Plateia by CGS-labs

Reconstructions

Tutorial/Workflow procedure

CGS SOFTWARE

CGS Labs d.o.o.

Brnčičeva ulica 13

1000 Ljubljana

Reconstructions Tutorial

Title: **Reconstructions Tutorial**

Document date: 15. 06. 2020

Version: 3.0.

Printing: CGS Labs d.o.o.

T: +386 1 235 06 00

E: info@cgs-labs.com

Internet: www.cgs-labs.com

Table of contents

INTRODUCTION

Street reconstruction generally includes the removal of all existing asphalt surfacing and excavation of the road subgrade materials. The road is rebuilt from the button-up, with new or reclaimed aggregate base and at least two layers of new asphalt surfacing. In the following procedure is represent how to design the road`s reconstruction using Plateia software.

1. Preparing Survey Data

Open the dwg file that contains point`s data and follow the steps that are described below. The commands in chapter Surface will guide you throw the operations to create appropriate input data that are relevant for the further processing. In case you already have the file of standard type (*XYZ*) and it contains also the data regarding the connections among the points, skip to chapter 1.5. *Input Points from file* and proceed following the tutorial from there.

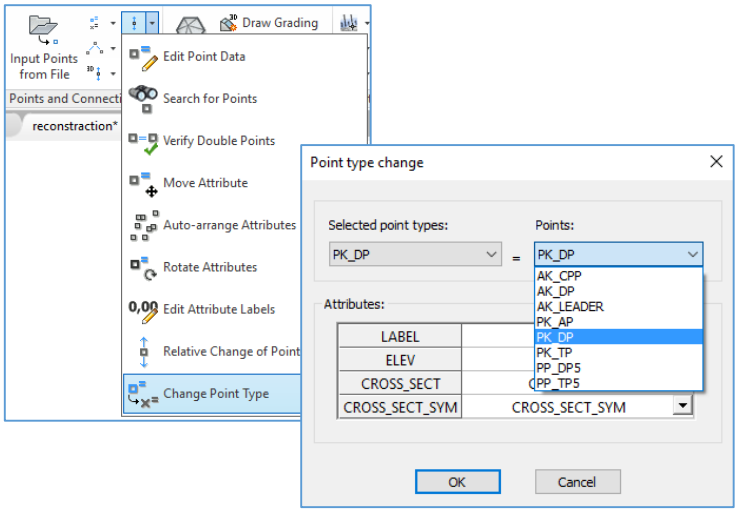
1.1. Change Point Type

1. Start with Utility Ribbon Panel.

2. Click on Change Point Type command and select the points in the drawing.

3. After pressing Enter, the **Point type change** dialog box opens.

4. On the left, there is a list from which you can select a point type into which you want to convert a selected point group. You can assign an appropriate attribute of an existing point for each new point. The existing point attributes can be selected from the pull-down list.

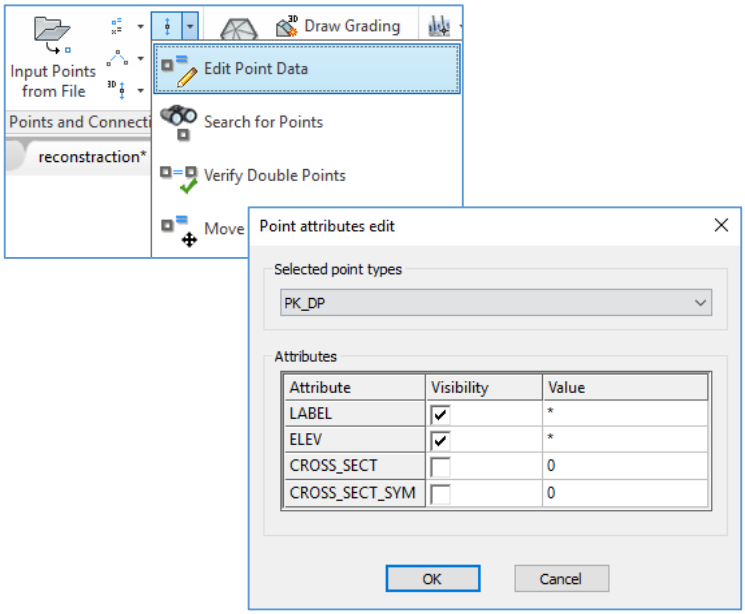


1.2.Edit Point Data

1. Click on Edit Point Data command.

2. Select all the points in the drawing which attribute you would like to change, and press *Enter.*

3. The *Point attributes edit* dialog box opens where you can change attribute values and decide whether they will be visible or not. After the point type selection is done, corresponding attributes automatically change.



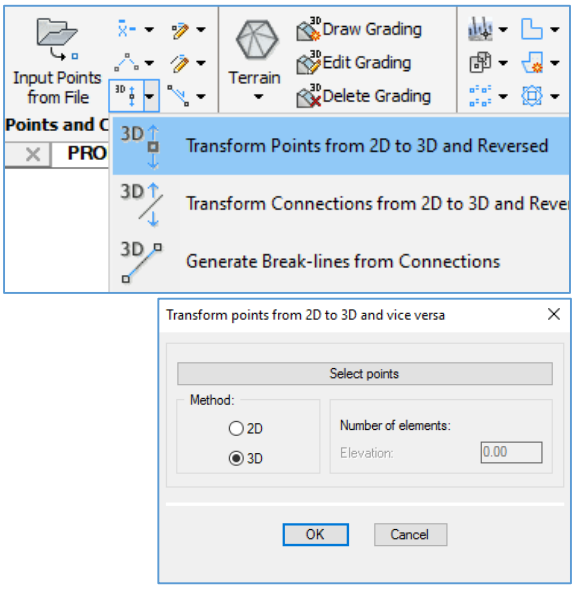
1.3.Transform 2D Points to 3D Points

1. Select the Transform points from 2D to 3D and Reversed command.

2. The *Transform points from 2D to 3D and vice versa* dialog box appears.

3. Press the button Select points and select the points you would like to transform.

4. Tick the *3D method* and press *OK*.



1.4.Extract X, Y, Z coordinates from Entities to an XYZ file

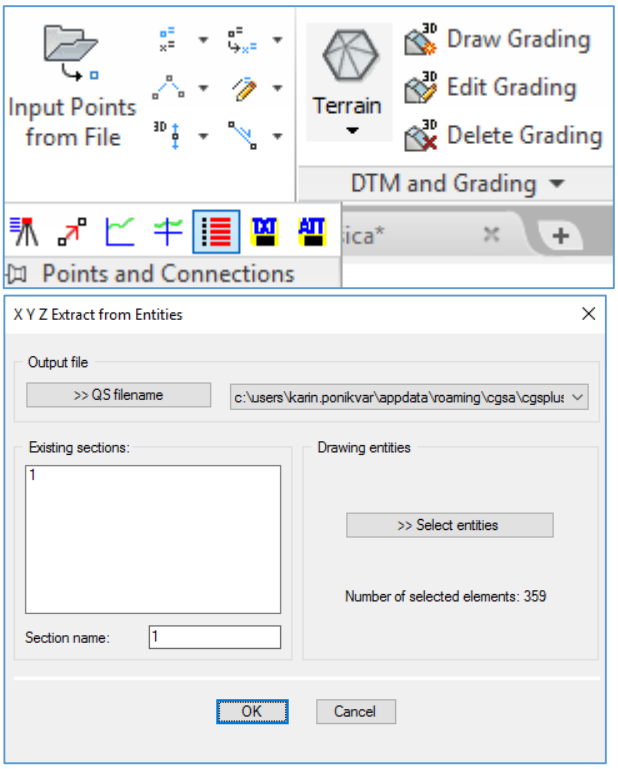
1. Select the XYZ Extract from Entities ->XYZ command.

2. After starting the command the following dialog box opens.

3. First press the button *Select entities* and select all the 3D AutoCAD entity points that you want to save as XYZ file.

4. Press the button *QS file name* to save the XYZ file. Define the file location.

5. Confirm with OK.



1.5.Input Points from File

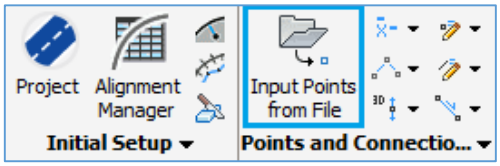
1. Press the command Input Points from File.

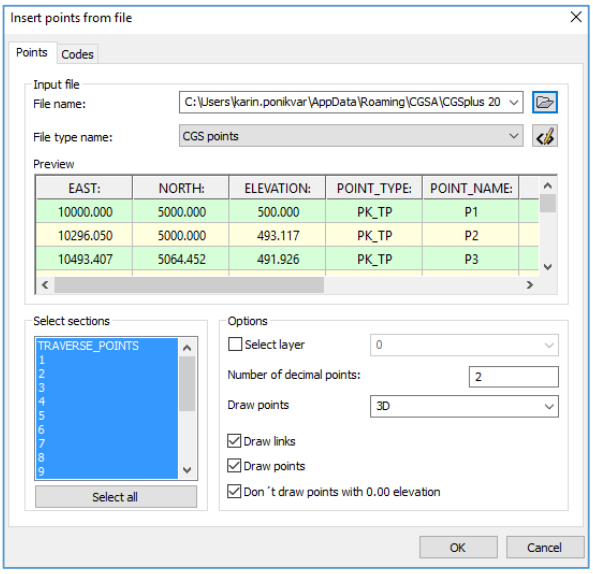
2. *Insert points from file* dialog box opens.

3. Press the icon  to open the folder, where you can select any file containing survey point data and connections data.

4. If the selected file was created using the Plateia program, then you need to define the appropriate code for the certain point using the *Codes* tab.

5. Press *OK* to insert points into the drawing.





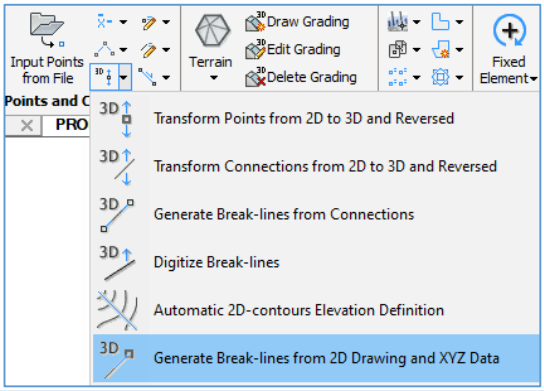
1.6.Generate Break-lines from 2D drawing and XYZ data

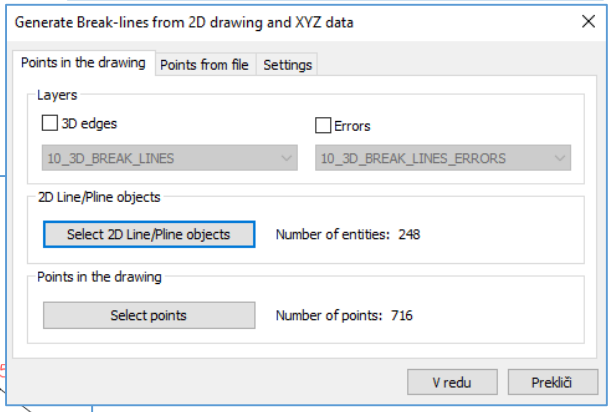
1. Connect the points that represent the edges of the road using the AutoCAD command PLINE.

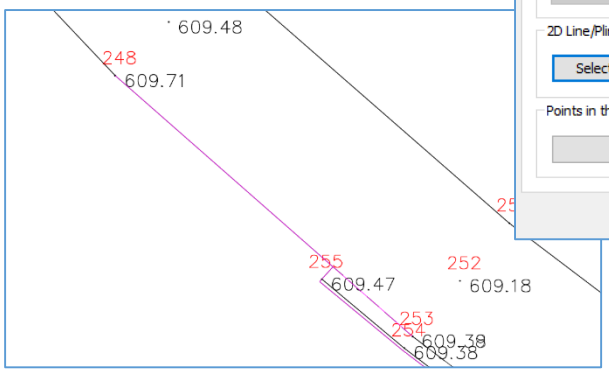
2. Select the Generate Break-lines from 2D drawing and XYZ data command.

3. Press the button *Select 2D Line/Pline objects*. Then choose the polylines that represent the road edges and press *Enter*.

4. If the line is not connected to the points, the error occurred and the lines are colored in a different color than the properly converted lines.

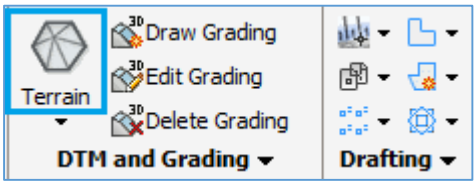




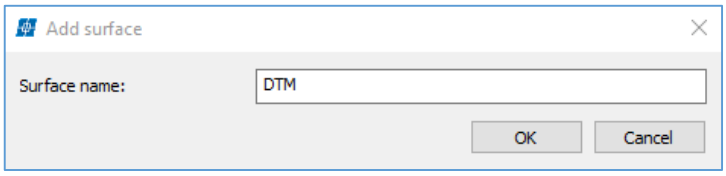


2. Surface

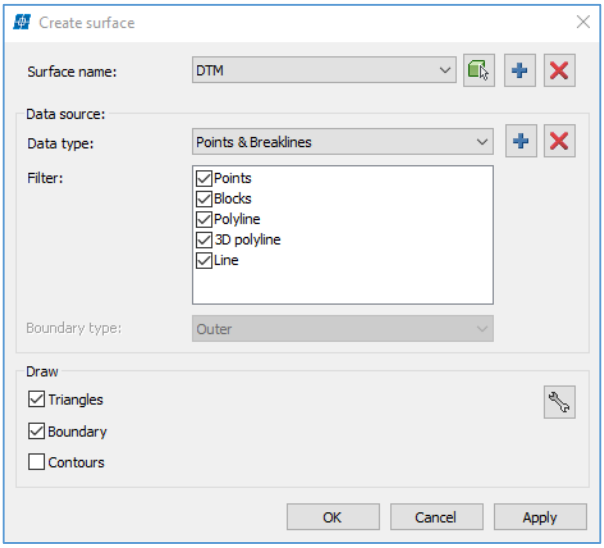
1. To create the digital terrain model select the Terrain command.



2. In *Add Surface* dialog box fill in the surface name and confirm with *OK*.

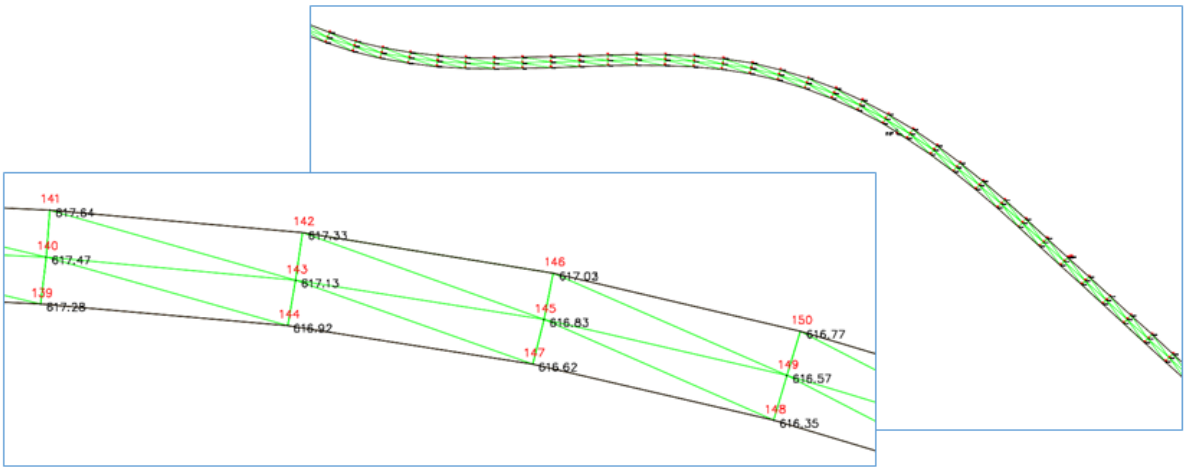


3. In Create surface dialog box, select a data-type from the drop-down menu and press the button  to add components. Select all points and polylines in the drawing.



4. Tick the *Triangles and Boundary* checkbox and press *OK.*

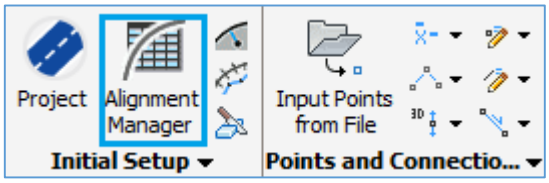
5. On the basis of the coordinates and breaklines – borders the command calculates a triangle net that is best fitted to the actual terrain condition.



3. Create Horizontal Alignment

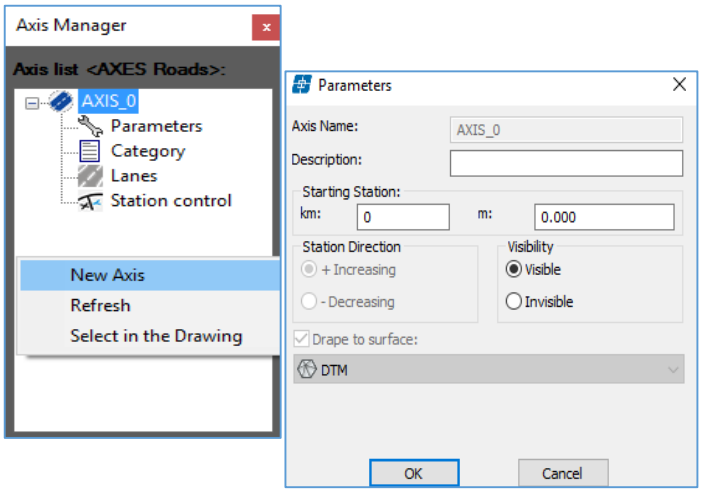
3.1.Alignment Manager

1. Click on Alignment Manager icon to define a new alignment name.



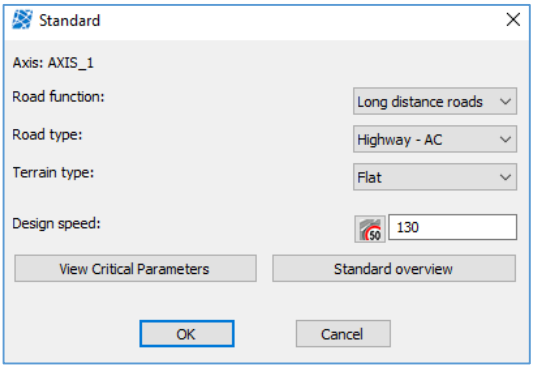
2. A dialog box with a list of alignments and its parameters opens up.

3. To create a new alignment right click in *Axis manager* dialog and select *New Axis*. Prior to designing of a new alignment, you need to define it by stating the initial properties (name, description, starting station, lanes type…) and define it as a current alignment.

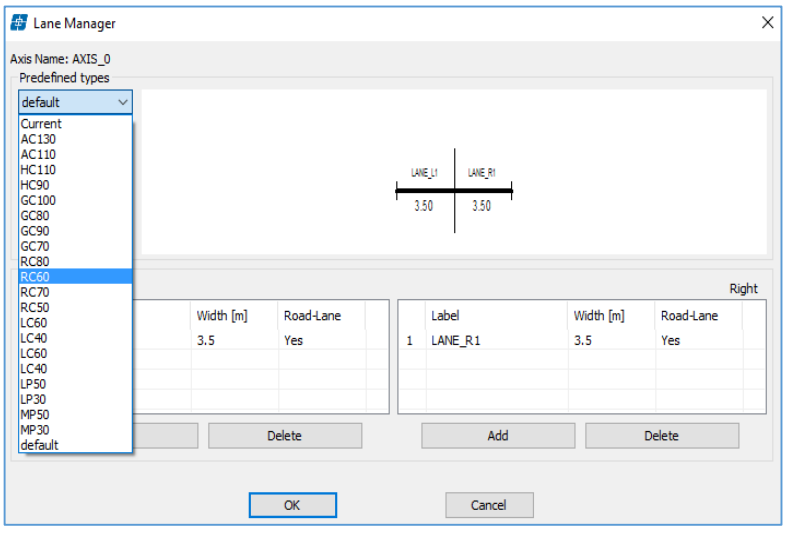


4. In the *Parameters* subsetting define new alignment name and starting station. Station direction on the alignment can increase or decrease. If you have more than one alignment, you can make a selected alignment invisible. This means that all layers related to a selected alignment can be automatically switched off.

5. Set the design speed for alignment in *Category* subsetting and define design speed influences on alignment design parameters.

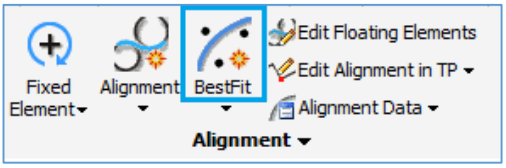


6. In *Lanes* subsetting define the characteristic lanes section. You can define lanes separately for left and right side according to the alignment. There are some predefined lane types available in the Predefined types window.



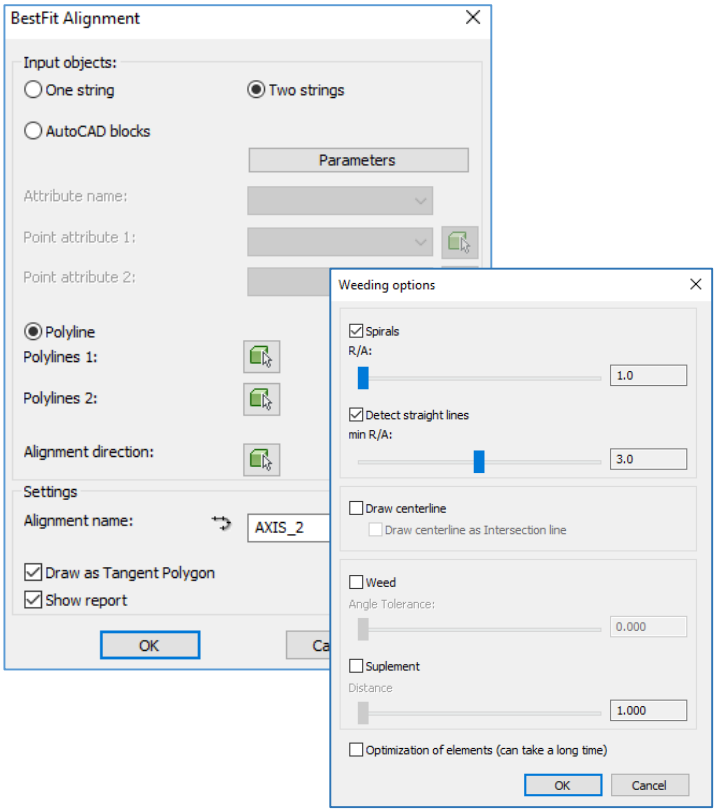
3.2.Create BestFit Analysis

1. The command Create BestFit Alignment on the basis of the given sequence of points or the polyline calculates and draws BestFit alignment that best fits the given elements.



2. After invoking the command the BestFit Alignment dialog box appears.

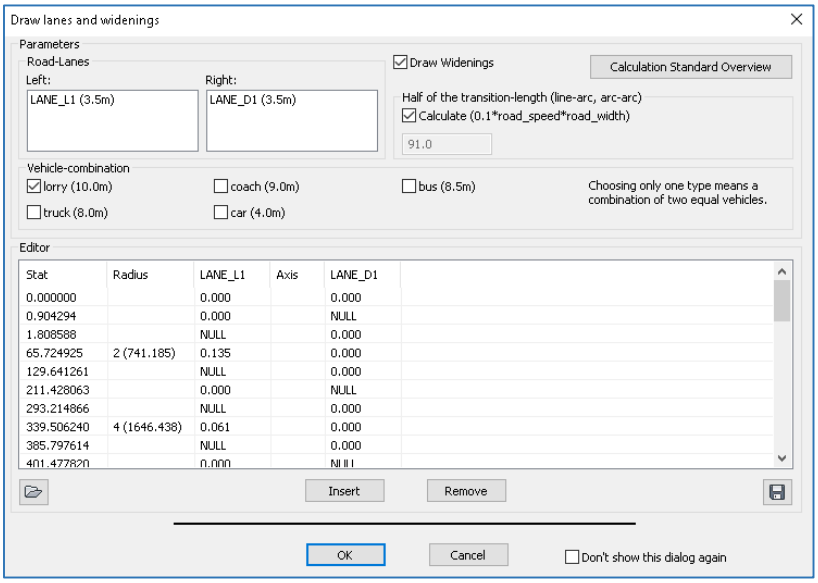
3. First, specify that the BestFit alignment will be created from two sets of input objects. Select *Polyline.* Press the button to select the Polyline 1 and select the polyline that represents the right roadway edge. Then repeat the procedure to define the Polyline 2, but in that case, select the polyline that represents the left roadway edge.



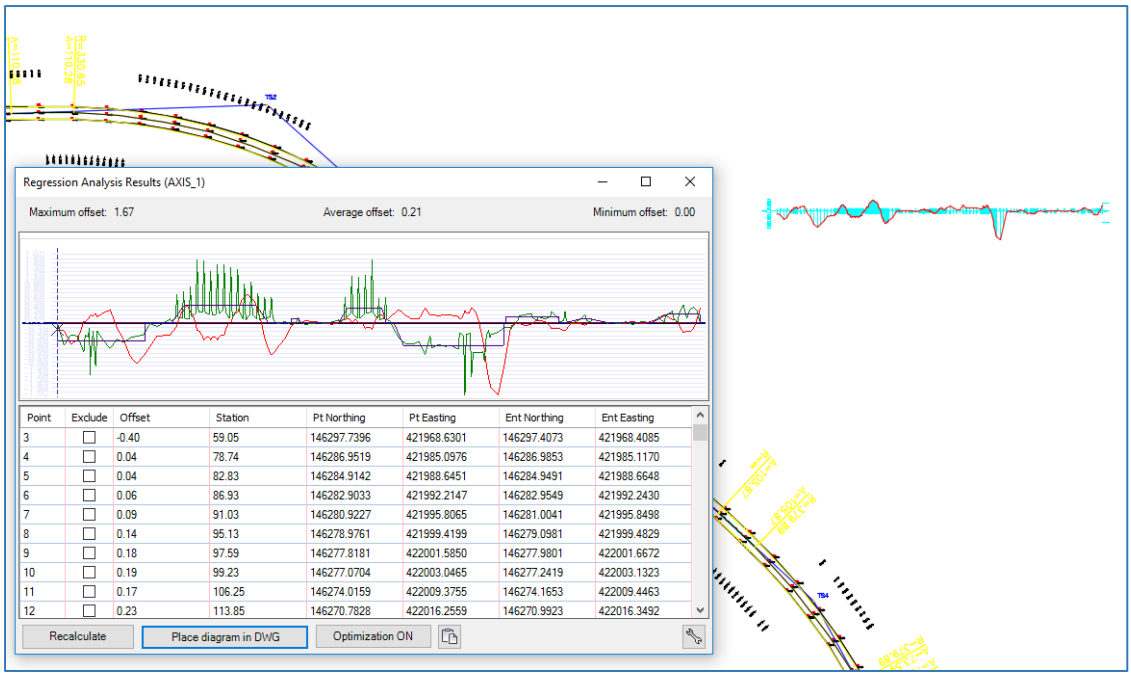
4. Check the *Show report* checkbox to draw BestFit report, including the regression analysis result.

5. Confirm with *OK*.

6. In the *Draw lines and widening* dialog box select *vehicle combination* to calculate widening.



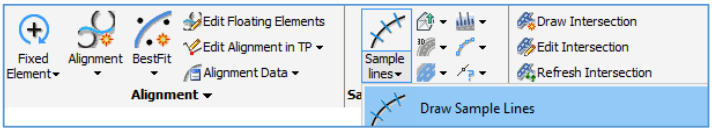
Output data is the alignment with main elements that best follows the course of the given elements. To input regression analysis results in the drawing select *Place diagram in DWG* and define the location of the report in the drawing.



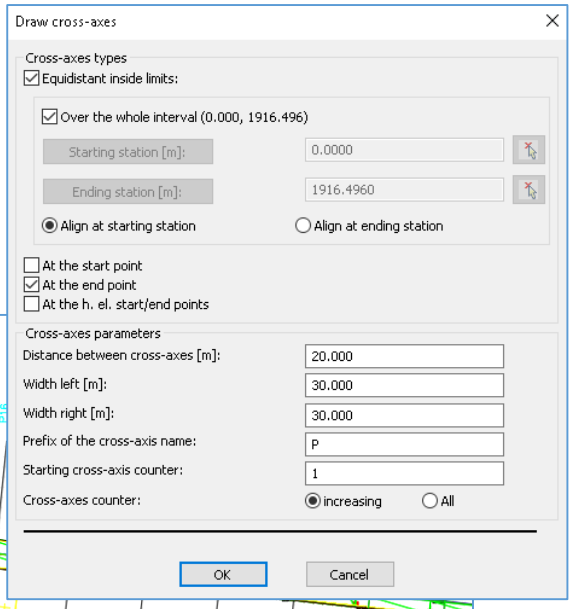
4. Create Sample Lines

Continue with defining Sample lines on the alignment. Plateia offers a variety of tools for designing sample lines. In this tutorial, we will use Draw Sample Lines command.

1. Click on Alignment Manager icon to define a new alignment name.



2. In the *Draw cross-axes* dialog box define the distance between sample lines. Enter left and right width of the generated sample lines and define the prefix and starting number for sample lines name.



5. Longitudinal profile and superelevations

Usually, the definition of superelevations follows the vertical alignment design. The program can calculate superelevations according to the official standards such as radius, speed and superelevation rate diagrams or they can be constructed based on the previously calculated data stored in the CRO file type. In this chapter we describe both procedures:

a) Create superelevations according to the standards
b) Superelevations constructed based on the previously calculated data

a) Create superelevations according to the standards

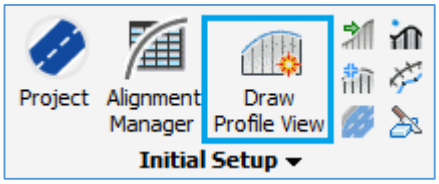
5.1.Create longitudinal profile

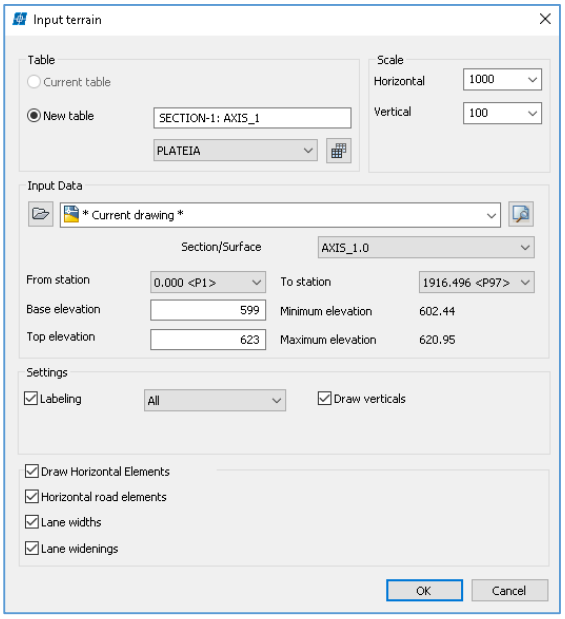
1. Click on Profile panel in the Plateia Ribbon to continue with the profile design.

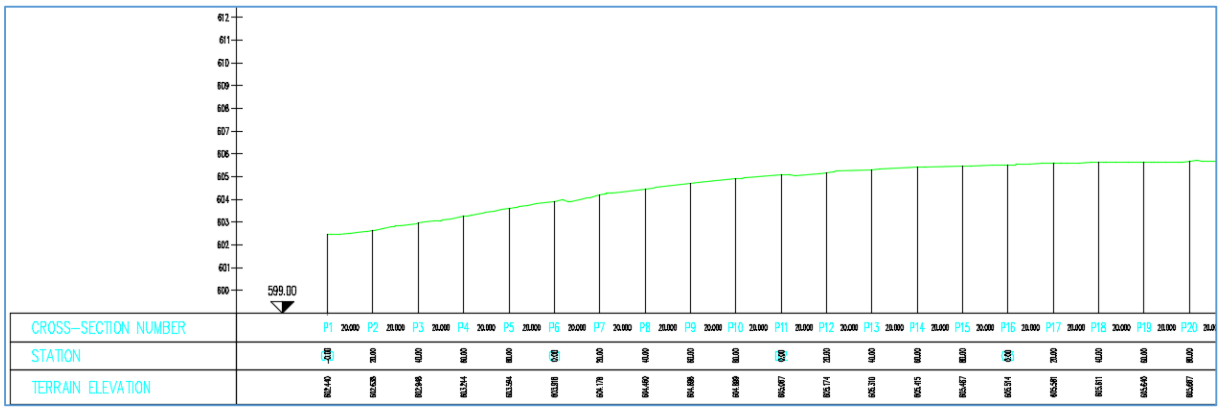
2. Insert terrain in profile view with the Draw Profile View command.

3. Select Plateia table type, for source data use **Current drawing**, or select another drawing to which your alignment design was saved if you started to draw profile in a new drawing.

4. Press *OK* and define the location of profile view in the drawing.

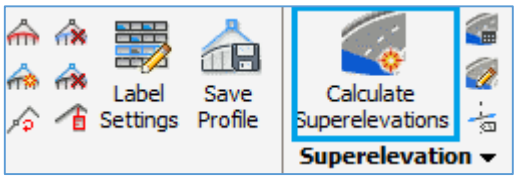






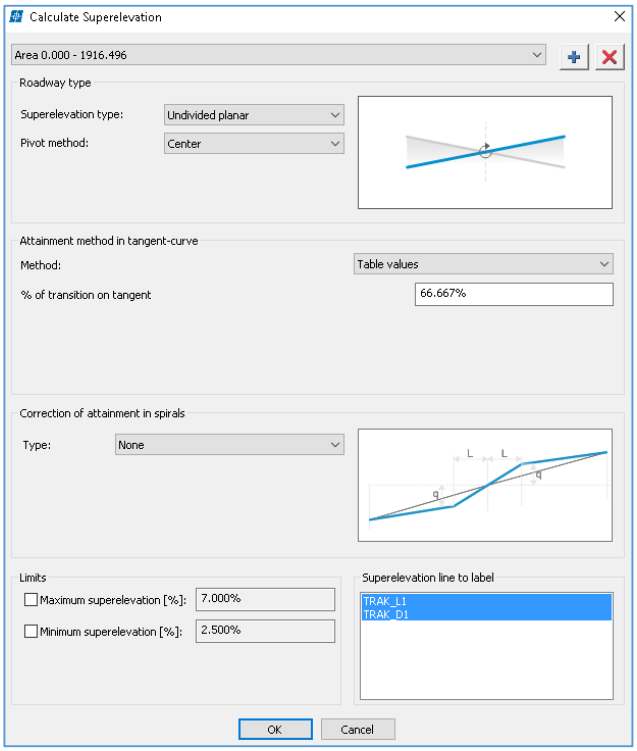
5.2.Define Superelevation

1. Define superelevation with Calculate Superelevations command.



2. In the *Calculate Superelevation* dialog box select the Roadway type. You can choose from:

- Undivided crowned,
- Undivided planar,
- Divided crowned with median,
- Divided planar with a median.

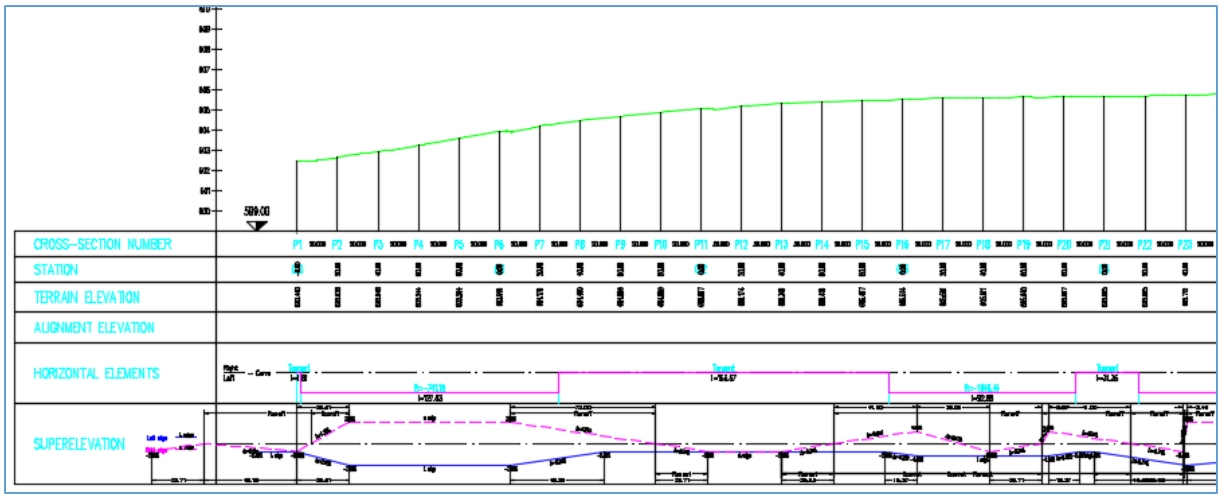


3. Select the Pivot method. You can choose from:

- Center means that the superelevated roadway pivots about the center of the roadway.
- Lane means that the superelevated roadway pivots about the edge of the roadway lane that can be defined for each side of the roadway.

4. To define the superelevation`s limits, tick the *Maximum and minimum superelevation [%]* checkbox and enter the value.

5. The result is the line that describes the road`s superelevation, which is drawn in the SUPERELEVATION rubric.



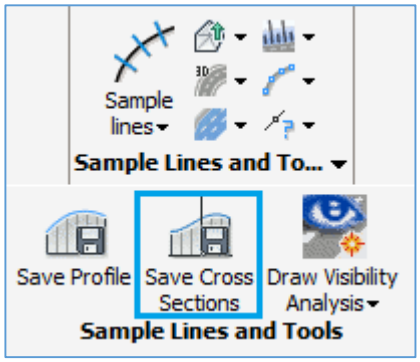
b) Superelevations constructed based on the previously calculated data

5.3.Save cross sections

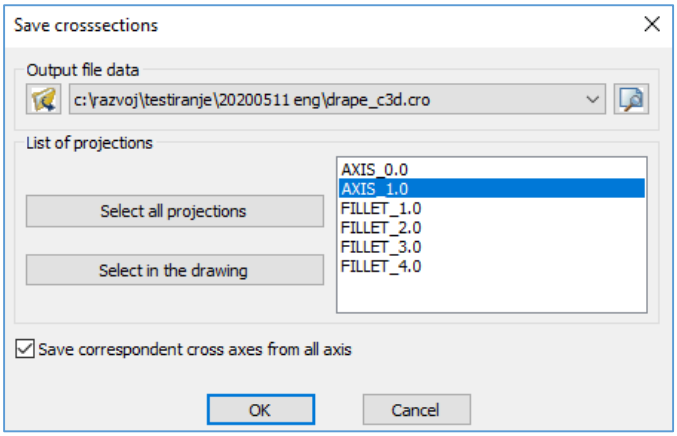
1. Click on Layout panel in the Plateia Ribbon.

2. Click on Save cross sections icon to save sample lines draped onto the DTM to CRO file.

3. Define output file data. In the *List of projections* select the alignment and press *OK*.




```
# AXIS_1.0
*
*! Cross Section    Station
*! Ref.Height   Height in axis
*! Distance     Height     Symbol
P1   0.0+0.000
   597.000   602.440
    -0.522   602.430
    -0.502   602.430
    -0.502   602.431
     3.218   602.498
     3.218   602.498
     3.281   602.500
&
P2   0.0+20.000
   597.000   602.638
    -3.837   602.527
    -3.837   602.527
     0.039   602.639
     0.074   602.640
     0.108   602.641
     2.755   602.730
     2.757   602.729
     2.762   602.729
     4.003   602.771
     4.003   602.771
```



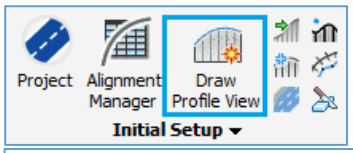
5.4.Create longitudinal profile

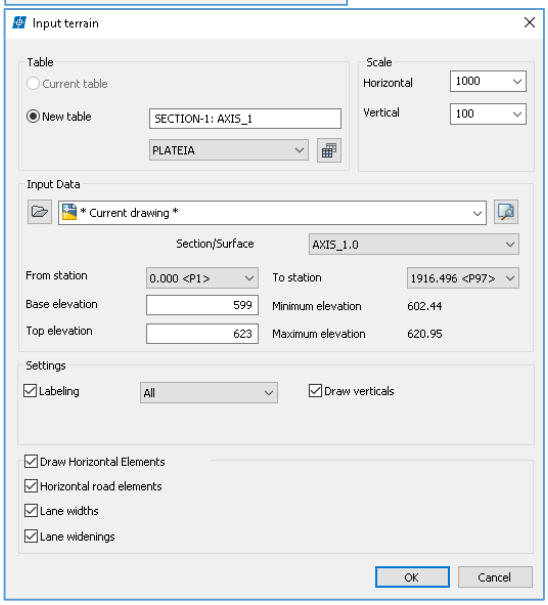
1. Click on Profile panel in the Plateia Ribbon to continue with the profile design.

2. Insert terrain in profile view with the Draw Profile View command.

3. Select Plateia table type, for source data use **Current drawing**, or select another drawing to which your alignment design was saved if you started to draw profile in a new drawing.

4. Press *OK* and define the location of profile view in the drawing.

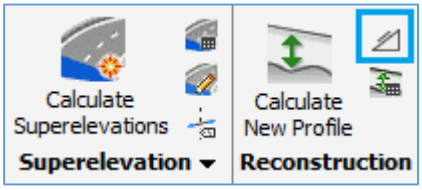




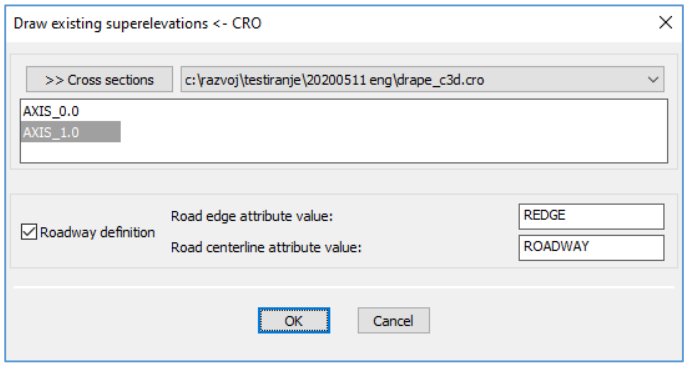
5.5.Define Superelevation

Superelevations of an existing road can be generated based on survey measurements of an existing road.

1. Use the command Draw existing superelevations <- CRO.



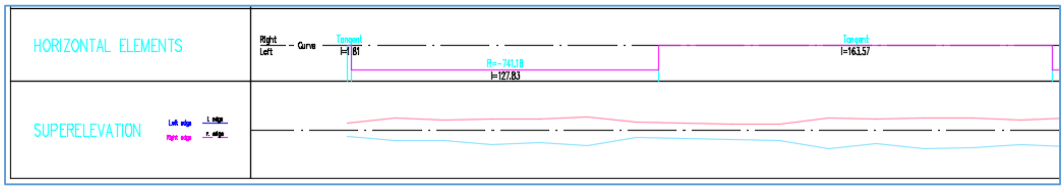
2. *Draw existing superelevations <- CRO* dialog box opens. Press the button *Cross sections* to open the CRO file.



3. Survey data prepared as a file type CRO is the input needed for the calculation of superelevations. The program calculates the superelevations for both left and right side of centerline based on three points:

- Two points (left and right of centerline) with an ROADEDGE attribute and
- One point on the road centerline.

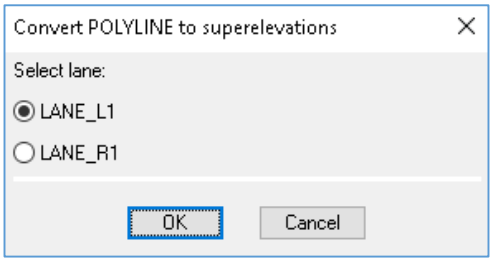
4. The result of superelevations calculation are the lines drawn in the *SUPERELEVATION* rubric. Based on superelevations of an existing road, you can design the superelevations of the new road.



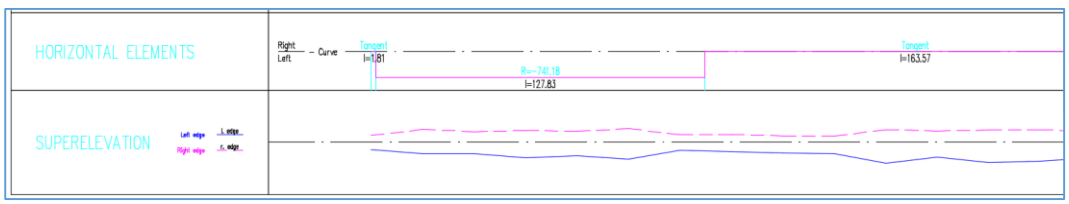
5.6.Convert POLYLINE to superelevations

The Convert Polyline to superelevations command is designed for a conversion of a PLINE object to a superelevation line. You have to decide if the converted PLINE object will become the left or the right superelevation.

1. Run the command Convert Polyline to superelevation (31K4).

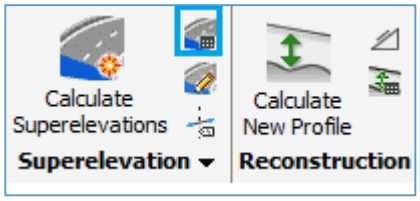


2. In the dialog box select the lane that will be converted. Choose the polyline in the longitudinal profile that represents the lane and press *Enter*. Repeat the same procedure to define the other lane.



6. Edit Superelevations and Curbs

1. Click on Edit superelevations and Curbs icon.



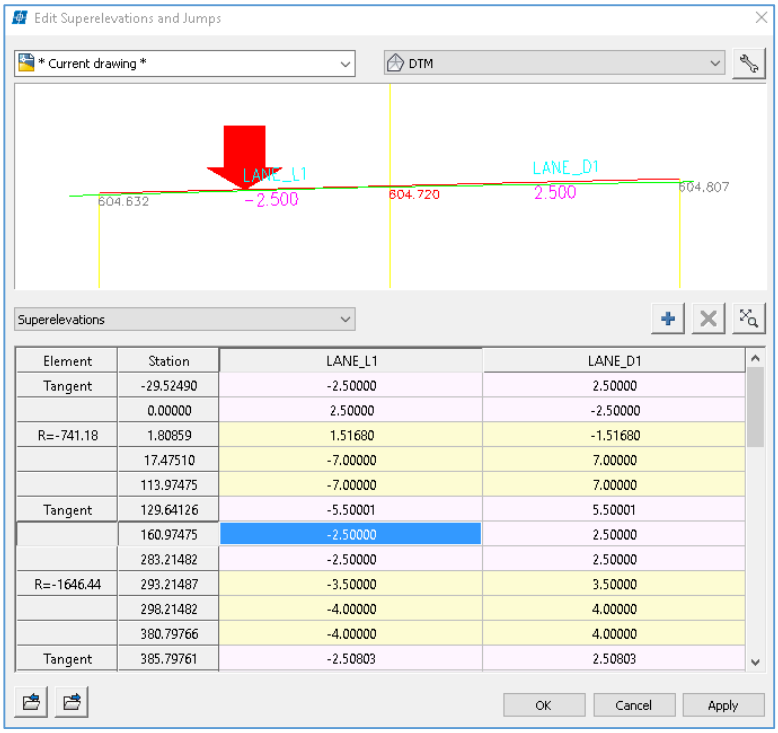
2. in Edit Superelevations and Jumps dialog box you can edit superelevations for particular lanes. Absolute and relative elevations can also be edited.

3. To edit the superelevation value, click on the appropriate field in the table and enter a new value.

4. Jumps can be added, deleted and their properties can be changed along the alignment.

5. To add stations to the list, press on button  . The station can be

- entered in the command line,
- shown at an optional point of the longitudinal profile,
- shown on an optional point along the alignment if it is located in the same drawing as the longitudinal profile.

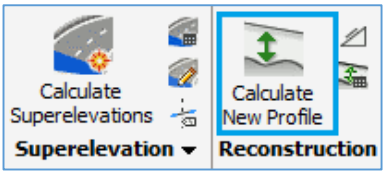


Element	Station	LANE_L1	LANE_D1
Tangent	-29.52490	-2.50000	2.50000
	0.00000	2.50000	-2.50000
R=-741.18	1.80859	1.51680	-1.51680
	17.47510	-7.00000	7.00000
	113.97475	-7.00000	7.00000
Tangent	129.64126	-5.50001	5.50001
	160.97475	-2.50000	2.50000
	283.21482	-2.50000	2.50000
R=-1646.44	293.21487	-3.50000	3.50000
	298.21482	-4.00000	4.00000
	380.79766	-4.00000	4.00000
Tangent	385.79761	-2.50803	2.50803

7. Calculate Points to Create New Profile

Command Calculate New Profile calculates points for a new profile. New points are calculated by raising/lowering entire roadway pavement.

1. Click on Calculate New Profile icon.



2. *Reconstruction* dialog box opens. Here you can define the thicknesses of the wearing course, minimum and maximum of the base course.

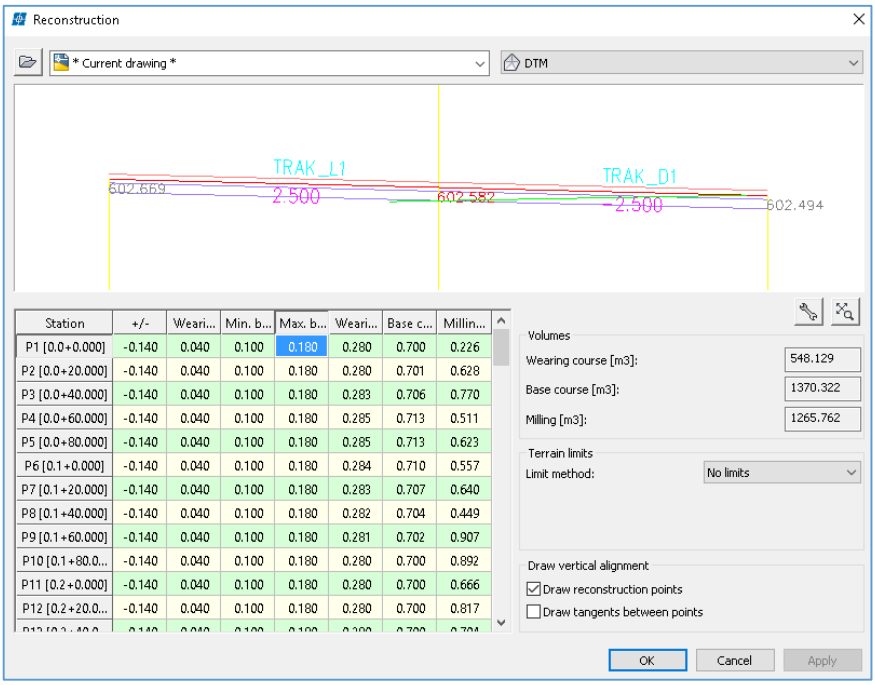
The wearing course represents the uppermost layer of a pavement that comes in contact with traffic. It is typically placed on the base course.

3. You can view the existing terrain line while editing thickness of resurfacing materials. Volumes of wearing course, base course and milling are calculated automatically, so the user can define the optimal height of vertical alignment.

4. If you press the button  , the *Settings* dialog box opens. Here you can define which parameters you want to see in the display window.

5. Check *Draw reconstruction points* option and confirm with *OK.*

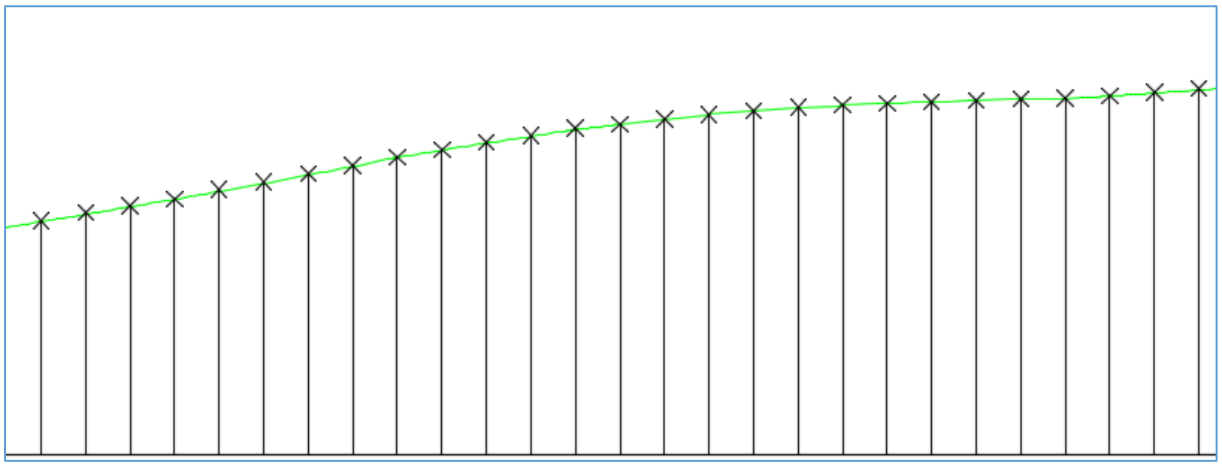
For a detailed description of the parameters see the Help file.



After the superelevations of an existing roadway have been calculated and the new ones designed, you have to define the elevation of the vertical alignment. Assuming the fact that you want to cover the roadway with an asphalt of appropriate minimal thickness, it is necessary to determine the point that will, with respect to the calculated superelevations, increase the vertical alignment to the highest possible level.

There are two ways to design new vertical alignment: by points or by tangents between points. If points are used, then the user can create vertical alignment with BestFit functionality. There are also possibilities to take the limited terrain into account for reconstruction analysis.

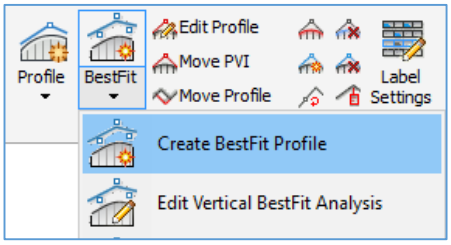
In our case, we used to add vertical alignment to profile by (reconstruction) points. You can see the result in the picture bellow.



8. Create Vertical Alignment

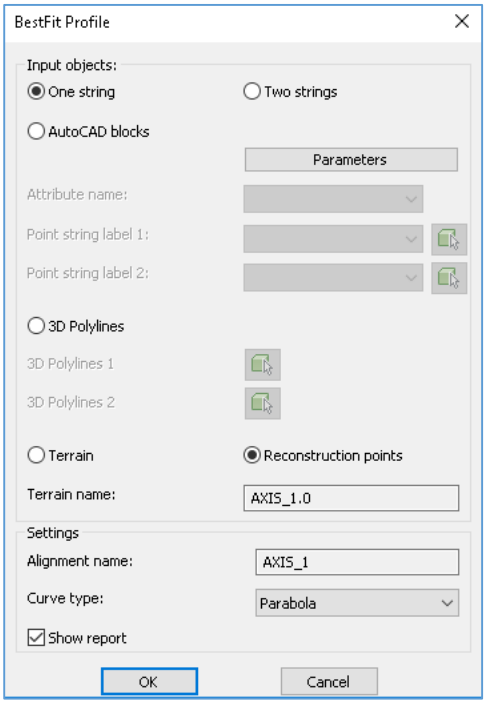
The command enables to calculate offset of a selected input object and to create the vertical alignment.

1. Click on Create BestFit Profile icon.



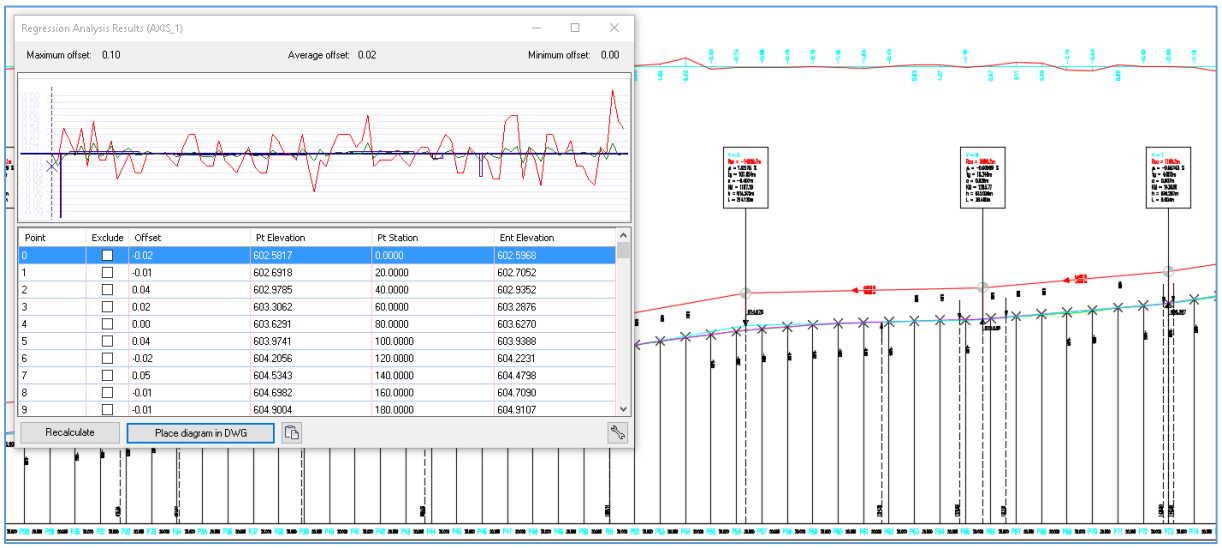
2. Input object can represent one or two sets of survey points as AutoCAD blocks or polylines. For the reconstruction, as input object we use the reconstruction points.

3. Select *One string* and tick the *Reconstruction points* checkbox. To enable the horizontal offset report, including regression analysis result, tick the *Show report* check box.



4. Confirm with *OK*.

5. The figure below shows the results of the offset analysis. The program allows checking for each point in the input data set, its offset from the selected Plateia alignments. Calculation settings are not allowed in the dialog, but it's possible to manage with the diagram settings.



9. Create Cross Sections Views

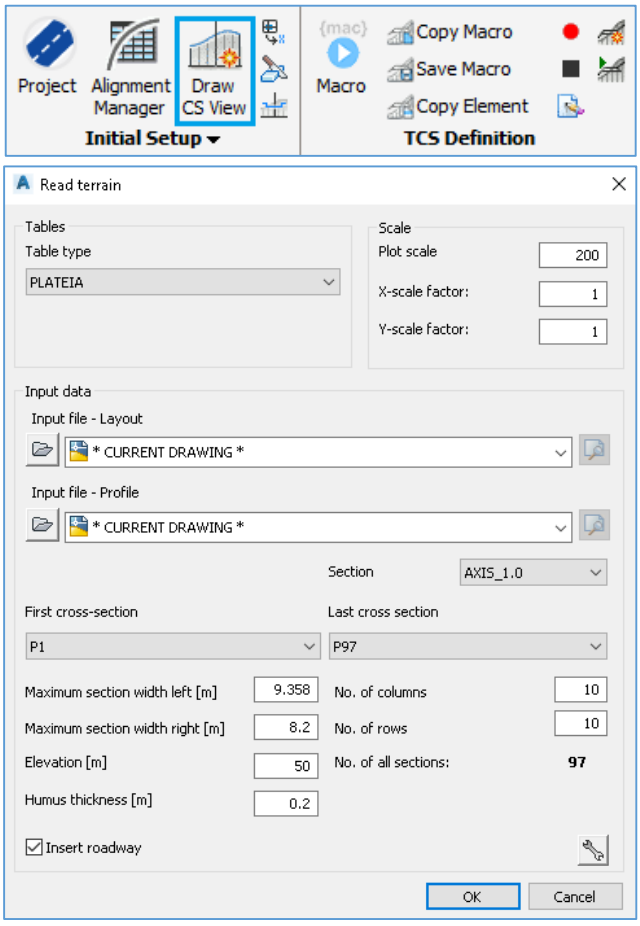
1. Click on Cross sections panel in the Plateia ribbon to continue with the Cross section design.

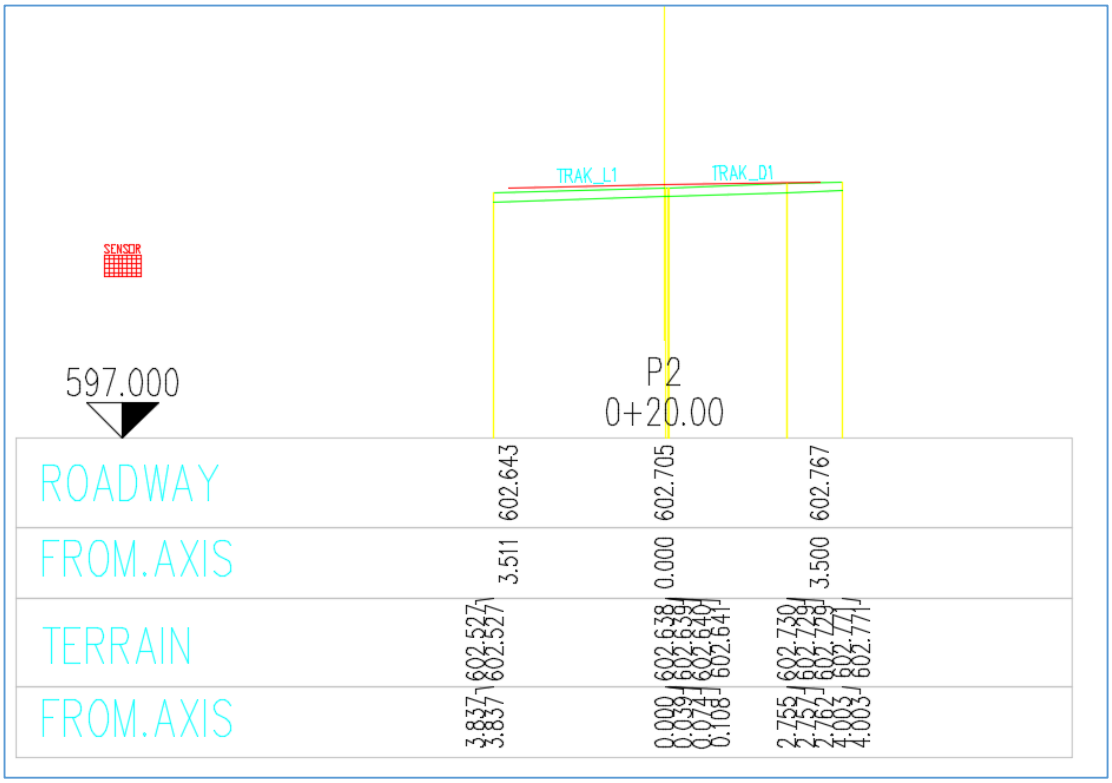
2. Insert Cross section table views with Draw CS View command.

3. In *Read terrain* dialog box select Plateia table type, for source data use **Current drawing**, or select another drawing if you started to draw cross section views in a new drawing.

4. Define horizontal and vertical scale of tables inserted and select the first and the last cross-sections in selected sections/segments.

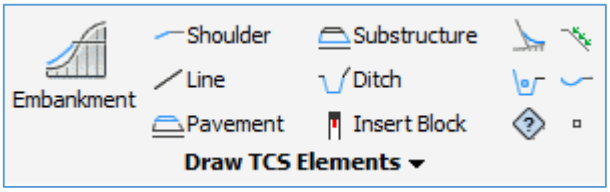
5. If the button *Insert roadway* is activated, the roadway will be inserted automatically in the cross sections.

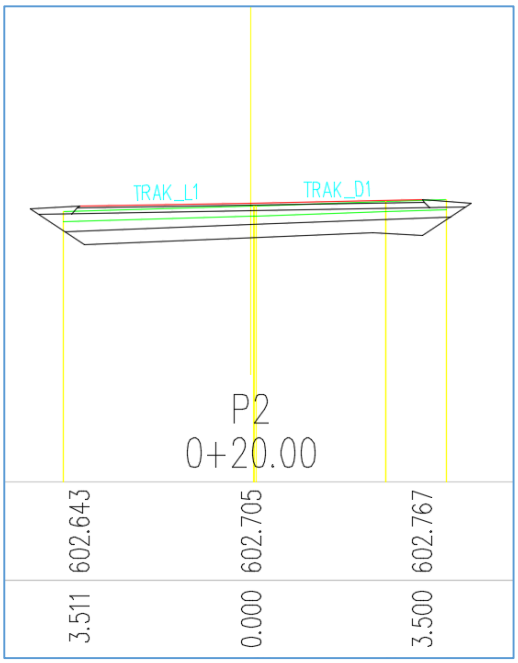




10. Draw Typical Cross Sections Elements

Construct roadway section geometry with Draw TCS Elements commands.

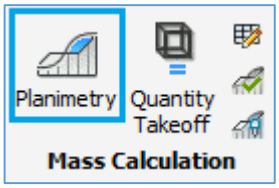




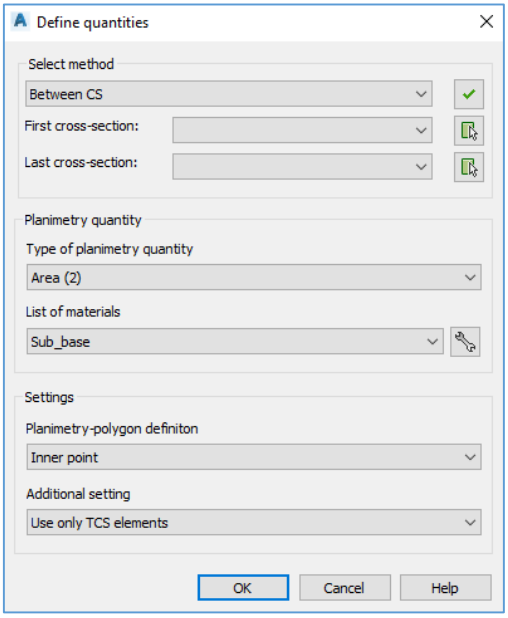
11. Mass calculation

11.1. Planimetry

1. Define material area with Planimetry command.



2. *Define quantities* dialog box opens. Select the planimetry method. Define the first and last section line, between which you want to define quantities.



3. Select type of planimetry quantities. Automatic planimetry is generally divided into two types:
   - surface and
   - length planimetry.

Choose the material and a planimetry polygon.

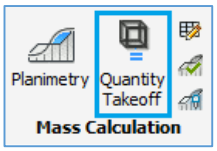
4. Confirm with *OK*.

Command draws completed polygons and hatches their inner part.

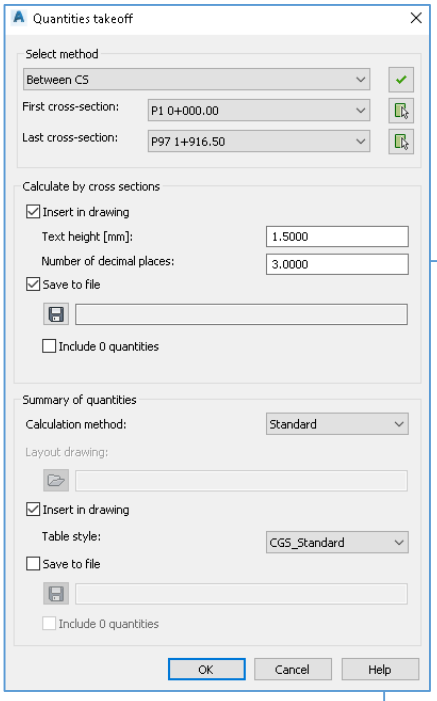
11.2. Quantity take off

The command Quantity takeoff calculates the quantities by sections as well as the summary for the whole area. The results can be saved to a file and/or displayed in the drawing.

1. Click on Quantity Takeoff icon.



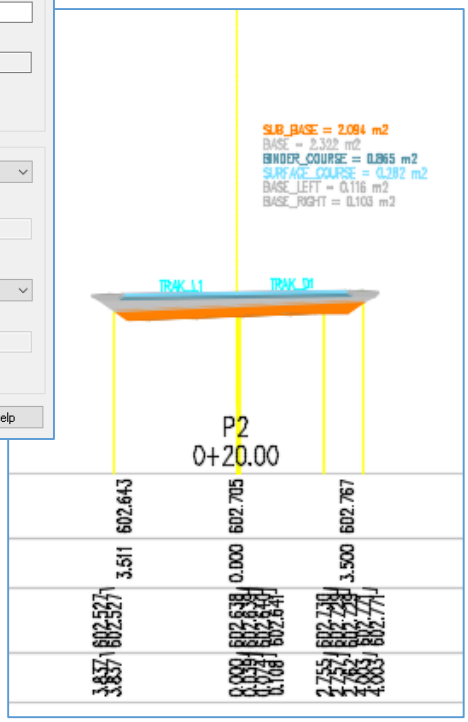
2. *Quantities takeoff* dialog box opens. Select method and define the first and the last cross section.



3. Under the field *Calculate by cross sections* tick the *Insert in drawing* checkbox and specify the location of the result in the cross section. The results are displayed in each cross section.

4. In the *Summary of quantities* tick the *Insert in drawing* checkbox and show the location of the table in the drawing. In the drop-down menu you can select type of the table.

5. Confirm with *OK.*



Below is the example of the table with the summary of quantities.

Quantity takeoff

Sect.	Stat Dist.	SUB_BASE [m³/m²]	Dist.	BASE [m³/m²]	Dist.	BINDER_COURSE [m³/m²]	Dist.	SURFACE_COURSE [m³/m²]	Dist.	CUT [m³/m²]	Dist.	BASE_LEFT [m³/m²]	Dist.	BASE_RIGHT [m³/m²]	Dist.
P1	0+0.00	2.190		2.094		0.864		0.282		0.000		0.101		0.118	
	20.000	42.848	20.000	44.159	20.000	17.283	20.000	5.637	20.000	0.000	0.000	2.163	20.000	2.214	20.000
P2	0+20.00	2.094		2.322		0.865		0.282		0.000		0.116		0.103	
	20.000	44.240	20.000	40.973	20.000	17.371	20.000	5.662	20.000	0.000	0.000	2.376	20.000	1.993	20.000
P3	0+40.00	2.330		1.776		0.872		0.284		0.000		0.122		0.096	
	20.000	47.161	20.000	34.835	20.000	17.514	20.000	5.710	20.000	0.000	0.000	2.497	20.000	1.840	20.000
P4	0+60.00	2.387		1.708		0.880		0.287		0.000		0.128		0.088	
	20.000	47.796	20.000	34.167	20.000	17.591	20.000	5.735	20.000	0.000	0.000	2.594	20.000	1.703	20.000
P5	0+80.00	2.393		1.709		0.879		0.287		0.000		0.132		0.082	
	20.000	47.784	20.000	34.124	20.000	17.560	20.000	5.725	20.000	0.000	0.000	2.632	20.000	1.646	20.000
P6	0+100.00	2.385		1.704		0.876		0.286		0.000		0.132		0.082	
	20.000	47.584	20.000	34.005	20.000	17.491	20.000	5.702	20.000	0.000	0.000	2.618	20.000	1.671	20.000
P7	0+120.00	2.373		1.697		0.873		0.284		0.000		0.130		0.085	
	20.000	47.268	20.000	33.862	20.000	17.415	20.000	5.677	20.000	0.000	0.000	2.543	20.000	1.776	20.000
P8	0+140.00	2.354		1.689		0.869		0.283		0.000		0.124		0.093	
	20.000	45.408	20.000	37.811	20.000	17.350	20.000	5.655	20.000	0.000	0.000	2.427	20.000	1.931	20.000
P9	0+160.00	2.187		2.092		0.866		0.282		0.000		0.118		0.100	
	20.000	43.599	20.000	42.059	20.000	17.307	20.000	5.641	20.000	0.000	0.000	2.364	20.000	2.009	20.000
P10	0+180.00	2.173		2.114		0.865		0.282		0.000		0.118		0.101	
	20.000	43.633	20.000	42.083	20.000	17.286	20.000	5.634	20.000	0.000	0.000	2.361	20.000	2.013	20.000

12. Create 3D Model

Create a 3D model with Draw 3D Model command.

1. Continue with Utility panel in the Plateia Ribbon.

2. Click on Draw 3D Model icon.

3. *Draw 3D Model* dialog box opens. From the drop-down menu, select a layout drawing, a profile drawing and a cross sections drawing of the road.

Data sources can be either in one group or in separate DWG-drawings

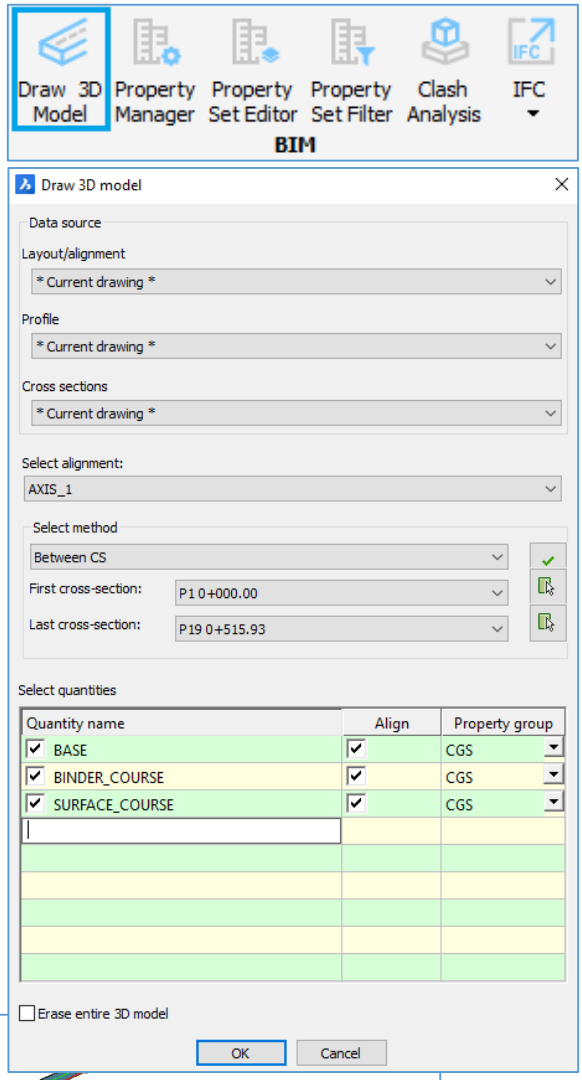
4. In the next step select the main alignment, method and define the first and the last cross section for the creation of 3D solid model.

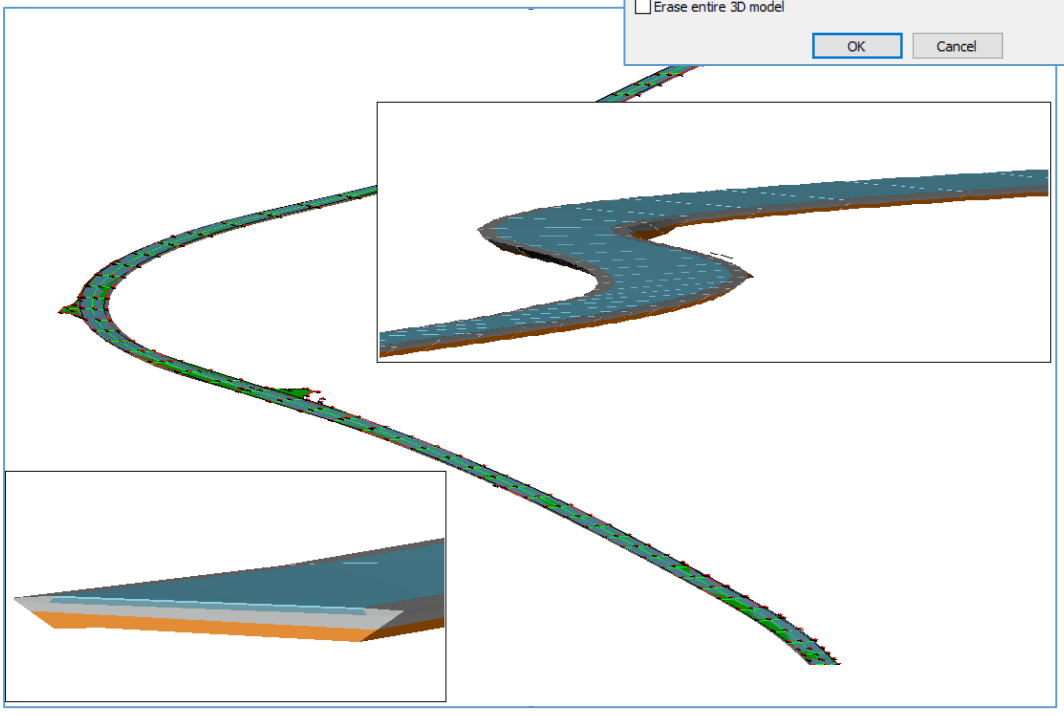
5. In the next step tick-off planimetry quantities.

6. Select *Align* option to connect the consecutive planimetry polygons along the alignment, so it takes geometrical (horizontal) road elements into account.

7. Define Property group.

8. Confirm with OK.





WORKFLOW SUMMARY

Below is a brief workflow summary of how to create a road reconstruction by using Plateia road design software.

Layout

- 1. Preparing Survey Data
  - 1.1. Change Point Type
  - 1.2. Edit Point Data
  - 1.3. Transform 2D Points to 3D Points
  - 1.4. Extract X,Y,Z coordinates from Entities to an XYT file
  - 1.5. Input Poits from File
  - 1.6. Generate Break lines from 2D drawing and XYZ data
- 2. Surface
- 3. Create Horizontal Alignment
  - 3.1. Alignment Manager
  - 3.2. Create BestFit Analysis
- 4. Create Sample Lines

Profile

- 5. Longitudinal profile and superelevations

- a) Create superelevations according to the standards
  - 5.1. Create longitudinal profile
  - 5.2. Define superelevations

- b) Superelevations constructed based on previously calculated data
  - 5.3. Save cross sections
  - 5.4. Create longitudinal profile
  - 5.5.Define Superelevations
  - 5.6. Convert POLYLINE to superelevations
- 6. Edit Superelevations and Curbs
- 7. Calculate Points to Create New Profile
- 8. Create Vertical Alignment

Cross Sections

- 9. Create Cross Section Views
- 10. Draw Typical Cross Sections Elements
- 11. Mass calculation
  - 11.1. Planimetry
  - 11.2. Quantity take off

Utility

- 12. Create 3D Model