SCC Training:
Getting Started

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12

Table of Contents

1   Introduction

Atlas Computers Ltd. has varies multi-media resources for SCC support and information providing extensive information in relation to SCC tools and functionality:

Youtube Channel

Provides videos on various options within SCC, examining specific functionality and case studies. This is a valuable resource with each video using data to demonstrate work flows in a step-by-step way. See Atlas youtube channel here;
https://www.youtube.com/channel/UCms5ASszWNlnb4ENs321jaA?view_as=subscriber

SCC User Group & LinkedIn Group

Provides a means to keep up to date with developments in SCC. See Atlas User Forum & LinkedIn Group: http://www.atlascomputers.ie/smf/index.php http://www.linkedin.com/groups/SCC-users-4971870

On-line help

The on-line help contain extra multi-media content such as video examples covering the use of different program options. The help file contains SCC Training Manual information as well as on Menus, Dialogs and Tools.

1.1   SCC Training Manual

The following document outlines the main principles, concepts and tools within SCC Modules during an SCC Training day (s).

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.

> **'DATA tab > '**

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

> **'MODEL > SCC Dataset'**

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.

2   Basic Concepts

This section deals with the basic concepts and terms used within SCC. It aims to explain how SCC is licensed, generates maps and surfaces from observed survey data, river section analysis, design data and point cloud data. It examines

mechanisms for processing and transferring the information generated between packages and producing deliverables.

2.1 Installation and set-up

SCC installation is available from links to the Atlas Computers Ltd. website https://atlascomputers.ie/download/.

Full installations or upgrade files are available for installation. If the user has a previous version of SCC installed the user can choose to update current version using an update file.

In cases when the SCC version on the PC/laptop is several version behind current release, the user is advised to uninstall previous versions within Settings > Apps, and then install the latest releases.

To Install SCC from link:

Download installation file from link provided

Once downloaded, right click on file and select 'Run As Administrator'

Follow prompts installing in the Default Location

The hardward lock driver will also install

Run SCC by double clicking on SCC Icon

2.2 SCC Versions & Updates

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 13.4.8 is SCC release 13, 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 link to installation 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 13.0.0 may not be able to fully read all files created with 13.1.0. A minor version change indicates a software modification that has no bearing on file format compatibility, for example SCC 13.4.2 can read files created in 13.4.8 as all data created in SCC 13.4.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.

2.3 SCC Licensing

SCC licensing is controlled by a a node lock license or a hardward dongle key (stand alone or network).

Node Lock License Key

Request file is created from specific PC/Laptop. A license file is generated. License cannot be transferred.

Stand Alone License Key

HASP USB key is used to license software on individual PC/Laptop. Codes are installed on USB key. Key can be moved between PC/Laptops to use SCC. HASP USB key driver is installed during installation but also available within \SCC\HASP4_driver_setup folder or from Atlas website https://atlascomputers.ie/download/

Network License Ky

NetHASP USB key can be used to license software on a Network. Codes are installed on USB key. Several SCC licenses can be controlled and used concurrently using network license. License is freed when user closes software.

NetHASP USB key driver is available from \SCC\HASP_License_Manager or from Atlas website https://atlascomputers.ie/download/

Additional support installation documentation and tools such as NetHASP Monitor and HASP USB key checker are available from Atlas website https://atlascomputers.ie/download/
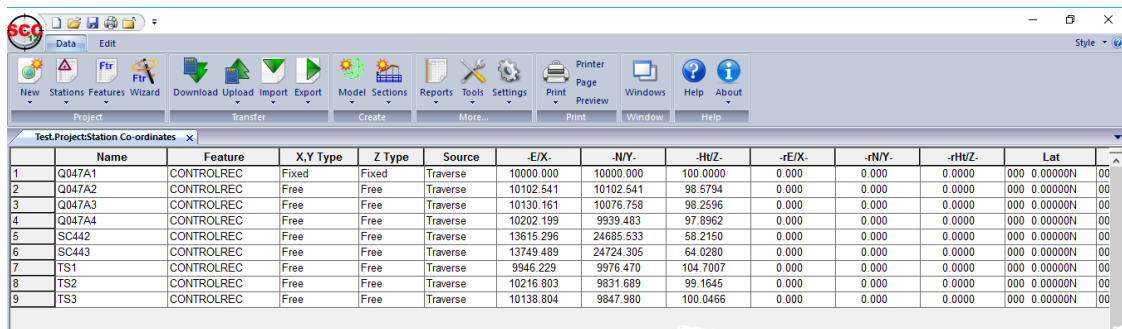
2.4 SCC File Types & Interface

SCC creates and works with the following document types: Projects, Survey Datasets, Traverses, Models, Sections, Transformations, Alignments and Point Cloud.

2.4.1 Project *.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

2.4.2 Traverse *.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.

SCC Traverse sheet displays all network / control observations

2.4.3   Dataset *.Survey

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.

- 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.

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

- 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.

- 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.

- 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.

2.4.4 Model *.Model

Models within SCC are formed from a variety of co-ordinate files, such as reduced survey, dataset, CAD files and point cloud files.

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.   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.
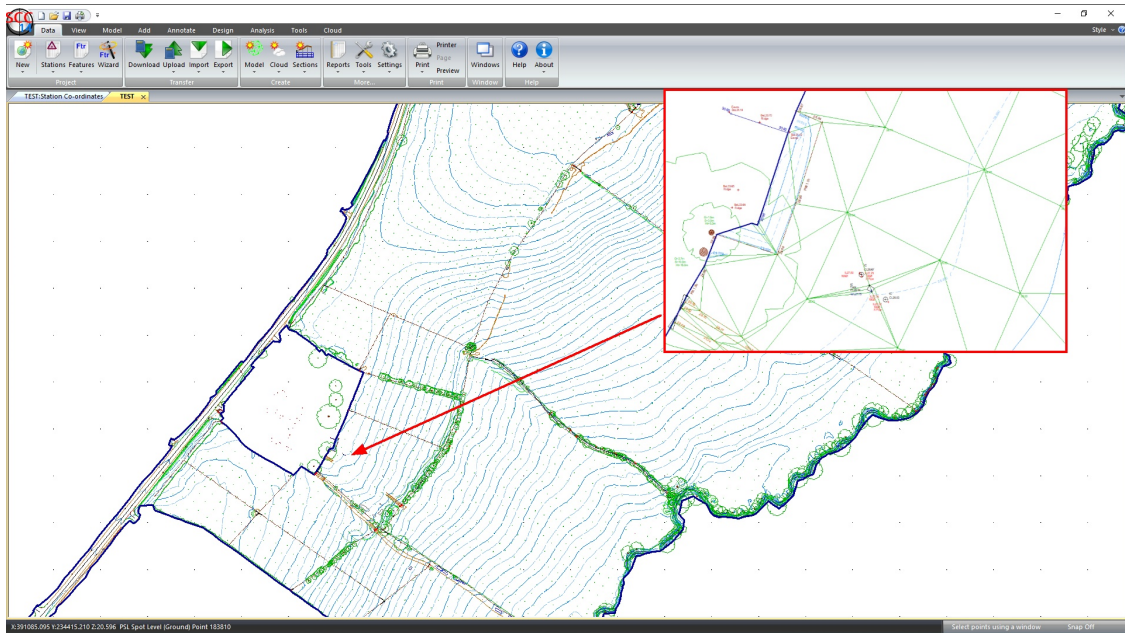
2.4.5   Section *.Section

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
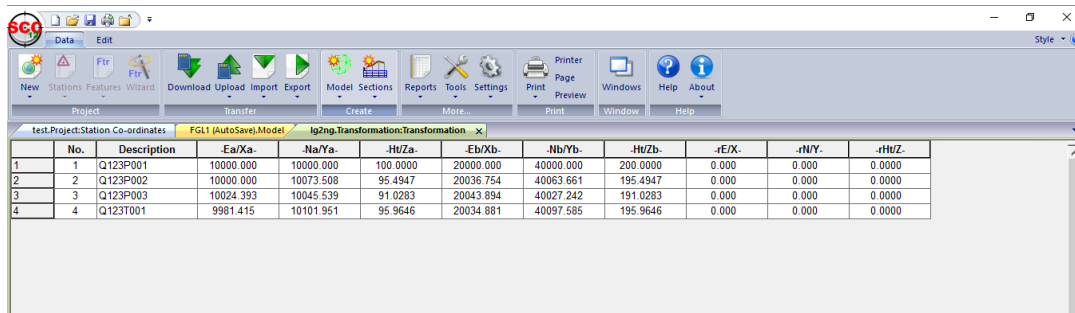
As with the project, the model also stores copies of all referenced symbols, line styles, text styles, bitmaps, and sheet layouts, such that it forms a fully self contained document. Section style files can also saved and loaded from section views to simplify the process of applying standard drawing 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.
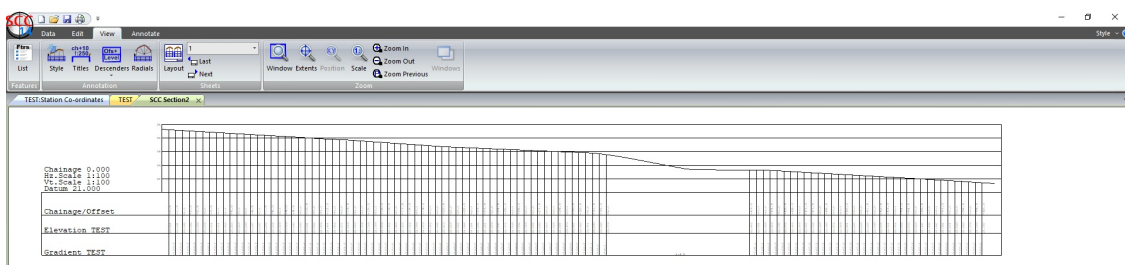
2.4.6   Transformation *.Transformation

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.
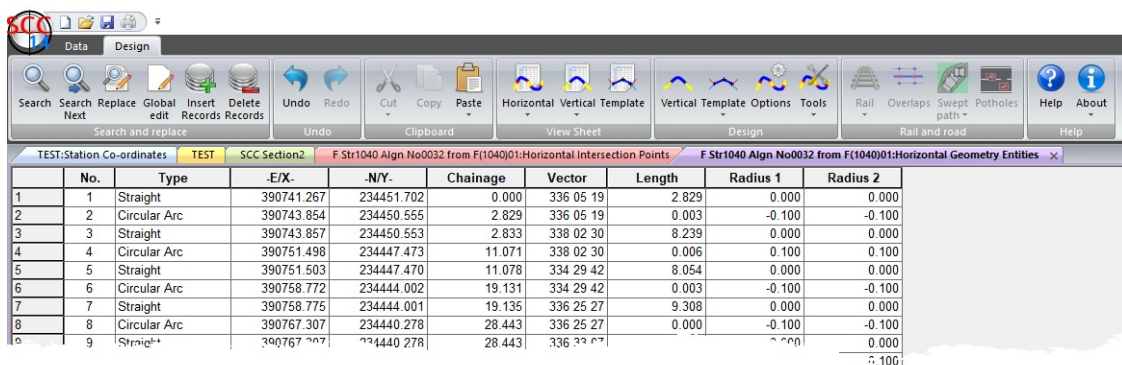
2.4.7   Alignment *.Alignment
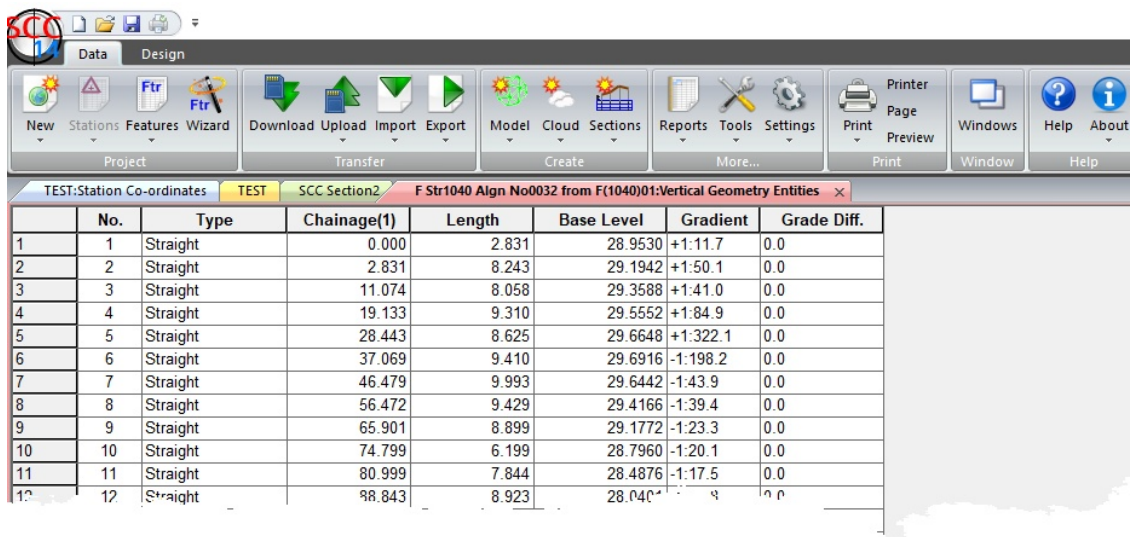
The alignment document stores all information relating to horizontal, vertical, and section template design data. SCC enables you to create linear and polygonal designs, using both interactive graphics and spreadsheets. Designs can include surfaces and multiple section templates for different chainage 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

- Rail Cant

- 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.

2.4.8   Point Cloud *.PointCloud

SCC Point Cloud file contain cloud data from file formats such as LAS or LAZ file (s), PTS files (s), E57 file, GeoTIFF file, Arc Info ASCII grid (Lidar), Leica MS50/MS60 or Faro FLS file (s).   A point cloud file will have a *.Model file of the same name which contains added detail information such as Feature Strings and Points, classifications and TIN.
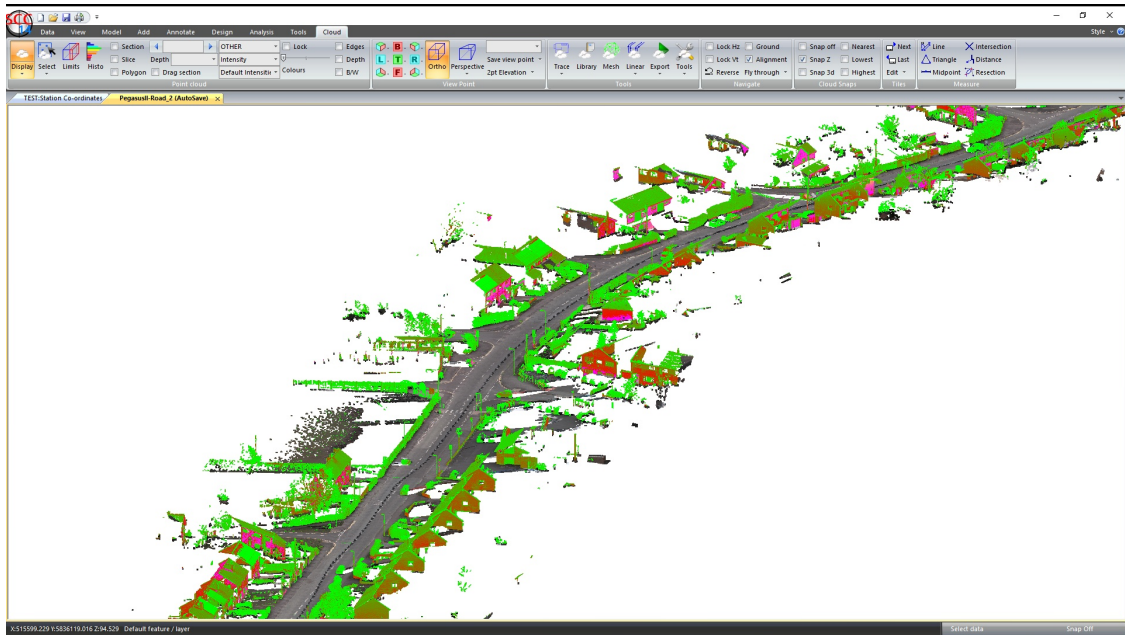
2.4.9 Backup File *.BAK

SCC Backup files can be used to retrieve lost files.

2.4.10 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 tab > Cut/Copy'.*

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

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.

2.4.11 Backup Strategies

In addition to saving documents using a revision number based file naming convention, it is recommended to create a backup file. 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 **'DATA tab > Settings > General Options > Directories and Files'** to allow the user to select auto save options but also to create backup files automatically.
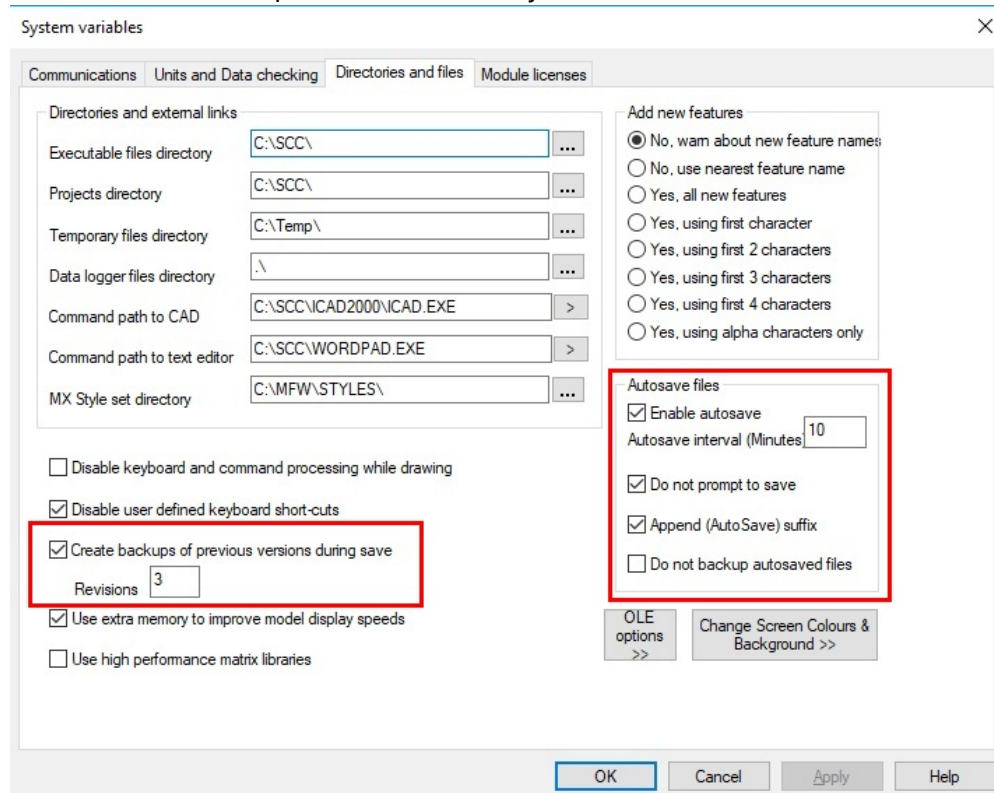
2.4.12 Data storage and user interface

Data Storage

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.
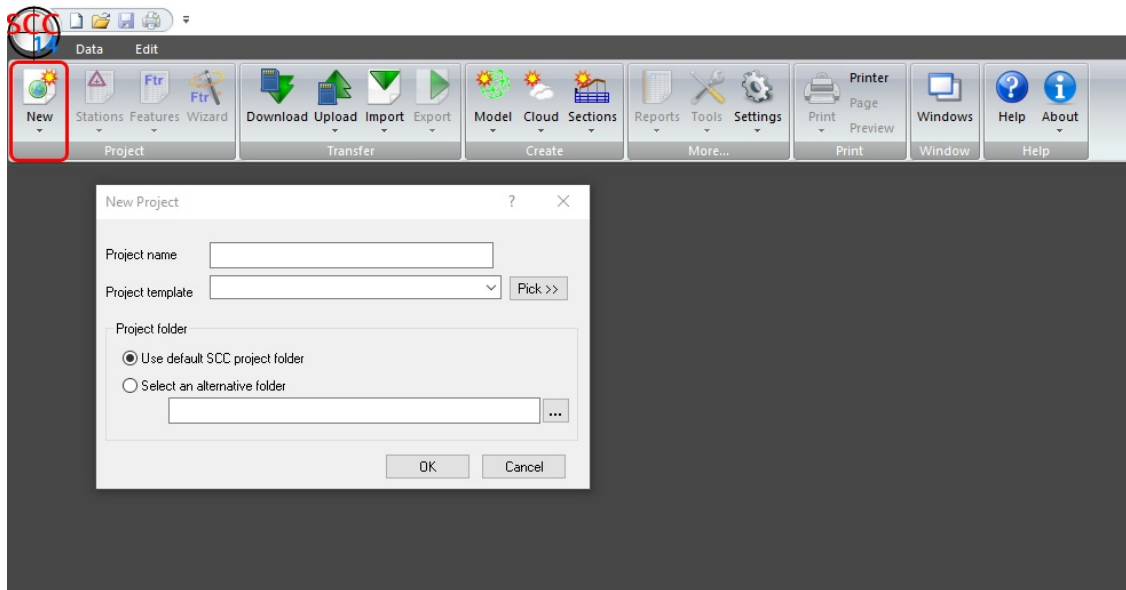
The location of this folder is set-up in the 'General Options > Directories and Files' dialog, by default it will be 'C:\SCC'.

DATA Tab > Settings > General Options
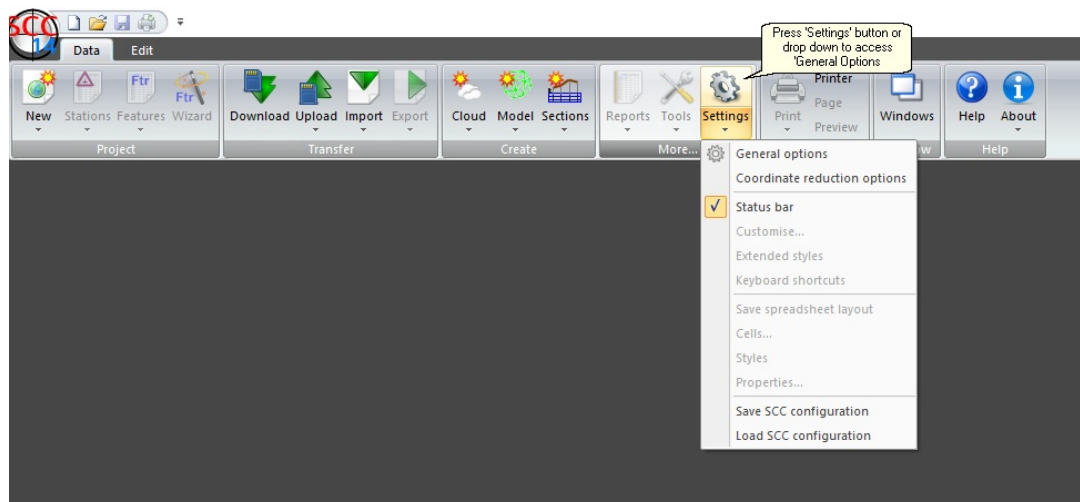
2.5   General Settings

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

DATA Tab > Settings > General Options
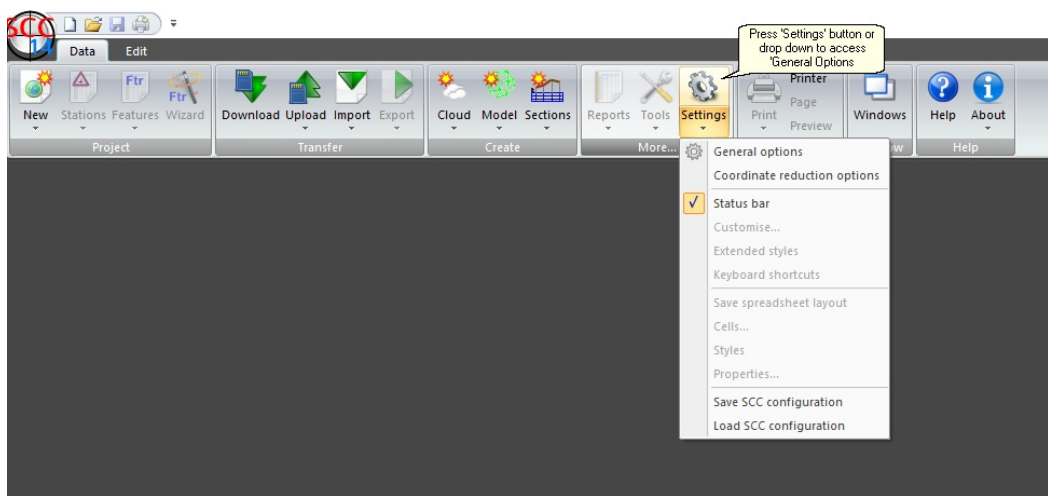
Communications

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)

Translate Survey Field Codes into Feature Codes

This option converts Field Codes present in raw file to be mapped to Feature Codes in the Library.

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.

Mouse Navigation

This option setups use of mouse buttons and controls.

Mouse wheel zoom factor %

This option defines the % of zoom available using mouse wheel

Disable mouse cursor repositioning for zooming and panning

This option turns off the re centering of the mouse to centre of screen when zooming and panning. Speeds up zooming and panning.

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

- Latitude / Longitude - This field specifies the units used when inputting and outputting latitude / longitude values

Decimal Minutes Seconds

Decimal Degrees Minutes

Decimal Degrees

Radians

DDM (Lat)

DDM (Long)

DMS (Lat)

DMS (Long)

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.

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;

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.

Decimal Displayed: Plan / Z / Angels / Grade

This options

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.

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.
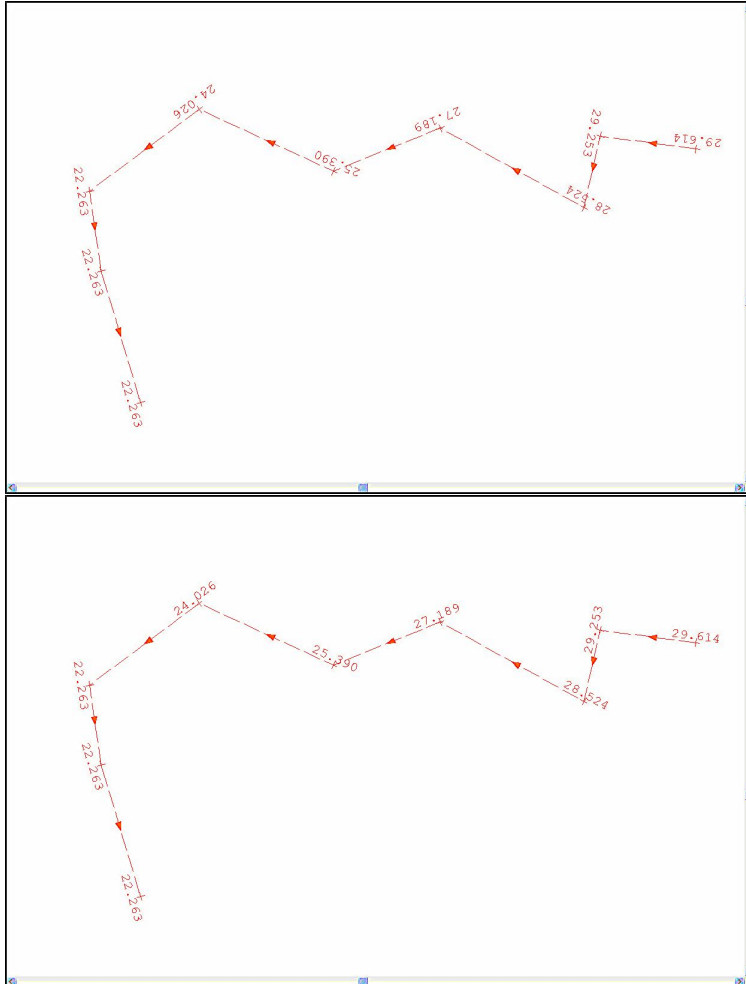
Disable Redrawing Of String Annotation With String Edits

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 DIT > 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.
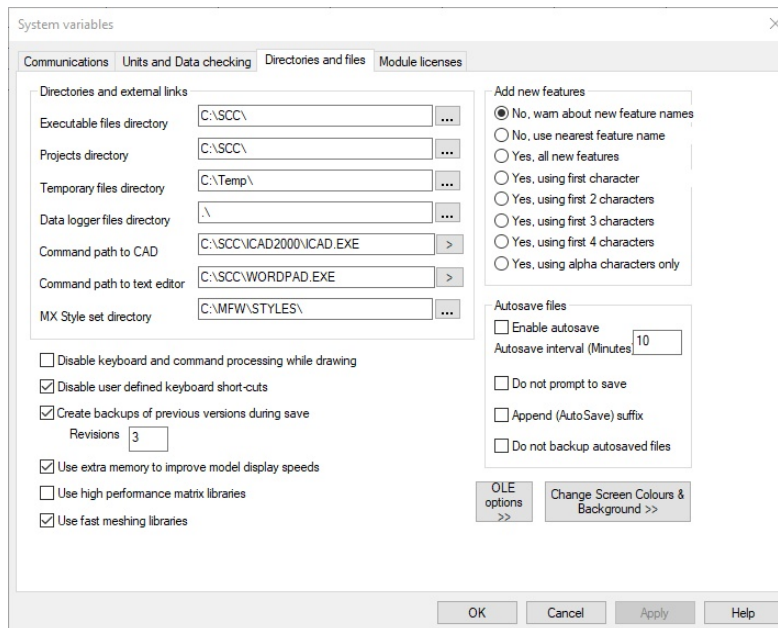
Executable Files Directory

- 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.
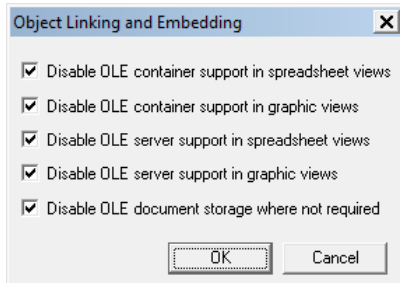
 OLE document storage is useful if the user wish to set and query user defined document attributes from Windows explorer, and if the user is embedding OLE objects into your SCC models.

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.
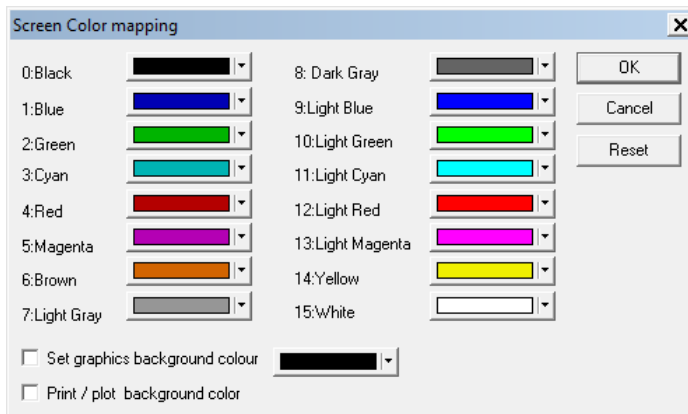
MX Version

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.

Modules and maintenance codes are contained within a license file *.lic file.

To install codes:

Close SCC

Place license file in \temp folder

Open SCC

Message detailing modules enabled will appear

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.

2.6 Coordinate Reduction Options

DATA Tab > Settings drop down button > Coordinate Reduction Options

Coordinate Reduction Parameters

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.

Name Feature Names

This option sets the way in which Feature Names are downloaded: Ignore, Use as strings, Remove from Feature

Parallel Feature Offsets

This option sets the way in which parallel offsets are processed: Do not apply offsets, Apply in X-Y Plane, Apply in X-Z, Apply in Y-Z Plane

Line Of Sight Offsets

This option sets the way in which Line of Sight Offsets are processed: Apply to slope distance, Apply to horizontal distance

Missing Stations

This option applies 0, 0, 0 Coordinates or gives a 'Warn about missing stations, do not create coordinates' when there are missing stations

Multiple remarks on one point

This option set the way in which multiple remarks for a single point: Ignore, Join Single Line, Join Multi-line

Close ends on parallels

Use MSMM offsets conventions

Create squares and rectangles

Resolve MOSS partial coding

Create 'Strip Levels'

Query files updates

Include construction points

Include curves in TIN

Force string numbers in advanced coding

Default tag and DTM codes in advanced coding

Allow observations between points on two and three points rectangles, arcs and circles

Enable duplicate tag codes

Change string with new feature

Strip leading zero from point IDs

Force point IDs to upper case

Reduce to active viewpoint

Set >99m rod heights to DTM Approx

Run inverts with coordinate rebuild

2.7   Points, Strings, Tag Codes & DTM

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 defined as the Line Connection Tags.   The string can be 3D or 2D be defining the DTM Code.

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.

Line Connections 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. The most commonly used Line Connection Tags are:
S - Straight
C - Curve
A - Arc
G - Gap
L - Link
DC - Discontinuous Curve
DS - Discontinuous Straight
Arc3 - 3 Point Arc
Rec2 - 2pt + Width (2 points and Dimension 1 defines width)
Rec3 - 3pt Rectangle

DTM Code

The DTM (Digital Terrain Model) status code determines the significance of the point of the surface model / digital terrain model being generated. DTM controls whether a point or string is included in the TIN. A string can be two or three-dimensional and can have varying significance to the surface depending on how it is defined referred to DTM tags. The most commonly used DTM Code are:
D - DTM
3D point (X, Y, Z) included in TIN and contour generation
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.
A - Approximate Elevation
2D point (X, Y, Z=0) not included in TIN and contour generation

An example of a two dimensional string might be an overhead telecommunications line which is displayed in plan for cartographic purposes.

E - Elevation

2D point (X, Y, Z is used for text annotation) not included in TIN and contour generation

An example of a non DTM three dimensional line might be a building eaves or height of bridge that does not influence the formation of the surface model but Z value text can be displayed.

2.8   Feature Names Conventions & The Feature Library

Feature Codes

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 sixteen 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, which can be based on an in-house or field string labelling conventions, or layer naming conventions for AutoCAD users, or from MX or a combination of all.

Feature Library

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.

MX Coding

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.

Controlling Feature Library

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. Many organisation set up and define a feature library that is distributed among SCC users. The addition of features to this library is restricted by the Settings 'Add New Feature' option

DATA tab > Settings > General Options > Directories and Files
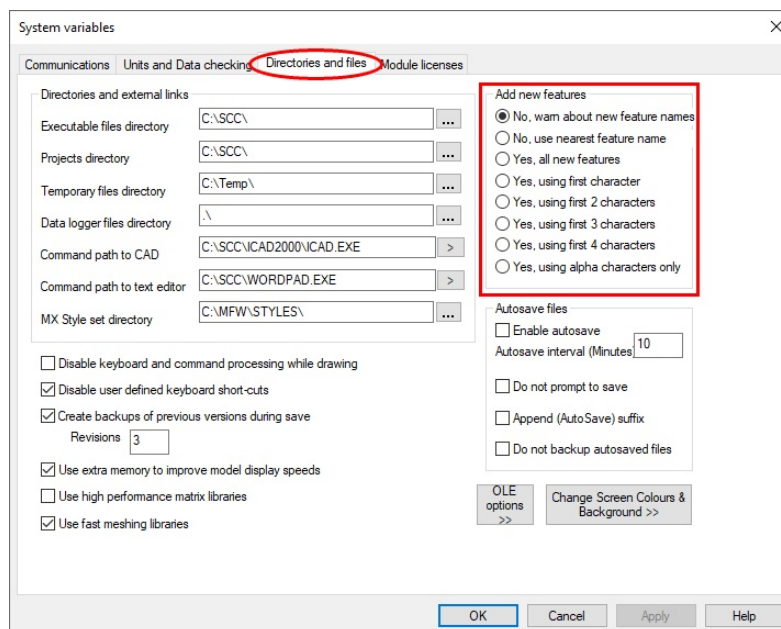
The variable name is 'Add new features' and its value will be one of the following;
- No, warn about new feature name
- No, use nearest feature name
- Yes, all new features
- Yes, using first character
- Yes, using first 2 characters
- Yes, using first 3 characters
- Yes, using first 4 characters
- Yes, using alpha characters only

3   Getting Started

3.1   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 feature that control how the specific feature is drawn, annotated, modelled, and output. Each project in SCC should have a feature library.   Many default feature libraries are available within \SCC folder (.*Project)

Fields within Feature Library

The feature library is made up of 100's of columns and the number of rows depends on the number of features defined by the user.

Note:

It is important that each library should always have a 0 feature, the first entry of library and default ~ layers

Key fields for the development of a library:

Feature

Eight character field contains the name of the feature being edited.

Field Code

Users can insert codes used in the field to map to feature codes set up in the default library. For example, surveyor may survey TBANK for Top of Bank on site but code in Feature Library is set to TB.   User would enter Field Code as TBANK against TB record. On download, the user would ensure that 'Translate survey Field Codes into

Feature Codes' is selected within 'DATA tab > Settings > System Variables > Communitations' prior to download.
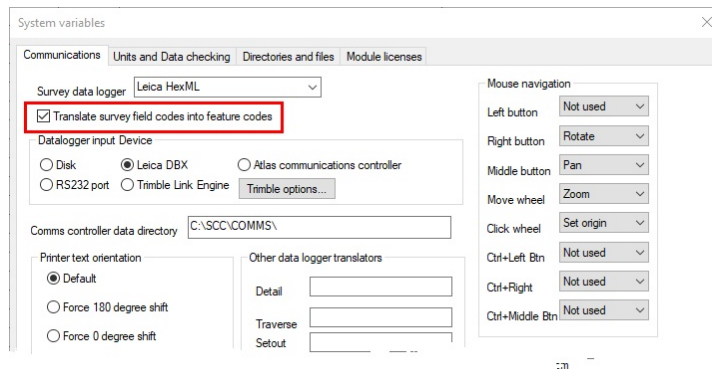
Description

This field contains a free form description of the current Feature.

Plot name

This field contains the name of the current feature for plotting purposes. This may be different from the surveyed feature name where restricted field coding is being used.

Land Use

This field contains the land use for this feature. More details on land use type can be found in the Ground Type Library within Help File.

Layer

This field specifies the layer on which graphical data will be placed within the CAD file. Suffixes and Prefixes may be applied as part of the drawing creation process.

Lbl

This field contains the MX string label prefix for all strings created with this feature name. Point strings will automatically be prefixed with the letter 'P', text strings will automatically be prefixed with the character '*'. While up to four characters may be entered, the second and subsequent characters are liable to be overwritten with the string number, especially in the case of large models. The following values are typically used:

MX Lbl	Description
B	Buildings
C	Channels
D	Ditches
H	Hedges

L	Level Strings
V	Verges
K	Kerbs

M and G should be avoided as they are reserved for MX Design Strings

Subr

This field contains the sub-reference for all strings passed into MX with this feature name. The sub-reference is used by SCC to associate feature data with the MX model for the purposes of DPF creation, string-querying etc.. When entering a value in this field for a new feature or modified feature the user should pick a valued that is not already present in the feature library. A four-letter abbreviation of the feature name is usually a good choice. Use the value 'INTC' where REPORT and GENIO are liable to be used with strings that are represented with scaled macro symbols or macro lines. This is required as such strings are output as non-standard five dimensional strings.

Tag

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 code is separate from the feature name because the geometry along a given string is liable to change. For example, the centre line of a road is likely to include straight and curved sections. Tag Codes / Line Connection Tags can be assigned either in the field or in the Feature Library

Tag Codes / Line Connection Tags can be assigned either in the field or in the Feature Library Sheet or Feature Wizard.

	Lbl	Subr	Tag	Master	DTM	Master	Wgt	
	A9	0000	S ⌄	Survey	A	Library	0	3
	PAV	0000		.			0	Po
	BB	0000	S	Straight			0	No
	PBB	0000	C	Curve			0	Po
	BA	0000	A	Arc			0	No
	BD	0000	G	Gap			0	No
			L	Link				
	BP	0000	S	Survey	D	Survey	0	No
	BR	0000	S	Survey	D	Survey	0	No
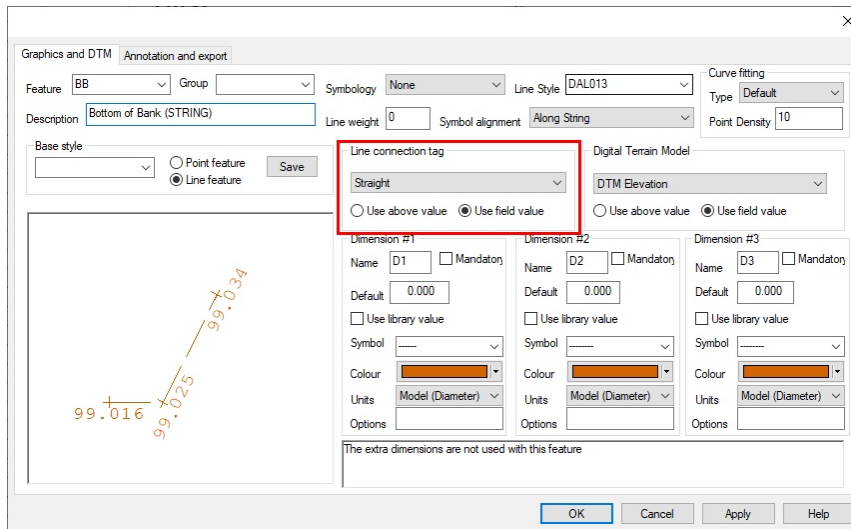
The most commonly used Tag Codes are defined as follows:

- Straight

The current point is joined to the next point by a straight line. If the straight connects to a curve, the curve segment is forced to be tangential to the straight. Horizontal position and vertical gradient changes should be surveyed as appropriate if a 3D line is required.

- Curve

The current point is joined to the next point by a curved line. If the next geometric command is STRAIGHT then the curve will be tangential to the outgoing straight. Curve fitting is three-dimensional when the appropriate DTM status command is selected and honours all the 'curve control' points surveyed. Horizontal position and vertical gradient changes should be surveyed as appropriate if a 3D line is required. The curve used is a cubic beta spline.

- Disc Curve

The current point is joined to the next point by a curve. This point is regarded as a horizontal discontinuity. In the instance of entry or exit straights these will be treated as being non-tangential and will not be used for curve fitting. In the case of two curves of differing radius meeting at a point, then a discontinuous curve point will not attempt to make the curves tangential. The curve used is a cubic beta spline.
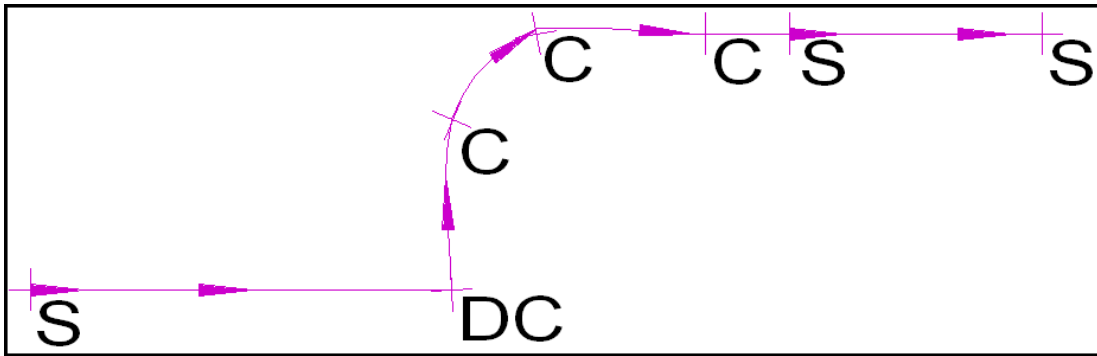
• Disc Straight

The current point is joined to the next point by a straight line. If the current point is at the end of a curve and the Line Tag is set to DISC STRAIGHT, then the incoming curve segment will not be tangential to the outgoing straight. If the tag is set to STRAIGHT by mistake then a distortion of the geometry can occur at the current point.
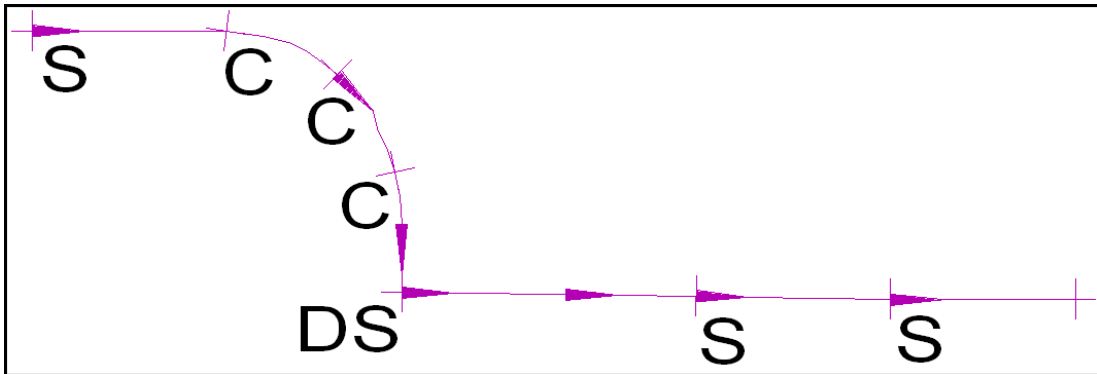
• Gap

The current point is not jointed to the next point. This is equivalent to a pen up command during graphic plotting. The gap infers a point of discontinuity in the string.

• Gap Arc

This is similar to gap curve except that the curve type used is a circular arc.

• Gap Curve

This point is not joined to the next point. If, however, the previous and next points are curves tangency will be maintained, that is to say that the curve fitting will continue through the gap and not form a discontinuity. This is useful, for example, when surveying strings around the outside edge of a roundabout, where a drop kerb may occur at a property entrance.

• Link Curve

This point is joined to the first point on the string by a curve. This curve will be tangential both to the last line / curve segment and the first line/curve segment on

the string. It is sometimes easier to start surveying a feature on a straight line segment of the geometric figure and end up by using the simple command LINK - thereby closing the figure with a STRAIGHT. The curve used is a cubic beta spline.

- Arc

The current point is joined to the next point by an arc. The previous and last line segments are used as tangents to generate the radius for this arc. This function is only used where the surveyor knows that the geometric element is a circular arc - e.g. the survey of a construction line that has been set out on site. For survey purposes, it is preferable to use curves, as the surveyor cannot be sure that the object on the ground is in fact a true arc.

- End

This code is used to terminate a string, such that even if the same string number is used in the future, it will get renumbered to form a new string. This code is commonly used where it is not desirable to collect explicit string numbers in the field, and for short strings where the string numbering is not significant.

Master

This field should be used in conjunction with the Tag Field, if the Master Tag is set to 'Survey' then the geometry of the plotted strings will be determined by the Tag setting in the Detail Coordinate file. If the Master Tag is set to 'Library' then the geometry of the plotted strings will be determined entirely by the Tag setting in the Feature Library and will be overwrite the command coming from the field survey:

bl	Subr	Tag	Master	DTM	Master	Wgt	
	0000	S	Survey	A	Library	0	3 Poi
\V	0000	S	Survey	A	Survey	0	Point
}	0000	S	Survey	D	Survey	0	None
3B	0000	S	Library	Feature Library		0	Point
\	0000	S	Survey	Survey coordinate file		0	None
)	0000	S	Survey	Survey		0	None
)	0000	S	Survey	D	Survey	0	None
t	0000	S	Survey	D	Survey	0	None
3U	0000	S	Survey	D	Survey	0	Point
\V	0000	S	Survey	D	Survey	0	None

Whether a feature point uses the line connection tag assigned in the field or in the feature library is set and controlled in the Master Tag Column in the Feature Library itself or alternatively assigned in the Feature Wizard.

○ Use above value ● Use field value

DTM

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

In simpler terms, it will control whether the point is 2D or 3D and whether it should be used in the Triangulated Irregular network (TIN) and other surface analysis such as area and volume calculations.

DTM Codes can be assigned either in the field or in the Feature Library Sheet or Feature Wizard..

Typical DTM Codes are defined as follows:

- DTM Elevation

Any 3D point, where the X, Y & Z co-ordinates of that point will be included in the creation of the model. Its elevation will also be displayed as part of the model annotation.

- Approximate Elevation

Any 2D point, that is, surveyed in plan only. The point will be displayed in the model but its level will be ignored from the TIN. Also, its elevation will not be included in the annotation of the model.

- Elevation

Any 3D point, which will be ignored from the surface model/TIN but will have its elevation used in subsequent drawing output. This status usually represents points such as invert levels, soffit levels of bridges, where the elevation has been carefully derived but does not lie at the surface.

- Ignore

This point will not be used in either model creation or drawing output. It will be ignored from the file.

- Boundary

Otherwise known as clip polygon, this point is included in all model creation/TIN and it will also form part of a closed polygon, outside of which, valid triangles will not be formed. This defines an outer boundary line for the TIN.

- Boundary Wall

Any point which will form part of the clip polygon above, but which could not be surveyed at the correct height. This point when used to produce a base boundary plan, is draped on the model surface using the elevation from the previous point and then used in surface analysis.

- Void Line

This is a closed polygon within which triangles will not be formed. This area would normally contain such features as buildings, lakes, ponds etc.

- Break Line

This is a line, clearly evident in the terrain, representing a definite change in slope. It will be included in the Triangulated Irregular Network in order to accurately define the surface model.

- 2D Void Line

Similar to the 'void line', this is a closed polygon within which triangles do not form.

- 2D Clip Polygon

This point will form part of a closed polygon, outside of which, valid triangles will not be formed.

Master

This field should be used in conjunction with the DTM field, if the Master DTM switch is set to 'Survey' then the DTM status of the surveyed points will be determined by the DTM setting in the Detail Coordinate file. If the Master DTM field is set to 'Library' then the DTM status of the surveyed points will be determined entirely by the DTM setting in the Feature Library and will be overwrite the command coming from the field survey. Like the Line Connection Master Tag there are two settings 'Feature Library' or 'Survey Coordinate File'.

Whether a feature point uses the DTM code assigned in the field or in the feature library is set and controlled in the Master Tag Column in the Feature Library itself or alternatively assigned in the Feature Wizard.

br	Tag	Master	DTM	Master	Wgt	Symbology
)	S	Survey	A	Library	0	3 Point Symbol
)	S	Survey	A	Survey	0	Point Symbol
)	S	Survey	D	Survey	0	None
)	S	Survey	D	Library Feature Library		bl
)	S	Survey	D	Survey Survey coordinate file		
)	S	Survey	D	Survey Survey		
)	S	Survey	D	Survey	0	None
)	S	Survey	D	Survey	0	None

○ Use above value   ● Use field value

Wgt

This field contains the weight of the lines used when defining this feature, i.e. the line thickness. This value can be from 0 to 31.

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.

Symbology

The symbology field determines how any given feature will be interpreted for the purposes of drawing, and how symbols will be placed in relation to the points surveyed on that feature.

Wg	Symbology	
0	None	CON
0	2 Point Symbol (Centre)	CON
0	Point Symbol	CON
0	2 Point Symbol (Centre)	CON
0	3 Point Symbol	CON
0	Macroline (Centre)	CON
0	Line Symbol	CON
0	In-line Symbol	CON
0	2 Point Symbol (Centre)	CON

- None

No additional symbology is created. Points are drawn as dots, lines are drawn as polylines. Note that level symbols, such as crosses showing the position of the surveyed point, may still be applied regardless of additional symbology.

- Point Symbol

One or two symbols, such as tree canopy and trunk, will be placed in plan, depending on the number of dimensions records. The third symbol is used for placing symbols in elevation on sections.

Whether the dimensions are surveyed or come from the feature library defaults are determined by the 'Use library value' field in the feature library.

The units of the dimensions are also determined by the feature library, in the 'Units' field. These can be paper units, or ground units specified as radius, diameter or

girth. In the case of the tree shown, both units would be set to 'Model (Diameter)', and the dimensions would be taken from the field. In the case of the lamp post the units would typically be 'Paper' and taken from the library. For example, if D(1) had a value of 1.5, the manhole symbol would be drawn at 1.5mm plotted, regardless of the plot scale selected. This will often be the case for features that are drawn thematically rather than to scale, such as most street furniture
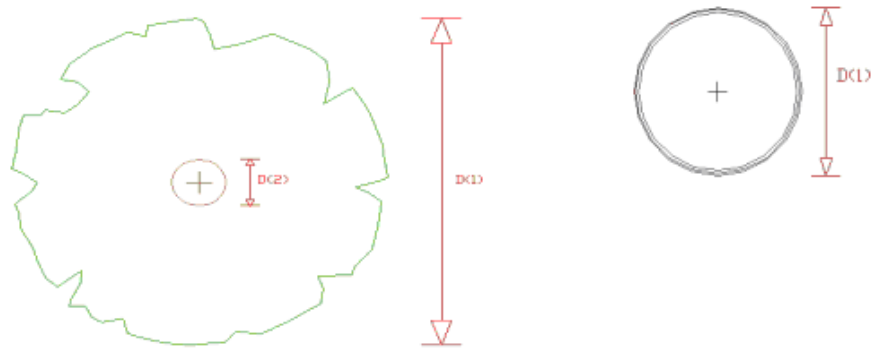
- 2 Point Symbol (Centre)

The first symbol is stretched between two survey points. If a non-zero value is given for the first dimension, it is used to control the symbols transverse width. The symbol is centred on the survey line.

- 3 Point Symbol

The symbol is oriented to lie between the first two surveyed points with the third survey point defining the width of the symbol.
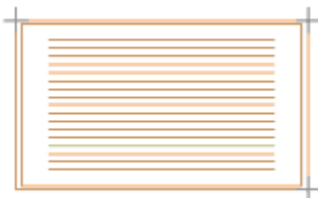
- Macroline (Centre)

A macroline uses lines and polylines rather than sequences of blocks to define a patterned string. Macrolines are slower to draw and make for larger CAD files but they are easier to edit in CAD. Macrolines automatically fillet corners with a radius of half the macroline width, and generally give a good quality of presentation.

Apart from hedges, macrolines are useful for drawing features such as regularly spaced white lines and similar road-markings.

This option allows for the generation of an extra string offset from the macro-line edge, to simplify tasks such as surveying hedges with an offset root line. If the feature description includes text of the form CL=<Feature Name> and additional string with the name <Feature Name> is created using an offset specified in d2.

- Line Symbol

A sequence of symbols are placed between every set of survey points along a string, scaled according to the dimension in the D(1) field.

- In-line Symbol

The first symbol is inserted along the survey at a regular interval, specified by D1. The size of the symbol is determined by D2. If D3 is non-zero, it determines the gap in the line used for the symbol, where it is different from D2.

- In-line Text

Similar to the In-line Symbol but using the text entered in the Plot Name field of the feature library. Note that this symbology has largely been supercede by the use of complex line styles, specified in the line style field.

- Parallel Strip Level (Centre)

A strip level, or parallel feature, is a widened line, optionally extruded in three dimensions. 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. A closed polygon that surrounds the survey line using a specified width replaces the surveyed center-line. The 'Create strip levels' switch in the 'Co-ordinate reduction parameters' menu of 'Detail co-ordinate file' must be set to 'Yes' for this option to work.

SCC provides the option to model three-dimensional strip-levels. Two lines closed at either end will replace the surveyed centreline.

D(1) – width at base of feature

D(2) – height/depth of feature

D(3) – width at top of feature

Note that if the top of the wall has been observed the height should be entered into the second dimensional field as a negative value. If the base of the wall is observed then the value will be positive.

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).
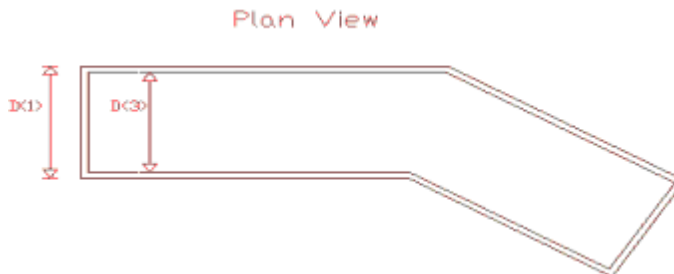
Please note that strip levels are computed during the coordinate reduction process, and changing dimensions in the model is not currently supported.

- Rectangle

A rectangle will be placed between two surveyed points with a breadth equal to dimension in the D(1) field. This is an alternative to using the '2 point rectangle' tag code.

- Steps

Steps are drawn as a 3D polygon created from four survey points. D1 controls the number of steps. If a D2 value is entered as a non-zero, it is used to determine the riser height. Otherwise, the riser height if set to 0 is determined from the polygon height differences.
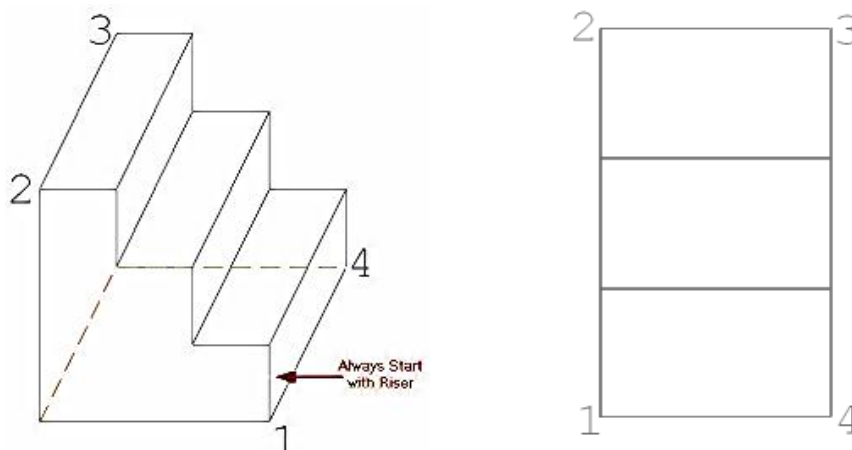
- Parallel Strip Level (Side)

This variation is used where the surveyor picks the side or face of the feature being surveyed, and uses the dimension to determine whether the feature lies on left or right side of the survey line. The convention used is that a negative dimension refers to the left side.

- 2 Point Symbol (Side)

This variation is used where the surveyor picks the side or face of the feature being surveyed, and uses the dimension to determine whether the feature lies on left or right side of the survey line. The convention used is that a negative dimension refers to the left side.

- Macroline (Side)

This macroline variation is used where the surveyor picks the side or face of the feature being surveyed, and uses the dimension to determine whether the feature lies on left or right side of the survey line. The convention used is that a negative dimension refers to the left side.

This option allows for the generation of an extra string offset from the macro-line edge, to simplify tasks such as surveying hedges with an offset root line. If the feature description includes text of the form CL=<Feature Name> and additional string with the name <Feature Name> is created using an offset specified in d2.

- Vertical Parallel

Pairs of points are used to create vertically separated strings, such as top and bottom of kerbs. If D1 determines the horizontal separation and if D2 determines the search radius, The higher point, if found, is used to determine the vertical offset to the upper string.

- Vertical, join bottom

A vertical line is drawn from the ground to a height specified in D3. The high points on these verticals are connected, for example, to form the top of fence.

- Vertical, join top

A vertical line is drawn from the ground to a height specified in D3. The low points on these verticals are connected, for example, to form a string at ground level.

- Vertical, join both

A vertical line is drawn from the ground to a height specified in D3. The high points and low points on these verticals are connected.

- Vertical, join none

A vertical line is drawn from the ground to a height specified in D3. These verticals are not connected in plan.

- 5 point symbol

The first symbol is placed based on a centre point and four compass points, such that non-uniform scaling as well as rotation can be applied, for example, for tree foliage.

- Macroline / Strip level

D1 controls the width of the parallel string such as strip level. D2 is the scale of the macroline generated along the parallel.

- Macroline / Strip level (Side)

D1 controls the width of the parallel string such as strip level. D2 is the scale of the macroline generated along the parallel. The lines are offset by half the first dimension, D1.

- Window / Vertical rectangle

Two points surveyed on the diagonal of a window used to create a vertical rectangle.

D(1)

This field contains the first dimension for the current points. If this value is non-zero it is used as a scale factor for symbols placed with this point.

Symbol(1)

This field contains the name of the symbol (SCC Symbol, AutoCAD Block, Microstation Cell or MX macro symbol / macro line) that corresponds to the graphical representation of the current feature.

Colour(1)

This field contains the colour used for this feature when drawing entities graphically or in CAD.

D(2)

This field contains the second dimension for the current point.

Symbol(2)

This field contains the name of the symbol (SCC Symbol, AutoCAD Block, Microstation Cell or MX macro symbol / macro line) that corresponds to the graphical representation of the current feature.

Colour(2)

This field contains the colour used for this feature when drawing entities graphically or in CAD.

D(3)

This field contains the third dimension for the current point.

Symbol(3)

This field contains the name of the symbol (SCC Symbol, AutoCAD Block, Microstation Cell or MX macro symbol / macro line) that corresponds to the graphical representation of the current feature.

Colour(3)

This field contains the colour used for this feature when drawing entities graphically or in CAD.

String

This field indicates how many instances of this feature have been used when creating the last model. It is used internally by the system. The system will modify this field when creating new models.

Text Insertion Method

The text insertion method field controls how text is created and displayed when the model is created. This can be either by associative display of dimensions, or creation of literal text nodes. The relative merits of these methods are as follows;

- Associative Dimension text is displayed as an annotation of the survey point, but is not stored in the model as a text node. This has the disadvantage that you must use the unlock text option before you can edit the text. It has the advantages that the text position relative to the survey point will change as you change the drawing scale, the model will be much smaller as there is no text entity stored, and that the position and value of the text will change as you alter the string with which it is associated. Using associative dimensions is recommended when creating new feature libraries, or when dealing with very large models.

- Literal Text means that an editable text node will be added to the model for all annotation relating to a given feature. This annotation will automatically be updated when the string, which it relates to, is edited, or if the feature settings for that feature are modified. Using literal text removes the need to use the 'unlock text' function for all text edits. String annotation for selected points and strings may also be manually updated where required using the 'EDIT > Text > Redraw String Annotation' function. Note that updating the annotation for a string will effectively undo any editing of that annotation. For this reason, it is advisable to complete major string editing operations prior to repositioning and altering literal dimensional text. It is generally advisable to use Macro text in preference of literal text, except in cases where you specifically wish text to be altered with string edits.

- Macro Text combines many of the advantages of associative text and literal text. Like associative text, the value of the text is constantly updated to reflect the item being annotated. Like literal text, the text is inserted as a text node that can be freely moved, rotated, deleted and resized as required. Thus with macro text you can freely mix string editing and text editing operations, and do not have to repeat text editing for many major model edits, such as changing grid or datum.

Using macro text is recommended for typical survey jobs where a large amount of text editing is liable to be required.

When using macro text or literal text, placing the mouse over any piece of text annotation will give details of that annotation on the status line. These include the survey point number, the feature and the field being annotated

Level Symbol

This field specifies how level symbols will be drawn in the model. There are seven options: None, Single Point, Circle Symbol, Cross Symbol, Point (No Text), Circle (No Text), Cross (No Text). When 'Ht/Z' value text is not annotated, one of the options with 'No Text' should be used.

Display

This option specifies whether or not the level symbol will be displayed in the model. There are 3 options; Default, No or Yes.

Microstation level, line style, colour number and weight

These fields are used when exporting from SCC into Microstation, and allow mapping of any SCC feature onto explicit Microstation levels rather than relying on the Microstation DWG converter. SCC uses these values to directly create Microstation V8 DGN files. Microstation DGN output now supports alpha-numeric layer names rather than level numbers in previous versions.

3.1.1 Setting Up Default Feature Library

It is advantageous for organisation to have their own feature library that contains specific features, symbols, line styles, text, CAD layers and/or MX labels to meet client needs. Often an individual within organisation develops the library and distributes to other SCC users within the company. An organisation having their own feature library:

- ensures that all users are using the same feature codes with defined set of symbols, line styles, annotation, etc., not their individual interpretation
- cartographic output is the same regardless of user
- data can be easily copy/paste or merged together
- models and final exports are to a specific standard
- time is saved as there is no need for individuals to develop their own library
- as user become familiar with feature library they can work more quickly

3.1.1.1   Creating New Feature Library

Many users choose to use a default feature library are available within \SCC folder (.*Project) as a starting point for their own organisation's feature library.

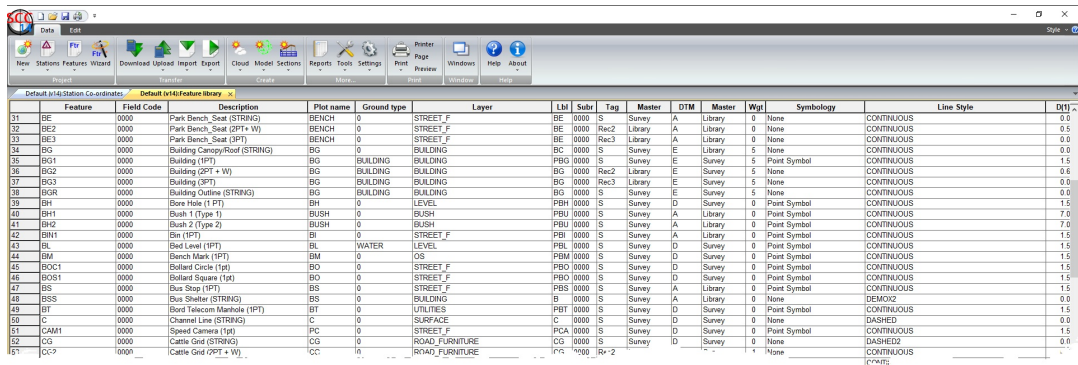## Open Existing Default Library: Use As Template

Open SCC

'SCC Button > Open'

Go to \SCC folder

Open 'Default (14).Project'

'Data tab > Features' to view library

Rename & Save New Template

'SCC Button > Save As'

Enter new name for feature library and Save in \SCC folder

Saving file in \SCC ensures that it is available on drop down menus when setting up future Projects.

3.1.1.2   Deleting Features

Features that are not required by the organisation should be deleted. For example, if there is only a need for one Bush Type in the library, delete record 41 Bush Type 2

Within Feature Library, go to 'EDIT tab > Delete Records'

Enter 41 as 'From Record' and 'To Record'

Press 'Ok'
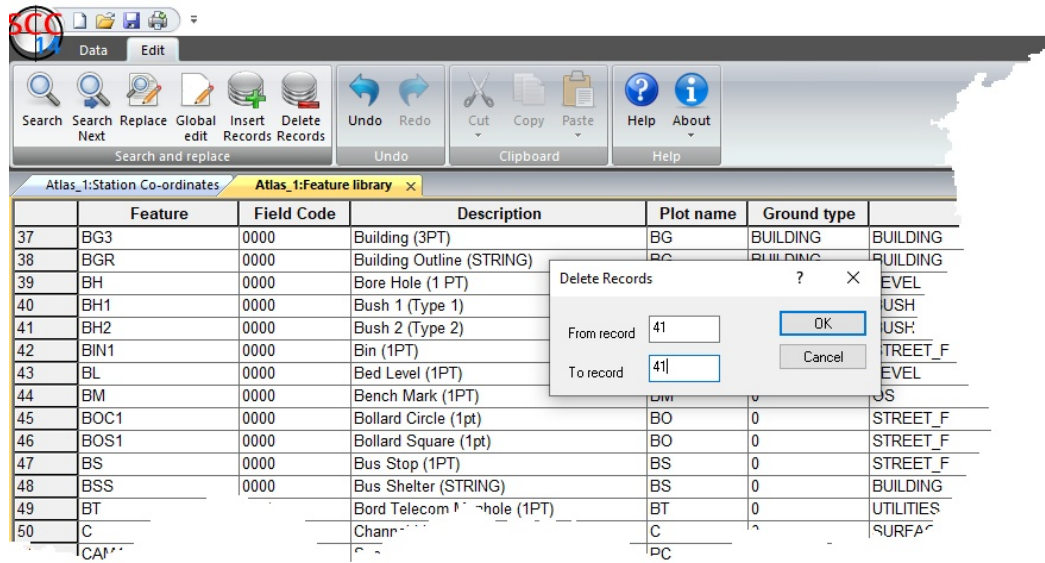
3.1.1.3   Insert New Features

Additional records can be added to create new features. For example, if a new Invert Level (INV) is needed, go to similar feature such as Spot Level (S) as copy / paste into new record. Then change feature code and other aspects such as colour.

Within Feature Library, scroll to Record 121 Spot

Go to 'EDIT tab > Insert Records'

Set 'Insert after record' as 121
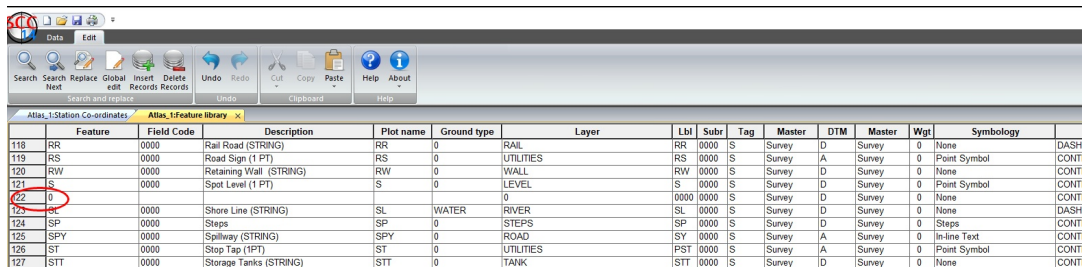
Set 'Number of Records' to 1

Tick Blank new records'

Press 'Ok'

A blank record is entered

Hightlight record 121 Spot Level

Go to 'EDIT tab > Copy'

Hightlight record 122 Blank Record

Go to 'EDIT tab > Paste'

On record 122, change Feature to 'INV' and description 'Invert Level (1 PT)

Additional Editing of Feature can be carried out in the Feature Wizard

3.1.1.4 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 *'Data tab > Feature Wizard'* from the feature library spreadsheet. This displays the dialog shown below;

The symbology option allows the user to specify the geometry used, and the number of survey points required to place a symbol on this feature. For example, a tree is a point symbol, with a new tree placed for each surey point coded with the tree feature. A gate, on the other hand, requires two points, which are used to size and orient the gate symbol.

The base style lets the user select the general feature type from a list of possible styles. Thus speeding up the process of creating a lot of similar features.

Line Connection Tag and Digital Terrain Model tags can be defined and forced by Library by selecting 'Use above value' or set to exact values from the raw survey file using 'Use field value'

The user can place up to three symbols per point, based on the symbology selected. Symbol dimensions can be taken from the survey or from the library, and the units can be specified either in paper or model terms.

Graphics and DTM | Annotation and export

Feature TE | Group FOLIAGE | Symbology Point Symbol | Line Style CONTINUOUS | Curve fitting Type Default
Description Tree (1PT) | Line weight 0 | Symbol alignment Along String | Point Density 10

Base style [ ] ○ Point feature ● Line feature | Save

Line connection tag: Straight | ○ Use above value ● Use field value

Digital Terrain Model: Approx. Elevation | ○ Use above value ● Use field value

Remark Canopy5.0 Girth0.5

Dimension #1 | Name D1 | Default 5.000 | ☐ Use library value | Symbol TREE_1 | Colour | Units Model (Diameter)
Dimension #2 | Name D2 | Default 0.500 | ☐ Use library value | Symbol MH_CIR2 | Colour | Units Model (Diameter)
Dimension #3 | Name D3 | Default 0.000 | ☐ Use library value | Symbol None | Colour | Units Model (Diameter)

The dimensions are used to specify the size of the symbol placed. Two symbols may be placed in plan, such as tree canopy and trunk. The third symbol is used for placing symbols in elevation on sections.

OK | Cancel | Apply | Help

The preview panel gives the user the idea of how points coded with this feature will be depicted in the model, complete with text annotation.

The help box describes the number of points and/or dimensions used for the different symbologies.

The text annotation and export box allows the user to precisely control the placement of text against each of the supported fields.

The Create/Edit Style button allows the user to set up the font type, for example, italics, bold and underlining.

Text can be exported to individual CAD layer either containing the feature layer name or only the specified layer prefix/suffix. Text can also be combine onto one specific layer using the Combine All Text Option.

Graphics and DTM | Annotation and export

Feature TE | Plot Name TE | D2 | Display Text on | Colour
Description Tree (1PT) | X-Offset -2.0 | Height 1.5 | Decimals 1 | Prefix
Layer TREE | Y-Offset 3.2 | Width 1.5 | Priority 7 | Suffix Girth
MX label PT | MX Subref 0000

Justification Left Bottom | Style Normal
Alignment Horizontal Sheet | Create / Edit Style
Interval All points | Text insertion method
Count 0 | Text Macro

☑ Include feature layer in annotation layer name | Layer Prefix
☐ Combine all text | Layer Suffix _D2

Remark Canopy5.0 Girth0.5

Level text style: ● Default level style ○ Justify decimal point over survey point ○ Subscript decimal places

Level Symbols None | Colour | Size 1.5 | ☐ Extra node
☐ Use different layer

OK | Cancel | Apply | Help

The Arrow buttons allows the user to interactively move the piece of text specified in the Text Annotation box.

The Text Insertion Method controls how the text is placed in the model. Text Macro are the most flexible, as the value of the text is updated when the model changes.

The placement of the decimal place can be specified as either justified over the survey point or subscript as is the norm for bathymetric charts.

The Extra Node option creates an extra display point for every survey point. This point is placed on the same layer as the surveyed feature and can be used to show the survey point in a layered manner on complex features such as macro-lines when exporting to CAD.

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.

Two examples are explored, setting up String Feature and Point Feature. Other examples are demonstrated during training.
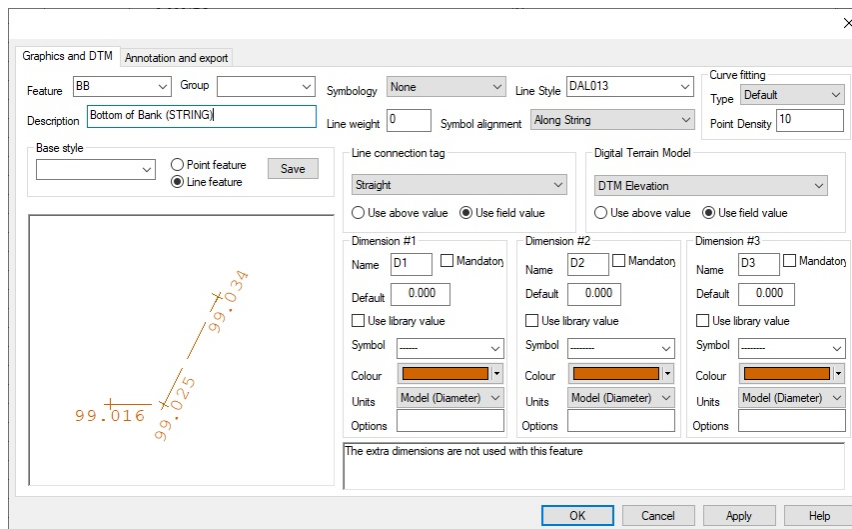
String Feature

Within Feature Library, 'DATA tab > Ftr Wizard button'

Within 'Graphic and DTM' tab, using mouse pick Feature Code from list
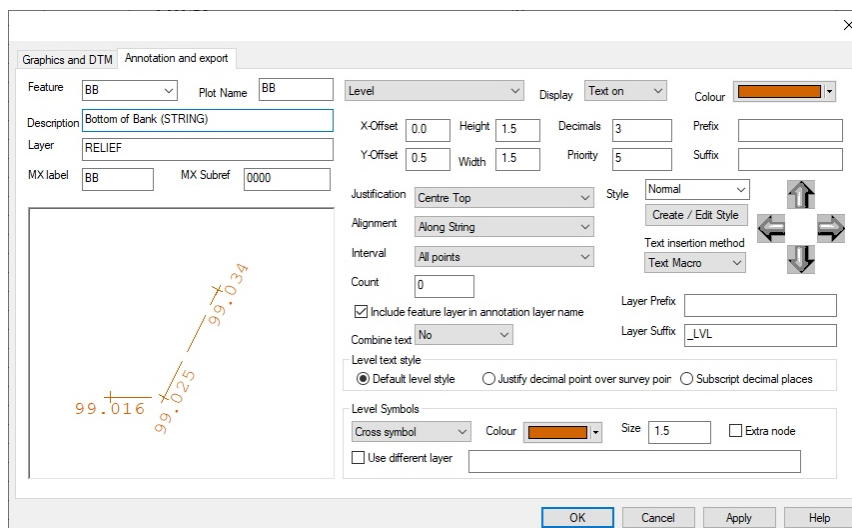
For example, BB shown below

The string has a Line Style of 'DAL013' and has colour Brown '6' assigned

Within 'Annotation and export' tab, annotation can be customised and export options such as CAD layers / MX layers assigned

*BB has 'Level' Text on, text justification set to 'Centre Top', alignment set to 'Along String' and on 'All points'*

As shown below BB CAD layers:

String goes to CAD Layer 'RELIEF'

Level Text goes to CAD Layer 'RELIEF_LVL'

Text Layer uses Layer Suffix as the option 'Include feature layer in annotation layer name' is selected. Note if this option was not selected Level Text would go to CAD layer '_LVL'
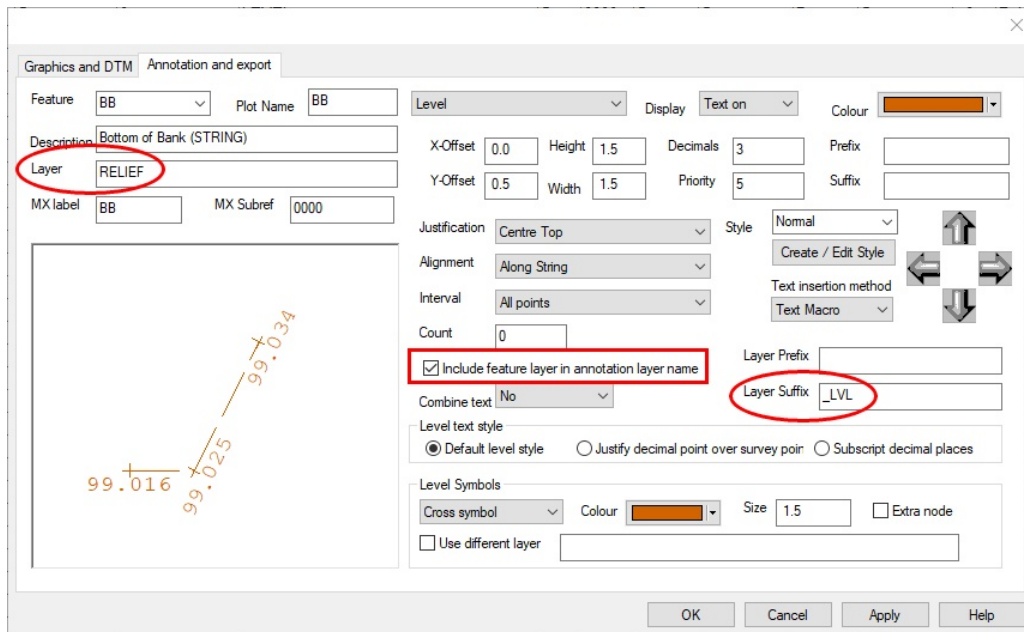
Point Feature

Within Feature Library, 'DATA tab > Ftr Wizard button'

Within 'Graphic and DTM' tab, using mouse pick Feature Code from list

For example, TE shown below

The point has a Symbology set to 'Point Symbol'

Dimension 1: Symbol set to 'TREE_1', Colour Green '18' and unit set to 'Model (Diameter)'. The Default value of 5 is assigned to allow preview to be displayed.

Dimension 2: Symbol set to 'MH_CIR2', Colour Brown '6' and unit set to 'Model (Diameter)'. The Default value of 0.25 is assigned to allow preview to be displayed.

Dimension 3: Symbol set to 'None', this field will be used to enter Height of Tree
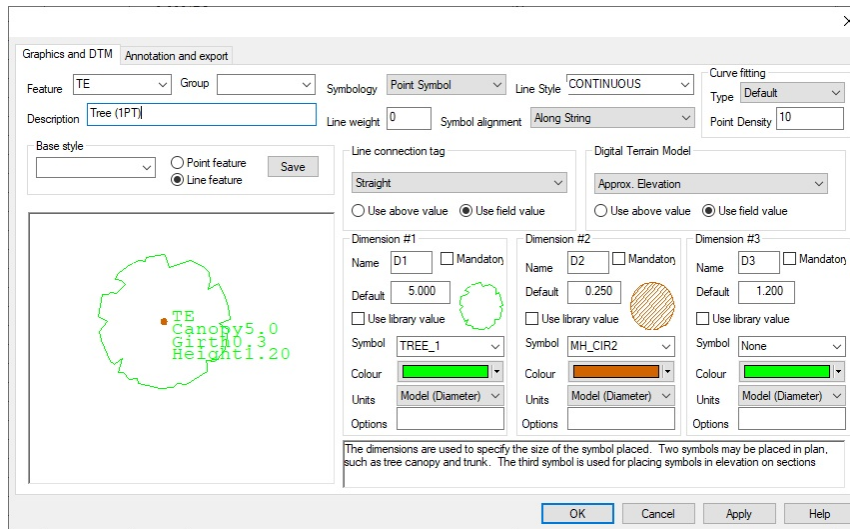
Within 'Annotation and export' tab, annotation can be customised and export options such as CAD layers / MX layers assigned
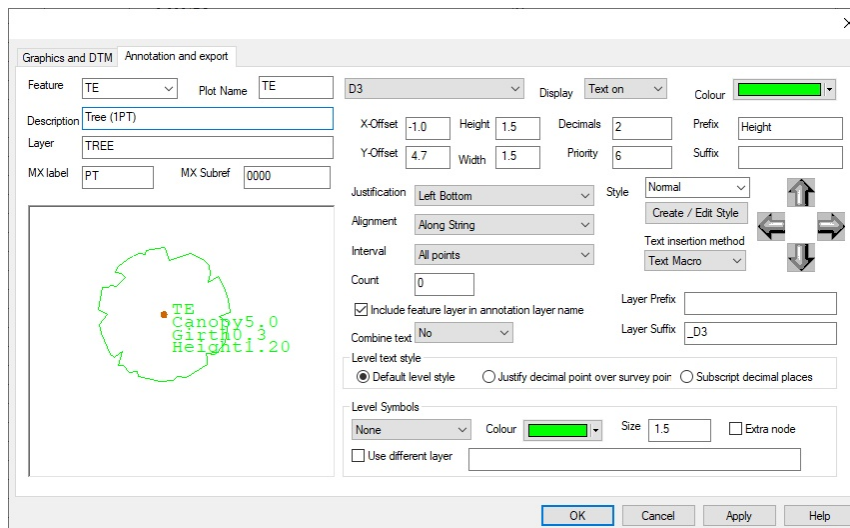
TE text is turned on and aligned for: 'Feature' Plot name, 'D1' which is tree Canopy, 'D2' which is Tree Girth and 'D3' which is Tree Height

Note how Text Prefix is assigned for each piece of text
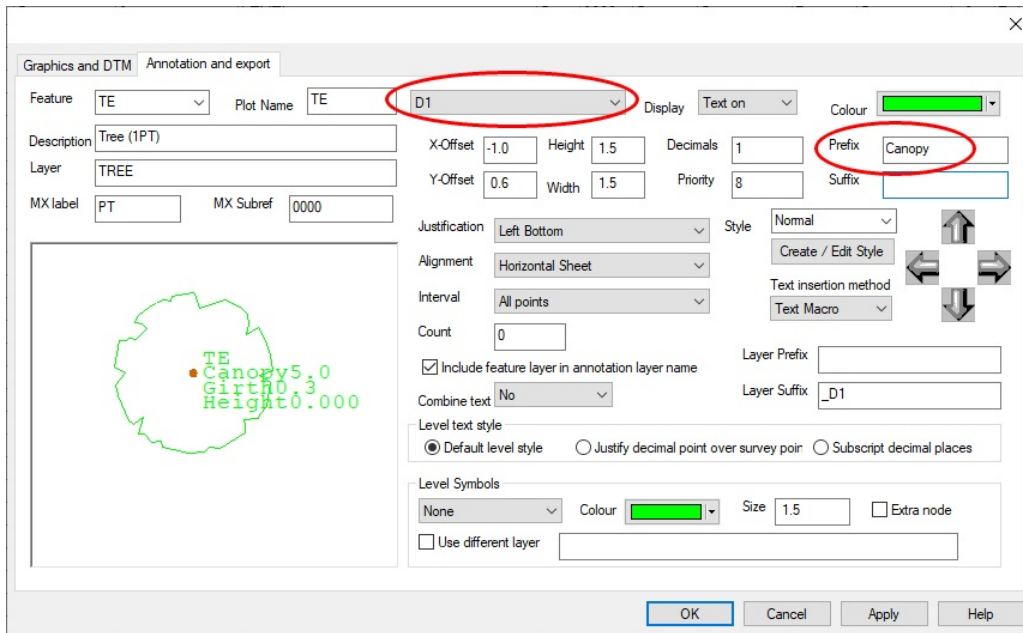
As shown below TE CAD layers:

'TREE_1' and 'MH_CIR2' Symbol goes to CAD Layer 'TREE'

Level Text goes to CAD Layer 'TREE_LVL'

Plot Text goes to CAD Layer 'TREE_FTR'

Dimension Text goes to CAD Layer 'TREE_D1', 'TREE_D2' and 'TREE_D3'

Text Layer uses Layer Suffix as the option 'Include feature layer in annotation layer name' is selected. Note if this option was not selected Level Text would go to CAD layer '_LVL'

Base Styles

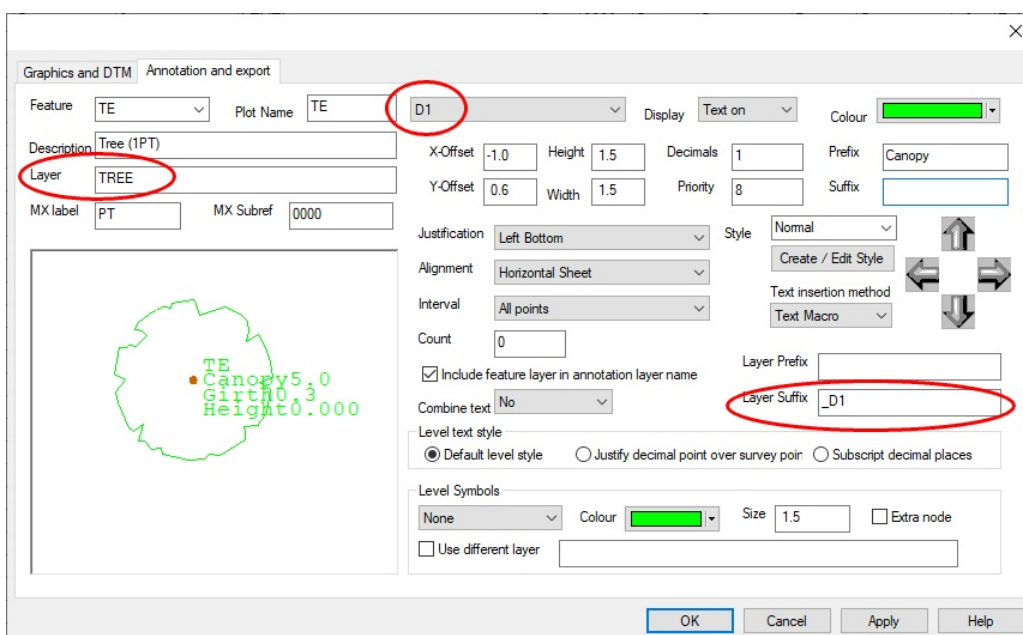Base Styles can be used to quickly add and edit new features to the library. A feature is set up with required symbol, colours, annotation, layers, etc., save as a base style that can be applied to other similar features.

Go to 'BB' feature

Enter 'Line' as base style, pick Line feature and press 'Save'

Go to 'KB' feature

Pick 'Line' from drop down base style, note how 'KB' now looks like 'BB'

Small changes can now be applied, such as Colour

3.1.1.5   Symbols & Line Styles

Default libraries within the \SCC folder include many symbols and line types. In addition, SCC supports the importing of Symbols and Line Styles from CAD
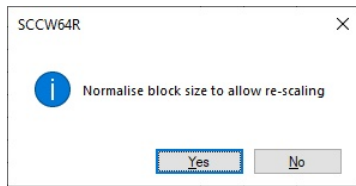
Importing Symbols from CAD

Within Feature Library, 'DATA tab > Features drop down menu > Symbols > Import Symbols from DXF'
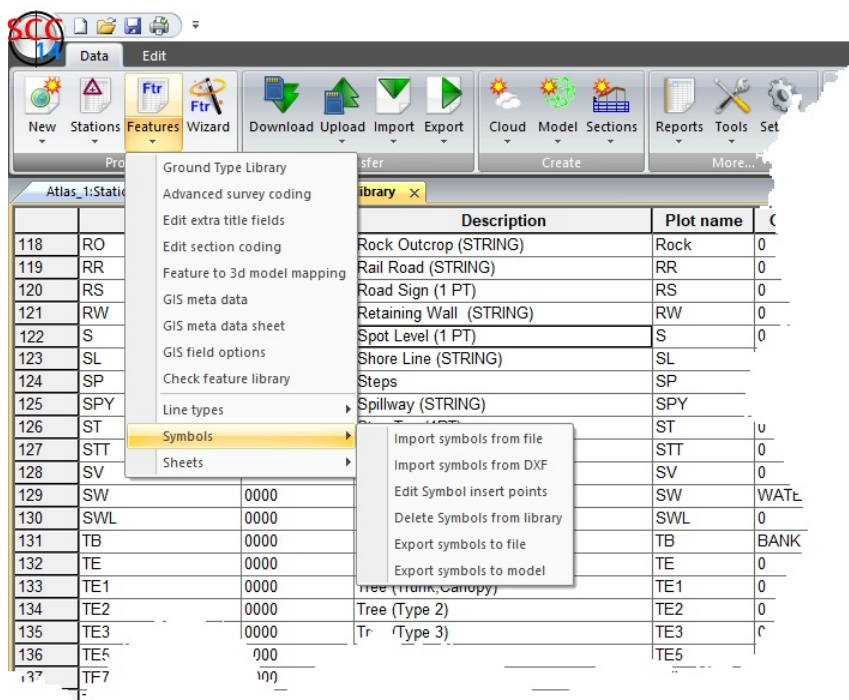
Pick DXF file

The option will appear to 'Normalise block size to allow re-scaling'

The symbol is then available in the library to assign to feature codes and define Insertion Points

Symbol Insertion Points

'DATA tab > Features drop down menu > Symbols > Edit Symbol insertion Points'

Select 'Three point insertion positions' and left click mouse on symbol to place 3 insertion points

Press 'OK'
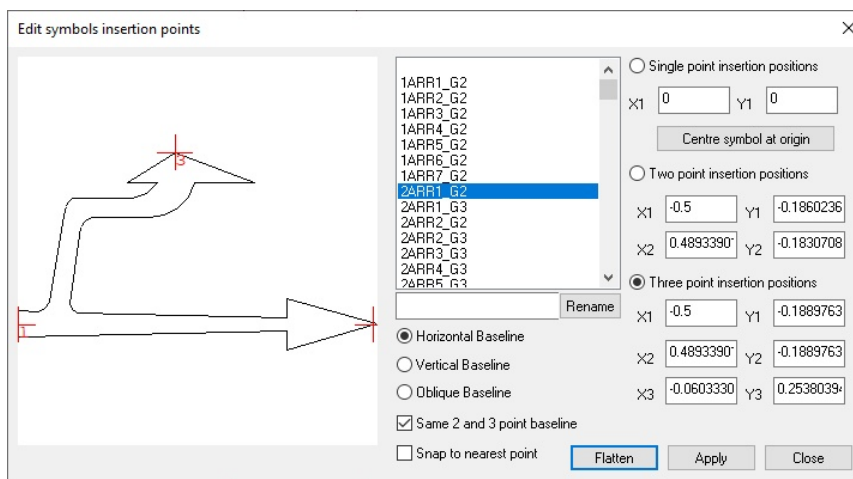
Creating Symbols from Model

Another approach is to Model the DXF file and then create the symbol. Sample file 'North.dxf' from \SCC\Tutorials folder can be used to test steps.

Go to 'DATA tab > Model drop down > DWG, DXF or DGN file'

Using Pick>> button, select 'North.dxf' from \SCC\Tutorials folder

Press 'Ok'

Right click mouse to bring up 'Data Selection Dialog', select 'All point in a window' and press 'OK'
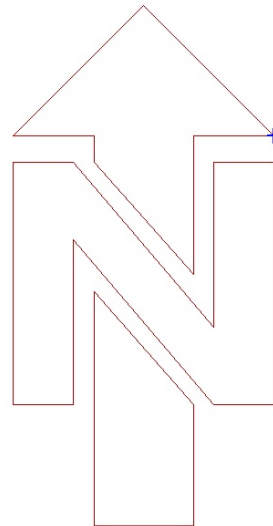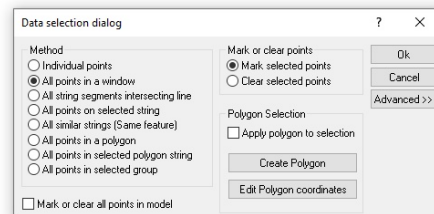
'ANNOTATION tab > New drop down > Create a new symbol'
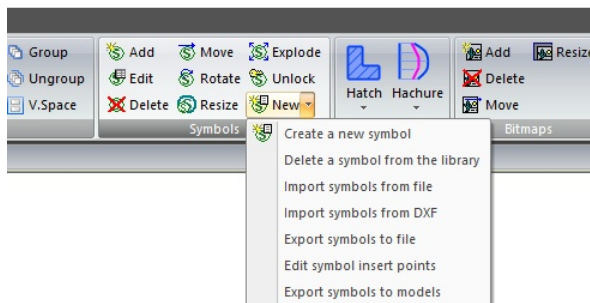
Enter New Symbol Name, define symbol type (1pt/2pt/3pt symbol) press 'Ok'
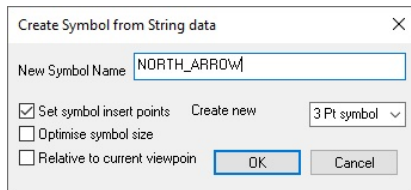
Press 'Ok'

The option to define insertion points is available.
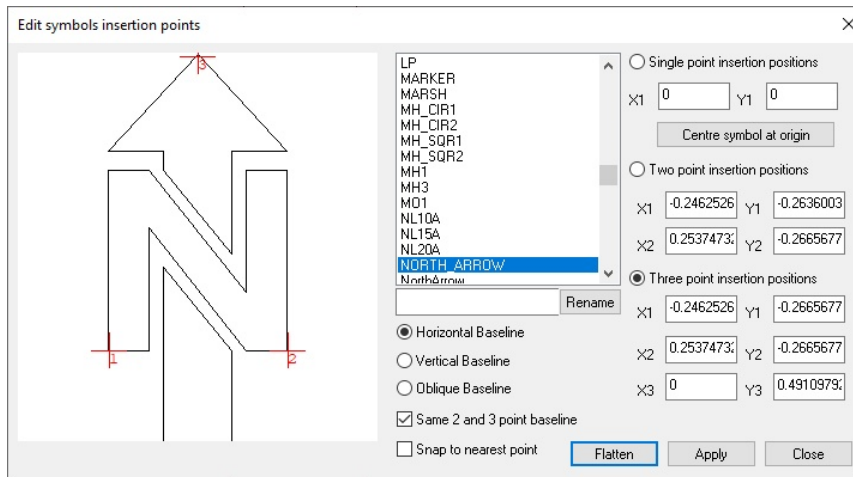
Select 'Three point insertion positions' and left click mouse on symbol to place 3 insertion points
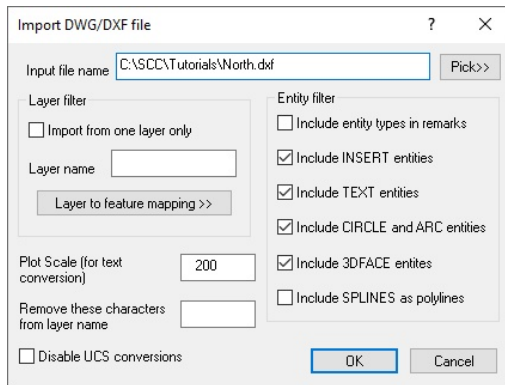
Press 'OK'

This option also automatically create a new feature and opens the Feature Library Entry dialog to set up the code
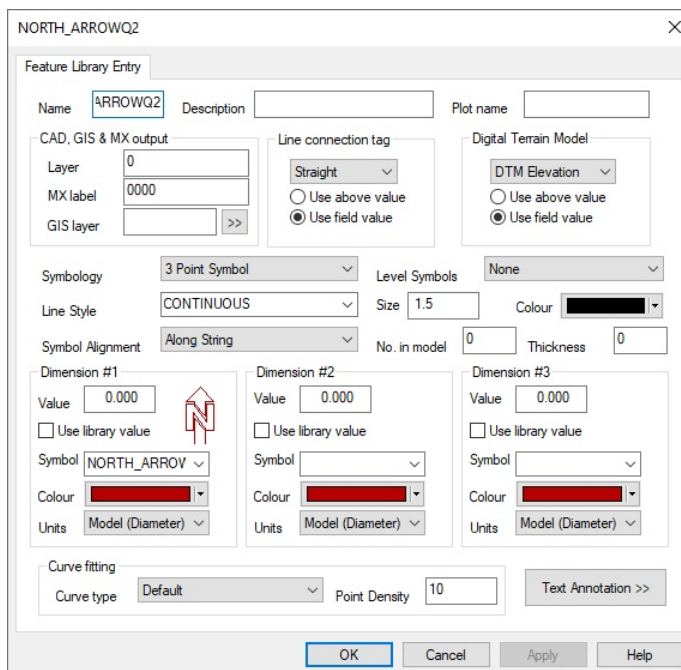
Using this approach the symbol is only available with the Model that is was created in. To make Symbol available to other feature libraries it is necessary to export to \SCC folder and then import to the specific Feature Library

> ***Within Model, Export symbol 'DATA tab > Features drop down menu > Symbols > Export Symbol to File'***

> ***Go to Project requiring new symbol, go ti 'DATA tab > Features drop down menu > Symbols > Import Symbols from File' and pick symbol***

> ***Continue to assign symbol to features using the Feature Wizard***

3.1.1.6   Model Feature Library

The Feature Library can be output to a Model.

> ***Within the Feature Library, go to 'DATA tab > Model drop down menu > Feature Library'***

> ***View at 1:1000 scale, within 'MODEL tab > Grid'***
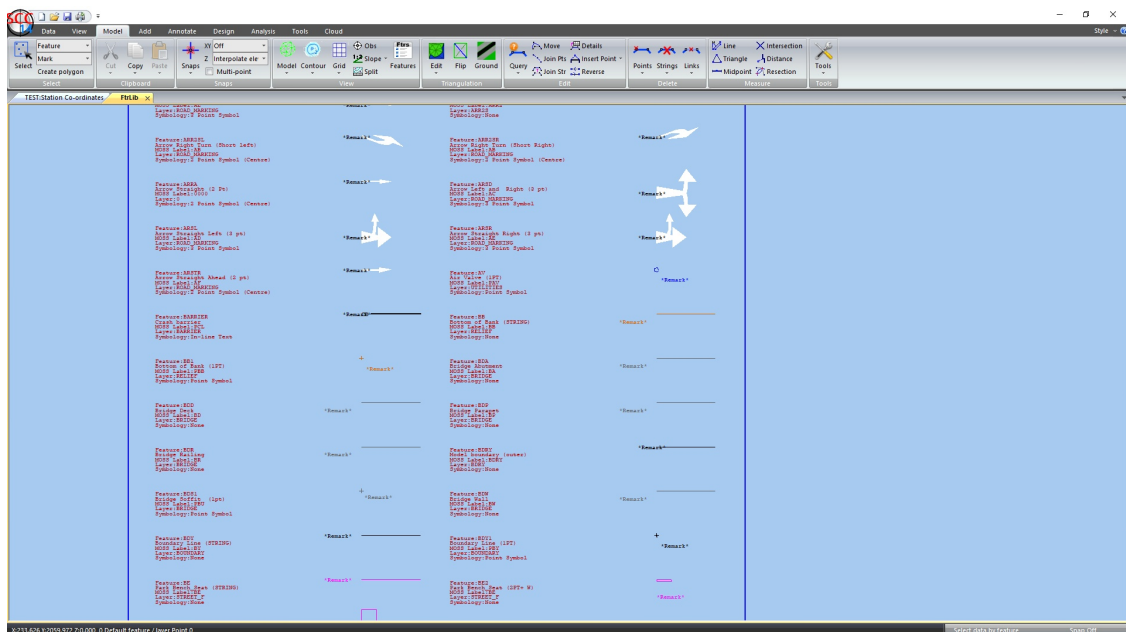
In addition to creating a plot the feature library can be created as a Report see sample below:

> ***Within Project tab, go to 'DATATtab > Reports drop down > Feature Library Specification'***

Group:	Category: Roads

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
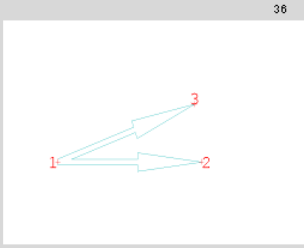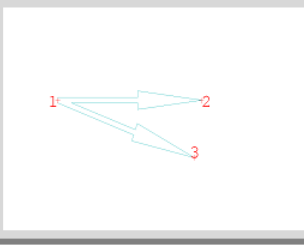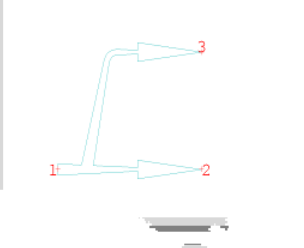This feature is 2D and is not included in the TIN surface.

This feature is represented by the AR_BUS_E symbol

3.1.1.7   Advanced Survey Coding Table

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 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	
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
	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

### 3.1.1.8 Saving Feature Library As Default Library

When complete the Feature Library should be saved to \SCC folder
> ***Go to SCC button (top left of screen), Save As***

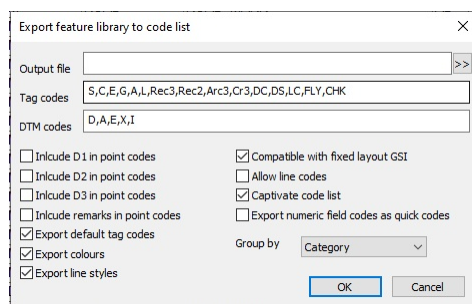The file can be distributed to other user and place in \SCC folder on individual PCs/

3.1.1.9 Creating Code List for Use On Instrument

The feature library can be exported and a Code list created for use on-board survey instruments.
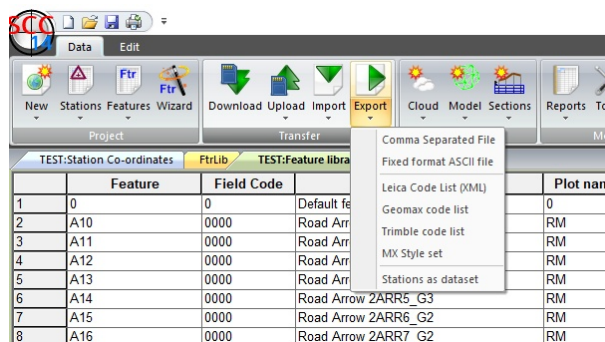
Leice Code List (XML): Files for Viva and Captivate can be created

> ***Within the Feature Library, go to 'DATA tab > Export drop down > Leica Code List (XML)'***

Geomax Code List

Within the Feature Library, go to 'DATA tab > Export drop down > Geomax code list'

A *.csv file is created

Trimble Code List

Within the Feature Library, go to 'DATA tab > Export drop down > Trimble code list'
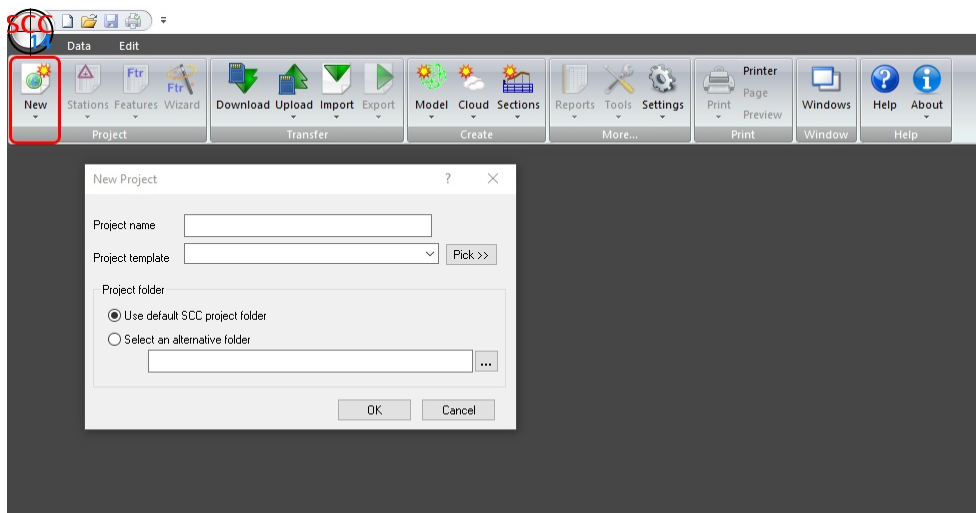
A *.FXL file is created

3.2 Creating A New Project

A new project should be created before data may be downloaded, imported or modelled within SCC. It is important that there is only one project file open at a time.

Creating A Project Directory

Press 'New' button or select 'New Project'

This gives the user to option enter Project Name and select Project Template

This gives the user to option enter Project Name and select Project Template

Once create the user can proceed to import and model data