TcpScancyr for Tunnels

Version 1.7

aplitop

REFERENCE MANUAL

Table of Contents

1 Application Characteristics

TcpScancyr for Tunnels is program used to calculate cross sections, surfaces and volumes based on points taken from a 3D scanner.

2 Requirements

Due to the complexity of some of the calculations, we recommend you use a computer with at least a double core processor.

Minimum requirements:

- Operating system: Windows XP / Vista / 7 / 8 in 32 and 64 bits
- Graphics card: minimum resolution of 1024x768 pixels, memory of 256 Mb and compatible with OpenGL™
- Processor: Intel Dual Core 2 GHz or higher
- Memory: minimum of 2 Gb

3 Main window

When the program has loaded the main window appears. You will see that the window is divided into various parts, from left to right and from top to bottom these are:

- Program menu
- Toolbar
- Project tree
- Data display window
- Status bar

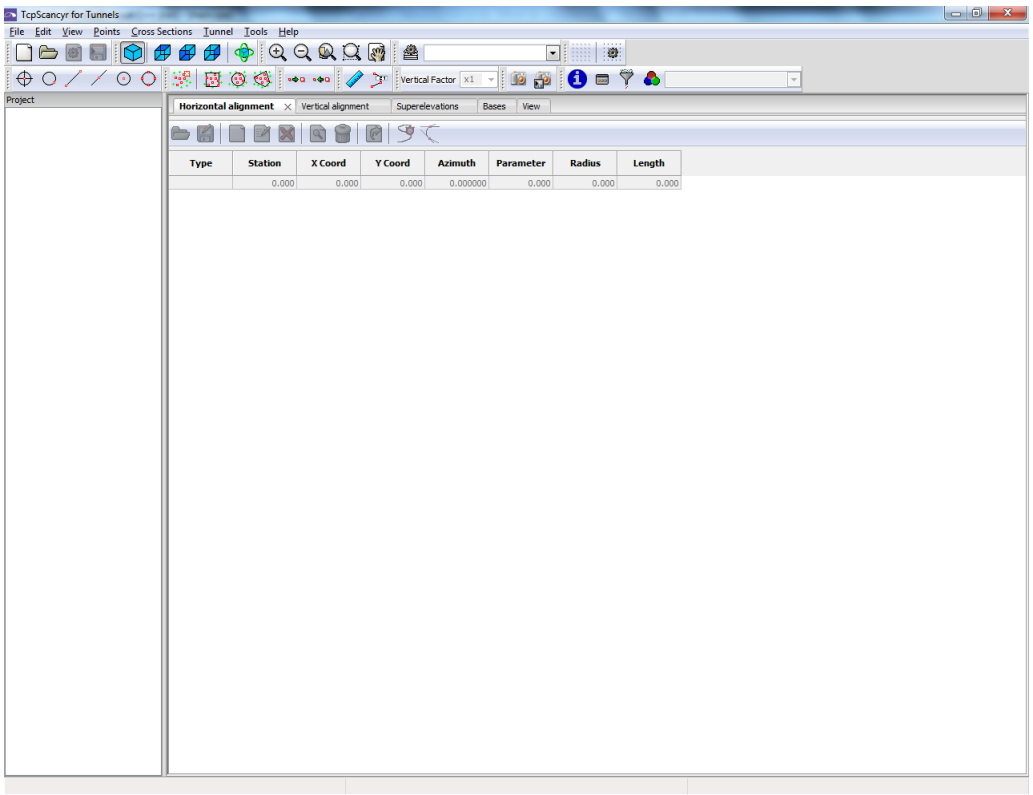


Figure 1 - Main window

Menu bar:. Allows you to access all program options

Toolbar: Quick access to the main application options.

Project Window Features a project tree showing the various parts that make up the project. Each node can be expanded by clicking on the '+' symbol. You may access the most common actions by using the context menu for each node by right clicking with the mouse.

Data display window: Features four windows which allow you to view the horizontal alignment in plan, vertical alignment, superelevations, bases and the view tab that that shows the last selected element.

Status bar: Situated at the bottom of the screen, this shows information regarding cursor coordinates and the current state of the program.

To create a new project, follow the steps below:

1. Create a new project.
2. Assign the plan, height and superelevation alignment, manually uploading the relevant data
3. Create the tunnel template by importing a DXF or TcpTunnel file - these can also be created manually using the keyboard.
4. Import the scanner points, after import they will be automatically analyzed.
5. Calculate cross sections

The order of steps 3 and 4 can be swapped around; you may even define the tunnel template section after calculating the cross sections. Nevertheless, it is important to create the alignment before importing points. If they are imported without the alignments, use the option *"Points -> Analyze"*. If not, the program will not know the position of the points with respect to the alignment and it won't calculate cross sections, nor will it correctly draw the points cloud with the alignment.

4 Project

In order to work with the application you need a number of elements as alignments, type sections, points etc. which are saved within the project file.

The main project options can be found in the menu *"File"*.

New: Create a project from zero. A dialog box will open allowing you to select the main project elements.

Open: Open the file selector in order to choose a project file **(*.PRO)**. If there is already a project open and it has been modified, you will be asked if you wish to save it.

Save: Save the current project in its project file. This option will only be enabled if the project has been previously saved, or is a loaded project.

Save As: Opens the file selector to save the project in a project file. From this point you may only save the project using the *"File -> Save"* menu

Properties: This opens a project dialog box which allows you to change the name, alignments or the file of the bases that make up the project.

Import: This option gives the ability to import horizontal and vertical alignment from different types of files.

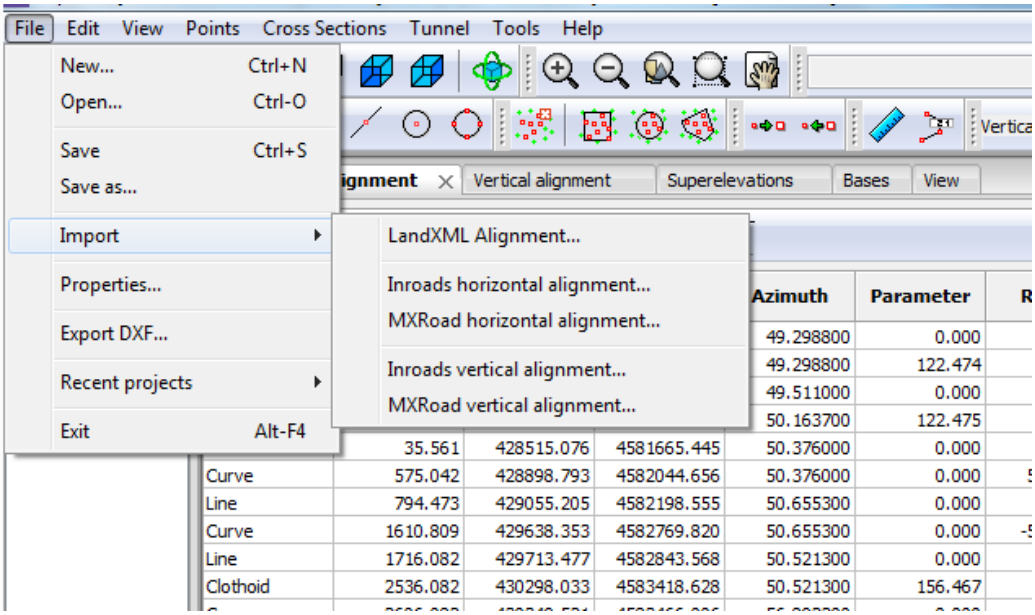


Figure 2 - Alignment import menu

This is the dialog box that appears when you create a new project or edit an existing one.

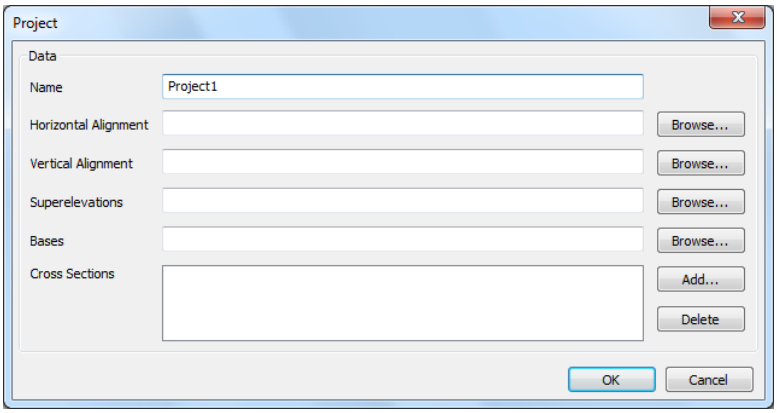


Figure 3 -Project dialog box

Name: The project name will appear at the head of the lists.

Horizontal alignment: The project alignment can be left blank in order to create one from start. The file should be compatible with the **MDT (*.EJE)** format. If the alignment is in another format, leave this field blank and use the import option.

Vertical alignment: The project gradient can be left blank in order to create one from zero. The file should be compatible with the **MDT (*.RAS)** format. If the alignment is in another format, leave this field blank and use the import option.

Superelevations: The superelevations file should be compatible with the **MDT (*.PER)** format.

Stations: Stations File.

Cross Sections: Project cross sections files, you can include as many as you need.

By clicking on Ok, the application will load the corresponding files and include them within the project.

4.1 Horizontal Alignment

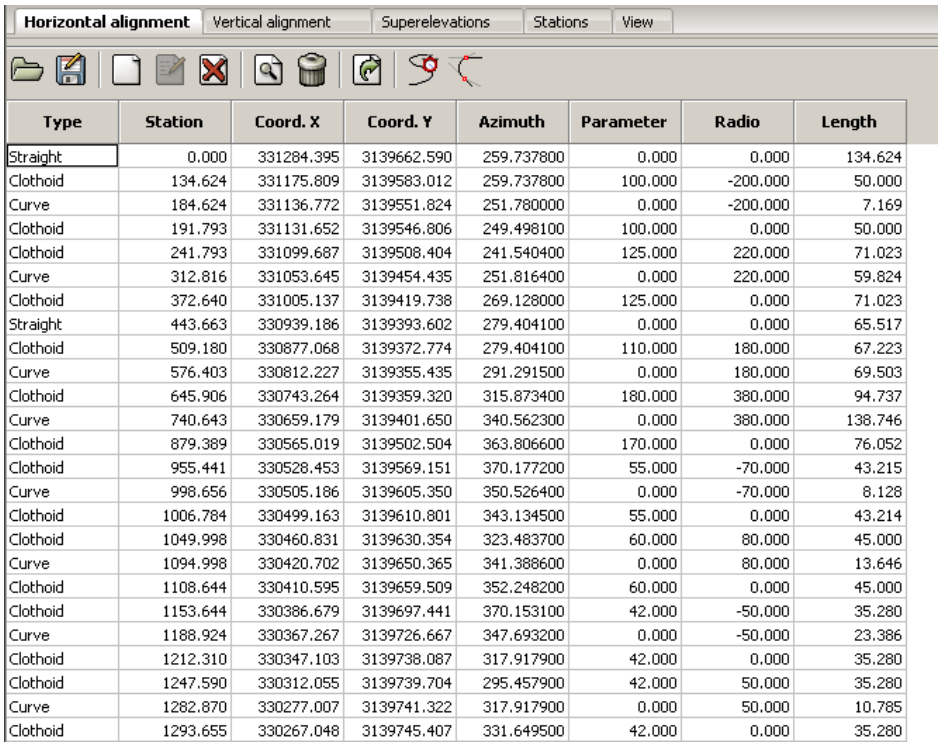
The application allows files in the alignment format **MDT (*.EJE)**, as well as permitting files to be imported in other formats using the *"File -> Import"* option.

You may also key in the alignment data in the main window, activating the *"Horizontal Alignment"* tab.

The alignment editing window is divided into two parts - in the upper area there is a toolbar whose use will be explained later. A table showing access data appears at the bottom of the window.

To add an alignment, the data must be entered from left to right. An alignment will only be inserted or modified after entering the *"Length"* field.

If you key *insert* or click on *new*, the previous alignment will split in two, respecting the same parameters of the azimuth, parameter and radius so that the alignment is not affected. If you click on the first line you will not be able to insert a new alignment.



Type	Station	Coord. X	Coord. Y	Azimuth	Parameter	Radio	Length
Straight	0.000	331284.395	3139662.590	259.737800	0.000	0.000	134.624
Clothoid	134.624	331175.809	3139583.012	259.737800	100.000	-200.000	50.000
Curve	184.624	331136.772	3139551.824	251.780000	0.000	-200.000	7.169
Clothoid	191.793	331131.652	3139546.806	249.498100	100.000	0.000	50.000
Clothoid	241.793	331099.687	3139508.404	241.540400	125.000	220.000	71.023
Curve	312.816	331053.645	3139454.435	251.816400	0.000	220.000	59.824
Clothoid	372.640	331005.137	3139419.738	269.128000	125.000	0.000	71.023
Straight	443.663	330939.186	3139393.602	279.404100	0.000	0.000	65.517
Clothoid	509.180	330877.068	3139372.774	279.404100	110.000	180.000	67.223
Curve	576.403	330812.227	3139355.435	291.291500	0.000	180.000	69.503
Clothoid	645.906	330743.264	3139359.320	315.873400	180.000	380.000	94.737
Curve	740.643	330659.179	3139401.650	340.562300	0.000	380.000	138.746
Clothoid	879.389	330565.019	3139502.504	363.806600	170.000	0.000	76.052
Clothoid	955.441	330528.453	3139569.151	370.177200	55.000	-70.000	43.215
Curve	998.656	330505.186	3139605.350	350.526400	0.000	-70.000	8.128
Clothoid	1006.784	330499.163	3139610.801	343.134500	55.000	0.000	43.214
Clothoid	1049.998	330460.831	3139630.354	323.483700	60.000	80.000	45.000
Curve	1094.998	330420.702	3139650.365	341.388600	0.000	80.000	13.646
Clothoid	1108.644	330410.595	3139659.509	352.248200	60.000	0.000	45.000
Clothoid	1153.644	330386.679	3139697.441	370.153100	42.000	-50.000	35.280
Curve	1188.924	330367.267	3139726.667	347.693200	0.000	-50.000	23.386
Clothoid	1212.310	330347.103	3139738.087	317.917900	42.000	0.000	35.280
Clothoid	1247.590	330312.055	3139739.704	295.457900	42.000	50.000	35.280
Curve	1282.870	330277.007	3139741.322	317.917900	0.000	50.000	10.785
Clothoid	1293.655	330267.048	3139745.407	331.649500	42.000	0.000	35.280

Figure 4 - Horizontal Alignment

On the toolbar there are two extra icons, the first optimizes the alignment joining consecutive straight sections with the same azimuth. The next icon displays a list of tangency errors at each individual point.

If you click on the *vision* tab you will see a graphic representation of the horizontal alignment.

When you move the cursor the application will analyze coordinates and show information from the analysis on the status bar.

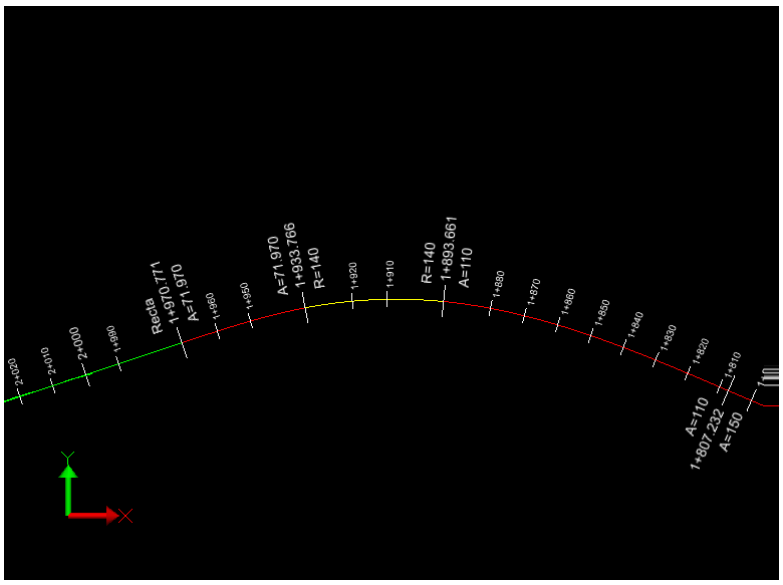


Figure 5 - Horizontal alignment

4.2 Vertical alignment

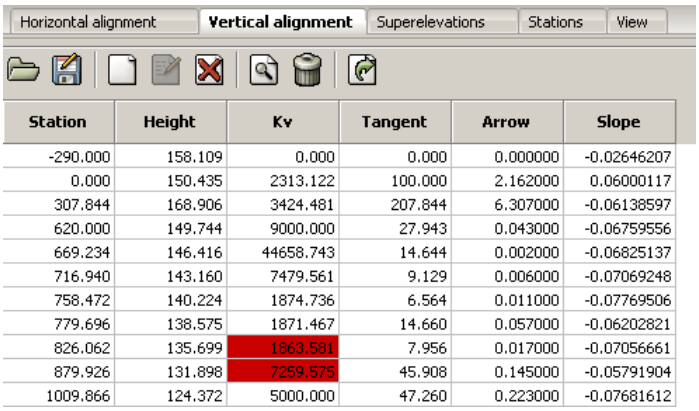
The application allows gradients in the alignments format **MDT (*.RAS)**, as well as permitting alignments to be imported in other formats using the *"File -> Import"* option.

You may also key in the gradient data in the main window, activating the *"Vertical alignment"* tab.

To enter a gradient, first add the *"Station"* and the *"Heights"*, and the application will automatically move the cursor in these two columns. You may then change the agreement data.

The application will calculate if there is any overlap lapel between the different sections, and the cell where the overlap occurs will be shown in red.

To add more data, go to the last row and click on *"Cursor down"*, and a new line for adding more data will appear. If you leave the new line without changing anything, it will be deleted automatically.



Station	Height	Kv	Tangent	Arrow	Slope
-290.000	158.109	0.000	0.000	0.000000	-0.02646207
0.000	150.435	2313.122	100.000	2.162000	0.06000117
307.844	168.906	3424.481	207.844	6.307000	-0.06138597
620.000	149.744	9000.000	27.943	0.043000	-0.06759556
669.234	146.416	44658.743	14.644	0.002000	-0.06825137
716.940	143.160	7479.561	9.129	0.006000	-0.07069248
758.472	140.224	1874.736	6.564	0.011000	-0.07769506
779.696	138.575	1871.467	14.660	0.057000	-0.06202821
826.062	135.699	1863.581	7.956	0.017000	-0.07056661
879.926	131.898	7259.575	45.908	0.145000	-0.05791904
1009.866	124.372	5000.000	47.260	0.223000	-0.07681612

Figure 6 - Gradient alignment with overlap

If you click on the *vision* tab you will see a graphic representation of the vertical alignment.

When you move the cursor the application will analyze coordinates and show the height and incline which corresponds to the cursor position on the status bar.

The following layers appear in the representation:

Short marks: Draws a vertical line from the minimum height to the gradient height. The distance between these marks is configurable.

Long marks: Draws a vertical line from the minimum height to the gradient height. The distance between these marks is configurable.

Unique points: Draws a vertical line at the following points:

- Station - tangent
- Station + tangent
- Station if the tangent equals zero.

Guitar: Layer showing separation lines and legend.

Upper ground spot height: Represents the maximum height of the intersection of the vertical that passes through the alignment and cross sections.

Lower ground spot height: Represents the minimum height of the intersection of the vertical that passes through the alignment and cross sections.

Gradient: Graphic representation of the gradient.

Real gradient: Graphic representation of the gradient calculated from cross sections and the tunnel template.

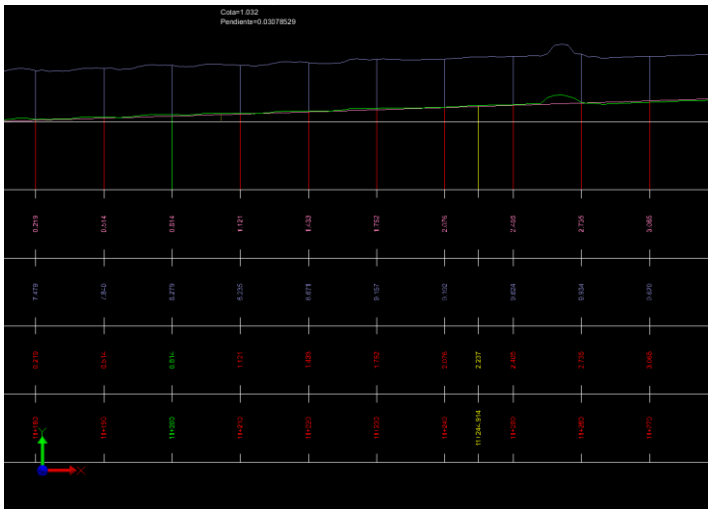


Figure 7 - Vertical alignment

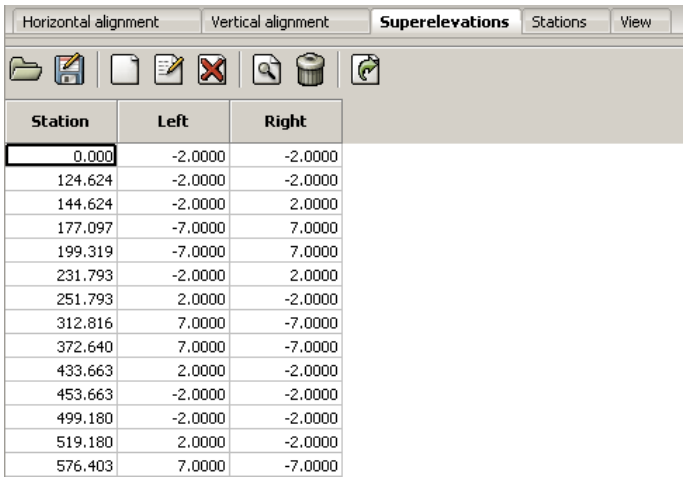
4.3 Superelevations

A superelevations file for the project can be included, assigning a file or keying in data in the *"Superelevations"* tab in the main window.

By clicking on *"New"* or *"Edit"*, a dialog box will appear allowing you to enter superelevations data. If you accept the superelevations they will be reordered in *"Station"* order.

By clicking *Insert* you can add a new row before the current row. The *Station* new row should be assigned to the mid-point between the previous and the current row, with the superelevations are inserted between the two rows.

To add more data, go to the last row and click on *"Cursor down"*, and a new line for adding more data will appear. If you leave the new line without changing anything, it will be deleted automatically.



Station	Left	Right
0.000	-2.0000	-2.0000
124.624	-2.0000	-2.0000
144.624	-2.0000	2.0000
177.097	-7.0000	7.0000
199.319	-7.0000	7.0000
231.793	-2.0000	2.0000
251.793	2.0000	-2.0000
312.816	7.0000	-7.0000
372.640	7.0000	-7.0000
433.663	2.0000	-2.0000
453.663	-2.0000	-2.0000
499.180	-2.0000	-2.0000
519.180	2.0000	-2.0000
576.403	7.0000	-7.0000

Figure 8 - Superelevations Alignment

If you click on the *vision* tab you will see a graphic representation of the superelevations.

When you move the cursor the application will analyze coordinates and show information from the analysis on the status bar.

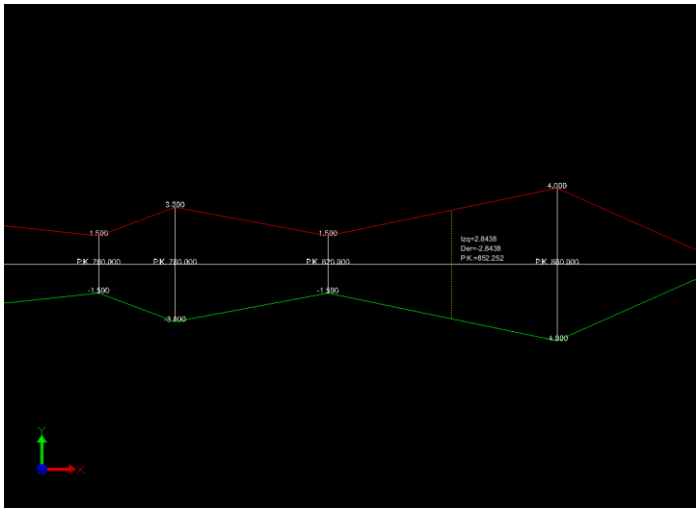


Figure 9 - Graphic representation of superelevations

4.4 Bases

You may include base coordinates which correspond to scanner positions when tunnel samples are taken.

When you apply a distance filter or symbol, it can always be applied using the centroid of the points. If you have included a base file, you will be able to apply the filter or symbol using the base of each file.

The bases are shown as a cylinder with a cone on the top, centered and supported by coordinates.

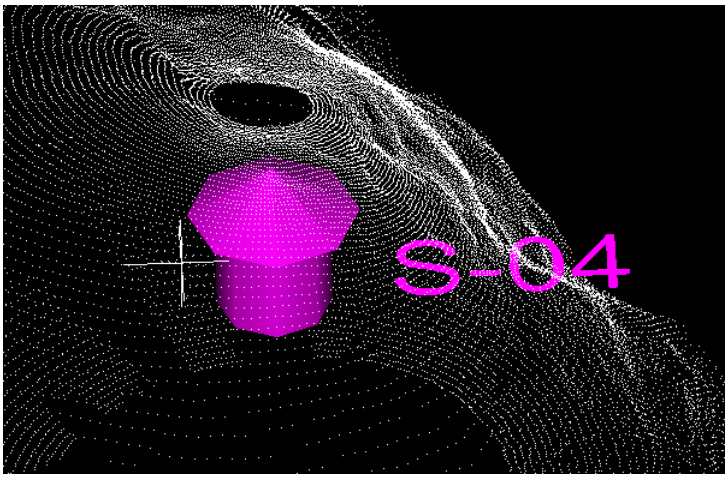


Figure 10 - Point file and its base

5 Project Points

After creating a new file you will need to include a file containing the points taken from the scanner.

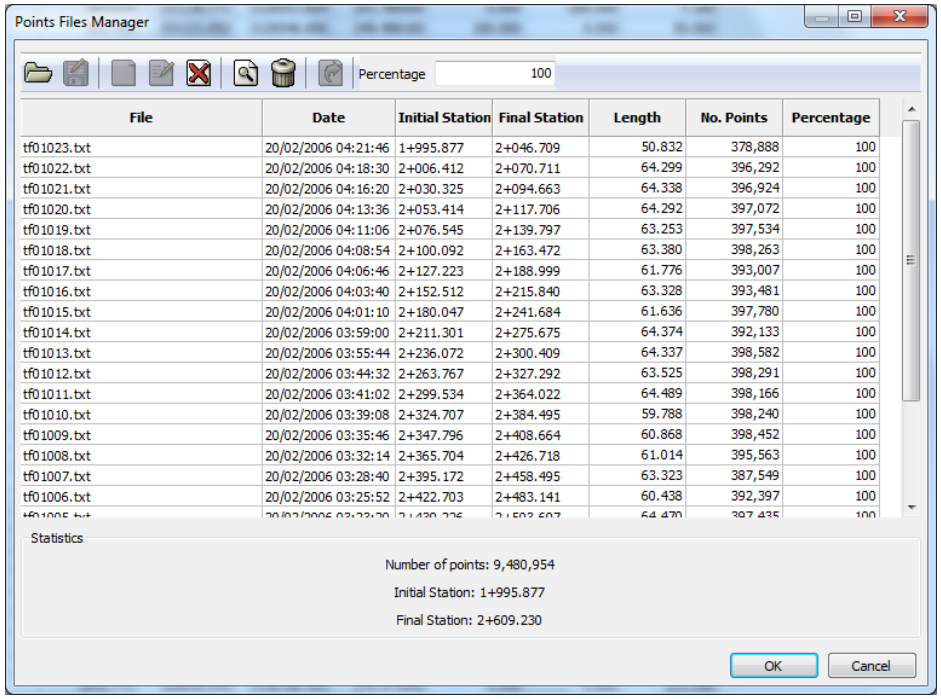


Figure 11 - Project with a number of analyzed files

In order to include points, use the "Open" option which will display a file selector. Here you can select more than one file at the same time. Using Percentage control we can reduce how many points are read from each file, by default is set to 100 to read all points.

The application can handle any number of files as long as there is enough disk space available. About 50 MB are needed for each million points.

As well as the file name, the table also displays a number of fields which are not filled in until you accept this dialog box and the points are analyzed. In order that this analysis is correct there must be a defined horizontal alignment.

Table description.

File: File name. In the event that there are a number of files in different locations, only the final, distinct part of each file is shown.

Description: Date and time the file was created.

Initial Station: Minimum station for the points that make up the file

Final Station: Maximum station for the points that make up the file.

Length: Points cloud length.

Nº Points: Number of file points.

Percentage: Percentage of points imported from original file.

In the statistics file, the initial and final station for all points appears, as well as total number of points.

5.1 Points File Format

The application accepts a number of format types for pointes files. If a specific manufacturer's format is not chosen, the default points format will be the following:

A text file, with one point per line and the line in the following format:

ID (Optional field)	**X, Y, Z Coordinates** (Obligatory field)	**Intensity.** (Optional field)	**Color RGB** (Optional field)

ID: Point identifier

X, Y, Z Coordinate: Point Coordinates

Intensity: Point intensity, it can be a real number [0..1] or an integer value depending on file format.

Color RGB: Three whole values which correspond to red, green and blue channels, with whole values in the range [0, 255]

Fields must always appear in the same order, although only the coordinates are obligatory. In the event that none of the color fields appear, points will be assigned the color white by default.

The formats that can be imported are:

Cyclone Format: These files have the extension **".PTX"** and **".PTS"**. The difference between the two formats is that in the former, the points are relative to the base, meaning that after reading each point, the absolute coordinates have to be defined, whilst in the case of the latter format they are expressed as absolute coordinates. The files for this format admit more than one sample per file. The application will create a file for each sample, adding a number as a suffix.

FARO Format: The main advantage of this format is that as the data is in binary format, import is significantly quicker. At this time only **"*.FLS"** files are supported.

Leica HDS 4500/6000 Format: These files have the extension **".FZS"**. The format of the points includes two whole values, the row and the column. These two numbers are ignored and only the coordinates of each point are read.

Leica Nova MS50 Format: These files have the extension **".XCF"**.

LAS Format: These files have the extension **".LAS"** or **".LAZ"** if the files are compressed.

E57 Format: These files have the extension **".E57"**.

Figure 12 - Imported points with color

5.2 Analysis of points

In order to accelerate calculations you need to have imported all points from the scanner that have been analyzed with respect to the horizontal alignment. If you follow the normal order when creating a project, the points will be analyzed on exiting the point's management dialog box.

In the event of changing the alignments, or if you have imported the points before establishing the project alignments, you should use the option *"Points -> Analyze"* in order to analyze the points with respect to the horizontal alignment.

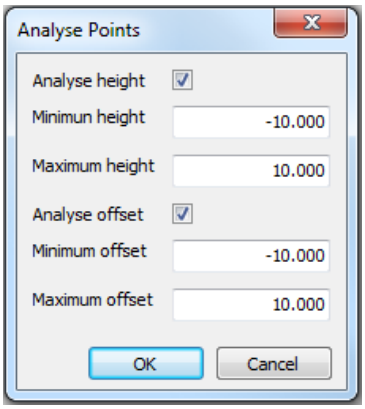


Figure 13 - Window for analyze points

[TcpScancyr Advanced] If you check "Analyze height" and "Analyze offset", the program will not analyze the points out of this intervals. These options are used for some cases where the tunnel has different heights or irrelevant points.

If you do not analyze the points, the application will not know what set of points fall within a specific station and you will not be able to calculate cross sections.

Once the project has been defined with the alignments and points files analyzed, you can use the project tree displayed on the left of the main window in order to view the points.

By selecting a node which corresponds to a points file you will activate the *"Vision"* tab, allowing you to view the selected file. By using this view you can independently apply filters at each file.

If you activate the projection with perspective, this window will appear in order to help you move over the alignment. If you have calculated and enabled the cross sections (using layer control) it will be easier to filter by selecting the points that distort cross sections calculation.

If no horizontal alignments have been defined, this window will not appear.

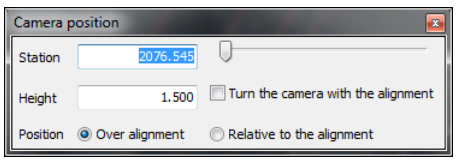


Figure 14 - Help window for positioning the camera

Changing the station allows you to move over the alignment.

Station: The station where the camera is located. You can write a specific station or use the space bar to move in real time. If you write a value, press ENTER in order to apply the changes

Height: The height of the camera with respect to the vertical alignment.

Turn the camera with the alignment: If you have this option checked, when you change the station by using the controls, the camera will position itself at the azimuth of the alignment.

The following options indicate where the camera will be positioned on changing the station.

Position over alignment: Place the camera on the alignment at the indicated height - if you have moved, the camera displacement will be cancelled.

Position relative to the alignment: Here you move by following the alignment but by maintaining the existing relative distance.

6 Filtering points

The point cloud obtained from the scanner normally contains as many object points that were close to the scanner on taking the sample. As these are not tunnel points, you can apply filters in order to mark them, and therefore not need to consider them when calculating cross sections. Each filter puts a different mark on each point.

You can apply two different types of filter, manual filter or visual filter. In order to access manual filter, use *"Points -> Manual Filter"*.

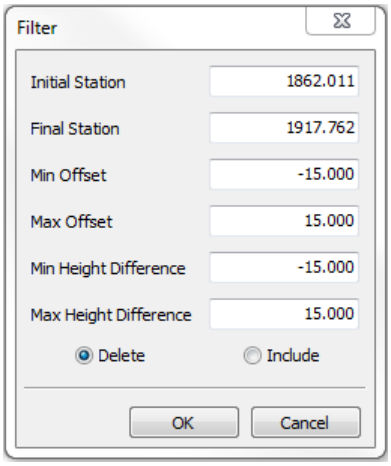


Figure 15 - Manual filter

You can choose initial and final station, offset and height using the manual filter window.

In order to access visual filters, use the *"Points -> Filters"* menu, or the corresponding icon on the toolbar.

When you apply a filter, a green filter symbol may appear on the points. The filter will only be applied to the points within the area marked in green.

On the right side of each slider there's a button to enter values manually.

The bottom of the screen shows the following icons.

Restore: Eliminate the selected filter for all the points in the files you are viewing.

Invert: For each point on the selected files, the mark of the current filter will be inverted.

Delete: Marks the points within the filter parameters. The marked points will not be used to calculate cross sections.

Include: Eliminate the mark on the points within the filter parameters. You may set the information area to see how many filtered points remain once the selected filter has been applied. If you want to include all points, you may also use the *"Restore"* option.

By checking *"Manual Station"* on applying a filter you will be asked for a station range. You can therefore apply a filter to a whole points cloud or a greater range of points without the need for them to be visible.

6.1 Filter by distance from the template

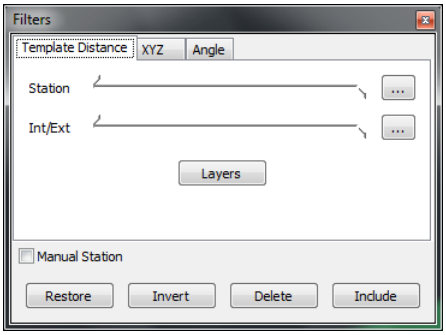


Figure 16 - Filter by distance from the template.

In order to apply for the filter by distance from the section you will need to have a section, a horizontal alignment, a vertical alignment and the analyzed points with respect to the alignment.

Station: Station interval where the filter will be applied. Coincides with the points cloud's limits you are viewing.

Int/Ext: Values for the inner and outer offset of the template.

Layers: Opens a dialog box to select the layer to be used on the filter. Only one layer may be selected per section.

With the maximum and minimum values a band will be created that will surround the template. If you go around the section in a clockwise direction, the negative values represent the area to the left or the outside of the section, whilst the positive values represent the area to the right or the inner points.

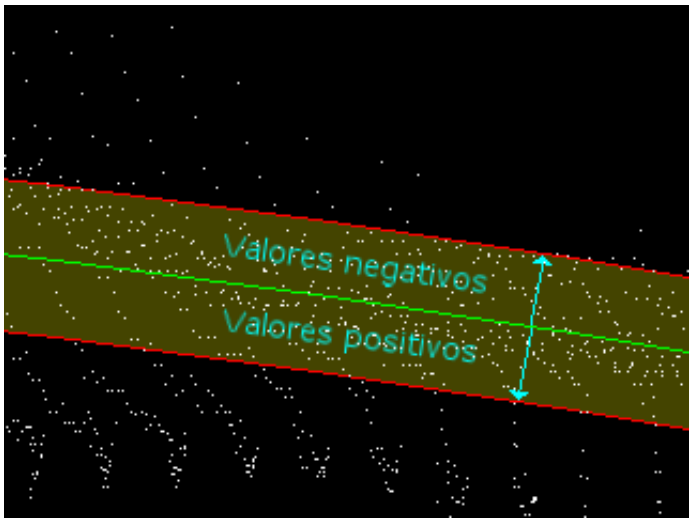


Figure 17 - Filter by distance from the section.

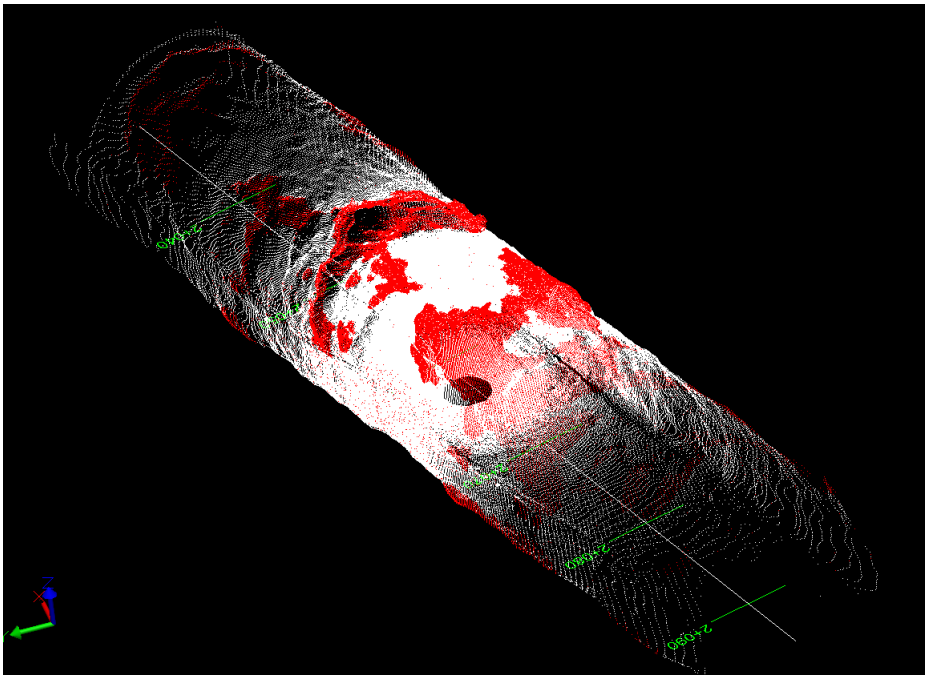


Figure 18 - Filter by selection, values [0, 5], have been eliminated

6.2 XYZ Filter

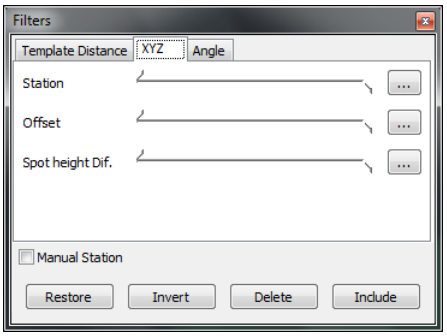


Figure 19 - Filter by station

Applies a station, offset and height filter.

Station: Station interval of the filter.

Disp: Maximum and minimum offset for the filter.

Height: Maximum and minimum height differences for the filter.

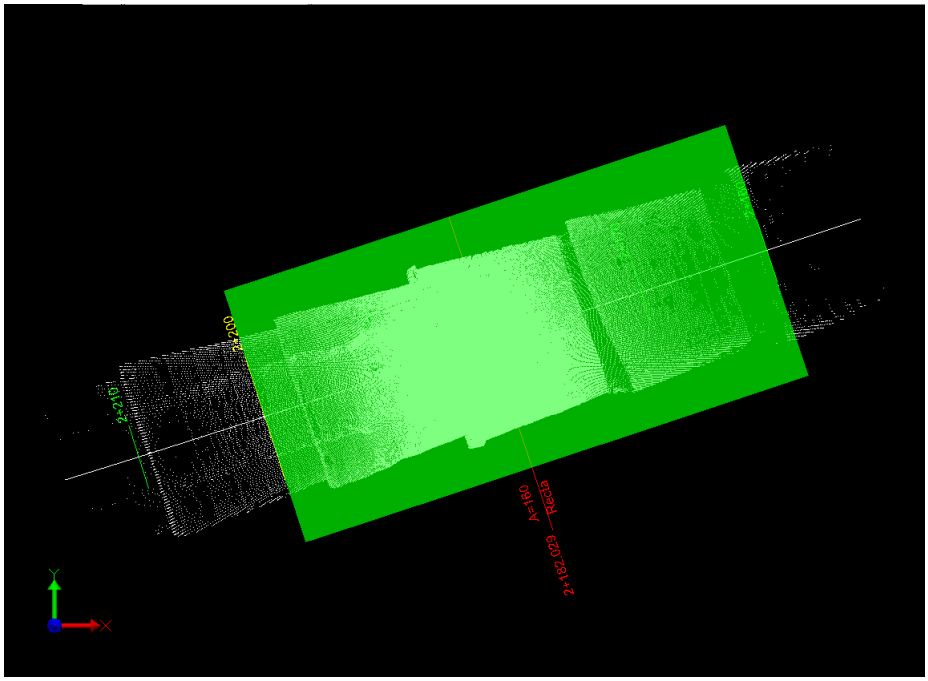


Figure 20 - Representation of filter by displacement

6.3 Filter by angle

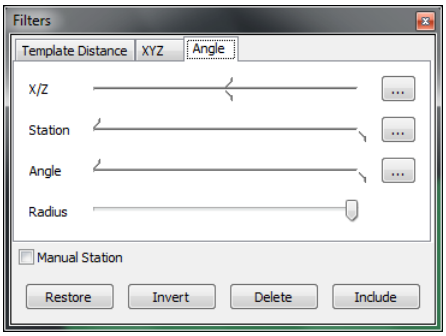


Figure 21 -Filter by angle

X/Z: X, Z position of the circle with respect to the alignments.

Station: Station interval of the filter.

Angle: You can vary the start angle and the angle taken by the filter.

Radius: Radius of the circumference or circular sector.

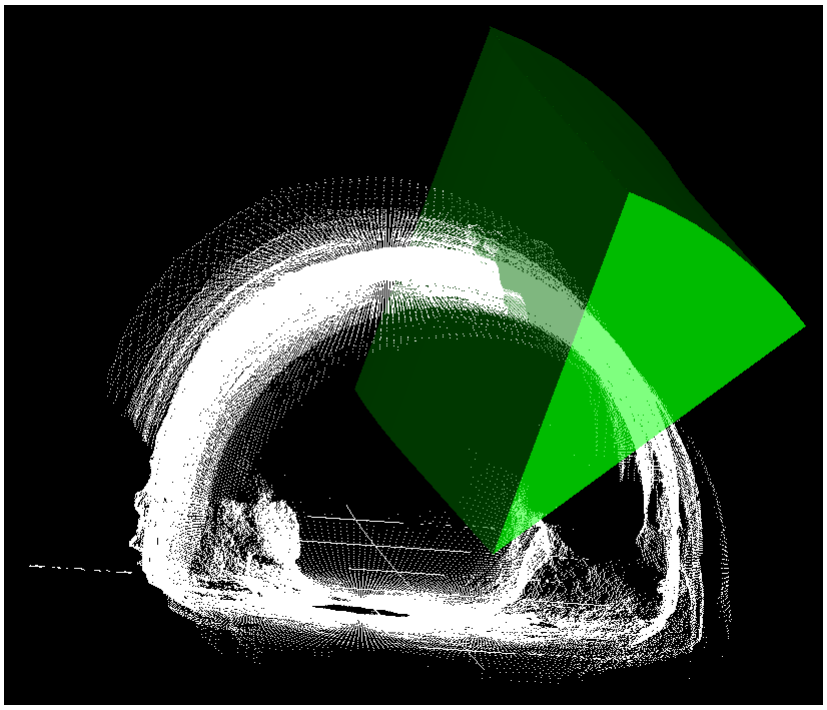


Figure 22 - Filter by angle, X=0, Z=3.0, Start=55, Arc=37

6.4 Filter by selection

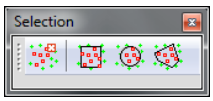


Figure 23 - Filters by selection

This filter is always applicable, you do not need an alignment, nor to have analyzed the points, as only point coordinates are used. It can also be applied whilst you look at the cross sections.

Select: When you activate the selection mode, you can select points by drawing a rectangle within the window displaying the points without the view or perspective you are using mattering.

The first click of the mouse marks the corner of the drawing, whilst the second will mark out the points within the rectangle.

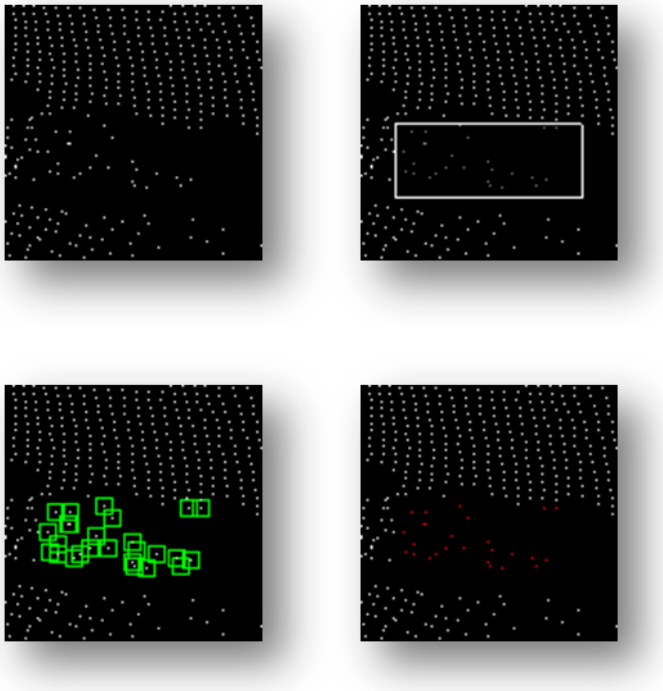


Figure 24 -Example of filter by selection

7 Symbology

You have the option to apply a symbology to point's files, allowing you to see the relationship between points based on the symbols chosen.

In order to apply such symbols, use the "Points -> Symbology" menu or the corresponding icon on the utility toolbar.

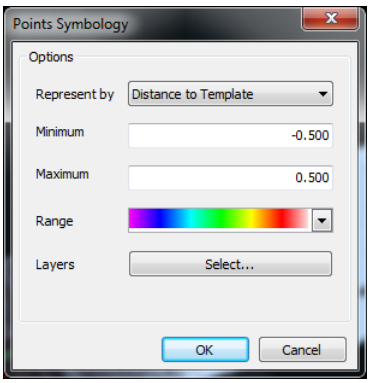


Figure 25 - Symbols showing height differences

If you do not have the necessary data to apply the selected symbology, the OK option will be disabled.

Symbols available:

Delete: Eliminates the symbology from the selected file. Points will be drawn using the first color from the selected range.

Angle: Colors points based on the angle formed between the vertical and its coordinates.

Scanner Color: Applies the color from each point. Points files should include information on color; if this is not the case all will appear in the same color.

Offset: Colors the points based on distance to the alignment.

Distance to the base: If a base is not defined for the file, calculations will be based on the centroid of the points. The distance is measured on the XY plane, with point height not taken into consideration.

Height difference: Colors the points based on the difference between the point height and gradient height at the point station.

Distance to the template: Colors the points based on distance to the template. When you set this option, an icon will be enabled which allows you to select the layers you wish to use in calculations.

Intensity: Maps points intensity to the color gradient, if intensity information is missing all points are mapped to the first gradient color.

Inside/Outside: These symbols are similar to previously (Distance to the template) although points only come in two colors, depending on their position with respect to the template.

File: Assigns a color to each file as part of the series of symbols. If you have ten files and you apply this symbol to the seventh of them, the seventh color from the selected range will be assigned to all points.

Station: Colors the points based on the station.

Using the *"Range"* control you can change the colors that are applied to the points. If you want to change it without changing the symbols applied, you can use the corresponding control in the application's main window.

Activating the *"Distance to selection"* symbols, click on *"Select"* which will open a dialog box to choose the layer to be used.

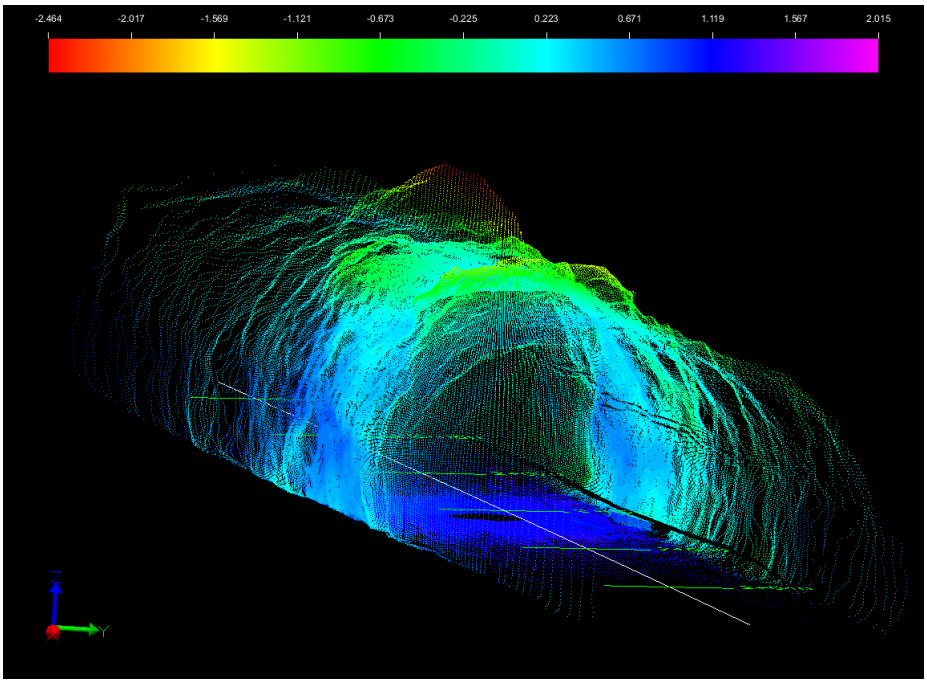


Figure 26 - Symbology by distance to the template

8 Export Points

To export a points cloud using the menu *"Points -> Export"*. A dialog box will appear allowing you to choose the files and points to export.

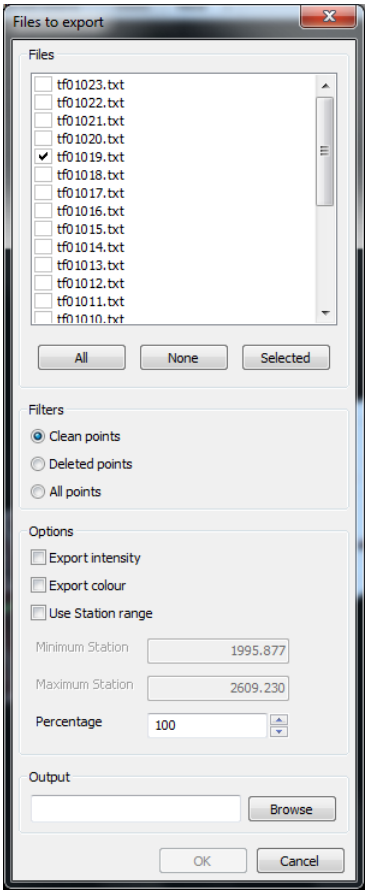


Figure 27 - Export points

The dialog box is divided into 3 sections:

- Files

You can choose the files you want to export by checking them in the file list. The points cloud files that you are viewing will be checked on by default. You will also have the following options available:

All: Marks all files

None: Removes the mark from all files. If no files are selected, the Accept icon will not be enabled.

Selected: Marks all the active points cloud files.

- Filters

Using the filter options you can choose the files you wish to export. If no files are marked, the points for which no filter is marked will be exported. If one or more filters are marked, points will be exported if there is any mark in common with those marked.

- Options

  Choose *Export Color* box to include color information on each point. Also you may choose a station interval, and only the points within will be selected for export.

- Output

After selecting the files and the points you wish to export, you should select a location where points are to be written.

There are two output file formats, choosing *ASCII (*.xyz)* format each source file will be written to a different destination file. When we use *Cyclone (*.pts)* format the selected files will be written into a single file.

9 Export percentage

Dialog to export a given percentage of the points contained in the project.

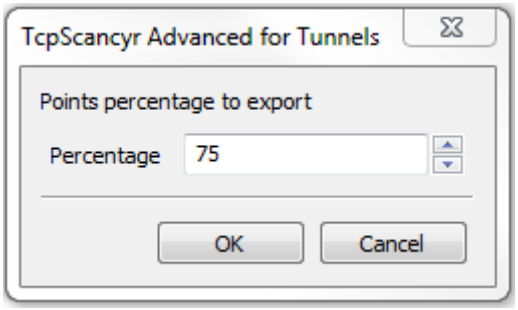


Figure 28 - Export percentage dialog

10 Cross Sections

The application can handle various cross sections files at the same time. For this reason, every time you select a command that affects the cross sections you will be asked for a cross sections file to be used. Depending on the necessary data there are dialog box fields that are hidden.

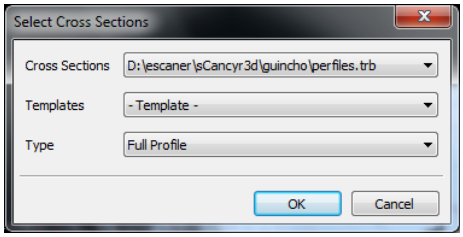


Figure 29 -Selection of cross sections and templates

Using the *"C*ross Sections*"* control, you can select the cross sections file that you wish to use as input data, whilst with the *"Template"* you can select the cross sections you wish to use as a reference, you can use the template or a cross sections file. Finally, the *"Type"* field allows you to choose the complete cross sections or the cut corresponding to the heading or bench section.

10.1 Cross Sections Calculation

When you have established the alignments and points you may then calculate the cross sections from the points cloud. The algorithm only uses points that are not filtered out.

The application features two methods to calculate cross sections. The first of these is accessed via the menu *"C*ross Sections *-> Calculate Cross Sections*" and can be used in points cloud taken with a scanner. You should use the menu *"Cross Sections -> Calculate Cross Sections by regression"* in case the points come from a station (low-density points cloud). The two methods use the same input parameters, except the second one the filter is not applicable.

When you select the calculation of cross sections, the following dialog box will be shown which allows you to alter the following parameters.

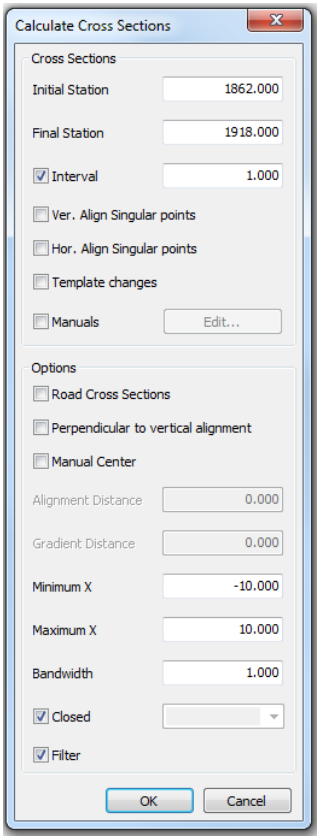


Figure 30 - Calculate cross sections

Initial Station: The station from which you will begin to calculate cross sections. The default value is the minimum station of the points cloud.

Final Station: The last station from which you will calculate cross sections. The default value is the maximum station of the points cloud.

Interval: Indicates the separation of each cross sections.

Unique points: To create a cross section on the unique horizontal or vertical alignment points depending on the mark.

Manuals: To create cross sections on specific stations.

Gradient perpendiculars: when enabled the cross sections will be perpendicular to the vertical alignment, if they are disabled they will be perpendicular to the XY plane, or the deviation you have defined in the cross sections (only for manual cross sections).

Manual Centre: This is used to change the origin of sorting algorithm. The values are relative to the horizontal and vertical alignment.

Bandwidth: The band of points taken in order to measure cross sections, using points within the following range:

$$\text{Station point} \in [\text{Station} - \text{Bandwidth} / 2, \text{Station} + \text{Bandwidth} / 2]$$

10.2 Quick Profile:

This option provides the possibility of create a cross section from a selection in the point cloud.

The selection of a crossing plane is asked when you select the “Quick Profile” menu. The program will show the intersection between the point cloud and the plane with the bandwidth selected.

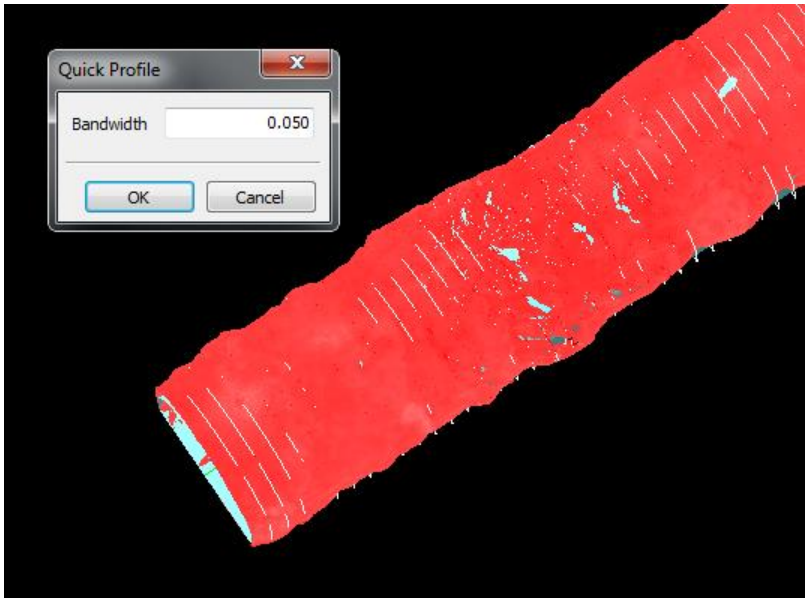


Figure 31 – Bandwidth selection

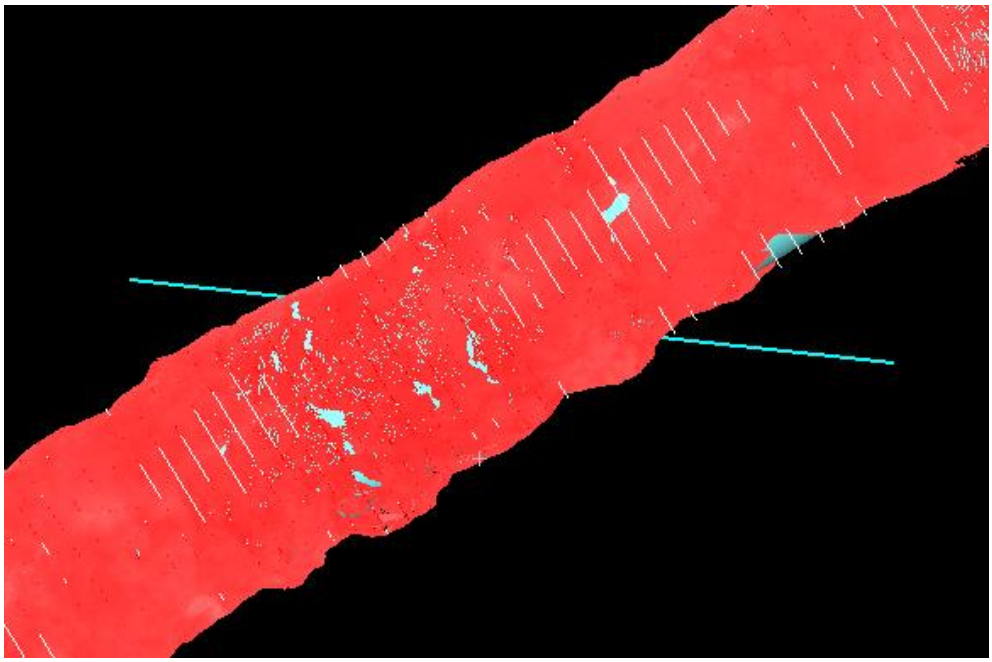


Figure 32 – Crossing plane selection

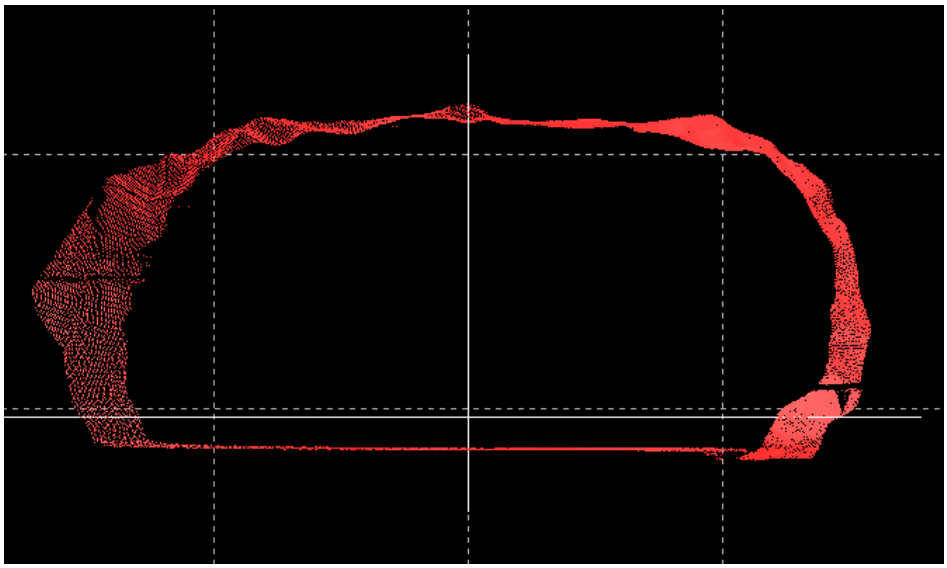
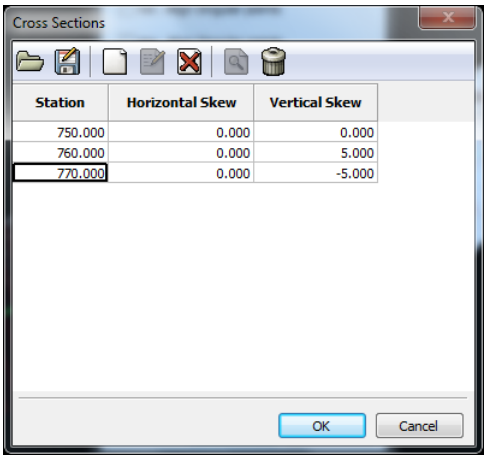


Figure 33 – Quick profile result

10.3 Manual Cross Sections:

Using the manual cross section option, a dialog box will appear, indicating a station and deviation list for each cross section.

The current horizontal alignment deviation is not known.



10.4 Open/Close Cross Sections

With this command you can open or close a cross sections range. When you open a cross sections range also you can tell how to open it. There are two options:

Stone Key: It erases the cross sections edge over the horizontal alignment.

Maximum edge: It erases the longest cross sections edge.

10.5 Parallel Cross Sections

If you need to create cross sections which are parallel to those from a project, use the menu *"Cross Sections -> Parallel Cross Sections"*.

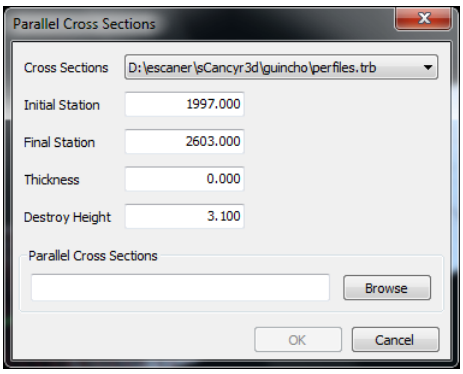


Figure 34 -Calculation of Parallel cross sections

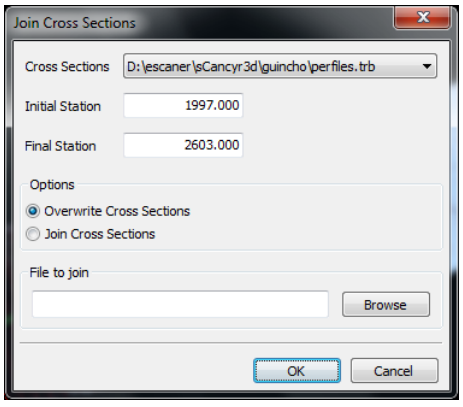
First select the input file (which must belong to the project) and the station range where you wish to calculate the parallel cross sections, using the field *"Thickness"*. To indicate the distance from the parallel cross sections, use a positive value to move the cross sections outside and a negative value to move it inside.

With the bench cut value you may cut the cross sections at a height relative to the gradient, always keeping the upper part of the cross sections resulting from the cut.

Finally you should add an output file allowing the application to create parallel cross sections. This file will automatically be added to the project.

10.6 Joining Cross Sections

You have the option to join two cross sections files by using the *"Cross Sections -> Join Cross Sections"* menu



First select the cross sections file you wish to modify (these should pertain to the project). Next, set the station range which affect the modification. Finally, select the cross sections files to be joined.

The application will go through the cross sections files to be joined. If there are cross sections that fall within the specified station range, the project's cross sections files will be included. For two cross sections at the same station the old one will be overwritten by the new cross section.

10.7 Elements to be Represented

Features options which change the representation of the cross sections on the screen. There are options that are only available if there is a station-defined template for the cross sections you are viewing.

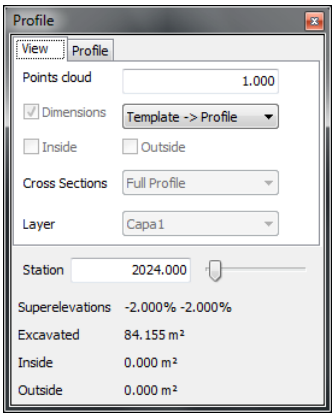


Figure 35 - Cross Sections viewing options

Points color You change the points band that you wish to take using the Edit box on the right. To show or hide the point cloud you must use the layer control.

Dimensions: Activate this option if you want to show dimensions between the template and the calculated cross sections. By selecting the option *"Section -> C*ross Section*"* or *"C*ross Section *-> Section"* you can choose the direction of these heights. In the first instance, the straight line from the section to the cross sections is used, whilst in the second, the minimum distance from the cross sections points to the section are displayed.

Inside: Fills in the cross sections areas that are within the template or reference cross sections.

Outside: Fills in the cross sections areas that are outside the template or reference cross sections.

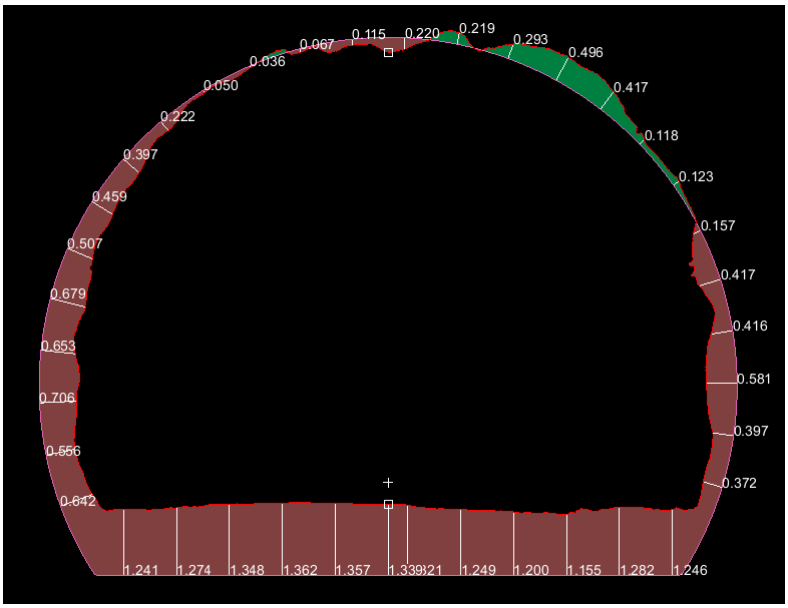


Figure 36 - Cross Sections showing all active heights and surfaces

10.8 Cross Sections Options

Features options for the selected cross sections.

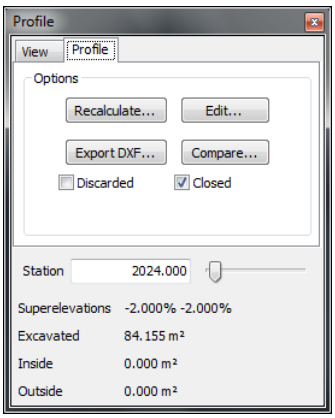


Figure 37 - Options for the selected Cross Section

Station: The cross section that is being viewed can be changed by writing its station or by dragging the scroll bar.

Recalculate: If you see a poorly defined cross section, you may click on this icon, to open a dialog box which will allow you to recalculate using a greater bandwidth.

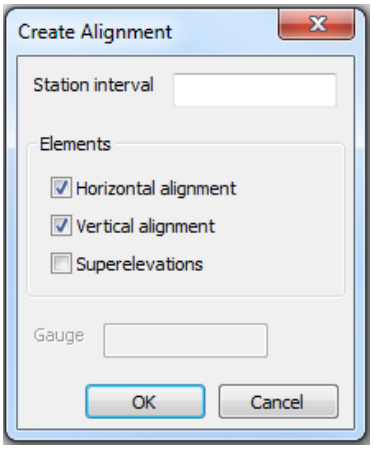
Edit: If you have not cleaned up the points cloud, the cross section may appear with false peaks or segments. By clicking on this button you will be able to access the cross section editor.

Export DXF: Access the dialog box in order to export one or more cross sections.

Discarded: The cross sections that are marked as discarded are not considered when calculating volume, alignment deviations, exporting cross section etc.

10.9 [TcpScancyr Advanced] Create Alignment

Creates a new alignment from points selected on the cross sections. This option can be accessed from “Tools -> Create alignment from Cross Sections ” or from the Cross Section Options dialog with the button “Create alignment”.

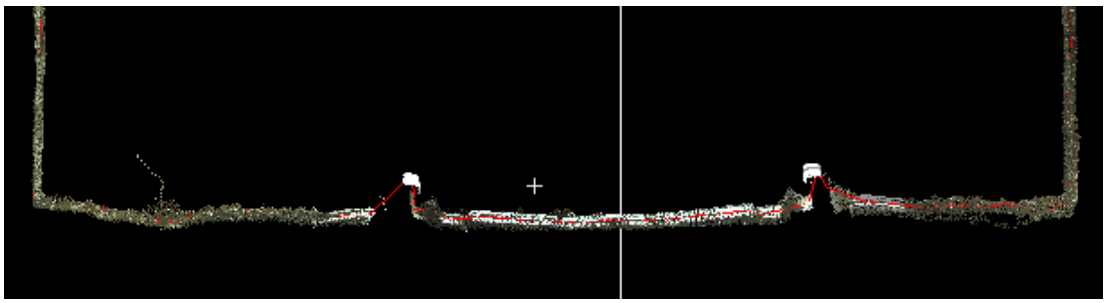


Station interval: You can define an interval and the cross sections will be showed with this step.

Horizontal alignment: Create the horizontal alignment from the selected points.

Vertical alignment: Create the vertical alignment from the selected points.

Superelevations: If this option is checked the program will create a parallel alignment searching the points with a X displacement of the gauge selected and the most high one in a selection range. This option is very useful to create railway alignments.



10.10 Cross Sections Filters

When you view an individual cross sections you can see if it has errors because the cross sections has points that should be marked as filtered. Instead of going to the points cloud containing the cross sections, eliminating the points and recalculating the cross sections, you may access the selection filters, using the corresponding toolbar. The difference is that the cross section will be recalculated automatically by eliminating and including points.

Here you can see a faulty cross section because there were points which should have been filtered. The points correspond to the roof of a van that was close to the scanner.

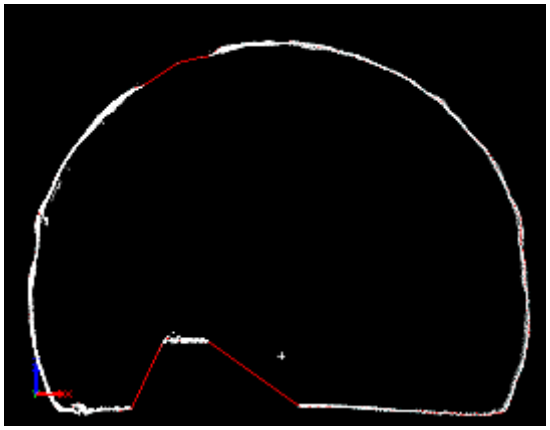


Figure 38 - Cross Section with errors

Click on *"Select"* in the *"Cross Sections -> Filter"* window, and draw a selection box on the points that damage the cross section.

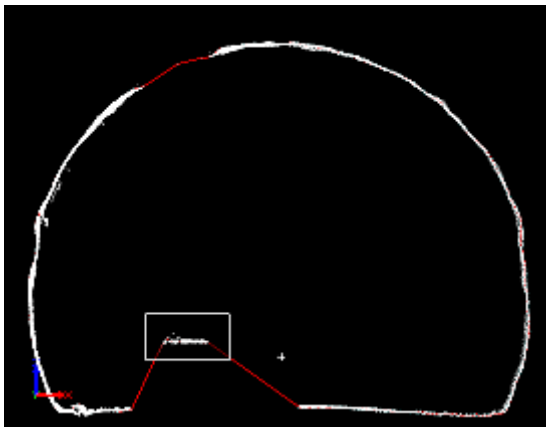


Figure 39 - Selecting the points to be eliminated

A sample of points marked.

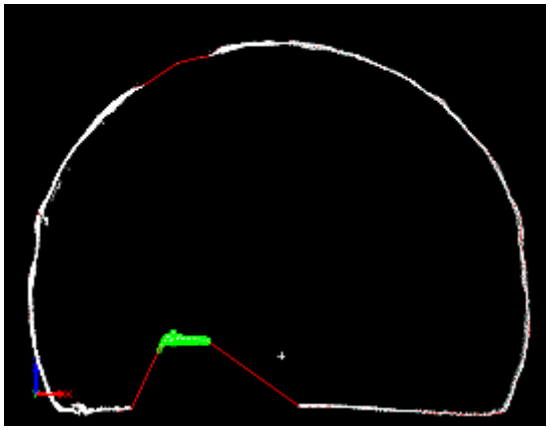


Figure 40 - The selected points appear marked in green

Click on “Delete” and mark the point as filtered by selection. The cross section will be automatically recalculated. As you can see in the image, the cross section is now correct.

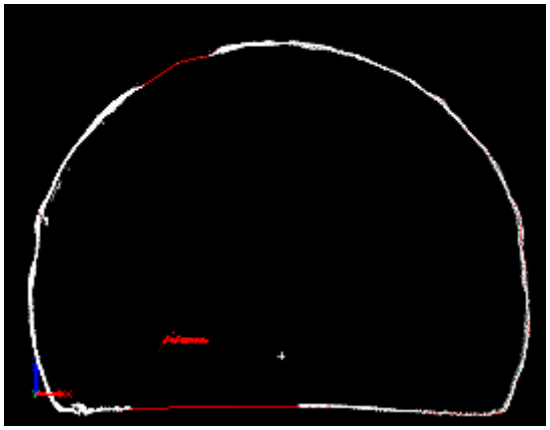


Figure 41 - After deleting the points

10.11 Importing Cross Sections

To import a cross sections file form **MDT (*.TRA)**, you must supply the file, horizontal and vertical alignments because the application needs the position and orientation of each cross section to show it in 3D.

10.12 Exporting Cross Sections

You can export cross sections in 2D to **MDT (*.TRA)** file format, or as a points file with the coordinates of each vertex in the 3D.

This command exports cross sections as cross-section files compatible with **MDT (*.TRA)**. First, you will be asked for a station range in order to be able to export the cross sections within the range.

Access is via the *“Cross Sections -> Export Cross Sections…”* menu.

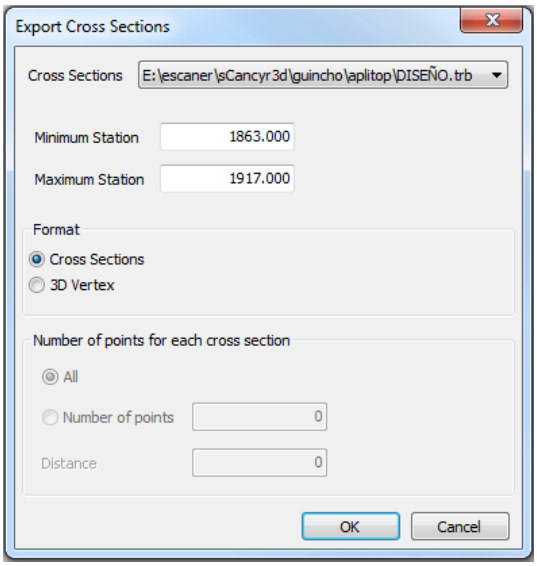


Figure 42 - Window for export cross sections

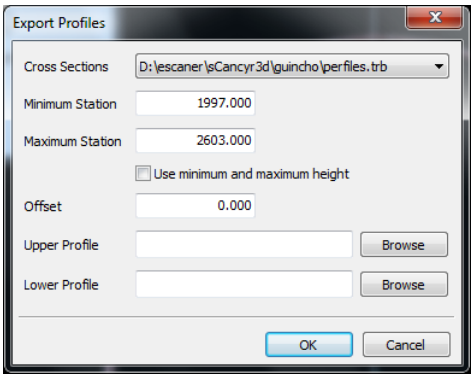
[TcpScancyr Advanced] There are two types of exporting 3D Vertex from the cross section. If you check "All", the program will export all the points contained in the polyline. If you check "Number of points", you will choose the number of points that you want to export. These points will be calculated with the intersection of the cross section and radial lines from the center.

10.13 Export Profiles

From a cross section file we can generate profiles compatibles with **MDT (*.LON)**.

Select a range stations and then choose if we take the upper and lower ends of each profile or dimensions for an offset chosen.

Then choose the output files to store data. It is not required to specify both files, only those who are interested.



10.14 Export Cross Sections to DXF

This command exports a cross sections file to a DXF. In order to set up the export, you will see the following dialog box:

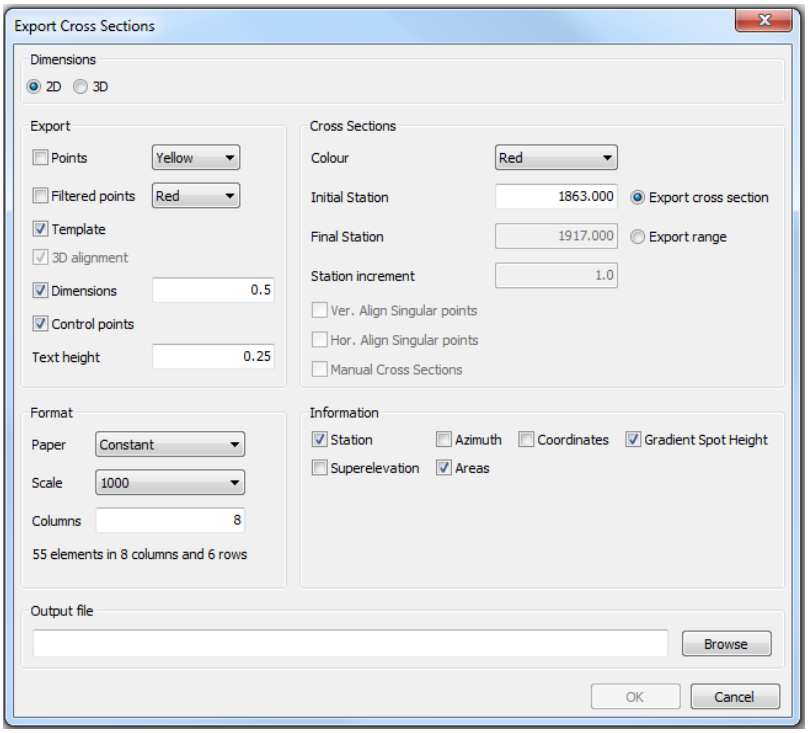


Figure 43 - Dialog box used for exporting Cross Sections

- ***Dimensions***

The cross sections can be exported in 2D or 3D. In 3D many of the options will not be available.

- ***Export***

Here you can indicate the various elements that make up the cross section you wish to export. All the layers you have defined are always exported. Each element to be exported (heights, surfaces, control points) has the name of the layer of which it is part as its prefix.

Points: Export the points that are close to the cross section, bandwidth is the same as in *"Cross Section -> View -> Points cloud"*

Template: Exports the templates that are applied to the cross section.

[TcpScancyr Advanced] 3D alignment : Exports the 3D alignment.

Surfaces: Included the various polylines that make up the under-excavation and over-excavation surfaces.

Dimensions: Includes a layer with the dimensions from the template to the cross section.

Control Points: Includes a layer with defined control points.

Text Height: Changes the size of the text showing cross sections information.

- ***Cross Sections***

You can export a single cross section, indicating its station, or a range indicating the initial and final station. You may also stipulate their color.

If you have calculated single-point or manual cross sections, these will be marked separately on export.

- ***Format***

Here you can specify the output format of the cross sections, in either continuous or sheet mode. You can also change the scale to adjust the drawing to the paper by using the corresponding control.

When you change values, a line will appear showing information as to how many cross sections fit on a sheet.

- ***Information***

For each cross section you can indicate the data you wish to appear, as well as controlling its position with respect to the drawing using the left, right, up and down icons.

Station: Cross Section station

Azimuth: Orientation of the alignment in the station where the cross section was calculated.

Slope: Inclination of the vertical alignment in the cross section position.

Coordinates: X and Y coordinate of the alignment.

Gradient Spot Height: Vertical alignment height of the station.

Superelevations: Left and right superelevations value of the station.

Surfaces: Under-excavation and over-excavation surface values for each layer of the template.

- ***Output file***

Write or select a DXF file where cross sections may be drawn. If you do not specify an output file the Accept icon will be disabled.

It is important that the selected file is not being used by any other application, nor it's write protected.

10.15 *[TcpScancyr Advanced]* Export Inner points

Export the cross section points that are inside the template.

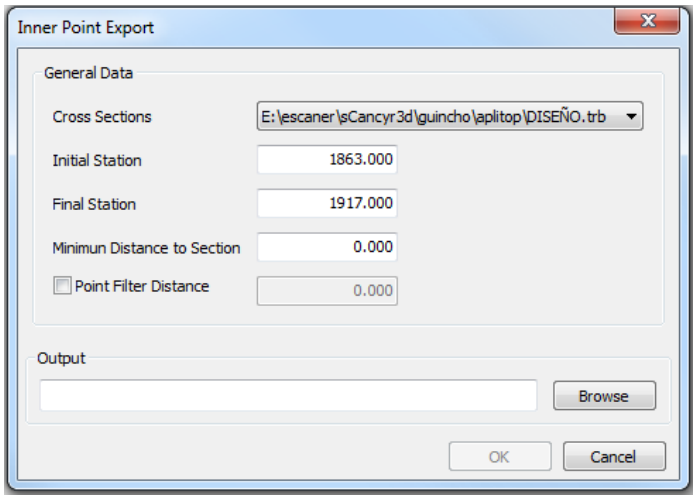


Figure 44 - Export inner points

11 Templates

In order to calculate excavation surfaces and volume you will need to define a template. The application does not set limits on the number of templates, although for a specific station there can only be one applicable template.

Each template contains an undetermined number of layers, and it is these that contain a polyline with the definition of the section.

Under the toolbar, the window is divided into two parts. On the left there is a project tree showing sections and their layers created for the tunnel. On the right you can see an editor used to alter the sections.

At the bottom is a toolbar with coordinates and current status information.

The editor menu features undo and redo commands, as well as the clipboard commands. They work the same as they do with any application.

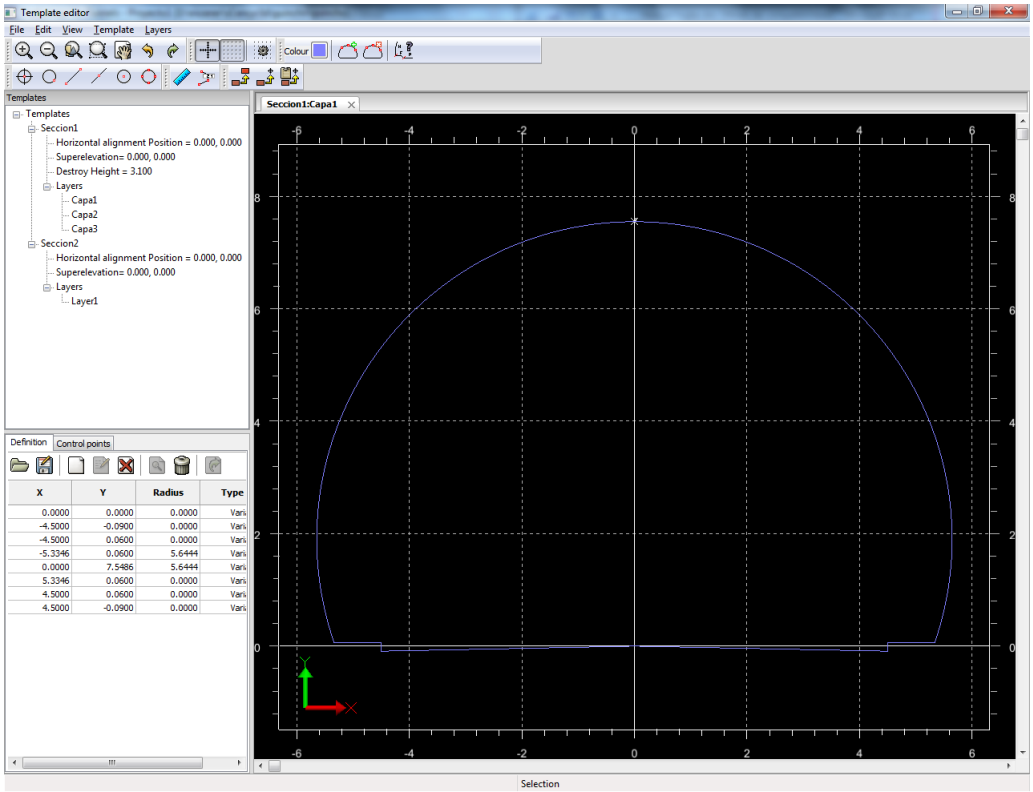


Figure 45 - Template editor

You can create as many sections as you wish, although these should not overlap. Use the *"Section -> New Section"* menu to create a new section, *"Section -> Edit Section…"* to edit section parameters or delete a section with all its layers via the *"Section -> Delete Section"*.

You may also use the context menu which appears when you select a section from the section tree.

The dialog box used to create or edit a section is the following.

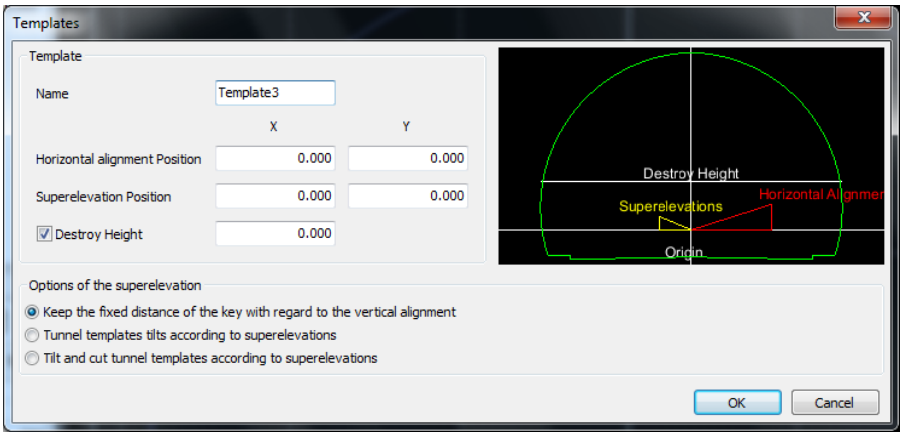


Figure 46 - Template Data

Name: Name of the section - no two sections may have the same name.

Station Range: Minimum and maximum values for the station where this value is to be applied. Minimum and maximum values for the project horizontal alignment are displayed.. These values may not overlap with already created sections.

Horizontal alignment Position: Coordinates where the horizontal and vertical alignment will pass. With this point you may displace the position of the section with respect to the alignments.

Superelevations Positions: Superelevations application point. This application point is supposedly the position of the section with respect to the axis origin (0.0).

Destroy Height: Indicate whether or not there is a destroy height and its position with respect to the gradient.

If you wish to displace all the created layers and control points, use the *"Section -> Move Section"* menu. Displays a dialog box where you may locate the horizontal and vertical offsets to be applied.

The positive values move the layers and points from the right and from the top, whilst the negative values in the opposite direction. If you wish to displace the control points you should check the corresponding box.

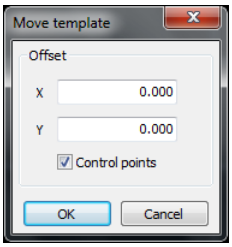


Figure 47 - Moving Section Layers and Points

11.1 Section Layers

You can assign any number of layers to a section. Use the *"Layers"* menu, or the context menu to select a layer within the tree in order to access the following options.

New Layer: Creates a new layer in the current section, also creates a new tab in which the layer can be drawn. A dialog box will be displayed allowing you to enter the layer name.

Edit Name: Edits the name of the current layer.

Edit Layer: Opens a new tab allowing you to edit the layer.

Delete layer: Deletes the current layer. If a tab is open, it will be closed.

11.2 Import Templates

Templates can be imported from TcpTunnel (*.TNL) and DXF files. It is recommendable that DXF files are not too complex, if possible containing only the template as the application does not recognize all DXF file entities.

Having imported a section, this will appear in a tab featuring the name of the file. You may use cut and paste commands to assign it to a specific layer. In the case of importing a TcpTunnel file, as it may contain more than one section, the application will open a tab for each file section.

In order to pass the imported sections to a layer, you will have to use the clipboard, using cut and paste options. You may also use... 25.13

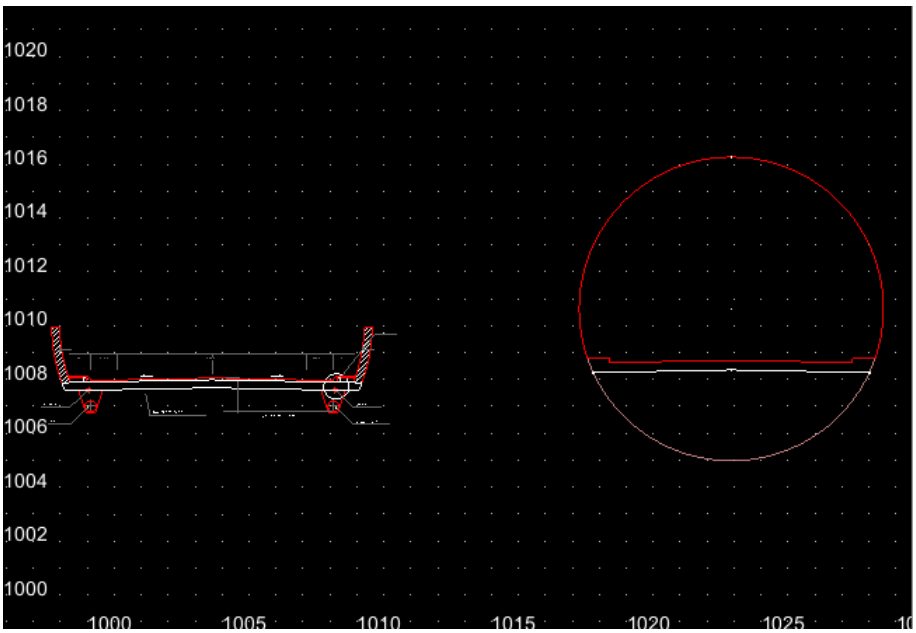


Figure 48 - Imported DXF File

[TcpScancyr Advanced] It is also possible import cross sections from the MDT format (".TRA"). This option can be accessed from the "Tunnel" menu, in the principal window. When you select the "Tunnel-> Import templates" the program will ask you for a template file, a vertical alignment file and you will can choose between open or closed templates.

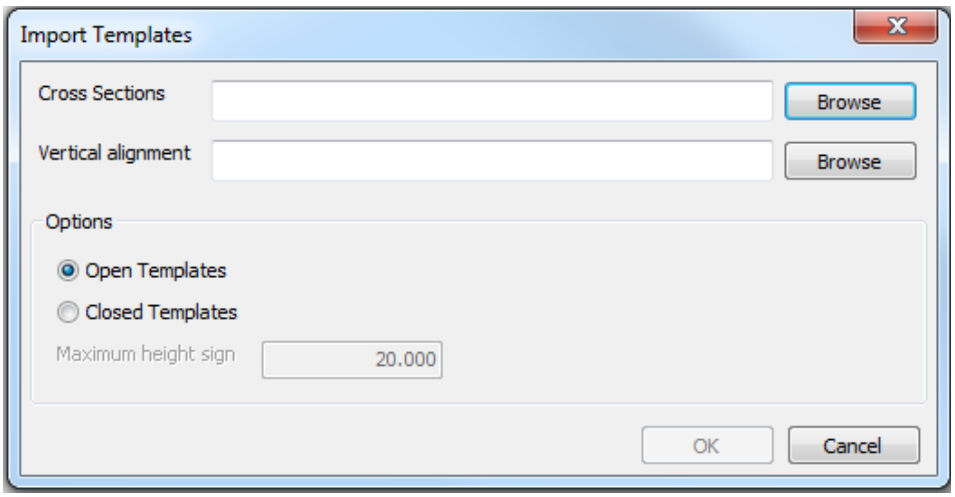


Figure 49 – MDT templates import dialog

11.3 Section Elements

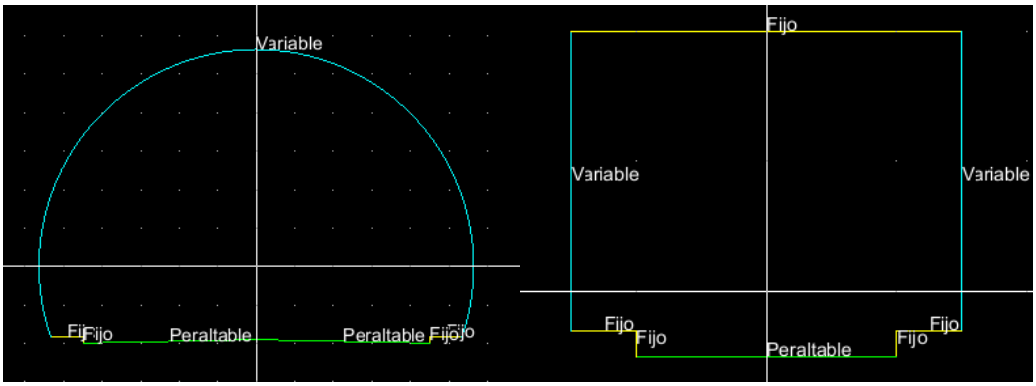
If you wish to apply superelevations to the template, you should check the different parts of the section, in order that the application knows how to modify the section. You can change the type of each part from the table that defines the template or use the corresponding icon on the toolbar.

Superelevations: Part of the section that is modified on applying the superelevations.

Fixed: Part of the section that is not modified, but is moved to coincide with the parts of sections that are connected.

Variable: Part of the template that is lengthened or shortened to coincide with the fixed part or superelevations from the earlier or subsequent part of section. A template may only have one or two variable parts.

In general, the lower part should be marked as a sup height, if there is a pavement it should be fixed and the vertical sections that make up the wall of the tunnel should be marked as variable. Examples:



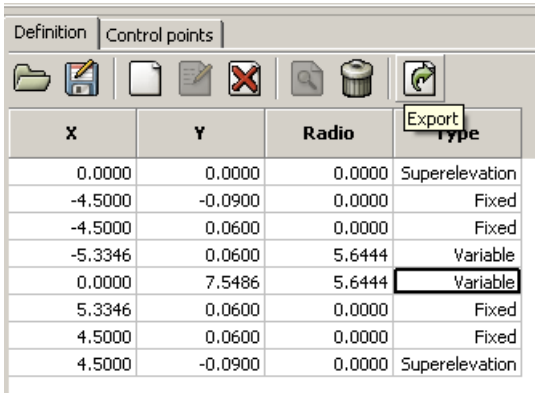
11.4 Manual Section Input

It is also possible to include a template by writing the coordinates and the radii of each vertex. In order to access the numerical input window, use the *"Numerical editing of the section"* icon.

The numerical input window is divided into two parts - in the upper area there is a toolbar whose use is the same as in other areas of the application.

Below the icons there is a table which allows us to fill in data. If a row has a radius other than zero, it will form an arc from this point to the point in the following row. If it is the last row, it will be linked to the first vertex. The final column shows the section type.

All sections should have the vertexes in the clockwise direction, and should also be closed. This means that the program will always join the last point to the first one, and the last point does not have to be the same as the first one.



X	Y	Radio	Type
0.0000	0.0000	0.0000	Superelevation
-4.5000	-0.0900	0.0000	Fixed
-4.5000	0.0600	0.0000	Fixed
-5.3346	0.0600	5.6444	Variable
0.0000	7.5486	5.6444	Variable
5.3346	0.0600	0.0000	Fixed
4.5000	0.0600	0.0000	Fixed
4.5000	-0.0900	0.0000	Superelevation

Figure 50 - Section Numerical Input

11.5 Radius Criteria

Given two points and a radius, there are four possible arcs. The program will determine what arc should be used based on the degrees they cover and the radius sign.

Supposing that you have an edge AB and a radius R, of the four possible solutions those which cover more than 180 degrees can be discarded. Of the two arcs that remain, if the

radius is positive, the arc to the left of the AB segment will be used. If it is negative, the arc to the right of the heading is used.

Another way to see how the arc sign affects the program is that the positive values create arcs toward the outside of the section, whilst negative values create arcs toward the inside.

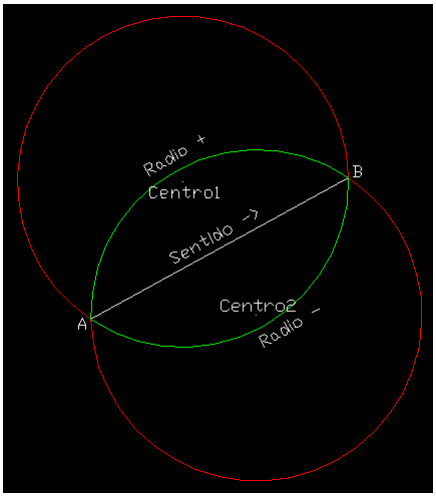


Figure 51 - Radius Sign Criteria

11.6 How to create a section from scratch

If you have opened a numerical input with an empty layer, or you have deleted a section, the table will appear empty. The editor is used as follows:

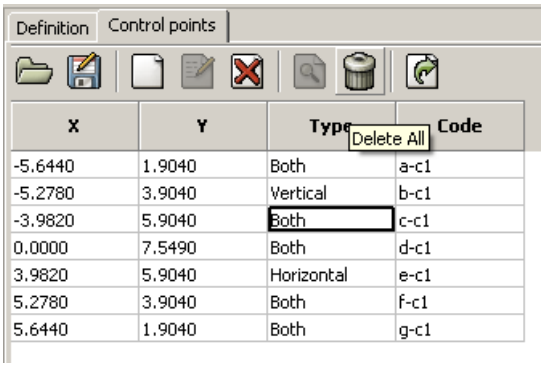
- Click on the icon again and a row will appear with all values to 0.0 if the table is empty. If it has elements, a row will be inserted before the cursor, with the same data as in the current row (where the cursor is at present).
- After keying in the radius and clicking on *Enter,* a new row will be created with the same values that you have entered, in this case, as the final row.
- When you modify the radius of an intermediate row, the program will calculate if it is possible to reach the limits of the arc. If this is not possible, a message will appear and the value changed to a minimum radius that joins the two extreme points of the arc.
- When leaving the last row, if this was created automatically (by setting a radius) or clicking on *cursor down* on the last row, it will be automatically deleted if it has not been modified.

11.7 Control points

For each created layer you can define a series of control points which will be used to calculate alignments deviations and to calculate the distances from these points to the cross sections.

Depending on the type of the point they can be used to calculate the horizontal alignment, the vertical alignment or both of them. More than one point must already have been defined or the calculations will not be correct.

Further on it will be explained how to use these points to calculate alignment deviation.



X	Y	Type	Code
-5.6440	1.9040	Both	a-c1
-5.2780	3.9040	Vertical	b-c1
-3.9820	5.9040	Both	c-c1
0.0000	7.5490	Both	d-c1
3.9820	5.9040	Horizontal	e-c1
5.2780	3.9040	Both	f-c1
5.6440	1.9040	Both	g-c1

Figure 52 - Control Points

You can also generate control points automatically using the *"Layers -> Generate control points…"* menu.

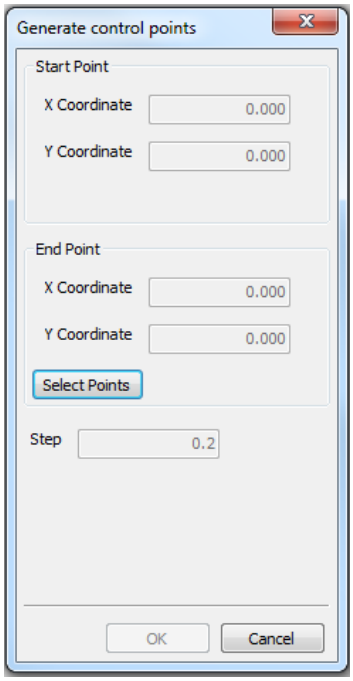


Figure 53 - Window to generate control points

In order to generate the control points, you will have to choose two points over the template, start and end point. The control points will be generated with a step separation.

11.8 Assign Templates

Once the templates are created we must define the template that we want to use in one or more station intervals.

We can assign the same template for different intervals and leave templates with no intervals assigned.

12 Tunnel Route

You may render the route of the tunnel by following the alignment. You may also export the route to an AVI file.

Routing the tunnel is carried out from the points cloud's minimum station to the maximum station, although if there are areas without calculated cross sections, or sections without points.

The lower part of the window is divided into three panels, which will be described later.

- Options

You may set up a number of viewing options - these values can be changed when you are in continuous advance mode.

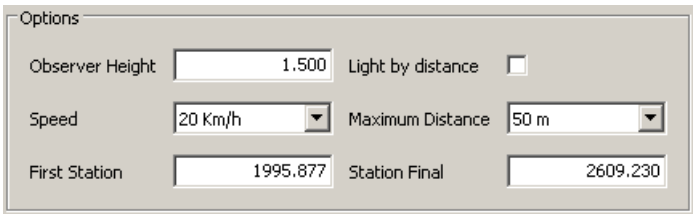


Figure 54 - Route Options Panel

Observer Height: The height of the observer with respect to the vertical alignment.

Light by distance: If enabled, the furthest points will appear as the darkest, depending on the maximum vision distance.

Speed: The speed at which the camera advances on the route by clicking on the advance or return icons in continuous mode.

Maximum distance: Maximum vision distance from the camera position.

Initial and Final Station: Station range covered by using automatic advance.

- Route

Panel used to move the camera following the alignment.

Figure 55 - Route Panel

The icons from left to right are:

First Moves the camera to the points cloud's initial station.

Previous: Moves the camera back a meter, following the alignment.

Return: Returns the camera in continuous mode, it will move following the alignment at the speed indicated on the corresponding control.

Stop: Stops the camera in continuous advance or return mode.

Advance: Advances the camera in continuous mode, it will move following the alignment at the speed indicated on the corresponding control.

Next: Moves the camera forward a meter, following the alignment.

Last: Moves the camera to the points cloud's final station.

Station: Station where the camera is located. This can be written as a value or the scroll bar can be used.

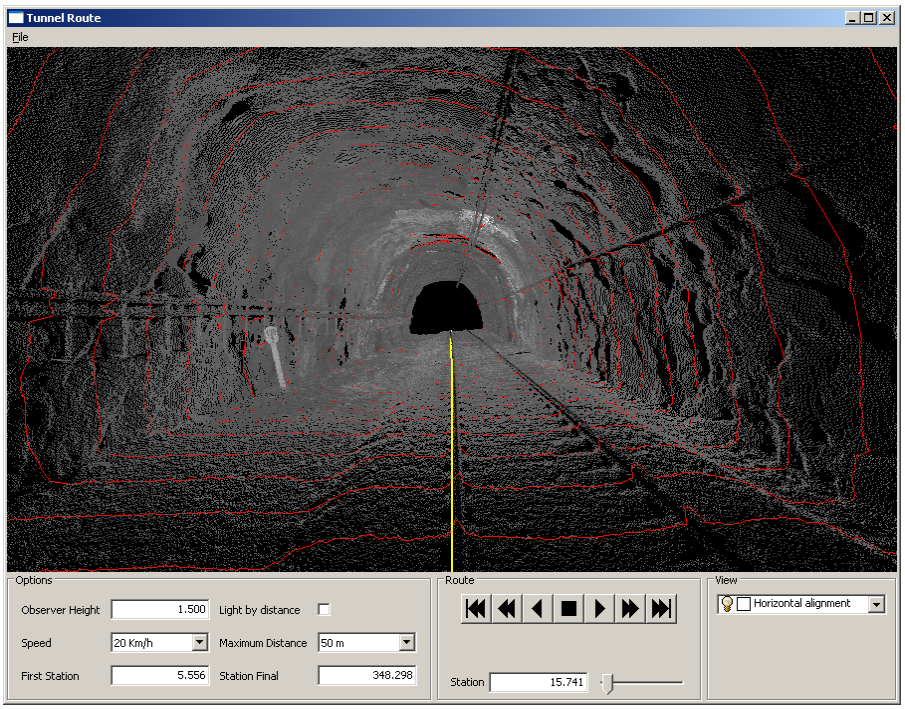


Figure 56 - Route showing points and cross sections

- View

This panel allows one to display or hide the different layers that make up the scene. The available layers will depend on the data you have calculated

- Export to AVI

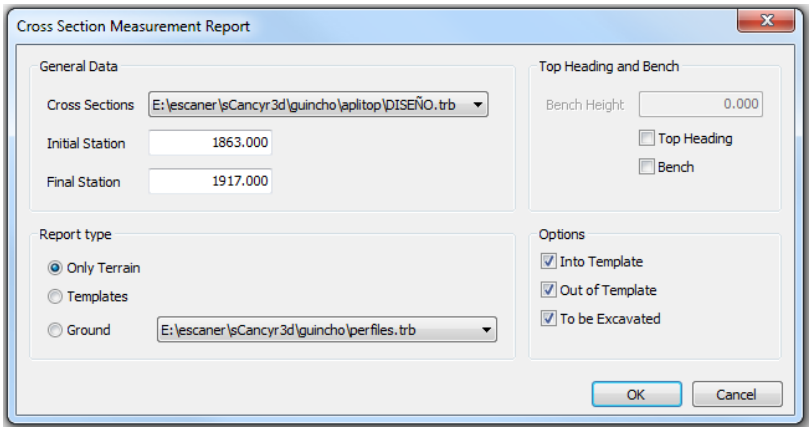
You may use the menu option File -> Export in order to create an AVI file with the route. The route will be created with the current speed, lighting and active layer parameters.

The quality of the created video will depend on the output format used and the data shown.

The output format will depend on the codecs installed on the computer, you also must know that you may have a codec installed which allows you to reproduce video media but not create it.

13 Area and volume report

Once the cross sections have been calculated and you have defined the sections the tunnel will be made up of, you may calculate the list of volume enabling you to view the volume of excavation excess or defect. This may be accessed from the *"Tools -> Area Reports"* menu.



In the general data section, choose the cross sections file to be used, as well as indicating the station range to be used. If you choose the *"Only Terrain"* option a volume report will be calculated without comparison with any other template.

By selecting the "*Top Heading*" and "*Bench*" options, columns will be added with the cross sections cut at the assigned benching height.

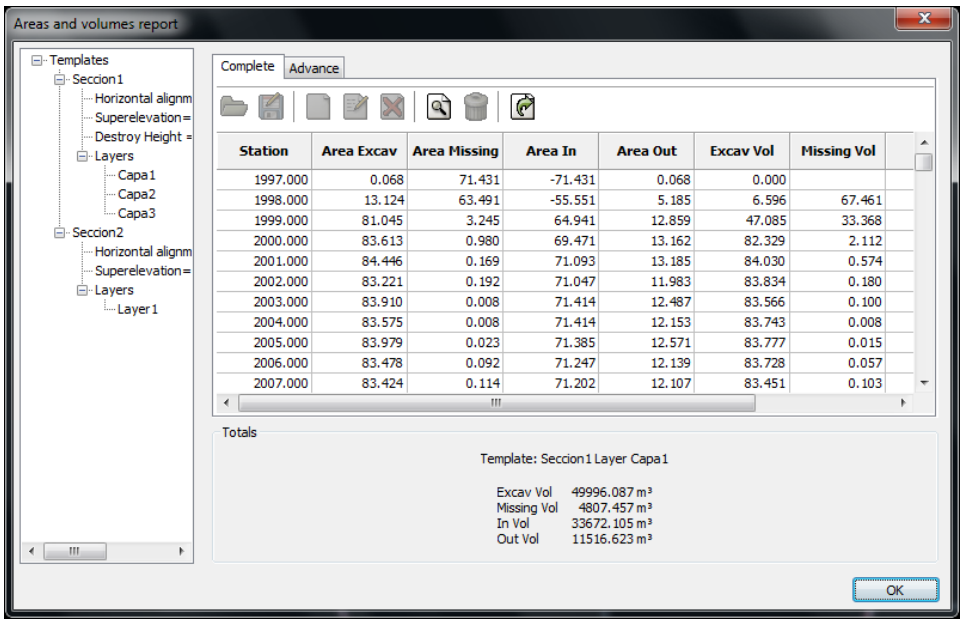
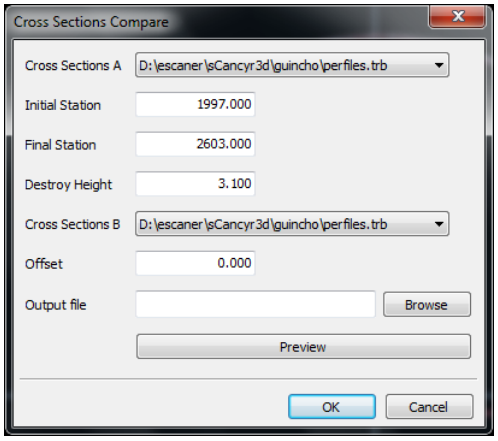


Figure 57 - Area and Volume Report

13.1 Cross Sections Comparisons

You can compare two cross sections files; both files should be included in the project.

The following dialog box will appear:



You will need to specify two cross sections files, the station range will be taken from the first cross sections file. You may also set the benching height and a offset (positive outwards, negative inwards) for the second cross sections file.

By clicking on *"Preview"*, an Export Cross Sections dialog box will open, allowing you to configure the fields you wish to export. Accepting the dialog box will create a preview of the cross sections comparison.

Accepting the dialog box will also show a report outlining the surface and volume differences between cross sections A and B.

14 Alignment deviation report

If you have the cross sections and templates defined, you can calculate the position of the alignment, based on the cross sections. If you select this option, a dialog box will appear enabling you to select the method to be used and a layer for each section of the defined alignment.

When you have calculated a deviation, this is represented on a horizontal and vertical alignment.

Select the method to be used and its parameters on the left-hand side. Underneath, select the layer to be used for the calculations. After choosing everything, click the *"Calculate"* button to calculate the deviation.

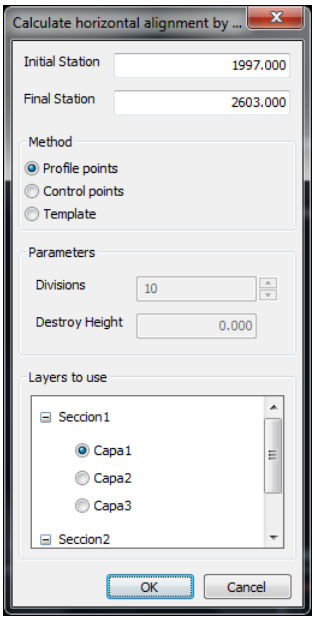


Figure 58 - Dialog box used for calculating the real alignment

Once calculated, the right-hand side of the dialog box will display a list with the points through which the alignment passes for each station where we have a calculated cross sections. The columns are as follows:

Station: Station from which a sample has been taken - coincides with the stations of the calculated cross sections.

Real X, Real Y, Real Z: Absolute coordinates for the calculated alignment.

Hor. Diff: Horizontal offset of the alignment with respect to the theoretical horizontal alignment.

Ver. Diff Vertical offset of the alignment with respect to the theoretical vertical alignment.

In the lower part you can select an output file in order to create a horizontal alignment file including details of offset.

The tree ways of calculating alignment offset are as follows:

14.1 Calculation based on cross sections points

You should only use this method if you have a circular section. The calculation method is as follows:

1. Identify the points which are highest, most to the left and most to the right for each cross section.

2. Using these three points the circle which passes through them can be calculated.

3. The displacement from the center of the circle and the center of the section can be calculated.

14.2 Calculation based on control points

This method first calculates the minimum rectangle that encompasses all cross section points. Within this rectangle the program looks for the best position for control points, trying to minimize the following values:

1. The distance from each point to the cross section. This enables the section to be positioned as close as possible to the cross section.

2. The variation in point distances. It is not enough to say that points are close to the cross section; the distance should also be as similar as possible in all control points.

If you do compensate for the positions of the control points, you can make the alignment disappear as the points “pull” in one direction. In the following figure we have calculated the alignment offset with the three control points (marked with an x).

The cross section can be seen in red, the position of the template over the alignment in white, and in green the calculated position of the template using the control points.

It will appear as displaced upwards, because if you lower the axis, the points on the sides will have a worse evaluation (they will be distanced from the cross section) because the cross section is widened.

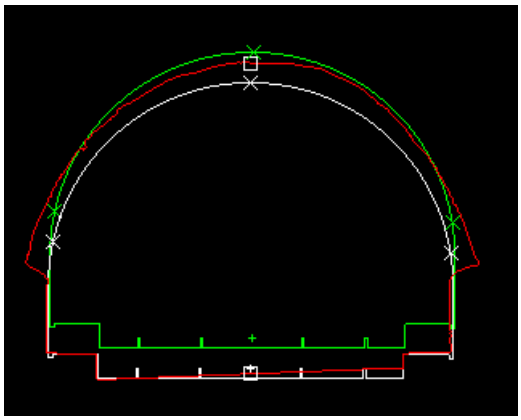


Figure 59 - Three Control Points

By adding a fourth point can make the point “pull away” upwards from the calculated position.

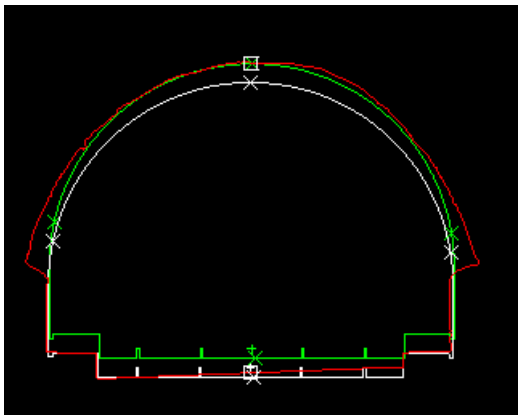


Figure 60 - Four Control Points

14.3 Calculation using the template

This method is based on dividing the template into 'x' number of parts and internally creating x' number of control points. These created points are passed on to the earlier algorithm in order to calculate alignment deviation.

You can use the “Divisions” control in order to create more or less points along the template - the greater the number of divisions, the better the results.

15 Cross Sections Points Report

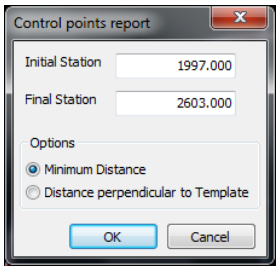
Using the command *"Tools ->Cross Sections Points Report"* you can create lists where you will see the distance from each cross section point to the template.

16 Control Points Report

Using the *"Tools -> Control Points Report"* menu you can create lists where you will see the distance from each control point to the template.

The program will calculate the projection of the control point on the template, and will use a straight line to this to calculate the distance to the cross section.

Using the context menu you can access the graphic representation of the cross section.



17 Gauge Report

Using the cross sections and the template you will be able to calculate the gauge report. This consists of calculating to confirm whether or not each cross section is within the template.

For each cross section that does not pass the gauge control, it will be added to a list that appears below a list of cross sections in the project window. This list is not saved with the project

18 Bolts Report

This report lets you see areas that remain to be excavated and can export the data calculated as 3D point or points to stake (station, offset and elevation).

The parameters to set are the range of stations. The minimum height regarding the vertical alignment over to where we analyze the cross section to find areas that need to be excavated.

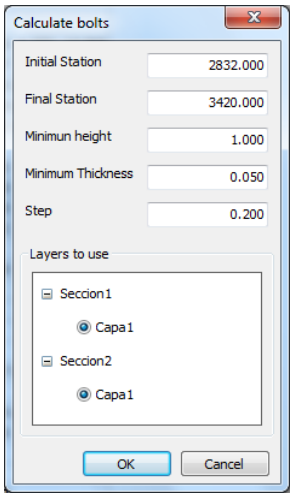
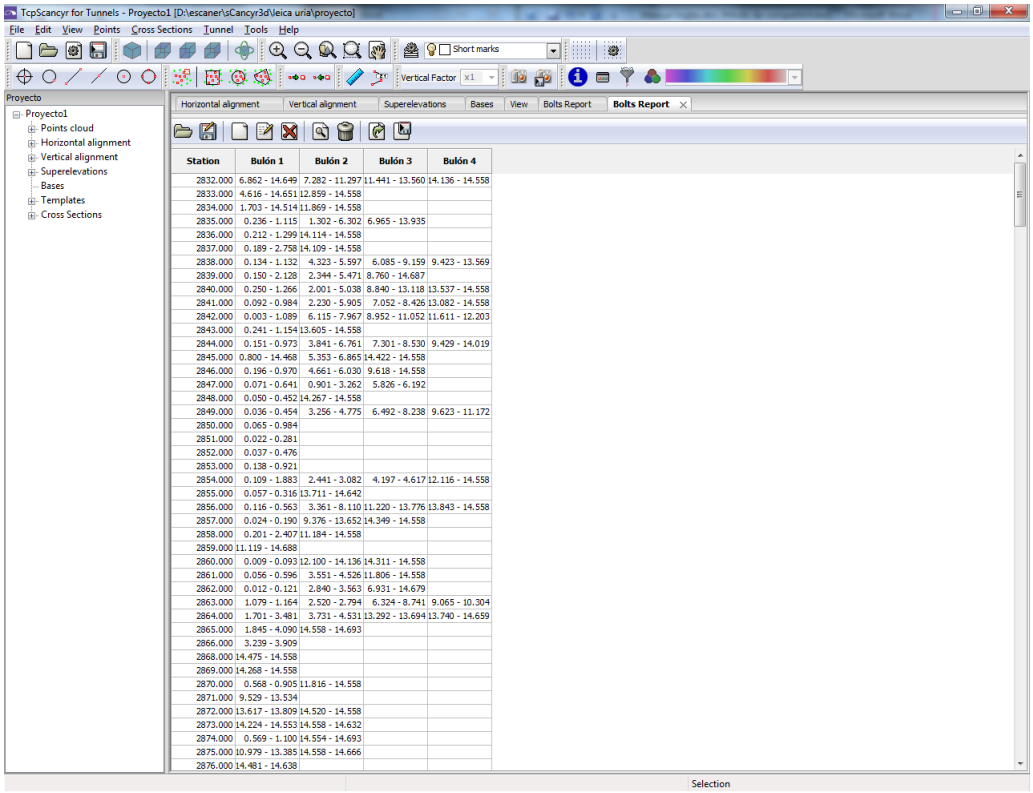


Figure 61 - Bolts calculation

The minimum thickness control this value for the area to be excavated. If we have a vertex with a thicker area to which it belongs it will be included in the report.

With the step parameter control vertices that we generate within each area to be excavated.

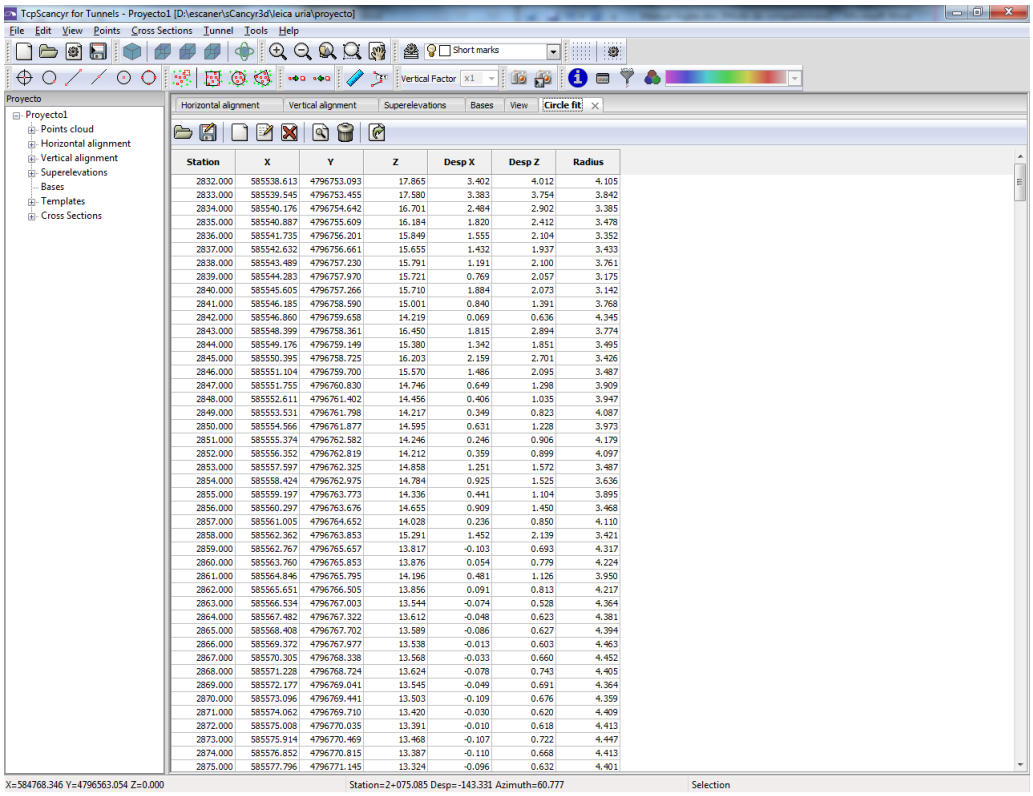
The report shows the bolts with its position regarding the development of the theoretical section. To export the data we use the button "Export bolts".

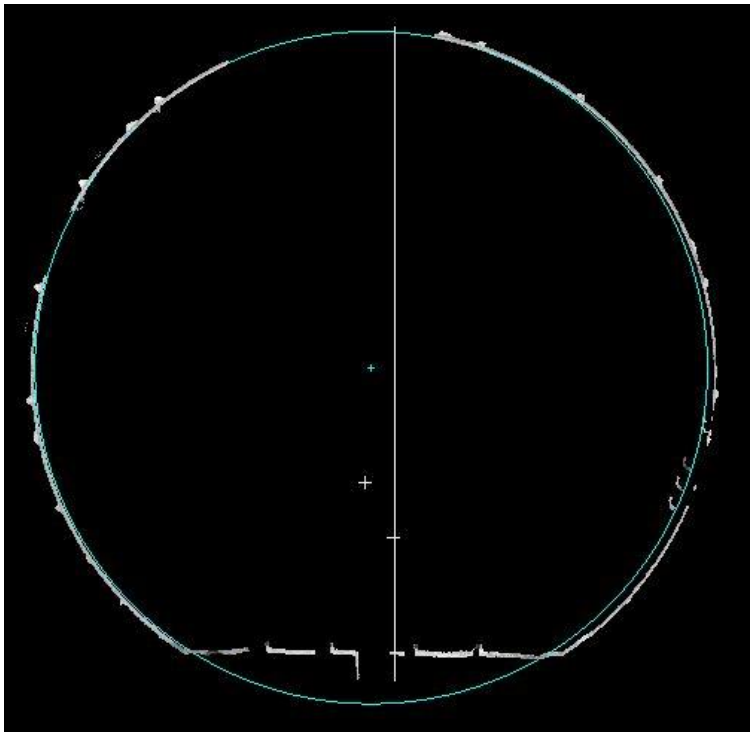


19 Circle fit

In case of a circular tunnel can generate a report by fitting a circle in each cross section. saving for each one the horizontal and vertical displacement, as well as radius.

The minimum height parameter is used to cut the cross section and thus disregard the bottom. Using this cut-off cross section the program search for side and top extents in order to calculate a circle passing through these three points.





20 Inspection map

With this command you can export an image with the representation of the tunnel projected on the theoretical section.

The generated image is the result of taking each point, measuring their distance from the theoretical section and its development, giving color and Y coordinate respectively. In the resulting image, the points below the alignment correspond to the points to the right of this (positive displacement).

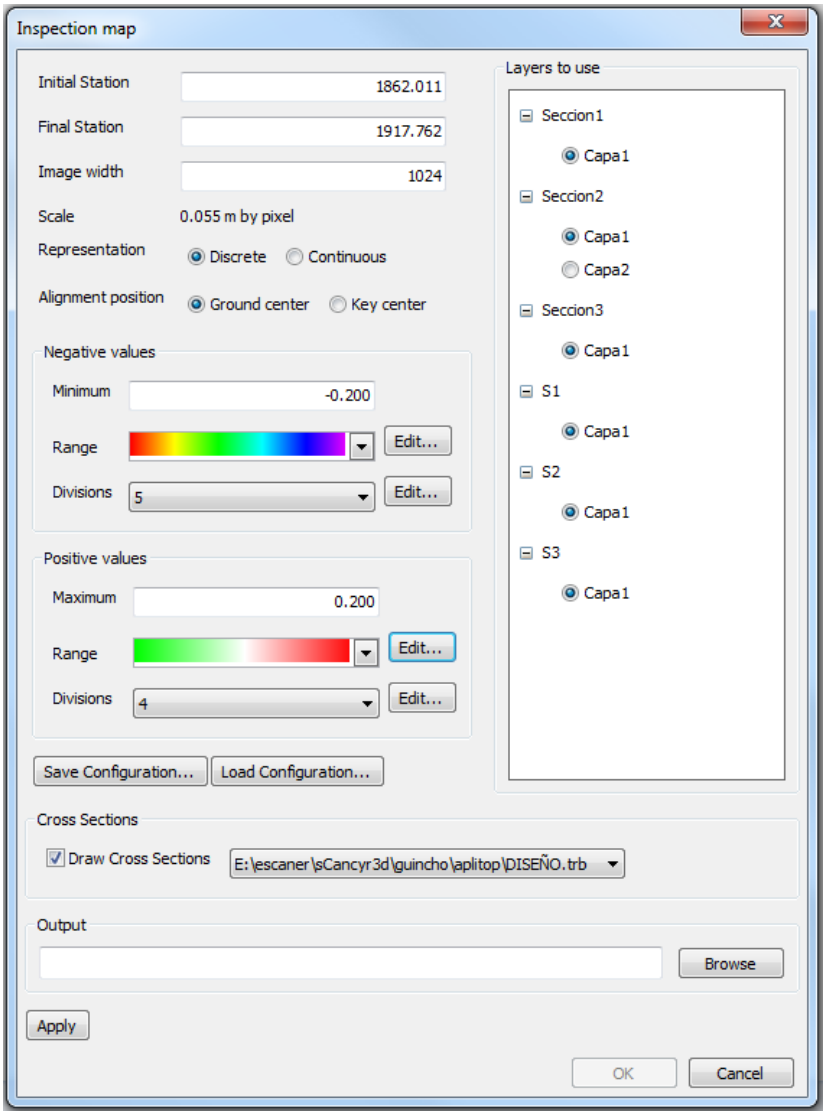
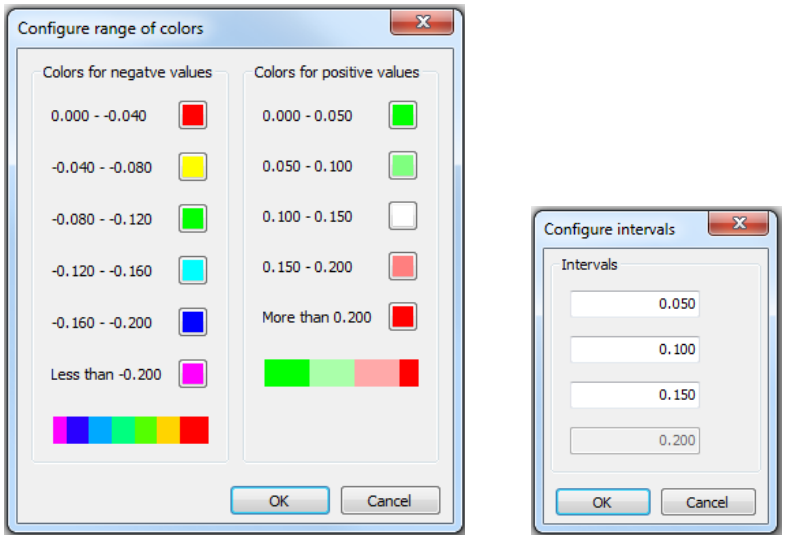


Figure 62 - Maps inspection parameters

The parameters to set are the range of stations, the minimum and maximum values to color. They represent the distance to the theoretical section and the size of the output image.

If you use the button "*Apply*", the program will show you the image result without closing the "Inspection map" window.

It is possible to choose different range of colors for positive values and negative values, edit the range colors and the value intervals.



The resulting image will always be a little bigger to draw the color scales on each side.

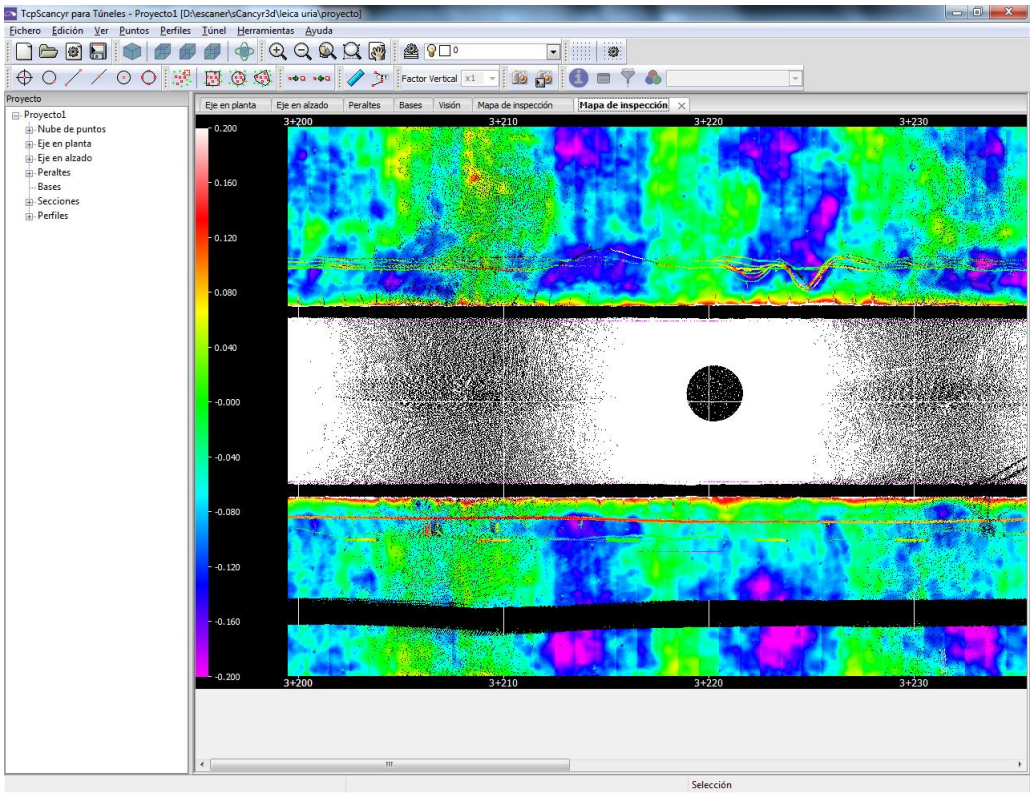


Figure 63 - Inspection map

21 Orthoimage

Just like Inspection map command, but this time using color or intensity of each point.

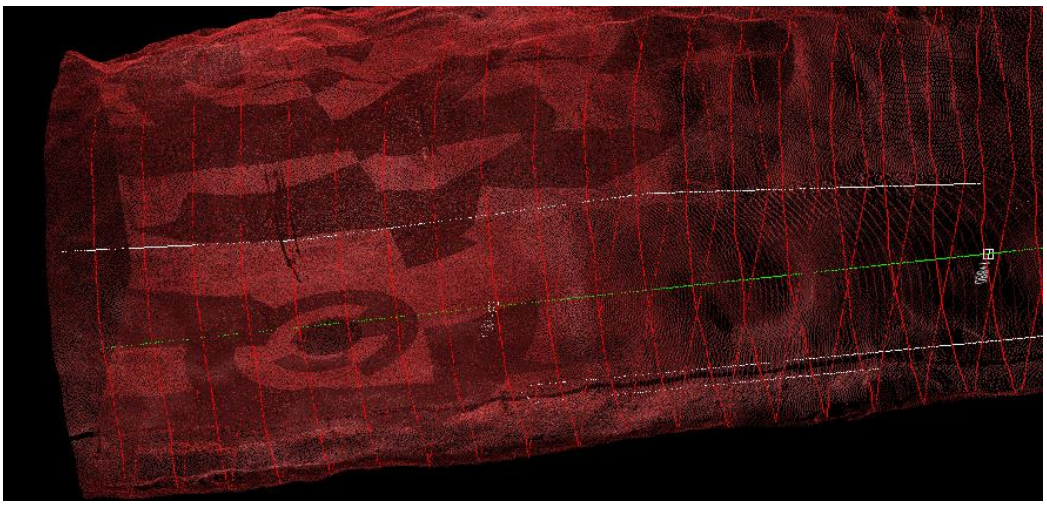
22 [TcpScancyr Advanced] Import DXF

Gives the possibility of import a DXF and show it in the point cloud.

23 [TcpScancyr Advanced] Draw 3D Polylines

Draw 3D polylines over the point cloud. To draw the polylines, first we have to create a new user layer and select it like the current one. Then we use the “Draw polyline” option from the toolbar.

The user layers and its polylines will be saved in a DXF file linked to the project with name `<project>_user.dxf`, in the same folder of project file.



24 Cross Section editor

The program includes a cross section editor which can be used to modify any project cross section. If you have defined the template, this will appear with a cross section to be edited. However, you will not be able to make any alterations, is only displayed as a point of reference.

The central part of the editor has a tab at the top that indicates the cross section being edited. If there is an asterisk at the end, the cross section has been modified since the last time it was saved.

Next the editor's operational mode is displayed. This is common to the cross section editor and the template editor. You should pay attention to the status bar, which will show information on the current state.

- If you click on the cross section, this will be marked as selected. You will see the position of each vertex in a green square.
- If you click on vertex or an edge, you will move on to the “Modify” state. Now you can use the cursor to drag the selected element to the desired position. If you double left click you can stop dragging the selection and return to the Selection state.
- Keying *“Esc”* will enable you to exit the current state.

- If you are in the Selection state and have selected a selected a cross section, this will be deselected.
- If you are modifying a figure, the modification will be cancelled and you will return to the Selection state.

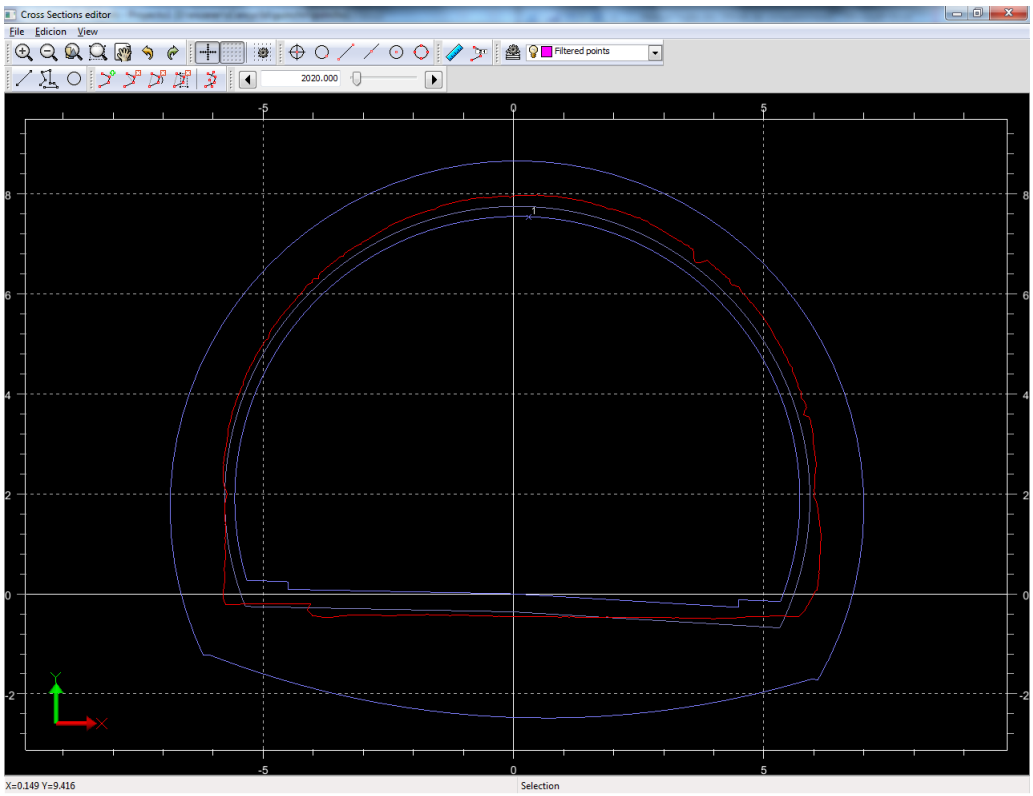


Figure 64 - Editing a Cross Section

On closing the editor you will be asked if you want to save any changes you might have made to the cross section.

25 Tool Bars

In order to access the application's various options use the toolbars beneath the menu bar. Depending on the part of the program you have active, these bars may appear as disabled.

The application's tool bars are as follows:

25.1 File

In order to access the most common file menu options there is a toolbar in the main window.

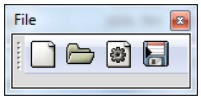


Figure 65 - Project File Toolbar

The icons from left to right are:

New Project: Opens a dialog box in order to create a new project.

Open Project: Opens the file selector to load an existing file.

Project Properties: Opens a dialog box in order to change certain areas of the project.

Save Project: Saves the current project without asking the user for the name. For this option to be enabled, the project should already be located on the computer.

25.2 View

Allows you to change the projection type and drawing view. If you are viewing a 2D drawing, these options will be disabled:

Figure 66 - View Toolbar

The icons from left to right are:

Projection Type: This option will be enabled in the case of 3D drawings. When enabled, orthographic projection will be applied. With this projection, the size of objects will not be based on their distance from the camera. If the option is disabled, a perspective projection will be applied. In this case, the size of the object will depend on their distance from the camera.

Front View Points the camera toward the Y axis

Top view: Points the camera toward the Z axis

Side view: Points the camera toward the X axis

Rotation center: Select a point into the drawing area (there must be something drawn) to change the rotation center.

25.3 Drawing

With this toolbar you can control the position and enlargement of the drawing.

If perspective projection is enabled, the zoom in, zoom out, enlarge extension and enlarge windows icons will be disabled.

Figure 67 - Standard

The icons from left to right are:

Zoom in: Zooms out of the drawing from its middle. One can also use the mouse wheel by moving it forward, but in this case the zoom point will be the position of the mouse.

Zoom out: Zooms out of the drawing from its middle. One can also use the mouse wheel by moving it forward, but in this case the zoom point will be the position of the mouse.

Zoom Extension: The view is enlarged or reduced so as to see all the items in the drawing, only taking into account the visible layers.

Zoom Window: To zoom in on an area of the drawing, the first click of the mouse marks a corner of the window, and the second marks the opposite corner.

Pan: The drawing can be moved by clicking on the window and moving the mouse without letting go of the window.

25.4 Layers

You may hide or display the layers that make up the drawing. For this reason you need to open Layer Control and select the light bulb icon. The name of the layer cannot be altered.

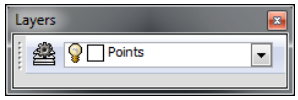
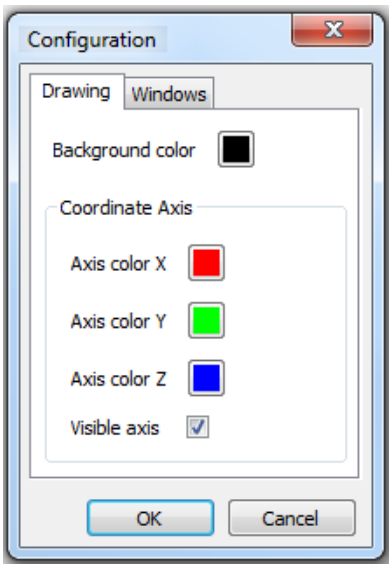
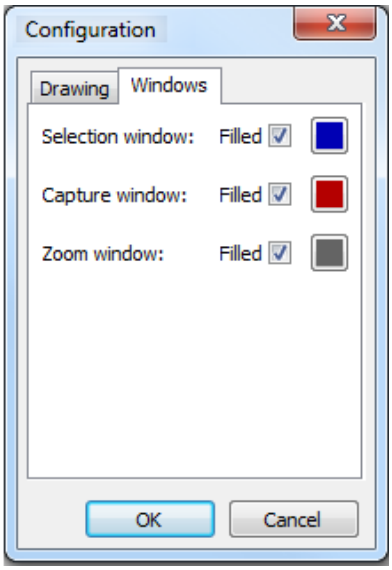


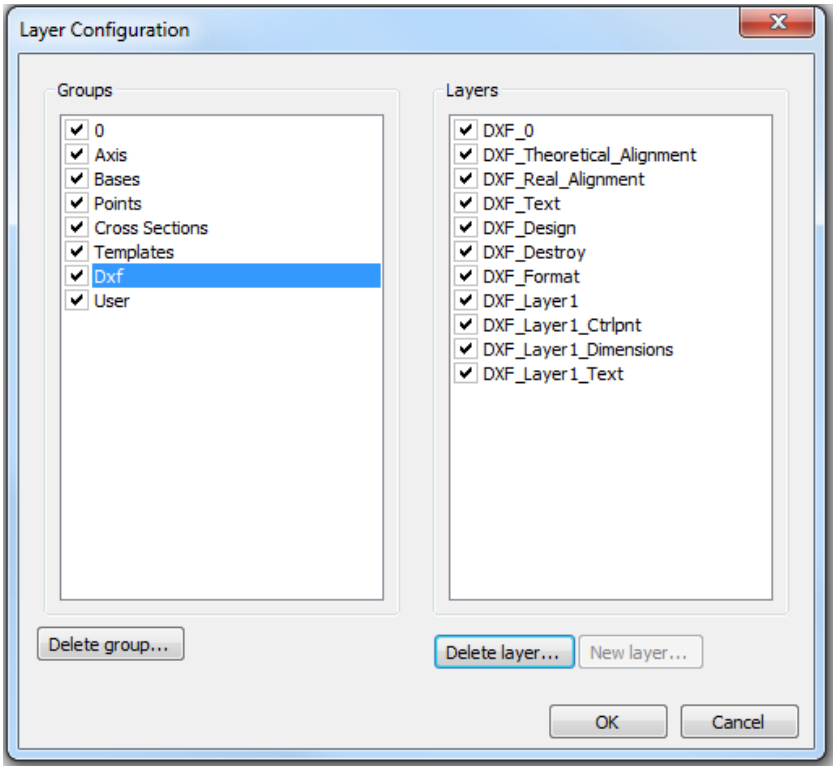
Figure 68 - Layers

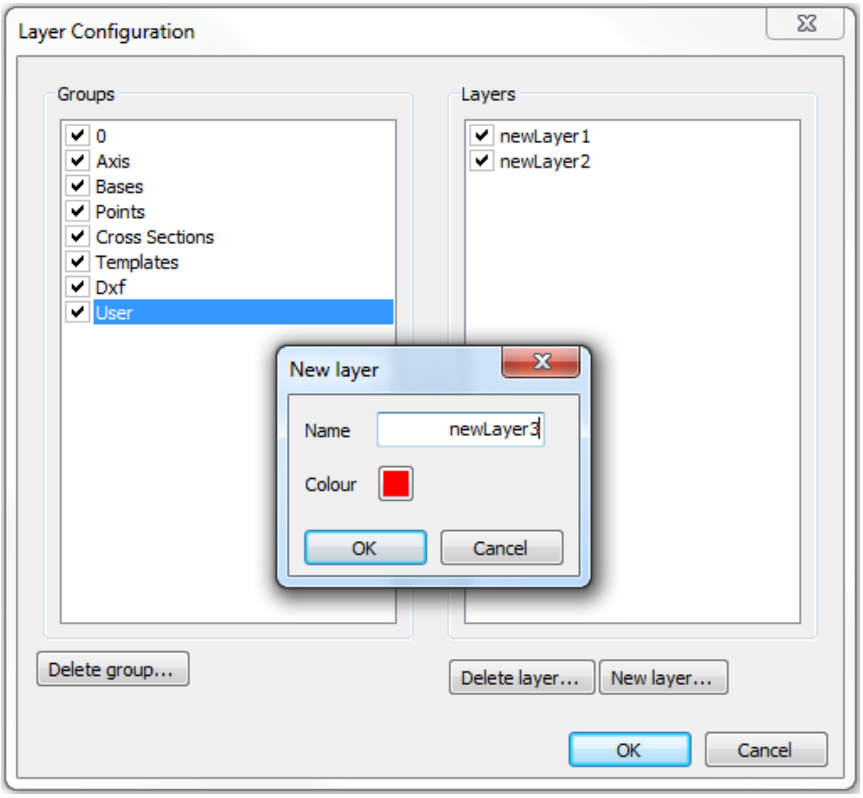
[TcpScancyr Basic] By clicking on the Set Up icon you can change the background color, the reference axes and the zoom and selection windows.





[TcpScancyr Advanced] Pressing configuration button we can see the list of layers sorted by group. This dialog allows also to hide layer groups, remove layers from groups “Dxf” and “User”, as well as create new layers in this group.





25.5 Grid

Includes buttons for enabling or disabling the references on the drawing currently being viewed. They will only be enabled when it is a 2D drawing.

Figure 69 - Grid

The icons from left to right are:

Axes: Draws the XY axes on the drawing if they are available.

Grid: Enables or disables grid view on the drawing.

Grid properties: Displays a dialog box allowing grid values to be changed.

25.6 References to Figures

References to objects allow you to quickly select exact geometrical points in existing figures, without having to know the exact coordinates of those points. References to objects can be used to select the end point of a line or arc, the midpoint of a circle, or any other geometrically significant position.

When more than one reference is activated, the closest of all the enabled ones will be displayed.

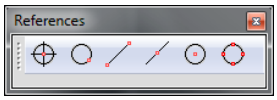


Figure 70 - References to Figures

The icons from left to right are:

Point: Marks a point as a reference.

Close: Marks the point closest to the cursor position, applicable to any figure, except the points.

End point: Marks the edge of the figure, or of one of its parts that is closest to the mouse position. Does not apply to circles.

Midpoint: Marks the midpoint of the figure.

Centre: Marks the center of the figure closest to the mouse.

Quadrant: Marks the four extremities of a circumference.

25.7 Points Selection

When viewing a points cloud or cross sections you may select the points to be marked as filtered or remove this mark.

Having selected the points, these will appear marked. The right-hand icon will open a context menu, allowing you to filter points (Eliminate Selection), or remove the filter mark (Include Selection).

In the case of being selected by polyline you may use the option *"Select"* in order to finish the polyline and select the points that are within.

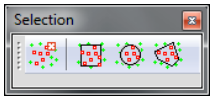


Figure 71 - Points Selection

The icons from left to right are:

Remove: Removes the points selection mark.

Window: Select the points via a rectangular window.

Circle: Select points via a circular window by first marking the center of the circle, moving the mouse to select the radius.

Polyline: Select the points via a polyline. By clicking on the left-hand icon you may add vertices, in order to finish the polyline, open the context menu with the right icon and select the corresponding option.

25.8 Scale

Depending on the drawing you are viewing, you will be able to change the vertical scale factor.

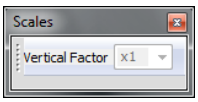


Figure 72 - Scales

The applicable values range from x1 (normal scale) to x10, if you need a greater value you may write it in Control.

25.9 Help

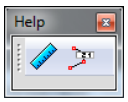


Figure 73 - Help

The icons from left to right are:

Measure distances: This command allows one to measure distances between two points, by first selecting the initial point of the measurement, and then the final point. The distance measured will be displayed in the status bar. It is advisable to activate the most necessary references to figures, or else the application may return incorrect data if it does not use the coordinates of the point you believe has been selected.

After the second point is selected, the next window appears.

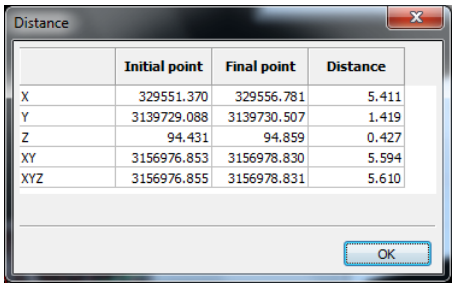


Figure 74 - Measurement between Two Points

The values of the initial and final point in row XY, XYZ represent the distance from the origin to the point on the XY or XYZ plane respectively.

Number Edit: Displays the following window, where the coordinates can be entered manually. If it is a 2D drawing, the Z coordinate control will be disabled.

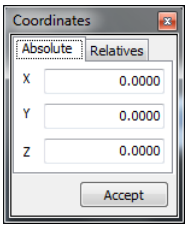
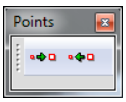


Figure 75 - Manual Coordinates

After entering the coordinates, press OK. In absolute coordinates mode, the entered coordinates will be added. In relative coordinates mode, the entered coordinates will be considered increments since the last point entered.

25.10 Points

Change points size, the value is unique for all points



25.11 Modify

Commands which allow you to modify polylines.

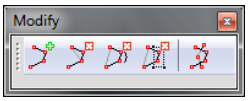


Figure 76 - Tools Used to Modify Figures

Insert vertex: Inserts a vertex at the selected point. It must be near an edge.

Eliminate vertex: Eliminates the selected vertex. It is advisable to have selected the polyline to see where the vertices are.

Eliminate range of vertices: Marks two vertices, with all the vertices between them deleted.

Eliminate vertices window: Marks a checkbox with the mouse and the vertices inside it will be deleted.

Join Polylines: This command allows you to join two polylines. Firstly you will need to draw a polyline that intersects the cross section at two points. You can then use this tool to select the cross section and then the polyline you have created.

Due to the fact that the points that make up the cross section are ordered by angle, there are cross sections that will emerge badly. Using this tool to join polylines you can repair these cross sections.

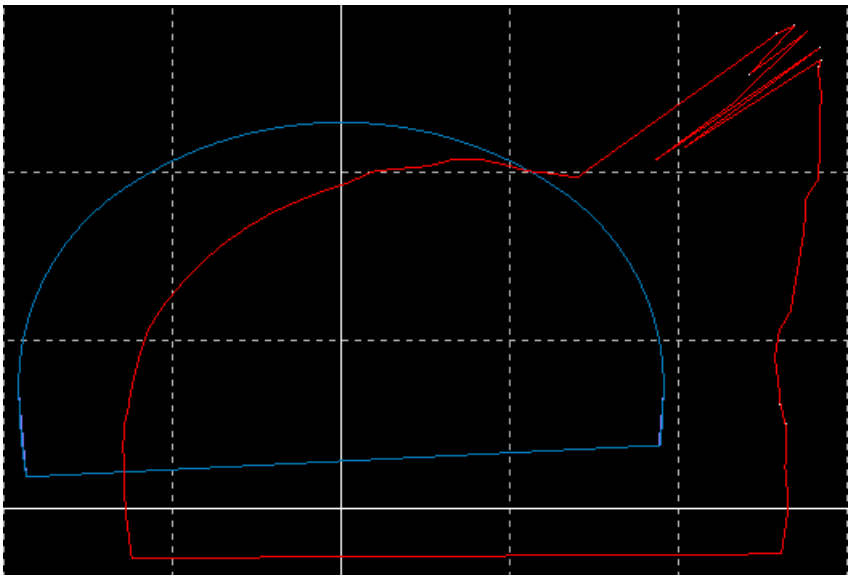


Figure 77 - Cross Section with errors

Draws a polyline that intersects the cross section. For the intermediate vertices you can use the reference tool in order to ensure that the same vertices are used as for the original cross section but taking them in the correct order.

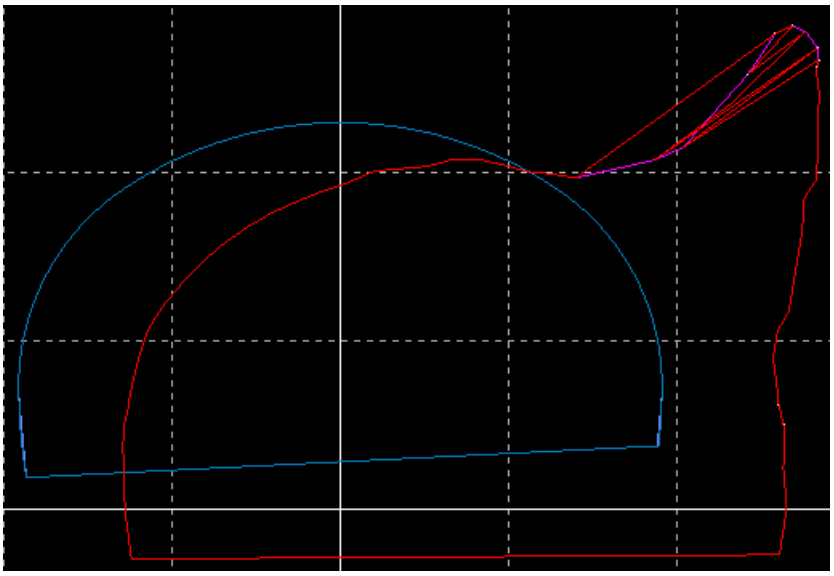


Figure 78 - Polyline Manual in Purple

Using the Join cross sections tool, first select the cross section and then the polyline. The program will automatically join the two polylines.

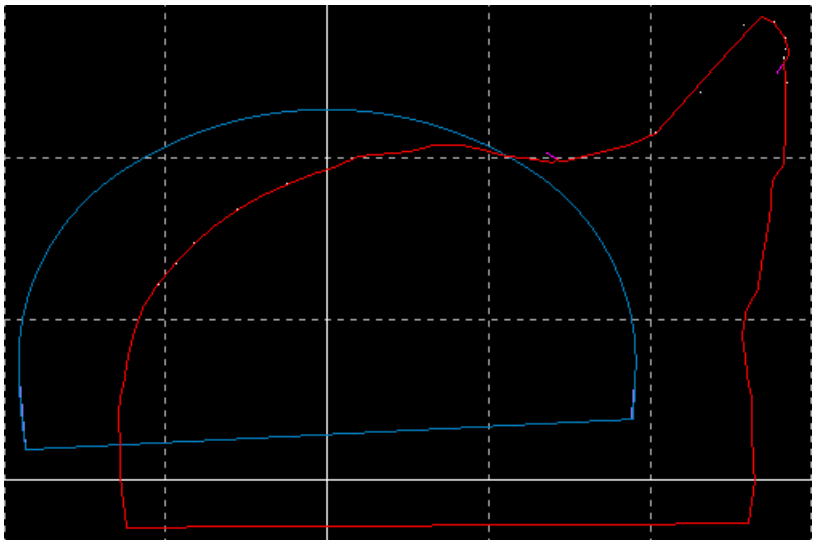


Figure 79 - Corrected Cross Section

25.12 Shapes

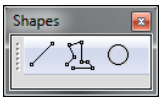


Figure 80 - Create Shapes

Using this toolbar you may create figures to add them to the drawing. From left to right these are lines, polylines and circles.

It is currently only possible to create polylines in order to join them to the cross section and thus correct any angle-ordering errors.

In future versions these tools and other new additions may be used to graphically create template.

25.13 Move

Commands used to move figures.

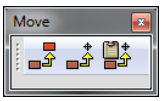


Figure 81 - Move Figures

From left to right, these are as follows.

Move figure: First select the figure to move, then select a point as the *origin*, and lastly select a point as the *destination*. The figure will be moved by the vector formed by *destination - origin*.

Move figure to the origin: First select a figure, then assign a *point of origin*. The figure will be moved by the vector *coordinate origin - point of origin*.

Copy with reference point: This command functions as previously (*Move figure to the origin*), but the figure will be copied to the clipboard. Then go to the layer that is to be modified and paste in the figure using *Ctrl+V*.

The best way to assign the origin or destination coordinates is to use the references to figures, or enter the coordinates manually, using the Coordinates command.

25.14 Utility toolbar

In order to make the application more comfortable there is a toolbar displaying the most-used points options. This bar will only be enabled if you are viewing a points cloud.

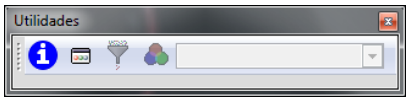


Figure 82 - Points Tools

From left to right these are, information, auxiliary windows, filters, symbols, color range.

Use the Information icon to consult details on any point on the points cloud. An information window on the selected point, depending on the available data (alignment, gradient), some of the field will be disabled.

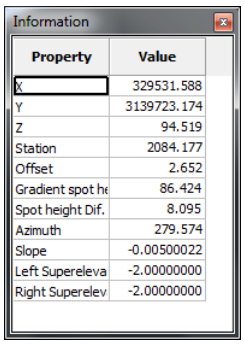


Figure 83 - Information Associated to a Point

The "Color Range" control is used to change the colors applied to a symbol without having to recalculate it.

If you have closed any of the floating windows (except filters) you can bring them up again by clicking on *"Auxiliary Windows"*.

26 Data Tables

You will then see a number of elements which appear in different areas of the program. These function in the same way, adapting the application to the data in question.

In various parts of the program you will see a table featuring a series of icons. In general the type of data displayed will vary (horizontal alignment, list of volume), although the way they function will be the same.

Depending on the associated data, some of these options may be hidden or disabled.

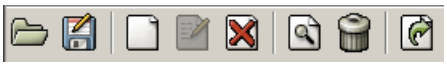


Figure 84 - Generic icons, all visible and enabled

The action which correspond to each icon are as follows, from left to right.

Open: Opens a file in order to change data. If you are in "Horizontal alignment" you can load an alignment.

Save: Saves file data. The format will depend on table data.

New: Creates a new data entry. A dialog box will appear allowing the various fields to be filled in.

Edit: Edits the selected row. A dialog box will appear allowing fields to be altered.

Delete: Deletes selected table elements.

Search: Opens a dialog box allowing you to search for data.

When you carry out a search, the corresponding element will be marked so that it coincides exactly with the given parameters. If there is no corresponding element, the nearest element will be marked.

More than one parameter may be specified per search. For example if you wish to carry out a search on the horizontal alignment, writing a radius = 150, station 1000, the application will search for the curve or clothoid with a radius close to 150 and a station close to 1000.

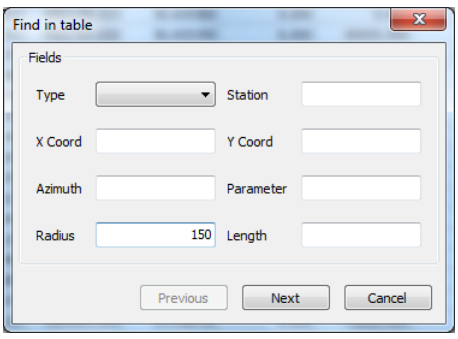


Figure 1 – Search for an element with radius 150

Delete All: Deletes all the data from the table.

Export: Exports data to a number of formats. Firstly a dialog box will be displayed, allowing you to select the data to be exported and its format. The tool also allows you to delete the fields to be exported without changing the order.

Depending on the table to be exported, the group of columns will vary. As an example, the list to export a horizontal alignment is shown.

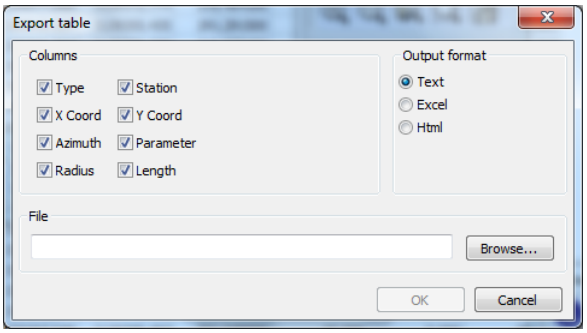


Figure 85 - Exporting Surface and Volume Lists

27 Configuration

The following are the various Configuration dialog boxes.

By clicking on *"Restore"* you can change the current values to the default values. This change will only affect the page you have selected.

27.1 [TcpScancyr Advanced] Drawing

It allows to change background and axes colors.

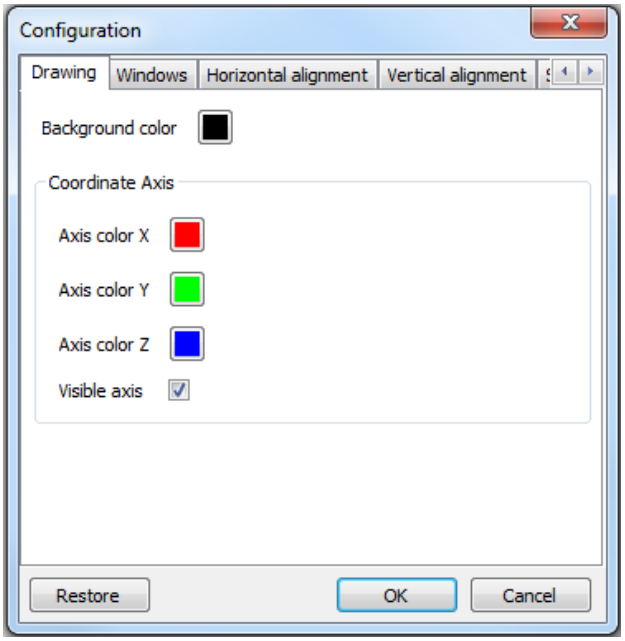


Figure 86 – Drawing configuration

27.2 [TcpScancyr Advanced] Windows

It allows to change selection, capture and zoom window colors.

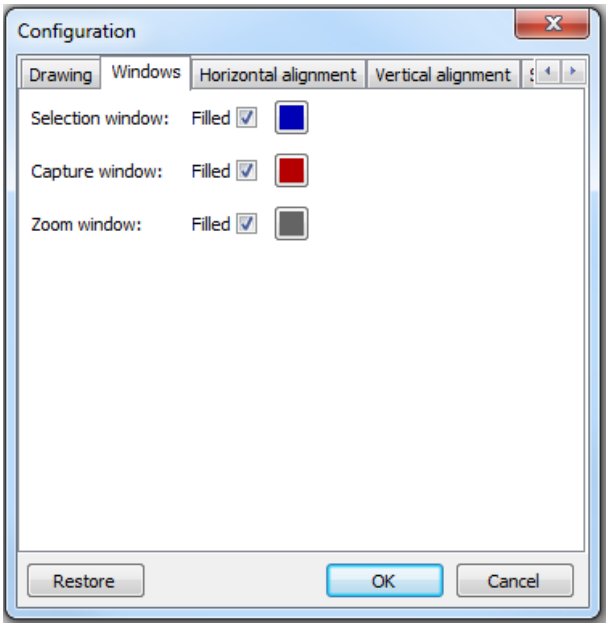


Figure 87 – Windows configuration

27.3 Horizontal Alignment

Allows one to change the colors and distances of the short and long marks, as well as the color of the unique points.

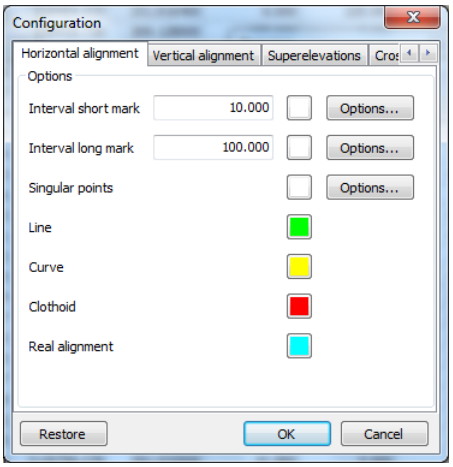


Figure 88 - Alignment Configuration

Short mark interval: The distance in meters between the short marks. Alongside is an icon for assigning them a different color. The “Options” icon can be used to configure the format of the marks.

Long mark interval: The distance in meters between the short marks. The mark color and format can also be configured.

Singular points: Only the color and format of the unique points can be configured.

Line, Curve, Clothoid: The color of each type of alignment section.

Real alignment: The color of the alignment calculated with cross sections and sections.

- Format of the marks and unique points.

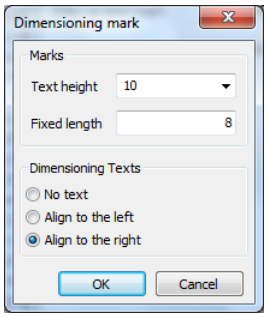


Figure 89 - Format of the Short and Long Marks

Mark length: Length of the mark. The line will be perpendicular to the alignment.

Extension length: If one draws texts, this value marks the extension of the mark towards the attached text.

Align texts: Texts can be aligned to the left, the right or not aligned at all.

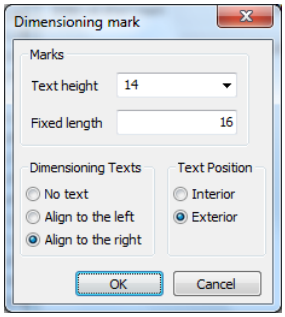


Figure 90 - Format of Unique Points

The options available for the unique points are the same as for the short and long marks. One can also indicate if the text is inside or outside.

27.4 Vertical Alignment

Allows the appearance of vertical alignment to be changed.

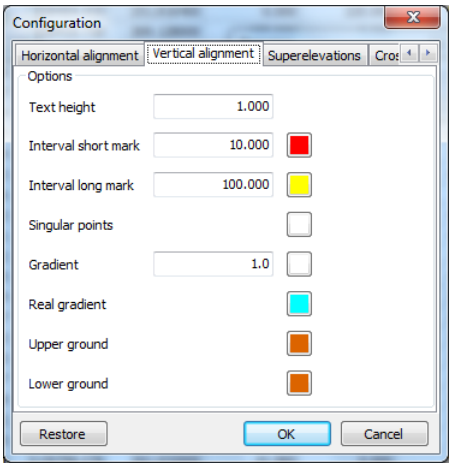


Figure 91 – Vertical alignment options

The vertical alignment colors can be changed, as can the previous gradient, vertical lines and text.

Text Height: Height of text in meters.

Short mark interval: The distance in meters between the short marks.

Long mark interval: The distance in meters between the short marks.

Unique points: Color of the unique points. These are drawn on the following points:

- Station - tangent
- Station + tangent
- Station if the tangent equals zero.

Guitar: Color of the separation lines and legend.

Gradient: Color and thickness in pixels of the horizontal alignment:

Real gradient: The color of the alignment calculated with cross sections and the template.

Upper ground: The color of the maximum height between the intersection of the vertical line that passes through the alignment and the cross section.

Lower ground: The color of the minimum height between the intersection of the vertical line that passes through the alignment and the cross section.

27.5 Superelevations

Allows the color of the left and right superelevations, as well as the size of the text in pixels.

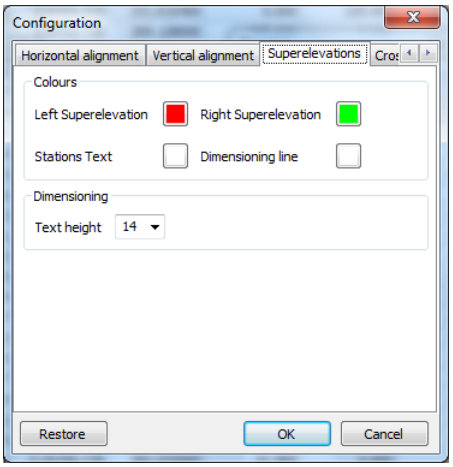


Figure 92 - Superelevations Configuration

27.6 Cross Sections

You can change the color of the elements which appear when you are viewing the cross sections. As you can see, no control appears to change the color of the points as these will appear with the color of the applied symbols.

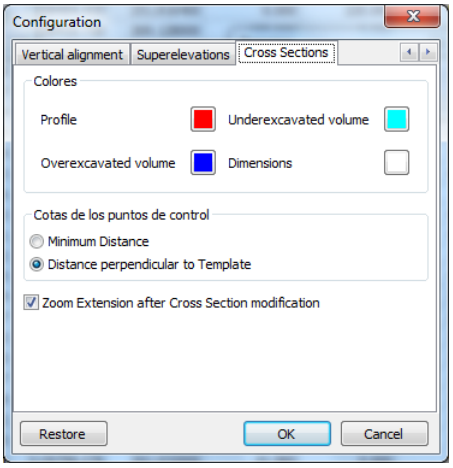


Figure 93 - Cross sections Configuration