



Plateia

by **CGS Labs**



BIM HIGHWAY DESIGN

Tutorial





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BIM Highway Design

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1. Introduction

This tutorial demonstrates the procedure for creating a BIM model of a highway in the Plateia program, using a short straight section as an example.

Start by opening a new drawing. Click on the CGS Labs tab and select the Plateia option. The next step is to create a terrain.

2. Terrain

Plateia offers a wide range of options for inserting points and creating terrain. It supports various surface types, including CGS Labs surface, BricsCAD surface, AutoCAD Civil 3D, and 3D faces.

There is only one limitation, which depends on which platform you have the Plateia program installed on. If you install it on the Civil 3D platform, then Plateia will not support the BricsCAD surface. However, if it is installed on BricsCAD, it will not support the Civil 3D surface.

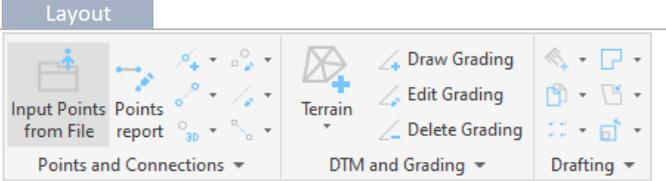
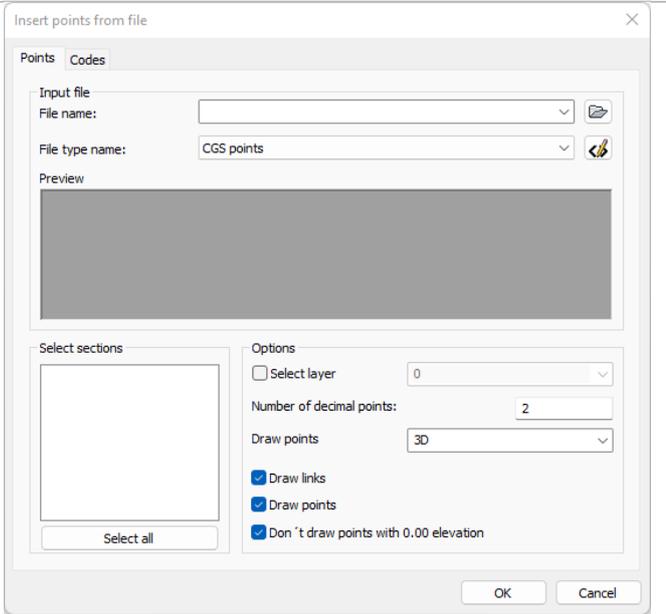
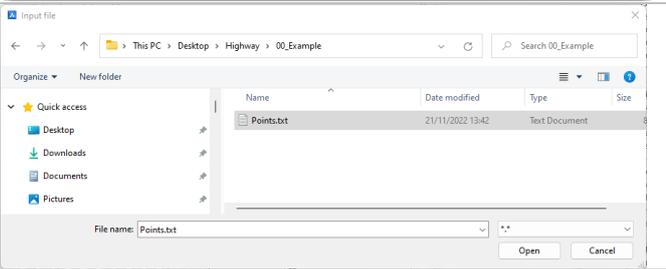
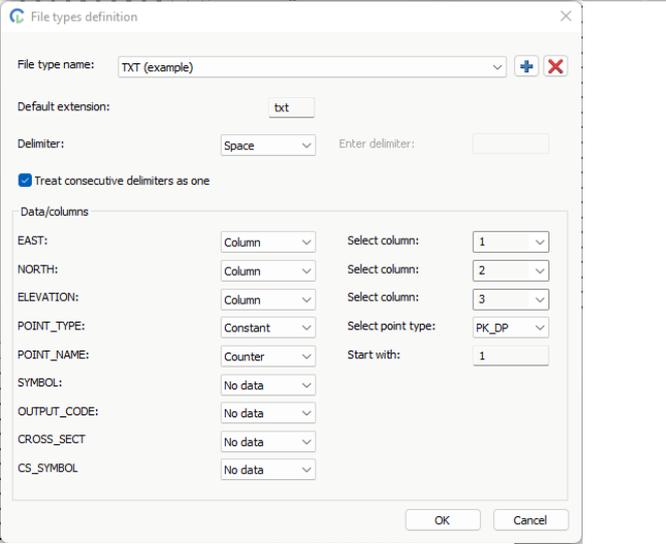
Plateia also supports External Surfaces, allowing you to keep your surface in a separate drawing. The main advantage of this approach is a reduced amount of data in the project drawing, which improves manageability.



In this tutorial two options will be shown:

- **input points from file** and
- **import from Google Maps.**

2.1 Input points from file

<p>1. Click on the Layout tab and execute the <u>Input Points from File</u> command.</p>																			
<p>2. A new dialog box opens, allowing you to select the file containing points and specify which data should be imported into the drawing.</p>																			
<p>3. Click on the <u>Folder</u> (📁) icon and find the <u>Points.txt</u> file. Select it and press Open.</p>																			
<p>4. Then click on the <u>Pencil</u> (🖋️) icon. It opens a new dialogue box, where you set which columns contain which data.</p>																			
<p>5. Press on the <u>Plus button</u> (+) to define a new file type name.</p> <p>6. Then define the extension.</p> <p>7. From the drop-down menu, select space as the delimiter, and check the box labeled Treat consecutive delimiters as one.</p> <p>8. Next, define which column in the TXT file corresponds to each data type. Once completed, press the OK button.</p> <p>Note: The Point_name field is optional. You can select the No data option, and the command will still insert all the points into the drawing. However, all point names will default to "0."</p>	<table border="1" data-bbox="735 1861 1401 2040"> <thead> <tr> <th>EAST</th> <th>NORTH</th> <th>ELEVATION</th> </tr> </thead> <tbody> <tr> <td>222988.833</td> <td>1930183.595</td> <td>564.787</td> </tr> <tr> <td>222661.302</td> <td>1930158.489</td> <td>564.594</td> </tr> <tr> <td>222631.564</td> <td>1930158.896</td> <td>564.577</td> </tr> <tr> <td>222691.040</td> <td>1930158.083</td> <td>564.332</td> </tr> <tr> <td>222750.516</td> <td>1930157.270</td> <td>561.086</td> </tr> </tbody> </table>	EAST	NORTH	ELEVATION	222988.833	1930183.595	564.787	222661.302	1930158.489	564.594	222631.564	1930158.896	564.577	222691.040	1930158.083	564.332	222750.516	1930157.270	561.086
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222691.040	1930158.083	564.332																	
222750.516	1930157.270	561.086																	

9. Select the newly defined file type from the drop-down menu. If everything has been defined correctly, the data from the file will automatically display in the table.

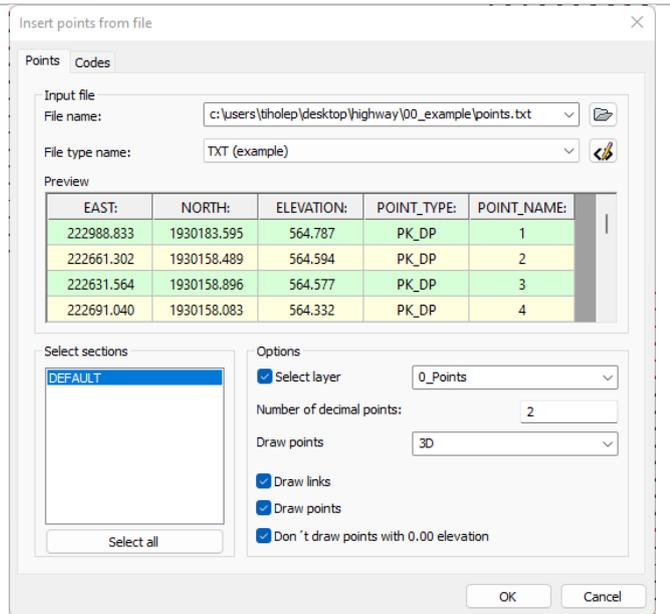
10. Check the Select Layer box and type 0_Points. Alternatively, you can select a predefined layer from the drop-down menu.

11. Set the **number of decimal points** to **2**.

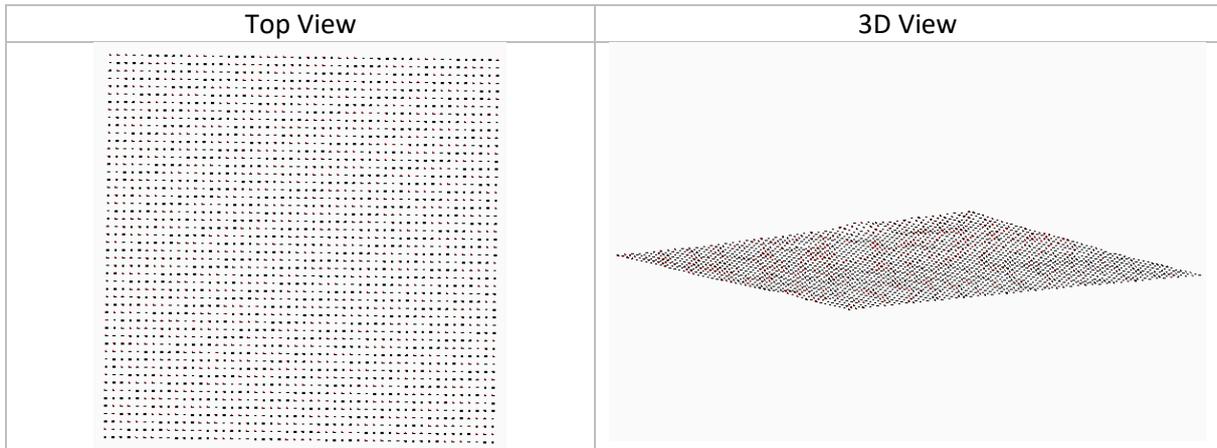
12. For the **Draw Points** option, select **3D** from the drop-down menu.

13. Uncheck the **Draw Links** box, and check the **Draw Points** and **Don't Draw Points with 0.00 Elevation** boxes.

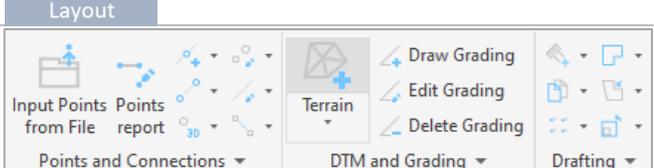
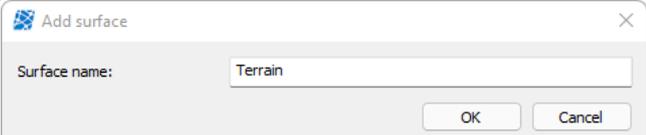
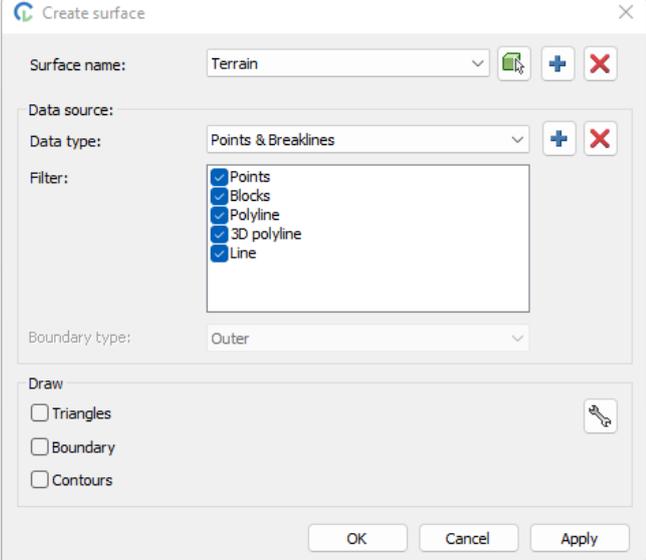
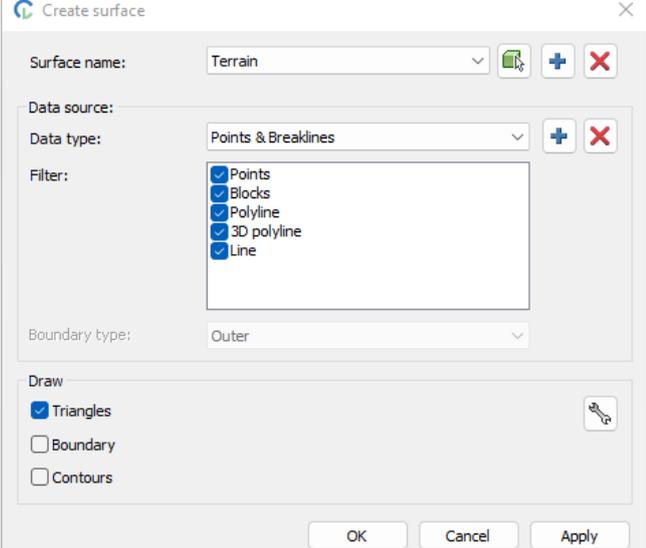
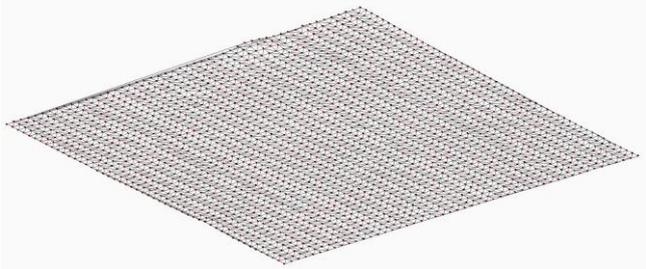
14. Confirm the parameters by clicking the OK button.

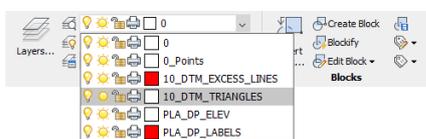


The points are now inserted into the drawing and are defined as blocks. In the next step, we will use these inserted points to create the terrain.



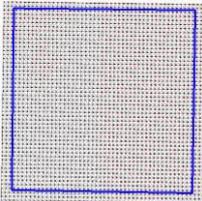
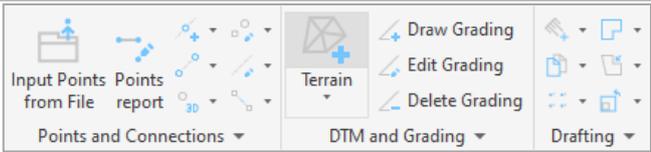
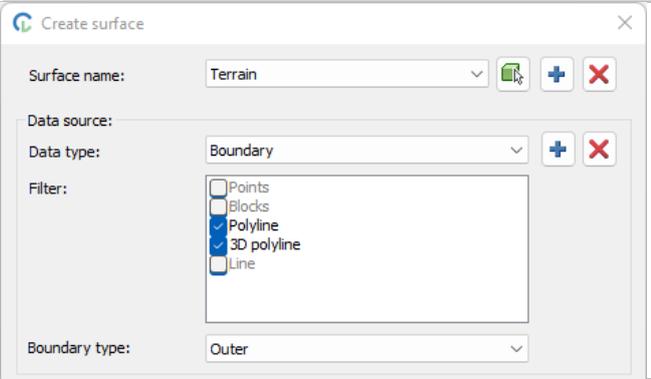
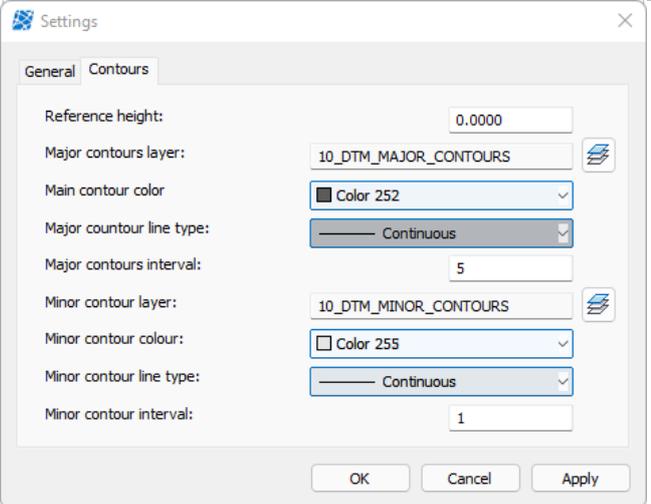
2.2 Create terrain

<p>1. Click on the <u>Terrain</u> icon.</p>	
<p>2. Define a surface name and press OK.</p>	
<p>3. As input data in the drawing are elevation points, you select “Points & Breaklines” option from the drop down-menu. Then click on the <u>Plus button</u> (+), select all the points in the drawing and press Enter.</p> <p>4. Next, you need to select how the terrain will be displayed in the drawing. Several display options are available. If you do not select any option and simply click OK, the drawing will remain unchanged; however, the software will still remember the terrain and use it for generating profiles and cross-sections.</p>	
<p>5. To display the terrain as a Triangulated Irregular Network (TIN), click the Terrain icon again. In the dialog box, check the Triangles option at the bottom and click OK.</p>	
<p>If desired, you can easily change the colour of the terrain by adjusting the colour of its layer.</p>	

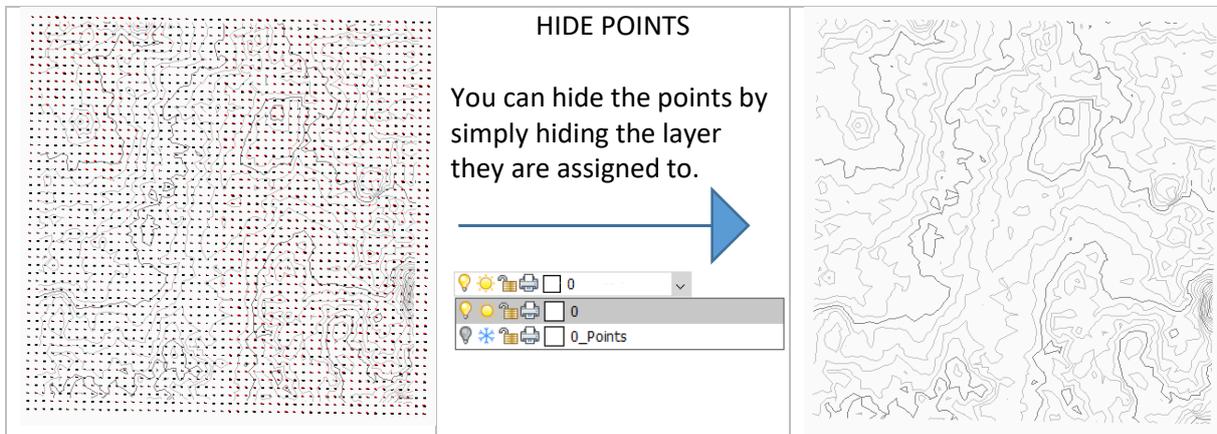
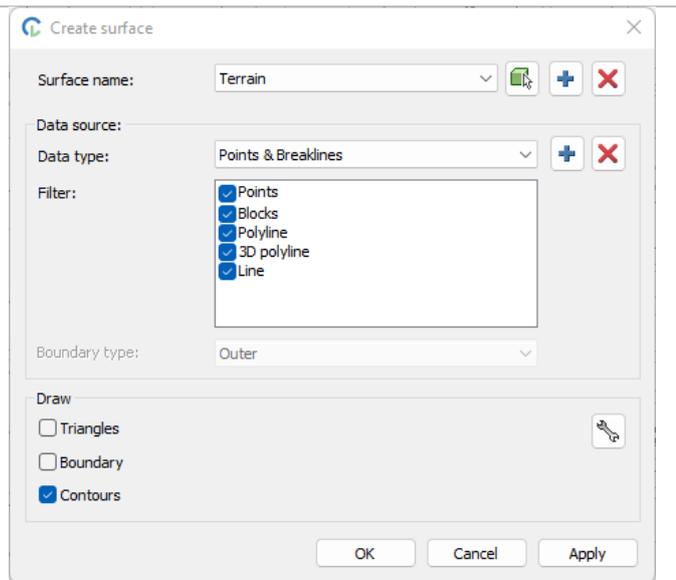


2.2.1 Edit terrain

To edit the terrain, run the Terrain command again and select the desired terrain from the drop-down menu.

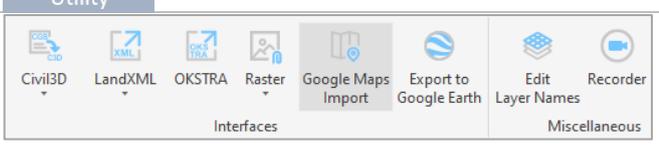
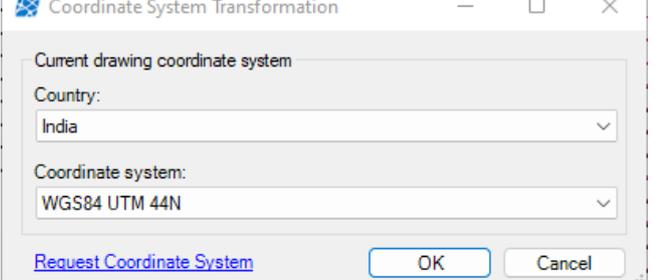
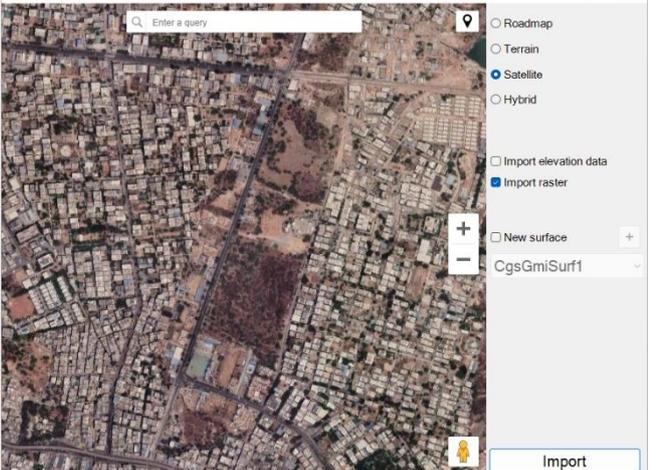
<p>1. First, type PLINE in the command bar and draw a 2D polyline to represent the boundary.</p> <p>Note: You can also use a 3D polyline if needed.</p>	
<p>2. After that run the <u>Terrain</u> command.</p>	
<p>3. Select the <u>boundary</u> option from the drop-down menu, and then select <u>Outer</u> for the boundary type. <u>Press Plus (+)</u>, select boundary directly in the drawing and press Enter.</p> <p>4. Press apply and terrain and the terrain will be reduced to the boundary area.</p>	
<p>If you want, you can also display terrain with contours.</p> <p>5. Click on the settings (🔧) button and select contours on the top of the dialog. Then define major contour colour and major contour interval. You also have to define minor contour colour and minor contour interval and then confirm clicking OK.</p>	

6. Uncheck the **Triangles** box, then check the **Boundary** and **Contours** boxes. Confirm your selection by pressing the **OK** button, and your terrain will be ready.



2.3 Import raster picture from Google Maps

The user has the option to import raster images and elevation data directly from Google Maps.

<p>1. Click the Utility tab and execute the <u>Google Maps Import</u> command.</p>	
<p>2. Click this icon .</p> <p>3. Select the country and coordinate system from the drop-down menu:</p> <ul style="list-style-type: none"> - country: India. - coordinate system: WGS84 UTM 44N 	
<p>4. Check the boxes at the <u>Satellite</u> and the <u>Import raster</u> options.</p> <p>5. Uncheck the boxes for Import Elevation Data and New Surface, as we have already inserted points and created the terrain.</p> <p>6. Click Import.</p> <p>We now have a raster image inserted into the drawing, which serves as the background.</p>	

3. Horizontal alignment

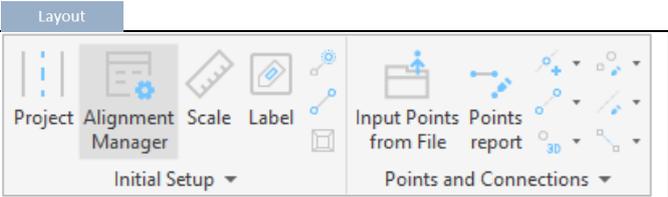
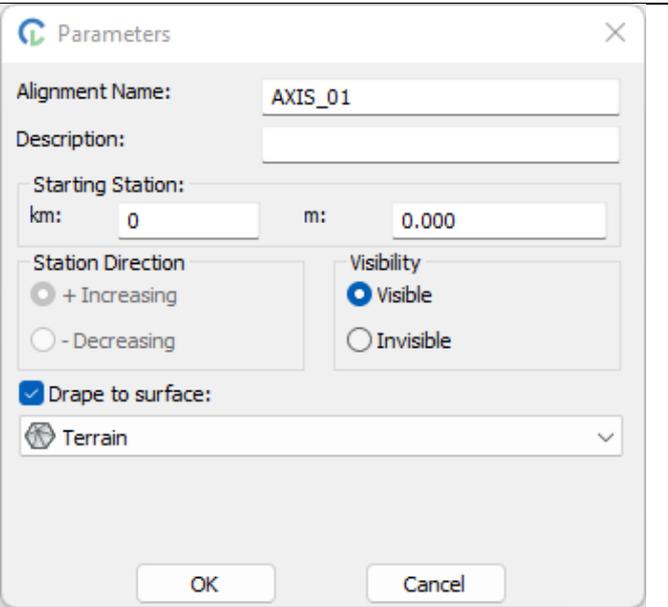
First, define the name of the alignment and set its basic parameters, such as design speed. After that, draw the alignment. Plateia offers several methods for drawing axes, and in this tutorial, the tangent polygon method will be used. However, the following methods are also available in Plateia:

- Draw with floating elements:
<https://cgs-labs.zendesk.com/hc/en-us/articles/1500000555961-Draw-with-Floating-Elements>
- Draw with stick method:
<https://cgs-labs.zendesk.com/hc/en-us/articles/360060888513-Draw-with-Stick-Method>
- Convert PLINE to alignment:
<https://cgs-labs.zendesk.com/hc/en-us/articles/360059061454-Convert-Pline-to-Alignment>
- Create Best Fit Alignment:
<https://cgs-labs.zendesk.com/hc/en-us/articles/360060888893-Create-Best-Fit-Alignment>

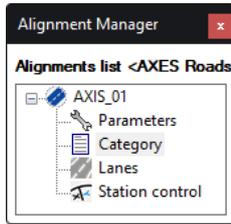
It will be easier to understand if you watch the video. Please click the button on the right to view it.



3.1 Define a new alignment

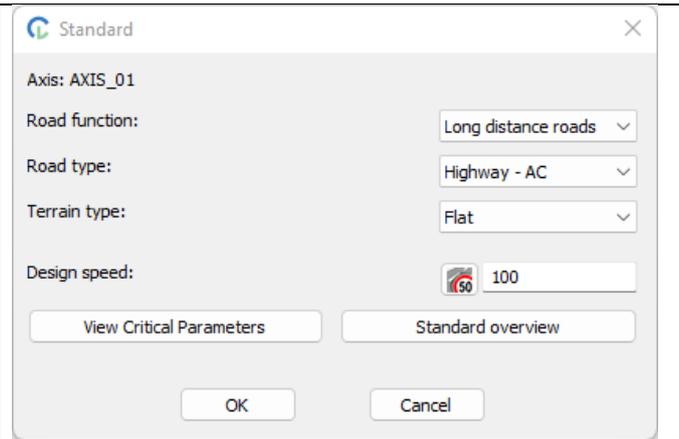
<p>1. Click on the Layout tab and execute the <u>Alignment Manager</u> command.</p>	
<p>2. Define the <u>Alignment Name</u>.</p> <p>3. Check the Drape to Surface box and select the existing surface Terrain.</p> <p>4. When finished, confirm the parameters by clicking the OK button.</p> <p>After that, a new dialog box named Alignment Manager opens. This tool is designed for managing the alignments present in the drawing. In this dialog box, you can edit axis parameters, category, and station. Additionally, you can add new axes or delete existing ones by right-clicking anywhere in the window.</p>	

5. In the **Alignment Manager** dialog box, double-click on the Category field.



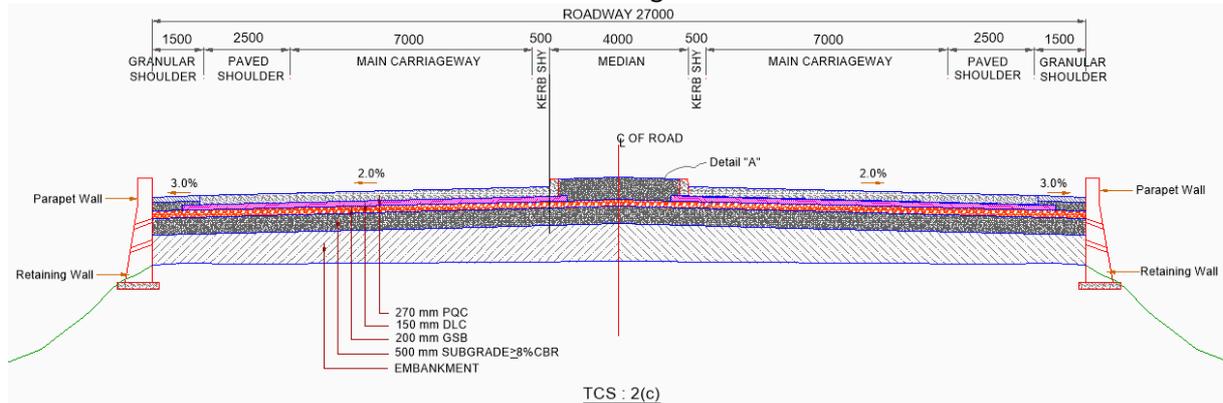
In **Standard** dialogue box define the following:

- Road function: Long distance roads
- Road type: Highway - AC
- Terrain type: Flat
- Design speed: 100 km/h

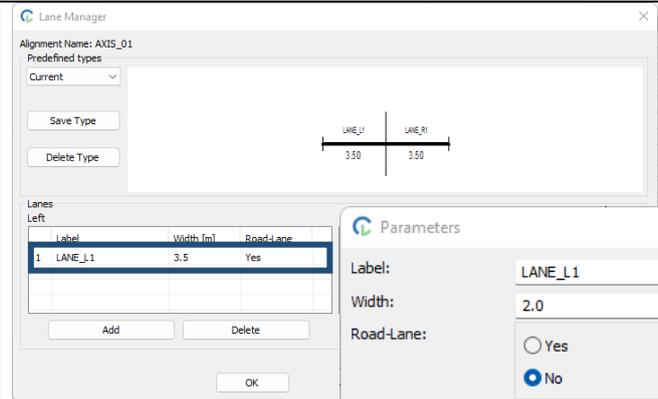


6. Confirm by pressing **OK**.

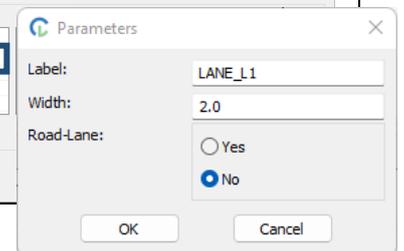
7. We will now define the lanes based on the following characteristic cross-section:



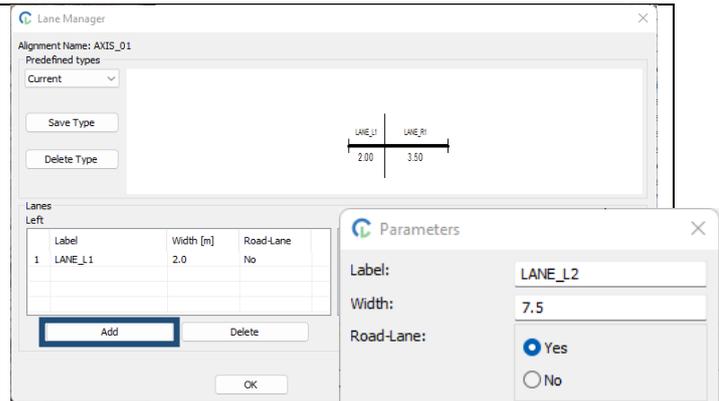
8. In the **Alignment Manager**, double-click on **Lanes**. At the top of the dialog box, you will find a list of predefined lane types. Select **Default**.



9. Double-click on **LANE_L1**, set the width to **2.0** meters, and check the box next to **NO**. This indicates that the lane is not intended for vehicle traffic and will always maintain a constant width. If you were to select **YES**, the lane width would adjust (extend) in curves.



10. Then, click Add to define the second lane on the left side. Set the desired width and check the box next to Yes, as this lane is intended for vehicle traffic.

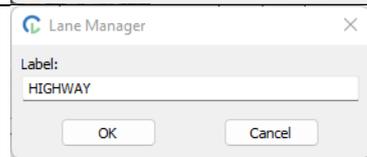


11. After that, add the remaining lanes. Follow the same procedure to add lanes on the right side as well.

In the image on the right, verify if all parameters have been entered correctly. If you notice any discrepancies, simply double-click on the respective lane to make corrections.



12. A customized lane type can be saved under its own name in the Predefined Types section for future use. This allows you to easily apply it in a new project. Click the Save Type button and enter the desired name.



In the following folder, you can find `cgsa_lanes.sqlite` file, where all the predefined types are saved. You can also send this folder to your co-worker:
C:\Users\tiholep\AppData\Roaming\CGSA\CGSApps 2023 ENG

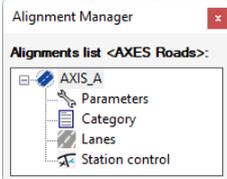
13. When finished, confirm by pressing the OK button.

3.2 Design Alignment – Draw with Tangent Polygon

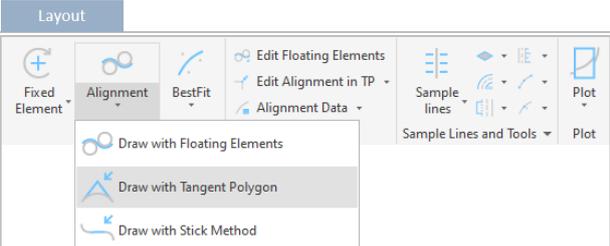
As mentioned earlier, there are various methods for drawing alignments. In this tutorial, the Tangent Polygon method will be used.

Using the Tangent Polygon method, you can define any combination of main elements. This method allows you to interactively insert a tangent polygon, based on which the main elements are drawn.

IMPORTANT! Before drawing an alignment, always ensure that the alignment is set as active (the icon next to the alignment name should be blue). If it is not active, double-click on the axis in the Alignment Manager to activate it.

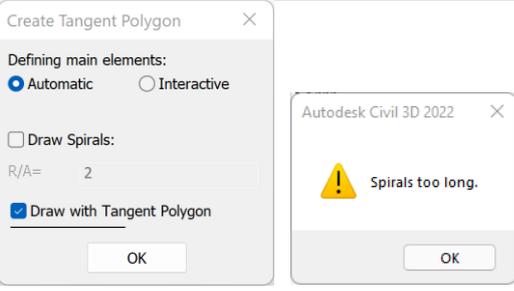


1. Run the Draw with Tangent Polygon command.



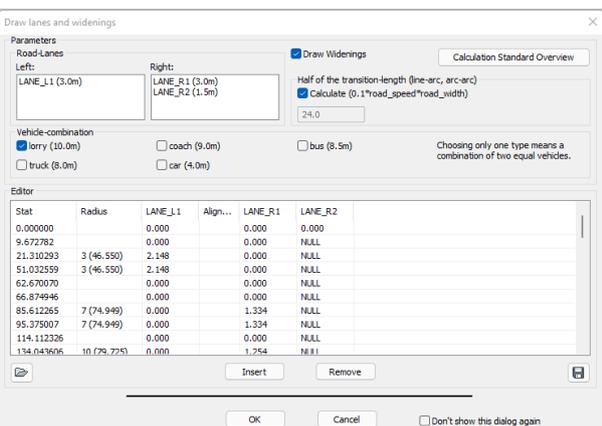
2. In the Create Tangent Polygon dialog box, the parameters are set to default. Confirm by clicking OK.

Next, select the first point of the tangent polygon in the drawing. Continue inserting the tangent polygon interactively; the main elements will be drawn along it. When finished, press Enter to complete the process.



3. The Draw Lanes and Widening dialog box opens, where the program calculates the individual lane widenings. You can adjust parameters, import or save widenings in a file, or review a calculation standard.

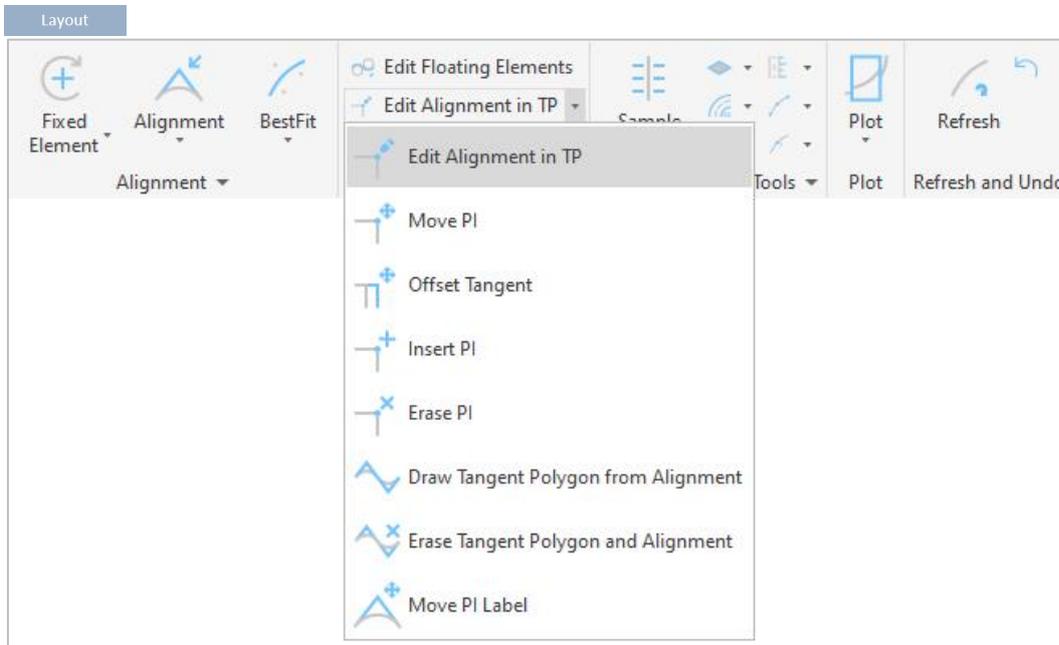
4. Confirm your selections by clicking the **OK** button.



Stat	Radius	LANE_1_1	Align...	LANE_R1	LANE_R2
0.000000		0.000		0.000	0.000
9.672782		0.000		0.000	NULL
21.310293	3 (46.550)	2.148		0.000	NULL
51.032559	3 (46.550)	2.148		0.000	NULL
62.670070		0.000		0.000	NULL
66.874946		0.000		0.000	NULL
85.612265	7 (74.949)	0.000		1.334	NULL
95.375007	7 (74.949)	0.000		1.334	NULL
114.112326		0.000		0.000	NULL
134.043616	10 (79.725)	0.000		1.754	NULL

3.2.1 Edit the Alignment

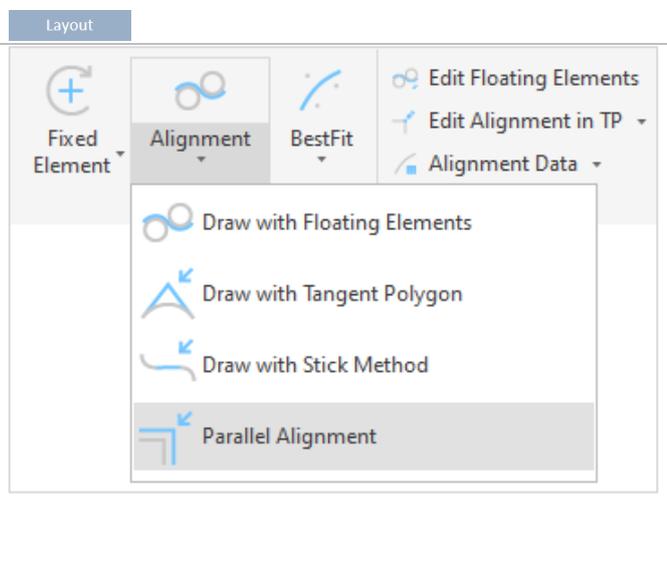
Using the tools in the Alignment section, you can easily edit the alignment at any time.



3.2.2 Parallel or copied alignment

When creating a conceptual design, it is common to develop several alignment variants. Typically, a basic variant is created first, followed by alternative solutions based on modifications to the original. To avoid redrawing each alignment from scratch, you can use the Parallel Alignment command.

After running the command, specify the reference alignment, the name for the parallel alignment, and the offset distance. If you set the offset to 0, the command will simply create a copy of the alignment.



3.3 Sample lines

Next, proceed with defining **Sample Lines** on the alignment. Plateia provides a variety of tools for designing Sample Lines to suit your needs.

Note: You can also choose to create a Profile View first and then define the Sample Lines before inserting the Cross-Section View.

1. Click the Sample Lines icon.

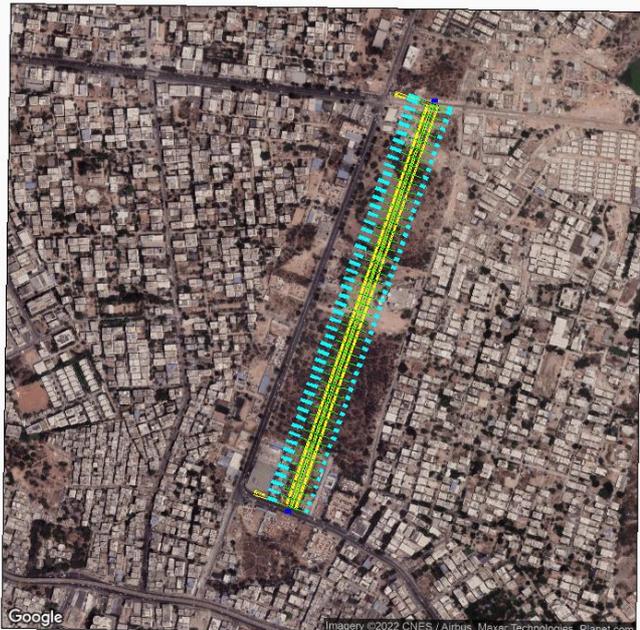
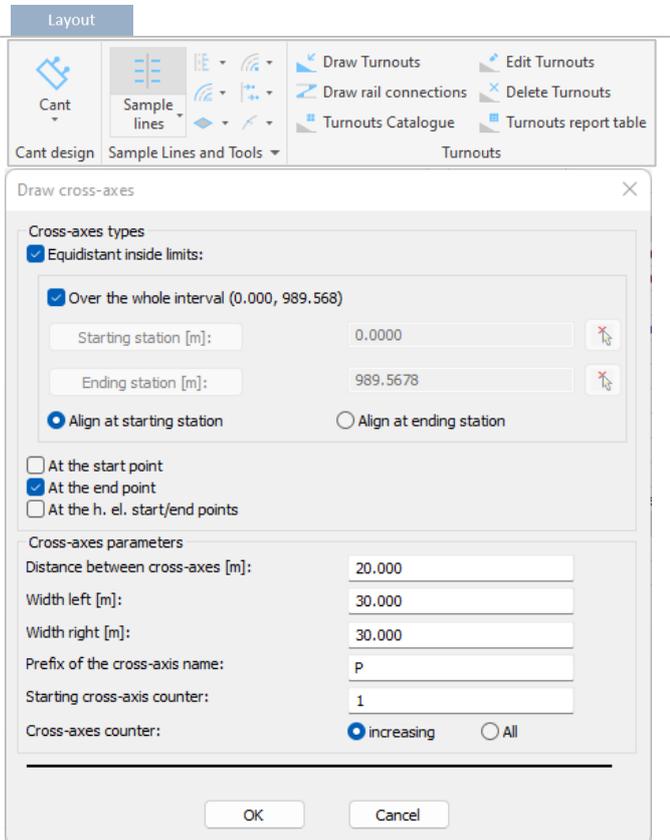
The Draw Cross-Axes dialog box will appear. Sample lines will be created equidistantly along the entire alignment if you check the Over the Whole Interval option.

Specify whether a sample line should be created at the start/end station and at the start/end points of horizontal elements.

2. Set the Distance between Sample Lines and the Width (Left/Right).

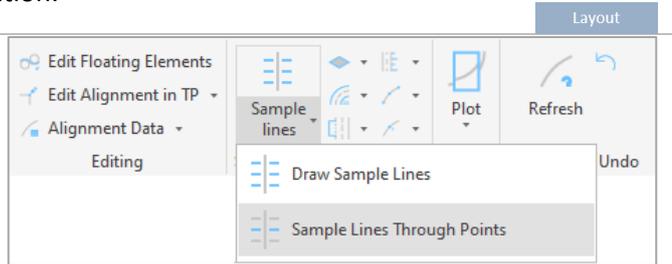
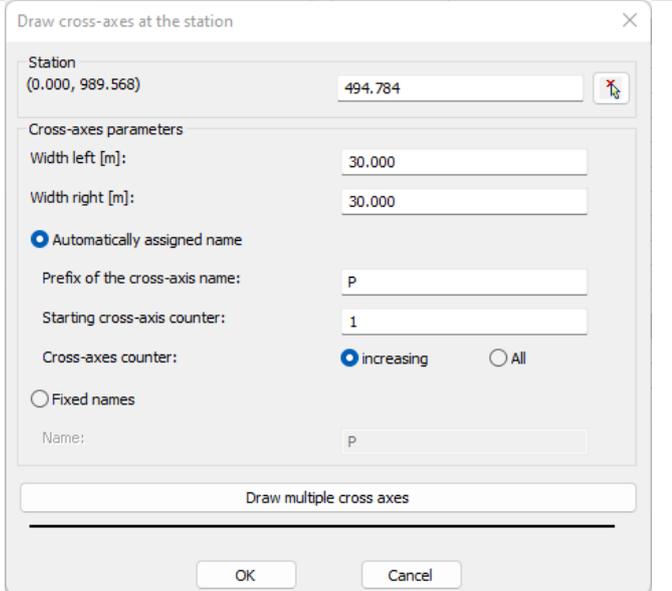
3. Define the Prefix for the sample line name and the Starting Counter.

4. Confirm by clicking OK.

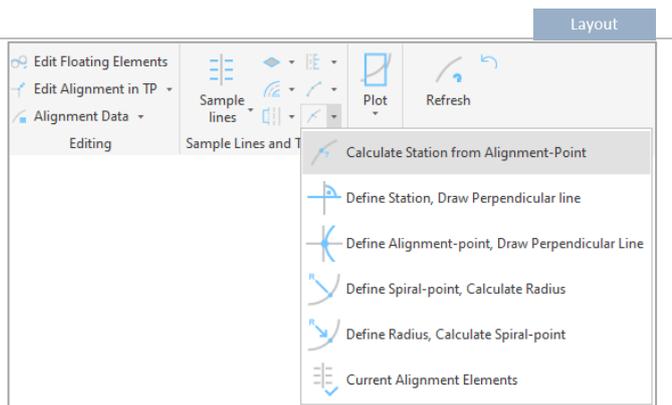


3.3.1 Sample line at the specific station (chainage)

You can also add chainage at the specific location.

<p>1. Run the <u>Sample Lines Through Points</u> command.</p>	
<p>2. You can now type the station (chainage) in the upper space or click this icon  and define station directly in the drawing.</p> <p>If you want to specify multiple stations in the drawing at once, click the Draw Multiple Cross-Axes button located at the bottom of the dialog box.</p> <p>3. When you have finished, click OK.</p>	

Information about the station (chainage)

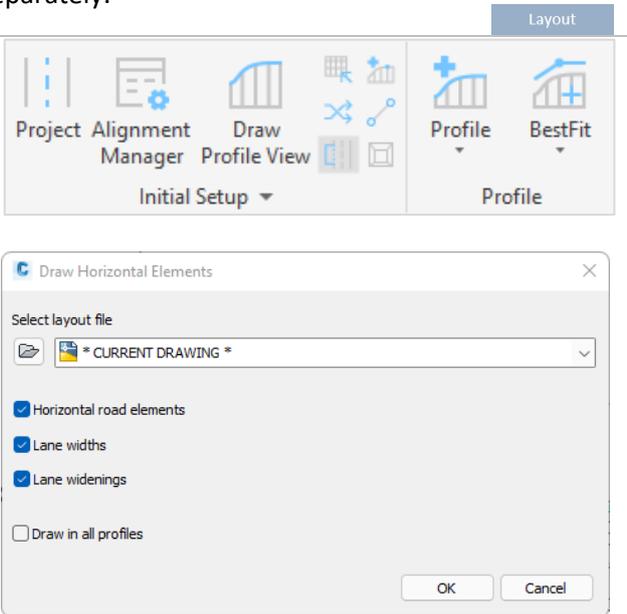
<p>If you're only interested in the station value at a specific point, Plateia offers several commands to assist you.</p> <p><i>Note: In order to run the Define Station, Draw Perpendicular Line, and Define Alignment-Point, Draw Perpendicular Line commands, you must have a longitudinal profile in the drawing.</i></p>	
---	--

Calculate station from alignment-point

<p>This command calculates the station, displays the value on the screen, and generates the corresponding station label.</p>	
--	--

3.3.2 Draw alignment geometry

If you did not check the "Draw Horizontal Elements" option when defining the alignment parameters, you will need to draw the alignment geometry separately.

<ol style="list-style-type: none">1. Click on the Profile tab and run the Draw Alignment Geometry command.2. In the dialog box, specify the layout file (input data) and check all the relevant options.3. Confirm by clicking OK.	 <p>The screenshot shows the software interface with the 'Layout' tab selected. The ribbon contains 'Project Alignment Manager', 'Draw Profile View', and 'Profile BestFit'. The 'Profile' group is active. Below the ribbon, the 'Draw Horizontal Elements' dialog box is open. It has a title bar with a close button. The dialog contains a 'Select layout file' section with a folder icon and a dropdown menu showing '* CURRENT DRAWING *'. Below this are four checked options: 'Horizontal road elements', 'Lane widths', and 'Lane widenings'. There is also an unchecked option 'Draw in all profiles'. At the bottom right are 'OK' and 'Cancel' buttons.</p>
--	--

4 Vertical Alignment

4.1 Draw profile view

This command reads data from the source DWG file or LON file, which contains the profile's terrain data, and draws the corresponding terrain line. It also allows the user to schematically draw horizontal road elements onto the active profile.

1. Click the Profile tab and run the Draw Profile View command.

2. In Input terrain dialog box specify:

Scale: 1000:100

Input Data: current drawing

From Station: select the first sample line

To station: select the last sample line

Check: Labeling

Draw verticals

Draw horizontal elements

Horizontal road elements

Lane widths

Lane widenings

3. Confirm by pressing OK.

4. Define the insertion point in the drawing.

Profile

Project Alignment Manager Draw Profile View Profile BestFit Edit Profile Move PVI Move Profile Label Settings

Initial Setup Profile Editing

Input terrain

Table

Current table

New table SECTION-1: AXIS_01

PLATEIA

Scale

Horizontal 1000

Vertical 100

Input Data

* Current drawing *

Section/Surface AXIS_01.0

Include correspondent sample lines (marked with *)

From station 0,000 <P1>

To station 989,568 <P51>

Base elevation 560 Minimum elevation 563.81

Top elevation 571 Maximum elevation 568.50

Settings

Labeling All Draw verticals

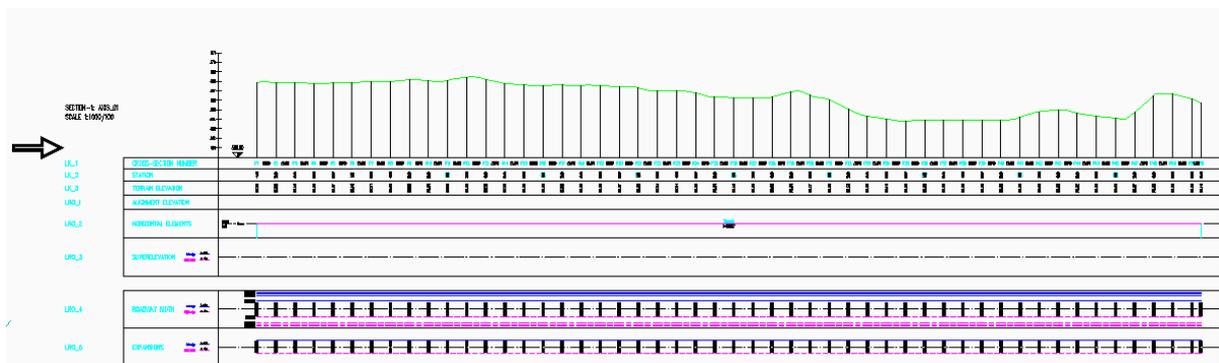
Draw Horizontal Elements

Horizontal road elements

Lane widths

Lane widenings

OK Cancel



4.2 Draw profile

In a profile view, you can insert tangents by interactively selecting vertex points. Alternatively, you can define the parameters in a dialog box after selecting the first tangent point in the drawing.

1. Click on the Profile icon.

2. Select first tangent point in the drawing.
Draw tangents dialogue box opens.

3. You can define vertex points interactively in the drawing, or you can specify tangent parameters in dialog box.

You can specify the following parameters:

- Station,
- Height,
- Tangent length,
- Slope and
- Section.

(You can specify two parameters at a time.)

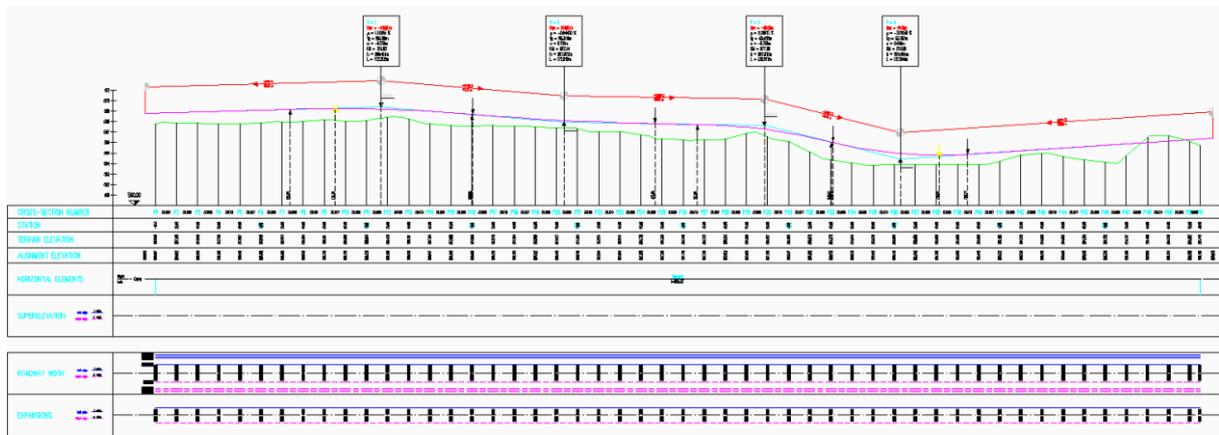
The screenshot shows the software's Profile menu with options: Profile, BestFit, Edit Profile, Move PVI, Move Profile, Label Settings, Draw Profile, Superimposed Profile, and Passive Profile. Below the menu is a profile drawing with a vertical axis from 581 to 589 and a horizontal axis. A 'Draw tangents' dialog box is open, showing input fields for Station [m] (0.0), h [m] (657.176507), L [m] (0.0), s [%] (39.186916), and Section. The dialog also has buttons for '>', 'Curve Parameters', 'Step settings', 'Back', 'Hide', and 'End'.

When drawing tangents, a preview of vertical alignment is shown based on the next tangent point/parameters selected.

The screenshot shows a profile drawing with a vertical axis from 0 to 20 and a horizontal axis. A 'Draw tangents' dialog box is open, showing input fields for Station [m] (292.0), h [m] (568.0), L [m] (302.0), s [%] (-0.264901), and Section. The dialog also has buttons for '>', 'Curve Parameters', 'Step settings', 'Back', 'Hide', and 'End'. Below the drawing is a table with columns for CROSS-SECTION NUMBER, STATION, TERRAIN ELEVATION, ALIGNMENT ELEVATION, HORIZONTAL ELEMENTS, and SUPERELEVATION. The table shows a series of stations from P1 to P24 and corresponding elevation values.

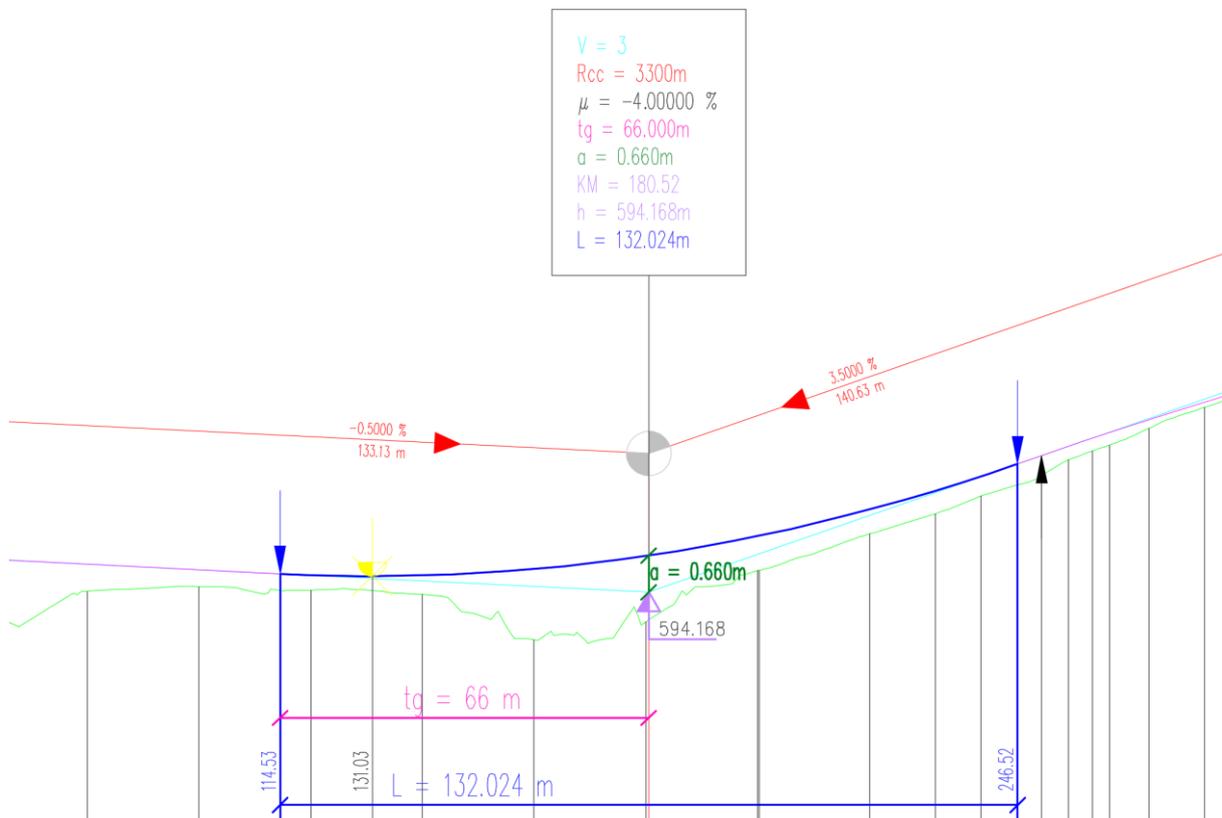
CROSS-SECTION NUMBER	STATION	TERRAIN ELEVATION	ALIGNMENT ELEVATION	HORIZONTAL ELEMENTS	SUPERELEVATION
P1	0	0	0		
P2	1	0	0		
P3	2	0	0		
P4	3	0	0		
P5	4	0	0		
P6	5	0	0		
P7	6	0	0		
P8	7	0	0		
P9	8	0	0		
P10	9	0	0		
P11	10	0	0		
P12	11	0	0		
P13	12	0	0		
P14	13	0	0		
P15	14	0	0		
P16	15	0	0		
P17	16	0	0		
P18	17	0	0		
P19	18	0	0		
P20	19	0	0		
P21	20	0	0		
P22	21	0	0		
P23	22	0	0		
P24	23	0	0		

4. When finished, press Enter. Vertical alignment and tangents are drawn and labelled in the drawing.



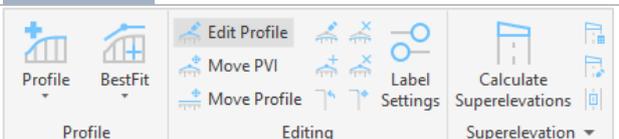
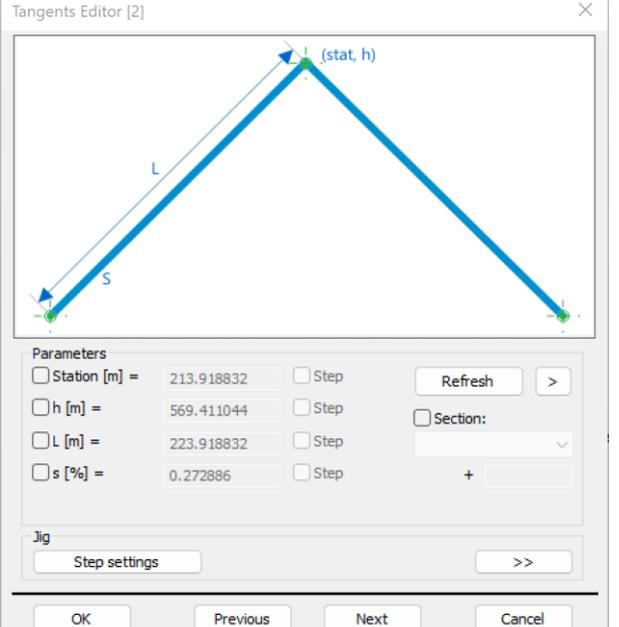
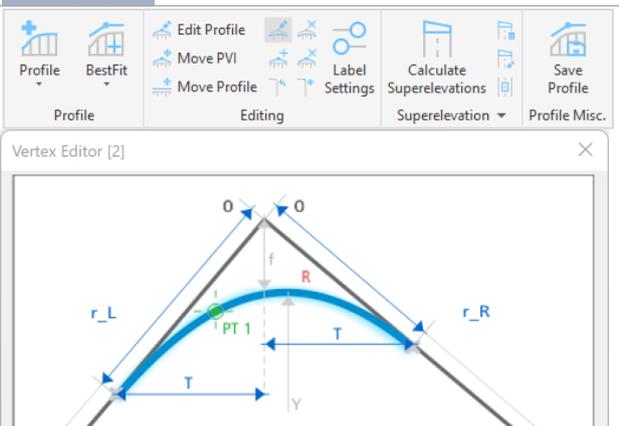
The following figure shows the meaning of the parameters that are displayed in the profile:

- Rcc/Rcv: the size of the radius of concave/convex vertical curve,
- μ : difference of grades of adjoining tangents,
- tg: tangent of curvature arc,
- a: Distance between vertical curvature and tangent,
- KM: the station of the apex point – refraction of tangents,
- h: the elevation of the apex point and
- L: the length of the vertical alignment curvature.



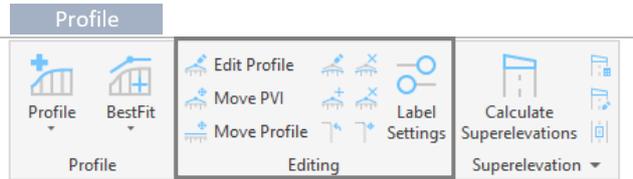
4.3 Profile editing

The Editing tab offers many commands for profile editing. For example, you can edit the geometry of the drawn tangents using the Edit Profile icon.

<ol style="list-style-type: none"> 1. Click on the <u>Edit profile</u> icon. 	
<ol style="list-style-type: none"> 2. Select the tangent in the drawing you want to edit. 3. In Tangents Editor dialogue box, check the parameter you want to edit and define new value. 4. Move forward to the next tangent vertex with the button Next. 5. When finished, click OK. 	
<p><i>You can also edit vertical curves.</i></p>	
<ol style="list-style-type: none"> 1. Run the <u>Edit Vertical Curve</u> command and select the tangent. 2. Check the box at the Interactive option. 3. Then check the parameter you want to edit and define a new value. 4. Move forward to the next vertex with the button Next. 5. When finished, click OK. 	

You can also edit geometry of the drawn tangent with the following commands:

- move PVI,
- insert PVI,
- delete PVI,
- move profile,
- rotate profile,
- change vertical curve,
- erase single vertical curve,
- reposition vertical curve labels.



4.3.1 Labels

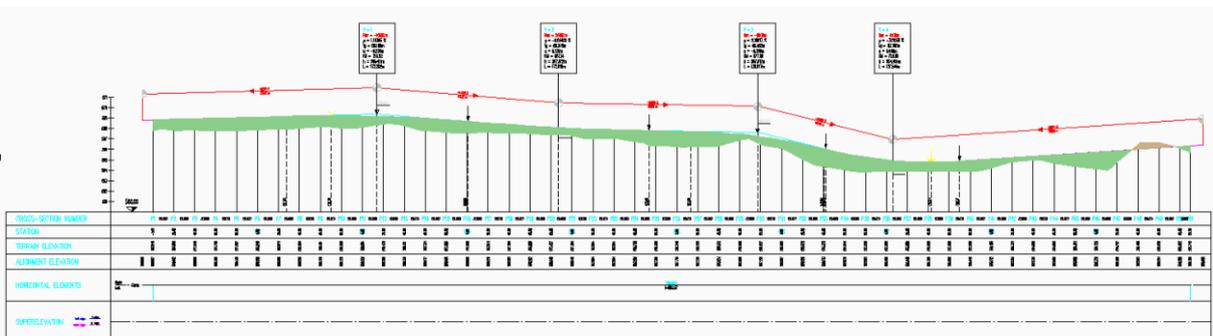
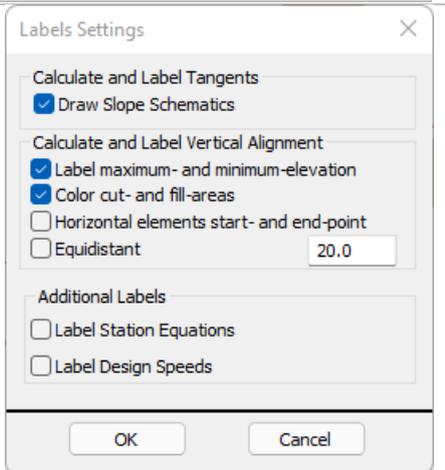
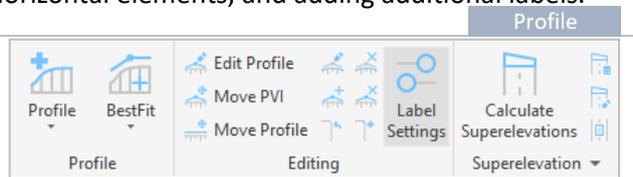
You can modify the label settings, including slope schematics, labeling maximum and minimum elevations, coloring cut and fill areas, adjusting horizontal elements, and adding additional labels.

1. Run the Label Settings command.

2. Check the box at the Color cut- and fill- areas.

3. Confirm by pressing the OK button.

4. Press Enter.



The tunnel example

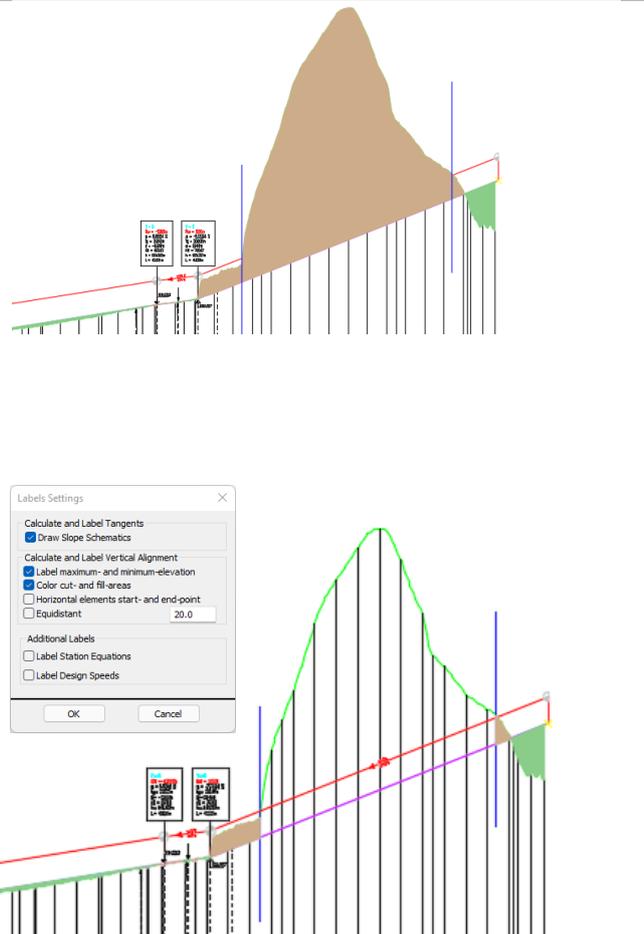
For example, if there is a tunnel, we may not want the cut hatch to be drawn in that area.

As shown in the image on the right, the tunnel area is currently hatched. You can change this quickly by following these steps:

1. Draw two lines that represents the start and the end of the tunnel. Use the CAD's Line command to draw those two lines.

2. Run the **Define Cut and Fill area (31G5)** command, select polylines and press Enter. In the drawing, select lines element, which represents hatch-boundary. After selecting the line, press Enter.

3. Run the **Label Settings** command again and confirm by pressing OK. Make sure that the Color cut- and fill areas option is checked. Press Enter or define tangent-labels position in the drawing.

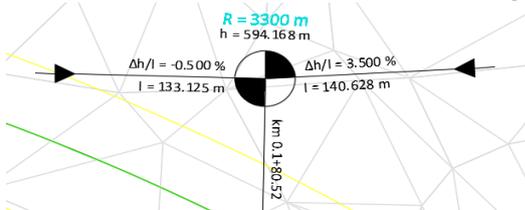


4.3.2 Draw Profile Labels command

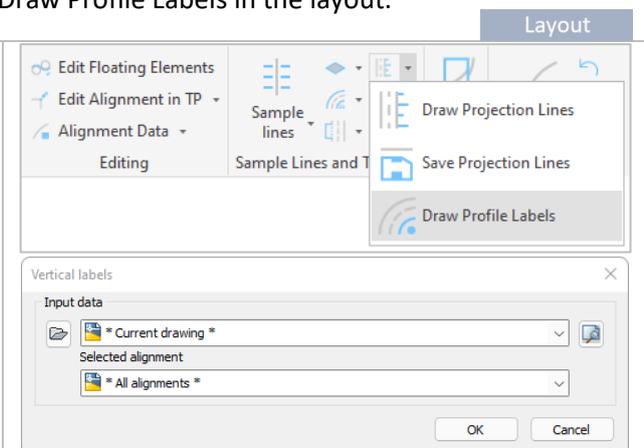
Once you have completed the profile, you can Draw Profile Labels in the layout.

1. Click on the Layout tab and run the **Draw Profile Labels** command.

A new dialog box opens, where the user defines input data. Confirm by pressing OK and the labels will be drawn in the drawing.



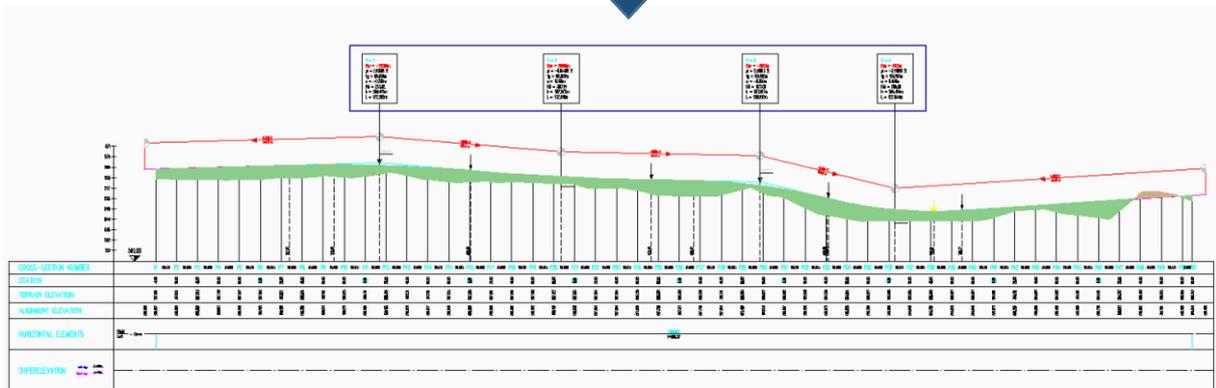
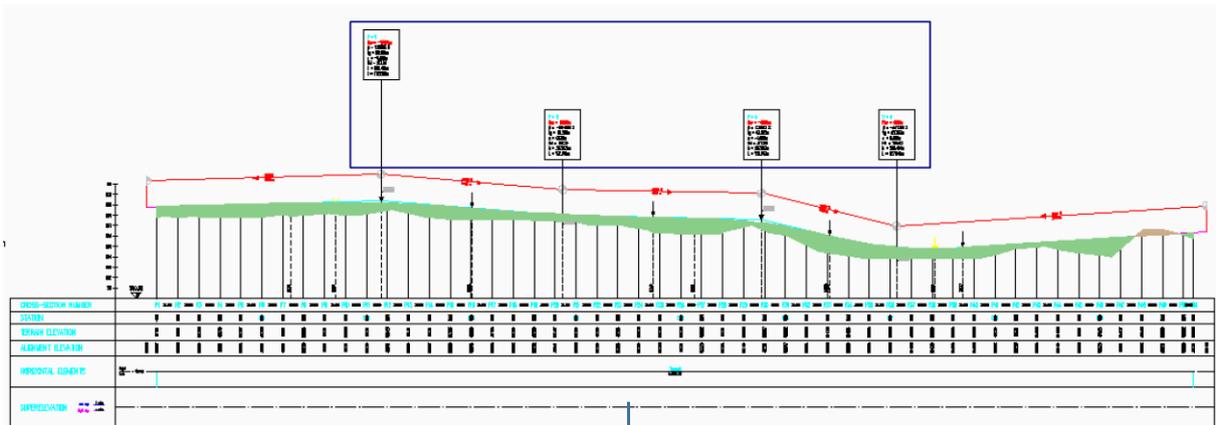
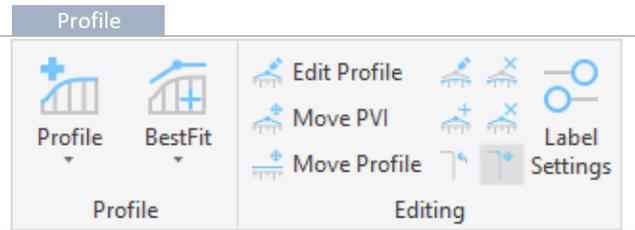
Profile labels are drawn with the default setting. If you want to change the default setting please read the following tutorial.



4.3.3 Move vertical curve labels

The table in which the calculated values of individual curvature elements are written can also be moved.

1. Run the Reposition Vertical Curve Labels (31H9) command.
2. Select the existing table and move it to a different location.



5 Superelevation

The definition of superelevation usually follows the vertical alignment design. Program calculates superelevation according to the horizontal roadway elements and design speed data.

1. Run the **Calculate Superelevations** command.

2. A new dialogue box opens. First define the area, where you want to calculate superelevations. Normally we calculate the superelevations on the whole axis, but you can also define your own area by pressing the Plus icon.

3. Then define superelevation type. Available options are:

- undivided crowned,
- undivided planar,
- divided crowned with median and
- divided planar with median.

In this case select the undivided crowned.

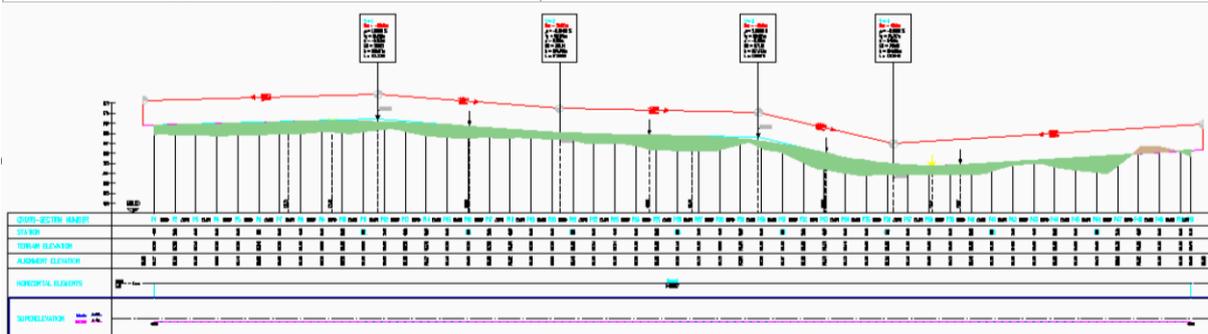
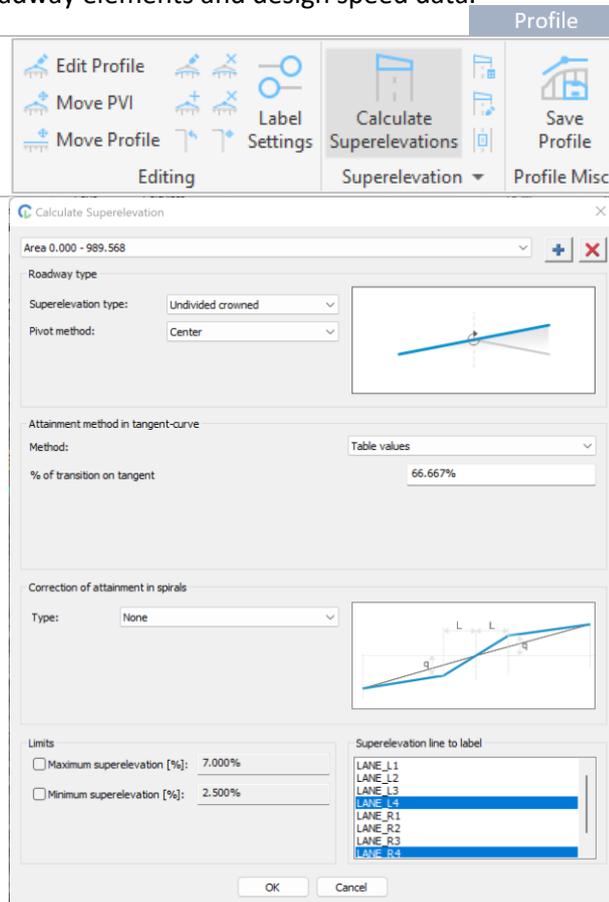
4. Then select the pivot method. It defines the point on the lane about which the roadway is superelevated. Select center.

5. The next two settings (Attainment method in tangent-curve and Correction of attainment in spirals) are advanced, so leave them as they are.

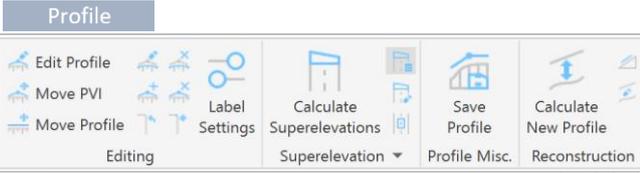
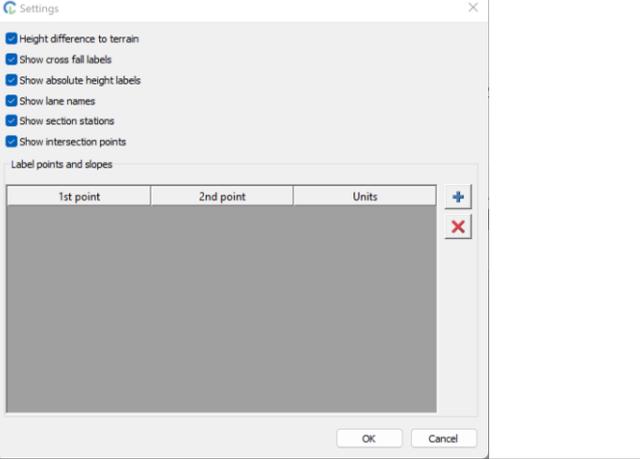
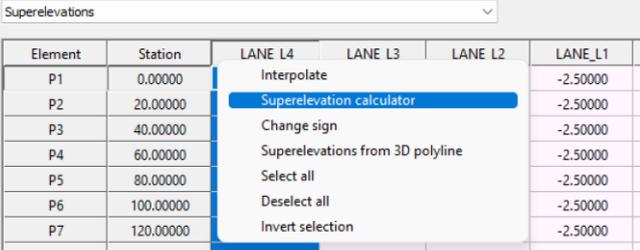
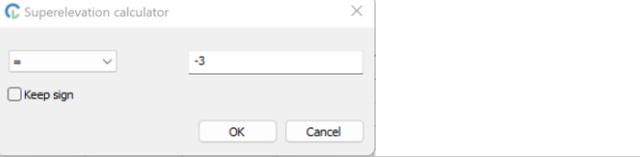
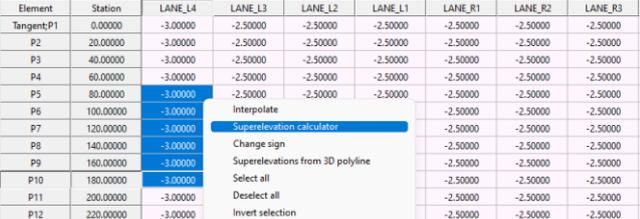
6. At the bottom of the dialog box specify limits (max. and min. superelevation).

7. On the right side you can specify which superelevation line should be labelled.

8. Confirm by pressing the OK button.



5.1 Edit superelevations

<p>1. Run the <u>Edit superelevation and curbs</u> command.</p>																																																																																																																																			
<p>2. Select the Terrain from the right drop-down menu on the top.</p>																																																																																																																																			
<p>3. Click settings button () and check all the options and click OK.</p>																																																																																																																																			
<p>4. Right click on the LANE_L4 and select the Superelevation calculator option.</p>	 <table border="1" data-bbox="740 1373 1380 1585"> <thead> <tr> <th>Element</th> <th>Station</th> <th>LANE_L4</th> <th>LANE_L3</th> <th>LANE_L2</th> <th>LANE_L1</th> <th>LANE_R1</th> <th>LANE_R2</th> <th>LANE_R3</th> <th>LANE_R4</th> </tr> </thead> <tbody> <tr> <td>P1</td> <td>0.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P2</td> <td>20.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P3</td> <td>40.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P4</td> <td>60.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P5</td> <td>80.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P6</td> <td>100.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P7</td> <td>120.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> </tbody> </table>	Element	Station	LANE_L4	LANE_L3	LANE_L2	LANE_L1	LANE_R1	LANE_R2	LANE_R3	LANE_R4	P1	0.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P2	20.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P3	40.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P4	60.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P5	80.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P6	100.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P7	120.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000																																																		
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<p>5. Select the = from the drop-down menu, uncheck the keep sign option and type -3. Press OK.</p>																																																																																																																																			
<p><i>NOTE! You can also change a single cell or a range. If you want to change the superelevation of an area, click in a first cell with the mouse, press Shift, and then click in the last cell of the desired area.</i></p>	 <table border="1" data-bbox="740 1756 1380 1975"> <thead> <tr> <th>Element</th> <th>Station</th> <th>LANE_L4</th> <th>LANE_L3</th> <th>LANE_L2</th> <th>LANE_L1</th> <th>LANE_R1</th> <th>LANE_R2</th> <th>LANE_R3</th> <th>LANE_R4</th> </tr> </thead> <tbody> <tr> <td>Tangent:P1</td> <td>0.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P2</td> <td>20.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P3</td> <td>40.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P4</td> <td>60.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P5</td> <td>80.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P6</td> <td>100.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P7</td> <td>120.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P8</td> <td>140.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P9</td> <td>160.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P10</td> <td>180.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P11</td> <td>200.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> <tr> <td>P12</td> <td>220.00000</td> <td>-3.00000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> <td>-2.50000</td> </tr> </tbody> </table>	Element	Station	LANE_L4	LANE_L3	LANE_L2	LANE_L1	LANE_R1	LANE_R2	LANE_R3	LANE_R4	Tangent:P1	0.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P2	20.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P3	40.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P4	60.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P5	80.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P6	100.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P7	120.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P8	140.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P9	160.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P10	180.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P11	200.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	P12	220.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000
Element	Station	LANE_L4	LANE_L3	LANE_L2	LANE_L1	LANE_R1	LANE_R2	LANE_R3	LANE_R4																																																																																																																										
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P6	100.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000																																																																																																																										
P7	120.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000																																																																																																																										
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P11	200.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000																																																																																																																										
P12	220.00000	-3.00000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000	-2.50000																																																																																																																										

5.2 Edit curbs

6. Select Curbs option in the drop-down menu.

7. Change the values where you want the curbs.

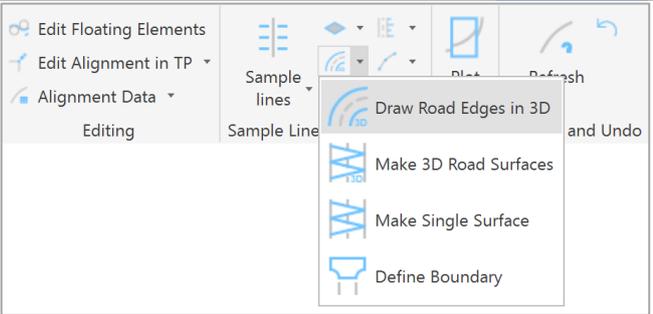
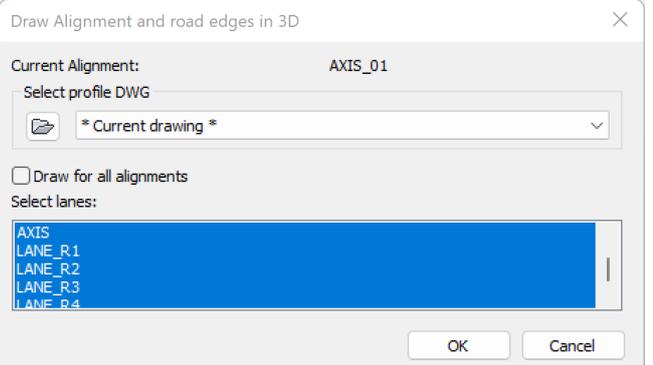
NOTE! This is optional. The user can also leave the value 0 here and specify the edge curbs in cross-sections.

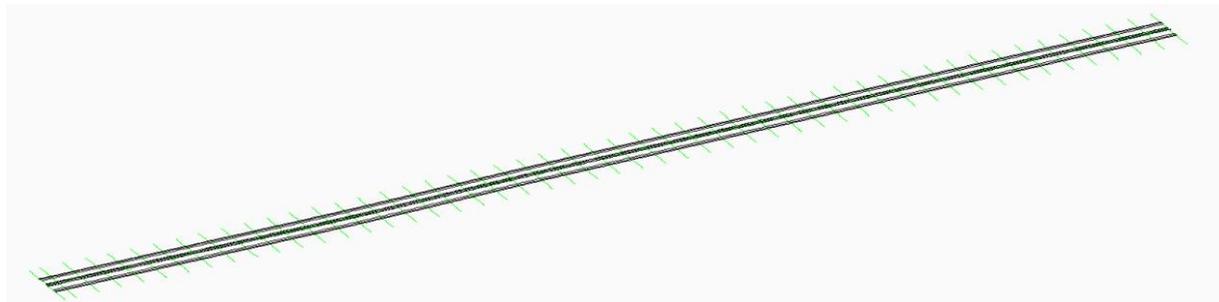
The screenshot shows the 'Edit Superelevations and Jumps' dialog box. The top part displays a cross-section diagram with lanes labeled LANE_L1 through LANE_S4 and various elevation values. A red arrow points to the 'Curbs' dropdown menu. Below the diagram is a table with columns for Element, Station, and multiple DH(LANE...) and DX(LANE...) columns. The table contains data for elements P1 through P12. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Element	Station	DH(LANE...)	DX(LANE...)										
Tangent;P1	0.00000												
P2	20.00000					-0.25000		-0.25000					
P3	40.00000					-0.25000		-0.25000					
P4	60.00000					-0.25000		-0.25000					
P5	80.00000					-0.25000		-0.25000					
P6	100.00000					-0.25000		-0.25000					
P7	120.00000					-0.25000		-0.25000					
P8	140.00000					-0.25000		-0.25000					
P9	160.00000					-0.25000		-0.25000					
P10	180.00000					-0.25000		-0.25000					
P11	200.00000					-0.25000		-0.25000					
P12	220.00000					-0.25000		-0.25000					

6. 3D Road Edges

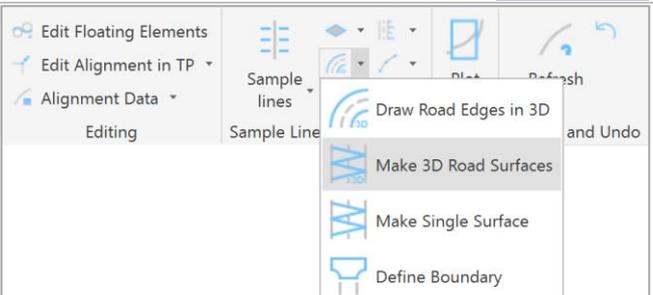
Once you have drawn the horizontal and vertical alignment, you can draw the 3D edges of the road.

<p>1. Run the <u>Draw Road Edges in 3D</u> command.</p>	 <p>The screenshot shows the software's ribbon interface. The 'Draw Road Edges in 3D' command is highlighted in the 'Sample Line' panel. Other visible commands include 'Edit Floating Elements', 'Edit Alignment in TP', 'Alignment Data', 'Sample lines', 'Sample Line', 'Make 3D Road Surfaces', 'Make Single Surface', and 'Define Boundary'.</p>
<p>2. Select all lanes from the list and press OK.</p>	 <p>The screenshot shows the 'Draw Alignment and road edges in 3D' dialog box. The 'Current Alignment' is set to 'AXIS_01'. The 'Select profile DWG' dropdown is set to '* Current drawing *'. The 'Draw for all alignments' checkbox is unchecked. The 'Select lanes:' list contains 'AXIS', 'LANE_R1', 'LANE_R2', 'LANE_R3', and 'LANE_R4', with all items selected. The 'OK' and 'Cancel' buttons are visible at the bottom.</p>



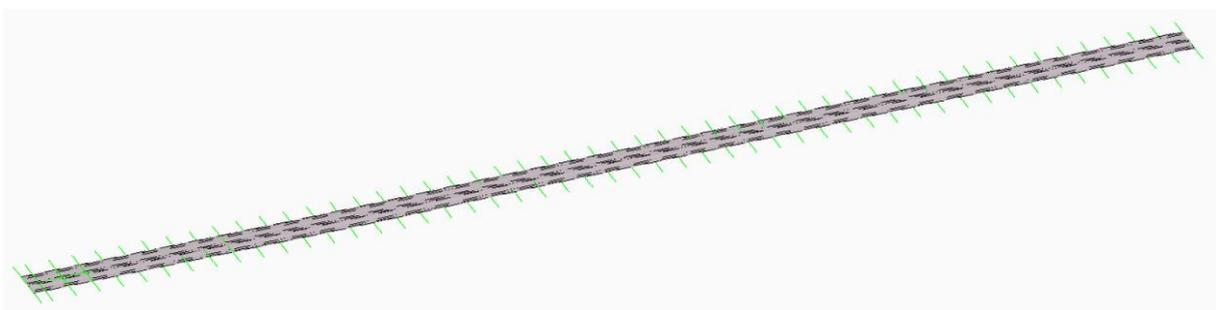
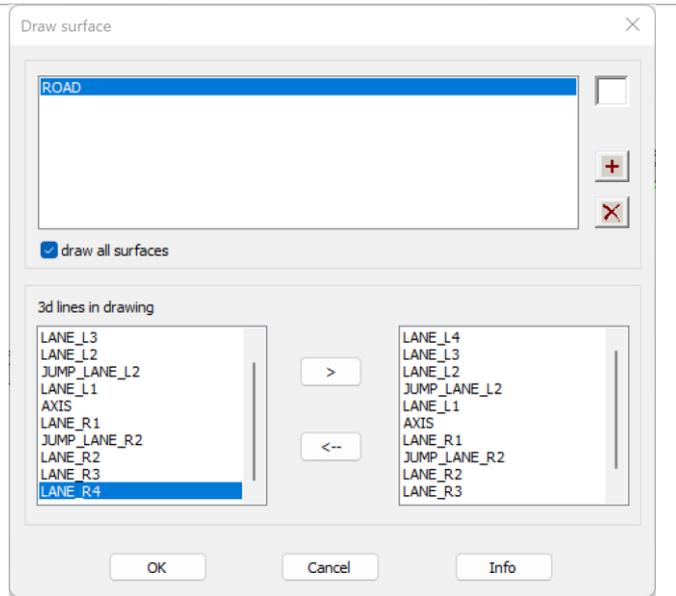
6.1 Top Surface

Based on 3D edges, we can create the surface of the roadway structure. This can also serve us to quickly calculate the volume of cut and fills in the next step.

<p>1. Run the <u>Make 3D Road Surfaces</u> command.</p>	 <p>The screenshot shows the software's ribbon interface. The 'Make 3D Road Surfaces' command is highlighted in the 'Sample Line' panel. Other visible commands include 'Edit Floating Elements', 'Edit Alignment in TP', 'Alignment Data', 'Sample lines', 'Sample Line', 'Draw Road Edges in 3D', 'Make Single Surface', and 'Define Boundary'.</p>
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2. Using the dialog box shown on the right, you can define between which lines a roadway surface is to be made.

3. After defining lines click OK.

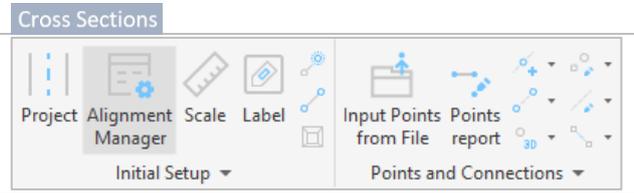
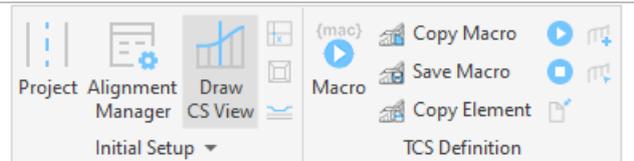
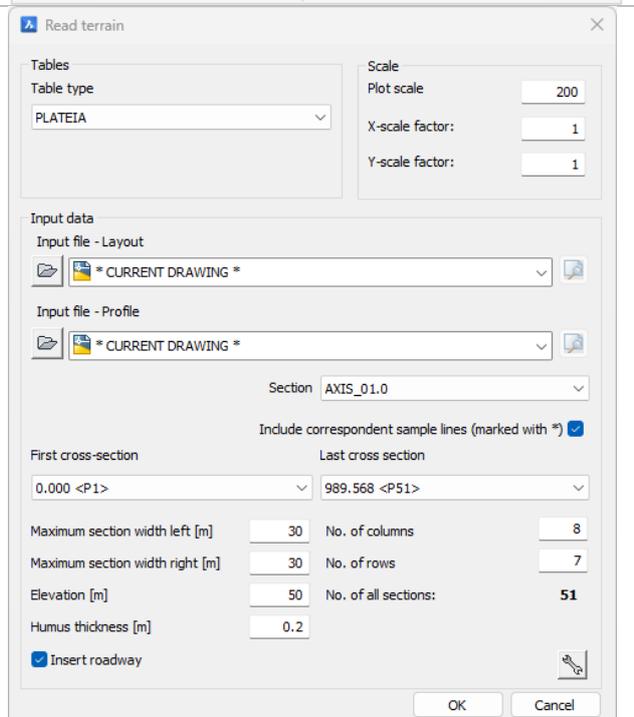


6.2 Quick Volume Calculation

<p>1. Run the <u>Surface Volume</u> command.</p>	<div style="border: 1px solid gray; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: -5px -5px 5px -5px;">Layout</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  Surface Civil </div> <div style="text-align: center;">  Surface volume </div> <div style="text-align: center;">  Polyline editor </div> <div style="text-align: center;">  2D/3D Polyline Polylines </div> <div style="text-align: center;">  Polyline from points </div> <div style="text-align: center;">  Polyline Section </div> <div style="text-align: center;">  Polyline Offset </div> <div style="text-align: center;">  Label Polyline </div> </div> </div>
<p>2. Select the base surface from the list.</p> <p>3. Select the target surface from the list.</p> <p>4. The result is cut and fill volume quantity, which is written in the command line.</p>	<div style="border: 1px solid gray; padding: 5px; background-color: #cccccc;"> <p>Select Base Surface</p> <p>Select Target Surface</p> <p>Cut:</p> <p>Fill:</p> </div>

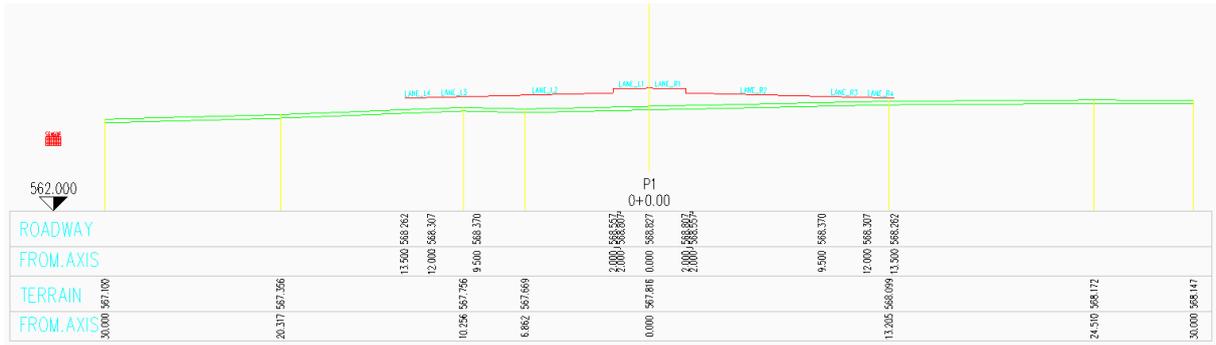
7. Draw cross-section view

This command reads the data from the source DWG files (Layout and Profile) or CRO and LS files and draws terrain lines and symbols in desired number of consecutive cross-sections. It also enables to insert and label the roadway.

<p>1. Click on the Layout tab, select <u>Alignment Manager</u> and double click on the Axis_A to set it as an active alignment.</p>	
<p>2. Click on the Cross-sections tab and run the <u>Draw CS View</u> command.</p>	
<p>3. In Read terrain dialog box specify:</p> <p>Table type: Plateia Plot scale: 200 X-scale factor: 1 Y-scale factor: 1</p> <p>Input file - Layout: <i>*current drawing*</i> Input file - Profile: <i>*current drawing*</i></p> <p>Select the first and the last cross-section from the drop-down menu.</p> <p>Maximum section width left [m]: 30 Maximum section width right [m]: 30 Elevation [m]: 50 Humus thickness [m]: 0.2</p> <p>Check: Insert roadway.</p>	
<p>4. Press OK to confirm parameters.</p>	

Select insertion point for upper-left corner and cross-sections will be inserted in the drawing.





5.3 Typical cross – section elements

Plateia provides capabilities for designing and editing roadway cross-sections in a detailed way with almost no geometry limitations to the final project design.

The typical cross-section elements (TSC) group of commands contains commands for inserting of individual TCS elements such as shoulders, embankments, substructure, ditches, pavements, etc. It is possible to insert TCS elements such as blocks, lines, points, etc.

NOTE! When editing a cross-section, it is essential to use **only Plateia's commands**, not AutoCAD's, such as Move, as this change will not be written to the cross-sections and will not be visible if we refresh them later.

Pavement

1. Run the Pavement command.
2. Select the first and the last cross-section:
 - first cross-section: P1
 - last cross-section: P51
3. Define other settings:
 - element label: PQC_L
 - a ... thickness [cm]: 27
 - b ... slope [1:x]: 0
 - c ... distance [cm]: 0
4. Click on the icon (🔑) and define new quantity:
 - name: PQC
 - type: Area (2)
 - hatch: solid
 - color: 251
5. Press OK to confirm this new defined quantity and select it from the drop-down menu.

Cross Sections

Embankment
 Line
 Pavement

Substructure
 Ditch
 Insert Block

Edit
 Extend
 Trim

Draw TCS Elements ▾ Edit TCS Elements

Pavement

Select method

Between CS

First cross-section: P1 0+000.00

Last cross-section: P51 0+989.57

Settings

Element label: PQC_L

a ... thickness [cm]: 27.0000

b ... slope [1:x]: 0

c ... distance [cm]: 0

List of materials: PQC

Output

Select elements

Select points on elements

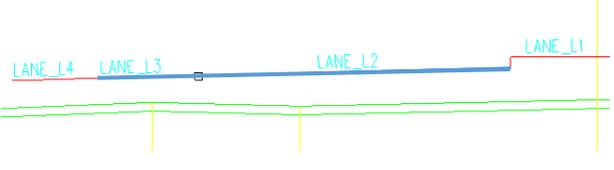
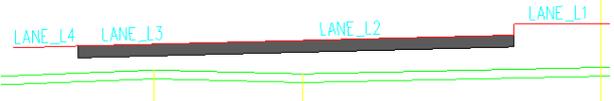
OK Cancel Help

Edit quantities

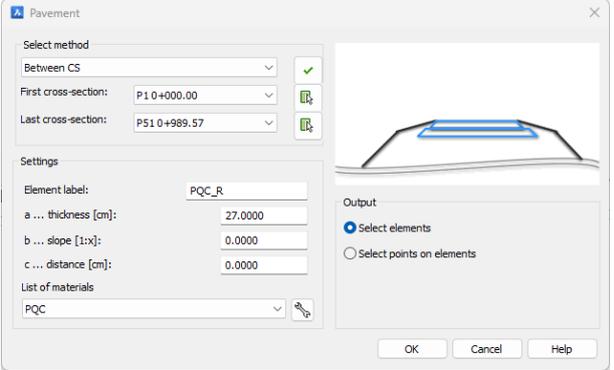
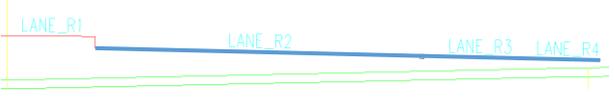
Name	Type	Hatch	Color	Code
Cut	Area (2)	SOLID	157	
Asphalt	Area (2)	SOLID	Magenta	
Crushed_stone	Area (2)	SOLID	40	
Sub_grade	Area (2)	SOLID	39	
Shoulder	Area (2)	SOLID	31	
Embankment	Area (2)	SOLID	74	
Drainage	Area (2)	SOLID	Cyan	
WALL	Area (2)	SOLID	Blue	
CONCRETE	Area (2)	SOLID	241	
Middle_Concrete	Area (2)	SOLID	104	
Curb_concrete	Area (2)	SOLID	13	
PQC	Area (2)	SOLID	251	

Hatch scale: 0.10

OK Cancel

<p>6. For output check the option at the <u>Select elements</u>.</p> <p>7. Click on the element LANE_L2 and LANE_L3 and press Enter or right-mouse click.</p>	
<p>The figure on the right shows the final result.</p>	

Now let's repeat the same procedure for the right lane.

<p>1. Run the <u>Pavement</u> command.</p>	
<p>2. Select the first and the last cross-section:</p> <ul style="list-style-type: none"> - first cross-section: P1 - last cross-section: P51 <p>3. Define other settings:</p> <ul style="list-style-type: none"> - element label: PQC_R - a ... thickness [cm]: 27 - b ... slope [1:x]: 0 - c ... distance [cm]: 0 <p>4. Select the PQC from the drop-down menu and then check the box at the <u>Select elements</u> option.</p> <p>5. When you have finished, confirm by pressing the OK button.</p>	
<p>6. Click on the element LANE_R2 and LANE_R3 and press Enter or right-mouse click.</p>	
<p>The figure on the right shows the final result.</p>	

Now we will add another pavement layer.

1. Run the **Pavement** command.
 2. Select the first and the last cross-section:
 - first cross-section: P1
 - last cross-section: P51
 3. Define other settings:
 - element label: DLC_L
 - a ... thickness [cm]: 15
 - b ... slope [1:x]: 0
 - c ... distance [cm]: 50
 4. Click on the icon and define new quantity:
 - name: DLC
 - type: Area (2)
 - hatch: solid
 - color: 253
 5. Press OK to confirm this new defined quantity and select it from the drop-down menu.
 6. For output check the option at the Select elements.
 7. Click on the lower edge of the first layer of pavement structure on the left and press Enter.
- The figure on the right shows the final result.

Cross Sections



Embankment



Shoulder



Substructure



Line



Ditch



Pavement



Insert Block



Edit



Extend



Trim

Draw TCS Elements ▾
Edit TCS Elements

Pavement

Select method: Between CS ✓

First cross-section: P1 0+000.00

Last cross-section: P51 0+989.57

Settings

Element label: DLC_L

a ... thickness [cm]: 15.0000

b ... slope [1:x]: 0.0000

c ... distance [cm]: 50.0000

List of materials: DLC

Output: Select elements

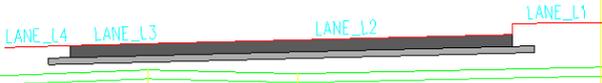
OK Cancel Help

Edit quantities

Name	Type	Hatch	Color	Code
Asphalt	Area (2)	SOLID	Magenta	
Crushed_stone	Area (2)	SOLID	40	
Sub_grade	Area (2)	SOLID	39	
Shoulder	Area (2)	SOLID	31	
Embankment	Area (2)	SOLID	74	
Drainage	Area (2)	SOLID	Cyan	
WALL	Area (2)	SOLID	Blue	
CONCRETE	Area (2)	SOLID	241	
Middle_Concrete	Area (2)	SOLID	104	
Curb_concrete	Area (2)	SOLID	13	
PQC	Area (2)	SOLID	251	
DLC	Area (2)	SOLID	253	

Hatch scale: 0.10

OK Cancel

Then repeat the same procedure for the right part:

1. Run the **Pavement** command.
2. Define parameters.
3. Click on the lower edge of the first layer of pavement structure on the right and press Enter.

Pavement

Select method: Between CS ✓

First cross-section: P1 0+000.00

Last cross-section: P51 0+989.57

Settings

Element label: DLC_R

a ... thickness [cm]: 15.0000

b ... slope [1:x]: 0.0000

c ... distance [cm]: 50.0000

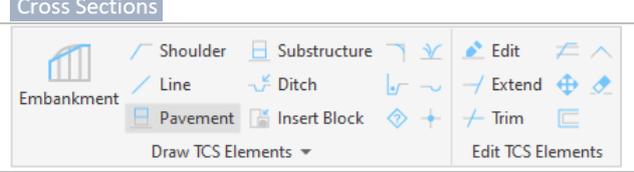
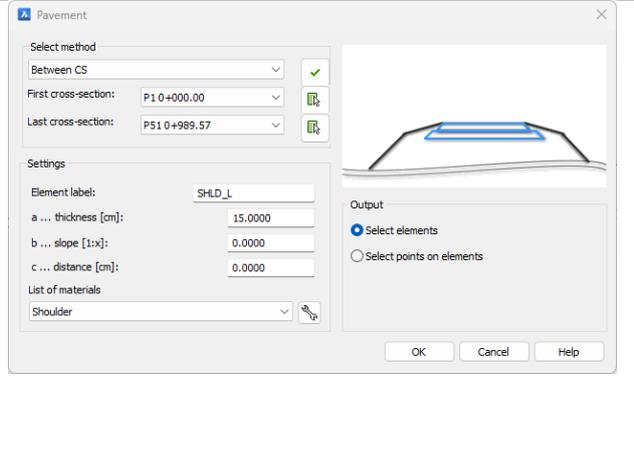
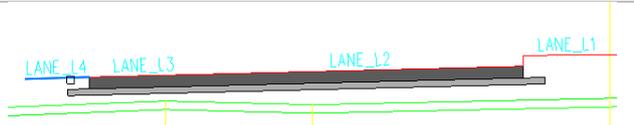
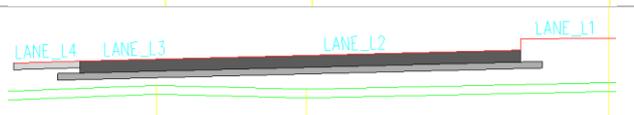
List of materials: DLC

Output: Select elements

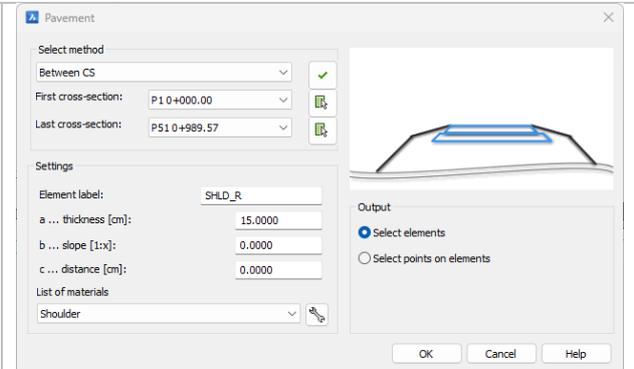
OK Cancel Help

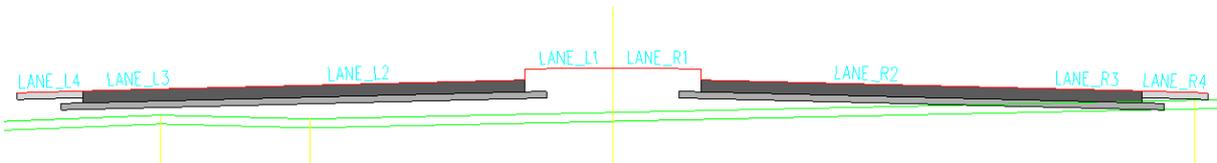


Shoulder

<p>1. Run the <u>Pavement</u> command.</p>	
<p>2. Select the first and the last cross-section:</p> <ul style="list-style-type: none"> - first cross-section: P1 - last cross-section: P51 <p>3. Define other settings:</p> <ul style="list-style-type: none"> - element label: SHLD_L - a ... thickness [cm]: 15 - b ... slope [1:x]: 0 - c ... distance [cm]: 0 <p>4. Select the Shoulder from the drop-down menu and then check the box at the <u>Select elements</u> option.</p>	
<p>5. Click on the element LANE_L4 and then press Enter or right-mouse click.</p>	
<p>The figure on the right shows the final result.</p>	

Then repeat the same procedure for the right part:

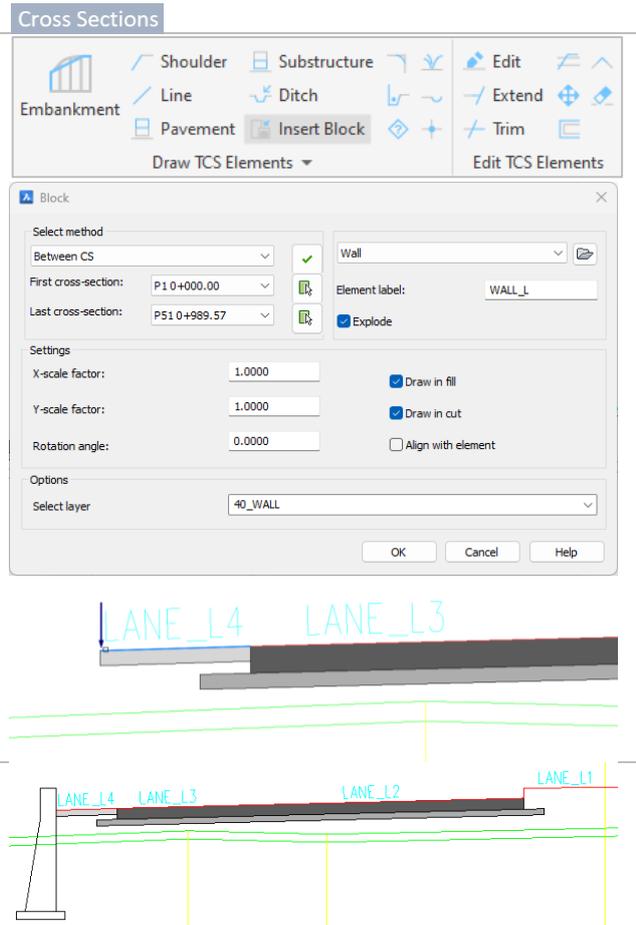
<p>1. Run the <u>Pavement</u> command.</p> <p>2. Define parameters.</p> <p>3. Click on the lower edge of the first layer of pavement structure on the right and press Enter.</p>	
--	--



Parapet Wall

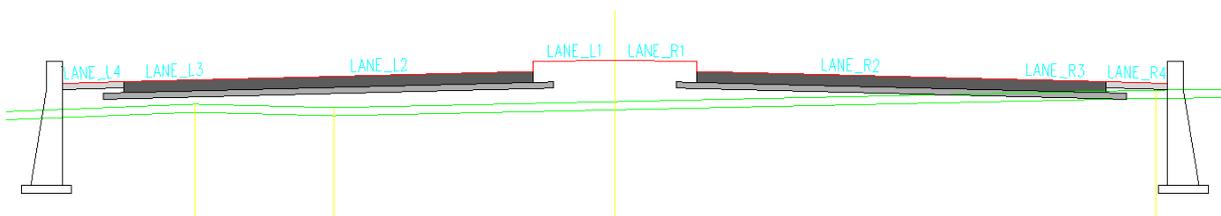
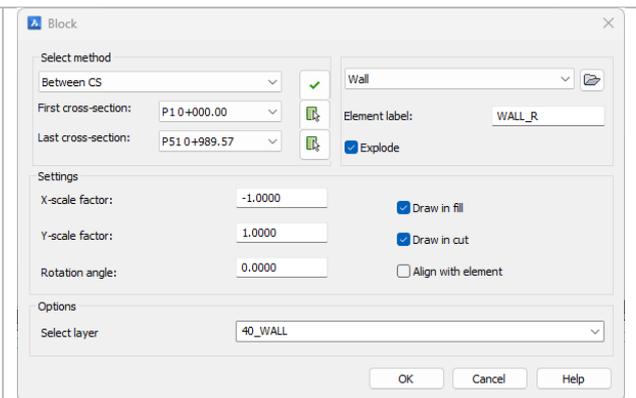
If you have a wall that is the same shape and size along the alignment, you can insert it as a block.

1. Run the Insert block command.
 2. Select block from the drop-down menu. In this case the name of the block is wall.
 3. Check the box at the Explode option.
 4. Define the layer name.
 5. Click OK.
 6. Select the left edge of the shoulder.
- The figure on the right shows the final result.



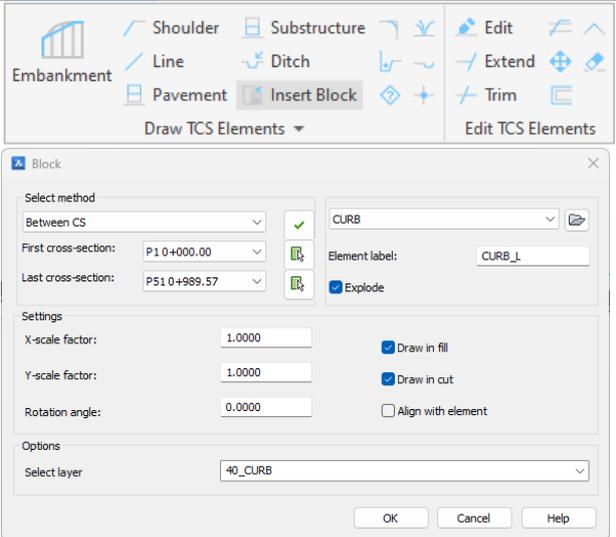
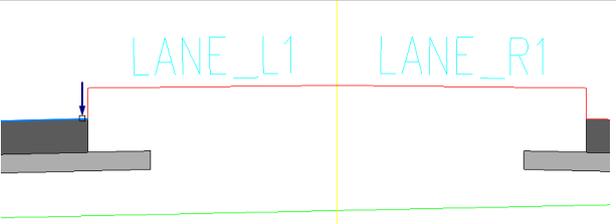
Repeat the same procedure for the right side.

1. Run the Insert block command.
2. Define parameters. Be careful that you type -1 for the X-scale factor to mirror the block.
3. Confirm by pressing the OK button.

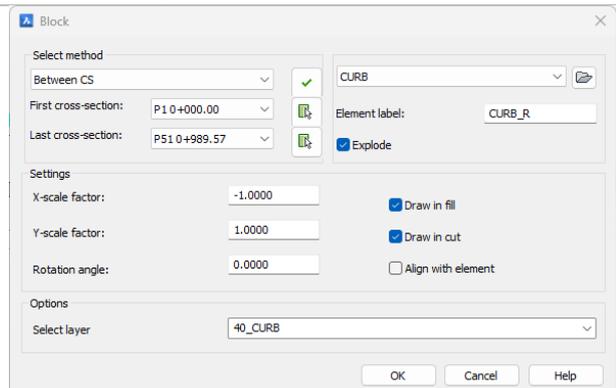


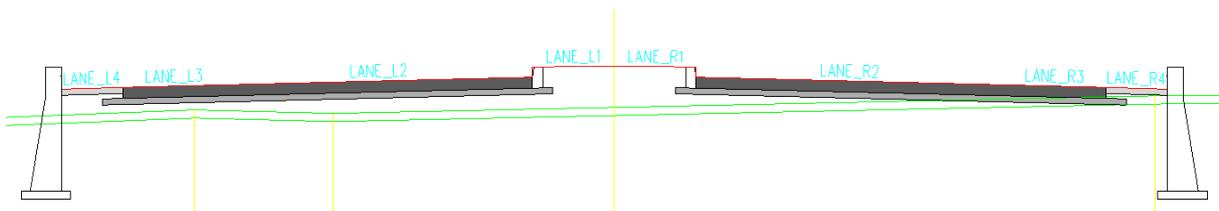
Curb

We will also insert the curb as a block.

<ol style="list-style-type: none"> 1. Run the <u>Insert block</u> command. 2. Select block from the drop-down menu. In this case the name of the block is curb. 3. Check the box at the Explode option. 4. Define the layer name. 5. Click OK. 	
<ol style="list-style-type: none"> 6. Click on the right edge of the LANE_L2. 	
<p>The figure on the right shows the final result.</p>	

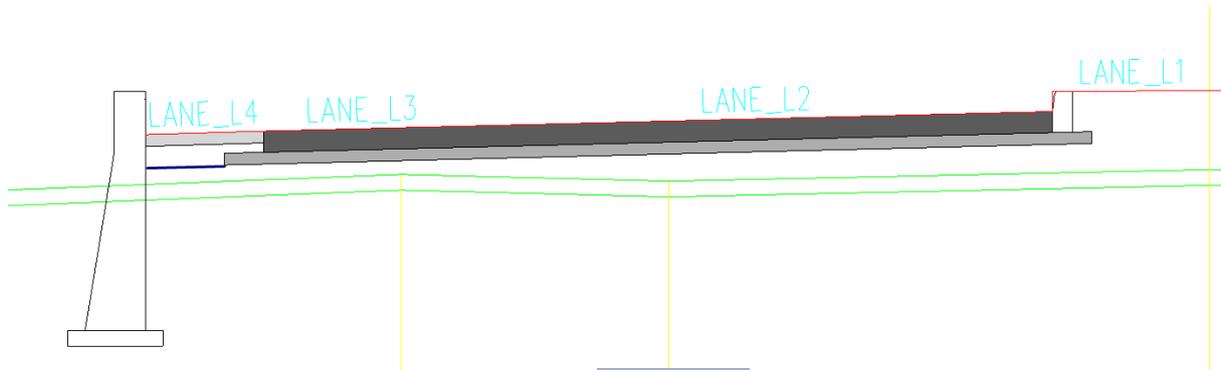
Repeat the same procedure for the right side.

<ol style="list-style-type: none"> 1. Run the <u>Insert block</u> command. 2. Define parameters. Be careful that you type -1 for the X-scale factor to mirror the block. 3. Confirm by pressing the OK button. 	
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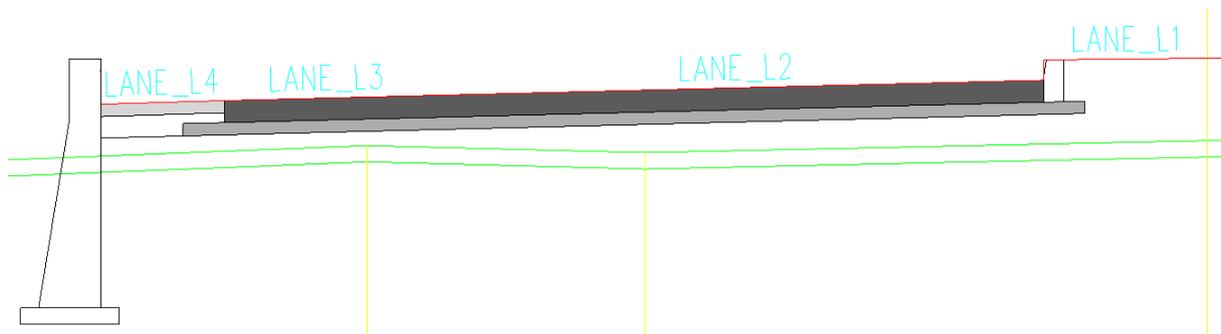


Shoulder – second layer

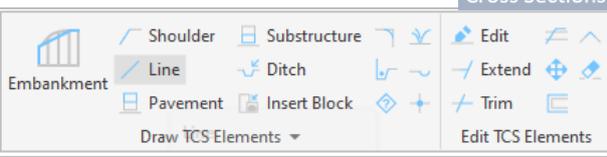
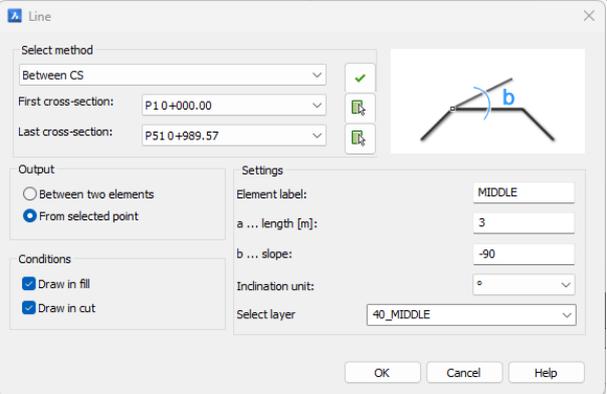
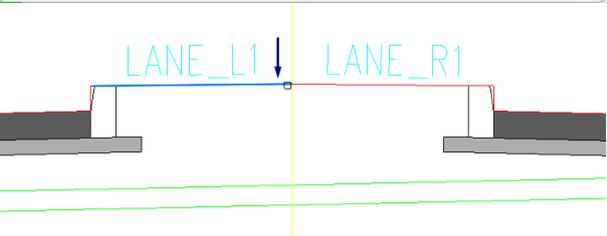
If you want to create a second layer of shoulder, you have to first define the bottom. This bottom represents the blue line in the image below. You draw this line by extending the line representing the lower part of the material DLC to the wall.

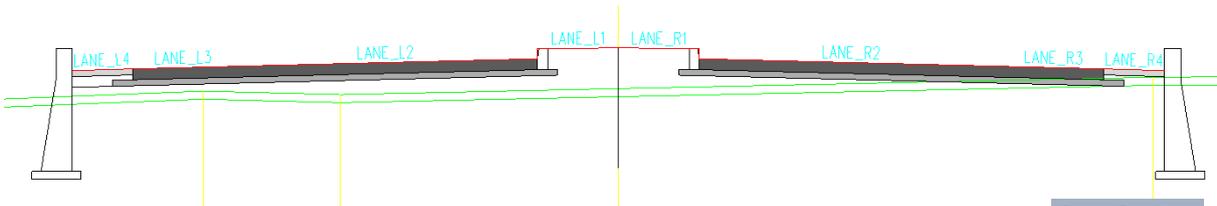


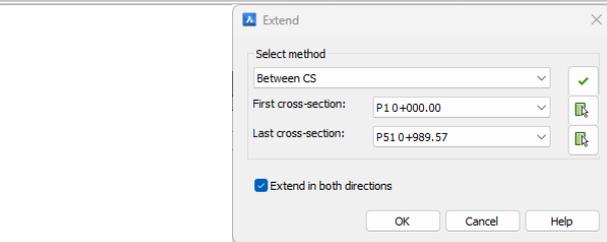
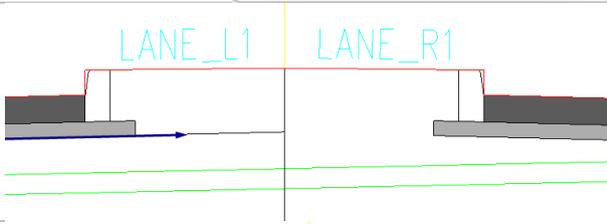
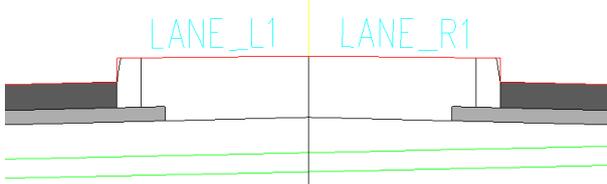
1. Run the <u>Extend</u> command.	
2. It opens a new dialogue box. Simply press OK.	
3. Select edge (wall) and press Enter.	
4. Select element to extend and press Enter.	



Middle of the road

<p>1. Run the <u>Line</u> command.</p>	
<p>2. Define parameters:</p> <ul style="list-style-type: none"> - element labels: MIDDLE - a ... length [m]: 3 - b ... slope: -90 - inclination unit: ° - layer: 40_MIDDLE <p>3. Press OK.</p>	
<p>4. Click on the right edge of the LANE_L1.</p>	



<p>1. Run the <u>Extend</u> command.</p>	
<p>2. It opens a new dialogue box. Simply press OK.</p> <p>3. Select edge (MIDDLE line) and press Enter.</p> <p>4. Select element to extend and press Enter.</p>	
<p>After that extend the line on the right side.</p>	
<p>After that extend the line on the right side.</p>	

8. Planimetry

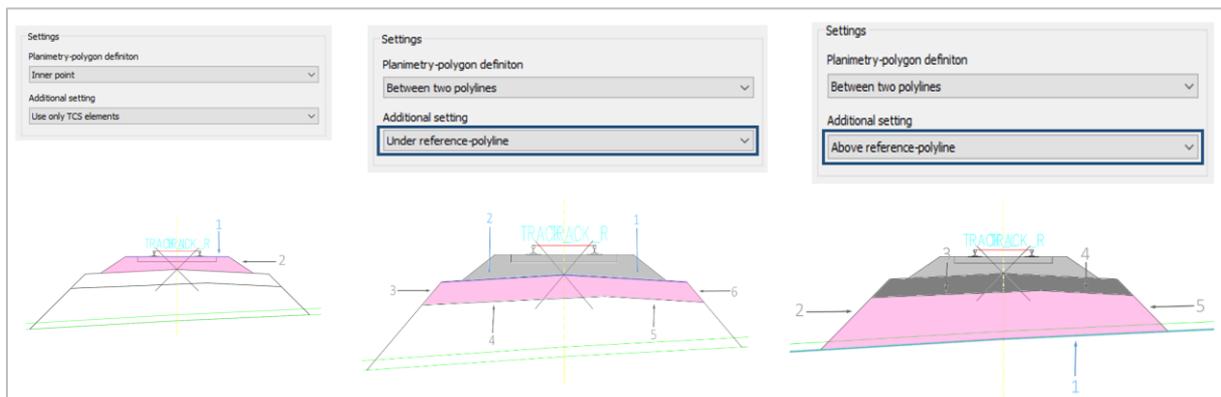
Based on constructed cross-sections, it is possible to precisely calculate the cut, the fill and other volumes. The calculation is based on the so-called planimetry polygon lines that represent borders of planimetry quantities.

When we made the Pavement element, we had the option to automatically create the planimetric quantity. For other elements, such as inserted blocks, we have to planimetry manually.

These planimetry quantities are the basis for quantity take-off report and 3D model creation.

The user has three options for creating planimetric quantities:

- inner point,
- under reference polyline and
- above reference polyline.



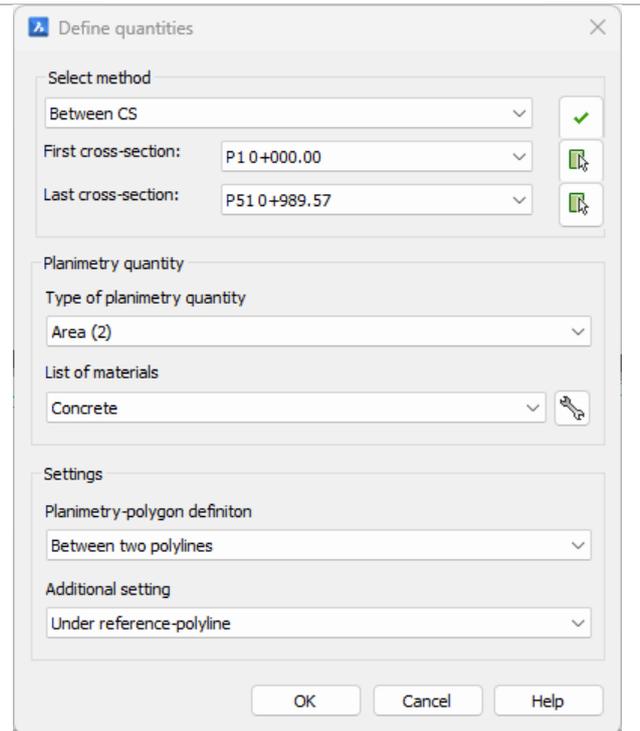
Retaining wall on the left – Under reference- polyline method

<p>1. Click on the Cross Sections tab and select the Planimetry icon.</p>																																																																		
<p>2. In the dialog box press the tick button to select all cross-sections and define the type of the planimetry quantity.</p>	<table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> <th>Hatch</th> <th>Color</th> <th>Code</th> </tr> </thead> <tbody> <tr> <td>CONCRETE</td> <td>Area (2)</td> <td>SOLID</td> <td>241</td> <td></td> </tr> <tr> <td>Middle_Concrete</td> <td>Area (2)</td> <td>SOLID</td> <td>104</td> <td></td> </tr> <tr> <td>Curb_concrete</td> <td>Area (2)</td> <td>SOLID</td> <td>13</td> <td></td> </tr> <tr> <td>PQC</td> <td>Area (2)</td> <td>SOLID</td> <td>251</td> <td></td> </tr> <tr> <td>DLC</td> <td>Area (2)</td> <td>SOLID</td> <td>253</td> <td></td> </tr> <tr> <td>Concrete</td> <td>Area (2)</td> <td>SOLID</td> <td>251</td> <td></td> </tr> <tr> <td>Foundation</td> <td>Area (2)</td> <td>ANSI31</td> <td>251</td> <td></td> </tr> <tr> <td>H1</td> <td>Area (2)</td> <td>SCREED</td> <td>254</td> <td></td> </tr> <tr> <td>SSB</td> <td>Area (2)</td> <td>GRAVEL1</td> <td>254</td> <td></td> </tr> <tr> <td>Subgrade</td> <td>Area (2)</td> <td>SCREED</td> <td>251</td> <td></td> </tr> <tr> <td>Curb</td> <td>Area (2)</td> <td>SOLID</td> <td>254</td> <td></td> </tr> <tr> <td>Concrete</td> <td>Area (2)</td> <td>SOLID</td> <td>251</td> <td></td> </tr> </tbody> </table>	Name	Type	Hatch	Color	Code	CONCRETE	Area (2)	SOLID	241		Middle_Concrete	Area (2)	SOLID	104		Curb_concrete	Area (2)	SOLID	13		PQC	Area (2)	SOLID	251		DLC	Area (2)	SOLID	253		Concrete	Area (2)	SOLID	251		Foundation	Area (2)	ANSI31	251		H1	Area (2)	SCREED	254		SSB	Area (2)	GRAVEL1	254		Subgrade	Area (2)	SCREED	251		Curb	Area (2)	SOLID	254		Concrete	Area (2)	SOLID	251	
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<p>3. Click on the button next to the list of materials. It opens a new dialog, where you add and edit quantities.</p>	<p>4. Press the plus button and define new quantity. Enter the name Curb and select the colour from the drop-down menu.</p>																																																																	
<p>5. When finished, press OK.</p>																																																																		

6. Select a new defined material from the list.

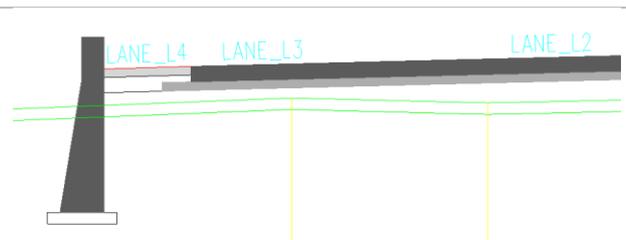
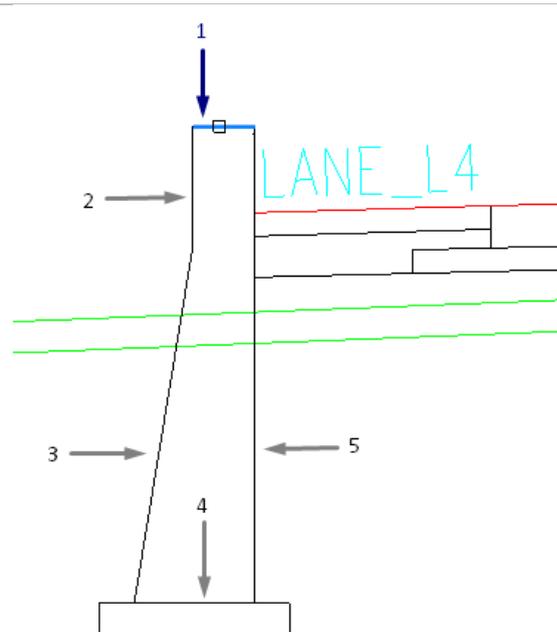
7. Select Between two polylines for the Planimetry-polygon definition and then define the additional settings. Select Under reference-polyline option from the drop-down menu.

8. Confirm by pressing OK.



9. First, click on the line, which represents the upper edge of the Wall. Press Enter and then click on the remaining lines, representing the wall's boundary. For this option (under reference-polyline) be sure to click lines in a counter clockwise direction.

10. When finished, press Enter.

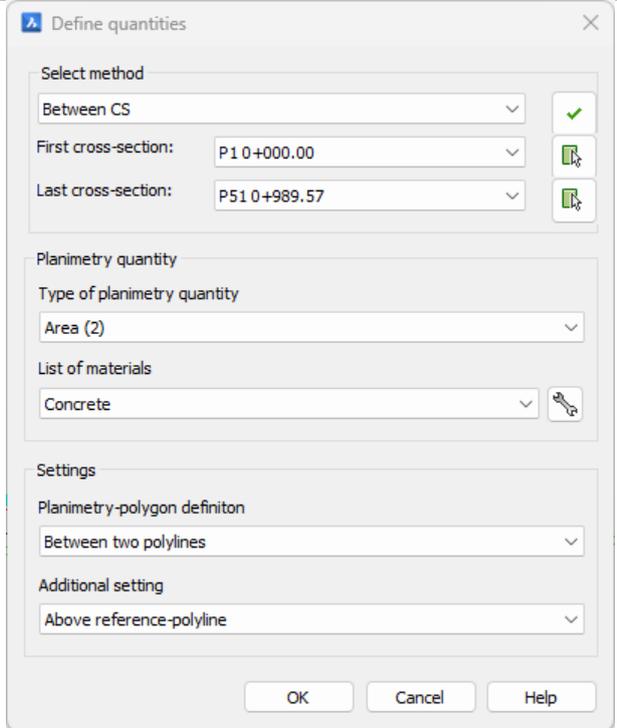


Retaining wall on the right– Above reference- polyline method

1. Click on the Planimetry once again and repeat the procedure.



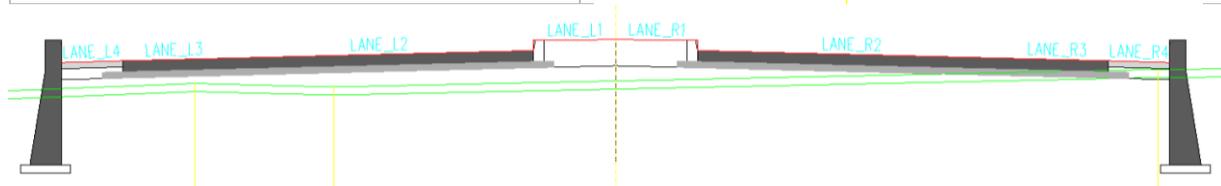
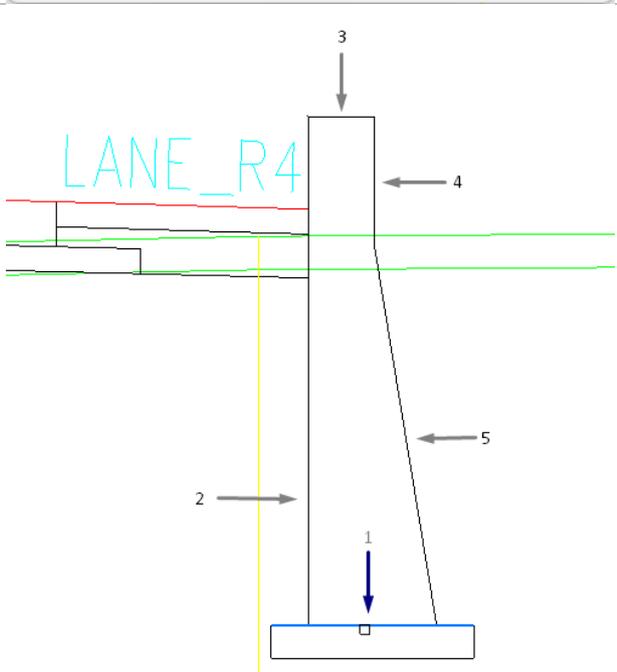
2. In the dialog box select all cross sections, select the planimetry quantity and select Concrete from the list of materials.



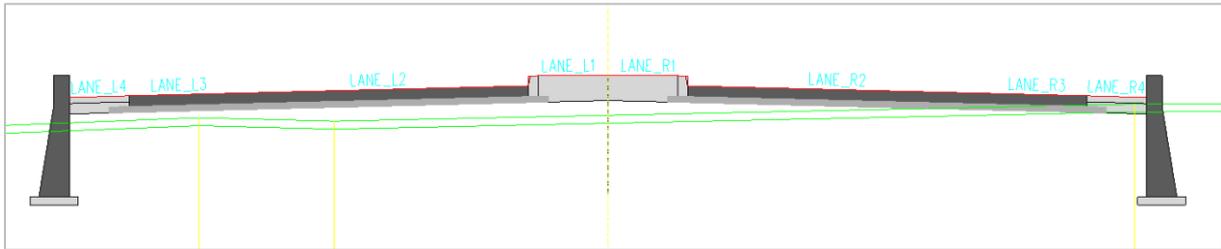
3. Select Between two polylines for the Planimetry-polygon again, but this time select the Above reference-polyline for the Additional settings.

4. Confirm by pressing OK.

First, click on the line that represents the bottom of the wall. Press Enter and then click on the remaining lines, representing the wall's boundary. For this option (above reference-polyline) be sure to click lines in a clockwise direction.



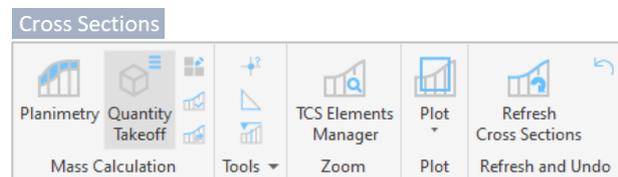
With the help of the Planimetry command, we then planimetrify the rest of the quantities, so that at the end we have the cross-section shown in the image below:



9. Quantity Take-Off

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

1. Click on the Cross Sections tab and select the Quantity take-off icon.

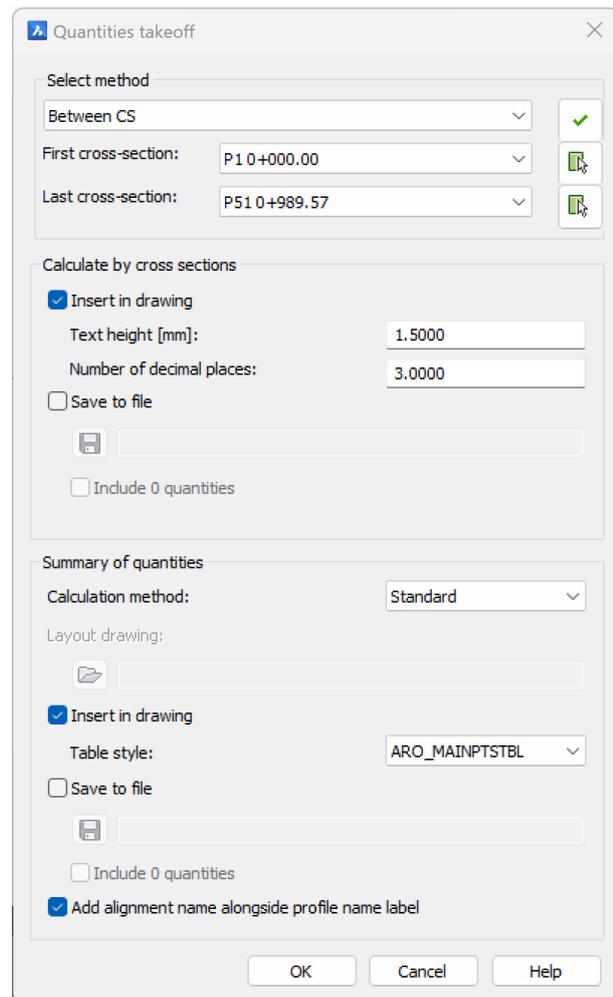


2. Press the tick button to select all cross sections.

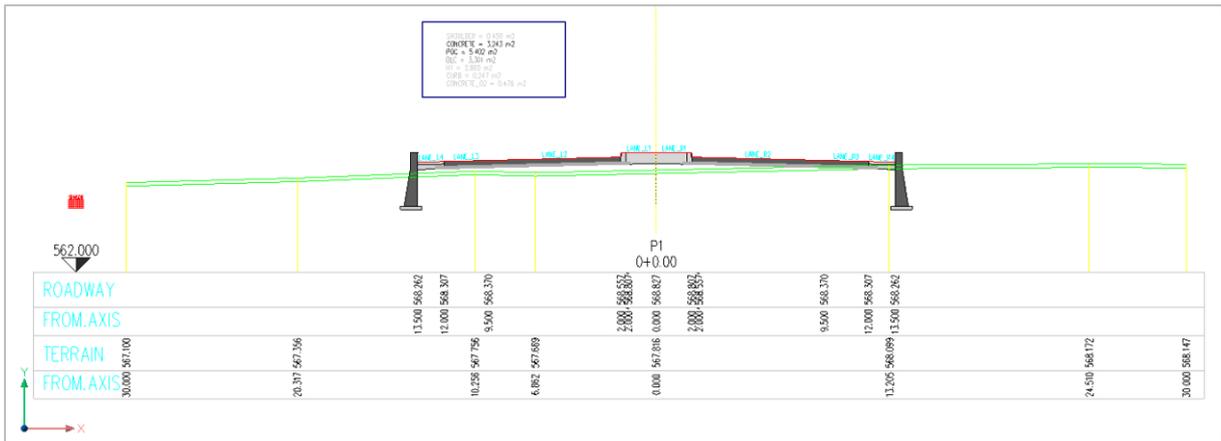
Check insert in drawing and select the location for planimetry labels in the drawing.

3. For summary of quantities calculation, check insert in drawing option and define an insertion point of quantity table in the drawing.

4. Confirm by pressing OK.



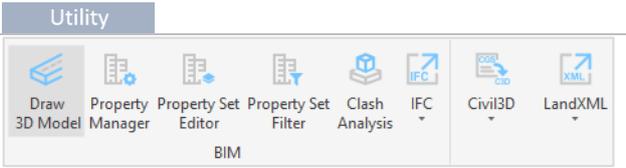
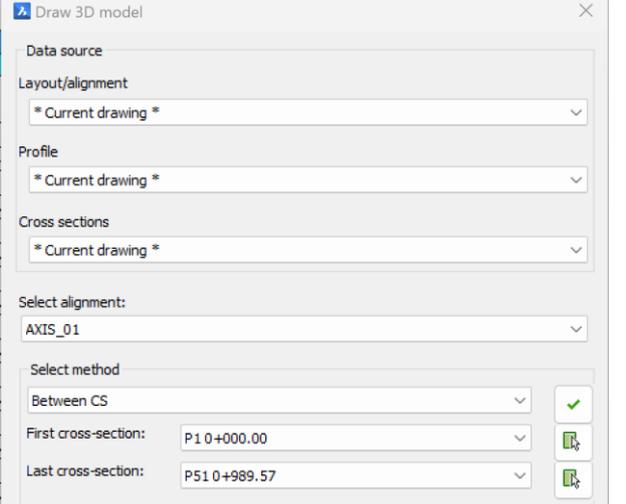
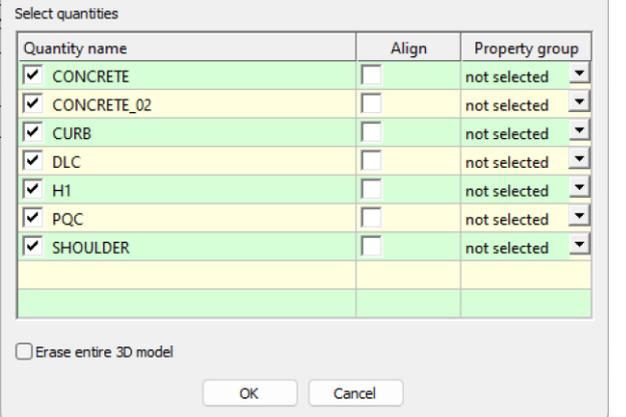
Calculate by cross-sections:

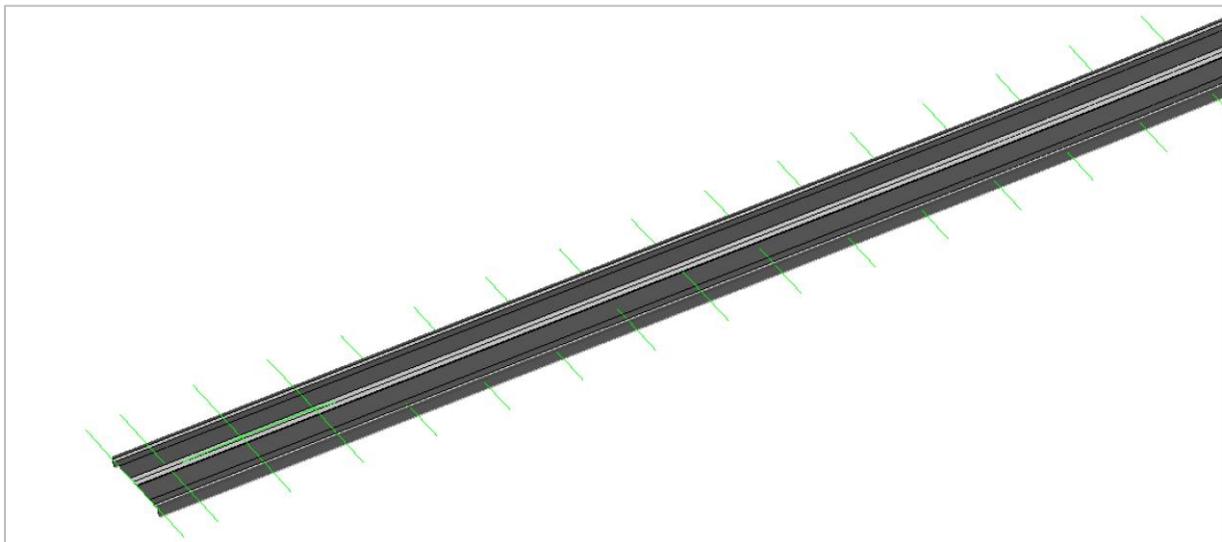


Summary of quantities for first ten cross-sections:

Quantity takeoff															
Sect	Slot	SHOULDER	Dist.	CONCRETE	Dist.	POC	Dist.	D.L.C	Dist.	HI	Dist.	CURB	Dist.	CONCRETE_02	Dist.
	Dist	[m ² /m]													
P1 AXIS_01	0+0.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P2 AXIS_01	0+20.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P3 AXIS_01	0+40.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P4 AXIS_01	0+60.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P5 AXIS_01	0+80.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P6 AXIS_01	0+100.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P7 AXIS_01	0+120.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P8 AXIS_01	0+140.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P9 AXIS_01	0+160.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
	20.000	9.004	20.000	64.869	20.000	108.034	20.000	66.019	20.000	57.207	20.000	4.933	20.000	9.518	20.000
P10 AXIS_01	0+180.00	0.450		3.243		5.402		3.301		2.860		0.247		0.476	
Sumar		81.036		583.823		972.304		594.169		514.865		44.397		85.660	
		SHOULDER		CONCRETE		POC		D.L.C		HI		CURB		CONCRETE_02	
		[m]		[m]		[m]		[m]		[m]		[m]		[m]	
						Calculation method		Standard							

10. Create a 3D Model

1. Click on the <u>Draw 3D model</u> icon.																									
2. Select *Current drawing* for the alignment, profile and cross-sections.																									
3. Select the alignment from the drop-down menu and define the starting and ending cross-section.																									
4. Check the boxes at the planimetry quantities you want to create a 3D solid model from.	 <table border="1" data-bbox="791 999 1366 1279"><thead><tr><th>Quantity name</th><th>Align</th><th>Property group</th></tr></thead><tbody><tr><td><input checked="" type="checkbox"/> CONCRETE</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> CONCRETE_02</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> CURB</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> DLC</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> H1</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> PQC</td><td><input type="checkbox"/></td><td>not selected</td></tr><tr><td><input checked="" type="checkbox"/> SHOULDER</td><td><input type="checkbox"/></td><td>not selected</td></tr></tbody></table>	Quantity name	Align	Property group	<input checked="" type="checkbox"/> CONCRETE	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> CONCRETE_02	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> CURB	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> DLC	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> H1	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> PQC	<input type="checkbox"/>	not selected	<input checked="" type="checkbox"/> SHOULDER	<input type="checkbox"/>	not selected
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<input checked="" type="checkbox"/> CONCRETE	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> CONCRETE_02	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> CURB	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> DLC	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> H1	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> PQC	<input type="checkbox"/>	not selected																							
<input checked="" type="checkbox"/> SHOULDER	<input type="checkbox"/>	not selected																							
7. Confirm by clicking OK.																									

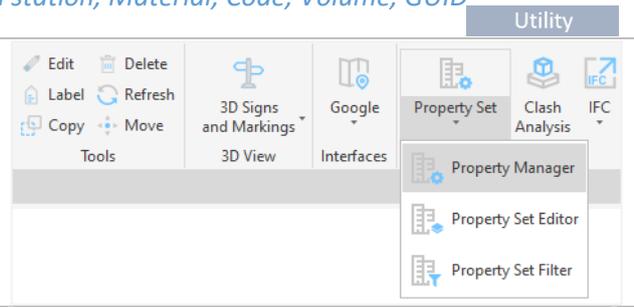
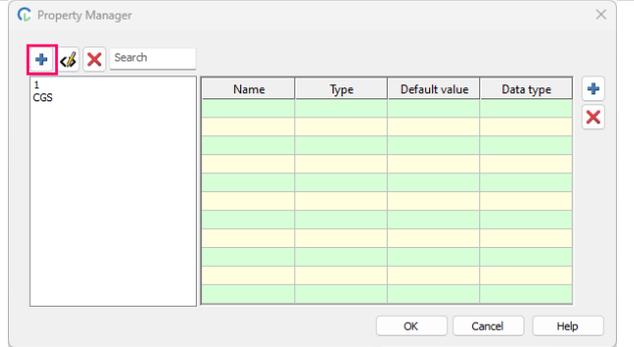
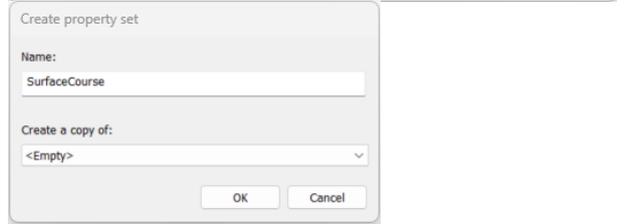
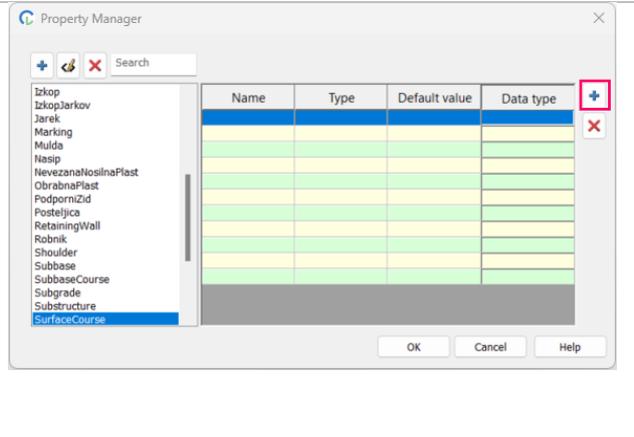


11. BIM Model

11.1 Defining Attributes

In the previous step, we created a 3D model. To directly generate a BIM model, we need to define property sets. There are two types of attributes available: automatic attributes, which are calculated and inserted automatically after creating the model with the "Draw 3D Model" command, and manual attributes, which are defined and attached manually.

Automatic Property Type: Axis, Start station, End station, Material, Code, Volume, GUID

<p>1. Run the "Property Manager" command: This command is used to create property sets.</p>	 <p>The screenshot shows the 'Utility' ribbon in a software interface. A dropdown menu is open, listing several options: 'Property Set', 'Clash Analysis', 'IFC', 'Property Manager', 'Property Set Editor', and 'Property Set Filter'. The 'Property Manager' option is highlighted.</p>
<p>2. Click the plus icon on the left section of the dialog box to add a new property set.</p>	 <p>The screenshot shows the 'Property Manager' dialog box. On the left side, there is a list of property sets. A red box highlights a plus icon (+) at the top of this list, indicating the action to add a new property set.</p>
<p>3. After that, the "Create Property Set" dialog appears, where the user enters the name of the property set and, if desired, selects an existing property set (e.g., CGS) as a template for the new property set or leaves the option as "empty."</p>	 <p>The screenshot shows the 'Create Property Set' dialog box. It has a 'Name' field containing 'SurfaceCourse' and a 'Create a copy of:' dropdown menu set to '<Empty>'. There are 'OK' and 'Cancel' buttons at the bottom.</p>
<p>4. Next, the user clicks the Plus button on the right to add attributes. (The list of property sets and their attributes is typically included in the BIM Execution Plan.)</p>	 <p>The screenshot shows the 'Property Manager' dialog box. On the right side, there is a table with columns 'Name', 'Type', 'Default value', and 'Data type'. A red box highlights a plus icon (+) at the top right of this table, indicating the action to add attributes.</p>

- First, define the name of the attribute.

- If you select "User-defined," you will manually enter the value. If you select "Volume" or any option other than "User-defined," the value will be calculated automatically.

In this case, "Axis" is selected, meaning the axis name will be automatically inserted as the value.

- Then select data type from drop-down menu and click OK.

Add new property

Name:
AxisName

Property type:
Axis

Default value:

Data type:
Real

OK Cancel

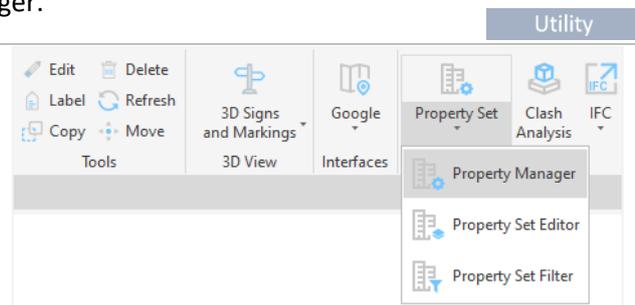
5. In this way, you can add additional attributes that apply to this property set.

Name	Type	Default value	Data type
PhaseStart	User defined	Phase1	Text
PhaseEnd	User defined	Phase2	Text
StationStart m	Start station		Text
StationEnd m	End station		Text
ElementType	User defined	SubbaseCourse	Text
Axis	Axis		Text
Material	User defined	Gravel	Text
Volume m3	Volume	0.000	Real

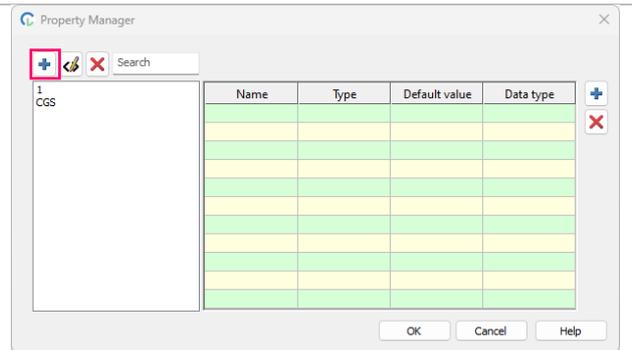
Property Type: User defined

This property type is used for all custom attributes where the values must be entered manually. It provides flexibility for defining attributes that do not have predetermined or automatically calculated values. The example below shows a property set that we will later manually add to the traffic sign, but we must first define it in the Property Manager.

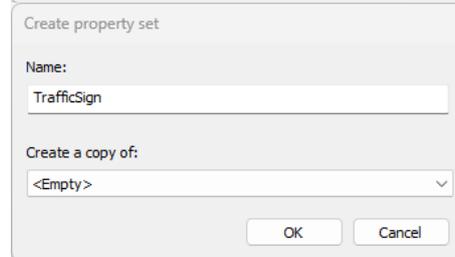
1. Run the "Property Manager" command, which is used to create property sets.



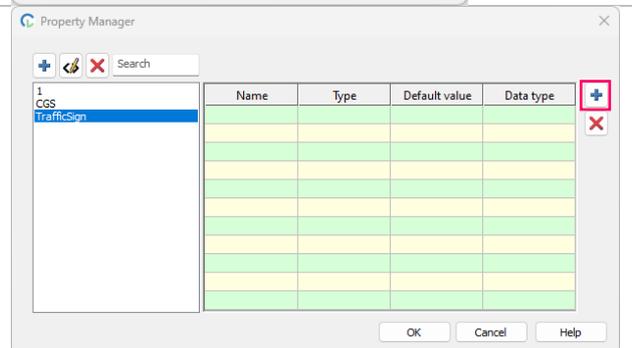
2. Click the plus icon on the left section of the dialog box to create a new property set.



3. After that, the "Create Property Set" dialog appears, where the user types the name of the property set and, if desired, selects an existing property set (e.g., CGS) as a template for the new property set or leaves the option "empty."



4. Then click the Plus button on the right to add attributes. *(The list of property sets and their attributes is usually included in the BIM Execution Plan.)*

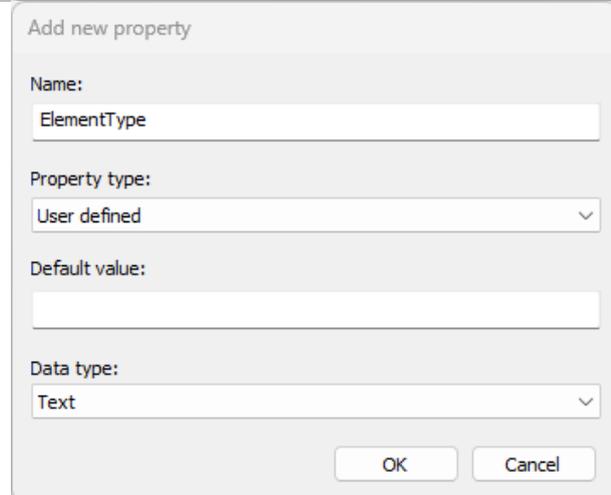


- First, define the name of the attribute.

- After that, define the type. If you select "user-defined," it means you will manually enter the value. If you select "Volume," it will be calculated automatically.

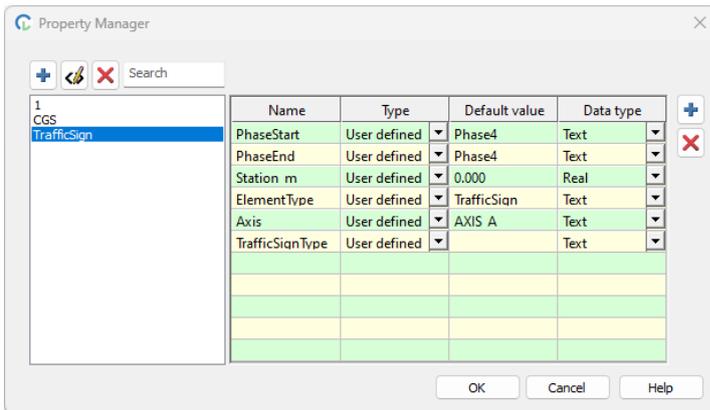
- Then define the default value. If you know that this value will always be the same, you can enter its value now. In our example, we will attach this property set to traffic signs, so you can enter "Traffic Sign" as the default value. However, if you have an attribute like TrafficSignType, the value will vary depending on the type of traffic sign. Therefore, leave this field blank and manually enter the type of traffic sign later.

- Then select data type from drop-down menu and click OK.



Note: Property types Axis, Start station, End station, Material, and Code work automatically in Plateia software, not in Autosign.

5. In this way, you then add other attributes that apply to this property set:

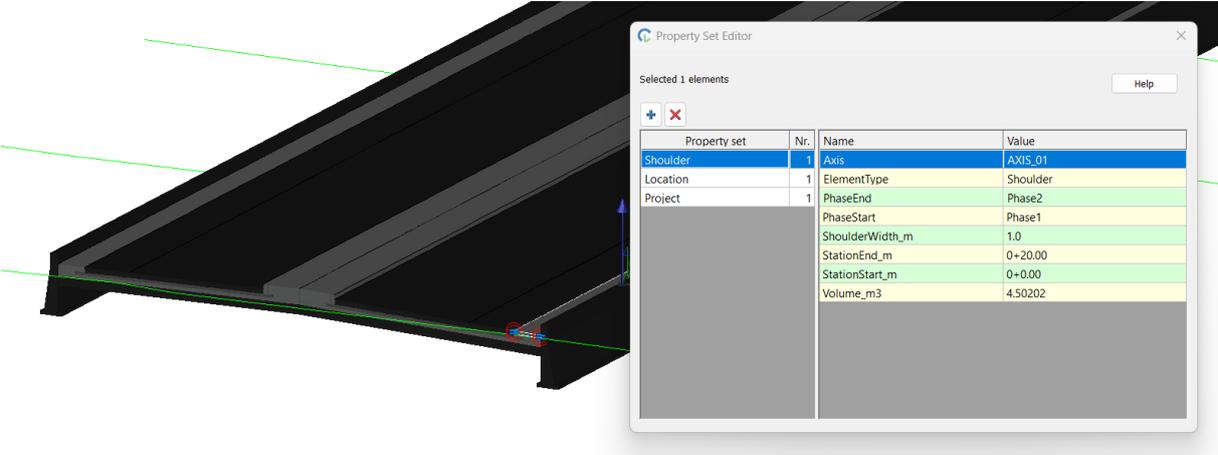


12. Creating a BIM model of the Highway

The only difference between creating a 3D model and a BIM model is that, in the "Draw 3D Model" dialog box, you define the corresponding property set for each quantity. For example, the Base Course property set is assigned to the base element.

<p>1. Click on the <u>Draw 3D model</u> icon.</p>	
<p>2. Select *Current drawing* for the alignment, profile and cross-sections.</p>	
<p>3. Select the alignment from the drop-down menu and define the starting and ending cross-section.</p>	
<p>4. Check the boxes at the planimetry quantities you want to create a 3D solid model from.</p>	
<p>5. Select property sets. Each element (quantity name) in the model can have multiple different property sets attached. This depends on the project requirements.</p>	
<p><i>*If no property sets are selected for a specific element, they will, of course, not be attached to the 3D model.</i></p>	
<p>6. Check the box for "Erase entire 3D model" if you already have a model in the drawing; otherwise, you will have duplicate elements.</p>	
<p>7. Confirm by clicking OK.</p>	

When this command is executed, the BIM model is drawn in the drawing. If you want to check the property sets, do so by running the **Property Set Editor** command, clicking on a 3D model, and viewing which sets are attached to that 3D model.

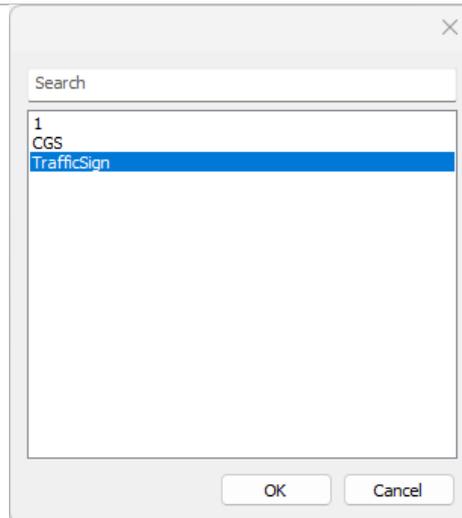


12.1 Attaching Property Sets to Traffic Signs

In cases where we have certain point elements, such as traffic signs, the Plateia program currently does not have tools that automatically attach property sets to them. Therefore, this must be done manually.

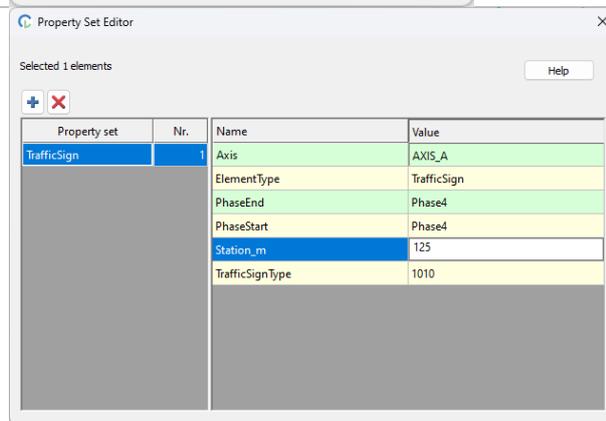
<p>1. Run the "Property Set Editor" command.</p>	
<p>2. Then, in the drawing, click on the 3D model of the traffic sign or block to which you want to add a property set. When you select the model in the drawing, the dialog box will display "Selected X elements."</p>	

3. Then, click the Push button and select the property set you want to add from the dropdown list and click OK. If necessary, you can select and add multiple property sets at once.

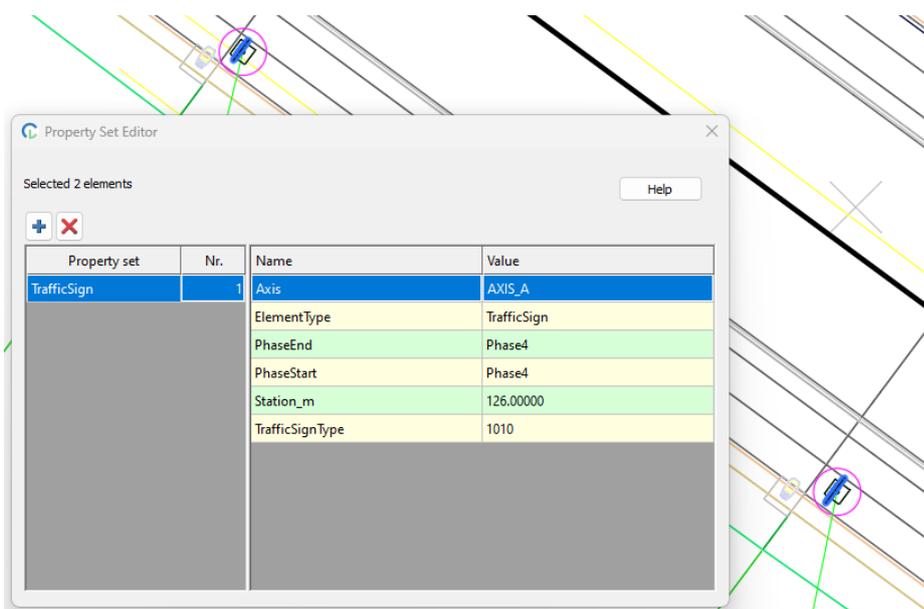


4. This property set is now attached to the model. If you wish, you can **manually enter and edit the values** by double-clicking on the desired cell and changing the value.

**This dialog box is modeless, which means it can remain open while you edit the drawing. This allows you to click in the drawing and then press Escape to deselect the current element. Afterward, you can select another 3D solid or block where you want to edit the property sets. If desired, you can also select multiple elements at the same time.*

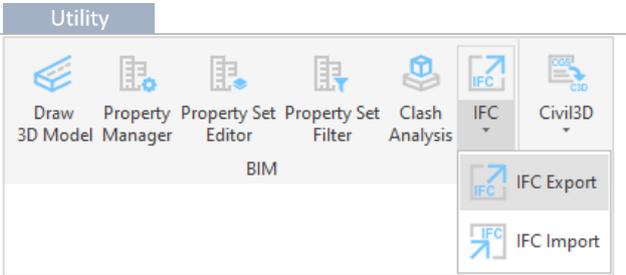
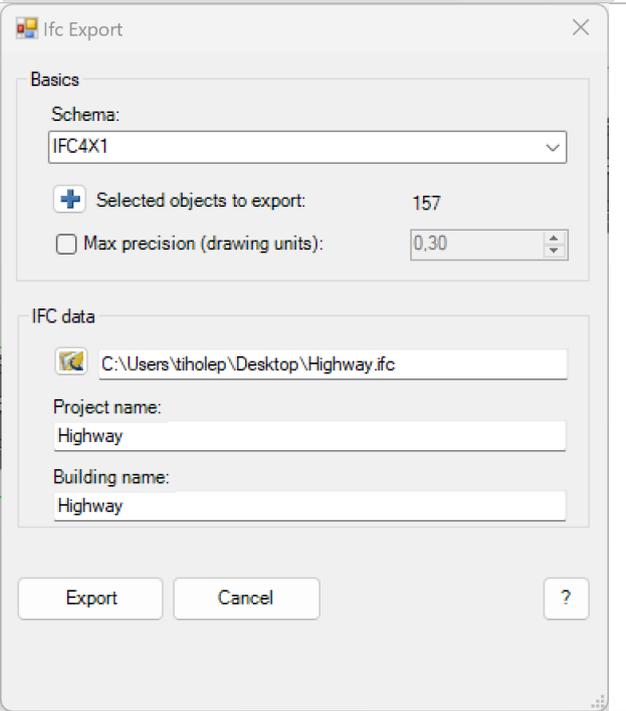


In the drawing below, you can see that two elements are selected. This is indicated at the top: selected 2 elements. However, the property set is added to only one of them. You can see this in the column number, which shows 1.



13. IFC Export

Export 3D solid objects with Property set definitions to external IFC exchange file with **IFC Export** command.

<p>1. Run the IFC Export command.</p>	 <p>The screenshot shows the Revit ribbon with the 'Utility' tab selected. The 'IFC' dropdown menu is open, showing 'IFC Export' and 'IFC Import' options. Other visible options include 'Draw 3D Model', 'Property Manager', 'Property Set Editor', 'Property Set Filter', 'Clash Analysis', and 'Civil3D'.</p>
<p>2. Click on the Plus icon and select the objects that you want to export.</p> <p>3. Select the path to save the file.</p> <p>4. Define project and building name.</p> <p>5. Confirm by clicking the Export button.</p>	 <p>The screenshot shows the 'Ifc Export' dialog box. It has two main sections: 'Basics' and 'IFC data'. In the 'Basics' section, the 'Schema' is set to 'IFC4X1'. There is a plus icon and a field for 'Selected objects to export' with the value '157'. There is also a checkbox for 'Max precision (drawing units):' set to '0,30'. In the 'IFC data' section, the file path is 'C:\Users\tiholep\Desktop\Highway.ifc'. The 'Project name' and 'Building name' are both set to 'Highway'. At the bottom, there are 'Export', 'Cancel', and '?' buttons.</p>