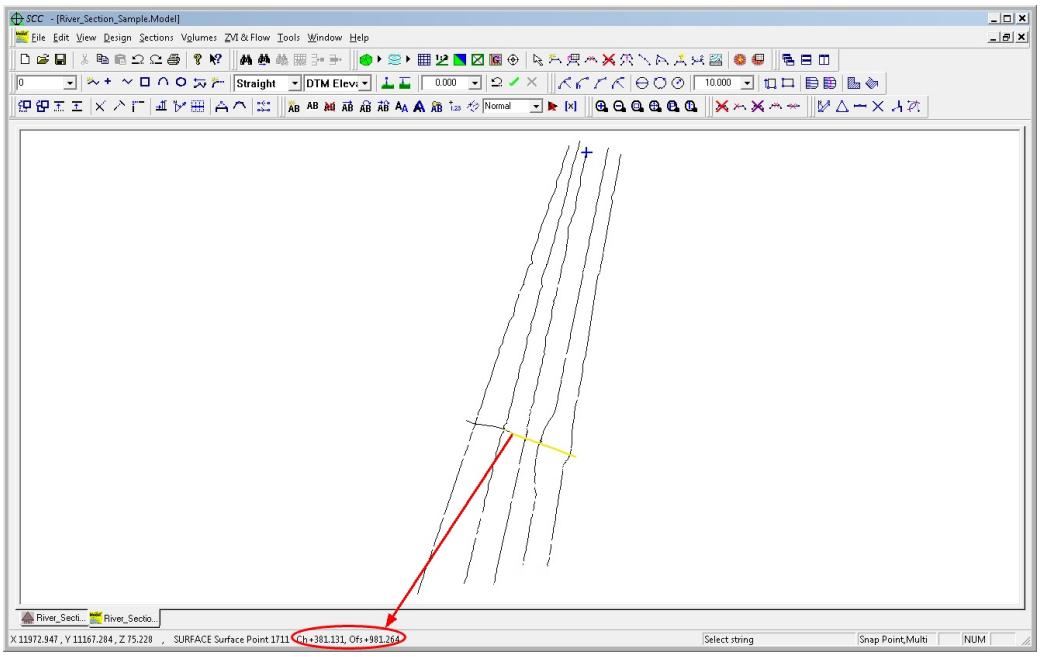


18.7 Attaching River Centreline Alignment to Survey Model

Prior to creating the river section the alignment file should be attached to the surveyed data model:

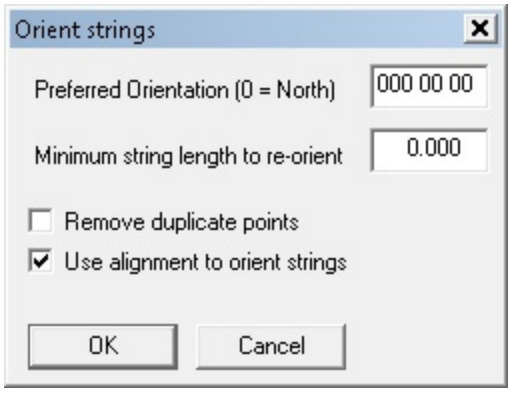
Select 'FILE > Attach / Detach > Attach Alignment file'

Pick river centreline alignment file



18.8 Setting Preferred String Direction

If the sections have been surveyed as strings, they can be re-aligned to match the centre line direction using **'TOOLS > Set preferred string direction'**, although this is not necessary for the river sections to be created.



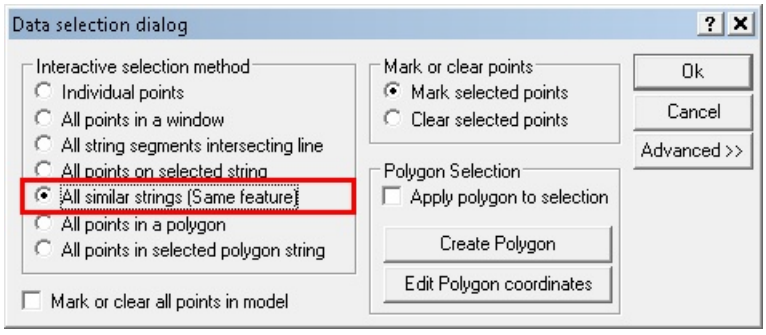
This option can be run directly from the River Sections dialog using 'Correct reversed strings'.

18.9 River Section Creation

Before creating the river sections, it is necessary to select all section data. For example, if one or more feature names have been used the data selection dialog with 'All similar strings (Same feature)' option selected should be selected.

Within 'River_Section.Model' with the alignment attached, right click the mouse to bring up the 'Data Selection Dialog'

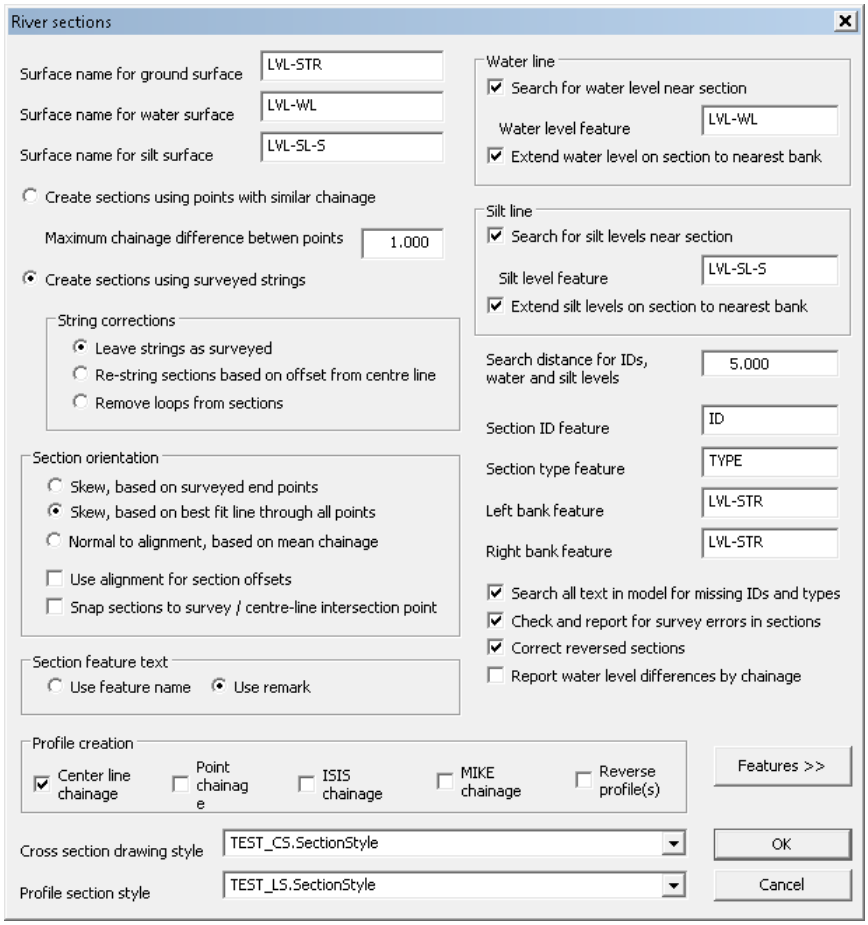
Pick 'All similar strings (Same feature)' and left click 'SURFACE' feature



Note that data that is not representative of the ground surface, such as water levels and any structures surveyed, should not be selected. As such, selecting all points in the model will typically not be appropriate when using this option. To create river sections:

Select 'SECTIONS > River sections to create the sections' which displays the dialog shown with the following options

For the sample data, set up the following options:



Specific settings are outlined as follows:

Surface Name for ground surface

This is the name displayed on the section title block for the profile line associated with the main ground surface.

Surface name for water surface

This is the name displayed on the section title block for the profile line associated with the water level and extrapolated water surface.

Create sections using points with similar chainage

This option is used when points on surveyed river sections are not collected as strings defining the section line. In this case, all points within a specified chainage range are grouped to form a section, and the points on each section are sorted by offset from the river centre line. This option has the advantage that it allows the user to collect feature names in the field, e.g. TOPBANK, BOTBANK, etc.. which will automatically be annotated on the section. It has the disadvantage that section lines should not overlap, as points may get placed on the wrong section.

Maximum chainage difference between points

This option is the maximum chainage separation allowed between points for them to be placed on the same section. For example, a value of 2m would indicate that all points on a section must be within a 2 meter chainage of one another. Note that for skew sections, i.e. sections not perpendicular to the centre line, this value should be increased to allow

for the skewing effect. This value should never be greater than half the distance between adjacent section, e.g. if your sections are 10m apart, this value should not exceed 5.

Create sections using surveyed strings

This option should be used where sections have been collected as complete strings. It has the advantage that sections can overlap, which can be useful on sharp changes of direction and small radii in the river centre line.

String corrections

These only apply where the above option has been selected, and relate to automatic correction of certain survey errors.

Leave strings as surveyed

Do not make any corrections.

Re-string sections based on offset from centre line

This option re-orders the points in the string based on their offset from the centre-line. This will correct any overlaps, loops and doubling back in the section.

Remove loops from sections

This option removes any loops that occur in plan in the section.

Section Orientation

These options refers to how the section centre lines are formed from the surveyed points for a given section, which due to the natural constraints of river surveying, will rarely form an exact straight line.

Skew, based on surveyed end points

The section centre line is formed by joining the leftmost and rightmost survey points. The survey points are then snapped onto this line when forming the section. This line will typically not be at exact right angles to the river centre line.

Skew, based on best fit line through all points

The section centre line is formed by creating a best fit line through all the survey points. The survey points are then snapped onto this line when forming the section. This line will typically not be at exact right angles to the river centre line.

Normal to alignment, based on mean chainage

The section centre line is formed by computing a mean chainage from all the survey points, and going at right angles to the left and right of centre-line at that chainage to meet the leftmost and rightmost offsets of the survey points. The survey points are then snapped onto this line when forming the section. This line will be at exact right angles to the river centre line. Note that if the surveyed section is not roughly at right angles to river centre line, points are liable to be moved significant distances when snapped onto the centre line, and the section line may be significantly shorter than the surveyed line.

Use Alignment for section offsets

The sections are formed using the offset value of the alignment.

Section Feature Text

This controls how the feature name field in the sections is populated.

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Use feature name

Use the feature name as entered in the survey.

Use remark

Use the remark from the associated survey observation. This is useful when surveying sections as strings, where all the points on the section have the same feature name for stringing purposes, but may refer to different items on the section, e.g. Top of bank, edge of water, etc…

Water line

This group of options refer to the extraction of water level points and extrapolation of a water surface in the sections produced. Typically this will be a single water level point per section where the water surface is being automatically extracted, or a string where water surface has been surveyed directly.

Search for water level near section

Select this option to search for water level points near the surveyed section.

Water level feature

This is the unique feature name, e.g. WLEV, used to denote water levels.

Extend water level on section to nearest bank

When a single water level has been surveyed per section, this option will extend the level left and right from the surveyed point to the ground profile on the section to form a water surface.

Silt line

This group of options refer to the extraction of silt level points and extrapolation of a silt surface in the sections produced. Typically this will be a several silt level points per section where the silt surface is being automatically extracted, or a string where silt surface has been surveyed directly.

Search for silt level near section

Select this option to search for silt level points near the surveyed section.

Silt level feature

This is the unique feature name, e.g. SILT, used to denote silt levels.

Extend silt level on section to nearest bank

When silt level points have been surveyed per section, this option will extend the levels left and right from the surveyed point to the ground profile on the section to form a silt surface.

Search distance for IDs, water and silt levels

This is the maximum allowable distance from the IDs, water and silt levels to the section it will be placed on.

Section ID feature

Section ID picked up the field are extracted and used to label individual sections.

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Section Type feature

Section Type picked up in the field are extracted and used for annotation and export purposes.

Left Bank Feature

Left Bank feature is used for annotation and export purpose. It is also used to control the extent of the Water and Silt level surfaces.

Right Bank Feature

Right Bank feature is used for annotation and export purpose. It is also used to control the extent of the Water and Silt level surfaces.

Search all text in model for missing IDs and types

This quality check examines each section for missing IDs and types. Errors are reported in a text file.

Check and report for survey errors in sections

This quality check examines each section for survey errors. Errors are reported in a text file.

Correct reversed sections

This option re-aligned sections to match the centre line direction. This option overcomes issues relating to section having been surveyed in a 'zig-zag' fashion and also address problems arising from left and right bank being incorrectly surveyed.

Report water level differences by chainage

This quality check option allows the water level difference to be reported based on chainage values.

Cross Section drawing style

This option allows the user to select a predefined section style.

Profile drawing style

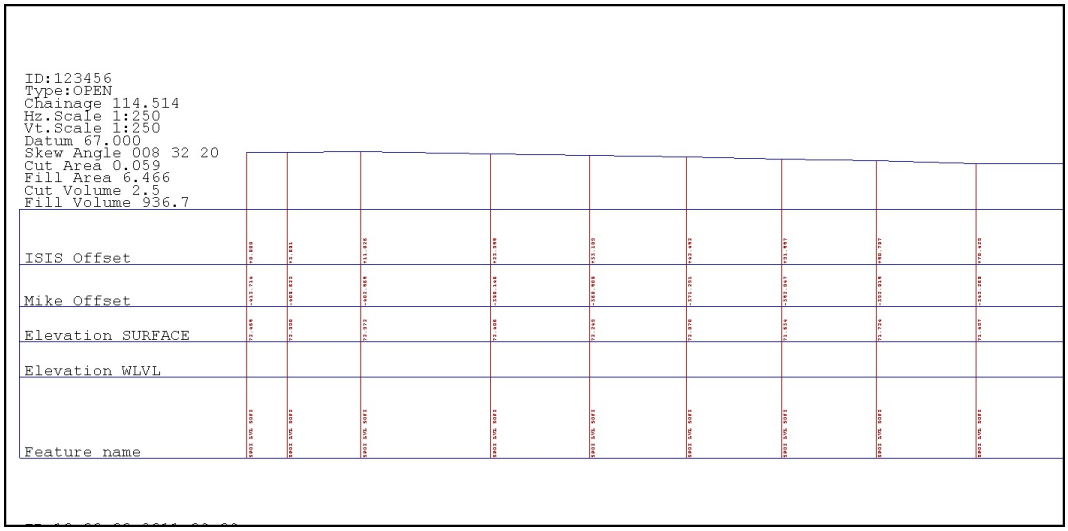
This option allows the user to select a predefined section style.

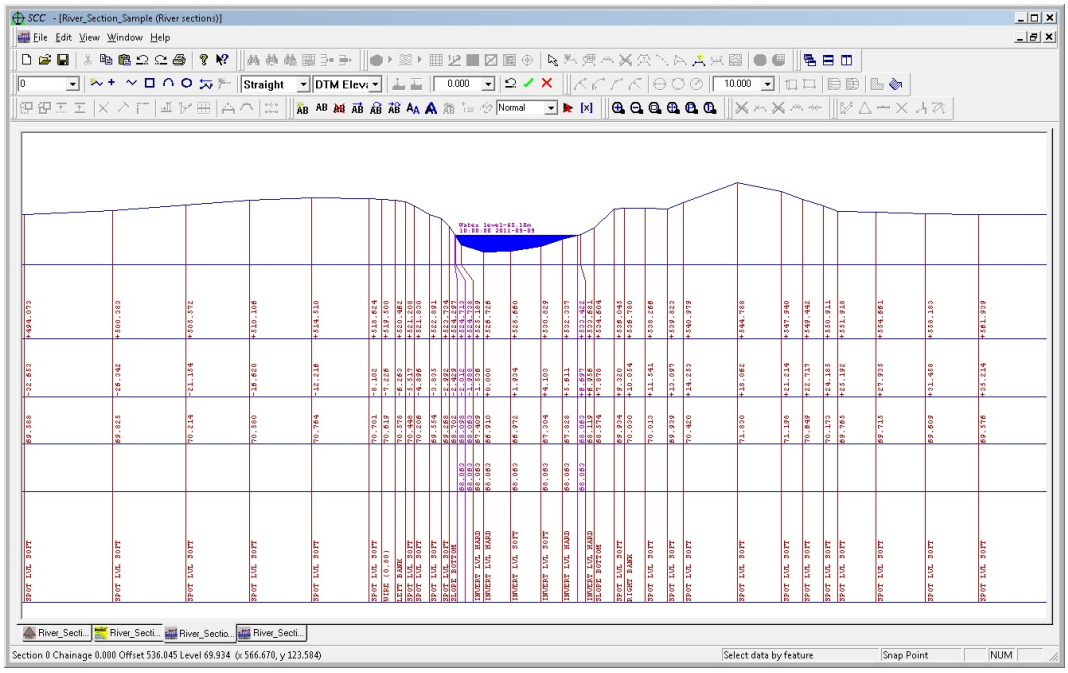
Feature >>

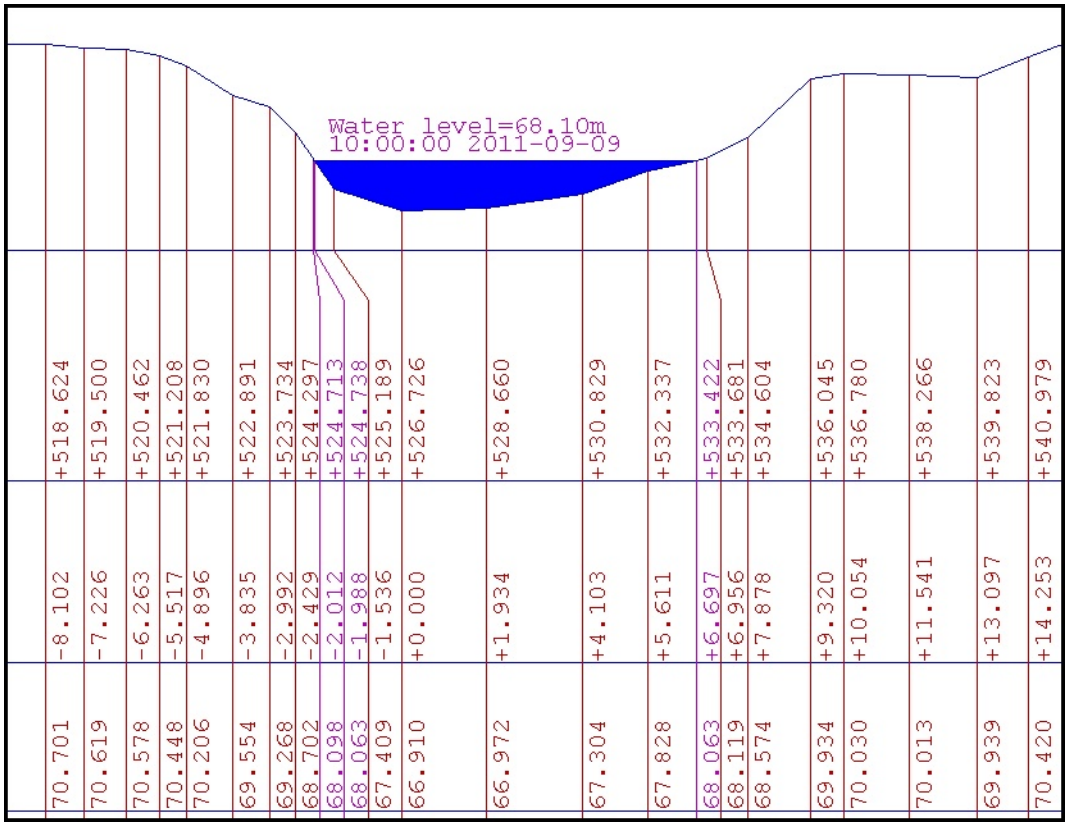
This option links to the Extended Field Code table.

The cross section and profiles are generated as shown below:

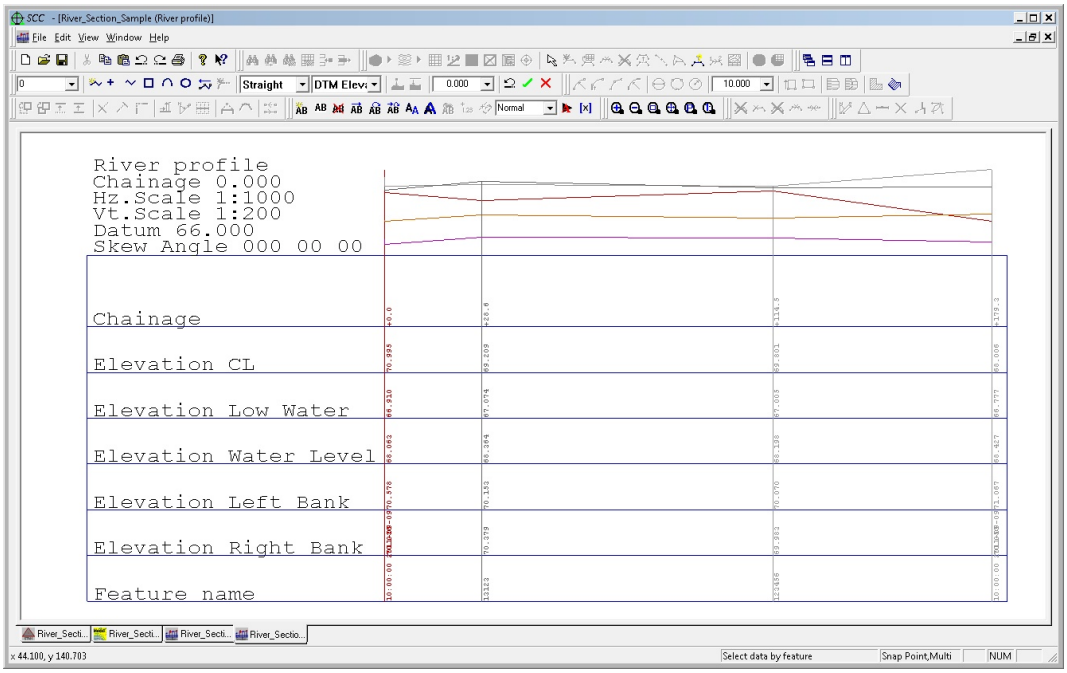
Cross Sections:







Profile:



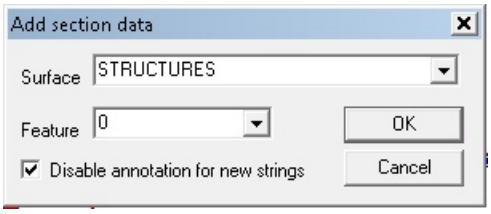
18.10 Displaying Structure On Sections

Structures and other detail can be copied from plan into section as shown below:

Select the required points to copy onto a given section using the data selection tools

Select 'EDIT > Copy > Copy to clipboard'

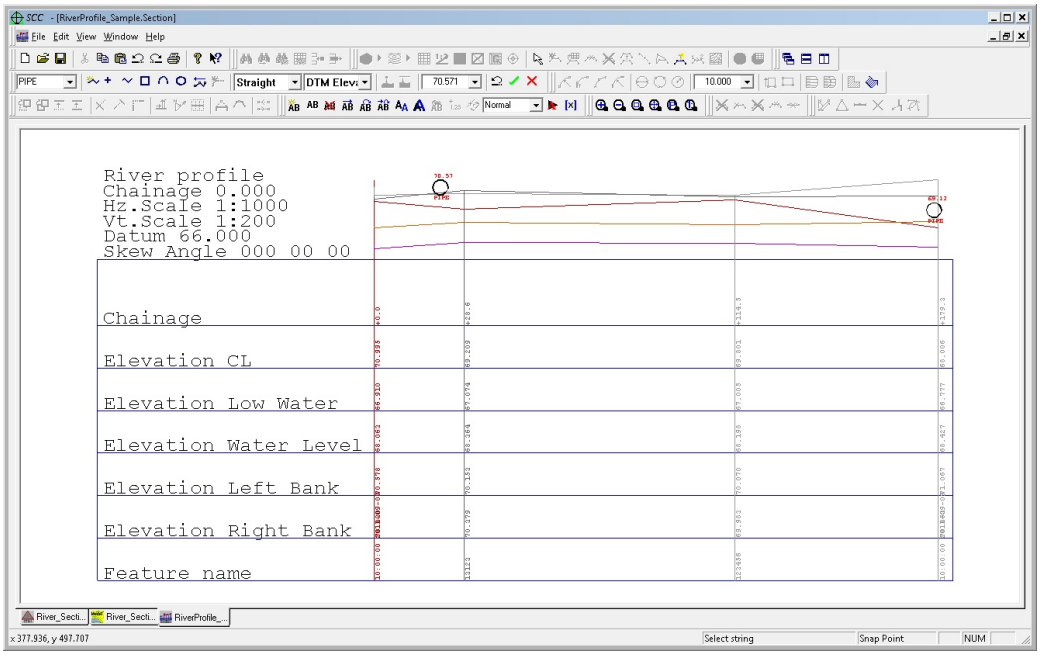
Switch to your section view



Select 'EDIT > Paste'

When prompted enter the surface name that the data will be associated with, e.g. structures, and whether or not the points will be annotated.

Click on the section you would like the data drawn on.



Note that data copied from plan to section in this manner is projected onto the section. Therefore if a line is copied that is not parallel to the section from plan, it will appear shorter in the section as it is the projected distance on view. The active alignment can be used to match offsets between plan and section where required, if not, the distance from the leftmost edge of the section will be used.

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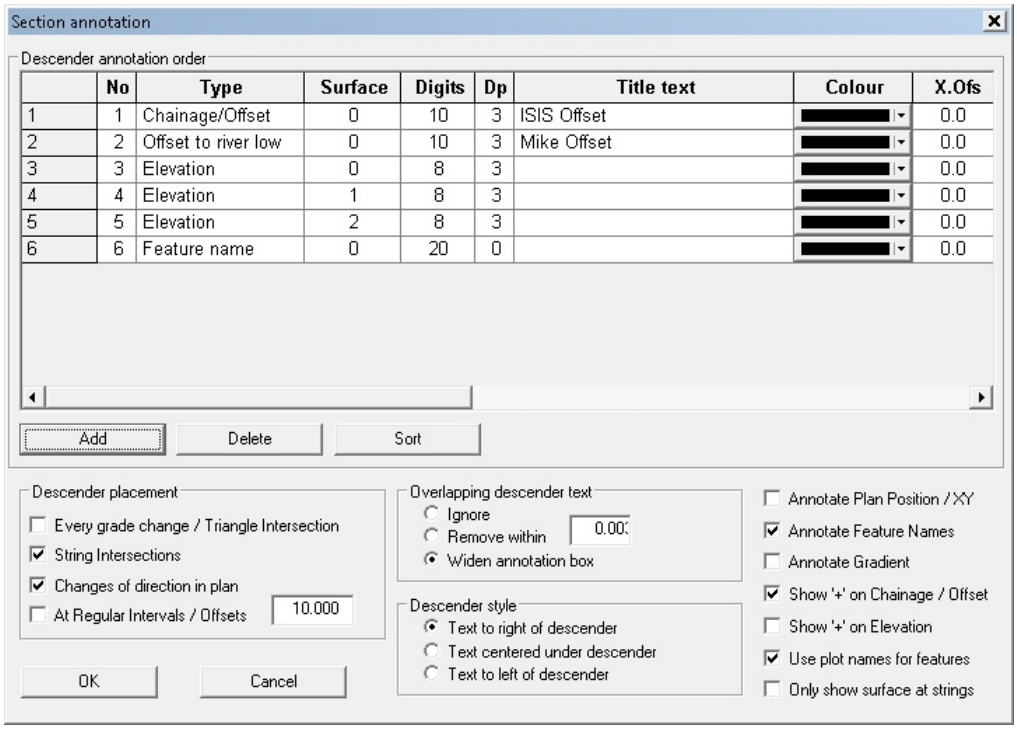
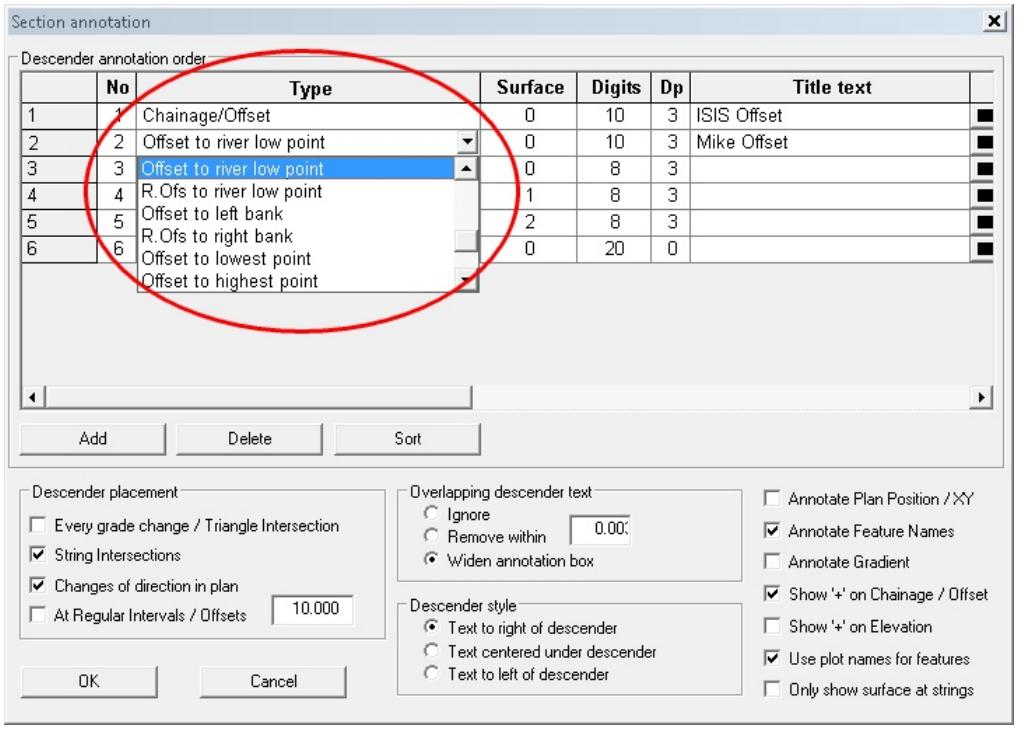
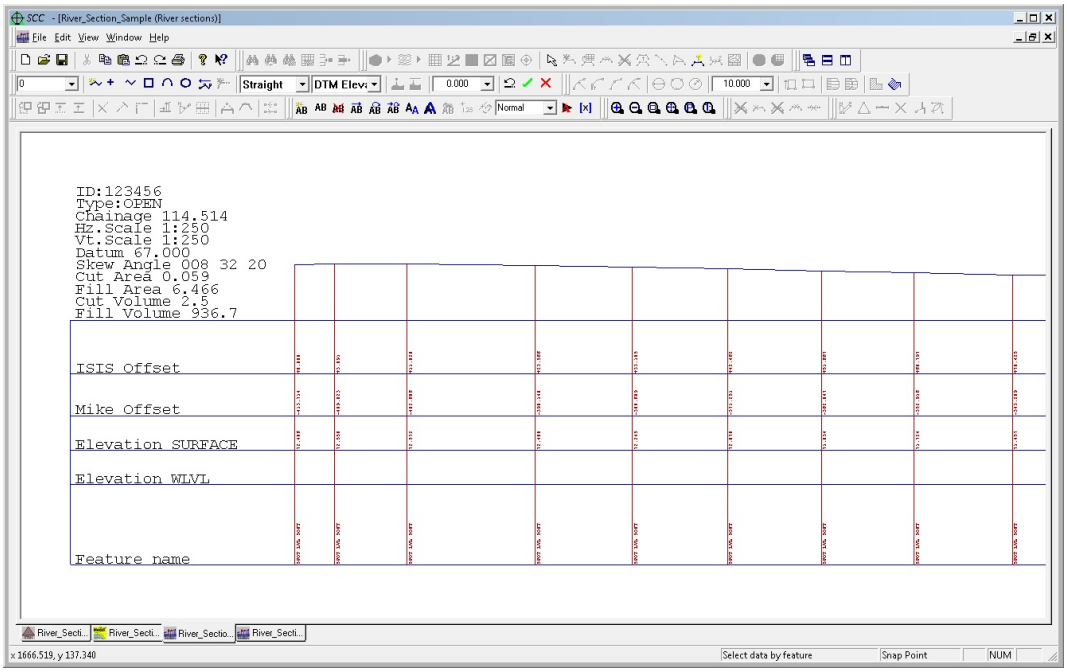
18.11 River Section Annotation

Section Annotation can be controlled within **'VIEW > Annotation Settings':**



Specific settings can be selected within the Type drop down menu to suit the required output.





18.12 River Section Scale Titles & Grids

The following notes common annotator for river section. Such annotator can be selected from **'VIEW > Scale, Titles & Grids'**

Chainage

The alignment chainage at the point where the river section, i.e best fit line through the survey points, cuts the alignment centre line.

River Chainage

The alignment chainage at the point where the surveyed section string cuts the alignment centre line

Diff Ch

The difference in chainage between this section and the next section (e.g. chainage value used in ISIS output)

Offset

The distance on the section from the leftmost point. Note that river sections are always displayed such that the left bank is on the left of the right bank regardless of the alignment direction or order in which the section string was surveyed. These values are always positive and always start from zero.

River offset

The distance from the current point on the section to the lowest point in the river bed, which is calculated as the point of lowest elevation between the left and right banks. Points to the left of the lowest point in the river bed have negative offsets, whereas those to the right have positive offsets.

Skew angle

The angle at which the section deviates from the alignment normal.

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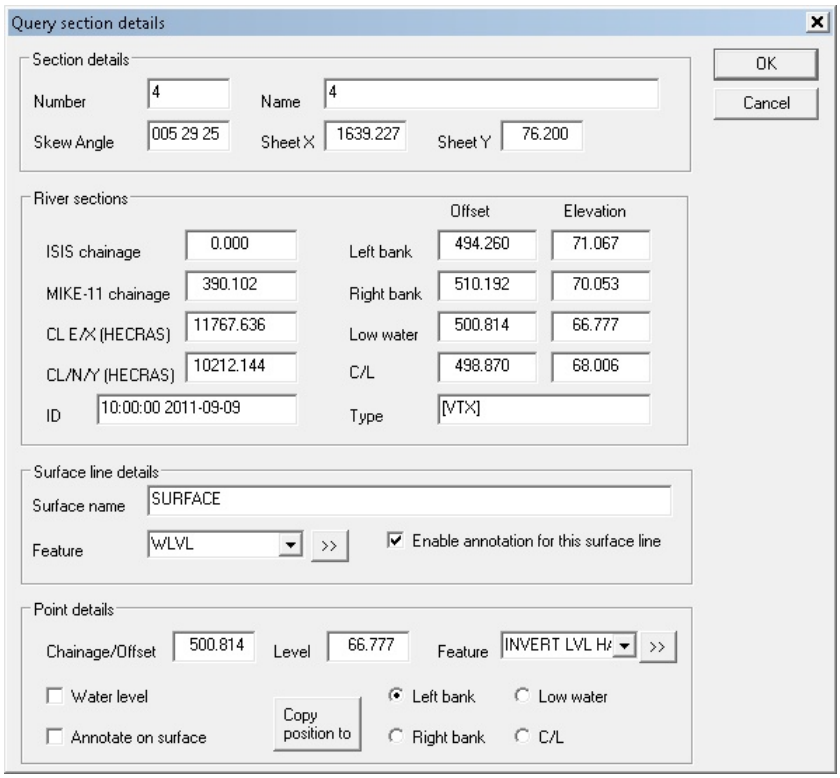
18.13 Editing Sections Using Query & Edit Function

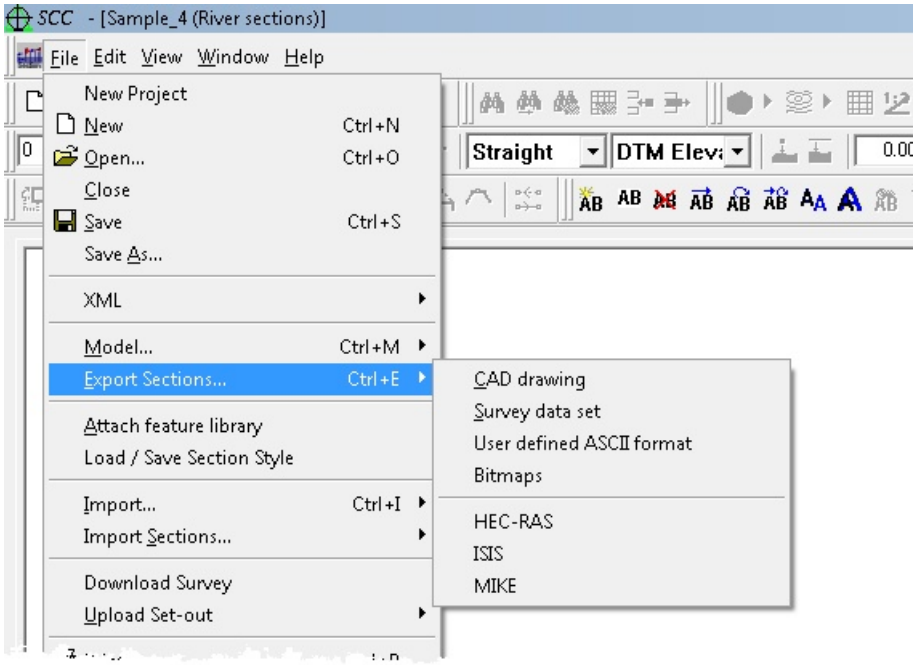
Sections can be manually edited using the 'Query & Edit Function'. This allows the user to set bank positions, and ISIS / MIKE & HECRAS specific values within any given section and to correct survey errors.

For example, specific users may require the option to define the lowest point between banks on a specific section at processing stages.



18.14 Exporting to Modelling Packages: ISIS, MIKE and HECRAS

These fields are also available under the Crystal Reports outing and user defined ASCII export, with sample format files available for modelling packages such as ISIS and HECRAS.



HEC-RAS

```
BEGIN STREAM NETWORK:

  ENDPOINT: 11755.013,10465.386,0.000,1
  ENDPOINT: 11767.636,10212.144,0.000,2

REACH:
  STREAM Id: River_Section_Sample (River sections)

  REACH Id: Reach 1
  FROM POINT: 1
  TO POINT: 2
  CENTERLINE:
    11755.013,10465.386
    11534.492,10066.627
    11909.390,10161.459
    11828.978,10191.503
    11767.636,10212.144
  END:
END STREAM NETWORK:
BEGIN CROSS-SECTIONS:

CROSS-SECTION:
  STREAM ID: River_Section_Sample (River sections)
  REACH ID: Reach 1
  STATION: 0.000
  BANK POSITIONS:  0.341,0.351
  CUT LINE:
    11561.147,9726.411
    11948.879,11204.361
  SURFACE LINE:
       11561.147,    9726.411,    72.681
       11563.967,    9737.158,    72.397
       11566.441,    9746.592,    71.924
       11568.995,    9756.324,    71.616
       11571.392,    9765.463,    71.246
       11573.691,    9774.226,    71.088
       11576.402,    9784.561,    71.129
```

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```
        11578.921,    9794.161,    71.132
        11581.472,    9803.885,    71.176
        11583.843,    9812.923,    71.254
        11586.344,    9822.457,    71.204
        11588.795,    9831.798,    71.034
        11591.409,    9841.761,    71.015
        11593.867,    9851.132,    70.816
        11596.305,    9860.426,    70.542
        11598.788,    9869.891,    70.612
        11601.506,    9880.251,    70.509
        11604.352,    9891.098,    70.350
.........

END   CROSS-SECTIONS:
```

ISIS

```
River_Section_Sample (River sections)
#REVISION#1
         5     0.750     0.900     0.100     0.001        12
    20.000     0.010     0.010     0.700     0.100     0.700     0.000
RAD FILE

END GENERAL
COMMENT
0
RIVER [VTX]
SECTION
10:00:00 2011-09-09
     0.000              0.0001
       175
     0.000    72.681     0.060     1.000            11561.15   9726.41
    11.111    72.397     0.060     1.000            11563.97   9737.16
    20.864    71.924     0.060     1.000            11566.44   9746.59
    30.925    71.616     0.060     1.000            11568.99   9756.32
    40.374    71.246     0.060     1.000            11571.39   9765.46
    49.434    71.088     0.060     1.000            11573.69   9774.23
    60.118    71.129     0.060     1.000            11576.40   9784.56
    70.044    71.132     0.060     1.000            11578.92   9794.16
    80.096    71.176     0.060     1.000            11581.47   9803.89
    89.440    71.254     0.060     1.000            11583.84   9812.92
    99.297    71.204     0.060     1.000            11586.34   9822.46
   108.954    71.034     0.060     1.000            11588.79   9831.80
   119.254    71.015     0.060     1.000            11591.41   9841.76
   128.941    70.816     0.060     1.000            11593.87   9851.13
   138.550    70.542     0.060     1.000            11596.31   9860.43
   148.336    70.612     0.060     1.000            11598.79   9869.89
   159.047    70.509     0.060     1.000            11601.51   9880.25
   170.261    70.350     0.060     1.000            11604.35   9891.10
   179.585    70.266     0.060     1.000            11606.72   9900.12
   182.300    70.203     0.060     1.000            11607.41   9902.74
   184.773    70.556     0.060     1.000            11608.03   9905.14
   186.689    70.598     0.060     1.000            11608.52   9906.99
   197.906    70.169     0.060     1.000            11611.37   9917.84
   210.304    69.970     0.060     1.000            11614.51   9929.83
   224.846    69.930     0.060     1.000            11618.20   9943.90
   245.081    69.969     0.060     1.000            11623.34   9963.47
   260.986    69.956     0.060     1.000            11627.37   9978.85
   273.086    70.223     0.060     1.000            11630.44   9990.56
   284.540    70.240     0.060     1.000            11633.35  10001.64
   295.899    70.253     0.060     1.000            11636.23  10012.62
   305.817    70.147     0.060     1.000            11638.75  10022.22
   316.464    70.066     0.060     1.000            11641.45  10032.52
   327.493    70.064     0.060     1.000            11644.25  10043.18
```

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```
   338.876    70.058     0.060     1.000            11647.14  10054.19
   349.581    69.904     0.060     1.000            11649.86  10064.55
   360.443    69.990     0.060     1.000            11652.61  10075.06
   370.113    69.984     0.060     1.000            11655.07  10084.41
   380.416    69.885     0.060     1.000            11657.68  10094.37
   391.959    69.892     0.060     1.000            11660.61  10105.54
   402.808    70.217     0.060     1.000            11663.36  10116.03
   413.339    70.461     0.060     1.000            11666.03  10126.22
   426.395    70.087     0.060     1.000            11669.35  10138.85
   438.595    69.909     0.060     1.000            11672.44  10150.65
   449.370    69.705     0.060     1.000            11675.18  10161.07
   458.598    69.650     0.060     1.000            11677.52  10170.00
   461.879    69.629     0.060     1.000            11678.35  10173.17
   461.942    69.626     0.060     1.000            11678.37  10173.23
   467.823    69.740     0.060     1.000            11679.86  10178.92
   480.240    69.537     0.060     1.000            11683.01  10190.93
   480.300    69.542     0.060     1.000            11683.03  10190.99
   494.073    69.588     0.060     1.000            11686.52  10204.31
   500.383    69.825     0.060     1.000            11688.12  10210.42
   505.572    70.214     0.060     1.000            11689.44  10215.43
   510.106    70.580     0.060     1.000            11690.59  10219.82
   514.510    70.764     0.060     1.000            11691.71  10224.08
   518.624    70.701     0.060     1.000            11692.75  10228.06
   519.500    70.619     0.060     1.000            11692.97  10228.91
   520.462    70.578     0.040*    1.000LEFT        11693.22  10229.84
   521.208    70.448     0.040     1.000            11693.41  10230.56
   521.830    70.206     0.040     1.000            11693.57  10231.16
   522.891    69.554     0.040     1.000            11693.83  10232.19
   523.734    69.268     0.040     1.000            11694.05  10233.00
   524.297    68.702     0.040     1.000            11694.19  10233.55
   525.189    67.409     0.040     1.000            11694.42  10234.41
   526.726    66.910     0.040     1.000            11694.81  10235.90
   528.660    66.972     0.040     1.000            11695.30  10237.77
   530.829    67.304     0.040     1.000            11695.85  10239.86
   532.337    67.828     0.040     1.000            11696.23  10241.32
   533.681    68.119     0.040     1.000            11696.57  10242.62
   534.604    68.574     0.040     1.000            11696.81  10243.52
   536.045    69.934     0.040     1.000            11697.17  10244.91
   536.780    70.030     0.060*    1.000RIGHT       11697.36  10245.62
   538.266    70.013     0.060     1.000            11697.74  10247.06
   539.823    69.939     0.060     1.000            11698.13  10248.56
   540.979    70.420     0.060     1.000            11698.42  10249.68
   544.788    71.830     0.060     1.000            11699.39  10253.37
   547.940    71.198     0.060     1.000            11700.19  10256.42
   549.442    70.649     0.060     1.000            11700.57  10257.87
   550.911    70.173     0.060     1.000            11700.94  10259.29
   551.918    69.765     0.060     1.000            11701.20  10260.26
   554.661    69.715     0.060     1.000            11701.90  10262.92
........

INITIAL CONDITIONS
 label   ?      flow     stage froude no  velocity     umode    ustate
       z
10:00:00 2011-09-09 y     0.000     0.000     0.000     0.000
0.000     0.000     0.000
123456       y     0.000     0.000     0.000     0.000     0.000
0.000     0.000
13123        y     0.000     0.000     0.000     0.000     0.000
0.000     0.000
123456       y     0.000     0.000     0.000     0.000     0.000
0.000     0.000
10:00:00 2011-09-09 y     0.000     0.000     0.000     0.000
0.000     0.000     0.000
```

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MIKE

```
River_Section_Sample (River sections)
River_Section_Sample (River sections)
                0.000
COORDINATES
    0
FLOW DIRECTION
    0
DATUM
      0.00
RADIUS TYPE
    2
DIVIDE X-Section
0
SECTION ID
10:00:00 2011-09-09
INTERPOLATED
    0
ANGLE
    0.00   0
RESISTANCE NUMBERS
   2  1     1.000     1.000     1.000    1.000    1.000
PROFILE        175
 -526.726    72.681     0.060     <#0>
 -515.614    72.397     0.060     <#0>
 -505.861    71.924     0.060     <#0>
 -495.800    71.616     0.060     <#0>
 -486.351    71.246     0.060     <#0>
 -477.292    71.088     0.060     <#0>
 -466.608    71.129     0.060     <#0>
 -456.682    71.132     0.060     <#0>
 -446.629    71.176     0.060     <#0>
 -437.286    71.254     0.060     <#0>
 -427.429    71.204     0.060     <#0>
 -417.772    71.034     0.060     <#0>
 -407.471    71.015     0.060     <#0>
 -397.784    70.816     0.060     <#0>
 -388.175    70.542     0.060     <#0>
 -378.390    70.612     0.060     <#0>
 -367.679    70.509     0.060     <#0>
 -356.465    70.350     0.060     <#0>
 -347.140    70.266     0.060     <#0>
 -344.426    70.203     0.060     <#0>
 -341.952    70.556     0.060     <#0>
 -340.037    70.598     0.060     <#0>
 -328.820    70.169     0.060     <#0>
 -316.422    69.970     0.060     <#0>
 -301.880    69.930     0.060     <#0>
 -281.645    69.969     0.060     <#0>
......
```

18.15 Exporting Text To GIS Attributes: Shape Files

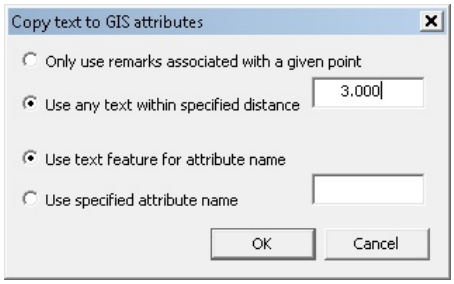
River IDs can be converted into GIS attributes which can be exported to shape files. The steps to do this are as follows;

Set up your GIS layer for features which are required for export, for example, set the GIS layer for SURFACE to RIVERS.

Process the river sections as normal

Select all river sections and all ID points

Select 'EDIT > Text > Copy text to GIS attributes' using the parameters below



Select 'FILE > Export > Shape File'

18.16 River Section Displayed on Model

To display the position of section lines in plan:

In the model use 'FILE > Attach/Detach > Attach Section file'.

Chainage can be annotated in plan by modifying the Chainage annotator on the '~SECT_T' feature.

Select 'VIEW > Feature Annotation'

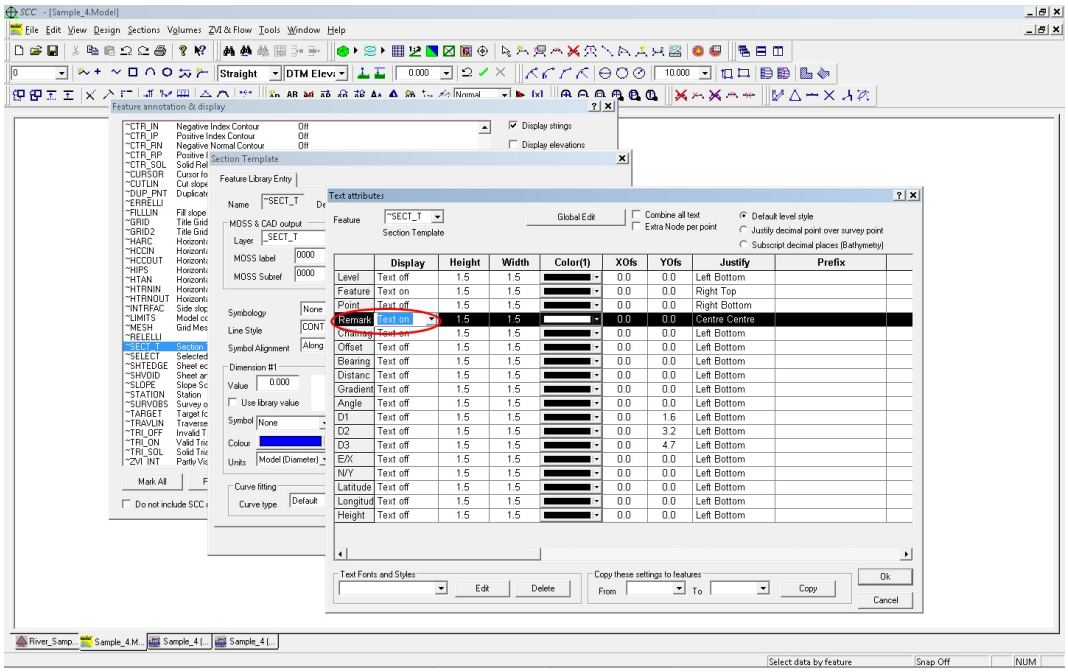
Pick '~SECT_T'

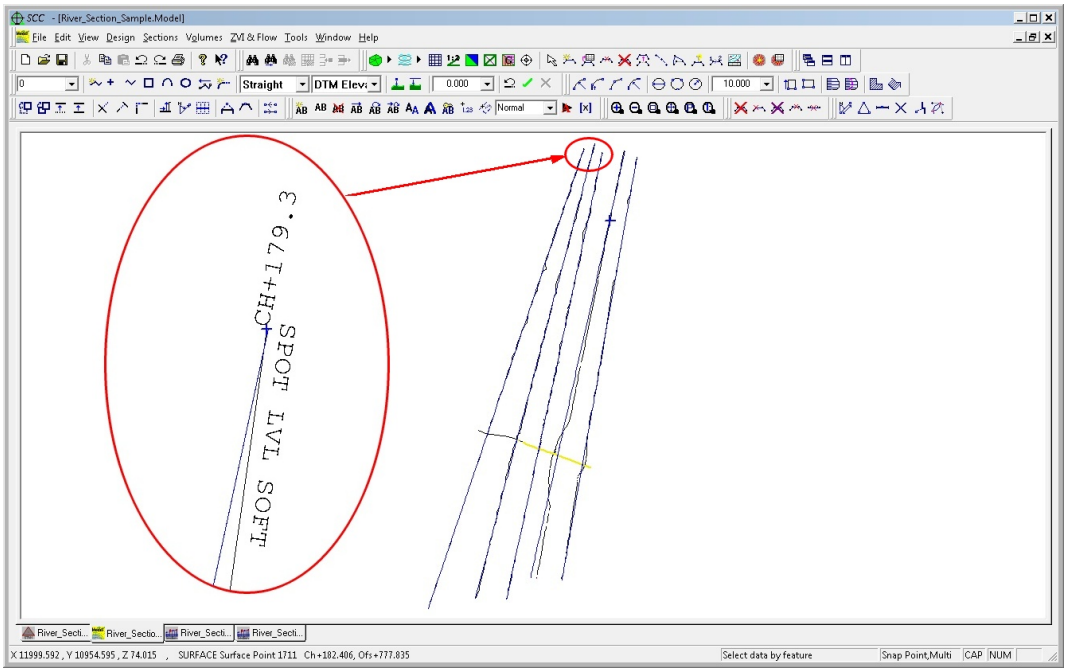
Press 'Edit Feature>>'

Press 'Text Annotation>>'

Set the value of Display, Remark and Chainage to Text On.

Alternatively, this can be set up in your feature library template, such that it is the default behaviour when attaching sections.





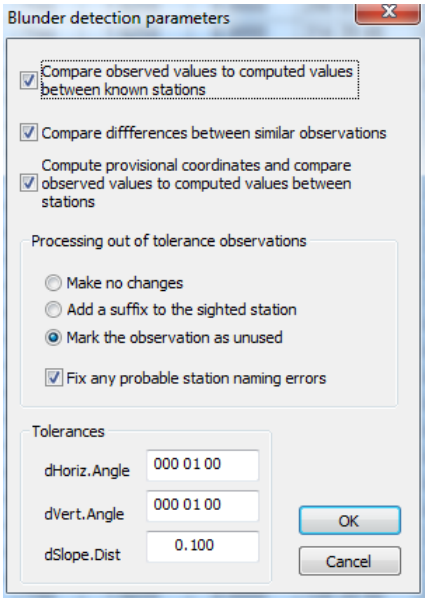
19 Blunder Detection And Analysis

SCC supports blunder detection and analysis in traverses and networks. This works in three stages as follows;

- Observed values, including angles and distances, are compared to computed values between known stations. For example, where you have an observed distance between two known stations, and a join distance computed from coordinates between the same stations, a difference in distance is calculated. If this difference exceeds a user defined tolerance a measurement blunder is considered to have occurred.
- Multiple observed values, including angles and distances, are compared for similarity. This could be the same observation, for example two observations from STNA to STNB, or a reverse observation, for example one from STNA to STNB and the other from STNB to STNA. Where differences between similar observations exceed a user defined tolerance a measurement blunder is considered to have occurred.
- Provisional values for unknown stations are computed, and differences between observed values and computed values are calculated for these provisional stations.

Where blunders are detected, you have three options to deal with how they are processed as follows;

- Take no action, simply highlight the blunder observations such that they can be edited manually.
- Mark the blunder observations to be excluded from the adjustment. In the case of networks or traverses with significant redundancy, this allows for the adjustment to be completed with minimal editing required.
- Rename the sighted station using a suffix, such that you will have multiple adjusted station values for blunder observations, e.g STNA, STNA(1), STNA(2), etc... This can be useful in situations where the sighted station name has inadvertently been re-used for more than one physical station.



There is also an option to automatically correct probable station naming errors, which account for a large proportion of typical blunders. This is done by comparing similar observations for a likely match, and failing that, calculating a provisional coordinate for the sighted station and comparing it to known stations.

The blunder analysis routines are available in the traverse observation view, under Edit / Blunder detection. The parameters are as described above, and on running the blunder detection and analysis, you'll be given the option to view a detailed report of the results.

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Created on 07/03/2008
By SCC for Windows v10.1.4 (Network)
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ATLAS

Traverse blunder analysis

Tel:
Fax:
email:
web:

Traverse file: E:\SCC\tp-trav\ALL.Traverse

Ha tolerance: 000 01 00
Va tolerance: 000 01 00
Distance tolerance: 0.100
Corrective action: Mark obs as unused

Analysis results:

	Known co-ords	Similar Obs	Computed co-ords
Checked:	Yes	Yes	Yes
Number of errors found:	59	73	1,866
Fixed (station renamed):	2	29	850
Corrective action applied:	57	44	1,016

The report is broken down into a summary, comparison between observations and known coordinates, comparisons between similar observations, and comparison between observations and computed provisional coordinates.

Comparison of similar observations

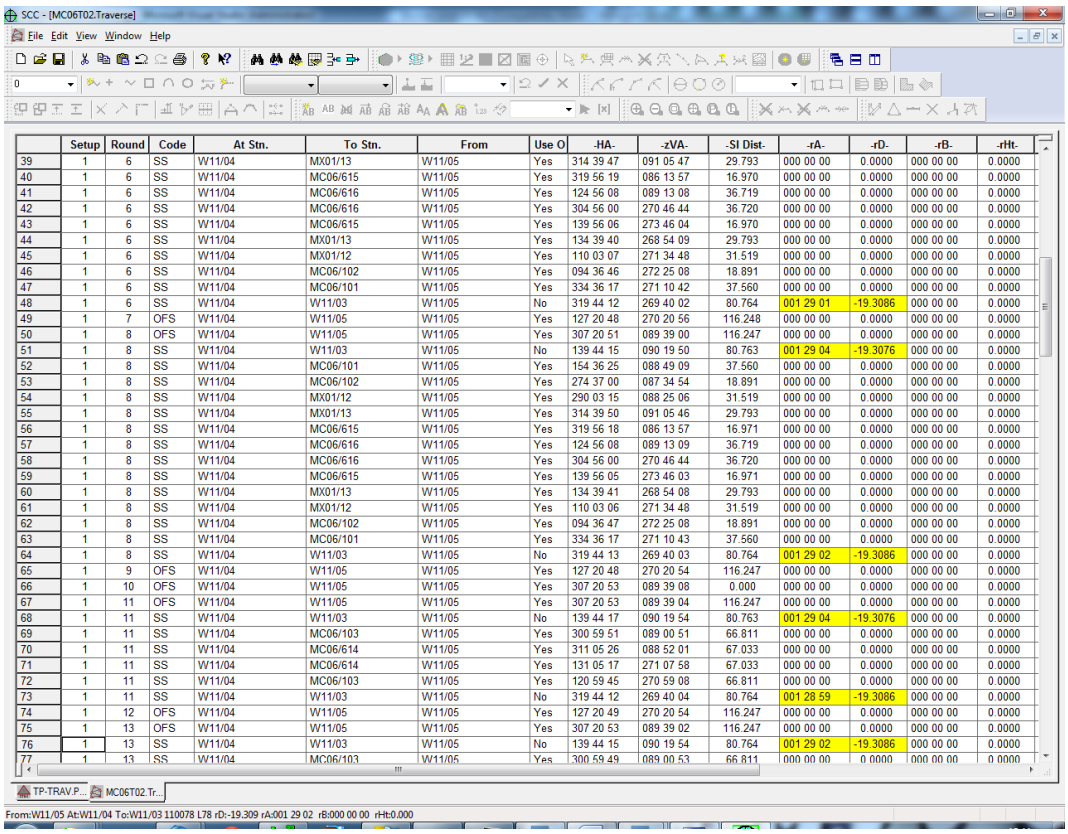
At Stn: MC06/10 To Stn: W11/03

Obs#	Remark	Ha	Va	S.Dist	dDist	Angle	From Stn	dAngle
109	**110113 L113**	**314 12 44**	**089 42 17**	**80.795**		**000 00 01**	**W11/04**	
107	110112 L112	314 12 43	089 42 17	80.795	73.003	000 00 00	W11/04	086 59 29
110	110114 L114	227 13 27	088 35 38	7.793	73.003	273 00 44	W11/04	086 59 17
113	110117 L117	227 13 17	088 35 26	7.793	73.003	273 00 37	W11/04	086 59 24
114	110118 L118	227 13 25	088 35 35	7.793	73.003	273 00 45	W11/04	086 59 16
117	110121 L121	227 13 16	088 35 27	7.793	73.003	273 00 33	W11/04	086 59 28
118	110122 L122	227 13 24	088 35 36	7.793	73.003	273 00 41	W11/04	086 59 20
121	110125 L125	227 13 16	088 35 27	7.793	73.003	273 00 34	W11/04	086 59 27
122	110126 L126	227 13 24	088 35 36	7.793	73.003	273 00 42	W11/04	086 59 19
125	110129 L129	227 13 17	088 35 28	7.793	73.003	273 00 32	W11/04	086 59 29
333	110351 L351	047 13 56	090 53 16	7.792	73.003	092 25 31	MC06/16	086 59 29
334	110350 L350	047 14 06	090 53 22	7.791	73.004	092 25 41	MC06/16	086 59 29
337	110354 L354	047 14 05	090 53 22	7.791	73.004	092 25 41	MC06/16	086 59 29
338	110355 L355	047 13 57	090 53 16	7.792	73.003	092 25 33	MC06/16	086 59 29
341	110358 L358	047 14 05	090 53 21	7.791	73.004	092 25 42	MC06/16	086 59 29
342	110359 L359	047 13 56	090 53 15	7.792	73.003	092 25 33	MC06/16	086 59 29
345	110362 L362	047 14 06	090 53 22	7.791	73.004	092 25 41	MC06/16	086 59 29
346	110363 L363	047 13 58	090 53 15	7.792	73.003	092 25 33	MC06/16	086 59 29

At Stn: W11/05 To Stn: MC06/103

Obs#	Remark	Ha	Va	S.Dist	dDist	Angle	From Stn	dAngle
451	**110107 L471**	**135 21 06**	**089 30 06**	**50.400**		**008 00 12**	**W11/04**	
461	110119 L483	135 46 46	089 30 05	50.401	-0.001	008 25 52	W11/04	-000 25 40
468	110126 L490	135 46 39	089 30 03	50.401	-0.001	008 25 45	W11/04	-000 25 33
475	110133 L497	135 46 43	089 30 07	50.401	-0.001	008 25 49	W11/04	-000 25 37
482	110140 L504	135 46 39	089 30 03	50.401	-0.001	008 25 45	W11/04	-000 25 33
489	110147 L511	135 46 45	089 30 08	50.401	-0.001	008 25 50	W11/04	-000 25 38

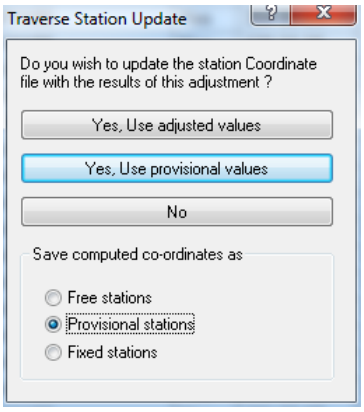
Where the option to fix station naming errors has been selected, fixed observations will be highlighted in green. In all other cases, the differences will be written back to the traverse observation sheet in the residual columns, and the traverse observation sheet layout will be changed to show these values.



	Setup	Round	Code	At Stn.	To Stn.	From	Use O	-HA-	-zVA-	-Sl Dist-	-rA-	-rD-	-rB-	-rHt-
39	1	6	SS	W11/04	MX01/13	W11/05	Yes	314 39 47	091 05 47	29.793	000 00 00	0.0000	000 00 00	0.0000
40	1	6	SS	W11/04	MC06/615	W11/05	Yes	319 56 19	086 13 57	16.970	000 00 00	0.0000	000 00 00	0.0000
41	1	6	SS	W11/04	MC06/616	W11/05	Yes	124 56 08	089 13 08	36.719	000 00 00	0.0000	000 00 00	0.0000
42	1	6	SS	W11/04	MC06/616	W11/05	Yes	304 56 00	270 46 44	36.720	000 00 00	0.0000	000 00 00	0.0000
43	1	6	SS	W11/04	MC06/615	W11/05	Yes	139 56 06	273 46 04	16.970	000 00 00	0.0000	000 00 00	0.0000
44	1	6	SS	W11/04	MX01/13	W11/05	Yes	134 39 40	268 54 09	29.793	000 00 00	0.0000	000 00 00	0.0000
45	1	6	SS	W11/04	MX01/12	W11/05	Yes	110 03 07	271 34 48	31.519	000 00 00	0.0000	000 00 00	0.0000
46	1	6	SS	W11/04	MC06/102	W11/05	Yes	094 36 46	272 25 08	18.891	000 00 00	0.0000	000 00 00	0.0000
47	1	6	SS	W11/04	MC06/101	W11/05	Yes	334 36 17	271 10 42	37.560	000 00 00	0.0000	000 00 00	0.0000
48	1	6	SS	W11/04	W11/03	W11/05	No	319 44 12	269 40 02	80.764	001 29 01	-19.3086	000 00 00	0.0000
49	1	7	OFS	W11/04	W11/05	W11/05	Yes	127 20 48	270 20 56	116.248	000 00 00	0.0000	000 00 00	0.0000
50	1	8	OFS	W11/04	W11/05	W11/05	Yes	307 20 51	089 39 00	116.247	000 00 00	0.0000	000 00 00	0.0000
51	1	8	SS	W11/04	W11/03	W11/05	No	139 44 15	090 19 50	80.763	001 29 04	-19.3076	000 00 00	0.0000
52	1	8	SS	W11/04	MC06/101	W11/05	Yes	154 36 25	088 49 09	37.560	000 00 00	0.0000	000 00 00	0.0000
53	1	8	SS	W11/04	MC06/102	W11/05	Yes	274 37 00	087 34 54	18.891	000 00 00	0.0000	000 00 00	0.0000
54	1	8	SS	W11/04	MX01/12	W11/05	Yes	290 03 15	088 25 06	31.519	000 00 00	0.0000	000 00 00	0.0000
55	1	8	SS	W11/04	MX01/13	W11/05	Yes	314 39 50	091 05 46	29.793	000 00 00	0.0000	000 00 00	0.0000
56	1	8	SS	W11/04	MC06/615	W11/05	Yes	319 56 18	086 13 57	16.971	000 00 00	0.0000	000 00 00	0.0000
57	1	8	SS	W11/04	MC06/616	W11/05	Yes	124 56 08	089 13 09	36.719	000 00 00	0.0000	000 00 00	0.0000
58	1	8	SS	W11/04	MC06/616	W11/05	Yes	304 56 00	270 46 44	36.720	000 00 00	0.0000	000 00 00	0.0000
59	1	8	SS	W11/04	MC06/615	W11/05	Yes	139 56 05	273 46 03	16.971	000 00 00	0.0000	000 00 00	0.0000
60	1	8	SS	W11/04	MX01/13	W11/05	Yes	134 39 41	268 54 08	29.793	000 00 00	0.0000	000 00 00	0.0000
61	1	8	SS	W11/04	MX01/12	W11/05	Yes	110 03 06	271 34 48	31.519	000 00 00	0.0000	000 00 00	0.0000
62	1	8	SS	W11/04	MC06/102	W11/05	Yes	094 36 47	272 25 08	18.891	000 00 00	0.0000	000 00 00	0.0000
63	1	8	SS	W11/04	MC06/101	W11/05	Yes	334 36 17	271 10 43	37.560	000 00 00	0.0000	000 00 00	0.0000
64	1	8	SS	W11/04	W11/03	W11/05	No	319 44 13	269 40 03	80.764	001 29 02	-19.3086	000 00 00	0.0000
65	1	9	OFS	W11/04	W11/05	W11/05	Yes	127 20 48	270 20 54	116.247	000 00 00	0.0000	000 00 00	0.0000
66	1	10	OFS	W11/04	W11/05	W11/05	Yes	307 20 53	089 39 08	0.000	000 00 00	0.0000	000 00 00	0.0000
67	1	11	OFS	W11/04	W11/05	W11/05	Yes	307 20 53	089 39 04	116.247	000 00 00	0.0000	000 00 00	0.0000
68	1	11	SS	W11/04	W11/03	W11/05	No	139 44 17	090 19 54	80.763	001 29 04	-19.3076	000 00 00	0.0000
69	1	11	SS	W11/04	MC06/103	W11/05	Yes	300 59 51	089 00 51	66.811	000 00 00	0.0000	000 00 00	0.0000
70	1	11	SS	W11/04	MC06/614	W11/05	Yes	311 05 26	088 52 01	67.033	000 00 00	0.0000	000 00 00	0.0000
71	1	11	SS	W11/04	MC06/614	W11/05	Yes	131 05 17	271 07 58	67.033	000 00 00	0.0000	000 00 00	0.0000
72	1	11	SS	W11/04	MC06/103	W11/05	Yes	120 59 45	270 59 08	66.811	000 00 00	0.0000	000 00 00	0.0000
73	1	11	SS	W11/04	W11/03	W11/05	No	319 44 12	269 40 04	80.764	001 28 59	-19.3086	000 00 00	0.0000
74	1	12	OFS	W11/04	W11/05	W11/05	Yes	127 20 49	270 20 54	116.247	000 00 00	0.0000	000 00 00	0.0000
75	1	13	OFS	W11/04	W11/05	W11/05	Yes	307 20 53	089 39 02	116.247	000 00 00	0.0000	000 00 00	0.0000
76	1	13	SS	W11/04	W11/03	W11/05	No	139 44 15	090 19 54	80.764	001 29 02	-19.3086	000 00 00	0.0000
77	1	13	SS	W11/04	MC06/103	W11/05	Yes	300 59 49	089 00 53	66.811	000 00 00	0.0000	000 00 00	0.0000

Pressing F4 in this view moves you to the next blunder detected, and pressing F5 brings you back to the default observation layout and may be used to cycle through other layouts. Note that each stage of the blunder detection and analysis clears down the residual values, so if you

wish the view the results from any given stage, maek sure that subsequent stages are not enabled.



The blunder detection also checks that provisional values can be calculated for all sighted stations. If this is the case, it should be possible to successfully adjust the traverse, although careful attention should be paid to the output report, as a significant amount of information may have been removed.

When updating the station coordinates, you now also have the option to store the resultant stations as free, provisional, or fixed. This is useful when working with a traverse spanning multiple jobs, where you wish to carry out the blunder analysis seperately on each job, but need to carry coordinates between jobs in order to be able compute the results. The traverse report now also details how each provisional coordinate was computed, which can be either by direct trigonometry, resection, or intersecting rays.

An additional option to use high performance matrix processing libraries for working with very large networks is available. This is available under File / General options / Use high performance matrix libraries. Note that for very large networks, memory is also likely to be a limitation, as calculation involves matrices based on the square of the size of the number of observations. Thus 8,000 total station sightings would give us 8000 distances and a slightly smaller number of angles, resulting in matrix sizes of ~ 15,000 x 15,000 or ~1.8gb of memory. This would need to be either reduced or broken down into a number of smaller jobs. Networks including < 2,000 observations should be accomodated by most 32 bit PCs, and < 4,000 is advised for 64 bit PCs.

20 Rail

20.1 Wriggle Survey Processing

Wriggle survey functionality which can be accessed as follows;

'FILE > Import > ASCII Wriggle Survey' from the main project control view

'TOOLS > Compute Wriggle Survey from the survey coordinates view'

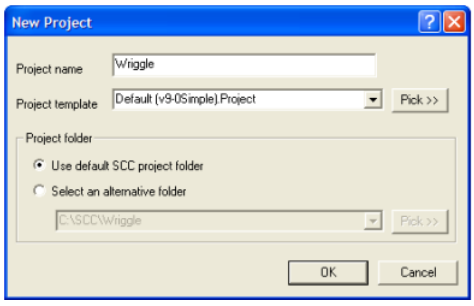
'TOOLS > String using Chainage > Offset from the survey coordinates view'

This is used in conjunction with an alignment to group point data into rings.

To process the sample files 9961065.ASC, 200_UPLINE-.CAN, 200_UPLINE-.HOR and , 200_UPLINE-.VER do the following;

Create a new project

'FILE > New Project



Create an alignment from the 200_UPLINE files

'FILE > New > SCC Alignment'

'FILE > Import > ACT horizontal entity file, picking 200_UPLINE-.HOR'

'FILE > Import > ACT vertical entity file, picking 200_UPLINE-.VER'

'FILE > Import > ACT cant file, picking 200_UPLINE-.CAN'

'FILE > Save As 200_UPLINE'

'FILE > Close'

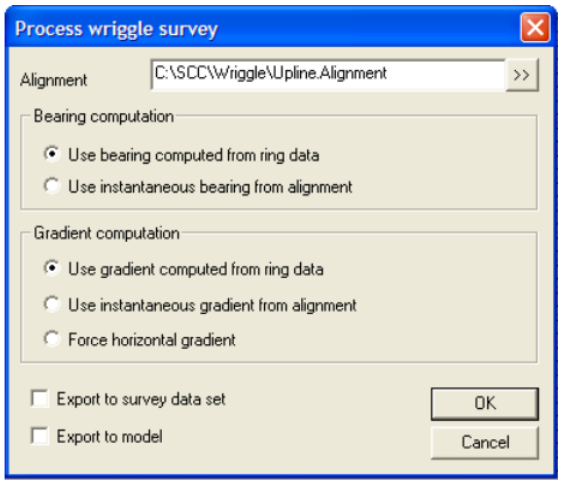
Import the ASCII survey file

'FILE > Import > ASCII Wriggle Survey, picking 9961065.ASC'

'FILE > Save'

Compute the wriggle survey

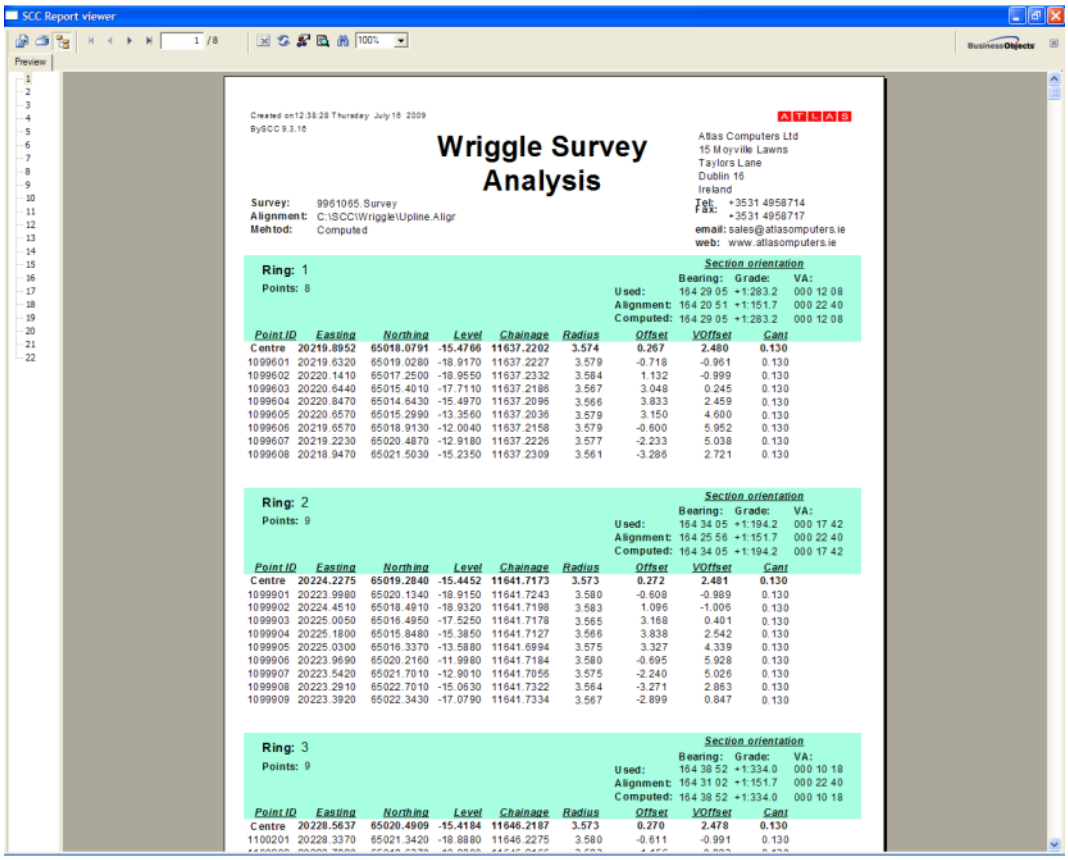
'TOOLS > Compute Wriggle Survey', using parameters shown and pick 'WriggleSurvey.RPT' as the report file



This will compute the wriggle survey and show the following report.

Note:

- that with bearing and gradient computed from ring data, the alignment is not used in the computations. It is still used in the report to show the difference between bearing and gradient values computed via linear regression and those computed for the alignment.



SCC Report viewer

Created on 12:38:28 Thursday July 16 2009
By SCC 9.3.16

Wriggle Survey Analysis

Atlas Computers Ltd
15 Moyville Lawns
Taylors Lane
Dublin 16
Ireland
Tel: +3531 4958714
Fax: +3531 4958717
email: sales@atlasomputers.ie
web: www.atlasomputers.ie

Survey: 9961065.Survey
Alignment: C:\SCC\Wriggle\Upline.Aligr
Mehtod: Computed

Ring: 1
Points: 8

	Bearing:	Grade:	VA:
Used:	164 29 05	+1:283.2	000 12 08
Alignment:	164 20 51	+1:151.7	000 22 40
Computed:	164 29 05	+1:283.2	000 12 08

Point ID	Easting	Northing	Level	Chainage	Radius	Offset	VOffset	Cant
Centre	20219.8952	65018.0791	-15.4766	11637.2202	3.574	0.267	2.480	0.130
1099601	20219.6320	65019.0280	-18.9170	11637.2227	3.579	-0.718	-0.961	0.130
1099602	20220.1410	65017.2500	-18.9550	11637.2332	3.584	1.132	-0.999	0.130
1099603	20220.6440	65015.4010	-17.7110	11637.2186	3.567	3.048	0.245	0.130
1099604	20220.8470	65014.6430	-15.4970	11637.2096	3.566	3.833	2.459	0.130
1099605	20220.6570	65015.2990	-13.3560	11637.2036	3.579	3.150	4.600	0.130
1099606	20219.6570	65018.9130	-12.0040	11637.2158	3.579	-0.600	5.952	0.130
1099607	20219.2230	65020.4870	-12.9180	11637.2226	3.577	-2.233	5.038	0.130
1099608	20218.9470	65021.5030	-15.2350	11637.2309	3.561	-3.286	2.721	0.130

Ring: 2
Points: 9

	Bearing:	Grade:	VA:
Used:	164 34 05	+1:194.2	000 17 42
Alignment:	164 25 56	+1:151.7	000 22 40
Computed:	164 34 05	+1:194.2	000 17 42

Point ID	Easting	Northing	Level	Chainage	Radius	Offset	VOffset	Cant
Centre	20224.2275	65019.2840	-15.4452	11641.7173	3.573	0.272	2.481	0.130
1099901	20223.9980	65020.1340	-18.9150	11641.7243	3.580	-0.608	-0.989	0.130
1099902	20224.4510	65018.4910	-18.9320	11641.7198	3.583	1.096	-1.006	0.130
1099903	20225.0050	65016.4950	-17.5250	11641.7178	3.565	3.168	0.401	0.130
1099904	20225.1800	65015.8480	-15.3850	11641.7127	3.566	3.838	2.542	0.130
1099905	20225.0300	65016.3370	-13.5880	11641.6994	3.575	3.327	4.339	0.130
1099906	20223.9690	65020.2160	-11.9980	11641.7184	3.580	-0.695	5.928	0.130
1099907	20223.5420	65021.7010	-12.9010	11641.7056	3.575	-2.240	5.026	0.130
1099908	20223.2910	65022.7010	-15.0630	11641.7322	3.564	-3.271	2.863	0.130
1099909	20223.3920	65022.3430	-17.0790	11641.7334	3.567	-2.899	0.847	0.130

Ring: 3
Points: 9

	Bearing:	Grade:	VA:
Used:	164 38 52	+1:334.0	000 10 18
Alignment:	164 31 02	+1:151.7	000 22 40
Computed:	164 38 52	+1:334.0	000 10 18

Point ID	Easting	Northing	Level	Chainage	Radius	Offset	VOffset	Cant
Centre	20228.5637	65020.4909	-15.4184	11646.2187	3.573	0.270	2.478	0.130
1100201	20228.3370	65021.3420	-18.8880	11646.2275	3.580	-0.611	-0.991	0.130

- the contact details in the report are taken from **'FILE > General Options > Module Licenses > Edit user details'.** The layout and content of the report can be modified to suit individual client needs independently of SCC using Crystal reports XI or later. Results from the SCC viewer can be saved into Microsoft Excel for further analysis by pressing the export button on the top left of the viewer. This also supports a wide range of other formats included Word, PDF and ODBC database tables.

When comparing the results with the output file provided, 9961065.out, SCC is producing identical radii, and horizontal and vertical offsets that agree to within 1mm. The easting and northing of the centres deviate by ~10mm to 30mm but looking at the radial residuals, e.g. the difference between the final computed radius and distance from computed centre to each point, I believe the SCC result is more accurate. I say this because the sum of the residuals in the SCC report is smaller than those in the output report provided, indicating a slightly better circle fit. For example on ring 1, both routines agree a radius of 3.574, and the residuals are as follows;

9961065.out				SCC	
Point	Radius	Residual		Radius	Residual
1099601	3.578	0.004		3.579	0.005
1099602	3.584	0.010		3.584	0.010
1099603	3.567	-0.007		3.567	-0.007
1099604	3.565	-0.009		3.566	-0.008
1099605	3.579	0.005		3.579	0.005
1099606	3.579	0.005		3.579	0.005
1099607	3.577	0.003		3.577	0.003

1099608	3.561	-0.013		3.571	-0.003
Sum of square of residuals					
		0.056			0.046

We can see from this that the SCC centre is a slightly better fit for the data provided.

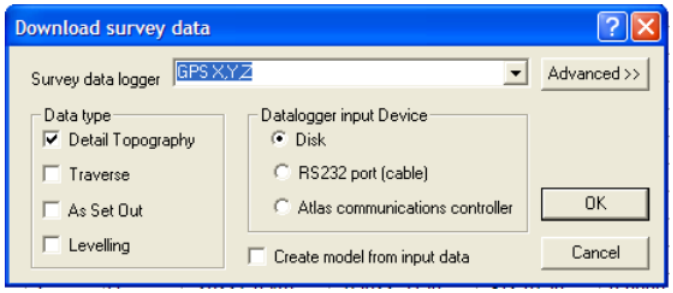
Case Study Data

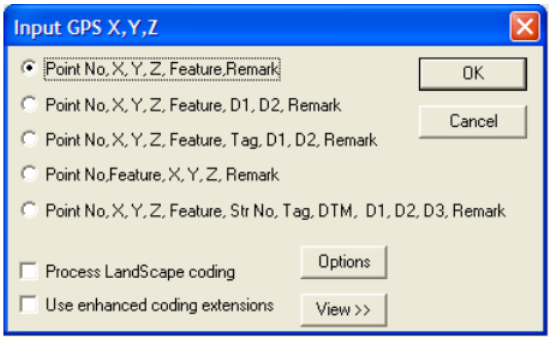
To process ascii compiler-1.csv, 300DOWNLINE-.HOR, 300DOWNLINE-.VER, and 300DOWNLINE-.CAN do the following

1) Create a new project as described previously

2) Import the ACT alignment files into SCC as described previously

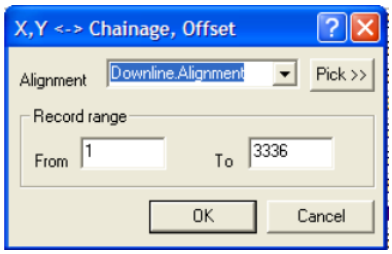
3) Select 'FILE > Download Survey' picking ascii compiler-1.csv using the parameters shown below



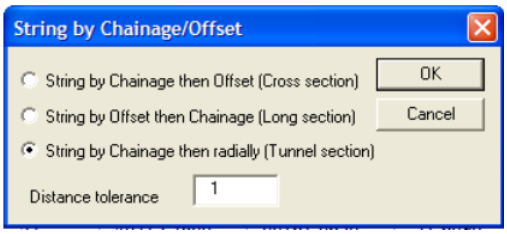


Select 'VIEW > Detail Coordinates'

4) To group the data into rings, select 'TOOLS > Compute Chainage,Offset from X,Y'

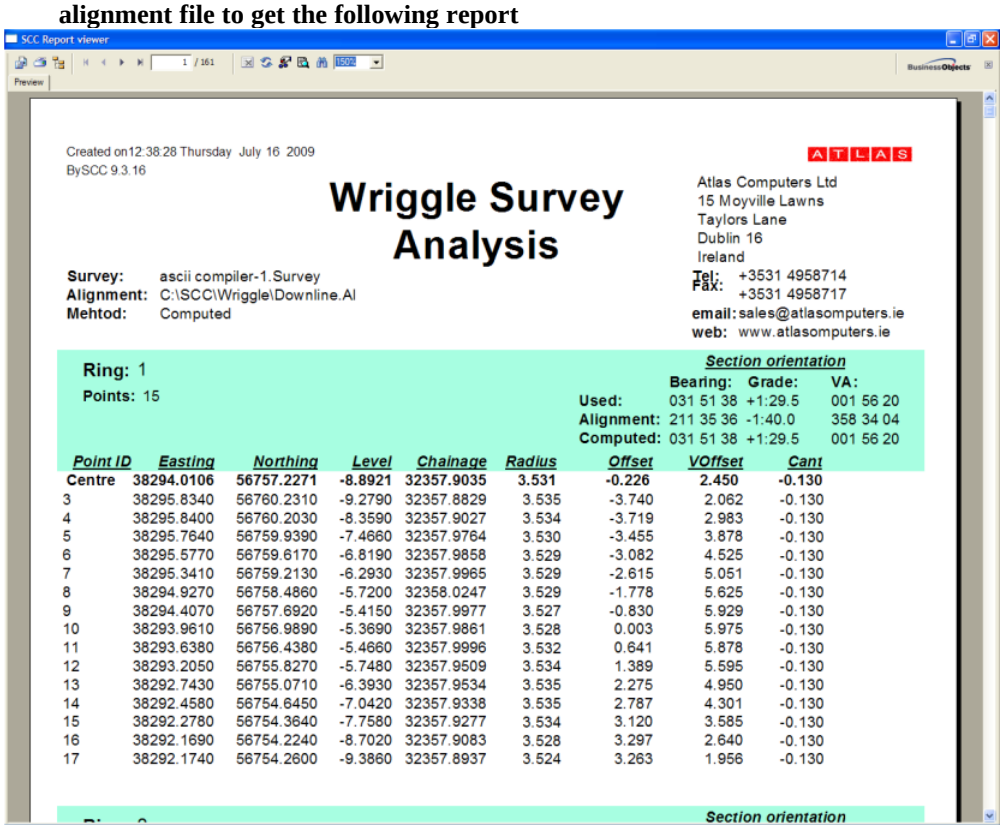


'TOOLS > String using Chainage & Offset'



'FILE > Save'

5) Compute the wriggle survey as described previously, picking the 300 downline alignment file to get the following report



SCC Report viewer

Created on12:38:28 Thursday July 16 2009
BySCC 9.3.16

Wriggle Survey Analysis

ATLAS

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Fax: +3531 4958717
email: sales@atlasomputers.ie
web: www.atlasomputers.ie

Survey: ascii compiler-1.Survey
Alignment: C:\SCC\Wriggle\Downline.Al
Mehtod: Computed

Ring: 1
Points: 15

	Section orientation Bearing:	Grade:	VA:
Used:	031 51 38	+1:29.5	001 56 20
Alignment:	211 35 36	-1:40.0	358 34 04
Computed:	031 51 38	+1:29.5	001 56 20

Point ID	Easting	Northing	Level	Chainage	Radius	Offset	VOffset	Cant
Centre	38294.0106	56757.2271	-8.8921	32357.9035	3.531	-0.226	2.450	-0.130
3	38295.8340	56760.2310	-9.2790	32357.8829	3.535	-3.740	2.062	-0.130
4	38295.8400	56760.2030	-8.3590	32357.9027	3.534	-3.719	2.983	-0.130
5	38295.7640	56759.9390	-7.4660	32357.9764	3.530	-3.455	3.878	-0.130
6	38295.5770	56759.6170	-6.8190	32357.9858	3.529	-3.082	4.525	-0.130
7	38295.3410	56759.2130	-6.2930	32357.9965	3.529	-2.615	5.051	-0.130
8	38294.9270	56758.4860	-5.7200	32358.0247	3.529	-1.778	5.625	-0.130
9	38294.4070	56757.6920	-5.4150	32357.9977	3.527	-0.830	5.929	-0.130
10	38293.9610	56756.9890	-5.3690	32357.9861	3.528	0.003	5.975	-0.130
11	38293.6380	56756.4380	-5.4660	32357.9996	3.532	0.641	5.878	-0.130
12	38293.2050	56755.8270	-5.7480	32357.9509	3.534	1.389	5.595	-0.130
13	38292.7430	56755.0710	-6.3930	32357.9534	3.535	2.275	4.950	-0.130
14	38292.4580	56754.6450	-7.0420	32357.9338	3.535	2.787	4.301	-0.130
15	38292.2780	56754.3640	-7.7580	32357.9277	3.534	3.120	3.585	-0.130
16	38292.1690	56754.2240	-8.7020	32357.9083	3.528	3.297	2.640	-0.130
17	38292.1740	56754.2600	-9.3860	32357.8937	3.524	3.263	1.956	-0.130

Section orientation

Notes from the results;

The computed bearing and gradient shown by SCC are ~180 degrees off the alignment value for the same section. This could be corrected using the alignment if required. Without an alignment the orientation of the section is arbitrary and can flip by 180 degrees, which also reverses the gradient.

It doesn't affect the centre, radius or offset values.

Comparing the results to those supplied in 320 wriggle analysis.xls all the radii in SCC are exactly 50mm smaller which appears to correspond to the BFC from DTA radial value and Lining radial value in the xls file. Horizontal and vertical offsets appear to agree to with about 2mm but centres are differ by ~50-60mm. This could possibly be related to radial offsets. Re-computing using alignment bearing and gradients does not appear to make a significant difference to this, though further investigation is probably required.

The xls provided appears to have a limit of size points per ring, though this could just be a reporting anomaly.

20.2 String Comparison & Overlap Processing

String comparison and overlap processing option are available within the model view under **'DESIGN > Compare strings and remove overlaps'**. This requires a model with one or more

overlapping strings, and an alignment for reference purposes. The following is an example of the usage of this function based around the sample data provided;

Create Project And Import Data

Create a new project, via 'FILE > New Project, or open an existing project

Create a model from the DXF files provide

'FILE > Model > DWG> DXF file' and select 'DM with compensation.dxf'

'TOOLS > Add strings from file DWG > DXF file', and select 'DM without compensation.dxf'

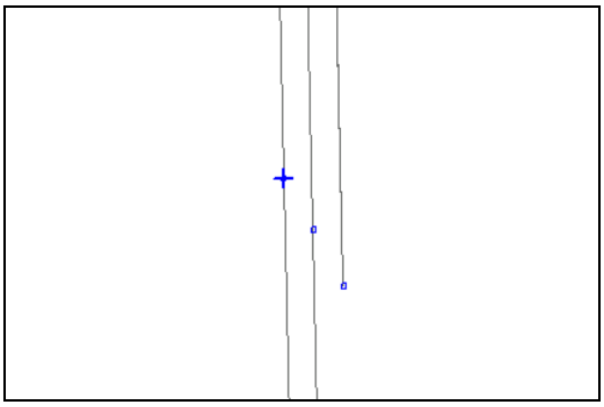
Create Alignment

Create a new alignment from existing centreline for analysis purposes

'DESIGN > Create alignment from existing string'

Pick LINTRACK, string 1

Select Create alignment from straights and fillet arcs and press Ok



String Analysis

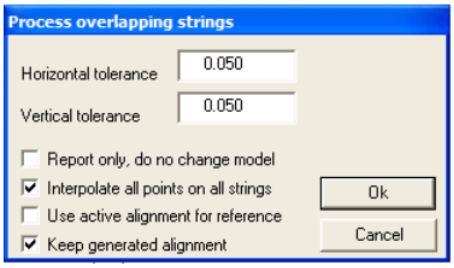
Select strings for analysis

Zoom into area 1009,1356

Right click to bring up data selection dialog

Select All points on selected string, Ok

Pick the three strings as shown



Select 'DESIGN > Compare strings and remove overlaps', using the parameters shown.

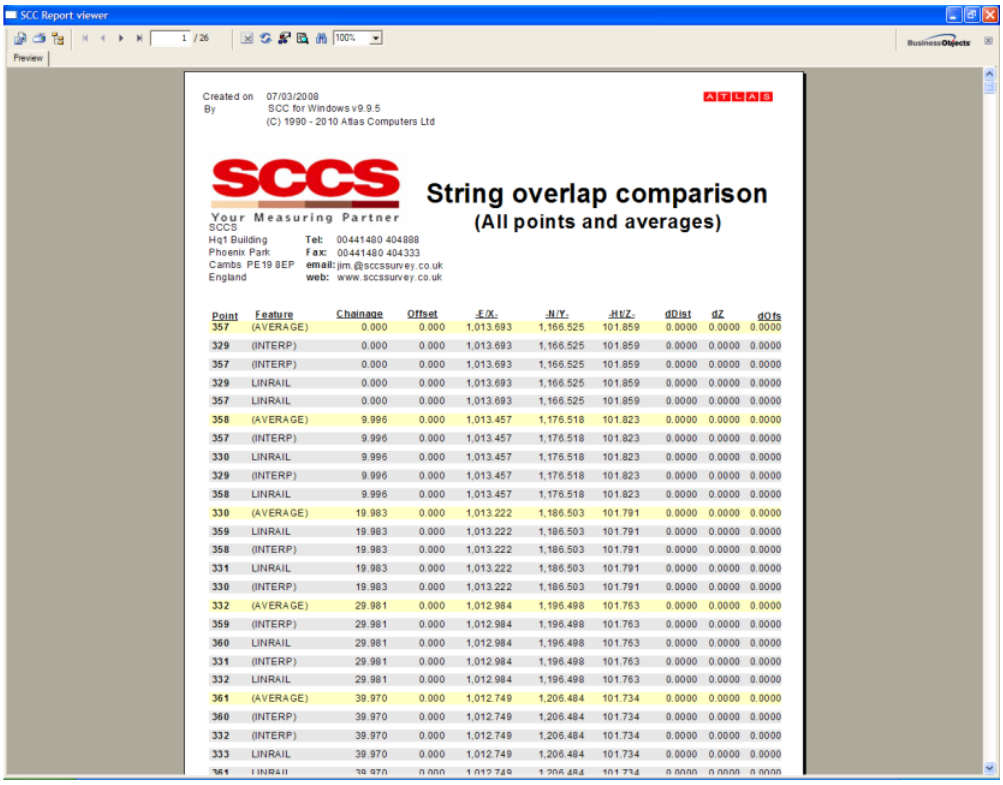
These parameters work as follows;

- Horizontal and vertical tolerances are used to determine the scope of the search.

- Points that are further away from each other that this are not considered for comparison.
- Report only is used to generate a comparison report, but will not change the model.
- Interpolate all points on all strings is use to generate additional comparison points at chainages where a point exists on one string under analysis but not others. It is typically useful where the same part of the same string has been surveyed more than once, but the surveyed points are at different locations.

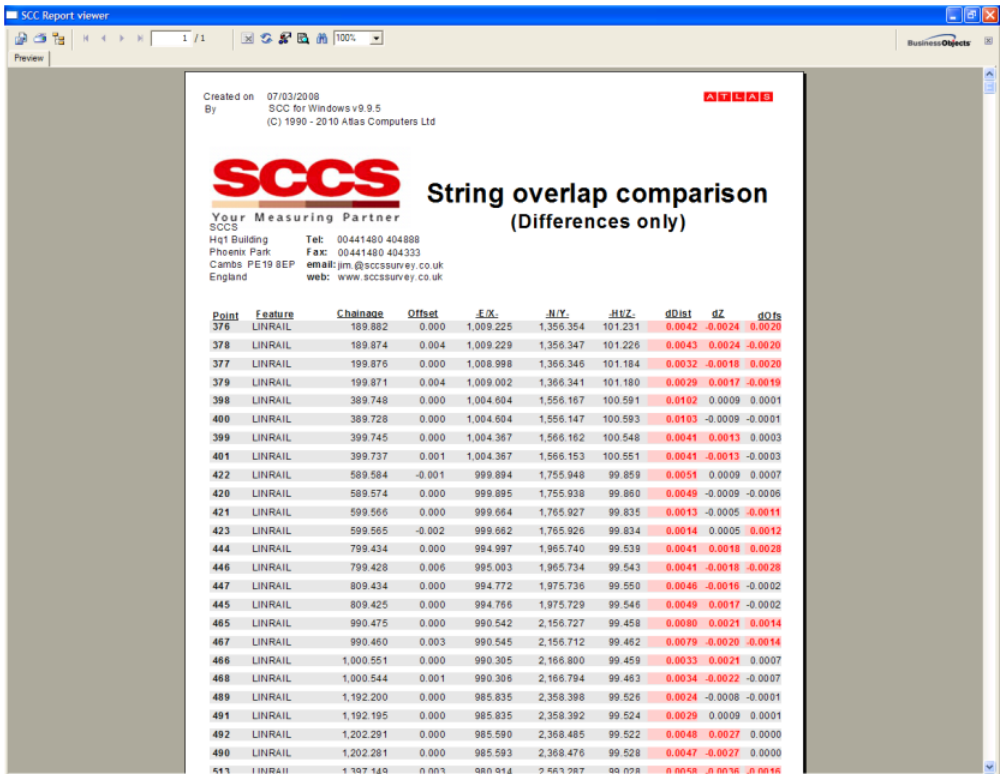
Press Ok to perform the analysis and pick a report.

Note that two standard reports have been added to SCC to support this option as follows;



Point	Feature	Chainage	Offset	-E/X-	-N/Y-	-H/Z-	dDist	dZ	dOfs
357	(AVERAGE)	0.000	0.000	1,013.693	1,166.525	101.859	0.0000	0.0000	0.0000
329	(INTERP)	0.000	0.000	1,013.693	1,166.525	101.859	0.0000	0.0000	0.0000
357	(INTERP)	0.000	0.000	1,013.693	1,166.525	101.859	0.0000	0.0000	0.0000
329	LINRAIL	0.000	0.000	1,013.693	1,166.525	101.859	0.0000	0.0000	0.0000
357	LINRAIL	0.000	0.000	1,013.693	1,166.525	101.859	0.0000	0.0000	0.0000
358	(AVERAGE)	9.996	0.000	1,013.457	1,176.518	101.823	0.0000	0.0000	0.0000
357	(INTERP)	9.996	0.000	1,013.457	1,176.518	101.823	0.0000	0.0000	0.0000
330	LINRAIL	9.996	0.000	1,013.457	1,176.518	101.823	0.0000	0.0000	0.0000
329	(INTERP)	9.996	0.000	1,013.457	1,176.518	101.823	0.0000	0.0000	0.0000
358	LINRAIL	9.996	0.000	1,013.457	1,176.518	101.823	0.0000	0.0000	0.0000
330	(AVERAGE)	19.983	0.000	1,013.222	1,186.503	101.791	0.0000	0.0000	0.0000
359	LINRAIL	19.983	0.000	1,013.222	1,186.503	101.791	0.0000	0.0000	0.0000
358	(INTERP)	19.983	0.000	1,013.222	1,186.503	101.791	0.0000	0.0000	0.0000
331	LINRAIL	19.983	0.000	1,013.222	1,186.503	101.791	0.0000	0.0000	0.0000
330	(INTERP)	19.983	0.000	1,013.222	1,186.503	101.791	0.0000	0.0000	0.0000
332	(AVERAGE)	29.981	0.000	1,012.984	1,196.498	101.763	0.0000	0.0000	0.0000
359	(INTERP)	29.981	0.000	1,012.984	1,196.498	101.763	0.0000	0.0000	0.0000
360	LINRAIL	29.981	0.000	1,012.984	1,196.498	101.763	0.0000	0.0000	0.0000
331	(INTERP)	29.981	0.000	1,012.984	1,196.498	101.763	0.0000	0.0000	0.0000
332	LINRAIL	29.981	0.000	1,012.984	1,196.498	101.763	0.0000	0.0000	0.0000
361	(AVERAGE)	39.970	0.000	1,012.749	1,206.484	101.734	0.0000	0.0000	0.0000
360	(INTERP)	39.970	0.000	1,012.749	1,206.484	101.734	0.0000	0.0000	0.0000
332	(INTERP)	39.970	0.000	1,012.749	1,206.484	101.734	0.0000	0.0000	0.0000
333	LINRAIL	39.970	0.000	1,012.749	1,206.484	101.734	0.0000	0.0000	0.0000
361	LINRAIL	39.970	0.000	1,012.749	1,206.484	101.734	0.0000	0.0000	0.0000

String Overlaps (all).rpt shows all points used in the comparison alongside their generated average positions. Any differences greater than 1mm in horizontal or vertical are highlighted in red.



SCC Report viewer

Created on 07/03/2008
By SCC for Windows v9.9.5
(C) 1990 - 2010 Atlas Computers Ltd

SCCS
Your Measuring Partner

String overlap comparison
(Differences only)

SCCS
Hq1 Building
Phoenix Park
Cambs PE19 8EP
England

Tel: 00441480 404888
Fax: 00441480 404333
email: jim.@sccssurvey.co.uk
web: www.sccssurvey.co.uk

Point	Feature	Chainage	Offset	-E/X-	-N/Y-	-Ht/Z-	dDist	dZ	dOfs
376	LINRAIL	189.882	0.000	1,009.225	1,356.354	101.231	0.0042	-0.0024	0.0020
378	LINRAIL	189.874	0.004	1,009.229	1,356.347	101.226	0.0043	0.0024	-0.0020
377	LINRAIL	199.876	0.000	1,008.998	1,366.346	101.184	0.0032	-0.0018	0.0020
379	LINRAIL	199.871	0.004	1,009.002	1,366.341	101.180	0.0029	0.0017	-0.0019
398	LINRAIL	389.748	0.000	1,004.604	1,556.167	100.591	0.0102	0.0009	0.0001
400	LINRAIL	389.728	0.000	1,004.604	1,556.147	100.593	0.0103	-0.0009	-0.0001
399	LINRAIL	399.745	0.000	1,004.367	1,566.162	100.548	0.0041	0.0013	0.0003
401	LINRAIL	399.737	0.001	1,004.367	1,566.153	100.551	0.0041	-0.0013	-0.0003
422	LINRAIL	589.584	-0.001	999.894	1,755.948	99.859	0.0051	0.0009	0.0007
420	LINRAIL	589.574	0.000	999.895	1,755.938	99.860	0.0049	-0.0009	-0.0006
421	LINRAIL	599.566	0.000	999.664	1,765.927	99.835	0.0013	-0.0005	-0.0011
423	LINRAIL	599.565	-0.002	999.662	1,765.926	99.834	0.0014	0.0005	0.0012
444	LINRAIL	799.434	0.000	994.997	1,965.740	99.539	0.0041	0.0018	0.0028
446	LINRAIL	799.428	0.006	995.003	1,965.734	99.543	0.0041	-0.0018	-0.0028
447	LINRAIL	809.434	0.000	994.772	1,975.736	99.550	0.0046	-0.0016	-0.0002
445	LINRAIL	809.425	0.000	994.766	1,975.729	99.546	0.0049	0.0017	-0.0002
465	LINRAIL	990.475	0.000	990.542	2,156.727	99.458	0.0080	0.0021	0.0014
467	LINRAIL	990.460	0.003	990.545	2,156.712	99.462	0.0079	-0.0020	-0.0014
466	LINRAIL	1,000.551	0.000	990.305	2,166.800	99.459	0.0033	0.0021	0.0007
468	LINRAIL	1,000.544	0.001	990.306	2,166.794	99.463	0.0034	-0.0022	-0.0007
489	LINRAIL	1,192.200	0.000	985.835	2,358.398	99.526	0.0024	-0.0008	-0.0001
491	LINRAIL	1,192.195	0.000	985.835	2,358.392	99.524	0.0029	0.0009	0.0001
492	LINRAIL	1,202.291	0.000	985.590	2,368.485	99.522	0.0048	0.0027	0.0000
490	LINRAIL	1,202.281	0.000	985.593	2,368.476	99.528	0.0047	-0.0027	0.0000
513	LINRAIL	1,397.149	0.003	980.914	2,563.287	99.028	0.0058	-0.0026	-0.0016

String Overlaps (Diffs).rpt only shows points where the difference exceeds either 1mm in the horizontal or vertical.

Following on from the analysis, we can see that the overlapping strings have been replaced with a single averaged string.

Note:

Report titles and logo relating to user details can be controlled throughout SCC using **'FILE > General options > module licenses > user details**.

20.3 Lift And Slue Reporting

This tutorial gives an example of how to use the lift and slue reporting functionality. This involves comparison of a design model with a survey model for left (vertical separation) and slue (lateral separation) on nominated left and right rails. It also computes cant a gauge between left and right rails, and reports any failures to meet tolerance in cant. To demonstrate this functionality, do the following;

Import GENIO files to create a design model, a survey model, and an alignment.

'FILE > Model > MOSS GENIO file' picking C:\SCC\Lift and Slue\Example1 - DESIGN.TXT

'FILE > Save > Design.Model'

'FILE > Model > MOSS GENIO file' picking C:\SCC\Lift and Slue\Example1 - SURVEY.crd

'FILE > Save > Survey.Model'

'FILE > New > SCC Alignment'

'FILE > Import > MOSS GENIO geometry strings' picking C:\SCC\Lift and

Slue\Example1 - DESIGN.TXT

Pick MC02 as the alignment string to import

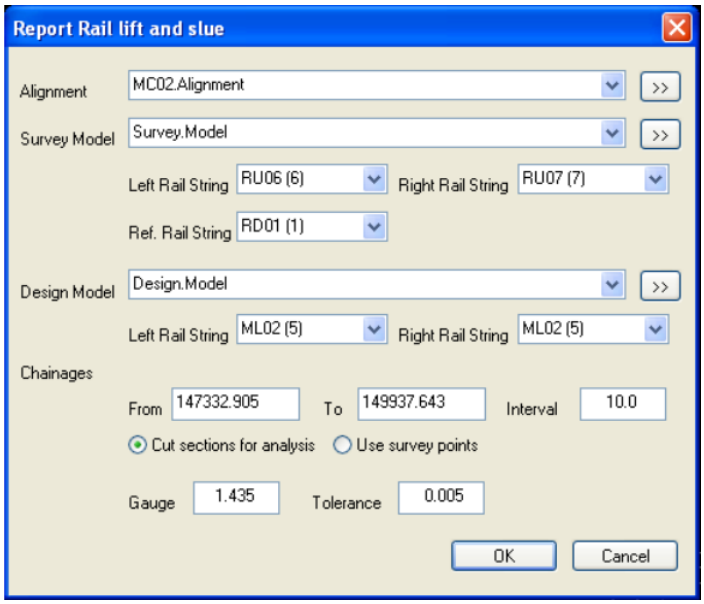
'FILE > Save > MC02.Alignment'

Rail Lift And Slue Analysis

Open the design model,

Pick 'DESIGN > Report rail lift and slue'

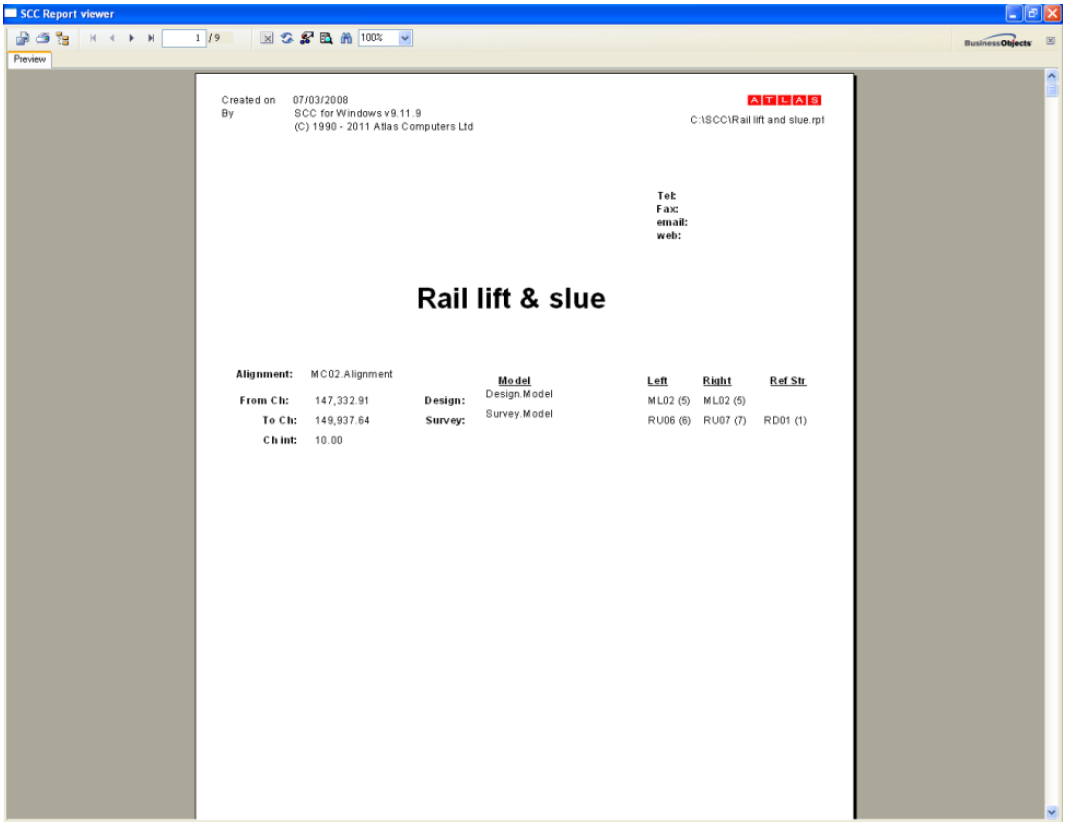
Select the files which have just been created and the design and survey strings to analyse.



Reporting Rail Lift And Slue

When prompted, pick 'Rail lift and slue.rpt' from the reports list.

This will produce a report as shown below. The report is broken down into separate sections for lift and slue values between survey and design for left and right rails, cant and gauge between rails with any values outside tolerance highlighted in red, and surveyed 6/10 foot.



20.4 Rail Cant Computations

Separate design sheet views for road super elevation and rail cant are available, and includes low rail cant calculations based on curve directions. This can be demonstrated using the a LandXML file including rail cant, such as readings.pax.land.xml. To process this file and check the results, do the following;

Create A New Project

Create a new SCC project

Import LandXML Files

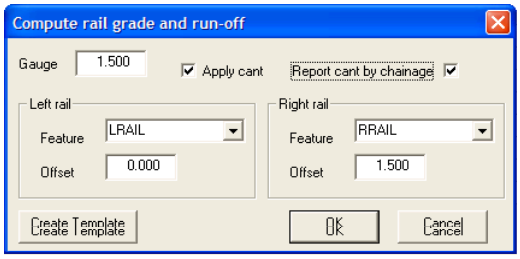
'FILE > Import > LandXML' and pick readings.pax.land.xml as the input file.

	Chainage	Cant	Rot
1	9857.035	10.669	CC
2	9864.255	8.661	CC
3	9871.057	8.010	CC
4	9884.879	0.508	CW
5	9892.152	9.086	CW
6	9898.901	19.766	CW
7	9905.943	12.978	CW
8	9912.923	19.845	CW
9	9926.657	19.614	CW
10	9933.803	21.776	CW
11	9940.840	21.292	CW
12	9954.909	16.788	CW
13	9961.805	23.564	CW
14	9968.853	22.139	CW
15	9975.754	29.744	CW
16	9982.833	31.809	CW
17	9989.718	34.964	CW
18	9996.593	31.754	CW
19	9999.818	33.451	CW
20	10004.996	34.120	CW

To view the cant stations, select VIEW > Rail Cant, which will show the following, which agrees with the LandXML values.

Checking Gauge And Cant

To check the gauge and cant, select 'DESIGN > Enter Gauge and compute Cant'. The gauge will have been read in from the LandXML file in this case, so you simply enter the feature names and offsets for left and right rails, as shown in the dialog below.



This option will also produce a report listing the cant stations, and applied cant values on either rail at a regular chainage interval. The chainage interval can be specified using ' **DESIGN > Interface and export parameters**'.

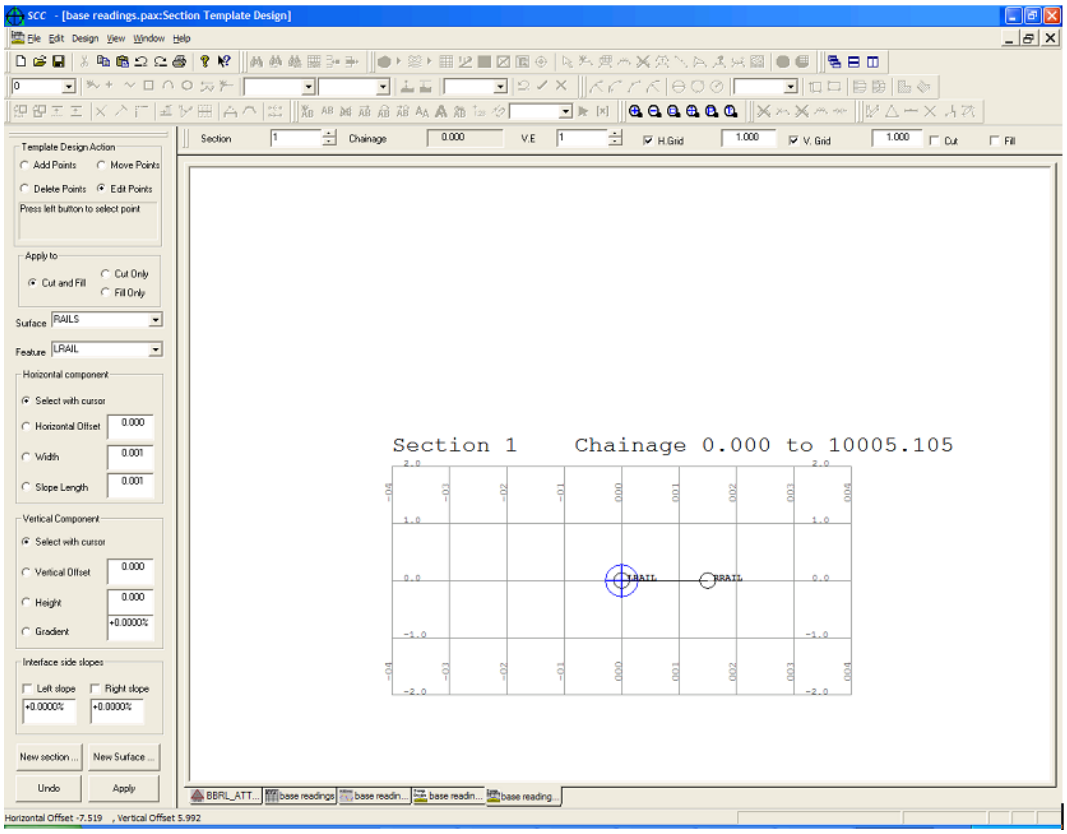
```
Rail cant check report

Date: Wed Aug 11 11:54:32 2010

Alignment: base readings.pax

Gauge: 1.500  Left Rail:LRAIL Offset 0.000  Right Rail:RRAIL Offset 1.500

Chainage    CL Height   L.Cant   R.Cant   L.Height    R.Height    Direction

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

  9860.000      99.169   +0.000   +9.844      99.169      99.178  Left (CCW)

  9870.000      99.126   +0.000   +8.111      99.126      99.134  Left (CCW)

  9880.000      99.077   +0.000   +3.156      99.077      99.080  Left (CCW)

  9890.000      99.013   +6.547   +0.000      99.020      99.013  Right (CW)

  9900.000      98.938  +18.707   +0.000      98.957      98.938  Right (CW)

  9910.000      98.873  +16.969   +0.000      98.890      98.873  Right (CW)

  9920.000      98.828  +19.726   +0.000      98.848      98.828  Right (CW)

  9930.000      98.778  +20.626   +0.000      98.799      98.778  Right (CW)

  9940.000      98.707  +21.350   +0.000      98.728      98.707  Right (CW)

  9950.000      98.642  +18.360   +0.000      98.660      98.642  Right (CW)

  9960.000      98.598  +21.790   +0.000      98.620      98.598  Right (CW)

  9970.000      98.532  +23.403   +0.000      98.556      98.532  Right (CW)

  9980.000      98.500  +30.983   +0.000      98.531      98.500  Right (CW)

  9990.000      98.482  +34.832   +0.000      98.517      98.482  Right (CW)

 10000.000      98.438  +33.475   +0.000      98.472      98.438  Right (CW)

Cant Stations

Chainage    Cant      Direction

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

  9857.035  +10.669   Left (CCW)

  9864.255   +8.661   Left (CCW)

  9871.057   +8.010   Left (CCW)
```

```
  9884.879   +0.508  Right (CW)
  9892.152   +9.086  Right (CW)
  9898.901  +19.766  Right (CW)
  9905.943  +12.978  Right (CW)
  9912.923  +19.845  Right (CW)
  9926.657  +19.614  Right (CW)
  9933.803  +21.776  Right (CW)
  9940.840  +21.292  Right (CW)
  9954.909  +16.788  Right (CW)
  9961.805  +23.564  Right (CW)
  9968.853  +22.139  Right (CW)
  9975.754  +29.744  Right (CW)
  9982.833  +31.809  Right (CW)
  9989.718  +34.964  Right (CW)
  9996.593  +31.754  Right (CW)
  9999.818  +33.451  Right (CW)
 10004.996  +34.120  Right (CW)
SCC for Windows v9.10.0  (C) 1990 - 2010 Atlas Computers Ltd
```

Pressing the create template, will create a simple design template consisting of just the two rails. This can be viewed as a spreadsheet using 'VIEW > Section template points'

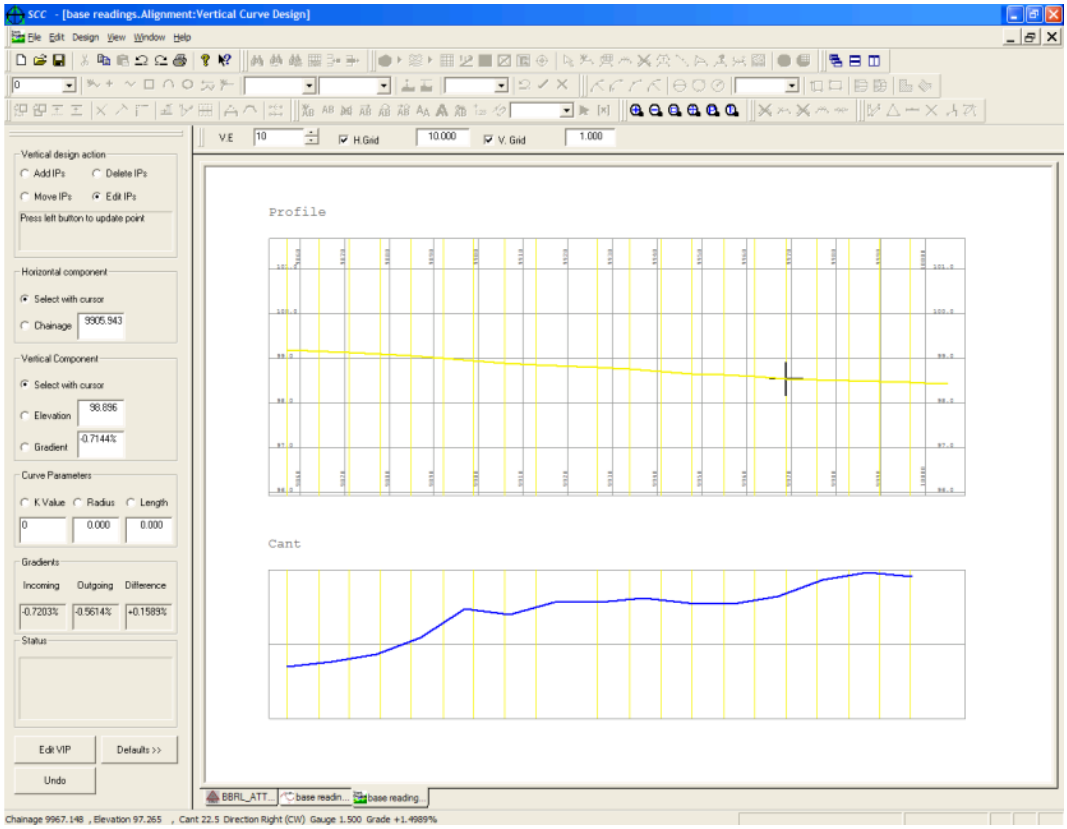
	Sect	Chainage 1	Chainage 2	Surface	Feature	Str	Hz.Offset	Vt.Offset	Type	Cut	Fill
1	1	0.000	10005.105	RAILS	LRAIL	1	0.000	0.000	Fixed - Both	+0.0000%	+0.0000%
2	1	0.000	10005.105	RAILS	RRAIL	1	1.500	0.000	Fixed - Both	+0.0000%	+0.0000%

or graphically via 'DESIGN > Section templates'



A cant graph can also be viewed with the profile using 'DESIGN > Vertical design'.

N.B. use the V/ E controls to change the vertical exaggeration.



On the vertical design view, the status bar shows instantaneous cant at the cursor

position, along with chainage, profile height, gradient and curve direction.

The cant at a given chainage is linearly interpolated based on the surrounding cant stations. For a given chainage and horizontal offset, if the cant direction is right > clockwise, the cant is given as

G = Interpolated cant > gauge

C = (Right rail offset – horizontal offset)*G

If the cant direction is left > ant-clockwise, the cant is given as

G = Interpolated cant > gauge

C = (horizontal offset - Left rail offset)*G

The design height for that chainage and offset is calculated as sum of the profile height at that chainage, the vertical offset in the template string point (e.g. 0 for the rails), and the cant as computed above. This is the same for all surfaces in the alignment.

20.5 Amberg Trolley Data

An input routine to support the Amberg Trolley data provided. This creates two points per line, one for left rail, one for right rail, using the station for string number and ident for point number. D1,D2, and D3 are used to store odometer, gauge, and super-elevation in the input file, such that they can be annotated as required. The rail features are named LRAIL and RRAIL. Note that the user defined ASCII input was limited to 255 characters per line, which I have now also changed to a maximum of 4096 characters per line. The new import is available from the Main Project > Station View, under **'FILE > Import> Export > Import Amberg Trolley data'**

20.6 Wriggle Survey From Point Cloud Data

This note covers the steps required to create a wriggle survey from a scanned tunnel in order to ascertain the circularity of the tunnel and produce an accurate best fit alignment through the tunnel. The stages are as follows;

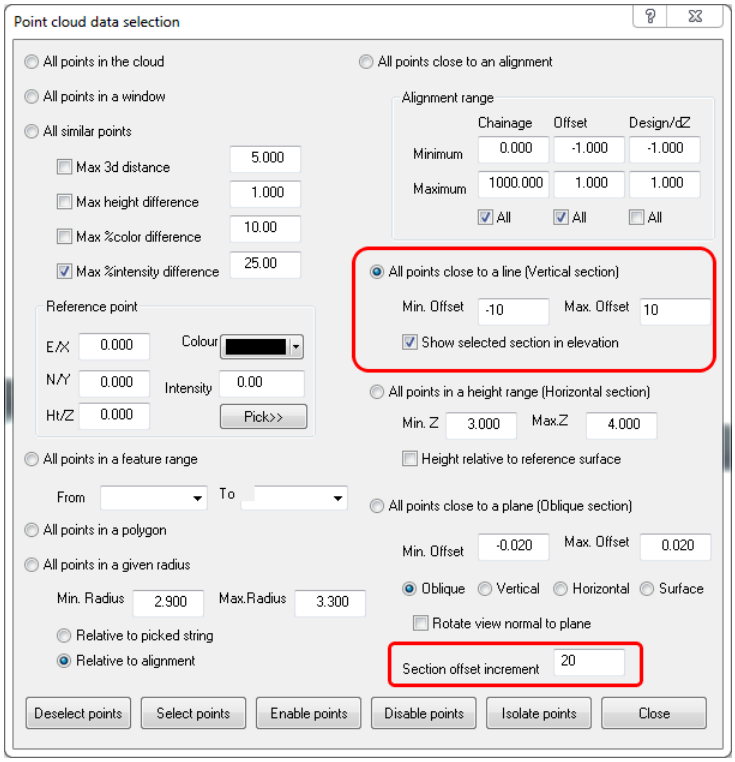
20.6.1 Setting Analysis Of Data

Open the tunnel project and model, and use the point cloud editing tools to separate tunnel wall data other scanned data within the tunnel. Set the analysis of data that is not part of the tunnel wall to Display only.

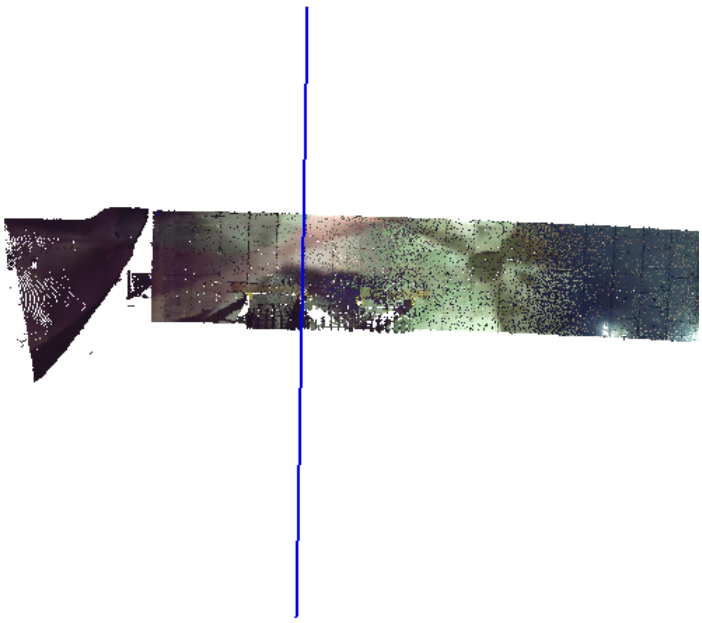
'FILE > Open', Open Project

'FILE > Open', Open Model

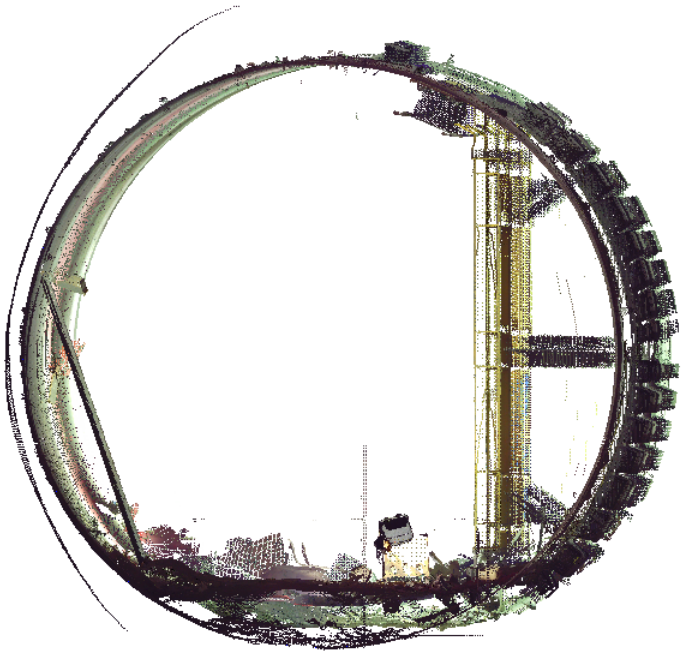
Right click to bring up the point cloud data selection dialogue, and select option to isolate an area 10 metres either side of the selected centre line. Set the section offset interval to 20m and press Isolate points



Select two points either side of tunnel roughly 90 degrees to the tunnel wall.



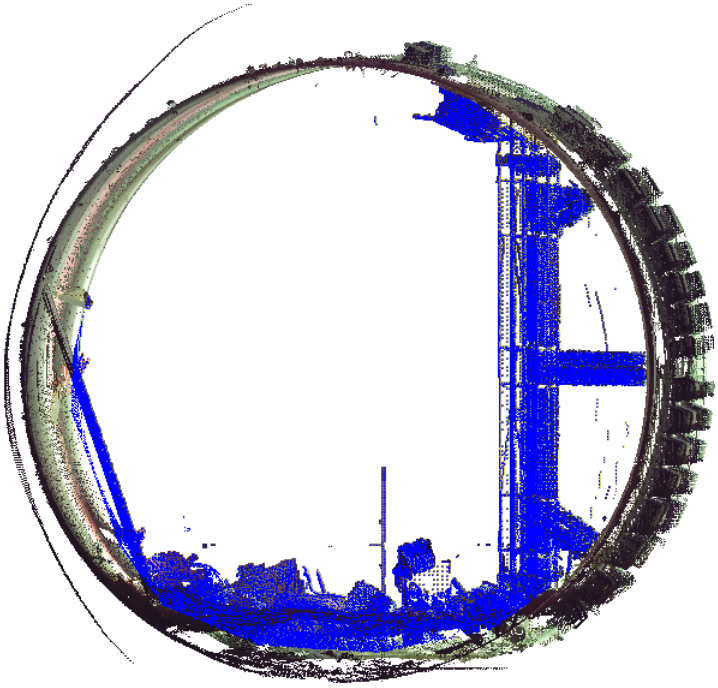
This will show an elevation through the tunnel, with a depth 10 metres either side of the centre line. The up and down arrows can be used to move the area displayed up and down the tunnel, and pressing 'P' or 'E' can be used to flip between plan and elevation.



Right click the mouse button to bring the data select dialog up again, and this time select 'All points in a polygon' and press the Select points button.

Left click to place points on a polygon that encloses the points we want to exclude from the wriggle analysis.

Right click to close the polygon and highlight the selected points



Use 'CLOUD > Edit selected points' to change the feature of the selected points to 'OTHER'. Repeat this to separate out all other points on the inside of the tunnel.

Use 'CLOUD > Point cloud features' to set the analysis type of 'OTHER' to be 'Display

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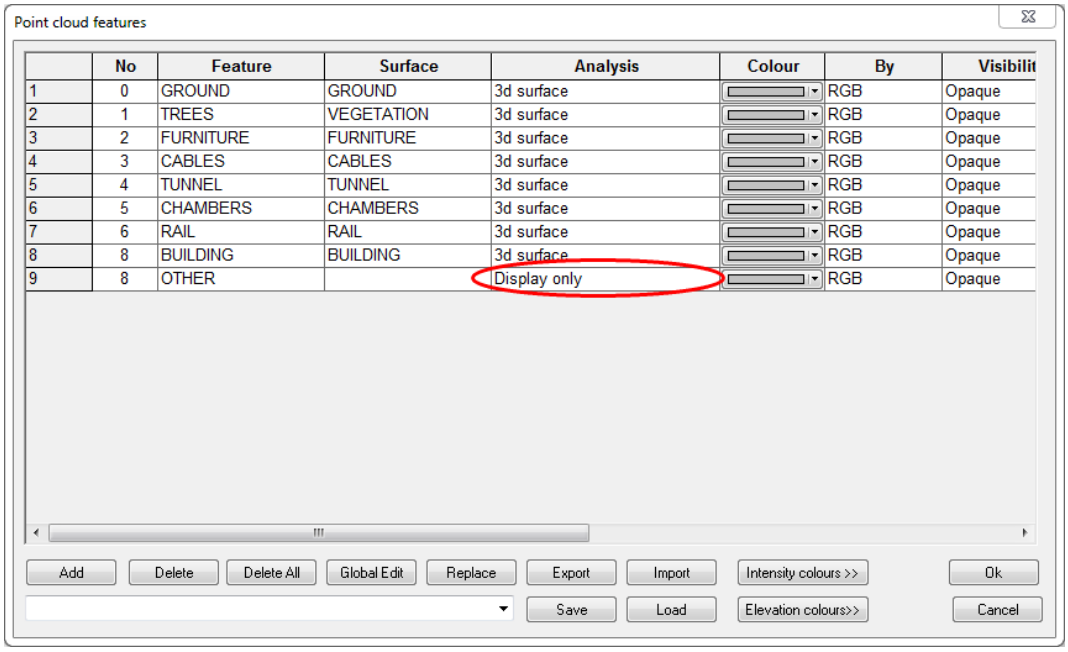
only', such that these points will not be included when creating sections.



Use 'FILE > Save' to save this model under the new name of 'XXX (edit 1).Model'

20.6.2 Setting Arbitary Centreline

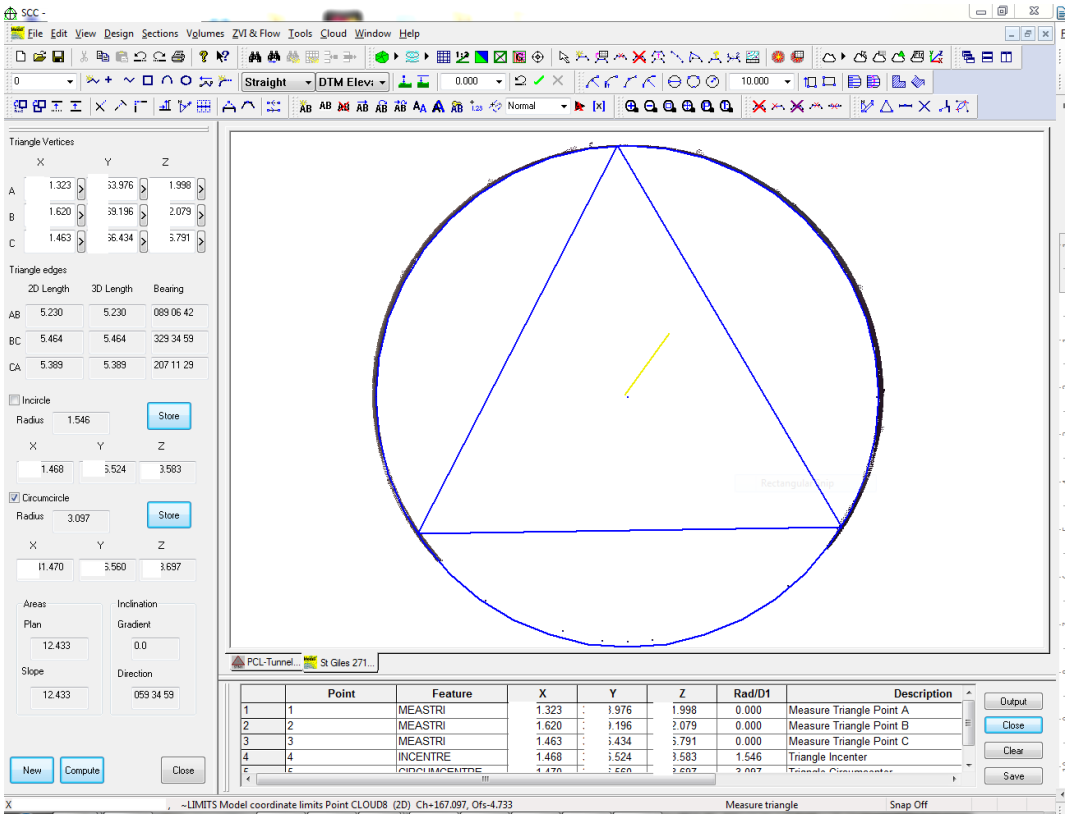
Create an arbitrary centreline through the tunnel. This will be used to cut sections through the tunnel and should roughly follow the tunnels plan position and gradient.

Select 'VIEW > Coordinate computations'

Isolate a vertical section through the tunnel at one end of the tunnel as described previously, but make the area narrower by specifying a minimum offset of -1 and a maximum offset of 1.

Select 'TOOLS > Measure > Triangle, areas, centres and gradient'

Pick three well separated points on the tunnel wall to generate a circumcircle as shown.



The coordinates for the triangle and circumcentre will be shown in a coordinate computations spreadsheet at the bottom of the screen.

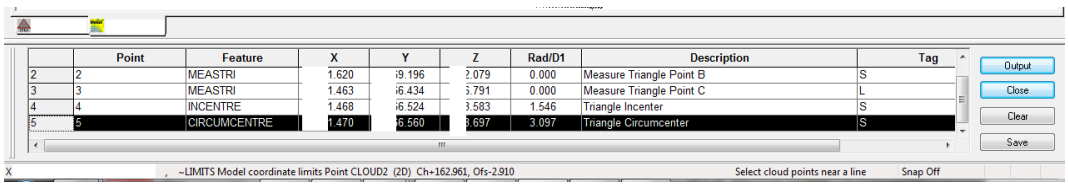
Repeat these steps for another circle at the middle of the tunnel, and a further one at the far end.

Press escape to close the triangle measurement dialog, and P to return to plan view.

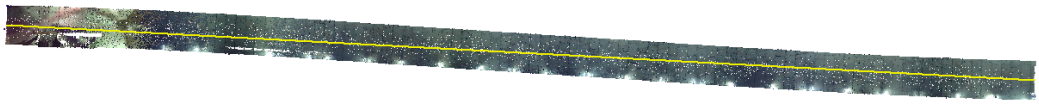
Right click to bring up the data selection dialog, select All points in cloud and press Enable points to turn all the points back on again.

Select 'EDIT > Add strings with cursor'

Select the first CIRCUMCENTRE point from the computed coordinates and press Output. Repeat for the other two CIRCUMCENTRE points



Right click and select Save string as interface from the pop-up menu. This create a 3d alignment that passes through the three points.

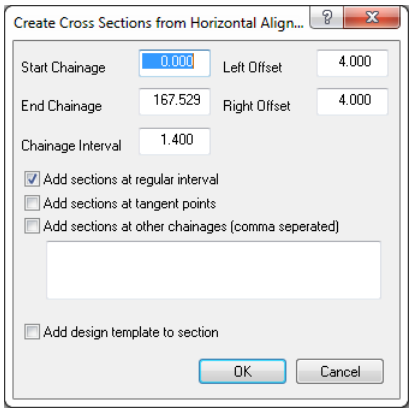


20.6.3 Cutting Sections

Cut sections at the desired interval through the tunnel, such that there is a section at every position where the tunnel changes direction or gradient. If the tunnel is not horizontal, these can be oblique sections rather than vertical cross sections

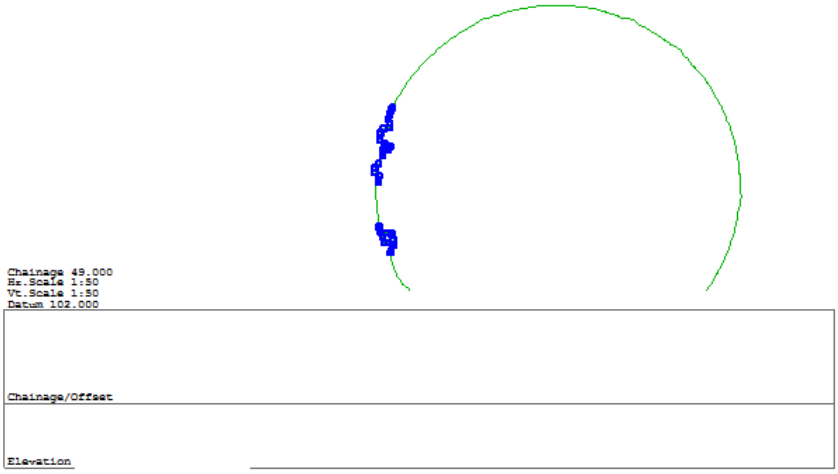
Select 'SECTIONS > Cross sections from an alignment'.

In this case, we're cutting sections every 1.4m on the basis that the tunnel direction can vary at any keystone on the tiled wall.



Visually check that the sections don't include any data that does not relate to the tunnel wall.

Use right click to use a window to select unwanted points, followed by 'EDIT > Delete / Delete points' to get rid of those points.

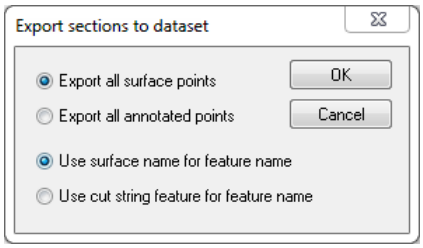


Use 'EDIT > Delete / Delete sections' to remove any sections that do not include enough data to contribute meaningful results to the wriggle survey.

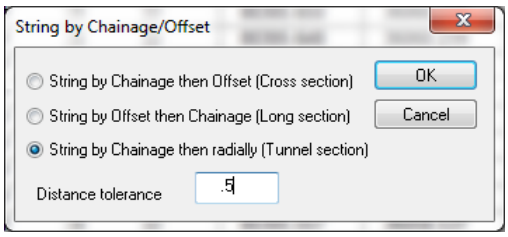
This will typically be areas that do not include enough scan data to create a section or areas where the tunnel is not circular.

Export the sections sections to a survey data set, which will be used as the input to the wriggle analysis.

Select 'FILE > Export sections > Survey data set'



In the coordinate spreadsheet, select 'TOOLS > String using chainage and offset', such that the wriggle survey will have all the contents of a single section as input for each ring.



'FILE > Save As' Wriggle input

20.6.4 Wriggle Analysis

Run the wriggle analysis to produce a report, sections and new alignment.

Select 'TOOLS > Compute wriggle survey' using the parameters shown. If we do not know the initial design radius, we can enter the mean value from the circumcircles computed previously.

Providing an outlier distance means that once the analysis is initially carried out, any outliers with a distance outside the the value specified will be removed and the analysis repeated.

The deformation tolerance is used for reporting purposes, where any points with a distance outside of this range are considered out of tolerance. For scanned data with a huge number of input points we can then elect to only report out of tolerance points to provide a more manageable report.

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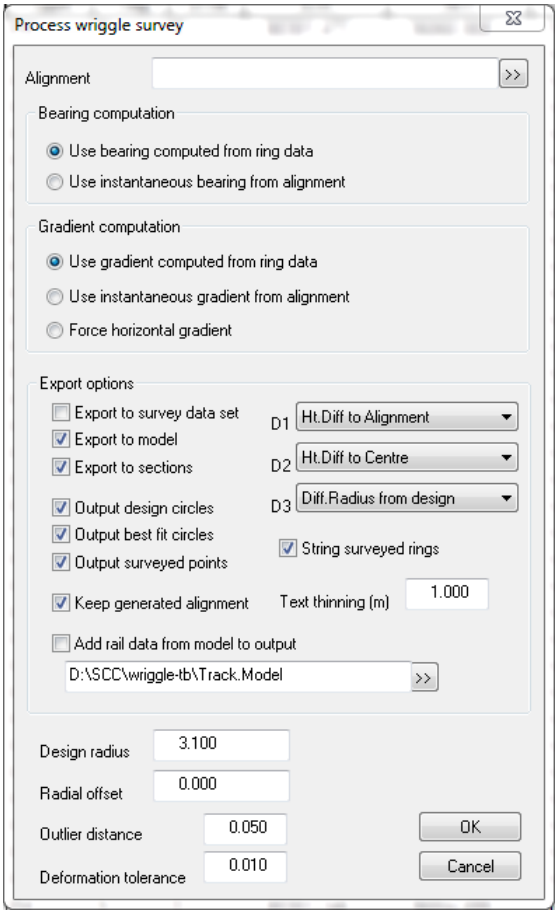

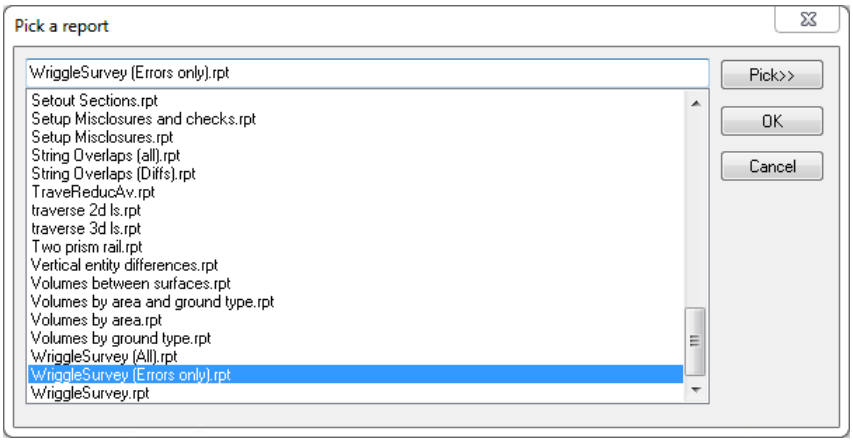

If the difference between the design radius and computed radius is similar for each ring, and we're working off a provisional design radius, we can repeat the analysis based on a new radius.

Created or
By SCC 11.5.0

Wriggle Survey Analysis (Errors)

Atlas Computers Ltd
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Taylors Lane
Dublin 16
Ireland
Tel: +3531 4958714
Fax: +3531 4958717
email: sales@atlascomputers.ie
web: www.atlascomputers.ie

Survey: wriggle-input.Survey
Alignment:
Gradient: Computed
Bearing: Computed
Tolerance: 0.010

Ring: 1
Points: 222
Radial offset: 0.000
Design radius: 3.110

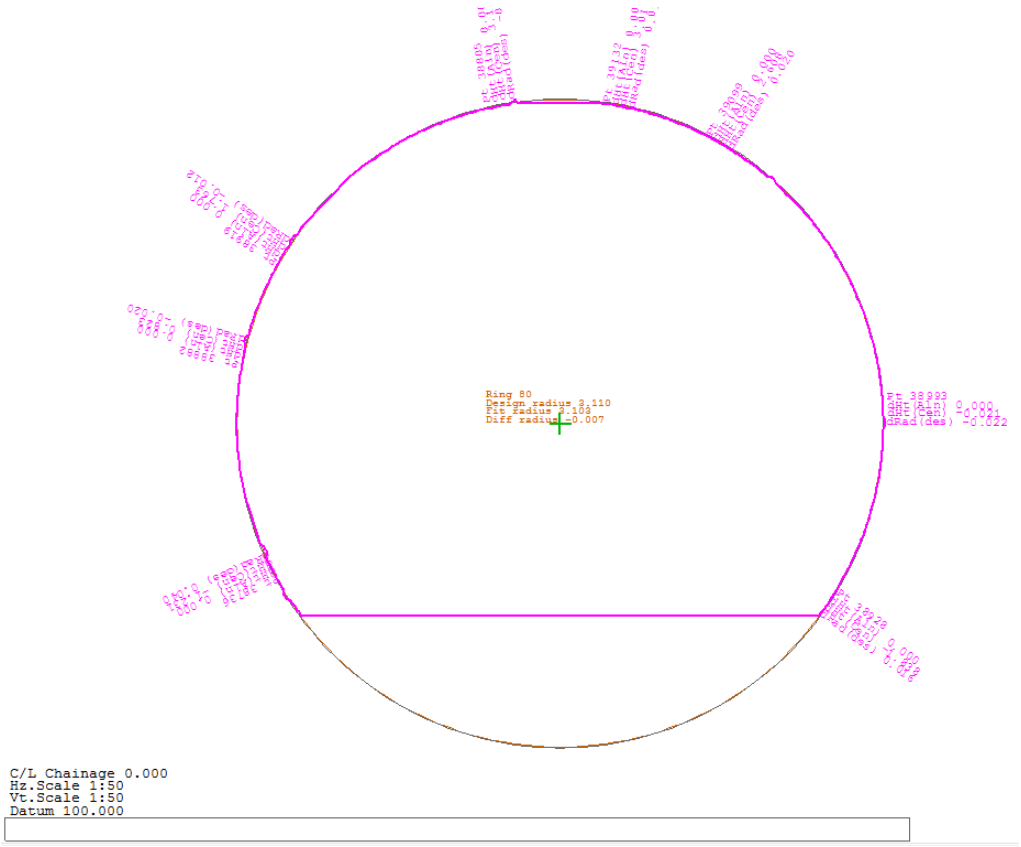
	Bearing:	Grade:	VA:
Used:	003 03 43	0	000 00 00
Alignment:	000 00 00		000 00 00
Computed:	003 03 43	0	000 00 00

Section orientation

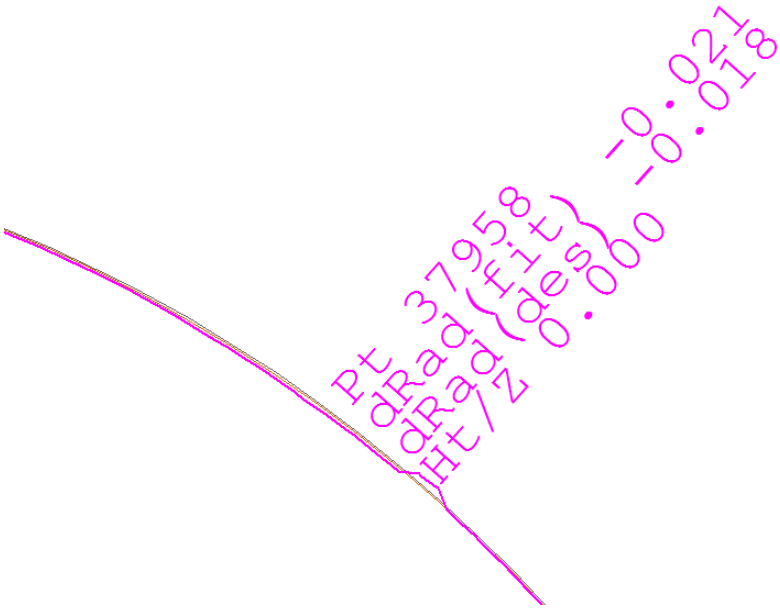
Point ID	Easting	Northing	Level	Chainage	Radius	dRadius	Offset	VOffset	Cant
Centre	1.3081	57.7346	4.4227	0.0000	3.115	-0.005	0.000	0.000	0.000
-1	1.4633	60.6366	5.5634	0.0000	3.122	-0.012	-2.503	0.000	0.000
-1	1.4534	60.4520	5.9544	0.0000	3.123	-0.013	-2.319	0.000	0.000
-1	1.4547	60.4749	5.9134	0.0000	3.123	-0.013	-2.342	0.000	0.000
-1	1.4557	60.4936	5.8779	0.0000	3.123	-0.013	-2.360	0.000	0.000
-1	1.4564	60.5071	5.8519	0.0000	3.123	-0.013	-2.374	0.000	0.000
-1	1.4571	60.5200	5.8259	0.0000	3.122	-0.012	-2.387	0.000	0.000
-1	1.4578	60.5330	5.7999	0.0000	3.122	-0.012	-2.400	0.000	0.000
-1	1.4585	60.5458	5.7734	0.0000	3.123	-0.013	-2.413	0.000	0.000
-1	1.4592	60.5587	5.7464	0.0000	3.123	-0.013	-2.425	0.000	0.000
-1	1.4598	60.5705	5.7199	0.0000	3.122	-0.012	-2.437	0.000	0.000
-1	1.4604	60.5823	5.6934	0.0000	3.122	-0.012	-2.449	0.000	0.000
-1	1.4519	60.4232	6.0044	0.0000	3.123	-0.013	-2.290	0.000	0.000

In our section view, use 'FILE > Load Save' section style and pick the Wriggle from scan style to set-up appropriate annotation and scales for wriggle survey from a scanned tunnel.

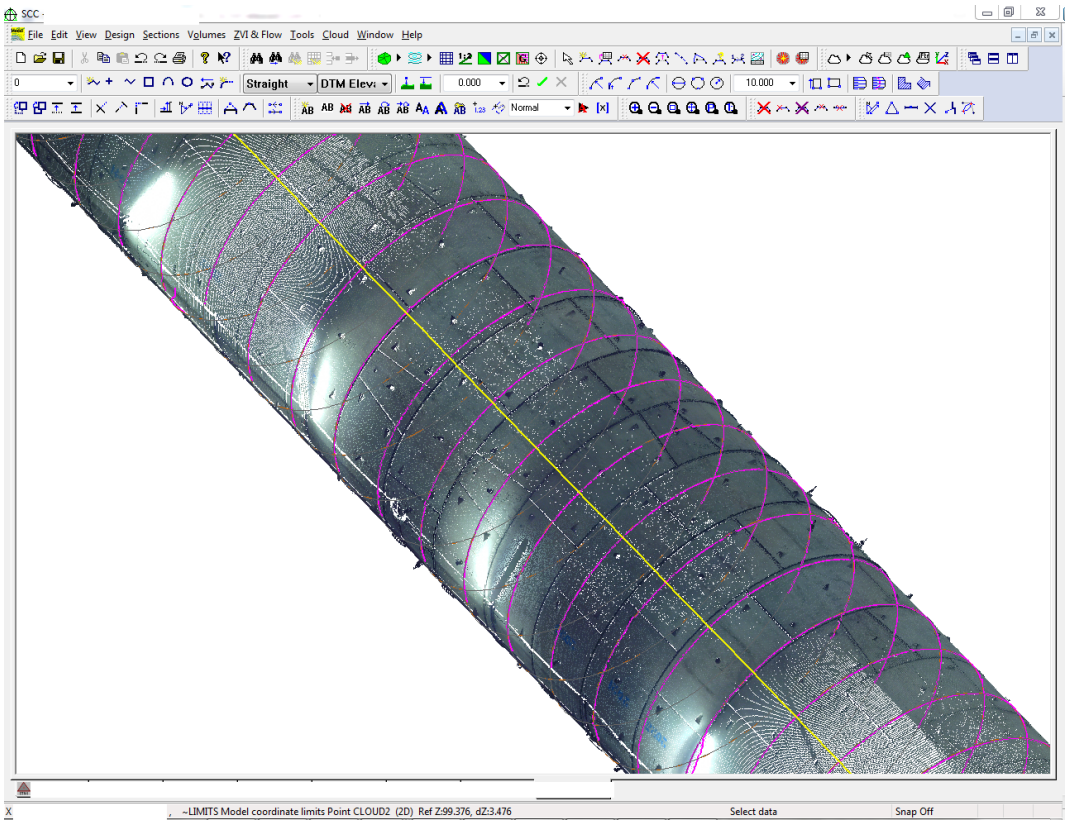
This shows us the difference between design and fit radius at each chainage, along with the worst of the out of tolerance points for each area of the section.



Zooming in we can see the scanned section overlaid with the design and best fit circles, with whatever annotators we've specified. Annotation is limited such that where it would overlap, only the annotator with the largest error is added.



The wriggle analysis will also output a model and alignment which can be saved and attached to our original scanned model for verification purposes.

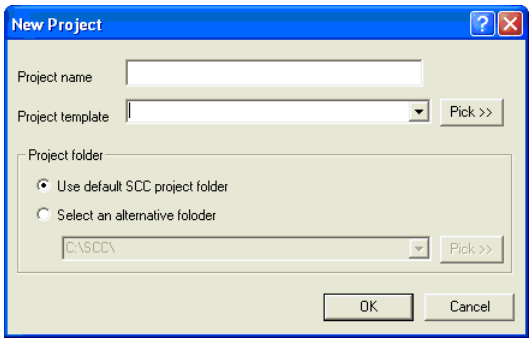


21 Processing LandXML File In SCC For Machine Control

The following text gives the steps required to import your 3d LandXML alignment into SCC, enter a type section including bottom ballast and formation surface details, and export those surfaces to Scanlaser via LandXML. The steps are as follows;

Create A New Project

Select 'FILE > New project' in SCC and enter a project name and template as shown below.

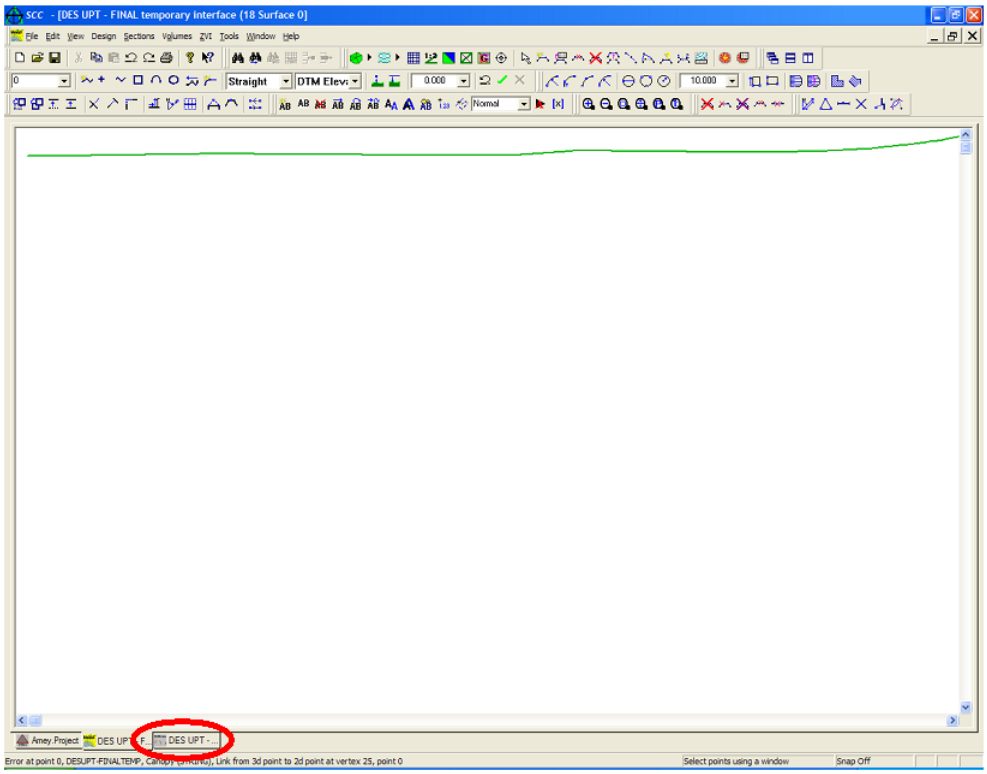


Import LandXML Files

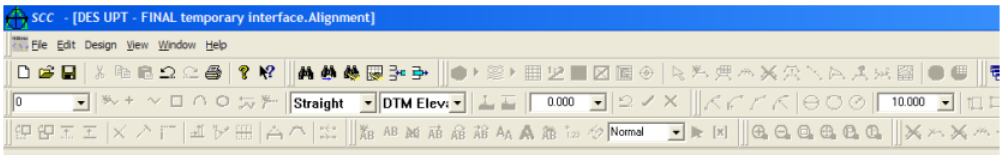
Import the alignment from LandXML and enter cant

Select 'FILE > Model > LandXML file' and pick the file DES UPT - FINAL temporary interface (18.556m - 2641.176m).xml

This will create a 3d alignment containing the horizontal and vertical entities in the XML file and 3d string model of the same. The initial view will be of the 3d string model in plan.

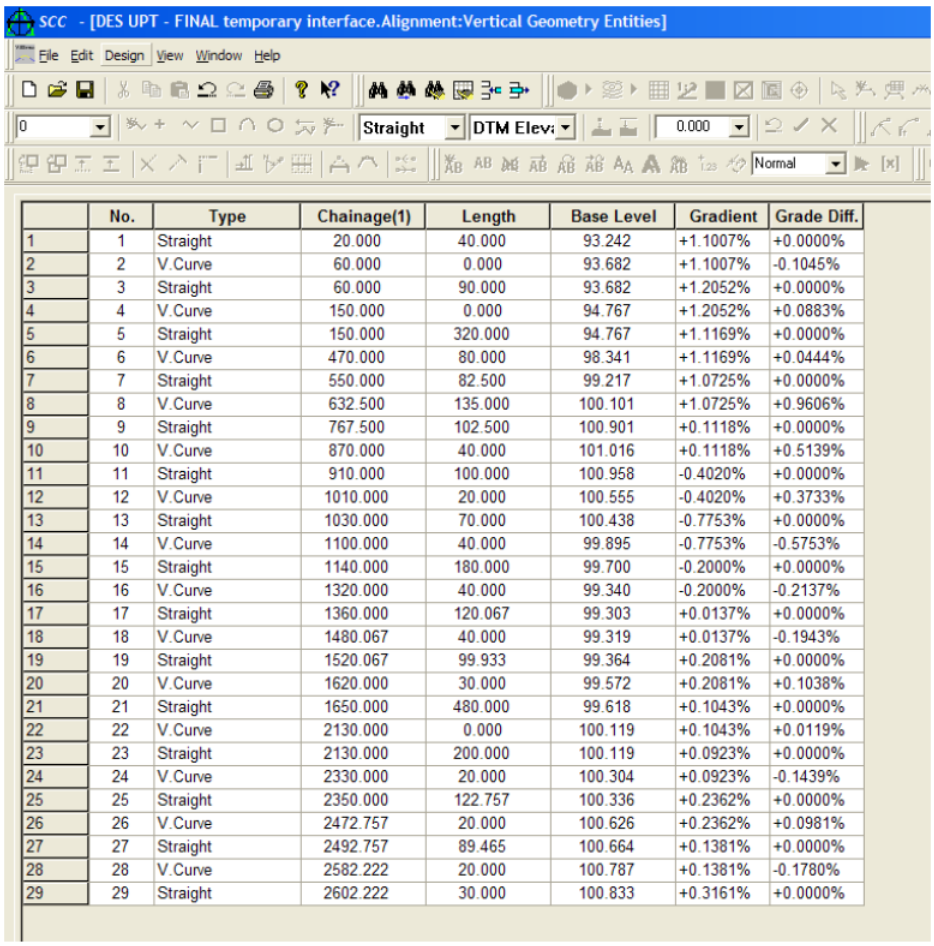


To view the horizontal entities, click the highlighted tab



	No.	Type	-E/X-	-N/Y-	Chainage	Vector	Length	Radius 1	Radius 2
1	1	Circular Arc	4751.549	4961.502	0.000	000 41 33.893	30.000	-17916.659	-17916.659
2	2	Straight	4781.546	4961.890	30.000	000 47 19.267	450.701	0.000	0.000
3	3	Spiral In	5232.205	4968.094	480.701	000 47 19.267	30.000	5780.826	1000000000.000
4	4	Circular Arc	5262.202	4968.481	510.701	000 38 24.053	92.923	5780.826	5780.826
5	5	Spiral Out	5355.124	4968.772	603.625	359 43 08.465	30.000	5780.826	1000000000.000
6	6	Straight	5385.123	4968.573	633.625	359 34 13.252	607.000	0.000	0.000
7	7	Spiral In	5992.106	4964.021	1240.625	359 34 13.252	65.083	-1372.344	-1000000000.000
8	8	Circular Arc	6057.188	4964.048	1305.707	000 55 44.252	42.846	-1372.344	-1372.344
9	9	Spiral Out	6100.010	4965.411	1348.553	002 43 03.992	65.000	-1372.344	-1000000000.000
10	10	Straight	6164.878	4969.518	1413.553	004 04 28.775	30.000	0.000	0.000
11	11	Spiral In	6194.802	4971.649	1443.553	004 04 28.775	60.000	1650.000	1000000000.000
12	12	Circular Arc	6254.675	4975.550	1503.553	003 01 58.507	70.967	1650.000	1650.000
13	13	Spiral Out	6325.601	4977.780	1574.520	000 34 07.039	60.000	1650.000	1000000000.000
14	14	Straight	6385.600	4977.648	1634.520	359 31 36.770	422.870	0.000	0.000
15	15	Spiral In	6808.455	4974.156	2057.390	359 31 36.770	55.030	-3119.863	-1000000000.000
16	16	Circular Arc	6863.484	4973.863	2112.420	000 01 55.880	210.274	-3119.863	-3119.863
17	17	Compound Out	7073.595	4981.065	2322.694	003 53 37.823	40.000	-2394.103	-3119.863
18	18	Circular Arc	7113.483	4984.063	2362.694	004 44 23.199	84.258	-2394.103	-2394.103
19	19	Circular Arc	7197.312	4992.501	2446.951	006 45 22.440	85.669	-2902.125	-2902.125
20	20	Compound Out	7282.225	5003.834	2532.620	008 26 51.243	30.000	-2486.195	-2902.125
21	21	Circular Arc	7311.875	5008.403	2562.620	009 05 21.810	60.000	-2486.195	-2486.195

To view the vertical entities, select 'VIEW > Vertical Entities'



	No.	Type	Chainage(1)	Length	Base Level	Gradient	Grade Diff.
1	1	Straight	20.000	40.000	93.242	+1.1007%	+0.0000%
2	2	V.Curve	60.000	0.000	93.682	+1.1007%	-0.1045%
3	3	Straight	60.000	90.000	93.682	+1.2052%	+0.0000%
4	4	V.Curve	150.000	0.000	94.767	+1.2052%	+0.0883%
5	5	Straight	150.000	320.000	94.767	+1.1169%	+0.0000%
6	6	V.Curve	470.000	80.000	98.341	+1.1169%	+0.0444%
7	7	Straight	550.000	82.500	99.217	+1.0725%	+0.0000%
8	8	V.Curve	632.500	135.000	100.101	+1.0725%	+0.9606%
9	9	Straight	767.500	102.500	100.901	+0.1118%	+0.0000%
10	10	V.Curve	870.000	40.000	101.016	+0.1118%	+0.5139%
11	11	Straight	910.000	100.000	100.958	-0.4020%	+0.0000%
12	12	V.Curve	1010.000	20.000	100.555	-0.4020%	+0.3733%
13	13	Straight	1030.000	70.000	100.438	-0.7753%	+0.0000%
14	14	V.Curve	1100.000	40.000	99.895	-0.7753%	-0.5753%
15	15	Straight	1140.000	180.000	99.700	-0.2000%	+0.0000%
16	16	V.Curve	1320.000	40.000	99.340	-0.2000%	-0.2137%
17	17	Straight	1360.000	120.067	99.303	+0.0137%	+0.0000%
18	18	V.Curve	1480.067	40.000	99.319	+0.0137%	-0.1943%
19	19	Straight	1520.067	99.933	99.364	+0.2081%	+0.0000%
20	20	V.Curve	1620.000	30.000	99.572	+0.2081%	+0.1038%
21	21	Straight	1650.000	480.000	99.618	+0.1043%	+0.0000%
22	22	V.Curve	2130.000	0.000	100.119	+0.1043%	+0.0119%
23	23	Straight	2130.000	200.000	100.119	+0.0923%	+0.0000%
24	24	V.Curve	2330.000	20.000	100.304	+0.0923%	-0.1439%
25	25	Straight	2350.000	122.757	100.336	+0.2362%	+0.0000%
26	26	V.Curve	2472.757	20.000	100.626	+0.2362%	+0.0981%
27	27	Straight	2492.757	89.465	100.664	+0.1381%	+0.0000%
28	28	V.Curve	2582.222	20.000	100.787	+0.1381%	-0.1780%
29	29	Straight	2602.222	30.000	100.833	+0.3161%	+0.0000%

You can change gradient units between ratios, e.g. 1:2, to percentages using **'FILE > General Options > Units and data checking'**

Note that in the data provided, the horizontal alignment is slightly shorter than the vertical alignment, so you may wish to edit the length of final horizontal entity. Once you are happy with the alignments, select **'FILE > Save to'** save the alignment file.

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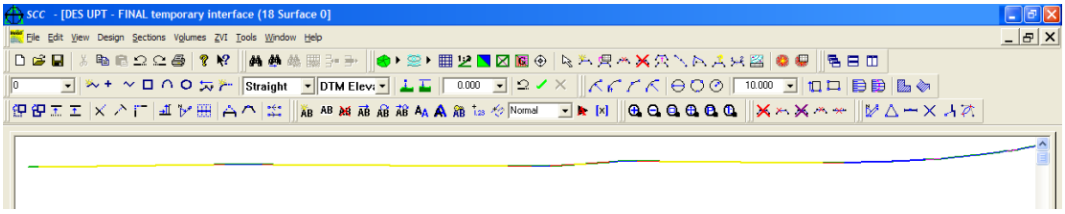
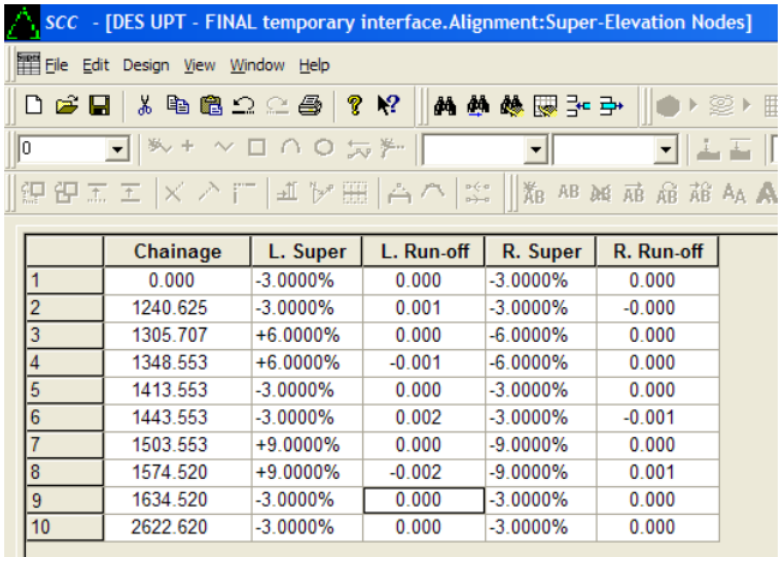
To view the horizontal entities in plan, switch back to plan view and select

'FILE > Attach> Detach > Attach Alignment File, picking the file DES DR CL - 644.Alignment



You will see the alignment drawn with straights in yellow, transitions in red, and circular arcs in blue. As you move around the screen you will also see the chainage and offset of the cursor position being updated.



	Chainage	L. Super	L. Run-off	R. Super	R. Run-off
1	0.000	-3.0000%	0.000	-3.0000%	0.000
2	1240.625	-3.0000%	0.001	-3.0000%	-0.000
3	1305.707	+6.0000%	0.000	-6.0000%	0.000
4	1348.553	+6.0000%	-0.001	-6.0000%	0.000
5	1413.553	-3.0000%	0.000	-3.0000%	0.000
6	1443.553	-3.0000%	0.002	-3.0000%	-0.001
7	1503.553	+9.0000%	0.000	-9.0000%	0.000
8	1574.520	+9.0000%	-0.002	-9.0000%	0.001
9	1634.520	-3.0000%	0.000	-3.0000%	0.000
10	2622.620	-3.0000%	0.000	-3.0000%	0.000

If you have any cant, you can enter this in using '**VIEW** > **Super-elevation** > **Cant**'. Selecting '**DESIGN** > **Compute super-elevation** > **Cant**' will place cant nodes at transitions, allowing you to enter cant values and run-off for each node.

To inspect the vertical profile graphically, this can be done from plan view by selecting '**DESIGN** > **Vertical Alignment**'. Vertical straights are shown in yellow and parabolic curves in blue. The positions of horizontal changes are shown as yellow, red or blue vertical lines. As you move the mouse on screen, the chainage and height of the current cursor position is displayed.

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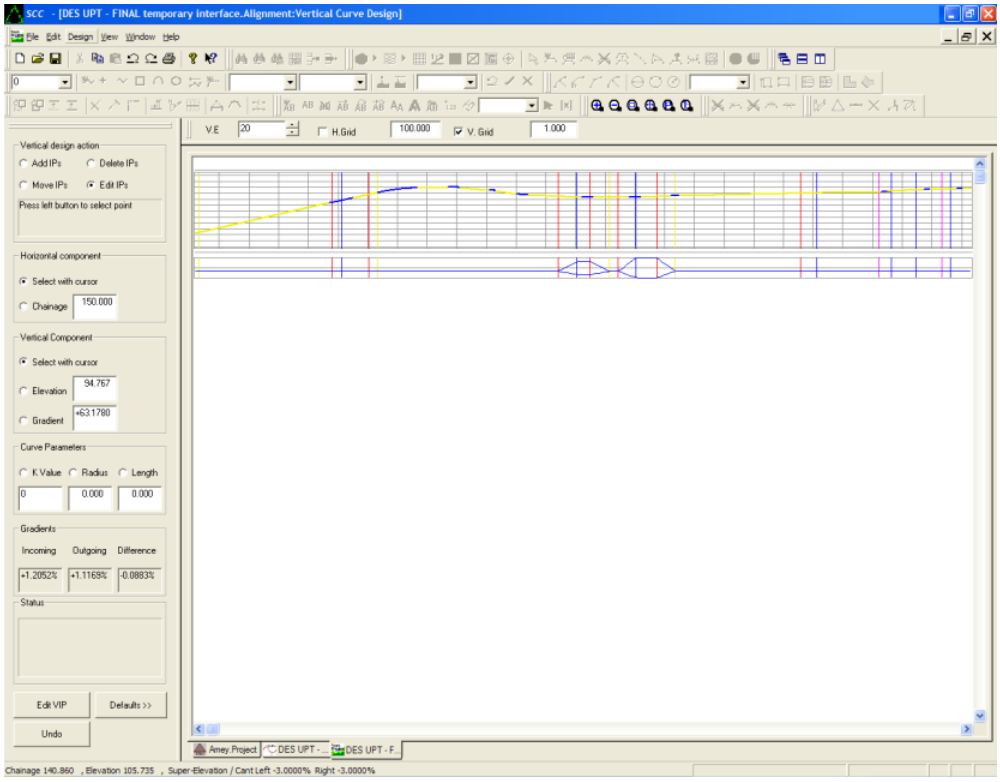
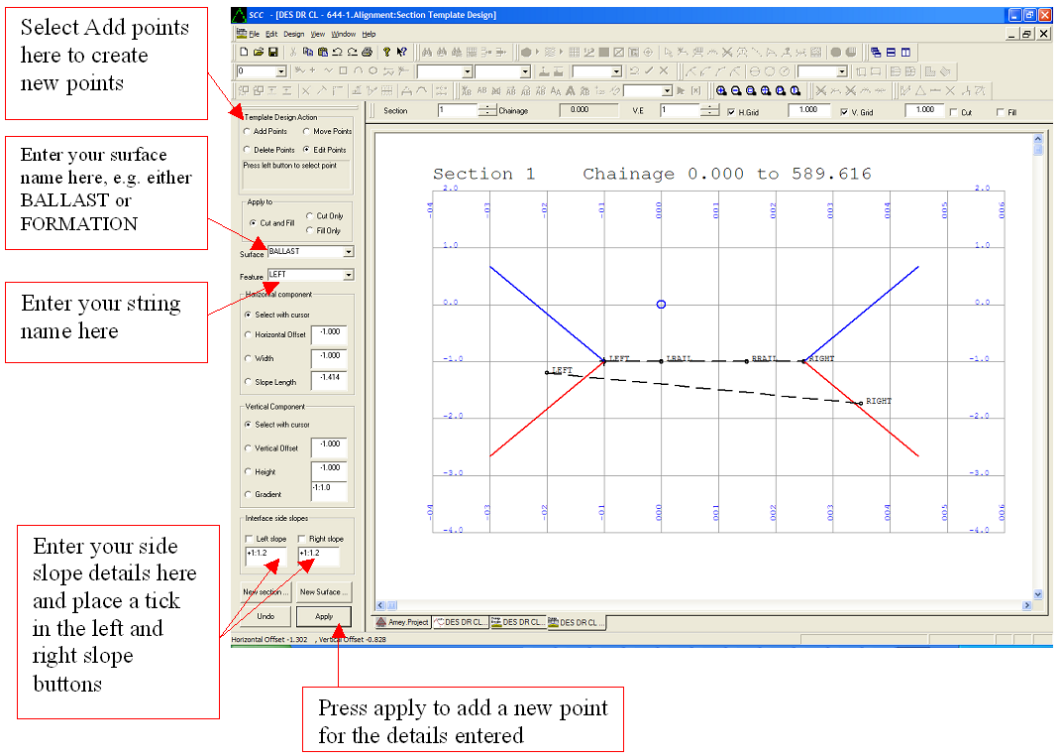


Below the vertical profile you will also see a diagram showing application of cant > super-elevation by chainage. This is also interpolated and updated in the status bar for the current cursor position as you move the mouse.

Cross Section Templates

Select 'DESIGN > Section Templates' to bring up the template design screen as shown.



Enter the following points to build the section templates as shown

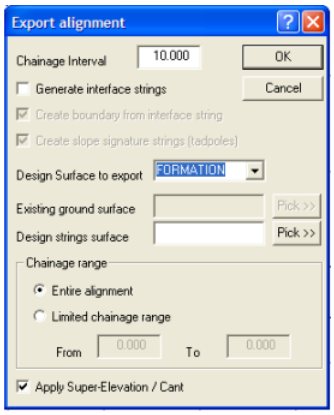
Surface	Feature	Hz.Offset	Vt.Offset
BALLAST	LEFT	-1.000	-1.000
BALLAST	LRAIL	0.000	-1.000
BALLAST	RRAIL	1.500	-1.000
BALLAST	RIGHT	2.500	-1.000
FORMATION	LEFT	-2.000	-1.200
FORMATION	RIGHT	3.500	-1.736

The values given here are arbitrary intended to illustrate the process. You can enter real values either using horizontal and vertical offsets, or any combination of offsets, height differences, widths and gradients. The small blue circle on the template indicates the position of the centerline.

Once you have entered the template points, select **'FILE > Save to'** save your work. You can also view, enter and edit these points in spreadsheet fashion by selecting **'VIEW > Section template points'**

Create the surface models

From the section template view, select **'Design > Export design as model',** and enter the following parameters to export the formation model.



Note that the chainage interval controls the number of points that will be output to the triangulated surface. A higher number can give better representation of horizontal and vertical curves in the triangulated surface, at the expense of a larger model.

If you do not wish to apply cant to this surface your can also disable it at this point.

To remove any spurious triangles around the model boundary, use the Add / Remove triangles tool. Use the options to remove all triangles to the left of the left edge and to the right of the right edge (lower on screen).

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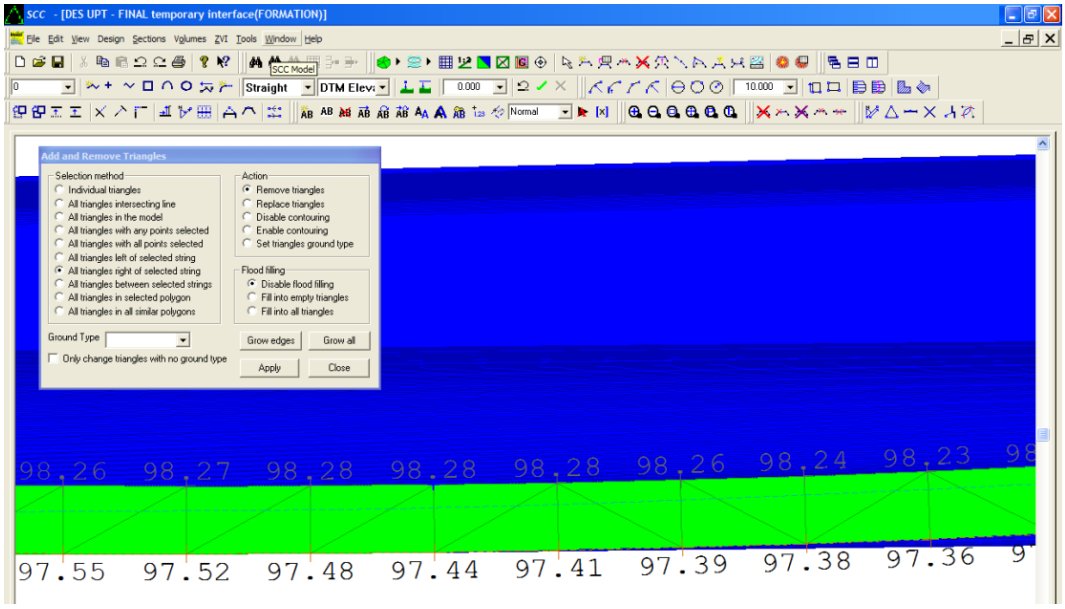
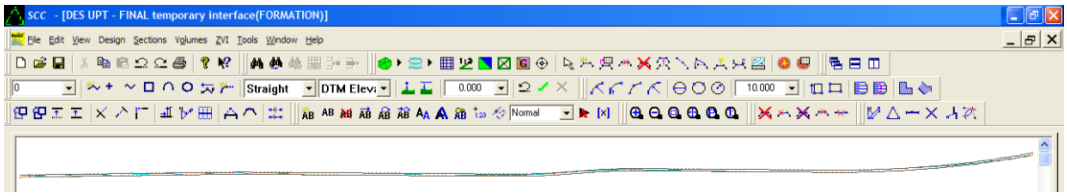
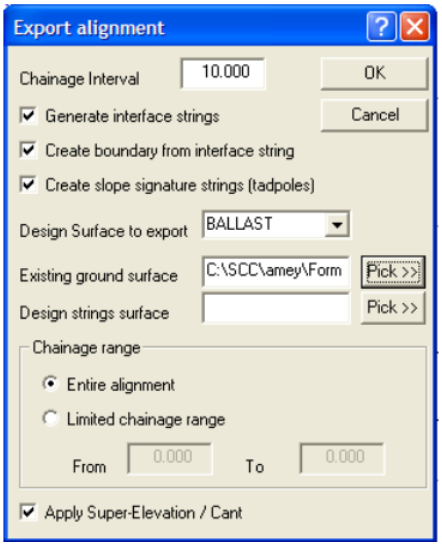


The final triangulated surface will appear as follows. Select '**FILE** > **Save**' once your are done, giving a name of Formation.Model



To export the bottom ballast surface, go back to the section template view and select '**DESIGN** > **Export design as model**' using the following parameters;



Note that we have picked the formation model as our existing ground surface and instructed SCC to generate an interface between these surfaces using the side slopes entered in the section template. When you zoom into the resulting model you will see red tadpoles connecting the edge of the ballast surface down to the formation surface.

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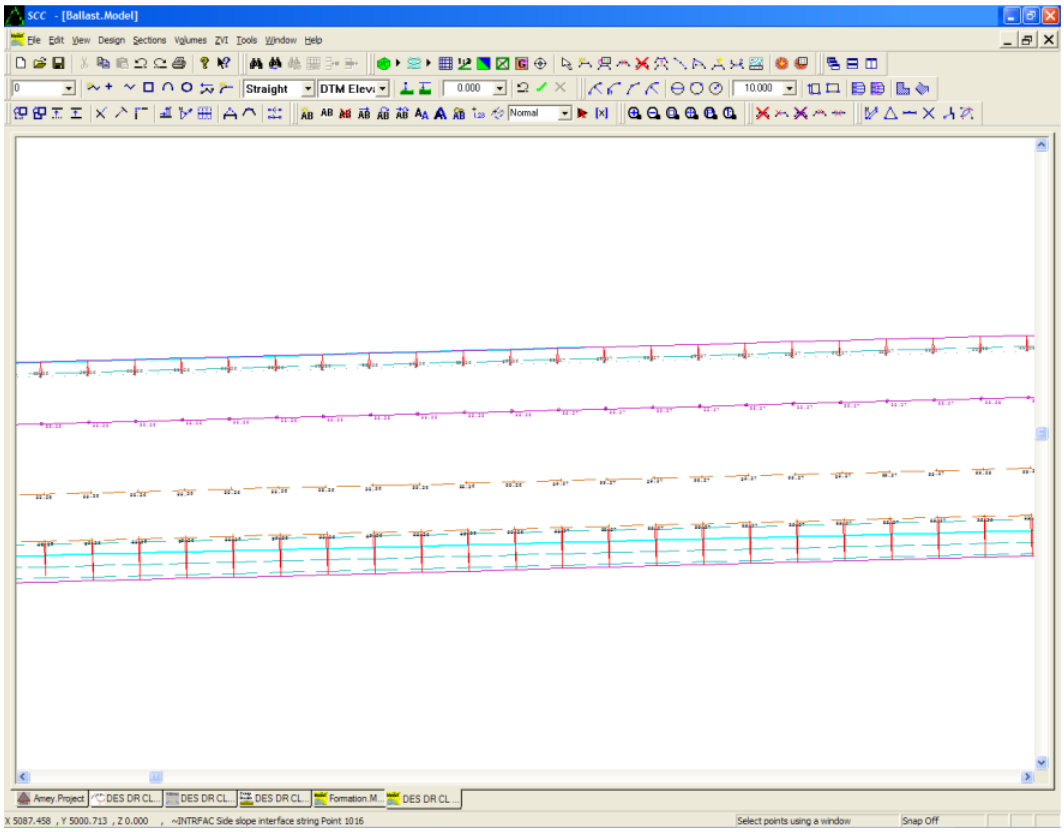
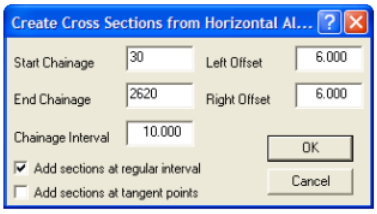


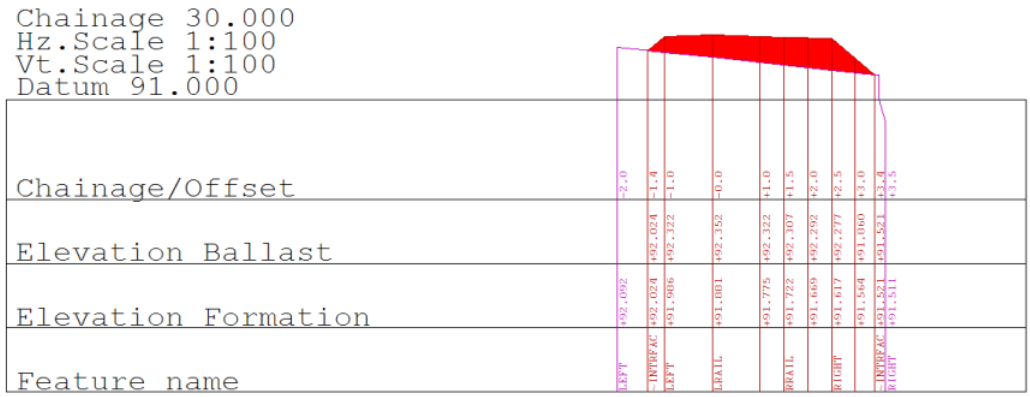
To verify the correctness of the surfaces generated we will cut some cross-sections through them.

Select 'FILE > Attach/Detach > Attach Alignment File', picking the file DES UPT - FINAL temporary interface.Alignment and then pick 'Sections > Cross sections' from an alignment using the parameters shown;



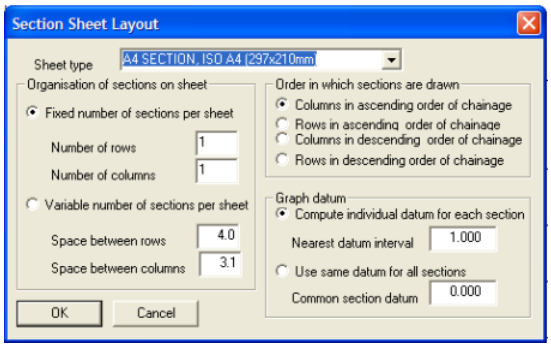
From the section view, select 'EDIT > Append surfaces' and pick the formation model.

This will result in sections as shown below:



To get an animated run through of the sections, use 'VIEW > Sheet layout' with the

parameters shown below;



Press + to move up the chainages and – to move back down. It is valuable to use this to check chainages where cant changes around transitions.

Note: If you want to apply a template position to points after cant has been applied, this can be done as follows;

- Exporting the surface with cant
- In plan view use '**Design** > **Create an alignment from an existing string**' to create a new alignment

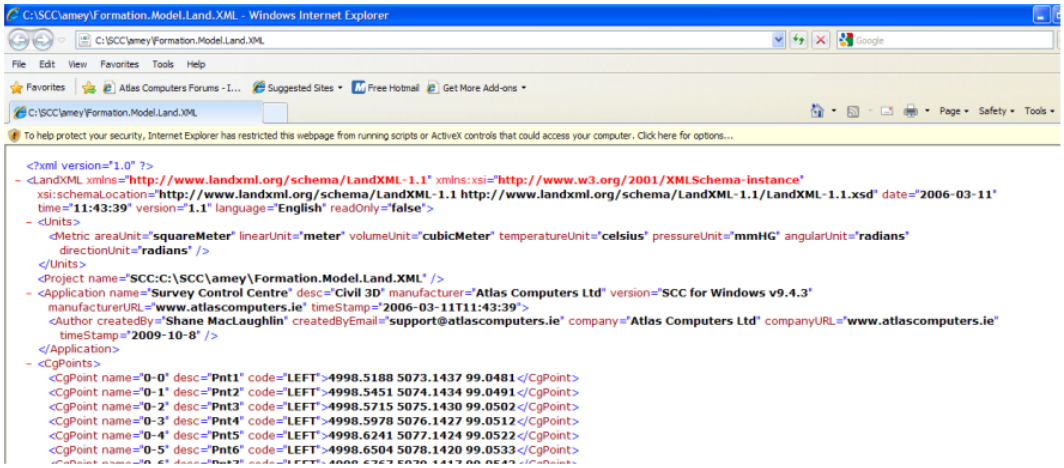
Add the second template to this alignment and proceed as described above.

Export LandXML files

To export a LandXML file for a given model, open the model and select 'FILE > Export > LandXML.'

Doing this for Ballast.Model and Formation.Model will result in the files Ballast.Model.Land.XML and Formation.Model.Land.XML.

These files can be opened in Internet explorer as shown below.



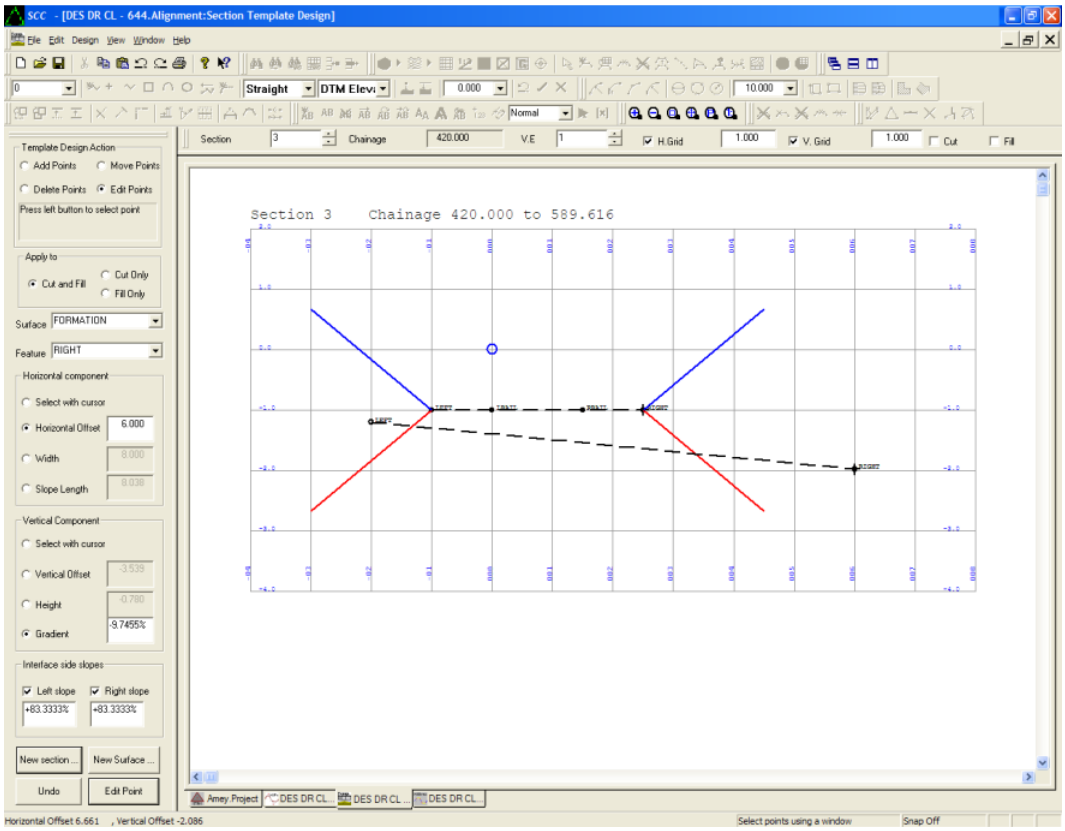
Examining the XML files shows they contain points, strings, breaklines and the triangulated surface

Note: Widening or narrowing at a given chainage

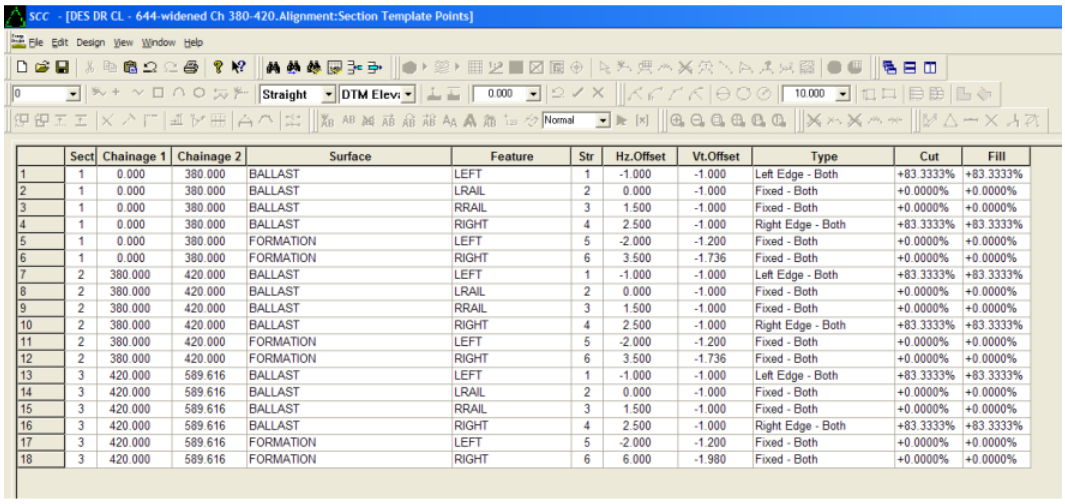
To widen or narrow an alignment between given chainages we need to create extra templates. For example say we wished to widen the formation surface between chainages 380 and 420, we would do the following;

- In section template view, press the New section button and create a new section at chainage 380.

- Press the New section button again, and create another section at chainage 420.
- Edit the right formation edge to have a new offset and/ or height as required
- Export to a model as described previously.



Viewing the section template points shows we now have three sections, each containing all the strings for both surfaces. The first and second sections, starting at chainages 0 and 380, are the same indicating there is no change between these chainages. The third section, at chainage 420, has a modified height and offset values for the right formation level. This means that there will be a linear change of height and offsets between chainages 380 and 420. As there are no further sections after chainage 420, the section template at 420 will be carried to the end of the alignment.



	Sect	Chainage 1	Chainage 2	Surface	Feature	Str	Hz.Offset	Vt.Offset	Type	Cut	Fill
1	1	0.000	380.000	BALLAST	LEFT	1	-1.000	-1.000	Left Edge - Both	+83.3333%	+83.3333%
2	1	0.000	380.000	BALLAST	LRAIL	2	0.000	-1.000	Fixed - Both	+0.0000%	+0.0000%
3	1	0.000	380.000	BALLAST	RRAIL	3	1.500	-1.000	Fixed - Both	+0.0000%	+0.0000%
4	1	0.000	380.000	BALLAST	RIGHT	4	2.500	-1.000	Right Edge - Both	+83.3333%	+83.3333%
5	1	0.000	380.000	FORMATION	LEFT	5	-2.000	-1.200	Fixed - Both	+0.0000%	+0.0000%
6	1	0.000	380.000	FORMATION	RIGHT	6	3.500	-1.736	Fixed - Both	+0.0000%	+0.0000%
7	2	380.000	420.000	BALLAST	LEFT	1	-1.000	-1.000	Left Edge - Both	+83.3333%	+83.3333%
8	2	380.000	420.000	BALLAST	LRAIL	2	0.000	-1.000	Fixed - Both	+0.0000%	+0.0000%
9	2	380.000	420.000	BALLAST	RRAIL	3	1.500	-1.000	Fixed - Both	+0.0000%	+0.0000%
10	2	380.000	420.000	BALLAST	RIGHT	4	2.500	-1.000	Right Edge - Both	+83.3333%	+83.3333%
11	2	380.000	420.000	FORMATION	LEFT	5	-2.000	-1.200	Fixed - Both	+0.0000%	+0.0000%
12	2	380.000	420.000	FORMATION	RIGHT	6	3.500	-1.736	Fixed - Both	+0.0000%	+0.0000%
13	3	420.000	589.616	BALLAST	LEFT	1	-1.000	-1.000	Left Edge - Both	+83.3333%	+83.3333%
14	3	420.000	589.616	BALLAST	LRAIL	2	0.000	-1.000	Fixed - Both	+0.0000%	+0.0000%
15	3	420.000	589.616	BALLAST	RRAIL	3	1.500	-1.000	Fixed - Both	+0.0000%	+0.0000%
16	3	420.000	589.616	BALLAST	RIGHT	4	2.500	-1.000	Right Edge - Both	+83.3333%	+83.3333%
17	3	420.000	589.616	FORMATION	LEFT	5	-2.000	-1.200	Fixed - Both	+0.0000%	+0.0000%
18	3	420.000	589.616	FORMATION	RIGHT	6	6.000	-1.980	Fixed - Both	+0.0000%	+0.0000%

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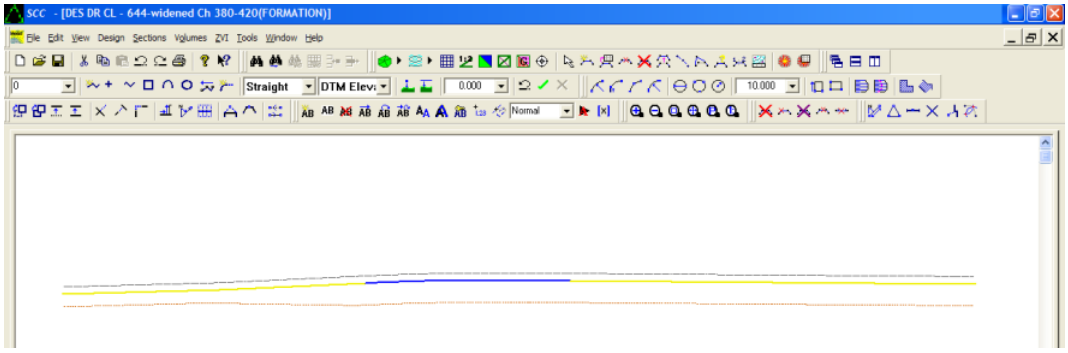


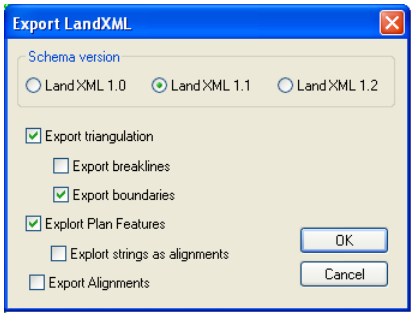
22 Working With AutoCAD Civil3D Files

22.1 Exporting TIN models from SCC to Civil 3d

The following examines how to export a triangulated surface from SCC to Civil 3d using the LandXML format. It is based around SCC 10.0.6 and Civil 3d 2013. The steps are as follows:

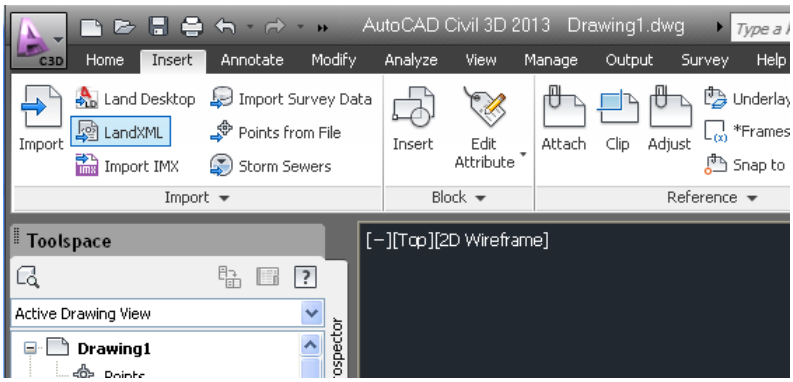
Open your model in SCC

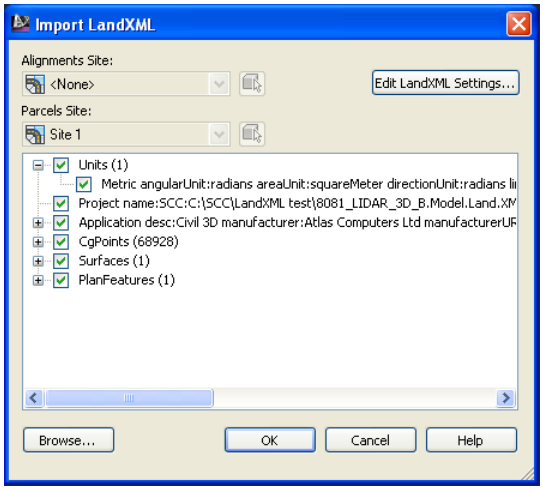
Select 'FILE > Export > LandXML' using the following parameters



Open Civil3d and start a new blank drawing

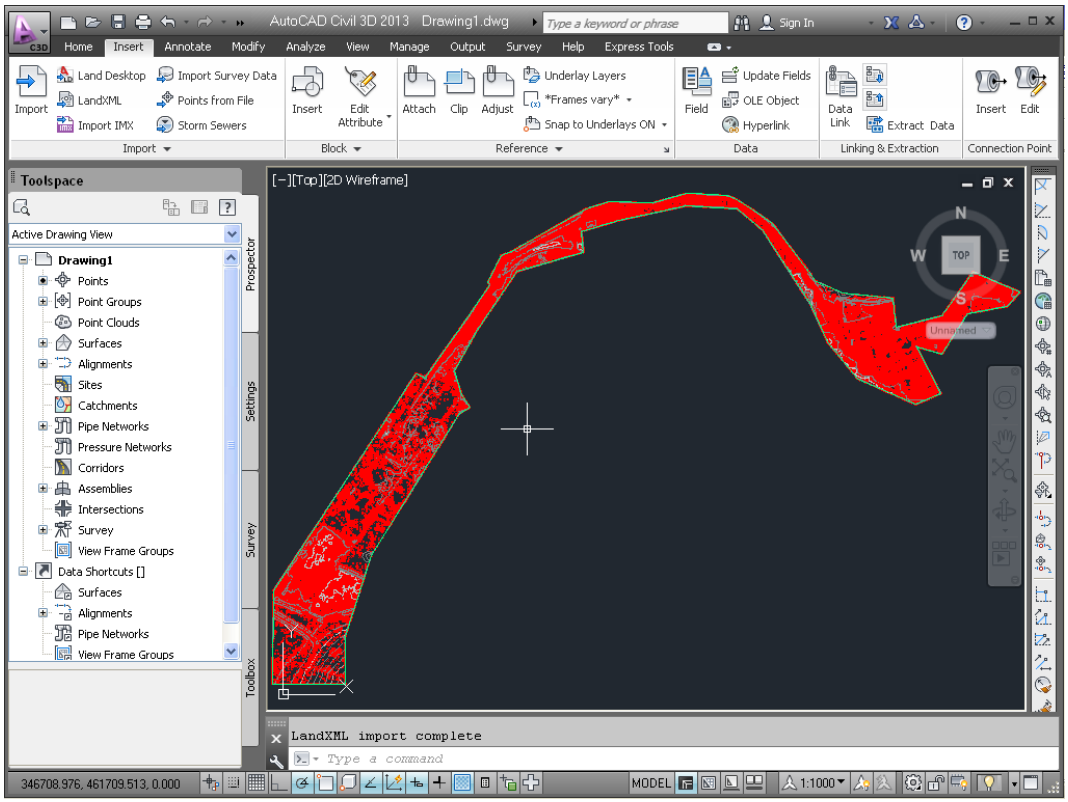
Select 'Insert > LandXML'

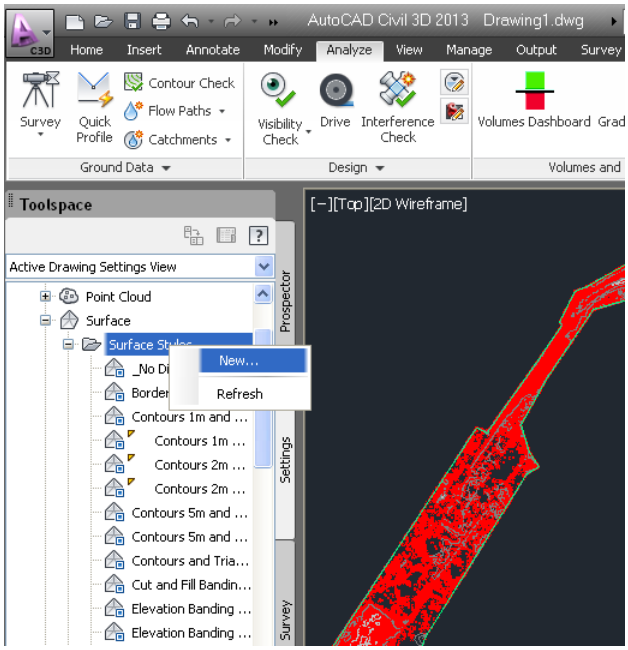




Pick the LandXML file created in SCC, the file contains a large number of points and one surface that corresponds to the TIN surface

When drawn initially in Civil3d it may not show the TIN, depending on the default surface style set in use.





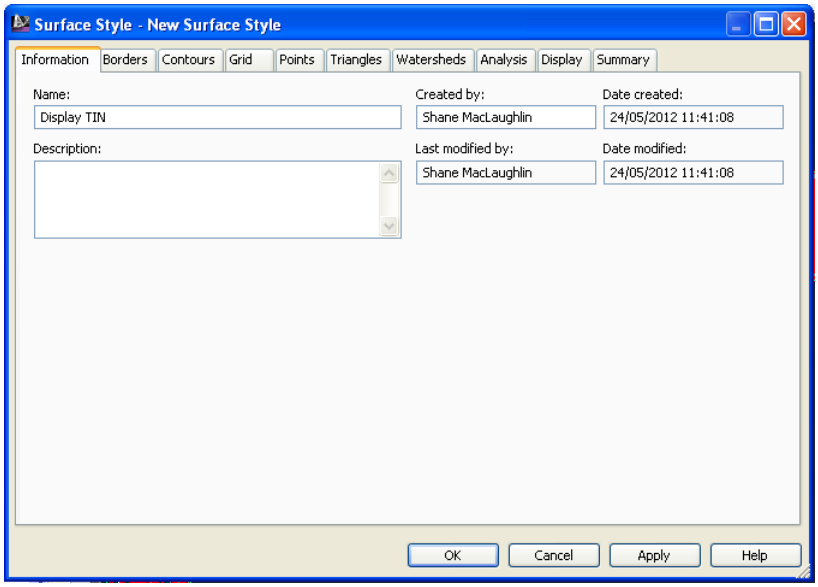
To display the TIN, first create a style set with triangles turned on as follows:

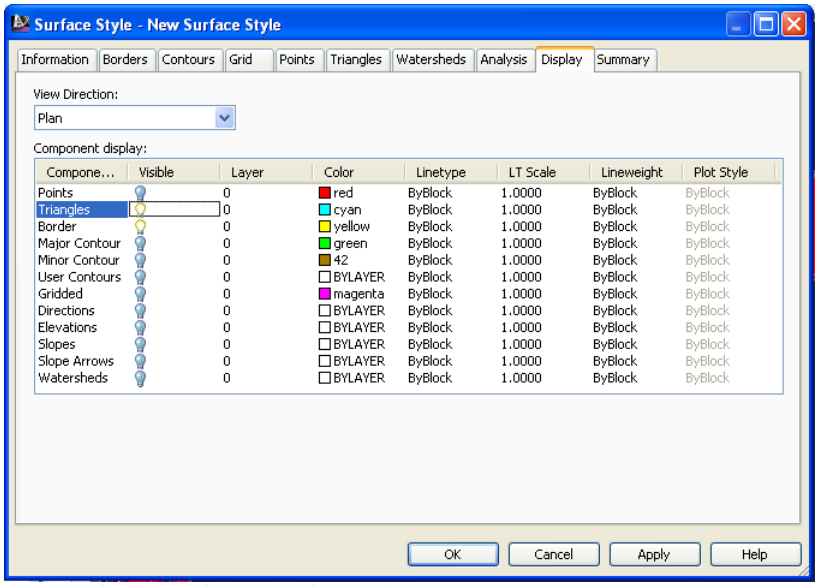
Click New in the Surfaces section of the Settings pane in the Toolspace.

Give your new surface style a name, e.g. Display TIN

In the Display tab, turn on the triangles

Press Ok to close the dialog





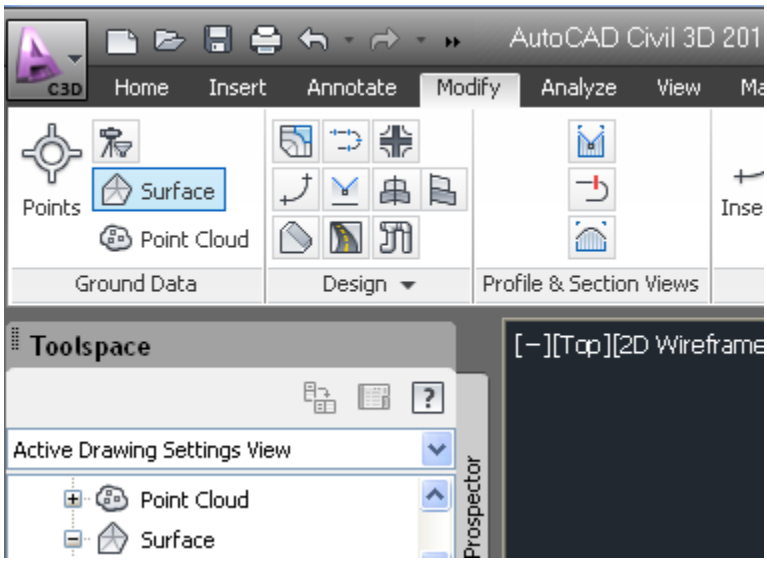
To apply the style set to the surface:

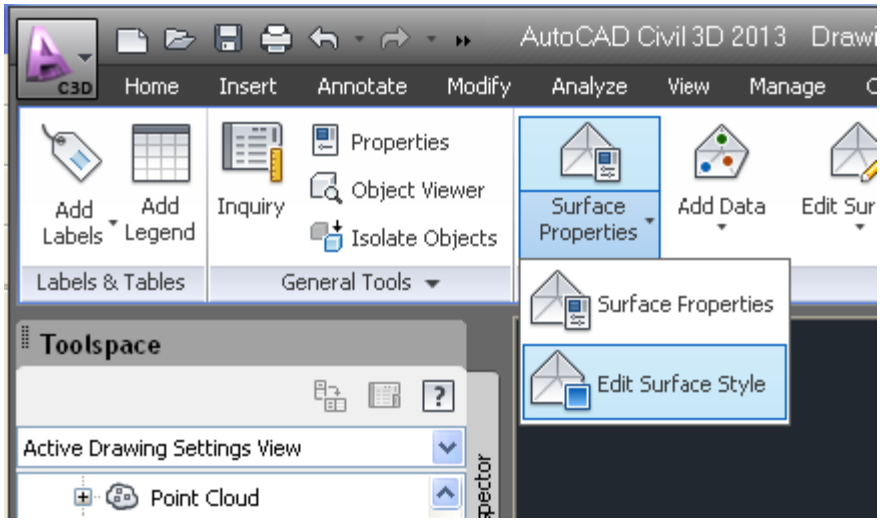
Click 'MODIFY > Surface'

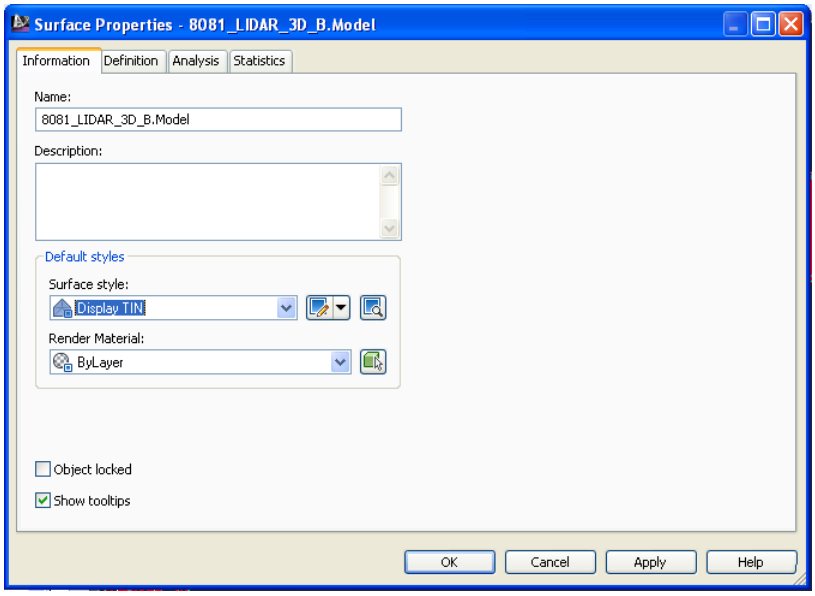
Click 'SURFACE > Properties'

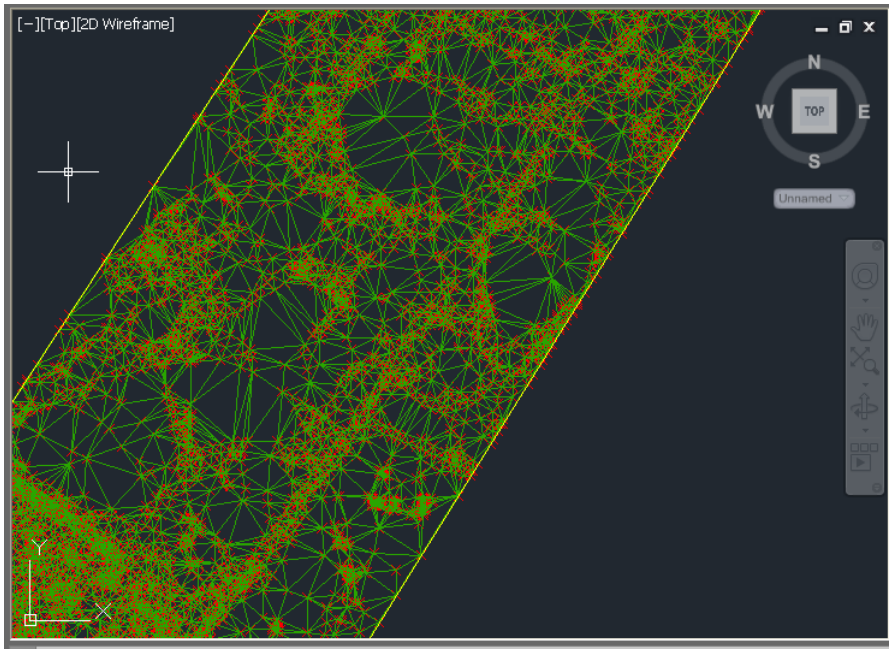
Select the appropriate style e.g. Display TIN, as the surface style

Press Ok




AutoCAD Civil 3D 2013
Home
Insert
Annotate
Modify
Analyze
View
Manage
Add Labels
Add Legend
Inquiry
Properties
Object Viewer
Isolate Objects
Surface Properties
Add Data
Edit Sur
Labels & Tables
General Tools
Surface Properties
Edit Surface Style
Toolspace
Active Drawing Settings View
Point Cloud


Surface Properties - 8081_LIDAR_3D_B.Model
Information
Definition
Analysis
Statistics
Name:
8081_LIDAR_3D_B.Model
Description:
Default styles
Surface style:
Display TIN
Render Material:
ByLayer
Object locked
Show tooltips
OK
Cancel
Apply
Help


[-][Top][2D Wireframe]
N
W
TOP
E
S
Unnamed

Triangles are now displayed and can be used for analysis.

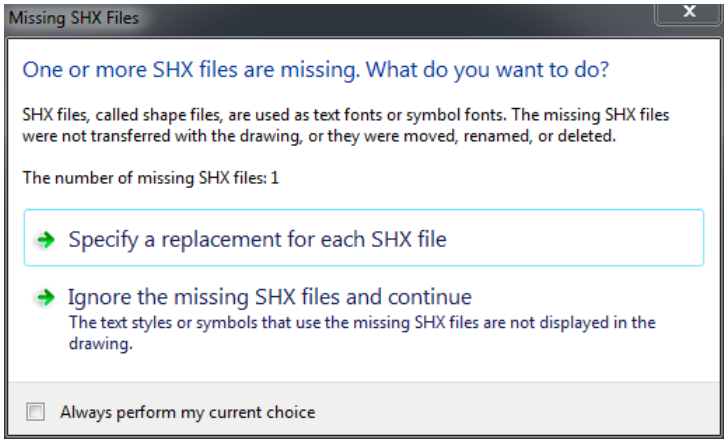
22.2 Importing AutoCAD Civil3D files into SCC

The following details the exporting of specific design entities from AutoCAD Civil3D 2013 which are then imported and modelled in SCC.

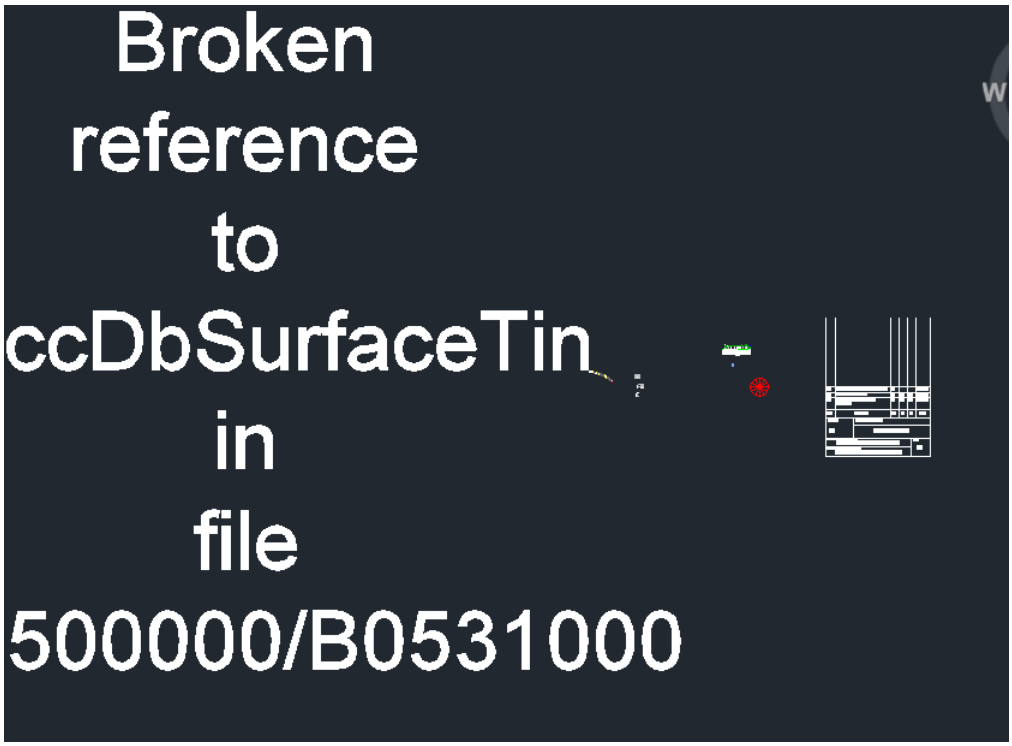
Exporting Specific Entities from AutoCAD Civil3D

Open the drawing file in AutoCAD.

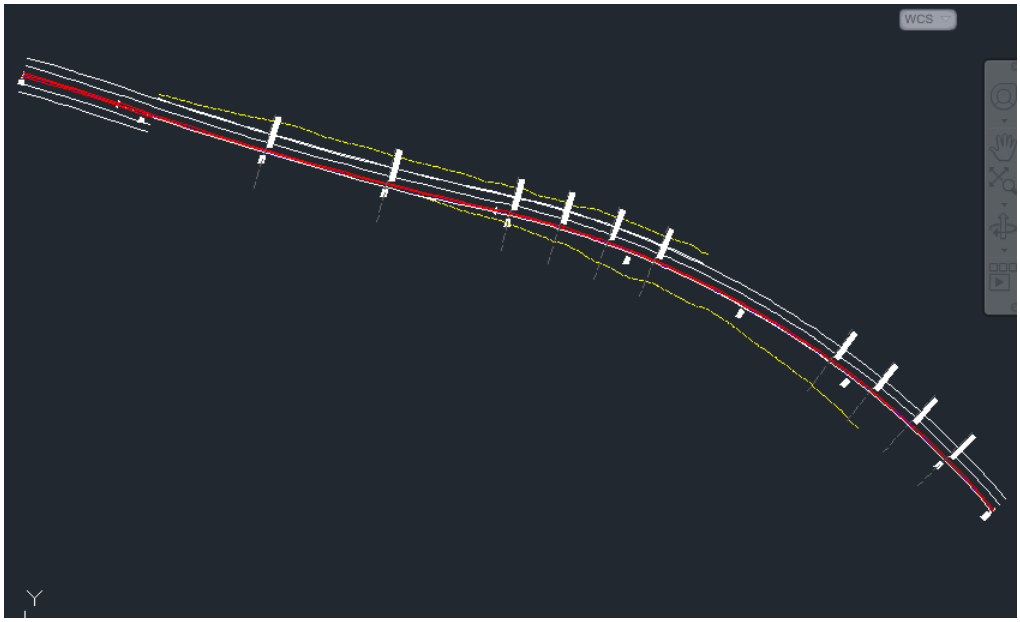
Note in some instance a message as shown below will detail that the drawing may be missing some shape files and xrefs. For the purpose of the demo this message is ignored. The error message will not appear if the file is opened on a PC where the files are available locally.



In the sample shown, the missing references appear as huge text in the drawing, where the area of interest to be exported is at the bottom right of the word Tin.



Zoom into the area of interest, and type in SAVEAS to save a copy of the file under a new name.



Type EXPLODE and select the corridor, to convert the entire C3D corridor object into an AutoCAD block.

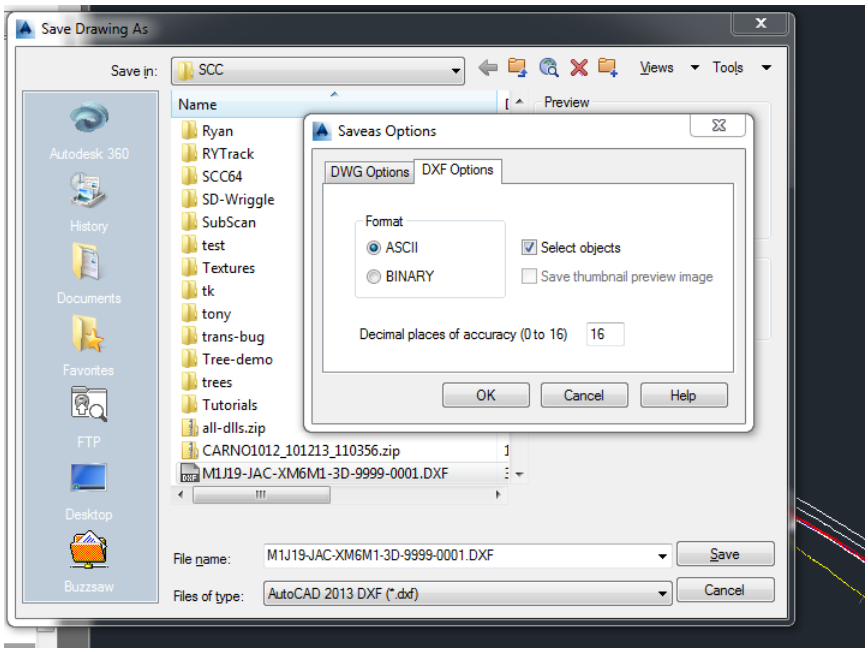
Type EXPLODE again to convert the block into simple entities.

Type DXFOUT to save these entities to a DXF file.

On the Tools menu of the Save Drawing As dialog, pick Select Entities, as this option allows for just the road corridor entities.

Enter a name and press Save.

Use the mouse to drag a window around the area of interest, and press Enter.

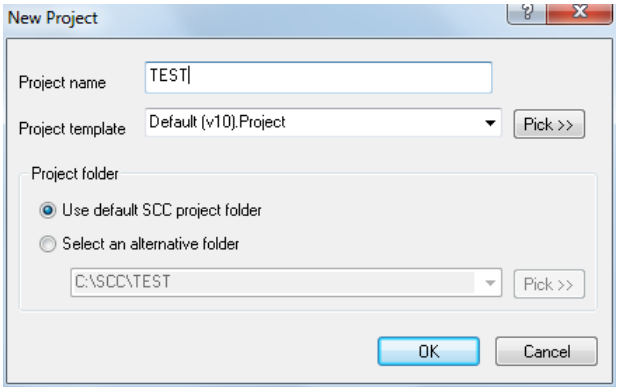


Close Civil 3d

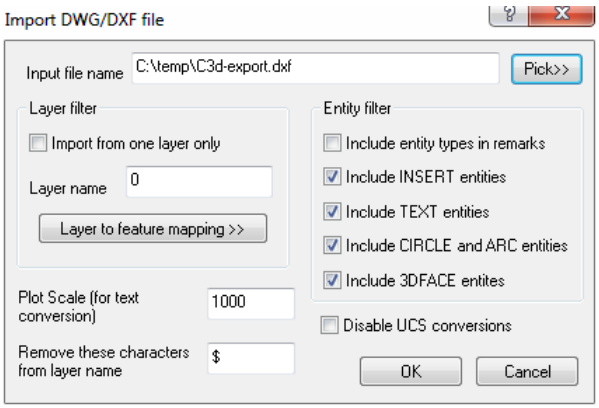
Importing Entities from AutoCAD Civil3D into SCC

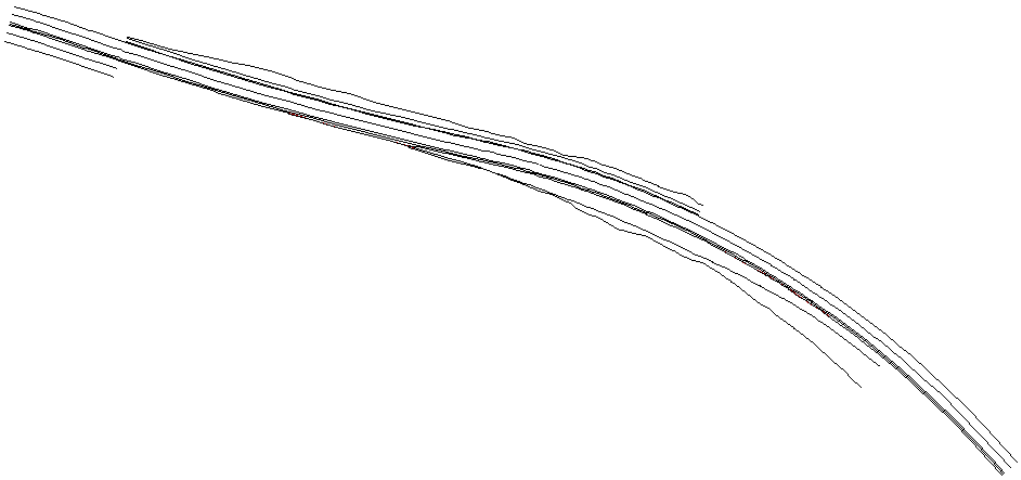
Open SCC

'FILE > New Project', to create a new project, or open an existing project



'FILE > Model > DXF or DWG' and pick the file just created





The data from Civil3d is all line segments, use 'TOOLS > Join adjacent strings (Same feature)' to convert them back to polylines.

Right click to select all the points in the model, and pick a DTM code of DTM elevation to ensure all points are triangulated for contouring, sectioning, etc...

Use 'EDIT > Add/Remove triangles' to limit the extents of the triangulation and form a boundary.

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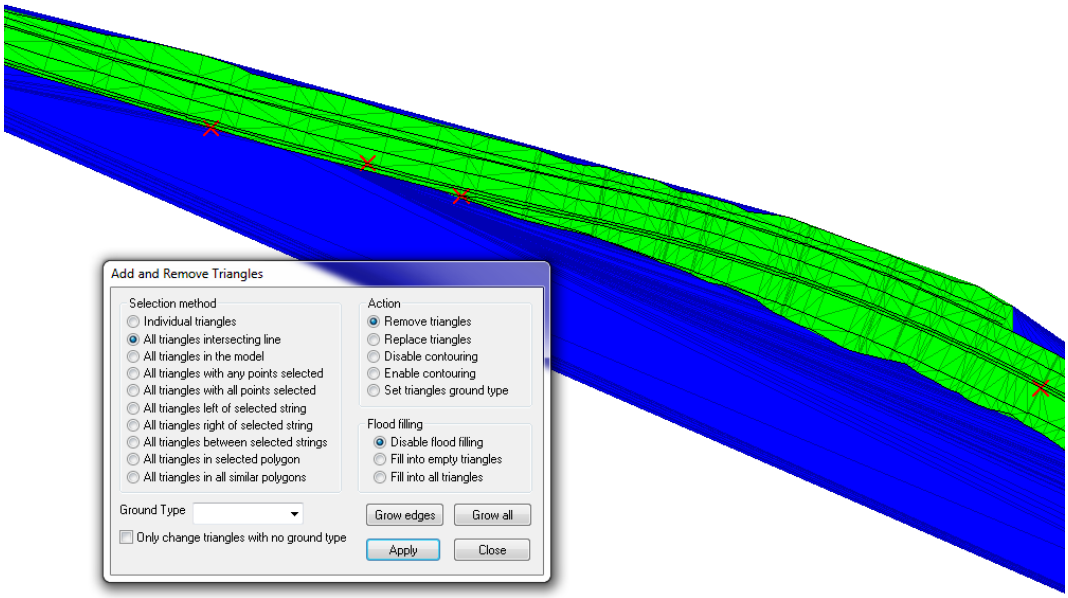
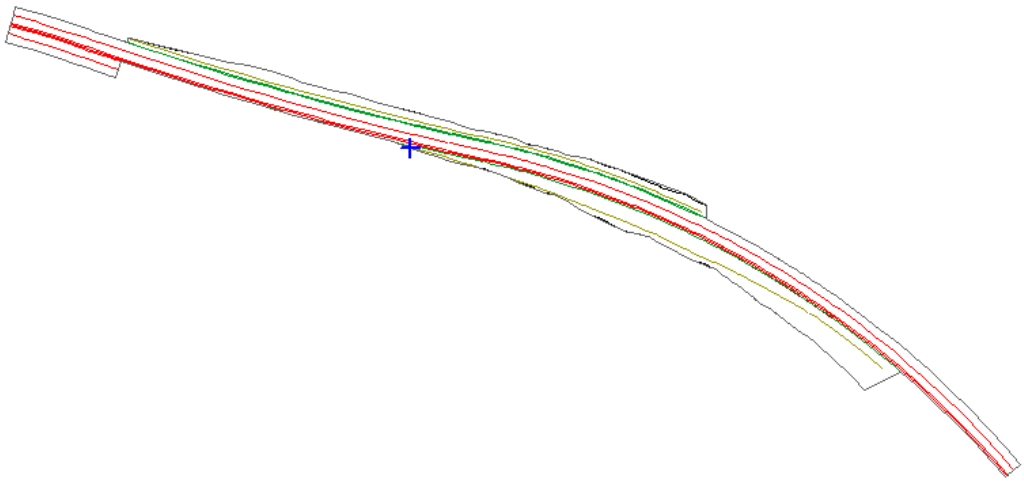


Use 'EDIT > Query & edit points' to set feature colours and line styles as required.

When prompted save the changes to the feature library, such that the feature library can be used as a template for future imports, such that this step is not necessary in future.



Notes:

If specific design lines are required out of Civil3d you can export the data as polylines, as described below. This is fine for a few lines but would become cumbersome on a large design as each line has to be done individually.

Exporting Feature Lines as Polylines

Export polylines from corridor feature lines.

Use this option if you want to use the corridor geometry for another purpose, such as for drafting or for surface data.

To export corridor feature lines as polylines

1. Click Home tab ➤ Create Design panel ▾ Create Polyline From Corridor.
2. In the drawing, click the corridor feature line. If you make an ambiguous selection, the Select A Feature Line dialog box is displayed. Select a feature line from the list.

   The feature line is exported as a polyline. The feature line's point code is displayed at the command line.

Ribbon

Home tab ➤ Create Design panel ▾ Create Polyline From Corridor

Command Line

CreatePolylineFromCorrdor

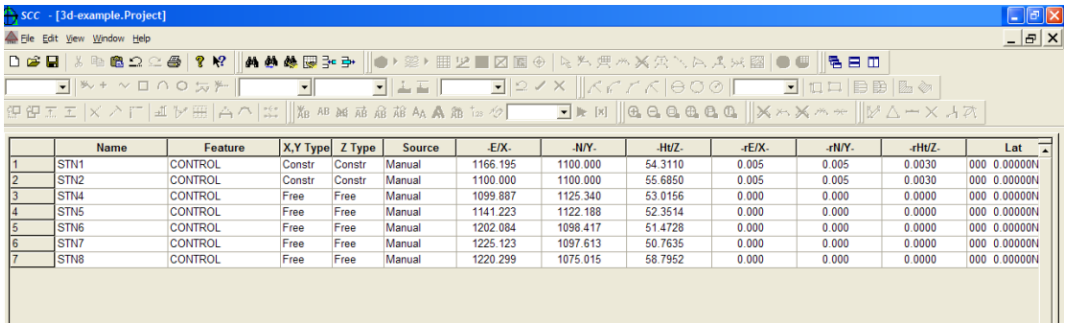
Dialog Box

Select a Feature Line

The TIN and alignments can be exported from Civil3d in LandXML as required, but this doesn't appear to create line work, so the above method give a better result.

23 Using Adjustment Constraints

Additional fields to enter coordinate constraints against station coordinates, and to include some extra adjustment options to deal with these have been added. Specifically, when you use **'VIEW > Station Coordinates'**, you will see three extra constraint fields, **rE/X, rN/Y and rHt/Z**, which correspond to the known accuracies > standard errors of the stations. You will also notice that the Type field has been broken down into two separate fields for **X,Y Type** and **Z Type**, and that a new type of **Constrained** has been added.



	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat
1	STN1	CONTROL	Constr	Constr	Manual	1166.195	1100.000	54.3110	0.005	0.005	0.0030	000 0.00000N
2	STN2	CONTROL	Constr	Constr	Manual	1100.000	1100.000	55.6850	0.005	0.005	0.0030	000 0.00000N
3	STN4	CONTROL	Free	Free	Manual	1099.887	1125.340	53.0156	0.000	0.000	0.0000	000 0.00000N
4	STN5	CONTROL	Free	Free	Manual	1141.223	1122.188	52.3514	0.000	0.000	0.0000	000 0.00000N
5	STN6	CONTROL	Free	Free	Manual	1202.084	1098.417	51.4728	0.000	0.000	0.0000	000 0.00000N
6	STN7	CONTROL	Free	Free	Manual	1225.123	1097.613	50.7635	0.000	0.000	0.0000	000 0.00000N
7	STN8	CONTROL	Free	Free	Manual	1220.299	1075.015	58.7952	0.000	0.000	0.0000	000 0.00000N

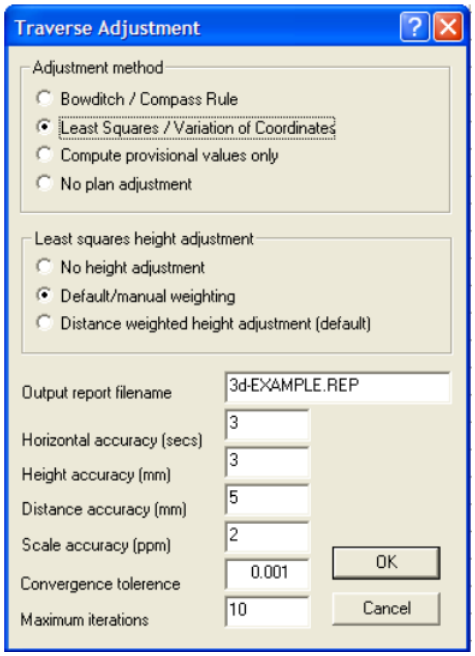
Entering a value into a constraint field, and setting the corresponding type to constrained will allow the station to be modified slightly during the course of a least squares adjustment to the limits of the constraint entered. For example, in the above spreadsheet, the X,Y, and Z coordinates have standard errors of 5mm, and hence may be adjusted by an amount that will normally be less than this value. Note that in networks with blunders and unusually large residuals, the adjustment may be greater than the standard error entered.

Open Existing Files

To illustrate the use of constraints, open 3d-example.project and 3d-example.traverse

Traverse Adjustment

Select 'EDIT > Adjust' with the following parameters.



This yields the report shown below. Note the report layout has been improved in SCC 9.9.0 to combine residual values and standard errors in with original observations and provisional coordinates, and similarly adjustments with adjusted coordinates. Note that the coordinates and elevation of STN1 and STN2 have been modified slightly in accordance with the constraints given.

```
SCC for Windows v9.9.0 (C) 1990 - 2009 Atlas Computers Ltd

   Traverse adjustment report

   Title   3d-EXAMPLE.Traverse

   Date    Thu Jun 03 08:48:43 2010

   Coordinate adjustment method  Variation of Co-ordinates

   Height adjustment method  Least Squares (Default weighting)

   Corrections applied

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

   Local scale factor : No local scale factor

   Earth curvature and refraction : Curvature only  (Earth Radius 6380000.000)

   Temperature and pressure : No

   Mean sea level correction : No

    Default Standard Errors

    Angles (secs)            : 3.000

    Distances (constant mm)  : 5.000

    Distances (ppm mm)       : 2.000

    Heights (mm)             : 3.000

    Provisional coordinates

    Name                    E> X       StdErr        N> Y       StdErr  Type
Ht> Z       StdErr  Type

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

    STN1                 1166.19500  0.0050      1100.00000  0.0050  Cons
54.31100  0.0030  Cons
```

```
    STN2                  1100.00000  0.0050      1100.00000  0.0050  Cons
55.68500  0.0030  Cons

    STN4                  1099.88478  0.0000      1125.34510  0.0000  Free
53.02486  0.0000  Free

    STN5                  1141.22028  0.0000      1122.19111  0.0000  Free
52.35902  0.0000  Free

    STN6                  1202.08301  0.0000      1098.41752  0.0000  Free
51.47829  0.0000  Free

    STN7                  1225.12102  0.0000      1097.61346  0.0000  Free
50.76723  0.0000  Free

    STN8                  1220.29787  0.0000      1075.01497  0.0000  Free
58.79736  0.0000  Free

    STN9                  1215.15799  0.0000      1142.77027  0.0000  Free
40.62047  0.0000  Free

    TEM1                  1101.17775  0.0000      1143.46424  0.0000  Free
52.22092  0.0000  Free

    TEM2                  1105.95935  0.0000      1132.62374  0.0000  Free
52.25085  0.0000  Free

    Adjusted coordinates

    Name                    E> X         Adj         N> Y         Adj       Ht> Z
      Adj

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

    STN1                  1166.19517  +0.0002      1100.00000  +0.0000
54.30905  -0.0019

    STN2                  1099.99983  -0.0002      1100.00000  +0.0000
55.68695  +0.0019

    STN4                  1099.88673  +0.0019      1125.33990  -0.0052
53.01638  -0.0085

    STN5                  1141.22332  +0.0030      1122.18748  -0.0036
52.35103  -0.0080

    STN6                  1202.08386  +0.0008      1098.41665  -0.0009
51.47357  -0.0047

    STN7                  1225.12161  +0.0006      1097.61285  -0.0006
50.76387  -0.0034

    STN8                  1220.29869  +0.0008      1075.01485  -0.0001
58.79446  -0.0029

    STN9                  1215.15749  -0.0005      1142.77221  +0.0019
40.61866  -0.0018

    TEM1                  1101.17898  +0.0012      1143.45910  -0.0051
52.21244  -0.0085

    TEM2                  1105.96101  +0.0017      1132.61879  -0.0050
52.24236  -0.0085

    Bearings

    At Station    To Station     Bearing    StdErr   Residual      StdRes

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

    STN1          STN2          270 00 00.0   0.000  -000 00 00.00   1.000
(Fixed)

    STN2          STN1          090 00 00.0   0.000  -000 00 00.00   1.000
(Fixed)

    Angles

    At Station    To Station      Angle     StdErr   Residual      StdRes

    ------------  ------------  ----------  ------  -------------  ------
```

STN1	STN8	204 47 16.0	3.000	-000 00 00.56	0.190
STN1	STN8	204 47 17.9	3.000	-000 00 02.56	0.857
STN8	STN7	077 15 36.0	3.000	-000 00 00.61	0.206
STN8	STN7	077 15 38.0	3.000	-000 00 02.61	0.872
STN7	STN9	155 30 36.9	3.000	-000 00 01.07	0.358
STN7	STN9	155 30 35.0	3.000	+000 00 00.92	-0.309
STN7	STN6	079 57 03.9	3.000	-000 00 01.05	0.351
STN7	STN6	079 57 05.0	3.000	-000 00 02.05	0.684
STN6	STN9	284 25 27.0	3.000	+000 00 00.90	-0.301
STN6	STN9	284 25 29.0	3.000	-000 00 01.09	0.365
STN6	STN5	199 20 14.0	3.000	-000 00 03.36	1.121
STN6	STN5	199 20 10.0	3.000	+000 00 00.63	-0.213
STN5	STN9	323 06 25.0	3.000	+000 00 00.91	-0.303
STN5	STN9	323 06 26.0	3.000	-000 00 00.08	0.030
STN5	STN4	163 01 38.0	3.000	-000 00 02.54	0.850
STN5	STN4	163 01 35.9	3.000	-000 00 00.54	0.183
STN4	TEM2	305 29 03.0	3.000	-000 00 00.00	0.000
STN4	TEM1	269 43 06.0	3.000	-000 00 00.00	0.000
STN4	TEM1	269 43 06.0	3.000	-000 00 00.00	0.000
STN4	TEM2	305 29 03.0	3.000	-000 00 00.00	0.000
STN4	STN2	085 23 01.0	3.000	-000 00 01.50	0.502
STN4	STN2	085 23 01.0	3.000	-000 00 01.50	0.502
STN2	STN4	269 44 39.0	3.000	+000 00 00.34	-0.115
STN2	STN1	090 15 21.0	3.000	-000 00 00.34	0.115
STN2	STN1	090 15 23.0	3.000	-000 00 02.34	0.781

Horizontal Distances

At Station	To Station	Distance	StdErr	Residual	StdRes
STN1	STN8	59.593	0.005	0.000692	-0.135
STN1	STN8	59.594	0.005	-0.000348	0.068
STN8	STN1	59.593	0.005	0.000649	-0.127
STN8	STN7	23.107	0.005	-0.000509	0.101
STN8	STN7	23.107	0.005	0.000358	-0.071
STN8	STN1	59.594	0.005	-0.000283	0.055
STN7	STN8	23.106	0.005	0.000475	-0.094
STN7	STN9	46.243	0.005	0.002698	-0.530
STN7	STN9	46.244	0.005	0.001672	-0.328
STN7	STN6	23.052	0.005	-0.000284	0.056
STN7	STN6	23.052	0.005	-0.000277	0.055
STN7	STN8	23.108	0.005	-0.001375	0.272
STN6	STN7	23.052	0.005	-0.000291	0.058
STN6	STN9	46.241	0.005	0.000829	-0.163

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STN6	STN9	46.242	0.005	-0.000144	0.028
STN6	STN5	65.341	0.005	-0.003070	0.598
STN6	STN5	65.339	0.005	-0.001065	0.208
STN6	STN7	23.054	0.005	-0.002290	0.454
STN5	STN6	65.339	0.005	-0.001078	0.210
STN5	STN9	76.745	0.005	0.001273	-0.247
STN5	STN9	76.744	0.005	0.002205	-0.428
STN5	STN4	41.456	0.005	0.000916	-0.180
STN5	STN4	41.458	0.005	-0.001084	0.213
STN5	STN6	65.340	0.005	-0.002070	0.403
STN4	STN5	41.457	0.005	-0.000081	0.016
STN4	TEM2	9.480	0.005	0.000000	-0.000
STN4	TEM1	18.165	0.005	0.000000	-0.000
STN4	TEM1	18.165	0.005	0.000000	-0.000
STN4	TEM2	9.480	0.005	0.000000	-0.000
STN4	STN2	25.340	0.005	0.000528	-0.104
STN4	STN2	25.340	0.005	0.000528	-0.104
STN4	STN5	41.457	0.005	-0.000081	0.016
STN2	STN4	25.339	0.005	0.001509	-0.299
STN2	STN4	25.342	0.005	-0.001435	0.284

Number of observations : 65

Number of unknowns : 20

Number of redundant obs : 45

Reference variance : 0.15305

Reference standard deviation So : 0.41621

Failed Chi-Square test at 95% level; exceeded lower bound (0.00)

Error ellipses

Station	Angle (t)	Standard Su	Standard Sv	At 90% conf. Su	At 90% conf. Sv	At 95% conf. Su	At 95% conf. Sv	At 99% conf. Su	At 99% conf. Sv
STN1	090 00 00.0	0.00165	0.00147	0.00362	0.00324	0.00416	0.00373	0.00526	0.00470
STN2	090 00 00.0	0.00165	0.00147	0.00362	0.00324	0.00416	0.00373	0.00526	0.00470
STN4	153 35 55.0	0.00169	0.00164	0.00372	0.00360	0.00428	0.00414	0.00540	0.00523
STN5	122 51 06.3	0.00172	0.00165	0.00379	0.00363	0.00436	0.00417	0.00551	0.00527
STN6	141 06 05.8	0.00171	0.00165	0.00377	0.00363	0.00433	0.00417	0.00547	0.00527
STN7	136 49 35.9	0.00174	0.00166	0.00382	0.00366	0.00440	0.00421	0.00555	0.00532
STN8	109 06 07.7	0.00172	0.00152	0.00378	0.00335	0.00435	0.00385	0.00549	0.00486

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```
STN9      173 25 53.7  0.00175  0.00169  0.00385  0.00372  0.00442  0.00428
0.00558  0.00540

TEM1      002 32 44.1  0.00224  0.00166  0.00493  0.00365  0.00567  0.00420
0.00715  0.00530

TEM2      038 17 50.0  0.00221  0.00168  0.00487  0.00370  0.00560  0.00425
0.00707  0.00537
```

Height residuals

At Station	To Station	HtDiff	StdErr	Residual	StdRes
STN1	STN8	4.486	0.003	0.000000	0.000
STN1	STN8	4.486	0.003	0.000945	0.315
STN8	STN1	-4.485	0.003	0.000442	0.147
STN8	STN7	-8.030	0.003	0.000000	0.000
STN8	STN7	-8.030	0.003	0.000190	0.063
STN8	STN1	-4.486	0.003	0.000475	0.158
STN7	STN8	8.030	0.003	0.001027	0.342
STN7	STN9	-10.147	0.003	-0.000752	-0.251
STN7	STN9	-10.147	0.003	-0.000607	-0.202
STN7	STN6	0.711	0.003	-0.001565	-0.522
STN7	STN6	0.711	0.003	-0.001555	-0.518
STN7	STN8	8.031	0.003	0.001349	0.450
STN6	STN7	-0.711	0.003	0.001573	0.524
STN6	STN9	-10.858	0.003	0.000161	0.054
STN6	STN9	-10.858	0.003	-0.001042	-0.347
STN6	STN5	0.881	0.003	-0.003018	-1.006
STN6	STN5	0.881	0.003	-0.003247	-1.082
STN6	STN7	-0.711	0.003	0.003264	1.088
STN5	STN6	-0.879	0.003	0.003554	1.185
STN5	STN9	-11.728	0.003	-0.001104	-0.368
STN5	STN9	-11.727	0.003	-0.001934	-0.645
STN5	STN4	0.666	0.003	0.004431	1.477
STN5	STN4	0.666	0.003	0.004954	1.651
STN5	STN6	-0.880	0.003	0.000505	0.168
STN4	STN5	-0.666	0.003	0.000537	0.179
STN4	TEM2	-0.774	0.003	-0.002581	-0.860
STN4	TEM1	-0.804	0.003	-0.000453	-0.151
STN4	TEM1	-0.804	0.003	0.000000	0.000
STN4	TEM2	-0.774	0.003	0.000000	0.000
STN4	STN2	2.671	0.003	-0.000000	-0.000
STN4	STN2	2.671	0.003	-0.000000	-0.000
STN4	STN5	-0.666	0.003	0.000480	0.160
STN2	STN4	-2.671	0.003	0.000480	0.160
STN2	STN4	-2.671	0.003	-0.000453	-0.151

Network contains 11 legs

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```
From     To         Comp Length  Meas.Length  Difference  Comp dHt  Meas dHt  Diff
dHt  Obs  Type    Bearing

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

STN8     STN1           59.594        59.594      0.0001    4.4854    4.4859
-0.0005  4    Loose   294 47 15.4

STN8     STN7           23.107        23.107     -0.0003    8.0306    8.0301
0.0005  4    Loose   012 02 50.8

STN7     STN9           46.246        46.243      0.0022   10.1452   10.1468
-0.0016  2    Closed  347 33 26.7

STN7     STN6           23.052        23.053     -0.0008    0.7097    0.7110
-0.0013  4    Closed  271 59 53.7

STN6     STN9           46.242        46.242      0.0004   10.8549   10.8580
-0.0031  2    Closed  016 25 21.6

STN6     STN5           65.338        65.340     -0.0018    0.8775    0.8803
-0.0028  4    Closed  291 20 04.3

STN5     STN9           76.746        76.745      0.0018   11.7324   11.7277
0.0047  2    Closed  074 26 30.3

STN5     STN4           41.457        41.457     -0.0000    0.6653    0.6658
-0.0005  4    Closed  274 21 39.8

STN4     TEM2            9.480         9.480     -0.0000    0.7740    0.7740
0.0000  2    Closed  039 50 42.8

STN4     TEM1           18.165        18.165     -0.0000    0.8039    0.8039
0.0000  2    Closed  004 04 45.8

STN4     STN2           25.340        25.340      0.0003    2.6706    2.6711
-0.0005  4    Loose   179 44 39.3

Total length 434.767, total length misclosure 0.008, total height misclosure
0.0154

Length after removing fixed legs 434.767, misclosure 0.008, height misclosure
0.0154

Length after removing fixed and loose legs 326.726, misclosure 0.007, height
misclosure 0.0140, equivalent linear accuracy 1:47115.3

(This result only takes into account closed loops, and legs on sections that lie
between fixed stations,

 It provides the best equivalent to a Bowditch adjusted result)

     Relative Error ellipses and standard errors of computed quantities between
points

                                      Ellipse details              Std Errors

From Station  To Station       Angle (t)     Su       Sv       Direction    Dist.

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

STN1          STN2           090 00 00.0  0.00353  0.00000   000 00 00.0  0.00353

STN1          STN4           005 25 09.0  0.00355  0.00192   000 00 06.0  0.00346

STN1          STN5           010 13 44.7  0.00300  0.00185   000 00 13.7  0.00274

STN1          STN6           014 47 45.8  0.00244  0.00194   000 00 11.2  0.00242

STN1          STN7           027 32 06.8  0.00236  0.00197   000 00 07.1  0.00229

STN1          STN8           024 41 58.0  0.00237  0.00056   000 00 01.9  0.00237

STN1          STN9           035 05 42.3  0.00253  0.00210   000 00 07.9  0.00213

STN1          TEM1           272 15 29.8  0.00405  0.00358   000 00 10.3  0.00371

STN1          TEM2           060 51 30.2  0.00456  0.00286   000 00 12.4  0.00343

STN2          STN4           270 30 28.2  0.00194  0.00020   000 00 01.6  0.00194

STN2          STN5           009 08 21.5  0.00243  0.00188   000 00 09.2  0.00224
```

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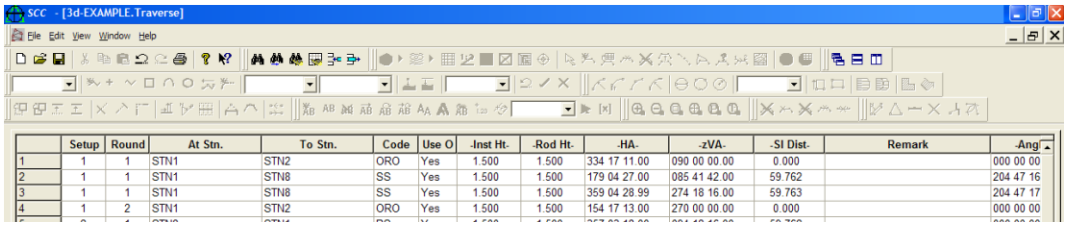
STN2	STN6	009 12 31.4	0.00280	0.00195	000 00 03.9	0.00279
STN2	STN7	008 05 48.0	0.00307	0.00203	000 00 03.3	0.00306
STN2	STN8	001 45 45.0	0.00314	0.00111	000 00 02.0	0.00310
STN2	STN9	079 07 27.9	0.00294	0.00223	000 00 03.7	0.00292
STN2	TEM1	273 35 01.4	0.00406	0.00040	000 00 02.0	0.00405
STN2	TEM2	302 20 09.0	0.00389	0.00113	000 00 11.1	0.00363
STN4	STN5	004 19 34.1	0.00242	0.00046	000 00 02.2	0.00242
STN4	STN6	008 08 05.1	0.00281	0.00122	000 00 02.4	0.00280
STN4	STN7	008 55 15.8	0.00309	0.00141	000 00 02.2	0.00308
STN4	STN8	001 36 05.7	0.00314	0.00204	000 00 03.4	0.00302
STN4	STN9	087 59 51.4	0.00291	0.00159	000 00 02.8	0.00290
STN4	TEM1	274 04 45.8	0.00356	0.00027	000 00 03.1	0.00356
STN4	TEM2	309 50 42.8	0.00355	0.00014	000 00 03.1	0.00355
STN5	STN6	020 55 55.7	0.00171	0.00081	000 00 02.5	0.00171
STN5	STN7	016 13 45.1	0.00220	0.00103	000 00 02.4	0.00220
STN5	STN8	088 14 48.6	0.00225	0.00194	000 00 04.5	0.00216
STN5	STN9	071 16 18.2	0.00193	0.00120	000 00 03.2	0.00193
STN5	TEM1	274 38 14.7	0.00359	0.00243	000 00 15.6	0.00265
STN5	TEM2	053 07 57.5	0.00392	0.00181	000 00 18.6	0.00275
STN6	STN7	005 32 45.6	0.00096	0.00029	000 00 02.6	0.00096
STN6	STN8	287 31 10.2	0.00195	0.00100	000 00 11.8	0.00138
STN6	STN9	287 13 53.2	0.00129	0.00075	000 00 03.3	0.00129
STN6	TEM1	271 42 35.4	0.00377	0.00283	000 00 06.8	0.00299
STN6	TEM2	055 26 04.4	0.00409	0.00229	000 00 07.2	0.00303
STN7	STN8	281 15 12.8	0.00195	0.00028	000 00 02.4	0.00195
STN7	STN9	167 20 09.1	0.00128	0.00072	000 00 03.2	0.00128
STN7	TEM1	179 29 50.3	0.00384	0.00310	000 00 05.8	0.00320
STN7	TEM2	058 21 22.6	0.00421	0.00251	000 00 05.8	0.00338
STN8	STN9	275 28 07.0	0.00222	0.00101	000 00 03.2	0.00219
STN8	TEM1	277 14 23.0	0.00411	0.00316	000 00 05.9	0.00332
STN8	TEM2	053 10 54.9	0.00443	0.00264	000 00 06.6	0.00308
STN9	TEM1	281 05 10.2	0.00392	0.00289	000 00 07.0	0.00293
STN9	TEM2	053 15 00.4	0.00430	0.00223	000 00 05.5	0.00385
TEM1	TEM2	291 56 08.9	0.00479	0.00156	000 01 02.6	0.00352

Traverse Observation Spreadsheet

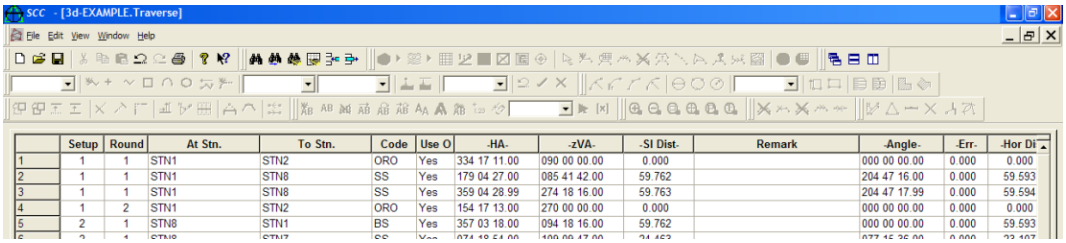
You will also notice that on the View menu in the traverse observations spreadsheet, there are additional commands to better organize the spreadsheet for specific tasks. These are as follows;

'VIEW > Layout > All observed and reduced data (3d)



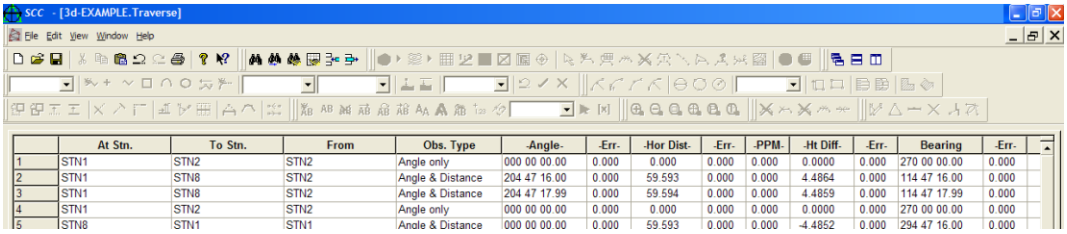
	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	Remark	-Ang
1	1	1	STN1	STN2	ORO	Yes	1.500	1.500	334 17 11.00	090 00 00.00	0.000		000 00 00
2	1	1	STN1	STN8	SS	Yes	1.500	1.500	179 04 27.00	085 41 42.00	59.762		204 47 16
3	1	1	STN1	STN8	SS	Yes	1.500	1.500	359 04 28.99	274 18 16.00	59.763		204 47 17
4	1	2	STN1	STN2	ORO	Yes	1.500	1.500	154 17 13.00	270 00 00.00	0.000		000 00 00

'VIEW > Layout > All observed and reduced data (2d)'



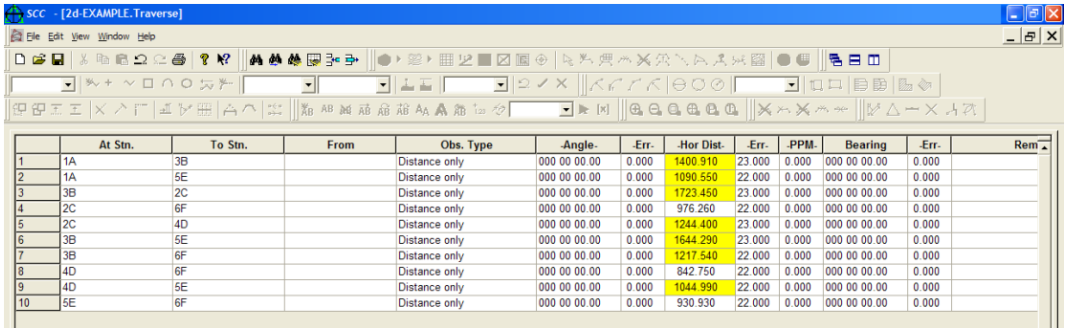
	Setup	Round	At Stn.	To Stn.	Code	Use O	-HA-	-zVA-	-Sl Dist-	Remark	-Angle-	-Err-	-Hor Di
1	1	1	STN1	STN2	ORO	Yes	334 17 11.00	090 00 00.00	0.000		000 00 00.00	0.000	0.000
2	1	1	STN1	STN8	SS	Yes	179 04 27.00	085 41 42.00	59.762		204 47 16.00	0.000	59.593
3	1	1	STN1	STN8	SS	Yes	359 04 28.99	274 18 16.00	59.763		204 47 17.99	0.000	59.594
4	1	2	STN1	STN2	ORO	Yes	154 17 13.00	270 00 00.00	0.000		000 00 00.00	0.000	0.000
5	2	1	STN8	STN1	BS	Yes	357 03 18.00	094 18 16.00	59.762		000 00 00.00	0.000	59.593

'VIEW > Layout > Reduced observations (3d)'



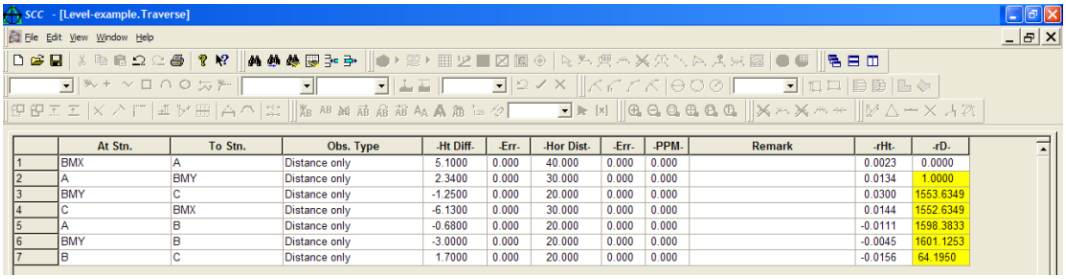
	At Stn.	To Stn.	From	Obs. Type	-Angle-	-Err-	-Hor Dist-	-Err-	-PPM-	-Ht Diff-	-Err-	Bearing	-Err-
1	STN1	STN2	STN2	Angle only	000 00 00.00	0.000	0.000	0.000	0.000	0.0000	0.000	270 00 00.00	0.000
2	STN1	STN8	STN2	Angle & Distance	204 47 16.00	0.000	59.593	0.000	0.000	4.4864	0.000	114 47 16.00	0.000
3	STN1	STN8	STN2	Angle & Distance	204 47 17.99	0.000	59.594	0.000	0.000	4.4859	0.000	114 47 17.99	0.000
4	STN1	STN2	STN2	Angle only	000 00 00.00	0.000	0.000	0.000	0.000	0.0000	0.000	270 00 00.00	0.000
5	STN8	STN1	STN1	Angle & Distance	000 00 00.00	0.000	59.593	0.000	0.000	-4.4852	0.000	294 47 16.00	0.000

'VIEW > Layout > Reduced observations (2d)'



	At Stn.	To Stn.	From	Obs. Type	-Angle-	-Err-	-Hor Dist-	-Err-	-PPM-	Bearing	-Err-	Rem
1	1A	3B		Distance only	000 00 00.00	0.000	1400.910	23.000	0.000	000 00 00.00	0.000	
2	1A	5E		Distance only	000 00 00.00	0.000	1090.550	22.000	0.000	000 00 00.00	0.000	
3	3B	2C		Distance only	000 00 00.00	0.000	1723.450	23.000	0.000	000 00 00.00	0.000	
4	2C	6F		Distance only	000 00 00.00	0.000	976.260	22.000	0.000	000 00 00.00	0.000	
5	2C	4D		Distance only	000 00 00.00	0.000	1244.400	23.000	0.000	000 00 00.00	0.000	
6	3B	5E		Distance only	000 00 00.00	0.000	1644.290	23.000	0.000	000 00 00.00	0.000	
7	3B	6F		Distance only	000 00 00.00	0.000	1217.540	22.000	0.000	000 00 00.00	0.000	
8	4D	6F		Distance only	000 00 00.00	0.000	842.750	22.000	0.000	000 00 00.00	0.000	
9	4D	5E		Distance only	000 00 00.00	0.000	1044.990	22.000	0.000	000 00 00.00	0.000	
10	5E	6F		Distance only	000 00 00.00	0.000	930.930	22.000	0.000	000 00 00.00	0.000	

'VIEW > Layout > Reduced levels only'



	At Stn.	To Stn.	Obs. Type	-Ht Diff-	-Err-	-Hor Dist-	-Err-	-PPM-	Remark	-rHt-	-rD-
1	BMX	A	Distance only	5.1000	0.000	40.000	0.000	0.000		0.0023	0.0000
2	A	BMY	Distance only	2.3400	0.000	30.000	0.000	0.000		0.0134	1.0000
3	BMY	C	Distance only	-1.2500	0.000	20.000	0.000	0.000		0.0300	1553.6349
4	C	BMX	Distance only	-6.1300	0.000	30.000	0.000	0.000		0.0144	1552.6349
5	A	B	Distance only	-0.6800	0.000	20.000	0.000	0.000		-0.0111	1598.3833
6	BMY	B	Distance only	-3.0000	0.000	20.000	0.000	0.000		-0.0045	1601.1253
7	B	C	Distance only	1.7000	0.000	20.000	0.000	0.000		-0.0156	64.1950

The observed options correspond to the layout available in previous versions of SCC, where the 2d option removes the instrument height, rod height and height difference fields. The reduced observations options show forward measured angles, horizontal distances, height differences, known bearings, and their corresponding standard errors. The reduced level option only shows height and distance information, again with standard errors, where distances may be used to calculate relative weights as an alternative to entering standard errors.

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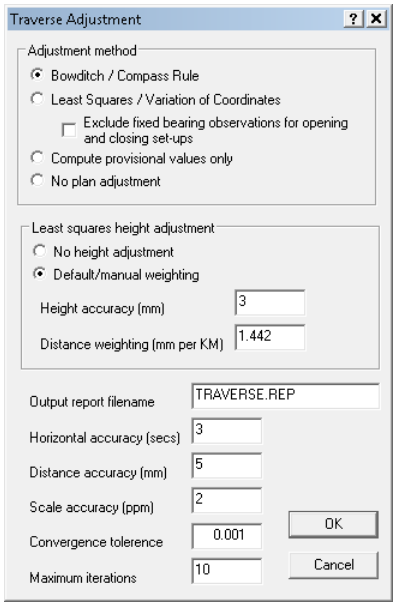
Constraint Adjustment

Standard errors in any of these views correspond to observation weights or accuracies, thus if I know a height difference is good to +> - 3mm I enter 3.0 in the **–Err-** field that follows the **–Ht Diff-** field. I can also use the modify the **Obs. Type** field to fix a height difference, horizontal distance, angle or bearing to further constrain the adjustment. For example, in the report above, you will notice a fixed bearing between **STN1** and **STN2** of 270 degrees, such if the coordinates are moved during the adjustment, the bearing between them will be fixed at 270 degrees.



The content of the report will also be modified by the type of adjustment selected. For example, if we open 2d-example.project and 2d-example.traverse, and adjust using the parameters given, we get the report shown below.

```
SCC for Windows v9.9.0 (C) 1990 - 2009 Atlas Computers Ltd

   Traverse adjustment report

   Title   2d-EXAMPLE.Traverse

   Date    Thu Jun 03 10:25:59 2010

   Coordinate adjustment method  Variation of Co-ordinates

   Corrections applied

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

   Local scale factor : No local scale factor

   Earth curvature and refraction : Curvature only  (Earth Radius 6380000.000)

   Temperature and pressure : No

   Mean sea level correction : No

    Default Standard Errors

    Angles (secs)            : 3.000

    Distances (constant mm)  : 5.000

    Distances (ppm mm)       : 2.000

    Heights (mm)             : 3.000

    Provisional coordinates

    Name                    E> X       StdErr        N> Y       StdErr  Type
```

```
----------------  --------------  ------  --------------  ------  ----
1A                  10000.00000  0.1800     10000.00000  0.1800  Cons
2C                  12487.08000  0.1800     10528.65000  0.1800  Cons
3B                  10862.48000  0.0000     11103.93000  0.0000  Prov
4D                  11990.88000  0.0000      9387.46000  0.0000  Prov
5E                  10948.55000  0.0000      9461.90000  0.0000  Prov
6F                  11595.22000  0.0000     10131.56000  0.0000  Prov
Adjusted coordinates
Name                    E> X         Adj         N> Y         Adj
----------------  --------------  -------  --------------  -------
1A                   9999.99844  -0.0016      9999.99967  -0.0003
2C                  12487.08156  +0.0016     10528.65033  +0.0003
3B                  10862.48289  +0.0029     11103.93327  +0.0033
4D                  11990.88203  +0.0020      9387.46189  +0.0019
5E                  10948.54878  -0.0012      9461.89972  -0.0003
6F                  11595.22309  +0.0031     10131.56264  +0.0026
Horizontal Distances
At Station    To Station    Distance    StdErr   Residual   StdRes
------------  ------------  ----------  ------  ----------  ------
1A            3B              1400.910   0.023    0.000000  -0.000
1A            5E              1090.550   0.022   -0.000030   0.001
3B            2C              1723.450   0.023   -0.002524   0.110
2C            6F               976.260   0.022    0.003354  -0.152
2C            4D              1244.400   0.023   -0.002556   0.111
3B            5E              1644.290   0.023   -0.002432   0.106
3B            6F              1217.540   0.022    0.003779  -0.172
4D            6F               842.750   0.022    0.002603  -0.118
4D            5E              1044.990   0.022   -0.002160   0.098
5E            6F               930.930   0.022    0.002896  -0.132
  Number of observations : 14
  Number of unknowns : 12
  Number of redundant obs : 2
  Reference variance : 0.00995
  Reference standard deviation So : 0.25426
Failed Chi-Square test at 95% level; exceeded lower bound (0.99)
     Error ellipses
                          Standard         At 90% conf.      At 95% conf.      At
99% conf.
Station    Angle (t)     Su       Sv       Su       Sv       Su       Sv       Su
    Sv
--------  -----------  -------  -------  -------  -------  -------  -------
-------  -------
1A        168 00 00.0  0.04577  0.03262  0.19417  0.13841  0.28212  0.20111
0.64398  0.45906
```

```
2C        168 00 00.0  0.04577  0.03262  0.19417  0.13841  0.28212  0.20111
0.64398  0.45906

3B        065 31 18.2  0.04029  0.03284  0.17093  0.13931  0.24835  0.20241
0.56690  0.46203

4D        049 54 36.3  0.04407  0.03298  0.18696  0.13993  0.27164  0.20331
0.62006  0.46410

5E        110 24 33.2  0.03931  0.03297  0.16680  0.13986  0.24235  0.20321
0.55321  0.46386

6F        017 58 02.5  0.03427  0.03289  0.14538  0.13956  0.21123  0.20277
0.48217  0.46286

Network contains 10 legs

From     To         Comp Length  Meas.Length  Difference  Comp dHt  Meas dHt  Diff
dHt  Obs  Type    Bearing

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

1A       3B           1400.910      1400.910     -0.0000    0.0000    0.1538
-0.1538  1    Closed  038 00 00.0

1A       5E           1090.550      1090.550     -0.0000    0.0000    0.0932
-0.0932  1    Closed  119 33 56.3

3B       2C           1723.448      1723.450     -0.0025    0.0000    0.2328
-0.2328  1    Closed  109 29 58.0

2C       6F            976.263       976.260      0.0034    0.0000    0.0747
-0.0747  1    Closed  245 59 58.7

2C       4D           1244.397      1244.400     -0.0025    0.0000    0.1214
-0.1214  1    Closed  203 30 00.0

3B       5E           1644.288      1644.290     -0.0025    0.0000    0.2119
-0.2119  1    Closed  176 59 58.6

3B       6F           1217.544      1217.540      0.0038    0.0000    0.1162
-0.1162  1    Closed  143 00 00.0

4D       6F            842.753       842.750      0.0026    0.0000    0.0557
-0.0557  1    Closed  331 59 57.0

4D       5E           1044.988      1044.990     -0.0021    0.0000    0.0856
-0.0856  1    Closed  274 05 05.3

5E       6F            930.933       930.930      0.0029    0.0000    0.0679
-0.0679  1    Closed  043 59 58.1

Total length 12116.073, total length misclosure 0.022, total height misclosure
1.2131

Length after removing fixed legs 12116.073, misclosure 0.022, height misclosure
1.2131

Length after removing fixed and loose legs 12116.073, misclosure 0.022, height
misclosure 1.2131, equivalent linear accuracy 1:543380.1

(This result only takes into account closed loops, and legs on sections that lie
between fixed stations,

 It provides the best equivalent to a Bowditch adjusted result)

     Relative Error ellipses and standard errors of computed quantities between
points

                                      Ellipse details              Std Errors

From Station  To Station       Angle (t)     Su       Sv       Direction    Dist.

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

1A            2C             168 00 00.0  0.25456  0.03248   000 00 20.6  0.03248

1A            3B             037 35 51.5  0.14265  0.02294   000 00 21.0  0.02296

1A            4D             287 21 04.3  0.21004  0.03043   000 00 20.7  0.03045

1A            5E             299 58 18.0  0.11276  0.02195   000 00 21.3  0.02197
```

```
1A            6F            175 23 29.0  0.16214  0.03288   000 00 20.8  0.03289
2C            3B            289 39 00.5  0.17420  0.02189   000 00 20.8  0.02190
2C            4D            023 17 43.6  0.12781  0.02187   000 00 21.1  0.02188
2C            5E            145 13 31.4  0.18896  0.02576   000 00 20.8  0.02576
2C            6F            156 01 43.1  0.10082  0.01989   000 00 21.3  0.01989
3B            4D            056 44 21.1  0.20791  0.02565   000 00 20.8  0.02565
3B            5E            086 56 01.1  0.16688  0.02192   000 00 20.9  0.02192
3B            6F            053 02 37.5  0.12493  0.01934   000 00 21.1  0.01934
4D            5E            274 15 14.6  0.10831  0.02117   000 00 21.3  0.02117
4D            6F            062 14 51.0  0.08875  0.02078   000 00 21.7  0.02078
5E            6F            043 47 19.3  0.09675  0.02043   000 00 21.4  0.02044
```

Similarly, to adjust a level network we can turn off the horizontal adjustment. For example, if we open Level-example.project and Level-example.traverse, and adjust using the parameters given, we get the report shown below.

```
SCC for Windows v9.9.0 (C) 1990 - 2009 Atlas Computers Ltd
   Traverse adjustment report
   Title   LevelAdjust.Traverse
   Date    Thu Jun 03 10:30:03 2010
   Height adjustment method  Least Squares (Default weighting)
   Corrections applied
   -------------------
   Local scale factor : No local scale factor
   Earth curvature and refraction : Curvature only  (Earth Radius 6380000.000)
   Temperature and pressure : No
   Mean sea level correction : No
    Default Standard Errors
    Heights (mm)            : 2.000
    Provisional heights
    Name                   Ht> Z       StdErr  Type
    ----------------  --------------  ------  ----
    BMX                    100.00000  0.0050  Cons
    BMY                    107.50000  0.0000  Fix
    A                      105.10000  0.0000  Prov
    C                      106.25000  0.0000  Prov
    B                      104.42000  0.0000  Prov
    Adjusted heights
    Name                   Ht> Z         Adj
    ----------------  --------------  -------
    BMX                    100.07566  +0.0757
    BMY                    107.50000  +0.0000
    A                      105.17338  +0.0734
    C                      106.22004  -0.0300
    B                      104.50447  +0.0845
```

```
Height residuals
At Station    To Station      HtDiff    StdErr   Residual   StdRes
------------  ------------  ----------  ------  ----------  ------
BMX           A                  5.100   0.002    0.002282   1.141
A             BMY                2.340   0.002    0.013378   6.689*
BMY           C                 -1.250   0.002    0.029957  14.978*
C             BMX               -6.130   0.002    0.014387   7.193*
A             B                 -0.680   0.002   -0.011096  -5.548*
BMY           B                 -3.000   0.002   -0.004473  -2.237
B             C                  1.700   0.002   -0.015570  -7.785*
```

In all of the least square adjustment reports, we will see equations listed in the form Stations used, observed value, standard error, observation residual, and standard residual. The standard error equates to how accurate you thought the observation was (e.g. a-priori value), whereas the residual corresponds to how much the observation was actually changed to reflect the adjusted station values (e.g. a-posteriori value). The standard residual is obtained by dividing the standard error by the observation residual, and as such should be close to one if the standard errors given match the residuals produced. High values for the standard residual are flagged with an asterisk, indicating lack of agreement between observations and standard errors given. Fixed observations will be marked as (Fixed) in the report and the standard residual forced to one.

If the average value of the standard residuals is more than 1, your observations are not as accurate as stated. If one observation has a particularly high standard residual, it should be checked. If the average values of all standard residuals are much less than one, the standard errors entered are two high, which in turn means the adjustment has been given too much freedom to move the stations. Either of these events will tend to trigger a failure to pass the chi-squared test, which is essentially a statistical analysis of the standard residuals.

Traverse And Error Ellipse Annotation

'VIEW > Station coordinates'

'FILE > Export > Station Coordinates as dataset'

'FILE > Save As', and give the stations a name, typically corresponding to the project name

'FILE > Model > SCC dataset', picking the dataset produced

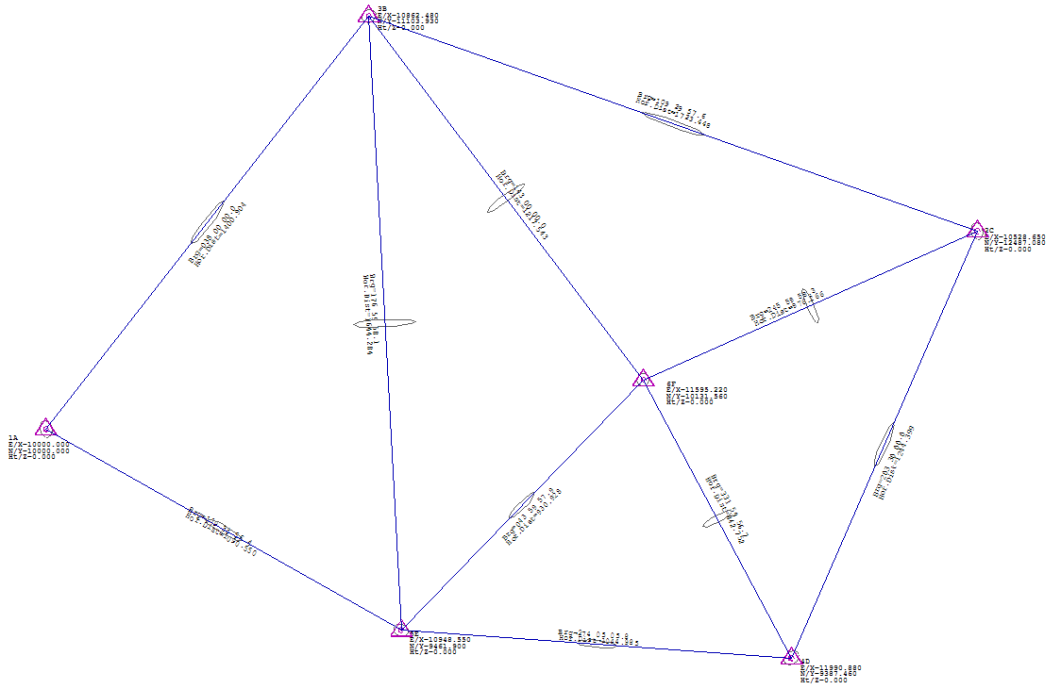
'FILE > Attach> Detach > Attach traverse'

'EDIT > Text > Annotate traverse', to add annotation for stations and legs as required. You will need to use this command twice if you wish to annotate both station and traverse leg information

The following features are used to control display of ellipses

~RELELLI Corresponds to relative ellipses drawn along legs

~ERRELLI Corresponds to error ellipses at stations



Ellipse scale and relative ellipse content can be set using '**FILE > Attach/ Detach**'

24 Working With Trimble Data

The following tutorial provides information relating to the downloading and processing of Trimble data within SCC.

24.1 Create A Project

A new project should be created before data may be downloaded into SCC or models formed.

From the Main Menu Bar, select 'FILE >New Project'

Enter in a Project/Job name

Select a Project Template from the list

Select 'OK'

24.2 Download Trimble Data from ACU

Trimble ACU Output

SCC support downloading files from the Trimble ACU, running Tsce software, using the SDR33 output format. These attributes can be used to describe dimensions, offsets, parallel features, and all other items available through the SCC extended coding library. We will demonstrate the use of this facility through the sample file 060228D.DAT. Note that in this file, Tsce attributes are stored in 13AT records, see extract below for an example;

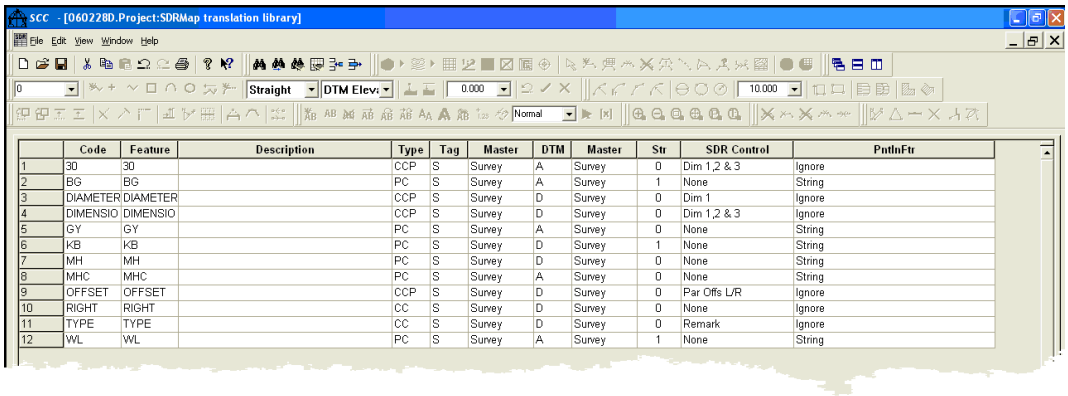
```
2NM        9020    308417.642000000231995.58500000051.33300000000001.50000000000000

07NM        9020            9021    27.900185437685727.9001854376857
03NM1.70000000000000
09F1        9020            9021    12.874430000000088.109739263113027.9001854376857STN

09F1        9020            1001    18.593340000000088.669171829746923.1694290000000BG

13ATOffset              0.30000000000000
```

```
09F1        9020            1002    17.165240000000088.759832243491514.1117367500000BG
```

To process this file in SCC, amendments must be made to the default project template as follows;

From within the Project, select Import / View SDR translation table

Add a record for each attribute type present in the Tsce format being used. For example, for the OFFSET attribute, we add a new record with the name and code of OFFSET, type of 'Control Code with Parameter (CCP)', and SDR Control type of 'Par Ofs L/R'. This means that when SCC encounters an attribute called OFFSET, it will take the attribute value and store it in the parallel offset field in SCC. For this job, the rest of the records will be as follows;



	Code	Feature	Description	Type	Tag	Master	DTM	Master	Str	SDR Control	PntInFtr
1	30	30		CCP	S	Survey	A	Survey	0	Dim 1,2 & 3	Ignore
2	BG	BG		PC	S	Survey	A	Survey	1	None	String
3	DIAMETER	DIAMETER		CCP	S	Survey	D	Survey	0	Dim 1	Ignore
4	DIMENSIO	DIMENSIO		CCP	S	Survey	D	Survey	0	Dim 1,2 & 3	Ignore
5	GY	GY		PC	S	Survey	A	Survey	0	None	String
6	KB	KB		PC	S	Survey	D	Survey	1	None	String
7	MH	MH		PC	S	Survey	D	Survey	0	None	String
8	MHC	MHC		PC	S	Survey	A	Survey	0	None	String
9	OFFSET	OFFSET		CCP	S	Survey	D	Survey	0	Par Offs L/R	Ignore
10	RIGHT	RIGHT		CC	S	Survey	D	Survey	0	None	Ignore
11	TYPE	TYPE		CC	S	Survey	D	Survey	0	Remark	Ignore
12	WL	WL		PC	S	Survey	A	Survey	1	None	String

Note that regular features that contain embedded string numbers should also appear in this sheet with a type of 'PC' and a PntInFtr setting of 'String'. This sheet can also be used to control default tag and DTM codes for these features.

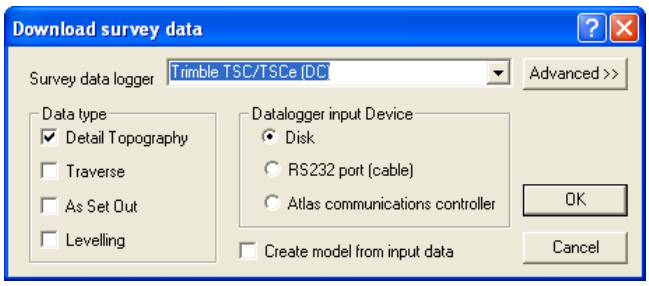
Once you have completed editing this translation table, you should save the project as a new template in the SCC folder, such that you do not have to repeat this exercise.

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Trimble TSC/TSCe (DC)'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'

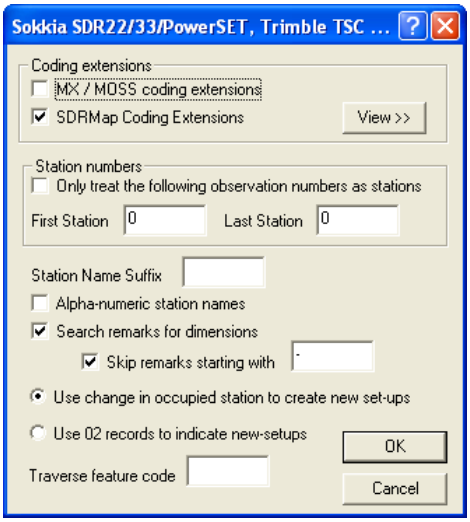


Select 'OK'

Select '060228D.Dat' from '\SCC\Tutorials' directory

Select 'Open'

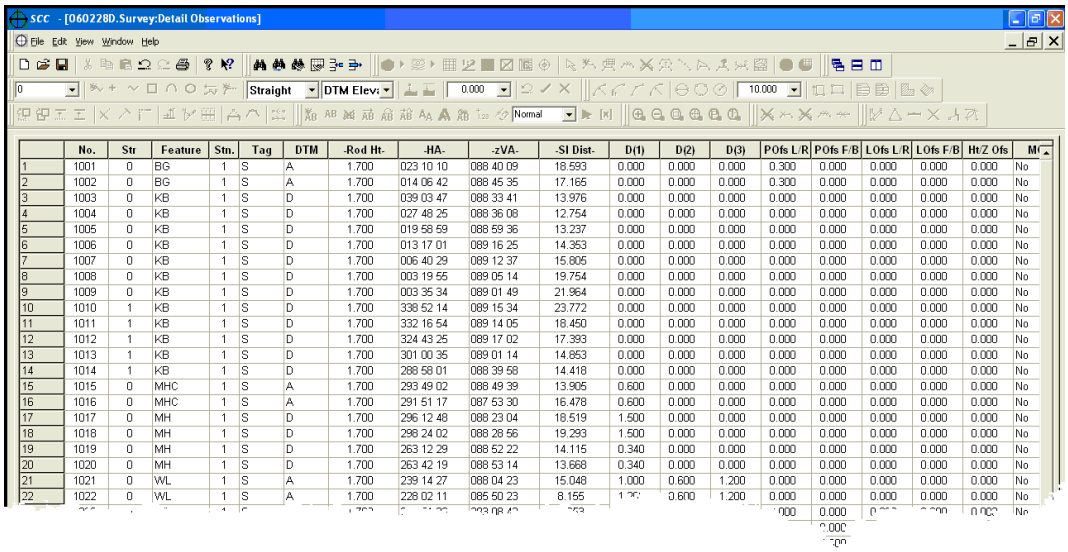
Select 'OK'



Set 'SDRMap Coding Extensions' and 'Search remarks for dimensions'

Select 'OK'

This will generate the following detail survey file;



	No.	Str	Feature	Stn.	Tag	DTM	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	D(1)	D(2)	D(3)	POfs L/R	POfs F/B	LOfs L/R	LOfs F/B	Ht/Z Ofs	M
1	1001	0	BG	1	S	A	1.700	023 10 10	088 40 09	18.593	0.000	0.000	0.000	0.300	0.000	0.000	0.000	0.000	No
2	1002	0	BG	1	S	A	1.700	014 06 42	088 45 35	17.165	0.000	0.000	0.000	0.300	0.000	0.000	0.000	0.000	No
3	1003	0	KB	1	S	D	1.700	039 03 47	088 33 41	13.976	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
4	1004	0	KB	1	S	D	1.700	027 48 25	088 36 08	12.754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
5	1005	0	KB	1	S	D	1.700	019 58 59	088 59 36	13.237	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
6	1006	0	KB	1	S	D	1.700	013 17 01	089 16 25	14.353	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
7	1007	0	KB	1	S	D	1.700	006 40 29	089 12 37	15.805	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
8	1008	0	KB	1	S	D	1.700	003 19 55	089 05 14	19.754	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
9	1009	0	KB	1	S	D	1.700	003 35 34	089 01 49	21.964	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
10	1010	1	KB	1	S	D	1.700	338 52 14	089 15 34	23.772	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
11	1011	1	KB	1	S	D	1.700	332 16 54	089 14 05	18.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
12	1012	1	KB	1	S	D	1.700	324 43 25	089 17 02	17.393	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
13	1013	1	KB	1	S	D	1.700	301 00 35	089 01 14	14.853	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
14	1014	1	KB	1	S	D	1.700	288 58 01	088 39 58	14.418	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
15	1015	0	MHC	1	S	A	1.700	293 49 02	088 49 39	13.905	0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
16	1016	0	MHC	1	S	A	1.700	291 51 17	087 53 30	16.478	0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
17	1017	0	MH	1	S	D	1.700	296 12 48	088 23 04	18.519	1.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
18	1018	0	MH	1	S	D	1.700	298 24 02	088 28 56	19.293	1.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
19	1019	0	MH	1	S	D	1.700	263 12 29	088 52 22	14.115	0.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
20	1020	0	MH	1	S	D	1.700	263 42 19	088 53 14	13.668	0.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000	No
21	1021	0	WL	1	S	A	1.700	239 14 27	088 04 23	15.048	1.000	0.600	1.200	0.000	0.000	0.000	0.000	0.000	No
22	1022	0	WL	1	S	A	1.700	228 02 11	085 50 23	8.155	[illegible]	0.600	1.200	0.000	0.000	0.000	0.000	0.000	No

*.DC files from TSCE containing observations in DC formats as defined in DC10.70 or DC7.5 are also supported. Observations must be in HA,Va,Sd or X,Y,Z formats. SCC does not currently read GPS vectors, or GPS lat,long, height records from this format.

Combined Total Station & GPS Files Trimble Data

SCC supports the download of combined Total Station and GPS information contained within one complete file.

Total Station Detail

```
08PD        1853    240109.491174308230536.45323307880.5785407722807CONC2
08PD        1854    240106.941616718230533.14415286880.4446191824330CONC2
08PD        1855    240106.934895243230533.12155861780.4350418868451K2
08PD        1856    240103.591644851230535.66377808680.3671757765827K2
08PD        1857    240102.973759388230536.67287284980.3818527249702K2
08PD        1858    240102.946912372230537.66137346080.3672869395576K2
08PD        1859    240108.024260067230544.61543070080.4062528838890K2
```

GPS Data

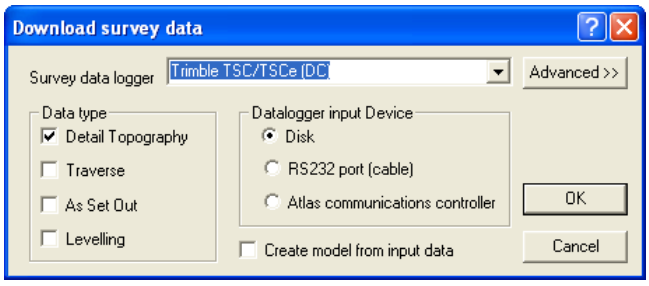
```
09F1        S4              1871    19.485780000000086.2995339500897308.269300500000SL

09F1        S4              1872    20.122220000000086.2101823251036306.161937000000HE3

13NMOFFSET HE3 2.0M LEFT
09F1        S4              1873    26.350400000000086.0417014778084314.111125500000HE3

09F1        S4              1874    36.881090000000086.4799984710826316.234896000000HE3

09F1        S4              1875    45.070550000000086.8506673231004318.345708000000HE3

09F1        S4              1876    56.991010000000087.4670758972154318.269134018868HE3

09F1        S4              1877    58.376750000000087.5556657440944316.922418000000EP

09F1        S4              1878    60.863180000000087.5235304357424318.604251600000B10

09F1        S4              1879    60.548220000000087.5381532946088326.509790400000B10
```

From the Main Menu Bar, select 'FILE > Download Survey Data'

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight 'Detail Topography' as the Data Type

Set Input Device to 'Disk'

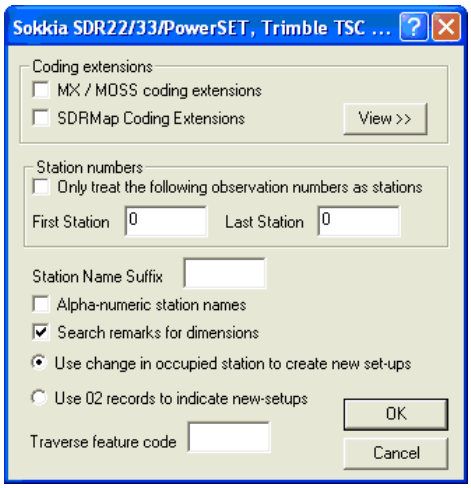


Select 'OK'

Select 'RAWsdr33dc.dc' from '\SCC\Tutorials' directory

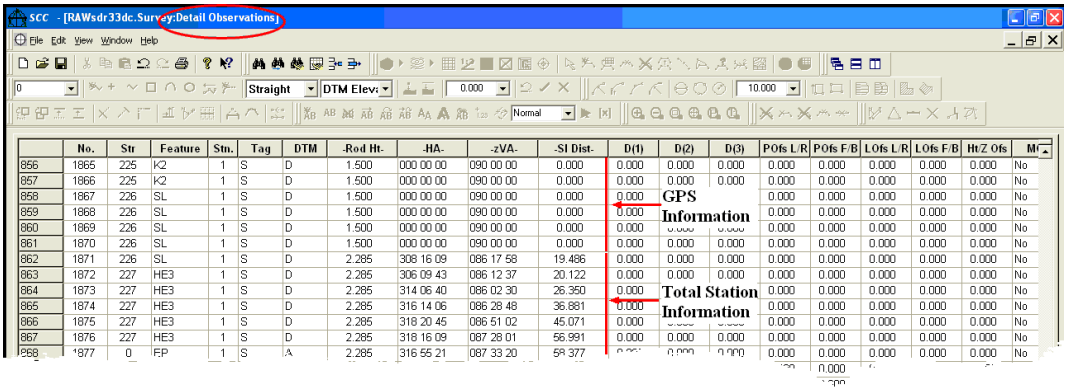
Select 'Open'

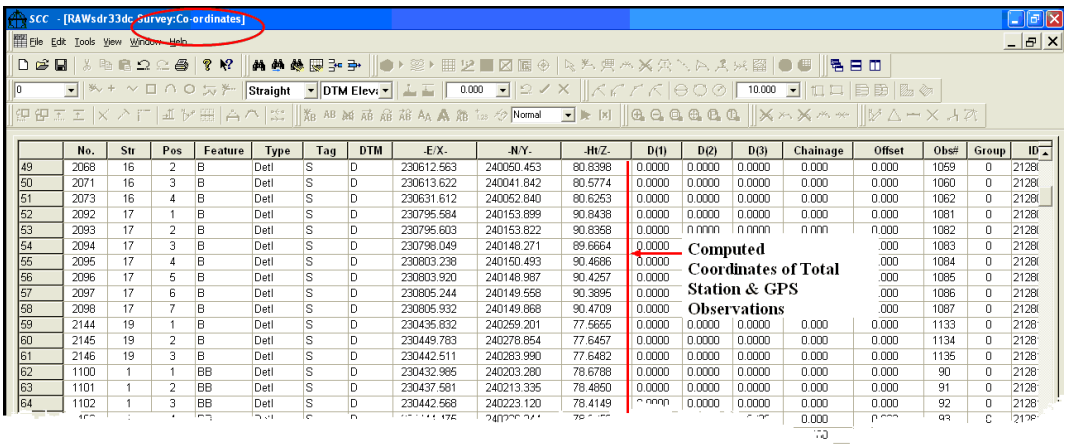
Select 'OK'



Set 'Search remarks for dimensions'

Select 'OK'





Note that the option to strip string numbers from field codes has bee selected with the 'Coordinate Reduction Options'.

Trimble DC Format

SCC also supports the direct download of DC format as follows:

```
D2NM1021.70000000000                0.14200000000000
        69FD         S22     137412.769000000253513.23000000046.1450000000000CON
   11
        E0NM         S22     1.620000000000001.000000000000001
        E1NM         S22             S21                     190.187083794199

         77NM1.500000000000002.000000000000000.00000000000000
        D9F1         S22             S21
91.250749347157591.8136377610403190.187083794199CON
50.003182501540000.001388888888890.00138888888889
        A6F1                -0.00090101528280.00846784874555
        D9F1         S22             1
90.790027562819091.9271004383258190.244880000000S
10.010181580100000.001388888888890.00138888888889
        D9F1         S22             2
90.795487574480291.9263806245318190.249560000000S
10.010181591020000.001388888888890.00138888888889
         77NM2.000000000000002.000000000000000.00000000000000
         10.010192322360000.001388888888890.00138888888889
        D9F1         S22             8001
86.761130395951992.3277570859462213.880050000000HEC1
10.010173522320000.001388888888890.00138888888889
        D9F1         S22             8002
77.753634782899292.0915956056461219.797010000000HEC1
10.010155507320000.001388888888890.00138888888889
         77NM1.500000000000002.000000000000000.00000000000000
        D9F1         S22             8003
73.815260826027192.3056179106150224.597520000000HEC1
10.010147630580000.001388888888890.00138888888889
        D9F1         S22             8004
68.620739011095391.8354586405055234.321300000000HEC1
10.010137241520000.001388888888890.00138888888889
        D9F1         S22             8005
```

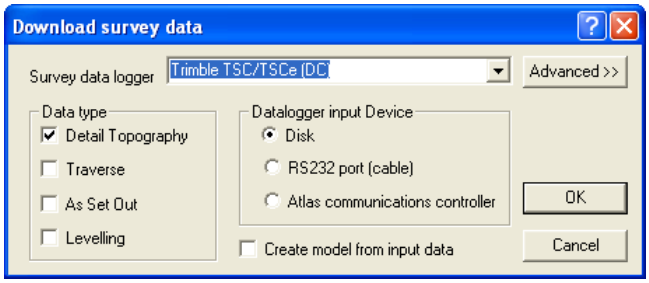
64.289547497628291.1620741098151249.494310000000HEC1
10.010128579120000.001388888888890.00138888888889

From the Main Menu Bar, select ‘FILE > Download Survey Data’

Set Survey Data logger to 'Sokkia SDR33/22 & Trimble TSC'

Highlight ‘Detail Topography’ as the Data Type

Set Input Device to 'Disk'

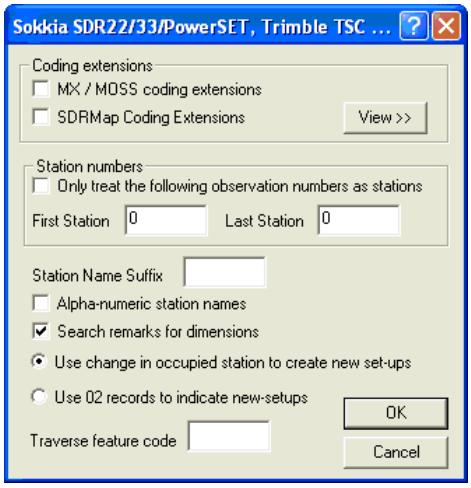


Select 'OK'

Select File

Select 'Open'

Select 'OK'



Set 'Search remarks for dimensions'

Select 'OK'

Trimble/Geodimeter UDS

SCC supports Trimble/Geodimeter format and can be processed as follows:

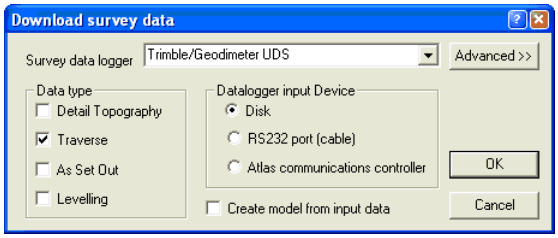
From the Main Menu Bar, select ‘FILE > Download Survey Data’

Set Survey Data Logger to 'Trimble/Geodimeter UDS'

Highlight ‘Traverse’ or ‘Detail Topography’ as the Data Type

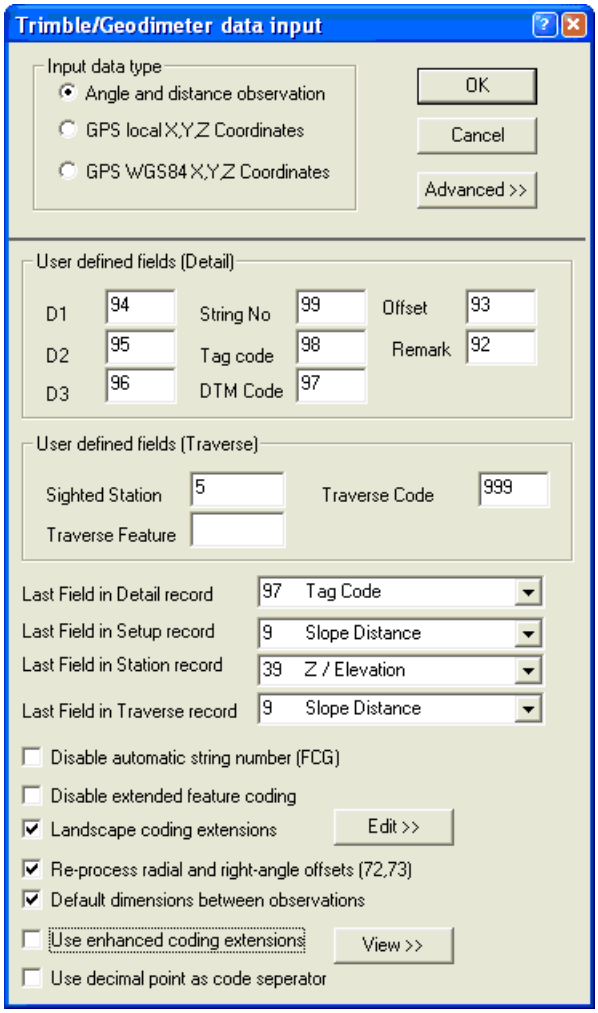
Set Input Device to 'Dsk', 'RS323 port (cable) 'or 'Atlas communications controller' as required

Select ‘OK’



Select the file you require and 'OK'

Additional settings may be checked at this stage that relate to the field coding standards used that are particular to a given instrument. Note that these settings will become the defaults for all future downloads from the Geodimeter and do not have to be entered with each download.



Codes 90 through to 99 in the Geodimeter are user definable and may be used log extra dimensions in SCC. For existing 'Landscape' users, the first time we download into SCC, we will also have to set up the coding options as shown above. The LandScape coding options determine how the numeric field codes entered in the instrument will be translated into SCC tag codes, DTM codes, and ancillary measurements based on existing ' Landscape' techniques.

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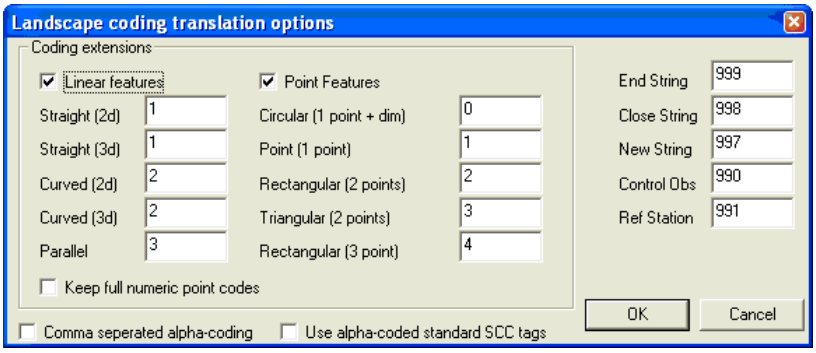


SCC lets us freely mix data from a range of different instrument manufacturers and instrument types within a given project. The LandScape processing options are currently enabled for the Geodimeter and Leica instruments.

Transferring survey data from a Geodimeter CU

Connect the Geodimeter instrument/keyboard to the PC with the appropriate cable and through the correct communications port. Enter program 54, for data transfer.

Choose from which device the data will be transferred from Internal memory (2. Imem) or Serial (3. Serial). Select internal memory (2. Imem).

Select the file type for transfer from 1. Job (file), 2. Area (file), 3. U.D.S. Choose option number 1 - Job file, and type in the job file number in which the observed data is stored.

Choose destination device for the job file from 2. Imem (internal memory) and 3. Serial (serial device - PC). Select 3 - Serial and accept or enter the correct serial parameters, which are Com=1.8.0.9600. Prepare SCC(PC) before accepting the serial parameters because once the serial parameters have been accepted then the data will be transferred.

The display on the Geodimeter/keyboard shows 'Wait' during the data transfer. When the data transfer is finished the Geodimeter/keyboard will exit from program 54 and return to program 0.

Transferring Setting Out and Control data to a Geodimeter CU

Connect the Geodimeter instrument/keyboard to the PC with the appropriate cable and through the correct communications port. Enter program 54, for data transfer.

Choose from which device the data will be transferred from Internal memory (2. Imem) or Serial (3. Serial). Select Serial (3. Serial) and accept or enter correct serial parameters, which are Com=1.8.0.9600

Select file type for the data to be saved as from 1. Job (file), 2. Area (file), 3. U.D.S. Choose option number 2 - Area file, and type in the area file number in which the data is to be stored.

The display on the Geodimeter/keyboard shows "Wait" and is now ready to receive data. Start the data transfer from SCC. When the data has been transferred the Geodimeter/keyboard will exit from program 54 and return to program 0.

24.3 Examination of Sample Code List For Trimble Unit

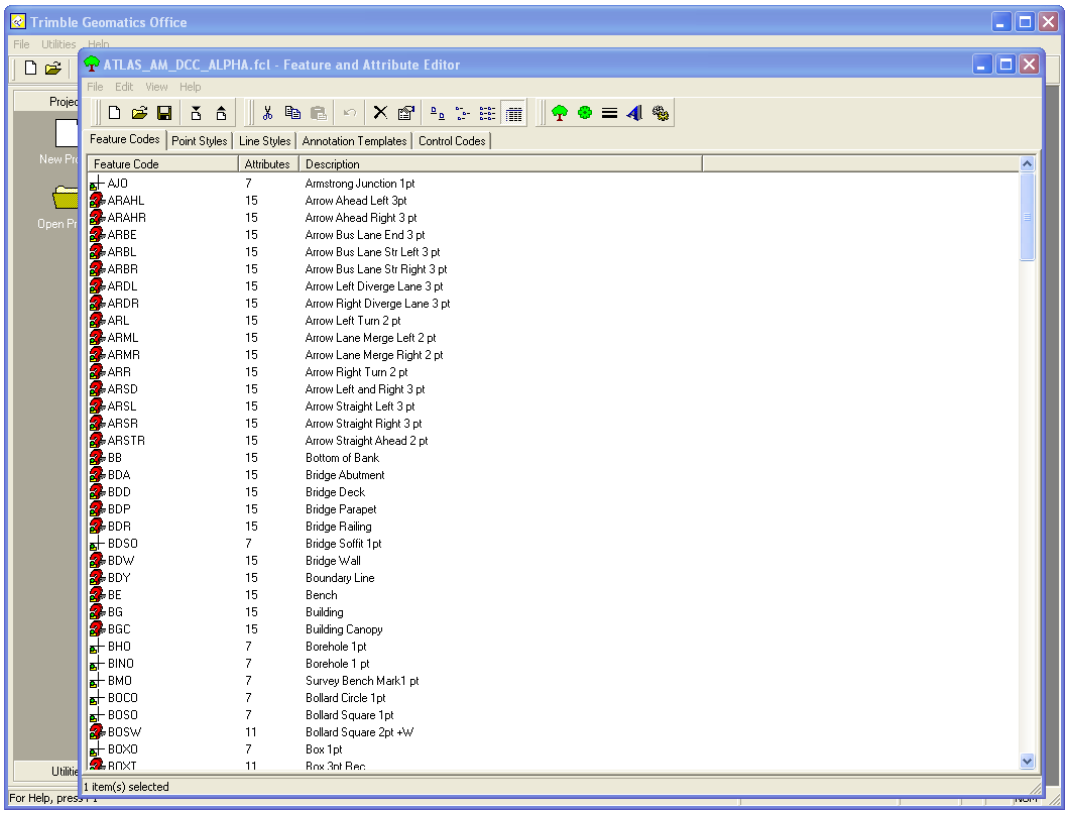
A sample feature code list 'ATLAS_AM_DCC_ALPHA.fal' is availalbe for use with Survey Pro onboard software. This codelist contains attributes such as dimensions, offsets, parallel features. The 'ATLAS_AM_DCC_ALPHA.fal' codelist should be used in conjunction 'Trimble_TSCE_ALPHA.Project' feature library in which all features coincide.

The following examines the feature library 'ATLAS_AM_DCC_ALPHA.fcl' within Trimble Geomatics Office:

Open Trimble Geomatics Office Software, select 'Utilities > Feature and Attribute Editor'

Within the Feature and Attribute Editor' dialog, select 'FILE > Open'

Select 'ATLAS_AM_DCC_ALPHA.fcl'



Template Features

5 specific template features have been set up within Trimble Geomatics Office which all other features are based. As a result, the library can be quickly edited by amending or changing the 5 main features on which all other features are based.

The following outlines each and details the attributes assigned:

'SO' Spot Height Feature set up as a 1pt Feature:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
SO	Spot Height	LINETAG	G
		DTM	D
		DIM1	
		REMARK	
		LOSLR	
		LOSFB	
		ZOFSUD	

NOTE:

LINETAG - Line Connection Tag, DTM - DTM Status, DIM1 - Dimension 1, LOSLR - Line

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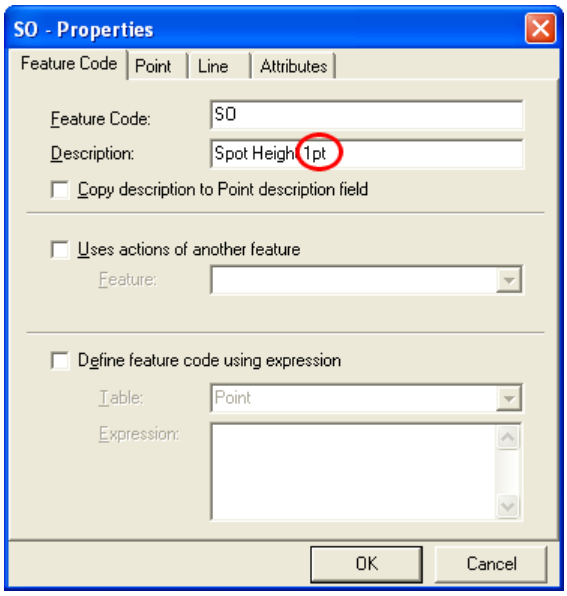
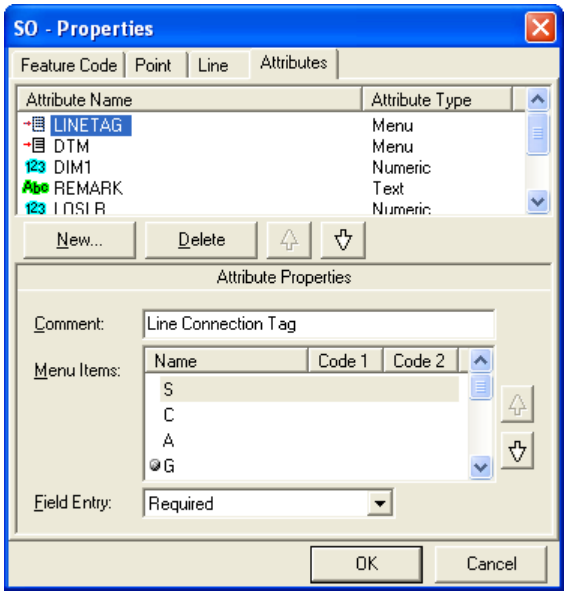
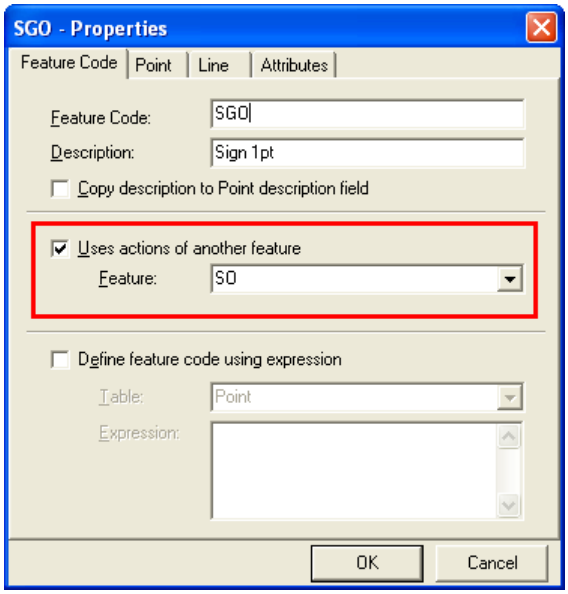
Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down



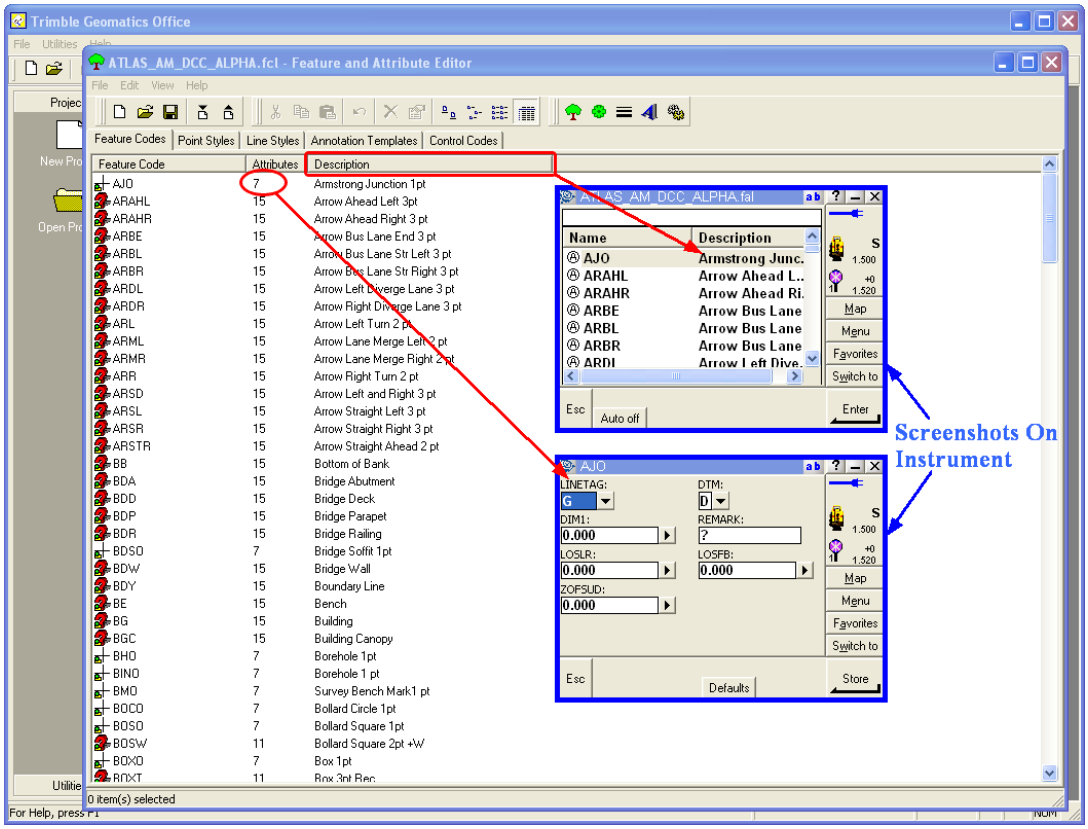


All other 1 point Features have been set up based on 'SO'.

Therefore, if you double click on a 1 point feature in the Feature and Attribute Editor or right click mouse on 1 point feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'SO'. In the example below, Sign 1 point 'SGO' uses 'SO' :



The following diagram demonstrates the relationship of the attributes within Trimble Geomatics Office 'Feature and Attribute Editor' dialog and the actually screens from the instrument showing the attribute:



To globally edit all 1 point feature the feature 'SO' can be modified.

For instance, if you do not wish to have specific attributes assigned to a 1 point feature, the feature 'SO' can be edited and in turn, all 1 point features based on 'SO' will be modified.

'KT' Kerb Top Feature set up as a String:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
KT	Kerb Top	STRING	1
		LINETAG	S
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	
		COPYFEAT	
		COPYLR	
		COPYUD	

NOTE:

STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back, COPYFEAT - Copy Feature, COPYLR - Copy Feature Left / Right Offset, COPYFB - Copy Feature Forward / Back Offset

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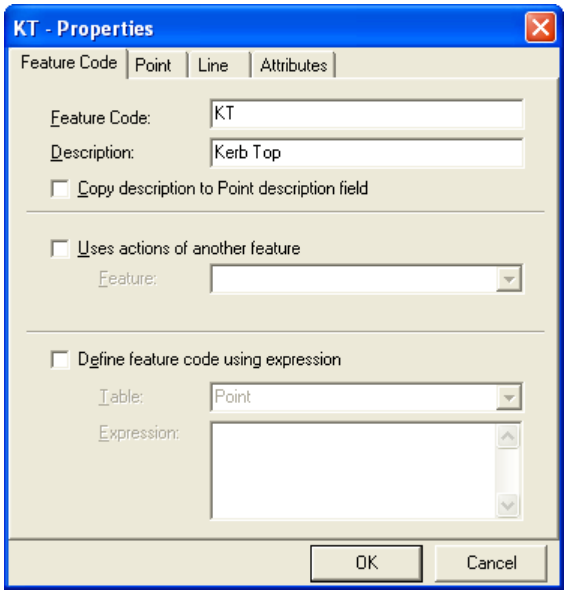
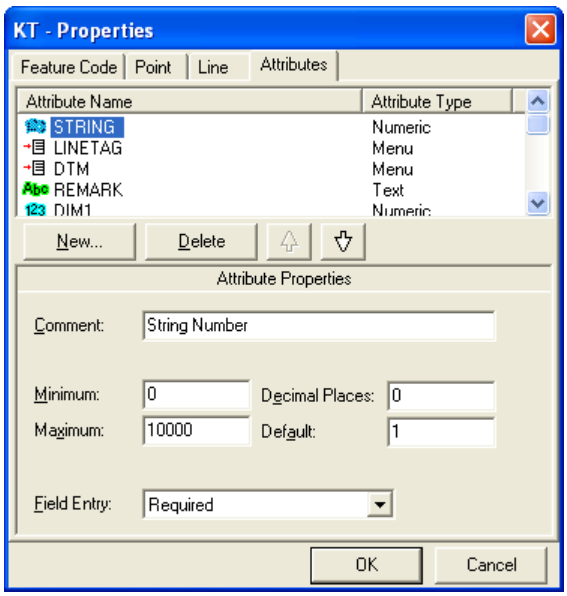
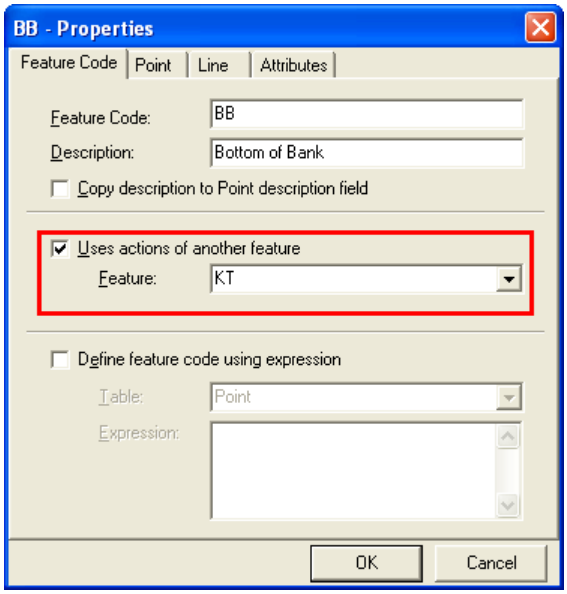


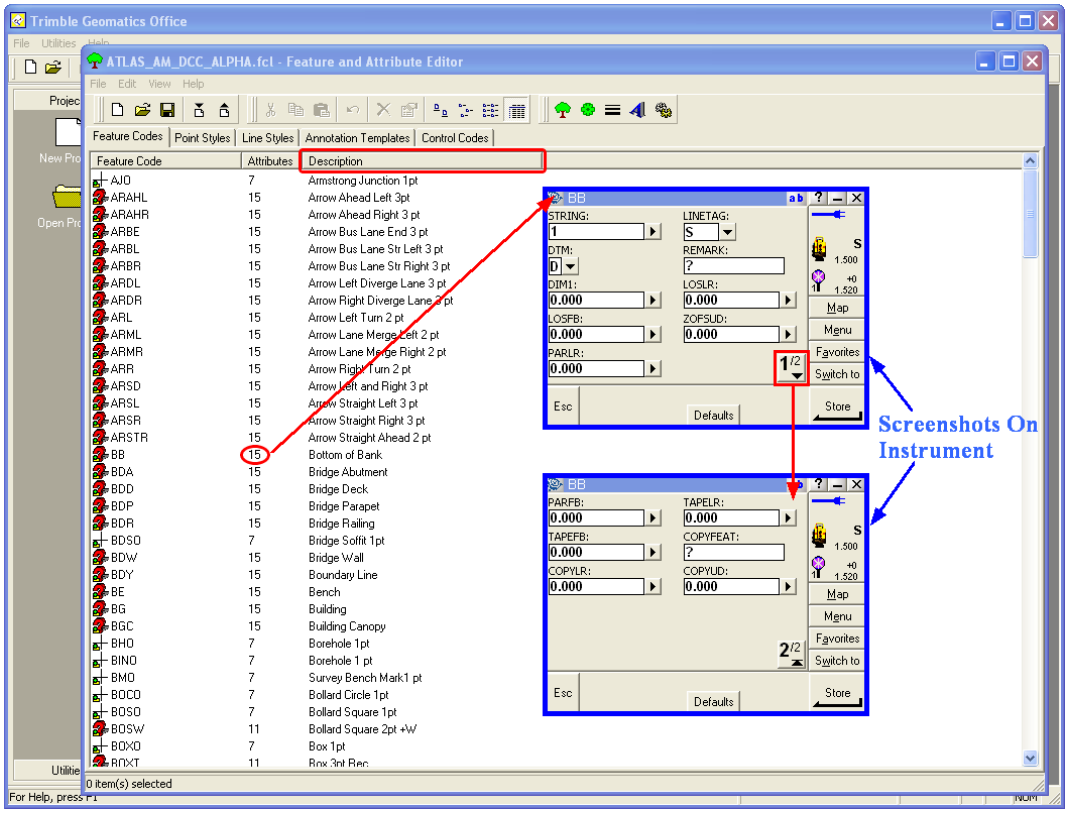


All other strings have been set up based on 'KT'.

Therefore, if you double click on a string feature in the Feature and Attribute Editor or right click mouse on string feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'KT'. In the example below, Bottom of Bank string 'BB' uses 'KT' :



The following diagram demonstrates the relationship of the attributes within Trimble Geomatics Office 'Feature and Attribute Editor' dialog and the actually screens from the instrument showing the attribute:



To globally edit all string features, the feature 'KT' can be modified.

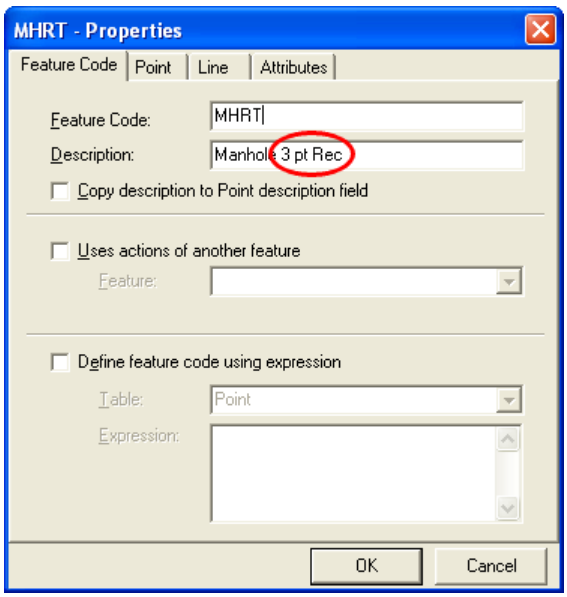
For instance, if you do not wish to have specific attributes assigned to a string, the feature 'KT' can be edited and in turn, all stings based on 'KT' will be modified.

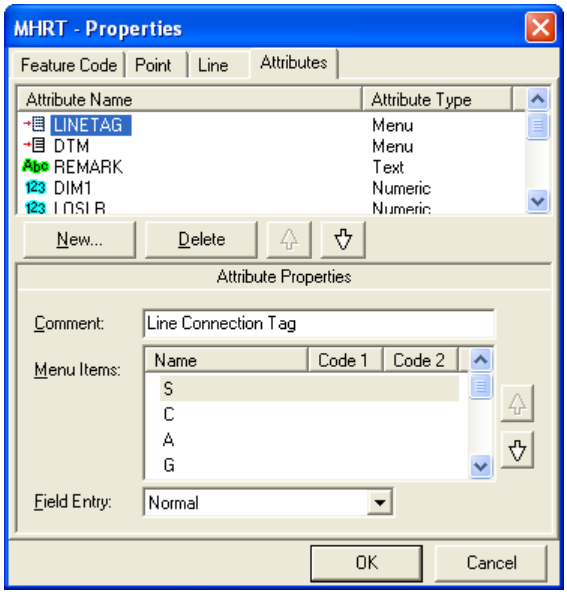
'MHRT' Manhole Feature set up as a 3 Point Rectangular:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
MHRT	Manhole 3pt Rec	LINETAG	Rec3
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

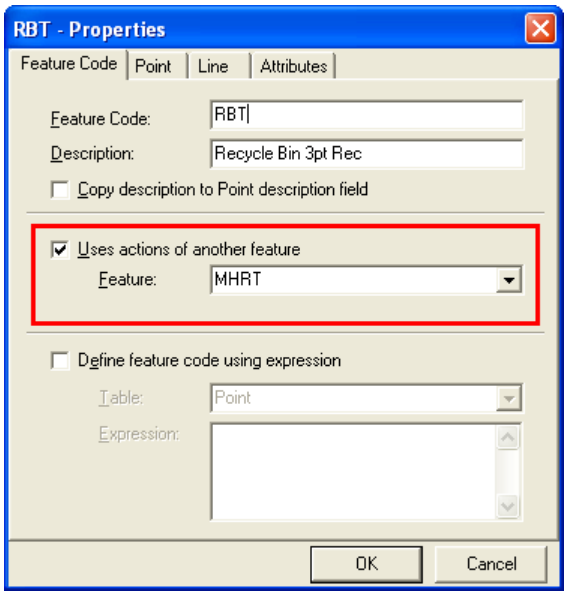
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 3 point rectangles have been set up based on 'MHRT'.

Therefore, if you double click on a 3 point rectangles feature in the Feature and Attribute Editor or right click mouse on a 3 point rectangles feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'MHRT'. In the example below, Recycle Bin 3 point rectangle 'RBT' uses 'MHRT' :



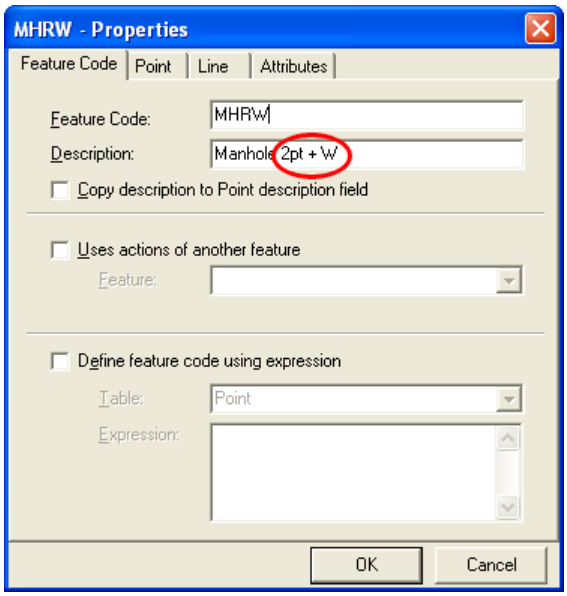
To globally edit all 3 point rectangles features, the feature 'MHRT' can be modified.

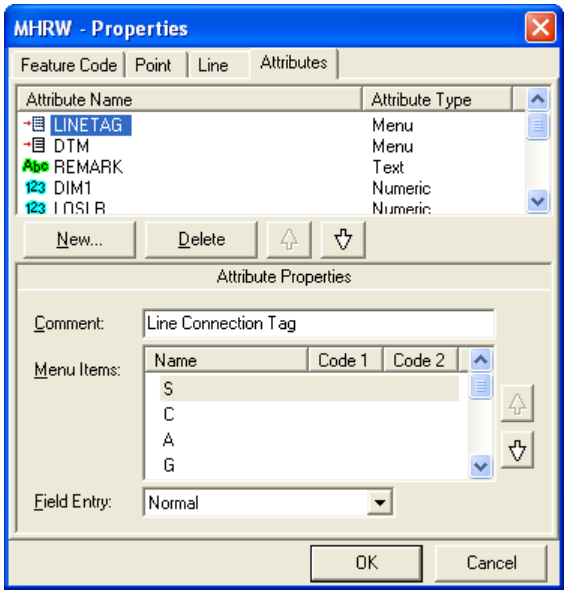
'MHRW' Manhole Feature set up as a 2 Points plus Width:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
MHRT	Manhole 3pt Rec	LINETAG	Rec2
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

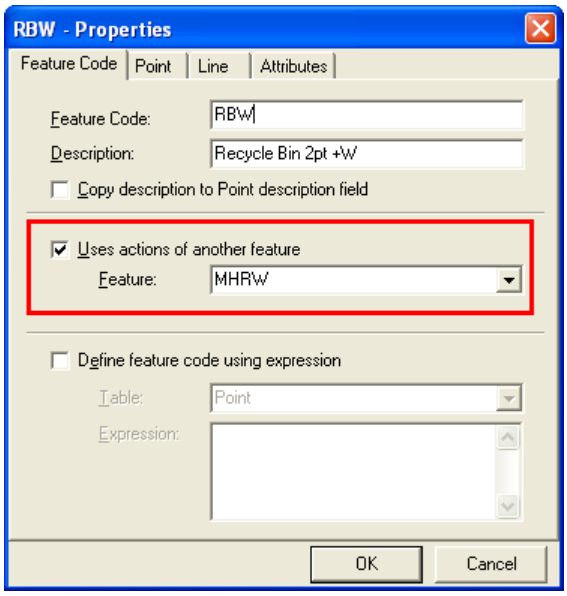
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 2 point plus width have been set up based on 'MHRW'.

Therefore, if you double click on a 2 point plus width feature in the Feature and Attribute Editor or right click mouse on 2 point plus width feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'MHRW'. In the example below, Recycle Bin 3 point rectangle 'RBW' uses 'MHRW' :



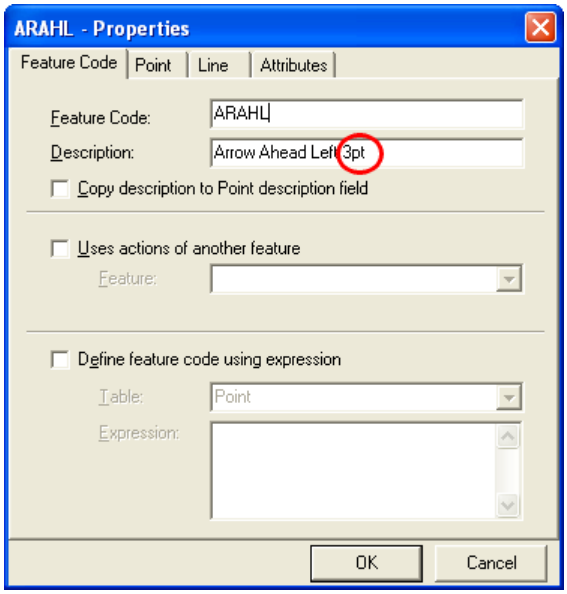
To globally edit all 2 point plus width features, the feature 'MHRW' can be modified.

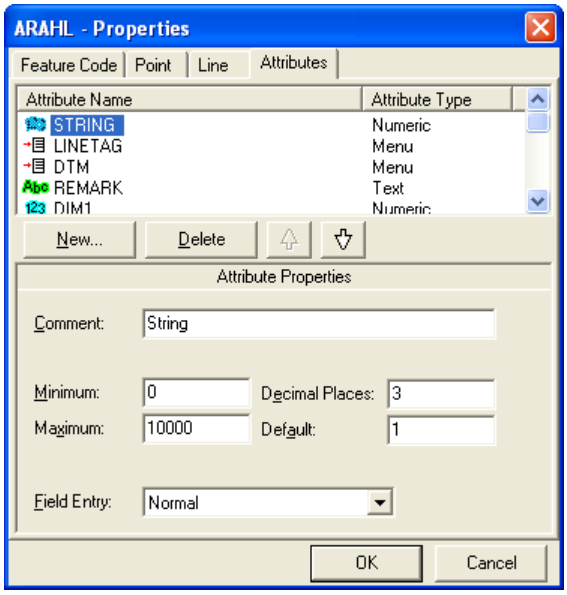
'ARAHL' Arrow Ahead Left Feature set up as a 3 Points:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
ARAHL	Arrow Ahead Left	STRING	1
		LINETAG	S
		DTM	D
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	
		COPYFEAT	
		COPYLR	
		COPYUD	

NOTE:

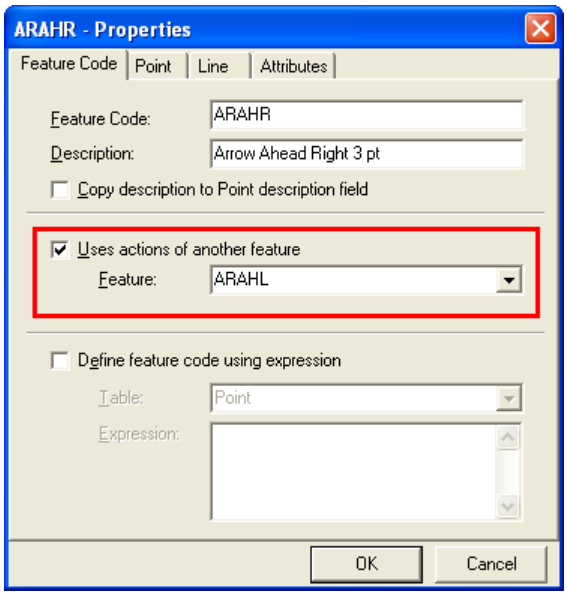
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back, COPYFEAT - Copy Feature, COPYLR - Copy Feature Left / Right Offset, COPYFB - Copy Feature Forward / Back Offset





All other 3 point features have been set up based on 'MHRW'.

Therefore, if you double click on a 3 point feature in the Feature and Attribute Editor or right click mouse on a 3 point feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'ARAHL'. In the example below, Arrow Ahead Right 3 point rectangle 'ARAHR' uses 'ARAHL :



To globally edit all 3 point features, the feature 'ARAHL' can be modified.

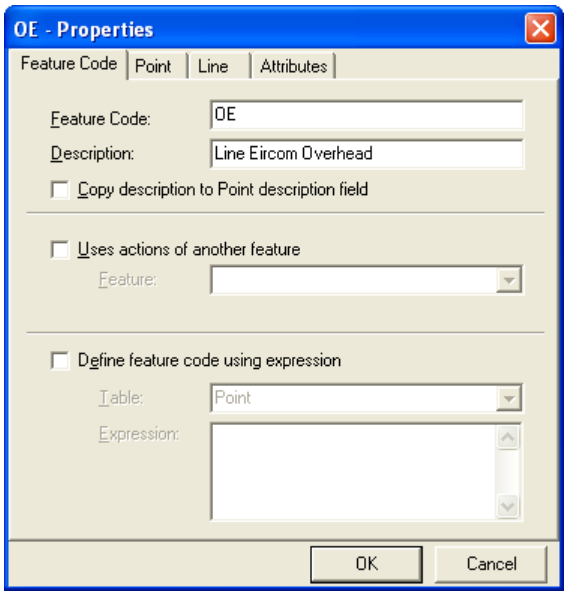
'OE' Line Eircom Overhead Feature set up as a 2D (Approx Elevation)

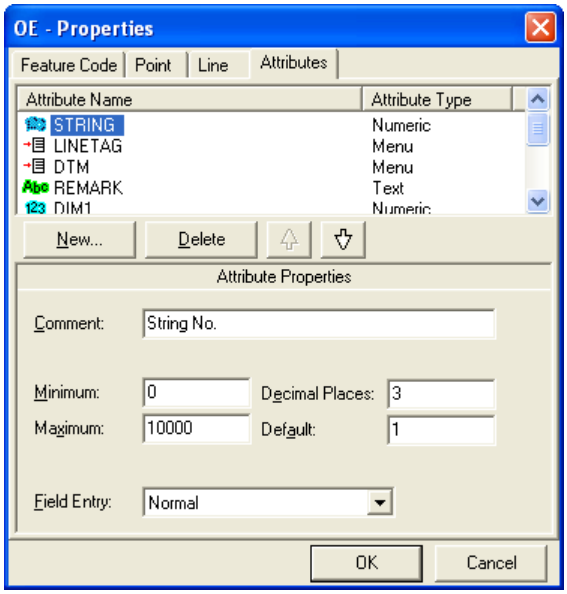
String:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
OE	Eircom Overhead	STRING	1
		LINETAG	S
		DTM	A
		REMARK	
		DIM1	
		LOSLR	
		LOSFB	
		ZOFSUD	
		PARLR	
		PARFB	
		TAPELR	
		TAPEFB	

NOTE:

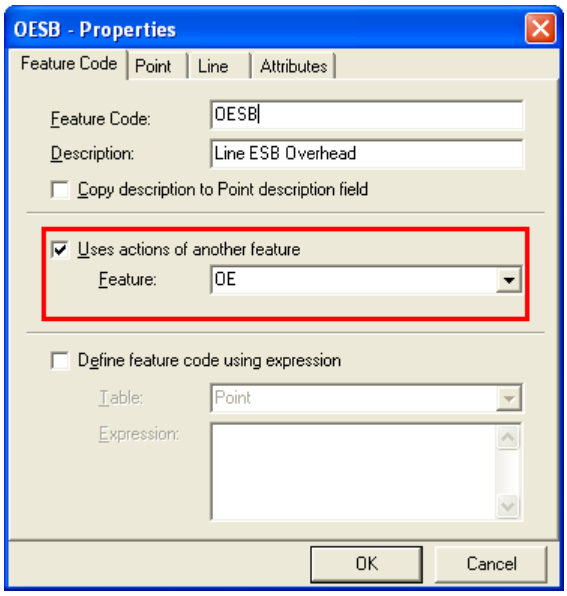
STRING - String No., LINETAG - Line Connection Tag, DTM - DTM Status, REMARK - Remark / Note, DIM1 - Dimension 1, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down, PARLR - Parallel Offset Left / Right, PARFB - Parallel Offset Forward / Back, TAPELR - Tape Offset Left / Right, TAPEFB - Tape Offset Forward / Back





All other 2D string features have been set up based on 'OE'.

Therefore, if you double click on a 2D string feature in the Feature and Attribute Editor or right click mouse on a 2D string feature and then select 'Properties' you can see the 'Uses actions of another feature' is set to 'OESB'. In the example below, ESB Overhead 'OESB' uses 'OE' :



To globally edit all 2D string features, the feature 'OE' can be modified.

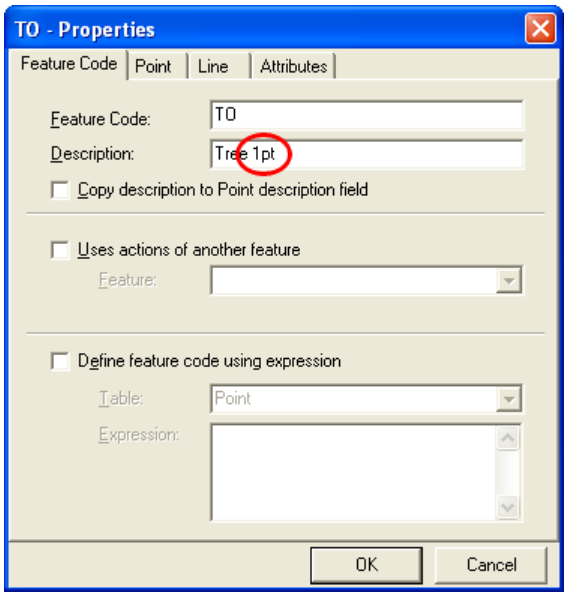
'TO' Tree Feature set up as a 2D (Approx Elevation) 1 point feature with

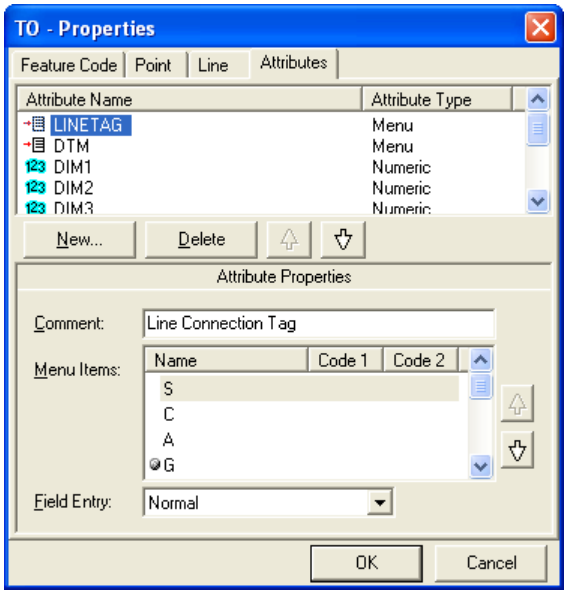
specific Dimension Attributes for Canopy and Trunk Size:

FEATURE	DESCRIPTION	ATTRIBUTES	DEFAULT VALUES
TO	Tree	LINETAG	G
		DTM	A
		DIM1	
		DIM2	
		DIM3	
		REMARK	
		LOSLR	
		LOSFB	
		ZOFSUD	

NOTE:

LINETAG - Line Connection Tag, DTM - DTM Status, DIM1 - Dimension 1, DIM2 - Dimension 2, DIM3 - Dimension 3, REMARK - Remark / Note, LOSLR - Line Of Sight Offset Left / Right, LOSFB - Line Of Sight Offset Forward / Back, ZOFSUD - Elevation Offest Up / Down

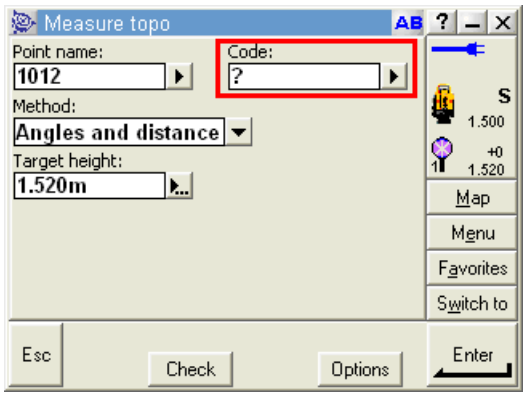


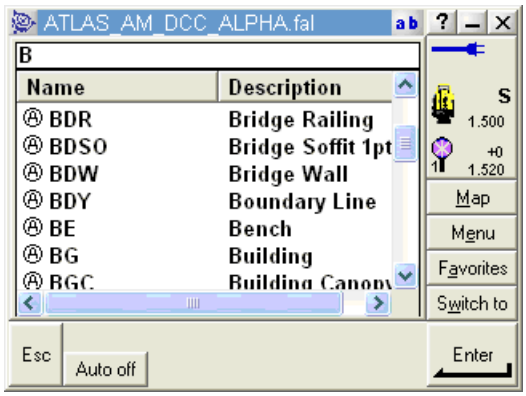


Examination of Feature File and Raw Data within SurveyPro software

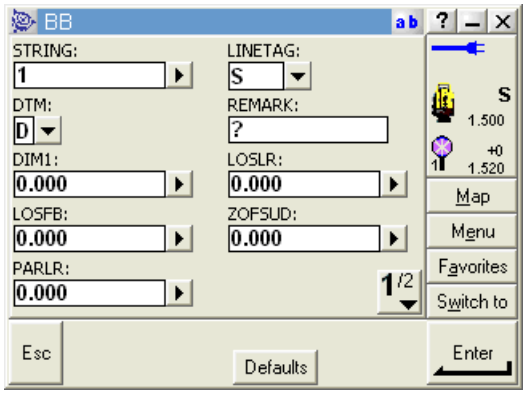
The following screenshots have been captured from Survey Pro to demonstrate the attributes set up in 'ATLAS_AM_DCC_ALPHA.fal'. Three common survey field codes have been examined 'BB' Bottom of Bank, 'SO' Spot Height and 'TO' Tree. In turn, extracts from raw survey data are displayed. Note that, Tsce attributes are stored in 13AT records.

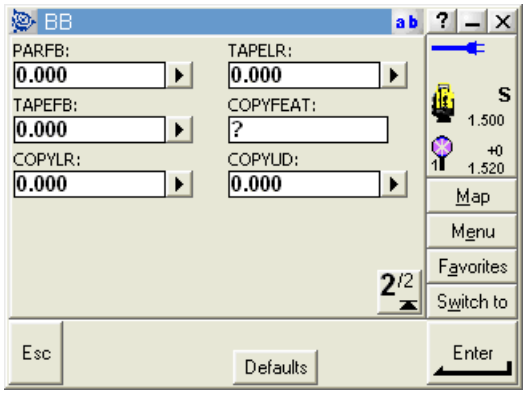
The drop down code list can be accessed within the main 'Measure Top' screen





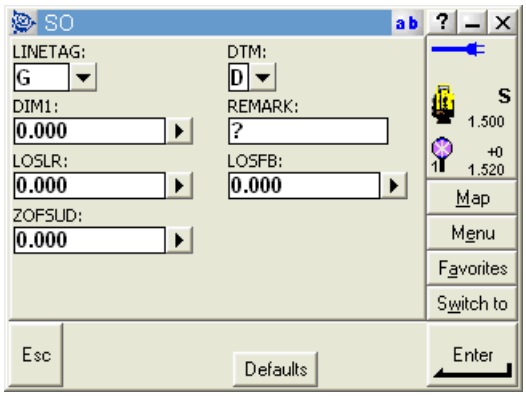
'BB' Bottom Of Bank String Feature and Attributes:





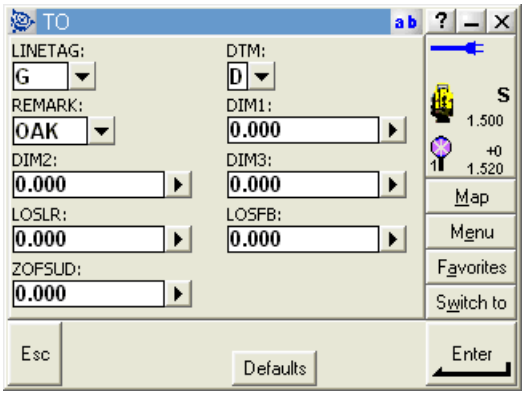

```
09F10003100034.698000090.7002777159.380833BB
13ATSTRING                1.00000000000000
13ATLINETAG               S
13ATDTM                   A

13ATREMARK
13ATDIM1                  0.00000000000000
13ATLOSLR                 0.00000000000000
13ATLOSFB                 0.00000000000000
13ATZOFSUD                0.00000000000000

13ATPARLR                 0.00000000000000
13ATPARFB                 0.00000000000000
13ATTAPELR                0.00000000000000
13ATTAPEFB                0.00000000000000
13ATCOPYFEAT
13ATCOPYLR                0.00000000000000
13ATCOPYUD                0.00000000000000
```

'SO' Spot Height Point Feature and Attributes:



```
09F10450106819.867000090.5027777255.889444SO
13ATLINETAG                G
13ATDTM                    E
13ATDIM1                   0.00000000000000
13ATREMARK
13ATLOSLR                  0.00000000000000
13ATLOSFB                  0.00000000000000
13ATZOFSUD                 0.00000000000000
  '
```

TO' Tree Point Feature and Attributes:




```
09F10450106738.205000090.0836111263.203611TO
13ATLINETAG                G
13ATDTM                    A
13ATREMARK                 OAK

13ATDIM1                   10.0000000000000
13ATDIM2                   0.75000000000000
13ATDIM3                   1.00000000000000
13ATLOSLR                  0.00000000000000
13ATLOSFB                  0.00000000000000
13ATZOFSUD                 0.00000000000000
```

Note:

Many attributes contain drop down menus. For instance, several line connection tags (tabulated below) which determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string are included as a drop down menu.

Alpha Code	Description
S	Straight
C	Curve
A	Arc
G	Gap
L	Link Back To First Point on the String
DC	Discontinuous Curve (Non-Tangential Incoming Tangent from Straight to Curve)
DS	Discontinuous Straight (Non-Tangential Outcoming Tangent from Straight to Curve)

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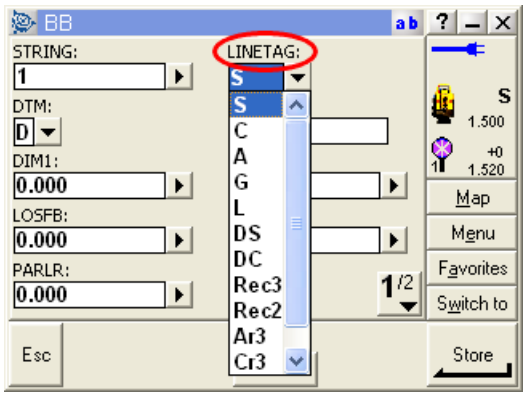
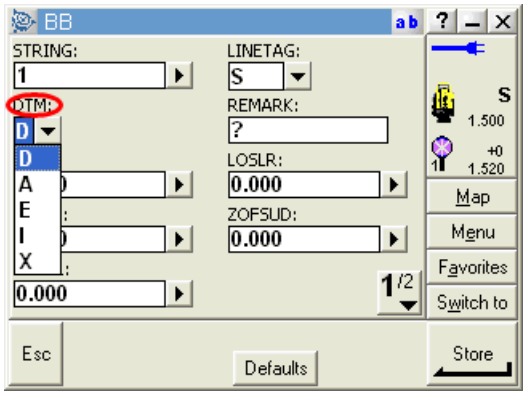
Ar3	Three Point Arc
Cr3	Three Point Circle
Cr2	Two Point Circle
C1R	Radius and Centre Circle
Rec3	Three Point Rectangle
Rec2	Two Point and Width Rectangle



In the same manner, common DTM (Digital Terrain Model) status code which determines the significance of the point of the surface model / digital terrain model are set up (tabulated below). As such DTM controls whether the point is 2D or 3D, whether it should be used in surface model generation and subsequent contouring and other surface analysis, and whether it lies on a string forming the model boundary.

Alpha Code	**Description**
D	DTM Elevation
A	Approximate Elevation (2D Point)
E	Non DTM Elevation
I	Ignore
X	DTM Elevation with text turned off on download



24.4 Download Trimble Data with Specific Attributes

Processing & Download Steps:

To process a file containing information based 'ATLAS_AM_DCC_ALPHA.fal' within SCC:

From the Main Menu Bar, select ‘FILE >New Project’

Enter in a Project/Job name

Select a Project Template from the list 'Trimble_TSCE_ALPHA.Project'

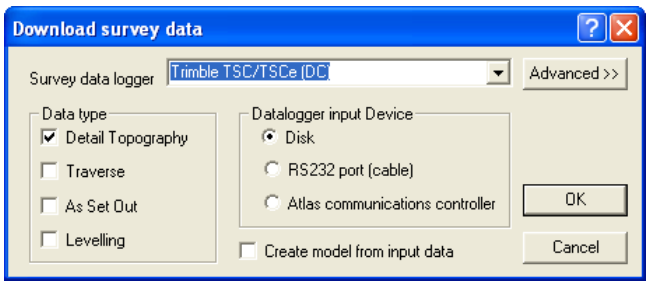
Select ‘OK’

From the Main Menu Bar, select ‘FILE > Download Survey Data’

Set Survey Data logger to 'Trimble TSC/TSCe (DC)'

Highlight ‘Detail Topography’ as the Data Type

Set Input Device to 'Disk'

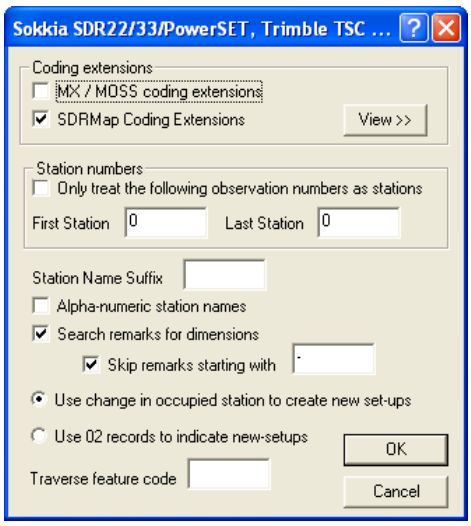


Select 'OK'

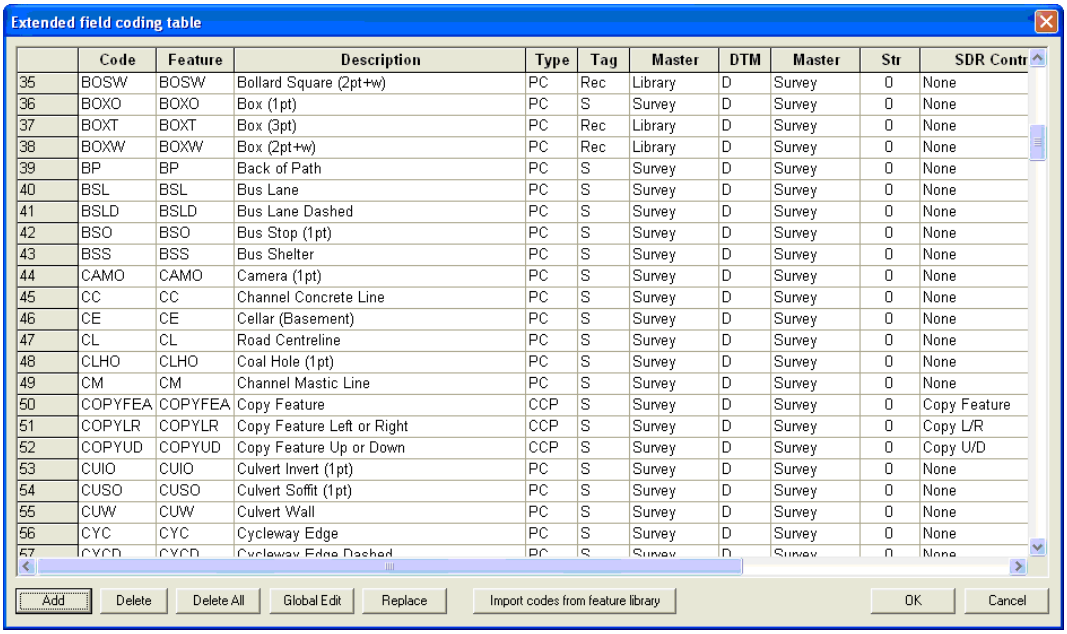
Select file

Select 'Open'

Select 'OK'



Select 'View>>' beside 'SDRMap Coding Extensions'



Extended field coding table

	Code	Feature	Description	Type	Tag	Master	DTM	Master	Str	SDR Contr
35	BOSW	BOSW	Bollard Square (2pt+w)	PC	Rec	Library	D	Survey	0	None
36	BOXO	BOXO	Box (1pt)	PC	S	Survey	D	Survey	0	None
37	BOXT	BOXT	Box (3pt)	PC	Rec	Library	D	Survey	0	None
38	BOXW	BOXW	Box (2pt+w)	PC	Rec	Library	D	Survey	0	None
39	BP	BP	Back of Path	PC	S	Survey	D	Survey	0	None
40	BSL	BSL	Bus Lane	PC	S	Survey	D	Survey	0	None
41	BSLD	BSLD	Bus Lane Dashed	PC	S	Survey	D	Survey	0	None
42	BSO	BSO	Bus Stop (1pt)	PC	S	Survey	D	Survey	0	None
43	BSS	BSS	Bus Shelter	PC	S	Survey	D	Survey	0	None
44	CAMO	CAMO	Camera (1pt)	PC	S	Survey	D	Survey	0	None
45	CC	CC	Channel Concrete Line	PC	S	Survey	D	Survey	0	None
46	CE	CE	Cellar (Basement)	PC	S	Survey	D	Survey	0	None
47	CL	CL	Road Centreline	PC	S	Survey	D	Survey	0	None
48	CLHO	CLHO	Coal Hole (1pt)	PC	S	Survey	D	Survey	0	None
49	CM	CM	Channel Mastic Line	PC	S	Survey	D	Survey	0	None
50	COPYFEA	COPYFEA	Copy Feature	CCP	S	Survey	D	Survey	0	Copy Feature
51	COPYLR	COPYLR	Copy Feature Left or Right	CCP	S	Survey	D	Survey	0	Copy L/R
52	COPYUD	COPYUD	Copy Feature Up or Down	CCP	S	Survey	D	Survey	0	Copy U/D
53	CUIO	CUIO	Culvert Invert (1pt)	PC	S	Survey	D	Survey	0	None
54	CUSO	CUSO	Culvert Soffit (1pt)	PC	S	Survey	D	Survey	0	None
55	CUW	CUW	Culvert Wall	PC	S	Survey	D	Survey	0	None
56	CYC	CYC	Cycleway Edge	PC	S	Survey	D	Survey	0	None
57	CYCD	CYCD	Cycleway Edge Dashed	PC	S	Survey	D	Survey	0	None

Add | Delete | Delete All | Global Edit | Replace | Import codes from feature library | OK | Cancel

Note:

The default library 'Trimble_TSCE_ALPHA.Project' already contains existing field codes within the Extended field coding table.

The dataset will be presented.

24.5 Creating A Model

Go to 'FILE > Model > SCC Dataset'

Select 'Create the model and triangulation' and set Initial Plot Scale of 250

Select 'FILE > Save As'

25 Working With Leica Data

The following tutorial provides information relating to the downloading and processing of Leica data within SCC.

25.1 Create A Project

A new project should be created before data may be downloaded into SCC or models formed.

From the Main Menu Bar, select 'FILE >New Project'

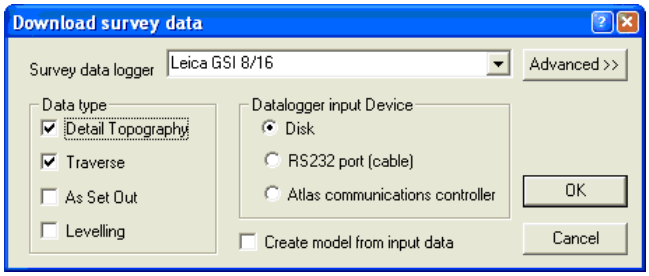
Enter in a Project/Job name

Select a Project Template from the list

Select 'OK'

25.2 Download Leica Data

SCC includes a number of different Leica interfaces to support correspondingly different data collection strategies. The simplest of these is the TPS series interface which maps user definable fields on the instrument directly onto SCC observation fields.



Downloading Leica Data

From the Main Menu Bar, select 'FILE > Download Survey Data'

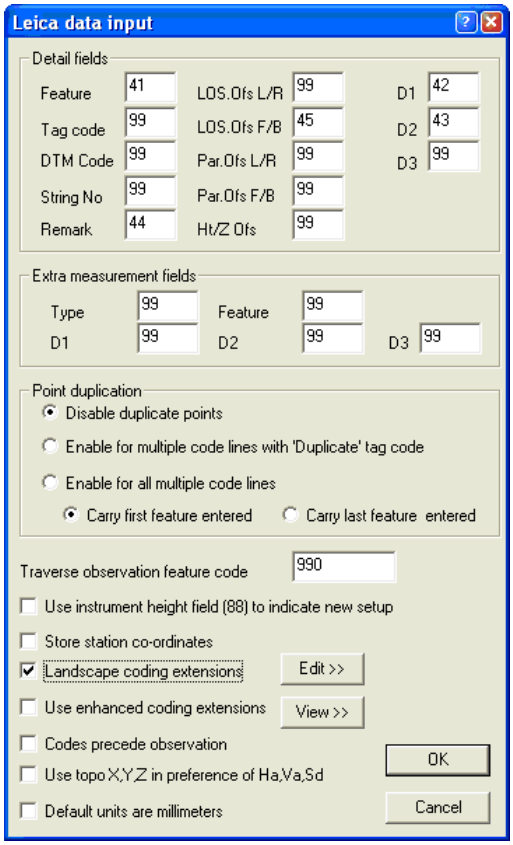
Set Survey Data Logger to 'Leica GS1 8/16'

Highlight 'Traverse' or 'Detail Topography' as the Data Type

Set Input Device to 'Dsk', 'RS323 port (cable) 'or 'Atlas communications controller' as required

Select 'OK'

Select the file you require and 'OK'

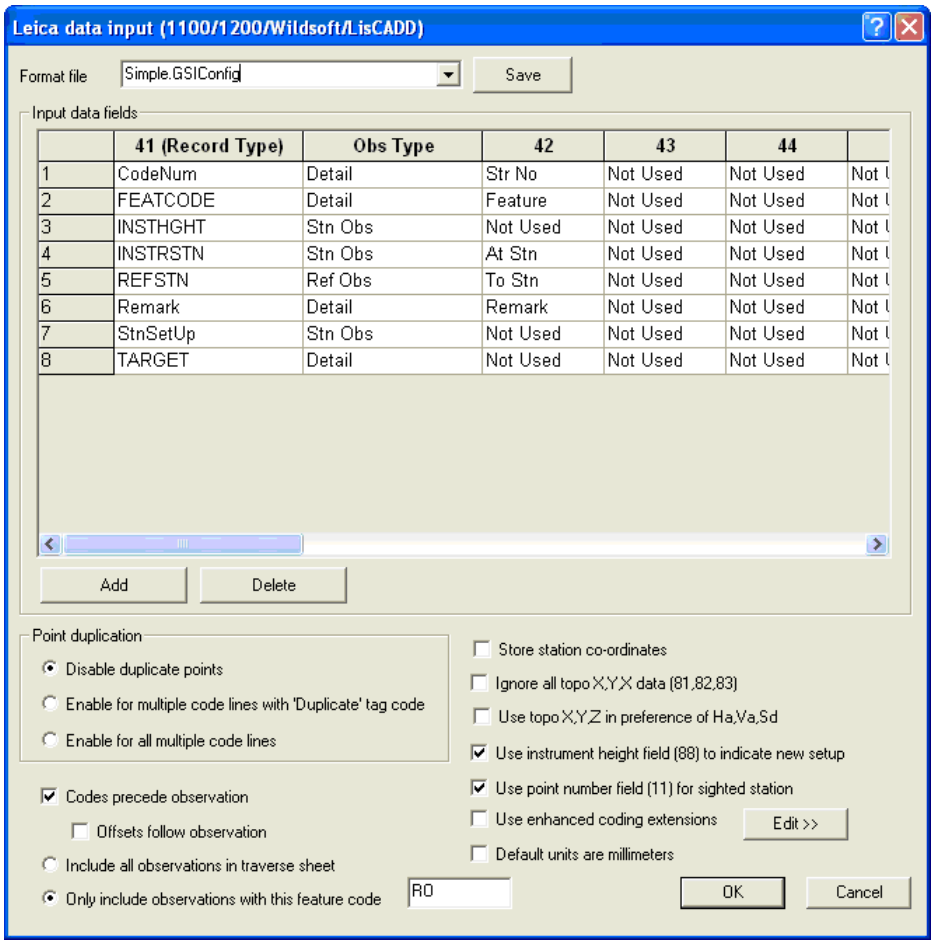


In this case, for example, field 41 on the instrument will be used to store the SCC feature name. Any SCC fields that are not being recorded in the field should be set to 99.

Note that these settings will become the defaults for all future downloads from the Leica and do not have to be entered with each download.

An alternative method is to use the LisCADD or WildSoft style coding (Leica 1100/1200 (GSI config)) which will be more familiar to LisCadd users. In this case field 41 on the instrument is always used to determine what is stored in other instrument fields. For example, in the dialog shown below, if field 41 contains the word 'FEATCODE' the feature

code is expected in field 42, whereas if it contains ‘Remark’ a survey remark is expected in field 42.



Note that in both cases, a traverse feature code may be provided to determine that subsequent observations are to be included in the traverse spreadsheet. This is provided to facilitate combined detail topography and traverse surveys.

Leica 1200 Data Input

The following outlines the transfer of format files on to a Leica1200 system and the use of the 'SCC Sys1200.FRT' file. Download steps into SCC are noted. The use of extra measurements such as 'Line of Sight offsets, Tape Offsets, Parallel Offsets, Dimensions and Remarks are examined.

A. Files for SCC Coding on Leica TPS1200 Series instruments:

SCCSys1200.FRT	Format File (*.FRT) generated in Leica GEO Office to a System 1200 sensor
badleyt_0405_211712.xcf badleyt_0405_211712.x23 badleyt_0405_211712.x06	Parameter Files

B. Setting up Coding on the TPS1200:

a)Transfer of Format Files on PC:

- **Copy Format Files to the Convert Directory on the Compact Flash [CF] Card**

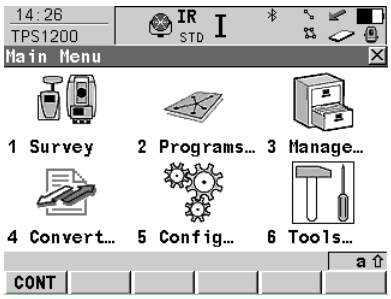
- **Copy the *.xcf, *.x23 and *.x06 files into the Code Directory on the Compact Flash [CF] card**

Note:

The Compact Flash card must always be “Stopped” before removing it from your computer. The System 1200 sensor must always be switched off before removing the Compact Flash.

b)PC Card in the instrument – Format File:

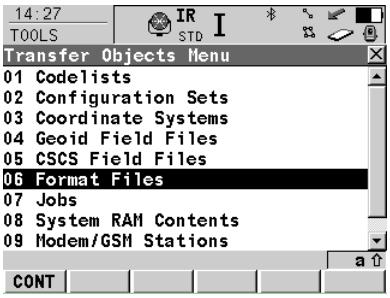
- **Select option 6 Tools… from the Main Menu**



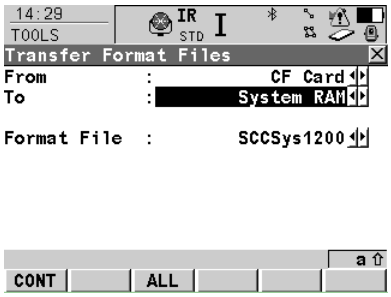
This option can be selected by pressing the number 6 key, or by navigating to 6 Tools... and pressing the Enter key, or by touching the Tools… icon when using an active touch screen

- **Select option 2 Transfer Objects… from the Tools Menu.**

- **Select option 6 Format Files from the Transfer Objects Menu**



- **Select the Format File (SCCSys1200.FRT) you wish to transfer, from the CF Card, to the SystemRAM, in the Transfer Format Files screen.**



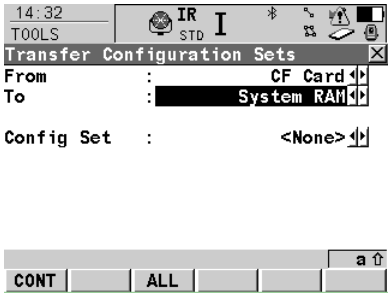
- **Select CONT [F1]**

The System 1200 sensor will return to the Main Menu once the Format File transfer is completed.

c)PC Card in the instrument – Transfer Configuration Sets:

- **Select option 6 Tools… from the Main Menu**

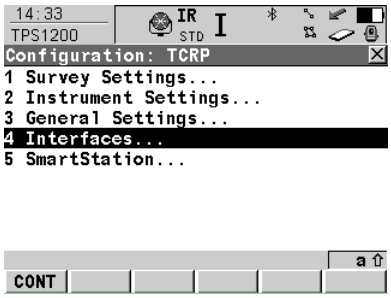
- **Select option 2 Transfer Objects from the Tools Menu**
- **Select option 2 Configuration Sets from the Transfer Objects Menu**
- **Set up appropriately (TC, TCRP RCS etc.):**



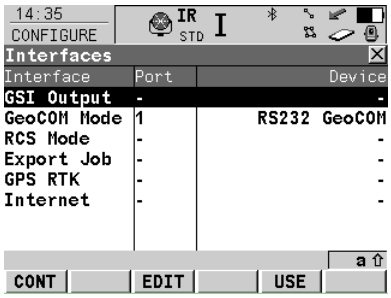
- **Select 'F3 – ALL'**

d)PC Card in the instrument – Configuration:

- **Select option 5 Configuration… from the Main Menu**
- **Select option 4 Interfaces from the Configuration: TC Menu**



- **Select GSI Output**



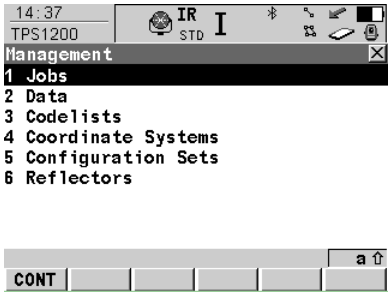
- **Select 'F1 – CONT'**

C. Setting up Survey

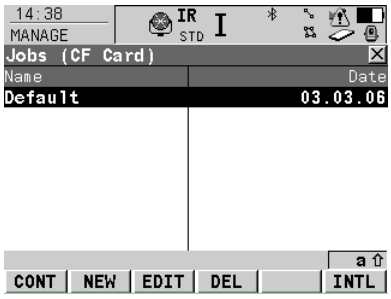
a)PC Card in the instrument – Management:

Select option 3 Management… from the Main Menu

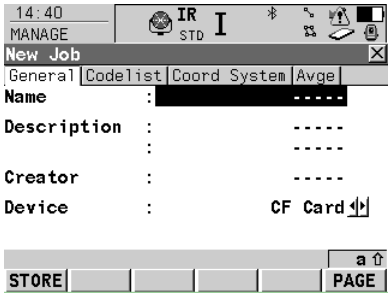
Select 1 Job from Management Menu



- **Select F2 New from Job (CF Card) Menu**

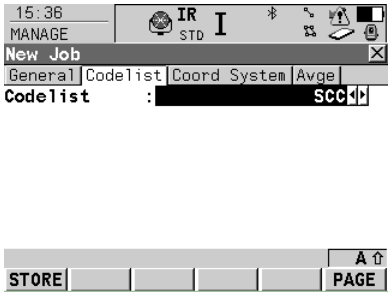


- **Within General Tab enter relevant details:**

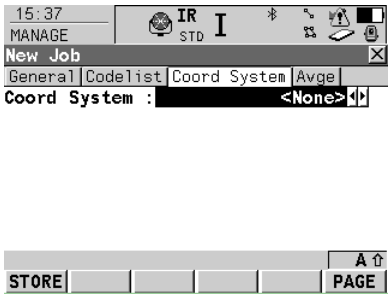


- **Tab to Codelist and ensure that the setting assigned in Step C d**

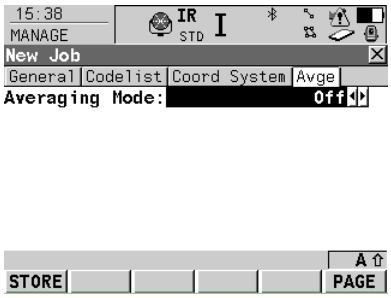
  (Transfer Codelist) have been attained



- **Within Tab Coord System select None**



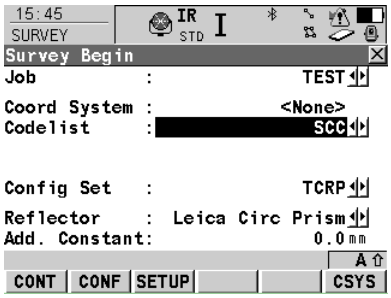
- **Within Avge Tab select Off**



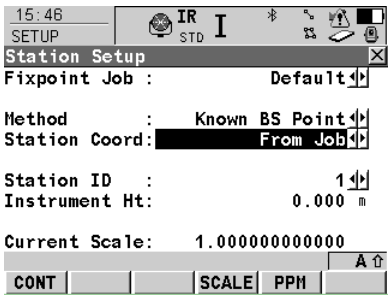
- **Select F1 Store**
- **Within Main Job Screen select F1 CONT with TEST highlighted**

D. Setting up Stations within 1200 Series: (Known Azimuth)

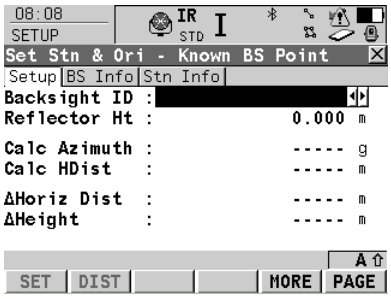
- **Select option 1 Survey… from the Main Menu**



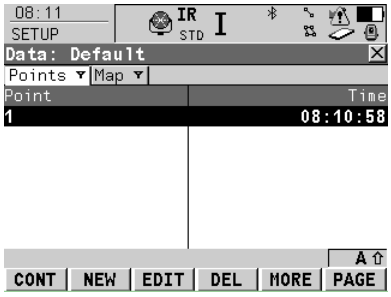
- **Set up the appropriate Reflector**
- **Set Method to Known BS**
- **Select Frm Fixpoint Job as Station Coord**



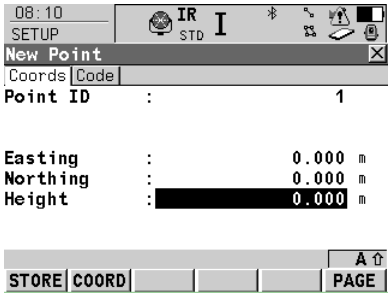
- **Select F1 CONT to access the Station Setup Panel**

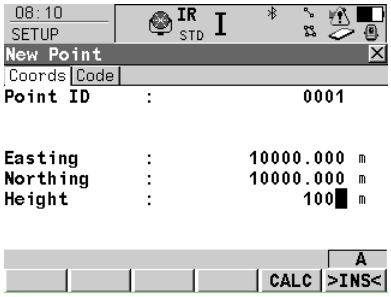


- **With Station ID highlighted select Enter (or Tap on Station ID focus)**

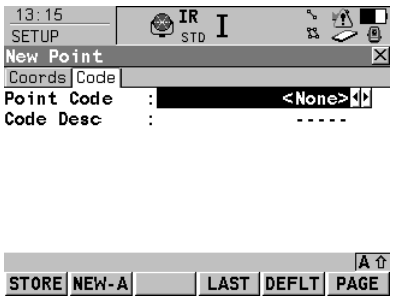


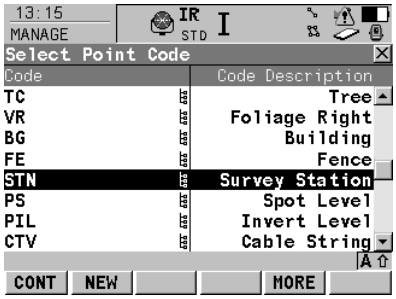
- **Select F2 NEW**
- **Enter Coords**

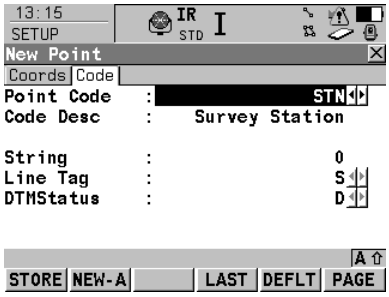




- **Within Code Tab**







- **Select F1 STORE**
- **Select F1 CONT twice to return to Select Station Dialog**
- **Select Station ID and enter Instrument Height**
- **Select F1 CONT**
- **Enter A Backsight ID and set Azmuith**

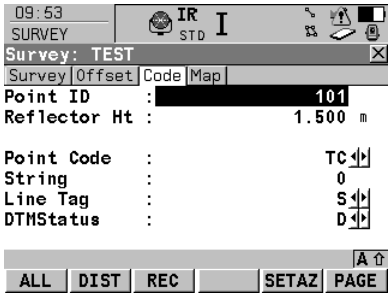
E. Surveying Detail with SCC Codelist:

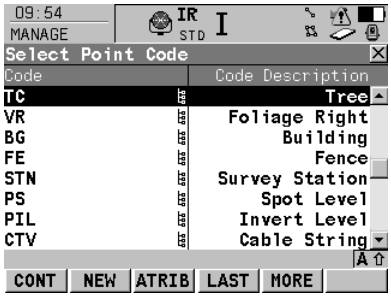
Leica TPS1200 Coding

- **After Station Set up select 1 Survey from Main Menu**
- **4 tabs are available**
- **For Example**

  Go to Code tab:Enter Reflector Ht.

  Assign Point Code either using arrows or double click to view Code and Code Description Dialog





- **Assign String, Line Tag and DTM Status appropriately**

Offsets are available from either the offset Tab or by within the Free Codes ‘F7’.

Extra Measurements have also been set up within the Free Codes ‘F7’.

F. SCC Settings for Leica coding using Leica TPS1200 Instruments

Open SCC and set up Project

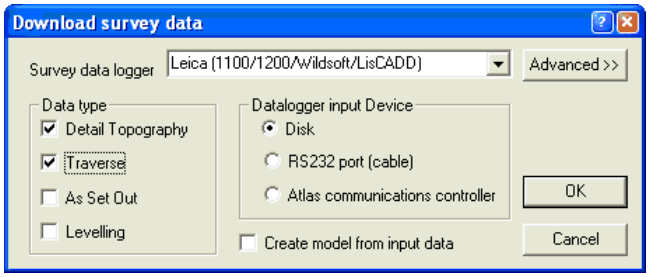
Select 'FILE > Download Survey'

Select 'Leica 1100/1200 (GSI Config)' as Survey Data Logger

Select the required 'Data Type'

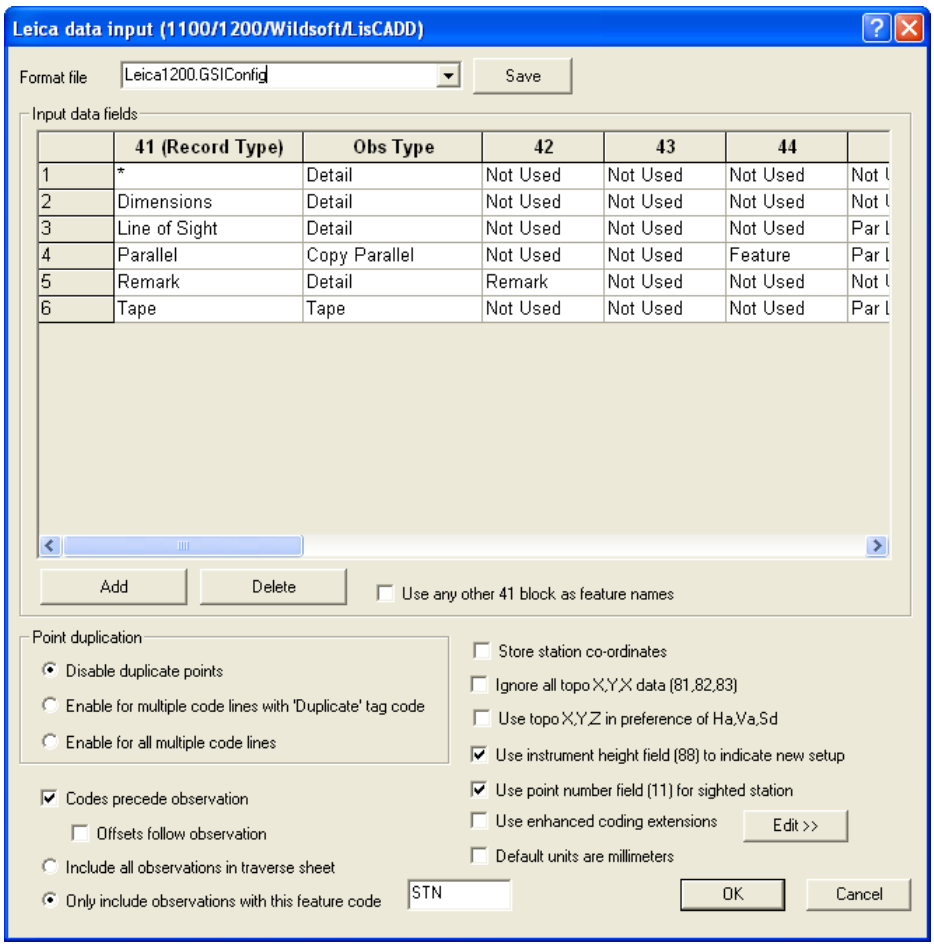
Select 'Data logger input Device'

Select 'OK'



Select 'Leica1200.GSIConfig' Format File

Set up additional settings as shown below:



Select 'OK'

Traverse Observation Feature Code

Traverse Observation Feature Code field should be filled with the user's individual code i.e. PSSA or STN etc.

If this is not filled in, no stations file will be produced.

Always include the decimal point when inputting any number so that SCC knows the units i.e. 12.0 or 0.25

G. Tag Codes

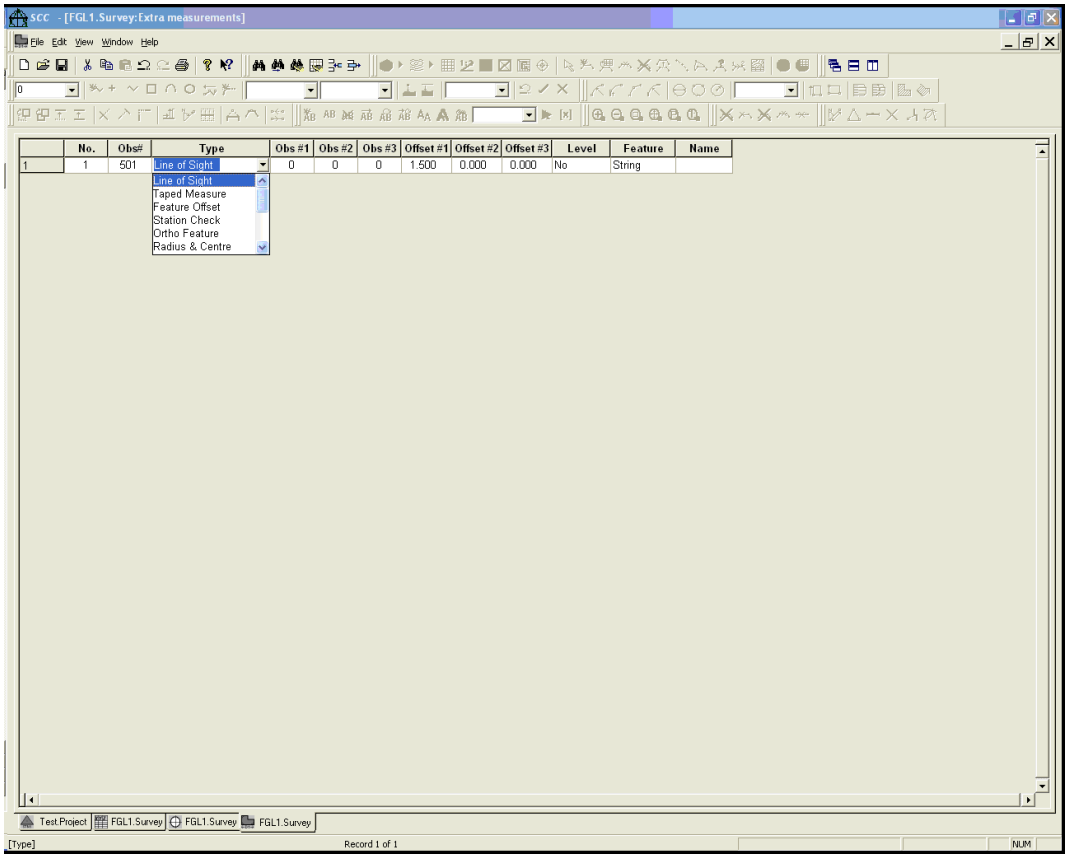
The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string. The tag codes may be entered either in numeric or alpha-numeric format.

H. DTM Tag Code

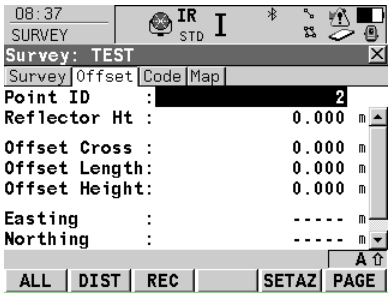
The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. The DTM codes may be entered either in numeric or alpha-numeric format

I. Extra measurement fields

Extra user defined GSI fields may be used to collect extra measurement information corresponding to the SCC extra measurement sheet.



Several offsets are available as part of the main interface:

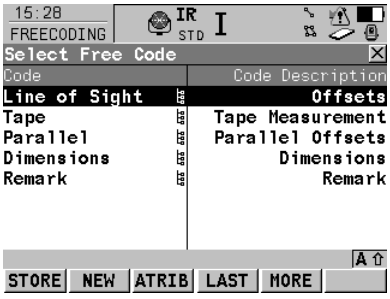


The Offsets are as follows:

Offset Cross:	Line Of Sight L/R (Radial Offset)
Offset Length:	Line Of Sight F/B (Lateral Offset)
Offset Height:	Elevation offset.

Additional Extra Measurements have been set up as part of the Free Codes (F7):

Free Code:

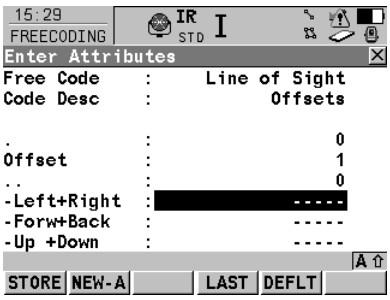


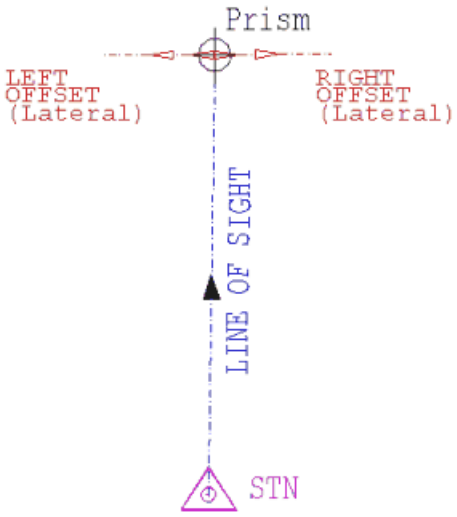
Line OF Sight

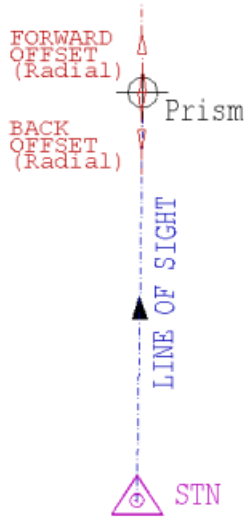
The **'-Left+Right'** offset corresponds to the distance left or right along the line of sight between the instrument and the target.

The **'–Forward+Back'** offset corresponds to the distance forward or back along the line of sight between the instrument and the target.

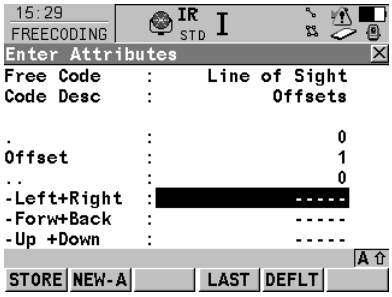
The **'–Up+Down'** offset corresponds to the elevation offset.





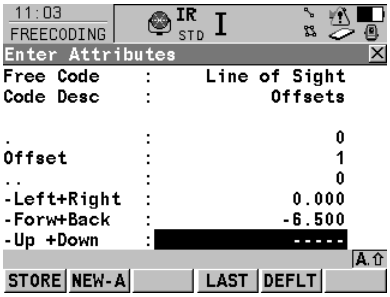


Point 101: **Line of Sight Offset to the left –3.500**



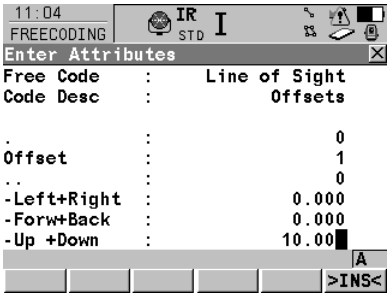
*110017+0000000000000**101** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410018+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 **45....+0000000000-3.500**
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 102: Line of Sight Offset to the Forward -6.500



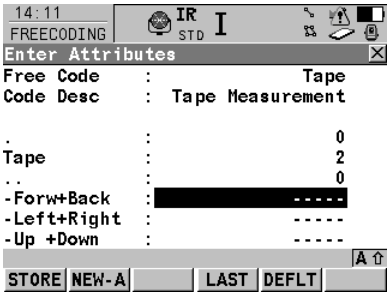
*110019+0000000000000**102** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410020+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 45....+000000000000.000
46....+0000000000-6.500 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 103: Line of Sight Offset to the Down +10.00



*110021+0000000000000**103** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000PS 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410022+000Line of Sight** 42....+0000000000000000
43....+0000000000000001 44....+0000000000000000 45....+000000000000.000
46....+000000000000.000 **47....+000000000010.000** 48....+0000000000000000
49....+0000000000000000

Tape

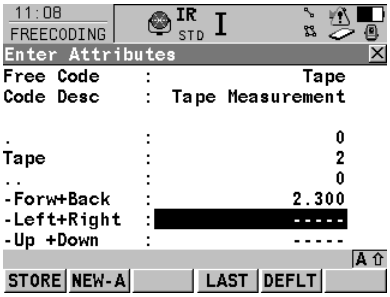


The'**–Forward+Back'** offset corresponds to the distance forward or back along the line (Baseline) connecting the last two survey points.

The **'-Left+Right'** offset corresponds to the distance left or right along the line (Baseline) connecting the last two survey points.

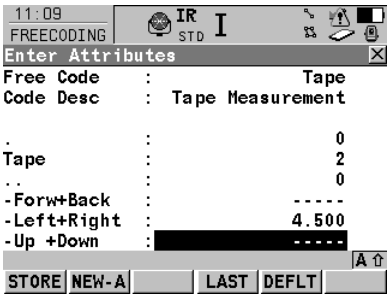
The **'–Up+Down'** offset corresponds to the elevation offset.

Point 201: Tape Offset to the Back +2.300



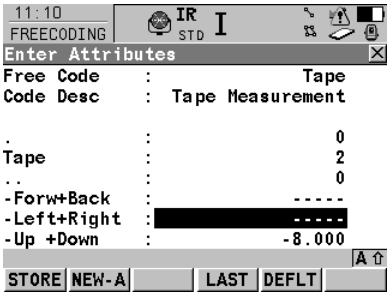
*110026+0000000000000**201** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410027+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 **45....+000000000002.300**
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 202: Tape Offset to the Right +4.500



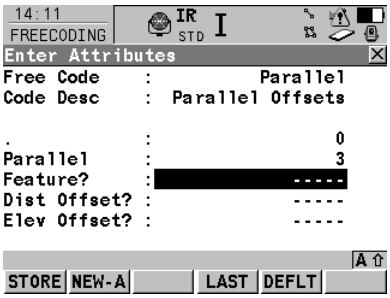
*110028+0000000000000**202** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410029+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 45....+0000000000000000
46....+000000000004.500 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 203: Tape Offset to the Up -8.000



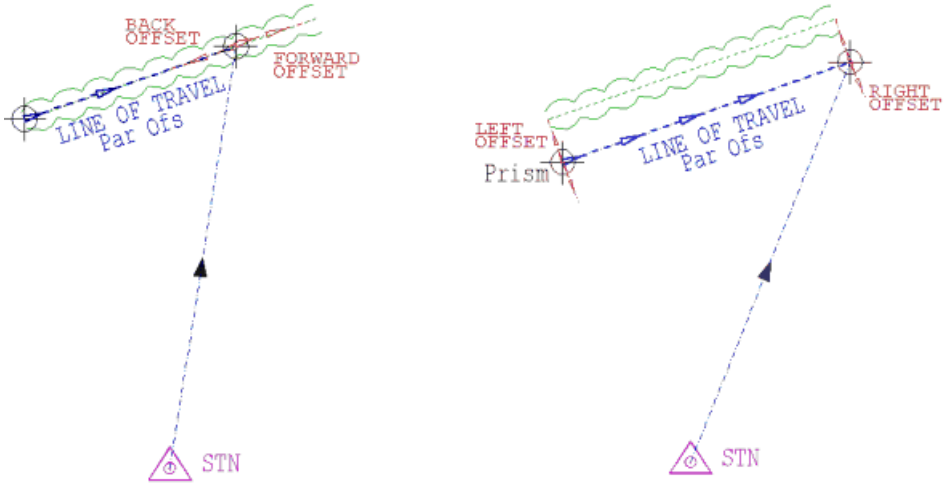
*110030+0000000000000**203** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+0000000000000PST 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410031+000000000000Tape** 42....+0000000000000000
43....+0000000000000002 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 **47....+0000000000-8.000** 48....+0000000000000000
49....+0000000000000000

Parallel Offset

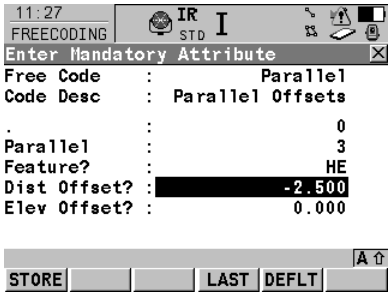


'**Dist Offset'** corresponds to the distance between the observed feature line and the generated feature line (Feature?).

'Elev Offset' corresponds to the elevation offset.

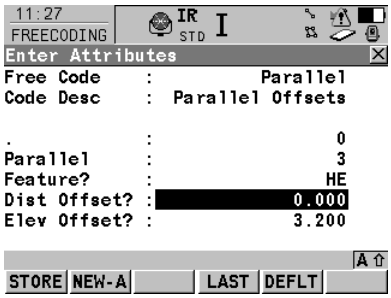


Point 302: Parallel Offset – Offsetting HE Left -2.500 from TB Feature



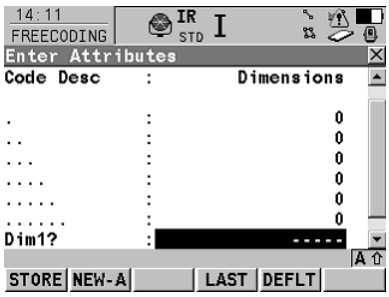
*110035+0000000000000**302** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TB 72....+0000000000000056 73....+000000000000000S
74....+000000000000000D ***410036+00000000Parallel** 42....+0000000000000000
43....+0000000000000003 **44....+00000000000000HE 45....+0000000000-2.500**
46....+000000000000.000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

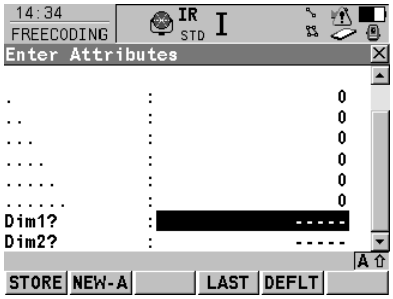
Point 302: Parallel Height Offset – Offsetting HE in Z +2.500 from TB Feature



*110037+0000000000000**303** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TB 72....+0000000000000056 73....+000000000000000S
74....+000000000000000D ***410038+00000000Parallel** 42....+0000000000000000
43....+0000000000000003 **44....+00000000000000HE** 45....+000000000000.000
46....+000000000003.200 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

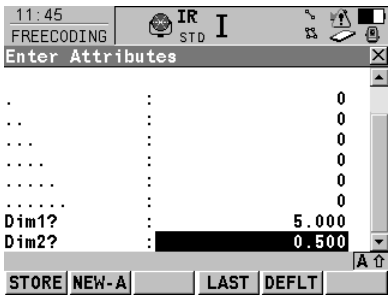
Dimension





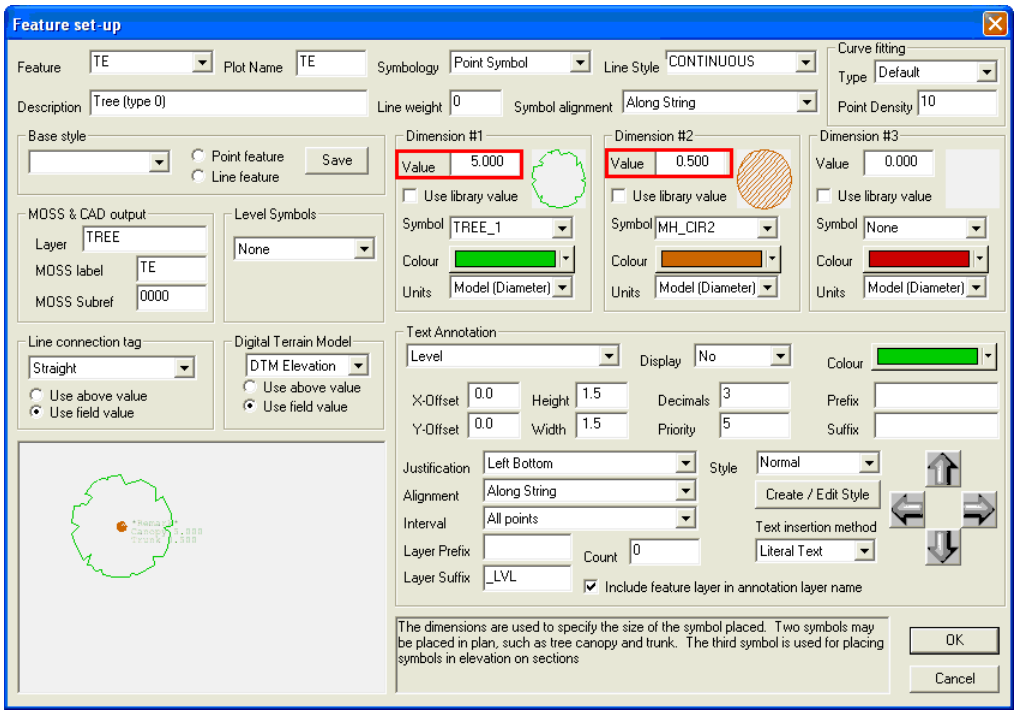
This option allows the user to manually input a Dimension 1 and Dimension 2 value.

Point 401: **TC feature with assigned D1 of 5.0 and D2 of 0.500**

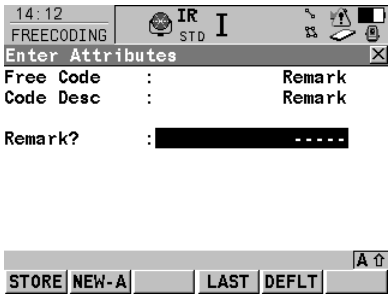


*110040+0000000000000**401** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TC 72....+0000000000000000 73....+000000000000000S
74....+000000000000000D ***410041+000000Dimensions** 42....+0000000000000000
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 **48....+000000000005.000**
49....+000000000000.500

For example, Feature 'Tree' may have a Dimension 1 value denoting the Canopy size and also a Dimension 2 referring to Tree Trunk size.

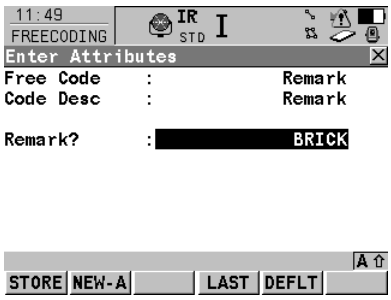


Remarks



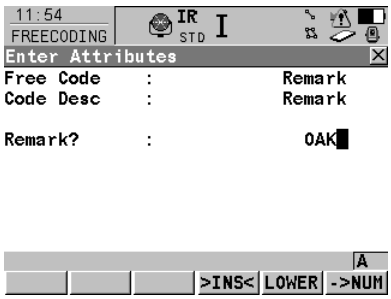
Additional annotation can be assigned to a specific point with ‘Remarks’.

Point 95: WALL feature with assigned Remark ‘BRICK’



*110043+0000000000000**95** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+000000000000WALL 72....+0000000000000001 73....+000000000000000S
74....+000000000000000D ***410044+0000000000Remark 42....+00000000000BRICK**
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

Point 376: TC feature with assigned Remark ‘OAK’



*110045+0000000000000**376** 21.044+0000000008100000 22.044+0000000008100000
31..00+0000000000010000 51....+000000000000+000 87....+0000000000001500
71....+00000000000000TC 72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 ***410046+0000000000Remark 42....+0000000000000OAK**
43....+0000000000000000 44....+0000000000000000 45....+0000000000000000
46....+0000000000000000 47....+0000000000000000 48....+0000000000000000
49....+0000000000000000

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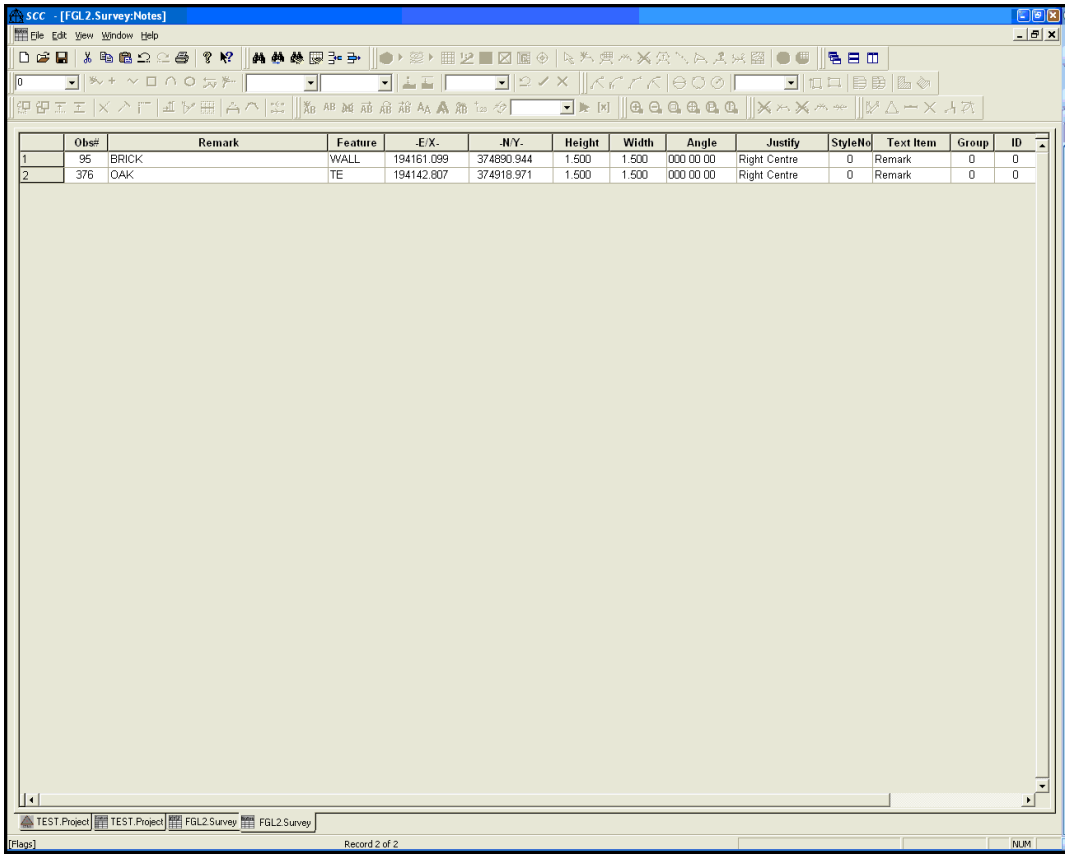


J. Traverse observation feature code (not specific to 1200)

An extra user defined feature code may be used to signify a control observation. This observation will be used as a reference observation in the instrument set-up sheet and as a traverse observation in the traverse sheet. This facilitates combined detail and traverse surveys using the GSI format. If this field is left blank, and tag codes are not being collected, all observations will be output to the traverse sheet. If this field is left blank and tag codes are being collected, observations with tag codes of FS, BS, and SS will be output to the traverse sheet.

K. Store Station co-ordinates (not specific to 1200)

Tick this field if you want to store station coordinates present in the input file, in fields 84 to 86, in the SCC project control file.

L. Codes precede observations (not specific to 1200)

This option controls whether a code block is associate with the preceding observation, or the following observation. For example, in the input below the code block precedes the data block

410006+000000KB 48....+0000000S 47....+0000000D 49....+00000002 110007+00000169 21.304+12359530 22.304+09515230 31...0+00003502

M. Use Topo X,Y,Z in preference to HA,Va,Sd (not specific to 1200)

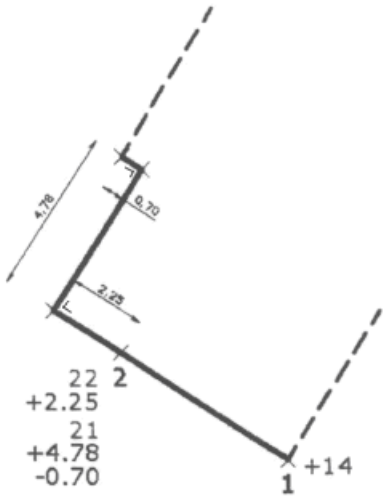
This option allows the computed X,Y,Z positions in the GSI input file to be stored in the SCC observation sheet rather than the Ha,Va,Sd values, where both occur in a single data line. This is useful if the GSI file does not include all of the survey observations, such as observed back-sights, as shown in the example below;

```
*110001+000000000000GR0A 84..10+0000000320728329
85..10+0000000376869559 86..10+0000000000099259
*110002+000000000000GR01 81..00+0000000320715339
82..00+0000000376754428 83..00+0000000000100000
*110003+000000000000GR0A 84..10+0000000320728329
```

```
85..10+0000000376869559 86..10+0000000000099259
87..10+0000000000001500 88..10+0000000000001602
79....+0000000000000GR01
*110004+0000000000000066 21.324+0000000018626250
22.324+0000000008940550 31..00+0000000000115851
87..10+0000000000001500 71....+0000000000000000
72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 81..00+0000000320715334
82..00+0000000376754441 83..00+0000000000100005
*110005+0000000000000067 21.324+0000000015216010
22.324+0000000008744130 31..00+0000000000074790
87..10+0000000000001500 71....+0000000000000OSC
72....+0000000000000000 73....+0000000000000000
74....+0000000000000000 81..00+0000000320763106
 82..00+0000000376803412 83..00+0000000000102315
```

Case Study

Case 1: Tape Offset




```
*110015+000000000000001  21.324+0000000001732120  22.324+0000000008645360
31..00+0000000000030223  81..00+0000000000109092  82..00+0000000000128773
83..00+0000000000013208  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*110015+000000000000002  21.324+0000000001732120  22.324+0000000008645360
31..00+0000000000030223  81..00+0000000000109092  82..00+0000000000128773
83..00+0000000000013208  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*110016+000000000000003  21.324+0000000000927290  22.324+0000000008548510
31..00+0000000000030413  81..00+0000000000104984  82..00+0000000000129919
83..00+0000000000013720  87..10+0000000000000000  71....+00000000000000BG
72....+0000000000000020  73....+000000000000000S  74....+000000000000000D

*410017+000000000000003  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000  45....+0000000000000000 46....+000000000002.250
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000

*410017+000000000000004  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000 45....+000000000004.760 46....  +000000000000000
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000

*410017+000000000000005  42....+0000000000000000  43....+0000000000000002
44....+0000000000000000  45....+0000000000000000 46....-000000000000.700
47....+0000000000000000  48....+0000000000000000  49....+0000000000000000
```

Tape Offset Pt. 3: Longitudinal Offset of +2.250

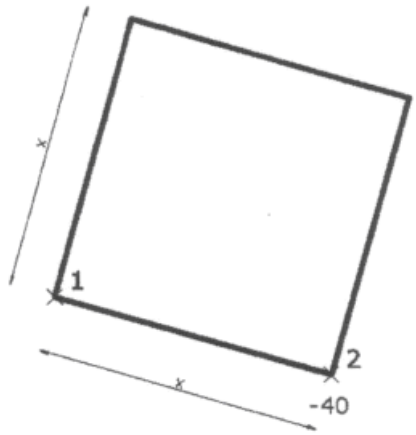
New Baseline is now Pt. 2- Pt. 3

Tape Offset Pt. 4: Lateral Offset of +4.760m (+Right)

Baseline now Pt. 3 – Pt. 4

Tape Offset Pt. 5: Lateral Offset of -0.700m (-Left)

Case 2: 2 Point Symbol OR 2 Point + Width

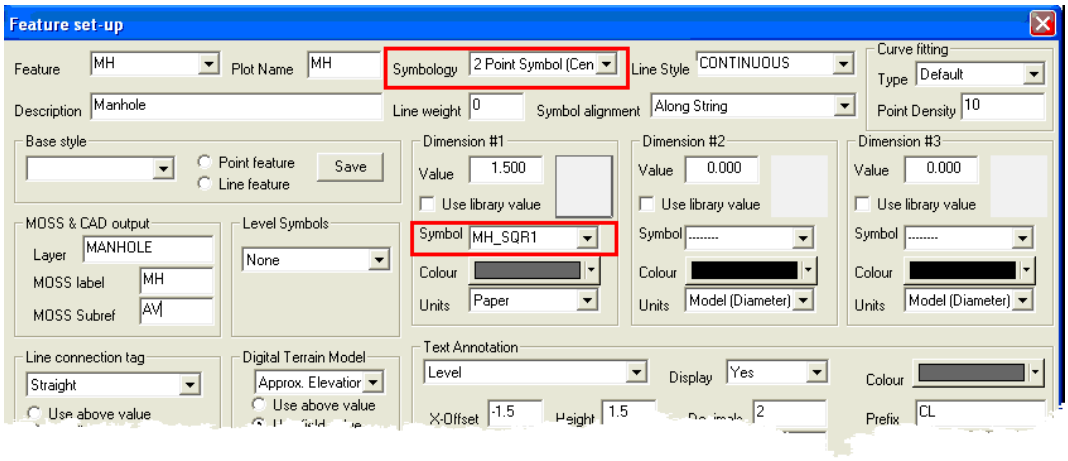


2 Point Symbol

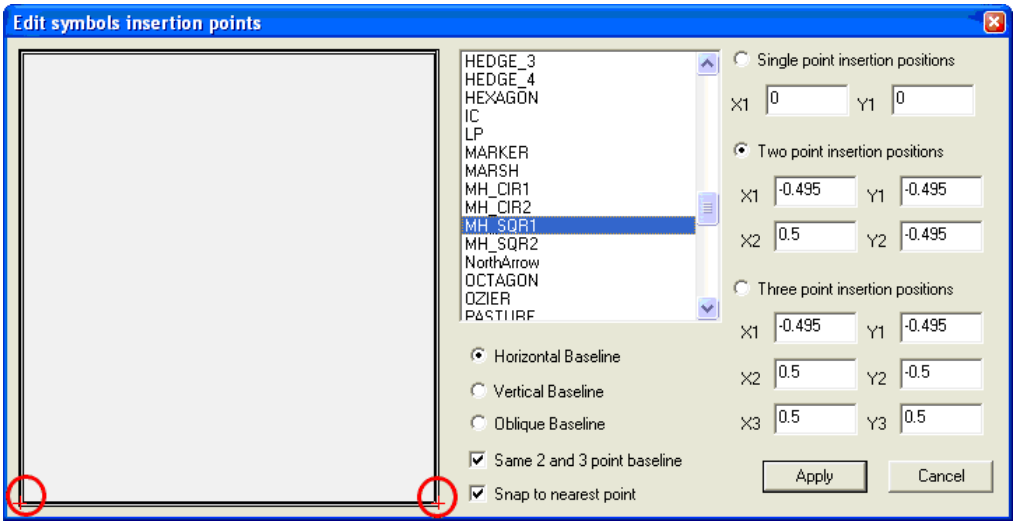
*110015+000000000000**01** 21.324+0000000001732120 22.324+0000000008645360
31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000030 73....+000000000000000S 74....+000000000000000D

*110016+000000000000**02** 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000030 73....+000000000000000S 74....+000000000000000D

Within the Project File assign '2Point Symbol (Side)' Symbology and select a Dimension 1 symbol which has side intersection points.

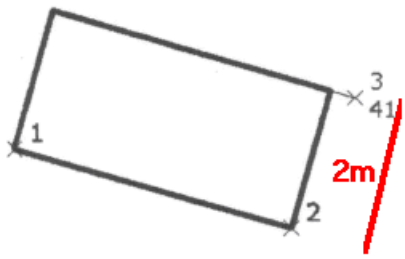


Within the Project select 'EDIT > Symbols > Edit symbols insert point'



Case 3: 2 Point + Width

Manhole / Utility Cover

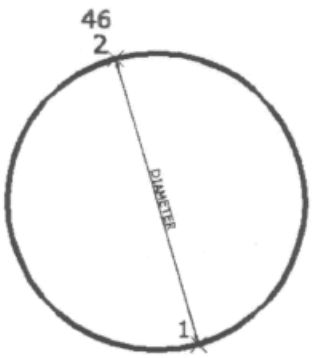


*110015+000000000000001 21.324+0000000001732120 22.324+0000000008645360
31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000020 **73....+0000000000000R2W** 74....+000000000000000D

*110016+000000000000002 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000MH
72....+0000000000000020 **73....+0000000000000R2W** 74....+000000000000000D

***410041+000000Dimensions** 42....+0000000000000000 43....+0000000000000000
44....+0000000000000000 45....+0000000000000000 46....+0000000000000000
47....+0000000000000000 **48....+000000000002.000** 49....+0000000000000000

Case 4: 2 Point Circle



*110015+000000000000001 21.324+0000000001732120 22.324+0000000008645360

31..00+0000000000030223 81..00+0000000000109092 82..00+0000000000128773
83..00+0000000000013208 87..10+0000000000000000 71....+00000000000000BG
72....+0000000000000020 73....+00000000000000**C2** 74....+000000000000000D

*110016+000000000000002 21.324+0000000000927290 22.324+0000000008548510
31..00+0000000000030413 81..00+0000000000104984 82..00+0000000000129919
83..00+0000000000013720 87..10+0000000000000000 71....+00000000000000BG
72....+0000000000000020 73....+00000000000000**C2** 74....+000000000000000D

25.3 Creating A Model

Go to 'FILE > Model > SCC Dataset'

Select 'Create the model and triangulation' and set Initial Plot Scale of 250

Select 'FILE > Save As'

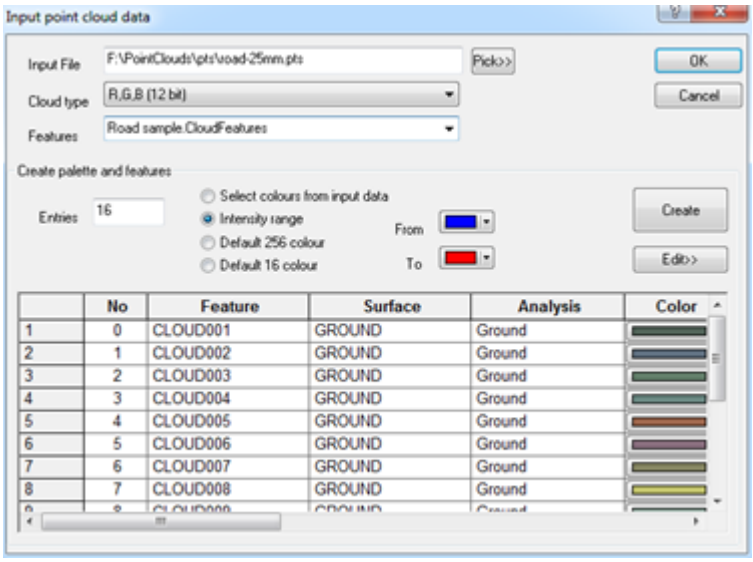
26 Point Cloud Module

To start using this functionality you must have the point cloud module licensed and can either create your own point cloud models or use the samples provided (Cathedral, Topo, and Bridge).

26.1 Importing Point Cloud Data

To create a new point cloud model you need data in either PTS, LAS, LAZ, or ESRI ASC format.

To start, select '**FILE** > **Model** > **Point clouds & LIDAR**' and pick the appropriate input format. This will show the following screen;

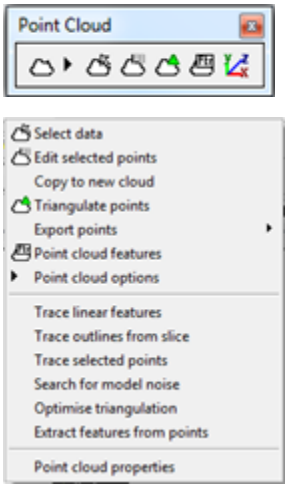


The colour usage option controls how much space is used per point, where RGB12 allows about 100 million points on a system with 1GB available memory. Palette colouring is slower to import data, but more efficient at the loss of some colour resolution. Selecting the Create palette option builds a palette and cloud feature library, based on paramers selected. This can be an optimized palette from the cloud RGB data, a colour range corresponding to intensities, or the standard AutoCAD 256 colour or VGA 16 colour palettes.

Pressing the Edit button allows you to make further edits to the point cloud feature library, and save it for re-use on other point clouds. This will be explained in more detail later on in this tutorial.

Point cloud functionality is accessed in the model via the **Cloud menu** and / or **Point Cloud tool**

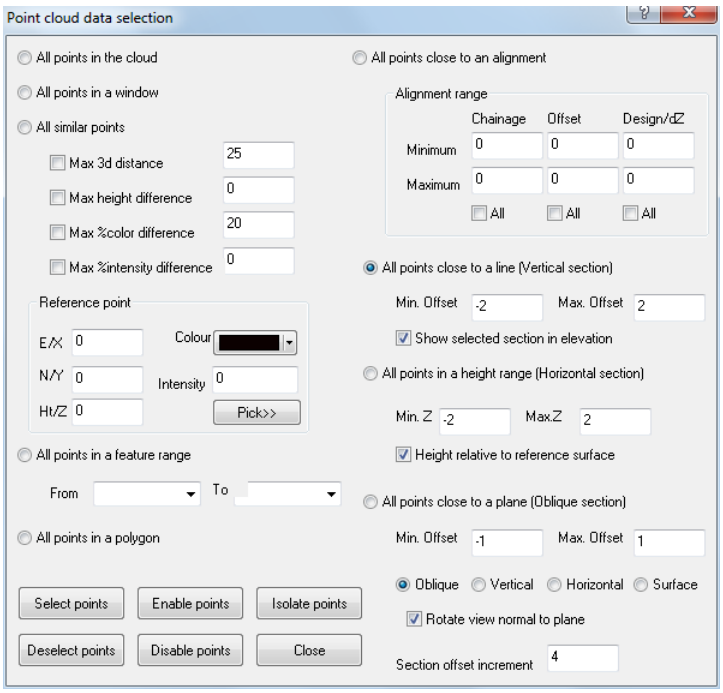
bar in the SCC model view.



In the current release of SCC a 13gb PTS file containing 270 million input points of X,Y,Z, intensity (no RGB color) takes about 34 minutes to process on a dual core PC running Windows 7 (64 bit) with 4GB of RAM. The SCC point cloud on disk comes out at 1.1gb, based on using 16 levels of intensity. Using an RGB12 format the same data takes 1.6gb on disk and takes 39 minutes. The current version of the software can handle approximately 300 million rgb colour points or about 450 million grey scaled, palletized or monochrome points. Anything larger than this would currently have to be broken into more than one file. This is based on a 32bit version of the software, where we are planning that the next major release will be a 64bit version supporting multi-billion point clouds on PCs with more available RAM.

26.2 Selecting And Isolating Parts of the Cloud

The most commonly used option will be data selection, which shows the point cloud selection dialog. The allows you to control how you are going to pick data (i.e. points in a window, points in a polygon, using a horizontal or vertical section / slice, relative to an alignment, points similar to a given reference point, points close to another SCC surface) and what to do with picked data.

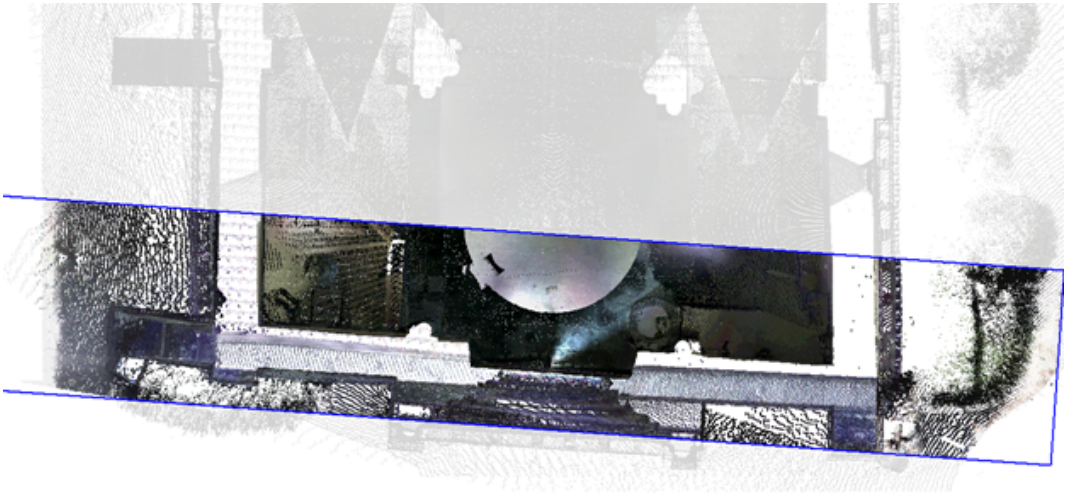


This includes selecting and deselecting data as per typical SCC usage, locking and unlocking

data which hides the data and prohibits it from being used in future operations, and isloting data which is the same as locking everything except the picked points.

To start with, we'll open the Cathedral model, and isolate an area of interest using the parameters as shown. After pressing All points close to a line and Isolate Data, the dialog is closed, and we can select the section of interest by clicking either end of its centre line.

This highlights the area of interest as an elevation and switches the colour of all the locked points to light gray. Pressing 'P' and 'E' we can move between plan and elevation view to get a better idea of what has just happened.



We can also use the up, down, left and right arrows to advance and move the section relative to the direction of view. The distance here is based on the Section offset increment in the data selection dialog, which can also be brought up using the right mouse button. From plan view we can also use the mouse at any stage to pick an alternate section as shown below;

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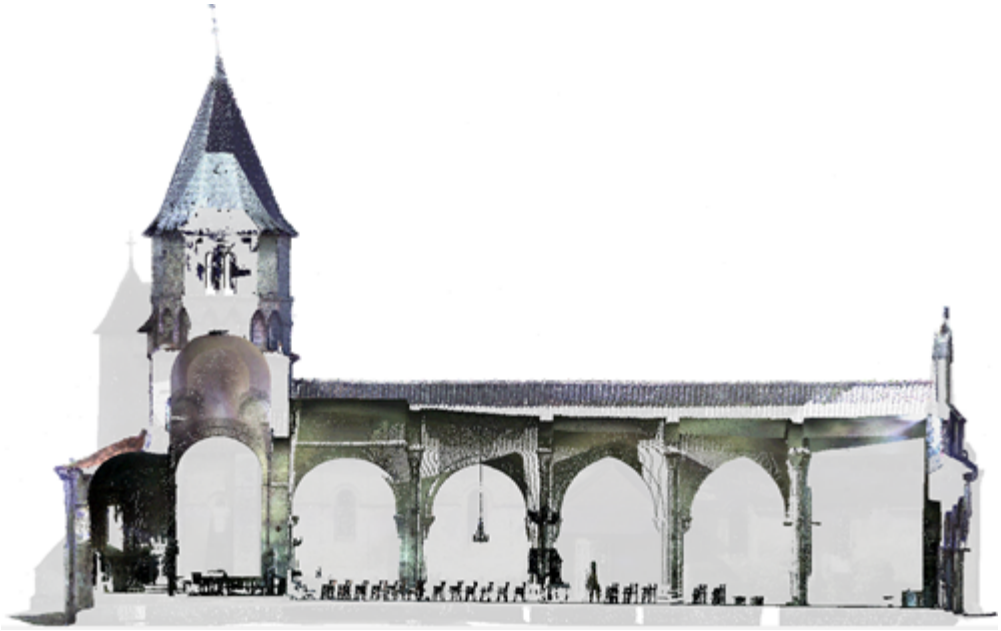

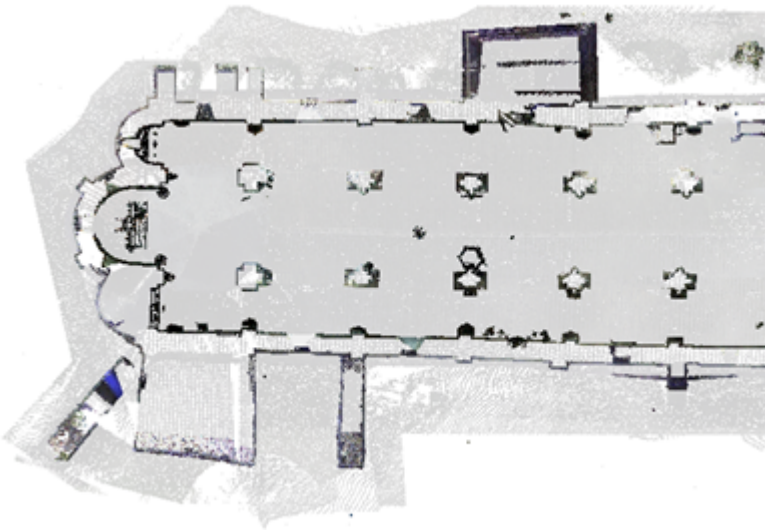

Other keyboard options are + and – to widen or narrow the area of interest, and L and X to move between long section and cross section related view when selection a sectional area relative to an alignment.

When a horizontal section / area of interest is in use the arrow keys may be used to raise or low the elevation of the section.

Note that as you move the cursor around in you cloud, either in plan or another view, you see the x,y,z position of the cursor in the cloud, and can snap to cloud positions as you would any other survey point. How this works is controlled via Cloud Options, which also helps control how the cloud is treated as a surface for section and volume analysis. Note that only active points are used for snapping, and other operations such as data selection, and export. This allows you to first select an area of interest for analysis purposes and hide all other parts of the cloud, and then select further points from that area of interest for editing. To illustrate this better we'll open our topographic model, TOPO, which if we look at in elevation contains a lot of trees and street furniture that we would like to exclude from any surface analysis such as sections, volume, and contours.

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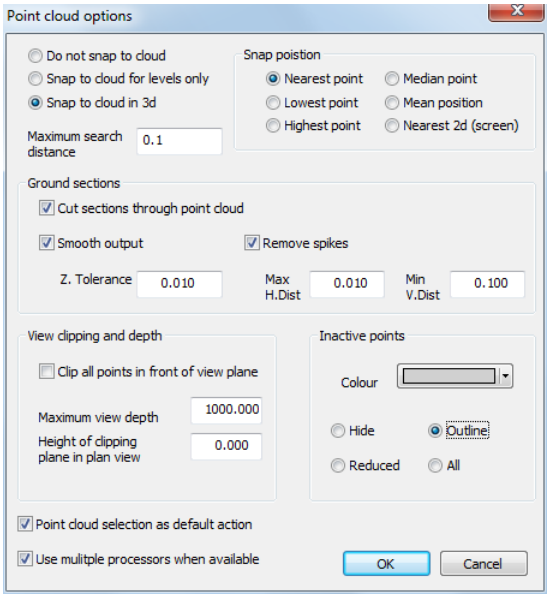
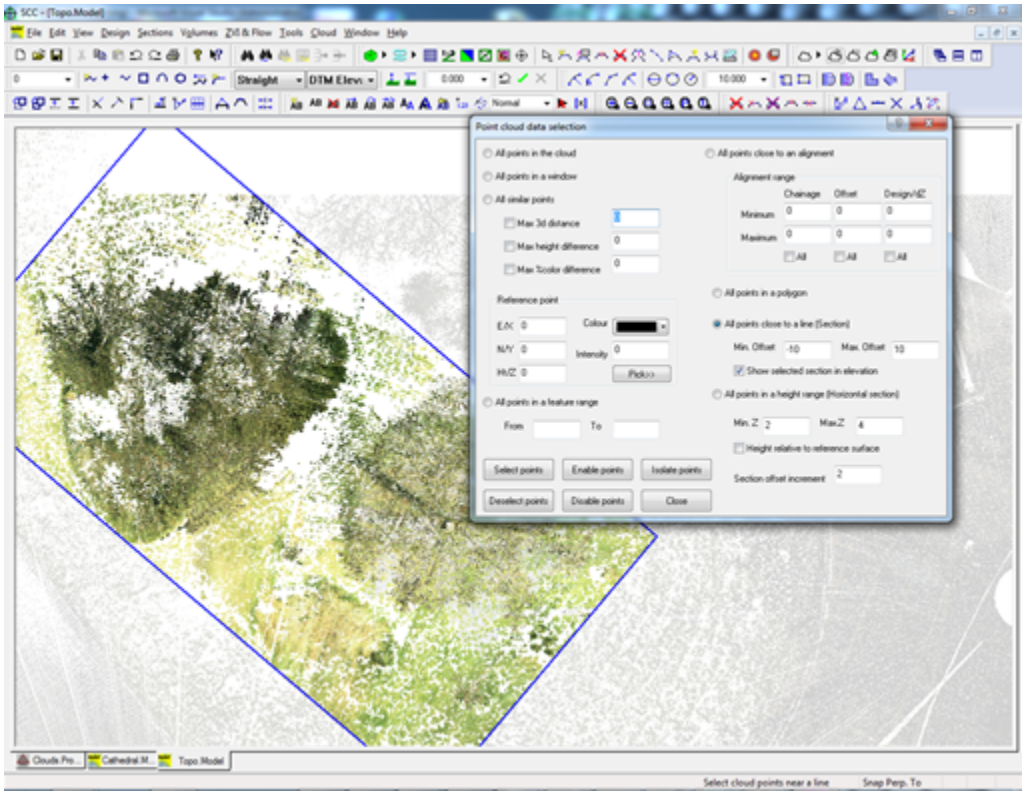
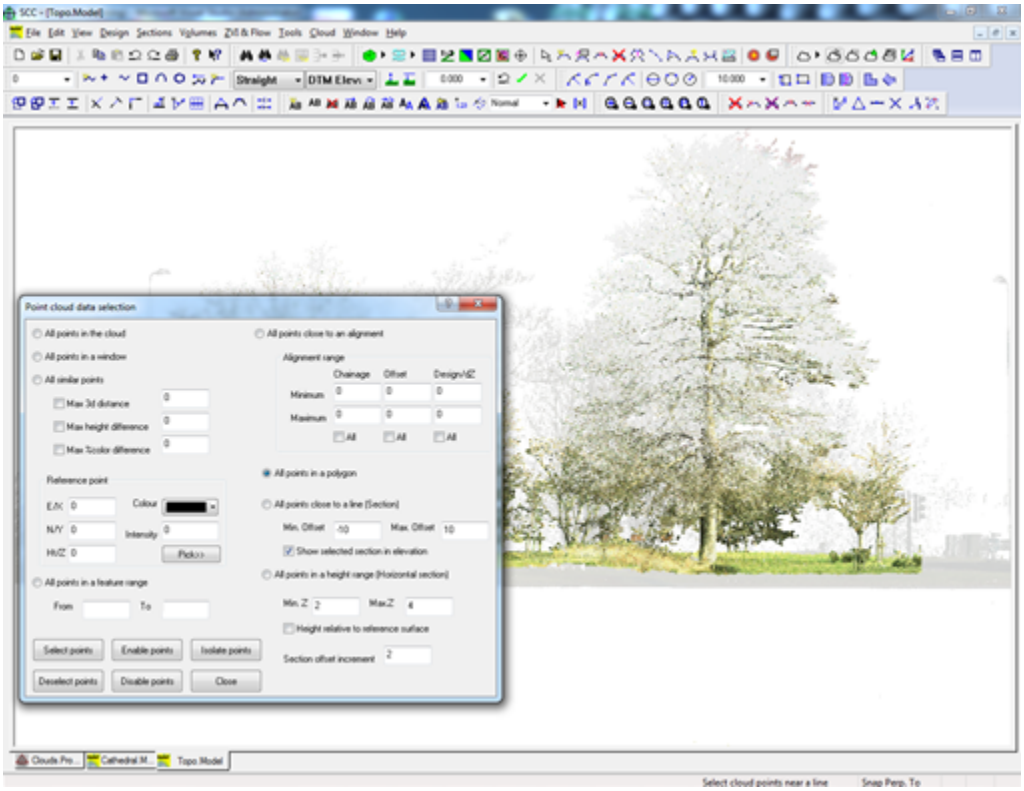
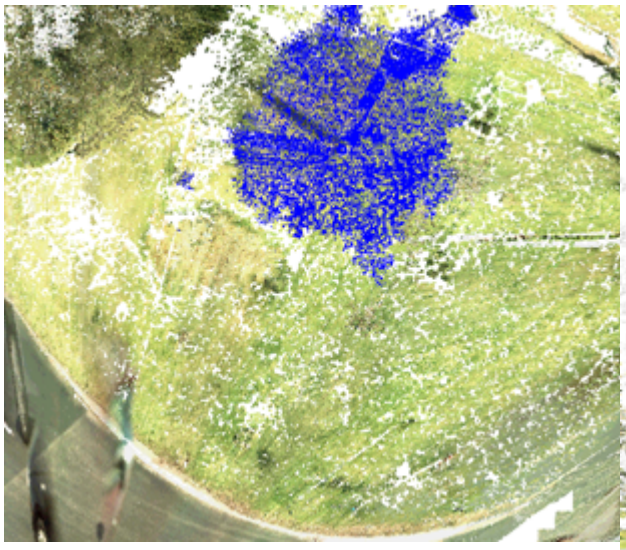


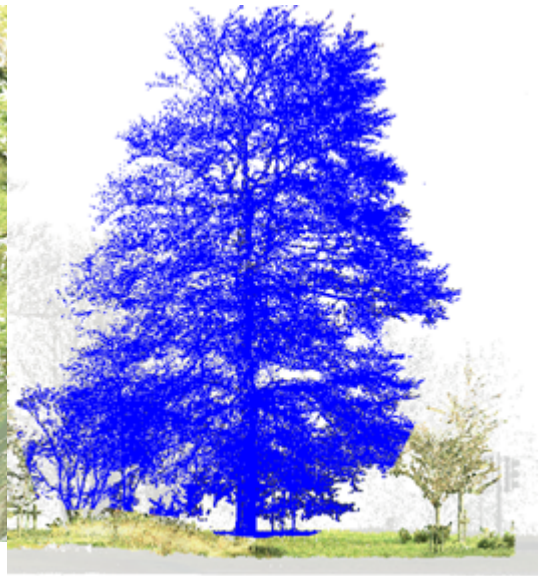
To get an elevation of the entire cloud, we'll use **'VIEW** > **Rotate Viewpoint** > **Two point elevation'**, picking points at either end of the road. While we can get all of the upper foliage using a polygon selection method, trimming the trunks closer to the ground is more problematic, as some are hidden behind hills, fences or in dips in the ground.

The solution here is to first isolate an area of interest, and then select from within that area, e.g.


SCC - [Topo.Model]
File Edit View Design Sections Volumes Drill & Flow Tools Cloud Window Help
Straight
DTM Elevs
Point cloud data selection
All points in the cloud
All points in a window
All similar points
Max 3d distance
Max height difference
Max Rgb difference
Reference point
E/X
N/Y
H/Z
Colour
Intensity
Pick>>
All points in a feature range
From
To
All points close to an alignment
Alignment range
Chainage
Offset
Design/HZ
Minimum
Maximum
All points in a polygon
All points close to a line (Section)
Min. Offset
Max. Offset
Show selected section in elevation
All points in a height range (Horizontal section)
Min. Z
Max. Z
Height relative to reference surface
Section offset increment
Select points
Enable points
Isolate points
Deselect points
Disable points
Close
Clouds.Pro...
Cathedral.M...
Topo.Model
Select cloud points near a line
Snap Perp. To







Note that one of the quickest ways of carrying out this type of analysis on a large topographic model is to develop a rough SCC TIN model based on a sample of spot levels taken from the cloud, and selecting all the points a set distance above this model, by ticking Height relative to selected surface in the data selection dialog.

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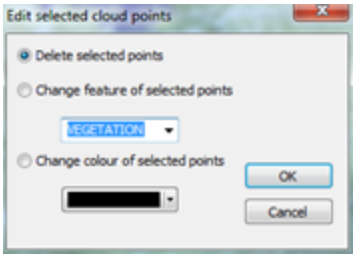
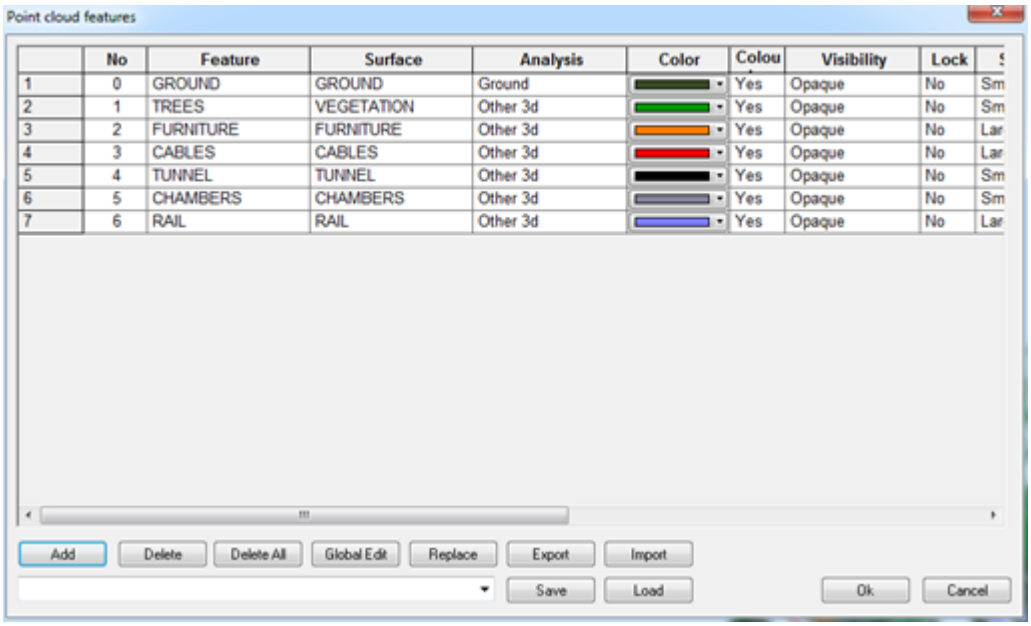


Once we have data selected, we can copy it, delete it, re-colour it, and most importantly group it by feature using **'Cloud** > **Edit selected points'**. This is done using **'Cloud** > **Point cloud features'** , which shows the following dialog. Most commonly, we will be changing the feature of selected points. Once we have have assigned features to groups of points we can then process those groups and tell SCC how they work with different types of analysis.

26.3 Point Cloud Feature Library

The point cloud feature library is used to break down the cloud into groups of points on similar feature, e.g. all points corresponding to vegetation, all points corresponding to the road surface etc… This allows us to fine tune how analysis operations work, as this will change significantly based on the type of feature. E.g. how we cut sections through the ground will be different to how we cut sections through more complex 3d features such as buildings.



	No	Feature	Surface	Analysis	Color	Colou	Visibility	Lock	S
1	0	GROUND	GROUND	Ground		Yes	Opaque	No	Sm
2	1	TREES	VEGETATION	Other 3d		Yes	Opaque	No	Sm
3	2	FURNITURE	FURNITURE	Other 3d		Yes	Opaque	No	Lar
4	3	CABLES	CABLES	Other 3d		Yes	Opaque	No	Lar
5	4	TUNNEL	TUNNEL	Other 3d		Yes	Opaque	No	Sm
6	5	CHAMBERS	CHAMBERS	Other 3d		Yes	Opaque	No	Sm
7	6	RAIL	RAIL	Other 3d		Yes	Opaque	No	Lar

The point cloud feature fields are as follows;

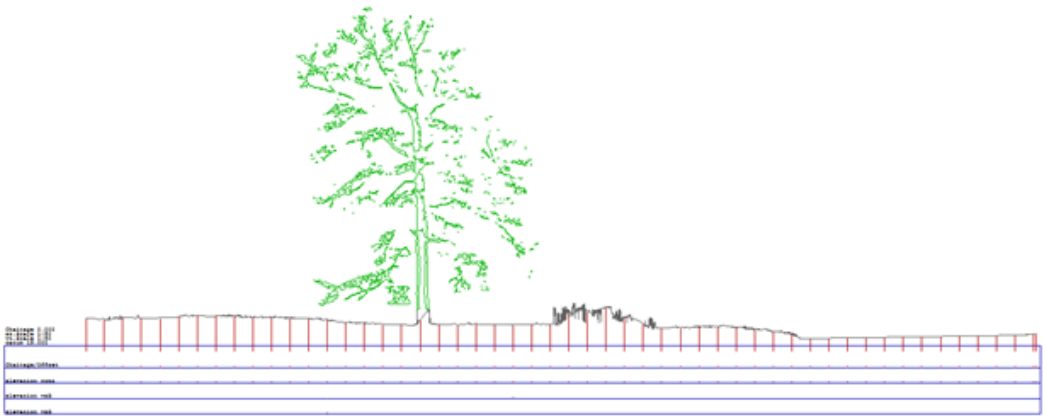
- Feature – The name of the feature
- Surface – The surface on which the feature is placed. Note that you can have multiple features placed on the same surface, e.g. trees and bushes might both go on a vegetation surface
- Analysis – This controls how SCC interprets these points for surface analysis purposes. Options are
  - Display only – The points are displayed only, but not subject to analysis
  - Ground – The points are treated in the same way as the triangulation surface in a normal SCC model, from the point of view of sections, volumes, draping points, extracting levels, etc…
  - Other surface – The points are treated in a similar manner as an additional triangular

surface, such as a reference model.

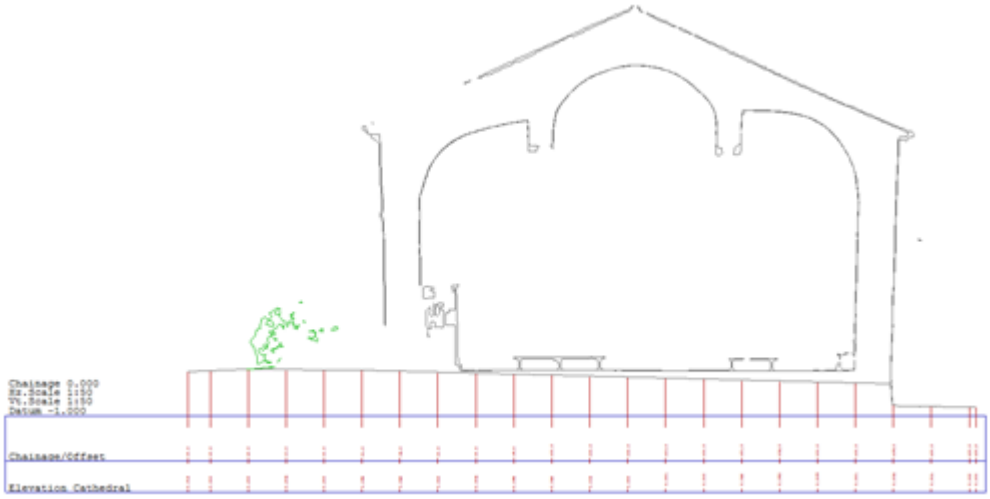
- o Other 3d – The points are treated as a non-mappable 3d surface, not suitable for surface analysis operations. Sectioning through 3d surfaces will be considerably slower than ground / mappable surfaces.

- Colour – The default colour of this feature when not coloured by point
- Colur by point – Whether points on this feature have individual colours or the same colour
- Visibility – Controls whether or not these points are displayed, and if they are displayed whether they are considered opaque or transparent.
- Lock – Whether or not these points are included in analysis
- Size – The size of displayed points
- Sect. Width – The search corridor width used when cutting sections through this feature. Note this will typically be small for ground surfaces, e.g. 10mm, and larger for 3d surfaces, e.g. 100mm – 500mm. The larger this value, the more 3d data will get projected onto a section and analysed. This in turn can slow down processing and significantly increase the size of sections produced.
- Max Dist. – For 3d features, the maximum distance to which points will be connected.
- Trace Dist. – For 2d features extracted by tracing selected points, the maximum distance between adjacent points
- Min. Length – For all traced output, the minimum total string length allowed for a string to be included in the output.

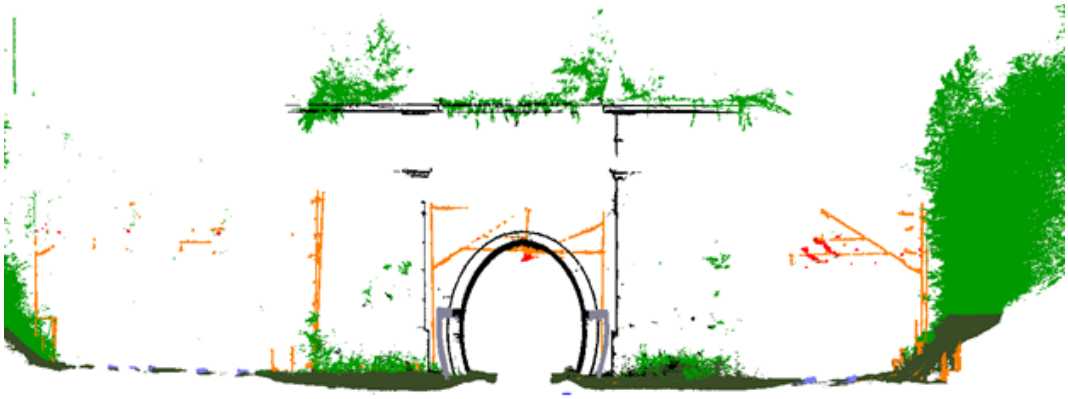
The cathedral and topo models already have some features applied. Thus is you cut sections through them, you'll see different items appearing. For example, if we use **'SECTION > Long section with cursor'** through our topo model taking in the tree above, we get the following;



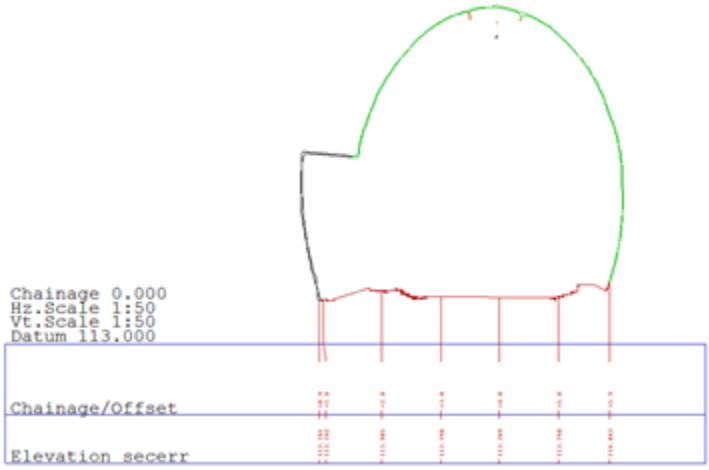
And similarly for the cathedral;



The feature library is also very useful for quickly colouring and analysing monochrome point clouds, as shown in the model below (Tunnel 950-1050 (edited).Model)

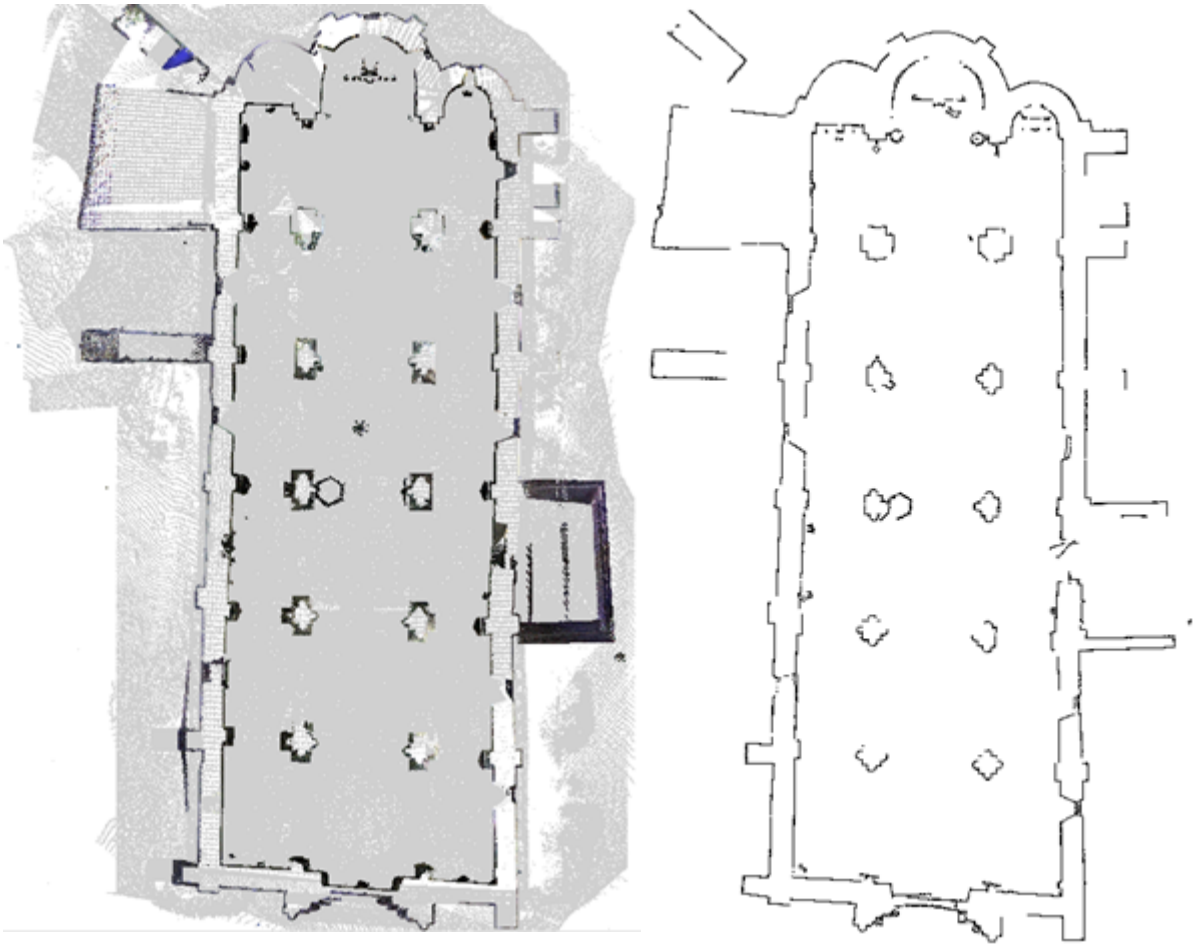


By selecting and isloting appropriate elevation and sectional areas, we can quickly differentiate the tunnel, cabling, rails, and foliage. This in turn allows is to cut complex sections, develop a ground surface and isolate features of interest.



26.4 Tracing Sections and Slices

In addition to cutting sections there are a number of other ways to extract linear data and analyse cloud surfaces. The simplest of these is via **'CLOUD** > **Trace outlines from slice'**, which will draw outlines based on an isolated sectional area. This can be either from plan, elevation or based on an oblique viewpoint.



The results can then be exported to other packages, such as CAD, in 2d or 3d, and multiple slices can be used to build-up a wire frame model from your cloud. The cloud feature library determines how the data is analyses, where the centre of the displayed section or slice is used as the centre-line for sectioning.

26.5 Tracing Linear Features On A Point Cloud

The option **'CLOUD** > **Trace Linear Features'** allows us to trace linear features contained in a point cloud by matching points on a section template to points in the cloud at regular chainages along an alignment. This is done in a split screen view, with the template details shown below the model, updated in real time as the template is developed.

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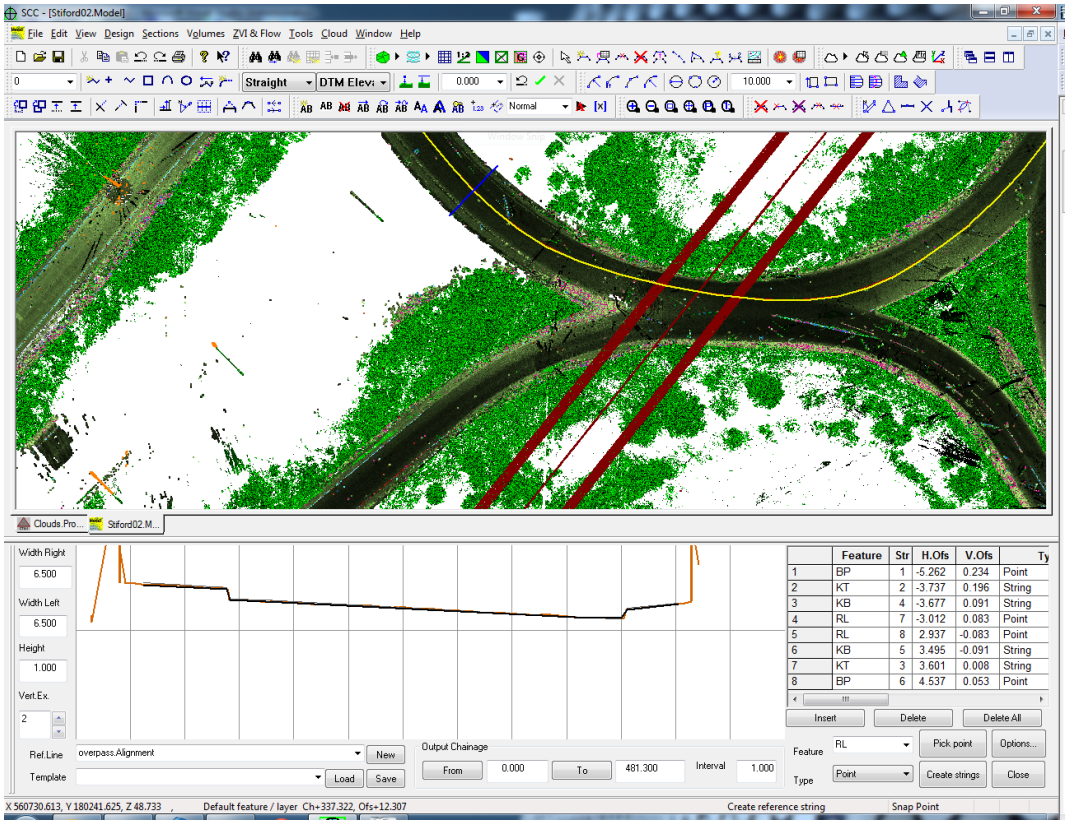


The stages involved are as follows;

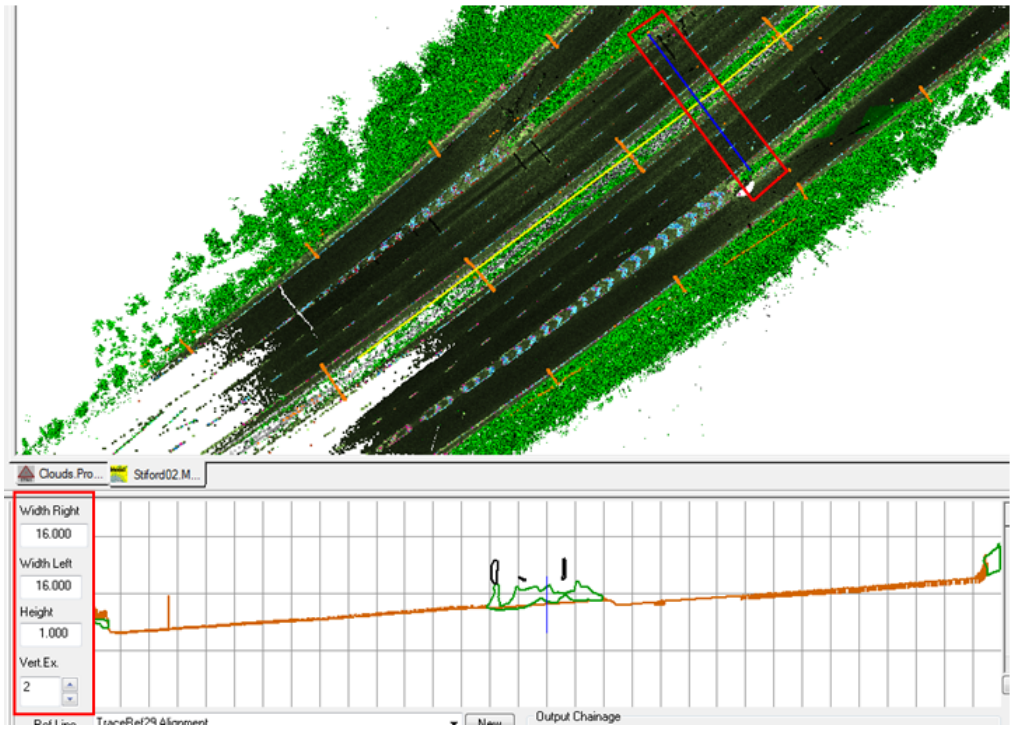
26.5.1 Select Or Create A Reference Alignment

This is a design line running roughly parallel to the features you want to extract. If you already have a suitable alignment attached, you can pick it using the Ref Line drop down. You can also interactively draw a new alignment as follows;

- Select an active tag code of Curve or Straight as require.
- Zoom into the area of interest in the model.
- Press New to create a new reference string.
- Left click on two or more points on the desired reference string.
- Right click to finish creating the reference string and start creating the template.
- The reference line will be saved such that it can be re-used later as required.

26.5.2 Enter Template Size & Parameters

Before creating our template we need to enter its width and height in reference to the centre line. We can also enter a vertical exaggeration to make it easir to find features such as kerbs.



Having entered width, height, and vertical exaggeration, as we move the mouse along the alignment in plan, we see a section cut through the cloud at the chainage corresponding to the mouse position. Pressing the left mouse button will lock the chainage to the current position, in order to allow us to create template points, pressing the right button unlocks the chainage to examine sections at other chainages. It is important that the widths specified are large enough to encompass the features being sought at all required chainages.

26.5.3 Creating Points On The Template

Once we have locked the section at a given chainage position, we can add points to the template either by left clicking on the section or the plan. This has the effect of adding points to the section template overlaying the cut section, and showing the details of those points in the accompanying spreadsheet to the right of the section drawing.

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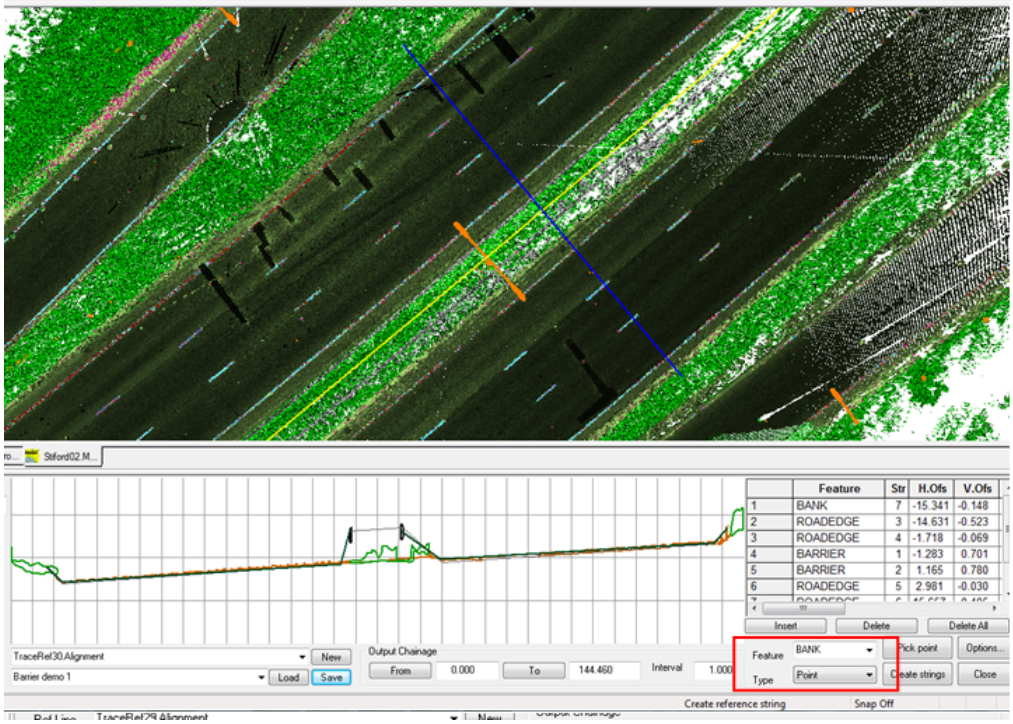

Newly created points are given a feature name and type based on values entered. The types are as follows;

- String – A string line will be output to the model based on this section template point. For any given chainage, a point in the cloud corresponding to this point on the template must be found for the template to valid.
- Point – A point will be output at each chainage to the model based on this section template point. As per the string, this point is required for the template to be valid.
- Reference – Nothing is output to the model, but a point corresponding to this point is required for the template to be valid.
- String (Opt) – A string line will be output to the model based on this section template point, but it is not required for the template to be valid.
- Point (Opt) – A point will be output to the model based on this section template point, but it is not required for the template to be valid.

Once the template points have been entered, right clicking the mouse allows us to unlock the chainage and test how well the template matches the points in the cloud at differing positions along the alignment.

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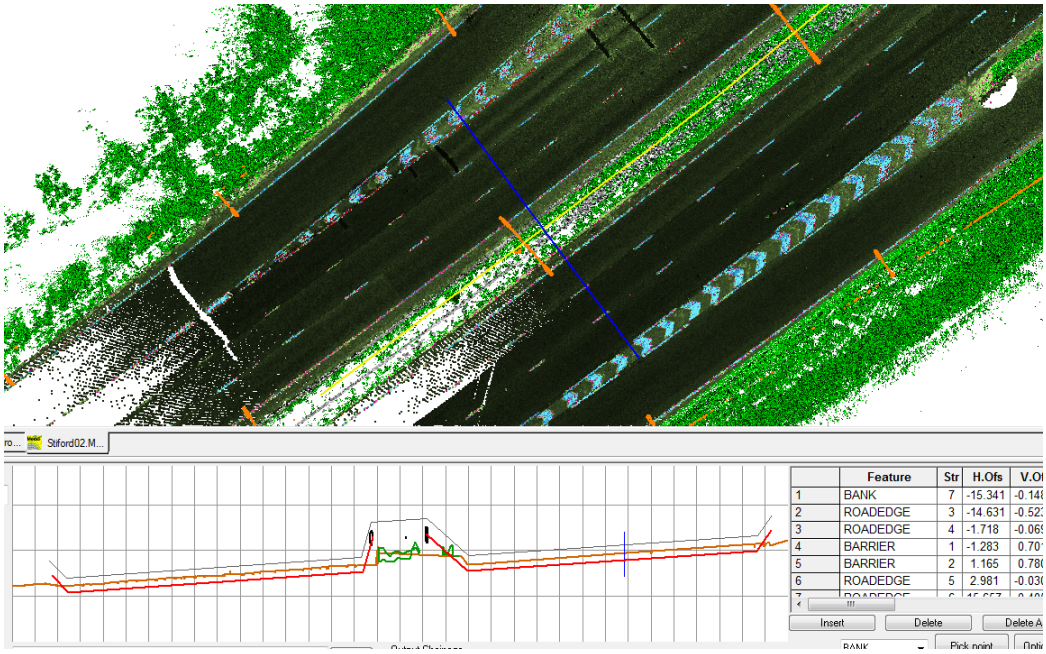


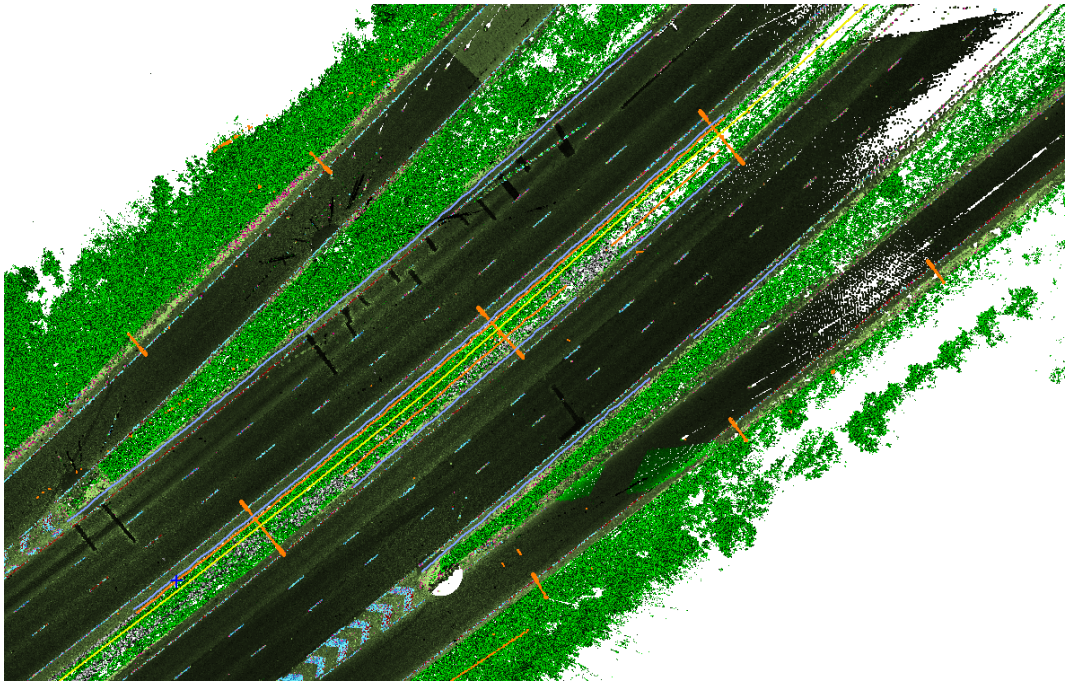
If the template is not valid at the current chainage, it is drawn in bright red. For example, in the case above the left and right road edges don't exist so a match to the template is not found. If those template points were optional, i.e. They had a type of String (Opt), the section would still be valid.

We can also save our template to file once created, such that it can be re-used elsewhere in this point cloud and future point clouds, simple by entering a template name and pressing Save.

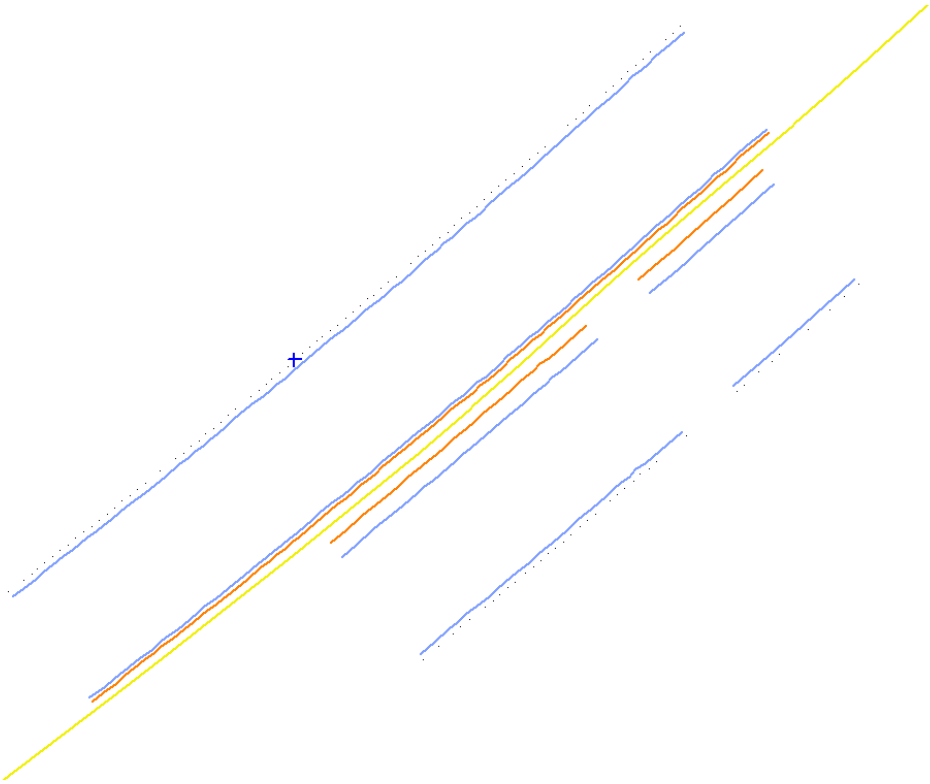
26.5.4 Creating Strings

Once we have created our template, we can generate our model by entering a chainage range and interval, and pressing **Create strings**. To pick a **From** or **To** chainage simply lock the section at the desired chainage by pressing the left mouse button and then clicking on the required From or To chainage button.

Created strings seen here with the cloud turned on

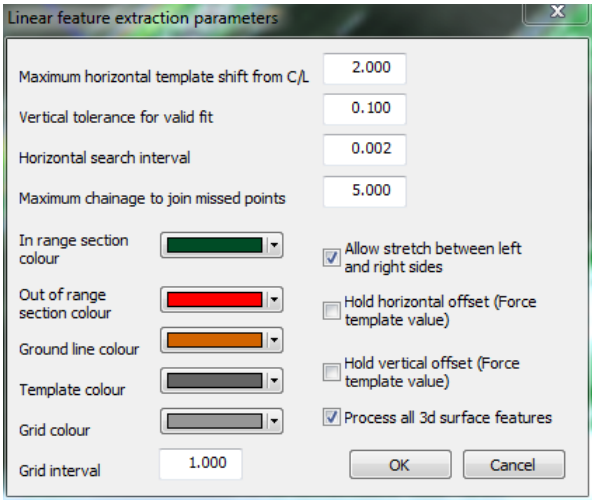


And below with the cloud turned off. Note the gaps in the strings at certain positions where an acceptable match to the template could not be found. This will typically be due to an interference factor, such as a car on the road obscuring the required point, or a required template point not existing on the ground at a given chainage.



26.5.5 Linear Feature Extraction Parameters

Pressing the options button from the linear feature extraction dialog brings up an additional parameters dialog that allows us to fine tune how the extraction process works. These parameters are as follows;



Maximum horizontal template shift from C/L

This controls how far the entire template can be shifted from the design centre line and still remain valid. Larger values enable the same template to be used over a wider range of conditions, but can also introduce incorrect data into the output.

Vertical tolerance for valid fit

This value, typically a few centimetres, is how close the relative height difference between points on the ground and points on the template must be to be considered valid.

Horizontal search interval

This value, typically a few millimetres, is the search interval used when matching template sections to cloud sections. The smaller the value, the better the probability of finding a fit, and the improved accuracy of the fit, at a cost of processing speed.

Maximum chainage to join missed points

When the template does not match the ground at a given chainage no points are output. Where the chainage distance between successive points on the same string fall above this value, a gap is introduced into the string.

Allow stretch between left and right sides

This switch allows the left and right points on the template to be treated as separate templates. This allows horizontal and vertical shift between left and right hand sides, while still holding the template valid. It also allows strings on one side of the template to be valid, even if the other side is not valid.

Hold horizontal offset (Force template value)

This forces the horizontal section template position to be held for all chainages

Hold vertical offset (Force template value)

This forces the height difference between section template points to be held for all chainages. The default is that the output height is based on the cloud values where other tolerances are met.

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Process all 3d surface features

This controls whether analysis is limited to cloud points on the primary ground feature, or whether all 3d feartures are analysed as in the example above. Analysing all features is significantly slower than limiting the analysis to ground features.

Grid colour

The colour of grid lines in the section display

Ground line colour

The colour of the interpolated ground line at the current chainage in the section display. Note that other 3d features take their colours from their point cloud feature library entries.

In range section colour

The colour used to draw the template as fitted to the ground at the current chainage, when the fit produces valid output based on the tolerances given.

Out of range section colour

The colour used to draw the template as fitted to the ground at the current chainage, when the fit does not produce valid output based on the tolerances given. The details drawn are based on the best fit found.

Template colour

The template line, not fitted to the ground, as it was originally entered

Grid interval

The horizontal and vertical grid interval on the section.

26.6 Extracting A TIN Surface From The Cloud

We can also triangulate selected areas of interest for further analysis and export to software that does not support point clouds. In this case we've created a small alignment and selected points in an area 7.5M either side of the centre line as shown below.

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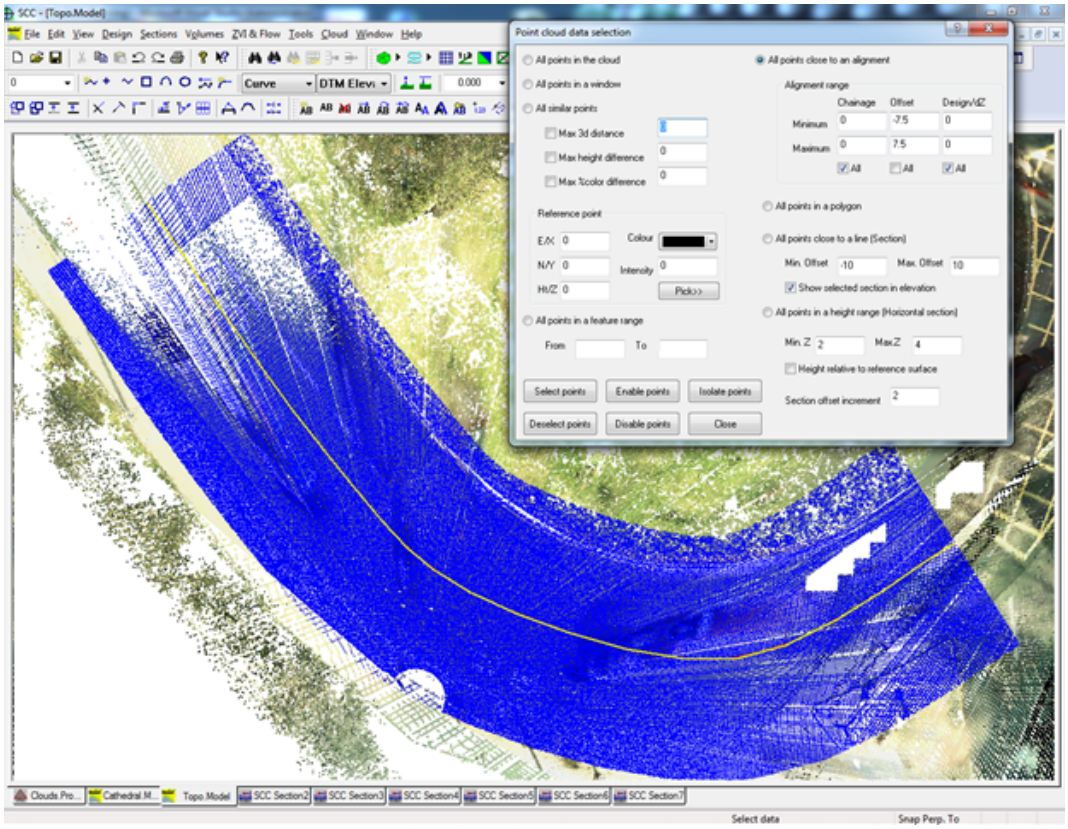
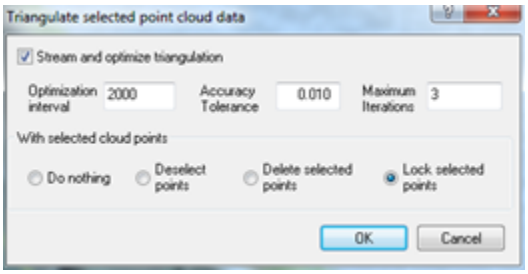


To triangulate the data we select '**CLOUD** > **Triangulate points**', which gives us the option of producing an optimized triangulation of the selected data. This reduces the amount of points used from the selected points in the cloud to just those required to achieve the stated vertical tolerance, in this case 10mm.



Note, this option can be slow depending on the parameters and the number of points selected. To improve performance and final result remove or isolate noisy features such as grass, trees, cars, street furniture and overhead cables prior to running this option. Only selected points whose features have an analysis type of **Ground** are considered when running this option, so simply changing the feature of such points to any other feature will accomplish this.

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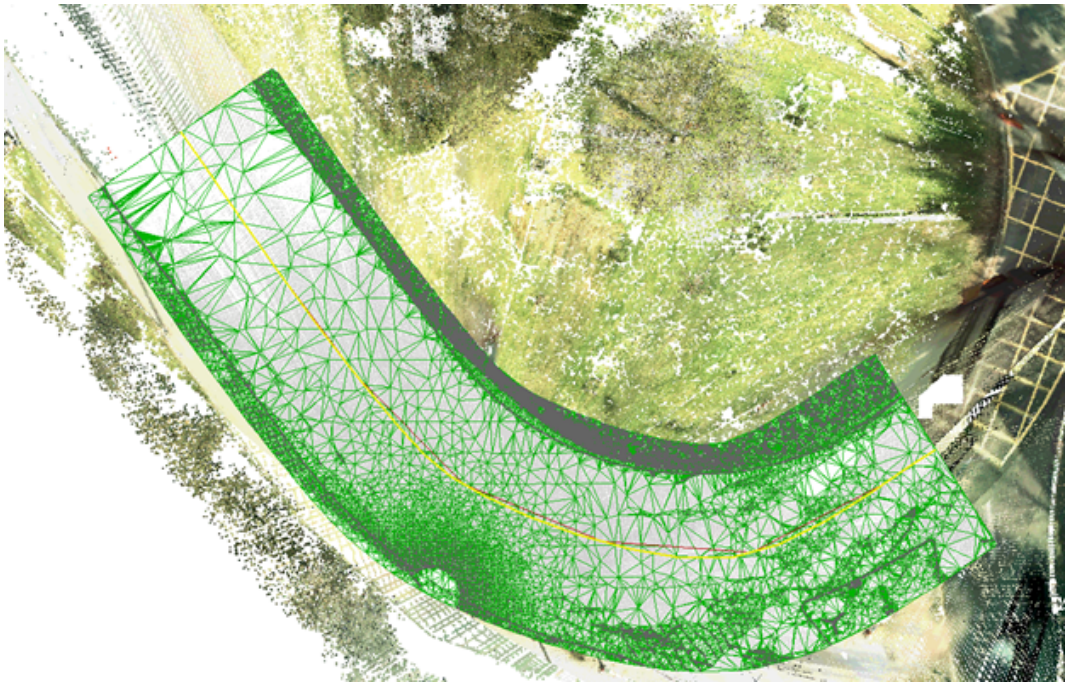
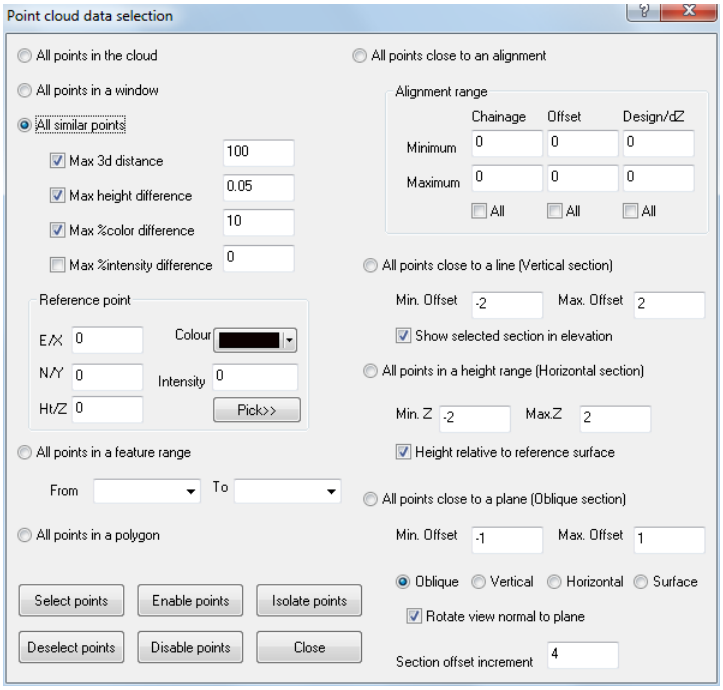


Other options relating to point cloud processing include linear feature extraction, density based feature extraction (stringing clumps of points), tracing string manually in conjunction with cloud snap, and use of other surface based tools in conjunction with the point cloud ground surface rather than the TIN.

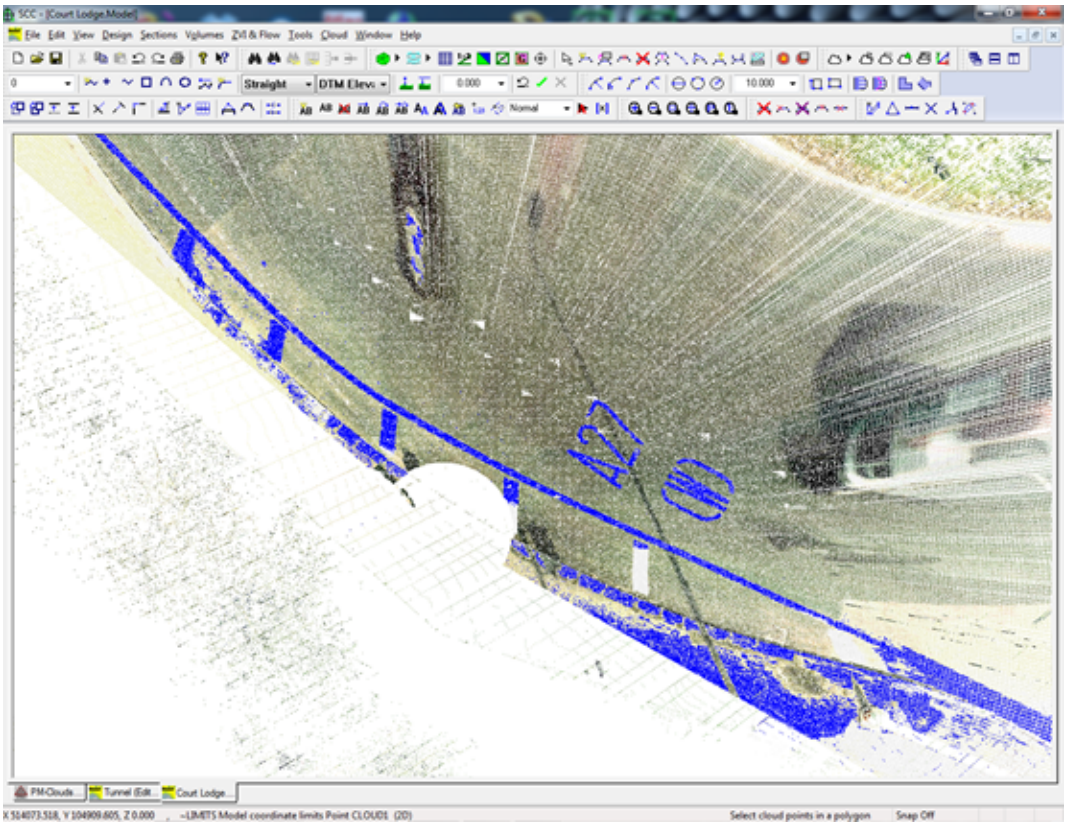
To add further information to our TIN model, from coarser areas of the model that may have lower accuracy requirements, we can use **'TOOLS** > **Extract a grid of levels'**, and add the generated data to the TIN created above, along with traced linear features such as kerbs described earlier. Note that when extracting a grid of levels, it is best to select the option to snap to the level of lowest point in the defined snap search radius, as this will tend to generate a more uniform surface, skipping small vegetation and similar items. This is set under **'CLOUD** > **Point cloud options'**.

26.7 Tracing 2D Features Such As Road Markings

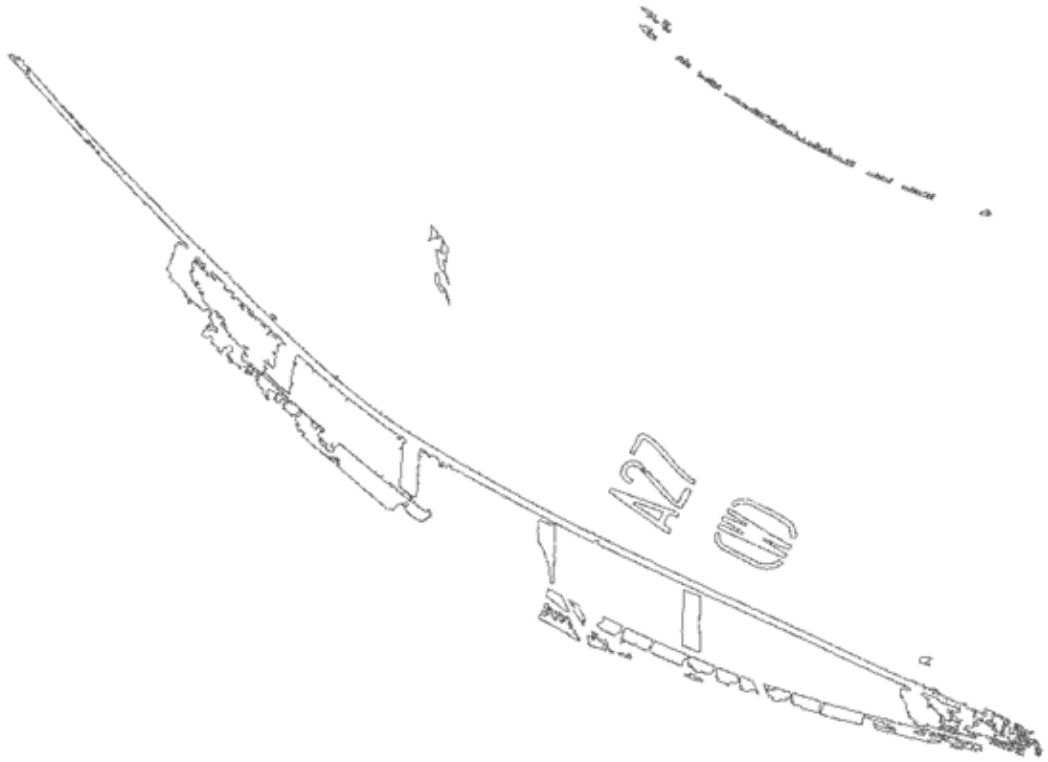
We can also use the SCC point cloud module to trace outlines of features using a combination of colour / intensity difference, height difference and distance from a reference point. To do this we start by selecting similar points as shown in the selection dialog. We start by pressing the **Pick**>> button to select a reference point for colour and position, and then press **Select points** to highlight all the points that are similar to that reference point. Note that if we were trying to pick up road markings we could first isolate the road area using a chainage / offset or polygon selection first.



Our selected data will appear as shown below;



We would typically now use additional reference points to add more data, and polygon based de-selection of any areas that were included but not required. Removing points in this many will also speed up the tracing process, and reduce the size of the output model. Selecting **'CLOUD > Trace selected points'** produces the following;



26.8 Using The Cloud With Other SCC Model Options

Most SCC options can interact with the cloud in a similar manner to the TIN surface generated from a traditional total station or GPS survey. This is largely controlled by use of the point snapping and sections mechanisms in '**Cloud** > **Cloud options**'. The following snaps are available;

- Do not snap to cloud – The cloud is not used with other SCC string creation functions.
- Snap to cloud for levels only – The cloud is used in plan view for interpolating elevations only.
- Snap to cloud in 3d – The cloud is snapped to in full 3d, regardless of the viewpoint.

When using could snaps, and interpolating from the cloud as a surface in general, a search radius is used. If a cloud point is not found within this radius, the cloud snap fails. When interpolating levels, the underlying TIN is used in place of the cloud in this circumstance. This allows us to seamlessly mix TIN and cloud interpolation in a single model.

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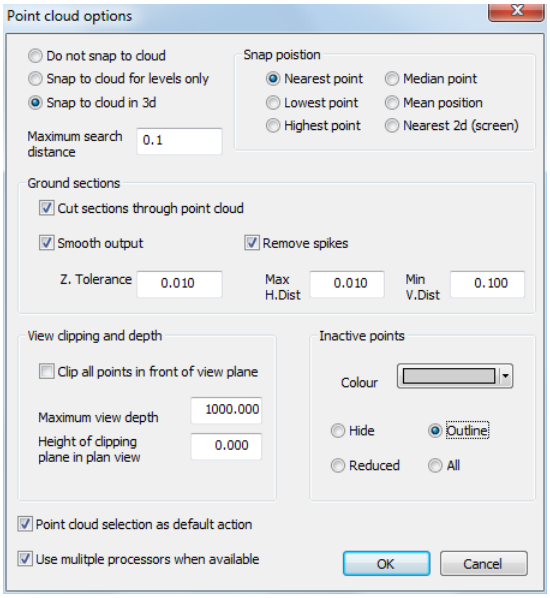


Given that we're searching for cloud points in a given radius, we can also control how the selected point or points are determined and used as follows;

- Nearest point – The nearest point to the desired position, e.g. mouse cursor position, is used
- Lowest point – The point with the lowest elevation of the points in range is used. This can be very useful for manually tracing lines such as bottom of kerb, where bottom of kerb and top of kerb are very close and difficult to distinguish. If is also very useful for extracting grids of elevations over ground that may include vegetation and other spurious high points on the ground such as lamp posts. Note that this option is best selected with small search radii, and used judiciously.
- High point - The point with the lowest elevation of the points in range is used. This can be very useful for manually tracing lines such as top of kerb.
- Median point – The point nearest the mean position of all the points in the selection radius is picked. This can be useful for drawing strings represented by dense linear groups of points in the cloud, such as walls shown in the slice taken from the cathedral model previously.
- Mean point - The mean position of all the points in the selection radius is picked. This will not correspond to any one point.
- Nearest 2d (Screen) – The point drawn on screen nearest the mouse cursor is picked.

For options such as sectioning, volumes, extraction of grids, draping of 2d data to extract levels, etc… the option to **Cut sections through the point cloud** must be selected. This allows the cloud to be used in a similar manner to a TIN surface for most SCC surface analysis operations. Interpolation is limited to points with a feature **Analysis** set to **Ground**, so it is very important to change the feature of all other cloud data, such as vegetation, buildings and overhead lines, prior to interpolating from the cloud in this manner.

For sectional analysis, we can also specify a level tolerance for smoothing, and horizontal and vertical tolerances for removing spikes from the section. This is necessary as cloud data is far denser than conventional survey data and is prone to include a significant amount of noise. Smoothing and spike removal also greatly reduces the size of the data extracted, which is also typically beneficial.

Other options on the same dialog control how the point cloud is visualized. These control whether the display is clipped behind and in front of the viewing plane, typically when using two point elevations, and how isolated points are displayed. Note that clipping the view has no effect on point selection in the way that isolating or disabling points would. Displaying Inactive points allows you to see where your active points are in relation to the rest of the cloud. Inactive points are always transparent and typically drawn in a lighter colour. Displaying a

reduced number or outline of isolated points will reduce display clutter and improve display speed on larger clouds.

26.9 PTS Point Cloud Data

PTS data can be reduce, processed and compared within SCC. Additional options are also available to extract linear features such as kerb lines from the data.

26.9.1 Extracting Linear Features From PTS Point Clouds

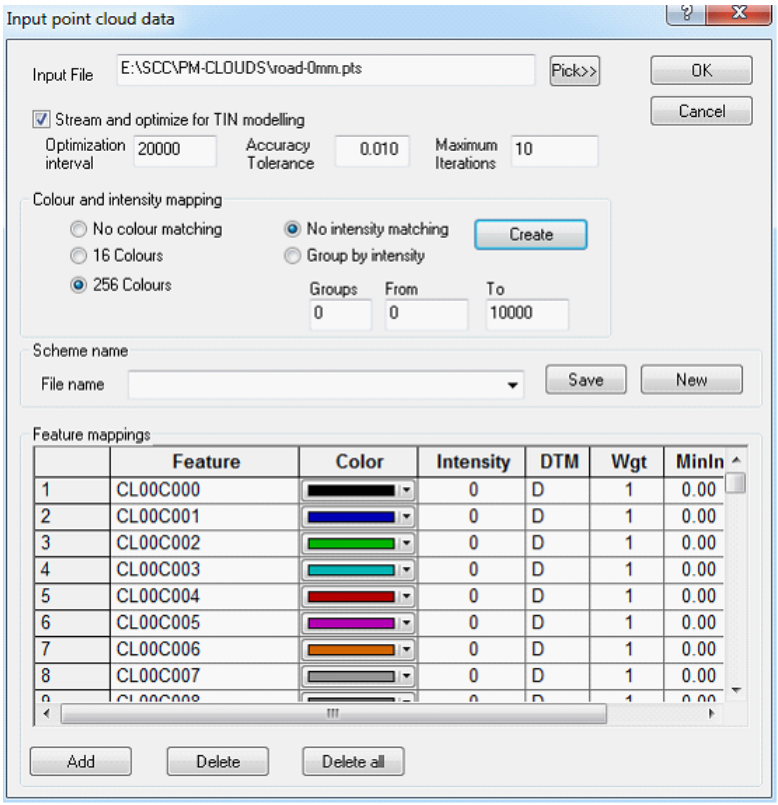
SCC can reduce, process and extract linear features such as kerb lines from PTS cloud data. The steps are as follows:

Create a new project, or open an existing one

'FILE > Open > SCC Project' and pick 'PM-Clouds.Project'

Model PTS File

Select 'FILE > Model > Point clouds & LIDAR > PTS file' which will show the following dialog:



The default options shown above stream in a RGB file which is mapped to a palette of 256 colours to an accuracy of 10mm. The fields are used as follows;

Stream and optimize for TIN modelling

Selecting this option inputs processes the point cloud in smaller sections such that SCC can handle very large point clouds relatively quickly. As data is input it is optimized to the specified vertical tolerance, and any points that would not make a change to the final surface are discarded. This eliminates vast number of co-planar points where they exist, leading to a much smaller, faster and more efficient TIN model without sacrificing any accuracy as would be the case with simpler decimation techniques.

Accuracy Tolerance

This is the vertical accuracy to which the TIN model is optimized. All points that would not affect the final surface by more than this amount are removed.

Maximum Iterations

This specifies the maximum number of times the optimization process is repeated. If no changes are made on any given iteration, the optimization is halted.

Optimization interval

This is the number of points at any given time that are held in memory when streaming and optimizing.

Colour and intensity mapping

These fields control how the RGB colours and intensities in the input data are mapped onto SCC features. Default colour mappings are No colour matching, 16 Colours, and 256 Colours.

Intensity Matching

Intensity matching is either off (No intensity matching), or grouped into a number of equal ranges (Group by intensity), controlled by the Groups, From and To fields.

Create

Pressing Create will generate a list of features for the number of colours multiplied by the number of intensity ranges. Each feature is mapped to the nearest SCC palette colour and named based on colour and intensity. The scheme also includes a DTM field to allow certain points to be either excluded from the surface or removed entirely. For example, setting the DTM code to IGNORE for all colours that represent a shade of green would strip most vegetation from the input data. Similarly points with low intensity values could be easily excluded.

Scheme Name

File name, Save, New

Feature Mapping

These fields allow colour and intensity schemes to be saved and loaded to and from file such that they can be re-used.

Using the 2.6 million point file available from the SCC Tutorials folder, 'ROAD-0mm.PTS' yielded the following results on an older 2ghz Athlon based PC under XP with 2GB of memory.

Vertical tolerance set to 10mm, 256 colour processing took 7 minutes and resulted in an optimized TIN model of 47 thousand points taking 12mb on disk. The model is shown below in plan, where we can see that the bulk of the points relate to the grass, the kerb edges, and the instrument box and tripod.

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Using '**VIEW** > **Rotate viewpoint**' the model can be viewed in perspective, as shown below;

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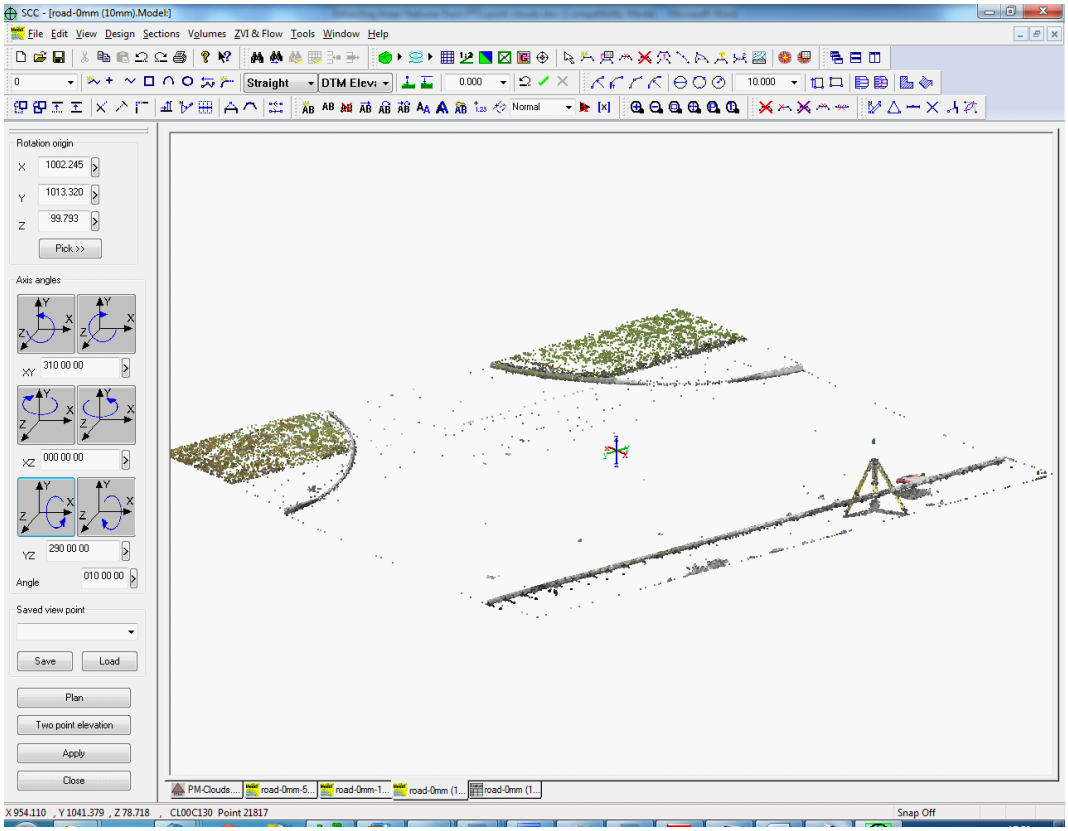

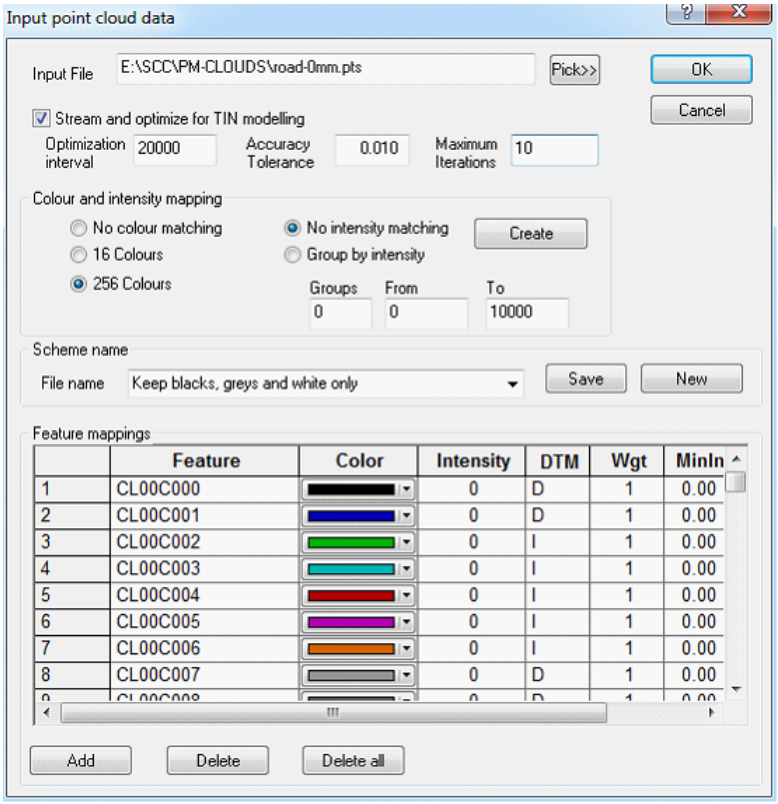

By re-running to input with all colours except blacks and greys and very dark shades filtered out as shown, we further automatically reduce the base model size to slightly over 27 thousand points.

This corresponds to automatic elimination of 99% of the input points to create a model

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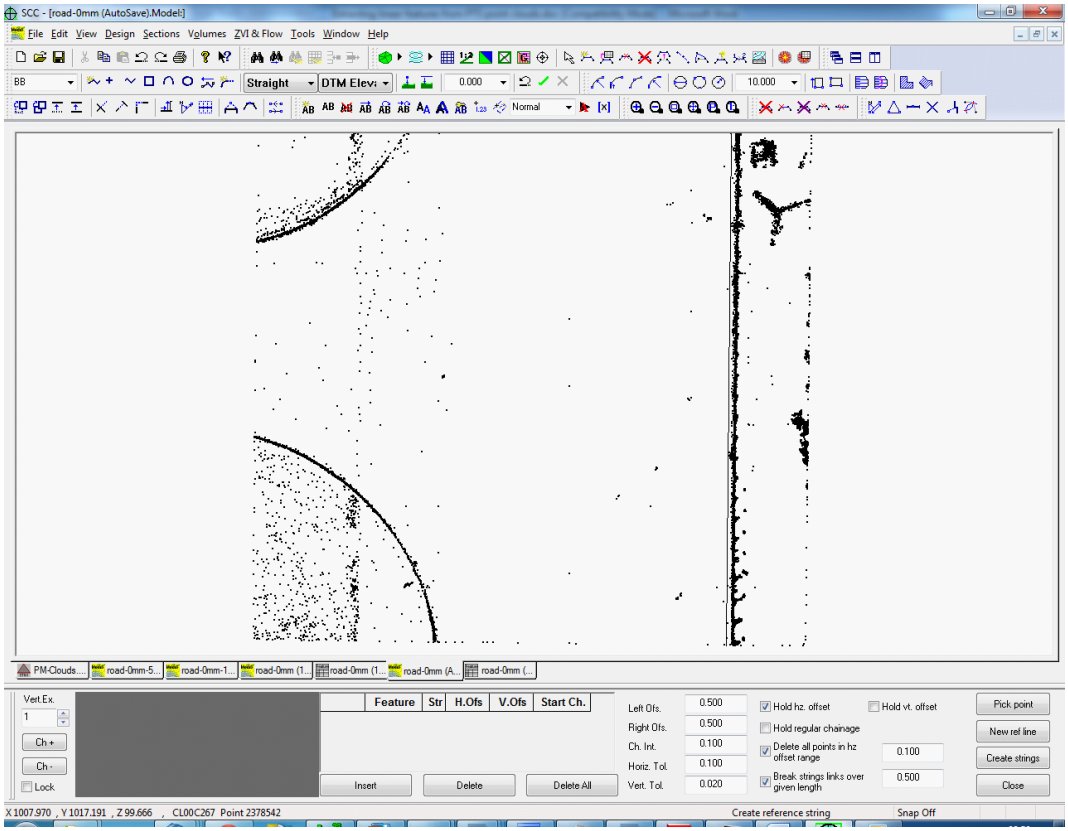
with a vertical accuracy of within 10mm of the original data.

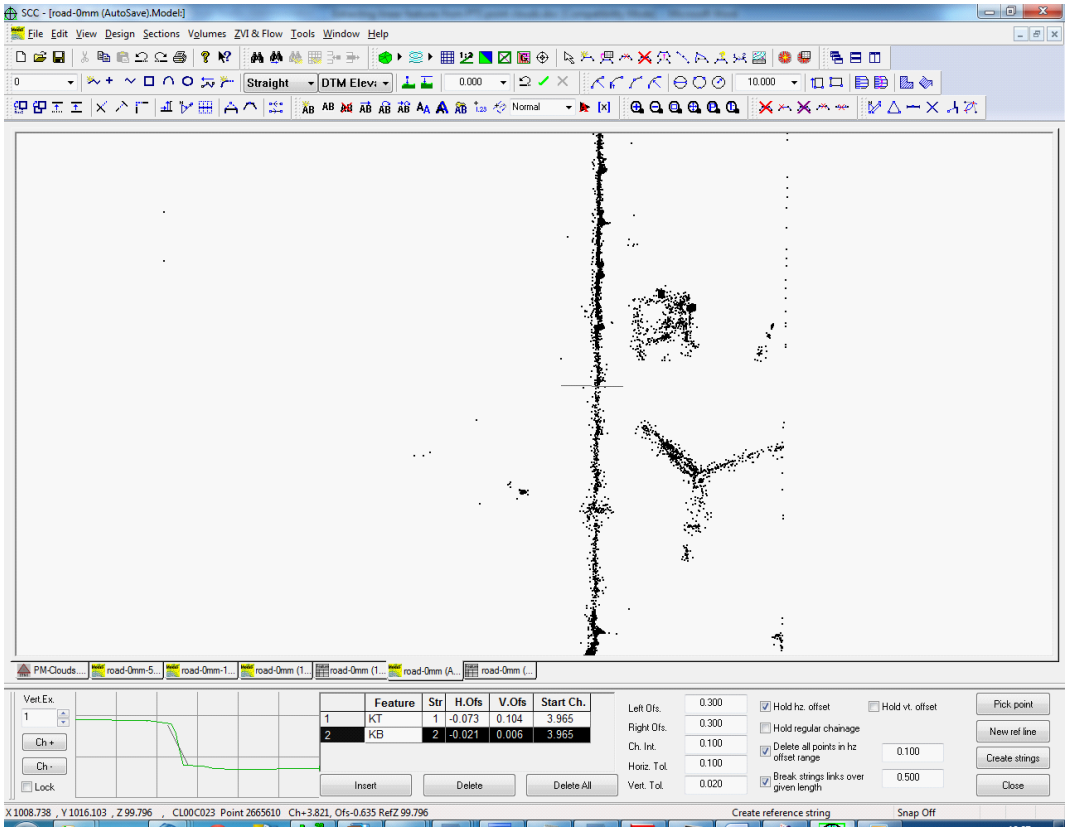
To start creating strings, select '**TOOLS** > **Point Cloud Trace linear features**' which will split the screen with a new dialog on the bottom as shown. Tracing linear features is broken down into two stages;

- Creating a reference line which involves drawing a polyline roughly parallel to the features you wish to extract. For example on the drawing below, we created a reference line by left clicking on the road beside kerb bottom at the top left hand corner of the drawing and again at the bottom left hand corner of the drawing. Right clicking closes the reference line, and switches to string selection mode. You can also change geometry when creating curved or angled reference lines by picking the appropriate tag code or geometry icon. So for example, the quickest way to create a reference line for the curved sections in the model is to use a 3 point arc. All points on the reference string should lie on the model, as this is a 3d entity corresponding to a simple alignment string.



To start a new reference line, simply press the New ref line button, which is also useful if you have made a mistake on your current reference line. Note that the reference line should lie entirely on one side or another of the set of features we wish to extract.

- Selecting strings to extract. Once you right click when creating a reference line, you can start selecting strings. As you move the mouse around the screen, you'll notice a sample section line in plan and in section on the bottom of the screen. The width of this section is controlled by the Left Ofs and Right Ofs fields. Pressing the left button again locks the chainage of the section, and as you move the mouse you will now see a vertical line in on the section corresponding to the mouse offset position in plan. Pressing the left mouse button again creates a point at the current offset, and adds it to the spreadsheet beside the section. The feature name and position can be edited in this sheet.



Pressing the right mouse button unlocks the chainage and allows you to move the section along the reference line, showing the selected points with the cut surface at varying chainages.

Pressing the create button creates the selected strings based on the parameters given. These are as follows;

Ch. Int.

This is the interval at which points will be created on the new string

Horiz. Tol.

This is the horizontal search distance that will be used to find a point from the cloud data to add to the new string at the current chainage. The distance is an offset distance from the reference point, and all points are searched within this distance and half the chainage interval along the line.

Vert. Tol.

This is the vertical search distance that will be used to find a point from the cloud data to add to the new string at the current chainage. The distance is a height difference from the reference point, and all points are within the defined horizontal tolerance are search. Where multiple points are found, the nearest point is selected.

Hold Hz Offset

If this option is selected, the new point is placed at the specified horizontal offset rather than the offset of the nearest point found. The effects of this can be seen on the pictures below

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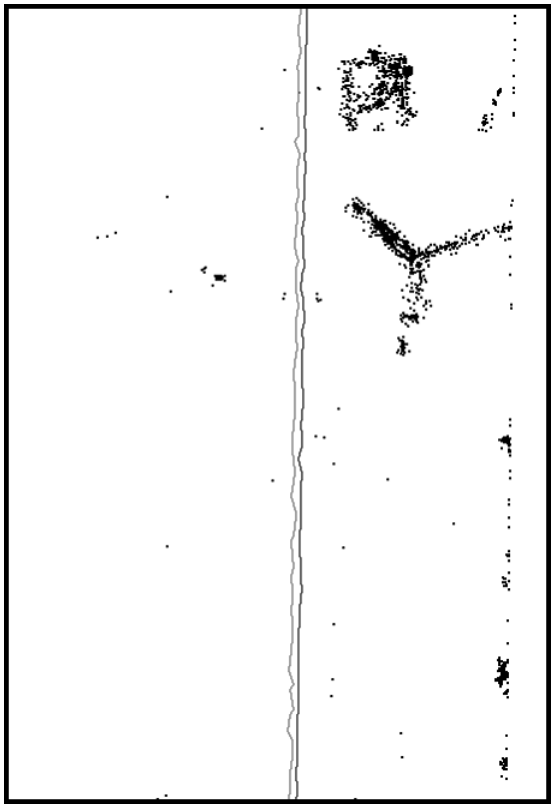

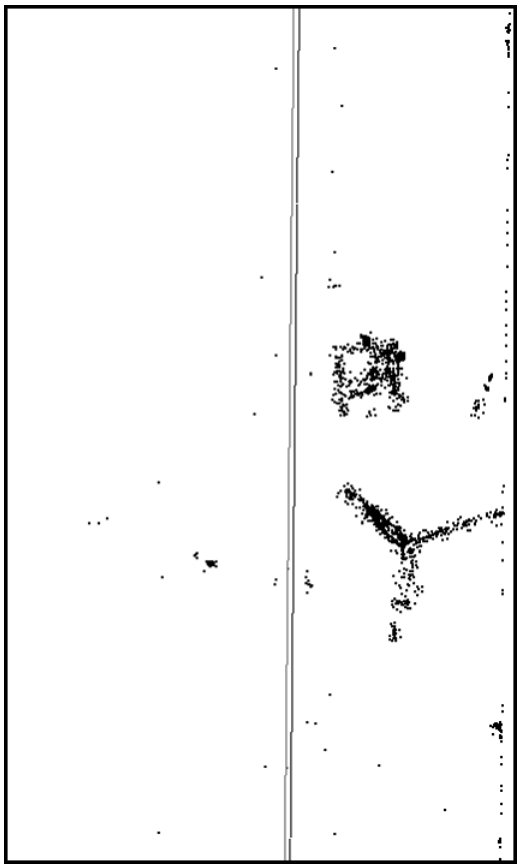

Hold Vt Offset

If this option is selected, the new point is placed at the specified vertical offset rather than the offset of the nearest point found.

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Hold regular chainage

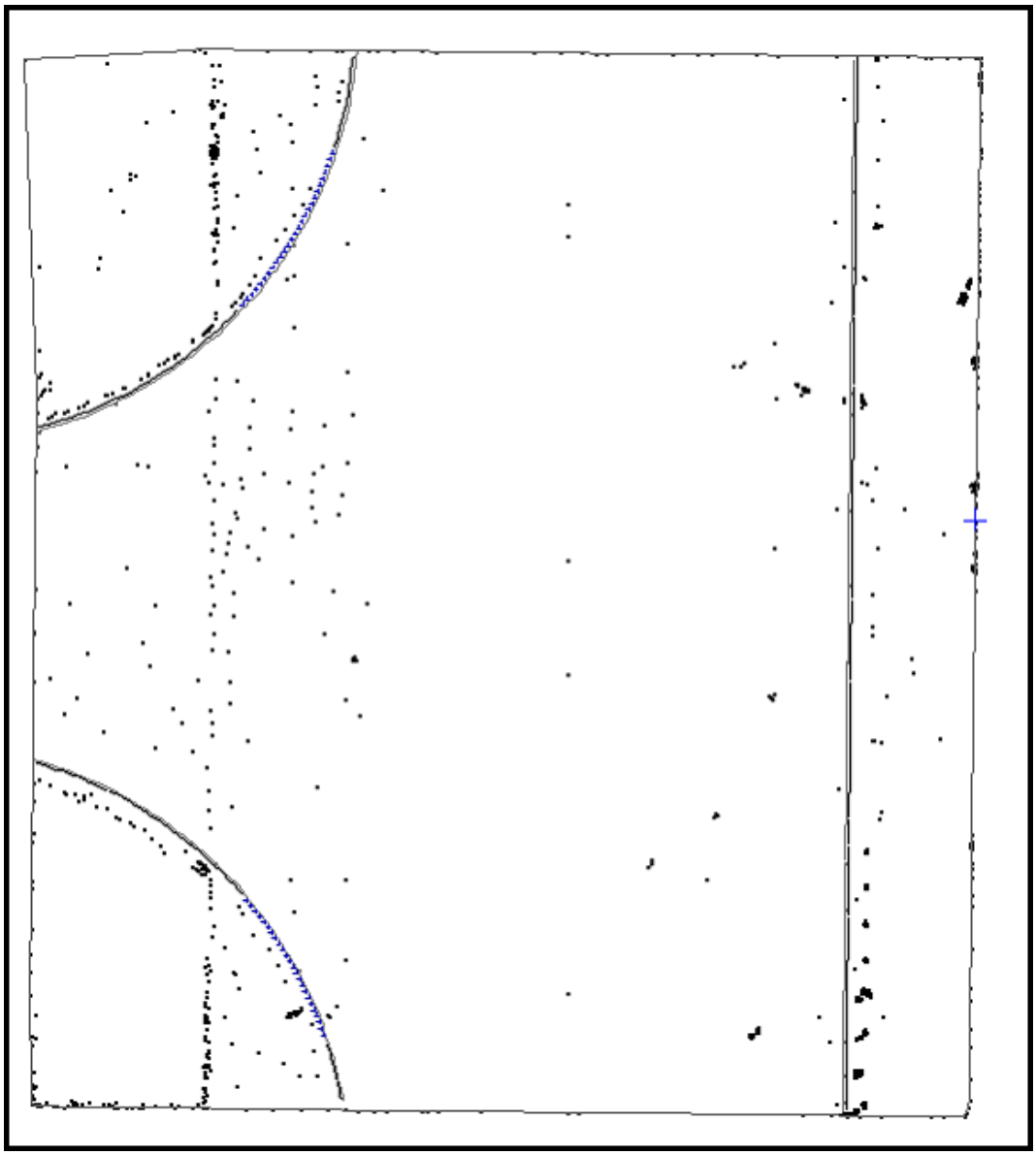
If this option is selected, the new point is placed at the current chainage rather than the chainage of the nearest point found.

Delete all points in hz offset range

This option deletes all the point cloud data within the specified horizontal distance of the points created for the chainage ranges along the alignment where new points are added.

Break string links over given length

This option forces the output strings to be broken between chainages over the specified length where not suitable cloud points are found for the new strings. In this case, extra spot levels are added at the chainage interval and offset with heights interpolated from the model, thus allowing deletion of extra unwanted points while maintaining the shape of the surface. This can be seen in the drop kerbs in the circular sections of the example below.



Extracting the linear features using the parameters given, and using the polygon selection options to delete the unnecessary grass points, tripod and instrument box, further reduces the final model down to approx two thousand point. This string model is now usable in most CAD, engineering, and visualisation packages with very little overhead, and

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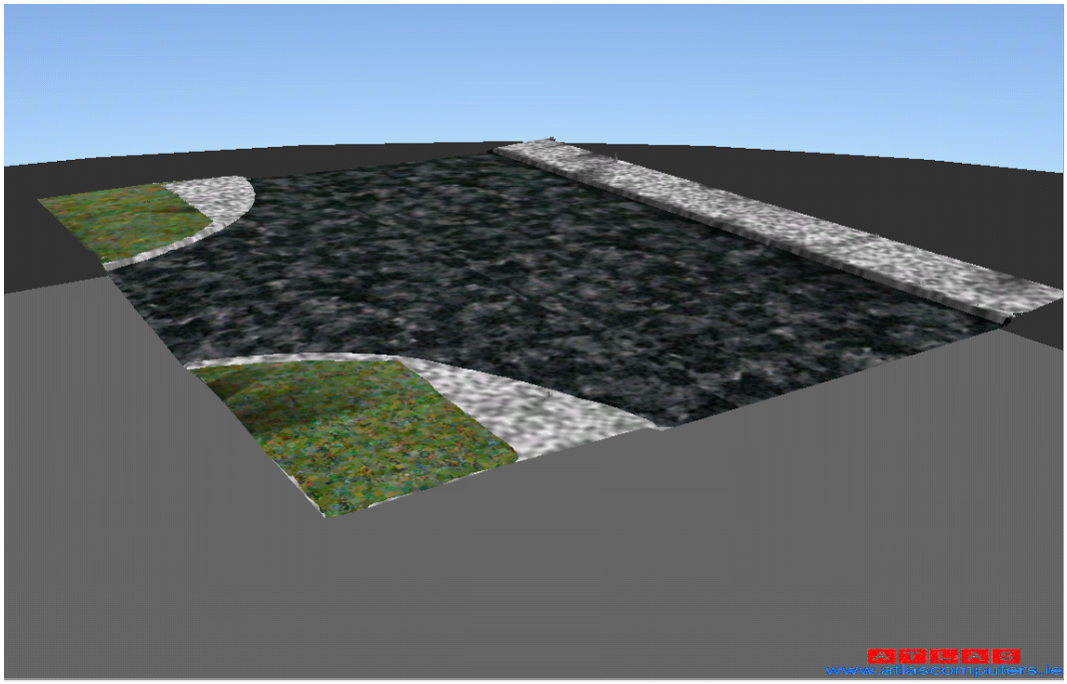
represents a reduction in size by a factor of over a thousand from the original input data.



26.9.2 Processing PTS Point Clouds

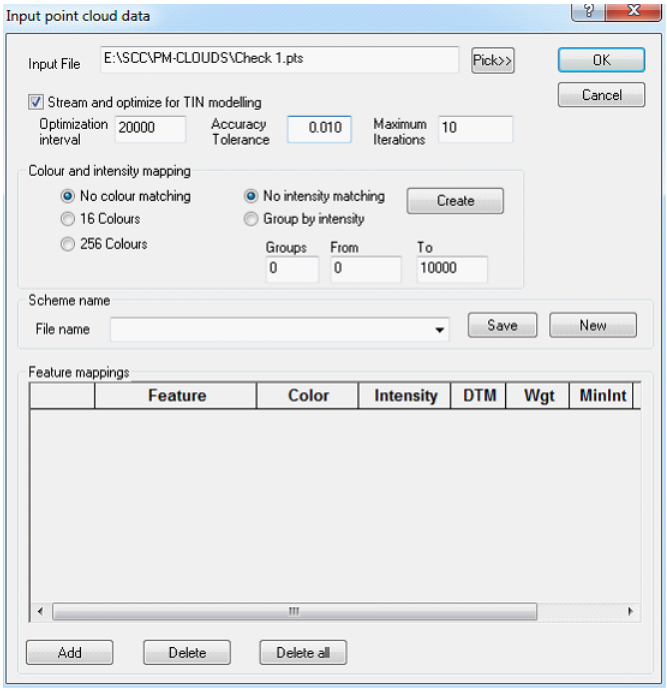
SCC can reduce, process and compare point clouds in PTS format using SCC. The steps are as follows;

Create a new project, or open an existing one

'FILE > Open > SCC Project' and pick 'PM-Clouds.Project'

Model PTS File

Select 'FILE > Model > Point clouds & LIDAR > PTS file' which will show the following dialog;



The default options shown above stream in a file in monochrome to an accuracy of 10mm. The fields are used as follows;

Stream and optimize for TIN modelling

Selecting this option inputs processes the point cloud in smaller sections such that SCC can handle very large point clouds relatively quickly. As data is input it is optimized to the specified vertical tolerance, and any points that would not make a change to the final surface are discarded. This eliminates vast number of co-planar points where they exist, leading to a much smaller, faster and more efficient TIN model without sacrificing any accuracy as would be the case with simpler decimation techniques.

Accuracy Tolerance

This is the vertical accuracy to which the TIN model is optimized. All points that would not affect the final surface by more than this amount are removed.

Maximum Iterations

This specifies the maximum number of times the optimization process is repeated. If no changes are made on any given iteration, the optimization is halted.

Optimization interval

This is the number of points at any given time that are held in memory when streaming and optimizing.

Colour and intensity mapping

These fields control how the RGB colours and intensities in the input data are mapped onto SCC features. Default colour mappings are No colour matching, 16 Colours, and 256 Colours.

Intensity Matching

Intensity matching is either off (No intensity matching), or grouped into a number of equal ranges (Group by intensity), controlled by the Groups, From and To fields.

Create

Pressing Create will generate a list of features for the number of colours multiplied by the

number of intensity ranges. Each feature is mapped to the nearest SCC palette colour and named based on colour and intensity. The scheme also includes a DTM field to allow certain points to be either excluded from the surface or removed entirely. For example, setting the DTM code to IGNORE for all colours that represent a shade of green would strip most vegetation from the input data. Similarly points with low intensity values could be easily excluded.

Scheme Name

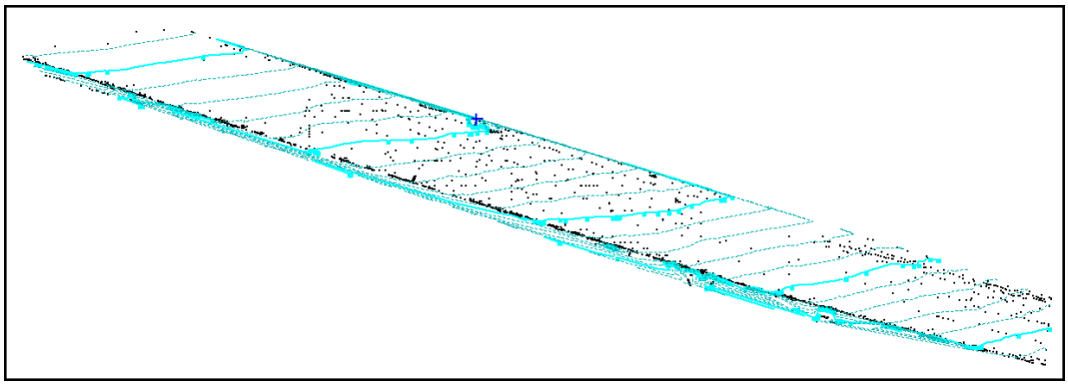
File name, Save, New

Feature Mapping

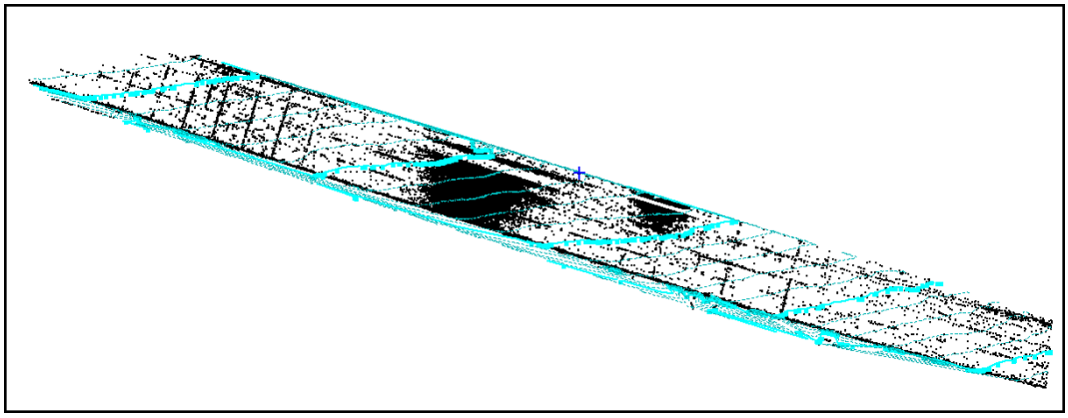
These fields allow colour and intensity schemes to be saved and loaded to and from file such that they can be re-used.

Using the 16 million point file available from the SCC tutorials folder, 'CHECK1.PTS' yielded the following results on an older 2ghz Athlon based PC under XP with 2GB of memory.

Vertical tolerance set to 10mm, monochrome, processing took 29 minutes and resulted in an optimized TIN model of 32 thousand points taking 4.6mb on disk. The model is shown below with 0.1 meter contours;



Vertical tolerance set to 5mm, monochrome, processing took 42 minutes and resulted in an optimized TIN model of 242 thousand points taking 25.5mb on disk. The model is shown below with 0.1 meter contours;



While contours and sections from these models look almost identical, the higher resolution model shows up line work relating to very shallow (<10mm) depressions in the surface that may be of value to the client. There is also a dark patch near the centre of the model, which is not present in the 10mm model, which correlates to the scanner position. This suggests that the scanner is slightly less accurate or prone to interference at very close ranges (e.g. ~5mm of noise at less than 10 meters range in this case).

Vertical tolerance set to 2mm, monochrome, processing took just under 4 hours and

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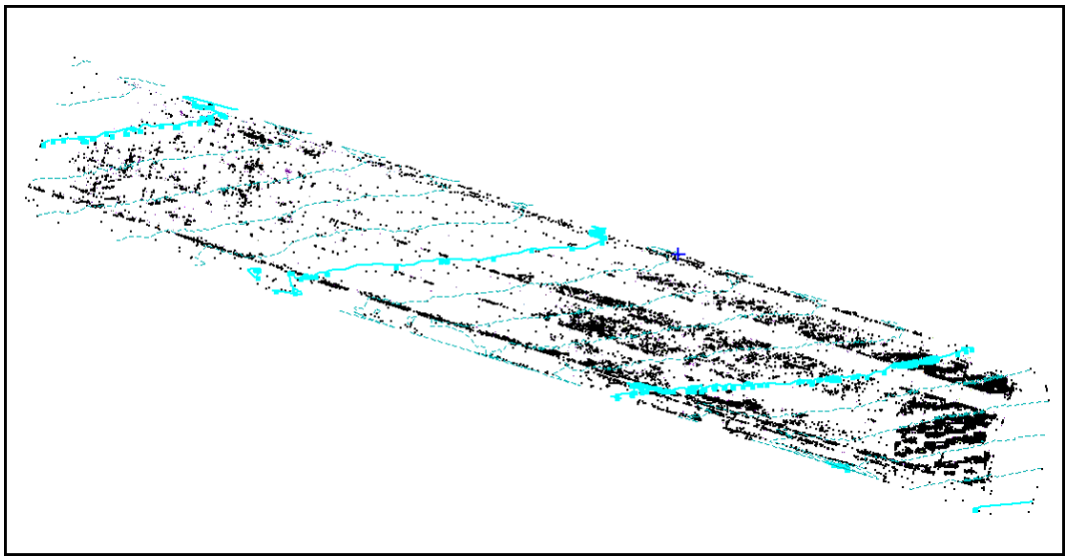
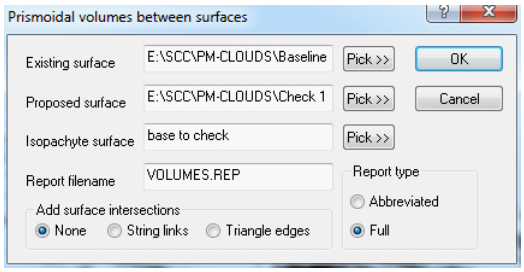
resulted in an optimized TIN model of 2.3 million points taking 362mb on disk.

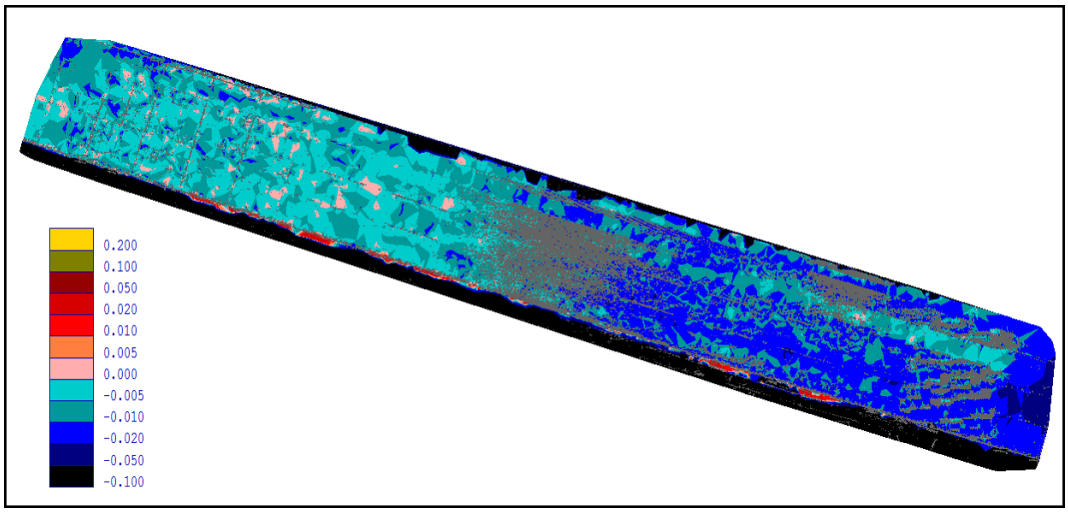
For the purposes of this exercise a 5mm vertical tolerance was used throughout. The same process was applied to BASE1.PTS which yielded a 48 thousand point model based on 5mm optimization as shown below.



To compare the base and check models, use **'VOLUMES > Volumes between surfaces (prismoidal)'** using the default values, as shown below;



This generated an isopachyte (height difference) model shown below, which can be coloured using relief contours as shown.

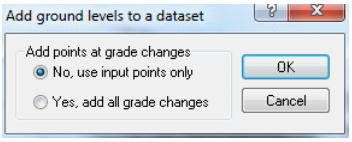


To take the test points in select 'FILE > Import > ASCII X,Y,Z' and pick the text file provided, Laser Scan Pointstxt.txt.

The file will initially have the levels in the text file.

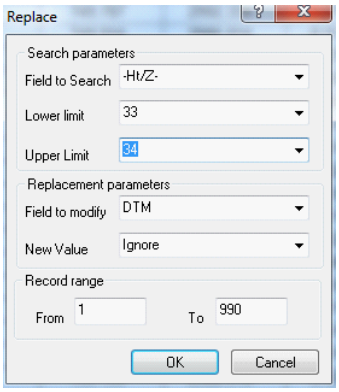
Select 'FILE > Save' to save this to disk as an SCC dataset.

To extract height differences for the points in the text file, go back to the isopachyte model and select 'TOOLS > Add ground levels to a dataset picking the dataset just saved and the parameters shown.



Going back to the dataset view, it can be seen that any points that overlaid the two models now have a height difference in the Z column.

To remove all the other points, select 'EDIT > Replace' with the values shown below, followed by 'TOOLS > Delete ignored points'



Columns can then be copied and pasted to other programs such as Excel, Word, Notepad, etc… as required. The values below have been copied from SCC;

Extract of file:

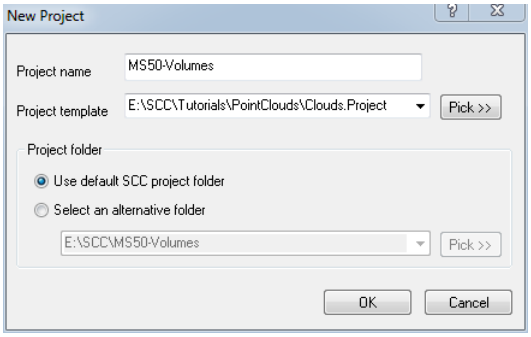
```
 95      654.559      3009.412      -0.1127
 99      655.153      3011.322      -0.0074
103      655.748      3013.231      -0.0017
107      656.342      3015.141      -0.0027
109      656.468      3008.818      -0.1453
112      656.937      3017.051      -0.0076
114      657.063      3010.727      -0.0060
117      657.531      3018.960      -0.0106
```

26.10 Cloud Volumes

This tutorial examines data from the Leica MS50. In addition, sample data is explored for volume analysis.

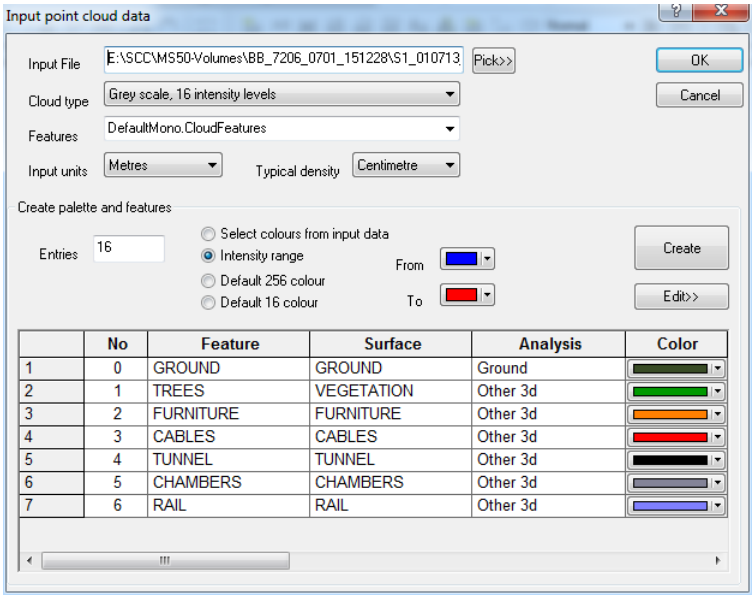
26.10.1 Creating New Project

'FILE > New Project' as shown below:



26.10.2 Importing MS50 Data

Insert the card from the MS50 into the PC, select 'FILE > Model > Point clouds and LIDAR > Leica MS50', and pick the XCF file from your MS50 project



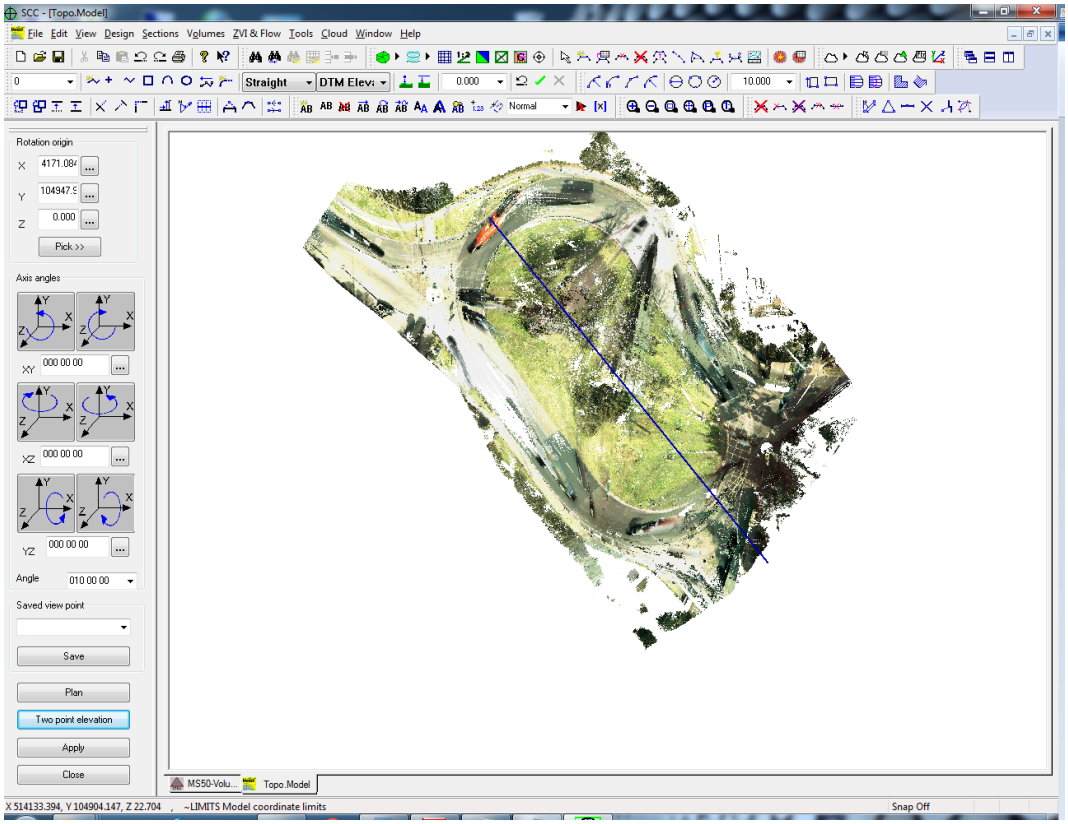
This tutorial uses the TOPO model from the SCC\Point clouds\Tutorials folder.

26.10.3 Rotating Viewpoints

The most important step computing volumes from point clouds is to ensure the cloud model is free from data not related to the measurement such as vegetation, street furniture, etc..

Select such data en-masse and change its feature. e.g. in the TOPO model compute the volume of the roundabout island to the surrounding road as follows;

'VIEW > Rotate viewpoint > Two point elevation', select a line running through the area of interest



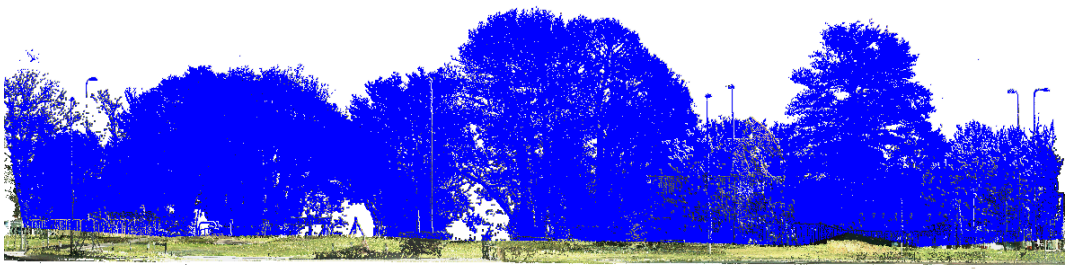
Note:

The option to allow setting a view point origin and orientation using the mouse and keyboard has been made optional, such that those primarily working in plan can't inadvertently change their viewpoint. This is controlled within **'FILE > General Options > Units & Data Checking > Allow mouse to be used to rotate'**

26.10.4 Cloud Data Selection & Editing

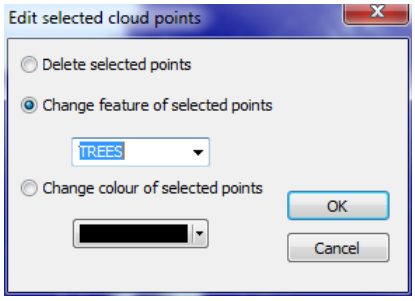
To select data, right click to bring up the Data selection dialog, followed by picking 'All points in a polygon' and press Select data

On the model to select points for exclusion from the measure, press left click on mouse to pick points on the polygon followed by right click to close it.



Select 'CLOUD > Edit selected point', and pick a new feature such as TREES for these points.

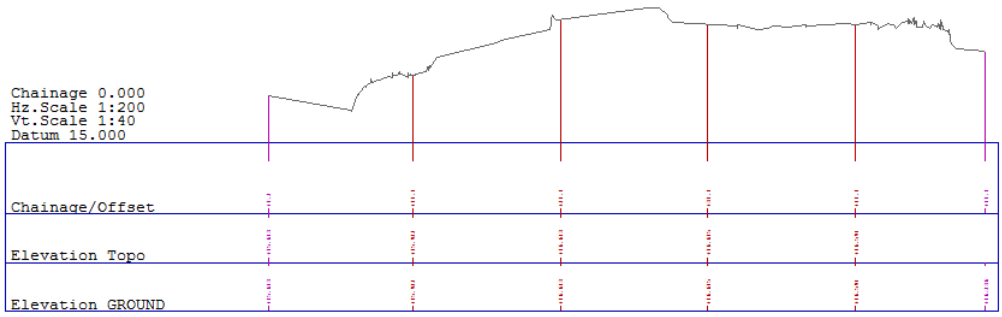
For volumes one feature in addition to GROUND will suffice. For more complex analysis this method can be use in conjunction with the isolate points option to break a model down into multiple features as has been done on the TOPO model.



26.10.5 Check Cloud Surface Data

Select 'CLOUD > Point cloud features', and change the analysis type for excluded features to 'Display only', and the Visibility to 'Hidden'.

To check the surface is as we intend, select 'SELECT > Long section with cursor', and take a section through a vegetated area of the traffic island.



Use 'FILE > Save As' to save a copy of our edited model.

26.10.6 Creating Base Model

On order to compute volumes, a base model is needed. The easiest way to create one is to simply draw a polygon around the area of interest, interpolating levels from the cloud, and saving it as a new surface. This can be done as follows;

'CLOUD > Point cloud options' and set a lowest point snap as shown.

This has the effect that levels will be taken based on the lowest point within the given radius of the plan point, thus avoiding any noise than may have been left in the model during the editing process.

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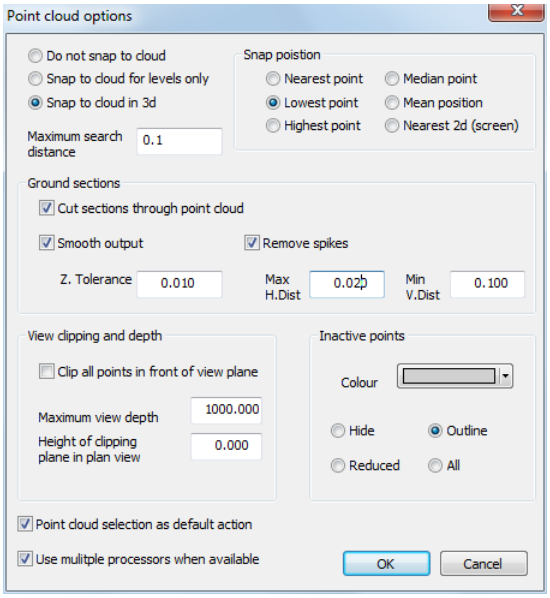
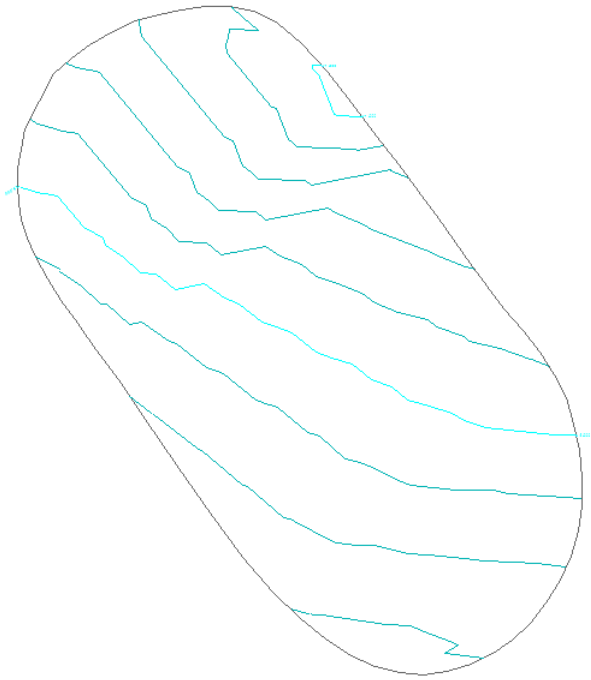


Create a new polygon or closed curve around the area of interest, using 'EDIT > Add strings with cursor' or one of the equivalent icons

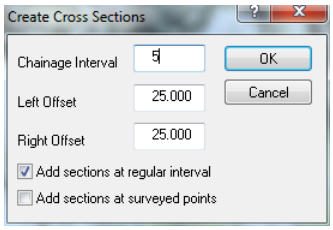
Press Right click, Save coordinates as dataset to save the 3d outline of the base model to a new dataset, followed by 'FILE > Model > SCC dataset' to create a model of the base



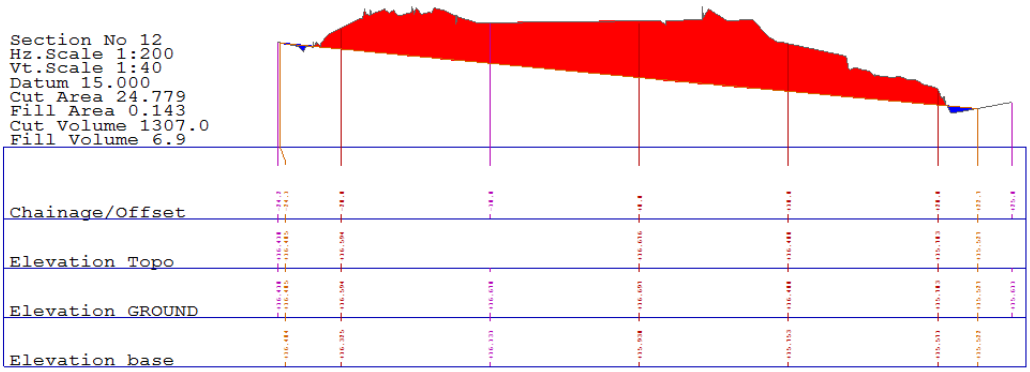
26.10.7 Volumes By Average End Method

Create a new string along the centre of the traffic island with a DTM code of approximate that can be used as a base line.

Select 'EDIT > Sections > Cross sections from exsiting string', and pick the selected centre line



In the sections, select 'EDIT > Append surfaces' and pick the base model



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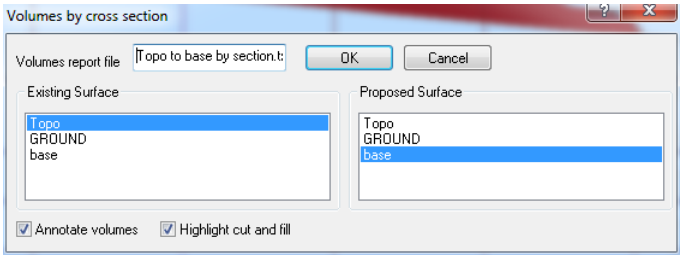
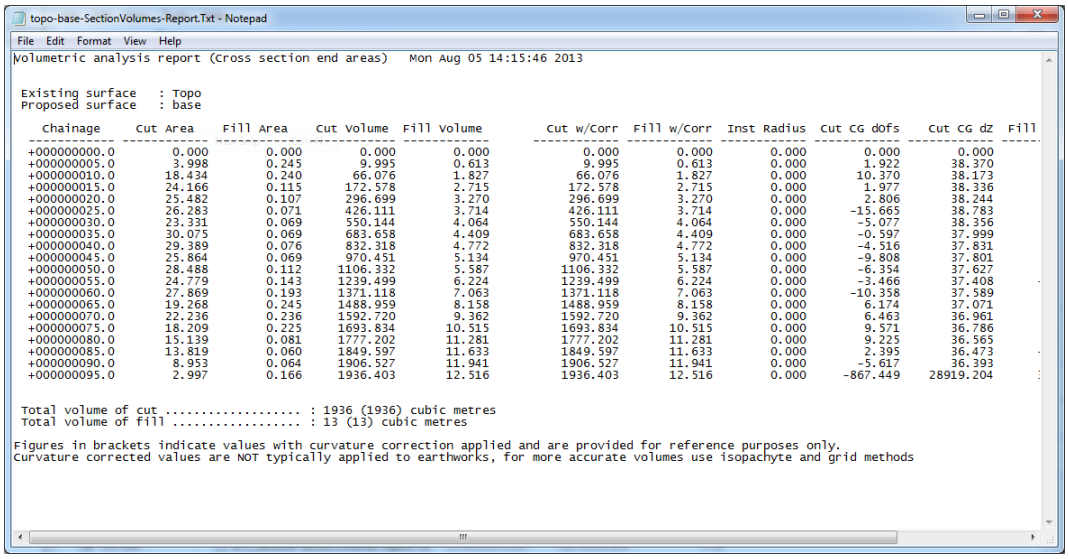
Select 'EDIT > Volumes' to compute the volumes





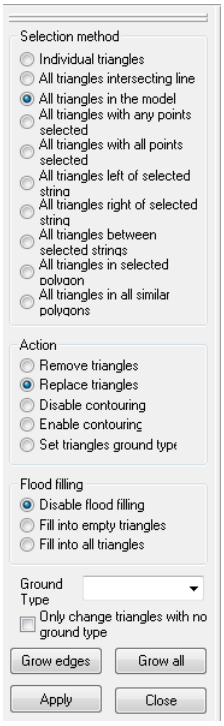

```
Volumetric analysis report (Cross section end areas)   Mon Aug 05 14:15:46 2013


 Existing surface   : Topo
 Proposed surface   : base

   Chainage     Cut Area    Fill Area    Cut Volume  Fill Volume        Cut w/Corr  Fill w/Corr  Inst Radius  Cut CG dOfs    Cut CG dZ  Fill
 ------------ ------------ ------------ ------------ ------------      ------------ ------------ ------------ ------------ ------------ -----
 +000000000.0        0.000        0.000        0.000        0.000            0.000        0.000        0.000        0.000        0.000
 +000000005.0        3.998        0.245        9.995        0.613            9.995        0.613        0.000        1.922       38.370
 +000000010.0       18.434        0.240       66.076        1.827           66.076        1.827        0.000       10.370       38.173
 +000000015.0       24.166        0.115      172.578        2.715          172.578        2.715        0.000        1.977       38.336
 +000000020.0       25.482        0.107      296.699        3.270          296.699        3.270        0.000        2.806       38.244
 +000000025.0       26.283        0.071      426.111        3.714          426.111        3.714        0.000      -15.665       38.783
 +000000030.0       23.331        0.069      550.144        4.064          550.144        4.064        0.000       -5.077       38.356
 +000000035.0       30.075        0.069      683.658        4.409          683.658        4.409        0.000       -0.597       37.999
 +000000040.0       29.389        0.076      832.318        4.772          832.318        4.772        0.000       -4.516       37.831
 +000000045.0       25.864        0.069      970.451        5.134          970.451        5.134        0.000       -9.808       37.801
 +000000050.0       28.488        0.112     1106.332        5.587         1106.332        5.587        0.000       -6.354       37.627
 +000000055.0       24.779        0.143     1239.499        6.224         1239.499        6.224        0.000       -3.466       37.408
 +000000060.0       27.869        0.193     1371.118        7.063         1371.118        7.063        0.000      -10.358       37.589
 +000000065.0       19.268        0.245     1488.959        8.158         1488.959        8.158        0.000        6.174       37.071
 +000000070.0       22.236        0.236     1592.720        9.362         1592.720        9.362        0.000        6.463       36.961
 +000000075.0       18.209        0.225     1693.834       10.515         1693.834       10.515        0.000        9.571       36.786
 +000000080.0       15.139        0.081     1777.202       11.281         1777.202       11.281        0.000        9.225       36.565
 +000000085.0       13.819        0.060     1849.597       11.633         1849.597       11.633        0.000        2.395       36.473
 +000000090.0        8.953        0.064     1906.527       11.941         1906.527       11.941        0.000       -5.617       36.393
 +000000095.0        2.997        0.166     1936.403       12.516         1936.403       12.516        0.000     -867.449    28919.204


 Total volume of cut ................... : 1936 (1936) cubic metres
 Total volume of fill .................. : 13 (13) cubic metres

Figures in brackets indicate values with curvature correction applied and are provided for reference purposes only.
Curvature corrected values are NOT typically applied to earthworks, for more accurate volumes use isopachyte and grid methods
```

26.10.8 Volumes By Prismoidal Method

To compute the volume using an isopachyte method, do the following;

Use 'EDIT > Add/remove triangles' to turn off any triangles in the TOPO model.

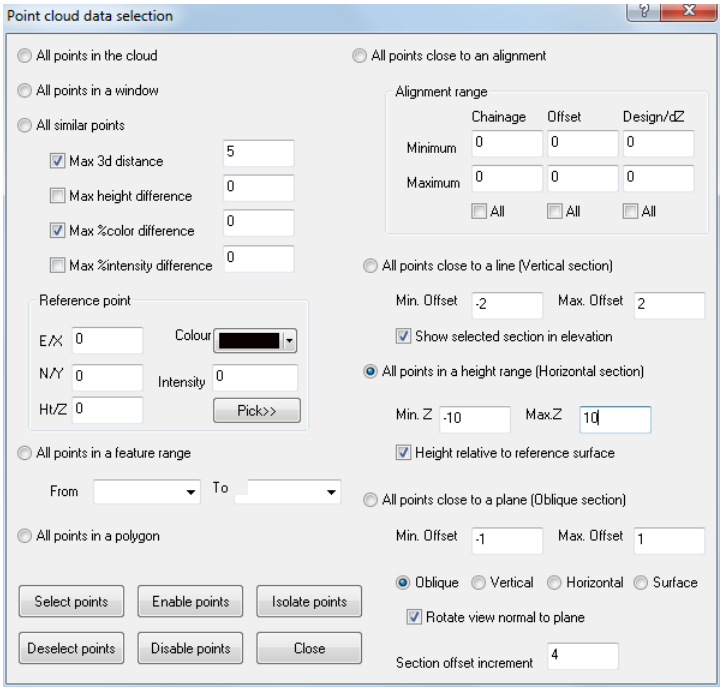
The reason for this is that SCC allows combined TIN and point cloud surface models, where levels will be interpolated from the TIN model if they are not found in the point cloud.

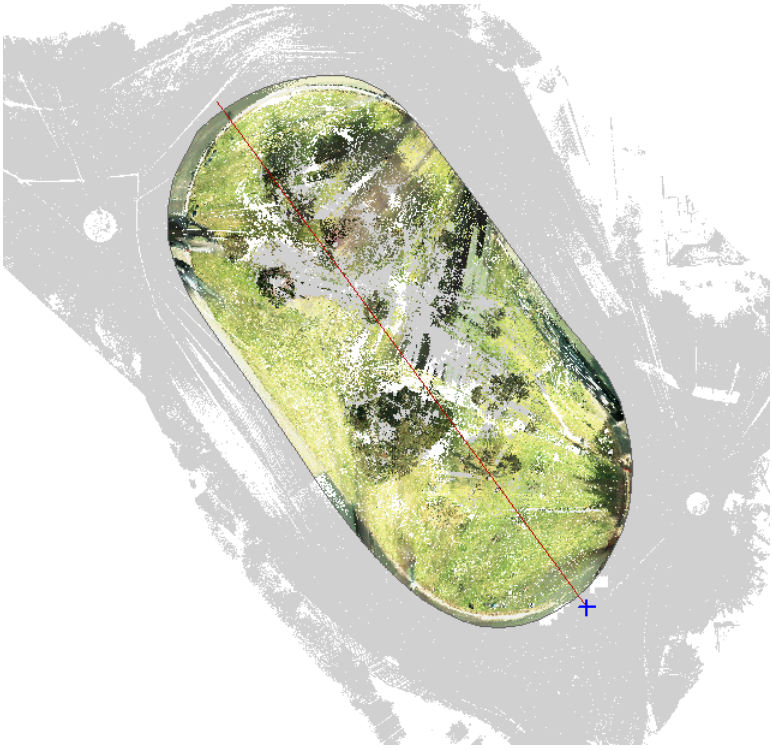


Select 'FILE > Attach/Detach > Attach model', and attach the base model to our point cloud.

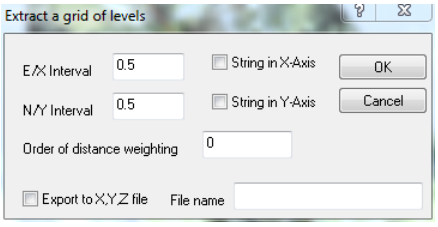
As the cursor is moved over the traffic island, x,Y,Z and dZ can be seen to the base surface.

Right click to bring up the data selection dialog and isloate all the points in the cloud relative to the base model as shown;



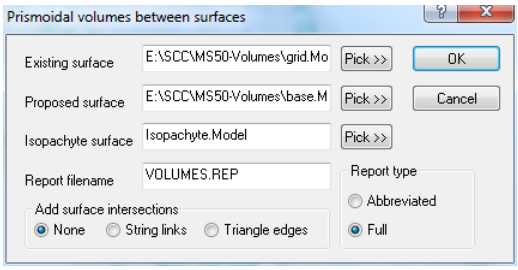


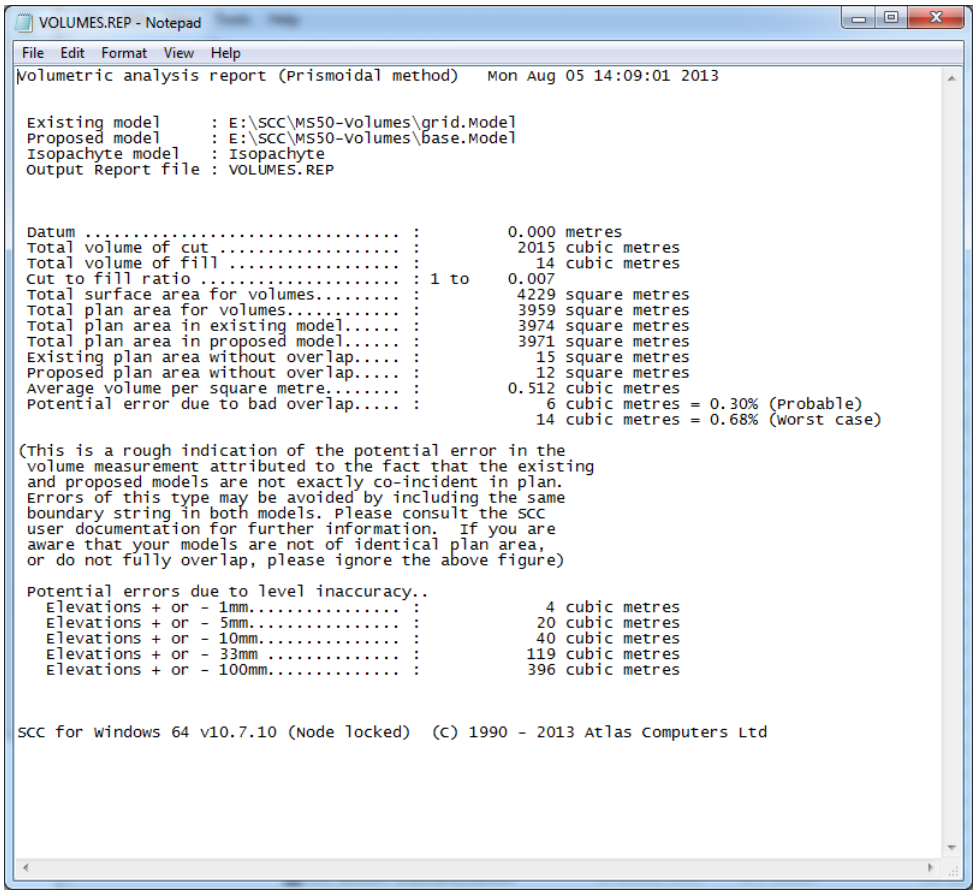
Select 'TOOLS > Extract a grid of levels' to take a 0.5m grid across the island, and save the resultant data set.



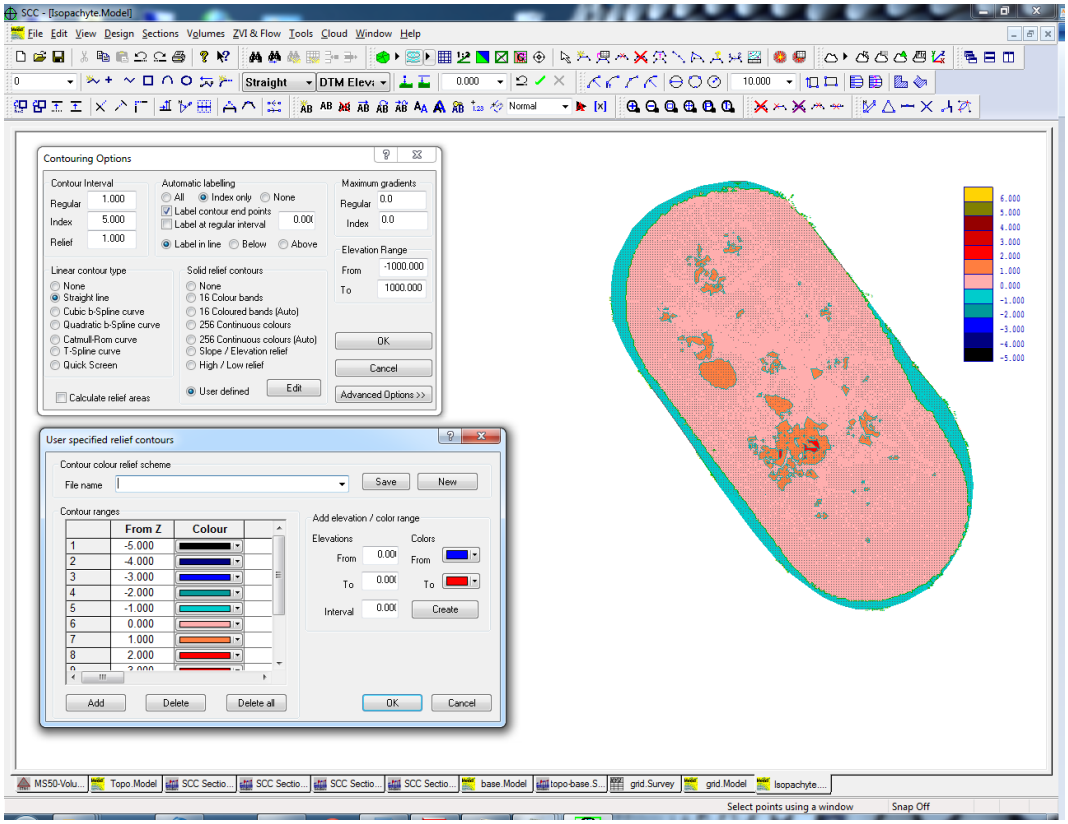
Use 'FILE > Model >SCC dataset' to create a model from the grid, and save this model

Select 'VOLUMES > Volumes between surfaces (Prismoidal)' to compute the volume between the base and island

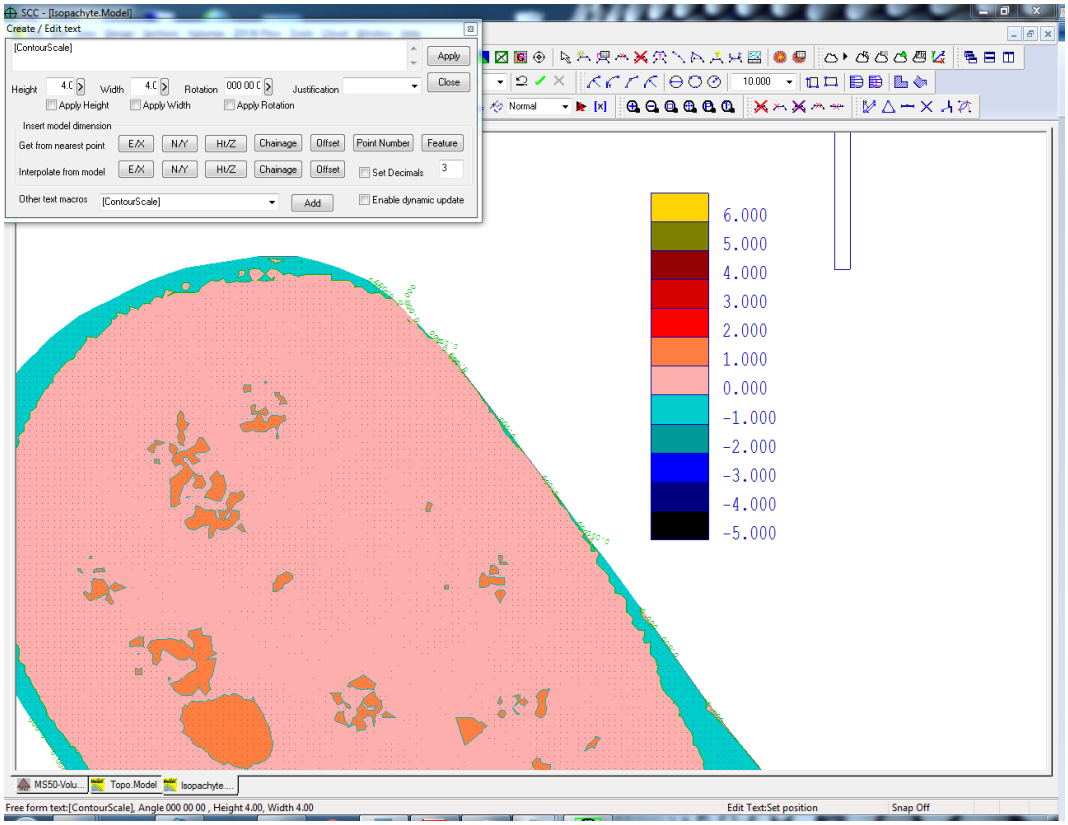




By applying a relief scheme in plan via our contouring options we can also visualise where the cut and fill is ocurring.

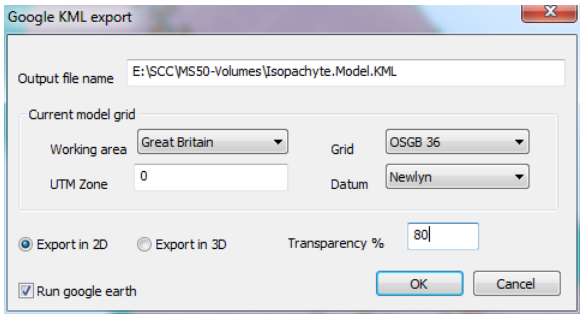


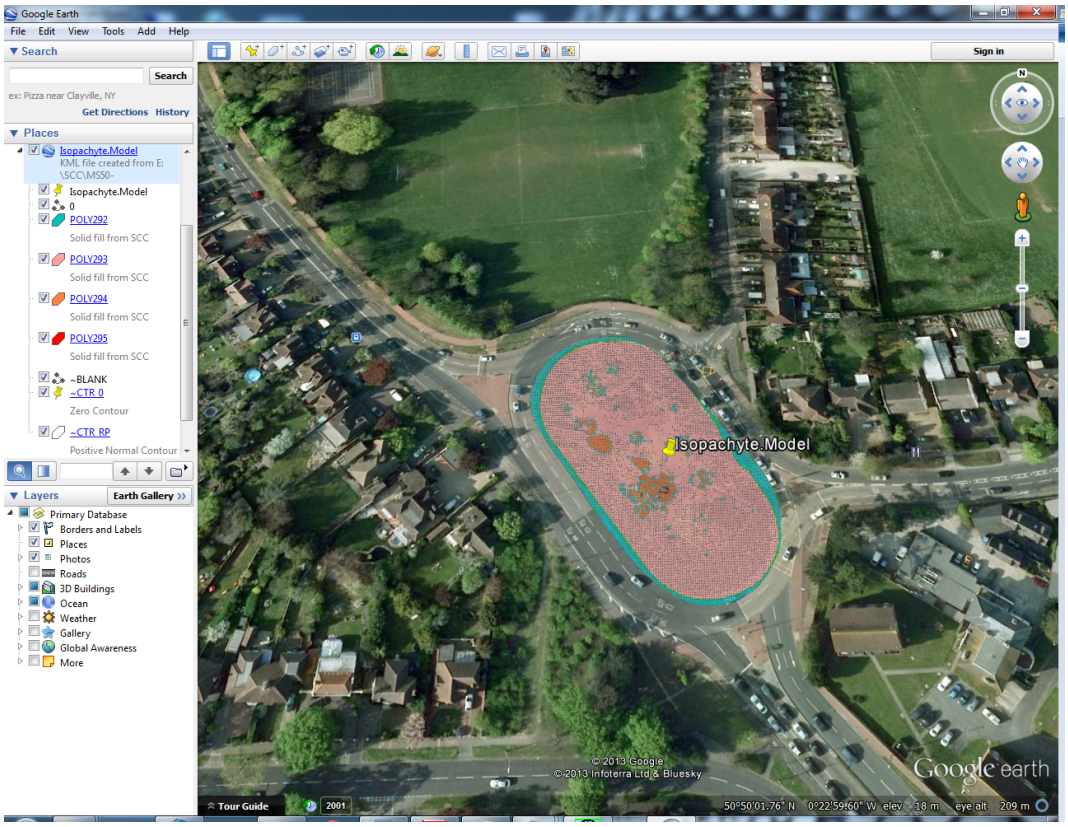
Using 'EDIT > Text > Create text', a scale to the relied scheme can be added to show how depths are coloured.

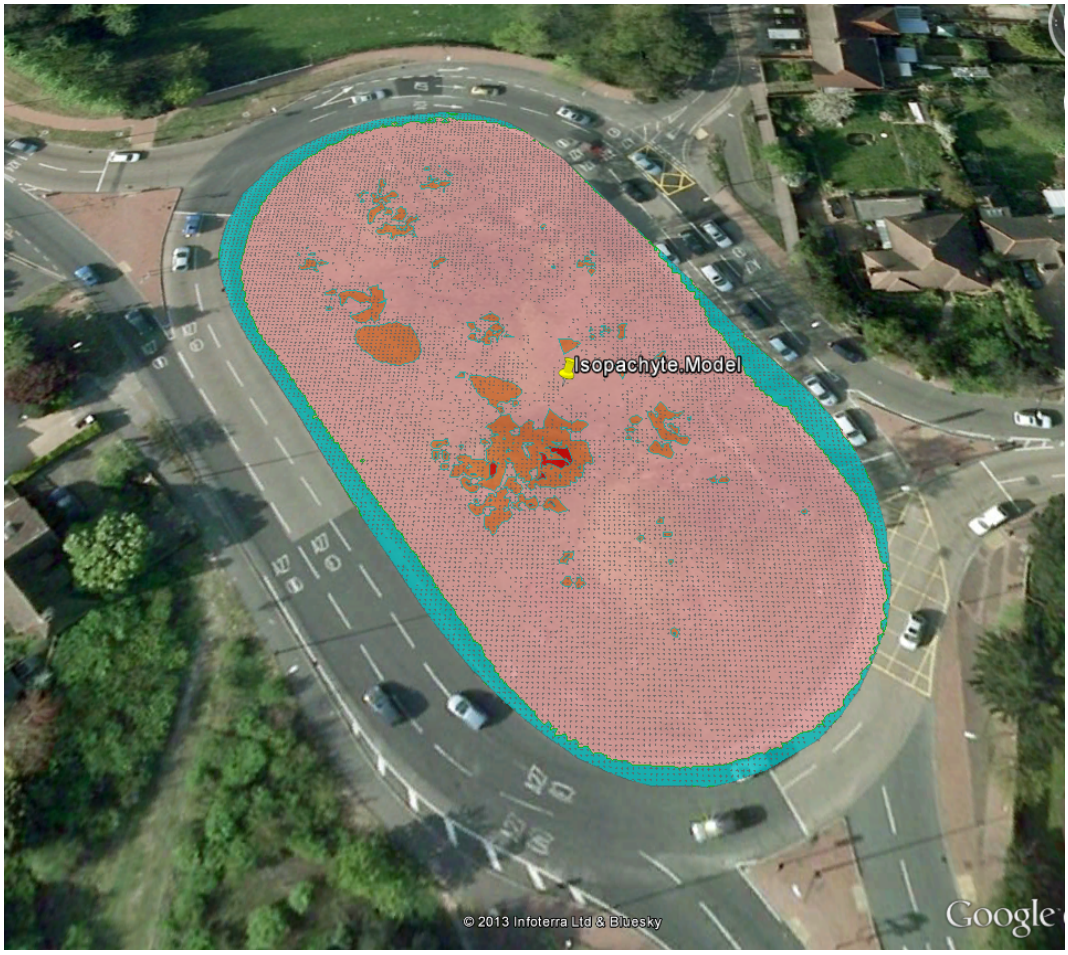


26.10.9 Export To Google Earth

If the model is in national grid, which will typically be the case using the MS50 with GPS, a quick visualise of result can be viewed in Google earth by selecting '**FILE** > **Export** > **Google earth**'





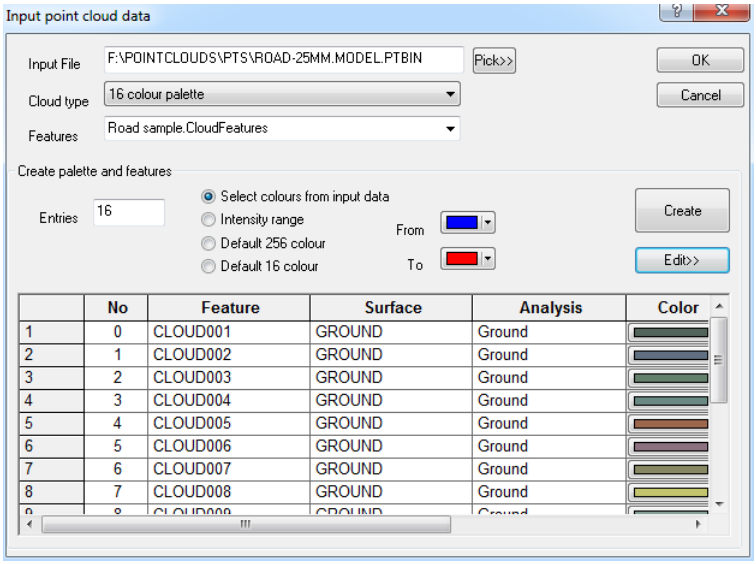


26.11 Point Cloud Volumes By Area

This tutorial can be implemented using either the user own point cloud models or the samples provided (Cathedral, Topo, and Bridge). To create a new point cloud model you need data in either PTS, LAS, LAZ, or ESRI ASC format. LAS and LAZ are significantly quicker to import than the ASCII based PTS format.

26.11.1 Importing Point Cloud Data

To start select '**FILE** > **Model** > **Point Clouds & LiDAR**' and pick the appropriate input format. This will show the following screen;

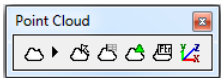


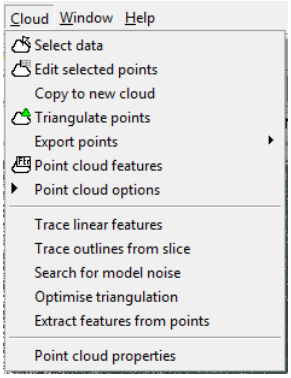
The colour usage option controls how much space is used per point, where RGB12 allows about 100 million points on a system with 1GB available memory. Palette and grey scale systems are slower to import data, but more efficient at the loss of some colour resolution. Selecting the Create palette option builds a palette and cloud feature library, based on paramers selected. This can be an optimized palette from the cloud RGB data, a colour range corresponding to intensities, or the standard AutoCAD 256 colour or VGA 16 colour palettes.

26.11.2 Point Cloud Data Selection

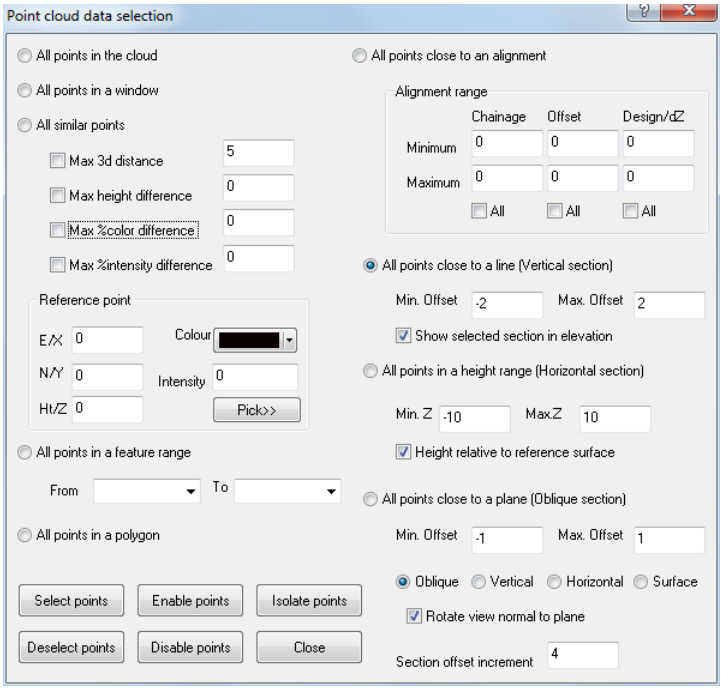
Pressing the edit button allows the user to make further edits to the point cloud feature library, and save it for re-use on other point clouds.

Point cloud functionality is accessed in the model via the **'Cloud menu'** and / or 'Point Cloud' tool bar.





The most commonly used option will be data selection, which shows the point cloud selection dialog. The allows you to control how you are going to pick data (i.e. points in a window, points in a polygon, using a horizontal or vertical section / slice, relative to an alignment, points similar to a given reference point, points close to another SCC surface) and what to do with picked data. This includes selecting and de-selecting data as per typical SCC usage, locking and unlocking data which hides the data and prohibits it from being used in future operations, and isolating data which is the same as locking everything except the picked points.

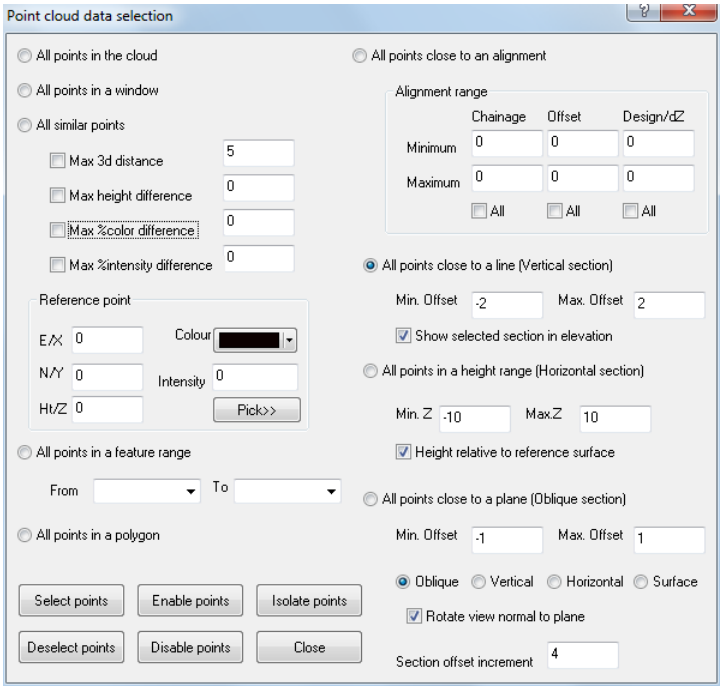


26.11.3 Isolating Area Of Interest

Open the Cathedral model from the tutorials directory

Isolate an area of interest by right clicking the mouse to bring up the Data Selection dialog.

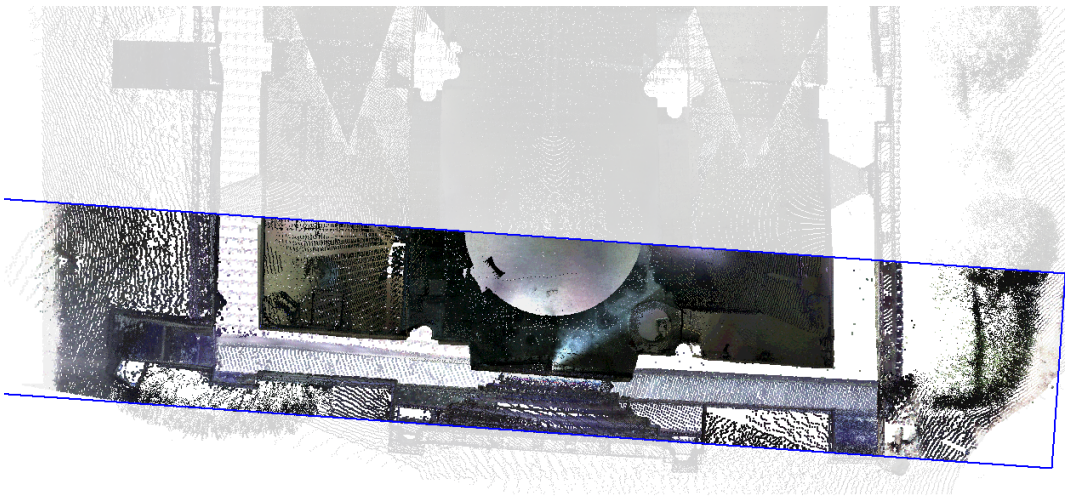
Set up the following parameters:



After pressing 'All points close to a line' and 'Isolate Data', select 'Close'

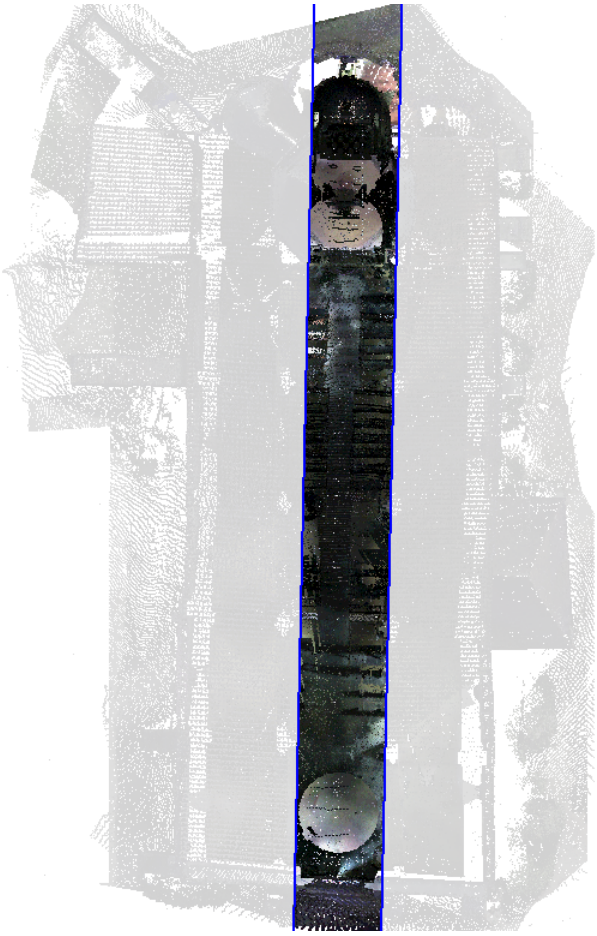
Draw the centre line of the section line of interest by left click on the model (first point and last point of line).

This highlights the area of interest as an elevation and switches the colour of all the locked points to light gray. Pressing ‘P’ and ‘E’ will move between plan and elevation view to get a better idea of what has just happened.



the up, down, left and right arrows are used to advance and move the section relative to the direction of view. The distance here is based on the Section offset increment in the data selection dialog, which can also be brought up using the right mouse button. From plan view we can also use the mouse at any stage to pick an alternate section as shown below;

Other keyboard options are + and – to widen or narrow the area of interest, and L and X to move between long section and cross section related view when selection a sectional area relative to an alignment.



When a horizontal section / area of interest is in use the arrow keys may be used to raise or low the elevation of the section.

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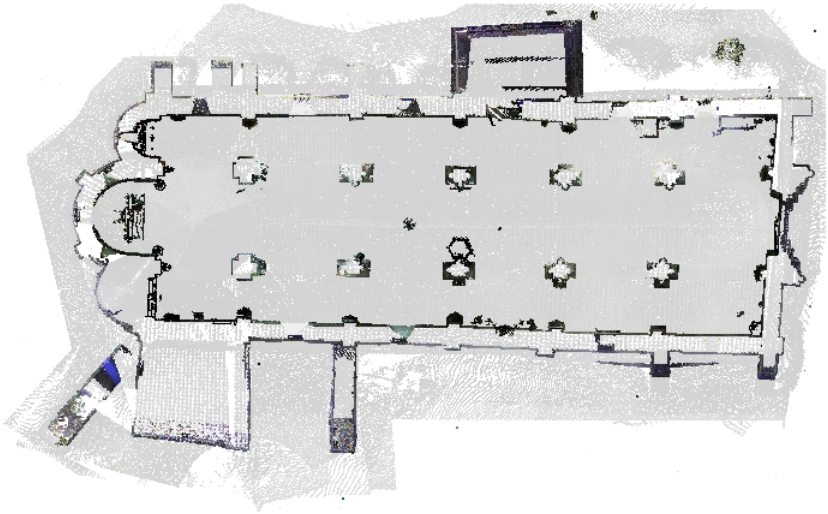
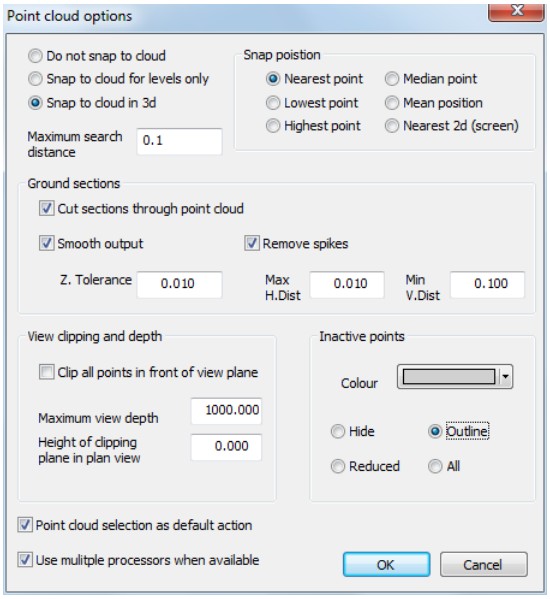


Note that as the cursor is moved around in the cloud, either in plan or another view, the x,y,z position of the cursor in the cloud can be seen, and cloud positions can be snapped to as in any other survey point.

How this works is controlled via Cloud Options, which also helps control how the cloud is treated as a surface for section and volume analysis.

Note that only active points are used for snapping, and other operations such as data selection, and export. This allows the user to first select an area of interest for analysis purposes and hide all other parts of the cloud, and then select further points from that area of interest for editing. To illustrate this better TOPO.Model from the SCC tutorials directory. When viewed in elevation the model can be seen to contain a lot of trees and street furniture that can be exclude from any surface analysis such as sections, volume, and contours.

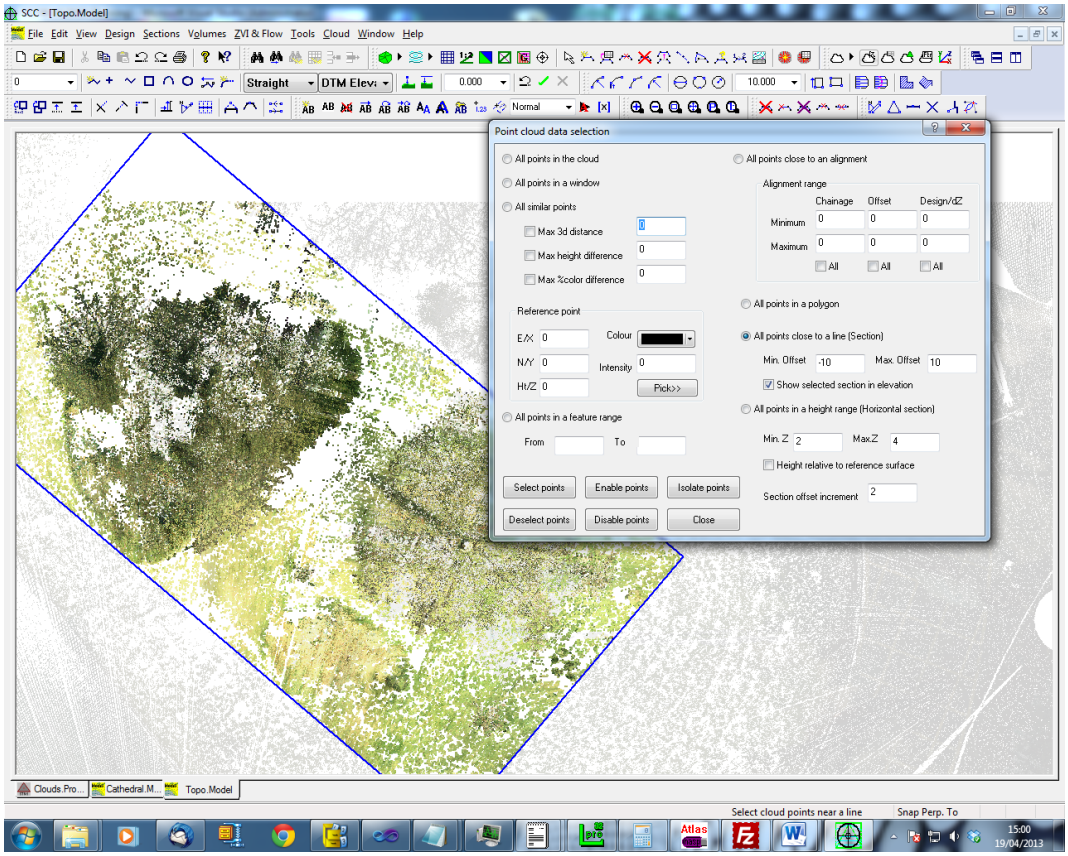


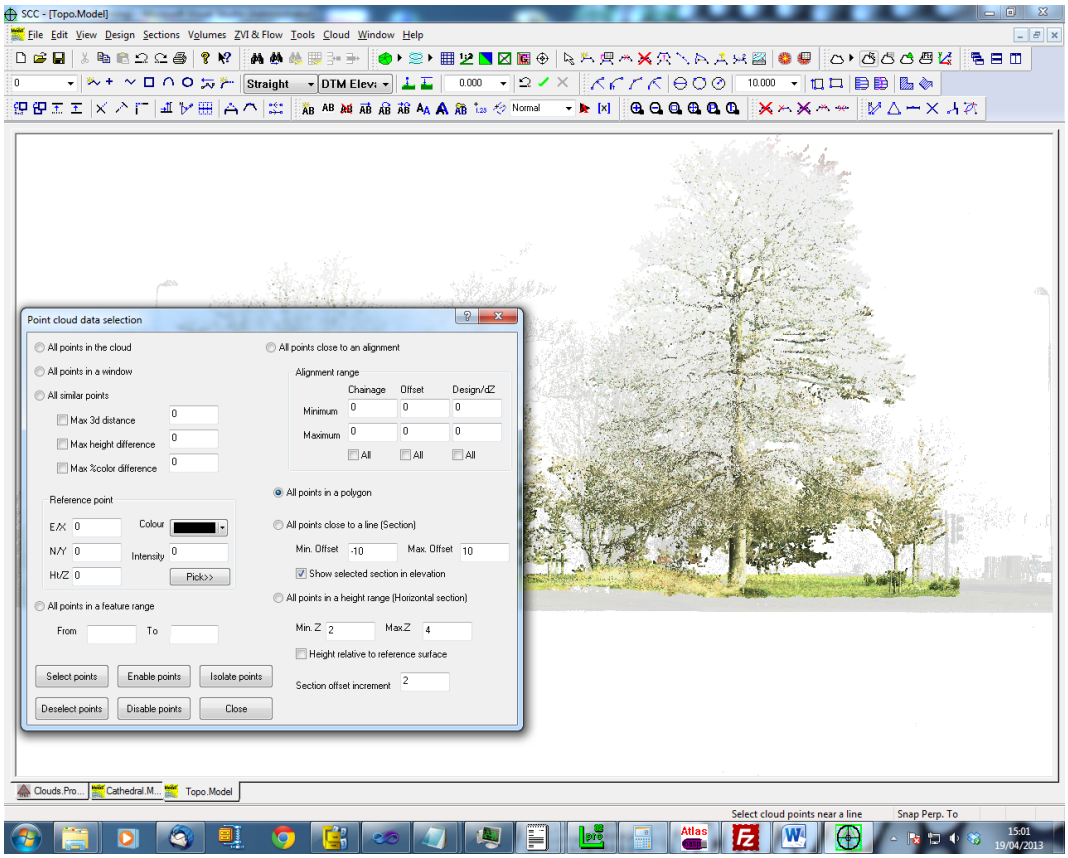
26.11.4 Rotating Viewpoint

To get an elevation of the entire cloud, select 'VIEW > Rotate Viewpoint > Two point elevation', picking points at either end of the road.

All of the upper foliage can be obtained using a polygon selection method, trimming the trunks closer to the ground is more problematic, as some are hidden behind hills, fences or in dips in the ground.

The solution here is to first isolate an area of interest, and then select from within that area, e.g.





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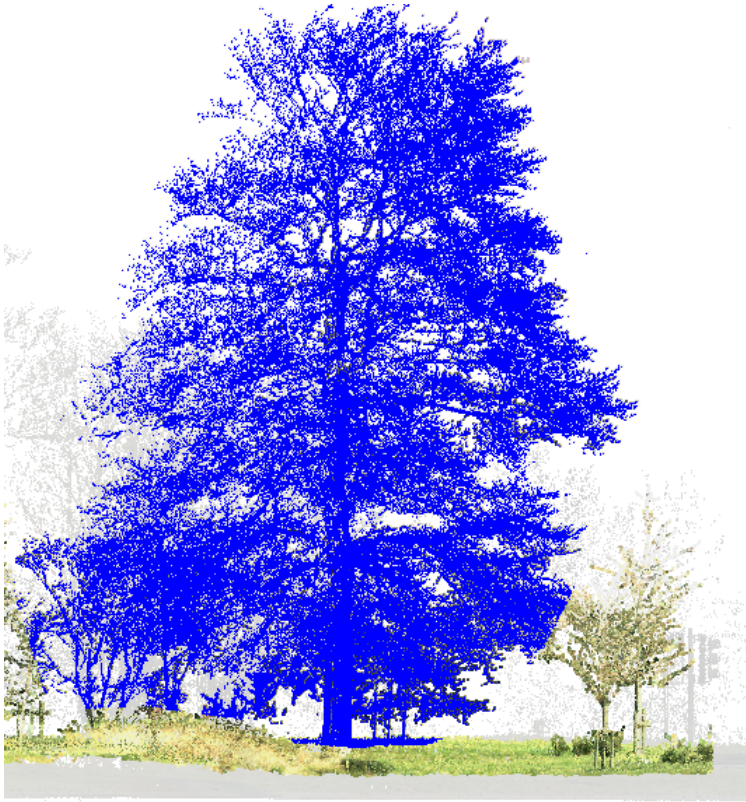

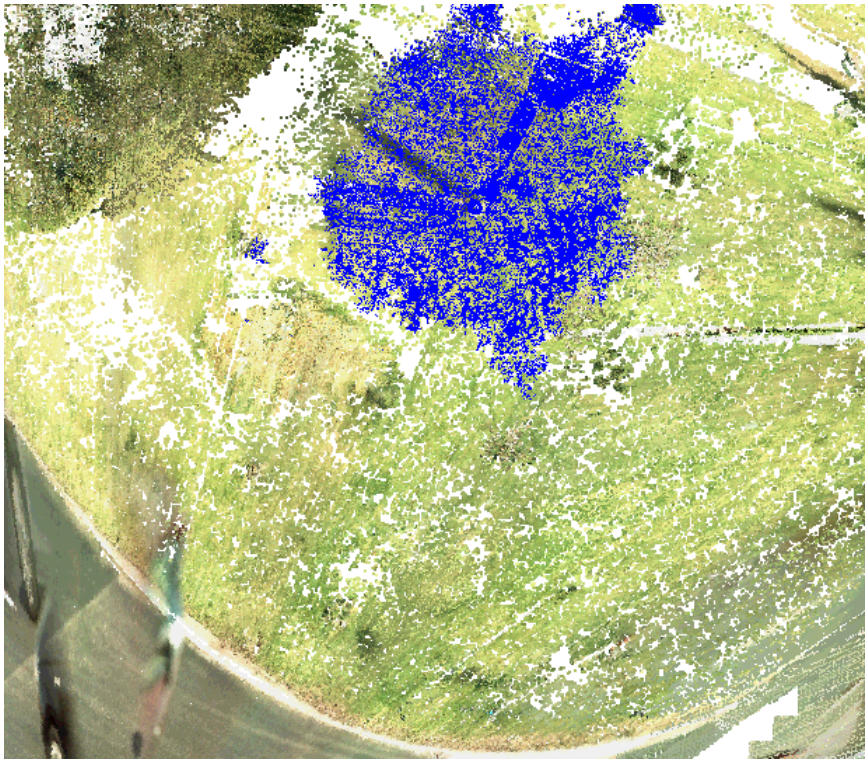

Note:

The option to allow setting a view point origin and orientation using the mouse and keyboard has been made optional, such that those primarily working in plan can't inadvertently change their viewpoint. This is controlled within '**FILE** > **General Options** > **Units & Data Checking** > **Allow mouse to be used to rotate**'

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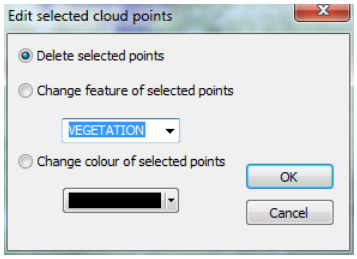
26.11.5 Analysis Of Surfaces

Note that one of the quickest ways of carrying out this type of analysis on a large topographic model is to develop a rough SCC TIN model based on a sample of spot levels taken from the cloud, and selecting all the points a set distance above this model, by ticking Height relative to selected surface in the data selection dialog.



Once data is selected, it can be copied, deleted, re-coloured, and most importantly grouped by feature using Cloud / Edit selected points.

When features are assigned to groups of points, the groups can then be processed and different types of analysis applied. This is done using Cloud / Point cloud features, which shows the following dialog. The point feature fields are as follows;

- Feature – The name of the feature
- Surface – The surface on which the feature is placed. Note that you can have multiple features placed on the same surface, e.g. trees and bushes might both go on a vegetation surface
- Analysis – This controls how SCC interprets these points for surface analysis purposes. Options are
  - Display only – The points are displayed only, but not subject to analysis
  - Ground – The points are treated in the same way as the triangulation surface in a normal SCC model, from the point of view of sections, volumes, draping points, extracting levels, etc…
  - Other surface – The points are treated in a similar manner as an additional triangular surface, such as a reference model.
  - Other 3d – The points are treated as a non-mappable 3d surface, not suitable for surface analysis operations. Sectioning through 3d surfaces will be considerably slower than ground / mappable surfaces.
- Colour – The default colour of this feature when not coloured by point
- Colour by point – Whether points on this feature have individual colours or the same colour
- Visibility – Controls whether or not these points are displayed, and if they are displayed whether they are considered opaque or transparent.
- Lock – Whether or not these points are included in analysis
- Size – The size of displayed points
- Sect. Width – The search corridor width used when cutting sections through this feature. Note this will typically be small for ground surfaces, e.g. 10mm, and larger for 3d surfaces, e.g. 100mm – 500mm. The larger this value, the more 3d data will get projected onto a section and analysed. This in turn can slow down processing and significantly increase the size of sections produced.
- Max Dist. – For 3d features, the maximum distance to which points will be connected.

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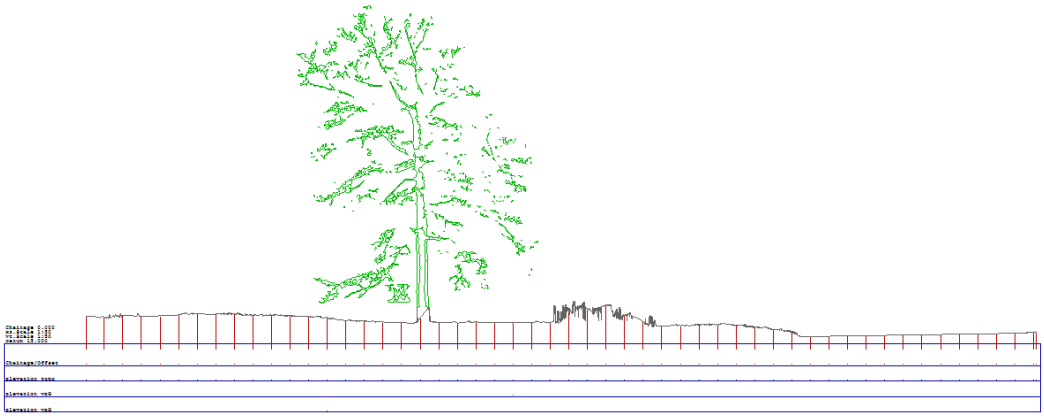
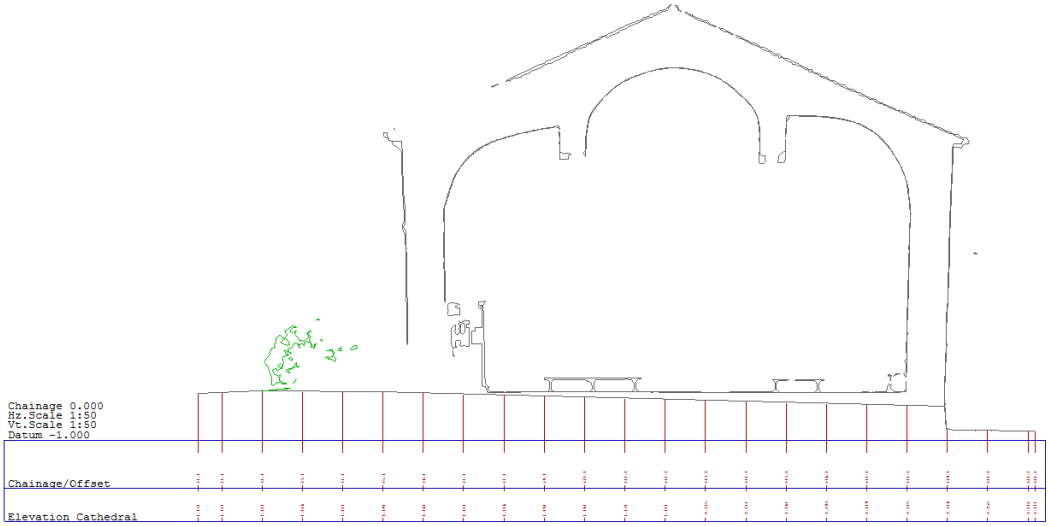
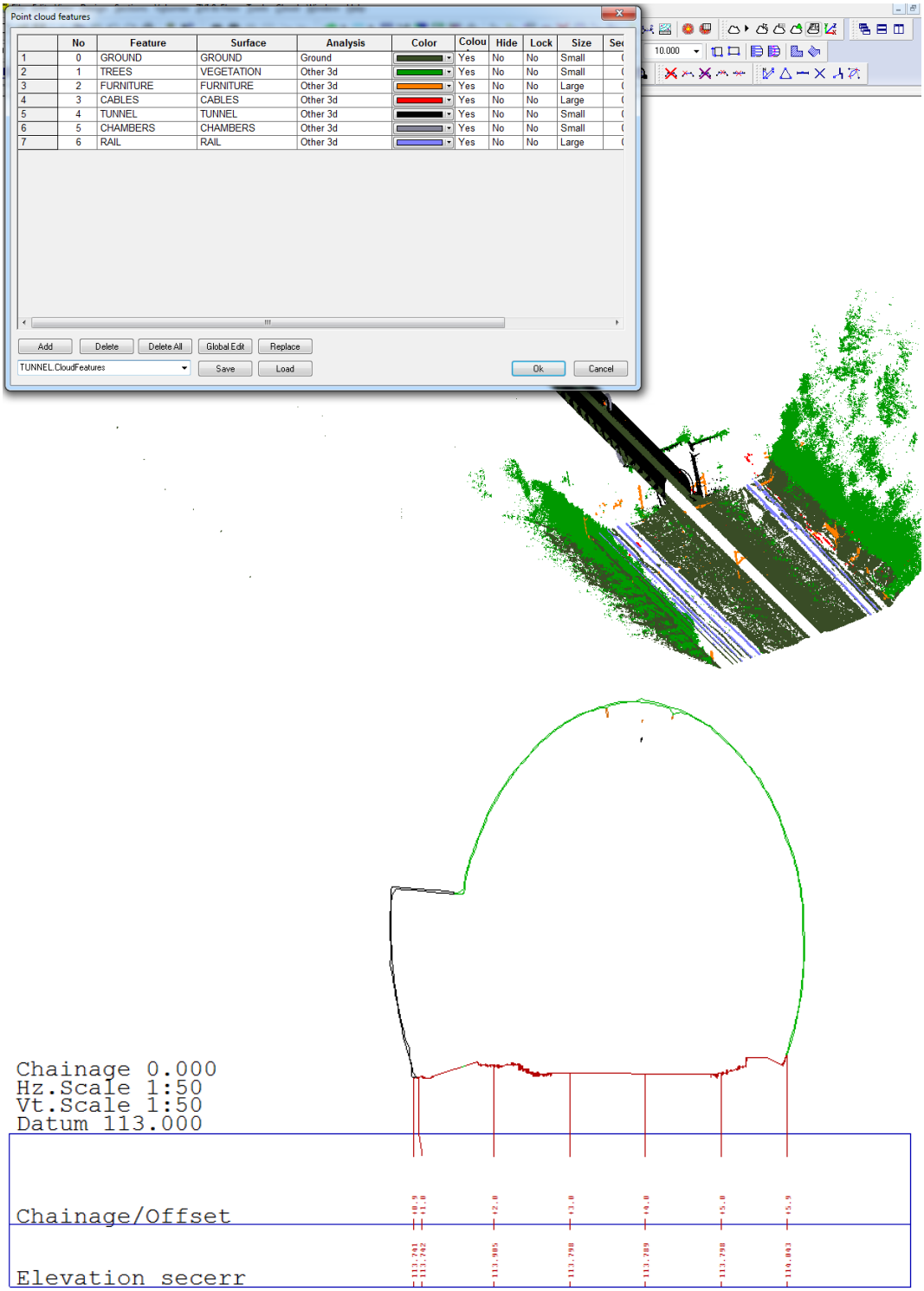
The sample models 'Cathedral.Model' and 'Topo.Model' already have some features applied. Different items appearing when displayed in section. As shown in the examples below:





The feature library is also very useful for quickly colouring and analysing monochrome point clouds, as shown in the model below (Tunnel 950-1050 (edited).Model)



By selecting and isloting appropriate elevation and sectional areas, data can be quickly differentiated the tunnel, cabling, rails, and foliage. This in turn allows the user to cut complex sections, develop a ground surface and isolate features of interest.

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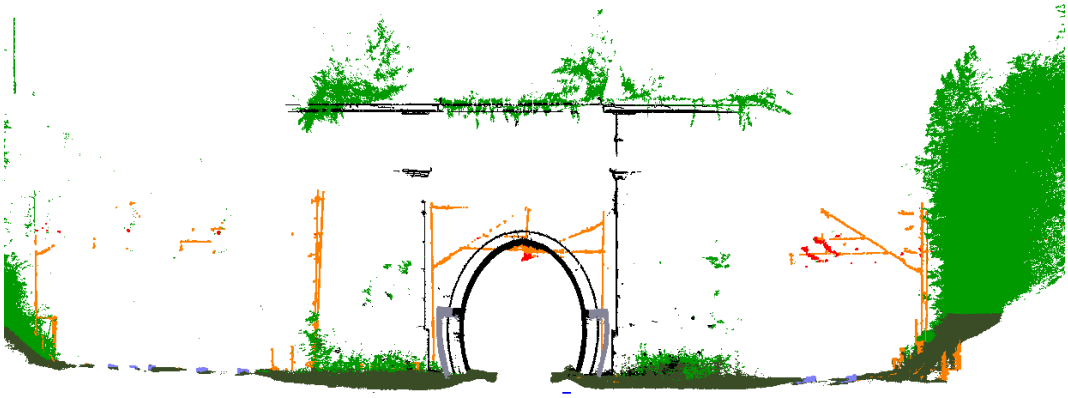
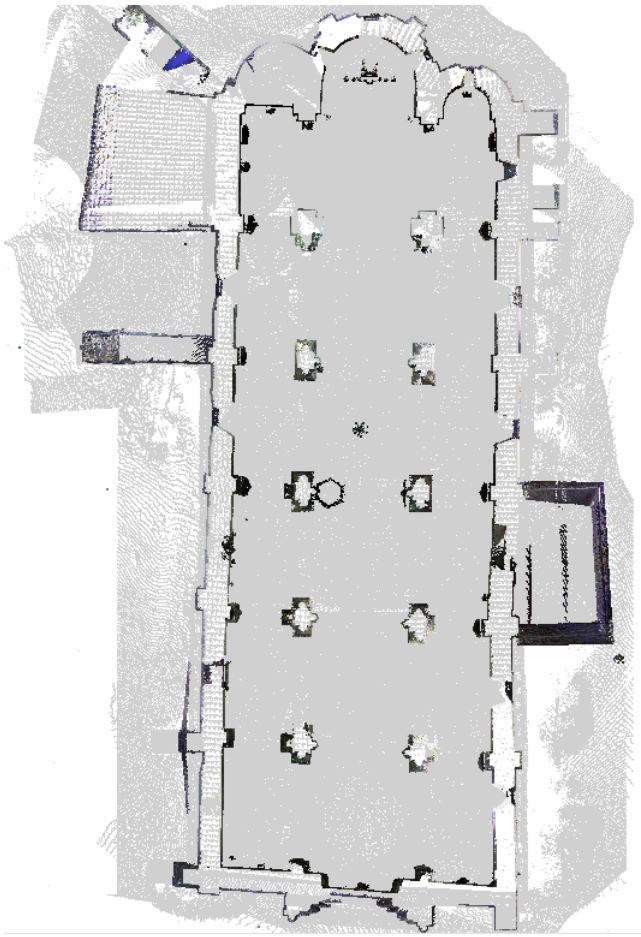
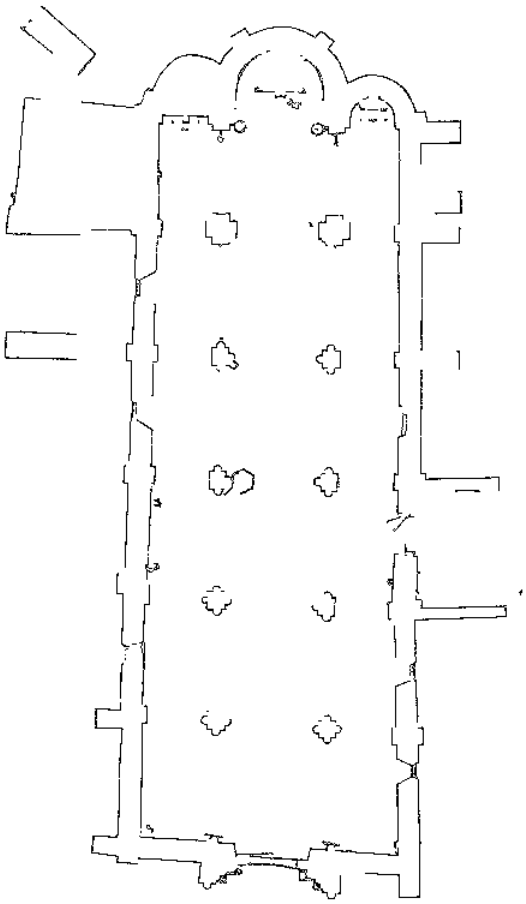


26.11.6 Trace Outline From Slice

In addition to cutting sections there are a number of other ways to extract linear data and analyse cloud surfaces. The simplest of these is via **'CLOUD** > **Trace outlines from slice'**, which will draw outlines based on an isolated sectional area. This can be either from plan, elevation or based on an oblique viewpoint.





The results can then be exported to other packages, such as CAD, in 2d or 3d, and multiple slices can be used to build-up a wire frame model from the cloud. The cloud feature library determines how the data is analyses, where the centre of the displayed section or slice is used as the centre-line for sectioning.

To extract linear features, sure as kerb lines, from the cloud, use **'CLOUD** > **Trace linear features'**. This function allows the user to create or select a reference line, which is a line running roughly parallel to the desired features, and create strings based on similarity to a given section template. To demonstrate this, do the following;

- Select an active tag code of Curve
- Zoom into the area of Topo.Model shown below
- Left click on three or more points within half a metre of the kerb to generate our reference string. Right clicking finishes the reference string and start analysing the data. Select any other active alignment to use as our reference string, or press New to create a new reference string.
- Once a reference string is defined, moving the mouse in the model cuts a cross section through the cloud at the chainage nearest the cursror, which is shown on the bottom left of the screen.
- Left clicking again freezes the position of this section, and further left clicks let us to pick sample template points. Pressing right click unfreezes the section position.

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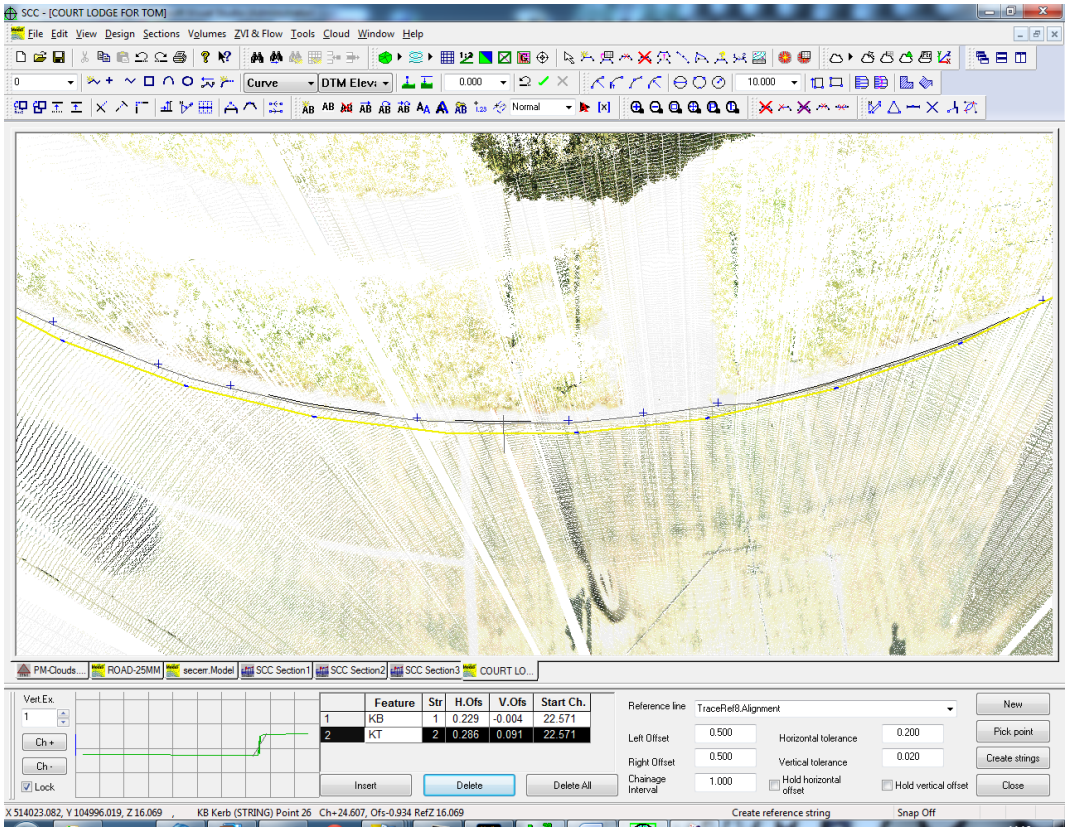
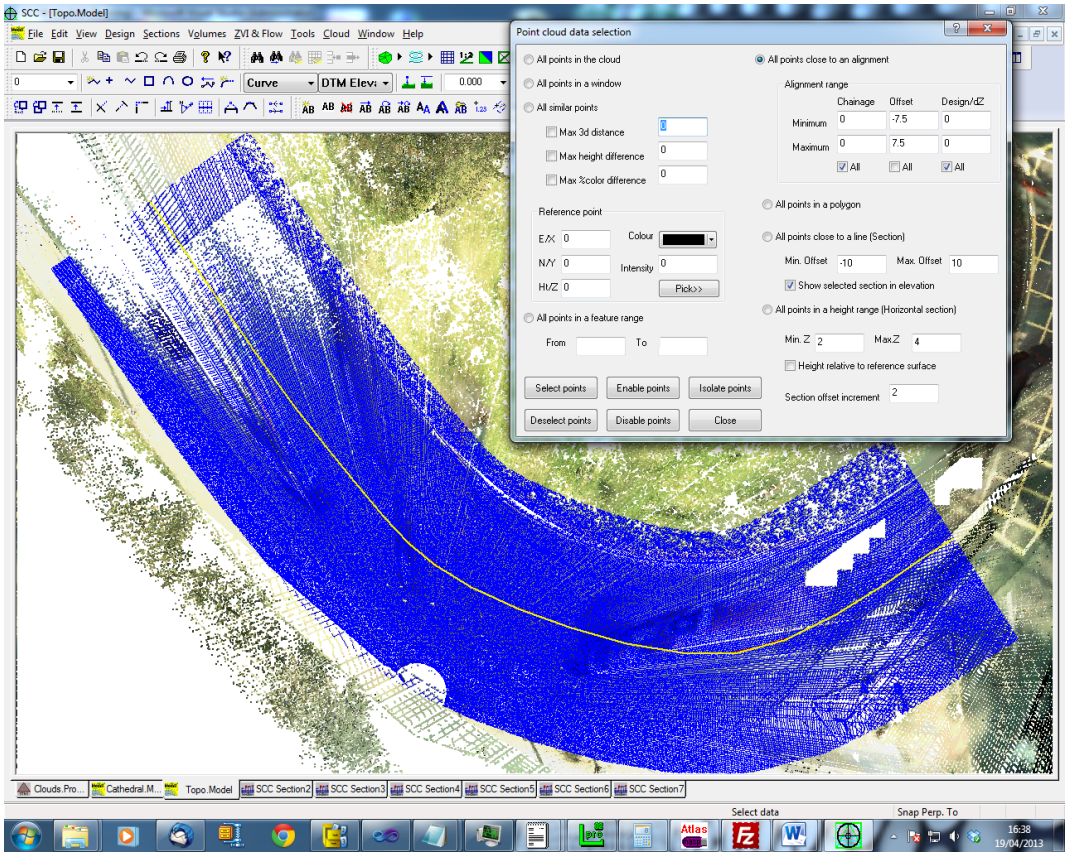


- Once points are selected, change the feature names and adjust the position in the section template sheet at the bottom of the screen.

- Pressing create, generates strings based on this template, with points at the specified chainage interval.

The horizontal tolerance controls how much the template can move along the section, from chainage to chainage, to find a best fit with points from the cloud. The vertical tolerance controls the maximum difference in relative vertical separation between points on the template and corresponding points on the cloud for the cloud points to be considered acceptable as string points. Where the vertical tolerance is not met, spot level points are out in place of string points at the correct horizontal position and cloud elevation. This helps identify areas such as drop kerbs, and positions where the feature has been occluded from the scanners line of sight.

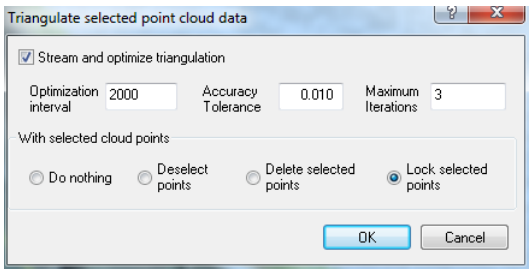
The user can also triangulate selected areas of interest for further analysis and export to software that does not support point clouds. In this case create a small alignment and select points in an area 7.5M either side of the centre line as shown below.

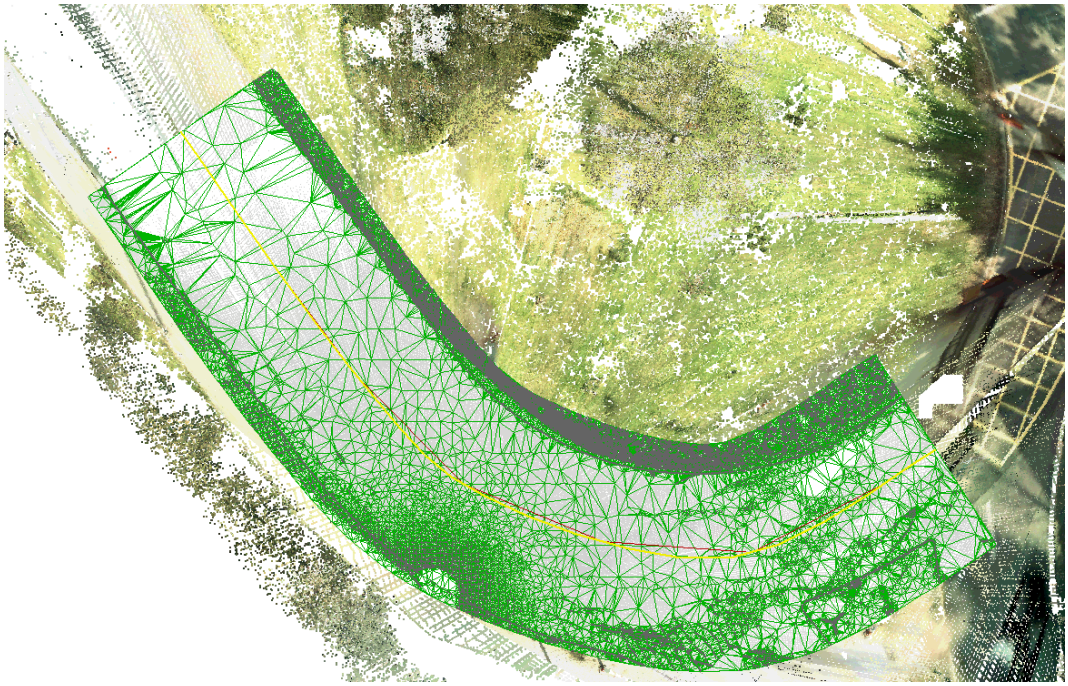


26.11.7 Triangulate Points

To triangulate the data, select 'CLOUD > Triangulate points', which gives the option of producing an optimized triangulation of the selected data.

This reduces the amount of points used from the selected points in the cloud to just those required to achieve the stated vertical tolerance, in this case 10mm. Note, this option can be slow depending on the parameters and the number of points selected. To improve performance and final result remove or isolate noisy features such as grass, trees, cars, street furniture and overhead cables prior to running this option. Only selected points whose features have an analysis type of Ground are considered when running this option, so simply changing the feature of such points to any other feature will accomplish this.





Other options relating to point cloud processing include linear feature extraction, density based feature extraction (stringing clumps of points), tracing string manually in conjunction with cloud snap, and use of other surface based tools in conjunction with the point cloud ground surface rather than the TIN.

To add further information to our TIN model, from coarser areas of the model that may have lower accuracy requirements, use **'TOOLS > Extract a grid of levels'**, and add the generated data to the TIN created above, along with traced linear features such as kerbs described earlier.

Note that when extracting a grid of levels, it is best to select the option to snap to the level of lowest point in the defined snap search radius, as this will tend to generate a more uniform surface, skipping small vegetation and similar items. This is set under **'CLOUD > Point cloud options'**.

26.12 Radial Comparison From Point Cloud Data

Support has been added for radial analysis of point clouds based on alignment, for the purpose of creating tunnel sections directly from scanned data with no additional interpolation.

This tutorial covers the use of the SCC survey, point cloud and sections modules to compare tunnels models, scanned using the Leica MS50, for deformation monitoring purpose.

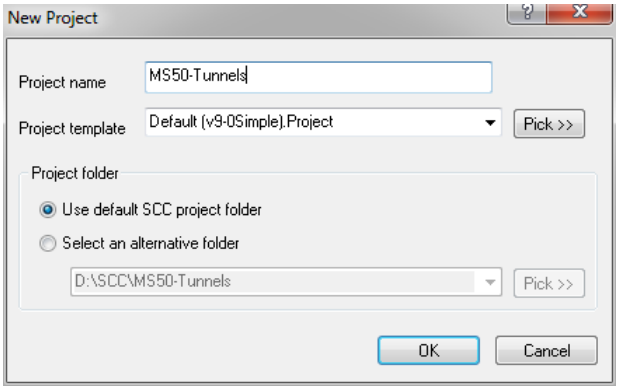
Control and scan information for the tunnel is collected using the MS50. Control Observations from the MS50 is downloaded SCC using DBX.

26.12.1 Project Creation & Data Download

Create New Project

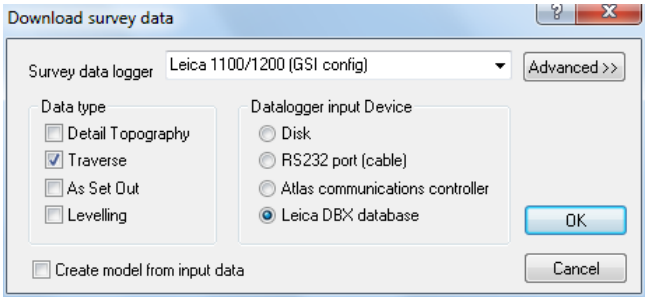
'FILE > New Project'

Pick a appropriate project name and template

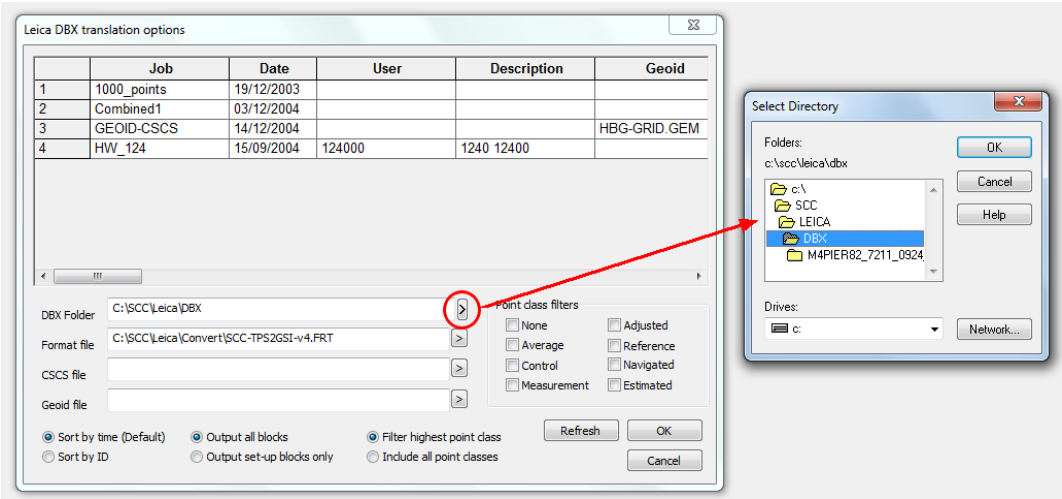


Download Survey Data

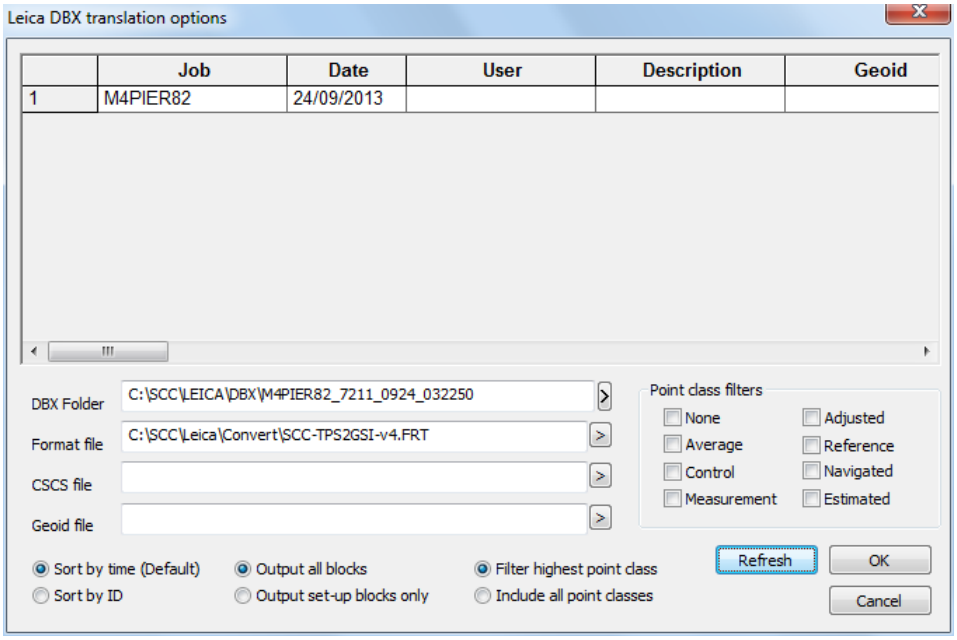
'FILE > Download Survey', pick the Leica 1100/1200 logger and DBX as the input device.



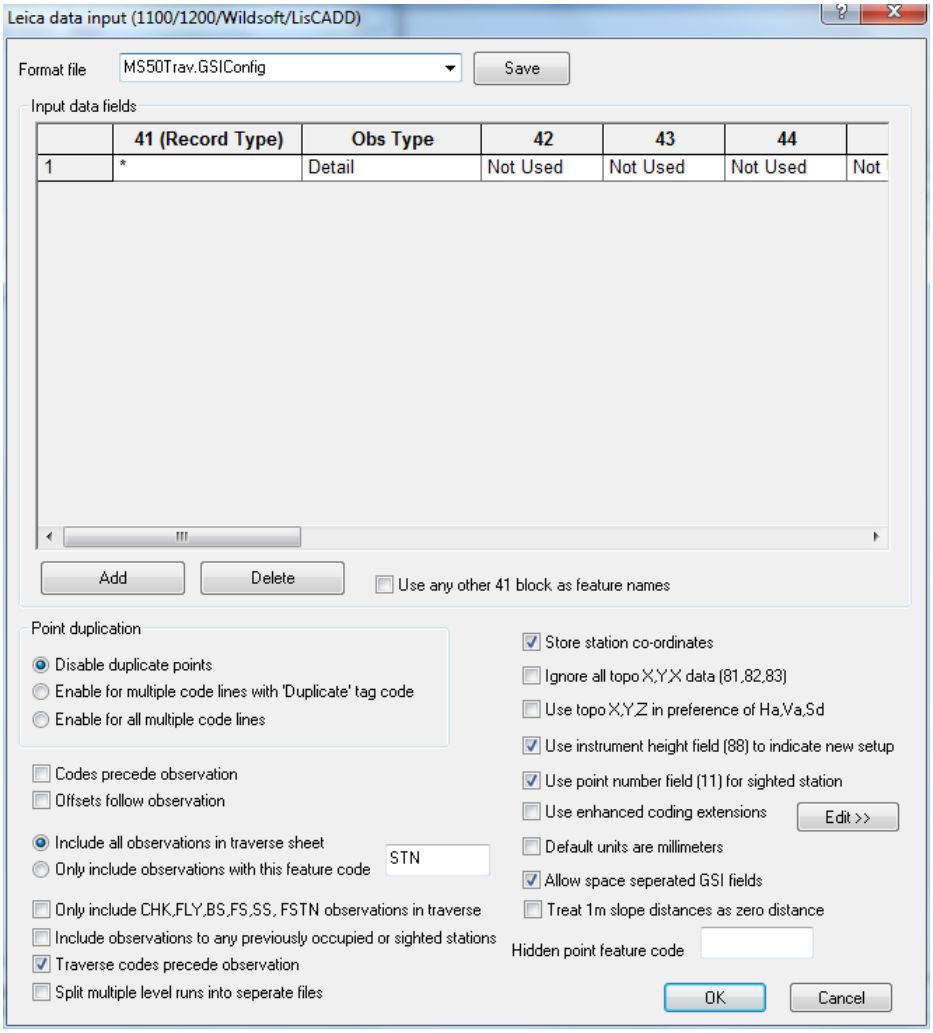
When the DBX translation dialog is shown change the DBX folder to point to location in which your MS50 scan data is stored and press Refresh to update the dialog.



Select SCC-TPS2GSI-v4.frt as your format file, click on your job file name (e.g. M4PIER82 in this case) and press OK.



Select MS50Trav.GSICONFIG in the Leica data input dialog and press Ok to download and import the survey data into SCC.



This will download control observations into the traverse spreadsheet, and any known

entered station coordinates into the project station coordinates sheet.

	Setup	Round	At Stn.	To Stn.	Code	Use O	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-SI Dist-	Remark	-Angle-
1	1	1	T1	S3	ORO	Yes	0.0000	1.8000	322 59 04	088 32 01	14.063	110006 L20	000 00 00
2	1	1	T1	S4	SS	Yes	0.0000	1.8000	279 47 53	089 40 48	28.199	110007 L21	316 48 49
3	1	1	T1	S8	SS	Yes	0.0000	1.8000	318 37 11	089 46 51	38.876	110008 L22	355 38 07
4	2	1	T2	S3	BS	Yes	0.0000	1.8000	017 52 40	088 23 15	16.764	110011 L30	000 00 00
5	2	1	T2	S4	SS	Yes	0.0000	0.0000	303 52 09	089 06 19	0.000	110012 L31	285 59 29
6	2	1	T2	S1	SS	Yes	0.0000	1.8000	072 57 18	088 54 21	11.982	110013 L32	055 04 38
7	3	1	T3	S1	BS	Yes	0.0000	1.8000	072 34 08	088 55 40	22.384	110016 L40	000 00 00
8	3	1	T3	S3	SS	Yes	0.0000	1.8000	038 10 23	088 26 53	24.362	110017 L41	325 36 15
9	3	1	T3	S4	SS	Yes	0.0000	1.8000	341 27 00	088 02 47	13.418	110018 L42	268 52 51
10	4	1	T4	S4	BS	Yes	0.0000	1.8000	084 46 02	089 03 11	5.216	110021 L50	000 00 00
11	4	1	T4	S1	SS	Yes	0.0000	0.0000	100 10 43	089 55 13	0.000	110022 L51	015 24 41
12	4	1	T4	S8	SS	Yes	0.0000	2.0000	016 20 02	089 23 18	25.894	110023 L52	291 34 00
13	5	1	T5	S1	BS	Yes	0.0000	1.8000	174 42 10	090 56 57	15.516	110026 L59	000 00 00
14	5	1	T5	S3	SS	Yes	0.0000	1.8000	238 18 37	090 09 46	5.733	110027 L60	063 36 27
15	6	1	T6	S4	BS	Yes	0.0000	1.8000	219 05 35	089 31 37	28.457	110030 L67	000 00 00
16	6	1	T6	S3	SS	Yes	0.0000	1.8000	174 58 49	088 24 42	15.721	110031 L68	315 53 14
17	7	1	T7	S3	BS	Yes	0.0000	1.8000	130 29 10	088 26 47	19.818	110034 L75	000 00 00
18	7	1	T7	S4	SS	Yes	0.0000	1.8000	192 26 31	089 01 23	19.762	110035 L76	061 57 21
19	8	1	T8	S3	BS	Yes	0.0000	1.8000	105 39 44	088 44 43	29.768	110038 L83	000 00 00
20	8	1	T8	S4	SS	Yes	0.0000	1.8000	147 10 34	088 30 03	17.221	110039 L84	041 30 50

26.12.2 Traverse Adjustment

Switch to the station coordinates sheet, and change the type of any known coordinates to either Fixed or Constrained in both XY and Z as required.

	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat
1	S1	CONTROL	Fixed	Fixed	Manual	517770.081	178259.432	11.5990	0.000	0.000	0.0000	000 0.00000N
2	S3	CONTROL	Fixed	Fixed	Manual	517763.764	178271.872	11.8410	0.000	0.000	0.0000	000 0.00000N
3	S4	CONTROL	Fixed	Fixed	Manual	517744.439	178265.439	11.6400	0.000	0.000	0.0000	000 0.00000N
4	S8	CONTROL	Fixed	Free	Manual	517746.527	178289.827	11.6330	0.000	0.000	0.0000	000 0.00000N
5	T1	CONTROL	Free	Free	al	517772.227	178260.648	13.2830	0.000	0.000	0.0000	000 0.00000N
6	T2	CONTROL	Free	Fixed	al	517758.624	178255.924	13.1710	0.000	0.000	0.0000	000 0.00000N
7	T3	CONTROL	Free	Constrained	al	517748.716	178252.730	12.9820	0.000	0.000	0.0000	000 0.00000N
8	T4	CONTROL	Free	Provisional	al	517739.245	178264.971	13.3550	0.000	0.000	0.0000	000 0.00000N
9	T5	CONTROL	Free	Prov.Trig	al	517768.647	178274.883	13.6570	0.000	0.000	0.0000	000 0.00000N
10	T6	CONTROL	Free	Prov.Resect	Manual	517762.386	178287.526	13.2050	0.000	0.000	0.0000	000 0.00000N
11	T7	CONTROL	Free	Free	Manual	517748.696	178284.734	13.1040	0.000	0.000	0.0000	000 0.00000N
12	T8	CONTROL	Free	Free	Manual	517735.108	178279.906	12.9890	0.000	0.000	0.0000	000 0.00000N

Switch back to the traverse observation view, and select 'EDIT > Adjust'

If the initial occupied stations are unknown (i.e. computed by resection or free station) make sure to have the option to exclude fixed bearings for opening and closing set-ups ticked, as the opening orientation will not be known. Instrument accuracies for height, angle and distance should be entered based in the stated accuracy of the instrument in use, number of rounds of measurement taken, and anticipated standard errors.

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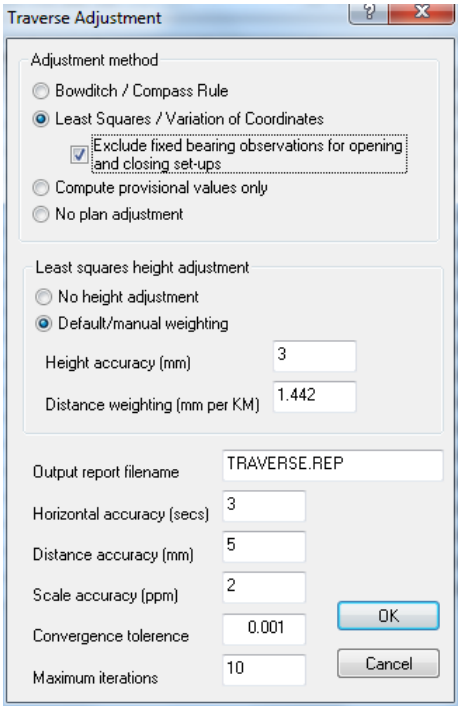
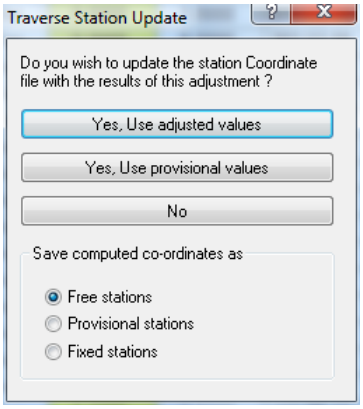


Check the traverse report to ensure that the errors reported and station positions and heights are all within an acceptable tolerance. Specific attention should be paid to chi-squared pass/fail results, error ellipses and height errors, and observation residuals. Where scanning is being carried out at the same time as control measurement, the absolute accuracy of any scanned point will be based around the station accuracy and standard error of the scanner EDM.

If the adjustment results are acceptable, update the project station values as shown.



26.12.3 Reprocessing Scan Data

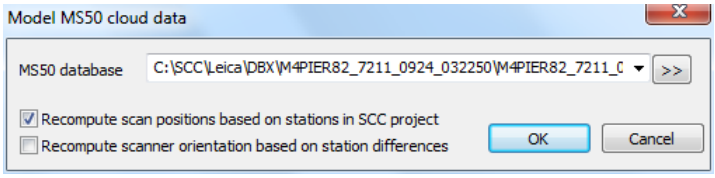
To reprocess the scan data based on the updated station values, select 'FILE > Model > Point Clouds & LIDAR > Leica MS50'.

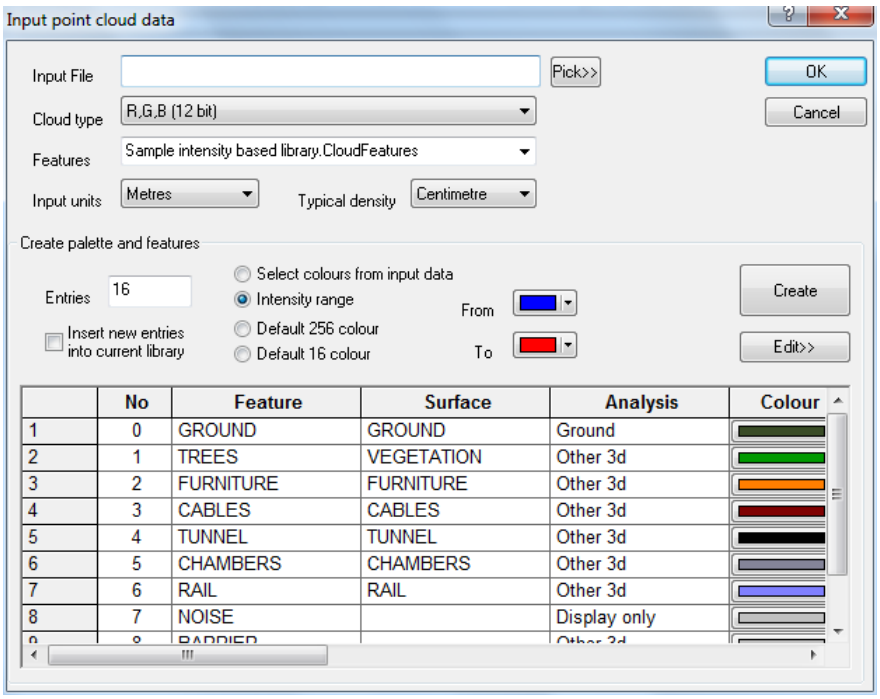
Pick your scanned project file, and tell SCC to recompute the scan positions based on the SCC stations.

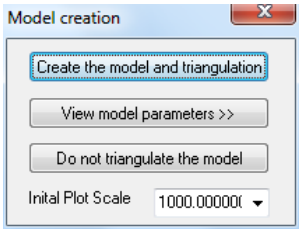
Note that we only recompute scanner orientation when moving between grid systems, as any transformation residuals are liable to reduce rather than improve overall accuracy.

Press OK on the point cloud, and create the model.

You will need to repeat this process for each survey.


Model MS50 cloud data
MS50 database
C:\SCC\Leica\DBX\M4PIER82_7211_0924_032250\M4PIER82_7211_(
>>
Recompute scan positions based on stations in SCC project
Recompute scanner orientation based on station differences
OK
Cancel


Input point cloud data
Input File
Pick>>
OK
Cancel
Cloud type
R,G,B (12 bit)
Features
Sample intensity based library.CloudFeatures
Input units
Metres
Typical density
Centimetre
Create palette and features
Entries
16
Select colours from input data
Intensity range
Default 256 colour
Default 16 colour
From
To
Create
Edit>>
Insert new entries into current library
No
Feature
Surface
Analysis
Colour
1 0 GROUND GROUND Ground
2 1 TREES VEGETATION Other 3d
3 2 FURNITURE FURNITURE Other 3d
4 3 CABLES CABLES Other 3d
5 4 TUNNEL TUNNEL Other 3d
6 5 CHAMBERS CHAMBERS Other 3d
7 6 RAIL RAIL Other 3d
8 7 NOISE Display only


Model creation
Create the model and triangulation
View model parameters >>
Do not triangulate the model
Inital Plot Scale
1000.00000(

Once we have two models created of the same tunnel in the same grid system we can compare them as follows

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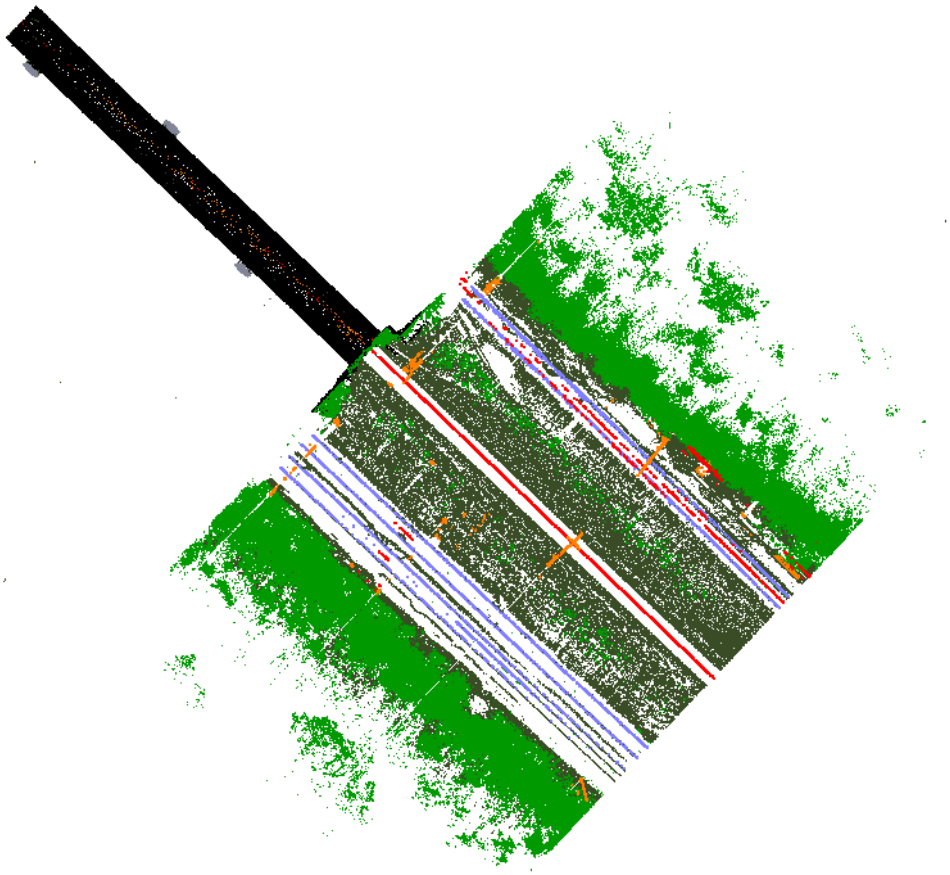
26.12.4 Comparison of Two Models

Open your base survey model 'Tunnel (Edited).Model' from \SCC\Tutorials\Point Clouds



For the purposes of this tutorial, we're only interested in the tunnel itself.

Press right click to bring up the point cloud data selection dialog, select 'All points in polygon' and press 'Isolate points'.

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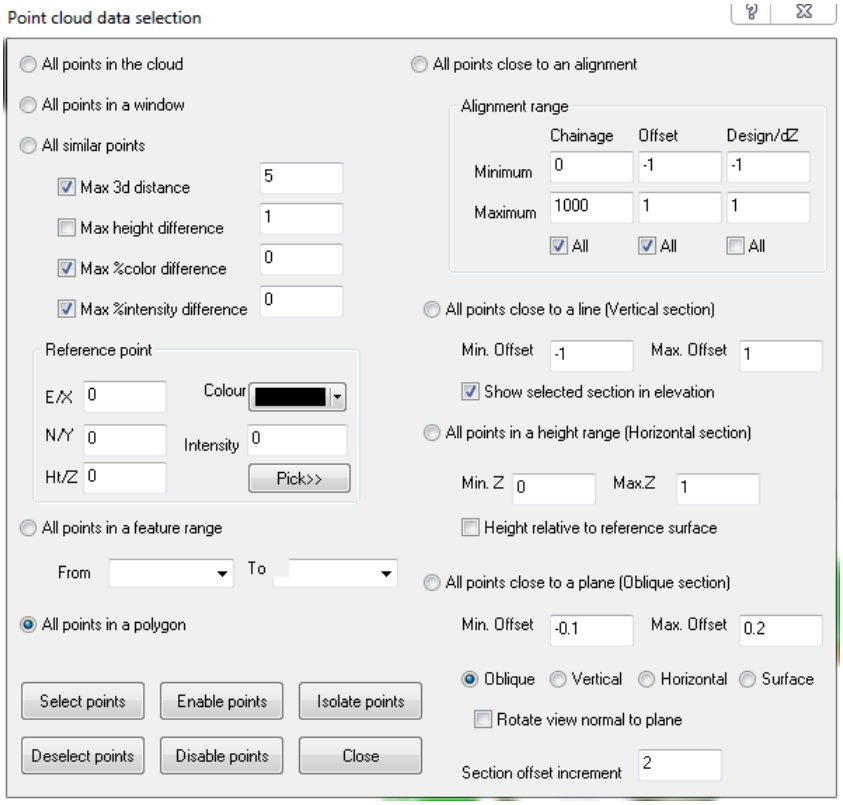
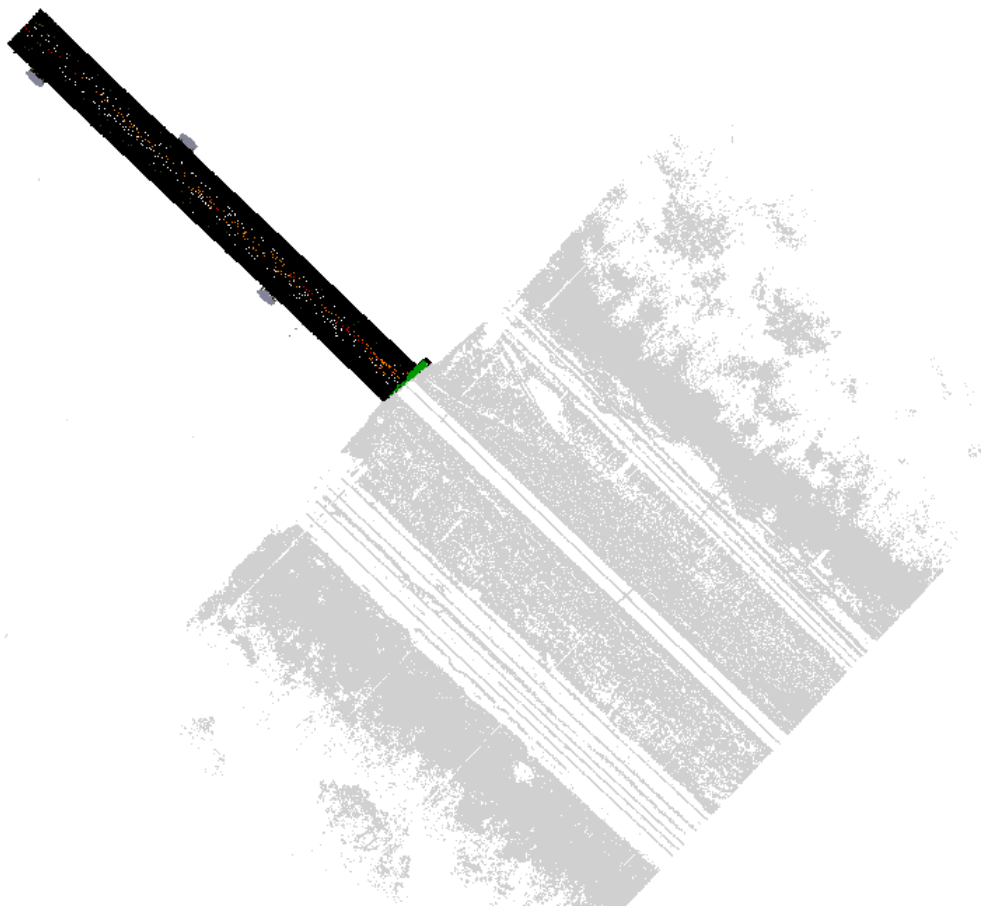
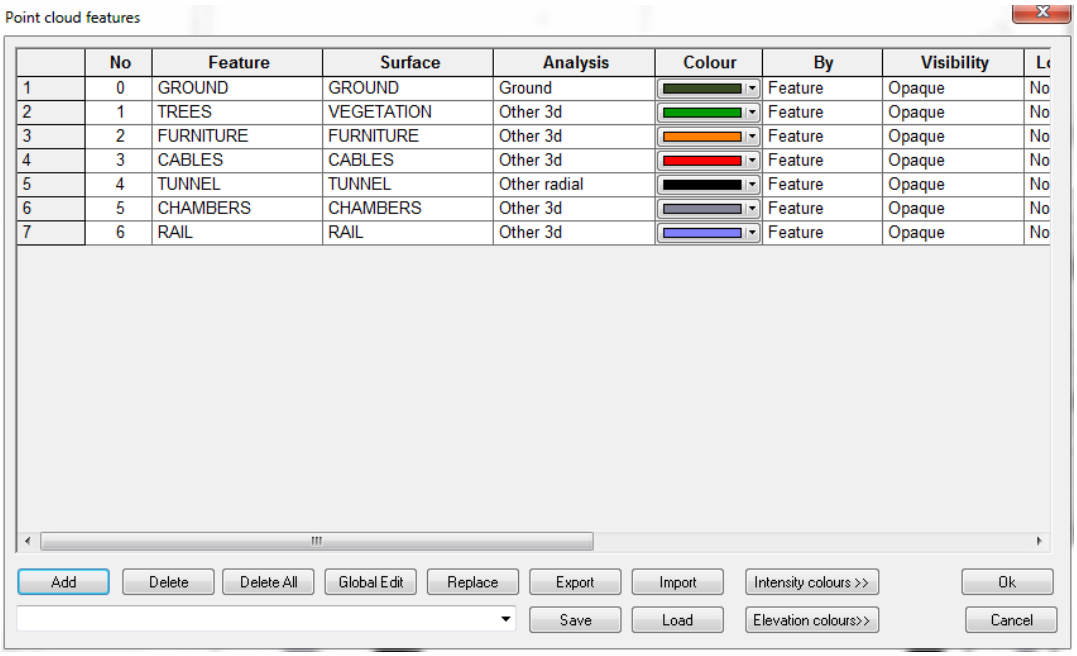


Left click on four or more points to form a polygon around the tunnel, and right click to turn off all points not inside that polygon.



Select 'CLOUD > Point cloud features', and change the Analysis of Tunnel from Other 3D to Other Radial.

This means that section points on this feature will be connected radially from the alignment centre line.



	No	Feature	Surface	Analysis	Colour	By	Visibility	L
1	0	GROUND	GROUND	Ground		Feature	Opaque	No
2	1	TREES	VEGETATION	Other 3d		Feature	Opaque	No
3	2	FURNITURE	FURNITURE	Other 3d		Feature	Opaque	No
4	3	CABLES	CABLES	Other 3d		Feature	Opaque	No
5	4	TUNNEL	TUNNEL	Other radial		Feature	Opaque	No
6	5	CHAMBERS	CHAMBERS	Other 3d		Feature	Opaque	No
7	6	RAIL	RAIL	Other 3d		Feature	Opaque	No

Select 'VIEW > Rotate Viewpoint, followed by Two point elevation to create a view point that looks down the tunnel.

Note that by changing the angle in the rotation side bar dialog to a small value, e.g. 1 degree, we can make fine adjustments to this view as required.

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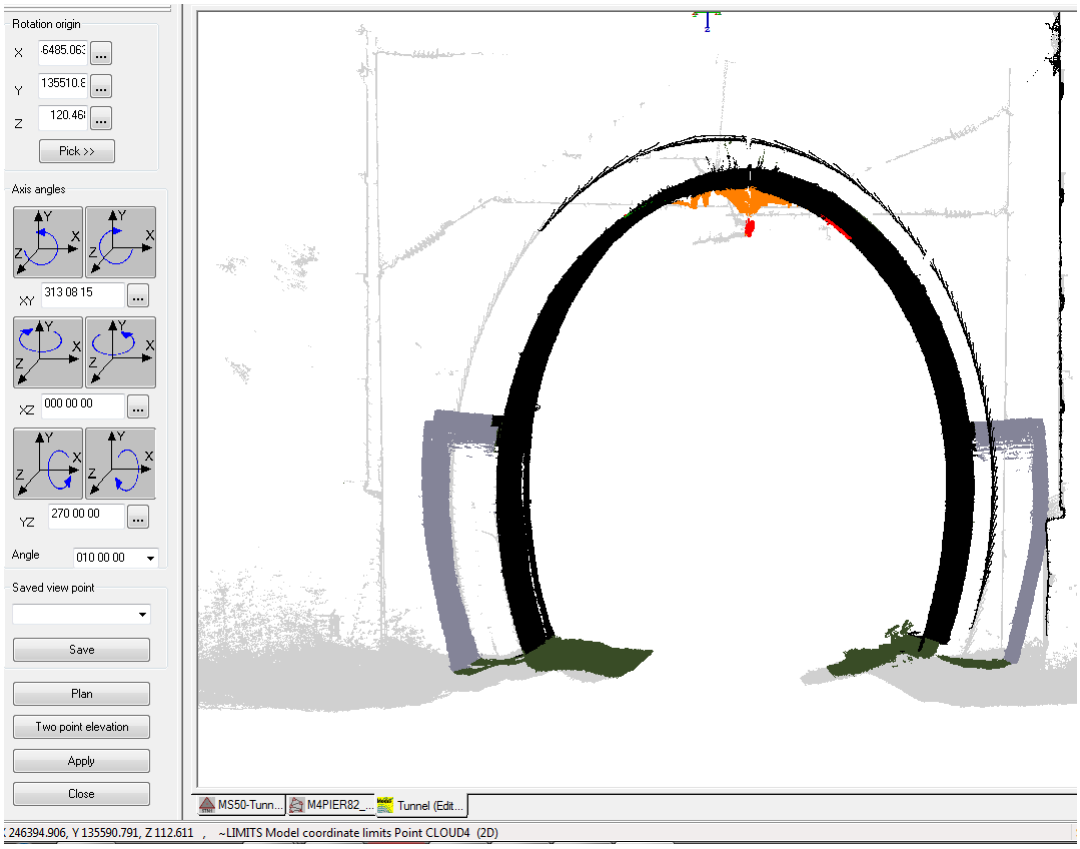
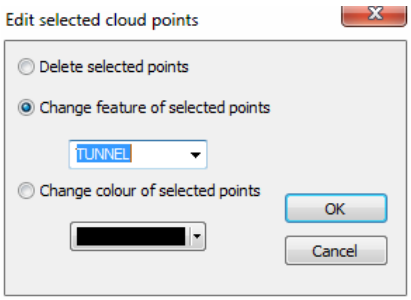


To set the feature of any group of points, right click to bring up the point cloud data selection dialog, select 'All points in a polygon' and press 'Select points'.

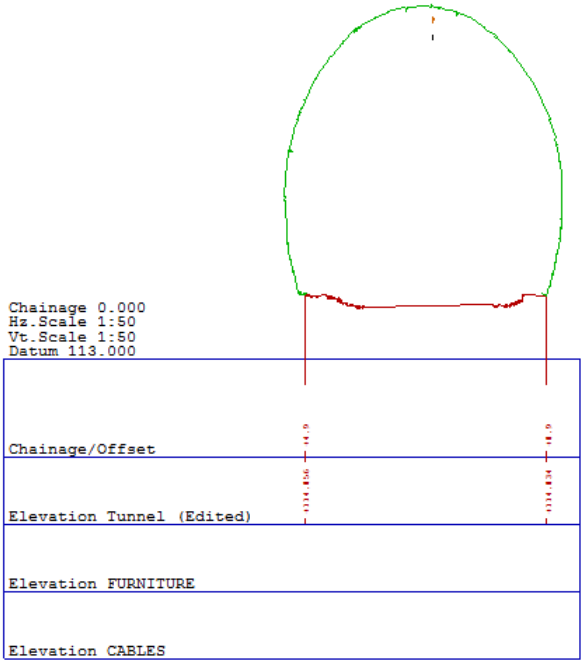
Left click on all the polygon points, and right click to select / highlight all the scanned points inside that polygon.

Select 'CLOUD > Edit Selected points', and change the feature of the selected points as required. Repeat this process to edit the cloud such that tunnel walls and ground are separated, and any spurious information is set to another feature such that it can be easily identified in section.



Press 'P' to return to a plan view, and 'SECTIONS >Long section with cursor' to verify the model is correct.

To create the section left click on two points, one on each side of the tunnel, and right click to finish.

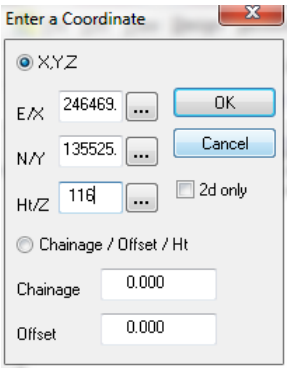


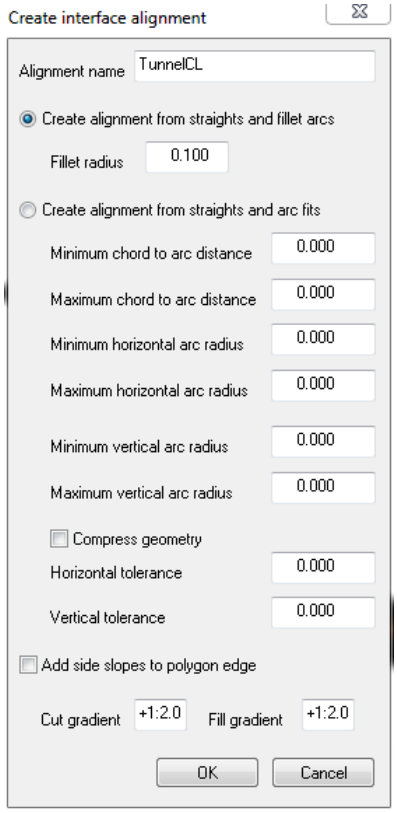
To create cross sections for a comparison, an alignment centre line is needed.

This can be imported from DXF/DWG, LandXML, or GENIO as requied. In this case, draw the centre line manually.

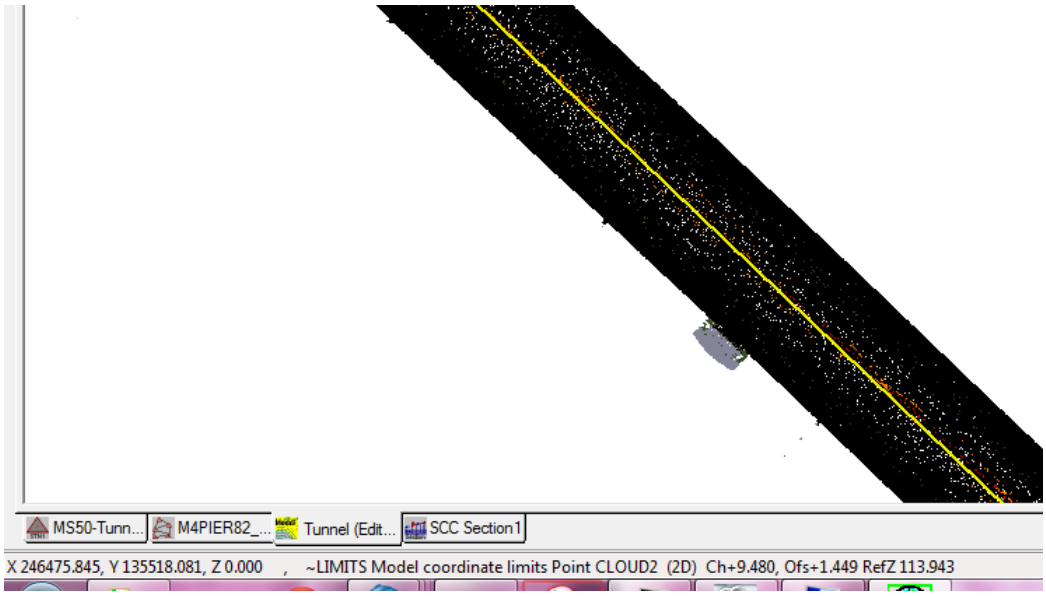
Select 'EDIT > Add strings with cursor'.

Place the mouse over the centre of the tunnel in plan and press enter. This will show a dialog with the current mouse position. Enter a height of 116 for this point and press ok. Repeat for a point at the other end of the tunnel, and press the right mouse button to bring up a pop-up menu. On this menu, select Save string as interface, as give this new alignment a name as shown.

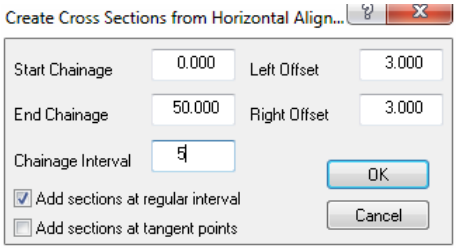


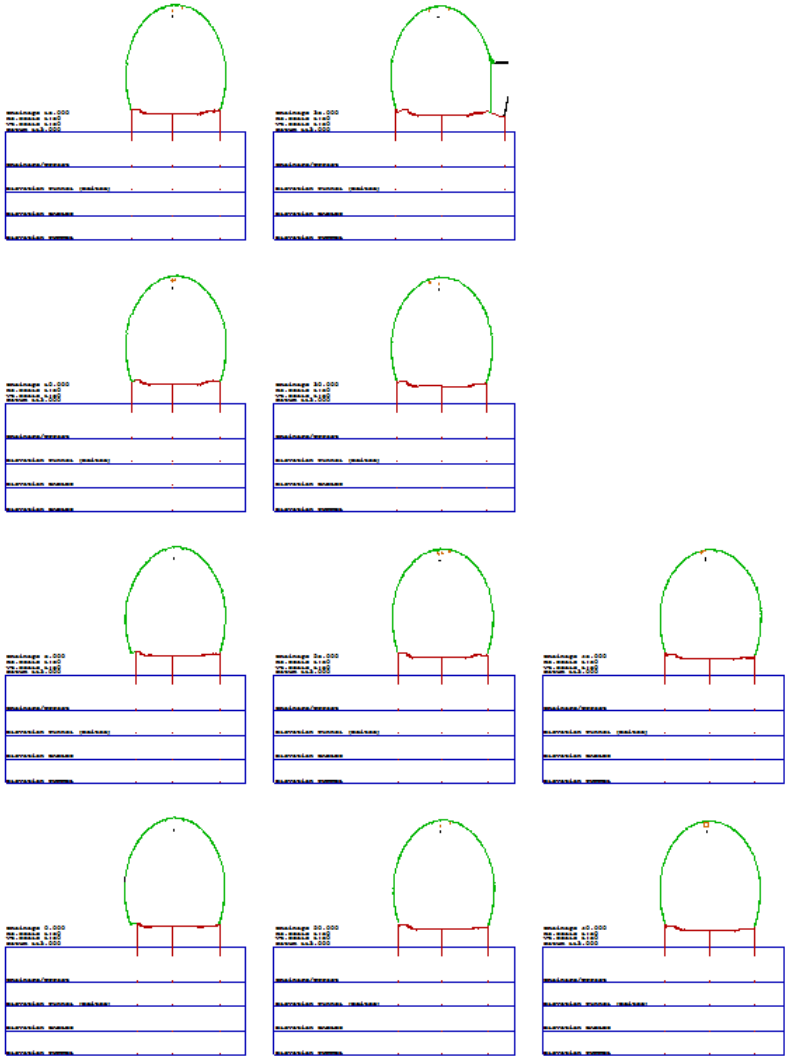


A chainage, offset and centre line height for the tunnel have been achieved, which are draw as a yellow line in the model. As the mouse cursor is moved around the screen, the chainage and offset is reported in the status bar in addition to X,Y,Z.

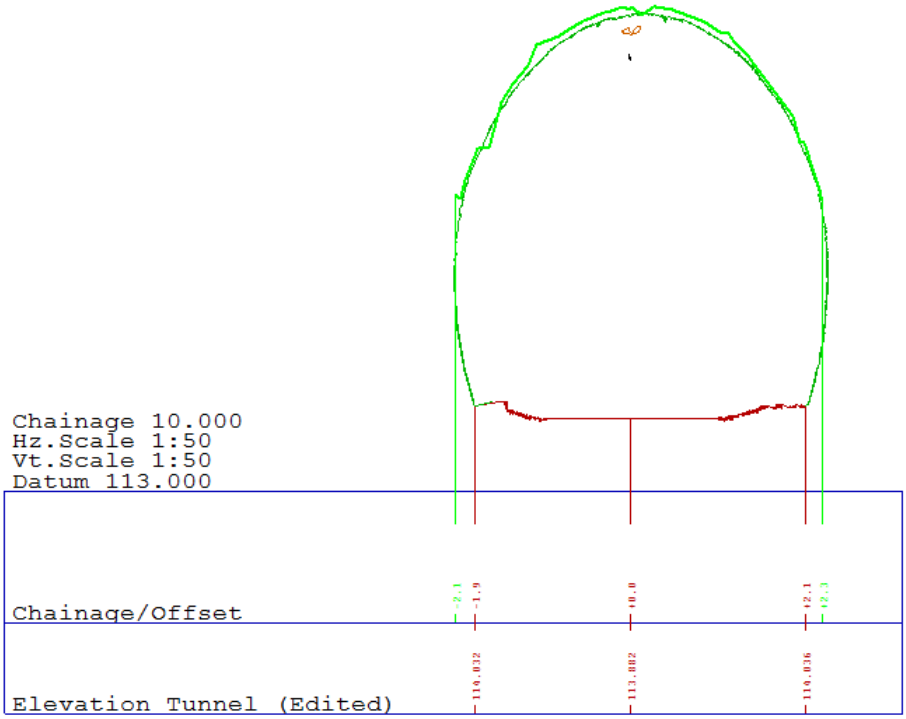


To cut some cross sections, select 'SECTIONS > Cross sections from an alignment' using the values given.



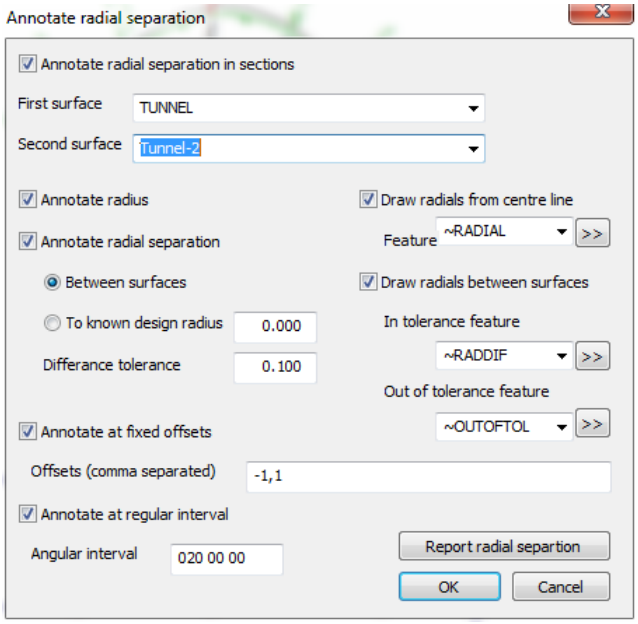


To add another survey model onto these sections, use 'EDIT > Append surfaces' and pick your second model.



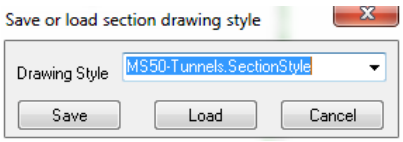
Select View / Radial annotation to show the radial separation between the two surfaces.

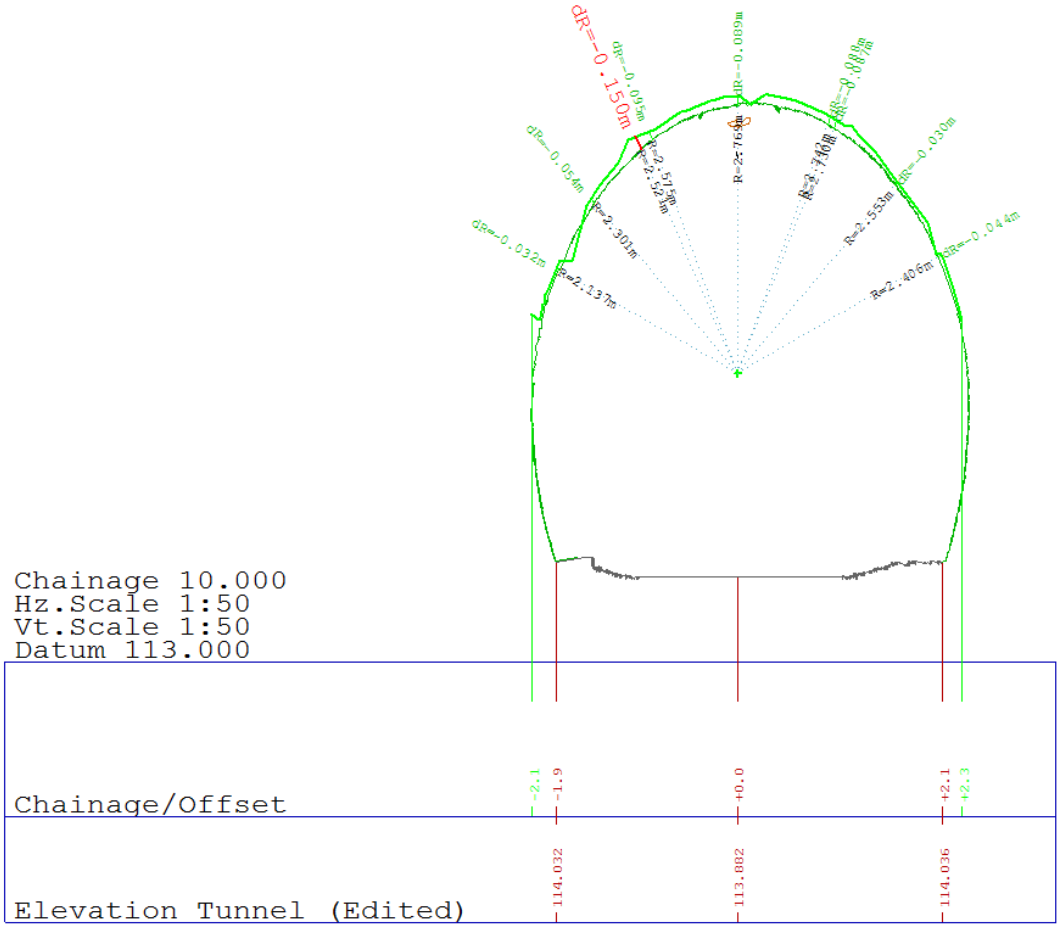
In this case, the radius of the base model is annotated and the difference in radius at offsets -1 and 1 and at every 20 degrees from the centre line.



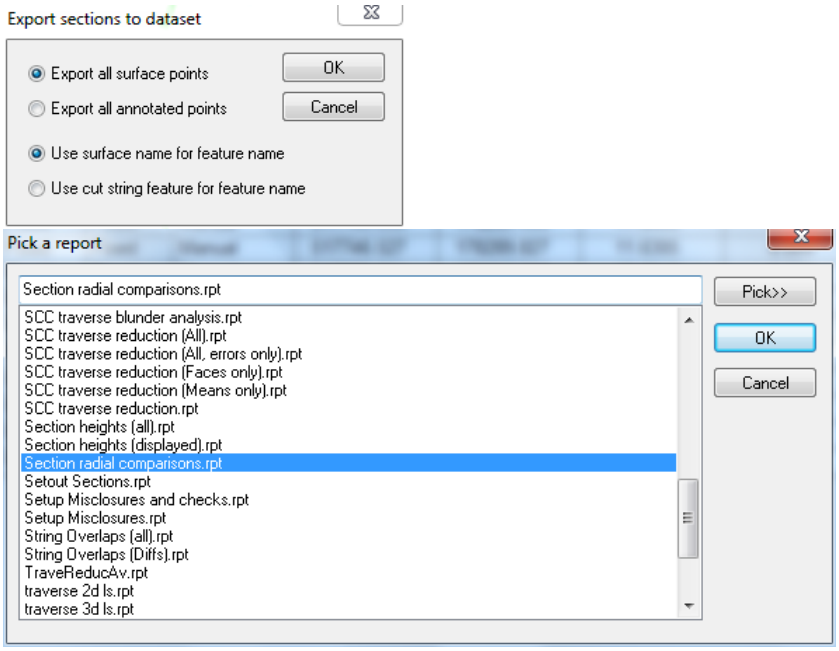
Separate features are used to show radial lines, differences and out of tolerance points.

A sample section style is also available to highlight these features, which can be loaded using 'FILE > Load save section style', and picking MS50-Tunnels.SectionStyle

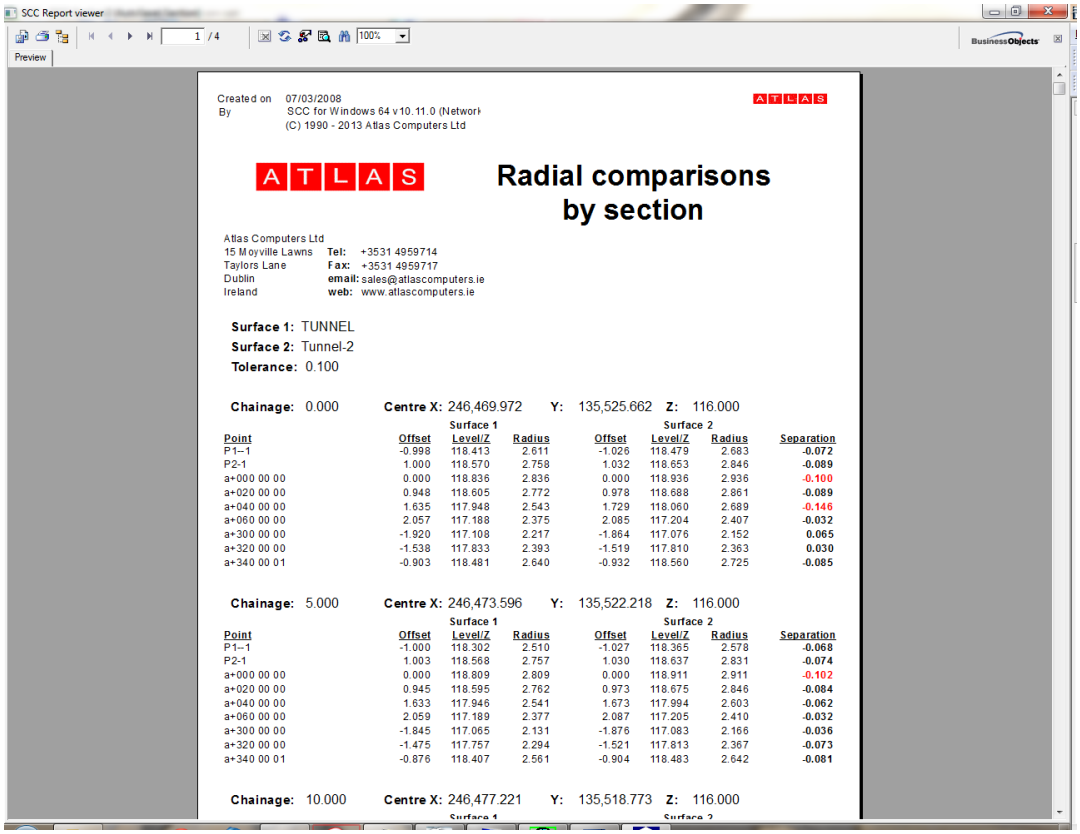




To export the differences in report format, select 'FILE > Reports' and pick 'Section radial comparisons.rpt'.



Pressing the top left button in the report viewer can be used to export the report to other formats such as Excel or PDF for analysis and archive purposes.



SCC Report viewer

Created on 07/03/2008
By SCC for Windows 64 v10.11.0 (Network
(C) 1990 - 2013 Atlas Computers Ltd

ATLAS

ATLAS

Radial comparisons by section

Atlas Computers Ltd
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Taylors Lane
Dublin
Ireland

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Fax: +3531 4959717
email: sales@atlascomputers.ie
web: www.atlascomputers.ie

Surface 1: TUNNEL
Surface 2: Tunnel-2
Tolerance: 0.100

Chainage: 0.000 **Centre X:** 246,469.972 **Y:** 135,525.662 **Z:** 116.000

	Surface 1			Surface 2			
Point	Offset	Level/Z	Radius	Offset	Level/Z	Radius	Separation
P1--1	-0.998	118.413	2.611	-1.026	118.479	2.683	-0.072
P2-1	1.000	118.570	2.758	1.032	118.653	2.846	-0.089
a+000 00 00	0.000	118.836	2.836	0.000	118.936	2.936	-0.100
a+020 00 00	0.948	118.605	2.772	0.978	118.688	2.861	-0.089
a+040 00 00	1.635	117.948	2.543	1.729	118.060	2.689	-0.146
a+060 00 00	2.057	117.188	2.375	2.085	117.204	2.407	-0.032
a+300 00 00	-1.920	117.108	2.217	-1.864	117.076	2.152	0.065
a+320 00 00	-1.538	117.833	2.393	-1.519	117.810	2.363	0.030
a+340 00 01	-0.903	118.481	2.640	-0.932	118.560	2.725	-0.085

Chainage: 5.000 **Centre X:** 246,473.596 **Y:** 135,522.218 **Z:** 116.000

	Surface 1			Surface 2			
Point	Offset	Level/Z	Radius	Offset	Level/Z	Radius	Separation
P1--1	-1.000	118.302	2.510	-1.027	118.365	2.578	-0.068
P2-1	1.003	118.568	2.757	1.030	118.637	2.831	-0.074
a+000 00 00	0.000	118.809	2.809	0.000	118.911	2.911	-0.102
a+020 00 00	0.945	118.595	2.762	0.973	118.675	2.846	-0.084
a+040 00 00	1.633	117.946	2.541	1.673	117.994	2.603	-0.062
a+060 00 00	2.059	117.189	2.377	2.087	117.205	2.410	-0.032
a+300 00 00	-1.845	117.065	2.131	-1.876	117.083	2.166	-0.036
a+320 00 00	-1.475	117.757	2.294	-1.521	117.813	2.367	-0.073
a+340 00 01	-0.876	118.407	2.561	-0.904	118.483	2.642	-0.081

Chainage: 10.000 **Centre X:** 246,477.221 **Y:** 135,518.773 **Z:** 116.000

26.12.5 Additional Radial Reports

Additonal Reports are available such as 'Section radial comparisons (with X,Y).rpt' which will produce the following;

Created on 07/03/2008
By SCC for Windows v10.16.1 (Workstatio
(C) 1990 - 2013 Atlas Computers Ltd

ATLAS

Radial comparisons by section

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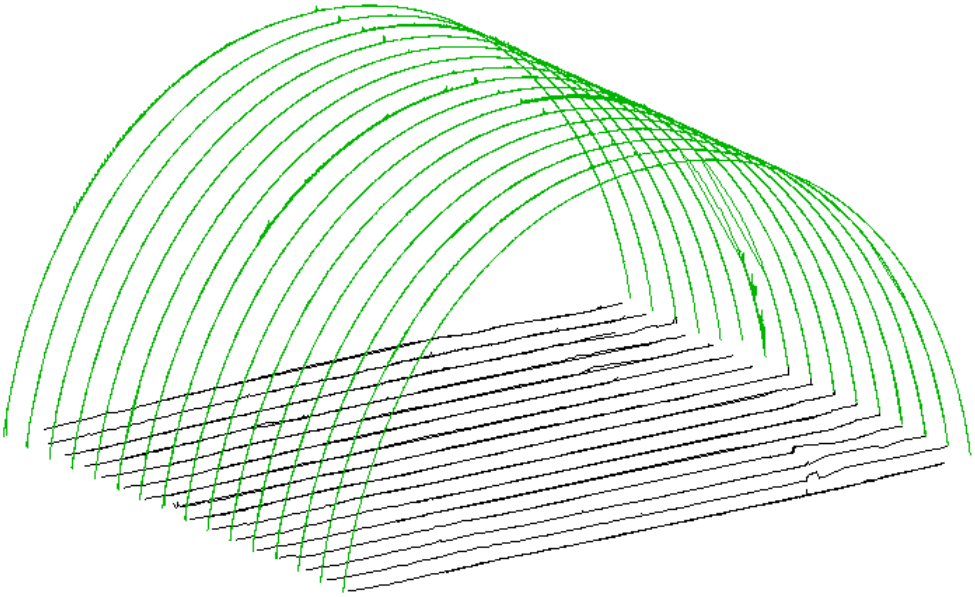
Tel: +3531 4958714
Fax: +3531 4958717
email: sales@atlascomputers.ie
web: www.atlascomputers.ie

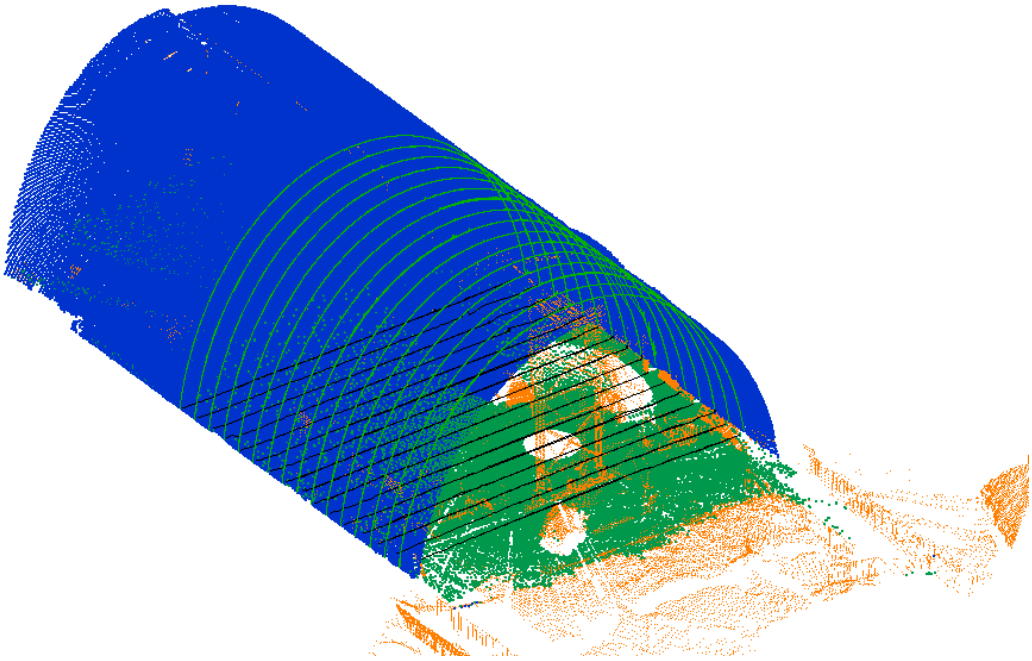
Surface 1: TUNNEL CARNO0412 1 041213 102745
Surface 2: TUNNEL CARNO1012 101213 110356
Tolerance: 0.020

Chainage: 15.000 **Centre X:** 26,441.228 **Y:** 12,720.337 **Z:** 358.279

	Surface 1					Surface 2					
Point	X	Y	Offset	Level/Z	Radius	X	Y	Offset	Level/Z	Radius	dRad
a+010 00 00	26,436.869	12,720.586	1.602	367.366	9.227	26,438.493	12,720.493	1.601	367.357	9.218	0.009
a+017 00 00	26,436.455	12,720.609	2.677	367.035	9.155	26,437.380	12,720.557	2.688	367.072	9.194	-0.039
a+019 00 00	26,436.559	12,720.604	2.980	366.934	9.153	26,437.103	12,720.573	2.989	366.960	9.181	-0.028
a+020 00 00	26,436.611	12,720.601	3.132	366.884	9.157	26,436.964	12,720.580	3.139	366.905	9.179	-0.022
a+030 00 00	26,435.786	12,720.648	4.539	366.142	9.079	26,435.726	12,720.651	4.537	366.139	9.075	0.004
a+040 00 00	26,434.587	12,720.716	5.758	365.142	8.958	26,434.421	12,720.726	5.757	365.140	8.956	0.002
a+050 00 00	26,432.624	12,720.828	6.775	363.964	8.844	26,433.590	12,720.773	6.778	363.967	8.848	-0.005
a+060 00 00	26,433.032	12,720.805	7.600	362.667	8.775	26,432.916	12,720.811	7.603	362.669	8.779	-0.003
a+070 00 00	26,432.430	12,720.839	8.254	361.284	8.784	26,432.464	12,720.837	8.248	361.282	8.778	0.006
a+080 00 00	26,432.383	12,720.842	8.725	359.818	8.859	26,432.184	12,720.853	8.723	359.818	8.858	0.001
a+280 00 00	26,448.735	12,719.909	-8.512	359.781	8.644	26,449.231	12,719.880	-8.577	359.792	8.709	-0.065
a+290 00 00	26,448.929	12,719.898	-8.130	361.239	8.652	26,448.876	12,719.901	-8.144	361.244	8.667	-0.015
a+300 00 00	26,447.662	12,719.970	-7.505	362.613	8.666	26,448.176	12,719.941	-7.516	362.619	8.679	-0.013
a+310 00 00	26,447.078	12,720.003	-6.694	363.896	8.738	26,447.295	12,719.991	-6.708	363.908	8.756	-0.018
a+320 00 00	26,445.794	12,720.076	-5.700	365.072	8.867	26,445.864	12,720.072	-5.709	365.083	8.882	-0.015
a+330 00 01	26,444.856	12,720.130	-4.504	366.081	9.008	26,444.708	12,720.138	-4.507	366.086	9.015	-0.006
a+340 00 01	26,442.682	12,720.254	-3.120	366.851	9.122	26,443.268	12,720.221	-3.121	366.854	9.125	-0.003
a+350 00 01	26,441.276	12,720.334	-1.597	367.336	9.196	26,441.781	12,720.306	-1.597	367.339	9.199	-0.003

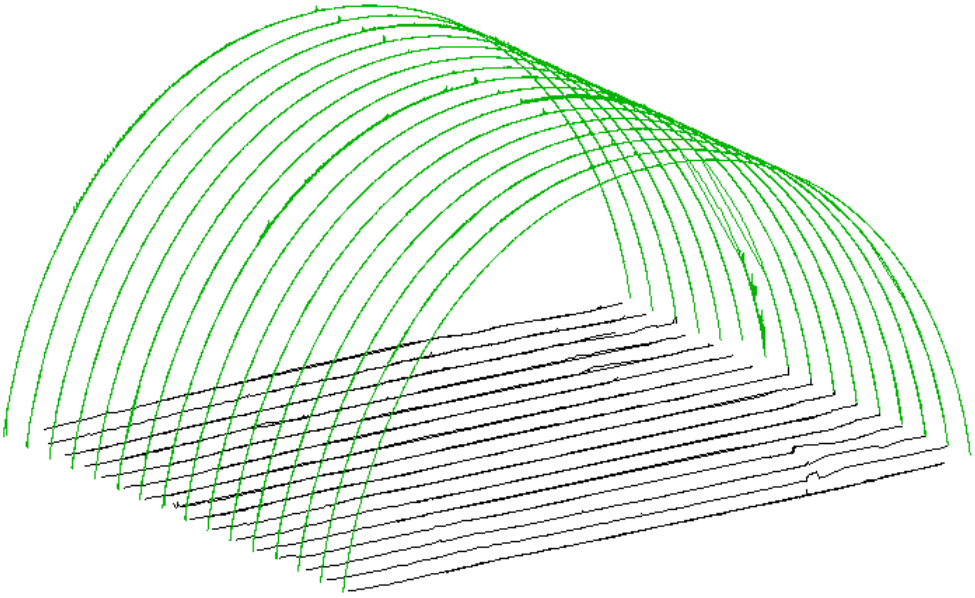
Note that you can also use File / Export / Export sections to a survey dataset, and model this dataset to get a further visual, e.g.



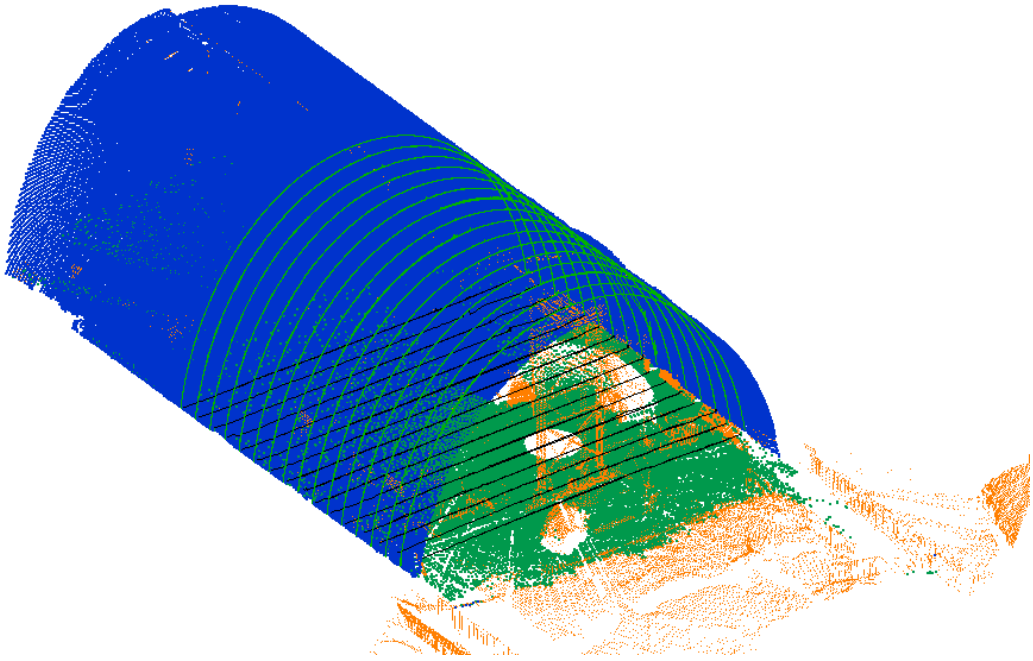


26.12.6 Further Visualisations

Note that using 'FILE > Export > Export sections to a survey dataset', and then modelling this dataset further visualisations can be achieved:



In addition the original point cloud can be attached.



26.13 Cutting Sections From MS50 Data

This tutorial examines the use of the SCC survey, point cloud and sections modules to model scanned using the Leica MS50, and cut sections from it.

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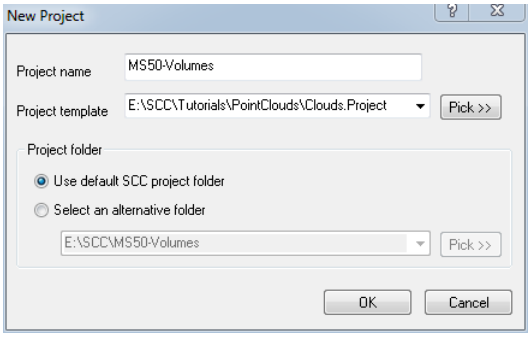
26.13.1 Create New Project

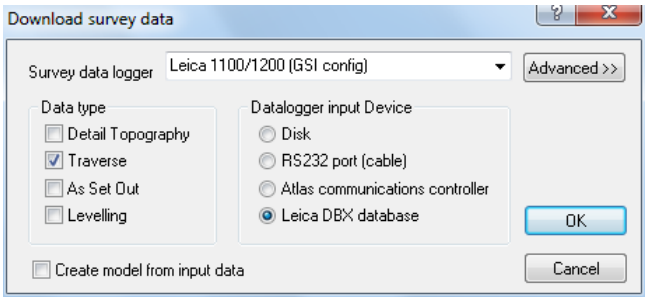
'FILE > New Project' as shown below:



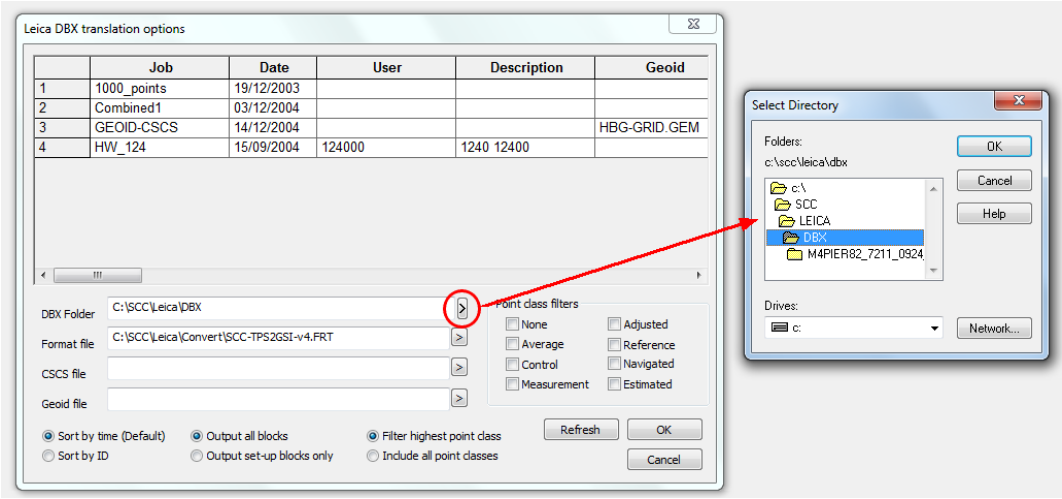
26.13.2 Downloading Control Data

'FILE > Download Survey'

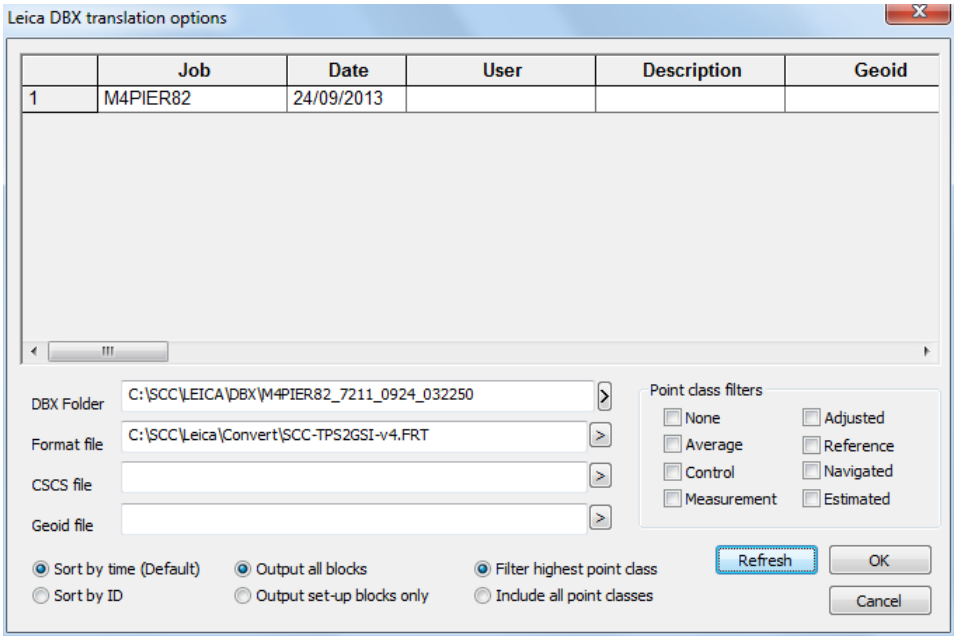
Pick the Leica 1100/1200 logger and DBX as the input device.



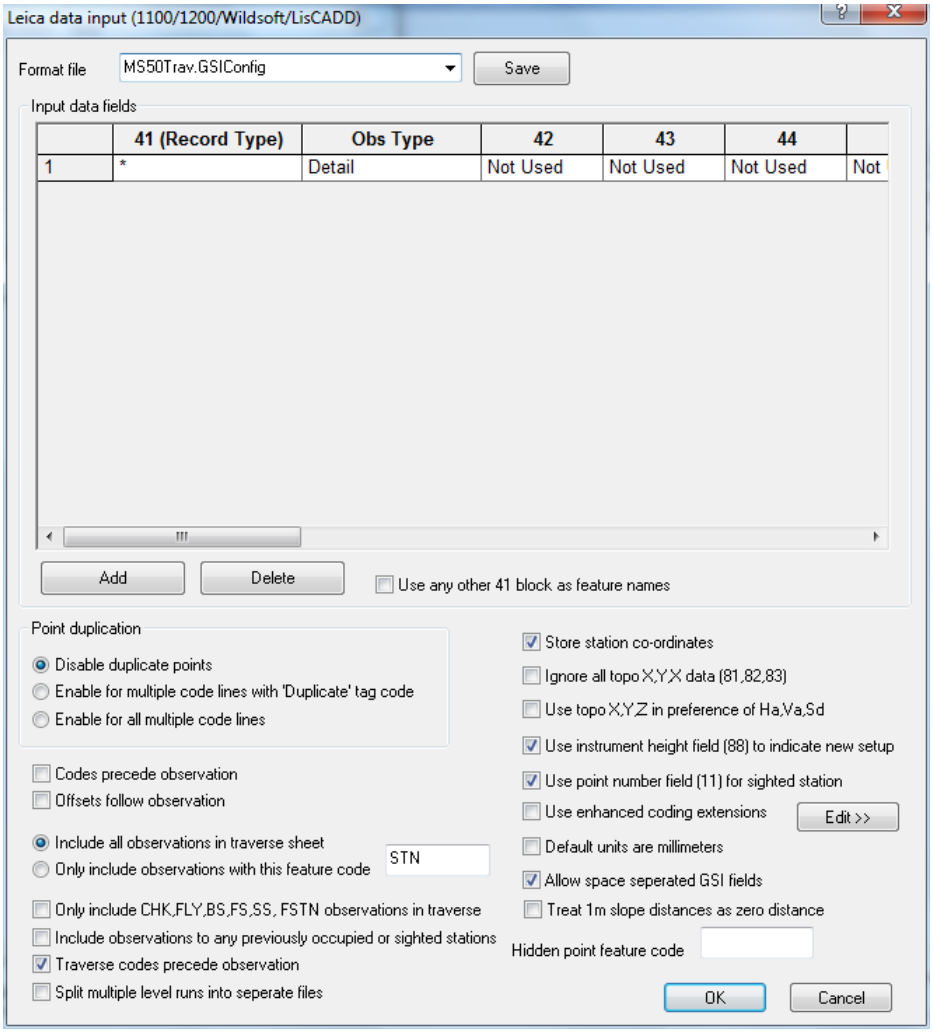
When the DBX translation dialog is shown change the DBX folder to point to the location in which the MS50 scan data is stored and press 'Refresh' to update the dialog.



Select 'SCC-TPS2GSI-v4.frt' as the format file, click on the job file name and press 'OK'



Select 'MS50Trav.GSICONFIG' in the Leica data input dialog and press 'OK' to download and import the survey data into SCC.



This will download control observations into the traverse spreadsheet, and any known

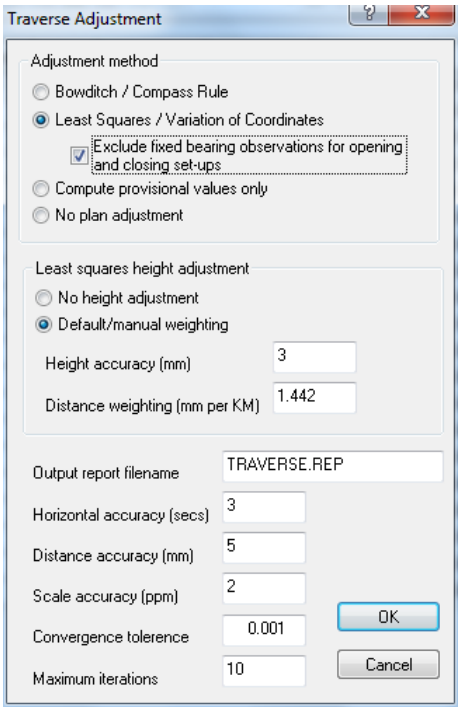
entered station coordinates into the project station coordinates sheet.

26.13.3 Processing Traverse

Switch to the station coordinates sheet, and change the type of any known coordinates to either 'Fixed' or 'Constrained 'in both XY and Z, and edit any changes to position or elevation as required.

Switch back to the traverse observation view, and select 'EDIT > Adjust'.

If initial occupied stations are unknown (i.e. computed by resection or free station) make sure the option to exclude fixed bearings for opening and closing set-ups is ticked, as the opening orientation will not be known. Instrument accuracies for height, angle and distance should be entered based in the stated accuracy of the instrument in use, number of rounds of measurement taken, and anticipated standard errors.



Check the traverse report to ensure that the errors reported and station positions and heights are all within an acceptable tolerance. Specific attention should be paid to chi-squared pass/fail results, error ellipses and height errors, and observation residuals. Where scanning is being carried out at the same time as control measurement, the absolute accuracy of any scanned point will be based around the station accuracy and standard error of the scanner EDM.

If the adjustment results are acceptable, update the project station values.

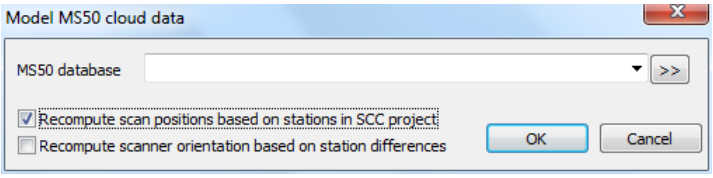
26.13.4 Reprocessing Scan Data Based On New Station Values

To reprocess the scan data based on the updated station values, select 'FILE > Model > Point Clouds & LIDAR > Leica MS50'.

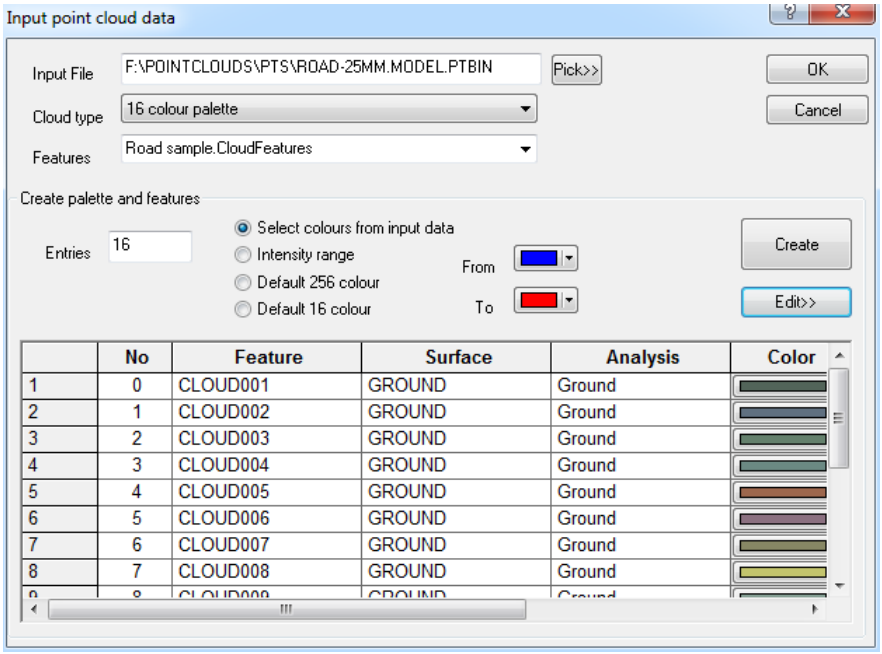
Pick the scanned project file

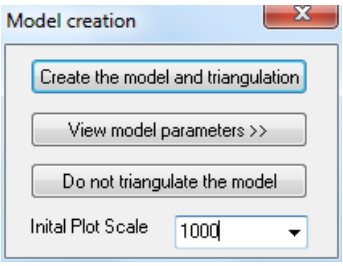
Pick 'Recompute scan positions based on stations in SCC project'

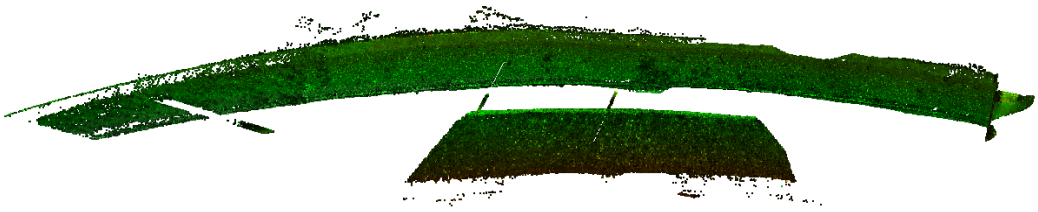
Note that 'only recompute scanner orientation' is selected when moving between grid systems, as any transformation residuals are liable to reduce rather than improve overall accuracy.



Press 'OK' on the point cloud, and create the model.







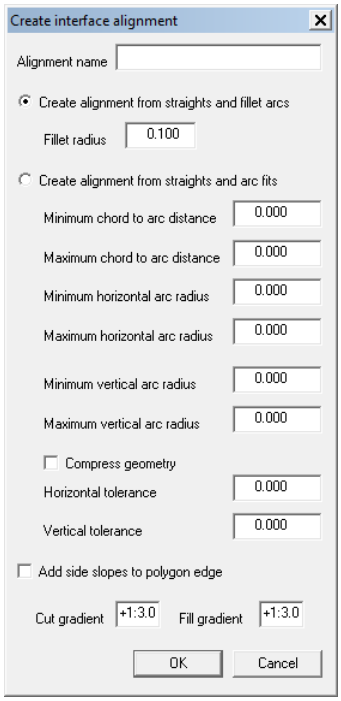
26.13.5 Creating Cross Sections For Comparison

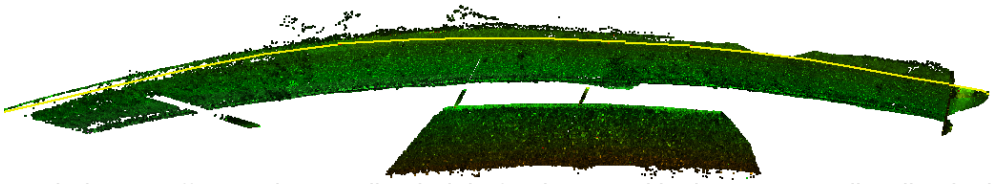
To create cross sections for a comparison, an alignment centre line is needed. This can be imported from DXF/DWG, LandXML, or GENIO as requied. In this case, a centre line manually is manually drawn.

Press the curve button on the tool bar and left click on all three or more points representing your centre line.

Press the right mouse button to bring up a pop-up menu.

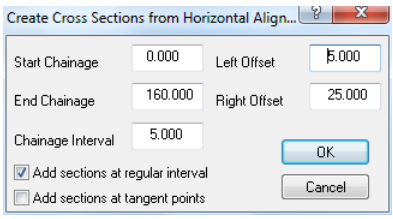
Select 'Save string as interface' and enter new alignment name

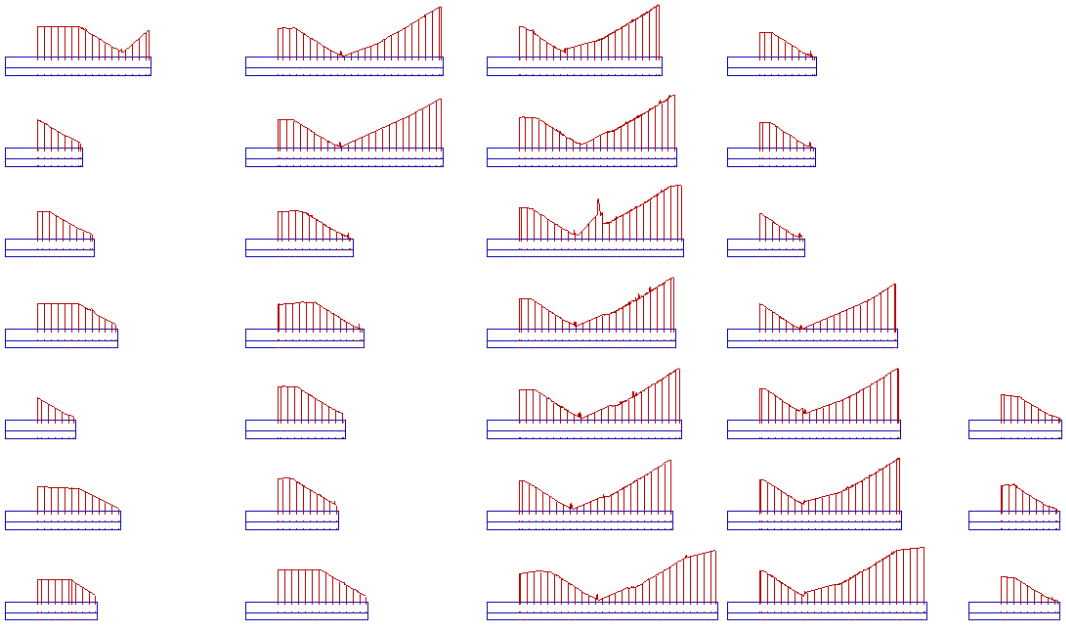




A chainage, offset and centre line height for the tunnel is drawn as a yellow line in the model. As the mouse is moved around the screen, a chainage and offset is reported in the status bar in addition to X,Y,Z.

To cut some cross sections, select 'SECTIONS > Cross sections from an alignment' using the values given.

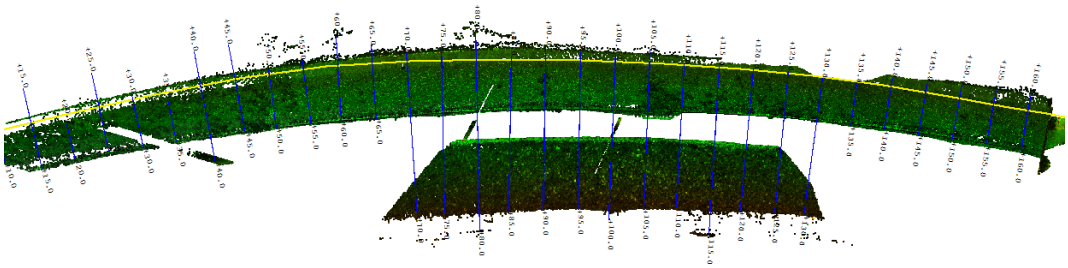




Save sections, 'FILE > Save As'

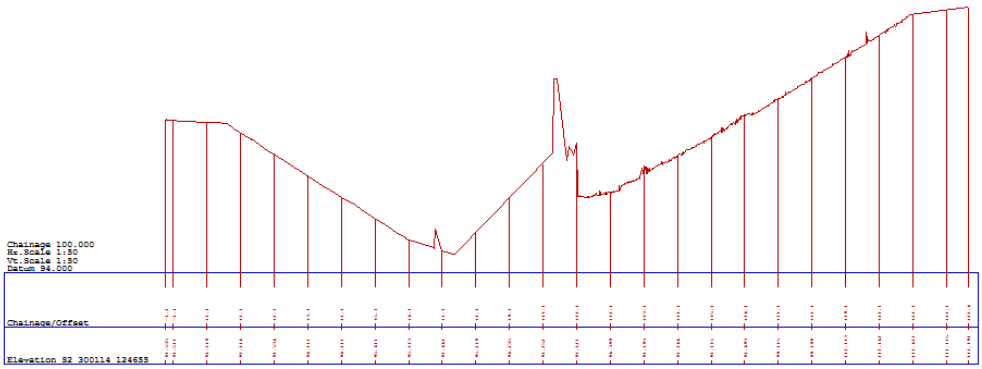
Sections can be displayed in plan:

'FILE > Attach/Detach > Attach sections'



26.13.6 Editing Scan Data Using Sections

In the event of the sections containing unwanted data, such as structures, overhead lines, noise from vegetation, etc. the scan can be edited as required and the sections re-cut. For example, at chainage 100 there is an obvious spike as shown below;



To edit sections, select 'FILE > Attach/Detach > Edit detach', pick section file.

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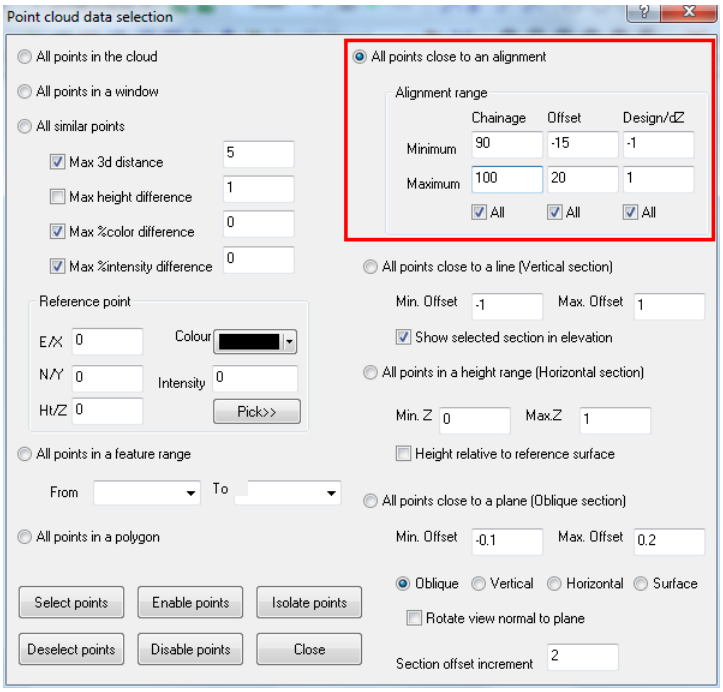
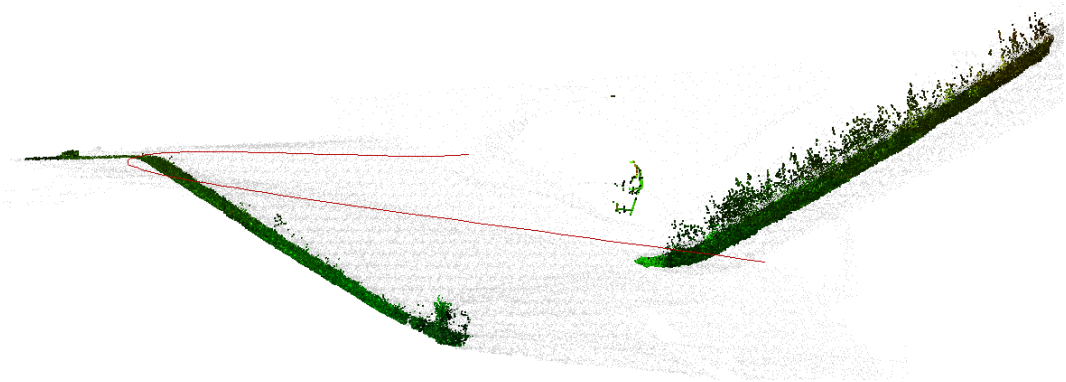
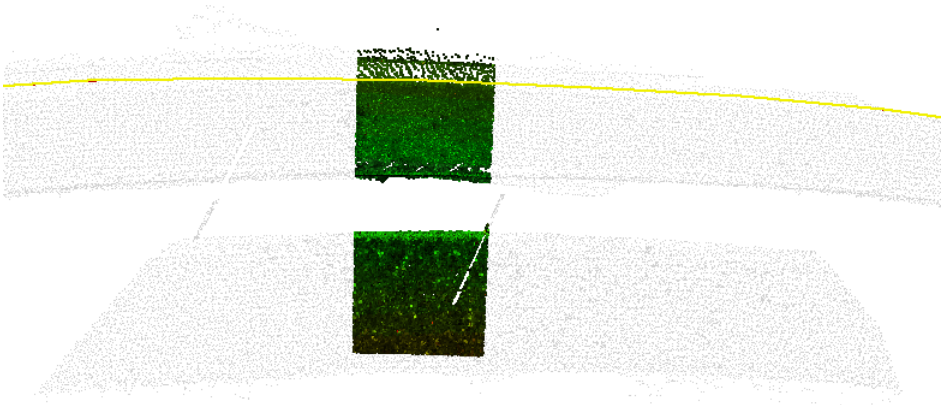
Right click to bring up the cloud selection dialog, and isolate all points in the chainage 90-110 range as shown.



This highlights the area of the scan in elevation as shown.

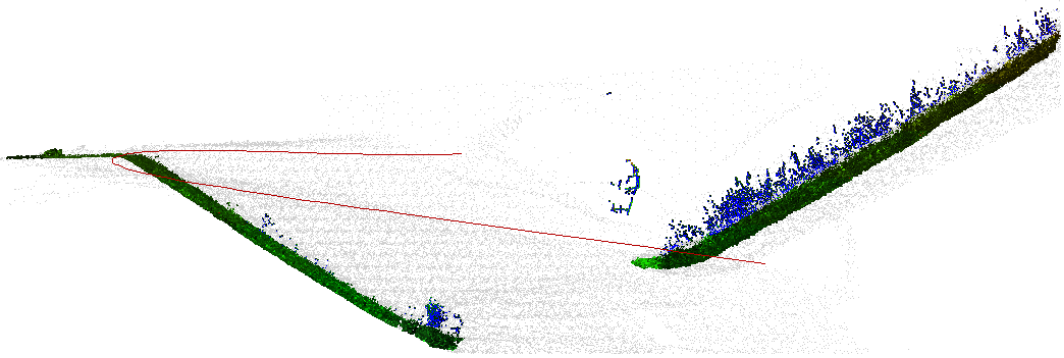


Press 'P' or 'E' to move between plan and elevation, and use the up and down arrows to move between chainages for the area isolated.



Move back to elevation view, press right click to bring up the 'Data Selection Dialog', tick 'All points in a polygon' and press 'Select points'. Use the left click button on mouse to

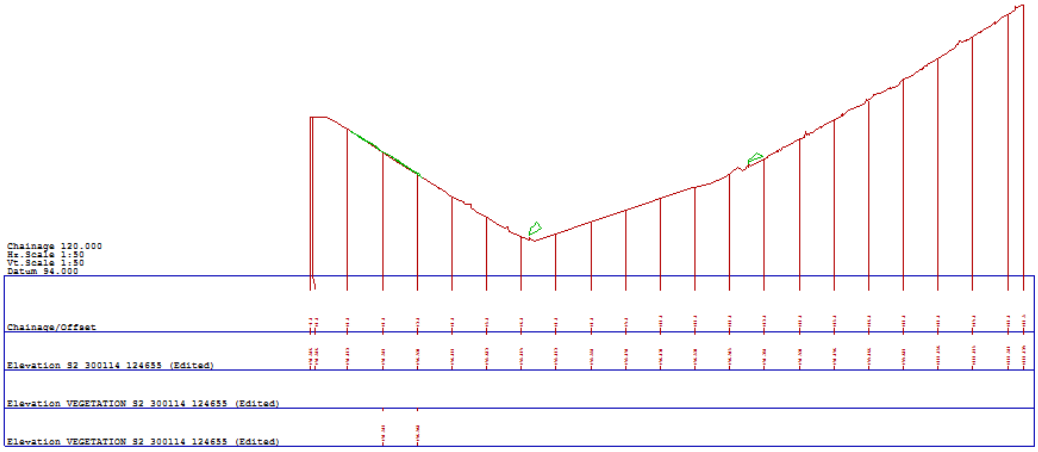
draw a polygon around the area of the scan to exclude from the sections as shown, and right click to close the polygon.

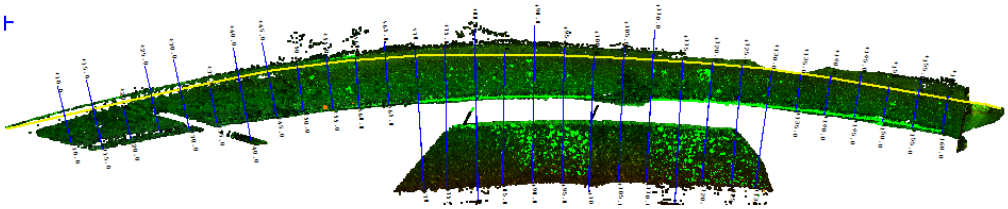


Select 'CLOUD > Edit selected points', and change the feature of the selected points to NOISE, TREES, etc. as appropriate.

Repeat this process throughout the model, and re-cut the sections.

A tidier surface line is achieved with any additional features outlined in 3d.





26.14 Transforming A Cloud To Show Differences To A Template Or Cylinder

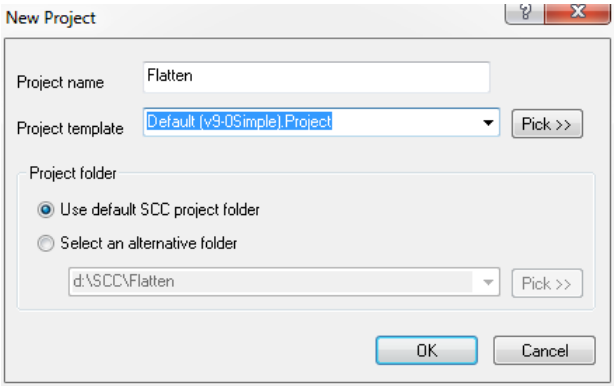
This note covers the steps required in importing a scanned tunnel job in LAS format into SCC and developing it into a plan model showing separation from a template design or cylinder.

The steps are as follows;

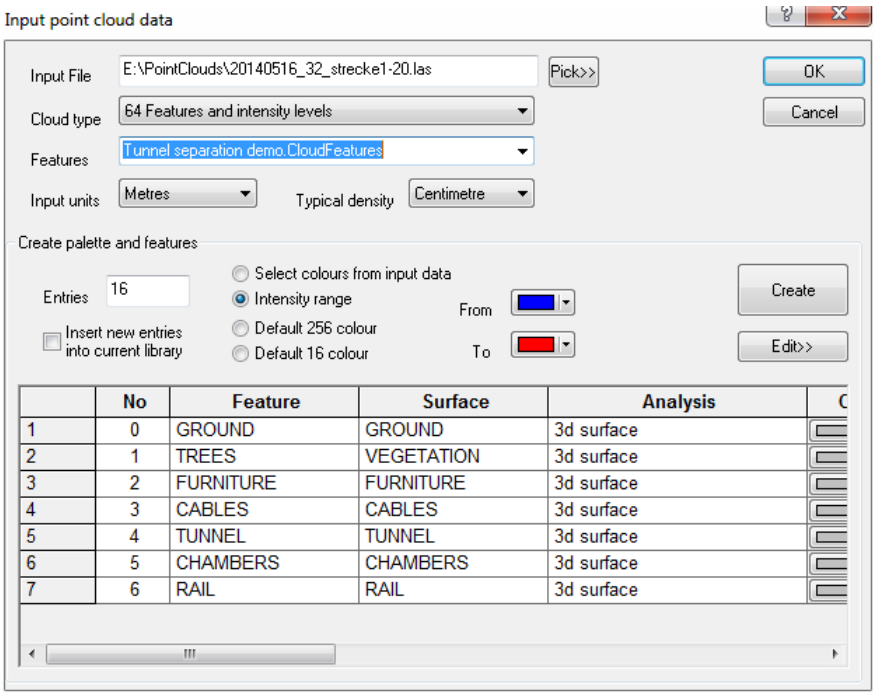
'FILE > New Project' entering a name for the new project and selecting a default template.

The project template contains the naming conventions, symbols, and drawing conventions that will be used when creating models.

Creating a new project also creates a folder in which all project items, such as models and drawings will be stored.

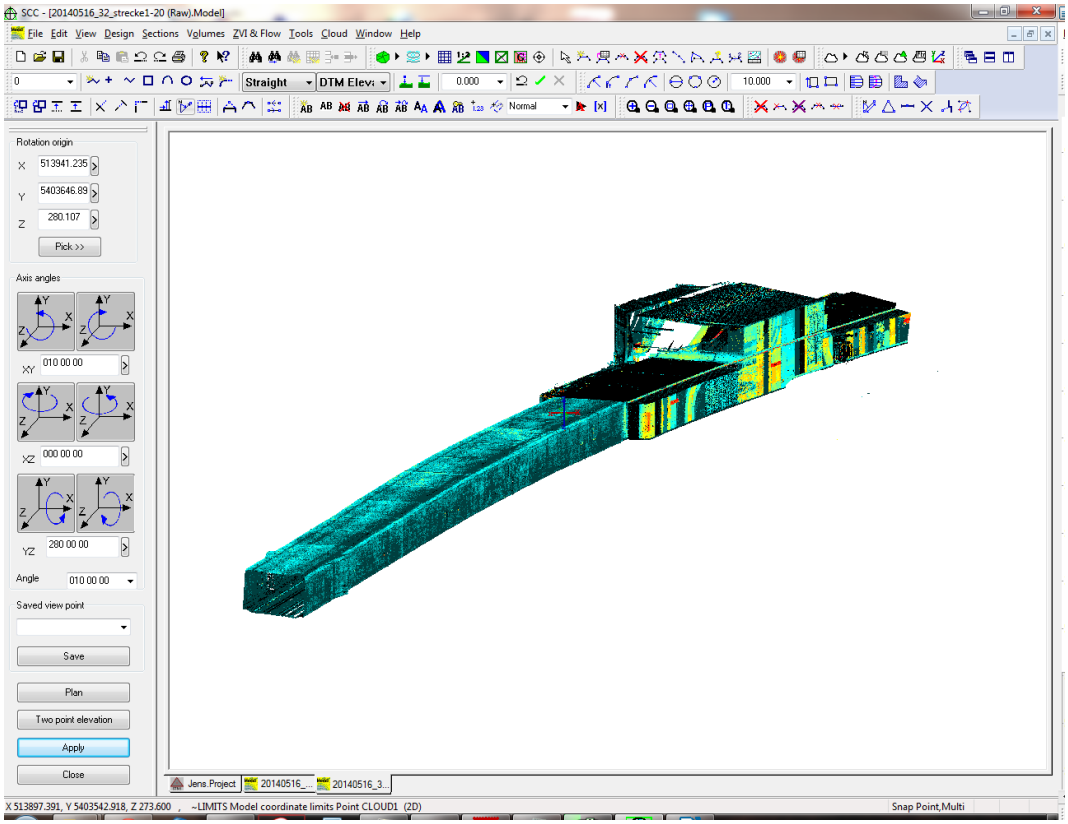


'FILE > Model > Point clouds & LIDAR > file', picking the sample file provided, followed by creating the model at 1:100 scale when prompted.



This creates the following model, containing ~145 million points from the 657mb LAS file and resulted in a 100mb SCC model using 64 intensity levels. On an 8 core AMD processor at 4ghz this takes ~37mins. The 64 features + intensity layout is both compact and quite flexible in terms of what you can do.

The default rendering for the library used is by intensity, where a palette has been selected that corresponds the height range in the scan. Turning the mouse wheel can be used to zoom in and out, and holding the wheel down and moving the mouse to pan. Alternatively, the **PgUp** and **PgDn** buttons can be used to zoom, and space bar to centre around the cursor. We can also rotate the view in 3d, using **'VIEW > Rotate ViewPoint'**

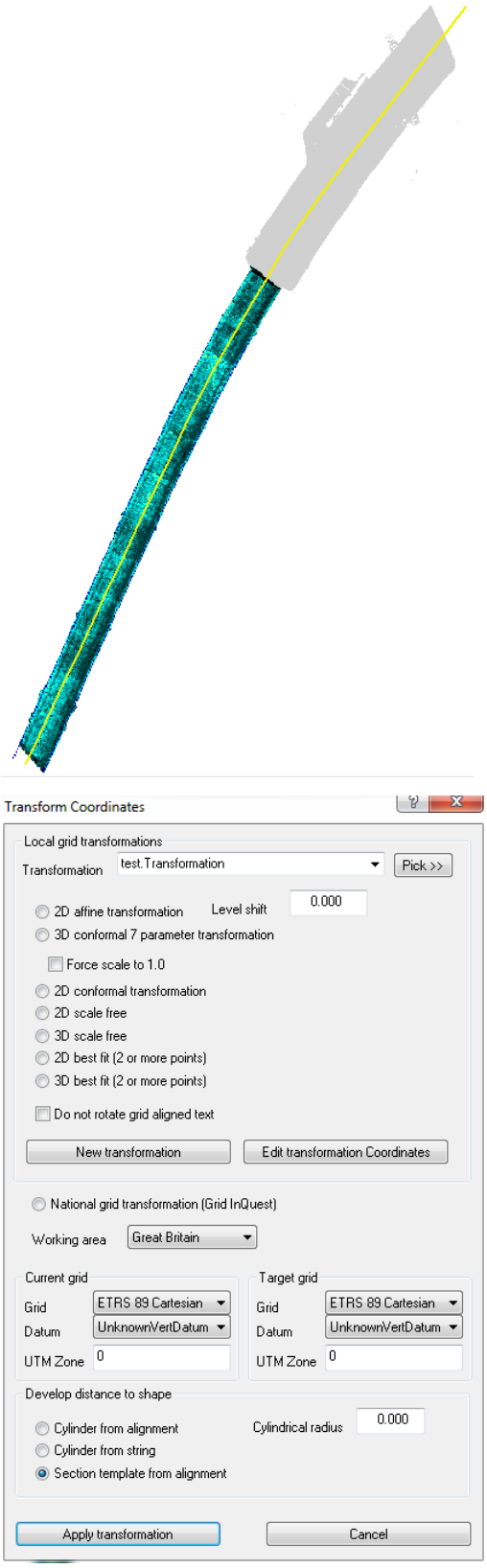


In order to unwrap the model, i.e. transform it such that x,y,z model coordinates become chainage (distance along a centreline), offset (lateral distance away from a centre line) and separation (perpendicular distance from a design surface), we need a design centreline, and one or more section templates. The centre line can be be imported from LandXML, DXF or Bentley MX, or manually created.

In this case we have a design centreline and templates which can be attached to our scanned model using '**FILE** > **Attach/Detach** > **Attach Alignment**' and picking CL with Template.Alignment. Details on how this alignment was created are given further on in this tutorial.

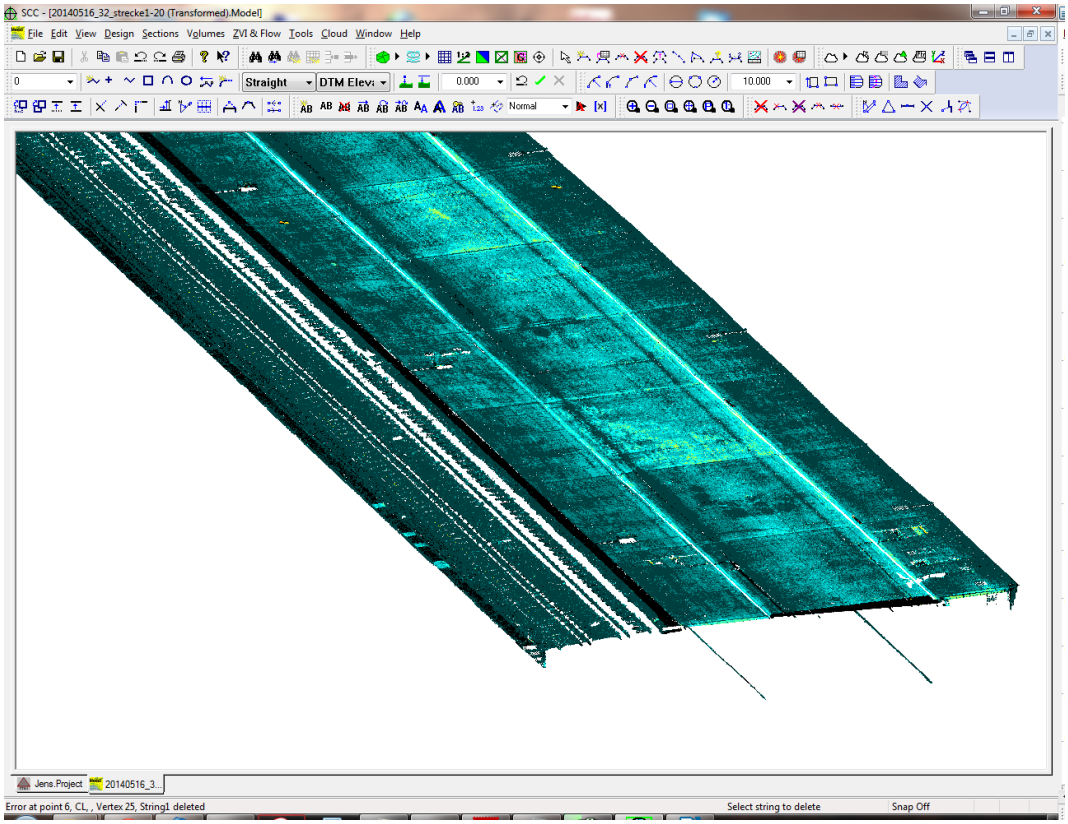
We can limit the area of the model being processed by right clicking to bring up the point cloud selection dialog, selecting 'All points in a polygon', followed by Isolate Points. Left click to pick points on the polygon, and right click to close the polygon and isolate an area of interest.

To unwrap the selected area, use '**TOOLS** > **Transform Coordinates**' with the following parameters. This is computation intensive operation that takes approx 4 minutes on this model, where the time taken is based on the total number of points being processed, to number points on the centreline, the number of section templates, and the number of points on each template.

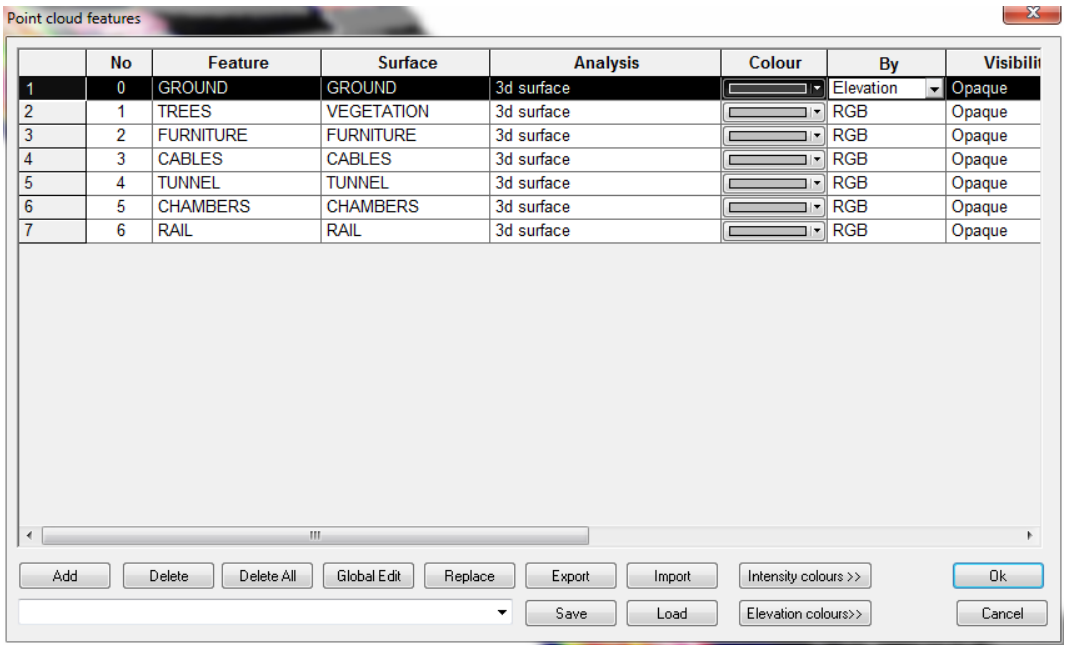


If we were working with a circular tunnel, we would not need a section template and could select either **Cylinder from Alignment or Cylinder from string along** with a design radius to create a model based on cylindrical separation rather than template separation.

Rotating this model we can see the effect of the transformation more clearly.



To render out model based on separation distance, select 'CLOUD > Point Cloud' features, and change the By field to Elevation for the GROUND feature. Specific colours and ranges can be changed by pressing the Elevation Colours button.



	No	Feature	Surface	Analysis	Colour	By	Visibilit
1	0	GROUND	GROUND	3d surface		Elevation	Opaque
2	1	TREES	VEGETATION	3d surface		RGB	Opaque
3	2	FURNITURE	FURNITURE	3d surface		RGB	Opaque
4	3	CABLES	CABLES	3d surface		RGB	Opaque
5	4	TUNNEL	TUNNEL	3d surface		RGB	Opaque
6	5	CHAMBERS	CHAMBERS	3d surface		RGB	Opaque
7	6	RAIL	RAIL	3d surface		RGB	Opaque

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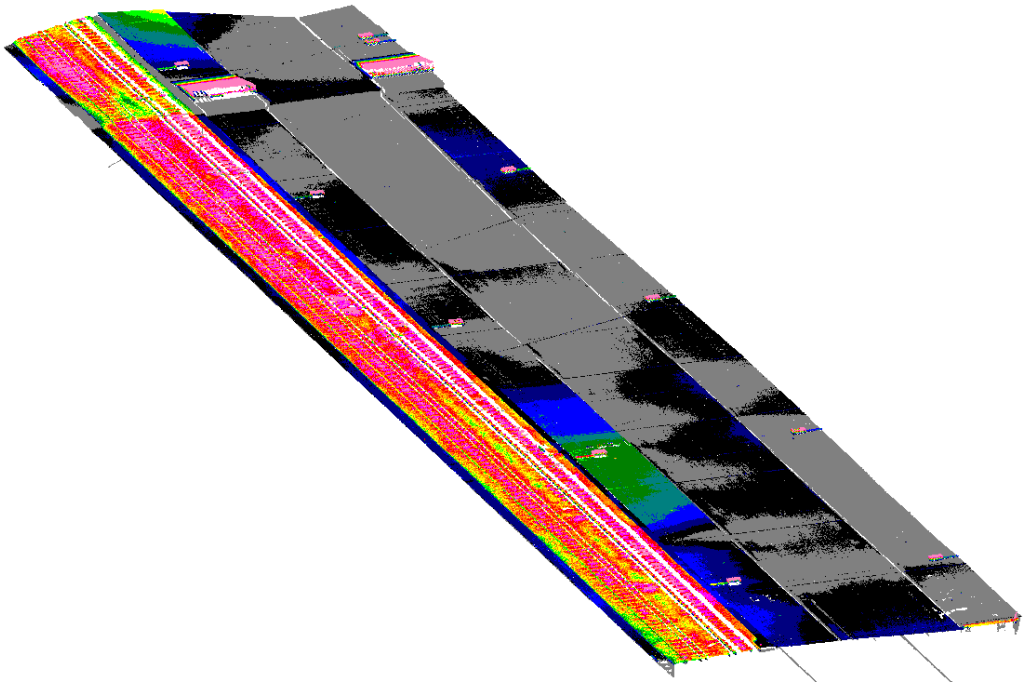
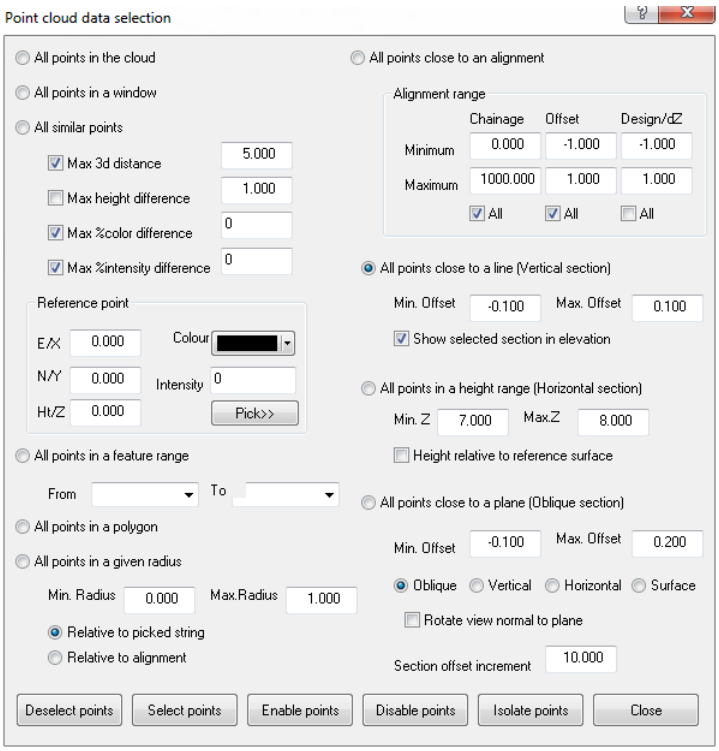


26.14.1 Creating A Centreline Template

If we do not have a design centreline and template for our model we can create them as follows;

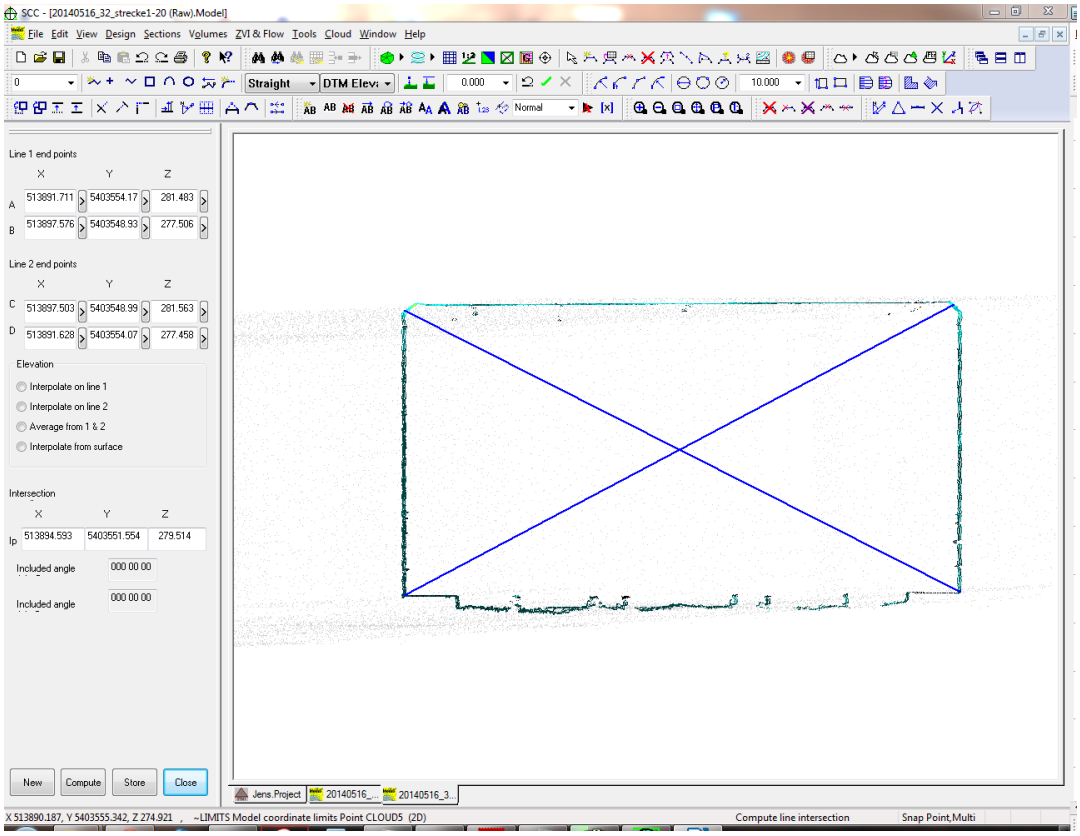
Right click to bring up the point cloud selection dialog. Select 'All points close to a line (Vertical section)' and press 'Isolate points'.

Click two points in plan to draw a line at right angles to the tunnel close to the start of the tunnel. This will show an isolated section of the start of the tunnel in elevation.



Select 'TOOLS > Measure > Intersect lines', and pick four points to create two intersecting

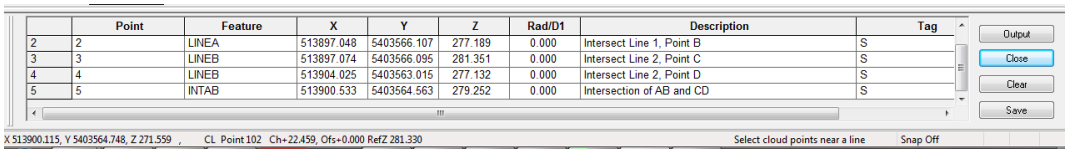
diagonals at the edge of the tunnel.



Select Close, press P to move from elevation back to plan, and repeat the above steps to create additional centreline points.

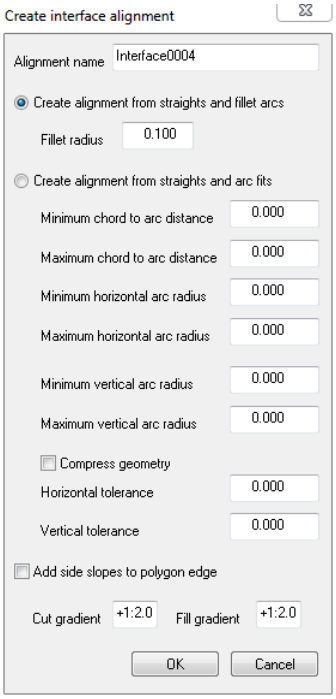
Select 'VIEW > Coordinate computations', to get a list off all generated intersection points.

Select 'EDIT > Add strings with cursor' to start creating a new string. For each intersection point, select it, and press Output to add it to the new string.

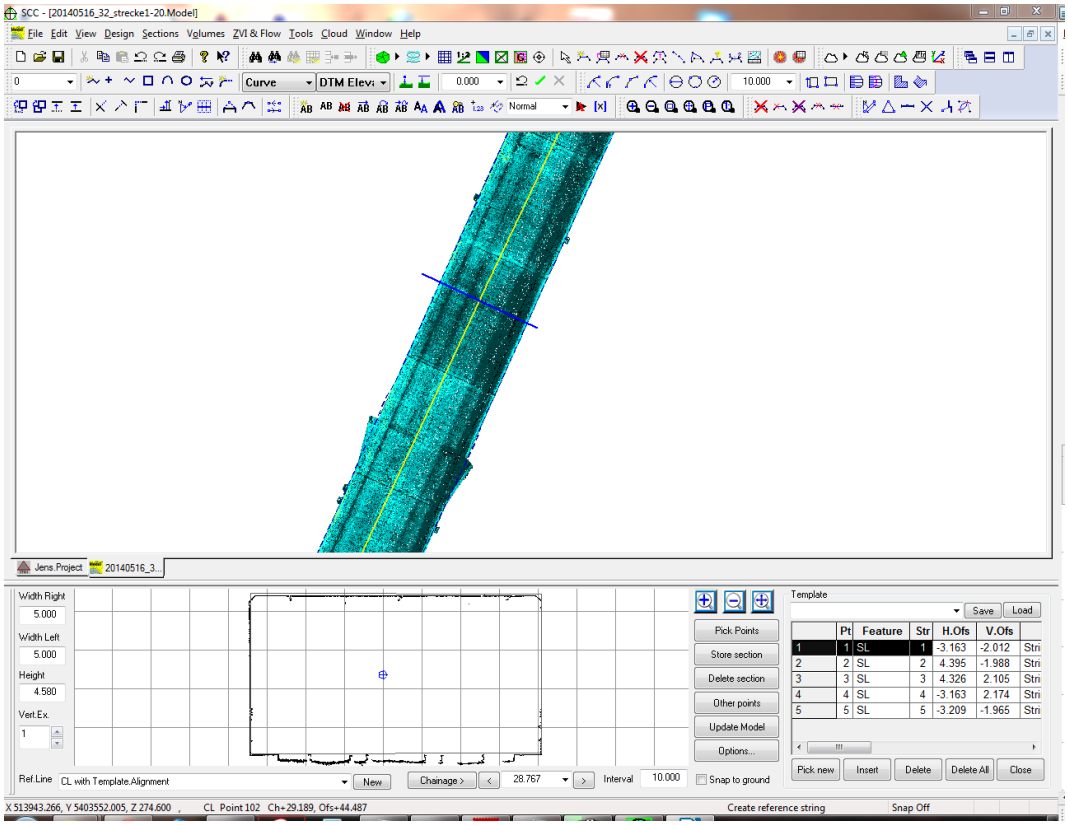


	Point	Feature	X	Y	Z	Rad/D1	Description	Tag
2	2	LINEA	513897.048	5403566.107	277.189	0.000	Intersect Line 1, Point B	S
3	3	LINEB	513897.074	5403566.095	281.351	0.000	Intersect Line 2, Point C	S
4	4	LINEB	513904.025	5403563.015	277.132	0.000	Intersect Line 2, Point D	S
5	5	INTAB	513900.533	5403564.563	279.252	0.000	Intersection of AB and CD	S

Right click the mouse, and select 'Save string as interface'.



Select 'CLOUD > Trace linear features > Manual', which will show the split screen view below



As we move the mouse in plan, we will see a section of scan at the current cursor position. In this case, we're tracing from the raw scan based on a 0.2m extract of points, which doesn't require any editing of the scan prior to using it. We've also selected to display a section for the current chainage 5m either side of the centre line. We can use the zoom in / out and extents keys to navigate the section, as well as changing the vertical exaggeration to allow for more accurate selection of levels, and dragging with the mouse

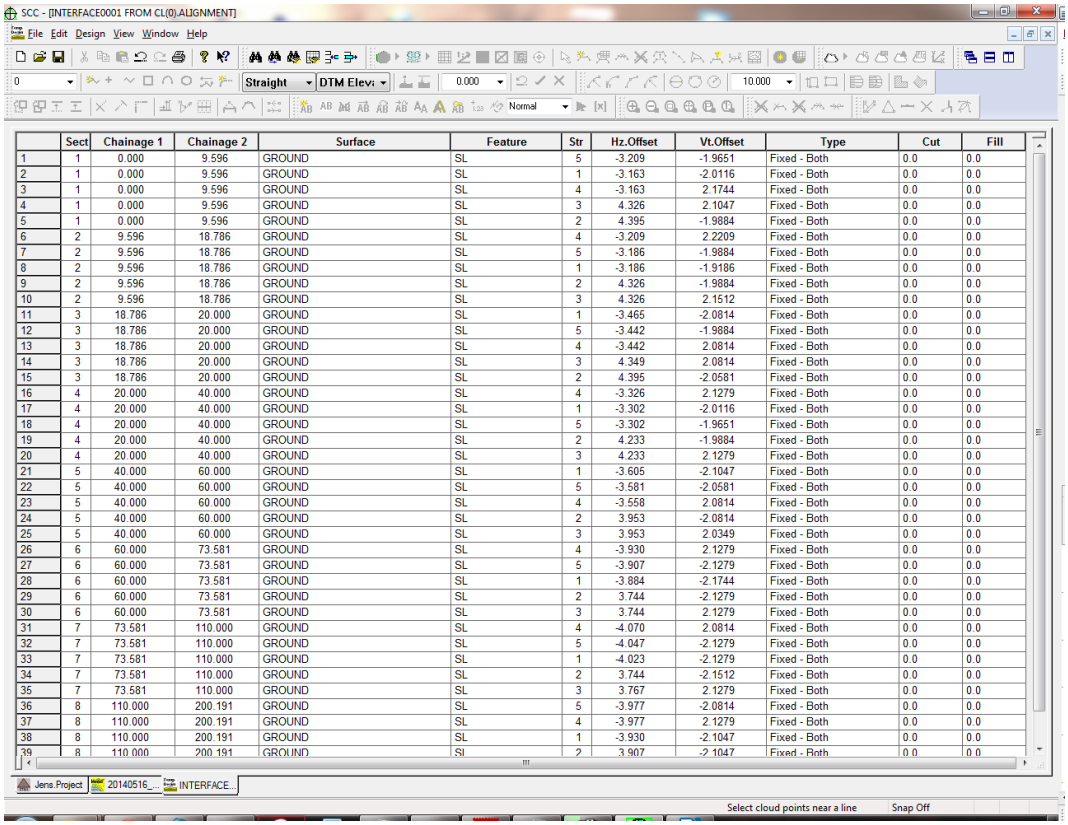
wheel.

To start creating a design template, left click on points in section or plan, edit point details such as feature name and string number, and repeat for the number of template points required. In this case, we'll pick five points representing the tunnel walls where the last point is the same as the first. If we know exact horizontal and vertical offsets to the design centreline we can enter them here.

To create section templates at specific chainages, select Pick Points, and select the highlighted point in plan or section for each point on the template. This allows us to vary the template by chainage, to accommodate changes in width of the tunnel and possible inaccuracies in the centreline.

Once enough sections have been entered, you can investigate the behaviour of the interpolated strings between chainages, by pressing the Chainage button. As you move the mouse around screen in plan, you will see the interpolated section along with the scanned points in the section view. Pressing the left mouse button locks the chainage and lets you enter an additional section where required.

Selecting 'DESIGN > View Design sheet > Section template points' shows us the points created.



	Sect	Chainage 1	Chainage 2	Surface	Feature	Str	Hz.Offset	Vt.Offset	Type	Cut	Fill
1	1	0.000	9.596	GROUND	SL	5	-3.209	-1.9651	Fixed - Both	0.0	0.0
2	1	0.000	9.596	GROUND	SL	1	-3.163	-2.0116	Fixed - Both	0.0	0.0
3	1	0.000	9.596	GROUND	SL	4	-3.163	2.1744	Fixed - Both	0.0	0.0
4	1	0.000	9.596	GROUND	SL	3	4.326	2.1047	Fixed - Both	0.0	0.0
5	1	0.000	9.596	GROUND	SL	2	4.395	-1.9884	Fixed - Both	0.0	0.0
6	2	9.596	18.786	GROUND	SL	4	-3.209	2.2209	Fixed - Both	0.0	0.0
7	2	9.596	18.786	GROUND	SL	5	-3.186	-1.9884	Fixed - Both	0.0	0.0
8	2	9.596	18.786	GROUND	SL	1	-3.186	-1.9186	Fixed - Both	0.0	0.0
9	2	9.596	18.786	GROUND	SL	2	4.326	-1.9884	Fixed - Both	0.0	0.0
10	2	9.596	18.786	GROUND	SL	3	4.326	2.1512	Fixed - Both	0.0	0.0
11	3	18.786	20.000	GROUND	SL	1	-3.465	-2.0814	Fixed - Both	0.0	0.0
12	3	18.786	20.000	GROUND	SL	5	-3.442	-1.9884	Fixed - Both	0.0	0.0
13	3	18.786	20.000	GROUND	SL	4	-3.442	2.0814	Fixed - Both	0.0	0.0
14	3	18.786	20.000	GROUND	SL	3	4.349	2.0814	Fixed - Both	0.0	0.0
15	3	18.786	20.000	GROUND	SL	2	4.395	-2.0581	Fixed - Both	0.0	0.0
16	4	20.000	40.000	GROUND	SL	4	-3.326	2.1279	Fixed - Both	0.0	0.0
17	4	20.000	40.000	GROUND	SL	1	-3.302	-2.0116	Fixed - Both	0.0	0.0
18	4	20.000	40.000	GROUND	SL	5	-3.302	-1.9651	Fixed - Both	0.0	0.0
19	4	20.000	40.000	GROUND	SL	2	4.233	-1.9884	Fixed - Both	0.0	0.0
20	4	20.000	40.000	GROUND	SL	3	4.233	2.1279	Fixed - Both	0.0	0.0
21	5	40.000	60.000	GROUND	SL	1	-3.605	-2.1047	Fixed - Both	0.0	0.0
22	5	40.000	60.000	GROUND	SL	5	-3.581	-2.0581	Fixed - Both	0.0	0.0
23	5	40.000	60.000	GROUND	SL	4	-3.558	2.0814	Fixed - Both	0.0	0.0
24	5	40.000	60.000	GROUND	SL	2	3.953	-2.0814	Fixed - Both	0.0	0.0
25	5	40.000	60.000	GROUND	SL	3	3.953	2.0349	Fixed - Both	0.0	0.0
26	6	60.000	73.581	GROUND	SL	4	-3.930	2.1279	Fixed - Both	0.0	0.0
27	6	60.000	73.581	GROUND	SL	5	-3.907	-2.1279	Fixed - Both	0.0	0.0
28	6	60.000	73.581	GROUND	SL	1	-3.884	-2.1744	Fixed - Both	0.0	0.0
29	6	60.000	73.581	GROUND	SL	2	3.744	-2.1279	Fixed - Both	0.0	0.0
30	6	60.000	73.581	GROUND	SL	3	3.744	2.1279	Fixed - Both	0.0	0.0
31	7	73.581	110.000	GROUND	SL	4	-4.070	2.0814	Fixed - Both	0.0	0.0
32	7	73.581	110.000	GROUND	SL	5	-4.047	-2.1279	Fixed - Both	0.0	0.0
33	7	73.581	110.000	GROUND	SL	1	-4.023	-2.1279	Fixed - Both	0.0	0.0
34	7	73.581	110.000	GROUND	SL	2	3.744	-2.1512	Fixed - Both	0.0	0.0
35	7	73.581	110.000	GROUND	SL	3	3.767	2.1279	Fixed - Both	0.0	0.0
36	8	110.000	200.191	GROUND	SL	5	-3.977	-2.0814	Fixed - Both	0.0	0.0
37	8	110.000	200.191	GROUND	SL	4	-3.977	2.1279	Fixed - Both	0.0	0.0
38	8	110.000	200.191	GROUND	SL	1	-3.930	-2.1047	Fixed - Both	0.0	0.0
39	8	110.000	200.191	GROUND	SL	2	3.907	-2.1047	Fixed - Both	0.0	0.0

SCC uses linear interpolation between sections templates to calculate horizontal and vertical offsets for arbitrary chainages. We can save our design for re-use simply by selecting 'FILE > Save As' from this view.

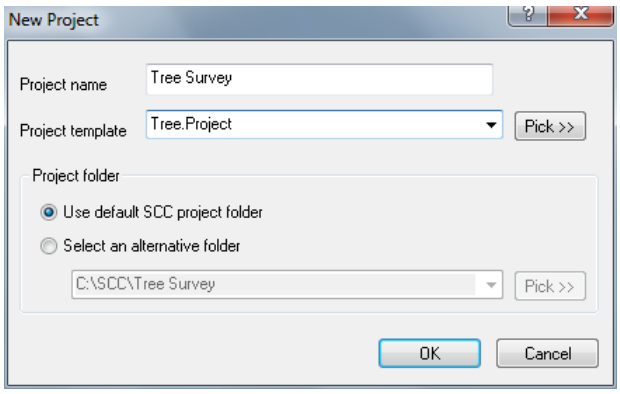
27 Tree Survey

This tutorial covers the steps required in processing a tree survey in ADB format in SCC and producing CAD drawings.

27.1 Create New Project

'FILE > New Project', entering a name for the new project and selecting 'Trees.Project' as the template.

The project template contains the naming conventions, symbols, and drawing conventions that will be used when creating models. Creating a new project also creates a folder in which all project items, such as models and drawings will be stored.

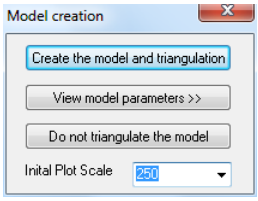


27.2 Model ADB Tree

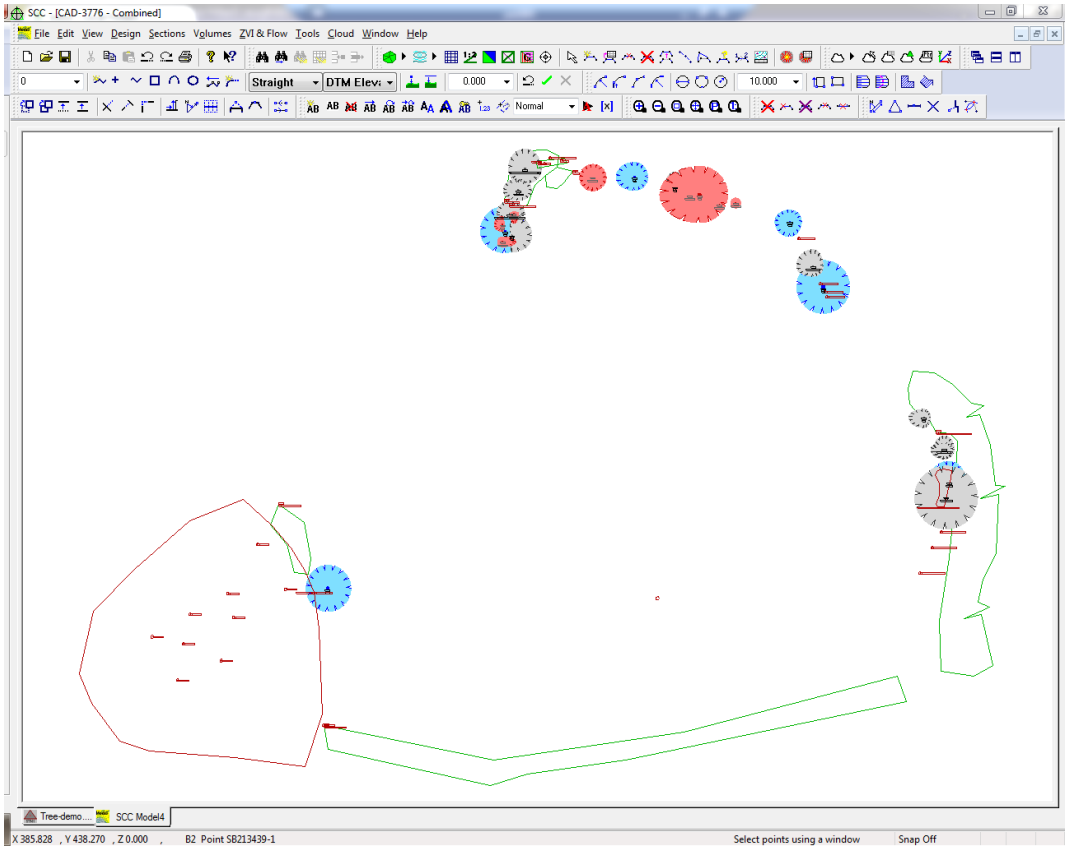
'FILE > Model > ADB tree file'

Pick the sample

Select Initial Plot Scale 250 and press 'Create the model and triangulation'

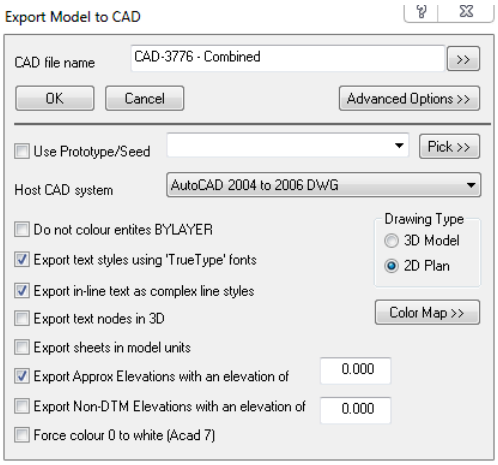


This creates the following model;



27.3 Exporting To CAD

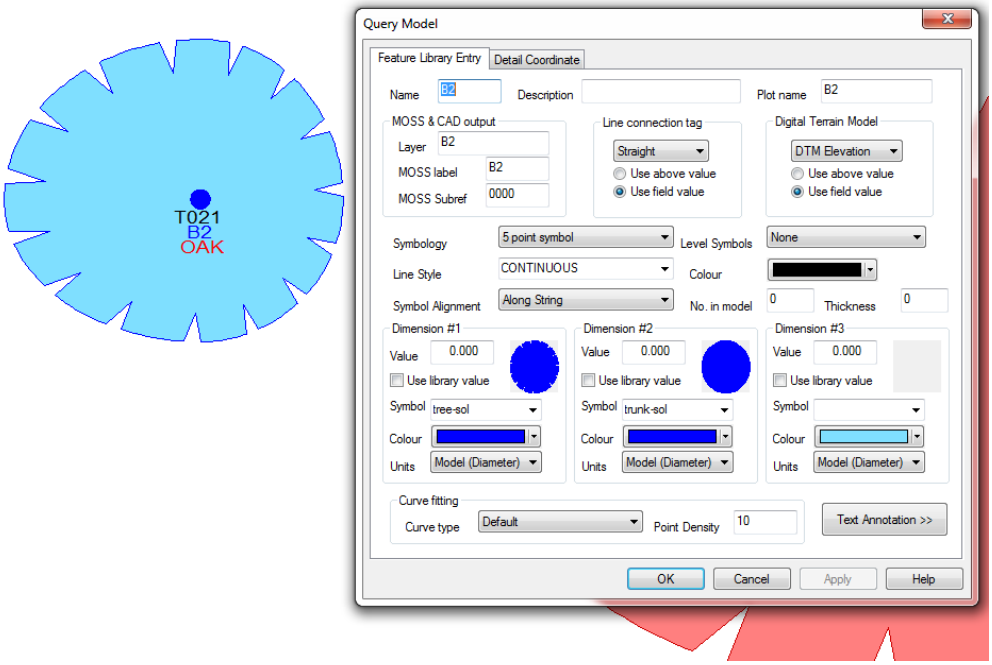
To create an AutoCAD drawing of this model, select 'FILE > Export model > CAD drawing', using the settings as given below.



27.4 Tree Symbols

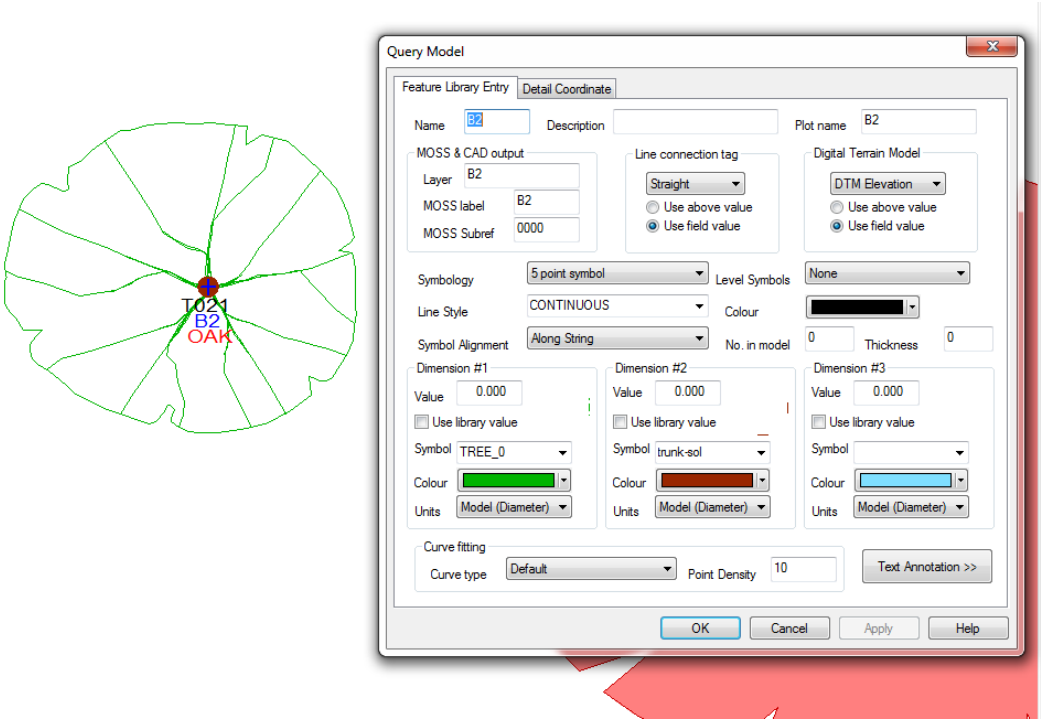
Note that tree symbols taken in ADB format are represented by five points, corresponding to a point at the trunk, and four points on the edge of the canopy. Colour, symbols and annotation are determined by feature name, which corresponds to the category field in the ADB file.

To examine this a bit further, select 'EDIT > Query and edit points' and click on tree T021.

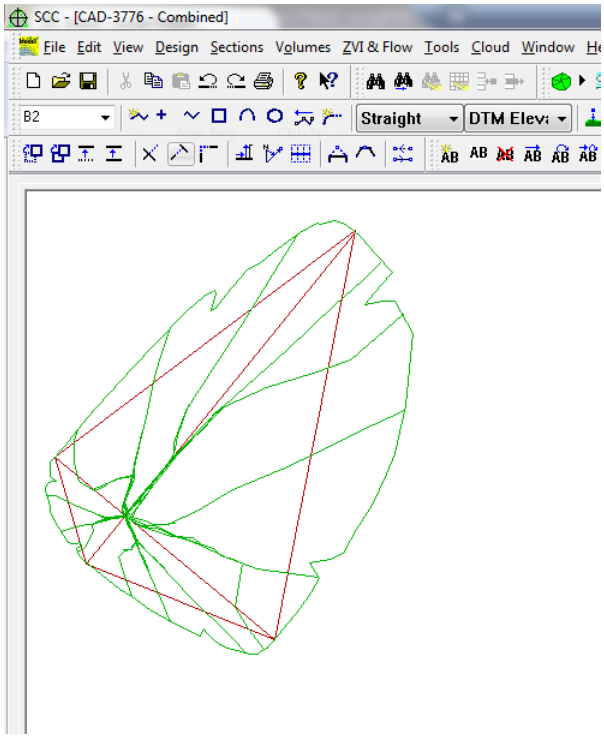


The feature B2 is set up to draw a five point symbol using tree-sol for the canopy and trunk-sol for the canopy, with draw blue used the outline and trunk, and light blue for the fill. The layer on which data will be exported can also be entered with the Query Model Feature Library Entry screen.

To illustrate how this works, change symbol 1 TREE_0, the colours to brown and green, and press ok. When prompted do not update the project library with these changes.



To create a new tree, or any other feature, select the feature name in the drop down box in the top left of the screen, and use 'EDIT > Add strings with cursor', and click five times on the screen on points corresponding to the trunk and four canopy points. Note that the four canopy points do not have to correspond to compass positions and can also be used to align the tree canopy, such that they form a rough kite shape as shown below.



'EDIT > Edit Strings > Move points can also be used to change any point on an existing string.

28 System Settings

28.1 General Options (File Menu)

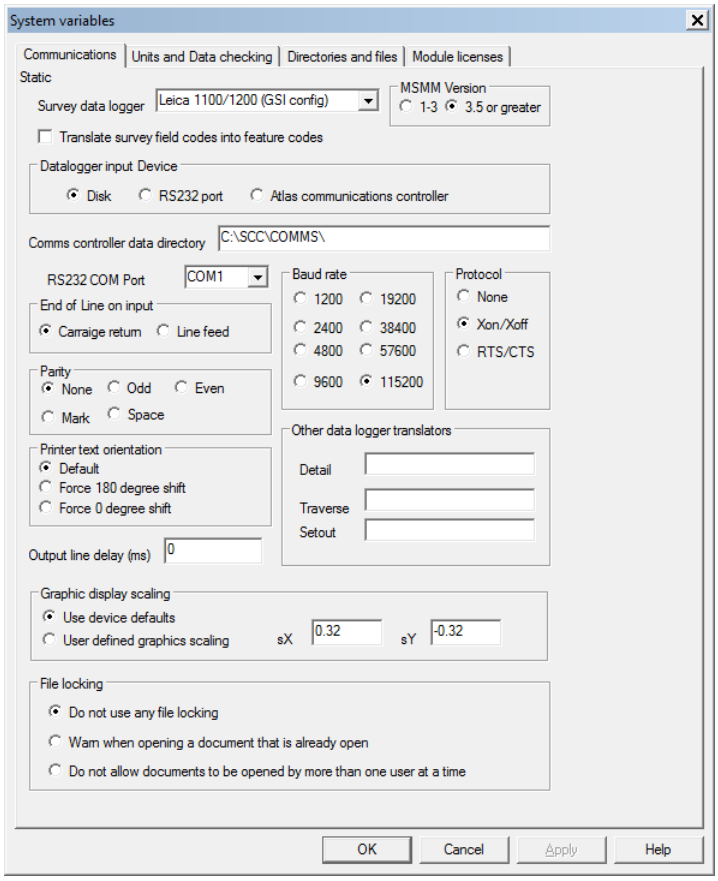
System Variables

The General Options section of SCC allows the user to set up any operational parameters that are global to SCC. These comprise of directories used on the PC, data logger selection and communications, and working units in terms of length, angles, scale and conversion factors. It is normally only necessary to set up these parameters once for a given installation. License codes for the SCC modules may be entered in the Module License section.

Communications

Here the user may specify the communication parameters used when downloading or uploading data to a survey datalogger. It is important that the baud rate, protocol and parity here agree with those set on the logger. If a datalogger is not supported translation programs may be written either by Atlas Computers Ltd or by the user, to convert the data into a form supported by the software.

This module controls all the functions relating to serial data transfer.



These are as follows:

- Downloading of survey data from the RS232 port.
- Uploading of setting out data to the RS232 port.
- Management of serial transfer parameters.

Default serial transfer parameters are read from device configuration files rather than relying solely on user knowledge to set the communication parameters. These parameters are:

- Communications port (COM1...COM4)
- Baud rate (110…115,250)
- Parity
- Data bits
- Stop bits
- Protocol (RTS/CTS, XON/XOFF, MSMM PC-LINK)

Graphic Display Scaling

This option allows you to correct the aspect ratio on screens where the pixels are not square and the screen driver provided does not correctly handle aspect ratio

- Use Device Defaults

This value assumes that there are no aspect ratio issues

- User Defined Graphics Scaling

This value allows you to enter user defined X and Y screen scaling to correct aspect ratio issues. To check that these values are correct, create and display a model of a circle and verify that it appears as a circle on screen.

File Locking

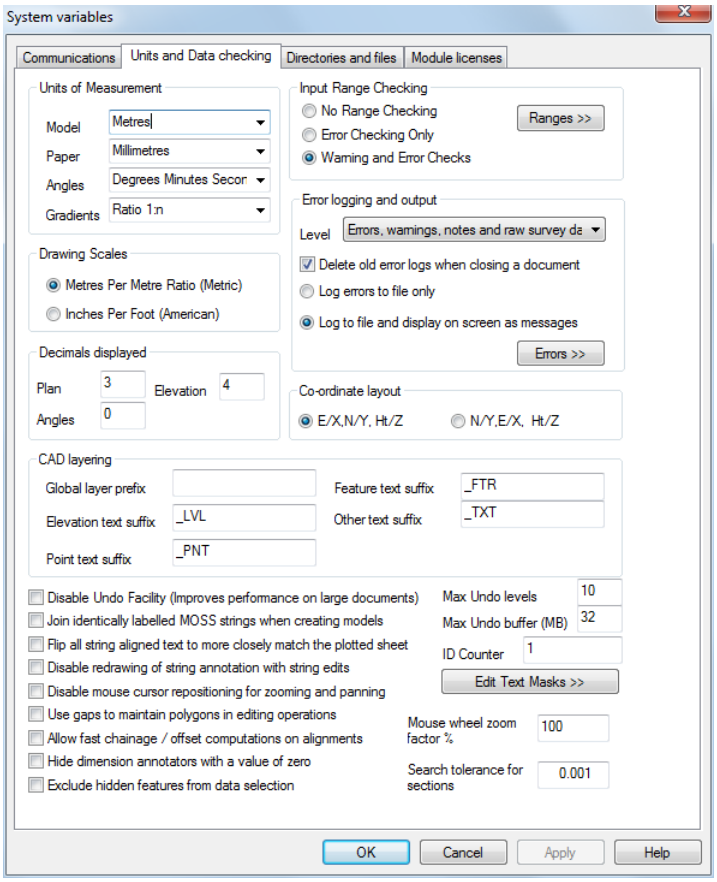
This option warns if a file is already open and in use by another user. This option is designed for use in networked environments that don't have explicit file sharing and locking enabled (see screenshot attached). The following options are available:

- Do not use any file locking
- Warn when opening a document that is already open
- Do not allow documents to be opened by more than one user at a time

By default the option 'Do not use any file locking' is set. The other options need to be manually selected. If a file has been locked delete the additional delete-error log file.

Units And Data Checking

This section specifies the measurement units and drawing scales which will be used throughout the software. The method of range checking on all data entered and the method of error reporting may also be set. CAD layers may be set with global prefixes and suffixes to make them more easily identifiable.



Units of Measurement

- Model - This field specifies the units used when inputting and outputting ground distance, length and height data. All lengths are stored internally as meters and converted for purposes of translation. Approximations of the conversion factors used are as follows: -

1 Metre	1000mm
1 Metre	100cm
1 Metre	0.001Km
1 Metre	39.370078 Inches
1 Metre	1/0.3048 Feet (International)
1 Metre	3937/1200 Feet (US Survey)
1 Metre	1.094 Yards
1 Metre	0.00062137 Miles
1 Metre	0.0005396 Nautical Miles

- Paper - This field specifies the units used when inputting and outputting paper length data such as text sizes and margins. All such values are stored internally as meters and converted for purposes of translation.

  Metre

  Centimetres

  Millimetres

  Kilometres

  Inches

  Feet (International)

  Feet (U.S. Survey)

  Yards

  Miles

  Nautical Miles

- Angles - This field specifies the angular units used when inputting and displaying data. All angles are stored internally as radians and later converted for purposes of input and output.

1 Degree	60 Minutes
1 Minute	60 Seconds
1 Degree	PI/180 Radians (0.0174532925199444)
1 GRAD	PI/200 Radians (0.0157079632679490)
PI	3.14159265358979323846

- Gradient - This field specifies the gradient units used when inputting and displaying data.

  Decimal (1.0=100%)

  Percentage %

  Ratio 1:n

  Vertical Angle

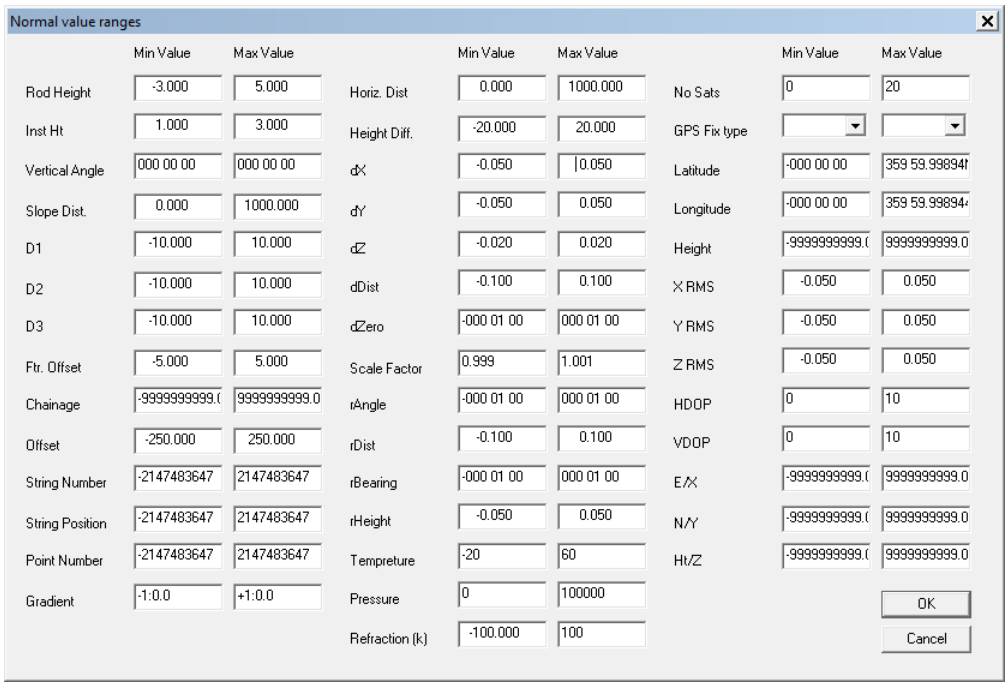
Drawing Scale

This field specifies how drawing scales are described. This may be either as a meter per meter ratio for metric units or inches per foot for imperial units.

Input Range Checking

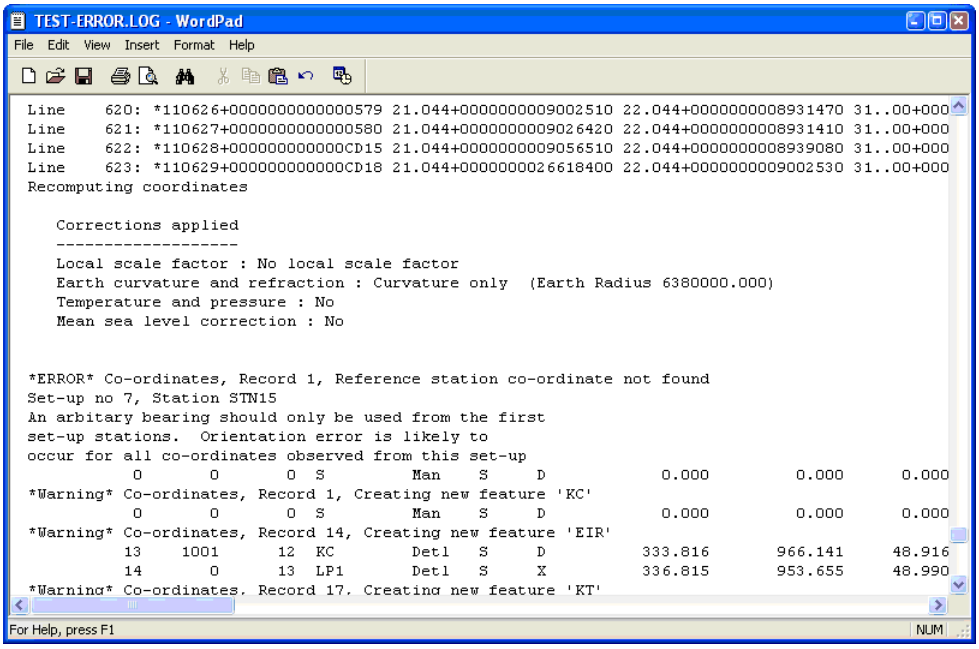
This field specifies whether extended validation checks will be carried out on all input fields. Every input field has a legal range and a normal range. The system can check one or both of these ranges when data is entered and provide warnings and errors for out of range data. These checks can be used to reduce the risk of error in your data.

The limits of normal values for each field type can be set by pressing the 'Ranges>>' button from the units and data checking dialog. Note that some of these fields, such as 'k' value, represent computed rather than directly surveyed values, but are still representative of the input data.



Error logging and output

This field controls the amount of detail that is written to the log file during processing. Error logging and reporting includes Crystal reports based log files broken down by menu items selected, and colour coded by message type. Multiple reports are available based on level of detail required. The default level is to include all errors, warnings, processing notes and raw data. The reason for including the raw data is that the error message will be shown in the context of the input file being processed, as shown below;



```
TEST-ERROR.LOG - WordPad
File  Edit  View  Insert  Format  Help

Line     620: *110626+0000000000000579 21.044+0000000009002510 22.044+0000000008931470 31..00+000
Line     621: *110627+0000000000000580 21.044+0000000009026420 22.044+0000000008931410 31..00+000
Line     622: *110628+000000000000CD15 21.044+0000000009056510 22.044+0000000008939080 31..00+000
Line     623: *110629+000000000000CD18 21.044+0000000026618400 22.044+0000000009002530 31..00+000
Recomputing coordinates

   Corrections applied
   -------------------
   Local scale factor : No local scale factor
   Earth curvature and refraction : Curvature only  (Earth Radius 6380000.000)
   Temperature and pressure : No
   Mean sea level correction : No


*ERROR* Co-ordinates, Record 1, Reference station co-ordinate not found
Set-up no 7, Station STN15
An arbitary bearing should only be used from the first
set-up stations.  Orientation error is likely to
occur for all co-ordinates observed from this set-up
            0       0       0  S         Man    S     D            0.000         0.000      0.000
*Warning* Co-ordinates, Record 1, Creating new feature 'KC'
            0       0       0  S         Man    S     D            0.000         0.000      0.000
*Warning* Co-ordinates, Record 14, Creating new feature 'EIR'
           13    1001      12  KC        Detl   S     D          333.816       966.141     48.916
           14       0      13  LP1       Detl   S     X          336.815       953.655     48.990
*Warning* Co-ordinates, Record 17, Creating new feature 'KT'
For Help, press F1                                                                          NUM
```

With all possible diagnostic information turned on, all intermediate calculation steps are output, along with detailed error checking. For example, when calculating a least squares network adjustment with diagnostic turned on, all the values of all the matrices used in the adjustment for each iteration would be output. This is not the default as its use will lead to the production of very large log file, and greatly reduce the overall performance of the software.

Delete Old Error Logs When Closing A Document

This option when selected automatically delete log files created during processing when the document is closed.

Log errors to file only

This options send error messages directly to log file.

Log to file and display on screen as messages

This options send error messages to log file and also displays information on screen.

CAD Layering

This option found in the Units and Data Checking section of the General Options, allows addition of prefixes and suffixes to layer names when exporting data to CAD. This may be used to make layers more easily identifiable. Suffixes may be added to elevation, point, feature and other text layers. A specified prefix may also be added to each layer.

Many user choose to set up specific prefixes and suffix within their own feature library instead of using this approach.

Co-ordinate Layout

The co-ordinate layout may be changed from the default X,Y,Z format to read data stored in Y,X,Z format. When the co-ordinate layout is changed to Y,X,Z format station co-ordinate, detail co-ordinate, survey notes, traverse co-ordinates, transformation co-ordinates, horizontal intersection points and horizontal entity sheets will also display their coordinates as Y, X, Z. Note that data is still stored internally on these sheets X, Y, Z and is translated on input, output and display.

Input of coordinates from any ASCII files assumes that coordinates in these files are given in Y, X, Z unless otherwise specified in the file. This includes station and detail coordinates coming from instrument/ datalogger files as well as GENIO N, Y, Z. file etc.

Model reporting and string editing will use the Y,X,Z switch.

Note: When this switch is turned on many of the tutorial datasets will not work. The reason for this is that survey station co9-ordinates will be reversed and will no longer correlate with station orientation and azimuth observations.

Configure Undo

Configuring the Undo facility allows the user to step back through one or more editing steps that has been completed, allowing the user to recover from a range of keying errors

Disable Undo Facility (Improves performance on large documents)

This option specifies whether or not the Undo facility is enabled. When undo is enabled a copy of the model will always be stored in the RAM. Hence, when working on large models the undo facility may use up a large amount of memory.

Max Undo Levels

This option documents the number of Undo and Redo stages through which you can move backwards and towards. The higher this figure the more memory required. If the amount of memory used within any given document exceeds the maximum undo buffer size, the number of undo stages will be reduces accordingly.

Max Undo Buffer (MB)

This is the limit of the amount of memory that will be used per open document for undo and redo operations. Note that using large undo buffers on machines with limited memory may have a significant impact on program performance.

Join Identically Labelled MX Strings When Creating Models

This option joins strings of the same name across multiple survey datasets, when using full MX coding

Flip All String Aligned Text To More Closely Match The Plotted Sheet

This option will force any model text to be re-oriented to more closely match the plotted sheet where it would otherwise appear upside down. It does not affect the bounding rectangle of the text, see the before and after pictures below for an example of the effect of this option.

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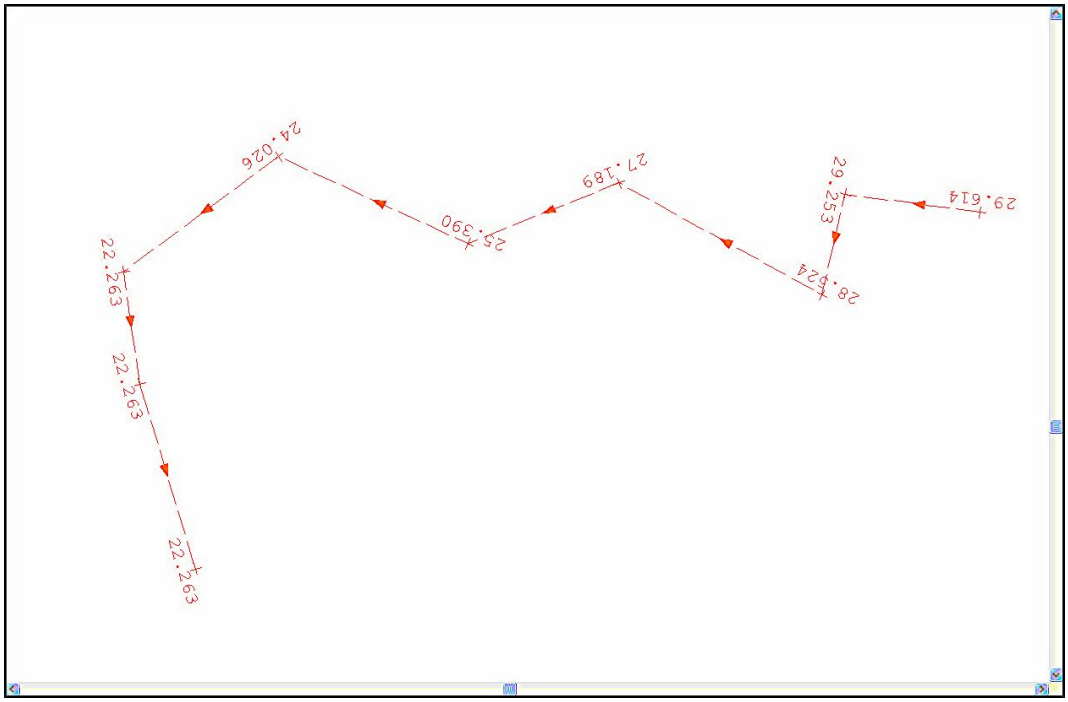

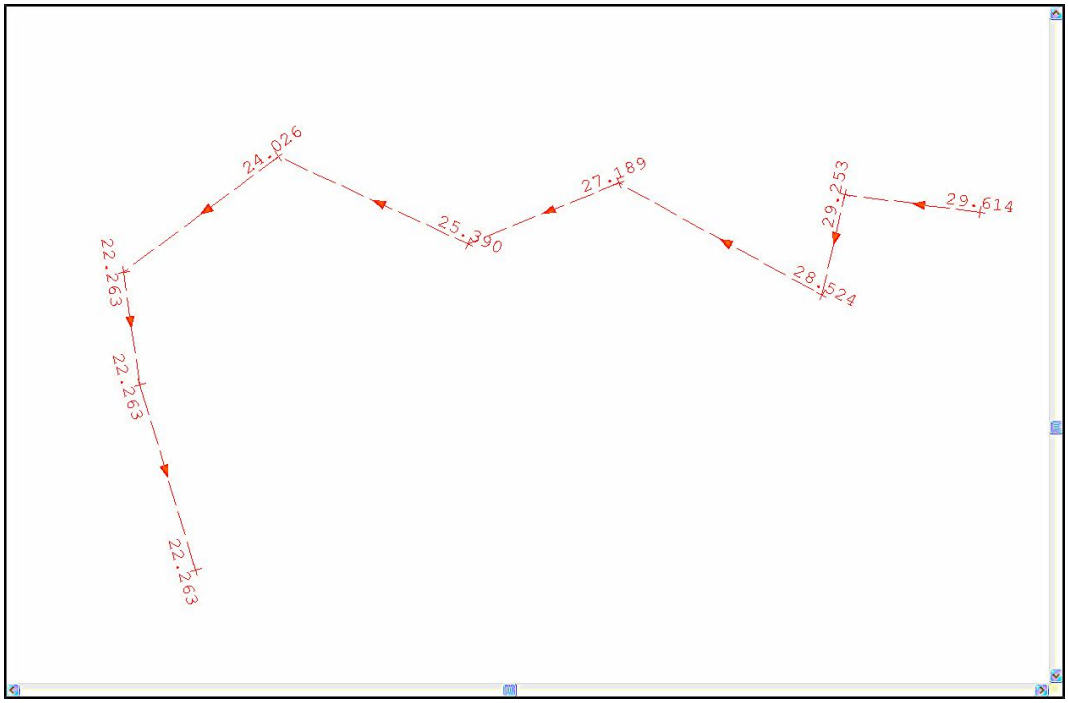

Disable Redrawing Of String Annotation With String Edits

Selecting this option disables the complete redrawing of all annotation for a given string once that string has been edited. This option should be selected if you are mixing string editing and model editing during any given model editing session. If you do not have this option selected, edting a string is liable to undo previous text edits, such as moving or deleting text, that related to points on the string being edited. To redraw the annotation, use 'EDIT > Text > Redraw String Annotation.

Disable Mouse Cursor Repositioning For Zooming And Panning

When using the Zoom and Pan operations within a model, SCC typically repositions the mouse at the center of the screen after completing the operation. The reason for this is

that when using search based panning operations, such as zoom to next selected point (F2) or zoom to next potential error (Tab), the cursor will lie exactly over the selected point when the operation is complete. This in turn leads to simplified editing. The status messages, given at the bottom of the screen, also depend on mouse repositioning to work correctly with search based panning operations. For example, when zooming to the next potential model error, the error message details will only be displayed correctly on the status line if cursor repositioning is enabled.

When zooming in, mouse repositioning guarantees that you will continue zooming into the same location on successive zoom in operations.

Select this option only if you do not wish the mouse cursor to be repositioned under these circumstances.

Use Gaps To maintain Polygons In Editing Operations

This option controls how certain model editing functions, such as trim strings and break links, behave when applied to polygonal strings. If this option is selected these functions will insert a gap in the string in order to preserve its status as a polygon. This means that it can still be used as a clip, void or boundary polygon, and will still have an area when queried. Note that using gaps in strings to maintain polygons can be confusing, as what appears as a line string on screen for editing purposes is actually a polygon.

If this option is not selected, breaking a polygon will cause the polygon to be converted into a simple line string. The latter option will provide more intuitive editing, and provide similar editing to CAD.

Hide Dimension Annotators With A Value Of Zero

This options turns off dimension text with a value of zero within a model

Allow Fast Chainage / Offset Computations On Alignments

This option allows for fast calculation of chainage and alignment data.

Exclude hidden features from data selection

This option prevents hidden features from being selected during model editing, operating in a similar manner to inactive layers in CAD.

Mouse wheel zoom factor %

This option controls the level of zoom applied with the mouse wheel, which has the effect of making zooming in smoother and slower on fast PCs.

Search tolerance for sections

Edit Text Masks >>

The text masks control which points in a model are excluded from automatic annotation. This typically includes all derived and interpolated points, such as curve fit points.

Directories and Files

This section specifies paths to different files used by SCC, such as the executable files, the projects directory, temporary files and datalogger files. If these are not set correctly the program will not work correctly and/or will not create automatic jumps to CAD, MX or the text editor. If you are using SCC in conjunction with MX, the version of MX being used must be selected. The 'Add New Features' section specifies how the feature library handles new features when downloading or importing data.

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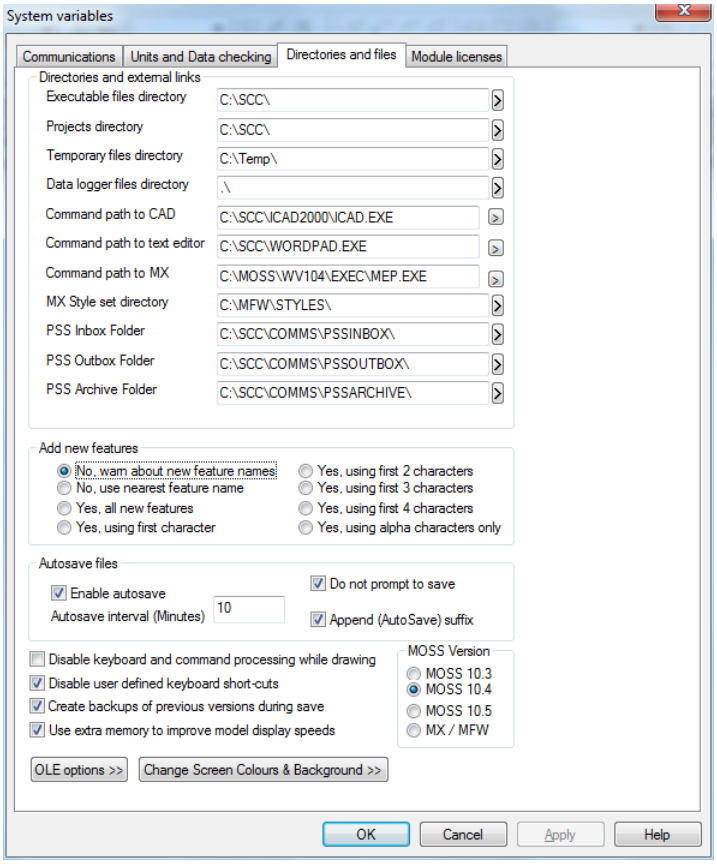


Executable Files Directory

This is the directory in which the SCC program and system data files reside.

Project Directory

This directory is used for permanent storage of raw field data, survey data sheets, models, drawings and related data.

Sub-Directories will be created off this directory for individual survey data sets.

Temporary Files Directory

This directory will be used for temporary storage of data within the program.

Data Logger Files Directory

This is the directory searched for raw survey data files. Usually it will be the root directory of the 3.5-inch floppy drive on your PC by default.

Command Path to CAD

This is the path to the AutoCAD executable file. This allows a link directly into AutoCAD when exporting a model or sections file to AutoCAD.

Command Path to Text Editor

This is the path to the text editor, which is used to view all report files generated by SCC.

Command Path to MX

This is the path to the MX executable file. This allows a link directly into MX when exporting a model or sections file to MX.

MX Style Set Directory

This specifies the path to the directory where all the Style Sets for MX are saved. Thus when a MX Style Set is being exported from SCC, it is created and stored in this directory.

Add New Features

This switch defines how new features encountered in a survey dataset, that do not exist in the feature library, are treated. If new features are NOT automatically added to the feature library the nearest match will be used when associating feature information with surveyed features. E.g. if the feature HEDGEROW occurs in the survey it will take its colour, layer, and symbology from the feature HEDGE. When surveying using MX labels in the logger this field may be used to group similar strings without allocating a record in the feature library for every string.

Autosave Files

This option allows the autosave function to be enabled and the time interval at which the saves occur to be determined.

Do not prompt to save

This option turns off prompt message when autosave is in use.

Append (AutoSave) suffix

This option adds the suffix AutoSave to the file name during autosave.

Disable Keyboard And Command Processing While Drawing

This option disables the ability for the user to interrupt drawing by selecting another option or pressing a function key. This is useful if you are capturing video footage from screen, or using an automated testing tool.

Disable user defined keyboard short-cuts

This options disables keyboard short-cuts.

Create backups of previous versions during save

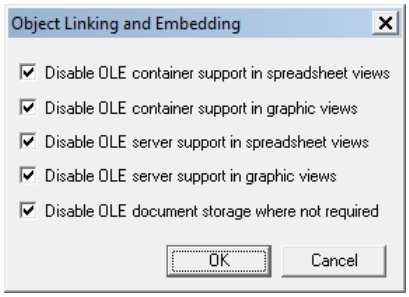
This option creates a backup file (*.bak) during saving.

Use extra memory to improve model display speeds

SCC takes full advantage of multiple processor PCs for drawing and model analysis for faster and more responsive processing.

OLE Options

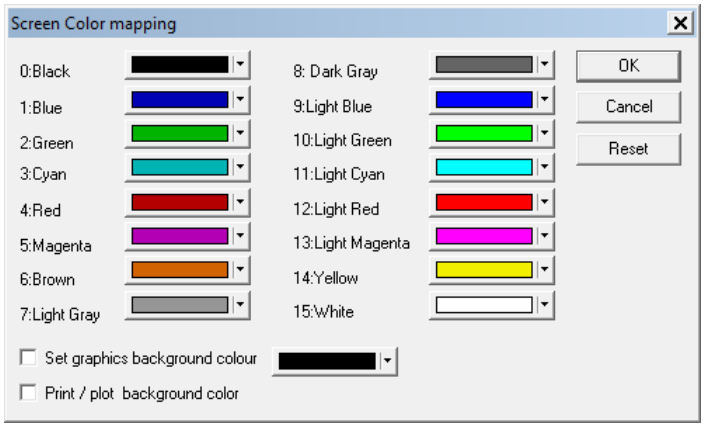
This option disables the use of OLE document storage, or compound document storage where it is not required. This typically halves the size of SCC document files on disk.



OLE document storage is useful if the user wish to set and query user defined document attributes from Windows explorer, and if the user is embedding OLE objects into your SCC models.

Change Screen Colours & Background >>

This option allows the user to change any of the sixteen pre-defined SCC palette colours to any true 24bit colour value. This dialog also allows the user to specify a screen background colour for the graphic views, and whether that colour is used when plotting. Note that for most output devices it is inappropriate to plot a background colour.

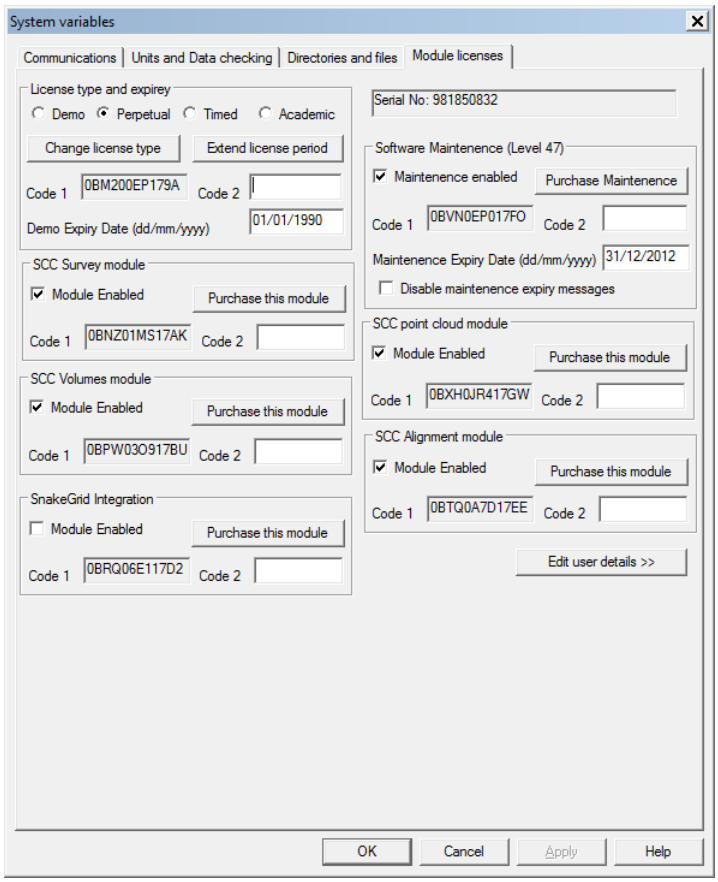


MX Version

The user can select the version of MX in use. The information is required when exporting files to MX.

Module Licenses

This dialog details the current SCC License serial number and the activated modules. The Maintenance Expiry Date is also available.



Maintenance Codes can be entered as follows:

Within SCC, go to 'FILE > General Options'

Within the 'System Variables' dialog box go to 'Module Licenses'

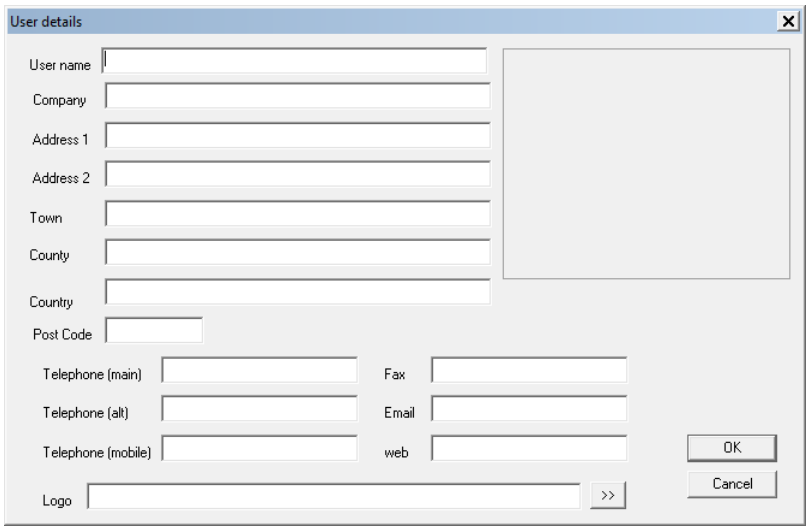
Enter Maintenance Code 2 and Maintenance Expiry Date

Select 'Purchase Maintenance'

A black correct symbol should appear in the box beside 'Maintenance Enabled'

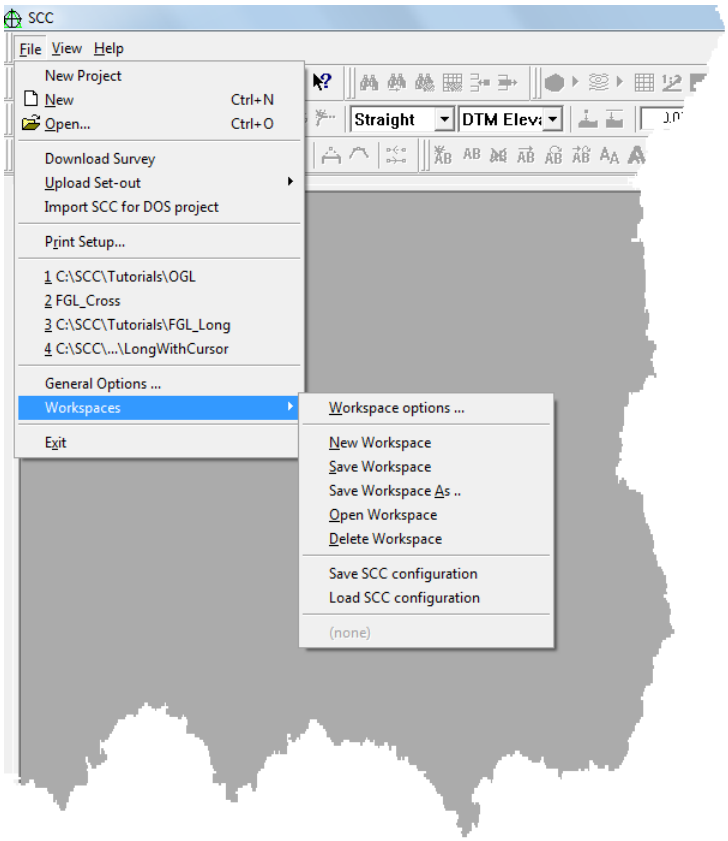
Edit User Details>>

This dialog allows the user the option of inputting company details and logo which can be automatically set up to appear within sheet layouts and reports.



28.2 Workspaces (File Menu)

Workspaces are used in SCC to store all the program settings that relate to the graphical user interface. This includes the display and positioning of tool bars and menus, keyboard shortcuts, the size of the main SCC frame window, a list of currently open documents, and the default spreadsheet colors and fonts.

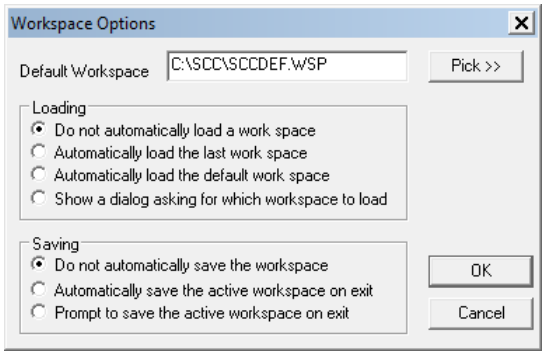


Workspace Options

The 'Workspace options' dialog, allows the user to control whether workspaces are automatically loaded at startup and saved on existing SCC.

If the user chooses to automatically load and save a workspaces, SCC will reopen the last used workspace.

If the user chooses to automatically load a default workspace, SCC will reopen the same each time you run it, with whatever GUI customization applied. This allows a senior surveyor to set-up a workspace that simplifies the operation of SCC for other users, by removing unused menu options and tool bars.



Saving and Loading Configuration Files

Two options are available in SCC to save and restore the SCC configuration to external files. These are **'FILE** > **Workspaces** > **Save SCC configuration'** and **'FILE** > **Workspaces** > **Load SCC configuration'**. These configuration files store all user definable parameters relating to survey download, reduction, etc... that are not stored as part of the project template or workspace, i.e. all the values in the system registry under 'HKEY_CURRENT_USER/SOFTWARE/Atlas computers Ltd'. Configuration files are placed in the SCC executables directory with the file type 'SCCConfig'.

Note that you require backup and restore privileges in order to use these options. If you encounter problems using these options, please contact your system administrator.

Use of external files rather than the system registry

To overcome issues with access to the registry (slow or restricted with some security policies), SCC now in addition to Workspace Configuration options uses external files rather than the system registry to store most of the configuration settings. The configuration file is now stored as <SCC directory >SCC Profile for <Logon Name>.BIN, e. g. C:\SCC\SCC Profile for Shane.BIN. If the user wishes to copy the configuration to another login, or another PC with a different login name it is just a matter of renaming the <Logon Name> part of this file accordingly. When moving from the previous versions of SCC to this version, configuration settings will automatically be moved from the registry to this file as they are required.

In addition, all configuration settings in SCC for the current user can be viewed in a prefined Crystal report 'SCC Settings.rpt', which can be accessed by selecting 'FILE > Reports'.

29 Import & Export

Many import and export options are supported within SCC.

See Also

Import SCC Text File (File Menu)

Import Comma Separated file (File Menu)

Import Fixed format ASCII file (File Menu)

Import STAR*NET Co-ordinate file (File Menu)

Import MOVE3 Co-ordinate file (File Menu)

Import DWG/DXF File

Import LandXML (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import ESRI Shapefile (File Menu)

Import ASCII Wriggle Survey (File Menu)

Import Amberg GRPwin Format (File Menu)

Import Amberg AR2 Format (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import AutoGrad/MSMM 'As Set-Out File' (File Menu)

Import AutoGrad/MSMM Levelling File (File Menu)

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Import AutoGrad/MSMM GDS Printout (File Menu)

Import DOER Husky File (File Menu)

Import MOSS GENIO File (File Menu)

Import MOSS 992 Report (File Menu)

Import MOSS 994 Report (File Menu)

Import User defined ASCII co-ordinate file

Panterra

Import Steanne MIDAS File (File Menu)

Import SDRMAP ASCII File (File Menu)

Import Eclipse Report File (File Menu)

Import ESBI Vectors File (File menu)

Import SCC for DOS Project

Landscape (File Menu)

29.1 Import SCC Text File (File Menu)

This option allows for the importing of *.sio files.

See Also

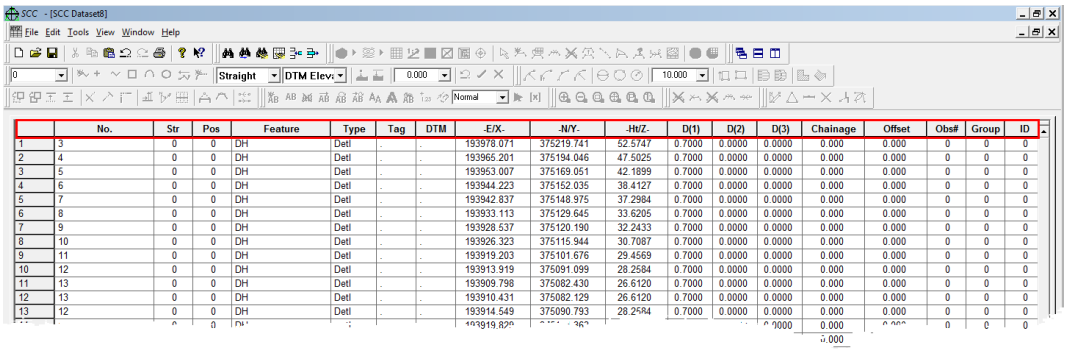
PocketDTM

29.2 Import Comma Separated file (File Menu)

This option allows the user to append data from a comma separated ASCII file to the current data sheet. This file may have been created from another data sheet or a spreadsheet or database.

It is important that the comma separated file has the relevant columns to match that of the Detail Coordinate Sheet:

No. Str. Pos Feature Type Tag DTM E/X N/Y Ht/Z D(1) etc.



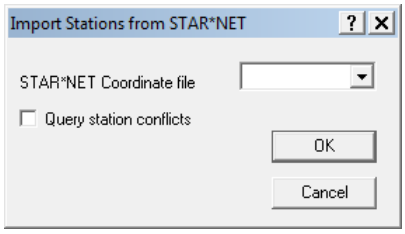
	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	3	0	0	DH	Detl	.	.	193978.071	375219.741	52.5747	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
2	4	0	0	DH	Detl	.	.	193965.201	375194.046	47.5025	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
3	5	0	0	DH	Detl	.	.	193953.007	375169.051	42.1899	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
4	6	0	0	DH	Detl	.	.	193944.223	375152.035	38.4127	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
5	7	0	0	DH	Detl	.	.	193942.837	375148.975	37.2984	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
6	8	0	0	DH	Detl	.	.	193933.113	375129.645	33.6205	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
7	9	0	0	DH	Detl	.	.	193928.537	375120.190	32.2433	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
8	10	0	0	DH	Detl	.	.	193926.323	375115.944	30.7087	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
9	11	0	0	DH	Detl	.	.	193919.203	375101.676	29.4569	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
10	12	0	0	DH	Detl	.	.	193913.919	375091.099	28.2584	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
11	13	0	0	DH	Detl	.	.	193909.798	375082.430	26.6120	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
12	13	0	0	DH	Detl	.	.	193910.431	375082.129	26.6120	0.7000	0.0000	0.0000	0.000	0.000	0	0	0
13	12	0	0	DH	Detl	.	.	193914.549	375090.793	28.2584	0.7000	0.0000	0.0000	0.000	0.000	0	0	0

29.3 Import Fixed format ASCII file (File Menu)

This option allows the user to append data from an ASCII file to the current data sheet. This file may have been created from another data sheet or a text editor. The input format is fixed width fields, sample input data may be obtained from the ‘Export Fixed format ASCII file’ option.

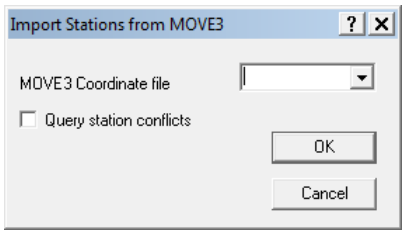
29.4 Import STAR*NET Co-ordinate file (File Menu)

This option appends station co-ordinates to the station co-ordinates spreadsheet from a STAR*NET '.PTS' file. Selecting the option presents the following options;



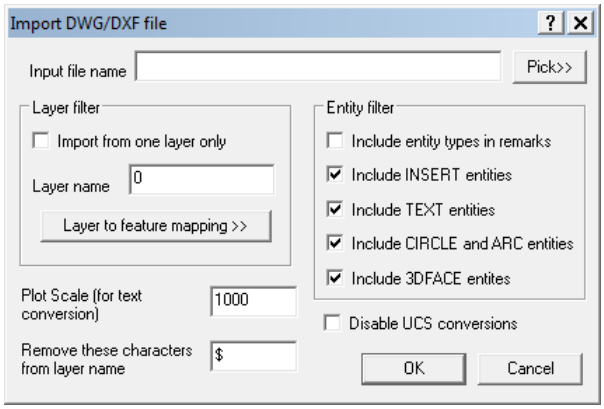
29.5 Import MOVE3 Co-ordinate file (File Menu)

This option appends station co-ordinates to the station co-ordinates spreadsheet from a MOVE3 '*.COR' file. Selecting the option presents the following options;

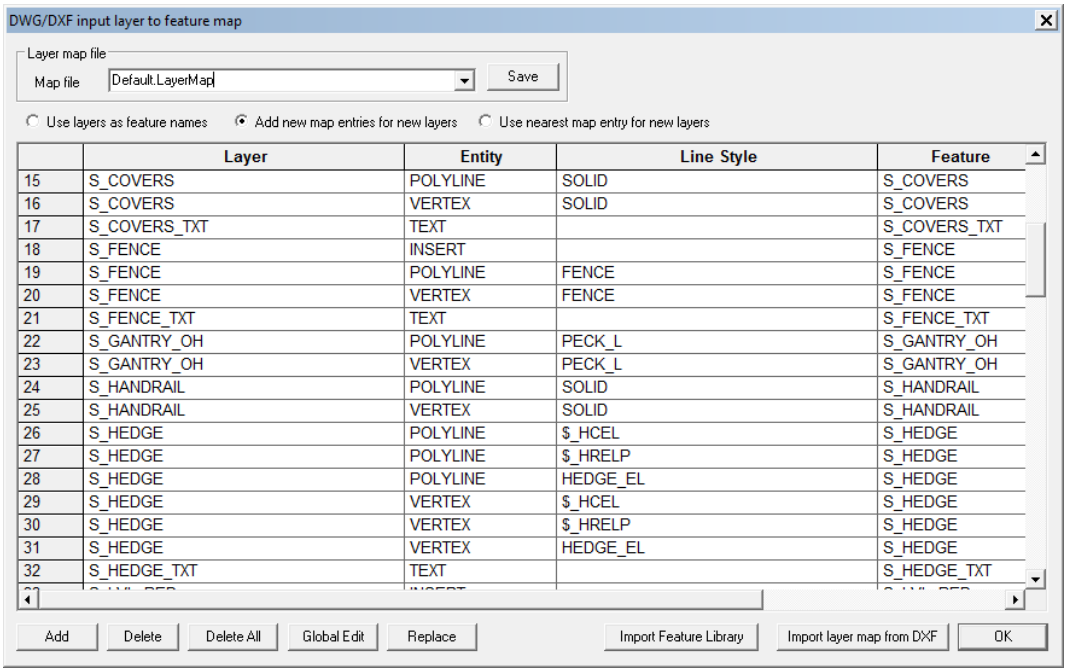


29.6 Import DWG/DXF File (File Menu)

This option converts a DXF or DWG file directly into an SCC survey dataset or model. It is ideal for transferring data from a variety of CAD packages such as AutoCAD, Microstation, and MX. The dialogue contains the following options;



For large DWG and DXF files it is considerably more efficient to model them directly in SCC, using **'FILE > Model > DWG/DXF'**, rather than importing them into a spreadsheet format.



	Layer	Entity	Line Style	Feature
15	S_COVERS	POLYLINE	SOLID	S_COVERS
16	S_COVERS	VERTEX	SOLID	S_COVERS
17	S_COVERS_TXT	TEXT		S_COVERS_TXT
18	S_FENCE	INSERT		S_FENCE
19	S_FENCE	POLYLINE	FENCE	S_FENCE
20	S_FENCE	VERTEX	FENCE	S_FENCE
21	S_FENCE_TXT	TEXT		S_FENCE_TXT
22	S_GANTRY_OH	POLYLINE	PECK_L	S_GANTRY_OH
23	S_GANTRY_OH	VERTEX	PECK_L	S_GANTRY_OH
24	S_HANDRAIL	POLYLINE	SOLID	S_HANDRAIL
25	S_HANDRAIL	VERTEX	SOLID	S_HANDRAIL
26	S_HEDGE	POLYLINE	$_HCEL	S_HEDGE
27	S_HEDGE	POLYLINE	$_HRELP	S_HEDGE
28	S_HEDGE	POLYLINE	HEDGE_EL	S_HEDGE
29	S_HEDGE	VERTEX	$_HCEL	S_HEDGE
30	S_HEDGE	VERTEX	$_HRELP	S_HEDGE
31	S_HEDGE	VERTEX	HEDGE_EL	S_HEDGE
32	S_HEDGE_TXT	TEXT		S_HEDGE_TXT

The layer to feature mapping dialog may be used to map any combination of DWG layers, entitiy types and line styles onto SCC features. Default layer maps may be created either from the current feature library or from the selected DWG or DXF file. Once a layer map has been set-up, it can be saved to file for re-use and distribution as required. After creating a layer map file, it will remain the default until changed.

Mapping layers onto a feature called IGNORE, which has a corresponding feature library entry with DTM code forced to IGNORE, is a good way of using the layer map to filter out unwanted drawing data.

29.7 Import LandXML (File Menu)

SCC incorporates bi-directional support for transfer of data in LandXML format, as described in www.landxml.org. This includes support for import of model, geometric alignment, and survey observations in LandXML, and export of model and alignment data in this format.

Support for LandXML has been provided as a mechanism to allow for exchange of data between SCC and a range of other software packages and survey instruments. It is not suitable as an alternative mechanism for archiving data, or exchanging complete model and survey data between SCC users as it does not include a complete representation of everything contained in an SCC model or survey dataset. Typically, LandXML is good for exchanging survey information, alignment geometry, and simple surface model information. It is not suitable for exchanging edited cartography, which may include symbols, line styles, bitmaps, surface textures, and various point and line annotation.

SCC currently supports import and export of data in both LandXML 1.0 and LandXML 1.1 format. We intend to deepen and extend our support to include LandXML 1.2 as it becomes ratified, and anticipate increasing use of LandXML as a preferred transfer format when communicating with total station and GPS equipment.

To directly model a LandXML file in SCC, **select 'FILE > Model > LandXML file'.**

To create a survey dataset from a LandXML file, **select 'FILE > Import LandXML file'.**

If alignment data is present in the input file in either of these cases you will be given the option save that data as an SCC Alignment document. To export a model from SCC in LandXML format, **select 'FILE > Export > LandXML'.**

If the model includes any attached alignments they will be included in the LandXML output file.

29.8 Import X,Y,Z ASCII file (File Menu)

This option provides a simple method of importing co-ordinates into a SCC Detail Coordinate spreadsheet. It can take in data in either X,Y,Z format or Point number, X, Y, Z, Feature name format.

In addition, this option checks to see if the file extension is .PTS and if so assumes PTS point cloud data is X, Y, Z, intensity, R, G, B. This import is slower as the software will carry out a nearest match RGB colour to the SCC & AutoCAD palette for feature naming purposes, for example, the point cloud data is grouped and sorted by colour for analysis purposes.

29.9 Import ESRI Shapefile (File Menu)

This option allows the user to import points, lines and polygons from an ESRI shape file

Note:

Shape files are limited in that they can only store one of the above in any given file.

29.10 Import ASCII Wriggle Survey (File Menu)

SCC supports the import of wriggle survey data for tunnel analysis. This option takes a file containing surveyed points representing rings / rough tunnel sections, and uses a least squares analysis to compute best-fit radii and plane details for each ring ('**TOOLS** > **Compute Wriggle Survey**').

29.11 Import Amberg (GRPwin format) (File Menu)

SCC supports data from the Amberg GRP rail trolley. This creates two points per line of data from the trolley file, one for left rail, one for right rail, using the station for string number and ident for point number. D1, D2 and D3 are used to store odometer, gauge, and super elevation in the input file, such that they can be annotated as required. The rail features are named LRAIL and RRAIL.

29.12 Import Amberg (AR2 format) (File Menu)

SCC supports data from the Amberg rail trolley. Where multiple AR2 files are selected for import, they are merged into a single job, where the string number is used to denote the input file number. The AR2 format is useful for importing continuous rail with closely spaced points.

29.13 Import AutoGrad/MSMM ‘As Set-Out File’ (File Menu)

This option imports a file from the AutoGrad Setting Out module.

29.14 Import AutoGrad/MSMM Levelling File (File Menu)

This option imports a file from the AutoGrad levelling module.

29.15 Import AutoGrad/MSMM GDS Printout (File Menu)

This module converts detail observation and station co-ordinate data from an AutoGRAD printout file into AutoGRAD / MSMM binary and SCC binary format. The printout option selected on AutoGrad should be the GDS detail printout option. This is similar but not identical to the GRAD GDS format. GRAD was the predecessor of AutoGrad.

29.16 Import DOER Husky File (File Menu)

This option provides a facility for inputting data from the Irish Dept. of the Environment Roads package, ‘DOER’. This module converts Husky Setout data generated by DOER into a SCC

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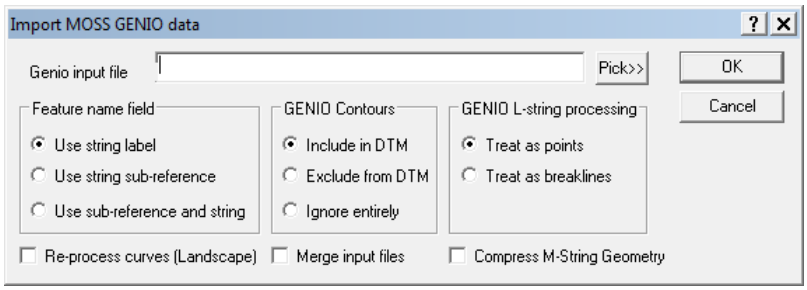
co-ordinate file. For newer versions of DOER, the option to create DXF polylines is a better method of transferring design data into SCC.

29.17 Import MOSS GENIO File (File Menu)

This option converts a GENIO file into a detail co-ordinates spread sheet. In doing so all strings are converted into 3 dimensional strings. This option has the advantage that models created can make full use of the SCC feature library facilities. As such it can be useful for converting external MX models into SCC generated models. Selecting this option presents a dialogue with the following options;



29.18 Import MOSS 992 Report (File Menu)

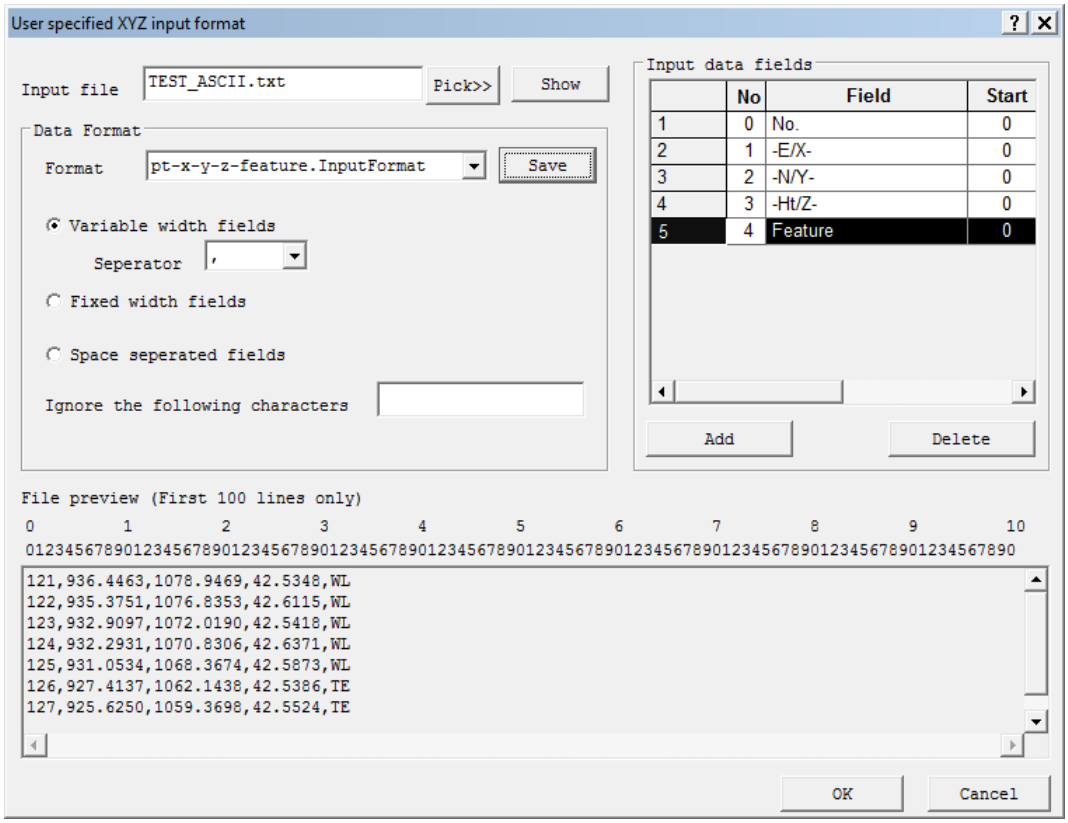
This option translates ASCII files containing 992 REPORT information into SCC co-ordinate spreadsheets. It is an alternative method for transferring string information from other MX systems into SCC.

29.19 Import MOSS 994 Report (File Menu)

This option translates ASCII files containing 994 REPORT information into SCC co-ordinate spreadsheets. It is an alternative method for transferring sectional information from other MX systems into SCC.

29.20 Import User defined ASCII co-ordinate file

This option provides a simple method of importing user defined XYZ ASCII co-ordinate files into a SCC Detail Coordinate spreadsheet. On selecting this option, a dialog is presented from which you can create your own ASCII input file based on the data file selected. This format can be saved as a template to be used for future files.



Data can be imported in fixed format or variable width fields, with options for automatically stripping out certain characters, such as white space, quotes, inverted commas, etc…

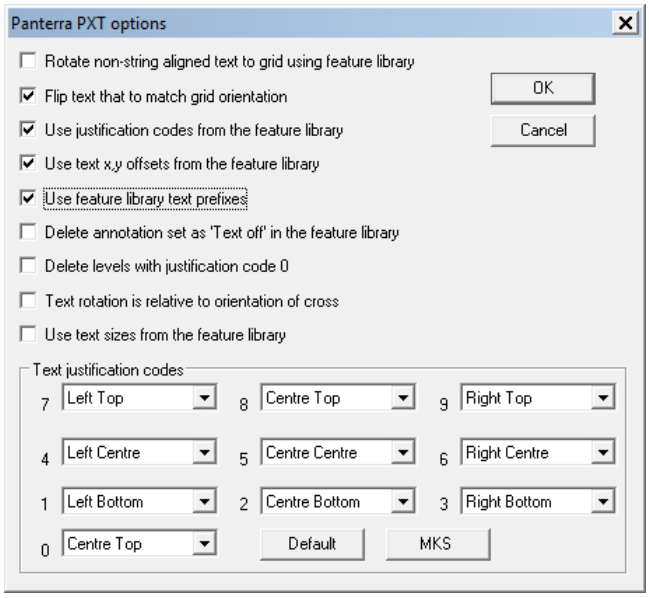
To create a new import format, first select your input file, and press ‘Show’. This will display a portion of your input file in the preview box and allow you to determined whether it is fixed or variable format, and if it is fixed format, to specify the column numbers for various fields. Having done this, press the ‘Add’ button to enter details for the fields you wish to extract. If the file is fixed format, you must enter the starting column and width for each field. If it is variable width, you must enter the field number for each field, in this case the start and width are ignored.

Once you have created your new format file, you should save it, such that the next time you wish to import a file in this format, you simply select the format file and press ok. The file is saved into your SCC executables file directory, normally C:\SCC\, with the extention ‘. InputFormat’.

To complete the import of your file, simply press ok.

29.21 Panterra PXT

This option allows you to either import or directly model a file in Panterra PXT format. The translation uses a combination of options from the feature library and Panterra PXT options dialog as follows;



Rotate non-string aligned text to grid using feature library

This option rotates any text that is set as 'string aligned' in the feature library to the survey grid, overriding the PXT text rotation value for given features.

Flip text that to match grid orientation

This option flips any text that is upside down to make it more readable.

Use justification codes from the feature library

This option uses the feature library to determine the justification code for any text in the PXT file with a justification set to zero

Use text x,y offsets from the feature library

This option applies X,Y offsets from the feature library to PXT text.

Use feature library text prefixes

This option applies feature library prefixes to any PXT dimensional text such as levels.

Delete annotation set as 'Text off' in the feature library

This option deletes any text from the PXT file that is set as Text Off in the feature library, enabling selective filtering of annotation by feature

Delete levels with justification code 0

This option deletes any text in the PXT file with a justification set to zero

Text justification codes

These fields control how PXT justification codes are interpreted by SCC

29.22 Import Steanne MIDAS File (File Menu)

This option translates ASCII files containing GPS co-ordinates from MIDAS into SCC co-ordinate spreadsheets. The MIDAS system is a general purpose GPS surveying system with full feature coding capability that ideally compliments SCC and the MSMM.

29.23 Import SDRMAP ASCII File (File Menu)

This option allows the user to convert ASCII data generated by SDRMAP into SCC co-ordinate file(s). Two formats are supported by this translator, these are SDR co-ordinate format and comma separated format.

29.24 Import Eclipse Report File (File Menu)

This translator allows the user to import data from an Eclipse report file into a SCC co-ordinate file. The report taken from Eclipse is a surface detail point listing report. This function can be very useful when transferring data from older Eclipse based systems that do not support GENIO and DXF.

29.25 Import ESBI Vectors File (File menu)

This module converts water velocity data in position-vector format into a SCC co-ordinate file. The co-ordinate file is 2D with a two-point string generated for each vector. This module is primarily designed to enable cartographic mapping of this data rather than modelling.

29.26 Import Symbols from DXF

This option imports symbols from a DXF file. Once you have imported symbols from a DXF file you may need to edit their insertion points in order to use them directly from survey.

29.27 Import SCC for DOS Project

This option allows conversion of SCC for DOS and TopoMOSS projects into SCC for Windows. Select the project directory to be convert and all control, traverse and co-ordinate information will be converted into .Project, .Traverse and .Survey files respectively. No model information is transferred. A project directory is created as a subdirectory of the main SCC directory and the project file opened.

29.28 Import Landscape (File Menu)

Landscape to SCC Model Converter

This option allows the user to convert a dxf created from Landscape together with a Genio file to produce an SCC Model.

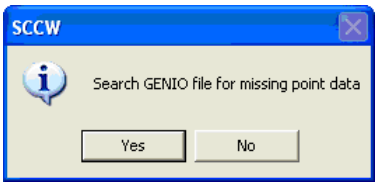
The following processing steps should be followed:

Open Project File

Select 'FILE > Import > Landscape > Landscape to SCC Model Converter'

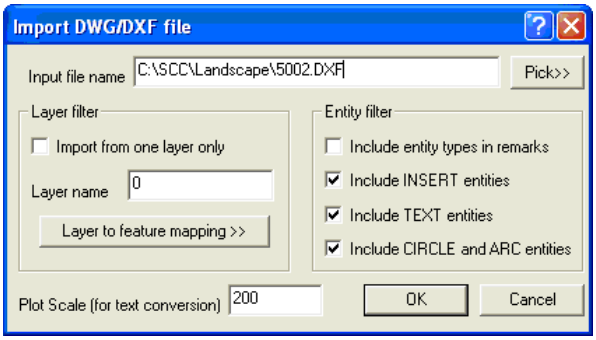
Select dxf file '\SCC\Landscape\5002.DXF'

Select 'Yes' to 'Search GENIO file for missing point data

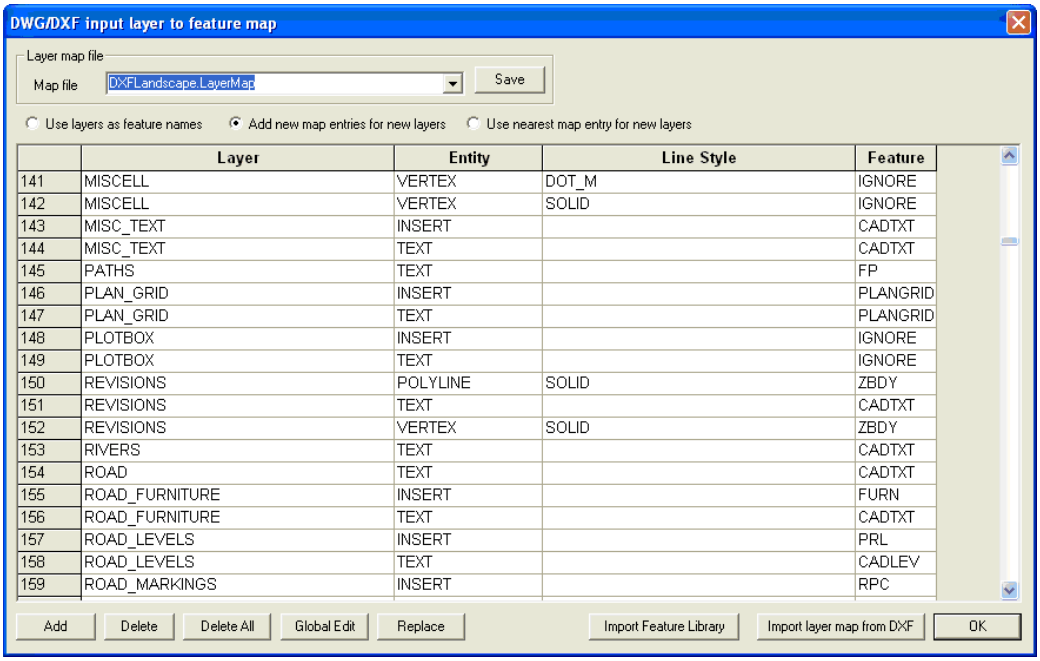


Set the Plot Scale (for text conversion) to 200

Select 'Layer to feature mapping>>'



Set 'DXFLandscape.LayerMap' as the Map file



	Layer	Entity	Line Style	Feature
141	MISCELL	VERTEX	DOT_M	IGNORE
142	MISCELL	VERTEX	SOLID	IGNORE
143	MISC_TEXT	INSERT		CADTXT
144	MISC_TEXT	TEXT		CADTXT
145	PATHS	TEXT		FP
146	PLAN_GRID	INSERT		PLANGRID
147	PLAN_GRID	TEXT		PLANGRID
148	PLOTBOX	INSERT		IGNORE
149	PLOTBOX	TEXT		IGNORE
150	REVISIONS	POLYLINE	SOLID	ZBDY
151	REVISIONS	TEXT		CADTXT
152	REVISIONS	VERTEX	SOLID	ZBDY
153	RIVERS	TEXT		CADTXT
154	ROAD	TEXT		CADTXT
155	ROAD_FURNITURE	INSERT		FURN
156	ROAD_FURNITURE	TEXT		CADTXT
157	ROAD_LEVELS	INSERT		PRL
158	ROAD_LEVELS	TEXT		CADLEV
159	ROAD_MARKINGS	INSERT		RPC

Select 'OK'

Select 'OK' within the 'Import DWG/DXF file' dialog

The user is then prompted to select the Genio file

Using the 'Pick>>' button, select '5002.CRD' from '\SCC\Landscape'

The conversion is now carried out and the model is created

Select 'FILE > 5002.Model' and the model is available as the last document

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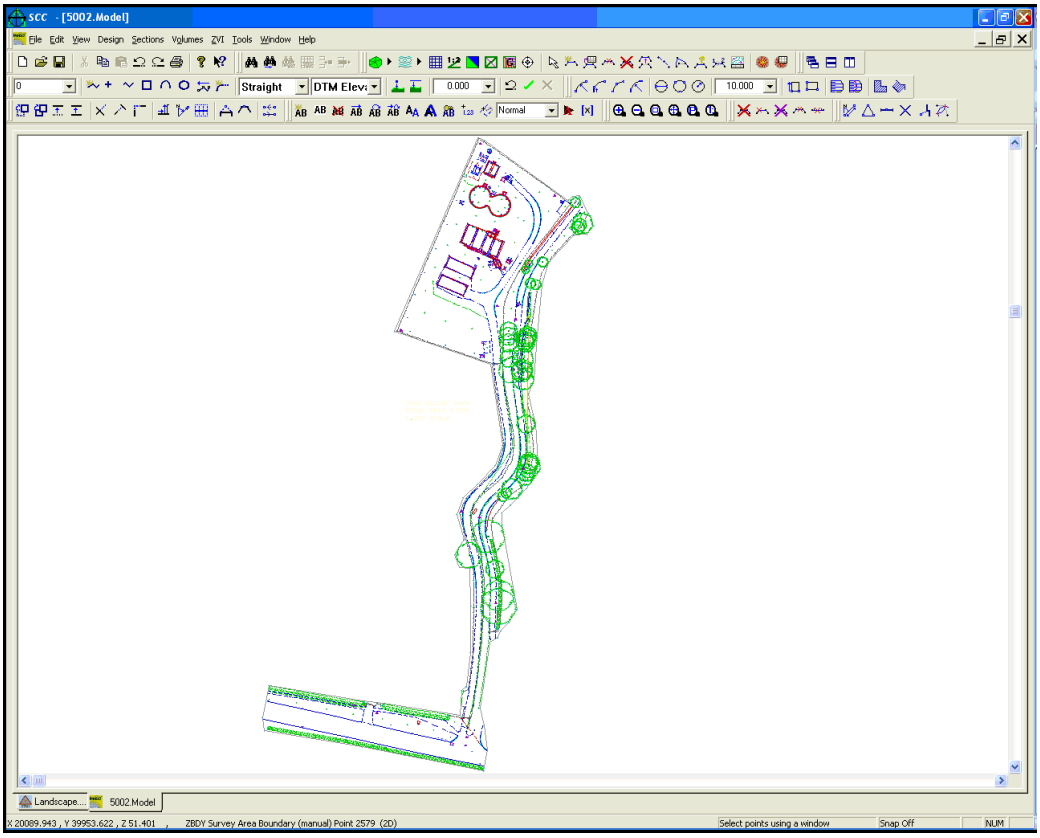

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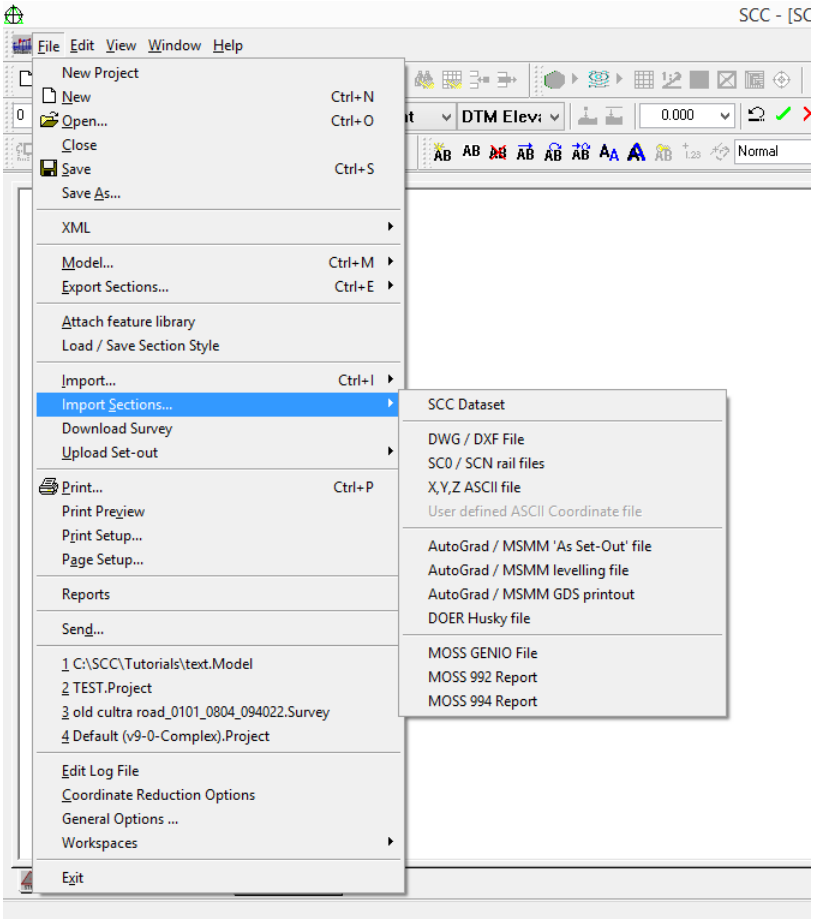
29.29 Import SC0 /SCN rail files (Sections File Menu)



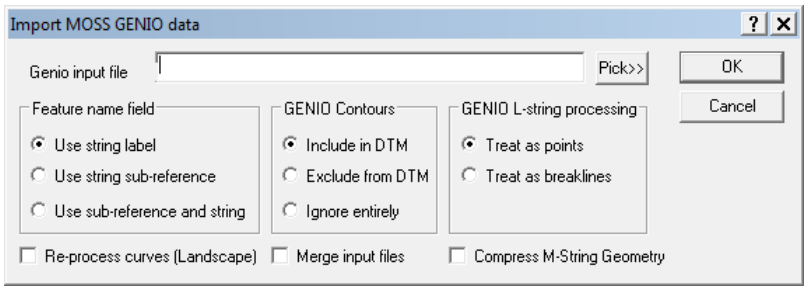
SCC can import SC0 and SCN files as sections, where the sections also include all the SC0 and SCN header information. A new section style, SC0 SCC.SectionStyle, for drawing these sections to show structure and rail information in included in the tutorials directory. Extra header information is available by querying the section.

29.30 Importing Alignment Data

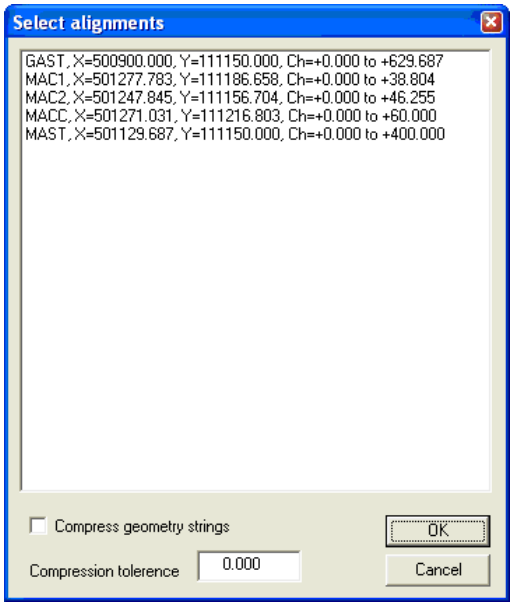
29.30.1 Import MX/MOSS GENIO Geometry strings (Alignment File menu)

This option imports Geometry string information from a MX GENIO file.

The file can be selected using the 'Import MX GENIO Data' dialog:



On importing, SCC list alignment strings to allow the user to select the specific one for download.



Compress Geometry Strings

This option is used to remove redundant elements from an alignment. It operates by testing the end conditions of any given element, extended by the length of the subsequent element, with the end conditions of the subsequent element. If they fall within the specified tolerance, the element is extended by that length, and the subsequent element is deleted. This is repeated until no more elements can be deleted.

Compress Tolerance

When compressing geometry strings, this tolerance is the maximum allowable deviation between the original input geometry and the compressed geometry at any given point in the alignment.

This geometric information is stored in the Horizontal Entities (Alignment View Menu) and Vertical Entities (Alignment View Menu) sheets. Note that SCC uses clothoid transitions throughout and may prove unsuitable where other MX design entities are in use, for example, Sine transitions in high-speed rail. The horizontal intersection points sheet will not be populated as there are no HIP points in a MX/MX geometry string.

29.30.2 Import Entities from DWG/DXF (Alignment File Menu)

This option reads horizontal geometry entities from polylines in a DXF or DWG file. These can include straights and arcs as required.

29.30.3 Import DOER HIPS (Alignment File Menu)

This option imports horizontal intersection point information from DOER. To view this information go to **'View** > **Horizontal Intersection Points'.**

See Also

Horizontal Entities (Alignment View Menu)

29.30.4 Import DOER VIPS (Alignment File Menu)

This option imports vertical intersection point information from DOER. To view this information go to **'View** > **Vertical Intersection Points'.**

See Also

Vertical Entities (Alignment View Menu)

29.30.5 Import Simple ASCII HIPS (Alignment File Menu)

This option reads a comma separated ASCII file of horizontal intersection points. Individual lines in this file can be in one of the following formats;

- Easting, Northing
- Easting, Northing, Incoming transition length, Radius , Outgoing transition length
- Easting, Northing, Incoming transition length, Radius 1, partial transition length, Radius 2 , Outgoing transition length, arc direction, arc length
- Easting, Northing, Incoming transition length, Radius 1, partial transition length, Radius 2 , Outgoing transition length, arc direction, arc length
- Easting, Northing, Incoming transition length, Radius 1, partial transition length, Radius 2 , Outgoing transition length, arc direction, arc length1, arc length2

29.30.6 Import Simple ASCII VIPS (Alignment File Menu)

This option reads a comma separated ASCII file of vertical intersection points. Individual lines in this file can be in one of the following formats;

- Chainage, level
- Chainage, level, length

29.30.7 Import Nikon FRG file (Alignment File Menu)

This option reads a Nikon full road geometry file from disk, and stores the details in the horizontal entity, vertical entity, and section template points sheets. For an example of this file format, see ‘Example.FRG’ in the tutorials directory.

29.31 Export Stations as dataset (File Menu)

This options exports station values present in a project file to a new dataset.

29.32 Export Automated Demarcation Certificate (File Menu)

This client specific option provides an automated demarcation certificate for use during land parcel surveys.

29.33 Export Create a file CRC report (File Menu)

This option computes CRC (cyclic redundancy checks) for a list of selected files and passes this on to the report viewer. CRC can be used for digital signing of documents.

29.34 Export Fixed format ASCII File (File Menu)

This option is available from the model, section, and coordinate view menus and allows you to export ASCII data in a user-defined format. The output file is broken down into five basic sections; the file header and footer, the string or section header and footer, and the point details. The section header and footer is written for each new section graph in a section file.

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The string header and footer is written for each new string in a model or coordinate data set. The point details are written for every point on a section or string.

Each section can contain literal text information and text corresponding to SCC data fields. SCC data fields are added to the output format using field macros, where a field macro is the name of any given field enclosed in square brackets. A field macro can also contain qualifiers to specify the field width, padding, and number of decimals. For example, given a chainage value of 1006.102, the following macros would give the following output;

[Chainage] 1006

[Chainage:010:1] 00001006.1

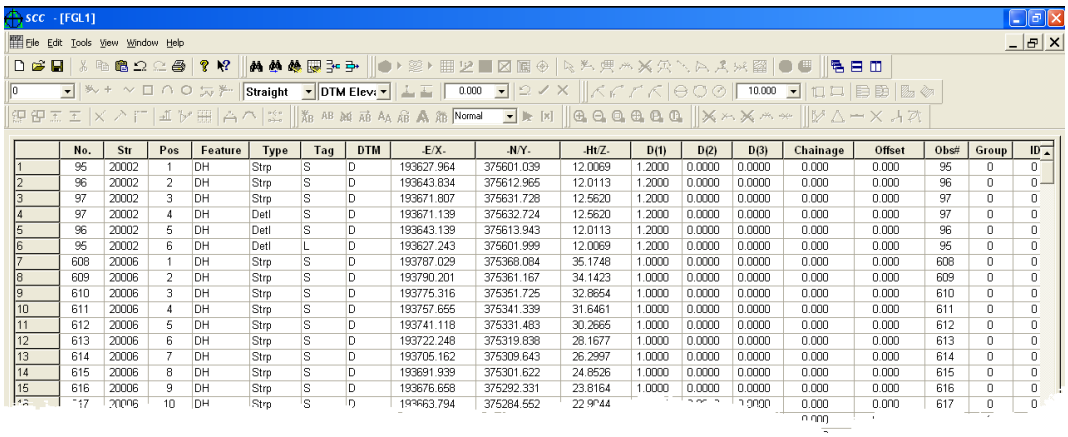
[Chainage: 0:3] 1006.102

[Chainage:5] 1006

Once you have defined an output format, you can save it to file, such that it can be re-used and distributed to other users.

Export From A Dataset

This option allows the user to create a comma separated ASCII file from your current data sheet. This file may be imported into a spreadsheet or database package. It may also be read into another sheet with the same fields using the 'Import Comma Separated file' option.



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	95	20002	1	DH	Strp	S	D	193627.964	375601.039	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	0
2	96	20002	2	DH	Strp	S	D	193643.834	375612.965	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	0
3	97	20002	3	DH	Strp	S	D	193671.807	375631.728	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	0
4	97	20002	4	DH	Detl	S	D	193671.139	375632.724	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	0
5	96	20002	5	DH	Detl	S	D	193643.139	375613.943	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	0
6	95	20002	6	DH	Detl	L	D	193627.243	375601.999	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	0
7	608	20006	1	DH	Strp	S	D	193787.029	375368.084	35.1748	1.0000	0.0000	0.0000	0.000	0.000	608	0	0
8	609	20006	2	DH	Strp	S	D	193790.201	375361.167	34.1423	1.0000	0.0000	0.0000	0.000	0.000	609	0	0
9	610	20006	3	DH	Strp	S	D	193775.316	375351.725	32.8654	1.0000	0.0000	0.0000	0.000	0.000	610	0	0
10	611	20006	4	DH	Strp	S	D	193757.655	375341.339	31.6461	1.0000	0.0000	0.0000	0.000	0.000	611	0	0
11	612	20006	5	DH	Strp	S	D	193741.118	375331.483	30.2665	1.0000	0.0000	0.0000	0.000	0.000	612	0	0
12	613	20006	6	DH	Strp	S	D	193722.248	375319.838	28.1677	1.0000	0.0000	0.0000	0.000	0.000	613	0	0
13	614	20006	7	DH	Strp	S	D	193705.162	375309.643	26.2997	1.0000	0.0000	0.0000	0.000	0.000	614	0	0
14	615	20006	8	DH	Strp	S	D	193691.939	375301.622	24.8526	1.0000	0.0000	0.0000	0.000	0.000	615	0	0
15	616	20006	9	DH	Strp	S	D	193676.658	375292.331	23.8164	1.0000	0.0000	0.0000	0.000	0.000	616	0	0
[illegible]	617	20006	10	DH	Strp	S	D	193663.794	375284.552	22.9044	[illegible]	[illegible]	0.0000	0.000	0.000	617	0	0

29.35 Export Comma Separated File (File Menu)

This option allows the user to create an ASCII file from your current data sheet. This file may then be printed or edited using a text editor. It may also be read into another sheet with the same fields using the 'Import Fixed format ASCII file' option.

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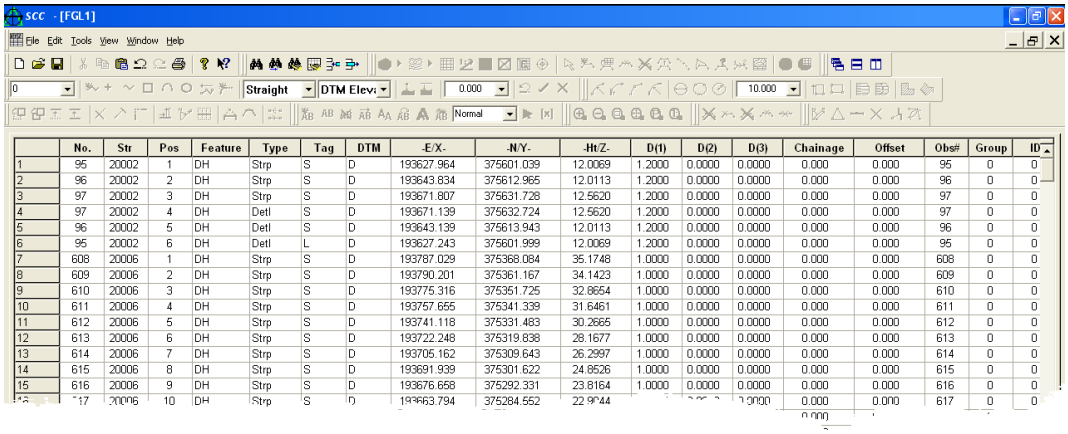
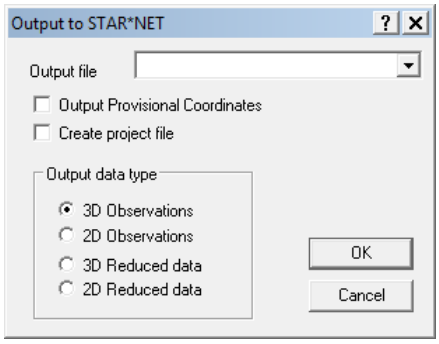


	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	95	20002	1	DH	Strp	S	D	193627.964	375601.039	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	0
2	96	20002	2	DH	Strp	S	D	193643.834	375612.965	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	0
3	97	20002	3	DH	Strp	S	D	193671.807	375631.728	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	0
4	97	20002	4	DH	Detl	S	D	193671.139	375632.724	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	0
5	96	20002	5	DH	Detl	S	D	193643.139	375613.943	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	0
6	95	20002	6	DH	Detl	L	D	193627.243	375601.999	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	0
7	608	20006	1	DH	Strp	S	D	193787.029	375368.084	35.1748	1.0000	0.0000	0.0000	0.000	0.000	608	0	0
8	609	20006	2	DH	Strp	S	D	193790.201	375361.167	34.1423	1.0000	0.0000	0.0000	0.000	0.000	609	0	0
9	610	20006	3	DH	Strp	S	D	193775.316	375351.725	32.8654	1.0000	0.0000	0.0000	0.000	0.000	610	0	0
10	611	20006	4	DH	Strp	S	D	193757.655	375341.339	31.6461	1.0000	0.0000	0.0000	0.000	0.000	611	0	0
11	612	20006	5	DH	Strp	S	D	193741.118	375331.483	30.2665	1.0000	0.0000	0.0000	0.000	0.000	612	0	0
12	613	20006	6	DH	Strp	S	D	193722.248	375319.838	28.1677	1.0000	0.0000	0.0000	0.000	0.000	613	0	0
13	614	20006	7	DH	Strp	S	D	193705.162	375309.643	26.2997	1.0000	0.0000	0.0000	0.000	0.000	614	0	0
14	615	20006	8	DH	Strp	S	D	193691.939	375301.622	24.8526	1.0000	0.0000	0.0000	0.000	0.000	615	0	0
15	616	20006	9	DH	Strp	S	D	193676.658	375292.331	23.8164	1.0000	0.0000	0.0000	0.000	0.000	616	0	0
16	617	20006	10	DH	Strp	S	D	193663.794	375284.552	22.9044			0.0000	0.000	0.000	617	0	0

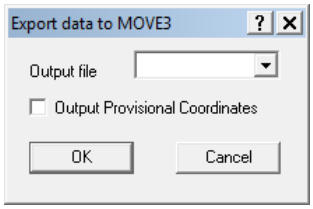
29.36 Export STAR*NET Input File (File Menu)

This function outputs the current traverse data sheet to a STAR*NET input file. The file is given the name <Data SetDAT>. On selecting the option the following dialog is presented;



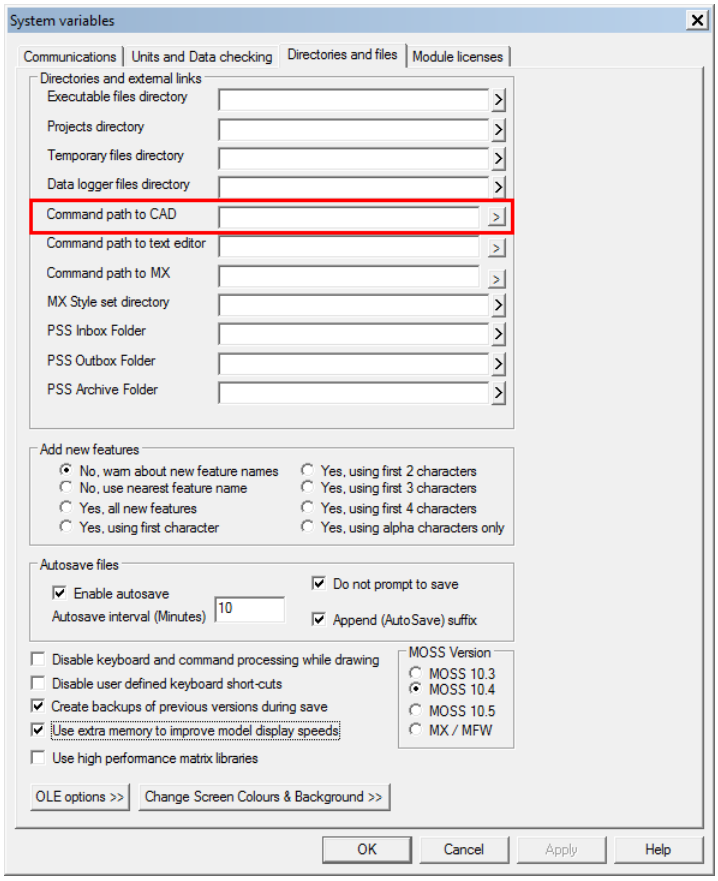
29.37 Export MOVE3 Input File (File Menu)

This function outputs the current traverse data sheet to a MOVE3 input file. This creates MOVE3 project, terrestrial observation, and terrestrial co-ordinate files. Note that the MOVE3 project created defines a default projection system that the user may wish to modify prior to computing the network. On selecting this option the following dialogue is presented;



29.38 Export CAD drawing (File Menu)

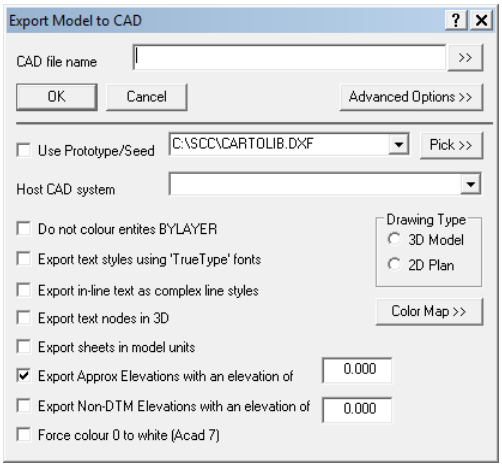
When outputting models to CAD a link may be made to the CAD system so that it is automatically called when this option is selected in SCC. For a direct link to your CAD system fill in the Command path to AutoCAD in the **'General Options** > **Directories and Files'.**



If the CAD system is not Windows based and no direct link is possible select the option 'Text DXF'. This creates a DXF in the current working directory.

CAD File Name

This is the name file that will output to your CAD system. For the purposes of exporting to CAD, please do not use spaces in your CAD filename.



Prototype File

This is the DXF file containing the symbols on which the feature library is based. There are different feature library files found in main SCC directory. Each symbol is an AutoCAD block. It is not necessary to select or use a prototype file as SCC will create a full prototype where one is not provided.

Host CAD System

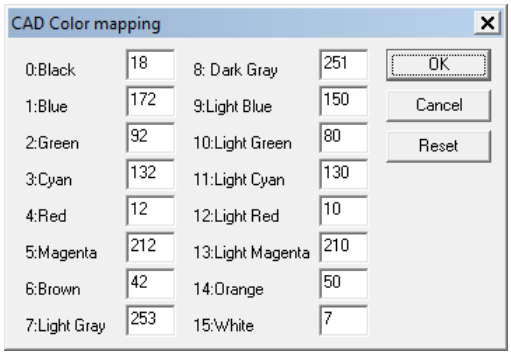
This specifies which CAD system the file will be output to. To automatically jump into your CAD system the 'Command path to CAD' in the 'Directories and Files' section of the 'General Options' must be set up correctly. If this is not set up correctly a link will not be made to the CAD system and the DXF file will be saved to the current working directory. If 'Text DXF' is selected as the mode of output the same occurs (that is, the DXF file is stored in the current working directory).

Drawing Type

This specifies whether the drawing output will be 2D or 3D. Note that some CAD systems may be limited in their ability to edit 3d drawings.

Colour Map

This option allows SCC colours to be mapped to colours in an AutoCAD system. This option is mainly used when exporting to MicroStation. Find the number associated with the colours from the colour table in the Host CAD system. Type this associated number in box opposite the colour.

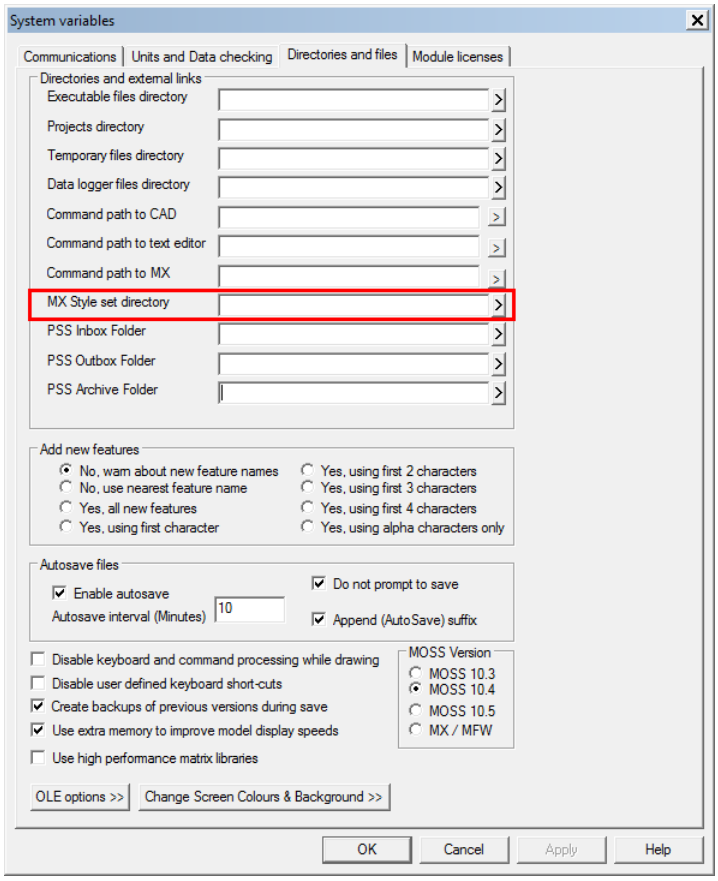


29.39 Export Optimal Pole CAD (File Menu)

This option allows for data to be exported from a model in Optimal Pole CAD format.

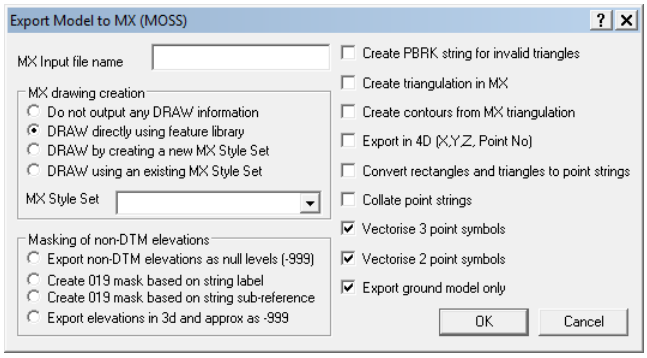
29.40 Export MX (MOSS)(File Menu)

This option exports a model directly into MX system. This includes translation of the strings in the SCC model to GENIO, and optionally converting drawing information either into MX Style sets, or MX DRAW statements. SCC will also create triangulation and contour statements in the input file if required. Note that the location of MX style sets must be specified in a directory in the general options.



The MX Label field in the feature library determines the labeling convention used when exporting to MX. If you elect to create DRAW information or MX style sets, the user should also ensure that any symbol names used in the feature library are consistent with available MX macrosymbol names.

When exporting to MX and MX, the SCC model is converted into multiple MX models using multiple GENIO statements. These include a ground model, a text notes model, and models containing the extra dimensional information. For example, if the SCC model is called 'Survey', this would get translated into the models SURVEY GROUND, SURVEY TEXT, SURVEY SYMBOLS1, and SURVEY SYMBOLS2. Many MX users will only require the first and possibly second models. The symbol models contain strings that include extra dimensional information for features of varying sizes, such as trees. So that for an given tree point will appear as an X, Y,Z coordinate in SURVEY GROUND, an X,Y,D1 coordinate, where D1 is the canopy diameter in SURVEY SYMBOL1, and an X,Y,D2 coordinate, where D2 is the trunk diameter in SURVEY SYMBOL1. If the surveyor had picked up the tree name and annotated the dimensions, these annotations would occur in SURVEY TEXT.



MX Drawing Creation

Do not output any draw information

The GENIO file is created with only co-ordinate information.

DRAW directly using feature library

Take DRAW information from the SCC feature library that is currently attached to the model.

DRAW by creating new MX style set

This option uses the feature library to create a new MX style set in the MX style set directory, and then draws the model using that style set. The style set will always be prefixed by the letters SCC and may be used within MX to draw other models or redraw this model.

DRAW using an existing MX Style Set

Select an existing MX Style Set in the dialog. The directory in which the Style Sets are stored is set in the Directories and Files section of the General Options.

Masking Of Non-DTM Point

Export non-DTM elevations as null levels (-999)

This option sets the elevation of non-DTM points in the GENIO file to -999 such that they will not get included in the MX triangulation. This means that the elevations of non-DTM strings will not be available in MX.

Create 019 mask based on string label

This option creates a MX 019 mask table using the DTM codes from the feature library. Any features with a DTM code that would exclude them from the SCC DTM will have a 091 entry generated to exclude them from the MX triangulation. This allows the third dimension of non-DTM strings to be included in the MX model.

Create 019 mask based on string sub-reference

This option adds a sub-reference of NULL to all strings going to MX that are not in the SCC DTM. A single 019 option is then added that excludes all such strings from the MX triangulation. This allows the third dimension of non-DTM strings to be included in the MX model. This has the added advantage that mixed DTM and non-DTM strings may be used for the same feature.

Create PBRK string for invalid triangle

This option creates a PBRK string for invalid triangles in MX such that surface editing involving adding and removing triangles, along with the effects of CLIP and VOID polygons, will get transferred into MX.

Create triangulation in MX

This option regenerates the SCC triangulation in MX using the MX triangulation options.

Create contours from MX triangulation

This option regenerates the SCC contours and triangulation in MX using the MX triangulation and contouring options

Export in 4D (X,Y,Z,Pt No)

Selecting this option will output survey strings as four dimensional strings when exporting the model, where the fourth dimension is the survey point number. This provides a useful

refernce system between the MX model and the SCC model. If this option is not selected, survey strings will be output in 3D.

Convert rectangles to point strings

Selecting this option converts four point rectangular strings, such as inspection covers, to point strings in the GENIO input file.

Collate point strings

Selecting this option collates multiple point strings under the same feature name into a single MS point string. This is useful for avoiding potential re-labelling issues, where four digit MX labels are used for point strings.

Vectorise 3 point symbols

This option draws 3 point symbols, such as road markings, into the MX GENIO file as strings such that they appear identical in MX and SCC. This will also make the MX model larger.

Vectorise 2 point symbols

This option draws 2 point symbols, such as road markings, into the MX GENIO file as strings such that they appear identical in MX and SCC. This will also make the MX model larger.

Export ground model only

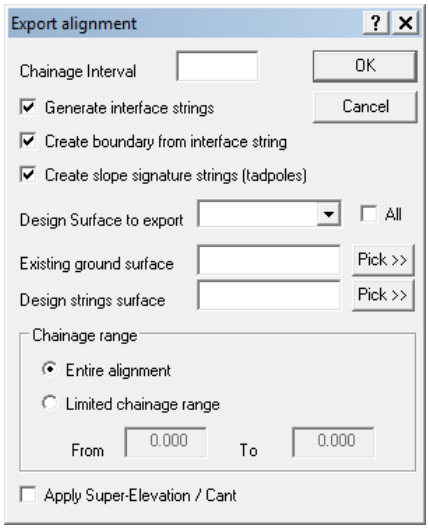
This options export only the ground model.

29.41 Export Survey Dataset (File Menu)

This option outputs the model information into a SCC dataset. The co-ordinate spreadsheet is presented on screen and may then be saved as a separate dataset.

29.42 Export Alignment Dialog (File Menu)

This dialog is presented when the option to Export the alignment as a survey dataset or as a model is selected, and when in the alignment file the option to View Interface and Export Parameters is selected.



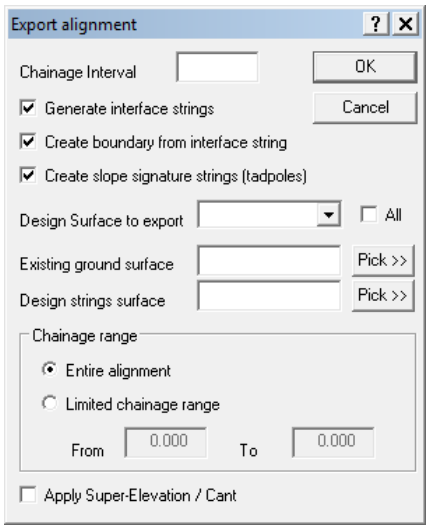
This option sets the parameters for exporting an alignment. The alignment may be output as an interface string.

If the option to Generate Interface Strings is selected the two options; 'Create boundary from

interface string' and 'Create slope signature strings' are enabled. The existing ground surface is the surface to which the interface line of the template extends.

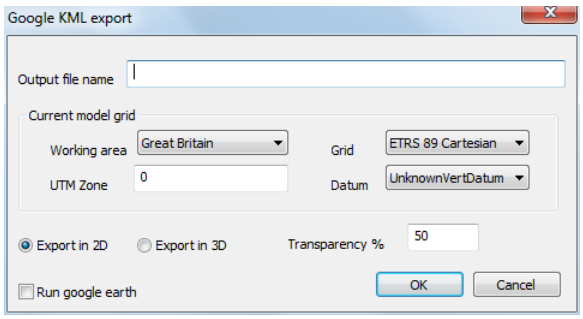
29.43 Export Model (File Menu)

This option creates a model from the alignment file. Selecting this model presents the Export Alignment option.



29.44 Export Google Earth KML (File Menu)

This options allows for a model which is in national grid to be exported for visualisation into Google Earth.



29.45 Export Nikon FRG file (File Menu)

Export the alignment to Nikon Full Road Geometry file and assign a file name and extension. The file will be saved to the current SCC project directory.

29.46 Export IFC file (BIM)

This option exports models in IFC format for import into most BIM packages such as Revit and ArchiCAD. This currently uses triangle ground types, with one mesh created per ground type. This export is suitable for large models, such as meshes created from point clouds. Additional options will be added to this export in future releases to include mapping of discrete and linear survey objects onto BIM objects.

30 Downloading

30.1 Download Survey Data (File menu)

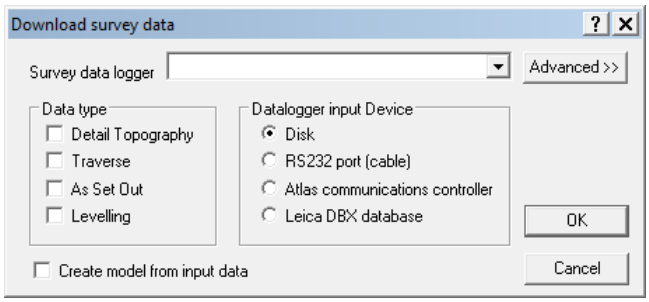
This option facilitates the download of data from any of the supported dataloggers.

From the 'Download Survey Data' dialog, it is possible to select the type of datalogger used (Detail Topography, Traverse, As Set Out or Levelling) and the input device being used.

Some data loggers will not record traverse and detail information in the one file and it important to specify which type of data is being input.

A model may be generated of the downloaded data.

When downloading data the raw observations are input into the Detail Observation spreadsheet, the co-ordinates are calculated and input into the Detail Coordinate spreadsheet. When the data is downloaded these spreadsheets remain open on the screen. On downloaded the Survey file is automatically saved. However when the option to 'Create model from input data' is selected the detail observations and calculated co-ordinates are saved in the survey file. The survey file is closed and the model is the only window remaining open. If traverse information is being downloaded, the Traverse Sheet remains open on the screen whether a model is created or not.



Survey Datalogger

This switch defines the type of datalogger that is being used. This may be either a MX site measurement module based data collector or a simpler instrument based datalogger, for example. Please note that the HP-1000 LX performs the same as the HP-100/200.

The following dataloggers are supported:

PocetDTM

Leica (1100/1200/Wildsoft/LisCADD)

Leica GSI 8/16

Trimble TSC/TSCe (DC)

Trimble /Geodimeter UDS

Trimble Job XML (JXL)

Sokkia SRX/SDR33/SDR22

TopCon (TopSurv & neutral formats)

Topcon GTS7 format

TopCon X, Y, Z

Nikon AP700

Nikon (Survey Supplies .NIK)

MDL ADS CDS &CDU

Huskey Hunter (MSMM)

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HP100LX/200LX RS232 (MSMM)

GPS X,Y,Z

Panterra

NRG PDF & GPF format

AASTHO SDMS

LSS Observation File

Zeiss REC Elta

Softdesk Field Book

NSS ASCII Export

Kingsland .OBS format

Geodimeter .DEC format

TDS

Trimble CST

Data Type

This dialog specifies the type of survey data being downloaded. Detail Topography and traverse data may be downloaded from any of the supported data loggers. Setout data and levelling data may be downloaded from loggers running the MX Site Measurement Module. Some data loggers contain both detail and traverse information in the one file so they may be downloaded in one step by highlighting both these options.

Datalogger Input Device

This switch specifies how the data is to be downloaded. Data may be transferred from a disk or via a RS232 cable

Create Model From Input Data

This switch defines whether or not a model is drawn as the data is downloaded or not.

Advanced >>

The ‘Advanced’ option accesses the System Variables Communications section of the General Options. It is important that the correct communications parameters are set.

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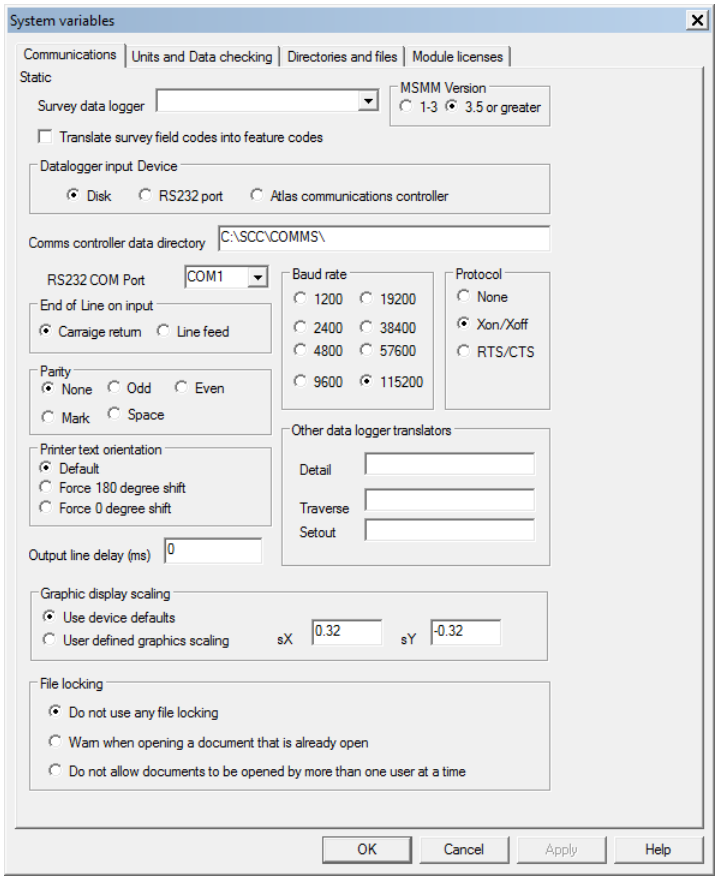


30.2 Datalogger Communications

SCC supports direct communications with a range of survey instrumentation. This is carried out using both generic survey data interchange formats, such as MX SURVEY and AASHTO SDMS, and formats that are proprietary to given instrument manufacturers.

The level of automatic model and drawing completion is largely governed by the limitations of these formats. In formats where free form comments are available, such as in the SDR22and the Zeiss REC Elta, they are used to code additional information such as tape measurements.

The MX Site Measurement Module can be linked to all other instruments that are not directly supported by SCC.

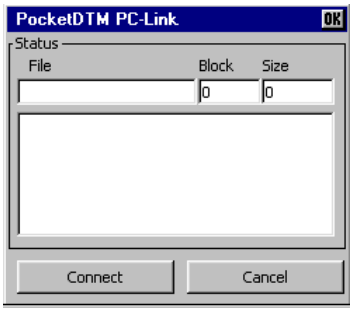
It also improves the level of error checking and speed of data collection for the other directly supported instrumentation. As such, it is to be recommended to anyone carrying out a substantial amount of surveying in a quality conscious productivity oriented environment.

30.3 PocketDTM

The following outlines the download steps from PocketDTM to SCC using an RS232 cable:

Before downloading to SCC from PocketDTM, ensure that ActiveSync is turned of on both the PC and the handheld device.

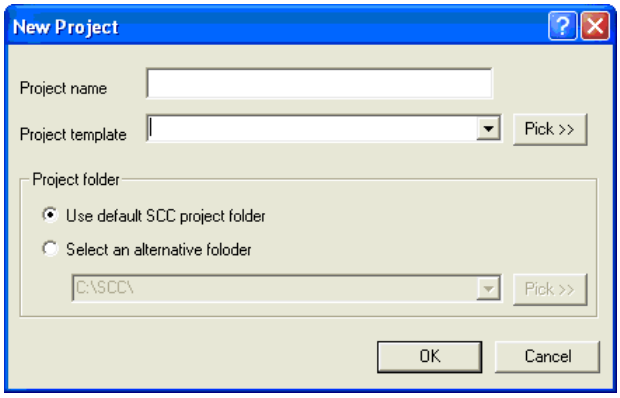
To download your survey from PocketDTM, connect the handheld device to the PC via the RS323 port. In PocketDTM, select the 'FILE > Export to SCC'. The following dialog is displayed;



In SCC, go to 'FILE > New Project'.

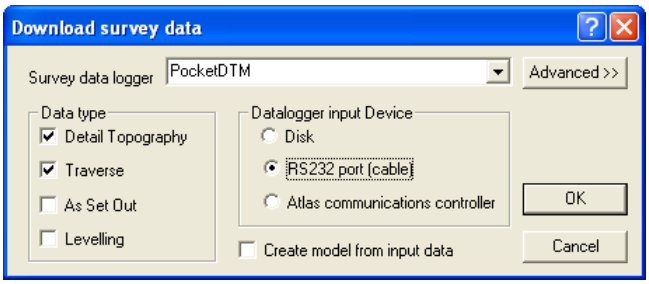
Enter in the job name and select from the list, the template you wish to base your survey on.

If you have used for example 'Default (v6-9 Simple).Project' feature library in PocketDTM, 'Default (v6-9 Simple).Project'should be selected from the list.



You will be presented with a blank station co-ordinate (project) file.

Go to'FILE > Download Survey'



Select 'PocketDTM' as the survey data logger, select 'Detail topography' as the data type and 'RS323 port' as the Datalogger Input Device.

Select 'OK' to begin.

A progress bar will appear in the top left hand corner of SCC with a message stating that SCC is 'searching for *.SIO…'.

Go back to the handheld device and press 'Connect'.

A dialog will now appear in SCC listing all the job files available from PocketDTM. Highlight the file you want and select 'OK' to download.

The file is then transferred to SCC and the user should see the progress bar moving until completion.

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SCC to PocketDTM file transfer format

The SIO format is used to transfer coordinate, GPS and total station data in comma separated ASCII format between SCC and PocketDTM. Where the value of a field is not available or relevant, use a default value of zero. PocketDTM ASCII files should have the extension '.SIO'. The principal record types are as follows;

Observation record

Observations that contain a non-zero slope distance are taken to be total station observations. Observations with a non-zero number of satellites are taken to be raw Lat/Long GPS observations. All other observations are assumed to have valid reduced coordinates. Line of sight offsets are only applied to total station observations, other offsets are applied to all observations.

Name	Type	Description
Type	OBS2	Record type
ObsNo	Integer	Point number
AtPt	char[8]	Occupied station name
ToPt	char[8]	Sighted station name
Feature	char[8]	Feature code
str_no	Integer	String number
tag	Integer	Tag code as numeric value 1 - Straight 2 - Curve 3 - Arc 4 - Gap 5 - Link 6 - Duplicate 7 - Square 8 - Disc Curve 9 - Gap Curve 10 - Gap Arc 11 - Link Curve 12 - Link Arc 13 - Link Square 14 - Disc Straight 15 - Vertical 16 - End 17 - Fly Station 18 - Check Station 19 - 3Pt Arc 20 - 2Pt+Tan Arc 21 - 2Pt+Rad Arc 22 - Fillet Arc 23 - 3Pt Circle 24 - 2Pt Circle 25 - 1Pt+Rad Circle 26 - 3Pt Rectangle 27 - 2Pt+Width Rect 28 - Begin 29 - Begin Closed Curve 30 - Begin Polygon 31 - Back-Sight

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Name	Type	Description
		32 - Fore-Sight 33 - Side-Shot 34 - Free Station 35 - GPS XYZ Shift 36 - GPS Trans. Point 37 - GPS Lat/Long Shift 38 - GPS Base set-up 39 - Triangle 40 - Taped point 41 - Parallel point 42 - Parallel string
		43 - Circle fit 44 - Arc fit 45 - Catmull-Rom curve 46 - Trig Spline 47 - Quadratic B-Spline 48 - Cubic B-Spline Back sights, free stations, and GPS tags will all be used to create instrument set-up records in the survey document. Back sights, fore sights, side shots and free stations will be included as traverse observations. Taped point, parallel point, and parallel string tags will be used to create extra measurements on the current string.
dtm	Integer	DTM code as numeric value 1 - DTM Elevation 2 - Approx. Elevation 3 - Elevation 4 - Ignore 5 - Break line 6 - Void Line 7 - Clip Polygon 8 - 2D Void Line 9 - 2D Clip Polygon 10 - 2D Boundary 11 - Approx. String 12 - Exclude
x	Double	E/X in meters
y	Double	N/Y in meters
z	Double	Height in meters
inst_ht	Double	Instrument height in meters
rod_ht	Double	Rod height in meters
ha	Double	Horizontal angle in radians
va	Double	Vertical angle in radians

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Name	Type	Description
sl_dist	Double	Slope distance in radians
d1	Double	D1 in meters
d2	Double	D2 in meters
d3	Double	D3 in meters
ParLatOffset	Double	Lateral offset based on line of travel of current feature
ParLongOffset	Double	Longitudinal offset based on line of travel of current feature
LosLatOffset	Double	Lateral offset based on line of sight from total station
LosLongOffset	Double	Longitudinal offset based on line of sight from total station
ZOffset	Double	Vertical offset
ObsSeq	Integer	Sequential observation number
ObsTime	Integer	Observation time
Lat	Double	WGS 84 latitude
Long	Double	WGS 84 longitude
Height	Double	WGS 84 height
XRMS	Double	XRMS error
YRMS	Double	YRMS error
ZRMS	Double	ZRMS error
HDop	Double	Horizontal dilution of precision
VDop	Double	Vertical dilution of precision
NoSats	Integer	Number of satellites used in computation
FixType	Integer	Quality of GPS fix 0 – No GPS 1 – Autonomous 2 – Float 3 – Fixed 4 – Fixed 5 – Fixed
CalibNo	Integer	Unused

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Station Coordinate Record

Name	Type	Description
Type	STN	Record type
Name	Char[8]	Station name
x	Double	E/X in meters
y	Double	N/Y in meters
z	Double	Height in meters
PointNumber	Integer	
PointType	Integer	
Lat	Double	WGS 84 latitude
Long	Double	WGS 84 longitude
Height	Double	WGS 84 height

Text note / Survey remark record

Name	Type	Description
Type	TXT	Record type
Feature	Char[8]	Station name
x	Double	E/X in meters
y	Double	N/Y in meters
z	Double	Height in meters
Height	Double	Text height in mm
Width	Double	Text width in mm
Rotation	Double	Text orientation in radians
Point number	Integer	
Justification	Integer	Set to 0
Flags	Integer	Unused
Style	Char[32]	Font style, set to ‘Normal’
Group	Integer	Unused
ID	Integer	Unused
Text	Char[255]	Survey remark

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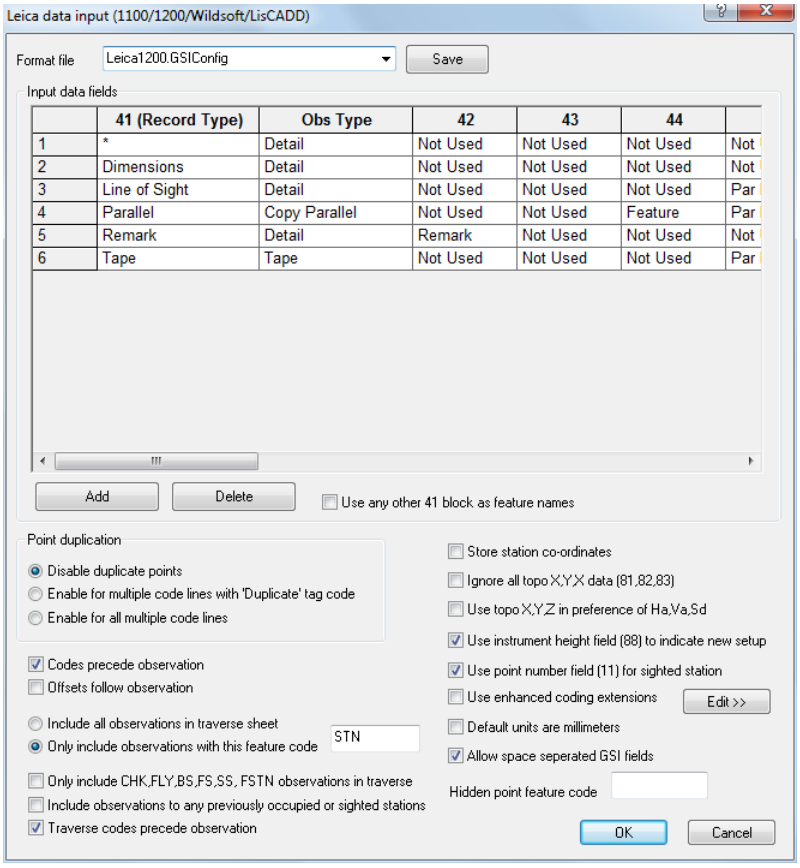
Sample of a PocketDTM .SIO file

```
STN,1       ,   10000.000,   10023.327,    99.831,       1, 1,  0.0000000000,
0.0000000000,     0.00000
STN,2       ,   10000.000,   10000.000,   100.000,      10, 1,  0.0000000000,
0.0000000000,     0.00000
STN,3       ,    9978.367,    9958.395,   100.183,      11, 0,  0.0000000000,
0.0000000000,     0.00000
STN,4       ,    9995.958,    9993.189,   100.042,      12, 0,  0.0000000000,
0.0000000000,     0.00000
STN,5       ,    9942.640,    9974.957,   100.544,      13, 0,  0.0000000000,
0.0000000000,     0.00000
STN,6       ,    9977.029,   10017.215,    99.990,      14, 0,  0.0000000000,
0.0000000000,     0.00000
STN,7       ,   10010.679,   10067.107,    99.148,      15, 0,  0.0000000000,
0.0000000000,     0.00000
STN,8       ,   10045.615,   10124.225,    98.028,      16, 0,  0.0000000000,
0.0000000000,     0.00000
STN,9       ,   10074.590,   10168.625,    97.805,      17, 0,  0.0000000000,
0.0000000000,     0.00000
OBS2,     1,2       ,1       ,~STATION,     0,031,002,   10000.000,   10023.327,
99.831,   1.591,   1.650,2.04123528,1.57550387,    23.327,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     1,1086157647,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
OBS2,     2,2       ,3       ,~STATION,     0,033,002,    9978.368,    9958.393,
100.185,   1.591,   1.660,5.66227958,1.56538581,    46.895,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     2,1086157685,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
OBS2,     3,2       ,1       ,~STATION,     0,032,002,   10000.001,   10023.326,
99.837,   1.591,   1.650,5.18288127,4.70792869,    23.326,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     3,1086157876,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
OBS2,     4,2       ,3       ,~STATION,     0,033,002,    9978.364,    9958.395,
100.197,   1.591,   1.660,2.52077419,4.71806615,    46.895,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     4,1086157918,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
OBS2,     5,2       ,1       ,~STATION,     0,032,002,   10000.001,   10023.327,
99.831,   1.591,   1.650,2.04126437,1.57550387,    23.327,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     5,1086157971,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
OBS2,     6,2       ,3       ,~STATION,     0,032,002,    9978.367,    9958.394,
100.187,   1.591,   1.660,5.66230382,1.56534217,    46.895,     0.000,     0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,     6,1086158008,  0.0000000000,
0.0000000000,     0.00000,   0.000,   0.000,   0.000,   0.000,   0.000,000,000,000
```

30.4 Leica (1100/1200/Wildsoft/LisCADD)

Leica WildSoft/LisCADD style interface



The 'WildSoft/LisCADD' style processing option for Leica GSI files lets us configure how the code fields in the GSI file are interpreted, based on the value stored in the '41' record. The value in the 41 field controls how all the other user definable GSI fields, i.e. 42 to 49, and 70 to 79 are interpreted. Additionally, for each 41 field value, we can specify the observation record type, i.e. detail, instrument setup, extra measurement, traverse obs, or remark. These settings are stored in a '.GSIConfig' file such that they can be recalled for later use.

The duplicate points setting shown below assumes that where there are multiple code lines, these represent the junction between two or more strings. For example, the code below would represent the junction between VO 8 and WB 2, where point 376 represents the last point on VO 8, and the first point on WB 2.

410495+FEATCODE 42....+000000VO

410496+0CodeNum 42....+00000008

410497+FEATCODE 42....+000000WB

410498+0CodeNum 42....+00000002

110500+00000376 21.324+18000260 22.324+08910400 31..00+00065931

See Also

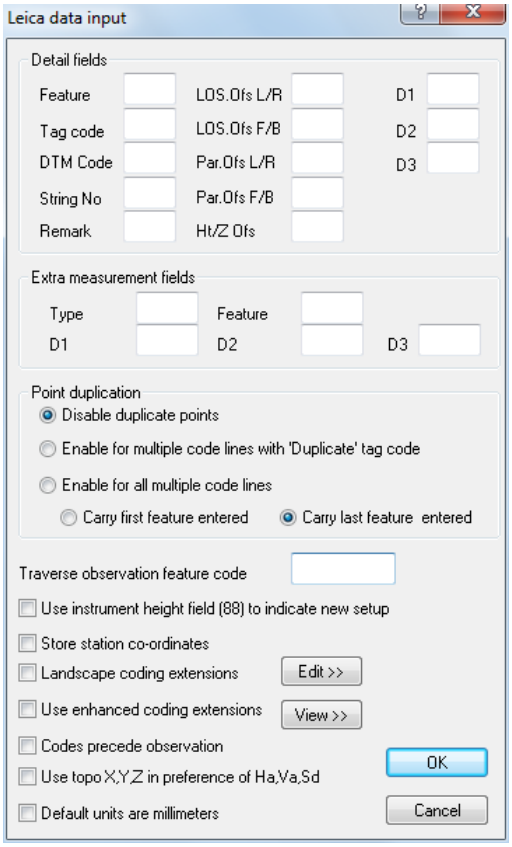
Downloading Leica Data

30.5 Leica GSI 8/16

This option allows the user to download Leica gsi data.

Detail Fields

These fields allow the user to define which GSI input fields correspond to which SCC observation fields. For example field 41, GSI Code block ID, will normally be used to store the SCC feature name. GSI fields 42 to 49 are typically used for additional survey coding, and fields 71 to 79 are used for survey attributes. Any of these fields can be used to store values for the feature name, tag code, DTM code, string number, parallel offset, and dimensions in the SCC observation file. Where an SCC observation field is not logged in the GSI input file, the value is taken from the SCC feature library currently open. As such, it is mandatory to log at least the feature code when surveying.



For example, given the dialog values shown in the picture below, the following code block might be used to describe a tree with a 6.0 meter canopy diameter and a 0.7 meter trunk diameter.

410006+000000TE47....+000006.048....+000000.7

This presumes that there is a feature called TE in the feature library which is used to generate trees, and that this feature assumes that D1 is used for the canopy diameter and D2 for the trunk diameter. This is the case for the default feature library. Note that alternative coding could be used where D2 represents the trunk radius or girth.

The following example, again assuming the same dialog values, would create a top of kerb string that includes a curved section

410006+000000KB42....+0000000S43....+0000000D44....
+00000002

110007+0000016921.304+1235953022.304+09515230

31...0+00003502410006+000000KB42....+0000000C
43....+0000000D

44....+00000002

110008+0000017021.304+3154409022.304+09831430
31...0+00001963

110009+0000017121.304+3031126022.304+09221420
31...0+00006222

110010+0000017221.304+2995931022.304+09046370
31...0+00010371

410006+000000KB42....+0000000S43....+0000000D44....
+00000002

110011+0000017321.304+2975112022.304+08934090
31...0+00015533

110012+0000017421.304+2973055022.304+08916290
31...0+00019686

Note that in this example there are three code blocks, and six data blocks, which will yield six observations in SCC. The first point will be joined to the second point via a straight line, signified by the 42....+0000000S. The second to the fifth points will be joined via a curve, signified by the 42....+0000000C, which is tangential to the incoming and outgoing straights. The fifth point will be joined to the sixth point by a straight. As all the points have the same string number, they will be part of the same string. The string will also be triangulated, as a DTM code of D has been given.

Tag Codes

The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string. The tag codes may be entered either in numeric or alpha-numeric format.

See Also

Feature Library (View menu)

DTM Code

The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. The DTM codes may be entered either in numeric or alpha-numeric format

See Also

Feature Library (View menu)

Extra Measurement Fields

Four extra user defined GSI fields may be used to collect extra measurement information corresponding to the SCC extra measurement sheet. These will be for measurement type, longitudinal offset, lateral offset, and elevation offset. The measurement type corresponds to the SCC extra measurement type field and can have the following values;

Name	Numeric Code	Description

Line Of Sight Offset	1	The first offset corresponds to the distance forward or back along the line of sight between the instrument and the target. The second offset corresponds to the distance left or right along the line of sight between the instrument and the target. The third offset corresponds to the elevation offset.
Taped Offset	2	The first offset corresponds to the distance forward or back along the line connecting the last two points. The second offset corresponds to the distance left or right from the line connecting the last two points. The third offset corresponds to the elevation offset.
Copy Parallel	3	The first offset corresponds to the distance between the observed feature line and the generated feature line. The third offset corresponds to the elevation offset.

Point Duplication

This field controls how junction points are created. Junction points are typically created when there are two successive code lines in the input file, with no intervening data lines. This facility can be disabled, enabled only for data lines that include a tag code of D (Duplicate), or enabled for all multiple code lines.

```
*41....+00000000000000WL420026+000000000000000D
    43....+00000000000000144....+00000000000000045....
    +0000000000000000

*41....+00000000000000HE420026+000000000000000D
    43....+00000000000000244....+00000000000000045....
    +0000000000000000

*110027+00000000000000142 1.322+0000000005145900
    22.322+00000000100391003 1..00+0000000000034988
    51..1.-000000000010+00287..10+0000000000001500

*110028+00000000000000152 1.322+0000000004558400
    22.322+00000000100544503 1..00+0000000000036128
    51..1.-000000000010+00287..10+0000000000001500

*110029+00000000000000162 1.322+0000000004059700
    22.322+00000000100460503 1..00+0000000000035758
    51..1.-000000000010+00287..10+0000000000001500
```

The GSI example above will generate four points, the first two are a junction between a wall and a hedge, the next two are on the wall. In this case, the tag code of ‘D’ has been used in field 42 to create the duplicate point. Note that point duplication is only supported where codes precede observations.

Traverse Observation Feature Code

An extra user defined feature code may be used to signify a control observation. This observation will be used as a reference observation in the instrument set-up sheet and as

a traverse observation in the traverse sheet. This facilitates combined detail and traverse surveys using the GSI format. If this field is left blank, and tag codes are not being collected, all observations will be output to the traverse sheet. If this field is left blank and tag codes are being collected, observations with tag codes of FS, BS, and SS will be output to the traverse sheet.

Use Instrument Height Field (88) To Indicate New Setup

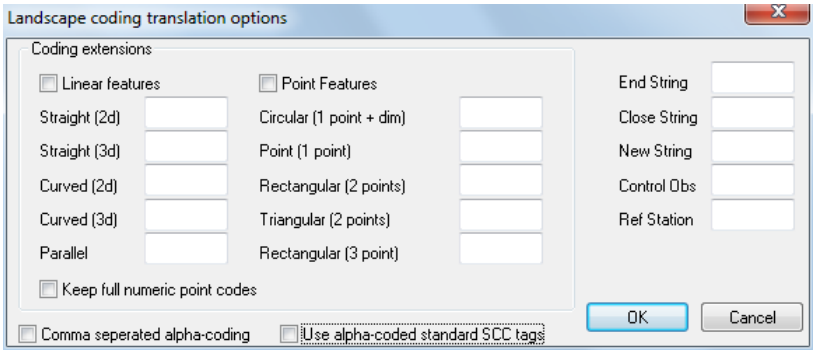
Tick this box to indicate that all 88 fields in the input file are to signify a new station set up.

Store Station Co-ordinates

Tick this field if the user wishes to store station coordinates present in the input file, in fields 84 to 86, in the SCC project control file.

Landscape Coding Extensions

Tick this box to indicate that the field coding used is in the landscape format, rather than the default SCC format . This box should only be ticked if you are replacing an existing Landscape system with SCC and wish to maintain your current field coding methods.



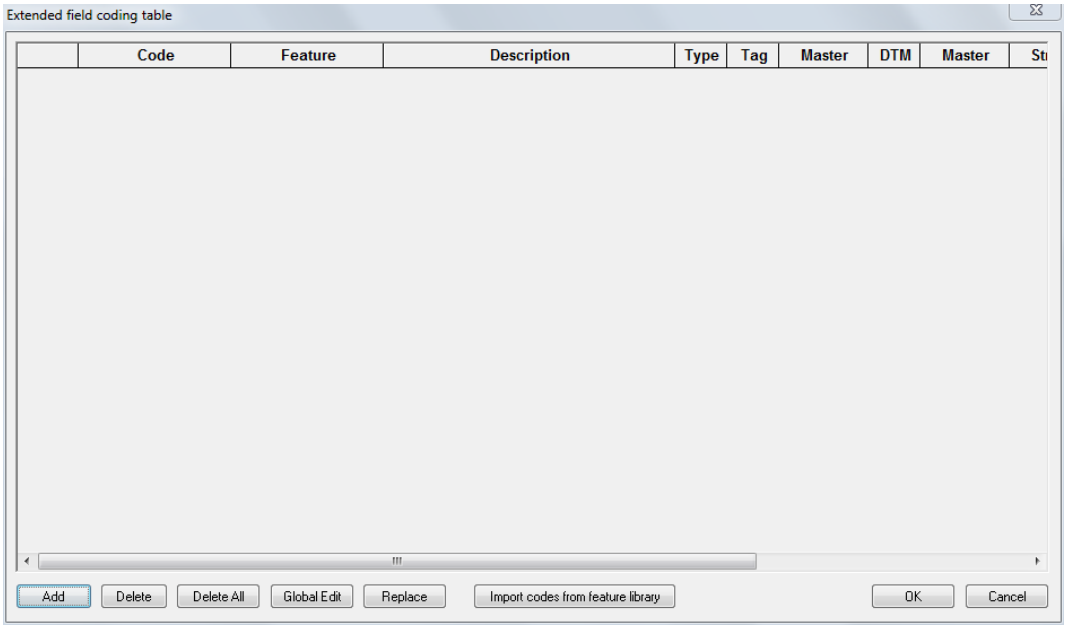
This dialog controls the translation, when applicable, from LandScape style field coding to SCC coding. The field values in this dialog are stored in the registry and only need to be changed when a modification is necessary.

See Also

Landscape Coding Extensions Trimble /Geodimeter UDS

Use Enhanced Coding Extensions

The enhanced coding extensions operates by providing an extra table, stored in the project file, that maps field codes onto feature codes, tag codes, DTM codes, and string numbers. It can be accessed in the project menu via ‘Import / View SDR translation table’.



See Also

Advanced Survey Coding (View Menu)

Codes Precede Observations

This option controls whether a code block is associate with the preceding observation, or the following observation. For example, in the input below the code block precedes the data block

410006+000000KB48....+0000000S47....+0000000D49....
+00000002

110007+0000016921.304+1235953022.304+09515230
31...0+00003502

Use Topo X,Y,Z in Preference to HA,Va,Sd

This option allows the computed X,Y,Z positions in the GSI input file to be stored in the SCC observation sheet rather than the Ha,Va,Sd values, where both occur in a single data line. This is useful if the GSI file does not include all of the survey observations, such as observed back-sights, as shown in the example below;

*110001+000000000000GR0A84..10+0000000320728329
85..10+000000037686955986..10+0000000000099259

*110002+000000000000GR0181..00+0000000320715339
82..00+000000037675442883..00+0000000000100000

*110003+000000000000GR0A84..10+0000000320728329
85..10+000000037686955986..10+0000000000099259
87..10+000000000000150088..10+0000000000001602
79....+000000000000GR01

*110004+0000000000000066 21.324+0000000018626250
22.324+000000000894055031..00+0000000000115851
87..10+000000000000150071....+0000000000000000
72....+0000000000000000 73....+0000000000000000 74....
+0000000000000000 81..00+000000032071533482..00

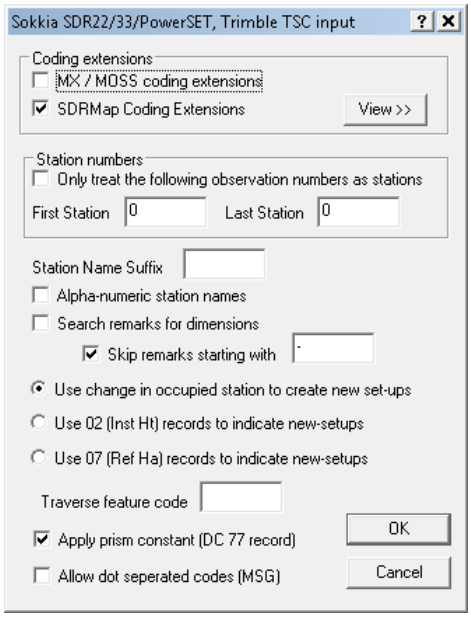
```
    +000000037675444183..00+0000000000100005

*110005+0000000000000006721.324+0000000015216010
    22.324+0000000008744130 31..00+0000000000074790
    87..10+0000000000001500 71....+0000000000000OSC
    72....+0000000000000000 73....+0000000000000000 74....
    +0000000000000000 81..00+000000032076310682..00
    +000000037680341283..00+0000000000102315
```

30.6 Trimble TSC/TSCe (DC)

SCC can read data from the Sokkia SDR series of loggers, and the later Trimble TSCE loggers, in their native format either from disk or RS232 port. This option can read data in wide and narrow SDR formats, and Trimble DC formats up to DC 10.70, supporting enhanced D9, 79, 80, E1 and E0 records. When exporting GPS data from the Trimble TSCE or ACU, it should be exported in SDR33 format to get coordinated output.

The following dialog is displayed on download;



MX / MOSS coding extensions

This field specifies whether MOSS SURVEY coding extensions are included in the Sokkia input file. These are as follows:

Station names occur in the description field

String labels occur in the description field

All labels starting with P or TP and containing numerics are FLY stations

201 and 203 indicators may be included in description and comment records

Dimensions for REP rectangular features are coded in the comment record

SDRMap Coding Extensions

This option uses the advanced field coding library to interpret SDRmap style field coding

Only treat the following observation numbers as stations

This assumes that a given range of survey point numbers, usually 0-999, are reserved for station observations, and all other point numbers refer to topography points

Station Name Suffix

This field contains a four character suffix that will be added to all station names input from this input file. This may be used to distinguish different sets of stations with the same names held in different traverses in the same project. Leave this field blank if you are using consistent station names across all the information in this project

Alpha-numeric station names

This assumes that station names are entered into the point code field. If this option is not selected the point number will be used as the station name

Search remarks for dimensions

This option enables support for entering of extra point and control codes in the comment fields. These can be SDR codes or MOSS codes depending on the coding option selected

Skip remarks starting with

If this option is selected, and 'Search remarks for dimensions is selected', remarks starting with this value are taken is a text notes rather than extra field codes.

Use change in occupied station to create new set-ups

Selecting this option assumes the instrument set-up changes whenever the occupied station changes

Use 02 (Inst Ht) records to indicate new-setups

Selecting this option assumes the instrument set-up changes whenever a new occupied coordinate record (02) is encountered

Use 07 (Ref Ha) records to indicate new-setups

Selecting this option assumes the instrument set-up changes whenever a new occupied coordinate record (07) is encountered

Traverse feature code

Entering a value into this field forces all observations with this feature code to be included in the traverse observation sheet

Apply Prism Constant (DC 77 record)

This options applies the prism constant present in the raw file to data on download.

Allow dot seperated codes (MSG)

This options supports advanced codes separated by a decimal point.

Setting Out / Stakeout with SDR/Power SET Dataloggers

Setting out data is passed to both the SDR loggers and the PowerSET total station as a series of 08 co-ordinate records. The format of these records will vary between the SDR loggers and the PowerSET due to the increased field width available on the PowerSET. The setting out information will contain co-ordinates for all the data to be set out along with all the station co-ordinates for the current project. Setting out data may be either written to file or transmit directly to the RS232 port.

30.7 Trimble /Geodimeter UDS

This option allows the user to download Geodimeter and Trimble data. The user can input specific fields within the 'Trimble/Geodimeter Data Input' Dialog to coincide fields set up on their own instrument considering that fields 90-99 are label which can be defined by the user.

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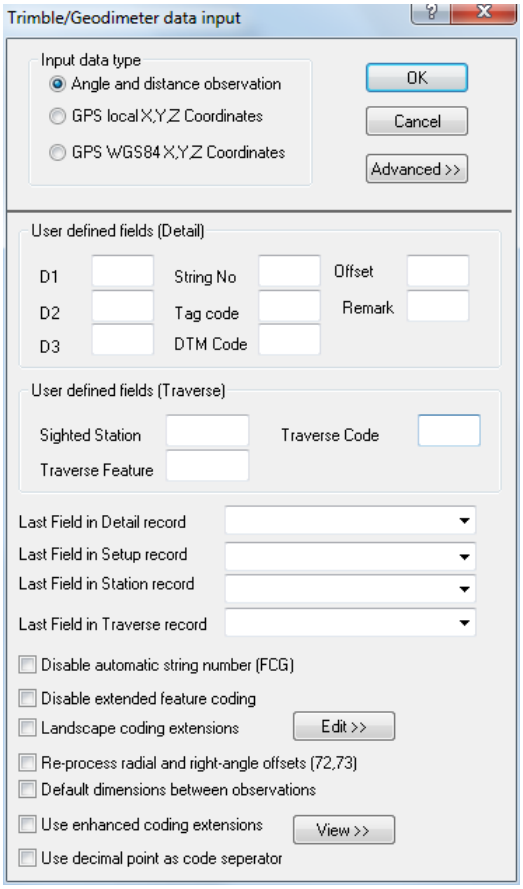
This interface also supports Landscape and Enhanced coding.



If your survey combines detail topography and traverse data, use the 'Traverse Feature' field to distinguish between traverse and detail observations.

If you are downloading data from the Geodimeter traverse program, set the 'Traverse Code' to 61 in the above dialog. This supports explicit face 2 measurements using the 17 and 18 fields, and UDS traverse codes in the 61 field.

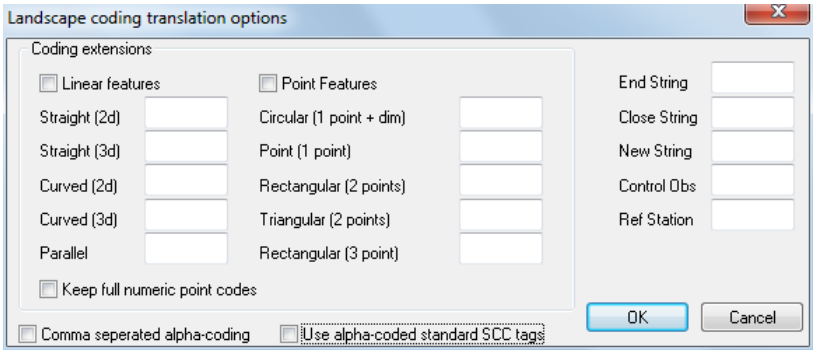
See Also

Downloading for the Geodimeter

Uploading to the Geodimeter

Landscape Coding Extensions

Tick this box to indicate that the field coding used is in the landscape format, rather than the default SCC format . This box should only be ticked if you are replacing an existing Landscape system with SCC and wish to maintain your current field coding methods.



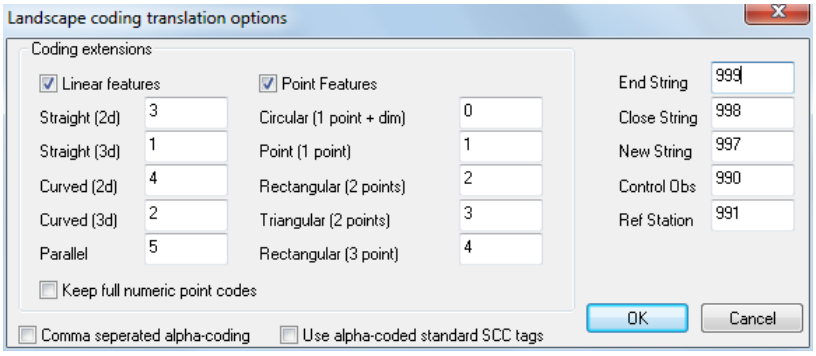
This dialog controls the translation, when applicable, from LandScape style field coding to SCC coding. The field values in this dialog are stored in the registry and only need to be changed when a modification is necessary.

Coding Extensions

The coding extensions determine the suffixes used on point and line codes. These can be applied to both numeric or alphanumeric coding.

Linear Features

If numeric coding is being employed, the first two digits of the survey code are used for the feature, and the third and fourth are used for the codes suffixes given below. For example, given the values below, a code of 4135 would represent a feature name of 41 on a 2d curved string, that also includes a parallel.



If alphanumeric coding is used, the last character of the survey code is used for the suffix. For example, KBC might be used to represent a curve point on a KB, or kerb line, feature. The suffix will only be checked if the full survey code is present in the feature library.

When linear feature suffixes are being checked, sequential linear features with different feature details will create string junctions. For example, given a four point sequence of 1 Kerb, 2 Gate, 3 Kerb, 4 Kerb, point 1 would be joined to point 2 by a kerb, point 2 to 3 by a gate, and 3 to 4 by a kerb.

Straight 2D

Indicates that the point is on a straight line and is not in the DTM

Straight 3D

Indicates that the point is on a straight line and is in the DTM

Curved 2D

Indicates that the point is on a curve and is not in the DTM

Curved 3D

Indicates that the point is on a curve and is in the DTM

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Parallel

Indicates that a second string will be generated from the survey string using the surveyed dimensions for offset distance. This is only applied with numeric coding.

Point Features

Circular (1 point + dim)

One or more symbols are placed at the point, with the dimensions taken from the surveyed dimensions. The feature library determines the units of the dimension. The number of dimensions controls the number of symbols placed.

Point (1 point)

A point or symbol is placed at the survey point. The feature library controls whether a symbol is placed, and gives the symbol a size.

Rectangular (2 points)

A symbol, such as a gate, is fitted between two survey points. Either the feature library, or survey dimension can be used to control the transverse dimension.

Triangular (2 points)

An equilateral triangle is placed using the two survey points as the base, and the apex on the right of the two points.

Rectangular (3 points)

A symbol is fitted into the rectangle generated by the three survey points.

Comma separated alpha-coding

This option allows the use of multiple, comma separated codes, in a given survey code, to produce a string junction. For example KB,GA might be used to create a point that is common to a kerb and gate.

Use alpha coded standard SCC tags

This option allows the use of SCC tag codes in the survey code. For example KB,C might be used to indicate a point of curvature on a string.

End String

Use this code to signify the end of the current linear string feature.

Close String

Use this code to signify the current point on the current linear string feature is to be linked back to the first point to form a closed polygon.

New String

Use this code to start a new string

Control Obs

Use this code to signify that the current observation is to be included in the traverse file, and/or used as an RO in the detail file.

Ref Station

Use this code to signify that the current observation is to be included in the traverse file, and/or used as an RO in the detail file.

Extract of Geodimeter File denoting two topographic points:

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5=3

7=225.2138

8=88.0915

9=90.158

4=HE

6=1.900

99=1

98=S

97=A

5=4

7=236.5228

8=88.1239

9=89.088

4=HE

6=1.900

99=1

98=S

97=A

where 4 =Point Code

5 = Point Number

6 = Signal Height

99 = String No. (User Defined)

98 = Tag Code (User Defined)

97 = DTM Code (User Defined)

30.8 Trimble Job XML (JXL)

This option allows the user to download Trimble Job XML files directly into SCC. This option supports multiple feature codes and/or dimensions entered as a single feature code when using the advanced coding options.

```
<?xml version="1.0" encoding="UTF-8"?>

<JOBFile jobName="TEST" version="5.2" product="Trimble
    SurveyController" productVersion="12.44"
    productDBVersion="1243-2"
    TimeStamp="2009-04-22T09:12:24"


    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
```

xsi:schemaLocation="http://www.trimble.com/schema/JobXML/5_2
http://www.trimble.com/schema/JobXML/5_2/JobXMLSchema-5.2.xsd">

<FieldBook>

<UnitsRecord ID="00000002"
TimeStamp="2009-04-22T09:12:41">

<DistanceUnits>Metres</DistanceUnits>

<HeightUnits>Metres</HeightUnits>

<AngleUnits>DMSDegrees</AngleUnits>

<AzimuthFormat>Azimuth</AzimuthFormat>

<LatitudeLongitudeUnits>DMSDegrees</LatitudeLongitudeUnits>

<CoordinateOrder>East-North-Elevation</CoordinateOrder>

<TemperatureUnits>Celsius</TemperatureUnits>

<PressureUnits>MilliBar</PressureUnits>

<GradeUnits>Percentage</GradeUnits>

<AreaUnits>SquareMetres</AreaUnits>

<StationingFormat>1+000.0</StationingFormat>

</UnitsRecord>

<FeatureCodingRecord ID="00000003"
TimeStamp="2009-04-22T09:12:41">

<LibraryName>TEST</LibraryName>

<SourceFilename>TEST.FXL</SourceFilename>

<AttributeCheckSum>0</AttributeCheckSum>

<AttributesStored>true</AttributesStored>

</FeatureCodingRecord>

<CorrectionsRecord ID="00000004"
TimeStamp="2009-04-22T09:12:41">

<SouthAzimuth>false</SouthAzimuth>

<GridOrientation>IncreasingNorthEast</GridOrientati

```
on>
<MagneticDeclination>0</MagneticDeclination>
.......
.......
<PointRecord ID="00000017"
TimeStamp="2009-04-22T09:18:26">
<Name>ST02</Name>
<Code>PSTN</Code>
<Method>Coordinates</Method>
<SurveyMethod>KeyedIn</SurveyMethod>
<Classification>Normal</Classification>
<Deleted>false</Deleted>
<Features>
<Feature Name="PSTN">
<Attribute>
<Name>REMARK</Name>
<Value/>
<Type>Text</Type>
</Attribute>
</Feature>
</Features>

<Grid>
<North/>
<East/>
<Elevation/>
</Grid>
</PointRecord>

<AtmosphereRecord ID="0000001b"
TimeStamp="2009-04-22T09:19:30">
<Pressure>1027</Pressure>
<Temperature>8</Temperature>
<PPM>-15.843347593016</PPM>
```


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30.9 Sokkia SRX/SDR33/SDR22

The format varies between SDR22 and 33 and can include attributes when taken from Trimble SC as per your feature library.

See Also

Trimble TSC/TSCe (DC)

30.10 TopCon (TopSurv & neutral formats)

This option can be used to download detail topography and traverse data from TopCon equipment in either TopSurv or CivilCAD Neutral (.NEU) formats. For more details on the TopSurv format, refer to the TDS interface.

30.11 Topcon GTS7 format

This option can be used to download detail topography and traverse data from TopCon equipment in GTS7 format. Feature codes in the GTS7 format can contain embedded string numbers to facilitate stringing in the field, for example KB01 would be KB string 1. Point codes that are less than 3 characters and point codes that do not include numeric data are taken to be discrete point features.

30.12 TopCon X, Y, Z

This option allows the user to import TopCon XYZ files.

Sample Files: *.txt file

```
JB,NMTOPCON001,DT07/04/2005,TM12:46:38

MO,AD0,UN1,SF1.0,EC0,EO0.0,AU0

OC,OPSTN1,N500.000,E1000.000,EL10.000,--STN,STN,STN,
    STN

LS,HI1.569

BK,OPSTN1,BP2,BS169.0120,BC0.0000

--HR at Backsight: 1.600

BK,OPSTN1,BPSTN2,BS169.0115,BC243.2606

BK,OPSTN1,BPSTN2,BS169.0115,BC243.2606

BK,OPSTN1,BPSTN2,BS169.0125,BC243.2606

BK,OPSTN1,BPSTN2,BS169.0125,BC243.2606

OC,OPSTN1,N500.000,E1000.000,EL10.000,--STN,STN,STN,
    STN

LS,HI0.000

BK,OPSTN1,BP10,BS0.0000,BC0.0000

--HR at Backsight: 0.000

LS,HI0.000,HR1.600
```

```
SS,OPSTN1,FPSTN2,AR292.5835,ZE93.5130,SD35.710,--STN
SS,OPSTN1,FPSTN2,AR292.5830,ZE93.5125,SD35.711,--STN
SS,OPSTN1,FPSTN3,AR72.0545,ZE89.3600,SD35.904,--STN
SS,OPSTN1,FPSTN3,AR72.0550,ZE89.3600,SD35.901,--STN
LS,HI0.000,HR99.000
--Z
SS,OPSTN1,FP500,AR73.2320,ZE90.1530,SD54.418,--BG
--Z
SS,OPSTN1,FP501,AR73.1310,ZE90.2225,SD54.142,--BG
LS,HI0.000,HR0.500
SS,OPSTN1,FP502,AR73.0645,ZE90.2035,SD54.130,--BG
SS,OPSTN1,FP503,AR71.4400,ZE90.5055,SD51.092,--BG
LS,HI0.000,HR2.000
SS,OPSTN1,FP504,AR67.4935,ZE90.1125,SD44.140,--BG
--X
```

*.raw fille

```
Header>>Delimiter(,)FileFormat(Name,Lon(East),Lat
    (North),Ht(G),FullCodes,Notes)<<
STN1,1000.000,500.000,10.000,STN,STN&"21",
    STN&"166",STN&"180",
STN2,967.198,513.908,5.997,STN,STN&"148",
    STN&"170",
STN3,1034.164,511.038,8.651,STN,STN&"37",
    STN&"170",
500,1052.146,515.557,-89.245,BG&"1"@"Z",
501,1051.835,515.631,-89.353,BG&"1"@"Z",
502,1051.795,515.724,9.176,BG&"1",
503,1048.512,516.013,8.743,BG&"1",
504,1040.875,516.659,7.853,BG&"1",
505,1039.694,516.736,7.849,BG&"2"@"X",
506,1034.155,517.235,7.370,BG&"2",
507,1034.215,517.464,7.368,BG&"2"@"X",
508,1034.252,517.502,7.350,BG&"3"@"X",
509,1034.474,520.342,7.156,BG&"3",
510,1034.675,521.455,7.148,BG&"4"@"X",
```

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511,1034.606,521.480,7.148,BG&"4"@"X",

512,1035.160,528.304,7.103,BG&"4",

513,1035.315,529.189,7.108,BG&"5"@"X",

514,1035.244,529.231,7.109,BG&"5"@"X",

515,1035.301,530.220,7.118,BG&"5"@"X",

516,1035.680,533.816,7.126,BG&"6",

517,1035.610,533.850,7.126,BG&"6"@"X",

518,1035.706,535.169,7.130,BG&"6",

519,1035.860,536.059,7.123,BG&"7"@"X",

520,1035.795,536.095,7.123,BG&"7",

521,1035.889,537.211,7.120,BG&"7"@"X",

522,1036.050,538.313,7.124,BG&"8"@"X",

523,1035.975,538.345,7.125,BG&"8",

524,1036.045,539.418,7.118,BG&"8"@"X",

525,1036.231,540.548,7.122,BG&"9"@"X",

526,1036.156,540.584,7.122,BG&"9"@"X",

30.13 Nikon AP700

AP700 files are obtained from the Nikon AP700 on board software.

The AP700 files contain six basic record types;

AP700 Record Types	How these records are represented in the survey files ?
Co-ordinates	UC
Station Records	ST
Control Points	CP
Side-shots	SS
Stakeout records	SO
Comments / Notes	CO

This data may be downloaded as raw data or co-ordinate data. It is best to work with raw observations for error detection, therefore it is strongly advisable to always download the raw data.

When downloading Nikon AP700 data in SCC the Nikon AP700 Data Input is presented after you select the file you wish to download. This dialog requires station naming and data formats to be set. There is an option to store Stakeout records in datasheet if there are any present in the data file.

30.14 Nikon (Survey Supplies .NIK)

FastMAP700 is the on board Nikon software that was developed by Survey Supplies Ltd. The software runs on the Nikon DTM700 series of field stations and the HP palmtop and Husky FS

series of dataloggers. SCC can read in the raw .NIK files and traverse .OBS files

When .NIK files are selected for download SCC presents the user with the Nikon Data Input (Survey Supplies .NIK) dialog. This dialog requires First Station Number and Station Feature . If MX coding was used in the survey SCC can be set to read this. The Remarks column may be searched for dimensions.

The following is a line of observation information taken from a NIK file;

0001 A,02.587,1854247,0881648,54.310,MHS

Detail Information in NIK file	What They Represent ?
0001	Observation Number
A	Raw Detail Observation Value
02.587	Target Height
1854247	Horizontal Angle
0881648	Vertical Angle
54.310	Height / Z value
MHS	Feature Name

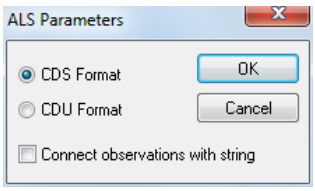
The following is a line of station information taken from a NIK file;

9001 B,500.000000,500.000000,50.000000,STN

Station Information in NIK file	What They Represent ?
9001	Station Name
B	Co-ordinates value
500.000000	Easting
500.000000	Northing
50.000000	Height
STN	Feature Name

30.15 MDL ADS CDS &CDU

This option downloads data created by MDL ALS scanners in either CDS or CDU format. Data can be downloaded as both topographic surveys and traverses as required, though only simple stringing is supported. When you choose to download from the ALS, you will be prompted for the data format and whether you wish to string the points. SCC uses P codes in the input file as feature codes. If you elect to connect points using strings, you can force given features back to point codes using the feature library. Tag and DTM codes cannot be logged and are taken from the feature library.



Change of station is noted by a feature code 54 in the CDS format, or 60 in the CDU format. Feature code 90 is used to generate a clip polygon in the CDS format. For sample CDS and CDU files, please refer to the SCC tutorials directory.

30.16 MOSS SURVEY formats (Leica VIP, SDR33 MOSS)

MX SURVEY is the set of minor options provided by MX to input detail and traverse survey information. As such it is a generic format output by many data loggers. SCC allows input of MX SURVEY information into the SCC database, or, directly into the MX model.

MX SURVEY information may be transferred into SCC either via disk or the serial port. When transferring MX SURVEY data from the RS232 port, SCC uses 9600 baud, no parity, and XON/XOFF handshaking. This may be set up on the SDR33 as follows ;

Press F3 to select COM

Select COMMS SETUP and enter the following settings

PORT	**BOTTOM**
MODEM	**NO**
BAUD RATE	**9600**
DATA BITS	**8**
PARITY	**NOT SET**
STOP BIT	**1**
OUTPUT DELAY	**0**

Select MX output and press Enter.

The MX SURVEY translator generates output in the log file that describes any errors or potential errors found in the input file. This information is accompanied with the offending line and its line number. The offending line is skipped and the remainder of the file is processed. The following error messages may be reported;

1. Warning, Wrong observation format <MX code>, SDVA, VASD, required
2. Error, Dimension of rectangle not coded
3. Error, Dimensions not coded on feature offset
4. Error, Horizontal offset not coded on parallel feature
5. Warning, Vertical offset not coded on parallel feature
6. Error, Dimensions not coded on tape measurement
7. Error, Radius not coded on circle
8. Error, Dimensions not coded on line of sight offset
9. Error, <MX code> in field 3 moved to field 2
10. Skipping string label <MX code> (Miscoded minor option record)
11. Error, <MX code> in field 3 moved to field 1
12. Error,No VA coded, using default from 190 record
13. Error,Bad observation number
14. Error,No station name coded

Only SURVEY records that have counterparts in the SCC database will be transferred.

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These records are input directly into a raw MX SURVEY file in the field

SURVEY records include the following

• Instrument set-up information	Minor option 200
• Angle and distance theodolite observations for detail and traverse	Minor option 201 Minor option 201,TRAV Minor option 201,FLY Minor option 201,CHE
• Station co-ordinates	Minor option 180
• Circular features	Minor option 201 CRC,CR2,CR3,CRD
• Rectangular features	Minor option 201 REM,REP
• Parallel strings	Minor option 203
• Offset strings	Minor option 201,OFF
• Taped measurements	Minor option 201,TAP
• Unit settings	Minor option 017

30.17 MOSS Site Measurement Module (MSMM)

Data is transferred in the internal binary formats used by the MSMM and as such may not be edited by the user. All data transfer occurs using either the high-speed serial link or the Oracle GT disk drive.

When transferring data via the RS232 port SCC will scan the MSMM for data in jobs 1 to 9. If data is found in any of these jobs the software will ask the user whether or not to download the job with a default name. The default name comprises of the MSMM job number and transfer date in the format J<Job number>Q<Date>.

For example, if one were to download data from job 7 on the 23rd of July the default job name would be J7Q29JUL. At this point, the user can do one of three things ;

- Select Load to download the job under its default name
- Type in an alternative name for the job and press Enter to download
- Select Skip to skip this job and move onto the next job

When all nine jobs have been checked, the communications program will automatically terminate on both the PC and MSMM.

Setting out data may be sent either directly to the logger or written to a disk. Setting out data includes point number, point description, chainage, offset, and x, y, z information. Setting out files will be created for both the setting out and levelling programs. The station co-ordinates will also be output as an MSMM control file.

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30.17.1 Huskey Hunter (MSMM)

Data is transferred in the internal binary formats used by the MSMM and as such may not be edited by the user. All data transfer occurs using either the high-speed serial link or the Oracle GT disk drive.

30.17.2 HP100LX/200LX RS232 (MSMM)

Downloading & Processing Traverse Data

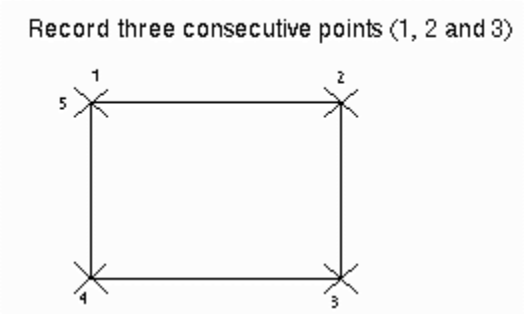
Downloading & Processing Detail Topography Data

30.17.3 MOSS SURVEY coding extensions

MOSS Coding Extensions

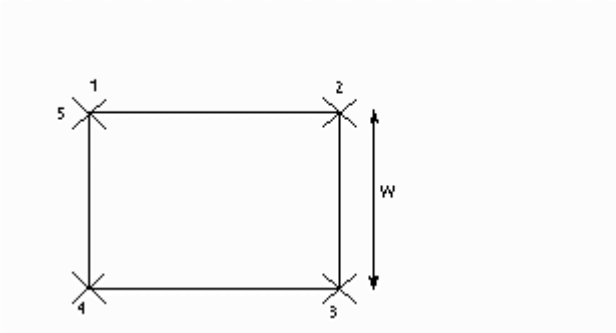
In addition to the SCC advanced field coding, SCC also supports MOSS SURVEY style coding on a number of its survey interfaces. The following options are available

3 point rectangle



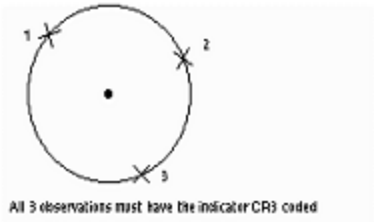
To create a three-point rectangle, where SCC generates the fourth point, in the Cd field enter REPS <Label> for three successive observations. You may also use REPR, and REPL. Strings coded with REPS and REPR will appear in the triangulation whereas those with REPL will not.

2 point rectangle



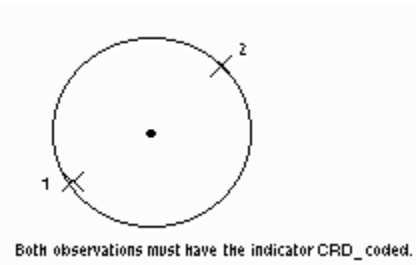
To create a two-point rectangle, where SCC generates the third and fourth points, in the Cd field enter REMS <Label> for two successive observations. You may also use REMR, and REML. Strings coded with REMS and REPR will appear in the triangulation whereas those with REML will not. After the second observation press the Note key and enter W=<Width>, where <Width> is the width of the rectangle. Negative values place the generated points to the left of the surveyed points. Positive values place the generated points to the right of the surveyed points.

3 point circle



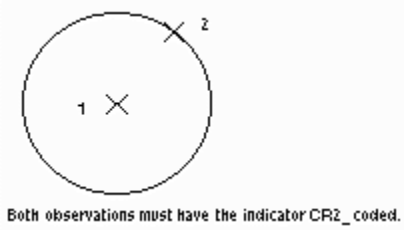
To create a three-point circle in the Cd field enter CR3S <Label> for three successive observations. You may also use CR3R, and CR3L

2 point circle (2 points on the diameter)



To create a two-point circle with two points on the diameter, in the Cd field enter CRDS <Label> for two successive observations. You may also use CRDR, and CRDL. Strings coded with CRDS and REPR will appear in the triangulation whereas those with CRDL will not.

2 point circle (Point on centre and circumference)



To create a two-point circle with the first points on the centre and the second on the circumference, in the Cd field enter CR2S <Label> for two successive observations. You may also use CR2R, and CR2L. Strings coded with CR2S and CR2R will appear in the triangulation whereas those with CR2L will not.

Taped measurements

SCC supports entry of tape measurements, in the form of lateral and longitudinal offsets, from a base line. The last recorded point and previous point on the same string are used as a base line. Once you have established a base line press the Note key and enter TAPE <Lat. Offset> <Long Offset>. You may also use the form TAPE <Label> <Lat. Offset> <Long Offset> to place the taped point in a different string. Additionally you can use TAPE CLOS <Lat. Offset> <Long Offset> or TAPE SQUC <Lat. Offset> <Long Offset> to close off the taped string by linking the current point back onto the first point in the string. Successive tape measurements will use the last two points, whether observed or taped, as the base line for the next measurement. The example below, in both graphic and SDR output format, illustrates tape measurement.

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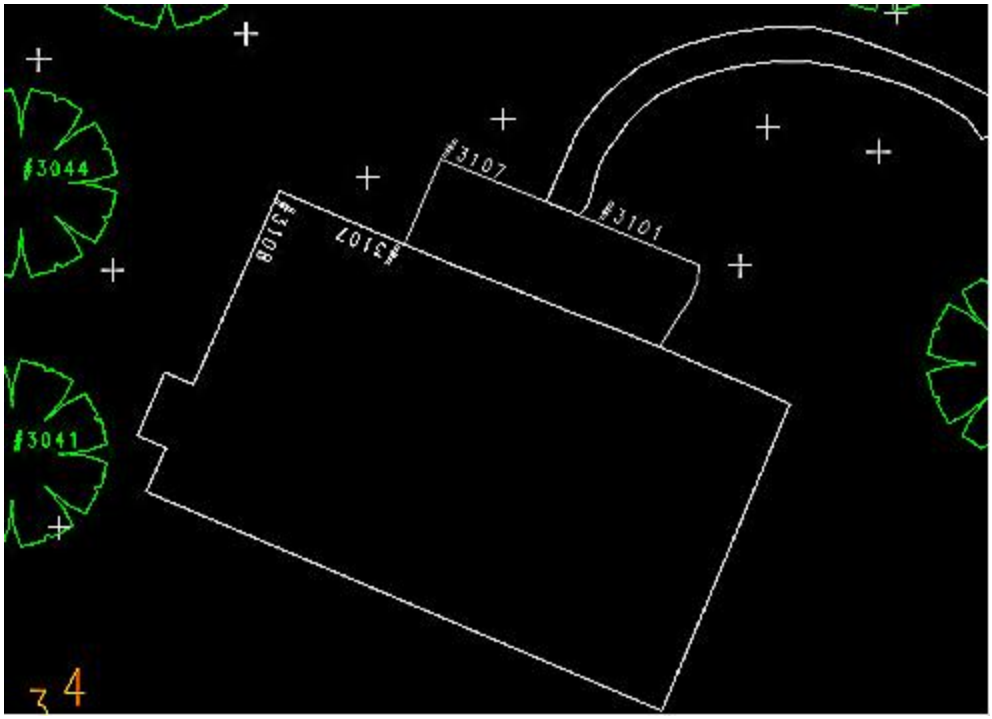


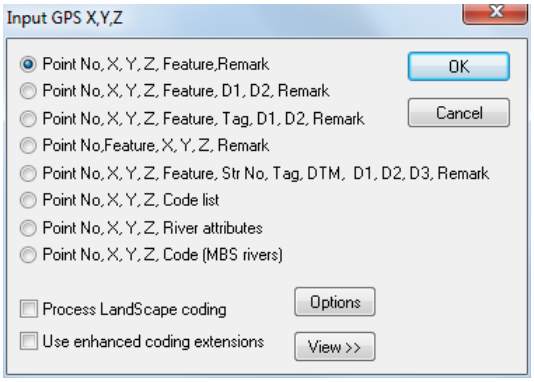

```
09F105003101113.44500084.8016666295.277777SK01
09F105003101113.44500084.8016666295.277777LP00       First point on base line
03NM5.00000000
09F105003102106.66000085.0094444295.616388202 SK01
09F10500310397.195000085.3947222293.794166SK01
03NM2.00000000
09F10500310489.405000088.1933333286.959444SK01
03NM5.00000000
09F10500310591.100000088.2391666276.691944SK01
09F10500310692.765000088.6469444275.394444201 CLOS SK01
13NMS SK01 STN AND CONC WLK
03NM1.80000000
09F105003107114.65000086.7227777300.166944LP00     Second point on base line
13TS19-Jun-92 12:08
13NM201 TAPE LP00 -8.2                             First taped point on LP00 (3107.2)
13NM201 BD03                                       Copy taped point into BD03 for new
baseline
03NM5.00000000
09F105003108125.31000086.0102777304.772500BD03     Second point of new base line
13NM201 TAPE BD03 -18.6
13NM201 TAPE BD03 2.7
13NM201 TAPE BD03 -6.0
13NM201 TAPE BD03 -2.7
13NM201 TAPE BD03 4.2
13NM201 TAPE SQUC -48.5                            Close BD03 to form a linked polygon
```

Copying a string parallel

To copy a string parallel on the SDR33 first press the Note button. Then enter 203 <Existing string> <New string> <V. Offset> <Hor. Offset>. For example, we have surveyed the edge of pavement and wish to generate the curb top as a copy of this string 0.1 above and 0.05 to the left. We press the note key and enter the remark as shown on the left. Apart from saving us a lot of survey work this ensures that the top of curb string will not cross the edge of pavement string at any point. Remember that we are surveying the road, NOT designing it. While this facility can save a lot of time it should be used with care.

30.18 GPS X,Y,Z

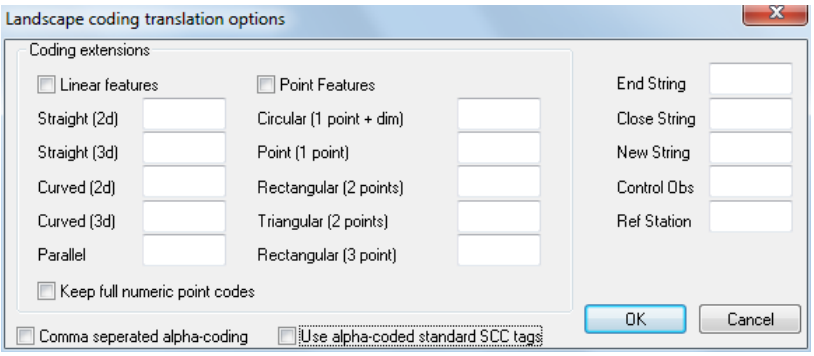
This option allows the user to download GPS data and has been extended to support multiple remarks as required by river surveys. In addition, the river attribute option treats unknown features with start and continue attributes as strings, and remark attributes as points.



The following options are also available:

Landscape Coding Extensions

Tick this box to indicate that the field coding used is in the landscape format, rather than the default SCC format . This box should only be ticked if you are replacing an existing Landscape system with SCC and wish to maintain your current field coding methods.



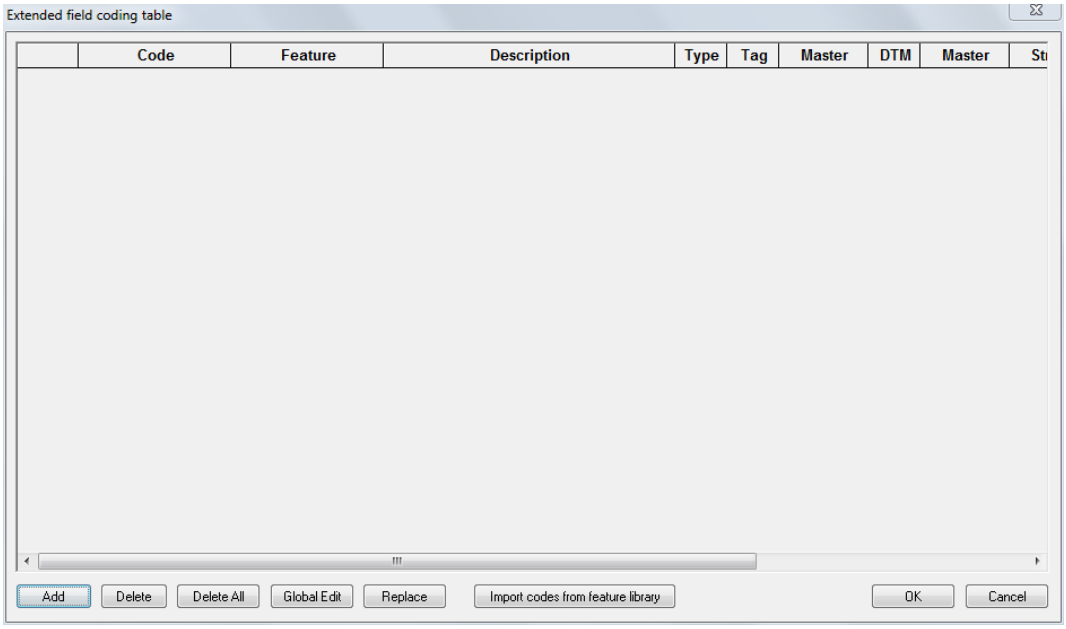
This dialog controls the translation, when applicable, from LandScape style field coding to SCC coding. The field values in this dialog are stored in the registry and only need to be changed when a modification is necessary.

See Also

Landscape Coding Extensions Trimble /Geodimeter UDS

Use Enhanced Coding Extensions

The enhanced coding extensions operates by providing an extra table, stored in the project file, that maps field codes onto feature codes, tag codes, DTM codes, and string numbers. It can be accessed in the project menu via 'Import / View SDR translation table'.



See Also

Advanced Survey Coding (View Menu)

30.19 Panterra

This option downloads data created by a Panterra Husky data logger, comprising of either topographic survey data or traverses data.

See Also

Panterra

30.20 NRG PDF & GPF format

This option downloads NRG format data either in reduced coordinate format from NRG (GPF) or radial format from a Psion logger (PDF). The PDF format can be used to transfer detail topography, stations and traverse data. The SCC Advanced survey coding library may be used in conjunction with the PDF and GPF format for complex stringing as required.

NRG '+' and '-' codes may also be used within the GPF format for stringing. Note that when downloading GPF data, the SCC feature library controls drawing defaults, such as colour, line style and annotation.

30.21 AASTHO SDMS

SCC supports the AASHTO (American Association of State Highway and Transportation Officials) SDMS standard (Survey Data Management System) as defined in the SDMS v3.1 manuals. SDMS tasks supported are radial topography (TK:RTO), traverse (TK:TRA), and stake out.

Data may be transferred to and from an SDMS logger either via disk or RS232 connection. The default communications settings for an RS232 connection are 9600 baud, no parity, 8 data bits, one stop bit, and XON/XOFF handshaking.

The following information is translated from an SDMS side shot into a SCC detail observation when processing radial topography;

Code	Value
AC:	SS
PN:	Point number
PD:	Comment
FE:	Feature name
GM:GM:	LINEARGM:POINTGM:MOSSGM:SPLIGM:CLOS Geometry codeJoin to next point by a straight lineSet this observation to be a single pointJoin to next point by a curveJoin to next point by a curveJoin back to first point on the string
PS:	Point specifier used for extra measurements
PS:IGN	Ignore elevation of point
PS:IGL	Ignore point entirely
PS:DISC	Insert a gap in a string (Discontinuity)
PS:DISB	Change string direction (Bearing discontinuity)
PS:REM	Rectangle using 2 points and an offsetTwo successive points must have PS:REM included, the second point should have the offset coded in the OF: field. If REML is used the level of the generated points will be ignored.
PS:REP	Rectangle using 3 pointsThree successive points must have PS:REP included. If REPL is used the level of the generated points will be ignored.
PS:CRD	Circle using 2 points on the diameterTwo successive points must have PS:CRD included. If CRCL is used the level of the generated points will be ignored.
PS:CR2	Circle using 2 points, radius and centreTwo successive points must have PS:CR2 included. The first is the centre, the second any point on the circle. If CR2L is used the level of the generated points will be ignored.
PS:CRC	Circle using 2 points, radius and centreTwo successive points must have PS:CR2 included. The first is the centre, the second any point on the circle. If CR2L is used the level of the generated points will be ignored.
PS:CR3	Circle using 3 pointsThree successive points must have PS:CR3 included. If CR3L is used the level of the generated points will be ignored.
PS:TAP	Taped measurementThis uses the last two observed points as a base line. The lateral offset is coded in the OF:field. The longitudinal offset is coded in the LN: field. If TAPL is used the level of the generated points will be ignored. It is not necessary to code a full radial observation with this measurement. Successive taped measurements without radial observation information will use the last two generated points as a base line.
PS:OFF	Offset pointThe lateral offset is coded in the OF: field. The longitudinal offset is coded in the LN: field. If OFFL is used the level of the generated points will be ignored.
PS:CHE	Station checkThis assumes that the station name is coded in the FE:

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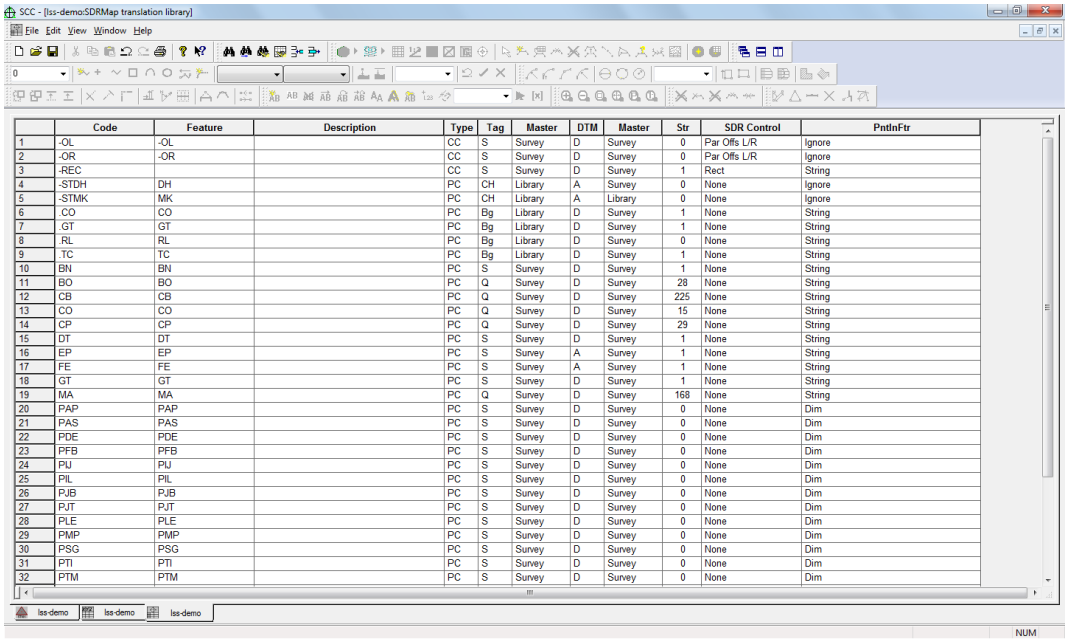
	field and that this is an observation to that station. The difference between the computed and stored co-ordinates for the station will be output to the log file during co-ordinate reduction.
PS:FLY	Fly stationThis assumes that the station name is coded in the FE: field and that this is an observation to that station. The station co-ordinates will be computed and output to the log file during co-ordinate reduction.
OF:	Offset value used for extra measurements
HT:	Horizontal angle
VT:	Vertical angle
DS:	Slope distance
CM: NEWS	Comment used to start a new string
RA:	Radius of circular features
LN:	Level difference used for extra measurements

30.22 LSS Observation File

This option can be used to download detail topography and traverse data from LSS load files. The SCC advanced field-coding library is used to translate LSS field codes into SCC features, tags, DTM and strings. Typically, point features will begin with the letter P, and new strings will be started with a full stop. String numbers will typically be embedded into feature names, e.g. KB10 will be used to identify KB string 10.



	Code	Feature	Description	Type	Tag	Master	DTM	Master	Str	SDR Control	PntInFtr
1	-OL	-OL		CC	S	Survey	D	Survey	0	Par Offs L/R	Ignore
2	-OR	-OR		CC	S	Survey	D	Survey	0	Par Offs L/R	Ignore
3	-REC			CC	S	Survey	D	Survey	1	Rect	String
4	-STDH	DH		PC	CH	Library	A	Survey	0	None	Ignore
5	-STMK	MK		PC	CH	Library	A	Library	0	None	Ignore
6	.CO	CO		PC	Bg	Library	D	Survey	1	None	String
7	.GT	GT		PC	Bg	Library	D	Survey	1	None	String
8	.RL	RL		PC	Bg	Library	D	Survey	0	None	String
9	.TC	TC		PC	Bg	Library	D	Survey	1	None	String
10	BN	BN		PC	S	Survey	D	Survey	1	None	String
11	BO	BO		PC	Q	Survey	D	Survey	28	None	String
12	CB	CB		PC	Q	Survey	D	Survey	225	None	String
13	CO	CO		PC	Q	Survey	D	Survey	15	None	String
14	CP	CP		PC	Q	Survey	D	Survey	29	None	String
15	DT	DT		PC	S	Survey	D	Survey	1	None	String
16	EP	EP		PC	S	Survey	A	Survey	1	None	String
17	FE	FE		PC	S	Survey	A	Survey	1	None	String
18	GT	GT		PC	S	Survey	D	Survey	1	None	String
19	MA	MA		PC	Q	Survey	D	Survey	168	None	String
20	PAP	PAP		PC	S	Survey	D	Survey	0	None	Dim
21	PAS	PAS		PC	S	Survey	D	Survey	0	None	Dim
22	PDE	PDE		PC	S	Survey	D	Survey	0	None	Dim
23	PFB	PFB		PC	S	Survey	D	Survey	0	None	Dim
24	PIJ	PIJ		PC	S	Survey	D	Survey	0	None	Dim
25	PIL	PIL		PC	S	Survey	D	Survey	0	None	Dim
26	PJB	PJB		PC	S	Survey	D	Survey	0	None	Dim
27	PJT	PJT		PC	S	Survey	D	Survey	0	None	Dim
28	PLE	PLE		PC	S	Survey	D	Survey	0	None	Dim
29	PMP	PMP		PC	S	Survey	D	Survey	0	None	Dim
30	PSG	PSG		PC	S	Survey	D	Survey	0	None	Dim
31	PTI	PTI		PC	S	Survey	D	Survey	0	None	Dim
32	PTM	PTM		PC	S	Survey	D	Survey	0	None	Dim

When processing traverse data, SCC assumes that all observations beginning with the sequence '-ST' are control observations. For an example of downloading LSS load files into SCC, see the project template 'LSS-Demo.Project', and the LSS load file 'LSS-Demo.001' in the tutorials directory. This data should be processed as combined detail and traverse.

30.23 Zeiss REC Elta

Data transfer is supported on the Zeiss REC Elta either via disk or RS232 serial port. RS232 parameters are set for 4800 baud, 8 data bits, no parity, 1 stop bit, Xon/Xoff handsaking protocol.

The Zeiss REC Elta stores data as a series of records where each record contains a user supplied information section and an observation. These records are numbered and transmitted to SCC in an ASCII format. The SCC interface has been designed to allow a range of measurement types to be coded in the user supplied information section of each record. These comprise of the following record layouts, where field information is expected at specified character positions in the record ;

Project Information

Pos	Value	Meaning
1-2	10	Record Type Identification
4-11		Job Name
13-16		Date in the Format DDMM
18-22		Project Name

Traverse Station Occupation

Pos	Value	Meaning
1-2	21	Record Type Identification
4-11		Occupied Station Name
13-16		Instrument height in millimeters

Traverse Observation

Pos	Value	Meaning
1-2	22	Record Type Identification
4-11		Target Station Name
13-16		Target Prism Height in millimeters

Detail Station Occupation

Pos	Value	Meaning
1-2	32	Record Type Identification
4-11		Occupied Station Name
13-16		Instrument Height in millimeters

Detail Reference Observation

Pos	Value	Meaning

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1-2	32	Record Type Identification
4-11		Target Station Name
13-16		Reference Station Height in millimeters

Detail Observation

Pos	Value	Meaning
1	4	**Record Type Identification**
2		**Line Connection Tag**
	0	Straight
	1	Arc
	2	Curve
	3	Duplicate
	4	Link
	5	Discontinuous Straight
	6	Discontinuous Curve
	7	Link with Curve
	8	Gap in Curve
	9	End String
4-6		**String Number**
	0	Point Feature
	1-999	String Feature
8-10		**Point Number, position of point within the string**
12-15		**Feature Name, used in conjunction with Feature Library to determine other attributes**
17-20		**Offset Value in millimeters**
22		**Offset Type**
	1	Forward Along the Line of Sight
	2	Backward Along the Line of Sight
	3	Left from the Line of Sight
	4	Right from the Line of Sight
	5	Extension to the Line in the direction of the String
	6	Start Free Interpolation for Taped Measurement
	7	Change Default Rod Height

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	8	Lateral Offset Left for Taped Measurement
	9	Lateral Offset Right for Taped Measurement

30.24 Softdesk Field Book

This option allows you to download detail and traverse data from the Field Book format file, used by LDD, SoftDesk, and DCA.

30.25 NSS ASCII Export

This option allows the user to download NSS ASCII files.

30.26 Kingsland .OBS format

Support for the Kingsland Surveys .Obs format is based on the format document (Coding.doc) and sample data files provided (Pound1.obs and Pound2.obs).

These files include control and detail survey information and may be processed in SCC.

30.27 Geodimeter .DEC format

This option allows you to download detail and traverse data from the Geodimeter .DEC format in use in the Netherlands

30.28 TDS

Tripod Data Systems TDS

TDS Survey tasks supported are detail, traverse and stake out.

Explanation of Topcon TDS field recorded data

At the end of each line of field data there are two minus signs. These are followed by point codes. These codes comprise of feature, tag and stringing information.

- A dot indicates that the point is a strung feature. If the dot is omitted the feature is a discrete point an does not form part of any string.

  For example;

  SS,OP49,FP1688,AR263.3840,ZE86.1410,SD39.255,--.TB3

  Defines string number 3 with feature TB (Top of Bank)

11 defines a curved point it may or may not be on a string , depending on whether or not there is a dot in front of it.

For example;

SS,OP83,FP1671,AR185.0005,ZE90.0650,SD373.650,--.11EP1

Defines a curve of feature EP (Edge of Pavement) on string number 1

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22 Defines the END of a string.

For example;

SS,OP49,FP1744,AR173.4705,ZE90.1100,SD93.230,--.22

Defines the end of the current string

33 Defines a LINK from the last point on a string back to the first point.

For example;

SS,OP49,FP1745,AR175.2925,ZE90.1105,SD94.040,--.33

Defines a link from the current point on the current string to the first point on that string

Features may be represented on more than one string. For example a point at the edge of footpath where the footpath and the grass verge meet may be a point on the string defining the grass verge and on the string defining the footpath.

For further information on the structure of native Topcon files consult your Topcon FS/2 manual.

30.29 Trimble CST

This option supports Lat/Long/Height values and reduces them using either Grid Inquest or SCC 7 parameter transformation functionality.

30.30 Trimble SCS900

30.31 STAR*NET

31 Spreadsheets

31.1 Editing Spreadsheets

SCC incorporates a powerful data editor for the purpose of editing your surveys. This editor operates in a similar manner to a spreadsheet in that it is aware of the type of information stored in each field. As such every field available is validated as it is entered. Tasks such as search and replace, global editing and limited arithmetic operations are available within the editor.

The user may move around the editor using the cursor keys or mouse. To change the value of any given field simply move the cursor to that field and enter a new value, clicking the right mouse button gives a list of all the options for that field or produces an Edit field dialog. The following keys may also be used within the data editor:

F1	Display a help screen relating to the current dialog
F3	Repeats the last ‘Find’ command

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PgUp	Page up through the editor
PgDn	Page down through the editor
Home	Move to the first field in the record
End	Move to the last field in the record
Delete	Delete the character in front of the cursor in the current field
Back Space	Delete the character at the cursor in the current field
Ctrl-Home	Move to the first record in the field
Ctrl-End	Move to the last record in the field

31.1.1 Mathematical Operations

To enter an arithmetic value for a numeric field rather than an absolute value, type '=' followed by the mathematical operator, followed by the operand. The following mathematical operators are available for numeric fields;

+	Add a constant value to the field, e.g. to add 10 to the value of a field, enter '= +10' in that field
-	Subtract a constant value from the field, e.g. to subtract 10 to the value of a field, enter '= -10' in that field
*	Multiply the field by a constant value, e.g. to multiply the value of a field by 10, enter '= *10' in that field
/	Divide the field by a constant value, e.g. to divide the value of a field by 10, enter '= /10' in that field
^	Raise the field to the power of a constant value, e.g. to square the value of a field, enter '= ^10' in that field
!	Subtract the field from a constant value, e.g. to subtract the value of the field from 10, enter '= !10' in that field
>	Clip the field to below a constant value (used in search and replace), e.g. to set the value of a field to 10 if it is greater than or equal to 10, enter '= >10' in that field.
<	Clip the field to above a constant value (used in search and replace), e.g. to set the value of a field to 10 if it is less than or equal to 10, enter '= <10' in that field.
:	Calculate a gradient value for an angle field, e.g. to enter a gradient of 1 in 10 for a vertical angle, enter '=1:10' in that field.

31.1.2 Sorting Of Data Within Spreadsheets

Each spreadsheet within SCC automatically sorts all the information into an order suitable for the particular type of data being entered. For example, records within the detail observations are sorted by point number, whilst detail co-ordinates will always be sorted alphabetically by feature and then by string number and position etc.

In the description of individual spreadsheets, certain fields will be noted as index fields and have an index number. For example, the Detail Coordinate spreadsheet is indexed first by feature name, then by string number, then by string position and then by point number. These are noted as being index fields 1, 2, 3 and 4 respectively. This means that the detail co-ordinates spreadsheet is sorted primarily alphabetically by feature name. String number will

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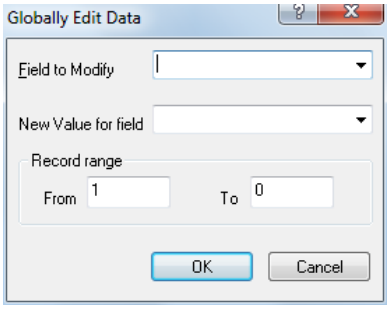
sort records with the same feature. Records with the same feature and string number will be sorted by string sequence position. Records with the same feature, string number and string position will be sorted by point number. Hence, changing the value of these fields may be used to change the position of a point within a string. This is useful if a point may not be observed on a string because of some temporary obstacle. This point may be observed out of sequence and by changing the point number, the correct line linkages may be performed.

31.1.3 Globally Edit A Range Of Data (Edit Menu)

This option allows the user to modify the value of a field in the current editor for a range of records. Selecting this option presents the user with a dialogue containing the following fields;



Field to Modify

This field specifies which field in the spreadsheet will be modified.

New Value for Field

This field contains the new value that will be stored in the selected field for the selected record range. This value may include mathematical operators and conversion suffixes where required.

Record Range

From

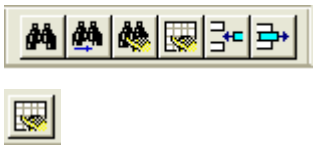
This field contains the record number, as displayed in the title of the first record that will be modified. Note that the record number will generally NOT be the same as the survey point number. See the replace option for more flexible global editing.

To

This field contains the record number, as displayed in the title of the last record that will be modified. Note that the record number will generally NOT be the same as the survey point number. See the replace option for more flexible global editing.

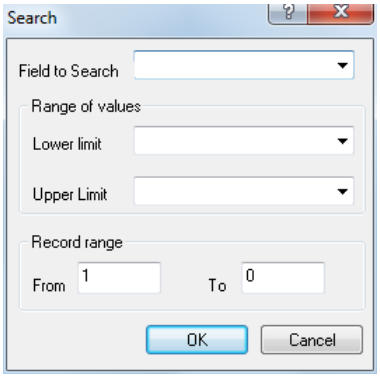
Shortcuts

Toolbar



31.1.4 Find (Edit Menu)

This option allows the user to search a range of records for a field value that lies within a specified range of values.



Field to search

This field specifies which field in the spreadsheet is to be searched.

Range of values

Lower limit

This field contains the lowest value of the selected field that will be used for the search and replace function.

Upper limit

This field contains the highest value of the selected field that will be used for the search and replace function.

Record Range

From

This field contains the record number, as displayed in the title of the first record that will be modified. Note that the record number will generally NOT be the same as the survey point number. See the replace option for more flexible global editing.

To

This field contains the record number, as displayed in the title of the last record that will be modified. Note that the record number will generally NOT be the same as the survey point number. See the replace option for more flexible global editing.

number will generally NOT be the same as the survey point number. See the replace option for more flexible global editing.

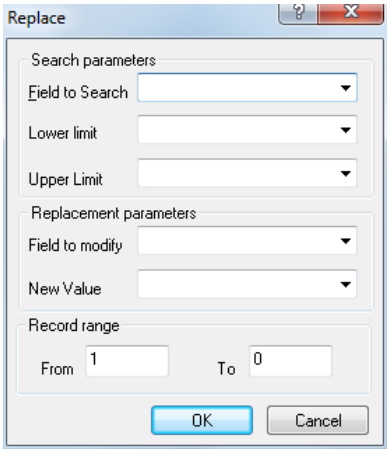
Shortcuts

Toolbar

Keys Ctrl + F

31.1.5 Replace (Edit Menu)

This option allows the user to modify the value of a field for a range of records in the editor that have a specified range of values in another field. Selecting this option presents you with a dialogue containing the following fields;



Selecting this option presents you with a dialogue containing the following fields;

Search parameters

Field to search

This field specifies which field in the spreadsheet is to be searched.

Lower limit

This field contains the lowest value of the selected field that will be used for the search and replace function

Upper limit

This field contains the highest value of the selected field that will be used for the search and replace function

Replacement parameters

Field to modify

This field specifies which field in the spreadsheet will be modified.

New value

This field contains the new value that will be stored in the selected field for the selected record range. This value may include mathematical operators and conversion suffixes where required.

Record Range

From

This field contains the record number, as displayed in the title of the first record that will be modified. .

To

This field contains the record number, as displayed in the title of the last record that will be modified.

Using the Replace facility

The global editor and search and replace facility may be used in each of the spreadsheets. The possible applications of them are endless, but the examples below provide an indication of how the replace facilities can be used to manipulate your survey

data:

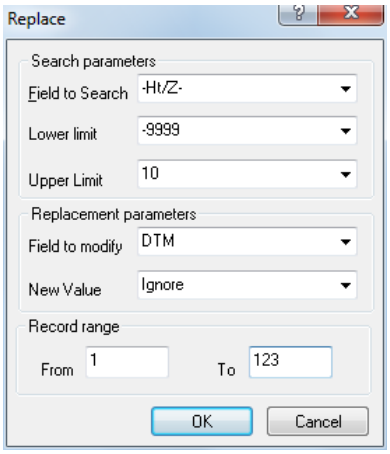
Example 1	Exclude a range of levels from the terrain model
Example 2	Correcting a rod-height error.
Example 3	Globally change feature names

Example 1: Exclude a range of levels from the terrain model

Use the replace facility to search the co-ordinate file for a range of levels and on the basis of this change the DTM code to IGNORE. This option might be used to globally remove unsuitable levels from the terrain model. This may often be the case where data has been provided by a third party and perhaps not expressly for the purposes to hand.

From the SCC Main Menu, select 'VIEW > Detail Co-ordinate' spreadsheet

Select 'EDIT > Replace'

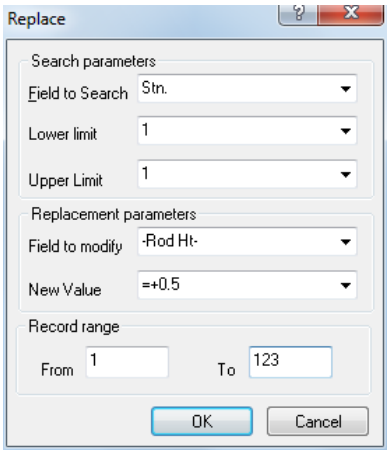


Example 2: Correcting a rod-height error.

Use the replace facility to search the observation file for a given station set-up number and on the basis of this add half-a-meter to the rod height. This may be used to correct a rod height error, which occurred at a particular station.

From the SCC Main Menu, select 'VIEW > Detail Observations' spreadsheet

Select 'EDIT > Replace'



Example 3. Globally change feature names.

Use the search and replace facility to change all feature names in the range T to TRZZ to the name TREE. This particular example can be adapted to change the feature names

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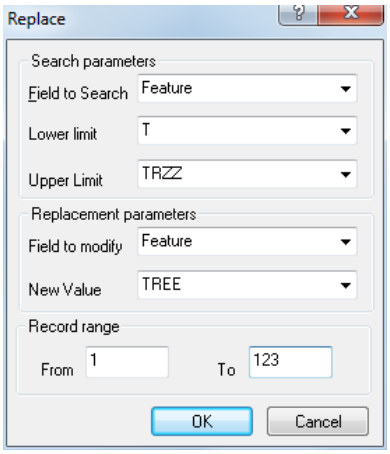
used by another surveying practice to match your own naming convention.

From the SCC Main Menu, select 'VIEW > Detail Co-ordinate' spreadsheet

Select 'EDIT > Replace'



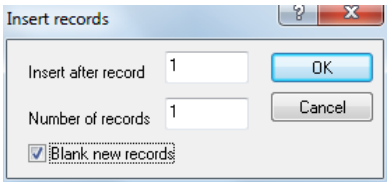
Note: Feature Names are case-sensitive.

Shortcuts

Toolbar

31.1.6 Insert Records (Edit Menu)

This option inserts a number of blank records into the data sheet.



Selecting this option presents you with a dialogue containing the following fields;

Insert after record

This field specifies the spreadsheet record number after which the new records will be inserted.

Number of records

This specifies the number of new records that will be inserted into the spreadsheet.

Blank new records

This field specifies whether or not the inserted records will be copies of the previous record or whether they will have the default string, position, tag, entries etc.

Shortcuts

Toolbar

31.2 Reports (File Menu)

SCC produces high quality reports from all SCC documents using the industry acclaimed Crystal reports engine. Reports have been added for editing log files, that include filters for currently open documents only, and last selected menu option only. These reports can include data, charts, bitmaps and other rich content, and can be output to printers, PDF, Excel, HTML and Word files.

Reporting options also allow that where a new default report is selected for any given activity, it becomes the new default for that activity.

Sample reports are available within the SCC directory.

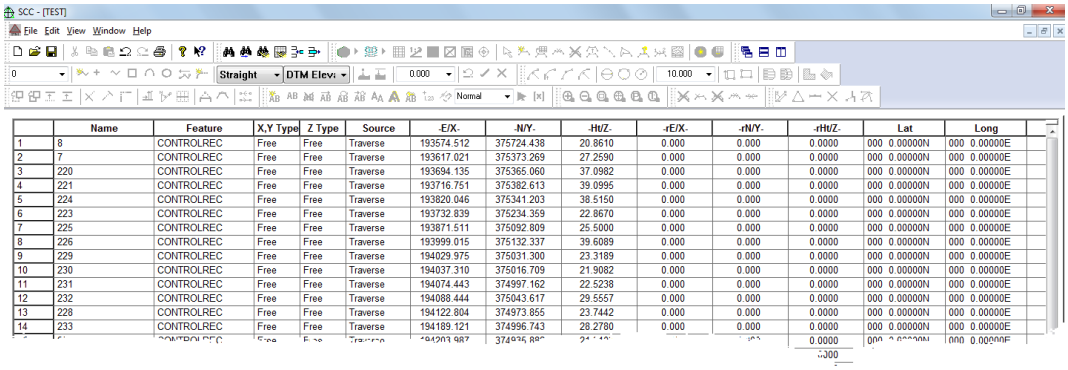
See Also

Reports Within SCC

31.3 Project Spreedsheets

31.3.1 Station Co-ordinates

The station co-ordinates spreadsheet is used to store all the station co-ordinates for a given SCC project. Individual traverse data sets will read fixed co-ordinates and write adjusted co-ordinates to this sheet. The instrument set-up sheet will refer to co-ordinates stored in this sheet for purposes of orientation and position when calculating detail co-ordinates from polar co-ordinates (Ha, Va, Slope Distance). Station co-ordinates may also be read directly from certain data loggers or entered manually from the keyboard.



	Name	Feature	X,Y Type	Z Type	Source	-E/X-	-N/Y-	-Ht/Z-	-rE/X-	-rN/Y-	-rHt/Z-	Lat	Long
1	8	CONTROLREC	Free	Free	Traverse	193574.512	375724.438	20.8610	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
2	7	CONTROLREC	Free	Free	Traverse	193617.021	375373.269	27.2590	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
3	220	CONTROLREC	Free	Free	Traverse	193694.135	375365.060	37.0982	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
4	221	CONTROLREC	Free	Free	Traverse	193716.751	375382.613	39.0995	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
5	224	CONTROLREC	Free	Free	Traverse	193820.046	375341.203	38.5150	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
6	223	CONTROLREC	Free	Free	Traverse	193732.839	375234.359	22.8670	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
7	225	CONTROLREC	Free	Free	Traverse	193871.511	375092.809	25.5000	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
8	226	CONTROLREC	Free	Free	Traverse	193999.015	375132.337	39.6089	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
9	229	CONTROLREC	Free	Free	Traverse	194029.975	375031.300	23.3189	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
10	230	CONTROLREC	Free	Free	Traverse	194037.310	375016.709	21.9082	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
11	231	CONTROLREC	Free	Free	Traverse	194074.443	374997.162	22.5238	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
12	232	CONTROLREC	Free	Free	Traverse	194088.444	375043.617	29.5557	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
13	228	CONTROLREC	Free	Free	Traverse	194122.804	374973.855	23.7442	0.000	0.000	0.0000	000 0.00000N	000 0.00000E
14	233	CONTROLREC	Free	Free	Traverse	194189.121	374996.743	28.2780	0.000	0.000	0.0000	000 0.00000N	000 0.00000E

Whenever a data logger transfer or survey computation attempts to change the value of an existing station co-ordinate, a check will be made for the differences between the new value and the existing value. If a difference of more than 1mm in any axis occurs a message will be presented asking you to keep the existing value or to overwrite it with the new value.

At this stage you will be offered a choice to keep the existing value or the new value. If either value is less than or equal to zero in the x or y axis it will automatically get rejected with no message displayed. This message will also get output to the current log file.

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Name

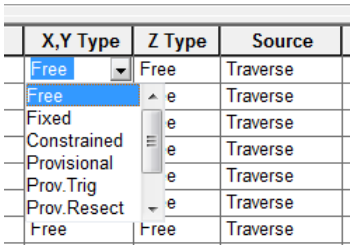
This field contains the name of the Control Co-ordinate being edited. This will be the station name entered or co-ordinate name from the datalogger.

Feature

Eight character field contains the name of the feature being edited

X, Y Type / Z Type

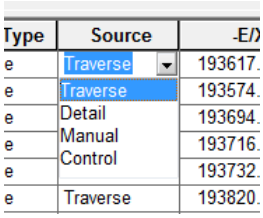
This field specifies whether traverse adjustment or other calculations may modify the co-ordinates of this station: Free, Fixed, Constrained, Provisional, Prov. Trig, Prov. Resect, Prov. Intersect, Adjusted.



Fixed co-ordinates may not be modified and may be used to constrain least squares network adjustment, i.e. 'Variation of co-ordinate' Adjustments applied in the traverse data sheet. In a Bowditch Adjustment, fixed co-ordinates may only be used for opening and closing stations. A station co-ordinate may be fixed in all dimensions (Fixed), fixed in plan only (Fixed X, Y), or not fixed at all (Free).

Source

This field specifies how the co-ordinate for the current station was established.



There are four options:

Traverse	Taken from the Traverse Module
Detail	A Fly Station
Manual	Manually entered (typed) in from the Keyboard
Control	Taken from the Logger

-E/X-

This field contains the co-ordinated X value or Easting for the current point in the file.

-N/Y-

This field contains the co-ordinated Y value or Northting for the current point in the file.

-Ht/Z-

This field contains the co-ordinated Z value or Elevation for the current point in the file.

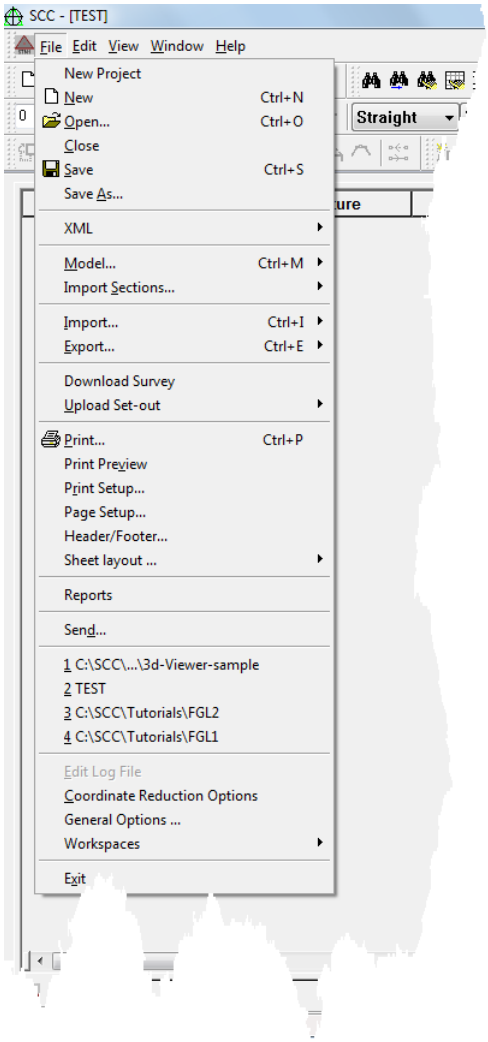
Remark

This field contains a free from remark entered in the data logger for this observation.

Use

This field contains a counter to indicate how many times this station was accessed in the last model created. It is used internally by the software when computing traverse adjustments and creating models.

31.3.2 Project File Menu



31.3.2.1 Export (Project File Menu)

The following options are available from the project export options:

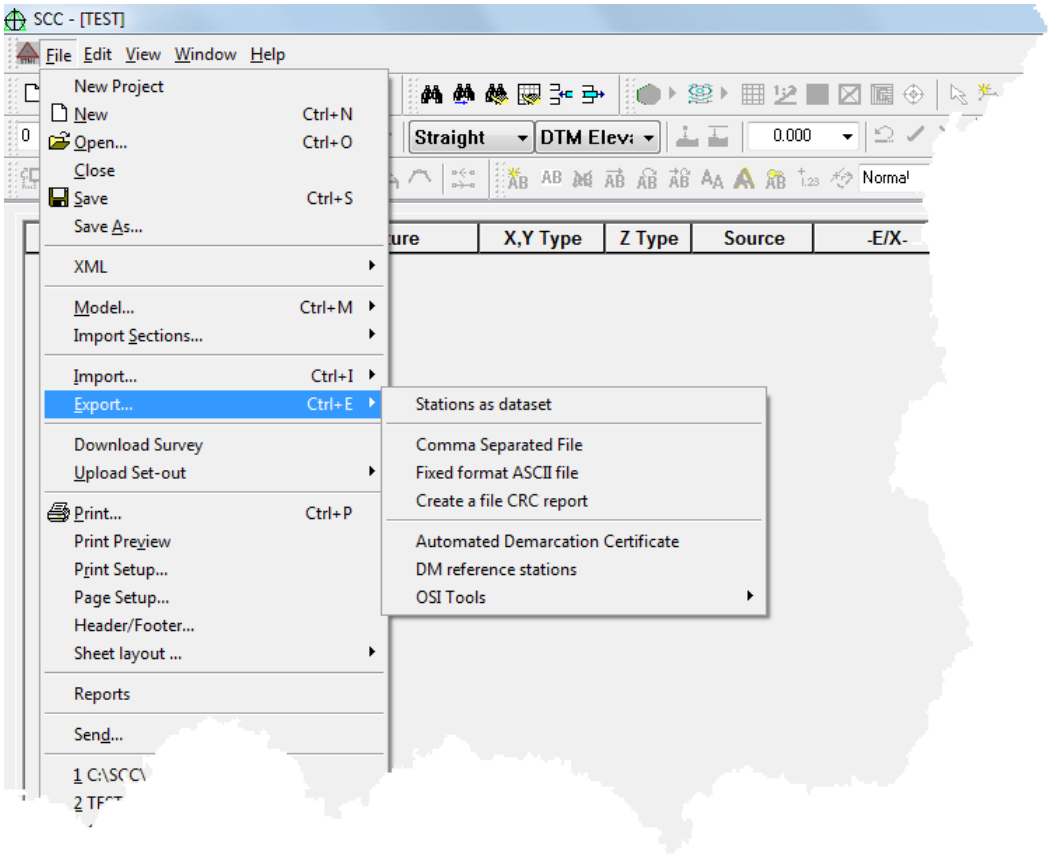
Export Stations as dataset (File Menu)

Export Comma Separated File (File Menu)

Export Fixed format ASCII File (File Menu)

Export Automated Demarcation Certificate (File Menu)

Export Create a file CRC report (File Menu)



See Also

Import & Export

31.3.2.2 XML (Project File Menu)

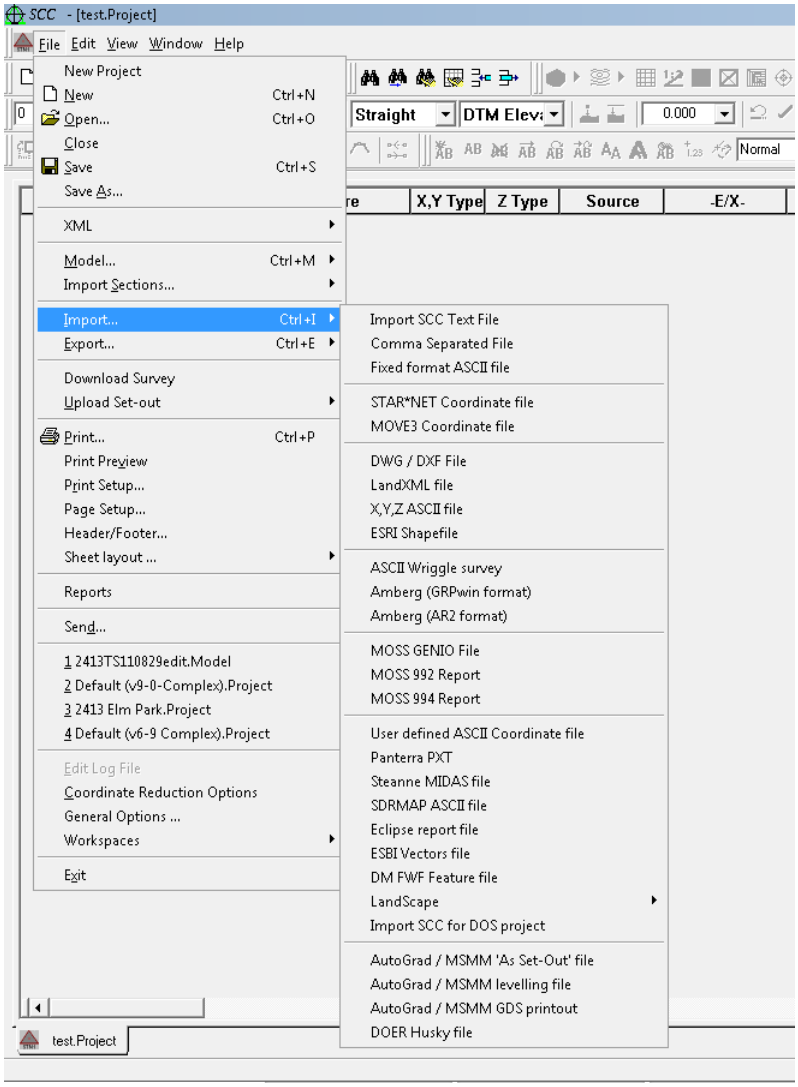
SCC supports loading and saving of all of its document files in the industry standard XML format, in addition to its native formats. XML (extensible mark-up language) is an ASCII format widely used in Internet and database applications for the exchange and archiving of data. XML has the advantage that it may be used to import SCC data from SCC into other programs and between versions. It has the disadvantages that it is slow and memory intensive to work with, and produces substantially larger files than native SCC formats. For transferring SCC data between SCC and other LandXML capable applications.

See Also

LandXML (Project File Menu)

31.3.2.3 Import (Project File Menu)

The following import options are available:

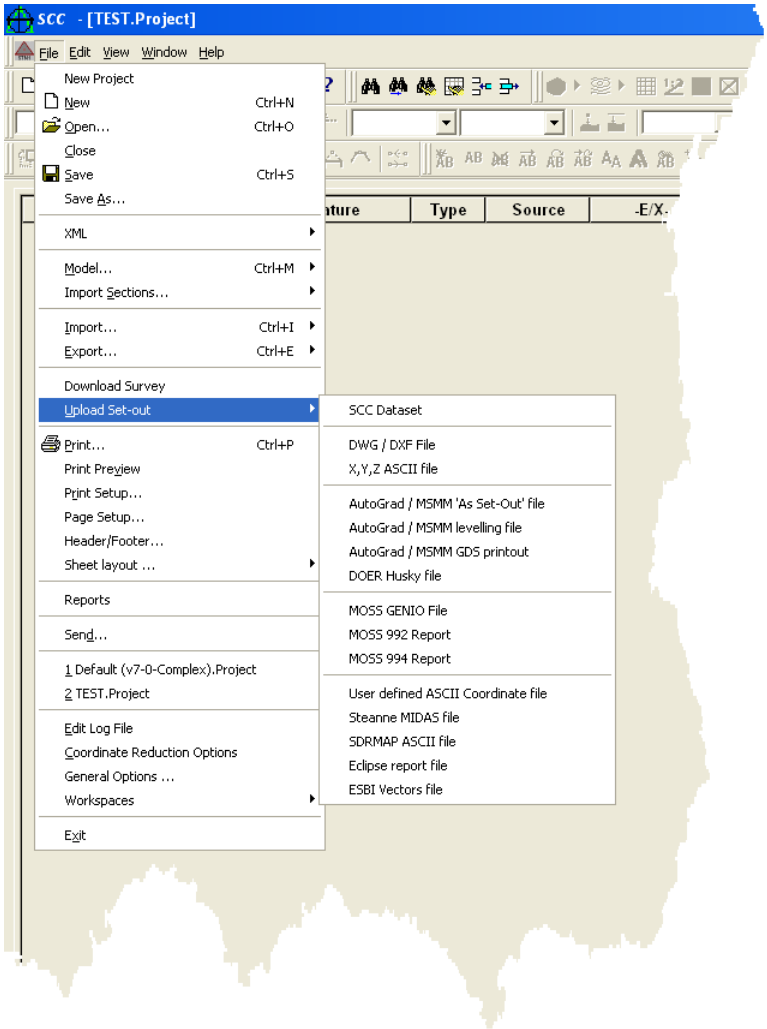


See Also

Import & Export

31.3.2.4 Upload Set-out (Project File Menu)

This option facilities the uploading of specific set out files to survey unit.

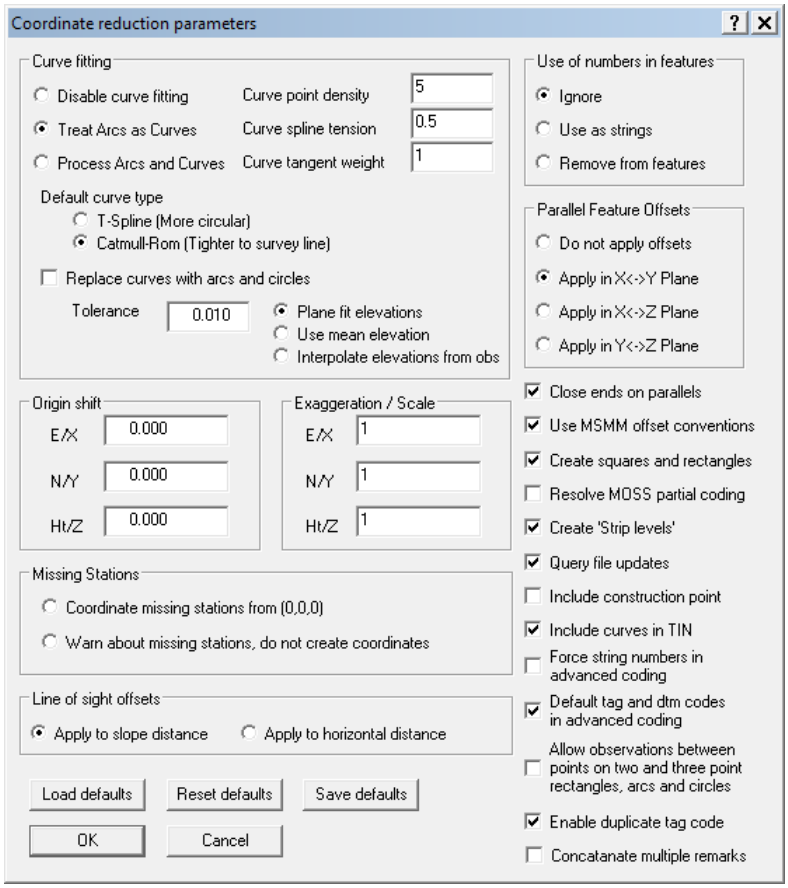


See Also

Import & Export

31.3.2.5 Co-ordinate Reduction Options (Project File Menu)

This option allows the user to edit configurable parameters relevant to the generation of the detail co-ordinate information. These parameters are used when creating detail co-ordinates from the detail observation spread sheet. These comprise of Apply Curvature and Refraction, Standard value for 'k', Radius of the Earth, Apply temperature and pressure. A full list of survey reduction parameters is as follows;



Curve Fitting

This switch defines whether extra curve points are generated in between surveyed curve points. Surveyed curves are generated by using the curve tag codes. The type of curves used is 'Splines under tension'. Curve generation parameters may be further defined by tension and point density parameters. Points used to define curves should be surveyed at even intervals apart. The number of points required for accurate delineation of a curve depends on the accuracy requirements. As a guide on tight curves on road belmouths, points for engineering accuracy requirements may be as close as 1 -2 meters - very tight curves on traffic islands may be at 0.1 to 0.2 meters centres depending on the tightness of the curve - main highway curves may be as far apart as 10 to 20 meter centres depending again on requirements.

No Curve Fitting

Points surveyed as curves are treated as straights. No extra points are generated for curve fitting.

Treat Arcs as Curves

All Arcs in the Detail Observation file are treated as curves in the detail coordinate file.

Process Arcs and Curves

Arcs and curves are processed as they appear in the detail observation file. That is, arcs are processed as arcs and curves are processed as curves.

Curve Point Density

This value defines the number extra curve points generated in between surveyed curve points. The final curve will be created as a set of straights joining these points.

Curve Spline Tension

This value defines the tension of curves created. The value range between 0.0 and 0.1, where 0.0 connects the surveyed points by a straight line. The curve fitting honors the points surveyed to define the curves by passing through these points. The tension either flattens or permits the curve to billow between these points.

Curve Tangent Weight

This value determines the effects of incoming tangents on curves produced. The larger the value, the higher the influence of the incoming and outgoing straight line on the curve produced. Typically, this value should be similar to the length of the surveyed curve segments.

Default Curve Type

T-Spline (More Circular)

A trigonometric spline curve will be fit through the survey points. This curve is suitable for more circular features that are not true circles. A T-Spline curve through an equilateral triangle will result in a circle. When collecting points on this type of curve, it helps if they are reasonably evenly spaced. Failure to do so may result in a curve that billows away from the surveyed line.

Catmull-Rom (Tighter to survey line)

A Catmull-Rom curve will be fit through the survey points. This curve type stays very close to the survey line and has user definable tension and tangent weights.

Replace Curves with Arcs and Circles

Tolerance

Plane fit elevations

Use mean elevation

Interpolate elevations from obs

The above options control how levels are created for circle fits and arc fit strings. These are to use a mean level, to drape all points on a best fit plane through the input data, or to interpolate non-planar levels for each input point based on the input data.

This option when selected will automatically replace open and closed Catmull-Rom curves with arcs and circles in situations where a best fit arc or circle lies within a given tolerance of the surveyed curve point, This is to allow SCC surveys to more closely match LandScape style curve fitting where required. Note that this is not advisable in situations where high accuracy is required, as the arc or circle is allowed to 'miss' the surveyed positions by the tolerance given in order to achieve a more aesthetically pleasing result.

Origin Shift

This value, normally 0.0, defines X/Easting, Y/Northing, and Z/Ht offsets that are added to all co-ordinates when they are being computed.

Exaggeration / Scale

This value, normally 1.0, defines an exaggeration or scale factor that will be applied to E/X, Y/N and Z/Ht when computing co-ordinates.

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Missing Stations

Coordinate missing stations from (0,0,0)

Warn about missing stations, do not create coordinates

The above options instruct SCC to set Station which are missing coordinates to use 0,0,0 or to warn user of missing station values.

Line of sight offsets

To options are available to facilitate the application of line of sight offsets:

Apply to slope distances or Apply to horizontal distance

Use Of Numbers In Features

Ignore

The numbers in the features entries are not used for stringing but may be used for feature coding.

For Example, if an oak tree were surveyed as TREE1, the feature name would be TREE1

Use as strings

This option allows the string field to be created from the numeric part of the feature field as opposed to using the MSMM string field.

For Example, the feature code CH0345 would be converted into feature CH and string 345

Remove from Feature

Any numerics held within a feature code to be removed altogether. The alpha part of the feature will remain and the current string numbers will also remain.

Parallel Feature Offsets

This switch defines whether or not offsets in the observation file are applied to the co-ordinate file and if so in which direction they are applied. They may be ignored, interpolated in the horizontal (X, Y) plane, or interpolated in the vertical (X, Z or Y, Z) plane. For land survey purposes it is normal to use the horizontal plane whereas for building facade surveys a vertical plane may be required.

Close Ends On Parallel

Selecting this option will cause parallel copied strings to close back onto the string that generated them, at the end points. This is useful when using the copy parallel facility to generate walls and similar features

Use MSMM Coding Conventions

This option is used to specify the convention used for parallel offsets. SCC has previously followed the Eclipse convention, which was later carried through to the MX Site Measurement Module (MSMM) remark coding. In this case a left (or negative) offset, implied that the survey point was on the left of the object being surveyed. The alternative, and to many people more logical, convention is to say that a left offset implies that the object is on the surveyors left. This convention is used in MX Survey and other packages. The former option is default, as it means that those already using parallel offsets do not have to change anything in the field.

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Create Squares And Rectangles

This switch defines whether squares/rectangles in the observation file will be placed when the detail co-ordinates are being generated from the raw data file. Squares can be created either via the square tag code or by linking a two-point string. Rectangles will be created if a side length is given in the first dimension field.

Resolve MX Partial Coding

This switch defines whether the observation file will be checked for partially coded MX data within the observation file. The rules used when interpreting partially coded data are as follows;

- If a feature name is left blank it is assumed to have the same name as the last feature entered.
- If a feature name is 4 characters long, it is taken as the full MX label and given a string number of 1.
- If a feature name has less than 4 characters it is allocated the next available string number for that feature.
- If a feature name begins with the letter P it is given a string number of zero.

Create 'Strip levels'

This switch defines whether strip levels in the observation file will be created during co-ordination of the raw data file. Strip levels are points that are placed offset to the left and right and offset by level of a given survey point. An example of this would be where the centre line of a wall is surveyed and the width and height are entered as the first and second dimensions respectively. In this case, for each surveyed centre line point taken, four co-ordinates would be generated for the top-left, top-right, bottom-left, and bottom right of the wall at that point.

Query file Updates

When data is entered in the observation file, the instrument set-up file, or the feature library, the corresponding co-ordinate files need to be updated to reflect the changes made. This may result in loss of any directly entered co-ordinates in those files. This switch defines whether the user is prompted as to whether this updating should take place when the system deems that it is required.

Include Construction Points

This switch defines whether survey points used in constructing squares, curves, offsets, and strip levels will be included in the co-ordinate file. The co-ordinate file will be larger as a result of doing this.

Include Curves In TIN

This switch dictates whether points interpolated on curves will be included in the TIN model when it is formed. Setting this option off will significantly decrease the size of TIN models.

Force string numbers in advanced coding

This options applies the string numbers present in the advanced coding table on import/download to string information.

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Allow observations between points on two and three point rectangles, arc and circles

This options allows the user to pick up detail between points on two and three point rectangles, arc and circles

Load Defaults

This option loads the default coordinate reduction options from the registry into the current project

Reset Defaults

This option resets the coordinate reduction options to the default values when SCC is first installed.

Save Defaults

This option saves the coordinate reduction options from the current project to the registry such that they will be used as default values for any new projects subsequently created.

Enable duplicate tag coding

This option provides for duplicate tag coding.

Concatenation multiple remarks

This option allows concatenation of multiple remarks into a single space remark for display on sections.

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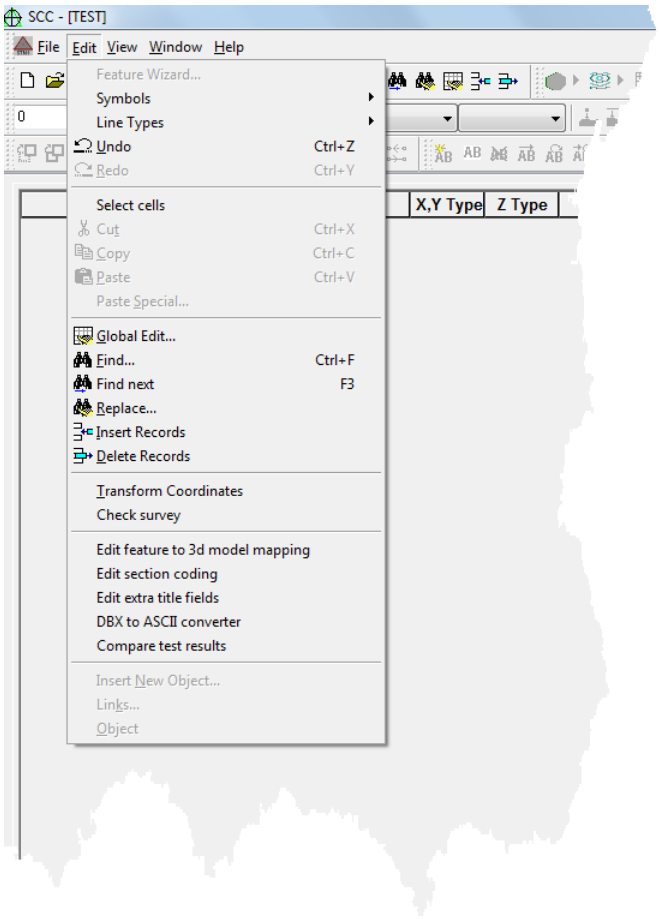
31.3.3 Project Edit Menu

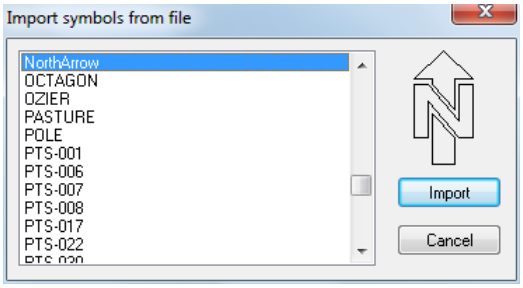


31.3.3.1 Symbols (Project Edit Menu)

This option allows the user to import, export and delete symbols from the feature library. In addition, the user can define the symbols insertion points.

Import Symbols from file

The user can import symbols from file by selecting the symbol from the list provided.



Import Symbols from DXF

The user can import symbols from a dxf file.

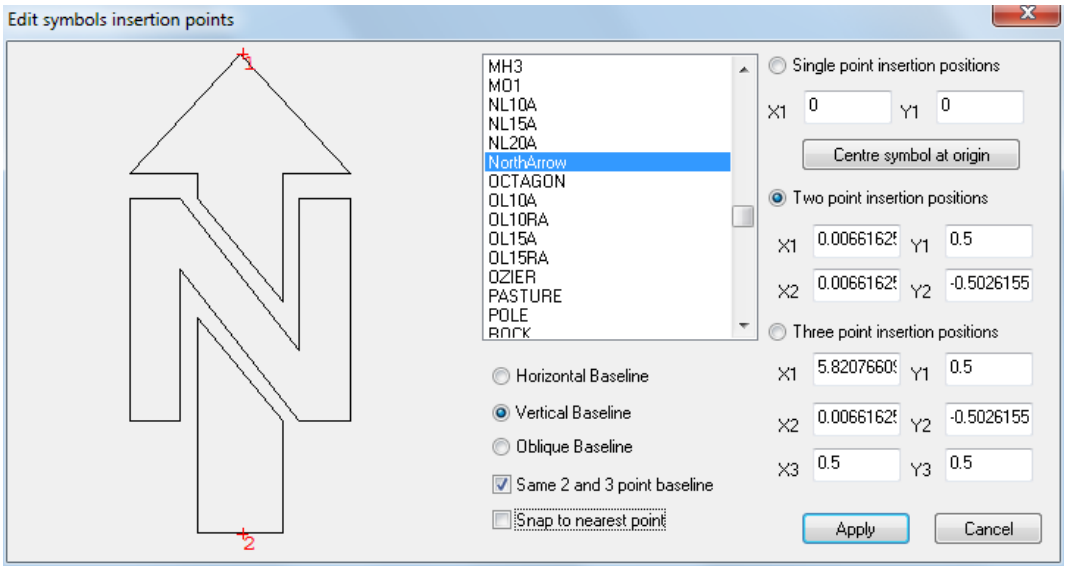
Export Symbols to file

Symbols can be export to the default project folder. The exported symbols can then be

imported to another feature library.

Edit Symbol insert point

The user can manually define the insert point of each symbol within the Edit Symbol Insert Point dialog.



Delete symbols from library

The user can select specific symbols to delete from the feature library.

31.3.3.2 Line Types (Project Edit Menu)

This option allows the user to import, export and delete line types from the feature library.

Import Line Types from File

This option allows the user to import line types from file.

Import Line Types from DXF

This option allows the user to import line types from a DXF file.

Export Line Types to File

Line styles that are present in the feature library can be exported. This option prompt the user whether an existing line style should be overwritten.

Delete Line Types from library

Specific line types can be deleted from the feature library.

31.3.3.3 Check Survey (Project Edit Menu)

In order to simplify the processing of check surveys, we have added some additional functionality to SCC to effectively automate the task. The automated processing of the check survey is carried out in three phases, as follows;

Comparison of contract survey stations with check survey stations

This assumes that the check survey traverse has been adjusted, the final values of check stations are available in a given SCC project file, and the final values of the contract survey stations are available in a separate SCC project file. It also assumes that the nominal accuracy of the check survey stations is known as a result of the adjustment, coupled with redundant measurements taken. Given these prerequisites, SCC searches for stations matched by name, and computes relative and absolute differences between them, in plan and elevation, referred to in the report as raw errors. The raw errors are reduced by the nominal accuracy to give corrected errors, which are subsequently compared to acceptance criteria at 67%, 95% and 99% levels, to determine if the contract survey stations meet specification. For the survey to meet specification, 67% of the stations must fall within given absolute and relative error criteria, 95% must fall within a looser criteria, and 99% must fall within a loosest criteria.

Comparison of discrete topographic detail from contract survey stations with similar detail in the check survey

A similar process is carried out for all discrete topographic detail features, which are identified by feature name. This assumes that the check model includes all final reduced check coordinates. In this case it is assumed that each point in the check survey has been surveyed twice from different stations, and the distance between the two positions is used in place of nominal accuracy. The contract survey is searched for points with the same feature name in a specified search radius, which are used as a basis for comparison. Acceptability computations are the same as used in the station analysis, with alternative acceptance parameters.

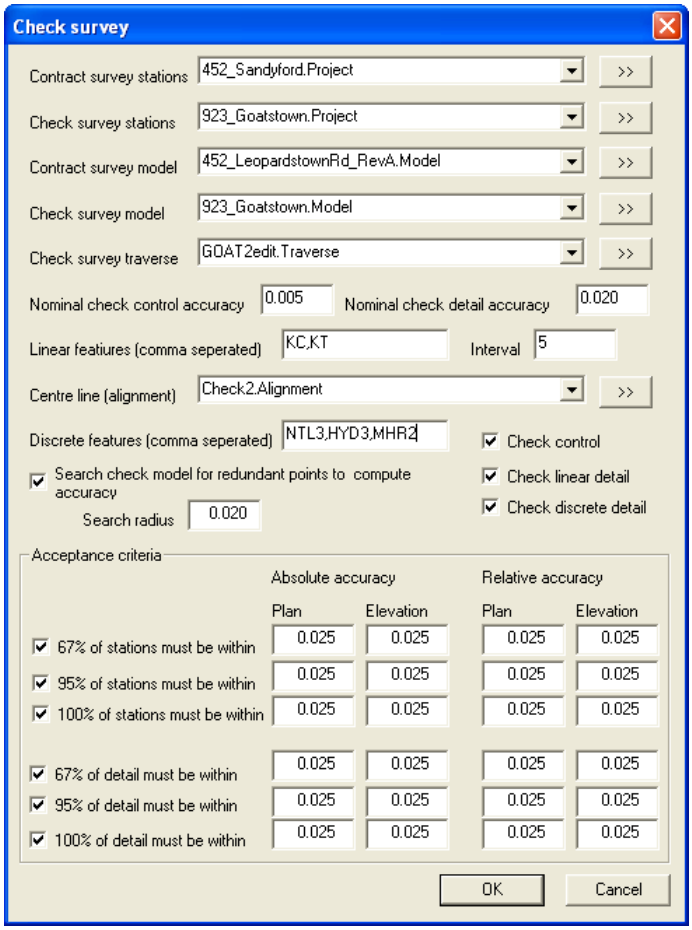
Comparison of linear detail from contract survey stations with similar detail in the check survey

In the case of linear features we cannot be sure that the check survey points are coincident with the contract survey points, so the checking routine cuts a series of cross sections and uses the chainage, offset and level of the position where the section cuts the linear feature in place of the surveyed coordinate. In this scenario, for any given cut the chainages will always agree whereas the offsets and heights are used to determine error. This is significant, as with offset (e.g. width of carriageway) is of primary interest to the client. As with the discrete points, it is assumed that the check survey will include each string twice surveyed from separate stations, as a means of computing the accuracy of the check survey.

To process the check survey we do the following;

Process the check survey control and models as with any other survey.

Select the 'Check Survey' option which will display the following dialog;



Provide details for check survey project and models, contract survey project and models, linear and discrete feature names, and acceptance criteria.

This will create a detailed report as shown below which includes a summary and breakdown for stations and topographic detail. All out of specification items are highlighted in red.

Category Stations

Survey data 452_Sandyford.Project

Check data 923 Goatstown.Project

Pass criteria

Minimum pass rate	Plan (absolute) Max error	Plan (absolute) Achieved	Height (absolute) Max error	Height (absolute) Achieved	Plan (relative) Max error	Plan (relative) Achieved	Height (relative) Max error	Height (relative) Achieved
67%	0.025M	100.0%	0.025M	55.6%	0.010M	100.0%	0.010M	100.0%
95%	0.050M	100.0%	0.050M	100.0%	0.020M	100.0%	0.020M	100.0%
99%	0.100M	100.0%	0.100M	100.0%	0.030M	100.0%	0.030M	100.0%

C.O.G. Coordinates

	E/X	N/Y	Ht/Z
Survey	319,405.101	226,128.150	96.008
Check	319,405.109	226,128.143	95.979

(Relative accuracies are based on distances to the contract and check survey's respective centres of gravity, absolute accuracies are based on distances to the common underlying grid)

No 1 **Name** PGM10 **Check err (plan)** 0.005 **Check err (z)** 0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	319,353.437	225,832.145	104.172
Check (abs)	319,353.448	225,832.132	104.145
Survey (rel)	-51.664	-296.005	8.164
Check (rel)	-51.661	-296.011	8.166

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.017				0.006			
Plan (Corr)	0.012	0	0	0	0.001	0	0	0
Z (Raw)	0.027				0.003			
Z (Corr)	0.022	0	0	0	0.000	0	0	0

No 2 **Name** PGM20 **Cl**

Coordinates	E/X
Survey (abs)	319,437.698
Check (abs)	319,437.714
Survey (rel)	32.597
Check (rel)	32.605

No 3 **Name** PGM290 **Cl**

Coordinates	E/X
Survey (abs)	318,733.407
Check (abs)	318,733.413
Survey (rel)	-671.694
Check (rel)	-671.696

No 4 **Name** PGM30 **Check err (plan)** 0.005 **Check err (z)** 0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	319,563.791	226,019.292	95.362
Check (abs)	319,563.800	226,019.288	95.337
Survey (rel)	158.690	-108.858	-0.646
Check (rel)	158.691	-108.855	-0.642

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.010				0.004			
Plan (Corr)	0.005	0	0	0	0.000	0	0	0
Z (Raw)	0.025				0.005			
Z (Corr)	0.020	0	0	0	0.000	0	0	0

No 5 **Name** PGM301 **Check err (plan)** 0.005 **Check err (z)** 0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	318,779.658	226,309.498	99.310
Check (abs)	318,779.665	226,309.487	99.272
Survey (rel)	-625.443	181.348	3.302
Check (rel)	-625.444	181.344	3.293

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.013				0.004			
Plan (Corr)	0.008	0	0	0	0.000	0	0	0
Z (Raw)	0.038				0.008			
Z (Corr)	0.033	X	0	0	0.003	0	0	0

No 6 **Name** PGM310 **Check err (plan)** 0.005 **Check err (z)** 0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	318,838.851	226,157.617	104.103
Check (abs)	318,838.859	226,157.612	104.064
Survey (rel)	-566.250	29.467	8.095
Check (rel)	-566.250	29.469	8.085

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.009				0.003			
Plan (Corr)	0.004	0	0	0	0.000	0	0	0
Z (Raw)	0.039				0.009			
Z (Corr)	0.034	X	0	0	0.004	0	0	0

No 7 **Name** PGM60 **Check err (plan)** 0.005 **Check err (z)** 0.005

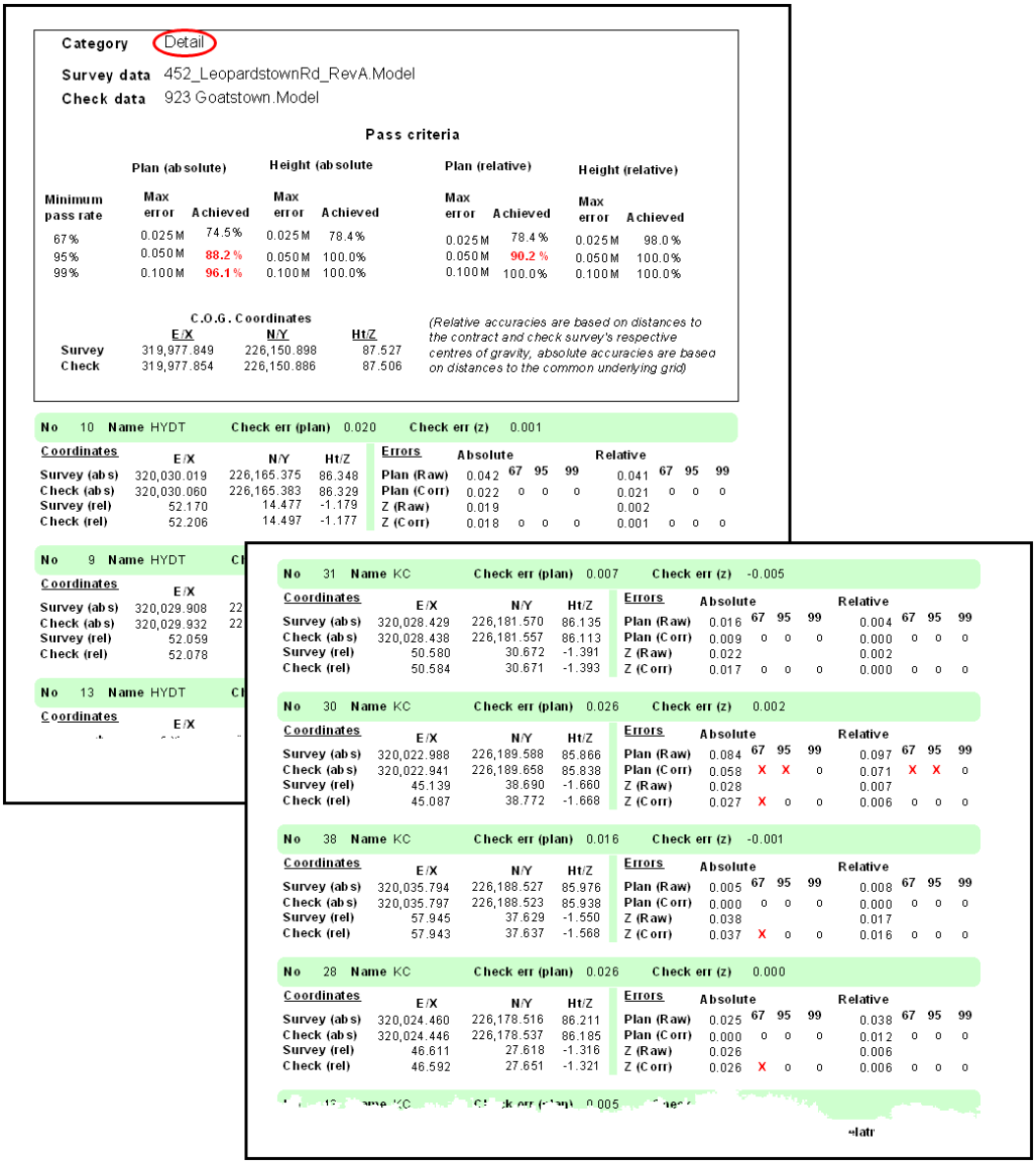
Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	319,880.357	226,097.639	90.557
Check (abs)	319,880.359	226,097.634	90.534
Survey (rel)	475.256	-30.511	-5.451
Check (rel)	475.250	-30.509	-5.445

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.005				0.007			
Plan (Corr)	0.000	0	0	0	0.002	0	0	0
Z (Raw)	0.023				0.007			
Z (Corr)	0.018	0	0	0	0.002	0	0	0

No 8 **Name** PGM70 **Check err (plan)** 0.005 **Check err (z)** 0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	319,992.612	[illegible]	87.496

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)					0.005			



Category Detail

Survey data 452_LeopardstownRd_RevA.Model

Check data 923 Goatstown.Model

Pass criteria

Minimum pass rate	Plan (absolute) Max error	Plan (absolute) Achieved	Height (absolute Max error	Height (absolute Achieved	Plan (relative) Max error	Plan (relative) Achieved	Height (relative) Max error	Height (relative) Achieved
67%	0.025M	74.5%	0.025M	78.4%	0.025M	78.4%	0.025M	98.0%
95%	0.050M	88.2%	0.050M	100.0%	0.050M	90.2%	0.050M	100.0%
99%	0.100M	96.1%	0.100M	100.0%	0.100M	100.0%	0.100M	100.0%

C.O.G. Coordinates

	E/X	N/Y	Ht/Z
Survey	319,977.849	226,150.898	87.527
Check	319,977.854	226,150.886	87.506

(Relative accuracies are based on distances to the contract and check survey's respective centres of gravity, absolute accuracies are based on distances to the common underlying grid)

No 10 Name HYDT Check err (plan) 0.020 Check err (z) 0.001

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,030.019	226,165.375	86.348
Check (abs)	320,030.060	226,165.383	86.329
Survey (rel)	52.170	14.477	-1.179
Check (rel)	52.206	14.497	-1.177

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.042				0.041			
Plan (Corr)	0.022	0	0	0	0.021	0	0	0
Z (Raw)	0.019				0.002			
Z (Corr)	0.018	0	0	0	0.001	0	0	0

No 9 Name HYDT

Coordinates	E/X
Survey (abs)	320,029.908
Check (abs)	320,029.932
Survey (rel)	52.059
Check (rel)	52.078

No 13 Name HYDT

No 31 Name KC Check err (plan) 0.007 Check err (z) -0.005

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,028.429	226,181.570	86.135
Check (abs)	320,028.438	226,181.557	86.113
Survey (rel)	50.580	30.672	-1.391
Check (rel)	50.584	30.671	-1.393

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.016				0.004			
Plan (Corr)	0.009	0	0	0	0.000	0	0	0
Z (Raw)	0.022				0.002			
Z (Corr)	0.017	0	0	0	0.000	0	0	0

No 30 Name KC Check err (plan) 0.026 Check err (z) 0.002

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,022.988	226,189.588	85.866
Check (abs)	320,022.941	226,189.658	85.838
Survey (rel)	45.139	38.690	-1.660
Check (rel)	45.087	38.772	-1.668

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.084				0.097			
Plan (Corr)	0.058	X	X	0	0.071	X	X	0
Z (Raw)	0.028				0.007			
Z (Corr)	0.027	X	0	0	0.006	0	0	0

No 38 Name KC Check err (plan) 0.016 Check err (z) -0.001

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,035.794	226,188.527	85.976
Check (abs)	320,035.797	226,188.523	85.938
Survey (rel)	57.945	37.629	-1.550
Check (rel)	57.943	37.637	-1.568

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.005				0.008			
Plan (Corr)	0.000	0	0	0	0.000	0	0	0
Z (Raw)	0.038				0.017			
Z (Corr)	0.037	X	0	0	0.016	0	0	0

No 28 Name KC Check err (plan) 0.026 Check err (z) 0.000

Coordinates	E/X	N/Y	Ht/Z
Survey (abs)	320,024.460	226,178.516	86.211
Check (abs)	320,024.446	226,178.537	86.185
Survey (rel)	46.611	27.618	-1.316
Check (rel)	46.592	27.651	-1.321

Errors	Absolute	67	95	99	Relative	67	95	99
Plan (Raw)	0.025				0.038			
Plan (Corr)	0.000	0	0	0	0.012	0	0	0
Z (Raw)	0.026				0.006			
Z (Corr)	0.026	X	0	0	0.006	0	0	0

In addition to the report, the delivery of the check survey should include check models, and all survey and traverse observations, as per the contract survey.

If the check survey includes a visual inspection on sight for missing detail, the results of this inspection should also be included with the check report.

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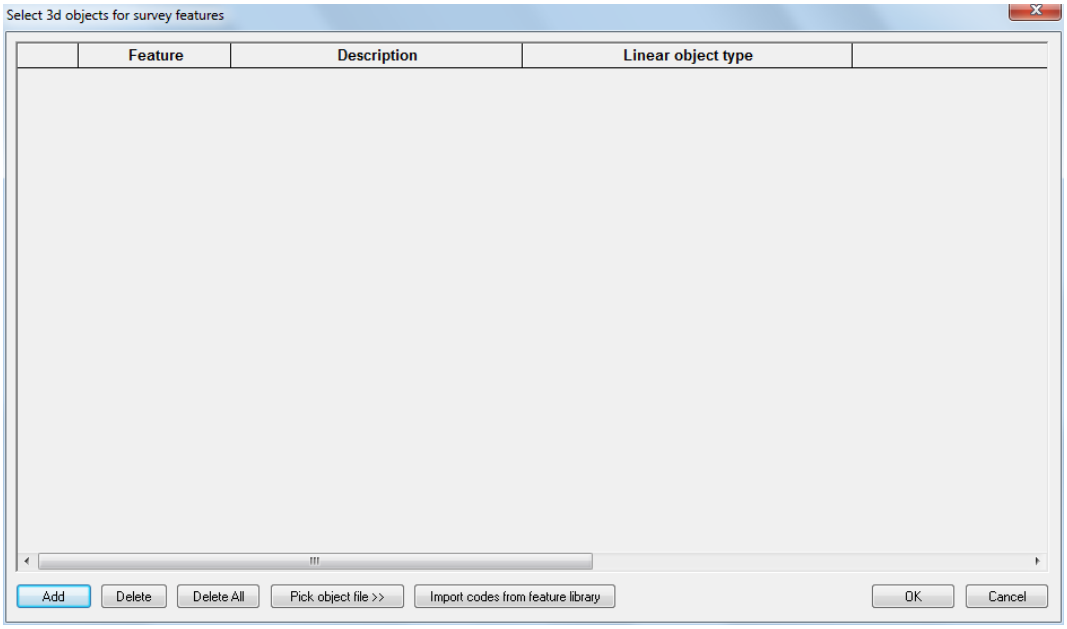
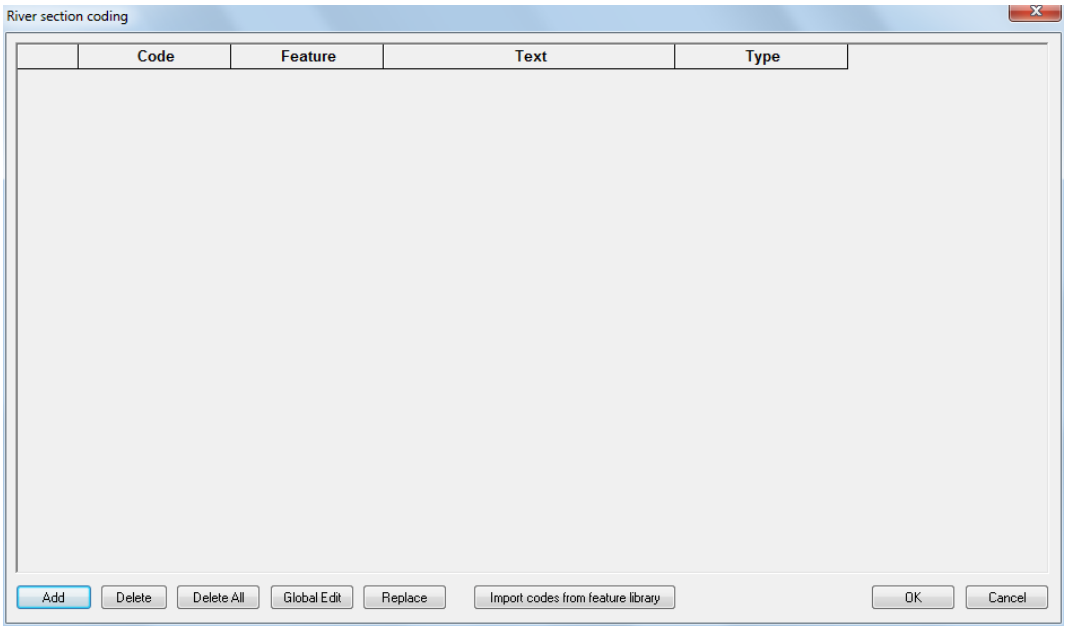
31.3.3.4 Edit Feature to 3D Model Mapping (Project Edit Menu)

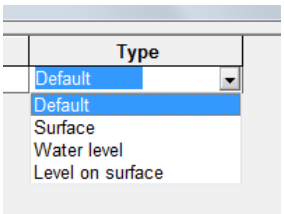
This option allows the user to map specific features to object for use within the 3D Viewer.



31.3.3.5 Edit Section Coding (Project Edit Menu)

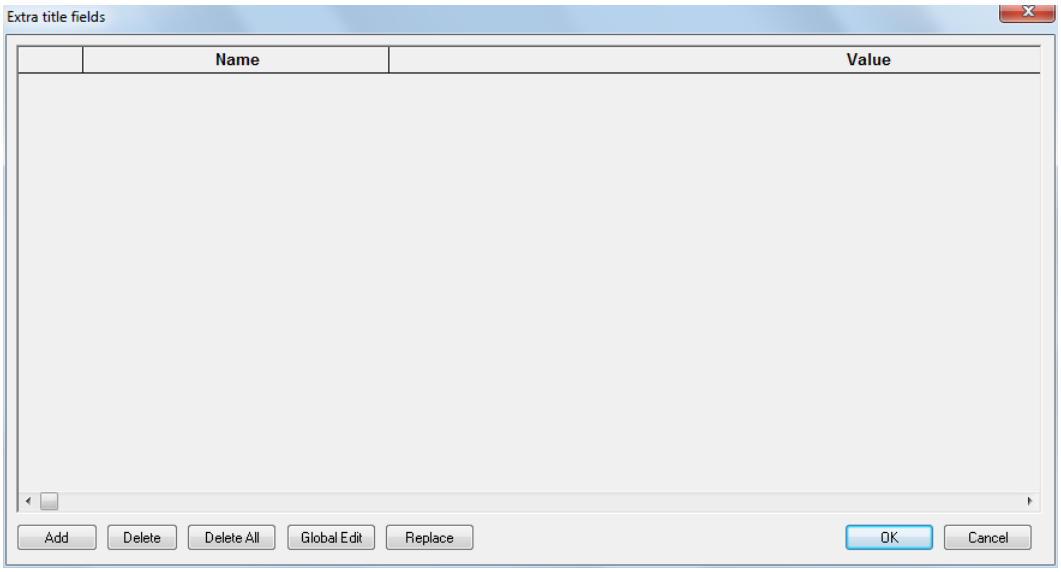
This option allows the user to map section codes picked up in the field to a feature and to dictate whether the code is a surface point or water level.





31.3.3.6 Edit Extra Title Fields (Project Edit Menu)

This options allows the user to enter additional attribute information specific to the model / project which will be used to update the attributes set up in a sheet layout or inserted within a model. For example, Drawing Revision No. or Surveyors Name.



31.3.3.7 Compare Test Results (Project Edit Menu)

This option is used internally by Atlas for large scale regression testing, where all the results are collated and any differences between versions can be explored in detail. It is not typically of use to end users.

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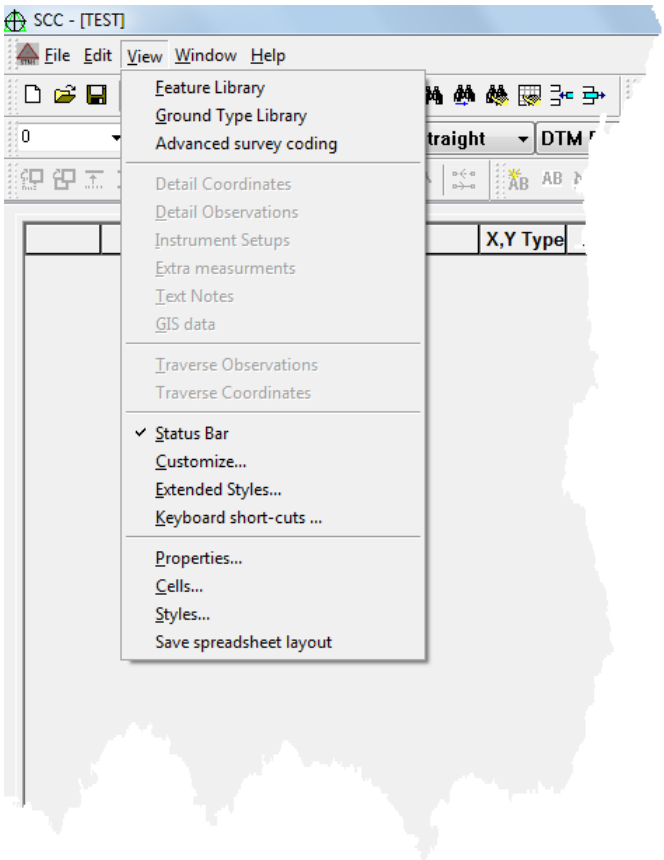
31.3.4 Project View Menu



31.3.4.1 Feature Library (Project View menu)

Feature Library

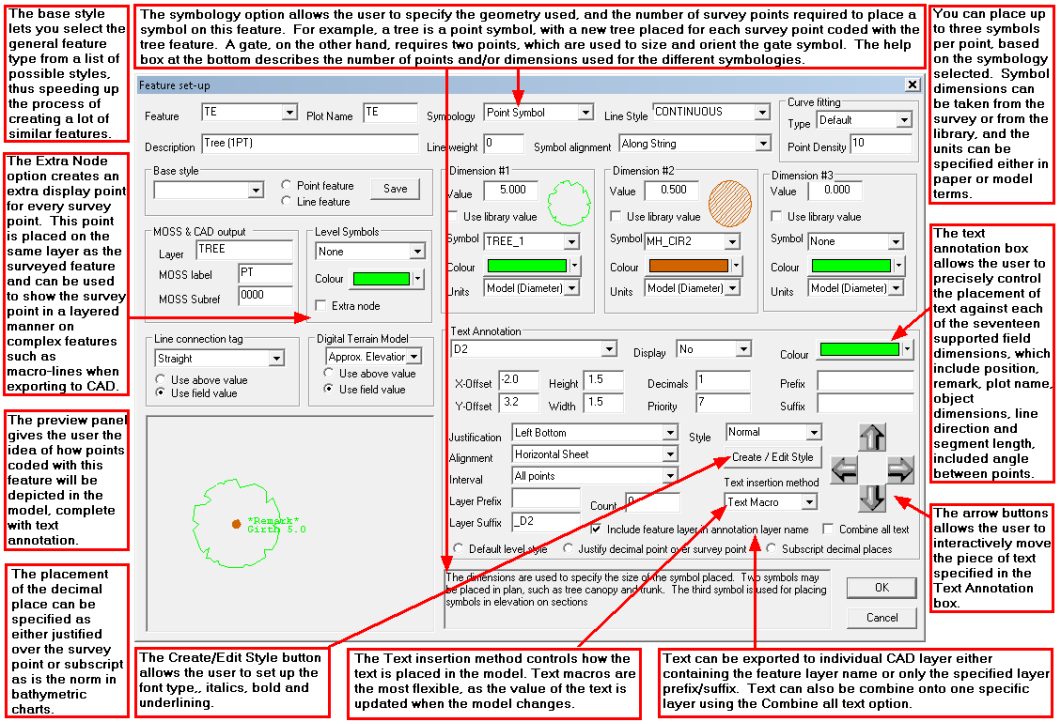
The Feature Library controls most of the translation required when converting surveys into models, AutoCAD drawings, and MX models. It comprises of a list of feature names, each of which has a set of user defined characteristics. Each project in SCC has it's own feature library. When a model is created from any dataset in the project a copy of the feature library will be made and saved as part of the model. The 'Feature' field indexes this spreadsheet.

Feature Wizard (Project Edit Menu)

The feature library contains a very large number of fields, approximately four hundred per feature, that allow for a very fine degree of control on how any given feature is drawn and annotated. While this allows for a very high degree of field to finish automation, it can be quite daunting to edit and maintain.

The solution to this dilemma is the 'Feature Wizard', which can be accessed using **'EDIT > Feature Wizard'** from the feature library spreadsheet.

The SCC feature wizard is an automation tool that helps you generate and maintain feature libraries. This option is available from the edit menu in the feature library and has the following features;



All of the fields for a given feature are displayed in a single dialog, with a preview panel that shows a sample string or point for that feature, including annotation and symbology. This preview panel is updated when any field is changed.

Annotators may be positioned interactively with arrow buttons. To turn an annotator on or off, first select the annotator, e.g. Level, in the text annotation box. Then set the display value to 'Yes' or 'No' to turn the annotator on or off respectively. Having done this modify the alignment, justification, and position as required. Prefixes and suffixes may be also be added, for example a cover level may be prefixed with CL, and dimensions may be prefixed with the dimension names such as spread, girth, radius etc…

Feature styles may be saved and re-used. For example, if you set up a manhole with a circular symbol, and the plot name and cover level to the left of the symbol, you might save this as a man hole feature style. If you then wish to set-up a similarly drawn feature, such as a gas valve, you simply re-select the man hole feature style, and the gas valve will inherit the man holes symbology and annotation settings. The feature style basically includes everything in the feature record except for the feature name, description, plot name, layer, and moss label. Feature styles are designed to speed up the feature editing process, and improve the consistency among similar feature types.

The feature wizard also allows you to create and edit text styles, which consist of font selection and display attributes, such as italicization, and underlining. Note that while SCC can use all Windows fonts, many CAD packages are restricted to using TrueType fonts, which are shown with a 'TT' or 'O' prefix in the font attributes dialog. For this reason, we recommend you restrict the fonts you use to commonly use true type fonts.

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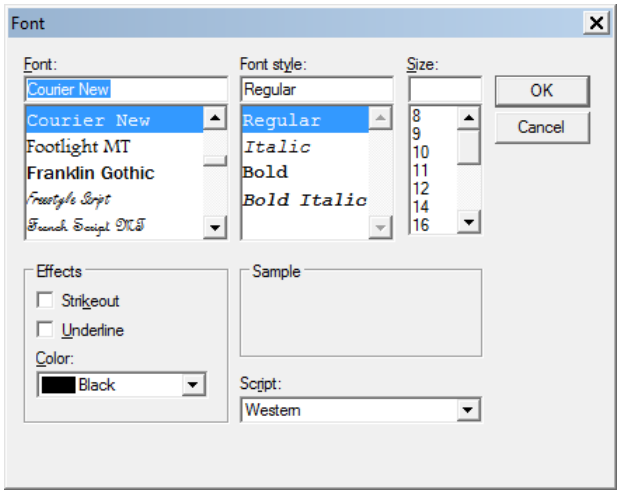
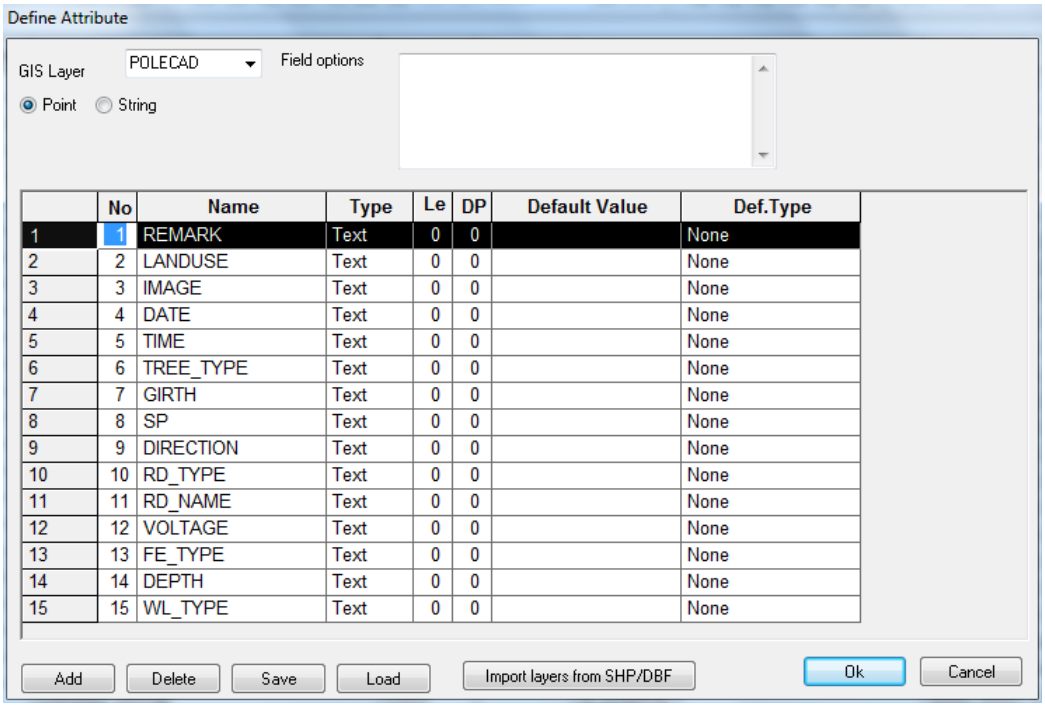


GIS Data Fields (Project Edit Menu)

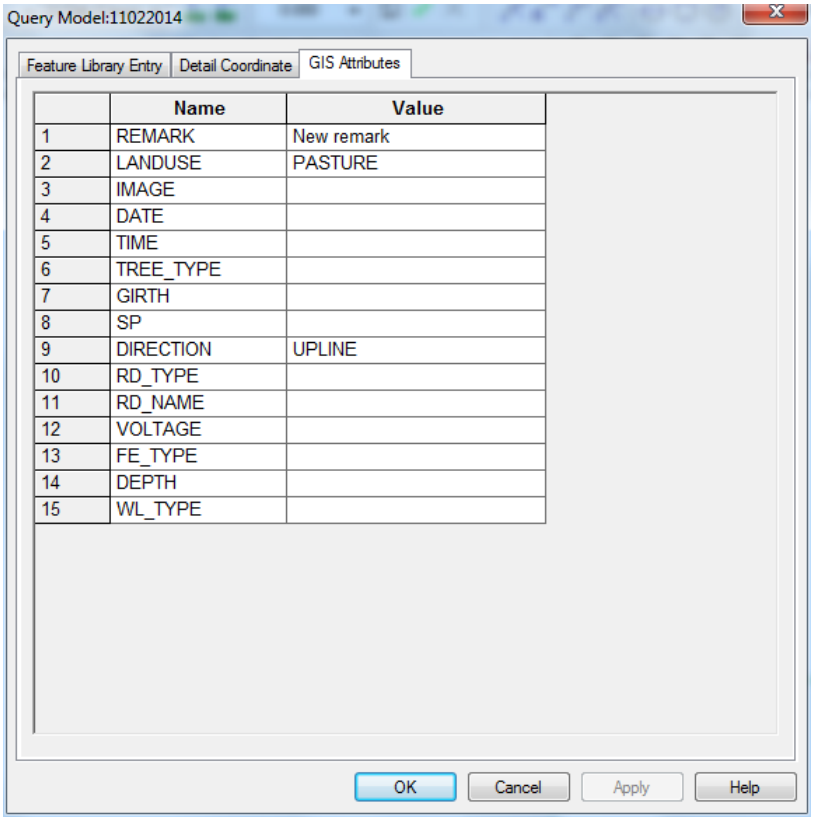
SCC allows for an arbitrary number of GIS attributes to be stored against survey observations and/or model points.



	No	Name	Type	Le	DP	Default Value	Def.Type
1	1	REMARK	Text	0	0		None
2	2	LANDUSE	Text	0	0		None
3	3	IMAGE	Text	0	0		None
4	4	DATE	Text	0	0		None
5	5	TIME	Text	0	0		None
6	6	TREE_TYPE	Text	0	0		None
7	7	GIRTH	Text	0	0		None
8	8	SP	Text	0	0		None
9	9	DIRECTION	Text	0	0		None
10	10	RD_TYPE	Text	0	0		None
11	11	RD_NAME	Text	0	0		None
12	12	VOLTAGE	Text	0	0		None
13	13	FE_TYPE	Text	0	0		None
14	14	DEPTH	Text	0	0		None
15	15	WL_TYPE	Text	0	0		None

This operates as follows:

- GIS layers can be specified in the feature library and specific GIS data fields can be entered within the Define attribute dialog. Therefore, any number of fields can be added against any given GIS layers.
- GIS layers can be imported form ESRI shape files.
- Models including GIS data can be exported to ESRI shape files with both vector and database information.
- GIS attribute information can be view within the model from **'EDIT** > **Query & Edit points** > **GIS Attribute tab'**. This works with any logger that can use advanced coding where there is a new control code for GIS attributes in this table.

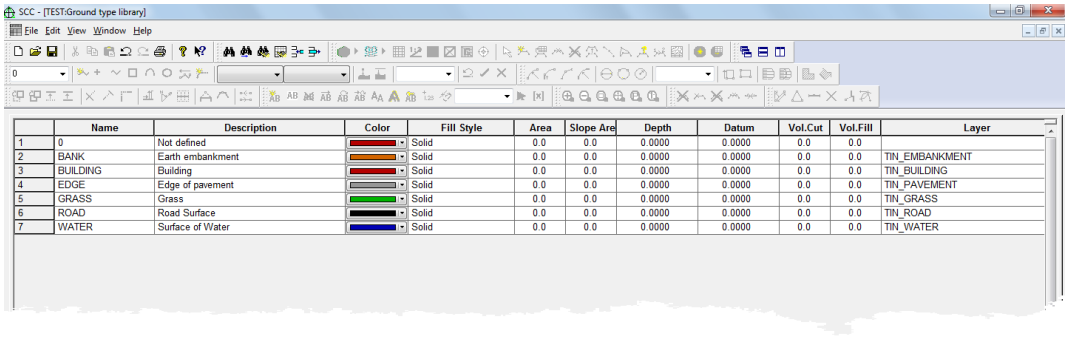


	Name	Value
1	REMARK	New remark
2	LANDUSE	PASTURE
3	IMAGE	
4	DATE	
5	TIME	
6	TREE_TYPE	
7	GIRTH	
8	SP	
9	DIRECTION	UPLINE
10	RD_TYPE	
11	RD_NAME	
12	VOLTAGE	
13	FE_TYPE	
14	DEPTH	
15	WL_TYPE	

31.3.4.2 Ground Type Library (Project View Menu)

Accessible from the Project window and the Model window.

The ground type or land use library contains information on the textures applied when using the 3D viewer.



	Name	Description	Color	Fill Style	Area	Slope Are	Depth	Datum	Vol.Cut	Vol.Fill	Layer
1	0	Not defined		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	
2	BANK	Earth embankment		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_EMBANKMENT
3	BUILDING	Building		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_BUILDING
4	EDGE	Edge of pavement		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_PAVEMENT
5	GRASS	Grass		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_GRASS
6	ROAD	Road Surface		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_ROAD
7	WATER	Surface of Water		Solid	0.0	0.0	0.0000	0.0000	0.0	0.0	TIN_WATER

Name

This field contains the land use name.

Description

This field contains a free form description of the current Land Use type.

Colour

This field contains the colour of the current land use.

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Fill Style

This field contains the style of the texture of the current land use.

This field has 7 options;

Backward Diagonal	Cross Hatch
Diagonal Hatch	Forward Diagonal
Horizontal	Solid
Vertical	

Area

This is the plan area under the current ground type. This field is populated after selecting the 'Areas by Ground Type' option

Slope Area

This is the slope area under the current ground type. This field is populated after selecting the 'Areas by Ground Type' option

Layer

This field contains the layer on which the current ground type will be stored.

Texture

This field contains the path to the bitmap image, from which the texture is obtained.

Triangles

Display

This field has two options; No or Yes

Model

This field has two options; No or Yes

Contour

This field has two options; No or Yes

Apply

This field has two options; No or Yes

31.3.4.3 Advanced Survey Coding (Project View Menu)

Enhanced Coding

SCC supports SDRmap style enhanced coding extensions in the Leica 1200, Leica GSI 8/16, Trimble/Geodimeter UDS, and GPS X,Y,Z interfaces. These coding extensions provide the following advantages;

- A single, user defined, field code may be used to control multiple SCC input fields

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including Feature code, tag code, DTM code, string number, and dimensions. For example, KB might represent a kerb, KBC the start of a curve on a kerb, and KBS the end of the curve on the kerb. Similarly, KBC1 and KB1 might be used to represent points on the first kerb string, whereas KBC2 and KB2 might be used to represent points on the second kerb string, thus allowing two kerb strings to be surveyed simultaneously without using a separate instrument field for string numbering.

- Field codes may be mapped onto features, as described above, or onto control functions that do not change the current string details. For example, a code of END or 999 might be used to terminate the current string.
- Multiple field codes may be used in a single instrument field. This can be used to represent junction points between strings. For example, the code HE,GA,WL could be used to signify the common junction point between a hedge, gate, and wall.
- This interface can be used in conjunction with the LandScape coding interface to allow automatic creation of string junctions to be created. For example, the four observations coded HE, GA, HE, HE would generate six points in SCC, due to the implicit junction between the hedge and gate. This is provided as mechanism for existing users using LandScape coding to maintain their existing practices, and is not recommended for new users.
- The interface also supports parallel features and tape measurements.

The enhanced coding extensions operates by providing an extra table, stored in the project file, that maps field codes onto feature codes, tag codes, DTM codes, and string numbers. It can be accessed in the project menu via 'Import > View SDR translation table'. This table is made up of the following fields;

Field	Description	
Code	The field code typed into the total station or logger	
Feature	The SCC feature created by this code	
Description	A description of this field code	
Type	PC	A point code; This code is used to directly map a field code onto an SCC feature code, tag code and dtm code. For example, KBC might be used to generate a feature KB that lies on a curve. A point is generated in the detail observation file for each point code in the input file. Thus multiple point codes for a single observation may be used to generate duplicate points, such as the junction between a fence and a gate.
	CC	A control code; This code is used to perform an operation such as starting or ending a string, or changing the tag or dtm code. It does not generate an extra point in the detail observation file. An example of a control code is END, which may be used to end the current string.
	PCP	A point code with parameter. This is a point code that includes extra dimensions, which are assumed to be in the subsequent codes. For example, PTR 5.4 might be used to indicate a tree with canopy diameter of 5.4. Up to three codes may be used for values stored in D1, D2 and D3 in SCC.
	CCP	A control code with parameter. This is a control code that requires a parameter in the following field, for example JP 54, might be used to join this string back to point 54.
Tag	SCC Tag Code	
Master	Controls whether the tag code for this code is used	

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DTM	SCC DTM Code	
Master	Controls whether the dtm code for this code is used	
Str	String number for this code	
SDR Control	This is used to perform operations that are not directly catered for using tag codes	
	It can be one of the following:	
	None	Not used
	Start	Start a new string for the current feature
	Join to Point	Join back to a specific point. The next code is used for the point number
	Close	Close the current string back with a link
	Close curve	Close the current string on a curve
	Close rect	Close the current string to form a rectangle
	Rect	Start a two point rectangle, the next code gives the width
	Feature offset	Perform one or more right angle offsets from the current string, similar to tape measurement. Each subsequent numeric code is used to generate a right angle offset point from the pervious two points
	Copy Parallel	The three subsequent codes are used for horizontal offset, vertical offset, and new string name. If only one or two subsequent codes are provided, the new string will be given the name as the current string, i.e. for the second side of a wall or ditch
	Dim 1	Dimension 1
	Dim 2	Dimension 2
	Dim 3	Dimension 3
	Dim 1 & 2	Dimension 1 & 2
	Dim 1,2 & 3	Dimension 1, 2 & 3
	Par Offs L/R	Parallel Offset Left/Right
	Par Offs F/B	Parallel Offset Forward/Back
	LOS Offs L/R	Line Of Sight Offset Left/Right
	LOS Offs F/B	Line Of Sight Offset Forward/Back
	Remark	Remark
	Z Offset	Z Offset
	Tag	Tag Code

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	DTM	DTM
	String No.	String No.
	Copy Feature	Feature which is being copied parallel
	Copy L/R	Value which to copy feature Left/Right
	Copy U/D	Value which to copy feature Up/Down
	Tape L/R	Tape Offset Left/Right
	Tape F/B	Tape Offset Forward/Back
	Multi Remarks	More than 1 remark entry
	GIS Attributes	GIS Attributes which are linked to GIS data fields and GIS Attribute tab within the models Query & Edit Tab
PntInFtr	This field controls how an embedded number in the code is treated. This can be one of three values;	
	Ignore	The number is not used
	Point	The number represents the observations point number
	String	The number represents the observations string number, for example KB05 would indicate the fifth KB string
	DIM	The number represents the D1 value for observation

See Also

Leica (1100/1200/Wildsoft/LisCADD)

Leica GSI 8/16

Trimble /Geodimeter UDS

GPS X,Y,Z

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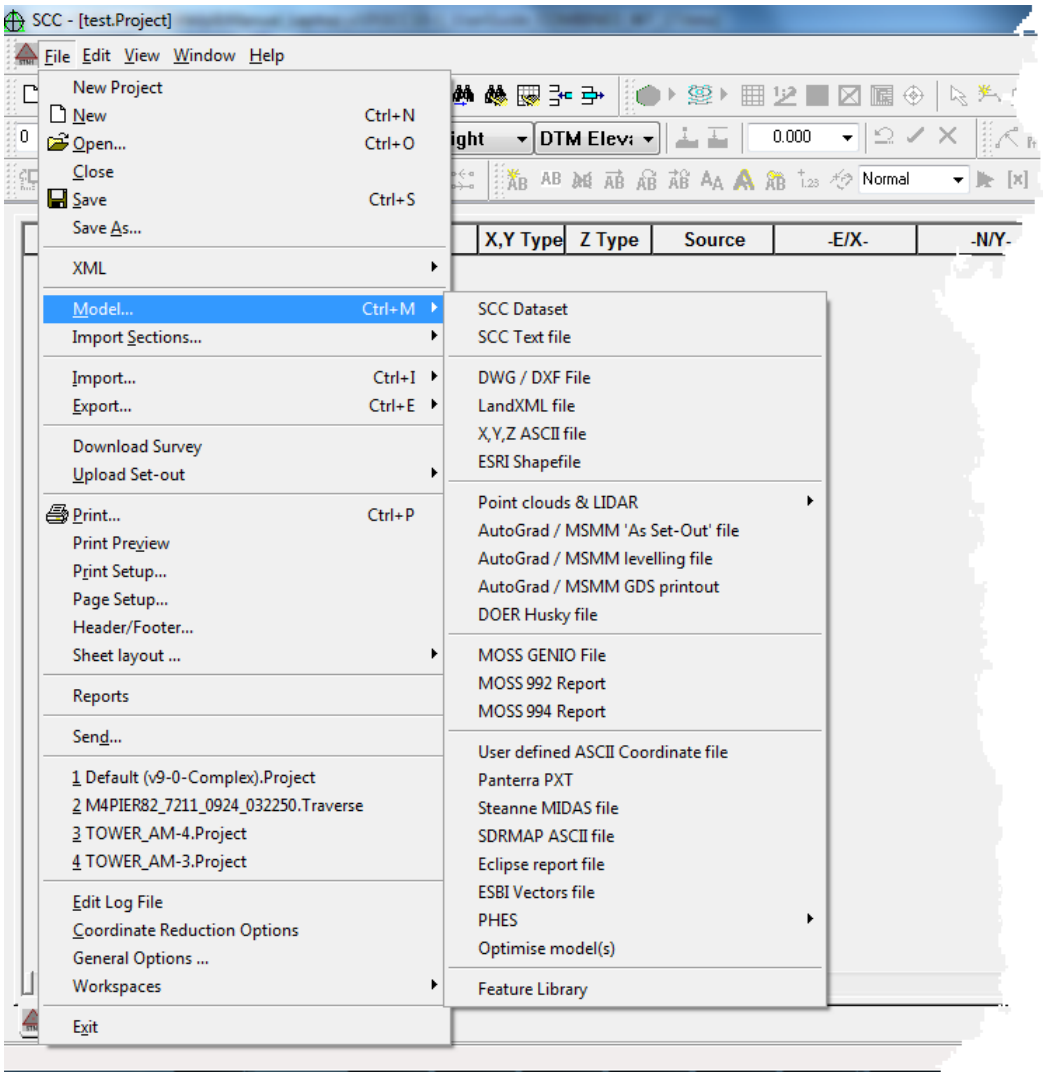
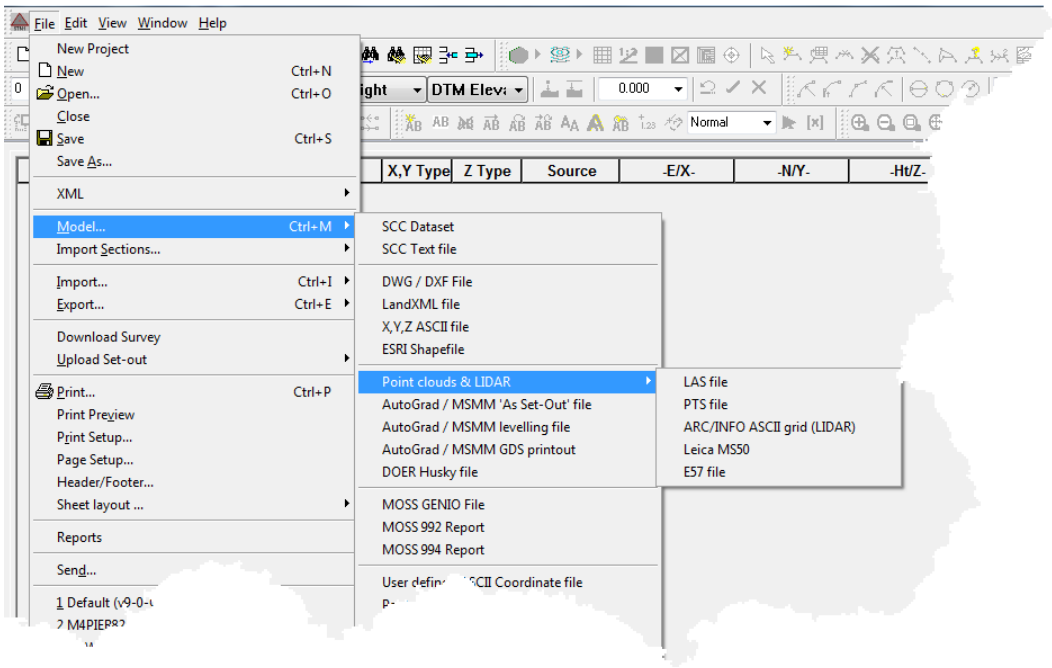
31.3.5 Project Model Menu



31.3.5.1 Point clouds & LIDAR (Project Model Menu)



LAS File

The LAS file format is a public file format for the interchange of 3-dimensional point cloud data between data users and developed primarily for exchange of lidar point cloud data. SCC supports the importing of LAS format data, with options to map colour and intensity to features and layers.

PTS File

PTS is a Leica proprietary format and does not retain any original scan or registration information. The PTS format is often used when exporting final registered point clouds that have been unified in Cyclone. SCC supports the importing of PTS format data, with options to map colour and intensity to features and layers.

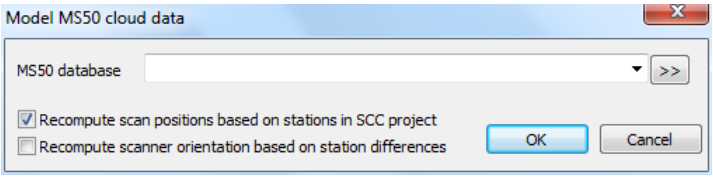
ARC/INFO ASCII grid (LIDAR)

ArcInfo Grid is a raster file format developed by ESRI to contain information about geographic space in a grid. SCC supports the importing of ARC/INFO ASCII grid files.

Leica MS50

SCC supports the importing of data directly from Leica MS50. On import the user has the following options:

- Recompute scan position based on stations in SCC project
- Recompute scanner orientation based on station differences



E57 File

The ASTM E57 Committee on 3D Imaging Systems has developed an open standard for 3D imaging system data exchange. The E57 File Format for 3D Imaging Data Exchange (E57 format hereafter) is capable of storing point cloud data from laser scanners and other 3D imaging systems, as well as associated 2D imagery and core meta-data. SCC supports the modelling of E57 format files.

31.4 Traverse

The **traverse** document is used to store observations relating to traverse and network adjustments. Within the Traverse document you can reduce and edit setups, apply relevant corrections and perform adjustments

31.4.1 Introduction To Traversing

A traverse is the most common method of establishing co-ordinated control for a survey. Traversing is flexible and well suited to providing control quickly over large areas. It is widely used because of operational convenience and speed. It is particularly suited to modern Total Stations.

However, the traverse network is simple and provides little in the way of structural strength to the geometry. For this reason, other measurements such as "cross-bracing" or GPS observations should be included in all control traversing. Low order work can dispense with the extra work and attendant costs. The traverse provides a framework within which all detail survey points will be co-ordinated. The accuracy of the entire survey is dependent on the quality of the control traverse.

A traverse connects chains of straight lines with measured lengths and angles. A traverse is one means of providing 2 or 3 Dimensional control in which position is determined by a combination of angle and distance measurements between successive lines joining control stations. SCC allows closed and open traversing with several methods of traverse adjustment computed. The calculations will generate co-ordinates based on the error adjustment selected and it is the surveyor's responsibility to assess the accuracy of the calculated co-ordinates.

In order to compute and adjust a traverse, a method of adjustment must be selected. The adjustment options are either;

Bowditch Adjustment

The Bowditch adjustment, or compass rule adjustment, is the preferred traditional method for adjusting a traverse. It operates by calculating an angular and length misclosure for the traverse and redistributing this misclosure evenly among the traverse legs. The disadvantages of this method are that cross bracing is not catered for, and that the traverse must be surveyed in one of five supported configurations.

Variations of Co-ordinates (Least Squares Adjustment)

All survey measurement is subject to error. In the establishment of a 2D or 3D control network, the basic measurements are angles and distances. It is very important that in practice, more data is observed than is strictly necessary. This is in order to provide checks on errors and enable a more statistically viable 'adjustment' and strength analysis to be carried out. The additional or extra data observed is referred to as 'redundant' measurements and is necessary to strengthen the overall geometry of the control network.

Modern instrumentation combined with professional skills enables the capture of the field data to almost perfect precision and very high accuracy. Therefore, while it is still necessary to adjust the data to produce a geometrically correct figure, only those methods of adjustment which produce minimal changes in the observations should be used. Least Squares adjustment is such a method as it has the advantages of affecting minimal

changes in the data, whilst still providing a statistically viable method that is universally applicable to all types of network control.

In surveying literature, the principle of Least Squares is shown derived for observations of normal distribution and is usually expressed as **'the most probable value or best linear unbiased estimate of an observation is the one for which the sum of the squares of the weighted residuals is a minimum'.**

SCC uses a 'variation of co-ordinates' method of adjustment, which is a least squares method using observation equations. There are many reasons for using this method;

1. The technique can be applied to all types of network, that is, triangulation, trilateration and traversing.
2. It affords a complete strength analysis of the final 'adjusted' network.
3. The adjustment allows weights to be assigned to each individual part of every observation. This allows the surveyor to control the effect that any given observation or set of observations has on the adjustment, based on external factors such as weather, calibration of instrument etc.

The procedure involved in the application of the 'variation of co-ordinates' method to network adjustment is as follows;

1. To obtain provisional co-ordinates for each station/control point in the network
2. Using these co-ordinates, included angles and distances of the observed data are then computed.
3. Formulate observation equations for each and every observation.
4. The corrections are applied and the adjusted co-ordinates now replace the provisional co-ordinates.

The adjustment employed by SCC independently adjusts X,Y using a 2d adjustment and levels using a 1D adjustment, such that external height difference observations from levelling can be used in conjunction with total station observations.

Error Ellipses

The error ellipse may be defined as the 'confidence limits of a point', as it indicates the standard error in the position of the adjusted control point in the network. The bearing of the semi-major axis is also significant for interpretation purposes in that, if normal to the direction to the fixed origin of the network, it implies predominant angular error. If the bearing of the semi-major axis is on the same bearing to the fixed origin the predominant error is linear. Therefore, the larger the error ellipse, the greater indication of error in the measurements.

Advantages of Variation of Coordinates Adjustment in comparison to Bowditch Adjustment

The variation of co-ordinates adjustment has a number of advantages over the Bowditch adjustment method. These are as follows;

1. The adjustment used is a full network adjustment rather than a simple traverse adjustment. This allows for a far stronger overall geometry including cross bracing and shots to external known stations. It also allows a wider range of measurement types including angle only and fixed bearing observations, and the mixing of direct observations with resections, intersections, and free stations.
2. The adjustment may be used to simultaneously adjust a number of connected traverses.
3. The adjustment provides a set of observation residuals as part of its output. These residuals show how much any given observation would have to be changed as part of the adjustment. Large residuals indicate an error in the survey and may be used to

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pinpoint that error.

4. The adjustment allows weights to be assigned to each individual part of every observation. This allows the surveyor to control the effect that any given observation or set of observations has on the adjustment, based on external factors such as weather, calibration of instrumentation etc.

5. The adjustment has superior survey error detection capabilities.

6. The adjustment can create provisional coordinates using mixed angles and distances, angle only resections, distance only resections, and angle only intersections, and works well with most ad hoc survey methods.

7. Support for fixing of coordinates in plan, elevation or both

8. Support for weighting and fixing for all or part of any observation

Equivalent Linear Accuracy

When adjusting by least squares the traverse report includes an equivalent linear accuracy figure, to reduce the need for bowditch adjustments. This value is computed by comparing the average observed distances on each leg with the computed join distances for each leg, summing the leg lengths and length differences, and computing the ratio from the result. While this is a comparable figure to a Bowditch linear accuracy, it has the following notable differences;

1. The linear accuracy reported will typically be less than the Bowditch accuracy for the same data as it is not affected by compensating errors, for example, a distance that is too short followed by a distance that is too long in a Bowditch adjustment will tend to cancel each other out. This will not be the case with the above computation.

2. The linear accuracy on a Bowditch adjustment is given as the total traverse length divided by the distance of the provisional value of the closing station to the known value of the closing station. The above figure assumes that each leg is a 'mini-traverse' in itself with known coordinates for stations at either end of the leg. This means that all observations, including cross braces and spur stations, are included in the computation.

3. The equivalent linear accuracy figure will not be valid for networks or traverses that do not contain either loops, or links between known stations. For open traverses, the value quoted will be artificially high.

The net effect of the above is that if a client specifies a Bowditch linear accuracy, a Bowditch adjustment must be carried out. In other cases, it may be advisable to notify the client that the linear accuracy has been computed as part of a least squares adjustment.

The equivalent linear accuracy computations also reports traverse leg types. These can be one of fixed, free, or closed, where a fixed leg is based on observations between two fixed stations, a free leg is a leg that is part of a run that is fixed at one end only, and a closed leg is a leg that lies on a loop, or on a run between fixed stations. The equivalent linear accuracy figures are now reported for all observations, all except free legs, and closed legs only. The computation based only on closed legs gives the best equivalent to a Bowditch or compass rule style traverse adjustment.

Chi squared test

The least squares adjustment also includes a Chi squared test and standardised residuals in the report. The Chi squared test is a 'goodness of fit' test based on the computed reference variance. An adjustment may fail the Chi squared test where large standardised residuals indicate that the computed model is not in good agreement with the observations. SCC computes the Chi squared test at a 95% confidence level, such that a network may fail the test if the result does not fall within the 5% to 95% confidence region. Failure at the high end of the confidence interval can be indicative of an error in the computed model, e.g. the residuals were significantly higher than the estimated standard errors. Failure at the low end of the confidence interval can be indicative of an error in the

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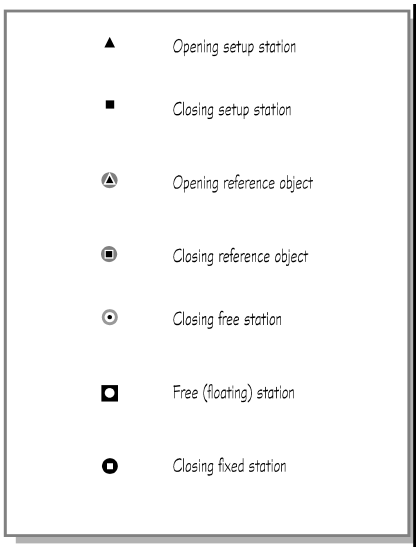
stochastic model, e.g. the residuals were significantly lower or not in good agreement than the estimated standard errors. Note that passing the Chi squared merely indicates that the residuals tend to agree with the estimated standard errors, and should be used in conjunction with reviewing the network geometry, observation residuals, and error ellipses.

No Adjustment/Use Provisional Co-ordinates

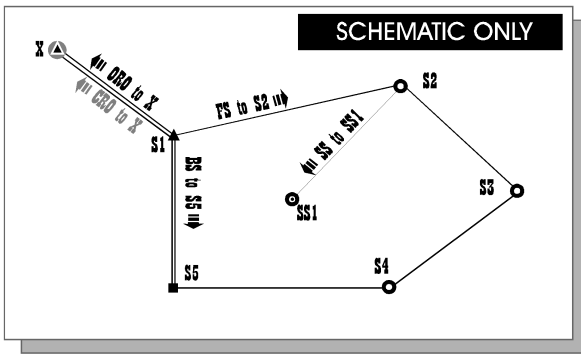
Alternatively no adjustment can be selected and SCC will compute the provisional co-ordinates of the traverse stations and use them for further processing if required.

The accuracy of the traverse is governed largely by the observation and measurement techniques applied and by the type of equipment used.

The following configurations are the configurations supported by the Bowditch/Compass Rule adjustment.



Explanation of Traverse Codes



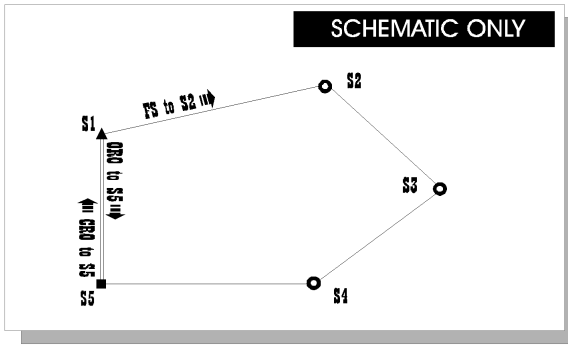
Traverse Reference Codes

ORO	Opening Reference Orientation
OBS	Opening Backsight
OFS	Opening Foresight
BS	Backsight
SS	Sideshot
FS	Foresight

CBS	Closing Backsight
CFS	Closing Foresight
CRO	Closing Reference Orientation

The above references are traverse activity codes. The instrument is set up at station S1, the opening reference orientation station X is observed and a backsight observation to S5 and a foresight observation to S2 are taken. Thus, the ORO station X is a special case of a backsight station of known orientation, which in this case is external to the traverse.

Each station, S2, S3, S4 and S5 are occupied and the back and foresight observations taken as usual, with the exception of station S2 which also includes the observations to a loose station SS1. In this case, station S1 is re-occupied for a second time to give an independent closing orientation (CRO) back on to station X.



The traverse above shows the opening ORO and traverse backsight is coincident. In this case the BS and is referred to as the ORO since the leg S1 to S5 has a known orientation. The other stations are observed as usual and the final set-up is on station S5 where the closing foresight to S1 is called the closing reference orientation (CRO).

In summary, a backsight of known orientation is the ORO and a foresight of known orientation is the CRO.

Case 1 - Loop traverse with external RO

Case 2 - Loop traverse with internal RO.

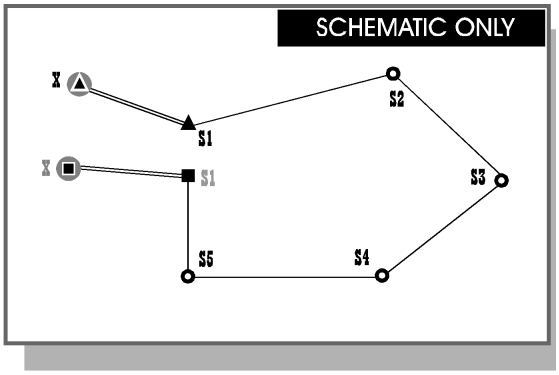
Case 3 - Link traverse.

Case 4 - Loop traverse with one fixed station.

Case 5 - Loop traverse with opening back sight

Case 6 - Open traverse (No adjustment)

31.4.1.1 Case 1 - Loop Traverse With External RO.



Double lines indicated above are separated for diagram purposes and are in fact the same

observed line.

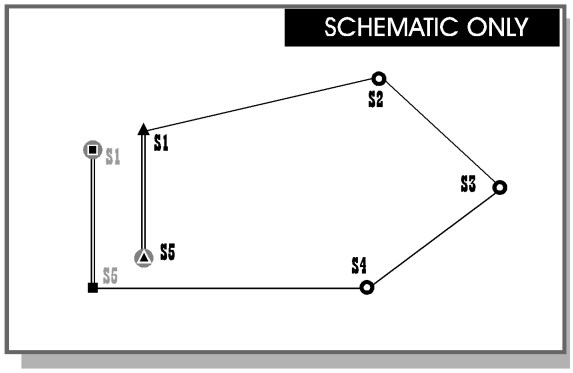
Set up the instrument at station S1 and observe the reference station, X recording the angles and distance, then observe station S2 recording the angles and distance. Move to station S2, observe the previous station (S1) and the forward station (S3). Repeat this for stations S3, S4 and S5. Finally occupy S1, observe S5, and station X as the closing orientation for the traverse. This provides the closing reference orientation.

Note: This closed loop traverse has an external reference station (X).

@ STN	To STN	T Code
S1	X	ORO
S1	S2	FS
S2	S1	BS
S2	S3	FS
:	:	:
:	:	:
S1	S5	BS
S1	X	CRO

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight
BS	Backsight
CRO	Closing Reference Orientation

31.4.1.2 Case 2 - Loop Traverse With Internal RO.



Double lines indicated above are separated for diagram purposes and are in fact the same observed line.

Set up the instrument at station S1 and observe the reference station S5 recording the angles and distance, then observe station S2 recording the angles and distance. Move to station S2, observe the previous station S1 and the forward station S3. Repeat this for stations S3 and S4. Finally occupy S5 and observe S4 and S1 as the closing orientation for the traverse.

Note: This closed loop traverse has an internal reference station S5.

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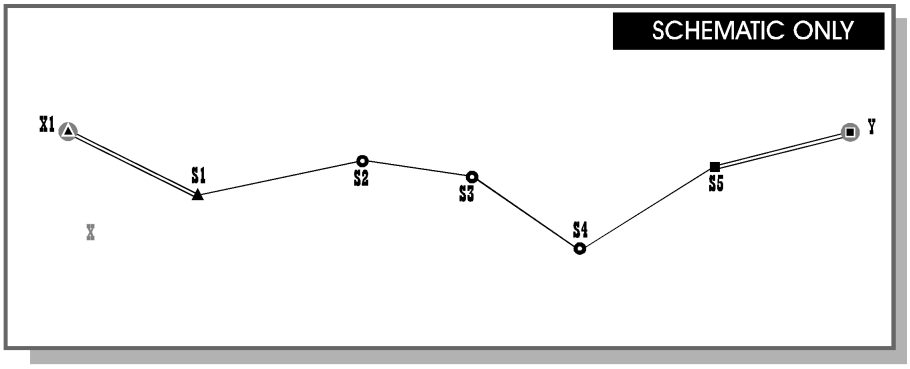
@ STN	To STN	T Code
S1	S5	ORO
S1	S2	FS
S2	S1	BS
S2	S3	FS
:	:	:
:	:	:
S5	S1	CRO

In this example, the traverse contains two fixed co-ordinated stations.

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight
BS	Backsight
CRO	Closing Reference Orientation

31.4.1.3 Case 3 - Link Traverse.



Double lines indicated above are separated for diagram purposes and are in fact the same observed line.

Set up the instrument at station S1 and observe the reference station X1, recording the angles and distance, then observe station S2 recording the angles and distance. Move to station S2, observe the previous station S1 and the forward station S3. Repeat this procedure at stations S3 and S4. Finally occupy S5 and observe S4 and Y as the closing orientation for the traverse.

@ STN	To STN	T Code
S1	X1	ORO
S1	S2	FS
S2	S1	BS
S2	S3	FS
:	:	:

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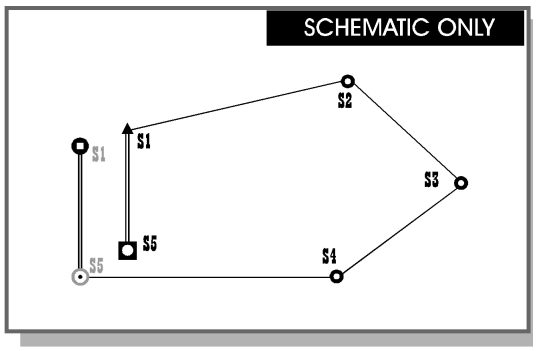
:	:	:
S5	S4	BS
S5	Y	CRO

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight
BS	Backsight
CRO	Closing Reference Orientation

31.4.1.4 Case 4 - Loop Traverse Wth One Fixed Station.



Double lines indicated above are separated for diagram purposes and are in fact the same observed line.

This traverse type only contains one fixed station S1 and an internal reference orientation S1 - S5.

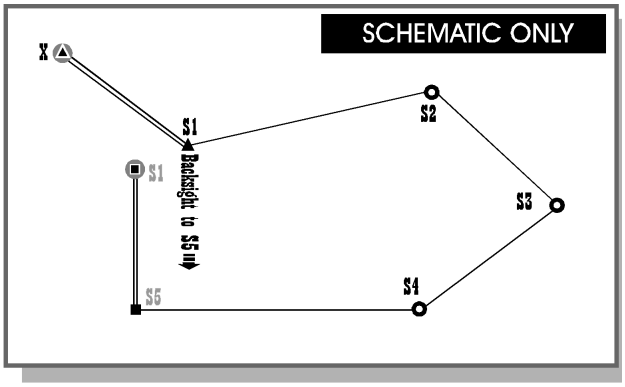
The first set-up is on station S1, observing S5 (Free) as the opening orientation of the traverse. Setup on S2, S3 and S4 and finally on S5, observing station S1 as the closing reference orientation for the traverse.

@ STN	To STN	T Code
S1	S5	ORO
S1	S2	FS
S2	S1	BS
S2	S3	FS
:	:	:
:	:	:
S5	S4	BS
S5	S1	CRO

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight

BS	Backsight
CRO	Closing Reference Orientation

31.4.1.5 Case 5 - Loop Traverse With Opening Back Sight



Double lines indicated above are separated for diagram purposes and are in fact the same observed line.

Setup on S1, the opening station set-up, and observe station X as the opening reference orientation, then observe station S5 for the opening backsight and finally S2 as the Fore Sight. Setup on S2, S3 and S4 and finally on S5, observing station S1 as the closing reference orientation (Fixed) for the traverse.

@ STN	To STN	T Code
S1	X	ORO
S1	S5	OBS
S1	S2	FS
S2	S1	BS
S2	S3	FS
:	:	:
:	:	:
S5	S4	BS
S5	S1	CRO

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight
BS	Backsight
CRO	Closing Reference Orientation

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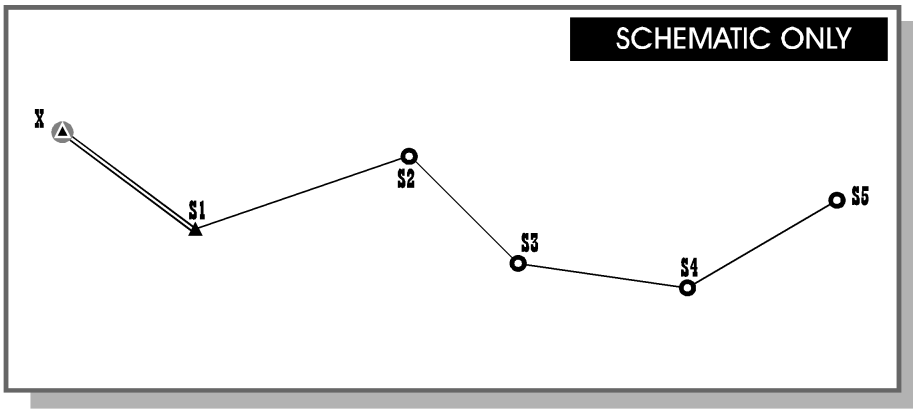
31.4.1.6 Case 6 - Open Traverse (No Adjustment)



Double lines indicated above are separated for diagram purposes and are in fact the same observed line.

Setup on station S1 and observe the opening reference station X recording the angles and distance. Observe station S2, recording the angles and distance. Setup on station S2, observe the previous station S1 and the forward station S3. Setup on S3, S4 and S5 and repeat this procedure.

@ STN	To STN	T Code
S1	X	ORO
S1	S2	FS
S2	S1	BS
:	:	:
:	:	:
S4	S3	BS
S4	S5Y	FS (End)

TCode	Travese Code
ORO	Opening Reference Orientation
FS	Foresight
BS	Backsight
CRO	Closing Reference Orientation

31.4.2 Traverse Co-ordinates

31.4.2.1 Traverse Co-ordinates (View Menu)

The traverse co-ordinate spreadsheet contains a list of provisional co-ordinates, adjusted co-ordinates, and adjustments applied for every station in the traverse. The traverse co-ordinates spreadsheet is stored as part of the traverse file.

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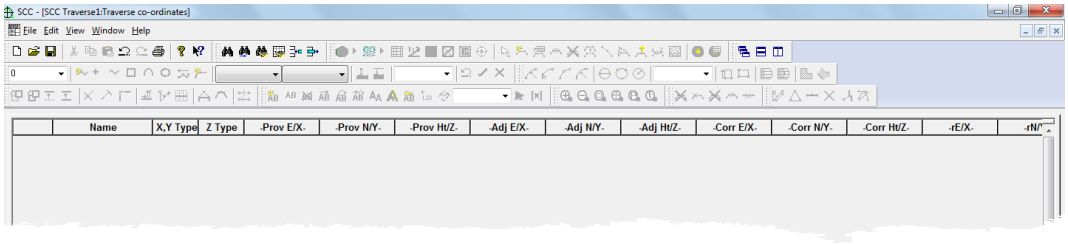

The traverse co-ordinate spreadsheet contains the following fields;

Name

This field contains the name of the Control Co-ordinate being edited. This will be the station name entered or co-ordinate name from the datalogger.

Code

This field specifies the method by which this point on the traverse are computed.

-Prov E/X-

This field contains the provisional Easting or X co-ordinate for the current point in the file.

-Prov N/Y-

This field contains the provisional Northing or Y co-ordinate for the current point in the file.

-Prov Ht/Z-

This field contains the provisional Level or Z co-ordinate for the current point in the file.

-Adj E/X-

This field contains the adjusted Easting or X co-ordinate for the current point in the file.

-Adj N/Y-

This field contains the adjusted Northing or Y co-ordinate for the current point in the file.

-Adj Ht/Z-

This field contains the adjusted Level or Z co-ordinate for the current point in the file.

-Corr E/X-

This field contains the correction to the Easting or X co-ordinate for the current point in the file.

-Corr N/Y-

This field contains the correction to the Northing or Y co-ordinate for the current point in the file.

-Corr Ht/Z-

This field contains the correction to the Level or Z co-ordinate for the current point in the file.

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Stn No

This field contains the station number for this point. The station number is used internally by the least squares adjustment routines. In all other cases, stations are referred to by name rather than number.

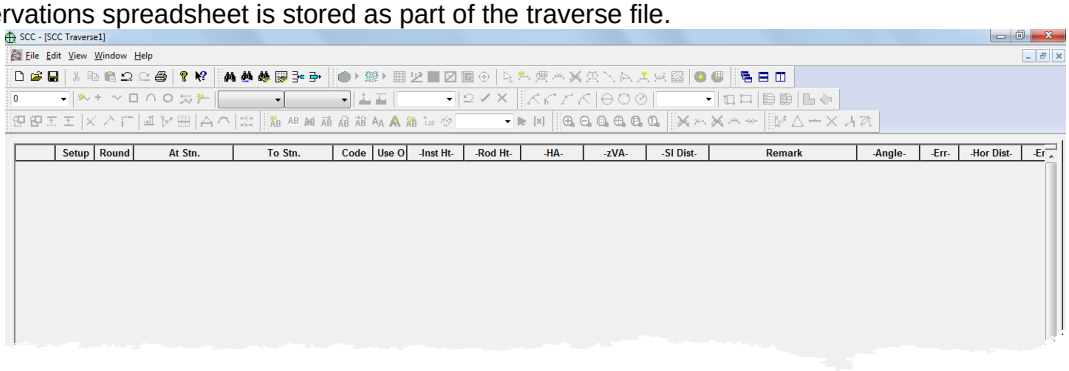
Remark

This field contains a free from remark entered in the data logger for this observation

31.4.3 Traverse Observations

31.4.3.1 Traverse Observations (View Menu)

Set-up number, round number, and code sorts traverse observations. The structure of the traverse spreadsheet and supporting computations allows for calculation of both traverses and networks. The ‘Set-up’ and then the ‘Round’ index this spreadsheet. The traverse observations spreadsheet is stored as part of the traverse file.



Each spreadsheet is comprised of the following record fields;

Set-up

This field contains the station set-up number for the current observation. All observations sighted from the same occupation of any given station will have the same set-up number. This value is used to sort the traverse observations. The software will normally automatically set the value in this field. The 'Check traverse route' option may be used to fill in values for this field for the entire traverse. This option is found in the 'FILE' menu.

Index 1

Round

This field contains the round or arc number for the current observation. All observations taken to the same backsight or RO station within a set-up should have the same round number. This field is used to facilitate changing the value of the zero of the horizontal circle between multiple rounds of observations within a given instrument set-up. It is used to sort data within a set-up. The software will normally automatically set the value in this field. The 'Check Traverse Route' option may be used to fill in values for this field for the entire traverse. This option is found in the 'FILE' menu.

Index 2

At Stn

This field contains the name of the current occupied station. The co-ordinate value for this

point may be found in the station co-ordinate spreadsheet.

To Stn

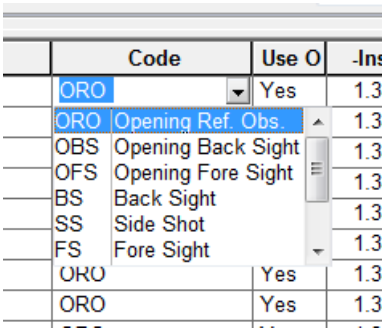
This field contains the name of the current station observed from the occupied base station. The co-ordinate value for this point may be found in the station co-ordinate spreadsheet

Code

This field specifies the relevance of this point to the traverse. Traverse codes are sorted, within a round, such that the RO and back sight will always occur at the start of the round and fore sights will occur at the end of the round. Fore sight and side shot angles are always computed as the included angle between the fore sight or side shot angle and the back sight or RO angle from the same round and set-up. The 'Check Traverse Route' option may be used to fill in values for this field for the entire traverse. This option is found in the 'FILE' menu.

Index 3

There are nine possible parameters; Opening Ref. Obs., Opening Back Sight, Opening Fore Sight, Back Sight, Side Shot, Fore Sight, Closing Back Sight, Closing Fore Sight, Closing Ref. Obs..



Use Obs

This field may be used to exclude observations from the adjustment.

Inst Ht-

This field contains the instrument height as entered in the field. It is used when calculating station elevations.

-Rod Ht-

This field contains the rod height entered for the current station observation. It is used in conjunction with the instrument height and the derived height difference (Ht Diff) between the instrument collimation and the tilting axis of the prism to check the height difference between the occupied station and the reference station from that computed from the control station elevations.

-HA-

This field contains the observed horizontal angle for the current observation.

-Err-

This field contains the accuracy of the horizontal angle for the current point in the file. For example, a value of 3 would indicate that the theodolite is accurate to plus or minus 3 seconds in the horizontal. The instrument manufacturer (DIN 18723) normally defines this. This value is only used when applying a least squares adjustment. This value is only

used when applying a least squares adjustment. An entry in this field over-rides the value in the error field in the Least Squares adjustment dialog.

-VA-

This field contains the observed vertical/zenith angle for the current observation.

-Err-

This field contains the accuracy of the observed vertical/zenith angle for the current point in the file. For example, a value of 3 would indicate that the theodolite is accurate to plus or minus 3 seconds in the vertical. The instrument manufacturer (DIN 18723) normally defines this. This value is only used when applying a least squares adjustment. This value is only used when applying a least squares adjustment. An entry in this field over-rides the value in the error field in the Least Squares adjustment dialog.

-Sl Dist-

This field contains the slope distance for the current observation.

-Err-

This field contains the accuracy of the slope distance for the current point in the file in millimeters. See also the help on parts per million error. For example, a value of 3 would indicate that the EDM is accurate to plus or minus 3 millimeters for this reading. The instrument manufacturer (DIN 18723) normally defines this. This value is only used when applying a least squares adjustment. This value is only used when applying a least squares adjustment. An entry in this field over-rides the value in the error field in the Least Squares adjustment dialog.

-PPM-

This field contains the accuracy of the slope distance for the current point in the file in terms of parts per million of the slope distance. It is applied as well as the normal distance error. For example, given a value of 3 in this field, a slope distance of 1000.0m (i.e. 1 Million mm), and a value of 2 in the 'Dist Err' field would indicate that the slope distance is accurate to plus or minus 5 millimeters overall, for this reading. This value is only used when applying a least squares adjustment. This value is only used when applying a least squares adjustment. An entry in this field over-rides the value in the error field in the Least Squares adjustment dialog.

Remark

This is the free form remark entered in the logger.

Bearing

This field contains the whole circle bearing for the current observation. This value is computed from the orientation and the horizontal angle. It is provided for reference purposes only.

-Hor Dist-

This field contains the horizontal distance, computed from the slope distance and the zenith angle, for the current point in the file. It is provided for reference purposes only.

-Ht Diff-

This field contains the height difference, computed from the slope distance and the zenith

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angle, for the current point in the file. It is provided for reference purposes only.

-Angle-

This field contains the forward measured clockwise angle for the current station in the file. It is computed as the angle contained between the ORO/backsight station and the current side shot or foresight station targets. This field is blank for a back sight observation record. It is provided for reference purposes only.

From

This field contains the name of the back sight station for this record. Its co-ordinate value may be found in the control file. This field is the same as the To Stn field for a back sight observation record.

Obs. Type

This field specifies the type of information stored in this traverse observation. This field is only used with variation of co-ordinates adjustment. Use this field to limit the use of a given observation to a particular component, such as angle only, bearing only, bearing and distance, etc... or to fix part of an observation. This may be used to include fixed bearings, angles, distances, and height differences into the adjustment. For intersection based networks, the observation type can be set to angle only, or angle and height difference.

-rA-

This field contains the residual angle generated by the least squares adjustment for this point, i.e. the number of seconds of arc that the observed angle would have to be changed in order to point to the adjusted result. This field is only relevant to angular measurements after a least squares adjustment has been completed. This residual is back-computed and presents the surveyor with the alteration of the field measured values in order to give an appreciation of the impact of the adjustment in measurement units. It is provided for reference purposes only.

-rD-

This field contains the residual distance generated by the least squares adjustment for this point, i.e. the number of millimeters that the observed horizontal distance would have to be changed in order to give the adjusted result. This field is only relevant to distance measurements after a least squares adjustment has been completed. This residual is back-computed and presents the surveyor with the alteration of the field measured values in order to give an appreciation of the impact of the adjustment in measurement units. It is provided for reference purposes only.

-rB-

This field contains the residual bearing generated by the least squares adjustment for this point, i.e. the number of seconds of arc that the observed bearing would have to be changed in order to point to the adjusted result. This field is only relevant to bearing measurements after a least squares adjustment has been completed. It is provided for reference purposes only.

BS 'k'

This field contains the refraction correction constant 'k' that has been computed locally for this set-up from the backsight observation. This is used in conjunction with the foresight 'k' to form a mean value of 'k' for this set-up.

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FS 'k'

This field contains the refraction correction constant 'k' that has been computed locally for this set-up from the foresight observation. This is used in conjunction with the backsight 'k' to form a mean value of 'k' for this set-up.

Mean 'k'

This field contains the refraction correction constant 'k' that has been computed for this set-up from the foresight and backsight 'k' values. This value is computed from the difference in height difference between the backsight and foresight stations. Refraction correction may then be used to improve the accuracy of side-shots via trigonometric levelling.

Scale

This field contains the PPM distance scale factor computed from temperature and pressure entered at time of survey. This value will not by default be applied as the instrument normally applies it.

To apply this value select the ‘Corrections' menu. It is calculated as -

ppm=275 - 79.55 x (p / (273 + t))

where p = pressure

t = temperature

Temperature

This field contains the temperature, in degrees centigrade, measured at time of survey. It is used in calculating atmospheric scale correction.

Pressure

This field contains the pressure, in millibars, measured at time of survey. It is used in calculating atmospheric scale correction.

Face 2

Used to indicate if an observation was taken on face 2

31.4.3.2 Traverse Observation File Menu

Append A Traverse

This option is used to combine two or more traverses into a single traverse job for the purposes of adjustment. To do this, open the first traverse, select 'FILE > Append a Traverse', and highlight one or more traverses to add to the currently open traverse.

SCC automatically renumbers round and set-up numbers for the appended traverse observations.

Extract New Route

This option may be used to extract a loop or link traverse from a more complex control network, made up of multiple intersecting traverses or more complex control. To use this option you must first use the Setup option to specify the opening and closing conditions for your sub-

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traverse. SCC will then analyze the control network for all possible routes through your data from the opening set-up to the closing setup.

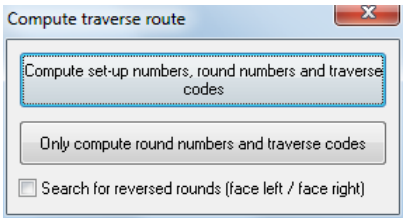
See Also

Processing A Complex Traverse

Check Traverse Route (Traverse File Menu)

This function searches the traverse observation file for pairs of matched back-sight (BS) and foresight (FS) observations. It then sets the codes of these observations to form a route through the traverse. It also renumbers the rounds, and optionally renumbers the set-ups.

The logic it uses is to set any observations in a given set-up to the next set-up as fore sights (FS), any observations in a given set-up to the last set-up as back sights (BS), and all other observations as side shots.



It will also attempt to make sure that every round has a valid back-sight, and that the opening and closing RO codes are correct for most typical traverse cases.

If the user has a traverse that includes two set-ups at the same occupied station, with one directly following the other in the input file, the user should NOT renumber the set-ups, as these will be incorrectly amalgamated into a single setup.

Rebuild Traverse From Raw Survey File

Selecting this option rebuilds the traverse data for this data set from the original raw data files. This will undo any editing that you have done on these files.

Edit Raw Survey file (File Menu)

Selecting this option allows the user to edit the ASCII file that was downloaded and used to create this file. A backup of this data is made to allow the user to return to the original version of the raw data. This option is only available for data collectors that transfer data in an ASCII format. This format will be different for different makes of data collector.

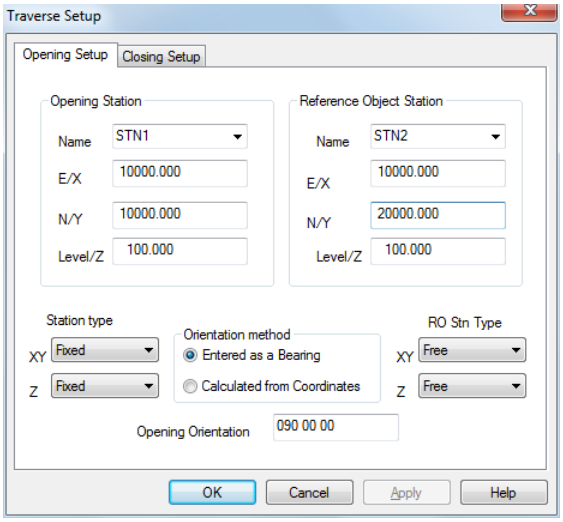
31.4.3.3 Traverse Edit Menu

Set-up (Traverse Edit Menu)

This allows you to enter details of your opening and closing stations for orientation and adjustment purposes.

Opening Setup

This option allows the user to enter values for your opening set-up. This includes values for the initial occupied station and reference orientation station. It is necessary to enter the opening set-up prior to attempting to adjust the traverse.



Opening Station

Name	This field contains the name of the station occupied as the origin of the traverse. If this corresponds to the name of a station in the control file that point will be used, if it does not, the named point will be added to the control file.
E/X	Easting grid value of station.
N/Y	Northing grid value of station
Level/Z	Reduced elevation of station.

Reference Object Station

Name	This field contains the name of the station sighted as the opening reference orientation station. If this corresponds to the name of a station in the control file, that station's grid values will be used. If it does not the manually entered values will be added to the control file.
E/X	Easting grid value of the RO station.
N/Y	Northing grid value of the RO station.
Level/Z	Reduced elevation of the RO station.

Station Type

This field specifies whether the opening station co-ordinates may be held fixed or are permitted to be changed during the traverse adjustment.

Orientation Method

This field specifies whether the opening orientation is calculated from the occupied station and the reference orientation station co-ordinates or entered directly as an azimuth.

Enter As A Bearing	The opening orientation is taken from the typed in bearing.
Calculate from Coordinates	Use the co-ordinates to compute a bearing for the reference orientation.

R.O. Stn Type

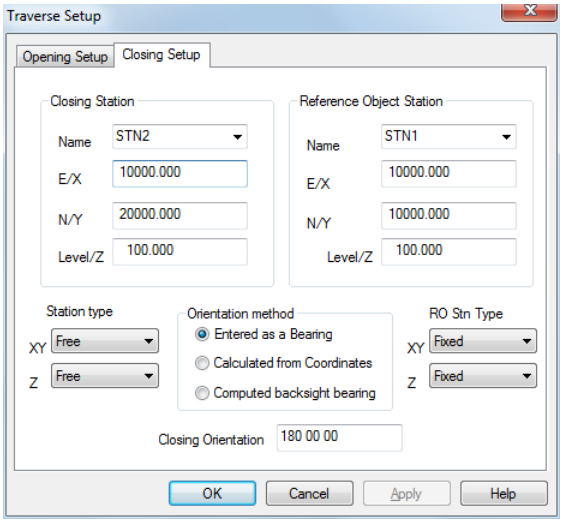
This field specifies whether the opening reference object may be moved during the traverse adjustment.

Opening Orientation

This field contains the whole circle bearing between the opening station and the opening reference object.

Closing Setup

This option allows the user to enter values for the closing set-up. This includes values for final occupied station and reference orientation station. It is necessary to enter ther closing set-up prior to attempting to adjust the traverse.



Closing Station

Name	This field contains the name of the station occupied as the origin of the traverse. If this corresponds to the name of a station in the control file that point will be used, if it does not, the named point will be added to the control file.
E/X	Easting grid value of station.
N/Y	Northing grid value of station
Level/Z	Reduced elevation of station.

Reference Object Station

Name	This field contains the name of the station sighted as the opening reference orientation station. If this corresponds to the name of a station in the control file, that station's grid values will be used. If it does not the manually entered values will be added to the control file.
E/X	Easting grid value of the RO station.
N/Y	Northing grid value of the RO station.
Level/Z	Reduced elevation of the RO station.

Station Type

This field specifies whether the opening station co-ordinates may be held fixed or are permitted to be changed during the traverse adjustment.

Orientation Method

This field specifies whether the opening orientation is calculated from the occupied station and the reference orientation station co-ordinates or entered directly as an azimuth.

Enter As A Bearing	The closing orientation is taken from the typed in bearing as the reference orientation.
Calculate from Coordinates	Use the co-ordinates to compute a bearing for the reference orientation.
Computed Backsight Bearing	Use the backsight as the reference orientation.

R.O. Stn Type

This field specifies whether the opening reference object may be moved during the traverse adjustment.

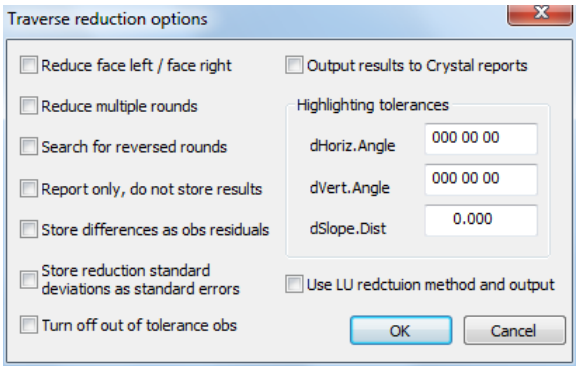
Closing Orientation

This field contains the whole circle bearings between the closing station and the reference object.

When adjusting via least squares, the minimum requirements are to have one fixed station and one fixed bearing, or two fixed stations. These can be entered into the opening setup. In this case, set the closing station and closing RO type to free.

Reduce (Traverse Edit Menu)

This option creates mean observations from sets of observations observed from the same set-up to the same target station. This includes conversion of horizontal directions to mean forward measured angles, reduction of double-faced observations, and meaning or averaging of multiple values.



This option searches for face left / face right pairs in sequential rounds and averages them into a single round. Thus if there are four rounds on both faces, then four rounds on face one will remain, where those represented the average of the two faces.

This option allows for the storage of reduction standard deviations for each round in the residuals of the reduced observations.

Results can be output to Crystal reports and the user can set tolerances to highlight on the exported file.

Adjust (Traverse Edit Menu)

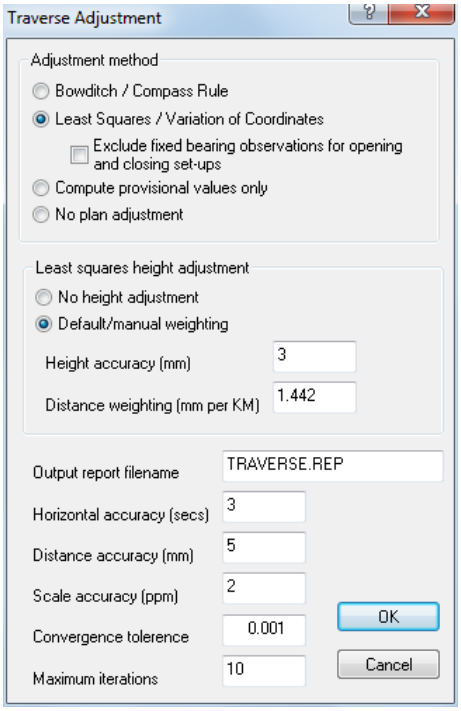
This option allows the user to adjust the traverse. This is carried out in three steps that are carried out in sequence on selecting this option.

1. To set your adjustment criteria and perform the adjustment.

2. To update the station co-ordinate file with the adjusted co-ordinates.

3. To review the adjusted co-ordinates.

On selecting 'EDIT > Adjust' the following options are presented;



Adjustment Method

This field specifies the computations used to adjust the traverse. Bowditch Adjustment is a more traditional method of adjustment, as such it may prove useful when checking existing traverses. The MSMM adjusts its traverses using this method. Variation of co-ordinates is a least-squares adjustment that gives the best possible distribution of errors and permits the user to influence the results by assigning weights to different readings. It also allows side shot bracing to be included in the traverse. The final option uses No adjustment and simply calculates the Provisional co-ordinates.

Least Squares Height Adjustment

No Height Adjustment

The levels of the stations are left unadjusted, adjustment takes place in X,Y only.

Default /Manual Weighting

The levels of the stations are adjusted based on the entered height accuracy and distance weighting

Distance weighted (mm per KM)

This option allows the user to specify distance weighting in terms of mm per KM, where entering a value of zero indicates the levels are not weighted by horizontal distances.

Output Report File Name

This is the name of the report file that will be created by the adjustment. The contents of the report will vary based on the method of adjustment selected. The variation of co-ordinates adjustment will provide the most detailed report.

Having adjusted the traverse, the user will be given an option to edit the output report file with the system editor.

Horizontal Accuracy (secs)

This field contains the default accuracy of the horizontal angle for all points in the file. It is usually based around the intrinsic accuracy of the instrument and the number of observations taken for a given final traverse observation. The accuracy may be accepted as that defined by the instrument manufacturer (DIN 18723) or may be derived by the user over a period by analysing previous traverses. This value is only used when applying weights in a least squares adjustment and may be overridden by entering a specific value in the 'Ha Err' field for any given observation.

Vertical Accuracy (secs)

This field contains the default accuracy of the zenith angle for all points in the file. It is usually based around the intrinsic accuracy of the instrument and the number of observations taken for a given final traverse observation. The accuracy may be accepted as that defined by the instrument manufacturer (DIN 18723) or may be derived by the user over a period by analysing previous traverses. This value is only used when applying weights in a least squares adjustment and may be overridden by entering a specific value in the 'zVa Err' field for any given observation.

Distance Accuracy (mm)

This field contains the default accuracy of the slope distance for all points in the file. It is usually based around the intrinsic accuracy of the instrument and the number of observations taken for a given final traverse observation. The accuracy may be accepted as that defined by the instrument manufacturer (DIN 18723) or may be derived by the user over a period by baseline calibration. This value is only used when applying weights in a least squares adjustment and may be overridden by entering a specific value in the 'SlDist Err' field for any given observation.

Scale Accuracy (ppm)

This field contains the default accuracy of the slope distance in parts per million for all points in the file. It is usually based around the intrinsic accuracy of the EDM. This value is only used when applying weights in a least squares adjustment and may be overridden by entering a specific value in the 'PPM' field for any given observation.

Convergence Tolerance

This value is the maximum shift between any two successive iterations of the adjustment that must occur for the adjustment to continue. If no stations move by more than this amount the adjustment is consider complete, if not it will continue until complete or the maximum number of iterations take place.

Maximum Iterations

This options specifies the number of time the computations/algorithm is run.

Corrections (Edit Menu)

This option allows the user to control how corrections for refraction, earth's curvature, local scale factor, temperature, and pressure are applied.

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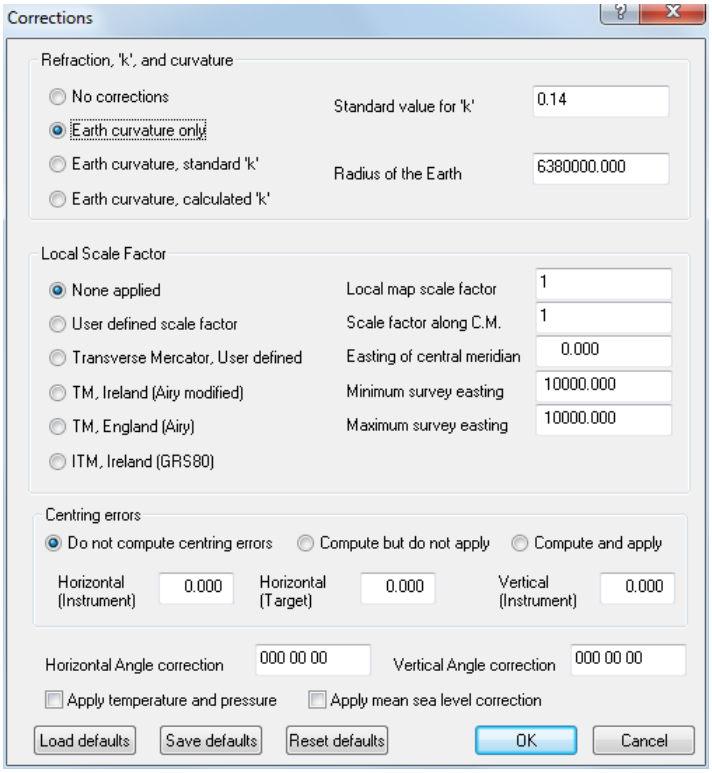

Values for 'k' will be computed in the traverse observation and station set-up files. These values should be within the following ranges if they are to be used

Refraction, 'k' and curvature

This variable determines how corrections due to the curvature of the earth and refraction 'k' are applied. Values for 'k' will be computed in the traverse observation and station set-up files. These values should be within the following ranges if they are to be used

Distance	'k' Range
50 - 100 meters	> -10 < 'k' < +10
150 - 200 meters	> -5 < 'k' < +5
200 - 300 meters	> -3 < 'k' < +3
>300 meters	> -2 < 'k' < +2

The correction applied is

dZ = ((1-k).(Hd.Hd))/(2.R) OR **dVa = ((1-k).Hd/(2.R)**

where dZ : Subtraction from Elevation in meters

dVa : Addition to Zenith Angle in radians

Hd : Horizontal Distance

R : Radius of the Earth

If you were using a correction in which the term (1-k) appears as (1-2k) you should double the value of 'k' that you were using in order to obtain the same results, e.g. 0.07 -> 0.14.

No Corrections

This should be selected if the data you are using has already been corrected for these

factors prior to transfer into SCC.

Earth curvature only

A correction for earth curvature only is applied. Refraction is not accounted for.

Earth curvature, standard 'k'

Corrections are applied for earth curvature and a standard value for refraction 'k' is applied. The standard value for refraction is defined above.

Legal Values	-1000.0000 to 1000.0000
Usual Values	-10.0000 to 10.0000
Default Value	0.14

Earth curvature, calculated 'k'

Corrections will be applied for earth curvature and refraction 'k'. The value for 'k' will be calculated from traverse and station set-up observations.

Standard value for 'k'

This value defines a standard value for the refraction constant 'k' that will be used where refraction correction is required but the values for 'k' computed from traverse and station set-up observations are not regarded as being suitable.

Radius of the Earth

This value is used when calculating earth curvature and refraction corrections. There are different accepted values for the radius of the earth based on different ellipsoidal projection systems. Typical values include 6400000, 6380000, 6375000, and 6370000 meters. This value primarily effects accurate trigonometric levelling.

Local Scale Factor

This variable determines how correction for mapping scale factor is applied. This correction of important when doing traverse and detail surveys that are to be combined with existing mapping data, typically Ordnance Survey data. The software allows you to either nominate a fixed scale factor or derive a local scale factor from your data.

This is calculated as

$$\mathbf{LSF = SF0.(1+((Ya^2 + Ya.Yb + Yb^2)/(6*R^2))}$$

where

LSF : Local Scale Factor

SFO : Transverse Mercator Scale Factor along Central Meridian

Ya : Minimum survey Easting - Easting value from the Central Meridian

Yb : Maximum survey Easting - Easting value from the Central Meridian

R : Radius of the Earth

None applied

No local scale factor will be applied to the data.

User defined scale factor

A scale factor defined by the user will be applied to all observations. The user may define the scale factor by inputting values in the local map scale factor, local scale factor along

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central meridian easting of central meridian.

Transverse Mercator, User defined

A transverse Mercator scale factor defined by the user will be applied to all observations. The user may define the scale factor by inputting values in the local map scale factor, local scale factor along central meridian easting of central meridian.

TM, Ireland (Airy Modified)

This is the map projection system used in Ireland. It is a modified version of the Airy Transverse Mercator projection.

TM England (Airy)

This is the map projection system used in the UK.

ITM, Ireland (GRS80)

This is the map projection system used in Ireland.

Local map scale factor

This value is the local scale factor applied to observed horizontal distances. The value may either be entered directly or computed by the software. This is determined by the scale factor/projection selected.

Scale factor along C.M.

This value is the transverse Mercator scale factor along the central meridian. It is used when computing a value for local map scale factor. This is 1.000035m for Ireland and 0.99960127 for England.

Easting of central meridian

This value is the easting or x value for the central meridian. This is used when computing local scale factor. Values are 200,000m for Ireland and 400,000m for England.

Minimum Survey Easting

This value is the minimum easting or y value for your current detail or traverse survey. This is used when computing local scale factor. It is derived from the co-ordinates of occupied stations in the station co-ordinate file.

Maximum Survey Easting

This value is the maximum easting or x value for your current detail or traverse survey. This is used when computing local scale factor. It is derived from the co-ordinates of occupied stations in the station co-ordinate file.

Centring Errors

This option supports the computation of errors due to instrument and target centring. The options allow the user to control whether centring errors are not computed, computed but not applied, or computed and applied.

Centring errors are input as mm errors to instrument and target positions, and calculated as errors in the horizontal angle. These errors will be inversely related to the lengths of the legs subtended by the included horizontal angle, with the error being larger for shorter lengths. Where centring errors are applied, it is in addition to standard errors (weights) on angles, and to a lesser extent on distances and height differences. The net effect of this is that on traverses or network with shorter leg lengths and centring errors applied, angles will carry lower weights than distances.

From 'Engineering Surveys' Schofield and Breach, some typical input values for centring errors are:

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3mm - 5mm for a plumb bob

0.5mm - 1mm for an optical plummet

1mm for a centring rod

0.1mm - 0.3mm for forced centring

Horizontal Angle Correction

This value, normally 000.00.00, defines an angular offset that is applied to all horizontal angles when computing co-ordinates.

Vertical Angle Correction

This value, normally 000.00.00, defines an angular offset that is applied to all vertical angles when computing co-ordinates.

Apply Temperature and Pressure

This variable determines whether a scale factor derived from temperature and pressure will be applied as a correction to your slope distances. This field will normally be set to 'No' as most modern total stations allow you to enter temperature and pressure and provide corrected readings. Only set this value to 'Yes' if scale factor has not already been applied to your EDM.

When refraction is being calculated, either in the traverse observations sheet or the detail station set-up sheet, multiple reference stations may be sighted. In this instance, a distance weighted mean value is calculated for 'k'.

Mean Sea Level Correction

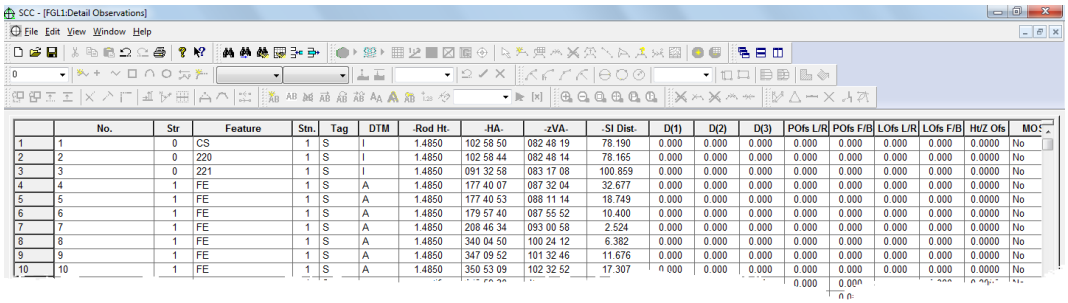
Mean sea level correction is not applied by default, but can be enabled by selecting this option. The correction is applied to the horizontal distance as Horizontal Distance x (Reduced Elevation / Radius of the Earth). See Bannister & Baker, Surveying, ISBN 0-582-23644-4, Page 34

31.5 Detail Observation

The detail observation spreadsheet contains all of the observations in any given survey. Note that these observations can be total station angles and distances, GPS latitude, longitude, height, or X, Y, Z.

31.5.1 Detail Observations (View Menu)

The detail observation spreadsheet contains all the topographical survey information as collected in the field by polar co-ordinate observation. Data is held in raw form, horizontal and vertical angle, slope distance and the other information that is required to generate map planimetery and the surface model. The sheet is sorted by survey point number (Index 1) and as such records are presented in the original chronological survey order.



	No.	Str	Feature	Stn.	Tag	DTM	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	D(1)	D(2)	D(3)	POfs L/R	POfs F/B	LOfs L/R	LOfs F/B	Ht/Z Ofs	MOS
1	1	0	CS	1	S	I	1.4850	102 58 50	082 48 19	78.190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
2	2	0	220	1	S	I	1.4850	102 58 44	082 48 14	78.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
3	3	0	221	1	S	I	1.4850	091 32 58	083 17 08	100.859	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
4	4	1	FE	1	S	A	1.4850	177 40 07	087 32 04	32.677	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
5	5	1	FE	1	S	A	1.4850	177 40 53	088 11 14	18.749	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
6	6	1	FE	1	S	A	1.4850	179 57 40	087 55 52	10.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
7	7	1	FE	1	S	A	1.4850	208 46 34	093 00 58	2.524	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
8	8	1	FE	1	S	A	1.4850	340 04 50	100 24 12	6.382	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
9	9	1	FE	1	S	A	1.4850	347 09 52	101 32 46	11.676	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No
10	10	1	FE	1	S	A	1.4850	350 53 09	102 32 52	17.307	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	No

The detail observation sheet comprises of the following fields;

No.

This field contains the original survey point number.

Str

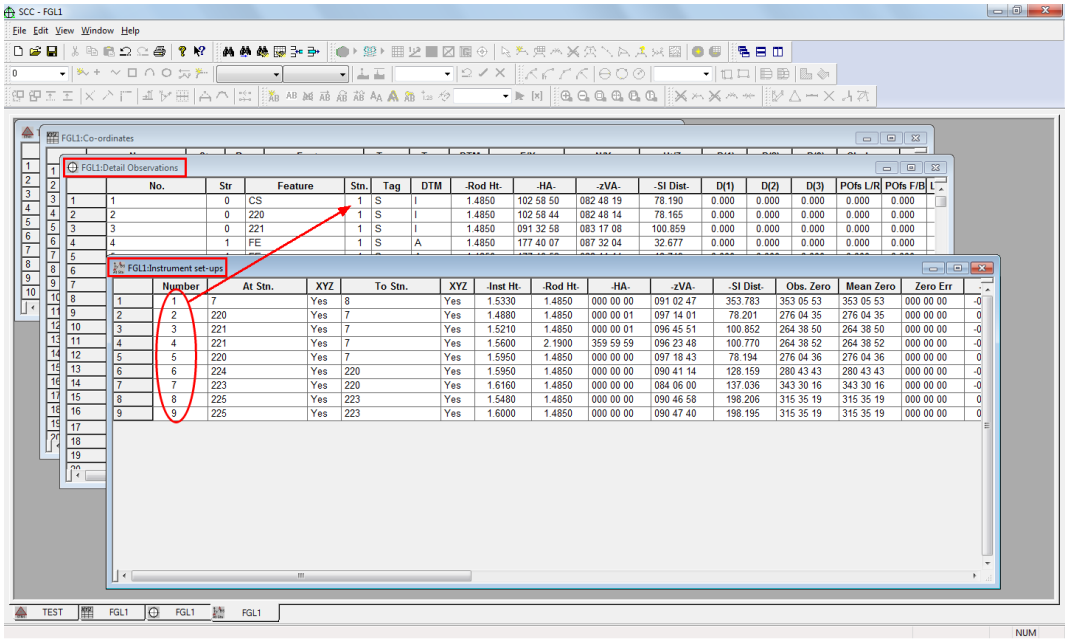
This field contains the string number of the surveyed point. The string number allows separate strung features of the same name to be distinguished from one another. Points in the detail co-ordinate file are ordered by Feature Name, String Number, Position and surveyed Point Number.

Feature

This eight-character field contains the name of the Feature being entered as entered in the data collector.

Stn

This field contains the station set-up number for this point. This corresponds with a station set-up number in a record in instrument set-up spreadsheet. This record contains information relating to the occupied and reference station used when this point was observed, along with the atmospheric conditions.



Tag Codes

The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string. The tag codes may be entered either in numeric or alpha-numeric format.

See Also

Feature Library (View menu)

DTM Code

The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. The DTM codes may be entered either in numeric or alpha-numeric format

---

See Also

Feature Library (View menu)

-Rod Ht-

This field contains the observed prism rod height for the current points in the file.

-HA-

This field contains the observed clockwise horizontal angle for the current point in the file.

To convert an angel between clockwise and anticlockwise enter a value of '=!360' either in the spread sheet or global editor.

-zVA-

This field contains the observed vertical/zenith angle for the current point in the file.

-Sl Dist-

This field contains the observed slope distance for the current point in the file.

Offset

Every observation in SCC can include up to five offsets as follows:

Line of Sight Offsets Left or Right (LOfs L/R)

This is an offset based on the line connecting the Total Station to the prism. The offset is lateral, with a negative value indicating a distance to the left of the surveyed line, or positive indicating a distance to the right of the surveyed line.

Line of Sight Offsets Forward or Back (LOfs F/B)

This is an offset based on the line connecting the Total Station to the prism. The offset is longitudinal, with a negative value indicating a distance towards the instrument, or positive indicating towards the prism. This corresponds to a radial offset, and might be used for tree trunks etc.

Line of Travel Offsets Left or Right (POfs L/R)

This is an offset based on the line connecting the last two survey points. The offset is lateral, with a negative value indicating a distance to the left of the surveyed line, or positive indicating a distance to the right of the surveyed line. It is used where it may be difficult to get to the centre of a wide linear object such as a hedge or ditch, where the feature coding does not explicitly specify that the face of the object is being surveyed.

Line of Travel Offsets Forward or Back (POfs F/B)

This is an offset based on the line connecting the last two survey points. The offset is longitudinal, with a negative value indicating a distance back along thesurveyed line, or positive indicating an extension of the surveyed line. It is used where a point may be obscured from the instrument view. such as an internal building corner, and

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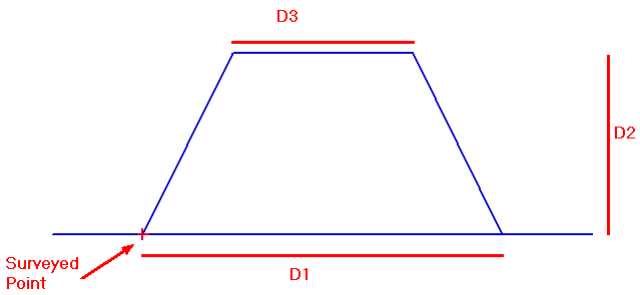
that point can be generated by extending from the last two survey points.

Height Offset (Ht/Z Ofs)

This is a simple offset to the Z value, with negative indicating a distance down, and positive indicating a distance up.

D(1)

This field contains the first dimension for the current point. If this value is non-zero it is used as a scale factor for primary symbols. It is also used as a width on strip levels/ parallel features such as walls, ditches etc. See diagram below.



D(2)

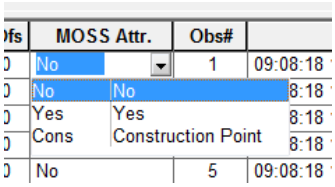
This field contains the second dimension for the current point. If this value is non-zero it is used as a scale factor for secondary symbols. It is also used as a width on strip levels/ parallel features such as walls, ditches etc. See diagram above.

D(3)

This field contains the third dimension for the current point. It is also used as a width on strip levels/parallel features such as walls, ditches etc. If a value is not entered into this field it is assumed to be same as D(1). See diagram above .

MX Attr.

This switch defines whether or not there is an attribute associated with this observation. To view the attributes/extra measurements select 'VIEW > Extra Measurements' . There are three options; No, Yes or Construction Point



Obs.

This field contains observation or survey numbers, it is used to link the measurement to a given observation or string.

Observations numbers are assigned to survey points in original chronological survey order.

Time

This field can be used to store the exact time at which the current observation was taken

X, Y, Z

The detail observation file also allows use of X,Y,Z coordinates as a form of raw data. These will be used in the absence of a valid slope distance or lat/long coordinates.

Lat, Long, Height

The detail observation file allows the user to enter and log observations from GPS in WGS84 latitude, longitude, and height. These will be converted into coordinates based on the settings of the GPS transformation options. If an observation contains a non-zero slope distance, its coordinates will be calculated using angles and distances, regardless of the values in these fields.

XRMS, YRMS, ZRMS

The root mean square variation of position between successive epochs for a given observation

H. DOP, V. DOP

Horizontal and vertical dilution of precision

No. Sats

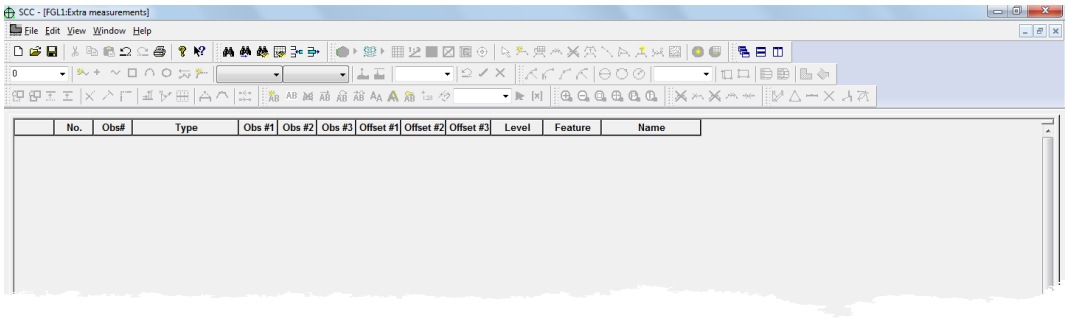
The number of satellites that were observed when this observation was taken

Fix

Solution type Whether the RTK solution was fixed, floating or autonomous. For survey work this should nearly always be fixed.

31.5.2 Extra Measurements (View Menu)

Attributes/Extra Measurements are additional measurements, which use the polar co-ordinates taken with the Total Station as the topographic control geometry for field survey completion. The attribute spreadsheet contains details of the extra measurements taken as part of the survey. These comprise of taped measurements, square and circular features and strings, parallel features, and offset measurements. Obs. and No order this spreadsheet respectively. The extra measurements spreadsheet is stored as part of the survey file. For further details on the collection of attributes see the MSMM manual.



No.

This field contains the extra measurements record number, it is used to order the measurements in this file.

Obs.

This field contains observation or survey numbers, it is used to link the measurement to a given observation or string.

Type

This field specifies the type of attribute employed for the current record e.g. Feature offset, taped measurement etc.

There are 13 possible options; Line of Sight, Taped Measure, Feature Offset, MX Check, Orhto Feature, Radius & Centre, Point & Centre, 2 Pts Circle, 3 Pts Circle, 3 Pts Rectangle, Change Bearing, Parallel Ftr, Real Co-ordinate.

Obs #1

This field contains the survey point number of the first reference point for the attribute.

For example, the first point on a base line, 3 point circle or rectangle.

Obs #2

This field contains the survey point number of the second reference point for the attribute.

For example, the second point on a base line, 3 point circle or rectangle.

Obs #3

This field contains the detail observation number of the third reference point for the attribute.

For example, the third point, on a 3 point circle or rectangle.

Offset #1

This field contains the first offset for the attribute.

For example, the distance along a base line for taped measurements.

Offset #2

This field contains the second offset for the attribute.

For example, the distance away from a base line for taped measurements.

Offset #3

This field contains the third offset for the attribute.

Level

This field determines whether the point generated is included or excluded from the planimetery and surface model. If this is set to 'Real', Offset #3 contains the level of the point. If the level is set to 'Ignore', then the level of the point is taken from the previous point.

The field has six possible options; Ignore. No, Real, T. Cons, T. Link or Yes

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Feature

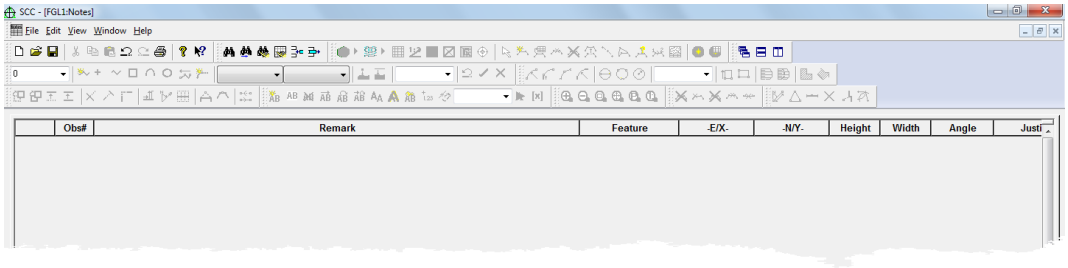
This feature determines whether the data generated by this attribute will be converted into a string or an object within SCC. Objects are drawn in the model as symbols and have no effect on the surface model

Name

This field contains the feature name given to this attribute.

31.5.3 Text Notes (View Menu)

This spreadsheet contains E/X, N/Y and rotation information about the remark text coded in the field. Each entry in the number column is associated with a corresponding number in the detail observations spreadsheet. The sheet is ordered Number. The text notes spreadsheet is stored as part of the survey file. The text notes sheet comprises of the following fields;



Number

This field contains the observation number that the text notes is associated with.

Remark

This is the free form remark entered in the logger.

Feature

This is the feature code of the surveyed point. Information relating to this feature in the feature library is associated with the remark text. Associated information includes colour and text size.

E/X

This field contains the Easting/X value of the first letter of the text.

N/Y

This field contains the Northing/Y value of the first letter of the text.

Angle

This field specifies the angle that the text notes are to be rotated if displayed in the model.

31.5.4 Detail Observation File Menu

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31.5.4.1 Edit Raw Survey file (File Menu)

Selecting this option allows the user to edit the ASCII file that was downloaded and used to create this file. A backup of this data is made in order that you may always return to the original version of the raw data. This option is only available for data collectors that transfer data in an ASCII format. This format will be different for different makes of data collector.

31.5.4.2 Rebuild Obs From Raw Data (File Menu)

Selecting this option rebuilds all survey data for this data set from the original read only raw data files. This will undo any editing that the user has carried out. The files affected are Detail Observation, Instrument Set Up, and Extra Measurements (View Menu) files.

31.5.4.3 Rebuild Co-ordinates (File Menu)

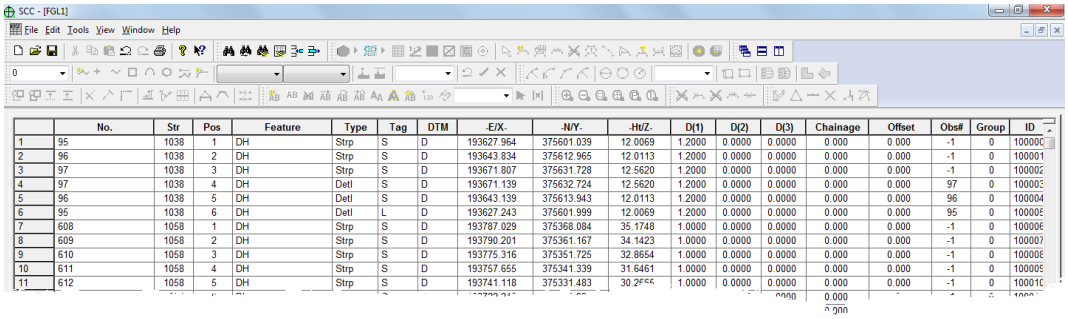
Selecting this option rebuilds all the detail co-ordinates from the current detail observation and control information. This will undo any editing that the user has carried out on this file. It will also create any fly stations present in the detail observation file.

31.6 Detail Coordinate

Detail Coordinate Sheet, used to store reduced topographic coordinates, sorted alphabetically by feature name and string number.

31.6.1 Detail Coordinate (View Menu)

The detail co-ordinates spreadsheet contains the reduced Cartesian co-ordinates for a survey. These co-ordinates may have been computed from a detail observation spreadsheet or read in from an external file, such as a DXF or GENIO file. The detail co-ordinates spreadsheet is sorted differently from the raw detail observation file, which is ordered by point number. The strings are grouped feature-wise and in numerical string order and appear in their correct order alphabetically down the sheet. The detail co-ordinates spreadsheet is stored as part of the survey file.



	No.	Str	Pos	Feature	Type	Tag	DTM	-E/X-	-N/Y-	-Ht/Z-	D(1)	D(2)	D(3)	Chainage	Offset	Obs#	Group	ID
1	95	1038	1	DH	Strp	S	D	193627.964	375601.039	12.0069	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100000
2	96	1038	2	DH	Strp	S	D	193643.834	375612.965	12.0113	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100001
3	97	1038	3	DH	Strp	S	D	193671.807	375631.728	12.5620	1.2000	0.0000	0.0000	0.000	0.000	-1	0	100002
4	97	1038	4	DH	Detl	S	D	193671.139	375632.724	12.5620	1.2000	0.0000	0.0000	0.000	0.000	97	0	100003
5	96	1038	5	DH	Detl	S	D	193643.139	375613.943	12.0113	1.2000	0.0000	0.0000	0.000	0.000	96	0	100004
6	95	1038	6	DH	Detl	L	D	193627.243	375601.999	12.0069	1.2000	0.0000	0.0000	0.000	0.000	95	0	100005
7	608	1058	1	DH	Strp	S	D	193787.029	375368.084	35.1748	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100006
8	609	1058	2	DH	Strp	S	D	193790.201	375361.167	34.1423	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100007
9	610	1058	3	DH	Strp	S	D	193775.316	375351.725	32.8654	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100008
10	611	1058	4	DH	Strp	S	D	193757.655	375341.339	31.6461	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100009
11	612	1058	5	DH	Strp	S	D	193741.118	375331.483	30.2[illegible]	1.0000	0.0000	0.0000	0.000	0.000	-1	0	100010

The detail co-ordinates spreadsheet has the following fields;

No.

This field contains the original survey point number.

Str

This field contains the string number of the surveyed point. The string number allows separate strung features of the same name to be distinguished from one another. Points in the detail co-ordinate file are ordered by Feature Name, String Number, Position and surveyed Point Number

Pos

This field contains the sequential string position number of the co-ordinated point within a given string. This means that points that are not surveyed sequentially may be re-ordered so as to be graphically correct within the model file. The first point taken on FEATURE - <Hedge>/STRING # <1> will have a STRING POSITION # <1> on the first hedge, and on FEATURE - <Hedge>/STRING #<2> will have a STRING POSITION <#1> on the 2nd hedge - the survey point number is independent and will be related to the number of all points surveyed in the current data set.

Feature

This eight-character field contains the name of the Feature being entered as entered in the data collector.

Type

This field specifies the source of the current point. Manual points are points entered by the user, construction points are points generated by the computer and detail and control points are generated by the survey datalogger.

Field has 25 possible options; 2 Pts Circle attribute, 3 Pts Circle attribute, 3 Pts Rectangle attribute, As Set Out Point, Construction, Control, Curve fit, Design, Detail, Draped Profile, DXF, External file, Feature Offset attribute, GENIO point, Levelled point, Line of Sight attribute, Manual, Ortho Feature attribute, Parallel Feature attribute, Point & Centre attribute, Radius & Centre attribute, Square, String, Offset, Strip level, Taped Measure attribute,

Tag Codes

The tag code determines the connective geometry and specifies how the current point on the string will be connected to the next point on the string. This can be used to specify straight lines, curves, arcs, and squared up pieces of geometry in a string. The tag codes may be entered either in numeric or alpha-numeric format.

See Also

Feature Library (View menu)

DTM Code

The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. The DTM codes may be entered either in numeric or alpha-numeric format

---

See Also

Feature Library (View menu)

-E/X-

This field contains the co-ordinated X value or Easting for the current point in the file.

-N/Y-

This field contains the co-ordinated Y value or Northing for the current point in the file.

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-Ht/Z-

This field contains the co-ordinated Z value or Elevation for the current point in the file.

D(1)

This field contains the first dimension for the current point. If this value is non-zero it is used as a scale factor for primary symbols. It is also used as a width on strip levels/ parallel features such as walls, ditches etc. See also Detail Observation.

D(2)

This field contains the second dimension for the current point. If this value is non-zero it is used as a scale factor for secondary symbols. It is also used as a width on strip levels/ parallel features such as walls, ditches etc. See also Detail Observation.

D(3)

This field contains the third dimension for the current point. It is also used as a width on strip levels/parallel features such as walls, ditches etc. If a value is not entered into this field it is assumed to be same as D(1) See also Detail Observation.

Chainage

This field contains the chainage of the current point along the current design string. This value may be used for reference when setting out via a datalogger. The chainage will only be set if the co-ordinate file has been created from a file containing relevant design information, e.g. a MX 992 REPORT file.

Offset

This field contains the offset distance of the current point from the current design string. This value may be used for reference when setting out via the Site Measurement Module. The offset will only be set if the co-ordinate file has been created from a file containing relevant design information, e.g. a MX 992 REPORT file.

Obs.

This field contains observation or survey numbers, it is used to link the measurement to a given observation or string.

Observations numbers are assigned to survey points in original chronological survey order.

Group

Each observation is allocated a unique group number. This number is used internally by SCC.

ID

Each observation is allocated it's own ID. This number is used internally by SCC to uniquely identify every point in a model, given that a model can contain two datasets with the same survey point numbers.

Flags 1 and Flag 2

SCC to preserve annoation flags when transferring data between the model and survey

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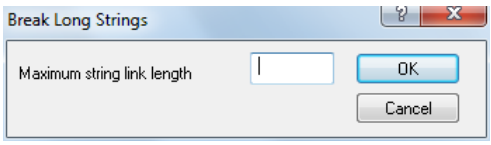
data sets uses these values internally.

31.6.1.1 Break Long strings (Coordinate Tools Menu)

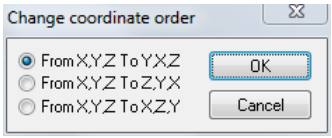
This option searches the co-ordinate file for string segment lengths greater than a specified distance and inserts gaps in the strings at those positions. All points remain on the same string. This facility is useful to automatically handle certain stringing errors arising due to survey feature/string number identification errors or importing data without full stringing.

The user can input the maximum length for each string segment:



31.6.1.2 Change X,Y,Z to Y,X,Z (Coordinate Tools Menu)

This option flips the file from being Easting, Northing, Level, or X,Y,Z to Northing, Easting, Level.

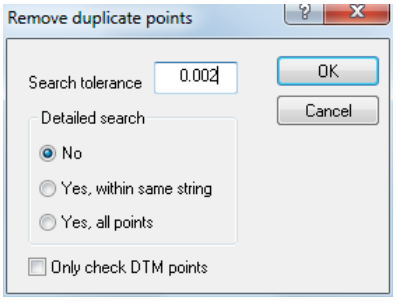


31.6.1.3 Remove Duplicate Points (Coordinate Tools Menu)

This option deletes points in the co-ordinate file that are within a specified plan distance of one another.

This is useful for minimising the co-ordinate file size and reducing the possibility of duplicate points appearing in the model. This option is particularly useful on files imported from CAD or another sources, where the modeller is reporting duplicate points. The option always attempts to minimise changes to the plan cartography and surface model.

For example, if it finds two points that are on separate strings and both in the DTM, it will remove one from the DTM rather than deleting it altogether. Selecting this option presents;



The following parameters are available:

Search Tolerance

This field specifies the plan distance below which points are considered to be identical.

Default value: 0.0020

Detailed search

This switch defines which points are checked for distance against the current point. This can be either every co-ordinate in the sheet, every co-ordinate in the same string, or just

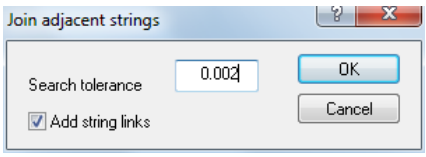
the co-ordinates immediately behind and ahead of that co-ordinate in the sheet. This option may be quite slow if every point is being checked against every other point. If a duplicate point found is a single point and is the same as a point lying on a string, the single point will be deleted.

Only check DTM points

If this switch is turned on duplicate points will only be removed when both points are in the DTM.

31.6.1.4 Join adjacent strings (Coordinate Tools Menu)

This option automatically joins adjacent strings to form new continuous strings (polylines). This is typically used when recreating strings from line segments input from CAD. This operates by searching for pairs of points that have similar co-ordinate values and feature names but different string numbers. When such a pair of co-ordinates is found one of the co-ordinates is deleted and the remainder of the string is renumbered to form and extension of the previous string. This option will also close strings, using a LINK tag, where the first point is the same as the last point. Selecting this option presents;



The following parameters are available:

Search tolerance

This field specifies the plan distance below which points are considered to be identical.

Default value: 0.0020

Add string links

If this option is selected any strings with start and end points within the tolerance given will have their last point deleted and the tag code of their second last point set to link (close string).

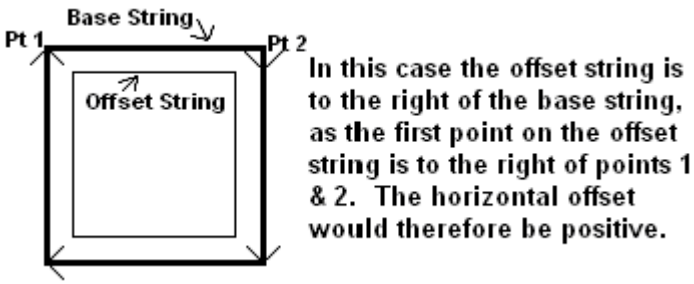
31.6.1.5 Delete ‘Ignored’ points (Coordinate Tools Menu)

This option deletes all points with the DTM code IGNORE from the sheet. Deleted points may not be recovered. This facility reduces the overall size of this co-ordinate sheet, it is called automatically by the co-ordinate reduction function. It may be used in conjunction with the search and replace functions in order to perform a search and delete operation. For example, if the user imported a DXF file from AutoCAD that included a layer called GRID that was not required in SCC. Use the search and replace function to set the DTM code of all records with feature name ‘GRID’ to IGNORE and then call this function.

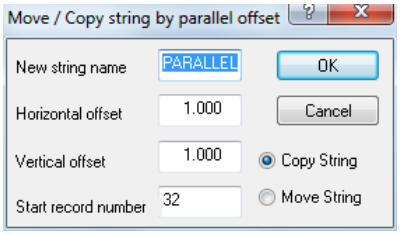
31.6.1.6 Move / Copy a string parallel. (Coordinate Tools Menu)

This option creates a new string, or moves an existing string, that is offset to a given string by a given distance in plan and level. The start record number determines the source string. This option is useful for extruding surfaces such as buildings, storage tanks and tops of kerbs. When using this option to extrude a surface, ensure that a small horizontal distance, such as 10mm, is given in order for the triangulation to form correctly. For example, if using this facility to put a roof on a building, ensure that the string representing the roof is inside the string representing the base. Checking the direction of the string visually, and entering a small horizontal offset to force the roof string inside the base string may do this. The building will now be represented in full 3D in the surface model and may be used in sectional, volumetric, and

viewshed analysis.



This facility is also available directly from survey by using the parallel feature attribute in the MSMM, or by entering a parallel feature attribute in the observation sheet. To extrude walls, ditches and similar features see the 'strip level' option in the feature library. Selecting the 'Copy > Move a string parallel' option presents you with a dialogue containing the following parameters; New string name, Horizontal offset, Vertical offset, Start record number, Copy String / Move String



Horizontal Offset

This field specifies the plan distance between the survey string and the parallel offset string. A negative distance indicates a left offset, a positive distance indicates a right offset.

Vertical Offset

This field specifies the height difference between the survey string and the parallel offset string.

Start record number

This field contains record number, as displayed in the title on the bottom of the sheet, of the first record that will be used or modified. Note that the record number will generally NOT be the same as the survey point number.

Copy String/Move String

This switch defines whether the co-ordinates that make up the existing string will be deleted. If this is the case the copy parallel facility operates as a move parallel facility. Setting the DTM status of the original string co-ordinates to IGNORE carries out deletion.

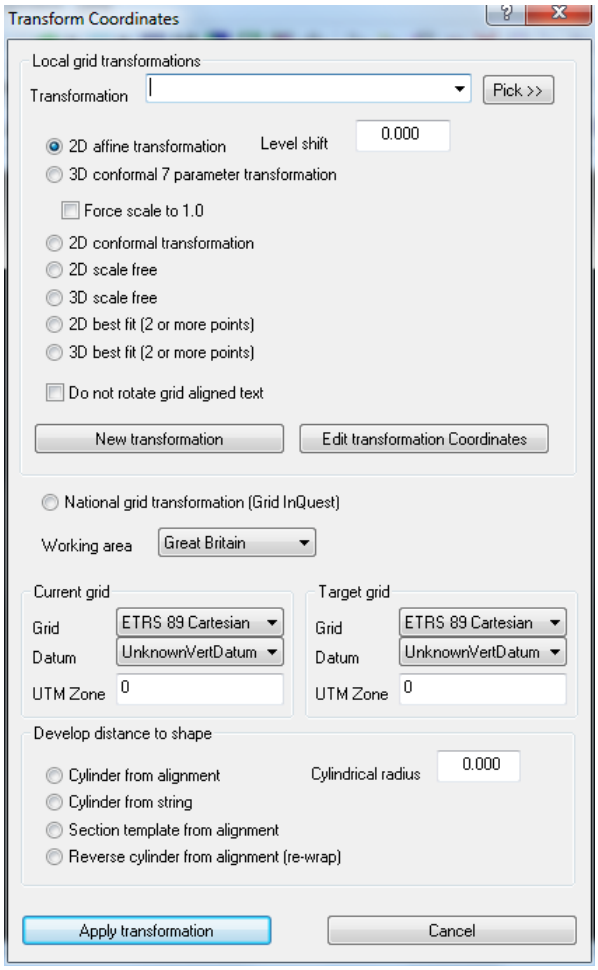
31.6.1.7 Flip Sort Order (Coordinate Tools Menu)

This facility sorts the co-ordinate file by X, Y, Z, starting at 000.000, 000.000, 00.00. This would be used so as to speed up the Remove Duplicate Points options and should be used in no other circumstances.

31.6.1.8 Transform co-ordinates (Coordinate Tools Menu)

This option permits the user to create or edit a transformation from one co-ordinate system to another. The transformation editor lets the user enter any number of co-ordinates in both systems and calculates a transformation that will convert data between these systems.

Selecting the transformation option brings up a dialogue with the following parameters;



Pick

Select an existing Transformation file.

Transformation file

Select the transformation file to be used for this transformation. This name will be used, with the extension '.REP', for the transformation results report.

Tranformation type

2D Affine

The transformation used is an affine two-dimensional transformation with elevation datum shift. This transformation allows for rotation, translation and scaling in plan along with translation of levels. Independent scaling will be used on both axes. This transformation is suitable for moving two dimensional data, that may have been digitized from mapping, from one coordinate system to another.

3D Conformal 7 Parameter Transformation

The transformation used is a 3D conformal transformation, sometimes called a 7 parameter transformation. This transformation shifts, rotates and scales in three dimensions. The scale is applied uniformly on all axes. This option is suited to moving between different 3d coordinate systems, such as local and national grid.

2D Conformal Transformation

The transformation used is a 2D conformal transformation. This transformation shifts, rotates and scales in plan. The scale is applied uniformly on both X and Y axes. This option is suited to moving between different coordinate systems in cases where you do not wish to change the surveyed elevations.

Force the conformal transformation to be scale free

The conformal transformations can now be forced to use a scale factor of 1.0

2D Scale Free

The coordinates will be shifted and rotated in plan but not scaled.

3D Scale Free

The coordinates will be shifted and rotated in plan but not scaled.

2D Best Fit (2 or more points)

The 2D Best Fit requires a minimum of two points rather than the 3 points required for the least squares transformations, and is based around a plan shift, level shift and plan rotation. The report includes the shifts, rotation, scale where appropriate, and CoG origin about which shift and rotation is performed

3D Best Fit (2 or more points)

The 3D Best Fit requires a minimum of two points rather than the 3 points required for the least squares transformations, and is based around a plan shift, level shift and plan rotation. The report includes the shifts, rotation, scale where appropriate, and CoG origin about which shift and rotation is performed

To obtain more detailed statistics, including CoG information, on the 2d and 3d (7 parameter) transformations, select '**FILE** > **General Options / Units & Data Checking** > **All Possible diagnostic information**'. This should be reset to 'errors, warnings, and notes' after completing the transformation

Do not rotate grid aligned text

This option allows the user to not rotate grid aligned text during a transformation.

National Grid Transformation (Grid InQuest)

Support has been added for national grid transformations between ITM, Irish Grid, OSGB36 and ETRS89. These transformations utilise Grid Inquest software provided by Quest Geo Solutions.

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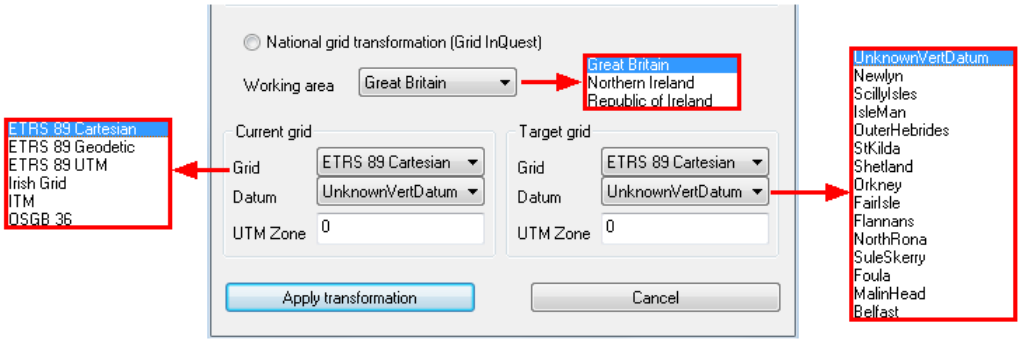


Developing Distance To Shape

Options are available to allow transforming of plan models onto the insider of a cylinder. This complements the cylinder unwrapping tool, to allow editing of unwrapped models such as tunnels to be re-wrapped to the tunnel coordinate system:

Cylinder from alignment

Cylinder from string

Section template from alignment

Reverse cylinder from alignment (re-wrap)

Cylindrical radius

Transformation Result Report

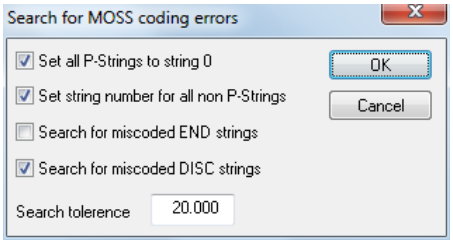
Once the transformation has been computed, a report file showing the transformation results is generated and may be edited. This report includes the data used, the residuals generated, and the transformation coefficients computed. Also generated are block creation, insertion, scaling and rotation values that may be used to apply the transformation to a CAD drawing. Block creation and insertion points based around the origin, and the centres of gravity of the original data are generated. If the user does not wish to apply the scale provided, the second of these should be used. If a drawing has been exported to CAD and subsequently requires transformation a block may be made of the original drawing. The block may then be transformed using the given co-ordinates of the block creation point, insertion point and the scale to be applied. If a significant inappropriate scale, or large residual values, is generated, check your input data. If the users has a large number of points in both systems, the user should try to replace points with large residuals with other matched points that are near to those points.

31.6.1.9 Search for String Errors (Coordinate Tools Menu)

Strings are searched for errors. When errors are found they are automatically fixed and reported to the logfile. Errors encountered may be a gap at the end of a string, one point on a string, less than three points on a curve etc.

31.6.1.10Search for MOSS Errors (Coordinate Tools Menu)

The file is searched to make sure that every string complies with MX coding. This option has been implemented for use specifically by INDOT.



31.6.1.11Renumber Points (Coordinate Tools Menu)

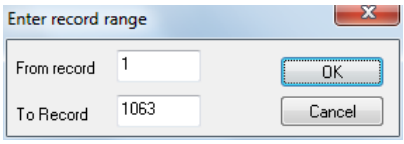
This option renumbers the construction points within a survey. '01' is added to the end of the point number.

For example, Point 91 becomes 9101. This option is present so as to make construction points easily recognisable.

31.6.1.12Remove Loops (Coordinate Tools Menu)

This option is designed for use in conjunction with the Edit Strings Details option from the Model Edit menu.

1. Select a string in the model that contains loops.
2. Go to **'Edit > Edit String Details'** and then select **'Edit > Remove Loops'**.
3. A dialog will be presented asking for the record range to be entered.



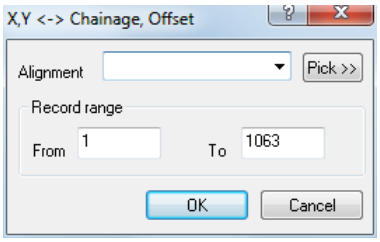
If the first point on a string is selected, all loops will be removed from the string.

If a point on a loop is selected as the first point in the record range, the loop will remain and the rest of the string will be deleted. When all changes have been made select 'Update string in model'.

This option may be used with a dataset when you determine the record range from which the loops should be removed.

31.6.1.13Compute X,Y from Chainage, Offset (Coordinate Tools Menu)

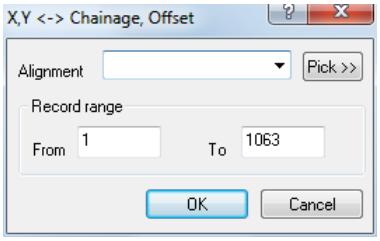
This option and the option to compute chainage, offset from X,Y have been added to the coordinate sheet to allow bi-directional conversion between chainage & offset, and X,Y. This option uses an alignment string to perform the necessary interpolations. This option greatly simplifies creation of DTMs from levelling data.



31.6.1.14Compute Chainage, Offset from X,Y (Coordinate Tools Menu)

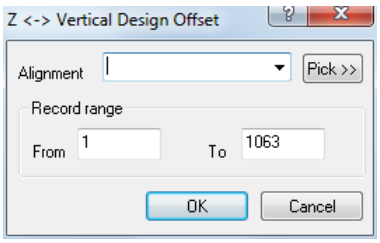
This option and the option to compute X,Y, from chainage, offset have been added to the coordinate sheet to allow bi-directional conversion between chainage & offset, and X,Y. These options use an alignment string to perform the necessary interpolations. This option greatly

simplifies the creation of sectional data where the design is available.



31.6.1.15Compute Vertical Design Offset from Z (Coordinate Tools Menu)

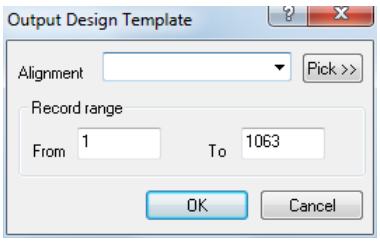
This option allows you to calculate and store differences between the current elevation and the design elevation for the current chainage, for a range of points. The design elevation used is the elevation of the vertical alignment at the chainage for the current point. This elevation is subtracted from the current elevation and the result replaces the current elevation.



This option also allows you to compute and store instantaneous cant / super-elevation in the dimension fields, d1, d2 and d3. The left instantaneous cant or super-elevation is stored in d1, the right in d2. The effect of super-elevation on the level of the current point, based on its chainage and offset, is stored in d3

31.6.1.16Output Coordinates as Section Templates (Coordinate Tools Menu)

This option presents an Output Design Dialog.



31.6.1.17String using Chainage / Offset (Coordinate Tools Menu)

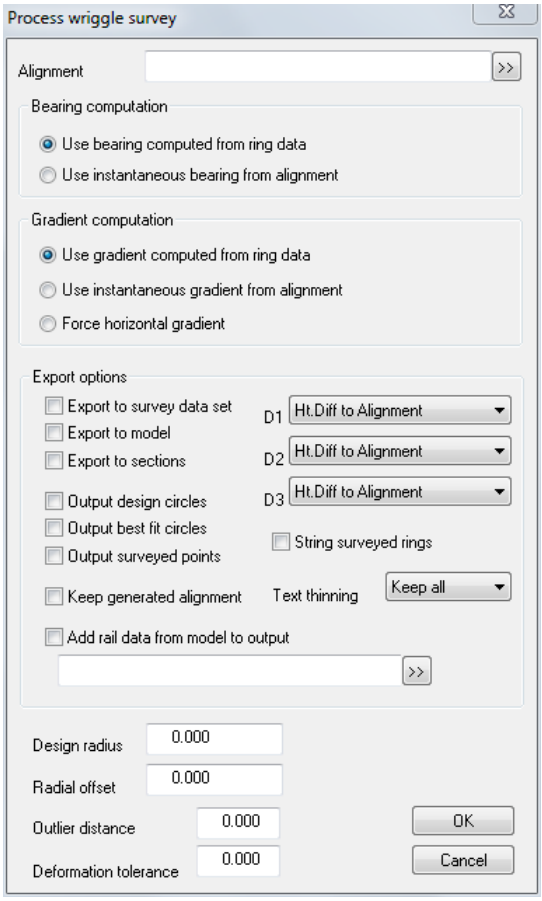
This option sorts data based on the chainage and offset values.

31.6.1.18Compute Wriggle Survey (Coordinate Tools Menu)

This option supports the computation of wriggle survey data. The following options are available:

- to export the rings as annotated sections, including surveyed points, design circle and best fit circle on each sections.
- to allow the alignment generated by connecting ring centres to be kept.
- to allow storage of additional information in exported dimension columns, which can be reviewed in the exported models
- to report details of design and best fit radii, and point by point difference to the design radius.

- to automatically detect and remove outliers while carrying out the wriggle processing, where a user defined tolerance may be used to control what constitutes an outlier. Outliers that have been removed appear as spots on the section, whereas points kept appear as the surveyed string.
- to set deformation tolerances, where out of tolerance points are highlighted in section and in the report files.
- to allow the output of raw data, fit data and design data.
- to display text on wriggle sections displayed radially, with thinning options to remove potentially overlapping text.



D1, D2 and D3

Specific Dimension 1, 2 and 3 options are available: Ht. Diff to Alignment, Ht. Diff to Alignment, Ht. Diff to Centre, Alignment Ht/Z, Radius, Diff Radius from mean, Diff Radius from design, None

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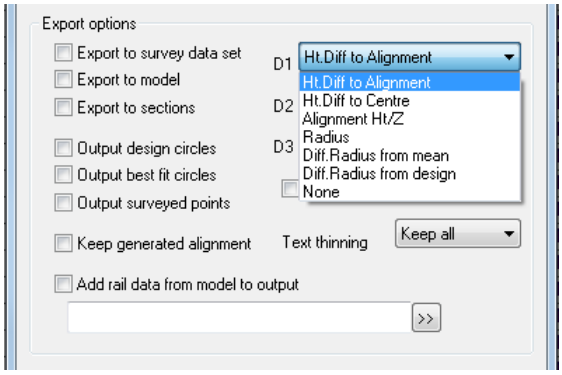
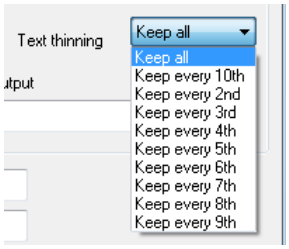
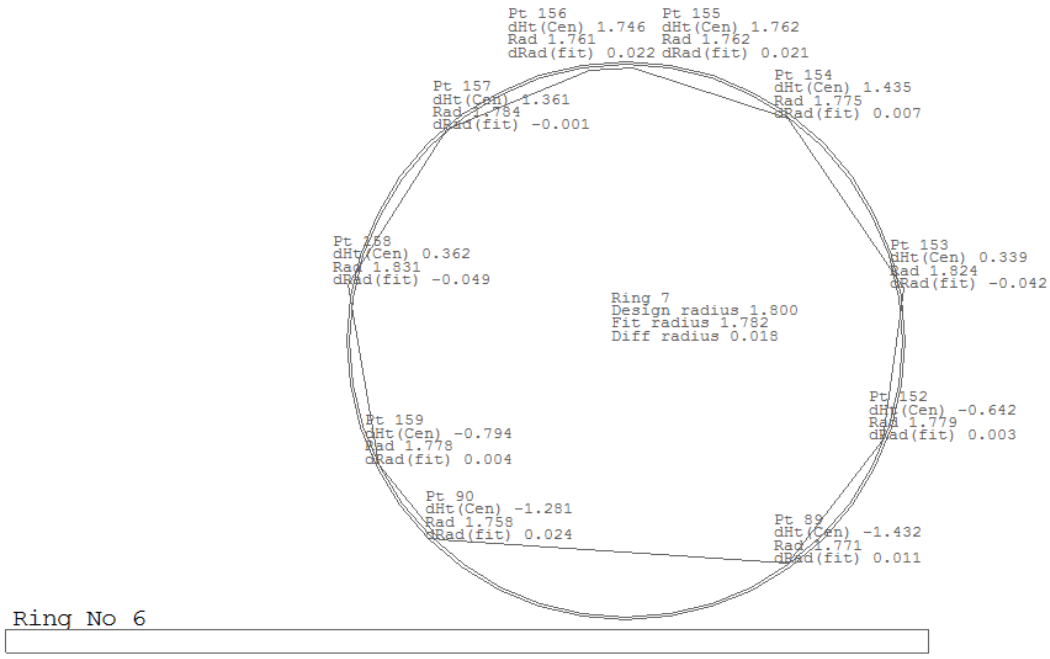


Text thinning

This options specifies the amount of text the user wishes to keep.



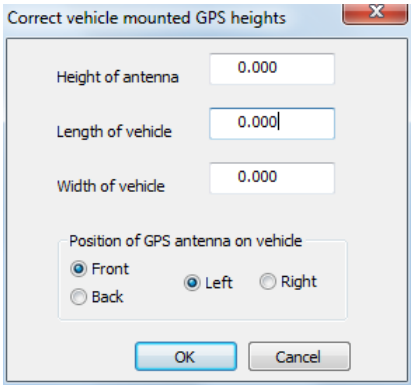
Sections are annotated with the dimensions with some extra annotation at the centres as can be seen below. Settings can be customised within the section style and feature library. Titles can be changed as required, and the text editing functions can be used to move and tidy up the text.



31.6.1.19Compute Vehicle Mounted GPS Errors (Coordinate Tools Menu)

This tool automatically corrects for errors occurring in vehicle mounted GPS surveys due to pitch and roll e.g. beach surveys done with a quad bike, where the effect of the vehicle travelling over non-level ground means that the GPS antenna and pole is not vertically above the ground. The roll and pitch of the vehicle in the direction of the vehicle are the cause of this

error, and can be calculated by creating a provisional DTM from the uncorrected data.



Once run, a new data set is created with the corrected coordinates, and longitudinal, lateral and height corrections are stored in D1, D2, and D3. Longitudinal corrections will be large when going up or down hill and small when on the flat or following a contour. Lateral corrections will be large when following a contour on a sloped surface, and small going directly up or down hill or on a flat.

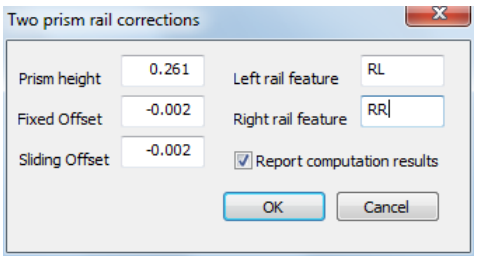
While the length and width of the wheel base are not that significant, whether the pole is to the front or to the back is as important as whether it is on the left or right. Basically, the vehicle dimensions and pole positions are used to determine the position of two points at which and elevation is taken, which in conjunction with the surveyed point are used to determine pitch and roll. If the pole is on the left, the point used to determine roll is taken on the right of the line of travel, otherwise it is taken on the left. This is important when the vehicle is following the edge of an embankment. If the pole is on the front of the vehicle, the point used to calculate pitch is taken from behind the line of travel, otherwise it is taken in front. This is important where the vehicle is going from a flat to sloped surface or vice versa. Both are important where there is a lot of grade change, e.g. dunes.

Entering an incorrect pole position relative to the wheel base of the vehicle would lead to the position of change of grades, e.g. top and bottom of bank, being incorrect. The size of the correction is due to the slope of the ground and the antenna height, with greater antenna heights leading to a larger correction. On test data sets used, with an antenna height of 1.45m and a gradient of 1:5, the horizontal correction was approx. ±260mm and the vertical correction ±25mm.

Note that the corrected dataset will be slightly smaller than the uncorrected dataset, as corrections cannot be safely calculated for all points at the edge of the model.

31.6.1.20 Compute Two Prism Rail Corrections (Coordinate Tools Menu)

This option supports surveying of rail tracks using a two prism method. This produces a report showing raw and adjusted coordinates, and will create a new survey containing the adjusted rail data. The point number is based on field 71 of the left hand rail rather than the survey point number.

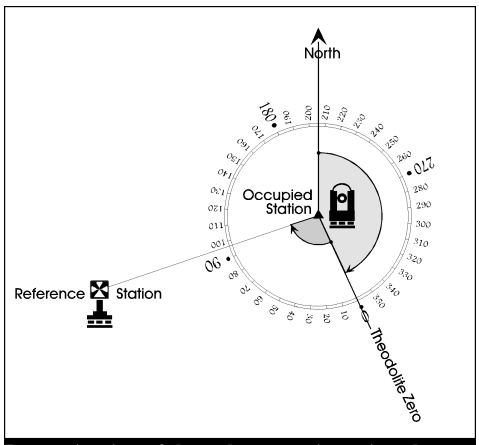


31.7 Instrument Set Up

Instrument Set-ups, containing observed back-sights, used to orient the horizontal circle whenever the total station is moved. The instrument set-up sheet also contains distance and coordinate misclosures, along with other QA fields.

31.7.1 Station Orientation

The primary function of the instrument set-up spreadsheet is to determine the orientation of the horizontal circle of your instrument. This is referred to in the software as the instrument zero. When we set-up a theodolite we measure included clockwise angles between the instrument zero and the target point. These angles are horizontal dimensions (that the current horizontal circle reading for the current telescope pointing) rather than bearings as they are not relative to grid north. However, in order to calculate co-ordinates from our detail observations we require that these directions be converted into bearings. To do this we must determine the included angle between grid north, the occupied station and the instrument zero. We refer to this angle as the HA datum, this is the angle that must be subtracted from any horizontal direction observed from this set-up to convert it into a bearing.



Determination of the unknown orientation element

In order to compute the HA datum we need to know the bearing of the line Occupies Station to Reference Station. This will be computed from co-ordinates, if co-ordinates for the occupied and reference station are available. If co-ordinates are not available the bearing of this line may be entered manually. This will often be the case when an arbitrary grid is being used on a small survey. We also require an observation to the reference station to be taken. Given these two pieces of information the HA datum can be calculated as the difference in angles between the observed direction and the calculated bearing.

If more than one reference station is sighted multiple values for the instrument zero are calculated and the mean value is used when computing co-ordinates. This provides a strong orientation solution when accurate surveying is to be undertaken. If the dispersion of the residuals about the mean is small, then this is in fact checking the included angles between successive reference orientation stations. This of course removes the possibility of gross error or will detect weakness in the control stations.

It is possible to perform multiple sightings to the same station to increase orientation strength but this will not provide the other checks as previously outlines. The other method of checking for gross error is to check the join distance between the occupied station as derived from the control co-ordinates and the values measured to a target in the field.

However, this is sometimes inconvenient in certain circumstances. For instance, if station points are on the periphery of a quarry and it takes a considerable time to observe these by occupying the reference station with the prism target, then by observing at least two reference stations for horizontal angel only, the included angle can be checked, the orientation improved and gross error avoided.

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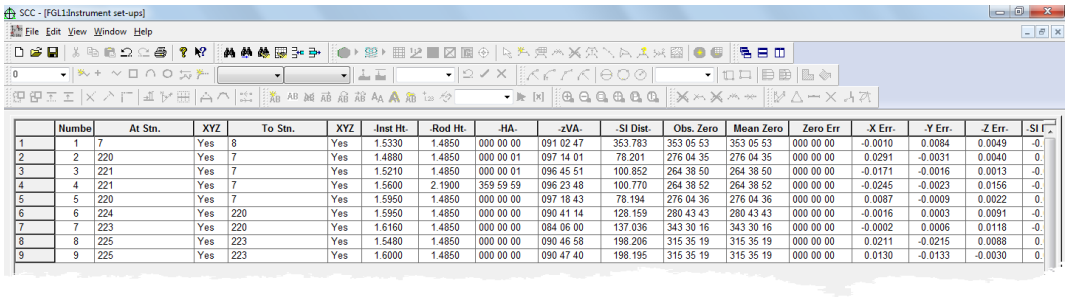
31.7.2 Instrument Set Up

Selecting this option allows you to edit the station set-up details from which the current point was fixed. Modifying the station set-up details will require the associated survey to be re-co-ordinated and the model to be rebuilt. If the co-ordinate file was not formed from a detail survey then this option may not be used.



	Numbe	At Stn.	XYZ	To Stn.	XYZ	-Inst Ht-	-Rod Ht-	-HA-	-zVA-	-Sl Dist-	Obs. Zero	Mean Zero	Zero Err	-X Err-	-Y Err-	-Z Err-	-Sl
1	1	7	Yes	8	Yes	1.5330	1.4850	000 00 00	091 02 47	353.783	353 05 53	353 05 53	000 00 00	-0.0010	0.0084	0.0049	-0.
2	2	220	Yes	7	Yes	1.4880	1.4850	000 00 01	097 14 01	78.201	276 04 35	276 04 35	000 00 00	0.0291	-0.0031	0.0040	0.
3	3	221	Yes	7	Yes	1.5210	1.4850	000 00 01	096 45 51	100.852	264 38 50	264 38 50	000 00 00	-0.0171	-0.0016	0.0013	-0.
4	4	221	Yes	7	Yes	1.5600	2.1900	359 59 59	096 23 48	100.770	264 38 52	264 38 52	000 00 00	-0.0245	-0.0023	0.0156	-0.
5	5	220	Yes	7	Yes	1.5950	1.4850	000 00 00	097 18 43	78.194	276 04 36	276 04 36	000 00 00	0.0087	-0.0009	0.0022	0.
6	6	224	Yes	220	Yes	1.5950	1.4850	000 00 00	090 41 14	128.159	280 43 43	280 43 43	000 00 00	-0.0016	0.0003	0.0091	-0.
7	7	223	Yes	220	Yes	1.6160	1.4850	000 00 00	084 06 00	137.036	343 30 16	343 30 16	000 00 00	-0.0002	0.0006	0.0118	-0.
8	8	225	Yes	223	Yes	1.5480	1.4850	000 00 00	090 46 58	198.206	315 35 19	315 35 19	000 00 00	0.0211	-0.0215	0.0088	0.
9	9	225	Yes	223	Yes	1.6000	1.4850	000 00 00	090 47 40	198.195	315 35 19	315 35 19	000 00 00	0.0130	-0.0133	-0.0030	0.

Number

This field contains the sequential station set-up or occupation number, which corresponds to the station field in the detail observations file. Multiple records with the same number indicate that mean values for orientation and corrections will be calculated based on multiple reference objects.

At Stn

This field contains the name of the station occupied for this set-up. The co-ordinate value for this station may be found in the station co-ordinates file.

XYZ

This field specifies whether a co-ordinate exists for the occupied station in the station co-ordinates file.

There are two parameters; Yes or No

To Stn

This field contains the name of the reference station observed for this set-up. The co-ordinate value for this station will normally be found in the station co-ordinate file. This field may be blank or have an invalid station name, in which case orientation is calculated from the bearing entered between the occupied and reference stations.

XYZ

This field specifies whether a co-ordinate exists for the occupied station in the station co-ordinates file.

There are two parameters; Yes or No

-Inst Ht-

This field contains the instrument height as entered in the field. It is used when calculating station elevations.

-Rod Ht-

This field contains the rod height entered for the current station observation. It is used in conjunction with the instrument height and the derived height difference (Ht Diff) between

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the instrument collimation and the tilting axis of the prism to check the height difference between the occupied station and the reference station from that computed from the control station elevations.

-HA-

This field contains the observed horizontal angle for the current observation. Note that this is a horizontal direction rather than an azimuth as it is measured from the zero of the horizontal circle of the instrument.

-zVA-

This field contains the observed vertical/zenith angle for the current observation. This is combined with the height and rod height in the formula to determine the difference in height between the occupied and reference station (as described under -Rod Ht-).

-Sl Dist-

This field contains the slope distance for the current observation. This is combined with the height and rod height in the formula to determine the difference in height between the occupied and reference station (as described under -Rod Ht-).

Obs. Zero

This field contains a value for the instrument zero for this observation. This will either be calculated from the co-ordinates of the occupied and reference stations, or entered directly if co-ordinates for the reference station are not available. For example, if orientation is being calculated from a landmark such as a church spire.

Mean Zero

This field contains the mean instrument zero for all the observations in this station set-up. It is used to convert observed horizontal angles (directions) into whole circle bearings.

Zero Err

This field contains the difference between the mean zero and the observation zero for this observation. It is only applicable to set-ups with more than one reference observation.

-X Err-

This field contains difference in X co- ordinate for the stored and calculated values of the reference station. It is only valid if a distance has been observed and the reference stations exist in the station co-ordinates file.

-Y Err-

This field contains difference in Y co-ordinate for the stored and calculated values of the reference station. It is only valid if a distance has been observed and the reference stations exist in the station co-ordinates file.

-Z Err-

This field contains difference in elevation/z for the stored and calculated values of the reference station. It is only valid if a distance has been observed and the reference stations exist in the station co-ordinates file.

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-Sl Dist Err-

This field contains difference between the observed slope distance and the join distances computed from the occupied and reference station co-ordinates. It is only valid if a distance has been observed and the reference stations exist in the station co-ordinates file.

Obs 'k'

This field contains the refraction correction constant 'k' that has been computed locally for this observation. This value will only be calculated if a distance has been observed and the reference stations exist in the station co-ordinates file. Refraction correction is used to improve accuracy for trigonometric levelling.

Mean 'k'

This field contains the mean refraction correction constant 'k' that has been computed from the individual computed values for each observation.

Scale

This field contains the PPM distance scale factor computed from temperature and pressure entered at time of survey. This value will not by default be applied as the instrument normally applies it.

To apply this value select the ‘Corrections' menu. It is calculated as -

ppm=275 - 79.55 x (p / (273 + t))

where p = pressure

t = temperature

Temperature

This field contains the temperature, in degrees centigrade, measured at time of survey. It is used in calculating atmospheric scale correction.

Pressure

This field contains the pressure, in millibars, measured at time of survey. It is used in calculating atmospheric scale correction.

Comp Dist

This field contains the join distance computed between the occupied station and the reference station. It is only valid if both stations exist in the station co-ordinates file.

Comp Brg

This field contains the join bearing computed between the occupied station and the reference station. If the reference station co-ordinates are not available a value may be entered here for the purposes of computing orientation.

-Hor Dist-

This field contains the horizontal distance, computed from the slope distance and the zenith angle, for the current point in the file. It is provided for reference purposes only.

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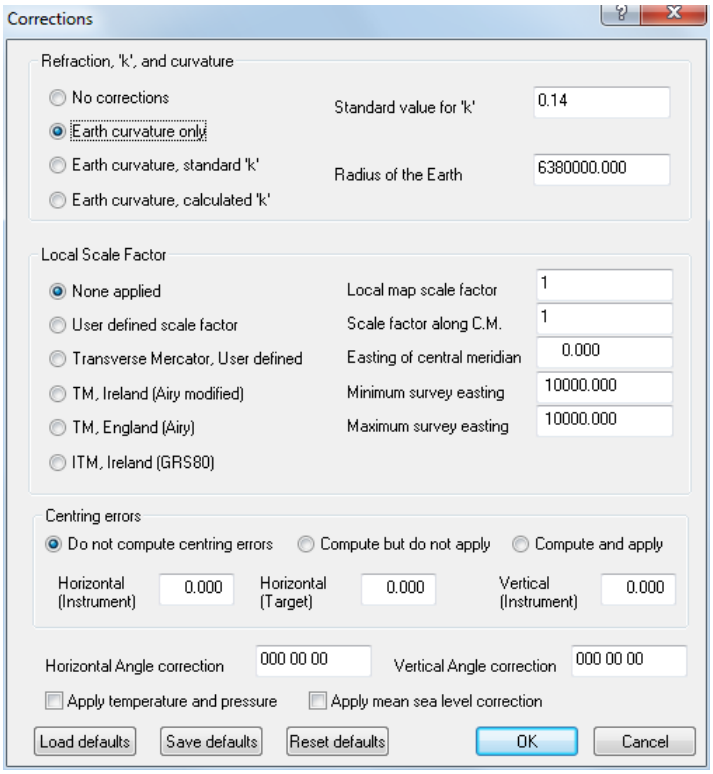
-Ht Diff-

This field contains the height difference, computed from the slope distance and the zenith angle, instrument and rod heights, for the current point in the file. It is provided for reference purposes only.

31.7.3 Corrections (Edit Menu)

This option allows the user to control how corrections for refraction, earth's curvature, local scale factor, temperature, and pressure are applied.



See Also

Corrections (Edit Menu)

31.8 Alignment Sheet

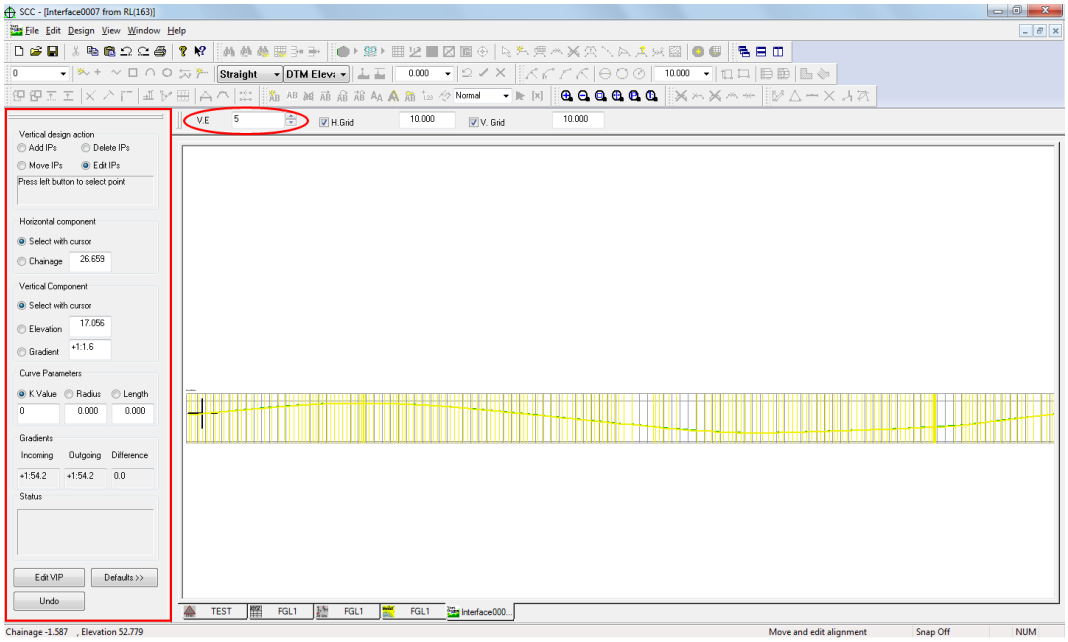
The **alignment** document stores all information relating to horizontal, vertical, and section template design data.

31.8.1 Alignment Design Menu

31.8.1.1 Design Vertical Alignment(Alignment Design Menu)

This option 'Design > Vertical Alignment' may only be selected when a horizontal alignment is currently attached to the model.

The horizontal menu bar appears at the top of the vertical design sheet contains the options increase/decrease the vertical exaggeration and display a horizontal or vertical grid across the profile. A better view of the existing ground profile may be obtained by increasing the Vertical Exaggeration.



The position of the horizontal design elements is indicated by the coloured vertical lines along the profile. The colours correspond to the colour of the elements on the horizontal design.

Colour	Design Element
Yellow	Straight
Red	Transition
Blue	Curve

When this option is selected a side bar menu and a top bar menu are opened. The side bar menu highlighted in red above contains the following options;

Vertical Design Action

The action required by the selected option is displayed in the bottom section of this dialog. This field contains 4 options;

Add IPs	Adds Intersection points interactively to the profile
Delete IPs	Allows existing intersection points to be deleted from the vertical alignment by selecting them interactively
Move IPs	Allows existing intersection points to be moved interactively on the profile.
Edit IPs	Allows existing intersection points information to be edited via the horizontal and vertical component, curve parameters and gradients dialogs.

Horizontal Component

The horizontal position of the vertical design may be specified with the cursor or by chainage. This option is used when Add IPs or Edit IPs is selected. This option is used in conjunction with the chosen vertical component.

Vertical Component

The vertical component of the design may be defined with the mouse, or by a predefined elevation or gradient. When Elevation or Gradient is specified the vertical component may only be moved along the specified elevation or gradient.

Curve Parameters

This field allows specification of the following parameters for the generation of vertical curves;

K Value

Radius

Length

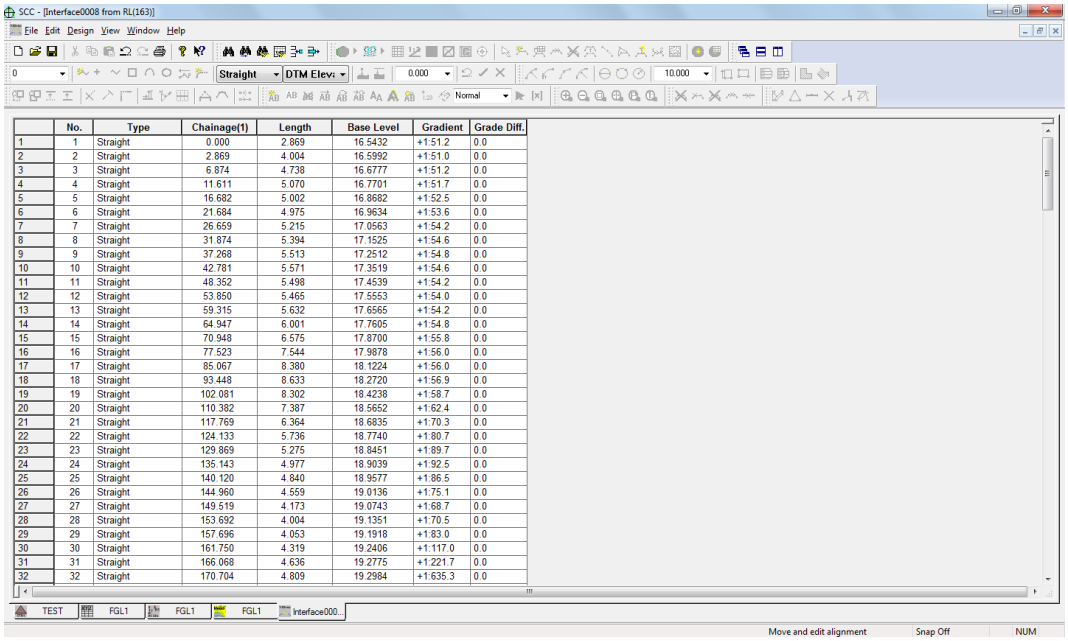
Gradients

This field allows specification of incoming and outgoing gradients. The units by which gradients are defined are specified in the 'Units and Data Checking' section of the General Options.

Status

This field defines the status of the current vertical design. If there is a problem with the design, it will be displayed here. When designing the alignment the next action required is displayed in this field.

The vertical design sheet displays the vertical profile of the model along the horizontal design and position of all horizontal design elements **'View > Vertical Design Entities'**.



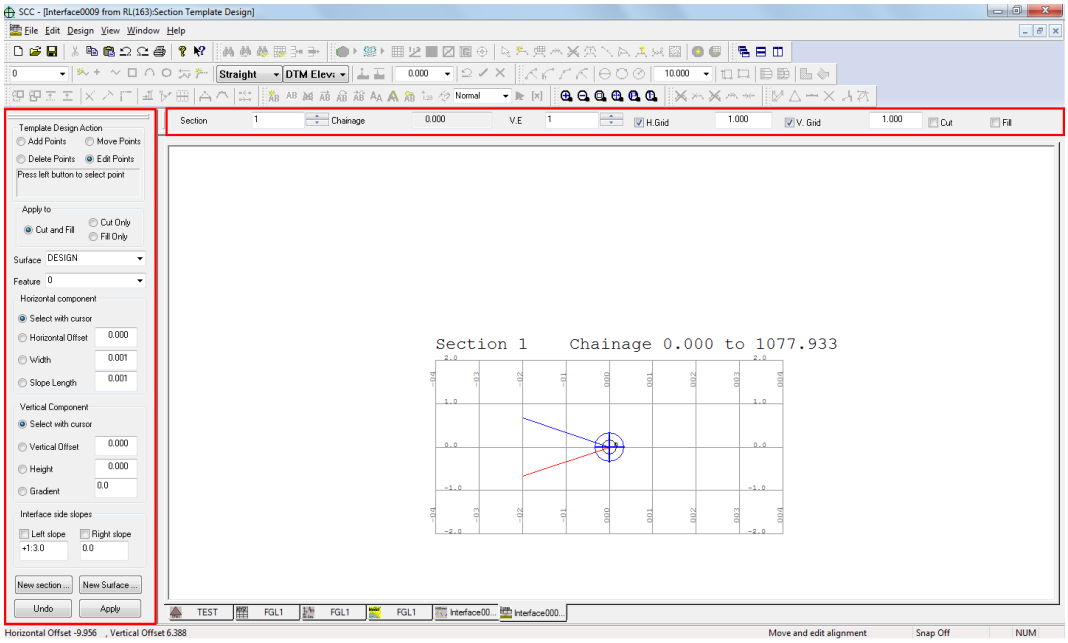
	No.	Type	Chainage(1)	Length	Base Level	Gradient	Grade Diff.
1	1	Straight	0.000	2.869	16.5432	+1:51.2	0.0
2	2	Straight	2.869	4.004	16.5992	+1:51.0	0.0
3	3	Straight	6.874	4.738	16.6777	+1:51.2	0.0
4	4	Straight	11.611	5.070	16.7701	+1:51.7	0.0
5	5	Straight	16.682	5.002	16.8682	+1:52.5	0.0
6	6	Straight	21.684	4.975	16.9634	+1:53.6	0.0
7	7	Straight	26.659	5.215	17.0563	+1:54.2	0.0
8	8	Straight	31.874	5.394	17.1525	+1:54.6	0.0
9	9	Straight	37.268	5.513	17.2512	+1:54.8	0.0
10	10	Straight	42.781	5.571	17.3519	+1:54.6	0.0
11	11	Straight	48.352	5.498	17.4539	+1:54.2	0.0
12	12	Straight	53.850	5.465	17.5553	+1:54.0	0.0
13	13	Straight	59.315	5.632	17.6565	+1:54.2	0.0
14	14	Straight	64.947	6.001	17.7605	+1:54.8	0.0
15	15	Straight	70.948	6.575	17.8700	+1:55.8	0.0
16	16	Straight	77.523	7.544	17.9878	+1:56.0	0.0
17	17	Straight	85.067	8.380	18.1224	+1:56.0	0.0
18	18	Straight	93.448	8.633	18.2720	+1:56.9	0.0
19	19	Straight	102.081	8.302	18.4238	+1:58.7	0.0
20	20	Straight	110.382	7.387	18.5652	+1:62.4	0.0
21	21	Straight	117.769	6.364	18.6835	+1:70.3	0.0
22	22	Straight	124.133	5.736	18.7740	+1:80.7	0.0
23	23	Straight	129.869	5.275	18.8451	+1:89.7	0.0
24	24	Straight	135.143	4.977	18.9039	+1:92.5	0.0
25	25	Straight	140.120	4.840	18.9577	+1:86.5	0.0
26	26	Straight	144.960	4.559	19.0136	+1:75.1	0.0
27	27	Straight	149.519	4.173	19.0743	+1:68.7	0.0
28	28	Straight	153.692	4.004	19.1351	+1:70.5	0.0
29	29	Straight	157.696	4.053	19.1918	+1:83.0	0.0
30	30	Straight	161.750	4.319	19.2406	+1:117.0	0.0
31	31	Straight	166.068	4.636	19.2775	+1:221.7	0.0
32	32	Straight	170.704	4.809	19.2984	+1:635.3	0.0

31.8.1.2 Section Templates (Alignment Design Menu)

Section Templates may be interactively designed. Sections of varying width may be attached to different chainages along the alignment. This may be needed to accommodate roads of varying width. Elements such as drains, which may occur only in cut or elements which occur only in fill may also be catered for in the section templates.

When this option is selected a side menu bar and a top menu bar are opened.

The top menu bar tells the section number, the chainage of the current section, the vertical exaggeration of the section, horizontal and vertical grid, and cut and fill displays.



The side menu bar contains the following options;

Action

The action required by the selected option is displayed in the status section of the Template Design Action.

This field contains 4 options;

Add IPs	Allows profile points to be added to the template interactively.
Delete IPs	Allows existing profile points to be moved interactively on the template.
Move IPs	Allows existing profile points to be deleted from the template by selecting them with the cursor.
Edit IPs	Allows existing profile points to be edited via the horizontal and vertical components and the Interface side slopes.

Feature

This option sets the feature for each point added to the template. Having a separate feature name for each point makes them more easily recognisable. Select a feature from the list given.

Surface

More than one surface may be created on a section template. Select a surface from the list given. To create a new surface select the New Surface option at the bottom of the side menu bar.

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New

This option allows a new section template to be designed. This option is used when the same template cannot be used for the whole of the alignment. When this option is selected specify the chainage where the new template will begin. The new template will run from this chainage to the end of the alignment.

Horizontal Component

This option works in conjunction with the vertical component. The horizontal component of each template point may be selected using 4 different methods. Select interactively with the cursor, select by specifying a horizontal offset, select by specifying a width or horizontal distance from the previous point or select by specifying a slope distance from the previous point.

Vertical Component

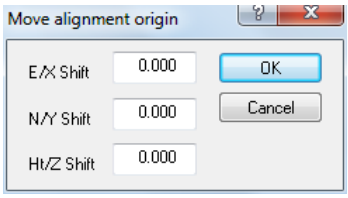
This option works in conjunction with the horizontal component. The vertical component of each template point may be selected using 4 different methods. Select interactively with the cursor, select by specifying a vertical offset, select by specifying a height difference from the previous point or select by specifying a gradient from the previous point.

Interface Side Slopes

Interface side slopes extend from the end points of the section at a specified gradient until they meet the ground surface. Specify the gradient of the side slopes and whether or not they are switched on.

31.8.1.3 X, Y, Z Shift (Alignment Design Menu)

This option moves the alignment by specified X, Y and Z values. These values are typed into the Move Alignment Origin dialog.



31.8.1.4 Export Design as Dataset (Alignment Design Menu)

This option allows the alignment to be exported to a survey data set. The Export Alignment dialog is presented.

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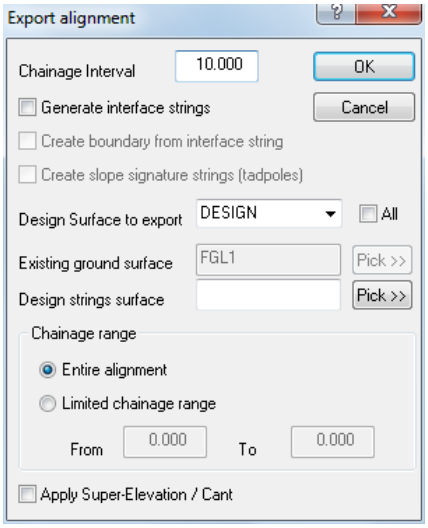
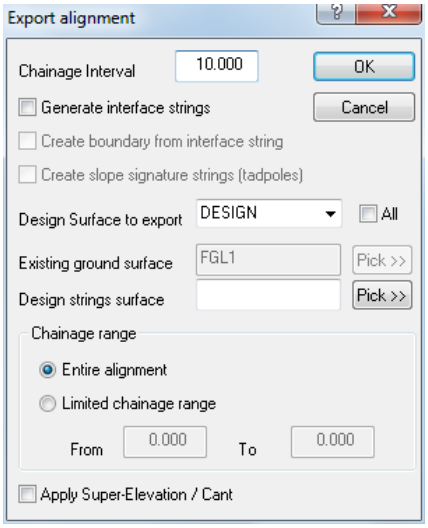


The data set will contain X,Y,Z, chainage and offset information.

31.8.1.5 Export Design as Model (Alignment Design Menu)

This option exports the alignment to a separate TIN model. The Export Alignment dialog is presented.



31.8.1.6 Interface and Export Parameters (Alignment Design Menu)

This option presents the Export Alignment Dialog which allows you to view and adjust the parameters for exporting the current alignment as an interface string.

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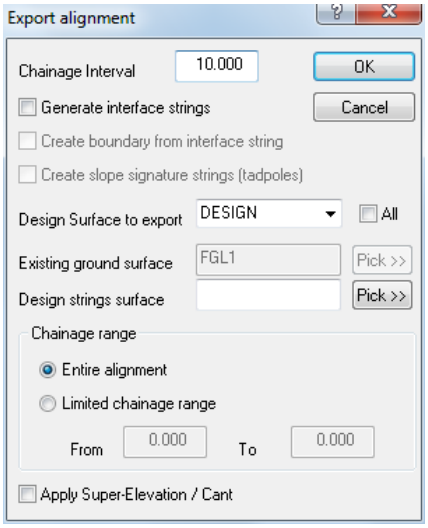
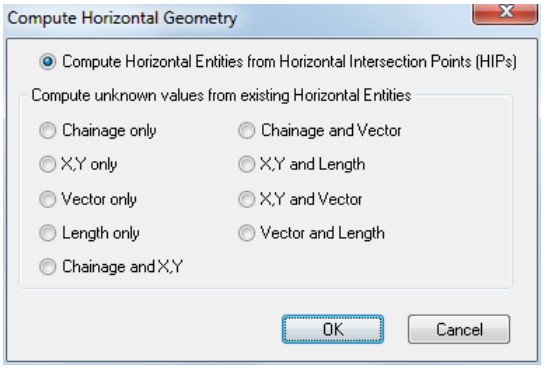


31.8.1.7 Compute Horizontal Entities (Alignment Design Menu)

This option allows the user to recompute the horizontal entities when a change has been made to the horizontal entity or horizontal intersection point spreadsheet. The horizontal entities are automatically computed when the horizontal intersection point information is downloaded, but is not automatically updated when changes are made to this information in SCC.

SCC can either compute horizontal entities from horizontal intersection points, or allow them to be entered directly. In the latter case, it is only necessary to enter the minimum number of fields required to compute the entities, and SCC will complete the rest. This allows the user to re-compute sets of unknown values in the horizontal entity sheet based around the input information you have available. For example, if the user did not have length and vector information could be re-computed from the other parameters. Alternatively, if the user did not have plan position, or chainage, such values could be re-computed. The user is limited to having up to two unknown fields, as this is the minimum computational requirement.



31.8.1.8 Compute Vertical Entities (Alignment Design Menu)

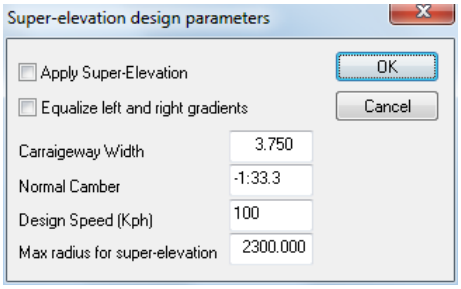
This option allows the user to recompute the vertical entities when a change has been made to the vertical intersection point spreadsheet. The vertical entities were automatically computed when the vertical intersection point (DOER VIPS file) information was downloaded, but is not automatically updated when changes are made to this information in SCC.

31.8.1.9 Compute Super-Elevation (Alignment Design Menu)

This option populates the super elevation sheet for the current design, based on the following specified road design criteria;

- Carriage way width

- Normal camber
- Design speed in Kph
- Maximum radius for super elevation



31.8.1.10Check and Report Design Geometry (Alignment Design Menu)

This option checks that the geometry of the current alignment is correct. This report tells whether the given start point of each element is the same as the computed end point of the previous element. An Alignment Geometry Test Report is generated detailing the horizontal and vertical entities.

This option reports all horizontal and vertical entity information. The differences between the given starting X, Y, Z and chainage of each element and the calculated end point of the previous element are given to test the geometry of the entities.

Horizontal Entities

No

This field contains the number of the horizontal intersection point.

Entity Type

This field specifies the type of the current horizontal entity. A compound curve is going from one known radius to another. Compound In curves go from a small radius to a larger radius, while Compound Out curves go from a large radius to a smaller radius. The radius at one end of a spiral curve is infinite, while the radius it's the other end known.

This field has 6 possible options; Circular Arc, Compound In, Compound Out, Spiral In, Spiral Out, or Straight.

X1

Starting X co-ordinate of current element.

Y1

Starting Y co-ordinate of current element.

Chainage

This field contains the chainage at the start of the current entity.

S. Radius

This field contains the incoming radius of the current entity.

L. Radius

This field contains the incoming radius of the current entity.

X2

Ending X co-ordinate of current element.

Y2

Ending Y co-ordinate of current element

Vector

Outgoing Vector of previous element.

E. Chainage

The ending/final chainage of the element.

Ch Diff

The difference between the ending chainage of the last element and the starting chainage of the current element.

X Diff

The difference between the easting of the last point on the previous element and the first point on the current element.

Y Diff

The difference between the northing of the last point on the previous element and the first point on the current element.

V Diff

The difference between the previous element's outgoing vector and the current element's incoming vector.

Vertical Entities

No.

This field contains the number of the vertical entity. SCC has assigned this number.

Entity Type

This field specifies the geometry of the current vertical entity. This field has two possible options; V. Curve or Straight

Chainage

This field contains the chainage at the start of the current entity.

Length

This field contains the length of the current entity.

Level

This field contains the level at the beginning of the current entity.

Gradient

This field contains the gradient of the current entity. This gradient is given in decimal form.

Grad. Diff

This field contains the algebraic difference in height between the first and last point of the entity.

Ch Diff

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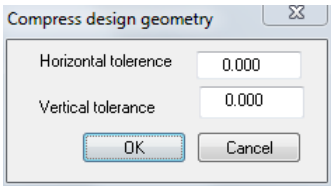
The difference between the ending chainage of the last element and the starting chainage of the current element.

31.8.1.11Compress Geometry (Alignment Design Menu)

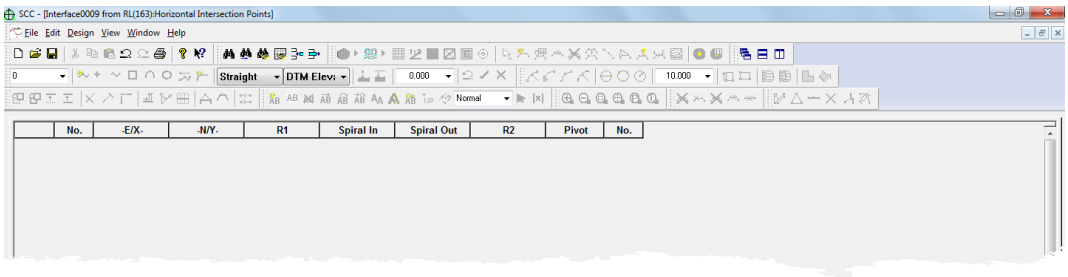
This option allows the user to enter a horizontal and vertical tolerance when compressing alignment geometry.



31.8.2 Alignment View Menu

31.8.2.1 Horizontal Intersection Points (Alignment View Menu)

The horizontal intersection points sheet, contains co-ordinate and geometric information about each of the intersection points in the alignment. The sheet is ordered by number. Intersection Point information may be obtained from DOER HIPS file or calculated from MX GENIO Geometry information.



No.

This field contains the number of the horizontal intersection point.

Pivot

Centre

Inside

Outside

Curve

Left

None

Right

E/X

This field contains the Easting/X value of the current horizontal intersection point.

N/Y

This field contains the Easting/X value of the current horizontal intersection point.

Spiral In

This field contains the length of the incoming spiral

R1

This field contains the radius of the first curve

R2

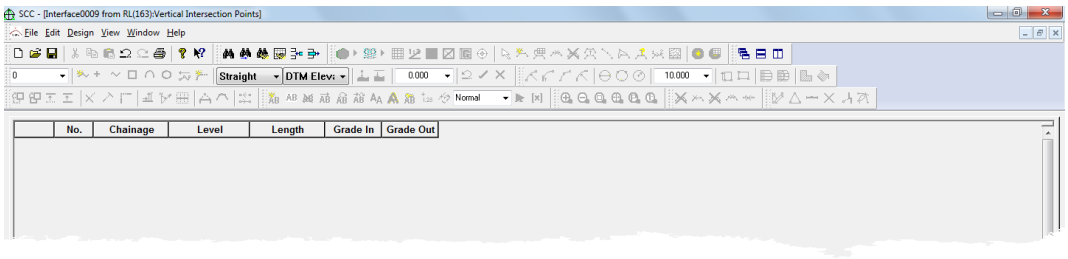
This field contains the radius of the second curve. This is used when the curve is complex curve or partial transition.

Sprial Out

This field contains the outgoing spiral

31.8.2.2 Vertical Intersection Points (Alignment View Menu)

The vertical intersection point spreadsheet contains chainage, level and gradient information on all vertical intersection points. This information is obtained from DOER VIPS files.



No.

This field contains the number of the vertical intersection point.

Chainage

This field contains the chainage of the current vertical intersection point.

Level

This field contains the level/Z value of the current intersection point.

Length

This field contains the length of the current vertical entity.

Grade In

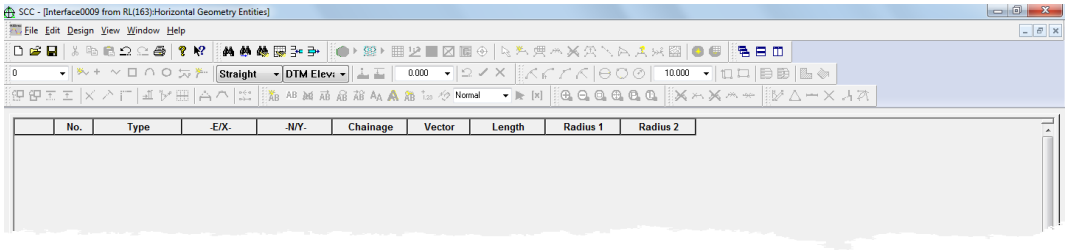
This field contains the value of the incoming gradient.

Grade Out

This field contains the value of the outgoing gradient.

31.8.2.3 Horizontal Entities (Alignment View Menu)

The horizontal geometry entities spreadsheet contains information on the horizontal alignment. This information is obtained from a MX GENIO Geometry File. If alignment information has been obtained from DOER HIPS or VIPS files then this sheet will remain blank.



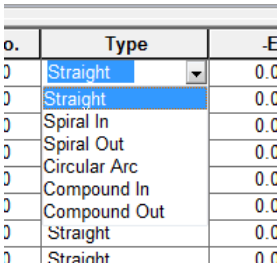
No

This field contains the number of the horizontal entity. SCC assigns this value.

Type

This field specifies the type of the current horizontal entity. A compound curve is going from one known radius to another. Compound In curves go from a small radius to a larger radius, while Compound Out curves go from a large radius to a smaller radius. The radius at one end of a spiral curve is infinite, while the radius it's the other end known.

This field has 6 possible options;



Circular Arc

Compound In

Compound Out

Spiral In

Spiral Out

Straight

E/X

This field contains the E/X value of the starting point of the current entity.

N/Y

This field contains the N/Y value of the starting point of the current entity.

Chainage

This field contains the start chainage of the current horizontal entity.

Vector

This is the mathematical direction of the current element.

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Length

This field contains the length of the current horizontal entity.

Radius 1

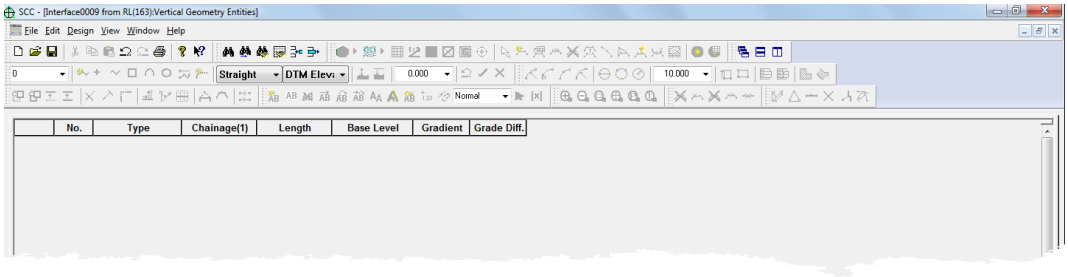
This field contains the incoming radius of the current entity.

Radius 2

This field contains the incoming radius of the current entity.

31.8.2.4 Vertical Entities (Alignment View Menu)

The vertical geometry entities spreadsheet contains information about the vertical alignment. This information is obtained from the MX GENIO Geometry file. If alignment information has been obtained from DOER HIPS or VIPS files then this sheet will remain blank.



No.

This field contains the number of the vertical entity. SCC has assigned this number.

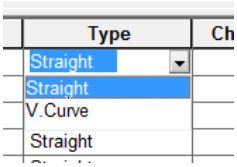
Type

This field specifies the geometry of the current vertical entity.

This field has two possible options;

V. Curve

Straight



Chainage(1)

This field contains the chainage at the start of the current entity.

Length

This field contains the length of the current entity.

Base Level

This field contains the level at the beginning of the current entity.

Gradient

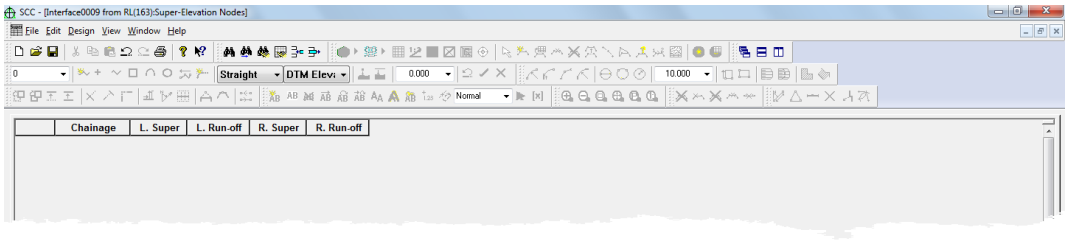
This field contains the gradient of the current entity. The gradient is given in decimal form.

Alg. Diff

This field contains the algebraic difference in height between the first and last point of the entity.

31.8.2.5 Super-Elevation Nodes (Alignment View Menu)

The super elevation nodes sheet contains three fields



Chainage

This is the chainage at which the current super elevation is applied

L.Super

This is the super elevation, given as a gradient away from the centre line, used for positions to the left of the centre line

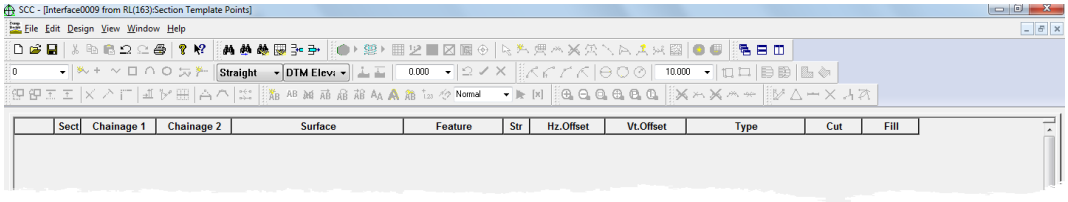
R.Super

This is the super elevation, given as a gradient away from the centre line, used for positions to the right of the centre line

The super elevation computed for any given chainage is linearly interpolated from the two super elevation nodes directly above and below that chainage. The super elevation is applied to the design elevation by multiplying the gradient by the horizontal offset to derive a height difference, which is then added back to the design elevation. Super elevation will typically be applied over the length of transitions in road design. The super elevation sheet may also be used for cant calculations in rail design.

31.8.2.6 Section Template Points (Alignment View Menu)

SCC allows simple template design for the alignment. There is no limit to the number of elements in each template. All sections are placed at right angles to the alignment string. Different templates may be designed for different sections of the alignment. This may be achieved by giving the templates different 'Sect numbers' and specifying the chainages where these templates should be used. The side slopes of the templates are determined by the cut and fill percentages. To export an alignment to a dataset or a model a section template must be created. It is sufficient to have one entry in this spreadsheet.



Sect

This field contains the number of the section template. This field will be 1, unless there was more than one template designed.

Chainage 1

This field contains the first chainage at which the template will be placed.

Chainage 2

This field contains the last chainage at which the template will be placed.

Surface

This field indicates the surface of the current section point. This is used where the design is being used to create multiple material layers of known thickness.

Feature

This field contains the feature of the current template element.

Str

This field contains the string number of the current element.

Hz. Offset

This field contains the value of the horizontal offset from the centre of the profile.

Vt. Offset

This field contains the value of the vertical offset from the centre of the profile.

Type

This field specifies element type for the current template point. A fixed element is a string point that will always get included in the design model. A left or right edge is a design point from which side slopes are projected. Elements can be included for cut situations only, fill situations only, or both cut and fill. Thus a 'Fixed – Cut' element will include a string point in the design model only in places where the design elevation is lower than the existing ground elevation.

This field has 3 possible options;

Fixed – Both

Left Edge – Both

Right Edge – Both

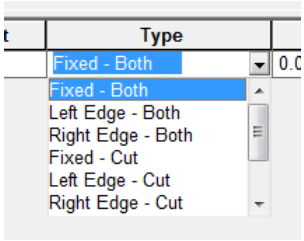
Fixed – Cut

Left Edge - Cut

Right Edge – Cut

Fixed – Fill

Left Edge – Fill



Right Edge – Fill

Cut

This field contains the upward side slope for the template, that is, the cut gradient between the design string and the existing ground.

Fill

This field contains the downward side slope for the template, that is, the fill gradient between the design string and the existing ground.

32 Modelling

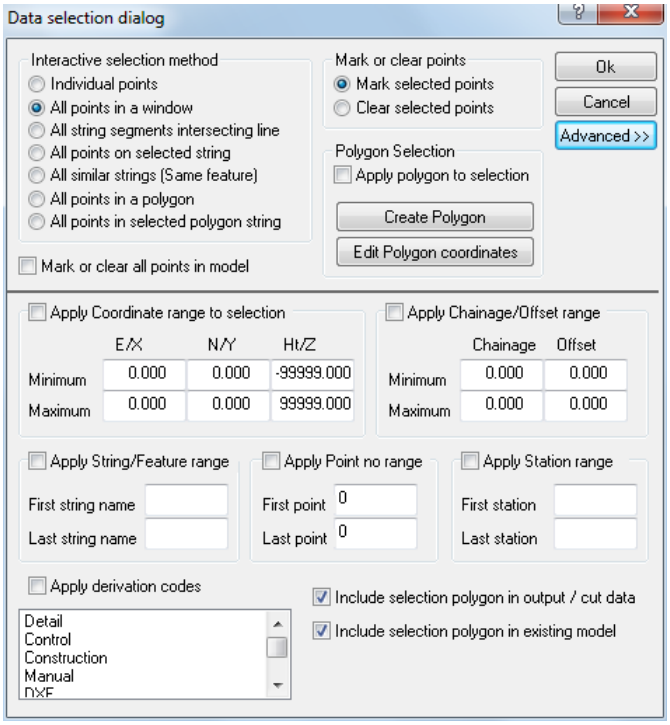
SCC models can be created either directly from coordinate data such as DXF or GENIO, or from reduced SCC Survey datasets. When working with large models, it is usually model the source data, such as DXF, directly rather than importing it into a SCC Survey dataset first.

See also

SCC Models

Models

32.1 Data Selection Dialog (Model)



The following selection options are available within the Model Data Selection Dialog:

Interactive selection method

Individual points

All points in a window

All string segments intersecting line

All points on selected string

All similar strings (Same feature)

All points in a polygon

All points in selected polygon string

Mark or clear points

Mark selected points

Clear selected points

Mark or clear all points in model

Highlights all points within the model

Polygon Selection

Apply polygon to selection

Create Polygon

Edit Polygon coordinates

Apply Coordinates range to selection

Minimum

Maximum

Apply Chainage/Offset range to selection

Minimum

Maximum

Apply String / Feature range

First string name

Last string name

Apply Point No range

First point

Last point

Apply Station range

First station

Last station

Apply derivation codes

- Detail
- Control
- Construction
- Manual
- DXF
- Draped Profile

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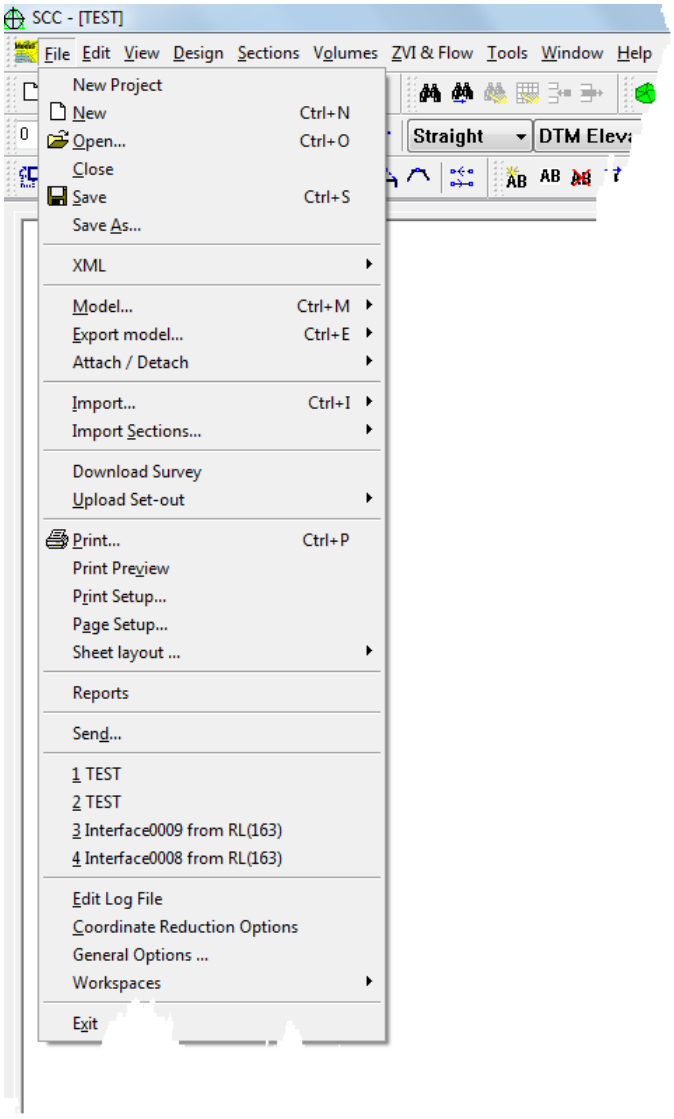
- Curve fit
- Strip Level
- Line of Sight attribute
- Ortho Feature attribute
- 2Pts Circle attribute
- Parallel Feature attribute
- Levelled point
- String Offset
- Design
- Taped Measure attribute
- Radius & Centre attribute
- 3Pts Circle attribute
- As Set Out Point
- Text insert point
- Square
- External file
- Feature Offset attribute
- Point & Centre attribute
- 3Pts Rectangle attribute
- GENIO point
- Steps

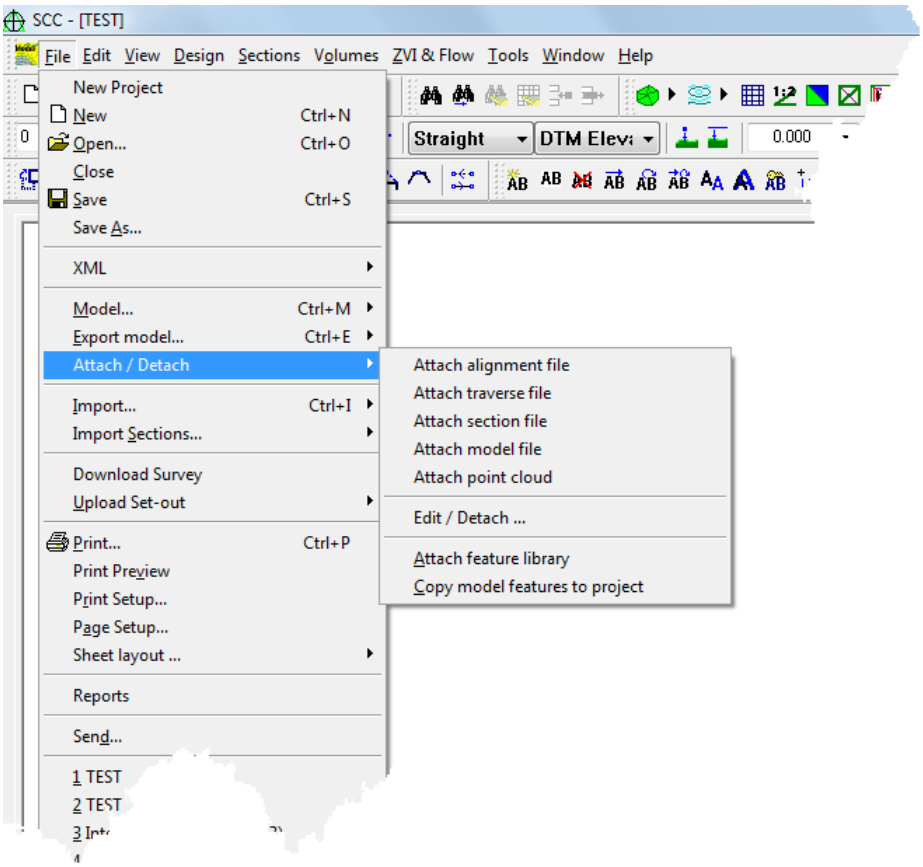
Include selection polygon in output / cut data

Include selection polygon in existing model

32.2 Model File Menu



32.2.1 Attach / Detach



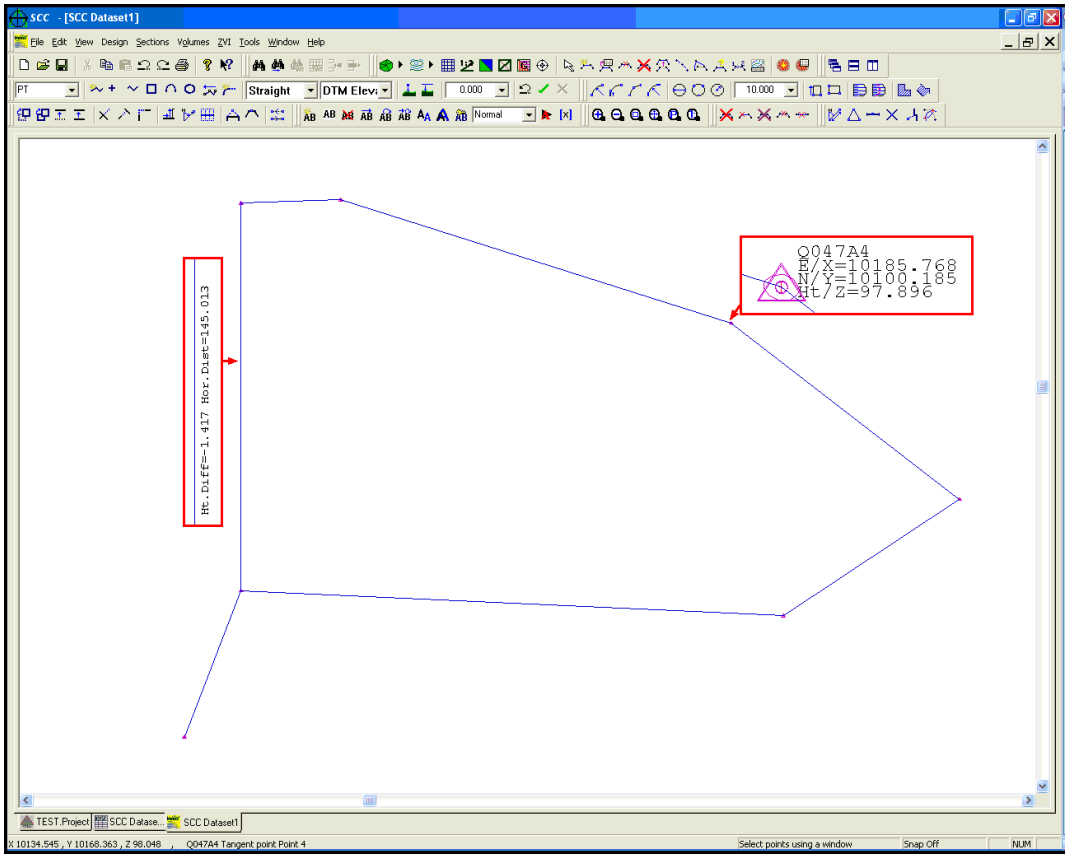
The follow options are available:

Attach Alignment File

This option attaches the selected alignment file to the current model. The alignment does not become part of the DTM. This option is simply a visualisation tool. Any changes made to the alignment file while it is attached to the model are updated automatically on the model screen.

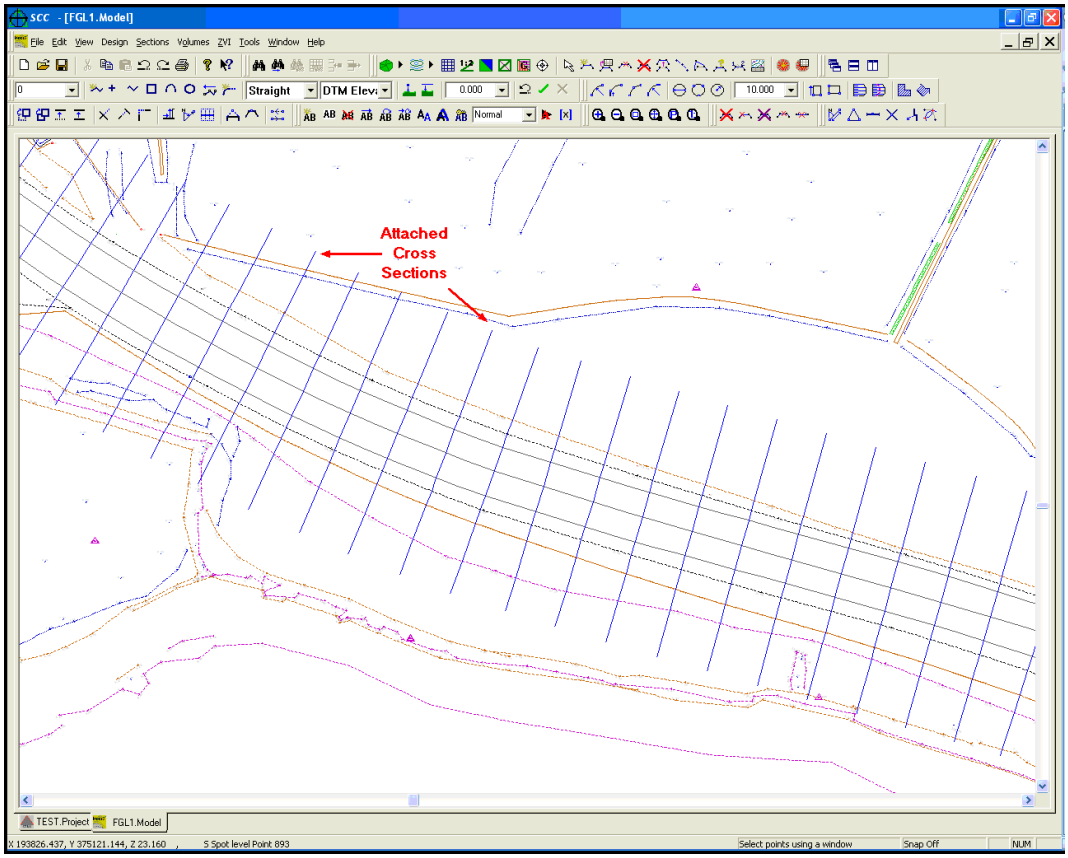
Attach Traverse File

This option allows the user to attach a Traverse file to the current model. The user can then annotate the Traverse Stations and Traverse Legs (**Edit** > **Text** > **Annotate Traverse**)



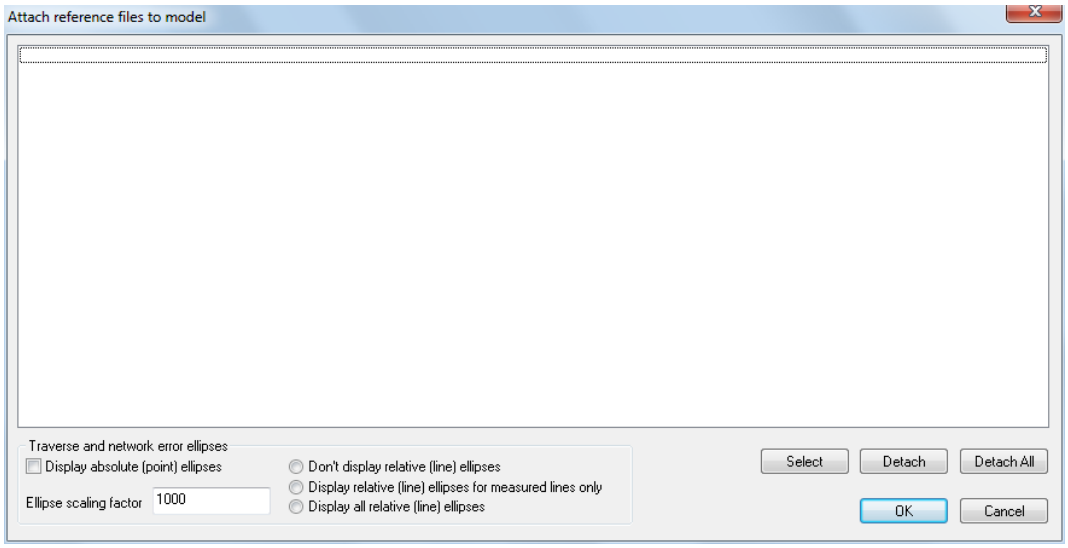
Attach Section File

This option allows the user to attach a Section file to the current model.



Edit / Detach

This option allows the user to Select or Detach listed files within the 'Attach reference files to model' dialog. Also within this dialog the user can change the scale of the Traverse station error ellipses.



Attach Model File

This option allows the user to attach a model to an existing opened model for reference purposes. The reference model is displayed in plan over the current model, and once attached, the height difference between current and reference model is displayed in the status bar. The option requires the alignment module to be licensed.

Note: 'EDIT > Offset height of selected points' option allow levels to be offset relative to the reference model, or to have the reference model elevation added or subtracted from the current model.

Attach Feature Library

This option attaches a feature library to the model. The library attached will overwrite the current feature library. This option is useful if the model, need different symbology when drawn at different scales or if the model was being given to different clients who have their own specific feature library.

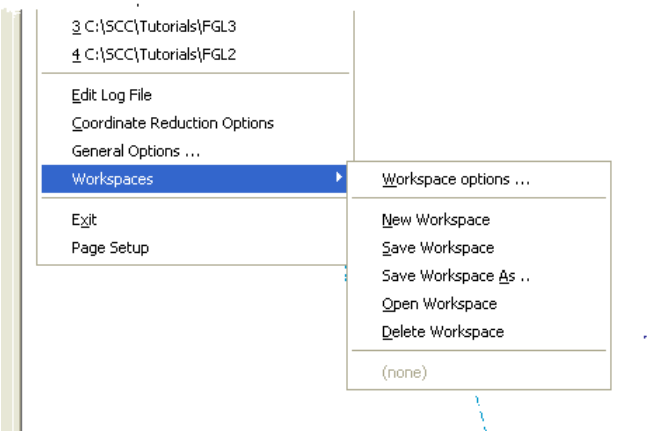
Copy Model Feature to Project

This option allows the user to update your current project with feature library changes that you have made to your model. This includes updating the feature library and symbols. Once you have done this you can save your project to the '\SCC' directory such that it can be used as a project template for future projects.

32.2.2 Workspaces (Model File menu)

Workspaces are used in SCC to store all the program settings that relate to the graphical user interface. This includes the display and positioning of tool bars and menus, keyboard shortcuts, the size of the main SCC frame window, a list of currently open documents, and the default spreadsheet colors and fonts.

The 'Workspace options' dialog, allows the user to control whether workspaces are automatically loaded at startup and saved on existing SCC.



If the user chooses to automatically load and save a workspaces, SCC will reopen the last used workspace.

If the user chooses to automatically load a default workspace, SCC will reopen the same each time you run it, with whatever GUI customization applied. This allows a senior surveyor to set-up a workspace that simplifies the operation of SCC for other users, by removing unused menu options and tool bars.

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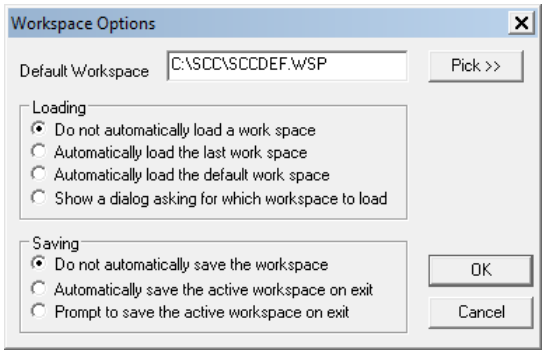
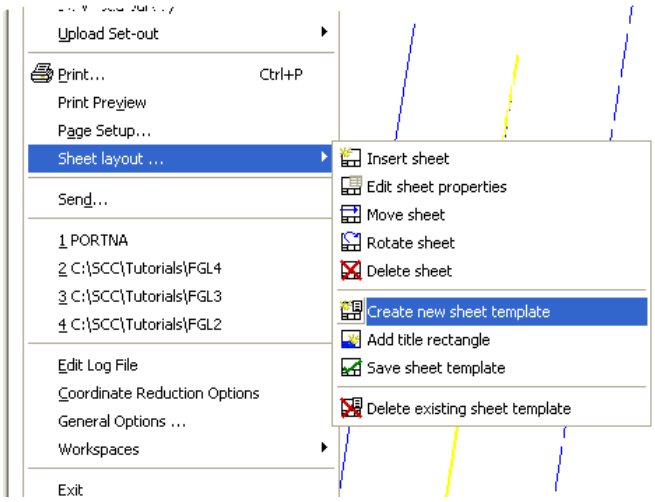


See Also

Workspaces (Project File Menu)

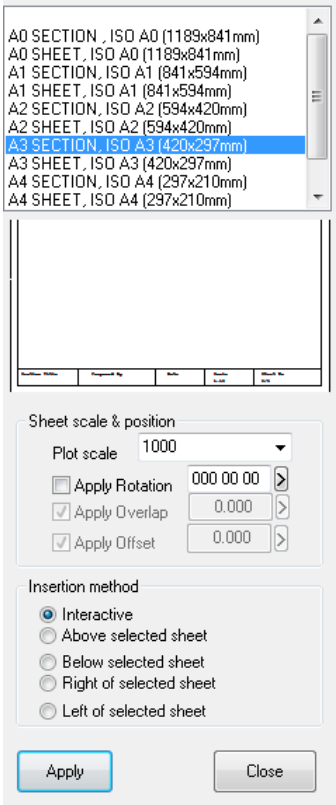
32.2.3 Sheet Layout (Model File Menu)



32.2.3.1 Insert Sheet

When the sheet has been created and saved to the relevant project file, it is then possible to insert this sheet in a model.

The user may have several sheet sizes available, and each can be inserted at any plot scale.



Remember, to insert the sheet templates, the user must have the correct feature library attached to the model.

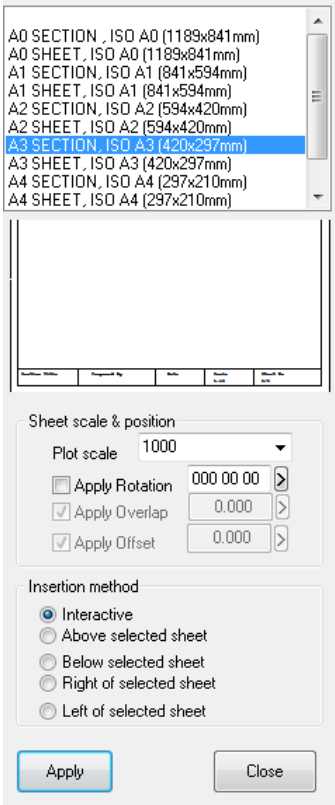
Shortcuts

Toolbar

32.2.3.2 Edit Sheet Properties

This options allows the user to edit the sheet layout while in the model.

It gives the user the option to change the plot scale or the rotation of the sheet.



It also allows the user to move the sheet without affecting the model itself.

Shortcuts

Toolbar

32.2.3.3 Move Sheet

This options allows the user to move / reposition the sheet within the model.

Shortcuts

Toolbar

32.2.3.4 Rotate Sheet

This options allows the user to rotate / reposition the sheet within the model.

Shortcuts

Toolbar

32.2.3.5 Delete Sheet

This options allows the user to delete the sheet within the model.

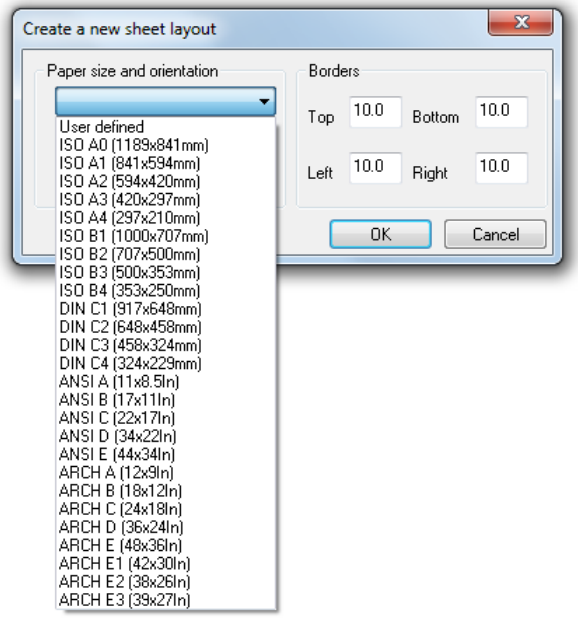
Shortcuts

Toolbar

32.2.3.6 Create New Sheet Template

This option allows the user to create a new sheet template, which can be used to plot models and sections.

When the user selects this option, a choice of paper sizes and orientation is given from which to base the sheet template on.



Select the sheet size and SCC then generates a new model consisting of a blank sheet. This sheet can be saved as a model file which can be edited at a later date or as a template which can be copied to the current feature library and inserted into model and section files.

Below is a list of macros that can be used to create the sheet template. When the sheet is inserted into a model or section these macros will be automatically updated with the relevant job data, either from the operating system that is being used or from the data entered into the 'Titles & grids' dialog.

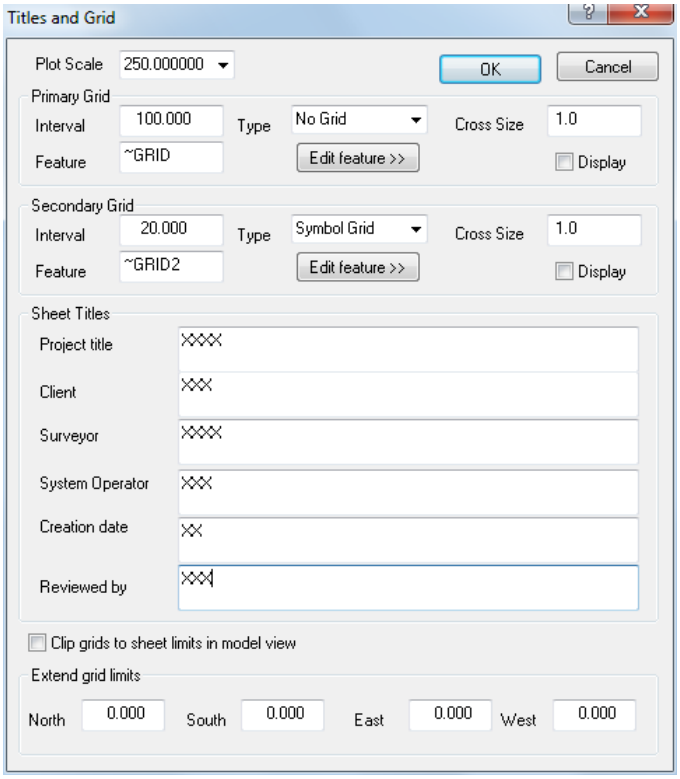
Sheet Creation Macros

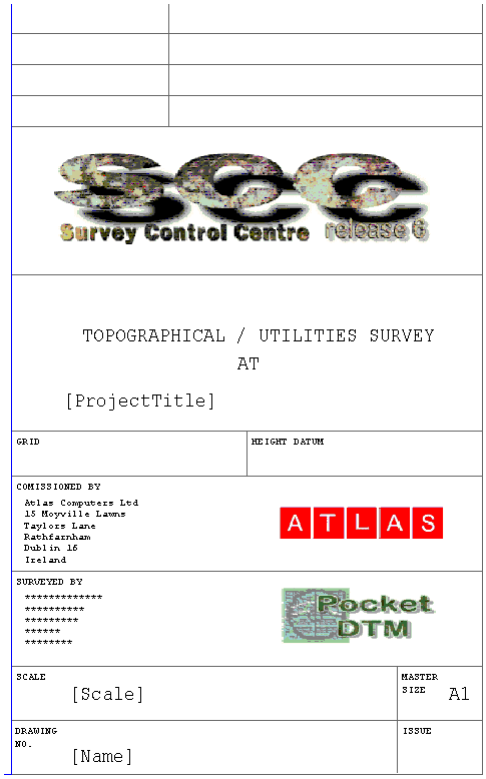
Operating System	
[Name}	Model / Section Name
[Path	Full Model/Section path
[Project]	Project Name

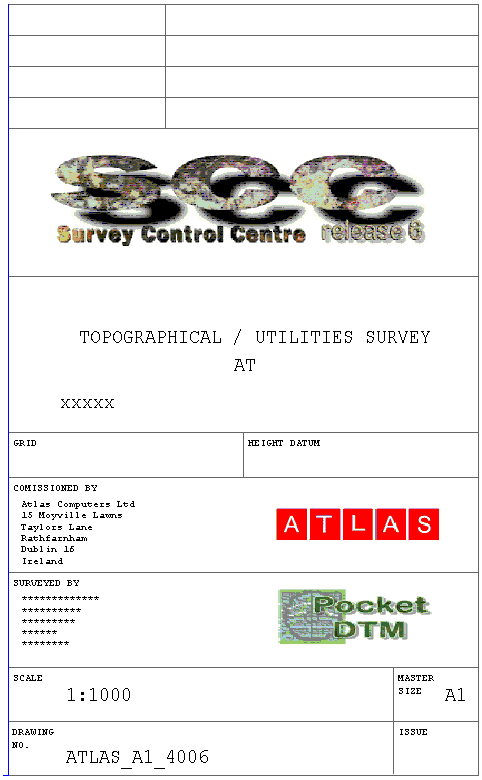
[Time]	Current time
[Version	SCC Version & Dongle Number
[Scale	Plot Scale
[Page]	Sheet Number
[Pages]	Number of Pages

Titles & Grids Dialog	
[ProjectTitle]	Job Name / Title
[Client	Client Name
[Date]	Date
[Surveyor]	Username
[Operator]	Operator

See the images below for an example of how the macros use the data entered in the 'Titles & Grids' dialog. The first grid box displays the macros typed in sheet creation. The second grid box show how the macros are used when inserted into the model.







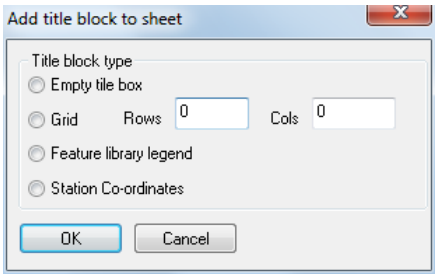
Shortcuts

Toolbar

32.2.3.7 Add Titles Blocks and Legends

This option allows the user to add and design title blocks for a sheet template.

The box is positioned using the right mouse button; the first click should be used to position the top left corner of the data box and the second click to denote the bottom right corner of the box. When the box is drawn the following dialog is presented:



Selecting one of the options on this dialog will determine the type of data displayed. The options are as follows:

Empty title box

This option allows the user to add an empty rectangular box to the sheet model, which can be used for data entry, borders etc.

Grid

When selecting this option, the user also needs to enter a value for the amount of rows or columns required in the grid. The grid may be used for entering data such as 'Project Name', 'Scale' or 'Date' etc..

Feature Library Legend

To select this option the user must enter a value in the rows box. This value indicates the total amount of feature library entries the user would like to display in the legend when the sheet is inserted into the model. This works by taking each entry in the model in sequential record number and displaying the description and the linetype or symbol in the feature library legend. Features that are not used in the model, do not count.

The image below on the left depicted the feature library legend in the sheet template whereas the image on the right depicts the legend when inserted into a model.

Station Co-Ordinates

The user must also enter a value in the rows box. The value entered is the total amount of station coordinates that the user wishes to display on the sheet, where STN 1 is the first record number in the station coordinates spreadsheet.

The images below show how the station coordinate box appears both in the sheet template and in the model.

Station Co-ordinates

[Stn 1 Name]	[Stn 1 X]	[Stn 1 Y]	[Stn 1 Z]
[Stn 2 Name]	[Stn 2 X]	[Stn 2 Y]	[Stn 2 Z]
[Stn 3 Name]	[Stn 3 X]	[Stn 3 Y]	[Stn 3 Z]
[Stn 4 Name]	[Stn 4 X]	[Stn 4 Y]	[Stn 4 Z]
[Stn 5 Name]	[Stn 5 X]	[Stn 5 Y]	[Stn 5 Z]
[Stn 6 Name]	[Stn 6 X]	[Stn 6 Y]	[Stn 6 Z]
[Stn 7 Name]	[Stn 7 X]	[Stn 7 Y]	[Stn 7 Z]
[Stn 8 Name]	[Stn 8 X]	[Stn 8 Y]	[Stn 8 Z]

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Station Co-ordinates

STN21	193716.751	375382.613	39.100
STN23	193732.839	375234.359	22.867
STN24	193820.046	375341.203	38.515
STN25	193871.511	375092.809	25.500
STN26	193999.015	375132.337	39.609
STN28	194122.804	374973.855	23.744
STN29	194029.975	375031.300	23.319
STN230	194037.310	375016.709	21.908
STN231	194074.443	374997.162	22.524
STN230	194088.444	375043.617	29.556
STN233	194189.121	374996.743	28.278
STN234	194203.987	374935.882	21.210
STN7	193617.021	375373.269	27.259
STN8	193574.512	375724.438	20.861
STN116	193603.381	375249.500	20.562
STN20	193755.134	375044.398	8.593
STN20X	193755.134	375044.398	8.569
STN321	193816.207	375025.769	6.463
STN21X	193816.207	375025.769	6.447

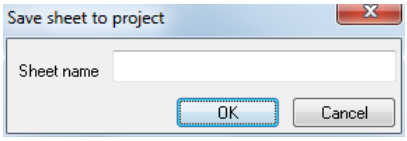
You can design the sheet template by adding your own company logo, the company feature library and legend and also additional information about stations, bench level values and location.

Shortcuts

Toolbar

32.2.3.8 Saving The Sheet

This option allows the user to save the sheet as a template, which is automatically copied to the current project file.



It is possible to edit existing sheet models once they have been created. However to save the new template to the feature library, SCC must first recognise the model as a sheet rather than a model file.

To overwrite an existing sheet template the user must first create a new sheet of the same size. Then open the existing sheet model and carry out any of the necessary editing. Save the sheet. Then go to 'FILE > Sheet Layout'. Select the option to ‘save sheet template’. This will automatically save the template to the feature library. SCC recgonises that a sheet has been created of a particular size and therefore saves the new template as that size also.

Shortcuts

Toolbar

32.2.3.9 Delete Existing Sheet Template

This option allows the user to delete the sheet template from the model only.

The sheet template will still remain in the feature library and can be inserted again as normal.

Shortcuts

Toolbar

32.2.3.10 Viewing The Sheet

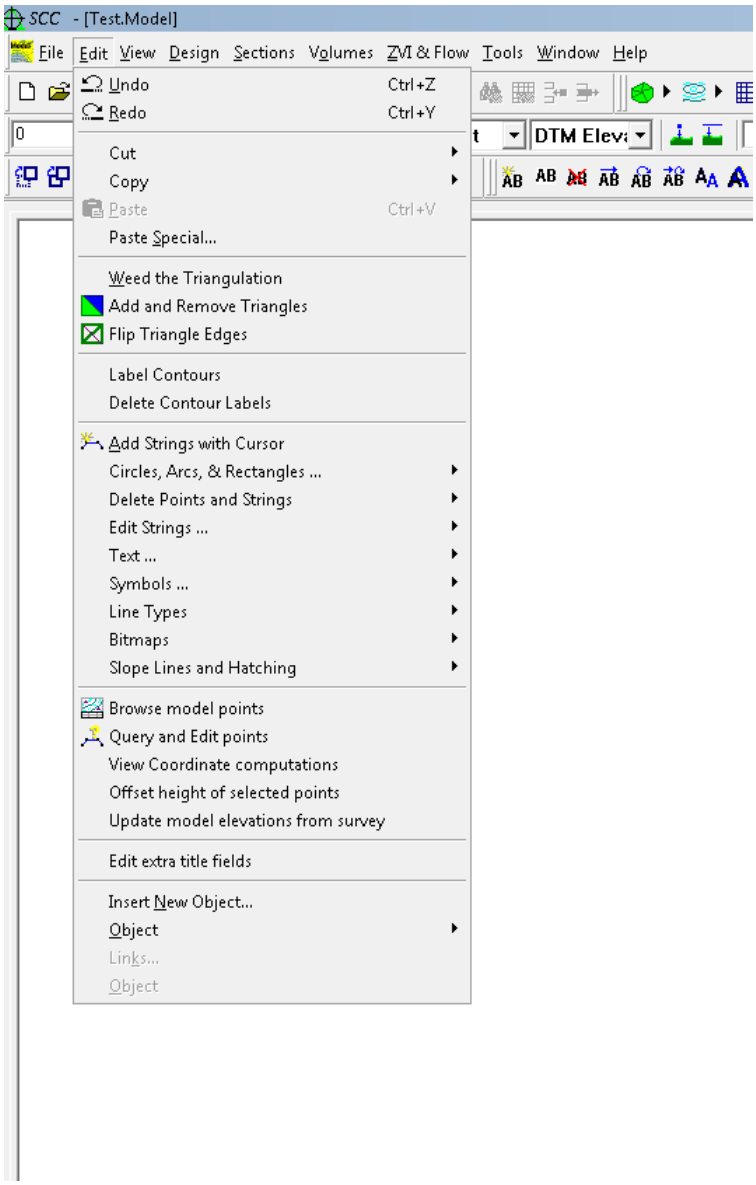
Once the sheet has been inserted into the model, the user can move between sheet and model view by either:

- using '+' or '-' keys on the keyboard
- using button on the toolbar
- or using the drop down menu on the Sheet layout toolbar

Shortcuts

Toolbar

32.3 Model Edit Menu



32.3.1 Undo (Model Edit Menu)

Use this command to reverse the last editing action, if possible. The name of the command changes, depending on what the last action was. The Undo command changes to Can't Undo on the menu if you cannot reverse your last action.

Shortcuts

Toolbar:

Keys: Ctrl + Z or

ALT + BACKSPACE

32.3.2 Redo (Model Edit Menu)

Redo the last option that was undone.

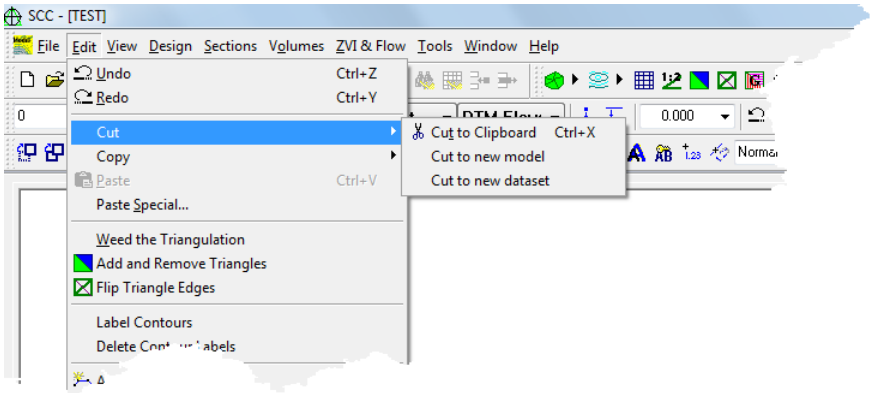
Shortcuts

Toolbar:

Keys: Ctrl + Y

32.3.3 Cut (Model Edit Menu)

The following options are available within the 'EDIT > Cut' menu:



Cut to Clipboard

This command is used to remove the currently selected data from the document and put it on the clipboard. This command is unavailable if there is no data currently selected.

Cutting data to the clipboard replaces the contents previously stored there.

Shortcuts

Toolbar

Keys CTRL + X

Cut to New Model

This command is used to remove the currently selected data from the document and paste the selected data into a new model.

Cut to New Dataset

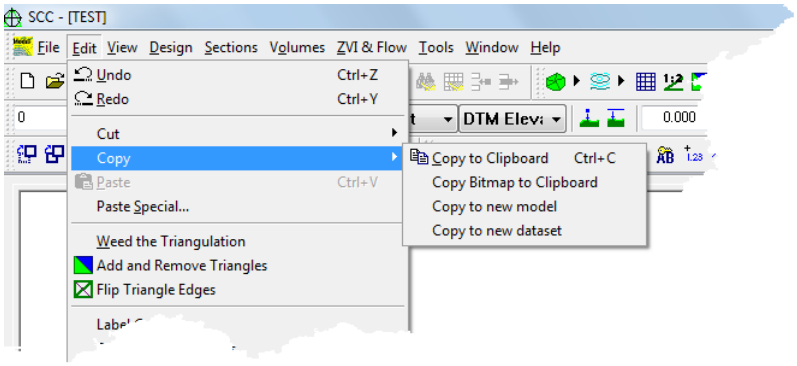
Use this command to remove the currently selected data from the document and put it in a survey dataset.

This command is unavailable if there is no data currently selected. To cut precise areas out of the model use the ‘Create Polygon’ option from the 'Data Selection Dialog' to define

your boundary.

32.3.4 Copy (Model Edit Menu)

The following options are available within the 'EDIT > Copy' menu:

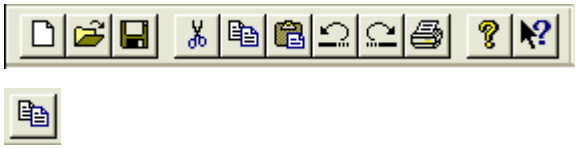


Copy to Clipboard

Use this command to copy selected data onto the clipboard. If there is no data selected, the entire model gets copied to the clipboard as an OLE object, such that it can be pasted into any other application, such as MS Word, that accepts pasting OLE objects, typically via the Paste Special command. If any points are selected, they are copied to the clipboard such that they can be pasted into other models.

Copying data to the clipboard replaces the contents previously stored there.

Shortcuts

Toolbar 

Keys CTRL + C

Copy Bitmap to Clipboard

This option copies the current graphical display to the clipboard such that it can be pasted into any other application, such as MS Word, that accepts pasting bitmaps.

Copy to Model

Use this command to copy selected data into a model. This command is unavailable if there is no data currently selected. To copy precise areas out of the model use the ‘Create Polygon’ option from the data selection dialog to define your boundary.

Copy to New Dataset

Use this command to copy the currently selected data from the document and put it in a survey dataset.

This command is unavailable if there is no data currently selected. To cut precise areas out of the model use the ‘Create Polygon’ option from the 'Data Selection Dialog' to define your boundary.

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32.3.5 Paste (Model Edit Menu)

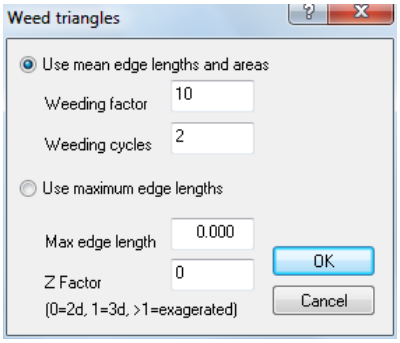
This command is used to paste data present on the clipboard into the opened or existing model.

32.3.6 Paste Special (Model Edit Menu)

This option is used to paste OLE objects, such as office documents, into your model file.

32.3.7 Weed The Triangulation (Model Edit Menu)

This option automatically removes any triangles from the surface that are likely to be unsuitable for interpolation purposes. This effectively automatically defines the external boundary for a model. This is carried out by interactively removing triangles with improbably long edges or large areas. On selecting this option the user are presented with a dialogue containing the following parameters;



Weeding Factor

This factor is the multiple of the standard deviation of any given triangle within the triangulation at which it is weeded. The standard deviation is calculated for a number of possible weeding criteria based on the type of triangulation used and the spread of data points. A large number may be used initially and then reduced if more weeding is required.

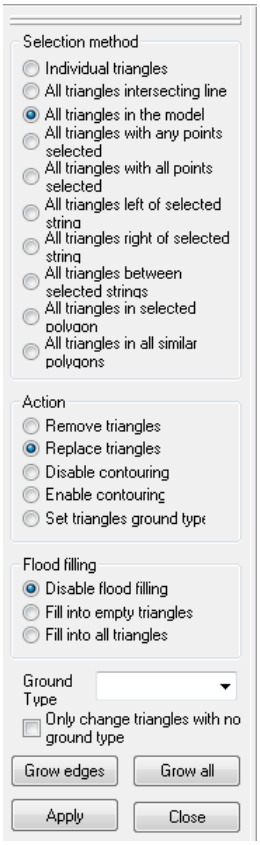
Weeding Cycles

This field contains the maximum number of iterations performed when weeding a triangulation. More than one iteration is often required, as the standard deviation will change having removed the worst triangles.

32.3.8 Add and Remove Triangles (Model Edit Menu)

This option allows the user to turn on and off given triangles in the triangulation. Triangles that are turned off (passive/sterile, are indicated by being filled in blue) will not be used when computing volumes, contours, grids, sections, viewsheds etc.

Selecting this option highlights all valid and invalid triangles (valid are highlighted in green). Selecting this option presents the Add and Remove Dialog.



The user can then remove multiple triangles from the model. When the selection method is 'All triangles intersecting line' a line has to be drawn with the cursor by pressing the mouse button over the end points of the line. Any triangle that has an edge that intersects this line will have the selected action applied.

Shortcuts

Toolbar

Selection Method

Individual Triangles

Select single triangles by clicking over them with the cursor

All Triangles intersecting line

Drag and drop a line over the triangles the user wishes to select

All Triangles in the Model

Apply the action to all triangles in the model.

All Triangles with any points selected

Apply the action to triangles with any one of their vertices selected.

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All Triangles with all points selected

Apply the action to triangles with all vertices selected.

All Triangles left of selected string

Apply the action to triangles left of the selected string.

All Triangles right of selected string

Apply the action to triangles right of the selected string.

All Triangles between selected strings

Apply the action to triangles between the selected strings.

All Triangles in selected polygon

Apply the action to triangles within selected polygon.

Action

Remove Triangles

This option removes triangles from the model. They will become invalid and will be turned blue. Once triangles have been removed they are no longer part of the DTM and therefore contours will not be generated in areas where there are invalid triangles.

Replace Triangles

This option changes invalid triangles to valid triangles. The triangles will now be included in the DTM.

Disable Contouring

Disable contours turns off the contours but does not exclude the survey data from the triangulation. For example, the user may have a building that they do not want contours going through but may require it to be included in sections.

Enable Contouring

This option is used over areas where the contours have been disabled.

Set Triangles Ground Types

Select a ground type from the ground type pick box. The selection method will determine which triangles this ground type will be applied to.

See Also

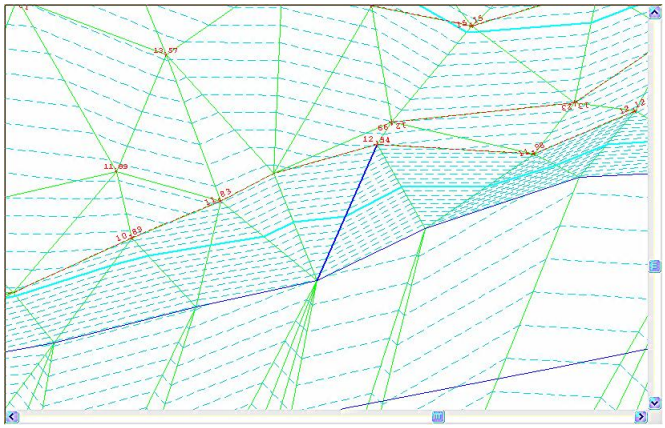
Ground Type Library (View Menu)

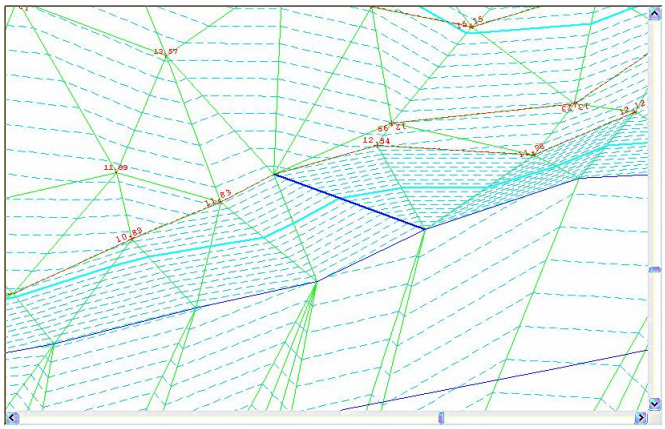
3D Viewer (Model View Menu)

32.3.9 Flip Triangle Edges (Model Edit Menu)

This option allows the user to change the diagonal connecting two adjacent triangles for pairs of triangles in the model. This has the effect of applying simple breaklines that may have been missed by the surveyor. Selecting this option highlights the triangle edge nearest the cursor. Pressing the left mouse button causes this edge to be flipped to the alternative diagonal. Rebuilding the model will undo any manual triangle edge flipping that has been carried out. It can be seen from inspection of the following diagrams that the data set in terms of point representation is correct but severe deformation of the surface has occurred from the surveyor

having omitted proper breakline definition during the survey. Averaging the surface and the selection of breaklines are prime requirements when surveying broken or badly behaved surfaces - for example in mining quarrying etc. The following diagrams show an example of the results of edge flipping.





If all significant grade changes in the model have been included in the model as strings, edge flipping should not be necessary. An alternative to edge flipping is to create any missing strings and rebuild the model.

Shortcuts

Toolbar:

Keys: Alt+E, F

32.3.10 Label Contours (Model Edit Menu)

This option allows the user to manually place contour labels within the model.

32.3.11 Delete Contour Labels (Model Edit Menu)

This option allows the user to manually delete contour labels within the model.

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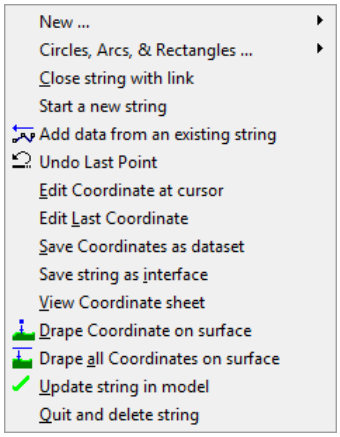
32.3.12 Add Strings with Cursor (Model Edit Menu)

This option allows the user to add new points and strings to the triangulation. This is carried out by generating a new detail co-ordinate file and adding points to that file whenever the left mouse button is pressed. The first time the left mouse button is pressed, the user will be prompted to enter the string details for the new string being added. When the user has finished adding points and wishes to update the surface model, or wishes to start a new string press the right button.

If the user already has a number of existing points selected, this option will convert the selected points into the chosen geometry. For example, if the user selects a number of points on a string that are currently connected by a straight line, and then press the 'Curve' button, those points will be curve fit. This works for curves, arcs, circles and rectangles.

Pressing the right mouse button brings up the following dialog;



New

This option starts a new string. The string may be either a Point, Line, Polyline, Polygon, Open Curve, or Closed Curve.

Point

This option creates a new point string. For example, when drawing trees.

Shortcuts

Line

This option creates a new line string. The feature code, line tag and DTM status of the string will be taken from what is set in the Create Strings toolbar.

Shortcuts

Polyline

This option creates a new polyline or string. The polyline may contain straight or curve segments or a combination of both.

Shortcuts

Polygon

This option creates a new polygon. The closed line can have any number of sides. When this option is selected the line tag is automatically set to Straight.

Shortcuts

Open Curve

This option creates an open curve. When this option is selected the line tag is automatically set to Curve.

Shortcuts

Closed Curve

This option creates a closed line curve. When this option is selected the line tag is automatically set to Curve.

Shortcuts

Circles, Arcs & Rectangles

This option allows the new string to be a circle, arc or rectangle.

The options are Arc 2Pts + Radius, Arc 2Pts + Tangent, Arc 3Pts, Fillet Arc , 2PT Circle, 3Pts Circle, Circle Radius + Centre, 2Pts Rectangle or 3Pts Rectangle.

Arc 2Pts + Radius

Select two points on the arc using the cursor on the model. Type the radius into the Radius/Width box on the Edit Strings Toolbar. If there is a value already in there this will be taken as the radius. This option is treated as an Add New String option, therefore if the right mouse button is selected the secondary menu of 'Add Strings with Cursor' will be presented. Update the arc in the model or delete it.

Shortcuts

Arc 2Pts + Tangent

Create a straight-line string, once the user has at least one points defined, select this option and select a further two points. An arc will be generated based on the incoming tangent derived from the first and second points, and the two points on the arc given by the second and third point. This option is treated as an Add New String option, therefore if the right mouse button is selected the secondary menu of 'Add Strings with Cursor' will be presented. Update the arc in the model or delete it.

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Shortcuts

Arc 3Pts

Select points to define an arc. If 3 existing points have been selected using the data selection option, then an arc will be drawn between these two points. This option is treated as an Add New String option, therefore if the right mouse button is selected the secondary menu of 'Add Strings with Cursor' will be presented.

32.3.12.1Add a new string with Feature Code

This option is used in conjunction with the ‘Add strings from cursor’ command.

By selecting the relevant feature code from the list and entering it in the box, any new string that is drawn in the model using the ‘Add strings from cursor’ option, will be of this feature.

If the user already has a number of existing points selected, this option will convert the selected points into the chosen feature code. For example, if the user selects a number of points on a string that are currently on layer ‘Ditch’, and then enters the feature ‘Wall’, all the points on the selected string will become a string with feature code ‘Wall’.

32.3.12.2Add a new string with a Tag Code

This option is used in conjunction with the ‘Add strings from cursor’ command.

By selecting a tag code from the box prior to using the above command, any new strings added to the model will have this new tag code.

If the user already has a number of existing points selected, this option will convert the selected points into the chosen geometry. For example, if the user selects a number of points on a string that are currently connected by a straight line, and then press the ‘Curve’ button, those points will be curve fit. This works for curves, arcs, circles and rectangles.

32.3.12.3Add a New String with DTM Status

This option is used in conjunction with the ‘Add strings from cursor’ command.

By selecting the relevant code from the list and entering it in the box, any new string that is drawn in the model using the ‘Add strings from cursor’ option, will have this DTM status.

This option also allows the user to change the DTM status of a selected string.

By using the 'Data Selection Dialog' box (right mouse button) and highlighting the string that the user wishes to change, one can then enter the new code in the DTM box and SCC will ask whether to convert all selected points to the new status.

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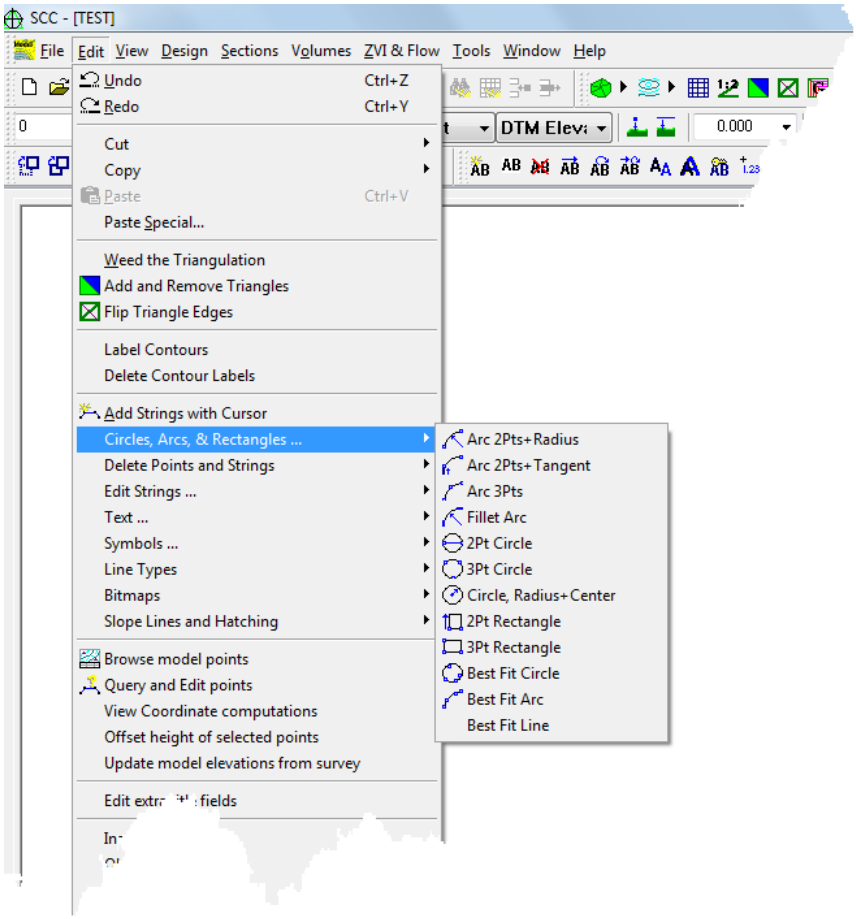
32.3.13 Circles, Arcs & Rectangles (Model Edit Menu)

This option allows the string to be a circle, arc or rectangle. This option has the same facilities as the 'Add Strings with Cursor' option , that is when the right mouse button is selected the same secondary menu appears.



The circles, arcs and rectangles that may be created are; Arc 2Pts + Radius, Arc 2Pts + Tangent, Arc 3Pts, Fillet Arc , 2PT Circle, 3Pts Circle, Circle Radius + Centre, 2Pts Rectangle, 3Pts Rectangle.

In addition the option to Best Fit Circle and Best Fit Arc are available:

Best Fit Circle

This option creates a best fit circle from the selected point. If more than three points are selected, none of them will typically lie directly on the resultant circle. The original points are converted into discrete points with DTM code 'Elevation' for annotation purposes. The circle fit also does a plane fit on the strings elevation for modeling purposes. Circle fitting is also available as a tag code for survey reduction and interactive string creation.

Best Fit Arc

This option creates a best fit arc from the selected point. The start and end point will always lie on the arc, other points typically will not. The original points are converted into discrete points with DTM code 'Elevation' for annotation purposes. The arc fit also does a plane fit on the strings elevation for modeling purposes. Arc fitting is also available as a tag code for survey reduction and interactive string creation.

Both options to Best Fit Circle and Best Fit Arc are also available within the drop down

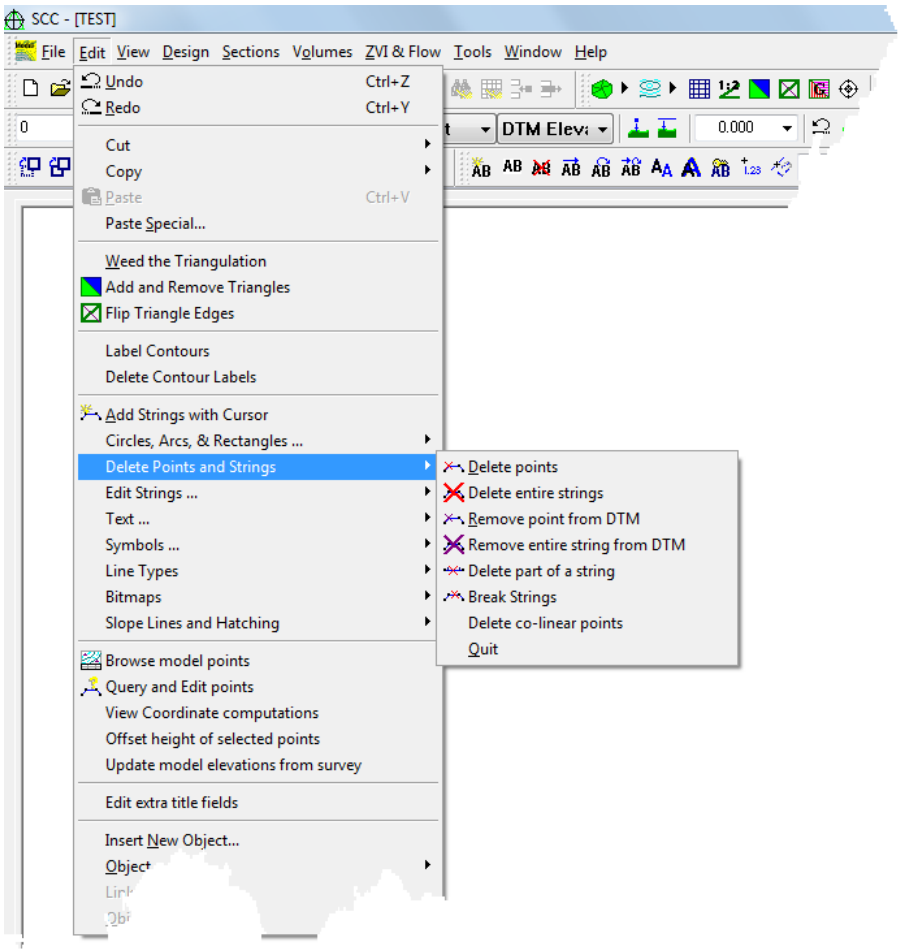
Tag menu.

These options all work in conjunction with the ‘Add strings with cursor’ option. As such they can be used to append arcs to strings being created with this option and may also be used to convert the geometry of previously selected points. For example, if the user selects a point on the corner of a building string, and then select the ‘fillet arc’ option, the building corner will be filleted with an arc. The radius of the arc is entered in the radius control on the Circles, Arcs & Rectangles dialog bar.

32.3.14 Delete, Points and Strings (Model Edit Menu)

This option allows the user to remove points and strings from the model. Modifying the DTM code(s) of any points involved and locally re-triangulating the affected portion of the surface carries this out.

Having selected this option, pressing the left mouse button will delete the point at the cursor. If the point has an associated detail co-ordinate it will also set the DTM code of the co-ordinate to IGNORE. If this co-ordinate was on a string, the two links on either side of the deleted point will not join to form a break-line. This deletion may be undone by using the 'Edit points' option to change the DTM code of the deleted point back to DTM ELEVATION. Pressing the right mouse button presents the user with a menu containing the following items. A number of points may be deleted or removed at the same time by selecting them before selecting this option.



Pressing the right mouse button presents the user with a menu containing the following items. A number of points may be deleted or removed at the same time by selecting them before selecting this option.

Delete Points

This option operates in a similar manner to the left mouse button but will only work with points that have associated detail co-ordinates.

Shortcuts

Delete Entire Strings

This option operates in a similar manner to the left mouse button but will only work with points that have associated detail co-ordinates. All the points on the string associated with the selected point will be deleted in this manner.

Shortcuts

Remove Point from DTM

This option operates in a similar manner to the left mouse button but will only work with points that have associated detail co-ordinates. Rather than setting the DTM code of the deleted point to Ignore it is set to Approx Elevation. This has the effect that the point will be removed from the triangulation without affecting the cartographic string detail.

Remove Entire String from DTM

This option operates in a similar manner to deleting the entire string but again sets the DTM codes of all the points in the string to Approx Elevation. The string will be removed from the triangulation and cease to be a break line but will still be displayed on screen.

Shortcuts

Delete Part of a String

This option allows part of a string to be deleted. A black line will appear at the mouse perpendicular to the nearest string. Use this black line to select the first and last point to delete on an existing string. Two points will be inserted into the string where the deleted section has started and finished. The tag code of the first inserted point will be Gap.

Shortcuts

Break Strings

This option allows the user to break links in strings in the model by inserting gaps into the selected strings. This option is useful for rectifying survey errors where the surveyor forgot to end a string or change a string number when such as change was required. For example, a string may zing across the site where such an error has occurred. This option currently operates only with strings in the DTM.

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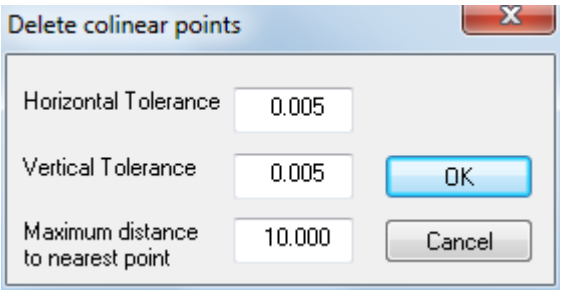
Shortcuts

Delete Co-Linear points

This option will automatically remove co-linear points on one or more selected strings. Options are included to specify horizontal and vertical tolerances for co-linearity, and maximum segment length above which the poin will not be considered for deletion. The purpose of this tool is to help in the removal of unnecessary points from models, particularly plan drawings that have had a lot of trim and extend type editing.

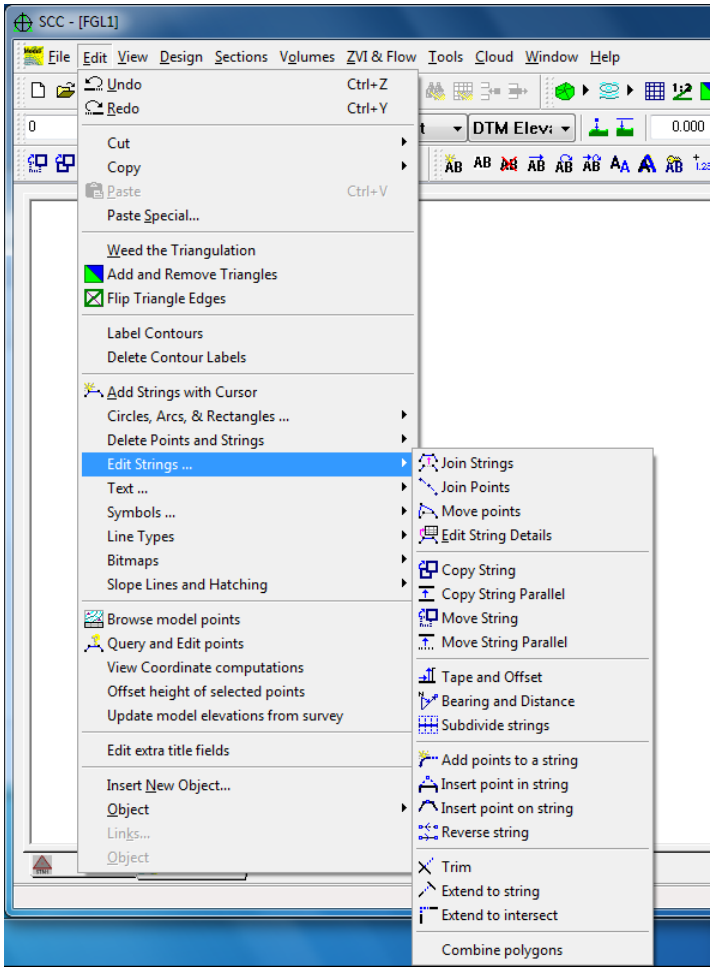


Quit

This option exits the 'Delete Points and Strings' command. The next command may now be selected.

32.3.15 Edit Strings (Model Edit Menu)

This option allows editing of the existing strings in the model.



The following options are available.

Join Strings, Join Points, Move Points, Edit Strings Details, Copy String, Copy String Parallel, Move Strings, Move String Parallel, Edit Strings, Bearing And Distance, Subdivide Strings, Add Points to a String, Insert Point In String, Insert Point On String, Reverse String, Trim or Extend To Intersect.

Join Strings

This option allows the user to join pairs of strings together to form single continuous strings. When selecting this option, simply pick the two strings with the cursor using the left mouse button. These strings will be joined by the end points nearest to the point selected, the exact end points do not have to be selected. Any number of pairs of strings may be joined in this manner.

- If the two strings selected are of different types, for example a wall and a hedge, the first string will be extended to meet the second string.
- If the points selected do not lie at the ends of their respective strings, a string will be generated with the same feature as the first string.
- This option may also be used to close gaps in strings, and to close an open string to form a polygon.
- This option may also be used to join strings with the same partial label, where MX/MX

coding is in use. For example, joining HE01 to HE02 will result in a single string called HE01.

To quit this option hit the Escape key.

Shortcuts

Keys: Alt+E, J

Join Points

This option allows the user to join single points together to form single continuous strings. When the user selects this option, simply pick the points with the cursor using the left mouse button. The string details will be inherited from either the first point selected or from the tool bar depending on the option selected prior to joining the points.

If a single point is selected to form a string, the original point will be removed from the model whereas if the point selected is already part of an existing string, it will remain. To complete the string, click on the right mouse button and the string will be updated in the model.

To quit this option hit the Escape key.

Shortcuts

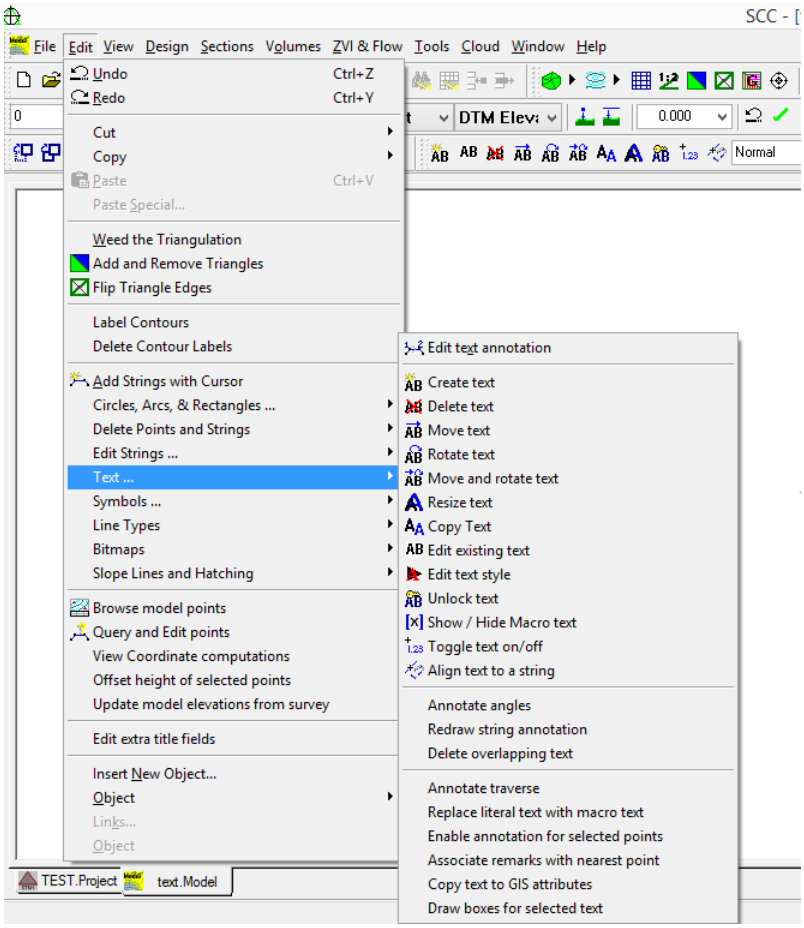
Move Points

This option allows points in a model to be moved by the user. Select the surveyed point the user wishes to move using the mouse. The point is now attached to the mouse pointer. Click the mouse a second time to place the point in its position. If the point is on a string, the string links either side it will be moved to the X,Y,Z position of the point. The option is useful for interactively editing obvious surveying errors, for example crossing top of bank (TB) and bottom for bank (BB) strings. A number of points may be moved at the same time by selecting them before selecting this option.

To quit this option hit the Escape key.

32.3.16 Text (Model Edit Menu)

This option allows text to be edited and created. Existing text may be edited. Dimensional text has to be unlocked before it can be edited. Text may now be scaled, rotated and moved.

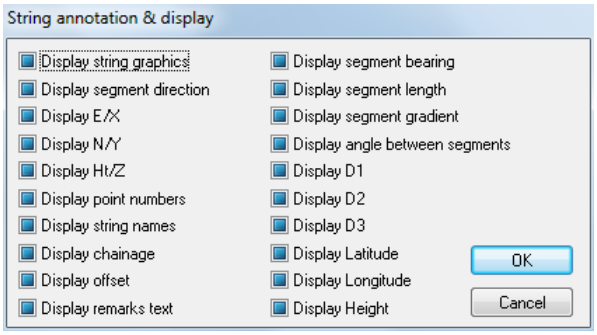


The following options are available.

Edit Text Annotation, Create Text, Delete Text, Move Text, Rotate Text, Move and Rotate Text, Copy Text, Edit Existing Text, Unlock Text, Show / Hide Macro Text , Toggle Text On/Off , Align Text To String , Annotate Angles, Delete Overlapping Text, Replace Literal Text with Macro Text, Enable Annotation of Selected Points, Associate Remark With Nearest Point or Copy Text To GIS Attributes

Edit Text Annotation

This option allows text and other information on the selected points to be displayed.



Points in the model must be selected before the user can access this option. If no points are selected when this option is selected then an error message will be displayed.

Display string graphics

String information for the selected point/s will be drawn in the model.

Display segment direction

An arrow will be drawn on the selected string showing the direction in which it was surveyed. This is especially useful when viewing traverse/station co-ordinates or prior to generating sections.

Display E/X

The Easting or X value for the selected point/s will be displayed. The unit of measurement is not displayed.

Display N/Y

The Northing or Y value for the selected point/s will be displayed. The unit of measurement is not displayed.

Display Ht/Z

The Elevation or Z value for the selected point/s will be displayed. The unit of measurement is not displayed.

Display point numbers

The survey point number of the selected point/s will be displayed.

Display string names

The string or feature name of the selected point/s will be displayed, at the first point on the string.

Display chainage

This option displays the chainage of the selected point along an alignment.

Display offset

This option displays the offset of the selected point from an alignment.

Display remarks text

Freeform text input in the ‘Remarks’ column of the data logger when the selected point/s were being surveyed, will be displayed. This remarks text can be found in the survey file by viewing the ‘text notes’.

Display segment bearing

This option displays the whole circle bearing between the incoming and outgoing segments of the selected. If individual points have been selected, the bearing is taken between the current point to the next point on the string.

Display segment length

This option displays the gradient of the selected segment/s. If individual points have been selected the length is taken between the current point to the next point on the string.

Display segment gradient

This option displays the gradient of the selected segment/s. The gradient will be displayed as a percentage. If individual points have been selected the gradient is taken between the current point to the next point on the string.

Display angle between segments

This option displays the clockwise angle between the incoming and outgoing string segments. No angle will be displayed for point strings.

Display D1

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This option displays dimension 1 for the selected point/points. This value is taken from the D1 field in the detail observation sheet.

Display D2

This option displays dimension 2 for the selected point/points. This value is taken from the D2 field in the detail observation sheet.

Display D3

This option displays dimension 3 for the selected point/points. This value is taken from the D3 field in the detail observation sheet.

Display Latitude

This option displays the latitude of the selected point/points. Please note that this will only work, if the points have been surveyed using GPS.

Display Longitude

This option displays the longitude of the selected point/points. Please note that this will only work, if the points have been surveyed using GPS.

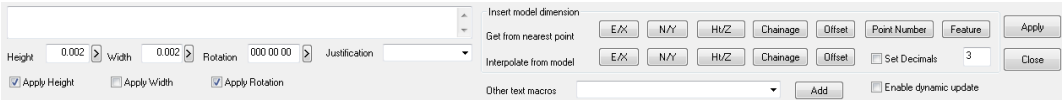
Display Height

This option displays the height of the selected point/points. Please note that this will only work, if the points have been surveyed using GPS.

Shortcuts

Create Text

This option presents the Create / Edit text dialog box.



Type in the text to add to the model. Then click on the model to insert the text. The user may set the height, width, rotation and justification of the text in the dialog or interactively when the text is inserted into the model. Font information for the text will be determined by the current text style.

There is also the option of adding X,Y and Z co-ordinates (in text form) to the model using the nearest and interpolation macros available. To do this, select X,Y or Z from either 'Get the nearest point' or 'Interpolate from model'. As the user moves the cursor about the model, the text will be automatically updated, giving either the interpolated co-ordinates of the point at the end of the cursor of the co-ordinates of the nearest point, depending on the option selected. Left click mouse to position text. Ticking the 'enable dynamic update' option means that if at a later stage you have to move the text, it will be updated automatically to display the co-ordinates of the new position.

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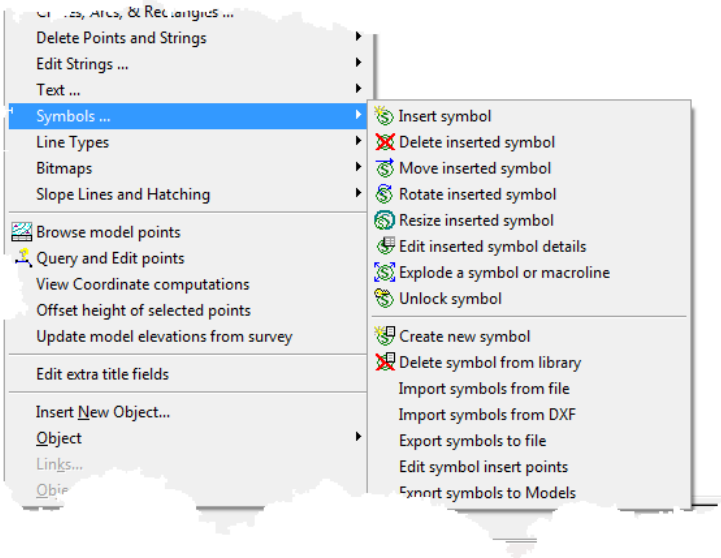
32.3.17 Symbols (Model Edit Menu)

This option allows symbols to be inserted and edited within the model.



The following options are available: Insert Symbols, Delete Inserted Symbol, Move Inserted Symbol, Rotate Inserted Symbol, Resize Insert Symbols, Edit Inserted Symbol Details, Explode a symbol or macroline, Unlock Symbol, Create New Symbol, Delete Symbols from Library, Import Symbols Form File, Import Symbols From DXF, Export Symbol To File, Edit Symbols Insert Points or Export Symbols to Model.

Insert Symbol

This option allows the user to insert a symbol in the model and to specify its size, position and rotation. Selecting the option displays the 'Create/Edit Symbol' Dialog. Selecting any of the 'Apply..' boxes allows you to edit this value with the mouse, otherwise values may be entered directly into the dialog box. Pressing Apply, or the left mouse button inserts the symbol in the model. Press Escape to finish this option.

Shortcuts

Delete Inserted Symbol

This option deletes an inserted symbol from the model. The user may either select this option, and click on the symbols to delete, or, pre-select the symbols to delete and then select this option. Press Escape to finish this option.

Shortcuts

Move Inserted Symbol

This option allows the user to move an inserted symbol with the mouse. Press the left button to select the symbol to move, press it again to select a new position. Press Escape to finish this option.

Note that this option only works for symbols inserted with the 'Insert Symbol' option.

Shortcuts

Rotate Inserted Symbol

This option allows the user to rotate an inserted symbol with the mouse. Press the left button to select the symbol to move, press it again to select a new rotation. Press Escape to finish this option.

The user may also pre-select the symbols to give either a new fixed or relative rotation.

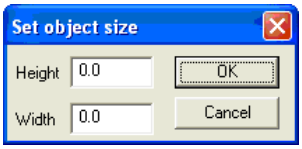
Note that this option only works for symbols inserted with the 'Insert Symbol' option.

Shortcuts

Resize Inserted Symbol

This option allows the user to resize an inserted symbol with the mouse. Press the left button to select the symbol to resize, press it again to select a new size. Press Escape to finish this option.

The user may also pre-select the symbols to give either a new height and width. If anything is selected the following dialog will be displayed :

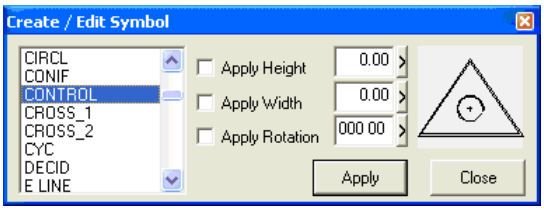


Note that this option only works for symbols inserted with the 'Insert Symbol' option.

Shortcuts

Edit Inserted Symbol Detail

This option allows the user to edit the symbol type, size, position and rotation for any symbol inserted in the drawing with the Insert symbol option. Selecting the option displays the 'Create > Edit Symbol' Dialog. Selecting any of the 'Apply..' boxes allows the user to edit this value with the mouse, otherwise values may be entered directly into the dialog box. Pressing apply, or the left mouse button updates the symbol in the model. Press Escape to finish this option.



Note that this option only works for symbols inserted with the 'Insert Symbol' option.

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Shortcuts

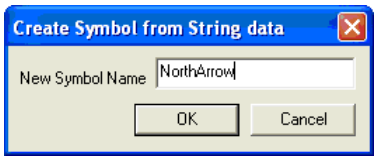
Unlock Symbol

This option converts a symbol associated with a survey point, such a tree symbol, into a symbol that may be edited with the edit symbol command.

Shortcuts

Create New Symbol

This option allows the user to apply a new symbol name.



Shortcuts

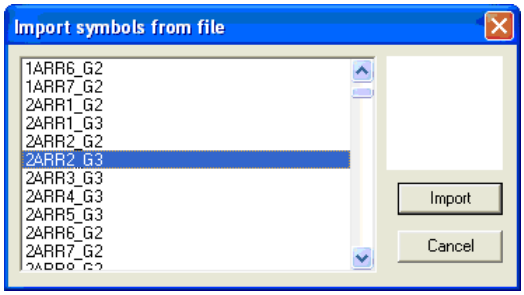
Delete Symbol From Library

This option deletes a symbol from the feature library either from a model or from a project. This may be used to reduce the file size of the model and to allow the symbol name to be re-used for a new symbol.

Shortcuts

Import Symbol From File

This option imports selected symbols from external '.VectorSymbol' files into the current model or project. These include the standard symbols shipped with SCC and any other symbols exported using the Export Symbols to File option.



Import Symbol From DXF

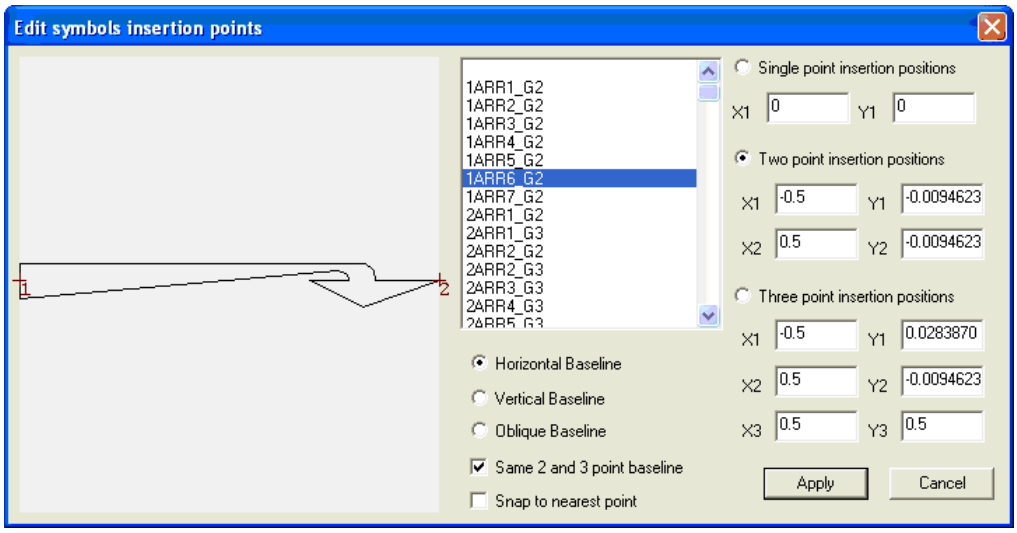
This option imports symbols from a DXF file. The symbols are attached to the project template. Feature library symbols may be drawn in CAD or MicroStation.

Export Symbol To File

This option exports all the SCC symbols from the current project to a external '.VectorSymbol' files. These files such that can then be imported into other SCC projects and models.

Edit Symbol Insert Points

This option allows the user to edit the insertion points, which correspond to the survey points, for existing symbols. Each symbol has a set of insertion points for insertion by 1, 2 or 3 points.



When creating insertion points for 2 and 3 point symbols, it is recommended that to use either a horizontal or vertical base line, such that SCC can easily mirror the symbol where negative dimensions are used, or where the third point lies on the other side of the first two points from the defined third point. This is done by specifying a horizontal or vertical base line.

Symbol coordinates are always normalized to the range of –0.5 to 0.5, such that symbols have an origin of 0,0, and are 1 unit wide. Symbols imported from DXF will be normalized and centred into this coordinate range, and as such, may require modification to their insert points.

Use the snap function to ensure that the insert point lies on an exact surveyed point on the symbol.

Explode a symbol or macroline

This converts all the line work that made up the symbol or macroline into editable strings.

Export Symbols to Models

This option exports all the SCC symbols from the current project to a model. This can be useful for editing and creating new, similar symbols, and for exporting symbols to other systems such as 3D studio .3DS

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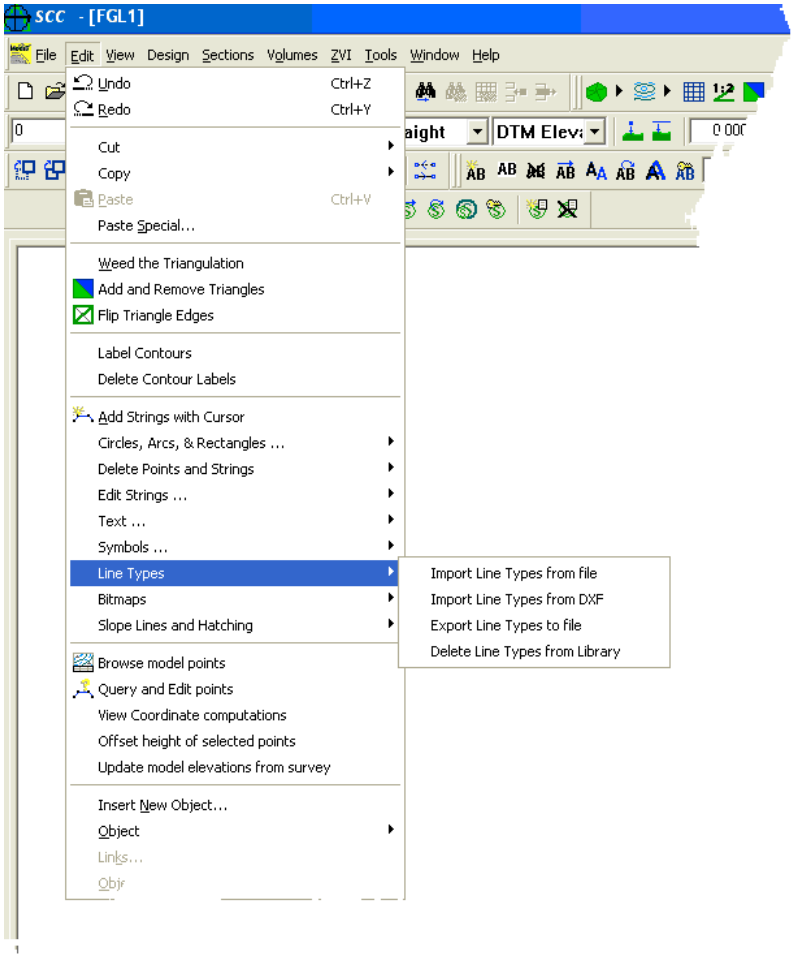
32.3.18 Line Types (Model Edit Menu)

The following options are available: Import Line Types From File, Import Line Types From DXF, Export Line Types To File and Delete Line Types From Library



Import Line Types From File

This option is used to import line types from SCC LINETYPE files into your current project or model. These may then be used within the feature library to draw those line types.

Import Line Types From DXF

This option is used to import line types from a DXF file into a SCC project or model file. These may then be used within the feature library and / or export to SCC LINETYPE files for use elsewhere. This option can be used to import all simple line types and complex line types containing embedded text.

Note that this option cannot be used to import complex line types containing embedded shapes, as these are dependent on shape files that are external to both DXF and DWG files. To create more complex line types in SCC, such as macrolines and lines with embedded symbols.

See Also

Symbology Feature Library

Export Line Types To File

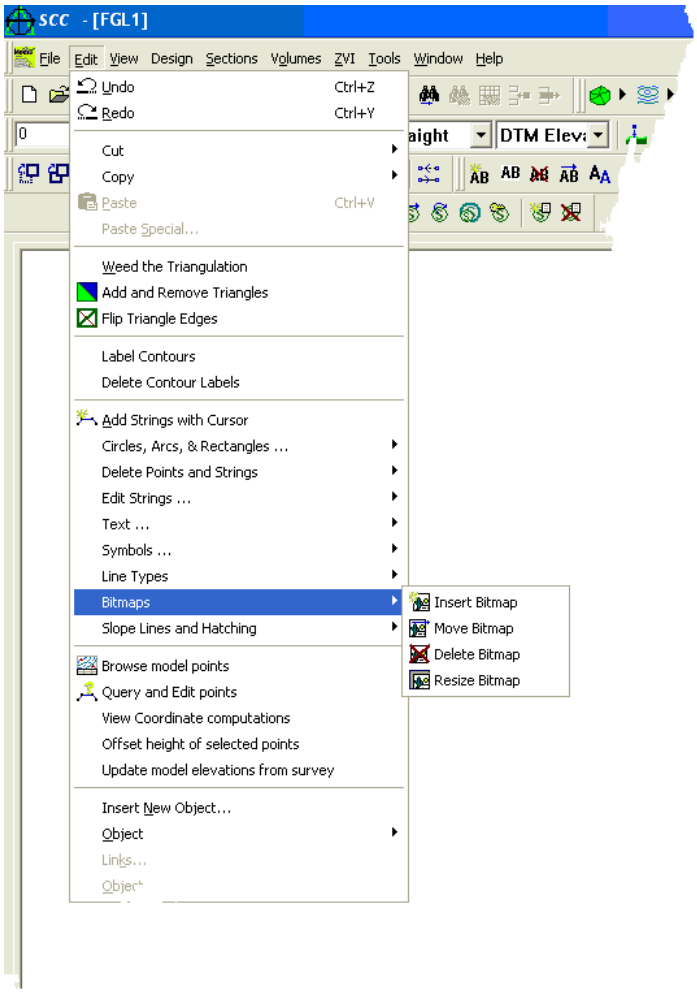
This option is used to export line types from a project or model into SCC LINETYPE files, such that they can be imported into other projects and / or models.

Delete Line Types from Library

This option is used to permanently delete line types from a project or model.

32.3.19 Bitmap (Model Edit Menu)

The following options are available: Insert Bitmap, Move Bitmap, Delete Bitmap and Resize Bitmap.



Insert Bitmap

This option inserts a windows bitmap (.BMP) file into the model in a given location and to define its size and aspect ration. This option can be used when creating sheet layouts, where bitmap information, such as company logo, are required on the sheet.

Move Bitmap

This option moves a bitmap created with the insert bitmap option. Press the left mouse

button on the bitmap to select it, then move the mouse and press the left button again to select a new location.

Delete Bitmap

This option deletes a bitmap created with the insert bitmap option. Press the left mouse button on the bitmap to delete it.

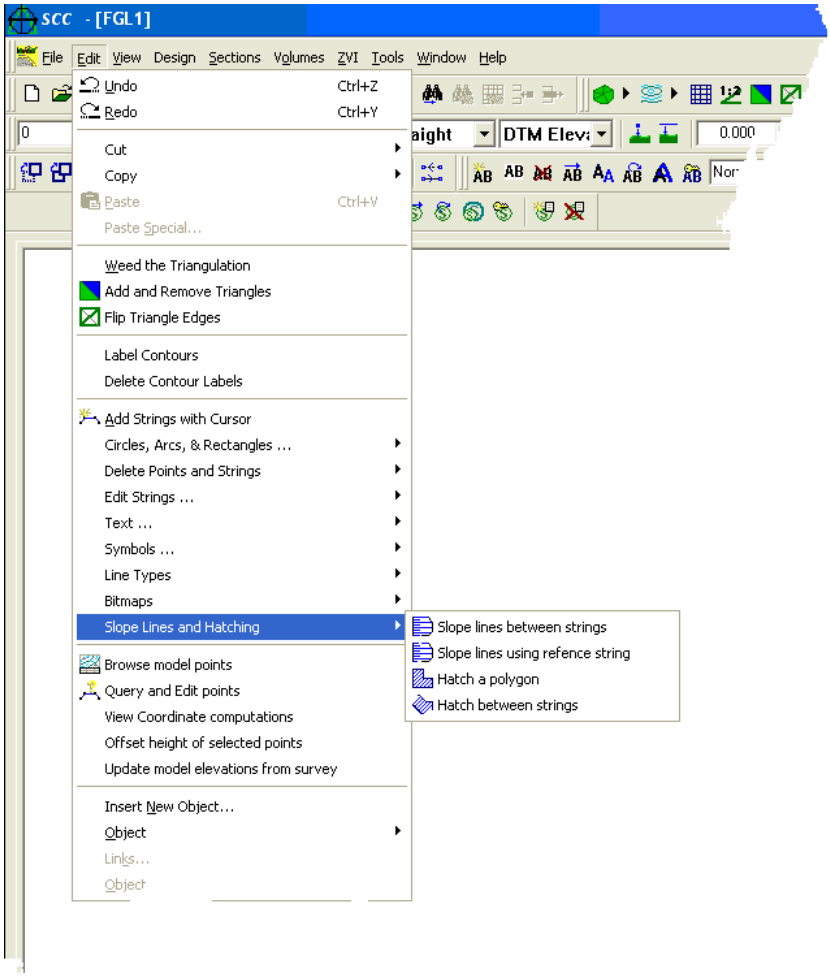
Resize Bitmap

This option resizes a bitmap created with the insert bitmap option.

Press the left mouse button on the bitmap to select it, then move the mouse and press the left button again to select a new size.

32.3.20 Slope Lines and Hatching (Model Edit Menu)

The following options are available: Slope Lines Between Strings, Slope Lines Using Reference String, Hatch A Polygon and Hatch Between Strings.



Slope Lines Between Strings

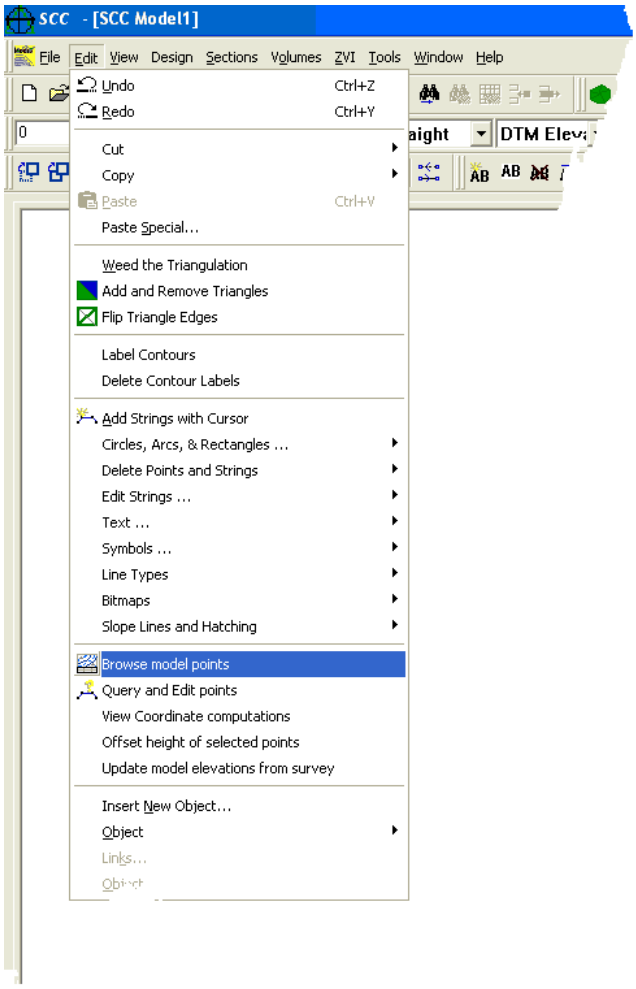
This option allows the user to add slope lines or hachures between two strings.

The first method requires the user to select two strings, and generates slope lines

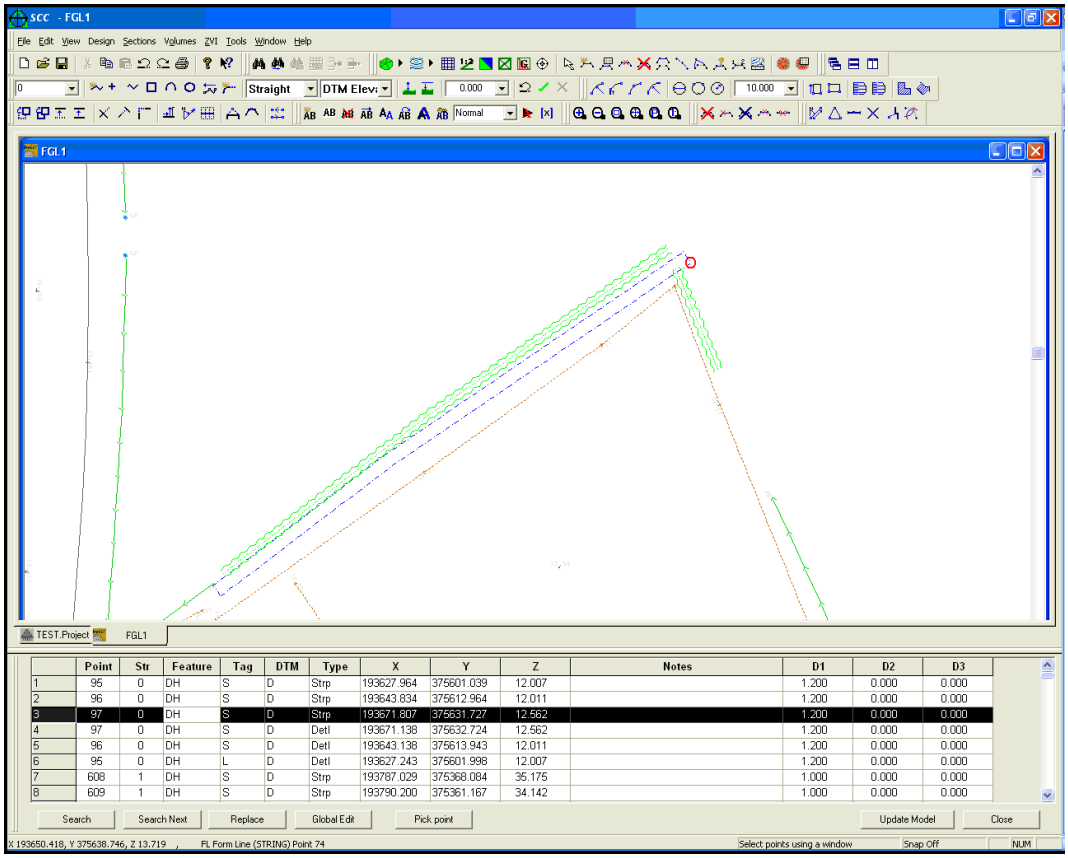
perpendicular to the first string selected.

32.3.21 Browse Model Points (Model Edit Menu)

The browse model option allows the user to simultaneously view the model in graphical and spreadsheet format.



Selecting a point on the graphics will update the spreadsheet position, similarly selecting a point in the spreadsheet will re-center the graphics around that point. Most graphical editing tools will also work while browsing the model, additionally search and replace, and global editing operations are available while in this model.

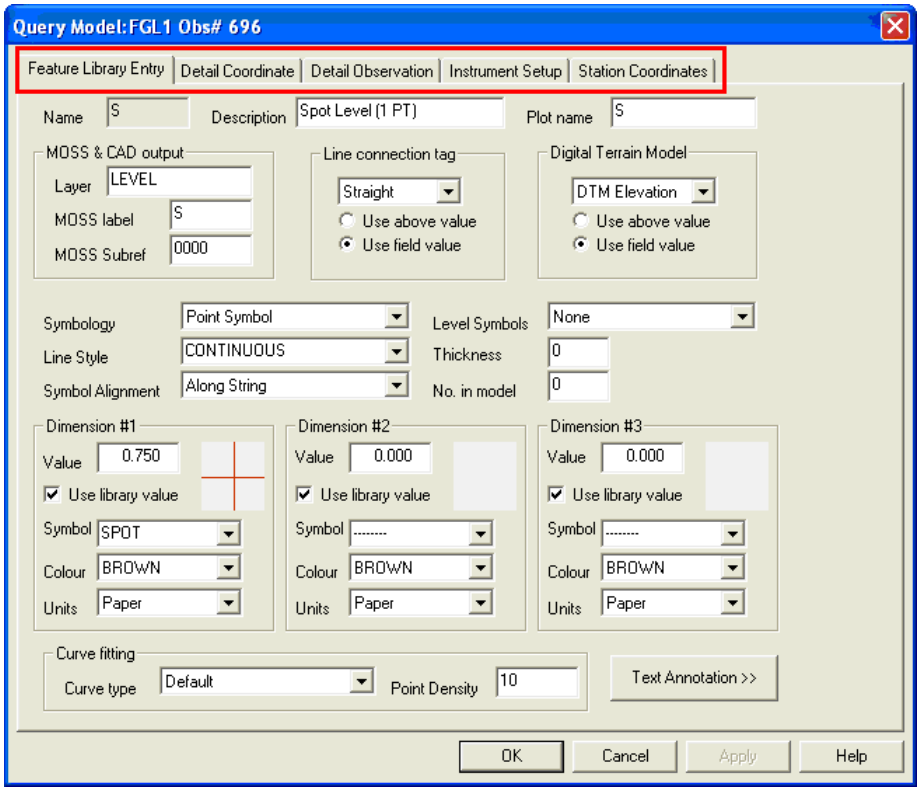


If the user makes a change to the spreadsheet view while browsing, 'Update Model' must be selected to see these changes reflected in the graphics. Any graphic editing is automatically reflected in the spreadsheet.

Shortcuts

32.3.22 Query and Edit Points (Model Edit Menu)

This option allows the user to query and edit survey information by simply using the mouse device to bring the screen cursor close to the point in question. The cursor will snap on to the nearest survey point. This facility may be used to query and edit any information relating to this point.



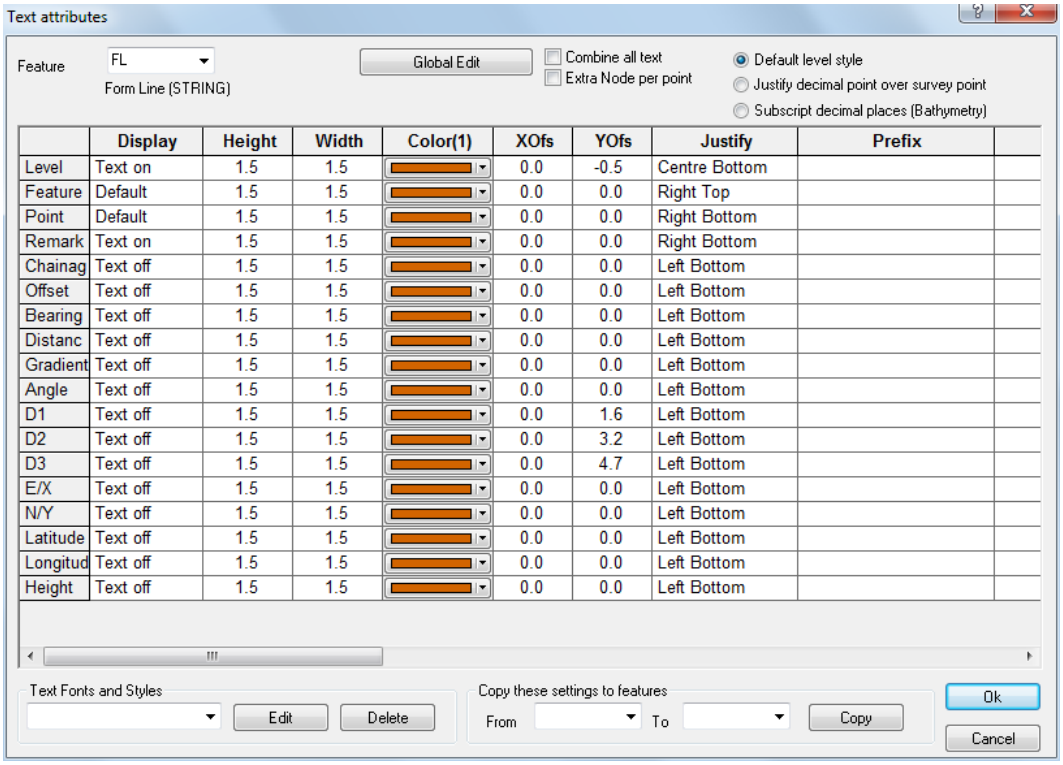
When editing data, it is important to make all changes to survey information, that is, station co-ordinates, station set-ups, and observations, prior to editing co-ordinate values directly. The reason for this is that any co-ordinate editing that has been done to a survey will be lost if the co-ordinates are rebuilt from the survey observations. If the option to search for multiple points enabled in the Snap Lock dialog box, a list of points within the given within the search radius. The 'Query and Edit points' menu contains the following options;

Feature Library, Detail Coordinates, Detail Observations, Instrument Set Up, Station Coordinates,

Feature Library

Selecting this tab, allows the user to view and edit the feature library entry associated with the selected point. This dialog can be used to change colour, line-style, symbology etc of the current point and any point in the model with the same feature code.

The user can also access the annotation settings of the selected feature from this dialog. Selecting the 'Text Annotation>>' button brings up the following dialog;



	Display	Height	Width	Color(1)	XOfs	YOfs	Justify	Prefix
Level	Text on	1.5	1.5		0.0	-0.5	Centre Bottom	
Feature	Default	1.5	1.5		0.0	0.0	Right Top	
Point	Default	1.5	1.5		0.0	0.0	Right Bottom	
Remark	Text on	1.5	1.5		0.0	0.0	Right Bottom	
Chainag	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Offset	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Bearing	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Distanc	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Gradient	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Angle	Text off	1.5	1.5		0.0	0.0	Left Bottom	
D1	Text off	1.5	1.5		0.0	1.6	Left Bottom	
D2	Text off	1.5	1.5		0.0	3.2	Left Bottom	
D3	Text off	1.5	1.5		0.0	4.7	Left Bottom	
E/X	Text off	1.5	1.5		0.0	0.0	Left Bottom	
N/Y	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Latitude	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Longitud	Text off	1.5	1.5		0.0	0.0	Left Bottom	
Height	Text off	1.5	1.5		0.0	0.0	Left Bottom	

The following items of annotation that can be displayed in the model;

Display

This field specifies whether or not the associated text will be displayed in the drawing for this particular feature or whether it will follow configuration defaults.

The Display field has 3 possible options:

Default

Text On

Text Off

Height

This is the height of the associated text, it requires that the plot scale be entered in order to operate correctly. The paper units specified in the General Options determine the units used in this field

Width

This is the width of the associated text, it requires that the plot scale be entered in order to operate correctly. The paper units specified in the 'General Options' determines the units used in this field.

Colour

This is the colour of the associated text, the default being black.

Xofs

The value entered in this column determines the amount that the associated text is offset from the surveyed point, in an east/west direction. The paper units specified in the 'General Options' determines the units used in this field.

Yofs

The value entered in this column determines the amount that the associated text is offset from the surveyed point, in a north/south direction. The paper units specified in the 'General Options' determines the units used in this field.

Justify

This option aligns or justifies the survey point with the associated text. For example, 'left top' means that the survey point is to the top left corner of the associated text.

The following options are available:

Left Top	Left Centre	Left Bottom
Centre Top	Centre Centre	Centre Bottom
Right Top	Right Centre	Right Bottom

Prefix

The user can enter text that will prefix the text. For example, entering CL (cover level) in the prefix column associated with level text will display 'CL100.98'.

Suffix

The user can enter text that will suffix the text. For example, entering IL (invert level) in the suffix column associated with the level text will display '100.98IL' or a suffix of m (metre) '100.98m'

Alignment

This option determines how text placed for this feature will be aligned within the model.

The following options are available:

Options	**Description**
String	Along String
H Sheet	Horizontal to Sheet
H Grid	Horizontal to Grid
V String	Normal to String
V Sheet	Vertical to Sheet
V Grid	Vertical to Grid
R String	Along String (Upside Down)
RH Sheet	Reverse Horizontal Sheet (Upside Down)
RH Grid	Reverse Horizontal Grid (Upside Down)
RV String	Reverse Normal to String
RV Sheet	Reverse Vertical Sheet
RV Grid	Reverse Vertical Grid

Priority

This option allows the user to prioritise text and works in conjunction with the 'Delete Overlapping Text' Option in the 'EDIT > Text' Menu. Any value between 0 and 100 can be entered and where two pieces of text overlap, the one with the lowest priority number will be deleted.

Characters

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This controls the maximum number of characters in the displayed field.

Decimal

This value determines to how many decimal places the text will be displayed.

Style

This field contains the line styles used for all lines drawn when defining this feature. This can include simple and complex user defined line styles, comprising of dashed, dots, and embedded text.

Layer Prefix

This is a prefix added to the features layer name for this annotator, when outputting to CAD. For example, 'AM_ROAD'

Layer Suffix

This is a suffix added to the features layer name for this annotator, when outputting to CAD. For example, on elevations, this defaults to '_LVL'. This would mean that if the road line-work went on the layer 'ROAD' the road elevations would appear on 'ROAD_LVL'.

Interval

This field determines the interval at which the text annotator is placed on the survey string. This can be the first point only, the end points, all points on the string, or points at a regular interval. For example, the feature name would generally only be annotated at the end points of a string, whereas the elevation is likely to be required at all points.

Point Count

Where points are being annotated at a regular interval, this field determines the interval. For example, a value of 2 would annotate every second point on the string.

See Also

Feature Library (View menu)

Detail Coordinates

Selecting this option allows the user to edit the co-ordinate record for the selected point in the model. It there are detail observations for the point they should be edited where possible instead of the coordinate because if the model is rebuilt the changes made to the coordinate file will be lost.

See Also

Detail Coordinate (View Menu)

Detail Observations

Selecting this option allows the user to edit the observation associated with the current point. Modifying the observation will require the associated survey to be re-coordinated and the model to be rebuilt. If the coordinate file was not formed from a detail survey then this option may not be used.

Instrument Set-Up

Selecting this option allows the user to edit the station set-up details from which the current point was fixed. Modifying the station set-up details will require the associated survey to be re-coordinated and the model to be rebuilt. If the co-ordinate file was not

formed from a detail survey then this option may not be used.

See Also

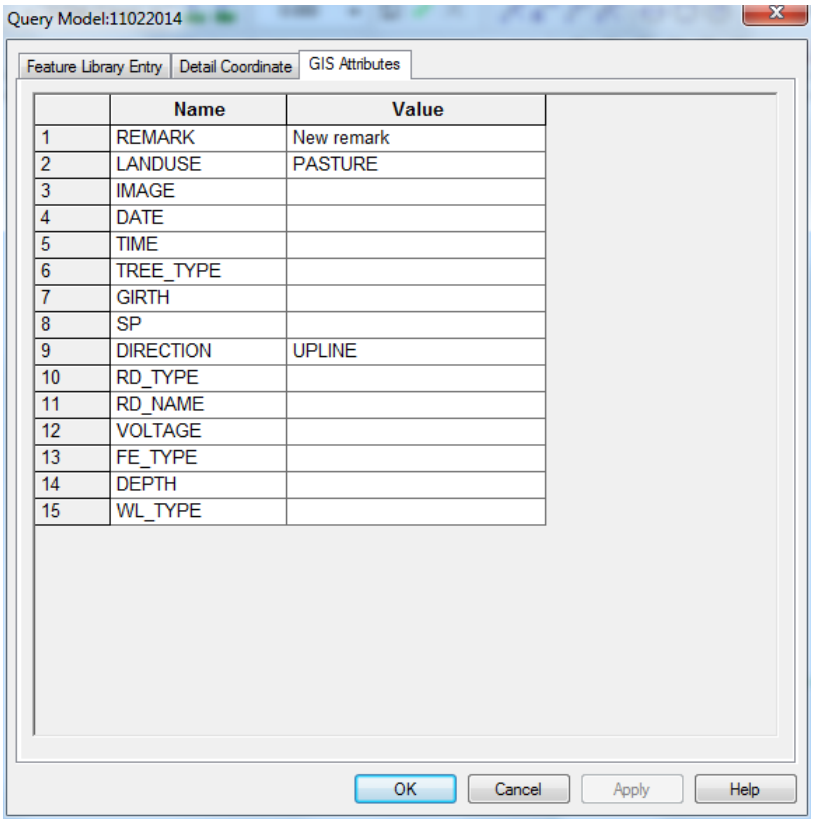
Instrument Set Up

Station Coordinates

Selecting this option allows the user to edit the station control co-ordinate from which the current point was fixed. Modifying the station control co-ordinate will require the associated survey to be re-co-ordinated and the model to be rebuilt. If the co-ordinate file was not formed from a detail survey then this option may not be used.

GIS Attributes

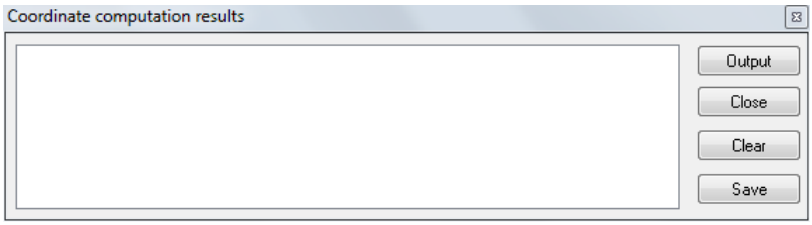
Additional attribute information can also be viewed within the Query & Edit Dialog.



	Name	Value
1	REMARK	New remark
2	LANDUSE	PASTURE
3	IMAGE	
4	DATE	
5	TIME	
6	TREE_TYPE	
7	GIRTH	
8	SP	
9	DIRECTION	UPLINE
10	RD_TYPE	
11	RD_NAME	
12	VOLTAGE	
13	FE_TYPE	
14	DEPTH	
15	WL_TYPE	

32.3.23 View Coordinate Computations (Model Edit Menu)

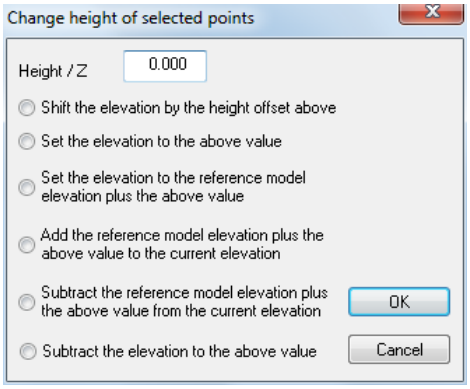
This dialog stores the results of calculations carried out using the edit strings options and the measurement options. If this dialog is not opened the calculations will not be stored to it. Output sends all the calculations to an output file. Clear deletes everything in the current dialog.



For example, to add the intersection point of two strings to one or both of those strings, use the 'Intersect' tool with snap lock on to compute the intersection. The resultant computed coordinate will be placed in the 'Coordinate Computations Results' Window. Then select the 'Insert Point onto String Tool' and select one of the strings, and select the intersection point displayed in the 'Coordinate Computations Results'. Press 'Output' in the 'Coordinate Computations Results' Window to insert the point in the string. Repeat this process for the second string if required. Note that all model tools that compute coordinates place their results in the 'Coordinate Computations Results' window such that they may be used in place of mouse selections for any other model operations.

32.3.24 Offset Height of Selected Points (Model Edit Menu)

This option is used to change the elevation of either the selected points, or, no points are selected, the entire model.



The function can be used to either shift the points to a fixed elevation, or to offset the elevation of the points by a given amount. This function is particularly useful when elevation changes to survey stations are made after a model has undergone editing. In this case, use the advanced options in the data select dialog to select all the points from a given station prior to using this option. Further options are for use with an attached 'Reference Model' ('FILE > Attach/Detach > Attach Model File')

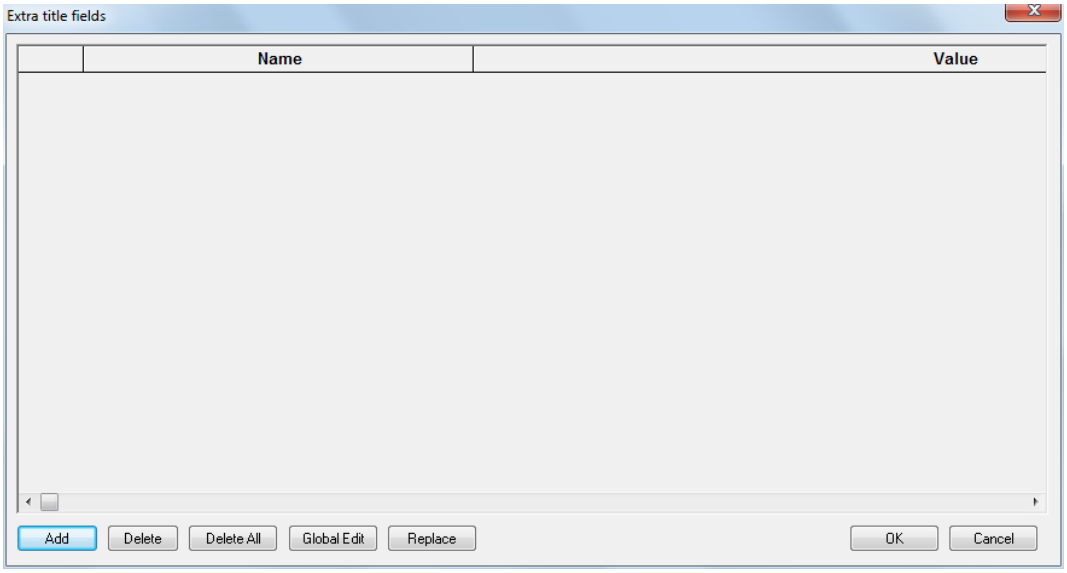
32.3.25 Update Model Elevations from Survey (Model Edit Menu)

This option is used to replace heights in a model with heights from the original data set that created that model. This allows the user to overcome potential errors in height offsets, rod heights, and benchmark changes that are discovered late in the editing process. It provides the advantage that the model heighting can be changed without having to re-process cartographic and topographic edits.

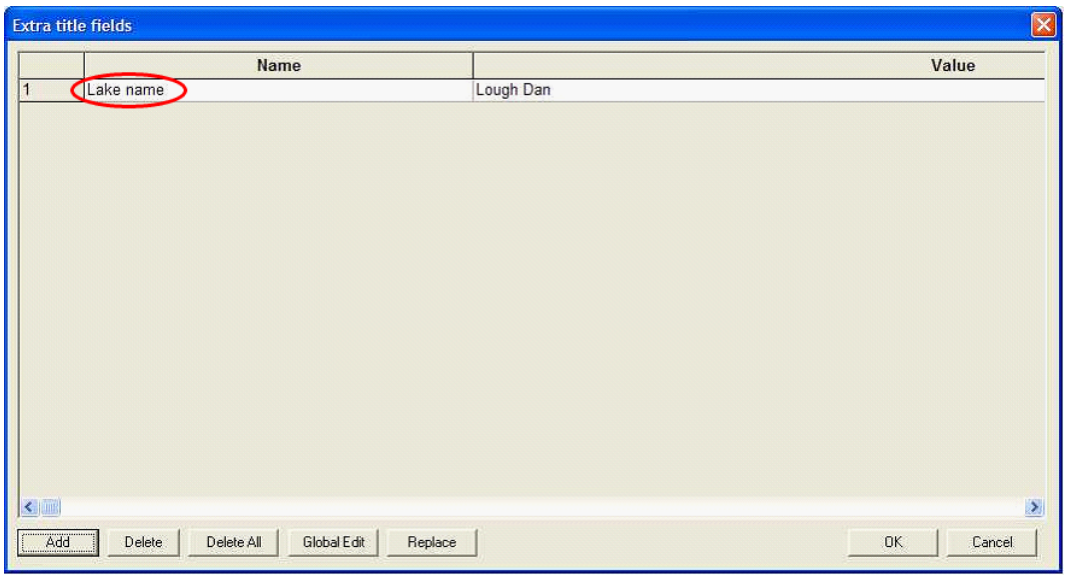
This option may be used with or without pre-selection of points. If no points are selected, the option will be applied to the entire model. If some points have been selected, the option will be applied to those points only. Note that this option works best either with associative level text or level text macros.

32.3.26 Edit Extra Text Fields (Model Edit Menu)

This option allows the user to set user defined text macros in models, sheet layouts, reports and projects.



The Add button can be used to add pairs of field name and value records as shown. In a model or sheet layout, these fields appear in the extra macro column, with the prefix ATTR as shown below;



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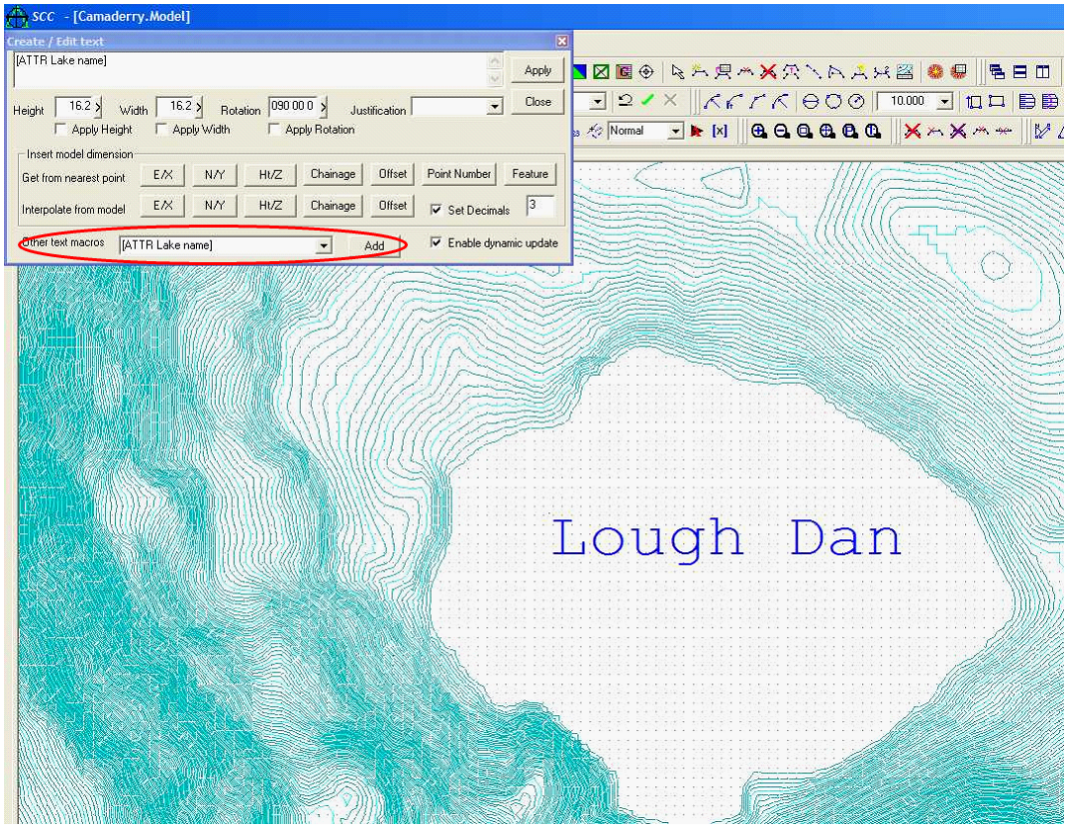
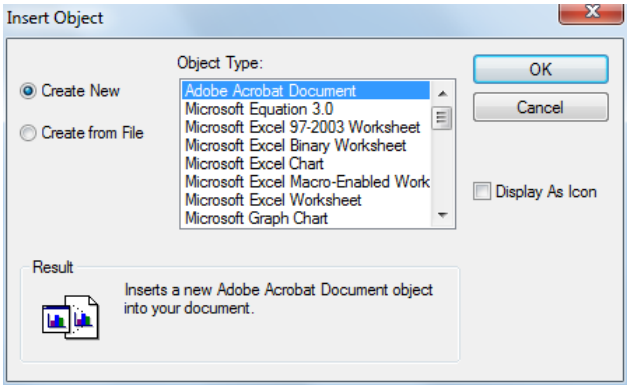


Extra text fields are saved and loaded as part of the project template, along with the feature library, line styles, symbols, etc... This means that if the extra fields added to a project, those fields will be available to any models created from that project. Thus if standard fields exist which are required by the surveyor to complete for each model, such fields should be added to the project template, so that they appear in sheet layouts and can be completed by surveyors on individual models. These fields are also exported when running reports, such that they are available for report titles, etc..

32.3.27 Insert New Object (Model Edit Menu)

Inserts and embeds an object, such as a chart or an equation in a document. The application in which the object was created becomes active on the screen. The SCC File menu will remain active.



The following options are available:

Create New

A new blank object is inserted into the current document. When you double click on the object or the icon the program in which the document was generated is opened. When the object is selected the top menu bar is changed to that of the program in which the object was created. The only menu that does not change is the File menu.

Create from File

An existing object is inserted into the current document. Double click on the object or the icon and it may be edited in the program in which it was generated. There is an option to create a link between the inserted object and the original document. If the file is linked to the current document changes to the object will be reflected in the current document.

Display As Icon

If this option is turned on the object will be inserted as an icon. When the icon is double clicked the document is opened in its source program.

32.3.28 Object (Model Edit Menu)

The option allows the user to Select the object by clicking on it and the following options are activated.

Display Content

Display the object in its original format. This option is used if the object is currently displayed as an icon.

Display Icon

Displays the object as its source program icon. This option is used if the contents of the object are currently displayed in the active SCC document.

Reset Size

Change the size of the object or the icon representing the object in the current document.

Clone

Make a copy of the current object

Delete

Delete the object from the current document

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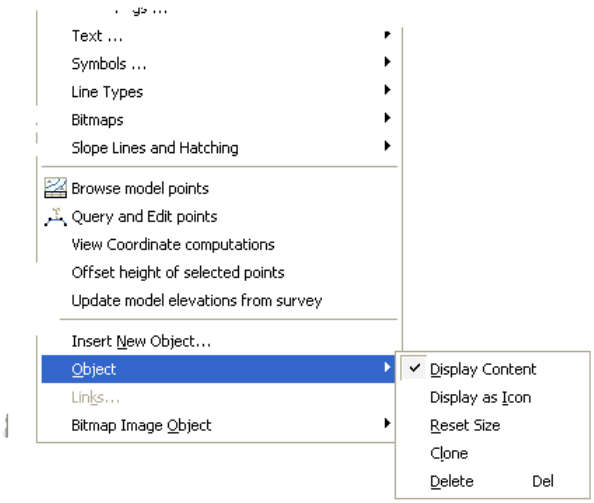
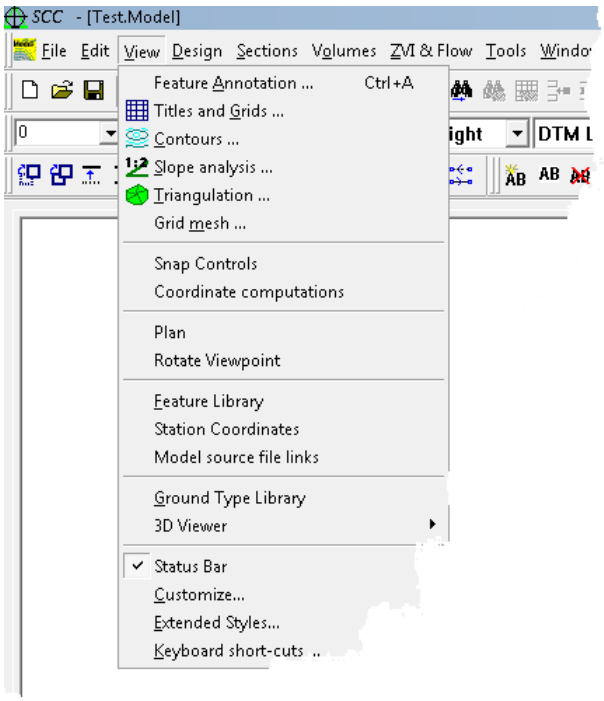


32.3.29 Links (Model Edit Menu)

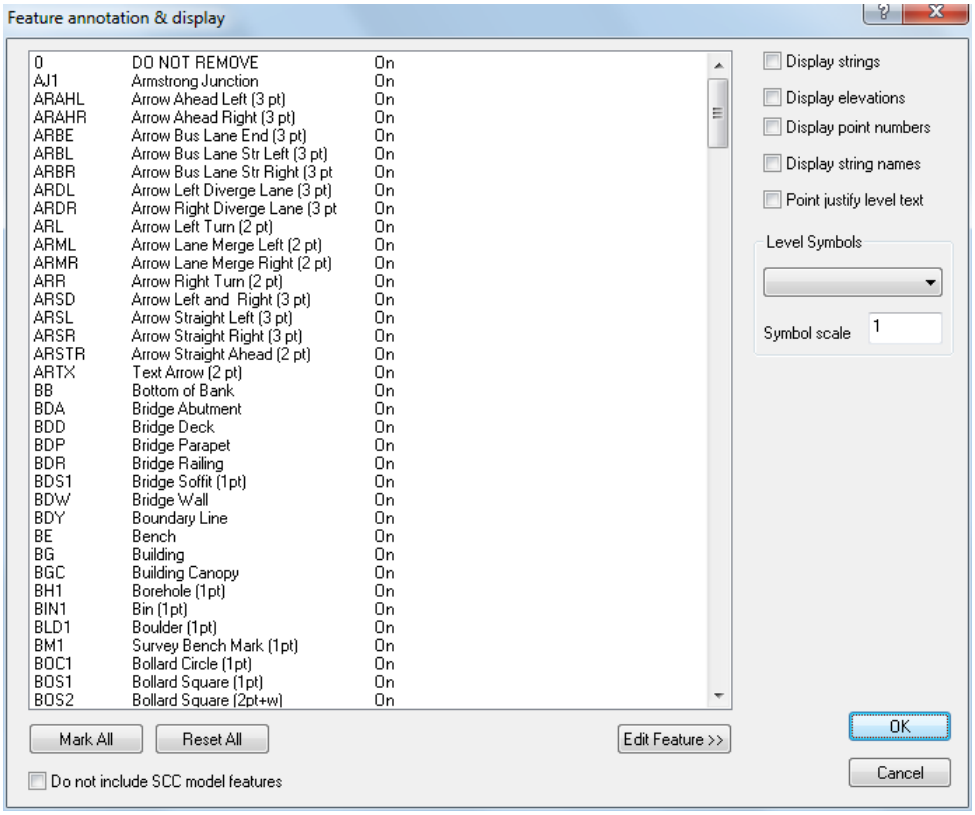
This option list and edit links to embedded documents.

32.4 Model View Menu



32.4.1 Feature Annotation (Model View Menu)

This option allows the user to turn on or off and edit features in the model. There are default entries, which are the basic model features. These will always be prefixed with '~'. Features without this sign will be features specific to the current project.



When this option is used with literal text or macro text annotation, it does not add or remove any text items, it merely shows or hides existing annotation. This option does not modify the model feature library unless the ‘Edit Feature’ option is selected. To add or hide annotation for selected points, use 'EDIT > Text > Edit Text Annotation' as before, or 'EDIT > Text > Redraw string annotation' to do this en-mass for using feature library settings. To permanently delete text, use the 'Delete Text' option, which can also be used with pre-selection to delete large amounts of text.

Turning off remarks using the facilities above merely hides the remark, such that it can be turned back on. Delete Text will permanently delete it.

Mark All

Highlights all features in the list.

Reset All

De-selects any highlighted features.

Edit Feature

Edits the currently highlighted/selected feature. If a change to a feature is made on this sheet the feature library spreadsheet will be simultaneously updated.

Display String

This switch defines whether cartographic map data for the selected feature/s, such as trees, walls, fences etc. will be displayed.

Display Elevations

This switch defines whether text will be placed for nominated spot elevations.

Display Point Numbers

This switch defines whether the point numbers of the selected features will be displayed.

Display String Names

This switch defines whether the feature name of the selected strings will be displayed.

Point Justify Level Text

This option allows you to align the decimal point of the elevation text over the surveyed point. This forces the elevation text into a mono-spaced font in both SCC and CAD, which may occupy slightly more display space that a normal font.

Level Symbols

This switch defines whether an additional symbol is placed for every survey point in the triangulation. This is useful for identifying points on strings and passing level data to other systems.

None

Single Point

Circle

Cross

Symbol Scale

The user can set the scale of the level symbol being applied.

32.4.2 Titles And Grids (Model View Menu)

This option allows selection of plot scale and primary grid and secondary grid. The 'Titles and Grids' dialog is also used in conjunction with the creation of sheet templates. The information entered in this dialog will be used to update the corresponding data in the inserted sheet. The displaying of grids in a model does not use the display cache, as very large grids caused significant extra memory usage with minimal speed benefits.

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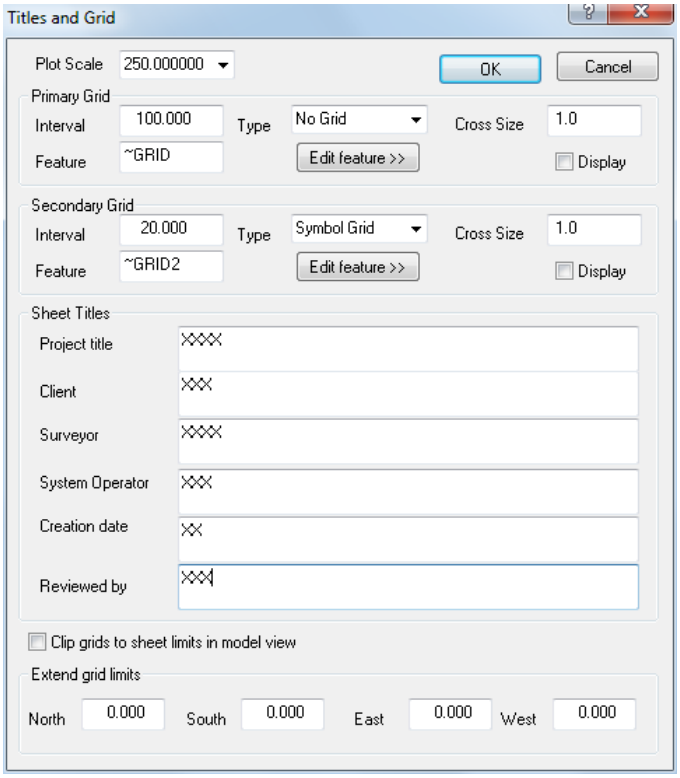


Note that primary and secondary grids are drawn using the '~GRID' and '~GRID2' features respectively. These features may be modified to add suffixes and prefixes to grid annotation, and to orient annotation text. Any of the reverse text alignments will allow the grid text to be inverted.

Clip grid to sheer limits in model view

With this option selected, SCC will minimise the gird limits in model view based on X and Y values in the model.

Extend grid limits

This option allows the user to specify limits in North, South, East and West direction.

Shortcuts

Toolbar:

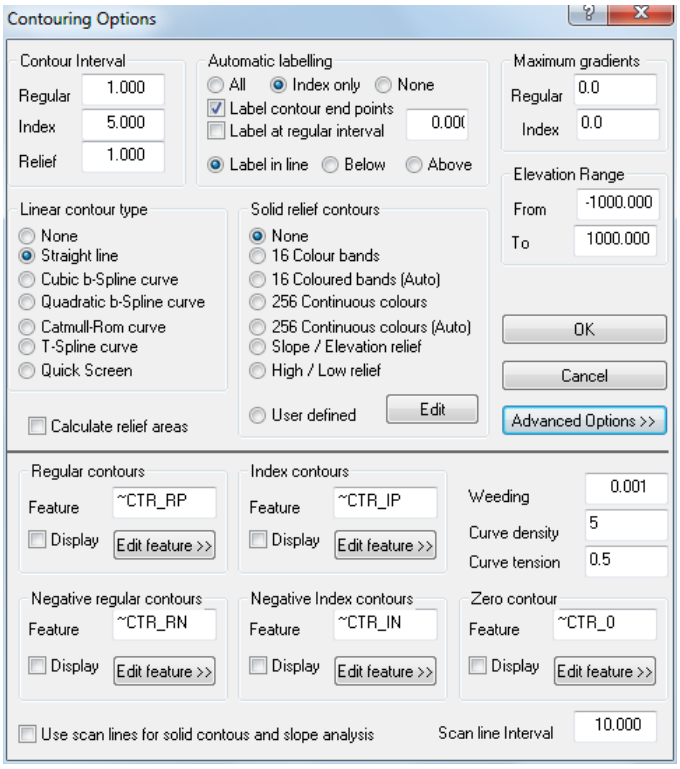
Keys: ALT + V, G

32.4.3 Contours (Model View Menu)

SCC provides options to produce an extensive range of both line contours and relief bands or solid contours.

Line contours may be drawn either as straight lines or use one of a variety of curve fitting algorithms. These include cubic and quadratic b-splines suited to cartographic work, and Catmull-Rom curves better suited to engineering work.

All the contour threading honours all the points interpolated on the triangle edges but the Catmull-Rom contours more closely follow the straight line contours which is the strict contour delineation according to the data set. However, the modification and error propagation brought about by the curve fitting would normally be of a much lower order than that which would be inherent in the physical point selection density, the definition of breaklines, the systematic errors from data acquisition instrumentation etc.,



Solid contours or relief bands provide a useful backdrop to a model showing a good overall impression of the shape of the terrain. SCC provides a variety of solid contouring options suitable for both 16 and 256 colour displays. These options provide facilities for highlighting elevation, gradient or a combination of both. Neither solid or line contours in SCC have any storage overhead in terms of disk space or memory. This is not the case, however, with most CAD packages. As such, it is wise to turn off solid contours when outputting to CAD unless they are specifically required. 256 Colour banding is particularly unsuited to most CAD packages due to the number of CAD entities required for its representation.

The contour menu provides the following options;

Contour Interval

Regular

This is the vertical distance at which interval contour lines are drawn. Large numbers of contours are liable to slow down screen redrawing time and increase the size of any CAD files produced.

Index

This is the vertical distance at which highlighted main contour lines are drawn. This value must be a multiple of the regular contour interval.

Relief

This is the vertical distance at which solid contour lines are drawn.

Automatic Labelling

This option allows the automatic labelling of contours dependent on the fields you select. The user may label all contours, index only or none at all.

The user may select whether or not to label the end points of each contour or at regular intervals along the contour line. The interval value is entered by the user and the alignment of the contour text can be set by going to the advanced options and editing the relevant contour feature.

It must be noted that the automatic labelling of contours will not work on quick screen contours. This option does not effect the ‘label contours’ option in the EDIT menu.

Maximum Gradients

This option allows the user to set the maximum gradient for displaying regular or index contour. This is particularly useful in very steep areas where contours are tight and the user may not wish to display all the contours at the selected interval.

Linear Contour Type

This option allows the user to create linear contours from the triangulation and specify the type of contour that will be created. These may be either straight-line contours or curved contours.

A number of curve types are supported, while they are more aesthetically pleasing they are slower to draw on screen, make for larger CAD files and are slightly less accurate for engineering purposes than straight line contours. Of the curved contours the splines give the most aesthetically pleasing curves, while the Catmull-Rom curve fit is closer to the planar triangular surface.

All curved contours will revert to straight lines in areas where they cross break lines or encounter extreme grade changes. Therefore when roads, for example, are crossed by contours then these revert to straight lines because of the kerb lines, road centrelines etc. This realistically reflects the angularity of contours defined by hard or manmade surfaces.

Straight-line contours are good for production of efficient and accurate draft drawings. T-Splines have the advantage over Catmull-Rom curves that they can be used to accurately render conics including circles, arcs, ellipses, hyperbolae and parabolas. As such, they may prove useful when surveying roundabouts, prefabricated kerbs etc. The downside is they tend to be less smooth than Catmull-Rom curves for irregular data and tend to highlight any noise in the input data. Quick screen contours should be used in place of straight line/curved contours when working on the screen. The contours can be changed to curves just prior to exporting to CAD. This increases speed of operation within SCC.

Solid Relief Contours

This option allows the user to create solid relief contours from the triangulation. These contours show areas of given elevation ranges as solid colour bands.

Relief contours are useful for visualising a surface and / or representing special models such as isopachytes, isotherms, hydrographic data etc. Solid contours may be combined freely with line contours. 256 colour contours are only available on screens that support this number of colours - VESA compliant screens, for example. Continuous colour bands have the visual effect of smoothing the surface to the eye. As such, they are very useful for illustrating non-terrestrial surfaces, such as pollution level or thermal surfaces, where the 'Z' value in the surface is of a lower order of accuracy than the plan position.

The slope high-lighted relief contours have the reverse effect. They are very useful for visually depicting terrestrial surfaces, particularly in highlighting potential problems in the surface as shown in the picture at the start of this chapter. High-low contours divide the

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surface into areas above and below a datum point. Areas above the datum point are coloured from green to red in order of height above datum. Areas below the datum are coloured from light blue to black according to depth below the datum. High - low contours are always autoscaled and are primarily useful for coastal surveys.

Auto scaled contours divide the range of levels in the model by the number of available colours in order to produce the contour interval. It is important when using solid contours that the elevation ranges corresponds to those in the model. Otherwise the range (-1000m to 1000m) over which the colours (16 or 256) will be spread over too wide a range.

Solid contours, particularly 256 colour solid contours, will generate very large files when output to CAD.

There is also the option to set up a user defined solid relief band where the user defines the colours for specific elevation ranges. User defined color relief schemes may be saved and re-used as required (example below).

User Defined Contour Bands

This options allows a unique relief scheme to be set up, based on intervals and colours specified by the user.

The relief scheme can be set up in two ways.

A) Creating a Relief Scheme with regular intervals using the ‘Add elevations/colour range’ option

To create a relief scheme where the elevation ranges are based on regular intervals, it is best to use the ‘Add elevations/colour range’ option. The user can enter the lowest elevation value in the ‘From’ box and the highest value in the ‘To’ box. Then specify the interval value and colour range, hit the ‘Create’ button and SCC will do the rest. To set up ranges of different colour bands, this procedure will need to be repeated until the last value entered in the ‘To’ box is the highest point of elevation required.

32.4.4 Slope Analysis (Model View Menu)

The slope analysis options in SCC highlights areas of the model within specified slope or grade ranges. They also include a facility to place an arrow on every triangle showing the direction down hill, these are referred as slope vectors. Applications for slope analysis include drainage design, landscaping, and general cartography. Slope vectors make it easier to distinguish a hollow from a hill on a contoured plan drawing, as can be seen from the picture above depicting a bunker on the edge of a golf course green.

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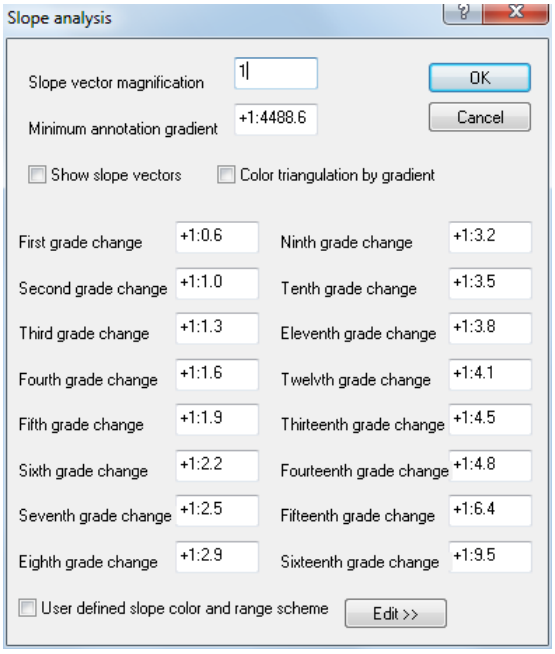

Slope analysis menu provides the following options;

Slope Vector Magnification

This value contains the magnification factor used when displaying slope vectors. A value of one ensures that vectors will not cross for slopes up to 90 degrees. Greater values may be used to display larger vectors or arrows for smaller inclinations.

Minimum Annotation Gradient

This value contains the smallest vertical angle for which slope vectors will be displayed. Slopes with smaller inclinations will not be displayed as vectors. This facility is useful to speed up display of slope data and reduce the total CAD file size.

Show Slope Vectors

This option displays a vector or arrow for every grade change within the triangular surface. The vectors generated points in a downhill direction and are scaled by the length and grade of the triangle. This feature is useful for drainage design and general topographic slope annotation.

Colour Triangulation By Gradient

This option colours the surface according to the absolute grade of each triangle.

First grade change

This is the minimum grade change that will be used in the slope analysis. Slope vectors less than this value will be coloured in black. Slope vectors may be entered either as vertical angles or as grades. For example, a forty-five degree slope could be entered either as 45 or as =1:1.

Second grade change

Grades between this value and the previous value will be coloured in dark grey.

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Third grade change

Grades between this value and the previous value will be coloured in dark blue.

Fourth grade change

Grades between this value and the previous value will be coloured in light blue.

Fifth grade change

Grades between this value and the previous value will be coloured in dark green.

Sixth grade change

Grades between this value and the previous value will be coloured in light green.

Seventh grade change

Grades between this value and the previous value will be coloured in dark cyan.

Eighth grade change

Grades between this value and the previous value will be coloured in light cyan.

Ninth grade change

Grades between this value and the previous value will be coloured in light grey.

Tenth grade change

Grades between this value and the previous value will be coloured in magenta.

Eleventh grade change

Grades between this value and the previous value will be coloured in dark brown.

Twelfth grade change

Grades between this value and the previous value will be coloured in dark red.

Thirteenth grade change

Grades between this value and the previous value will be coloured in light magenta.

Fourteenth grade change

Grades between this value and the previous value will be coloured in light red.

Fifteenth grade change

Grades between this value and the previous value will be coloured in yellow.

Sixteenth grade change

This is the maximum grade used within slope analysis. Grades between this value and the previous value will be coloured in white.

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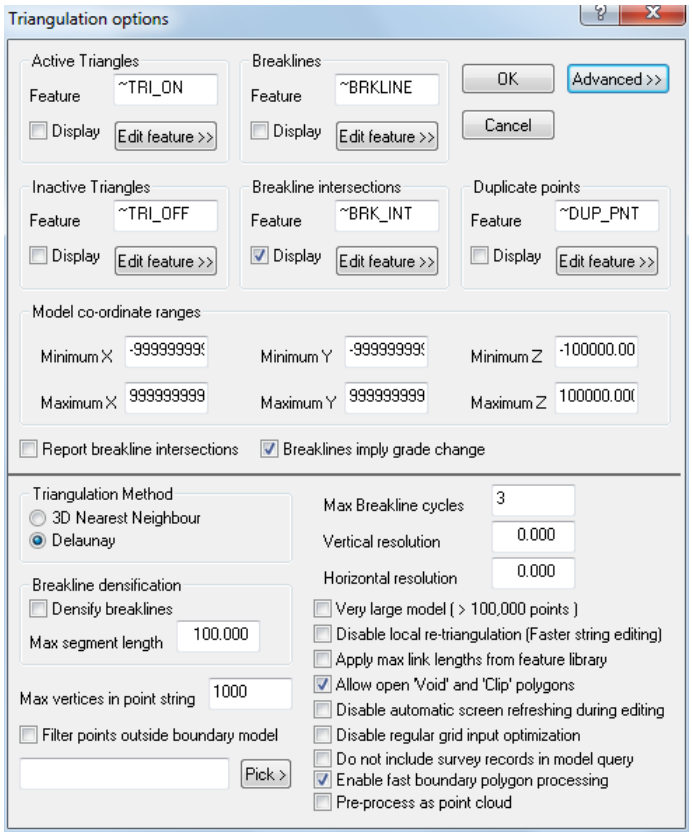
Shortcuts

Toolbar:

32.4.5 Triangulation (Model View Menu)



Active Triangles

This option displays the feature name for the active or valid triangles and provides an option to display them on screen. There is also an option to edit the feature. This will present the Feature Library Entry sheet. Any updates carried out here will be simultaneously made to the corresponding entry in the feature library spreadsheet.

Inactive Triangles

This option displays the feature name for inactive or invalid triangles and provides an option to display them on screen. There is also an option to edit the feature. This will present the Feature Library Entry sheet. Any updates carried out here will be simultaneously made to the corresponding entry in the feature library spreadsheet. The inclusion of the legitimate model in CAD for rendering purposes is achieved by having the valid triangular facets turned on and the invalid facets turned off.

Breaklines

This option displays the feature name for breakline data and provides a switch that defines

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whether surface model breaklines will be displayed on screen. This can be useful for showing which strings have been used as breaklines. It is also useful for showing string information for models, such as isopachyte models, that do not have associated survey information. However, when switched off these lines which do not represent hard planimetery on the ground will not appear in the CAD system. Breaklines are normally from lines taken for the purposes of constructing the folding characteristics in the terrain surface.

Breakline Intersections

This option displays the feature name for breakline intersection data and provides a switch that defines whether they will be displayed on screen. This may be useful for detecting possible errors in the triangulation and hence contouring.

Duplicate Points

This option displays duplicate points. The feature for duplicate points, ~DUP_PNT, has a circle as a symbol. Circles are drawn around both points, which makes them easily identifiable.

Model Co-ordinate Ranges

This option allows specification the minimum and maximum X,Y,Z values. These values must be set before creating the model so as to be effective when transferring the data. If the model is already created and these values are changed the model must be rebuilt for the changes to have any effect. It is useful for example when triangulating a drawing input from CAD that contains text and graph information. This information is not desired in the triangulation. It is given a Z/Ht value of 0 by the CAD system. Change the ‘Minimum Z’ value to a value higher than 0 and this information will not be input into the model or if rebuilding the model, it will be deleted from the model.

Report Breakline Intersections

This field specifies whether an error report will be produced for all points introduced due to breakline intersection. If this switch is turned on the co-ordinates of all such intersections will be appended to the file LOGFILE.PRN.

Breaklines imply grade change

This field specifies whether the triangulation algorithm checks for contours and flat spots in its input data. The Delaunay criterion for Triangulation will form the most equilateral triangles for a given data set. This algorithm is modified to force triangle edges to be influenced by the selection of breaklines in the field. However, deformation of the model surface may still occur. SCC is capable of repairing this deformation automatically. If this switch is set to 'yes' the system will make additional checks in order to remove flat areas caused when triangulating contour and string data. This is done by assuming that all breaklines imply a grade change. Note that the breaklines and design contours are honoured in both cases although the two surfaces produced are quite different.

This switch is turned on by default. If you are modeling data that includes large numbers of contour strings, it is essential that this facility is alive. Visual comparison of the surface profiles highlights the significance of this deformation and the likely impact on design, surface contouring, surface profiles, cross-sections and volumes determination.

Triangulation Method

SCC supports two methods of triangulation. 'Delaunay' or '3D Nearest Neighbour' may be selected depending on the requirements of the data set under consideration. Generally the final model produced by either method for a given data set will be almost identical. Delaunay triangulation forms the set of most equilateral triangles for a set of points. As

such it is deciding the final triangulation based on a purely 2 dimensional criterion and then adding elevations to form a surface. As a rule it normally gives the most even spread of triangles, and hence interpolation results, particularly in areas where data is sparse. 3D nearest neighbour joins every point to all its nearest neighbours while not allowing any edges to cross. While not providing as even a spread of triangles as Delaunay, the triangulation is being weighted on a 3D criterion. This may often be more suitable for surfaces where strings have not been surveyed and points are being selected randomly from the surface, for example, for bathymetric work. This is because triangle edges will form more along contours than across them, hence finding the equivalent of natural strings.

Breakline Densification

This field specifies whether additional points will be inserted in each breakline at a given interval. Densifying breaklines increases the overall model size while improving the quality of triangulation around breaklines. Densification may be used in situations where long breaklines have been surveyed, and additional triangles are required on these breaklines N.B. Breakline post-processing will ensure that a minimum number of points will be added to breaklines in order that those breaklines are honoured in the model.

Max. segment length

This field specifies the maximum length that a breakline segment will be. If a segment is longer than this it will be broken down into a series of smaller segments. It is only used if the 'Densify breaklines' switch is turned on.

Max vertices in point string

This option specifies the maximum number of vertices that are allowed in a single point string before splitting it into a number of point strings. Limiting the size of point strings can speed up drawing times in large models. Set this option to a very high number if you are exporting your model to MX/MX and do not wish to subdivide point strings.

Filter Points outside boundary model

This option is used when creating models from one or more very large datasets, where only a subset of the input data is required. For example, when modeling a road corridor that spans a series of Ordnance Survey digital elevation models. In this case, first make a model of the boundary area, outside of which points are to be excluded, and select this option and the boundary model prior to creating the main model.

Max. Breakline cycles

This field contains the maximum number of iterations applied when post-processing breaklines in a triangulation. Breakline post-processing involves adding points to a breakline wherever it intersects a triangle in plan. In certain cases, such as where two parallel breaklines are close together it may be necessary to perform this operation more than once.

Vertical resolution

This field specifies the vertical resolution to which the data will be modeled. For example, if this field contains 0.005 (5mm) all level data within the model will be rounded to the nearest 5mm. This has the effect of removing surface 'noise' and hence smoothing contours and profiles.

Horizontal resolution

This field specifies the horizontal resolution that the data will be modeled to. For example, if this field contains 0.005 (5mm) all plan data within the model will be rounded to the

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nearest 5mm. This has the effect of removing surface 'noise' and hence smoothing contours and profiles.

Very Large Model (>100,000 points)

This field specifies whether the size of model being formed is very large for the machine being used. If this is the case, the system will minimize its use of memory in order to allow more memory for the model being generated. This will increase model generation time but allow generation of larger models.

Disable local re-triangulation

Disabling local triangulation greatly speeds up string editing operations on large models where a lot of editing is required. Changes may be reflected in the triangulation either by re-enabling local triangulation or by selecting the rebuild model option.

Apply max link lengths from feature library

Selecting this option uses the ‘Max Len’ field in the feature library to determine the maximum link length between consecutive points on a string for a given feature. If a link for the given feature exceeds this length, it is automatically broken as part of the modeling process. This can eliminate a significant amount of model editing in situations where strings in the input survey data have not been properly terminated.

Allow open 'Void' and 'Clip' Polygons

Selecting this option allows non-polygonal strings, that is open strings, to be used as ‘Clip’ and ‘Void’ polygons. This can be useful in isopachyte volumes, where boundary strings are not included in their entirety in the overlapping area between two models. In contrast, it can also lead to problems, in other isopachytes, where a single clip polygon string is cut up into multiple clip polygons. In the latter case, this option should be disabled.

Disable automatic screen refreshing during editing

This option disables automatic screen updating during the editing process. It is provided to speed up editing of large models on slower machines. Press the space bar to manually refresh the screen when using this option.

Disable regular grid input optimization

SCC typically checks model input data for point a string that contain regular grids, and, where it finds them, optimizes the triangulation process as a result. This can slow down the triangulation of non-grid based models, and can therefore be disabled.

Do not include survey records in model query

Selecting this option prevents the ‘Query and Edit’ function from accessing any survey datasets that were used to create this model. When selected, ‘Query and Edit’ will be restricted to displaying feature library and detail coordinate entries only, both of which are taken from the model.

Enable fast boundary polygon processing

This option speeds up the processing of boundary polygon.

Shortcuts

Toolbar:

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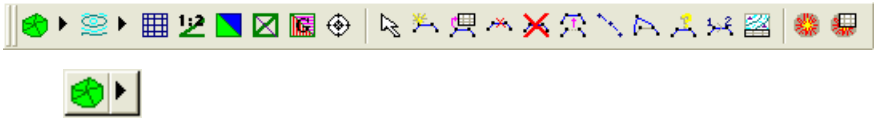
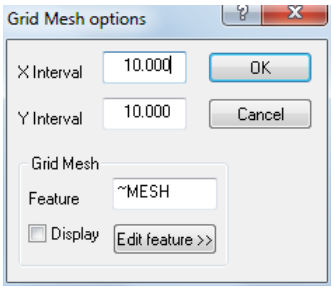


32.4.6 Grid Mesh (Model View Menu)

This option creates a 3D-grid mesh over the model. When the model with a grid mesh is output to CAD Hidden Line Removal may be used to create 3D image of the model. Selecting this option opens the Grid Mesh dialog.



X Interval

The grid will be displayed along the X-axis at this interval.

Y Interval

The grid will be displayed along the Y-axis at this interval.

Feature

This is the name by which the Grid Mesh will be referred to in the Feature Library.

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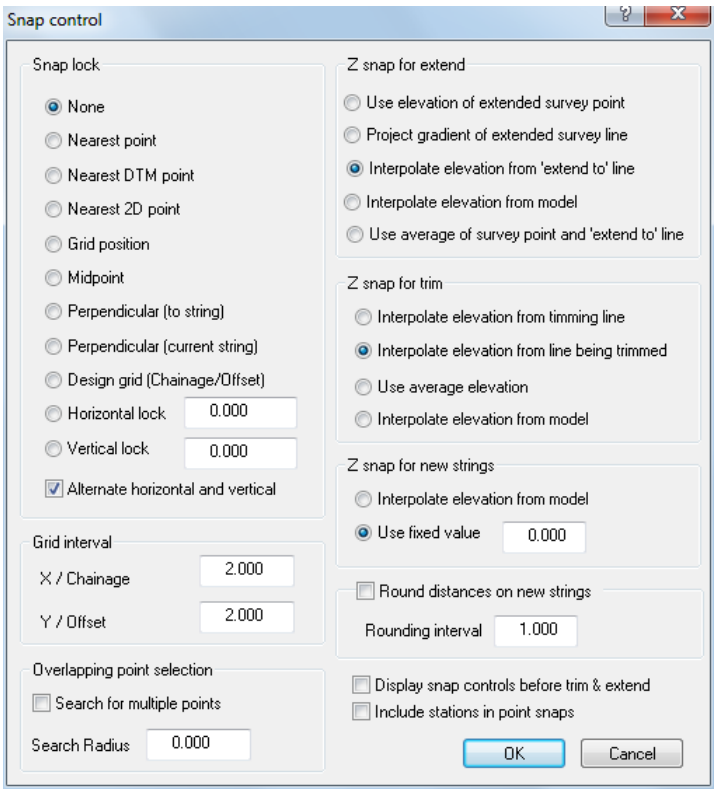
32.4.7 Snap Controls (Model View Menu)

This option allows setting the mouse to snap onto different elements in the model.



The snap selection may be changed in the middle of a command. For example, if adding points the user snaps to grid and in the middle the user wishes to snap to a feature, the snap control can be changed to 'Nearest point' and allow the user to continue with the previous command, 'Adding strings with cursor'. Note when snapping in a rotated view point, **Z Snap for new strings** should be set to **Interpolate elevation from model**.

Snap Lock

This field has the following options;

None

This option turns snap off.

Nearest Point

This option snaps to nearest point.

Nearest DTM Point

This option snaps to the nearest 3D point.

Nearest 2D Point

This option snaps to the nearest 2D point.

Grid Position

This option snaps to a grid point.

Midpoint snap

This options snaps to the midpoint of the line segment nearest the cursor.

Perpendicular (to string)

Snap perpendicular to existing string can be utilised when creating new strings. This snaps to a point on the existing string nearest the cursor perpendicular to the last point created.

Perpendicular (current string)

Snap perpendicular from current string can be utilised when creating new strings. This snaps the cursor position to a line perpendicular to the last two points created.

Design grid (Chainage/Offset)

This snaps the cursor to the nearest multiple of chainage and offset entered on the currently active alignment. This option requires the alignment option to be licensed in order to work.

Grid Interval

This option allows selection of the grid interval, which will be snapped to, if the grid interval option is selected.

Overlapping Point Selection

Selecting this option allows the user to alter the method by which SCC selects points. This may either be by selecting the point nearest the cursor, or, by selecting a point from a list of points within a specified distance of the cursor. The user is presented with a dialog containing the following parameters;

Enable search for multiple points

This switch defines whether an option to select a point from a list of all points within a set distance of the cursor is enabled. This facility allows the user to access points that may have the a similar or identical plan position

Search Radius

This field contains the horizontal search distance used when selecting points on screen. It is a radial distance from the current mouse position.

Z snap for extend

The following options are available when using the Extend command:

- Use elevation of extended survey points
- Project gradient of extended survey line
- Interpolate elevation form 'extend to' line
- Interpolate elevation from model
- Use average of survey point and 'extend to' line

Z snap for trim

The following options are available when using the Trim command:

- Interpolate elevation form trimming line
- Interpolate elevation from line being trimmed
- Use average elevation

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- Interpolate elevation form model

Z snap for new strings

The following options are available for New Strings:

- Interpolate elevation form model
- Use fixed value

Round distances on new strings

This option can be utilised when creating new strings or adding to an existing string to ensure that the length of a given segment will always be a multiple of the specified snap value.

Display snap controls before trim & extend

When this option is selected, the 'Snap Control' Dialog will be presented after the 'Trim' or 'Extend' command has been selected.

Shortcuts

Pressing ‘S’ in the model view will toggle ‘Snap to Points’ on and move between snap modes.

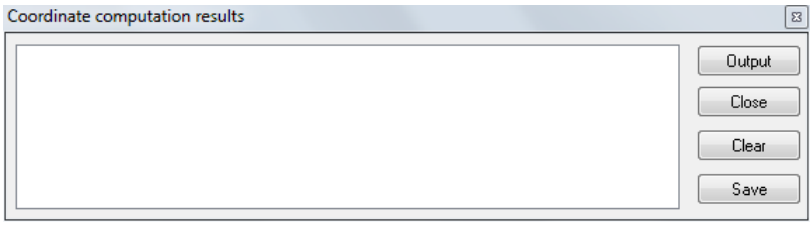
Pressing ‘N’ in the model view will turn snap off.

Pressing ‘G’ in the model view will toggle ‘Snap to Grid’ on and off.

Pressing ‘M’ in the model view will toggle ‘Overlapping point selection’ on and off.

32.4.8 Coordinate Computations (Model View Menu)

This dialog stores the results of calculations carried out using the edit strings options and the measurement options. If this dialog is not opened the calculations will not be stored to it. Output sends all the calculations to an output file. Clear deletes everything in the current dialog.

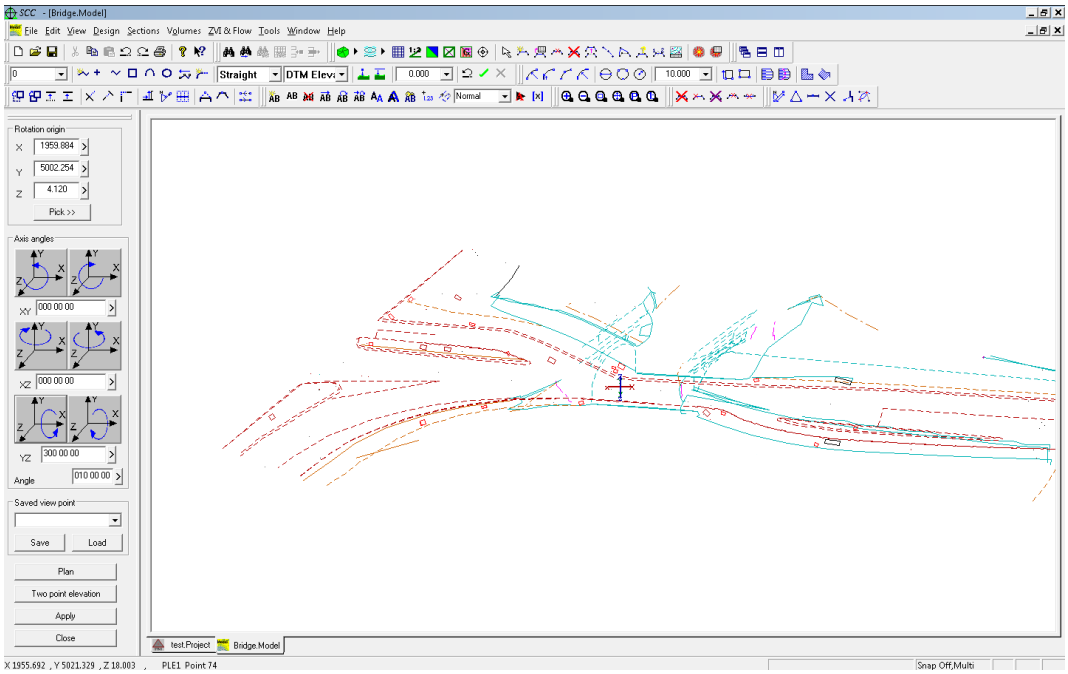


For example, to add the intersection point of two strings to one or both of those strings, use the ‘Intersect’ tool with snap lock on to compute the intersection. The resultant computed coordinate will be placed in the ‘Coordinate Computations Results’ Window. Then select the ‘Insert Point onto String Tool’ and select one of the strings, and select the intersection point displayed in the ‘Coordinate Computations Results’. Press ‘Output’ in the ‘Coordinate Computations Results’ Window to insert the point in the string. Repeat this process for the second string if required. Note that all model tools that compute coordinates place their results in the ‘Coordinate Computations Results’ window such that they may be used in place of mouse selections for any other model operations.

32.4.9 Plan (Model View Menu)

This option changes the view point back to plan, i.e. model viewed from above, and switches back to model view if in the feature library.

32.4.10 Rotate Viewpoint (Model View Menu)



These options allow you to work in arbitrary display axes, and support creation and editing of strings on the current display plane. For example, copy parallel in an elevation copies the string up/down and forward back relative to the elevation rather than plan. This also allows creation of circles, arcs, rectangles etc.. on a given plane. This option also supports interactive 3D rotation by dragging the mouse, as well as stepped rotation using the view point dialog.

The option to allow setting a view point origin and orientation using the mouse and keyboard has been made optional, such that those primarily working in plan can't inadvertently change their viewpoint. This is controlled within **'FILE > General Options > Units & Data Checking > Allow mouse to be used to rotate'**

The option automatically save viewpoints whenever the dialog is closed and allows selection of a range of angle increments from a drop down list.

Rotation Origin

The user can either enter or pick from the screen a X, Y and Z point on which to rotate the model. The origin point is displayed as part of the cursor.

Axis Angles

The user can use the axis buttons to manually rotate the model along either axis or enter an angle.

Saved view point

This option allows the user to save a specific viewpoint or to load an existing viewpoint.

Plan

This option activates the model window and hence the model menu when the feature library is active.

Two Point Elevation

These option allows the user to work in arbitrary display axes, and support creation and editing of strings on the current display plane.

See Also

Viewports

32.4.11 Feature Library (Model View Menu)

The feature library controls most of the translation required when converting surveys into models, AutoCAD drawings, and MX models. It comprises of a list of feature names, each of which has a set of user defined characteristics. Each project in SCC has it's own feature library. When a model is created from any dataset in the project a copy of the feature library will be made and saved as part of the model.

See Also

Feature Library Spreedsheet

32.4.12 Station Coordinates (Model View Menu)

The station co-ordinates spreadsheet is used to store all the station co-ordinates for a given SCC project. Individual traverse data sets will read fixed co-ordinates and write adjusted co-ordinates to this sheet. The instrument set-up sheet will refer to co-ordinates stored in this sheet for purposes of orientation and position when calculating detail co-ordinates from polar co-ordinates (Ha, Va, Slope Distance). Station co-ordinates may also be read directly from certain data loggers or entered manually from the keyboard.

Whenever a data logger transfer or survey computation attempts to change the value of an existing station co-ordinate, a check will be made for the differences between the new value and the existing value. If a difference of more than 1mm in any axis occurs a message will be presented asking you to keep the existing value or to overwrite it with the new value.

At this stage you will be offered a choice to keep the existing value or the new value. If either value is less than or equal to zero in the x or y axis it will automatically get rejected with no message displayed. This message will also get output to the current log file.

See Also

Station Coordinate Spreedsheet

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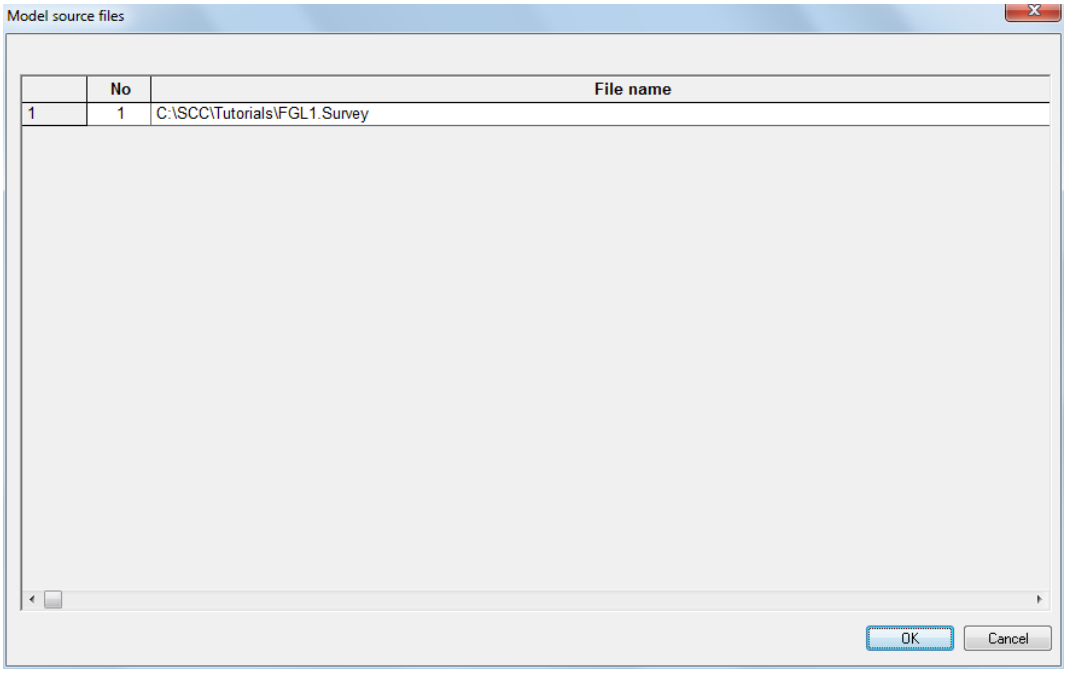
32.4.13 Model Source Files (Model View Menu)

This option allows the user to list the data and source used to generate a model.



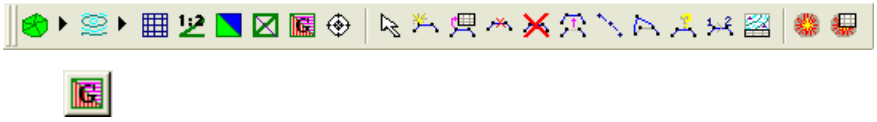
32.4.14 Ground Type Library (Model View Menu)

This option opens the Ground Type Library spreadsheet. When a model is created this spreadsheet will be blank. Apply textures to the model from the \SCC\TEXTURES\ .

Using the button on the Model Toolbar toggles the display of ground types on or off in the plan display. To assign ground types to triangles, use the Edit / Add Remove triangles option. To edit ground types, use View / Ground type library.

Shortcuts

Toolbar:



See Also

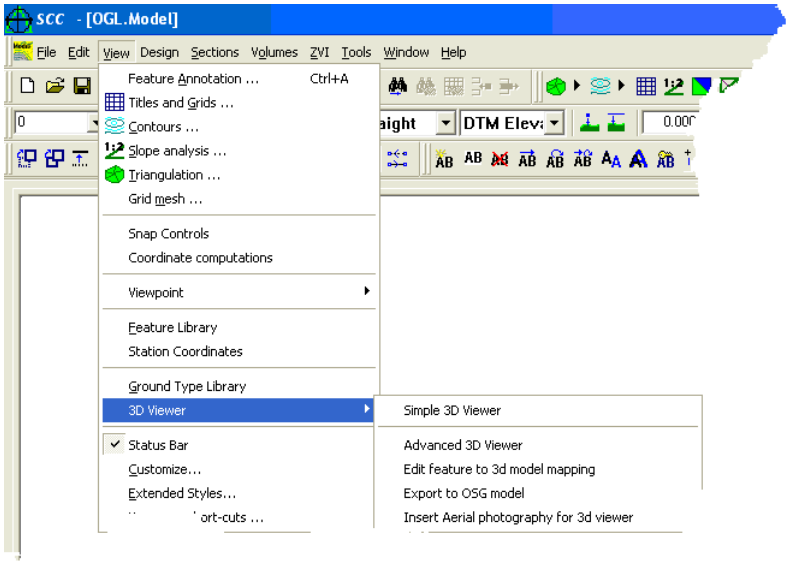
Ground Type Library (View Menu)

32.4.15 3D Viewer (Model View Menu)

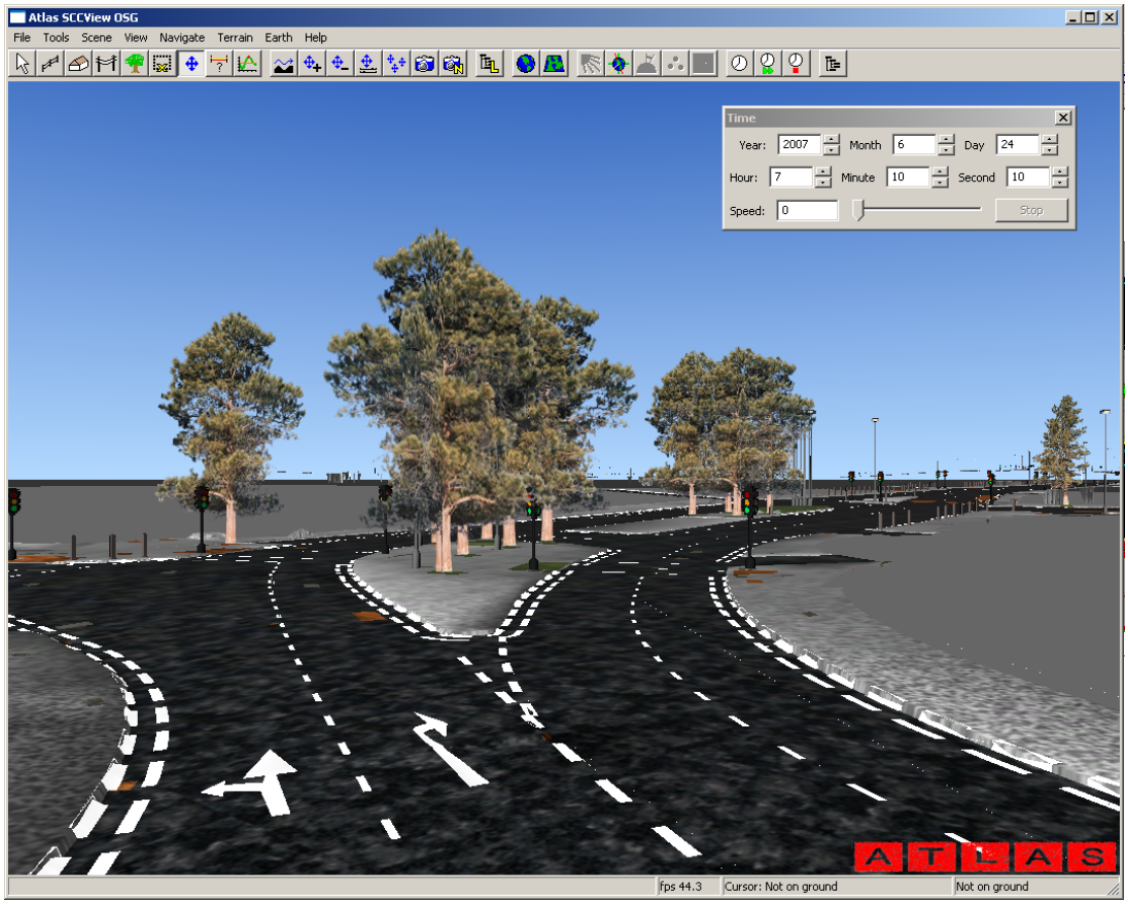
The SCC advanced 3d viewer is a 3d terrain viewer based on the viewing engine used in the Virtual Terrain project, http://www.vterrain.org/ This viewer supports surface texturing, draping of digital photography, placement of 3d objects, shading , overlaying of simple vector information and 3d fly-throughs.

To utilise the advanced 3d viewer, you should first use the 'Edit / Add Remove Triangles' option to assign ground types to any parts of the surface you wish to visualise. You may also want to use the 'View / 3D Viewer / Edit feature to 3d model mapping' to assign placement

of 3d objects against selected survey features.



The simple 3d viewer is identical to the advanced viewer, but does not support objects such as trees and road markings, or flight paths.



Enhanced support for road markings in the 3d viewer

The 3d viewer now includes support for automatic painting of 2d road markings onto the

rendered 3d surface. This works for any polygonal symbol or macroline element, and is activated by setting the ‘Drape Z’ field in the 3d object mapping for any given feature to ‘Road marking’. The 3d object mapping dialog is available from ‘View / 3d Viewer / Edit feature to 3d model mapping’

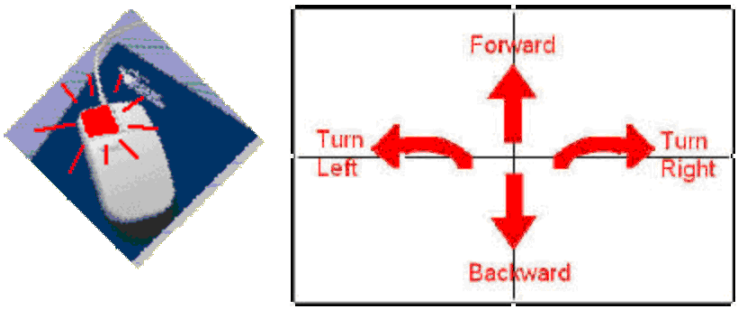
Navigation on a virtual terrain

Mouse Navigation - the Standard Terrain Flyer

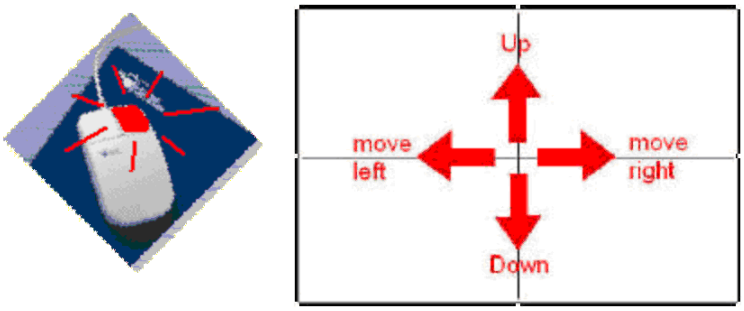
The drawback to the mouse is that its difficult to move in more than one degree of freedom at a time. For example, you can turn right, or move down, but not both at the same time. There are many ways to map the mouse position and mouse buttons to movement. This is the way Enviro does it:

The further you are from the centre of the window, the faster you move.

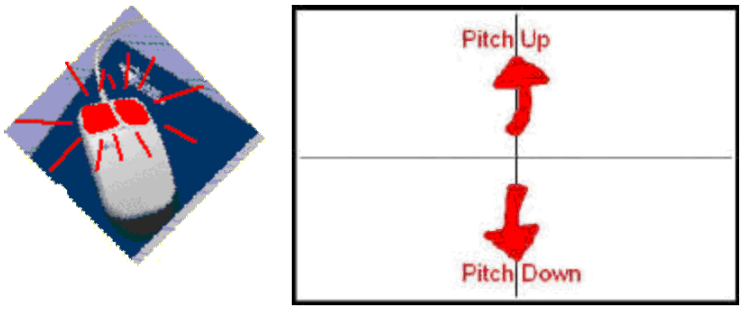
Hold down the left mouse button:



Hold down the right mouse button:



Hold down both mouse buttons:

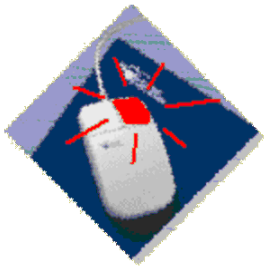


If you find yourself moving too fast, keep your mouse cursor close to the centre of the window, or decrease your Flight Speed with the +/- toolbar buttons, or the 'F'/'S' shortcut keys ("faster / slower")

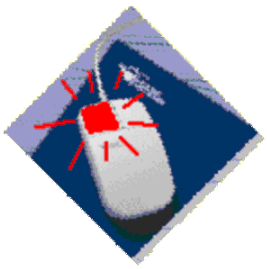
Mouse Navigation - the Grab/Pivot Flyer

Click and drag the left mouse button on a specific point on the ground to pivot around it.

(Be aware that if you click far from the center of your view, it is possible to undesirably roll the camera.)



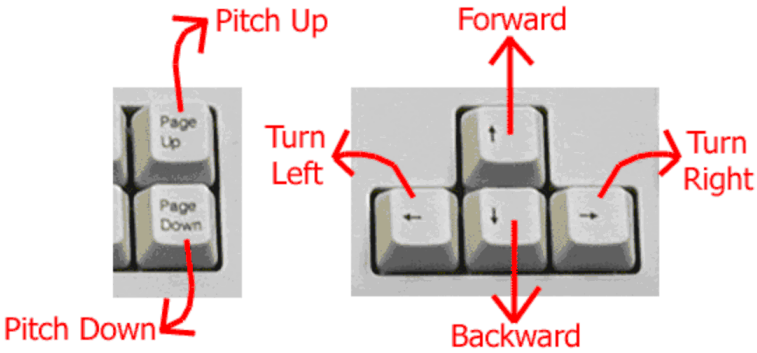
Click and drag the right mouse button to grab the ground and move it underneath you

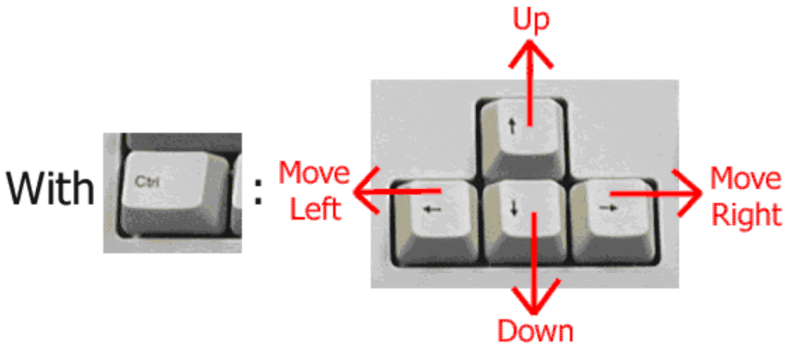


Hold down both mouse buttons to zoom in or out.

Flight Speed does not have an effect on this style of navigation.

Keyboard Navigation





The SHIFT key accelerates all other keys.

Same as with mouse navigation, the 'F'/'S' shortcut keys ("faster / slower") can be used to change speed.

Edit feature to 3d model mapping

This option allows you to edit a spreadsheet that controls how 3d objects will automatically be created in the advanced 3d viewer, based on the feature name. This spreadsheet contains the following fields;

Feature

This corresponds to the feature name in the survey and feature library views.

Description

A brief optional description of how this object is represented

Linear Object Type

This field contains a series of defaults detailing how linear objects such as walls, hedges, fences and overhead lines are represented in the 3D viewer. You can also use this option to insert other 3D objects at regular intervals along a string in cases where the defaults do not met your needs. In this case a 3D object file must also be specified and object dimensions.

3d Object file

This field contains the full path name to the 3d object file being placed against this feature. This can be any .3DS or .OSG object file. The 3d viewer includes a wide range of standard objects including street furniture, vegetation and road markings, which can be found in the '\Program files\VTP\Data\Objects' directories. You can also use the SCC option 'Export to OSG model' to create your own 3d objects.

The street furniture objects present in '\Program files\VTP\Data\Objects\101-street-furniture' are licensed from GeoMetricks for use solely with the SCC advanced 3d viewer. If you wish to use these objects within other packages, or you require further 3d object libraries, please contact http://www.geo-metricks.com/ to obtain a license.

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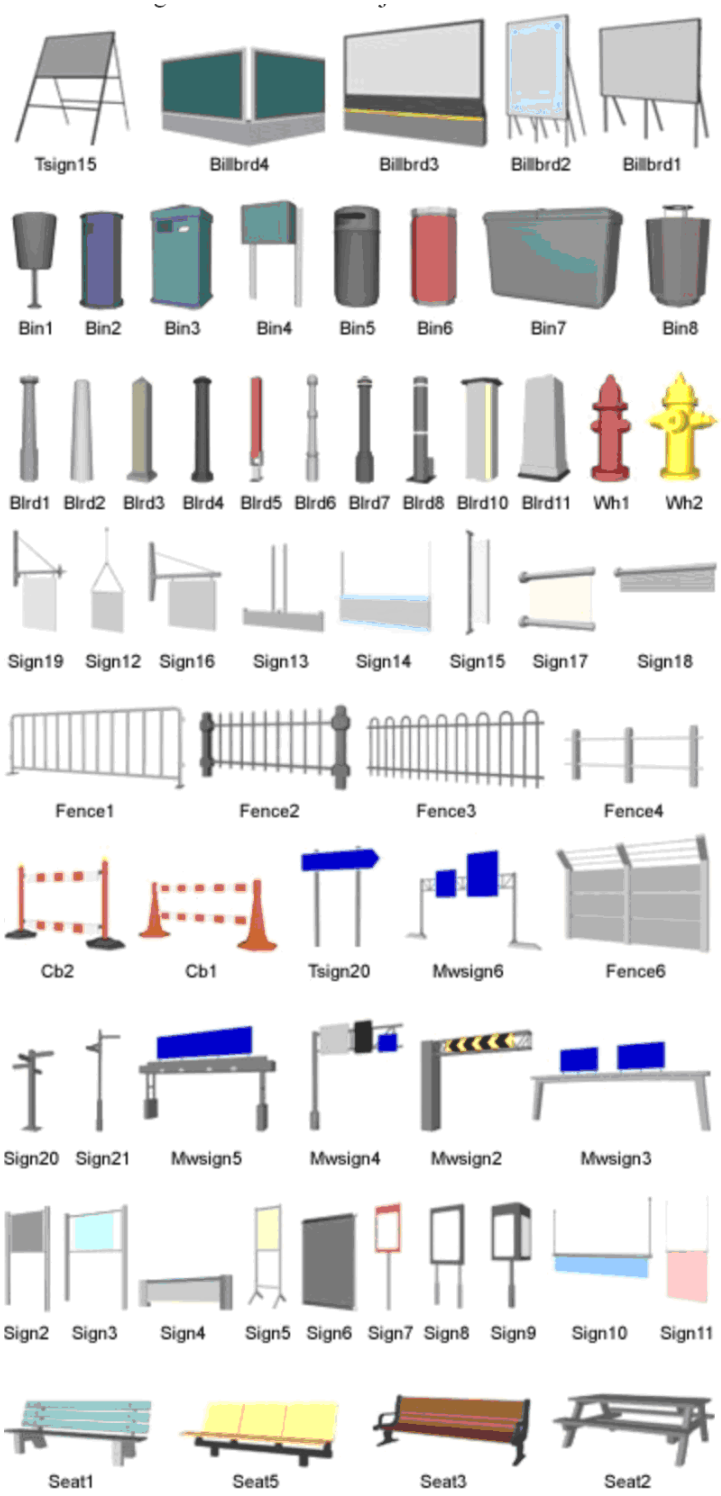

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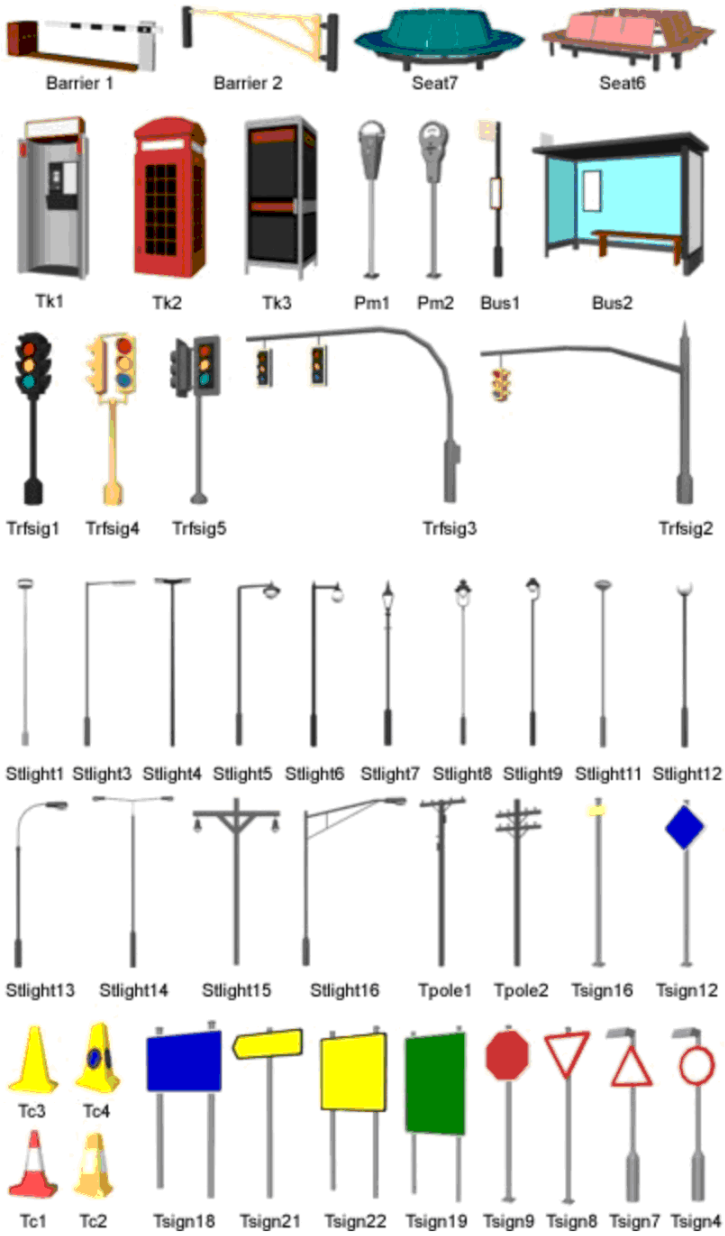

The viewer also comes with a very extensive range of vegetation. If you open C:\Program Files\VTP\Data\PlantModels in explorer, and select View / Film Strip, you can see all of the 300+ vegetation types along with their latin names. To map a specific tree or vegetation type, enter the latin name in the **3d object file** field.

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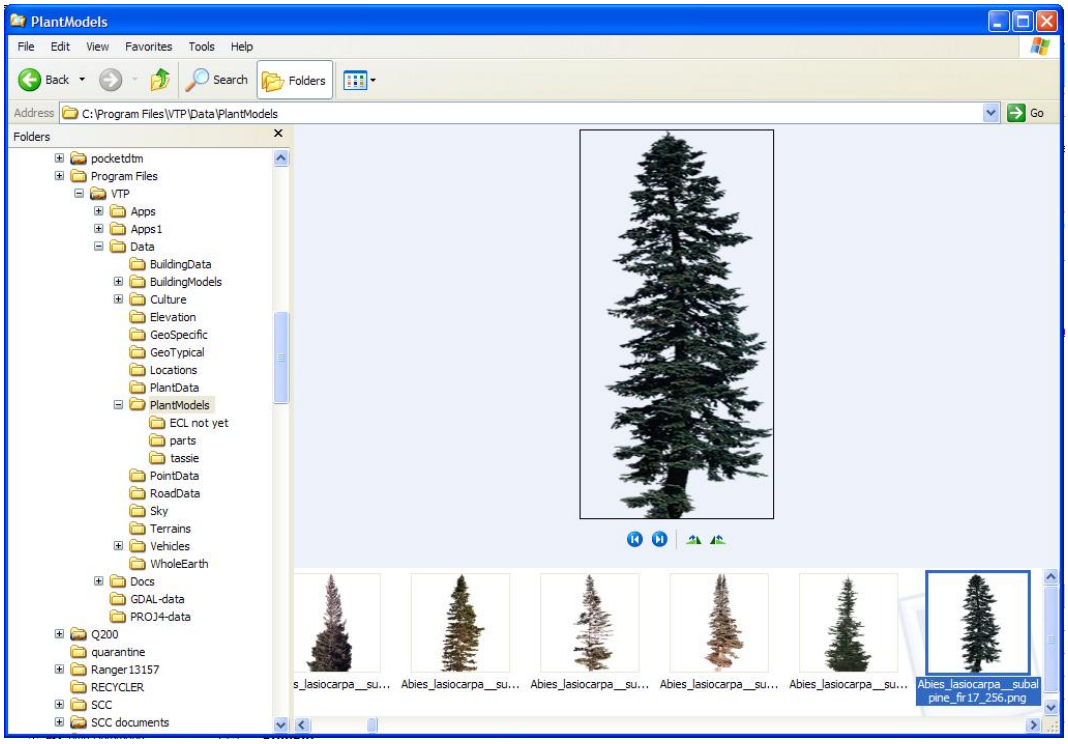

If you have a look at the file **C:\Program Files\VTP\Data\PlantData\species.xml** you will get a good idea of how trees are stored. This is a text file that can be edited in notepad, and is laid out similar to the following;

```
<species name="Sophora chrysophylla" max_height="7.00">
<common name="Mamane" />
<appearance type="1" filename="mamane1_v2_256.png" width="3.00" height="3.00" />
</species>
```

Simply replace the tree names and filenames in the above with your own values, and insert your addition in the file before the line `</species-file>`

Other 3d models are either courtesy of the virtual terrain project, or have been generated directly from SCC symbols.

Drape Z

This field controls how the base elevation for the 3d object being placed is determined. It can be one of the following values

No	The base elevation for the 3d object is taken directly from the model.
Yes	The 3d object's base elevation is generated by draping its plan position on the triangulated surface.

Road marking

The 3d object is assumed to be a polygonal road marking, such as a road arrow or road centre-line. The road marking is painted onto the 3d surface. For repeating linear patterns, such as dashed road lines, use macro-lines in the SCC feature library that include closed polygons.

X, Y, and Z offset

These fields contain an optional 3d offset to the 3d objects insertion point. The Z offset

may be used to raise or lower the object with respect to the surface.

Apply Scale

This field determines how the 3d object will be scaled when shown in the advanced 3d viewer, this can be one of the following values;

None	The object will not have any additional scaling applied. This will be the default value for most objects taken from the 101-street furniture library that are already correctly ground scaled.
Values entered	The 3d object is scaled using the values in the X, Y and Z scale columns.
Model values	The 3d object is scaled using the dimension values present in the SCC model.
Both	The 3d object is scaled using the dimension values present in the SCC model and those in the X, Y and Z scale columns.

Apply Rotation

This field determines how the 3d object will be rotated when shown in the advanced 3d viewer, this can be one of the following values;

None	The object will not have any additional rotation applied.
Values entered	The 3d object is oriented using the values in the X, Y and Z rotation columns.
Model values	The 3d object is oriented using the symbol orientation present in the SCC model.
Both	The 3d object is oriented using the symbol orientation present in the SCC model and those in the X, Y and Z rotation columns

Export to OSG model

This option exports the current SCC surface to an OSG model such that it can be used as an object in the advanced 3d viewer, or other software packages capable of rendering 3d objects. This is primarily designed to allow you to use SCC to build additional 3d objects for the advanced 3d viewer.

Insert aerial photography for 3d viewer

This option allows you to insert a rectified aerial photograph into an SCC model, such that it can be visualised in the 3d viewer. To do this, you will require at least three known coordinates on the photograph for which you have both pixel and real world coordinates. To insert a rectified aerial photograph into SCC using this option do the following;

A. Use the ‘Pick>>’ button to select your photograph, which may be in TIFF, BMP or JPEG format. This will display a preview of the image.

B. Enter the known coordinates, and press compute. This will compute the model coordinates for the image corners, and display the selected coordinates over the image as red crosses. You can also save these coordinates as a transformation by pressing the ‘Save’ button.

C. Press the ‘Ok’ button to insert the image into the SCC model. This will also create a new clip polygon string around the edge of the photograph, such that the area of the photo corresponds with the plan area of the triangulation.

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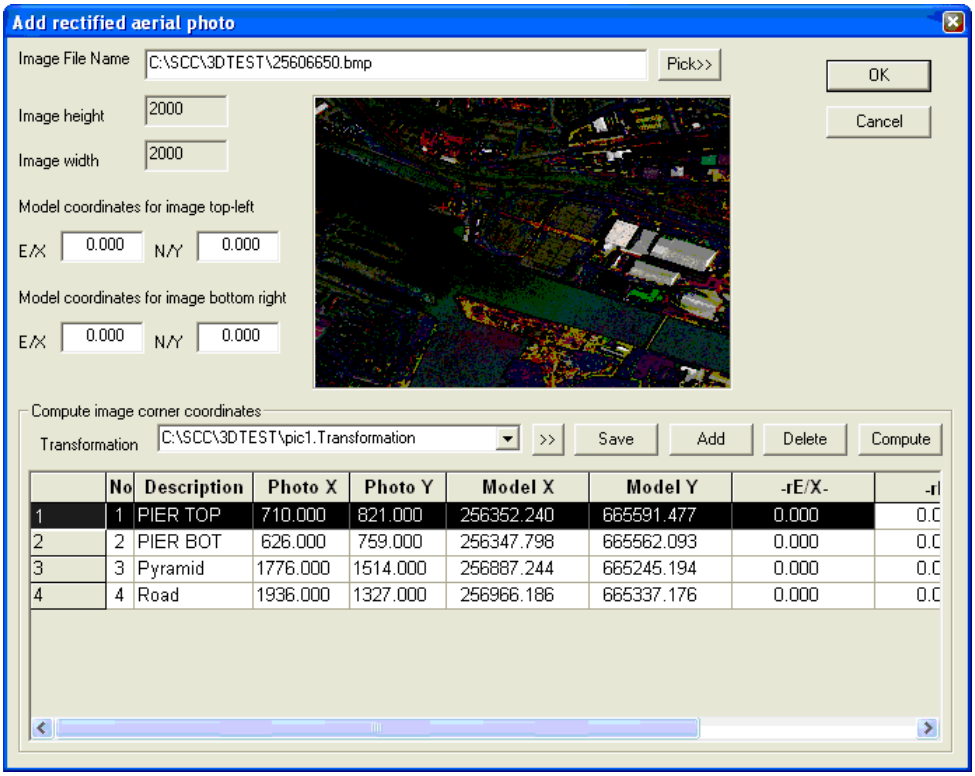


D. Use the 'Edit / Add Remove Triangles' option to assign an appropriate ground types to any parts of the surface on which you want to drape the photograph. The ground type selected should have its 'Photo' field set to 'Yes', and its texture field set to the file name of the inserted image. Using the above option will automatically create a ground type called 'PHOTO' with these values set if it does not already exist. Other ground types may also be mixed in as required.

E. Use View / 3d Viewer / Advanced 3d viewer, to visualise the result in the 3d viewer.

32.4.16 Status Bar (Model View Menu)

The status bar is displayed at the bottom of the SCC window. To display or hide the status bar, use the Status Bar command in the View menu.

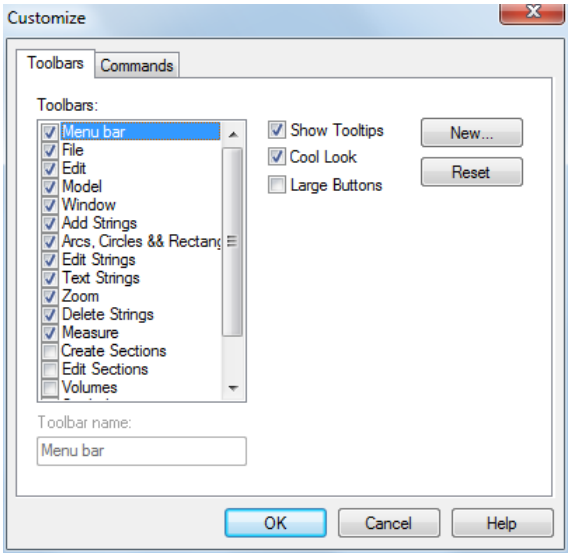
The left area of the status bar describes actions of menu items as the user uses the arrow keys to navigate through menus. This area similarly shows messages that describe the actions of toolbar buttons as they are depressed, before releasing them. If after viewing the description of the toolbar button command the user wishes not to execute the command, then release the mouse button while the pointer is off the toolbar button.

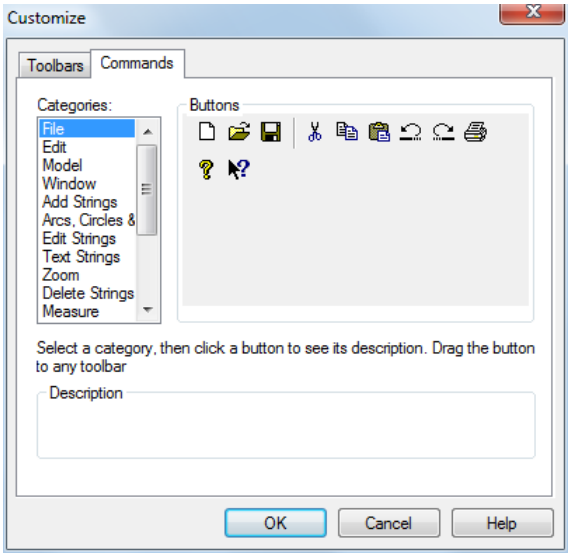
The right areas of the status bar indicate which of the following keys are latched down:

CAP	the Caps Lock Key is turned on
NUM	the Num Lock Key is turned on
SCRL	the Scroll Lock Key is tuned on

32.4.17 Customised (Model View Menu)

This option allows the user to select the toolbars which SCC displays and to create new users defined toolbars.





To Display a toolbar click the box to the left of the toolbar name. A tick beside the toolbar means that the toolbar will be displayed if the box is blank then the toolbar will not be displayed.

Select New to create a customised toolbar. When the user gives this toolbar a name it will be added to the client area. Drag icons from the Command tab to the new toolbar. Icons from any number of different toolbars may be added to the new toolbar.

32.4.18 Extended Styles (Model View Menu)

This option defines how the toolbars appear. The Traditional or New look may be selected.

Traditional Look Toolbar

New Look Toolbar

The New look has distinctive Gripper Bars. The gripper bars are the vertical lines at the right of the toolbar.

32.4.19 Keyboard Short-cuts (Model View Menu)

This option allows the user to select a combination of keystrokes which may be used as shortcuts for any menu command in SCC. Keyboard shortcuts will generally only be defined on commands that are used very often. There is an option in the General Options to disable this option. The option Disable user Defined keyboard shortcuts is in the 'Directories and Files' section of the General Options.

Model Editing Shortcut Keys

Esc	Quits any of the interactive editing options
Home	Zoom Extents
End	Zoom Previous
Page Up	Zoom Out
Page Down	Zoom In
Space Bar	Zoom Centre (Pan)
TAB	Pan to the next crossing breakline, next duplicate point, or next potential model error. This option will only pan to crossing breaklines and / or duplicate points if they are currently being displayed. This is controlled using `View / Triangulation options'. Other potential model errors that are detected with this option include links between 2d and 3d points, duplicate 3d points with different elevations, and polygons with less than three points. This key press is very useful when correcting survey errors interactively.
F2	Pressing this key pans to the next selected point. This option should be used in conjunction with the data selection dialog, and is very useful for finding specific points in the model. For example, to find a specific point in the model, use the advanced section of the data select dialog to highlight the point (or point range), and press F2 to pan to that point.
s	Pressing ‘s’ toggles between the available snap lock modes, including nearest point, nearest DTM point, nearest 2D point, gird position, midpoint, perpendicular (to string), perpendicular (current string) and design grid (chainage/offset).
n	Pressing ‘n’ turns snap lock off.
g	Pressing ‘g’ enables snap to grid mode.
m	Pressing ‘m’ enables multiple point selection mode. This is useful when selecting a point, or piece of text that overlaps other items. If multiple point selection is enabled, and a position on screen is selected where there are multiple overlapping points, a dialog will be presented that allows you to select the desired point from a list of points within a specified range from the cursor.
****	Use of ‘\’ and ‘*’ keyboard shortcuts can be used to the create text

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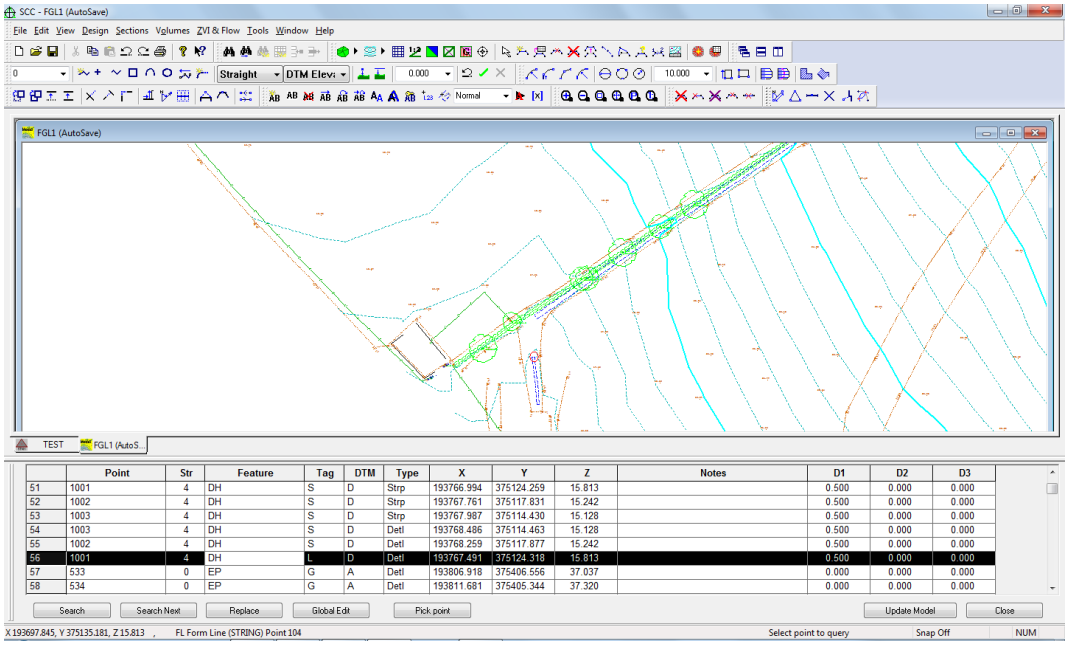
	function, as per other text editing functions. Note that when creating new free form text, the drop down feature list in the tool bar may be used to set the texts feature and hence colour and CAD layer.

32.4.20 Browse Model View

The browse model option allows the user to simultaneously view the model in graphical and spreadsheet format.



	Point	Str	Feature	Tag	DTM	Type	X	Y	Z	Notes	D1	D2	D3
51	1001	4	DH	S	D	Strp	193766.994	375124.259	15.813		0.500	0.000	0.000
52	1002	4	DH	S	D	Strp	193767.761	375117.831	15.242		0.500	0.000	0.000
53	1003	4	DH	S	D	Strp	193767.987	375114.430	15.128		0.500	0.000	0.000
54	1003	4	DH	S	D	Detl	193768.486	375114.463	15.128		0.500	0.000	0.000
55	1002	4	DH	S	D	Detl	193768.259	375117.877	15.242		0.500	0.000	0.000
56	1001	4	DH	L	D	Detl	193767.491	375124.318	15.813		0.500	0.000	0.000
57	533	0	EP	G	A	Detl	193806.918	375406.556	37.037		0.000	0.000	0.000
58	534	0	EP	G	A	Detl	193811.681	375405.344	37.320		0.000	0.000	0.000

Selecting a point on the graphics will update the spreadsheet position, similarly selecting a point in the spreadsheet will re-center the graphics around that point. Most graphical editing tools will also work while browsing the model, additionally search and replace, and global editing operations are available while in this mode.

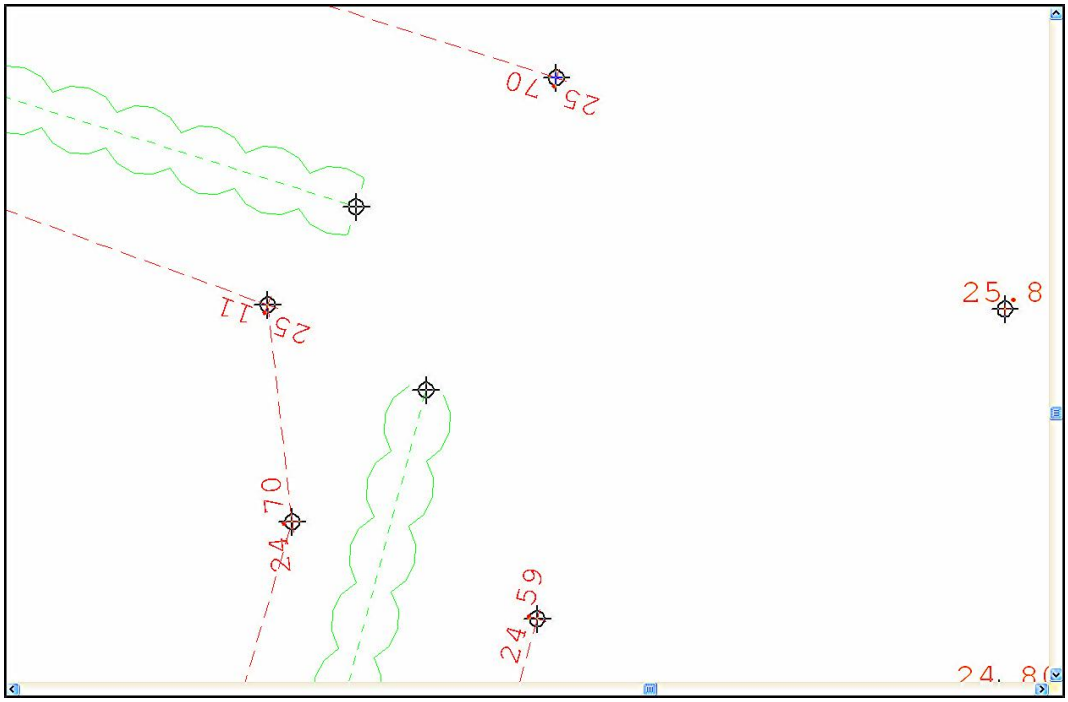
If the user makes a change to the spreadsheet view while browsing, the user must select 'Update Model' to see these changes reflected in the graphics. Any graphic editing is automatically reflected in the spreadsheet.

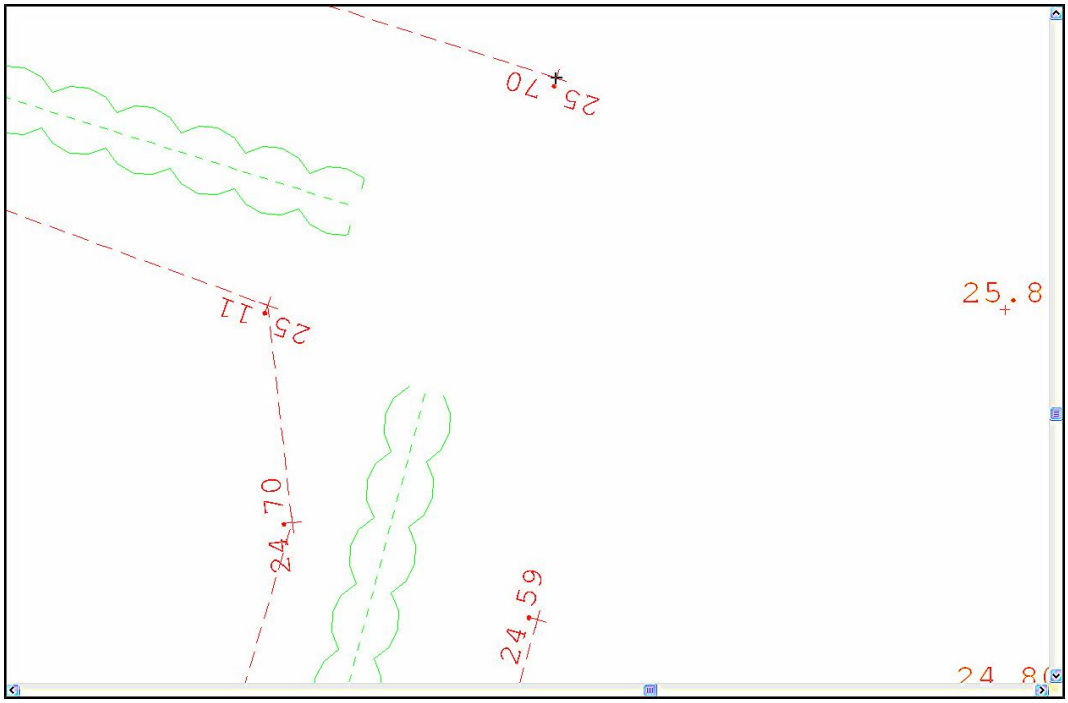
Shortcuts

Toolbar:

32.4.21 Show Or Hide Survey Observations Positions

This option toggles the display of survey observation markers on or off. For this option to work, you must have a feature '~SURVOBS' set-up in your feature library as a point symbol with the desired dimensions. A feature style file, SURVOBS, is included in the SCC installation to simplify the process of adding this feature to existing models and projects.



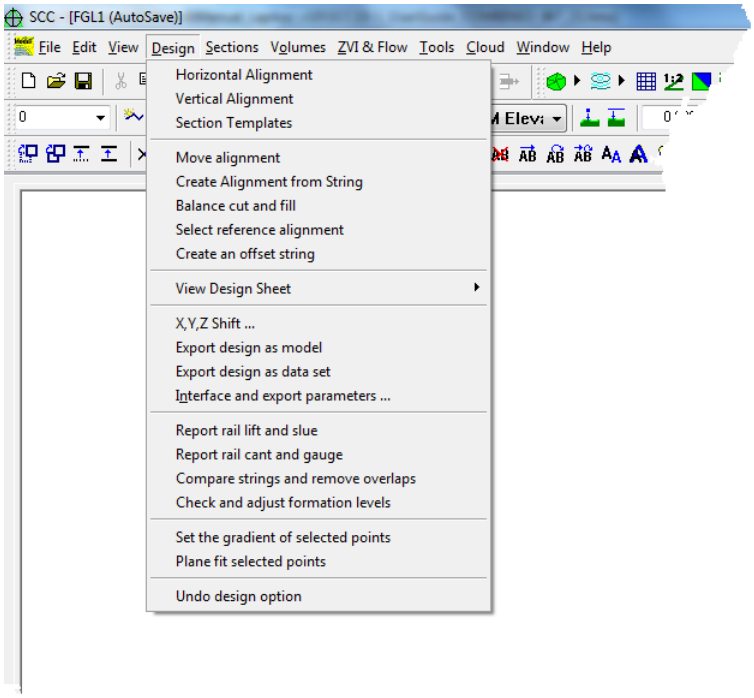


Shortcuts

Toolbar:

32.5 Model Design Menu

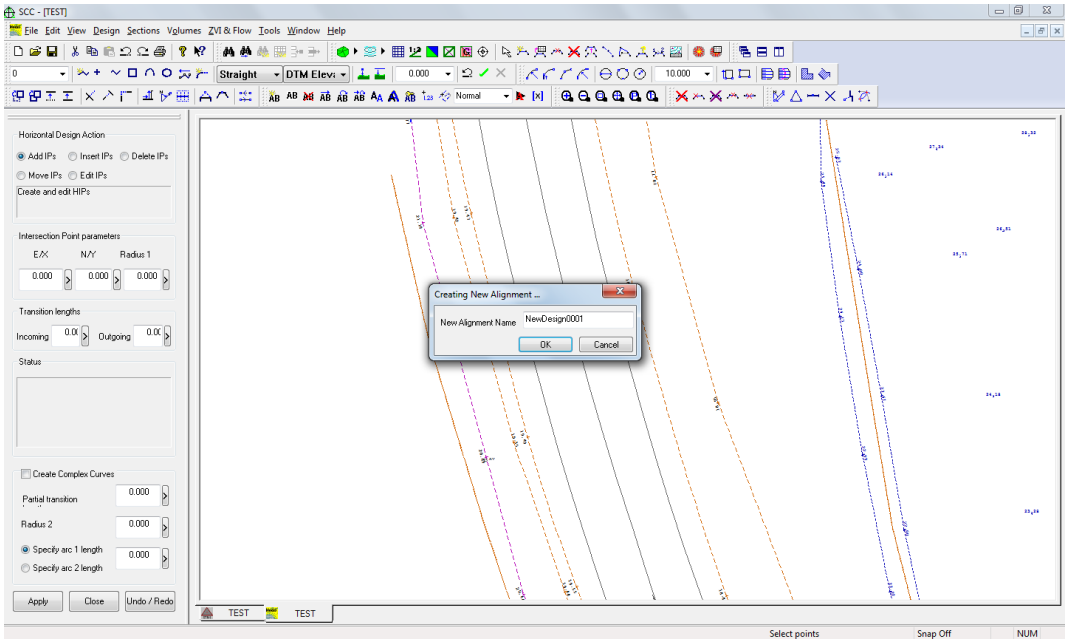
This menu allows access from the SCC model to SCC design tools.



32.5.1 Horizontal Alignment (Model Design Menu)

SCC's alignment designer allows interactive design or horizontal and vertical alignments.

Horizontal alignments may be designed and/or viewed interactively. When this option is selected a dialog is opened and placed on the left hand side of the model.



This dialog contains the following options;

Horizontal Design Action

The action required by the selected option is displayed in the bottom section of this dialog.

Add IPs	Adds Intersection points interactively to a model
Insert IPs	Allows intersection points to be inserted by entering co-ordinate and radius values in the Intersection Point parameters box.
Delete IPs	Allows intersection points to be selected and then deleted.
Move IPs	Allows existing Intersection points to be moved interactively on the model.
Edit IPs	Allow the existing intersection point information to be editing via the Intersection Points parameters and Transition lengths dialogs.

Intersection Point Parameters

This field displays the Easting, Northing and Radius of current Intersection Point. When generating a horizontal alignment from given co-ordinates and other given parameters, type the Easting, Northing and Radius of the curve here. When entering information manually here have the Horizontal Design Action set to Inset IPs.

When the Horizontal Design Action is set to Add IPs the Easting and Northing fields are automatically updated as new Intersection Points are added to the horizontal alignment interactively. The Radius field has to manually updated at each new Intersection Point.

Transition Lengths

This field specifies the lengths of the incoming and outgoing transition curves. These fields have to be entered manually no matter which Horizontal Design Action is selected.

Status

This field defines the status of the current horizontal design. If there is a problem with the design, it will be displayed here. When designing the alignment the next action required is displayed in this field.

Create Complex Curves

This field allows complex curves to be inserted into the design. This option is typically used for designing reverse curves. When this option it turned on the following parameters must be specified;-

Partial Transition length,

Radius 2 length,

Define an arc length and specify whether this is arc length 1 or arc length 2.

At any stage in the design the last option can be undone, if a mistake has been made.

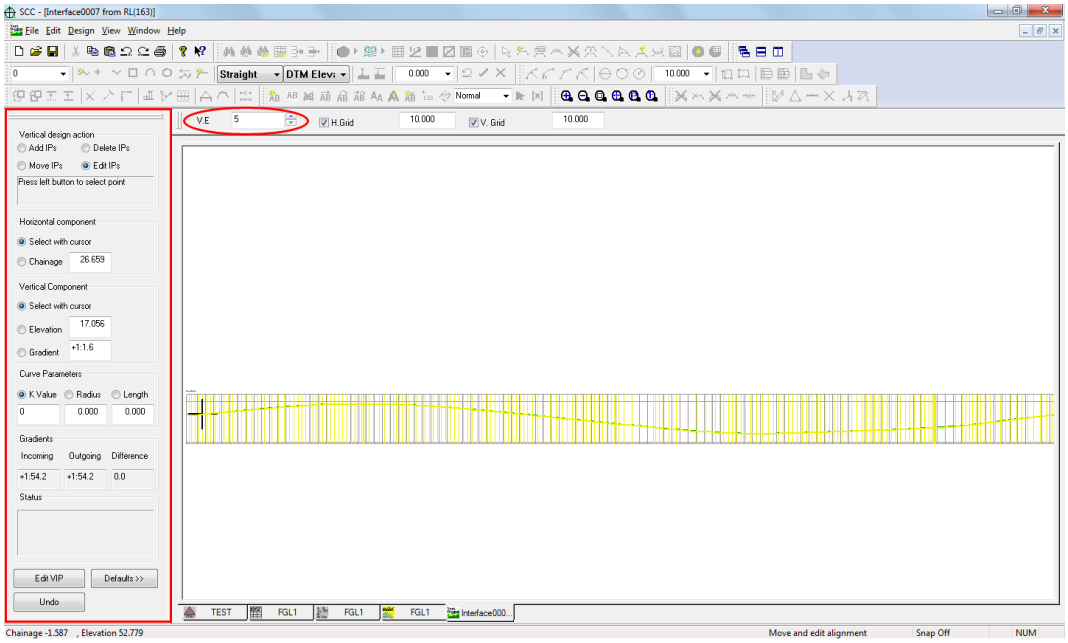
Note:

That the Undo option only goes back one step, so if a mistake is made make sure Undo is selected straight away before any other action is carried out.

32.5.2 Vertical Alignment (Model Design Menu)

This option may only be selected when a horizontal alignment is currently attached to the model. The vertical design sheet displays the vertical profile of the model along the horizontal

design and position of all horizontal design elements.



See Also

Design Vertical Alignment(Alignment Design Menu)

32.5.3 Section Templates (Model Design Menu)

Section Templates may be interactively designed. Sections of varying width may be attached to different chainages along the alignment. This may be needed to accommodate roads of varying width. Elements such as drains, which may occur only in cut or elements which occur only in fill may also be catered for in the section templates.

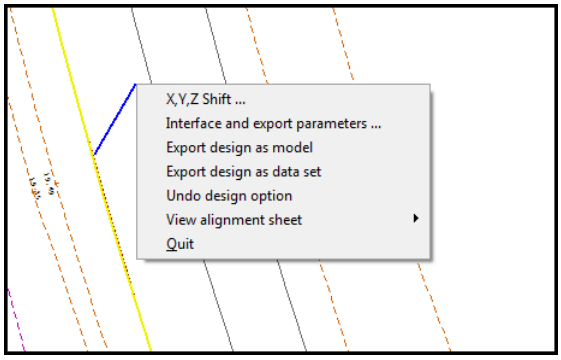
See Also

Section Templates (Alignment Design Menu)

32.5.4 Move Alignment (Model Design Menu)

This option allows the alignment to be moved by selecting a start/base point and a second/ placement point with the mouse.

This option has it's own secondary menu.



The following options are available;

X, Y, Z, Shift...

Interface and Export Parameters....

Export Design As Model

Export Design As Dataset

Undo Design Option

View Alignment Sheet

Quit

Exits this command ignoring all the changes that have been made.

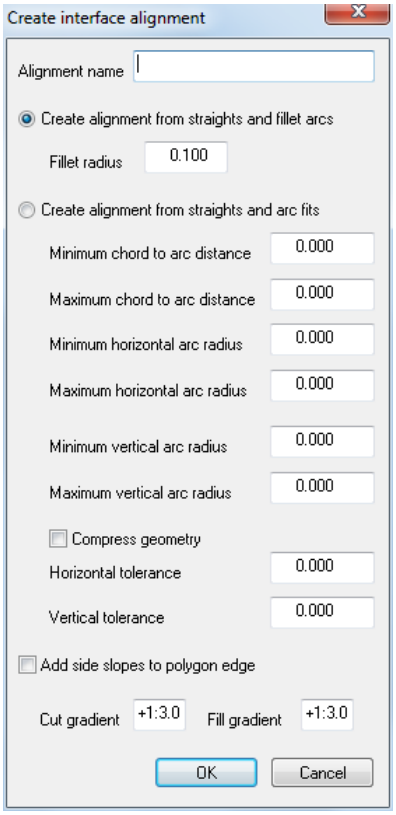
32.5.5 Create Alignment From String (Model Design Menu)

The option is allows you to create a 3d alignment from any SCC string, and optionally create default side slopes for that alignment. The option can be used in one of two ways.

The first method is to convert all straight-line segments in the string to alignment straights, and optionally insert a filleting arc of a specified radius in between the straights. It is advisable to include these arcs to ensure that chainages can be calculated for points that are offset from the centre-line. This also allows for creation of more aesthetically pleasing side-slopes and offset strings. Entering a fillet radius of zero means that these arcs will not be created. This option will work with any string, and will result in two horizontal entities and one vertical entity per string point.

The second method attempts to fit the minimum number of straights and arcs to the current string, based on a specified range of acceptable radii and chord to arc distances. This option is suitable for surveyed or imported road or rail centre-line strings where the original geometry strings are not available.

Compressing the design geometry will join adjacent horizontal entities of the same type that fall within a specified, reducing the overall size of the alignment.

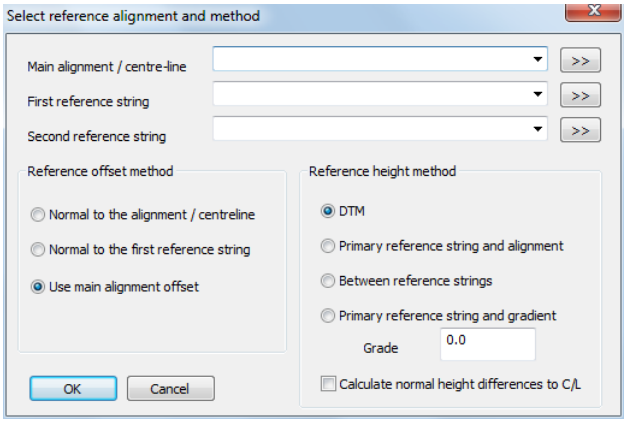


32.5.6 Balance Cut and Fill (Model Design Menu)

This option shifts the datum of the currently active alignment and design strings surface such that when modeled and compared to the current surface, the cut and fill volumes will be the same. Compaction and bulking factors can be entered for cut and fill, and the balance is computed based on the corrected volumes. The user may also enter a level tolerance, which lets SCC know when to stop the balancing.

32.5.7 Select Reference Alignment (Model Design Menu)

This option provides a means of selecting a reference alignment, a first and a second reference string and methods for calculating reference offsets and reference heights.



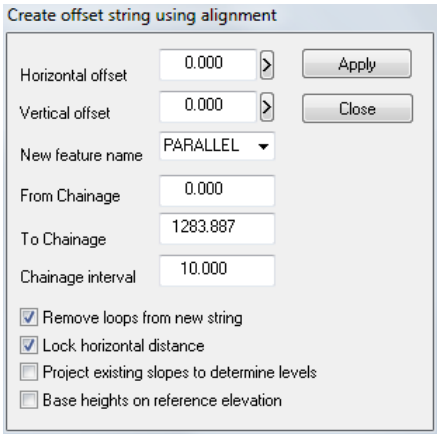
SCC calculates the difference in height between the current reference height and the alignment centre line at the current chainage. This can be reported using the report Reference Chainage, offsets and heights which shows the vertical height difference as well as the normal height

difference.

The normal height difference is calculated at right angles to the vertical alignment, based on gradient. This gradient is calculated at regular interval based on the 'Design > Interface and export parameters' chainage interval settings, default 10m.

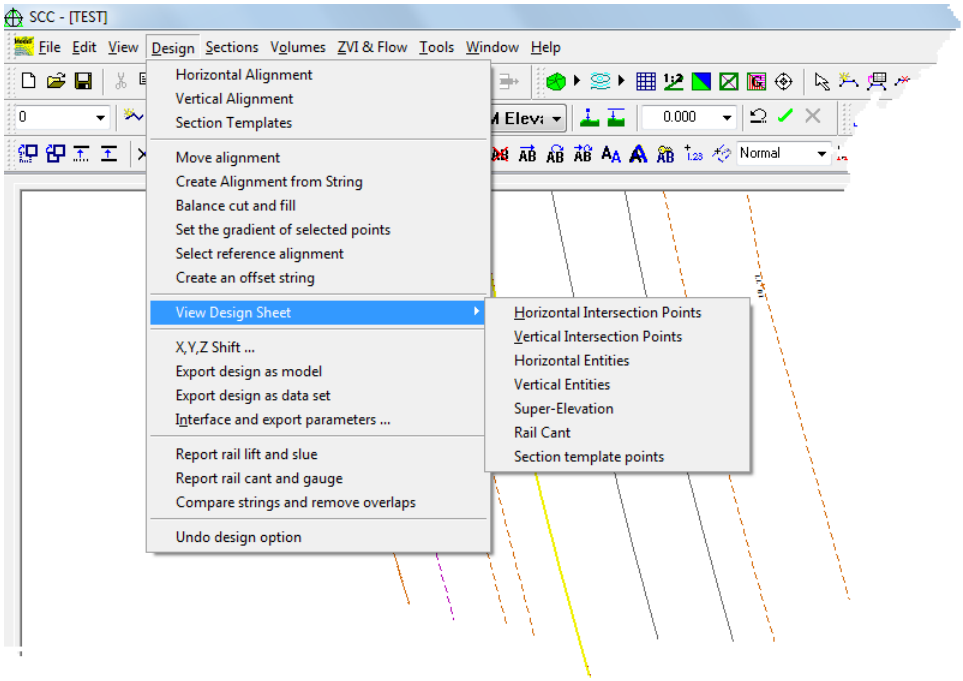
32.5.8 Create an offset setring (Model Design Menu)

This option allows you to create an offset string from a given model string, in relation to the currently active alignment, with inclusion of points at regular chainage in addition to base string points. Projecting existing slopes allows you to offset at a variable gradient based on the slope of the existing ground from the base string at right angles to the alignment.



32.5.9 View Design Sheet (Model Design Menu)

This option allows the user to open any of the spreadsheets associated with the alignment file.



These are

Horizontal Intersection Points

Vertical Intersection Points

Horizontal Entities

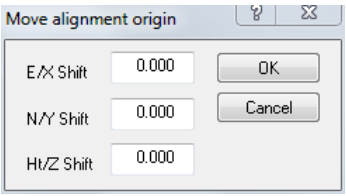
Vertical Entities

Super-Elevation Nodes

Section Template Points

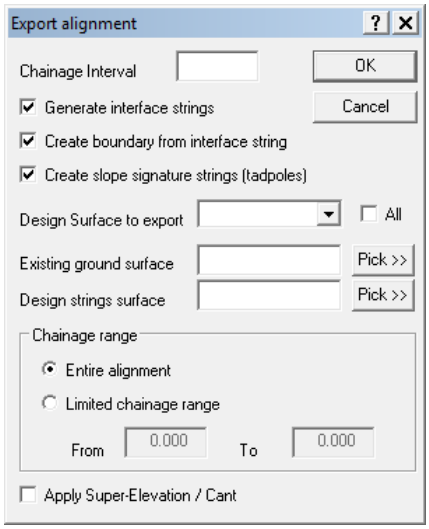
32.5.10 X, Y, Z, Shift...(Model Design Menu)

This option moves the alignment by specified X, Y and Z values. These values are typed into the Move Alignment Origin dialog.



32.5.11 Export Design As Model (Model Design Menu)

This option exports the alignment to a separate TIN model. The Export Alignment dialog is presented.



Chainage interval controls how often points are interpolated along the alignment.

Generate Interface string controls whether the points where the design surface intersects the ground surface are output as a string

Create boundary string controls whether the interface string generated is turned into a clip polygon that trims the out TIN model

Create slope signature strings controls whether tadpoles or hachure lines are output at each interface point connecting the edge of the design to the point it meets the ground.

Design surface to export selects which surface is exported from a design surface that contains multiple surfaces

Existing ground surface is the name of the ground model used for interface computations. This defaults to the current model when this dialog is accessed from the model design menu.

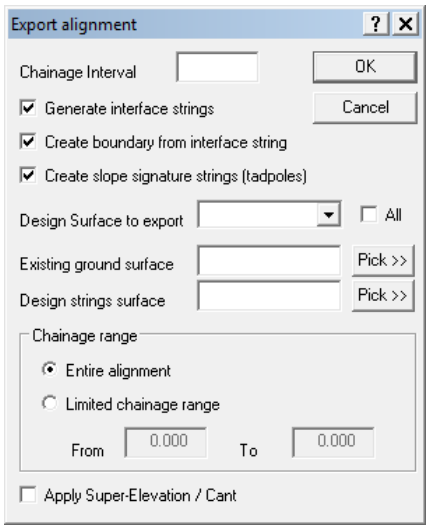
Design strings surface is an optional additional model that will get output with the design. This is also useful for cut/fill balancing situations where this additional model will

also be taken into account.

See also Interface and export parameters

32.5.12 Export Design As Dataset (Model Design Menu)

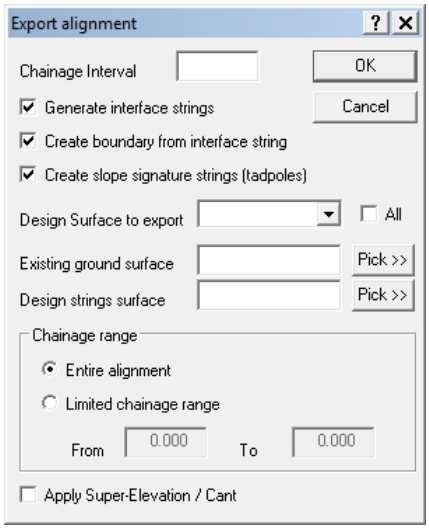
This option allows the alignment to be exported to a survey data set. The Export Alignment dialog is presented.



The data set will contain X,Y,Z, chainage and offset information. See also Interface and export parameters

32.5.13 Interface and Export Parameters.... (Model Design Menu)

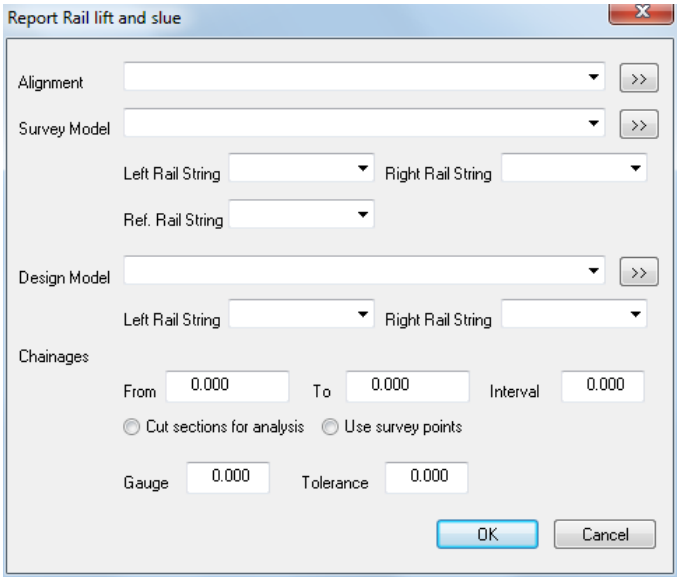
This dialog is presented when the option to Export Design as Dataset and Export Design As Model is selected and when in the alignment file the option to 'View Interface and Export Parameters is selected.



This option sets the parameters for exporting an alignment. The alignment may be output as an interface string. If the option to Generate Interface Strings is selected the two options; Create boundary from interface string and Create slope signature strings are enabled. The existing ground surface is the surface to which the interface line of the template extends.

32.5.14 Report Rail Lift And Slue (Model Design Menu)

This option reports rail lift and slue which involves comparison of a design model with a survey model for left (vertical separation) and slue (lateral separation) on nominated left and right rails. It also computes cant a gauge between left and right rails, and reports any failures to meet tolerance in cant.

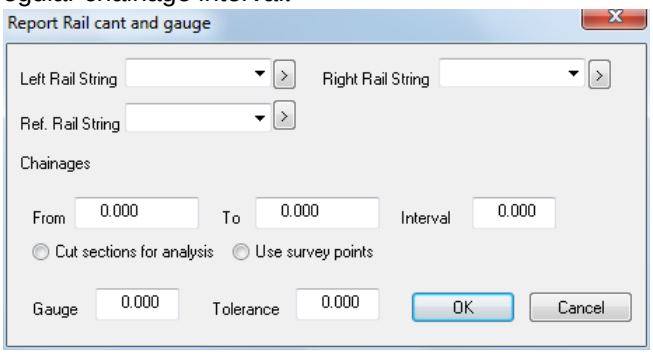


See Also

See also Lift And Slue Reporting

32.5.15 Report Rail Cant And Gauge (Model Design Menu)

This option will produce a report listing the cant stations, and applied cant values on either rail at a regular chainage interval.



The cant and gauge report includes cant differences between successive chainages, to show the amount of twist on the track. Large values are highlighted to show potential areas requiring further investigation.

See Also

Rail cant computations

32.5.16 Compare Strings And Remove Overlaps (Model Design Menu)

This options compares, merges and reports on overlapping rail strings. Strings must be selected prior to running this tool.

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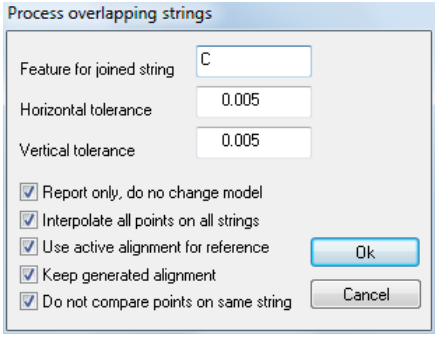
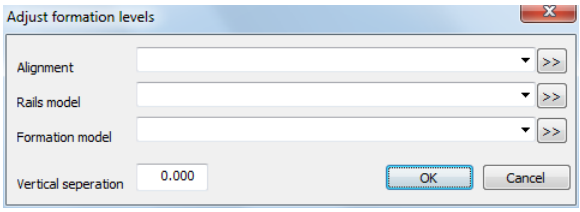


See Also

[String Comparison & Overlap Processing]

32.5.17 Check and Adjust Formation Levels (Model Design Menu)

This option creates a new formation model from an existing rails and formation model where the depth between the low rail (or sleeper) and top of formation is held fixed. Level adjustment and depths to formation are output by chainage. Note that the point of minimum depth can move from one side to another based on relative cant and gradient direction.

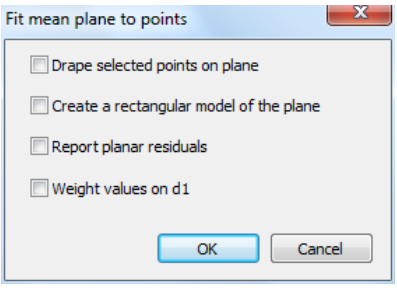


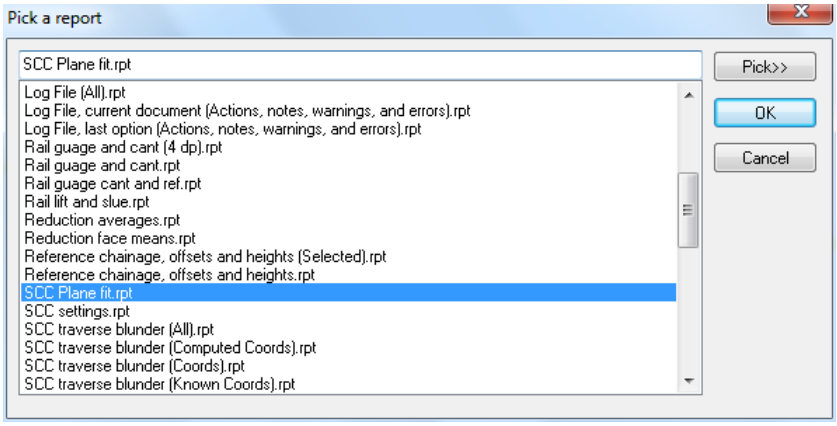
32.5.18 Set the Gradient of Selected Points (Model Design Menu)

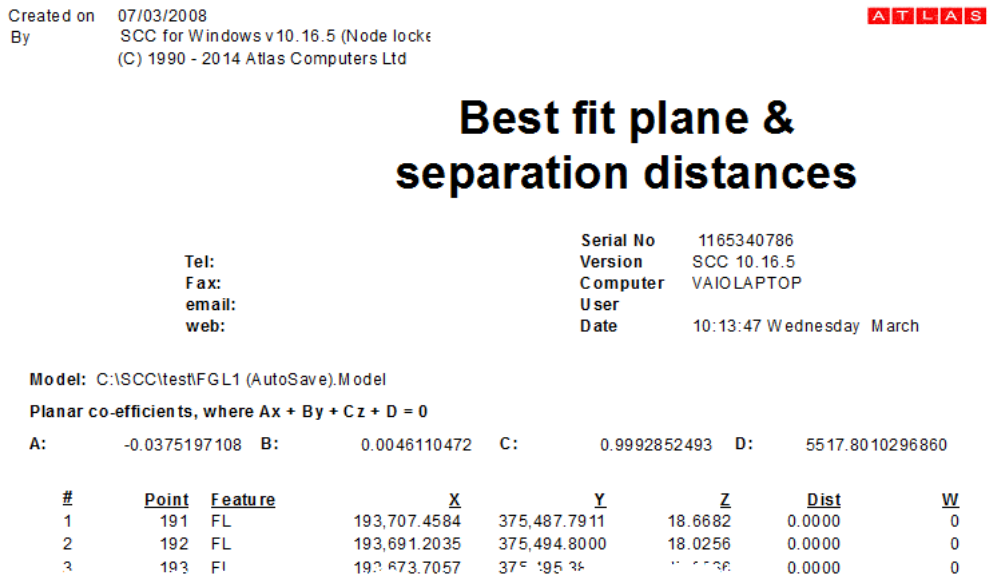
This option enables the user to set the gradient between a group of points, based on a base point, gradient, and direction. This is useful for draping groups of points onto a plane, typically for building design and land fill foot prints.

32.5.19 Plane Fit Selected Points (Model Design Menu)

This option allows the user to plane fit selected points from a model and to generate a results report.







Created on 07/03/2008
By SCC for Windows v10.16.5 (Node locke
(C) 1990 - 2014 Atlas Computers Ltd

ATLAS

Best fit plane & separation distances

		Serial No	1165340786
Tel:		Version	SCC 10.16.5
Fax:		Computer	VAIOLAPTOP
email:		User	
web:		Date	10:13:47 Wednesday March

Model: C:\SCC\test\FGL1 (AutoSave).Model

Planar co-efficients, where Ax + By + Cz + D = 0

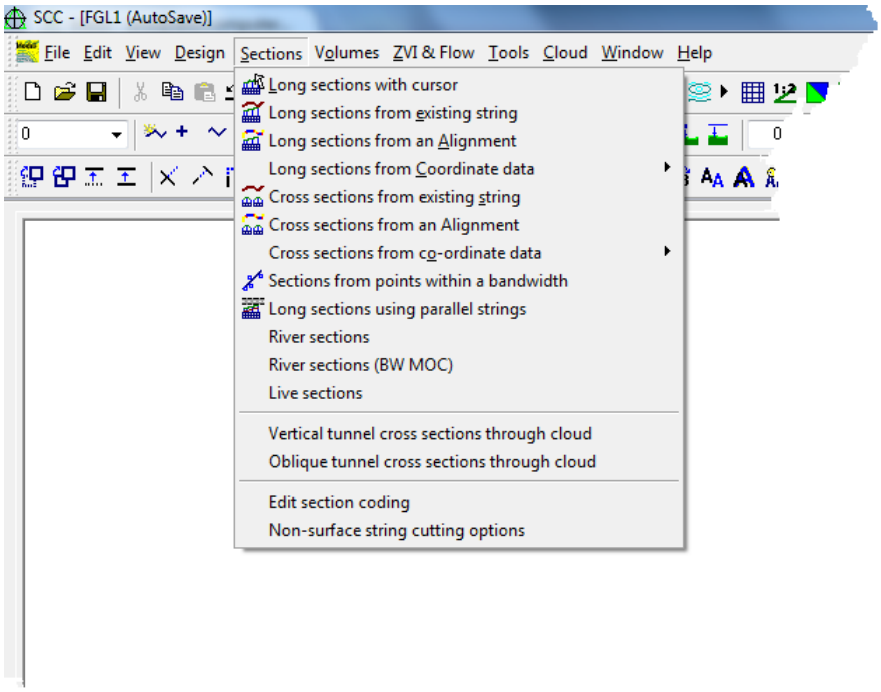
A: -0.0375197108 **B:** 0.0046110472 **C:** 0.9992852493 **D:** 5517.8010296860

#	Point	Feature	X	Y	Z	Dist	W
1	191	FL	193,707.4584	375,487.7911	18.6682	0.0000	0
2	192	FL	193,691.2035	375,494.8000	18.0256	0.0000	0
3	193	FL	193,673.7057	[illegible]	[illegible]	0.0000	0

32.5.20 Undo Design Option (Model Design Menu)

This option undoes any editing that has been carried out to the alignment. This facility is present because the Undo option under the Edit menu only applies to model information. The alignment file is only attached to the model and is not part of the model. As the attached alignment and the alignment spreadsheets are directly related, this option applies to any editing that was carried out on the spreadsheets as well.

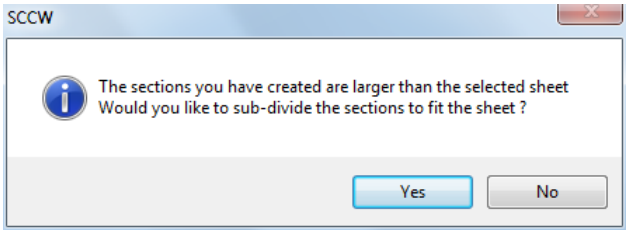
32.6 Model Sections Menu



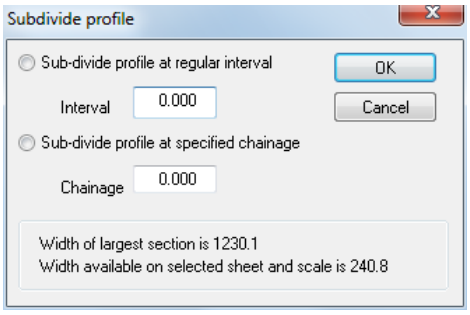
32.6.1 Long Section with Cursor (Model Section Menu)

This option allows the user to interactively create long sections from the current ground model using the cursor. Pressing the left button allows the user to add a point to the existing section line. Pressing the right button finishes the section and opens the sections file automatically.

SCC automatically remembers the last sheet size applied to a section and therefore, if the section created is too long for the sheet, the following message will appear;



If the user selects 'No' to sub-divide the sheet, no sheet will appear. However, if the user selects 'Yes', then the following dialog will be displayed;



The user may sub-divide the section by either a specific chainage or at regular intervals. The length of the section and the length of the selected sheet are listed at the bottom of the dialog so as to make it easier to determine the required interval.

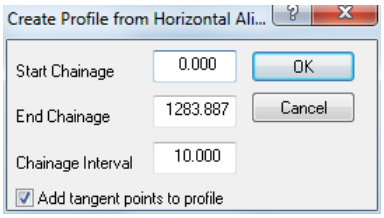
32.6.2 Long Section from Existing String (Model Section Menu)

This option allows the user to create a section graph from a string displayed in the model. This option uses surveyed levels on this string directly rather than interpolating from the ground model. To create a section graph simply press the left mouse button on the desired string. This will generate a section file from that string which is automatically opened. If the user moves back to the model view, additional strings can be selected that will be added to the same section document.

When selecting this option initially, the user will be prompted with the question 'Would you like to store survey remarks in the section feature column ?'. This enables the user to annotate the section with field notes attached to survey points as required.

32.6.3 Long Section From An Alignment (Model Section Menu)

This option generates a Long Section along the attached alignment string.



32.6.4 Long Section from Coordinate Data (Model Section Menu)

This option allows long sections to be extracted from a ground model by using any of the standard input co-ordinate file formats as the section template.

A section will not be generated if the points in the co-ordinate file;

- are not strung (i.e. point features)
- have a DTM status other than D
- contain gaps in the strings

See Also

Detail Coordinate

Import DWG/DXF File

Import Fixed format ASCII file (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import AutoGrad/MSMM 'As Set-Out File' (File Menu)

Import AutoGrad/MSMM Levelling File (File Menu)

Import AutoGrad/MSMM GDS Printout (File Menu)

Import DOER Husky File (File Menu)

Import MOSS GENIO File (File Menu)

Import MOSS 992 Report (File Menu)

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Import MOSS 994 Report (File Menu)

Import Steanne MIDAS File (File Menu)

Import SDRMAP ASCII File (File Menu)

Import Eclipse Report File (File Menu)

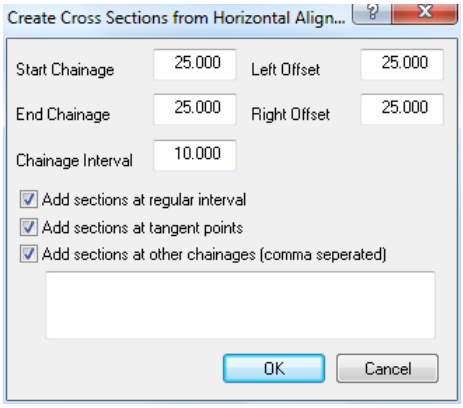
Import ESBI Vectors File (File menu)

32.6.5 Cross Section From Existing String (Model Section Menu)

This option allows the user to create cross sections from a string displayed in the model. To create sections simply press the left mouse button on the desired string. The Create Cross Sections dialog will then be presented. This option can create cross sections at regular intervals (i.e. chainages) and/or at the surveyed points on the string.

32.6.6 Cross Section From An Alignment (Model Section Menu)

This option generates a Cross Section at right angles to the attached alignment string, using a specified chainage range and interval. Additional options allow the user to add sections at regular intervals, at tangent points (e.g. start and end of tangents, transitions, and arcs in the horizontal design) or at user specified chainages.



Shortcuts

Toolbar

See Also

Detail Coordinate

Import DWG/DXF File

Import Fixed format ASCII file (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import AutoGrad/MSMM ‘As Set-Out File’ (File Menu)

Import AutoGrad/MSMM Levelling File (File Menu)

Import AutoGrad/MSMM GDS Printout (File Menu)

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Import DOER Husky File (File Menu)

Import MOSS GENIO File (File Menu)

Import MOSS 992 Report (File Menu)

Import MOSS 994 Report (File Menu)

Import Steanne MIDAS File (File Menu)

Import SDRMAP ASCII File (File Menu)

Import Eclipse Report File (File Menu)

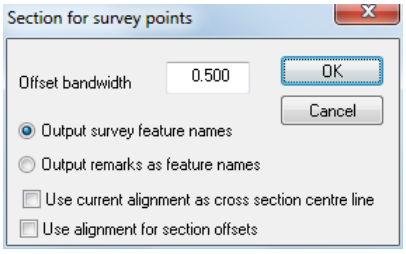
Import ESBI Vectors File (File menu)

32.6.7 Cross Sections From An SCC Section File (Model Section Menu)

This option creates cross sections at right angles to centre line(s) taken from all long section templates in the selected SCC long Sections file. The start of each string in the co-ordinate file is considered to be at chainage zero for the purposes of this option. This option will usually be used when the long section has been created with the cursor.

32.6.8 Section From Points in a Bandwidth (Model Section Menu)

This option creates a long section from all points within a specified distance of a user-defined centreline. To use this option, first enter the search distance or bandwidth, then press the left mouse button over two or more points on the desired centreline, then press the right mouse button to generate the section line. To add further sections to the section document, simply go back to the model view and repeat the steps given.



This option is typically used when creating river sections, where the surveyed section line is greater than the actual river width. The section is created using the surveyed elevations snapped, at right angles, onto the user-defined centreline.

This option can also be used in conjunction with an alignment to create cross sections from points in a bandwidth, that can be skewed from the centre line. In this case the skew angles can be annotated on the sections, and reported on for flow analysis and area correction purposes. Note that cross sections created in this manner should only include two end points if they are to be used for area or flow measurement purposes. The chainage of a skew cross section is the computed position of where it intersects the alignment.

32.6.9 Long Section Using Paralllel Strings (Model Section Menu)

This option allows you to create parallel string sections. The term ‘parallel string section’ is used in this case to refer to a section graph that shows one or more strings, from the same surface, overlaid on each other. An example of a parallel string section would be a section graph showing the centre-line and left and right edges of a road carriage way.

Parallel sections present us with a number of potential problems, insofar as we are overlaying strings with different coordinates, and thus require a common reference coordinate system to tie the strings together. The common reference coordinate system must be a chainage / offset based coordinate system.

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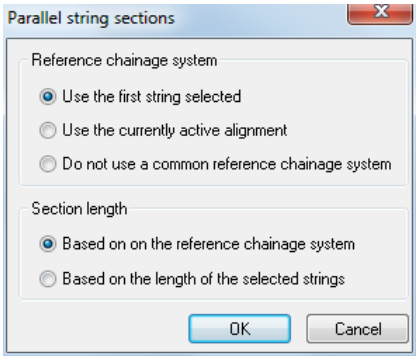


SCC provides us with three alternative solutions to this issue, which are as follows;

Use the first selected string to define the chainage/offset system.

The first string selected is converted into a temporary alignment string, and the chainage values of all points on all strings in the section are calculated in relation to this alignment. Points on the second and subsequent strings that have chainages lower than zero, or greater than the extent of the first string, are ignored.

Use the currently active alignment to define the chainage/offset system.

The current alignment is used to generate chainage values for all points. Points on all strings that have chainages lower than zero, or greater than the extent of the alignment, are ignored.

Do not use a common reference system

In this case, the first point on each string is treated as having a chainage of zero, and the chainage system is based on the distance between string points.

When using a reference coordinate system, the length of the individual section lines can also be determined in one of two possible manners listed below;

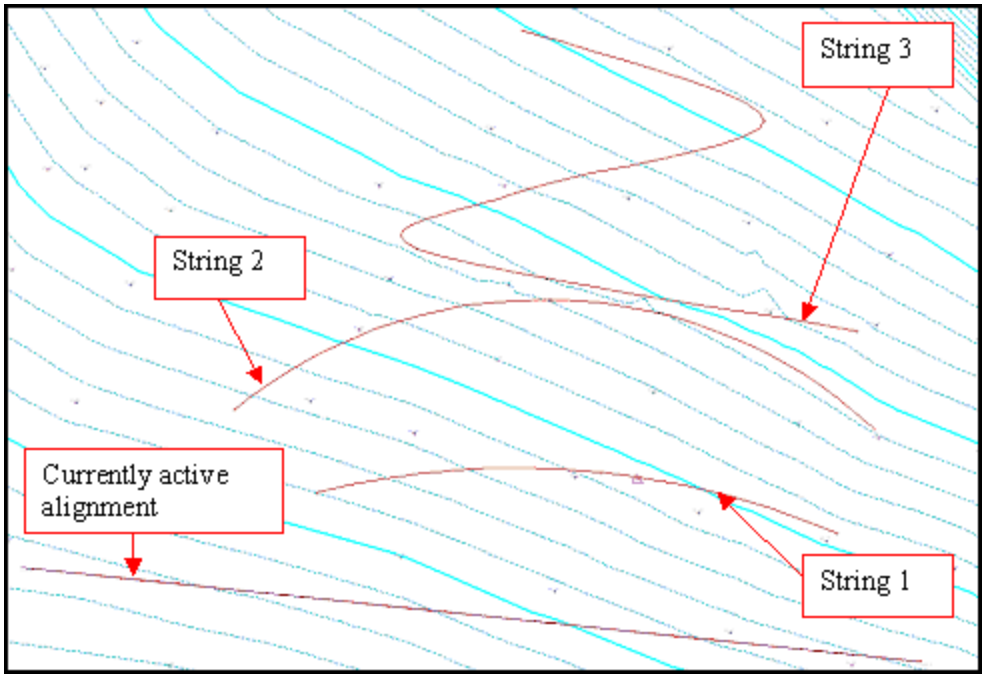
Based on the reference chainage system

In this case, all of the string coordinates are projected onto the alignment, based on the common chainage system. For example, in the case of a curved road that goes over hill, the hill would appear at the same position in each section in the graph.

Based on the length of the selected strings

In this case, the true lengths of the individual strings are used, and reference coordinate system is only used to determine the extents of the sections. For example, in the case of a curved road that goes over hill, the hill would appear at staggered positions in each section in the graph. This is because the string on the inside of the curve will be shorter than the string on the outside of the curve.

The model shown below illustrates the use of parallel sections, and some of the differences obtained by selecting the various options.



32.6.10 River Section (Model Section Menu)

This option provides the main interface for river section generation within SCC. Sections and profiles can be automatically generated with multiple outputs. The main aspects include:

- River profiles include output of centre line, bed level / low water, water level, left bank, right bank, minimum silt level and maximum silt level using the features CL, Low Water, Water Level, Left Bank, Right Bank, Silt Max and Silt Min respectively. Default river profile section style has been added to accommodate these features.
- Export options allow for the generation of ISIS, HEC-RAS and MIKE 11 formats, and have been designed in such a way that sections can be output to all formats without any re-processing.
- Specific features can be assigned for left bank, right bank, section ID, section type and water level. SCC will generate a report while processing river sections providing details of any sections that are missing any of these details.
- Typically one or two digit, can be used as section feature codes, which are mapped onto larger names for display on the section. Such features can be displayed either in the annotation box or on the section surface.
- In addition to cross sections, SCC will also create a river profile showing bank levels, bed levels, water and silt level for all sections. This profile can be annotated with section chainages and IDs.
- Where a water level has been surveyed within a specified distance of a section between the river banks, a water surface can optionally be added to the sections. In addition a time stamped water level annotator, fitted between the left and right banks, above the water level line can be generated.
- Silt surfaces can be automatically added to the river sections as per the water level, with the addition that silt surfaces can either be created from a single point or a multi-point string.
- Structures can be copied and pasted from plan onto both river sections and the river profile.
- A scaled symbol can be automatically placed on the surface for each feature, where required. Additional symbol annotation options have been added to support display of pipes with their dimensions, and other structures such as walls and fence on river sections and

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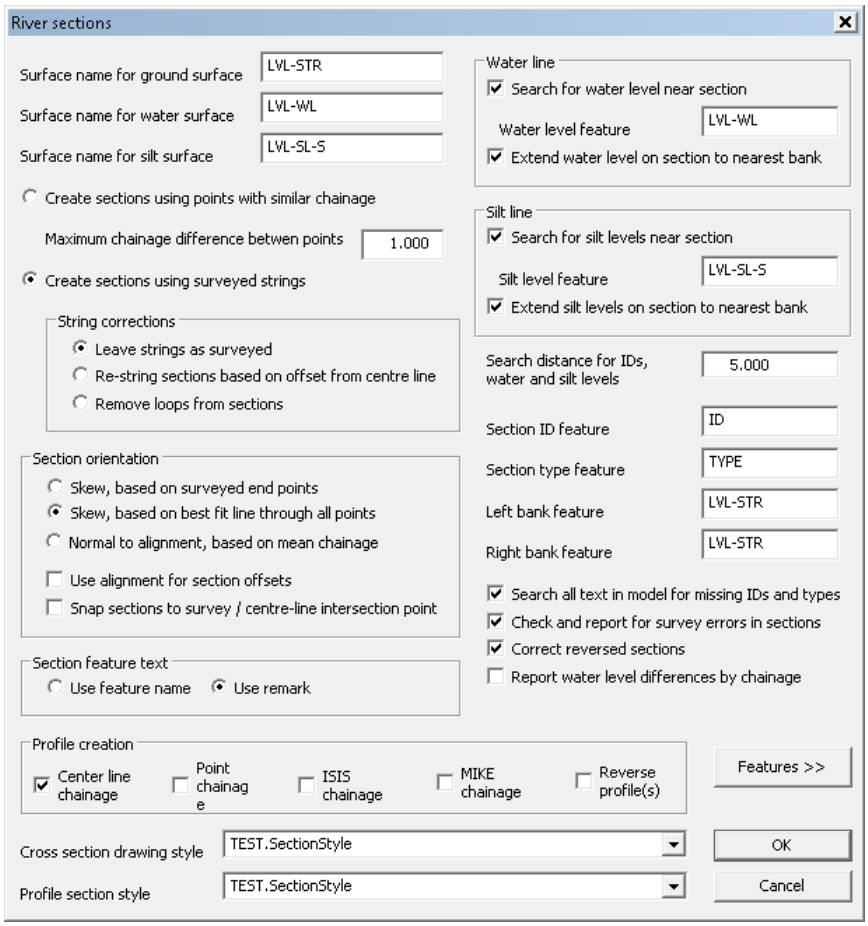
profiles.

- Where left and right banks have been surveyed, and the right bank has a smaller offset than the left bank, the section will automatically be mirrored.
- Annotation options allow for labelling the offset relative to the left edge or right edge of section, low water point, banks, and highest and lowest point on the section as well as title annotators for section ID and section type.
- When left and right banks have been picked up, SCC will automatically search for the lowest point between the banks, and use this point as an additional offset reference system (ISIS offset).
- Section title options have been added for annotation of upstream and downstream chainage (MIKE 11 & ISIS), and difference in chainage between points.



Specific settings are outlined as follows:

Surface Name for ground surface

This is the name displayed on the section title block for the profile line associated with the main ground surface.

Surface name for water surface

This is the name displayed on the section title block for the profile line associated with the water level and extrapolated water surface.

Surface name for silt surface

This is the name displayed on the section title block for the profile line associated with the silt level and extrapolated water surface.

Create sections using points with similar chainage

This option is used when points on surveyed river sections are not collected as strings defining the section line. In this case, all points within a specified chainage range are grouped to form a section, and the points on each section are sorted by offset from the river centre line. This option has the advantage that it allows the user to collect feature names in the field, e.g. TOPBANK, BOTBANK, etc.. which will automatically be annotated on the section. It has the disadvantage that section lines should not overlap, as points may get placed on the wrong section.

Maximum chainage difference between points

This option is the maximum chainage separation allowed between points for them to be placed on the same section. For example, a value of 2m would indicate that all points on a section must be within a 2 meter chainage of one another. Note that for skew sections, i.e. sections not perpendicular to the centre line, this value should be increased to allow for the skewing effect. This value should never be greater than half the distance between adjacent section, e.g. if your sections are 10m apart, this value should not exceed 5.

Create sections using surveyed strings

This option should be used where sections have been collected as complete strings. It has the advantage that sections can overlap, which can be useful on sharp changes of direction and small radii in the river centre line.

String corrections

These only apply where the above option has been selected, and relate to automatic correction of certain survey errors.

Leave strings as surveyed

Do not make any corrections.

Re-string sections based on offset from centre line

This option re-orders the points in the string based on their offset from the centre-line. This will correct any overlaps, loops and doubling back in the section.

Remove loops from sections

This option removes any loops that occur in plan in the section.

Section Orientation

These options refers to how the section centre lines are formed from the surveyed points for a given section, which due to the natural constraints of river surveying, will rarely form an exact straight line.

Skew, based on surveyed end points

The section centre line is formed by joining the leftmost and rightmost survey points. The survey points are then snapped onto this line when forming the section. This line will typically not be at exact right angles to the river centre line.

Skew, based on best fit line through all points

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The section centre line is formed by creating a best fit line through all the survey points. The survey points are then snapped onto this line when forming the section. This line will typically not be at exact right angles to the river centre line.

Normal to alignment, based on mean chainage

The section centre line is formed by computing a mean chainage from all the survey points, and going at right angles to the left and right of centre-line at that chainage to meet the leftmost and rightmost offsets of the survey points. The survey points are then snapped onto this line when forming the section. This line will be at exact right angles to the river centre line. Note that if the surveyed section is not roughly at right angles to river centre line, points are liable to be moved significant distances when snapped onto the centre line, and the section line may be significantly shorter than the surveyed line.

Use Alignment for section offsets

The sections are formed using the offset value of the alignment.

Snap sections to survey / centre-line intersection point

This option allows the section position to be snapped to the position where the surveyed section line cuts the alignment centre line. This means that centre line chainage and ISIS chainage are coincident.

Section Feature Text

This controls how the feature name field in the sections is populated.

Use feature name

Use the feature name as entered in the survey.

Use remark

Use the remark from the associated survey observation. This is useful when surveying sections as strings, where all the points on the section have the same feature name for stringing purposes, but may refer to different items on the section, e.g. Top of bank, edge of water, etc…

Water line

This group of options refer to the extraction of water level points and extrapolation of a water surface in the sections produced. Typically this will be a single water level point per section where the water surface is being automatically extracted, or a string where water surface has been surveyed directly.

Search for water level near section

Select this option to search for water level points near the surveyed section.

Water level feature

This is the unique feature name, e.g. WLEV, used to denote water levels.

Extend water level on section to nearest bank

When a single water level has been surveyed per section, this option will extend the level left and right from the surveyed point to the ground profile on the section to form a water surface.

Silt line

This group of options refer to the extraction of silt level points and extrapolation of a silt

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surface in the sections produced. Typically this will be a several silt level points per section where the silt surface is being automatically extracted, or a string where silt surface has been surveyed directly.

Search for silt level near section

Select this option to search for silt level points near the surveyed section.

Silt level feature

This is the unique feature name, e.g. SILT, used to denote silt levels.

Extend silt level on section to nearest bank

When silt level points have been surveyed per section, this option will extend the levels left and right from the surveyed point to the ground profile on the section to form a silt surface.

Search distance for IDs, water and silt levels

This is the maximum allowable distance from the IDs, water and silt levels to the section it will be placed on.

Section ID feature

Section ID picked up the field are extracted and used to label individual sections.

Section Type feature

Section Type picked up in the field are extracted and used for annotation and export purposes.

Left Bank Feature

Left Bank feature is used for annotation and export purpose. It is also used to control the extent of the Water and Silt level surfaces.

Right Bank Feature

Right Bank feature is used for annotation and export purpose. It is also used to control the extent of the Water and Silt level surfaces.

Search all text in model for missing IDs and types

This quality check examines each section for missing IDs and types. Errors are reported in a text file.

Check and report for survey errors in sections

This quality check examines each section for survey errors. Errors are reported in a text file.

Correct reversed sections

This option re-aligned sections to match the centre line direction. This option overcomes issues relating to section having been surveyed in a 'zig-zag' fashion and also address problems arising from left and right bank being incorrectly surveyed.

Report water level differences by chainage

This quality check option allows the water level difference to be reported based on

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chainage values, that is, to report water level height differences between sections to check downstream direction.

Profile Creation

When creating river sections, multiple river profiles may be output based on different chainage systems and treatment of skew sections. These are as follows:

Centre line chainage

Each point on the profile for any given section is given the chainage of the point where the section cuts the centre line. Thus for each section, all the points are lined up on the profile at that chainage.

Point chainage

Each point on any given section on the profile will have its chainage computed from the centre line / alignment. Thus for skew sections, multiple points will occur on the profile for each section, highlighting the range of chainages covered by the skew section.

Note that care should be taken when copying and pasting structures and pipes from plan onto river profiles, as the chainage used will be computed from the alignment rather any given section. Thus where skew sections are being used, copying and pasting will typically provide best results when used in conjunction with the profiles based around point chainage. SCC gives a message to this effect when creating multiple profiles.

ISIS chainage

This is the same as the centre line chainage, except the chainage used is the chainage where the surveyed line, rather than the section line, cuts the centre line.

MIKE chainage

This is the same as the centre line chainage, except the chainage used is the MIKE chainage, which typically runs in the opposite direction as the centerline and ISIS chainage.

Reverse Profile(s)

This options allows the reversal of profile directions.

Cross Section drawing style

This option allows the user to select a predefined section style.

Profile drawing style

This option allows the user to select a predefined section style.

Feature >>

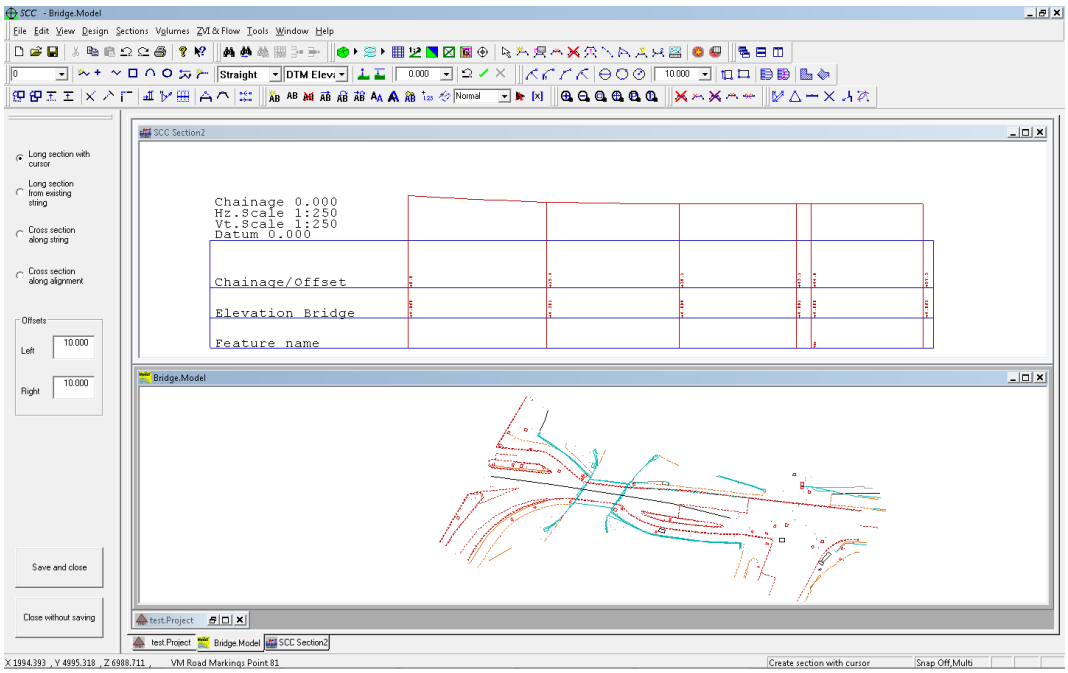
This option links to the Extended Field Code table.

See also River sections tutorials for more details on typical work flows pertaining to river surveying

32.6.11 Live Section (Model Section Menu)

This options supports real time creation and display of long sections, cross sections and string profiles. It operates in split screen mode, with the section view being updated as you move the cursor in plan view.

Live sections support multiple models. To show more than one model on live sections, the additional models should be attached to the main model using **'FILE > Attach/Detach > Attach Model'.**

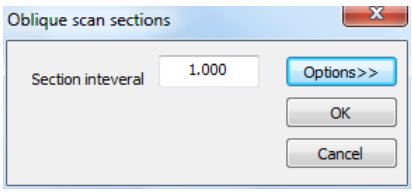


32.6.12 Vertical Tunnel Cross Sections Through Cloud (Model Section Menu)

This option allows the user to create vertical tunnel cross sections through cloud data. This option requires a single mouse click for the vertical centre point. This is effectively the same as isolating sets of points close to a plane, and tracing the outlines of those points. In this instance, the planes are horizontal and the interval is the vertical interval.

32.6.13 Oblique Tunnel Cross Sections Through Cloud (Model Section Menu)

This option allows the user to create oblique tunnel cross sections through cloud data. Two mouse clicks are used to define an oblique base line. This is effectively the same as isolating sets of points close to a plane, and tracing the outlines of those points. The planes are normal to the 3d line defined by the two points selected. The active cloud area is sectioned, so to limit the analysis to a given area, isolate those cloud points.



32.6.14 Edit Section Coding (Model Section Menu)

This option allows the user to specify additional annotation options be feature. Using a value of 'Level on Surface' annotates the level of any given point on the surface in addition to the annotation boxes. A code and feature value of ~BLANK may be used for triangle cuts that do not relate to a string.

Extended field coding table

	Code	Feature	Text	Type
296	HE	HE		Level on surface
297	IL	IL		Level on surface
298	KB	KB		Level on surface
299	MK	MK		Level on surface
300	OHL	OHL		Level on surface
301	PIPE	PIPE		Level on surface
302	PR	PR		Level on surface
303	RIVER	RIVER		Level on surface
304	S	S		Level on surface
305	S901	S901		Level on surface
306	S901A	S901A		Level on surface
307	S902	S902		Level on surface
308	S903	S903		Level on surface
309	S904	S904		Level on surface
310	S905	S905		Level on surface
311	S906	S906		Level on surface
312	SC	SC		Level on surface
313	SV	SV		Level on surface
314	TE	TE		Level on surface
315	UG	UG		Level on surface
316	V	V		Level on surface
317	WL	WL		Level on surface
318	WW	WW		Level on surface

Add | Delete | Delete All | Global Edit | Replace | Import codes from feature library | OK | Cancel

32.6.15 Non-surface String Cutting Options (Model Section Menu)

This option determines the strings that are used to generate a section. When selected within a model, the above rules will apply to all newly cut sections created using long or cross sections, created using the cursor, existing strings or alignment. The following options are available:

Input model is only used when the option is used from within an existing section

Output surface name is the same given to the surface annotation line within the sections

Cut all strings in the input model is only used when calling the option from an existing section, and causes all cut strings to be added to the section

Only cut Non-DTM points (Approx and Elevation) will cut all strings that are not part of the DTM surface in the input model and add the cut positions as single points to the section.

Only cut Elevation strings does the same but is restricted to strings with a DTM code of Elevation.

Only use the following features (comma separated) cuts all string with the nominated features. For example, a value of TB,BB,RL,RR would only cut strings with one of these feature names.

None indicates that this function will not be used when creating new section.

Cut data does not have valid levels forces the cut points output to assume the level of the sections datum.

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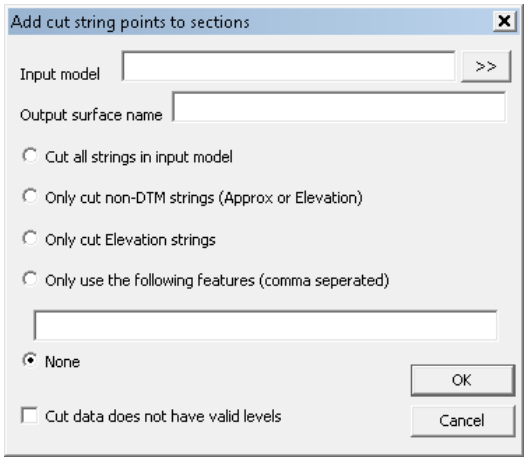
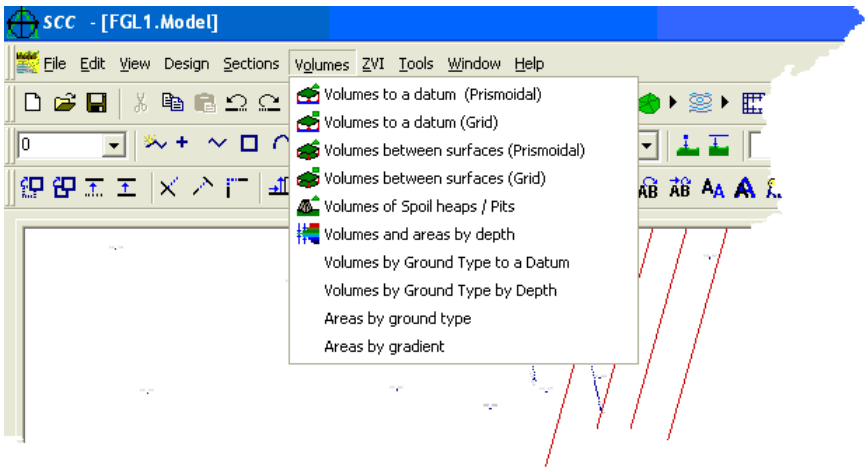


32.7 Model Volumes Menu

In SCC there are 3 methods by which volumes may be calculated.

- Prismoidal method
- Grid method
- Cross Sectional End Areas method

When calculating volumes all three methods should be performed, as each is independent of the other, and hence each provides a check on the other. Differences of more than one or two percent indicate possible errors.



Things to look out for when calculating volumes;

It is important that there be a common boundary between the two surfaces, defining a common area about which volumes will be measured. Accurate volumes cannot be calculated between two surfaces where a common boundary is not defined. Poor boundary definitions are probably the most common cause of gross error in volume calculations. The boundary string should have a DTM status of Clip Polygon. The boundary will normally take the form of a string line, either surveyed or added manually to the model. Most modelling packages will automatically determine a boundary, using a convex hull or similar algorithm, if one is not provided. Such boundaries rarely reflect conditions on site, as can be evidenced by contours appearing outside the surveyed areas. In any case, such a boundary is ambiguous as it is dependent on the algorithm selected by the software package rather than the judgment / agreement of the engineers and surveyors on site. Weeding may also be used to define plan areas although use of a boundary string is superior.

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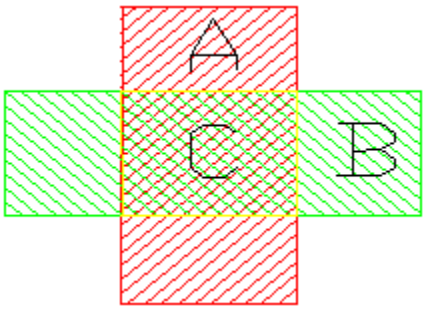
Check the plan area of both surfaces.



If we have two surfaces, for example, surface A, shown here in red and surface B shown in green. Areas A and B do not overlap exactly. Where they do overlap they form the area C. Volumes will be calculated for the area C and not for the whole of A and B (i.e. volumes will be calculated only where two areas overlap).

Check that both surfaces overlap by;

1 Creating a model of both surfaces in SCC. Open one of the models in SCC. Go to 'TOOLS > Merge two Model'. Select the existing and proposed models. The smaller model will be inserted into the larger model.

2 Exporting both surfaces to CAD. Make one surface into a BLOCK and INSERT it on top of the other. They should overlap exactly.

3 Defining the boundary line of both areas by drawing a POLYLINE around the area of interest. Use the LIST command to find the area. Compare both areas, they should correspond.

This method is not as accurate as using the INSERT command.

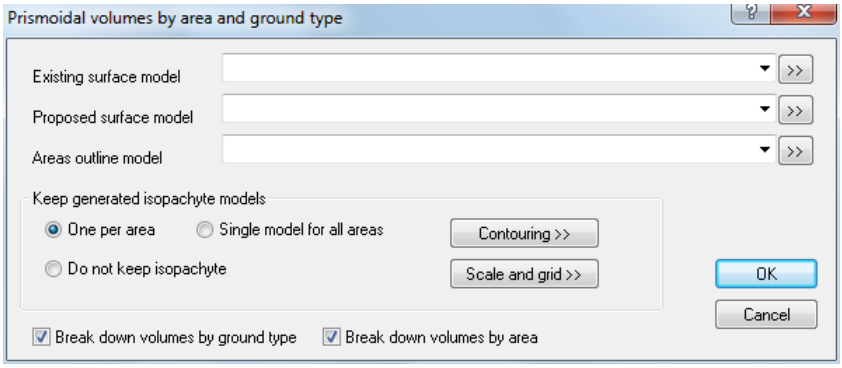
Discrete points do not provide enough information to accurately define a triangulated surface that contains significant grade changes such as embankments. The accepted method of triangulating a surface is the Delaunay method, which takes no account of elevation when configuring triangles. This method is always modified in surface modelling applications, such as SCC, to allow for the introduction of breaklines or strings. These strings are used to define such linear discontinuities such as embankments. Without using such strings / breaklines a surface that contains significant grade changes will be inaccurate and may lead to inaccurate computation of volumes, sections and contours.

Check that the same surface is referred to as the Existing model each time and it is not called the Proposed model when recalculating volumes using a different method of calculation.

See also Volume tutorials

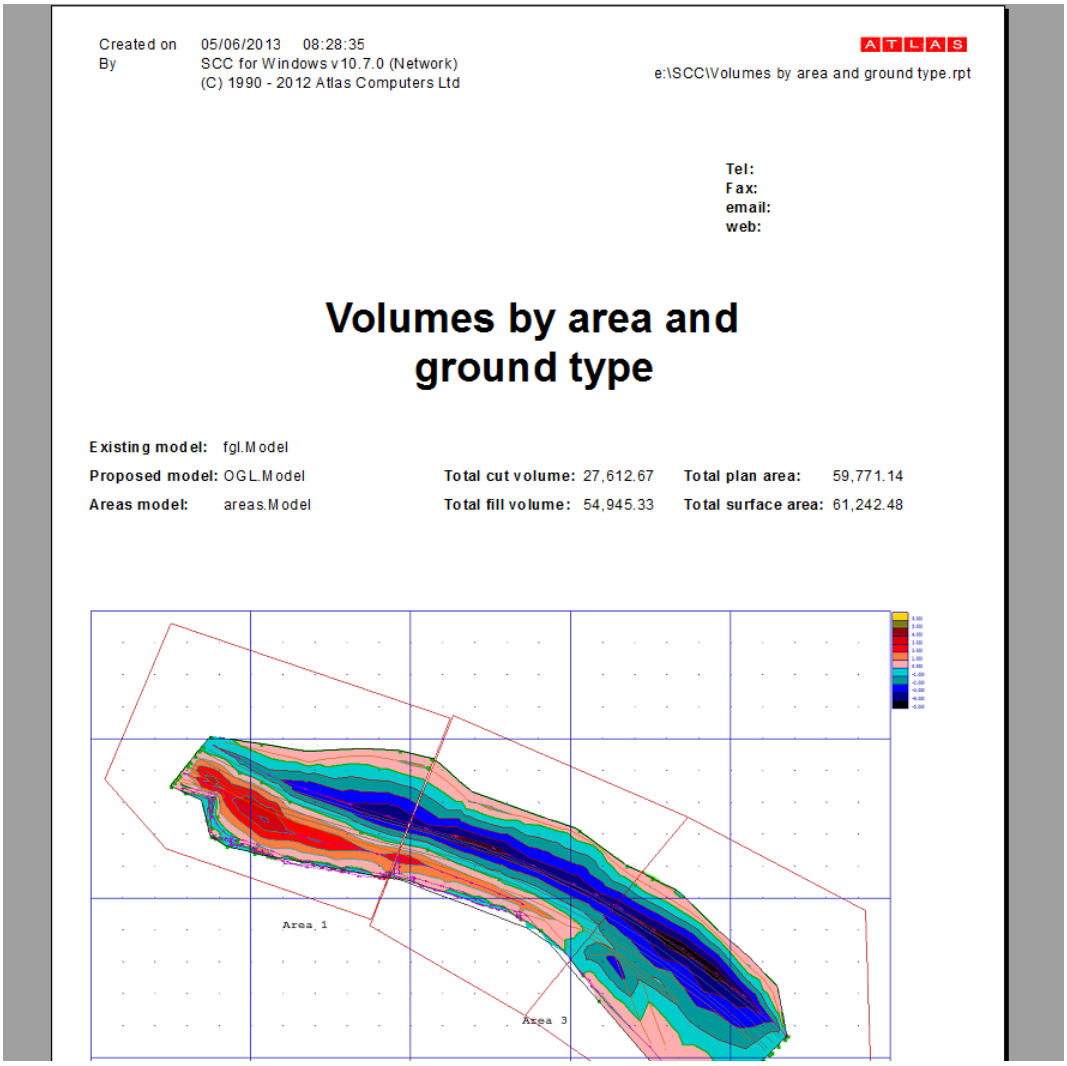
32.7.1 Volumes between surfaces by area (Model Volumes Menu)

This method allows the user to compute volumes broken down by areas, and further broken down by ground type.



If processing using areas an extra areas model is needed, which in simple terms is a set of 2D polygons outlining individual areas to be measured.

The reports generated includes graphics of the areas based on the contouring and grid options specified in the dialog, as well as an overview.



Created on 05/06/2013 08:28:35
By SCC for Windows v10.7.0 (Network)
(C) 1990 - 2012 Atlas Computers Ltd

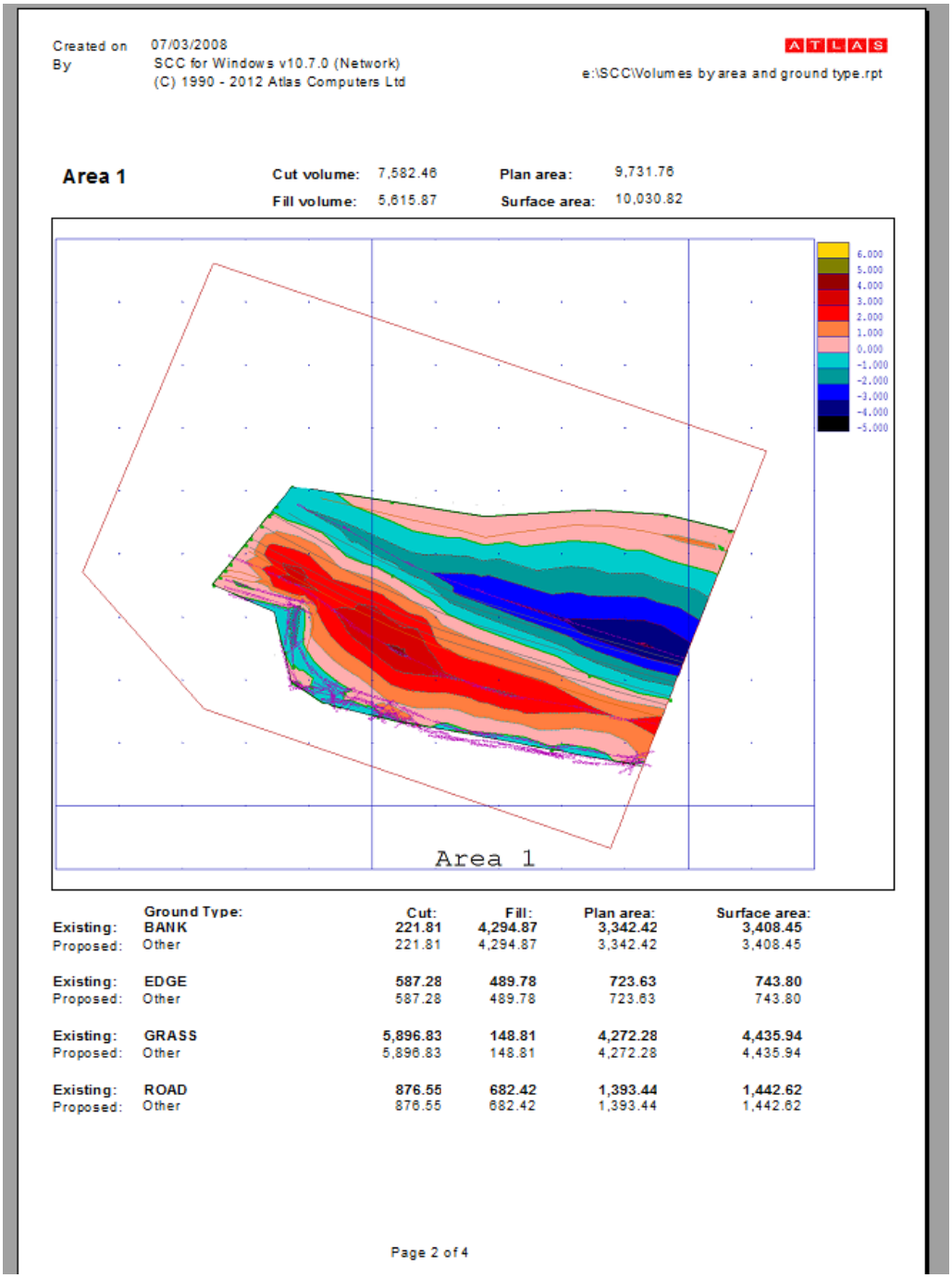
ATLAS
e:\SCC\Volumes by area and ground type.rpt

Tel:
Fax:
email:
web:

Volumes by area and ground type

Existing model: fgl.Model
Proposed model: OGL.Model
Areas model: areas.Model

Total cut volume: 27,612.67
Total fill volume: 54,945.33
Total plan area: 59,771.14
Total surface area: 61,242.48



Created on 07/03/2008
By SCC for Windows v10.7.0 (Network)
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e:\SCC\Volumes by area and ground type.rpt

Area 1

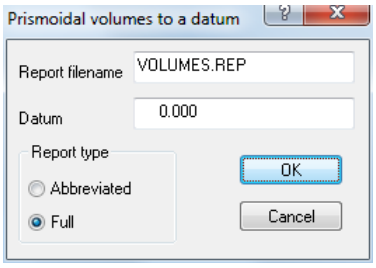
Cut volume: 7,582.46 Plan area: 9,731.76
Fill volume: 5,615.87 Surface area: 10,030.82

	Ground Type:	Cut:	Fill:	Plan area:	Surface area:
Existing:	BANK	221.81	4,294.87	3,342.42	3,408.45
Proposed:	Other	221.81	4,294.87	3,342.42	3,408.45
Existing:	EDGE	587.28	489.78	723.63	743.80
Proposed:	Other	587.28	489.78	723.63	743.80
Existing:	GRASS	5,896.83	148.81	4,272.28	4,435.94
Proposed:	Other	5,896.83	148.81	4,272.28	4,435.94
Existing:	ROAD	876.55	682.42	1,393.44	1,442.62
Proposed:	Other	876.55	682.42	1,393.44	1,442.62

Page 2 of 4

32.7.2 Volumes to a Datum (Prismoidal) (Model Volumes Menu)

This method allows the user to calculate volumes using the prismoidal method between a model and a specific datum set within the 'Prismoidal Volumes to a Datum' dialog.

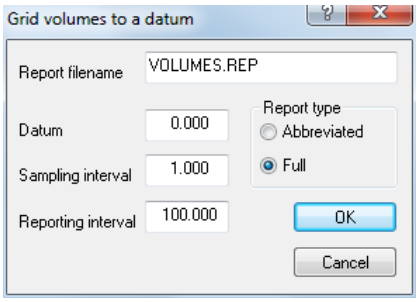


See Also

Prismoidal volumes tutorial

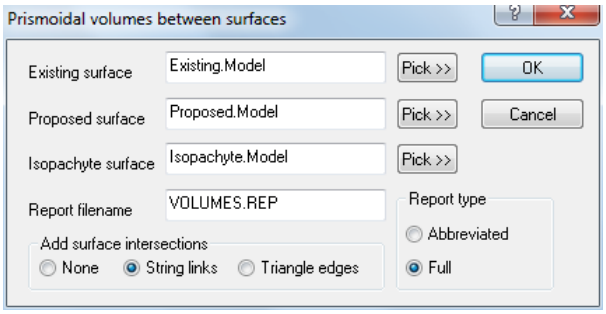
32.7.3 Volumes to a Datum (Grid) (Model Volumes Menu)

This method allows the user to calculate volumes using the grid method between a model and a specific datum set within the 'Grid Volumes to a Datum' dialog.



32.7.4 Volumes Between Surfaces (Prismoidal) (Model Volumes Menu)

This option allows the user to calculate volumes between two surfaces using Prismoidal method and produces a detail volumes report

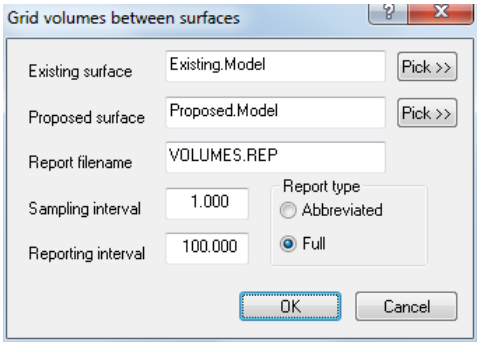


See Also

Prismoidal volumes tutorial

32.7.5 Volumes Between Surfaces (Grid) (Model Volumes Menu)

This option allows the user to calculate volumes between two surfaces using Grid method and produces a detail volumes report



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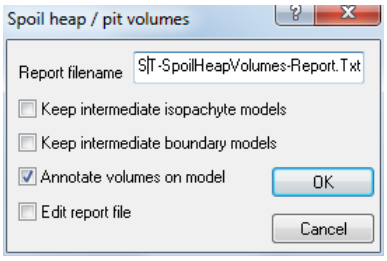
32.7.6 Volumes of Spoil Heaps / Pits (Model Volumes Menu)

This option allows the user to calculate volumes for all spoil heaps or pits contained in the model at one time. That is, any boundary defined by a clip polygon will be used in the calculations and a separate boundary and isopachyte model generated for each one. The method used for computing the volumes is the prismodial method, which is potentially the most accurate method of volume calculation between surfaces.

Once this option has been selected, the user will be presented with a dialog and the following options:



Keep intermediate isopachyte models

This option means that each isopachyte model generated during the volume calculation process will be kept and named according to the spoil heap number.

Keep intermediate boundary models

This option means that all boundary models used to calculate the spoil heap volumes will be saved and named according to the spoil heap number.

Annotate volumes on model

This option means that each spoil heap in the model will be annotated with a number, the area and the amount of cut and fill it contains.

Edit report file

This option allows the user to view and edit the volume report file.

See also Spoil heap volumes tutorial

32.7.7 Volumes And Areas by Depth (Model Volumes Menu)

This option allows the user to calculate material volumes by areas and depth, using a horizontal section end-areas method of calculation. It is often most appropriate to perform this calculation on an isopachyte model, in which the horizontal sections are representative of thickness or depth of material between two other surfaces.

32.7.8 Volumes by Ground Type to a Datum (Model Volumes Menu)

This option computes separate volumes for each ground type in the model, to a datum that may be separately specified for each ground type. To use this option, first use the Add/ Remove Triangles option to allocate ground types., and enter a value in the datum field for each record in the ground type library. This option is similar to calculating a prismoidal volume to a datum for each ground type.

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32.7.9 Volumes by Ground Type to a Depth (Model Volumes Menu)

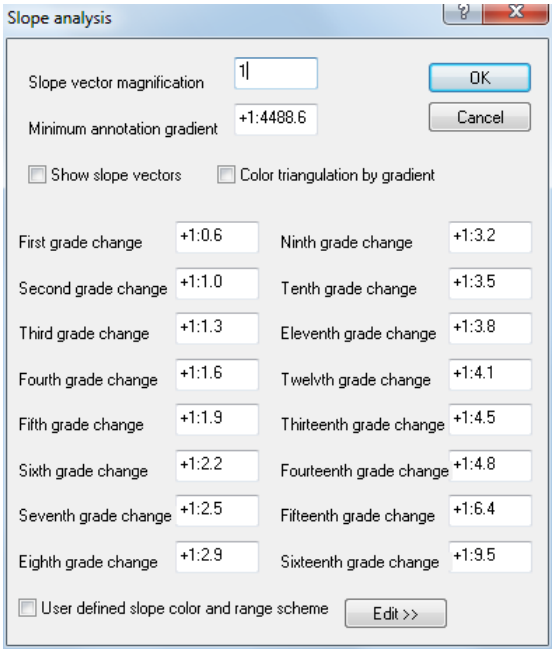
This option computes separate volumes for each ground type in the model, to a given depth that may be separately specified for each ground type. To use this option, first use the Add/ Remove Triangles option to allocate ground types., and enter a value in the depth field for each record in the ground type library. This option is useful for calculations such as the effect of stripping top-soil, and equates to the plan area under each ground type multiplied by the plan area under that ground type.

32.7.10 Areas by Ground Type (Model Volumes Menu)

This option reports the total plan and slope areas of the triangulation, broken down by ground type. To use this option you must first assign ground types to the triangulated surface, using the Add / Remove triangles option.

32.7.11 Areas by Gradient (Model Volumes Menu)

This option reports the total plan and slope areas of the triangulation, broken down by ground type. On selecting this option, you will be presented with the slope analysis dialog, which allows you to enter the gradients between which areas will be measured.

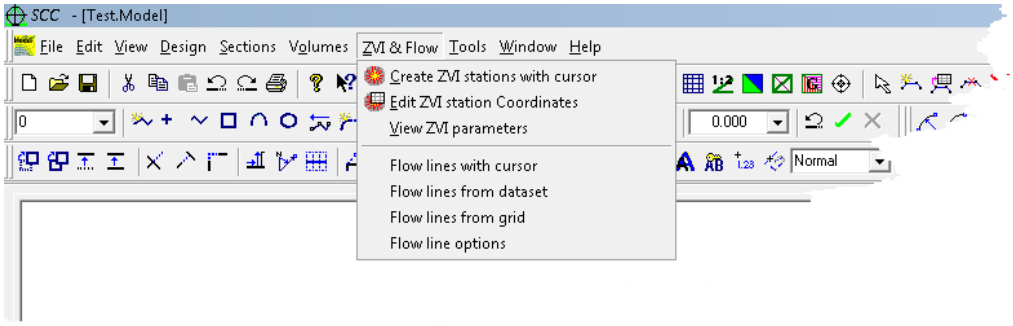


You also have the option of colouring the triangulation by gradient or displaying the slope vectors as this point. Note that the gradient of any given triangle is given by the steepest grade across that triangle, and the slope vector is the direction in which this gradient occurs.

32.8 Model ZVI & Flow Menu

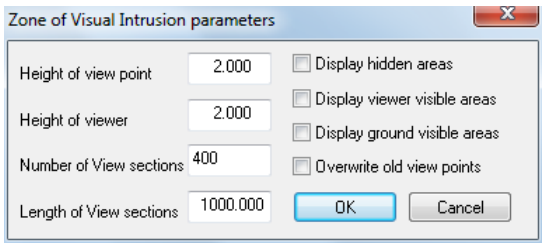
ZVI (Zone of Visual Intrusion) or viewshed analysis, otherwise known as intervisibility analysis is an analysis that determines all the points on a surface at which a given object or set of objects is visible. This is accomplished by projecting a series of polar rays (view sections) at even horizontal angular intervals from each object (view station) being analysed. These rays are coloured, based on whether the object is visible either from the ground or at a defined eye

level.



32.8.1 Create ZVI Stations with Cursor (Model ZVI & Flow Menu)

The areas where the view station is visible at ground level and above are shown in yellow. The areas where the view station is not visible at ground level but is visible at eye level and above are shown in magenta. The areas where the view station is hidden at eye level and below are shown in grey. Note the shadowing effects caused by the buildings for example above and below the view station on the left of the picture. Everything behind these such buildings is hidden from view. It is essential for all objects to be surveyed fully in 3D if you intend to use viewshed analysis. In the example above, the trees have not been surveyed as 3D objects and as such will not be used in the viewshed analysis. Concave or hollow areas may distinguished as being hidden from view while not casting any shadows. Use of SCC viewshed analysis does not have any overhead in terms of memory or disk storage space required.



Height of View Station

This field contains the height of the view station above the ground. A value of zero will place the view station at ground level.

Height of Viewer

This field contains the eye level or height of the viewer above the ground.

Number of View Sections

This is the number of radiating view sections that will be cast from each view station. The view sections will be cast at a regular angular interval from each view station. A value of 360 would cause a view section to be generated every sexagesimal degree, 400 every metric degree.

Length of View Section

This is the maximum length to which views sections will be cast. It is assumed that view stations will not be visible at greater distances than the entered value.

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Display Hidden Areas

This switch defines whether to highlight areas hidden to the station point.

Display Viewer Visible Areas

This switch defines whether to highlight areas visible from the viewer station point.

Display Ground Visible Areas

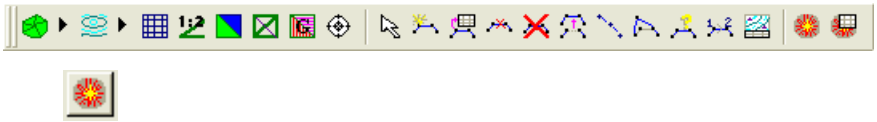
This switch defines whether to highlight areas visible from the station point.

Overwrite old View Points

This allows old view station co-ordinates to be retained or overwritten with new station co-ordinates.

Shortcuts

Toolbar:

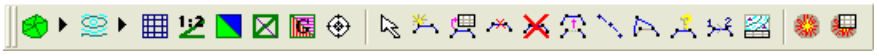


32.8.2 Edit ZVI Station Coordinates (Model ZVI & Flow Menu)

The co-ordinate data sheet containing the co-ordinates of the view stations is presented for viewing or editing. It may be saved as a SURVEY file.

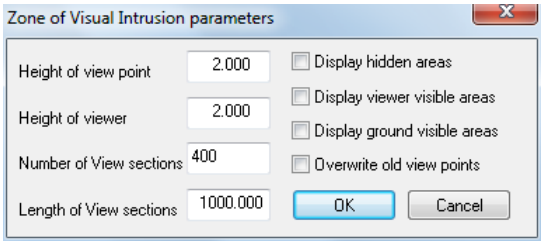
Shortcuts

Toolbar:



32.8.3 View ZVI (Model ZVI & Flow Menu)

This option allows the user to view current ZVI.



See Also

Create ZVI stations for more information

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32.8.4 Flow Lines With Cursor (Model ZVI & Flow Menu)

This allows you to select flow line source points interactively with the mouse.

See Also

Flow lines tutorial

32.8.5 Flow Lines From Dataset (Model ZVI & Flow Menu)

This creates flow line source points from a SCC coordinate file.

See Also

Flow lines tutorial

32.8.6 Flow Lines From Grid (Model ZVI & Flow Menu)

This creates a regular grid of flow line source points across the entire model.

See Also

Flow lines tutorial

32.8.7 Flow Lines Options (Model ZVI & Flow Menu)

This allows you to control the features used to control flow lines based on the number of incoming flow lines. It is also used to specify the grid interval used when creating flow lines from a grid, and control whether sink points are annotated.

Flow Grid Interval

The grid interval used when creating flow line source points at a regular interval.

Compute Cumulative Flows

This controls whether the number of lines that pass through a given point are counted. This is required is compound flow lines are to be drawn using different features, but is slower when generating flow lines.

Local Sink Feature

The feature code used to draw flow line sink points.

Annotate Sinks

This controls whether sink points are annotated with an index number and counter.

Minimum Line Count To Display

Flow lines that have less than this number of input lines passing through them will not be displayed.

Minimum Sink Count to Display

Sink points that have less than this number of input lines reaching them will not be displayed.

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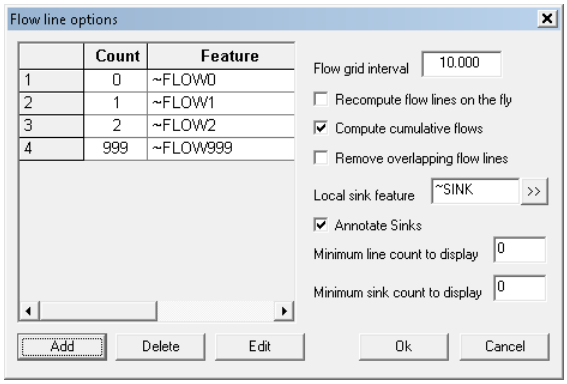
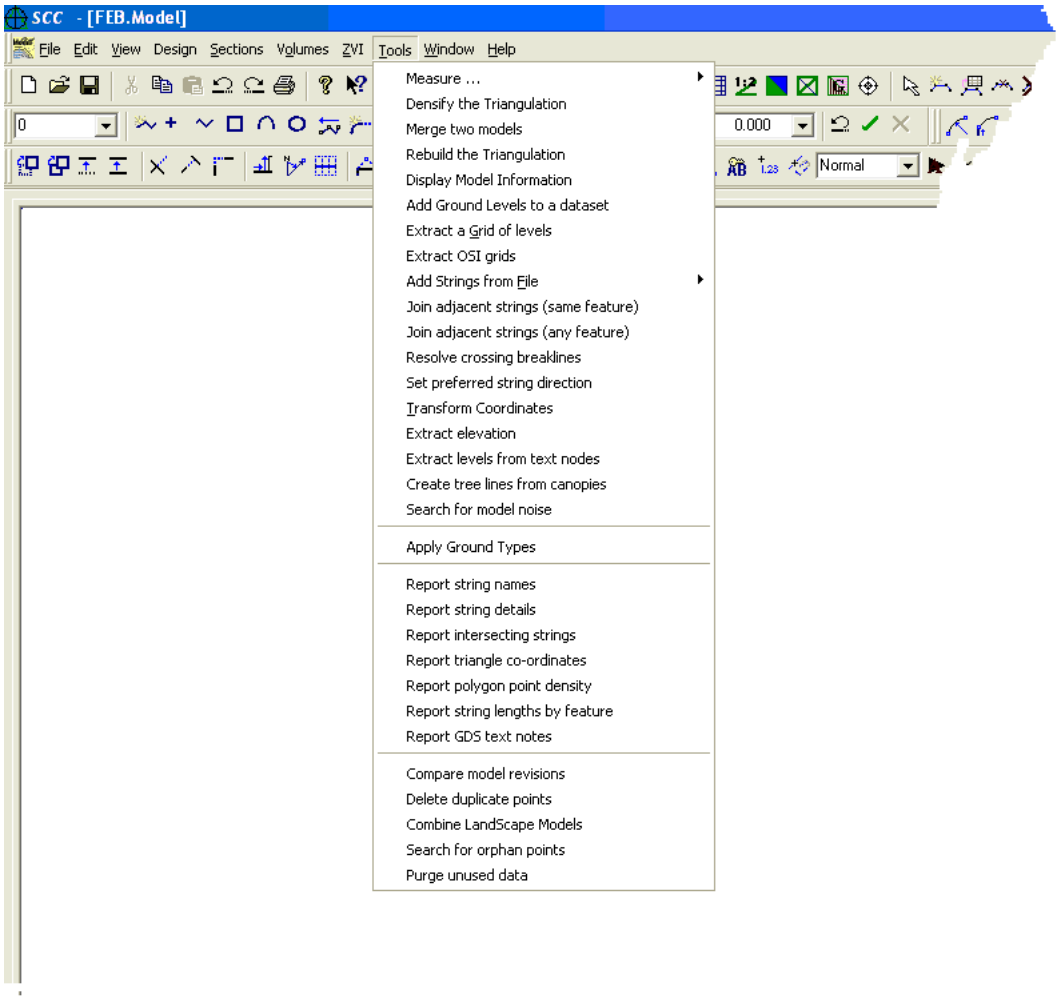


See Also

Flow lines tutorial

32.9 Model Tools Menu



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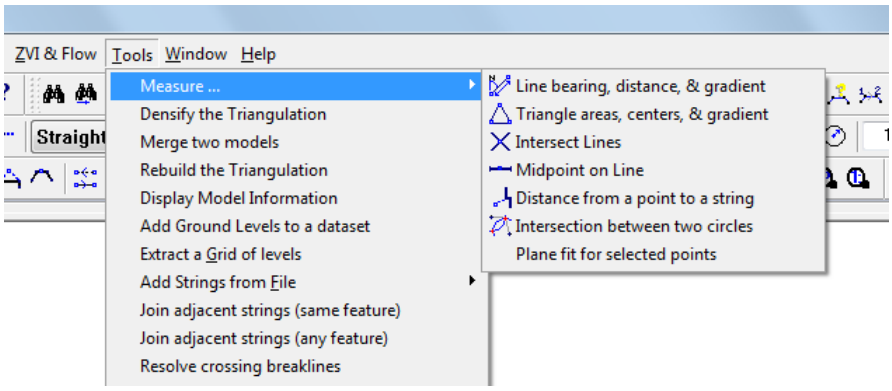
32.9.1 Measure (Model Tools Menu)



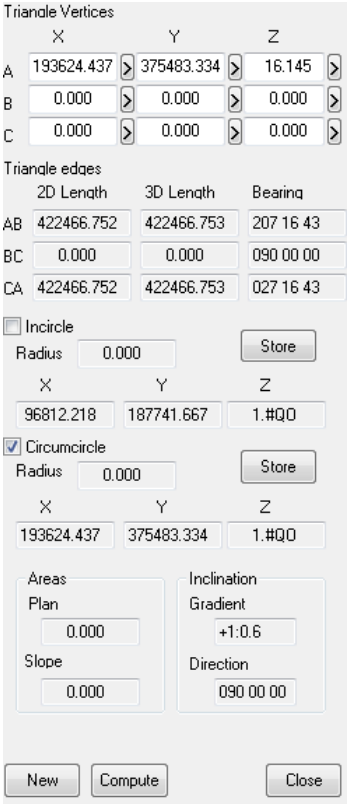
The following options are available within **'TOOLS** > **Measure':**

Line Bearing, Distance & Gradient

This option allows the user to compute bearing, distances and gradients between two points. Coordinates can be manually entered or chosen with the cursor.

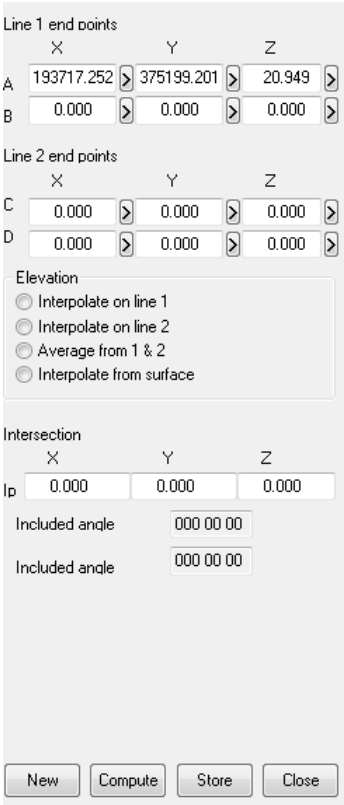
Triangle Areas. Centres & Gradient

This option allows the user to compute the in-centre, circum-centre, radius, area (plan and slope), length (2D and 3D) and bearing between three points. Coordinates can be manually entered or chosen with the cursor.



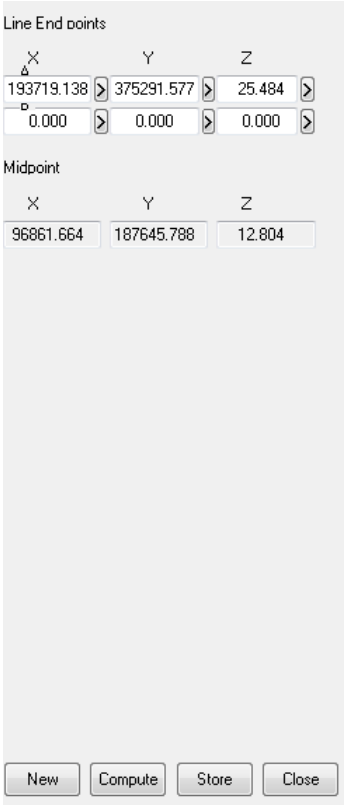
Intersect Lines

This option allows the user to calculate the intersection between two strings. Coordinates can be manually entered or chosen with the cursor.



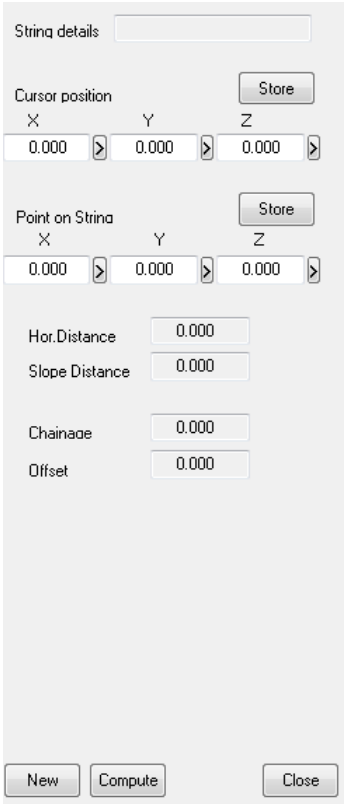
Midpoint on Line

This option allows the user to calculate the midpoint on a line. Coordinates can be manually entered or chosen with the cursor.



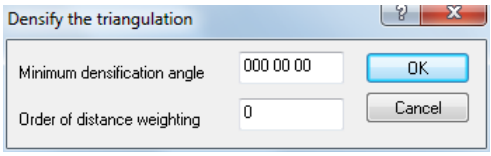
Distance from a Point to a String

This option allows the user to calculate the distance from a point to a string, selected using the 'Pick>>' button.



32.9.2 Densify the Triangulation (Model Tools Menu)

This field specifies whether additional points will be inserted in each breakline at a given interval.



Densifying breaklines increases the overall model size while improving the quality of triangulation around breaklines. Densification may be used in situations where long breaklines have been surveyed, and additional triangles are required on these breaklines N.B. Breakline post-processing will ensure that a minimum number of points will be added to breaklines in order that those breaklines are honoured in the model.

Max. segment length

This field specifies the maximum length that a breakline segment will be. If a segment is longer than this it will be broken down into a series of smaller segments. It is only used if the 'Densify breaklines' switch is turned on.

32.9.3 Merge Two Models (Model Tools Menu)

This option allows the user to merge an existing survey model with a proposed design model to achieve an overall representation of the area after the design has been constructed. For example, a proposed model of a building may be merged into a model of the existing green field site to achieve a model representing the completed project after construction.

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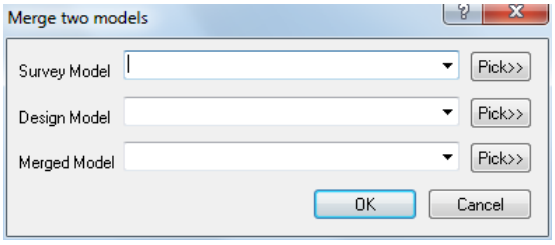
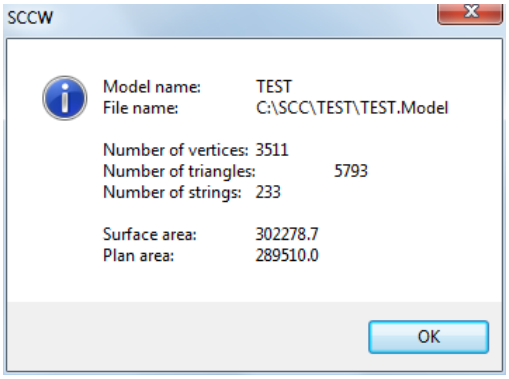


32.9.4 Rebuild The Triangulation (Model Tools Menu)

This option forces the triangulation to be recomputed.

32.9.5 Display Model Information (Model Tools Menu)

This options details model information in a screen dialog box, for example:

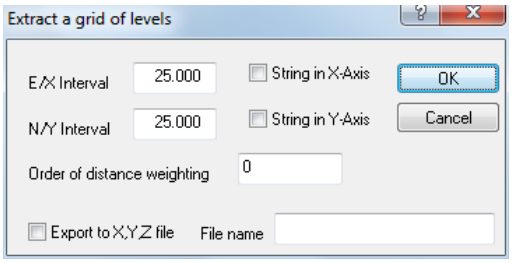


32.9.6 Add Ground Levels to a Dataset (Model Tools Menu)

This option allows the user to strip out ground levels from an open model for each point (x, y position) present in the dataset.

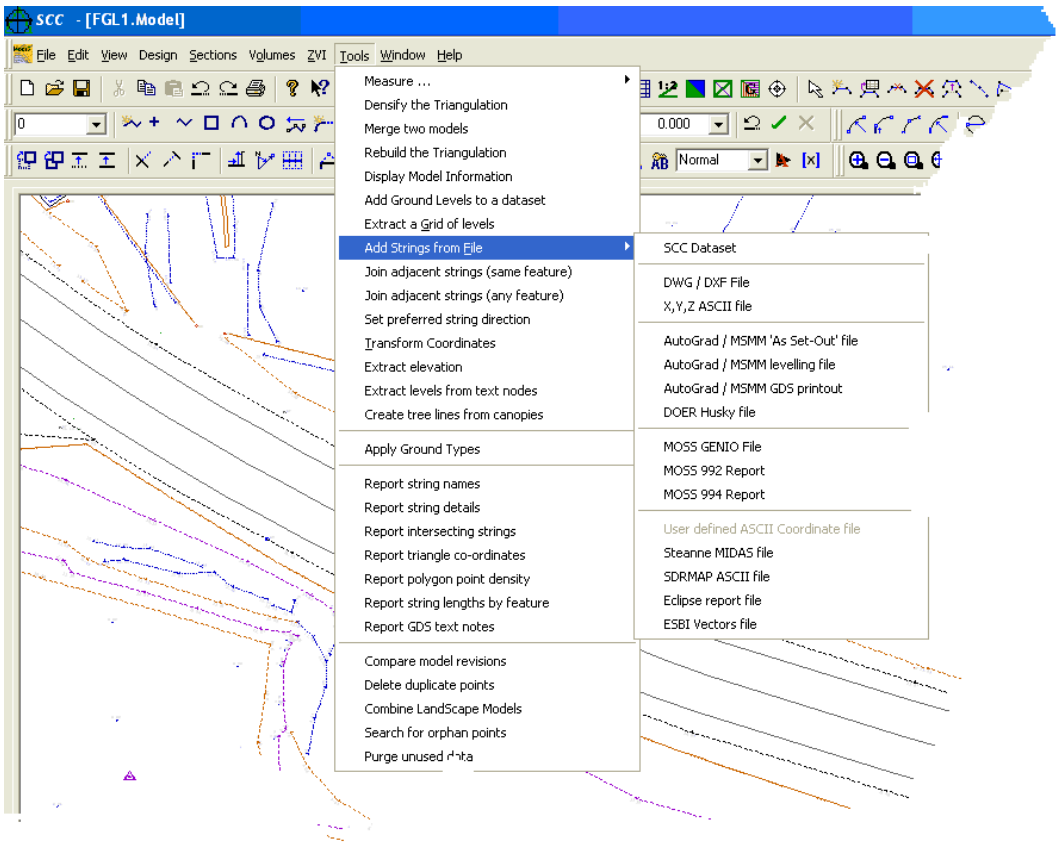
32.9.7 Extract A Grid of Levels (Model Tools Menu)

This option allows the user to extract a defined grid from a model.



32.9.8 Add Strings From File (Model Tools Menu)

This option allows the user to add additional data to an existing Model.



The following options are available:

SCC Dataset, DWG/DXF File, X,Y,Z ASCII file, AutoGrad/MSMM 'As Set-Out' file, AutoGrad/MSMM levelling file, AutoGrad/MSMM GDS printout, DOER Husky file, MX GENIO File, MX 992 Report, MX 994 Report, Steanne MIDAS file, SDRMAP ASCII file, Ecllipse report file and ESBI Vectors file.

See Also

Detail Coordinate

Import DWG/DXF File

Import Fixed format ASCII file (File Menu)

Import X,Y,Z ASCII file (File Menu)

Import AutoGrad/MSMM 'As Set-Out File' (File Menu)

Import AutoGrad/MSMM Levelling File (File Menu)

Import AutoGrad/MSMM GDS Printout (File Menu)

Import DOER Husky File (File Menu)

Import MOSS GENIO File (File Menu)

Import MOSS 992 Report (File Menu)

Import MOSS 994 Report (File Menu)

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Import Steanne MIDAS File (File Menu)

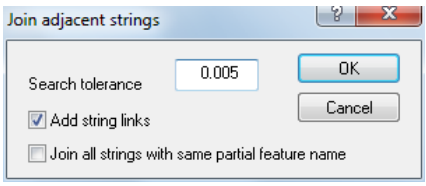
Import SDRMAP ASCII File (File Menu)

Import Eclipse Report File (File Menu)

Import ESBI Vectors File (File menu)

32.9.9 Join Adjacent Strings (Same Feature)(Model Tools Menu)

This option is used to join all strings together in the model, within a specified tolerance, that have the same feature name. This is particularly useful when processing polylines from CAD that were exploded into lines for editing purposes.



Add String Links

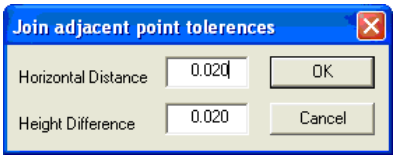
This option will convert strings into closed polygons if there start and end points lie within the stated tolerance.

Joining strings with the same partial feature name

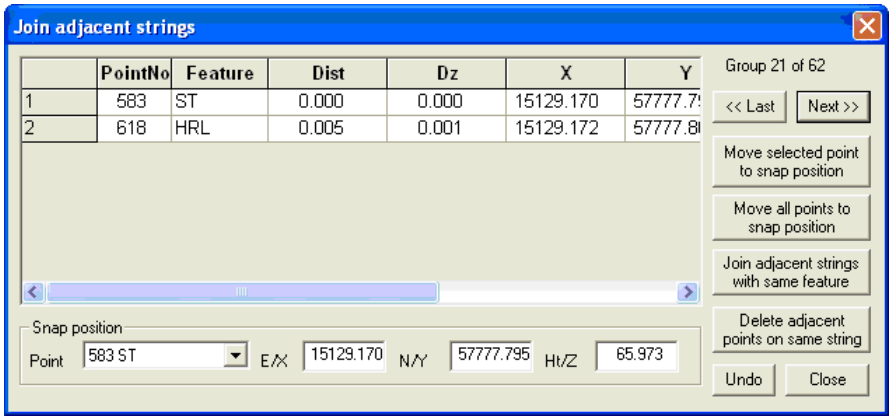
This option ignores the numeric part of the feature name when performing the comparison. For example, KB01 and KB02 would be considered to have the same feature name in this case, if the feature KB was in the feature library, and the features KB01 and KB02 were not. In this case the edited string will be given the name KB.

32.9.10 Join Adjacent Strings (Any Feature) (Model Tools Menu)

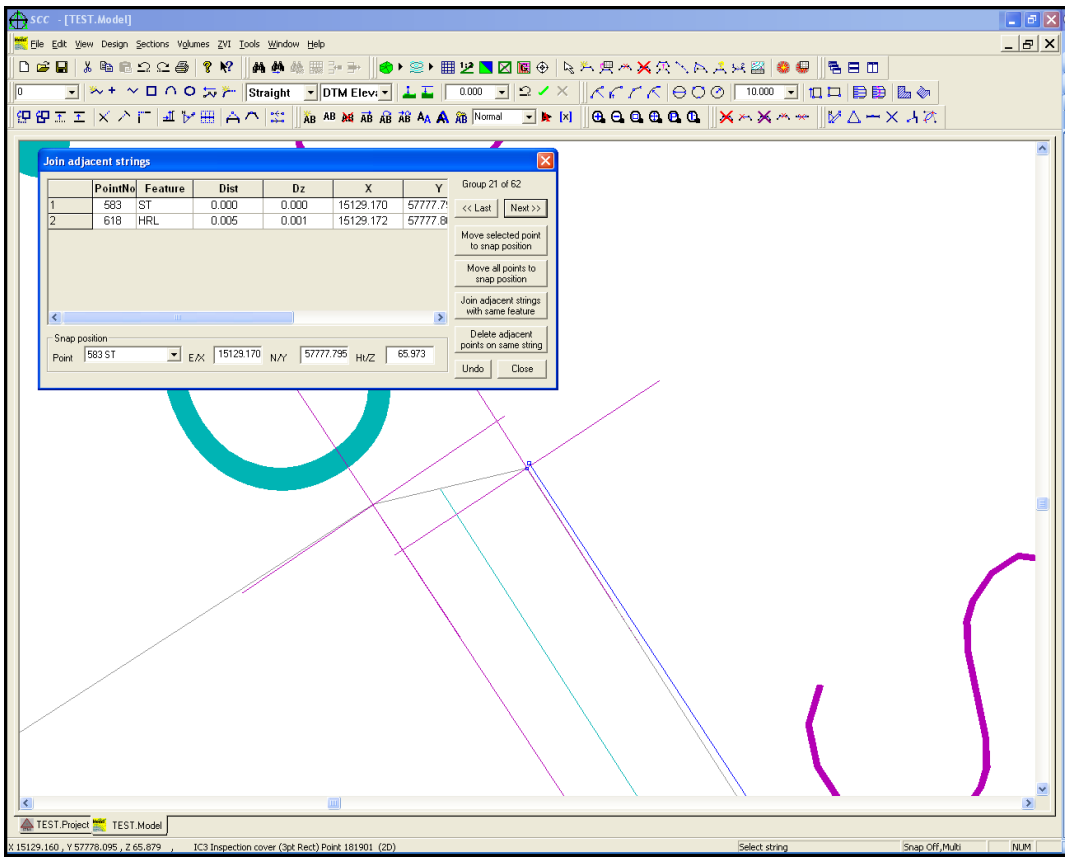
This option is used to search for groups of proximate points that are within a given horizontal and vertical distance from one another, and edit them such that they are all snapped to the same point. This function is available in the model via 'TOOLS > Join Adjacent Points (any feature)'. On selecting the tool you are first prompted for your horizontal and vertical tolerances .



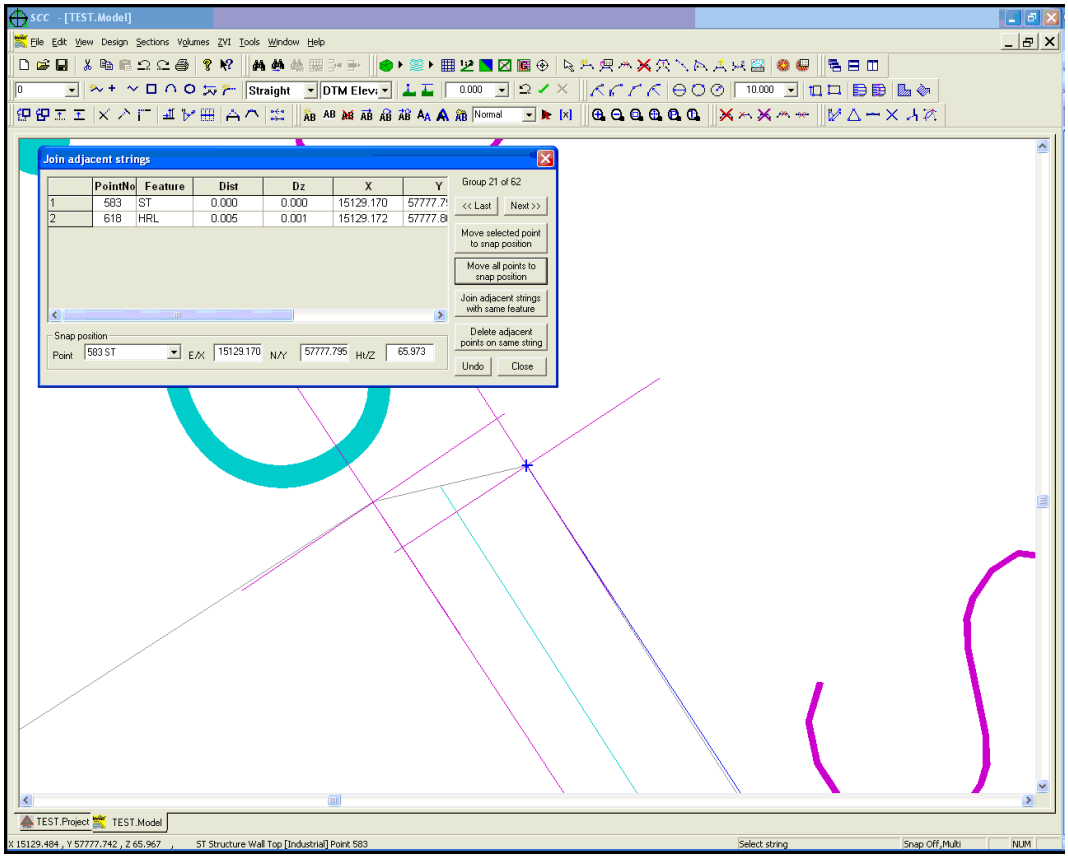
On entering your tolerances, SCC searches for all groups of proximate points, and displays the dialog shown below. To continue, you should ideally be zoomed in close enough that millimetre distances are visible on screen. The screen will be centred on the first group of proximate points, and these points will be highlighted in plan. The next and last buttons may be used to pan between all the groups of proximate points, and other editing buttons are available to resolve those points. The position to which points will be snapped may also either be selected or entered directly. The various editing options are appropriate to the different model conditions shown below;



If the group is made up of string end points that have the same feature name, select the 'Join adjacent strings with same feature' option.

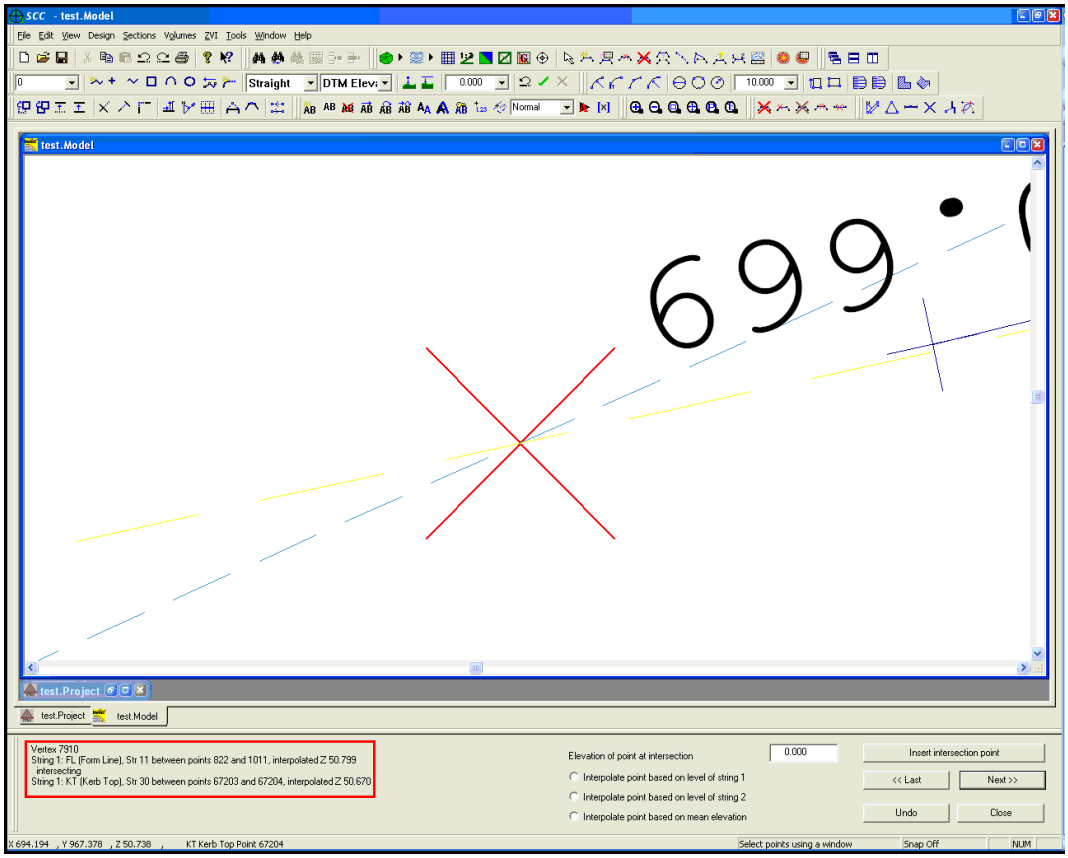


This will also close polygons with links where appropriate.



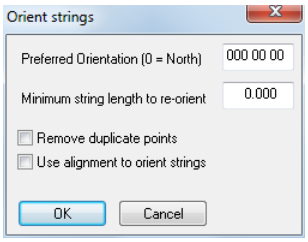
32.9.11 Resolve Crossing Breaklines (Model Tools Menu)

This option allows the user to quickly resolve breaklines such as a Gully with a Road Marking on top. That is, if the contractor has surveyed a gully with an elevation of 10m and subsequently a Double Yellow line with elevation of 10.5m which crosses over the gully, a 'red cross' highlights the 3D error where both intersect. With this tool, the user has the option to create an intersection point at the correct level on either string.



32.9.12 Set Preferred String Direction (Model Tools Menu)

This option allows the to globally re-orient either selected strings, or all strings in the model, such that they all have the same general orientation. This is particularly useful for annotation purposes, and when creating long sections or profiles from existing survey strings. When run, this option reverses any strings, over the specified length, whose average orientation is away from the selected orientation. Polygonal strings will be given an clockwise orientation. This option also allows the user to set string direction based on an active alignment attached to the model, which is beneficial for river section generation.



32.9.13 Transform Coordinates (Model Tools Menu)

This option permits the user to create or edit a transformation from one co-ordinate system to another.

See Also

Transform Coordinates

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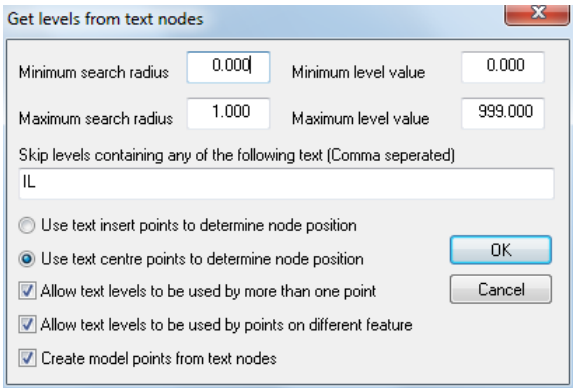
32.9.14 Extract Elevation (Model Tools Menu)

This option is used to extract an elevation of façade model from a plan model. This is carried out by selecting two points on a line parallel to the façade required. A new model will be generated, with the coordinate system aligned to the selected line, and the Y and Z axes swapped. If there is any data selected prior to choosing the base line, only that data will be placed in the elevation model, otherwise the entire plan model will be used.

Note that the elevation model will have a different coordinate system (grid) to the original survey model. If 'Snap 3d' is NOT selected when generating the base line, that is either 'Snap point' or 'No Snap' is used, the elevation will have an X axis corresponding to the chainage along the base line, a Y axis corresponding to the model height, and a Z axis corresponding to the offset distance from the base line. If snap 3D is selected, these axes are also used, but the Y axis corresponds to the vertical distance from the base line rather than the absolute elevation.

32.9.15 Extract Levels from Text Nodes (Model Tools Menu)

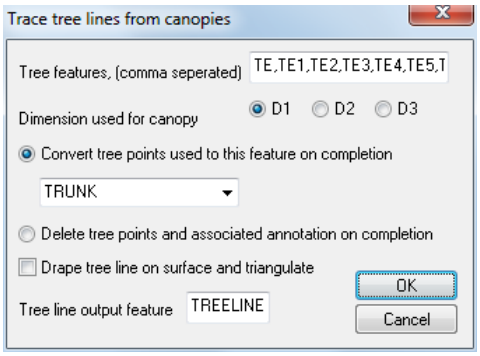
This option allows the user to convert 2d drawings to 3d models using the text nodes in that model. This is primarily aimed at creating models from 2D DXF file. This option searches for text nodes within a given distance from each point and sets the level of that point accordingly. Filters are provided for given text prefixes (for example, IL), elevation ranges, and feature name matching. Where levels are not found for given points, they can be interpolated either from surrounding string points or the rest of the surface.



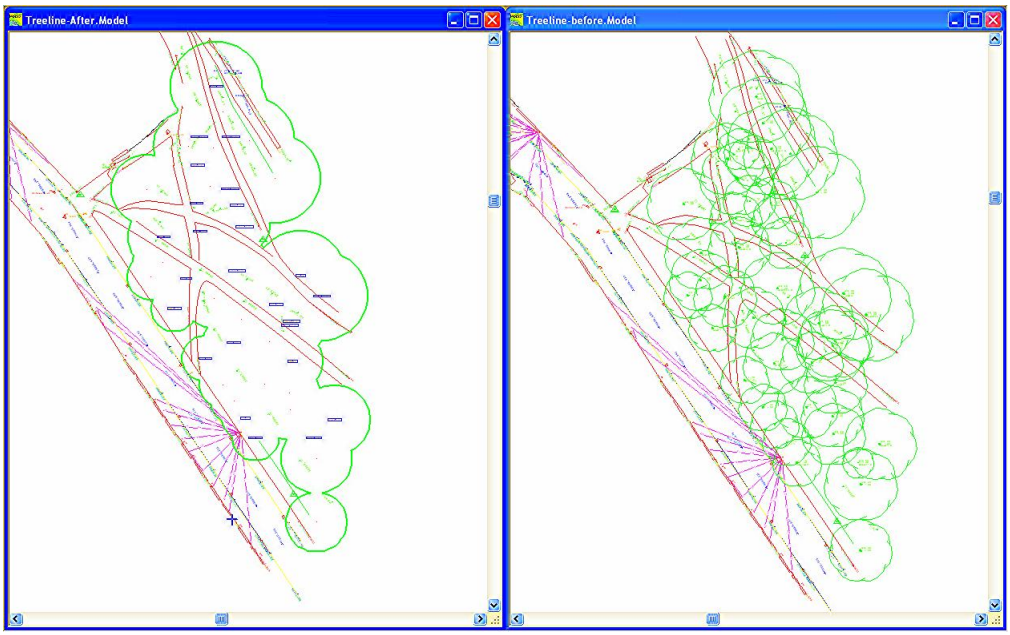
Entering minimum and maximum level values can be useful for excluding numeric text that does not relate to surface height, such as tree dimensions, station coordinates, etc…

32.9.16 Create Tree Lines From Canopies (Model Tools Menu)

This option allows the user to create tree canopy outlines lines from select tree symbols. The user can choose to either keep or remove the trunk, and allow use of one or more tree features.



Example of drawing after canopy outlining, and the original model beforehand. Note that the canopies are stored as polygonal strings, suitable for area measurement and ground type analysis and viewing.



32.9.17 Search for Model Noise (Model Tools Menu)

This option is used to remove noise from surface models, typically those created using scanning technology, such as scanners or LIDAR. The noise in this case is defined as anomalous local low or high points that have been inadvertently been included in the model, but are not representative of the typical surface. Examples of such noise include street furniture or vehicles in a road model. The picture below illustrates an example model including noise.

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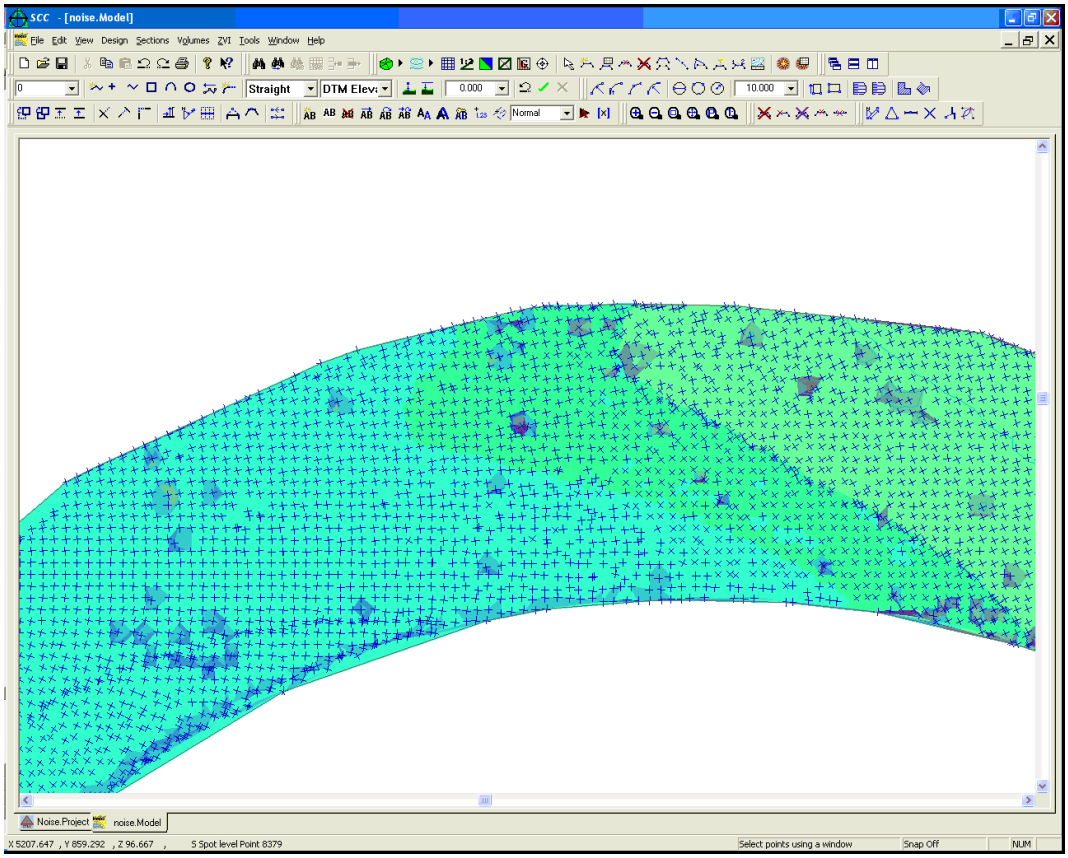
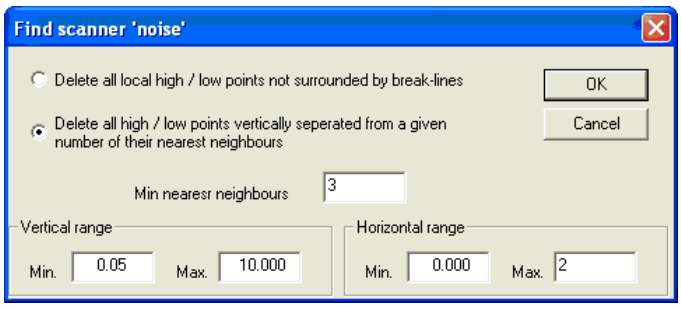


When the Search for Model Noise option is selected, the find scanner noise dialog is presented, which contains the following fields;



Delete all local high / low points not surrounded by break-lines

Selecting this option only considers local high points and local low points for deletion. A local high or low point, in this case, is a point that is higher or lower than all of its neighbours, and is not surrounded by a break-line

Delete all high / low points vertically seperated from a given number of their nearest neighbours

Selecting this option only considers any points with a given number of neighbours higher or lower than the point in question for deletion. Neighbouring points lying on break-lines are not counted in this computation.

Min nearest neighbours

This field controls the number of higher or lower neighbours required to meet the above criterion.

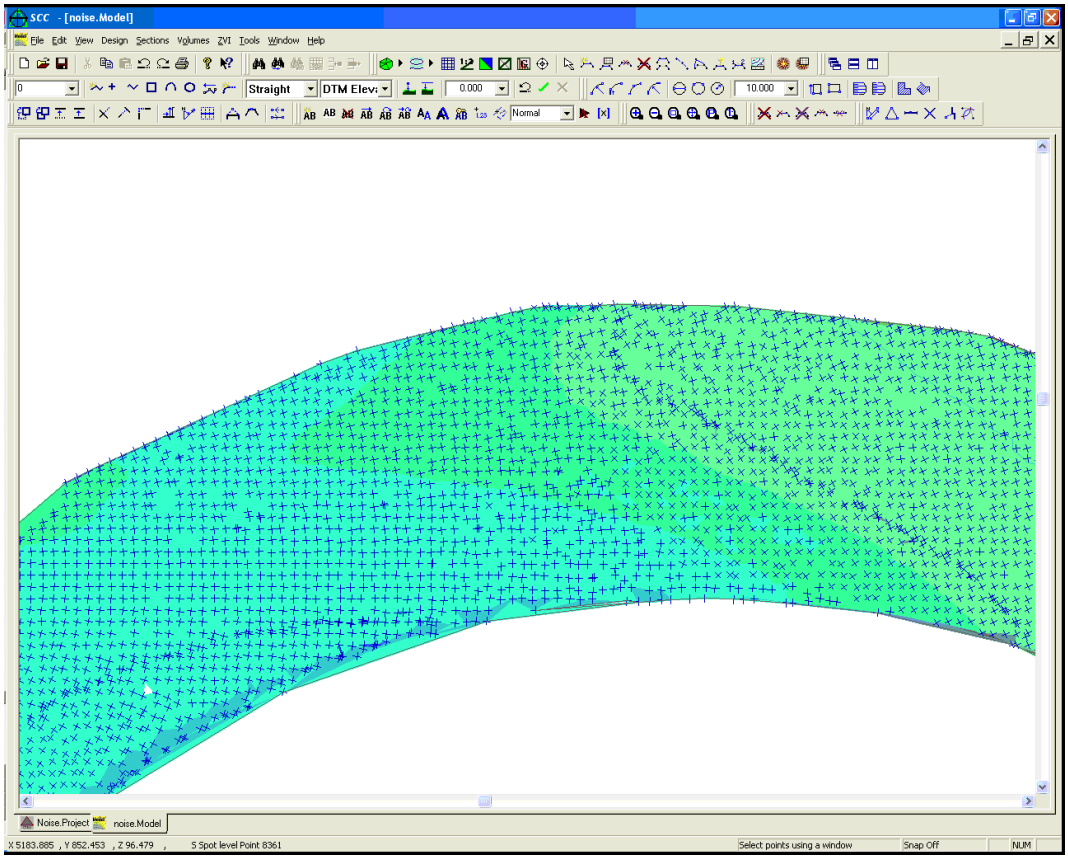
Vertical range

These min and max values represent the allowable range of level differences that are considered to constitute model noise.

Horizontal range

These min and max values represent the allowable range of horizontal distances between any two points that allows them to be considered as neighbours.

Note that after running this option, all of the points meeting the entered noise criteria will be selected. Use the 'Delete points' option to delete them from the model entirely, or pick a DTM code of 'Elevation' or 'Approx' to remove the from the triangulation.



32.9.18 Apply Ground Types (Model Tools Menu)

This options applies textures to the current model previously set up within the Ground Type Library. This uses the **Ground type** field in the feature library to ascertain the preferred ground type for each string. It works by filling closed polygons with the right ground type, and using points as seeds to fill remaining triangles.

See Also

Ground Type Library (View Menu)

32.9.19 Report String Names (Model Tools Menu)

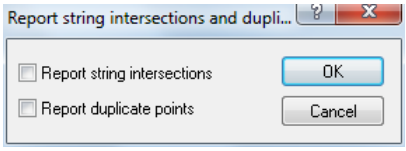
This options reports all string names present in a model.

32.9.20 Report String Details (Model Tools Menu)

This option reports string details of all string in the model. For example, feature Name, MX code number of points on string and length

32.9.21 Report Intersecting Strings (Model Tools Menu)

This option allows the user to report string intersections (denoted in model graphically by red crosses) and duplicate points.



32.9.22 Report Triangle Coodinates (Model Tools Menu)

This option report coordinates of triangle within a model.

32.9.23 Report Polygon Point Density (Model Tools Menu)

This option allows the user to automatically establish the number of points in a polygon.

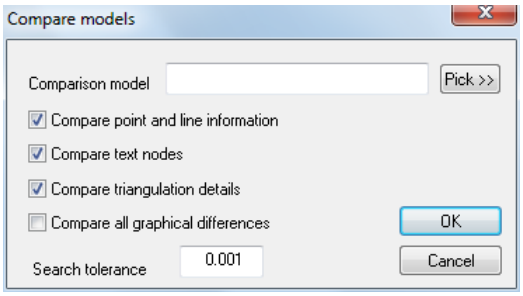
The point density report will deselect a number of points during the course of its operation, this is true of many operations using pre-selected data, and does not affect the validity of the report. Note that using an existing string to generate the polygon is not advisable if you wish to include all the points on the polygon in the report, as points on the polygon may not be considered to be in the polygon. This is particularly true when using geometries such as circle fitting, as the survey points will not lie exactly on the modelled circle where more than three points have been used.

32.9.24 Report String Lengths by Feature (Model Tools Menu)

This option reports the cumulative length of selected strings, or all strings in the model if no strings are selected, broken down by feature. It is typically used in asset and utility surveys where the total length of given types of pipes or cables is required. To ascertain the lengths of individual strings use the Report String Names, or Report String Details option.

32.9.25 Compare Model Revisions (Model Tools Menu)

This tool is used to compare two models for any differences.



These differences are broken down as follows;

Compare Point and Line Information

Point and line changes, which indicate a significant change in model, probably relating to model editing.

- Point Moved
- Point Deleted
- Point Added
- Point connects to a different point
- Point number changed
- Point feature changed
- Point links to a different observation

Compare Text Nodes

Text nodes, which can indicate text or model editing.

- Text Contents changed
- Text Appears Different
- Text Moved
- Text Deleted
- Text Added
- Text Rotation Changed
- Text Size Changed
- Text Alignment Changed
- Text Justification Changed
- Text Refers to a Different Point
- Text Feature Changed

Compare Triangulation Details

Triangulation changes, which will typically be present if there are any point and line changes.

- Vertex Status Changed
- Triangle Coordinates Different
- Triangle Area Different
- Surface Height Different
- Surface Height Different
- Triangle Deleted

Compare All Graphical Differences

Graphic differences, which will typically be present if there are any point and line changes. They will also be present if there are feature library changes.

- Graphics Appear Different
- Graphics Colour Different
- Graphics Weight Different

Stations

- Station Deleted
- Station Plan Position
- Station Height Position Changed

When using this option, the user will typically not search for graphic and triangulation changes, as they will usually have been created as a consequence of model editing, which is shown more succinctly under point and line changes.

32.9.26 Delete Duplicate Points (Model Tools Menu)

This option allows the user to delete all duplicate points in the model, based on horizontal and vertical tolerances, whether the points are on strings or are discrete points, and whether or not they have the same feature name.

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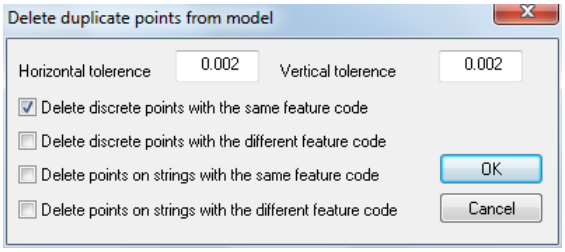


Note that deleting all string points with different feature names is generally not a good idea, as these are common and correct in many surveys, as they indicate the position of a junction between two features; for example, the common point between a gate and a fence.

32.9.27 Combine LandScape Models (Model Tools Menu)

This option is used when transferring model data from LandScape into SCC. This operation may be carried out as follows;

1. Export your model from LandScape as GENIO
2. Export your model from LandScape as 3DDXF
3. Export trees from LandScape using the print option
4. Export stations from LandScape using the print option
5. Import the trees into SCC using 'File / Import / LandScape ASCII Text Notes' from the project control screen, and save this trees dataset.
6. Import the stations into SCC using 'File / Import / LandScape ASCII Stations' from the project control screen
7. Model and save the 3D DXF file, selecting the appropriate model scale
8. Model and save the Genio file, selecting the appropriate model scale
9. From the model select Tools / Combine LandScape Models, and pick the saved DXF and GENIO models.
10. In the new combined model, select Tools / Add strings from file / SCC Dataset, and select the saved tree file.
11. Use Copy and Paste to copy the project stations into the model
12. Save the combined model

Using this sequence of events leaves you with an SCC model that contains the following;

1. All the reduced line work from the DXF file, with the feature names taken from the Genio file
2. All the text from the DXF file with the feature name based on the DXF layer name.
3. All the stations, annotated from the DXF file, with values in the station file.
4. All the trees with correct survey dimensions

32.9.28 Search for Orphan Points (Model Tools Menu)

This option searches for, and highlights, all orphaned points in the mode. An 'orphaned' point, is a single point that, due to editing, is the only point on what otherwise should be a line-string, such as a kerb or building. Orphan points can cause labelling problems when exporting in GENIO format to MX/MX or LSS.

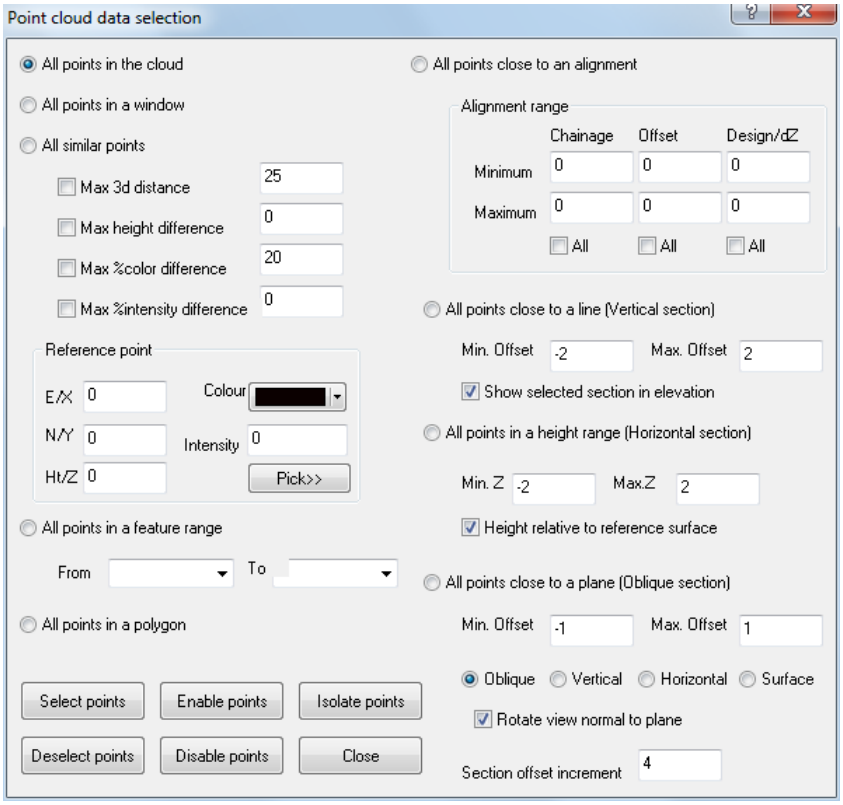
32.9.29 Purge Unused Data (Model Tools Menu)

This option removes unused symbols and feature library entries from the model.

32.10 Model Cloud Menu

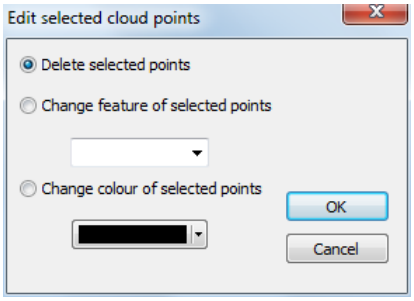
32.10.1 Select Data (Model Cloud Menu)

This option allows the user to control how data is selected (i.e. points in a window, points in a polygon, using a horizontal or vertical section / slice, relative to an alignment, points similar to a given reference point, points close to another SCC surface) and what to do with picked data. This includes selecting and deselecting data as per typical SCC usage, locking and unlocking data which hides the data and prohibits it from being used in future operations, and isloting data which is the same as locking everything except the picked points.



32.10.2 Edit Selected Points (Model Cloud Menu)

This option provides edit options for selected data: deleting, change feature to another group available from the drop down list or changing the colour of selected points.



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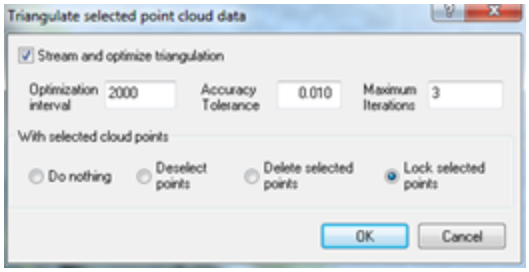
32.10.3 Copy To New Cloud (Model Cloud Menu)

This option allows the user to easily copy selected data to a new model.

32.10.4 Triangulate Points (Model Cloud Menu)

This option provides a method of producing an optimized triangulation of selected data. This reduces the amount of points used from the selected points in the cloud to just those required to achieve the stated vertical tolerance, in this case 10mm.



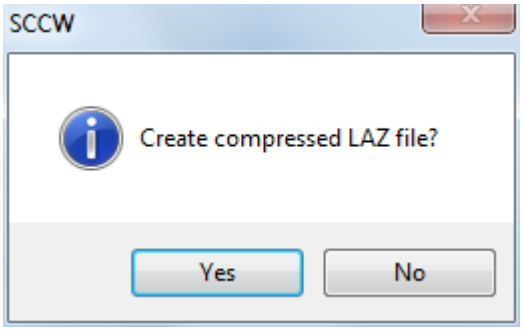
Note, this option can be slow depending on the parameters and the number of points selected. To improve performance and final result remove or isolate noisy features such as grass, trees, cars, street furniture and overhead cables prior to running this option. Only selected points whose features have an analysis type of **Ground** are considered when running this option, so simply changing the feature of such points to any other feature will accomplish this.

32.10.5 Export Points (Model Cloud Menu)

Two export options are available: LAS or PTS files.

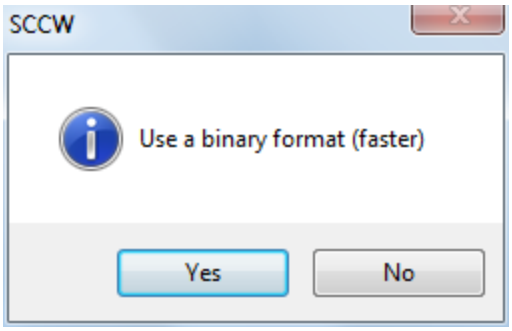
32.10.5.1Export LAS

This option exports a LAZ file.



32.10.5.2Export PTS

This option exports a binary format PTS file.



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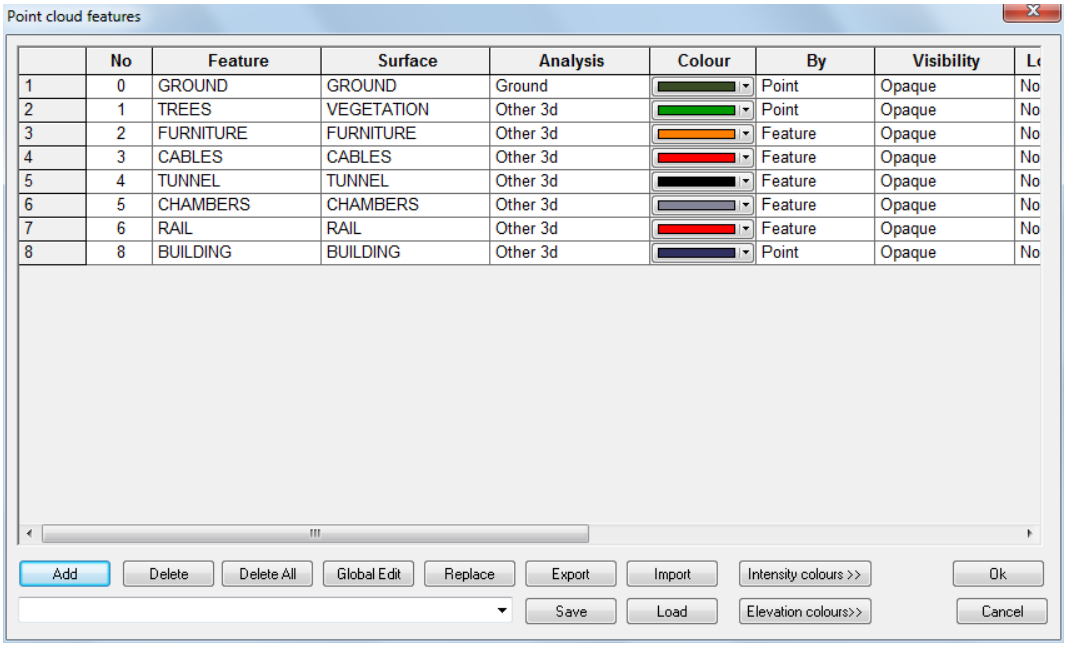
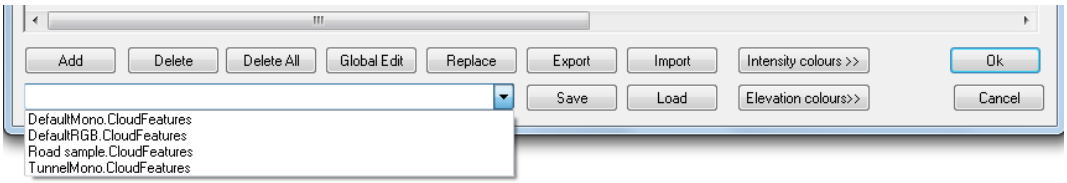
32.10.6 Point Cloud features (Model Cloud Menu)

This option lists all point cloud features, surface, analysis options (display only, ground, other surface, other 3d), colour, colour by point (feature, intensity, elevation, feature and intensity or feature and elevation), visibility (Opaque, Hidden, Transparent), Lock (Yes/No), Size (Small/ Large), Sect Width, Max Dist, Trace Dist, Min Length, Fit Tol., Spike Angle and Spike Distance.



	No	Feature	Surface	Analysis	Colour	By	Visibility	Lo
1	0	GROUND	GROUND	Ground		Point	Opaque	No
2	1	TREES	VEGETATION	Other 3d		Point	Opaque	No
3	2	FURNITURE	FURNITURE	Other 3d		Feature	Opaque	No
4	3	CABLES	CABLES	Other 3d		Feature	Opaque	No
5	4	TUNNEL	TUNNEL	Other 3d		Feature	Opaque	No
6	5	CHAMBERS	CHAMBERS	Other 3d		Feature	Opaque	No
7	6	RAIL	RAIL	Other 3d		Feature	Opaque	No
8	8	BUILDING	BUILDING	Other 3d		Point	Opaque	No

Additional option allow the feature to be easily edited; Add, Delete, Delete All, Global Edit, Replace, Export, Import. Also, a Cloud Feature file can be customised, save and later reloaded.



The point cloud feature library is used to break down the cloud into groups of points on similar feature, e.g. all points corresponding to vegetation, all points corresponding to the road surface etc… This allows us to fine tune how analysis operations work, as this will change significantly based on the type of feature. E.g. how we cut sections through the ground will be different to how we cut sections through more complex 3d features such as buildings.

The point cloud feature fields are as follows;

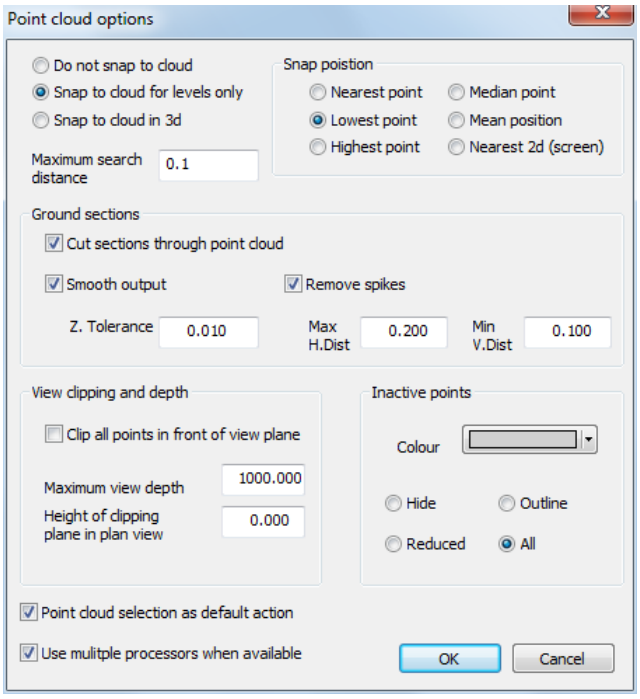
- Feature – The name of the feature
- Surface – The surface on which the feature is placed. Note that you can have multiple features placed on the same surface, e.g. trees and bushes might both go on a vegetation surface
- Analysis – This controls how SCC interprets these points for surface analysis purposes. Options are
  - Display only – The points are displayed only, but not subject to analysis
  - Ground – The points are treated in the same way as the triangulation surface in a normal SCC model, from the point of view of sections, volumes, draping points, extracting levels, etc…

- o Other surface – The points are treated in a similar manner as an additional triangular surface, such as a reference model.
- o Other 3d – The points are treated as a non-mappable 3d surface, not suitable for surface analysis operations. Sectioning through 3d surfaces will be considerably slower than ground / mappable surfaces.

- Colour – The default colour of this feature when not coloured by point
- By – Point clouds can be selectively coloured by point (e.g. RGB as given on input), feature, intensity, elevation, feature and intensity or feature and elevation. Colour schemes for height and intensity are as per relief contouring.
- Visibility – Controls whether or not these points are displayed, and if they are displayed whether they are considered opaque or transparent.
- Lock – Whether or not these points are included in analysis
- Size – The size of displayed points
- Sect. Width – The search corridor width used when cutting sections through this feature. Note this will typically be small for ground surfaces, e.g. 10mm, and larger for 3d surfaces, e.g. 100mm – 500mm. The larger this value, the more 3d data will get projected onto a section and analysed. This in turn can slow down processing and significantly increase the size of sections produced.
- Max Dist. – For 3d features, the maximum distance to which points will be connected.
- Trace Dist. – For 2d features extracted by tracing selected points, the maximum distance between adjacent points
- Min. Length – For all traced output, the minimum total string length allowed for a string to be included in the output.

32.10.7 Point Cloud Options (Model Cloud Menu)

This dialog provides snap tools, section facilities, clipping and depth viewing options and inactive point methods.



Most SCC options can interact with the cloud in a similar manner to the TIN surface generated

from a traditional total station or GPS survey. This is largely controlled by use of the point snapping and sections mechanisms in '**Cloud** > **Cloud options**'. The following snaps are available;

- Do not snap to cloud – The cloud is not used with other SCC string creation functions.
- Snap to cloud for levels only – The cloud is used in plan view for interpolating elevations only.
- Snap to cloud in 3d – The cloud is snapped to in full 3d, regardless of the viewpoint.

When using could snaps, and interpolating from the cloud as a surface in general, a search radius is used. If a cloud point is not found within this radius, the cloud snap fails. When interpolating levels, the underlying TIN is used in place of the cloud in this circumstance. This allows us to seamlessly mix TIN and cloud interpolation in a single model.

Given that we're searching for cloud points in a given radius, we can also control how the selected point or points are determined and used as follows;

- Nearest point – The nearest point to the desired position, e.g. mouse cursor position, is used
- Lowest point – The point with the lowest elevation of the points in range is used. This can be very useful for manually tracing lines such as bottom of kerb, where bottom of kerb and top of kerb are very close and difficult to distinguish. If is also very useful for extracting grids of elevations over ground that may include vegetation and other spurious high points on the ground such as lamp posts. Note that this option is best selected with small search radii, and used judiciously.
- High point - The point with the lowest elevation of the points in range is used. This can be very useful for manually tracing lines such as top of kerb.
- Median point – The point nearest the mean position of all the points in the selection radius is picked. This can be useful for drawing strings represented by dense linear groups of points in the cloud, such as walls shown in the slice taken from the cathedral model previously.
- Mean point - The mean position of all the points in the selection radius is picked. This will not correspond to any one point.
- Nearest 2d (Screen) – The point drawn on screen nearest the mouse cursor is picked.

For options such as sectioning, volumes, extraction of grids, draping of 2d data to extract levels, etc… the option to **Cut sections through the point cloud** must be selected. This allows the cloud to be used in a similar manner to a TIN surface for most SCC surface analysis operations. Interpolation is limited to points with a feature **Analysis** set to **Ground**, so it is very important to change the feature of all other cloud data, such as vegetation, buildings and overhead lines, prior to interpolating from the cloud in this manner.

For sectional analysis, we can also specify a level tolerance for smoothing, and horizontal and vertical tolerances for removing spikes from the section. This is necessary as cloud data is far denser than conventional survey data and is prone to include a significant amount of noise. Smoothing and spike removal also greatly reduces the size of the data extracted, which is also typically beneficial.

Other options on the same dialog control how the point cloud is visualized. These control whether the display is clipped behind and in front of the viewing plane, typically when using two point elevations, and how isolated points are displayed. Note that clipping the view has no effect on point selection in the way that isolating or disabling points would. Displaying Inactive points allows you to see where your active points are in relation to the rest of the cloud. Inactive points are always transparent and typically drawn in a lighter colour. Displaying a reduced number or outline of isolated points will reduce display clutter and improve display speed on larger clouds.

An additional option allows for multiple processors / cores use when available, which greatly improves speed of most cloud operations on multi-core PCs.

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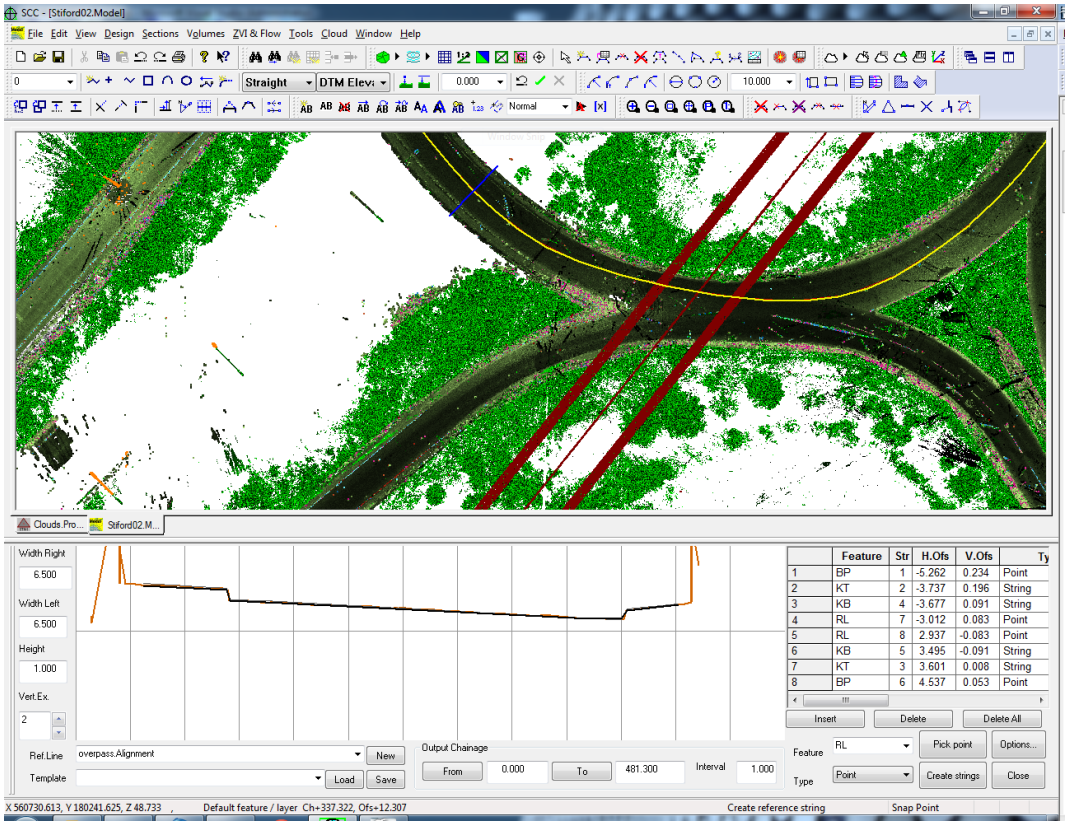
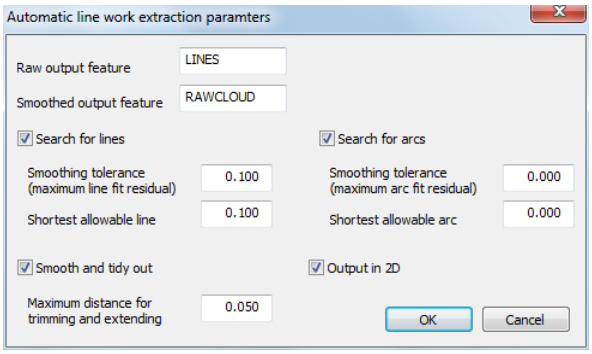
32.10.8 Trace Linear features (Model Cloud Menu)

The option '**CLOUD** > **Trace Linear Features**' allows the user to trace linear features contained in a point cloud by matching points on a section template to points in the cloud at regular chainages along an alignment.



32.10.9 Trace Outlines From Slice (Model Cloud Menu)

This option will draw outlines based on an isolated sectional area. This can be either from plan, elevation or based on an oblique viewpoint.



This option has been enhanced to create mean centre lines through cut objects rather than outlines. Automatic line and arc fitting, and line work tidying, has also been improved as a result and is considerably faster than in other versions. This applies to any point cloud features with an **Analysis** type set to **3D surface**, and also to all traces around selected points. Setting **Analysis** type set to **3D outline** creates an outline rather than a mean line, and is suitable for smaller cut strings such as rails and cables in cross sections.

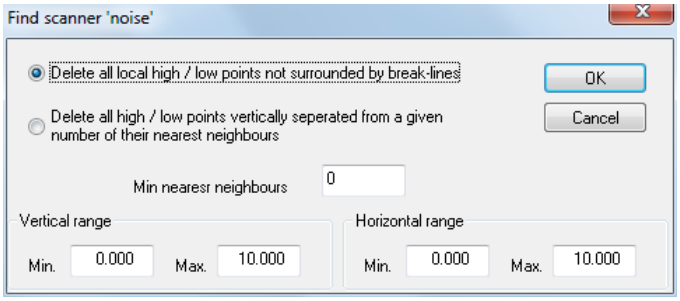
32.10.1 Trace Selected Points (Model Cloud Menu)

This option draws outlines based on an isolated sectional area. This can be either from plan, elevation or based on an oblique viewpoint. The results can then be exported to other packages, such as CAD, in 2d or 3d, and multiple slices can be used to build-up a wire frame model from your cloud. The cloud feature library determines how the data is analyses, where the centre of the displayed section or slice is used as the centre-line for sectioning.

This option has been enhanced to create mean centre lines through cut objects rather than outlines. Automatic line and arc fitting, and line work tidying, has also been improved as a result and is considerably faster than in other versions. This applies to any point cloud features with an **Analysis** type set to **3D surface**, and also to all traces around selected points. Setting **Analysis** type set to **3D outline** creates an outline rather than a mean line, and is suitable for smaller cut strings such as rails and cables in cross sections.

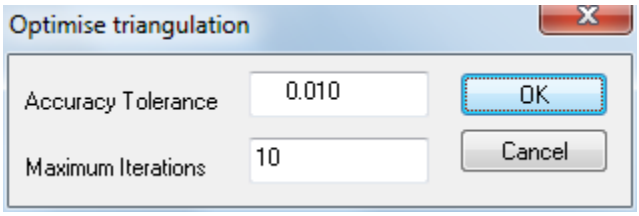
32.10.1 Search For Model Noise (Model Cloud Menu)

This option automates the remove of model noise whilst allowing the use to define minimum nearest neighbour, vertical and horizontal ranges when needed.



32.10.1 Optimise Triangulation (Model Cloud Menu)

This tool reduces the size of a DTM significantly based on a desired vertical resolution.



Thus if we have a 20k x 20k OS tile of points every 10m, in its raw form it will be made up of 4 million points. If we optimise it,say based on a 0.5m tolerance, this might reduce the size of the dataset to around 1 million points. The actual size of the final data set is based to a large degree on the flatness of the terrain in question as well as the vertical resolution required. Our initial tests show the following;

Vertical resolution Approx. data size reduction:

0.01m	10%
0.05m	18%
0.1m	30%
0.2m	50%
0.5m	70%
1m	85%
2m	93%

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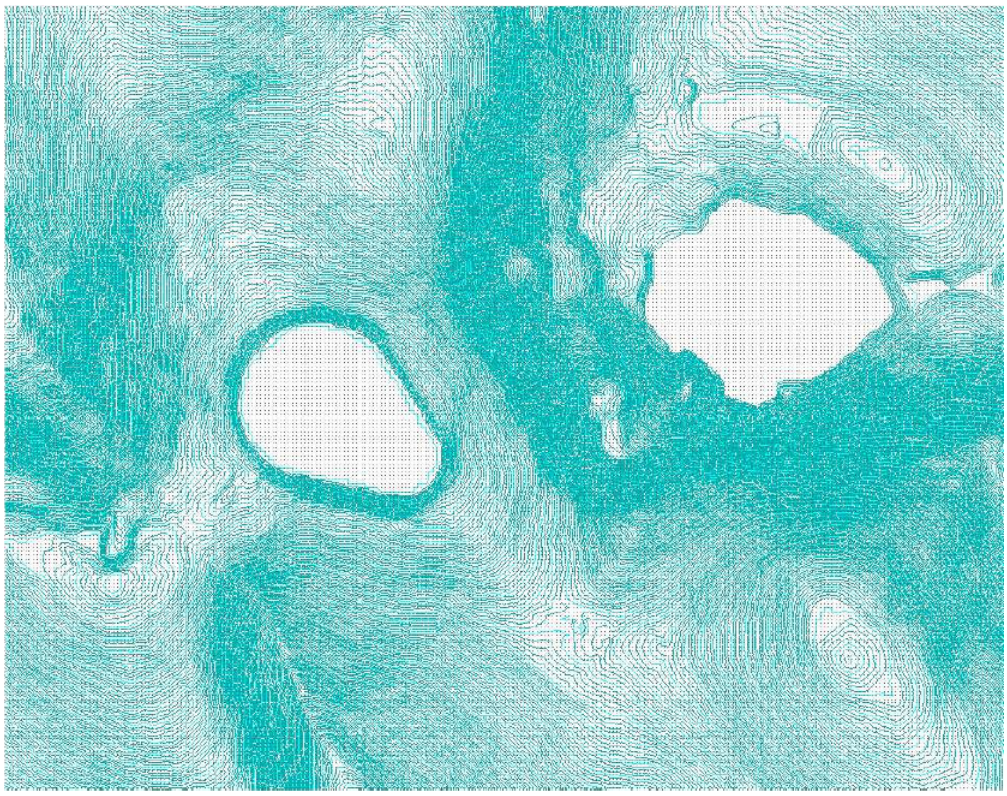
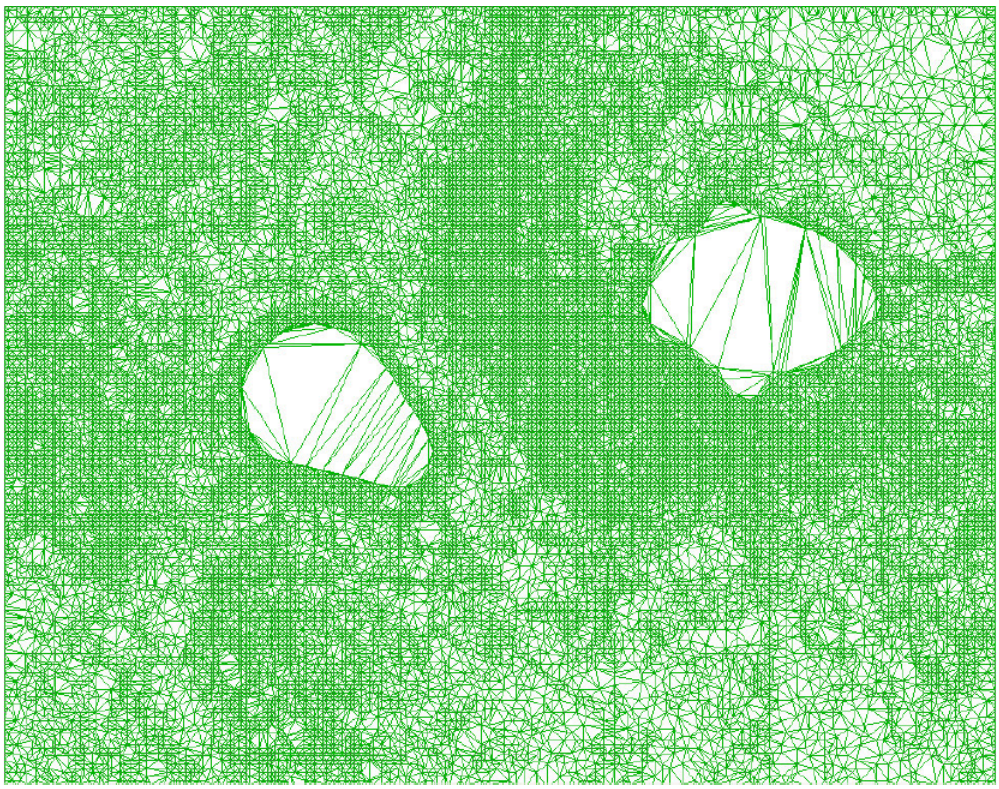
The optimisation in use guarantees that no point in the initial data set will be more than the specified vertical tolerance away from the optimised triangulated surface. Optimised data can be provided in a variety of point or TIN outputs, such as ASCII, LandXML, DXF, DWG and GENIO. The following sample shows an original contoured model and optimised TIN model for the Turlough hill area in Wicklow. Note the removal of points from the optimised TIN model wherever planar areas were detected in the original:





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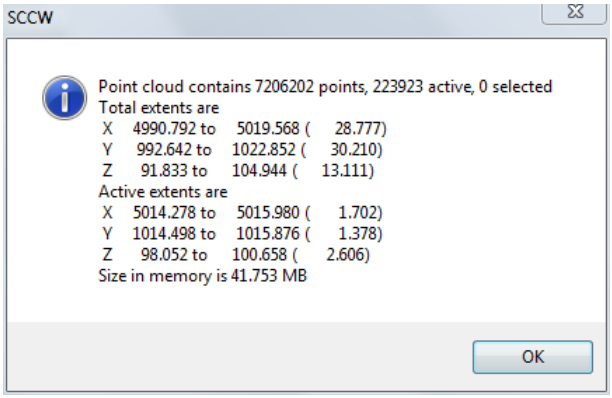
In addition large OS tiles, this appears to be a good method of reducing LIDAR data sets that include a significant amount of largely flat areas such as roads, bodies of water, etc…

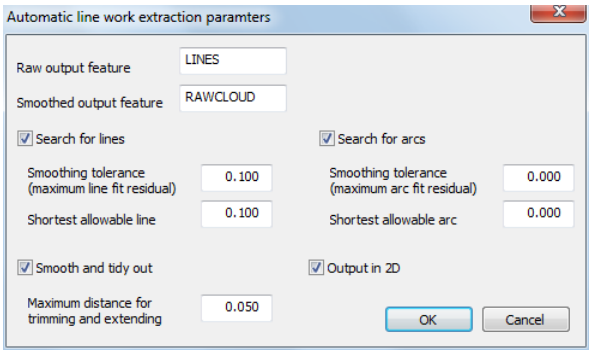
32.10.13 Point Cloud Properties (Model Cloud Menu)

This option summaries point cloud properties.

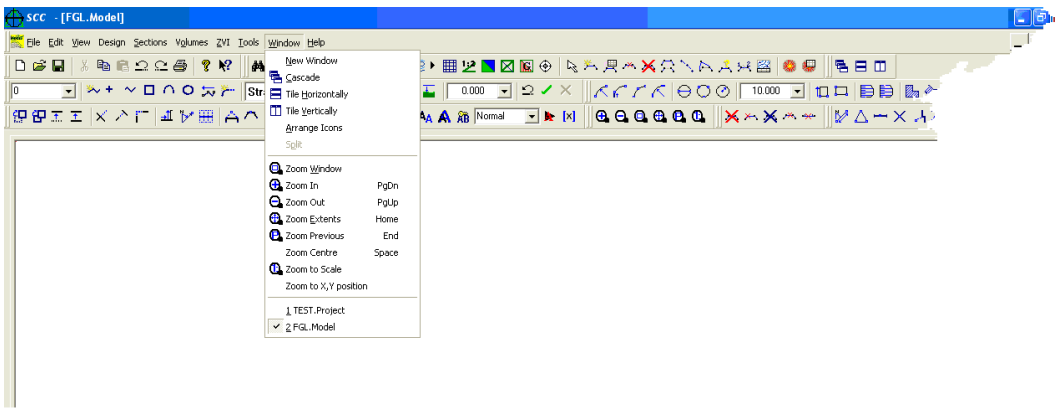


32.10.14 Smooth (Model Cloud Menu)

This option allows the user to set maximum distance for smooth and tidying the model.



32.11 Model Windows Menu



32.11.1 New Window (Model Windows Menu)

This command to open a new window with the same contents as the active window. The user can open multiple document windows to display different parts or views of a document at the same time. If the user changes the contents in one window, all other windows containing the

same document reflect those changes. When the user opens a new window, it becomes the active window and is displayed on top of all other open windows.

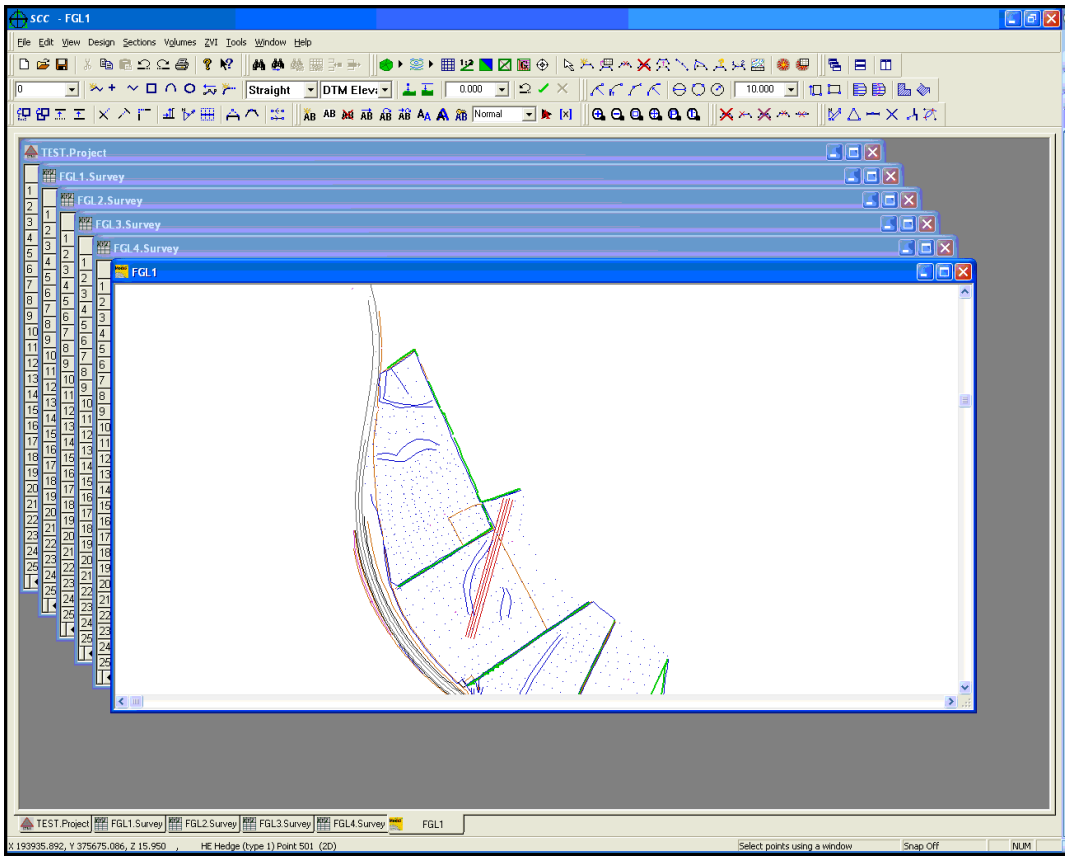
32.11.2 Cascade (Model Windows Menu)

Use this command to arrange multiple opened windows in an overlapped fashion.

Shortcuts

Toolbar:

Keys: ALT + W, C



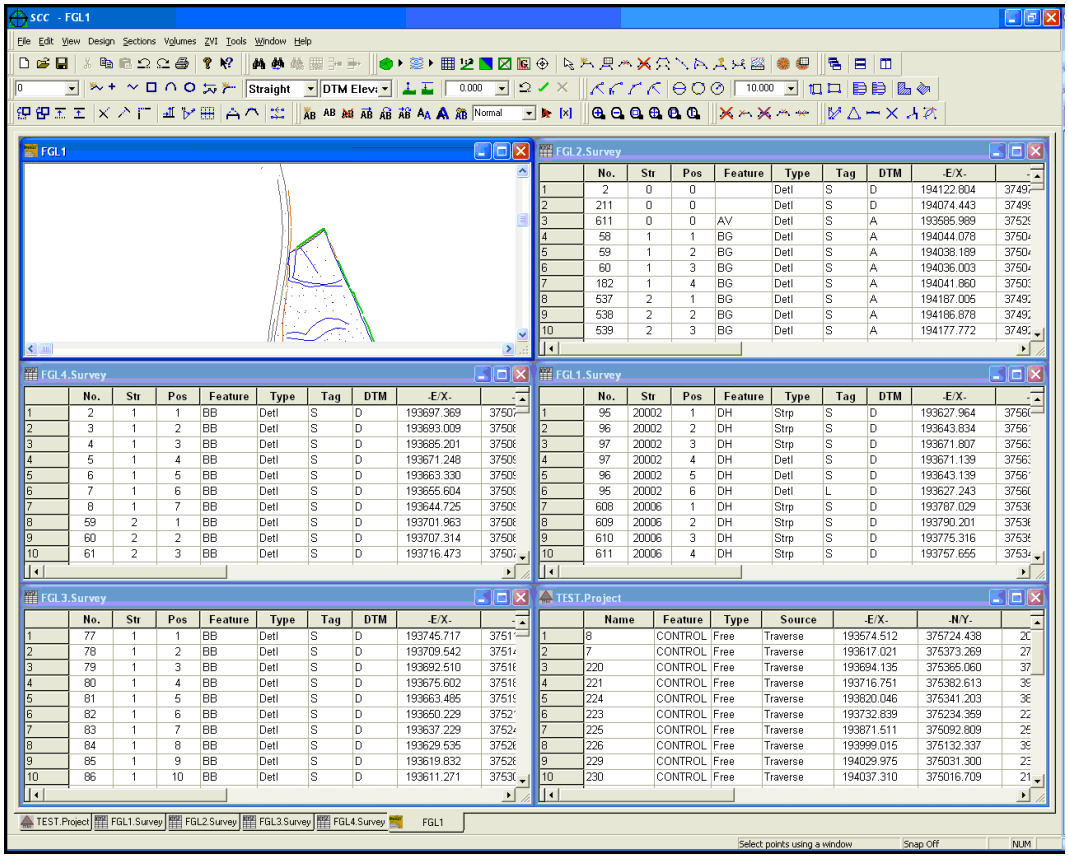
32.11.3 Tile Horizontal (Model Windows Menu)

Use this command to horizontally arrange multiple opened windows in a non-overlapped fashion.

Shortcuts

Toolbar:

Keys: ALT + W, H



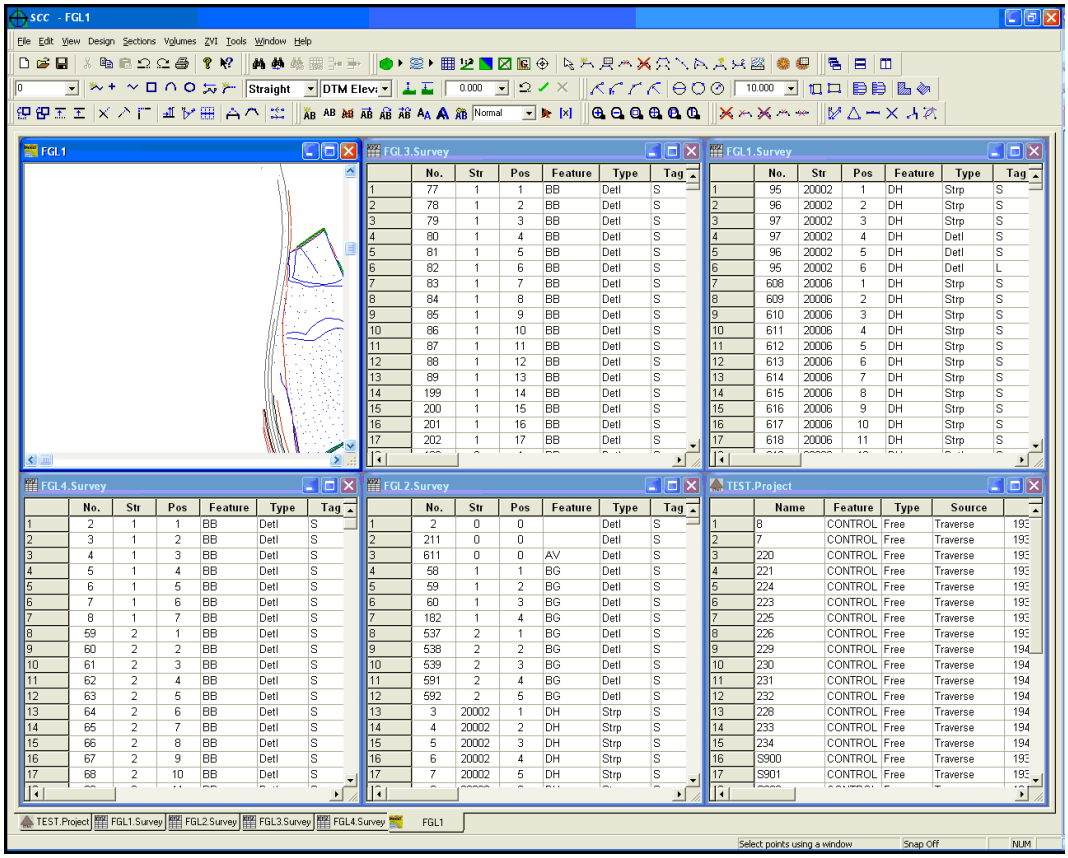
32.11.4 Tile Vertical (Model Windows Menu)

Use this command to arrange multiple opened windows vertically side by side.

Shortcuts

Toolbar:

Keys: ALT + W, H

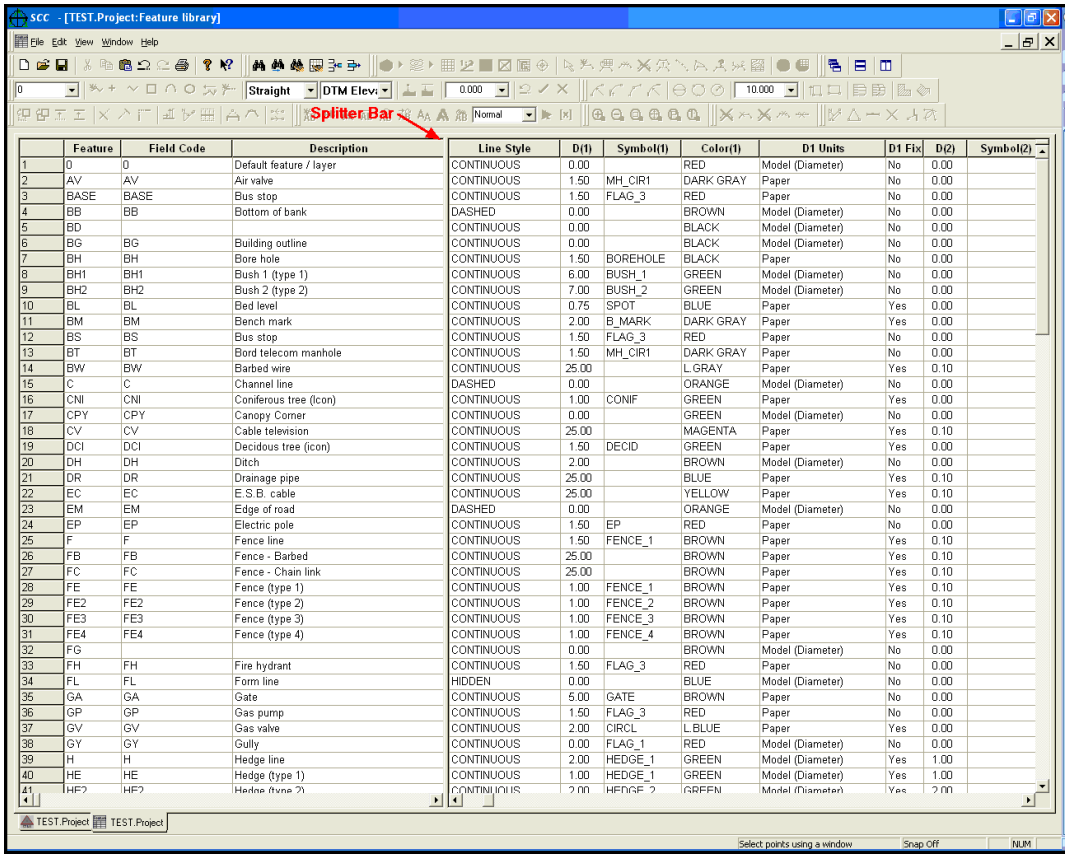


32.11.5 Arrange Icons (Model Windows Menu)

Use this command to arrange the icons for minimized windows at the bottom of the main window. If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

32.11.6 Split (Model Windows Menu)

Use this command to split the active window into panes. The user may then use the mouse or the keyboard arrows to move the splitter bars. When you are finished, press the mouse button or enter to leave the splitter bars in their new location. Pressing escape keeps the splitter bars in their original location.



	Feature	Field Code	Description	Line Style	D(1)	Symbol(1)	Color(1)	D1 Units	D1 Fix	D(2)	Symbol(2)
1	0	0	Default feature / layer	CONTINUOUS	0.00		RED	Model (Diameter)	No	0.00	
2	AV	AV	Air valve	CONTINUOUS	1.50	MH_CIR1	DARK GRAY	Paper	No	0.00	
3	BASE	BASE	Bus stop	CONTINUOUS	1.50	FLAG_3	RED	Paper	No	0.00	
4	BB	BB	Bottom of bank	DASHED	0.00		BROWN	Model (Diameter)	No	0.00	
5	BD			CONTINUOUS	0.00		BLACK	Model (Diameter)	No	0.00	
6	BG	BG	Building outline	CONTINUOUS	0.00		BLACK	Model (Diameter)	No	0.00	
7	BH	BH	Bore hole	CONTINUOUS	1.50	BOREHOLE	BLACK	Paper	No	0.00	
8	BH1	BH1	Bush 1 (type 1)	CONTINUOUS	6.00	BUSH_1	GREEN	Model (Diameter)	No	0.00	
9	BH2	BH2	Bush 2 (type 2)	CONTINUOUS	7.00	BUSH_2	GREEN	Model (Diameter)	No	0.00	
10	BL	BL	Bed level	CONTINUOUS	0.75	SPOT	BLUE	Paper	Yes	0.00	
11	BM	BM	Bench mark	CONTINUOUS	2.00	B_MARK	DARK GRAY	Paper	Yes	0.00	
12	BS	BS	Bus stop	CONTINUOUS	1.50	FLAG_3	RED	Paper	No	0.00	
13	BT	BT	Bord telecom manhole	CONTINUOUS	1.50	MH_CIR1	DARK GRAY	Paper	No	0.00	
14	BW	BW	Barbed wire	CONTINUOUS	25.00		L.GRAY	Paper	Yes	0.10	
15	C	C	Channel line	DASHED	0.00		ORANGE	Model (Diameter)	No	0.00	
16	CNI	CNI	Coniferous tree (Icon)	CONTINUOUS	1.00	CONIF	GREEN	Paper	Yes	0.00	
17	CPY	CPY	Canopy Corner	CONTINUOUS	0.00		GREEN	Model (Diameter)	No	0.00	
18	CV	CV	Cable television	CONTINUOUS	25.00		MAGENTA	Paper	Yes	0.10	
19	DCI	DCI	Decidous tree (icon)	CONTINUOUS	1.50	DECID	GREEN	Paper	Yes	0.00	
20	DH	DH	Ditch	CONTINUOUS	2.00		BROWN	Model (Diameter)	No	0.00	
21	DR	DR	Drainage pipe	CONTINUOUS	25.00		BLUE	Paper	Yes	0.10	
22	EC	EC	E.S.B. cable	CONTINUOUS	25.00		YELLOW	Paper	Yes	0.10	
23	EM	EM	Edge of road	DASHED	0.00		ORANGE	Model (Diameter)	No	0.00	
24	EP	EP	Electric pole	CONTINUOUS	1.50	EP	RED	Paper	No	0.00	
25	F	F	Fence line	CONTINUOUS	1.50	FENCE_1	BROWN	Paper	Yes	0.10	
26	FB	FB	Fence - Barbed	CONTINUOUS	25.00		BROWN	Paper	Yes	0.10	
27	FC	FC	Fence - Chain link	CONTINUOUS	25.00		BROWN	Paper	Yes	0.10	
28	FE	FE	Fence (type 1)	CONTINUOUS	1.00	FENCE_1	BROWN	Paper	Yes	0.10	
29	FE2	FE2	Fence (type 2)	CONTINUOUS	1.00	FENCE_2	BROWN	Paper	Yes	0.10	
30	FE3	FE3	Fence (type 3)	CONTINUOUS	1.00	FENCE_3	BROWN	Paper	Yes	0.10	
31	FE4	FE4	Fence (type 4)	CONTINUOUS	1.00	FENCE_4	BROWN	Paper	Yes	0.10	
32	FG			CONTINUOUS	0.00		BROWN	Model (Diameter)	No	0.00	
33	FH	FH	Fire hydrant	CONTINUOUS	1.50	FLAG_3	RED	Paper	No	0.00	
34	FL	FL	Form line	HIDDEN	0.00		BLUE	Model (Diameter)	No	0.00	
35	GA	GA	Gate	CONTINUOUS	5.00	GATE	BROWN	Paper	No	0.00	
36	GP	GP	Gas pump	CONTINUOUS	1.50	FLAG_3	RED	Paper	No	0.00	
37	GV	GV	Gas valve	CONTINUOUS	2.00	CIRCL	L.BLUE	Paper	Yes	0.00	
38	GY	GY	Gully	CONTINUOUS	0.00	FLAG_1	RED	Model (Diameter)	No	0.00	
39	H	H	Hedge line	CONTINUOUS	2.00	HEDGE_1	GREEN	Model (Diameter)	Yes	1.00	
40	HE	HE	Hedge (type 1)	CONTINUOUS	1.00	HEDGE_1	GREEN	Model (Diameter)	Yes	1.00	
41	HE2	HE2	Hedge (type 2)	CONTINUOUS	2.00	HEDGE_2	GREEN	Model (Diameter)	Yes	2.00	

32.11.7 Zoom Window (Model Windows Menu)

Zooms to a rectangular window defined by two opposite corner points selected by the mouse.

Shortcuts

Toolbar:

Keys: ALT + W, W

32.11.8 Zoom In (Model Windows Menu)

Increases the apparent size of the model on screen, centred on the section of model where the mouse is pointed.

Shortcuts

Toolbar:

Keys: Page Down

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32.11.9 Zoom Out (Model Windows Menu)

Decreases the apparent size of the model on screen.

Shortcuts

Toolbar:

Keys: Page Up

32.11.10 Zoom Extent (Model Windows Menu)

Zooms to display the extent of the model.

Shortcuts

Toolbar:

Keys: Home

32.11.11 Zoom Previous (Model Windows Menu)

Zooms to the previous display.

Shortcuts

Toolbar:

Keys: End

32.11.12 Zoom Centre (Model Windows Menu)

The current window is centred on the mouse position.

Shortcuts

Keys: Space

32.11.13 Zoom to Scale (Model Windows Menu)

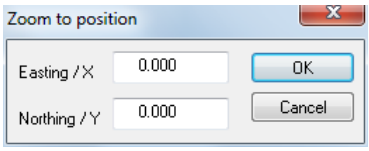
Zooms to the scale specified in the Titles and Grid option

Shortcuts

Toolbar:

32.11.14 Zoom to X, Y Position (Model Windows Menu)

On selecting this option the user will be asked to type in X,Y co-ordinates of the point you wish to find. This point will be displayed in the centre of the screen at the zoom scale the position the user was at prior to selecting this option. Therefore if the user zooms in more and then select this option it will be easier to identify the requested point.



33 Sections

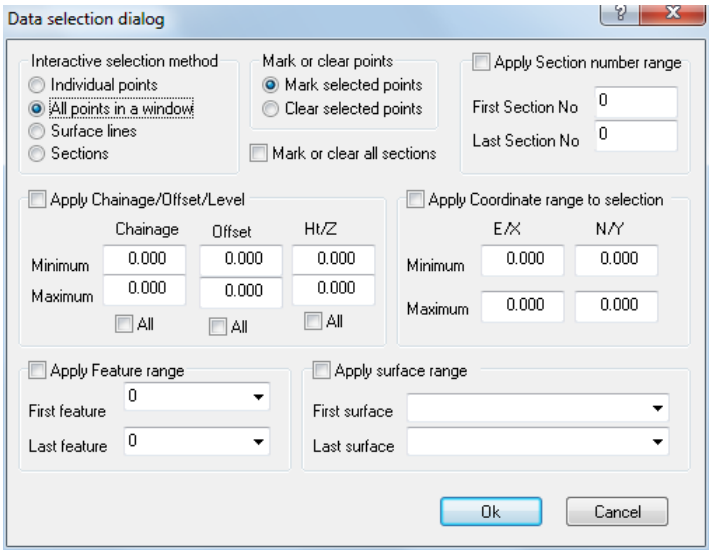
Sections in SCC can be cut from a model, created directly from coordinate or chainage offset source, or created by searching for all points in a model within a given bandwidth. Cross sections may be generated with references to an alignment or simple string. Skew cross sections may also be taken with references to an alignment. Sections may include multiple surfaces, or may be used to show multiple strings in the same model side by side in elevation. All section drawing, layout and annotation settings are fully user definable in SCC.

See Also

Section

Section Editing

33.1 Data Selection Dialog (Section)



The following selection options are available within the Sections Data Selection Dialog:

Interactive selection method

Individual points

All points in a window

Surface lines

Sections

Mark or clear points

Mark selected points

Clear selected points

Mark or clear all sections

Apply Section number range

First Section No.

Last Section No.

Apply Chainage/Offset/Level

Minimum

Maximum

Apply Coordinates range to selection

Minimum

Maximum

Apply Feature range

First Feature

Last Feature

Apply surface range

First Feature

Last Feature

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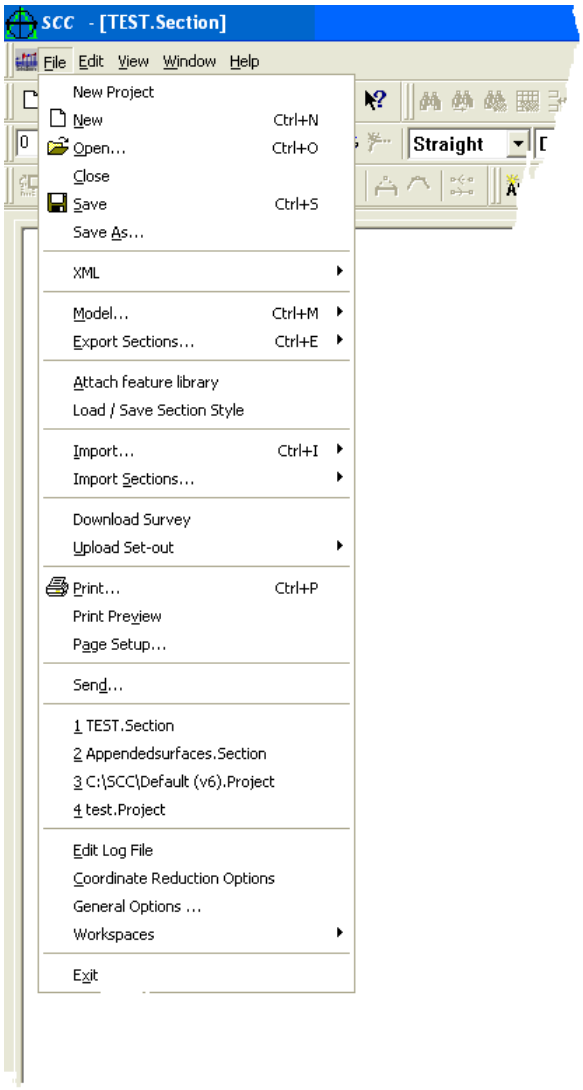
33.2 Sections File Menu



33.2.1 XML (Section File Menu)

Section data can be loaded and saved in the industry standard XML format, in addition to its native formats. The following options are available:

Open XML

Save XML

Save As XML

See Also

LandXML (Project File Menu)

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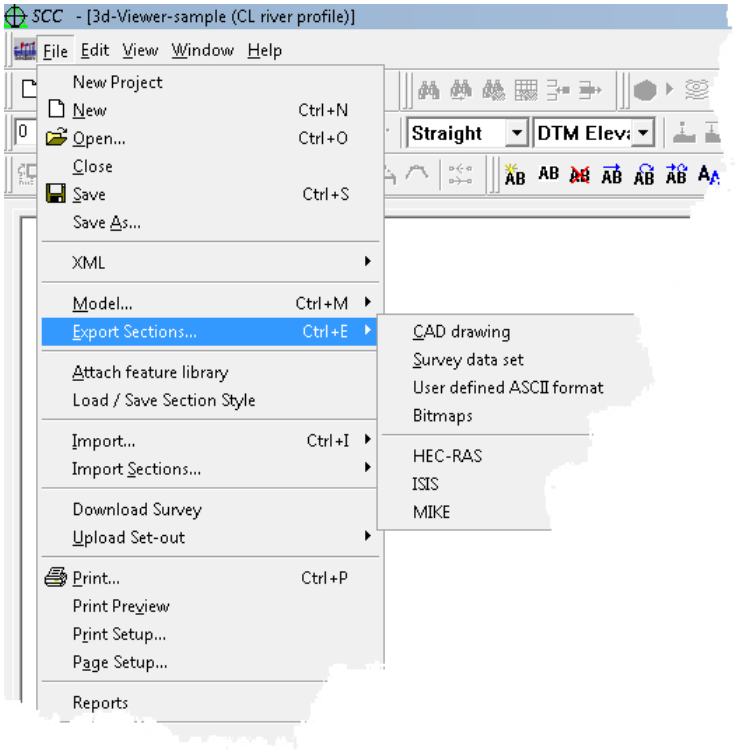
33.2.2 Export Sections (Section File Menu)

The following options are available:



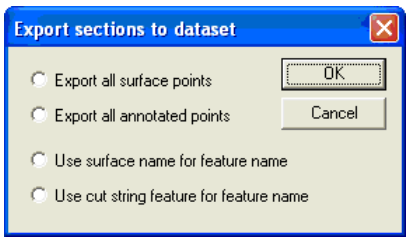
CAD Drawing

See Also

Export CAD drawing (Model & Section File Menu)

Survey Data Set

The following options are available:



Export all surface points

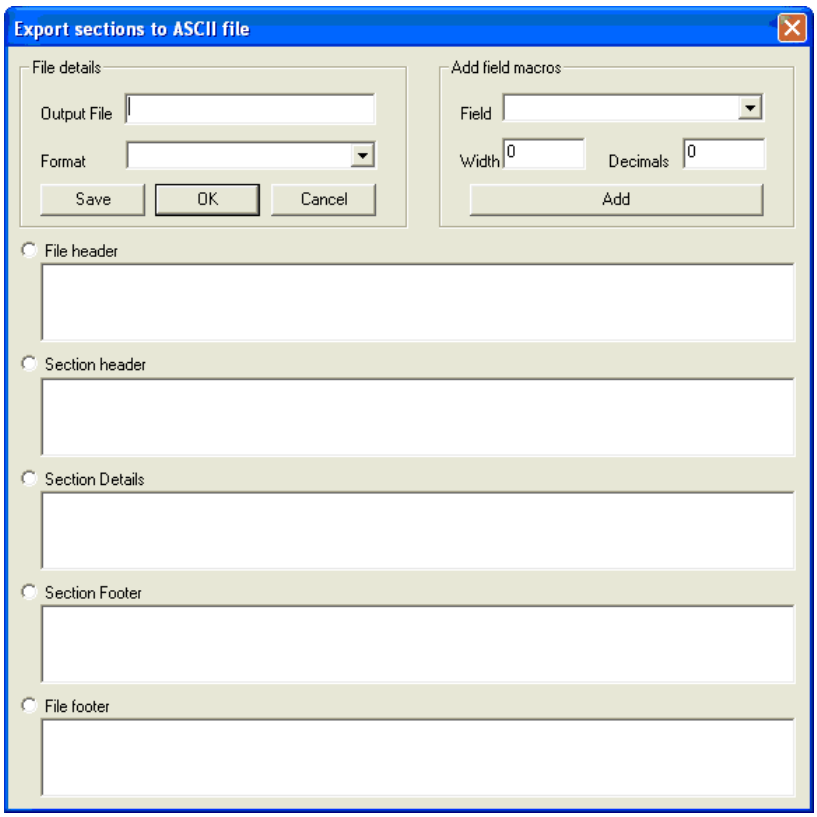
Export all annotated points

Use surface name for feature name

Use cut string feature for feature name

User Defined ASCII Format

This option allows the user to output sections in a specific format.



Bitmap

This option allows the user to export each section as a bitmap.

For instance, in a section file containing 20 sections at chainage intervals of 10 each section can be exported as a bitmap and the file name will contain the section file name, no of section and the chainage value of the specific section 'RiverL,18 of 20, Ch+18.BMP'

HEC-RAS

SCC supports the export of river sections to Hydrological Engineering Centres River Analysis System (HEC-RAS) software.

ISIS

SCC supports the export of river sections to ISIS software. On export the user can choose to reverse section order, output coordinates, specify Mannings factors, and specify whether chainage is output as chainage, distance to next section or distance to last section.

MIKE

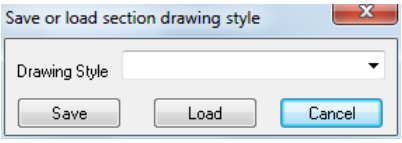
SCC supports the export of river sections to MIKE 11 format.

33.2.3 Attach Feature Library (Section File Menu)

This option attaches a feature library. The library attached will overwrite the current feature library.

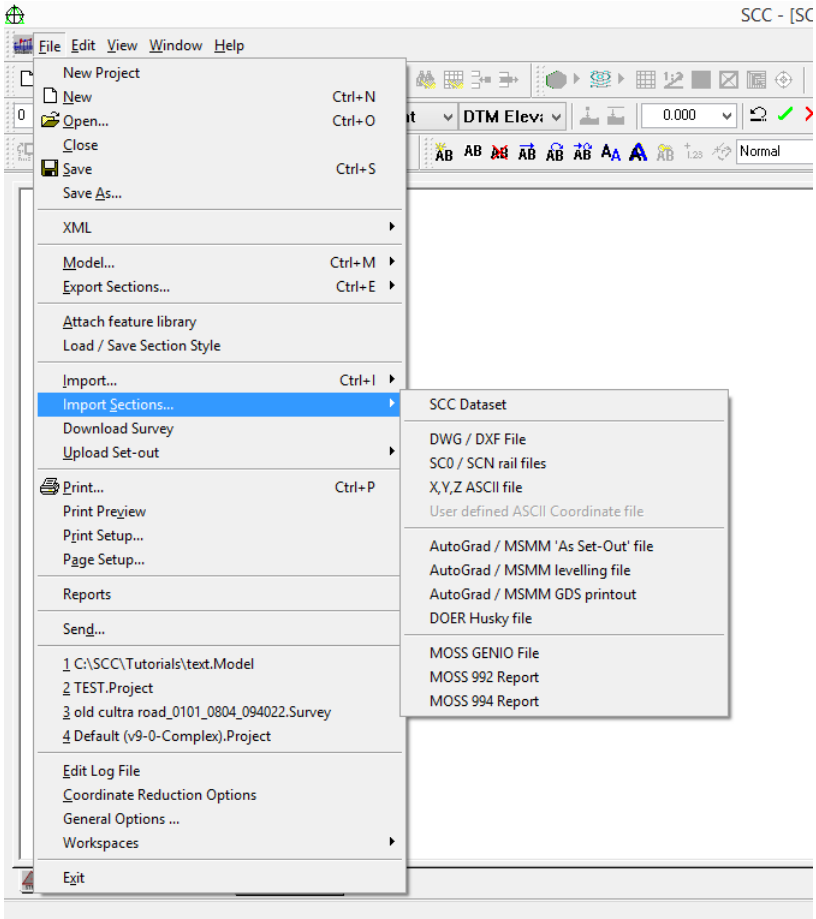
33.2.4 Load / Save Section Styles (Section File Menu)

This option can be used to load or save all current section drawing parameters to or from a file. This includes all the parameters listed in the 'VIEW > Scales titles and grids', 'VIEW > Section sheet layout' and 'VIEW > Annotation settings dialogs.



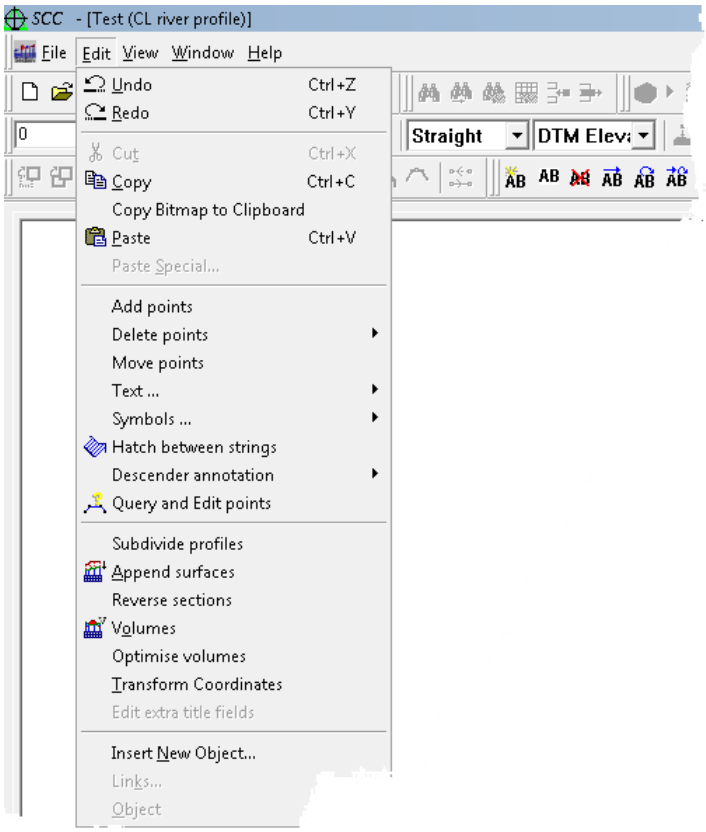
This allows the user to maintain and distribute multiple section drawing standards. Section styles are stored with the extension '.SectionStyle' in the SCC executable files directory, normally C:\SCC.

33.2.5 Import Sections (Sections File Menu)



A new function has been added to import SC0 and SCN files as sections, where the sections also include all the SC0 and SCN header information. The release includes a new section style, SC0 SCC.SectionStyle, for drawing these sections to show structure and rail information. Extra header information is available by querying the section.

33.3 Sections Edit Menu



33.3.1 Undo (Section Edit Menu)

Use this command to reverse the last editing action, if possible. The name of the command changes, depending on what the last action was. The Undo command changes to Can't Undo on the menu if you cannot reverse your last action.

Shortcuts

Toolbar:

Keys: Ctrl + Z or

ALT + BACKSPACE

33.3.2 Redo (Section Edit Menu)

Redo the last option that was undone.

Shortcuts

Toolbar:

Keys: Ctrl + Y

33.3.3 Copy (Section Edit Menu)

Use this command to copy selected data onto the clipboard. This command is unavailable if there is no data currently selected.

Copying data to the clipboard replaces the contents previously stored there.

Shortcuts

Toolbar

Keys CTRL + C

33.3.4 Copy Bitmap to Clipboard (Section Edit Menu)

Use this command to copy the current section to the clipboard.

33.3.5 Paste (Section Edit Menu)

This command is used to paste data present on the clipboard into the opened or existing model .

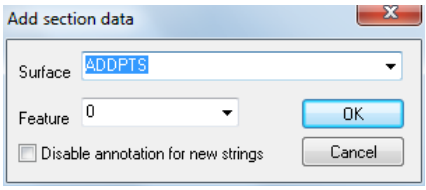
See Also

Adding Surface String & Point Data To An Existing Section

33.3.6 Paste Special (Section Edit Menu)

This option is used to paste OLE objects, such as office documents, into your model file.

33.3.7 Add Points (Section Edit Mentu)



Surface

The user can enter a new surfaces name on which to place data being added to the created section.

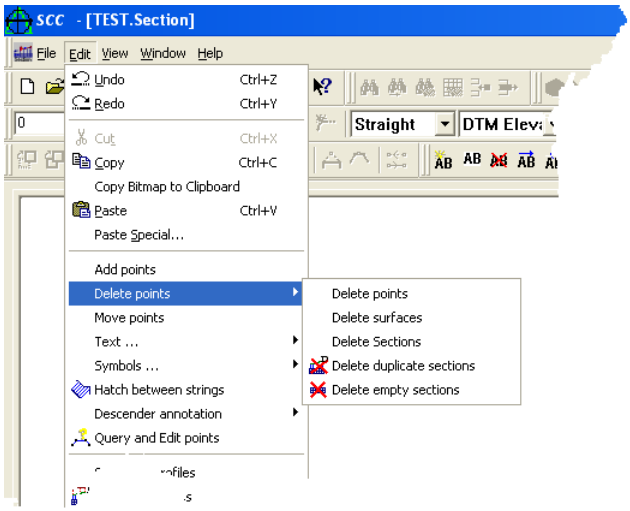
Disable annotation for new strings

This options turns off all annotation for new strings being added to the section

See Also

Adding Surface String & Point Data To An Existing Section

33.3.8 Delete Points (Section Edit Menu)



Delete Points

This option allows the user to delete individual points from a section.

33.3.9 Move Points (Section Edit Menu)

This option allows points in a section to be moved by the user. Select the surveyed point the user wishes to move using the mouse. The point is now attached to the mouse pointer. Click the mouse a second time to place the point in its position. To quit this option hit the Escape key.

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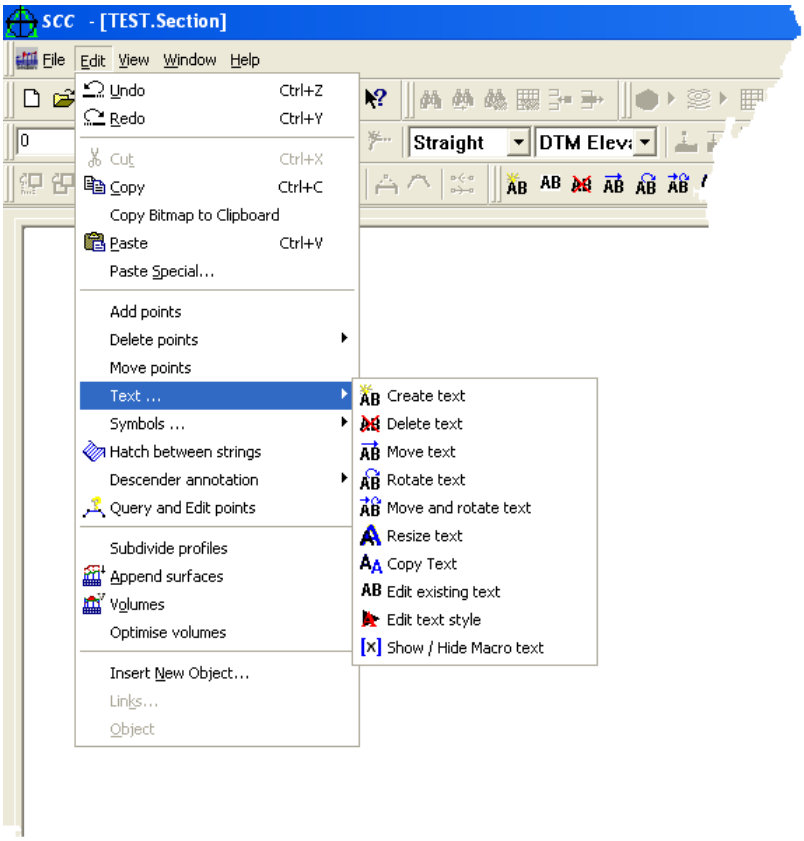
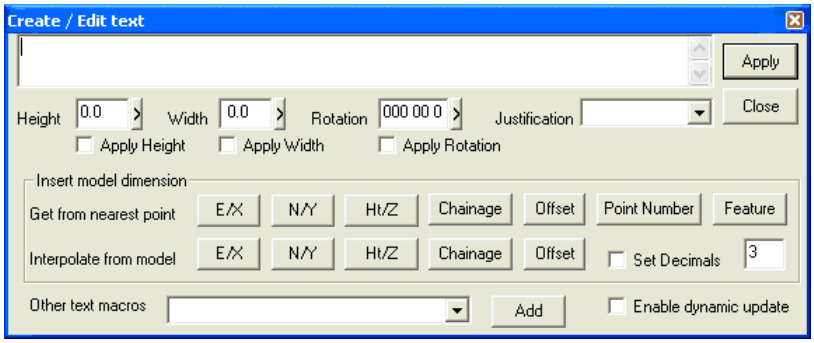
33.3.10 Text (Section Edit Menu)



The following text options are available: Create Text (Section Edit Menu), Delete Text (Section Edit Menu), Move Text (Section Edit Menu), Rotate Text (Section Edit Menu), Move and Rotate Text (Section Edit Menu), Resize Text (Section Edit Menu), Copy Text (Section Edit Menu), Edit Existing Text (Section Edit Menu) and Show / Hide Macro Text (Section Edit Menu)

Create Text

This option presents the Create / Edit text dialog box.



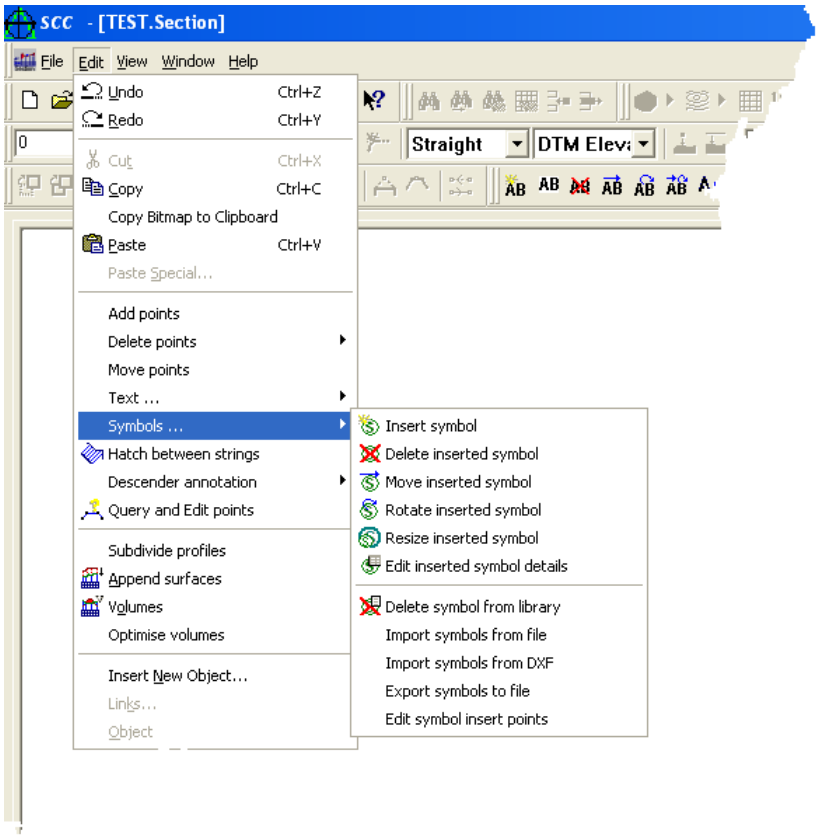
Type in the text to add to the model. Then click on the model to insert the text. The user may set the height, width, rotation and justification of the text in the dialog or interactively when the text is inserted into the model. Font information for the text will be determined by the current text style.

There is also the option of adding X,Y and Z co-ordinates (in text form) to the model using the nearest and interpolation macros available. To do this, select X,Y or Z from either 'Get

the nearest point' or 'Interpolate from model'. As the user moves the cursor about the model, the text will be automatically updated, giving either the interpolated co-ordinates of the point at the end of the cursor of the co-ordinates of the nearest point, depending on the option selected. Left click mouse to position text. Ticking the 'enable dynamic update' option means that if at a later stage you have to move the text, it will be updated automatically to display the co-ordinates of the new position.

Shortcuts

33.3.11 Symbols (Section Edit Menu)



The following symbol options are available: Insert Symbol (Section Edit Menu), Delete Inserted Symbol (Section Edit Menu), Move Inserted Symbol (Section Edit Menu), Rotate Inserted Symbol (Section Edit Menu), Resize Inserted Symbol (Section Edit Menu), Edit Inserted Symbol Details (Section Edit Menu), Delete Symbol From Library (Section Edit Menu), Import Symbol Form File (Section Edit Menu), Import Symbol From DXF (Section Edit Menu), Export Symbol To File (Section Edit Menu) and Edit Symbol Insert Points (Section Edit Menu)

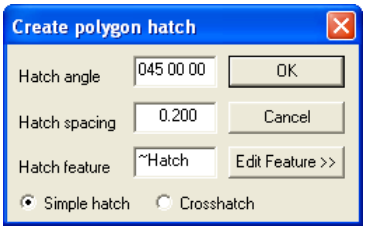
Insert Symbol

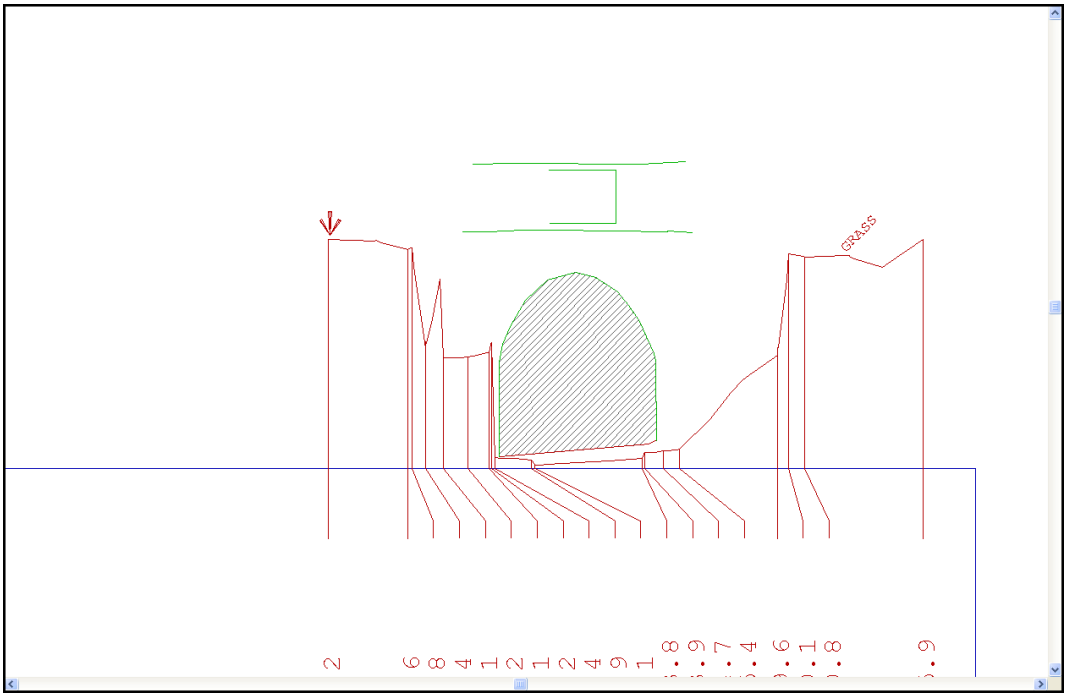
This option allows the user to insert a symbol in the model and to specify its size, position and rotation. Selecting the option displays the 'Create/Edit Symbol' Dialog. Selecting any of the 'Apply..' boxes allows you to edit this value with the mouse, otherwise values may be entered directly into the dialog box. Pressing Apply, or the left mouse button inserts the symbol in the model. Press Escape to finish this option.

Shortcuts

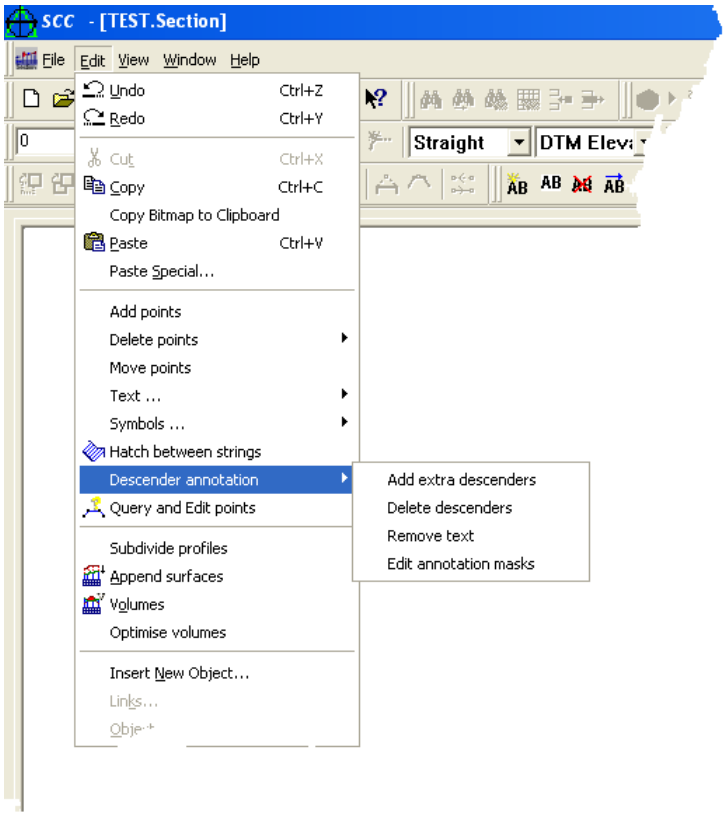
33.3.12 Hatch between strings (Section Edit Menu)

This option allows the user to hatch between two strings. The 'Create polygon hatch' dialog is present to allow you to specify the angle, spacing and hatch type before selecting the specific strings to hatch between.



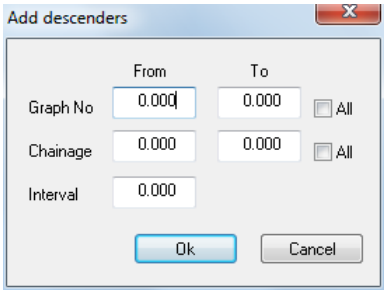


33.3.13 Descender Annotation (Seciton Edit Menu)



Add extra descenders

This option allows the user to add extra descenders to the section graph by defining a specific chainage range and interval value. The user can select 'all' to define all sections and between all chainages, otherwise a value must be entered.



The dialog above shows that the user has defined that extra descenders are to be added to all graphs (in this case, one) at 5m intervals along the entire length of the profile.

Delete descenders

This option allows the user to delete descenders from the section graph between a specific chainage range. The user must enter the number of the graph to be edited (selecting 'all' for all graphs) and also the chainage range.

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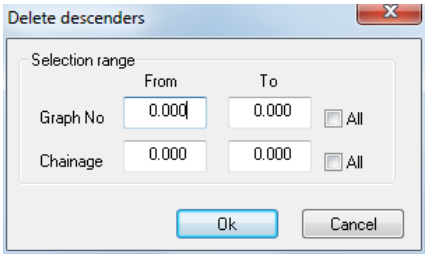
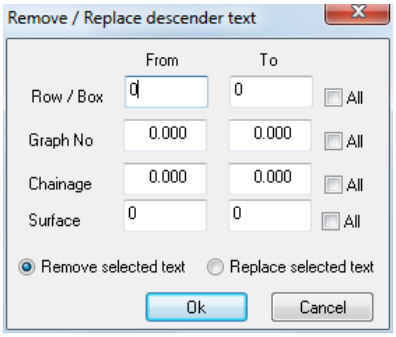


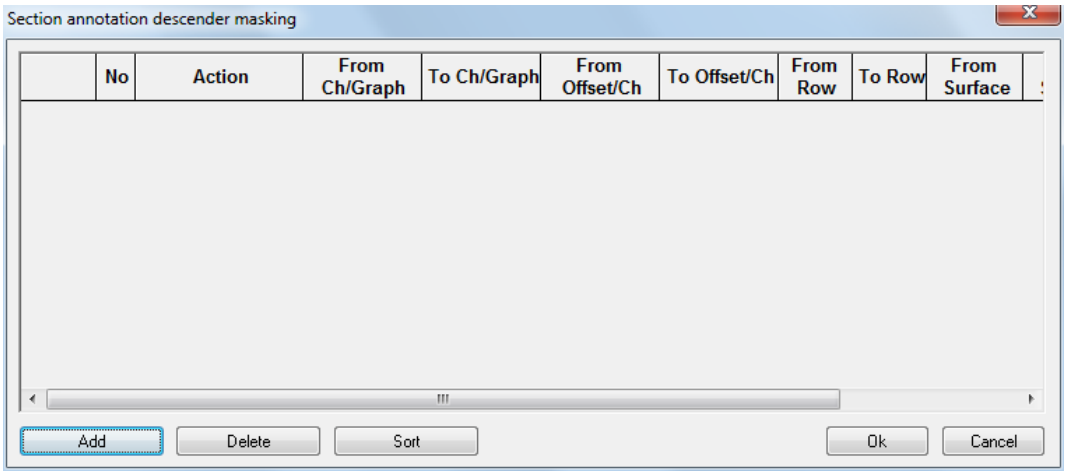
Remove Text

This option allows the user to hide/replace text along the section graph by specifying the row, graph number, chainage range and the surface the user wishes it applied to.



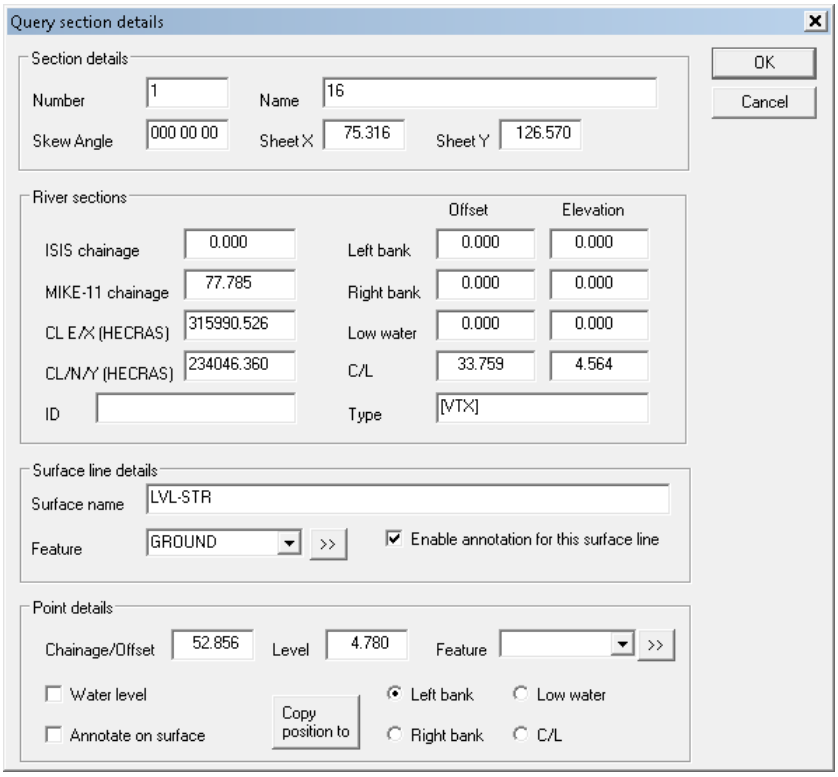
Edit Annotation Mask

This option allows the user to edit any of the annotation masks already specified on the section graph. The user may also use this dialog to delete any of the existing changes and add new ones.



33.3.14 Query and Edit Points (Section Edit Menu)

The Query and Edit function can be utilised to obtain specific information in relation to a point on the section:



This option supports editing of all river specific information, including position of banks, low water points, section type and ID, and MIKE-11 and ISIS specific chainages. This enables any cross sections to be easily manually converted to river sections for output to packages such as ISIS, MIKE-11 and HEC-RAS.

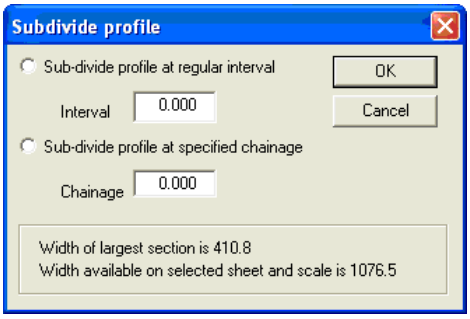
See Also

Query Points (Section Edit Menu)

33.3.15 Subdivide Profiles (Section Edit Menu)

This option allows the user to sub-divide the profile either at a specified chainage or at regular intervals along the section.

This makes for easier layout design where profiles can be spilt at specific sections along the graph so as to fit on particular sheet sizes.



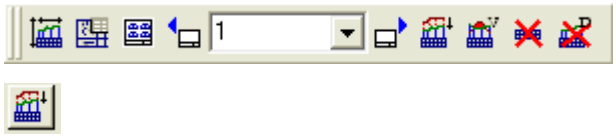
33.3.16 Append Surfaces (Section Edit Menu)

This option adds data from another surface, whether comprising of long sections or cross sections. This allows sections depicting graphs with a number of ground profiles lines, taken from multiple surfaces. For example, top soil strip, unsuitable material, rockhead etc. Data is added in the form of new surface ground profile line for the current surface, on the existing

graphs. An extra annotation box is added to each graph to annotate elevations for this surface. The Open dialog is presented to allow the extra model to be selected

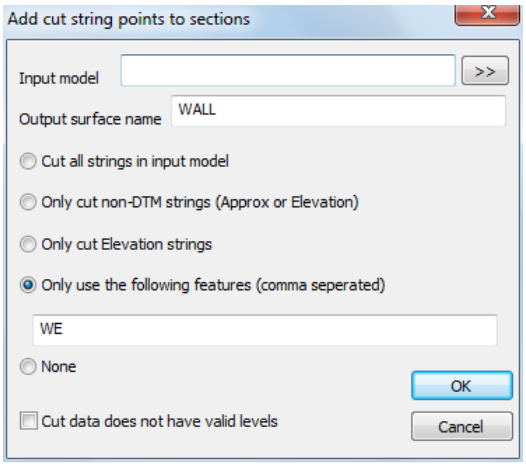
Shortcuts

Toolbar:



33.3.17 Append Other Model Data (Section Edit Menu)

This options allows for addition specific data to be added to a section.



33.3.18 Reverse Sections (Section Edit Menu)

This option support reverses the direction of all river sections in a file, while also giving the option to renumber the offsets to zero form the left hand edge. It does not affect the Chainage. This option gives the user the ability to convert sections from up river orientation to a down river orientation without having to re-edit the sections, thus allowing the user to output the sections in multiple formats with differing orientation requirements. Note that the reverse section option supports multiple surfaces and section string detail, but does not currently work on sections with colour coded volumes.

33.3.19 Volumes (Sections Edit Menu)

This option allows the user to calculate and display cut and fill volumes between any two surfaces shown in the section graph using an end areas method. Volume is displayed and calculated incrementally by chainage along the long section or string. To use this option the section graph must contain two surfaces. The total area and volume of cut and/or fill is calculated at each cross section.

Volumetrics Report File Name

The name given to the report name. This file will contain either full or abbreviated volumetric analysis report.

Existing Surface

This is the name of the existing ground model. As such it must have been created with the create TIN model option and added to the section file. The existing ground model will normally be your surveyed model.

Proposed Surface

This is the name of the proposed or design surface. As such it must have been created with the create TIN model option and added to the section file. The proposed ground model will normally be a design model or previous surveyed model.

Annotate Areas and Volumes

This option specifies whether areas and cumulative volumes of cut and fill will be annotated at each cross section.

Highlight Cut/Fill Areas

This switch defines whether areas of cut/fill will be displayed on the cross section graph.

The effect of curvature on cross section volumes

It is usually assumed when calculating prismoidal and end-area volumes, that the cross sections are parallel. When this is not the case, and the excavation is curved, the sections are radial and a curvature correction must be applied.

Pappus's Theorem states that the correct volume is where the distance between the cross sections is taken along the path of the centroid.

SCC calculates a center of gravity or centroid for the cut and fill area of each section. Where sections are likely to include multiple cut and fill areas, the curvature correction should not be applied, as the center of gravity may not be appropriate.

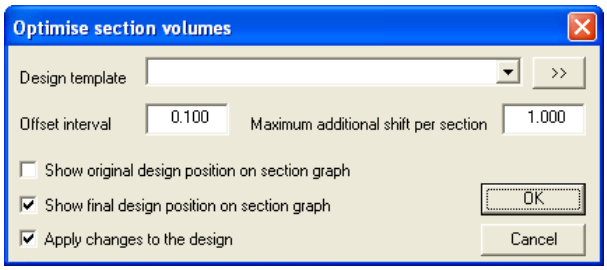
It must be noted also that curvature corrected values are NOT typically applied to earthworks in practice. For more accurate volumes, it is best to use isopachyte and grid methods.

Shortcuts

Toolbar:

33.3.20 Optimise Section Volumes (Section Edit Menu)

The optimise section volumes function allows the user to optimise a design centreline to minimise the amount of cut required in a dredging or similar situation where excavation is required, it does this by shifting the design section in relation to the survey section for every section in a set of sections such that the cut volume is minimised.



Offset Interval

Offset Interval is the value, which the design section is iteratively shifted with respect to the survey river section. The larger the offset interval value the quicker the optimisation

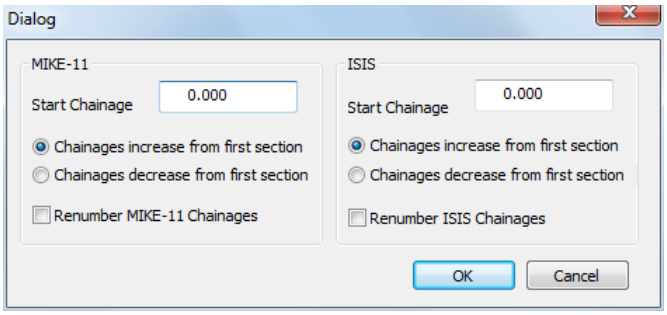
processes. The smaller offset interval value the slower but more accurate the optimisation process. For example, the default value is 0.1 means that the design section will be placed within 0.1m of the optimum position.

Maximum Additional Shift per Section

This parameter controls the amount the design section may be shifted in position relative to the position of the previous design section. The value controls the maximum deviation of the optimised centre line from the original centre line. For example, a value of 2m would mean that the centreline position of the current design section could only deviate a maximum of 2 m from the design centreline. A large value can potential allow the optimum design centreline to zig zag across the river in order to optimise or to minimized the dredged volume. A smaller value prevents the optimum centreline from deviating sharply away from the design centreline.

33.3.21 Renumber River Chainage (Section Edit Menu)

This tool can be used to renumbering of MIKE-11 and ISIS chainages, in both forward and backward directions.



33.3.22 Transform Coordinates (Section Edit Menu)

This option permits the user to create or edit a transformation from one co-ordinate system to another.

See Also

Transform Coordinates

33.3.23 Insert New Object (Section Edit Menu)

Inserts and embeds an object, such as a chart or an equation in a document.

See Also

Insert New Object (Model Edit Menu)

33.3.24 Links (Section Edit Menu)

This option list and edit links to embedded documents.

33.3.25 Object (Section Edit Menu)

The option allows the user to Select the object by clicking on it and the following options are activated.

Display Content

Display the object in its original format. This option is used if the object is currently displayed as an icon.

Display Icon

Displays the object as its source program icon. This option is used if the contents of the object are currently displayed in the active SCC document.

Reset Size

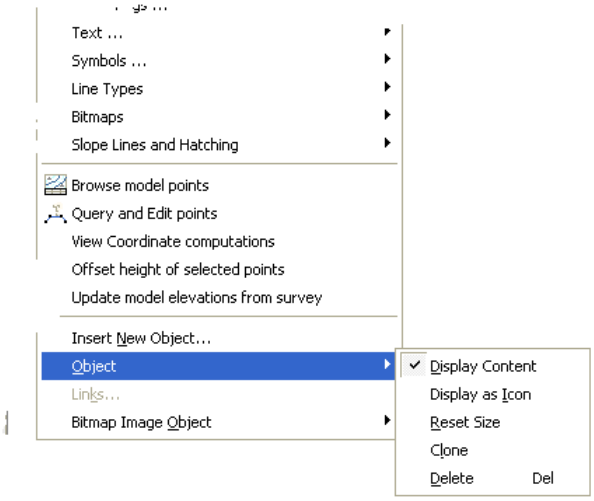
Change the size of the object or the icon representing the object in the current document.

Clone

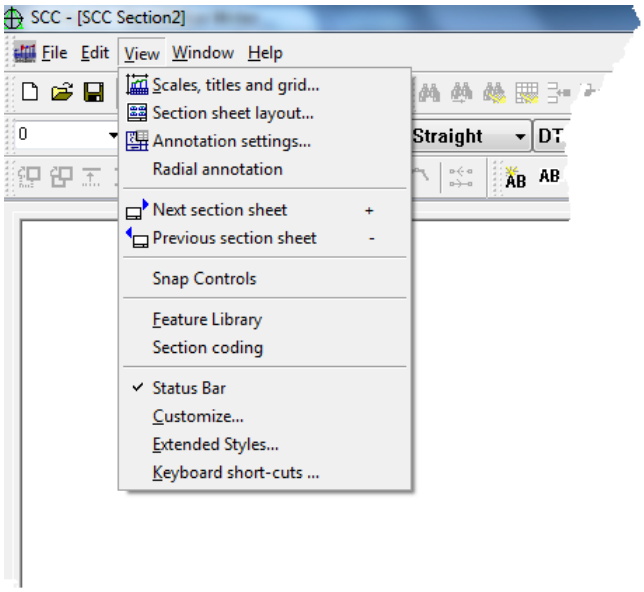
Make a copy of the current object

Delete

Delete the object from the current document

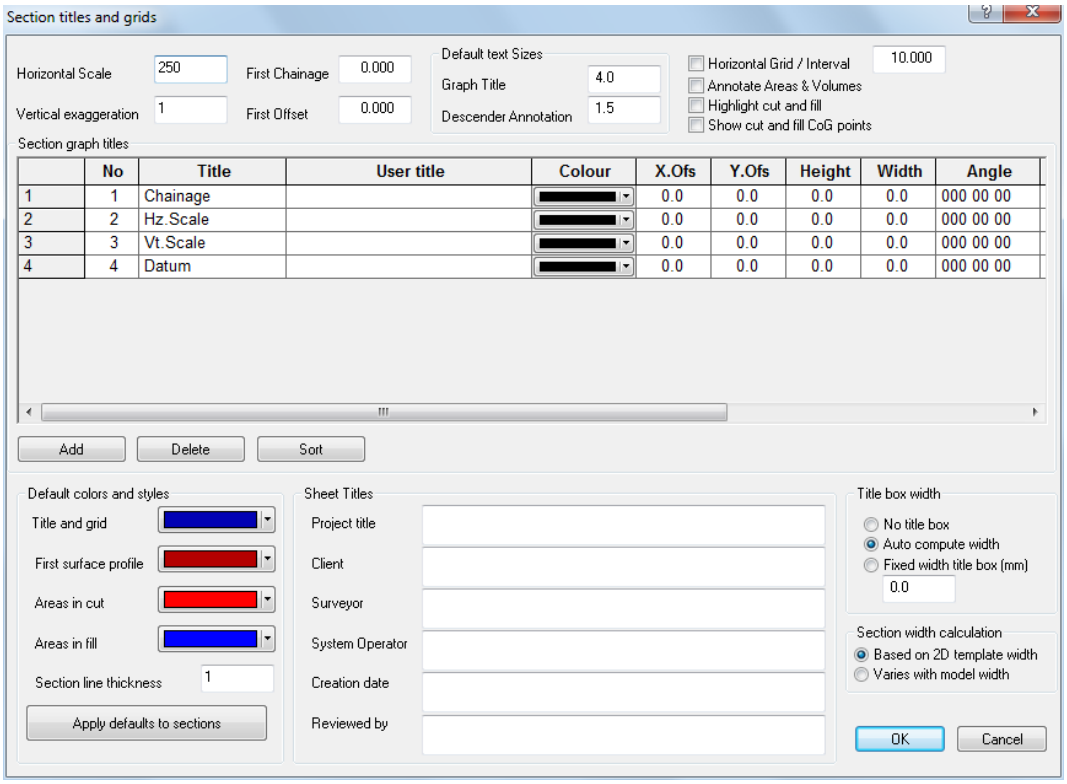


33.4 Section View Menu



33.4.1 Scales, Titles And Grids (Section View Menu)

This option allows the user to set the scales, titles and grids to be drawn in relation to the section graph. Selecting this option presents you with a dialogue containing the following parameters;



Horizontal Scale

This value is the plot scale that is used when determining text and symbol sizes for

section graph annotation.

Vertical Exaggeration

This is the vertical exaggeration multiplier used when forming the profile graph. This allows grade changes to be more easily identified. The vertical scale is equal to the horizontal scale divided by the vertical exaggeration, for example, if the horizontal scale is 1:1000 and the vertical exaggeration is 4 the vertical scale would be 1:250.

First Chainage

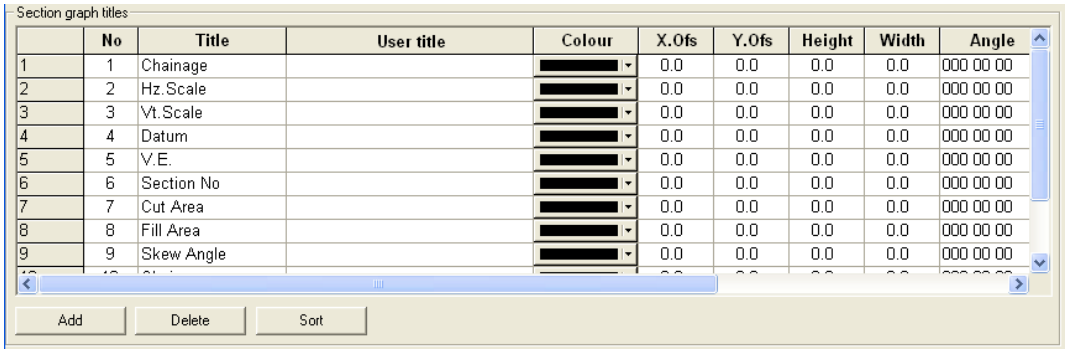
This value is a constant that will be added to all chainages for the purposes of output. If the first point on the section is chainage 0 then this value will be 0. This facilitate is particularly useful when dealing with partial or incomplete surveyed long sections.

First Offset

This value is a constant that will be added to all offsets for the purposes of output. If the centre point on the cross section is offset 0 then this value will be 0.

Section Graph Titles

This option allows you to modify the titles that are displayed with each section. You can add titles, deletes existing titles or even change the order in which they appear on the section. There is also the option to define the colour, size, orientation and position of each piece of text independently by entering values in the relevant fields and then selecting the 'OK' button.



	No	Title	User title	Colour	X.Ofs	Y.Ofs	Height	Width	Angle
1	1	Chainage			0.0	0.0	0.0	0.0	000 00 00
2	2	Hz.Scale			0.0	0.0	0.0	0.0	000 00 00
3	3	Vt.Scale			0.0	0.0	0.0	0.0	000 00 00
4	4	Datum			0.0	0.0	0.0	0.0	000 00 00
5	5	V.E.			0.0	0.0	0.0	0.0	000 00 00
6	6	Section No			0.0	0.0	0.0	0.0	000 00 00
7	7	Cut Area			0.0	0.0	0.0	0.0	000 00 00
8	8	Fill Area			0.0	0.0	0.0	0.0	000 00 00
9	9	Skew Angle			0.0	0.0	0.0	0.0	000 00 00

This option also allow inclusion of user defined attribute information, such as SC0 headers, in the section title. These are implemented as text macros, where the macro [ATTR:<Attr Name>] can be used for a section specific attribute and [USER:<Attr Name>] for a global attribute. For example, [Attr:DIST] would be used to annotate the distance from an SC0 file.

SCC will default to using the annotation specified in the 'Title' field unless text is otherwise entered in the 'User Title' field. Default titles can be accessed by clicking on any box in the 'title' column and selecting a title from the pull down menu.

Text Sizes

Graph Title

This is the text size used for the graph title, it requires that the plot scale be entered to operate.

Descender Annotation

This is the text size used when annotating graph descenders, it requires that the plot scale be entered to operate.

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Default colours and styles

Title and grid

This field contains the colour used for the profile construction grid.

First surface profile

This field contains the colour used for the ground profile line for the first surface. Profile lines for other surfaces are given other colours.

Areas in cut

This field contains the colour filling areas of cut in a cross section graph.

Areas in fill

This field contains the colour filling areas of fill in a cross section graph.

Section Line Thickness

This field allows the thickness of the surface lines on the profile or sections to be set. When this option is changed select the option Apply Defaults to sections.

Apply Defaults to sections

This option applies any changes made in this dialog to the section file before closing the dialog. This option must be selected to apply any changes made in this section of the dialog.

Horizontal grid interval

This is the distance, in meters, at which horizontal construction lines are drawn.

Annotate areas & volumes

This option specifies whether areas and cumulative volumes of cut and fill will be annotated at each cross section.

Highlight cut/fill areas

This switch defines whether areas of cut/fill will be displayed on the cross section graph.

Sheet Titles

This title box is used to enter information about the current section drawing. When a sheet template is inserted into the section, the relevant data is atuomatically updated to the sheet.

This option only works if the sheet macros have been used to create the sheet template.

Title box width

This option allows you to control the width of the title box, and whether or not it is drawn. Selecting a value of ‘auto compute width’ will compute the width base on the width of the title items, and draw the title box. Selecting any other value will use the entered width for positioning the title text and drawing the box.

Section width calculation

This option controls how the width of an individual sections is calculated. This may be base on the 2d template width or the extents of the 3d surface cut. For example, if the

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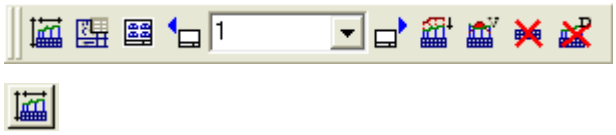
section was specified as having a 25m left and right offset, and the former option was selected, all graphs will be generated with a width of 50m. If the latter option is selected, individual graphs may be narrower than this, based on the width of the model cut.

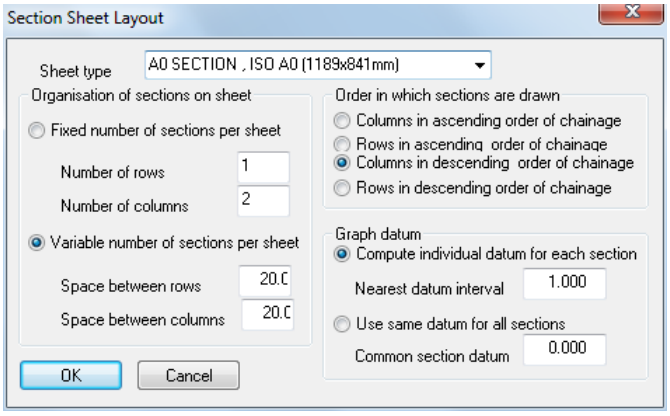
Shortcuts

Toolbar:



33.4.2 Section Sheet Layout (Section View Menu)

This option allows the user to insert a sheet and control the layout of the sections on that sheet. Selecting this option presents a dialogue containing the following parameters;



Sheet Type

This option allows you to select your sheet type from the list.

Organisations of Sections on sheet

This option allows you to select the way in which you want your sections displayed on the sheet.

'Fixed number of sections per sheet' allows you to fix the amount of sections you want displayed on a sheet, by rows and columns.

'Variable number of sections per sheet' 'allows you to display variable amounts of sections on a sheet by entering specific values for spacing between rows and columns.

Order in which Sections are drawn

This option allows the user to set the order for the sections to appear on the sheet. The four options are:

- columns in ascending order of chainage
- rows in ascending order of chainage
- columns in descending order of chainage
- rows in descending order of chainage

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Graph Datum

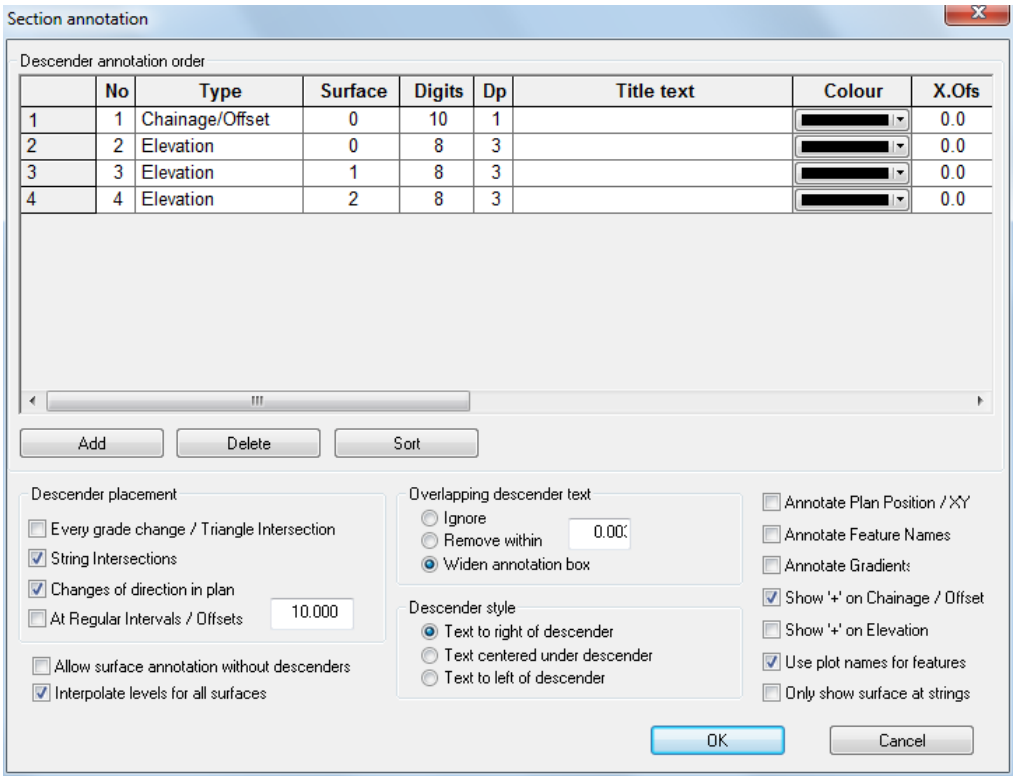
This option allows the user two options:

- To enter a datum value which is used as the datum on all sections.
- To compute a relevant datum for individual sections. This value is computed as the next lowest grid interval below the lowest point on the graph. The horizontal grid interval may be specified in the scale,titles and grids menu.

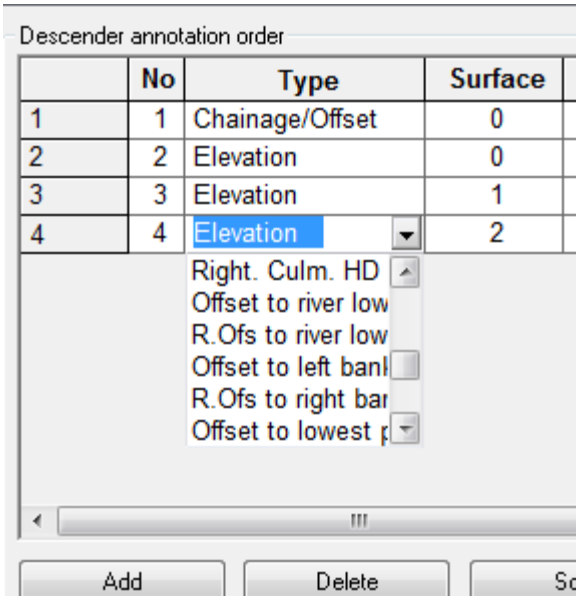
For example, if the lowest point on the section graph is 45.000m and the horizontal grid interval is 10m, then the computed datum is 40.000m.

33.4.3 Annotation Settings (Section View Menu)

This option determines the annotation of section descenders and allows the user to select descender placement, text, style and colours for example.



Predefined Descender types can be selected.

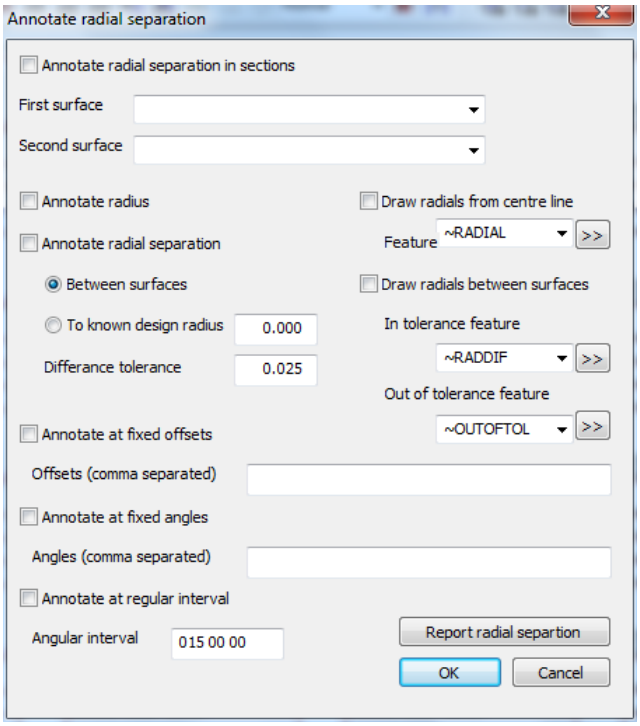


Additional descenders have been include to support river section functionality and required exports to HEC-RAS, ISIS and MIKE formats: Chainage/Offset, Elevation, Plan X, Plan Y, Gradient, Feature Name, Height Difference, Slope Distance, Partial Chainage, Culm. Slope Distance, Culm. Horizontal Distance, Right Culm. Horizontal Distance, Offset to river low point, R. Ofs to river low point, Offset to left bank, R. Ofs to right bank, Offset to lowest point, Offset to highest point, R. Ofs to lowest point, R. Ofs to highest point, H. Distance to lowest point, H. Distance to highest point.

Level (All surfaces), has been added to annotate levels from all surfaces and features in a single row rather than by surface.

33.4.4 Radial Annotation (Section View Menu)

This options allows for extra annotators at specific angles as well as offsets.

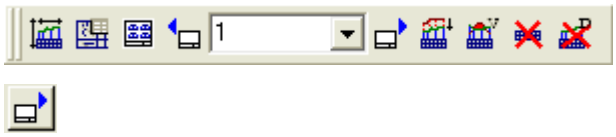


33.4.5 Next Section Sheet (Section View Menu)

This option allows the user to scroll through the section sheets from the current sheet back to sheet 1.

Shortcuts

Toolbar:



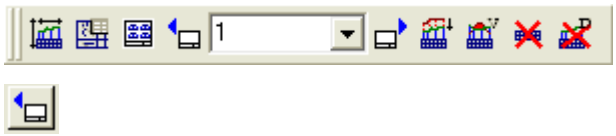
Keys: +

33.4.6 Previous Section (Section View Menu)

This option allows the user to scroll through the section sheets from the current sheet onwards .

Shortcuts

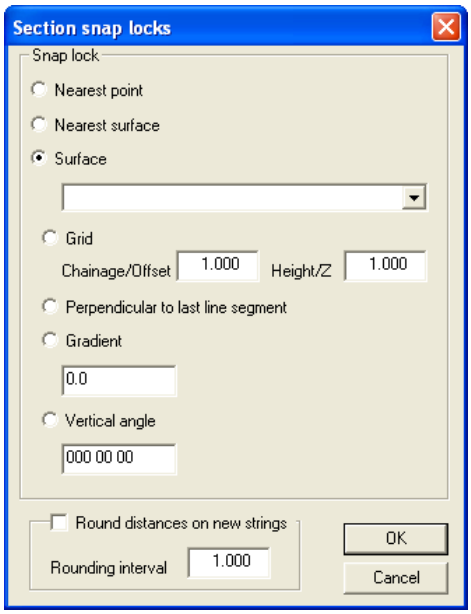
Toolbar:



Keys: -

33.4.7 Snap Controls (Section View Menu)

The following snap controls are available within a section file:



33.4.8 Feature Library (Section View Menu)

Feature names in sections are automatically generated as follows;

The first character is the surface number, starting at 0 for the first surface. For grid lines and annotation the first character is set to 'G', for title blocks 'T', for cut area polygons 'C' and for fill

area polygons 'F'. The second character corresponds to the annotator or title text number , starting with 0. The third character corresponds to the descender type, i.e. surface intersection, change of direction, string intersection or end point. The remaining characters contain the first four characters of the cut string feature name.

This naming convention has been used such that entire blocks of related information can be easily manipulated in SCC sections that have been exported to CAD.

33.4.9 Status Bar (Section View Menu)

The status bar is displayed at the bottom of the SCC window.

See Also

Status Bar (Model View Menu)

33.4.10 Customise (Section View Menu)

This option allows the user to select the toolbars which SCC displays and to create new users defined toolbars.

See Also

Customised (Model View Menu)

33.4.11 Extended Styles (Section View Menu)

This option defines how the toolbars appear.

33.4.12 Keyboard short-cuts (Section View Menu)

This option allows the user to select a combination of keystrokes which may be used as shortcuts for any menu command in SCC. Keyboard shortcuts will generally only be defined on commands that are used very often. There is an option in the General Options to disable this option. The option Disable user Defined keyboard shortcuts is in the Directories and Files section of the General Options.

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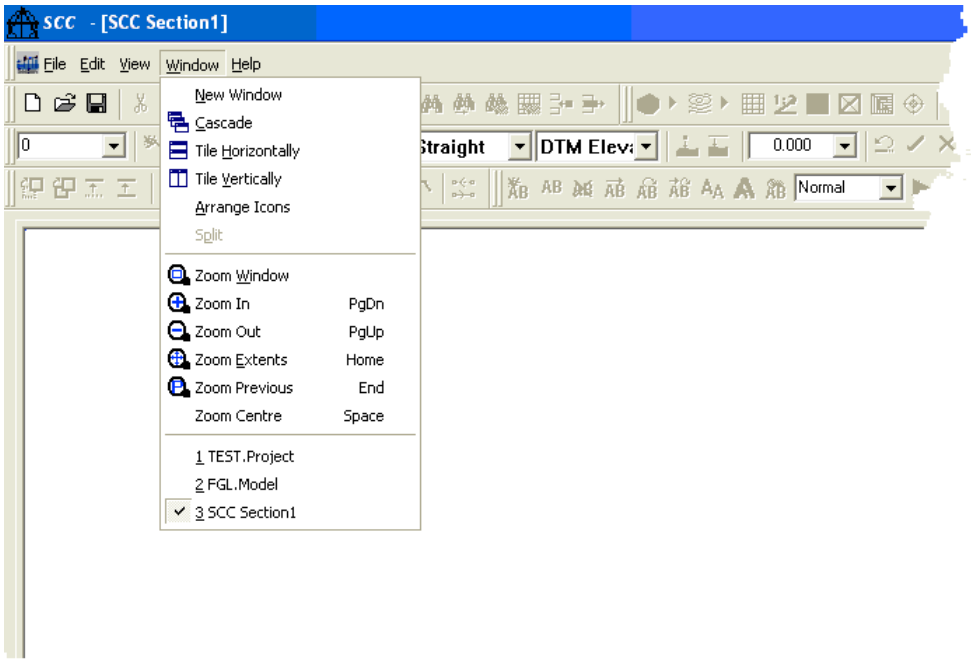
33.5 Section Window Menu



33.5.1 New Window (Section Window Menu)

This command to open a new window with the same contents as the active window. The user can open multiple document windows to display different parts or views of a document at the same time. If the user changes the contents in one window, all other windows containing the same document reflect those changes. When the user opens a new window, it becomes the active window and is displayed on top of all other open windows.

33.5.2 Cascade (Section Window Menu)

Use this command to arrange multiple opened windows in an overlapped fashion.

See Also

Cascade (Model Windows Menu)

33.5.3 Tile Horizontal (Section Window Menu)

Use this command to horizontally arrange multiple opened windows in a non-overlapped fashion.

See Also

Tile Horizontal (Model Windows Menu)

33.5.4 Arrange Icons (Section Window Menu)

Use this command to arrange the icons for minimized windows at the bottom of the main window. If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

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33.5.5 Split (Section Window Menu)

Use this command to split the active window into panes.

See Also

Split (Model Windows Menu)

33.5.6 Zoom Window (Section Window Menu)

Zooms to a rectangular window defined by two opposite corner points selected by the mouse.

Shortcuts

Toolbar:

Keys: ALT + W, W

33.5.7 Zoom In (Section Window Menu)

Increases the apparent size of the model on screen, centred on the section of model where the mouse is pointed.

Shortcuts

Toolbar:

Keys: Page Down

33.5.8 Zoom Out (Section Window Menu)

Decreases the apparent size of the model on screen.

Shortcuts

Toolbar:

Keys: Page Up

33.5.9 Zoom Extents (Section Window Menu)

Zooms to display the extent of the model.

Shortcuts

Toolbar:

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Keys: Home

33.5.10 Zoom Previous (Section Window Menu)

Zooms to the previous display.

Shortcuts

Toolbar:

Keys: End

33.5.11 Zoom Centre (Section Window Menu)

The current window is centred on the mouse position.

Shortcuts

Keys: Space