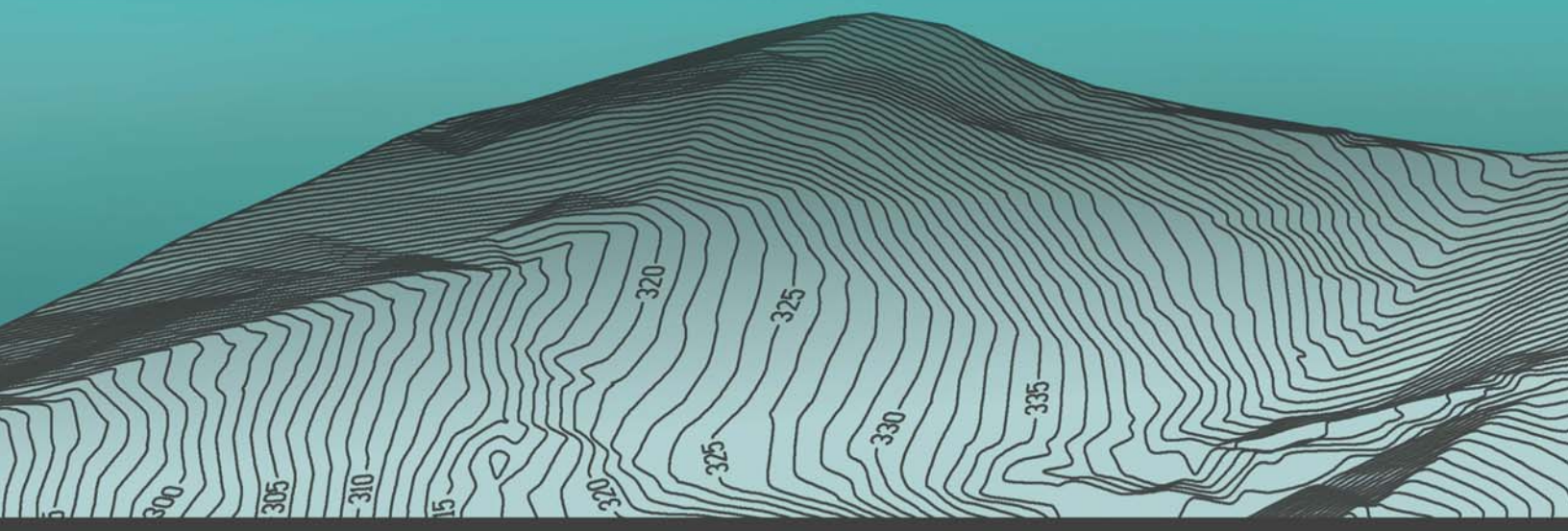
# SOKKIA

## GEOPRO OFFICE



SOKKIA

# GEOPRO Field Operator's Manual

Part Number 1020509-01

Rev A



April 2017

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# Preface

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# Manual Conventions

This manual uses the following conventions:

| Convention | Description | Example |
|---|---|---|
| **Bold** | Menu, or drop-down menu selection | **File ▸ Exit** (Click the **File** menu and click **Exit**) |
| | Name of a dialog box or screen | From the **Connection** screen... |
| | Button or key commands | Click **Finish**. |
| `Mono` | User supplied text or variable | Type `guest`, and click **Enter.** |
| *Italic* | Reference to another manual or help document | Refer to the *Sokkia User's Manual.* |

Further information to note about system configuration, maintenance, or setup.

Supplementary information that can have an adverse effect on system operation, system performance, data integrity, measurements, or personal safety.

Notification that an action has the potential to result in system damage, loss of data, loss of warranty, or personal injury.

# Introduction

## Views

The program uses one unique window for all opened files. This window is divided into two parts to list and display the various information:

- **Right part:** called *Specific View*, is used to display the information in the open document in a detailed manner. Each *View* is activated from the node selected in the navigation tree.
- **Left part:** composed of a navigation tree, with nodes and subnodes, it contains all the information on the open document.

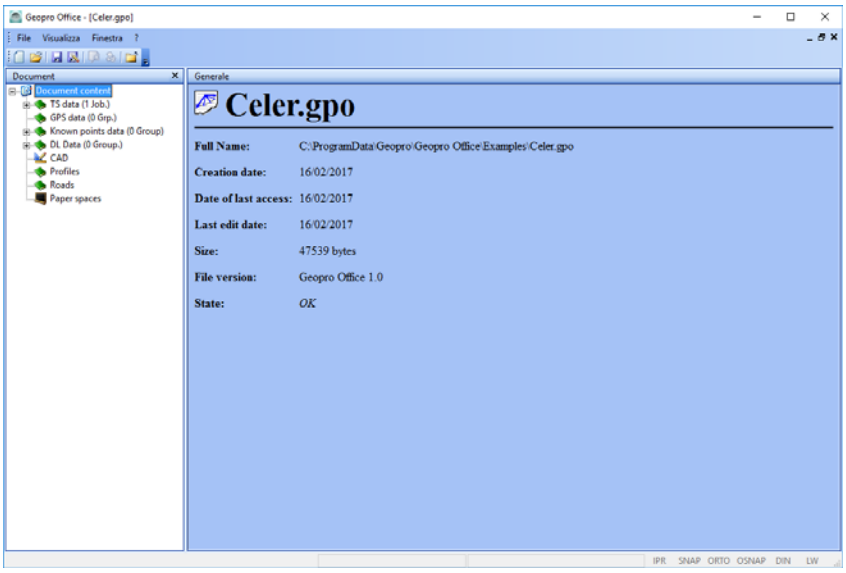



**Figure 1:**

The navigation tree can be expanded or reduced by clicking on the "+" or "-" symbols found alongside the node.

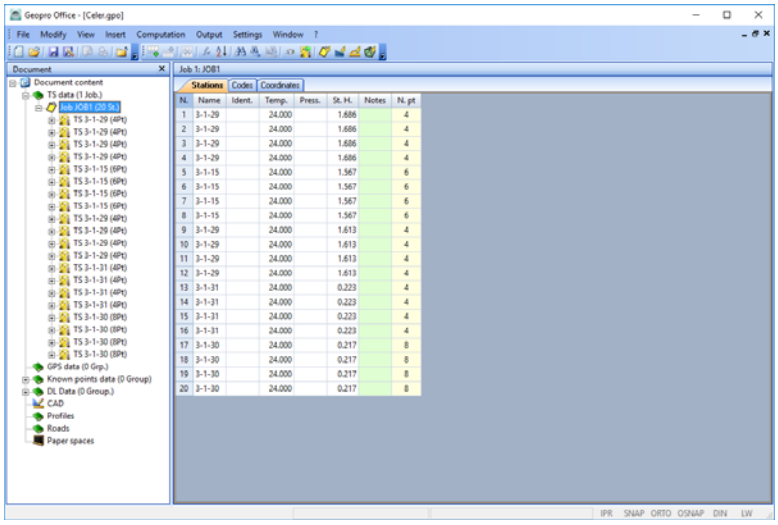


**Figure 2:**

By expanding the **Document content** node the program's primary views will be listed, which are: **TS Data**, **GPS Data**, **Known points Data**, **DL Data**, **CAD**, **Profiles**, **Roads** and **Paper Spaces**; and each of these may have other subnodes.

# TS Data

The **TS Data**, is the display of information inherent in the TS Data acquired through a Total Station.

Depending on the node selected in the navigation tree, the corresponding views are activated; in particular:

Selecting the **TS Data** will activate the view displaying **Jobs**;

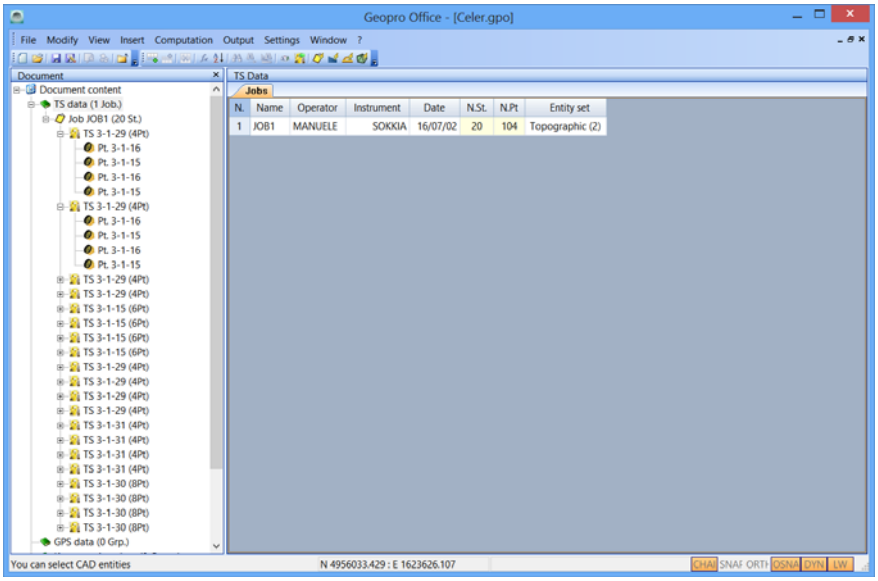



**Figure 3:**

Selecting the **Job** name will activate the view that displays **Stations** archived in the same job;

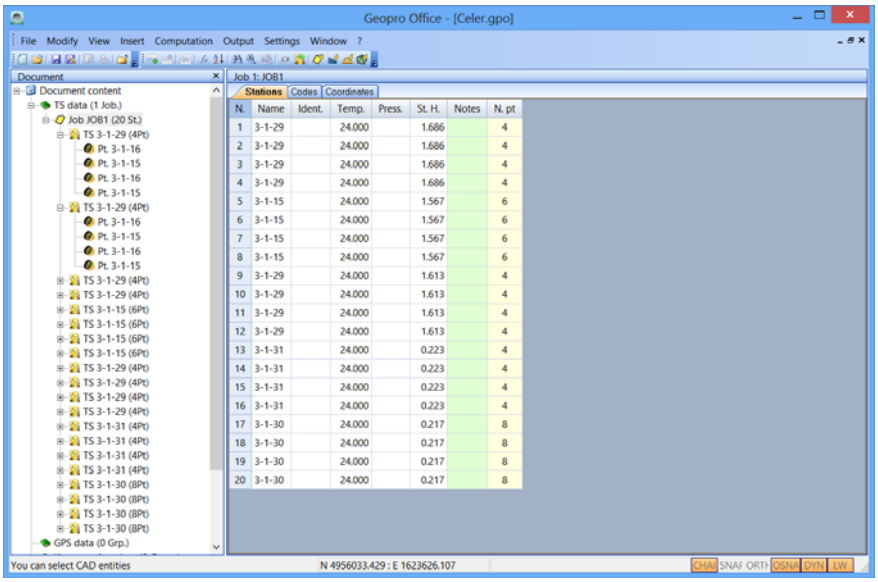



**Figure 4:**

Selecting the **Station** name will activate the view that lists the **TS points**;

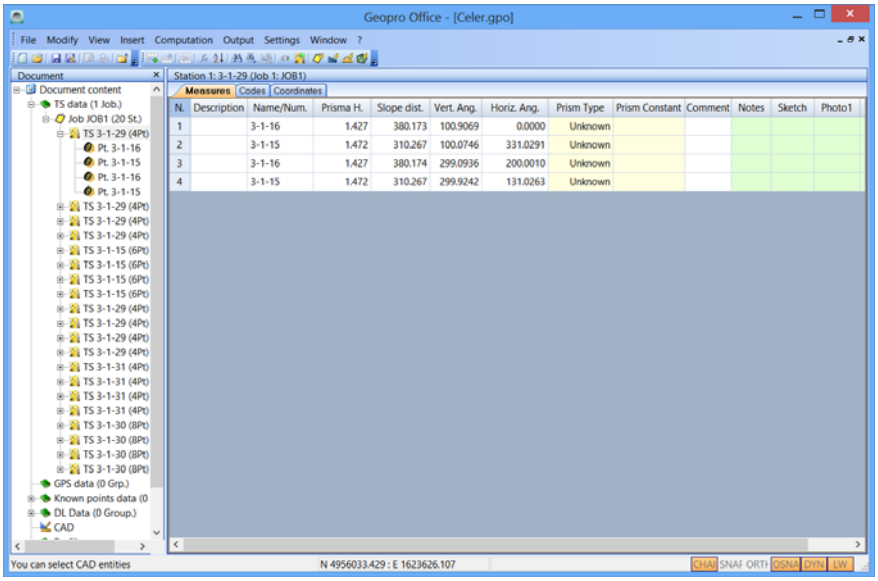



**Figure 5:**

Selecting the **Point** name will activate the view that displays the **TS Point** view;

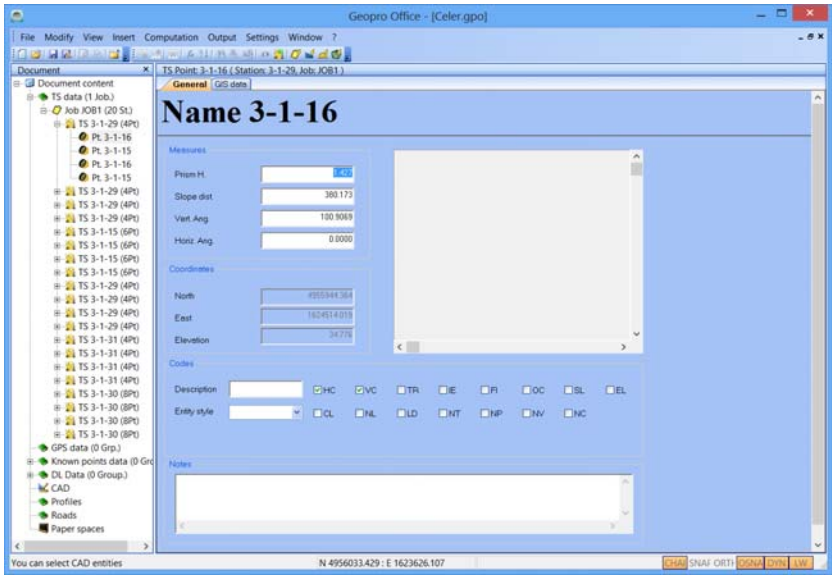



**Figure 6:**

The **TS Point** view includes two pages: the first is called **General** and describes the point in detail (listing coordinates, measures, etc.); the second is called **GIS Data** and it is here that the user can read and/or change the GIS data associated with the point.

# GPS Data

The **GPS Data**, is the display of information collected through a GPS receiver.

The view is divided into one or more Groups, to which a certain number of measured base points is associated.

Along with the TS Data, depending on the node selected in the navigation tree, the corresponding views are activated; in particular:

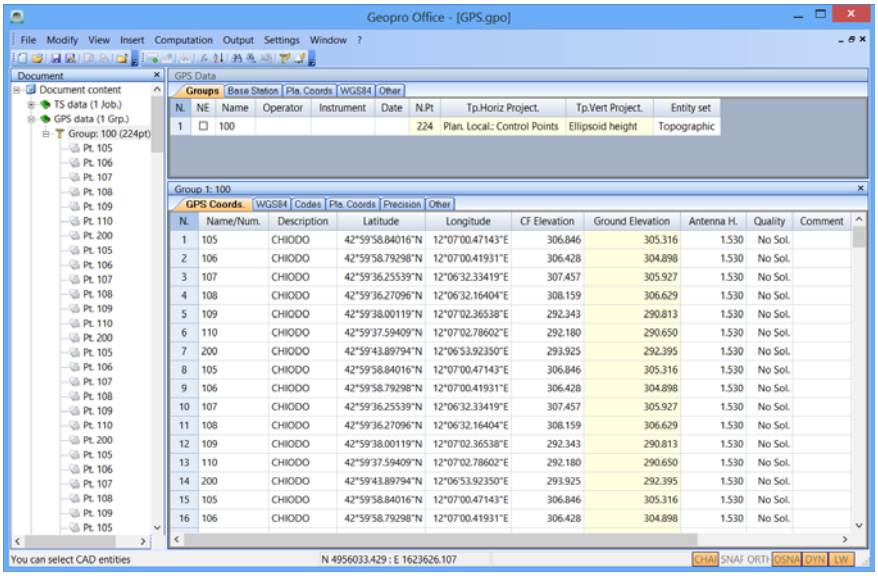



**Figure 7:**

Selecting the **GPS Data** node will activate the view that lists the **Groups** present, similar to selecting the name of a Group will activate the view that illustrates the measured **Points**.

Selecting the individual point will open the **GPS Point** view composed of two pages.

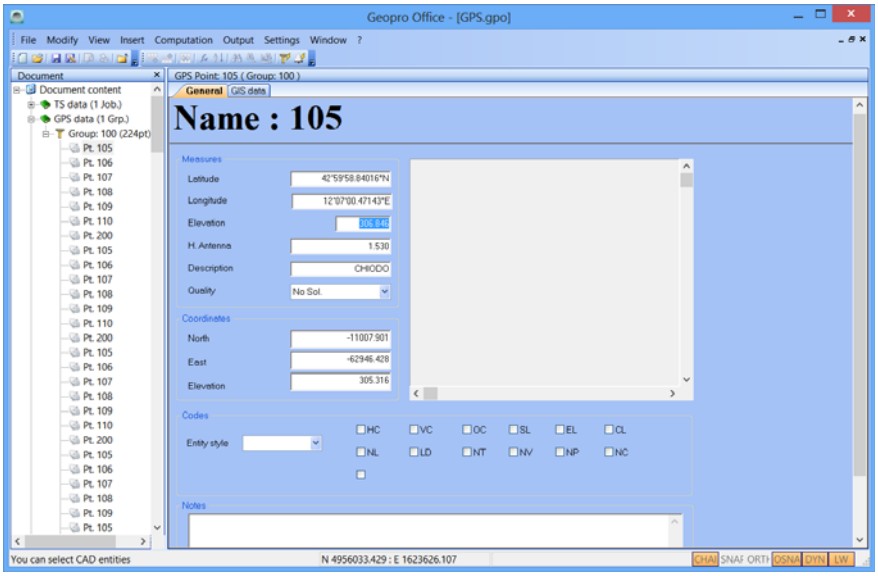



**Figure 8:**

The first displays the data associated with the selected point; the second shows the GIS data associated with the point.

# Known points data

The **Known points data** is the display of information on the points (archived in one or more groups) whose coordinates and/or quote are known.

The **Known points data** and Control Points are represented primarily through a grid; each line corresponds to a group or point and an associated characteristic to each column; the grid can be highlighted and resized.

Depending on the node selected in the navigation tree, the corresponding views are activated; in particular:

Selecting the **Known points data** activates the view that displays **Groups**; selecting the name of a Group activates the view that displays the corresponding **Known points data**; finally, selecting the name of a Point activates the view that displays, in extended form, the data of the **Known point**.

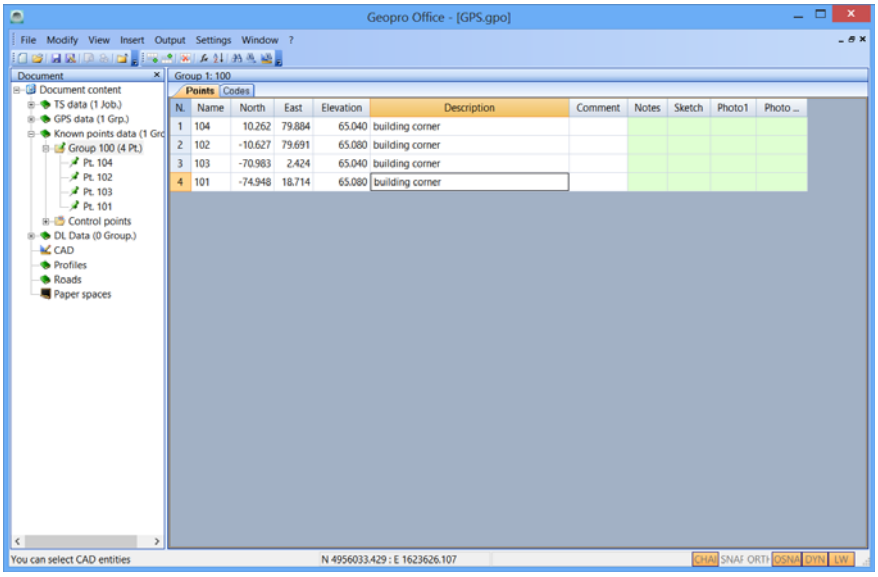



**Figure 9:**

Selecting the **Control points** node activates the view where the user can insert the coordinate points or noted quotes to be used subsequently in the elaboration of data.

This view includes two pages: **Points** and **Geographic Points** (these last are used in the **Post Processing Calculation**).

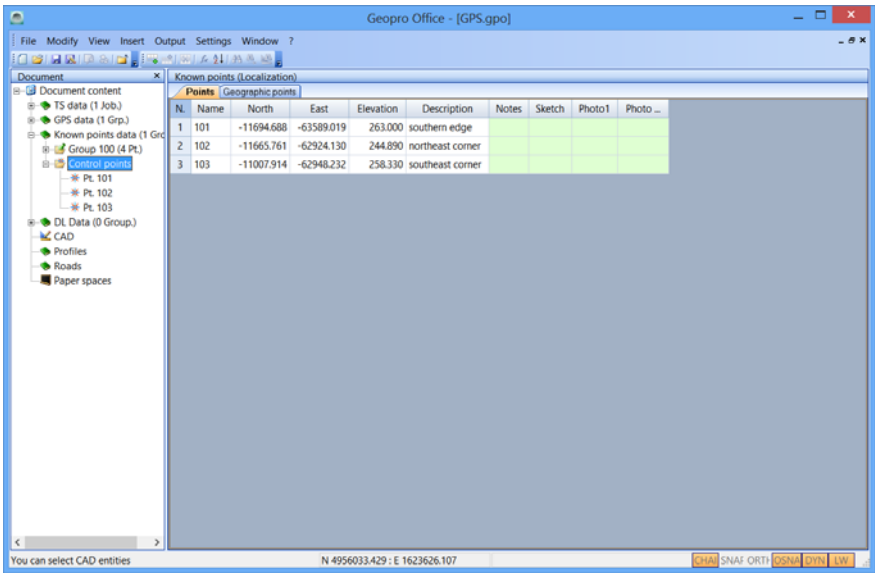



**Figure 10:**

The **Control points** view is also available for orientation points where the data associated with them are displayed.

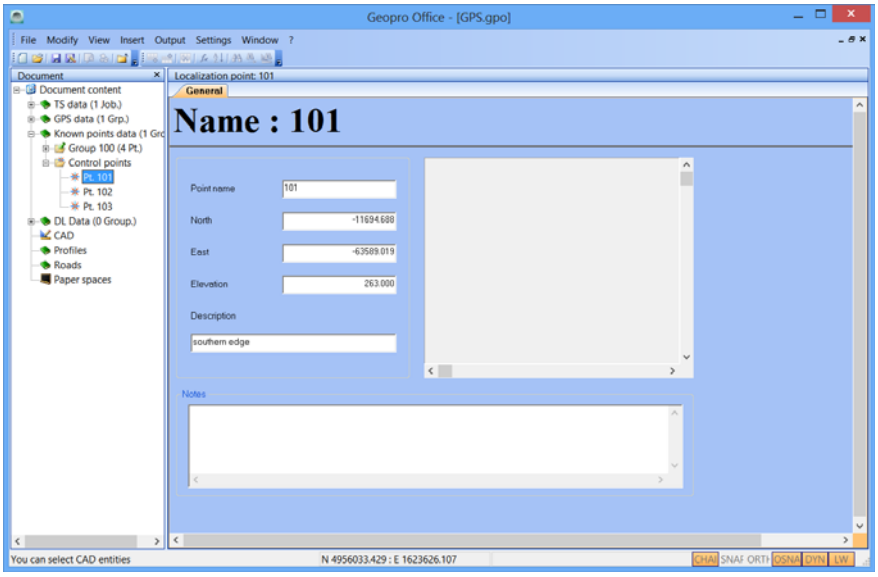



**Figure 11:**

# DL data

The **DL data** view is the display of information collected using a Digital Level; one or more levels can be archived which contain the data associated with a certain number of measurements run; the views are represented through a grid whose lines represent the **DL data** type (Benchmarks) and the associated characteristic columns.

Depending on the subnode selected in the navigation tree, the corresponding views are activated:

Selecting the **DL data** node will activate the view displaying **Leveling**;

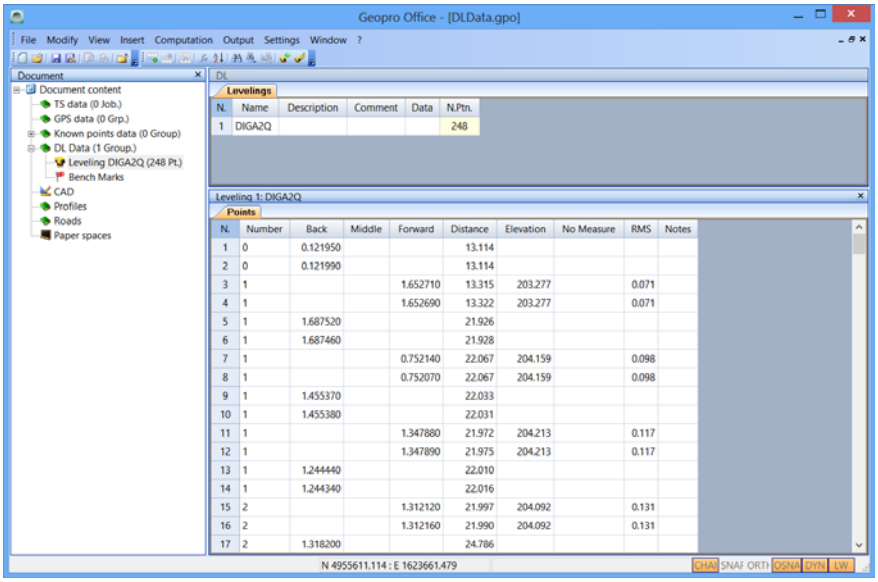



**Figure 12:**

Selecting the name of a Benchmark activates the view that displays the **Points** where all of the information is inserted for elaborating the measured data.

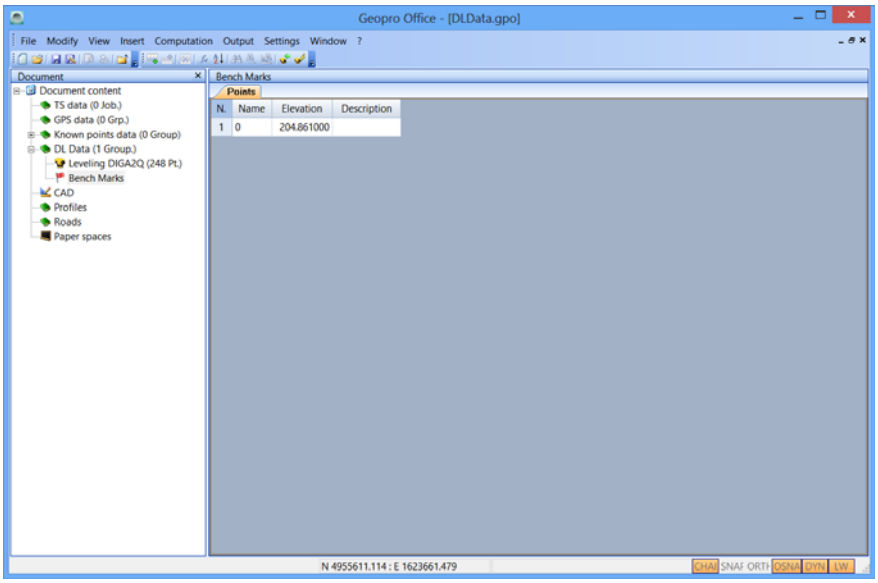



**Figure 13:**

# CAD View

**CAD View** is the representation of a document's graphic information, which, using specific instruments, can be changed.

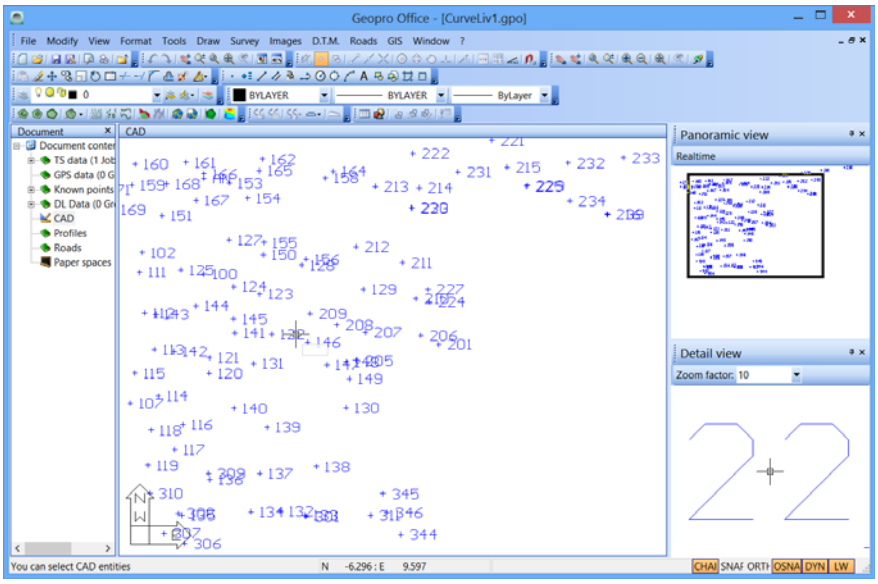



**Figure 14:**

The **Graphic View** is used to manage:

- Graphic entities;
- Celerimetric data;
- GPS data;
- Known points data;
- DTM Projects;
- Roads Projects;
- GIS Projects;
- Images.

The following views can be associated to the **CAD View** using the View menu:

- Property view;
- Commands View;
- Panoramic view;
- Detail view.

These views are described in the **CAD View** chapter of the Base course.

# Profile View

The **Profiles View** is the graphic or numeric (grid) display of the information associated with a Profile or cross section calculated by the program.

Depending on the node selected in the navigation tree, the following views are activated:

Selecting the **Profiles** node will activate the Profiles view that lists the various profiles and their respective projects;

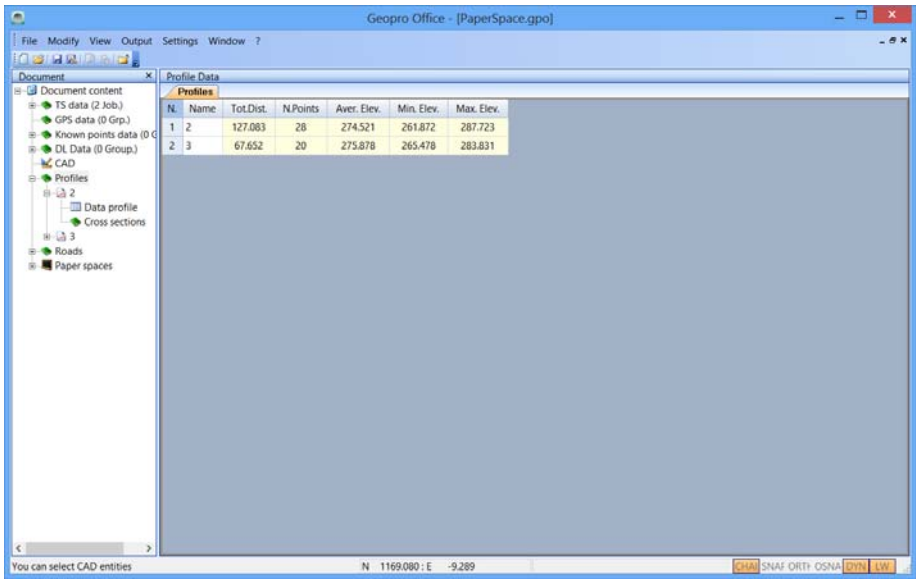



**Figure 15:**

Selecting the name of the Profile activates the view that graphically displays the terrain profile where the user can change the graphic appearance (scale of lengths or heights), design projects and polylines.

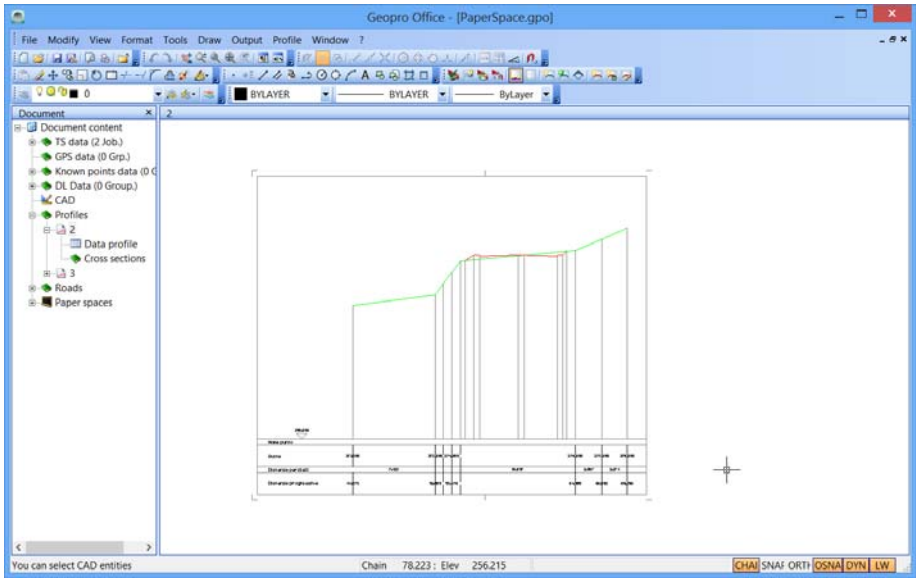



**Figure 16:**

Selecting the **Data Profile** node will activate the grid view of the numeric data characterizing the Profile; this view may include other pages displaying the data of any projects and polylines associated with the profile.

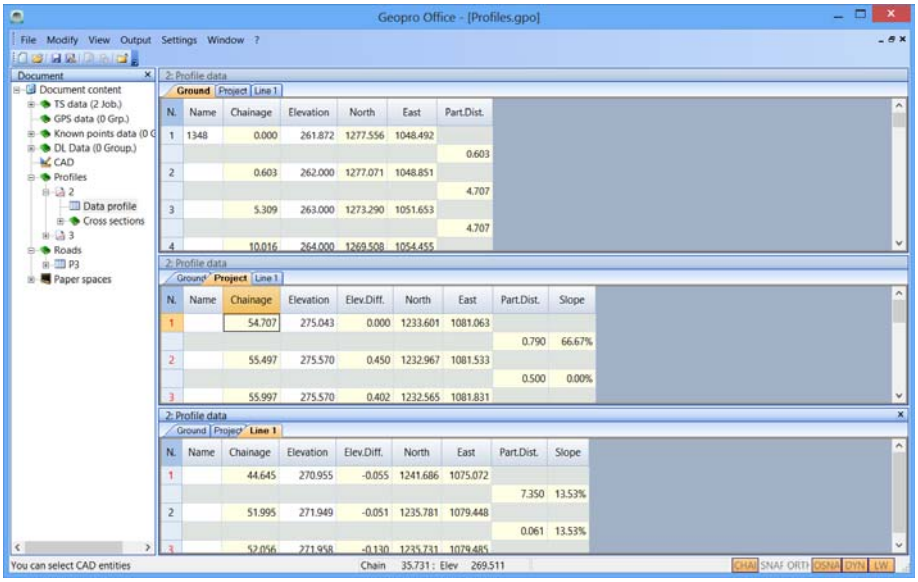



**Figure 17:**

Selecting the **Cross Sections** node will activate the **Sections View** that includes the list of the cross section of the selected profile;

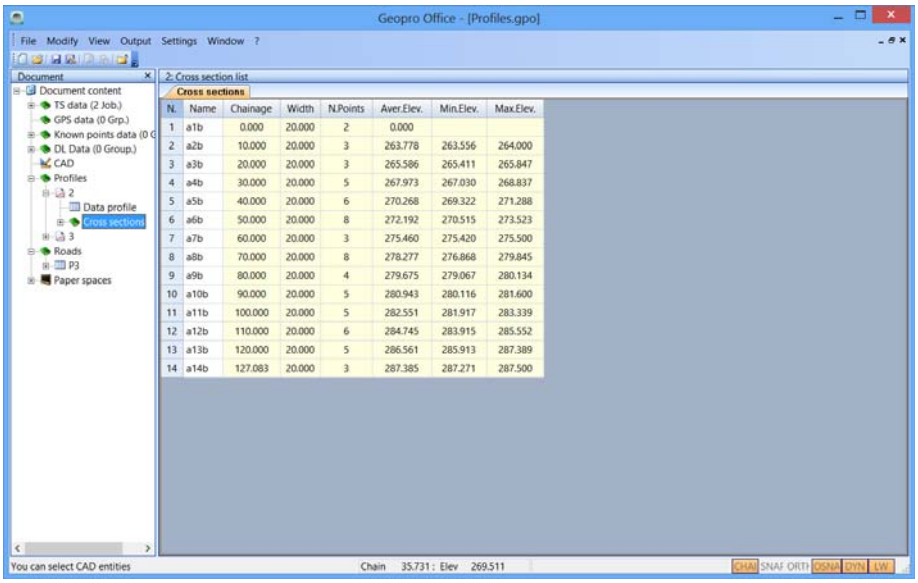



**Figure 18:**

Selecting the name of the Section activates the view that graphically displays the cross section profile where the user can change its graphic appearance as well as design polylines;

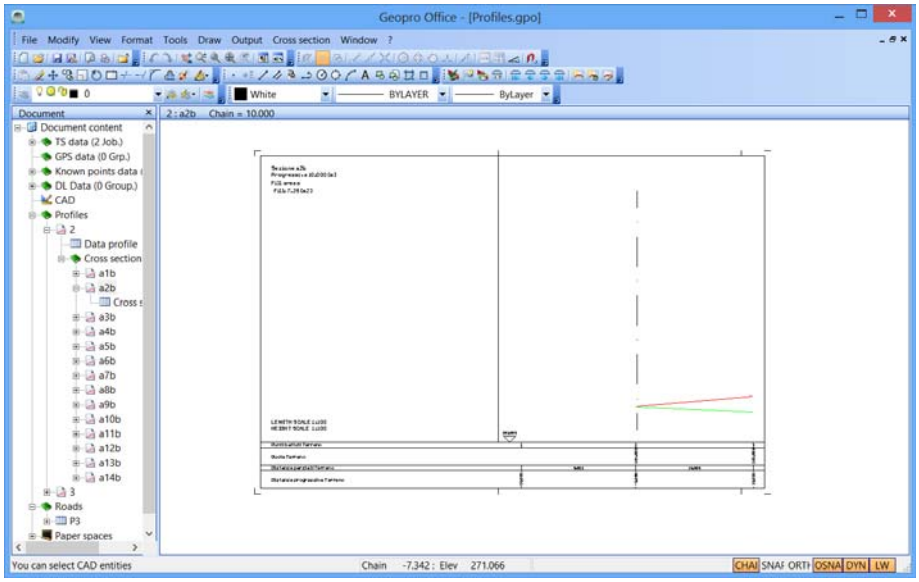



**Figure 19:**

Selecting the **Cross Sections Data** node will open a view that may include one or more pages: the first page includes the information on the section while the other page(s) include information on the additional polylines.

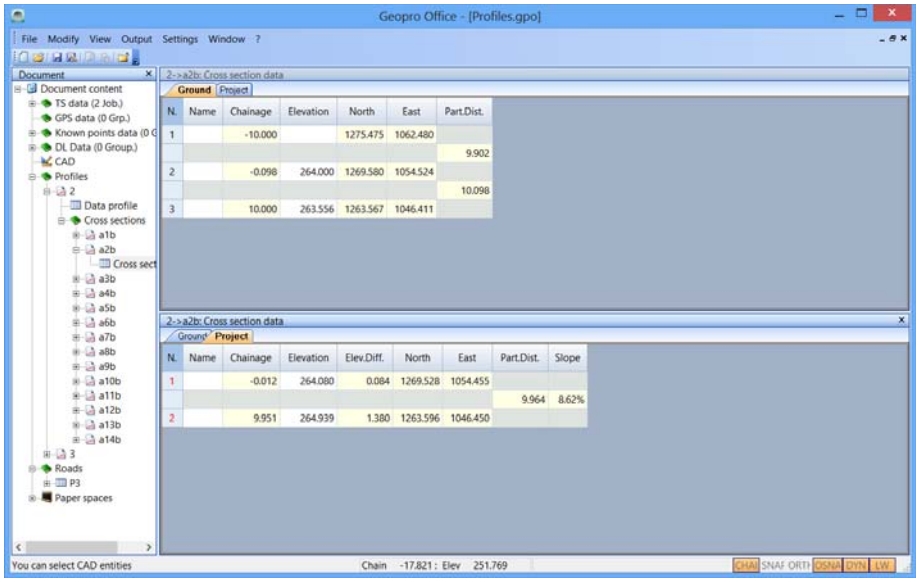



**Figure 20:**

# Roads View

The **Roads View** is the graphic or numeric display of the information associated with a road and its road sections.

Depending on the node selected in the navigation tree, the following views are activated:

Selecting the **Roads** node will activate the R**oads View** that lists all the roads;

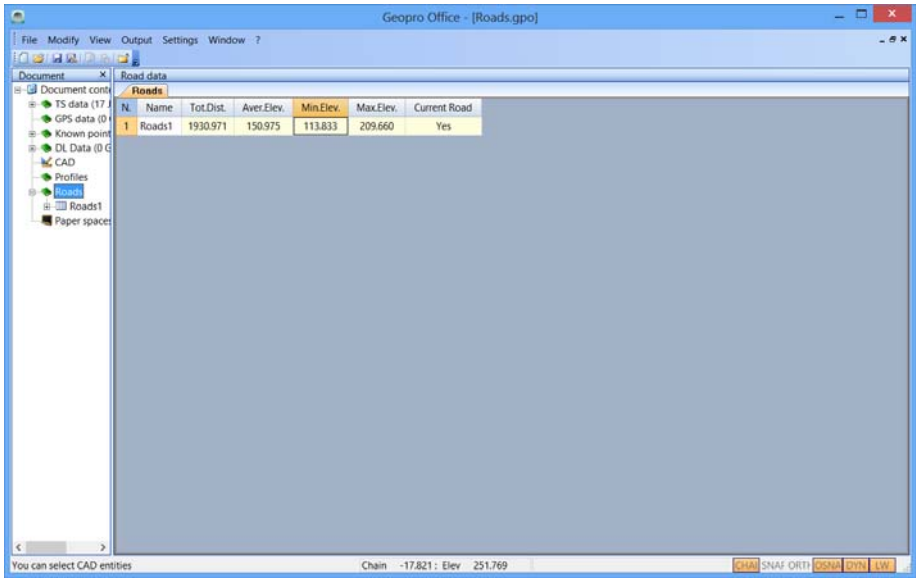



**Figure 21:**

Selecting the **Road Named** node will activate the road name view graphically displaying the road tracking;

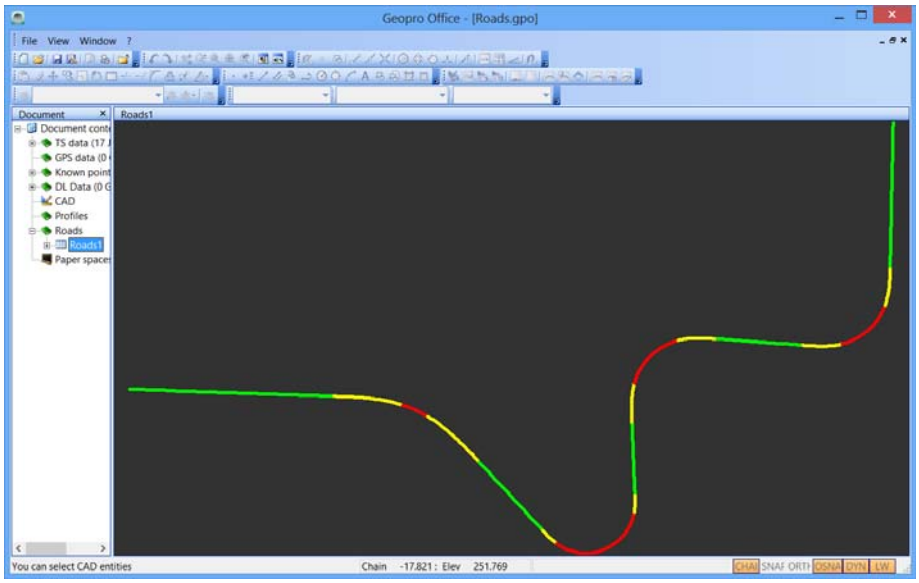



**Figure 22:**

Selecting the **Altimetry** node will activate the **Altimetry View** where the user can change the graphic appearance of the road and design projects and polylines within it.

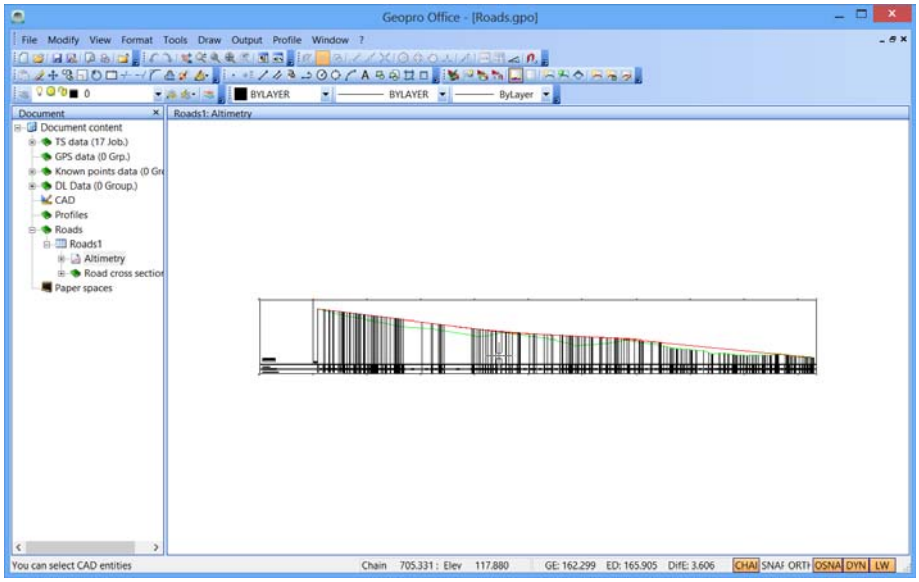



**Figure 23:**

Selecting the **Altimetry Data** node will open the view, divided into one or more pages, depending on the quantity of projects/polylines designed.

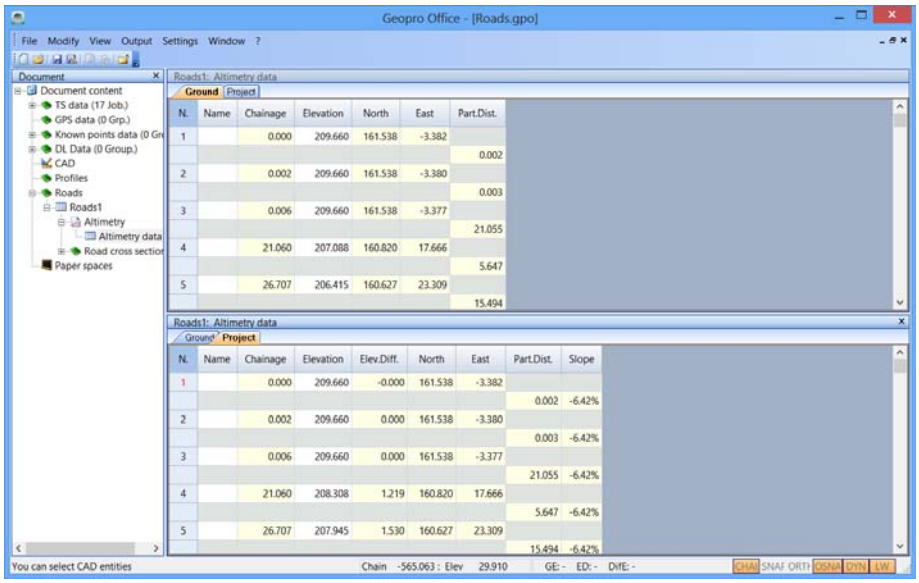



**Figure 24:**

Selecting the **Roads Cross Sections** node will activate the **Sections View** that includes the list of Road sections;

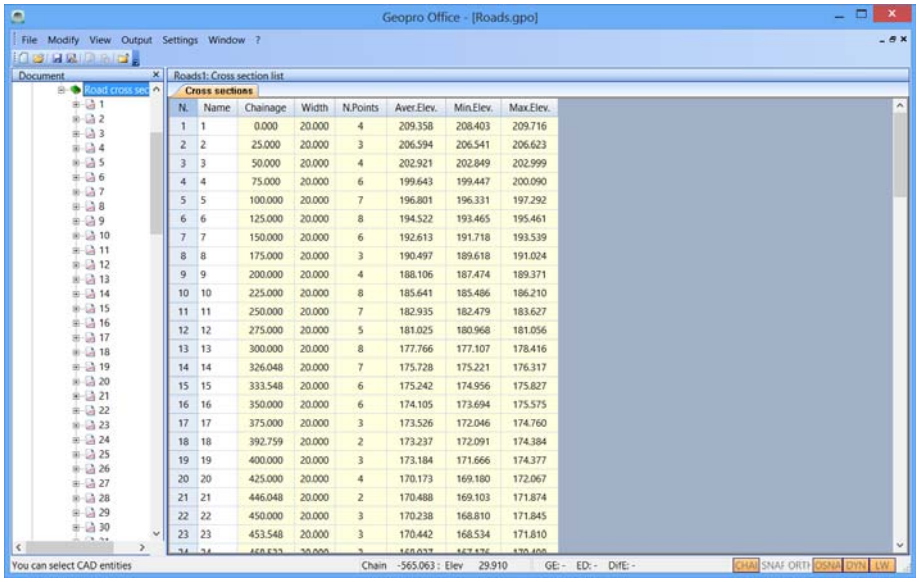



**Figure 25:**

Selecting the name of the Road section activates the view that graphically displays the section where the user can change its graphic appearance as well as design polylines;

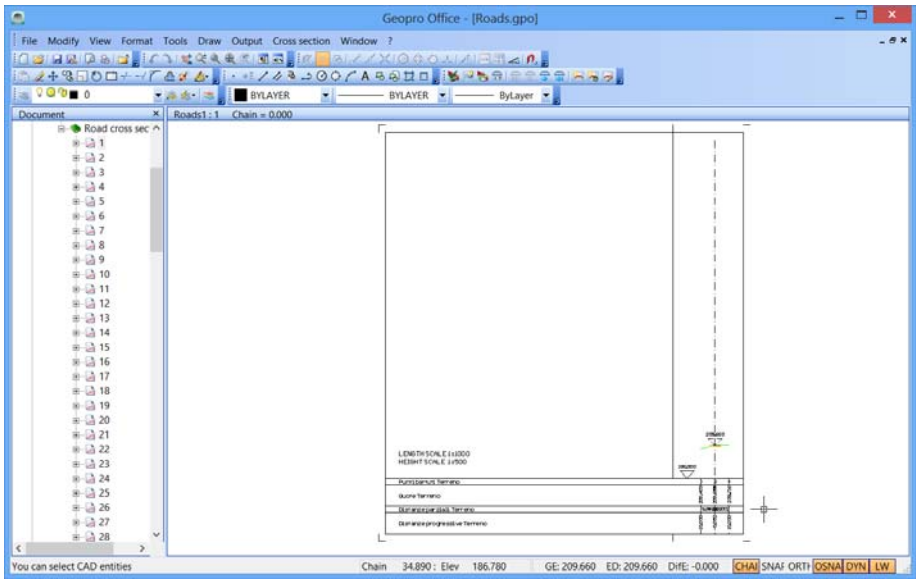



**Figure 26:**

Selecting the **Cross Sections Data** node will open a view that may include one or more pages: the first page includes the information on the section while the other page(s) include information on the additional polylines.

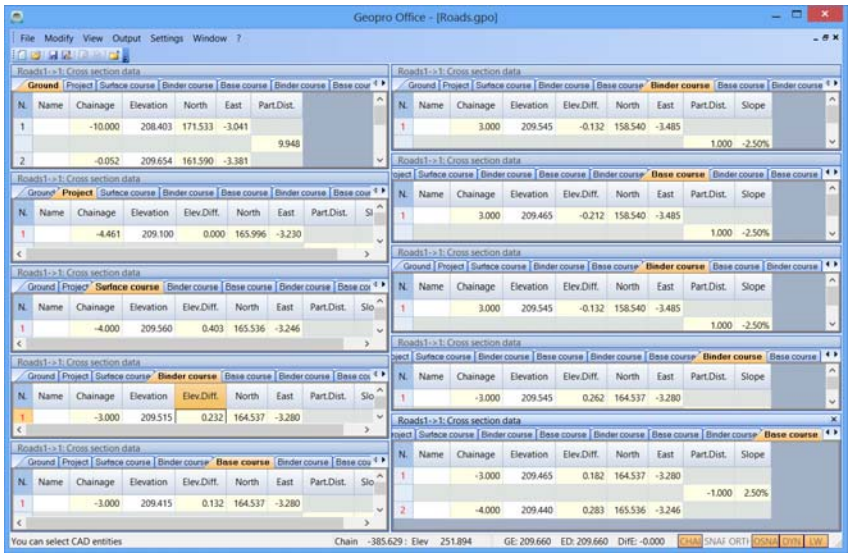



**Figure 27:**

# Paper Spaces View

The **Paper Spaces View** allows the user to create tables with multiple panes that can includes portions of the **CAD View** as well as the **Profile View**.

The **Paper Space View** lists all the Paper spaces created.

For each paper space created, the program creates a **Cad View** identified by its name where the user can add, change or eliminate the panes.

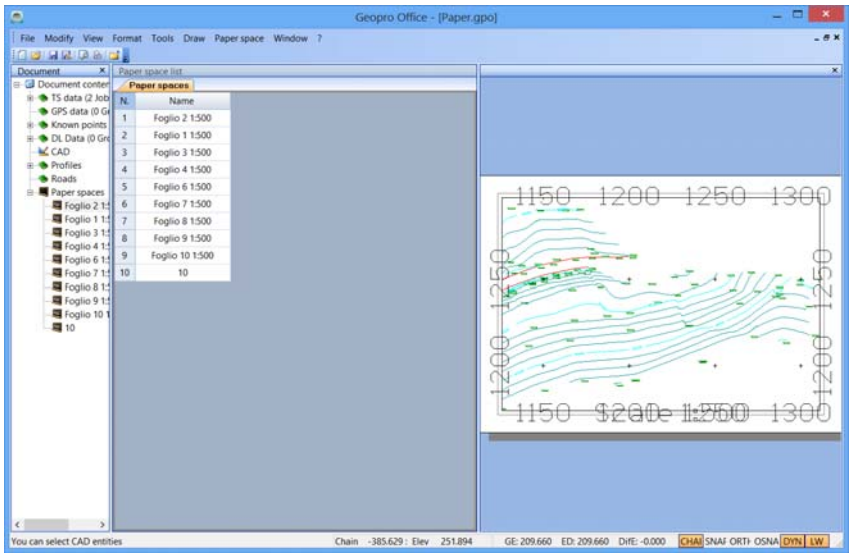



**Figure 28:**

# Meaning of Codes

The program uses a series of codes applied during elaboration of the data or in different phases of the calculation; here following is the description of each of them and their use is outlined in the following chapters.

- **HC** (Horizontal Control point) - The Point "seen" is actually an Orientation Point and will be used by the program to orient the Station from which it is "seen". To be used by the program, the **Name/Num** field of the Point must be identical in each and every facet (a capital letter is not considered equal to a lower case letter) to the **Name** field of an Orientation Point. It is also required that at least the **Horizontal Angle** of the **HC** Point and the N**orth Coord.** and **East Coord.** fields of the Orientation Point are filled with values valid for the calculation. The **Slope Distance** and **Vertical Angle** fields are optional.

- **VC** (Vertical Control point) - The Point "seen" is actually a Quote Point and will be used by the program to quote the Station from which it is "seen". To be used by the program, the **Station Height** field of the Station from which the point was "seen", the **Prisma Height**, **Slope Distance**, and **Vertical Angle** of the VC Point and the **Elevation** field of the Orientation Point must all be filled with valid values.

- **TR** (Transverse) - The Point "seen" is actually another Station and will be used by the program to calculate any Polygonals (open or closed). To be used by the program the **Name/Num** field of the **TR** Point must be identical in each and every facet to the **Name** field of a Station. It is also required that at least the **Prisma Height**, **Slope Distance**, **Vertical Angle** and **Horizontal Angle** of the **TR** Point are filled with values valid for the calculation.

- **IE** (Inaccessible Elevation) - The Point is considered as an inaccessible quote. To be used by the program, the **Vertical Angle** field must be filled with valid data.

- **FI** (Forward Intersection) - The Point is used to calculate the forward intersection. To be used by the program, the **Vertical Angle** and **Horizontal Angle** fields must be filled with valid data.

- **OC** (Orientation Created) - During the first phase of the elaboration, this type of point is not taken into consideration. Only after calculating the coordinates and quotes of all possible Stations, the program will proceed with calculating the coordinates and quotes of these Points, transforming them into **HC** points. The elaboration is then run again from the beginning to see if, using these Orientation Created Points it can orient or quote other Stations. This process is run again until it is no longer possible to orient or quote other Stations. As such, the user can quote a series of Stations from which shared points were "seen" and from which at least one the coordinates and quote calculation can be done.

Here following is the description of the other Codes managed by the program in other environments or other phases of the calculation:

- **SL** (Start Line) - This code, along with the two following, are interpreted during the design phase. All Points (or Stations) beginning with the one containing this code and up to the one containing the E**L** or **CL** code will be subsequently connected by dash lines.

- **EL** - (End Line) - This is the last in a series of Points (or Stations) connected by dash lines.

- **CL** - (Close Line) - This has the same meaning as the **EL** code except that this Point (or Station) will also be connected to the **SL** one so as to obtain a closed dash line.

- **NL** (No Line) - The Points or Stations with code **NL** are used to indicate that the point falling between the other codes SL, EL, CL must not be considered in the design of the lines.

- **NT** (No Triangles) - The Points or Stations with code **NT** will not be considered during the Triangle creation phase.
- **NP** (No Profile) - The Points or Stations with code **NP** will not be considered during the Profiles calculation using the "by quoted plane" method and with selecting a fascia of inclusion points.
- **NV** (Not Visible) - The Points or Stations with code **NV** will not be displayed in Graphic and will not be considered during the Triangle creation phase.
- **LD** (Line for Description) - This code is used to design a polyline that joins it with all of the subsequent points with the same description up to the end of the same Work (Celerimetric Booklet) or the same Group (Noted Pt. and GPS Booklet).
- **NC** (No Computation) - This code, if activated, is used to exclude a Celerimetric Station, Celerimetric Point, Base GPS Station or GPS Point from the celerimetric calculation and from projection calculation.

# General Options

Using the **General Options** command will open the **General Options** window composed of three pages.

In the **TS data** page, the user can specify whether to work in 2D or 3D and whether to create the Historic file (.STO) where the date and time of the changes applied to the elaborations run are stored.

For this type of selection, the **Save CFG** and **Load CFG** commands are also available whose functionality is described for the **File** page of this window.

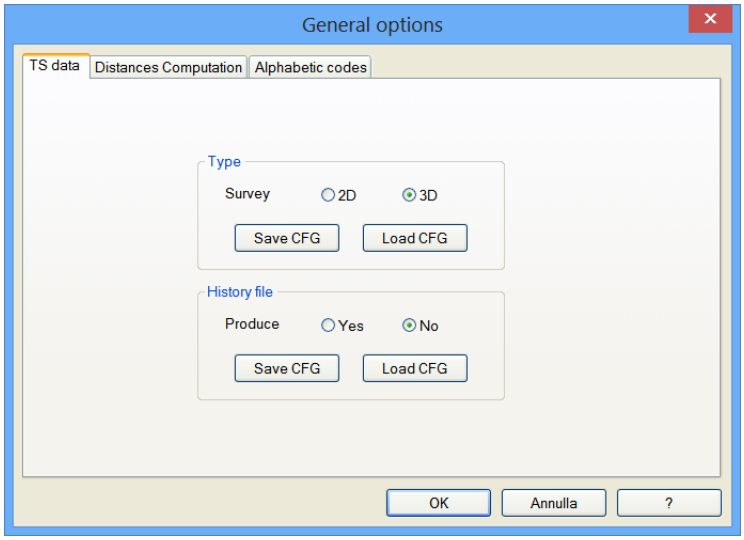



**Figure 29:**

The **Distances Computation** page is used to select the method for calculating the Horizontal Distance once the values associated with the Slope Distance and Vertical Angle are known.

In fact, the user can select whether or not to apply the correction due to the refraction index and to the value of the Earth radius.

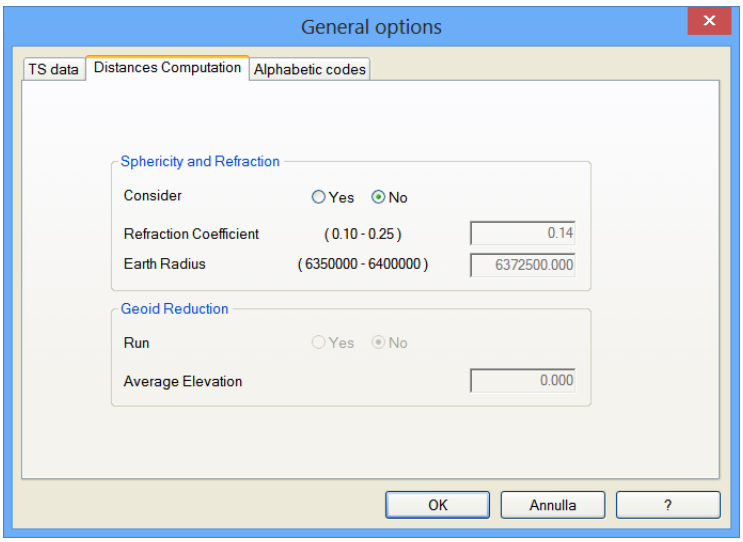



**Figure 30:**

Initially, the field associated with **Consider** for **Sphericity and Refraction** is set at **No**.

Setting this window to **Yes** will allow the user to change the fields associated with the **Refraction Coefficient** and the **Earth Radius** which are initially set, respectively at, 0.14 and 6,372,500 m.

These can be changed even while remaining within the limits indicated in the display; the user can also select whether or not to run the **Geoid Reduction**.

In this case, the user must also insert the value of the **Average Elevation** which is initially set at 0.

Using the **Alphabetic Codes** page, the user can select whether or not to cancel the Alphabetic Codes from the Points and Stations Code field.

The user can cancel the points from the open file or set the option to cancel on all files created with the program's previous versions and those that will open in the future.

The Explicit Codes already converted will remain set and can be changed in the specific pages.

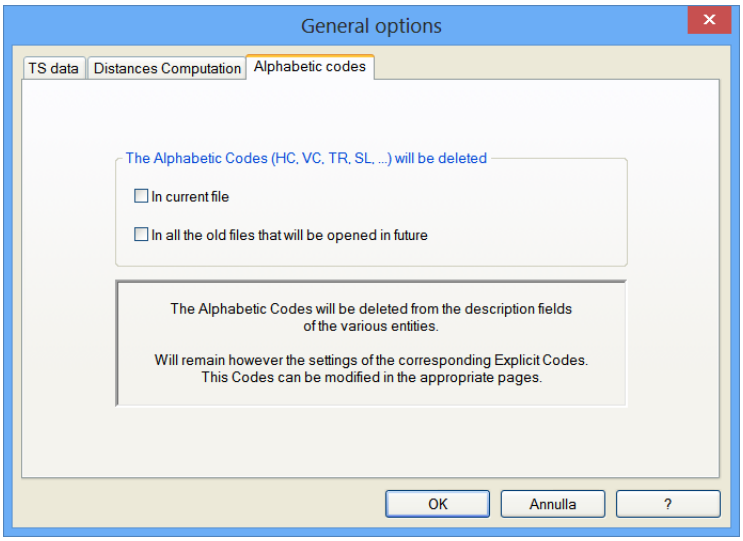



**Figure 31:**

## Presentation

Geopro Office is a topographic program for Computers of Workstations installed with Windows 95/98/ME, NT4/2000/XP/Windows Vista/Windows 7/Windows 8 and Windows 10.

Data can be acquired by the program in various ways:

•Directly from Total Stations, data registries or digital levels

•From files imported onto PCs from Total Stations, GPS receivers, data registries or digital levels

•From .GPF files produced by Geopro Field, the data acquisition program on Sokkia palms

•From ASCII or DXF files

•Inserted by keyboard.

When data is imported, the program can recognize the codes that, depending on what the user has set, will allow various functionalities: completion of the description field, tracking the line between points, designing points with symbols and particular characters depending on the code...

The program runs elaboration of the data from Total Stations using a guided procedure that allows the user to analyze the inserted data and check any errors at each step by displaying the discards in reference to the set tolerances. Orientation of the stations can refer to a local system or anchored to orientation points. The following calculation methods are used automatically by the program, depending on the available data: roto-translation (rigid or at minimum squares, with fixed or variable scale factor), Snellius and Ex-centro. For the quotes calculation, the program can also assign a false quote to a station or use benchmarks as reference. The calculation of open or closed polygonals, with associated compensation, is conducted totally in automatic. The user can select the rigorous compensation module for the layout or altimetric calculation.

For data from GPS receivers, the program offers a specific calculation module. First of all, preliminary transformations can be used if the surveys refer to reference systems such as IGS05. The calculation can refer to a local system or it can use orientation points with noted coordinates; it can also run cartographic projections on geodetic systems such as WGS84, ED50 and ROMA40 The calculation can also use the data from the Total Stations if they are anchored to GPS points.

The elaboration, whether from Total Station data or GPS, can also be conducted using the Pregeo software module if the user wants full compatibility with it.

The results of the various elaborations can be displayed graphically within a powerful and complete CAD environment prepared specifically for the program. This allows implementation of functions specific to the topographic environment: calculating fractioning, areas and polar coordinates, transforming graphic points into Stations, celerimetric points or GPS; creating slope lines and frames,...

The CAD environment allows displaying of raster images to overlay on the surveys. These images can be accurately calibrated and georeferenced taking into consideration all of the deformations that the image may undergo.

The program is able to automatically create a mathematical model of the terrain as triangles, using points from surveys run with the Total Station or GPS receiver, or from graphic points or noted coordinates.

Beginning with the mathematical model of the terrain, level curves can be automatically created: the user must only insert the value of the equidistant, the notable equidistant and the rounding factor of the spline.

Calculating the volumes is done using a guided procedure that allows the user to select: whether to run calculation on all of the surveys or a part of them, if the calculation is to be done on the horizontal plane or incline, if a plane of equal excavation and fill is to be identified or a plane of compensation with minimum movement of land or excavation or of minimum absolute movement. The program also allows calculation of volumes for differences with other surveys that may have been done at different times (cables, unloads, ...).

Generating profiles can be done beginning with the triangles in the mathematical model of the terrain, the dash lines or the splines of level curves, or finally from the quoted plane even using a fascia for including points. Viewing the generated profile is automatic and can be customized through selecting the columns, scale, page dimensions, colors, quote jumps, ... It is also possible to plan gradients graphically as well as by inserting appropriate length and slope/drop/quote values.

Finally, there is a complete module for road planning. Road tracking, circular connections and clothoids, curved slopes, gradients, vertical connections can also be inserted. The sections can be calculated on the entire section, on selected sections or individually using selected templates from time to time (whether single or double lane, with or without traffic separator, quay and sidewalk) selecting it from a specific archive housing also the specifications for walls and ditches. Once the project is completed, the user can print a detailed calculation on the earth movement as well as obtain a layout or three-dimensional representation of the road and embankment areas.

# Create a TS data

There are two primary methods for creating a TS data:

1.manual insertion

2.inserting data from instrument

# Manual Insertion

The first step is to run the **File|New** command. The program opens a new document and assigns it a default name (Document1); **General** is the first displayed view.

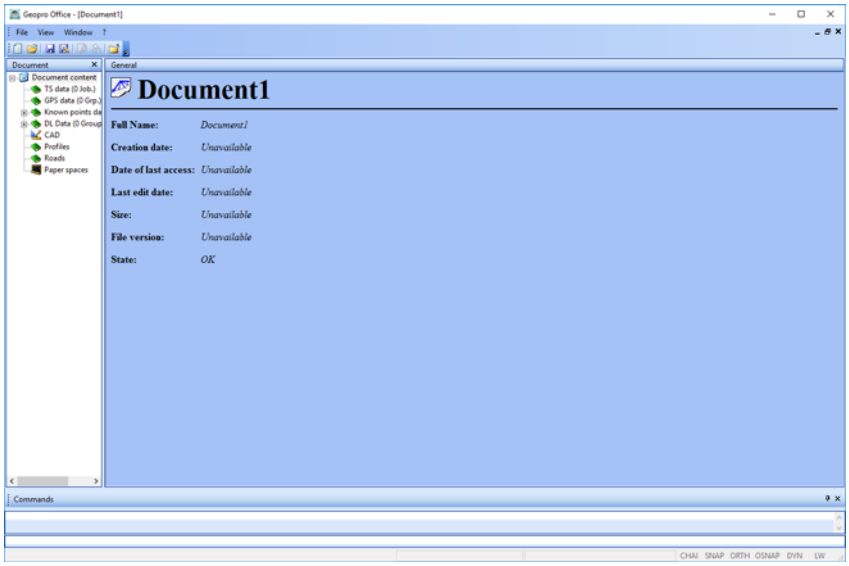



**Figure 32:**

# Inserting a Job

•The TS data can be organized in one or more Jobs.

•To insert one or more Jobs, the user must activate the **TS Data View** and add one or more lines using the **Insert|Add row** and/or **Insert|Insert row** commands.

•The **Insert|Add row** command is used to insert the first line and, when there are already other lines, it will insert a line under the current one.

•The **Insert|Insert row** command allows the user to insert a line above the current one.

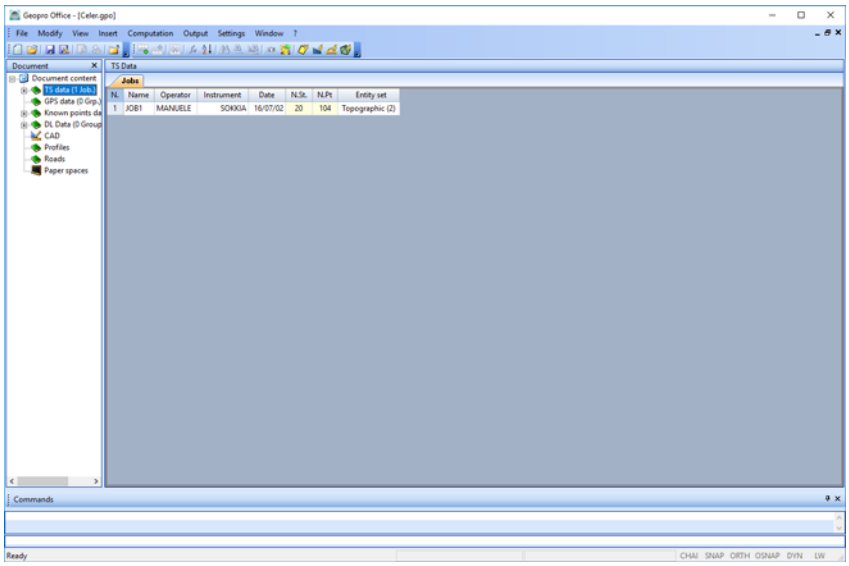


**Figure 33:**

In the example above, a **Job** has been added.

# Inserting a Station

Jobs in the TS data can be organized in one or more Stations.

To insert one or more Stations, the user must:

•Activate the **Job View** used to insert the Stations;

•Use the **Insert|Add row** and/or **Insert|Insert row** commands; the functionality of these commands is the same as that for inserting Jobs.

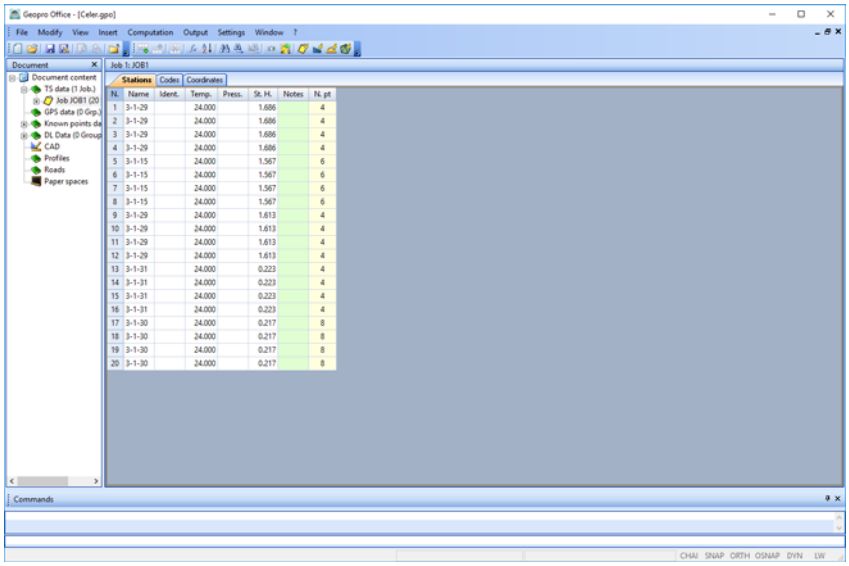


**Figure 34:**

In the example seen on the previous page, three Stations have been associated to the **JOB1** Job.

# Inserting a Station Point

•The Stations that compile the Jobs in the TS data can contain multiple points.

•To insert a point, the user must activate the corresponding **Station View** and use the **Insert|Add row** and/or **Insert|Insert row** commands (the functionality of these commands is the same as that for inserting Jobs).

In the example below, various Points have been added with the associated data.

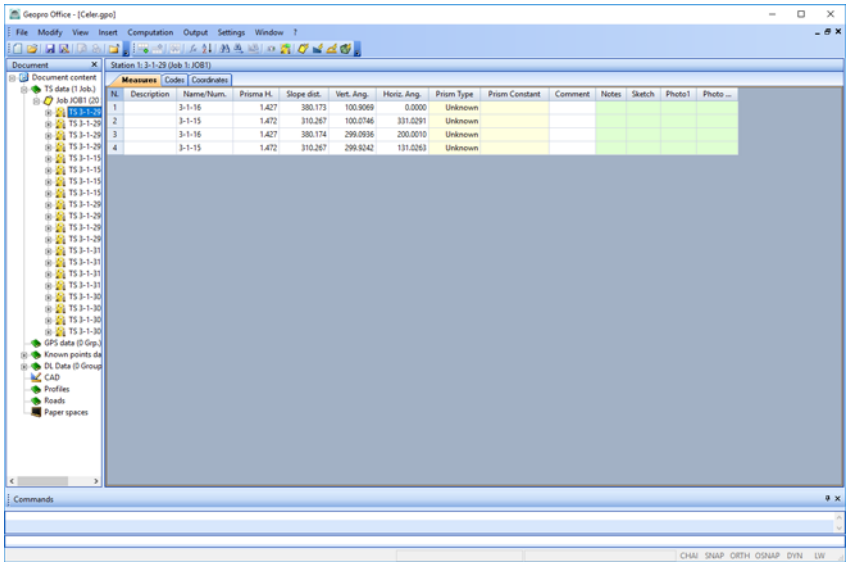


**Figure 35:**

The TS data is associated to each point where the data associated with the point is summarized.

Once the booklet is edited, Orientation Points can be inserted.

These points must be inserted into the **Points** page in the **Control points view** that opens by expanding the node corresponding to the **Known points data** in the navigation tree; the points can be inserted manually using the commands available for inserting data in the TS data.

The **Orientation Points** summary view is also available for these points.

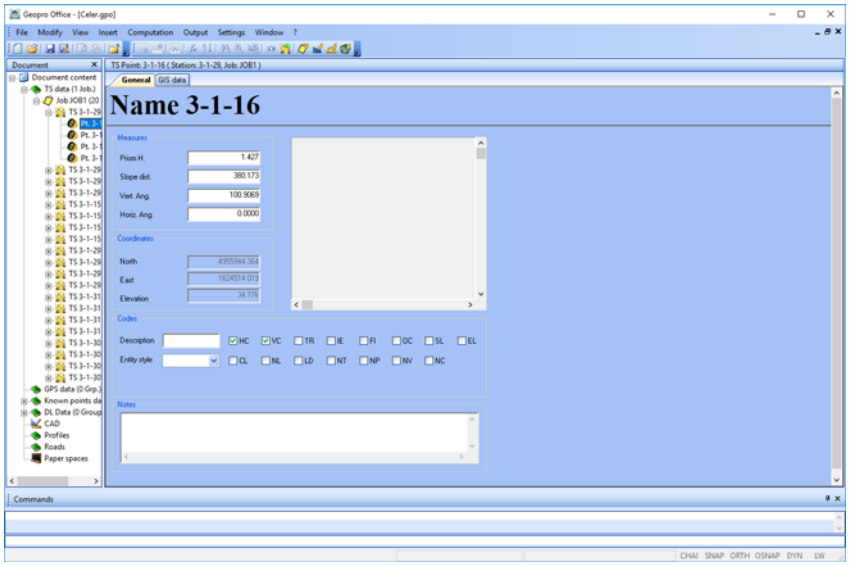



**Figure 36:**

# Inserting Data from Instrument

In regard to inserting instrument data, the operations to run are as follows:

1.Create a new document;

2.Select the item **TS Data** from the navigation tree view;

3.Run the **Insert|Instrument Data...** command.

Using this command will activate a guided procedure where the user can insert all of the information needed for transmitting data from the instrument to the PC and, the option to save the specified profile so as to reuse it again in another transmission.

The image below shows the first window in the procedure.

A more detailed description of this operation can be found in the course instruction on using Geopro Office.

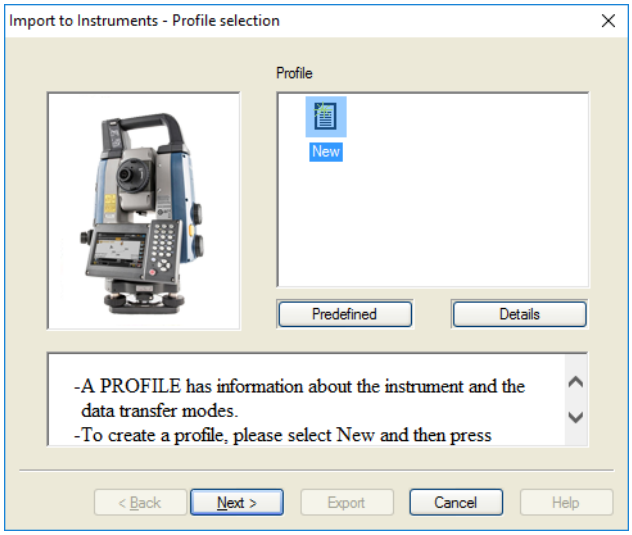



**Figure 37:**

# Change a TS Data

The TS Data data can be changed using the commands found in the Modify menu or in the context menu activated by clicking the right mouse button on the booklet.

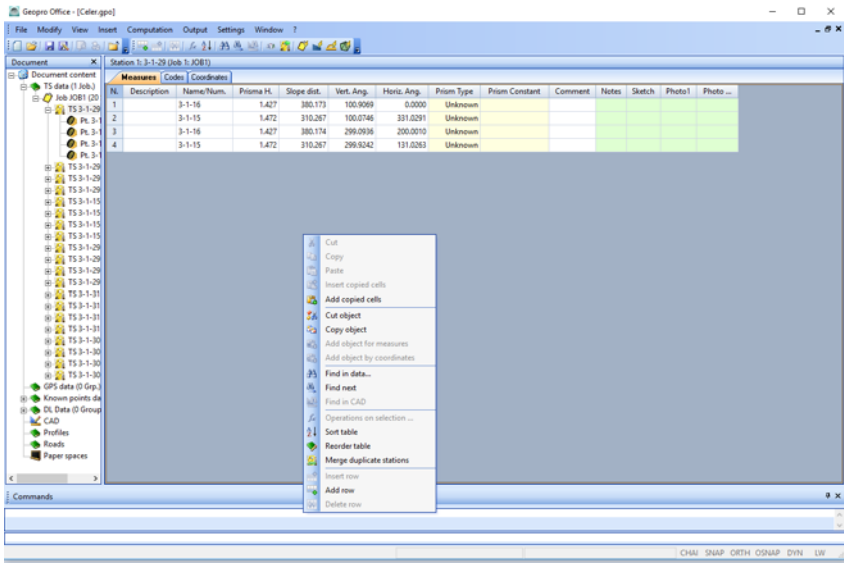


**Figure 38:**

Note that "Description of Modify Menu Commands" on page 47 has a brief description of the various functions included for changing and searching data.

# Elaborate a TS Data

The following section describes 2D and 3D elaboration.

## 2D Elaboration: example Celer2D,gpo

This example shows the elaboration of a layout survey with open polygonal and orientation referring to noted coordinate points.

To elaborate the booklet, the user must select the TS Data from the navigation tree, open the Computation Menu and click on **Automatic Celerimetric**.

The Celerimetric calculation is a guided procedure: the first window displayed is seen here below.

This window is used to select the jobs to be elaborated by clicking on the corresponding box; also, if an elaboration has already been executed, then it must be canceled using the **Cancel the computation** box; pressing the **Next** button will continue the elaboration.

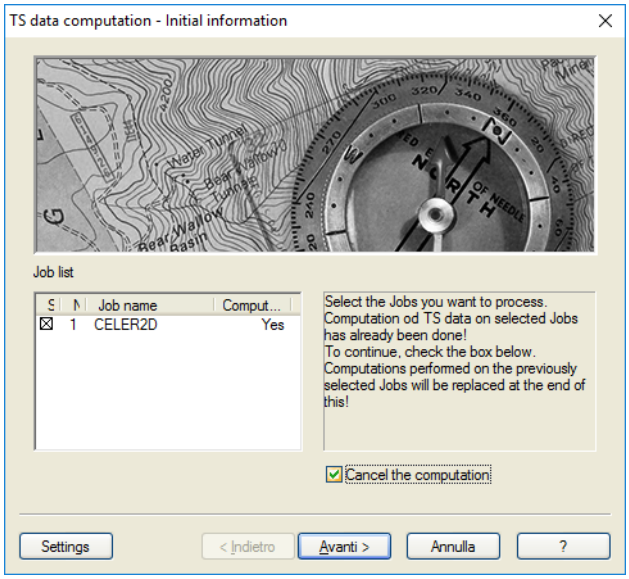



**Figure 39:**

Click on the Options button to check the options for the elaboration associated with automatically recognizing codes and checking tolerances.

This information can be changed only at the beginning of the elaboration.

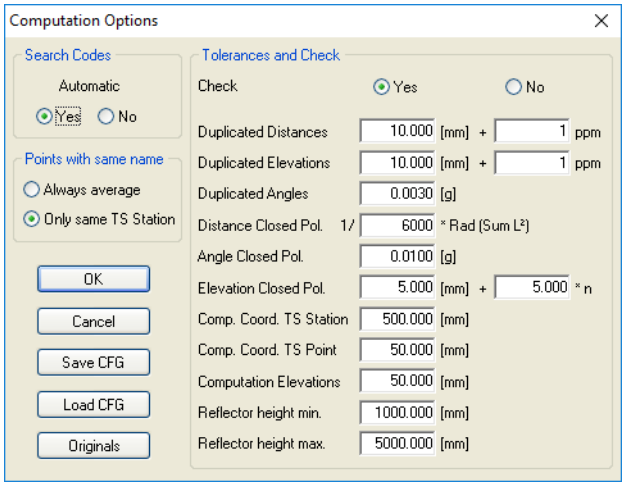



**Figure 40:**

The second window shows an analysis of the Celerimetric Booklet data (number of stations included, number of points with a certain code and their validity, any presence of duplicate points and/or stations, etc.).

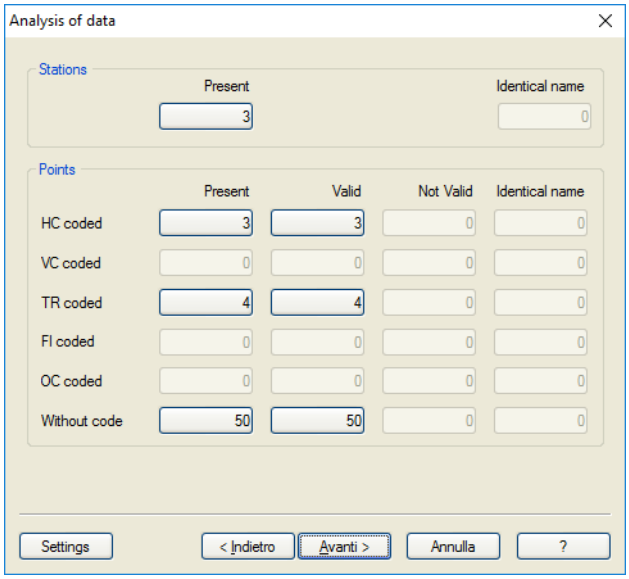



**Figure 41:**

Here following are the code descriptions that can be assigned to the points and that are used during the celerimetric calculation:

HC (Horizontal Control point) - The Point "seen" is actually an Orientation Point and will be used by the program to orient the Station from which it is "seen".

VC (Vertical Control point) - The Point "seen" is actually a Quote Point and will be used by the program to quote the Station from which it is "seen".

TR (Transverse) - The Point "seen" is actually another Station and will be used by the program to calculate any Polygonals (open or closed).

IE (Inaccessible Elevation) - The Point is considered as an inaccessible elevation.

FI (Forward Intersection) - The Point is used to calculate the forward intersection.

OC (Orientation Created) - During the first phase of the elaboration, this type of point is not taken into consideration. Only after calculating the coordinates and quotes of all possible Stations, the program will proceed with calculating the coordinates and quotes of these Points, transforming them into HC points. The elaboration is then run again from the beginning to see if, using these Orientation Created Points it can orient or quote other Stations. This process is run again until it is no longer possible to orient or quote other Stations. As such, the user can quote a series of Stations from which shared points were "seen" and from which at least one the coordinates and quote calculation can be done.

The next window is **Station Analysis** and, in essence, will display any coordinate calculations that Meridiana can run in association with the inserted orientation points. In the case in question, the calculation run is a roto-translation; given that this is a layout work, there are no quotable stations.

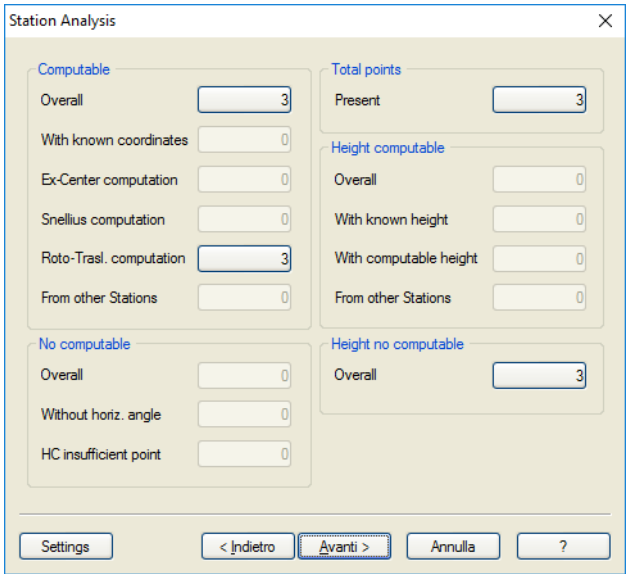



**Figure 42:**

At this point, the next window is **Options for the next computations** where the user can make selections that will be used in the next steps of the elaboration. Given that this is a 2D work, the section associated with calculating the quote is deactivated.

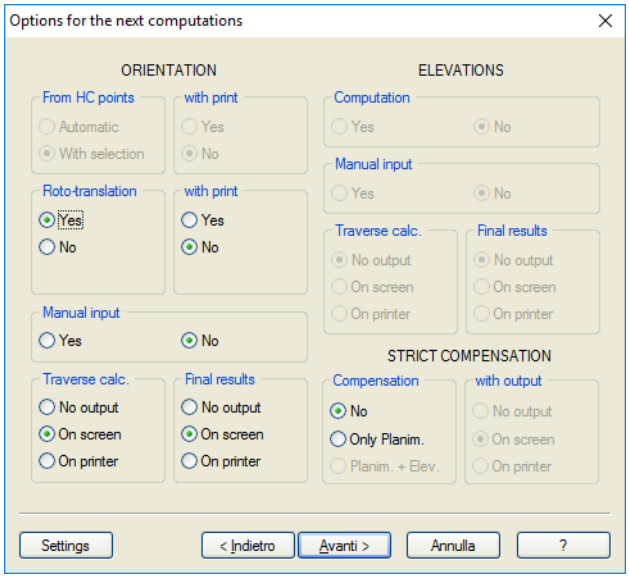



**Figure 43:**

After pressing **Next** the roto-translation calculation is displayed with its associated discards. The coordinates of the fiducial points can be excluded from the calculation by deselecting the associated box.

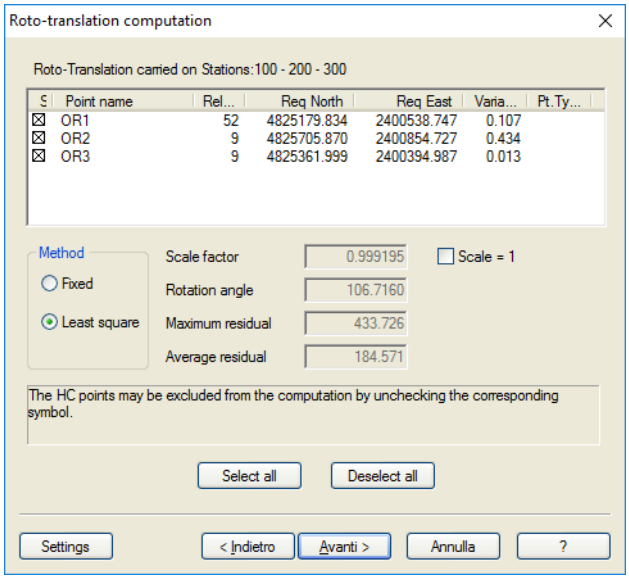



**Figure 44:**

The next window shows the coordinates of the calculated stations.

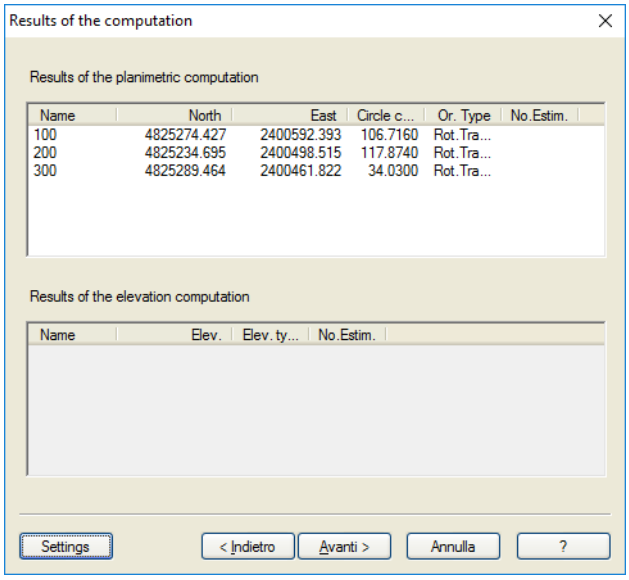



**Figure 45:**

To complete the elaboration, press **Completed**. To view the final result, click on the CAD item in the navigation tree.

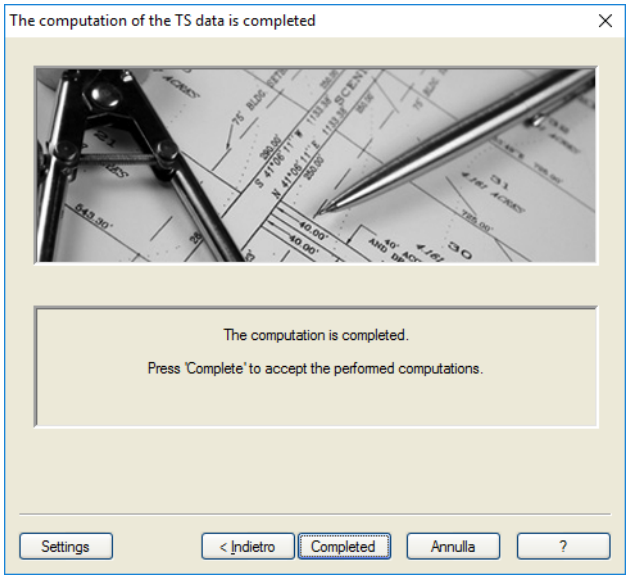



**Figure 46:**

The final result of the elaboration:

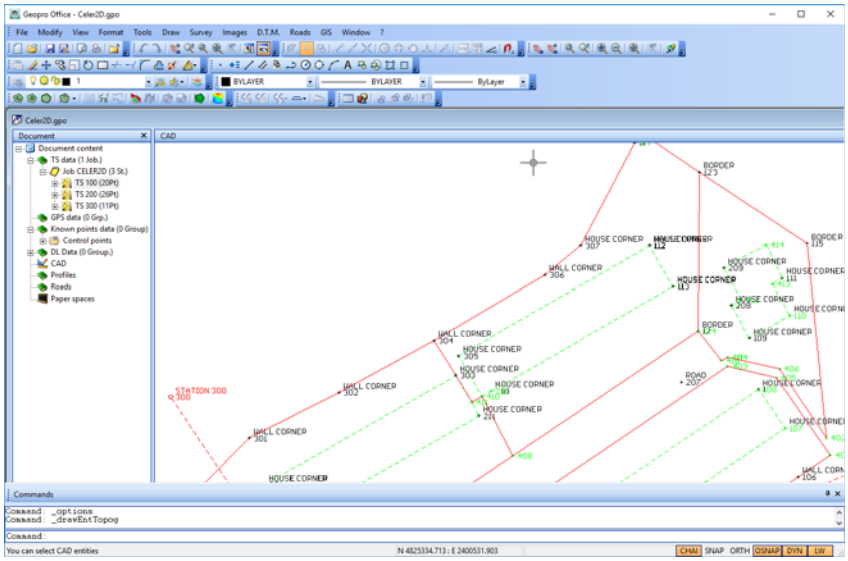


**Figure 47:**

# 3D Elaboration: example Countors.gpo

This example shows the elaboration of a plano-altimetric survey with closed polygonal and orientation referring to local coordinates.

The first window that appears is similar to the one described in the 2D elaboration.

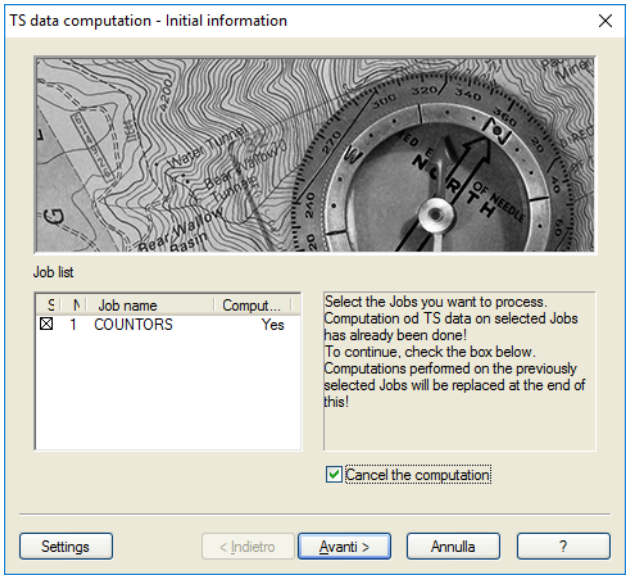



**Figure 48:**

In the **Analysis of data** window the program will mark the stations present, any polygonal wearing (TR) and the detail points in the survey.

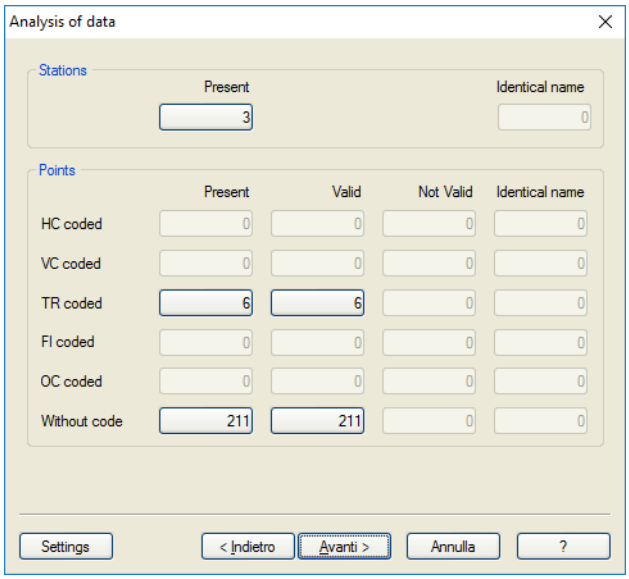



**Figure 49:**

Given that it is not dependent on orientation points and noted quote points, the surveys cannot be oriented or quoted with noted references.

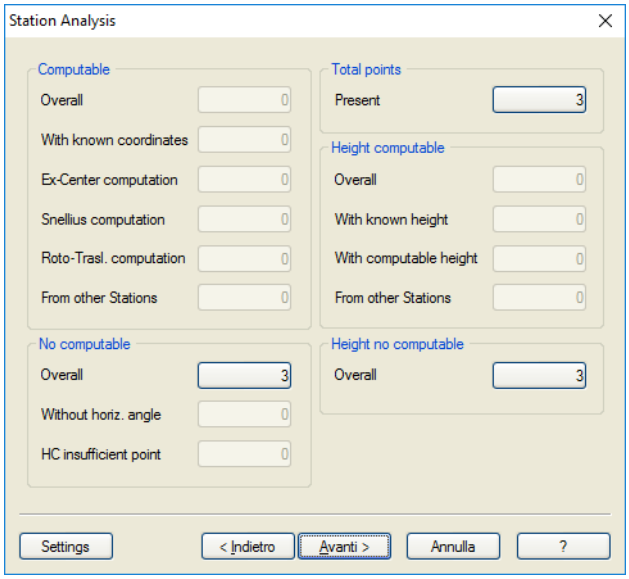



**Figure 50:**

At this point, the user can set the various options for the elaboration.

In our example, we selected Manual Input, which also happens to be the only possible selection.

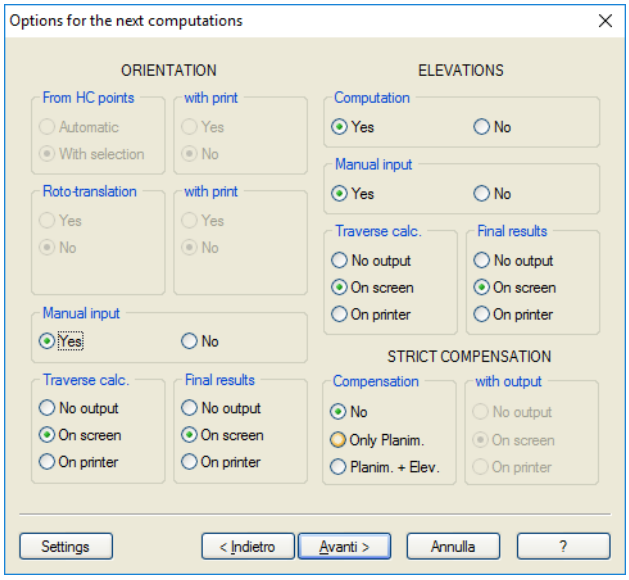



**Figure 51:**

In the **Manual entry of Station coordinates** window, the user inputs the associated coordinates, the azimuth correction and the quote of a station by following the indicated instruction, for the Station 100 as well as the Station 200.

To assign points to the selected station, the user must press the **Assign Values** button; if the user presses the **Cancel Values** button then the values assigned to the station will be canceled.

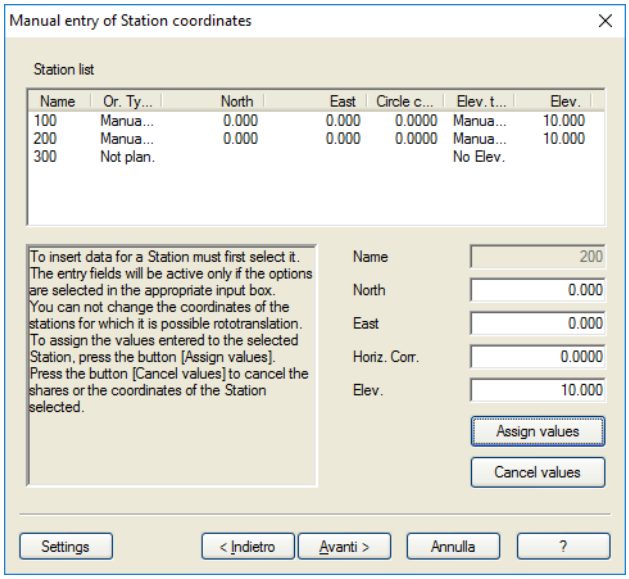



**Figure 52:**

The next windows display the intermediate results of the elaboration on the layout compensation of the polygonal and the altimetric compensation.

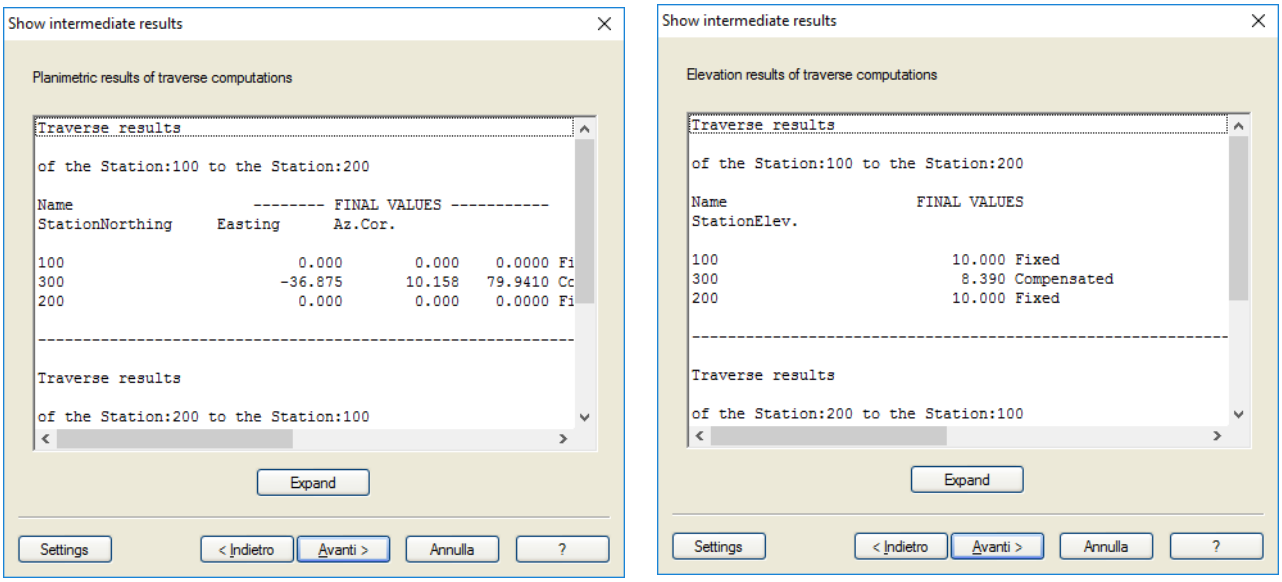



**Figure 53:**

The **Results of the Elaborations** window shows the coordinates and quotes of the stations.

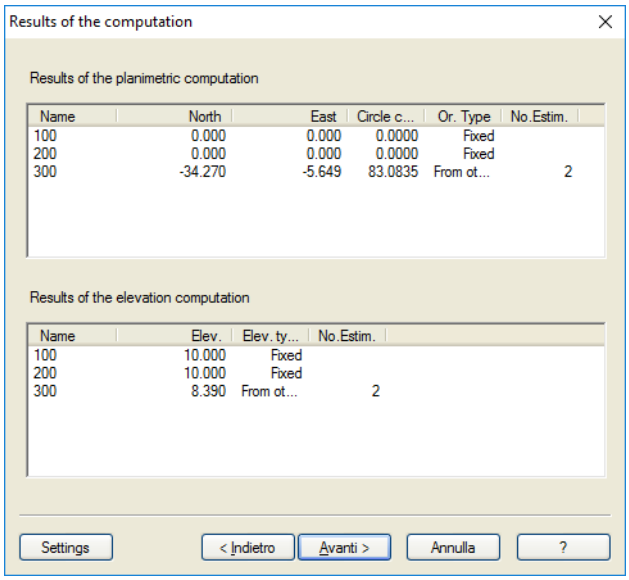



**Figure 54:**

If the TS data has already been elaborated previously and there are specific entities found in the file, then a window will appear in which the user can select whether to modify the position of these entities (that is, roto-translate them) based in the re-elaboration run on the TS data. A check box is included for each type of entity, used to decide whether or not to roto-translate. For the graphic entities, the user can specify whether to roto-translate all of them or only those included in the non-blocked planes. The deactivated check boxes indicate that there are no entities of the type represented by the check box itself.

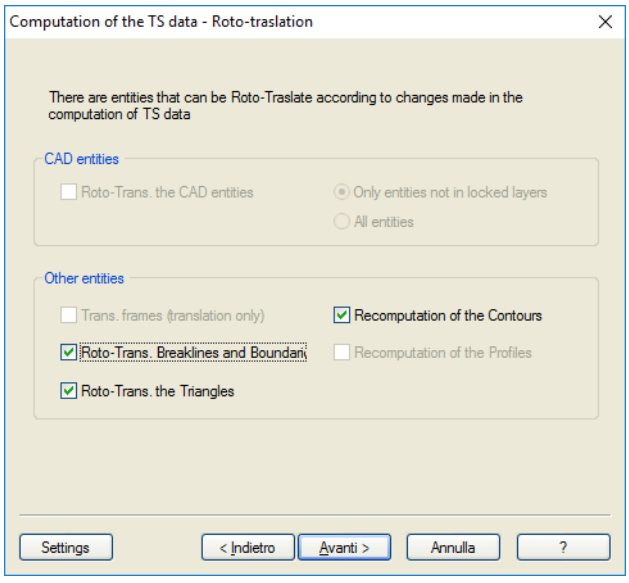



**Figure 55:**

Press **Completed** to end.

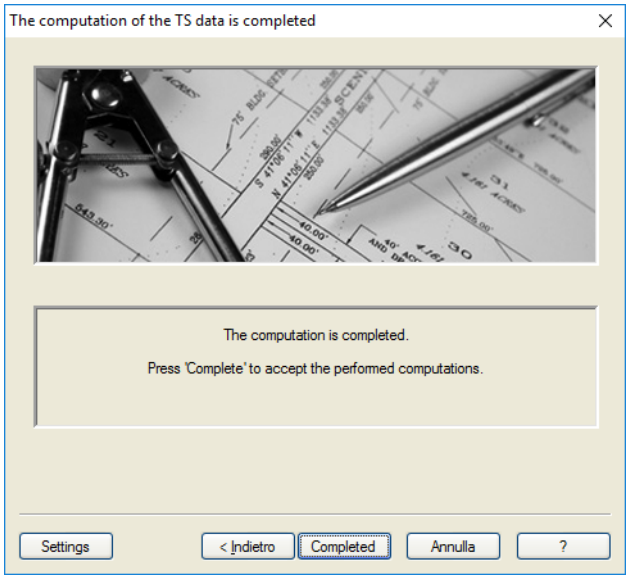



**Figure 56:**

The final result of the elaboration:

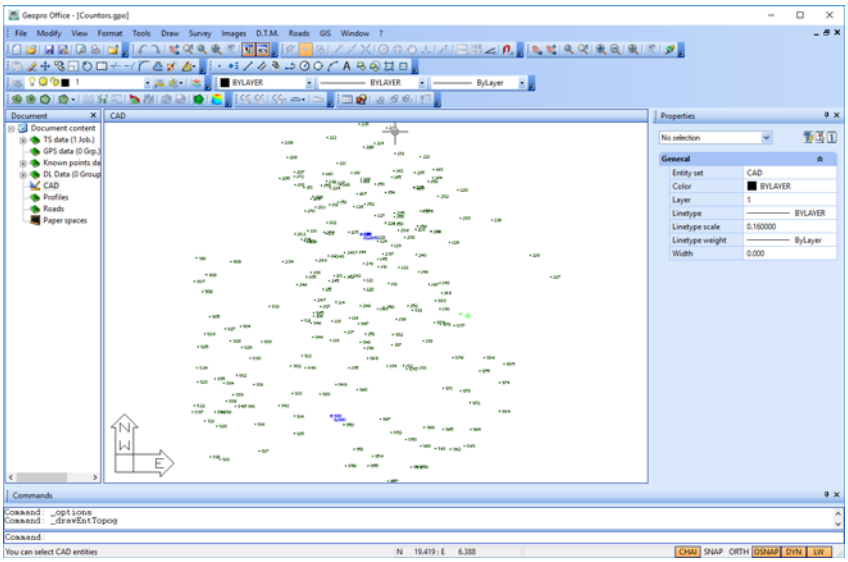


**Figure 57:**

# TS data: output

Once the **TS data** item is selected from the navigation tree, select the Output menu. The procedures in this menu are used to print or transfer to other programs the data found in the TS data and the results of any elaborations executed.

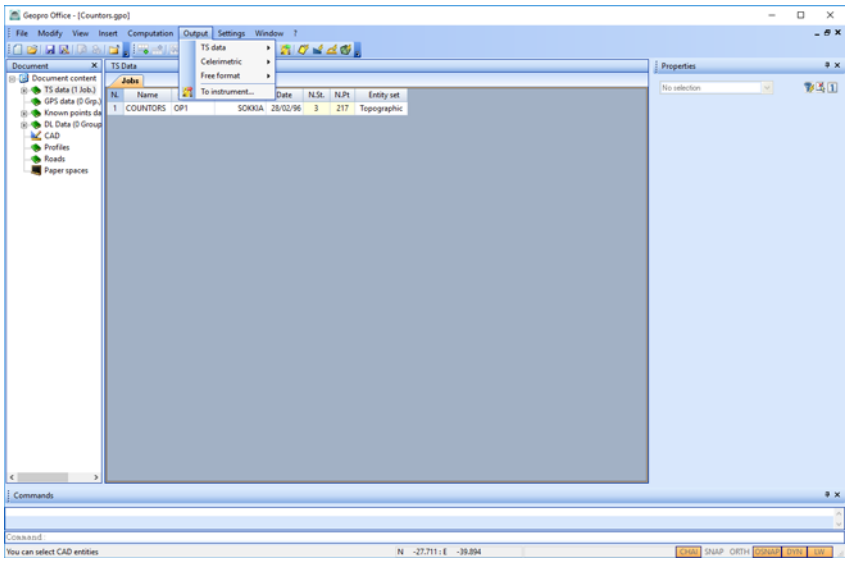



**Figure 58:**

Here following is a short description of the primary print functions.

•Output Menu|TS data|Print All Stations: select this to print the measurement booklet of all stations.

•Output Menu|Celerimetric|Print All Stations: select this function to print the results of the celerimetric calculation of all existing stations.

•Output Menu|Free Format|Print All Stations: this function is used to obtain a free format printout of the data found in the TS data and the results of the Celerimetric Calculation. Free Format means that the user is free to decide which data to print, in what order, and with how many decimal numbers. To make these selections, the user must activate the **Settings|Print options** procedure. The user must also ensure that the Celerimetric Calculation has been executed so that the data can be properly printed.

For all of the versions described above, there is also a version to Print Selected Stations: using this command, the program will open the following window allowing the user to select the stations to print.

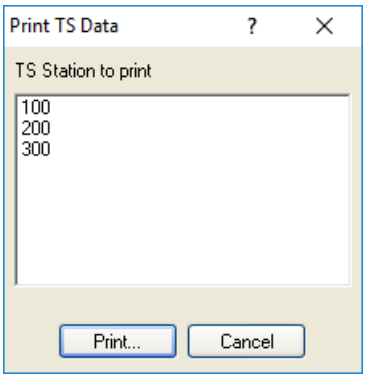



**Figure 59:**

# Create a GPS data

The first step is to run the **File|New** command. The program opens a new document and assigns it a default name (Document1); **General** is the first displayed view.

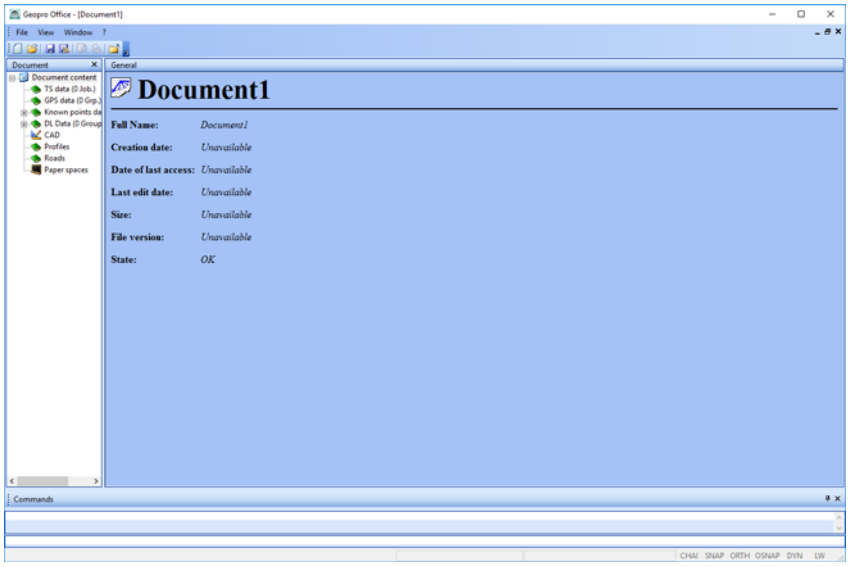



**Figure 60:**

# Inserting a Group

The GPS data can be organized in one or more Groups.

•To insert one or more Groups, the user must activate the **GPS data view** and add one or more lines using the **Insert|Add row** and/or **Insert|Insert row** commands.

•The **Insert|Add row** command is used to insert the first line and, when there are already other lines, it will insert a line under the current one.

•The **Insert|Insert row** command allows the user to insert a line above the current one.

# Inserting a Group Point

•Groups that comprise the GPS data can contain multiple points.

•To insert a point, the user must activate the corresponding **Group View** and use the **Insert|Add row** and/or **Insert|Insert row** commands (the functionality of these commands is the same as that for inserting Groups).

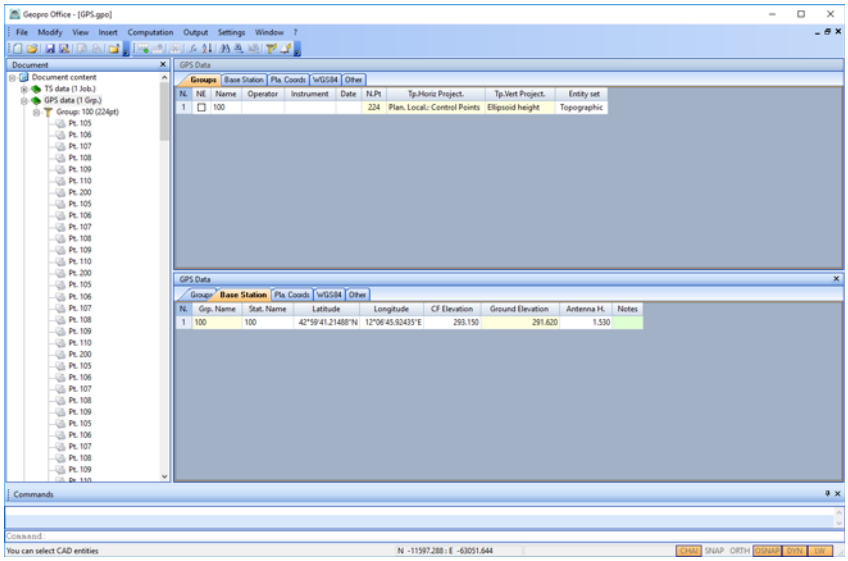


**Figure 61:**

In the example below, various Points have been added with the associated data.

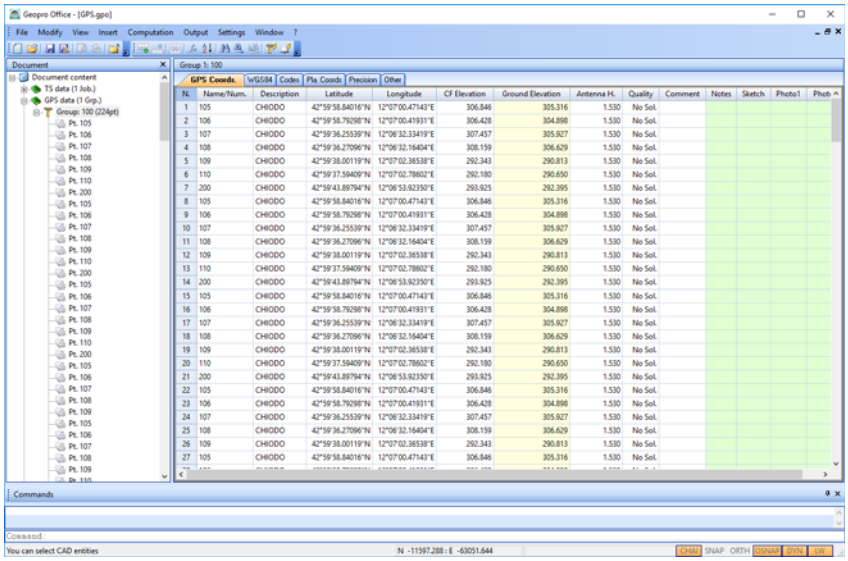


**Figure 62:**

The **GPS Point view** is associated to each point where the data associated with the point is summarized.

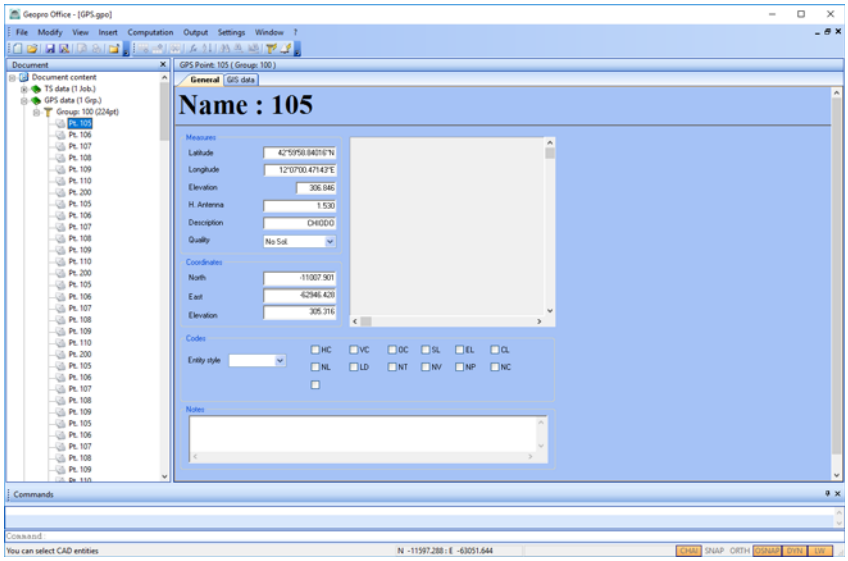



**Figure 63:**

Similar to the TS data, once the GPS data is edited, Orientation Points can be inserted.

# Change a GPS data

The GPS data can be changed using the commands found in the Modify menu or in the context menu activated by clicking the right mouse button on the booklet.

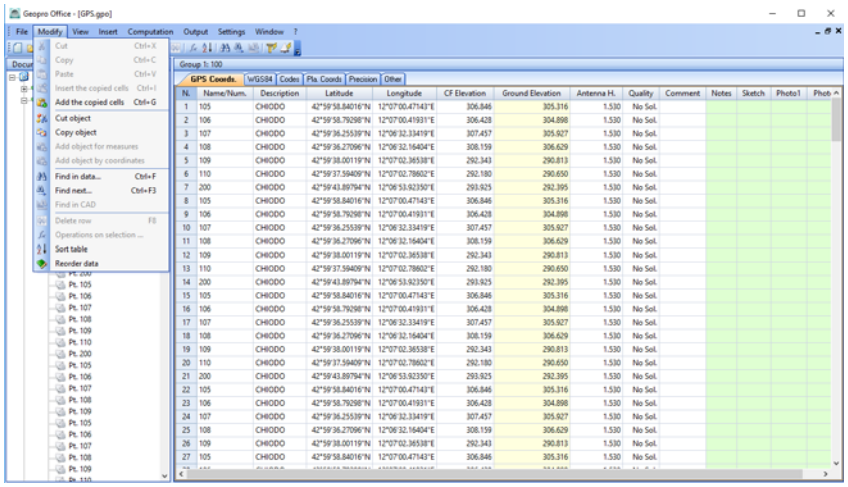


**Figure 64:**

Note that "Description of Modify Menu Commands" on page 47 has a brief description of the various functions included for changing and searching data.

# Elaborate a GPS data

The command to elaborate the GPS data is **Computation | Projection computation** activated from the **Groups View**.

This chapter will illustrate the functionality of the procedure referencing as an example "ExampleGps.fw1" in which various phases of the procedure are explained.

The image below shows the first window displayed by the procedure, used to:

-Indicate the Groups on which to run the calculation;

-Request elaboration of the TS data if present.

In this case, given that the GPS data has already been elaborated, to proceed the user must place a check mark in the **Cancel the computation** box and then press **Next>**.

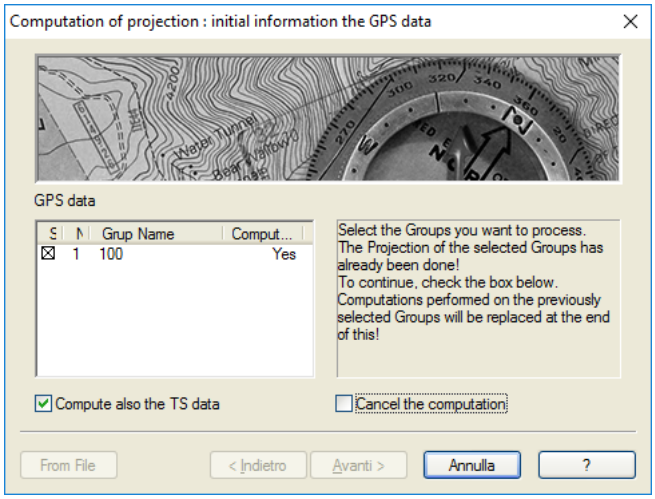



**Figure 65:**

Continuing in the guided procedure, a page will appear in which the user can insert certain options:

-Read from file: placing a check mark in this box will activate the edit box below and the "**...**" button used to select the file from which to take the values for the calculation.

-Pre-transformation Original Coordinates: if the measured GPS coordinates refer to a system other than WGS84 WGS 84.

-Computation options: placing a check mark in this box will activate the program to search various codes (HC, VC, OC, ...) needed for the elaboration.

-Print Options: placing a check mark in this box the user will have, at the end of the calculation, a printout of the layout calculation results.

In the example, the procedure was only asked to search codes automatically by selecting the specific check box.

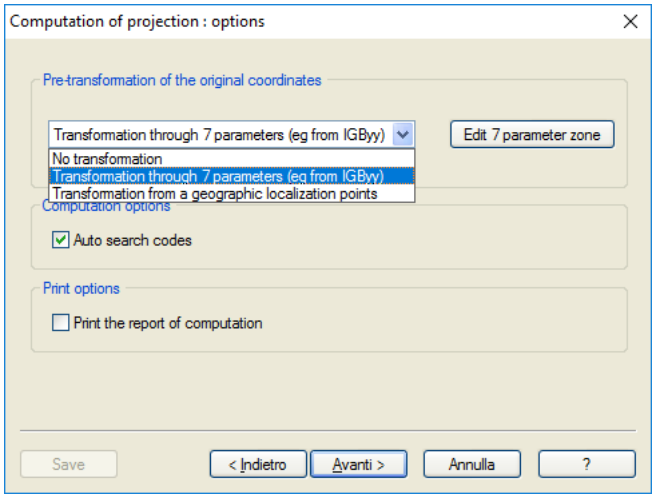



**Figure 66:**

Press the **Next>** button in the **Planimetric projection** and in the **Vertical projection** windows to respectively select the type of projection whether horizontal or vertical.

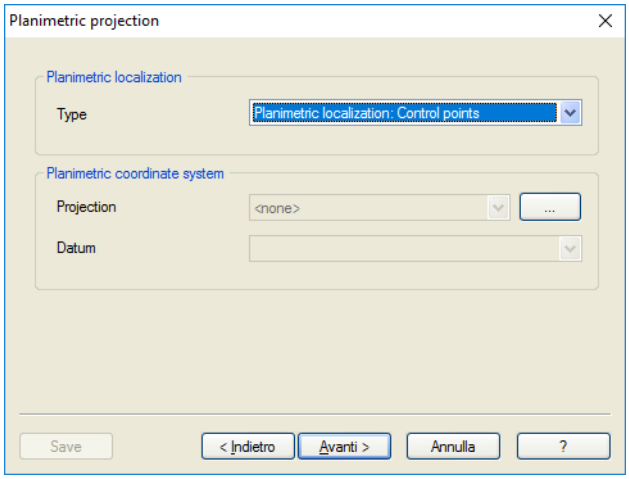



**Figure 67:**

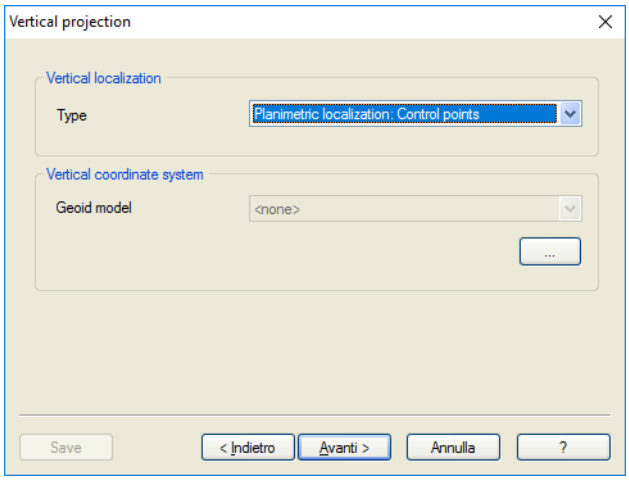



**Figure 68:**

Moving forward, a window will appear with the lists of points that have been coded HC automatically or by the user and their horizontal localization will run.

For this type of calculation, at least two GPS points are needed or, for mixed calculation, two celerimetric points whose coordinates are identified in the reference plane where all of the GPS Groups or selected TS Jobs points are to be roto-translated.

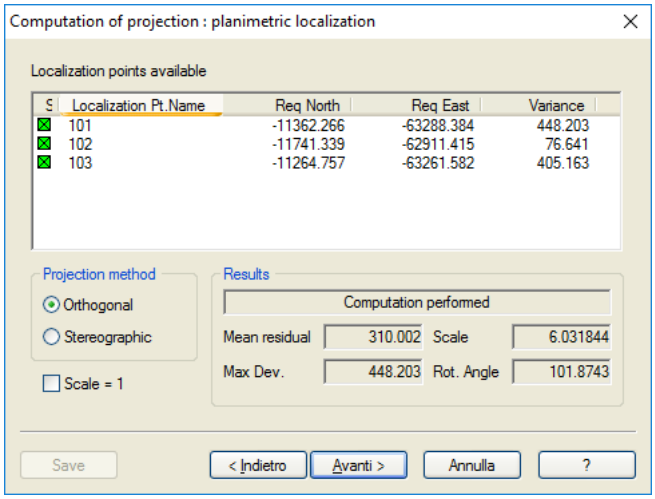



**Figure 69:**

Next is the vertical localization whose calculation will be run through the window shown below where all of the points coded VC automatically or by the user are listed.

For this type of calculation, at least one GPS point is needed whose quote is identified in the reference system in which the selected GPS Groups points are being calculated.

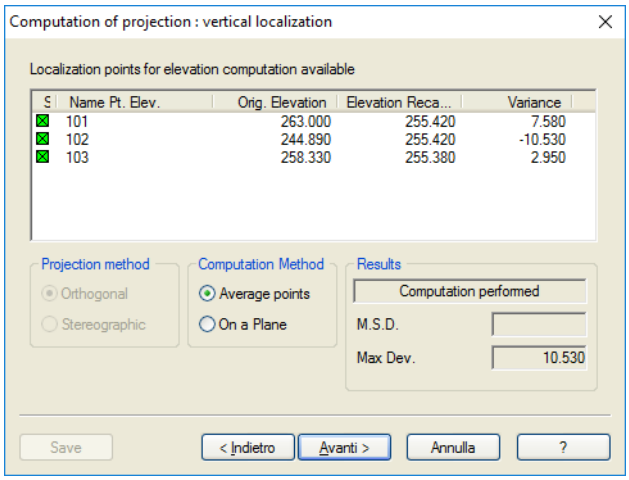



**Figure 70:**

Next, the program checks to see if the GPS data has already been elaborated. If so, then it checks for the presence of other entities in the file and displays a window where the user can select whether to change the position of the entities (roto-translate) based on the re-elaboration run previously.

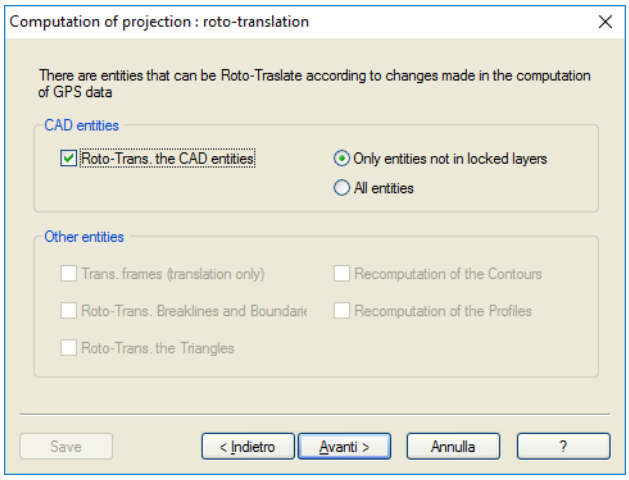



**Figure 71:**

At the end of the procedure, a last window will appear where the user must press the **Complete** button to run the real and true calculation of the points.

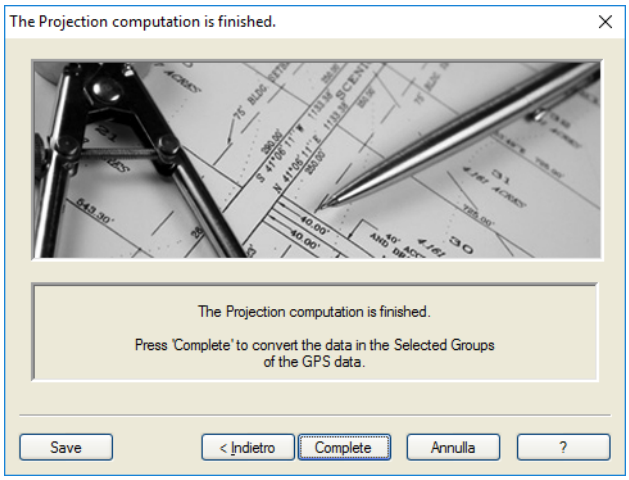



**Figure 72:**

# GPS data: output

Once the **GPS data** item is selected from the navigation tree, select the Output menu. The procedures in this menu are used to print the data found in the GPS data and the results of any elaborations executed.

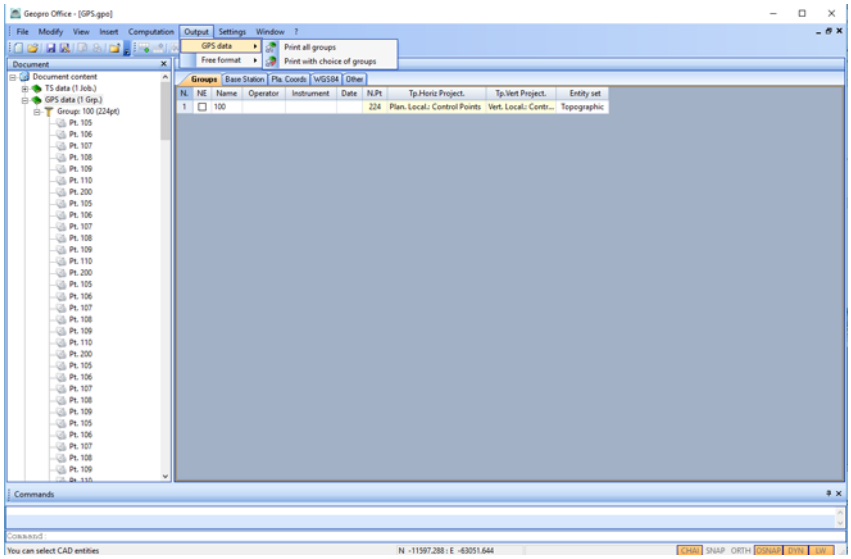


**Figure 73:**

Here following is a short description of the primary print functions:

- **Output Menu | GPS data | Print All Groups:** select this to print the measurement of all points.
- **Output Menu | GPS data | Print with Selected Groups:** executing this command the program will open a window allowing the user to select groups to print.
- **Output Menu | Free Format | Print All Groups:** select this to print all points found in the GPS groups.

- **Output Menu|Free Format|Print with Selected Groups:** executing this command the program will open a window allowing the user to select groups to print.

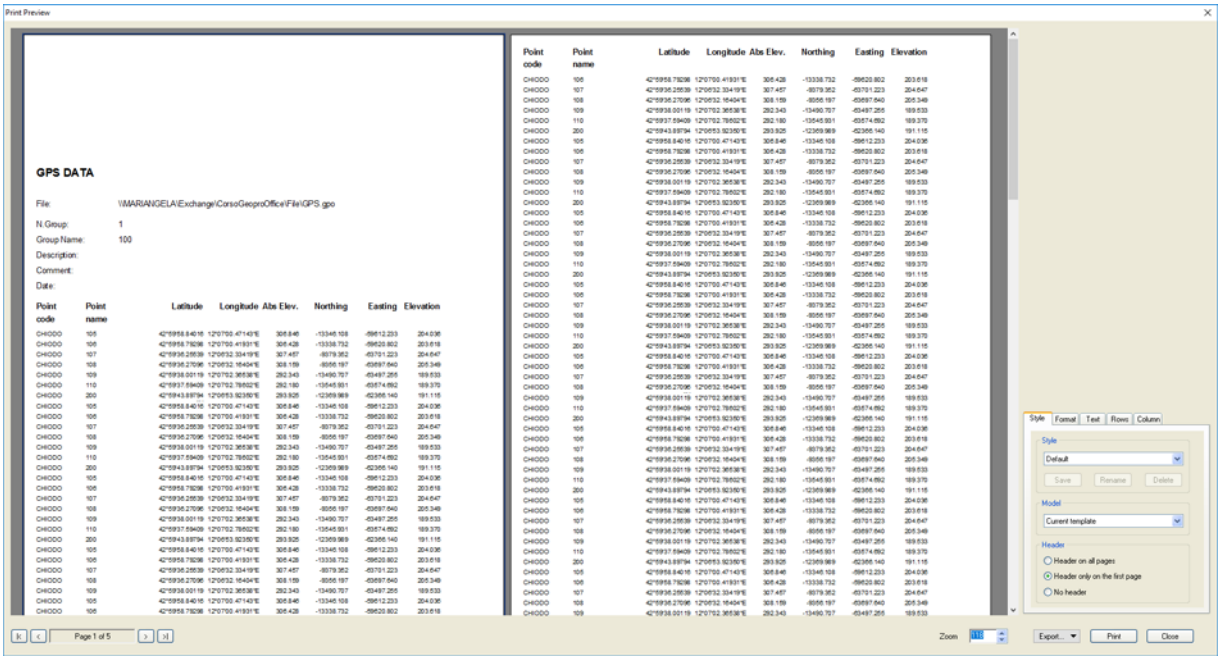



**Figure 74:**

# Print Component

Once the printing is activated, a print preview will appear that can be used to customize the printout.

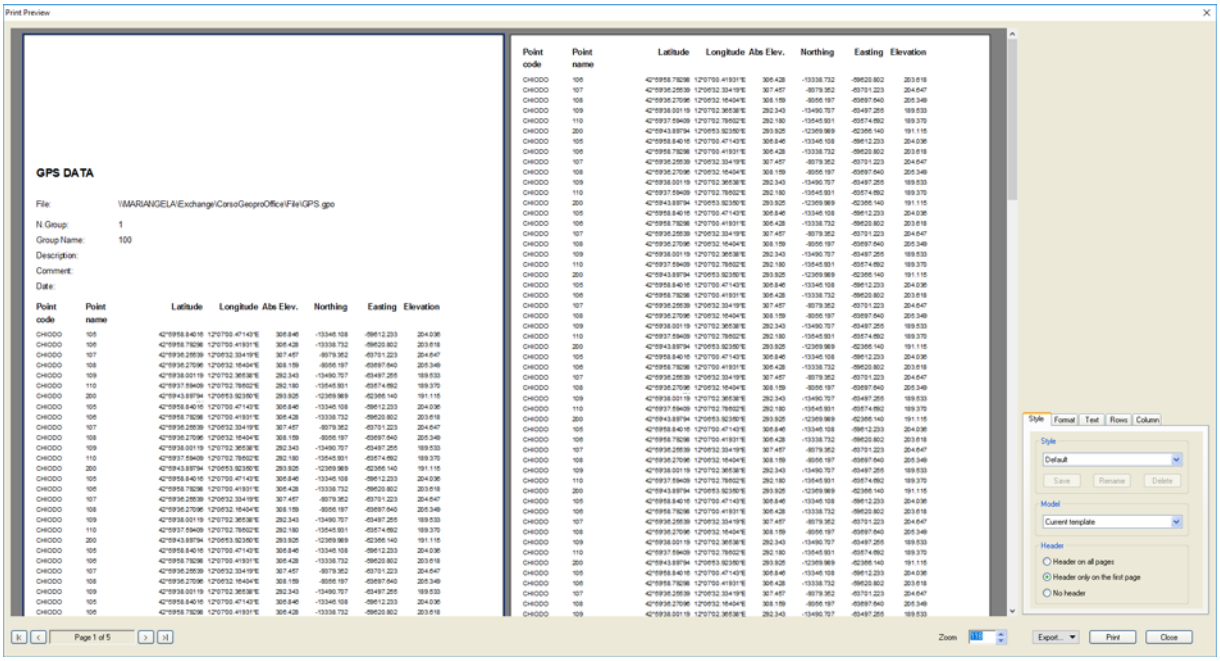



**Figure 75:**

The **Style** page allows the user to:

1.select the style;

2.select the model;

3.establish whether to insert the page heading of the document to print and, potentially in what manner.

In regard to the **Format** page, it has the following:

1.allows the user to set the margins (as in the old component) and establish the page orientation.

2.one element more than the old component which is whether or not to activate borders.

The Text page is used to select the various text entities from a navigation tree view and to modify its Font.

The Rows page and Columns page respectively allow the user to change the height of the lines and width of the columns of the entities selected from the navigation tree.

# Description of Modify Menu Commands

**Cut Function:** remove the selection from the active document (selected cells) and insert it into the clipboard; the function is active only if a cell or group of cells has been selected; select the line or cells to be cut, press CTRL+X or click on Cut from the Modify or Context menu.

**Copy Function:** copy the selection from the active document (selected cells) and insert it into the clipboard; the function is active only if a cell or group of cells has been selected; select the line or cells to be copied, press CTRL+C or click on Copy from the Modify menu.

**Paste Function:** paste the selection found in the clipboard of the active document, including the original content of the cells; the function is active only if a cell or group of cells has been selected; select the line or cell from where to copy the section of notes, press CTRL+V or click on Paste from the Modify menu.

**Insert Copied Cells Function:** insert the selection found in the notes in the active document. The original content of the cells will not be included but first a number of lines equal to that stored in the clipboard will be inserted and then the content of the clipboard itself will be copied onto these lines. The function is active only if a cell or group of cells has been selected; select the line or cell to precede the inserted lines and where the section of notes will be copied, press CTRL+I or click on Insert Copied Cells from the Modify menu.

**Add Copied Cells Function:** add the selection found in the clipboard in the active document. The original content of the cells will not be included but first a number of lines equal to that stored in the clipboard will be inserted and then the content of the clipboard itself will be copied onto these lines. The function is always active even when there are no lines present in the preselected view. If no lines or cells are selected, the new lines will be added to the end of the page, or after the last line found. Or, in the case of having no original lines, the necessary lines will be created. If instead, lines or cells are selected, the new lines will be added after the last selected. In any case, the content of the notes will be copied into these added cells. To execute the function, press CTRL+G or click on Add Copied Cells from the Modify menu.

**Cut Object Function:** this is used to cut one or more objects to bring them into other jobs/stations or other files. The objects that can be cut are stations and celerimetric points.

**Copy Object Function:** this is used to copy one or more objects to bring them into other files or jobs/stations. The objects that can be copied are jobs, stations and celerimetric points.

**Add Object for Measure Function:** this is used to add one or more copied/cut objects into other files or jobs keeping the measures constant. The objects that can be added for measure are jobs, stations and celerimetric points.

**Add Object for Coordinates Function:** this is used to add one or more copied/cut objects into other files or jobs keeping the coordinates constant. The objects that can be added for coordinates are celerimetric points.

**Find in data Function:** this procedure is used to find a Point in the data view; activating this function will open a window used to insert the Point Name or Code to search. The search can be done by Name, Code or both. Once the window is confirmed the program will search within the Points archive for the point with the desired characteristics. If the program finds it, it will open the section associated with the Station where the Point belongs and highlight this Point.

**Find Next Function:** this procedure is used to automatically repeat the search operation on a Point in the data view without having to reopen the window to insert data. This functionality can be very helpful when searching for another Point with the same Point Name and/or Code found previously by means of the Find in data function. This procedure can be launched even by simply pressing the F3 button on the keyboard.

**Find in CAD Function:** this procedure is used to find a Point in the CAD View. The procedure is activated after selecting the line corresponding to the desired point. The program will open the CAD environment and highlight this point by running a Pan operation, or it will bring the found point exactly to the center of the screen while keeping the previously selected zoom factor. If the CAD environment was already opened in another view, the program will be limited to running the Pan operation.

**Delete row Function:** this will eliminate lines (and Jobs, Stations or Points depending on the selected view). Once the procedure is launched, the line where the cursor is positioned or the selected lines will be eliminated. To select multiple lines from the grid, just click on the Number "N" field and keeping the left mouse button held down, drag the cursor over the next or previous lines. The selected lines will be highlighted.

Note that if the user attempts to eliminate a Job that includes at least one Station (or a Station that includes various Points) the program will notify the operator and request confirmation to continue. Note that the function can be executed even by pressing the F8 button on the keyboard.

**Operation on Selection Function:** this procedure is used to run operations or assignments to one or more cells in the data view grid. First of all, the user must select the group of cells to be used in the operations. Then the function to open the window is activated. Using this function the user can select the operation to run. The 4 arithmetic operations are possible, a fill operation and a renumbering operation. If an arithmetic operation is selected then the value to be used in the operation is input. Once the window is confirmed, the program will add, subtract, multiply or divide each value found in the selected cells with the value input into the specific field. The arithmetic operations are possible only in numeric field and not on any alpha-numeric.

If the **Fill** operation is selected, the program will substitute the content of each selected cell with the text inserted into the specific field. This operation is applicable to all fields present. Instead, selecting the Renumber operation, the beginning value must be inserted to be used for launching the renumbering. The program will substitute the content of the first cell selected with the beginning

value inserted and then will fill the selected cells underneath with those present. However, if the field is alphanumeric with the Name or Code, the initial value may also contain letters (ex.: P101); in this last case, the program will increase just the numeric part (ex.: P102, P103, ...).

**Sort Table Function:** this is used to shuffle the order that the Stations or Points (depending on the selected view) appear in the table. Once the procedure is launched, a window will appear used to insert the options for ordering. In particular, the user can select whether to order the entire table or only those selected lines. Also, the user can select to take into account or not any differences between capitals and lower case. In regard to the real and true ordering, the user can select up to three columns to apply the ordering. The desired fields will be selected for each column. Finally, the user can select whether to order in increasing or decreasing order.

**Reorder data Function:** this is used to reorder the TS data and/or the GPS data; the user can decide whether to reorder.

- Only the TS data,
- Only the GPS data,
- Both data, determining their priority.

For both data, the user can decide the initial name as well as the Stations (100,1000, 10.000, By choice) and the Points (Stat,+1, By choice); the VRS option is available only for the GPS data. To reorder only one data the user will activate the specific check box, telling the program to rename the entities with the same name as the other data.

Using the **Preview** button will display how the booklet will be changed.

Using the **Run** button will apply the changes shown in the preview.

**Join Duplicate Stations Function:** this is used to join celerimetric stations with the same name that may also be in different Jobs.

The **Preview** button displays the results from joining the stations.

The **Run** button will finalize the joining of the stations.

## TS Data Views

The TS Data is structured in one or more jobs associated with the stations with the respective measured points; the jobs are listed under the **Jobs** page and can be activated by selecting the **TS Data** node.

Each job can be associated with the following information:

- NAME (alpha-numeric);
- OPERATOR (alpha-numeric);
- INSTRUMENT (alpha-numeric);
- DATE (alpha-numeric);
- NUMBER of the STATIONS INCLUDED IN THE JOB (numeric);
- NUMBER of the TOTAL POINTS INCLUDED IN THE JOB (numeric).
- ENTITY SET: The **Entity set** are entities grouped by type.

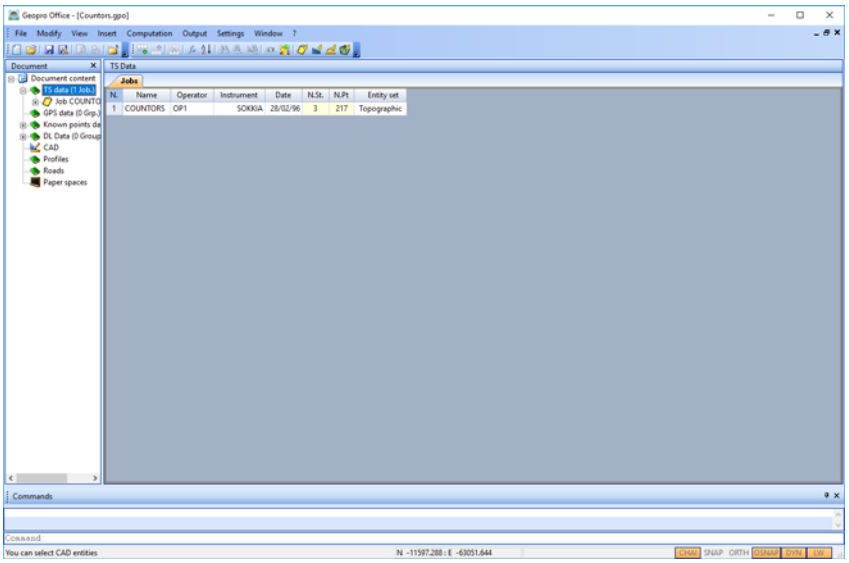



**Figure 76:**

Clicking in the "+" alongside the **TS Data** node in the navigation tree will display a list of the jobs included in the document; selecting a job will access the **Jobs** view that includes three pages:

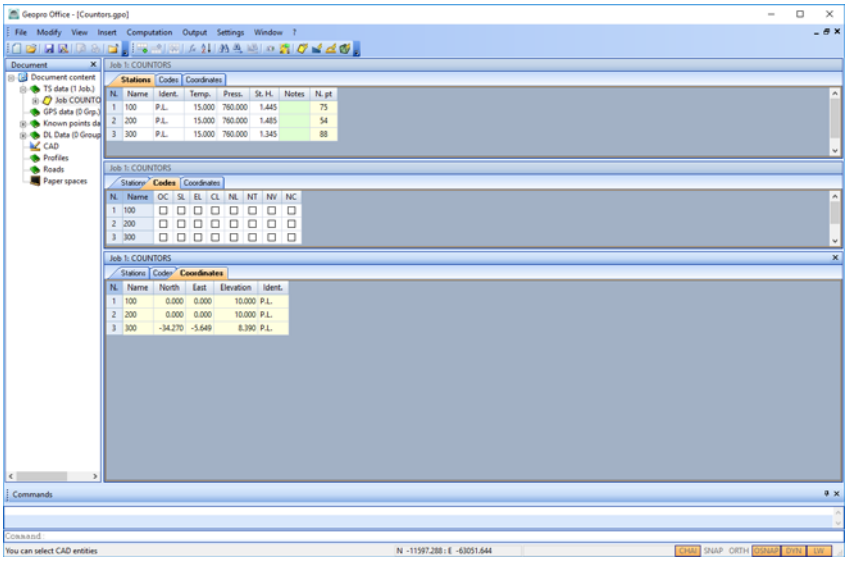


**Figure 77:**

1. The **Stations** page that includes the following data: station name, identification, temperature, pressure, instrument height and number of points seen by the station.

2. The **Codes** page where the first column displays the name of the station and the other columns display the list of codes that may be activated/deactivated using the check box. These codes are used for the celerimetric calculation as well as for other purposes.

3. The **Coordinates** that includes the station name, its coordinates and its associated description.

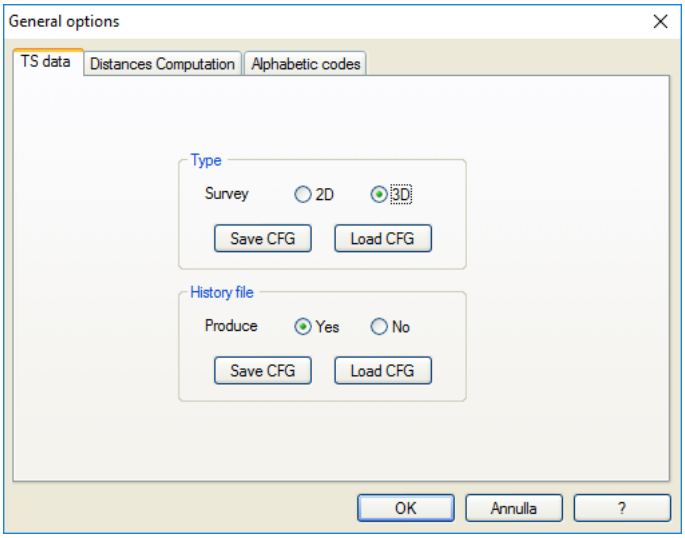



**Figure 78:**

Note that in these views the altimetric information (instrumental height for the **Stations** page and quote for the **Coordinates** page) will not be found if the Survey type option of the **Celerimetric** page in the **Options|General Options** command is set at 2D.

Extend the node corresponding to a job to list its stations.

Select the node corresponding to a Station to activate the **Station** view that also includes three pages that will display all of the information associated with the measured celerimetric points.

In particular, the **Measurements** page will display and allow modifications to the following data: name/number, prism height, slope distance, vertical angle, horizontal angle, prism type, prism constant, notes, sketch, photo1 and photo2.

In this case too, the altimetric information (**prism height** and **vertical angle**) will not be displayed if the Survey type option of the **Celerimetric** page in the **Options|General Options** command is set at 2D; besides this, the slope distance will be substituted by the horizontal distance.

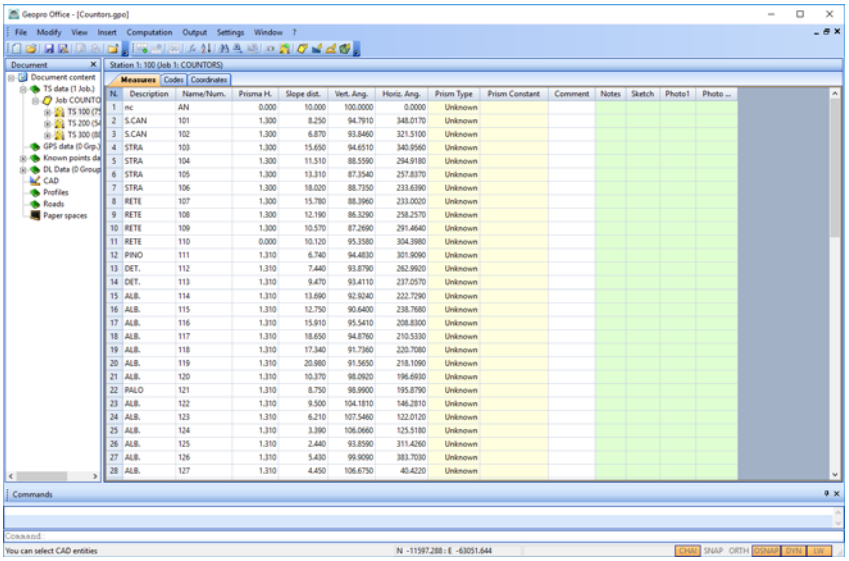


**Figure 79:**

The **Codes** page shows the description and name associated with the point; the following columns though can be used to:

1. identify the design model to associate with the point that can be created using the **Entity Appearance** command in the **Format** menu of the CAD View; if no design model is associated the standard one will be used;

2. identify the GIS theme created with the commands available in the **GIS** menu of the CAD View;

3. activate/deactivate the codes used by the program for the celerimetric calculation or for other purposes.

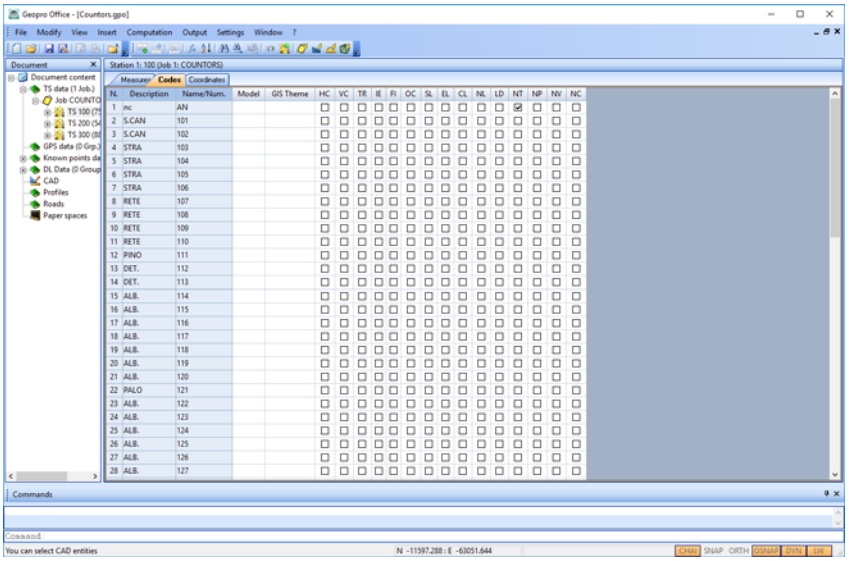


**Figure 80:**

Finally, the **Coordinates** page includes the data obtained from elaborating the measures (using the **Computation|Automatic Celerimetri**c command) including the point coordinates.

In this case too, the altimetric information will not be displayed if the Survey type option of the **Celerimetric** page in the **Options|General Options** command is set at 2D.

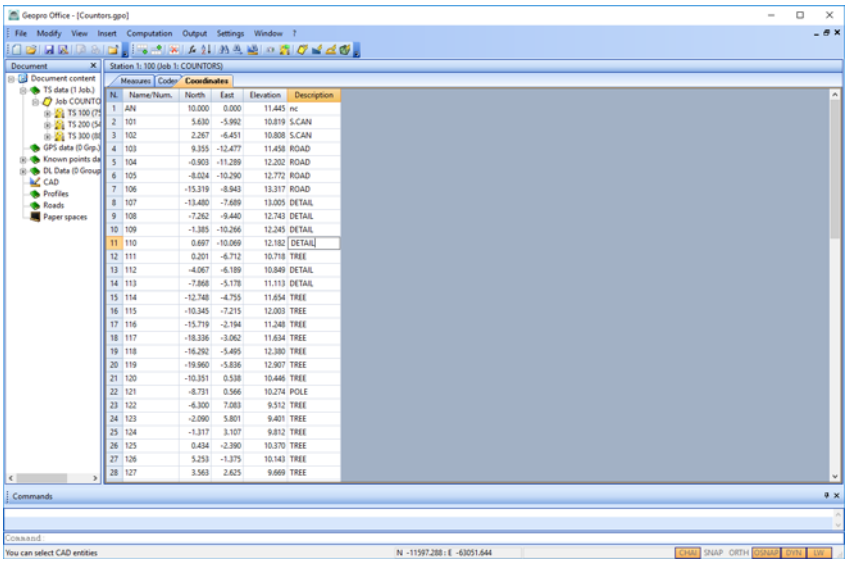


**Figure 81:**

Expanding the node of a **Station** in the navigation tree, all of the points measured from the station will be listed.

Selecting one of these points will display the **Celerimetric Point** view.

The **Celerimetric Point** is composed of two pages.

The first, called **General** includes all of the fields corresponding to the measurements, coordinates, codes, notes and any drafts associated with the point itself.

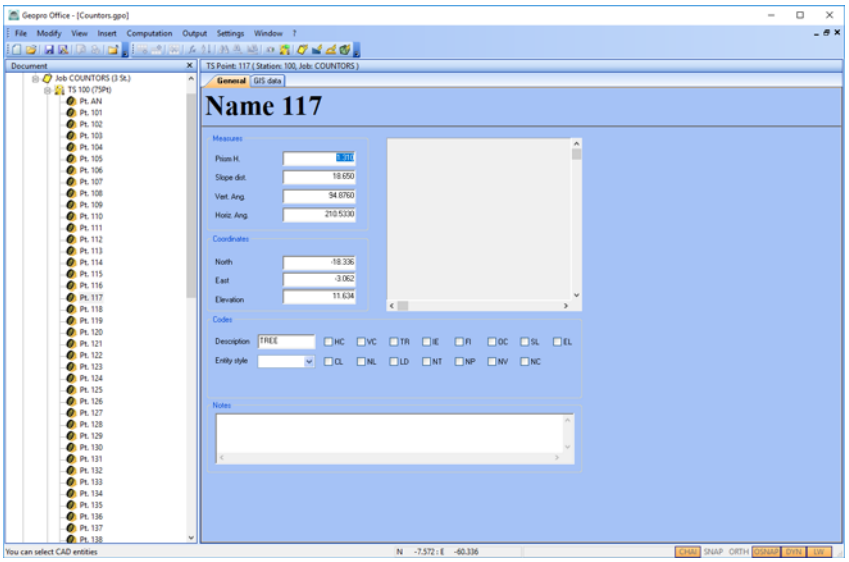



**Figure 82:**

The **GIS Data** page includes the GIS data associated with the point once the theme has been defined (in turn, once the theme is associated, it must be associated with a table).

To work on the GIS entities, proceed to the **CAD View** and use the commands found in the GIS menu.

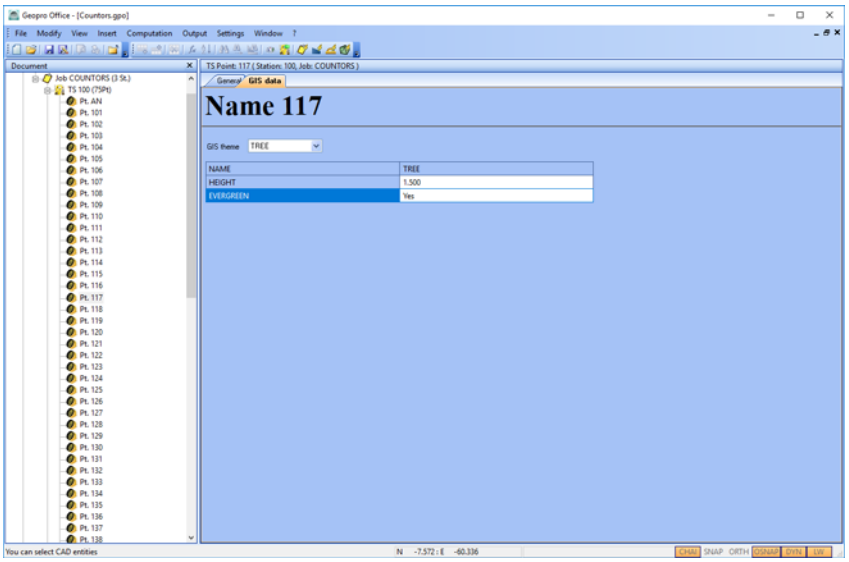



**Figure 83:**

# Creating TS Data Manually

The following sections describe how to create TS Data manually.

## Creating a job

To insert a job the user must:

1. Open the Jobs page from the navigation tree by clicking on the **TS Data** item.

2. Use the **Insert|Add Row** command to insert the first row and, once some lines have been added, insert a row under the current one. Another command that can be used (only if rows have already been inserted) is the **Insert|Insert Row** that is used to insert a row above the current one.

3. Added rows can be edited; each row corresponds to a job.

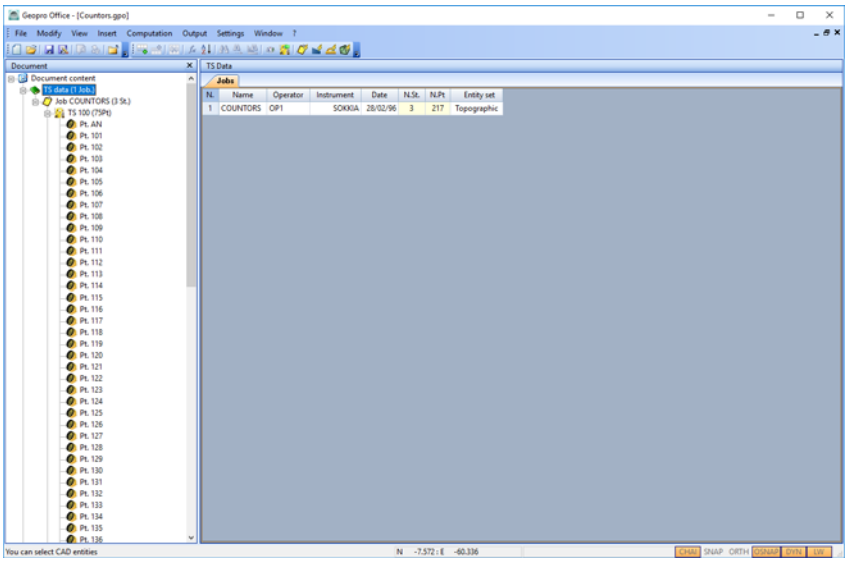



**Figure 84:**

## Creating a station

To insert a station click in the navigation tree on a job where it is to be added and work in the Jobs View using the commands available for inserting jobs. Each added row corresponds to a station.

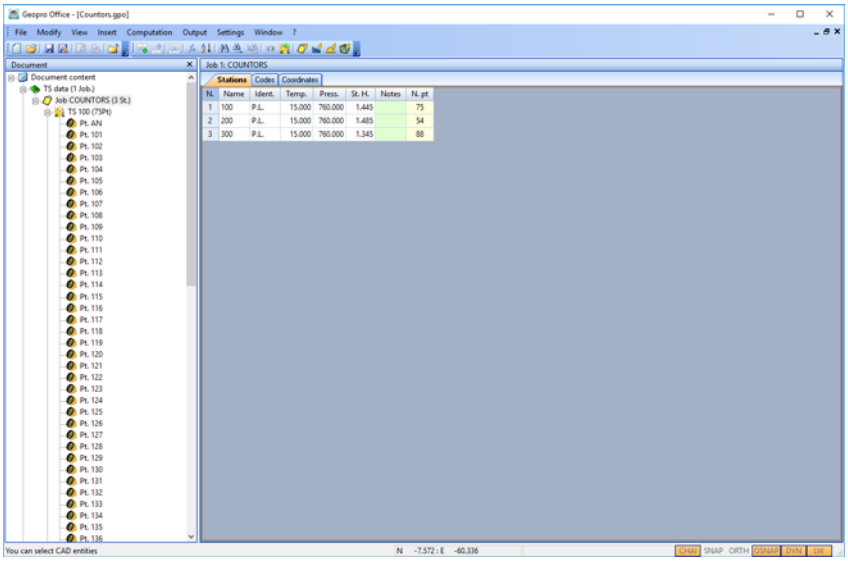


**Figure 85:**

# Creating a celerimetric point

To insert a celerimetric point, click in the navigation tree on a station where it is to be added and work in the Station View using the commands available for inserting stations and jobs. Each row corresponds to a celerimetric point.

Once the celerimetric point is inserted, its information can be edited using the specific grid or view activated by selecting it from the navigation tree (see the images below).

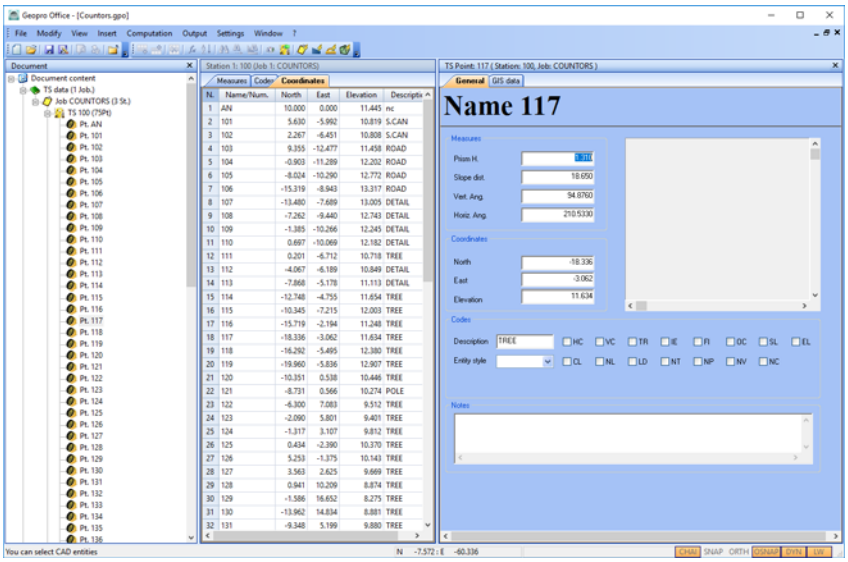



**Figure 86:**

To change the TS Data, commands are available from the **Modify** menu.

- **Cut Function:** remove the selection from the active document (selected cells) and insert it into the clipboard; the function is active only if a cell or group of cells has been selected; select the row or cells to be cut, press CTRL+X or click on Cut from the Modify or Context menu.

- **Copy Function:** copy the selection from the active document (selected cells) and insert it into the clipboard; the function is active only if a cell or group of cells has been selected; select the row or cells to be copied, press CTRL+C or click on Copy from the Modify menu.

- **Paste Function:** paste the selection found in the clipboard of the active document, overwriting the original content of the cells; the function is active only if a cell or group of cells has been selected; select the row or cell from where to paste the clipboard, press CTRL+V or click on Paste from the Modify menu.

- **Insert Copied Cells Function:** insert the selection found in the clipboard in the active document. The original content of the cells will not be overwritten but first a number of rows equal to that stored in the clipboard will be inserted and then the content of the clipboard will be copied onto these rows. The function is active only if a cell or group of cells has been selected; select the row or cell to precede the inserted lines and where the section of the clipboard will be copied, press CTRL+I or click on Insert Copied Cells from the Modify menu.

- **Add Copied Cells Function:** add the selection found in the clipboard in the active document. The original content of the cells will not be overwritten but first a number of rows equal to that stored in the clipboard will be inserted and then the content of the clipboard will be copied onto these rows. The function is always active even when there are no rows present in the preselected view. If no rows or cells are selected, the new rows will be added to the end of the page, or after the last row found. Or, in the case of having no original rows, the necessary rows will be created. If instead, rows or cells are selected, the new rows will be added after the last selected. In any case, the content of the clipboard will be copied into these added cells. To execute the function, press CTRL+G or click on Add Copied Cells from the Modify menu.

- **Cut Object Function:** this is used to cut one or more objects to bring them into other jobs/stations or other files. The objects that can be cut are stations and celerimetric points. For each cut object, all of the information associated with it is stored (except for the GIS data which will be lost) and not just the information selected during execution of the command. Once the command has been executed, the objected copied can be brought to other jobs/stations/groups and files using the commands **Add Object for Measure** or **Add Object for Coordinates**. For known coordinate points, the command is **Add Object** since there is no distinction between the addition for measure or for coordinates.

- **Copy Object Function:** this is used to copy one or more objects to bring them into other files or jobs. The objects that can be copied are jobs, stations and celerimetric points. For each copied object, all of the information associated with it is stored (except for the GIS data which will be lost) and not just the information selected during execution of the command. Once the command has been executed, the objected copied can be brought to other jobs/stations/groups and files using the commands **Add Object for Measure** or **Add Object for Coordinates**. For known coordinate points, the command is **Add Object** since there is no distinction between the addition for measure or for coordinates.

- **Add Object for Measure Function:** this is used to add one or more copied/cut objects into other files or jobs keeping the measures constant. The objects that can be added for measure are jobs, stations and celerimetric points. For known coordinate points, the corresponding command is **Add Object** since there is no distinction between the addition for measure or for coordinates.

- **Add Object for Coordinates Function:** this is used to add one or more copied/cut objects into other files or jobs keeping the coordinates constant. The objects that can be added for coordinates are celerimetric points. For known coordinate points, the corresponding command is **Add Object** since there is no distinction between the addition for measure or for coordinates.

- **Find in data Function:** this procedure is used to find a Point in the data view; activating this function will open a window used to insert the Point Name or Code to search. The search can be done by Name, Code or both. Once the window is confirmed the program will search within the Points archive for the point with the desired characteristics. If the program finds it, it will open the section associated with the Station where the Point belongs and highlight this Point.

- **Find Next Function:** this procedure is used to automatically repeat the search operation on a Point in the data view without having to reopen the window to insert data. This functionality can be very helpful when searching for another Point with the same Point Name and/or Code found previously by means of the Find in Data function. This procedure can be launched even by simply pressing the F3 button on the keyboard.

- **Find in CAD Function:** this procedure is used to find a Point in the CAD View. The procedure is activated after selecting the line corresponding to the desired point. The program will open the CAD environment and highlight this point by running a Pan operation, or it will bring the found point exactly to the center of the screen while keeping the previously selected zoom factor. If the CAD environment was already opened in another view, the program will be limited to running the Pan operation.

- **Delete row Function:** this will eliminate rows (and therefore Jobs, Stations or Points depending on the selected view). Once the procedure is launched, the row where the cursor is positioned or the selected rows will be eliminated. To select multiple lines from the grid, just click on the Number "N" field and keeping the left mouse button held down, drag the cursor over the next or previous lines. The selected lines will be highlighted.

Note that if the user attempts to eliminate a Job that includes at least one Station (or a Station that includes various Points) the program will notify the operator and request confirmation to continue. Note that the function can be executed even by pressing the F8 button on the keyboard.

- **Order Table Function:** this is used to shuffle the order that the Stations or Points (depending on the selected view) appear in the table. Once the procedure is launched, a window will appear used to insert the options for ordering. In particular, the user can select whether to order the entire table or only those selected lines. Also, the user can select to take into account or not any differences between capitals and lower case. In regard to the real and true ordering, the user can select up to three columns to apply the ordering. The desired fields will be selected for each column. Finally, the user can select whether to order in increasing or decreasing order.

- **Operation on Selection Function:** this procedure is used to run operations or assignments to one or more cells in the data view grid. First of all, the user must select the group of cells to be used in the operations. On function activation a a window will be shown. Using this dialog the user can select the operation to run. The 4 arithmetic operations are possible, a fill operation and a renumbering operation. If an arithmetic operation is selected then the value to be used in the operation is input. Once the window is confirmed, the program will add, subtract, multiply or divide each value found in the selected cells with the value input into the specific field. The arithmetic operations are possible only in numeric field and not on any alpha-numeric. If the Fill operation is selected, the program will substitute the content of each selected cell with the text inserted into the specific field. This operation is applicable to all fields present. Instead, selecting the Renumber operation, the beginning value must be inserted to be used for launching the renumbering. The program will substitute the content of the first cell selected with the beginning value inserted and then will fill the selected cells underneath with those present. However, if the field is alphanumeric with the Name or Code, the initial value may also contain letters (ex.: P101); in this last case, the program will increase just the numeric part (ex.: P102, P103, ...).

# Importing Data from Instrument

Using the command **Insert|Data Instrument...** menu, the user can import the data stored in the instrument.

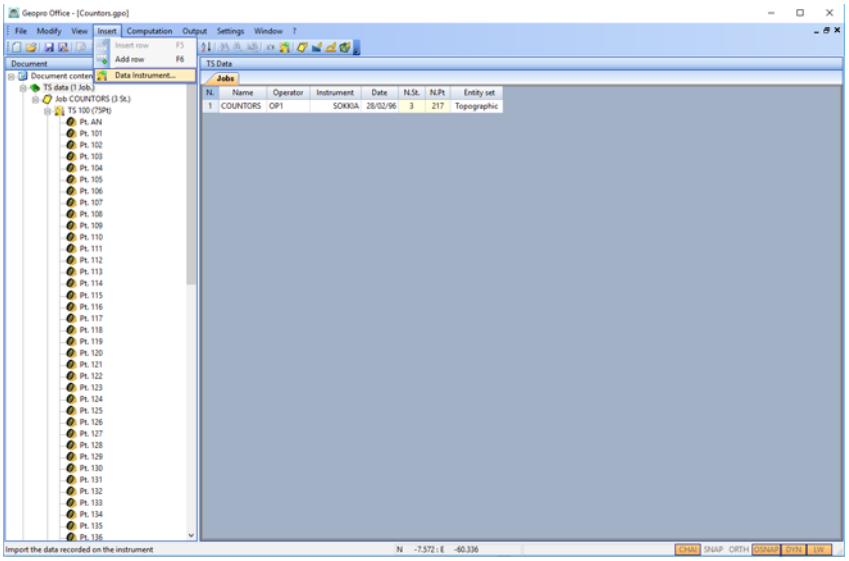


**Figure 87:**

The procedure will display existing profiles upon launch.

Profiles can be selected for any changes or to directly run the data transfer operation by pressing the **Import** button.

The **Details** button will display the profile characteristics, while the **Large Icons** button will return to displaying only the icons.

The program allows setting a profile as Default, so that upon subsequent launches of the procedure, this appears selected.

A profile can be Eliminated or Renamed by using the commands available in the menu activated by selecting the profile and pressing the right mouse button.

If profiles have not yet been created or new ones must be generated just select the New Icon and progress to the next page by pressing the **Forward** button.

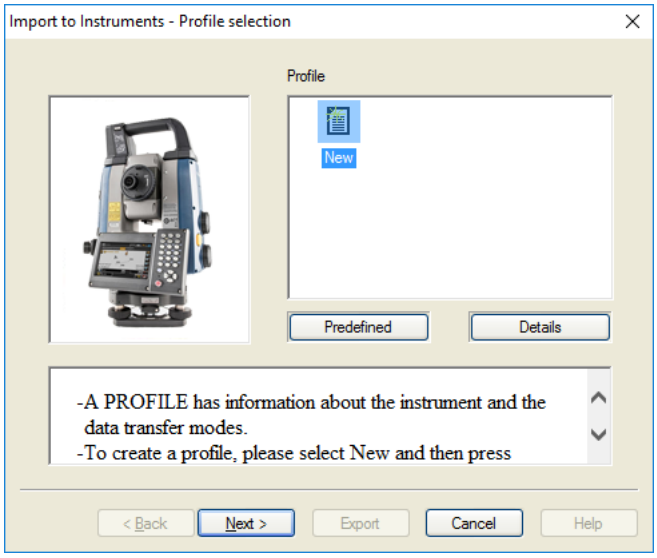



**Figure 88:**

In the next window the user must select the brand and model of the instrument used.

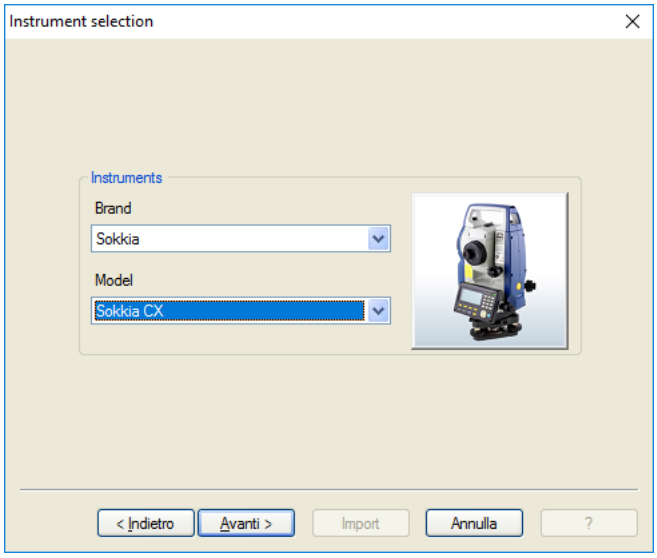



**Figure 89:**

Once the instrument is selected, the data download speed (for those instruments that allow it) and the serial port used for the connection from the instrument to the computer must be set.

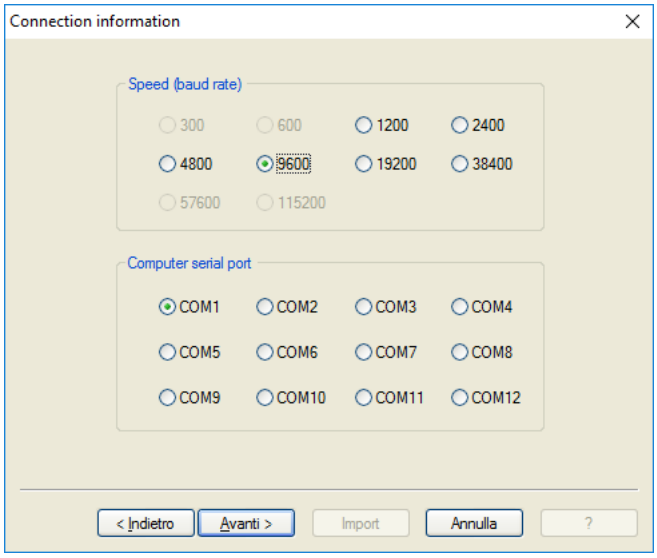



**Figure 90:**

On the next page the type of conversion must be indicated: Convert, No Convert, Ask the user whether to convert.

These options are used to decide whether to automatically insert or not the data imported from the instrument into the TS Data or to have a window appear for the selection.

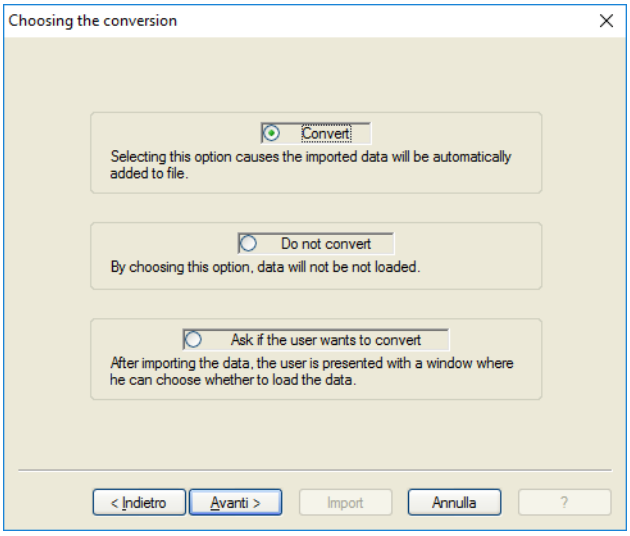



**Figure 91:**

The next window displays the list of existing profiles and allow saving of the just created profile; once the profile is saved, the user can return to the previous pages to change the profile settings, but cannot return to the selection of the instrument.

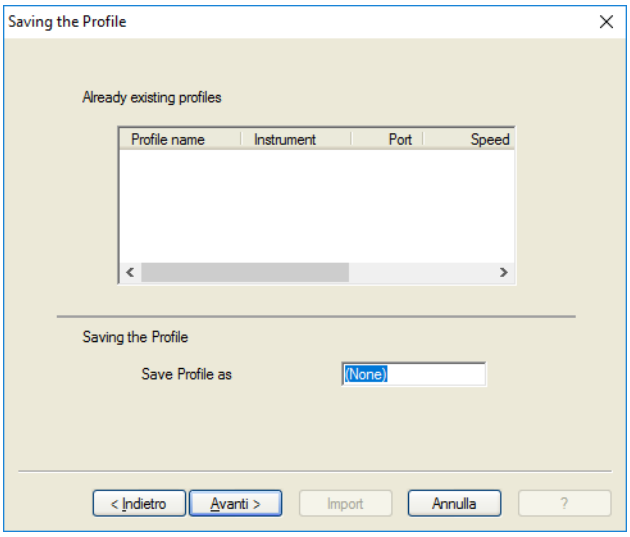



**Figure 92:**

At this point the program will display a series of windows showing the user all of the steps necessary to run the setting of the instrument to execute the proper data import. The image below shows the window if the instrument is SOKKIA SET.

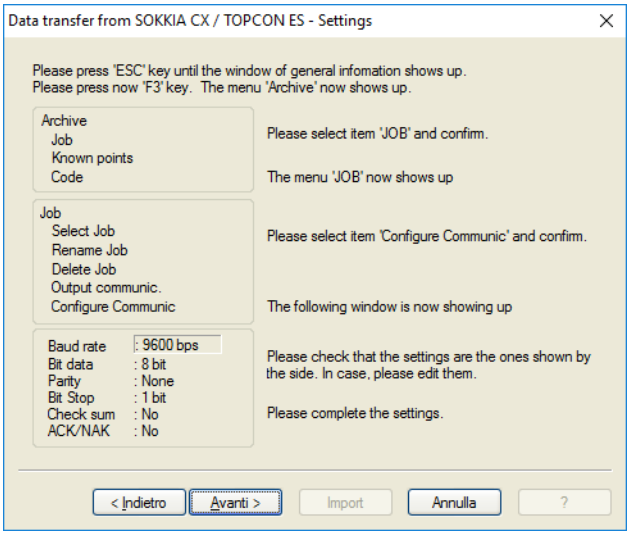



**Figure 93:**

The last page shows the result of the transmission; if it was not successful the user can retry by pressing the **Retry** button; the causes may be:

- The correct serial port was not selected;
- Another program is using the selected port;
- The import parameters were not properly set;
- The instrument's cable is not functioning.

At the end of the import the data can be saved in the format received; furthermore, if the convert imported data was selected, the result of the import can be seen directly in the TS Data view.

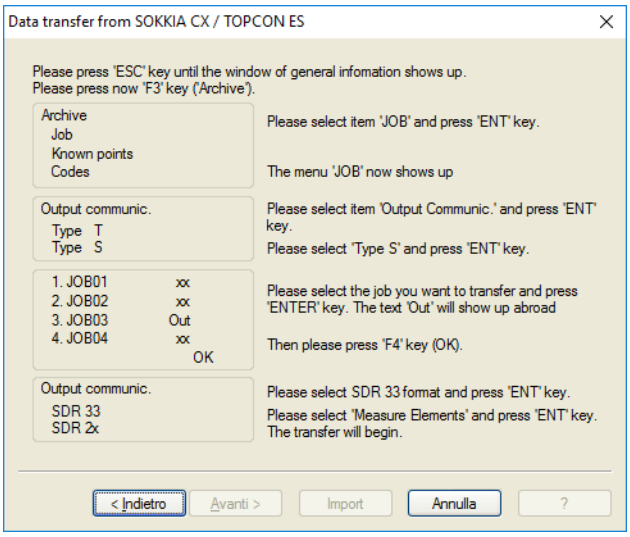



**Figure 94:**

# File Menu|Import Command

Once the command is selected, a drop down menu will appear with the name of the file formats that can be converted.

The currently supported formats are: Topcon (.SRC), GTS-500-600-700-800/AP-L1/GMT 100 (.GT7), GPT-7000 (.TLSV), Sokkia (.SDR).

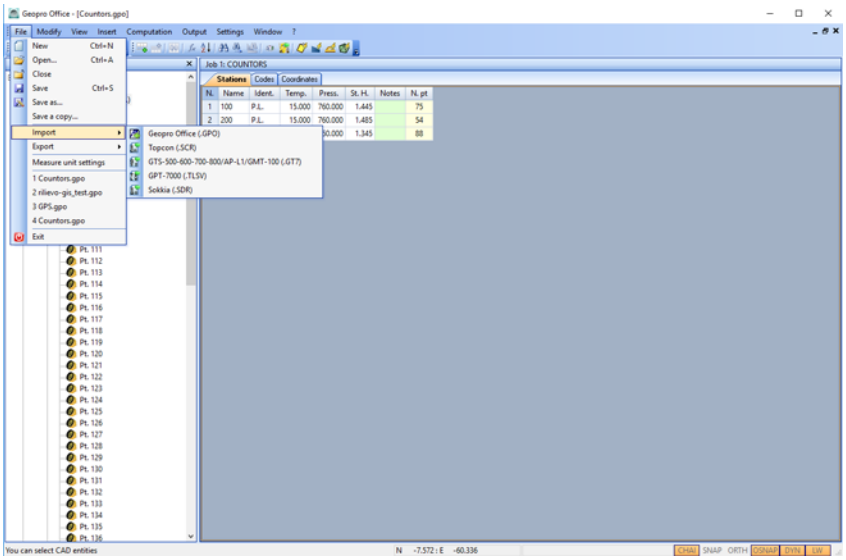



**Figure 95:**

# Celerimetric Computation

The program offers a guided procedure for running the Celerimetric Computation (Computation |Automatic Celerimetric command) requiring a minimal intervention from the user thanks to the following elements:

1. Have available a series of codes to assign to the detail points;

2. Be able to automate code recognition;

3. Be able to interrupt, restart and change the calculation at any moment.

The **Computation |Automatic Celerimetric** procedure includes the following steps:

## Step 1 - Select the Job to Elaborate

The **Initial Information** window is associated with this step, highlighting the jobs included in the document; for each job, the program indicates the number, name and status of elaboration.

If a job with a **Yes** elaboration status has been selected, the item **Cancel the computation** is activated and the **Forward** button is deactivated. In this case the associated box must be checked to reactivate this button and allow continuation of the elaboration.

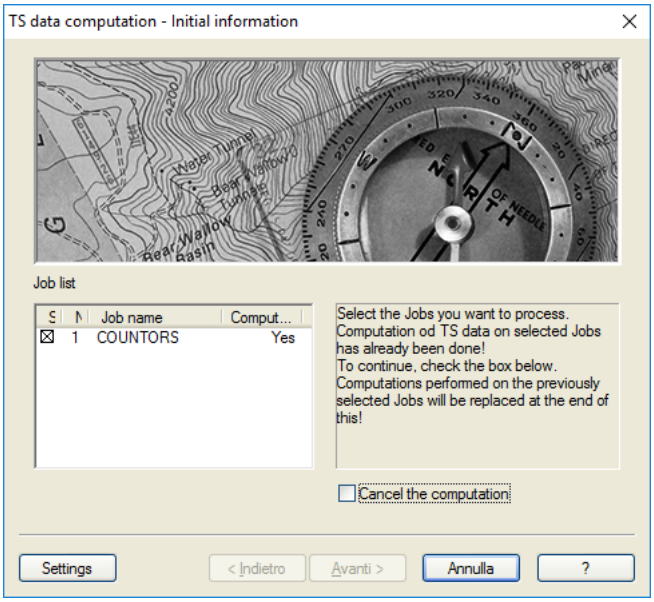



**Figure 96:**

The **Settings** button can be found in the lower left which will open the **Computation Options** window where the user can select:

•Whether to use the automatic code search;

•How to elaborate the points with same names, deciding whether or not to run an average of the points belonging to the same station.

•Whether to run verifications of the tolerances during elaboration.

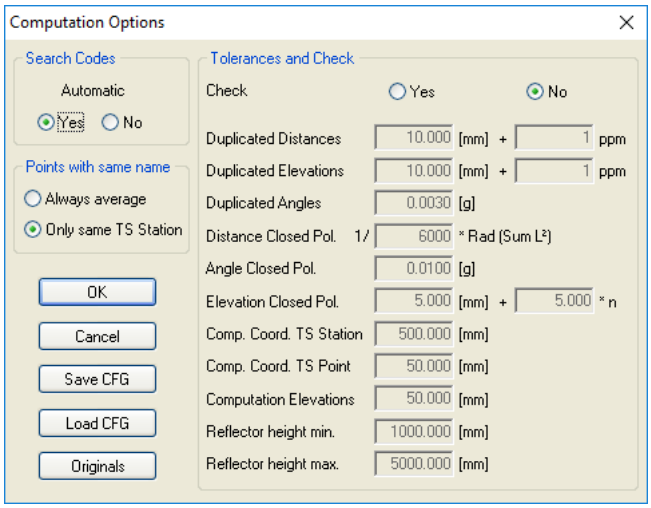



**Figure 97:**

## Step 2 - Preliminary Verification of Prism Heights

If the tolerances control is activated, press the **Forward>** button to open the **Show Intermediate Results** window where the user can check the prism heights.

The window can be extended to the entire screen using the **Expand** button.

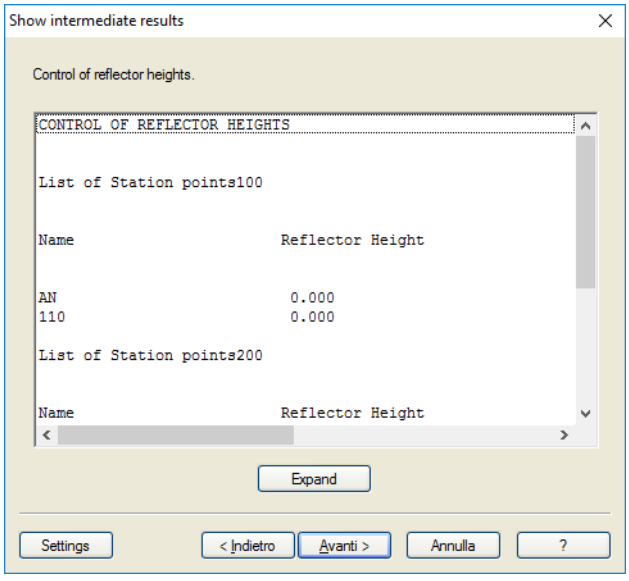



**Figure 98:**

## Step 3 - Data Analysis

In this step the program displays the results of the Points or Stations analysis found in the selected jobs, required for the calculation using the **Analysis of data** window.

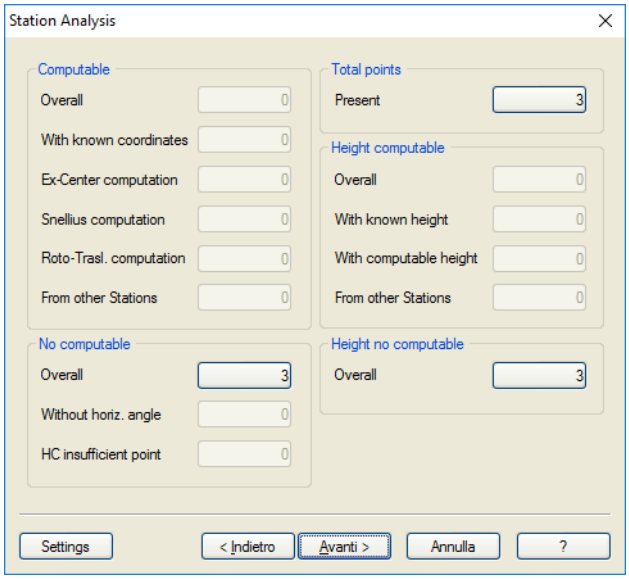



**Figure 99:**

## Step 4 - Calculating Double Points and Polygonals

In this step the program tracks the Points with the same **Code** and **Name**, belonging to the same Station or Stations with the same name, considering them double. This indicates that during the calculation the coordinates and quote calculated for each of these points will be averaged among them.

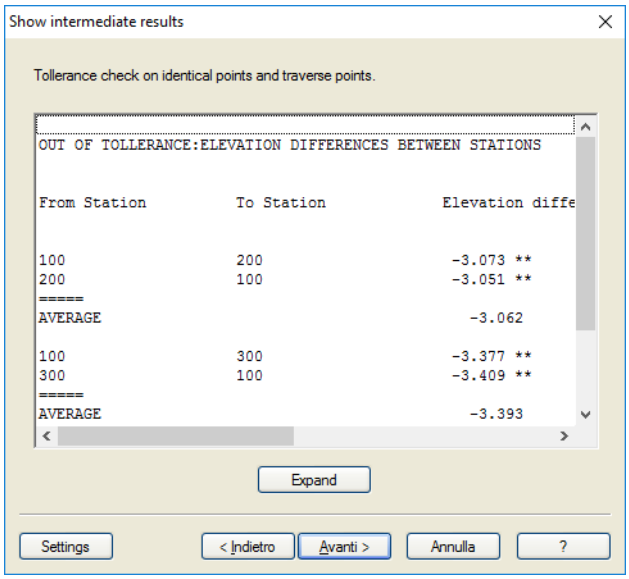



**Figure 100:**

Also, the out of tolerances associated with the distances reflected for the polygonal points are checked.

Only if the tolerances have been activated and if out of tolerance values have been found, the program will display these values.

## Step 5 - Preliminary Calculation of Station Azimuth

The calculation of the azimuth corrections for the duplicate stations is displayed separating the duplicate Stations with the shared Points from those without shared Points.

For each one, the associated job number, station number, reference station number, job number associated with the reference station and finally the azimuth correction are indicated.

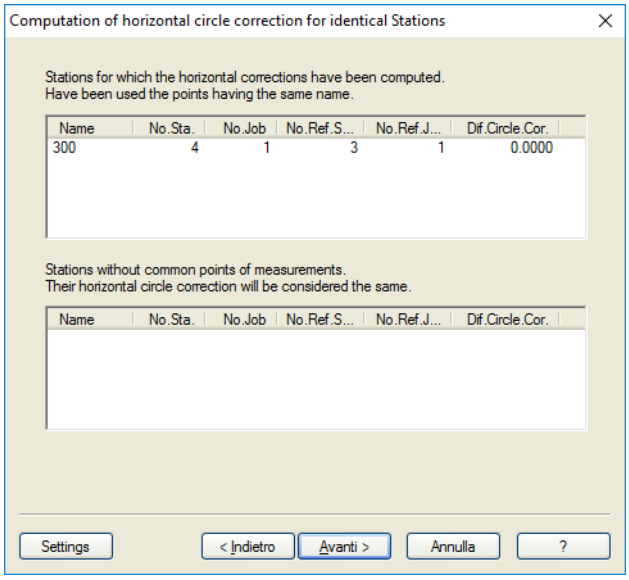



**Figure 101:**

## Step 6 - Station Analysis

All of the orientations of the Stations to elaborate are searched in the station analysis.

At the end of these search operations, the program will display a window showing the orientable and quotable stations.

Any non-found stations are also shown in the window.

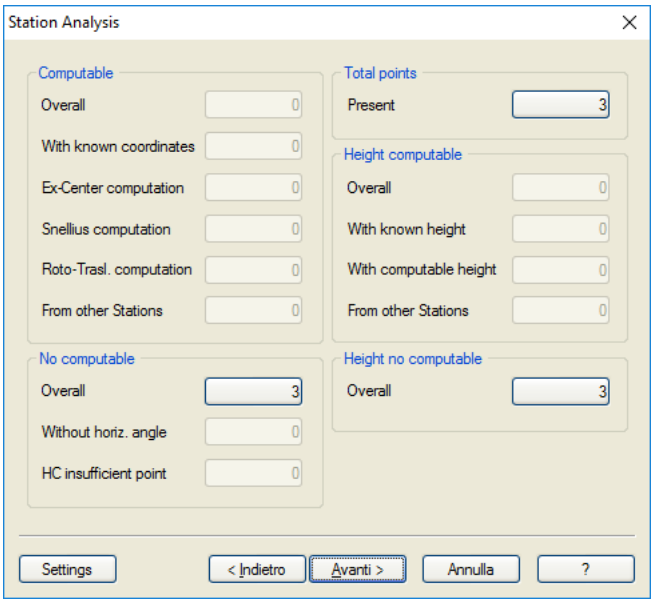



**Figure 102:**

## Step 7 - Option for the next computation

In step 7 the program requires options to be used in continuing the calculations.

In regard to the significance of the various options, for example it will be possible to orient the Stations from HC points using the Snellius or Ex-Centro methods automatically or interactively. Furthermore, it is possible to decide whether to print the results or not.

If the data found in the document allow it, the user can select whether to run the Roto-Translation calculation or not.

The print option or simply viewing the results can be activated even just for the polygonal calculation results and for the final station orientation.

Other options allow on screen inserting of the orientation or quote of the individual Stations. Another offer the possibility of waiving the quote calculation.

The last choice involves whether or not to run the Rigorous Layout or Altimetric Compensation.

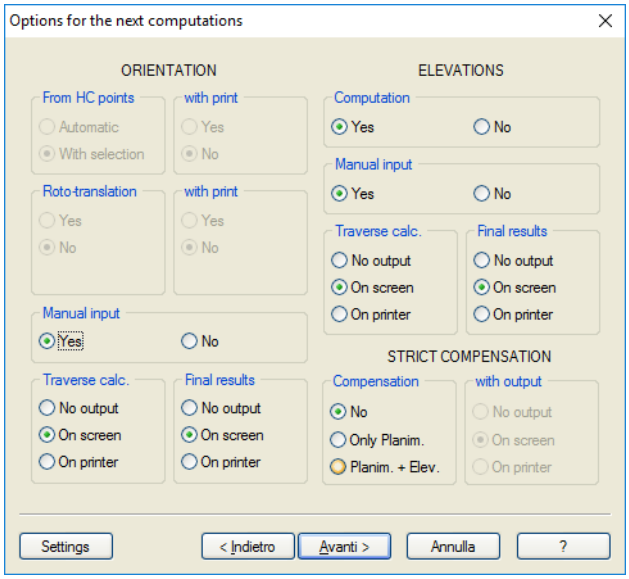



**Figure 103:**

## Step 8 - Station Orientation Analysis

Calculation of the station orientation uses the Ex-Centro or Snellius methods and will be run only if the data allow this kind of calculation.

For each station, a window will appear where the user can select the method to use.

The functionality of this window depends on the selections made in the previous window.

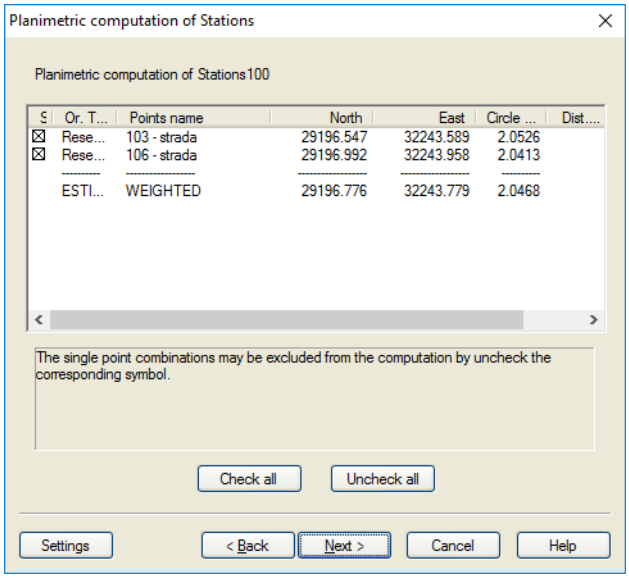



**Figure 104:**

# Step 9 - Roto-Translation Calculation

The roto-translation calculation includes orientation of one or more stations simultaneously.

Even in this case, the calculation will be run only if the data allow it.

In this window the list of orientation points is displayed and it is possible to select which one to exclude from the calculation.

The calculation can be obtained in two different modes:

-Fixed: the transformation is done by setting the orientation point with the highest reliability value rotating the plane until it aligns with another point that, among those remaining, has the highest reliability value.

-Least square: this minimizes the squares of the distances between the real coordinates of the various orientation points and their coordinates calculated in the false reference system where the various Stations were initially oriented. The user can decide whether to force the scale factor equal to 1 or whether to allow the program to factor the calculation.

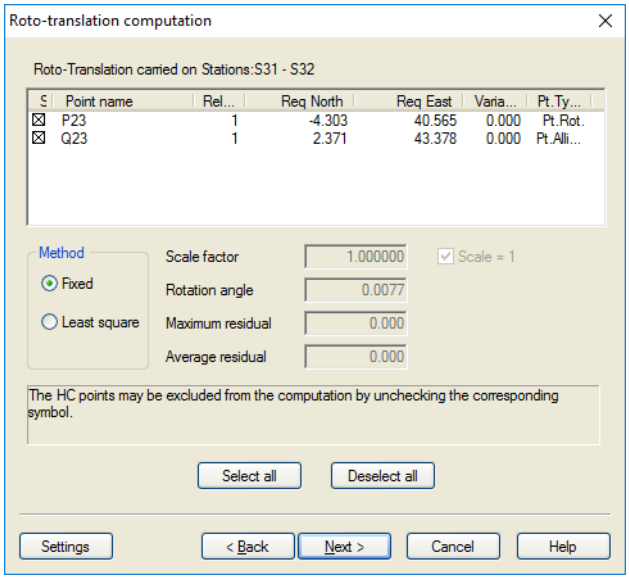



**Figure 105:**

# Step 10 - Station Quote Calculation

The program is able to calculate the Stations quotes by means of the QU Points.

Any out of tolerances are displayed if the associated option has been activated, otherwise no window is displayed.

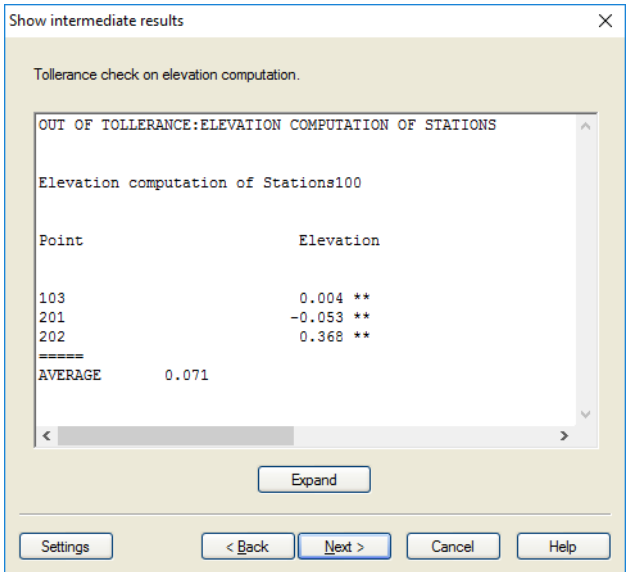



**Figure 106:**

## Step 11 - Inputting Data from Keyboard

This step is run from the program only when the option to input the orientation of one or more Stations from the keyboard has been selected.

Also, the program displays the list of Stations that can be selected to assign the values from the keyboard.

To assign typed data to the Station, the user must press the **Assign values** button.

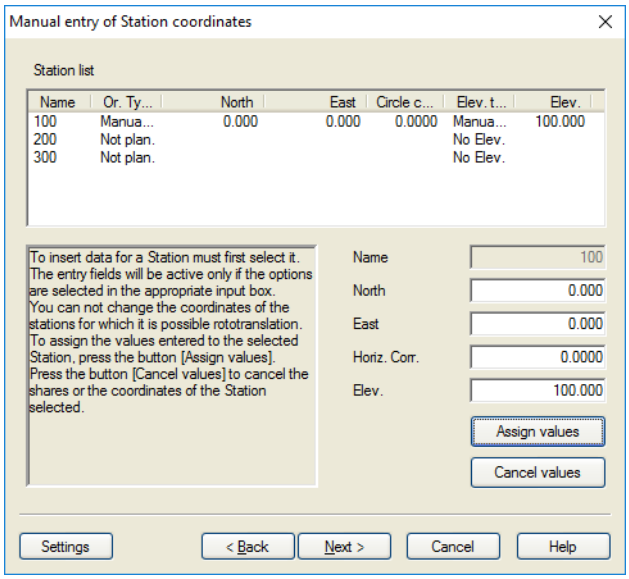



**Figure 107:**

# Step 12 - Polygonal Calculation

To run orientation of the Stations in polygonal two Stations must "see" each other, that is, the two respective horizontal angles must be measured.

If outcomes for Step 7 of the procedure have been set for display, the program will display the results of the calculation in this window.

For each calculated polygonal, the angular tolerance and closure line values are also displayed.

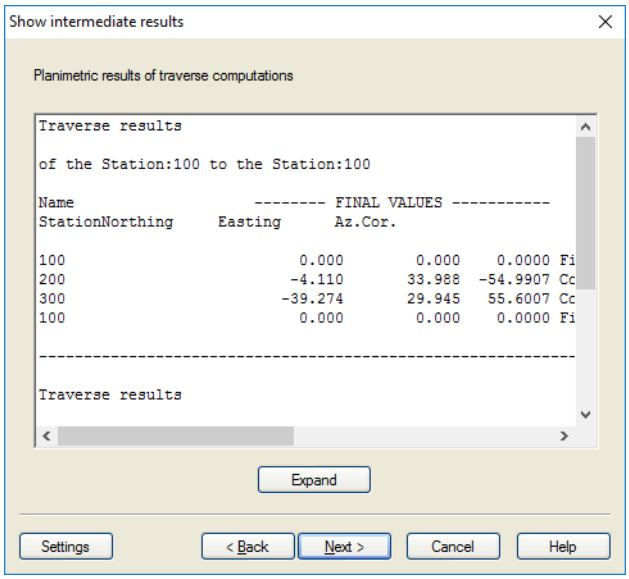



**Figure 108:**

In regard to the altimetry, the same goes for the layout with the difference being that for the stations to be considered fixed they must have been quoted previously by VC points.

If outcomes for Step 7 of the procedure have been set for display, the program will display the results of the calculation in this window. In this case as well, for each calculated polygonal, the quote closure values are also displayed.

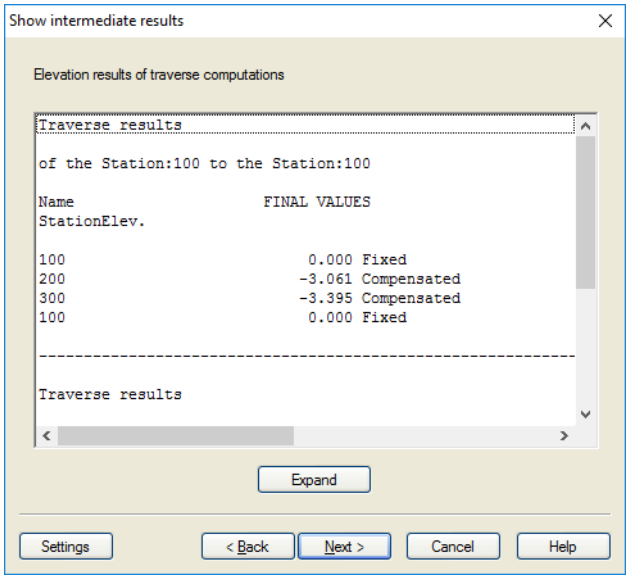



**Figure 109:**

## Step 13 - Isolated Station Calculation

During this step the Isolated Station coordinates and quotes are calculated. That is, those Stations not oriented or quoted with any of the previous methods but for which there is a reciprocal "view" from one that is already oriented or quoted.

No particular window is displayed.

## Step 14 - OC Points Elaboration

This step is executed only if OC points are found in the Jobs selected for elaboration. If indeed there are, then their coordinates and quotes are calculated.

The program will then attempt to associate these values with any HC or VC Points which were not previously associated.

If the association is successful, the program will restart execution of Step 8 to elaborate a new group of stations which, thanks to the values made available by the OC points, can now be oriented.

## Step 15 - Input Options for Rigorous Compensation

This is the point reserved for inputting the Rigorous Compensation options if this calculation was selected during Step 7.

The program first of all offers insertion of the discards anticipated for measuring angles and distances. For the distances, there is a fixed part and a proportional part to the distance.

During this step, the maximum number of iterations allowed for calculating the Compensation is set.

Press Forward and the calculation will execute with the results displayed in the next step.

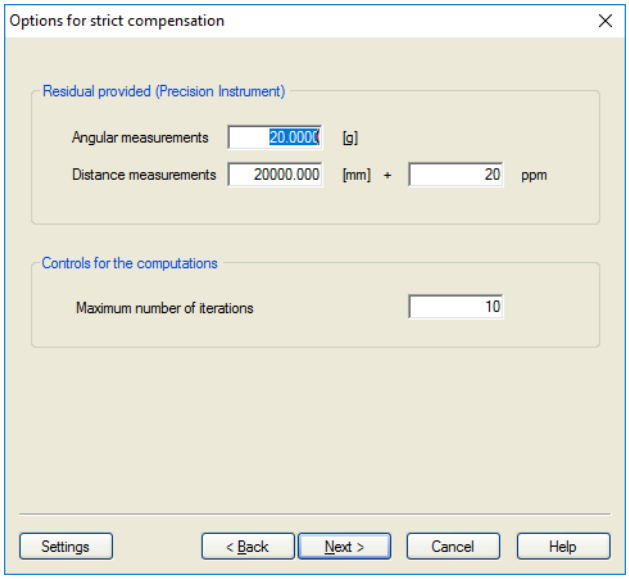



**Figure 110:**

## Step 16 - Rigorous Compensation Results

This step conducts the rigorous compensation and the program will report the calculation results in the **View Intermediate Results** window.

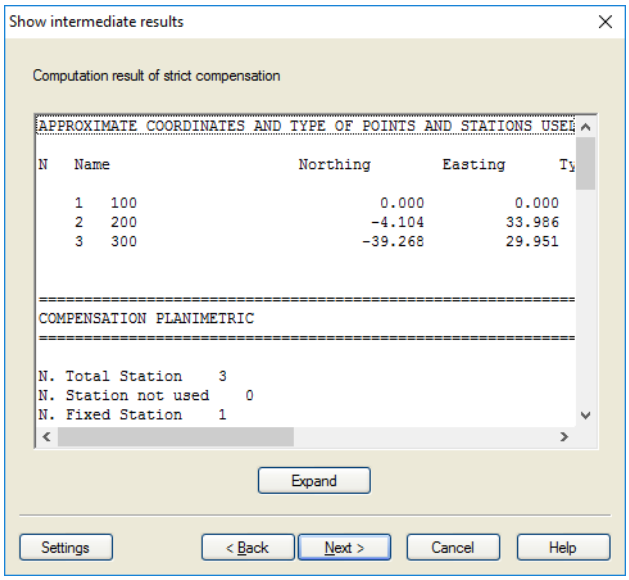



**Figure 111:**

## Step 17 - Final Results

In the **Results of Elaborations Executed** window, the program displays the final results of the layout and altimetric elaborations on the Stations found in the considered Jobs, identifying the type of coordinates or quote calculation.

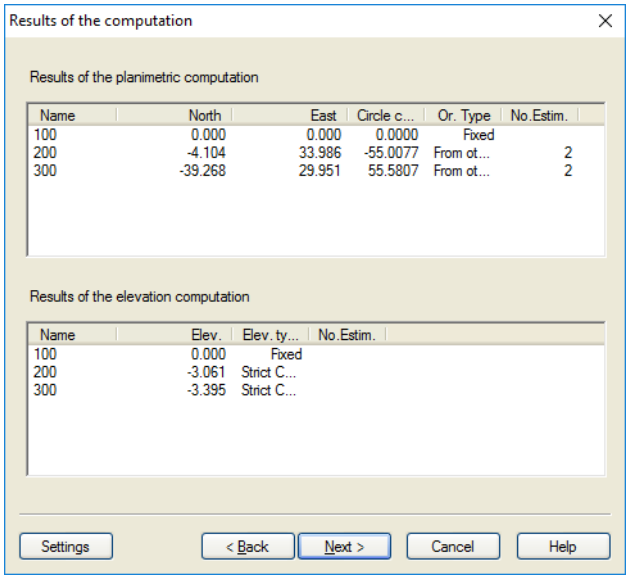



**Figure 112:**

## Step 18 - Detail Points Elaboration

The program now progresses to the orientation and calculation of the quote of the individual Points seen from each of the Stations oriented previously. During this step, Points with IE codes (Inaccessible Elevation) are elaborated in a particular manner.

When the program encounters a IE code, it attributes coordinates the same coordinates, same horizontal distance and same azimuth of the Point preceding it, but recalculates its quote based on the vertical angle seen in the IE point.

The program displays any out of tolerances for duplicate Points if the tolerance check was activated during the initial step of the Celerimetric Calculation.

The next step is calculation of the FI Points (Forward Intersection).

When the program encounters an FI Point, the first thing it does is check into the subsequent Stations to see if there are other FI Points with the same "Name" as the first one. If there are at least 2, then the program will calculate the orientation and quote of the first of the points found using calculation of the triangle with the vertices held by the two Stations from which the Point is "seen". It is possible to "see" an FI Point from 2 Stations: in this case the calculation will be done using the average of all possible combinations.

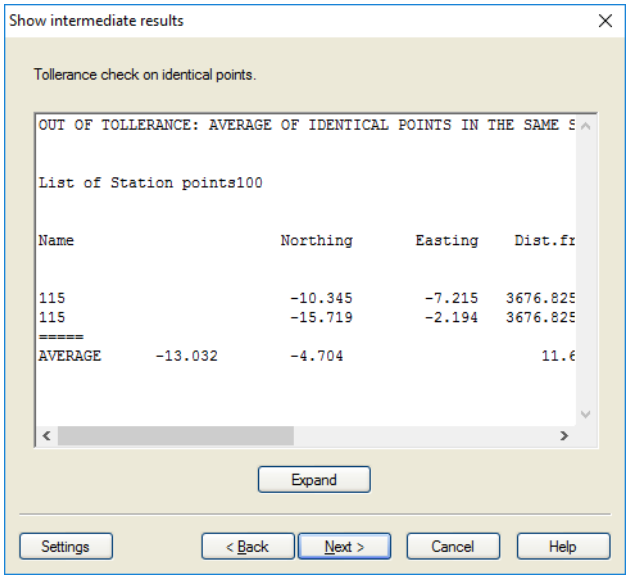



**Figure 113:**

The program displays any out of tolerances for FI Points if the tolerance check was activated during the initial step of the Celerimetric Calculation.

As in the case of other duplicate Points, in the case of FI Points too, the values are averaged and assigned only to the first of these Points found in the archive.

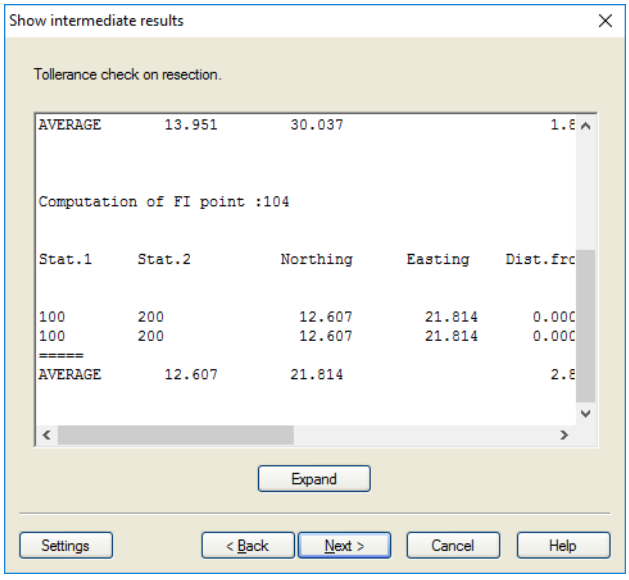



**Figure 114:**

## Step 19 - Any Roto-Translations of Various Entities

The program checks to see if the TS Data has already been elaborated. If so, then it checks for the presence of other entities in the file (Frames, Graphic Entities, Constraints, Borders, Triangles, Level Curves, Profiles and associated Projects) and displays a window where the user can select whether to change the position of the entity (roto-translate) based on the re-elaboration run on the TS Data.

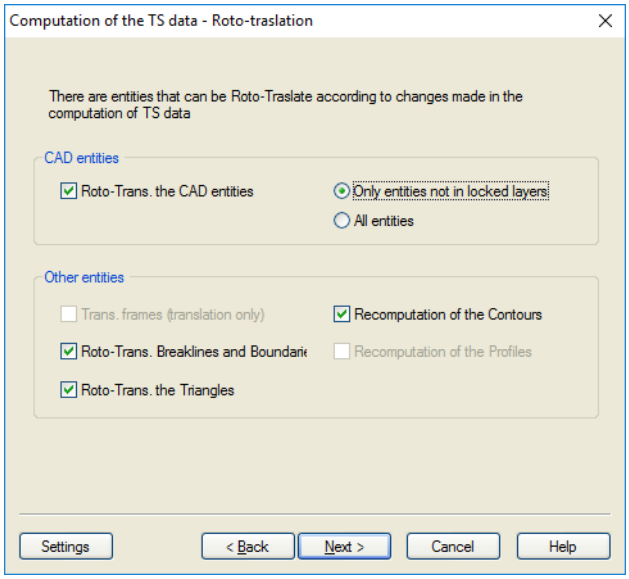



**Figure 115:**

## Step 20 - Final Confirmation of Calculation Executed

Here is the final step of the celerimetric calculation.

It is also possible in this step to go back using the specific button to review counts or potentially run changes to the calculation options.

Also, a **Cancel** button is available to exit from the procedure without any effect on the document.

The **Completed** button allows the user to transfer what has been elaborated to the FW1 file so that it can be used in the printing procedures or graphic view to be used in subsequent elaborations.

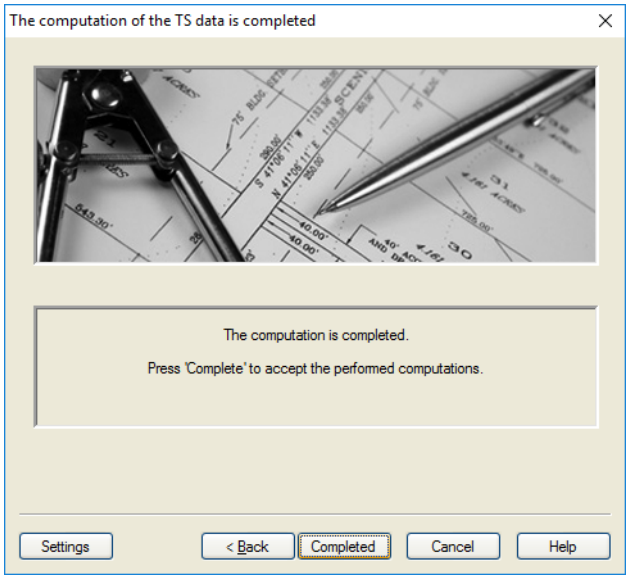



**Figure 116:**

# Manual Input

The manual input is used primarily to work with local orientation or for a preview of the surveys.

In the **Options for the next computations** window, input **Yes** in the section **Manual Input**.

If the user wants to edit the quotes too, follow the same procedure in the **ELEVATIONS** section.

Press the **Forward** button to open the window allowing insertion of the data associated with the stations.

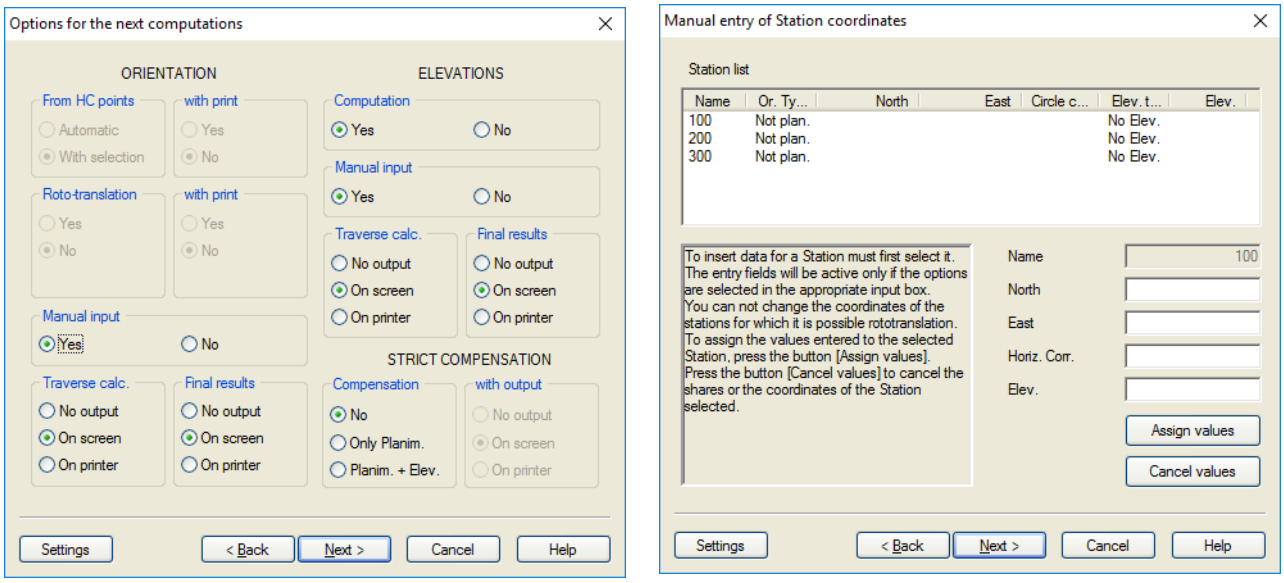



**Figure 117:**

After selecting the station in the upper part of the window, the user can proceed with inserting the coordinates and azimuth correction.

Once the insertion is complete, it is important to press the **Assign values** button to ensure that the inserted data are definitively associated with the selected station.

The window below displays the intermediate calculation results; in particular, identified and calculated polygonals are displayed.

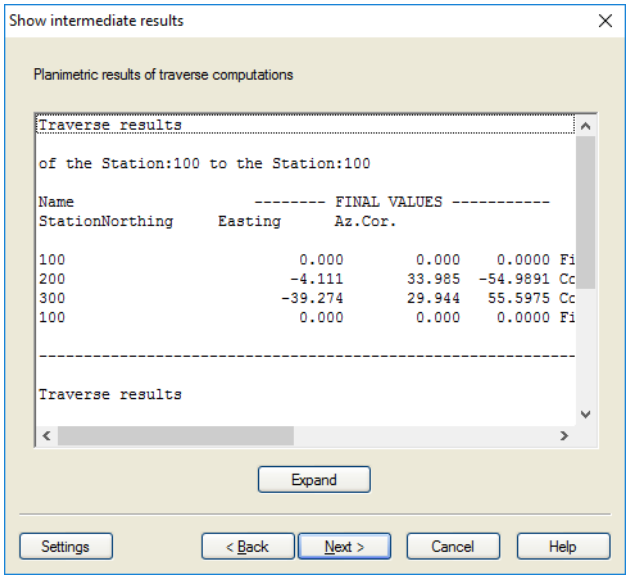



**Figure 118:**

Moving forward with the guided procedure brings the user to the final window and by pressing the **Complete** button, the calculation will finish transferring the data to the TS data.

The results can be viewed also graphically.

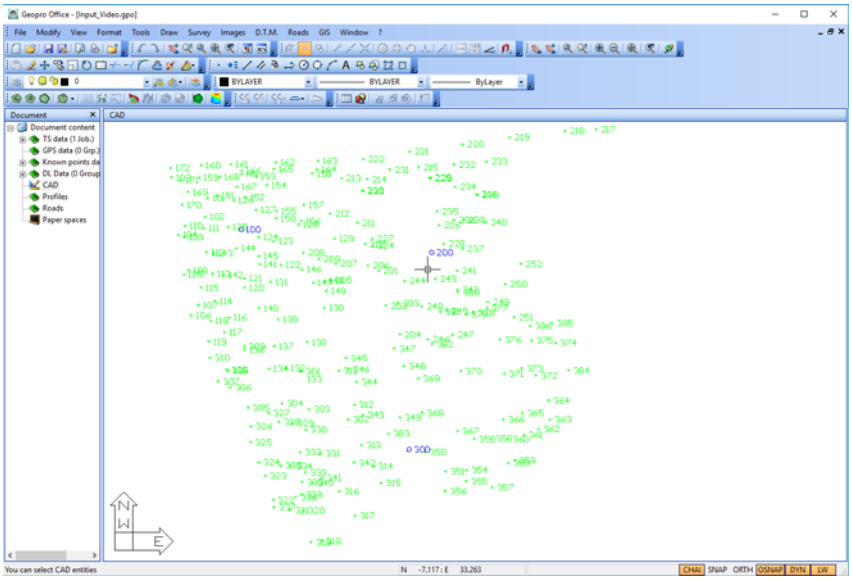


**Figure 119:**

# Elaboration with HC and VC Codes

The points coded as HC are used for orienting the layout surveys when the user wants a highly precise system of reference identified by the Orientation Points.

The points coded as VC are used to orient the surveys in altimetry compared to various benchmarks; a point can be coded HC as well as VC.

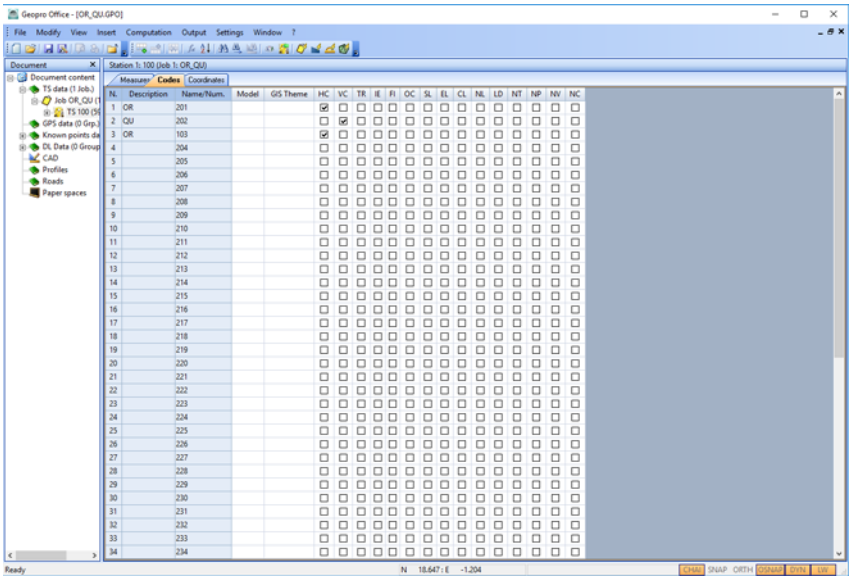


**Figure 120:**

The program uses points coded as HC for three types of orientation:

- Snellius: a Station, to be oriented this way, must have at least 3 points coded as HC and all of them observed as only angles and not as distance.
- Ex-Centro: a Station, to be oriented this way, must have at least 2 points coded as HC and they must be observed as: one only as angles (therefore not distance) and the other as either angle or distance.
- Roto-Translation: one or more Stations connected in polygonal, to be oriented this way, must have at least two points coded as HC and all of them observed as angles as well as distance.

If the automatic search in the **Computation Options** window is set to **No** then during the data analysis, the program will recognize only the codes inserted by us.

Otherwise, it will automatically associate also the orientation points and detail points that have an identical name; in this case, it is not necessary that the detail points are coded as HC or VC.

The identified HC and VC points are displayed in the **Data Analysis** window of the procedure; also, for each one of these, the validity for the calculation is indicated.

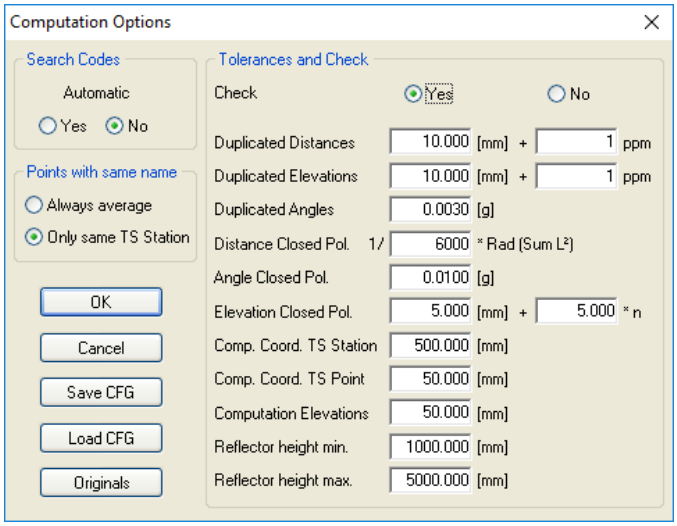



**Figure 121:**

Proceeding with the elaboration will progress to the window where the stations are analyzed.

The image below shows that the station used can be oriented by layout using the Roto-Translation method with can be quoted.

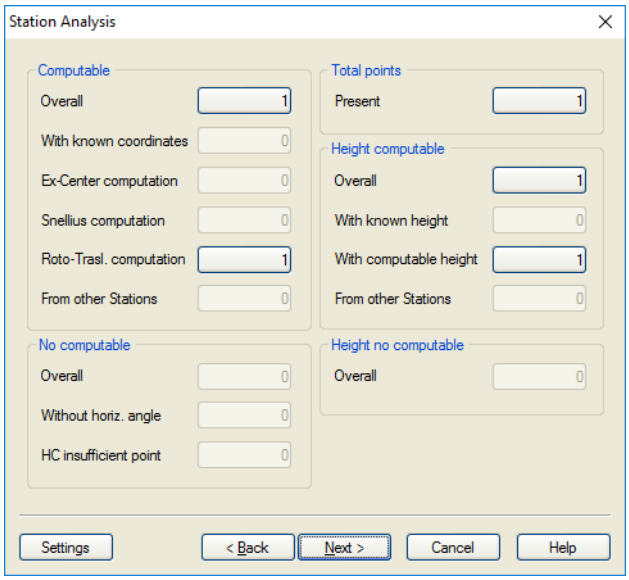



**Figure 122:**

The program automatically searches the methods by which it is possible to orient the Stations by layout.

In this case, activate the automatic calculation by Roto-Translation deactivating the other options; also, given that the station can be quoted, in the **ELEVATIONS** section, the calculation is set as **Yes** while the **Manual Input** is set at **No**.

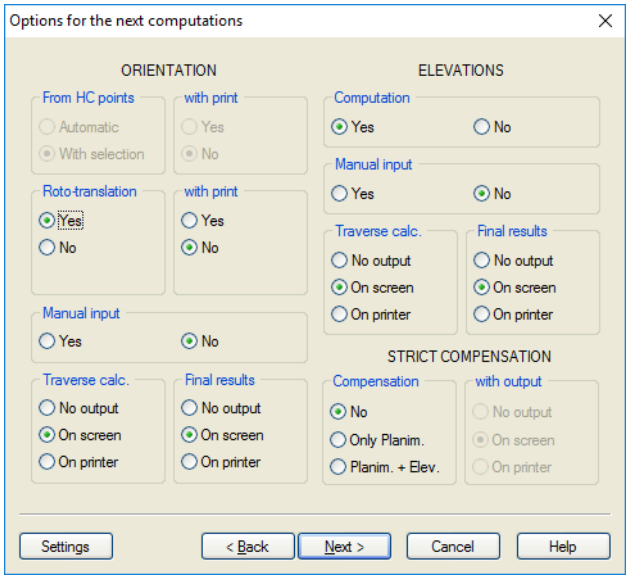



**Figure 123:**

At this point, proceed with the Roto-Translation calculation; this calculation can be done in two ways: using the fixed method or the one with least square (in this case the second was selected).

To run the calculation the program uses the HC points that are summarized in the upper part of the window; some may be unused (that is, deselected) by the user.

Once this selection is complete, the celerimetric calculation will run until it reaches the final window where, by pressing the **Complete** button, the user will initiate transfer of the results to the TS Data; the final results are those displayed in graphic.

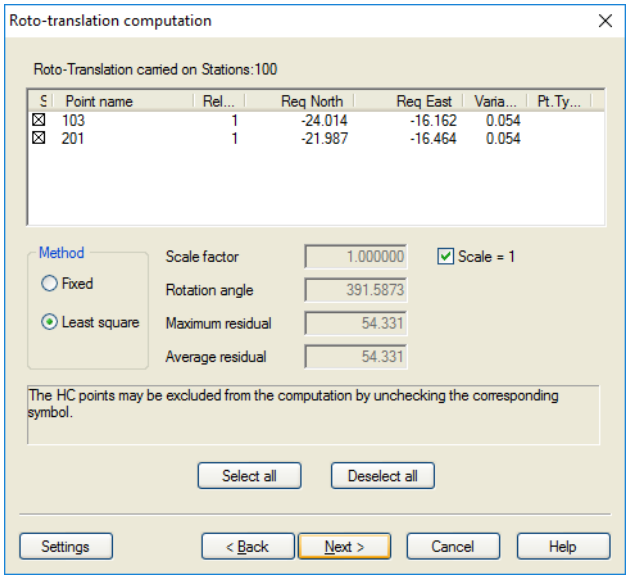



**Figure 124:**

# Using TR Code

The points coded as TR are those seen by the program as observations to other Stations; in particular, they are used in the calculation of the polygonals (open or closed).

The point search can be done automatically (selecting the **Yes** option in the **Search Codes** section of the **Computation Options** window) or manually.

In the first case, the program will automatically associate Stations and Detail Points with the same names (in this case it is not required that the detail points are coded as TR);

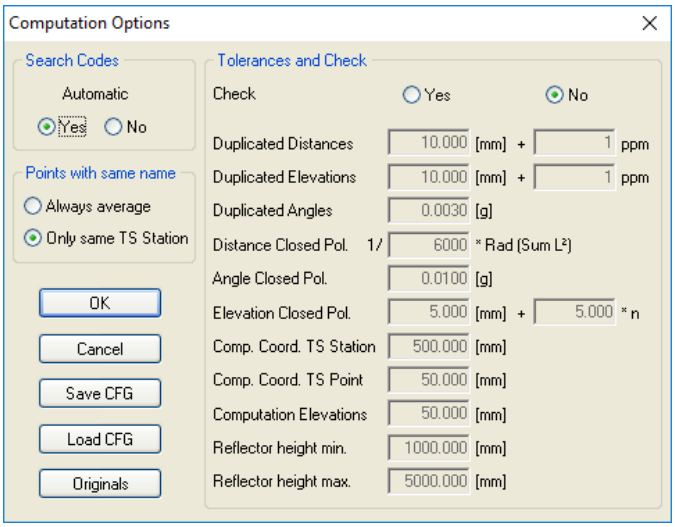



**Figure 125:**

In the second case, the calculation procedure will only use those points coded as TR.

After setting the elaboration options, the calculation will proceed moving onto the **Analysis of data** window.

In this window the quantity of points coded as TR will be identified, how many are deemed valid and how many not valid.

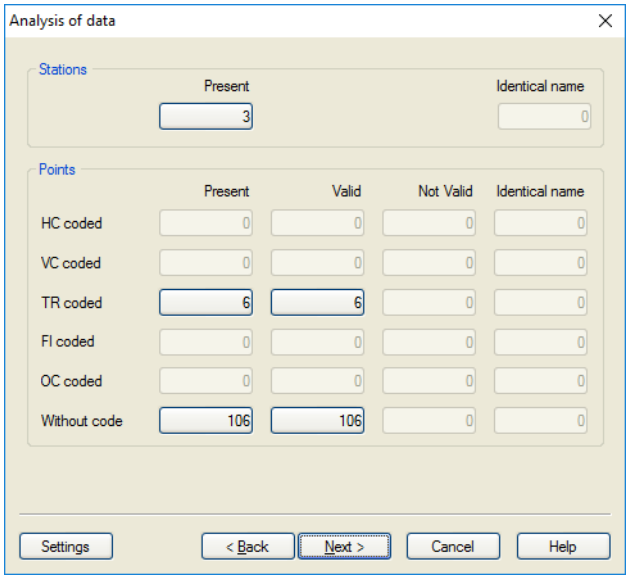



**Figure 126:**

After selecting the type of orientation in the **Options for the next computation**, the program will display the result of the polygonal calculation for layout as well as altimetry.

Only the following are displayed:

•Closed polygonals (those that end on the same Station which is deemed independently orientable);

•Those constrained at the ends (those that end on two orientable Stations).

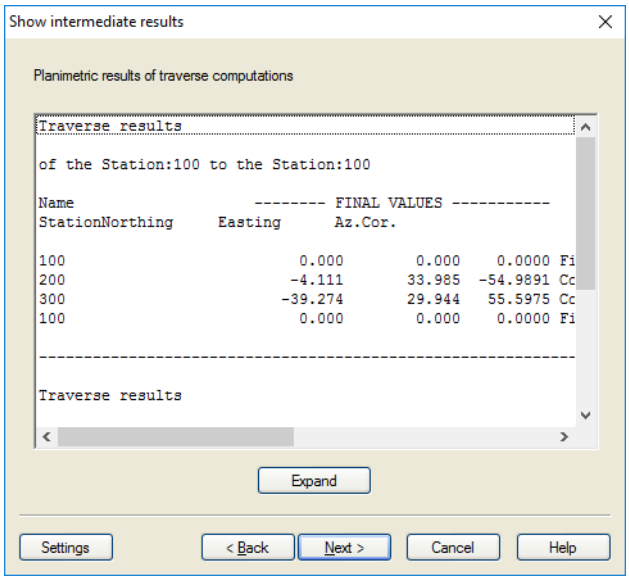



**Figure 127:**

The image below displays the graphic result of the celerimetric calculation.

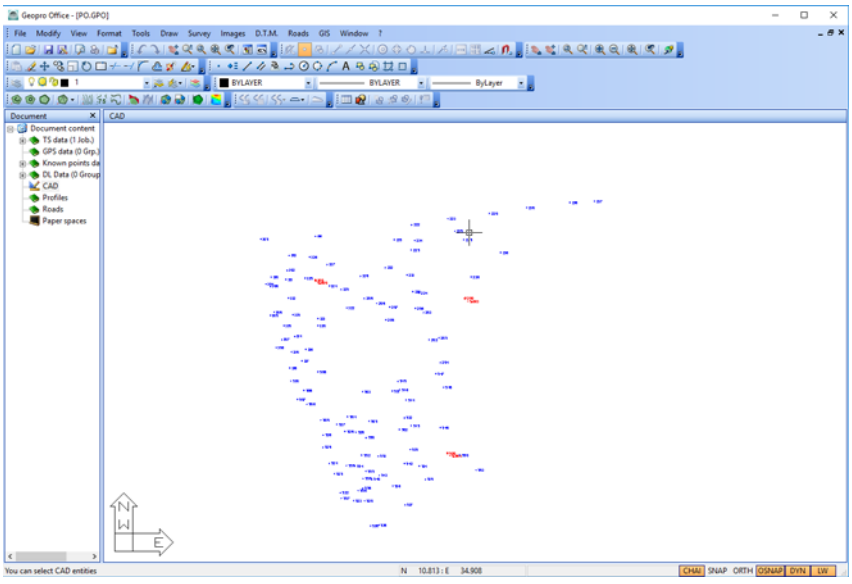


**Figure 128:**

# Forward Intersection

The FI code is used when an inaccessible point has been hit by at least two stations or when only the vertical and horizontal angles have been measured and not the distance; this code is inserted specifically because there is the option to apply an automatic search.

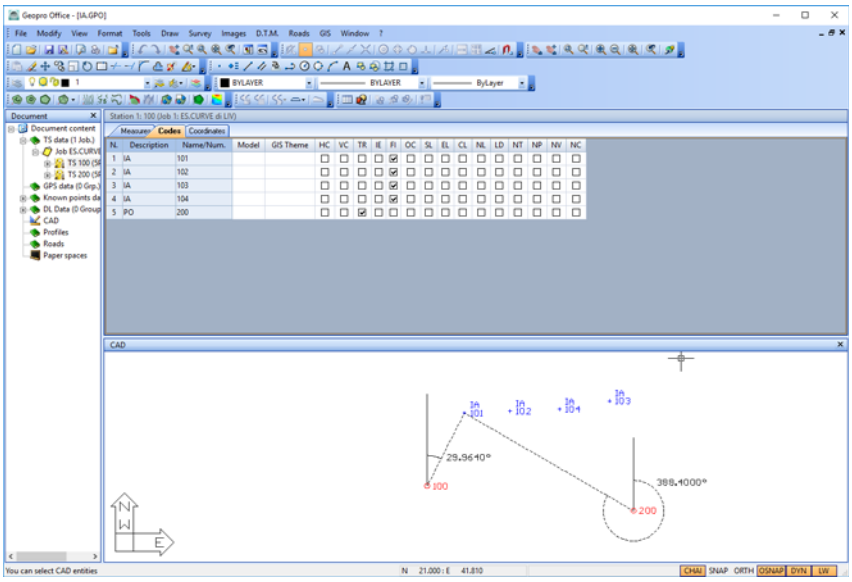


**Figure 129:**

Once the Celerimetric Calculation has been launched, tell the program to run checks on the tolerances and other checks using the **Elaboration Options** window.

Moving forward with the elaboration there will be a window displaying the results of the data analysis identifying how many points with the FI code were found, how many are valid and how many are not valid.

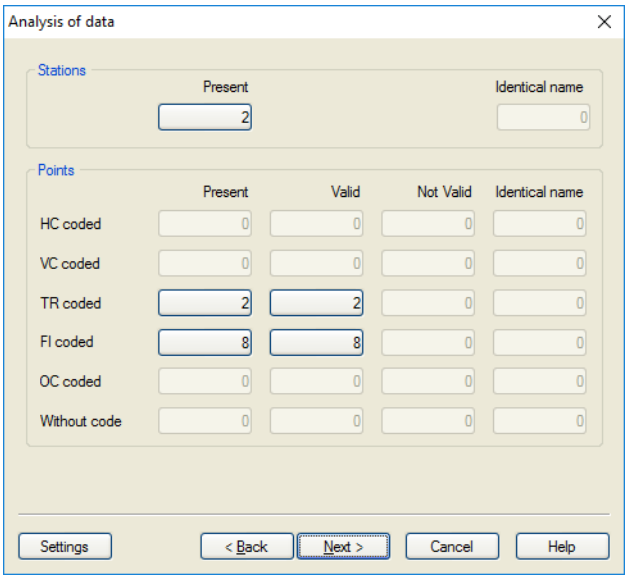



**Figure 130:**

The calculation of intersections forward is done only after orientation of the stations.

The image below displays the window seen when tolerances have not been respected.

The results can be seen in a larger window by pressing the **Expand** button.

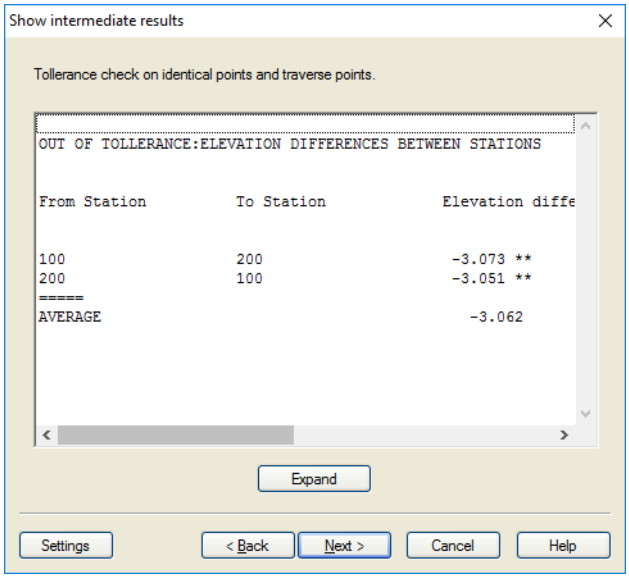



**Figure 131:**

# Connecting Two Surveys

Two surveys can be connected in two different ways:

•When there is a shared Station and at least one point has been observed by both Stations (used, for example, in a suspension of the survey).

•Using OC and HC/VC codes (used, for example when two Stations are to be connected and they don't "see" each other).

When there is a shared Station it means that in a Job (or Jobs) included in the Celerimetric Booklet, two Stations have an identical name.

The program, in this case, will consider the Stations with the identical name as duplicate Stations that have, at the conclusion of the Celerimetric Calculation, the same layout coordinates and the same quote but it is not determinate that they have the same azimuth correction.

The shared point is used by the program to calculate the difference of azimuth correction.

The image below shows the duplicate station 100, for which point 104 was found shared in both surveys, displayed in the upper table in the **Azimuth Correction Calculation** window; in the field called **Az. Corr. Diff.** a value is displayed.

The duplicate station 200, for which no shared point was found, is displayed in the second table and in the field called **Az. Corr. Diff.** with the value of 0.

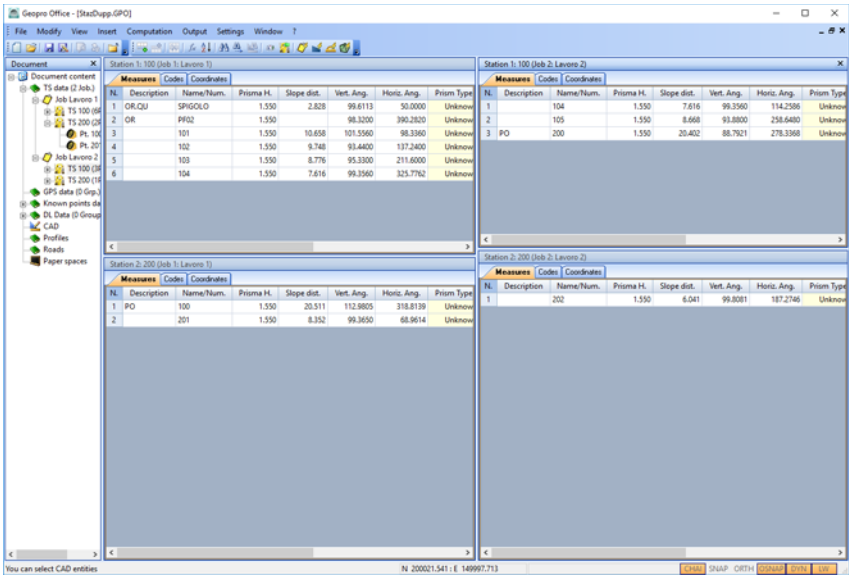


**Figure 132:**

The OC and HC/VC codes are used if the surveys have no shared Stations, but there are at least two detail points observed in both surveys. In this case, additional information must be inserted into the document. At the beginning it must be established which of the two surveys can be individually oriented; in this case, the orientation can be done either using the Orientation Points or by inserting the station coordinates during execution of the Celerimetric Calculation (manual input).

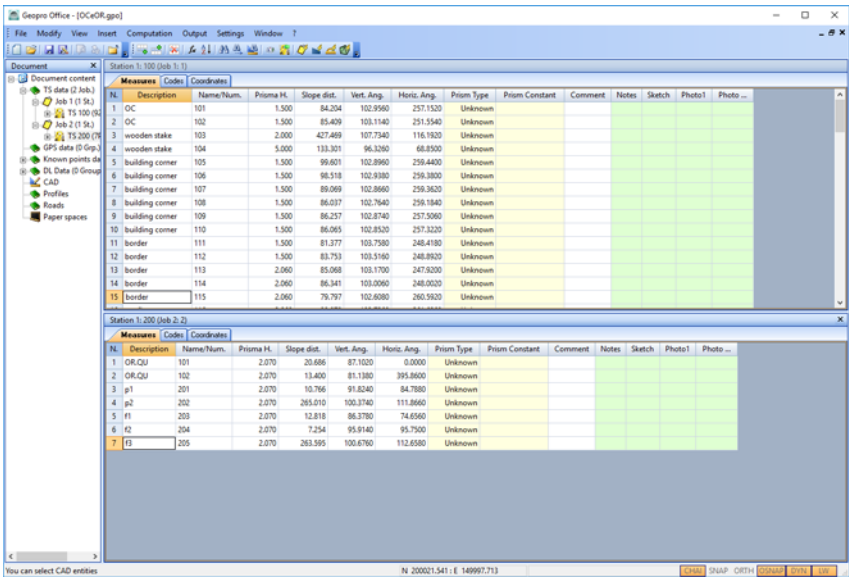


**Figure 133:**

Next the two (or more) Detail Points that share the two surveys must be identified in the associated Job. Then the OC (Orientation Created) Code must be assigned to these two Points and finally in the other Job, associated with the second survey, identify the same Points and assign them the HC (Horizontal Control point) Code and then the VC (Vertical Control point) if the user wants to connect the two surveys also by quote using these points.

Running the Celerimetric Computation will bring the user to the **Analysis of data** page where the program notifies the user that points with HC, VC and OC codes have been identified; all of these points are considered valid.

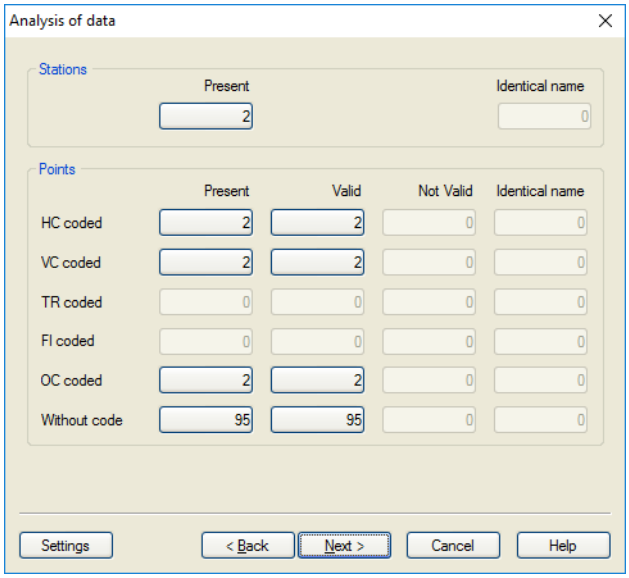



**Figure 134:**

In the **Station Analysis** window those stations that cannot be orientable or quotable are identified.

Press **Next** to move on to the **Options for the next computation** window where the program automatically sets the display input for the layout and the quotes in that, as already seen in the **Station Analysis** window, some stations cannot be oriented or quoted.

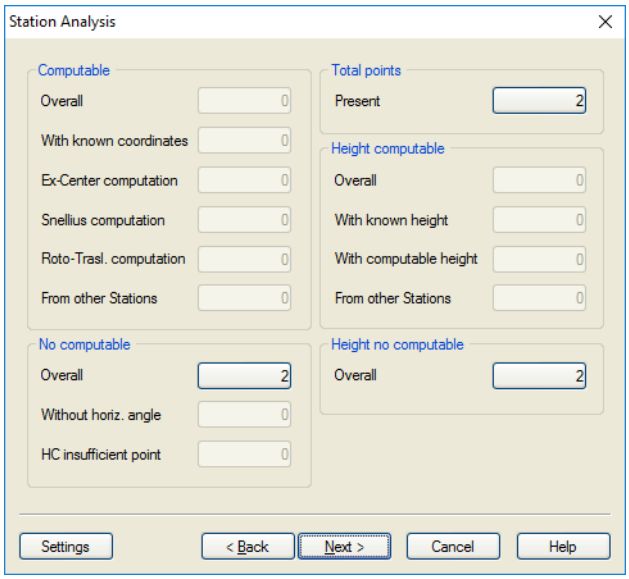



**Figure 135:**

At this point we input the coordinates and azimuth correction of station 100 into the **Manual entry of Station coordinates** window.

Station 200 remains not oriented and not quoted.

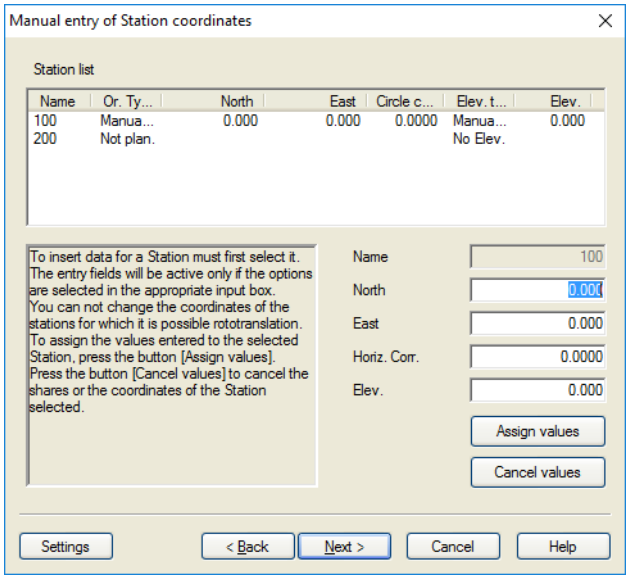



**Figure 136:**

Then the user arrives at the Roto-Translation Calculation.

At the end of the first step in the Celerimetric Calculation, when the Station 100 coordinates are inserted, the coordinates for points 101 and 102 are calculated.

At the second step of the Calculation, the coordinates of points 101 and 102 are used to orient Station 200 using the Roto-Translation method.

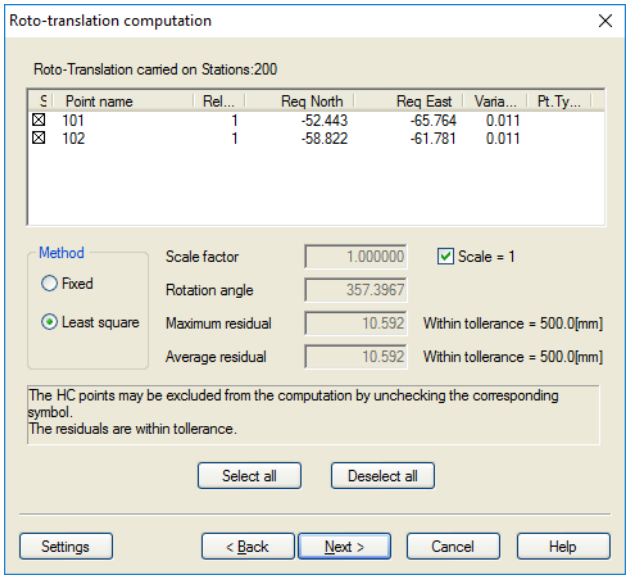



**Figure 137:**

The result of the elaborations executed is shown in the image below.

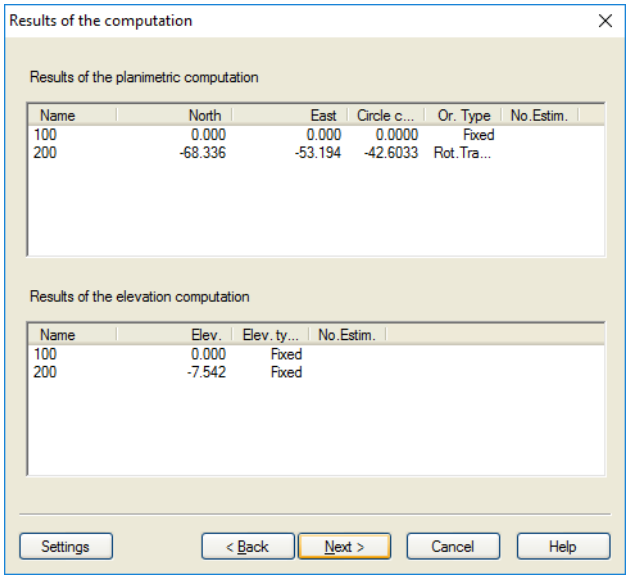



**Figure 138:**

# Using SL, EL and CL Codes

The SL, EL and CL codes are used to graphically design polylines connecting successive points found in the booklet.

The SL code signifies Start Line and is used to initiate the polyline; the EL signifies End Line and is used to terminate the polyline.

In the example shown in the image, point 137 is coded as SL and point 142 is coded as EL.

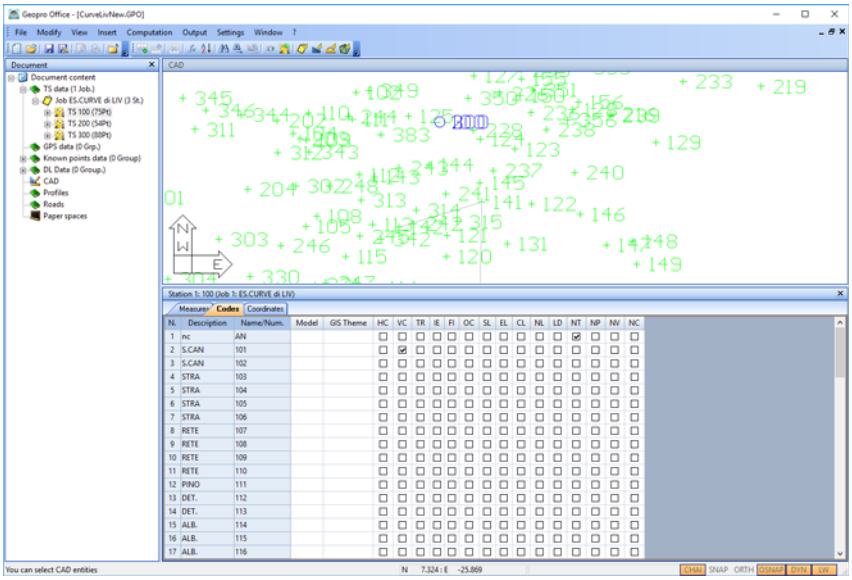


**Figure 139:**

The CL code means Close Line and is used to terminate and close the polyline.

In the following example, point 142 is coded as CL and the polyline is seen closed.

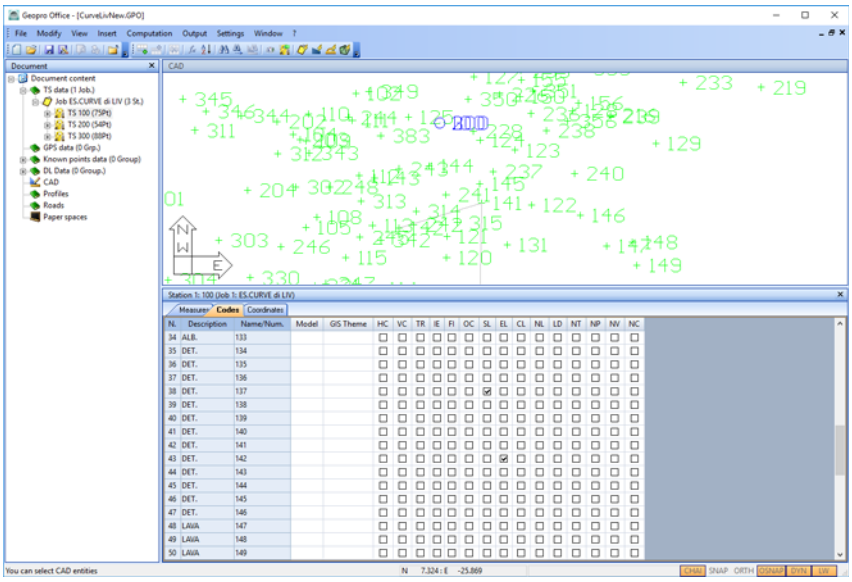


**Figure 140:**

The **Transform into Graphic Lines** function, found on the Survey|SL-EL-CL-LD Codes menu transforms lines derived from these codes into graphic polylines.

These graphic polylines can be handled easily as graphic entities; also, if changes are made on the booklet, they are not updated automatically.

The **Undo Transformation** command is used to cancel the result produced by the **Transform into Graphic Lines** command, thereby erasing the graphic entities found in the **LINES-FROM-CODES** plane.

The created graphic polylines, even if changed, will be erased, while the original lines joining the various points set by the SL, EL and CL codes will be redesigned.

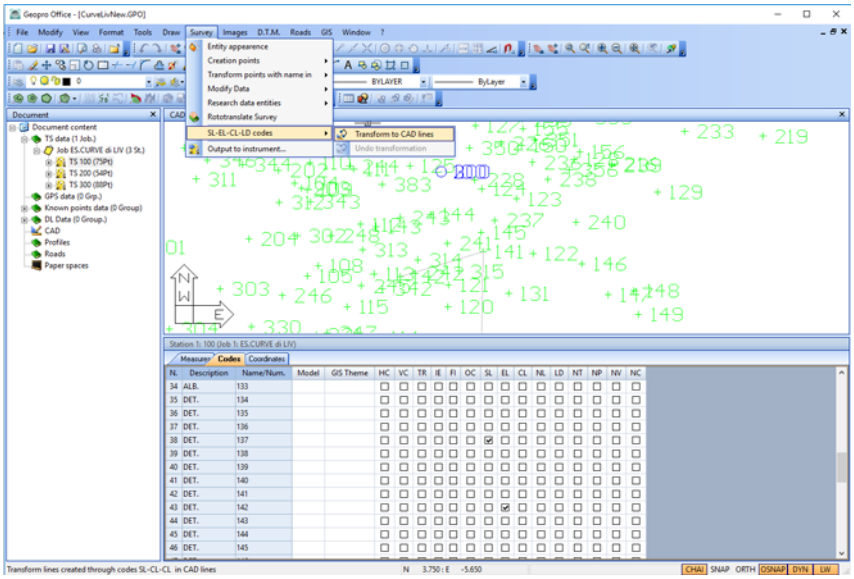


**Figure 141:**

# Exporting Data to Instrument

The **Output|To Instrument...** command is used to transfer data to the instrument; the program offers the user a guided procedure for inserting all of the information needed for transmitting the data.

The settings selected for exporting and the type of instrument used can be stored in a profile and used again for a subsequent export.

The first step is to tell the program what to transfer by selecting the entities from the list and pressing the corresponding **arrow** button.

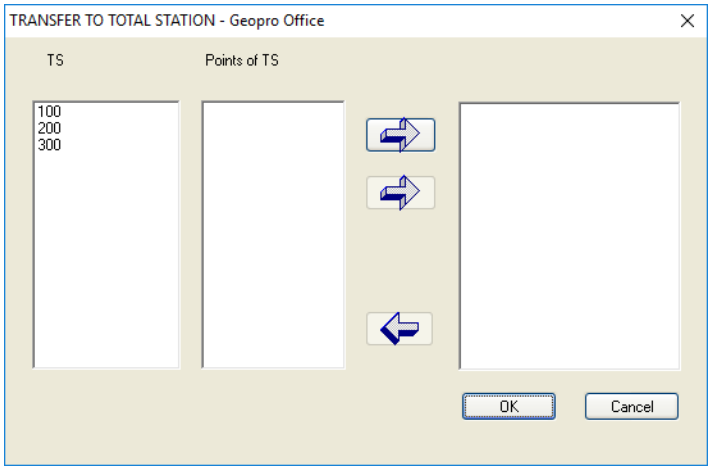



**Figure 142:**

Once this operation is complete, the procedure continues by displaying the **Import to Instruments – Profile selection** window.

This window is used to create a new profile or use one that has already been created. To use an already created profile, just select it or press the **Export** button; to create a new one, just select the **New** icon and press the **Next** button.

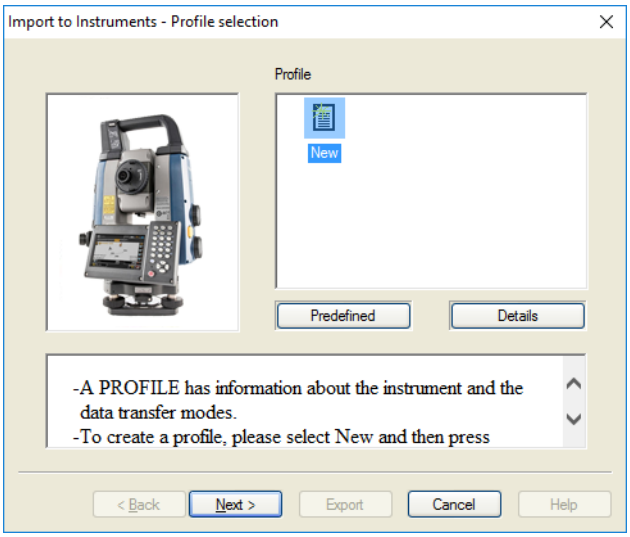



**Figure 143:**

The next window is used to tell the program which type of instrument by specifying the brand and model.

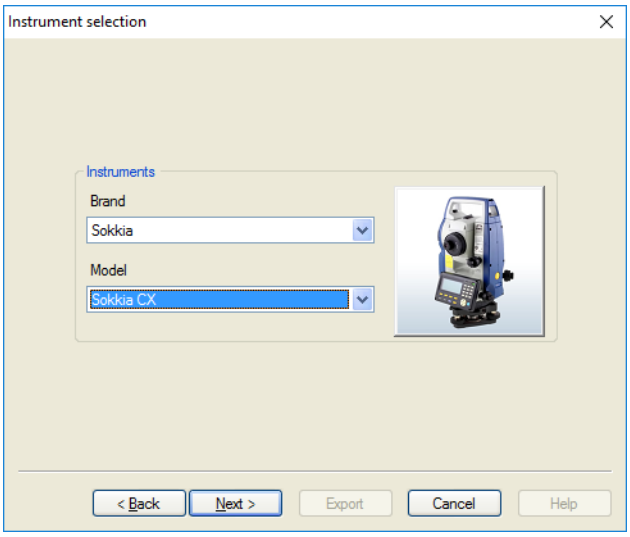



**Figure 144:**

Once the instrument is selected, the procedure will display the **Connection Information** window used to specify the communication parameters.

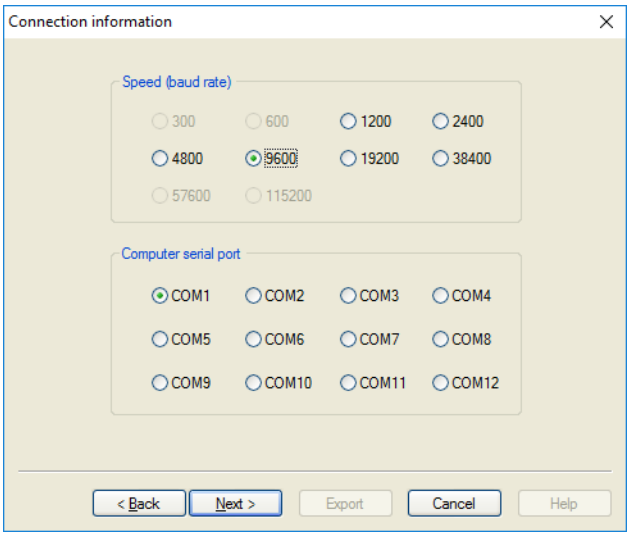



**Figure 145:**

Moving forward in the procedure, the user will arrive to a window that lists those already created profiles and where it is possible to save the created profile.

Then there are windows that display the details to continue with the exporting of data to the selected instrument.

The last window suggested by the procedure, finally, displays the result of the transmission; if it did not execute successfully, the user can apply the **Retry** command to send it again.

The transfer of data to the instrument can be executed also directly in Graphic by using the **Output|To Instrument...** command; in this case, before launching the guided procedure the elements to be exported must be graphically selected.

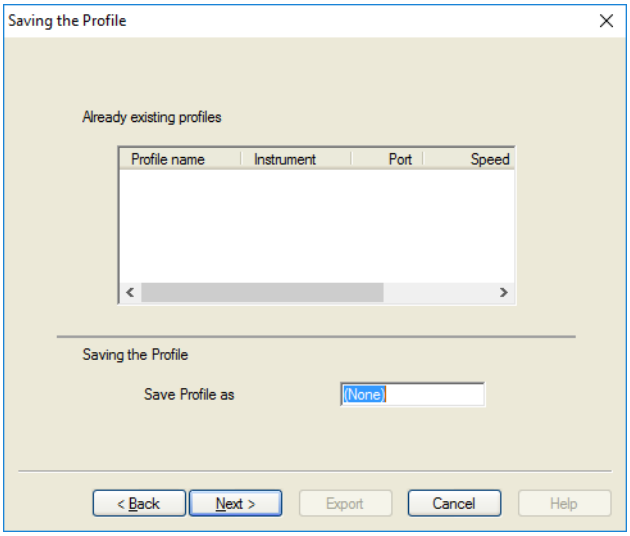



**Figure 146:**

# File Menu|Export

This command includes a series of commands used to save the work in particular formats usable by other programs or instruments.

These are:

1. TS Data: this is used to create a report of the measures.

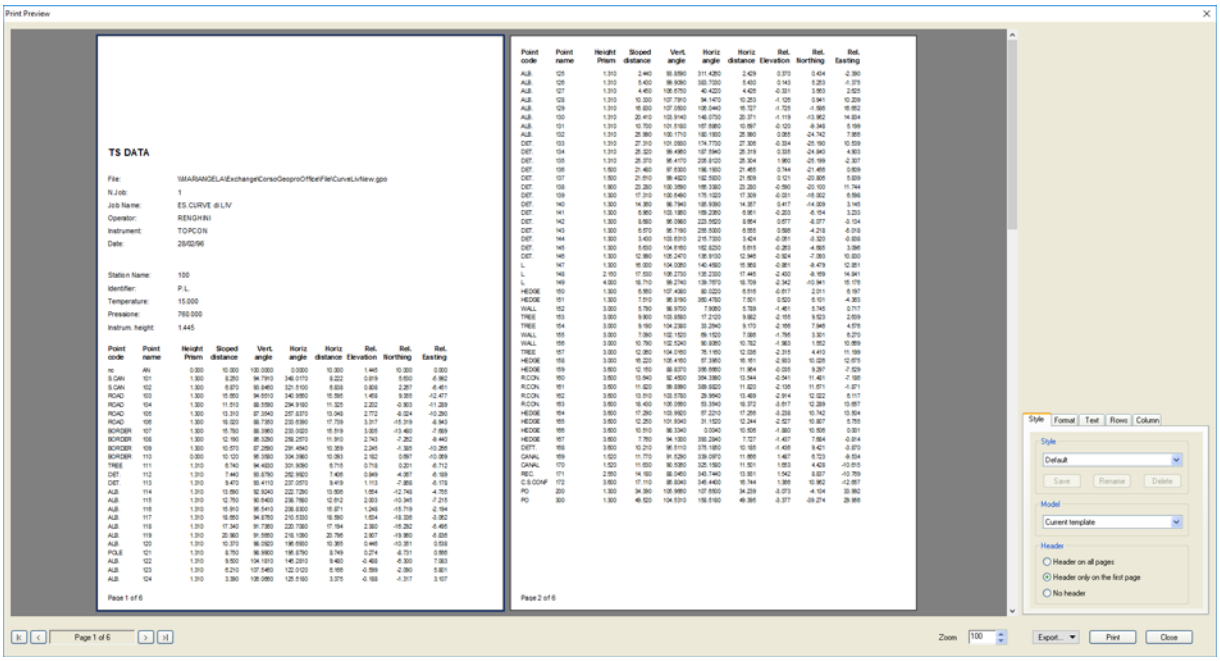



**Figure 147:**

2. Celerimetric: this allows the user to create a file where the celerimetric calculation results are reported.

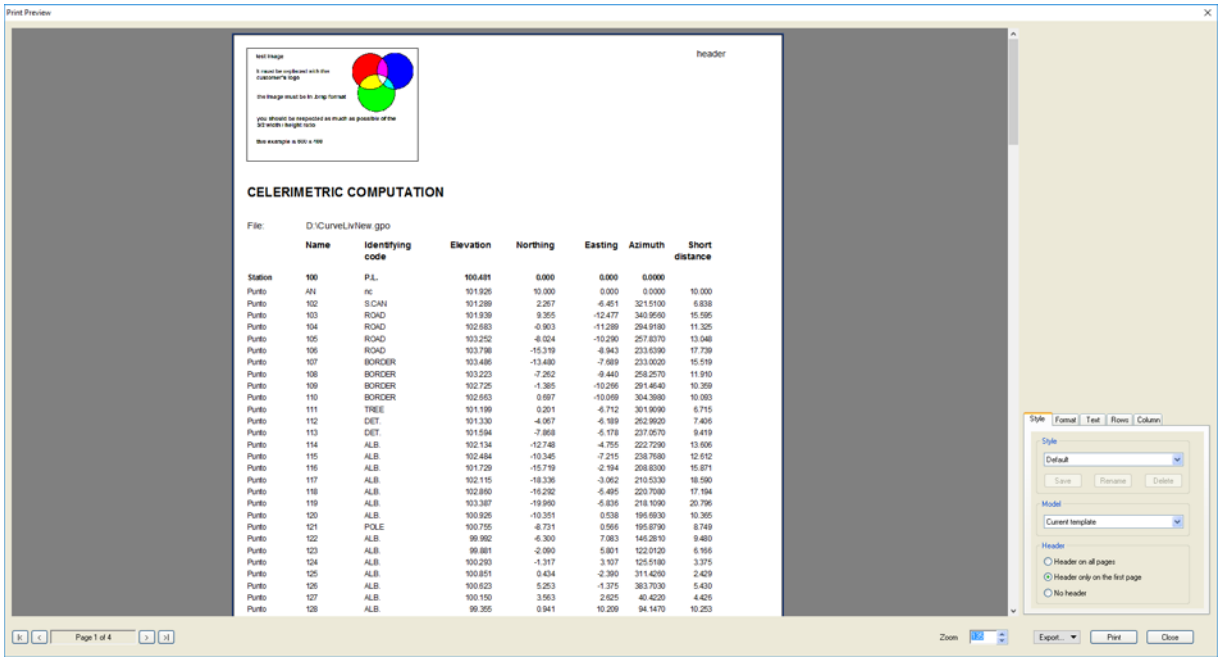



**Figure 148:**

3. Free format: this procedure is used to create a file with selection of data from the TS Data and/or results from the Celerimetric Calculation. The selection of data and decimal numbers to use can be made using the Options|Print Options command.

4. File of Coordinates: this procedure is used to create a file by selecting the variables and their order. Once this procedure is activated, a window will appear in which to select the variables to be inserted into the file to create.

It is also possible here to select the number of decimals, the separator between one datum and another and whether to include names among the double apexes.

Once this window is confirmed, the file preview will activate used to create: the screen displayed is very similar to the print preview for the celerimetric.

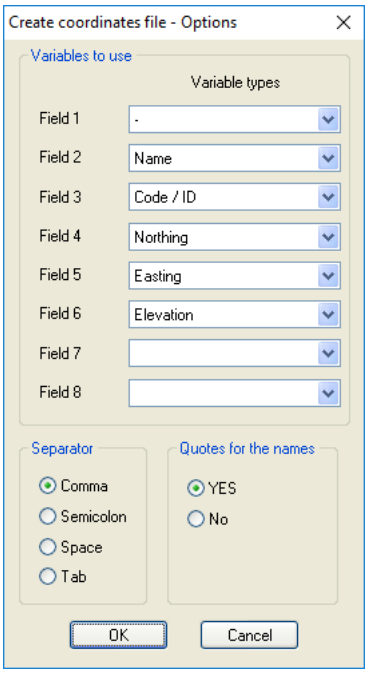



**Figure 149:**

# Output

TS Data: activating this command will display another menu that lists the possible outcomes available.

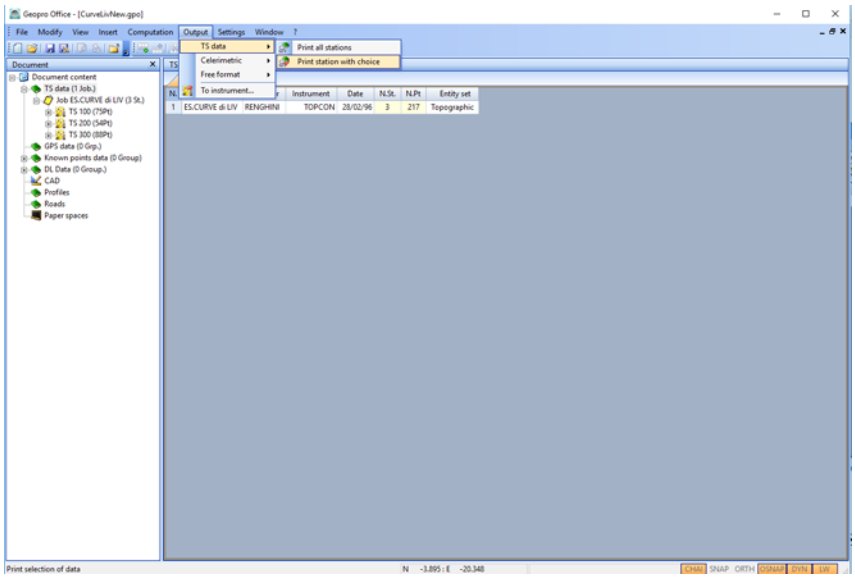



**Figure 150:**

The **Print All Stations** command creates a printout of all stations existing while the **Print with Station Selection** command offers the user the option (using the specific window shown here below) to use the mouse to select which station to print.

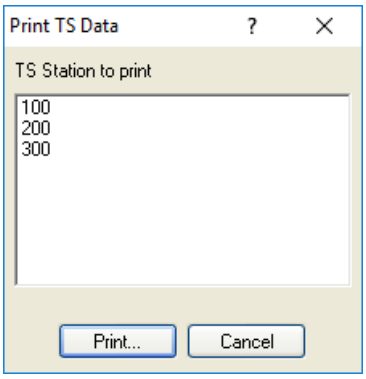



**Figure 151:**

In both cases, a preview is created where the user can confirm or modify (using the specific functions offered by the program's print module) the produced outcomes.

Celerimetric: in this case as well, execution of this command will display another menu summarizing the outcomes that can be produced.

Similar to the Celerimetric Booklet and the Celerimetric Calculation, the **Print All Stations** and **Print with Station Selection** commands remain the same as the one for printing the Campaign Booklet.

Free Format: execution of this command will display a menu grouping a series of commands that are similar to the ones already described; what is different is the fact that it uses a free format defined by the **Settings | Print Options** command on the **TS Data** page.

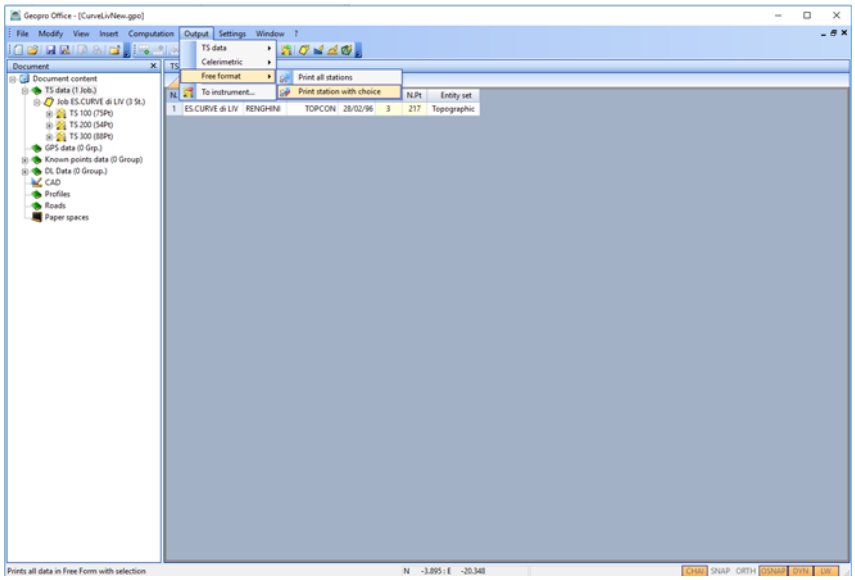



**Figure 152:**

The image below shows the printout of all stations in the Celerimetric Booklet as Free Format.

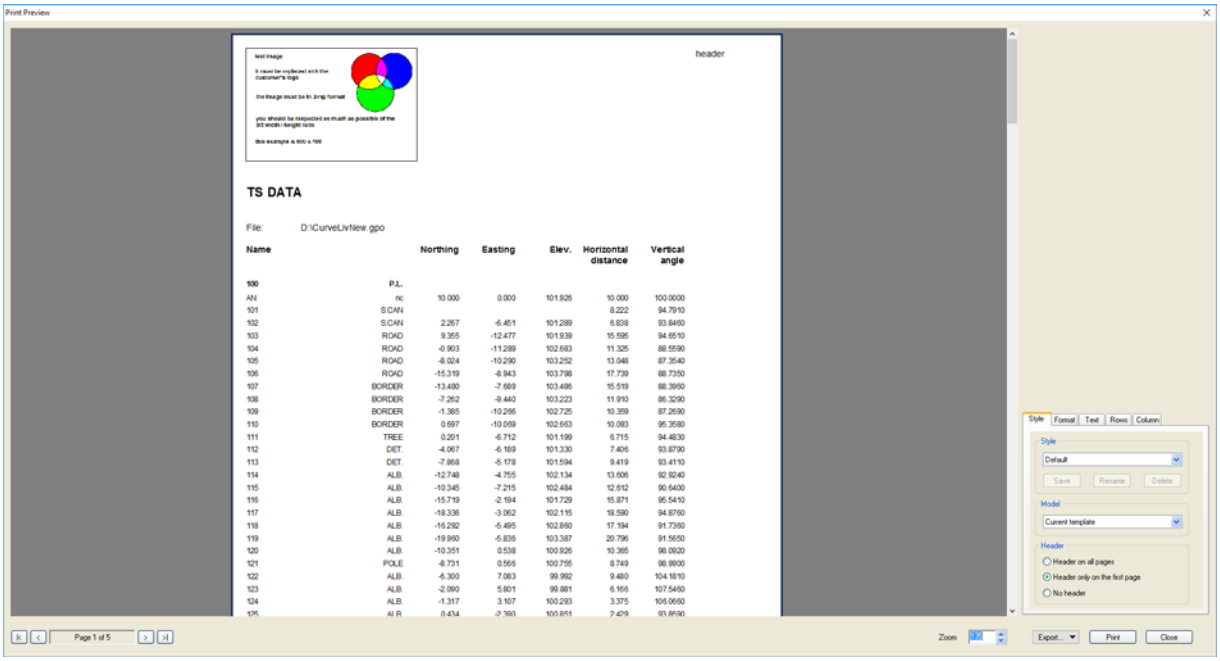



**Figure 153:**

# Details

**Code Meanings:** see the "Introduction" section of the Base course or the program's online guide, "Point Codes" chapter.

**GIS:** refer to the program's online guide, GIS menu in the Graphic View.

**Creating Design Models:** see the "CAD View" section of the Base course or the program's online guide, CAD View|Format menu.

**Modify Menu:** refer to the program's online guide, Modify Menu in the Numeric Views.

**Common Points:** see the document in the "How to..." section of the program's online guide.

**Free Format:** see the Print Module section of the base course or the program's online guide File|Export menu or the Output Menu in the TS Data View or the Settings Menu (Print Options).

**Celerimetric Computation:** refer to the program's online guide, TS Data View Computation Menu "Automatic Celerimetric"

**Entity set:** refer to the program's online guide, Format|Entity sets.

# GPS Data Views

The GPS Data is the display of information collected through a GPS receiver.

This part of the document is used to archive one or more Groups, which in turn contain the data associated with a certain number of measured points.

To display the archived data, click the left mouse button on the GPS data node or nodes they produce (Groups) in the navigation tree of the document or drag the node into the display area, keeping the left mouse button held down.

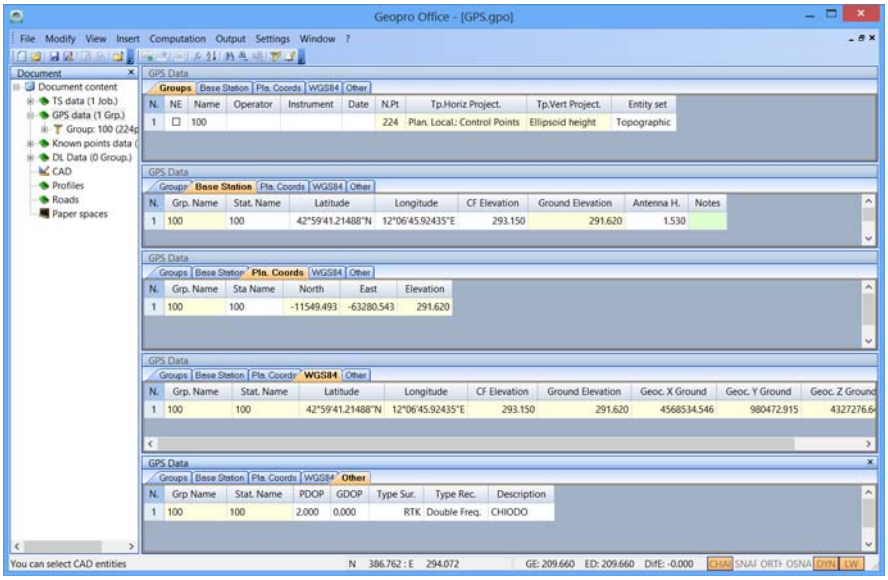



**Figure 154:**

Click on the **GPS Data** node and the corresponding view will open including the following pages:

1.**Groups** Page :

•Group name (alpha-numeric).

•Operator (alpha-numeric).

•Instrument (alpha-numeric).

•Date (alpha-numeric).

•Number of points in Group (numeric).

•Tp. Horiz.Projec. (numeric)

•Tp.Vert.Projec. (numeric).

•Entity set.

2.**Base Station** Page :

•Group name (alpha-numeric).

•Base station name (alpha-numeric).

•Base station latitude (numeric).

•Base station longitude (numeric).

•Base station elevation (numeric).

•Ground elevation (numeric).

•Antenna height (numeric).

3.**Pla. Coord.** Page

•Group name (alpha-numeric).

•Base station name (alpha-numeric).

•Coordinate - North of base station (numeric).

•Coordinate - East of base station (numeric).

•Elevation of Base station (numeric).

4.**WGS84** Page :

•Group name;

•Station name;

•Latitude;

•Longitude;

•CF elevation;

•Geoc. X;

•Geoc. Y;

•Geoc. Z.

5.**Other** Page:

•Group name;

•Station name;

•PDOP;

•GDOP;

•Sur. type;

•Receiver type;

•Description;

Select the node corresponding to a group and the **Group** view will open.

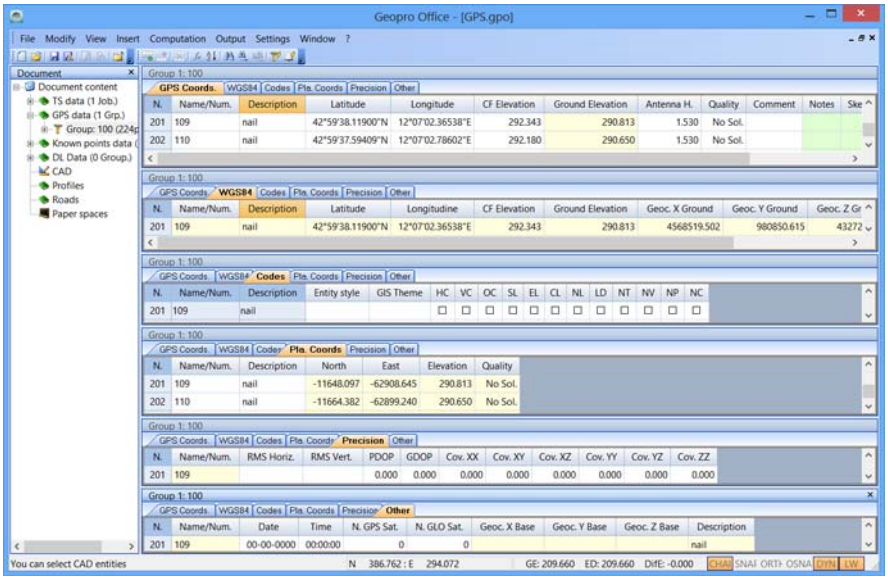



**Figure 155:**

This view includes six pages.

In the page under the name **GPS Coord.** the columns included are:

1.Name/Number (alpha-numeric).

2.Description (alpha-numeric).

3.Latitude (numeric).

4.Longitude (numeric).

5.CF elevation (numeric).

6.Ground Elevation  (numeric).

7.Antenna height (numeric).

8.Quality.

9.Comment.

10.Notes.

11.Sketch.

12.Photo1.

13.Photo2.

In the page under the name **WGS84. Coord.** the columns included are:

1.Name/Number (alpha-numeric).

2.Description (alpha-numeric).

3.Latitude (numeric).

4.Longitude (numeric).

5.CF elevation (numeric).

6.Geoc. X.

7.Geoc. Y.

8.Geoc. Z.

9.Antenna height (numeric).

10.Quality.

In the page under the name **Codes**, the columns included are:

1.Name/Number (alpha-numeric) cannot be modified on this page.

2.Description (alpha-numeric).

3.Model (alpha-numeric).

4.GIS theme.

5.Various columns associated with Codes (HC, VC, SL, ...).

In the page under the name **Pla. Coord.** the columns included are:

1.Name/Number (alpha-numeric).

2.Description (alpha-numeric):

3.Coordinate - North (numeric).

4.Coordinate - East (numeric).

5.Elevation (numeric).

6.Quality (selected from a certain number of items).

In the page under the name **Precision**, the columns included are:

1.Name/Number (alpha-numeric).

2.SQM horizontal (numeric).

3.SQM vertical (numeric).

4.PDOP (numeric)

5.GDOP (numeric)

6.Covariance XX (numeric)

7.Covariance XY (numeric)

8.Covariance XZ (numeric)

9.Covariance YY (numeric)

10.Covariance YZ (numeric)

11.Covariance ZZ (numeric)

In the page under the name **Other**, the columns included are:

1.Name/Number (alpha-numeric).

2.Date (numeric day-month-year, all at two digits).

3.Milliseconds beginning with the start of the day (numeric).

4.Number of GPS satellites (numeric).

5.Number of GLONASS satellites (alpha-numeric).

6.**Geoc. X Base**, **Geoc. Y Base**, **Geoc. Z Base** (contains the geocentric coordinates of the base from which the GPS correction was received).

7.Description (alpha-numeric).

If the Group node is expanded in the navigation tree, the list of points it contains is displayed.

Select a point and the program will open the corresponding view that includes two pages: **General** and **GIS Data**.

The **General** page shows the geographic coordinates, the plane coordinates, codes, notes and any drafts associated with the point.

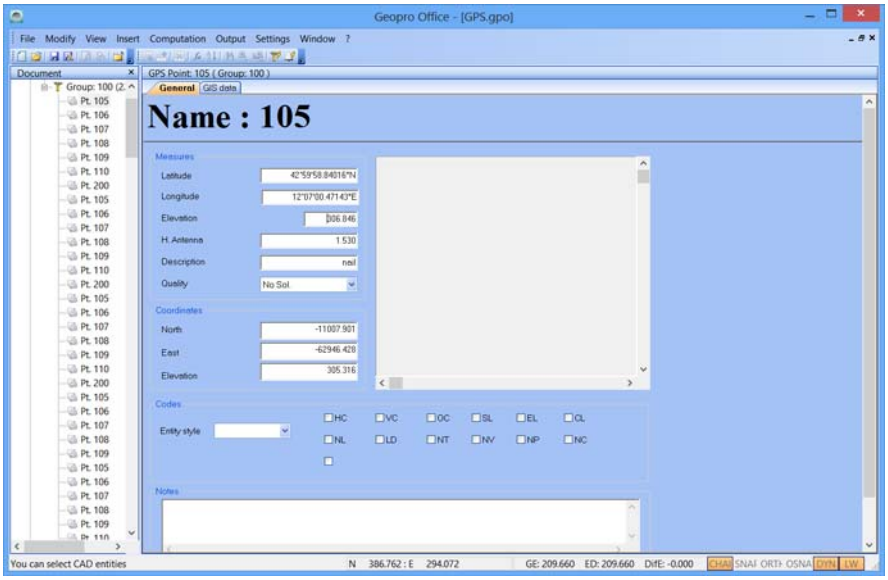



**Figure 156:**

The GIS data is included on the GIS data page (again given that the association with the corresponding database has been executed).

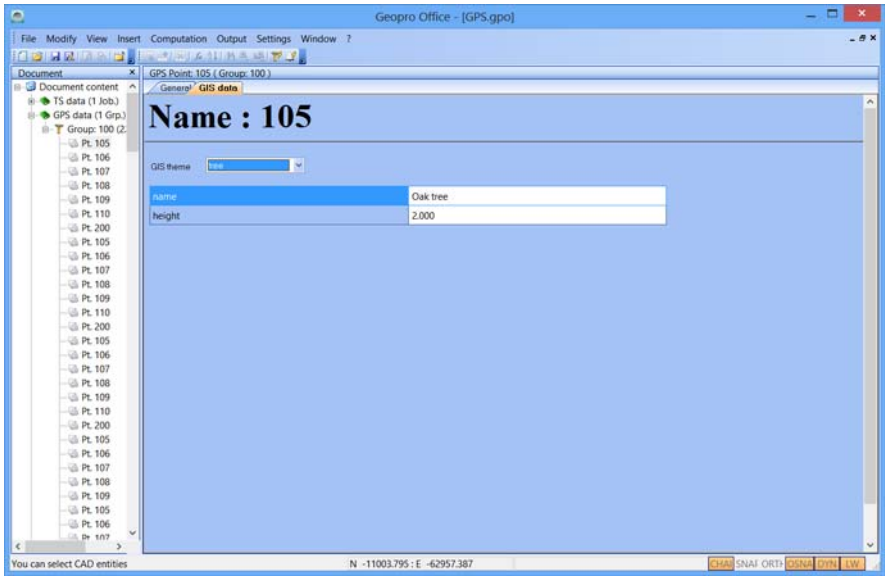



**Figure 157:**

# Insert and Change GPS points

To insert the GPS points the user must first create a group executing the following operations:

•open the **Groups** page from the navigation tree by clicking on the **GPS data** item.

•use the **Insert|Add row** command to insert the first line and, once some lines have been added, insert a line under the current one.

•another command that can be used (only if lines have already been inserted) is the **Insert|Insert row** that is used to insert a line above the current one.

To create a GPS point, the user must work within the pages corresponding to the node of the group where the point will be inserted and use the same commands offered for the groups.

Once the lines are inserted (corresponding to the GPS points) the user can insert the data or edit it directly in the table or specific point view.

GPS points can be changed through the **Modify** menu functions.

# File |Import

Composable format: This function is used to import a text file into the GPS data; after activating the function, the program will open the **Open** window and ask the user to specify the file to import.

Once the file is selected, the **Select** window will open allowing the user to tell the program if the fields are to be fixed length or unlimited, the number of header lines and whether or not to eliminate the text apexes; the lower part of the window will display the preview of the file to import.

If the user selects the **Fixed length fields** option then the next window will display the number of recognized valid fields and the preview of the file based on the selections made in the previous window.

Also in this window, using the grid to insert the data length, the user can tell the program the length that each field must have.

If, instead, the **Unlimited fields** option was selected, then the window will display the file preview taking into account the selections made in the previous window as well as offer the user a section used to specify the types of separators to utilize.

In the last window of this guided procedure, the user can continue by assigning the data to import into the booklet fields.

This operation can be done by clicking on the column header where temporarily the text notes **Ignore**; if this name is not changed then the column will not be included in the import.

Another task to do in this window is specify whether or not a line is to be imported using the check box below of the line.

The procedure is very similar to the one associated with the **File|Import| Coordinates activated by Graphic View File** menu command.

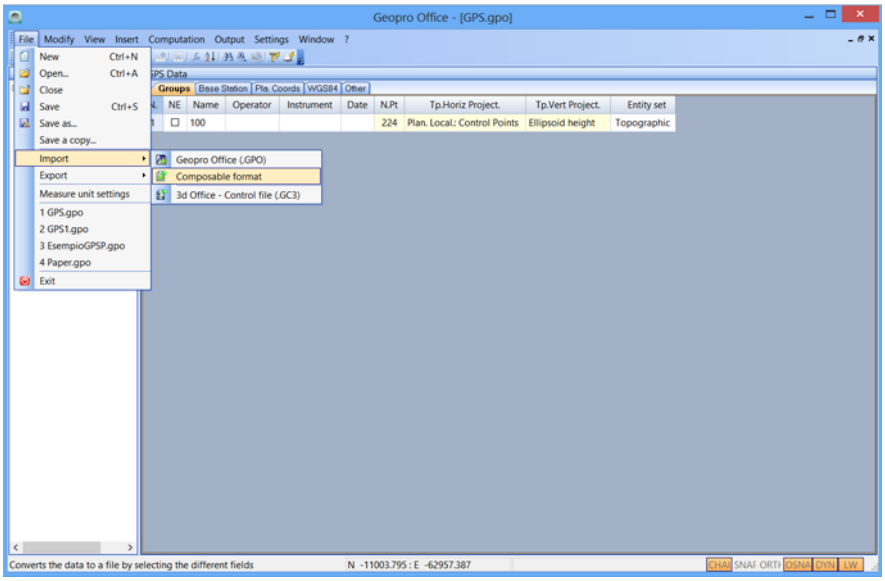



**Figure 158:**

# Import 3d Office - Control file (.GC3)

This function is used to import control points from a file in GC3 format. When this command is activated, the file name to open is requested.

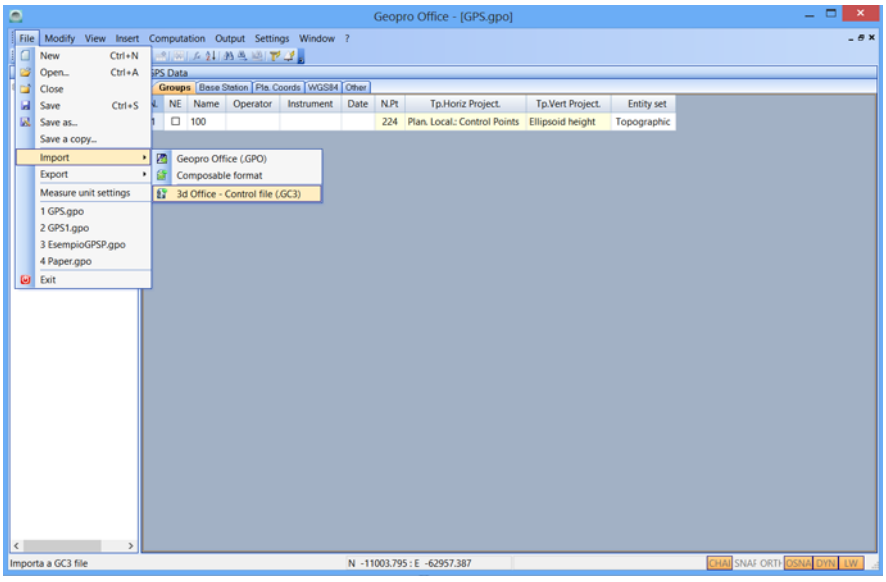



**Figure 159:**

A GPS group is created with the file name; for each point included in the file, the following will be created:

•A GPS point, inserted into the just created group, if there are geographic coordinates present.

•An orientation point, if the plane coordinates are present.

# Computation| Projections computation

This command, activated from the **Computation** menu in the **GPS data** view, is used to set the type of projection to be used for transforming the geographic coordinates into plane and altimetric coordinates through a guided procedure.

The first window opened by the procedure is used to select the group of points on which to calculate the projection.

If a projection has already been calculated for a group, then to continue, the user must insert a check mark in the **Cancel the computation** box thereby canceling the previous elaboration.

If the file includes TS data, then a check box will appear allowing the user to select whether or not to elaborate this data along with the GPS data.

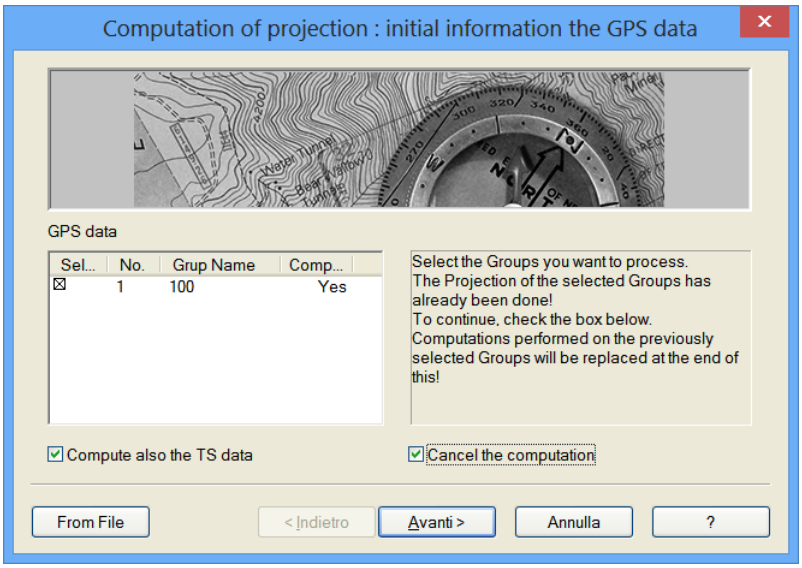



**Figure 160:**

If the user selects to elaborate the data together, then the next window asks which TS jobs are to be elaborated.

If they have already been elaborated, the user is asked to confirm that the program is to elaborate the data again using the specific check box.

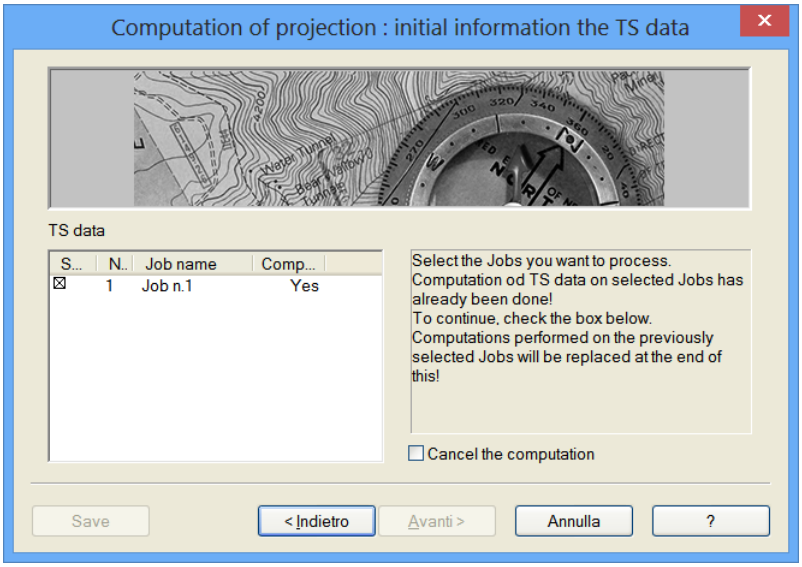



**Figure 161:**

Continuing in the guided procedure, a page will appear in which the user can insert certain options:

•Read from file: this option is used to select whether to read the values used in the projection from a file saved at the end of a previous calculation onto another file. Placing a check mark in this box will activate the edit box found under the "**...**" button. Press this button to select the file from which to take the values for the calculation. All other options will be disabled and pressing the **Next>** button will carry the user directly to the end of the procedure.

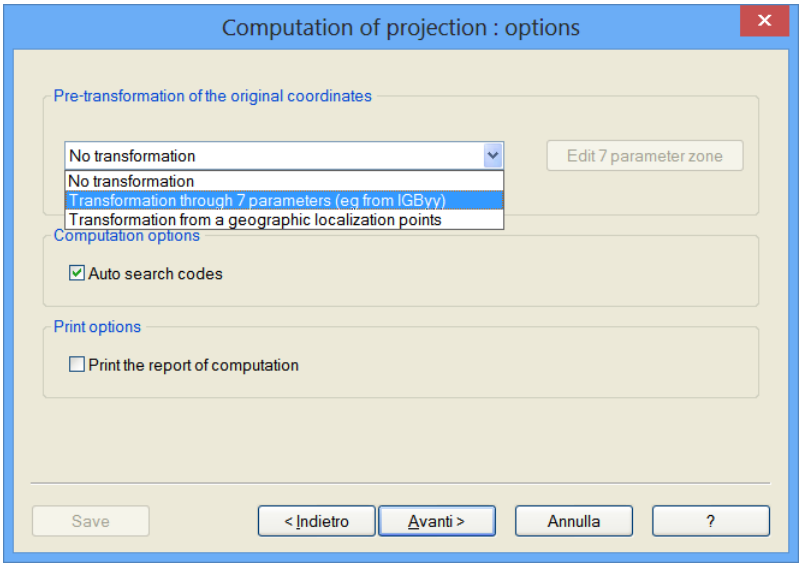



**Figure 162:**

•Pre-transform Original Coordinates: if the measured GPS coordinates refer to a system other than WGS84 then the following transformations are available to run:

1. Using 7 parameters: in this case, the user must insert the conversion parameters from/to WGS 84.

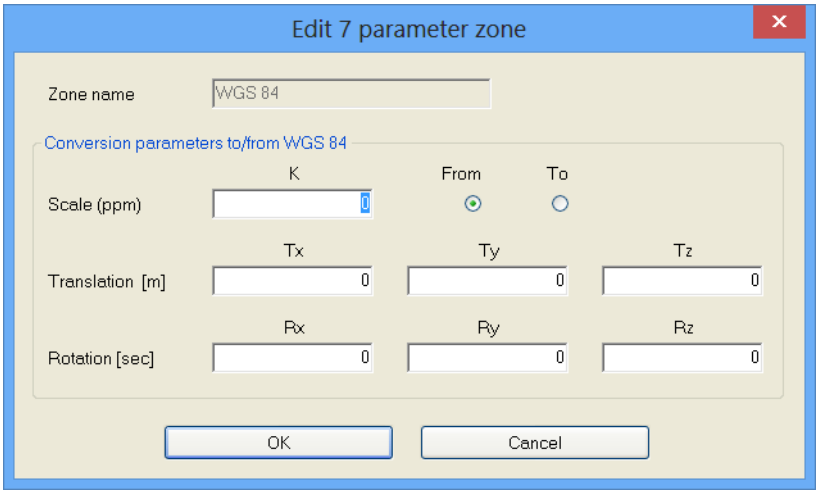



**Figure 163:**

2.From geographic orientation points: this transformation is automatic and the results (including the discards and translation values) are posted in the window seen here below activated by pressing the **Next>** button in the **Calculate projections: calculation options** window.

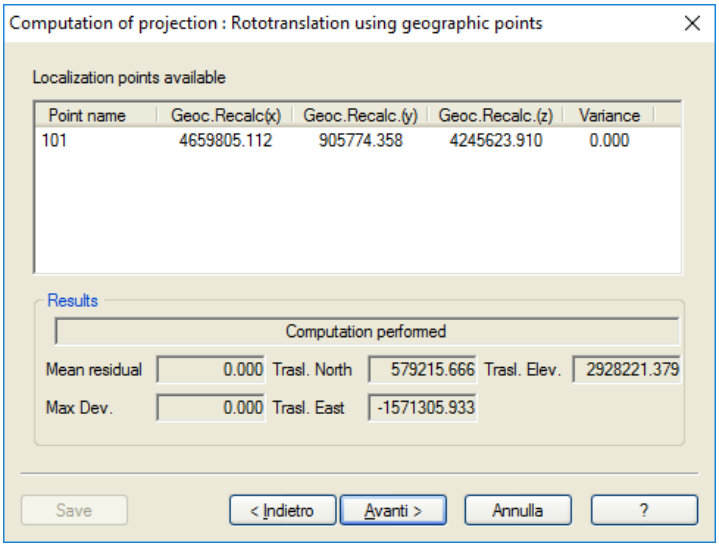



**Figure 164:**

•**Options for Calculation:** placing a check mark in this box will activate the program to search various codes (HC, VC, OC, ...) needed for the elaboration. This association is done comparing the TS point and GPS point names and with orientation point names. The association will be run only if the names are absolutely the same, including capital and lower case letters.

•**Print Options:** placing a check mark in this box the user will have, at the end of the calculation, a printout of the layout calculation results of it is run by control points.

The next window is used to select, respectively, the type of horizontal and vertical projection.

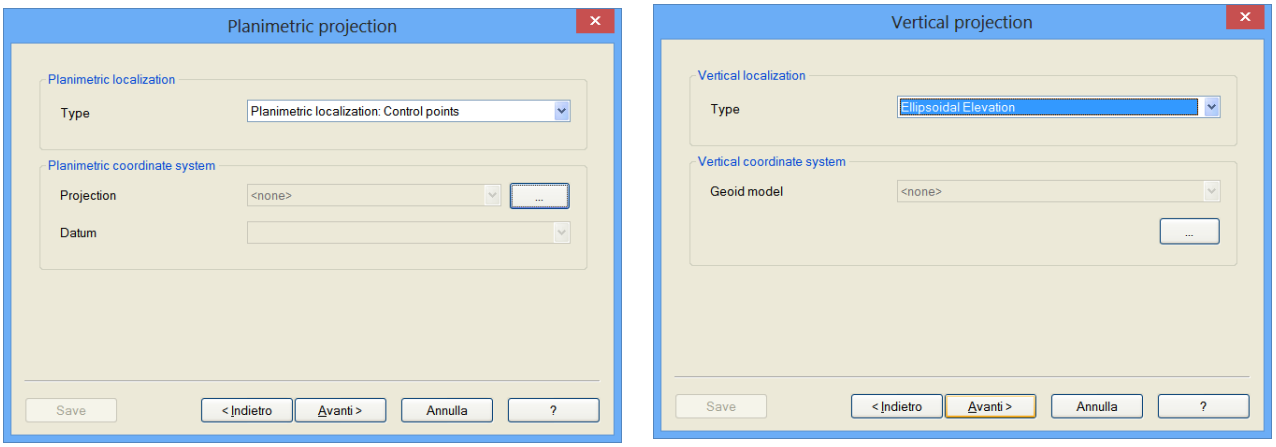



**Figure 165:**

The selections available for the horizontal projection are:

# Plane localization: Control points

For this type of calculation, at least two GPS points are needed or, for mixed calculation, two TS points whose coordinates are identified in the reference plane where all of the GPS Groups or selected TS Jobs points are to be roto-translated. Translation, scale and rotation angle will be calculated by the program using the minimum squares method. Roto-translation is done after a GPS points projection that can be orthagonal or stereographic, as chosen by the operator.

A window will appear with the lists of points that have been coded HC automatically or by the user. Alongside each point will be a small box colored:

•White for invalid GPS points, that is for those that did not find correspondence with orientation points.

•Yellow for valid GPS points

•Blue for base GPS

•Green for TS points and stations.

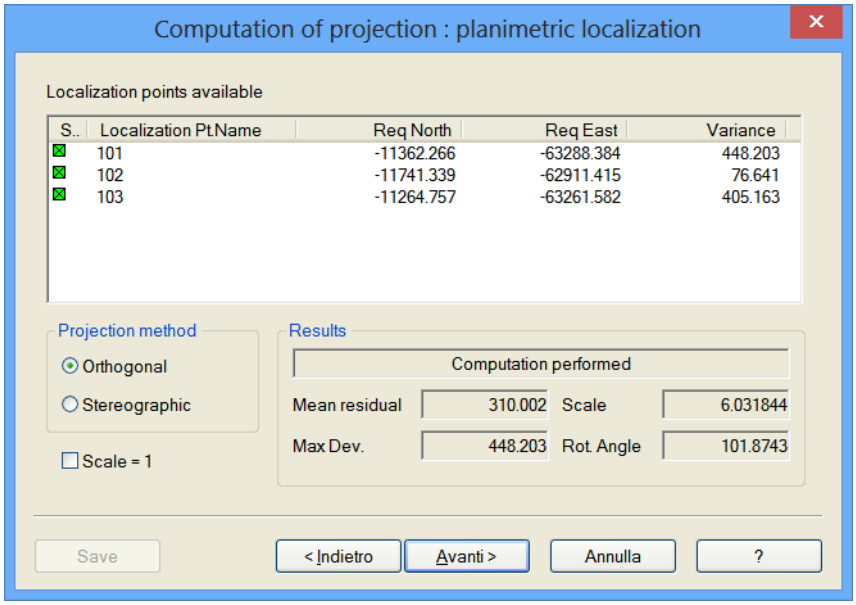



**Figure 166:**

Click on the small box to either remove or replace the check mark to include or not the point in the calculation. If at least two were found and used then the calculation can be executed. This will be appropriately highlighted in the Results section of the window. In the same section the average and maximum discards will be identified along with the scale and rotation angle calculated. Alongside each point the corresponding discard will be indicated.

Finally, a check box is included used to set the scale at 1 to be used for the projection.

# Plane localization: Data Entry

This type of calculation will roto-translate the selected GPS groups points to assign to them the coordinates desired by the operator. Again the operator must insert the values for the scale and the rotation angle. Here too, the roto-translation is done after a GPS points projection that can be orthagonal or stereographic, as chosen by the operator.

A window will open, similar to the preceding ones, only that in this one will list all of the points included in the GPS groups and any selected TS jobs. Alongside each point will be a small box whose color indicates the same information as the previous options.

Only one point can be selected. This point will show the corresponding small box checked off. The selection can be done for all points independent of the fact that correspondence with the orientation points was found or not. Selecting a point for which this correspondence was found, the North and East coordinate fields will be filled with the values inserted for the orientation points; otherwise the user must insert the desired values using the keyboard. Similarly, the user must insert the values for the scale and rotation angle which, in this case, will not be calculated by the program but rather are selected by the user. Each point with noted coordinates (yellow box) will display alongside it the corresponding discard.

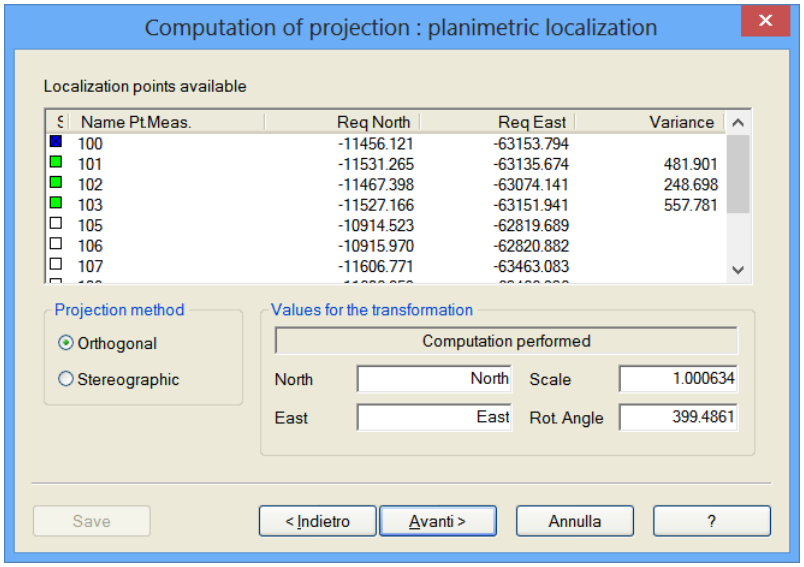



**Figure 167:**

The selections available for the vertical projection are:

# Quote localization: Control Pt.

For this type of calculation, at least one GPS point is needed whose quote is identified in the reference system in which the selected GPS Groups points are being calculated.

A window will open, similar to the one that appears by selecting **Localization plane: Control points** in regard to its functionality as well as in regard to the system of point colors. In this window all of the points that have been coded OR automatically or by the user will be listed.

Click on the small box to either remove or replace the check mark to include or not the point in the calculation. If at least three have been found and considered then the calculation can be run for **Average points** as well as **By plane**. If fewer than 3 points are considered then the calculation can be run only for **Average points**.

The **Average points** calculation involves finding a vertical translation value from the average, for each considered point, of the differences between the ellipsoid quote and the quote inserted in the Orientation points section. The **By plane** calculation involves first an orthogonal or stereographic projection of the points and then the calculation, using the minimum squared method, on a plane that passes along selected points.

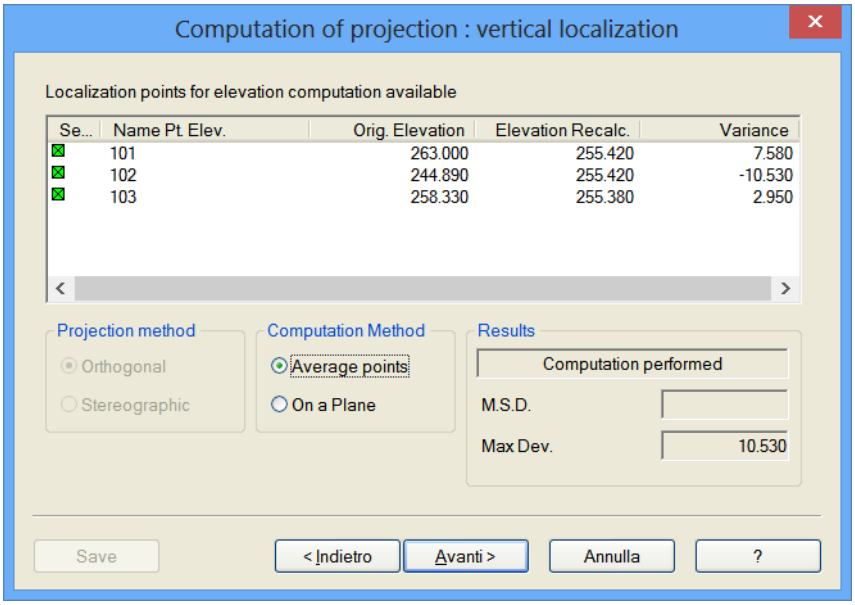



**Figure 168:**

# Quote localization: Data entry

A window will open whose functionality is similar to the one that appears when selecting the Localization plane option: Calculation. The only difference is in the fact that in this case, for the desired point, a quote value is inserted while for the other, the North and East coordinates are inserted.

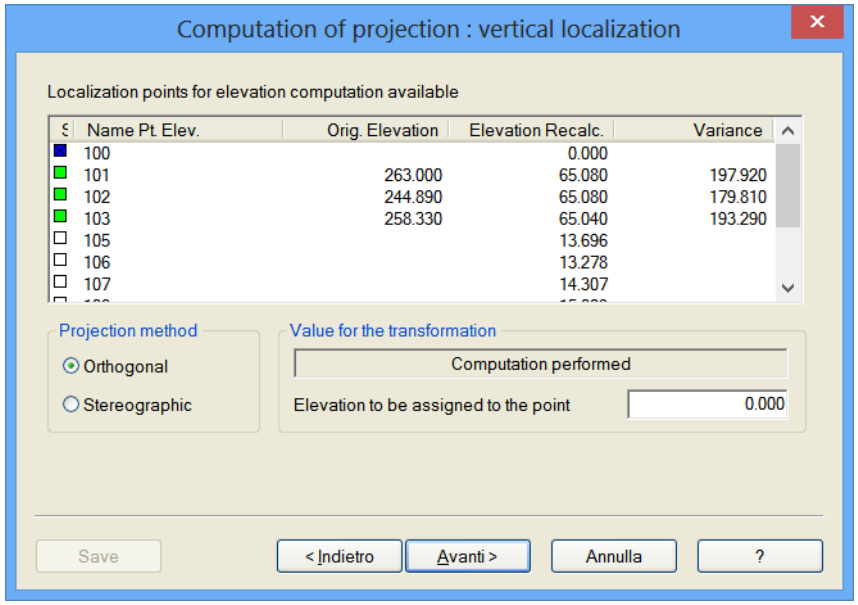



**Figure 169:**

# Ellipsoid height

In this case, the ellipsoid quote assigned to the points is used.

# Any Roto-Translations of Various Entities

The program checks to see if the GPS Booklet has already been elaborated. If so, then the program checks for the presence of other entities in the file (Frames, Graphic Entities, Constraints, Borders, Triangles, Level Curves, Profiles and associated Projects) and displays a window where the user can select whether to change the position of the entity (roto-translate) based on the re-elaboration run previously.

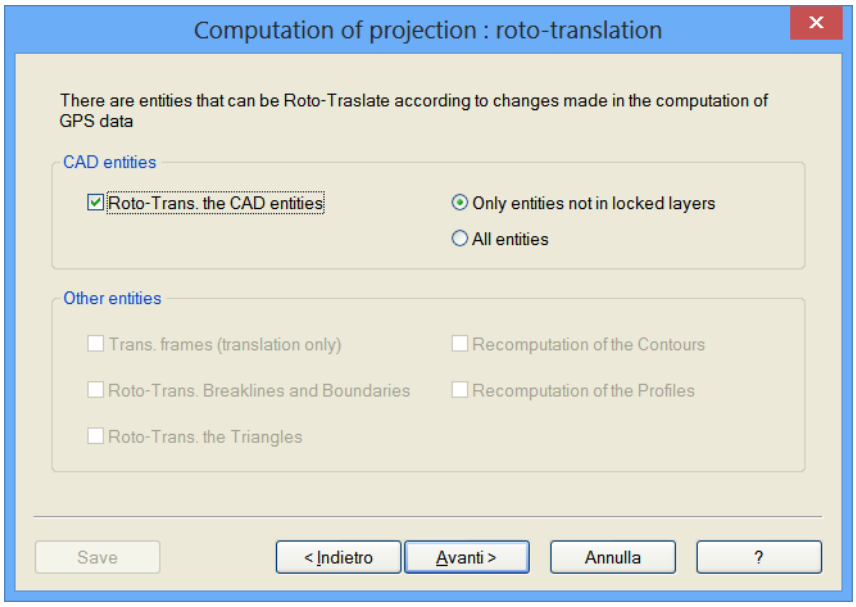



**Figure 170:**

At the end of the procedure, a last window will appear where the user must press the **Complete** button to run the real and true calculation of the points.

It is also possible in this step to go back using the specific button to review counts or potentially run changes to the calculation options.

Also, a **Cancel** button is available to exit from the procedure without any effect on the program document.

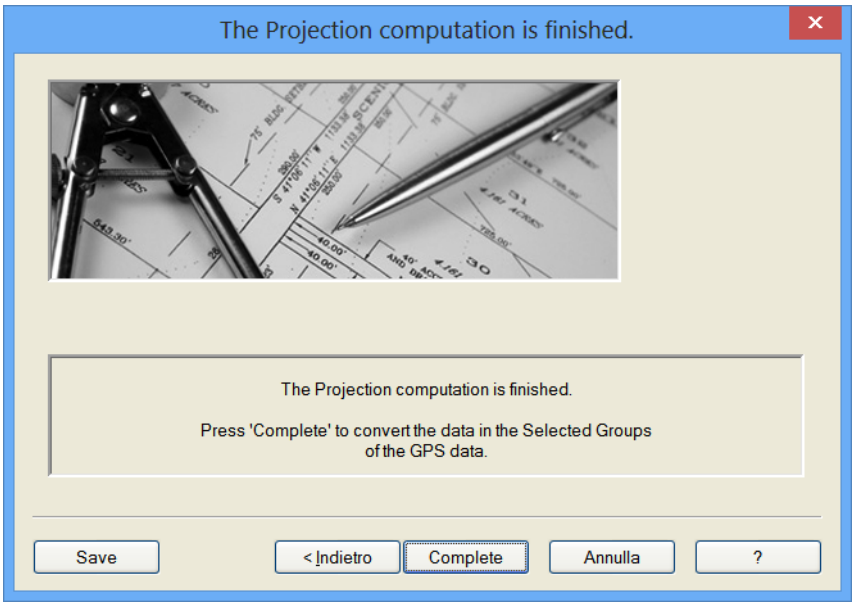



**Figure 171:**

# Output

The Output Menu in the GPS data includes two commands:

•Gps data|Print all groups

•Gps data Print with select groups offers the user the option (through the specific window) to use the mouse to select which station to print.

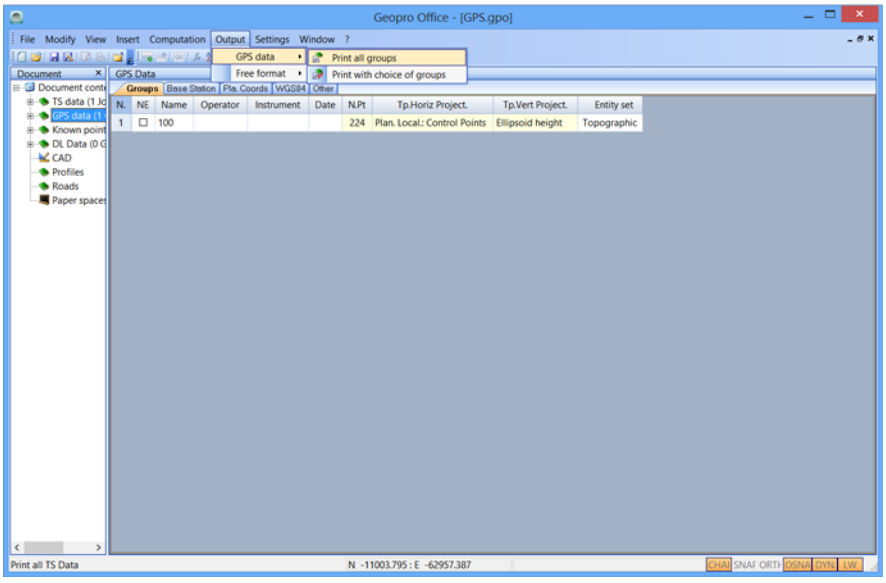



**Figure 172:**

The GPS groups can be printed also according to a free format defined by using the **Settings|Print Options** command. For this type of print the user can also select whether to print all groups or just some.

The **Settings|Print Options** command is used to also define the free format to be applied if the user wants to also produce an outcome of the File data (**File|Export|Free format** command).

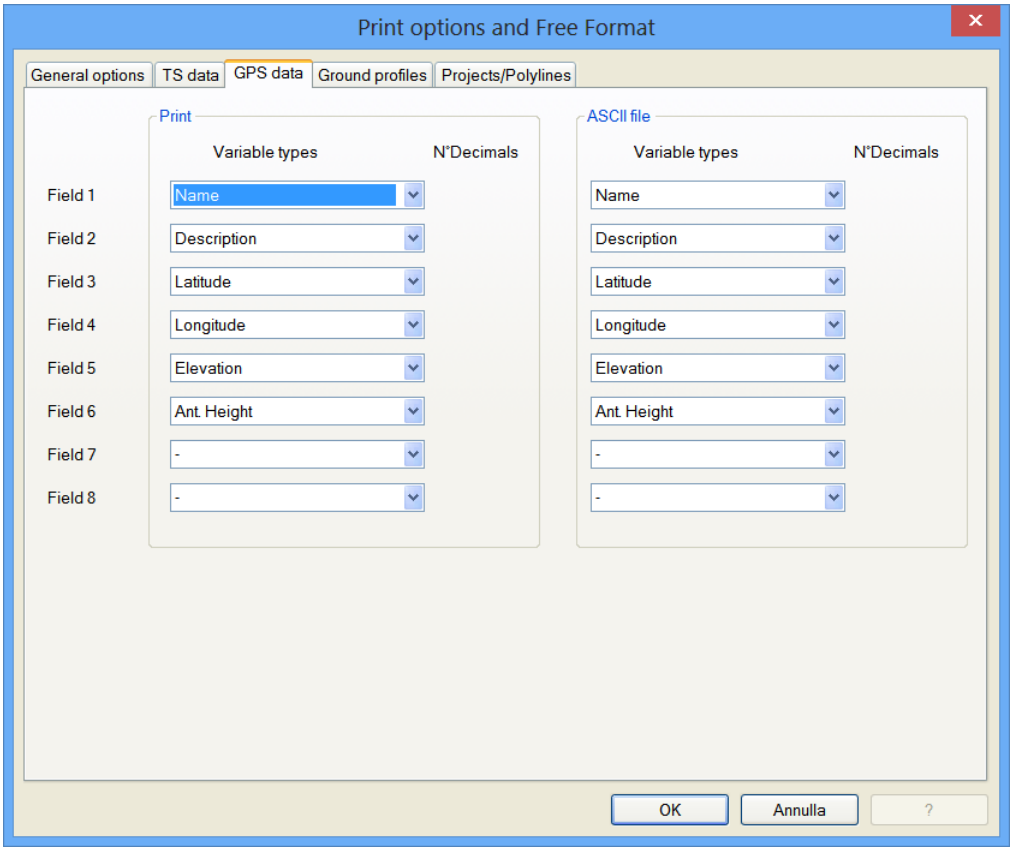



**Figure 173:**

# File|Export

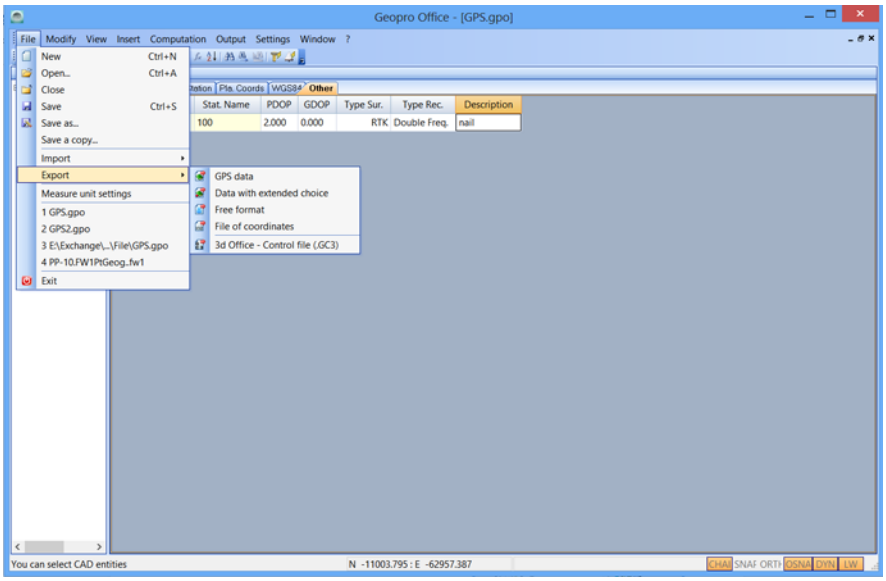



**Figure 174:**

**GPS data:** by running the **File|Export|GPS data** the user can export the GPS data in file by selecting the file name and save path through the specific window.

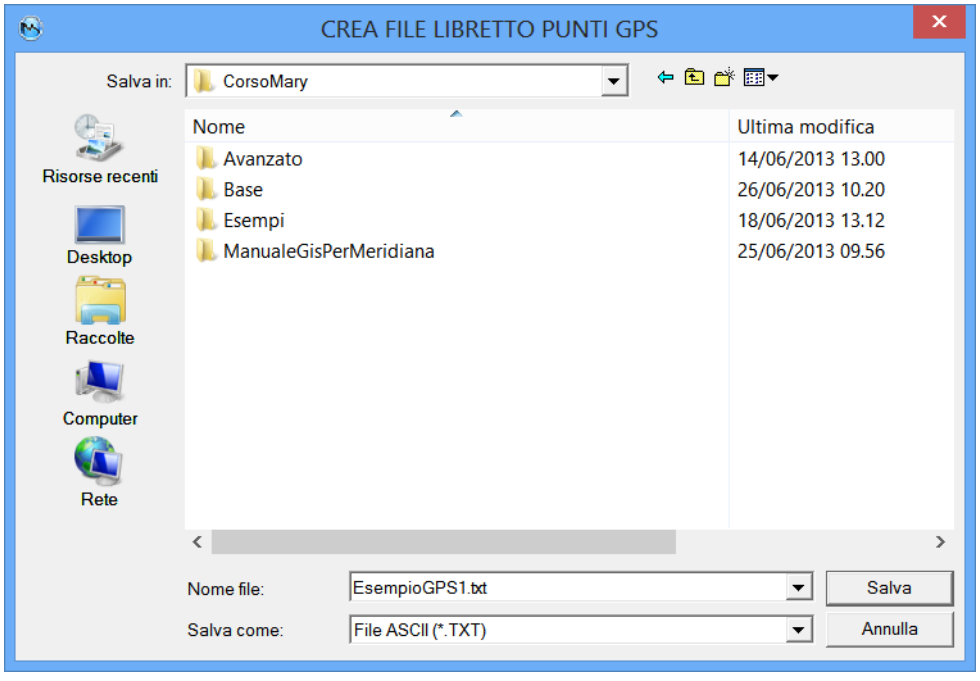



**Figure 175:**

**Data with extended choice:** this command creates an ASCII format file that can be set as desired.

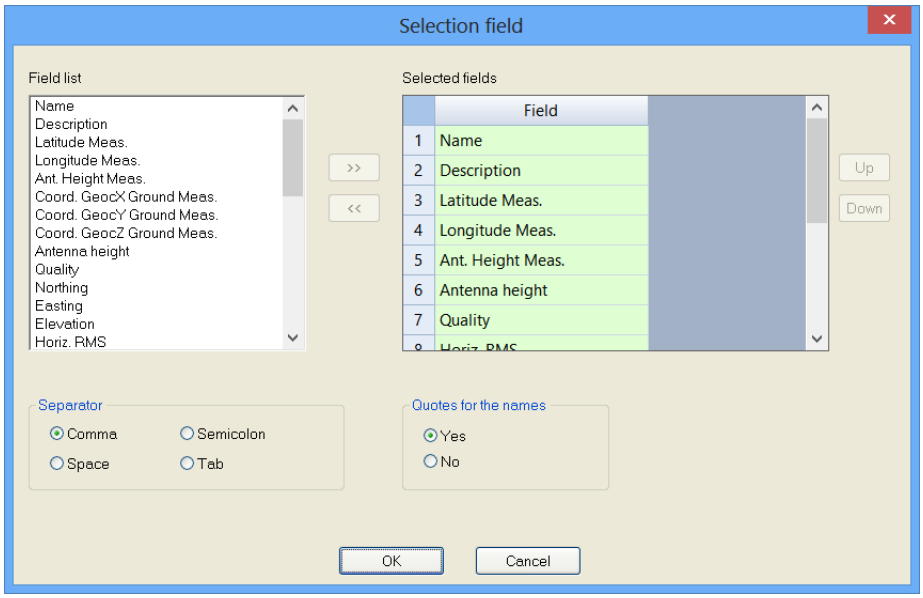



**Figure 176:**

Once the command is run, a window will appear used to insert the information for creating the file.

The left part of the window shows the list of fields available to export. To make the export effective, the user must select the desired field and then press the "**>>**" button. A new line will be inserted into the list shown in the right part of the window. Selecting a line from list on the right and pressing the "**<<**" button will instead eliminate that field from export.

It is possible to select the separator character inserted between the various fields and the usage of double apexes for names.

Press **OK** in this window and another one will open to select the name of the file to create. Initially the name will be set equal to the open program file but will instead have the TXT extension. This name can be changed by the user and the file can be saved in a file as desired.

**Free format:** This procedure creates a file based on a format set using the **Settings|Print Option** command, GPS data Page, used to select the field to insert and any decimals numbers to be used.

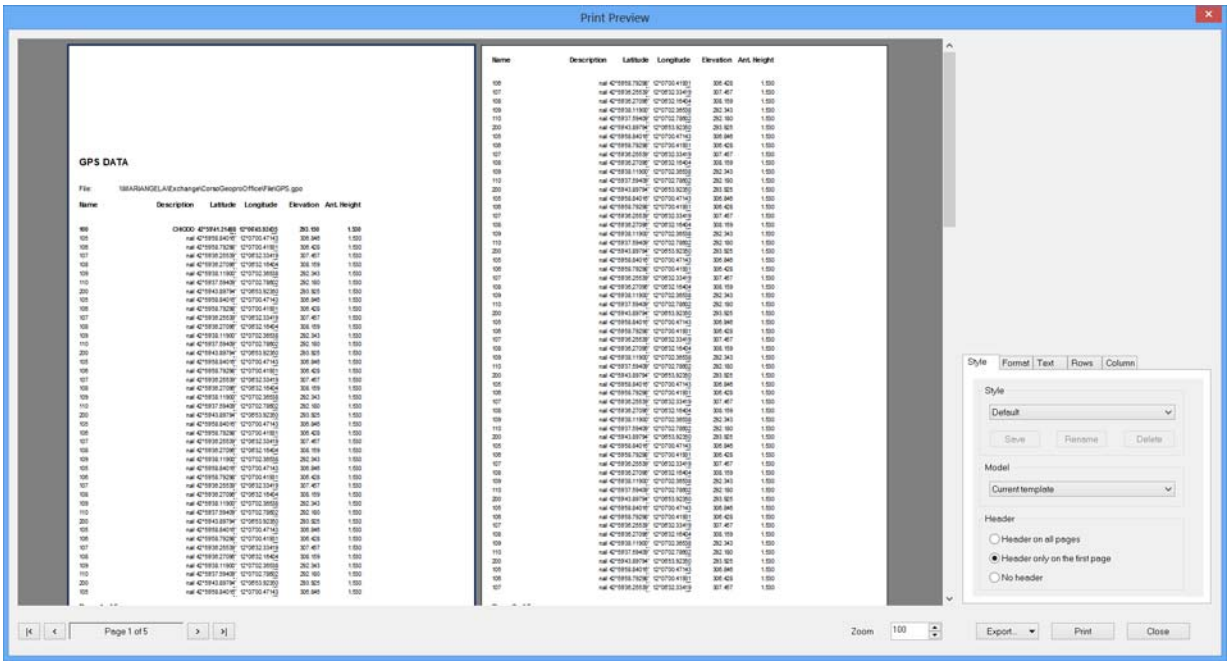



**Figure 177:**

File of coordinates: this procedure is used to create a file by selecting the variables and their order. The file will take into account the results of the Projection calculation run on the GPS data.

Once this procedure is activated, a window will appear in which to select the variables to be inserted into the file to create. It is also possible here to select the number of decimals, the separator between one datum and another and whether to include names among the double apexes.

Once confirmed, this window will activate the preview of the file selected for creation.

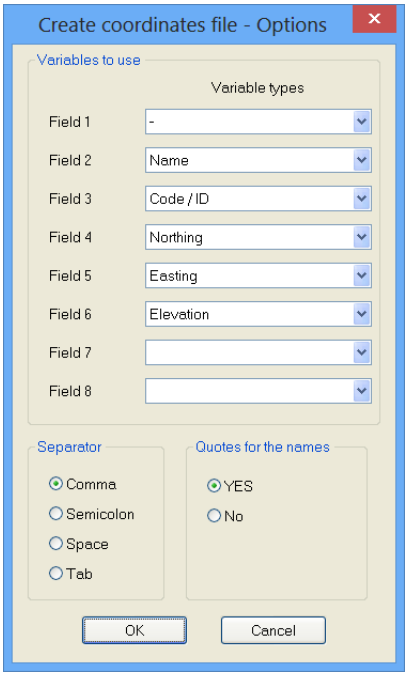



**Figure 178:**

**3d Office – Control file (.GC3):** this function is identical to the one in the Known point data and is described in chapter III of the base course (Known and Control Points) paragraph VIII.

# Details

**Code Meanings:** see the "Introduction" section of the Base course or the program's online guide, "Point Codes" document.

**Run the projection calculation:** see the online guide GPS data View Elaboration Menu.

**GIS:** refer to the program's online guide, CAD View|GIS menu.

**Creating Design Models:** see the "CAD View" section of the Base course or the program's online guide, CAD View|Format menu.

**Modify Menu:** refer to the program's online guide, Modify Menu (Numeric Views).

**Free format:** see the Print Module chapter in the base course or the online guide of the GPS data View Menu File|Export, Outcomes and Options.

**Entity sets:** refer to the program's online guide, Format|Entity sets.

# Post Processing Calculation

## Introduction

This chapter will outline the Post Processing Calculation with an example file (PP-10.gpf) created with the Geopro Field program. All the same, note that the calculation can be run also through other data acquisition methods, for example, data stored directly within Sokkia/Topcon receivers in TPS format, or using RINEX, RINEX-Hatanaka and compressed files obtained from other receivers.

The data in the example were obtained from Geopro Field using **Points also in Post Processing** mode. When selecting this method, Geopro Field creates a folder with the same name of the .gpf file and stores inside it a TPS file format for each measured point also in RTK (see Appendix).

The command to run this calculation is found in the **Computation** menu of the GPS data View.

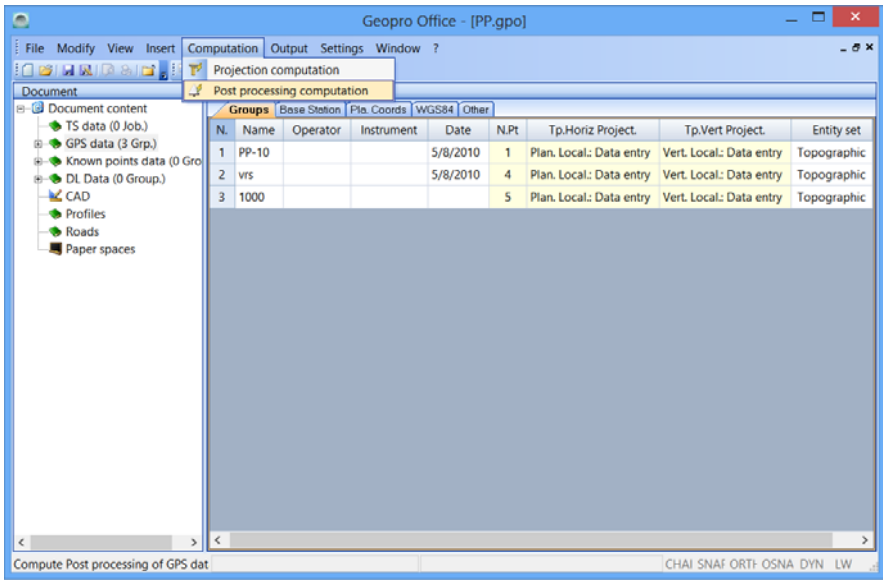



**Figure 179:**

# Step 1 - Selecting Rover points

Having opened a work created with Geopro Field as **Points also in Post Processing** mode, the program will use the files found in the folder with the same name as the .gpf file (PP-10) to identify the Rover points.

The table includes one line for each inserted point.

The data shown in the **Details** and **Antenna Used** squares refer to the line selected in the table.

The table columns are:

- Used. (To exclude but not completely eliminate the point from the calculation the user must remove the check from the column);

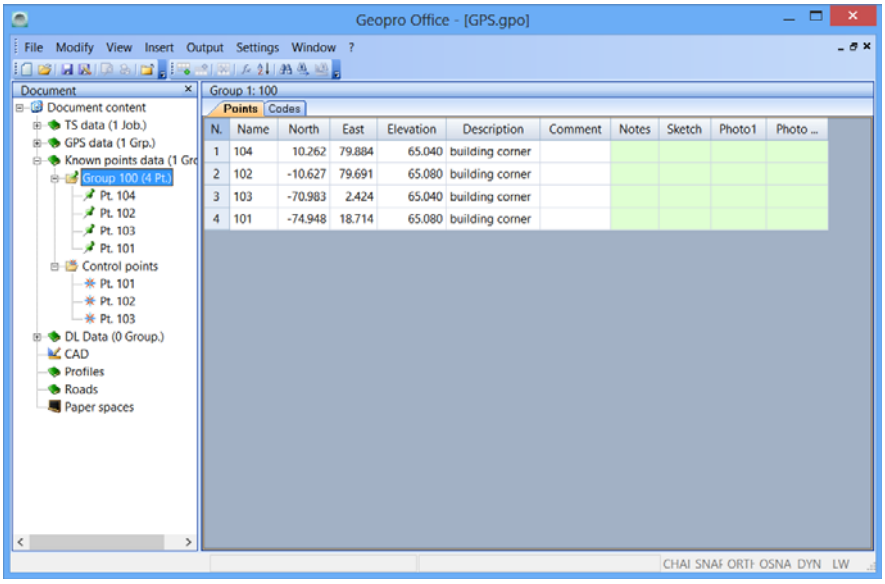



**Figure 180:**

- Name;
- Status (if the symbol is green then the file is properly present in the computer at the indicated path, if the symbol is red, then the file is no longer present in the computer; this may occur when there is repetition of the elaboration);
- Start: this indicates the moment when the measuring begins;
- End: this indicates the moment when the measuring ends;
- Ant. Type, this identifies the antenna model used which may be changed using the **Change Antenna** button;
- Hei.Ant.Mea. (m), indicates the height measurement of the pole supporting the receiver.

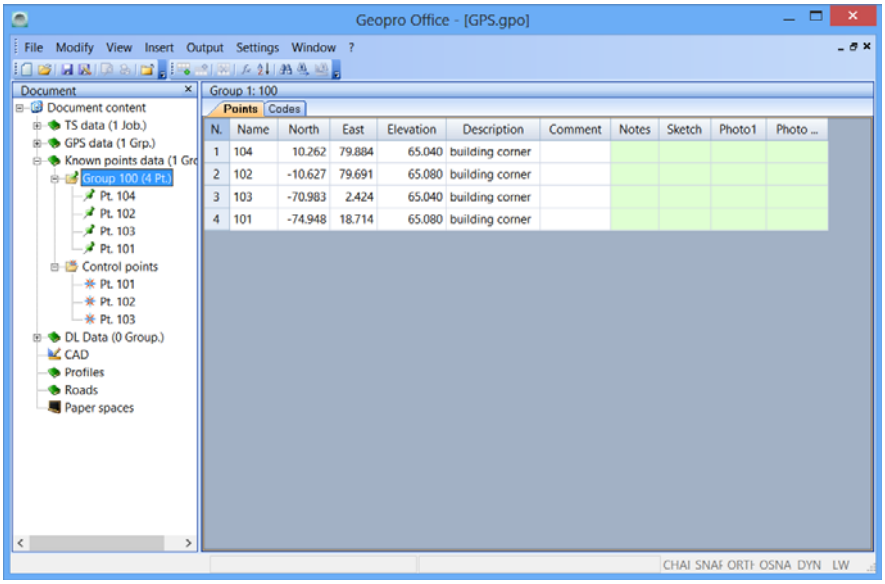



**Figure 181:**

The information that the receiver tends to recover from the loaded file and displaying it can be changed by the user.

Press the **Add** button in the Step 1 window to open another window used to select the file to be used for the calculation. These files may contain data in various formats such as .tps, RINEX, RINEX-Hatanaka and compressed files. The **Eliminate** button is used to eliminate a previously selected file from the calculation.

# Step 2: Selecting Base points

Continuing in the guided procedure, a window will open where the user must select the files holding the data needed for the Post Processing and that represent the Base Points, that is, those points for which the noted coordinates are known exactly.

The functionality of this window is similar to the one used for selecting the Rover points.

The only differences involve the **Change Coordinates** and **Add** buttons.

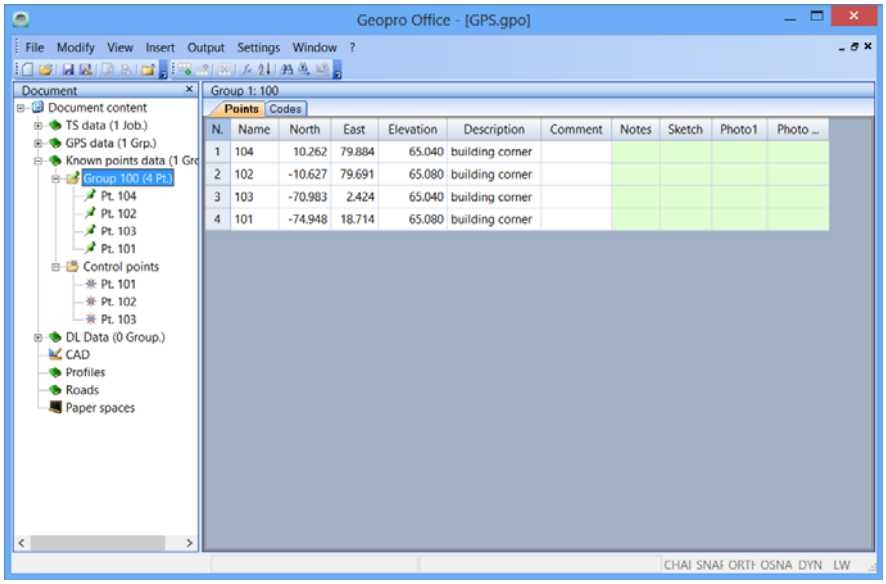



**Figure 182:**

After selecting the desired file (in format .tps, RINEX, RINEX-Hatanaka and compressed files) the **Add** button will activate Step 2 where the user must select the exact coordinates of the Base corresponding to the just added file.

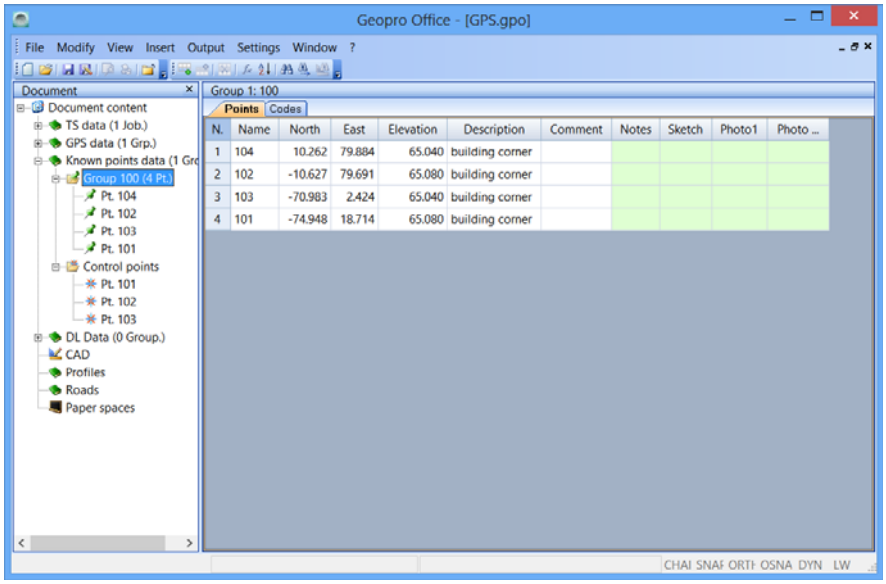



**Figure 183:**

This window is used to select the method to select/insert coordinates to be considered as exact for the inserted Base point. The information and approximated coordinates taken from the selected file are shown in the specific square found in the lower left part of the window.

The right part of the window shows the information on the antenna used.

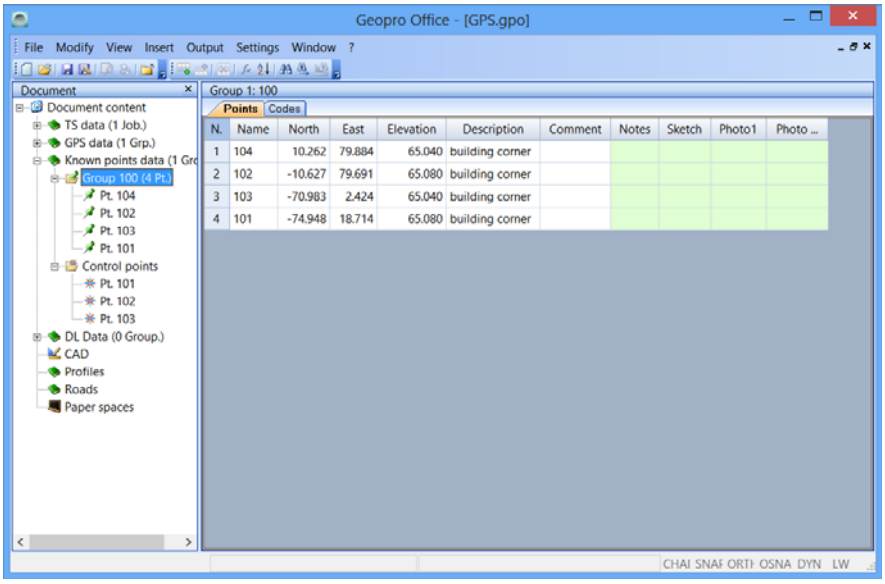



**Figure 184:**

This last information is identical to what is shown in the window associated with Step 2 and can, as selected, be changed in this or the other window.

In the illustrated example the Null antenna is selected. As such, the value 0 is inserted for the height and set as the vertical measurement.

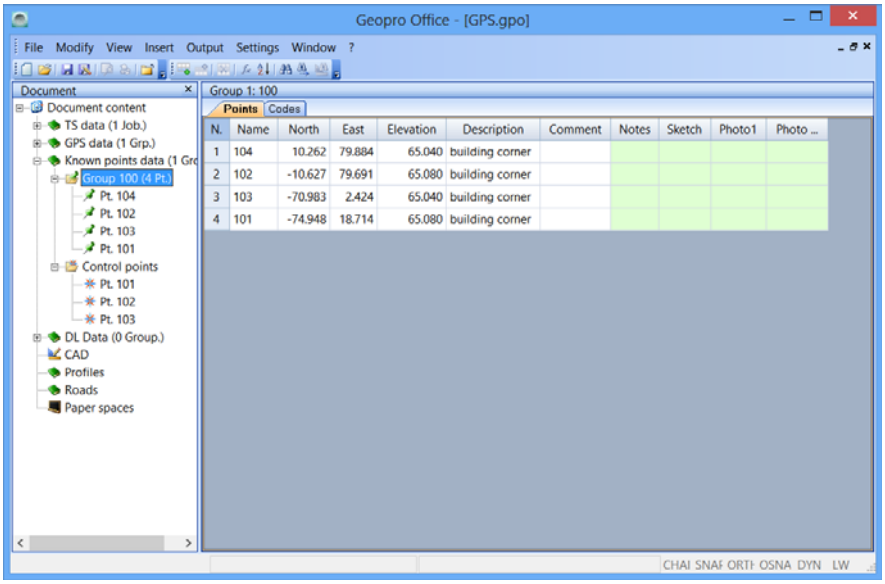



**Figure 185:**

The choices available for the selection of exact coordinates of the inserted base are:

1.Association with a Localization Point / Insert New Point. Executing this selection and pressing the **Next>** button will proceed to Step 2b where the user can select one of the Orientation Points in geographic coordinates or insert a new one. The coordinates of this point will be used as the exact ones for the inserted Base point.

2.Present values in the selected File. It is correct to select this option if the user knows with certainty that the coordinates present in the file are to be considered exact: for example, if the file is a virtual RINEX. Press **Next>** to return directly to Step 2 without executing other operations.

3.Association with a base station RTK present in the file. Executing this selection and pressing the **Next>** button will proceed to Step 2c where the user can select one of the RTK stations. In this case, the coordinates of this station will be used as the exact ones for the inserted Base point. Normally, the RTK base coordinates are obtained from the rover receiver through remote connection and stored in the work. This selection is correct only if the receiver used as RTK base is the same used to store the file for the Post Processing.

In the example the third option was selected, and therefore moves to Step 2c.

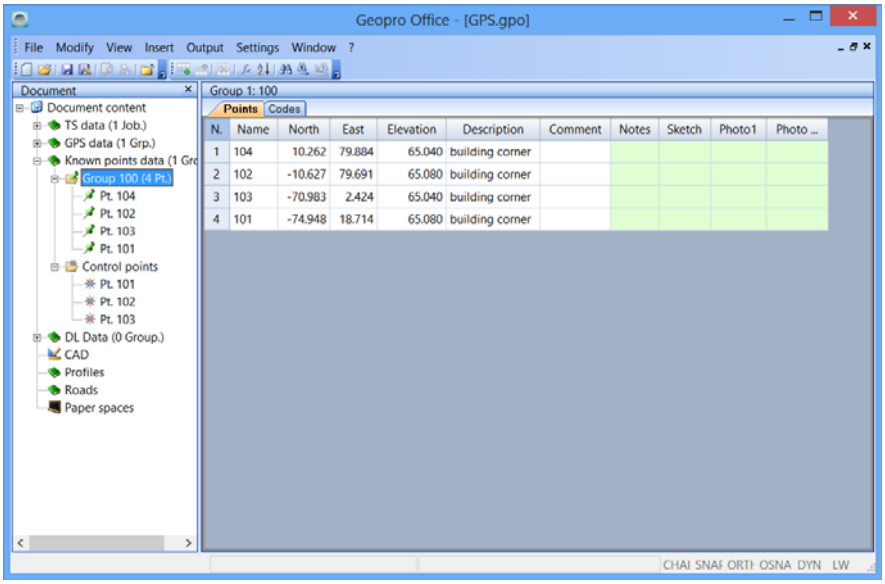



**Figure 186:**

Completing Step 2c, press **Next>** to return to Step 2.

The **Change Coordinate** button is used to change the coordinates selected for a specific Base point already inserted into the list.

The functionality of this button is similar to the **Add** button, only that it does not allow the selection of a new file but rather acts directly on the file corresponding to the line selected and will activate Step 2a.

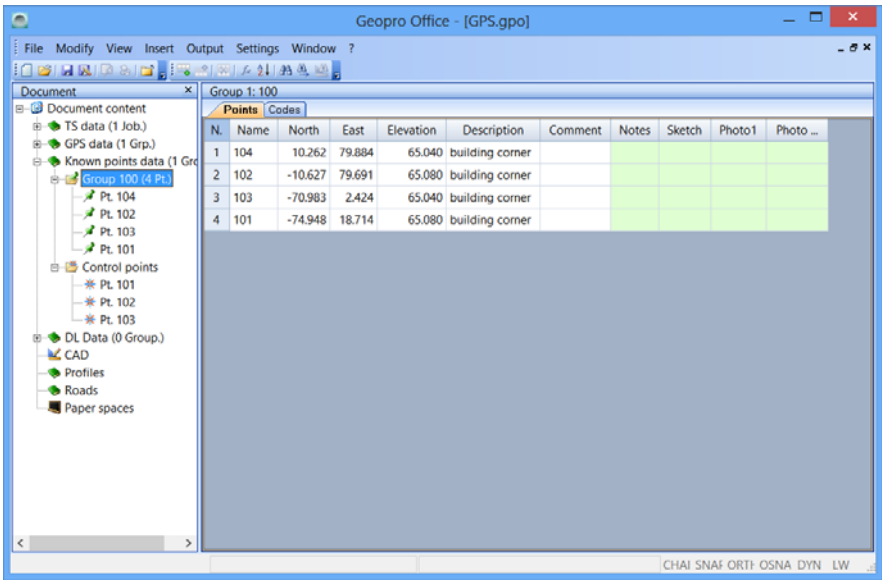



**Figure 187:**

The list above displays all of the Orientation Points in geographic coordinates found in the open survey.

These are points that can be consulted and edited in the **Geographic Points** page corresponding to the **Known points data |Control Points** node of the navigation tree.

To select the desired point, place the check mark in the associated box of the **Sel. column**.

The details corresponding to this point will be displayed in the part under the window.

The attention symbol displayed in the **Valid** box indicates that the distance between the approximate coordinates, found in the file (.tps, RINEX, RINEX-Hatanaka and compressed files) and those of the corresponding point is greater than the warning value.

To find more information, just use the mouse to click on this symbol and an **Attention** notice will appear.

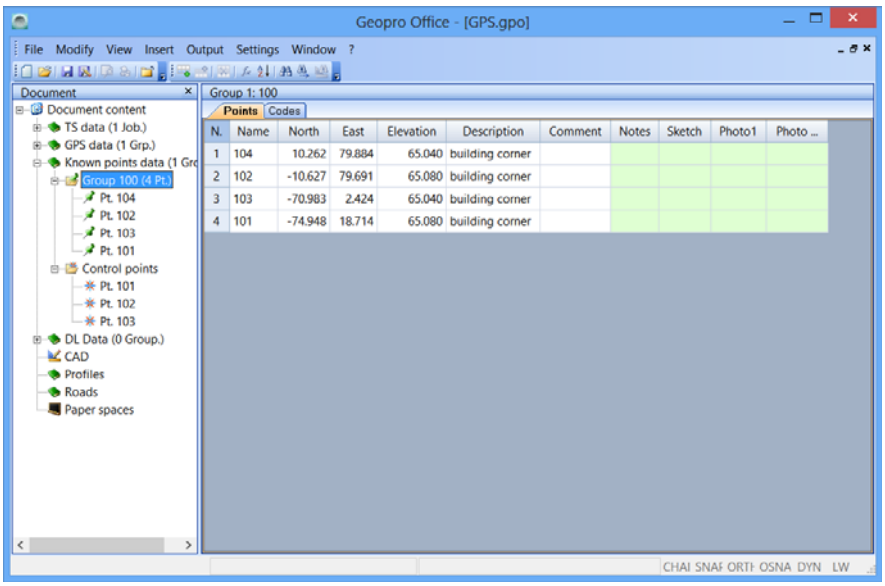



**Figure 188:**

If what is desired is not found in the displayed points, the user can insert it by pressing the **Add** button.

In this case, the following window will open where the user is required to insert the name and coordinates.

For the coordinates the user can insert values in even just one of two ways: latitude, longitude and elevation or in geocentric format.

The program will run the calculation and automatically insert the values for the other method.

Press the **OK** button and the new point will be inserted into the specific section.

Then the program returns to the previous window where this new point is displayed along with any others.

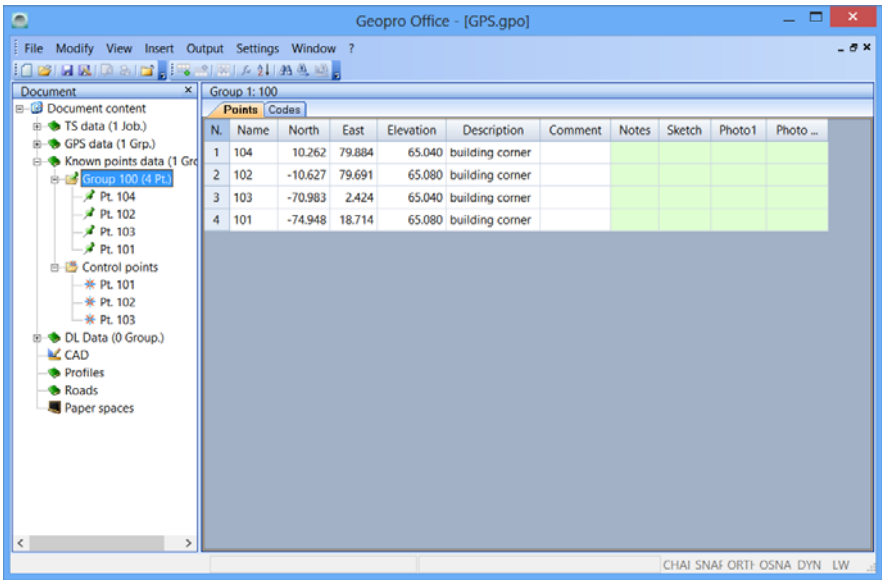



**Figure 189:**

Step 2c - Select Coordinates for Base from RTK Stations Present in Open Work

The functionality of this window is similar to the one used in Step 2b.

However, the RTK base stations present in the open work are displayed instead of the Orientation Points.

Further, the **Add** button is not available as new stations cannot be added.

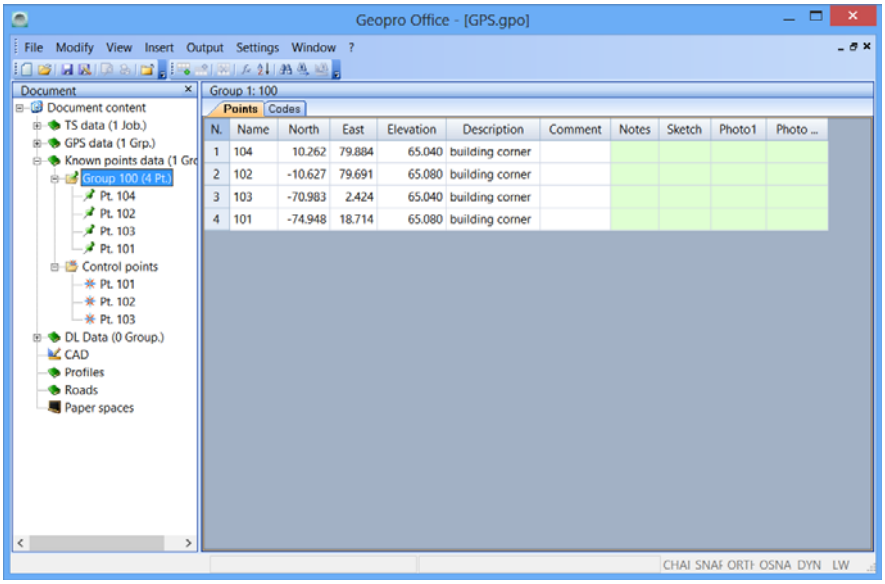



**Figure 190:**

# Step 3: Calculate Base Line

The Post Processing calculation is activated automatically when it is launched and the bar, found on the lower part of the window, displays the percentage of calculation completed.

During this phase the user cannot execute any other operation.

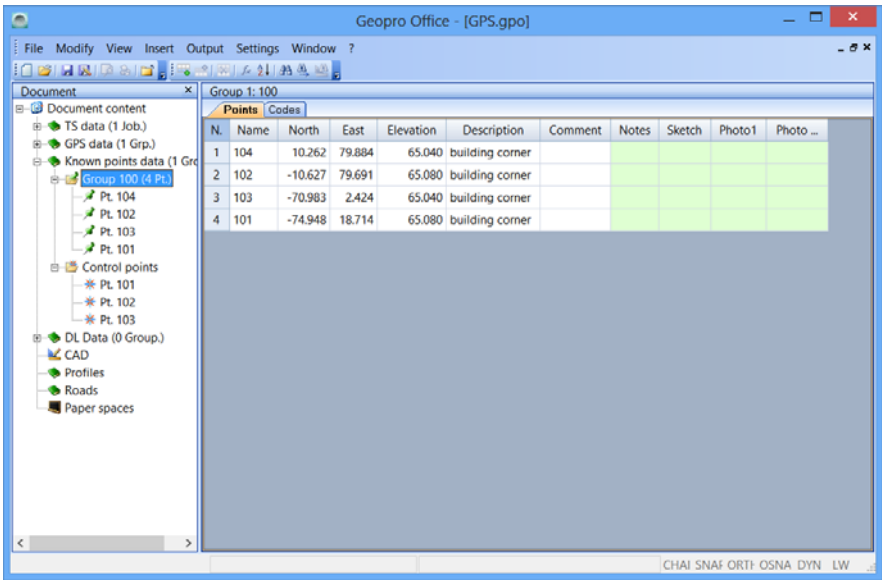



**Figure 191:**

When the calculation is completed the window will assume this appearance...

The table above lists the Rover points inserted during Step 1, while the lower part displays the detailed results of the calculation for the point selected in the table.

The green colored symbol found in the **Elab.** column of the table indicates that the elaboration was completed successfully; otherwise, it would be red.

The **Method** column will display the calculation method used and as such an alarm symbol will appear if any of the following values is not in tolerance.

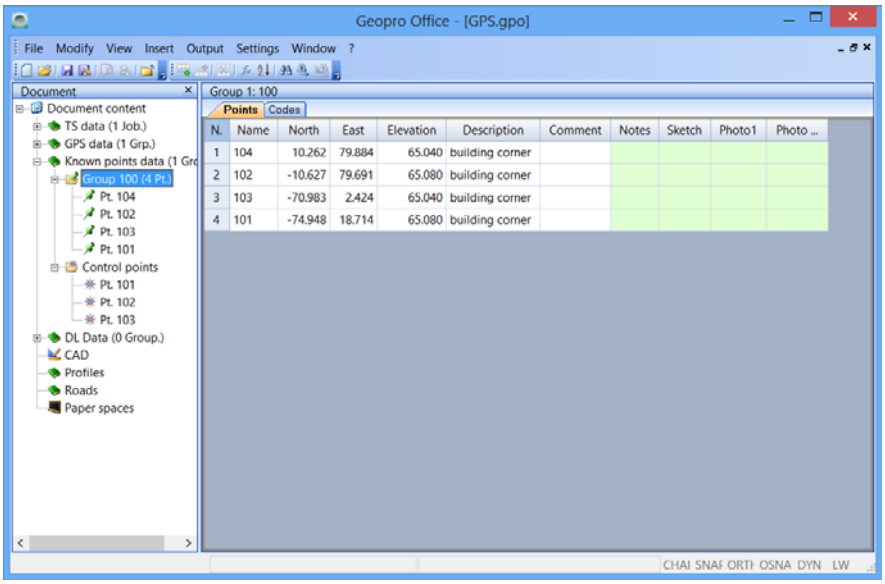



**Figure 192:**

Using the mouse to click on this symbol will bring up a window that details the values that are not in tolerance.

Also, those values that do not comply with the tolerances are found with a red background in the table rather than the standard light yellow.

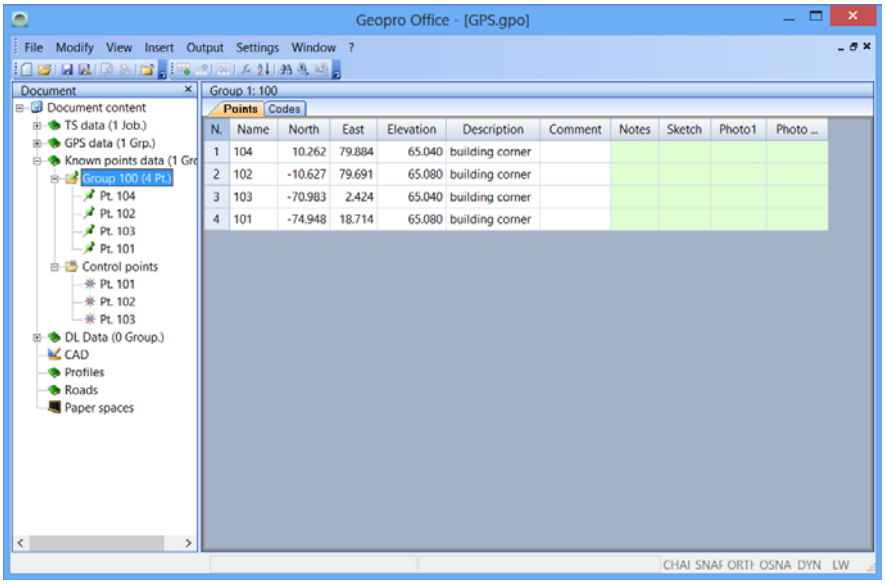



**Figure 193:**

It only needs one point that does not comply with the tolerances and the lower part of the window will display the text in red **Attention! Some of the values calculated are out of tolerance!**"

It is advised to closely evaluate whether to continue anyway with the calculation procedure accepting the results.

To activate the Post Processing calculation again, press the **Compute** button. This operation can be repeated after selecting or deselecting the points on which to run the calculation, using the check mark found in the **Used** column or after having changed the calculation options using the **Options** button.

Note that if a point has already be calculated and the user wants to deselect the associated box for the subsequent calculation, then the calculation run previously for this point will remain valid.

As such, if the result of the first calculation fails to deliver the expected results for all the points, those points whose calculation delivered valid values can be deselected (while maintaining the obtained results); then the user can attempt to change the possible options and repeat the calculation on the points with dubious results.

Press the **Options** button to open the following window used to insert the values that may directly affect the calculation and the values that control the validity of the obtained results.

The values able to affect the calculation are:

- Minimum elevation of satellites to consider them in the calculation;
- Constellation to use; the options are **GPS+Glonass** or **Only GPS**.

The values and tolerances able to control validity of the calculation are:

- Quality of the accepted calculation; the selectable values are: **Only Fixed**, **Fixed and Float** and **Fixed, Float and Code**;
- The minimum acceptable horizontal accuracy;
- The minimum acceptable vertical accuracy;
- The maximum distance between Base and Rover;
- Minimum hold time on an expressed point as minutes per km of Base-Rover distance.

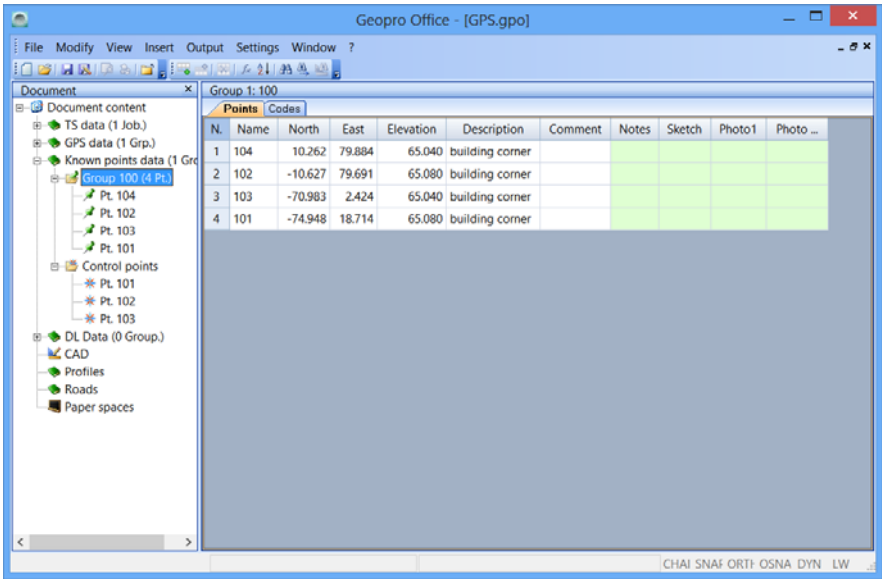



**Figure 194:**

It is not advisable to change the first, fourth or fifth of these values as less restrictive than what is suggested. By changing these values to be less restrictive, the lower part of the window will display the text **Some values set are not advised!**.

This warning will not though block confirming them.

Press the **Default** button and the values considered standard by the program will be refreshed. Press **OK** or **Cancel** to return to the previous window, respectively by conserving or canceling any changed data.

# Step 4: Operations to run in GPS data

This window is used to insert the options for the changes to apply to the booklet based on the calculations executed.

The first option involves creating the new points from the Post Processing calculation.

The possible options are:

- In the same group as the original points;

- In a single existing group to be specified;
- In a new group to be created specifically for this.

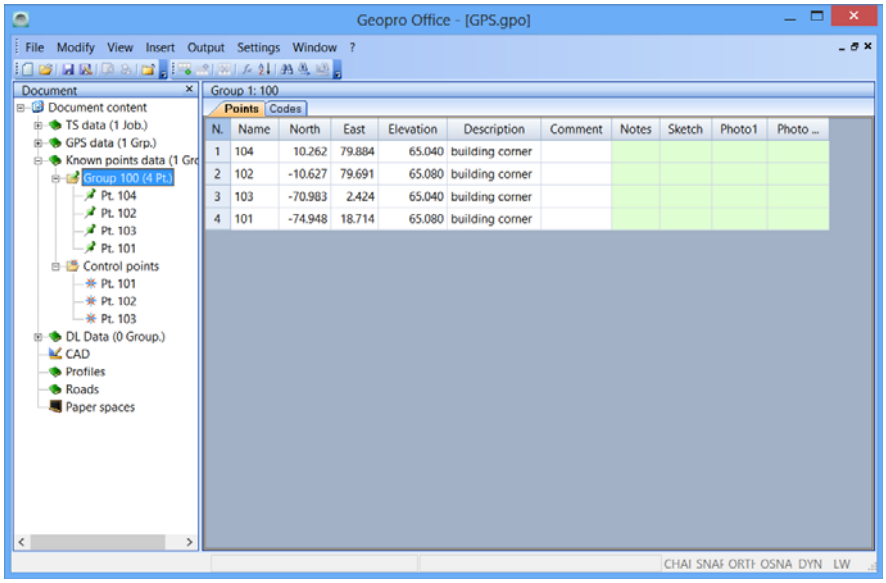



**Figure 195:**

Original points are those points with the same name as the newly calculated points. They are, for example, those points measured with Mercurio/Pegaso using **Points also in Post Processing** mode.

If the second option is selected then the **Groups in Which to Create Points** box will activate where the user can select the existing group to run the new point creation operation.

The possible options are:

- Use names assigned in the previous windows;
- Add a suffix to the new points.

If the last option is selected then the box below will activate to insert the desired suffix.

The last option involves original points and the possible options are:

- Add a suffix to the names of original points;
- Erase points;
- Do no operation.

If the first option is selected then the box below will activate to insert the desired suffix.

Press the **Finish** button to conclude the procedure with the creation of new points and running the other operations with the methods just selected.

If the procedure was interrupted in any of its steps, the options and data that may have been inserted will be lost. Instead, if the procedure is completed, then all of this information is stored and suggested again in a future calculation.

The image below shows the result of the **Post Processing Computation** using the options set in the previous window: the **GPS Coord.** page of the PP-10 Group just created shows the new points with the **new** suffix, which the previous points have been renamed adding the suffix **OLD**.

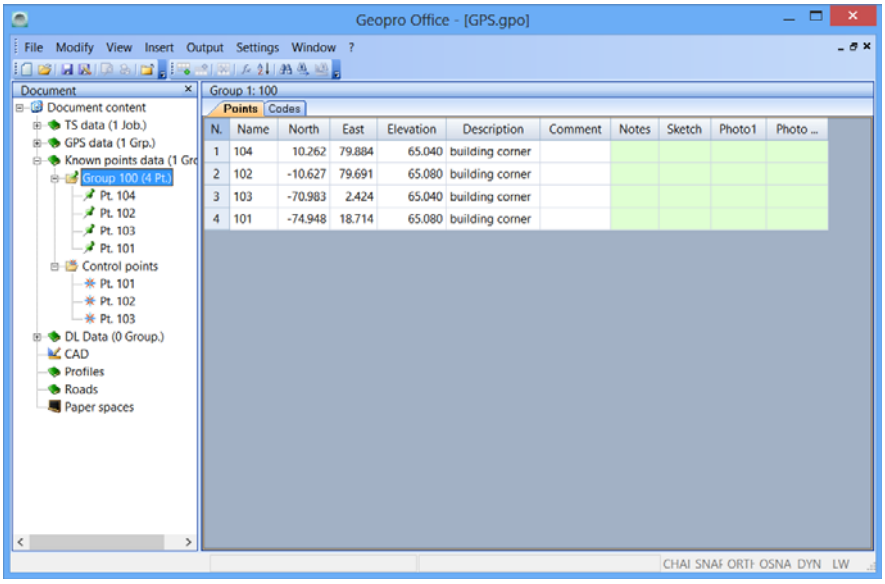



**Figure 196:**

# How to measure points from Geopro Field using “Points also in Post Processing” mode

To set the **Points also in Post Processing** mode in Geopro Field, open the **Opt.** page in the currently displayed window during GPS data acquisition.

More specifically, the user must select the item corresponding to the box found in the **Acquisition Method** square. The point holding time must also be set.

Use of the **Automatic Duration [min]** method is advised setting a time equal to 2 minutes per km of distance from the base station.

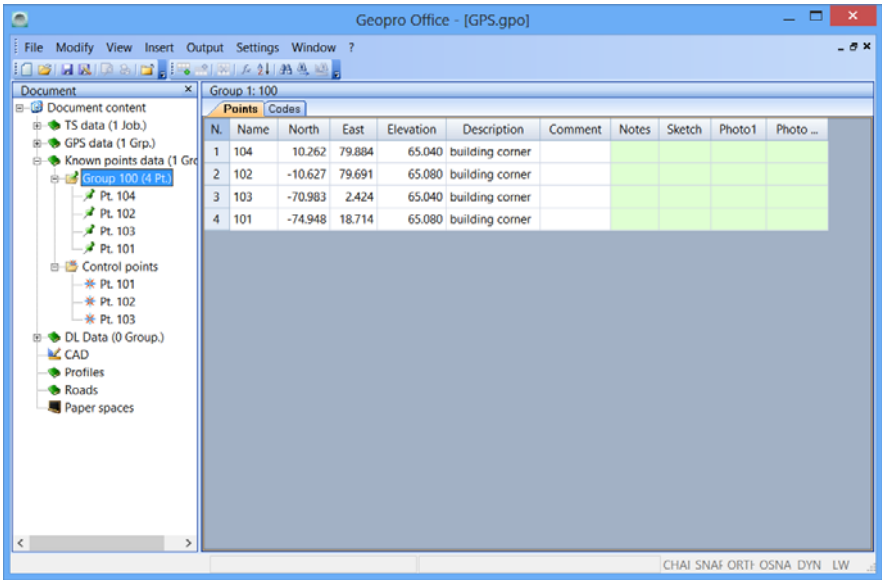



**Figure 197:**

Returning to the **Point** page the user can begin acquisition in both methods: RTK and Post Processing. For this purpose, press the **Start** button.

In the **Pass** box the time elapsed will display, while the **Rem** box will display the time still remaining to wait on the point. Once this time is elapsed, the acquisition will automatically terminate.

As noted from the texts seen on the window, the current point does not have a valid correction and therefore the precision with which it will be stored on the GPF file will be limited.

After transferring the data to the program and running the Post Processing calculation, this point will be substituted with another having an appropriately measured precision.

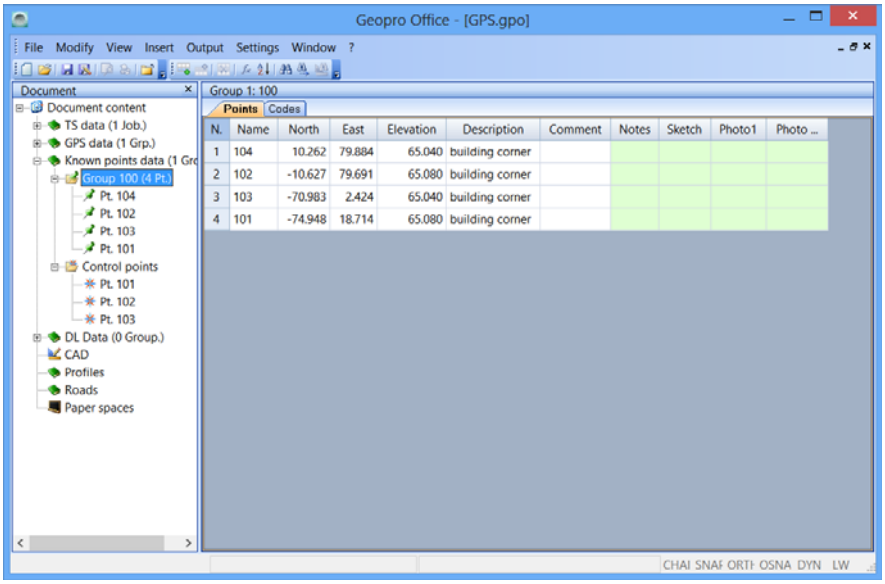



**Figure 198:**

Because Geopro Field creates a folder with the same name as the .GPF file where the TPS format file is stored holding the data used for the Post Processing, for each point measured with this method, the user must remember to transfer onto the PC not only the .GPF file but this folder too.

## Known and Control Point Data

Known Coordinate points are very important and can be used:

- In calculating triangles;
- In calculating level curves;
- In profiles;
- In calculating volumes.

Control Points are those coordinate or noted quote points that can be used in elaborating data.

## Known Points Data View

The view associated with the **Known points data** is composed of just one page called **Groups**.

The following information is found on the **Groups** page:

- Name (alpha-numeric)
- Description (alpha-numeric)
- Comment (alpha-numeric)
- Date (alpha-numeric)
- Number of points in Group (numeric)
- Entity set

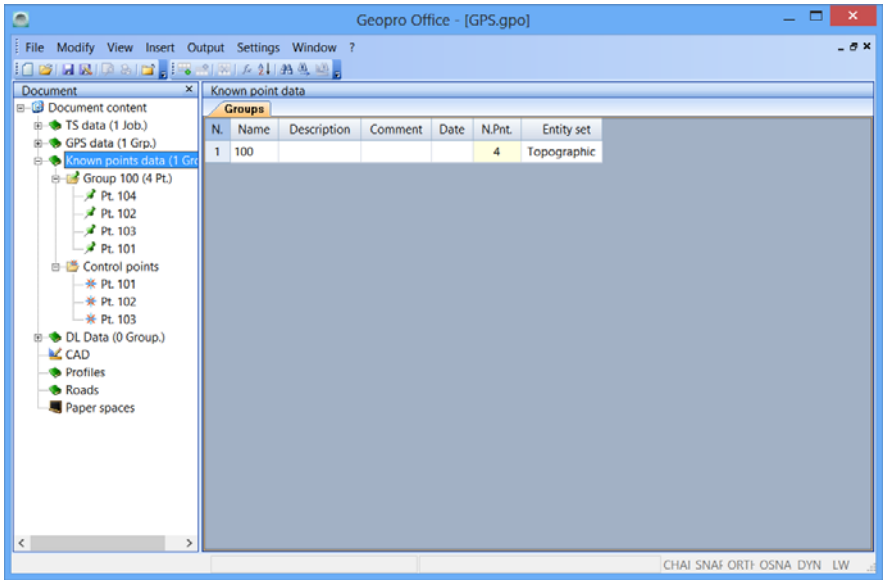



**Figure 199:**

Selecting the node corresponding to the Group created will open the corresponding view composed of two pages: **Points** and **Codes**.

The **Points** page is used to verify/change the following information: name, coordinates, description, Comment, note, sketch and two photographs.

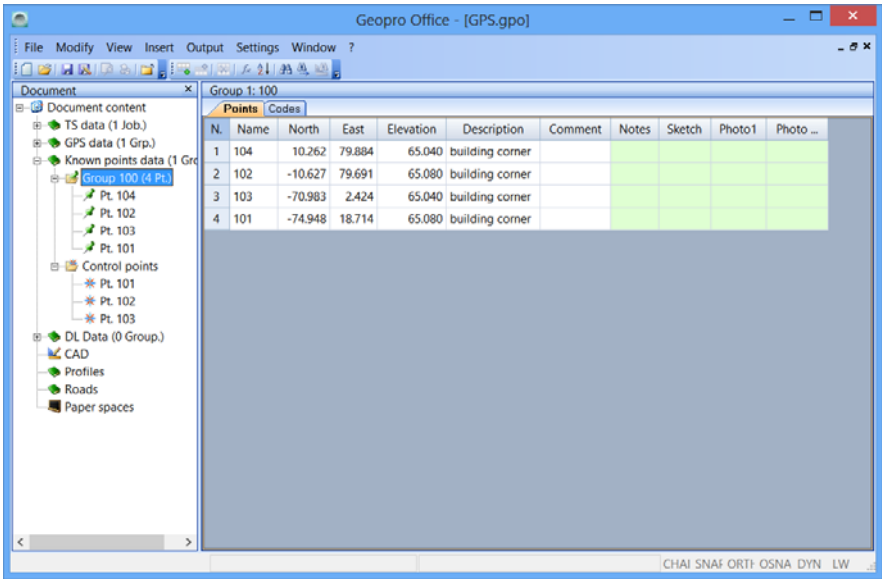



**Figure 200:**

On the **Codes** page, the user can:

- select the design model to associated to the point in CAD View; if the model is not selected the the standard is used. To create design models the user must activate the **Entity appearance** command from the **Format** menu in CAD View.
- insert the GIS theme (if defined). To create a GIS theme, the commands in the **GIS** menu found in the Graphic View are used. The theme must always be associated with a table.
- Activate/deactivate the codes used by the program to elaborate data or for other purposes.

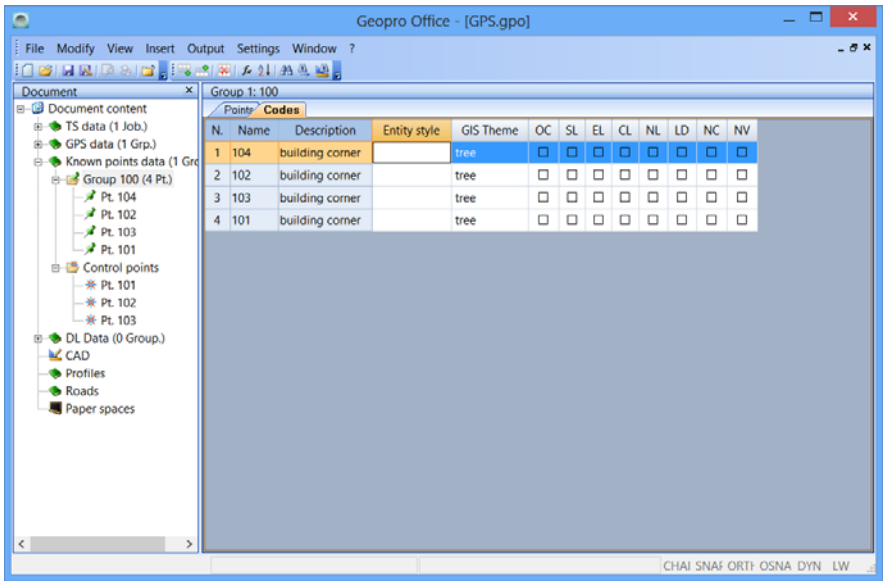



**Figure 201:**

If we extend the Group node (clicking the "**+**" alongside it) the navigation tree will extend listing the points that belong to the group.

Selecting a single point will display the view corresponding to the point which is also composed of two pages.

On the **General** page the user can verify/change the data associated with the point itself.

The GIS data is included on the GIS data page (again given that association with the GIS theme has been done).

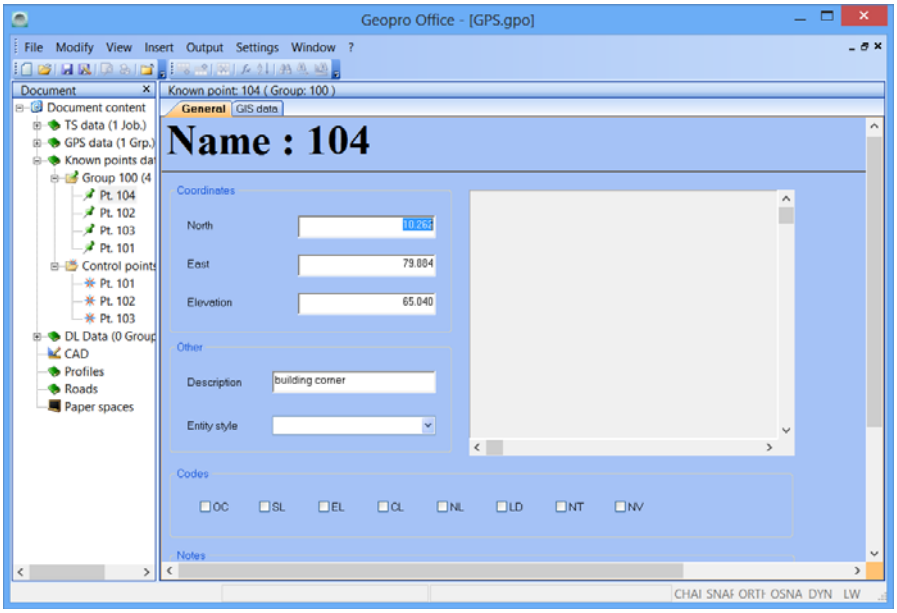



**Figure 202:**

The **Known points data** node not only includes the various known coordinate points groups but it also houses the **Control Points** node.

Clicking here will display a view composed of two pages: **Points** and **Geographic Points**.

The **Points** page displays all the information about orientation points, that is, the name, coordinates, description and the user can associate a note, sketch and two photographs.

The **Geographic Points** page displays the list of geographic points used in the **Post Processing Computation** procedure.

By expanding the **Control Points** node the program will display the navigation tree with the list of inserted orientation points.

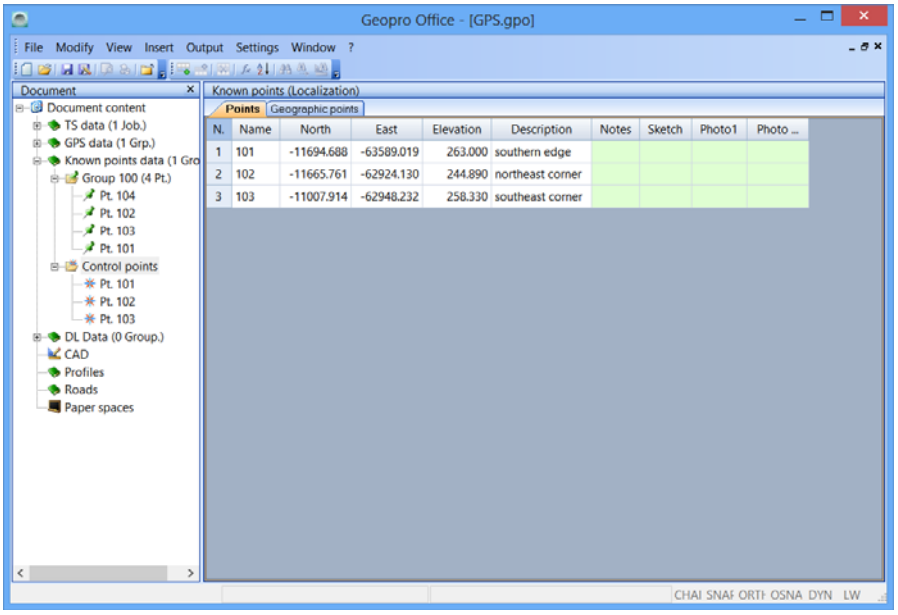



**Figure 203:**

Selecting the point from the navigation tree will open the **Localization Point** view where the user can display/edit the associated data.

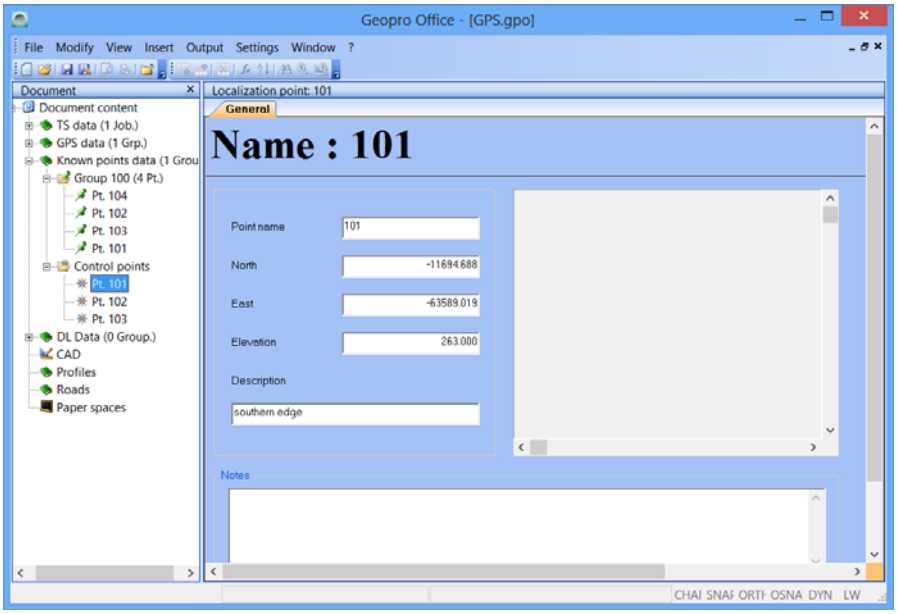



**Figure 204:**

# Insert and Change Known coordinates points

To insert the known coordinate points the user must first create a group executing the following operations:

- Open the Groups page from the navigation tree by clicking on the **Known points data** node.
- Use the **Insert|Add row** command to insert the first line and, once some lines have been added, insert a line under the current one.

- Another command that can be used (only if lines have already been inserted) is the **Insert|Insert row** that is used to insert a line above the current one.

To create a known coordinate point, the user must work within the pages corresponding to the node of the group where the point will be inserted and use the same commands offered for the groups.

Once the lines are inserted (corresponding to the noted coordinate points) the user can insert the data or edit it directly in the table or specific point view.

Known coordinate points can be changed through the **Modify** menu functions.

# Insert and Change Control Points

Manually inserting control points can be done using the **Add row** and **Insert row** commands in the **Insert** menu of the **Control Points** view.

Once the line is added, the data can be edited:

– Using the table;

– Using the view associated with the point.

For this view as well, to change the data there are functions available in the **Change** menu.

# File Menu|Import

## Coordinate Files

This command will activate a guided procedure to create noted coordinate points beginning with a coordinates file. A specific group is created for these points.

## File|3D Office - Point file (.PT3)

This function is used to import points from a file in PT3 format. When this command is activated, the file name to open is requested. For each plane found in the file, a group of known coordinate points is created whose name is assigned by the juxtaposition of the file name and the plane name. For each plane a design model is also created with the same name as the plane and will be assigned to all points in the plane.

## File|3D Office - Control file (.GC3):

This function is used to import control points from a file in GC3 format. When the command is activated, the user is asked for the name of the file to open and a GPS group will be created using the file name. For each point contained in the file, the following will be created:

– An orientation point, if the plane coordinates are present;

– A GPS point, inserted into the just created point, if there are geographic coordinates present.

# File Menu|Export

## File of coordinates

The **File of coordinates** command is used to create a file by selecting the data to include and their order.

## Control Points

The **Control Points** command is used to create a file with all the defined control points.

## 3D Office - Control File (.GC3)

The outcomes to *.GC3 file (3D Office format from Topcon) is used to export the orientation points in .GC3 format.

If a GPS point in a GPS group exists for each orientation point with the same name then the associated geographic coordinates are also exported.

# Output|Known points data

Executing the Output|Known points data menu command will display a submenu that includes a series of commands corresponding to various types of outcomes that are available.

In regard to the **Print All Groups** command, the program will print all groups and the known coordinate points contained in the Known points data; the **Print with Selected Groups** command allows the user to tell the program (using the specific window) which groups to print.

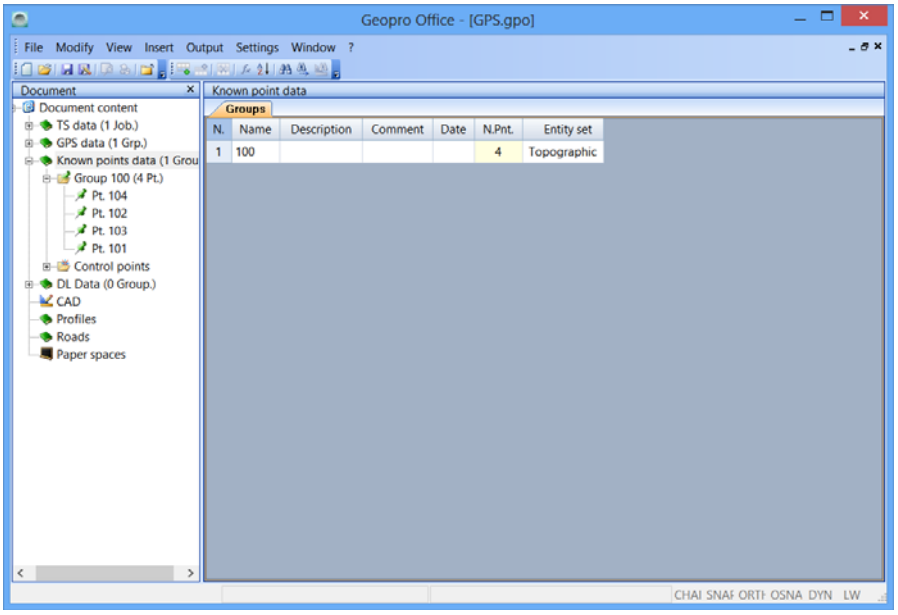



**Figure 205:**

The **Print Localization Points** command allows the user to print all of the control points found in the open file.

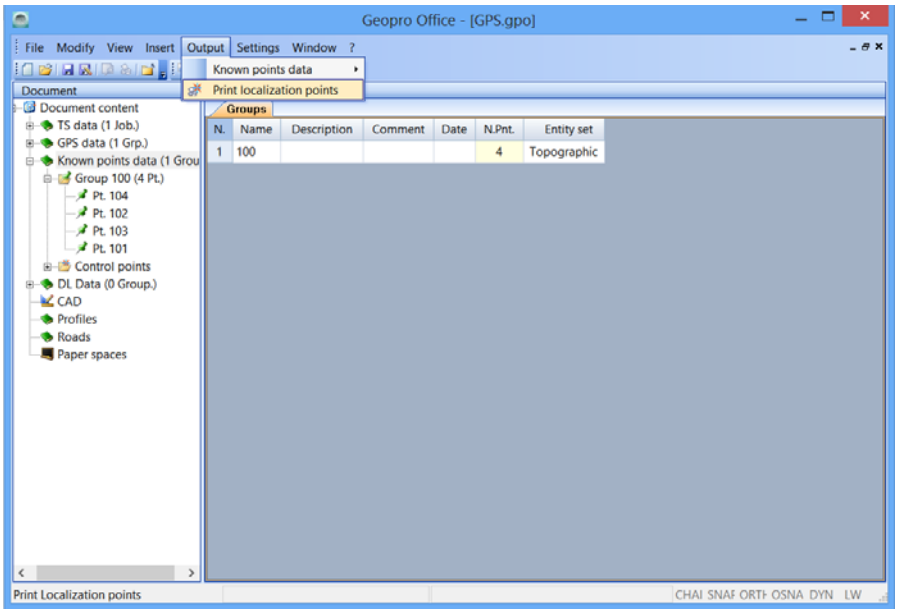



**Figure 206:**

# Details

**Design Mode**l: for greater detail on the **Design Model** refer to the Online Help CAD View Menu|Format|Entity Appearance.

**GIS**: for greater detail on **GIS**, refer to the Online Help Graphic View Menu|GIS.

**Entity set**: refer to the program's online guide, Format|Entity sets.

# Graphic View

The program's Graphic View offers the user a series of functionalities to handle graphic items, items associated with various books, DTM projects, Road projects, GIS projects, and images.

The Graphic View makes it possible to use:

- Property view;
- Commands view;
- Panoramic view;
- Detail view;
- Dynamic input.

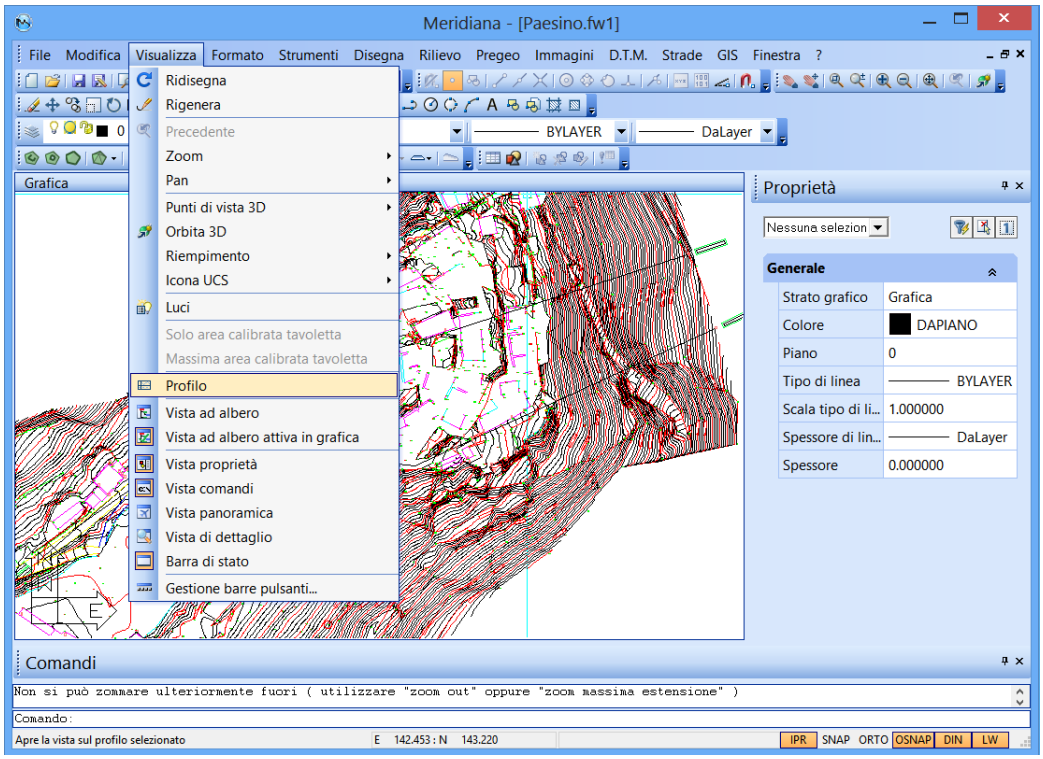



**Figure 207:**

# Property view

The Property View includes a list of information associated with the graphic items that have been selected; also, using the specific commands found above and on the right, the user can:

- **Activate/deactivate the double click during the selection** - specifically, if the third button is set at "1", the double click is activated and so by continuing with the same item the selection is not determined; if, instead, a "+" is set, then the second click is not considered and the item remains selected.
- **Deselect all selected entities** - using the second button.

- **Run a rapid search** - using the first button.

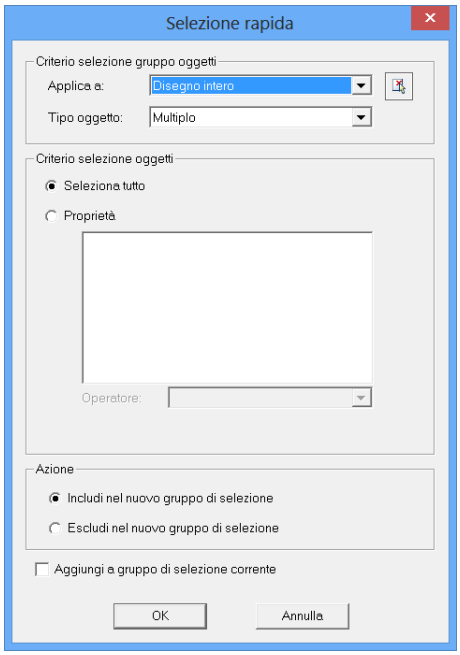



**Figure 208:**

The rapid selection command is very interesting in that not only does it make it possible to run a fast selection by specifying the characteristics of the item to search, but it also creates multiple selection groups.

Below is a view of the window that will open for executing the command.

Use the upper part to specify in which context the search is to be applied, which type of object to select, and then run a deselection of the already selected items, if needed.

Use the central part to decide whether to select everything or specify the properties that the graphic items to search must have.

Use the lower part to notify the program whether to include/exclude the selection of the new selection group; finally, identify if the selection must be added to the current selection group.

The Property View can be activated or not by selecting/deselecting the **Property View** item from the **View** menu in the Graphic View.

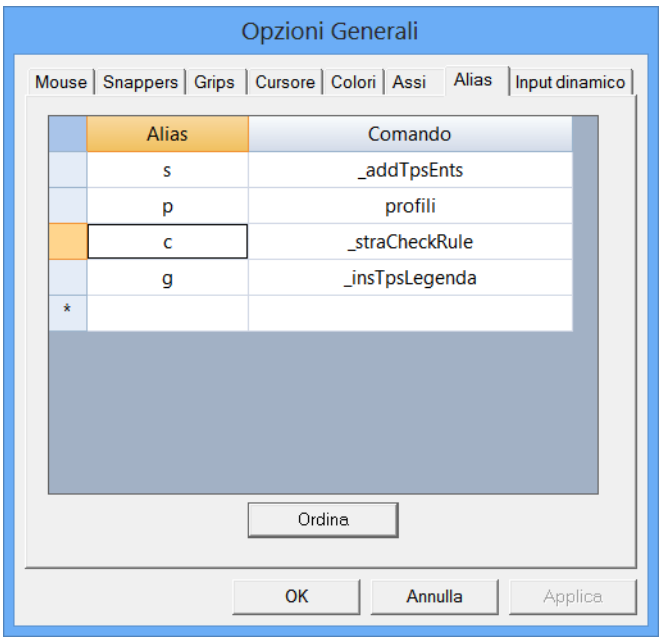



**Figure 209:**

# Commands View

The Commands View offers the user a command line to run all of the menu commands in the Graphic View.

Once the command has run, it is stored in a list that can be recalled by using the **arrow** buttons; the user can also use storable alias commands by using the **General Options** command (**Alias** page).

Like the Property View, activation/deactivation of the view is done through the **Commands View** item on the **View** menu.

If the view has been deselected, functioning of the commands remains unchanged compared to the previous versions.

If, though, the view is activated, it is important to remember that to input data the dialogue window notes cannot be used but rather the view itself.

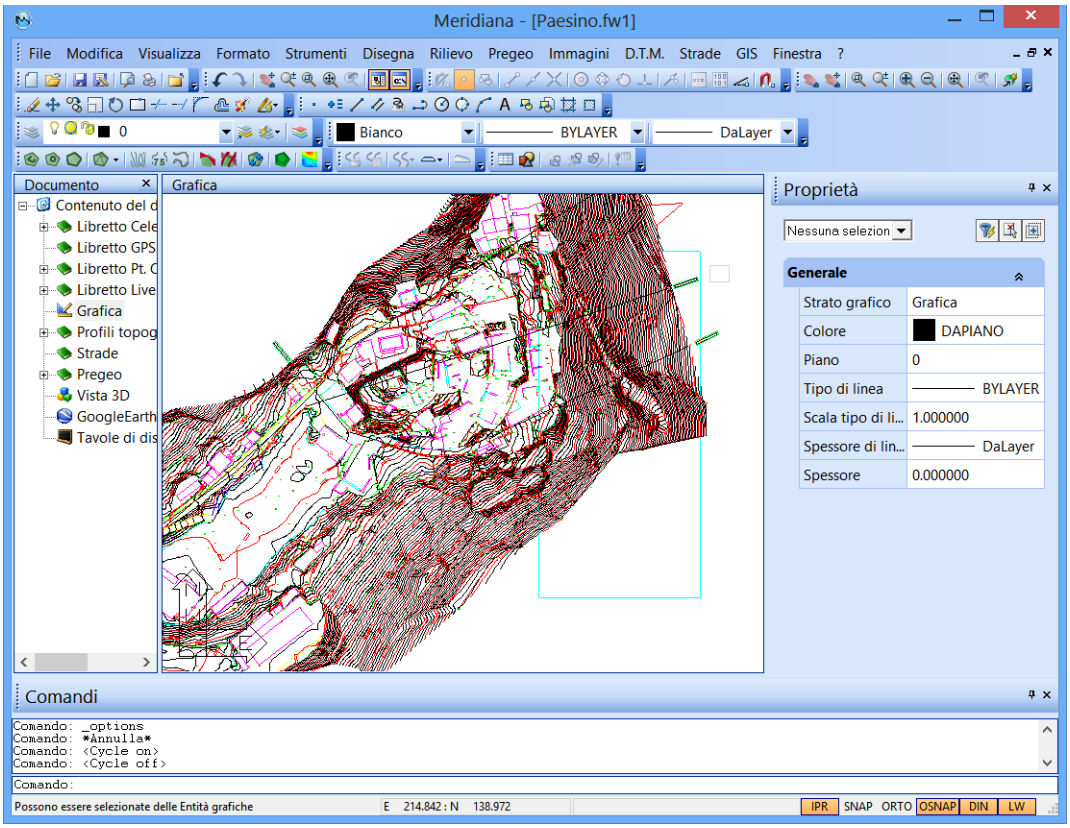



**Figure 210:**

The Command View offers the user the most selection options: for example, during insertion of coordinates, use the '**@**' symbol to specify that associated coordinates are being inserted and/or the '**<**' symbol to indicate angles.

During execution of the commands, it is also possible to use the booklet entity by editing it directly on the command line or by selecting it using the navigation tree view (if activated).

"Commands View: list of commands" on page 213 includes the list of recognized commands.

# Panoramic Graphic View

The Panoramic View displays a window used to select an area to view in detail in the Graphic View. The window can be resized or moved. If the Real-Time option is selected and the left mouse button is held down, the effects of moving the window can be seen in real time in the Graphic View; otherwise, the Graphic View will be updated only when the final position is reached.

# Graphic View in detail

The Detail View offers a detailed view of the graphic corresponding to the position of the mouse in the Graphic View. If the shift button is pressed, the mouse pointer will no longer be activated in the Graphic View but will be activated in the Detail View. This functionality was introduced to facilitate operations in Graphic.

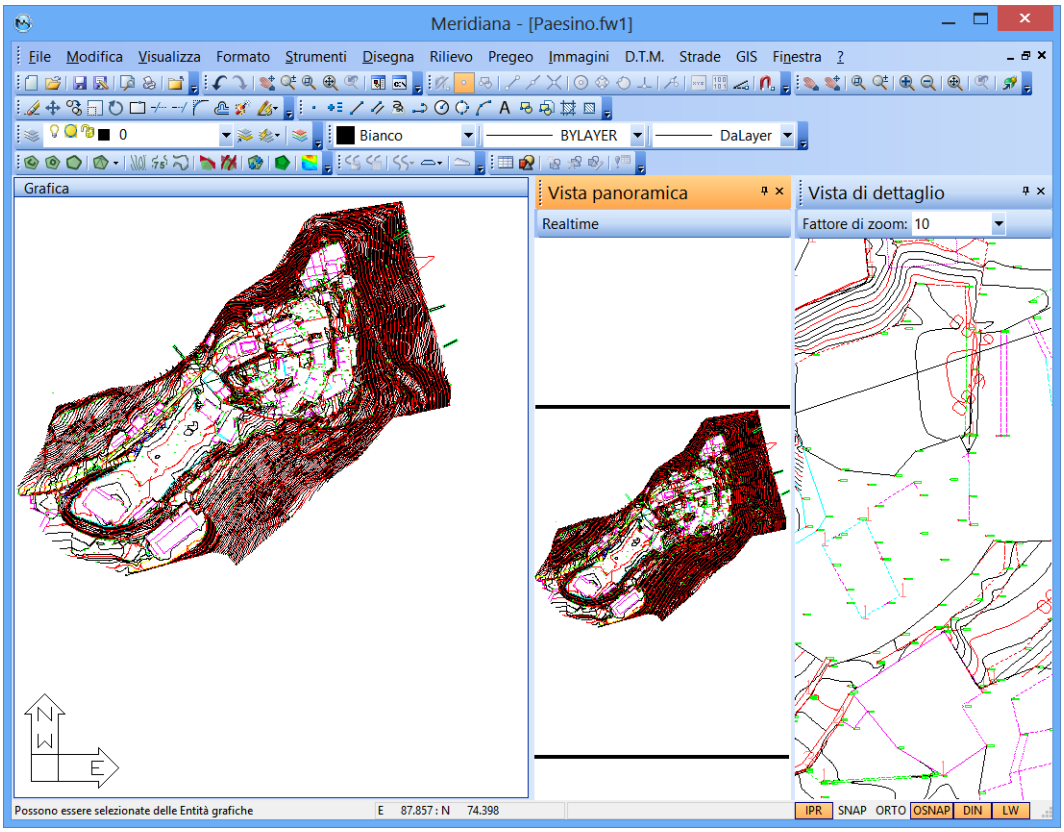
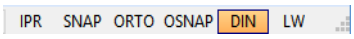



**Figure 211:**

# Dynamic input

Activating this option during execution of Graphic View commands will display, near the cursor, a prompt of commands whose functions are similar to those of Commands View.



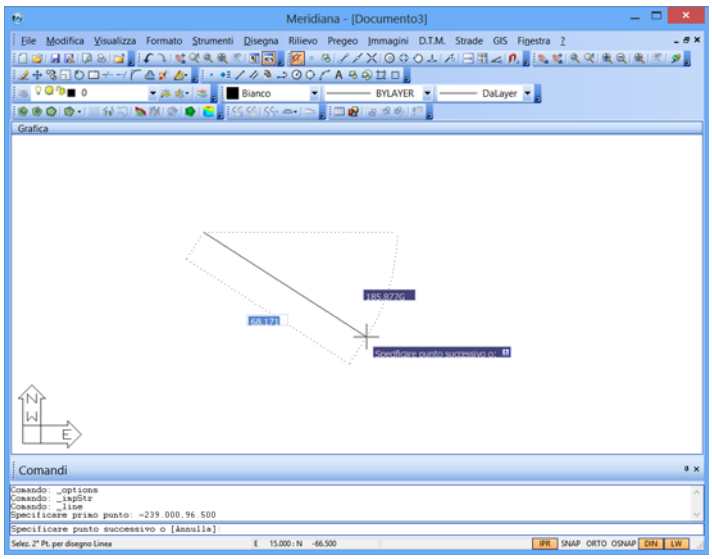




**Figure 212:**

More specifically, an edit will appear to input data associated with the designated object. It is updated continuously with the movement of the mouse.

The following buttons are used in the dynamic input:

– **Down Arrow:** to select the options available by the command.

– **TAB:** used to move between edits and dynamic insertion.

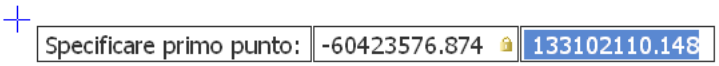
– **,:** inserted coordinates will be Cartesian.

– **<:** inserted coordinates will be polar.

– **#:** inserted coordinates will be absolute type.

– **@:** inserted coordinates will be relative type.

– ***:** the value inserted will be considered as the name of the booklet points.




Note that after inserting a value into an edit using the keyboard, the value will be blocked and a padlock symbol will appear. In this situation, moving the mouse will update only the unblocked coordinates. To unblock an edit, erase its contents and press **Tab**.

The dynamic input can be customized using the **Format|General** command in the **Dynamic Input** page of the **Graphic View**.

This page allows the user to:

- Select whether to activate execution of the commands and whether to view the coordinates and/or lengths;
- Specify the format (Cartesian or polar) and the type (absolute or relative) of the coordinates;
- Select the color of the text and command line fill;
- Specify the size and transparency of the command line.

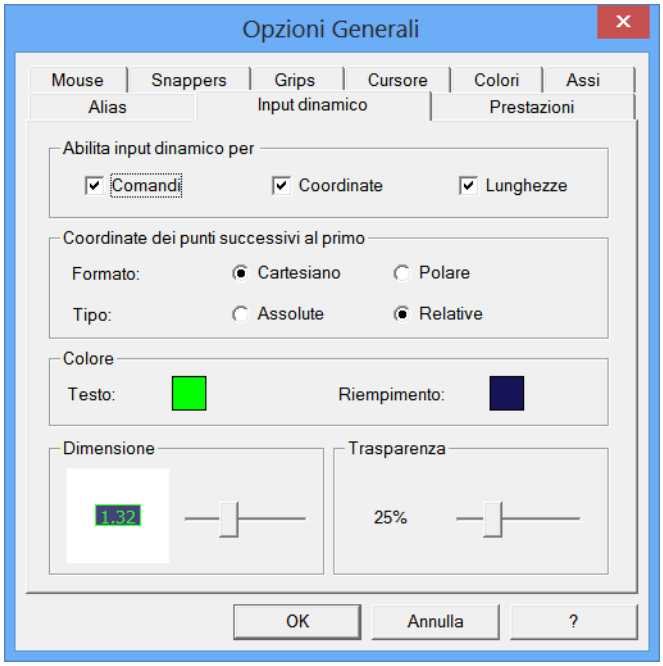



**Figure 213:**

Example - draw a circle:

1.Using the dynamic input, recall the command from the Graphic View directly from the command line associated with the prompt.

2.Activating the command, the program will ask whether to specify the center of the circle (in this case the circle will be designed specifying the radius or diameter) or indicate using the **Down Arrow** button if using another method of design.


**Figure 214:**

3.If 3 points are selected:

The program will request identification of the first point on the circle.


**Figure 215:**

4.Then it will request selection of the second and third points.


**Figure 216:**

5.Final result.

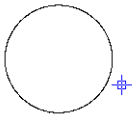


**Figure 217:**

# Importing an AutoCAD file (.DXF/.DWG)

The Program allows creation of a Celerimetric Booklet using a DXF/DWG file.

After creating a new file, select the Graphic View and run the command: **Menu File|Import AutoCad (.DXF/.DWG)**.

The first thing the user must do is identify the file to import.

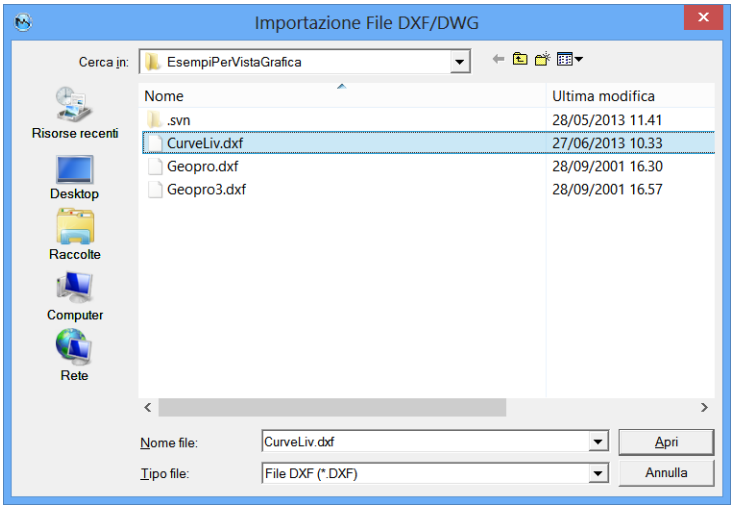



**Figure 218:**

Once the file to import has been selected, a window will appear used to:

– Indicate in which Graphic Layer to store the imported graphic entities;

– Select whether to associate the points to the text or not.

If the **Associate texts to imported points** option is not selected, the points and texts will be stored separately.

Otherwise, association can be done using a distance criteria or by selecting to in any case input a point corresponding to the text.

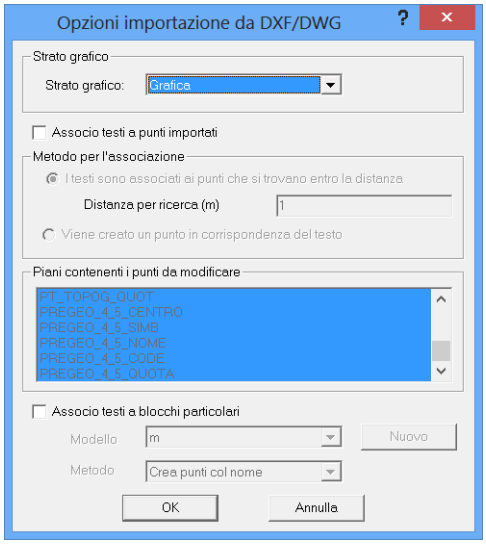



**Figure 219:**

Independently of the association method selected, the user can select the levels holding the points to be modified.

Press the OK button and the program will proceed with the Import.

Note that the settings of the AUTOCAD file will be maintained; more specifically, the graphic entities will be placed in the associated levels which will continue to retain the same name and same properties.

If module C is included, the program is able to interpret certain level names in a particular manner which may be found in the DXF/DWG file to be imported.

The names of these levels are:

- **VERT-TRI** - All of the Points, Texts, Arches or Circles that belong to the level with this name are imported normally and placed in the level with this name. In regard to the Lines and Polylines, only the vertices are included. These are imported as Graphic Points and again, placed in the level with this name. This allows for any level curves found in the DXF/DWG file to be separated in points that can then be used for calculating the Triangles.
- **VERT-T-C** - The program interprets this level the same as the previous with the only exception being that besides creating the Graphic Points from the vertices, a Tie for each Line and for each section of Polyline that belong to this level are also created. This makes it possible to force the triangulation along the level of the imported curves.
- **CONSTRAINTS** - The Lines and Polyline sections that belong to the level using this name are imported as Constraints. All of the other Entities that may belong to this same level are ignored.

- **BORD-INT** and **BORD-EXT** - The Polylines that belong to this level with this name are imported respectively as Internal Borders and External Borders. All of the other Entities that may belong to this same level are ignored.
- **DASH-NOR** and **DASH-SIG** - The Polylines that belong to this level with this name are imported respectively as Dash Normal and Dash Significant. Beginning with these dashes, the splines will be calculated automatically. All of the other Entities that may belong to this same level are ignored.

The **Associate texts to specific blocks** option, is used to transform specific blocks found in the file being loaded as points with the name or as noted coordinate points.

To execute this transformation a model is needed.

The creation of a model can be done by pressing the **New** button.

Once pressed, the program will display a window where it is possible to set the options to associate the particular blocks, what to associate with the name, to the description and to the point model to be created; these selections are not required.

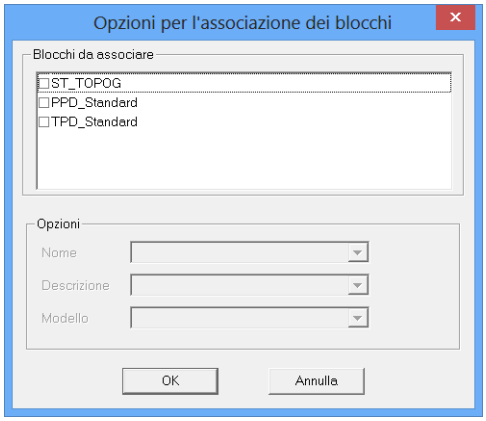



**Figure 220:**

The image below shows the result of importing in the **Graphic View**.

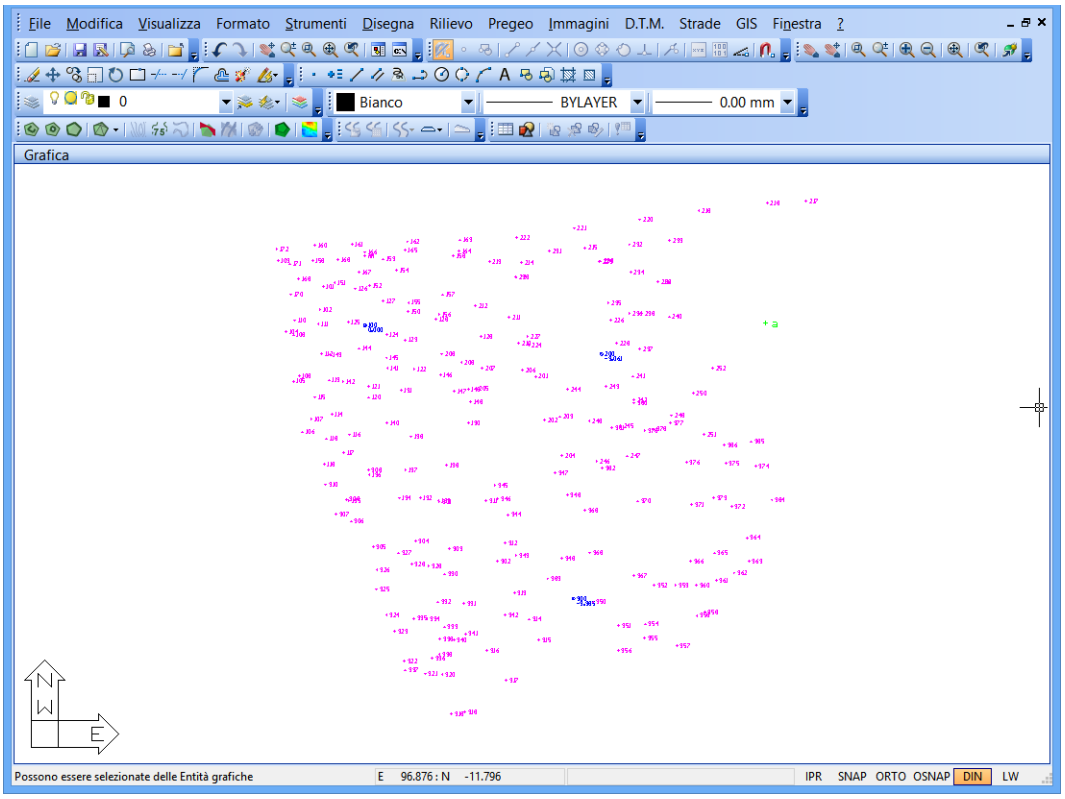



**Figure 221:**

# Importing a Coordinate file

Use the **File|Import|Coordinate File** menu command to insert the entities stored in a coordinates file into the **Graphic View**.

Once the command is activated and the file to be imported is identified, the program will display the **Initial Selections** window.

Use this window to decide whether to run the import using the fixed length fields modality or the unlimited length fields; it is also possible to set the heading lines which will be discarded from the conversion and determine whether to eliminate the apexes from the texts.

The lower part of the window displays a summary of the selected file.

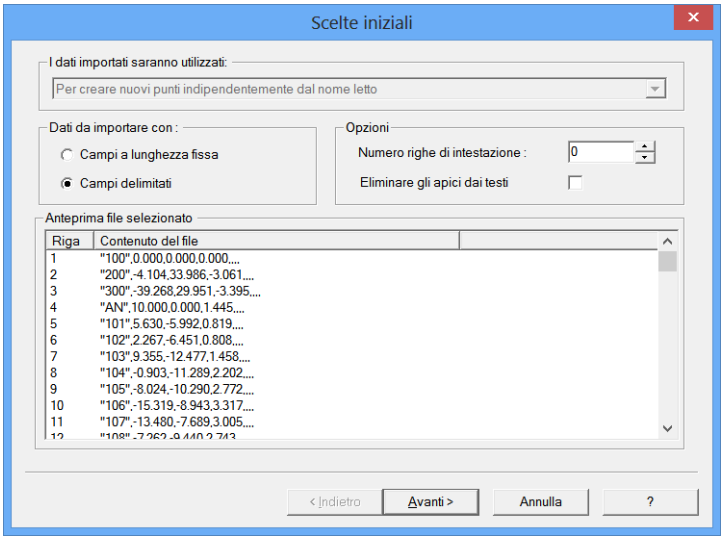



**Figure 222:**

If the **Fixed Length Fields** option is selected, the next window is used to set how many fields to be imported and the length of each one.

This last piece of information must be inserted into the grid found in the upper part of the window while the lower part of the grid will display section by section the result obtained by the selected settings.

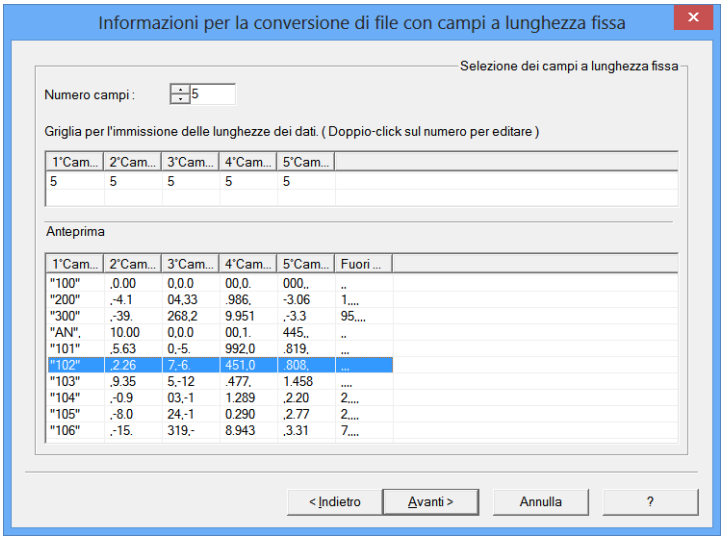



**Figure 223:**

If instead the unlimited fields option is selected, then the window that appears is used to select the field separator(s) to be used; here too, the lower part of the window displays the awaited result.

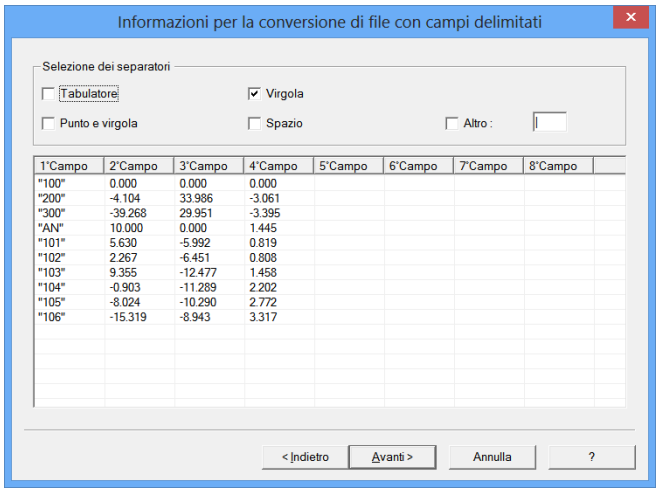



**Figure 224:**

Using both selections will progress to a final window used to select, for each field, the variable used to associate it (**Name**, **Code**, **North Coord.**, **East Coord.**, **Quote**).

To make the selection, click on the table heading: a list of possible variations will appear from which to select the one desired. The data found in the selected file divided into the specified fields will appear under each variable. If the result is not the one expected, press the **Back** button and change the options inserted until the desired result is obtained.

Another possibility offered by the last window is that of excluding, as selected, some import lines by removing the check mark from the specific box identifying the lines to not be imported (the identified lines as headers are displayed already without the check mark).

The image below shows the result of importing in the **Graphic View.**

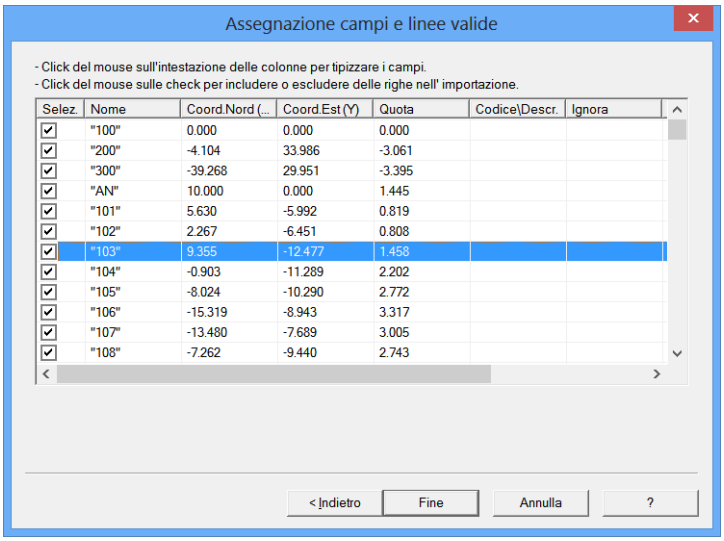



**Figure 225:**

# Importing a 3d Office file - Linework file (.LN3) and 3d Office - TIN file (.TN3)

**File|Import| 3d Office-Linework file (.LN3):** Use this command to import the graphic entities found within an LN3 file created from 3dOffice or Pocket3d into the open file.

**File|Import|3d Office-TIN file (.TN3):** Use this command to import the triangulation found within a TN3 file created from 3dOffice or Pocket3d into the open file. A new DTM project will be created and named "3dOffice" wherein all of the triangles found in the file will be created.

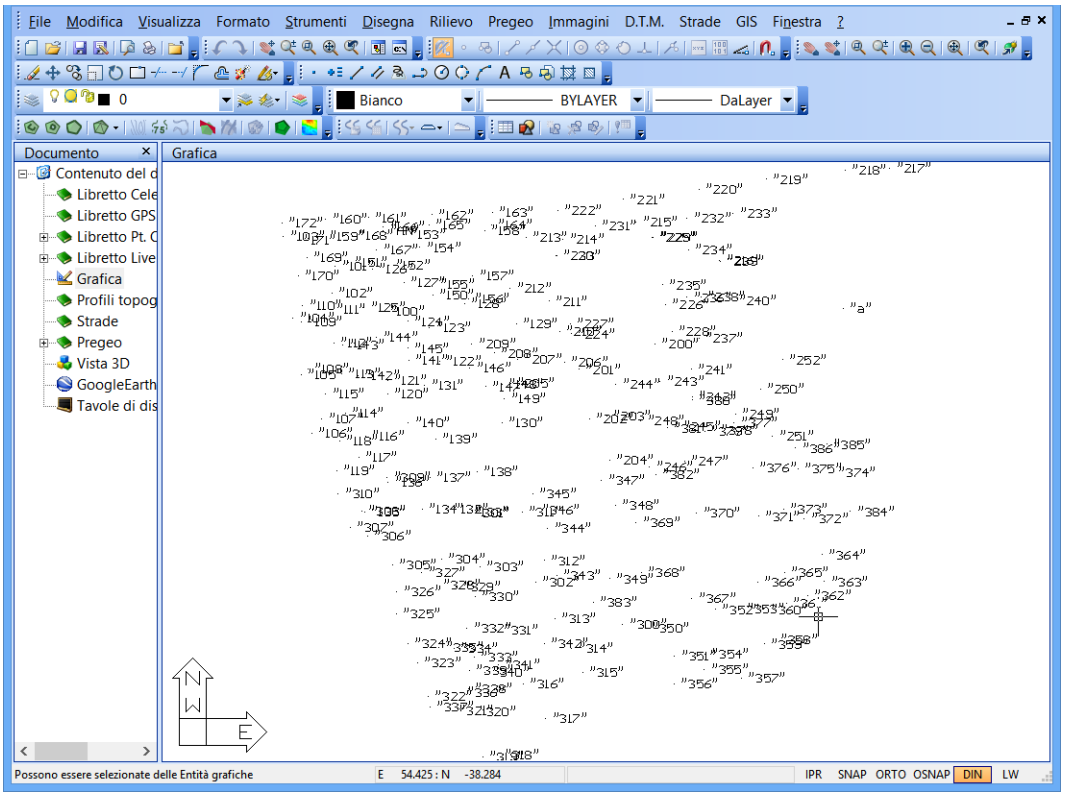



**Figure 226:**

# Transforming points with name

The Graphic View offers a series of commands used to create new types of points beginning with points already available.

These commands offer a common characteristic: transforming a graphic point will result in its elimination.

To activate them, just access the **Survey** menu in the Graphic View and select the option **Transform points with name to**; next a detailed description of each one will display.

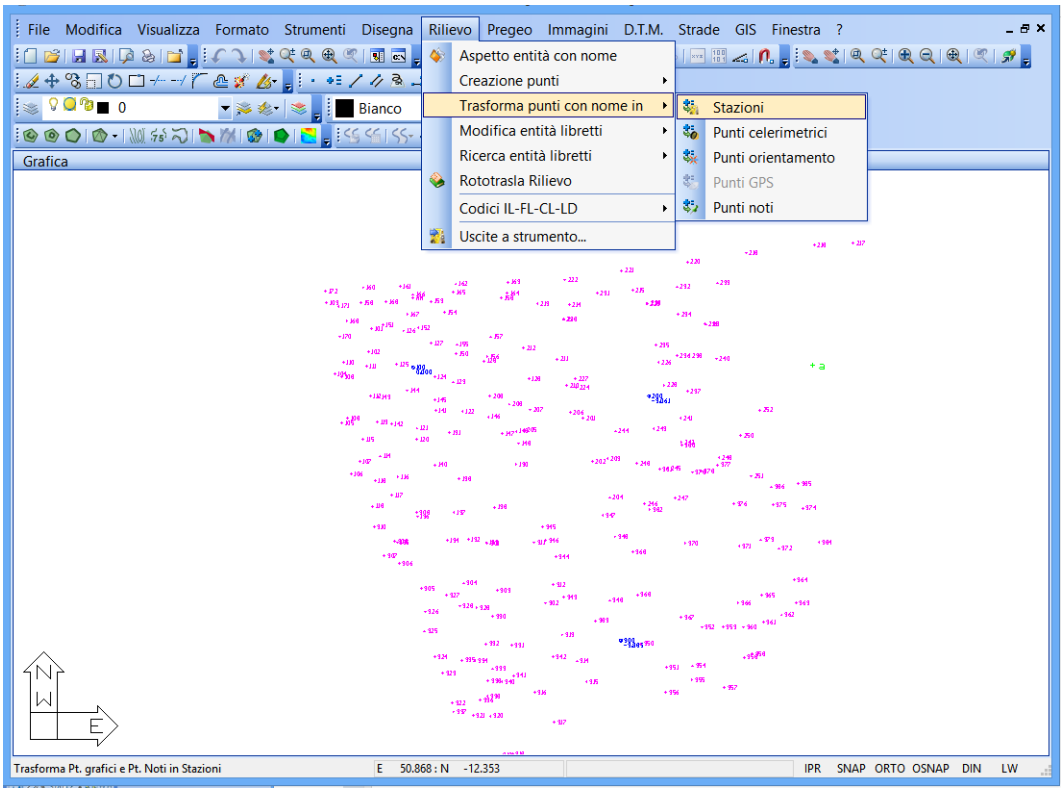



**Figure 227:**

1.**In Stations:** this command is used to transform graphic points, noted coordinate points, GPS points and Line 5 points in Stations.

Suppose the graphic point 700 in Station is to be transformed.

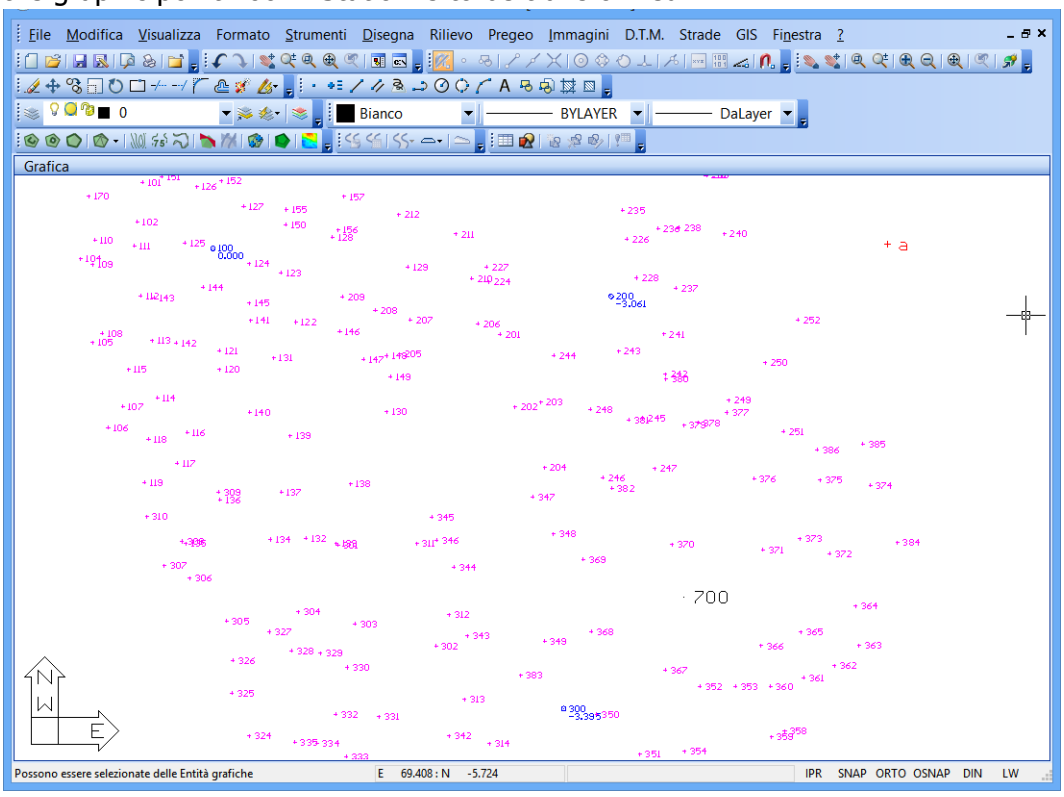



**Figure 228:**

After selecting the point, press the right mouse button and the program will display the **Transformation in Station** window where the user can conduct the selections used to create the station.

The **No Orientation** option of the window does not allow creating of an orientation; the second though, includes selection of a station to be used as a reference to conduct the orientation (in this case, two PO coded points will be created, one for each Station).

The third option, finally, includes orientation by creating an Orientation Point with the same name and coordinates of the created Station.

Use the same window to insert the Instrument Height values, when using a 3D file, or if the **Orientation from another Station** option has been selected, the user must insert the Prisma Height values for the PO points and the roundings for the angles and distance to be calculated prior to saving them in the Campaign Booklet.

**Orig. Rounding** button found in the window is used to set the default values for the distances from 0.001 and for angles from 0.0001.

The modifications made to these values will be stored on the configuration file and suggested again at the next use of this functions, even on a different file.This same window will identify which Work to be used for inputting the Station or Stations to be created.

If there are no Works and no Work to be created, and if there are already multiple available, select the one to be used for assigning the Stations.

Upon closing the **Transformation in Station** window, given that an orientation from another station was selected, we can, for example select station 300.

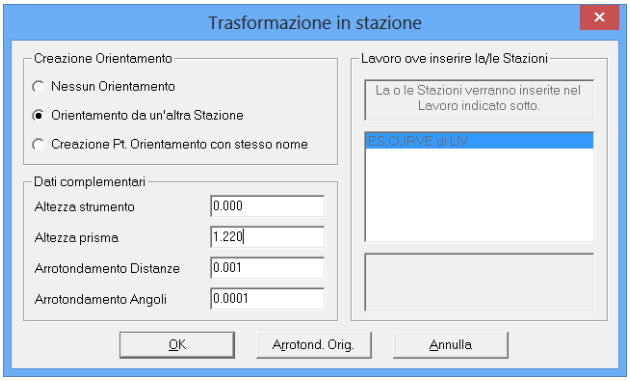



**Figure 229:**

Once the selection is completed, the program will display a video window displaying the number of points selected and a request to confirm the transformation.

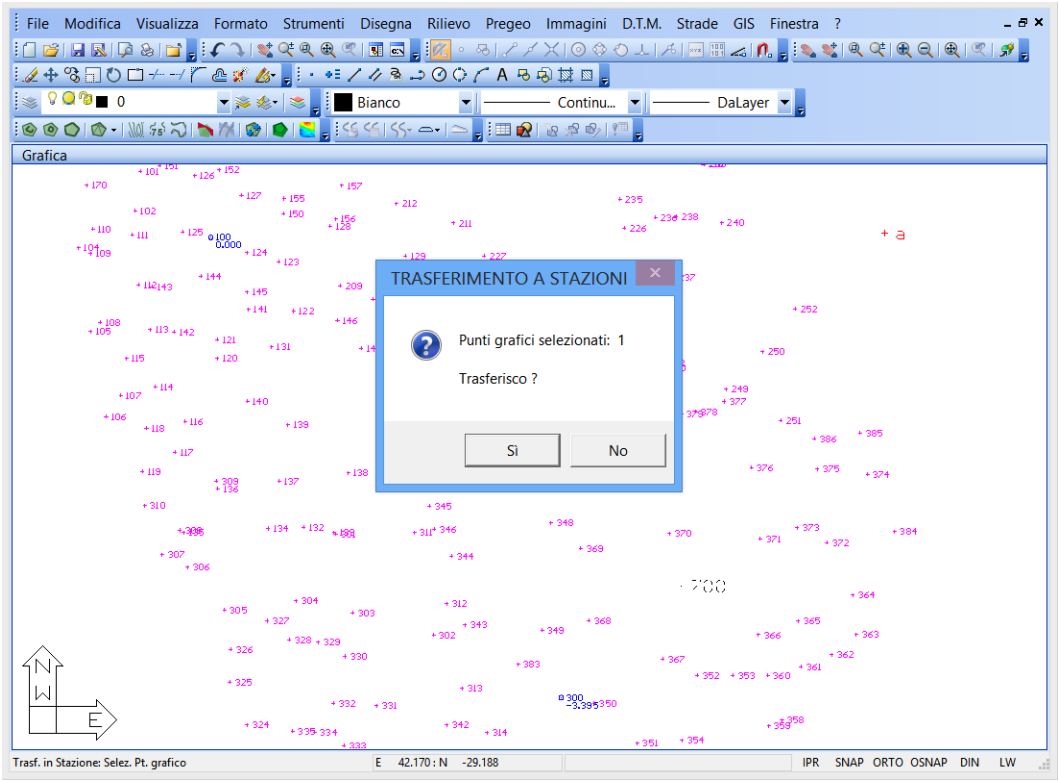



**Figure 230:**

Note that the Station created will be considered oriented.

If the file is to be elaborated further, the presuppositions must be created (Orientation Points, Polygonal, etc.) so that its orientation is properly recalculated.

The image below shows the result of the transformation.

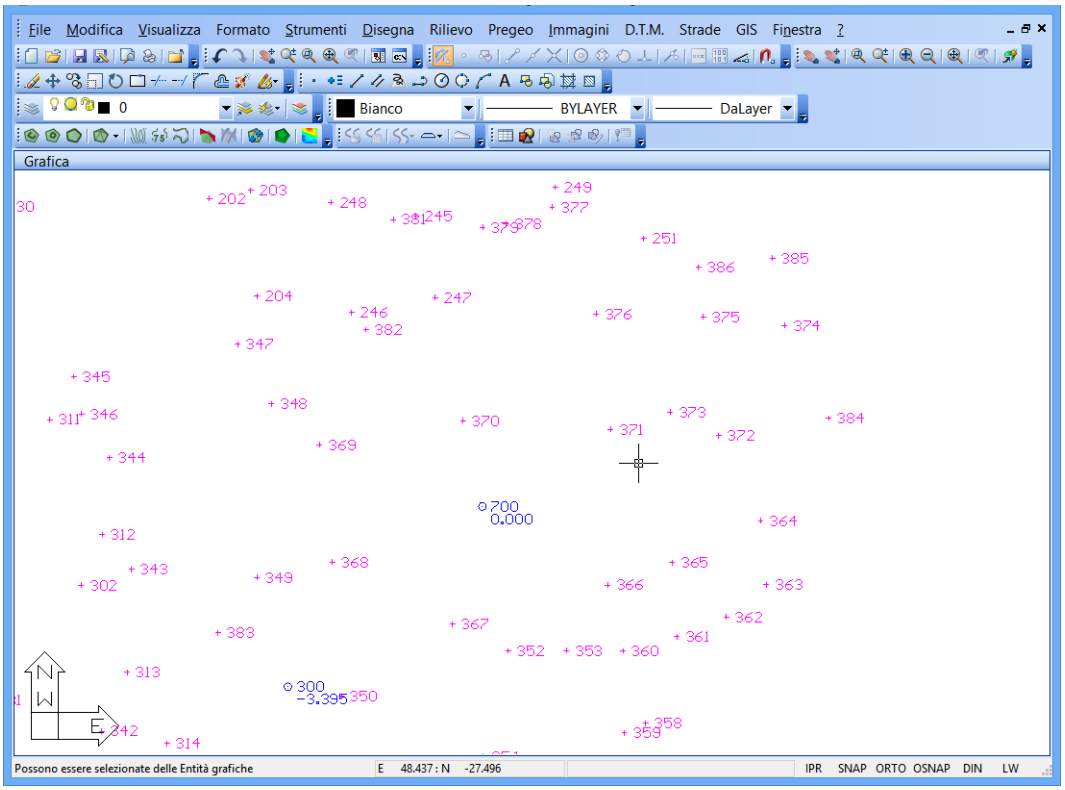



**Figure 231:**

2.**In Celerimetric Points:** this command is used to transform graphic points, noted coordinate points, GPS points and Line 5 Pregeo points in the station's detail points

First of all, select the Station (ex. 200) to receive the transferred points using the mouse and pressing the left button.

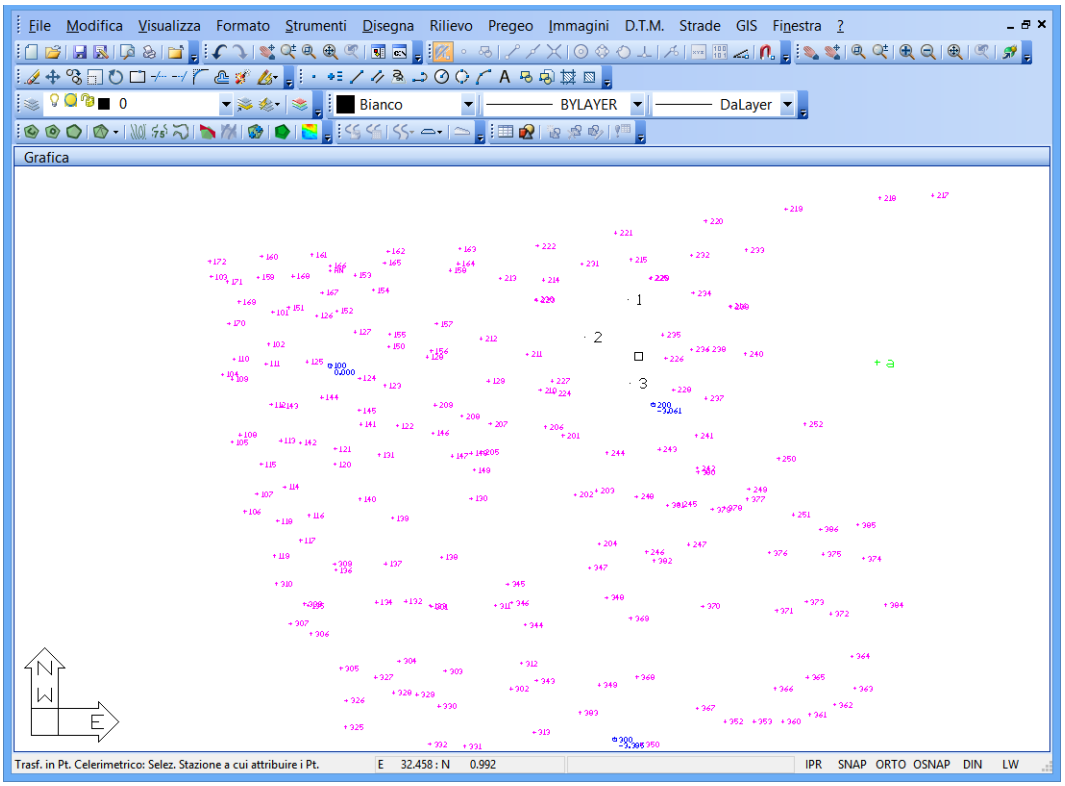



**Figure 232:**

Then select the graphic points, following the same methods outlined for selecting the Stations; the points can be selected one at a time or in groups using the selection rectangle.

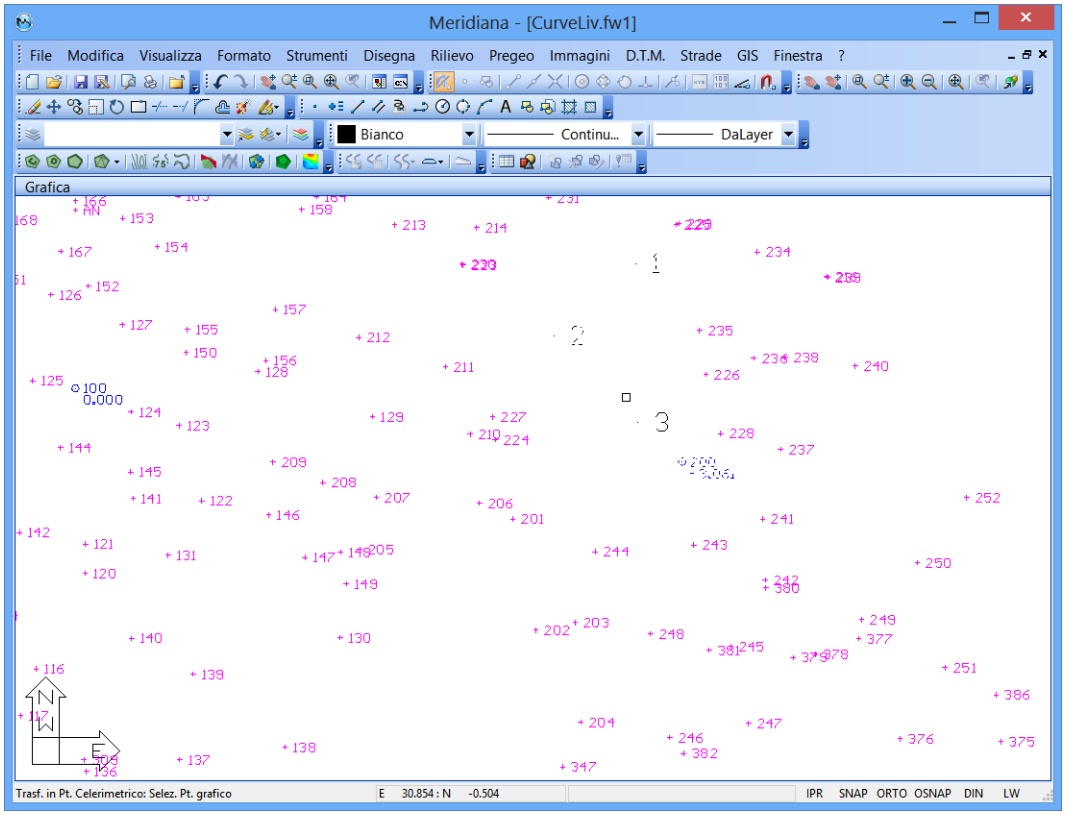



**Figure 233:**

An already selected point can be erased simply by selecting it again; to end the selection phase, press the right mouse button.

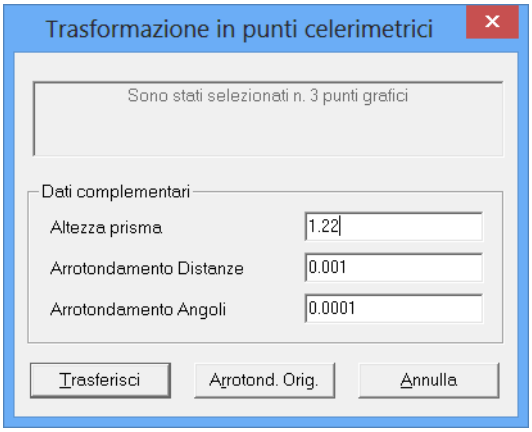



**Figure 234:**

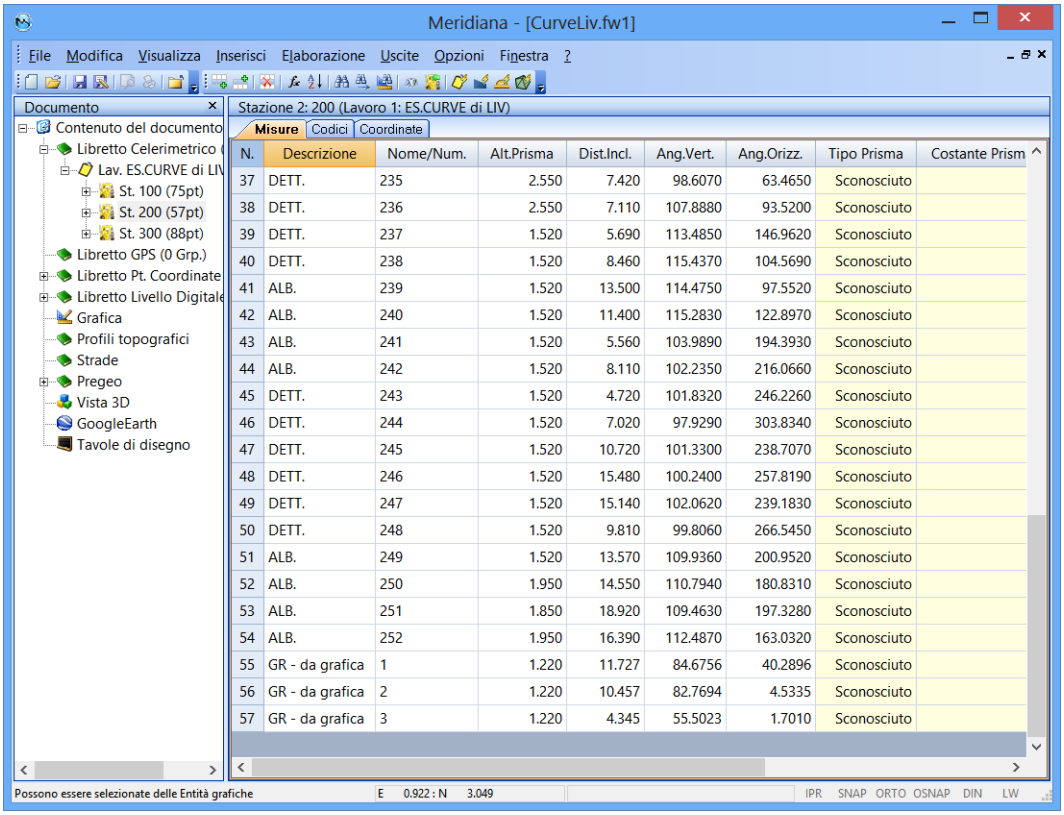
At the point, the program will open the **Transformation in Celerimetric Points** window.

The first part of the window shows a summary of the points selected while the second part allows the user to insert complementary data shared by the selected points.

If the **Rounded Distances** fields and the **Rounded Angles** fields are changed, then upon completion of the transformation they will be stored in a configuration file and suggested again when the command is launched again (even if working in a different file).

If, instead, the transfer has not been confirmed and the original values of these two fields are to be refreshed, just press the **Orig. Round.** button.

Once the operation is complete (**Transfer** button) the points will be inserted into the selection station (200); the new celerimetric points data will be assigned automatically by the program taking into account those already inserted. The image shows the result of the transformation.




| N. | Descrizione | Nome/Num. | Alt.Prisma | Dist.Incl. | Ang.Vert. | Ang.Orizz. | Tipo Prisma | Costante Prism |
|---|---|---|---|---|---|---|---|---|
| 37 | DETT. | 235 | 2.550 | 7.420 | 98.6070 | 63.4650 | Sconosciuto | |
| 38 | DETT. | 236 | 2.550 | 7.110 | 107.8880 | 93.5200 | Sconosciuto | |
| 39 | DETT. | 237 | 1.520 | 5.690 | 113.4850 | 146.9620 | Sconosciuto | |
| 40 | DETT. | 238 | 1.520 | 8.460 | 115.4370 | 104.5690 | Sconosciuto | |
| 41 | ALB. | 239 | 1.520 | 13.500 | 114.4750 | 97.5520 | Sconosciuto | |
| 42 | ALB. | 240 | 1.520 | 11.400 | 115.2830 | 122.8970 | Sconosciuto | |
| 43 | ALB. | 241 | 1.520 | 5.560 | 103.9890 | 194.3930 | Sconosciuto | |
| 44 | ALB. | 242 | 1.520 | 8.110 | 102.2350 | 216.0660 | Sconosciuto | |
| 45 | DETT. | 243 | 1.520 | 4.720 | 101.8320 | 246.2260 | Sconosciuto | |
| 46 | DETT. | 244 | 1.520 | 7.020 | 97.9290 | 303.8340 | Sconosciuto | |
| 47 | DETT. | 245 | 1.520 | 10.720 | 101.3300 | 238.7070 | Sconosciuto | |
| 48 | DETT. | 246 | 1.520 | 15.480 | 100.2400 | 257.8190 | Sconosciuto | |
| 49 | DETT. | 247 | 1.520 | 15.140 | 102.0620 | 239.1830 | Sconosciuto | |
| 50 | DETT. | 248 | 1.520 | 9.810 | 99.8060 | 266.5450 | Sconosciuto | |
| 51 | ALB. | 249 | 1.520 | 13.570 | 109.9360 | 200.9520 | Sconosciuto | |
| 52 | ALB. | 250 | 1.950 | 14.550 | 110.7940 | 180.8310 | Sconosciuto | |
| 53 | ALB. | 251 | 1.850 | 18.920 | 109.4630 | 197.3280 | Sconosciuto | |
| 54 | ALB. | 252 | 1.950 | 16.390 | 112.4870 | 163.0320 | Sconosciuto | |
| 55 | GR - da grafica | 1 | 1.220 | 11.727 | 84.6756 | 40.2896 | Sconosciuto | |
| 56 | GR - da grafica | 2 | 1.220 | 10.457 | 82.7694 | 4.5335 | Sconosciuto | |
| 57 | GR - da grafica | 3 | 1.220 | 4.345 | 55.5023 | 1.7010 | Sconosciuto | |

**Figure 235:**

3.**In Orientation Points:** this command is used to transform graphic points, noted coordinate points, GPS points and Line 5 Pregeo points into orientation points

The procedure to follow is very similar to the one outlined for transforming into celerimetric points: the only difference is that here there is no requirement to select the station.

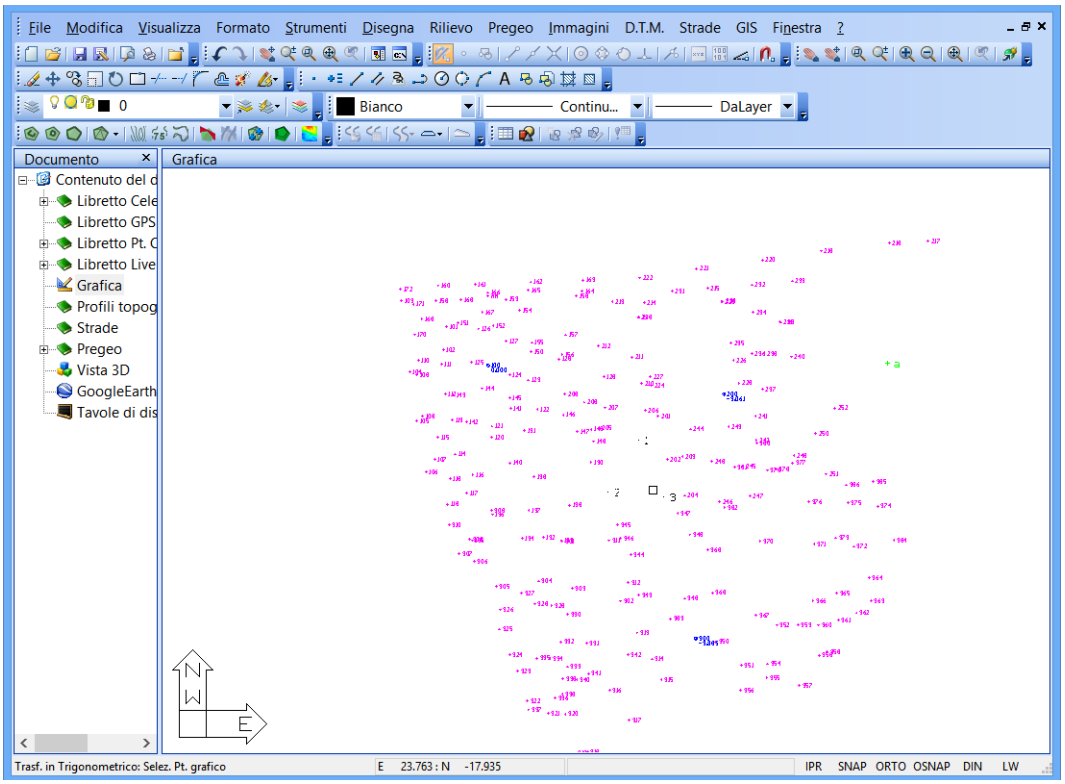



**Figure 236:**

After selecting the points (ex. 1, 2, 3) the right mouse button must be pressed to display the window summarizing the number of points selected and the request to confirm the transfer.

Respond **YES** and verify the result of the transformation by going to **View in the Coordinates Pt. Booklet**, **Orientation Points** navigation tree.

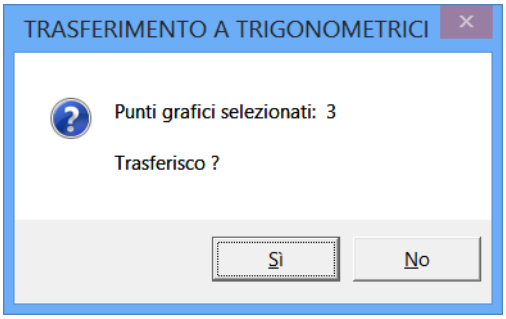



**Figure 237:**

The image below shows the result of the transformation.

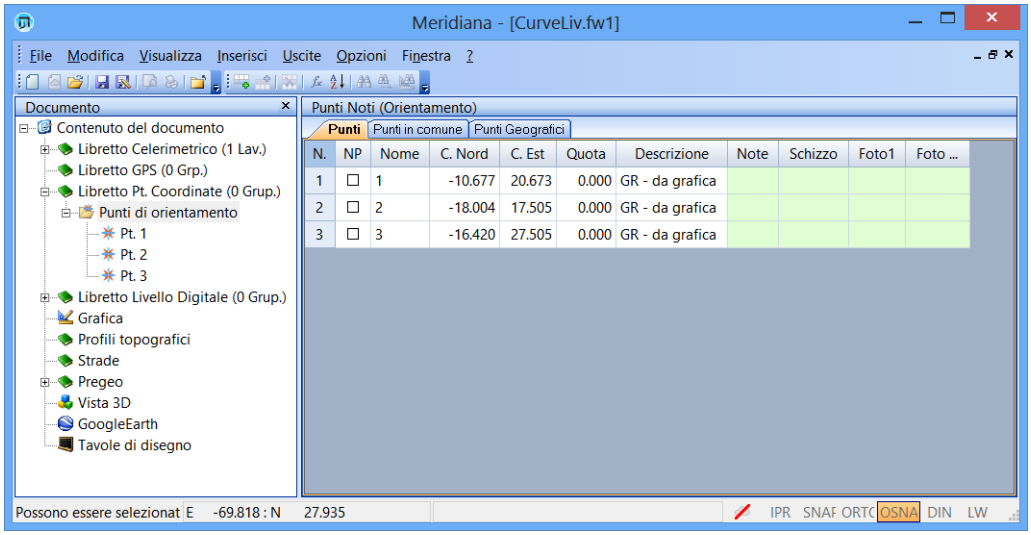



**Figure 238:**

4.I**n GPS Points:** this command is used to transform graphic points, noted coordinate points and celerimetric points, Line 5 Pregeo points and station points into GPS points

As in the orientation points, select the points (ex. 101, 102, 103, 104) in the **Graphic View** and then press the right mouse button to view the **Transforming into GPS points** window.

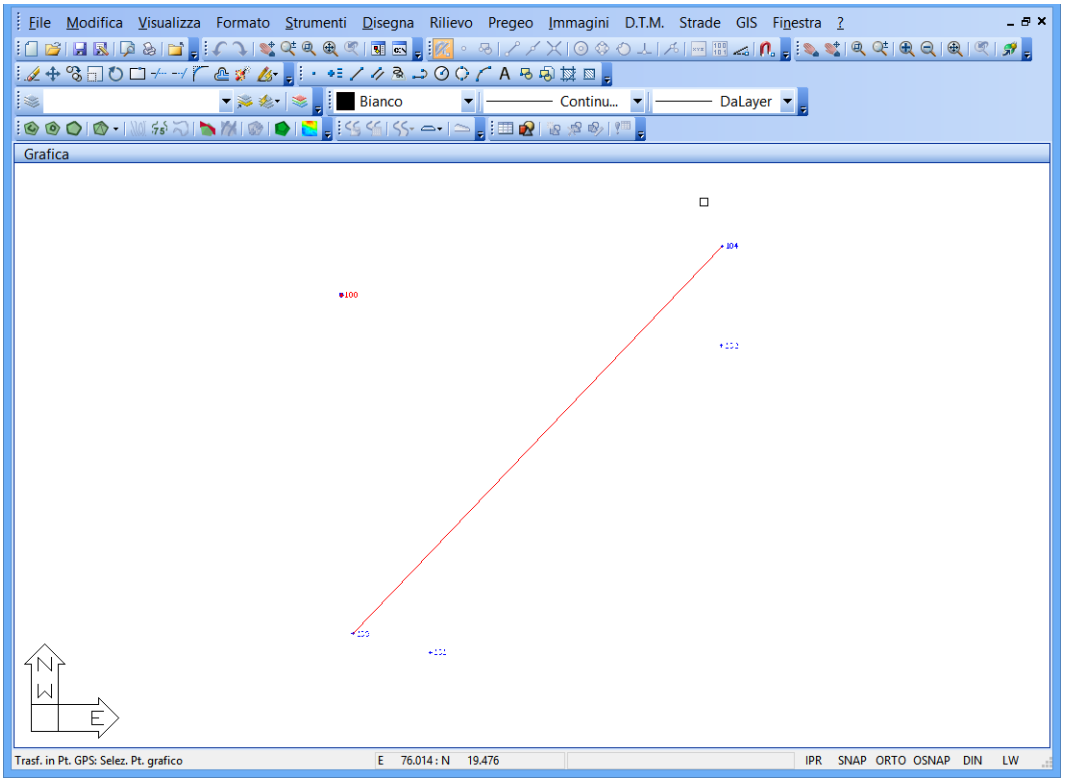



**Figure 239:**

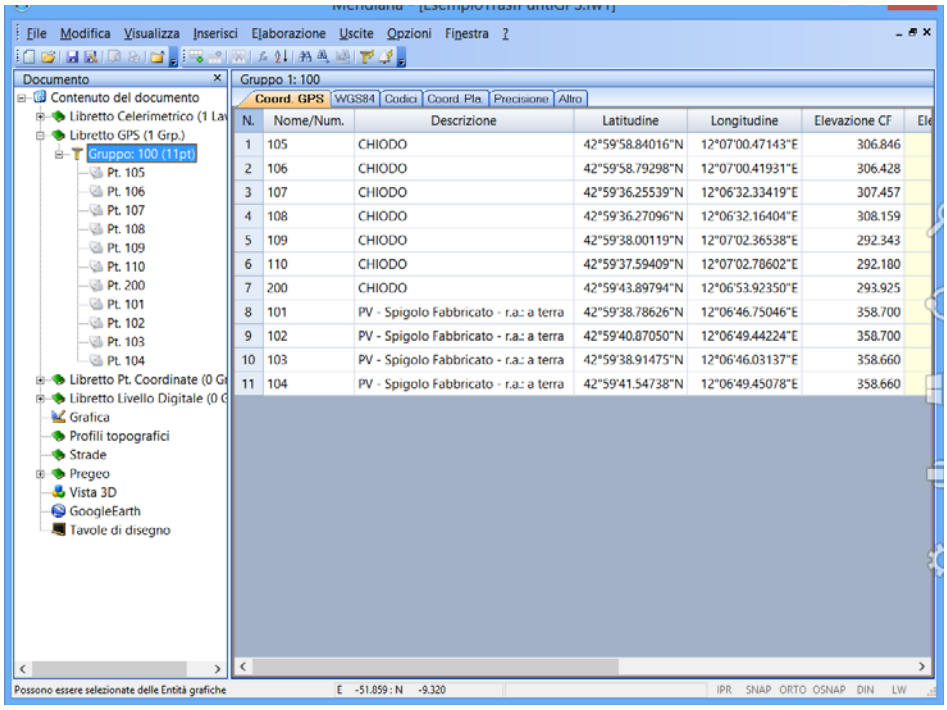
This window displays a summary of the number of points selected while the destination group and height are still to be assigned.

The transfer is completed when the **Transfer** button is pressed; to ensure that the transfer is executed properly it is important that the projection calculations have been done correctly.


**Figure 240:**

**Figure 241:**

The image below shows the result of the transformation.




5.In **Noted Points**: this command is used to transform graphic points, celerimetric points, Line 5 Pregeo points, stations and GPS points into noted points

In this case too, select the points in the **Graphic View** (ex. 101, 102, 103, 104) and then press the right mouse button: the program will display the **Transforming into Noted Points** window.

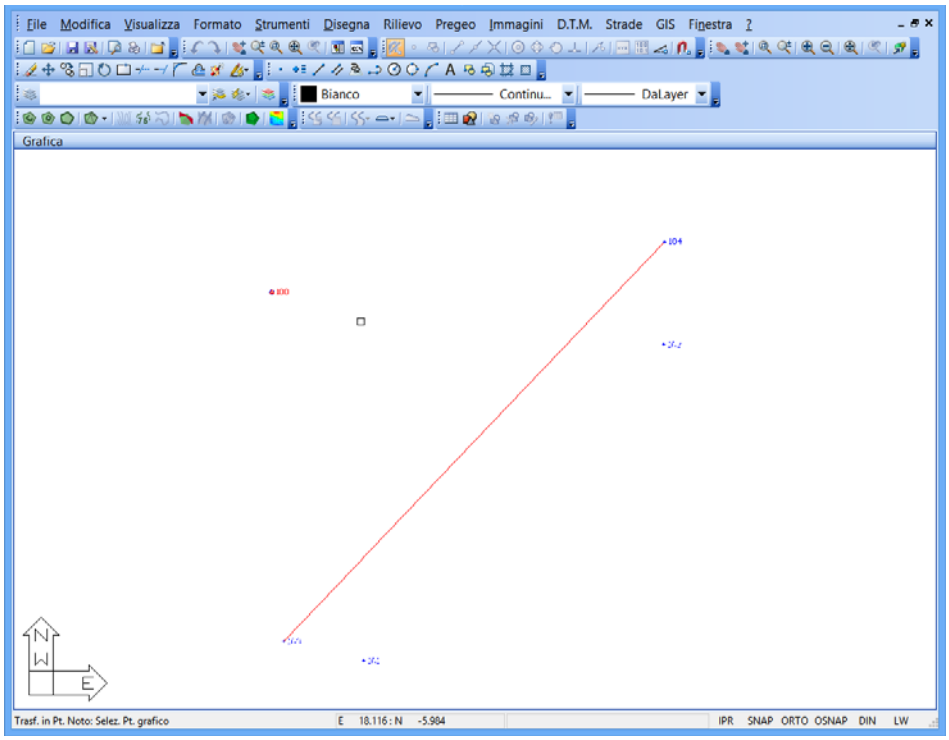



**Figure 242:**

Through the **Transforming into Noted Coordinate Points** window the user must identify the destination group for the selected points.

If the group does not exist, the program will create it automatically.

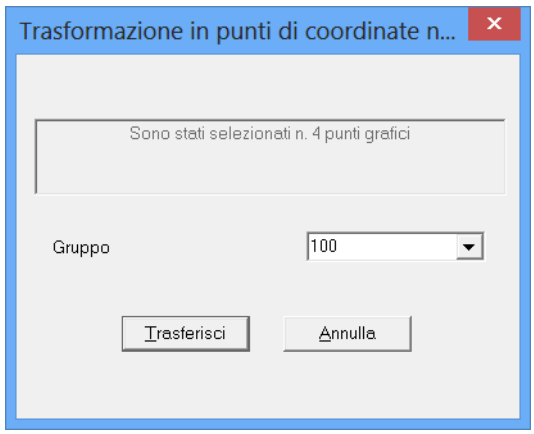



**Figure 243:**

The image shows the result of the transformation.

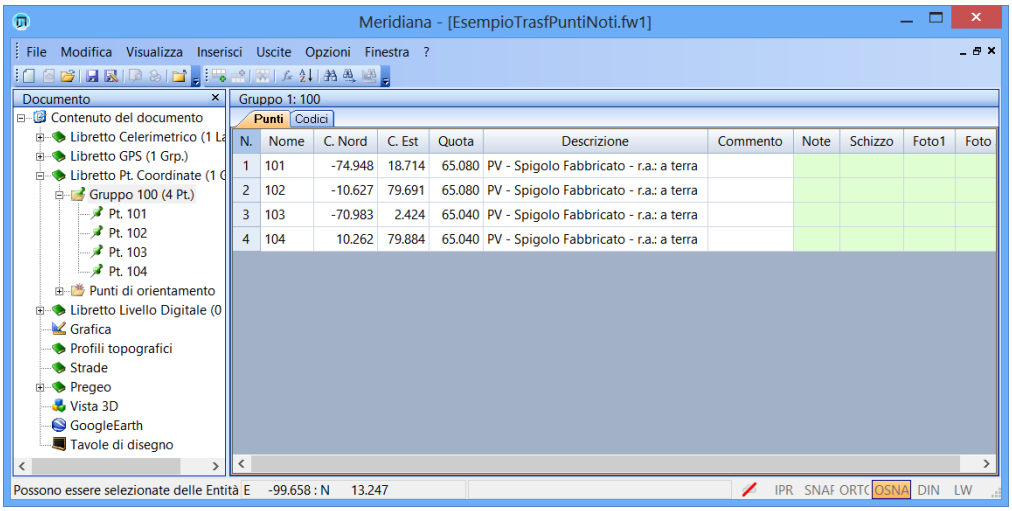



**Figure 244:**

# Survey|Creating points

The Graphic View offers a series of commands to design celerimetric , GPS, and noted coordinate points; to use them, access through the **Survey|Creating points** menu.

# Survey|Creating Points|Celerimetric.

To create a celerimetric point, initially the station must be selected and then it must be designed as a graphic using the left mouse button.

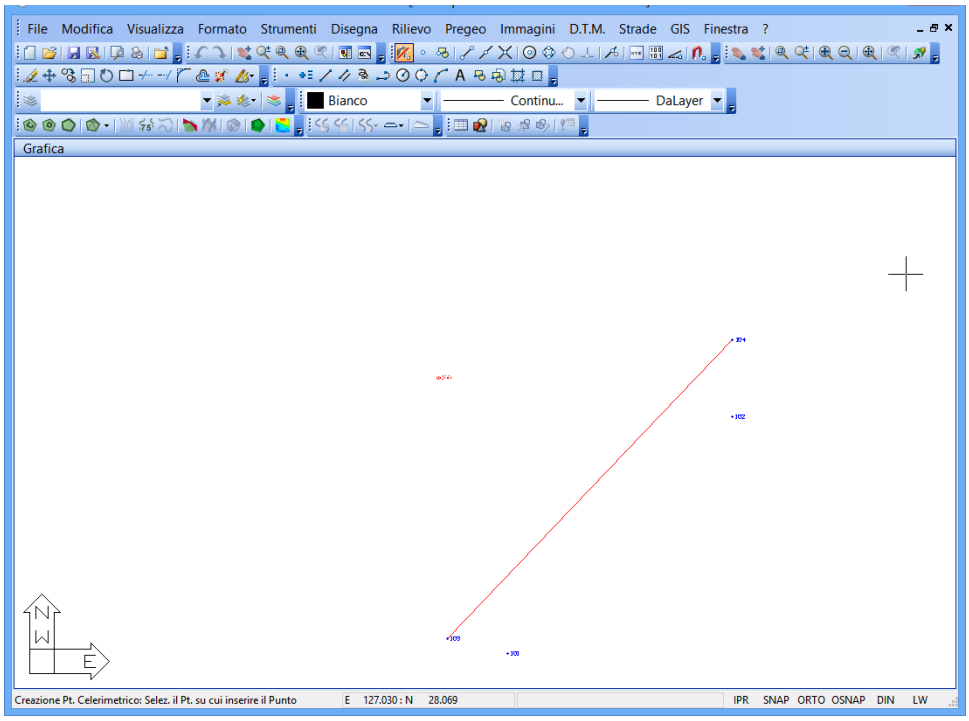



**Figure 245:**

Once the design is completed, the program will display the **Creating celerimetric points** window where the user can insert the information associated with the created point.

After designing the point, press the **Create** button and verify the result as a graphic as well as in the Station view 100.

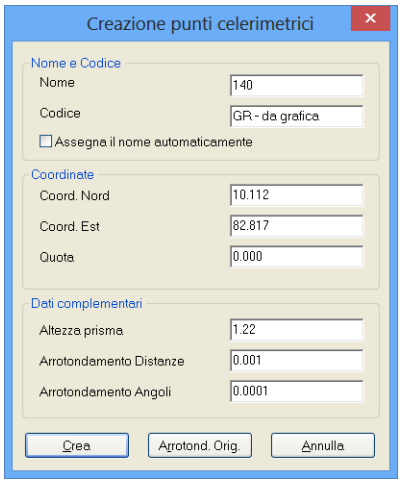
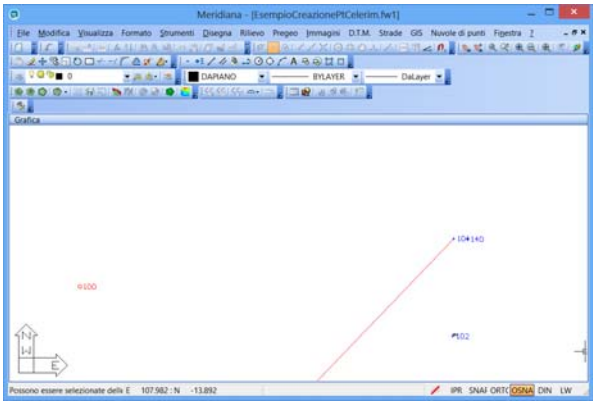



**Figure 246:**

The following images will appear:



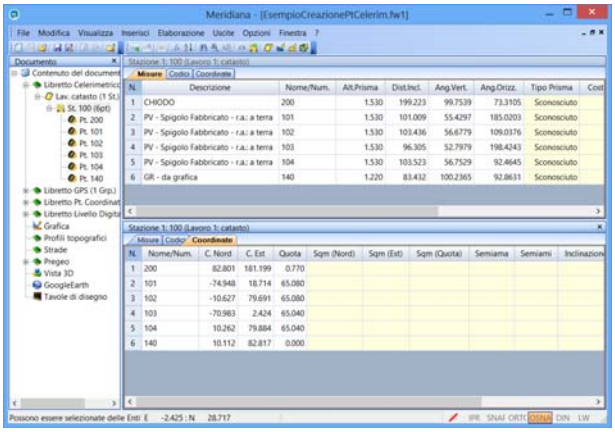


**Figure 247:**

# Survey|Creating Points|GPS

To create a GPS point, it must be designed as a graphic using the left mouse button.

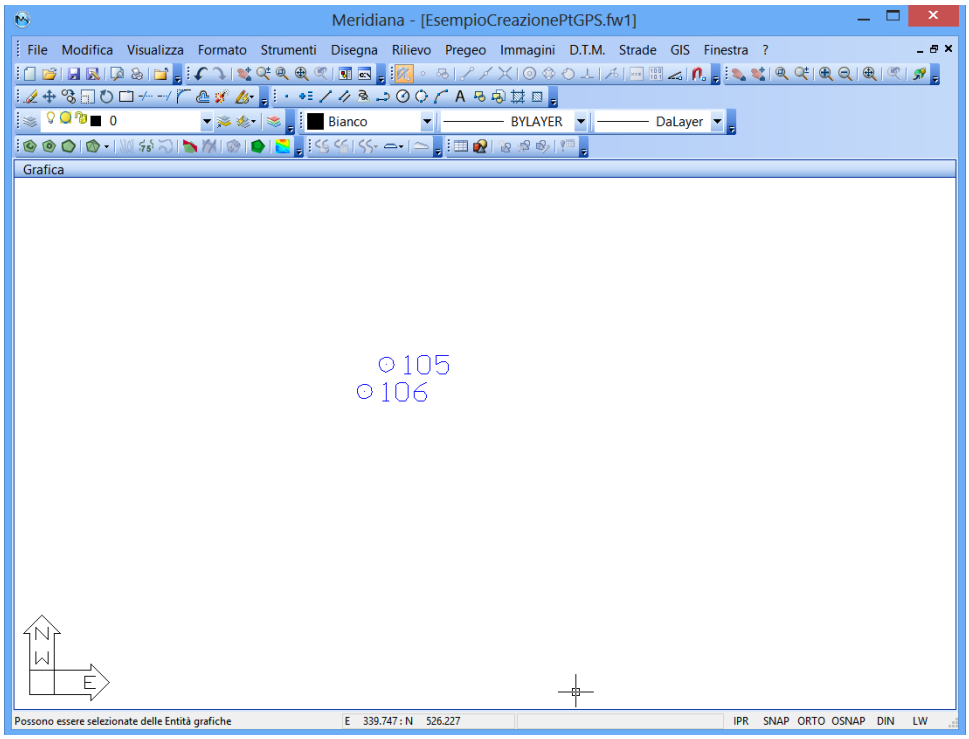



**Figure 248:**

Once the design is completed, the program will display the **Creating GPS points** window where the user can insert the information associated with the created point.

After designing the point, press the **Create** button and verify the result as a graphic as well as in the GPS Booklet, Group 100.

It is important to note that creating a GPS point results positively only when the projection calculation has been done.

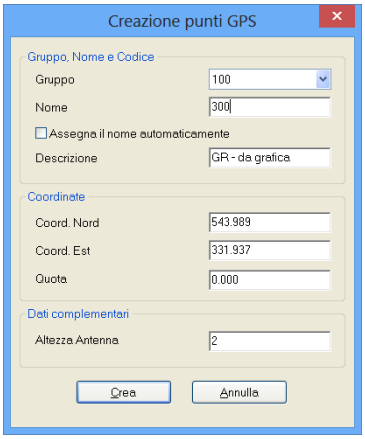
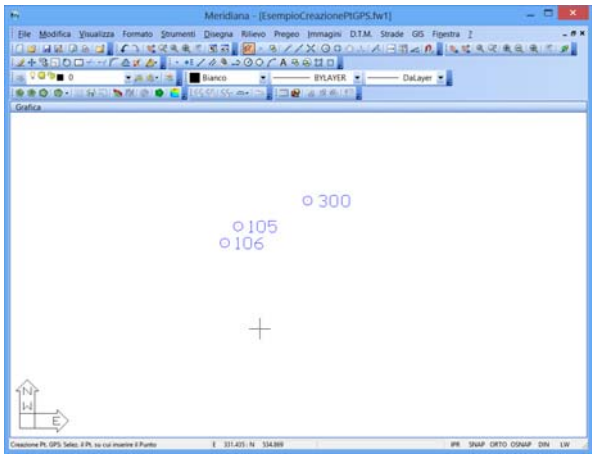



**Figure 249:**

The following images will appear:



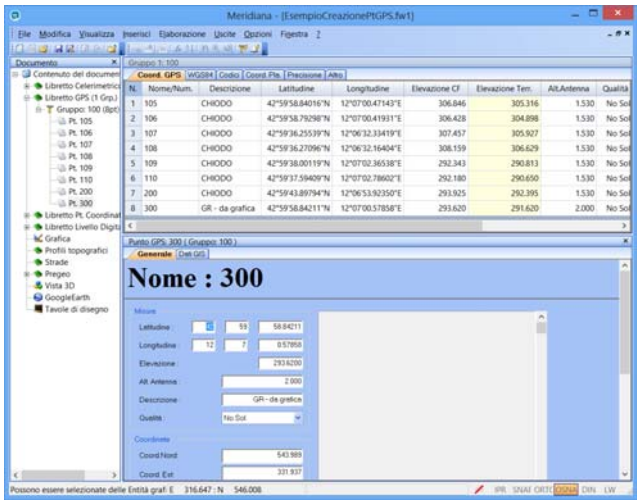




**Figure 250:**

# Survey|Creating Points|Notes

To create a Noted point, initially the station must be selected and then it must be designed as a graphic using the left mouse button.

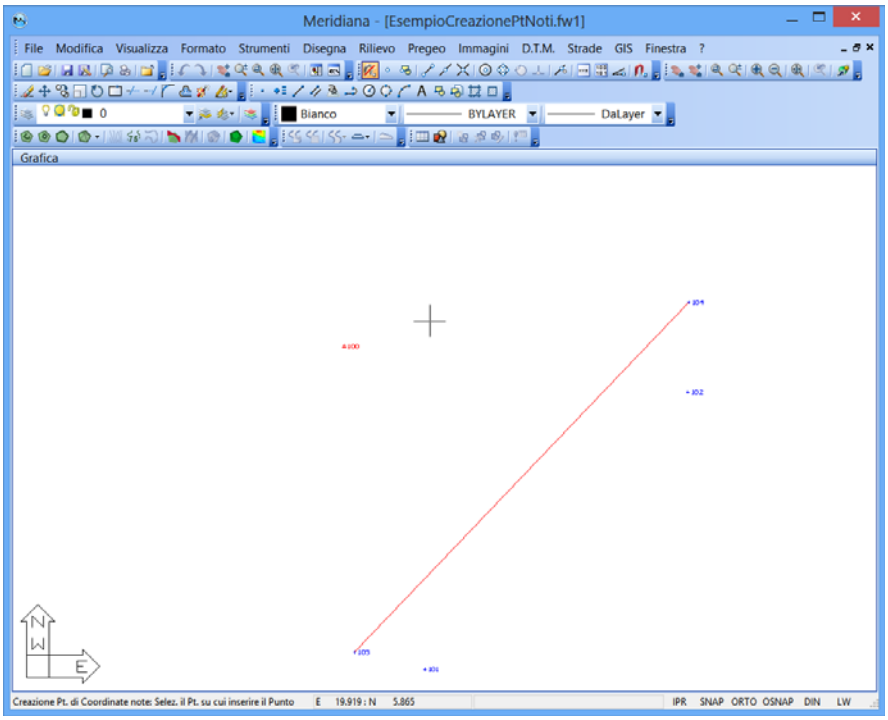



**Figure 251:**

Once the design is completed, the program will display the **Creating noted points** window where the user can insert the information associated with the created point.

After designing the point, press the Create button and verify the result as a graphic as well as in the Coordinate Pt. Booklet, Group 100.

It is important to note that the creation of a noted coordinate point will occur even if the destination group has not been specified (the program will create it automatically).

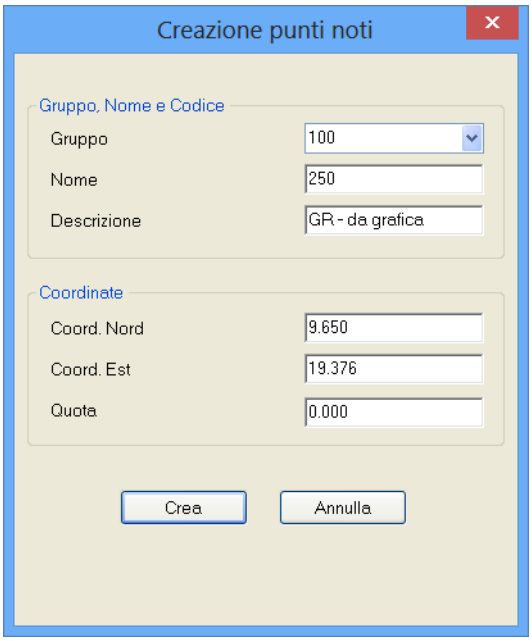



**Figure 252:**

The following images will appear:

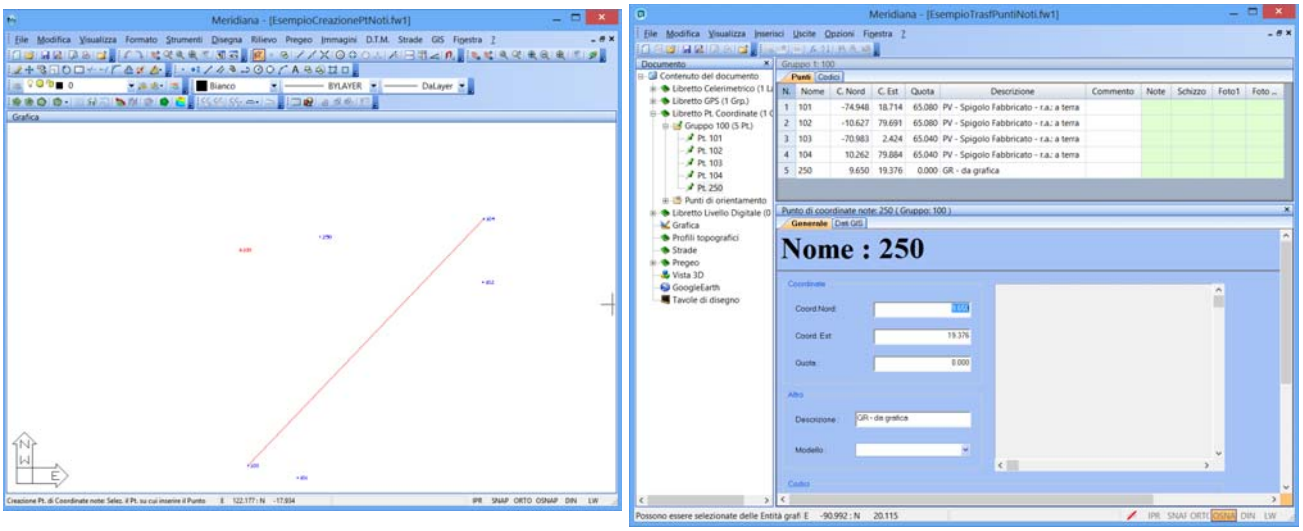



**Figure 253:**

# Survey|Changing Booklet Entities

The **Graphic View** allows for applying changes to the entities associated with the various booklets; to use these commands just proceed to the **Higlighting|Changing Booklet Entities** menu.

Here following is a description of each one.

# 1.Change Points

This procedure allows for editing of Celerimetric Points, GPS points and Noted Coordinate Points after having selected them using the graphic method. Depending on the point selected, a window displaying its information will appear. On the lower left of the window, use the **Notes** button to insert various notes associated with the point.

## Celerimetric Points

Once the point is selected, the program will open a window made of 4 pages.

The first one shows the values of the measurements contained in the Celerimetric Booklet; the user can change them or confirm them.

If any changes are made, the coordinates and quote shown in the final part of the window will be recalculated in real time.

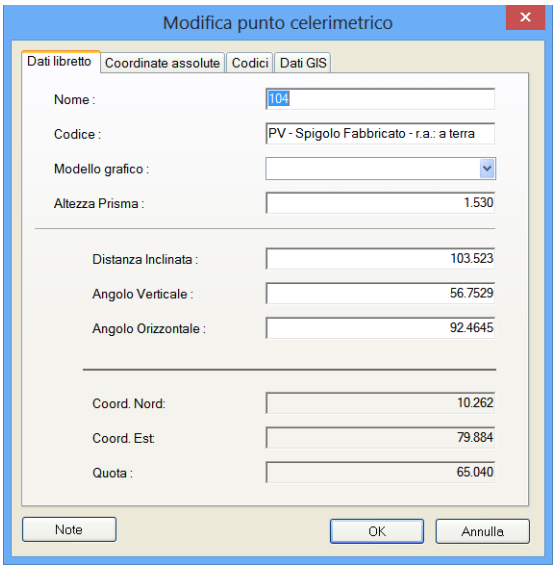



**Figure 254:**

The second page allows the user to change the coordinates and quote by observing the result on the measurements compared to the Station to which it belongs.

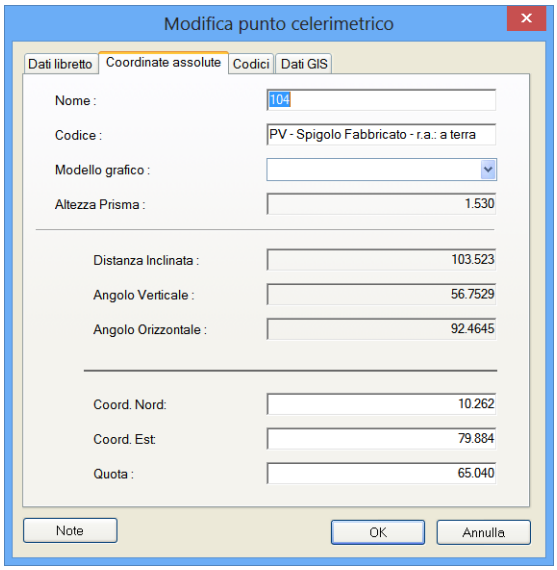



**Figure 255:**

The third page is used to change the codes associated with the point. This procedure is found to be particularly useful to change the coding of the Points: for example, assign the NC code to those Points not to be considered in creating Triangles (Code Definition).

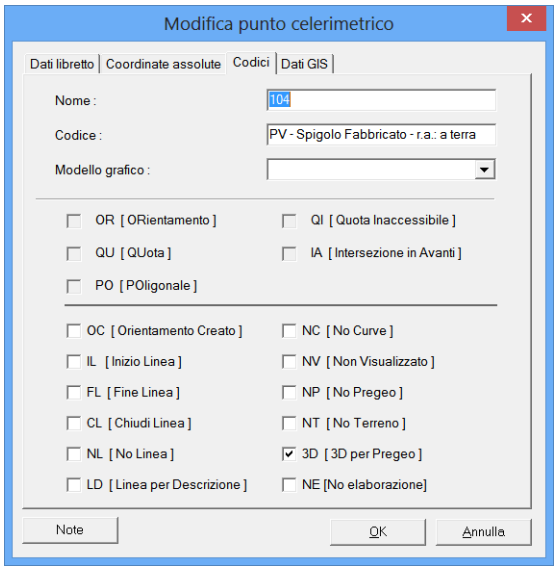



**Figure 256:**

The fourth page is used to change the GIS data associated with the point; this page is the same as the one for the **GPS Points** and the **Noted Coordinates Points**.

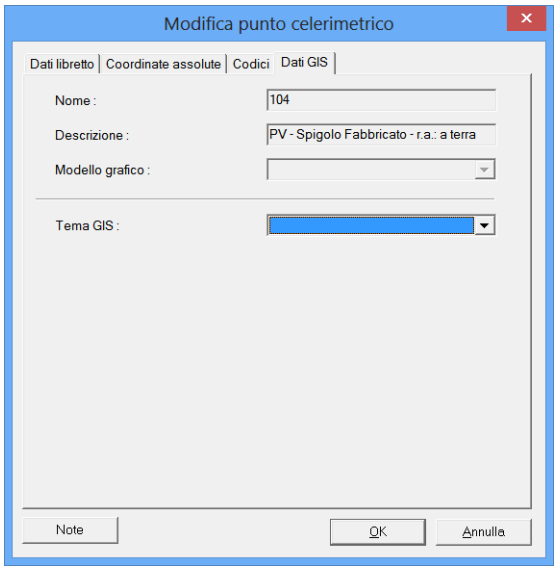



**Figure 257:**

Celerimetric Points with IA or QI codes or Points with a duplicate "Name" inside the same Station cannot be edited in this mode; changing the points data using this procedure means that re-elaboration of the data is not required.

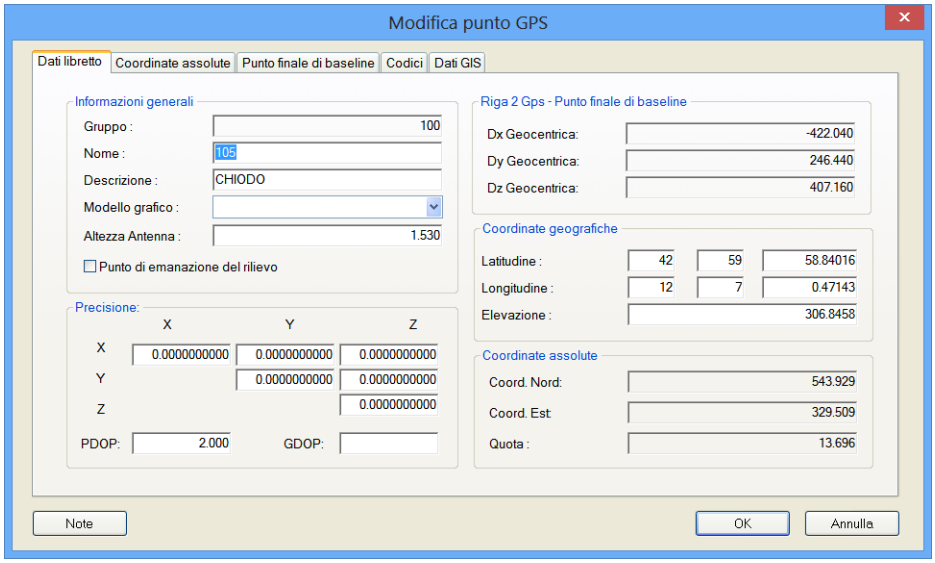



**Figure 258:**

# GPS Point

The **Change GPS Points** window includes five pages.

The following information can be edited in the **Booklet Data** page:

– General information on the point;

– Geographic coordinates;

– Precision values.

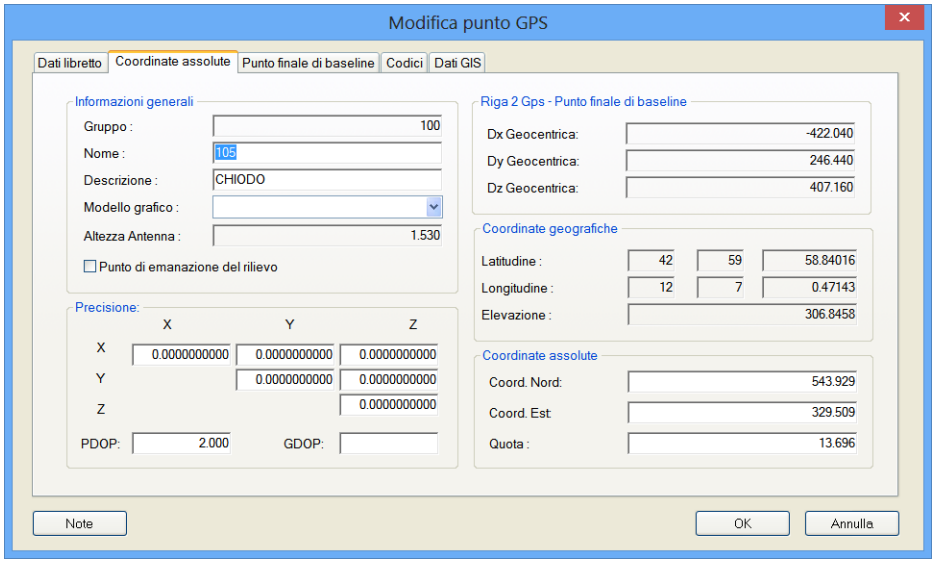



**Figure 259:**

Besides these, the user can also establish if the point is an emanation.

Editing the geographic coordinates is done automatically when the geocentric and absolute coordinates are recalculated.

Functionality of the **Absolute Coordinates** page is similar to the **Booklet Data** page with the only difference that the user can change the absolute coordinates.

Changing of the absolute coordinates will trigger updating of the geographic and geocentric coordinates in real time.

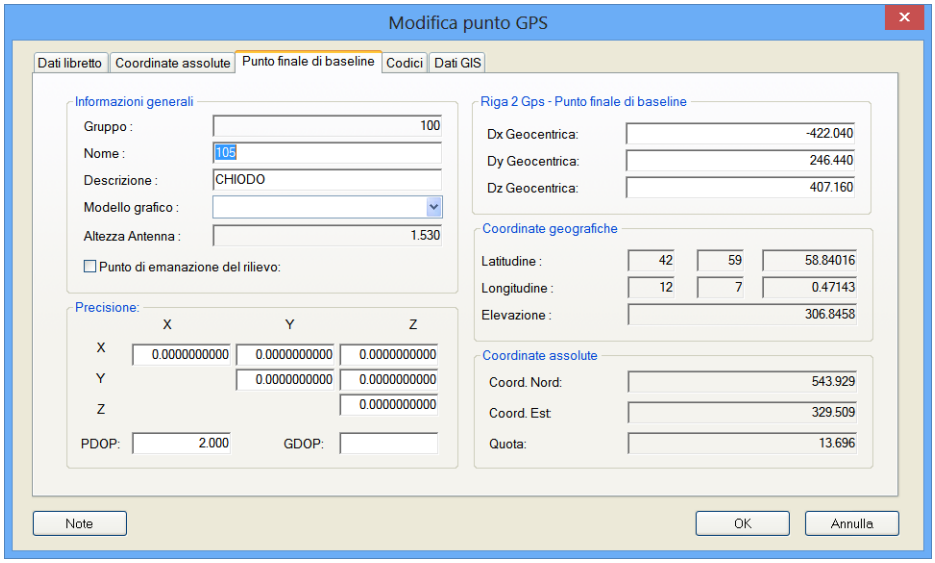



**Figure 260:**

The same goes for the **Final Baseline Point** page: in this case the user can edit the geocentric coordinates.

Changing of the geocentric coordinates will trigger updating of the absolute and geographic coordinates in real time.

The **Codes** page is used to change the codes associated with the point.

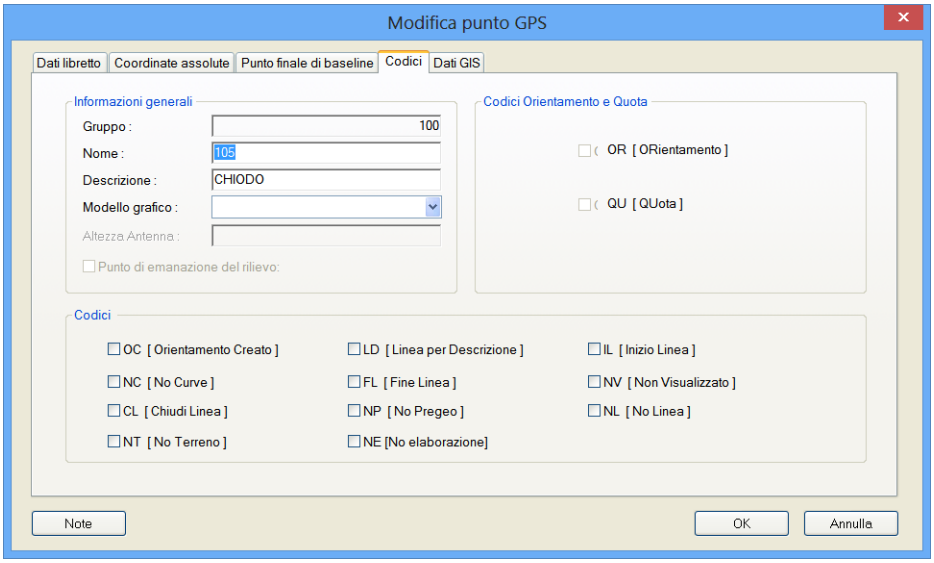



**Figure 261:**

The **GIS Data** page is used to change the GIS theme of the point.

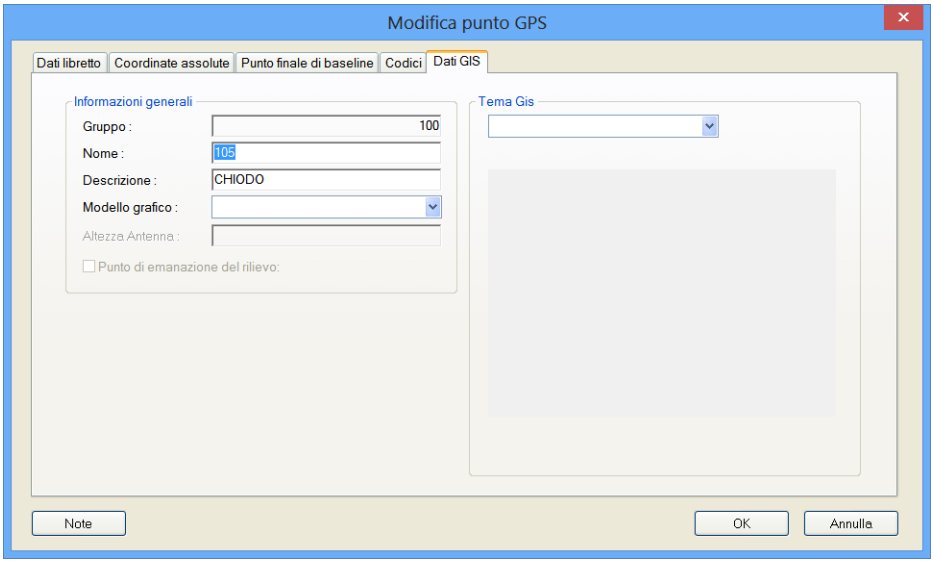



**Figure 262:**

Changing the data using this procedure does not require re-elaboration.

## Noted Coordinates Point

This window includes two pages:

The first page is used to change/confirm the coordinates of the booklet and the codes associated with the point.

The second page is used to change the GIS Data.

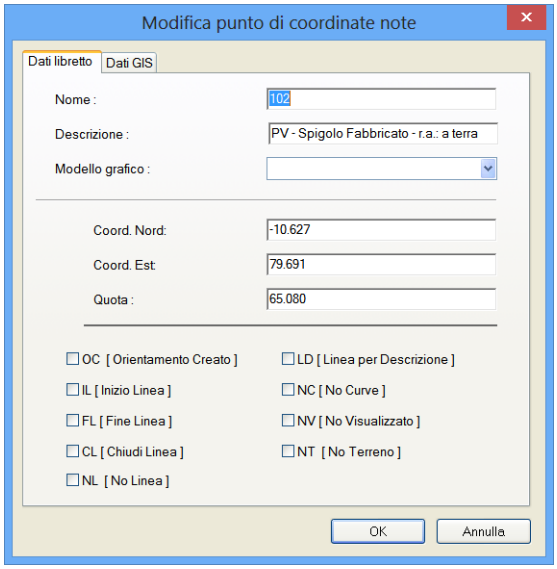



**Figure 263:**

# 2.Erase Points

This function is used to erase Celerimetric, GPS and Noted Coordinate points.

Once the selection of points is completed (ex. 103, 104, 200, 110) in the Graphic View by pressing the right mouse button, a window will appear summarizing the selected points and requesting confirmation of the operation.

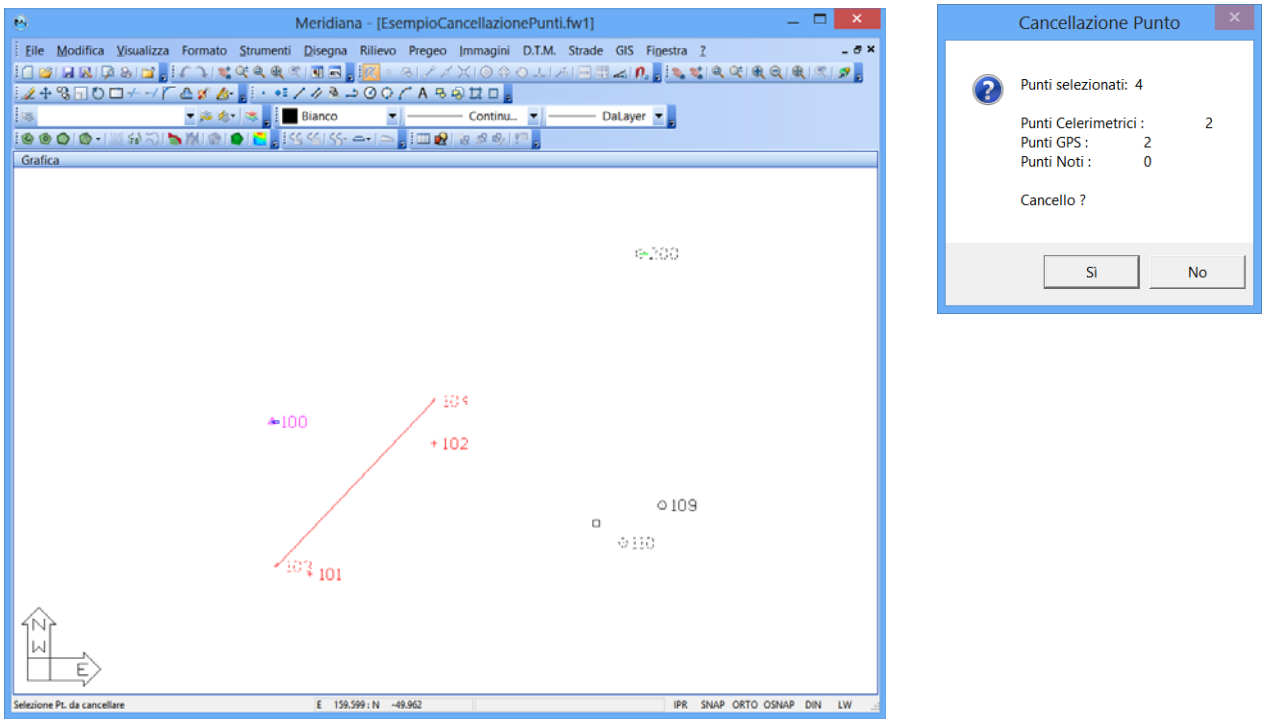



**Figure 264:**

The cancellation will take effect graphically as well as in the booklet that held the selected points.

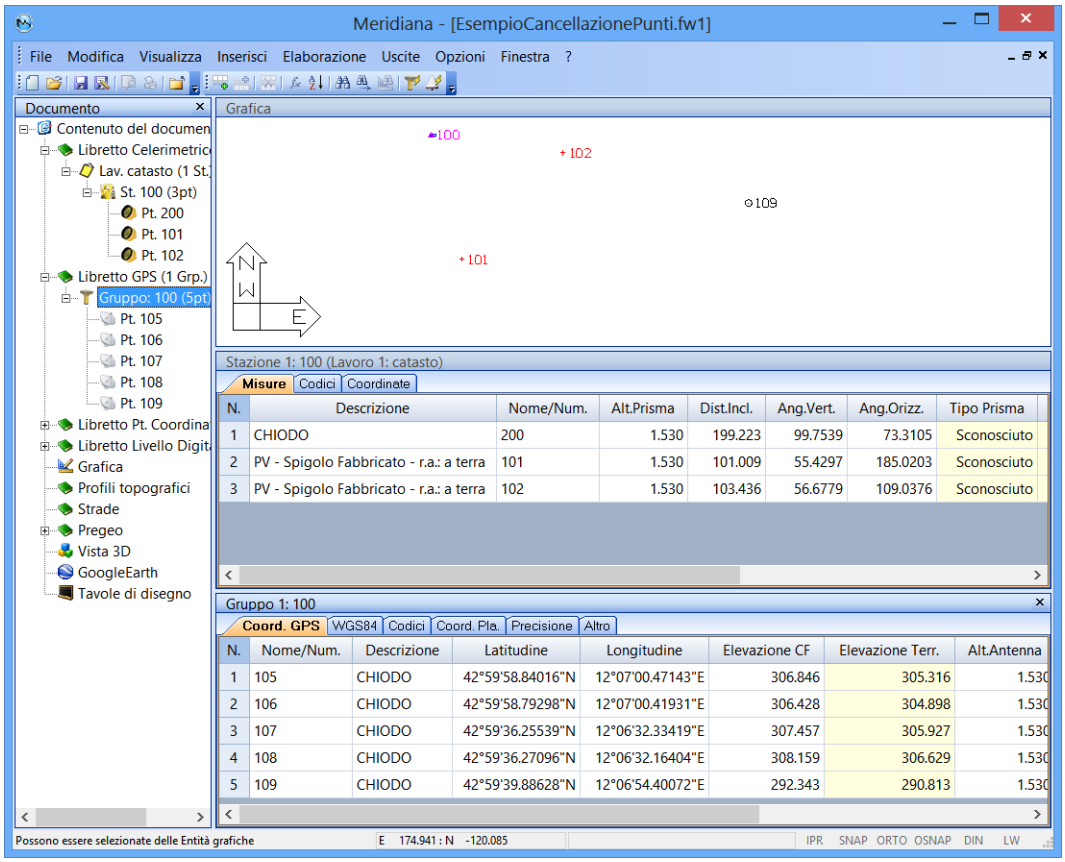



**Figure 265:**

# 3.Move Points

This function is used to move Celerimetric, GPS and Noted Coordinate points.

The entity can be selected by pressing the left mouse button; once the selection is made movement can be executed by using the free design instrument.

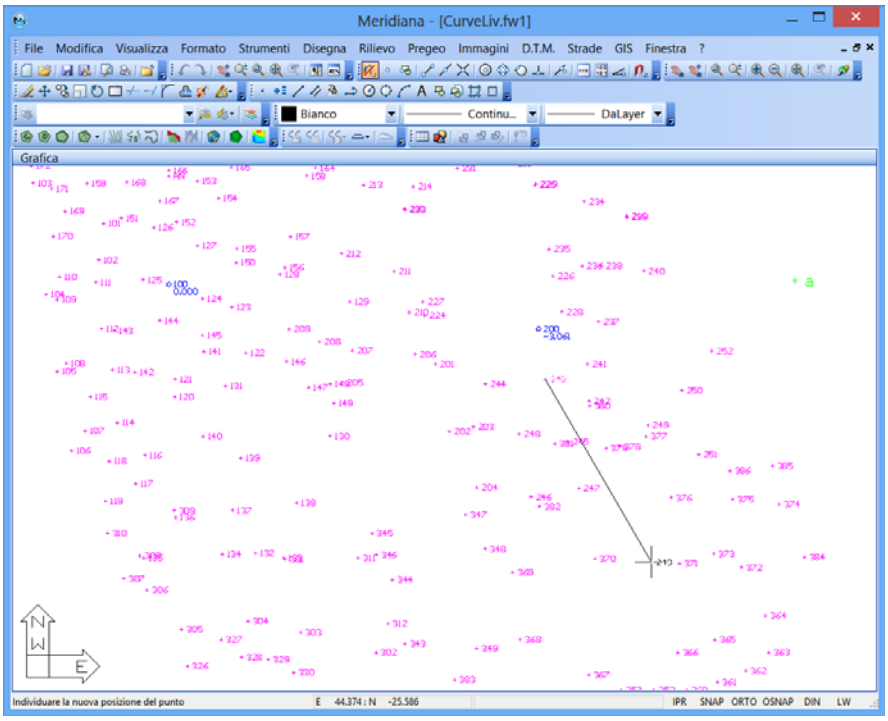



**Figure 266:**

The coordinates of the point will be updated automatically once the operation is completed; for Celerimetric Points, the measurements are also updated and for GPS Points, the geographic coordinates will also be updated.

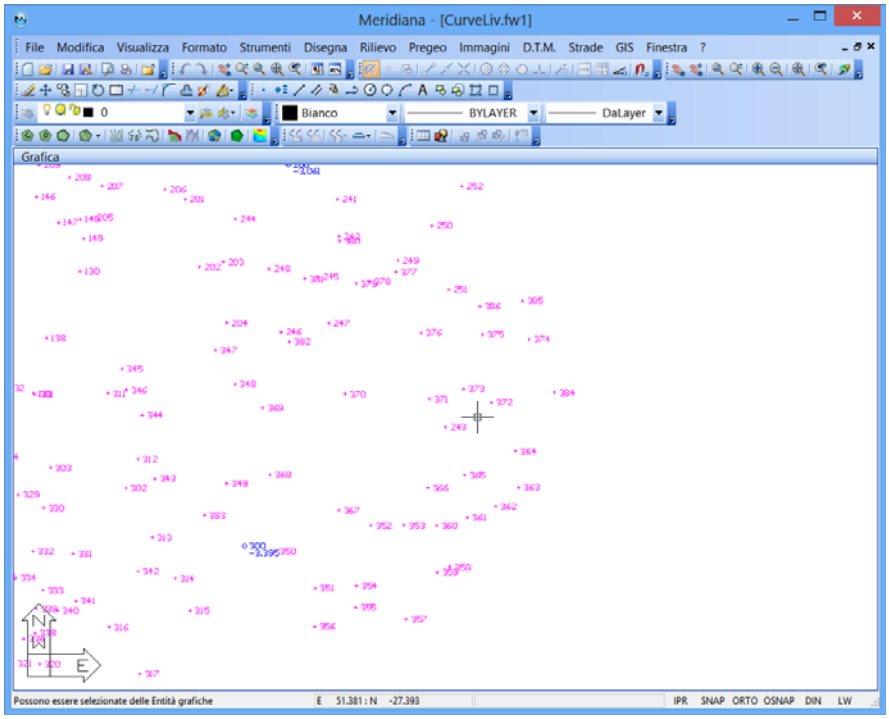



**Figure 267:**

# 4.Move Celerimetric Stations

Moving the stations is done similar to the way points are moved; the operation involves recalculating all of the celerimetric point measurements without changing the position.

# 5.Move GPS Base

This command allows moving of the GPS base station by selecting a graphic or GPS point in the Graphic View.

Example 1: move the GPS base with graphic point

Once the command is launched, the program will display the **Move GPS Base** window where the user can select the station to be moved and, if desired, change its antenna height.

Suppose the Station Base 300 is to be moved and leave the antenna height unchanged.

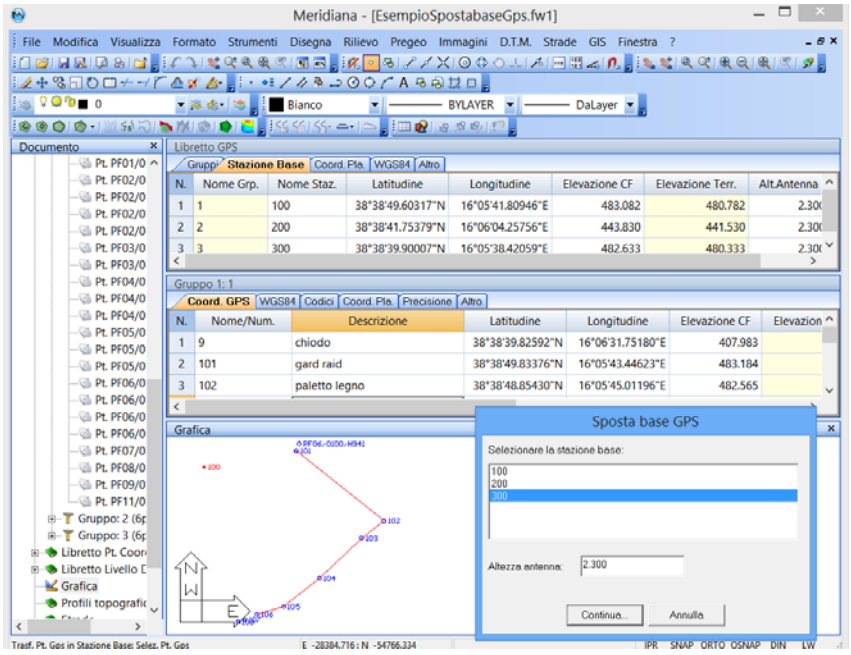



**Figure 268:**

Press **Continue...** and the user can select, through the **Graphic View,** the point where to set the GPS base station.

To identify the position graphically, the **Object Snap** must be changed because the default command launches the **connect to point Snap**, while what we need must allow designing of the point graphically.

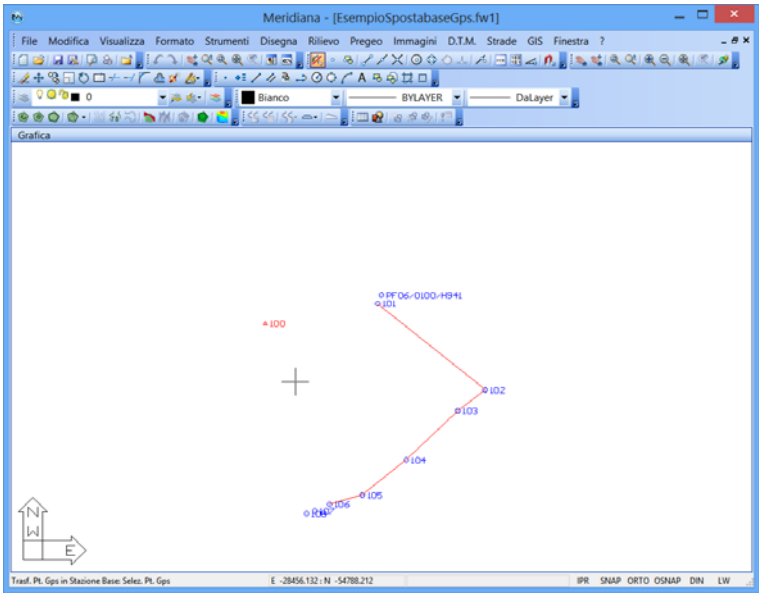



**Figure 269:**

In our example we selected to use **free design**.

Once the graphic selection is completed, the program will display the following message to request confirmation of the operation executed.

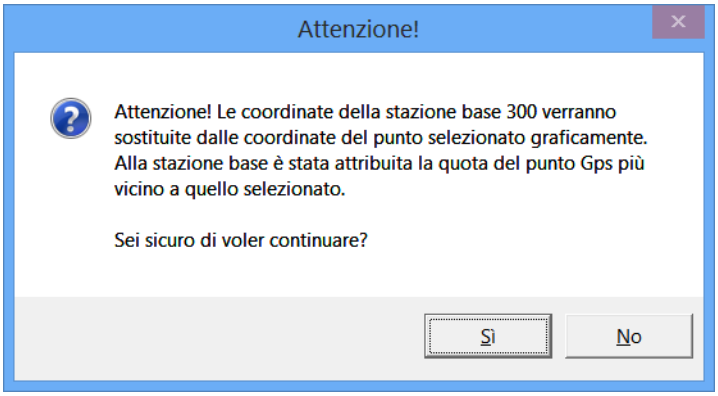



**Figure 270:**

By responding **Yes**, the Base 300 will be moved to the new point and will be assigned a quote equal to that of the closest GPS point.

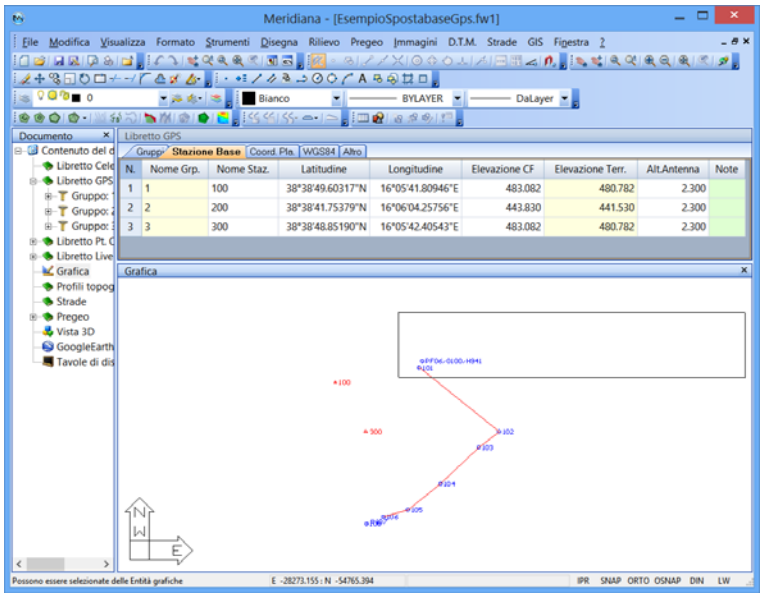



**Figure 271:**

Example 2: move the GPS base with GPS point

In this example it was decided to move the GPS station base 100 to point 108 and change the antenna height from 2.3 to 1.

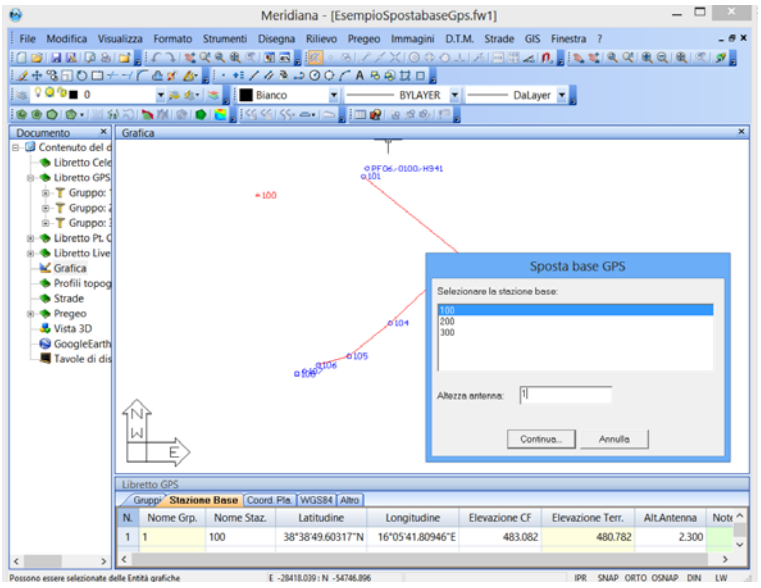



**Figure 272:**

After pressing **Continue...** the program will suggest **Object Snap Connect to point** and at this point it is possible to immediately select point 108.

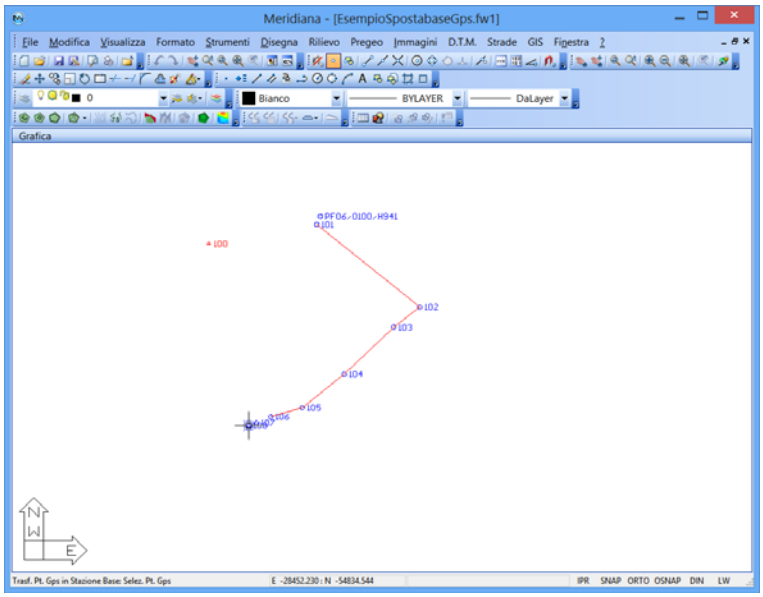



**Figure 273:**

Once the selection of the point is completed, the program will display the window shown at the side to receive confirmation of the operation executed.

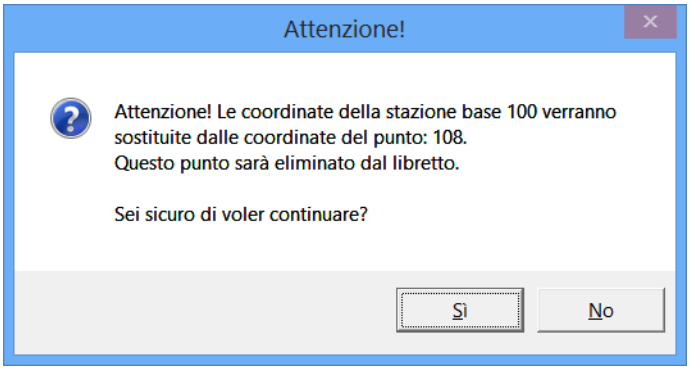



**Figure 274:**

The final result is shown in the image below.

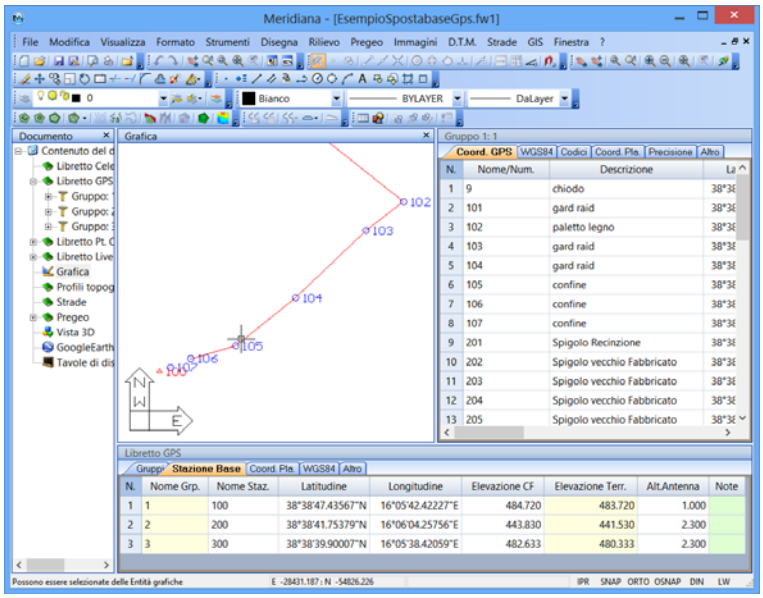



**Figure 275:**

# 6.Move Texts

This procedure is used to change the position of the texts (**Name**, **Code**, **Identification**, **Comment**, and **Quote**) associated with the Entities bearing the associated name.

Once activated, a selection symbol will appear on the video (a small square) to be positioned on the text to be moved. With a mouse click, the text will be "captured" and its graphic position can be changed.

If the **Ctrl** button on the keyboard is held down while making the mouse click on the various texts, more than one text can be selected at a time.

If a text is not selected but a click is made on any part of the graphic where there is no entity, the program will activate the **by window** modality to allow selecting of all the texts found within that window itself.

If the button is released, the next mouse click will restart the selection from the beginning. To exclude a text from being moved, just click on it with the left mouse button.

To proceed to the movement phase, press the right mouse button: the new text positions will be stored as positions relative to the point where the entity with the name is found.

Thus, if the user proceeds with a new data elaboration, the texts previously moved will maintain their unchanged positions compared to the Entity to which they belong.

The image shown below displays the selection phase for texts 102 and 104.

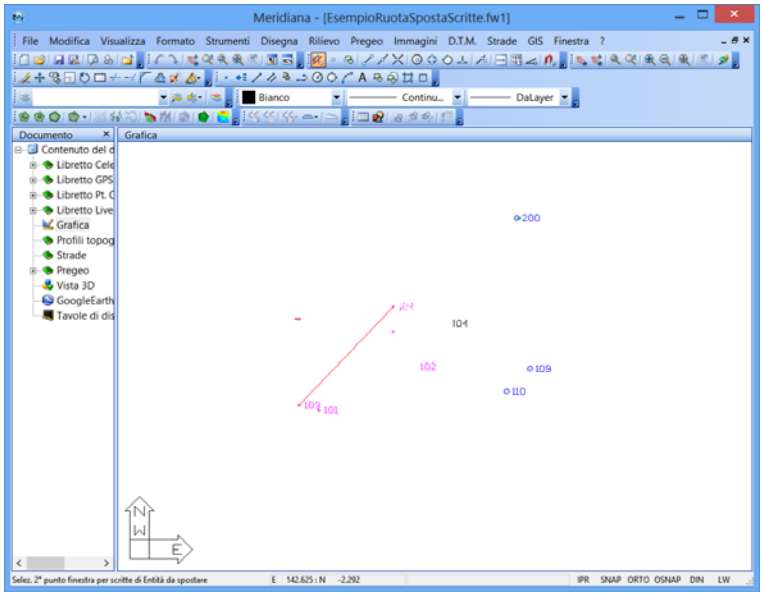



**Figure 276:**

This other image shows the results of the movement.

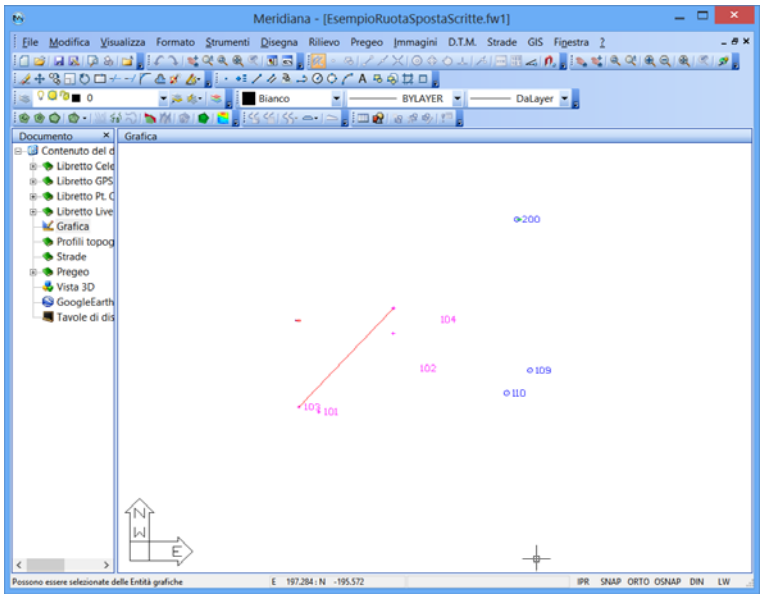



**Figure 277:**

# 7.Rotating Texts

This procedure is used to rotate the direction of the texts (**Name**, **Code**, **Identification**, **Comment**, and **Quote**) associated with the Entities bearing the associated name.

Once activated, a selection symbol will appear on the video (a small square) to be positioned on the text to be rotated.

With a mouse click, the text will be "captured" and its graphic direction can be changed.

The rotation is done around the coordinates of the Entity to which the text belongs.

If the **Ctrl** button on the keyboard is held down while making the mouse click on the various texts, more than one text can be selected at a time.

If a text is not selected but a click is made on any part of the graphic where there is no entity, the program will activate the **by window** modality to allow selecting of all the texts found within that window itself.

If the button is released, the next mouse click will restart the selection from the beginning. To exclude a text from being rotated, just click on it with the left mouse button.

To terminate the selection and proceed with the rotation phase, just press the right mouse button.

The new rotation angles of the text will be stored in association with the Entities.

Thus, if the user proceeds with a new data elaboration, the texts previously rotated will maintain their unchanged directions compared to the Entity to which they belong.

The image below shows the selection of the text;

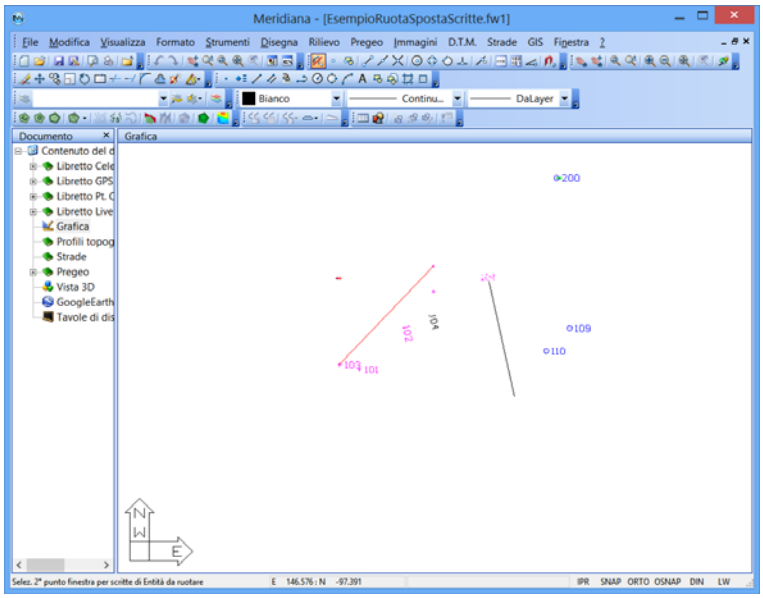



**Figure 278:**

in this image instead, the result of the rotation can be seen.

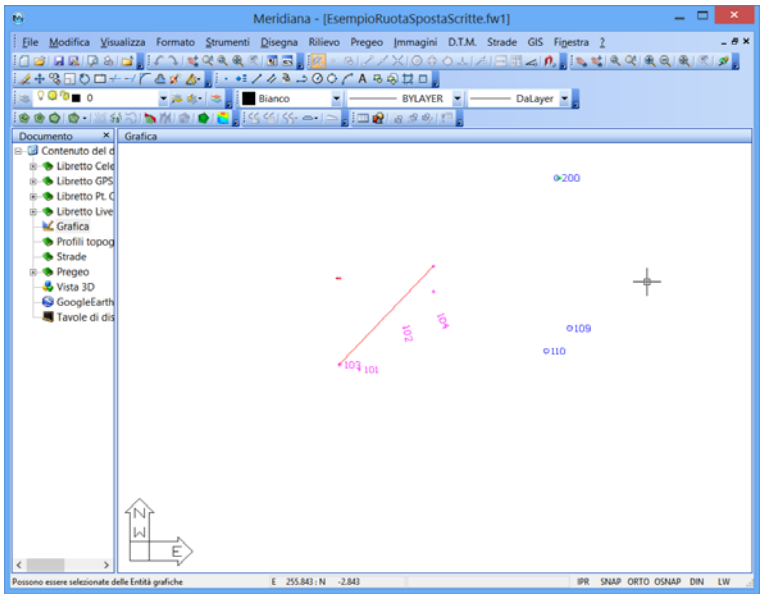



**Figure 279:**

# 8.Changing Design Model

This procedure is used to change the design model of the entities that have an associated name.

Once activated, a selection symbol will appear on the video (a small square) to be positioned on the entity whose design model is to be changed.

If a click is made on any part of the graphic where there is no entity, the program will activate the **by window** selection modality to allow selecting of all the entities found within that window itself.

To exclude the entity from being changed, the selected entity must be clicked on.

To terminate the selection press the right mouse button.

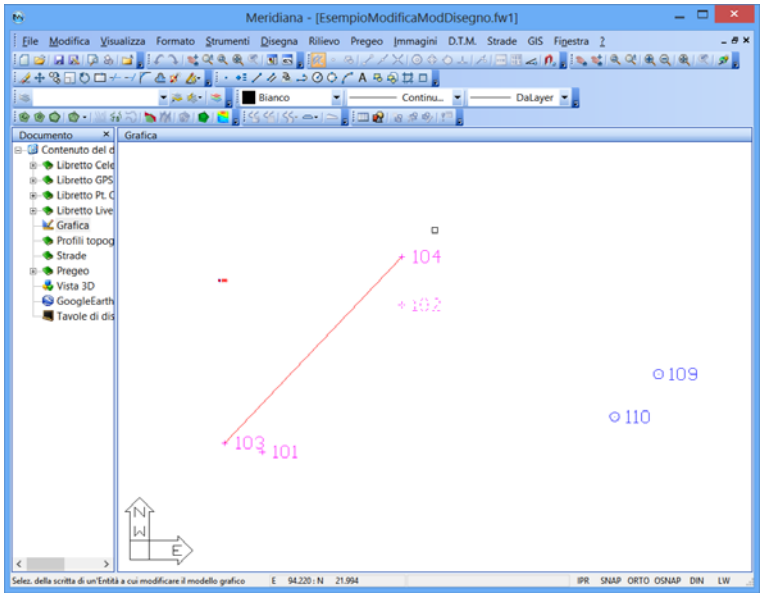



**Figure 280:**

At this point a window will appear in the upper part of the window summarizing the Entities selected divided by categories **(Celerimetric Points**, **GPS**, ...).

The lower part of the window will display a box in which to select the graphic model from a list that shows all of the models already created by means of the **Entity Format|Appearance With Name** procedure.

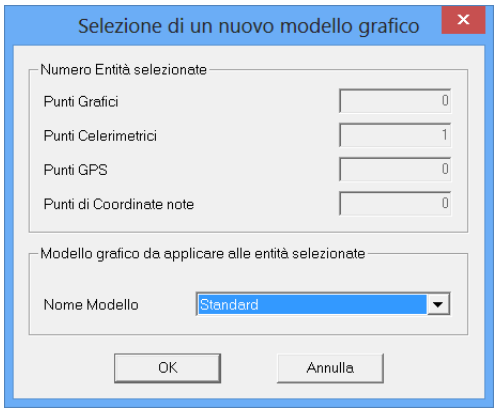



**Figure 281:**

Once the **ModelPoint3** model is selected, press the **OK** button to conclude the operation.

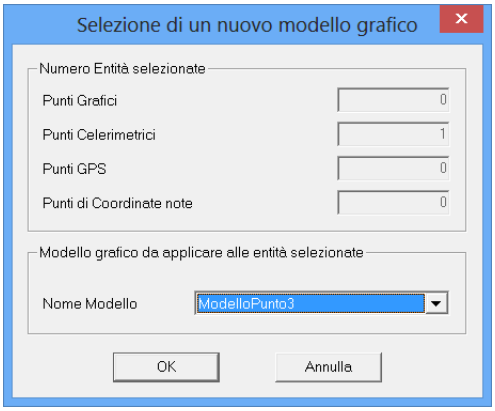



**Figure 282:**

The result will take effect graphically as well as in the views that include the selected points.

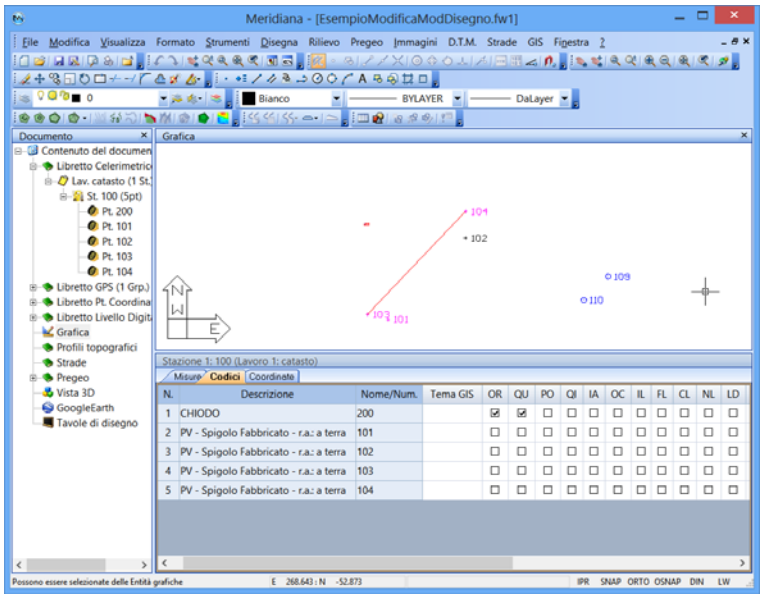



**Figure 283:**

# 9.Changing Codes

This function is used to changes the codes of one or more **Celerimetric**, **GPS**, and **Noted Coordinate** points.

Once the procedure has been launched using the left mouse button, select the points whose codes are to be changed in the **Graphic View**.

Once the operation is complete, press the right mouse button and the program will open the **Select Codes** window.

The window is divided into two sections: the first shows a summary of how many points have been selected based on their type; the second is used to select or deselect the codes.


**Figure 284:**

# 10.Refresh Text Position

This procedure is used to refresh the original positions of the texts, their rotational angle and their graphic model if they had been changed using the **Move Text**, **Rotate Text**, and **Change Design Model** functionalities.

Once activated, a video window will appear used to select the characteristics to be refreshed: movement, rotation and/or graphic model.

It is also possible to decide whether to proceed with a graphic selection of the entities to refresh or to refresh all entities that belong to a certain category: **Celerimetric Points**, **Stations,** ...

In the first case, once this window is closed, the user must proceed with selecting the points; in the second case, the program will proceed directly with refreshing what has been selected and for the categories selected.

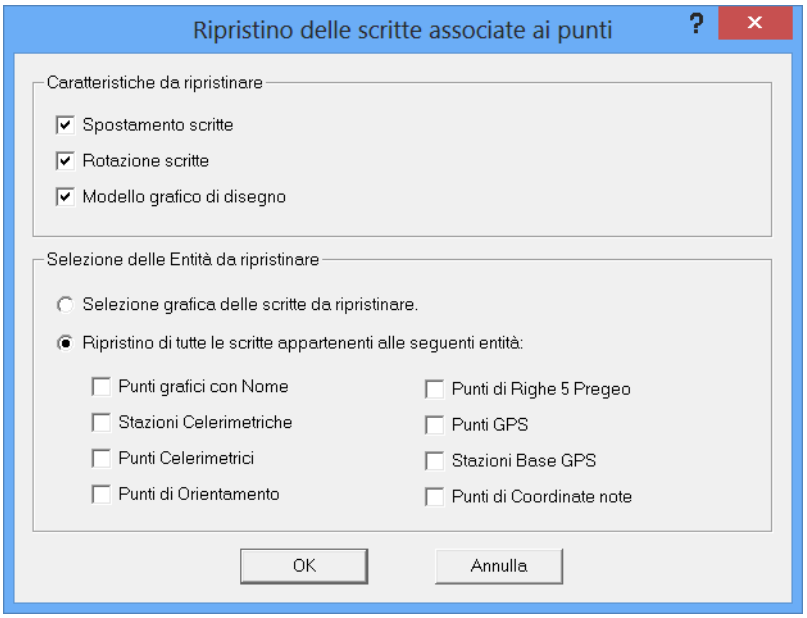



**Figure 285:**

# Searching Booklet Entities

The Graphic View offers the following types of searches:

- Find point in booklet: This procedure is used to highlight, after graphically selecting it, a Point within the corresponding view (**Celerimetric Booklet**, **GPS Booklet**, C**oordinate Pt. Booklet**).
- Find point in graphic: activating this function will display the **Search - Meridian** window.

Use the first part of this window to identify what to search: the search can be done by name, code or both; use the second part of the window then to specify where to run the search; note that the selection is not exclusive.

Once the window is confirmed, the program will search for that point based on the specified characteristics: if the booklet data has been elaborated correctly, once the point is found the program will run a Pan operation, that is, it will bring the identified point exactly to the center of the screen keeping the zoom though, unchanged.

- Find Next in graphic: this command is used to repeat without reinserting the search data under the command **Find point in graphic**.
- Search point by image: this procedure is used to search a point using the image associated with it.

Once this procedure is activated, a video window appears displaying the images associated with the points; using the **Previous** and **Next** buttons to scroll through the various images and proceed with the selection.

The selection is confirmed by pressing the **OK** button and, in this case, the program runs a pan so as to position the point that the image was associated with at the center of the screen.

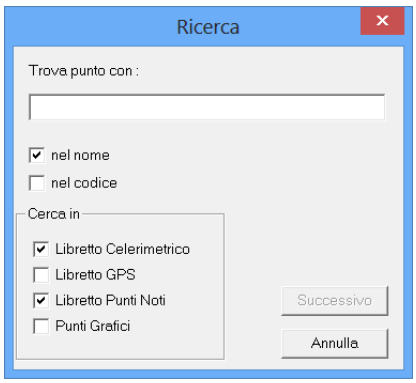



**Figure 286:**

# Entity Format - Appearance with Name

The **Format|Entity appearance with Name** command was included specifically to have the user select how to design the various entities to which a name, a description and a quote are associated.

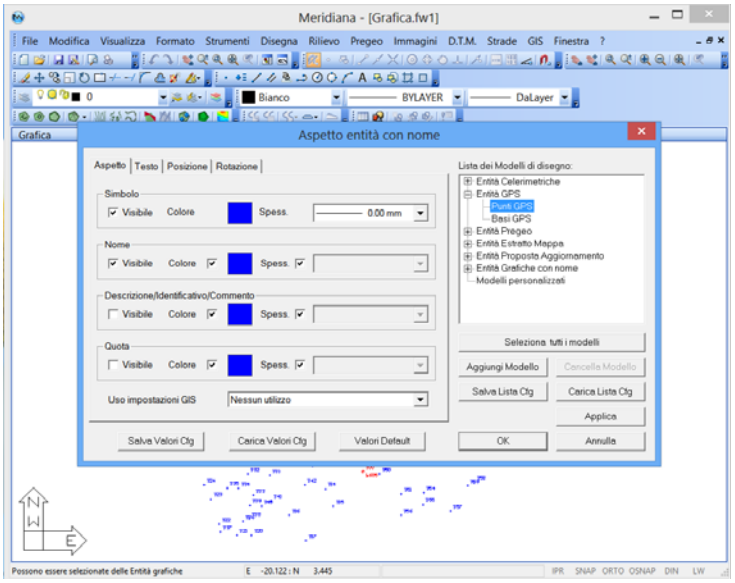



**Figure 287:**

Using the command, the **Entity Appearance with Name** window is opened and divided as follows: on the right is displayed the **List of Design Models**, on the left is a series of pages that allow the user to tell the program how the various entities are to be represented.

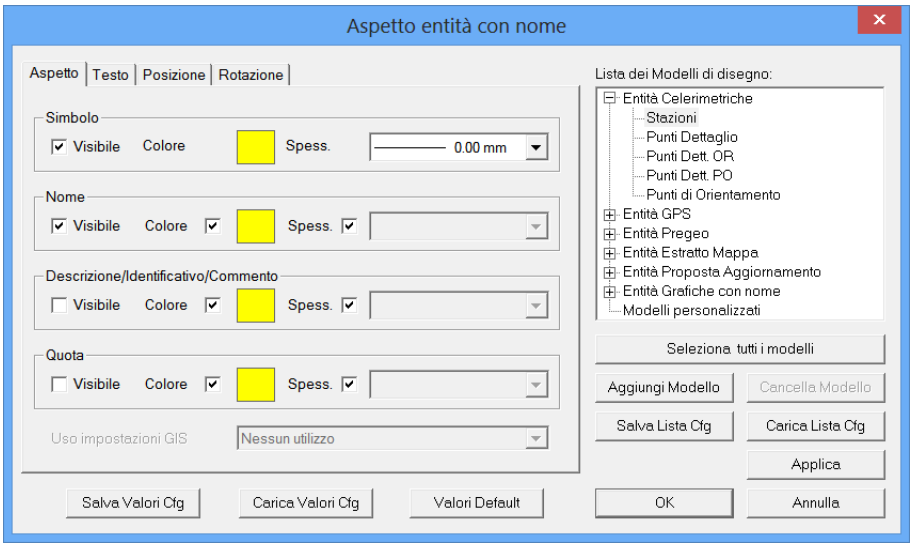



**Figure 288:**

The navigation tree is composed of knots that represent the various entities.

The entities that can be included in the list (the number and type depend on the license held by the program) are:

- Celerimetric,
- GPS,
- Noted Coordinates Point
- Pregeo Entities,
- Map Extracted Entities,
- Update Suggested Entities,
- Graphics with Name,
- Customized Models.

A standard design model is associated to each category of points by which it is possible to specify the modality to be used for graphically representing the points that belong to the same category. Under the Customized Models item, those design models created by the user will be added using the commands available in this window.

Here following is a brief description of the window commands and a brief guide on how to create Customized Models.

Window command **Entity Appearance with Name**

- **Save CFG Values** is used to save a configuration of values associated with a specific Model in the configuration file;

- **Load CFG Values** assigns values previously saved for a Model with the same name to this Model.
- **Default Values** assigns standard values to the various fields for the selected Model;
- **Apply** allows the application and observation of the changes made to the design without exiting the window;
- **OK** and **Cancel** buttons close the window respectively maintaining or discarding any changes made.

The window also allows selecting of multiple entities simultaneously using the Ctrl button and the left mouse buttons so as to set a characteristic shared by the selected entities. When more than one line is selected, only those values that are identical among the models of the selected entities are displayed.

The **Select All Models** button then allows selection of the models of all entities.

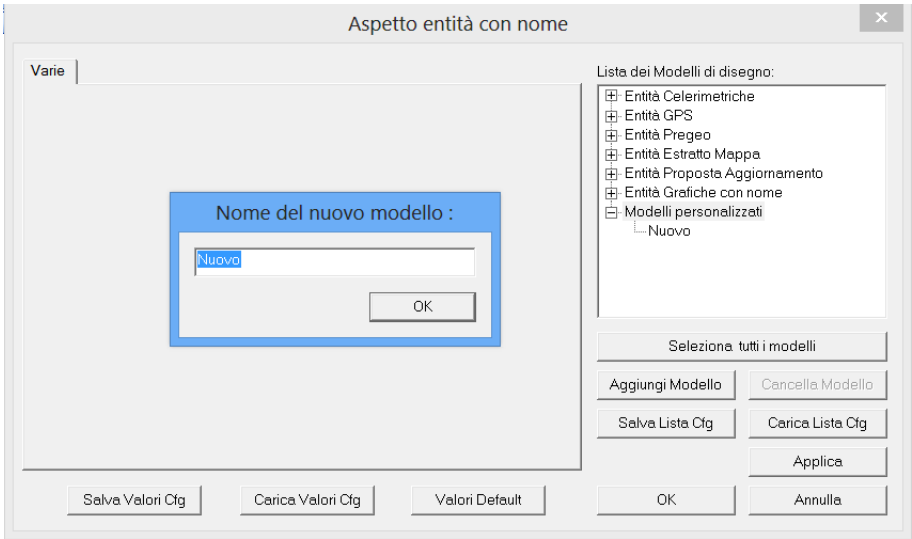



**Figure 289:**

# Creating a Customized Model

Customized models are used to associate with one or more entities characteristics that are different from those suggested by the standard model. More specifically, while the standard model acts on all categories of points, the customized model will act only on entities to which it has been assigned.

The assignment of the model can be done:

a)Using the Celerimetric, GPS and Coordinate Pt. Booklet

b)Through the Survey|Change Booklet Entity|Change Design Model in the **Graphic View**.

To ad a design model then as a subnode under the category of **Customized Models** just press the **Add Model** button.

The **Cancel Model** button is activated only when a Model is selected that belongs to the **Customized Models** category - the other types of models cannot be canceled.

The **Save CFG List** button is used to save the list of Models, shown in video, in the configuration file.

Use the **Load CFG List** to recall the list of previously saved Models within an already created file.

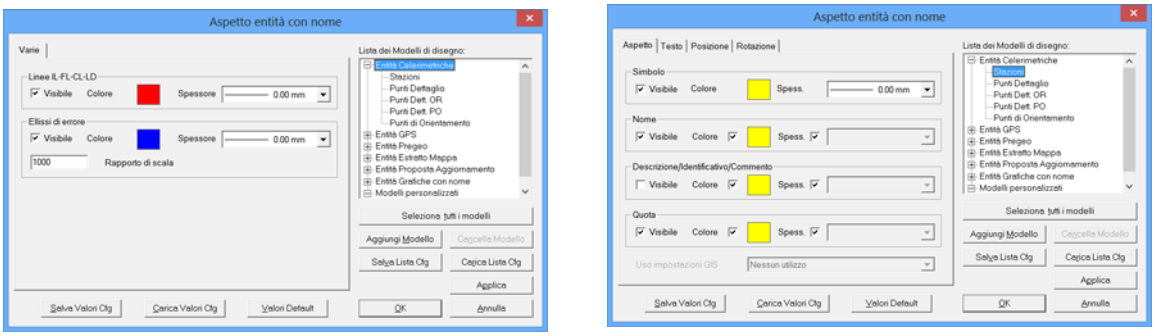



**Figure 290:**

# Description of Tabs

Selecting a primary node (**Celerimetric Entities**, **GPS Entities**, ...) will display one unique tab called **Various**, while selecting a subnode or design model will display 4 tabs (**Appearance**, **Text**, **Position**, and **Rotation**).

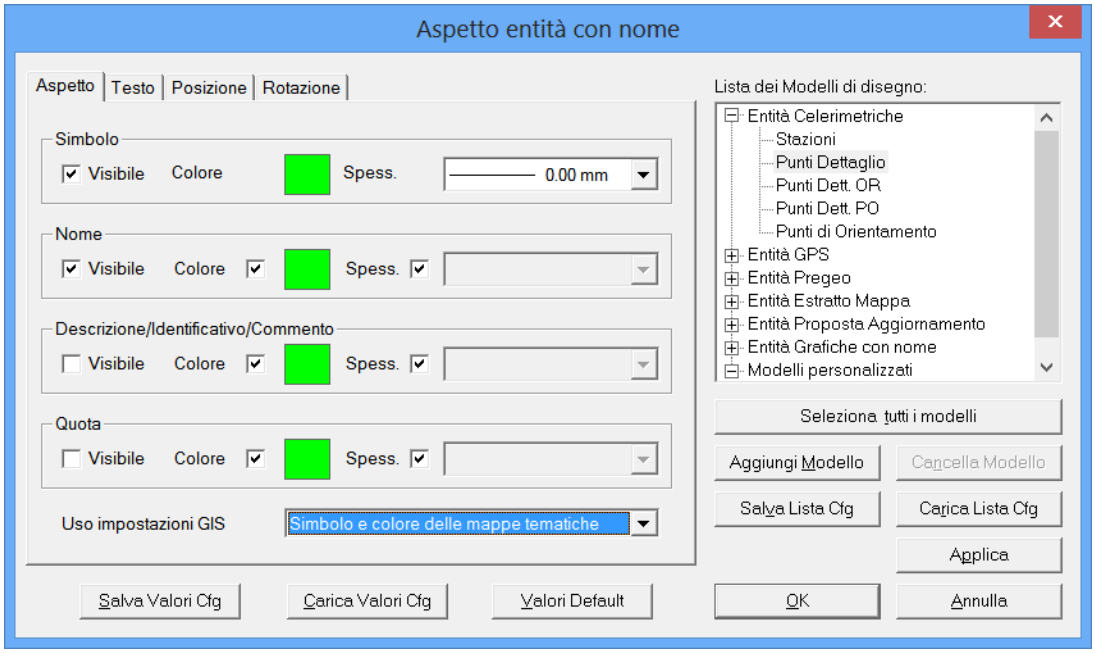



**Figure 291:**

The **Appearance** tab is used first of all to select the information to be displayed; by removing the check mark from the box associated with the Model symbol, no other information will be displayed either.

This tab is also used to select the color of the symbol and the other information associated with the model.

If the check mark is placed in the box to the right of the text **Color** the same color as the symbol will be set for the various texts (**name**, ....); otherwise a different color for each of them can be assigned.

If as a color **DAPIANO** or **DABLOCCO** is selected, then the buttons indicating the color for the design will appear as white crossed by vertical and diagonal lines. In this case, the selections of **DAPIANO** and **DABLOCCO** are the same and cause the **Points** to be the same color as the plane to which they belong, while the selection of a particular color will result in them being designed by this color regardless of the plane's color.

If the point has been associated with GIS data then the user can decide using the **Use GIS Settings** option:

– To not use the thematic map associated with the point (in this case it is displayed as a point to which no GIS information has been associated);

– To use only the color selected in the thematic map in its representation;

– To use only the symbol selected in the thematic map in its representation;

– To use the color as well as the symbol selected in the thematic map in its representation.

Using the tab (Text) the symbol's dimensions can be indicated.

Also, the user can specify if the symbol and texts are to be designed in meters (and therefore in measurements that are proportional to the rest of the design) or in pixels (that is, in dimensions that are constant to any scale factor).

If the check boxes near the Dim. Item have been selected then the various texts will retain the same dimension as the symbol; otherwise (similar to the **Color** property in the **Appearance** tab) different dimensions can be assigned.

In the frame associated with the name there is also a drop down box to be used to identify a style for the text from those stored in the document. In this case as well, use the specific check boxes and drop down boxes to determine if the other texts (code/identification/comment and quote) will have the same style as the name.

Finally, for the quote, insert the number of decimal figures desired.

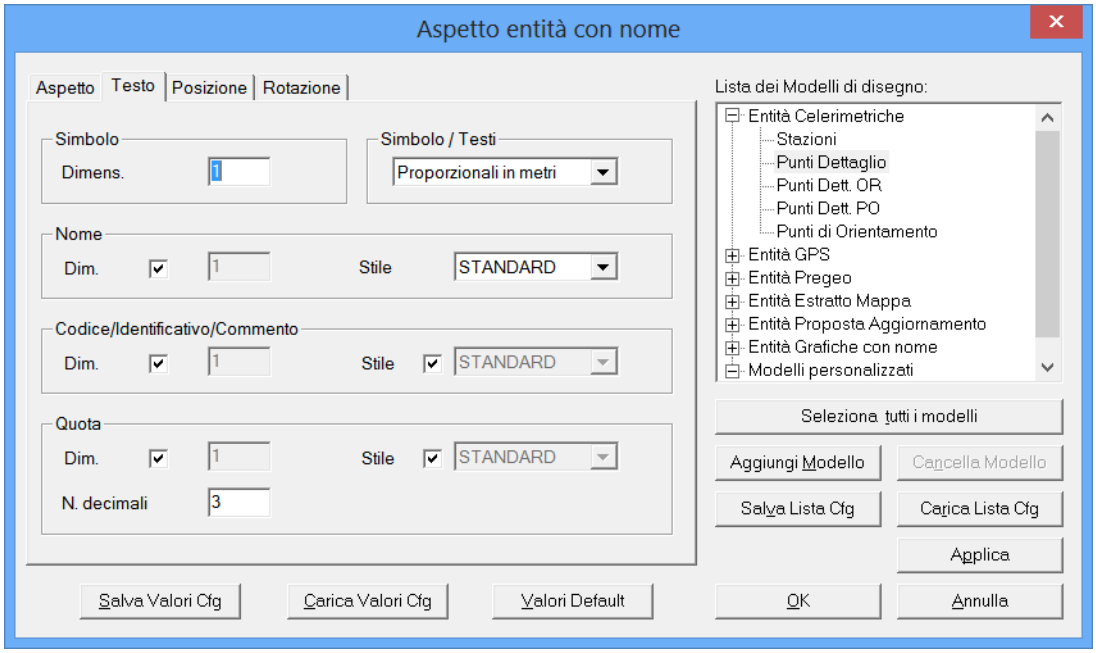



**Figure 292:**

The **Position** tab is used to select the symbol with which the Point's position will be identified.

The same tab is used to select the associated position of the various texts compared to the symbol; the values to input are the coefficients that the program will multiply by the dimensions of the associated text to calculate the position of the text.

This tab is also used to specify the UCS compared to which the symbols and texts are designed; the UCS World is always available, while other texts will appear only if other UCSs have been created in the file.

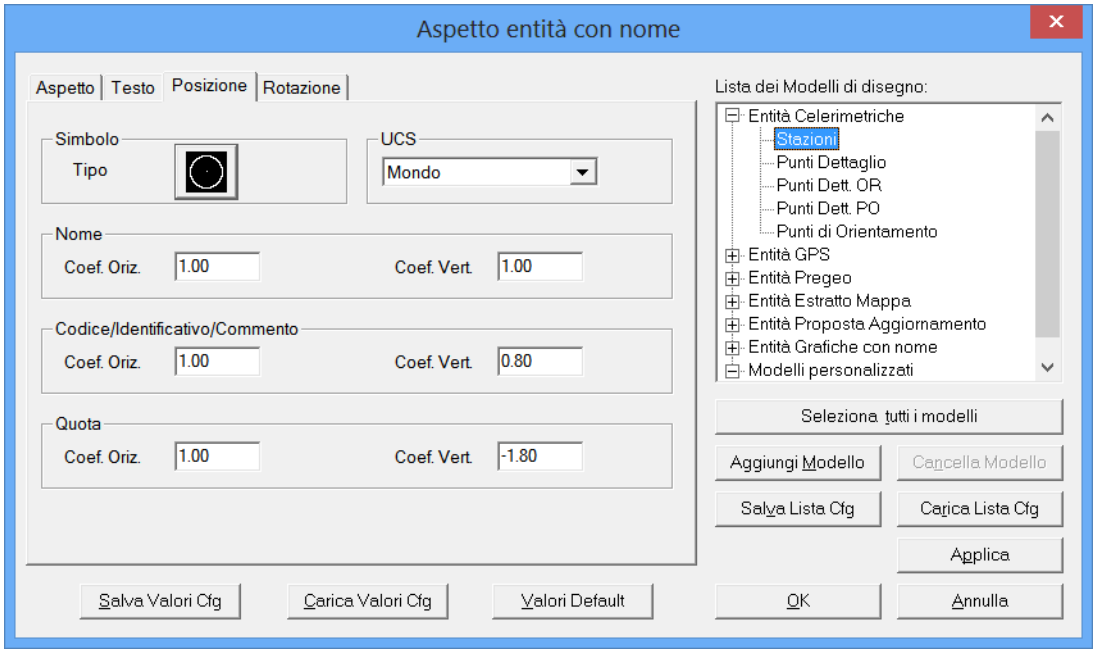



**Figure 293:**

The **Rotation** tab is used first of all to specify a rotational angle for the entire symbol and all of the texts.

Using the mechanism of the check boxes seen earlier, the user can input a different rotational value for the symbol and for the texts: for example, the symbol can remain horizontal while rotating just the texts. The rotational angle is expressed in the units of measure selected with the specific option.

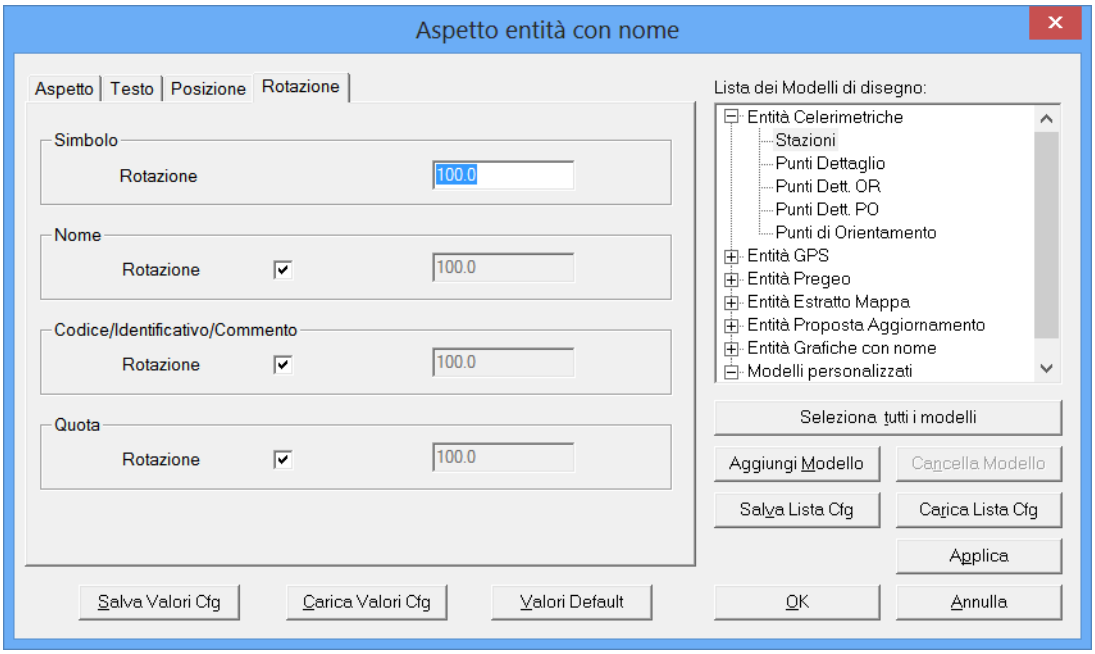



**Figure 294:**

The **Various** tab is displayed differently depending on the node selected:

**Celerimetric Entities Node** is used to select whether to display the lines produced using the IL-FL-CL codes input into the specific fields. Each line can be associated with a color and thickness.

The same selections apply to the error ellipses for the various Stations using this module.

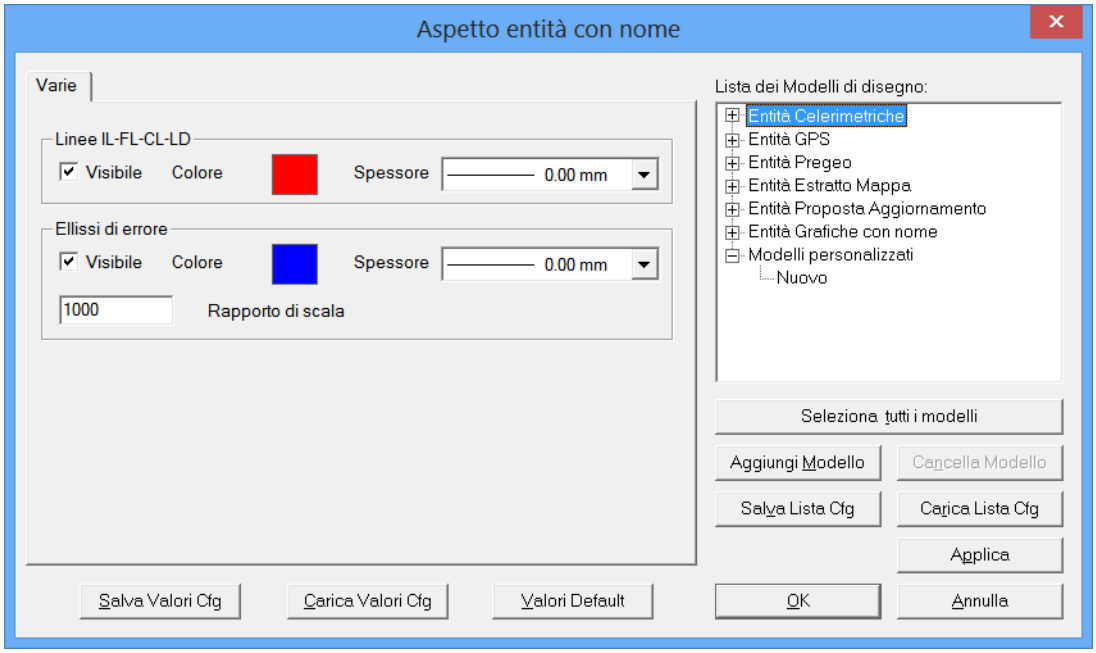



**Figure 295:**

**GPS Entities Node** offers only those options associated with the use of IL-FL-CL codes similar to the way the celerimetric entities can be associated with a color and thickness.

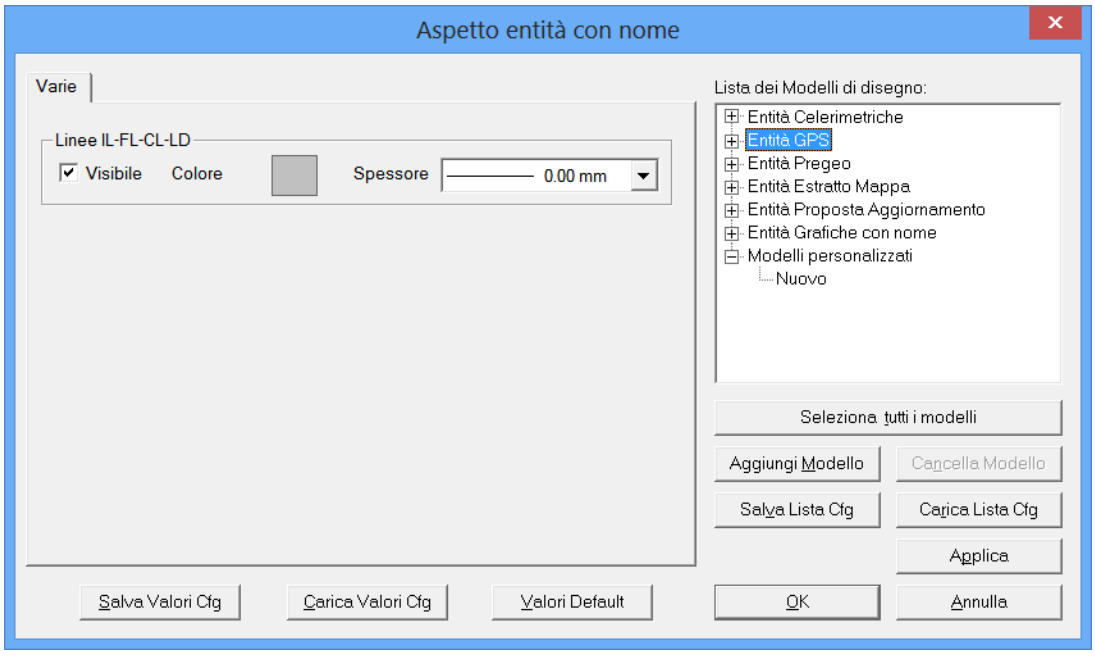



**Figure 296:**

**PT Coordinates Entities Node** offers only those options associated with the use of IL-FL-CL codes similar to the way the celerimetric entities can be associated with a color and thickness.

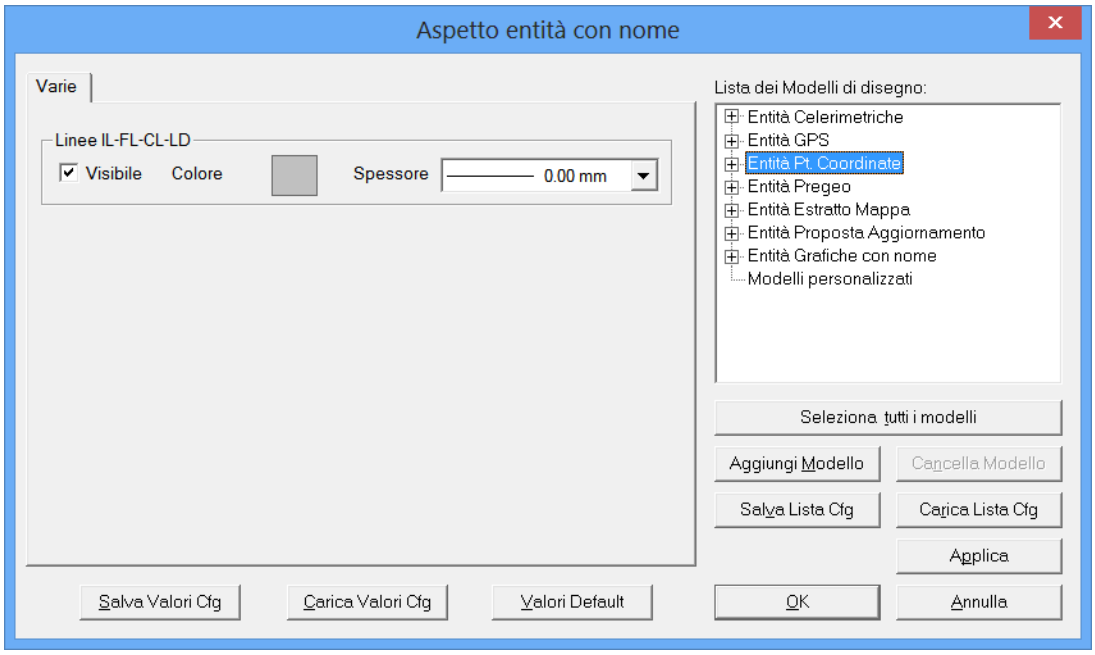



**Figure 297:**

**Pregeo Entities Node** offers the option to select to display or not type 7 and type 3 lines; for type 3 lines a color can also be associated.

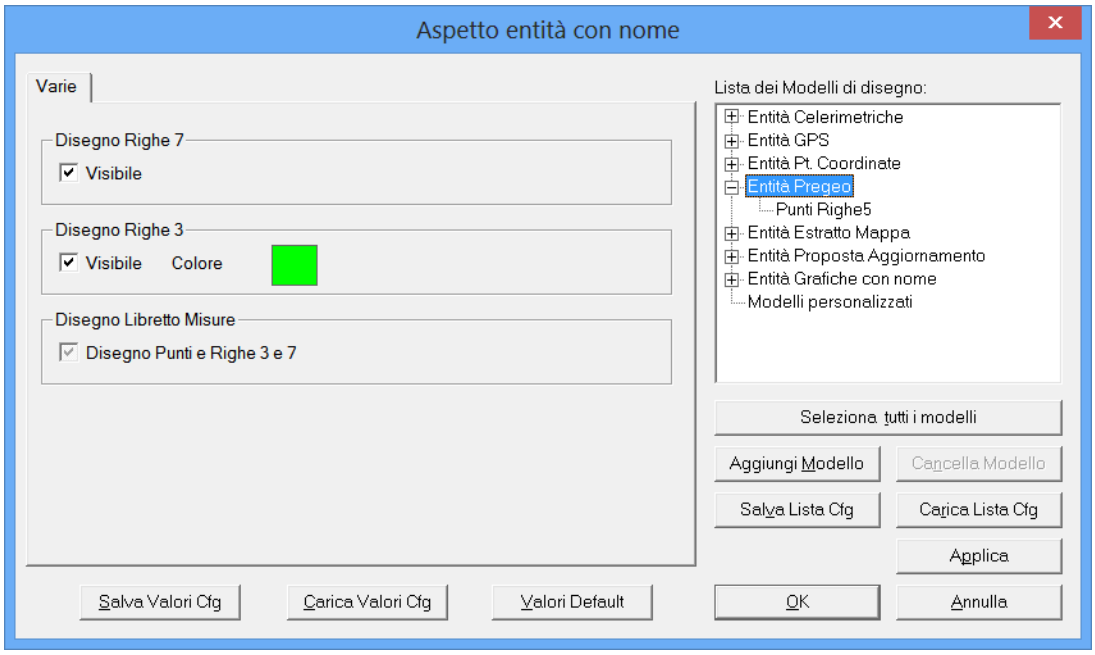



**Figure 298:**

**Map Extraction Entities Node** and **Suggested Update Entities Node** are selected when the user want to be able to select:

– the color and thickness of the particle outlines;

– whether to display or not the entire extract/suggestion.

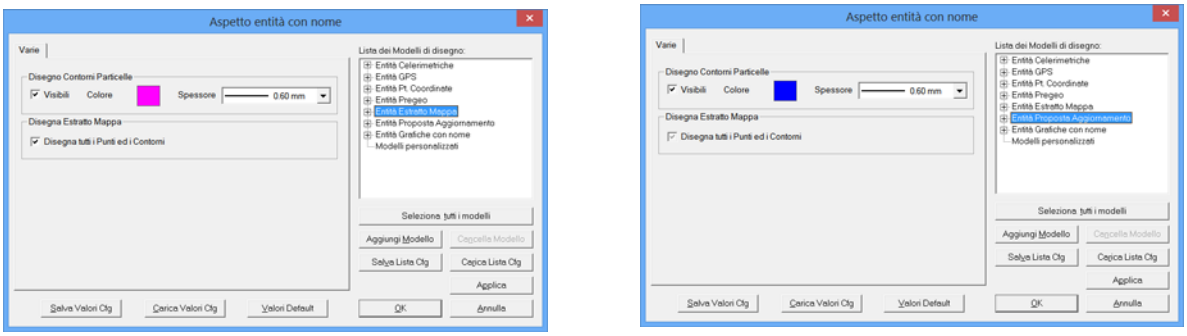



**Figure 299:**

The Various tab does not include any options if the **Graphic Entities with Name** or **Customized Model** nodes have been selected.

# Calculate Area, Polar Coordinates, Show Coordinates and Show Distances Commands

To access these functions just open the **Instruments** menu from the Graphic View; here following are their descriptions.

## 1.Show Distances

This procedure is used to understand the distance between two selected points.

The method for proceeding is similar to that for tracking a line only that after selecting the second point a video window is displayed showing the value of the distance between the two selected points.

After closing the window, the last point selected previously is considered as the beginning point for calculating another distance; to terminate, press the right mouse button.

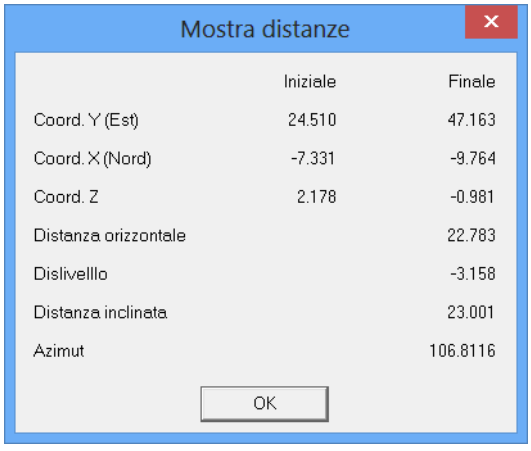



**Figure 300:**

# 2.Calculate Polar Coordinates

This procedure is used to calculate and print the polar coordinates of a series of points selected as compared to another point.

First step is to select the point from which to calculate the polar coordinates and then select the points for which the polar coordinates are to be identified.

The program will video track the conjunction line of the first selected point with the subsequent ones.

To terminate the selection press the right mouse button.

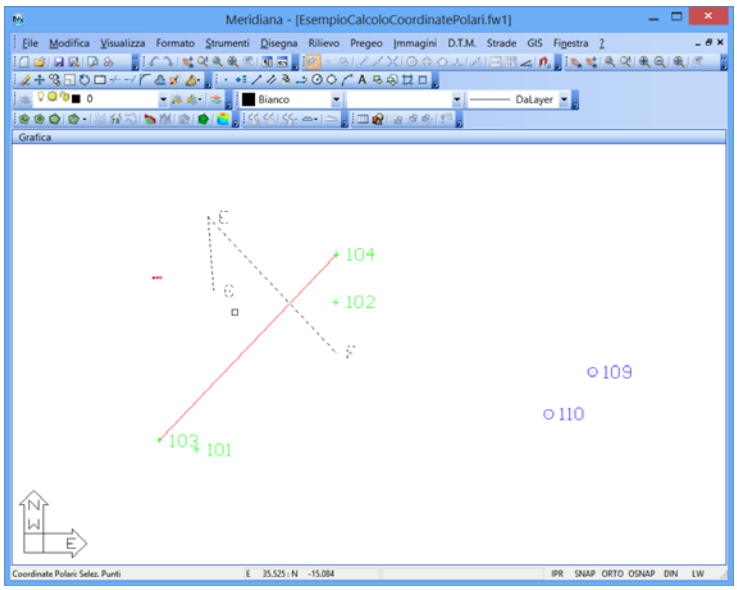



**Figure 301:**

At this point a window will open displaying the value of the additional angle which will be different than zero if the center selected is a station and in this case it corresponds to the opposite of the azimuth correction of the station itself.

The value associated with the additional angle can be change and is used to be added to the point's azimuth to obtain the campaign angle.

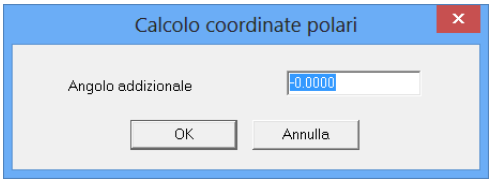



**Figure 302:**

Press **OK** and the program will display the results in a print preview.

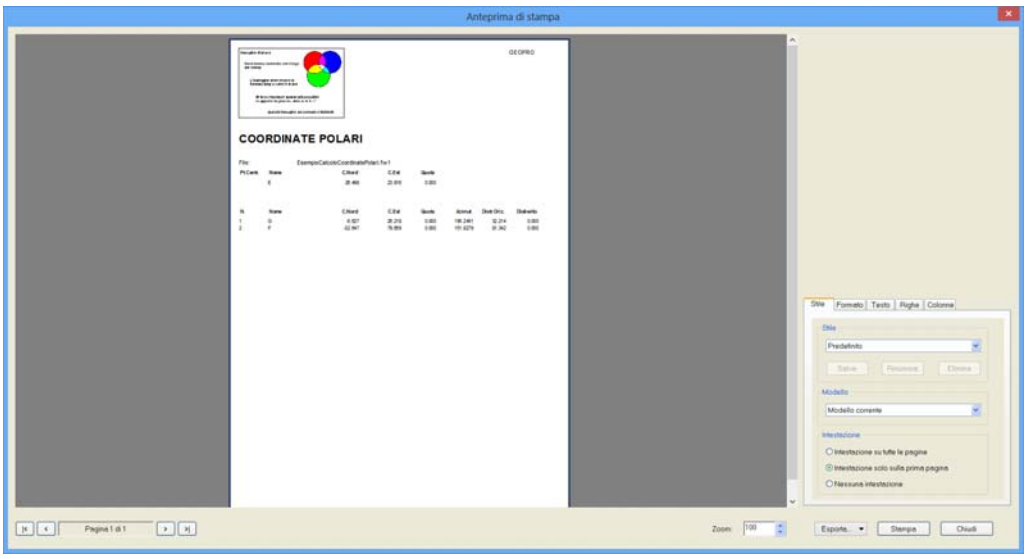



**Figure 303:**

# 3.Calculate Areas

This procedure is used to calculate the area of a surface, creating the outline of the border using the graphic selection of the vertex points.

First step is to outline the surface whose area is to be calculated; if a closed polyline has already been selected when this procedure is to be executed, it will be considered as the perimeter of the surface.

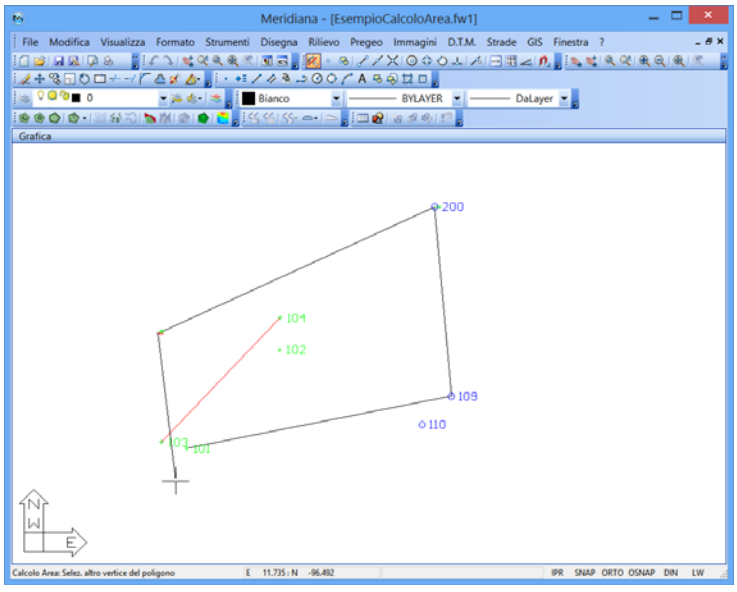



**Figure 304:**

This first phase terminates either by selecting the beginning point of the polygonal or by pressing the right mouse button or the **Instruments|Close Polylines** button; if the right mouse button is pressed without having selected any points, the program will continue on to selection mode to select a closed polygon that it will consider as the perimeter of the surface.

Once the selection is completed, the results will be displayed using the **Print Area** window which displays not only the results but also allows them to be printed.

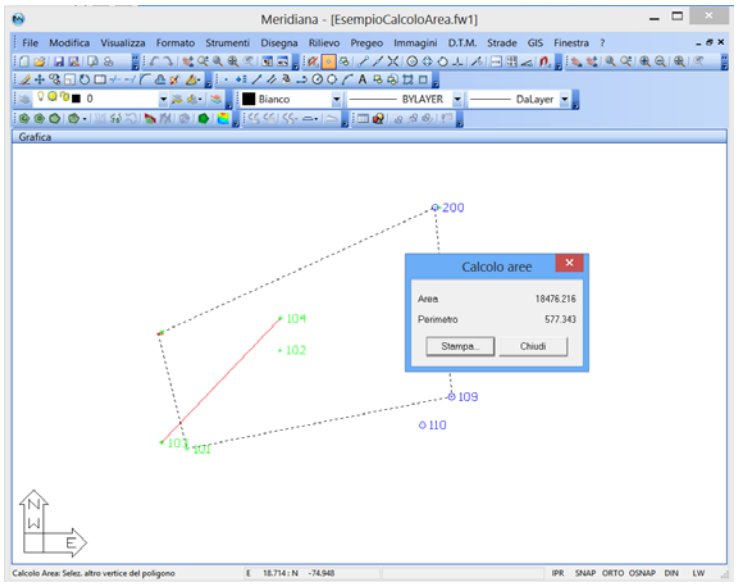



**Figure 305:**

# 4.Show Coordinates

This procedure is used to understand the coordinates, radius values or dimensions of a designed entity (Celerimetric, GPS, Noted Coordinates and Graphic).

Once it is activated on the graphic view a graphic selection symbol will appear (a small rectangle) to be positioned on the Entity whose information is to be displayed.

To confirm the selection, press the left mouse button: at this point a specific window will appear displaying all of the information available for the selected Entity.

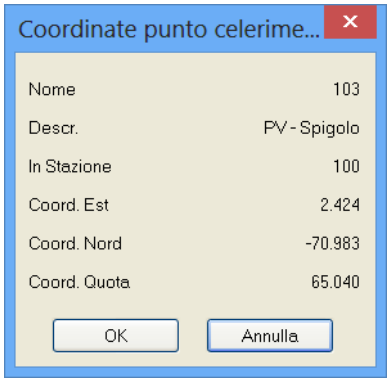



**Figure 306:**

If a polyline has been selected, the values of the individual vertices can be displayed by pressing the Next Vrt. button.

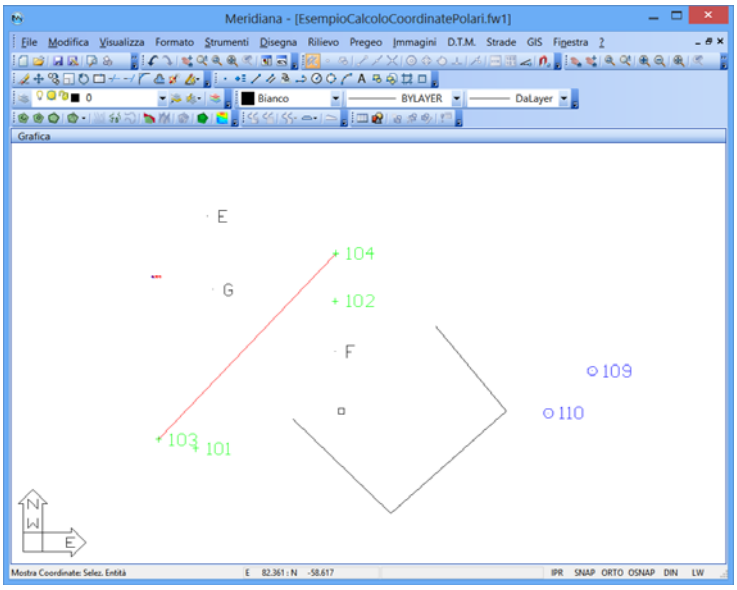



**Figure 307:**

Press the **OK** button and the window will close. The program will allow selection of another Entity; to terminate the selection, press the right mouse button.

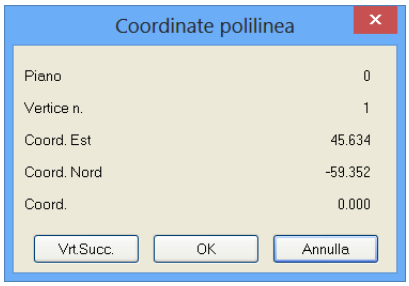



**Figure 308:**

# File Menu|Export

This menu offers the following commands:

**Design on BMP file:** A file is created that contains a BMP format image of all Entities designed as video. To select the name of the file a standard Windows window will open. Once the file name is inserted, another window will open used to select the horizontal dimensions of the image. The vertical dimensions will be calculated in relation to the dimensions of the display window. The dimensions that the file will occupy once created are also displayed.

**Coordinate Files:** This procedure is used to create a file by selecting the order of the coordinates, the names and the codes. The file will count the results in Ascii, Doc, and Html format.

Once this procedure is activated, the user must select the graphic entities whose coordinates are to be printed; the entities that can be selected are those that have an associated name.

At the end of the selection a video window will appear in which to select the variables to be inserted into the file to create and their order.

Also, this window is used to:

- insert the number of decimals;
- insert the separator between one datum and another;
- specify whether to place the names between double apexes.

Press the **OK** button and the program will display the preview of the file to be created.

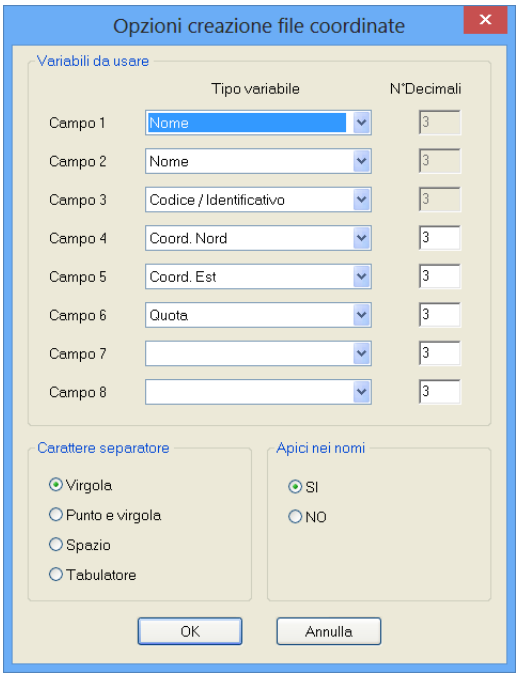



**Figure 309:**

**AutoCAD (.DXF/.DWG):** use this option to create a file that can be read and used by the AUTOCAD program.

To select the name of the file, a standard Windows window will open to select the files.

After identifying the name of the file to create, a window will open for the user to:

Select whether to explode or not the entities with the name; if this option is not selected the entities can be exported as Blocks, otherwise the blocks will be exploded and the entities will be formatted as texts, lines, and points.

Select whether to insert headings or not; if the option is selected, the program will export all of the characteristics associated with the entities to be transferred.

Select the number of spatial dimensions to be transferred; that is, specify whether or not to transfer the quote to Autocad.

Using the fourth option, the user can select whether to also transfer entities that are not displayed in the graphic.

The last option involves the possibility of projecting the entity on a specific UCS at the time of export.

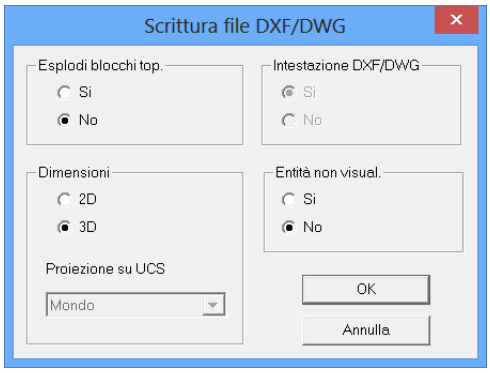



**Figure 310:**

**3d Office-Point file (.PT3):** this procedure is used to create a file by selecting the Celerimetric entities, GPS points and noted coordinate points and the points with the name in a PT3 file format for exchanging data with Pocket3d and 3d Office. Once the command is launched, select the entities to export; when the step is complete the name used to save the file will be requested. The exported points will belong to a plane determined as follows:

- **Points with name:** They will be inserted into a plane with the same name as the insertion plane.

- **Topographic Entities:** If a design model has been specified, they will be inserted into a plane with the same name as the design model; otherwise they will be inserted inot a plane that identifies the type of entity.

  If there is at least one point from among those being exported that includes a non-numeric character, the program will automatically rename all the points, setting the description of the points to their original name.

- **3d office-Linework file (.LN3):** this procedure is used to create a file in LN3 format for exchanging data with Pocket3d and 3d Office. Once the command is launched there will be a request for the name to be used for saving the file. All of the lines, circles, arches, polylines and texts of the current project will be saved.

- **3d Office - TIN file (.TN3):** this procedure is used to create a file in TN3 format for exchanging data with Pocket3d and 3d Office. Once the command is launched, a dialogue window will open used to select which triangulations to export. At least one triangulation must be selected, but more than one can also be selected. If there is only one triangulation in the project, the window is not displayed and it is automatically selected. When this step is terminated, the name of the file to create is requested.

# Commands View: list of commands

## Commands in File Menu

| Command | Action |
|---|---|
| _impDxfDwg | To import DXF/DWG files |
| _impPnt | To import Coordinate files |
| _gisImpShape | To import Shape files |
| _ImpMapImage | To import Pregeo images/maps |
| _ImpImagePDF | To import PDF images |
| _ImpCxf | To import CXF files |
| _ImpLn3 | To import - 3d Office - LineWork file (.LN3) |
| _ImpTn3 | To import - 3d Office - TIN file (.TN3) |
| _createDxfDwg | To create DXF/DWG files |
| _createCoordFile | Coordinates on files |
| _createBmp | Design on Bmp file |
| _gisExpShape | To export Shape files |
| _ExpPt3 | To export - 3d Office - Point file (.PT3) |
| _ExpLn3 | To export - 3d Office - LineWork file (.LN3) |
| _ExpTn3 | To export - 3d Office - TIN file (.TN3) |
| _straPrtSezAree | Export - Calculate sections areas |
| _straPrtSezAreeElement | Export - Calculate elementary sections areas |
| _straPrtSezVol | Export - Calculate sections volumes |
| _preview | Print preview |
| _PageSetup | Set page |
| _print | Print |

# Commands in Modify Menu

| Command | Action |
|---|---|
| _undo | To erase last operation executed |
| _redo | To repeat last operation erased |
| erase /_erase | To erase an entity |
| move / _move | To move an entity |
| copy / _copy | To copy an entity |
| reflect | To reflect an entity |
| scale / _scale | To change the scale of an entity |
| rotate / _rotate | To rotate an entity |
| _adapt2d | To adapt graphic entities |
| offset /_offset | Object offsets |
| MATCHPROP / _matchprop | Correspondence with property |
| _property | To change the properties of the graphic entities |
| eattedit / _eattedit | To edit an attribute |
| eattmove / _ eattmove | To move an attribute |
| _altAtt | To change the height of the attributes |
| extend / _extend | To extend an entity |
| trim / _trim | To eliminate objects adjacent to others |
| tip | To change the length of two line segments so that their ends are the same. |
| fillet / _fillet | To fillet lines |
| break / _break | To break objects |
| explode / _explode | To explode blocks |
| _purge | To eliminate objects |
| _editpline | To change a polyline |

# Commands in View Menu

| Command | Action |
|---|---|
| _redraw | Redraw |
| _regen | Regenerate |
| _zoompr | View previous zoom |
| _zoomrt | View real time zoom |
| _zoom | View window zoom |
| _zoomin | Enlarge current design window |
| _zoomout | Decrease current design window |
| _zoomex | View max extension zoom |
| _panrt | View real time pan |
| _pan | To move the design window to display |
| _panleft | To move the window to the left |
| _panright | To move the window to the right |
| _panup | To move the window up |
| _pandown | To move the window down |
| _3dplancurucs | Set the level view from the current UCS |
| _3dtop | Set the level view from above |
| _3dbott | Set the level view from below |
| _3dleft | Set the level view from the left |
| _3dright | Set the level view from the right |
| _3dfront | Set the level view from the front |
| _3dback | Set the level view from the back |
| _3dswiso | Set the isometric level view from SW |
| _3dneiso | Set the isometric level view from NE |
| _3dnwiso | Set the isometric level view from NW |
| _3dseiso | Set the isometric level view from SE |
| 3dorbit / _3dorbit | View 3D orbit |
| _shade2dwf | To display only the external parts of the images |
| _shadeflat | To display also the surfaces of the images |
| _ucsIcon | To display or not the UCS icon |
| _ucsIconOr | To position or not the icon in its original location |
| _lights | Select lights |
| _viewAreaCal | Only plate calibration area |
| _viewMaxAreaCal | Max plate calibration area |
| _viewProf | To display the profile |
| _barCustom | Commands to customize the button bar |

# Commands in Format Menu

| Command | Action |
|---|---|
| layer/_layer/ | Select layer |
| _laymcur | Update entity plane |
| _layiso | Isolate entity plane |
| _layuniso | Cancel plane isolation |
| _layoff | Turn off entity plane |
| _allLayon | Turn on all planes |
| _layfreeze | Freeze entity plane |
| _allLayThaw | Unfreeze all planes |
| _laylock | Block entity plane |
| _layunlock | Unblock entity plane |
| color / _color | Select color |
| _linetype | Select line type |
| _lweight | Select line thickness |
| style / _style | Select text style |
| _curdimstyle | Select dimension style (quote) |
| elevation /_elevation | Select quote |
| _angleType | To change the unit of measure of angles |
| REFLECTTEXTS | Used to tell program whether to reflect or not texts |
| _disEntNome | Appearance of entities with name |
| _disCurLev | Level curves appearance |
| _disPrflName | Profiles/Roads/Sections name appearance |
| _disPrflStili | Profile Style |
| options / _options | General options selection |

# Commands in Instruments Menu

| Command | Action |
|---|---|
| _viewDist | To display distances |
| _calcPolar | To calculate polar coordinates |
| area/_area | To calculate the area |
| _viewCoord | To display coordinates |
| _printEnts | Print graphic entities |
| _createEntsFile | Graphic entities on File |
| _design | Free design |
| _connPt | Connect to point |
| _ptMed | Middle point |
| _ptFin | End point |
| _perp | Perpendicular |
| _inters | Intersection |
| _center | Center |
| _quadr | Quadrant |
| _tang | Tangent |
| _ins | Insertion |
| _near | Near point |
| _coord | Input Coordinates |
| _libc | Free Data Celerimetric |
| _impStr | Instruments setting |
| _attOrt | Activate Move Orthog. |
| _gridsnap | Select snap and grid |
| _+ucsman | To select UCS or change any information about it |
| _ucsOrthoT | UCS Above |
| _ucsOrthoB | UCS Below |
| _ucsOrthoL | UCS Left |
| _ucsOrthoR | UCS Right |
| _ucsOrthoF | UCS Front |
| _ucsOrthoBa | UCS Back |
| _ucsNewView | To create a new UCS defining a new display |
| _ucsorigin | To create a new UCS defining a new origin |
| _ucsz | To create a new UCS specifying a direction on the z axis |
| _ucs3 | To create a new UCS specifying 3 points in the space |
| _ucsxrot | To create a new UCS rotating the x axis |
| _ucsyrot | To create a new UCS rotating the y axis |
| _ucszrot | To create a new UCS rotating the z axis |
| _ucsy | To create a new UCS identifying only two points in the space |
| _viewTables | To display the created tables in graphic |

| Command | Action |
|---|---|
| _creaTables | To create the design tables from Graphic View |
| _closePoly | Close polyline |
| _digitchoose | Select plate |
| _calTabGri | Calibrate plate for grid |
| _calTabPt | Calibrate plate for spread points |
| _suspCalTabGri | Suspend calibration |
| _resCalTabGri | Reactivate calibration |

# Commands in Design Menu

| Command | Action |
|---|---|
| point / _point | To create points |
| _ptName | To create points with name |
| _ptSquad | To create squared points |
| _ptAngDist | To design points identifying the angle and distance |
| _ptSuLIn | To create points on lines/arches/circles/polylines |
| line / _line | To create lines |
| parallel / _paralline | To create parallel lines |
| _ptLinFraz | Creating lines by fraction of areas |
| arc / _arc | To create arches |
| circle / _circle | To create circles |
| _circletan | To create circles that are tangent to two segments |
| _paral | To create parallelograms |
| _rect | To create rectangles |
| _psqr | To created squared polygons |
| text / _text | To create texts |
| _pLine | To create 2D polylines |
| _3dpoly | To create 3D polylines |
| block / _block | To define blocks |
| _insert | To insert a block |
| _attdef | To create attributes |
| _hatchpoly | To set a hatch for a polyline |
| _bhatch | To create hatch |
| dmlinear /dimlinear | To create linear dimensions |
| dimaligned / _imaligned | To create aligned dimensions |
| dimangular / _imangular | To create angular dimensions |

# Commands in Survey Menu

| Command | Action |
|---|---|
| _disEntName | Appearance of entities with name |
| _ptCeler | Creating celerimetric points |
| _ptGps | Creating GPS points |
| _ptNoted | Creating noted points |
| _ptInStat | To transform points into stations |
| _ptInCeler | To transform points into celerimetric points |
| _ptInOri | To transform points into orientation points |
| _ptInGps | To transform points into GPS points |
| _ptInNoted | To transform points into Noted points |
| _modPt | Change points |
| _cancPt | Erase points |
| _movePt | Move points |
| _moveSta | Move stations |
| _SpstBaseGps | Move GPS base |
| _muoveAtt | Move texts |
| _rotAtt / eattrot / _eattrot | Rotating texts |
| _modDisMod | Changing design model |
| _modCod | Changing codes |
| _undoPosScri | Refresh text position |
| _findPtLib | Find point in booklet |
| _findPtGraf | Find point in graphic |
| _findPtSuccGraf | Find next in graphic |
| _findPtImm | Search point by image |
| _ifcTrasf | To transform graphic lines |
| _ifcCanTrasf | To cancel transformation |
| _adaptSurvey | To rototranslate Survey |
| _ToStrum | To instrument... |

# Commands in Pregeo Menu

| Command | Action |
|---|---|
| _pgeo3 | To create the 3 lines |
| _pgeo45 | To create the 4-5 lines |
| _pgeo7 | To create the 7 lines |
| _pgeo7PtIs | To create the 7 lines vertices/direction |
| _pgeoAut | To automatically create lines |
| _pgeoElGra | To create elements in graphic |
| _pgeoDel7 | To cancel 7 lines |
| _pgeoDel3 | To cancel 3 lines |
| _pgeoImp45 | To import 4-5 lines in graphic |
| _pgeoImp7 | To import 7 lines in graphic |
| _pgeoAnnImp | To cancel import |
| _pgeoTPt | Verify tolerances for alignment points |
| _pgeoTDist | Verify tolerances between distances |
| _pgeoTSup | Verify tolerances between surfaces |
| _pgeoTRilDist | To verify tolerances for surveyed object relative to distances |
| _pgeoTRilSup | To verify tolerances for surveyed object relative to surfaces |
| _pgeoTTri | To verify if there are stations outside the triangle |
| _pgeoTSta | To verify the distances between stations |
| _pgeo89Par | To design particles for automatic-setup |
| _pgeo89ModPar | To change particles for automatic-setup |
| _pgeo89Prop | To generate update suggestion |
| _pgeoPropCanc | To cancel map extraction and update suggestion |
| _pgeo10AddText | To add a text in update suggestion |
| _moveAtt | To move a text in update suggestion |
| _eattrot | To rotate a text in update suggestion |
| _pgeo10AddSymb | To add a symbol in update suggestion |
| _pgeo10MoveSymb | To move a symbol in update suggestion |
| _pgeo10RotateArrow | To rotate an arrow symbol in update suggestion |
| _pgeo10DelProp | To eliminate texts, dotted/dash lines and symbols in update suggestion |
| _pgeo10MovePtProp | To move points in update suggestion |
| _printUpd | Print update suggestion |
| _pgeo10GetTypeLine9 | Identify type |

# Commands in Image Menu

| Command | Action |
|---|---|
| _ImMgr | Manage images |
| _ImCalLin | To run linear calibration |
| _ImmCalGri | To run grid calibration |
| _ImCalPt | To run spread points calibration |
| _ImmCalFrame | To run frame calibration |
| _ImmCalAuto | To run Pregeo auto-setup calibration |
| _ImmExpArea | Export area |

# Commands in D.T.M. Menu

| Command | Action |
|---|---|
| _disPrjCLiv | Manage level curves project... |
| _disCurLev | Level curves appearance |
| _disPrflName | Profiles/Roads/Sections name appearance |
| _disPrflStili | Profile Style |
| _optPrflOptCalc | Profile calculation options |
| constraints | To create constraints |
| _eraseCon | To erase constraints |
| _bordInt | To create internal borders |
| _bordExt | To create external borders |
| _editBrd | To edit borders |
| _eraseBrd | To erase borders |
| _triang | To create triangles |
| _modTri | To modify triangles |
| _eraseTri | To erase triangles |
| _eraseAllTri | To erase all triangles |
| _curvelev | To create level curves |
| _scrSplineAut | Spline text automatically |
| _modSpline | To modify spline tension |
| _scrSpline | Add/cut spline texts |
| _cancTrSpline | To erase spline sections |
| _rotTexSpline | To rotate spline texts |
| _eraseAllCvLv | Erase all level curves |
| profiles | To create profiles |
| sections | To create sections |
| _calcQuoPrfl | To recalculate profile quotes |
| _editPrfl | To edit profiles |

| Command | Action |
|---|---|
| _erasePrfl | To erase profiles |
| ptiQuotTriang | To design points quoted by triangles |
| painters | To create painters |
| _trasfEntGrf | To transform graphic entities |
| _polyquotfix | To assign a fixed quote to polyline |
| _polyquotplan | To assign a plane quote to polyline |
| _polyquotdtm | To assign a DTM quote to polyline |
| _tripoly | To create triangles within a polyline |
| _creaslope | To create a slope |
| _creaslopdtm | To create DTM slope |
| _excav | Excavation project |
| _jointri | To join models |
| _extpnttri | To extract points from triangles |
| _calcVolAss | Calculate absolute volumes |
| _calcVolDiffS | Calculate volumes by simple difference |
| _calcVolDiffC | Calculate volumes by complex difference |
| _calcVolSzRag | Print calculation of leveled sections volumes |
| _calcVolSzRagF | Create file with leveled sections volumes |
| _map | Generate map |

# Commands in Roads Menu

| Command | Action |
|---|---|
| _road | Create a new road |
| _roadCurr | Set current road |
| _roadProp | Road property |
| _roadRecalc | Recalculate road |
| _roadRect | Layout - New rectilinear |
| _roadCurve | Layout - New curve |
| _roadCurveMod | Layout - Change curve |
| _roadFlex | Layout - New flex clothoid |
| _roadRotat | Insert rotational |
| _roadCancElem | Erase an element |
| _roadTable | Elements table |
| _roadQuote | Altimetric - Recalculate roads quote |
| _roadSectOpt | Sections - Sections options |
| _roadSectPt | Sections - Section manual by point |

| Command | Action |
|---|---|
| _roadSectProg | Sections - Section manual by progressive |
| _roadSectCanc | Sections - Erase sections |
| _roadSectInterv | Sections - Intervals template |
| _roadSectEditor | Sections - Editor templates |
| _roadPend | Slopes and enlargements |
| _addTpsEnts | Tracking layout - Generation |
| _delTpsEnts | Tracking layout - Eliminate tracking layout |
| _insTpsLegenda | Tracking layout - Insert legend |
| _roadPlaniPrj | Project layout |
| _roadVel | Velocity graphic |
| _roadNorm | Guidelines check |
| _roadPos | Road position |
| _roadStake | Road stakeout |
| _roadVolOpt | Set volumes calculation |
| _roadVolSect | Print calculation of leveled sections volumes |
| _roadVolTray | Print volumes calculation tray |
| _roadVolSectFile | Create file with leveled sections volumes |
| _roadVolTrayFile | Create file with volumes tray calculation |
| _roadPrtSectAreas | Calculate sections areas |
| _roadPrtSectAreasElement | Calculate elementary sections areas |
| _roadPrtSectVol | Calculate sections volumes |

# Commands in GIS Menu

| Command | Action |
|---|---|
| _gisTable | Manage tables |
| _gisTheme | Manage themes |
| _gisExpTheme | Export definition themes |
| _gisImpTheme | Import definition themes |
| _gisEntCrea | Create entities |
| _gisEntDel | Erase entities |
| _gisEntEdit | Edit entities |
| _gisExpShape | Export Shape files |
| _gisImpShape | Import Shape files |
| _gisQuery | Query |

# Commands of Points Clouds Menu

| Command | Action |
|---|---|
| _pntCldProps | Property |
| _pnt _RotoTrasl | Georeference |
| _pntCldMorph | Terrain filter |
| _pntCldCnt | Generate external border |
| _pntCldDecimate | Decimation |
| _pntCldDelPnts | Erase points |

## Details

**Graphic Layer**: enter online program guide, Format|Graphic Layers.

# Print Options

The **Print Options** command opens a window divided into five pages.

The first page, **General Options** is composed of two sections.

In the **Header** section the user can tell the program whether or not to print the heading and logo, and to insert the heading to be shown on the page.

In the second section **TS Data** the user is able to tell the program whether or not to print the TR or HC/VC points.

The remaining pages are used to select the information to include in the printouts and the free format output identifying the **Variable Type**.

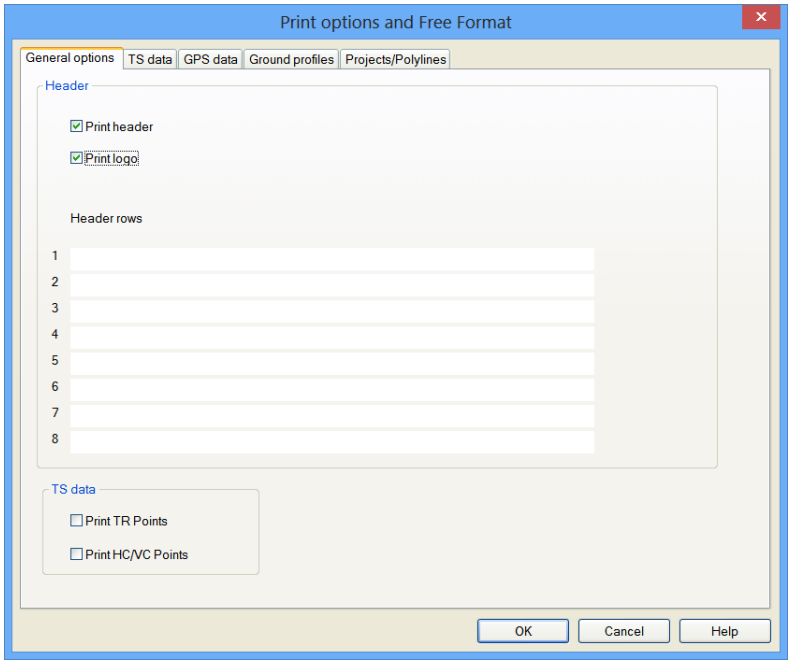



**Figure 311:**

# TS Data

This page is used to set the free format for printing the TS Data (Output|Free Format|Print All Stations and Output|Free Format|Print With Selected Stations) and for creating files (File|Export|Free Format).

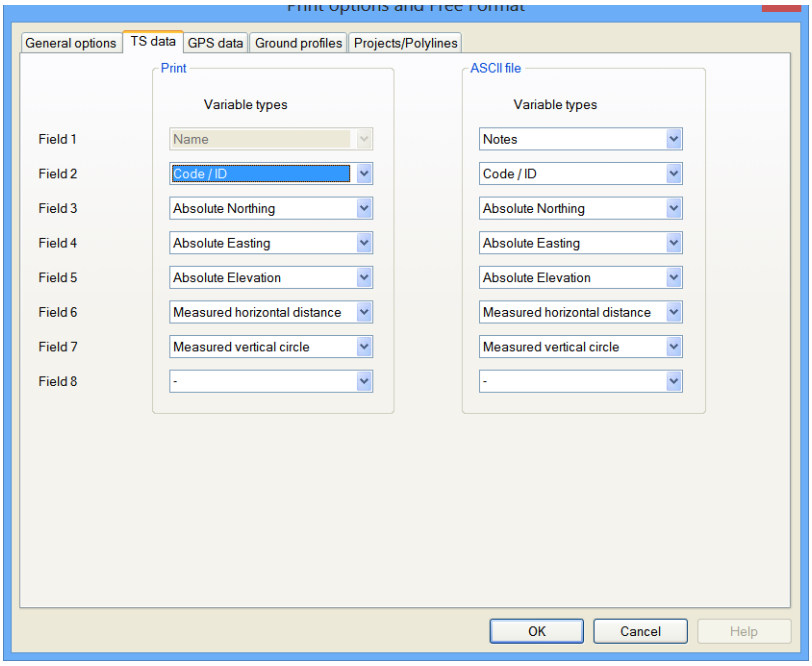



**Figure 312:**

# GPS Data

This page is used to set the free format for printing the GPS data (Output|Free Format|Print All Groups and Output|Free Format|Print With Selected Groups) and for creating files (File|Export|Free Format).

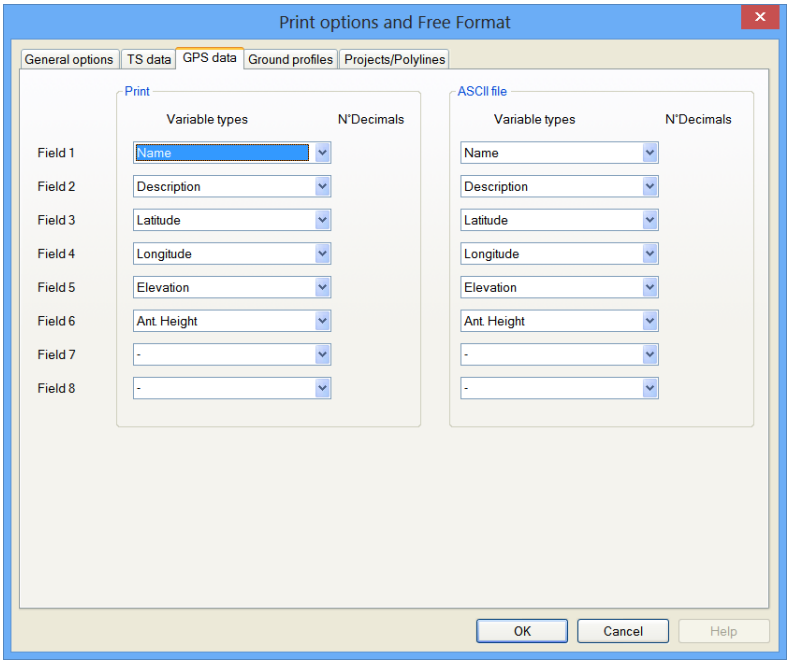



**Figure 313:**

# Ground Profiles

This page is used to set the free format for printing Profiles (Output|Printout Ground Profile|Print Free Format Profile and Print Free Format All Profiles) and for creating ASCII files (File|Export| Printout Ground Profile and Printout of all ground Profiles).

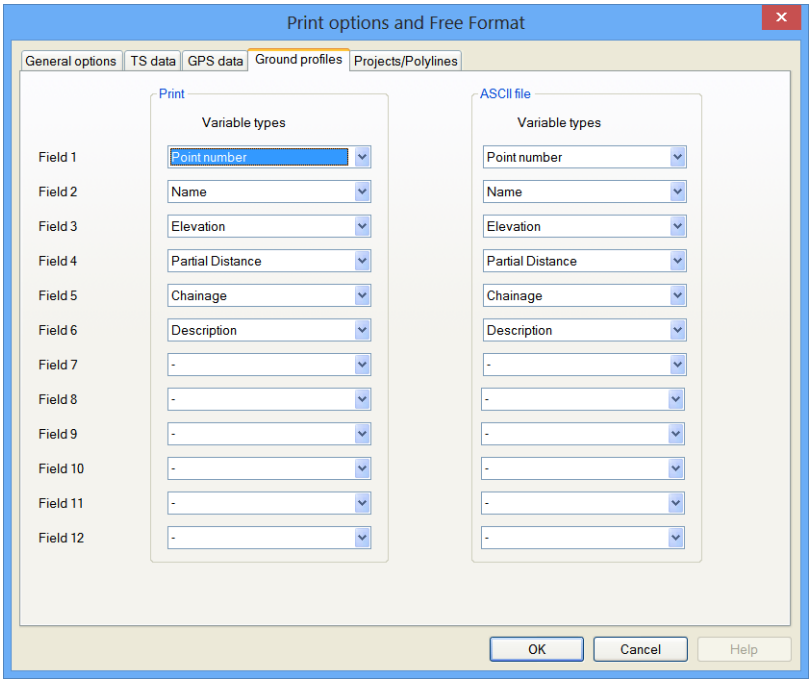



**Figure 314:**

# Projects/Polylines

This page is used to set the free format for printing Projects (Output|Printout of Project/Poyline|Print Free Format Project and Print Free Format All Projects) and for creating ASCII files (File|Export| Printout of Project/Poyline and Printout of all Project/Poyline).

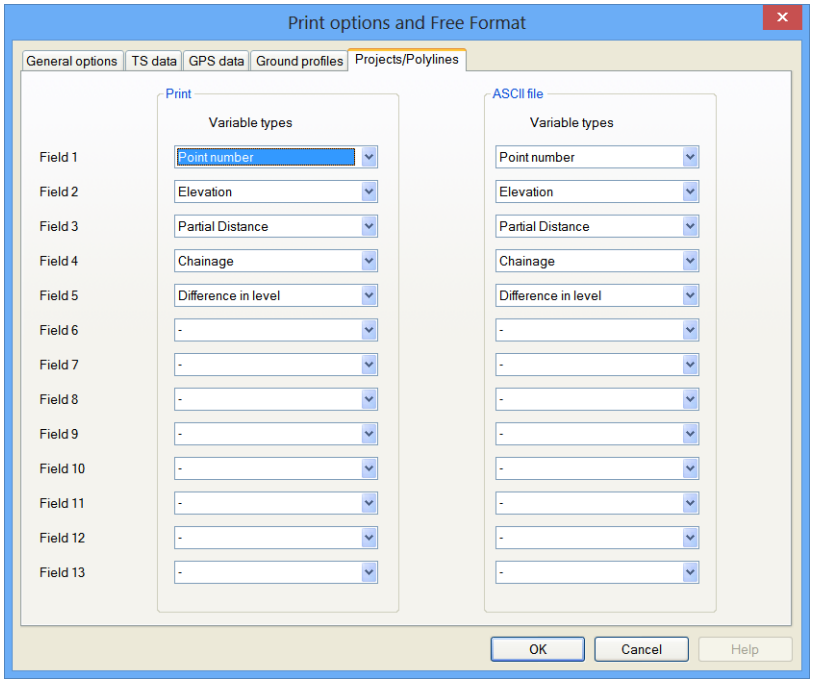



**Figure 315:**

# Print Component

There are five tabs available in the **Print Component** used to customize the printout.

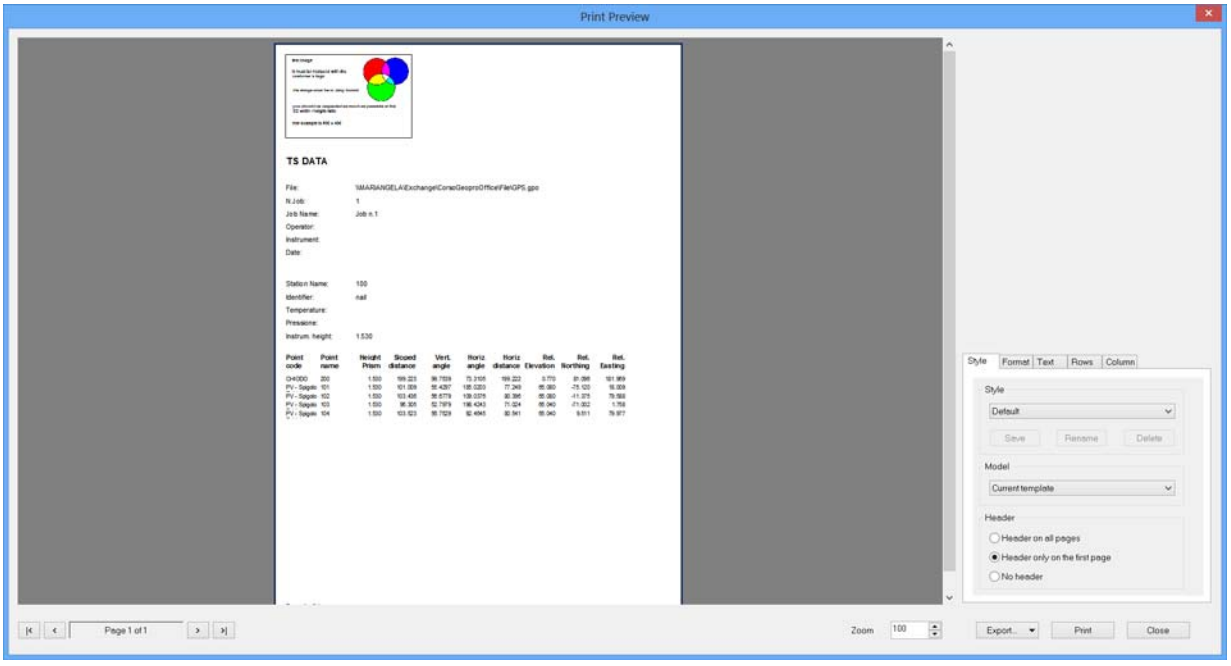



**Figure 316:**

The **Style** tab is used to insert the style type (default or customized), the model to use and whether or not to print the heading.

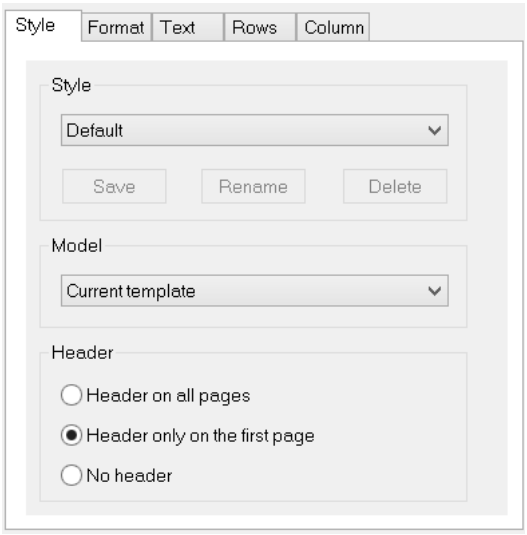



**Figure 317:**

The **Format** tab is used to indicate the orientation of the printout (vertical or horizontal), margins (upper, lower, left, right) and whether or not to activate borders.

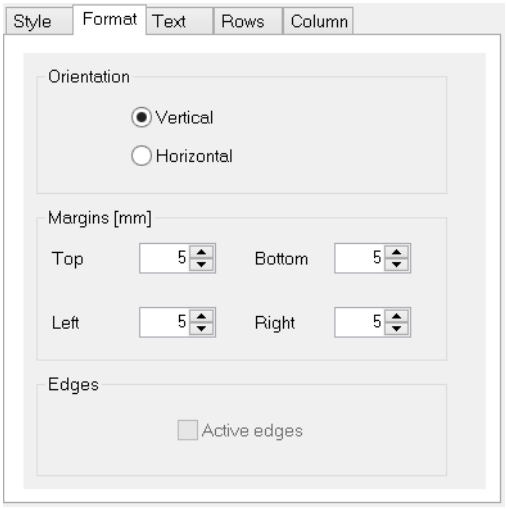



**Figure 318:**

The **Text** tab displays a tree structure showing the organization of the document to be printed.

Each part of the document is identified by and name and can be selected.

If a text part is selected then the Select Font button is enabled allowing the user to change the format of the text selected.

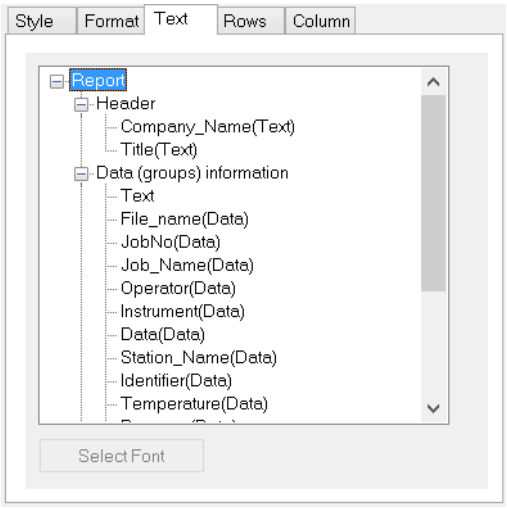



**Figure 319:**

The **Rows** tab also displays the organization of the document (tree structure).

This tab is used to change the height of the line for the selected component by inserting the datum into the specific box.

If this operation cannot be executed then the box remains disabled.

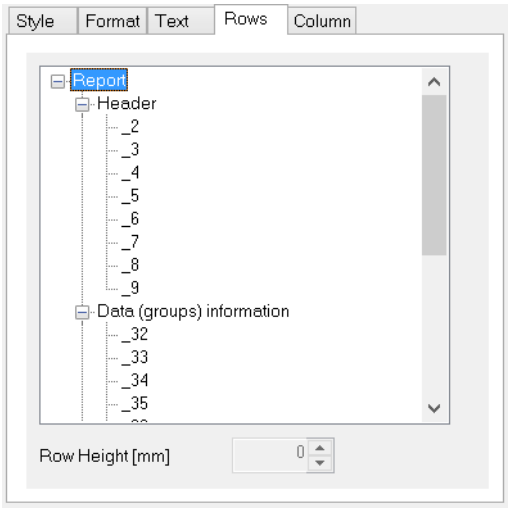



**Figure 320:**

The **Columns** tab is used to change the width of the columns; if the operation is not feasible then the box remains disabled.

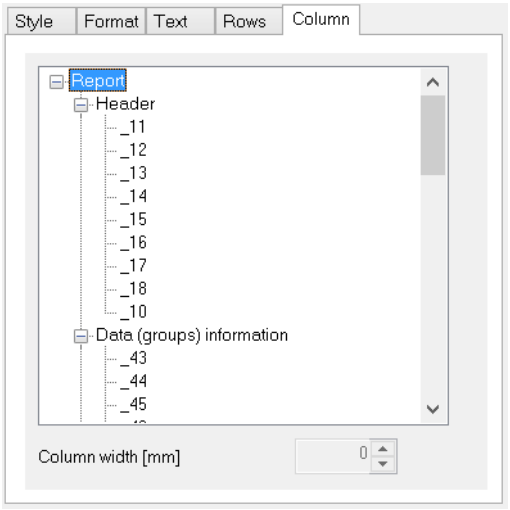



**Figure 321:**

The following commands are available in the preview:

- "Export..." : to export the printout into the following formats: PDF, XML, RTF, HTML, TXT, JPEG, TIFF, BMP.
- "Print" : to select the print options and activate them.

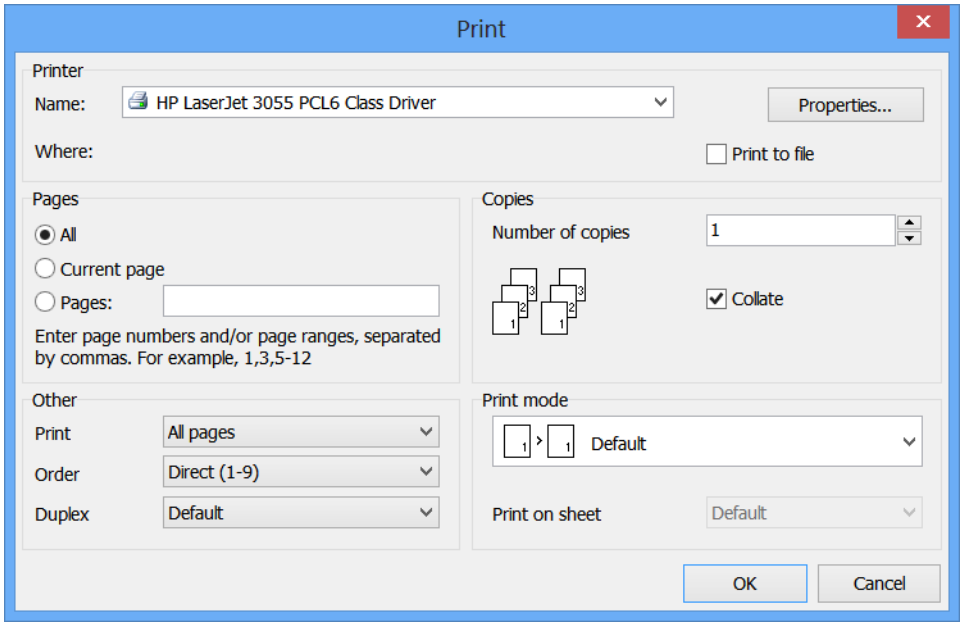



**Figure 322:**

# Digital Level Data View

The **Digital Level Data View** is the display of information collected through a Digital Level.

This part of the document is used to archive one or more Levelings, which in turn contain the data associated with a certain number of measurements executed. Further, the **Benchmarks** node is always available, used to insert the information for elaboration of the measured data.

Selecting the **DL data** node will open the view displaying the Levelings; for each of these, the display includes the name, comment, data and number of points present.

Once the **DL data** node is expanded in the navigation tree, the list of levelings will be displayed; these levelings can be selected which will open the view corresponding to where the points measured are represented by a grid.

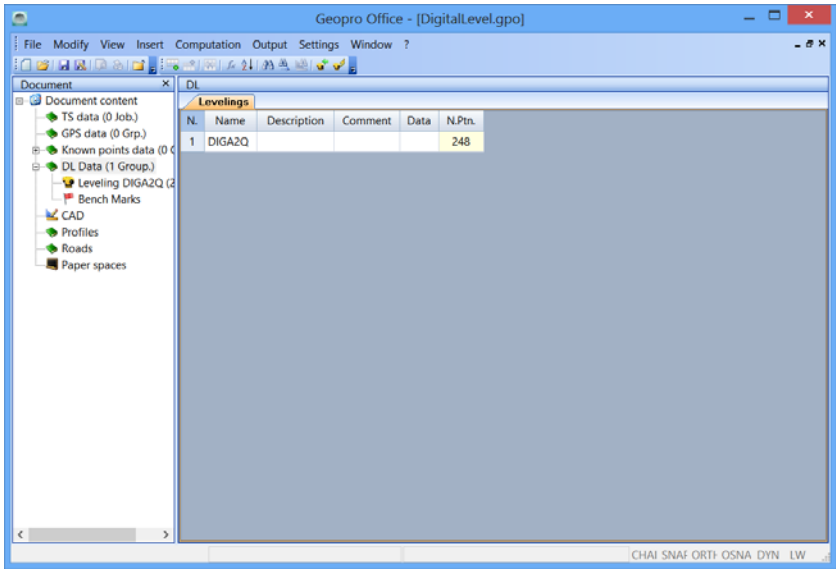



**Figure 323:**

For each point, a series of information is associated that varies depending on the type of measurement conducted and may be:

Number, Back, Forward, Distance, Elevation, Measurement no., RMS, and Notes;

Number, Measurement, Distance, Elevation, Measurement no., and Note.

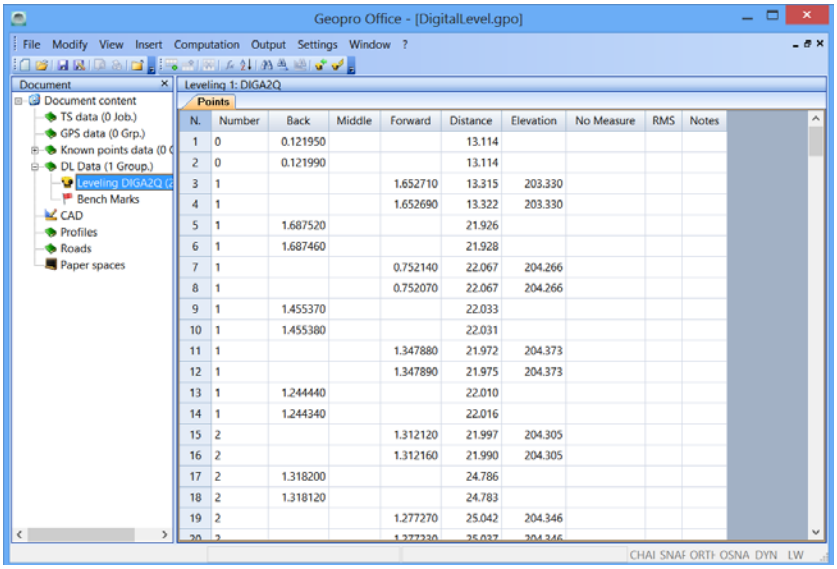



**Figure 324:**

Selecting the **Benchmarks** node will display the corresponding view where the measured points are seen on a grid with their respective data (Name, Elevation and Description).

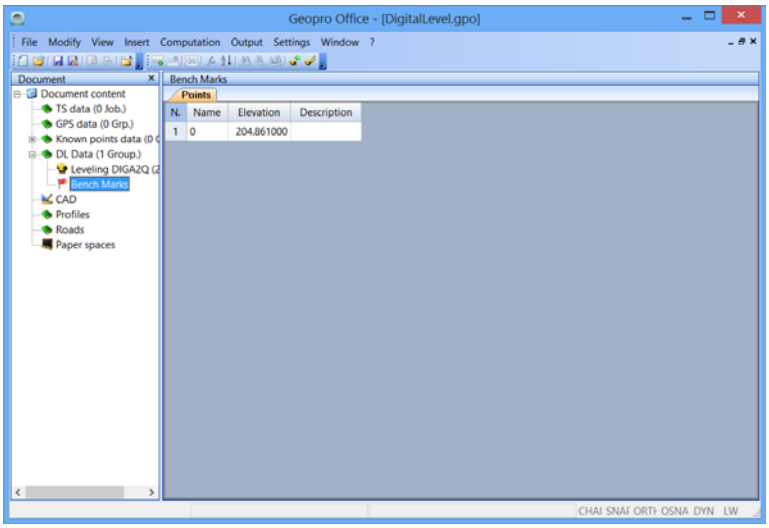



**Figure 325:**

# Importing Data from Instrument

Using the command **Insert|Data Instrument...** menu, the user can import the data measured by the instrument into the Digital Level Booklet.

The program offers the user a guided procedure for inserting all of the information necessary for transmitting the data.

Instrument and settings can be stored in a profile to avoid repeating the complete procedure for each instrument data import.

Upon activation, the procedure displays a window where the user can execute the following operations:

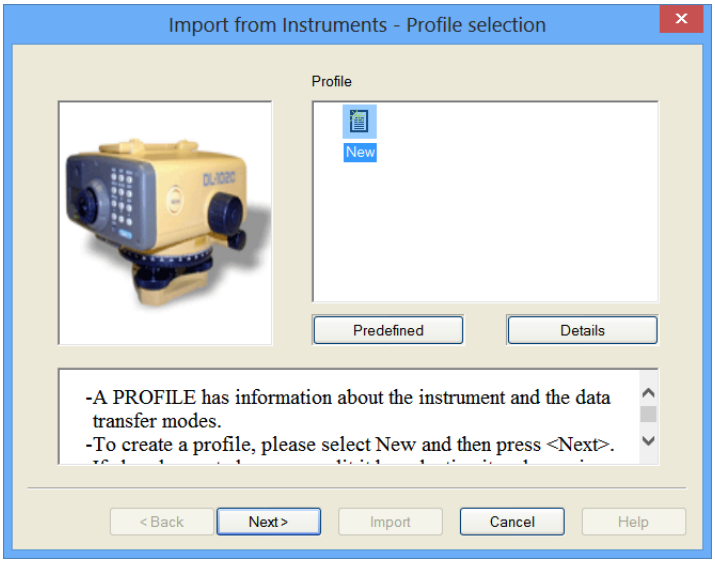



**Figure 326:**

1) Create a new profile selecting the **New** icon and press **Next>** until the procedure is complete: at a certain point a window will appear where the profile can be saved and therefore also save all selections made in the previous windows.

2) Use a profile, without activating the procedure, by selecting it and pressing the **Import** button.

3) Cancel or rename a profile using a menu activated by clicking the right mouse button.

The list of profiles can also be seen in detail using the **Details** button; to refresh the default display, press the **Large Icons** button.

Finally, the profile can be set as default using the **Predefined** button; the default profile is the one then suggested upon activating the procedure.

Press **Next>** and the next window will display a list of instruments that the program makes available to users.

To continue, the user must select the instrument (for the moment the available instruments are Topcon DL-100 and DL-200; Topcon DL500).

Press the **Forward** button and the program will suggest a window where the user can insert the associated settings to transfer data.

Once their correctness is checked, press **Next>** to display a window where the type of conversion can be selected: Convert, No Convert, Ask the user whether to convert.

These options are used to decide whether or not to automatically insert the data imported from the instrument or to have a window appear for the selection.

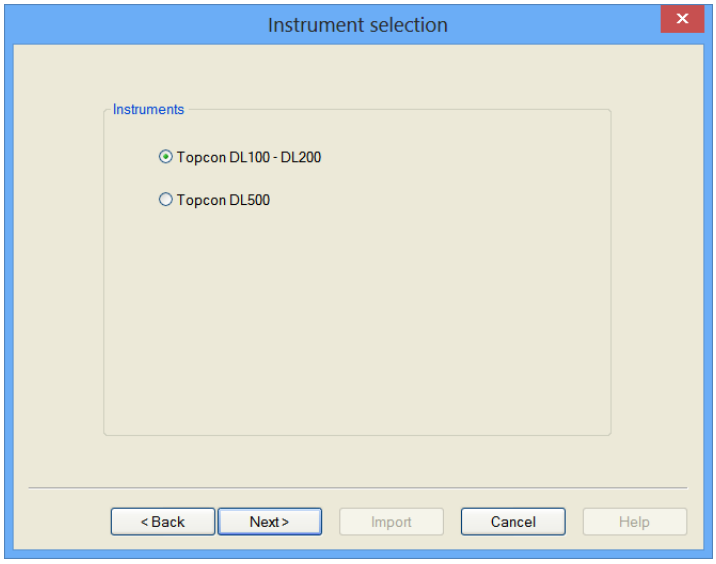



**Figure 327:**

Once the conversion type is selected the **Save Profile** window will appear listing the existing profiles and allowing the just created profile to be saved.

Once the profile is saved, the user can return to the previous pages to change the profile settings but cannot return to selecting the instrument.

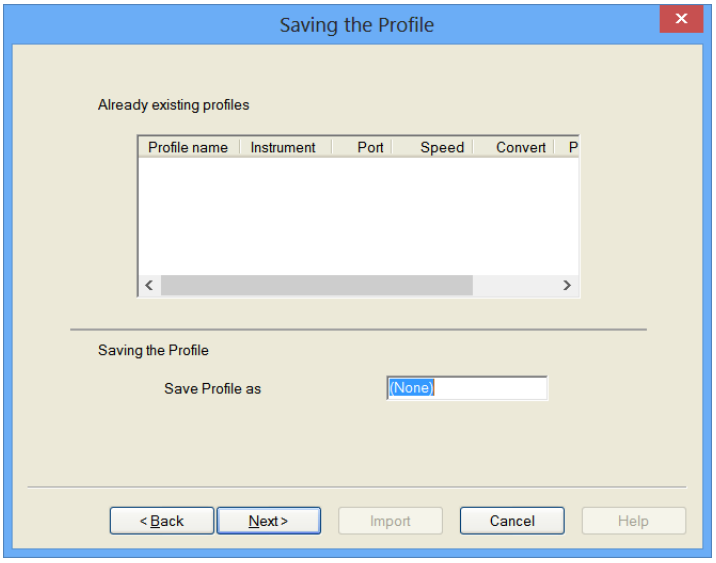



**Figure 328:**

The following windows show the steps to take for setting the instrument to allow importing the data.

The last window shows the result of the transmission; if the importing was not successful the user can retry by pressing the **Retry** button.

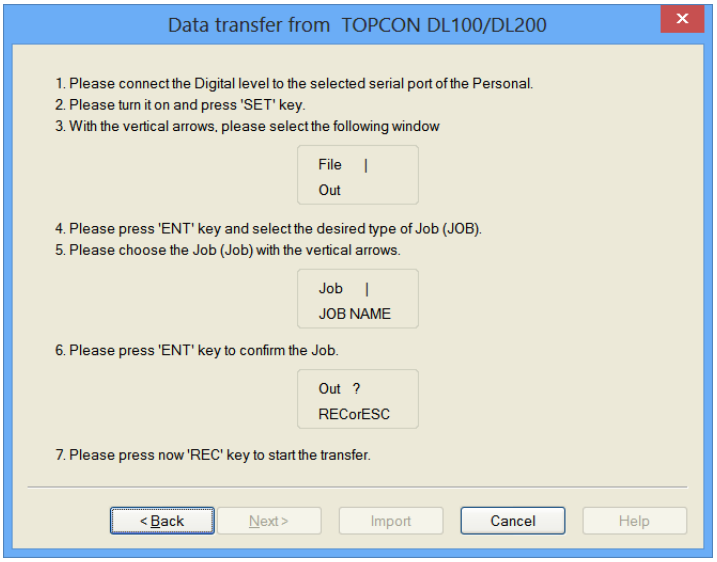



**Figure 329:**

# File|Import|Various Formats

This command is used to convert the following file types:

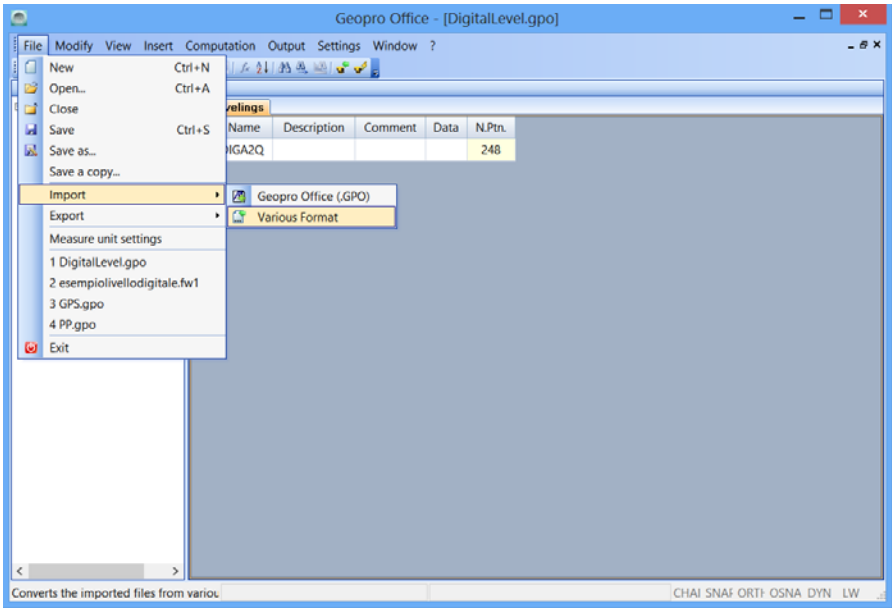



**Figure 330:**

DL-100 (*.DL1) File ;

Leica (*.WLD) File .

Executing the command will open a window used to select the file to be imported.

The selected file will be suggested again in the future executions of the command.

Once the name is selected, the conversion will run immediately, creating a group in the Digital Level Booklet in the currently open file.

# Elevation Compensation

his command is used to run the Compensation Calculation of the Quotes on the data archived in the Digital Level of the open document.

Executing the command will activate a guided procedure where, in the first window, the user is able to select which Levelings are to be considered in the calculation and, make selections to set the type of calculation to apply and the type of outcomes to produce.

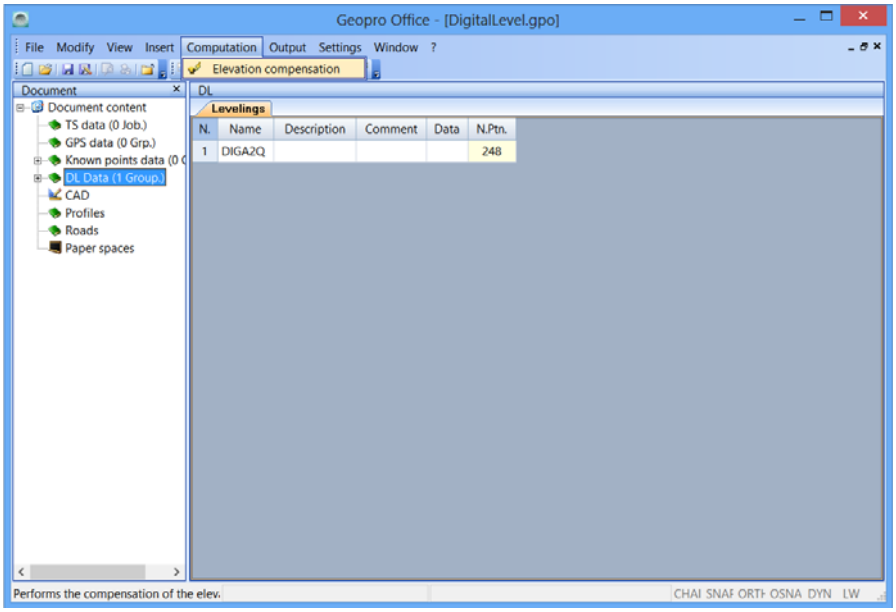



**Figure 331:**

By selecting **Yes** in the **Compensation** section the calculation will execute with more accuracy in that the strict compensation mechanism will be used.

By selecting **On printer** in the **with output** section, the user is telling the program to print the produced results.

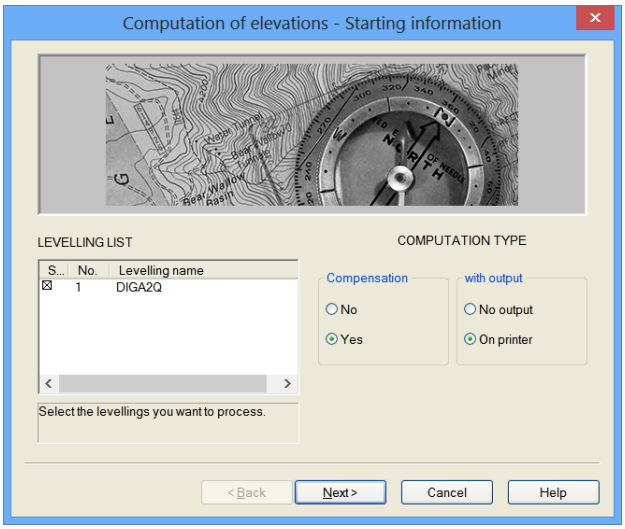



**Figure 332:**

Pressing the **Next>** button will display the window with the compensation results.

The **Enlarge** button will display the results in a larger window.

Again pressing the **Next>** button will continue to a final window where the user transfers the calculation results by pressing the **Complete** button.

If the user decided to receive the outcome on the printer, the program will also activate the print preview.

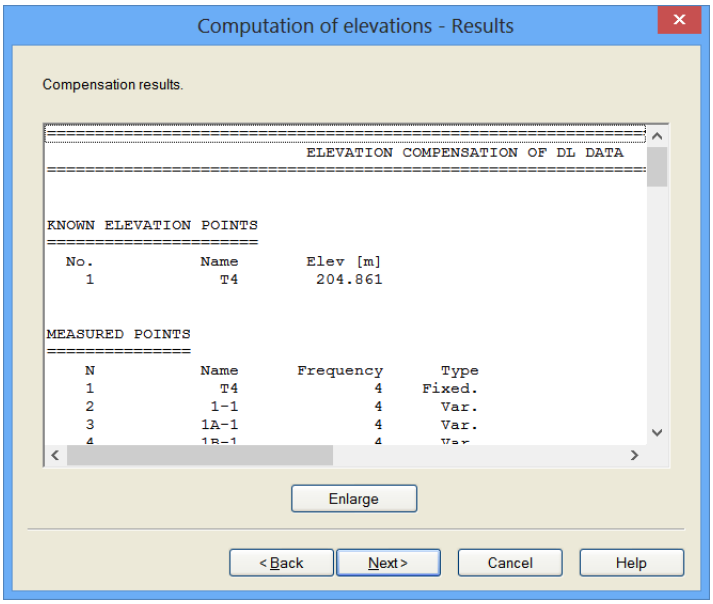



**Figure 333:**

# Output

The **Output** menu of the Digital Level data includes two commands:

**Print All Levelings:** this command is used to activate the printing of all levelings;

**Print With Selected Levelings:** here the user can tell the program which levelings to print by means of the selection window.

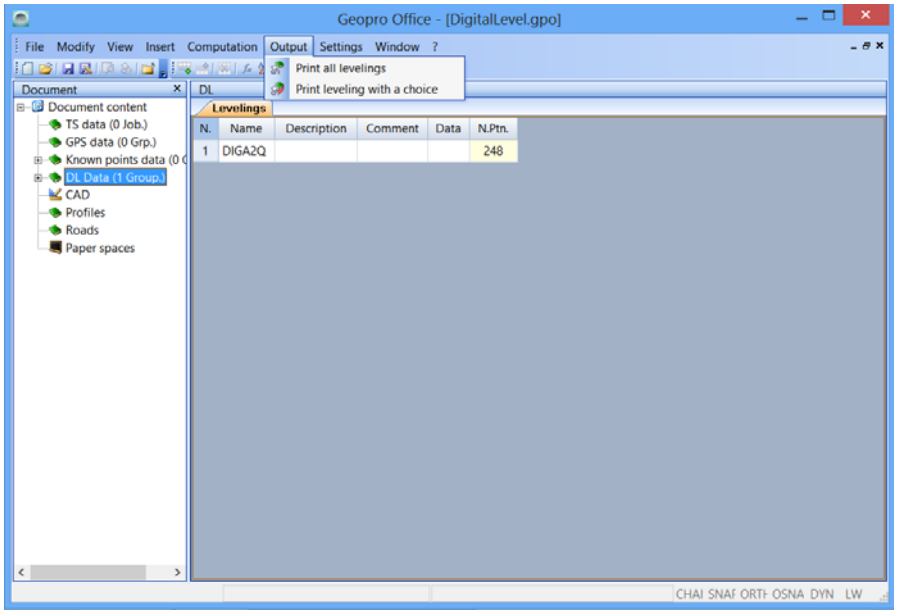



**Figure 334:**

# Export File|Leveling (.CSV)

**Export on File|Levelings (.CSV):** this function is used to create an ASCII type file with the CSV extension. Executing this command will open a window where the user can insert the path for saving and the file name; the file produced can be easily imported into Excel.

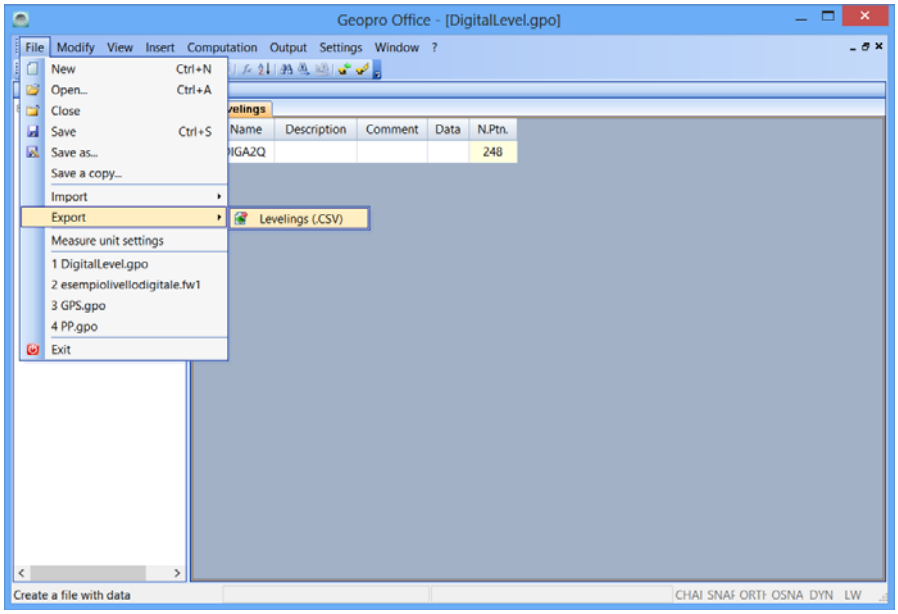



**Figure 335:**

# Introduction

The Geographic Information Systems (GIS) are based on a merger of the computerized design and the relational databases.

The first system allows computerized design of the geographic entities, while the second stores the data and information associated with these entities. The merger of these two systems in the GIS is used to analyze a geographic entity, whether for its complete geometric nature (and symbolic) as well as for its total informational content; in essence, these systems create a link between each geographic entity in a map and a line of a database.

With these new systems, each piece of data can be represented through a geographic position, defined by the coordinate system adopted and along with all of the information that applies to it, which can be stored in a database. In this way, the analysis of the geometric properties of the entities represented in a geographic map (for example, their exact physical dimensions) can be combined with the general properties of other cartographic entities (such as reciprocal distance between houses, habitations, schools and hospitals, etc.), and for each entity preselected, the user can analyze in detail all of the information about it.

Over the last few years, almost all traditional geographic cartography, of any genre and type, is becoming digital and shortly will be part of territorial information systems that, through the GIS, are able to produce geographic and thematic maps for all of our needs and goals.

The use of a GIS is obvious:

- In all sectors where the use of geographic or topographic cartography (military, industrial, administrative sectors, etc.) is strategic: such as in the management of funds for defending a state, which will, for example, be directed toward border regions; in the selection of where to place new clinics and hospitals, fundamental for those in charge of the health sector; or in the selection, just as fundamental for a transportation company, of the routes to take for completing its deliveries.
- In all geothematic, geologic, geomorphologic, hydrogeologic, resource, forestry, environmental cartography sectors of use and development. A forestry company, for example, must know where to plant or cut trees and must know roads and paths to access them; a geological service must be aware of where there are land slides, sources, quarry probes, etc.
- In all territorial planning sectors: a public agency that manages the territory uses GIS to prepare and develop urban plans (regulatory plans, coordinating territorial plans or structural plans); a tourist or anyone taking a trip must make selections on where to go, how to get there and at which point to lodge.

To work with GIS the commands in the **GIS** menu found in the CAD View are used.

In particular, the user must begin working from zero through these commands:

– Manage Tables to manage the tables and the fields associated with the GIS database;

– Manage Themes to define the thematic maps to associate to the GIS graphic entities;

– Create Entities, Delete Entities and Edit Entities to manage the GIS graphic entities.

Or by beginning with files saved in previous works using these commands:

– Import theme definitions (.gis, .gtd);

– Import Shape files.

The *.gis file is a format that includes the definition of the database tables and the themes created by the user.

The Shapes file is characterized by three files with the .shp, .dbf and .shx extension which must have the same name and contain the GIS graphic entities including the associated table with all the additional information.

Once the work is completed, the user can:

– Export the definition of the tables and themes using the command Export themes definition;

– Export the GIS graphic entities with the respective table and all the additional information in the Shape format using the command Export Shapes file;

– Run querys using the Query command.

– The sections in this chapter illustrate the functions of these commands with examples.

# Import themes definition

The **Import themes definitions** command in the GIS CAD View, is used to import a *.gis/gtd file created by the user previously, to insert into Tables and Themes into the project. The result of the import can be seen through the following commands:

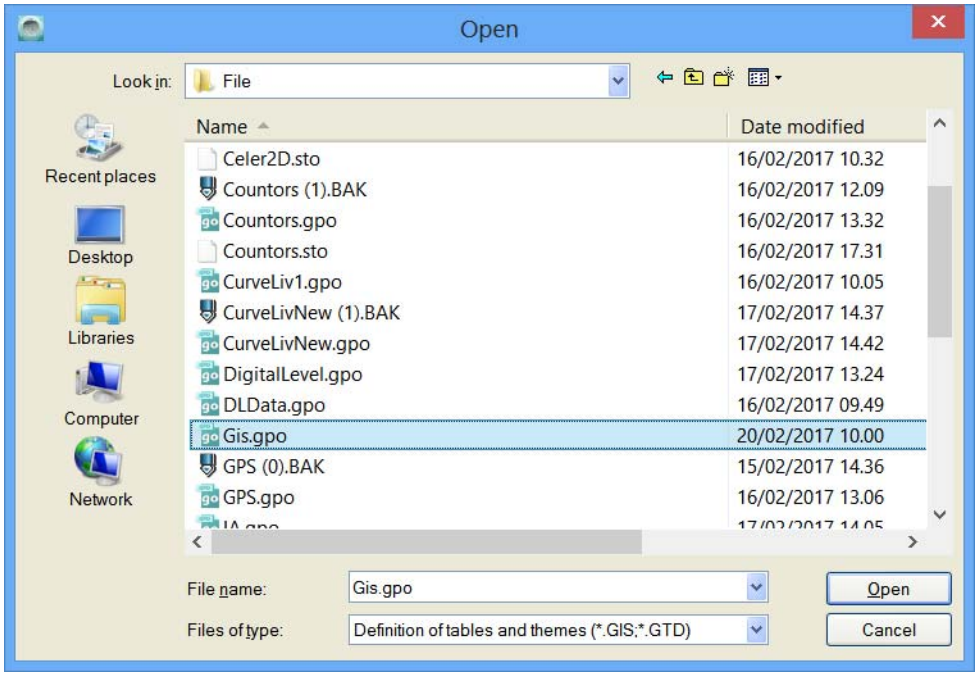



**Figure 336:**

**GIS|Tables** displays the **Table** window that shows the list of all imported GIS Tables.

**GIS|Themes** displays the **Themes** window that shows the list of all imported GIS Themes.

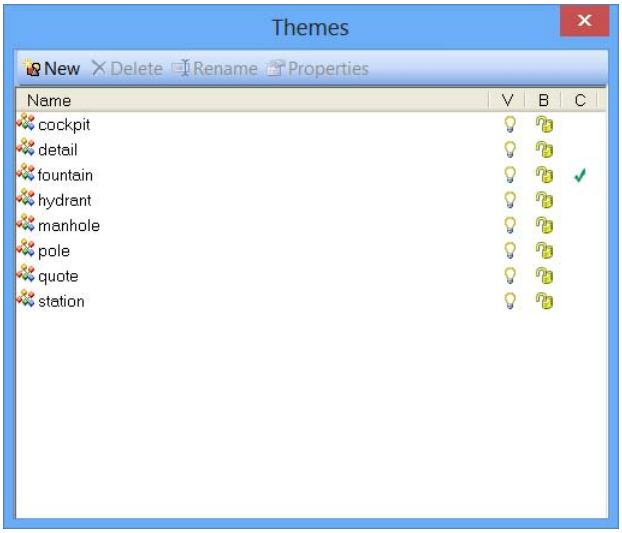



**Figure 337:**

# Import Shape files

The **GIS|Import Shape files** command is used to import files with the .shp, .shx and .dbf extension that contain GIS Graphic Entities and the associated table with all of the additional information.

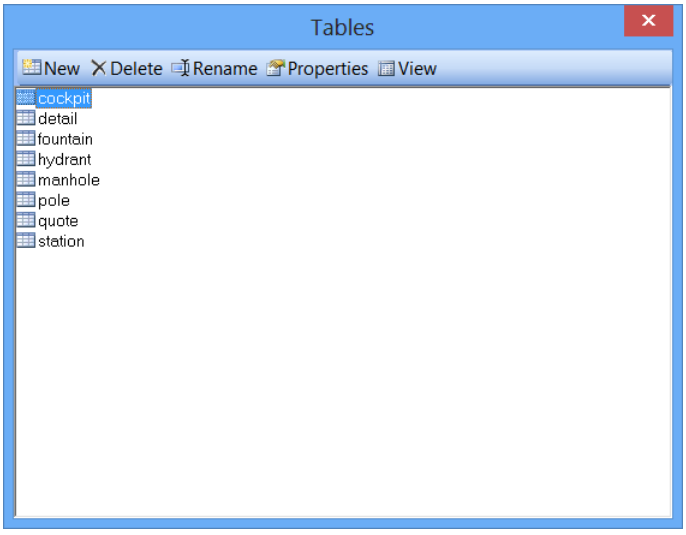



**Figure 338:**

Once the command is activated a dialogue window will appear asking for the path of the file to import.

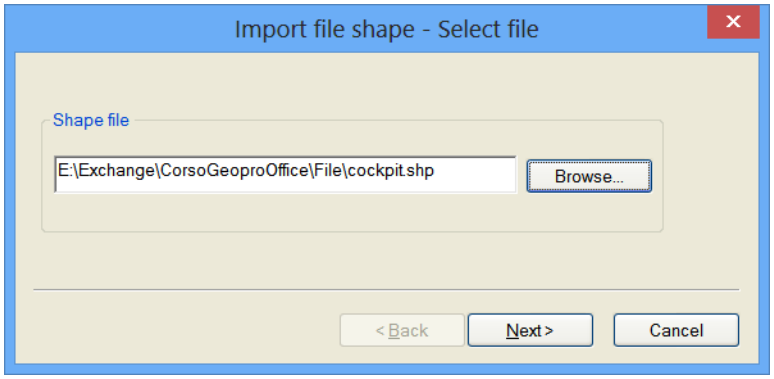



**Figure 339:**

Press the **Next>** button to access the second screen, used to specify whether or not to create a known point for each vertex of the imported entities. It is advised to activate this option only when you have to stakeout the vertices.

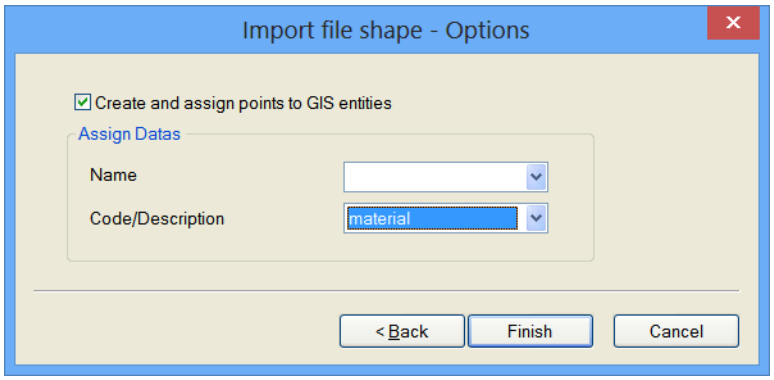



**Figure 340:**

If a .shp file is imported that contains points (ex. Manhole) and the user wants to create known points, then the name and description (material) of the noted coordinate points can be specified by the values contained in the fields of the table associated with the entity.

The following image shows the final result:

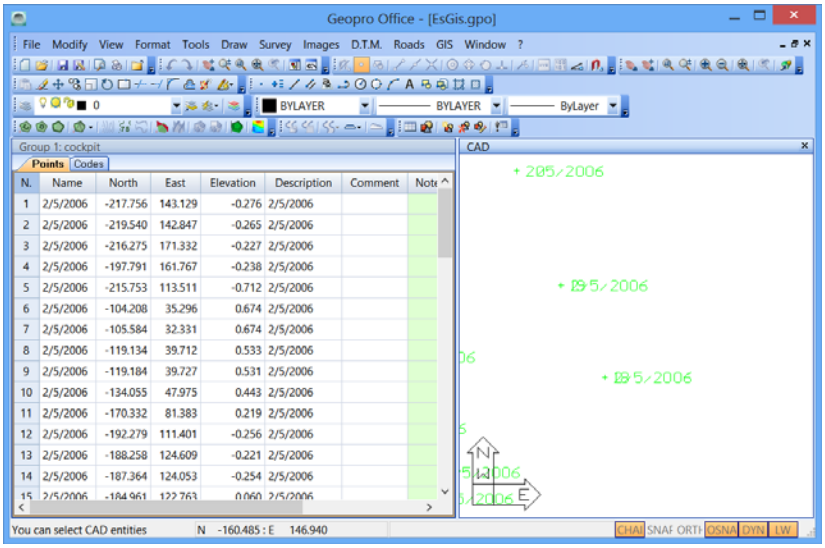



**Figure 341:**

If the user imports a file that contains a GIS table with the same name of a table created previously, but with differences in fields, then the **Imported table conflicts** window will appear.

At this point the user must select whether to rename the table to import or join the two tables resolving the conflicts.

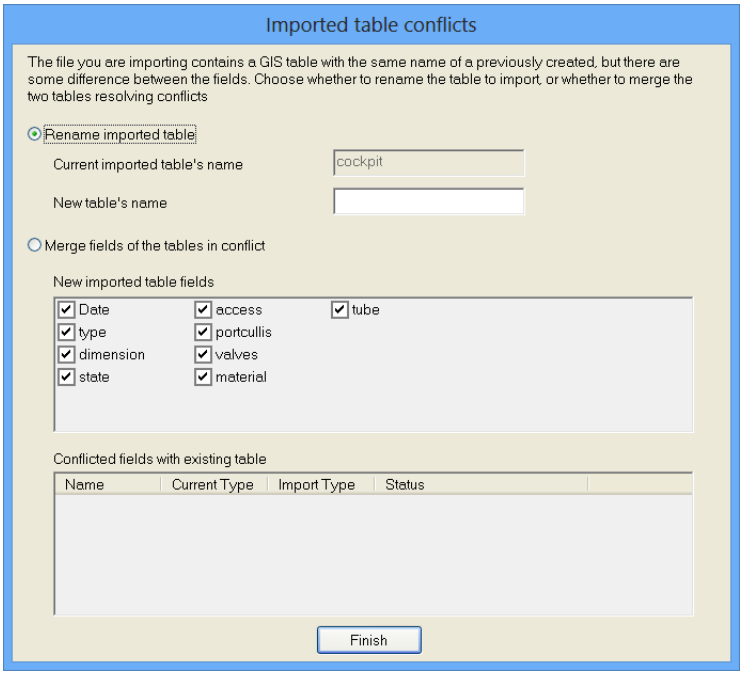



**Figure 342:**

# Manage Tables

Using the **Tables** command, the user can manage the tables of the database and can change them using these buttons: **New**, **Delete**, **Rename**, and **Property**.

The **New** button will bring up the **Table name** window where the user must insert the name of the new table to be created, initially empty, that is, without fields.

The purpose of a table is to represent the characteristics of any entity that are strict and can be consulted such as: particles, poles, wells.

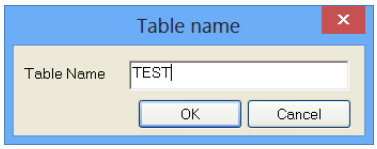



**Figure 343:**

To define a table field, the user must specify its name, type and format.

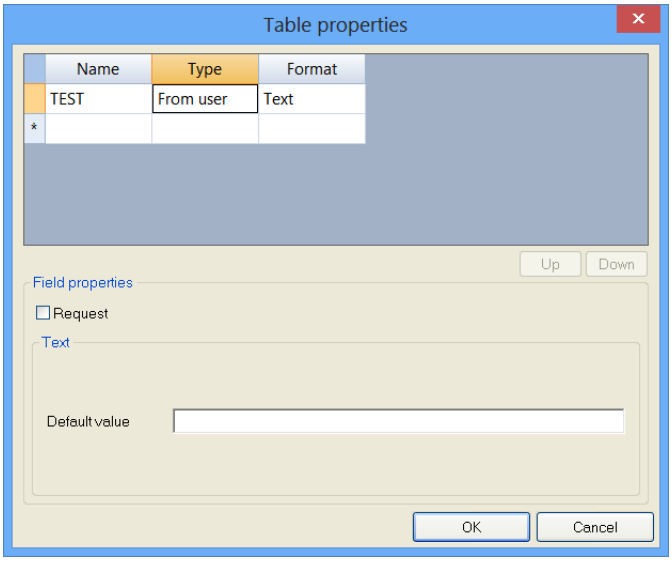



**Figure 344:**

The **Delete** button will open the window asking the user for confirmation to cancel the selected table.

A table with an associated theme cannot be canceled.

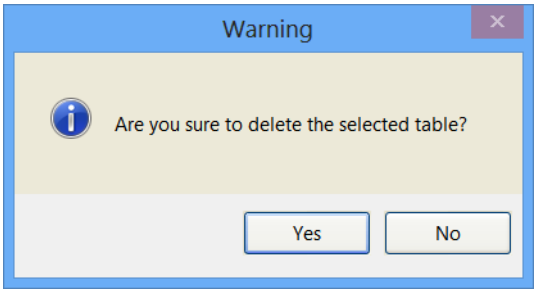



**Figure 345:**

The **Rename** button requires the user to insert the new name to give the selected table.

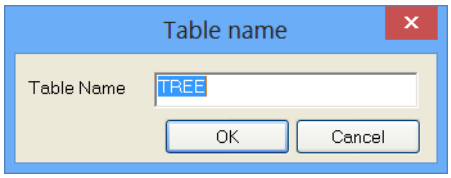



**Figure 346:**

The **Property** button will bring up the **Table properties** window where the user can change, insert and cancel fields in the selected table.

To view the content of a table, the user must select the table to inspect and then press the **View** button.

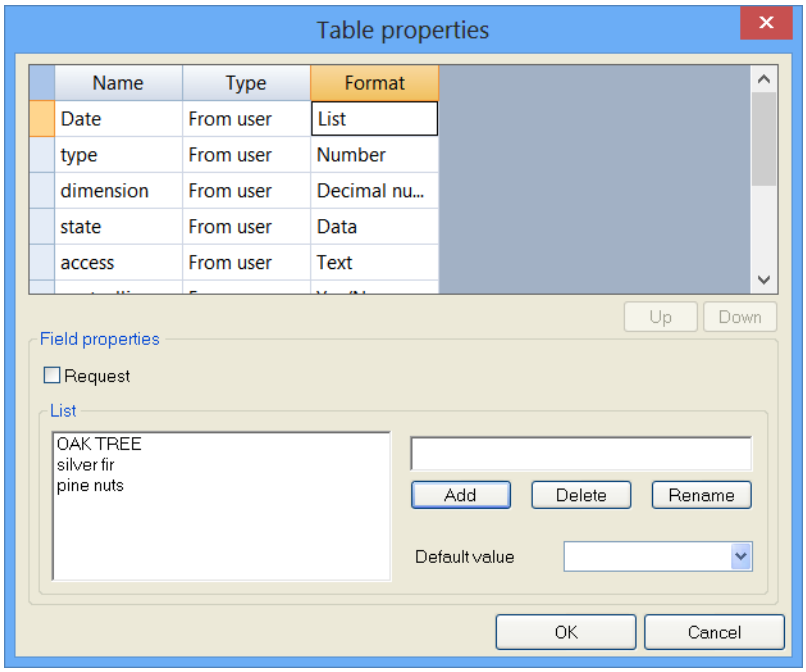



**Figure 347:**

This window does not allow adding or eliminating lines, though the value of individual fields can be changed.

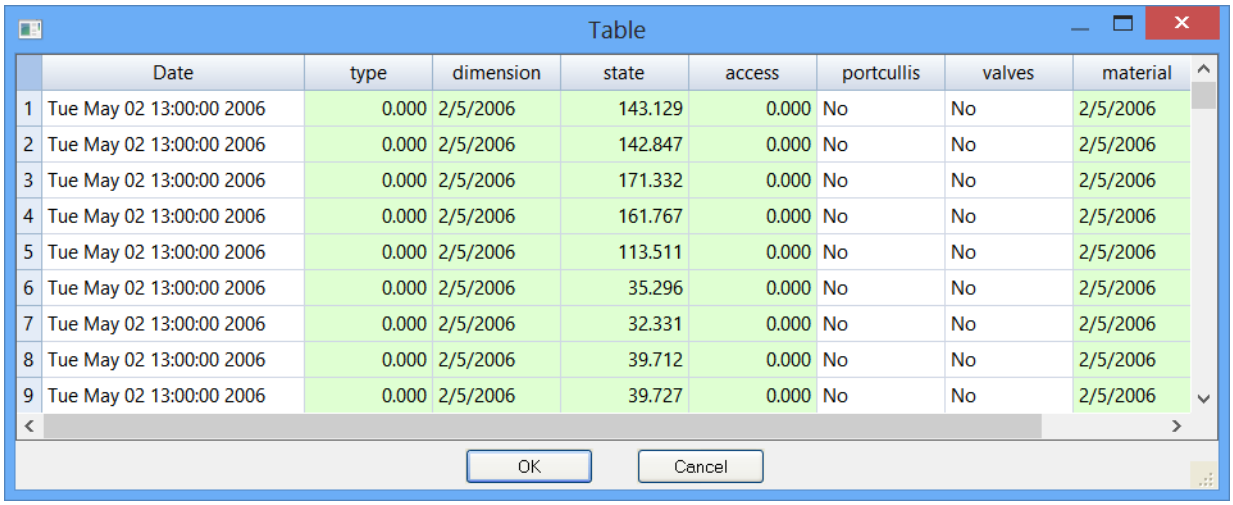



**Figure 348:**

# Change Table Structure

A name, type and format can be associated with each field of the table. To cancel a field, the user must select the entire line and then press the **Canc.** button. To change the position of a field, the user must select the corresponding line and then press the buttons **Up** and **Down**.

The types available are:

**From User** - The user must insert the appropriate value.

**Point name** - Valid only for GIS entities point. Automatically compiles the field with the name of the associated TS/GPS/Known point.

**Point description** - Valid only for GIS entities point. Automatically compiles the field with the description of the associated TS/GPS/Known point.

**Area** - Valid only for GIS entities polylines and polygons. Automatically compiles the field with the are of the associated entity.

**2D perimeter** - Valid only for GIS entities polylines and polygons. Automatically compiles the field with the perimeter of the associated entity. In the calculation of the quotes, the individual vertices are ignored.

**3D perimeter** - Valid only for GIS entities polylines and polygons. Automatically compiles the field with the perimeter of the associated entity. In the calculation, the quotes of the individual vertices are considered.

**Barycenter X** - Automatically compiles the field using the average of the X coordinates of the vertices for the associated entity. If the associated GIS entity is a point, the barycenter of the entity corresponds to the coordinates of the same.

**Barycenter Y** - Automatically compiles the field using the average of the Y coordinates of the vertices for the associated entity. If the associated GIS entity is a point, the barycenter of the entity corresponds to the coordinates of the same.

**Barycenter Z** - Automatically compiles the field using the average of the Z coordinates of the vertices for the associated entity. If the associated GIS entity is a point, the barycenter of the entity corresponds to the coordinates of the same.

**Draft** - Valid only for GIS entities point. Automatically compiles the field with the path of the draft for the associated TS/GPS/Known point.

**Photo 1** - Valid only for GIS entities point. Automatically compiles the field with the path of the Photo 1 for the associated TS/GPS/Known point.

**Photo 2** - Valid only for GIS entities point. Automatically compiles the field with the path of the Photo 2 for the associated TS/GPS/Known point.

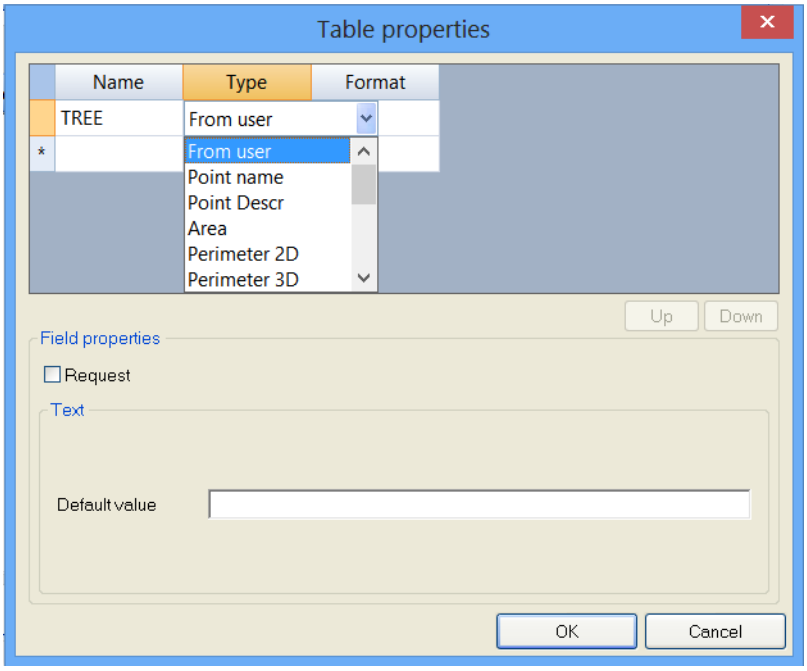



**Figure 349:**

The **Format** of a field indicates the format of the values that can be assigned to a field.

The formats available are:

**Text** - Any sequence of characters can be assigned to the field.

**Numeric** - Any internal value can be assigned to the field.

**Decimal number** - Any real value can be assigned to the field. The difference between numeric and decimal formats is that the decimals field can have values with a comma inserted while this is not possible in numeric fields.

**List** - Only the values contained within a list can be assigned to the field.

**Yes/No** - Only the values Yes or No can be assigned to the field.

**Date** - One date can be assigned to the field.

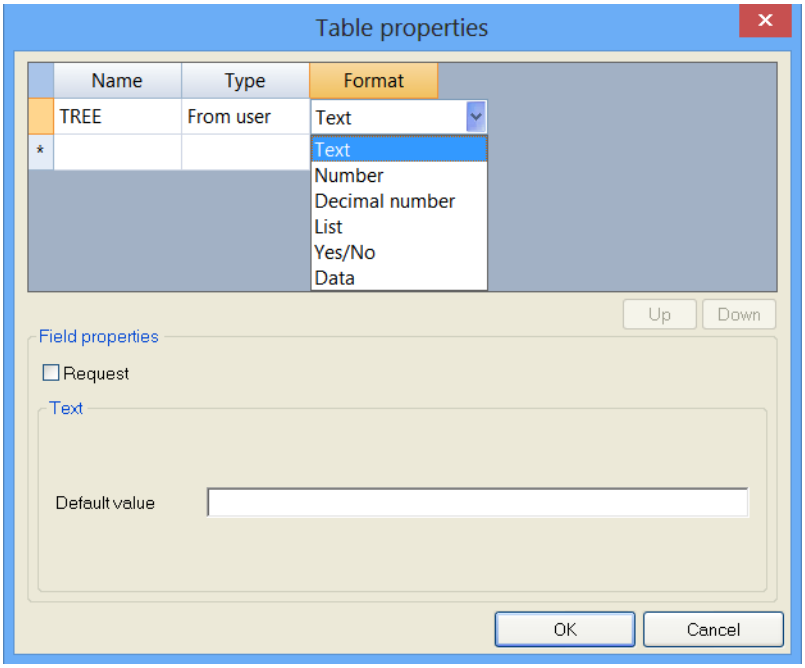



**Figure 350:**

If a field type different from **From User**, the program will automatically select the corresponding format.

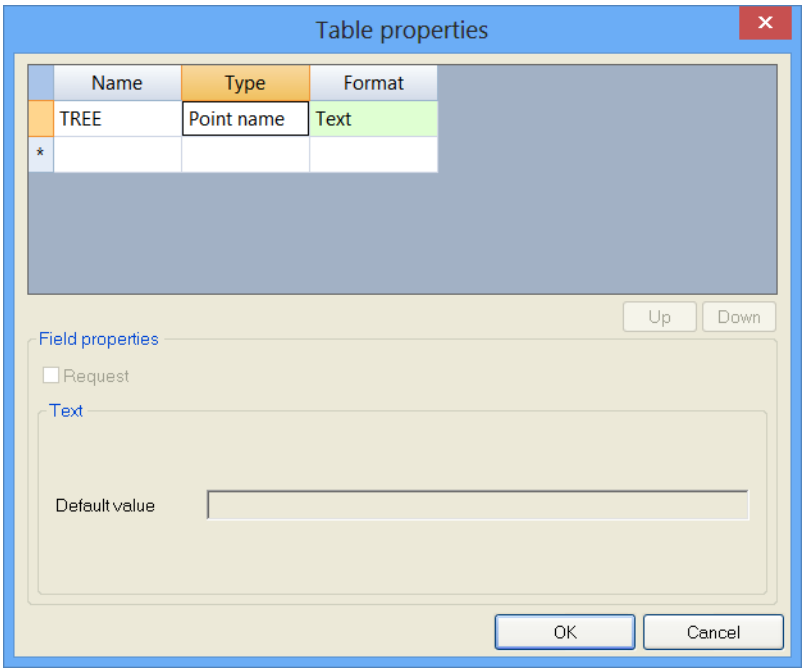



**Figure 351:**

Indifferently from the field format, the user can specify a default value and whether it is required; in this last case, the field can never be left empty.

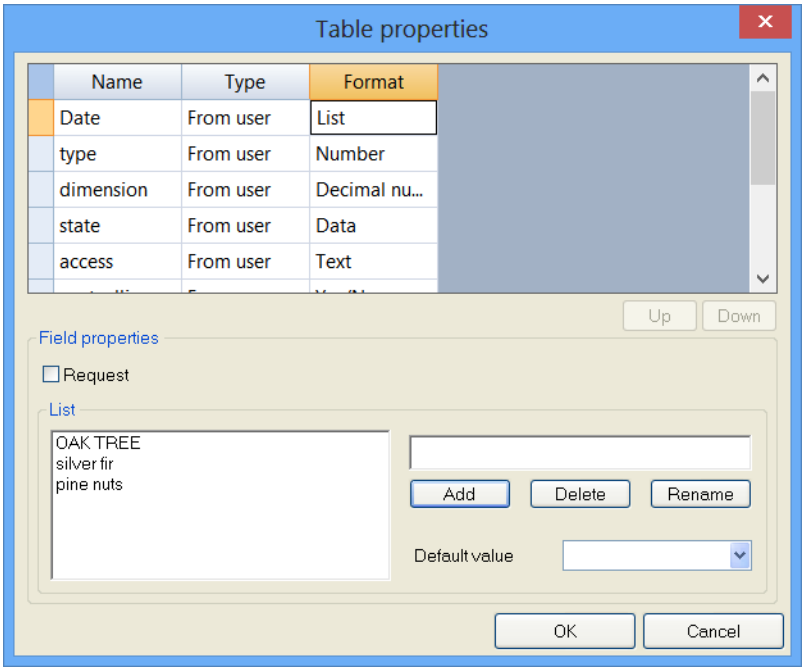



**Figure 352:**

If the format is numeric or decimal the minimum and maximum value can also be specified.

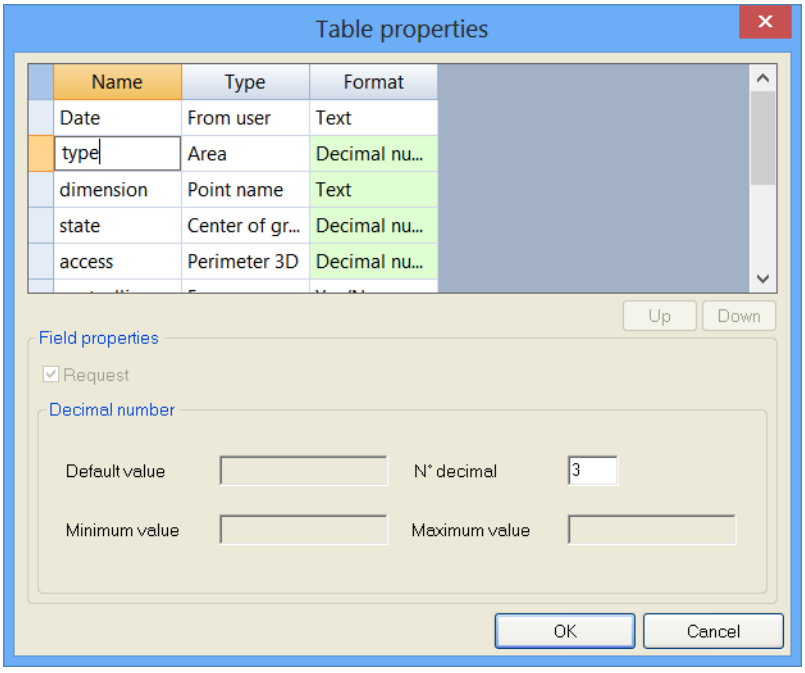



**Figure 353:**

# Manage Themes

The **GIS|Themes** command will display a window that is used to manage the GIS Themes sorted in the file using the **New**, **Delete**, **Rename**, and **Properties** commands.

Each theme has icons associated with it that indicate whether the theme is visible, blocked and which is currently active.

One theme is abstract entity which includes a group of graphic entities of the same type, each of which is associated with a line in a table. All of the graphic entities that constitute the theme refer to the same table.

Graphic entities can be: points, polylines or closed polygons.

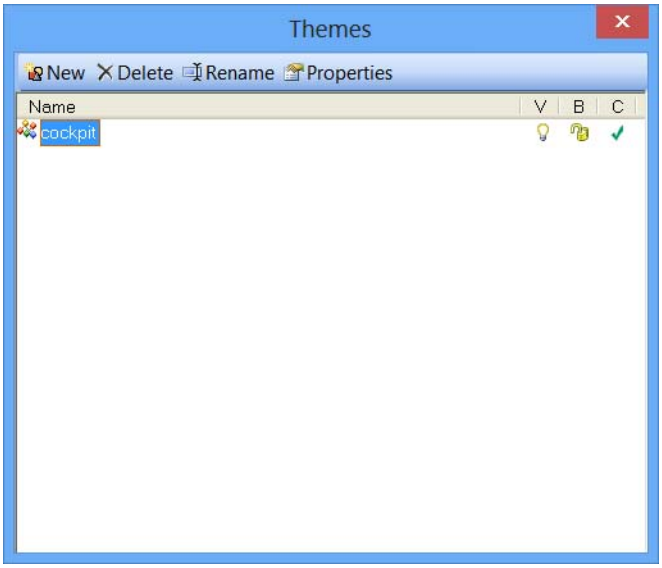



**Figure 354:**

The **New** button will display the **Create Theme** window where the user can insert:

– The name of the theme to create;

– The type of coordinates (2D or 3D);

– The type of entity (Point, Line or Polygon);

– The name of the table to which it is associated;

– The Entity set to which it belongs (one already existing or a new one).

The new created theme becomes the active theme. The active theme is the theme to which the new GIS entities will be added.

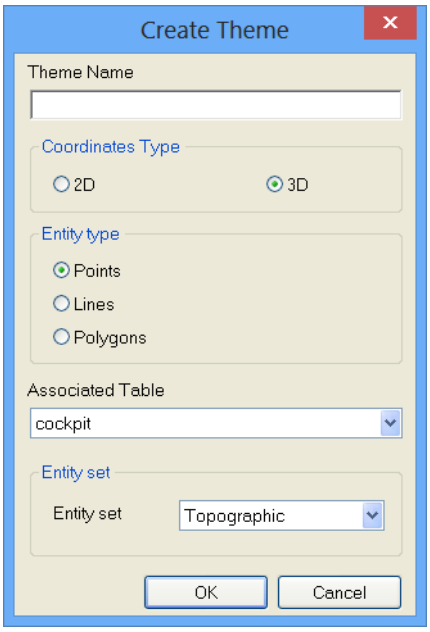



**Figure 355:**

The **Delete** button will open the window asking the user for confirmation to cancel the selected theme.

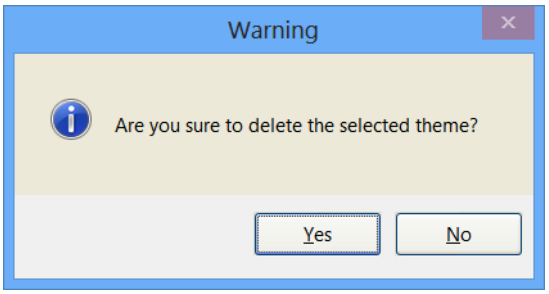



**Figure 356:**

The **Rename** button requires the user to insert the new name to give the selected theme.

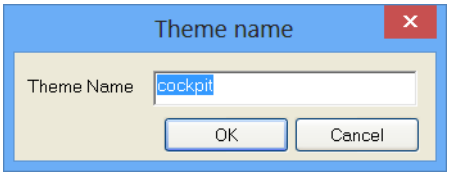



**Figure 357:**

The **Properties** button will open the **Theme Properties** window with the **Theme Options** tab indicating by the check mark if the theme is active and the general characteristics of the edited theme:

- Type of entity,
- Type of coordinate,
- Associated table.

This window is used to change the **Entity** set associated with the theme by selecting the already existing one or a new one.

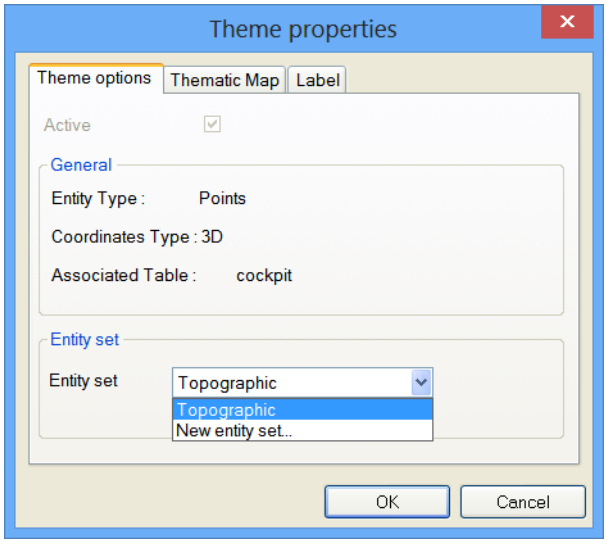



**Figure 358:**

The Thematic Map tab, in the **Theme Properties** window indicates the option to display the entities constituting a theme with different colors depending on the values of the fields.

There are three types of thematic maps that can be created:

**None** - All of the entities are displayed with the same color. This is the map selected by default settings.

If the **None** type is selected, then only the **All** element is displayed in the list below; this element represents all of the theme elements.

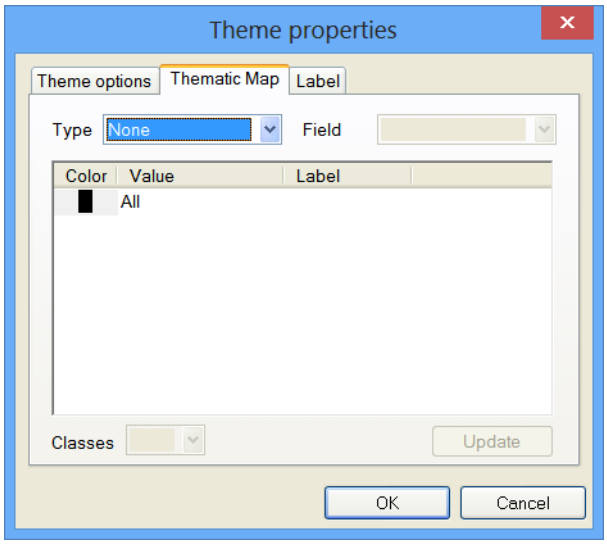



**Figure 359:**

**Single value** - A different color is used for each value assumed by one column. This type of map is helpful for highlighting elements that are limited in number and recurring values; ex: registry sheet, shared code, element status.

The **Update** button is used to add associated thematic maps to any new GIS entities designed in the CAD View to which a new values was added to the selected **Field**.

Executing the **Update** field will cancel all of the already created thematic map settings.

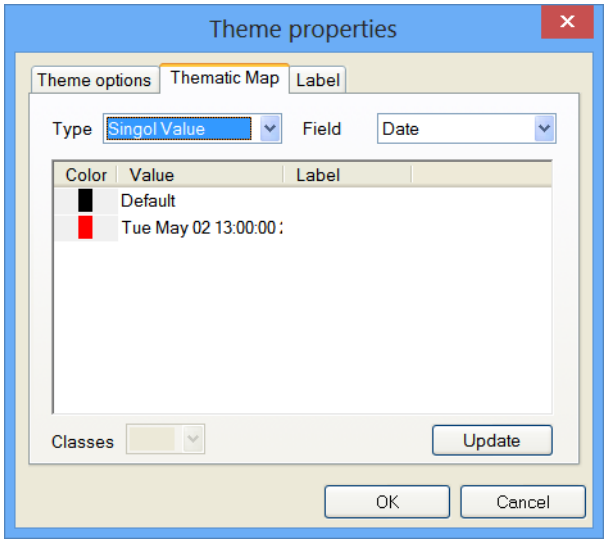



**Figure 360:**

**Range** - The range of values assumed by fields in a column is divided into multiple intervals, each of which is colored with a different color. This type of map is helpful to highlight the value of a field (typically decimal) that can have many values and for which a single value representation would not produce an easily interpreted result; ex: quotes map, classification based on a field.

If the **Range** type is selected, then the user can customize the intervals by pressing the left button on the cell of the **Value** column to change; the inserted value will be considered as the maximum interval value.

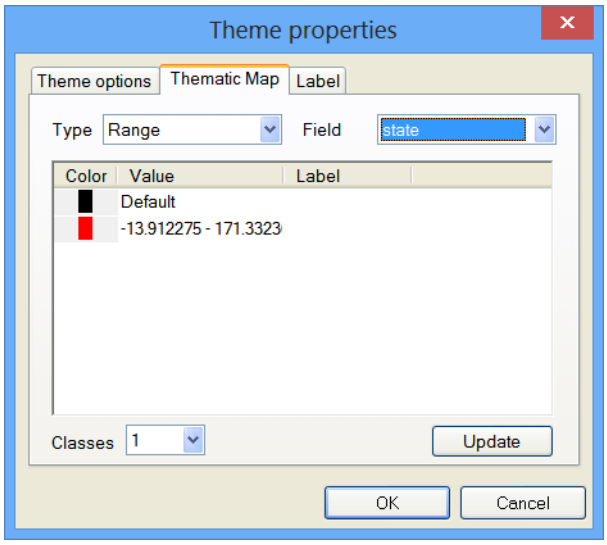



**Figure 361:**

The appearance used to display the entities belonging to a class can be changed by double clicking on the color to the left of the class. A different dialogue window will appear depending on the type of entity constituting the theme.

For polylines, the user can specify color, thickness and type of line used to design them.

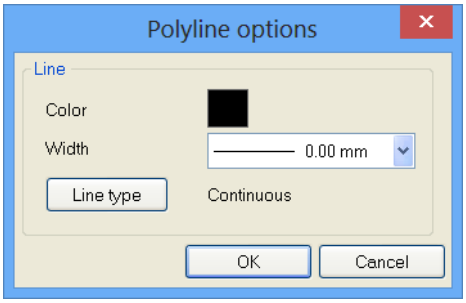



**Figure 362:**

For points, the user can specify color, symbol, scale and the rotation angle used to design them.

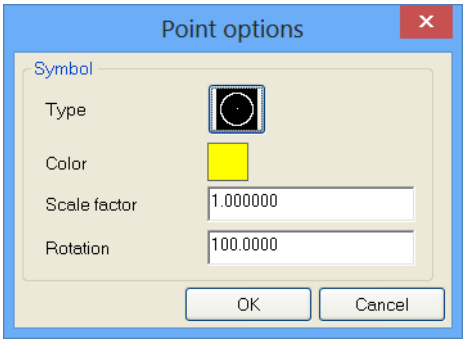



**Figure 363:**

For polygons, the user can specify the color and type of hatching, the color and thickness of the border line.

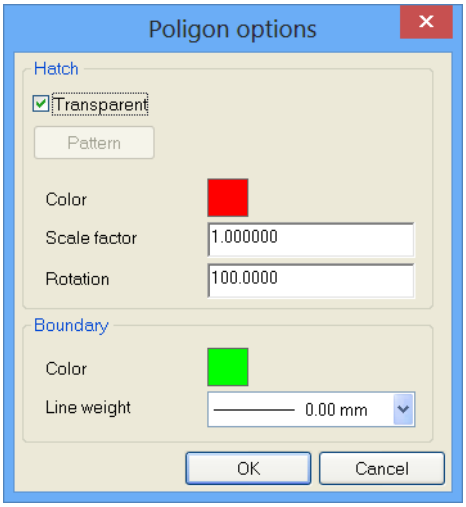



**Figure 364:**

The **Label** tab, in the **Theme Properties** window is used to indicate the option of displaying the value of an attribute alongside each GIS entity for the associated table.

The displayed field will be the same for all entities belonging to a theme.

The summary box **Field to Use** is used to select the field to be displayed alongside the GIS entity.

To not display any label, the user selects the value **None**; this is the default value.

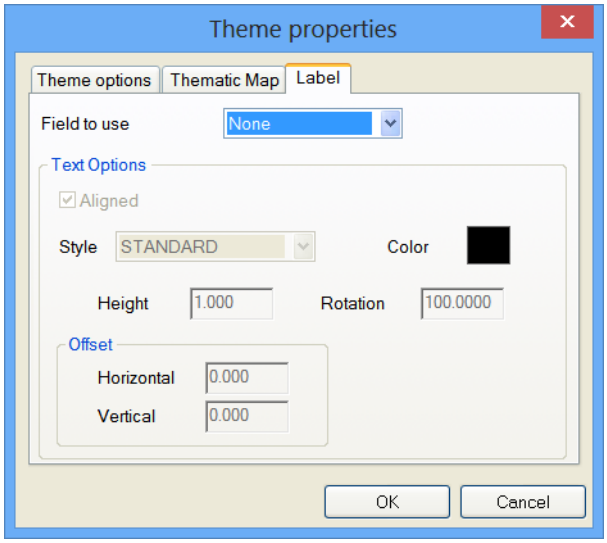



**Figure 365:**

The program will position the label based on the graphic type:

- **Symbol:** the text will be positioned at the location identified by the horizontal and vertical offset parameters. The user can specify the text's rotational angle.
- **Line:** the text will be positioned along the long side. The user can specify whether to align the text to the line or specify a fixed rotational angle. The user can specify by how distant the text should be from the line.

- **Polygon:** the text will be positioned along the polygon's barycenter. The user can specify the text's rotational angle and any offset.

In all cases, the user can specify the height, style, and color of the text.

# Manage Graphic Entities

## Create entities

The **Create entity** command from the GIS menu is used to create entities associated with the point, the line and the polygon depending on the active theme of the **Manage themes** table.

By activating this command, the user can design/select the vertices necessary for creating a new GIS entity.

Once the selection of entity vertices is completed, a dialogue window will appear in which the user can insert data associated with the just created entity.

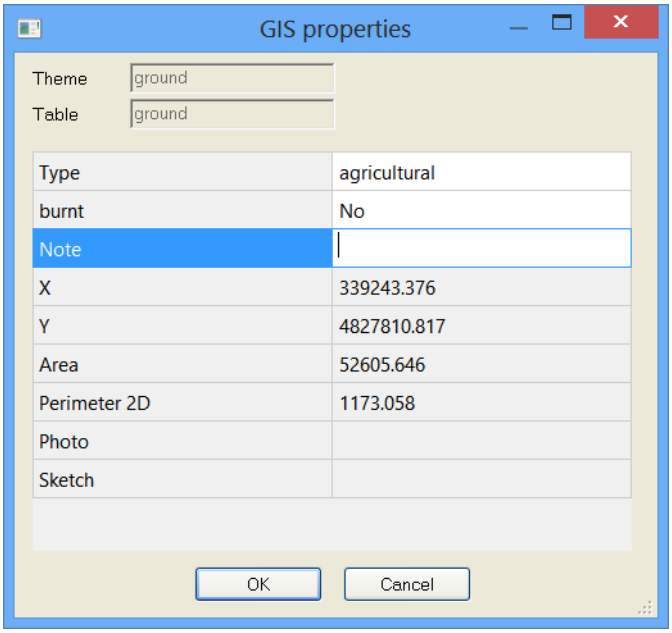



**Figure 366:**

## Example of created entity

Select the **ground** theme from the **Themes** table and place the check mark for active.

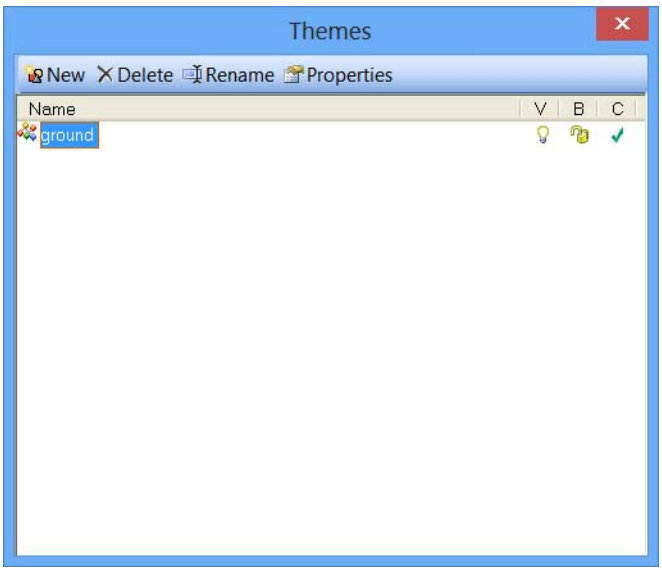



**Figure 367:**

After activating the Ground theme, the user can design the polygon by using the **Create entity** command in the **GIS** menu of the **CAD View.**

Once the design is completed, the **GIS properties** window will appear, used to edit the characteristics of the graphic entity.

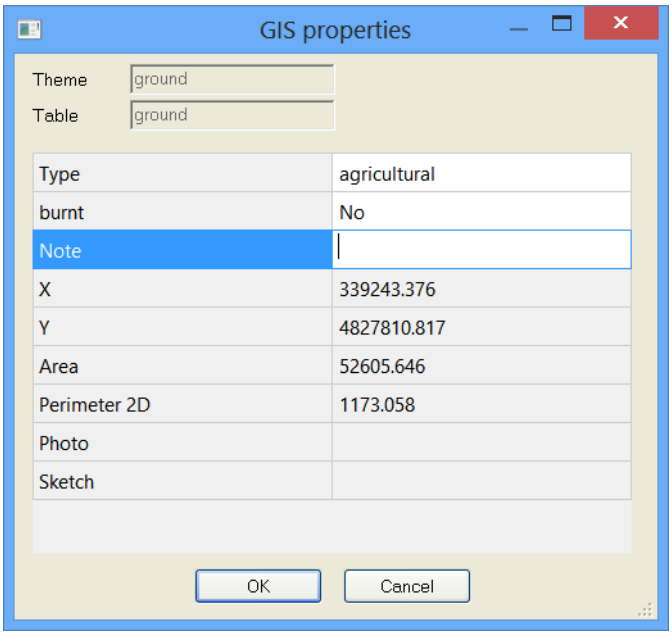



**Figure 368:**

Press **OK** and the graphic entity will be created (see image below).

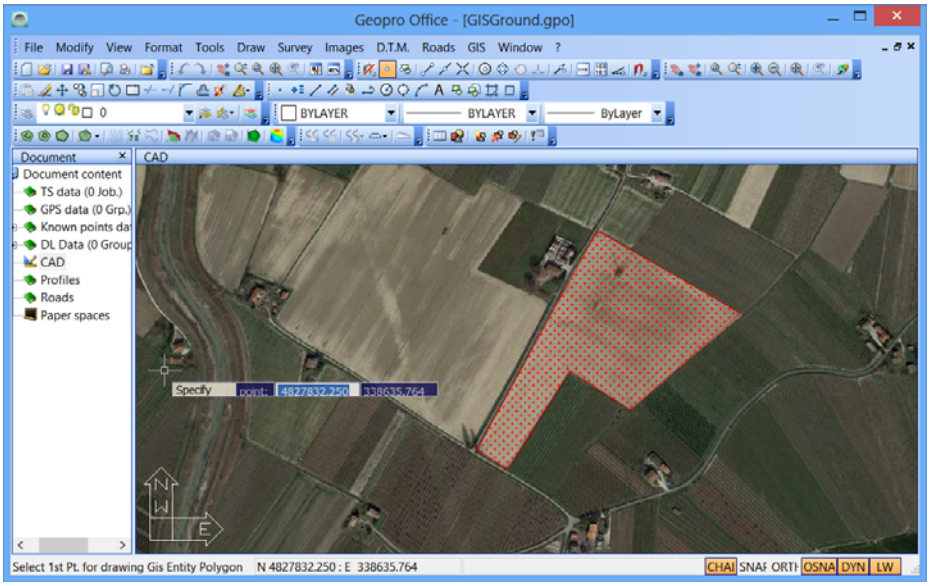



**Figure 369:**

The newly created entity is represented by a red colored grid, because the agricultural terrain is identified with this thematic map as seen in the **Theme Properties** window.

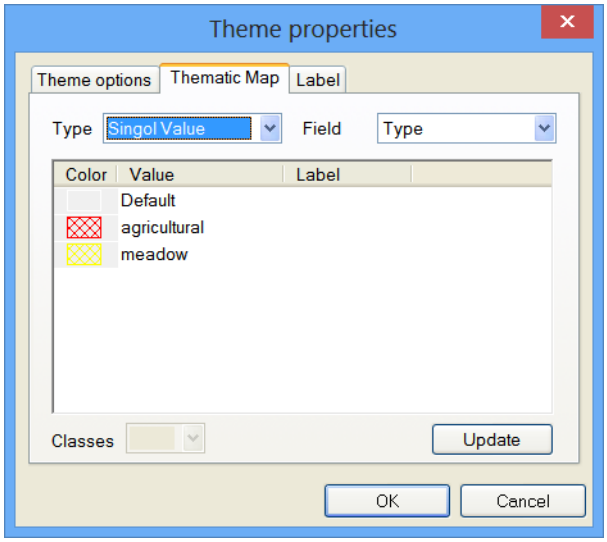



**Figure 370:**

# Delete entities

The **Delete entity** command in the GIS menu will bring up the selection mark to cancel one or more existing GIS entities.

Once the selection is completed, press the right button to confirm; a dialogue window will appear displaying the number of the canceled entities and requesting confirmation of the operation.

If there are points from the booklet associated with the graphic entity, they cannot be canceled.

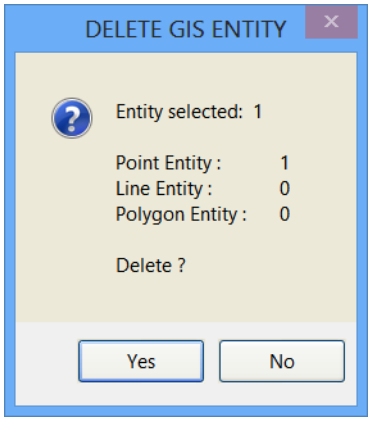



**Figure 371:**

# Edit entities

Use the **Edit entity** command from the **GIS** menu and the selection mark will appear, clicking in the graphic entity will bring up a dialogue window displaying the values of the fields associated with the entity.

The values can be changed directly in this window. To confirm the changes, press the **OK** button; at the same time, press the **Cancel** button and any changes made will be canceled.

If the entity is part of a theme for which a **Single Values** or **Interval** type thematic map has been defined and the changed field is the used in creating the thematic map, the appearance of the entity changes immediately according to the thematic map.

Displaying the properties of a GIS entity, the command will not terminate, thereby allowing the properties of other entities to be displayed. To terminate the command, the user must press the right button.

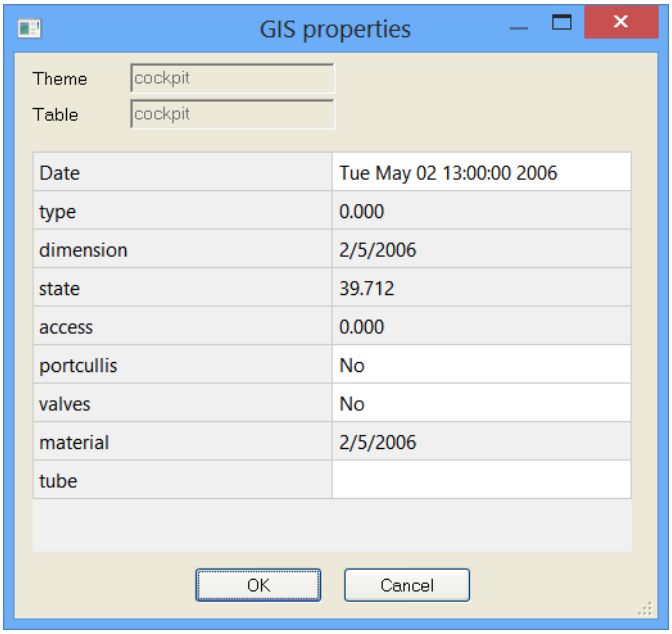



**Figure 372:**

# Query

This function is used to run a search on the GIS entities using the values of the fields associated to them.

Activating the command will bring up the following dialogue window:

In the upper left part the user can select the theme on which to run the query.

To run the search, the user must insert an expression into the **Query** tab text box.

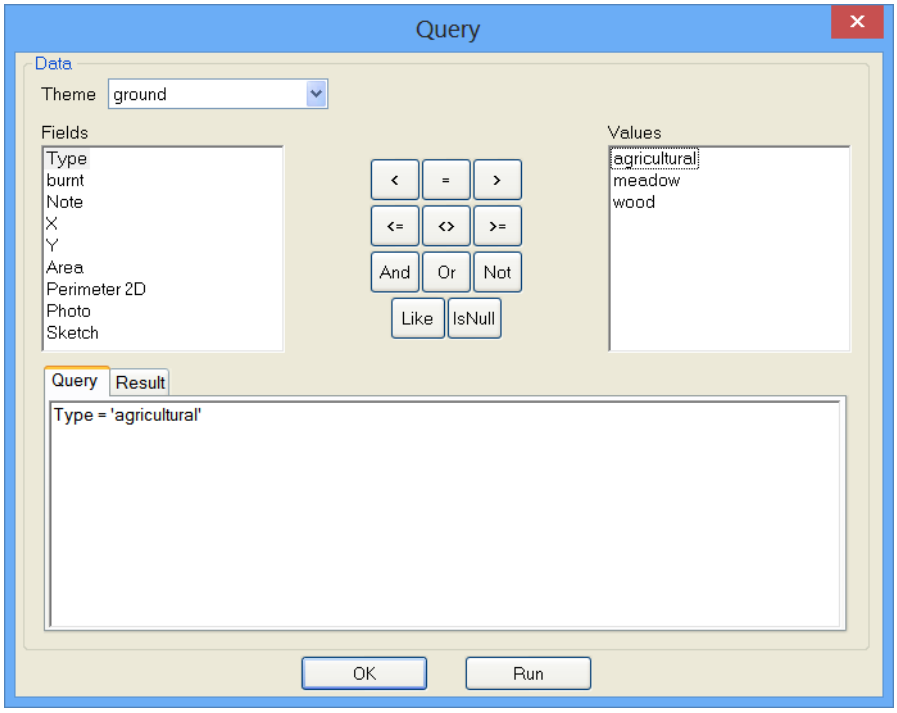



**Figure 373:**

The query can be edited directly in the **Query** box or as follows:

- Select the **Theme** item,
- Double click on an element from the **Fields** list,
- Select the operator,
- Double click on an element from the **Values** list,

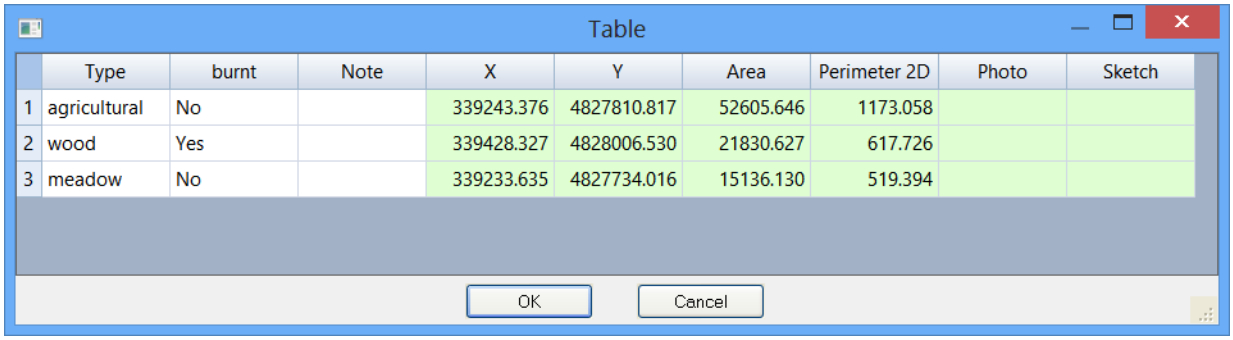



**Figure 374:**

Example - run a query on the **Terrain** table.

1.Select the **Ground** theme

2.Double click on the **Type** element in the **Fields** list

3.Press the [**=**] button

4.Double click on the **Agricultural** element in the **Values** list

By doing so, the expression **Type = 'Agricultural'** will appear in the text box of the **Query** page.

To run the search press the **Run** button. The program will consider all entities belonging to the selected theme and will list those for which the expression was found verified in the grid of the **Result** tab.

Selecting one line from the result, the program will center the view on the corresponding entity. To exit the window, press the **OK** button.

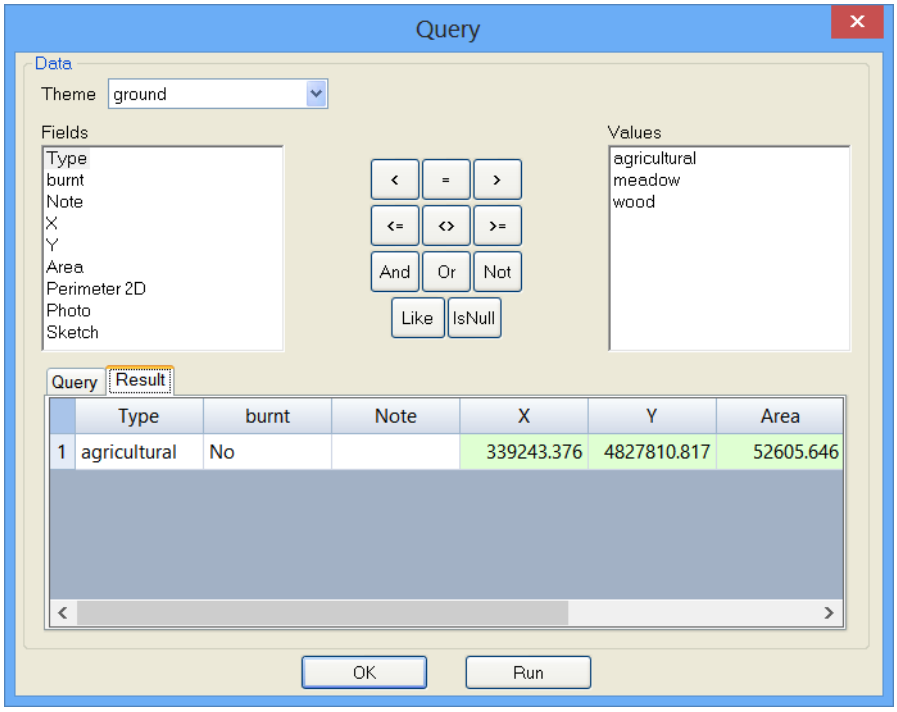



**Figure 375:**

# Export themes definition

This function is used to save the organization of the tables and the definition of the themes currently found in the project so as to be able to load them into a future project.

Once the command is activated, the program will display a dialogue window used to specify the folder in which to save the file with the definition of the themes and the tables.

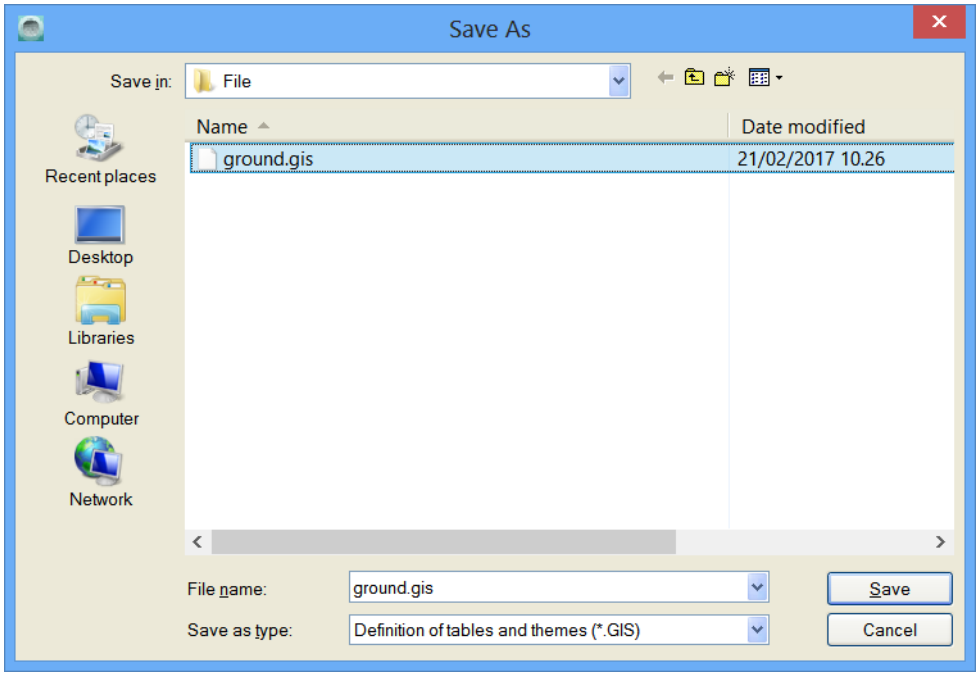



**Figure 376:**

# Export Shape files

This operation is used to export GIS .shp interchange files.

Activating the command will bring up the following window used to select:

- The themes to export;
- The type of 2D/3D coordinates to use in generating the files; From Theme means that it takes the type of coordinate selected during creation of the theme;
- The folder where the files are saved, for each selected theme, three files will be created with the same name as the theme but with different extensions: .shp, .dbf, .shx.

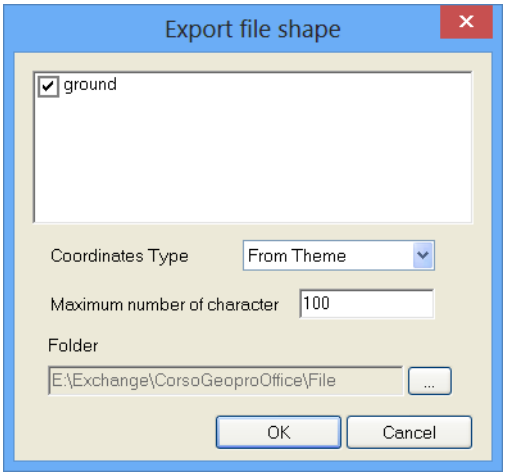



**Figure 377:**

# Associate GIS Data to Topographic Points

GIS data can be associated with topographic points by using the **GIS Data** page.

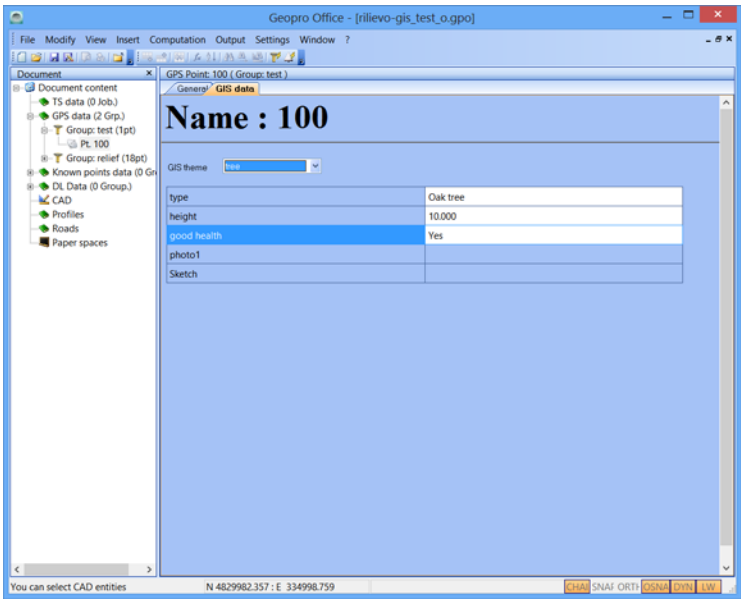



**Figure 378:**

Once the theme is selected, the user can insert its characteristics determining the addition of a line in the respective table (ex. tree).

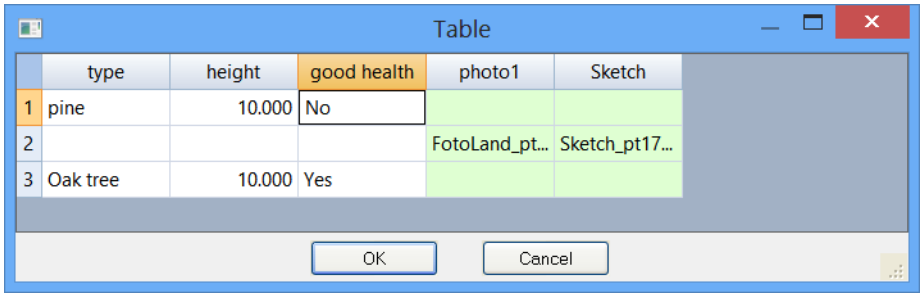



**Figure 379:**

If the topographic points are associated with GIS data, then the user can:

- With the option **Tree view active in CAD** from the **Display** menu, the user can select whether or not to activation the pan automatically to bring the entity selected from the tree into the center of the screen;

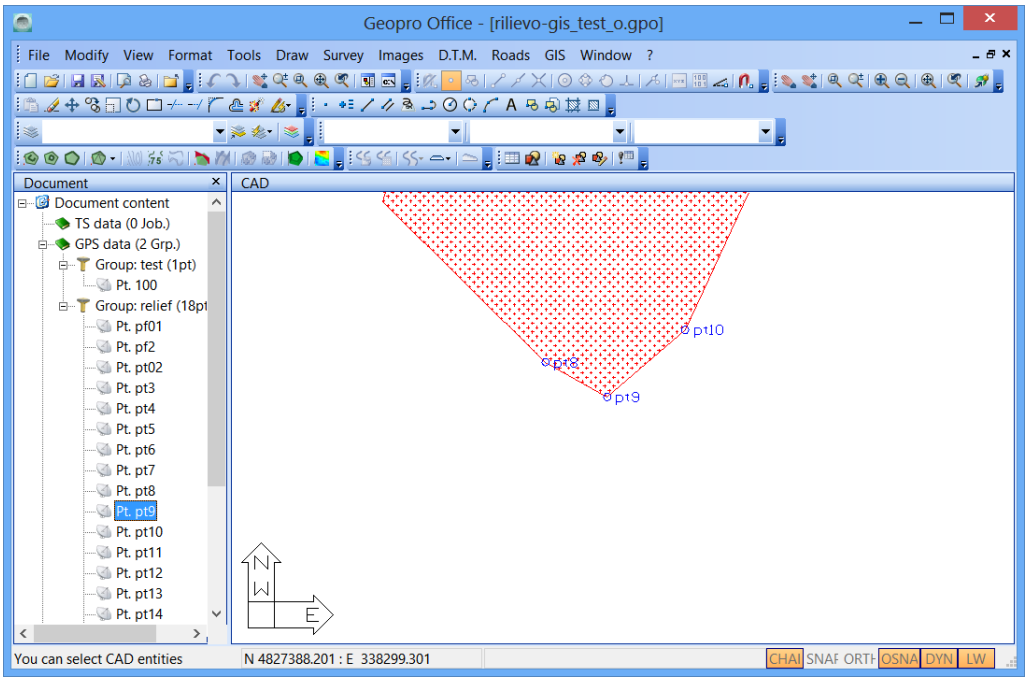



**Figure 380:**

- Export the GIS data from the ASCII file produced by the **File | Export | Free Format** command after having specified it with the **Print Options** command;

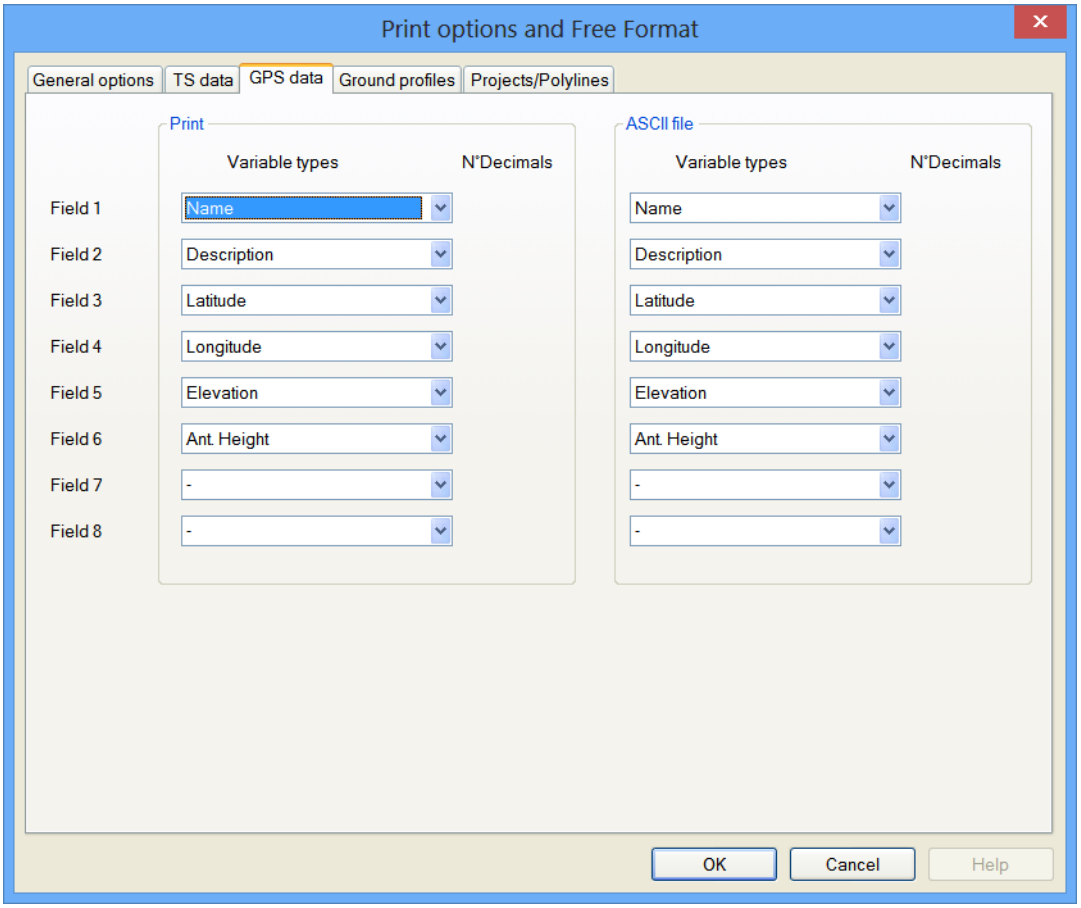



**Figure 381:**

- Manage the display of the thematic map for celerimetric, GPS and noted coordinate points using the **Entity appearance** command.

The user can decide:

– To not use the thematic map associated with the point (in this case it is displayed as a point to which no GIS information has been associated);

– To use only the color selected in the thematic map in representing the point;

– To use only the symbol selected in the thematic map in its representation;

– To use the color as well as the symbol selected in the thematic map in its representation.

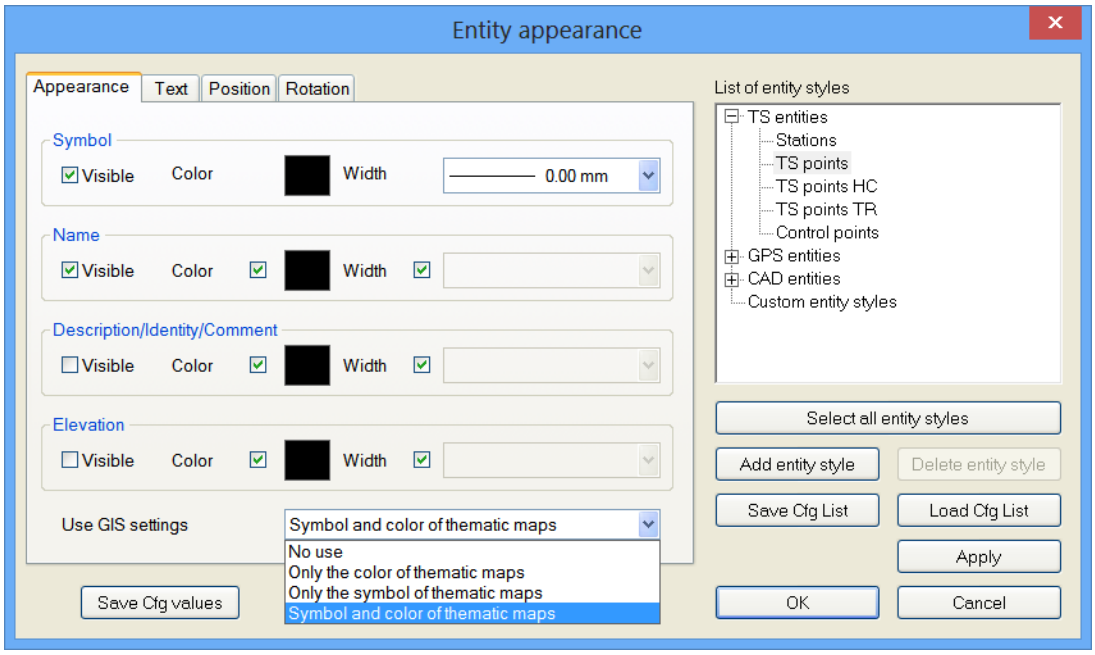



**Figure 382:**

# Example

In this example, a GPS survey was taken into consideration.

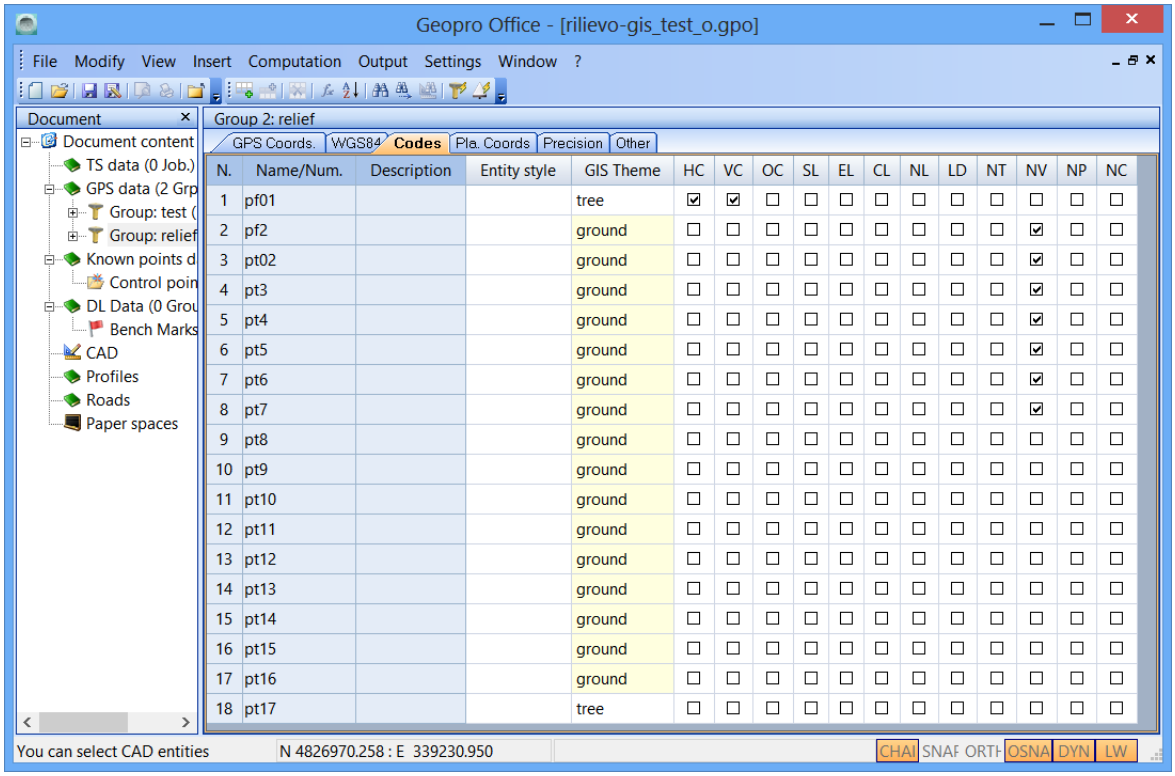



**Figure 383:**

In this case, the user selected to use the symbol and color of the thematic map.

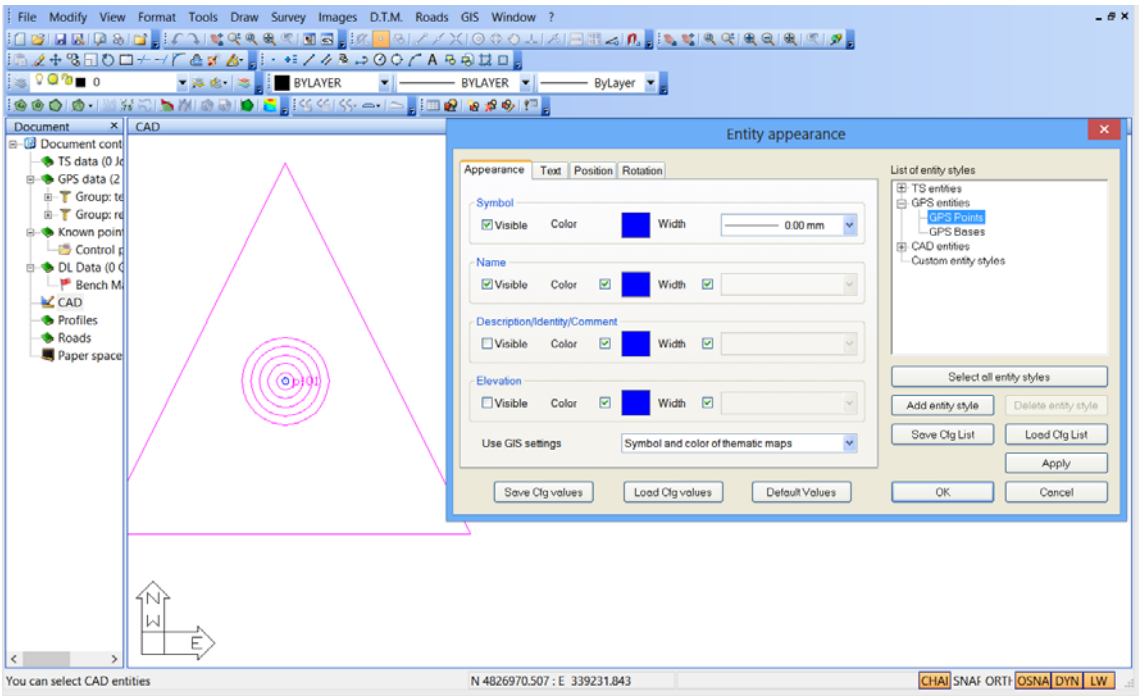



**Figure 384:**

In this case, the user selected to not use the thematic map.

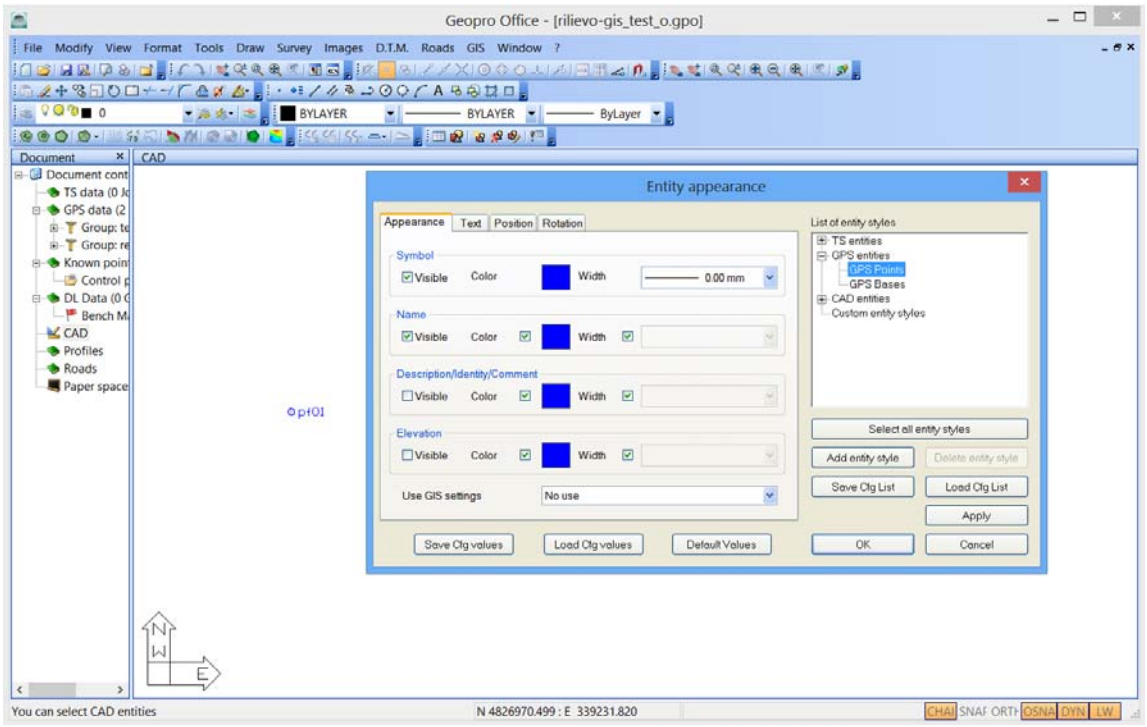



**Figure 385:**

# Roads view

## Introduction

Roads are planned using the CAD View and the Roads View; the Roads planimetry is done in the CAD View while the altimetric is done in the Roads View.

Roads are managed through codes associated upon creation: the Roads profile is always associated to the GND code.

Projects (max 10) and polylines can be inserted into the Roads profile and are identified also by codes; the first project inserted is considered with a particular code (PRO) as it is seen as the principal project.

Projects are different from polylines as they can have vertical curves inserted and cannot be loaded by dtm.

Roads can be divided into Road Cross Sections whose information is displayed either in CAD View or in the Roads Cross Sections View.

Also the Roads Cross Sections are managed by codes; the ground profile of a cross section has the GND code.

Only polylines can be added to the Roads Cross Sections and the user can create a grubbing, terracing or excavation.

The graphic display of the Roads and Roads Cross Sections in the Roads View can be customized using styles that can be used again in other projects.

## Profile Codes

Profile codes are managed using the **Profile Codes** command in the **Profile** menu of the **Altimetric View**.

Running the command will display the **Profile Codes** window divided into two pages: **Projects** and **Profile Polylines**.

The **Projects** page lists the codes associated with the projects (max 10); the **PRO** code is associated with the principal project; codes **PR2..PR10** are instead associated with the secondary projects that can be used for various purposes.

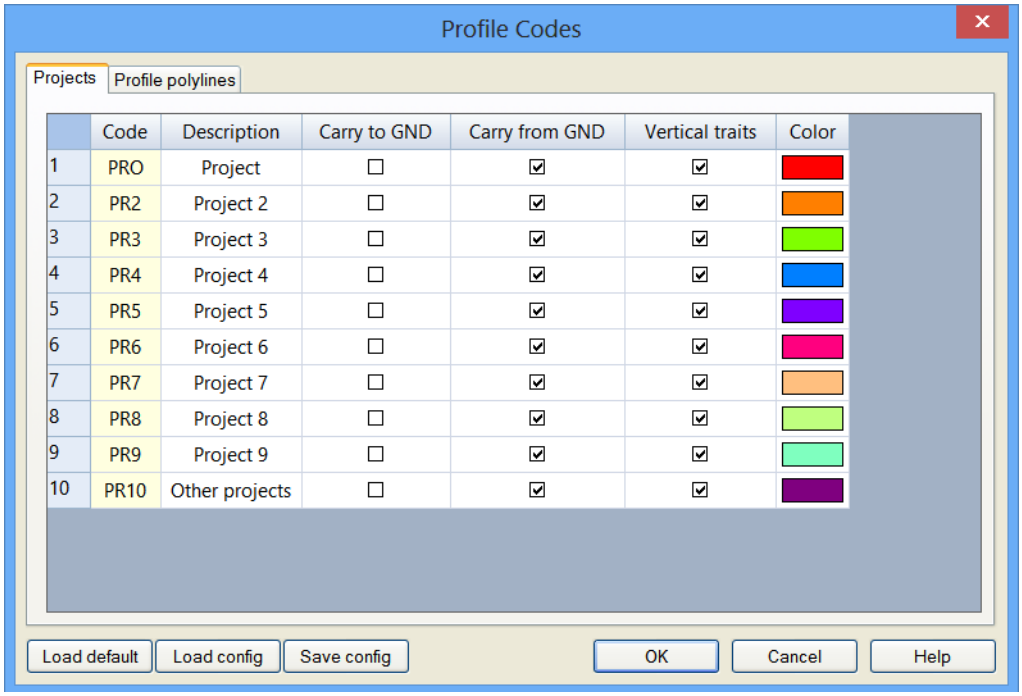



**Figure 386:**

The **Profile Polylines** page includes the code associated with the profile (GND) and the codes associated with the profile polylines (LN1, LN2, ... etc.). The following information is associated with the profile codes:

- **Description:** information found in the headings of the **Altimetric Data** view pages and the profile columns.
- **Carry to GND:** the selected altimetric profile points are added to the terrain
- **Carry from GND:** the terrain points and intersections (between the terrain and altimetric profile) are added to the selected altimetric profile.
- **Vertical traits:** to select whether or not to display the vertical traits of the profile/project/polyline in the profile's CAD View.
- **Color:** to select the color of the profile/project/polyline used in the graphic display.

Three buttons are included in the final part of the window:

1.**Load Default:** to load the default settings;

2.**Load Config:** to load the previously saved settings;

3.**Save Config:** to save the current settings and be able to reload them in another context.

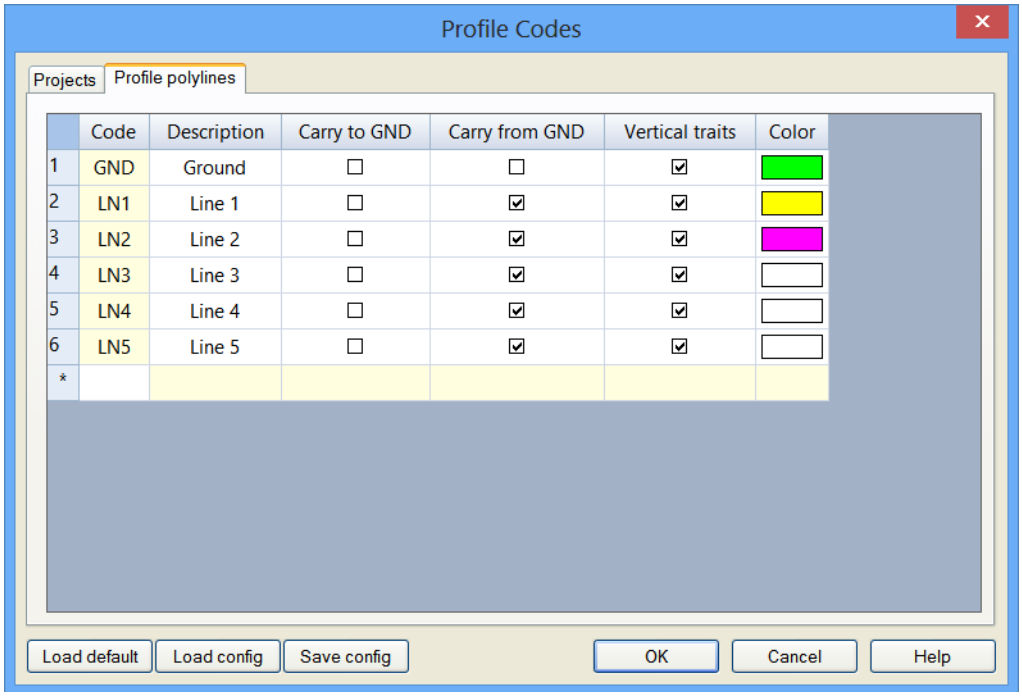



**Figure 387:**

# Cross Sections Codes

Cross Section codes must be managed using the **Cross Sections Codes** command in the **Cross Section** menu of the **Roads Cross Section's CAD View.**

Executing the command will open the **Set Volumes Calculation** window: the sections codes are found in the **Lines** page.

The GND code is associated with the cross section's terrain profile; the other codes are used for the profile polylines that can be added to the cross section.

The following information is associated with the sections codes:

- **Description:** information found in the headings of the **Section Data** view pages and the section columns.
- **Carry to GND:** the selected altimetric profile points are added to the terrain.
- **Carry from GND:** the terrain points and intersections (between the terrain and altimetric profile) are added to the selected altimetric profile.
- **Vertical Sections:** to select whether or not to display the vertical sections of the profile/project/polyline in the profile's graphic view.
- **Color:** to select the color of the profile/project/polyline used in the graphic display.
- **Planimetry:** to select whether to include the polyline in the calculation of the project layout; this option is functional only on road sections.

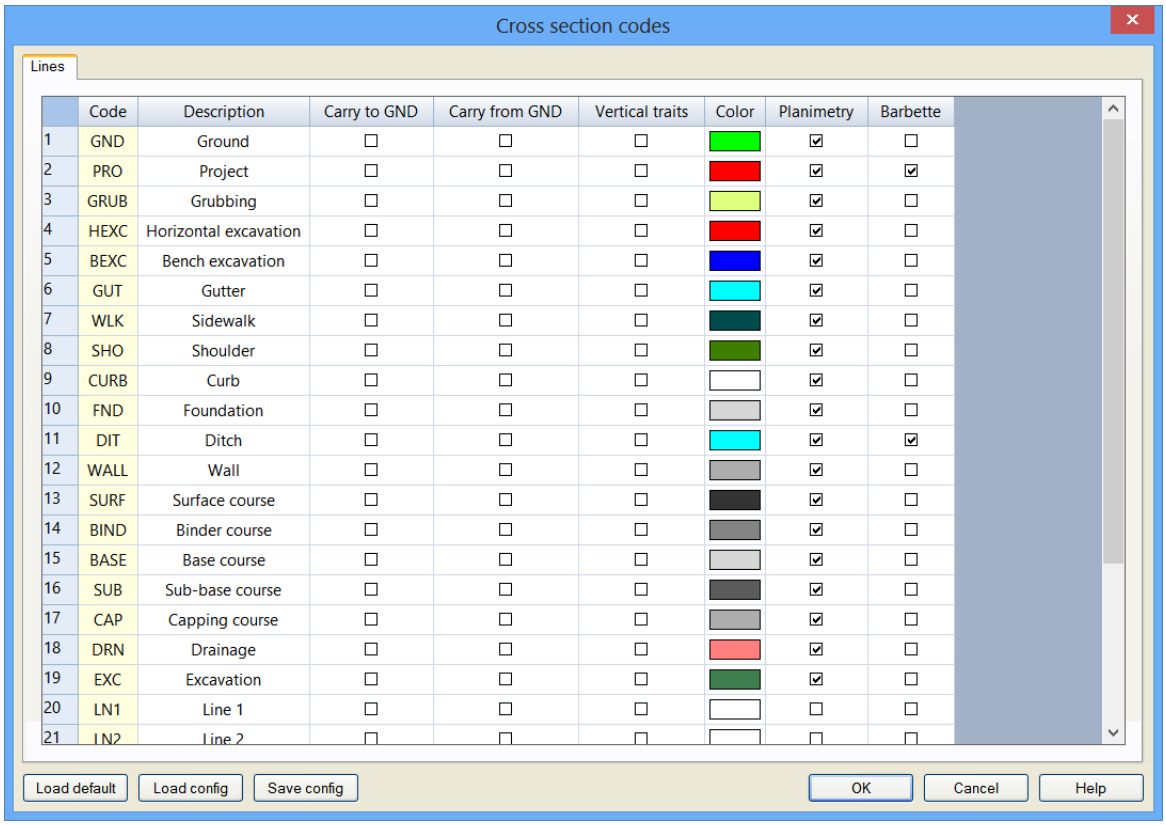
– **Barbette:** to select whether to include the slope line corresponding to this polyline in calculating the project layout; this option is functional only on road sections.

Three buttons are included in the final part of the window:

1.**Load Default:** to load the default settings;

2.**Load Config:** to load the previously saved settings;

3.**Save Config:** to save the current settings and be able to reload them in another context.




| | Code | Description | Carry to GND | Carry from GND | Vertical traits | Color | Planimetry | Barbette |
|---|---|---|---|---|---|---|---|---|
| 1 | GND | Ground | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 2 | PRO | Project | ☐ | ☐ | ☐ | | ☑ | ☑ |
| 3 | GRUB | Grubbing | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 4 | HEXC | Horizontal excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 5 | BEXC | Bench excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 6 | GUT | Gutter | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 7 | WLK | Sidewalk | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 8 | SHO | Shoulder | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 9 | CURB | Curb | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 10 | FND | Foundation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 11 | DIT | Ditch | ☐ | ☐ | ☐ | | ☑ | ☑ |
| 12 | WALL | Wall | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 13 | SURF | Surface course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 14 | BIND | Binder course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 15 | BASE | Base course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 16 | SUB | Sub-base course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 17 | CAP | Capping course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 18 | DRN | Drainage | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 19 | EXC | Excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 20 | LN1 | Line 1 | ☐ | ☐ | ☐ | | ☐ | ☐ |
| 21 | LN2 | Line 2 | ☐ | ☐ | ☐ | | ☐ | ☐ |

**Figure 388:**

# Roads View

The Roads View manages the Roads altimetric information similar to the Topographic Profiles method.

Select the **Roads** node to open the **Roads** view that lists the Roads created by the user.

Roads can be inserted only in the CAD View using the **Roads|Create New Road** command or by adding a **Road entity set** using the **Format|Entity set** command.

By default, the last Road inserted is set as **Current Road**. This means that all commands in the **Roads** menu of the CAD View will operate only on this Road. To change the Road status, use the **Roads|Set Current Road** or **Format|Entity sets** commands in the CAD View.

The information included in this view is as follows:

1.Name;

2.Tot. Distance;

3.Average elevation;

4.Minimum elevation;

5.Maximum elevation;

6.Current Road.

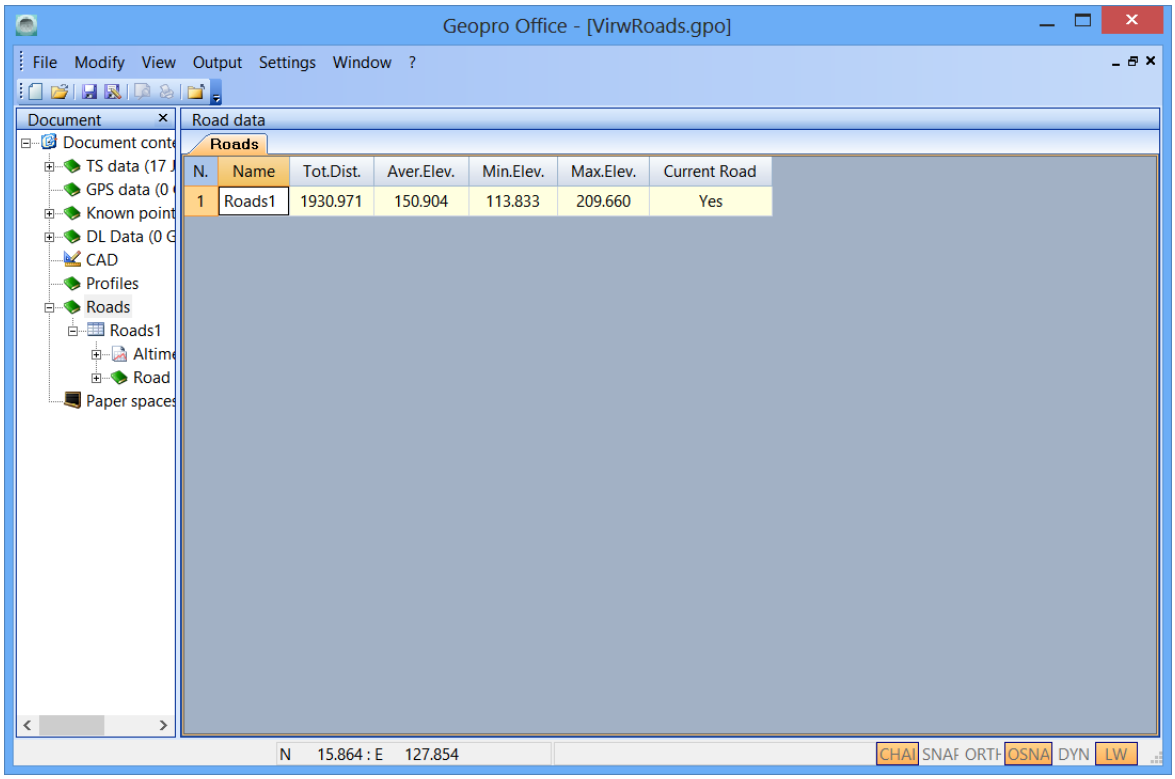



**Figure 389:**

If the node corresponding to the **Road Name** is selected (in our example P1, Road1), then the program will display a graphic preview of the Road planimetry.

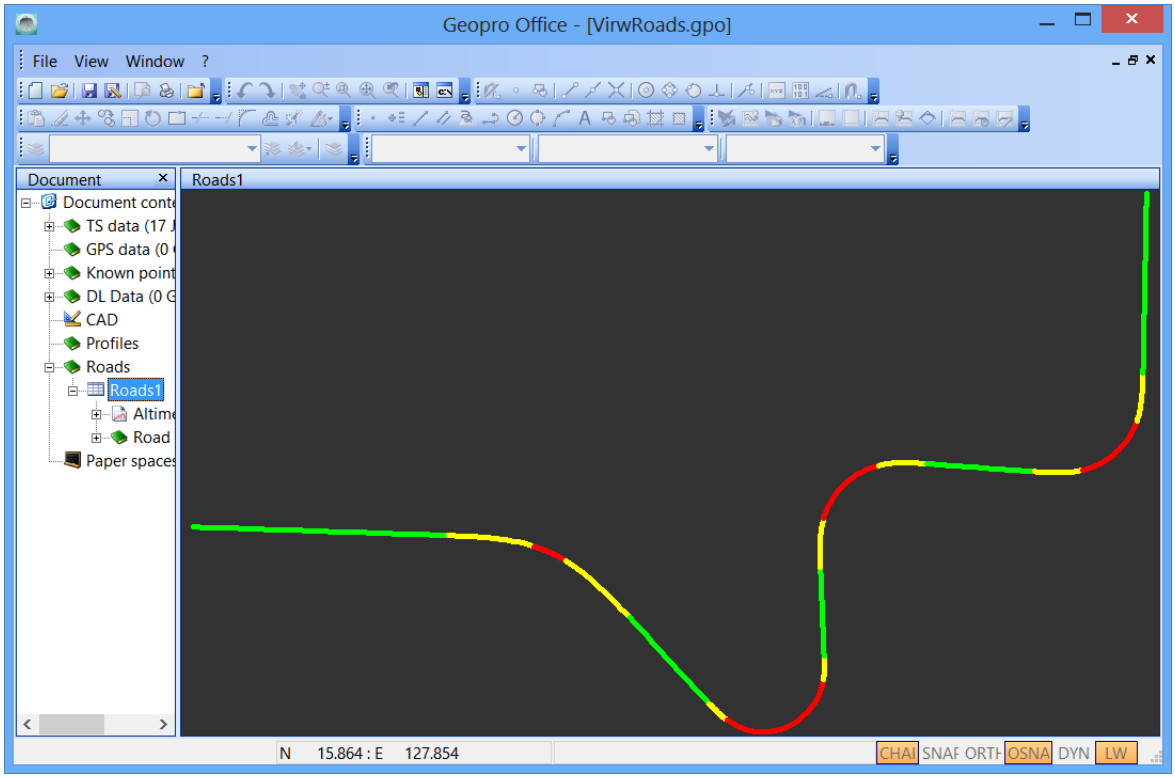



**Figure 390:**

Activating the Altimetric node, the program will graphically display the Road altimetry.

The road can be displayed in two ways: with box or as bar.

The image below shows the box method. The method used to display this graphic can be personalized using Styles managed through the **Format|Profile Styles**, **Format|Current Profile Style** and **Format|Set Profile Style** commands.

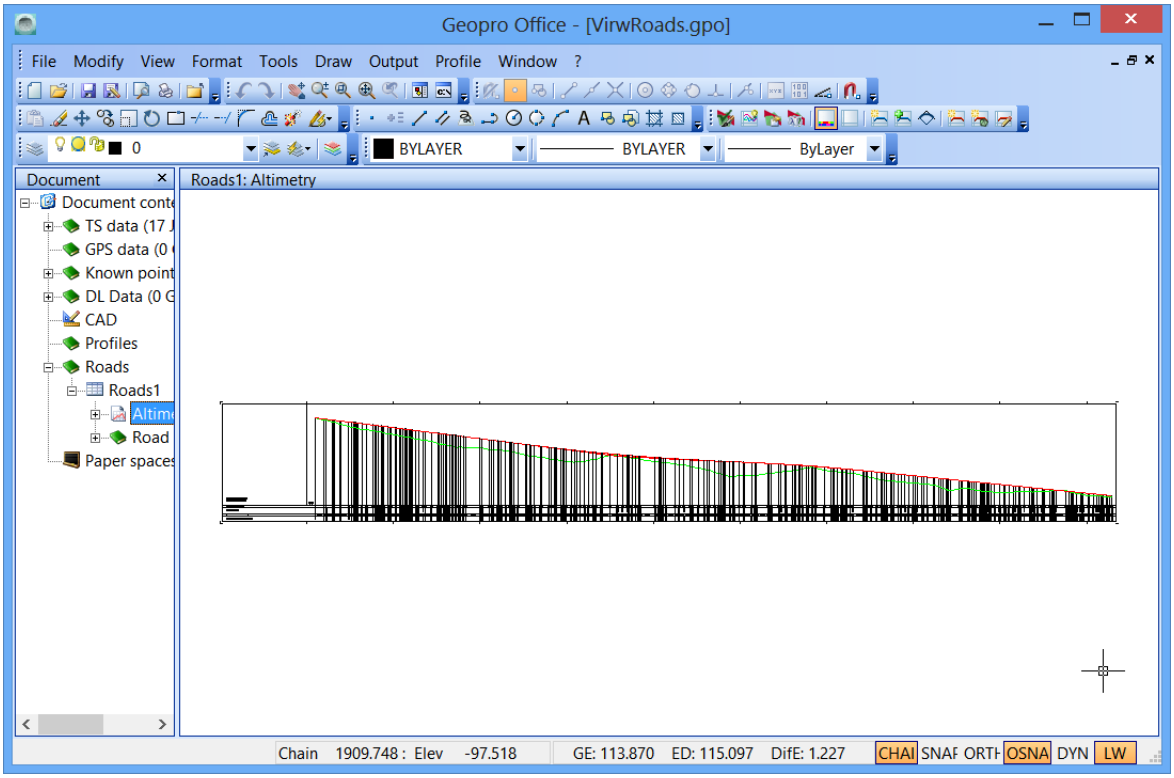



**Figure 391:**

This other image shows the bar method.

In this case, two bars are displayed under the graphic:

– The first shows the sequence of road planimetric elements with their respective length;

– The second shows the longitudinal slope and, if present, the radius length of the curve.

In the **Altimetric View** the user can add Projects and Polylines as well as manage the **Profile Codes**.

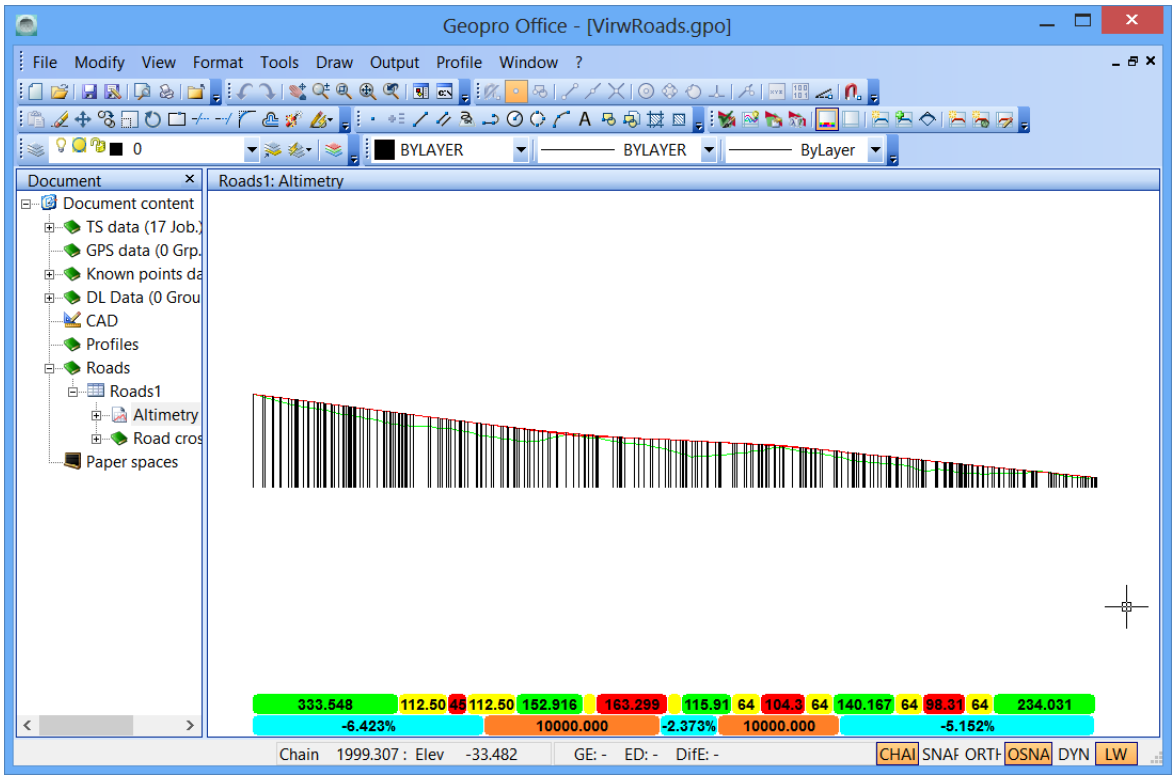



**Figure 392:**

In the **Altimetric Data** view, multiple pages may be included that show the numeric data associated with the Road altimetry. The first page will count the data associated with the ground profile (code GND) while additional pages may include information on the projects (code PRO, PR2, PR3... PR10) and/or on polylines (code LN1, LN2...). The heading on these pages shows the description that varies depending on the code that describes the entity reference (profile, polyline, project). This description can be changed using the **Profile|Profile Code** command.

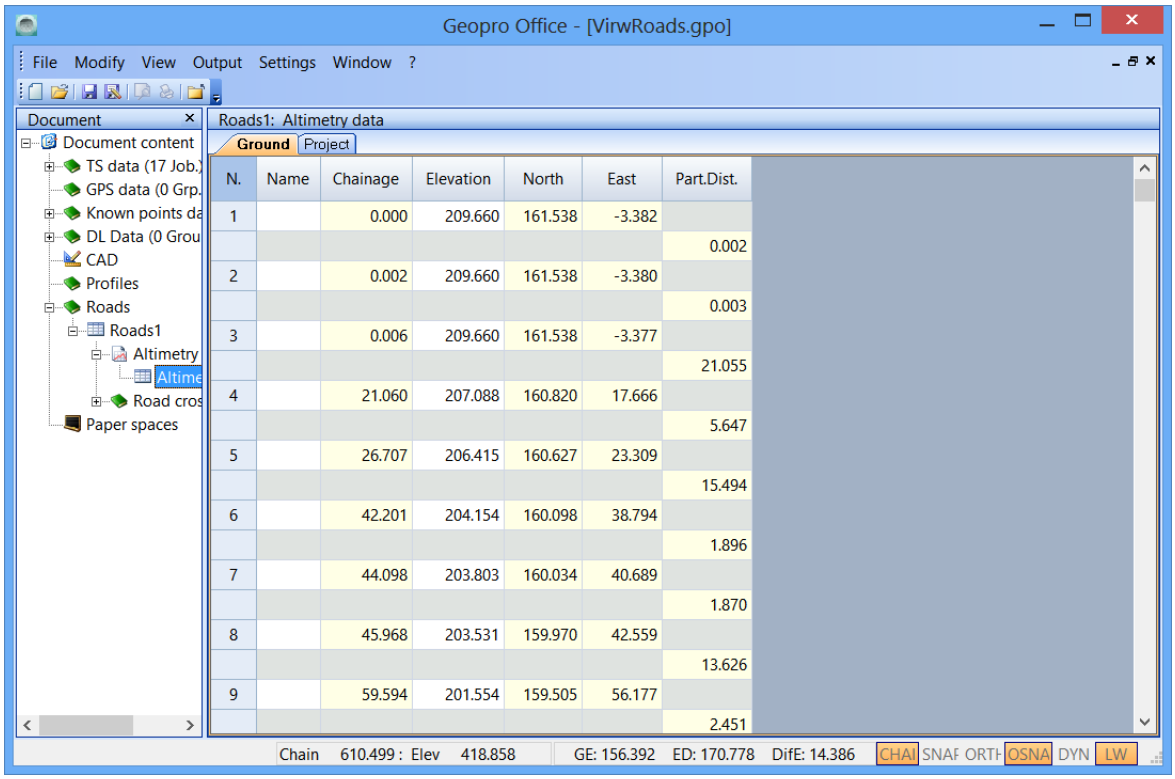



**Figure 393:**

The data included on the first page are:

1.Name (alpha-numeric);

2.Chainage (numeric).

3.Elevation (numeric).

4.North (numeric).

5.East (numeric).

6.Partial distance (numeric).

In the pages associated with the Projects and Polylines, the columns included are:

1.Name.

2.Chainage (numeric).

3.Elevation (numeric).

4.Elevation difference (numeric).

5.North (numeric).

6.East (numeric).

7.Partial distance (numeric).

8.Slope (numeric).

The Road Cross Sections of the road are listed in the **Roads Cross Sections** node.

The Roads Cross Sections can be added automatically (see **Roads | Road Properties** command) and manually (see **Roads | Cross Sections** menu in the CAD View).

The information shown in the **Roads Cross Sections** node is:

1.Name (alpha-numeric);

2.Chainage (numeric);

3.Width (numeric);

4.N. Points (numeric);

5.Average elevation (numeric).

6.Minimum elevation (numeric).

7.Maximum elevation (numeric).

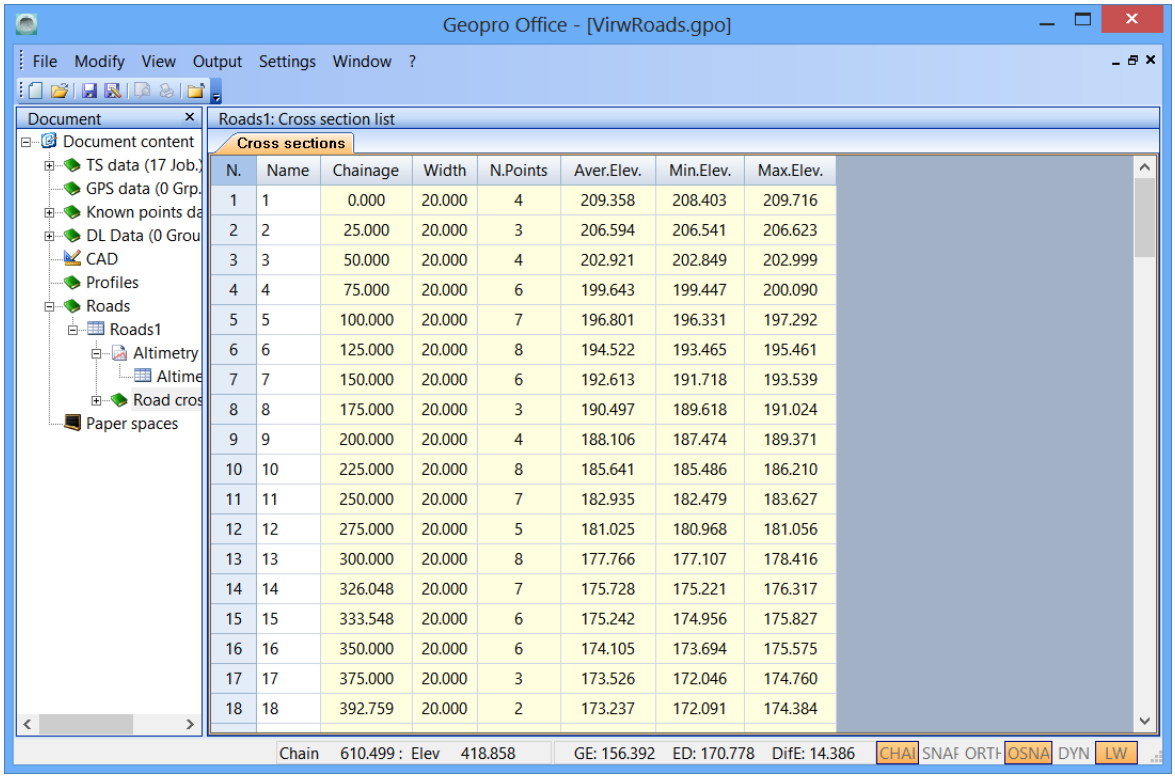



**Figure 394:**

Selecting the individual Road Cross Section, the program will display its graphic appearance which can also be customized using the styles managed through the **Format|Profile Styles**, **Format|Current Profile Style** and **Format|Set Profile Style** commands.

In the Roads Cross Section the user can add Polylines, create a new grubbing, horizontal and bench excavations, and manage the **Cross Section Codes**.

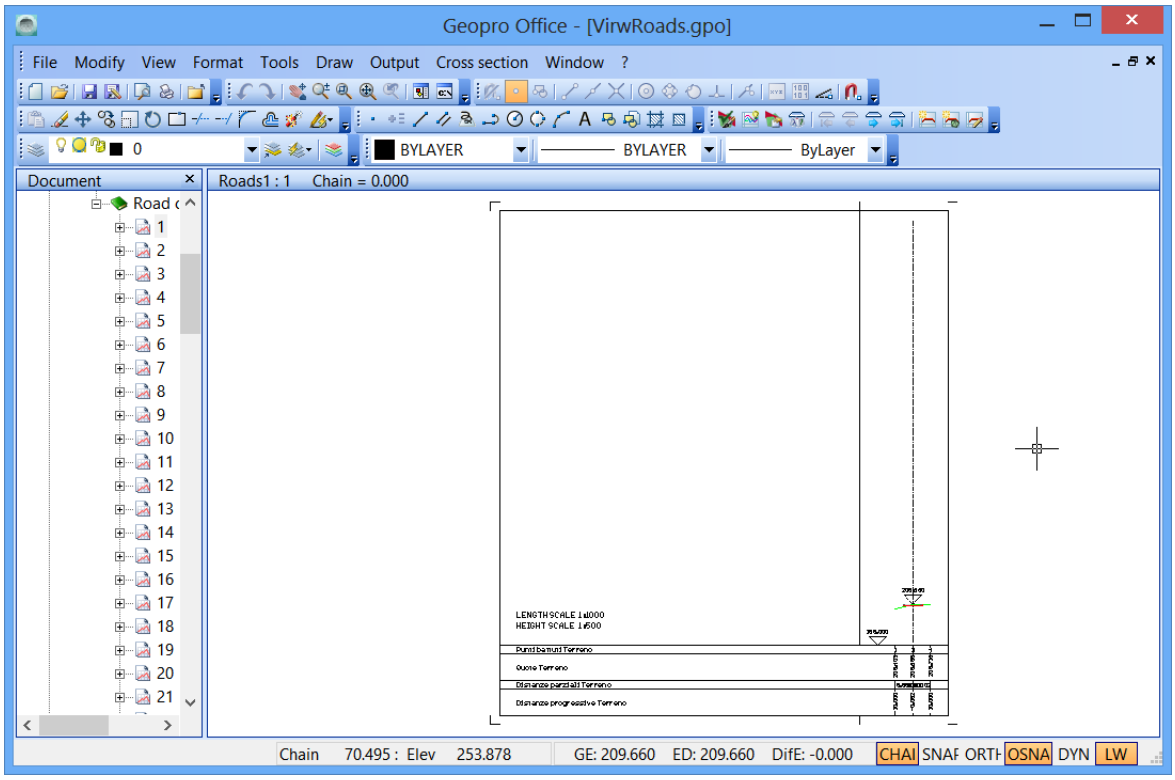



**Figure 395:**

The **Cross Section Data** view shows the numeric data associated with the cross section altimetry.

The view can include multiple pages whose heading can be changed using the **Cross Section Codes** command.

On the first page the cross section information is included (code GND) while the other pages show the information associated with any added polylines (code PRO, GRUB, HEXC...).

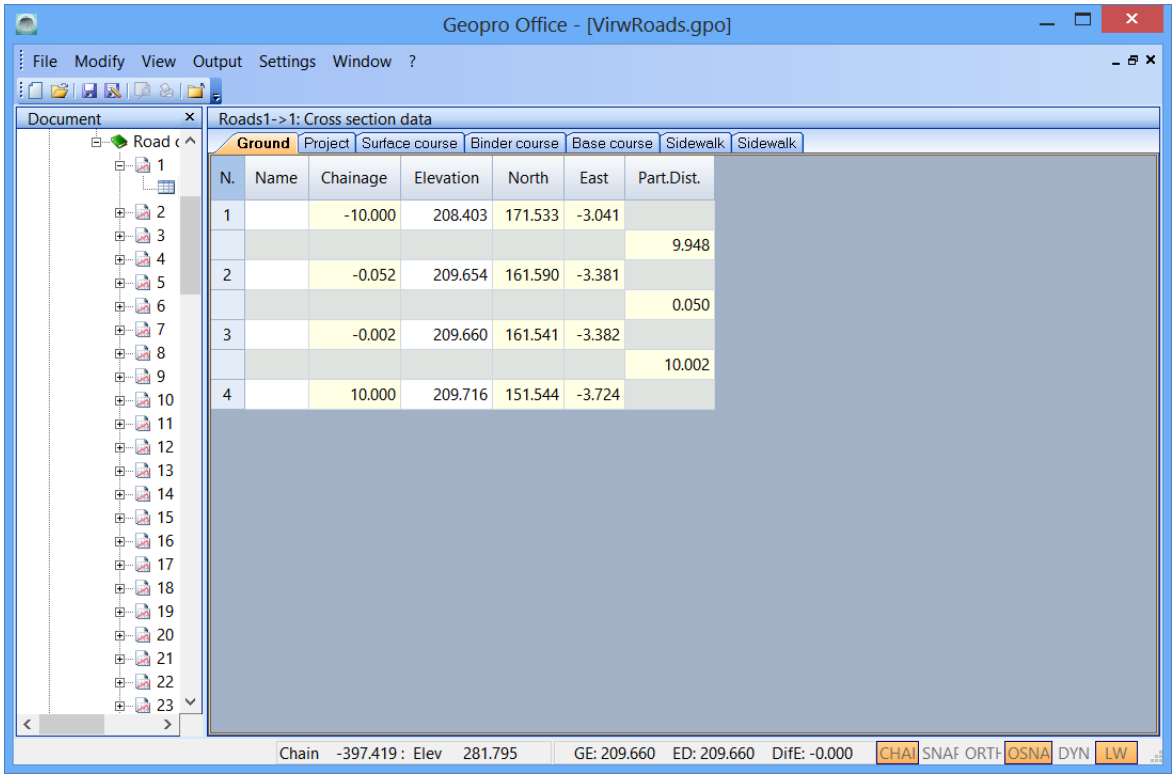



**Figure 396:**

The information included on the first page is as follows:

1.Name (alpha-numeric);

2.Chainage (numeric).

3.Elevation (numeric).

4.North (numeric).

5.East (numeric).

6.Partial distance (numeric).

In the pages associated with the Polylines, the columns included are:

1.Name.

2.Chainage (numeric).

3.Elevation (numeric).

4.Elevation difference (numeric).

5.North (numeric).

6.East (numeric).

7.Partial distance  (numeric).

8.Slope (numeric).

# Managing Profiles/Cross Sections Styles

The Roads and Roads Cross Sections styles are managed by the **Profile Style** command in the **Format** menu of the profile or cross section CAD View.

Execution of the command will open the **Profile Style** window.

This window is used to manage the profile and sections styles in the **Project (current file)** as well as **Archive (computer)**; the styles stored in the archive can be reused in other projects.

The following commands are available in the window:

- **Properties:** this command displays the **Edit Profile Style** window and allows the user to change the characteristics of the selected style (style name, dimensions, first page text, columns, texts and colors). The **Edit Profile Style** window is described in the following paragraph as it is similar to the one displayed by the **Current Profile Style** command (Format menu in the profile or cross section CAD View).

- **Add:** to add a new profile or cross section style in the **Project (current file)** or **Archive (computer)**;

- **Delete:** to eliminate a selected style;

- **Set Current:** to set the style selected as the default style for profiles or sections to be created;

- **Save in Archive:** to store a **Project (current file)** style in the **Archive (computer)**;

- **Load from Archive:** to reload a project style beginning from its version stored in the archive;

- **Import in Project:** to import a project from the **Archive (computer)** to the **Project (current file)**.

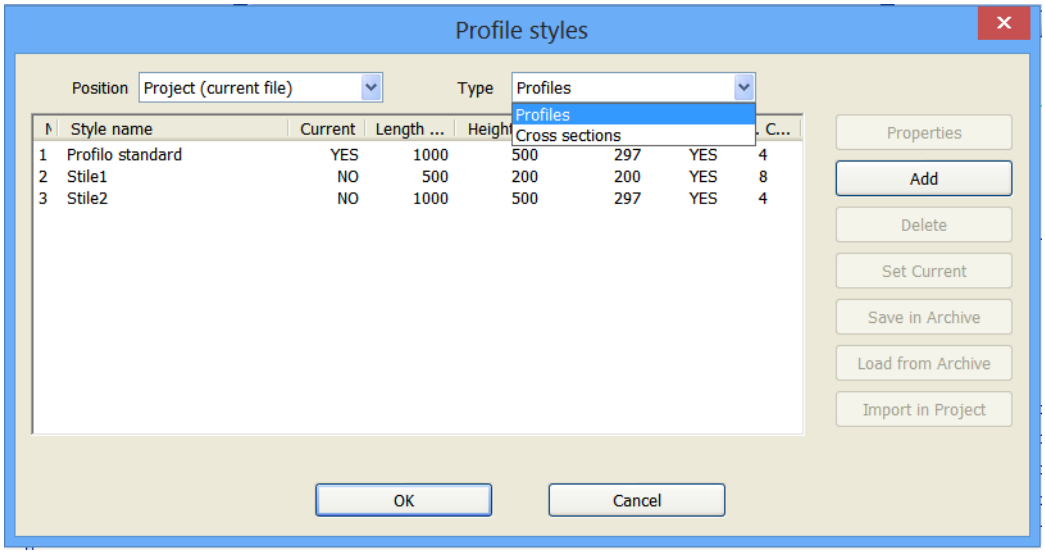



**Figure 397:**

# Changing Current Profile/Cross Section Style

The **Current Profile Style** command is used to change the characteristics of the style associated with a road or road cross section.

When a road or road sections are created from the CAD View, the program assigns the default style; this association can be changed using the **Format|Current Profile Style** command that can be activated from the Altimetric View as well as the road cross section CAD View.

The **Edit Profile Style** window includes six pages.

The **General** page is used to change the name of the current style.

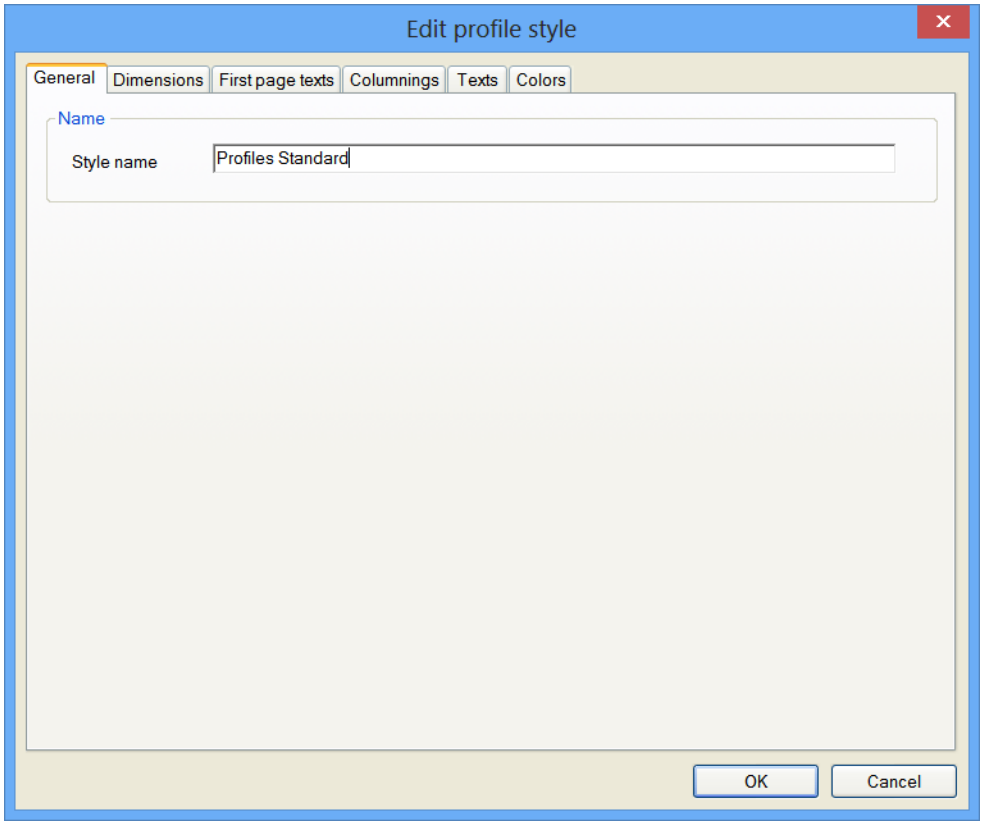



**Figure 398:**

The **Dimensions** page is used to edit the following information: scale used for length and height.

- Whether or not to design the initial page. If this option is set at Yes, the dimensions of the first page can be specified. The horizontal dimensions of the design are instead determined automatically by the presence of the initial page, the scale of the lengths and the interval of the progressive distances to design;
- The vertical dimensions of the sheet for the design;
- The value of the design's external margins;
- The value of the margins between the profile design and the surrounding frame;
- The value of the margins to apply to the text found on the first page and the headings on the columns;
- Whether or not to design some lines helpful for folding the final design. If affirmative, then their dimensions and intervals can be changed. It must be noted that horizontal fold lines are intended as those used to horizontally fold the sheet and will be marked in this direction;
- The length of the sections highlighting the Profile component points, any Projects/Polylines and Particular Points designed by the Add Particular Point command activated through the Project menu as well as the Profile Polylines menu. To avoid them set the associated field at 0. To trace a continuous line from the Profile or from the Projects/Polylines to the design base, insert a very high value into these fields (for example 1000);

- The dimensions of the symbol indicate the reference quote and its movement compared to the initial point. It must be noted that for each quote jump, one of these symbols will be designed, and will be moved, compared to the point where this jump occurs, from the quantity specified by means of this procedure.

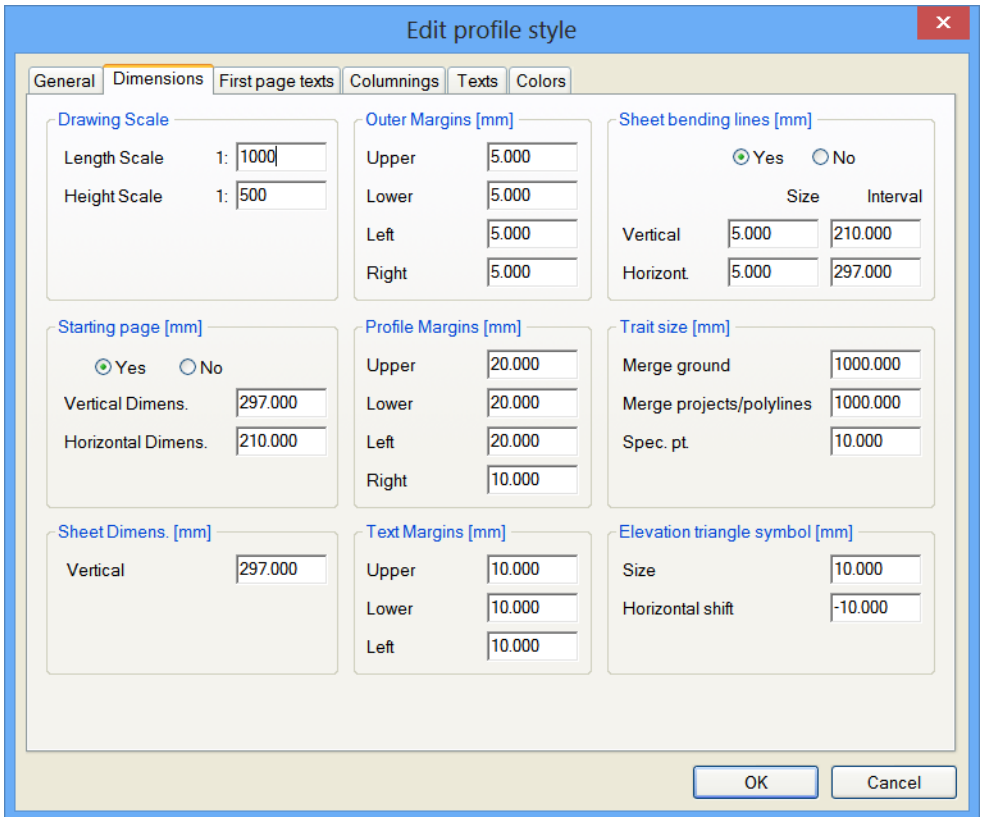



**Figure 399:**

The **First Page Texts** page is used to select which fields to input onto the initial page and the number of decimals used to view the values. The upper part of the tab includes a list of the texts and their characteristics.

The order of the texts can be changed using the **Down** and **Up** buttons. The **Insert** and **Add** buttons, respectively, add a text before or after the one currently selected.

The **Delete** button will remove the selected text from the list. To change the characteristics of a text, select it and then intervene in the fields available in the lower part of the tab:

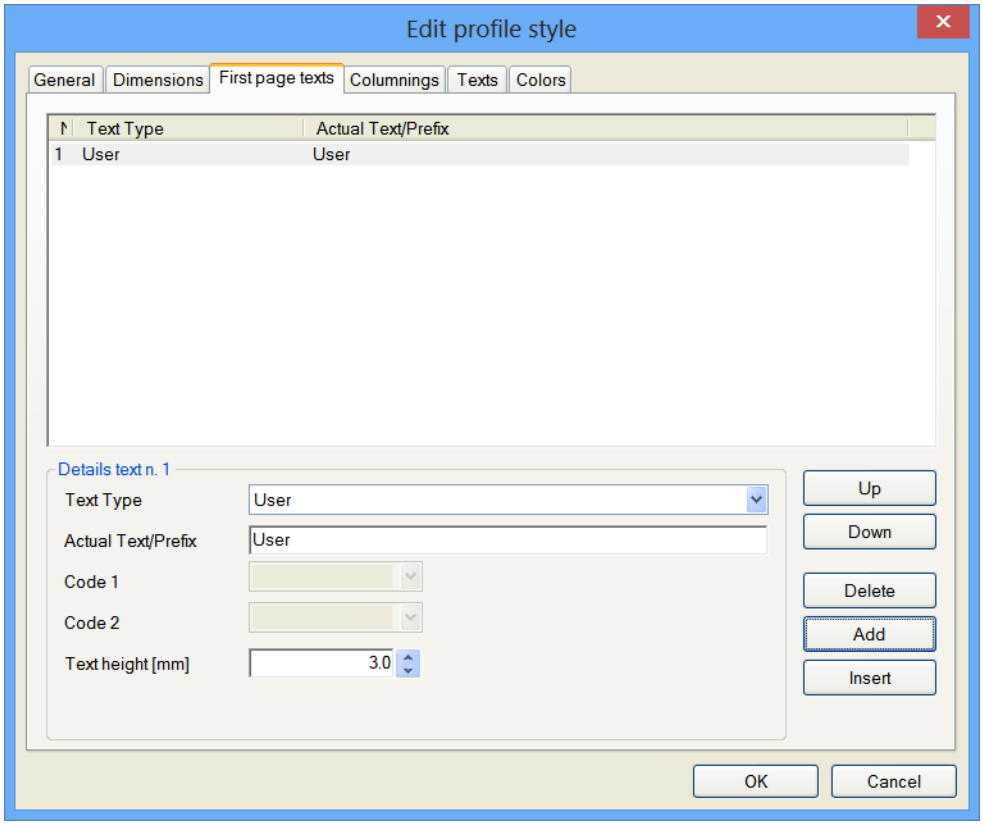



**Figure 400:**

**Text Type:** this specifies the type of text to view.

The types of text available are:

- User - to write a note at the user's discretion.
- Cross Section - to view the name of the profile/cross section.
- Road - to view the name of the road.
- Chainage - to view the progression of the cross section.
- Project Elevation - to view the quote of the selected project at progression 0.
- Previous Chainage - to view the progression of the previous cross section.
- Subsequent Chainage - to view the progression of the subsequent cross section.
- Cut Area - to view the total amount of the excavation area between the terrain profile and the project profile.
- Fill Area - to view the total amount of the fill area between the terrain profile and the project profile.
- Cut Area Between Projects - to view the total amount of the excavation area between two project profiles.

- Fill Area Between Projects - to view the total amount of the fill area between two project profiles.
- Computable Sections Area - this is used to list the areas and developments of the elements found in the cross section.

**Actual Text/ Prefix:** identifies the text that describes the text.

**Code 1:** this is activated only for those types of text that refer to a project

**Code 2:** this is activated only for texts **Excavation/Fill Area Between Projects**.

**Text Height:** this identifies the height of the written text to be inserted.

The **Columnings** page is used to identify which fields to include in the columnings, their dimensions in millimeters and whether to position the columnings below or above.

The upper part of the tab includes a list of the added columnings and their characteristics.

The order of the columings can be changed using the **Down** and **Up** buttons.

The **Insert** and **Add** buttons, respectively, add a new columning to the list before or after the one currently selected; the **Delete** button will cancel the selected columning from the list.

To change the characteristics of a columning, select it and then modify the fields present in the lower part of the tab:

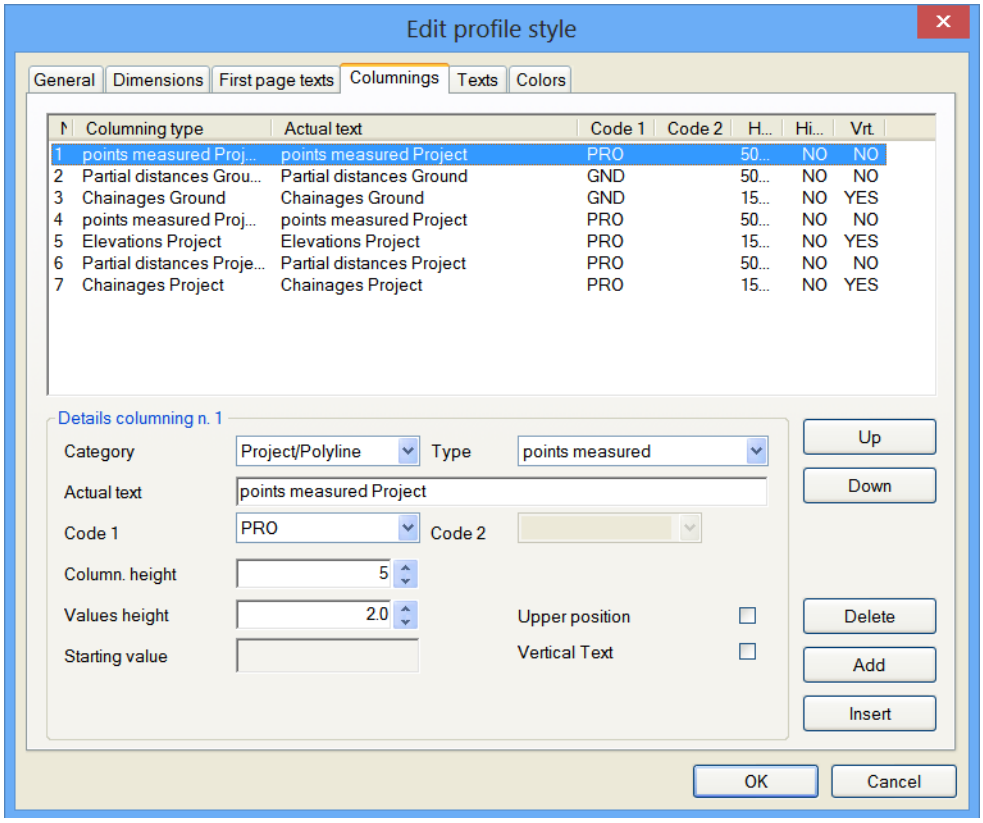



**Figure 401:**

- **Category** - to specify to which category of Columnings the one selected belongs. There are 4 types of categories available: ground, project/polyline, road/profile, additional texts.
- **Code 1:** this is activated only for those types of text that refer to a project
- **Code 2:** this is activated only for texts **Cut/Fill Area Between Projects**.
- **Type** - this list depends on the category selected:

  – If the category selected for the columning is ground, then the list of columning types includes:

    – Points measured,

    – Elevations,

    – Partial distances,

    – Chainage,

    – Point name,

    – Partial inclined distances,

    – Total inclined distances,

- If the category selected for the columning is project/polylines, then the list of columning types includes:
  - Points measured,
  - Elevations,
  - Partial distances,
  - Chainage,
  - Difference in level
  - Horizontal partial distances
  - Sloped partial distances
  - Elevation differences
  - Slope %
  - Slope variation.
  - Area
  - Elem. Area Prev. Sec.
  - Elem. Area Next Sec.
  - Area between projects.
- If the category selected for the columning is road/profile, then the list of columning types includes:
  - Hectometer dist. type 1,
  - Hectometer dist. type 2,
  - Kilometer dist. type 1,
  - Kilometer dist. type 2,
  - Planim. variation angle,
  - Horizontal alignment,
  - Edge course,
  - Partial distance cross sections,
  - Chainages and cross sections,
  - Cross section elevations.

  - If the category selected for the columning is additional text, then the list of columning types includes:
    - Part. Select. distance,
    - Changeable text no. 1,
    - Changeable text no. 2,
    - Changeable text no. 3,
    - Changeable text no. 4,
    - Changeable text no. 5,
    - Changeable text no. 6,
    - Changeable text no. 7,
    - Changeable text no. 8,
    - Changeable text no. 9,
    - Changeable text no. 10.

- **Actual Text** - this edit field is automatically set once the Category and Columning Type are selected and includes the text that will appear in the design.
- **Text Height** - to specify the height of the columning in mm.
- **Upper Position** - This is a check box that will activate to move the Columning into the upper part of the design. The only exception is represented by the Elevation difference Columning (project/polylines category). In this case, by selecting Above, the text is placed immediately above the project.
- **Vertical Text** - selecting this check box activates the print text of the columning vertically, otherwise it is printed horizontally.

The **Texts** page, activated through the **Texts** menu, is divided into sections.

The **Texts Style and Dimensions** section is used to change the dimension of the various texts included in the design.

The **Columning Identifiers** section is also used to determine whether or not to design the texts that identify the various columns.

In the **Texts in Intervals if Too large** the user can execute operations on the texts placed within the intervals if they are too big.

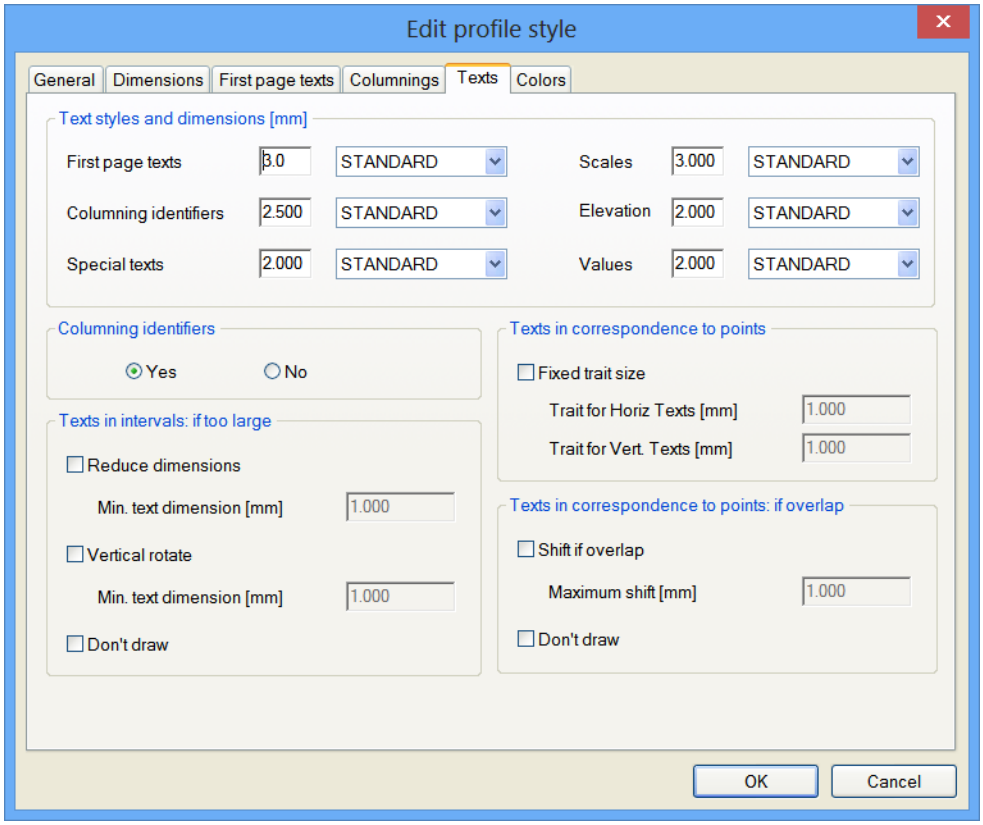



**Figure 402:**

Finally, in the **Texts in correspondence to Points** section the user can associate the dimensions of the text sections horizontally as well as vertically to texts that correspond to points. When the texts corresponding to points are overlaid, the user can select whether or not to design them telling the program the maximum dimension of the move.

The **Colors** page, accessed through the **Elements Colors** menu is used to change the colors of the various elements found in the design:

- Profile box;
- Merge traits;
- Other lines;
- First page text;
- Columning text

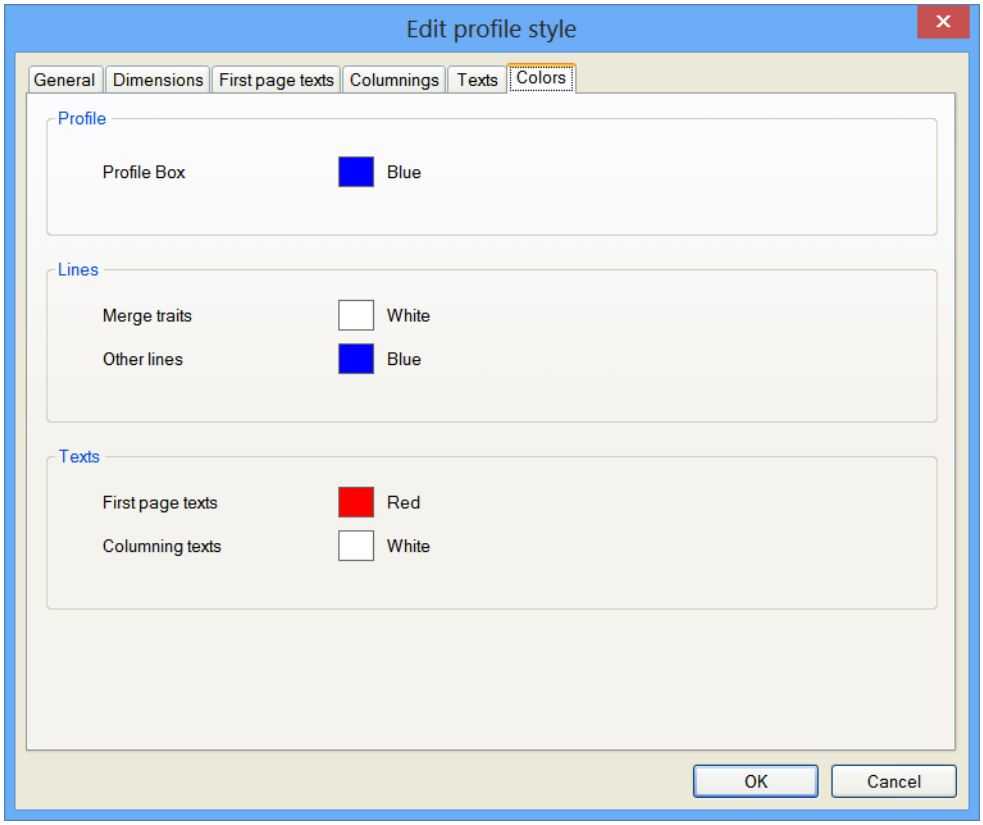



**Figure 403:**

# Assigning Profile/Cross Section Style

The **Set Profile Style** command found in the **Format** menu of the **Altimetric CAD View** or the **Roads Cross Section CAD View** is used to assign a new style to a road or its cross section.

Execution of the command will open the **Assign Style** window where the user can select the profile and associate its style using a specific drop down menu.

The style can be associated with multiple profiles/sections.

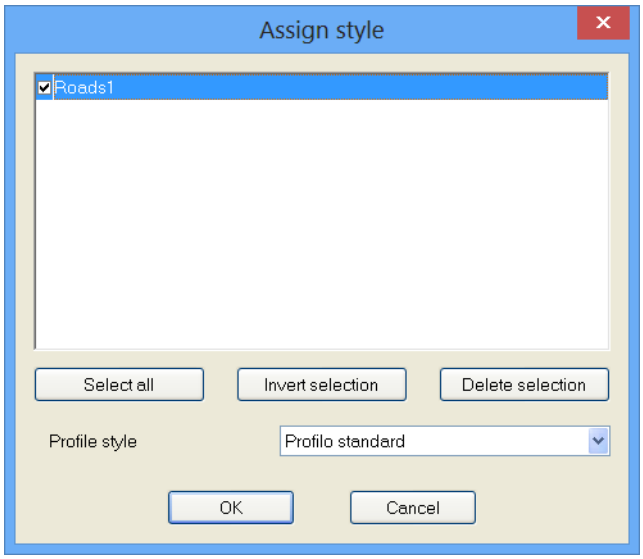



**Figure 404:**

# Profile/Cross Section Properties

This command is used to change the properties of a road or its cross sections:

- The name;
- The style;
- The initial reference elevation (or minimum elevation) calculated by the program;
- The minimum progressive distance (initially set at 0) and the maximum, so as to display only one part of the Profile.

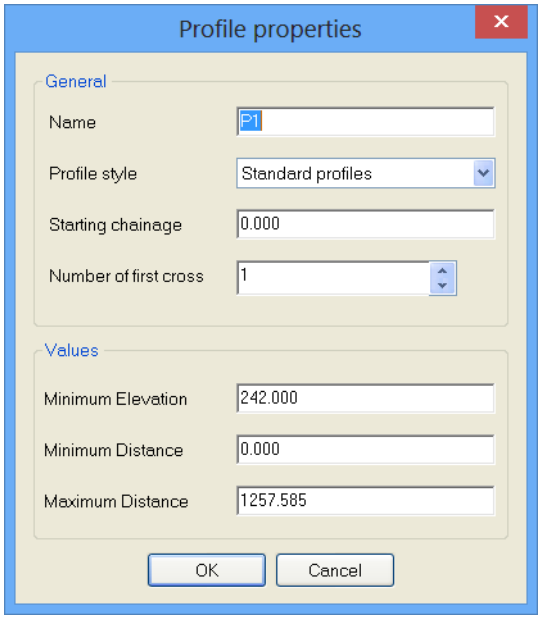



**Figure 405:**

# Project Management

Inserting a project in a Road profile can be done in the view corresponding to the profile, using the **New** command in the **Profile|Projects** menu.

Executing the command will open the **Draw project profile** window that initially shows the code associated with the project (see Profile codes).

Use this window to select the type of project to create and which method to use to create it.

Selecting the type of project can be done with the following possibilities:

1)By graphic points: continue the same way as in designing a polyline; although, after identifying each vertex confirmation will appear for the progressive distance and the quote of the created point;

2)By edited points: for each section of the project there will be a window used to insert the progressive distance and the initial and final quotes of the section in question;

3)Starting point + slope; for each section, the user must insert the progressive distance, initial quote, horizontal length and slope of the section itself;

4)Ending point + slope; for each section, the user must insert the progressive distance, final quote, horizontal length and slope of the section itself;

5)Fixed elevation difference: the user must insert the values of the initial and final progressive distances and a fixed value for the drop. The distance values are preset to those for the entire profile.

The possible selections for the type of design are:

1.Single line: the project will be made of a continuous simple line;

2.With thickness: this must be edited in the specific thickness to be assigned to the project line being created;

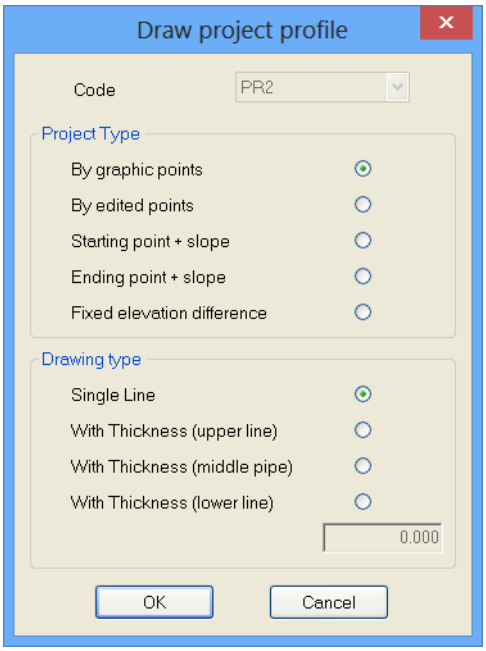



**Figure 406:**

Here following are the images for inserting the project.

Insert Project by graphic points.

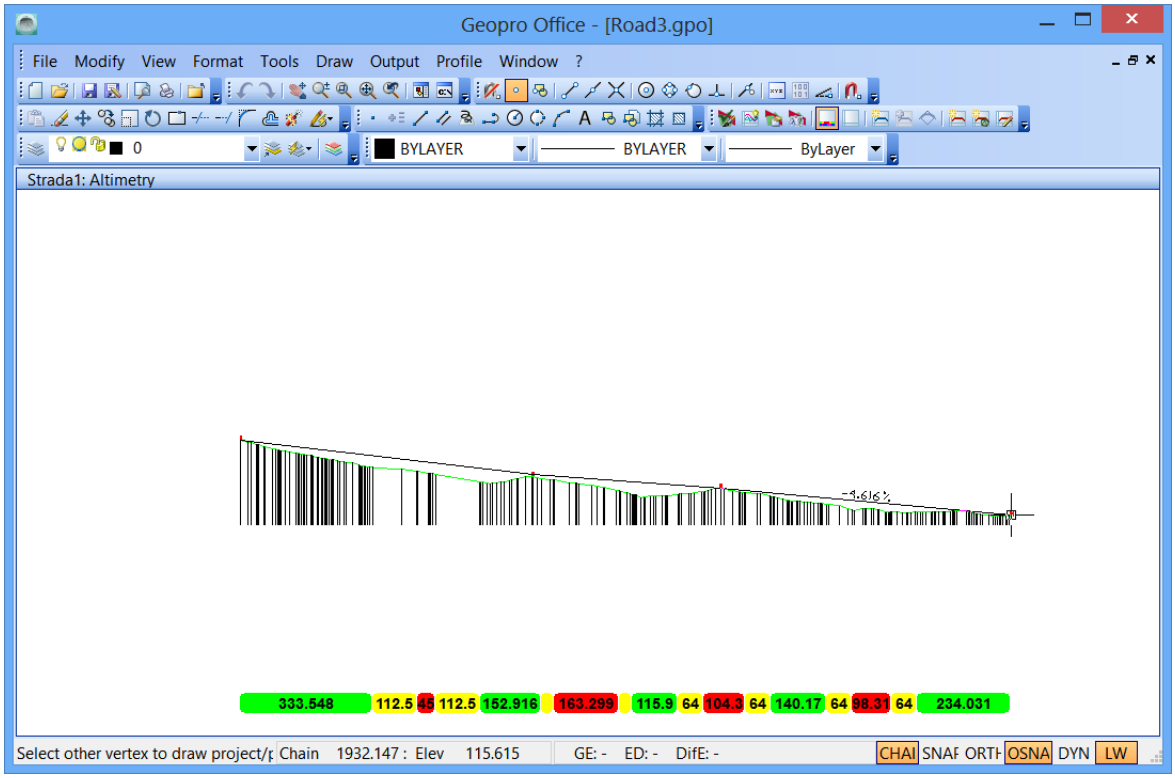



**Figure 407:**

Complete Insert Project by graphic points.

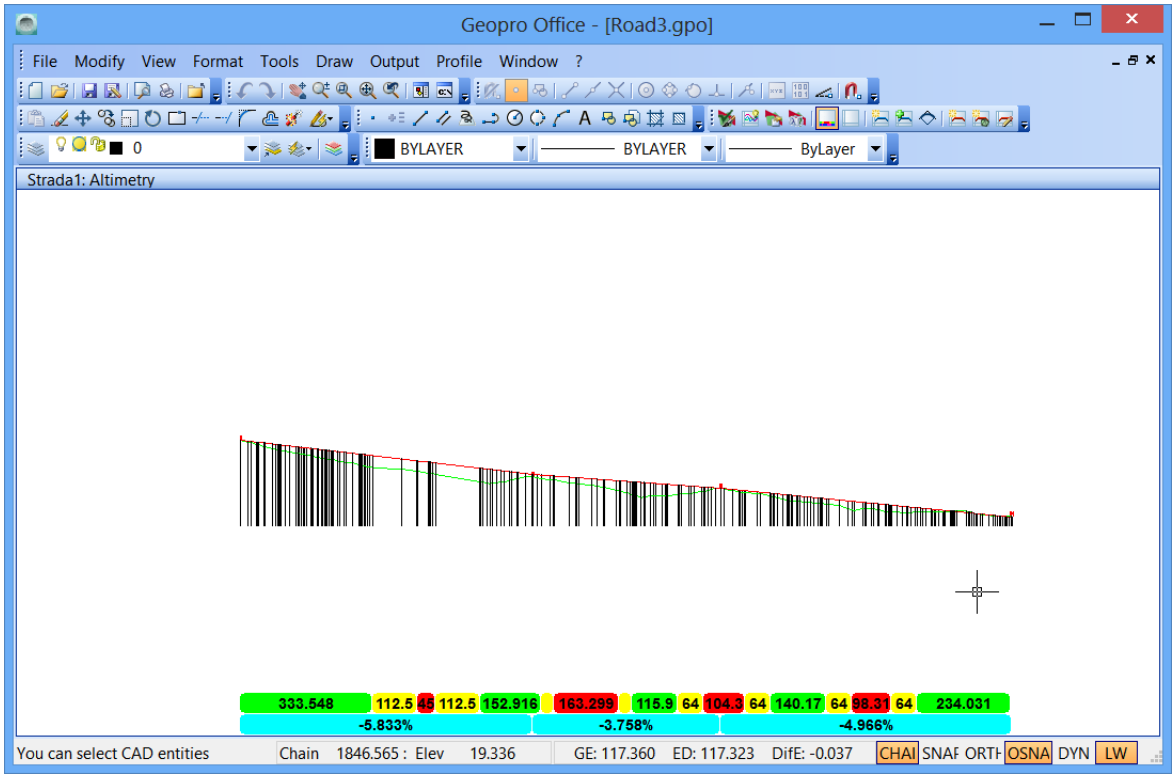



**Figure 408:**

The user can add points to the project by using the **Add Points** function found in the **Profile|Projects** menu.

The functionality of the **Add Points** command is similar to the functionality of the **New** command; the only difference is that the points can be added only at the two ends.

Vertical curves can be inserted into the project using the **Profile|Projects|Vertical Curve** command.

Once the command is activated, the user must graphically select the vertex where the curve should be inserted at.

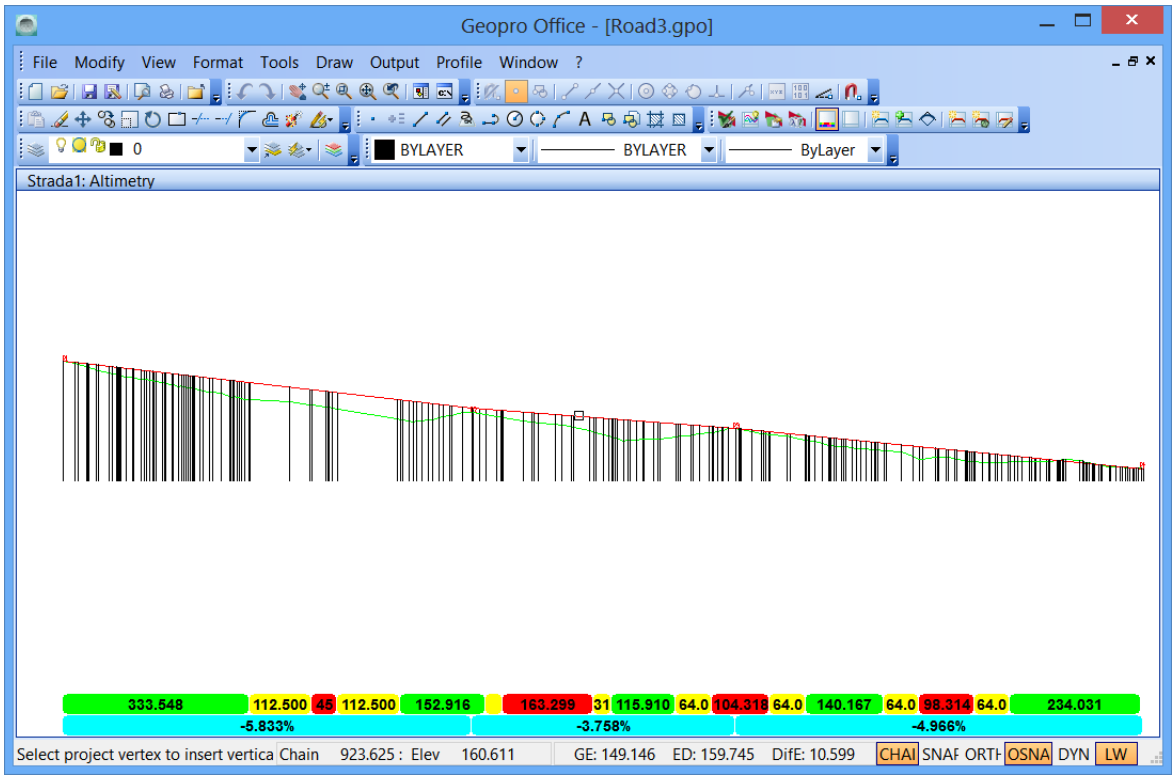



**Figure 409:**

Once the selection is completed, the program will display an **Insert Vertical Curve** window.

This window is used to select:

– The radius of the curve;

– Approximation to use.

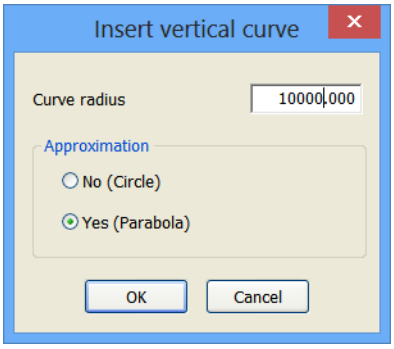



**Figure 410:**

Here following is the final result.

The following graphic information can be inserted into the vertical curves:

– Direct segments representing the radii of the vertical curve;

– Table with the characteristic values of the vertical curve;

– Vertical comments corresponding to the beginning and end points of the horizontal curve.

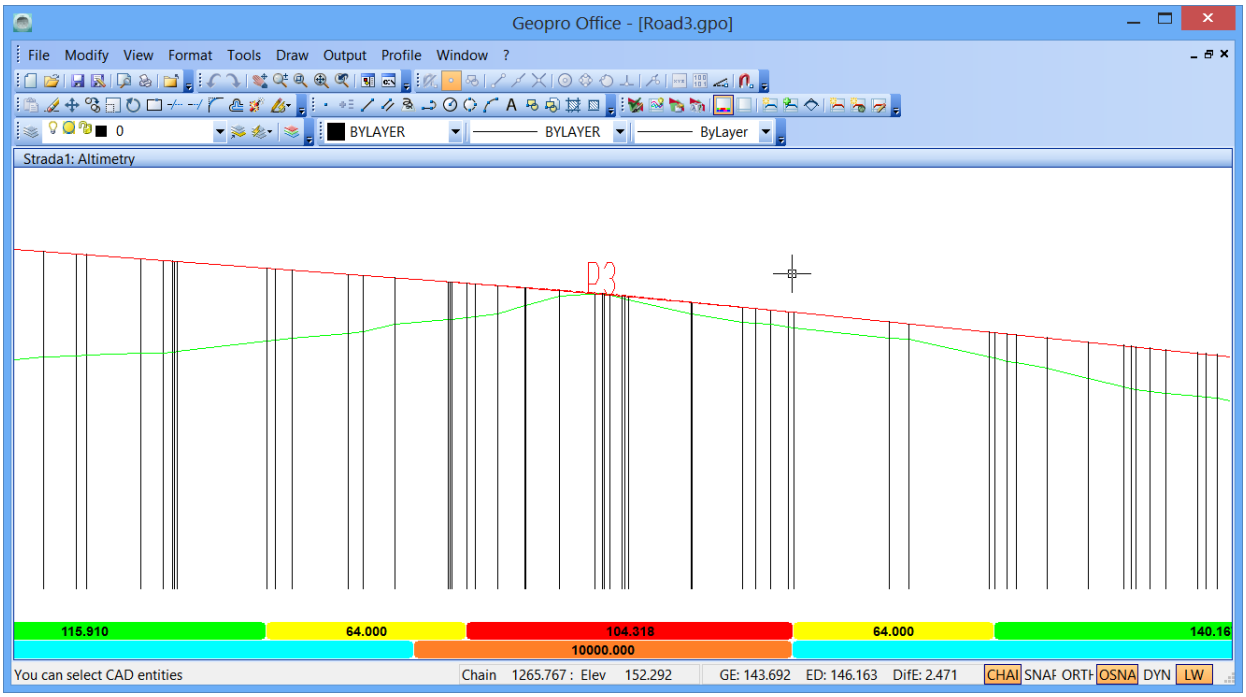



**Figure 411:**

Inserting this information can be done using the **Draw special elements** command.

The entities created will be placed in special planes and can be changed as common entities. Redoing the function will not eliminate the previously created entities. To do so, the user must proceed with canceling through the Erase Graphic Entities function.

Using the Delete Project function, the user can cancel previously designed projects.

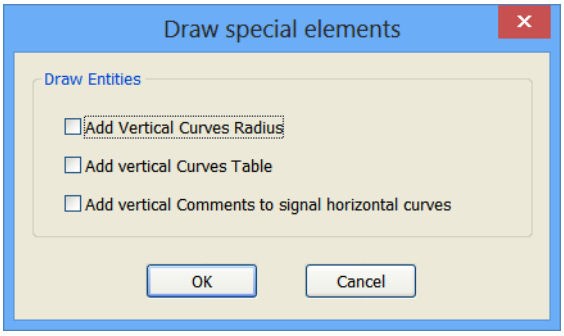



**Figure 412:**

# Polylines Management

To create a profile polyline, there are two commands available: **Profile Polylines|New** and **Profile Polylines|New from DTM...**; these two commands are available from the **Profile** (profile graphic view) and **Cross section** (section graphic view) menus.

The profile polylines are similar to project and differ from them in the following ways:

– Vertical curves cannot be inserted;

– They can also be created from DTM projects.

For this reason, the procedure to create a profile polyline with the **New** command is similar to the one seen for projects with the difference in that the code to associate with the polyline can be selected which, among other things, can be shared by multiple polylines.

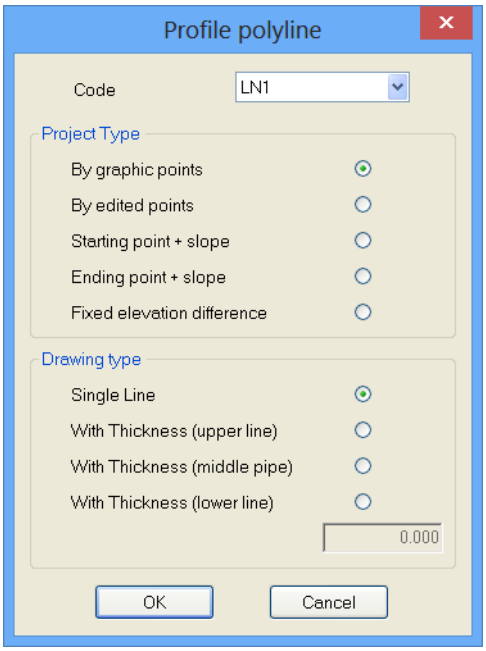



**Figure 413:**

In regard to creating from a DTM project, once the command is activated, the program will display the **Choose DTM for profile polyline** window which differs depending on whether the polyline is added in a profile or a cross section.

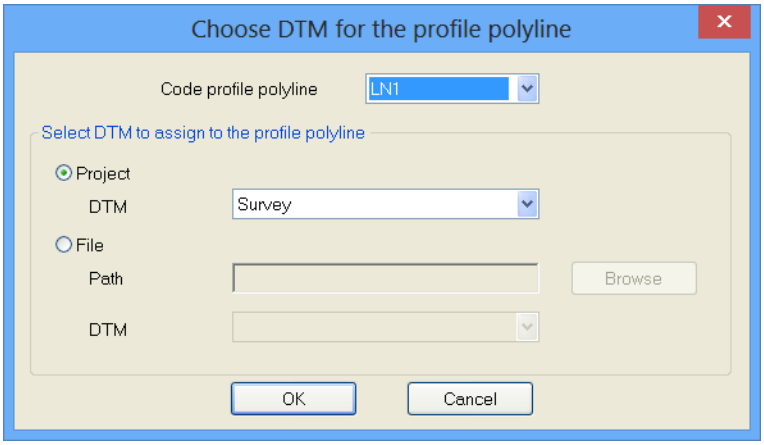



**Figure 414:**

In the cross section, besides the altimetric profile code and the DTM project data, the user is asked to specify into which cross section the polyline is to be inserted.

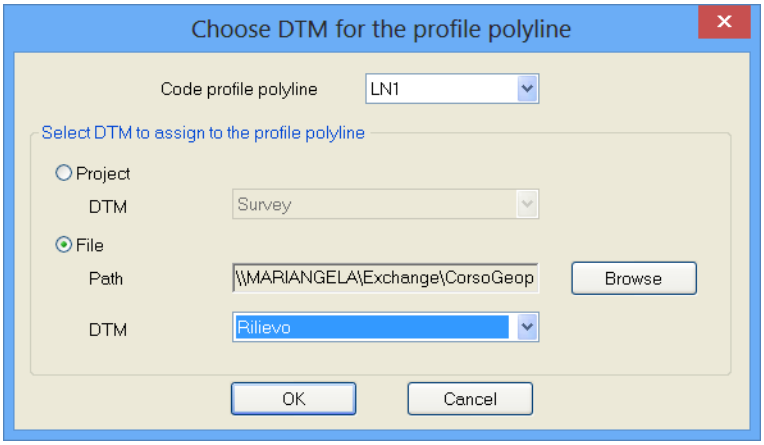



**Figure 415:**

After selecting the code to associate to the polyline, the user must tell the program which DTM project to use, which may be in the current file or an external file (in this case the route must be specified).

Once the selection is completed, press **OK** and the polyline will be added into the graphic as well as the numeric data view.

The polyline can be edited using the **Profile Polylines|Edit** command.

Once the command is activated the polyline can be changed using the commands from the **Modify|Polyline** menu.

# Operations Common to Projects and Polylines

Here following are descriptions of various commands common to Projects and Polylines.

- Add Particular Point: this function is used to insert particular points into projects and polylines; to activate it, go to the **Projects** menu or the **Profile Polylines** menu depending on where to add the points.

Inserting the point can be done in two ways:

1. By chainage: the user must insert a value for the progressive distance from the beginning of the profile.

2.By chosen point and partial distance: the user must select, first of all, the project point from which to begin and then, the distance from this point.

- Trim/Merge: After activating the function, select the first project/polyline and then the second. Then confirm the operation in the window that appears. Projects and Polylines will be cut or extended depending on their disposition; at the end there will be only one Project/Polyline.
- Break: Once activating the function, select the project/polyline to divide using the left button and then select the point where to divide the project/polyline; at the end there will be two Projects/Polylines.
- Delete Project/Polyline Once activating the function, select the project/polyline to eliminate using the left mouse button and confirm with the right button.

- Delete Point: Once activating the function, graphically select the project/polyline points to eliminate. Once the point to be eliminated is identified, it will be immediately eliminated and the design will refresh. The command will conclude by right mouse button.

Note that the selecting operator cannot be positioned along the vertical joint or on the column associated with the point to avoid any ambiguity in selecting between profile points and project points.

- Delete Intermediate Points: this function will automatically eliminate intermediate points of a project or a profile polyline.

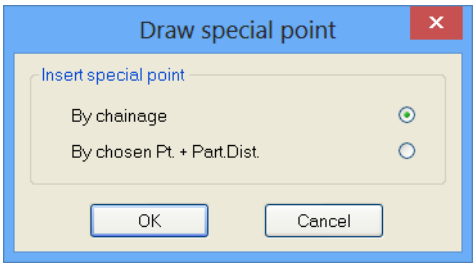



**Figure 416:**

# Profiles/Roads/Cross Sections Appearance

Use this command to run selections associated with the CAD View display of the Topographic/Roads Profile and Cross Sections names.

Once the command is activated, the program will open a window made of 2 pages:

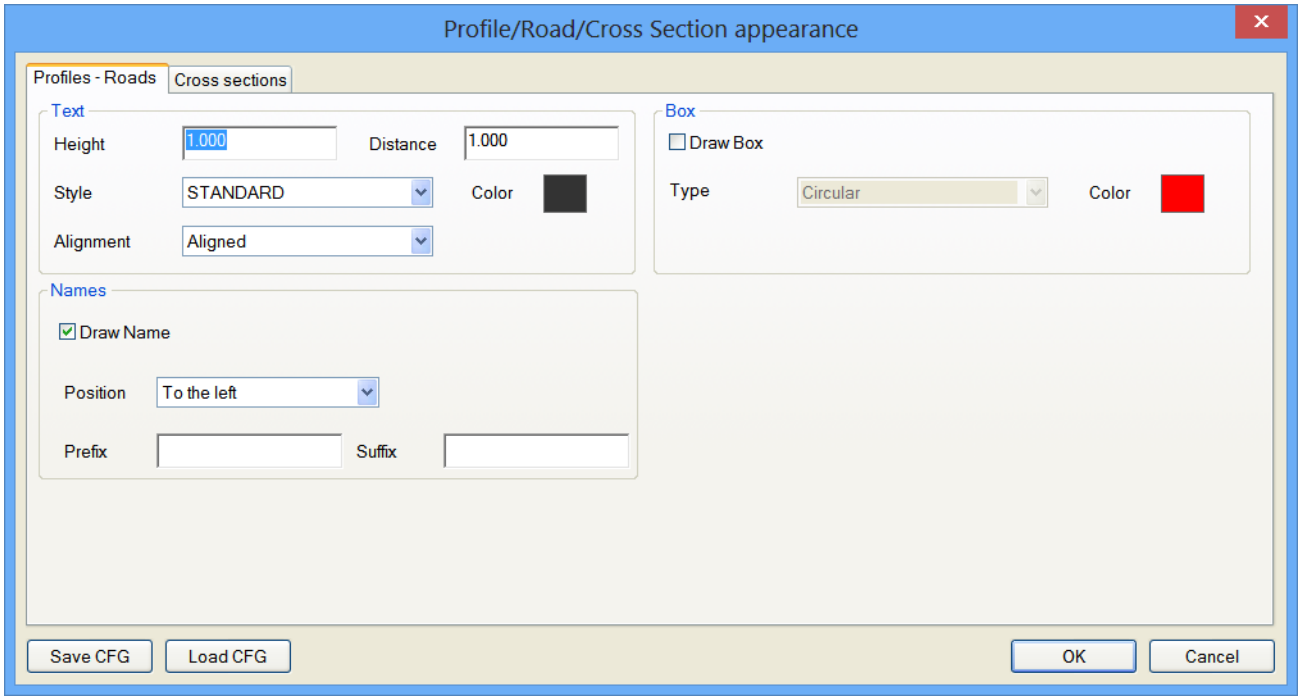



**Figure 417:**

1.**Topographic Profiles - Roads**, for the profile and roads name, the user can:

- specify the height, distance, style, color and alignment;
- insert a frame with a circle or rectangle of any chosen color;
- select whether to display the name indicating its position and whether to associate a prefix/suffix;

2. **Cross Sections** - for the sections name, the user can:

- specify the height, distance, color ,style, and alignment;
- insert a frame with a circle or rectangle of any chosen color;
- select whether to display the name indicating its position and whether to associate a prefix/suffix;
- select whether or not to display the Progressive indicating its position and the format with the number of decimals, associate a prefix/suffix to the Progressive name;
- insert text to the right or left of the significant sections (ex. <Fr/Icl> for a cross section in the point that ends a connection and begins a clothoid);
- insert a symbol "A to the right or left of the sections for those created automatically and "M" for those created manually.

The **Save CFG** and **Load CFG** buttons are used respectively to save the current configuration and to refresh it. The configuration saved with **Save CFG** will be automatically suggested again upon creation of a new document.

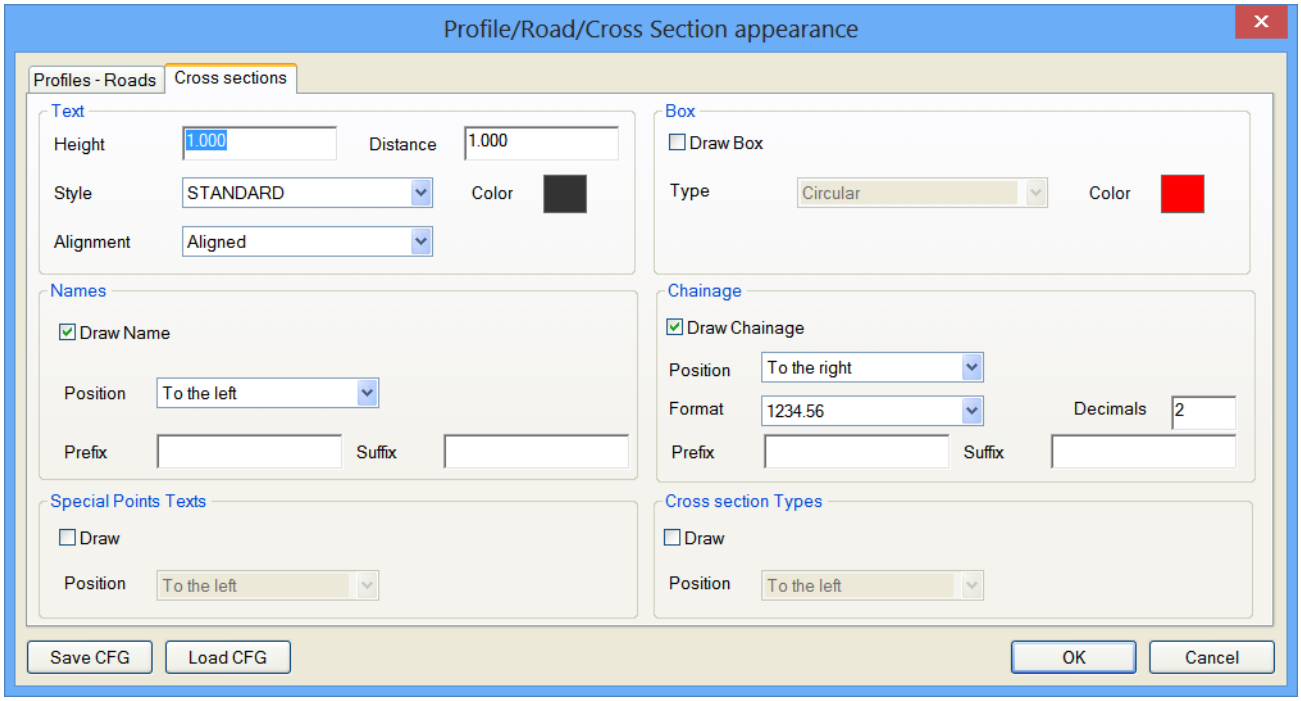



**Figure 418:**

# Elevation Jump

If the profile exits from the graphic where it is inserted, the function **Elevation Jump** is used to keep the profile within the graphic.

The profile will be separated into two or more parts that will be carried into the graphic itself; if the Elevation Jump is activated, projects cannot be designed nor can any changes be made to them; in order to redesign Projects, any Elevation Jumps created must be canceled.

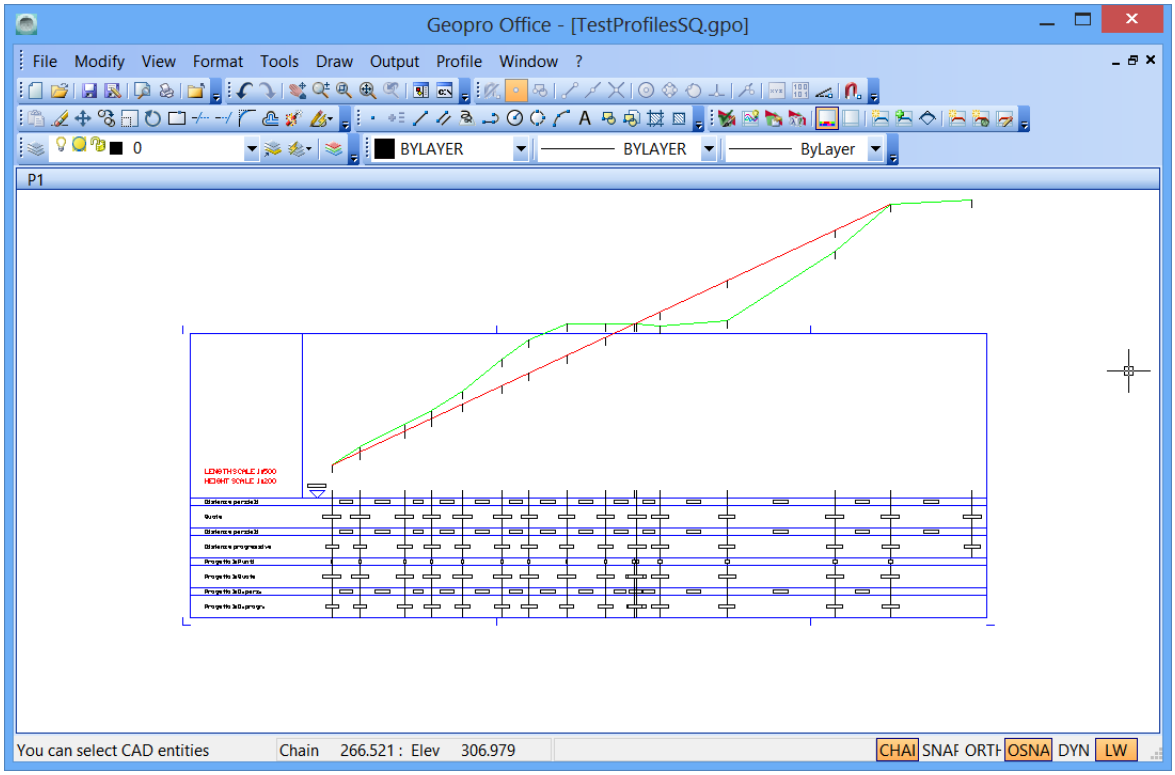



**Figure 419:**

From the view corresponding to the profile where the user is working, go to the **Profiles|Elevation Jump** menu; the possible choices are:

- Automatic: use this procedure and the program will automatically calculate the points where to apply the Elevation Jump.
- Select point: the user must graphically select the point in which to insert the Elevation Jump, or divide the Profile.

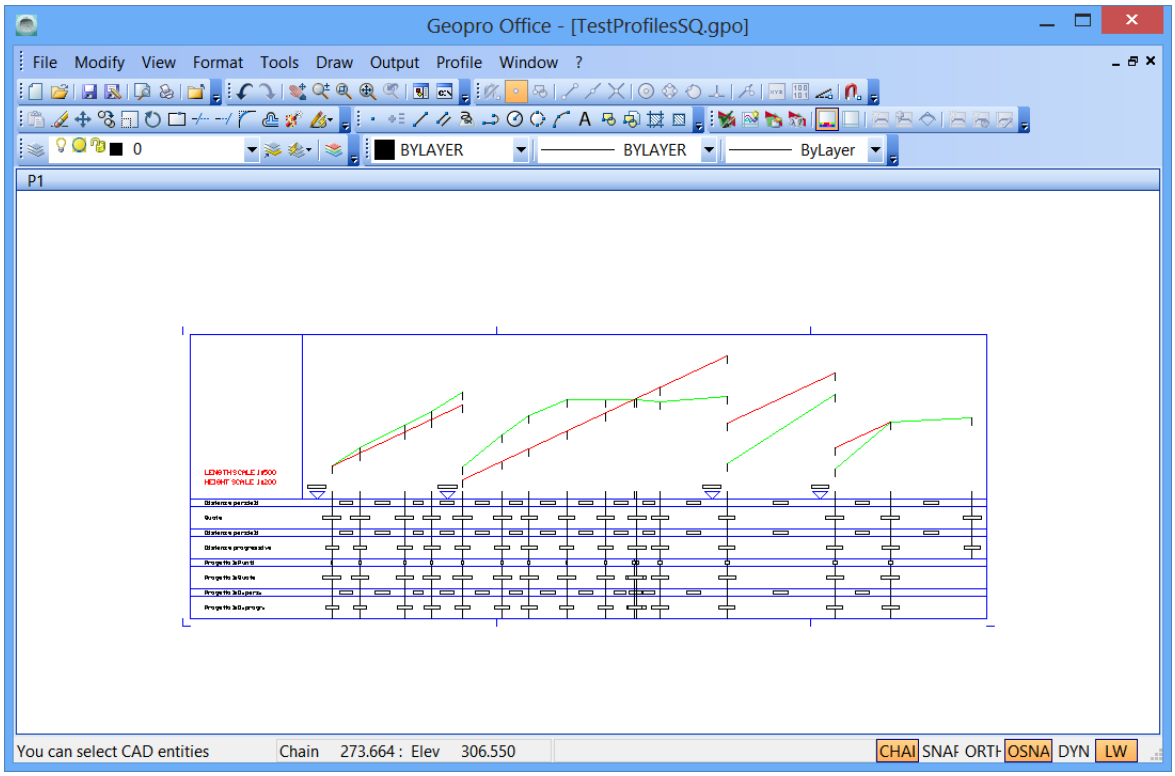



**Figure 420:**

The image shown above displays the beginning status; the image below shows the graphic result of the **Elevation Jump|Automatic**: as can be clearly seen after each quote jump, the triangle indicating the new profile reference point will repeat.

The beginning status is similar to the one suggested for the automatic Elevation Jump. The image below shows the functionality of the **Elevation Jump|Selection** operation.

After specifying the point graphically, a window will appear to confirm or change the value of the suggested Elevation Jump.

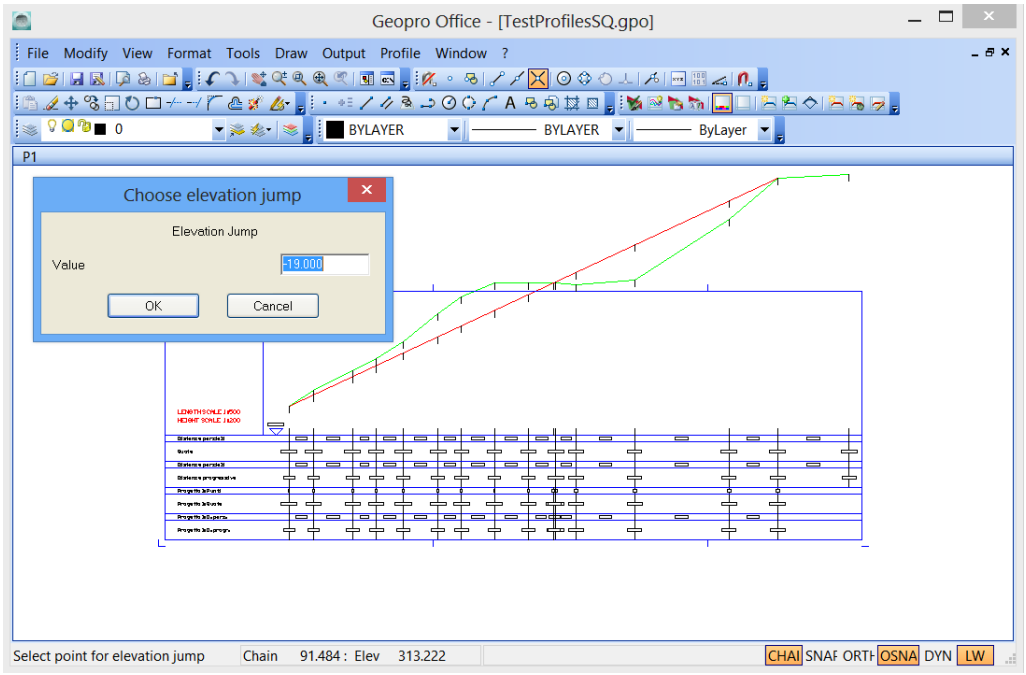



**Figure 421:**

Once this operation is executed, this result is obtained.

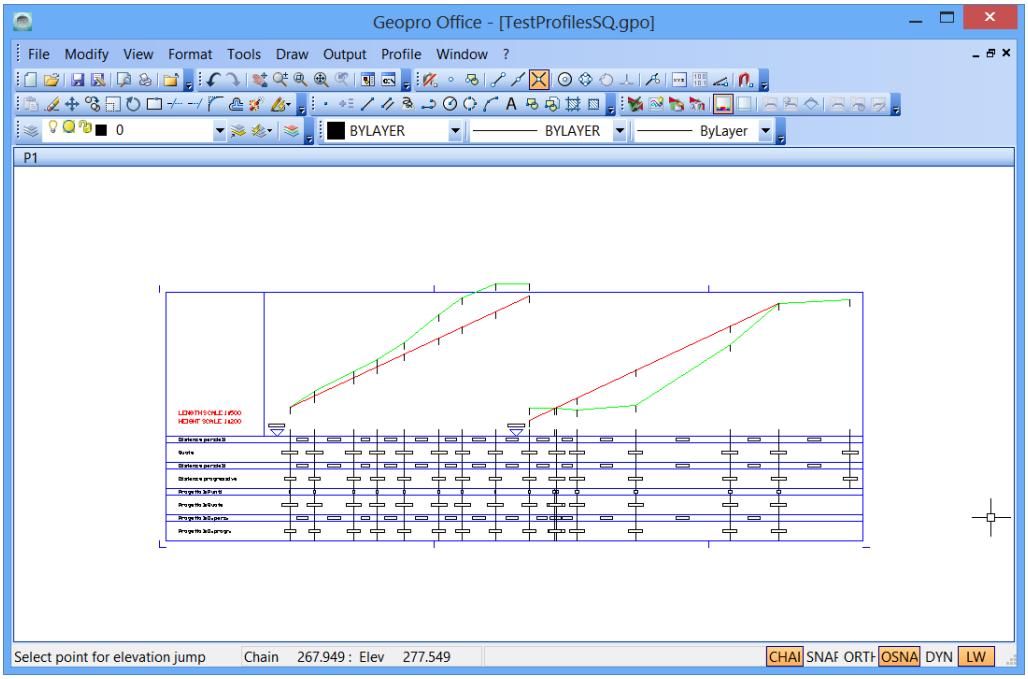



**Figure 422:**

# Active Altimetric Profiles

This procedure is always activated from the **Format|Altimetric Profiles Active** menu and lists the created profiles.

This window is used to determine whether or not to display the profile (turning on/off the light found under the **Visible** columning); similarly, the user can select whether or not to view the columns (turning on/off the light found under the **Columning** column).

To confirm the selections, press **OK**.

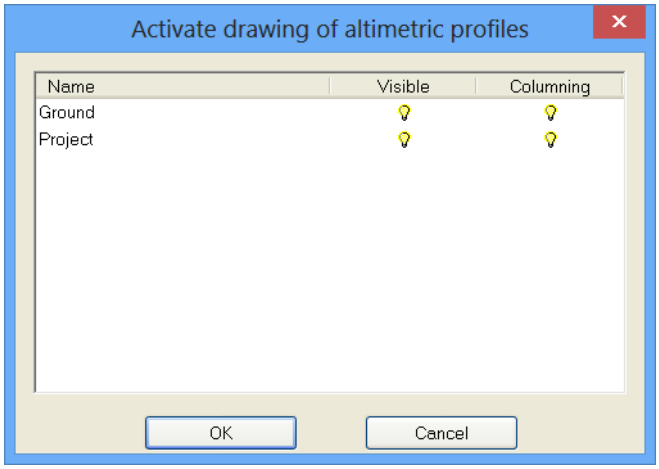



**Figure 423:**

# Special Texts

The view corresponding to the profile, found through the **Format|Current Profile Style** menu will offer a series of functions used to insert the typical profile texts.

## Culture Texts

Before activating the **Culture Texts** function, the user must add the **Culture** columning into the profile style through the **Columnings** tab in the **Edit Profile Style** window, activated using the **Format|Current Profile Style** command.

To add the **Culture** columning, select the **Additional Texts** category and then select it from the **Columning Type** list.

In the **Actual Text** field, the description **Culture** will be automatically inserted; this description can be changed.

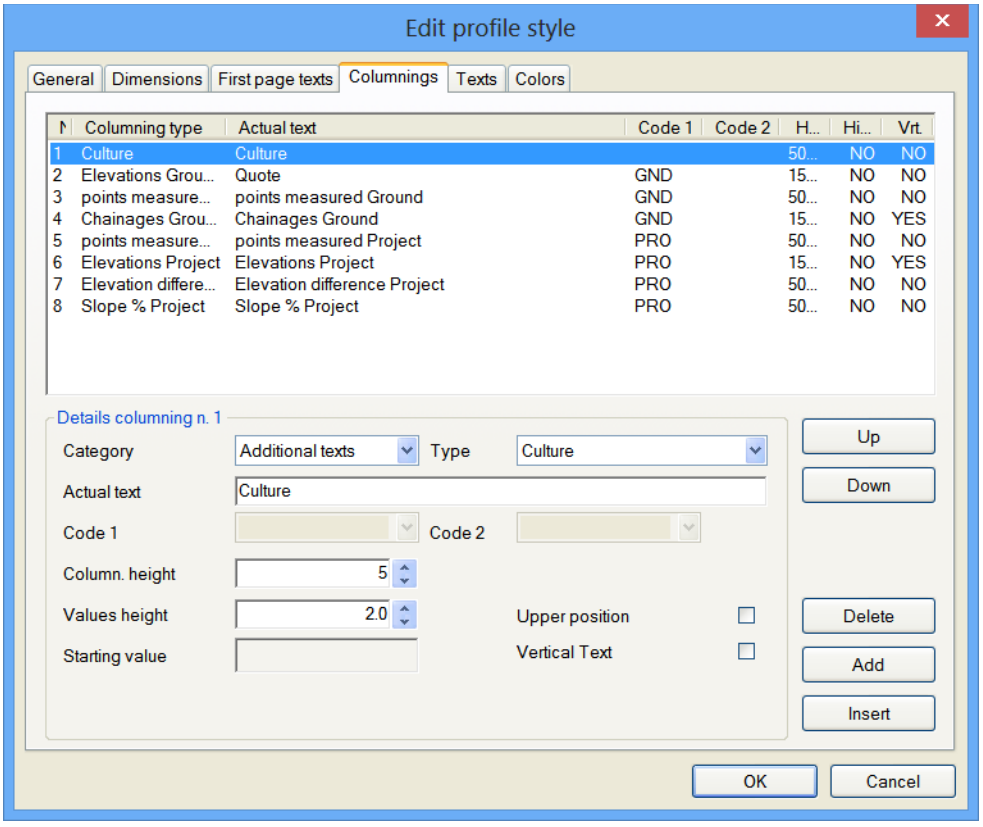



**Figure 424:**

Proceed with **OK** and verify that the column has been added to the profile graphic currently in progress.

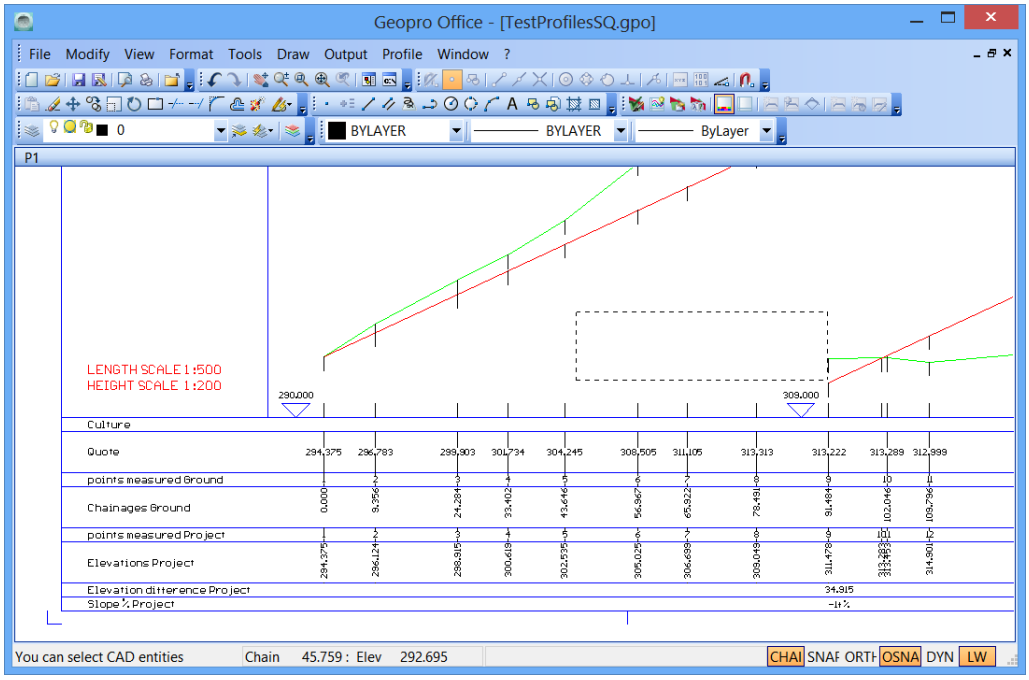



**Figure 425:**

Activate the **Culture Texts** function and then select the two points (in the profile or columning) that will outline the space where the text will be inserted.

After selecting the second point, a window will appear used to insert the text.

The text will be positioned at the center of the selected interval. At the edges of the interval, separator lines will be designed.

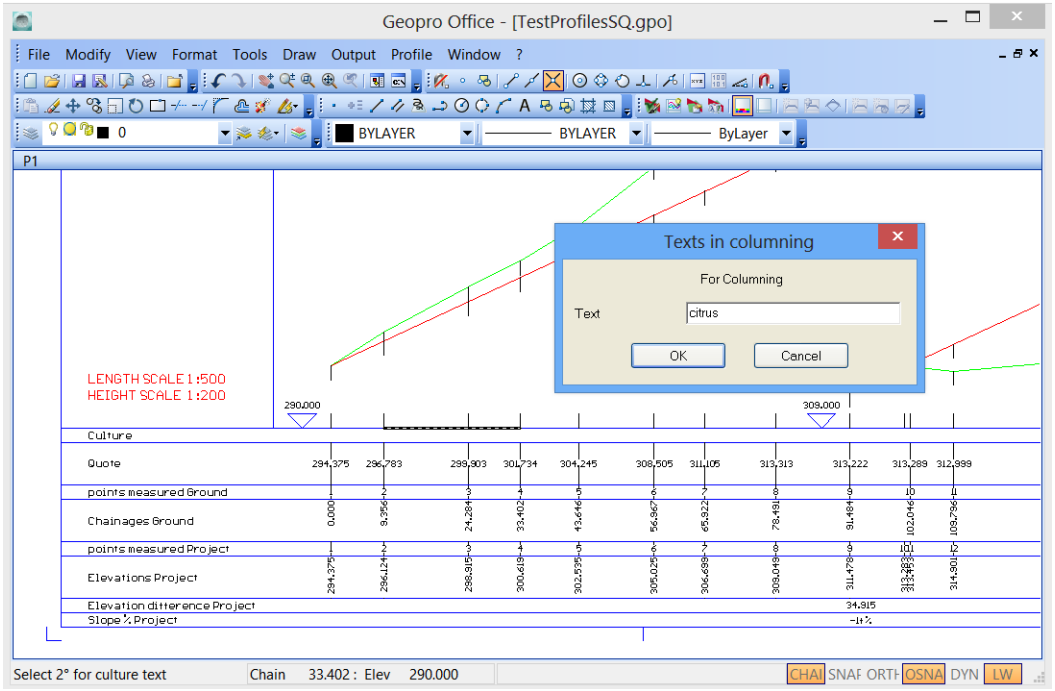



**Figure 426:**

The user is free to continue with inserting more texts beginning with the last point selected or to terminate the command using the right mouse button.

The image here below shows the result from inserting the text.

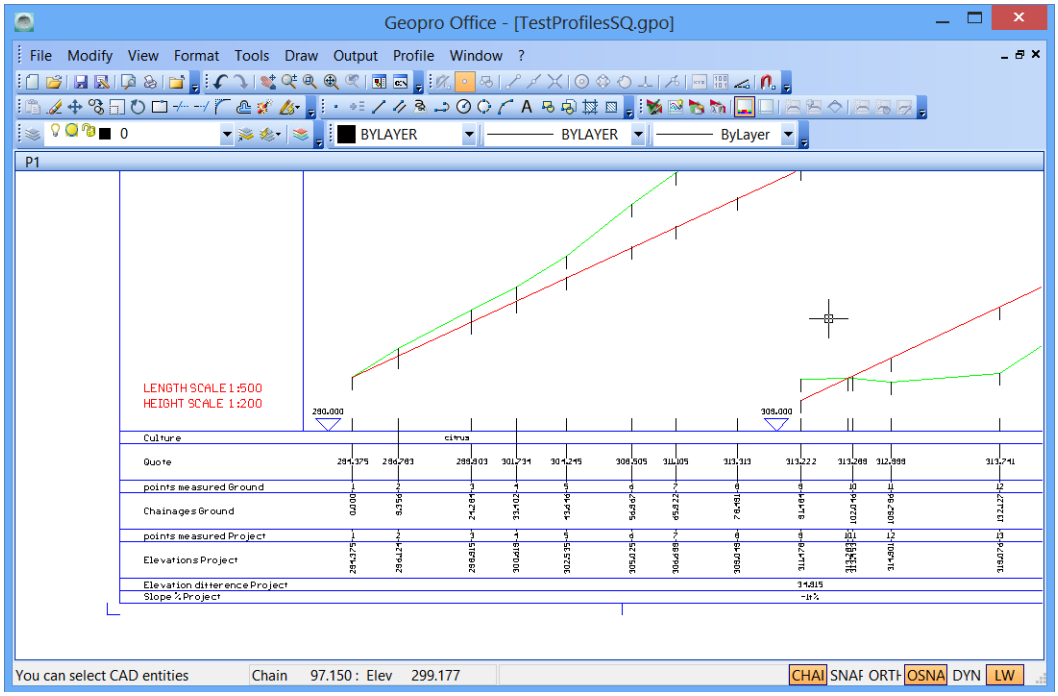



**Figure 427:**

# Columning Editable Texts

Before activating the **Columning Editable Texts** function, the user must add the **Change Text no....** columning into the profile style through the **Columnings** tab in the **Edit Profile Style** window, activated using the **Format|Current Profile Style** command.

To add the **Change Text no....** column, select the **Additional Texts** category and then select it from the **Columning Type** list.

The description will be automatically inserted into the **Actual Text** field.

**Change Text no....**; this description can be changed (in this example the effective text is SEDIMENT).

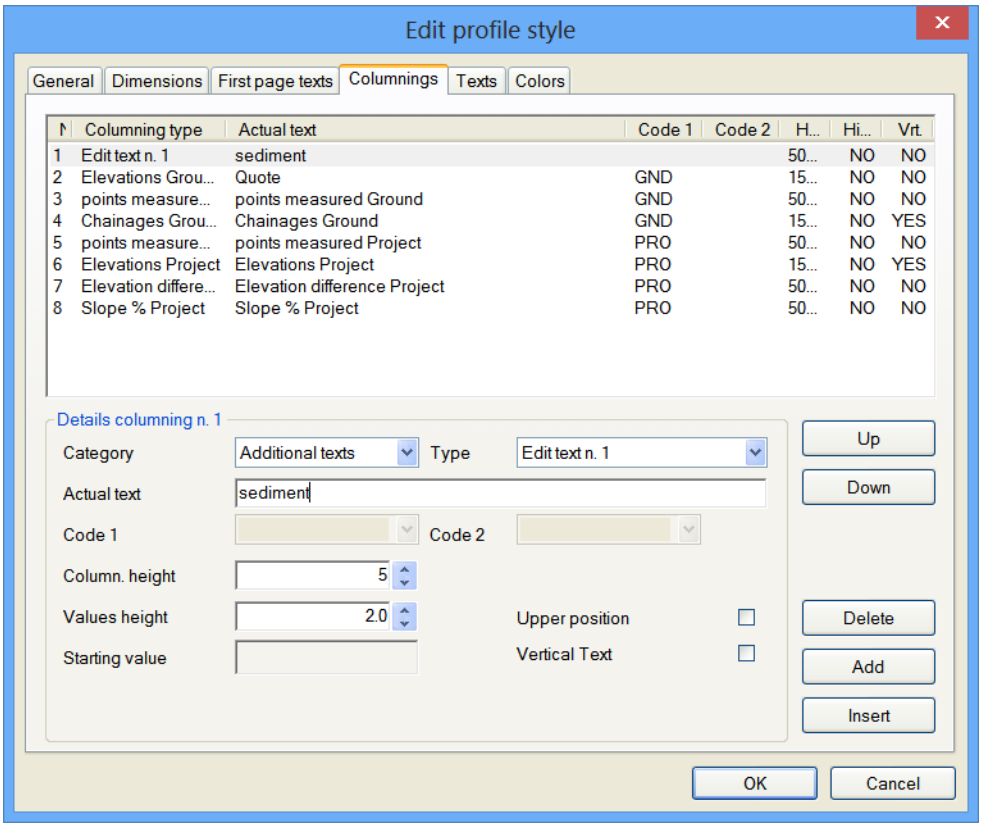



**Figure 428:**

Proceed with **OK** and verify that the column has been added to the profile graphic currently in progress.

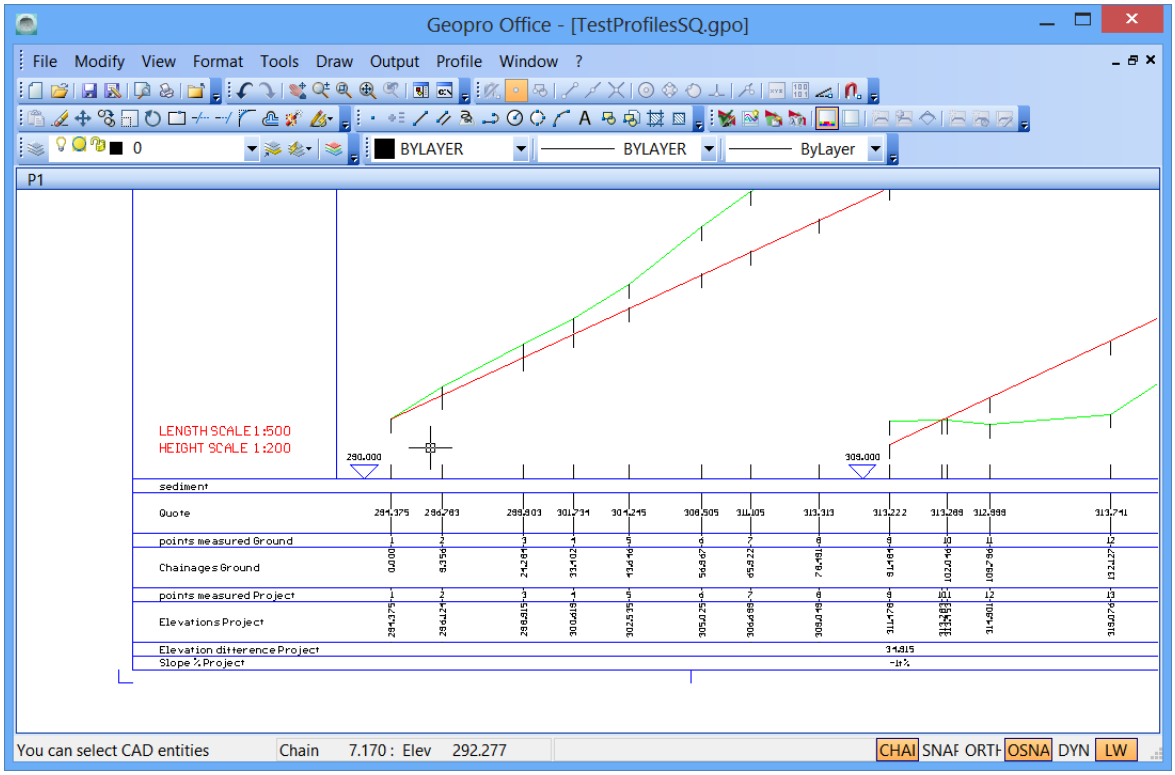



**Figure 429:**

Activate the **Columning Editable Texts** function: the program will display the **Draw Texts in Columning** window where the user can select the text to insert; in this example, we confirm **SEDIMENT** and then press **OK** to proceed with graphically identifying the interval on which to insert the text.

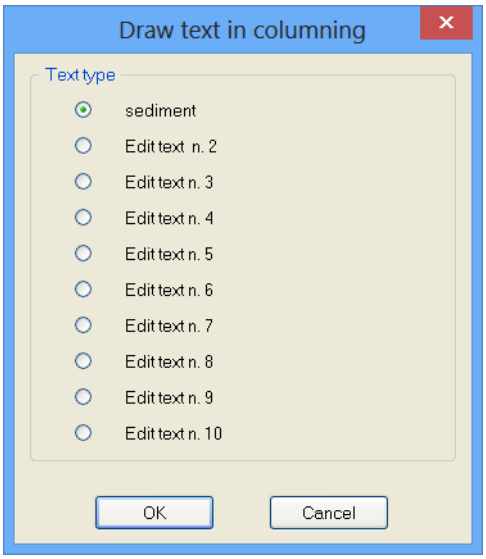



**Figure 430:**

Once the selection is completed, the window will appear for inserting the text itself.

The text is positioned at the center of the interval while the two edges are designed with separator lines.

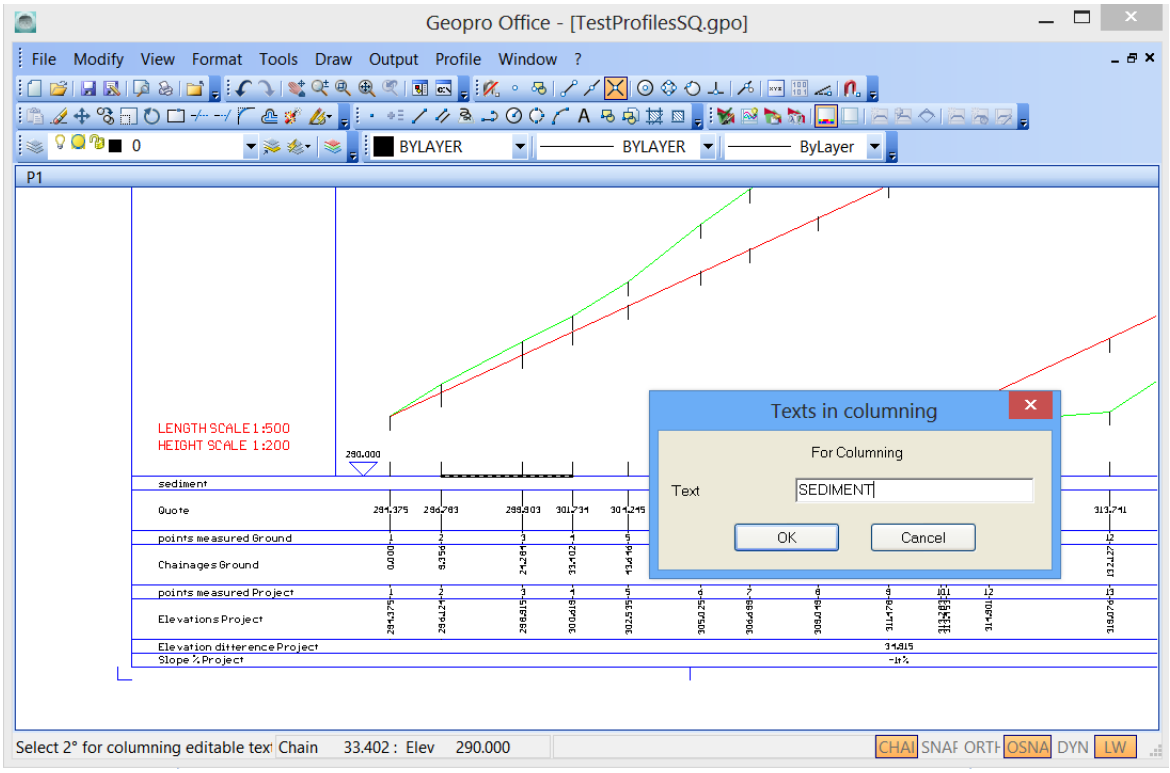



**Figure 431:**

The result of the operation is shown in the image below.

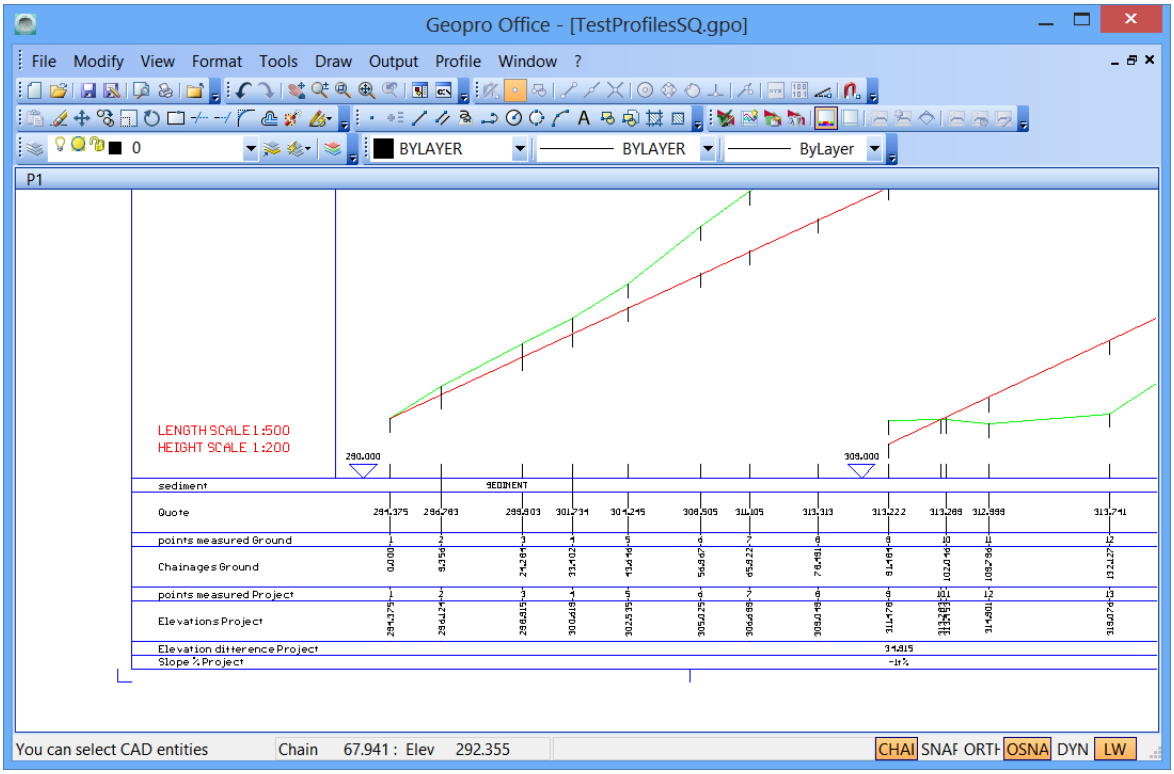



**Figure 432:**

# Selected Distances Texts

Before activating the **Distance Text Selected** function, the user must add the **Sel part. Distances** columning into the profile style through the **Columnings** tab in the **Edit Profile Style** window, activated using the **Format|Current Profile Style** command.

To add the **Sel part. Distances** column, select the **Additional Texts** category and then select it from the **Columning Type** list.

In the **Actual Text** field, the description **Sel part. Distances** will be automatically inserted; this description can be changed.

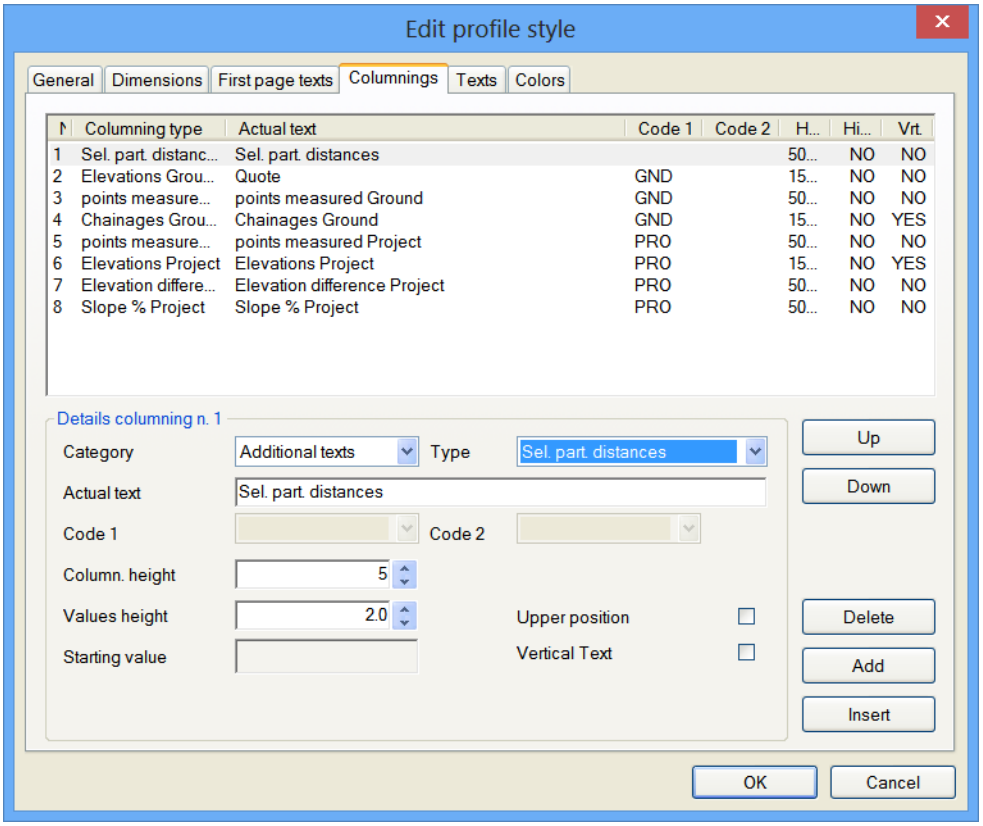



**Figure 433:**

This function is used to insert the partial distance between two terrain or project peaks into Columnings.

In fact, at the end of the procedure, the partial distance separating the selected points will be automatically posted into the selected intervals.

After graphically selecting the two points, there is no need to edit a text and it will be automatically created by the program based on the real distance between the points.

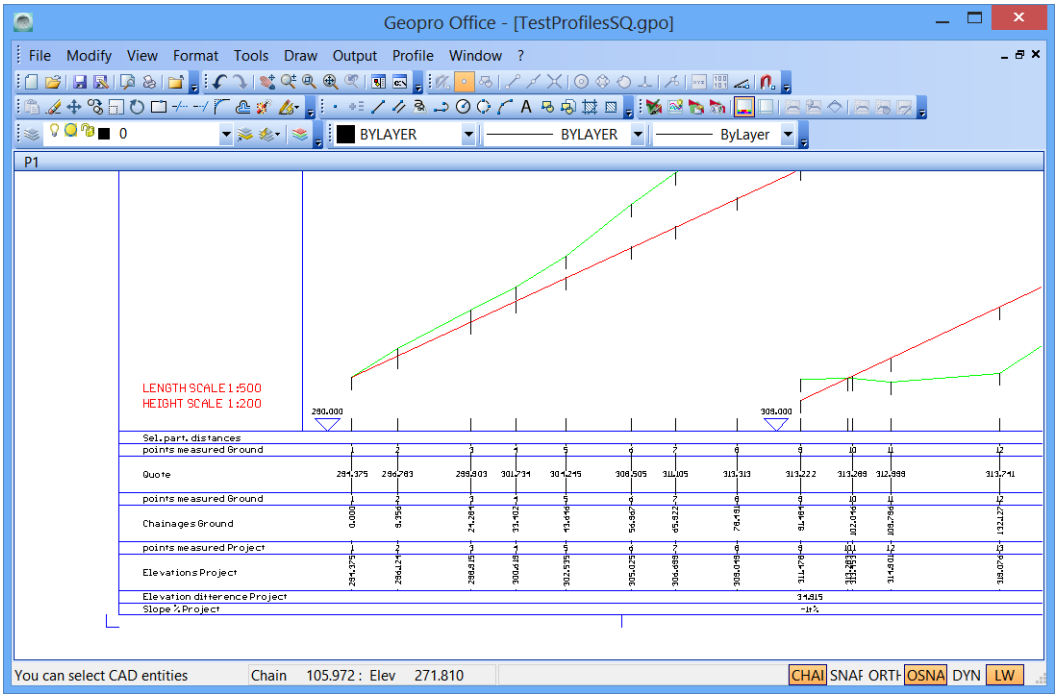



**Figure 434:**

# Vertical Comments

This command is used to specifically insert vertical texts alongside profile-columning or project-columning connections.

First of all, set the graphic selection symbol onto the connection alongside the one to be used for inserting a comment; after executing the selection a window will appear used for inputting the comment to be inserted; once the comment is inserted and confirmed, another one can be inserted; to conclude, press the right mouse button.

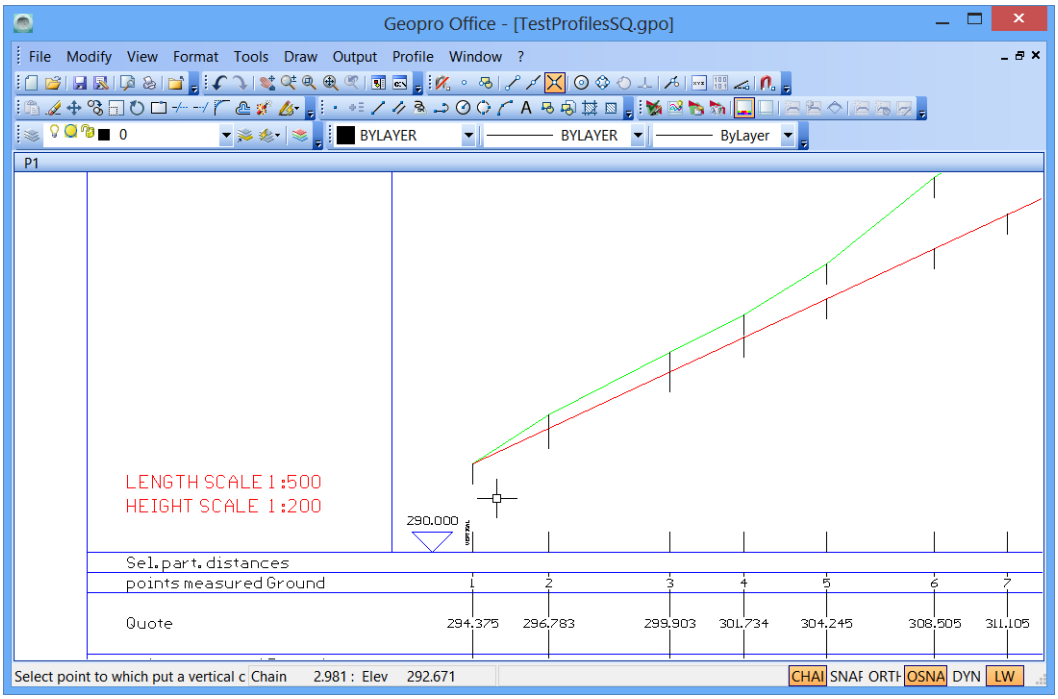



**Figure 435:**

# Delete

This is activated through the **Profile** menu and is used to eliminate particular texts that were previously inserted (**Culture Texts**, **Columning Editable Texts**, **Distance Text Selected**, **Vertical Comments**); the selection of the texts is done through the Profile CAD View using the left mouse button and the right mouse button is used to confirm it.

# File |Export

The following commands are available in the **File|Export** menu:

- **DXF/DWG Profile File:** this command is used to create a DXF/DWG file containing the profile; in particular, the user is asked only for the name to assign to the file and the design is created as a block that can be exploded after importing it into Autocad.

- **All DXF/DWG file sections:** activating this function from the Profiles View allows the user to create a dxf/dwg file format containing all of the sections found in a profile/road. This function is activated only if the profile displayed refers to a road or a cross section of it. After activating this function and after giving a name to the file in the window called **Create DXF/DWG File** another window will open so the user can customize the order in which the sections are inserted into the file. In particular, the user can decide if the order of the sections designs must proceed by line or by column. Further, the user can establish the maximum number of lines or columns. Another option involves the sections to be included in the file; in fact, the user can change the initial number as well as the final number of the sections to include.

- **Multiple profiles to DXF/DWG files All DXF/DWG file sections:** activating this function from the Profiles View allows the user to create a dxf/dwg file format containing all of the sections found in multiple profiles/roads. After activating this function and giving a name to the file in the window called **Create DXF/DWG File** the **Transfer Profiles to DXF** window will open so the user can determine the order of the profiles by line or by column indicating the maximum number of lines or columns.

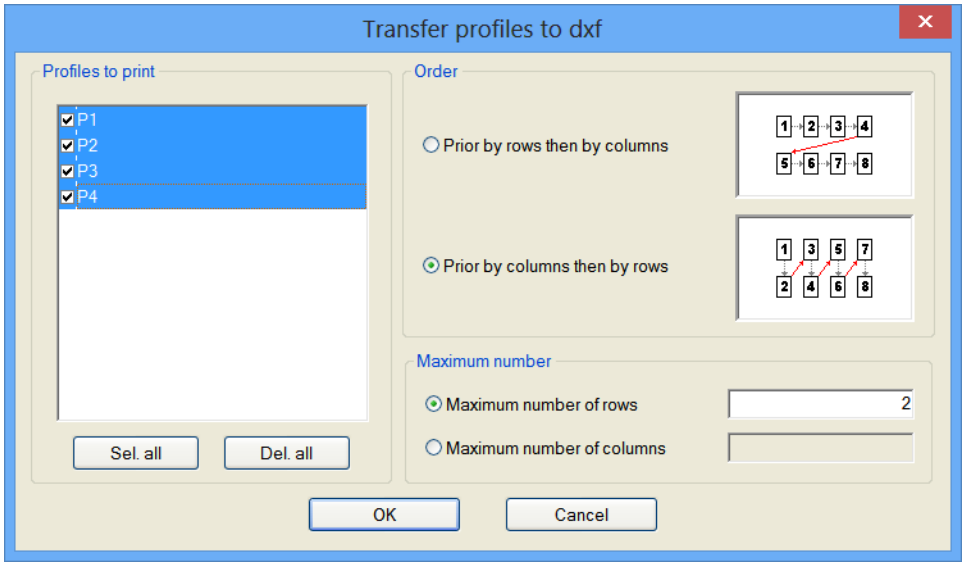



**Figure 436:**

- **Printout of Terrain Profile:** This procedure produces a file spreadsheet associated with the profile taking into account the settings saved through the Options|Print Options procedure. Before creating the file a preview is displayed (see the image below) where the user can change the character font, increase or reduce the zoom and specify the type of file to create. To create the file the user must press the Save button and indicate the save route.

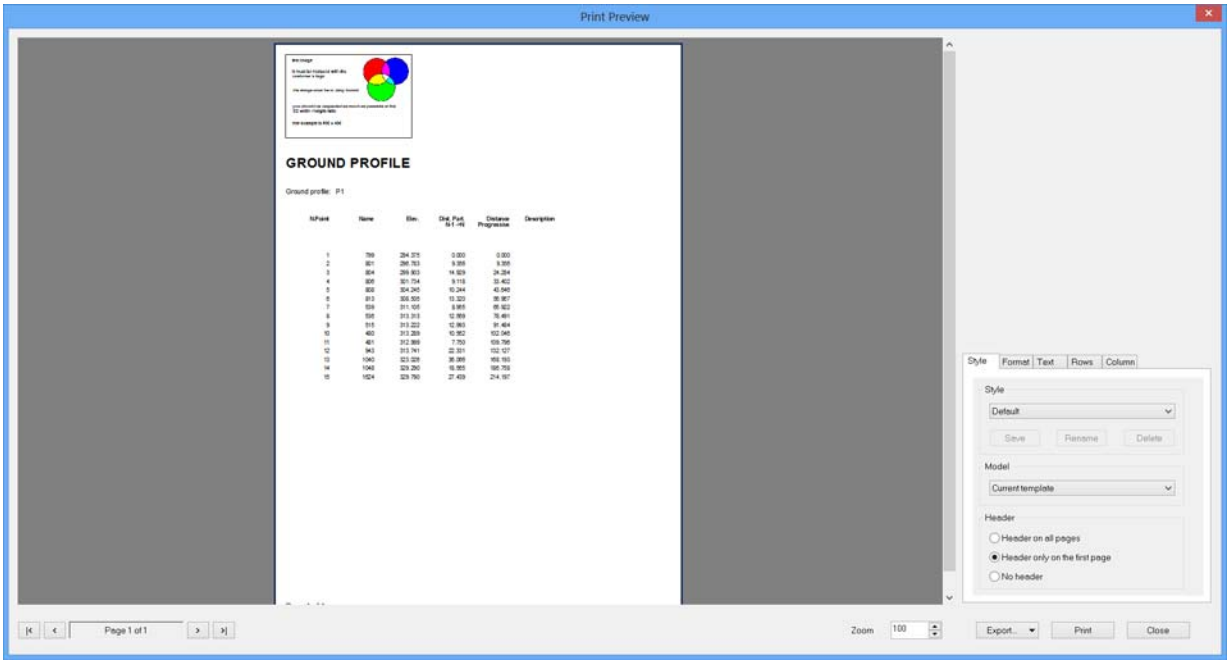



**Figure 437:**

- **Printout of All Terrain Profiles:** this command is similar to the **Printout of Terrain Profile** with the only difference being that all profiles are printed.

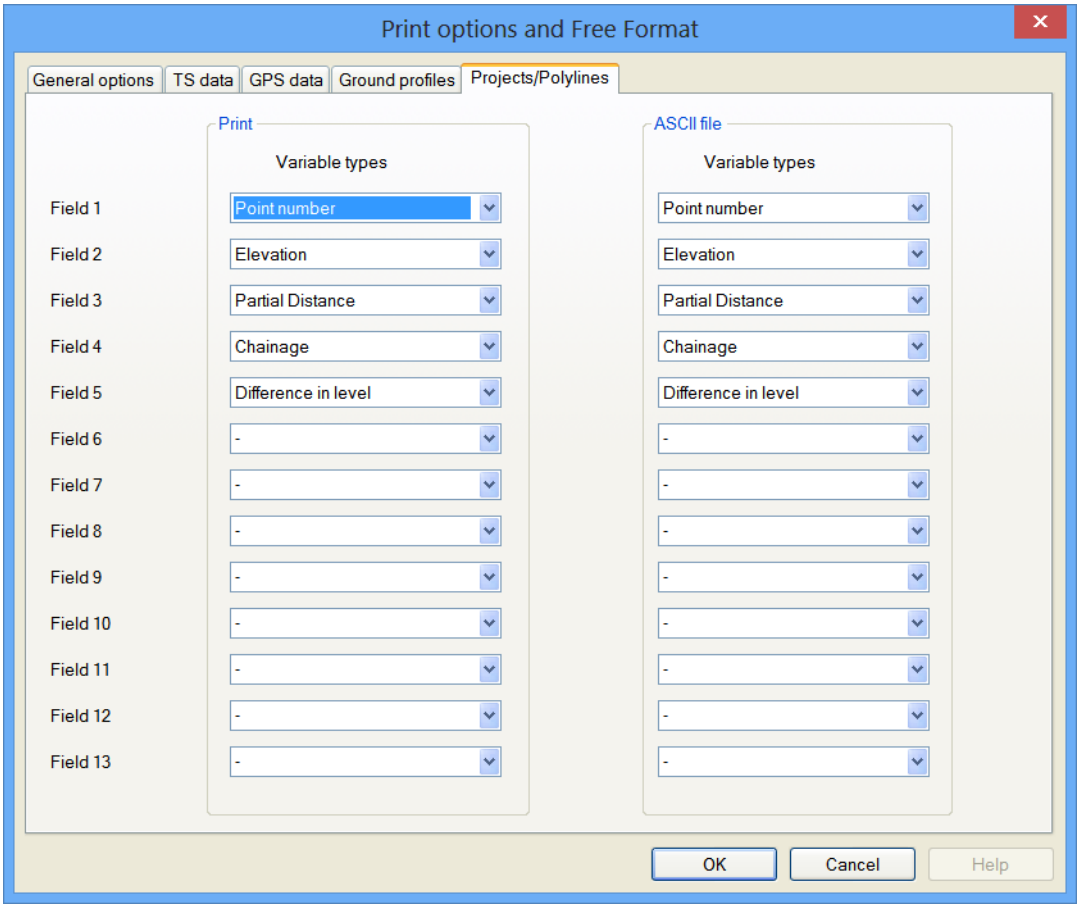



**Figure 438:**

- **Printout of Project/Polyline:** this function allows the user to create a file containing the data of a selected project (project page must be activated). The data to insert into the file can be specified using the Options|Print Options command. Before creating the file a preview is displayed (see the image below) where the user can change the character font, increase or reduce the zoom and specify the type of file to create. To create the file the user must press the Save button and indicate the save route.

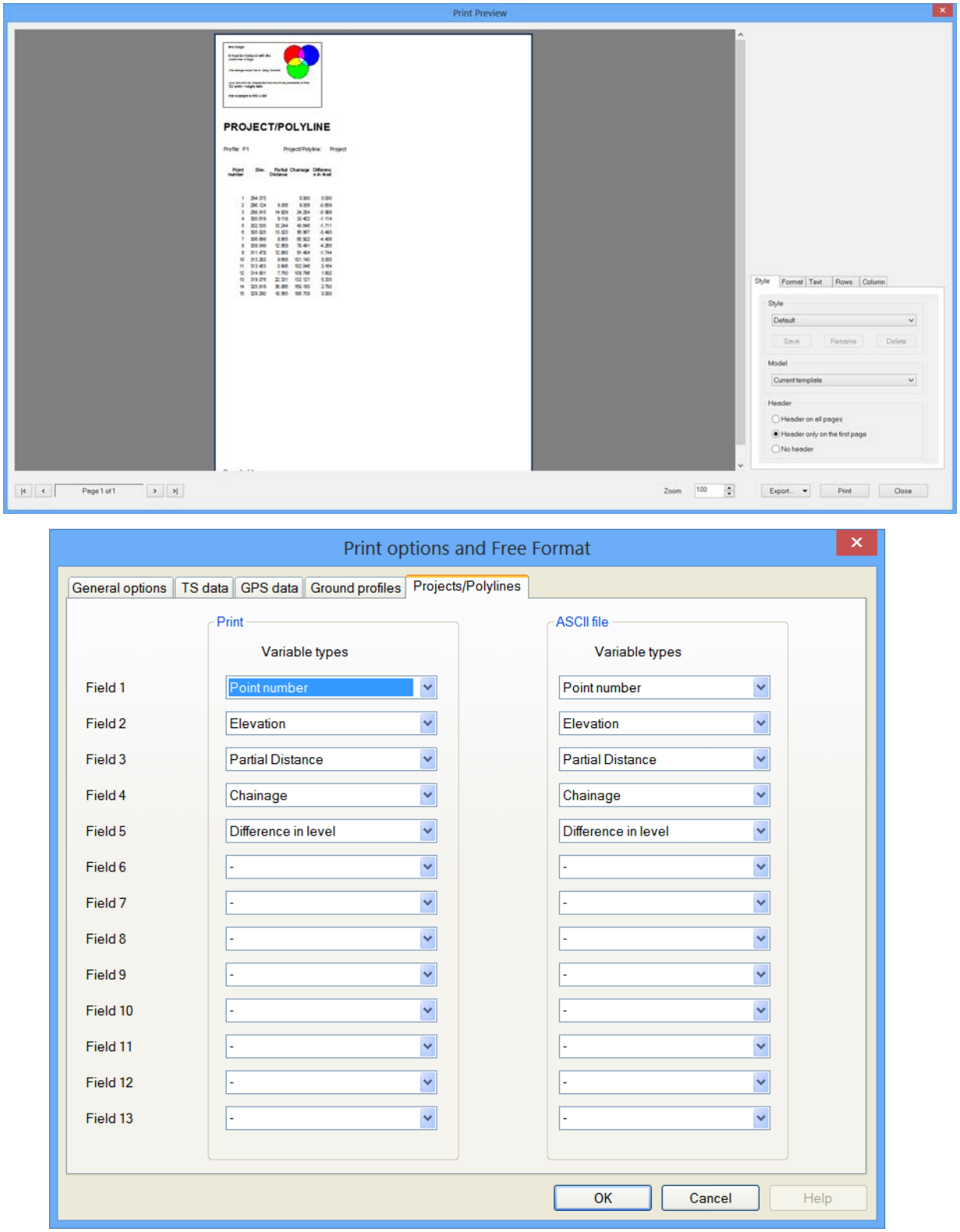



**Figure 439:**

- **Printout of All Projects/Polylines:** this function is similar to the **Printout of Project/Polyline** with the only difference being that all projects of the profile are printed.

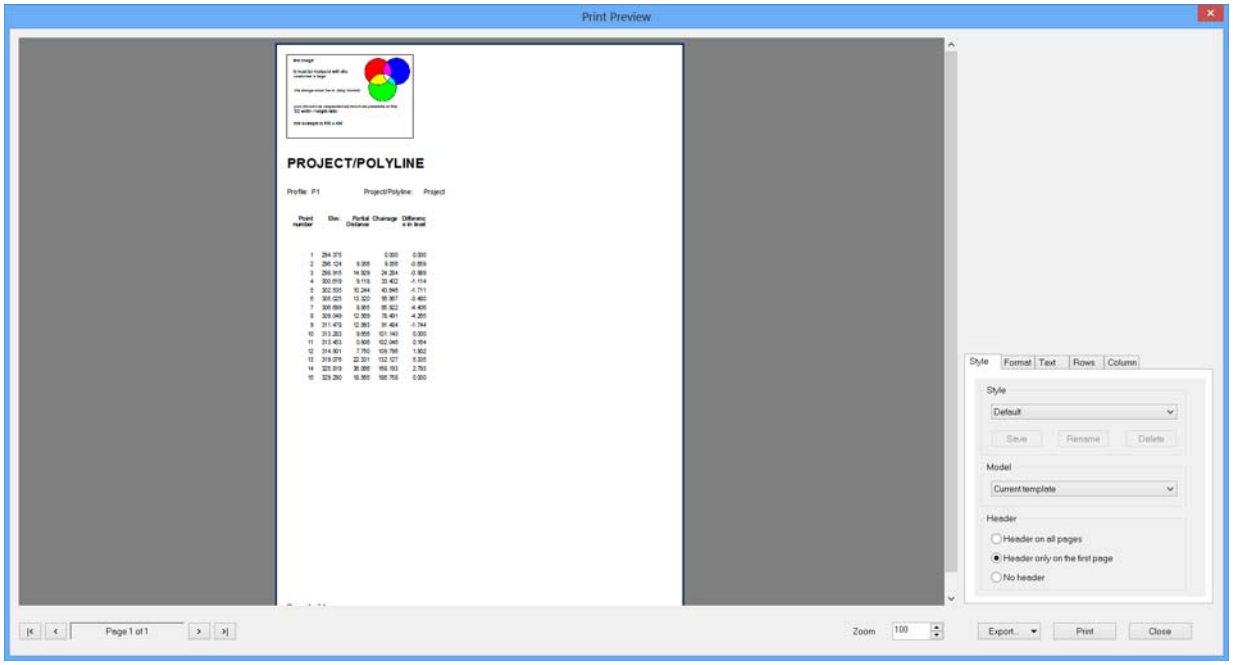



**Figure 440:**

# Output

Selecting the **Printout of Terrain Profile** from the **Output** menu allows the user to execute the following printouts:

standard format printing;

1.standard format printing;

2.free format printing;

3.All free format printing;

If the user selects to print the profile spreadsheet in standard format, the program will display first of all the print preview and as can be clearly seen, the profile information is printed on a spreadsheet che includes the following information:

- Progressive numbering of the point,
- Any name,
- Quote,
- Partial distance,
- Progressive distance,
- Any comment.

If the user selects a free format printout then the data printed will be what was selected using the **Options|Print Options** command.

In regard to the printing of projects, the user is not offered a standard print choice like for profiles and therefore the free format must be set (using the **Options|Print Options** command). For projects, like for profiles, one single project or all projects (Spreadsheet Project/Polyline|Free Format Print and Spreadsheet Project/Polyline|Free Format Print All).

Here following is an example of a print preview.

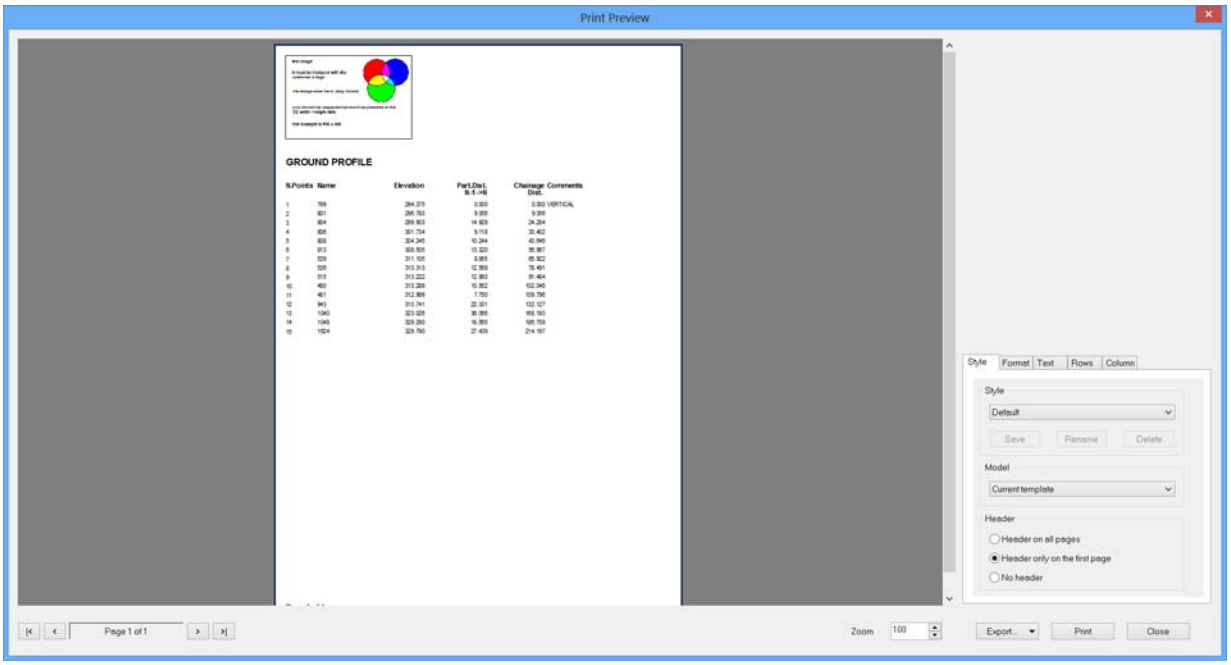



**Figure 441:**

# Commands View: list of commands

The following tables list the commands in Commands View.

## Commands in File Menu

**Table 1.**

| | |
|---|---|
| _ImpDxfDwg | Import\|Autocad (.DXF/.DWG) |
| _profDxfDwg | Export profile to file (.DXF/DWG) |
| _secDxfDwg | All sections to DXF/DWG files |
| _profMultiDxfDwg | Multiple profiles to file DXF/DWG files |
| _printProfFile | Spreadsheet of profile is saved on file |
| _printAllProfFile | Spreadsheet of all profiles is saved on file |
| _printPrgPolFile | Spreadsheet of project is saved on file |
| _printAllPrgPolFile | Spreadsheet of all projects is saved on file |

**Table 1.**

| | |
|---|---|
| _preview | Print preview |
| _PageSetup | Set page |
| _print | Print |

# Commands in Modify Menu

The commands for this menu are similar to those seen for the CAD View.

# Commands in View Menu

The following are added to the commands offered in the CAD View:

**Table 2.**

| | |
|---|---|
| _sezIni | Initial Cross Section |
| _sezPre | Previous Cross Section |
| _sezSuc | Next Cross Section |
| _sezFin | Final Cross Section |

# Commands in Format Menu

The following are added to the commands offered in the CAD View:

**Table 3.**

| | |
|---|---|
| _profStyles | Profile Style |
| _optProfAct | Active Altimetric Profiles |
| _profCurStile | Current Profile Style |
| _reassStile | Assign Profile Style |
| options / _options | General options selection |

# Commands in Instruments Menu

The commands for this menu are similar to those seen for the CAD View.

# Commands in Design Menu

The commands for this menu are similar to those seen for the CAD View.

# Commands in Outcomes Menu

**Table 4.**

| | |
|---|---|
| _printProfStd | Print profile in standard format |
| _printProfFree | Print profile in free format |
| _printAllProfFree | Print all profiles in free format |
| _printPrgPollFree | Free format printing; |
| _printAllPrgPolFree | Print all in free format |

# Profile/Cross Sections Menu Commands

| | |
|---|---|
| _optPropProf | Profile Properties |
| _optPrflOpzCalc | Profile Calculation Options |
| _optCodProf | Profiles Codes |
| _newPrg | New Project |
| _addPtPrg | Add Points |
| _raccPrg | Vertical Connector |
| _disElemPrg | Particular Elements Design |
| _newPol | New Profile Polyline |
| _newPrgDTM | New Profile Polyline from DTM |
| _editPol | Edit Profile Polyline |
| _addPtPrgPol | Add Particular Point |
| _cimaPrgPol | To Tip/Join Projects and Profiles |
| _spePrgPol | To Divide Projects and Profiles |
| _delPrgPol | Cancel Project/Polyline |
| _optCancPt | Erase Point |
| _optCancPtInt | Erase Intermediate Points |
| _scriCol | Culture Texts |
| _scriFinc | Changeable Column Texts |
| _scriDist | Selected Distances Texts |
| _scriComm | Vertical Comments |
| _delScr | To Eliminate Particular Texts |
| _elevJumpAuto | Automatic Quote Jump |
| _elevJumpSel | Quote Jump Selection |
| _elevJumpAnn | Cancel Quote Jump |
| _newGrubAutoScotAuto | Cross Section - Create Automatic Grubbing |
| _newHorizEx | Cross Section - Create Reclamation |
| _ newBenchEx | Cross Section - Create Terracing |
| _editSag | Change Template |
| _roadVolOpt | Set volumes calculation |
| _roadVolSect | Print calculation of leveled sections volumes |
| _roadVolTray | Print volumes calculation tray |
| _roadVolSectFile | Create file with leveled sections volumes |
| _roadVolTrayFile | Create file with volumes tray calculation |
| _roadPrtSectAreas | Calculate sections areas |
| _roadPrtSectAreasElement | Calculate elementary sections areas |
| _roadPrtSectVol | Calculate sections volumes |
| _chkRule | Guidelines check... |

# Road Template Editor

This command is used to create road templates that may then be mounted onto a progressive interval ("**Roads|Cross Sections|Template intervals"** command in the CAD View).

The road template can be stored in a .sag format file so that it can be used in multiple projects.

The editor used for creating the template is very simple and versatile: the right side lists the elements that can be added while the left side shows those already inserted.

In the "**Element information**" view, the user can read and change the information associated with the element selected in the "**Elements list**" view while the central part offers a graphic view that can display the planned template as well as its mounting on the current road.

The following information is found on the "**Cross section Data**" view:

– Section chainage values;

– Ground and project values;

– Slope and widening values.

In the **"Template Editor**" these values can be edited to test the mounting of the template; in the "**Mount on road"** they are calculated based on the current road and cannot be changed, except for the chainage (using the edit field or the slider).

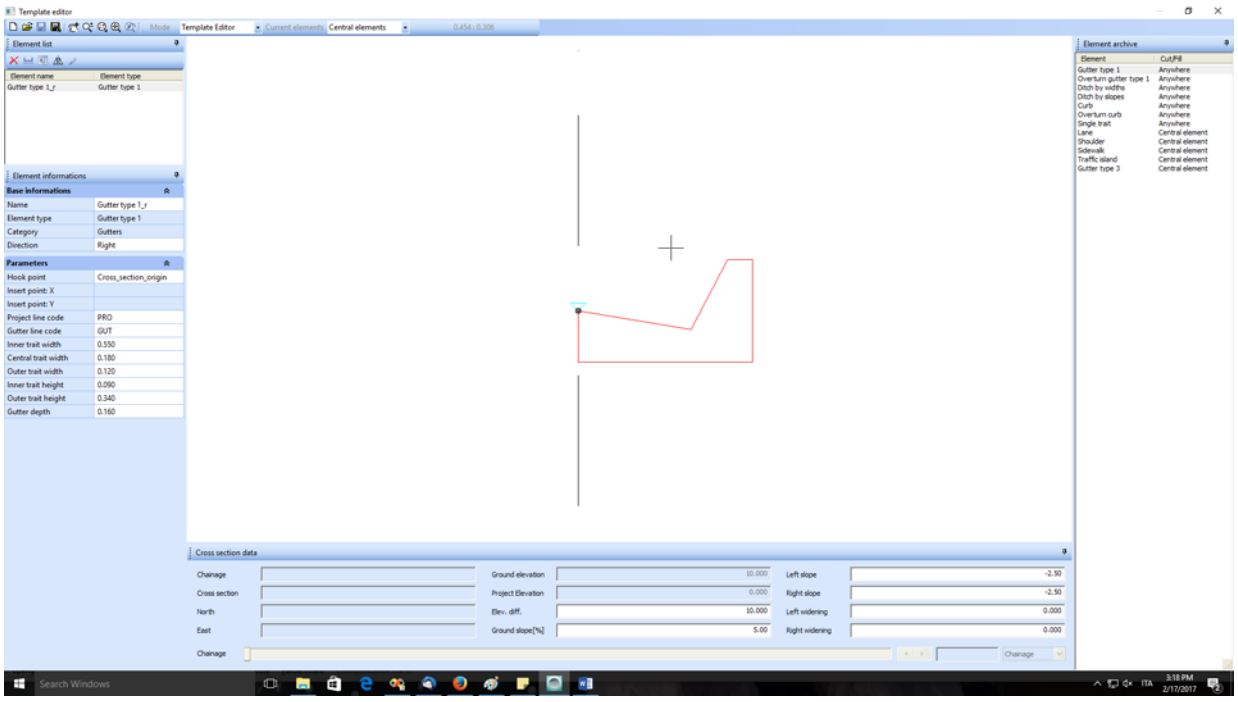



**Figure 442:**

# Template edit method

## Road elements

Road elements that can be inserted into a road template are divided into three types:

Central elements:

- Gutter type 1
- Overturn gutter type 1
- Ditch (by width, by slopes)
- Single trait
- Lane
- Shoulder
- Sidewalk
- Curb
- Overturn curb
- Gutter type 3

Excavation elements:

- Gutter type 1
- Overturn gutter type 1
- Ditch (by width, by slopes)
- Single trait
- Cantilever wall
- Gravity wall
- Fixed slope
- Automatic slope
- Fixed bench
- Automatic bench
- Gutter type 2 by slope
- Gutter type 2 by width

Fill elements:

- Gutter type 1
- Overturn gutter type 1
- Ditch (by width, by slopes)
- Single trait
- Retaining wall
- Gravity wall
- Fixed slope
- Automatic slope
- Fixed bench
- Automatic bench
- Gutter type 2 by slope
- Gutter type 2 by width

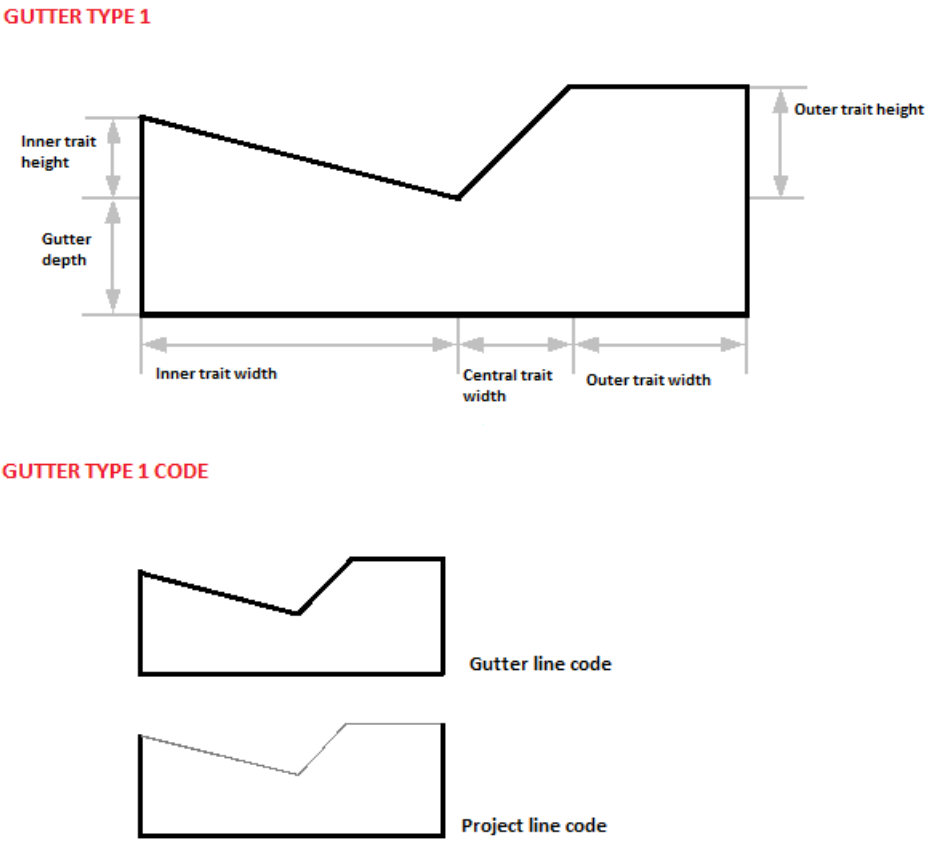



**Figure 443:**

The parameters for the gutter type 1 are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and gutter line codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (inner, central, outer trait);

– Height (inner, outer trait);

– Depth.

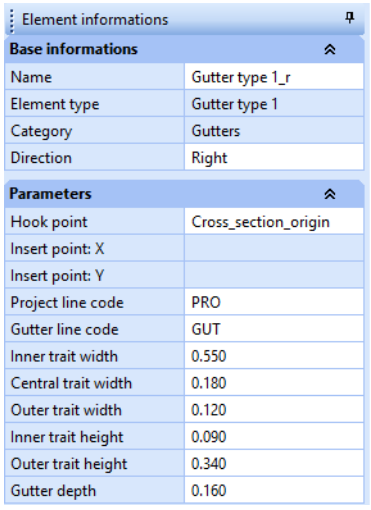



**Figure 444:**

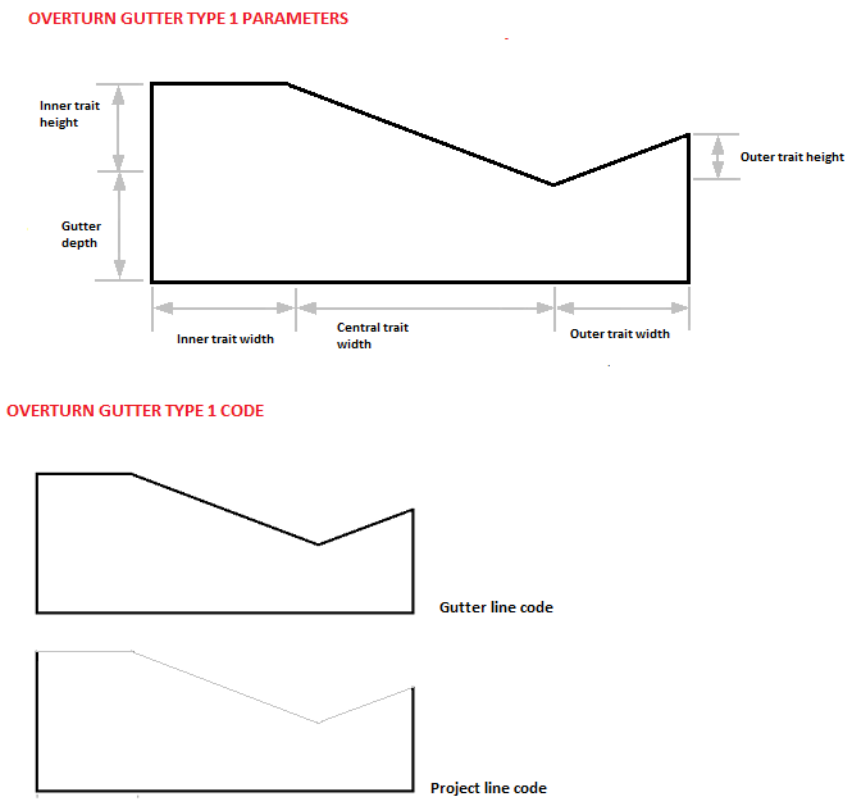



**Figure 445:**

The parameters for the Overturn gutter type 1 are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and gutter line codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (inner, central, outer trait);

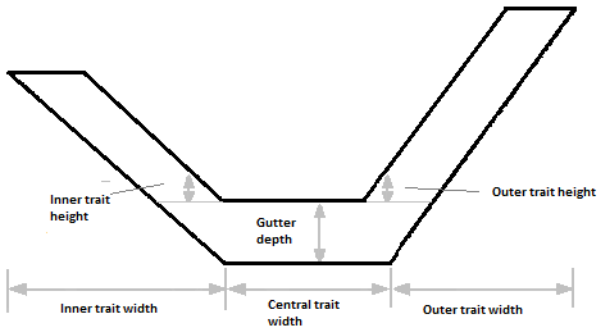
– Height (inner, outer trait);

– Depth.

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Overturn gutter type 1_r |
| Element type | Overturn gutter type 1 |
| Category | Gutters |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Gutter line code | GUT |
| Inner trait width | 0.120 |
| Central trait width | 0.180 |
| Outer trait width | 0.550 |
| Inner trait height | 0.340 |
| Outer trait height | 0.090 |
| Gutter depth | 0.160 |

**Figure 446:**

GUTTER TYPE 2 BY WIDTHS PARAMETERS




GUTTER TYPE 2 BY WIDTHS PARAMETERS

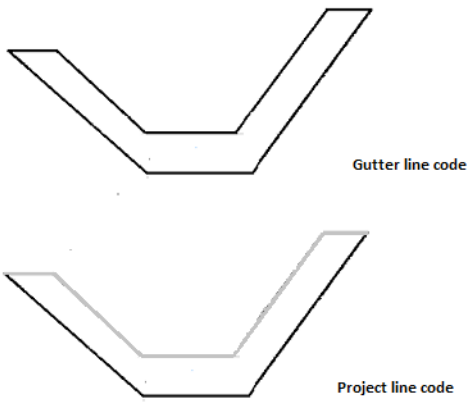



**Figure 447:**

The parameters for the gutter type 2 defined by widths are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and gutter line codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (inner, central, outer trait);

– Gutter thickness;

– Height (inner, outer trait);

– Gutter depth;

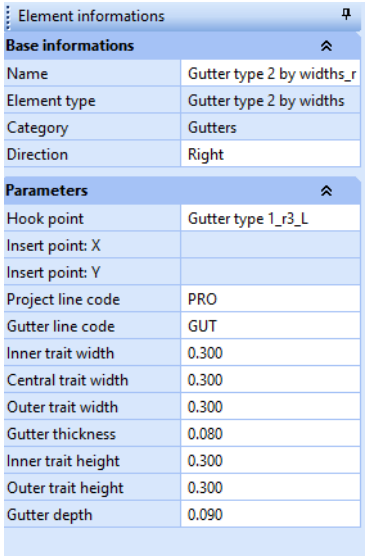



**Figure 448:**

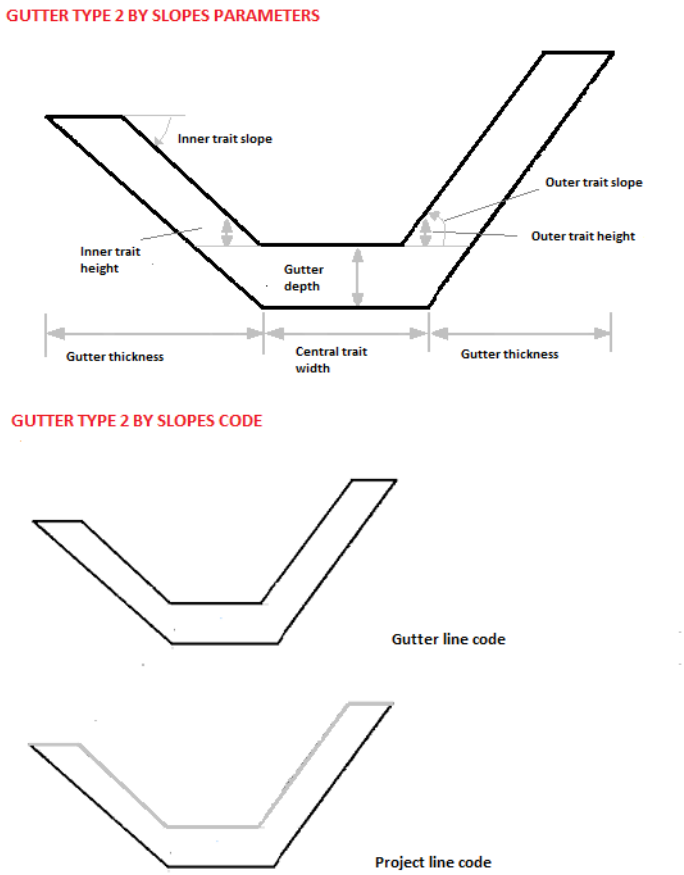



**Figure 449:**

The parameters for the gutter type 2 defined by slopes are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and gutter line codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (central trait);

– Gutter thickness

– Height (inner, outer trait);

– Inner trait slope;

– Outer trait slope;

– Gutter depth.

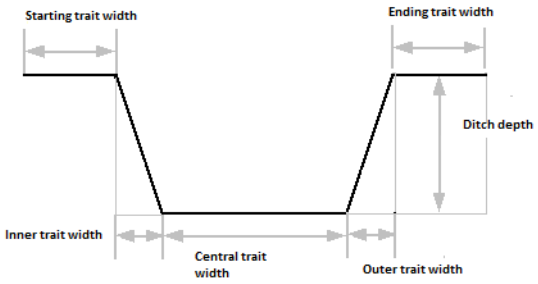
Element informations

| Base informations | |
|---|---|
| Name | Gutter type 2 by slopes_r |
| Element type | Gutter type 2 by slopes |
| Category | Gutters |
| Direction | Right |

| Parameters | |
|---|---|
| Hook point | None |
| Insert point: X | 0.057 |
| Insert point: Y | 0.095 |
| Project line code | PRO |
| Gutter line code | GUT |
| Central trait width | 0.300 |
| Gutter thickness | 0.080 |
| Inner trait height | 0.300 |
| Outer trait height | 0.300 |
| Inner trait slope [%] | 100.000 |
| Outer trait slope [%] | 100.000 |
| Gutter depth | 0.090 |

**Figure 450:**

DITCH BY WIDTHS PARAMETER




DITCH BY WIDTHS CODE

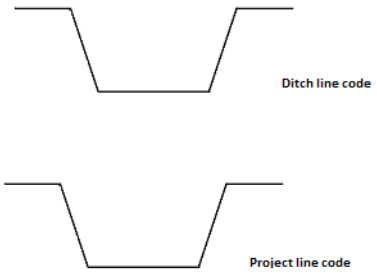



**Figure 451:**

The parameters for the ditch defined by width are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and ditch codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (starting, inner, central, outer, ending trait);

– Ditch depth.

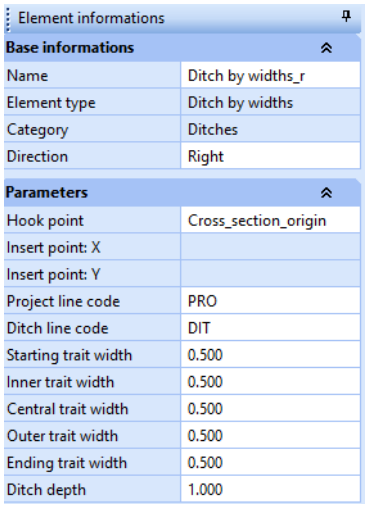



**Figure 452:**

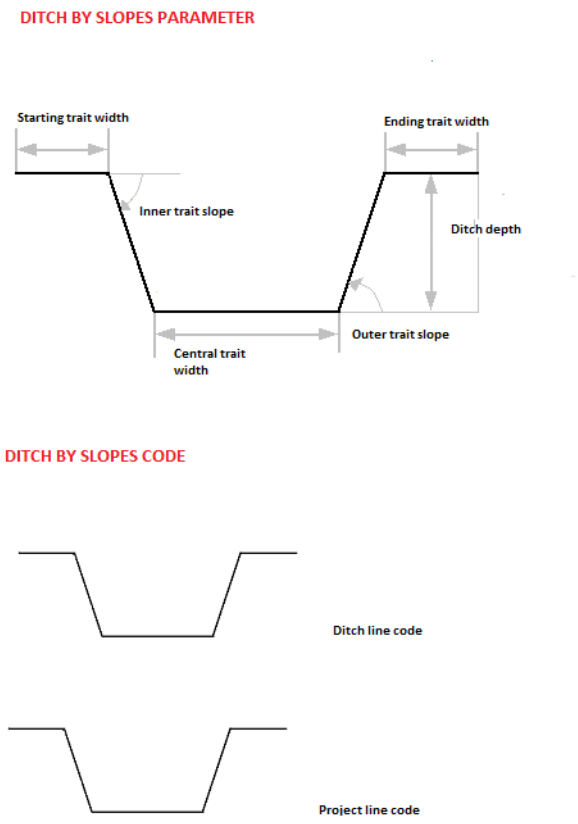



**Figure 453:**

The parameters for the ditch defined by slopes are:

– Name;

– Direction (right or left);

– Insert point (none or section origin or other);

– Project and ditch codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Width (starting, central, ending trait);

– Inner trait slope;

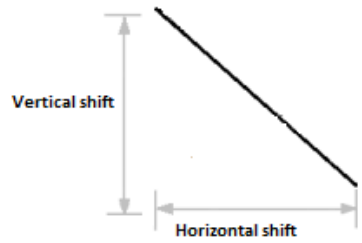
– Outer trait slope;

– Ditch depth;

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Ditch by slopes_r |
| Element type | Ditch by slopes |
| Category | Ditches |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Ditch line code | DIT |
| Starting trait width | 0.500 |
| Central trait width | 0.500 |
| Ending trait width | 0.500 |
| Inner trait slope [%] | 100.000 |
| Outer trait slope [%] | 100.000 |
| Ditch depth | 1.000 |

**Figure 454:**

SINGLE TRAIT PARAMETER




SINGLE TRAIT CODE


**Figure 455:**

The parameters for the Single trait are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line code: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Horizontal shift;

– Vertical shift;

– Visible, to make the single trait visible (Yes) or invisible (No).

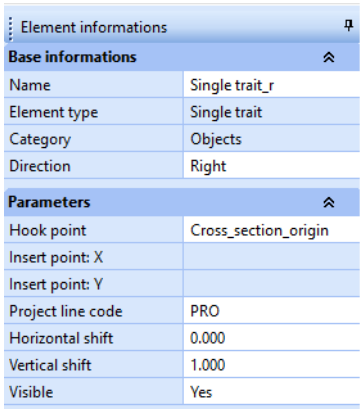



**Figure 456:**

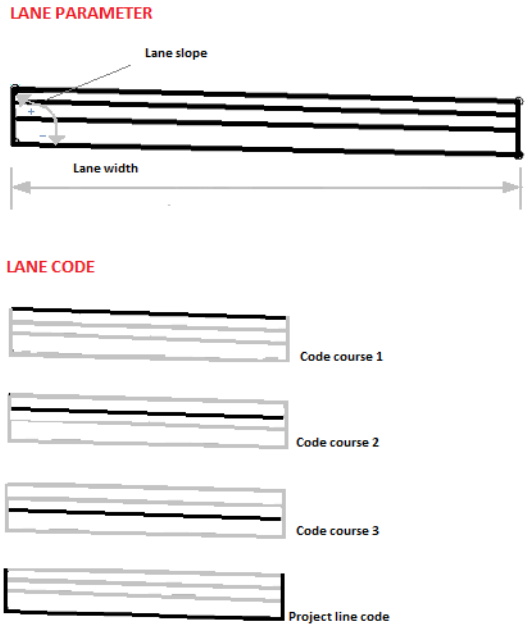



**Figure 457:**

The parameters for the Lane are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and courses codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Widening: if this option is set at "**Yes**" then the element will consider the graph of the slopes and widenings in the road mount method.

– Lane width;

– Type of slope; this can be:

– 1."**By Graph**": the slope is calculated taking into account the graph of the slopes and widenings of the road;

– 2."**Fixed**": the slope is selected by the user and must be inserted into the "**Lane Slope [%]**" field;

– Courses: these represent the courses that constitute the lane. Each course has a code, a depth, a widening and a slope associated. Courses can be changed using the "**Manage courses**" command available in the "**Element list"** view.

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Lane_r |
| Element type | Lane |
| Category | Roadways |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Widening | Yes |
| Lane width | 3.000 |
| Slope type | By graph |
| Lane slope [%] | -2.500 |
| **Courses** | |
| Code course 1 | USUR |
| Depth course 1 | 0.070 |
| Widening course 1 | 0.000 |
| Slope course 1 [%] | 0.000 |
| Horizontal course 1 | No |
| Code course 2 | BIND |
| Depth course 2 | 0.100 |
| Widening course 2 | 0.000 |
| Slope course 2 [%] | 0.000 |
| Horizontal course 2 | No |
| Code course 3 | BASE |
| Depth course 3 | 0.150 |
| Widening course 3 | 0.000 |
| Slope course 3 [%] | 0.000 |
| Horizontal course 3 | No |

**Figure 458:**

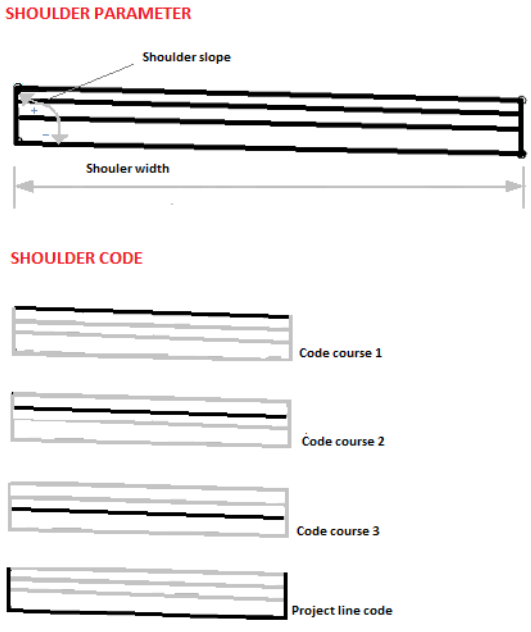



**Figure 459:**

The parameters for the shoulder are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and courses codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Shoulder width;

– Type of slope; this can be:

1.“**By Graph**”: the slope is calculated taking into account the graph of the slopes and widenings of the road;

2.“**Fixed**”: the slope is selected by the user and must be inserted into the “**Shoulder Slope [%]**” field.

– Courses: these represent the courses that constitute the shoulder. Each course has a code, a depth, a widening and a slope associated. Courses can be changed using the “Manage courses” command available in the “Element list” view.

Element informations

| Base informations | |
|---|---|
| Name | Shoulder_r |
| Element type | Shoulder |
| Category | Roadways |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Shoulder width | 1.000 |
| Slope type | By graph |
| Shoulder slope [%] | -2.500 |
| **Courses** | |
| Code course 1 | USUR |
| Depth course 1 | 0.070 |
| Widening course 1 | 0.000 |
| Slope course 1 [%] | 0.000 |
| Horizontal course 1 | No |
| Code course 2 | BIND |
| Depth course 2 | 0.100 |
| Widening course 2 | 0.000 |
| Slope course 2 [%] | 0.000 |
| Horizontal course 2 | No |
| Code course 3 | BASE |
| Depth course 3 | 0.150 |
| Widening course 3 | 0.000 |
| Slope course 3 [%] | 0.000 |
| Horizontal course 3 | No |

**Figure 460:**

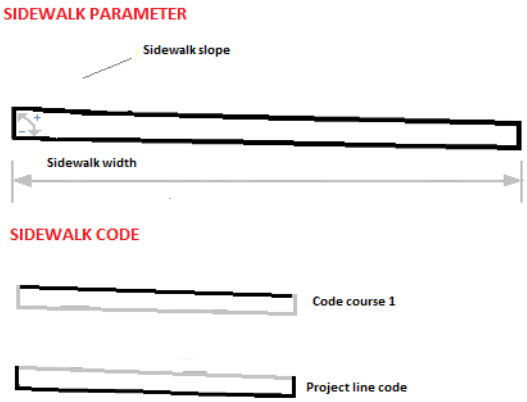



**Figure 461:**

The parameters for the sidewalk are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and sidewalk codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Sidewalk width;

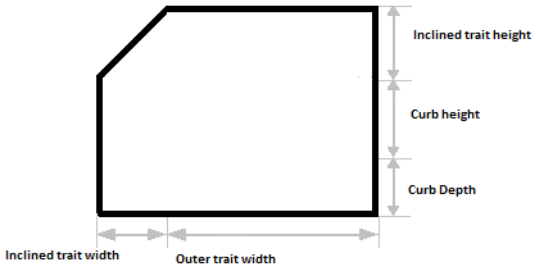
– Sidewalk slope;

– Courses: these represent the courses that constitute the sidewalk. Each course has a code, a depth, a widening and a slope associated. Courses can be changed using the "**Manage courses**" command available in the "**Element list**" view.

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Sidewalk_r |
| Element type | Sidewalk |
| Category | Roadways |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Sidewalk width | 1.000 |
| Sidewalk slope [%] | 0.000 |
| **Courses** | |
| Code course 1 | PAV |
| Depth course 1 | 0.080 |
| Widening course 1 | 0.000 |
| Slope course 1 [%] | 0.000 |
| Horizontal course 1 | No |
| Code course 2 | CONC |
| Depth course 2 | 0.080 |
| Widening course 2 | 0.000 |
| Slope course 2 [%] | 0.000 |
| Horizontal course 2 | No |

**Figure 462:**

CURB PARAMETER




CURB CODE

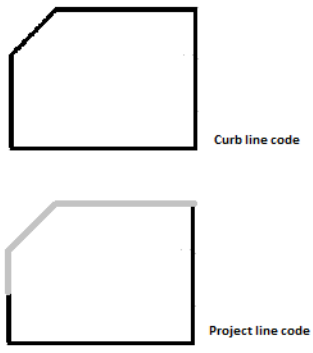



**Figure 463:**

The parameters for the curb are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and curb codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Inclined trait width;

– Outer trait width;

– Curb height;

– Inclined trait height;

– Curb depth.

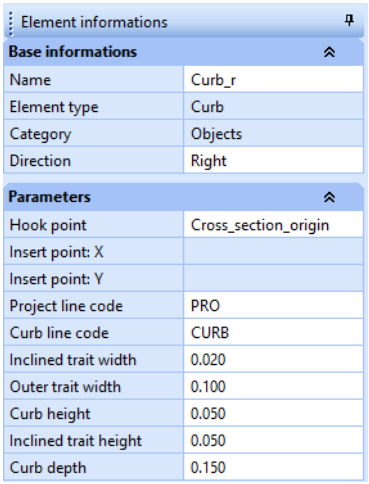



**Figure 464:**

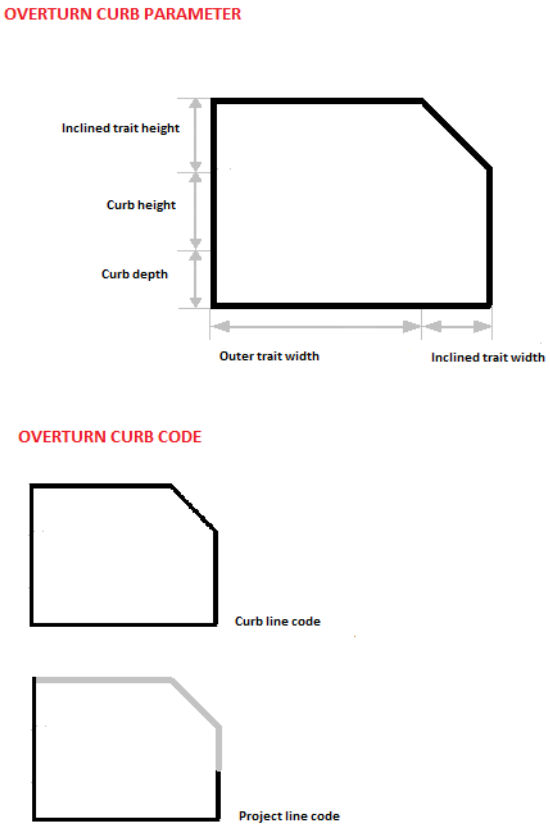



**Figure 465:**

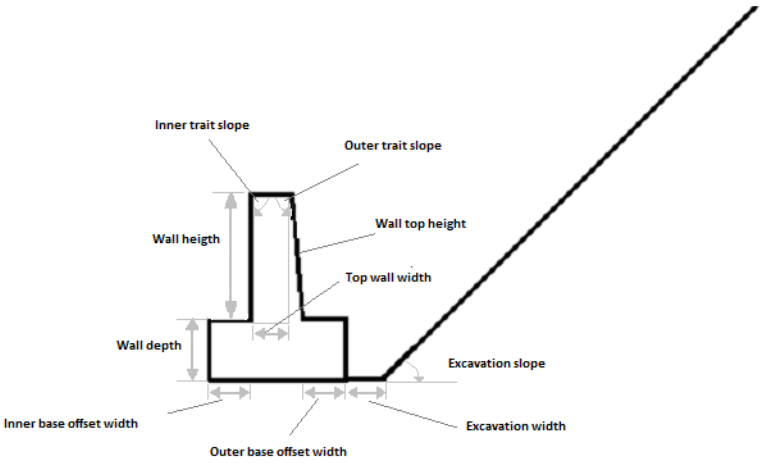
The parameters for the overturn curb are:

- Name;
- Direction;
- Insert point (none or section origin or other);
- Project line and curb codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;
- Inclined trait width;
- Inner trait width;
- Curb height;
- Inclined trait height;
- Curb depth.

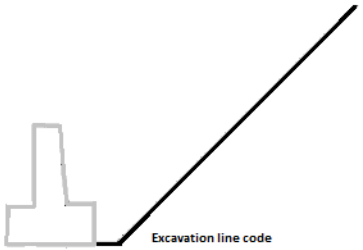
| Element informations | |
|---|---|
| **Base informations** | |
| Name | Overturn curb_r |
| Element type | Overturn curb |
| Category | Objects |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Curb line code | CURB |
| Inner trait width | 0.100 |
| Inclined trait width | 0.020 |
| Curb height | 0.050 |
| Inclined trait height | 0.050 |
| Curb depth | 0.150 |

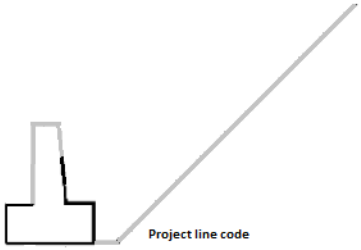
**Figure 466:**

CANTILEVER WALL PARAMETER




CANTILEVER WALL CODE




CANTILEVER WALL CODE

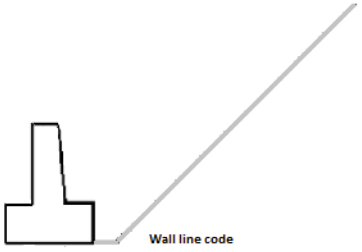



**Figure 467:**

The parameters for the cantilever wall are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line, wall and excavation codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Top wall width;

– Outer base offset width;

– Inner base offset width;

– Excavation width;

– Wall height: this value is considered only if the "**Automatic height**" field is set at "**No**" and is used to set the wall height;

– Maximum height: the maximum height value of the wall if the automatic height has been activated;

– Minimum height: the minimum height value of the wall if the automatic height has been activated;

– Wall top height (represents the point where another element can be connected);

– Inner trait slope;

– Outer trait slope;

– Excavation slope;

– Wall depth.

| Base informations | |
|---|---|
| Name | Cantilever wall_r |
| Element type | Cantilever wall |
| Category | Walls |
| Direction | Right |
| **Parameters** | |
| Hook point | None |
| Insert point: X | 1.046 |
| Insert point: Y | 1.046 |
| Project line code | PRO |
| Wall line code | WALL |
| Excavation line code | EXC |
| Top wall width | 1.000 |
| outer bae offset width | 1.000 |
| Inner base offset width | 1.000 |
| Excavation width | 1.000 |
| Automatic height | Yes |
| Wall height | 3.000 |
| Maximum height | 9.000 |
| Minimum height | 0.500 |
| Wall top height | 0.000 |
| Inner trait slope [%] | 0.000 |
| Outer trait slope [%] | 10.000 |
| Excavation slope [%] | 100.000 |
| Wall depth | 1.500 |

**Figure 468:**

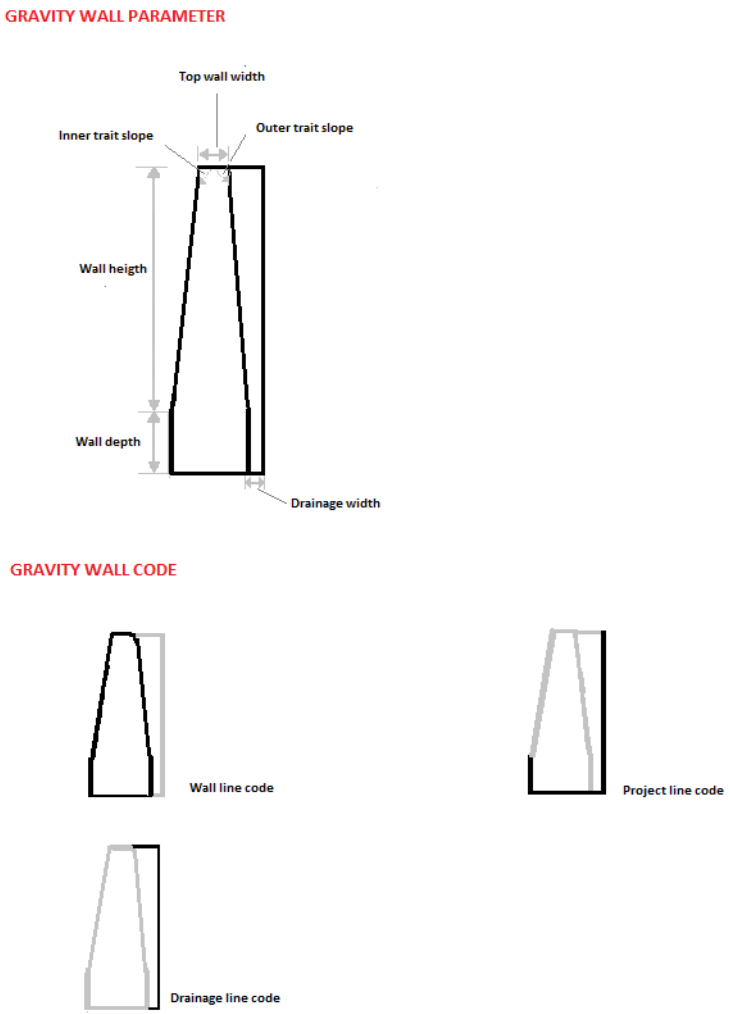



**Figure 469:**

The parameters for the gravity wall are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line, wall and drainage codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Top wall width;

– Drainage width;

– Automatic height: if set to "Yes" then the height is calculated with the intersection of the ground and cannot be greater than the value inserted in the "**Maximum height"** field;

– Wall height: this value is considered only if the **"Automatic height"** field is set at **"No"** and is used to set the wall height;

– Maximum height: the maximum height value of the wall if the automatic height has been activated;

– Minimum height: the minimum height value of the wall if the automatic height has been activated;

– Inner trait slope;

– Outer trait slope;

– Wall depth.

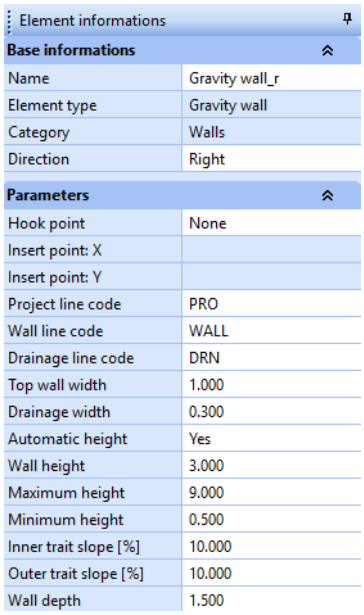



**Figure 470:**

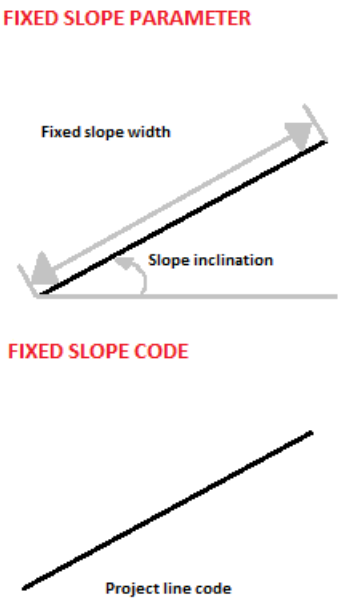



**Figure 471:**

The parameters for the fixed slope are:

– Name;

– Direction;

– Inssert point (none or section origin or other);

– Project line code. these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Slope width;

– Slope inclination;

– Grass course depth

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Fixed slope_r |
| Element type | Fixed slope |
| Category | Slopes |
| Direction | Right |
| **Parameters** | |
| Hook point | Fixed bench_r19_L |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Grass course code | GRS |
| Slope width | 5.000 |
| Slope inclination[%] | 100.000 |
| Grass course depth | 0.000 |

**Figure 472:**

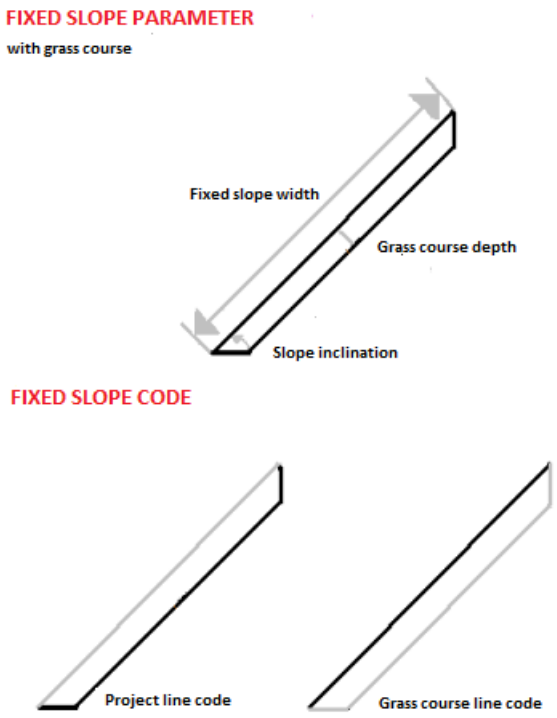



**Figure 473:**

The parameters for the fixed slope with vegetal terrain are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line code. these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Slope width;

– Slope inclination;

– Grass course depth.

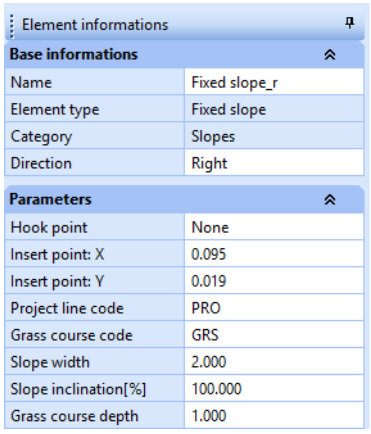



**Figure 474:**

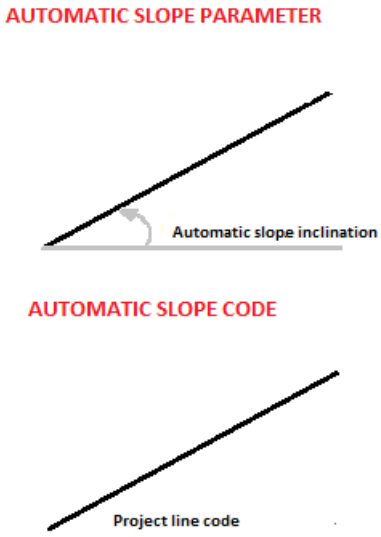



**Figure 475:**

The parameters for the automatic slope are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line code. these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

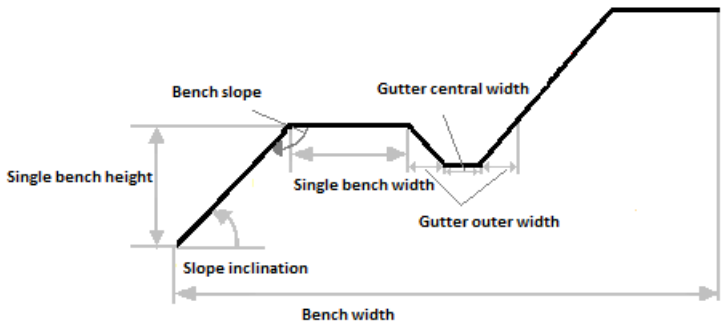
– Slope inclination;

– Grass course depth.

| Element informations | |
|---|---|
| **Base informations** | |
| Name | Automatic slope_r |
| Element type | Automatic slope |
| Category | Slopes |
| Direction | Right |
| **Parameters** | |
| Hook point | None |
| Insert point: X | 0.014 |
| Insert point: Y | -0.020 |
| Project line code | PRO |
| Grass course code | GRS |
| Maximum width | |
| Maximum height | |
| Slope inclination[%] | 100.000 |
| Grass course depth | 0.000 |

**Figure 476:**

FIXED BENCH PARAMETER




FIXED BENCH CODE


**Figure 477:**

The parameters for the fixed bench are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line code: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Single bench width;

– Insert gutter: to establish whether or not to insert gutter.

– Gutter outer width;

– Gutter central width;

– Bench width;

– Single bench height;

– Gutter height;

– Slope inclination;

– Bench slope;

– Maximum number of steps.

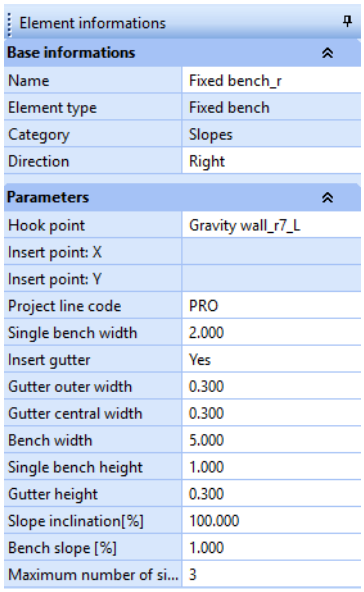



**Figure 478:**

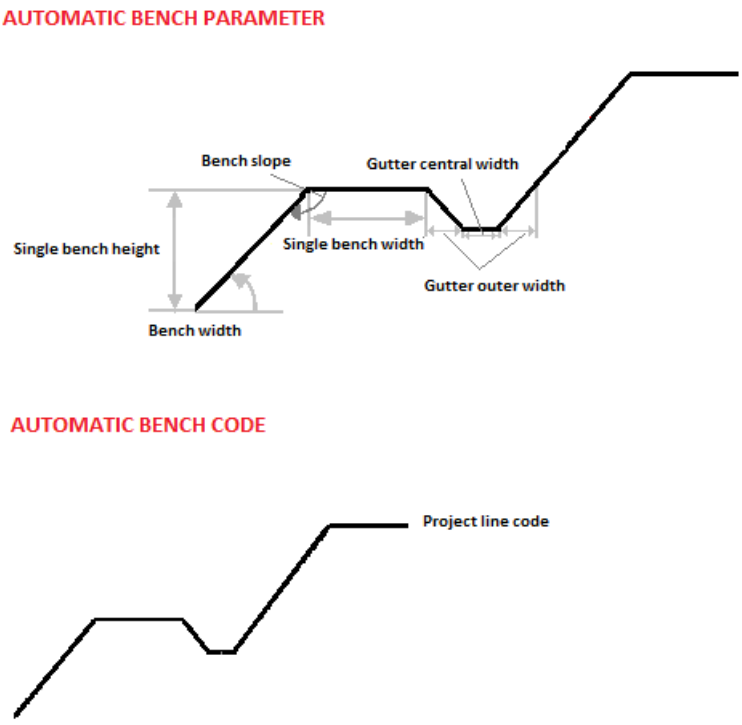



**Figure 479:**

The parameters for the automatic bench are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line code: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Single bench width;

– Insert gutter: to establish whether or not to insert gutter.

– Gutter outer width;

– Gutter central width;

– Bench height;

– Gutter height;

– Slope inclination;

– Bench slope;

– Maximum number of steps.

| Base informations | |
|---|---|
| Name | Automatic bench_r |
| Element type | Automatic bench |
| Category | Slopes |
| Direction | Right |
| **Parameters** | |
| Hook point | None |
| Insert point: X | 0.014 |
| Insert point: Y | 0.459 |
| Project line code | PRO |
| Maximum width | |
| Maximum height | |
| Single bench width | 2.000 |
| Insert gutter | Yes |
| Gutter outer width | 0.300 |
| Gutter central width | 0.300 |
| Single bench height | 1.000 |
| Gutter height | 0.300 |
| Slope inclination[%] | 100.000 |
| Bench slope [%] | 1.000 |
| Maximum number of si... | 3 |

**Figure 480:**

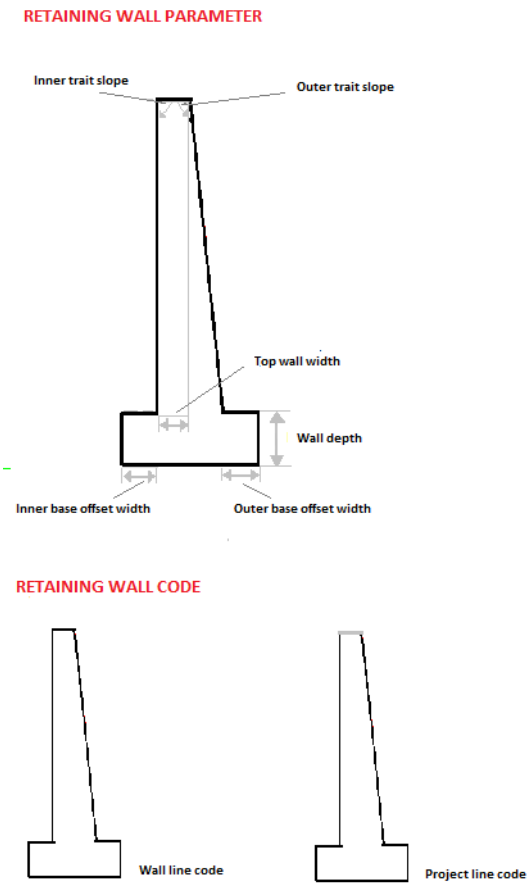



**Figure 481:**

The parameters for the retaining wall are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and wall codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Top wall width;

– Outer base offset width;

– Inner base offset width;

– Automatic height: if set to " - " then the height is calculated with the intersection of the terrain and cannot be greater than the value inserted in the "**Maximum height**" field;

– Maximum height: the maximum height value of the wall if the automatic height has been activated;

– Wall height: this value is considered only if the "**Automatic height"** field is set at "**No**" and is used to set the wall height;

– Maximum height: calculation of the wall height is always automatic and the user can select only the maximum height;

– Inner trait slope;

– Outer trait slope;

– Wall depth.

| **Base informations** | |
|---|---|
| Name | Retaining wall_r |
| Element type | Retaining wall |
| Category | Walls |
| Direction | Right |
| **Parameters** | |
| Hook point | None |
| Insert point: X | 0.171 |
| Insert point: Y | 0.133 |
| Project line code | PRO |
| Wall line code | WALL |
| Top wall width | 1.000 |
| outer bae offset width | 1.000 |
| Inner base offset width | 1.000 |
| Automatic height | Yes |
| Wall height | 3.000 |
| Maximum height | 9.000 |
| Minimum height | 0.500 |
| Inner trait slope [%] | 0.000 |
| Outer trait slope [%] | 10.000 |
| Wall depth | 1.500 |

**Figure 482:**

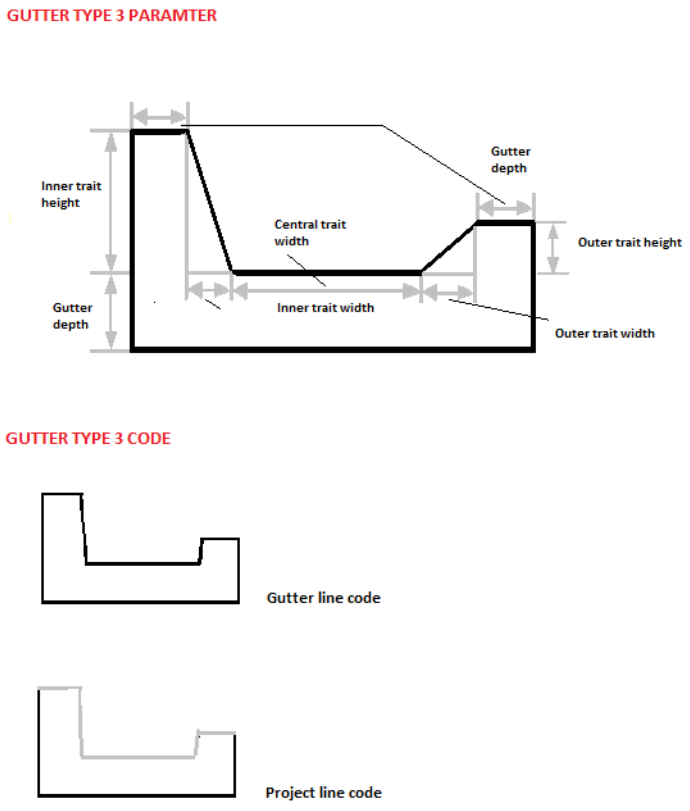



**Figure 483:**

The parameters for the curb trough are:

– Name;

– Direction;

– Insert point (none or section origin or other);

– Project line and gutter codes: these codes are used by the Altimetry view and create the lines describing the template mounted on the section;

– Inner trait width;

– Central trait width;

– Outer trait width;

– Gutter thickness

– Inner trait height;

– Outer trait height;

– Gutter depth.

Element informations

| Base informations | |
|---|---|
| Name | Gutter type 3_r |
| Element type | Gutter type 3 |
| Category | Gutters |
| Direction | Right |
| **Parameters** | |
| Hook point | Cross_section_origin |
| Insert point: X | |
| Insert point: Y | |
| Project line code | PRO |
| Gutter line code | GUT |
| Inner trait width | 0.010 |
| Central trait width | 0.200 |
| Outer trait width | 0.010 |
| Gutter thickness | 0.070 |
| Inner trait height | 0.130 |
| Outer trait height | 0.050 |
| Gutter depth | 0.070 |

**Figure 484:**

# Inserting an Element

To insert an element the user must first specify if an element is central, cut or fill using the menu found alongside the current elements.

After selecting the type of element, it is selected from the Elements Archive and dragged into the graphic view using the mouse, keeping the left button pressed down.

If the element is not set in a valid connection point, the program will display the "**Insert element**" window where the user can:

– not specify the connection point and edit the x,y insertion coordinates;

– specify the connection point (origin_section or other).

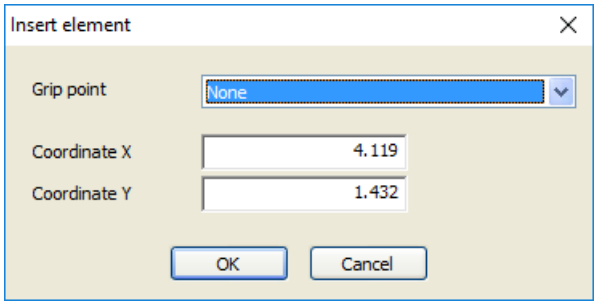



**Figure 485:**

If the element is connected at the same point as another element, then the program will ask whether to connect the other elements to that element.

Another thing the program may ask, during the element insertion phase, is its direction (right or left) according to the origin point.

Only for inserting a lane, berm or sidewalk the program will display the "**Manage layers**" window described below.

## Delete an Element

To delete an element, the user will activate the "**Delete**" command from the "**List elements"** view after selecting it.

## Change Element Property

The properties of an element can be changed through the "**Element informations**" view after selecting the element to change in the "**List elements**" view.

## Reflect One Side of Template

To reflect the side of a temple, the user must activate the "**Mirror side**" command; this command is used to copy the elements found on one side of the template onto another and eliminate those existing. The side onto which the elements are to be copied must be specified by the user.

## Transfer Properties from One Element to Another

This command is used to transfer the settings from one element in the template to another element of the same type specifying it graphically.

## Manage courses

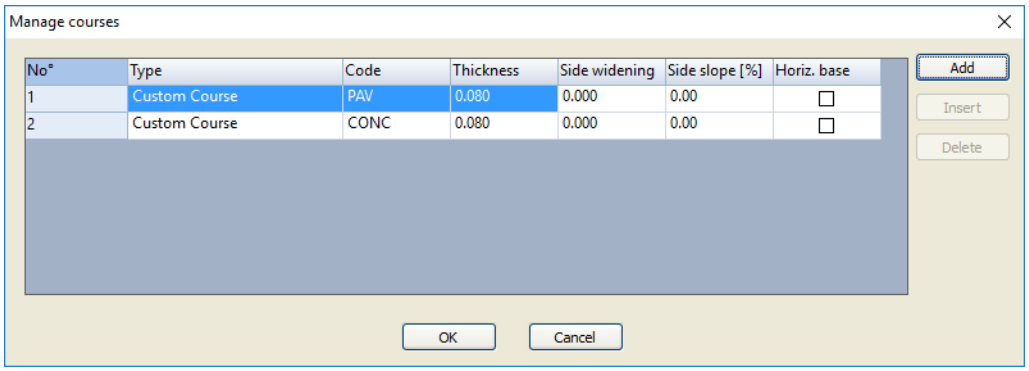



**Figure 486:**

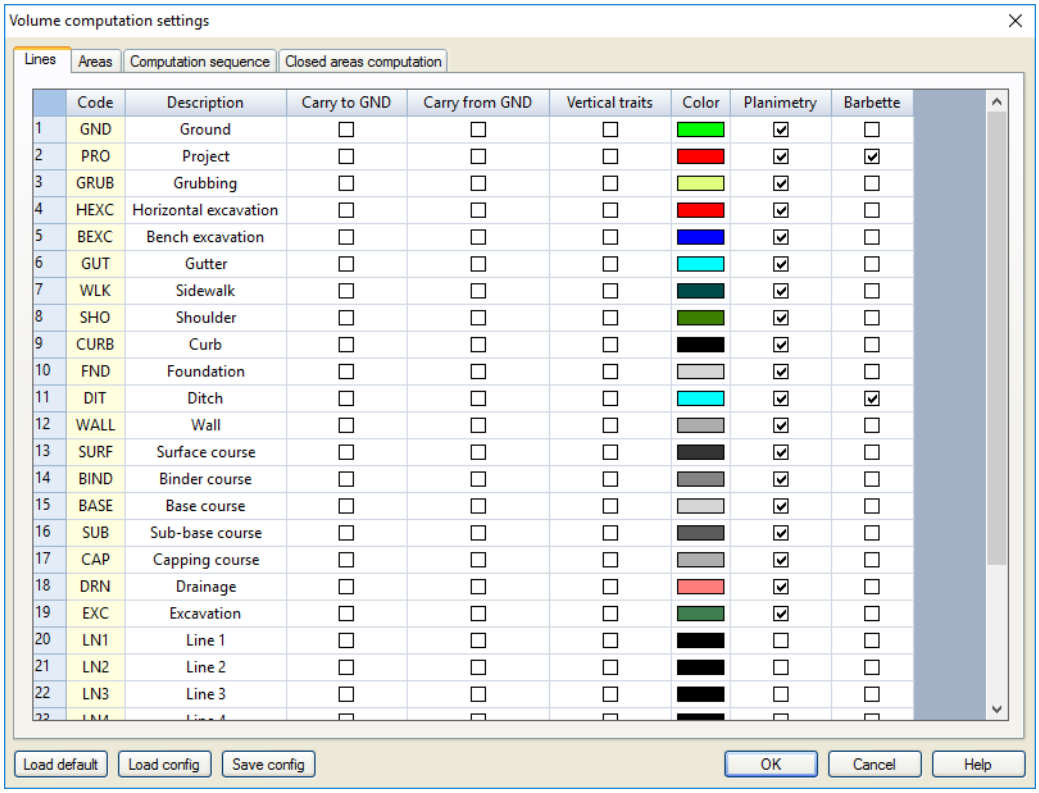
The "**Manage courses"** command in the "**List elements**" view is used to add/insert or eliminate courses from a lane, shoulder or sidewalk.

There are various types of courses:

- Surface course;
- Binder course;
- Base course;
- Subbase course;
- Capping course;
- User defined course.

For each course the user can define the thickness; if the course is defined by the user then the course code must also be inserted.

To ensure that the course code is valid, it must also be inserted into the Sections Codes or it will not be considered.




| | Code | Description | Carry to GND | Carry from GND | Vertical traits | Color | Planimetry | Barbette |
|---|---|---|---|---|---|---|---|---|
| 1 | GND | Ground | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 2 | PRO | Project | ☐ | ☐ | ☐ | | ☑ | ☑ |
| 3 | GRUB | Grubbing | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 4 | HEXC | Horizontal excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 5 | BEXC | Bench excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 6 | GUT | Gutter | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 7 | WLK | Sidewalk | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 8 | SHO | Shoulder | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 9 | CURB | Curb | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 10 | FND | Foundation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 11 | DIT | Ditch | ☐ | ☐ | ☐ | | ☑ | ☑ |
| 12 | WALL | Wall | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 13 | SURF | Surface course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 14 | BIND | Binder course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 15 | BASE | Base course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 16 | SUB | Sub-base course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 17 | CAP | Capping course | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 18 | DRN | Drainage | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 19 | EXC | Excavation | ☐ | ☐ | ☐ | | ☑ | ☐ |
| 20 | LN1 | Line 1 | ☐ | ☐ | ☐ | | ☐ | ☐ |
| 21 | LN2 | Line 2 | ☐ | ☐ | ☐ | | ☐ | ☐ |
| 22 | LN3 | Line 3 | ☐ | ☐ | ☐ | | ☐ | ☐ |

**Figure 487:**

# Cross section data

The following values can be changed in the Cross Sections Data view:

- Chainage: in this mode it is disabled;
- Section: in this mode it is disabled.

– East, North coordinate: in this mode they are disabled;

– Groud elevation: terrain quote at the template's central point;

– Project elevation: in this mode it is always zero;

– Elevation difference: difference between the project quote and the terrain quote at the template's central point;

– Ground slope: slope of the line representing the terrain;

– Left slope: left slope of the slopes and widenings graph;

– Right slope: right slope of the slopes and widenings graph;

– Left widening: left widening of the slopes and widenings graph;

– Right widening: right widening of the slopes and widenings graph;

– Progressive/Section slider: in this mode it is disabled;


**Figure 488:**

To test the road mounting.

# Mount on road method

This method is used to preview the mounting of the template on the current road point by point.

To ensure that the mounting is possible, the road must have the primary (PRO code) and ground (GND code) project.

In this method, the "**Elements Archive**" view is not available while the other view can be displayed but the values cannot be edited.

The only exception is the "**Cross Sections Data"** view where the user can change the chainage or section (using the chainage/section slider).

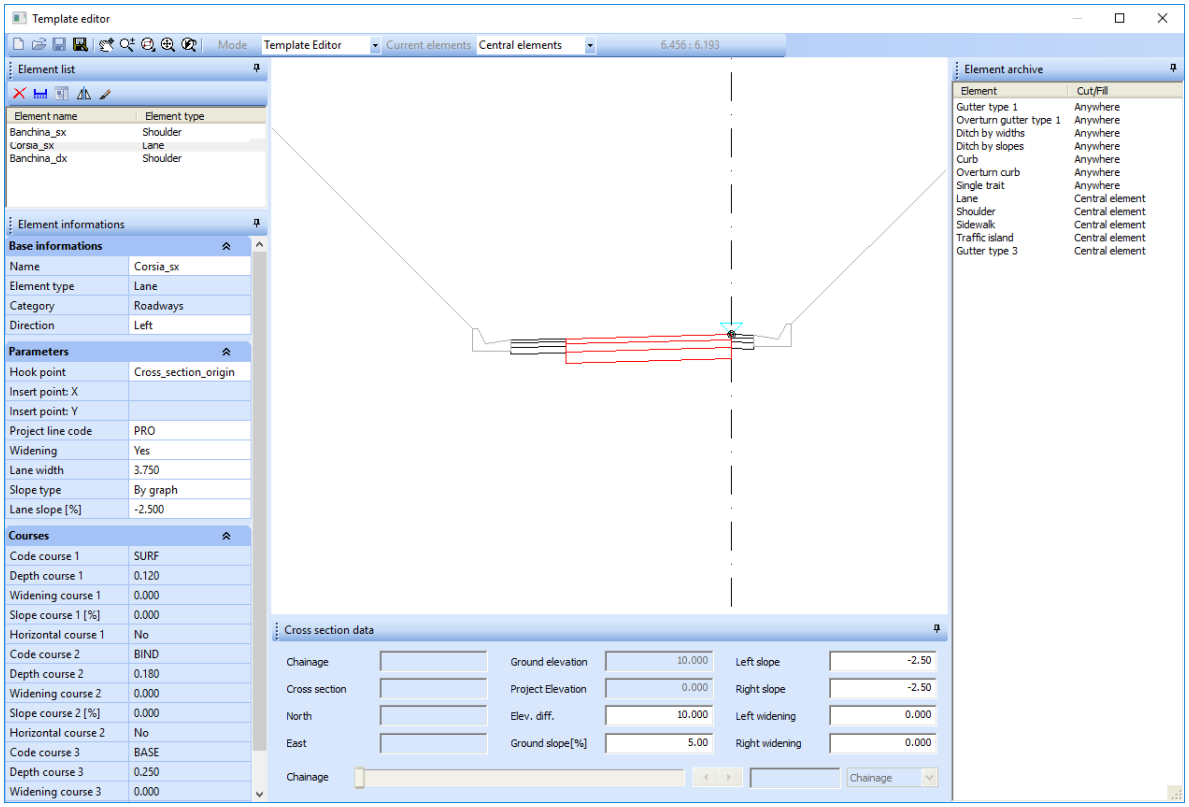



**Figure 489:**

In the "**Element Information**" view the user can set the characteristics for the entire road; to specify these characteristics for the chainage interval then the "**Element Properties"** window must be used, activated with the "**Edit Characteristics**" command (this command is active only if the editor is open from the "**Template Intervals**" window).

The window shows the list of changeable properties for the element selected in the **"List Elements"** view and a table where the intervals can be inserted.

The table includes three columns:

– Chainage;

– Value;

– Transition (none, linear, constant).

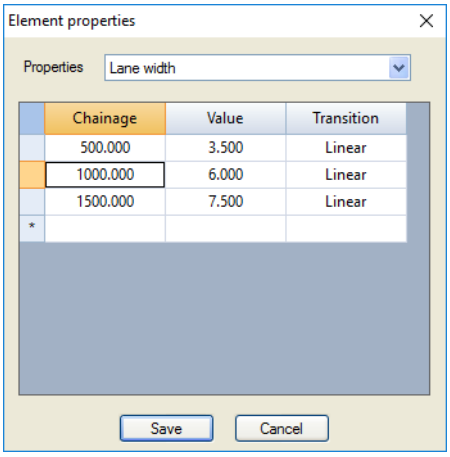



**Figure 490:**

The table is read vertically: if the transition is not set (none) then the value inserted applies only to the indicated chainage; if the transition is liner or constant then it applies to the chainage interval included between the current line and the next line.

If the transition is constant then the property of the element is fixed at that value in the interval.

If the transition is linear then the property of the element varies until it reaches the final one.

Consider two particular cases:

– If the "**Slope type**" property in the **"Element Information"** view is set at "**By Graph**" then this table is not taken into consideration.

– If the **"Widenings"** option in the "**Element Information"** view is active, then the widening is added to the width defined in the table.

# Mounting automatic slopes and automatic walls

Among the elements that can constitute a template, slopes, benches and walls are the only ones that can be automatic (for slopes selecting the **"Automatic slope**" element, for benches selecting the "**Automatic bench**" element, and for walls setting the "**Automatic Height"** property to "**Yes**"). When any of these automatic elements must be mounted, the program will design it until it finds the intersection with the terrain.

What happens if there is an automatic wall and an automatic slope (or bench)?

The program will rationalize as follows:

– If the slope/bench has no maximum limit (maximum width and maximum height are both not set) or if it is possible to connect the slope/bench to the ground without exceeding this limit, then only the slope/bench will be mounted.

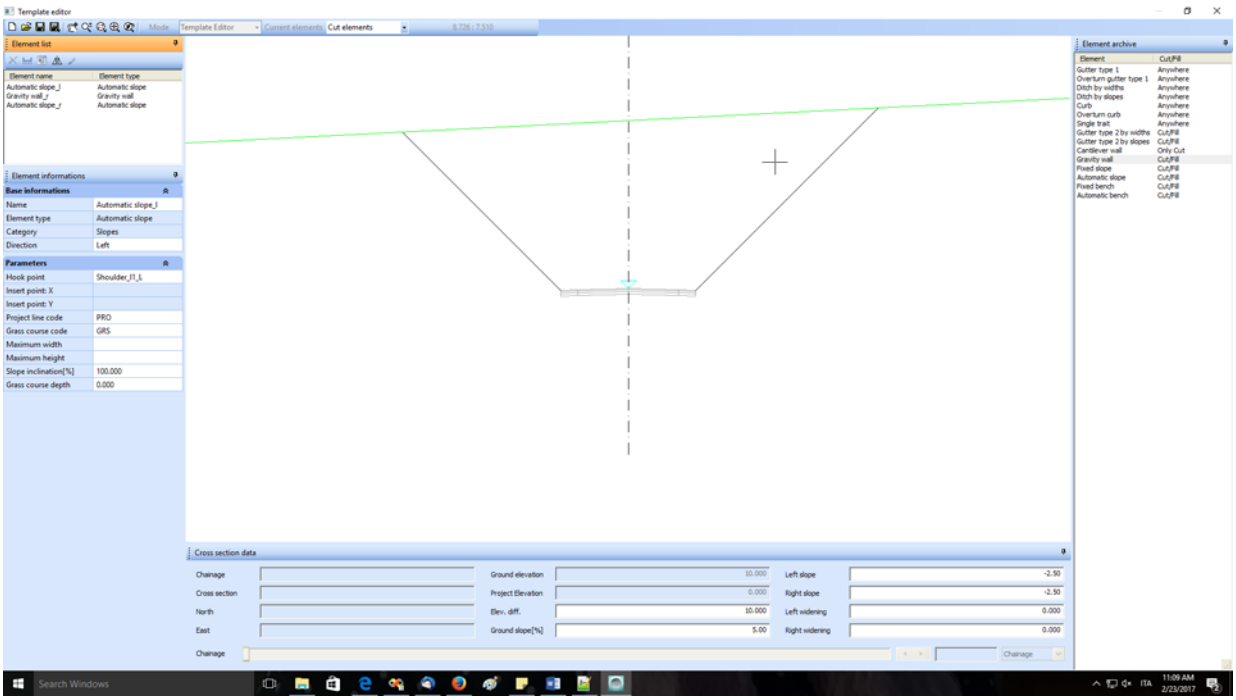



**Figure 491:**

– Otherwise the wall with the minimum height and the slope/bench needed to find the intersection with the ground will be mounted.

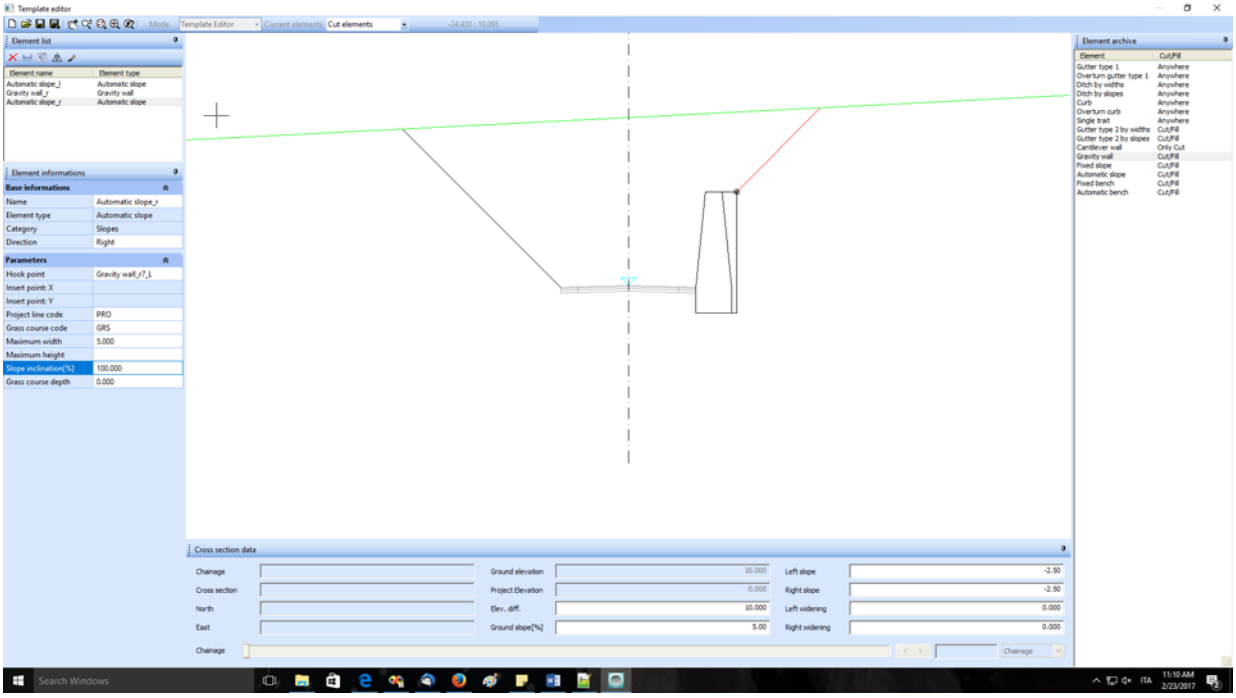


**Figure 492:**

– If in this case the slope/bench should exceed the maximum set limit, then the slope/bench will be mounted with the maximum width and the wall with the height needed to find the intersection with the ground.

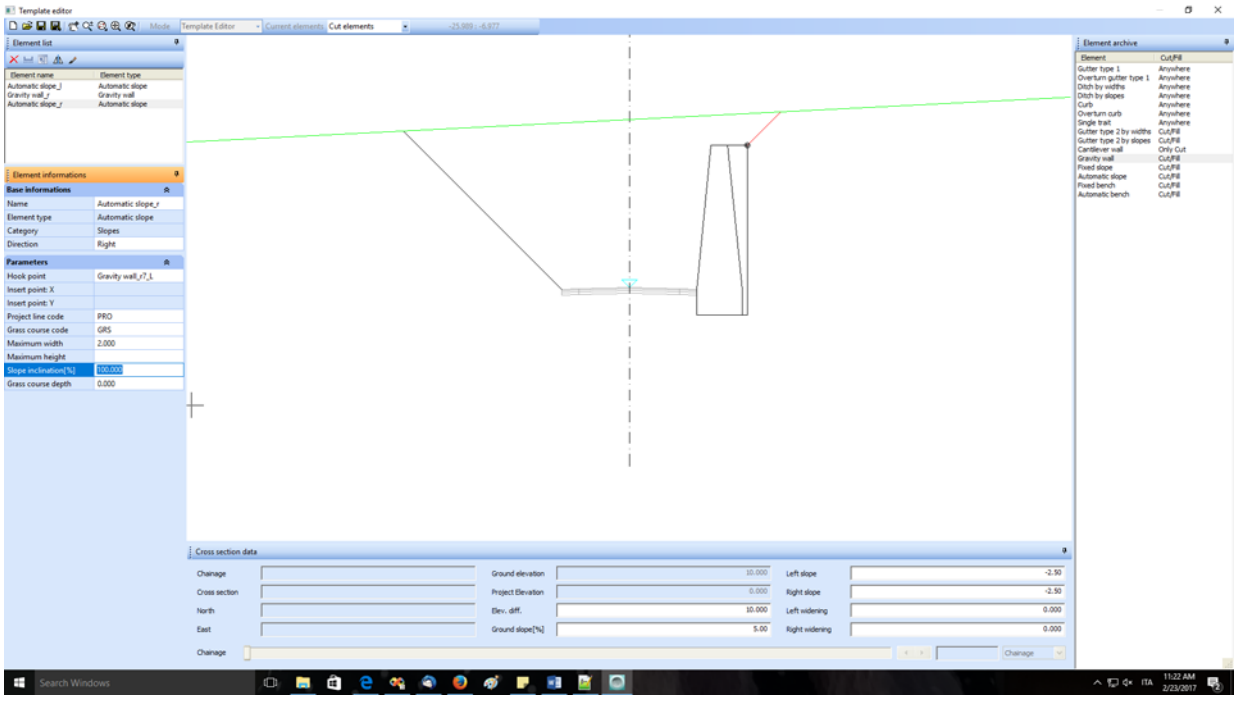


**Figure 493:**

– If in this case it cannot find an intersection, then both elements are mounted with maximum height.

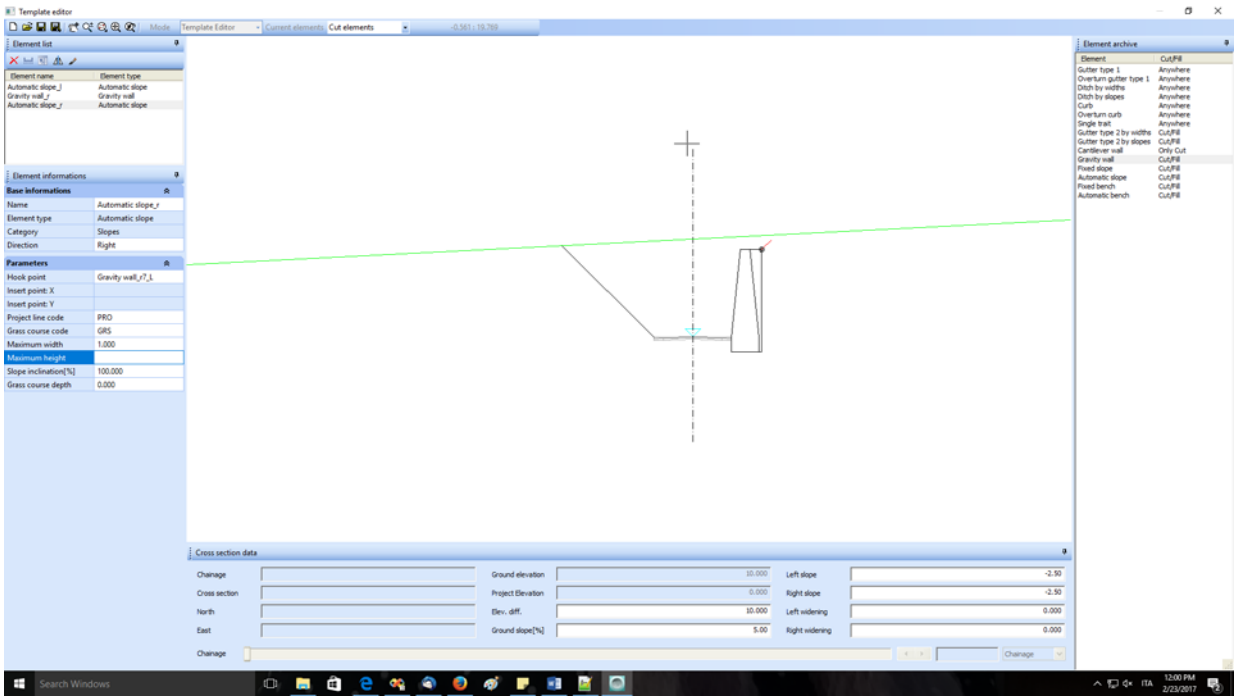



**Figure 494:**

# 3D Booklet

To work with level curves or profiles the survey must be oriented planimetrically and altimetrically.

In this case, the Celerimetric Booklet must be in 3D and each station must have valid values in the **Instrument height** field.

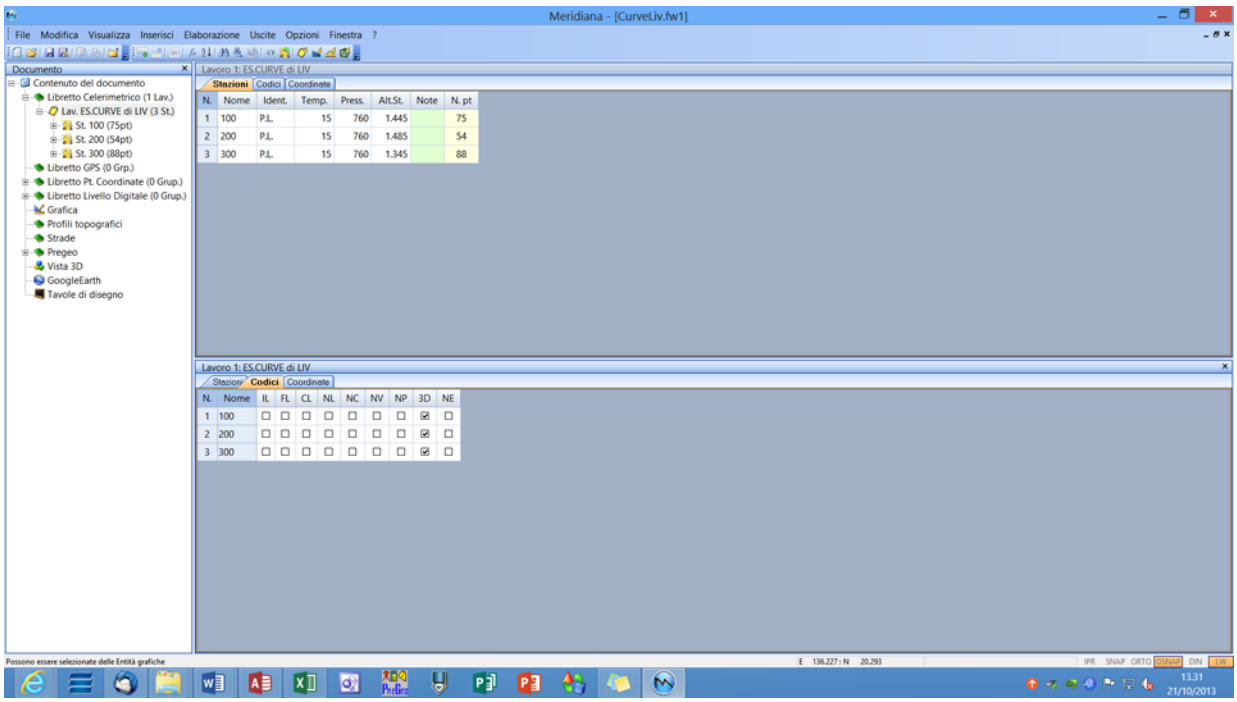



**Figure 495:**

The detail points must have valid values in the **Prisma height** and **Vertical angle** fields.

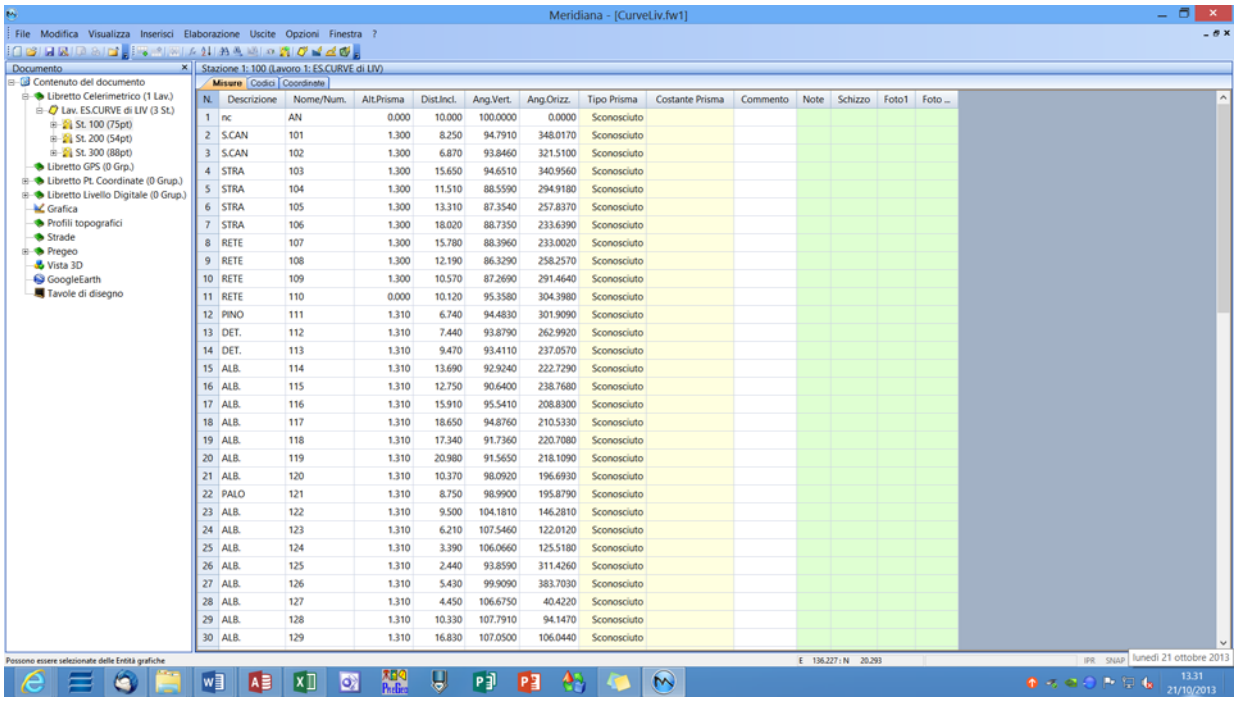



**Figure 496:**

It must also be possible to quote the survey; to do this a noted quote point was inserted in the orientation points (101).

Here following is an example of a 3D file celerimetric calculation.

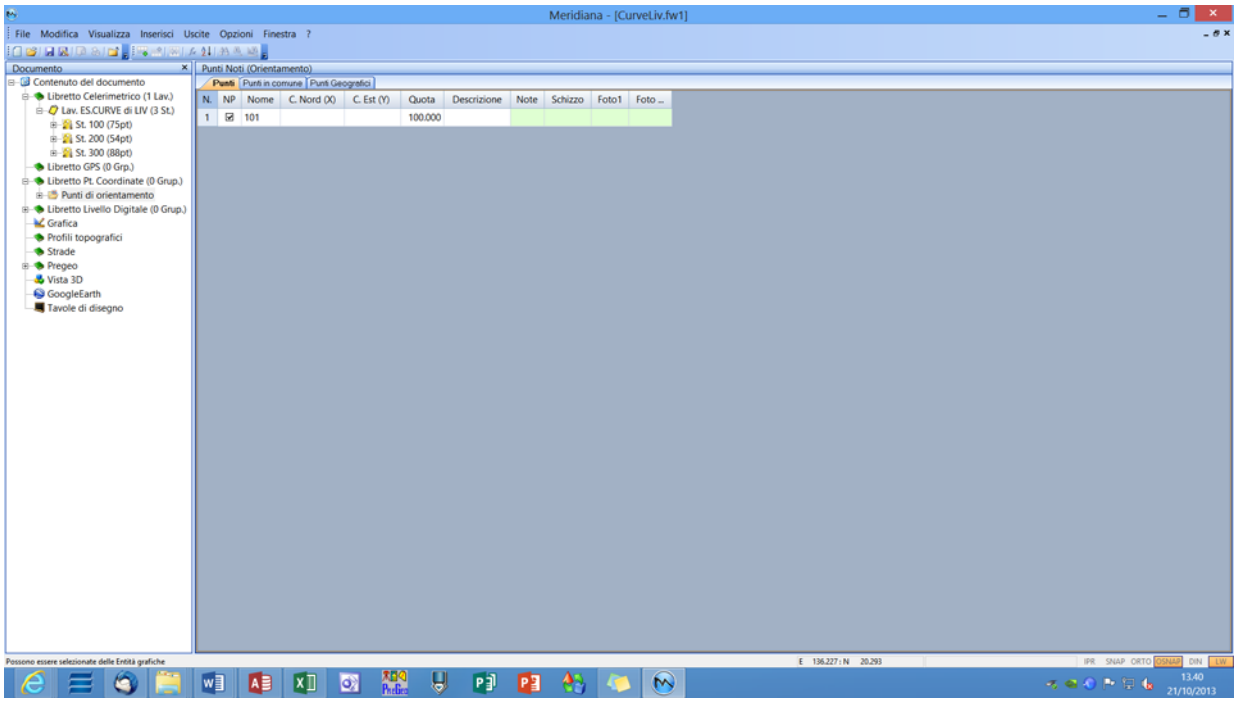



**Figure 497:**

Note in the **Data analysis** window that the noted quote point 101 was seen by Station 100 and coded as QU.

This page notes that the point was found and recognized as a valid point for the calculation.

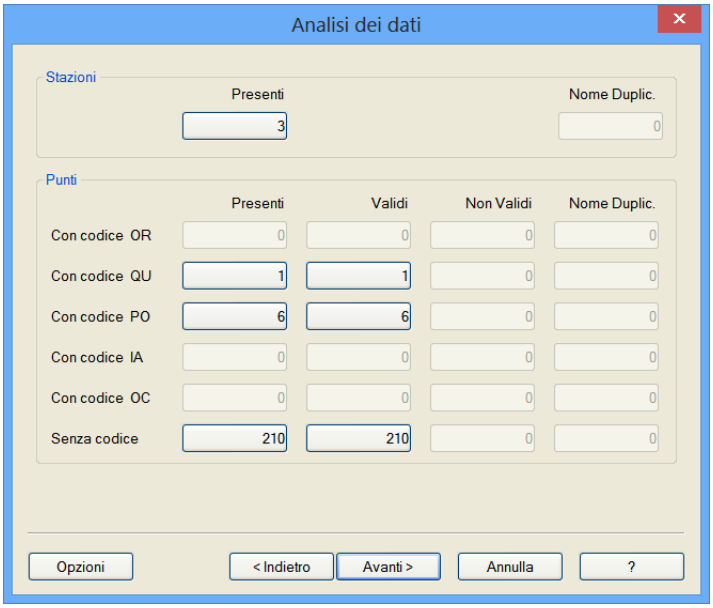



**Figure 498:**

The **Stations analysis** page notes that the three stations were found to be planimetrically not orientable.

But they are quotable: Station 100 using the identified QU point; the other two, instead, using Station 100 itself.

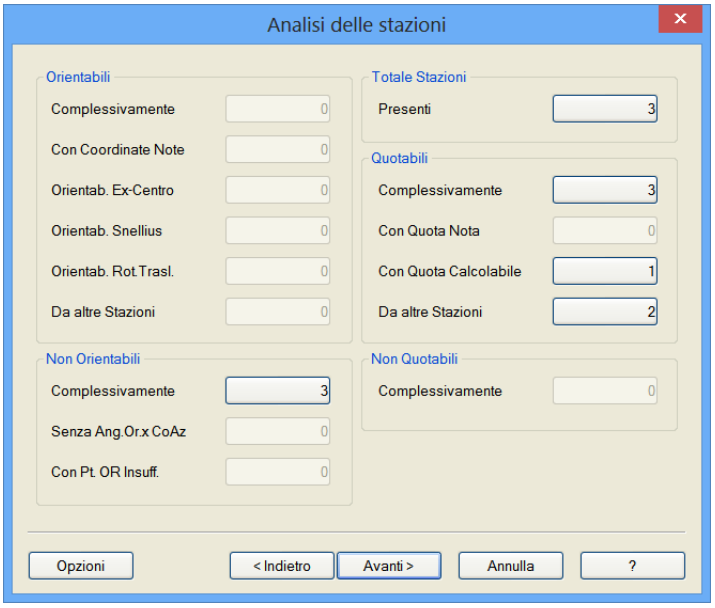



**Figure 499:**

In the **Options for continuing elaboration** window, the program will automatically place **Yes** in the **Display input** option for the planimetry; this is because the survey stations are not planimetrically orientable.

Vice versa for the quotes: in fact, the **Calculation** option was put automatically at **Yes** while the **Display input** option was set at **No** given that Station 100 is quotable through the identified QU point.

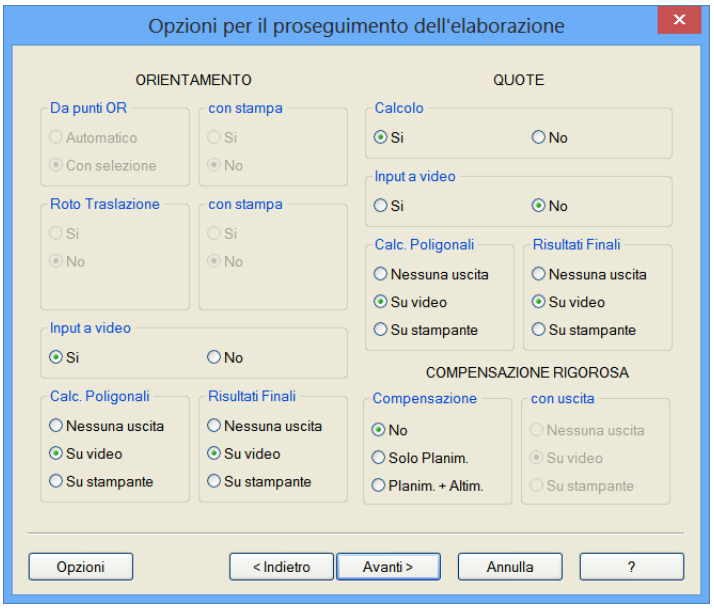



**Figure 500:**

The **Input data for stations** window asks for the planimetric coordinates for the stations (in fact, in the previous window, the display for the planimetry was set at **Yes**) while the quote cannot be inserted (in fact, in the previous window, the display for the quote was set at **No**).

As already noted, the quote was calculated for the Station 100 using the point 101.

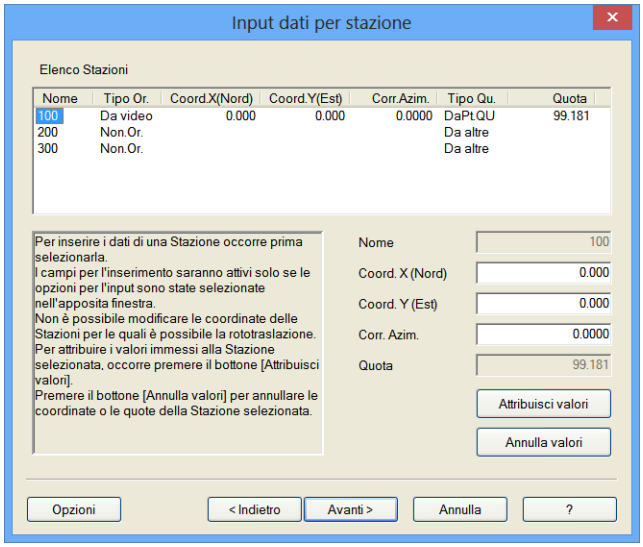



**Figure 501:**

The **Results of elaborations conducted** window is used to verify that all Stations are found oriented (upper frame); another item that can be verified is that their quotes have also been calculated (lower frame).

In this case, the survey was oriented locally in the planimetry; in the altimetry it was oriented in association with the noted quote point 101.

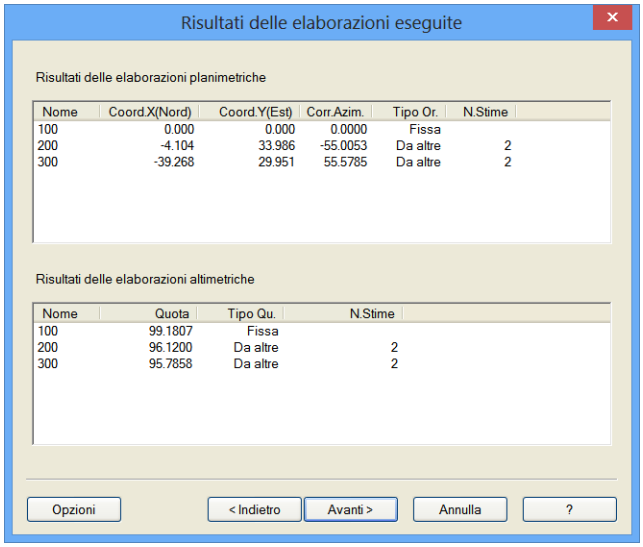



**Figure 502:**

Use the **Outcomes|Celerimetric|Display** command to see a preview of the results of the calculation executed.

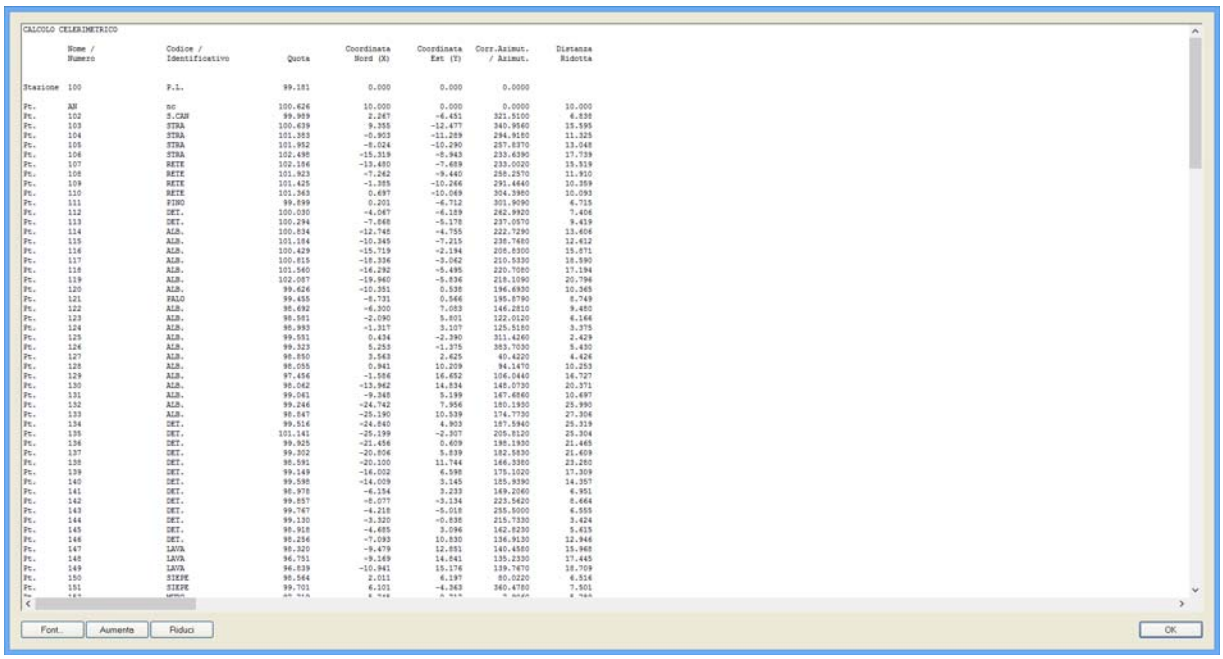



**Figure 503:**

Here is another example where no point is coded QU and no quoted point is found among the orientation points.

The attempt is to run a 2D celerimetric calculation; it can be seen that under the same conditions the calculation will not be successful.

An analysis of the data shows that no QU points were identified and no points were quoted from the orientation points.

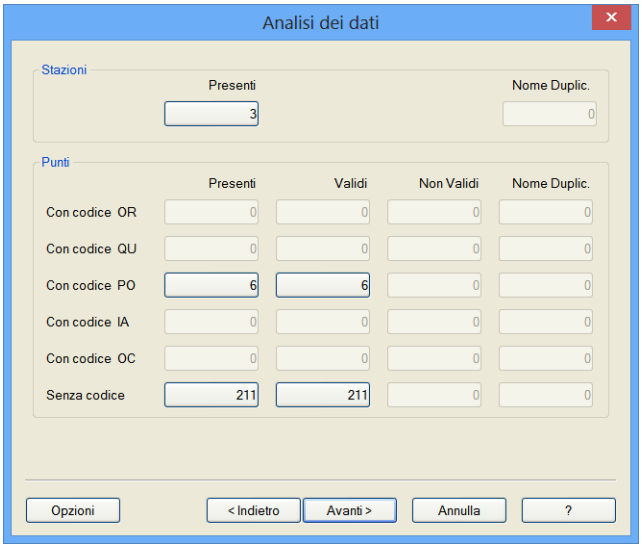



**Figure 504:**

In this case too, the user selects to display the planimetric coordinates used specifically to orient the stations planimetrically while for the quotes the **Calculation** option is left at **Yes** while the **Display input** option remains set at **No**.

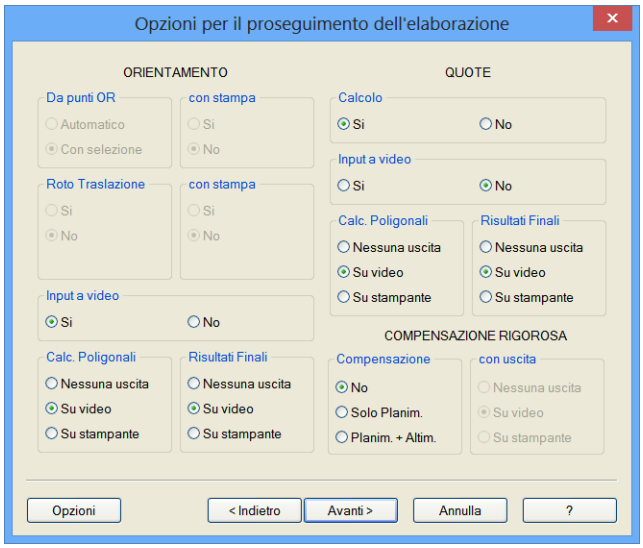



**Figure 505:**

The elaboration results clearly show in this case that all stations were oriented planimetrically thought the altimetric orientation was not successful for any of them.

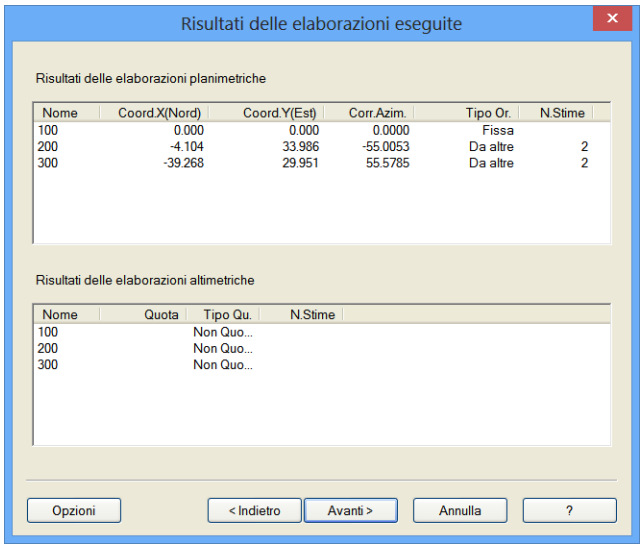



**Figure 506:**

When the calculation is terminated in Graphic nothing is displayed and if the **Outcomes|Celerimetric|Display** command is activated, then it will be noted that the three stations were not oriented.

This means that if the user decides to run the calculation of the quotes but the data inserted is not appropriate for the operation requested then the work will not be oriented planimetrically either.

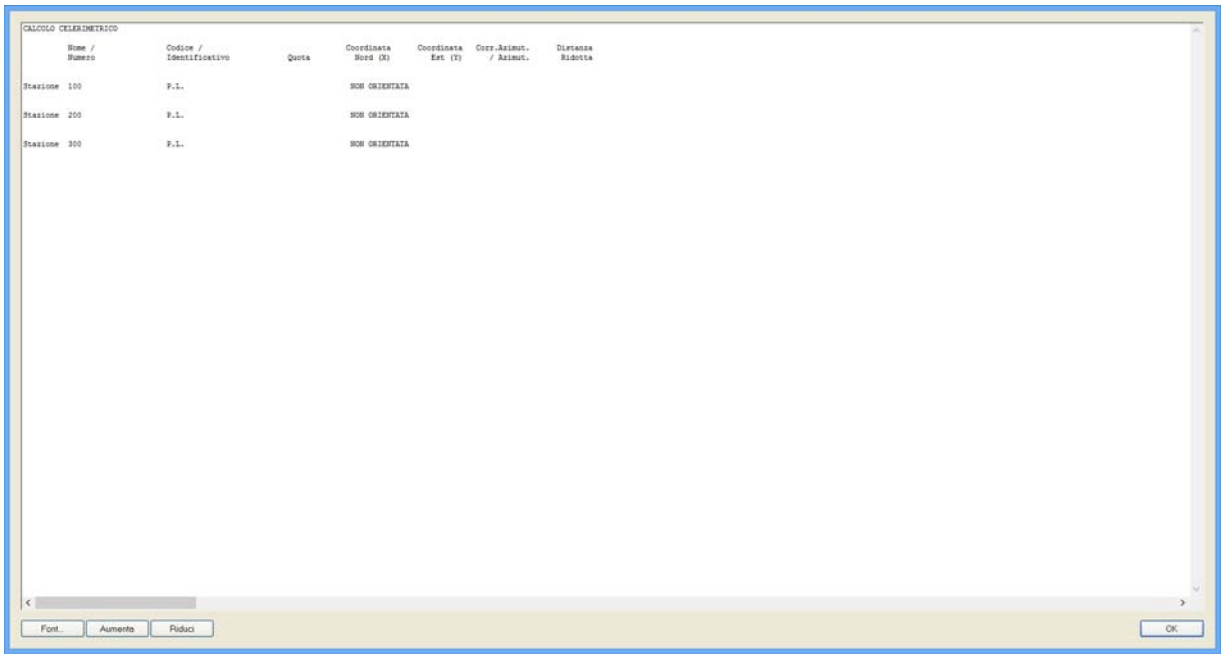



**Figure 507:**

To resolve this problem the user need only return back to the **Options for continuing elaboration** window and place a **No** for the quote calculation.

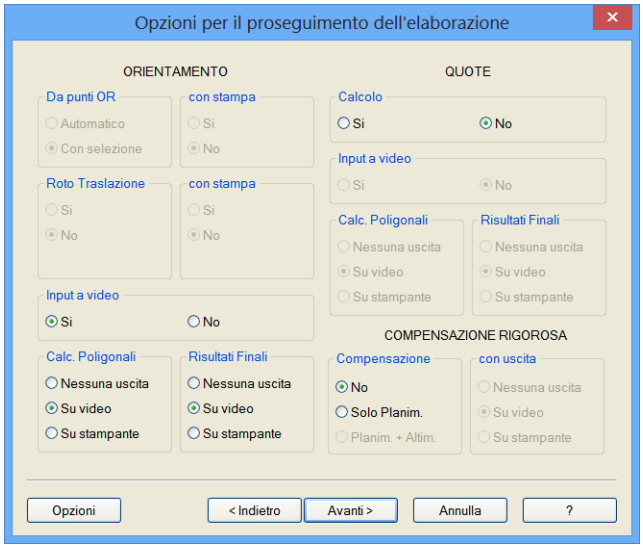



**Figure 508:**

With this selection, the user will note that in the next windows the sections associated with the quotes will be deactivated and the calculation will run only planimetrically.

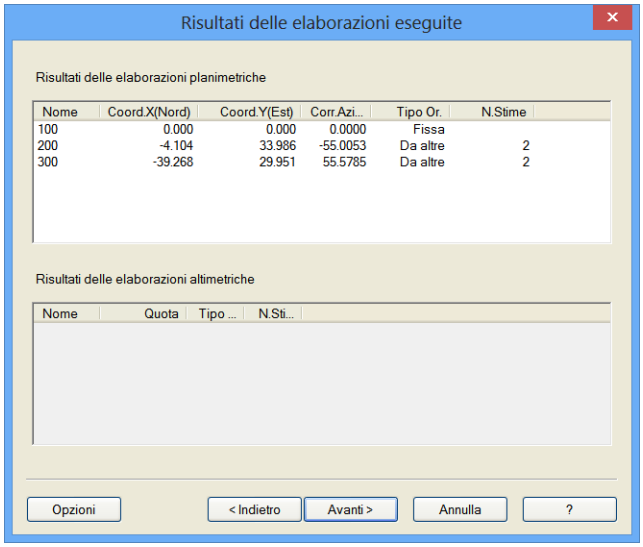



**Figure 509:**

The image below shows the result in the **Graphic View** of the calculation just run.

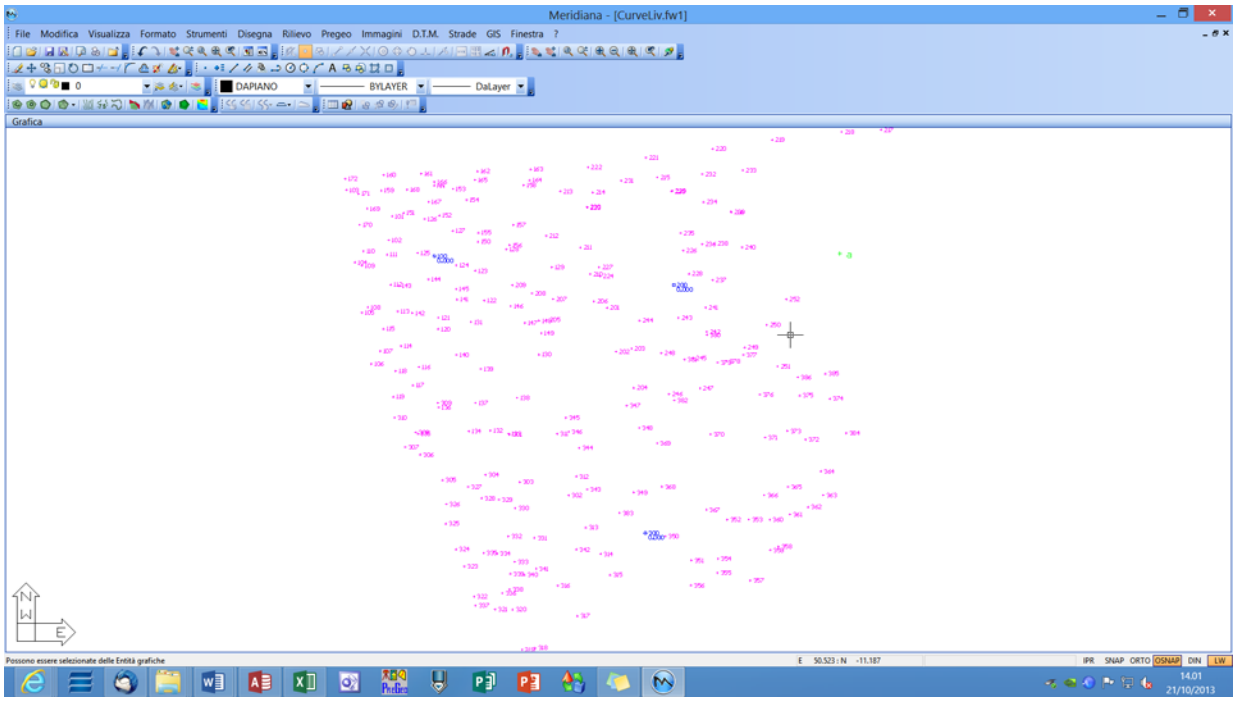



**Figure 510:**

# Manage level curves project...

Multiple projects can be open on the same file in the program.

For each project, the user can:

- Define constraints, internal and external borders;
- Run calculation of the triangles;
- create level curves;
- Define profiles.

To manage projects the user must activate the **D.T.M.|Manage level curve projects...** command in the **Graphic View**.

Executing the command will open a window where the existing projects are listed and the following information is displayed:

- Whether or not it is displayed in graphic according to the indicator light which is lit for displayed and off if not displayed;
- Whether the project is blocked or not according to the padlock symbol that is closed if the project is blocked and open if it is not blocked. Note that when working with a blocked project design operations can be done but not changes;
- Whether the project is active or not: if yes, then there will be a check mark and if not, nothing.

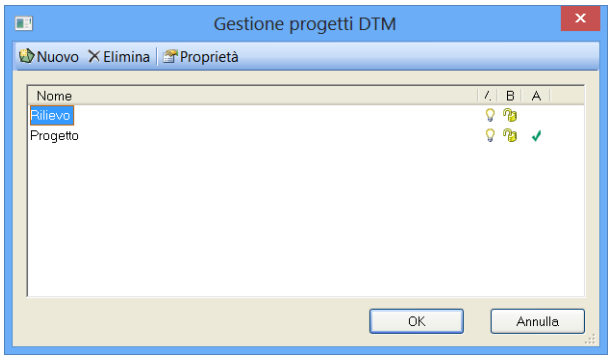



**Figure 511:**

The following commands are available in the window:

- **New** to add a new project;
- **Eliminate** to eliminate a selected project;
- **Properties** to change the project's design options.

Note that the operations on various projects will be affected by the selections made in this window; details are outlined in paragraphs below.

# Constraints

Constraints are those entities used to control the calculation of triangles; in the program the triangles represent the mathematical model of the quoted plane.

When there is a constraint, a triangle is created with a side coinciding with the constraint itself.

In some programs the constraints are also called **Discontinuity Lines** in that they are primarily used in cases of discontinuity of the terrain: escarpments, ditches, etc.

To design constraints on the active project the **D.T.M.|Constraints|Create constraints** command must be run from the **Graphic View** menu.

This command is used to design the constraints (whose design is similar to the normal design of a line) and transform graphic lines into constraints (in this case the lines are selected and by pressing the right mouse button the transformation operation will be completed).

In order for the constraint to be considered in the calculation of the triangles its vertices must be included in the group of points that will be used in the triangulation. In this case, triangles will be created with sides adjacent to the constraints.

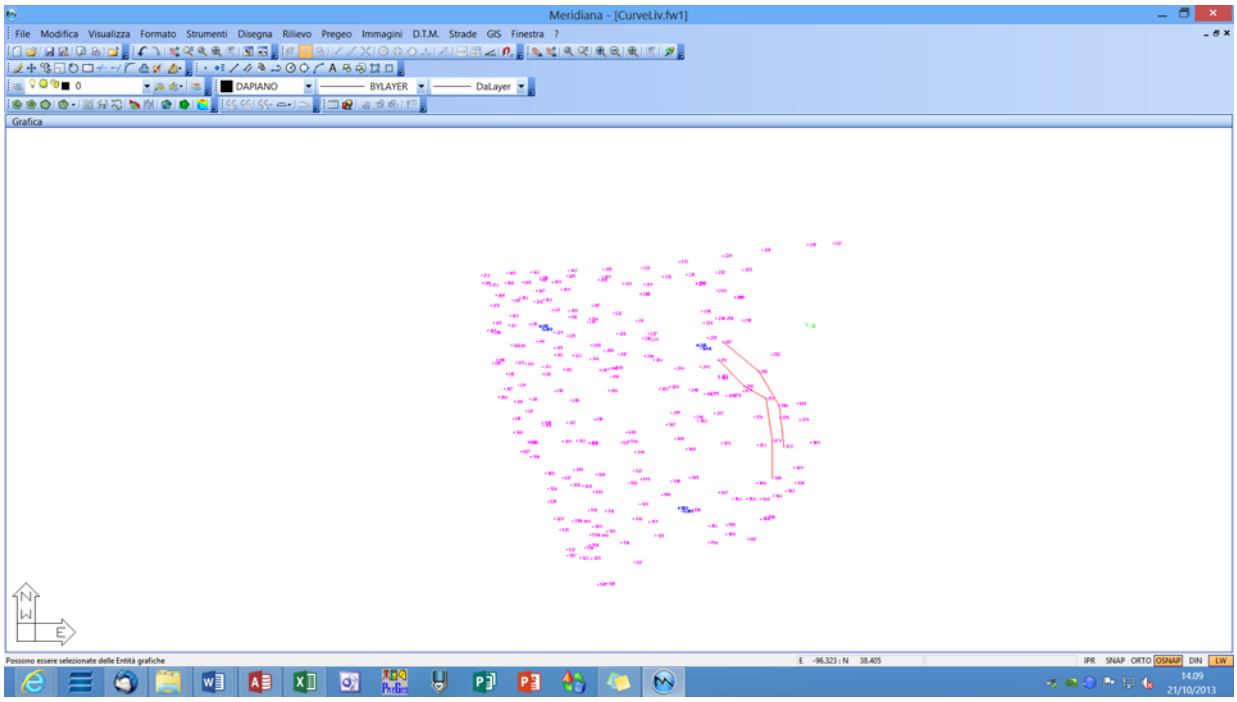



**Figure 512:**

If the constraints are part of a non blocked project they can be:

1)Eliminated using the **Constraints|Eliminate constraints** command in the D.T.M. menu. Once the constraints are selected by the selection operator, press the right mouse button.

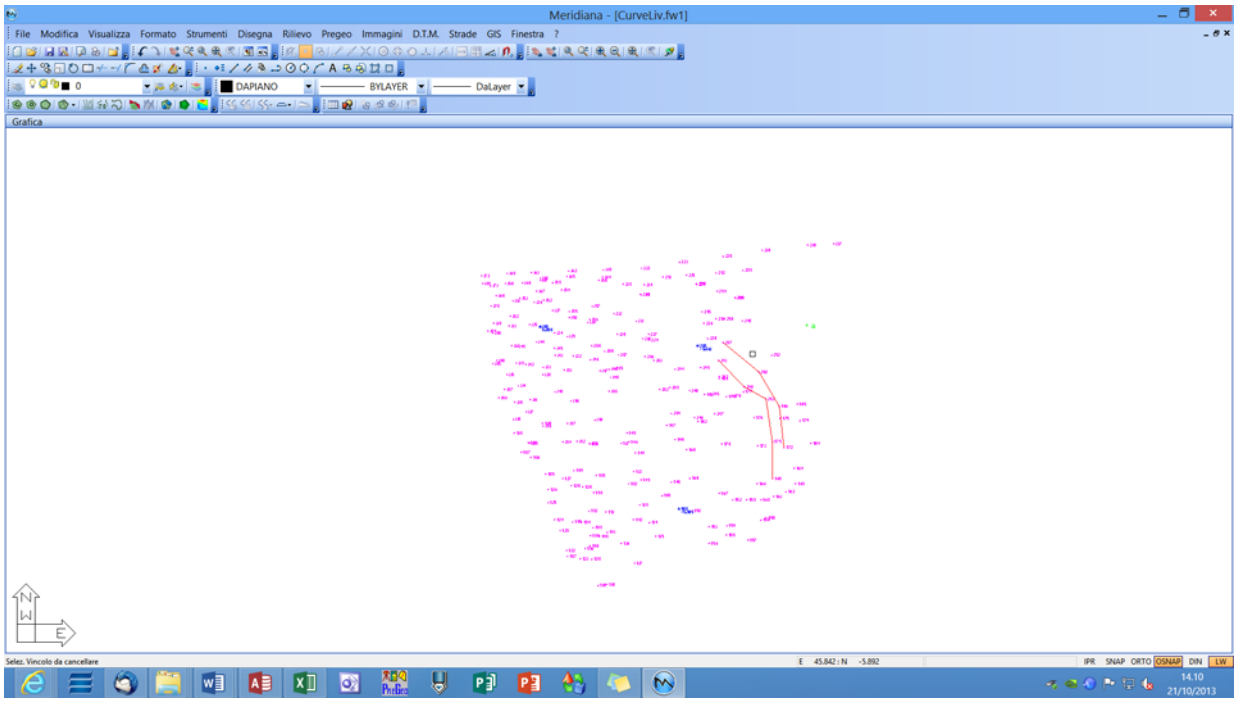
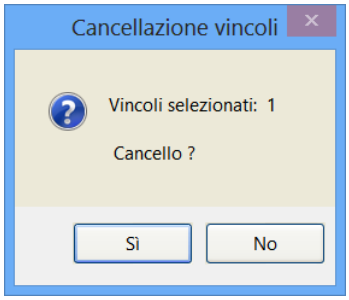



**Figure 513:**

The **Eliminate Constraints** window will open showing the number of constraints selected and request operation confirmation.




2)Transformed into graphic entities using the **Transform in graphic entities** command in the D.T.M. menu;

3)Changed in the vertices position as if they were normal graphic entities; once the entity is selected the user can execute on the grips or run the commands from the **Change** menu.

Changes on the constraints can be eliminated as well as refreshed.

Here is an example of a calculation on triangles where the entities of the Celerimetric Booklet were considered without using constraints: the example represents an escarpment.

The figure below displays the **Graphic View** prior to calculation of the triangles.

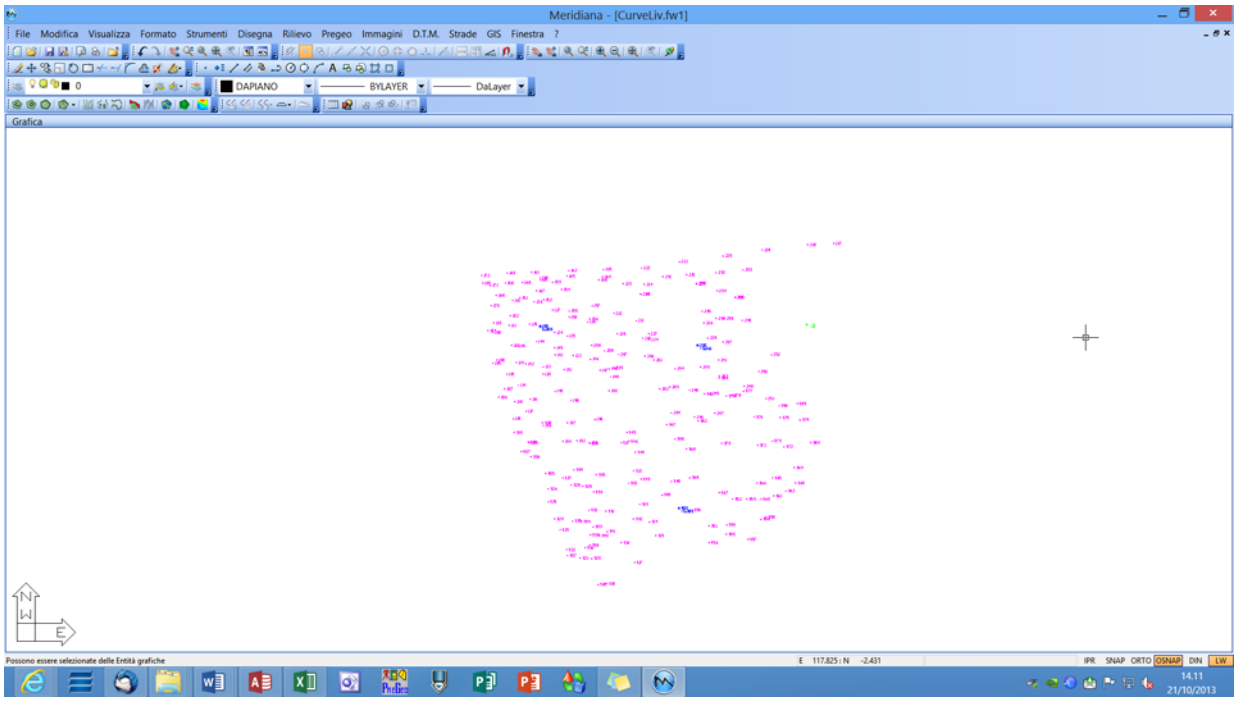



**Figure 514:**

The figure below displays the **Graphic View** after calculation of the triangles.

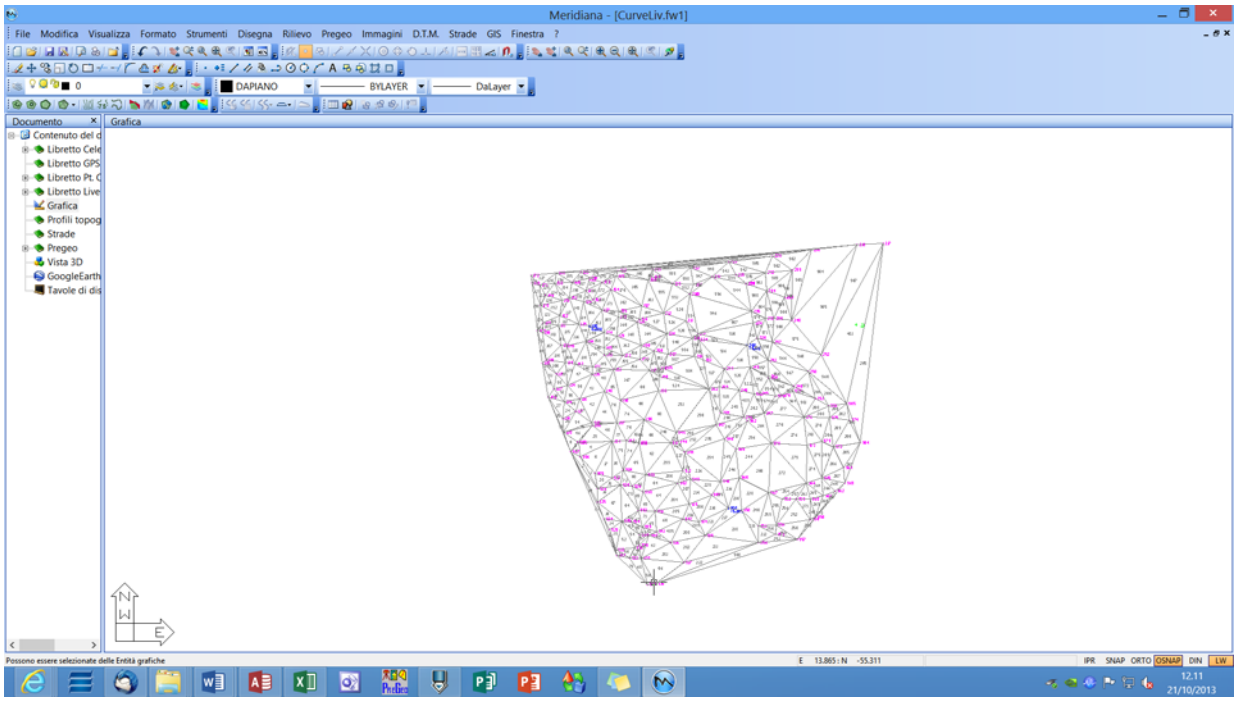



**Figure 515:**

The figure below displays the **3D View** of the calculated model: triangles are placed badly. To resolve the issue, constraints must be added.

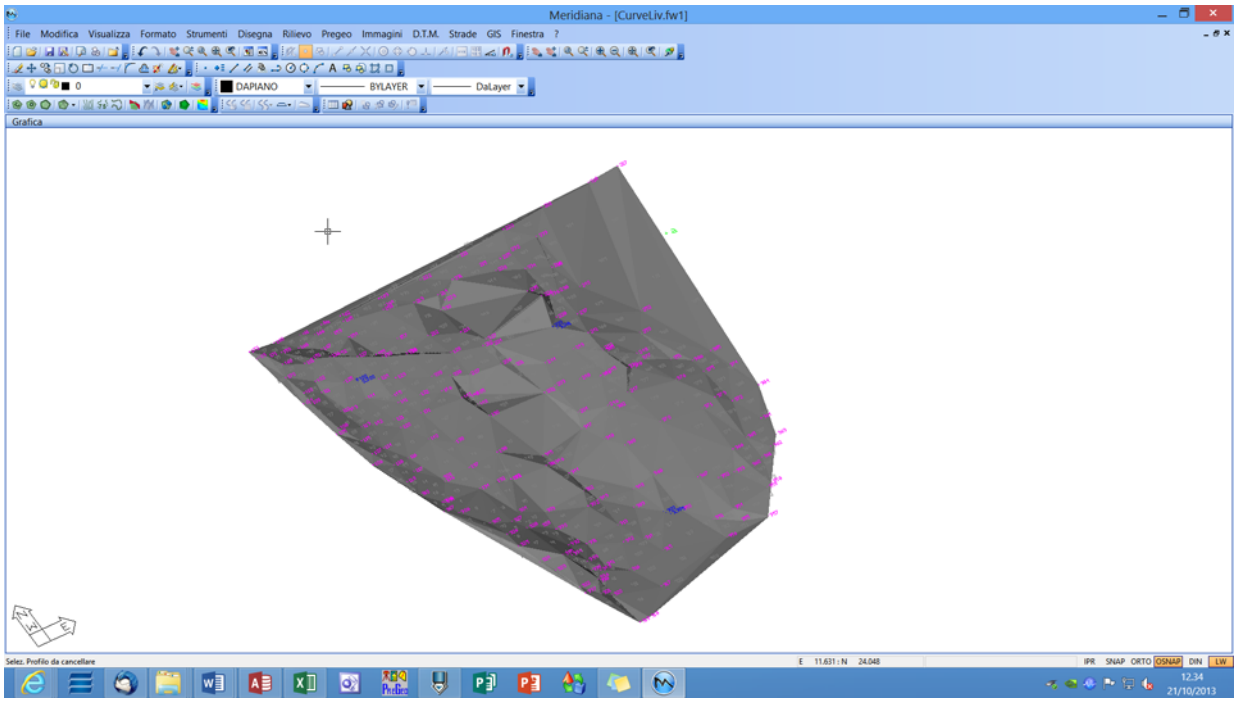



**Figure 516:**

The figure below displays the **Graphic View** after adding the constraints.

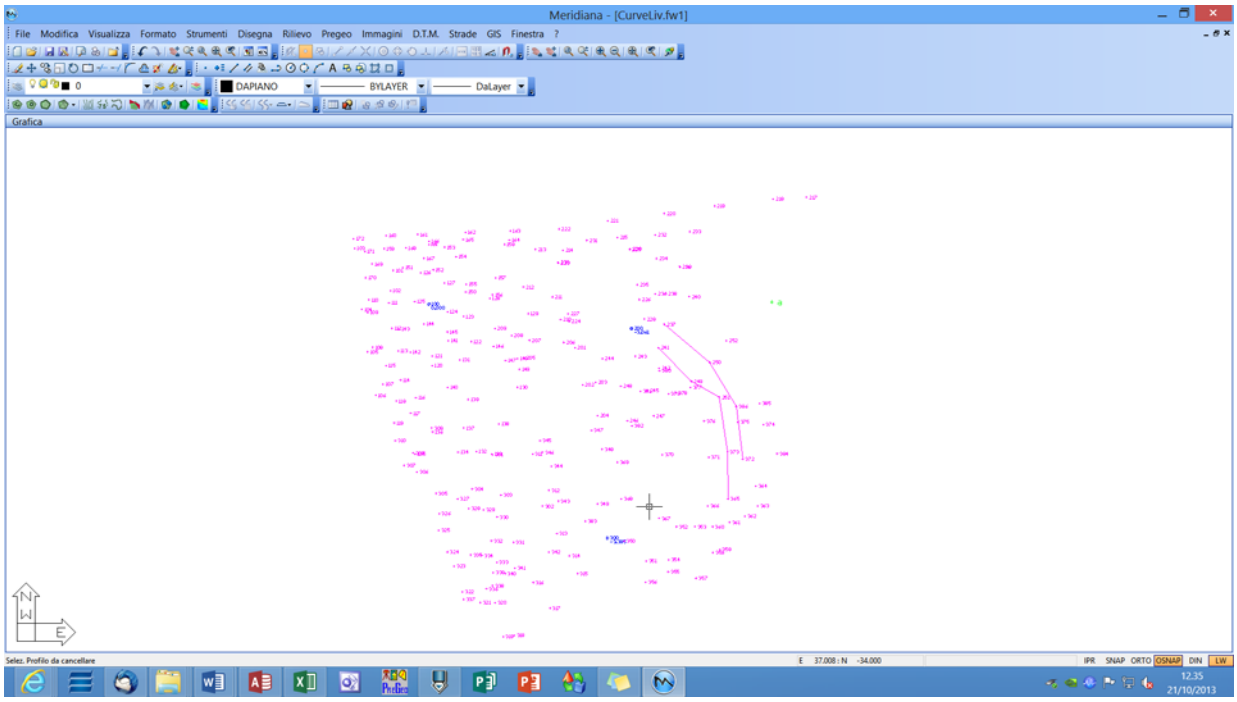



**Figure 517:**

The figure below displays the **Graphic View** after running the calculation of the triangles with the added constraints.

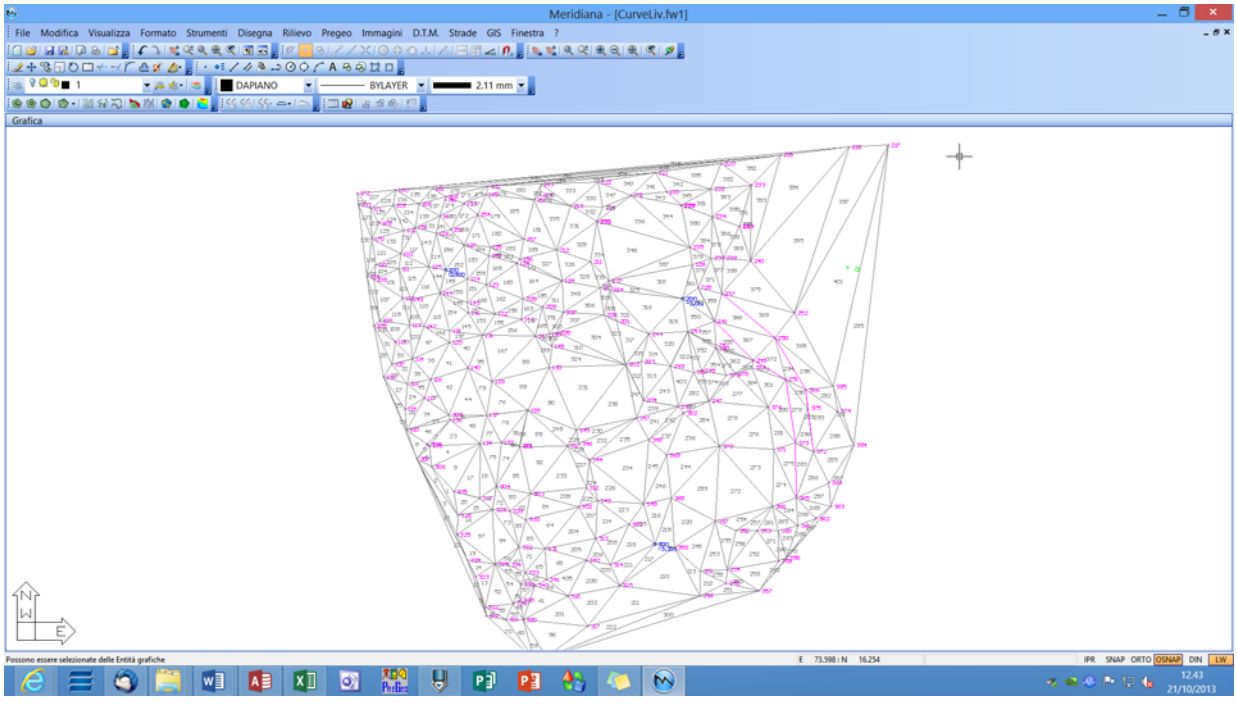



**Figure 518:**

The figure below displays the **3D View** of the calculated model, which clearly illustrates that introducing the constraint resulted in a proper representation of the calculated model (triangles properly represent the escarpment).

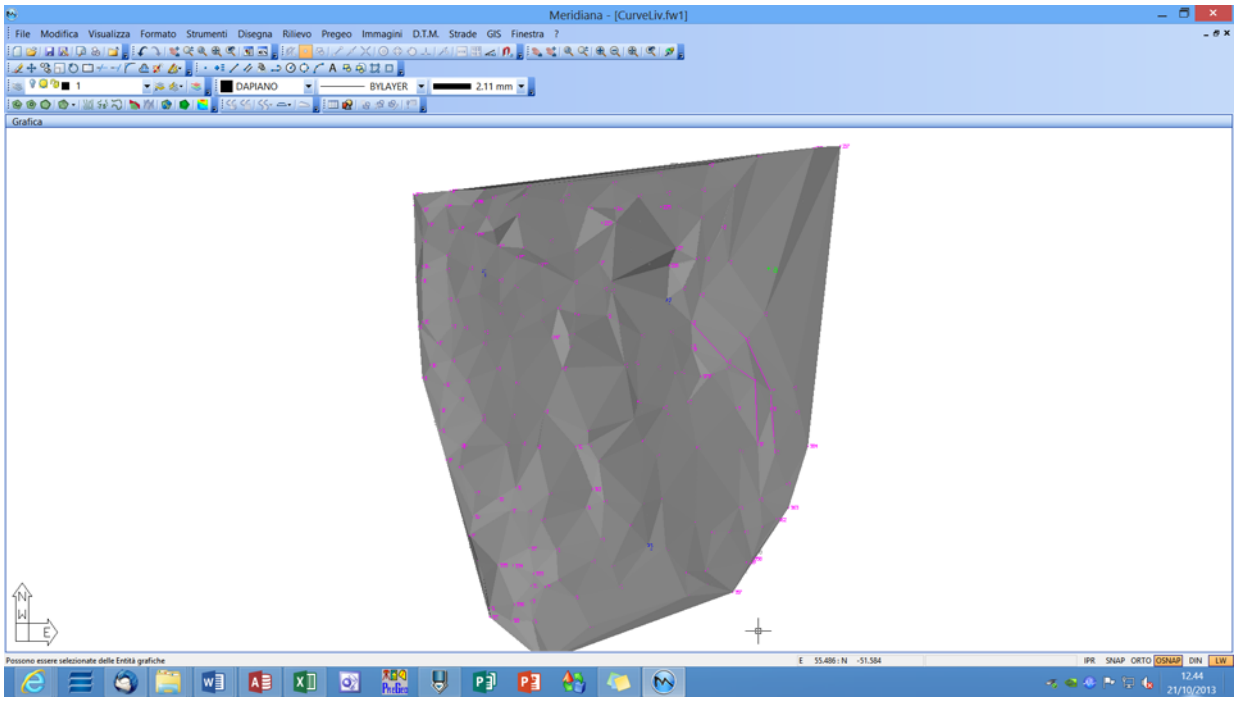



**Figure 519:**

# Borders

Borders, like constraints, are used to control the calculation of the triangles.

Borders outline survey areas that may be included or not in the calculation:

- **Internal Border** is used to exclude from the triangulation all points enclosed.
- **External Border** is used to exclude from the triangulation all points identified as outside the border itself.

It is advisable to connect the Borders to the points that will be used for the triangulation in that the sides of the Borders are also considered as constraints.

To create Borders in the current project commands are available in the **D.T.M.|Borders** menu: **Create external borders** and **Create internal borders**.

The border can be designed or created beginning with a polyline graphic.

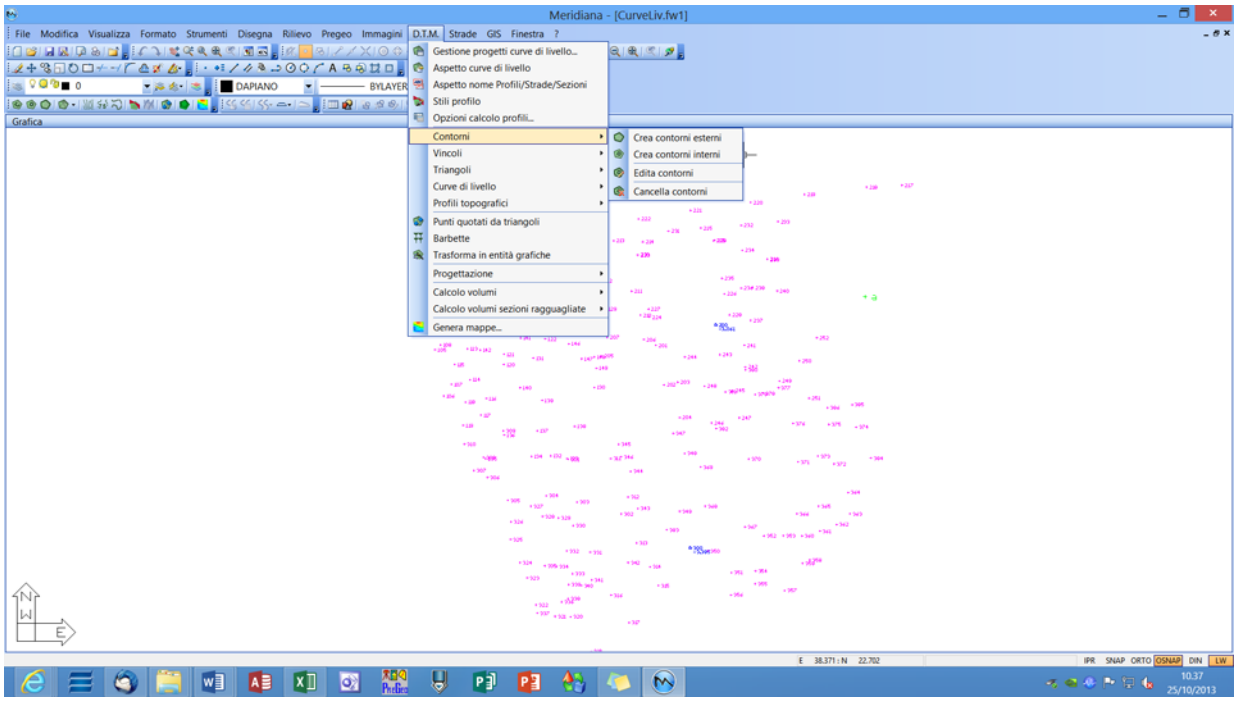



**Figure 520:**

To design a Border, proceed similar to designing a graphic polyline; it is important to select at least 3 vertices.

In the design operation, it is good to remember that:

– selecting the point previously selected will cancel the selection;

– the design terminates either by selecting the end point or by pressing the right mouse button (and by doing this the design will automatically close).

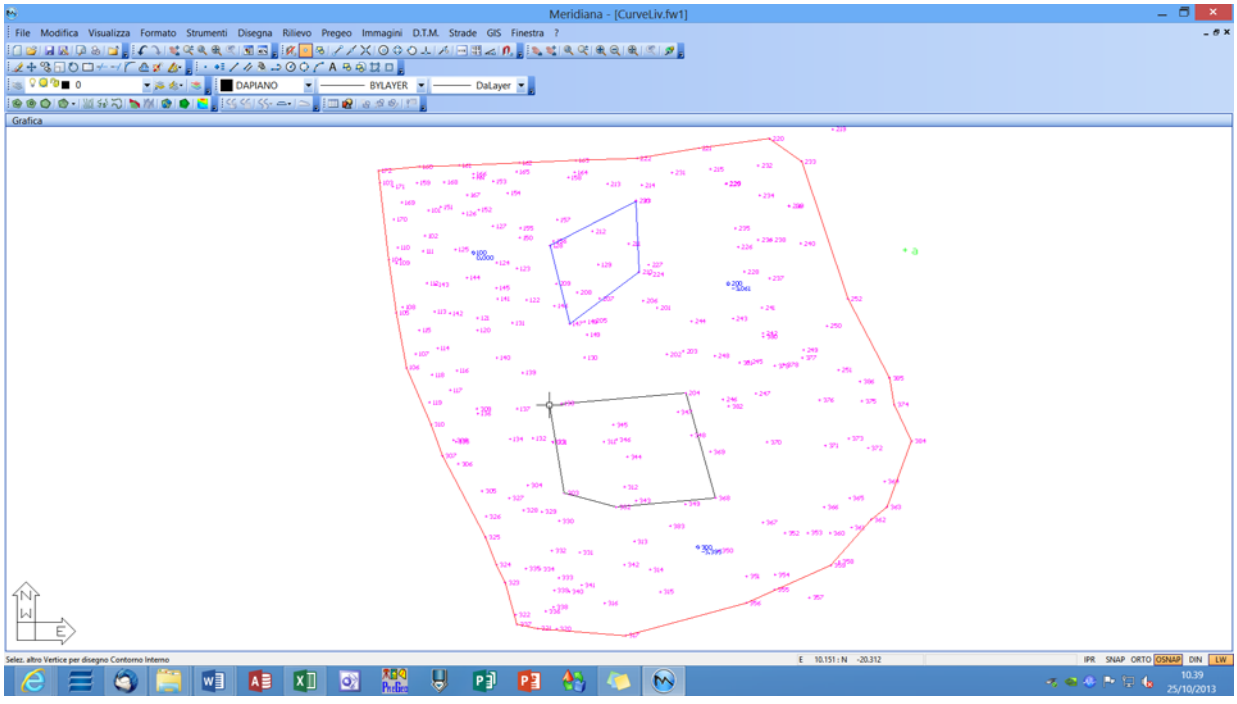



**Figure 521:**

To create the border beginning with a graphic polyline, the user must, through the right mouse button, change the design operator to selection operator; once this switch is made, the transformation will execute automatically selecting the polyline with the left mouse button.

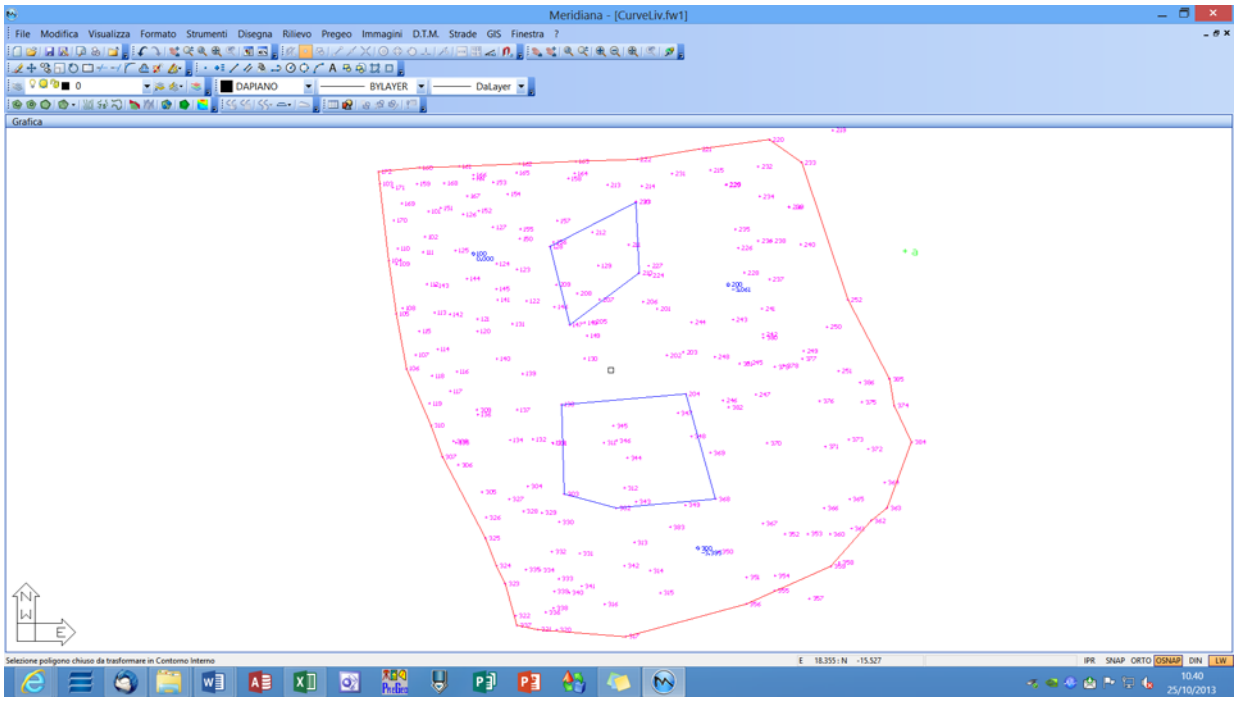



**Figure 522:**

If the borders are part of a non blocked project they can be:

- Eliminated, whether internal or external, using the **D.T.M.|Borders|Cancel borders** menu command;
- Transformed into polylines from the **D.T.M.|Transform into graphic entities** menu.
- Changed in the vertices position as if they were normal graphic entities; once the entity is selected the user can execute directly on the grips or run the commands directly from the **Change** menu.

Changes on the borders can be eliminated as well as refreshed.

# Triangles

The program considers triangles as the representation of the mathematical model for the quoted plane.

The triangles calculation is an automatic procedure; the program optimizes the plane layout of the triangles and the user must only set some options prior to running the calculation.

If the user wants to completely determine the triangulation then constraints need to be created along the sides where the triangles are to be positioned.

If changes are made to the quoted plane (for example, on the planimetric reference system or the quotes) then the calculation must be rerun.

The calculation of the triangles on the current project can be launched from the Graphic View by selecting the **D.T.M.|Triangles|Create triangles** menu.

After activating the function, the program will display the **Triangulation** window that includes three pages:

- Triangulation;
- Symbols;
- Colors.

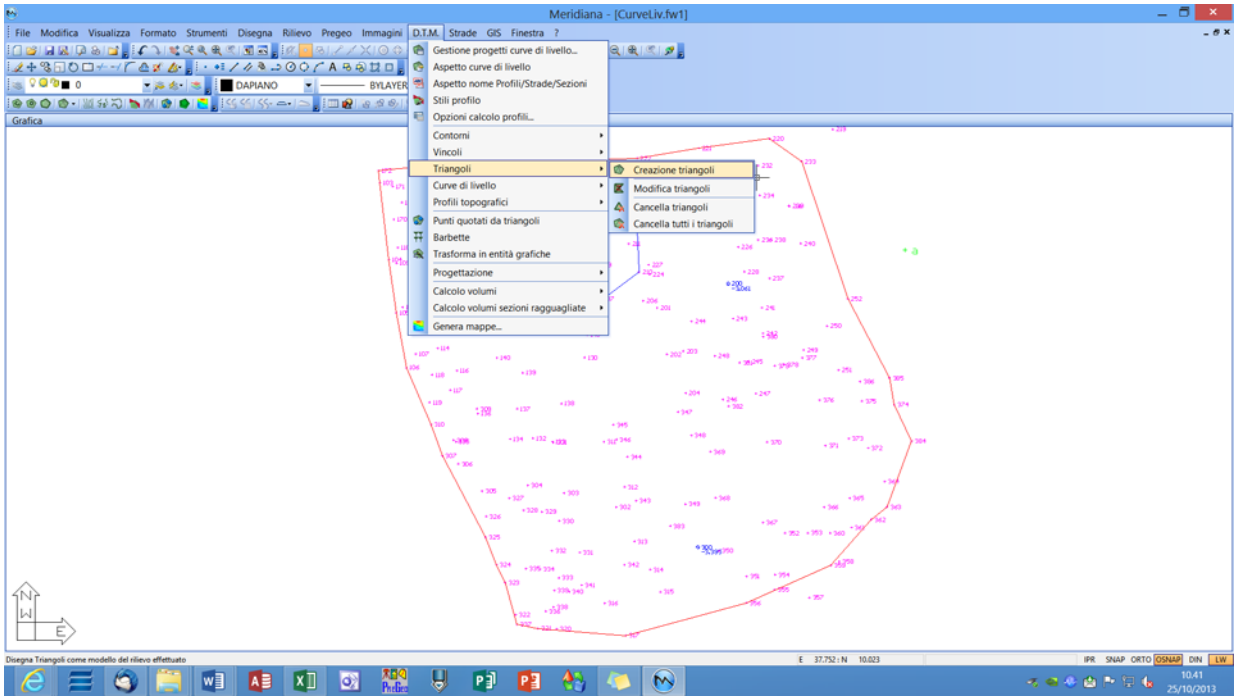



**Figure 523:**

Use the **Triangulation** page to tell the program which points are to be used to create the grid through an easy navigation tree that lists the entities included in the current project.

The entities can be selected using the specific check box set to the side; by expanding the node of the various entities, the program will display the entity in detail.

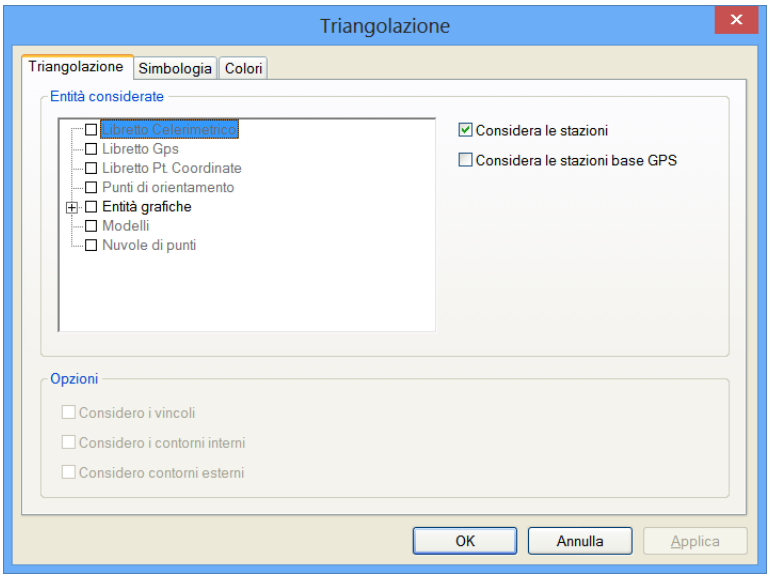



**Figure 524:**

In particular:

- extending the **Celerimetric Booklet** node the program will list the works that are part of it;
- extending the **GPS Booklet** node the program will list the groups associated with the GPS Booklet;
- Extending the **Coordinate Pt. Booklet** the program lists the groups associated with the Noted Pt. Booklet;
- the **Orientation points** node cannot be extended in that it refers to orientation points defined in the **Orientation points** page of the Coordinate Pt. Booklet;
- extending the **Graphic Entities** node will list the layers;
- extending the **Models** node will list the design models created using the **Format|Entity Appearance with name** command. It is through this list that the user can tell the procedure to include the points associated with that model in the calculation. If the model is not selected then the points associated with it will not be considered in the calculation.
- extending the **Points Cloud** node will list all of the loaded clouds.
- Other considerations on the calculation:
- Only noted quote points are considered;
- Points with Station NC code, Celerimetric Points, GPS points and Noted Points are not considered during the Triangle creation phase;
- Celerimetric Points with PO or OR/QU code, displayed in graphic correspond to the calculated triangles.

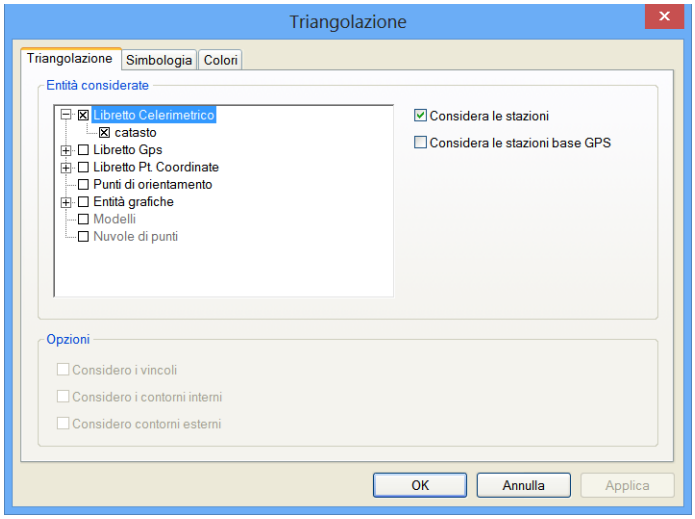



**Figure 525:**

Still on the triangulation page, the user can indicate whether to consider:

- celerimetric stations in the calculation;
- GPS stations in the calculation;
- constraints;
- internal borders;
- external borders.

In the **Symbols** page the user can indicate the type of symbol to use within the triangle.

The possible choices are:

- none;
- name;
- barycentric;
- slope (in this case the box marked **Text Dim.** becomes the **Scale** box; with this selection the user asks the program to represent the survey slope; the larger the arrow the higher the slope.

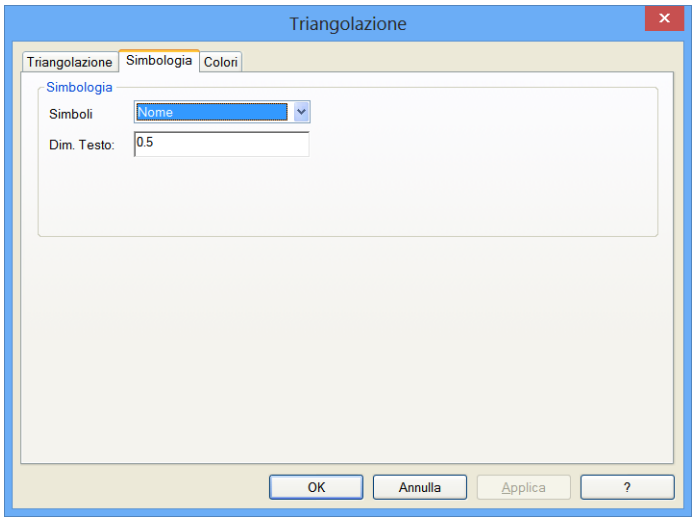



**Figure 526:**

On the **Colors** page, finally, the user can select whether to use uniform colors for the triangles and the symbols; or a gradation of colors. If gradation is selected, then the coloration is done taking into account the quote and the number of intervals indicated.

The quote intervals can be customized by selecting the specific check box.

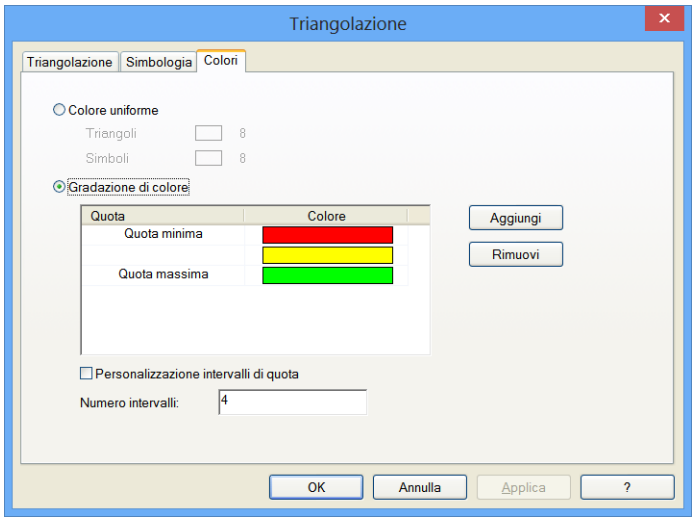



**Figure 527:**

The result of the calculation is shown in the image below.

As can be seen, the constraints connect to their adjacent triangles, further, within the internal border and outside of the external border no triangle has been designed.

If the project is not found blocked, then the triangles can also be erased (**D.T.M.|Triangles|Cancel triangles** and **Cancel all triangles** menu) or changed (**D.T.M.|Triangles|Change triangles** menu).

Note that erased triangles are redesigned if the calculation is redone and that triangles cannot be changed if they form a concave quadrilateral.

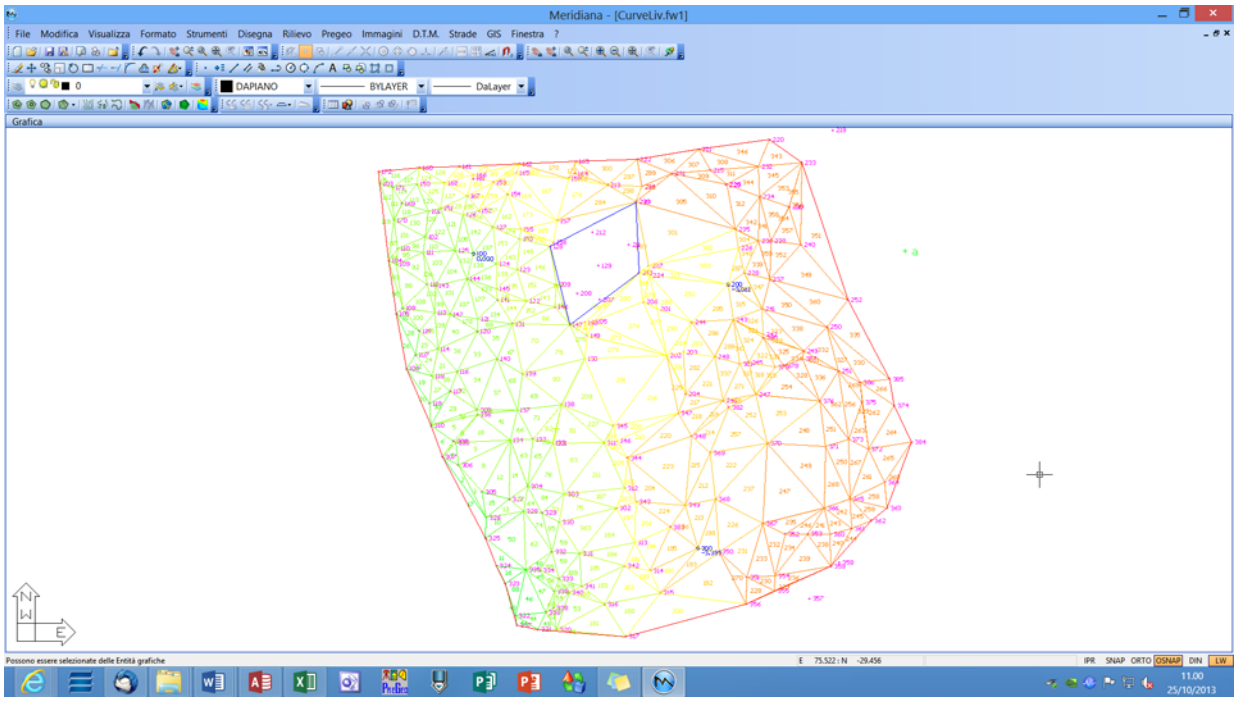



**Figure 528:**

# Level curves

The level curves are polylines that join all points found at a determinate quote.

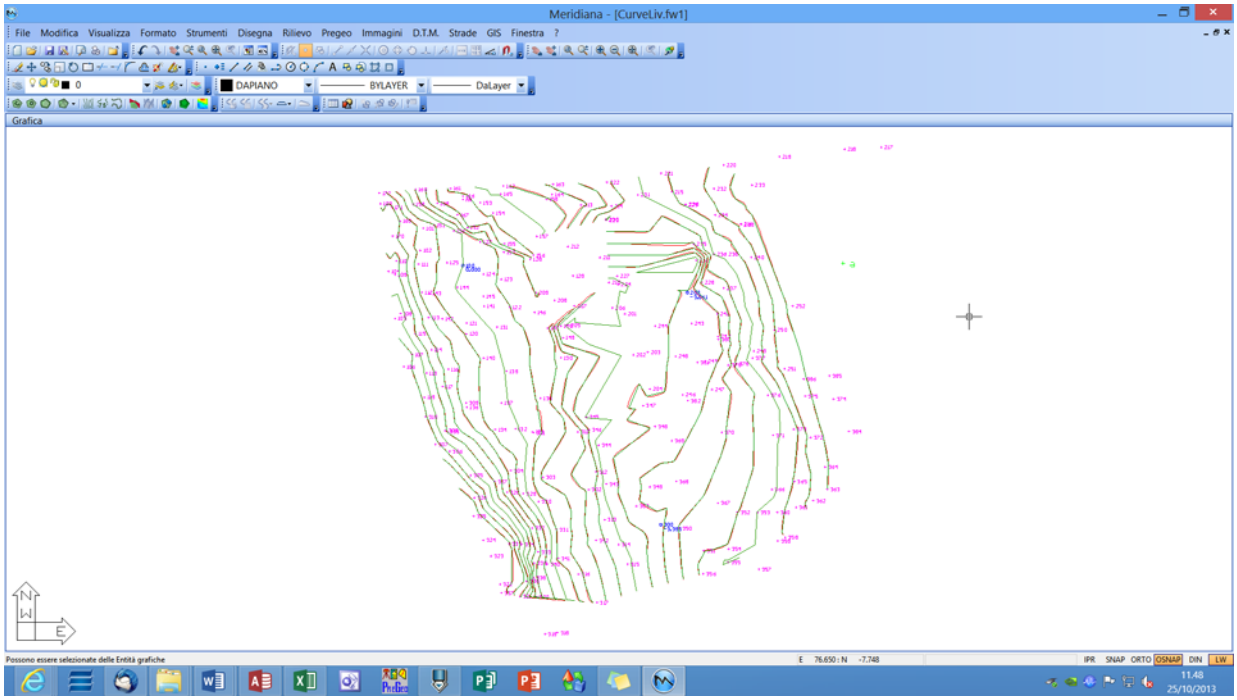



**Figure 529:**

There are two types of level curves in the program: **Dash Lines** and **Splines**.

**Dash lines** (green color) are non-rounded polylines that join points of equal quote on triangles; these represent a second level of quoted plane approximation after triangles.

**Splines** (red color) are calculated beginning with the dash lines and represent an embellishment in that it rounds the corners.

**Splines** do not represent a mathematical model of approximation and the degree of rounding can be controlled individually.

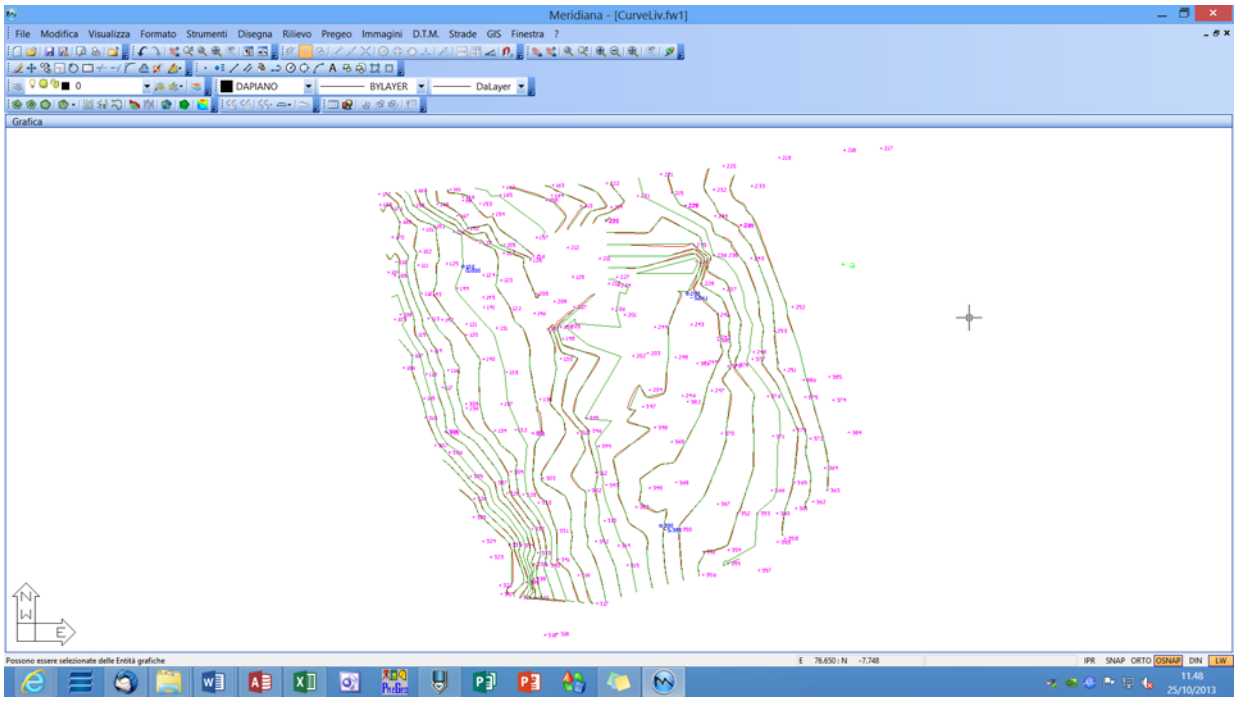



**Figure 530:**

To designed the level curves on the active project, triangles must have already been created.

Creating level curves is an automatic procedure and the user must only set various options prior to launching the calculation.

During calculation, dash lines and splines are generated and the calculation is repeated each time that changes to the triangles or to the quoted plane are made (changes to the planimetric reference system, changes to the reference quote, etc.).

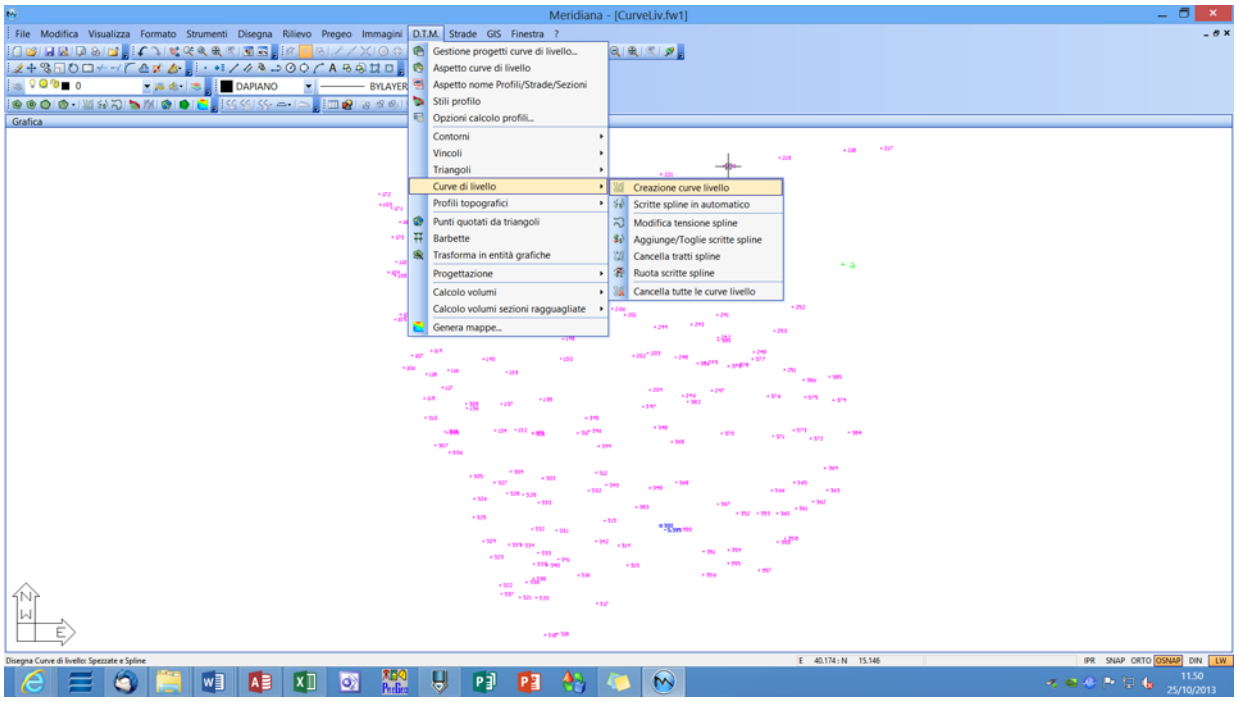
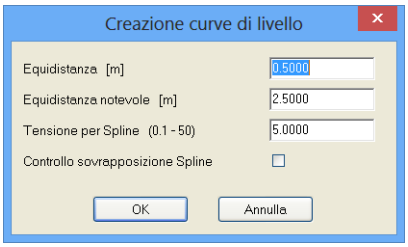



**Figure 531:**

The procedure is activated by accessing the **Graphic View** and selecting the **Create Level Curve** command found in the **D.T.M.|Level curve** menu.

Executing the command will open the **Create Level Curve** window.




If the calculation has been run, then the program, prior to opening this window, will ask the user for confirmation before being able to continue with the operation.

The **Equidistance (m)** field is the distance in meters between two consecutive dash lines; changing the distance affects the number of dash lines that are displayed and their distance: the shorter it is, the closer the dashes will be.

The **Notable equidistance (m)** field is the distance in meters between two notable dash lines; they can be colored differently from the others.

The **Tension by Spline** field expresses the degree of spline rounding; the higher value inserted will display a spline that is more similar to the dash lines, while the lower value inserted will display a spline that assumes a more curved form.

The **Check spline overlay** check box is used to activate or not the check spline overlay; this selection can significantly slow the spline calculation.

The image below shows the results of the calculation run; the level curves were designed only in that part of the survey where the triangles were calculated.

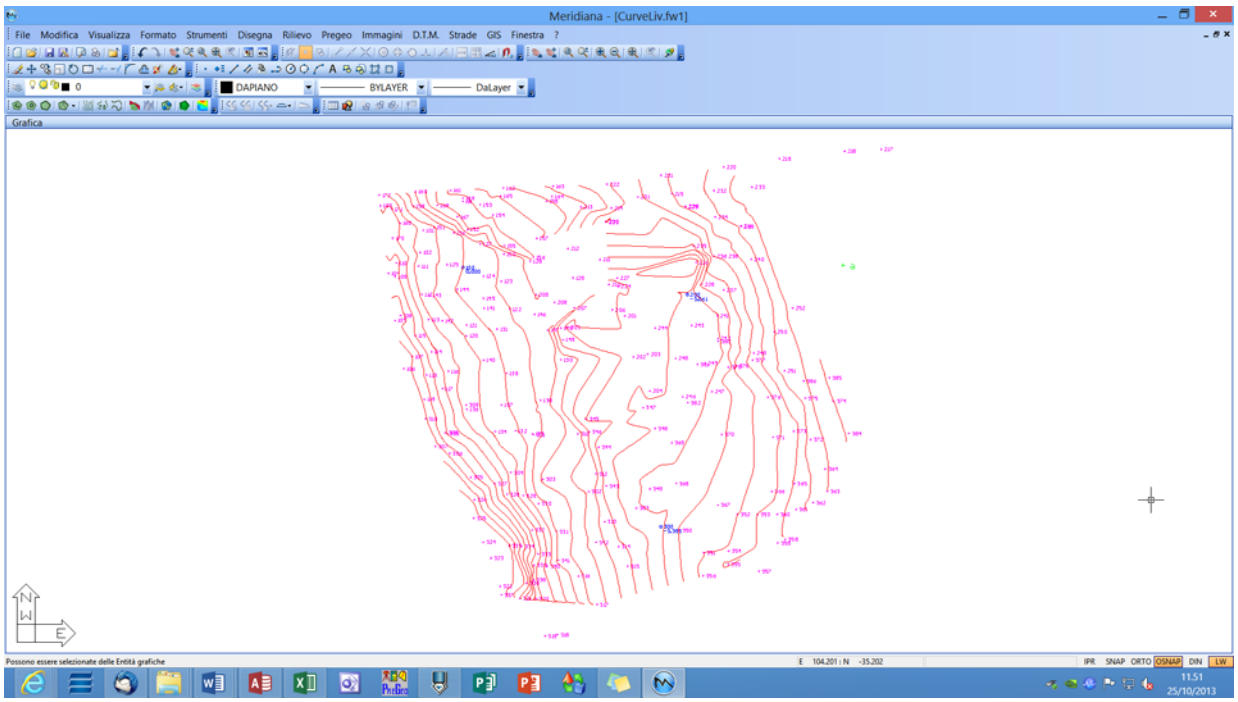



**Figure 532:**

Here following is the description of some of the commands in the **D.T.M.|Level curves** menu.

- **Cancel all level curves:** created level curves can be erased using the **D.T.M.|Level curves|Cancel all level curves** command.

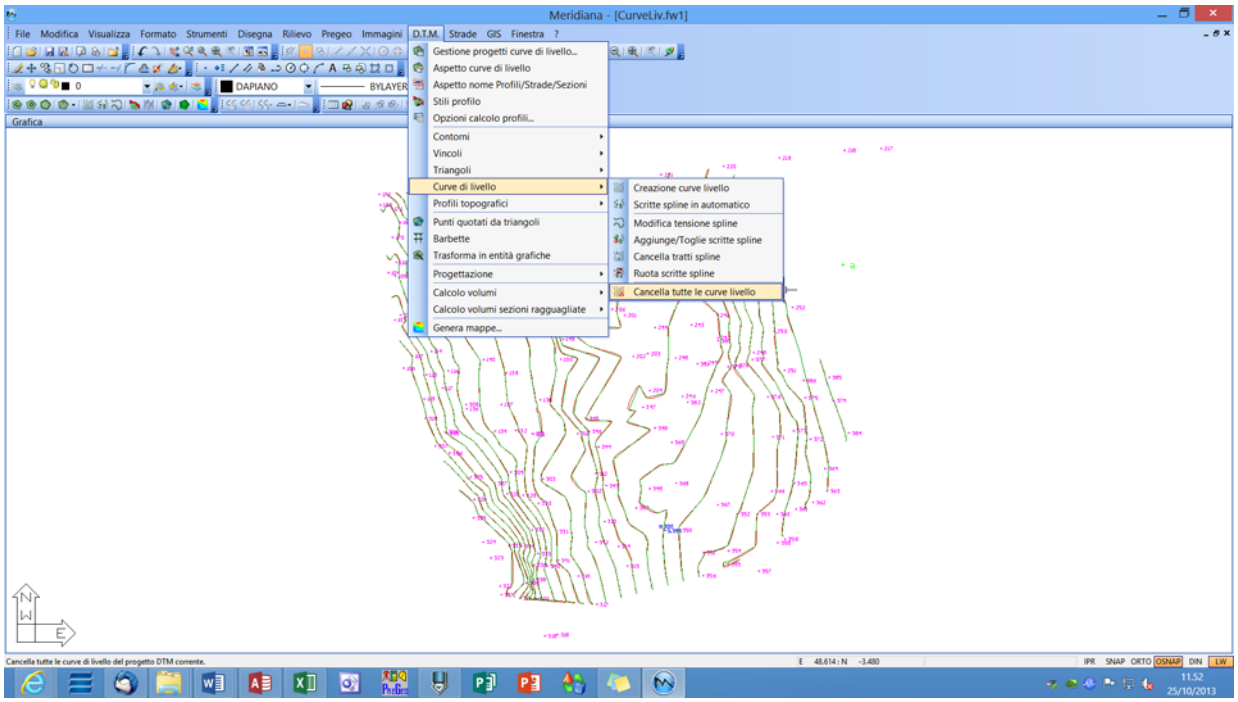
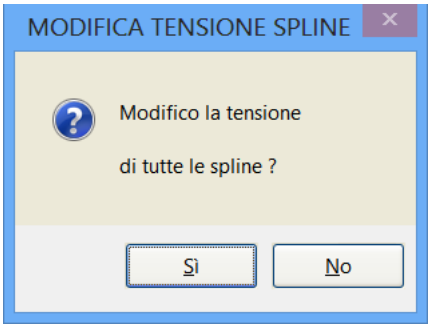



**Figure 533:**

- **Level curve | Change spline tension:** this command is used to change the degree of rounding of one or all splines in the non blocked active project. Once the command is executed, the program asks the user whether or not to modify all created splines. Should the user respond **No**, prior to inserting the new tension value, the user must graphically select the spline. Should the user respond **Yes**, the user will proceed immediately into inserting the tension value through the specific window.

  In this case, the tension value of the spline is equal to 1.



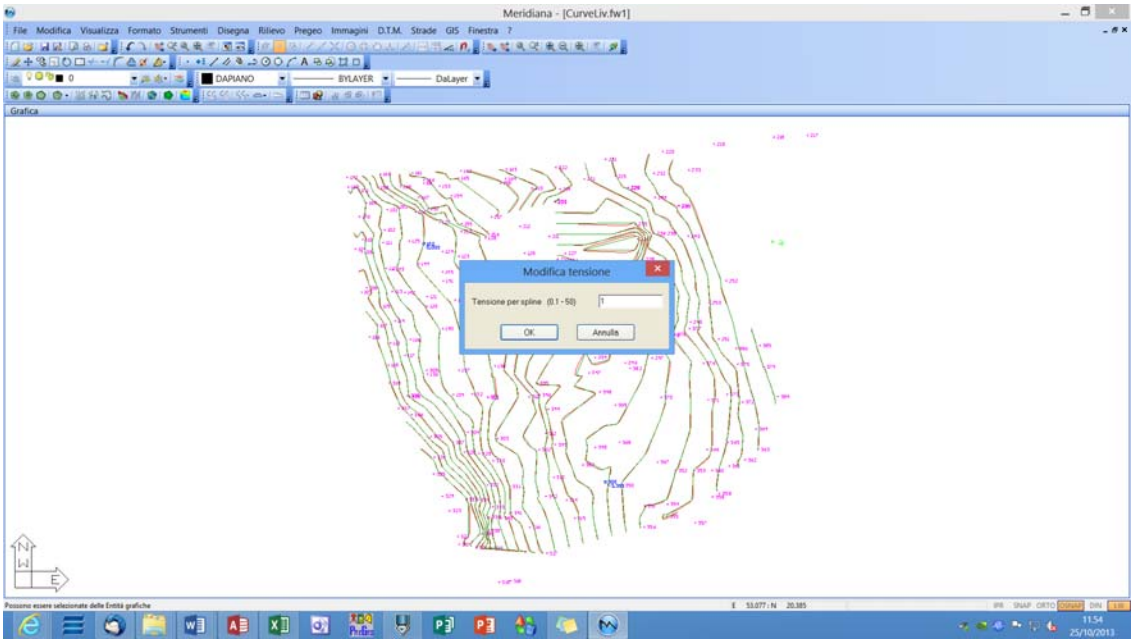




**Figure 534:**

The result of the operation is shown in the image below.

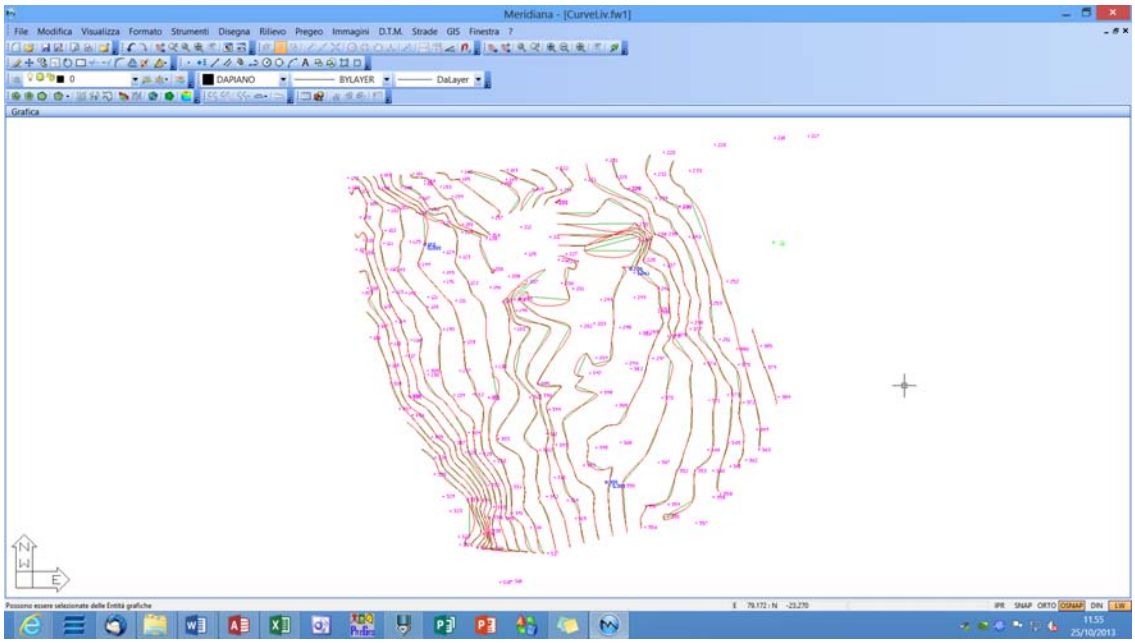



**Figure 535:**

The image below shows the result in **Graphic View** for when tension is set equal to 10.

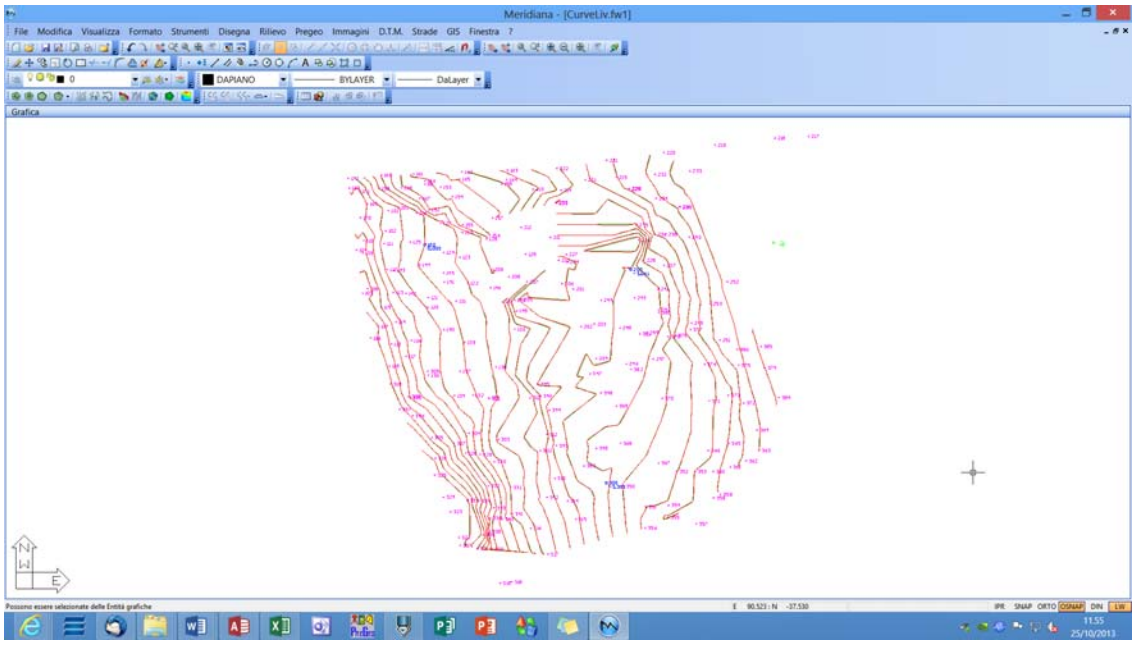



**Figure 536:**

- **Add/Remove spline texts:** this can be activated from the **D.T.M.|Level curves** menu.

  This function is used, whether the spline texts were inserted automatically or not, to add some or eliminate others if the project is not blocked.To add texts on the splines the user must click on the point of the spline where to execute the addition; it is important to remember that texts cannot be added anywhere, in fact, it is necessary that there is enough space along the spline section. Elimination of the text can be done by clicking on the spline to eliminate.

  The **Rotate spline text** function from the **D.T.M.|Level curve** menu is used to rotate the text previously inserted on the spline in the opposite direction, again, given that the project is not blocked.

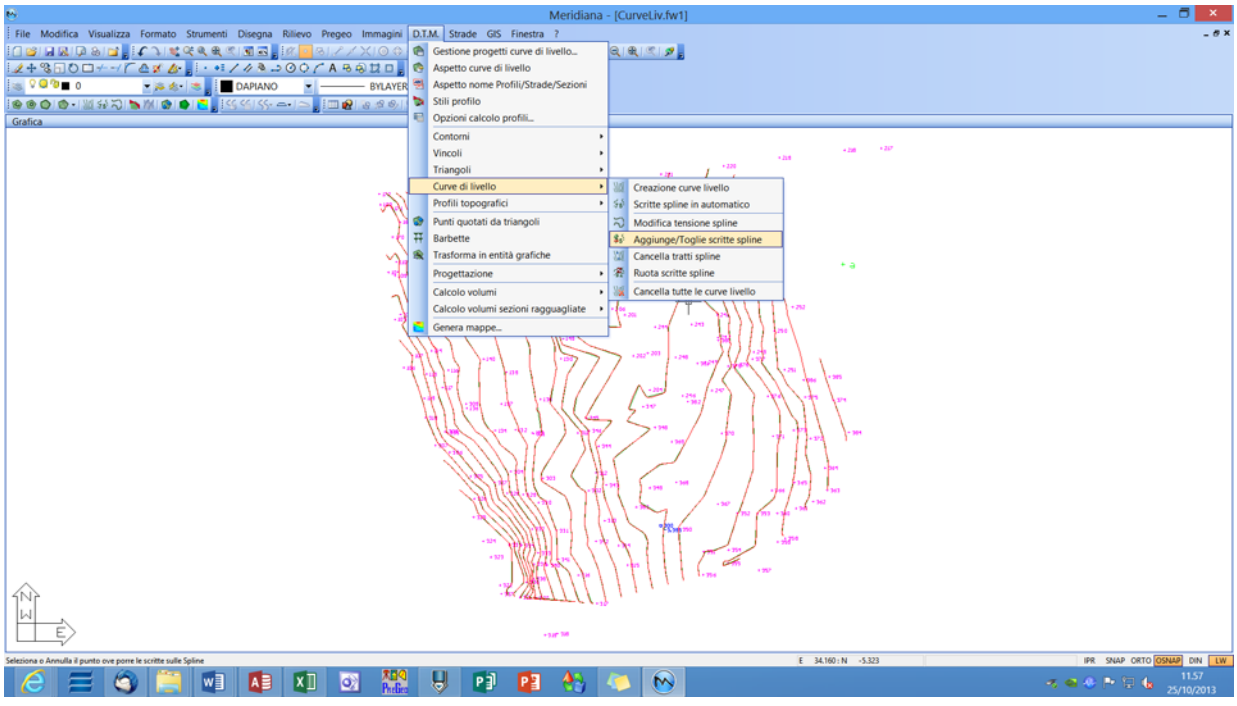



**Figure 537:**

# Format|Level curves appearance

Activating the **Format|Level curve appearance** function will open a window composed of three pages used to change the settings associated with the active project.

The first page is used to set the filters for the design or display or hide the various elements by selecting/deselecting the specific check box placed to its side.

Also, the color can be selected (uniform) for the various elements by clicking on the box where the color is shown (note that for triangles and curves a gradation in color can be used and this is managed only on the **Triangles** page for triangles and **Level curves** page for the level curves).

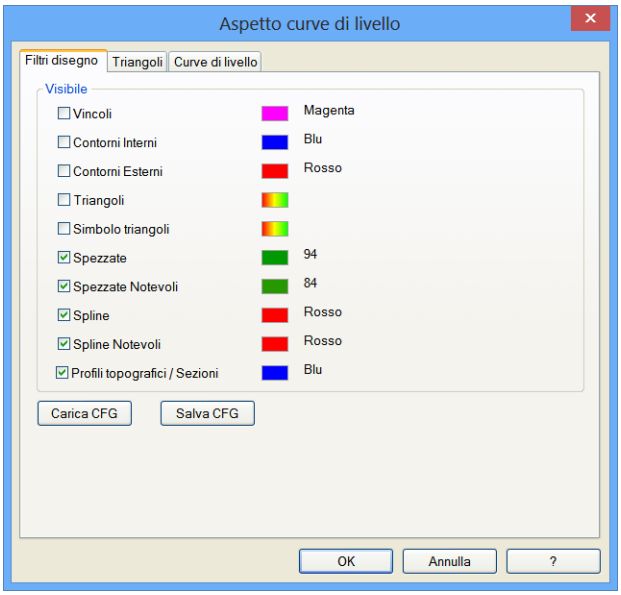



**Figure 538:**

On the **Triangles** page, the user can select which symbol is to be inserted within the triangles; the choices are: none, name, barycentric, slope.

If the user selects slope, then the **Text Dim.** box becomes the **Scale** box; in this case, the graphic will represent

the survey slope; the larger the arrow the higher the slope.

In the colors section, the user is able to set a gradation in color in representing the triangles; the coloration is done taking into account the quote and number of selected intervals; the quote intervals can be customized by selecting the specific check box.

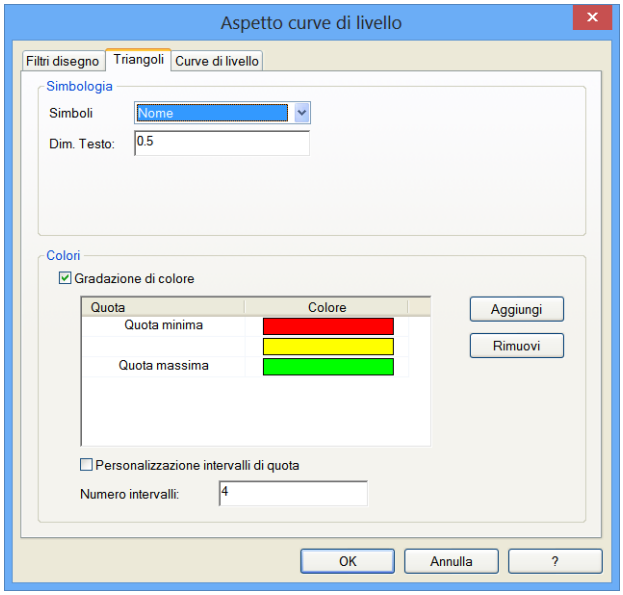



**Figure 539:**

On the **Level Curve** page, the user can set the text dimension, the number of decimals, and the position of the quote of the dash lines and the splines.

Further, the user can set a prefix or suffix to its side depending on the requirements and set an orientation that can be standard or legible.

If the orientation is standard, based on how the text was positioned, the progression of the terrain can be understood; instead, if a legible orientation has been selected, then the terrain progression is not considered and the program will position this information in a way that makes it most legible.

This page too allows setting a gradation of color for the level curves similar to that for triangles.

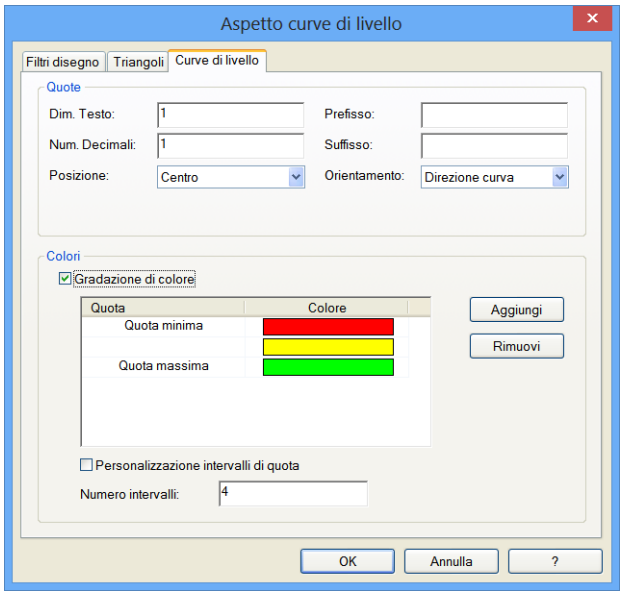



**Figure 540:**

# Slope lines

Slope lines are graphic entities used to represent terrain progression; for example, they can be used to delineate escarpments whether natural or artificial; these entities are managed by the program as blocks.

To activate the function of these entities the user must access the **D.T.M.|Slope lines** menu.

Prior to activating the procedure, the user must design the polylines using the **Design|2D or 3D polylines** command as can be seen in the image below.

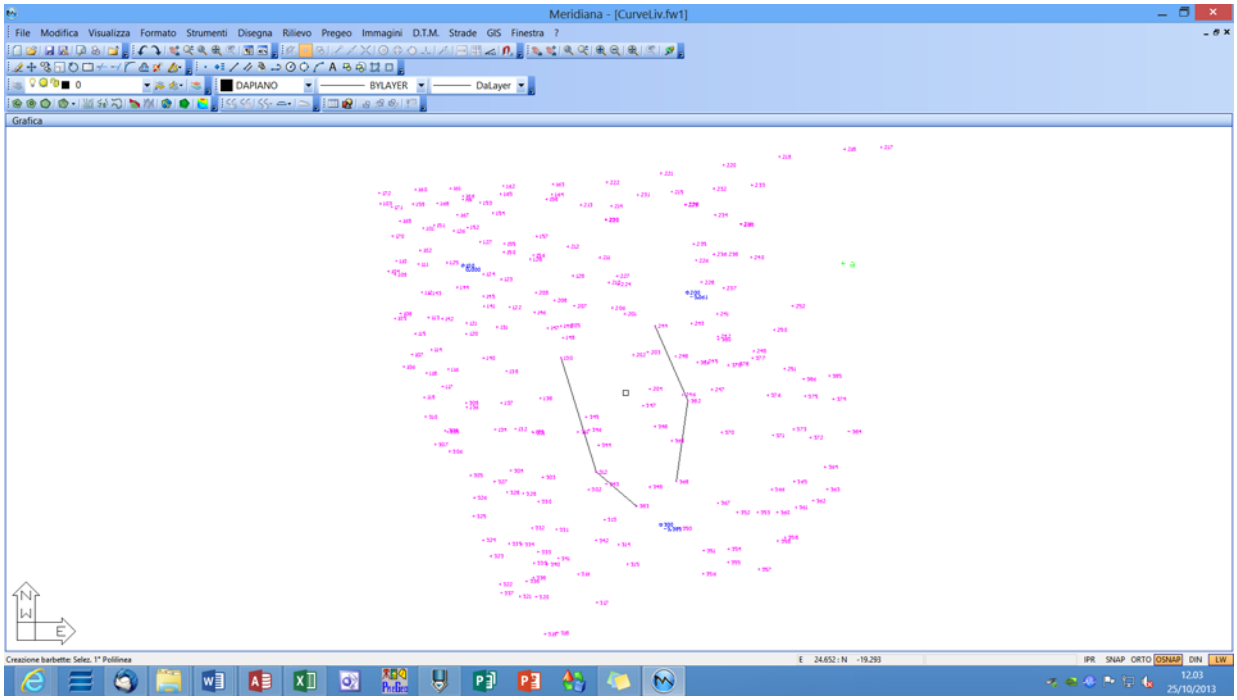



**Figure 541:**

Once the procedure is activated, the first operation to do is select the next two designed polylines within which the slope lines are created (the first polyline will be specifically the one from which the slope lines begin).

Once this selection is made, the program will open the **Create slope lines** window allowing the user to set the options for creating these entities.

The **Create slope lines** window is divided into three sections:

- In the **Dimensions** section, the user can:
  - set the distance between the sections, that is, between one slope line and another;
  - set the original distance of the section that is, the distance between the first polyline and the beginning of the slope line;
  - set the distance of the end section that is, the distance between the second polyline and the end of the section.
- In the **Options** section, the user can:

– Activate or not the **Close polyline ends** option.
By activating **Close polyline ends**, if the two polylines do not have the same length then the user can design the sections also in those parts that are not shared between the two polylines; the length of the sections will be joined at the juncture between the ends of the two polylines.

– Activate or not the **Approximate curve sections** option.
By activating **Approximate curve sections**, the bases of the slope lines do not set against the first polyline; in particular, they are places near it so that the sections can be joined.

– Activate or not the **Cut sections intersection** option.
By activating **Cut sections intersection**, if the two polylines form a curve, then the user can eliminate any intersections within the slope line sections.

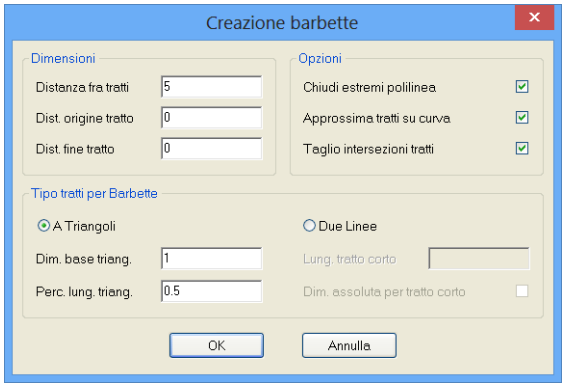



**Figure 542:**

- In the **Section type for slope lines** section, the user can select the type of section to use in the design; the sections can be triangular in form that ends on a line or represented by two lines (one long and one short).

  If the slope lines are to be represented triangles, the user can set the dimension of the triangle bases and the percentage of triangle length in accordance with the total length of the section.

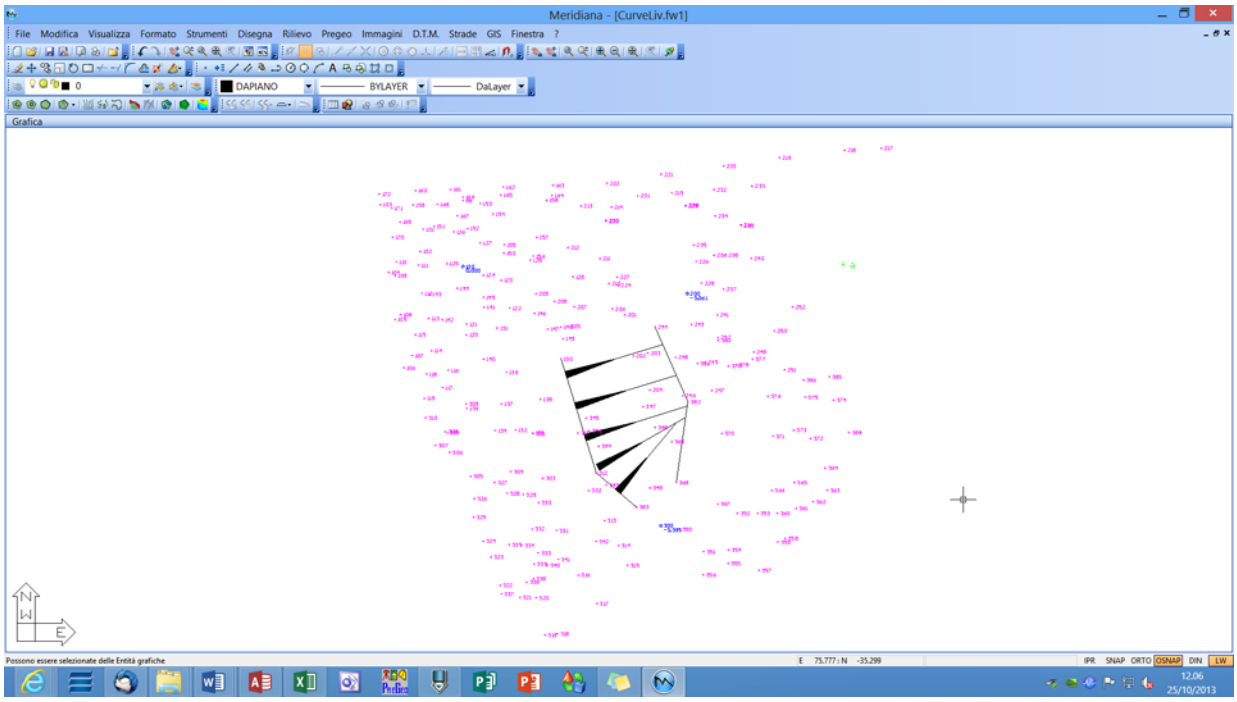



**Figure 543:**

If the slope lines are to be represented as two lines then the user can insert the shorter section length and select whether to treat it as an absolute dimension or as a percentage of the long section.

To eliminate the slope lines, given that they are graphic entities, the user must activate the **Cancel** command found in the **Graphic View** of the **Change** menu.

Elimination can also be canceled by using the **Annul** command found in the **Change** menu.

One last thing to note on slope lines is that because they are graphic entities, they can be changed as such, in particular:

– the user can change their color, move them and rotate them using the graphic menu;

– they can exploded as any block; once exploded, the individual sections will be graphic lines or polylines that can be individually moved, rotated, scaled, etc.

# Planning

Meridiana offers the user various functions for three dimensional modeling of parking, plazas, tunnels and general planning works.

The "Excavation Project" command allows the user to create the project by running the following operations:

1.Quote polyline vertices layout

2.Calculate escarpments

3.Create triangles

4.Create peg points.

By obtaining a flattening project bordered by a layout polyline where the sides have escarpments created to enclose the terrain.

The operations executed by the "Excavation Project" procedure can be run also individually using the "DTM|Planning" menu functions.

These functions are used by the planner to have more control over the project and create solutions that the "Excavation Project" command does not offer (excavations on multiple levels, create escarpments with berms, create terracing, create excavations beginning from the external perimeter, create ditches, create projects beginning from open polylines).

The sequence of operations that the user must follow to create the project in general is as follows:

1.Define a beginning graphic polyline

2.Polyline vertices layout quote For this purpose there are three functions available: assign the same quote to all vertices, assign the quote to vertices so they lay on a plane defined by the user, place the polyline onto the current triangulation. In this case, the user can create a project beginning with the external border.

3.Creating an escarpment at a finished height or to intersect the terrain. The extension of the finished height escarpment can be specified in various ways: height and width, height and slope, width and slope or up to a fixed quote.

4.Point 3 can be repeated multiple times beginning from the project as it is created. By doing so, the user can create terraces, ditches, ramps.

5.Creating triangles within the internal part of the project.

6.Extracting points to peg.

Further, the user can also create a triangulation as merger of the project and the current status to properly view the finished project.

# Example 1

This example will illustrate the steps to create a finished height escarpment beginning from a fixed quote polyline.

## Phase 1 - Assign a fixed quote polyline

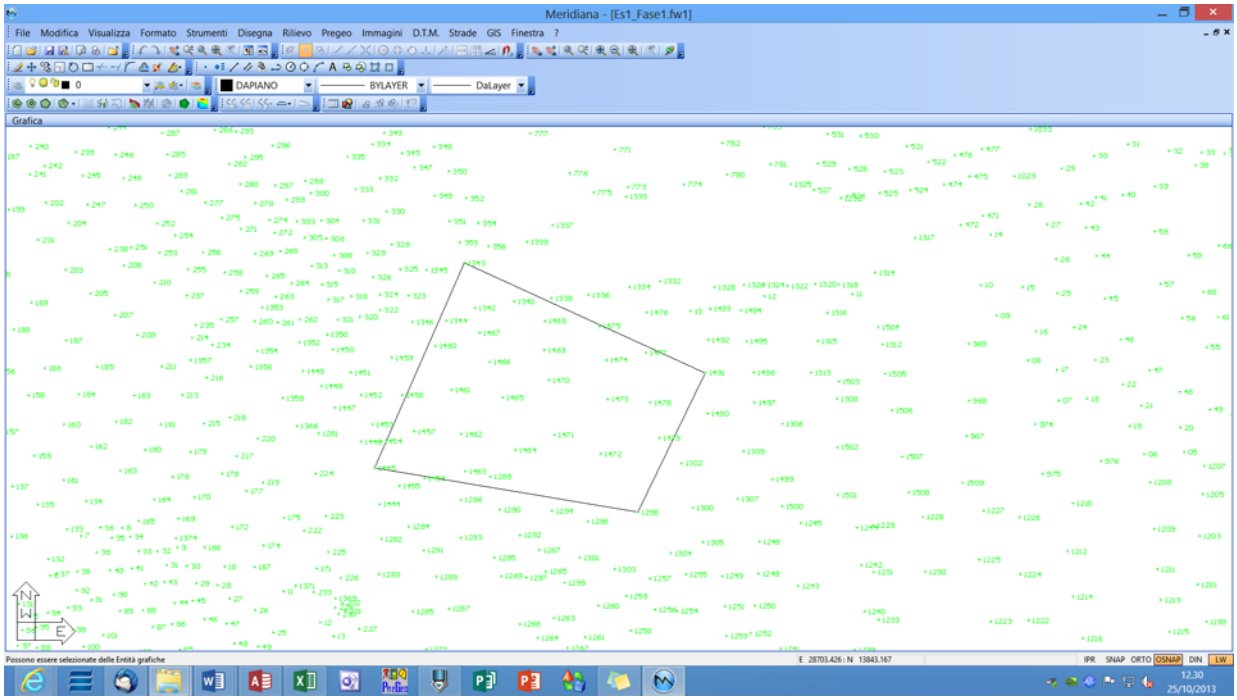
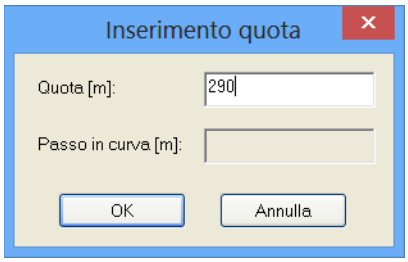



**Figure 544:**

After designing a closed polyline, activate the "Assign a fixed quote polyline" command and select the polyline; verify that the "Insert quote" window appears and insert 290 as the fixed quote.




Press OK and the Z coordinate of all the polyline vertices will be set equal to 290.

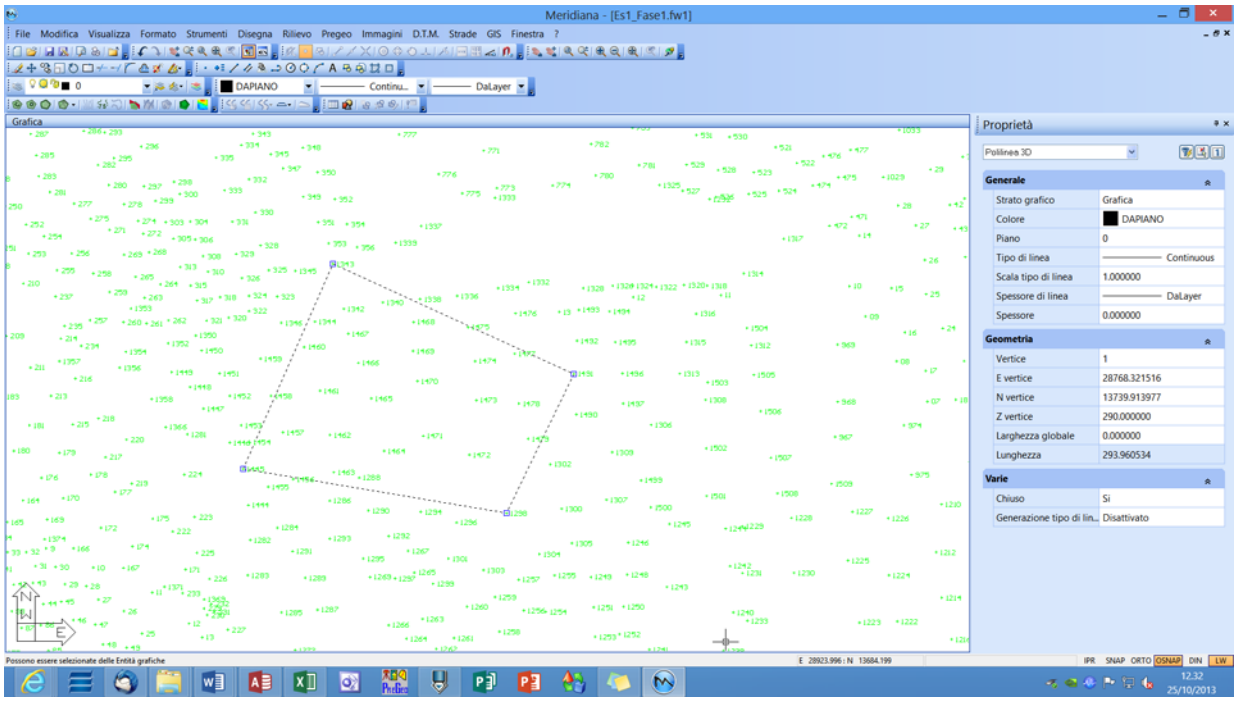



**Figure 545:** Reference file Ex1_Phase1.fw1

# Phase 2 - Create escarpment

Before creating a escarpment the user must add a new project using the "D.T.M./Manage level curve project..." command.

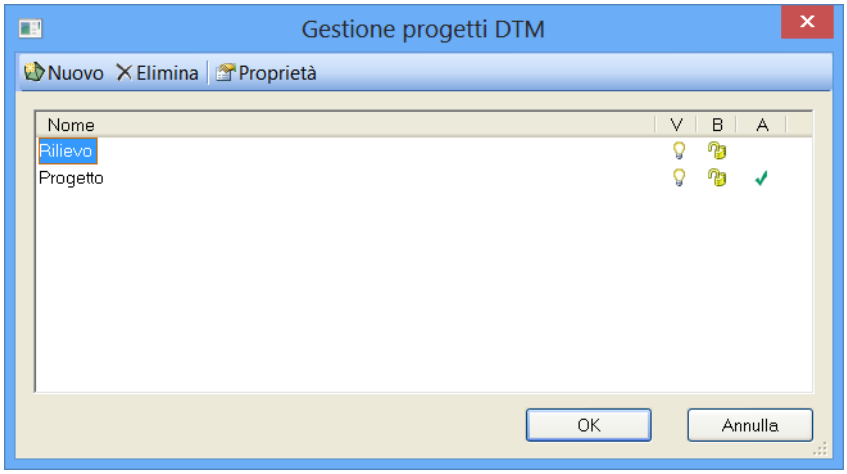
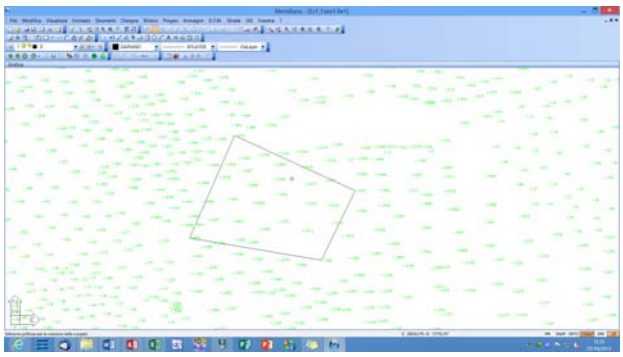



**Figure 546:**

Running the "D.T.M./Planning/Create escarpment" command, the program will display the selection symbol used to select the polyline and then its external point.



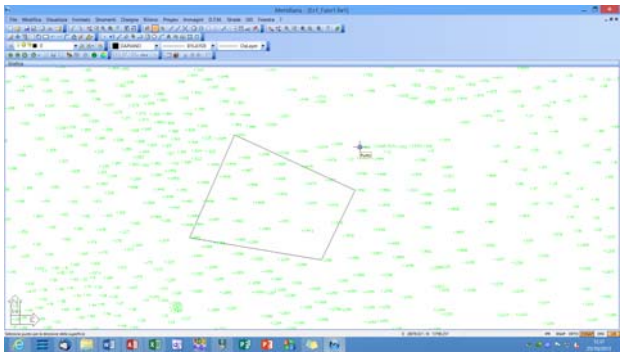


**Figure 547:**

After selecting the point, the program will display the "Create escarpment" window used to insert the Slope equal to 66,667 and Height equal to 7 as the calculation method.

Press **OK**.

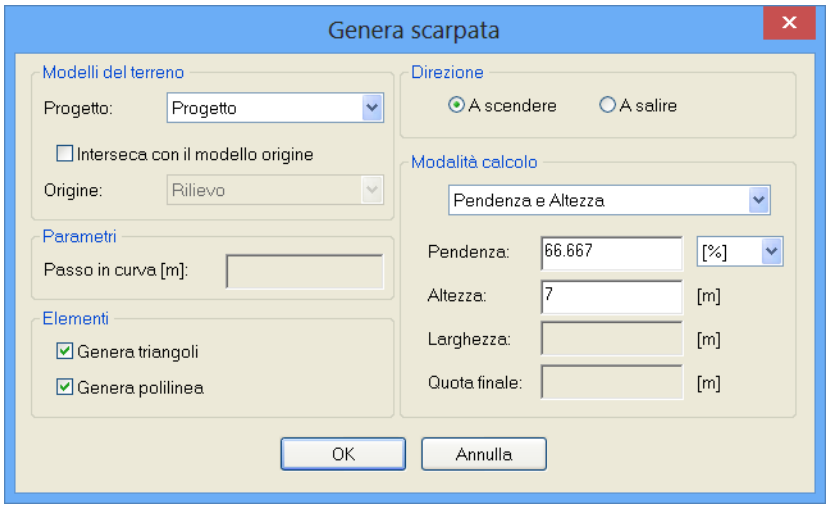



**Figure 548:**

The image to the side shows the result of the excavation highlighted in red using the "Format/Level curve appearance" command.

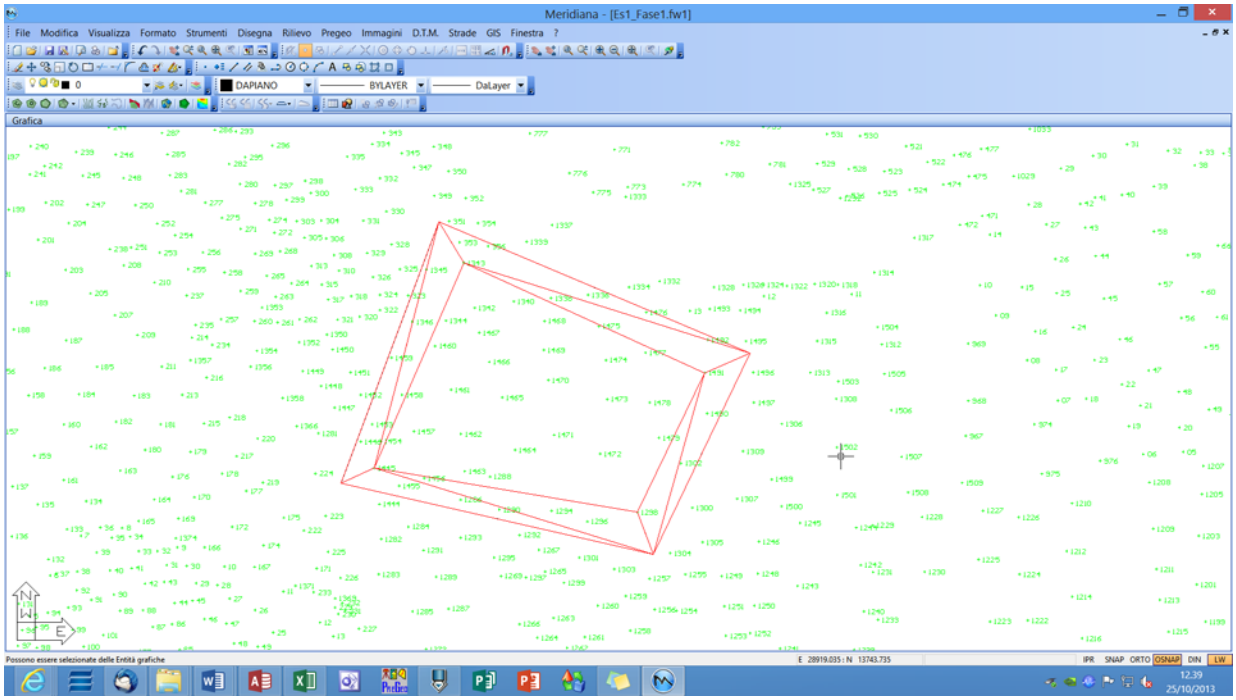



**Figure 549:** Reference file Ex1_Phase2.fw1

## Phase 3 - Create Horizontal Terracing

To create the horizontal terracing, run the "D.T.M./Planning/Create escarpment" command where the program will display the selection symbol used to select the outermost polyline and then a point external to it.

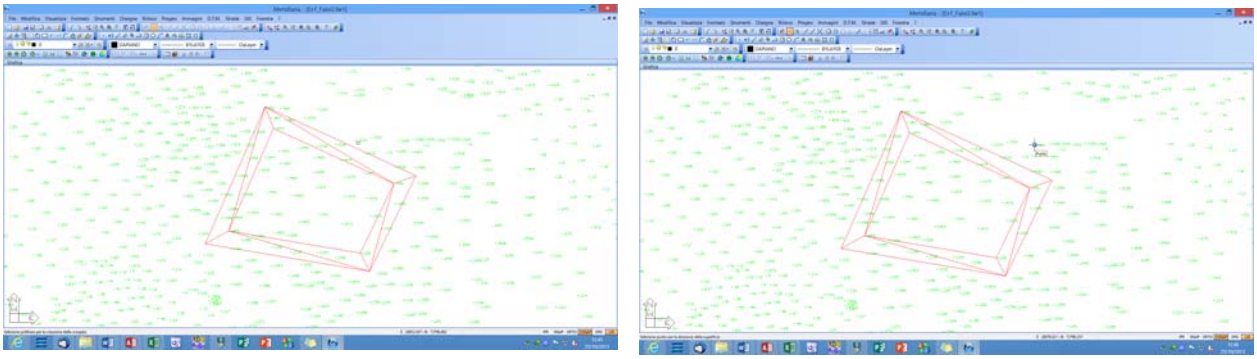


**Figure 550:**

After selecting the point, the program will display the "Create escarpment" window used to insert the Height equal to 0 and the Width equal to 5 as the calculation method.

Press OK.

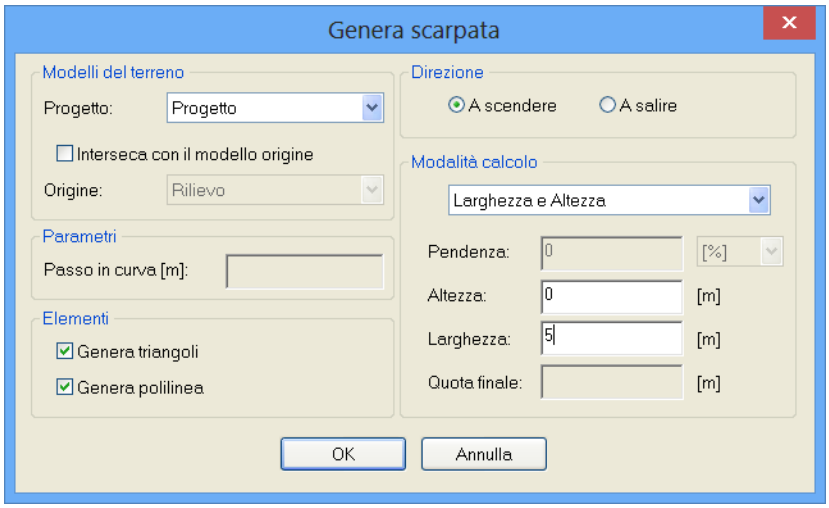



**Figure 551:**

The image below shows the result of the excavation highlighted in red using the "Format/Level curve appearance" command.

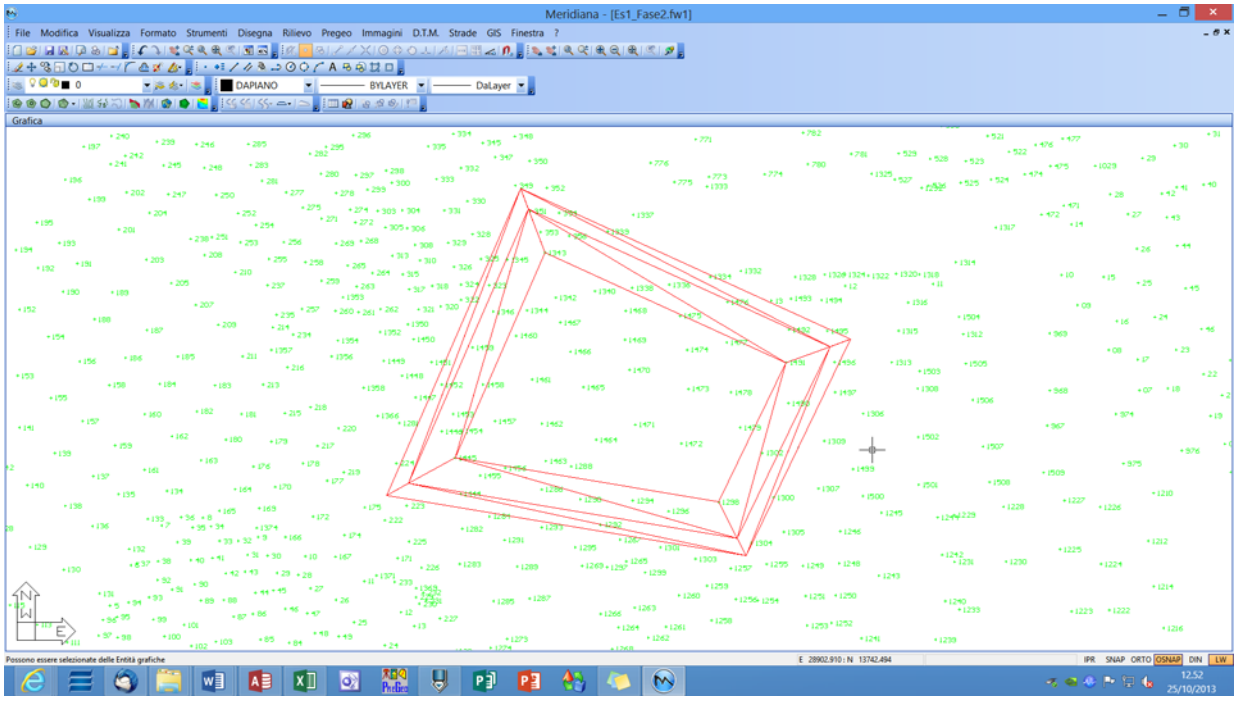



**Figure 552:** Reference file Ex1_Phase3.fw1

## Phase 4 - Create escarpment at DTM

To create the escarpment at DTM, run the "D.T.M./Planning/Create escarpment at DTM" command where the program will display the selection symbol used to select the outermost polyline and then a point external to it.

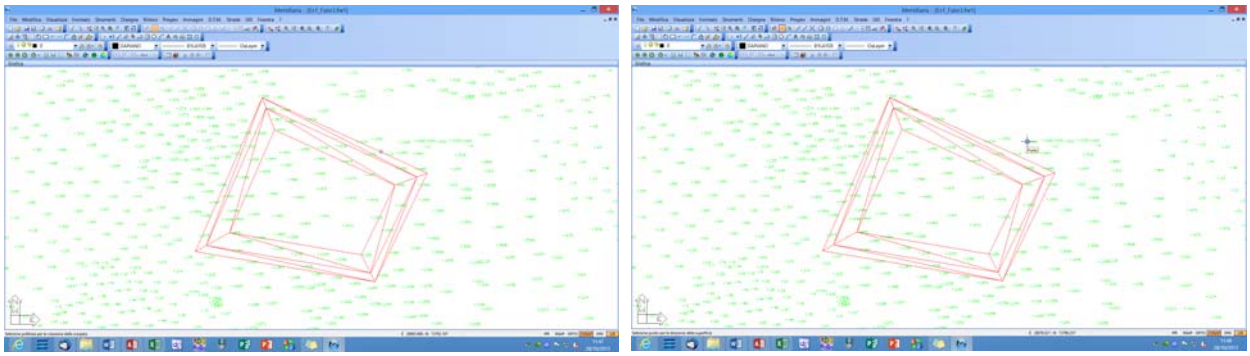


**Figure 553:**

After selecting the point, the program will display the "Generate escarpment at DTM" window used to insert the excavation slope value equal to 66,667 and the fill slope value equal to 100 as the calculation method.

Press **OK**.

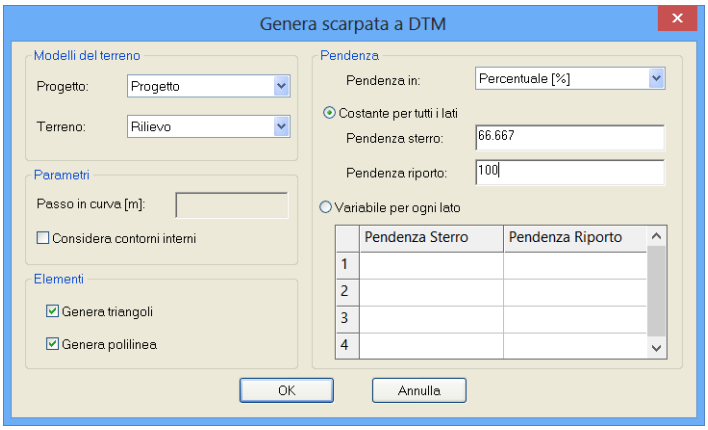



**Figure 554:**

The image to the side shows the result of the excavation highlighted in red using the "Format/Level curve appearance" command.

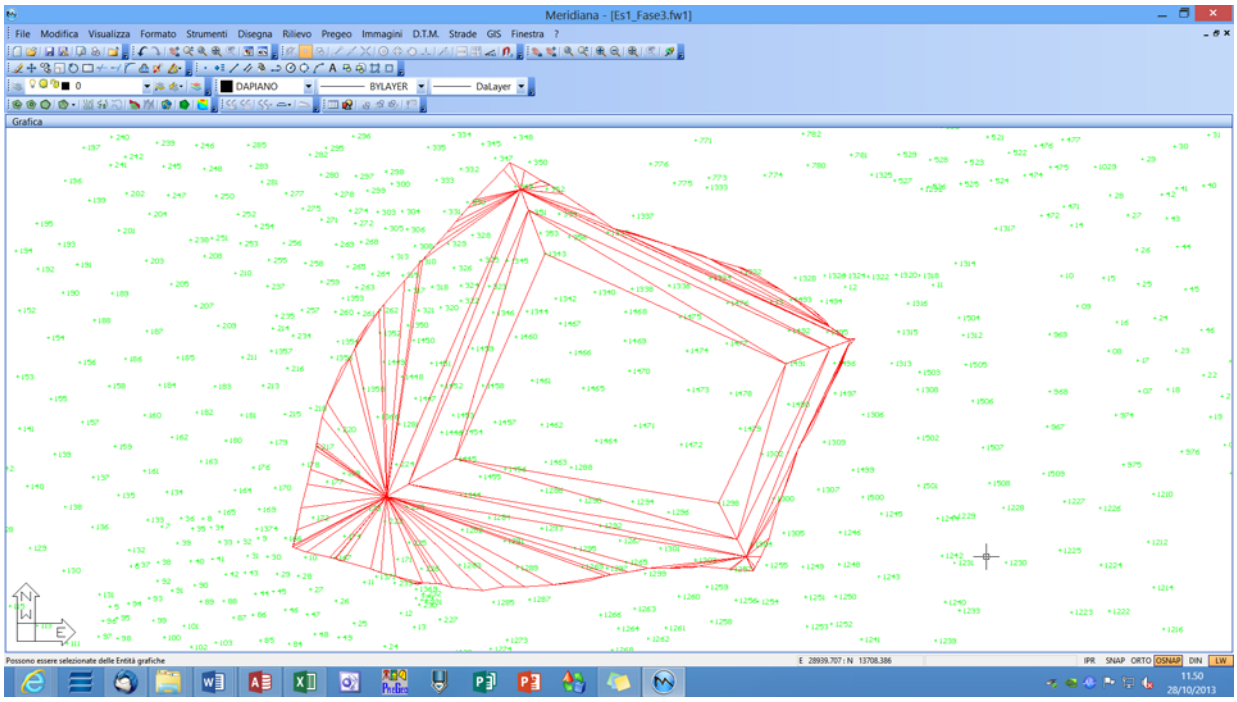



**Figure 555:** Reference file Ex1_Phase4.fw1

## Phase 5 - Create triangles within polyline

To insert triangles within a polyline, the user must activate the "D.T.M./planning/Create triangles within polyline" command.

Executing the command involves graphically selecting the polyline (in our case the innermost).

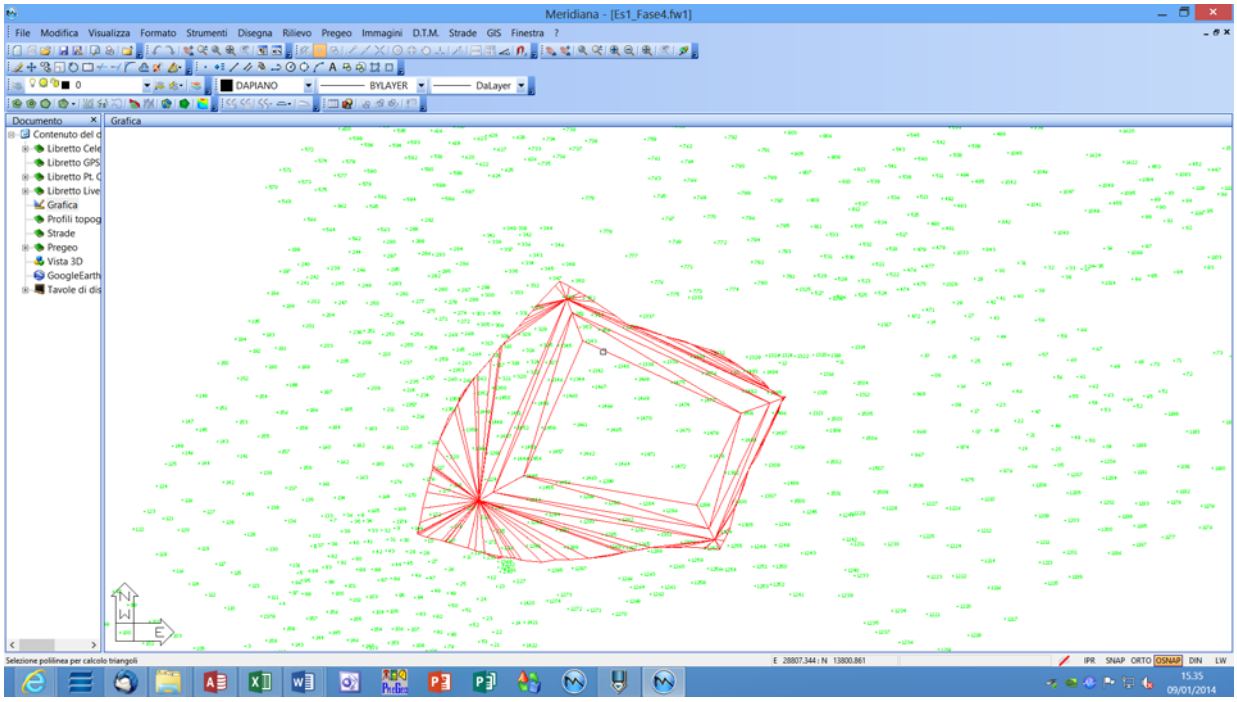



**Figure 556:**

Once the selection is completed, the program will immediately activate the creation of triangles as can be seen in the image to the side.

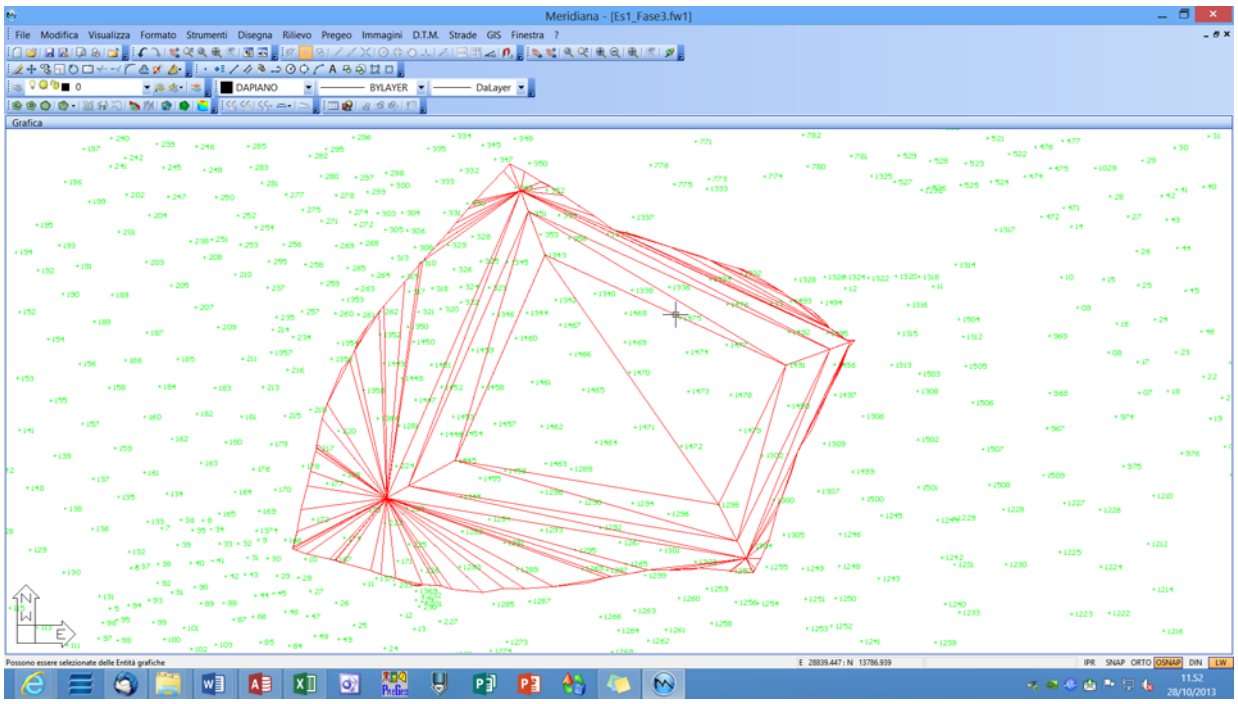



**Figure 557:** Reference file Ex1_Phase5.fw1

The final result is seen in the image below, after executing the "Display/Fill/Shaded" command.

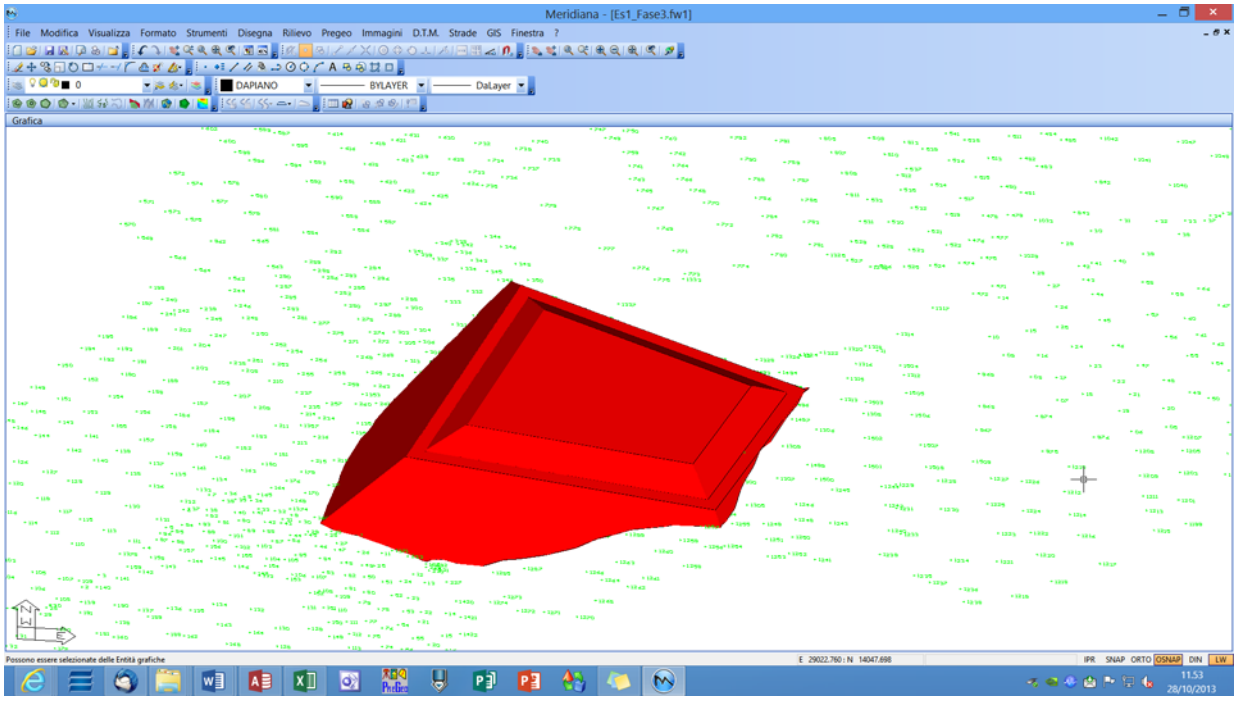



**Figure 558:** Reference file Ex1_FinalResult.fw1

# Example 2

This example illustrates the phases used to create a escarpment beginning from a quoted polyline and arriving at the intersection line with the terrain.

## Phase 1 - Assign a quote polyline from plane

After designing a closed polyline, activate the "Assign a quote polyline from plane" command and select the polyline.

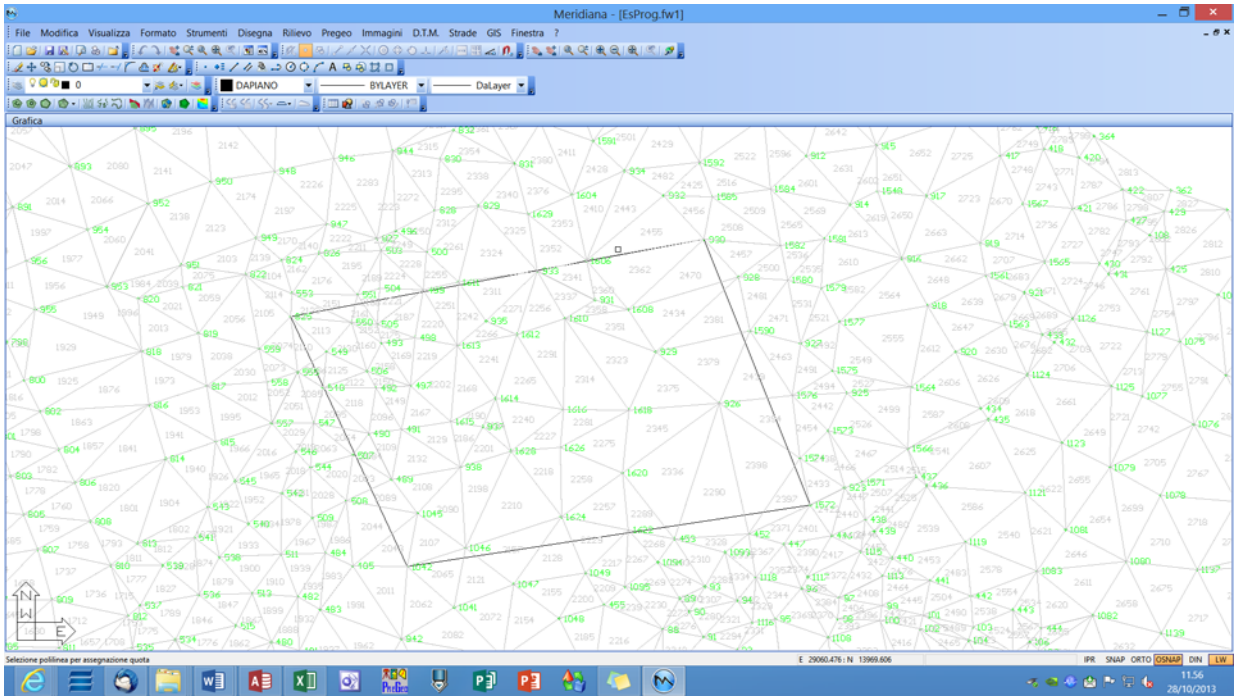



**Figure 559:**

Verify that the "Select plane for assigning quote" window appears and then indicate the plane selection at 3 points, continue.

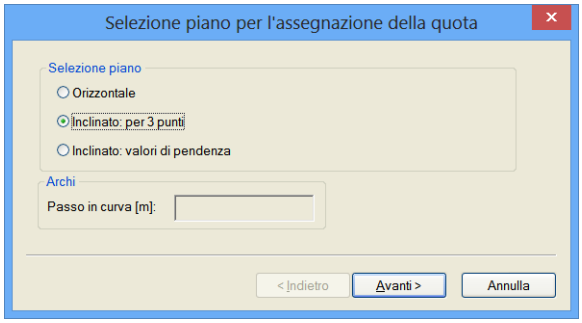



**Figure 560:**

Select points 1610, 1612 and 1616: once the selection is completed, the program will display the "Display and Change Points" window. To end, press "End".

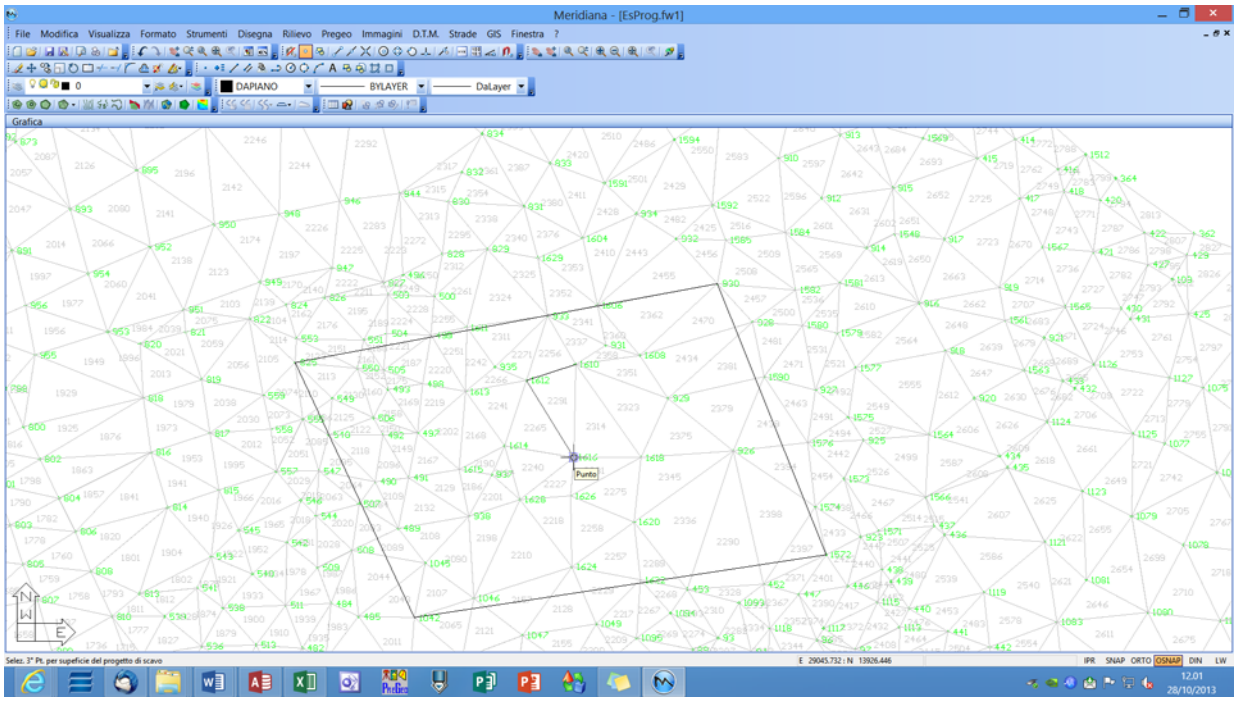



**Figure 561:**


**Figure 562:**

Reference file ExProg1.fw1

# Phase 2 - Create triangles within polyline

To highlight the triangles within the polyline the user must first create a new project using the "D.T.M./Manage level curves" command.

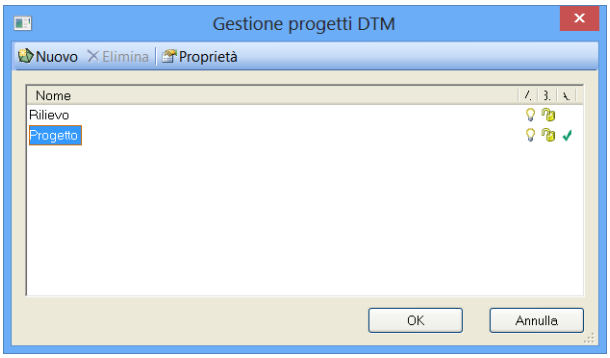



**Figure 563:**

Activating the "D.T.M./Planning/Create triangles within polyline" command will open the selection symbol used to indicate the polyline within which the triangles highlighted in red will be created, after changing the color with the "Format/Level curve appearance".

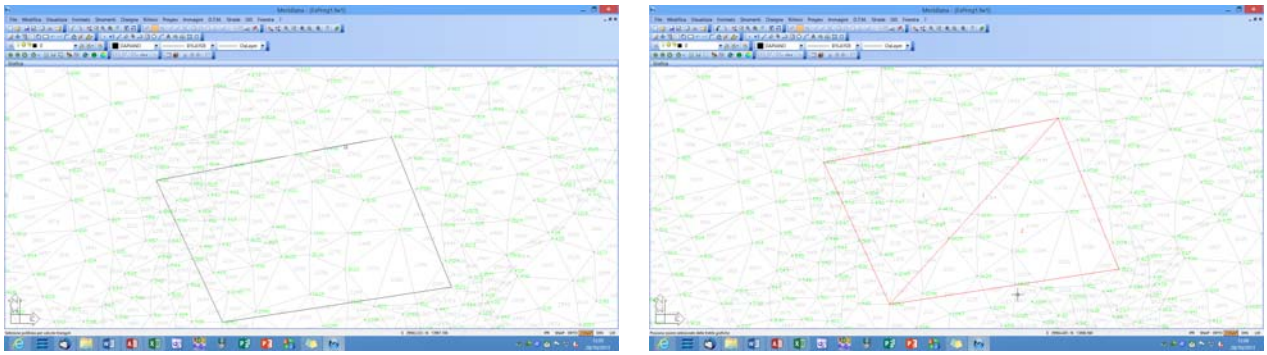


**Figure 564:**

Reference file ExProg2.fw1

# Phase 3 - Create escarpment

After creating the triangles, use the "D.T.M./Planning/Create escarpment" command to first identify the polyline and then a point external to it, for example 829.

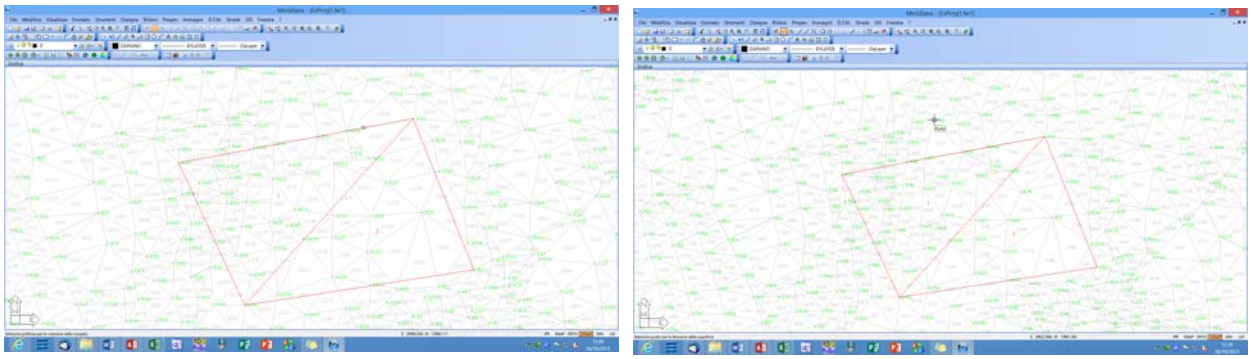


**Figure 565:**

After selecting the point, the "Create escarpment" window will open, used to insert the Slope equal to 100 and Height equal to 10 as the calculation method; press OK and verify the result of the escarpment.

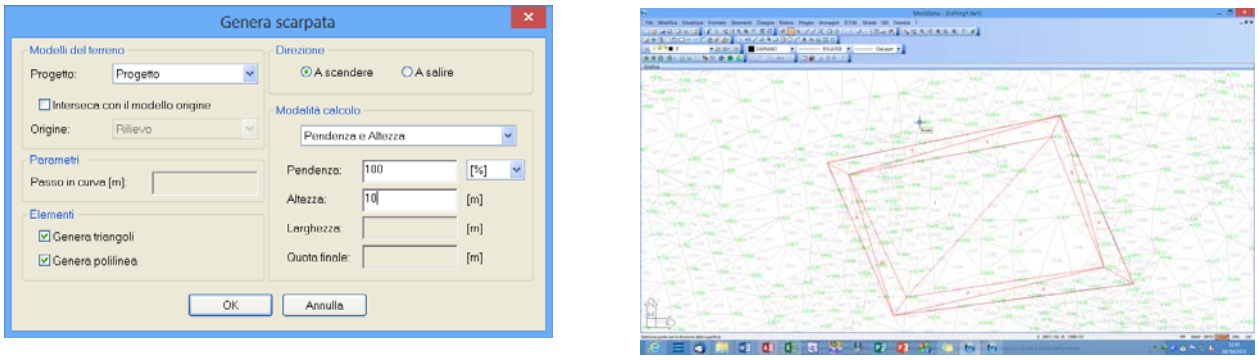



**Figure 566:**

Reference file ExProg3.fw1

# Phase 4 - Create escarpment at DTM

To create the escarpment at DTM, use the "D.T.M./Planning/Create escarpment at DTM" command to first identify the external polyline and then  a point external to it, for example 828.

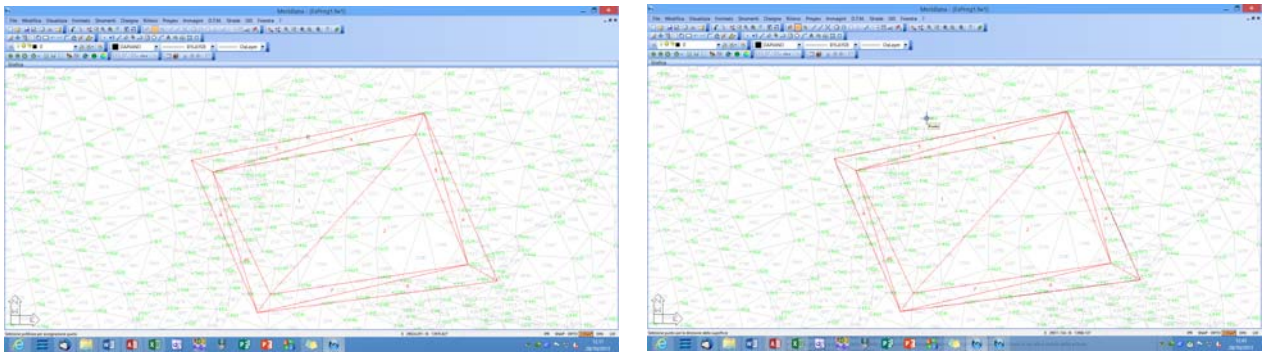


**Figure 567:**

When the point selection (828) is made, the "Generate escarpment at DTM" window appears used to identify the excavation slope at 100 and the fill slope at 100; press OK and verify the excavation created.

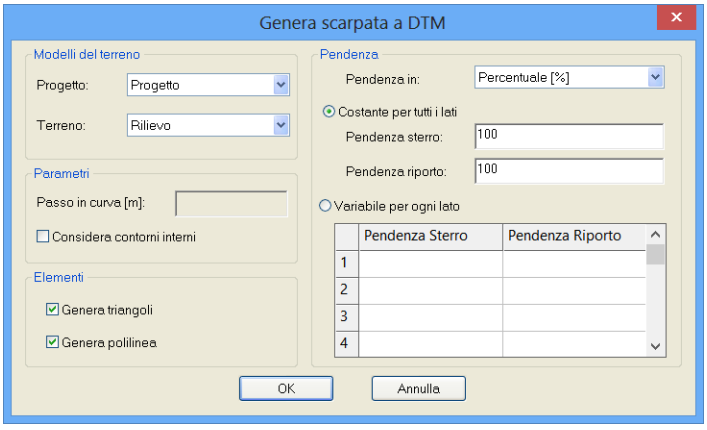



**Figure 568:**

Reference file ExProg4.fw1

See the final result in the image below.

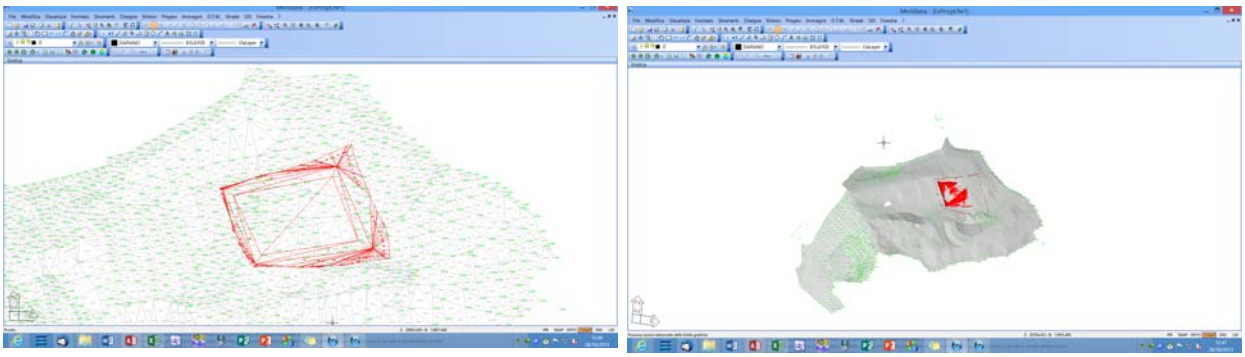


**Figure 569:**

# Example 3 - Excavation project

Planning an excavation can be done in two ways:

-Using the DTM Guided|Planning|Excavation Project procedure;

-Using the individual commands available in the Planning menu.

Here following is the description of the guided procedure and an example showing the planning of an excavation using both methods.

# DTM|Planning|Excavation Project

This guided procedure is used to plan an excavation by identifying a surface and the slopes at the borders to enclose the terrain.

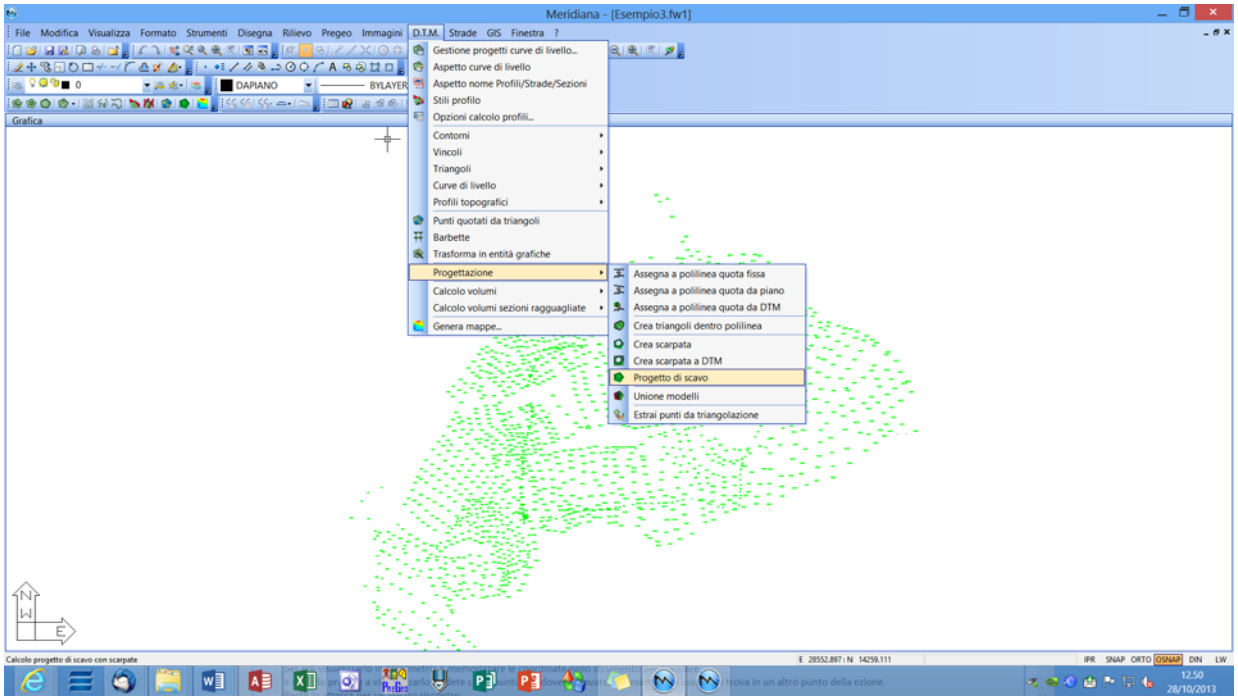



**Figure 570:**

The left part of the window shows the current operation in bold.

In this case, the user must select the beginning project (the destination project is represented by the active one).

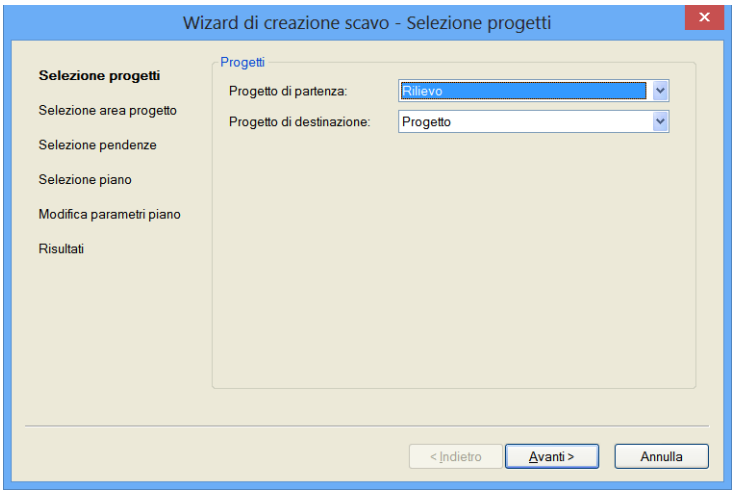



**Figure 571:**

Press the "Forward" button to continue to the window that, pressing the "Activate" button will open the Graphic View and allow the user to define the area where the work will be executed.

Once the area is defined, the program will ask the user to insert the slopes (excavation and fill); these values can be constant for all sides or change for each side.

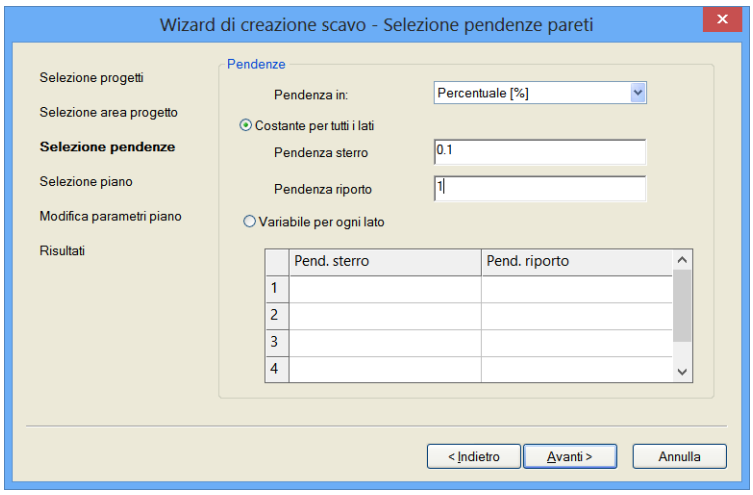



**Figure 572:**

Press "Forward" to open the window for selecting the plane where the user is to indicate to the program the type of plane to be used (horizontal, inclined at three points, or inclined according to the slope values).

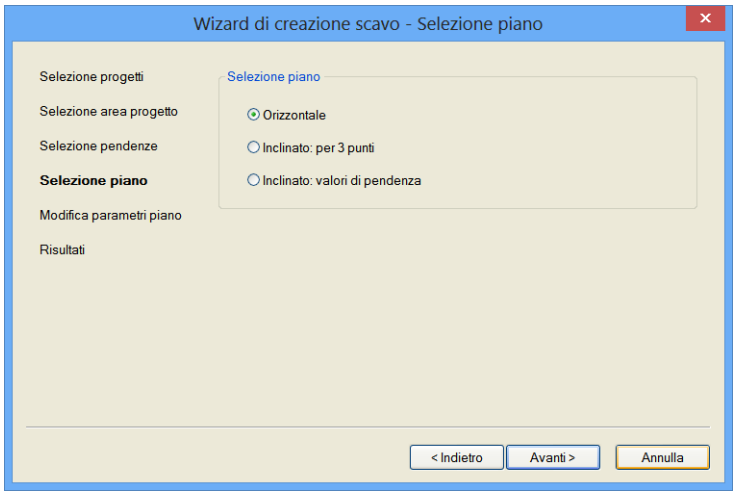



**Figure 573:**

If the user selects to apply a horizontal plane then during the "Change parameters" phase, the quote value must be inserted.

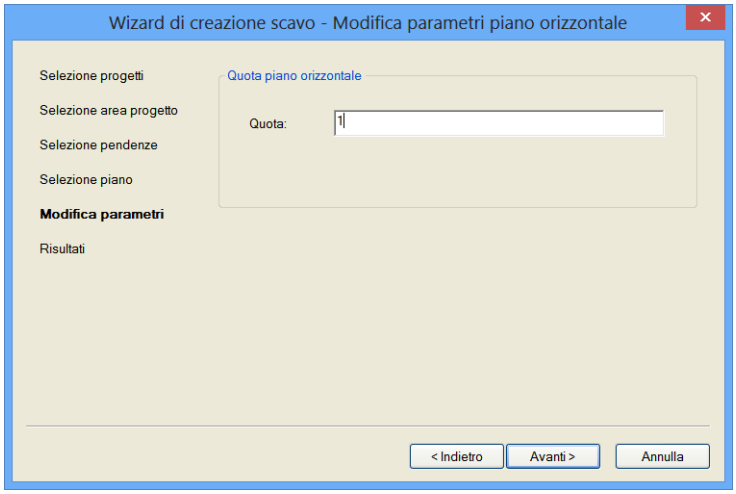



**Figure 574:**

Instead, if the user decides to apply an inclined plane at three points, then the three points must be selected in Graphic.

Once the selection is made, the program will display the window shown here to the side where the coordinates of the selected points are summarized (that can also be changed).

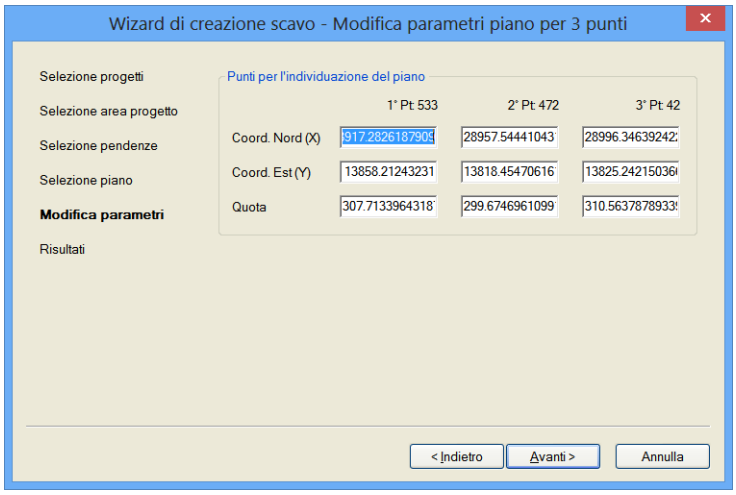



**Figure 575:**

Finally, if the user tells the program to use an inclined plane by slope values, the user must select two points in Graphic that are used to calculate the slope values.

Once this operation is completed, the program will open a window showing the coordinates of the first selected point, the slopes and calculated directions.

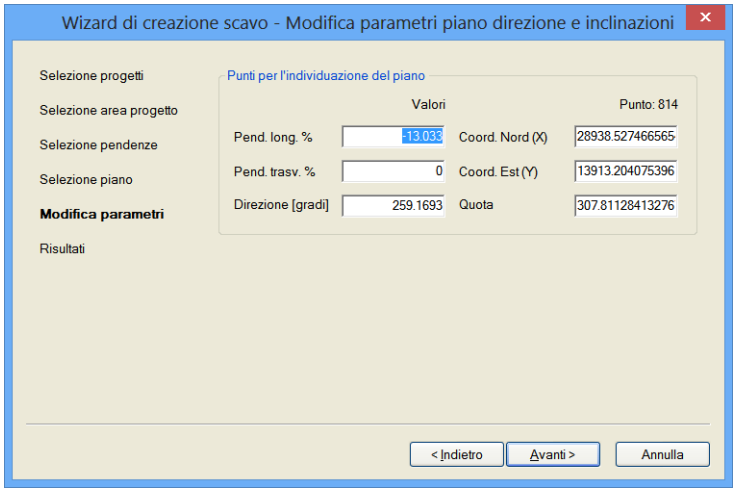



**Figure 576:**

The last window is used by the program to show the user the results of the operation.

One of the main reasons that the final result is not positive is the lack of triangles.

In the "Notable points options" section, the user must specify the name of the group where the created points will be transferred, the name of the points at the base and the name of the points at the summit.

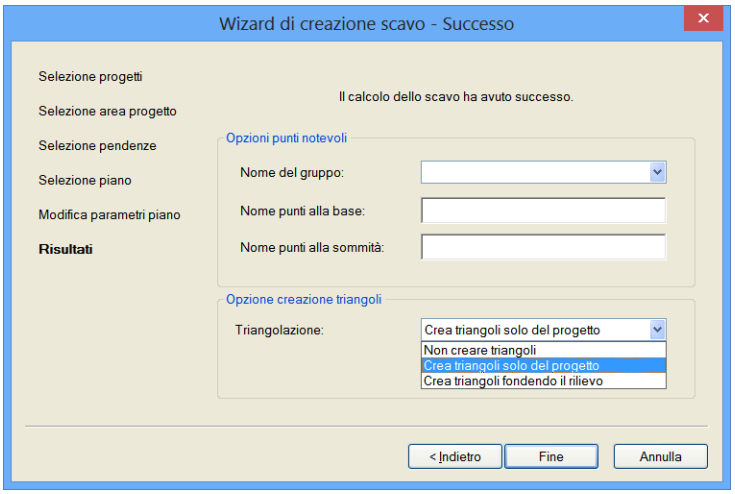



**Figure 577:**

In the "constraints option" section, the user can select to not create triangles, and to create them only by project and to create them merging the survey.

At the end of the procedure, noted coordinate points will be created on the salient points so as to allow easy calculation of a triangulation representing the created excavation; the result of the procedure can also be viewed directly in the Graphic View.

The calculation run can be used to execute the calculation of volumes by simple or complex difference with the original survey.

# Examples

## 1 Method - Excavation project

Before activating the procedure, at least 2 projects must have been created.

In this example, the project area has already been designed (Reference Example Ex3_1_Phase1.fw1).

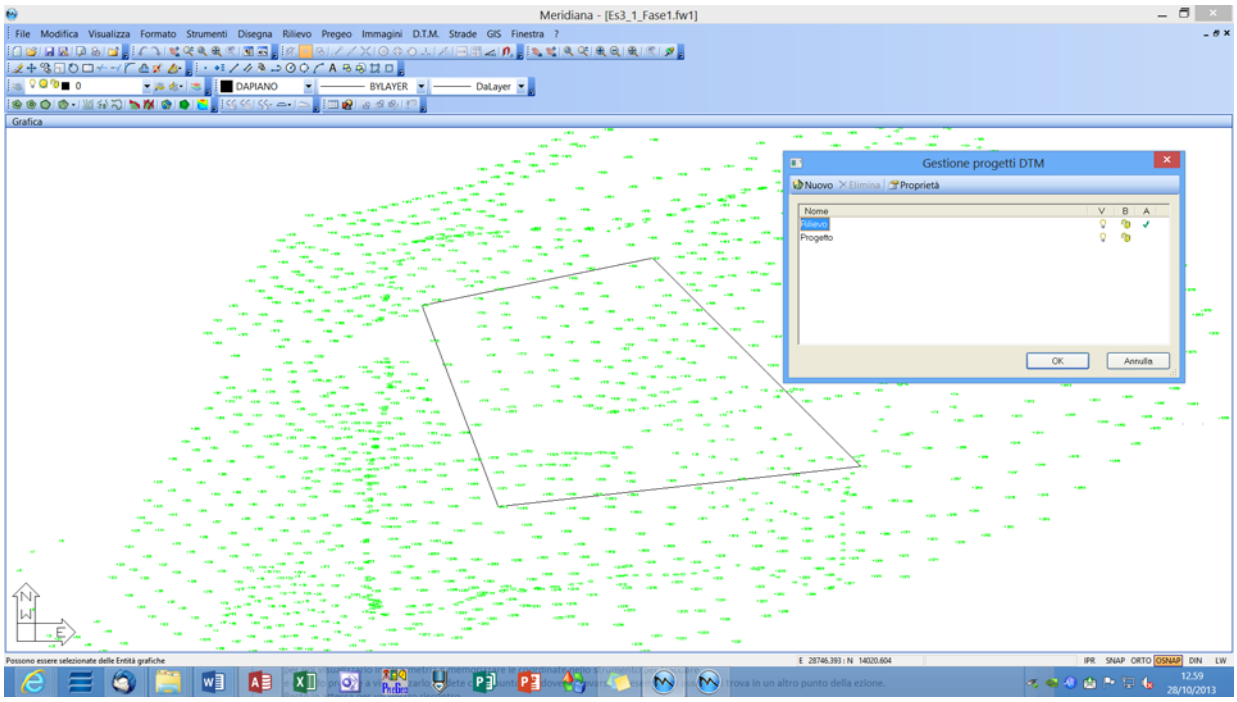



**Figure 578:**

Once the "DTM|Planning|Excavation project" procedure is activated, the program will ask the user to select the beginning project. The destination project is always the active one.

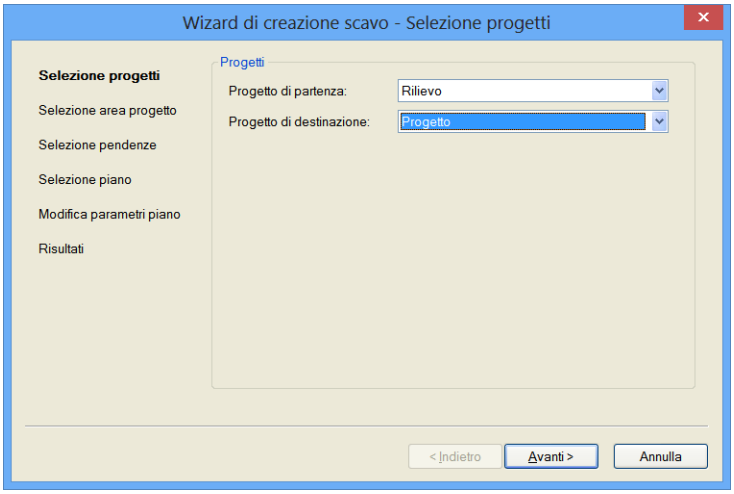



**Figure 579:**

Press "Forward>" and the user must identify the area involved in the project: in this case, the user just selects it.

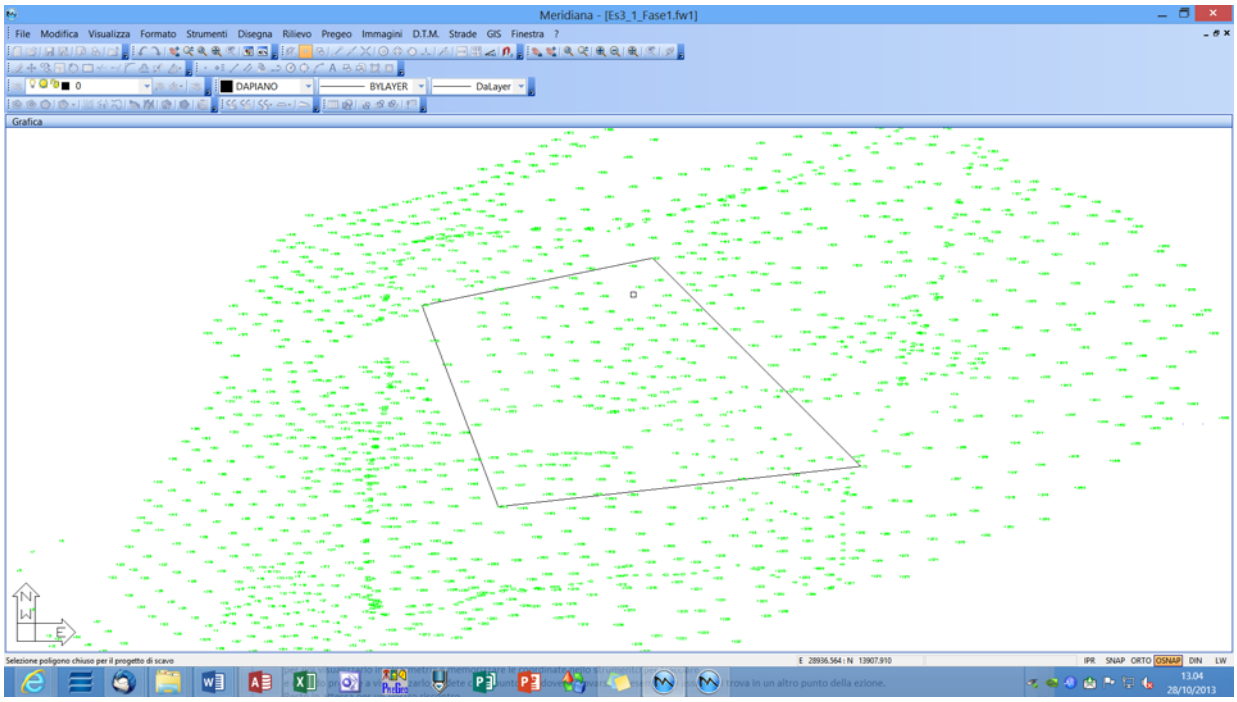



**Figure 580:**

After selecting the area, the procedure asks the user to indicate the excavation and fill slope. In our case, it was determined to leave it constant for all sides and to assign a value of 100 to both.

Press "Forward>" and the procedure will ask the user to indicate the method for identifying the plane to run the calculation.

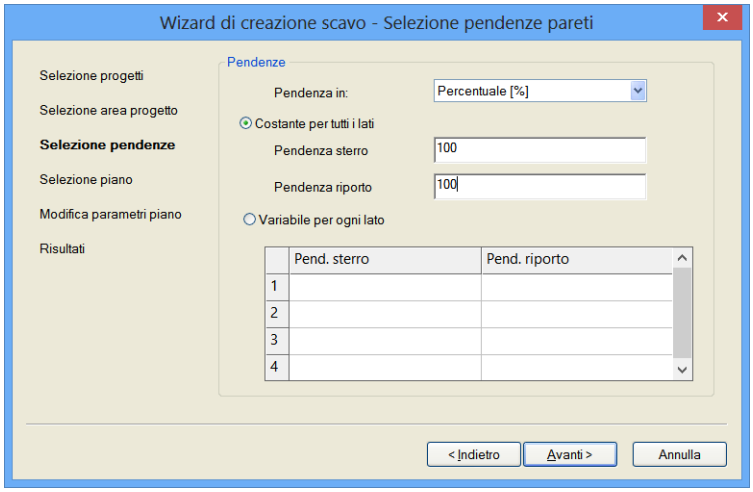



**Figure 581:**

In this example, the horizontal plane was selected and therefore, in the next window, the user must insert the quote (300).

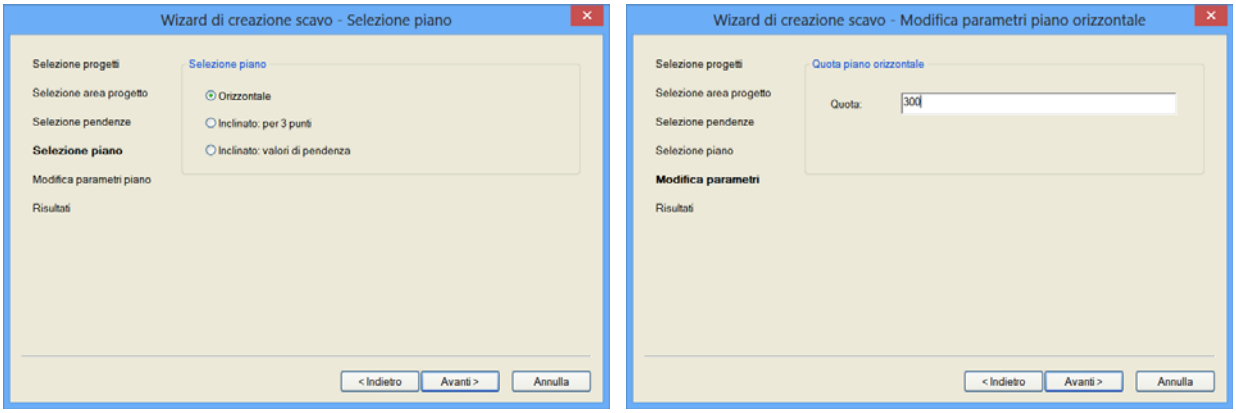



**Figure 582:**

The procedure continues with calculating the excavation and, once completed, opens the window with the results.

Besides this, the user can select whether to create notable points (Group 1) and/or whether or not to run the triangulation (in this example it was determined to create only project triangles).

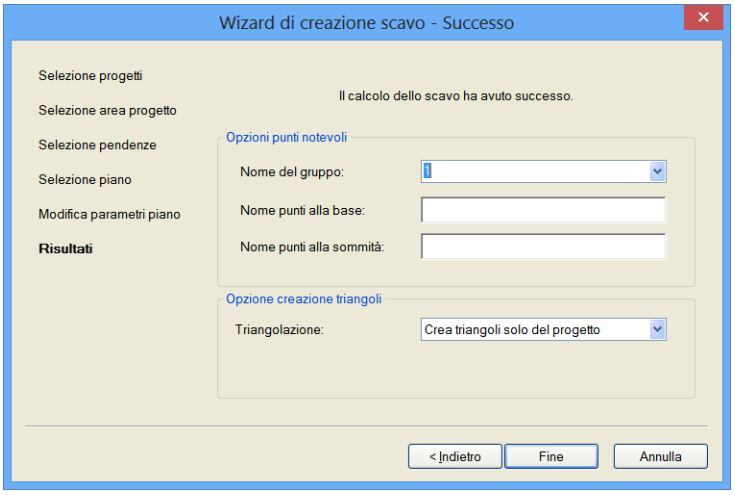



**Figure 583:**

The result in Graphic View is shown in the image below.

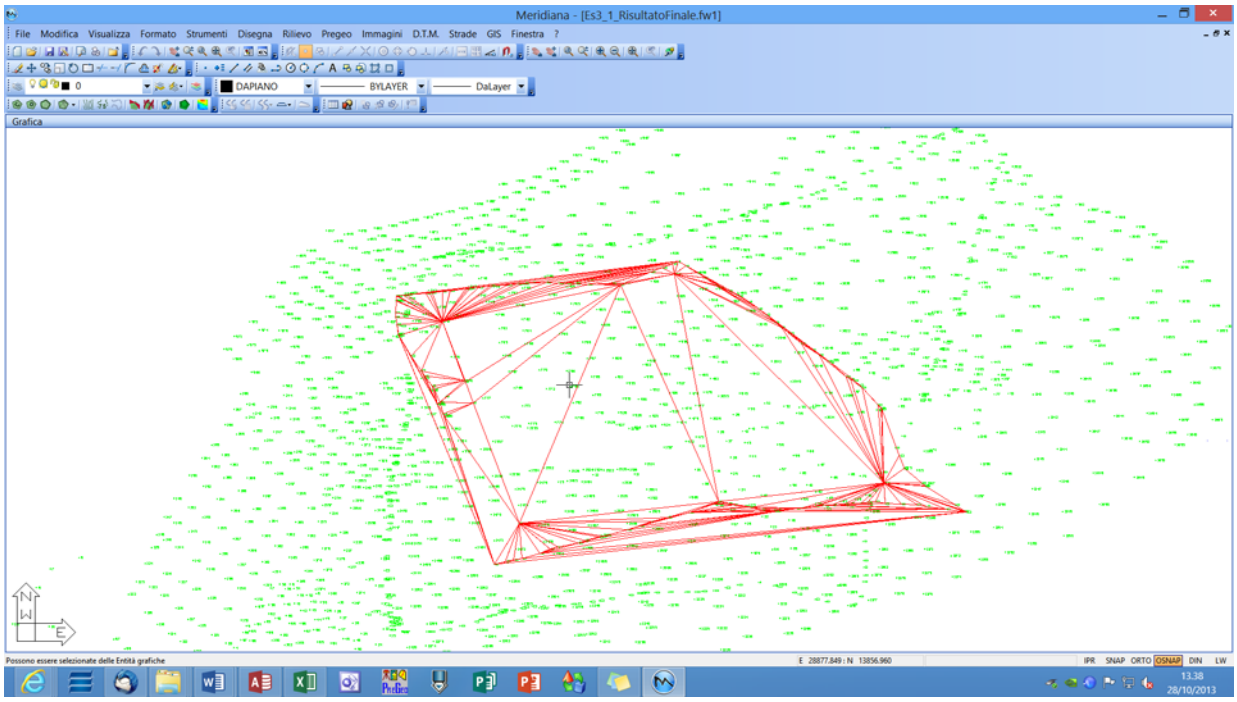
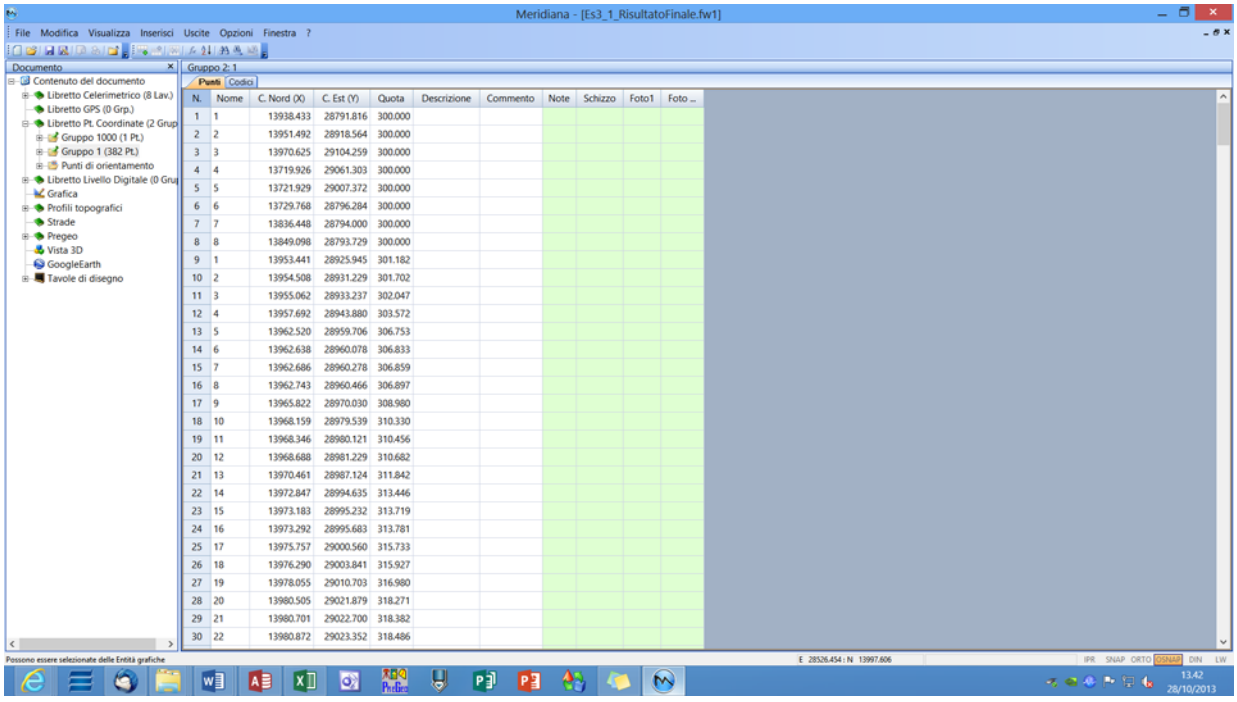



**Figure 584:**

Reference file Ex3_1_FinalResult.fw1

The result of creating notable points is shown in the image below.




| N. | Nome | C. Nord (X) | C. Est (Y) | Quota | Descrizione | Commento | Note | Schizzo | Foto1 | Foto ... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 13938.433 | 28791.816 | 300.000 | | | | | | |
| 2 | 2 | 13951.492 | 28918.564 | 300.000 | | | | | | |
| 3 | 3 | 13970.625 | 29104.259 | 300.000 | | | | | | |
| 4 | 4 | 13719.926 | 29061.303 | 300.000 | | | | | | |
| 5 | 5 | 13721.929 | 29007.372 | 300.000 | | | | | | |
| 6 | 6 | 13729.768 | 28796.284 | 300.000 | | | | | | |
| 7 | 7 | 13836.448 | 28794.000 | 300.000 | | | | | | |
| 8 | 8 | 13849.098 | 28793.729 | 300.000 | | | | | | |
| 9 | 1 | 13953.441 | 28925.945 | 301.182 | | | | | | |
| 10 | 2 | 13954.508 | 28931.229 | 301.702 | | | | | | |
| 11 | 3 | 13955.062 | 28933.237 | 302.047 | | | | | | |
| 12 | 4 | 13957.692 | 28943.880 | 303.572 | | | | | | |
| 13 | 5 | 13962.520 | 28959.706 | 306.753 | | | | | | |
| 14 | 6 | 13962.638 | 28960.078 | 306.833 | | | | | | |
| 15 | 7 | 13962.686 | 28960.278 | 306.859 | | | | | | |
| 16 | 8 | 13962.743 | 28960.466 | 306.897 | | | | | | |
| 17 | 9 | 13965.822 | 28970.030 | 308.980 | | | | | | |
| 18 | 10 | 13968.159 | 28979.539 | 310.330 | | | | | | |
| 19 | 11 | 13968.346 | 28980.121 | 310.456 | | | | | | |
| 20 | 12 | 13968.688 | 28981.229 | 310.682 | | | | | | |
| 21 | 13 | 13970.461 | 28987.124 | 311.842 | | | | | | |
| 22 | 14 | 13972.847 | 28994.635 | 313.446 | | | | | | |
| 23 | 15 | 13973.183 | 28995.232 | 313.719 | | | | | | |
| 24 | 16 | 13973.292 | 28995.683 | 313.781 | | | | | | |
| 25 | 17 | 13975.757 | 29000.560 | 315.733 | | | | | | |
| 26 | 18 | 13976.290 | 29003.841 | 315.927 | | | | | | |
| 27 | 19 | 13978.055 | 29010.703 | 316.980 | | | | | | |
| 28 | 20 | 13980.505 | 29021.879 | 318.271 | | | | | | |
| 29 | 21 | 13980.701 | 29022.700 | 318.382 | | | | | | |
| 30 | 22 | 13980.872 | 29023.352 | 318.486 | | | | | | |

**Figure 585:**

# 2 Method - Excavation project

## Phase 1 - Created projects

Before activating the procedure, at least 2 projects must have been created.

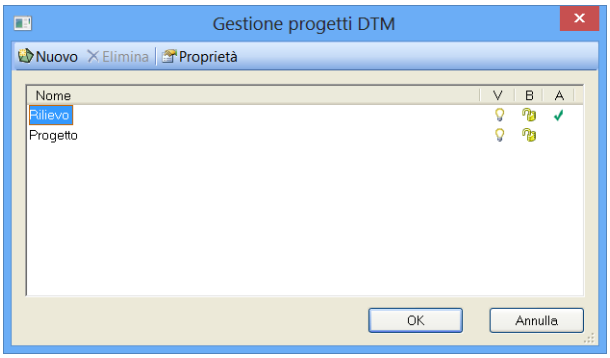



**Figure 586:**

The reference example is "Example3.fw1".

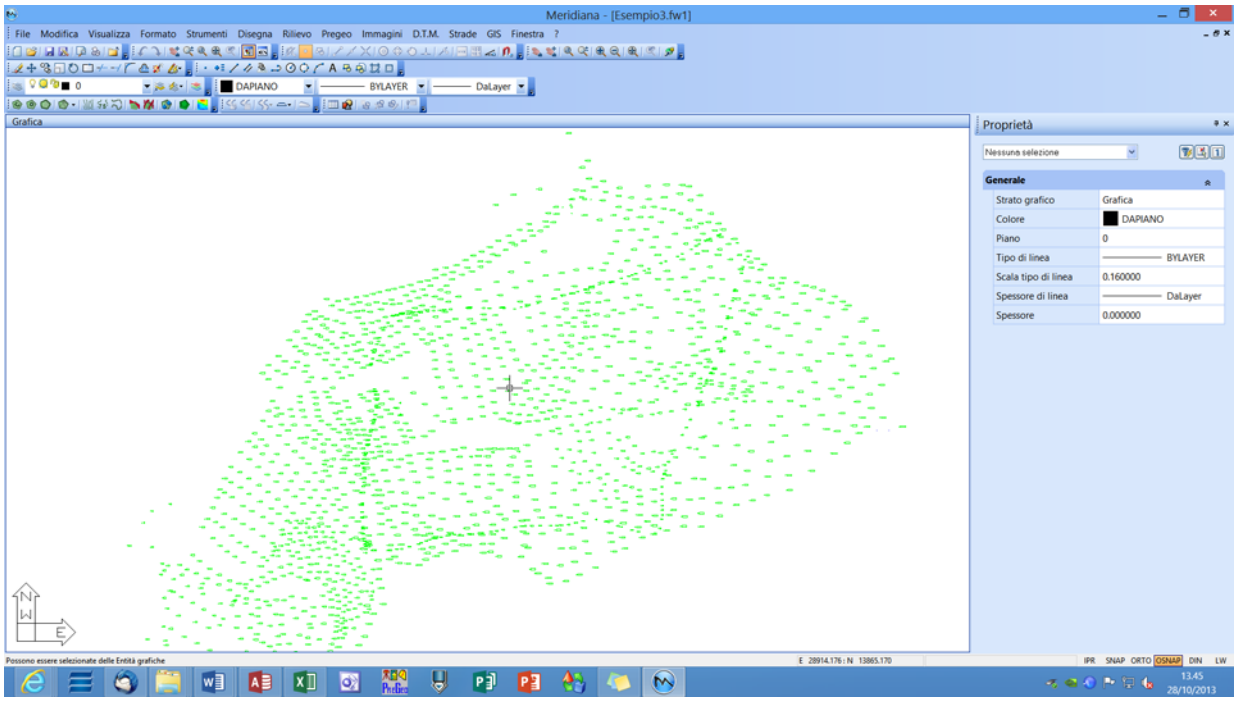



**Figure 587:**

## Phase 2 - Design polyline

Use the "Design/2D Polyline" command and with the connect point instrument design a closed polyline with the points: 817 ,72, 1473, 737.

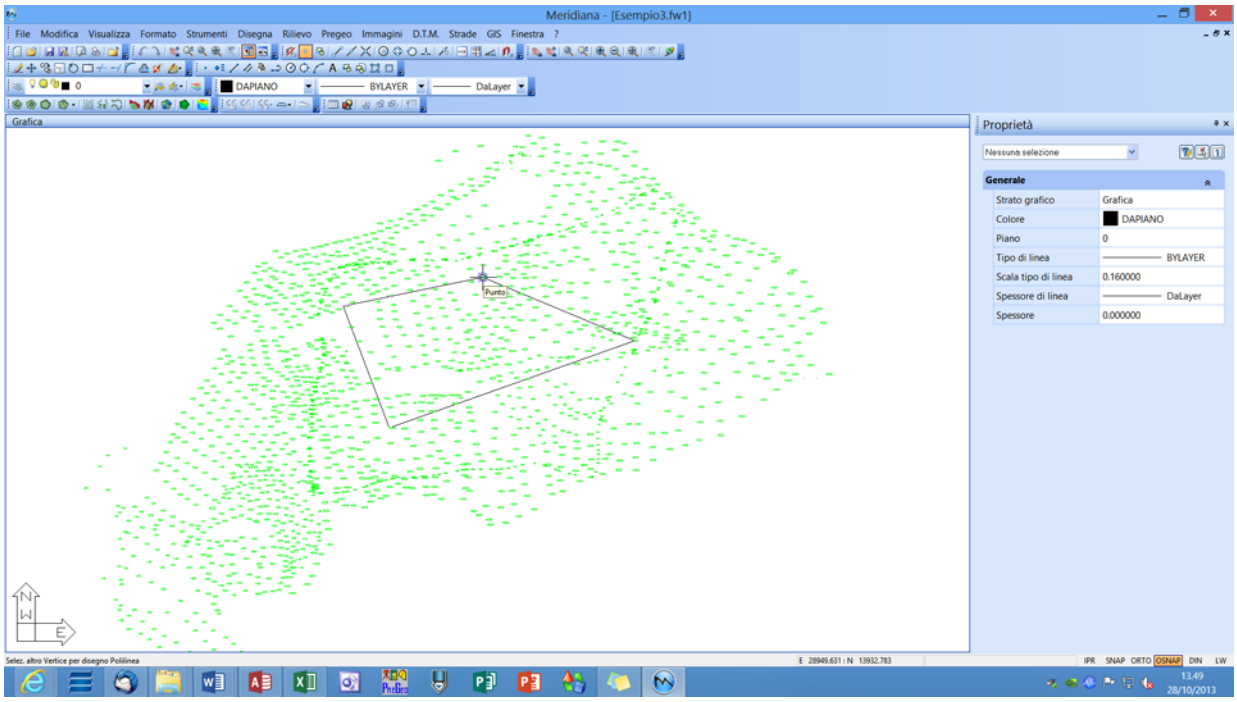



**Figure 588:** Reference file: Es3_2_Phase2.fw1

## Phase 3 - Assign a quote from plane

Use the "DTM/Planning/Assign polyline quote from plane" command to select the created polyline and select the horizontal plane in the Select Plane window for assigning the quote. Press "Forward>".

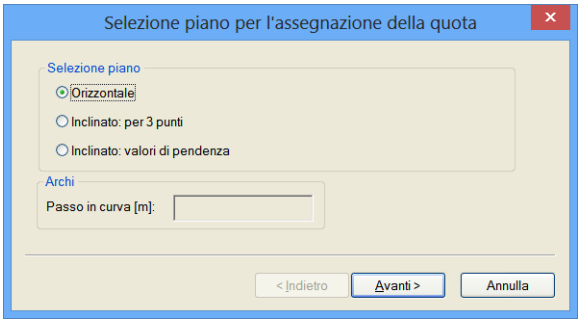



**Figure 589:**

Insert the next horizontal plane quote value equal to 300 into the next window; then End.

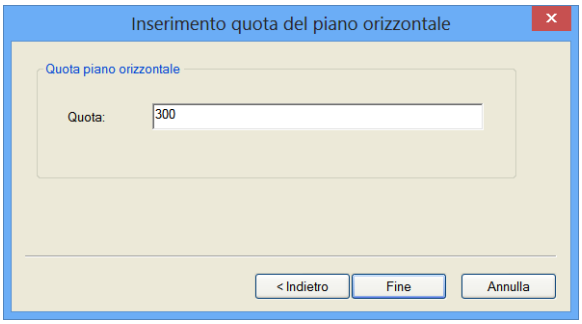



**Figure 590:**

## Phase 4 - Generate escarpment from DTM

Use the "DTM/Planning/Create escarpment from DTM" command to select the polyline and then a point external to it, verify that the "Generate escarpment at DTM" window opens used to insert 100 for the excavation slope and 100 for the fill slope.

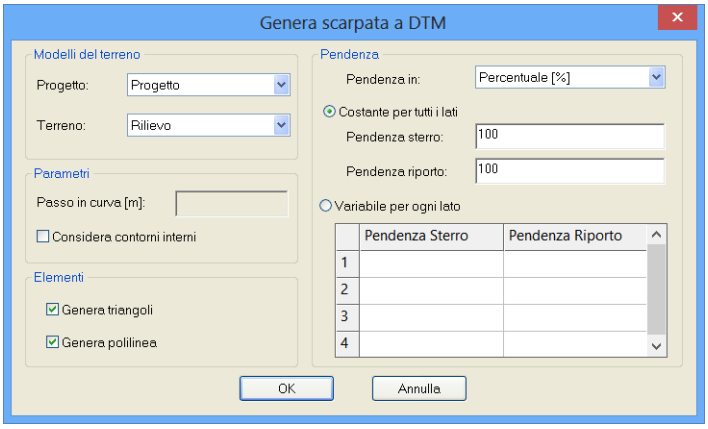



**Figure 591:**

Observe the result in the image below.

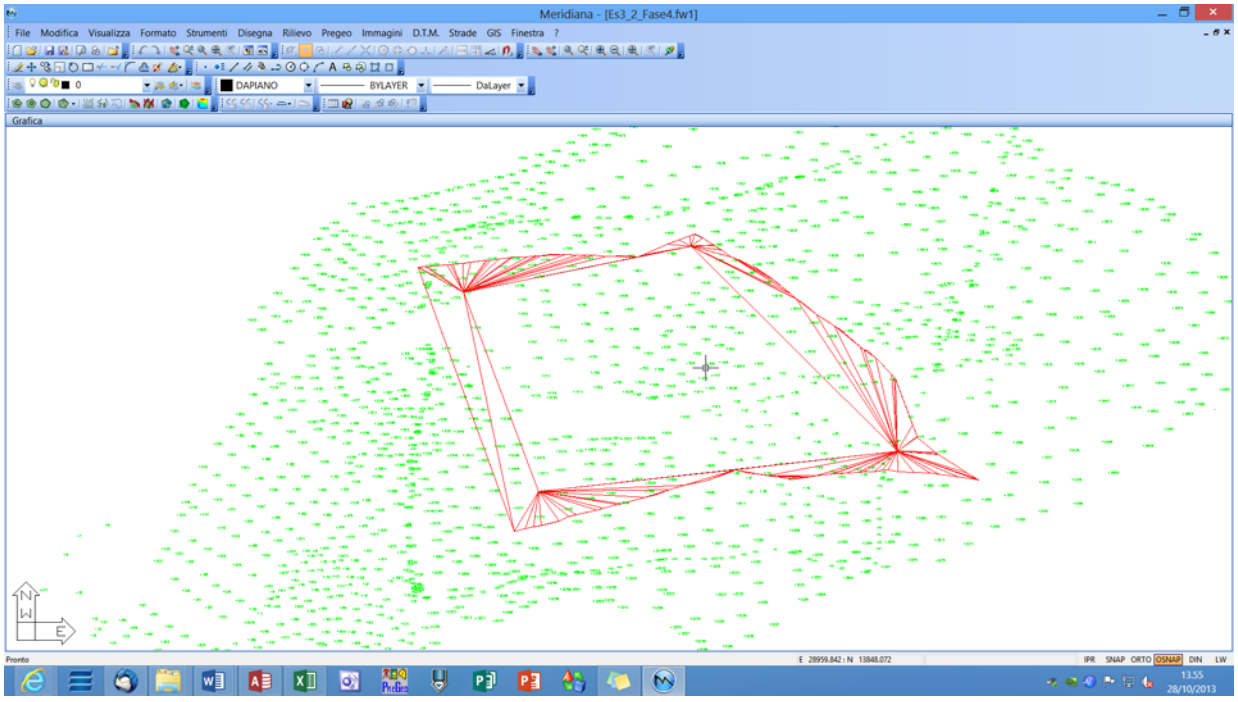



Figure 592: Reference file Ex3_2_Phase4.fw1

## Phase 5 - Create triangles within polyline

Use the "DTM/Planning/Create triangles within polyline" command to select the polyline and verify the creation of the triangles, as seen in the image below.

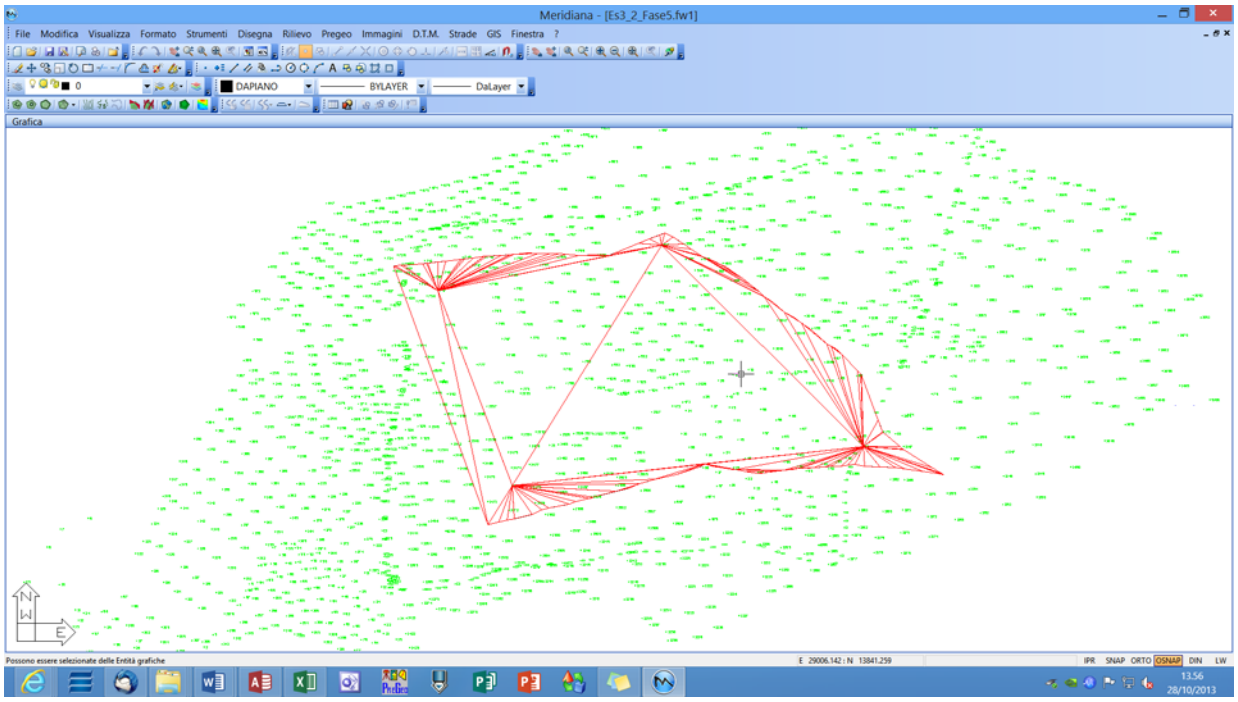
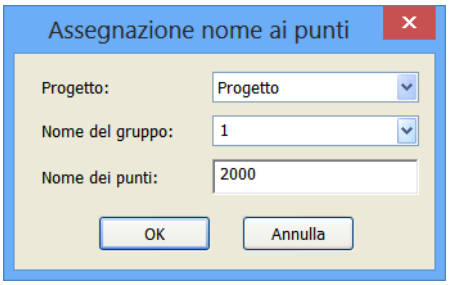



**Figure 593:** Reference file Ex3_2_Phase5.fw1

## Phase 6 - Extract pt. from triangles

Use the "DTM/Planning/Extract pt. from triangles" command and the "Assign names to points" window will immediately appear, used to identify the reference project, the group name and the name of the points.




The result of creating the points is shown in the image below.

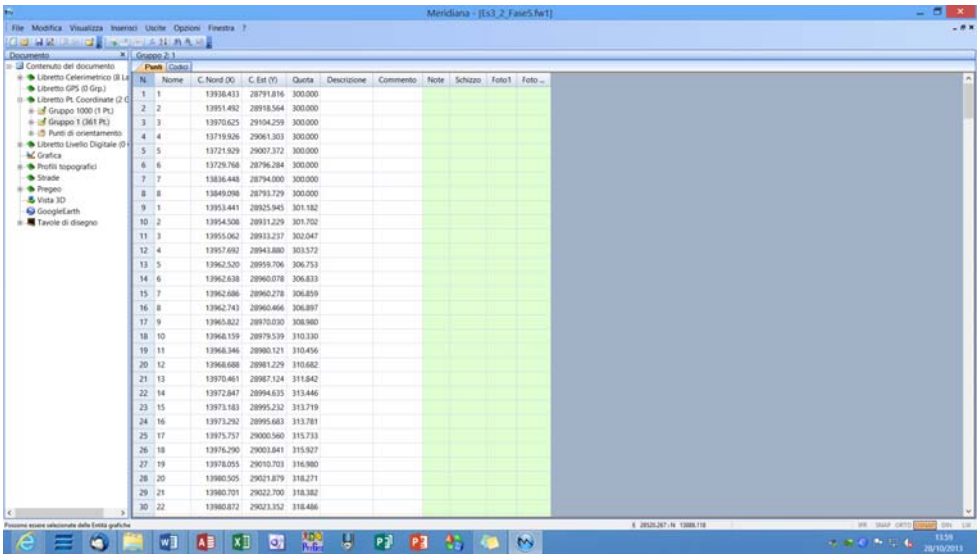



**Figure 594:**

# Calculate volumes

There are two types of calculation available in the program:

1.Calculate absolute volumes;

2.Calculate volumes between models.

Here below is a description of these two procedures that can be activated in the Graphic View using the "D.T.M." menu.

Calculating volumes is done by using the current triangulation; as such, it is necessary that it has already been calculated when executing either one of the two commands for calculating volumes.

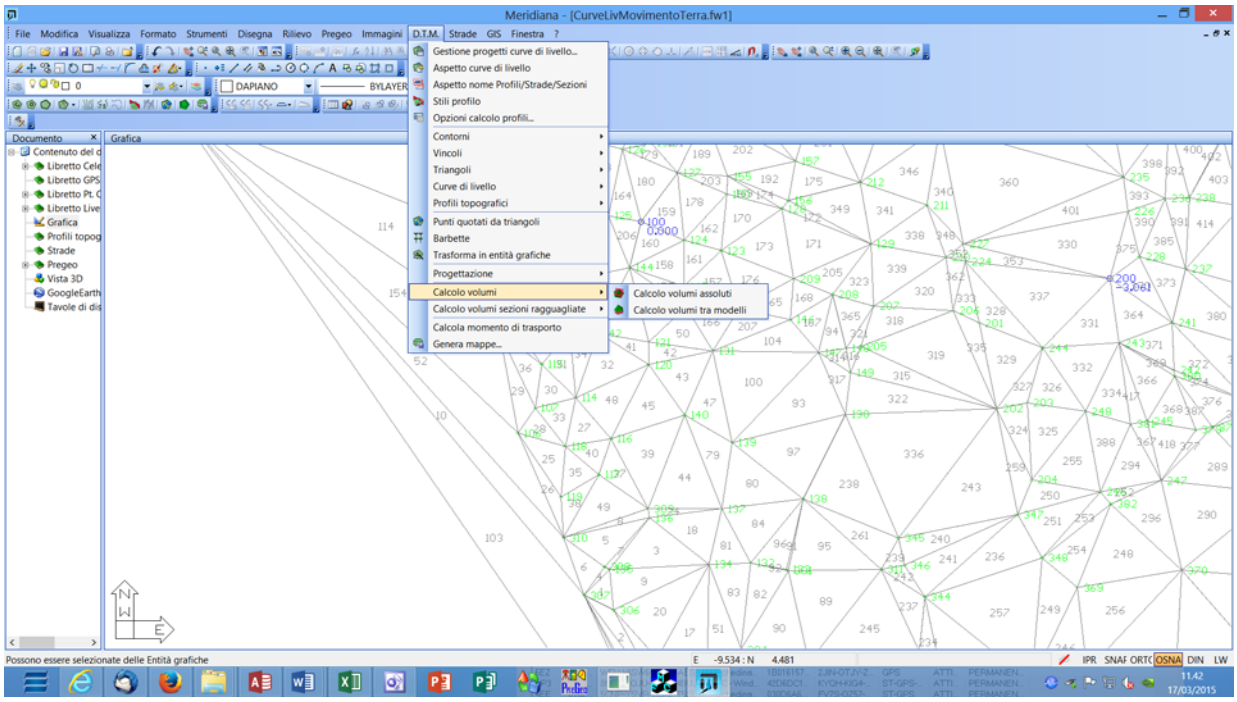



**Figure 595:**

# Calculate absolute volumes

The calculation is run on the active project; executing the command will launch a guided procedure where the user, in the first window, can select whether to consider all triangles for the calculation or whether to select a polygon.

If the user selects the polygon then the perimeter must be defined in Graphic. The program will proceed as if tracking a polyline, the design terminates either by selecting the polygonal end point or by pressing the right mouse button or by selecting the Close Polyline instrument.

In all cases, the point selected is joined to the first; if the right mouse button is pressed without having selected any points then the program will proceed to the selection method allowing the user to select a close polyline considered as perimeter.

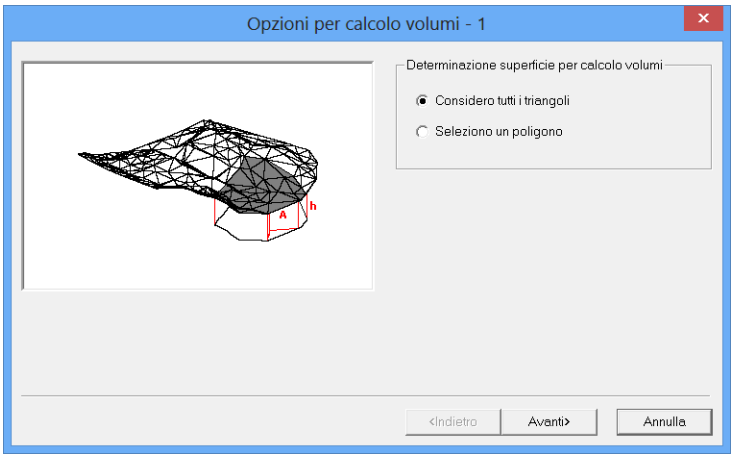



**Figure 596:**

In the second window of the procedure the user can select the method for running the options calculation and the method used for identifying the reference plane; in total there are nine combinations.

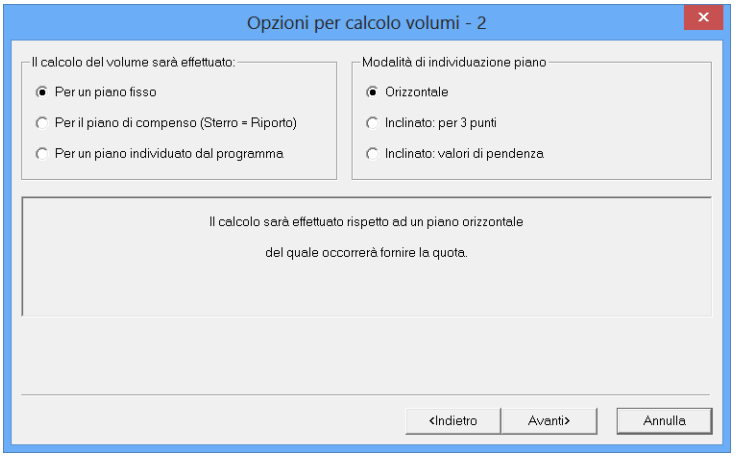



**Figure 597:**

The appearance of the third window depends on the selected method of calculation.

If the calculation method includes identifying an inclined plane between two or three points, the program will first proceed to a third window asking the user to graphically select the points.

The calculation run varies depending on the method used to identify the plane; in particular:

1.Absolute calculation by fixed plane:

•Horizontal: the calculation is done according to a horizontal plane for which the quote must be supplied;

•Inclined by 3 points: the calculation is done according to an inclined plane; the user must graphically identify three points by which the plane will pass;

•Inclined slope values: the calculation is done according to an inclined plane; the user must first identify two points indicating the direction and angle of the slope. Next the slope values are selected;

2. Absolute calculation by compensation plane (excavation=fill):

•Horizontal: the calculation is done according to a horizontal plane. The program will identify the quote by which the excavation comes up as equal to the fill.

•Inclined by 3 points: the calculation is done according to an inclined plane. The three points must be graphically identified. The program will find the plane parallel to it that makes the excavation equal to the fill.

•Inclined slope values: the calculation is done according to an inclined plane. A direction must be identified (two points) and the slope values inserted. The program will find the compensation plane with the desired slope and direction.

3.absolute calculation by plane identified by program:

•Compensation plane and minimum earth movement: the calculation is done in accordance to an inclined plane. This plane is identified by the program so that not only is it compensated (excavation=fill) but it minimizes the movement of earth.

•Compensation plane and minimum excavation: the calculation is done according to an inclined plane. This plane is identified by the program so that not only is it compensated (excavation=fill) but it minimizes the maximum excavation.

•Absolute minimum earth movement plane: the calculation is done in accordance to an inclined plane. This plane is identified by the program to minimize the movement of earth without being compensation, that is, the excavation may be different from the fill.

Here is the description of the next windows.

If a horizontal plane was selected and the quote must be furnished, this window will include an edit field used to insert specifically the value of this quote.

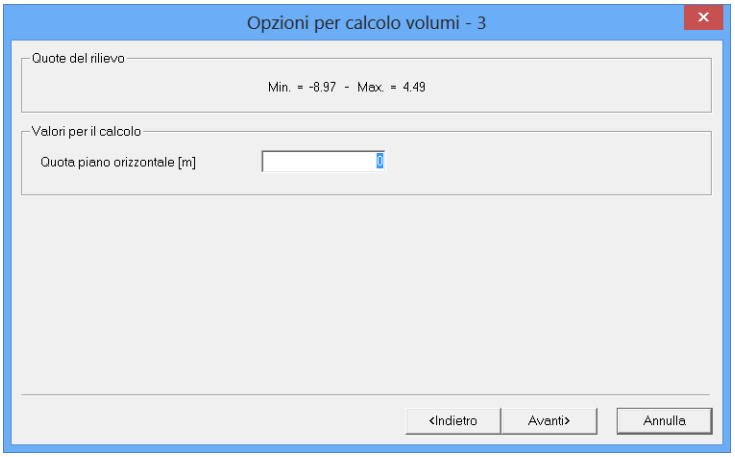



**Figure 598:**

If, instead, it was selected to use an inclined plane passing for three points, then the user must first select the three points in the Graphic View and then confirm them or change them using the window seen below.

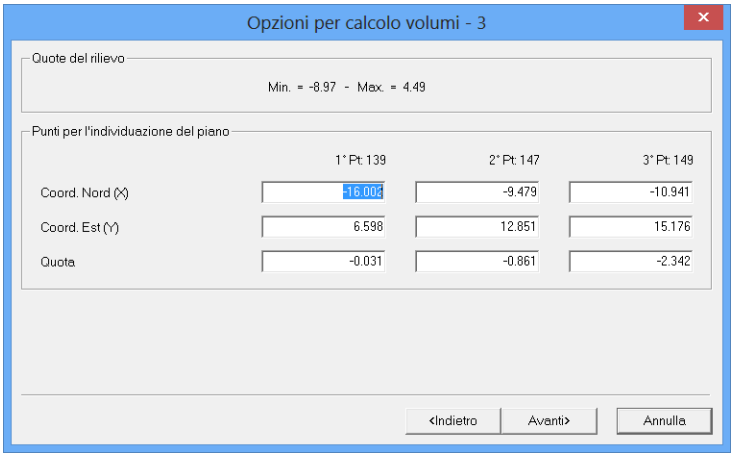



**Figure 599:**

Finally, if the inclined plane was selected, the user must initially select two points using the Graphic View. When the selection is completed, the procedure suggests the window seen here to the side that includes:

1) the coordinates of the first selected point;

2) the slope values along the direction identified graphically;

3) the slope values transversally and at the angle of direction;

All of this data can be found using the two points selected in Graphic.

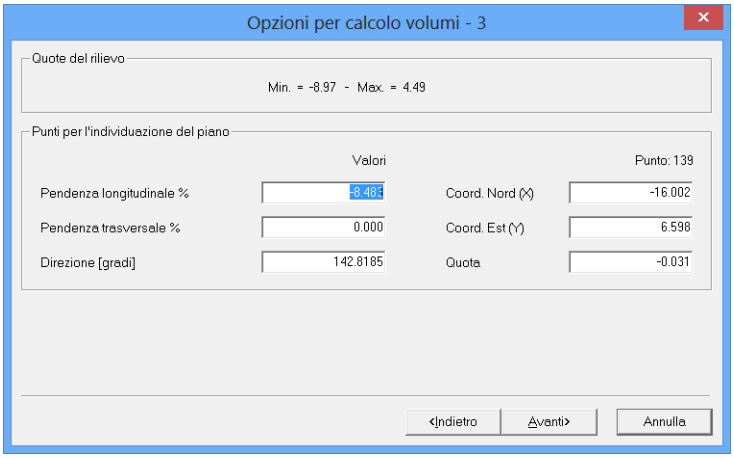



**Figure 600:**

If the user decides to run the calculation using the compensation plane (excavation=fill) or to run the automatic calculation, then the next window will display an edit box for inserting the volume coefficient value between the excavation and the fill.

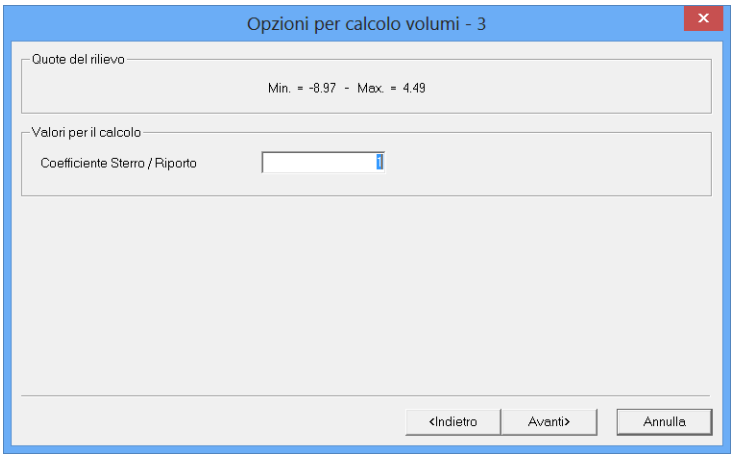



**Figure 601:**

After showing various examples of the third procedure window, here is the description of the fourth window.

In the "Graphic Options" section, the user can tell the program whether to print the results obtained or to print partials.

To also print the partials, the user has three options: the first is to report the partial results "with coordinates" that is, reporting also the coordinates of the elementary triangle vertices; the second "with side length" reports the length of the sides and semi-perimeter of the individual elementary triangles; the third, finally, will print both sets of information (in this case it is advisable to use a horizontal print layout).

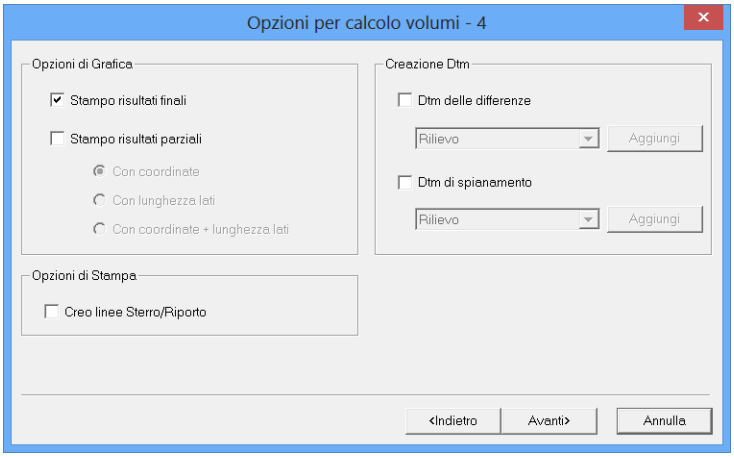



**Figure 602:**

In the "Print Option" section the user can select whether or not to create the Excavation/Fill lines; in particular, if the option is activated then a series of graphic lines will be created that separate the excavation area from the fill area.

There will also be a small line designed in the middle of these lines (along the halfway part of the dimensions of the celerimetric text) oriented toward the fill area; the two types of lines will be respectively placed in the "EXC-FIL-1" and "EXC-FIL-2" planes created specifically for this; these lines can be changed or eliminated like any other graphic line.

In the "Create DTM" section, the user can decide whether to create a "DTM of differences" in the quote between the primary DTM and the plane selected for calculation and/or create a "Flattening DTM" defined by the DTM primary points quoted on the selected plane for the calculation.

Here following is an example of the results preview of a volumes calculation; in this case the user selected to also print the partials (with coordinates) along with the finals (which are shown on the last page).

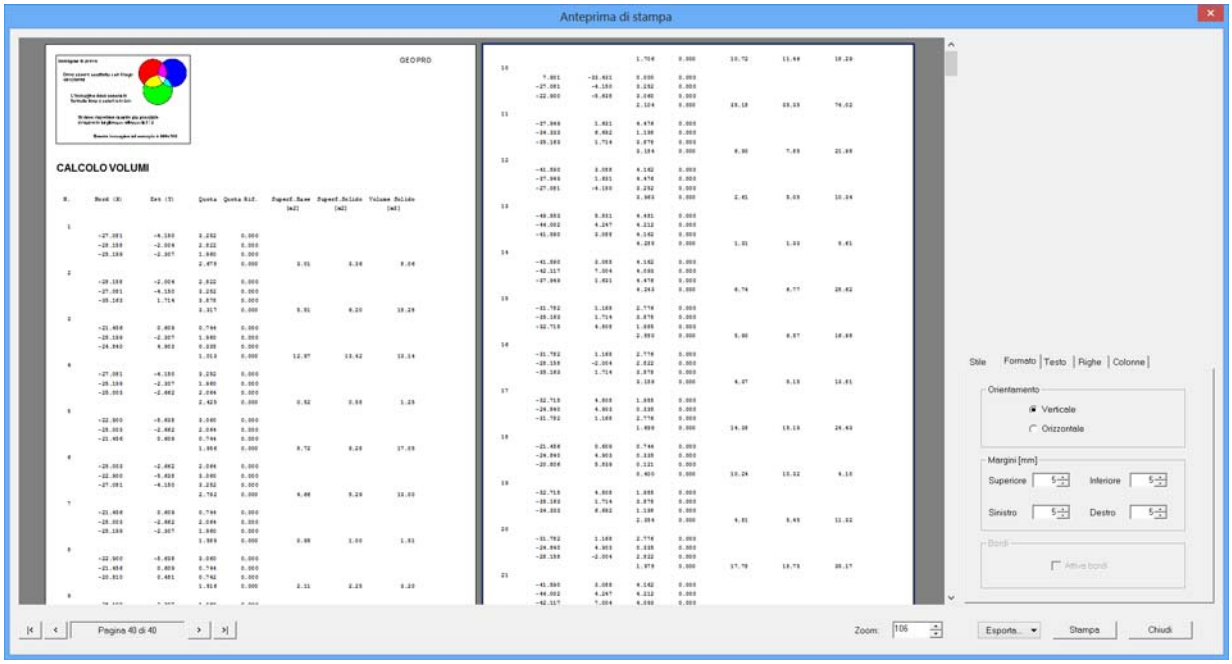



**Figure 603:**

The final results of the calculation include the following information:

•Total horizontal surfaces: represents the area projected on the horizontal plane of the region considered for the volumes calculation.

•Total solid surfaces: this is the sum of the surface of all faces of the considered triangles.

•Total excavation volume: represents the quantity of the calculated excavation.

•Total fill volume: represents the quantity of the calculated fill.

•Residual excavation volume: indicates the residual quantity of excavation or fill.

The final results printout will also show:

•The text "All triangles were considered" if at the beginning of the calculation the "Consider all triangles" option was activated.

•Otherwise the text "A border was defined" is printed.

•If the option "By 3 points" was selected, then the text "By inclined plane" is printed, followed by the coordinates of the selected three points.

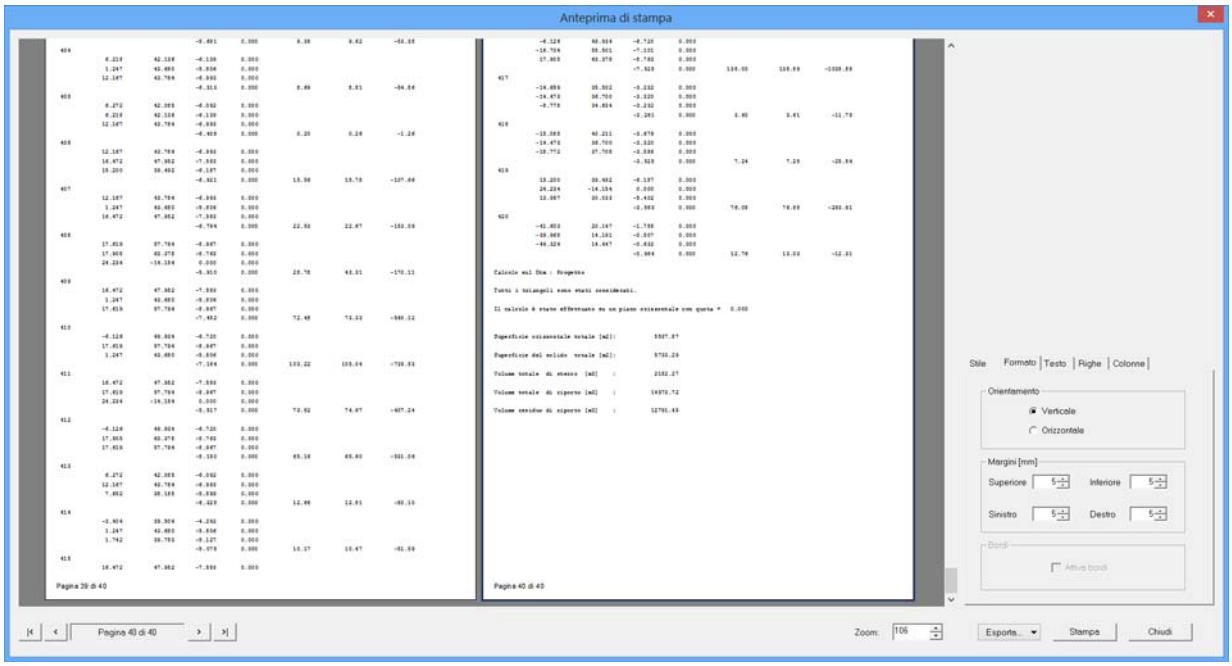



**Figure 604:**

Once the preview is printed or closed, the no. 5 window appears where the user can select whether or not to create project points and in which Coordinates Points Booklet group to insert them.

The quantity of points created will correspond to the quantity of triangle vertices that fall within or on the polygon vertices taken into consideration for the calculation (or all of them if all triangles have been used).

The plane coordinates of the created points will be identical to the triangle vertices while the quote values will be identified by the plane used as reference for the calculation or identified automatically by the program (for example, compensation plane).

Press the "Complete" button will conclude the procedure and the results of the calculation can be seen in the graphic while the Coordinates Points Booklet can be checked to verify the project points (if selected to create them).

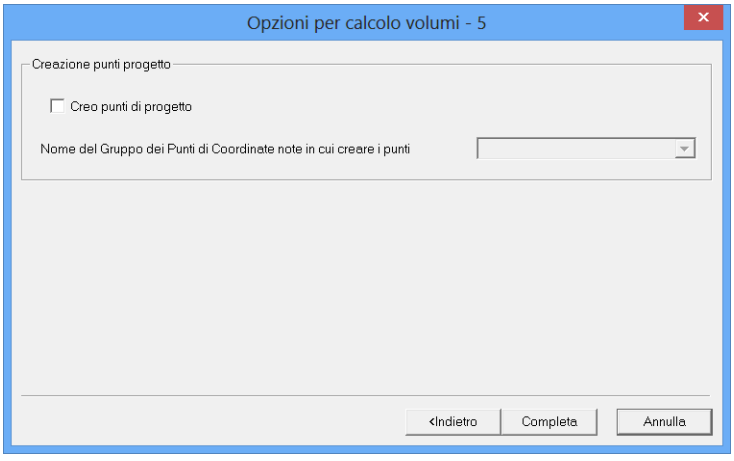



**Figure 605:**

# Example 1

The example offered is the "Quoted Plane.fw1" available in the customization file examples (?|Explore customization file).

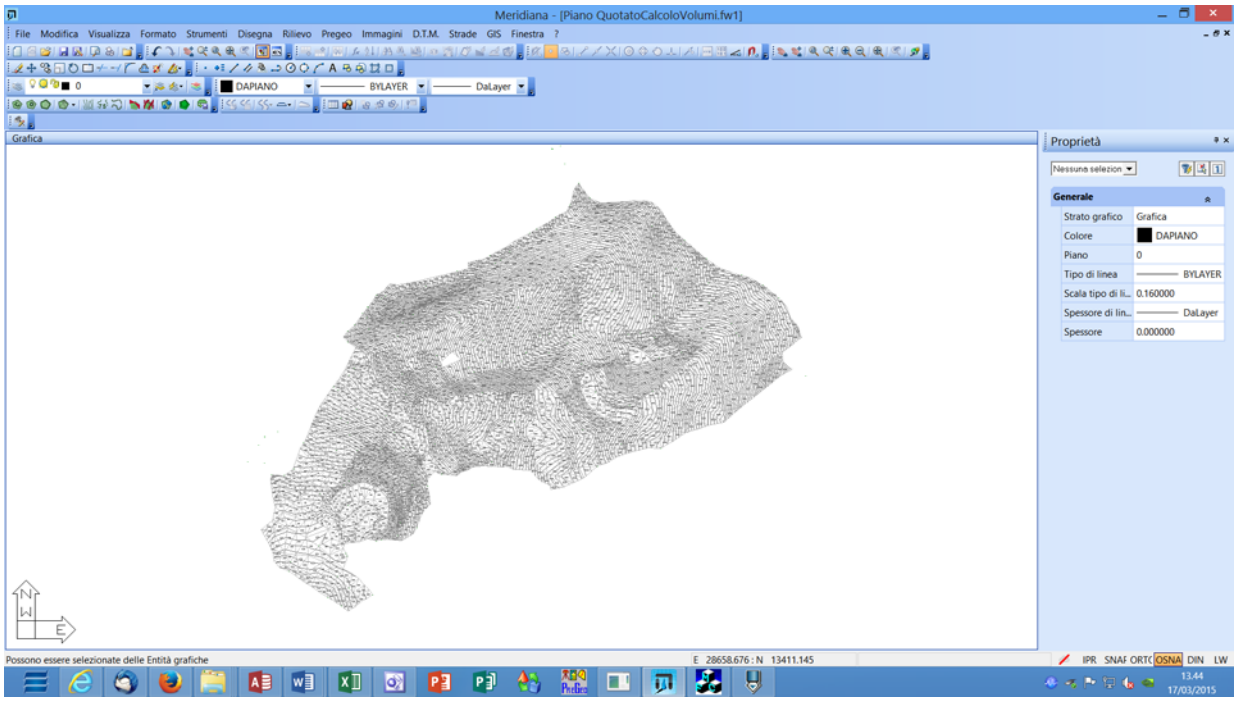



**Figure 606:**

This example has the volumes calculation run on all triangles.

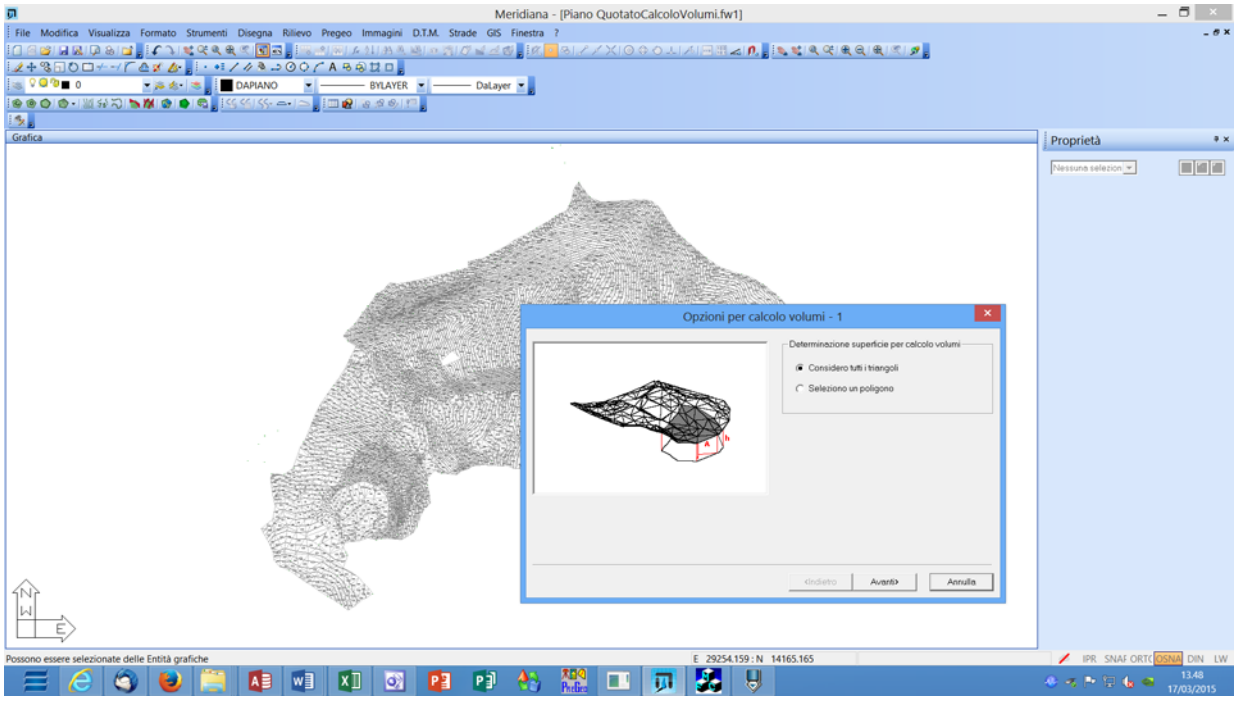



**Figure 607:**

After specifying the surface on which to run the calculation, the user must indicate the method for running the calculation as well as the method for identifying the reference plane.

In this example the calculation is run on the horizontal plane and the program will identify a quote by which the excavation will be equal to the fill.

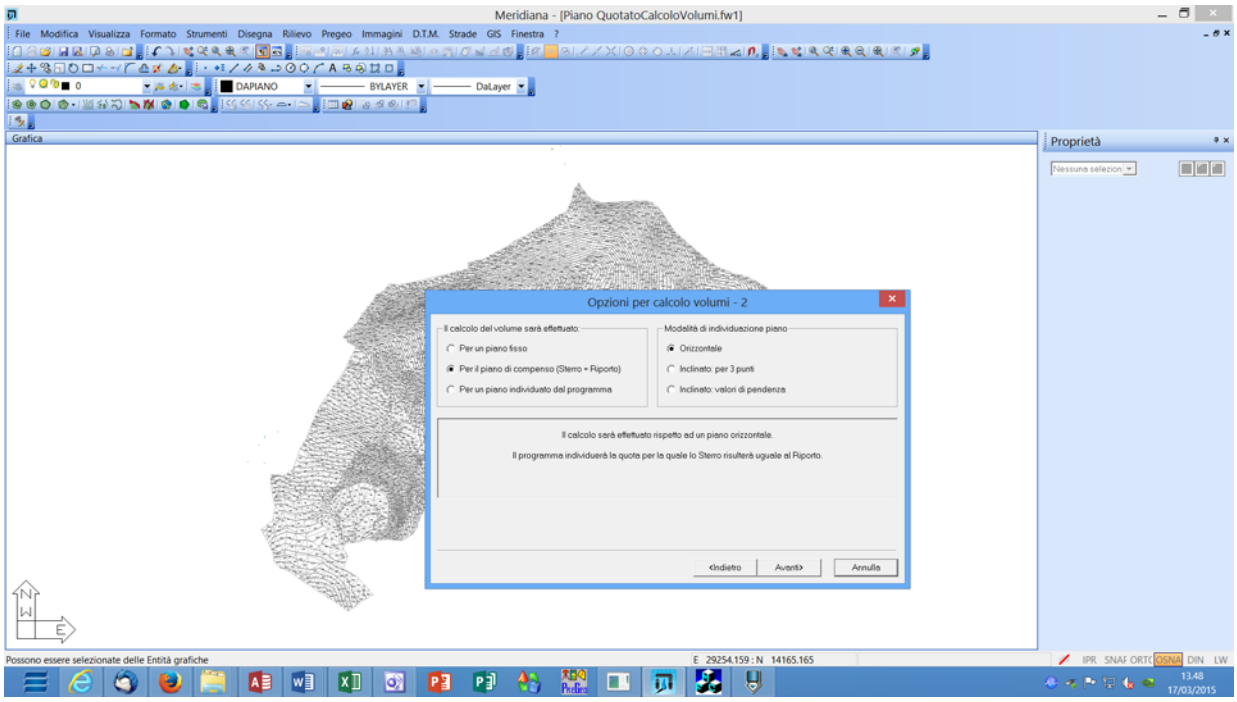



**Figure 608:**

In the next window the user must insert the Excavation/Fill Coefficient.

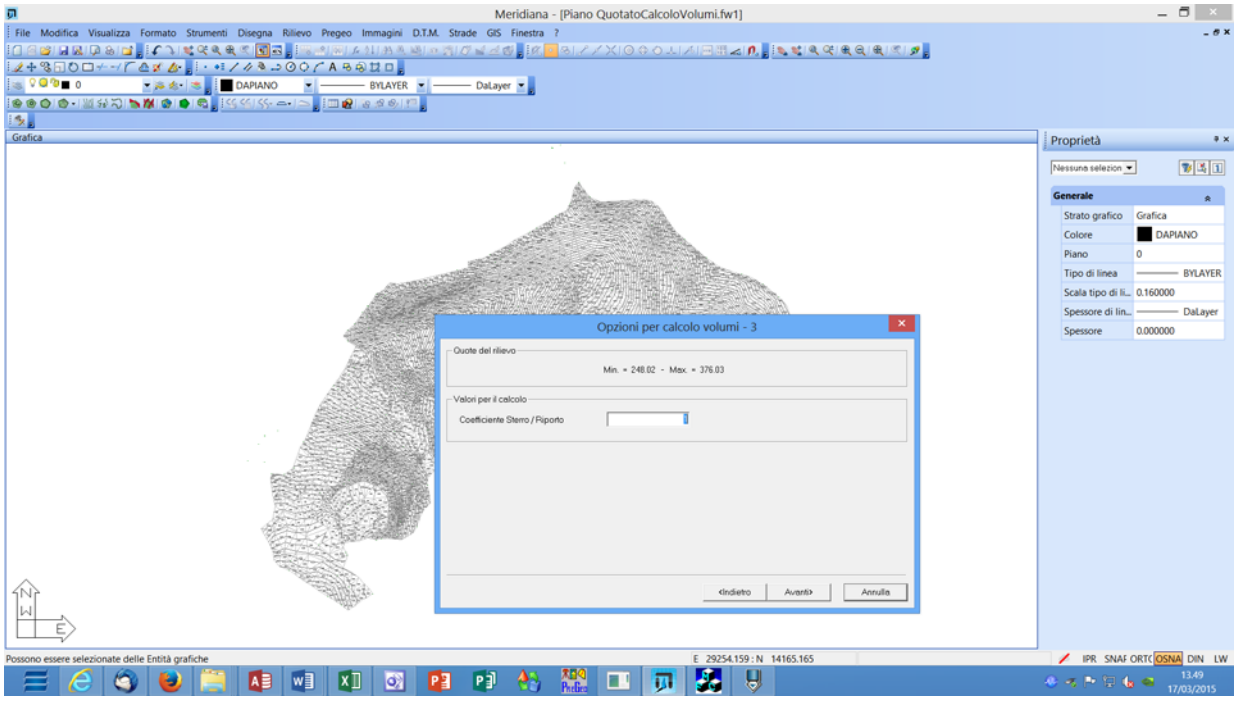



**Figure 609:**

Press "Forward>" and the procedure will run the calculation and then display the window where the user can set the print options.

In this case, the selection was made to print the final results and create the Excavation/Fill lines.

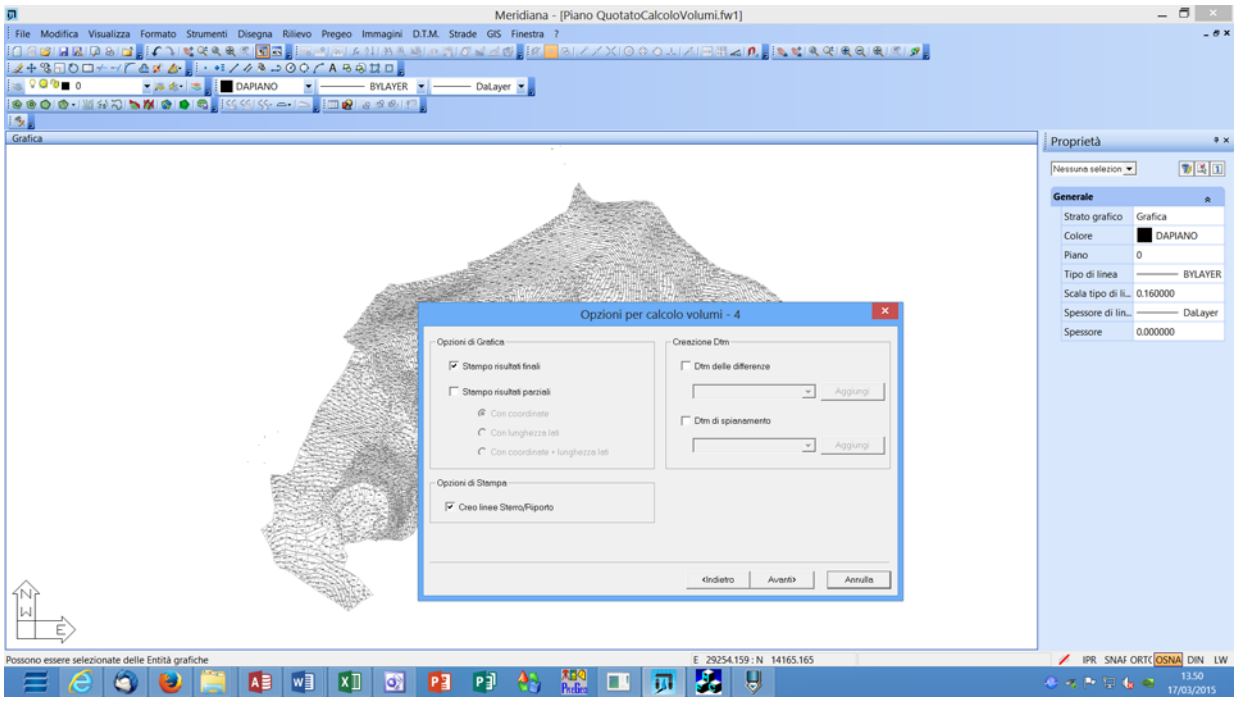



**Figure 610:**

Final result.

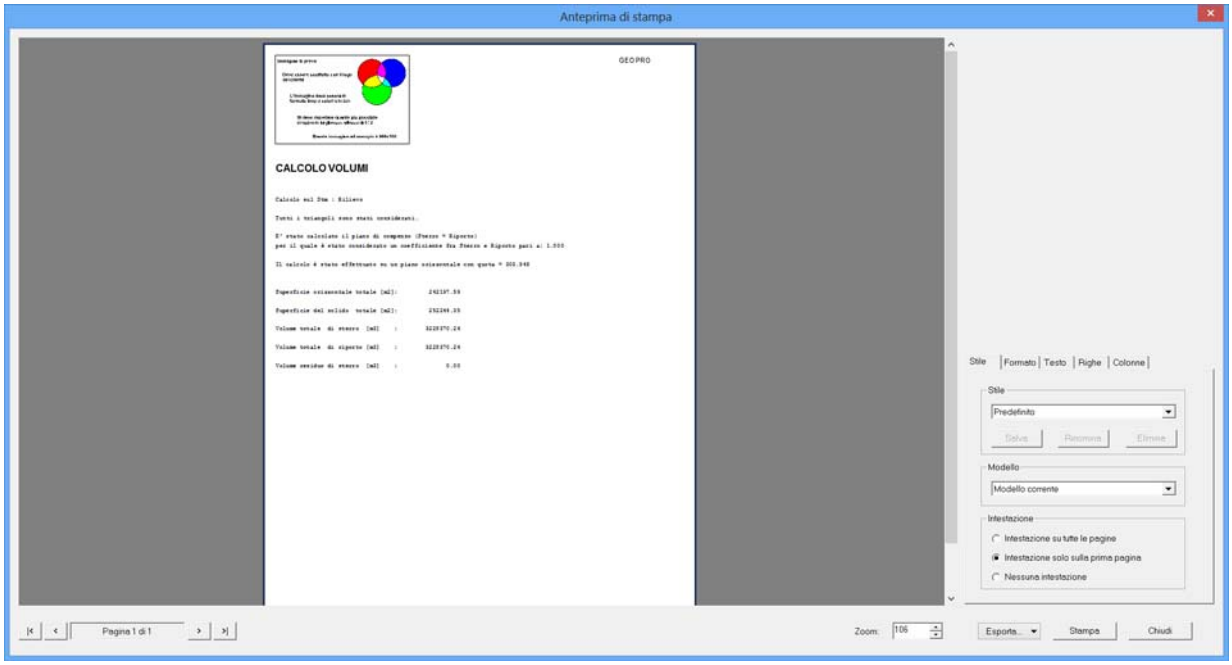



**Figure 611:**

This example selected to not create project points.

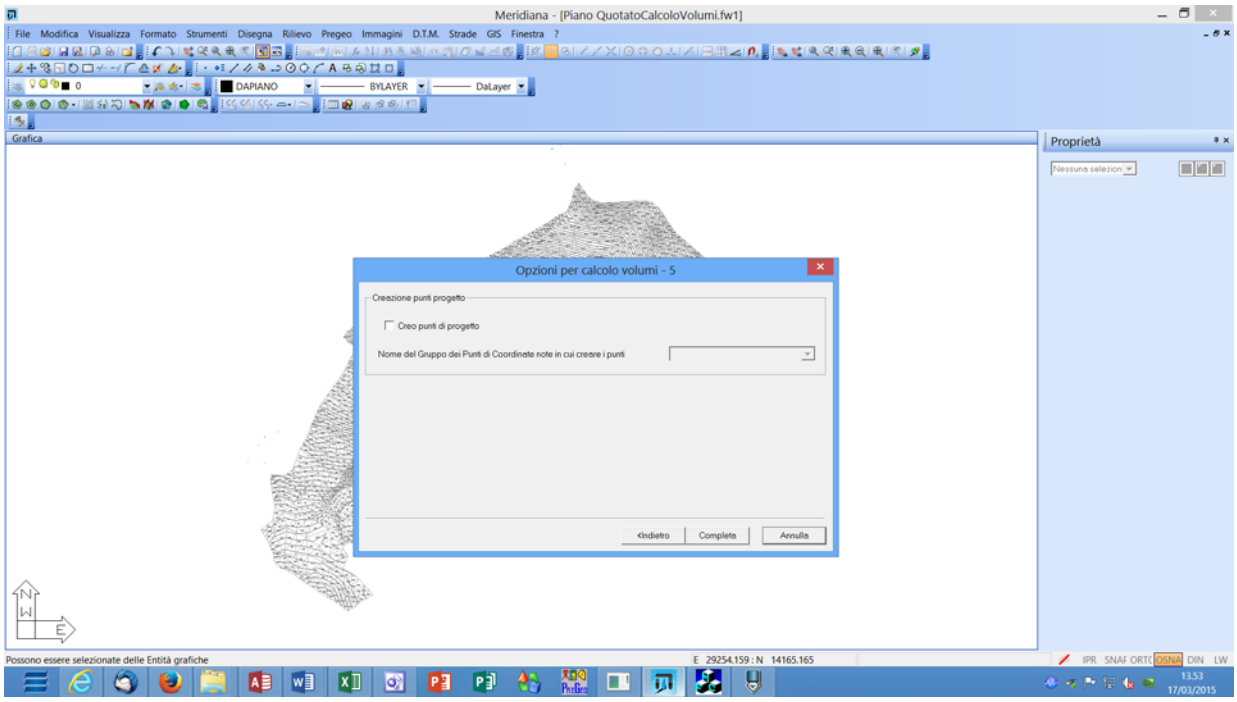



**Figure 612:**

# Example 2

The example offered is the "Quoted Plane.fw1" available in the customization file examples (?|Explore customization file).

In this example we suggest running the volumes calculation on a polygon that must be selected graphically.

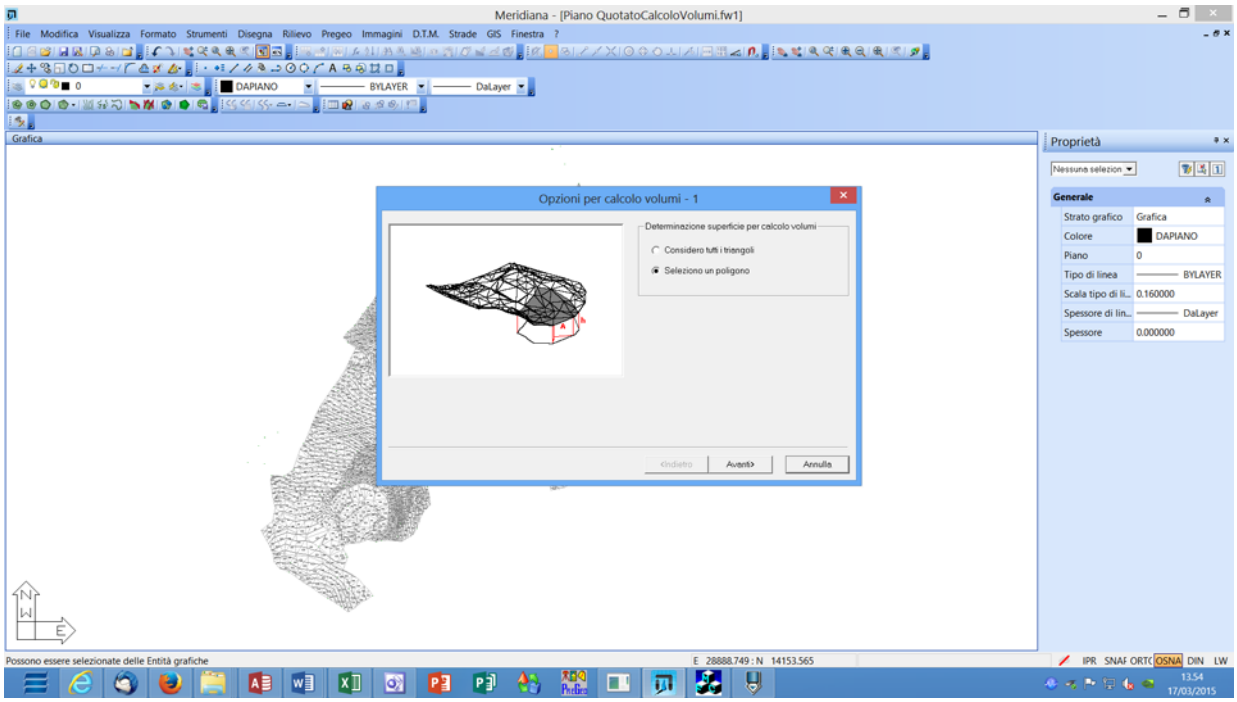



**Figure 613:**

In fact, pressing "Forward>" the procedure will activate the Graphic View specifically to select the polygon on which to run the calculation.

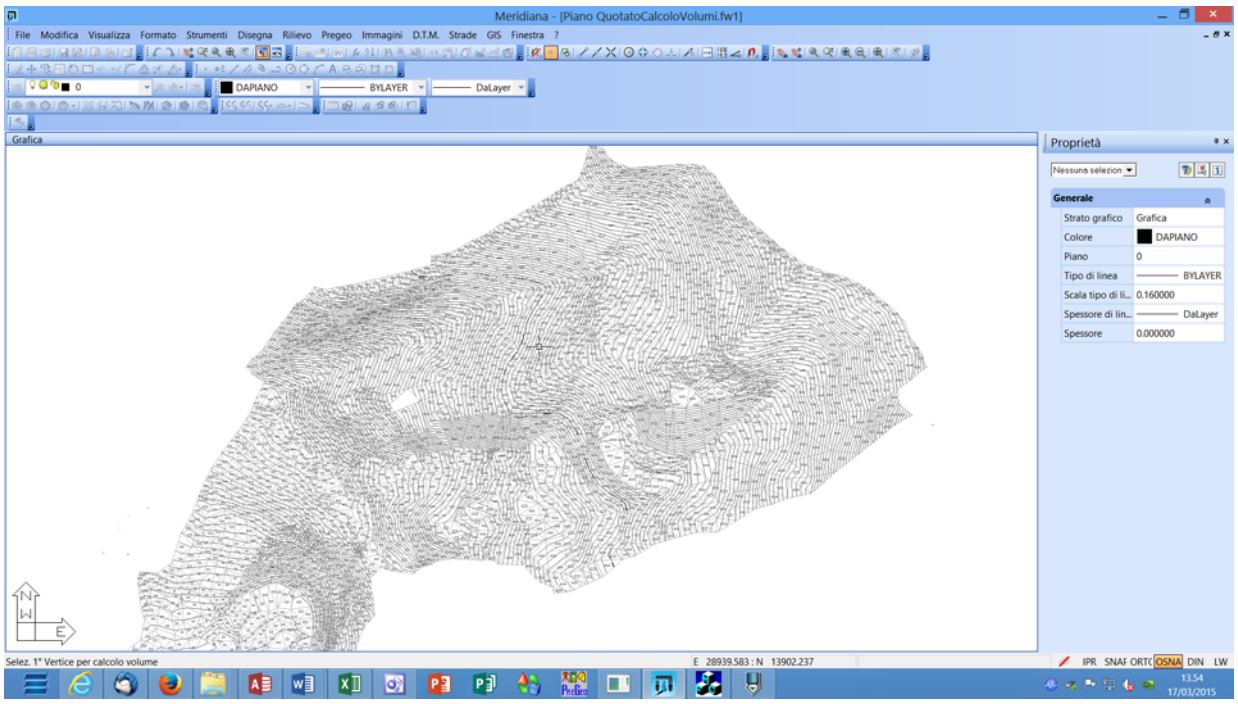



**Figure 614:**

Once the design is complete the user can select the calculation method (for a fixed plane) and identify the plane (Inclined: slope values).

Given that identification of the plane is done by the slope values, the user must select 2 points that indicate the direction and angle of the slope.

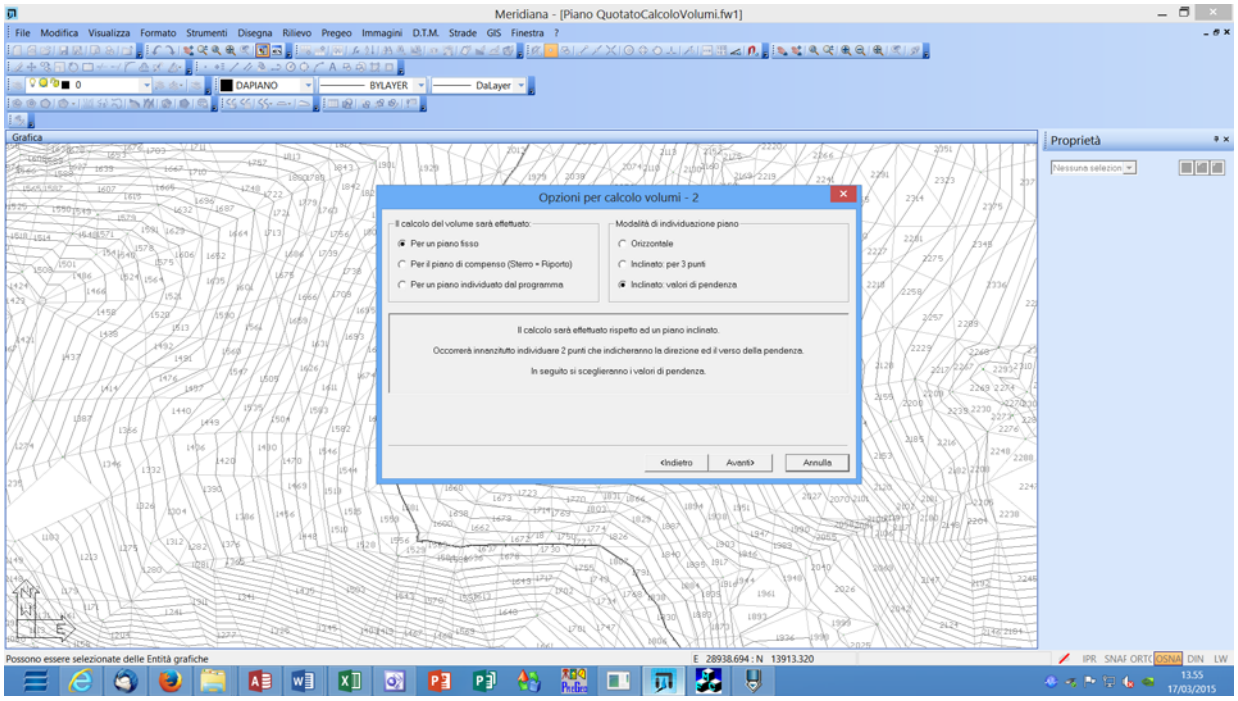



**Figure 615:**

Press "Forward>" and the procedure will reactivate the Graphic View specifically to identify the two points.

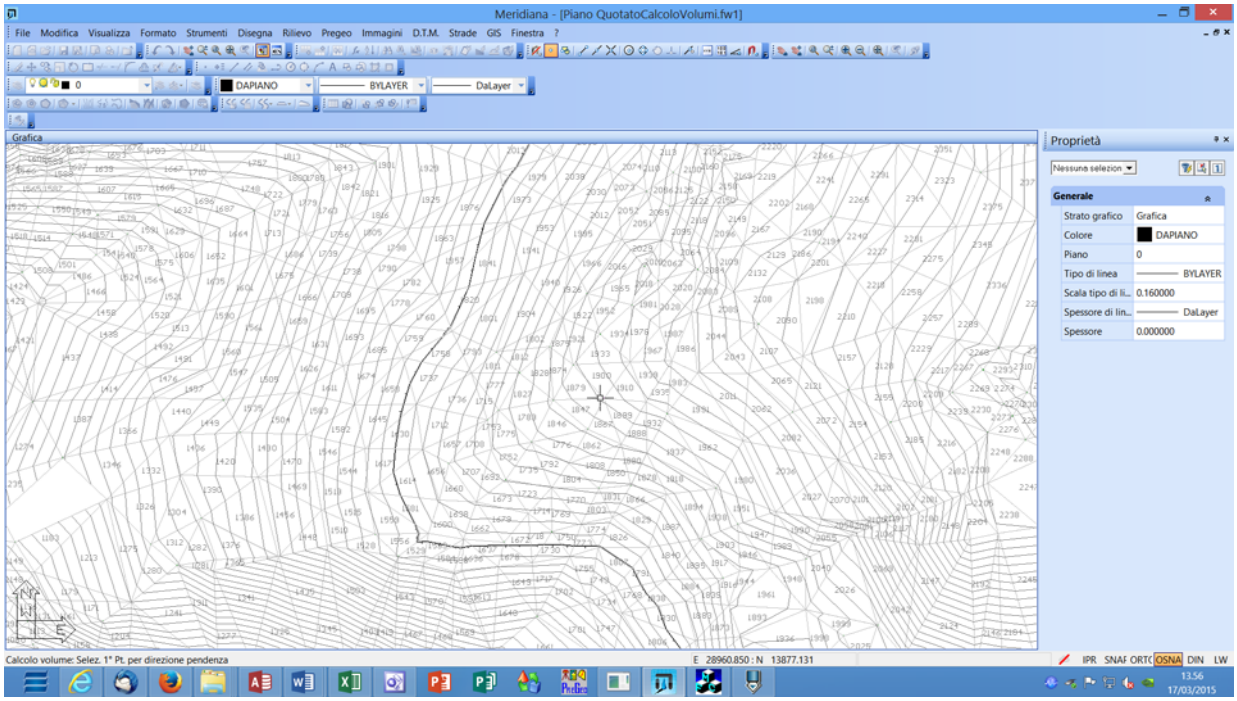



**Figure 616:**

Once the selection is completed, the procedure will suggest values for the slope, for the direction and the coordinates of the first selected point.

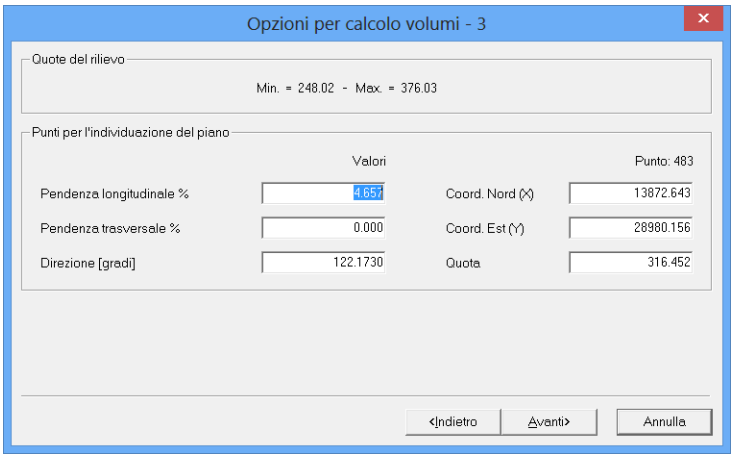



**Figure 617:**

Press "Forward>" and the final window will appear where the user can set the print options.

In this case, besides printing the final results, we decided to also print the partials "With coordinates".

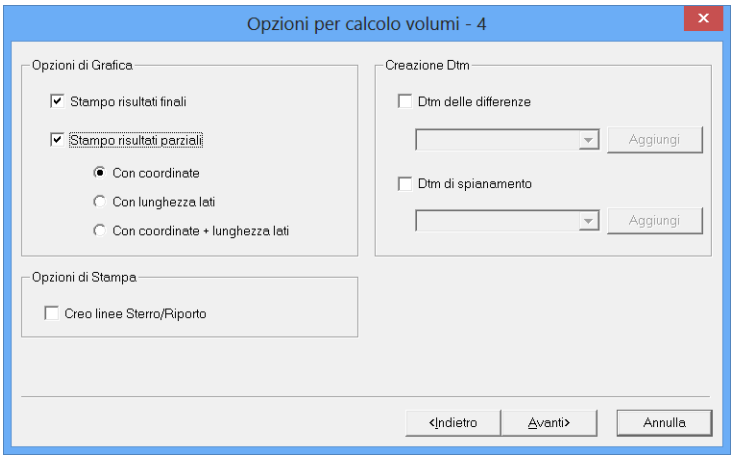



**Figure 618:**

Final result.

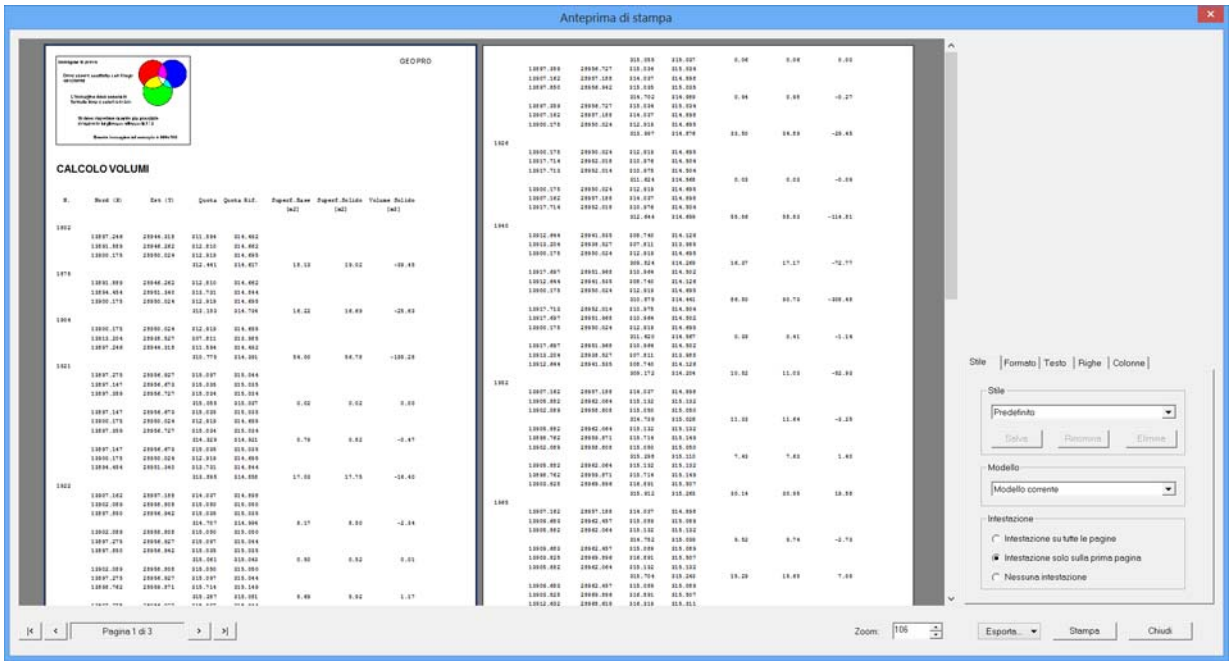



**Figure 619:**

Once the printout is complete, the user can decide to create project points.

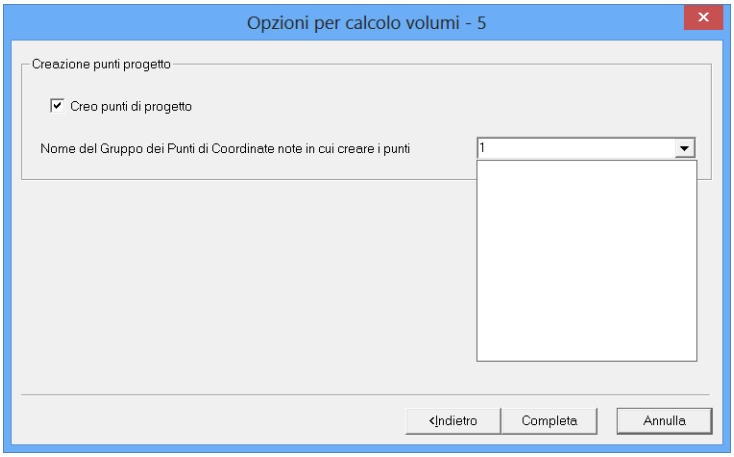



**Figure 620:**

The image below shows that the project points were created and inserted into Group 1 of the Noted Coordinates Points Booklet as indicated in the last window of the procedure.

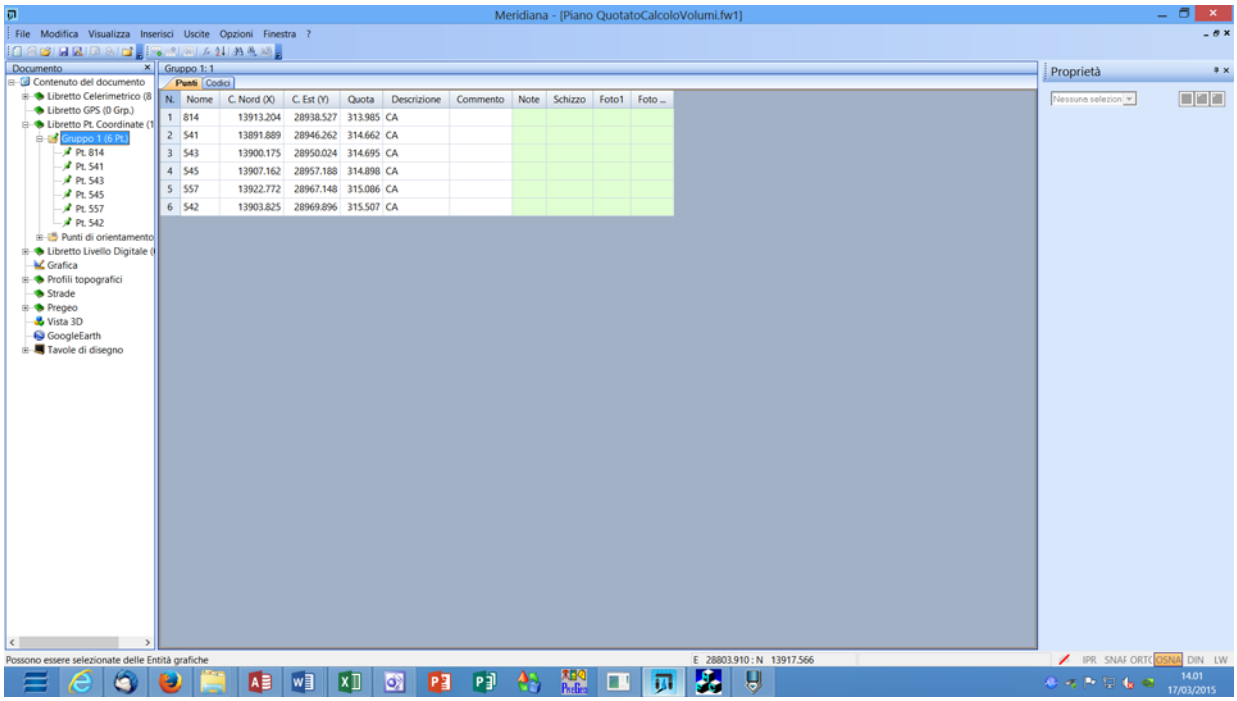



**Figure 621:**

# Calculate volumes between models

The calculation of the volumes between models allows the user to determine the volume contained in the current DTM and another one selected by the user. As such, if it was necessary to have already calculated the triangulation for the current project to run the absolute volume calculation then in this case it will be necessary to have calculated the triangulation also for the other project used in the calculation.

A typical use case for this command is determining the quantity removed in an excavation by comparing the survey of the first map with that of the second map created at the end of the works.

To run this command it is indispensable that the two surveys are oriented according to the same reference system and that they can be overlayed at least partially, this is because the calculation is run exclusively in the areas where there are triangles from both DTMs; the areas where there are triangles from just one of the two DTMs are completely ignored.

The calculation is done in the following method:

1.First of all the user must determine whether to run the calculation on all triangles or just one region bordered by a closed polyline;

2.The program examines each triangle found in the second survey; for each one of these it identifies the triangle or portions thereof corresponding to the first survey. The program will calculate the prismoid volume determined as follows;

3.The calculation is run on all triangles enclosed within the selected region and totals the partial results.

Once the calculation is completed, the program will be able to:

1.Create graphic separation lines between the excavation and fill areas;

2.separately display the excavation volume and the fill volume;

3.Create the DTM of the differences.

As said previously, the program uses the active project as survey of the first map.

The survey of the second map, though, can be selected using a specific window where the user can select either a project found in the file currently under work or a project found in another file.

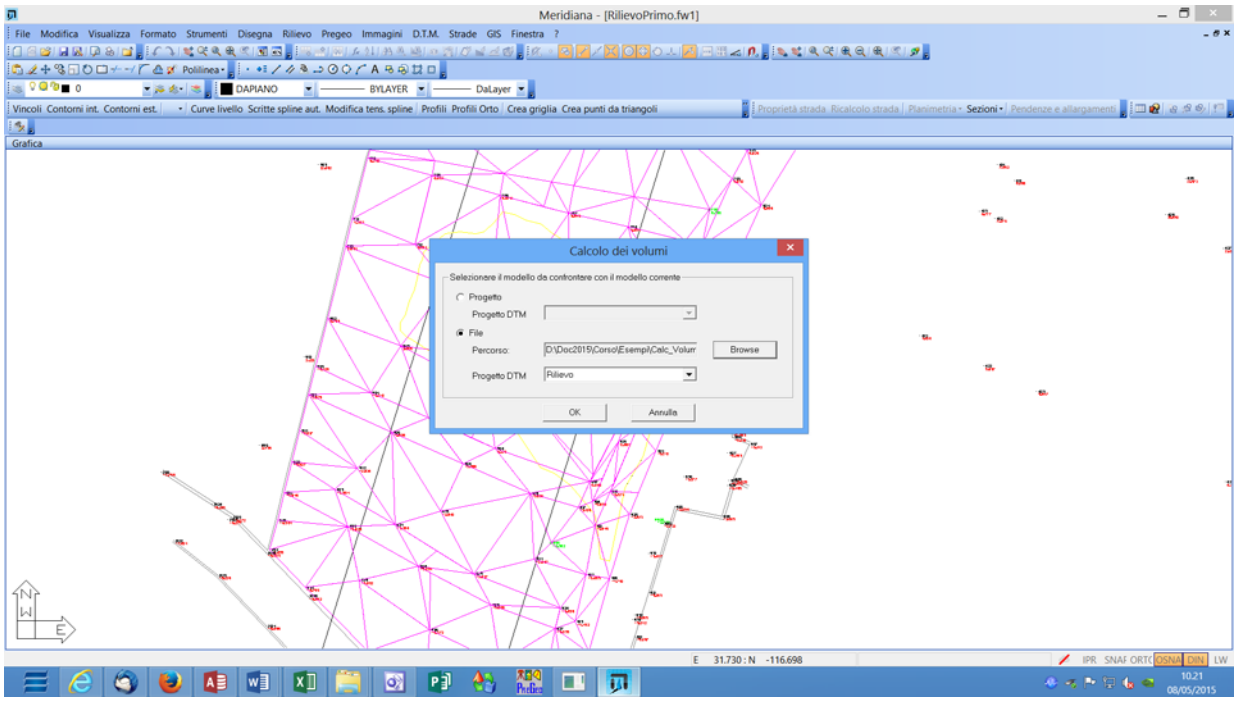



**Figure 622:**

Once the selection is confirmed the program will ask the user to identify a region to border the area where to run the calculation (the region can be defined on all triangles or with a closed polyline that may be designed or selected graphically).

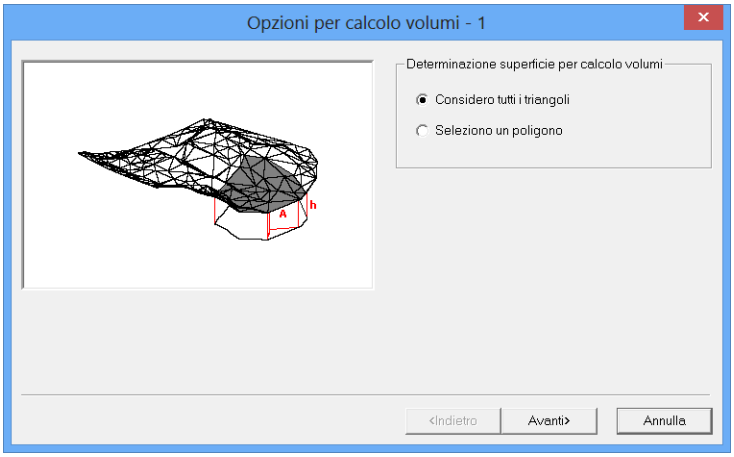



**Figure 623:**

The "Options for volumes calculation-4" is used to specify:

1.The information to include in the print report;

2.Whether to create the excavation/fill lines;

3.Whether to create the DTM of the quote differences between the two models.

In the volumes calculation between models a DTM of flattening cannot be created (see Absolute volumes calculation)

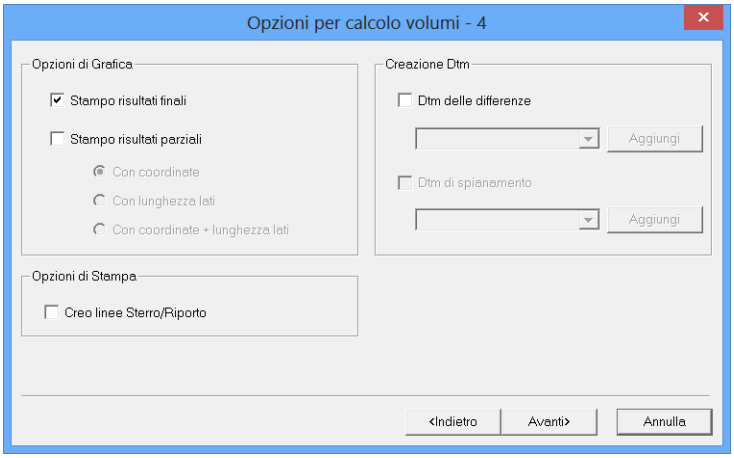



**Figure 624:**

The print preview of the final results includes:

•The horizontal area considered (intersection between two surveys, that is, the parts shared by the two triangulations taken into consideration by the program for the calculation);

•The solid surface (intersection between two surveys);

•fill values.

•excavation values.

•difference between excavation and fill.

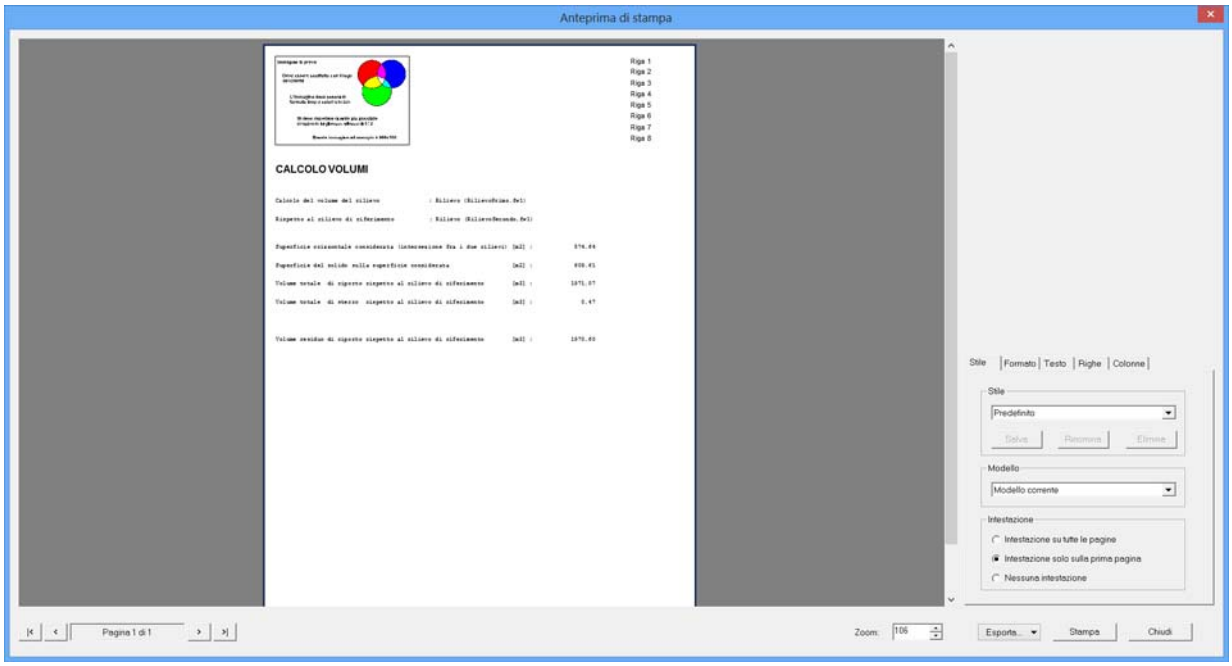



**Figure 625:**

Analyzing the partial results it can be seen that first the coordinates of the vertices for each individual triangle of the second project are reported and then the coordinates of the triangles and their portions of the first project are reported with which they are intersected; finally, the volumes calculated portion for portion are reported.

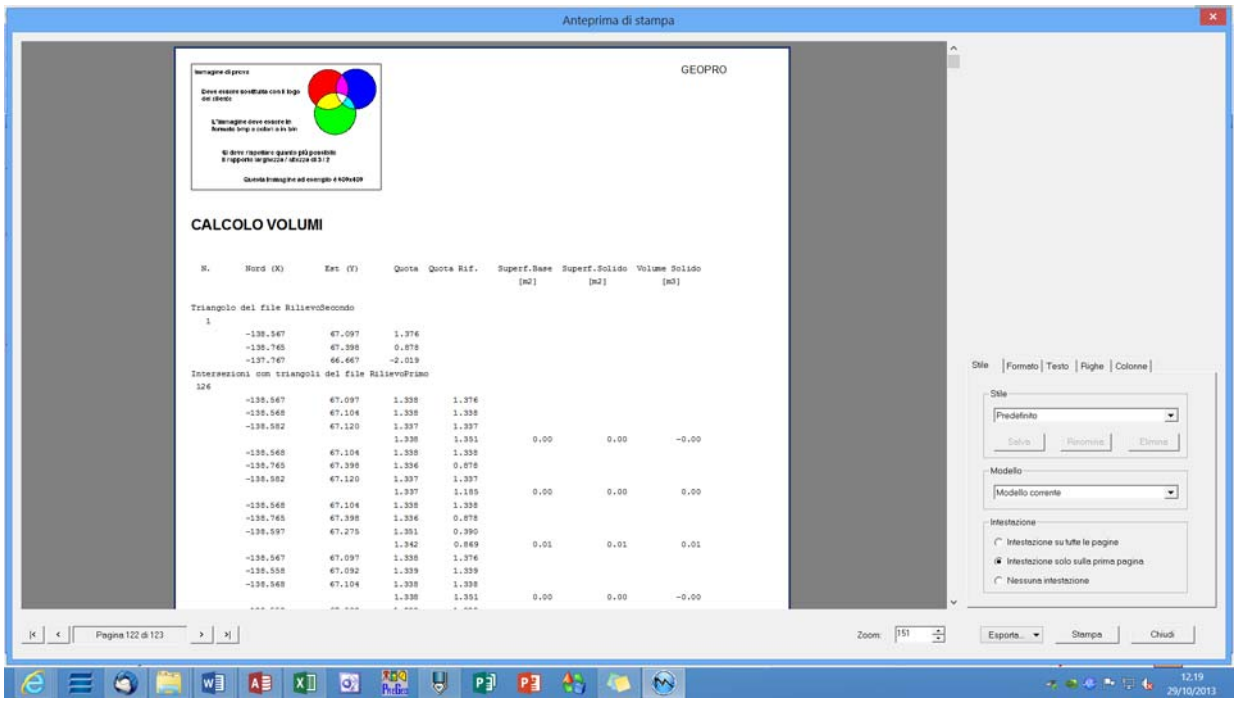



**Figure 626:**

# Example 1

This example is the suggestion to run the calculation of the volumes between models.

After opening the first file, run the "Calculate volumes/Calculate volumes between models" command.

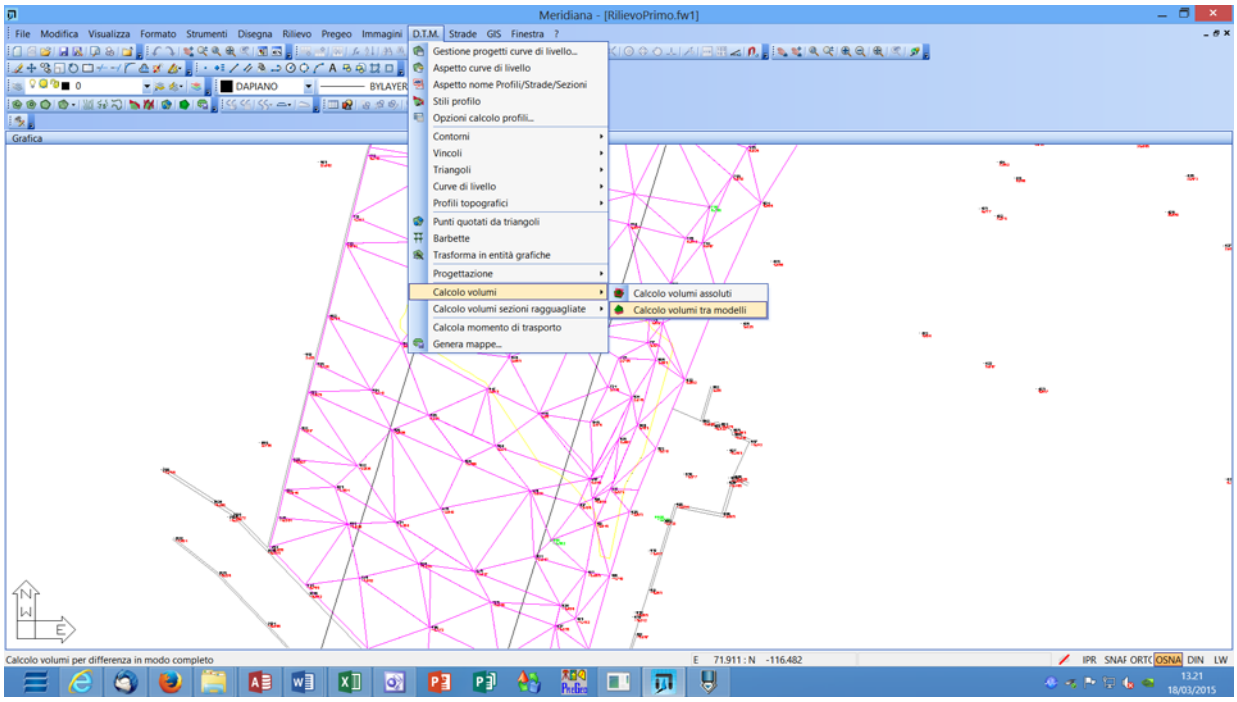



**Figure 627:**

The command displays a window used to select the second file.

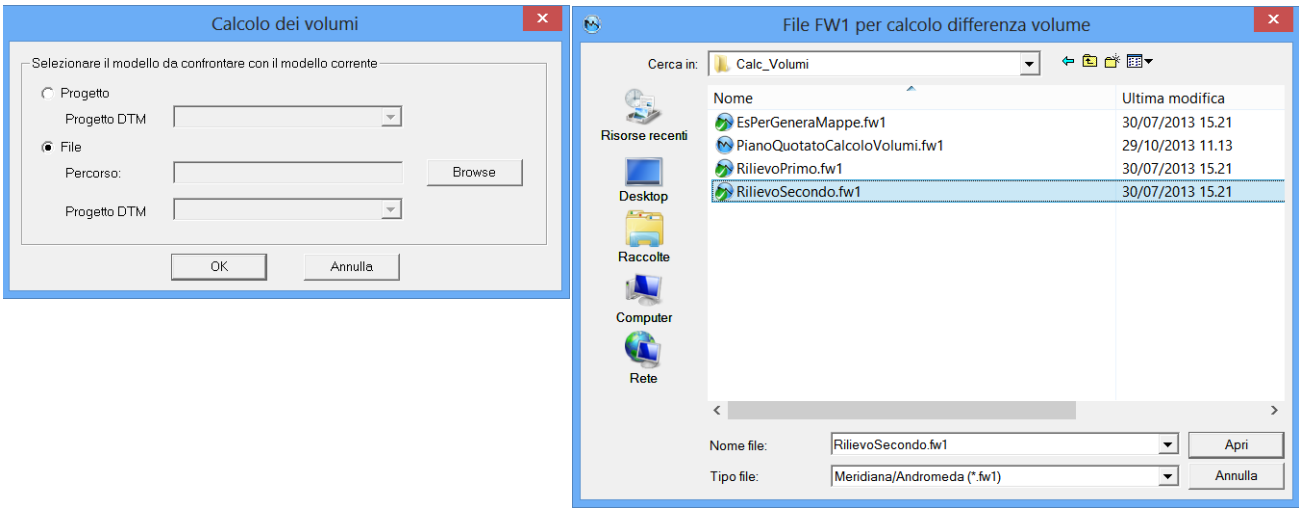



**Figure 628:**

Press OK and verify that the window appears used to select "Consider all triangles".

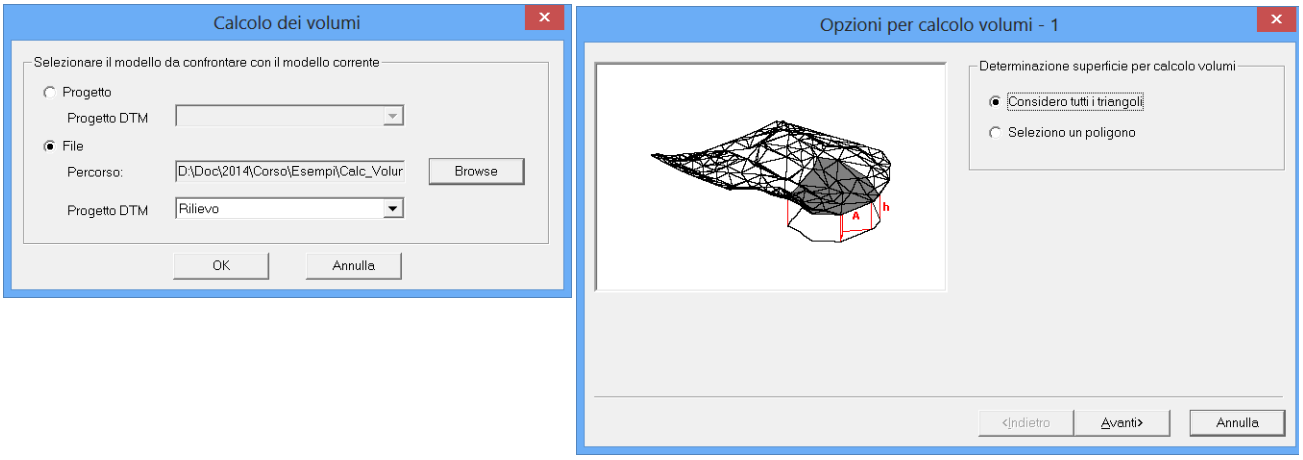



**Figure 629:**

Press "Forward" and the program will display the "Options for volumes calculation" window used to select whether:

- to print the final results;
- to print the partial results;
- or not to create the excavation or fill lines;
- or not to create the DTM of the differences.

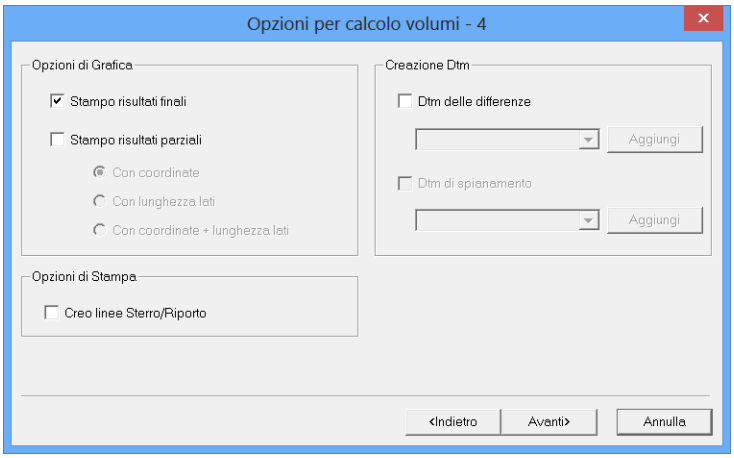



**Figure 630:**

Below is the image of the final results printout.

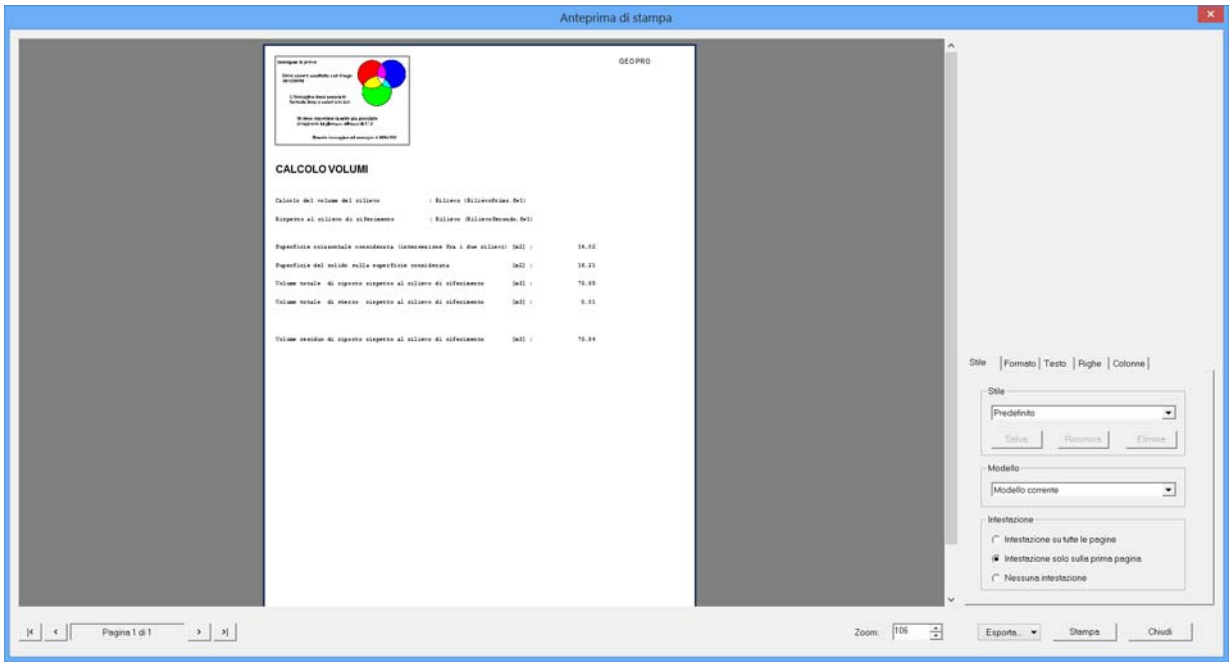

Anteprima di stampa
GEOPRO
CALCOLO VOLUMI
Stile
Formato
Testo
Righe
Colonne
Predefinito
Modello
Modello corrente
Intestazione
Intestazione su tutte le pagine
Intestazione solo sulla prima pagina
Nessuna intestazione
Pagina 1 di 1
Zoom:
Esporta...
Stampa
Chiudi

**Figure 631:**

# Calculate leveled sections volumes

## Print calculation of leveled sections volumes

The calculation of volumes is done with the leveled sections method .

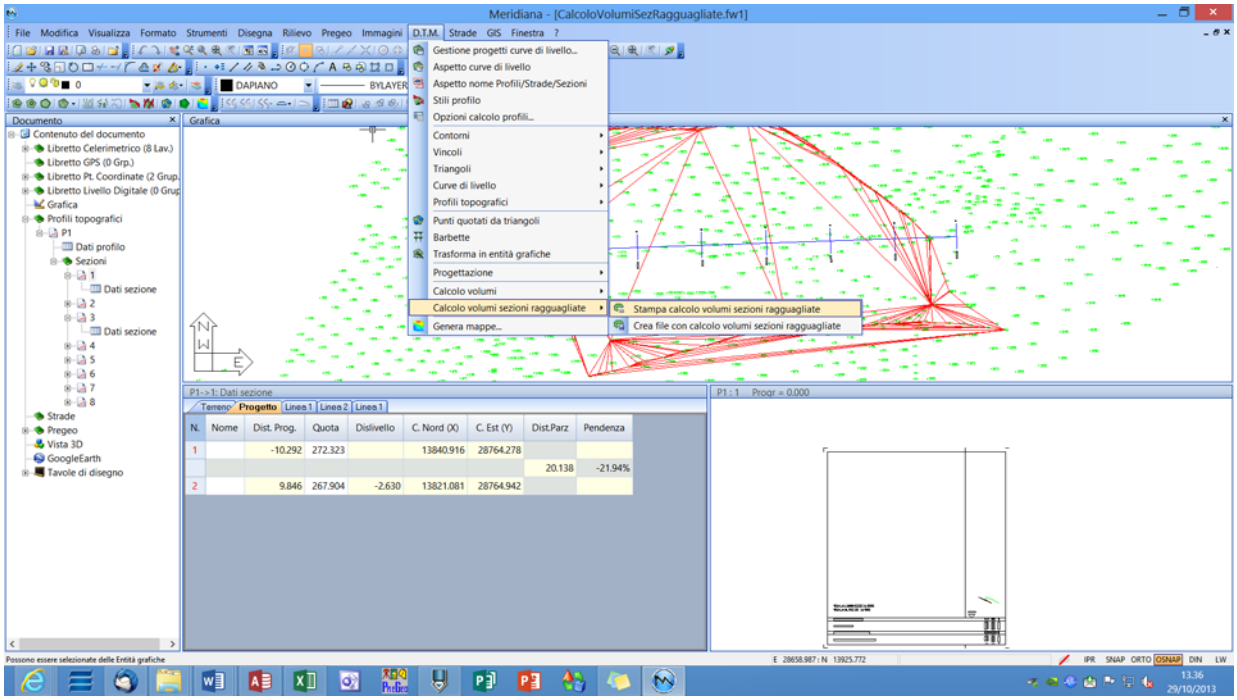



**Figure 632:**

To run the printout of the leveled sections the user must first select the Profile where the sections and profiles were calculated.

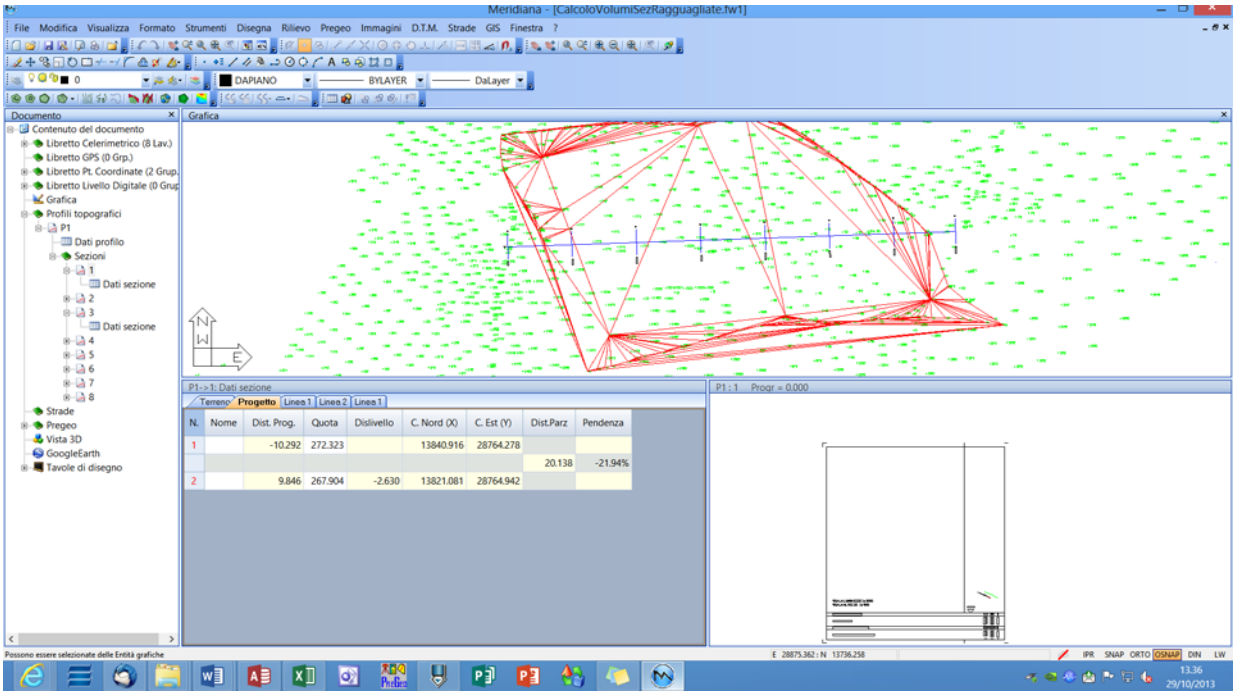



**Figure 633:**

After selecting the profile, the program launches the print display.

The printout includes the analytical calculation section by section of the calculations executed.

For each section, the volume compensated between excavation and fill is calculated and its algebraic total with the values of the previous sections.

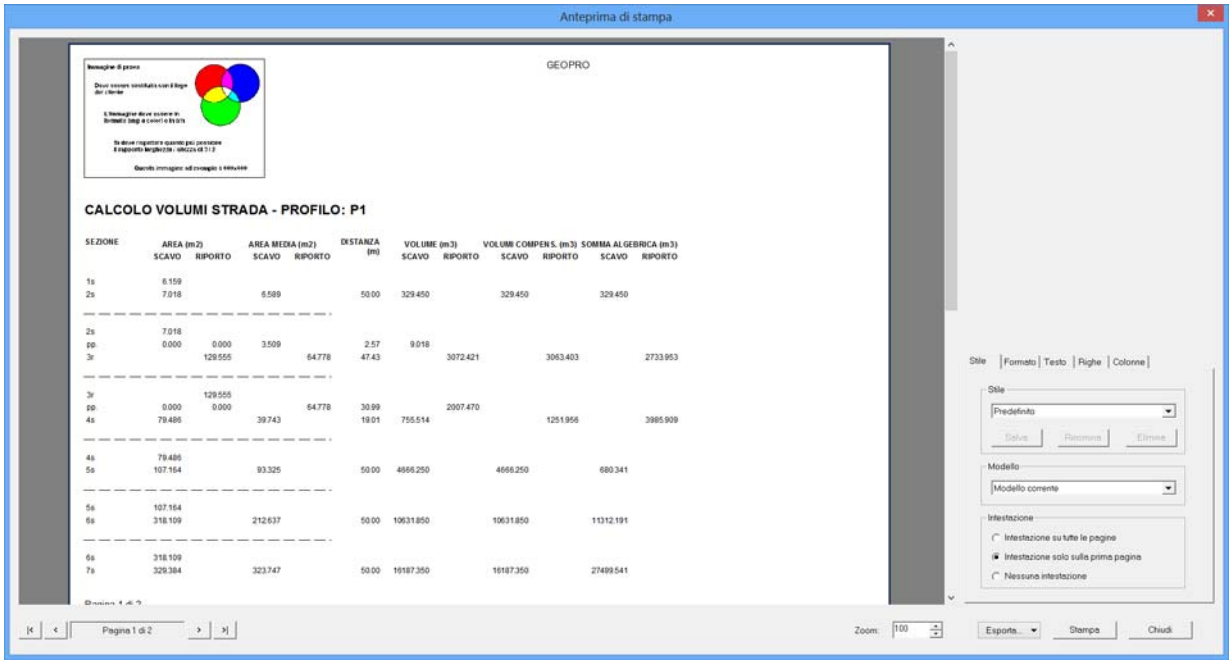
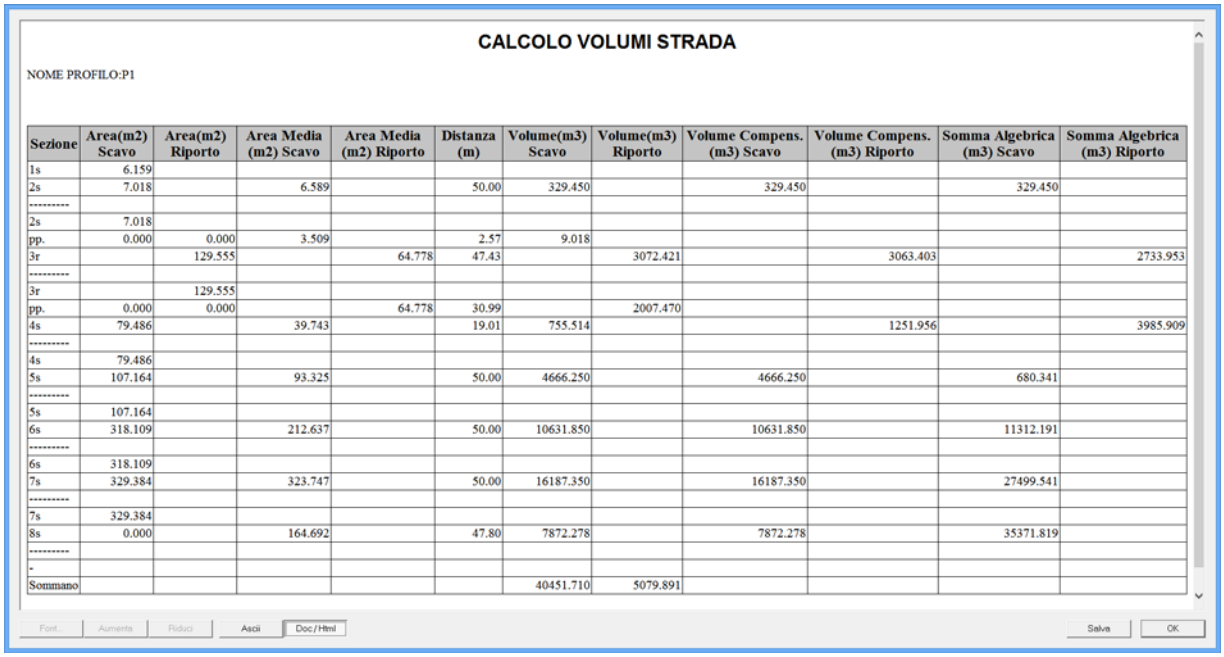



**Figure 634:**

# Create file with leveled sections volumes

The functionality of this command is similar to "Print Adjusted Section Volumes Calculation" with the difference being that the result must be stored on an ASCII or DOC/HTML file.

Here to the side is an image of the DOC/HTML format print preview.



CALCOLO VOLUMI STRADA

NOME PROFILO:P1

| Sezione | Area(m2) Scavo | Area(m2) Riporto | Area Media (m2) Scavo | Area Media (m2) Riporto | Distanza (m) | Volume(m3) Scavo | Volume(m3) Riporto | Volume Compens. (m3) Scavo | Volume Compens. (m3) Riporto | Somma Algebrica (m3) Scavo | Somma Algebrica (m3) Riporto |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1s | 6.159 | | | | | | | | | | |
| 2s | 7.018 | | 6.589 | | 50.00 | 329.450 | | 329.450 | | 329.450 | |
| ---------- | | | | | | | | | | | |
| 2s | 7.018 | | | | | | | | | | |
| pp. | 0.000 | 0.000 | 3.509 | | 2.57 | 9.018 | | | | | |
| 3r | | 129.555 | | 64.778 | 47.43 | | 3072.421 | | 3063.403 | | 2733.953 |
| ---------- | | | | | | | | | | | |
| 3r | | 129.555 | | | | | | | | | |
| pp. | 0.000 | 0.000 | | 64.778 | 30.99 | | 2007.470 | | | | |
| 4s | 79.486 | | 39.743 | | 19.01 | 755.514 | | | 1251.956 | | 3985.909 |
| ---------- | | | | | | | | | | | |
| 4s | 79.486 | | | | | | | | | | |
| 5s | 107.164 | | 93.325 | | 50.00 | 4666.250 | | 4666.250 | | 680.341 | |
| ---------- | | | | | | | | | | | |
| 5s | 107.164 | | | | | | | | | | |
| 6s | 318.109 | | 212.637 | | 50.00 | 10631.850 | | 10631.850 | | 11312.191 | |
| ---------- | | | | | | | | | | | |
| 6s | 318.109 | | | | | | | | | | |
| 7s | 329.384 | | 323.747 | | 50.00 | 16187.350 | | 16187.350 | | 27499.541 | |
| ---------- | | | | | | | | | | | |
| 7s | 329.384 | | | | | | | | | | |
| 8s | 0.000 | | 164.692 | | 47.80 | 7872.278 | | 7872.278 | | 35371.819 | |
| ---------- | | | | | | | | | | | |
| - | | | | | | | | | | | |
| Sommano | | | | | | 40451.710 | 5079.891 | | | | |

Font.. Aumenta Riduci Ascii Doc/Html Salva OK

**Figure 635:**

# Calculate transport moment

The "Calculate transport moment" command is used to obtain a summary of all values used to prepare the estimate of a work such as, for example, the distance traveled, the volume moved, the number of machinery movements, etc.

Once the command is activated the "Calculate transport moment" window appears used to select:

- The choice of DTM:
  - – Current and reference DTM;
  - – DTM of the differences generated during the volumes calculation procedure (see paragraph II).

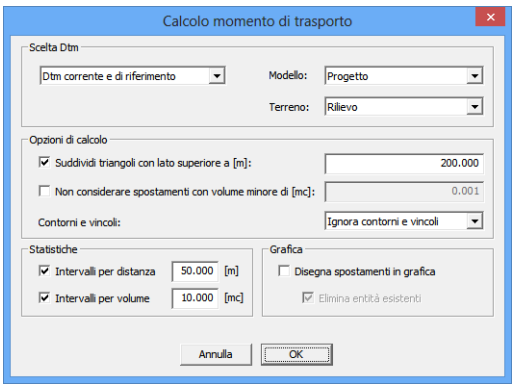



**Figure 636:**

- Options for the calculation:

  Subdivide triangles with larger side at [m]: this is a parameter to be used especially when the survey was not done on a regular grid but rather with a topographic instrument and therefore with irregular points, as such it adjusts the maximum distance for the operating machine to run during the work operations.

  Do not consider movements with volumes less than [mc]: indicates the minimum value to consider in decomposing the movements. Normally a value of 0.001 mc is considered and so any volumes lower are ignored during calculations.

  Borders and constraints: determines the movements of the machinery within the terrain:

  – Ignore borders and constraints the movement from the excavation zone to the fill zone occurs in any direction, even exiting from the border;

  – Only borders, the machinery route is controlled so as to never exit from the border of the terrain model;

  – Only constraints, the machinery route is controlled so as to not exceed the constraints;

  – Borders and constraints, in this case there is a double control, the machinery cannot exit the border and cannot cross the constraints such as ditches, roads, etc.

  If the earth movement is set as Only borders, Only constraints and Borders and constraints then the notice window shown below appears.

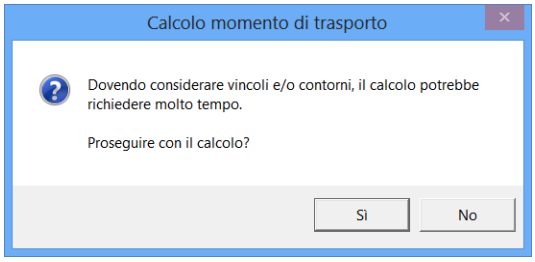



**Figure 637:**

Check the Design movements option in graphic to enable the display of the graphic representation showing the machinery movements.

In the Statistics section the user can include in the report the display of movements per pass of x meters section with the associated average volume moved (Intervals by distance); and the number of movements per pass of x cubic meters of volume and the associated average distance (Intervals by volume).

Press "OK" once all calculation parameters are set and the program will display the movement that the machinery must execute to complete the work.

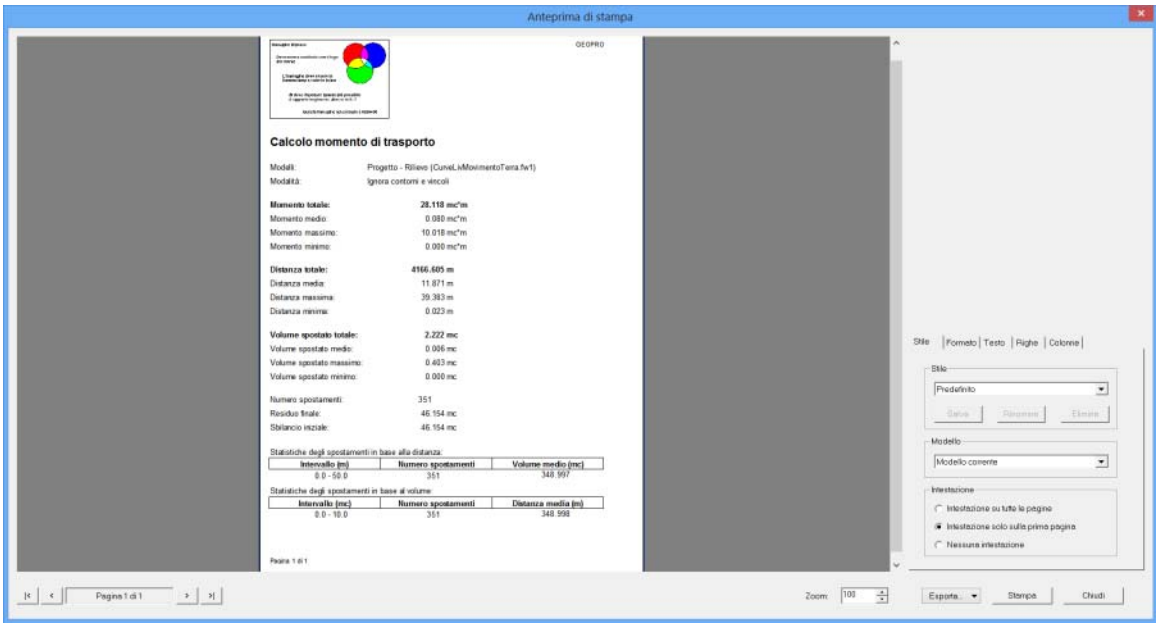



**Figure 638:**

# Generate maps

The "Generate maps" command can be activated from the D.T.M. Menu in the Graphic View and is used to create maps of the altimeters, slopes or the exposure beginning with the mathematical model of the terrain corresponding to the active project.

Executing the command will launch a guided procedure described below.

The first window displayed is "Map type" where the user can:

•Select the type of map to be created (Map of altimeters, slopes, and exposure);

•Select the name and directory where to save the map (also using the "Search...." button);

•Identify the map title (using the "Font..." button the user can change the type of font used).

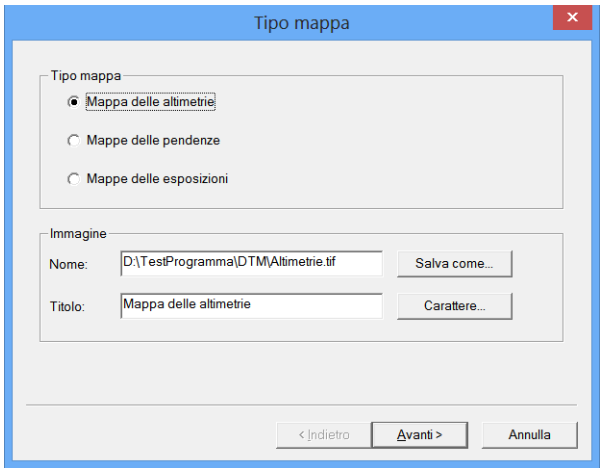



**Figure 639:**

Press the "Forward" button to open the "Legend" window used to select whether or not to create a legend to associate with the map by selecting/deselecting the specific check box.

The window is divided into two sections: "Position" and "Quoting".

In the first, the user must indicate where to position the legend (right/left) and its dimensions; in the second, the user must select the interval and number of decimals to use in quoting (in this case too the font used can be changed).

It is important to keep in mind that if the interval selected for the quoting determines the overlay of the legend's text then the program will automatically change it to avoid this inconvenience.

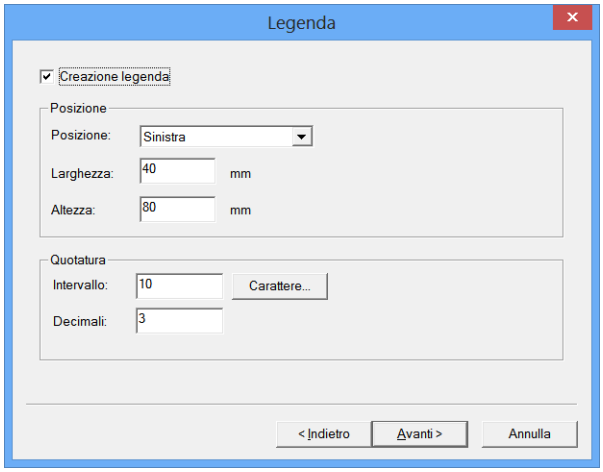



**Figure 640:**

After the "Legend" window there is a "Resolution" window used to indicate the parameters for defining the resolution of the image (scale, resolution, margins) and the scale of values.

Note that the width, height and dimensions fields cannot be edited and their value depends on the scale, resolution and margins and whether or not there is a legend.

The scale indicates the reduction factor, the resolution indicates the number of pixel per inch, while the margin is the width of the border added to the map (setting the margin at 0 the map is created without an external border).

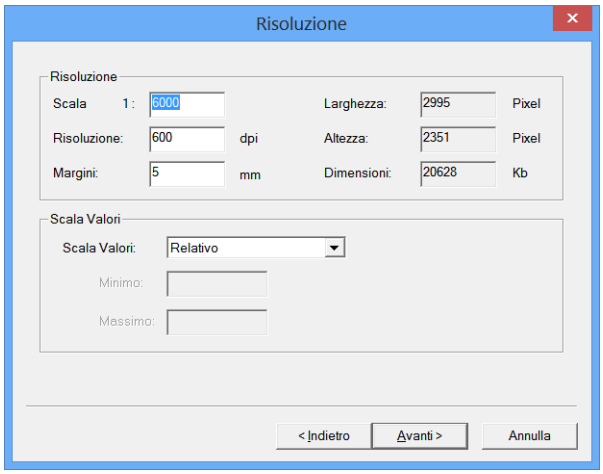



**Figure 641:**

Selecting the scale of values allows the user to specify the interval to represent (relative, absolute, or defined by the user).

The relative interval has its extremes the minimum and maximum characteristics (altimetry, slope, exposure) of the current model.

The absolute interval, selectable only during creation of the slope and exposure maps, sets the minimum and maximum at preset values to allow a rapid interpretation (0 - 100 for the slope map; 0 - 180 for the exposure map).

The user interval allows setting the value of the extremes based on the user demands.

Once the data on the map resolution are inserted, the next window is "Colors".

This window is used to tell the program which colors to use in the map; the available commands are:

•"Add" to add a color;

•"Remove" to remove a color;

•"Up" and "Down" to change the order of the inserted colors.

The background of the image that holds the map can also be selected (black or white).

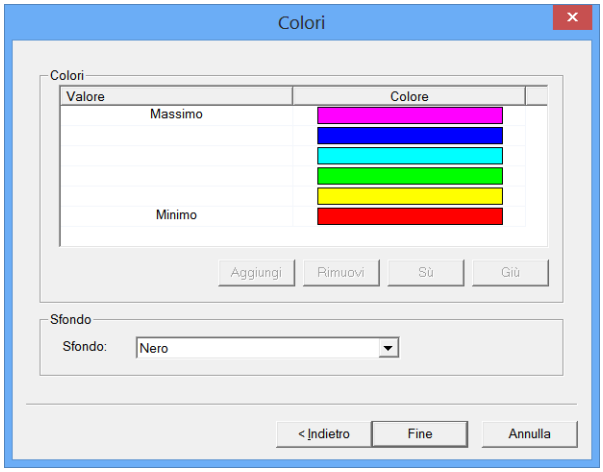



**Figure 642:**

Press the "End" button and the program will create the map; once the operation is completed, the user is asked whether to load it immediately into the Graphic View; if not, then loading can be done later on using the command "Insert Image/Pregeo Map" from the File menu.

The image below shows the created map and the altimetry map.

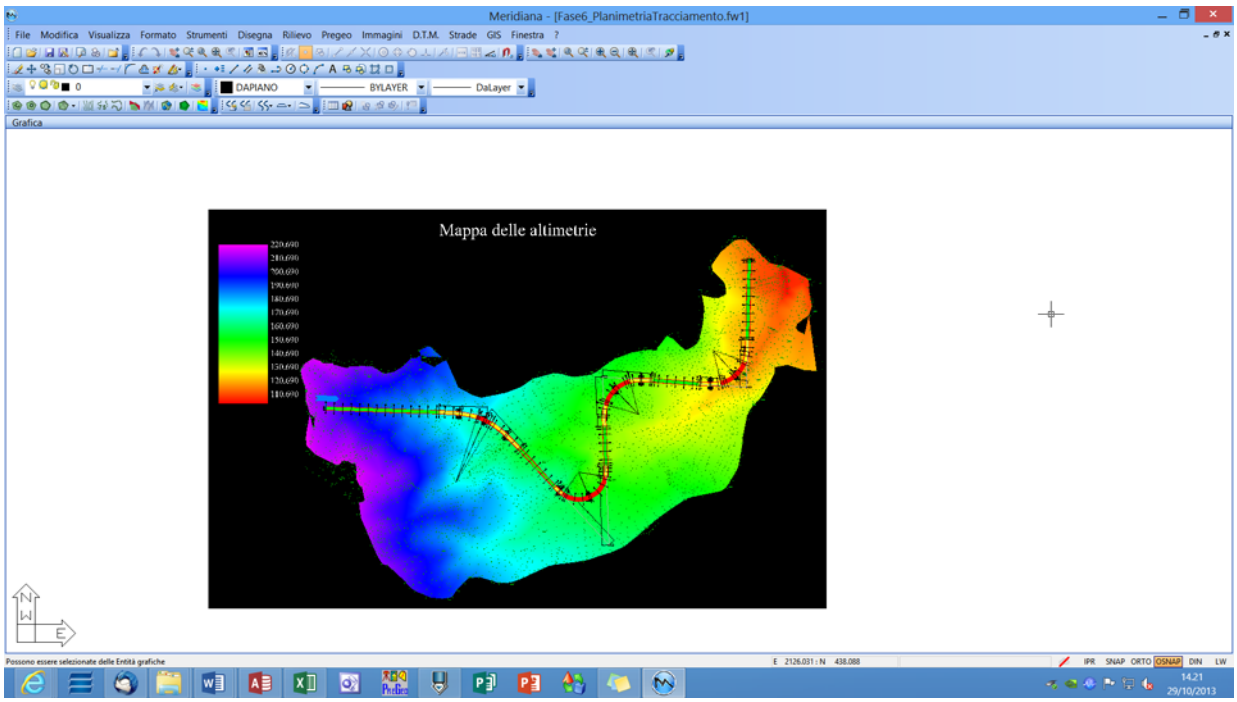



**Figure 643:**

SOKKIA


Concerns regarding this Sokkia product may be sent to Service and Repair Department,
Topcon Positioning Systems, Inc., 7400 National Drive, Livermore, California 94550
www.sokkia.com

 1020509-01 Rev A April 