Profiles

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14.1 Introduction

Hereafter will be illustrated all commands available from the *Profiles* pull-down menu shown in *Fig.13-1*.
These commands are only active when operating in Profiles environment, i.e. if a Profile object is active. The entities that can be handled on Profiles are 2D polylines and Sections (anonymous blocks placed at a certain chainage, with information regarding name, notes and one or more elevations).

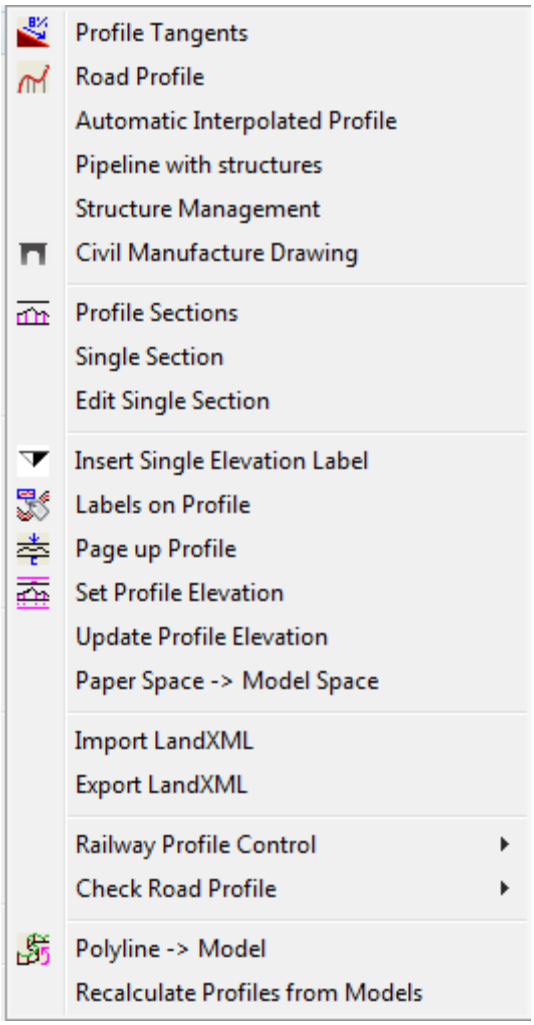


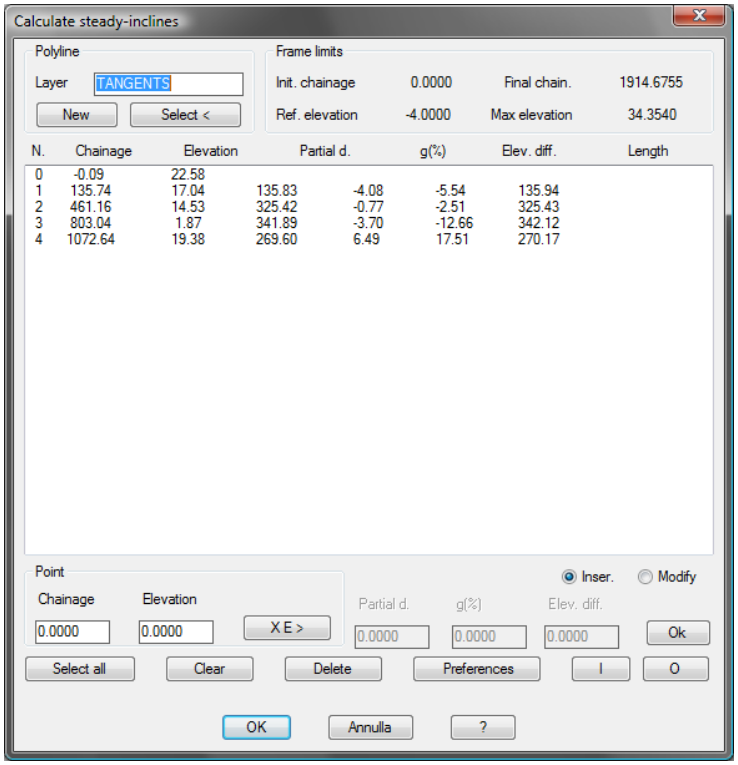
Fig.13-1 Profiles menu

14.2 Profile Tangents command (*Calcliv*)

This command creates or modifies a tangent in an existing Profile. Tangents are graphically represented by polylines.

Format: Calcliv

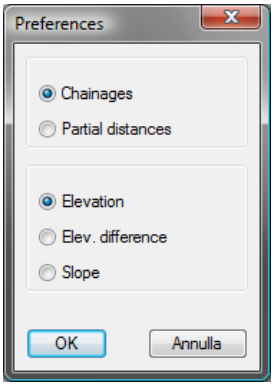
When launching the command, the **Calculate steady-inclines** dialog is displayed.



Tangents can be inserted by:

- inserting special points of the tangents, to be directly selected on screen with the mouse, pressing the **XE >** button;
- **chainage** or **partial distance**, associated with an elevation, elevation difference or slope.

The **Preferences** dialog, appearing when pressing *"Preferences"*, enables to choose among possible input combinations.



With the *"Select <"* button it is possible to select an existing steady-incline (polyline), while the *"New"* button enables to copy the steady-incline on a different layer (the name of which must be typed in the relevant edit-box), likewise all commands intended for drawing and modifying 2D polylines.
It is besides possible to import/export data from/to a file, or send them to a printer by using the I and O buttons.

All polylines representing tangents can be anyway modified by using any of the available AutoCAD commands.

Quick Strade solution and CAD&Pillar
In this solution, the selection button and the layer edit-box are not available; tangents are automatically drawn on the TANGENTS layer and the selection is automatically performed on the first polyline drawn on the same layer.

14.3 Design Profile Command (*Profs*)

The command allows the user to draw or modify a polyline representing the design profile of a road in an easy and interactive way.
The command includes the functions of the *Tangents* command and allows you to insert in the profile vertical curves in compliance with the Italian Ministerial Order 5/11/2001. In particular it is possible to insert parabolic shape vertical curves.

Format: profs

A dialog box, as shown in the figure, opens up.

The *Layer* text field in the *Polyline* frame can be used to set the layer to which the polyline belongs; by clicking *Select* < you can pick an existing polyline from the screen.
If the *Keep Original* check-box is ticked, a copy of the original polyline is created on the layer specified in the *Layer* text field when the command is quitted. This can be very useful to duplicate the polyline that only contains gradients of the tangents (and therefore only straight stretches) and obtain another polyline with vertical curves inserted at the vertices.

The *Frame Limits* frame supplies information:

- on the length of the profile
- the reference elevation (elevation of the lowest point in the frame)
- the maximum elevation (elevation of the highest point in the frame)

By right-clicking on the **Vertical Transition Curves** grid you access the dialog box **Design Standard Settings**, where it is possible to select the reference norms (rules in the Italian Ministerial Order of 05/11/2001 or the C.N.R. Rules N. 78/80) and the type of platform;

When the dialog box is opened, the program automatically adopts the norms and platform type previously chosen with the *Alignment -> Set Road Regulations*; the predefined design speed for the vertical curves corresponds to the maximum design speed linked to the type of road; as further on described, the designer can locally modify the design speed for each v. curve within the appropriate **Profile Vertical Curves** dialog box.

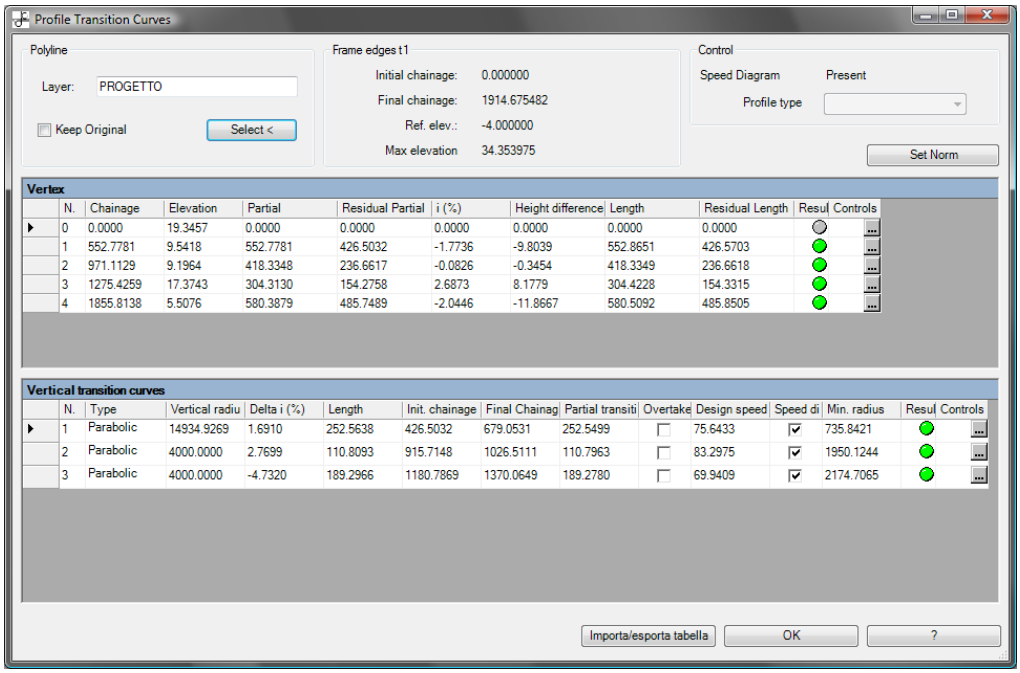
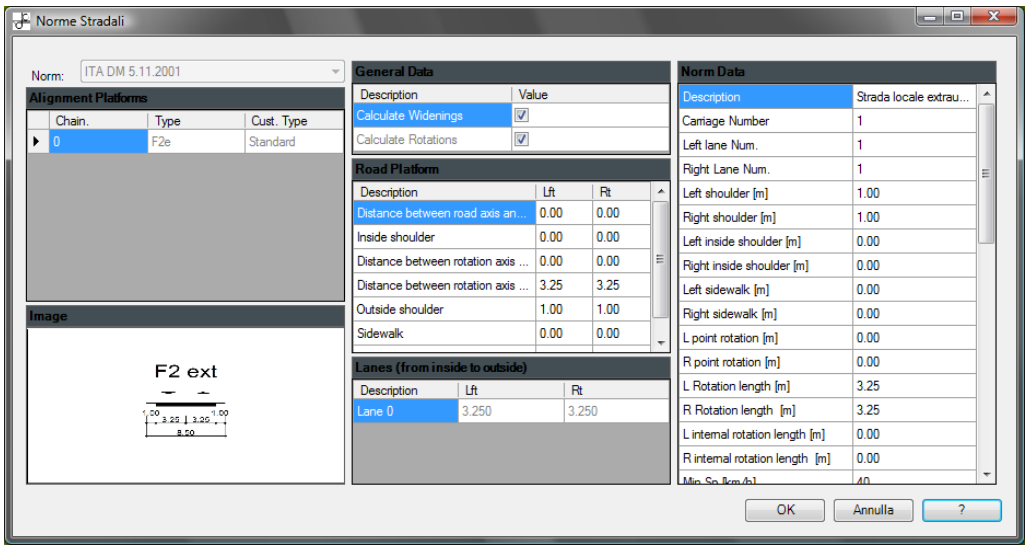


Figura 0-2 Road Profile Command Dialog box.



Vertex grid
In this grid there are fields that report, for each vertex of the selected polyline:

- chainage
- elevation
- partial distance
- residual partial distance
- longitudinal gradient
- difference in elevation
- length of the tangent
- residual length
- result of the comparison between the gradient of the tangent and the maximum gradient provided for by the regulations.

The partial distance and the length of the tangent are calculated between the two vertices of every single tangent; the residual partial distance and the residual length refer to the straights that remain after having inserted the vertical curves. If no vertical curve is added the residual partial distance and the residual length are equal to the partial distance and the tangent length, respectively.

Right clicking on the grid enables you to:
Add a vertex. Adds a vertex at the end of the polyline with partial distance equal to that between the last and the second last point;
Insert e vertex. Inserts a vertex between the selected vertex and the preceding one in order to obtain equal residual partial distances;
Delete a vertex. Eliminate the selected vertex.

Every time a vertex is added or modified, the other vertices maintain the same chainage and elevation, while the remaining parameters are updated.

By double clicking the cells of the *Chainage*, *Elevation*, *Partial*, *i [x 100]*, *Difference (in Elevation)* columns it is possible to change the single values; with a single click you can change the value of the cell.

When you **modify**…
…the **chainage** the vertex remains at the elevation previously set, while the other parameters are re-calculated;
…the **elevation**, the chainage does not change, while the other parameters are updated;
…the **partial distance** between two vertices, the elevations remain the same, while the remaining parameters are re-calculated;
…the longitudinal gradient or the difference in elevation is changed, the chainages remain the same, while the remaining parameters are updated.

If the modification you wish to operate results in the **overlapping** of two adjacent vertical curves, which is, the elimination of the partial residual between the two vertices, an error message appears and the geometry of the polyline will not be modified.

Vertical transition curves
This area displays as many rows as there are vertices to be joint.
It is possible to choose *Circular* to *Parabolic* curves.
In the *Vertical Radius* cells type the value of the circular curve radius or of the calculation radius of the parabolic curve; in order to have a correctly dimensioned curve, in compliance with the regulations, control the value of the minimum vertical radius reported in the *Min. Radius* column and the result of the R>Rmin verification indicated in the last column; the minimum radius is calculated according to the visibility verifications provided for by the regulations according to the road types previously set (Table 13-1 and Table 13-2).

Road Types	**Concave Curve**		**Convex Curve**	
	Visibility distance	Description	Visibility distance	Description
I, II, III, A	D_a	Safe stopping in front of a fixed obstacle.	D_a D_{sr}	Safe stopping in front of a fixed obstacle. Safe overtaking. Sorpasso.
IV, V, VI, B, C	D_a	Safe stopping in front of a fixed obstacle.	D_a $2\ D_a$ D_s	Safe stopping in front of a fixed obstacle. Safe stopping in front of a mobile obstacle. Safe overtaking.

Table 13-1 – Visibility verification provided for by the C.N.R. Rules N. 78/80.

Note 1 In the case of roads type IV, V, VI, B, C as provided for by the C.N.R. Rules N. 78/80 or of roads type C1, C2, E1, F1e, F2e, F1u provided for by the Italian Ministerial Order of 05/11/2001, overtaking is normally forbidden. If you wish to dimension one or more vertical curves in order to allow safe overtaking select a cell of the *Overtake* column and click to open a quick choice menu *Yes/No*.

Note 2 In the case of roads type A1e, A2e, SA2esx, SA2edx, A1u, A2u, SA2usx, SA2udx, B1, B2, SB2sx, SB2dx, D1, D2, D3, SD2sx, SD2dx, E2, E3 the *Dc* column is active, and there it is possible to activate or deactivate the safe changing lane manoeuvre sight distance verification through a quick choice menu *Yes/No*.

The *Delta i (%)* column displays the gradient difference between consecutive steady-inclines. When the difference in gradient is negative, the program calculates the minimum radius with the verification provided for by the regulations concerning a concave curve and displays the result in the *Min. Radius* column, when the difference in gradient is positive the calculation is performed for a convex curve.

The *Design Speed* column reports the project speed of the vertical curve; its value is determined following the criterion set in the *Set Regulations* dialog box: constant value or value calculated from the speed diagram; in the first case the project speed is by default equal to **Vpmax** and can be manually modified; in the second case the project speeds are updated according to the speed diagram for every modification performed on the profile.

Road Types	**Concave Curve**		**Convex Curve**	
	Visibility distance	Description	Visibility distance	Description
All	D_A	Safe stopping in front of a fixed obstacle.	D_A	Safe stopping in front of a fixed obstacle.

A1e, A2e, SA2esx, SA2edx, A1u, A2u, SA2usx, SA2udx, B1, B2, SB2sx, SB2dx, D1, D2, D3, SD2sx, SD2dx, E2, E3			D_C	Changing lane manoeuvre
C1, C2, E1, F1e, F2e, F1u			Ds	Overtaking manoeuvre

Table 13-2 – Visibility verification provided for by the Italian Ministerial Order of 05/11/2001.

14.3.1Advises to use the command Design Profile (Road)

The following procedures are recommended when using the *Road Profile* command.

14.3.1.1 Create a new design polyline

Set the name of the layer on which the design polyline is to be created in the *Polyline* frame. You can control or change the reference regulations by clicking on the *Set Norm* button; in the *Vertex* grid add the necessary vertices and type the chainages and elevations, or the partials, the gradients and the differences in elevation; in the *Vertical transition curves* area assign the vertical radius values and select the type of curve (circular/parabolic).

14.3.1.2 Modify a project polyline

In the *Polyline* frame click on *Select* < and pick the polyline to be modified; clicking on the *Set Norm* button you can control or modify the reference regulations; in the *Vertex* grid change the chainages, the elevations, the partials, the gradients, and the differences in elevation; add or eliminate vertices; in the *Vertical transition curves* area modify the type of curve and the vertical radii values.

Note If you pick an existing polyline which was not created with the *Road Profile* command, the program recognizes the presence of previously inserted circular curves.

14.3.1.3 Duplication of a project polyline

Generally two polylines are represented in a profile: a polyline only made of straights (tangents polyline), a polyline with circular or parabolic curves (project polyline). If the polyline containing the tangents has already been traced, and you want to duplicate the polyline in order to have the one with vertical curves (project polyline), simply select the polyline with the tangents (*Select* < button), in the *Layer* text field type the name of the layer on which create the new polyline and activate the *Keep Original* check-box.

14.3.1.4 Transform a traditional polyline in a polyline with parabolic curves

The parabolic vertical curves can only be inserted with the *Road Profile* command; to transform a traditional polyline made up of straights and circular curves into a polyline containing parabolic curves select the polyline (*Select* < button); in the *Curves* area it is possible to modify the type of curve by following the previously outlined procedure (*Circular* or *Parabolic*).

A polyline containing curves, either circular or parabolic, must not be cut, trimmed or changed with grips. The chainages, elevations, partials, gradients, and differences of elevation of a polyline with curves must be modified with the Road Profile command.

14.3.1.5 Customize the computing parameters

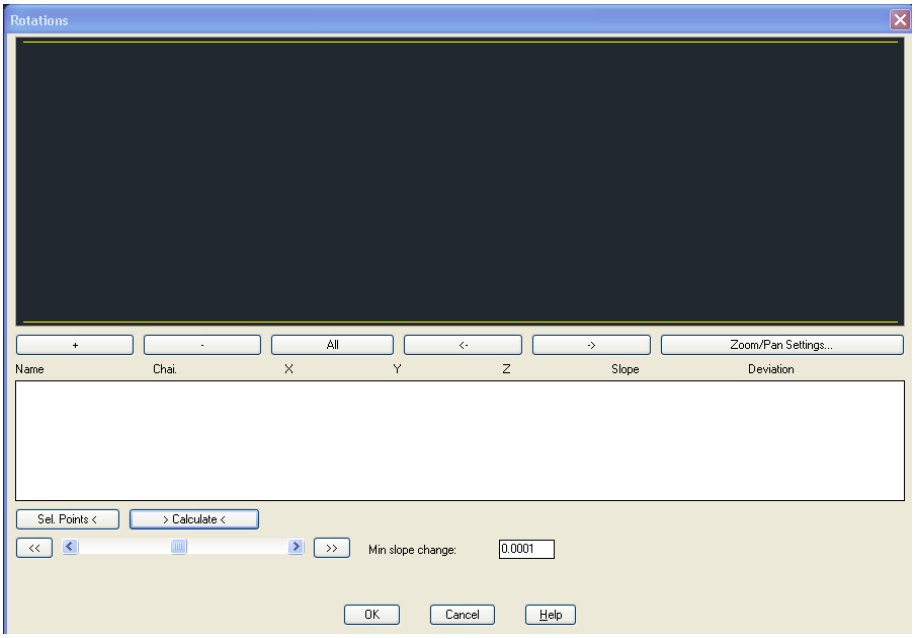
The command Set Road Regulation of the menu Alignments allows specifying the **obstacle height** to be considered in calculation of minimum vertical radius, set by default equal to 0.10 m.

14.4 Interpolated automatic Profile command (anprof)

The command allows calculating automatically an interpolated profile going throught a survey, based on topographic points which have a code between 1 and 10 (it's a convention in order to distinguish them from points linked to obstacles with codes > 11) and drawing the interpolated profile in a profile view. It's also requested the selection of a line or a polyline which represents the planimetric alignment.

Format: Anprof
Select a line or a polyline:

With the mouse cursor select the line or the polyline which represents the planimetric alignment. The polyline or the line will be used in the following in order to retrieve the chainages of th points.
You will see the dialog **Rotations**.



With the button "Sel. Points <" select the topographic points: the graphic of the existing slopes will be shown and, in the list-box, all the points with their chainage, coordinates and slope calculated among three following points (the previous and the next).

Point codes
The program recognizes as survey only topographic points which have a code between 1 and 10. Without code or with a code > 10 or an alphanumeric code are codes related to details or obstacles and so they are excluded.
Clicking a point on graphic you will see underlined the nearest point in the list box.
With the buttons you can zoom in/out (buttons +-) and you can pan (buttons <- and <>). You can set the zoom and pan width with the specific button. With the button "All" you will see all the zone of the selected points.
In order to calculate and view the design trend, you can move the slide bar to the left or the right. Moving the bar to the right, the design trend is nearer to straight lines, while moving to the left the trend will be discretized in parts nearer to the survey. If you reach the end slide bar you can extend the range clicking on the button << or >> one or more times. There is a filter to erase design parts with slope value below a certain value, imposed in the control.
With the button "> Calculate <" the interpolated profile will be calculated and in the list-box you will see all the slopes, point by point, with the deviation of the slopes. This value is very useful to compare different solutions, calculated moving the slide bar.

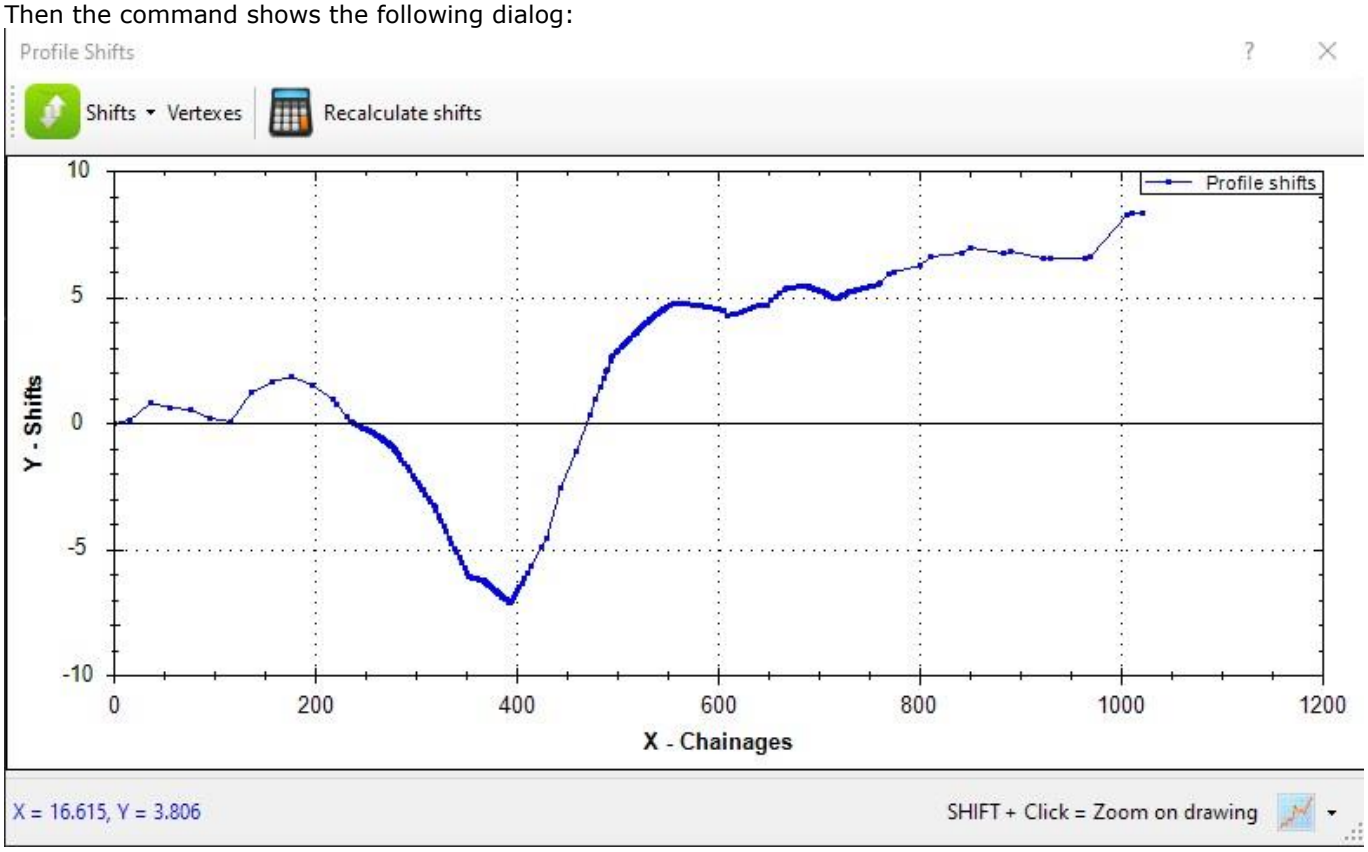
Clicking on the button OK (enabled after the calculation operation), you will requested the insertion point where the profile view will be drawn, containing the tangents and the interpolated transition curves.

14.5 Shiftings from Profile command (*cursc*)

The command allows to see the shiftings between two polylines in a profile view. The command is active only if a profile view is active.

Formato: *cursc*
Select the first polyline…
Select the second polyline…

Then the command shows the following dialog:



The chart shows the shifting of the second polyline from the first one. The shiftings can be calculated on vertices of polylines or with a constant step, by clicking on the button "Shiftings" in upper left side.

14.6 Draw artifacts command (*cdmanuf*)

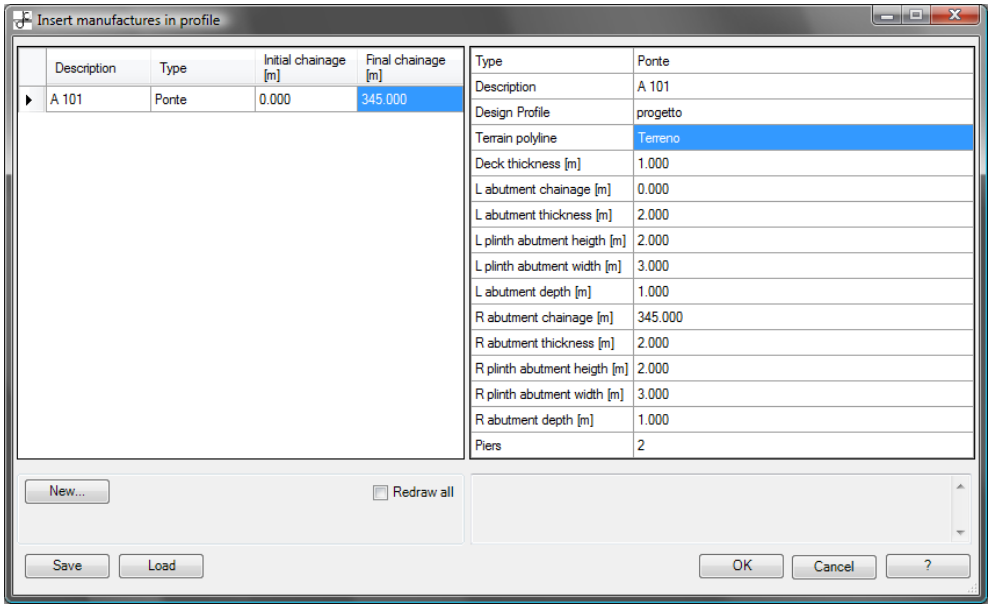
This command allows to insert a representation of artifacts long a longitudinal profile.

Format: *cdmanuf*

Activate the profile you want to work with. The dialog that appears has a grid where you can manage all the artifacts along a profile.
Just insert:

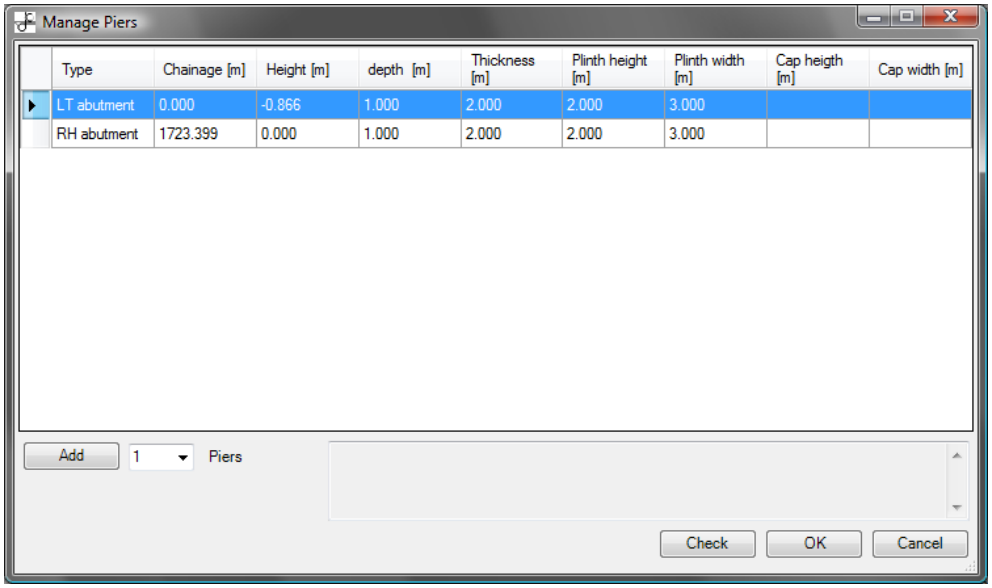
- a **description**
- a type (Bridge or (generic) block
- initial and final chainages.

Click the right mouse button to **add** a new artifact, **eliminate** or **edit it**.



The grid on the right will show all the parameters associated at each element.
For a generic block:
Type.
Description.
Design profile. It is associated to the artifact.
Terrain polyline. Idem for existing profile.
Design elevation. It's the design elevation at the chainage selected.
Design elevation offset. You can choose an insertion point and specify an offset respect a design elevation (e.g. type "-1" to insert a block 1 meter below the design elevation.
Block. It's the name of the selected dwg file.
File path. It can be changed after the insertion.
Point block insertion. These are the chainage and the elevation of insertion of the dwg.

To manage the parameters associated with the Bridge type click on the three dots into the cells: a dialog appears and you can set the number and features of the bridge.
The check button controls if there no errors like chainage overlapping, etc.



Comments
The artifacts inserted with this command are **dynamically linked** to the design profile.
You can save the settings in a external XML file to recall it later.

Button "**Save**". It is possible to save the list of artifacts with their settings to an external xml format file for later re-import. To save the entire list of artifacts, it is necessary to select all rows of the artifact list (click on cell in the upper left corner of the table).

Example steps for drawing artifacts on profile:

1. If artifacts are Block type, create N blocks, one for each artifact to be inserted, with individual artifact properties and (height, length) actual of each artifact.
1. If the artifacts are Bridge type, the properties are set during insertion.
2. Set the profile environment by selecting the target profile View.
3. CDMANUF > New... create new artifact of type block/bridge; with block, select the artifact block. If artifact of type Bridge, set the properties in the dialog.
4. in the inserted record of the artifact list, set only the initial/final chainage on the profile
5. select the destination profile (Project profile, in the right part of the dialog)
6. Possible selection of the Terrain profile.
7. click Ok button and the program draws the artifact(s) on the profile.

Repeat steps 3-6 for each new artifact.

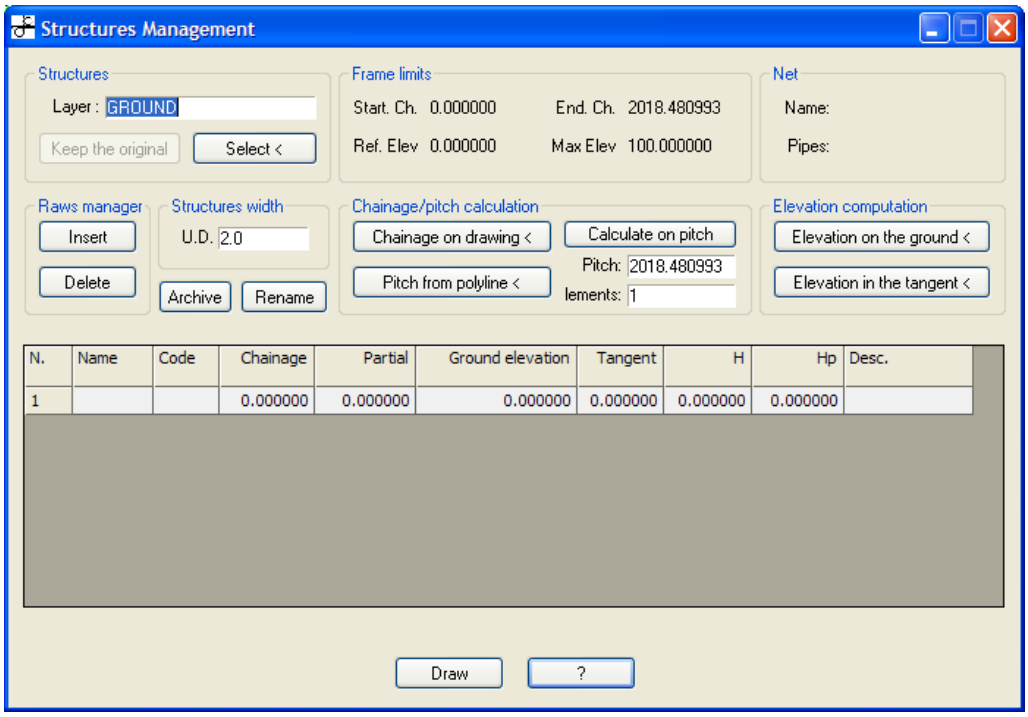
14.7 Pipeline with structures Profile Command (Geporet)

The *Pipeline with Structures Profile* command allows to insert and/or modify the graphical object (AutoCAD block) that represent structures on the profile of the examined network.

Format: *geporet*

Before launching the command it is necessary to select a profile view (that is a CAD block) using the CIVIL Design command *Activate Object*.

When the command is launched the **Structures Management** dialog box opens up and appears as shown below:

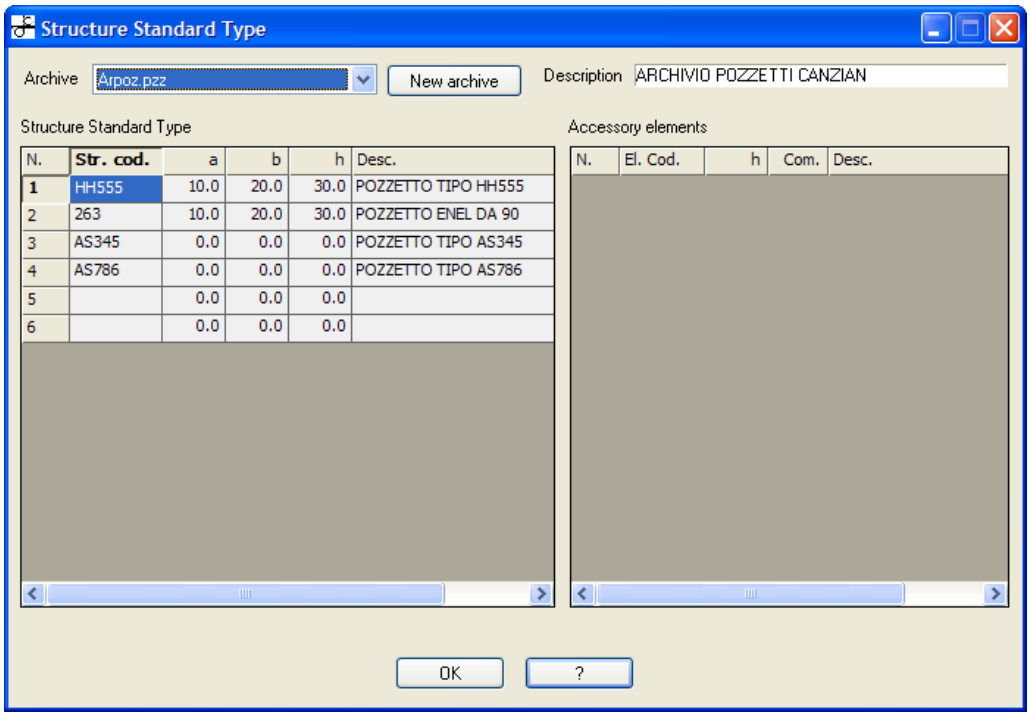


In the *Structures* frame there is a text field where the name of the structure target layer is to be inserted. If previously drawn structures have been already selected (in order to modify them) with the *"Select <"* button, the text field displays the name of the layer to which the selected structures belong.

In this case the *"Keep the original"* button is activated and when clicked, allows, to copy the selected entities in the new layer which is to be specified in the text field, in place of the selection layer, leaving the selection layer unaltered.
The *Frame Limits* frame displays a summary of the coordinates of the selected profile frame. These values include: *Initial Chainage*, *Final Chainage*, *Reference Elevation*, *Maximum Elevation*.

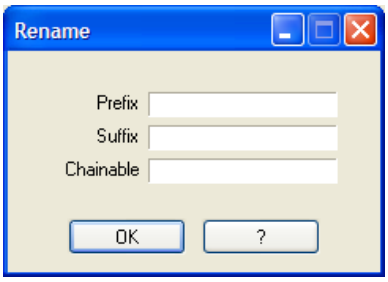
The *Net* frame displays the *Name* of the examined network and the *Pipes* that form the active profile.

In the *Rows Manager* frame there are two buttons. The *"Insert"* button allows to insert a new line in the spreadsheet. Before inserting a new line select a line of the spreadsheet (refer to the description of the "Ground Elevation" button for the selection procedure). The new line is inserted just above the selected one, which will be shifted below. The "Cancel" button is used to cancel the selected line.
In the *Structure Width* frame it is possible to set the width of the structures in Drawing Units.
The "Archive" button opens the only readable **Structures Standard Types** dialog box, and by selecting the structure code and clicking OK it is copied in the cell of the *Code* column of the lines selected in the **Manage Structure**s dialog box.



It is also possible to create a structure type by using single special pieces indicating the number in the *Com* column (*composition*).

The total height of the project is calculated and copied in the cell of the *Ph* (*Project height*) of the selected lines (refer to the description of the *"Elevation on the ground"* button for the selection procedure) in the **Manage Structures** dialog box. (Refer to the description of the *ARPORET* command).



By clicking "*Rename*" button the **Rename** dialog box opens up and allows the user to automatically rename the cells of the *Name* column of the selected lines in the **Manage Structures** dialog box (refer to the description of the *"Elevation from terrain"* button for the selection procedure).
In the *Calculate chainages/pitch* frame there are various buttons that can be used to automatically insert the chainages.

The *"Chainage on drawing <"* button allows to insert a new structure line in the spreadsheet. When this button is clicked, the user is prompted to select a point of the profile and the chainage is automatically calculated; the result will be added in a new line of the spreadsheet. If, before clicking the button, you select a line (refer to the description of the *"Elevation from terrain"* button for the selection procedure), the selected chainage will be substituted.

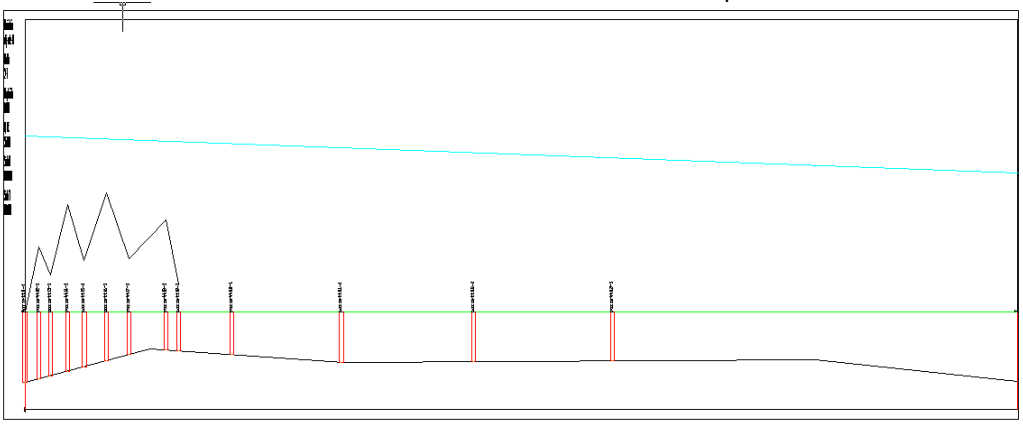
The *"Pitch from polyline"* button allows to insert the structure lines in the spreadsheet by selecting a previously drawn base polyline, from which the chainages of the vertices are automatically calculated, and which become the chainages of the structure to be inserted.

The *"Calculate by pitch"* button allows to insert the structure lines in the spreadsheet, after having set a fixed pitch to generate the chainages. The figure on the side shows the text fields in which insert the pitch or the number of parts before pressing the button. By inserting the pitch, the number of parts on the active profile is automatically calculated, or, inserting the number of parts of the profile, the pitch to generate the chainages is automatically desumed.

In the *Elevation computation* frame there are two buttons to calculate the elevations directly from the drawing.
The *"Elevation on the ground"* button allows to select the polyline of the ground in the profile frame, from which the relative elevations are deduced and correspond to the inserted chainages, for the selected lines. To select the lines to be automatically dimensioned select the first line by using the mouse; then, pressing the *Shift* button select the last line of the selection with the mouse, as shown in the figure.

After having performed the selection as just described, click the *"Elevation on the ground"* button and select the polyline. The calculated elevations will be added in the cells of the *Ground elev.* column.

The *"Elevation in the tangent"* button allows to select the tangent polyline in the profile frame, from which the elevations corresponding to the inserted chainages are automatically calculated, for the selected lines.
The procedure is similar to that operated for the ground elevations. The calculated elevations will be then added in the cells of the *Tangents* columns.
The "*Draw*" button draws the structure blocks on the active profile.



Example of profile with structures in a deformed view.

Legend of symbols used in the column headings of the **Manage Structures** spreadsheet.

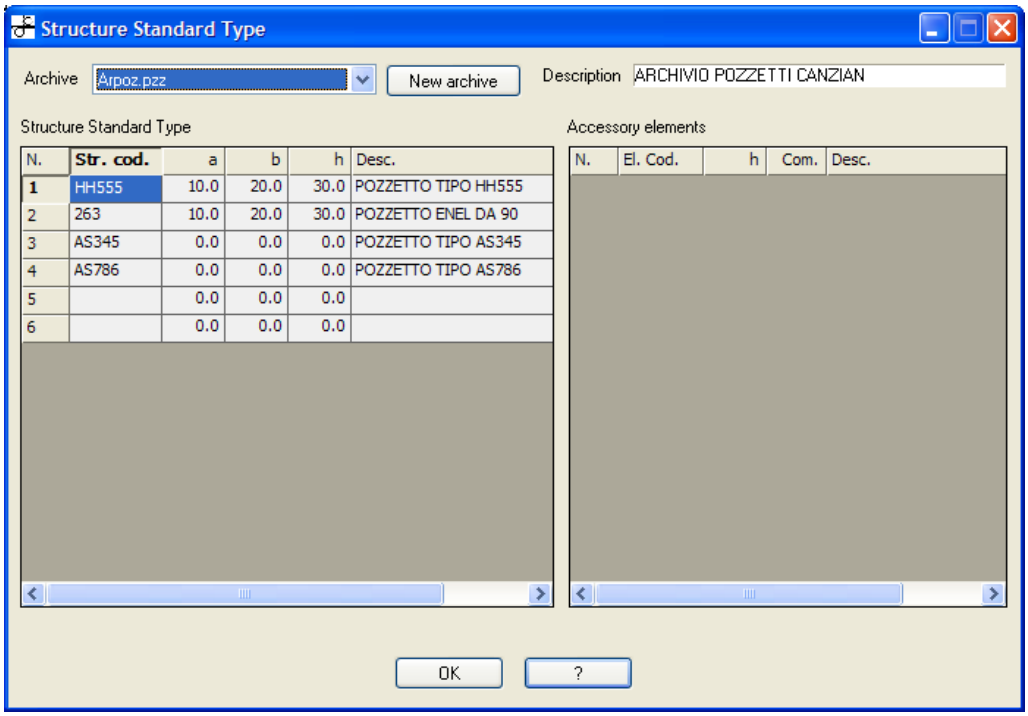
Column	*Description*
N.	Automatic progressive number
Name	Name of the structure
Code	Code of the structure
Chainage	Chainage
Partial	Partial Distance
Ground Elevation	Ground Elevation
Tangent	Tangent elevation
H	Structure height
Hp	Project height
Desc.	Description

14.8 Structures Management Command *(Arporet)*

This command allows you to create and/or modify the standard structure archive.

Format: *arporet*

When the command is activated a dialog box named **Structures Standard Type** opens and is displayed as follows:



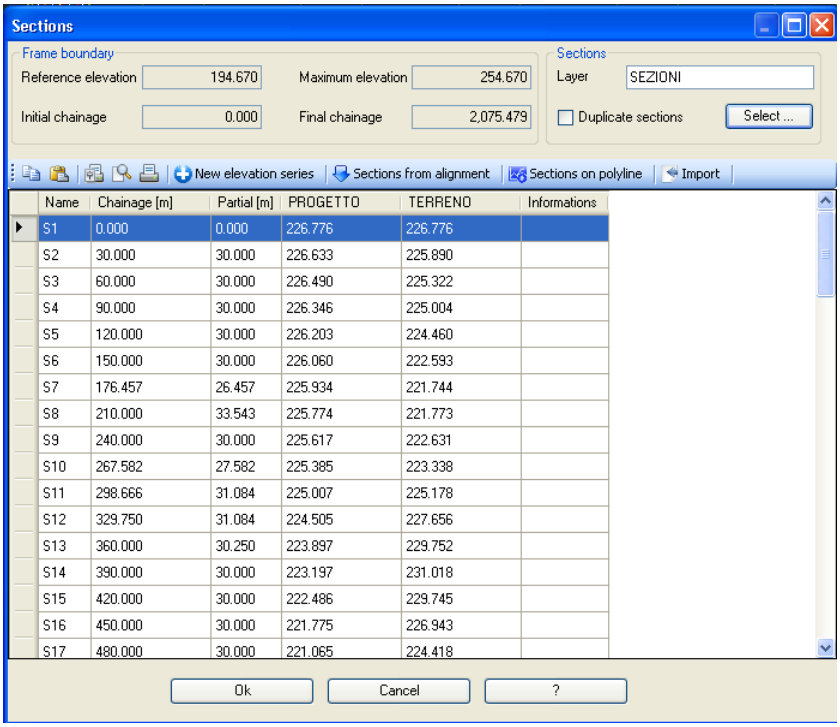
In the archive combo-box there are all the files **with extension .PZZ** (example MYARCHIVE:PZZ), which represent the standard structures archive, inserted.

14.9 Profile Sections Command (*cdprsez*)

The command allows inserting in a profile view the cross sections, already defined in planimetry or from new ones. So it allows calculating, in points corresponding to these sections, the elevation of existing polylines represented in the profile.

This command is not necessary to read the elevations in insertion of automatic sections. Infact that command will read the design elevations automatically and in continuous. The usage of this command is necessary to prepare the profile view (drawing of candles and elevations). The recalculation of a series of elevations and candles is dynamic.

Format: cdprsez



You will see the Sections dialog, structured as an excel sheet. In the table you can do operations like manual insertion and copy/paste, very useful in order to import/export in Microsoft Excel. The table can be printed directly from the dialog by the buttons "Page setting", "Print Preview" and "Print".
In the dialog, in right top position, there is the control "Layer", where by default you find the layer "CRSECTIONS". If the sections are already existing and you want to modify them, you can load them using the layer as filter and clicking on the button "Select…". You will obtain the message:

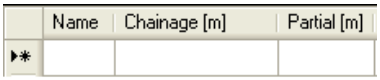
Select the section:

As we have seen in planimetric sections, it's possible to insert more section series on the same alignment: in order to create a new series of sections you can only insert the new name in the control "Layer". In this way the different section series will be separated following the containing layer.

14.8.1 Section insertion

The section insertion can be done in the following way:

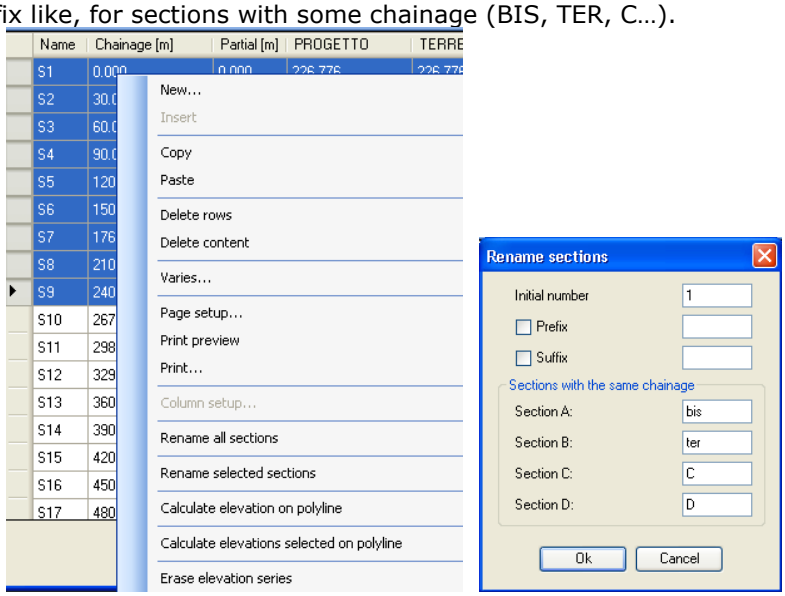
- **Manually**, by inserting chainage or partial value in the dedicated cells;
- With **selection from drawing.** Selecting a cell in "Chainage" column you will see the button "…" and clicking on it you can select on the drawing (on profile) the point where you want to insert the section.
- **With automatic insertion of sections already defined on the planimetric alignment,** click on the button "Sections from alignment". In this case, the layer name of sections, currently present in the "Layer" control, must be equal to the layer of sections on alignment. The associated alignment is linked only by the name; if doesn't exist any alignment with the same name of the profile, the program will request the



selection of an alignment to associate to the profile; this behavior is applied also if there are more alignments with the same name;

- **By automatic insertion on a polyline vertices** using the button "Sections on polyline".
- **Importing from an extern file,** with click on the button "Import". The requested data are the chainage and eventually the section name. The format of the ASCII file is user definable.

It's possible to rename a section modifying manually the single cell. It's possible to rename more sections selecting the cells to rename and clicking with right mouse button: in the pop-up dialog, selecting rename selected sections you will see the dialog in figure below, by which you can set the initial number of the first section and, eventually, a prefix/suffix like, for sections with some chainage (BIS, TER, C…).



14.8.2Elevation computing

The section elevations are organized by an elevation series. Every series is represented in table by a column with the name of the series itself. The elevation series by default are "TERRAIN" and "DESIGN". In order to add another elevation series, if you want to set elevations of walls, ditches, cable ducts…, click on the button "New elevation series": the program will request the name of the new series and then it will add the associated column in the table.

Then the elevations can be inserted modifying the single cells or can be calculated automatically on a polyline: after the selection of the cells in the column for elevations, associated to the sections to be labeled with elevations and clicking with right mouse button you will see a pop-up dialog where you can select "Calculate elevations selected on polyline". If you select "Calculate elevations on polyline" the program will calculate elevations of all sections. You will see the following message:

Select the polyline:

You should select the polyline where the program will calculate the elevations.

Name	Chainage [m]	Partial [m]	PROGETTO	TERRENO	WALL1	Informations
S1	0.000	0.000	226.776	226.776		
S2	30.000	30.000	226.633	225.890		
S3	60.000	30.000	226.490	225.322		
S4	90.000	30.000	226.346	225.004		
S5	120.000	30.000	226.203	224.460		
S6	150.000	30.000	226.060	222.593	222.615	
S7	176.457	26.457	225.934	221.744	222.061	
S8	210.000	33.543	225.774	221.773	222.206	
S9	240.000	30.000	225.617	222.631	223.160	
S10	267.582	27.582	225.385	223.338		
S11	298.666	31.084	225.007	225.178		
S12	329.750	31.084	224.505	227.656		

In every profile which you want to label with elevations (terrain profile, design profile, walls, ditches, etc.) you can have a corresponding elevation series which should be defined with its elevations singularly.

In every section you can associate many elevations (terrain, design, wall, ditch, etc.): in the section drawing (anonymous block) the different elevations will be drawn as points on layer CD-LQ-ELEVNAME where in place of "ELEVNAME" you will have terrain, design, wall, ditch, etc..
These points are necessary for a next Profile elevation labeling (command Quotapro) and for the automatic insertion of section frame in the red elevation labels of the Profile (design elevations) with the command Automatic Sections.

In the drawing, above the candle, you can see the section name. The name is shown correctly in the scaled view of the Profile. Execute, therefore, always the deformed View. Moreover these entities will be drawn on a layer SECTIONNAME-NP , where sectionname is the layer containing the Sections in the drawing.

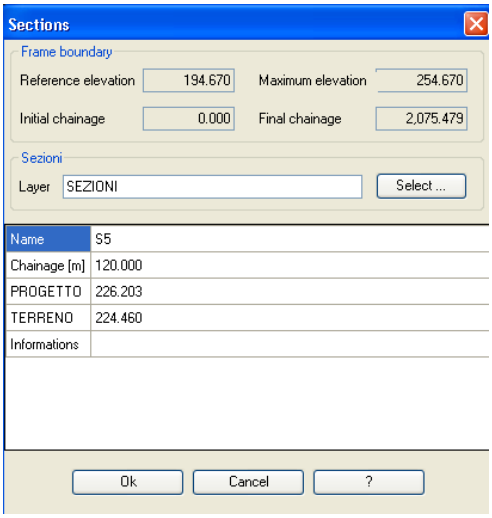
Quick Strade and Surf Solutions, CAD&Pillar.
The Sections are drawn automatically on the layer SECTIONS; the selection is automatic; it's also possible to insert only two elevations: design and terrain.

14.8.3Single Section command (*cdprsez1*)

The command *Single Section* inserts a section in a profile or modifies an existing section. It's useful if you want to add an element, in a specific position, to an elevation series, or you want to modify a section in a faster way than with the command "Profile Sections".

Format*:* *cdprsez1*
Select a section to be modified
(ESC to insert a new section)...

Selecting an existing section you will see the dialog in figure, where you can modify all the section features (layer, name, chainage, elevation).
Instead if you select to insert a new section, the program will request to select the insertion point, in the drawing, in the profile view and then you will see the dialog: the section will have only the chainage, the other features should be defined.
The elevations can be inserted manually in the cell or selecting the button "…", which offers two options in order to calculate the elevation (from point or from polyline), selecting on the command line:
Select a point (ESC to select a polyline):



Quick Strade and Surf Solutions, CAD&Pillar.
The Sections are drawn automatically on the layer SECTIONS; the selection is automatic; it's also possible to insert only two elevations: design and terrain.

14.10 Insert Single Elevation (*qs1*)

The command inserts an elevation symbol (triangle + elevation) in a point selected by using the mouse, within the profile frame currently active.

Format: *qs1*

14.11 Labels on profile (*cdlabel*)

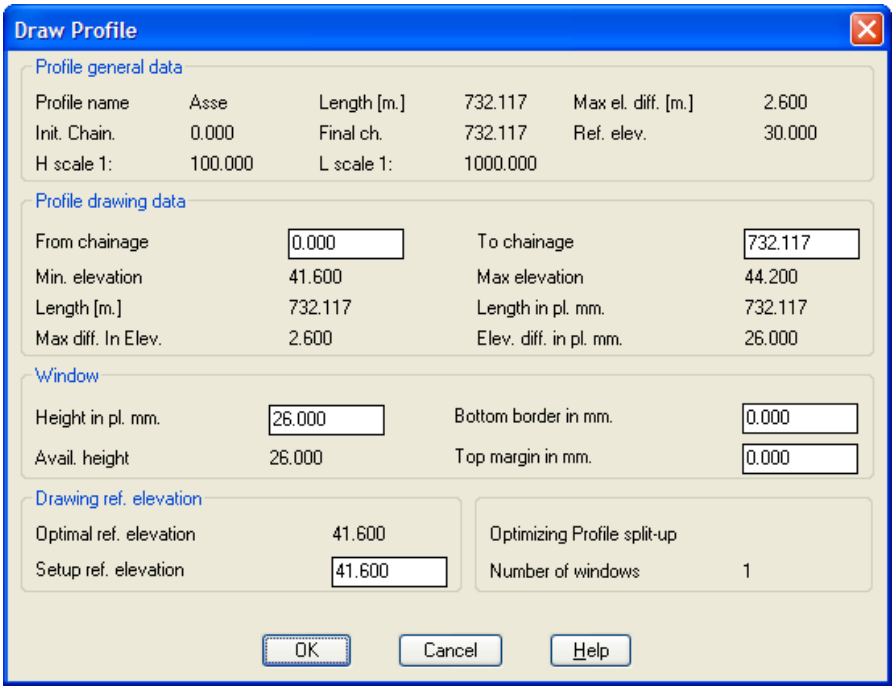
Format: *cdlabel*

See in the chapter Alignments the paragraph Labels on Alignment.

14.12 Page up Profile command (*Disprof*)

This command creates one or more windows on the paper space, inside which the Profile is outlined in scale, ready to be labelled and plotted.
Format: *Disprof*

The **Draw Profile** dialog appears.



All data concerning the drawing are given in the "*Profile general data*" section.
The **chainage range** to be paged up can be set up in the "*Profile drawing data*" section: when modifying such interval, all data (minimum and maximum elevations, length, etc.) will be updated, enabling to evaluate the size of the drawing to be plotted.

The **maximum height of the drawing** (in plotted mm.) and the lower and upper margins can be set up in the "Window" section of the dialog.

The optimum **reference elevation** will be displayed in the "*Drawing reference elevation*" section. Alternatively, the reference elevation can be manually set up in order to have the Profile centered on the sheet.

Should the height be insufficient to contain the Profile, the splitting up into several windows will be optimized.

Pay attention to the window height in plotted mm. Often when drawing has an extremely flat Profiles a very short windows may be given (by default, the window is calculated to fit the profile). In such cases AutoCAD is not able to create a window on the paper space having such a high width/height ratio. This value has therefore to be modified, and taken to at least 100 plotted mm.

The windows generated on the paper space can be modified with the common AutoCAD commands or by handling the 'grips'.

14.13 Profile Labelling Command (*quotapro*)

This command allows you to perform the Profile texturing within the AutoCAD paper space. The alignment linked to the Profile to have labelled (for planimetric course labelling) is individuated because the name is the same.

Format: *Quotapro*
Select objects:

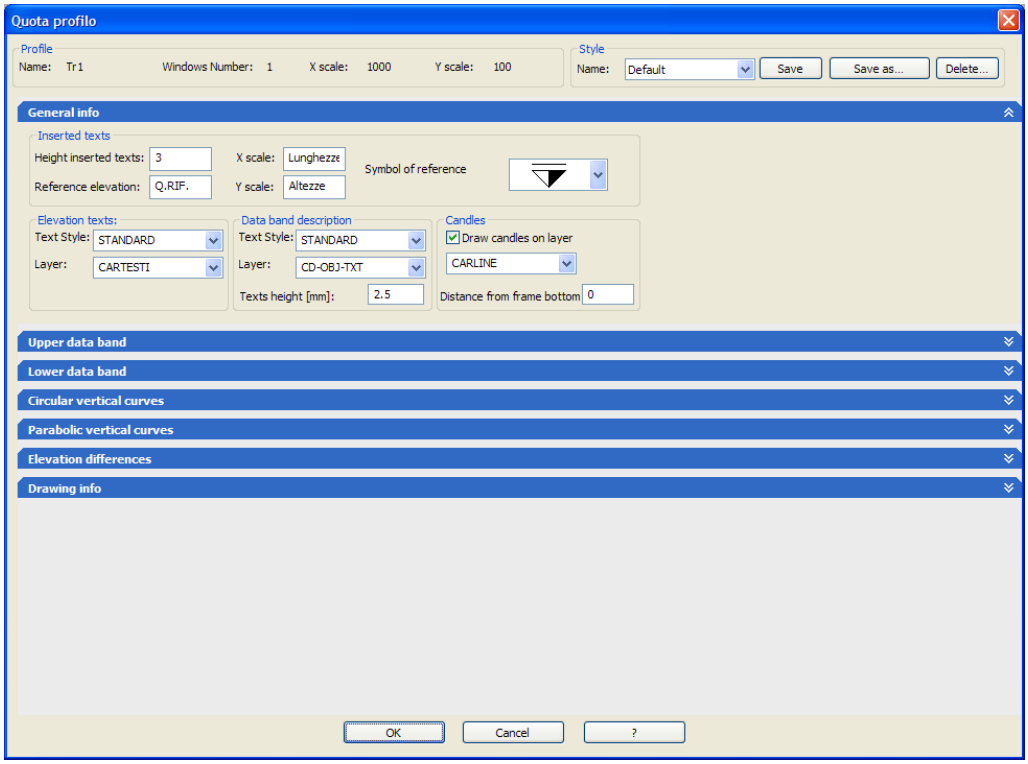
After having selected the window created with the *Page up Profile* command the **Dimension Profile** dialog box opens up.

The "*Profile*" frame displays the name of the selected profile, the number of selected windows and the X and Y scales.
In the "*Style*" frame it is possible to select a style from those listed in the drop-down menu. To create a new style, click the *Save* button after having set all the appropriate parameters. The style file is characterized by a .prf extension. These files are stored in the CD-C20xx/PRF folder, and can be passed on to other users.
The dialog box is subdivided into different sections:

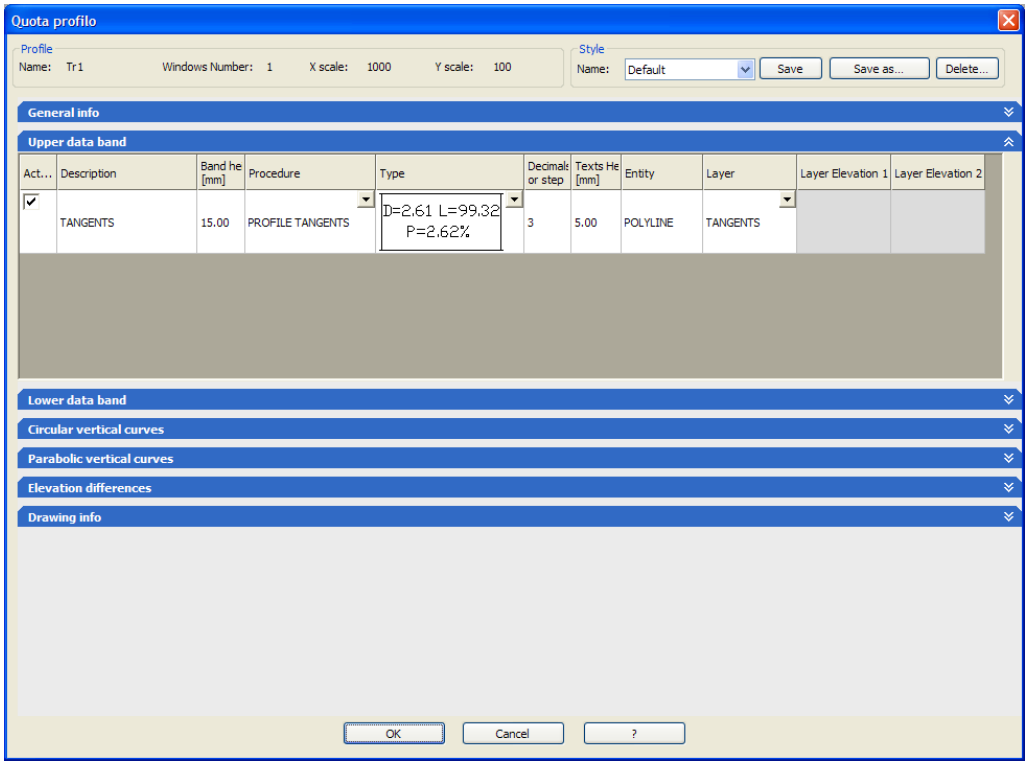
General Information
Upper Data Labels
Lower Data Labels
Circular Vertical Curves
Parabolic Vertical Curves
Elevation Differences
Extra Information

14.12.1 General Information

This section contains all the general settings: text size (in mm of paper space), the reference elevation symbol, the extra strings of text, data labels styles and text, the option to have extension lines drawn, etc.



14.12.2 Upper Data Labels



To add a new data label click your mouse right button on the grid area and choose "*Add Data Label*" from the context menu. Use the same menu to delete a label or modify its position on the drawing. The settings are organised by columns:

- *Activate*. By ticking the check-box the label is drawn.
- *Description*. Type the text that is to be displayed as heading of the data label.
- *Height of the data label*. Label height in plotted mm.
- *Procedure*. Answer to the question "What type of data do I want to have displayed?". Partial distances, chainages, tangents, hectometrics, planimetric course, road edges development… According to the process you choose to follow, the software requires that you set several different settings. The fields highlighted in grey contain data that are not relevant for the chosen process. The text highlighted in red means that there is a missing data and therefore the process cannot be performed. The available procedures are listed in the following table.

Process	**Description**	**Entity Info**
PARTIAL DIST	partial distances	sections defined in Profile Sections
PART PROG DIST	progressive and partial distances between polyline vertices or Sections	Idem
PROGRESSIVE DIST	progressive distance between polyline vertices or Sections	Idem
ELEVATIONS	series of elevations	Idem
SECTION NAMES	section names	Idem
DESCRIPTIONS	descriptions extracted from the information linked to the polyline vertices or from the sections	information field of 2D/3D polylines linked to the polylines
HECTOMETRICS	representation of hectometric distances	Automatic
PROFILE TANGENTS	data concerning the tangents extracted from the polyline	Polyline

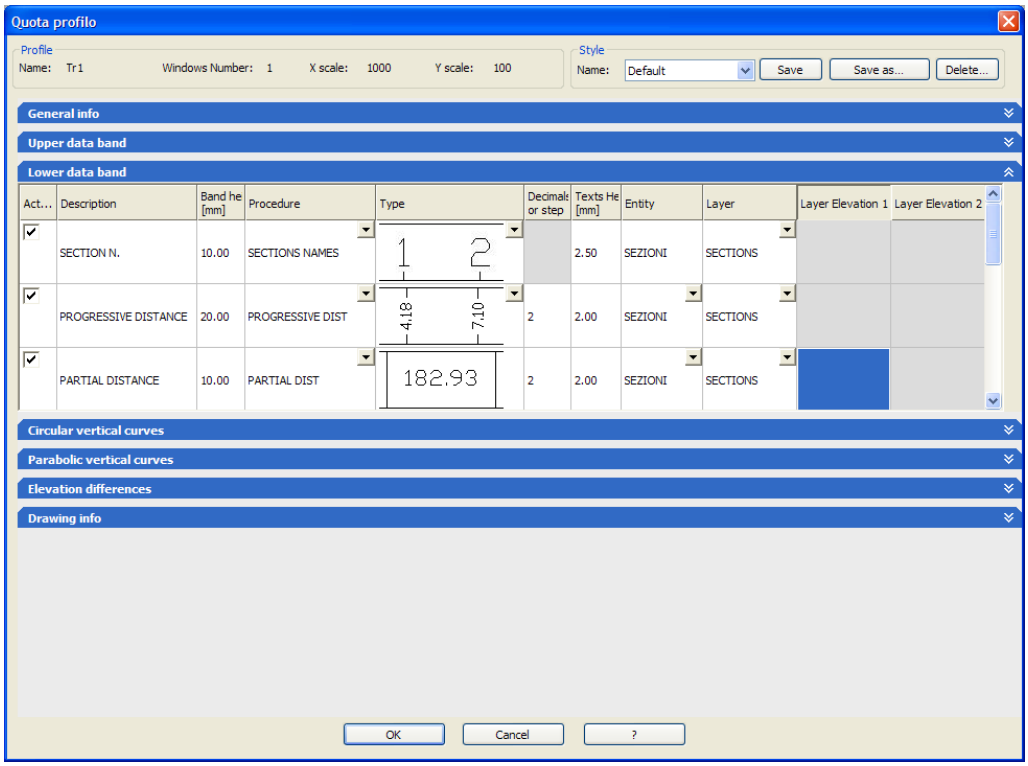
PROFILE TANGENTS REMAINING	As for the procedure profile tangents but in the set profile elevation it is excluded if is present vertical curve	Polyline (work if the polyline has a vertical curve)
ELEVATION DIFF	elevation differences between polylines or between Sections elevations	2 Polylines
HORIZONTAL GEOM	horizontal geometry of the alignment linked to the Profile	
EDGE GEOM	road edge geometry of the Axis linked to the Profile; it can be used if a rotation computation has been performed on the alignment	Calculate rotations
SPEED DIAGR	speed diagram traced as provided for by the Italian Ministerial Decree 2001	Speed diagram
NODES	nodes of a pressure network	
PIPES	pipes of a pressure network	
STRUCTURES	structures	

The different labelling procedures of a data label get the data from several entities that are specified in the homonymous column.

- *Type (of representation)*. Different graphical options to represent the data.
- *Decimals*. For numbers.
- *Text Size*.
- *Entity*. Is the source of the data that are to be displayed in the data label. It depends on the process you choose to apply and it is indicated in the last column of the table shown above.
- For example, a data column for partial distances picks out a series of elevations defined by the *Profile Section* command and therefore the entity to be specified in the dedicated column is "Sections". The same is for the chainages, terrain elevations, project and elevation differences.
- The "hectometrics" band do not need any entity.
- The speed diagram reads what has been calculated with the homonymous command.
- In a tangents data label instead, the entity is the Polyline (the tangent). You need to specify the layer on which the polyline is drawn, choosing among the listed ones and insert it in the Layer column.
- As for the elevation differences, you need to indicate the layer to which the first polyline belongs "*Elevation 1 Layer*" and the second "*Elevation 2 Layer*".

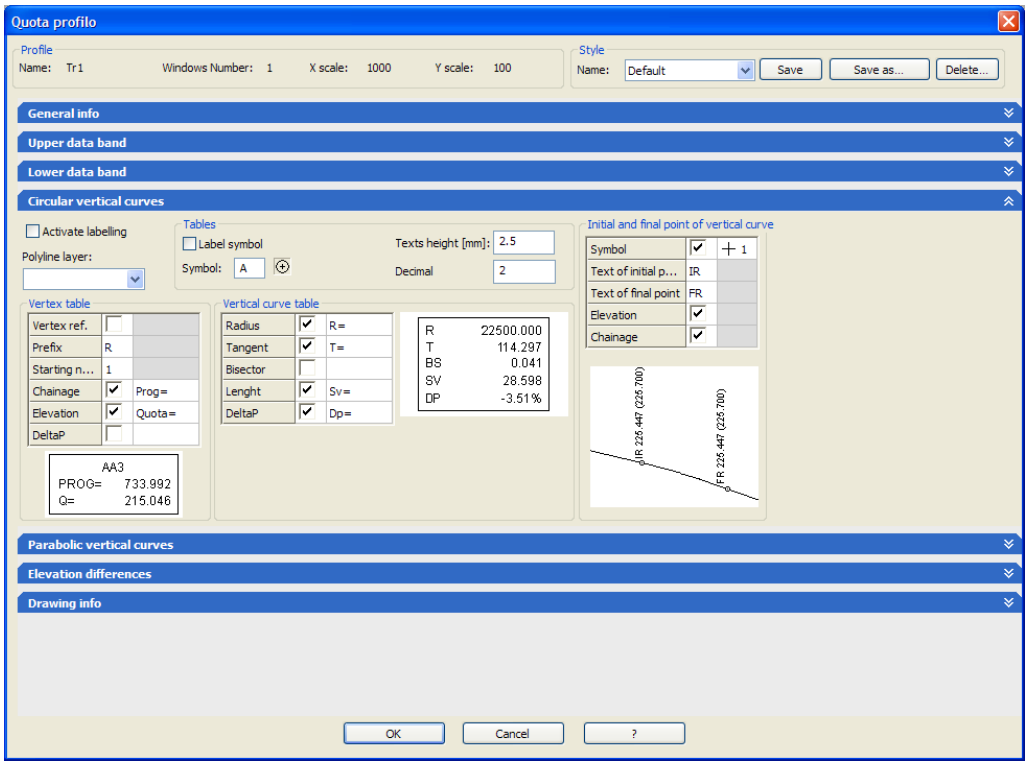
14.12.3 Lower Data Labels

The same considerations made for the Upper Data Labels are valid for the Lower Data Labels as well.



14.12.4 Circular Vertical Curves

The circular vertical curves are labelled by ticking the "*Activate Labelling*" item. Choose the layer on which the profile polyline to be labelled is drawn from the drop-down menu that opens up.
You can choose the symbol you want to use, the text size and the number of decimals, from the "*Tables*" frame.



In the *Vertex Table* frame you can choose the parameters to be indicated in correspondence of the junctions. By enabling the *Ref. Vertex* box you have a table containing the junction vertex name added. The name can contain a prefix (in the example "ver") and a progressive number. In the same table. In the same table it is also possible to add the chainage, the elevation and the gradient difference. In order to have the labelling of the chainage perform you need to tick the *Chainage* item and specify the text you want displayed in the adjacent field (in the example: *Chain=*). In the same way, to add the elevation label, you need to tick the *Elevation* item and type in the text (for example: *Elevation=).* The same, again, for the gradient difference "*DeltaP*".
In the *Vertex Table* frame it is possible to tick the items that you want to have displayed in a new table just below the previous one, specifying the prefixes (or texts) that you want to have displayed before the numeric value. The available parameters are the following:

- Radius (value in m of the circular junction radius)
- Tangent (value of the tangent)
- Bisecting line (value of the junction bisecting line)
- Development (calculated as a horizontal projection)
- DeltaP (gradient difference between the entrance and exit tangent)

In the *Initial and final point of vertical curve* frame, following the same system, you can tick the items relative to the tangent points specifying the prefixes to be used. The parameters are the following:

- Symbol (choosen among the available symbols)
- Text strings at curve beginning and end
- Elevation (of the tangent point)
- Chianage (of the tangent point)

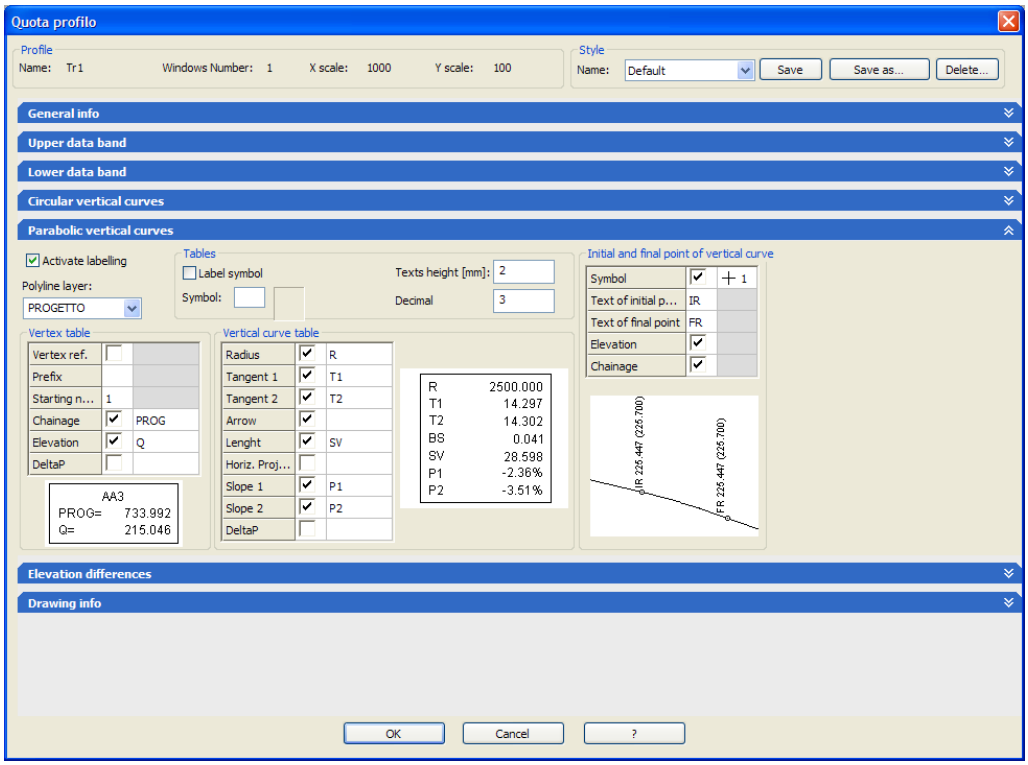
14.12.5 Parabolic Vertical Curves

The labelling of parabolic curves defers from the circular one, for several parameters:

Vertical Curve Table:

- Radius (value in m of the circular junction radius)

- Tangent 1 and 2
- Arrow
- Development (calculated as a horizontal projection)
- Horizontal Projection
- Gradient 1 and 2
- DeltaP (gradient difference between the entrance and exit tangent)



14.12.6 Elevation Differences

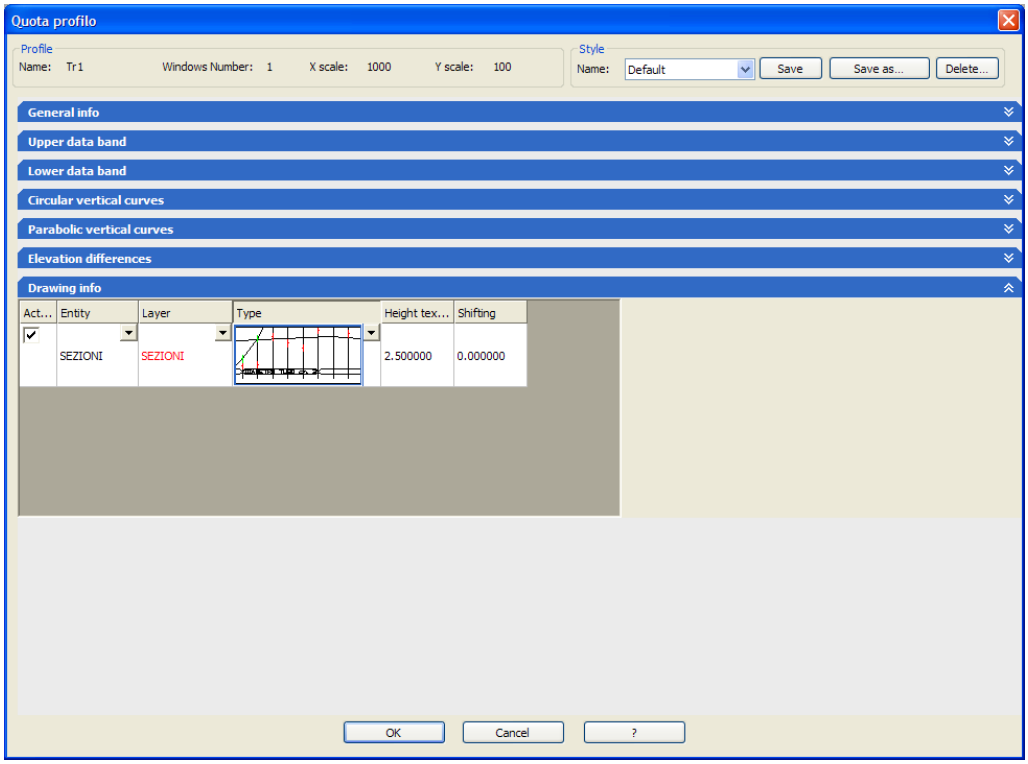
To label the elevation differences between two profiles enable the data label in the *Elevation Differences* section:

- in the *Entity* column specify from which type of entity extract the data (sections or polylines);
- specify the layer on which the sections in the Section Layer column are drawn (layer on which the extension lines are drawn with the *Profile Section* command);
- specify the layer of the first and second polyline in the Elevation 1 and 2 Layer fields (referring to the labelling in *Profile Section*);
- specify the text size (in plotted mm);
- choose the position of the elevation difference among those available;
- the distance from the bottom (in plotted mm);
- the number of decimals.

14.12.7 Extra Information

By enabling the data label concerning the information on the drawing, you need to specify the entity from which extract the data:

- *Polyline*: the information used is extracted from the information linked to the polyline vertices with the *2D Polyline* command.
- *Sections*: the information is to be inserted using the item *Description* of the *Profile Section* command.



Specify the text size (in plotted mm) and the labelling deviation from the selected entity and the type of labelling:

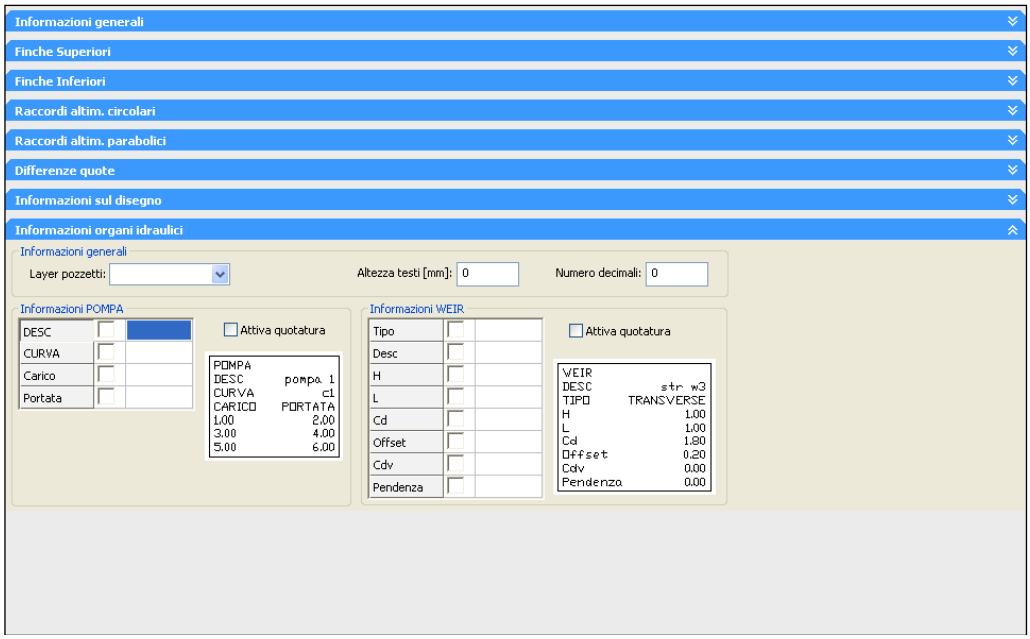
- type 1: vertical information on the entity at the bottom of the frame;
- type 2: vertical information on the entity in the middle of the frame;
- type 3: horizontal information between the entities to be labelled.

The Polylines or Sections from which the information is extracted are specified according to the layer they are drawn on.

The mechanism used to define the labelling style allows you to fully customise entities and data labels. Nevertheless, it is advisable to follow a standard "operating logic", always using the same layer names for polylines, sections and elevations, so as to avoid having to change the labelling styles for every new work.

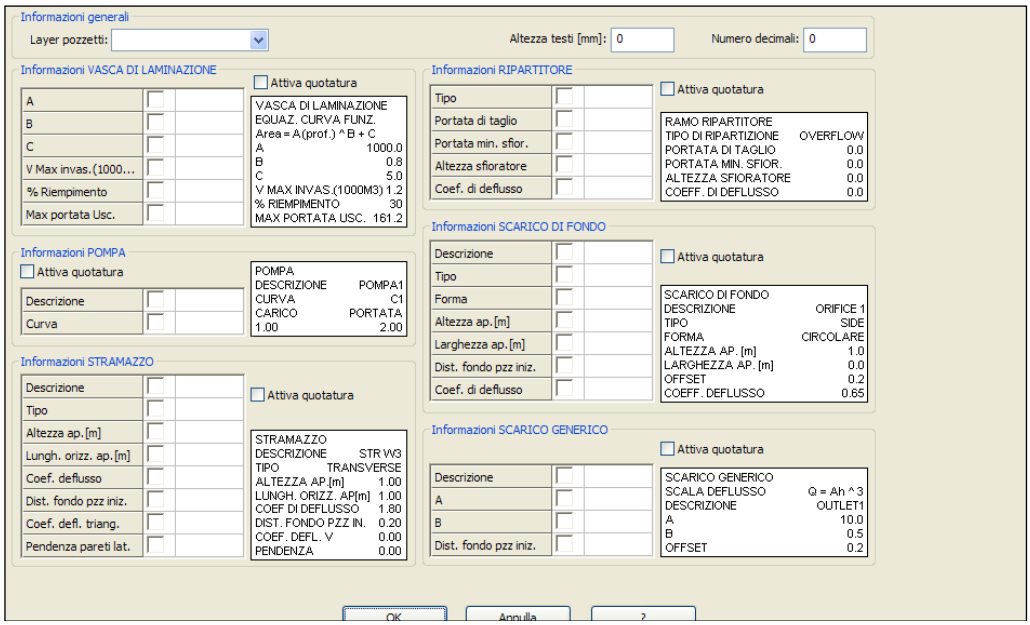
Information Hydraulic Structures

By activating that data band it will be possible to define the parameters to be visualized into tables about pump and weir.



Information organs hydraulic

By activating information band for hydraulic organs, you can define the properties, that you can view as tables for the sewerage hydraulic organs.



14.14 Paper Space → Model Space Command (*Propp*)

This command allows to export the labeled profile created by user in paper space into a new .dwg file or to create a copy in the model space.

Format: *Propp*

Select the window of the profile to export by clicking on the frame in the page space.
The command will generate new entities that duplicate the ones in the window (project profile polyline, ground profile polyline, etc.) that are drawn on the *PROJECTION-originallayername*: the name of the layer will maintain the connection with the name of the original entity.

In this way it is possible to export the whole dimensioned longitudinal profile to a new .dwg file using the copy-paste method; the profile can be supplied on a file to third parties without the original entities (profile frame, section on the profile, profile polylines etc.).
Still using the copy and paste method, the longitudinal profile can be in the model space of the same file.

The command has an even more general function: in fact, it can be used to transform the visible entities of any window of the page space into vectorial entities.

The command can be used on more than one window at a time.
While the command is being performed the visualization will switch between model space and page space as many time as the number of selected windows.

14.15 Import LandXML command (*cdalimp*)

This command allows to import an alignment and its profile (road or railway one) using the landxml ver. 1.2 file exchange format. Please visit www.landxml.org. or contact DIGICORP Ingegneria Srl to get more information.

Format: *cdalimp*

14.16 Export LandXML command (*cdalexp*)

This command allows to export an alignment and its profile (road or railway one) using the landxml ver. 1.2 file exchange format. Please visit www.landxml.org. or contact DIGICORP Ingegneria Srl to get more information.

Format: *cdalexp*

The user must select all the profiles he wants to export. An automatic zoom on the profile view helps to select the polylines.

14.17 Railway Profile Control Menu

14.16.1 Export Profile -> Truck (*profile*)

This command allows to export a rail profile to a rail survey truck. Please visit www.landxml.org. or contact DIGICORP Ingegneria Srl to get more information.

14.16.2 Altimetric Shiftings command (corralt)

This command gives all the elevation difference between a design and a surveyed profile. Select the two polylines: they have to stay into the profile view:

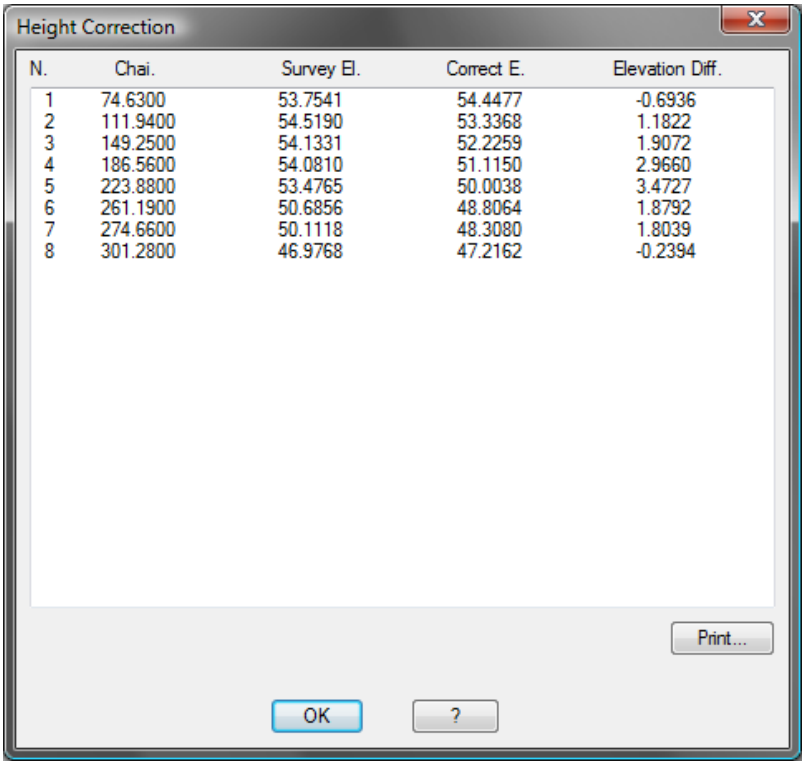
Select the design polyline:

Select the existing polyline:

if you select a wrong entity an error message will appear.

The selected entity is not valid:

A dialog appears containing design and survey elevations and their difference.



Press Print to create an external file.

14.18 Check road profile menu

14.17.1 Analysis of Slow Vehicle Carriage (Cdcvl)

The command is used to make valuations from DM 05/11/2001 in § 4.2 on the appropriateness of introducing an additional lane for slow vehicles. In particular we determined:
a) the heavy vehicles speed, which must not be reduced to below 50% of the cars speed;
b) the service level, which must not become unacceptable for the given type of road.

Format: *cdcvl*

Compare the dialog "slow vehicles lane"; notes that there are two main tabs: in the first (Figure 12 44) is calculated the passenger cars speed and heavy vehicles speed in function of the profile project; in the second (Figure 12 44) determined the flows associated with service levels depending on the context (flat, undulated, mountainous), the lanes width and shoulders, the percentage of heavy vehicles, etc.. following the procedure Highway Capacity Manual.

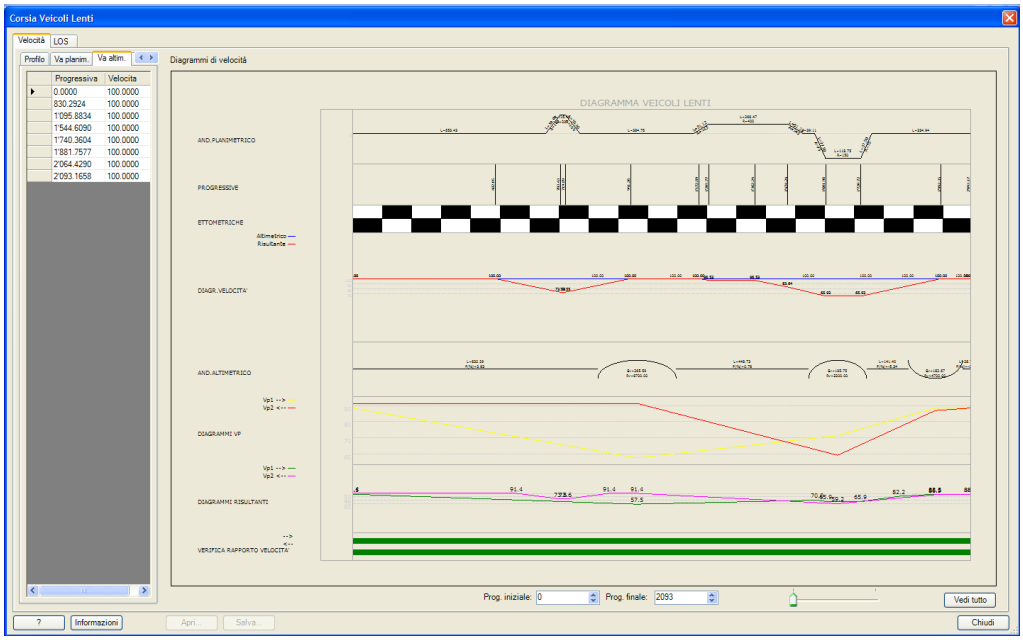


Figura 12-3 – Dialogue slow vehicles lane – Speed tab

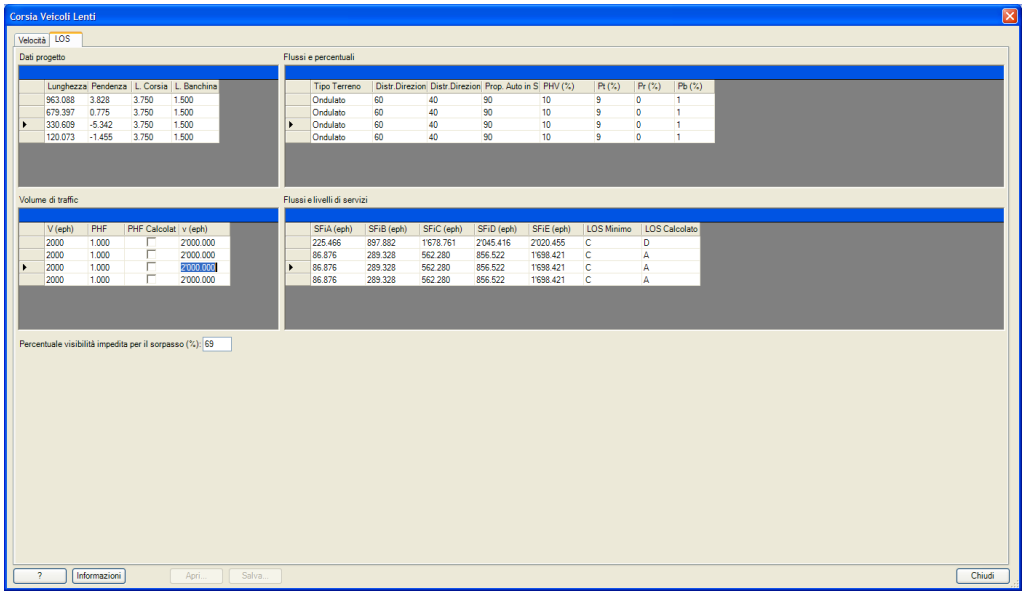


Figura 12-4 – Dialogue slow vehicles lane – LOS tab

Speed Tab

In the "*Speed*" Tab there are the following sub-tabs:

Profile. Shows the tangents slope and their initial chainage;

Horiz. Va. Shows the speed derived from the speed diagram in function of planimetric axis

Vert. Va. In *Vert. Va* shows the cars speed in relation to the tangents slope, according to the table from the Regulation (you switch between speed of 95 Km/h to 6% slope, at speeds of 70 km / h on slopes of 10%) for lower slopes of 6% apply the same speed established by the speed diagram.

VP1. Here are calculated the heavy vehicles speed in direction agree with alignment, and these speeds are derived from the performance diagram shown in Appendix I of HCM depending on the length and tangents slope.

VP2. Here are valued using the same criterion the heavy vehicles speed in the direction opposite to the alignment.

VP1ris. Shows the resulting speed in agree direction to the alignment, measured as the minimum between VP1 and Vert. Va, or as the lowest speed that can be held in function of elevation axis respectively by heavy vehicles or cars.

VP2ris.. Shows the speed measured with the same measure, but in the opposite direction to the alignment.

The diagrams present on the right represent the Horizontal geometry, the chainages, the hectometres, the speed diagram (ie cars speed), the vertical geometry, heavy vehicles speed diagrams (one in each direction), resulting heavy vehicles speed diagrams , and two color bars in green or red depending of the comparison between heavy vehicles speed and cars speed. Each section is highlighted in red where it occurs that the resulting heavy vehicles speed is less than 50% of the cars speed . In this case should be taken into account the introduction of an additional slow vehicles lane, with the geometry provided by the Regulation.

LOS Tab

LOS tab is divided into 4 panels: *Design data, flows and percentages, traffic volume, flow and service levels.*

- Design data: the alignment is divided into many portions as there are tangents into profile project; for each of them shows the length, slope, lanes width and shoulders width.

- Flows and Percentages: it is identifying the type of terrain (flat, undulating, mountainous), the distribution of flows according to the direction (50/50, 60/40, etc..), the percentage of cars in uphill flow, the percentage of heavy vehicles on total flow (PHV%), the percentage of trucks (% Pt), the percentage of tourist vehicles (Pr%), the percentage of transport vehicles public (% Pb).

- Traffic volume: it is specifies two-way traffic flow observed (V) expressed in equivalent passenger cars per hour, peak hour factor (PHF), can be activated the calculated peak hour factor (PHF calculated), thus arriving at the vehicular flow calculation (v).

- Flow and Service Level: there are listed for each section flows associated with different service levels (SFiA, SFiB, ..., SFiE); also indicated the minimum service level associated with the DM 05/11/2001 on type of road (minimum LOS) and service level (LOS calculated) determined by comparing traffic flow (v) and flows on the service levels (SFi). In the case of tangents with longitudinal slope greater than 3% and longer than ½ mi (804.7 m) SFi values are calculated automatically with the "special procedures" provided HCM.

Comparing the service level calculated with the minimum service level, the designer can then evaluate the opportunity to introduce an extra slow vehicles lane.

14.19 Polyline -> Model command (*Pmod*)

This command creates a 3D polyline on the model, developed from a 2D polyline selected inside the Profile frame.
The Alignment is recognized by name, otherwise it must be selected.
The command works properly only on Alignments with no curves.

Format: *Pmod*
Select the polyline within the frame:

The program checks that the Profiles frame be linked to an Alignment, otherwise it displays the following message:
No axis is linked to the Profiles frame

and asks to select the Alignment on which the 3D polyline will be developed.
The 3D polyline will be drawn on the layer named CD-3D*_2Dpolylinelayername*.

14.20 Recalculate Profiles from Model (*Ricalcprof*)

The command allows to update the profile calculated from model.