Plateia

by CGS Labs

BIM INTERSECTION MODEL

Tutorial

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BIM Intersection Model

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Table of Contents

INTRODUCTION

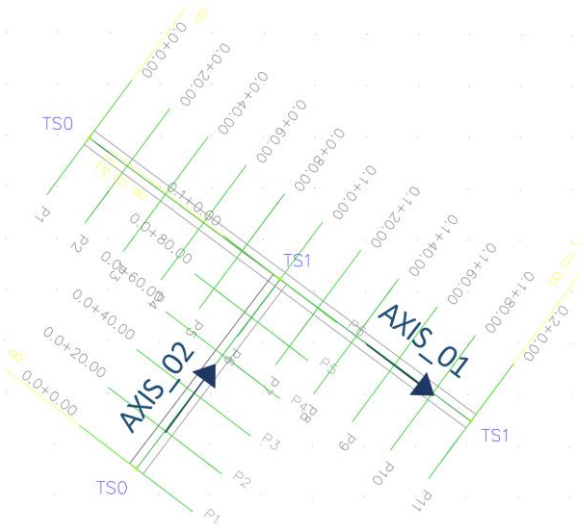
This step-by-step instruction will lead you through the workflow procedure to get familiar with creating a BIM intersection model in the Plateia software.

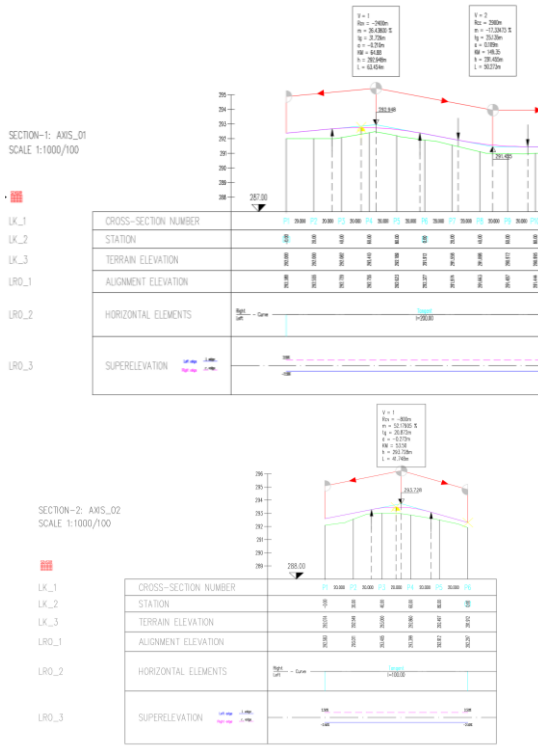
Designing a BIM intersection is divided into 5 key steps:

- preparation: creating two alignments with sample lines, profiles and calculating superelevation.
- drawing of the intersection surface: making the surface of the intersection with the help of Plateia's tool.
- drawing of projection lines: drawing projection lines that represent the edges of the intersection model.
- 3D model: creating a 3D model of the roadway.
- attributes: attaching sets of attributes.

1. PREPARATION

The first step of creating an intersection is preparation. By that, I mean inserting terrain, creating two alignments that intersect, defining sample lines, drawing a profile and calculating superelevation. This step is always the same, no matter if you're creating 2D documentation plans or a BIM model.





If you don't know how to draw alignment with sample lines, create a profile and calculate superelevation, please watch the Getting Started Tutorial.

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Basic Training for Plateia

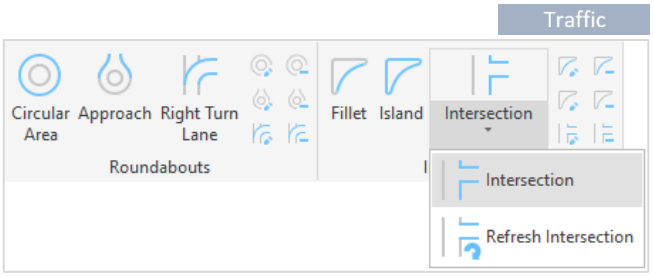
2. INTERSECTION SURFACE

The surface of the intersection is made with Plateia's tool named Intersection, which can be found in the Traffic ribbon. It significantly accelerates the intersection planning process with automatic adjustment of the slope and superelevation of the minor alignment according to the major alignment. The program automatically draws the alignment and the longitudinal section in the intersection. Slopes of the fillets are tangentially fitted to the lanes of the major and minor alignment. Then 3D road lanes and fillets are drawn.

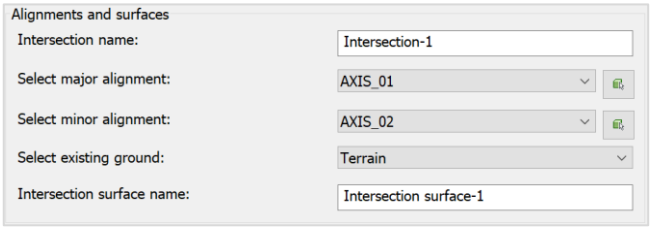
In addition, according to the defined criteria, the 3D gradients from intersection lanes to the selected ground are also drawn. In the last step, the program assembles a 3D intersection model or a DTM on the basis of all 3D elements of the intersection. The latter enables the user a 3D graphic representation of the intersection for the following operations and analyses.

1. Download and open the Intersection drawing.

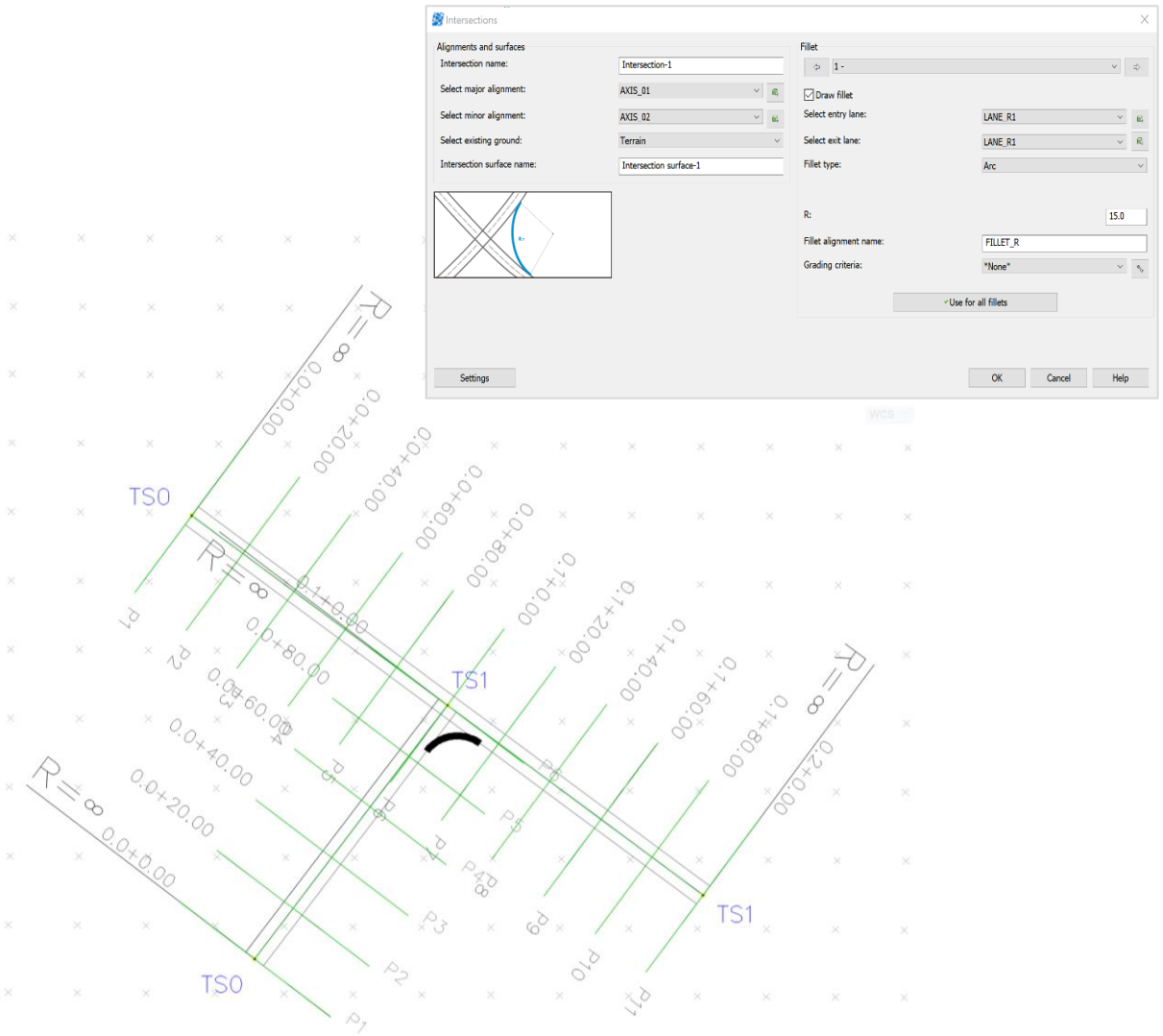
2. Run the Intersection command.



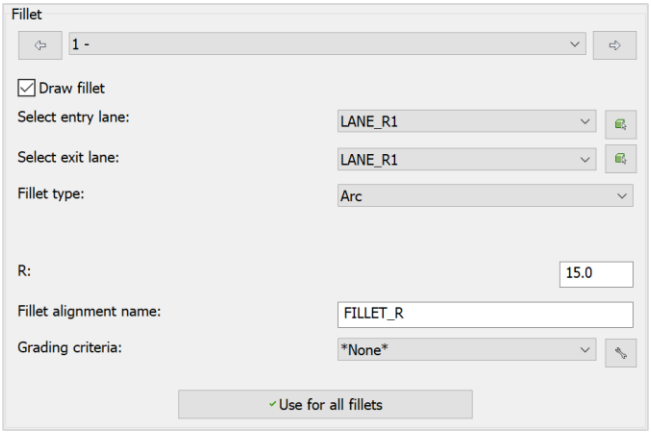
3. Define alignments and surfaces:
- intersection name: Intersection-1
- major alignment: AXIS_01
- minor alignment: AXIS_02
- existing ground: Terrain
- intersection surface name: Intersection surface-1



Then continue with defining parameters for individual fillets. The tool always offers to draw four fillets. Since we want to create a three-way intersection in our case, we will exclude two of them. We can also help ourselves with a sketch. If the fillet is possible, the software automatically shows it in the layout as shown in the figure below.



4. Define the following settings for the first fillet:
- check the Draw fillet box,
- select entry lane: LANE_R1
- select exit lane: LANE_R1
- fillet type: Arc
- R: 15
- fillet alignment name: FILLET_R
- grading criteria: *None*

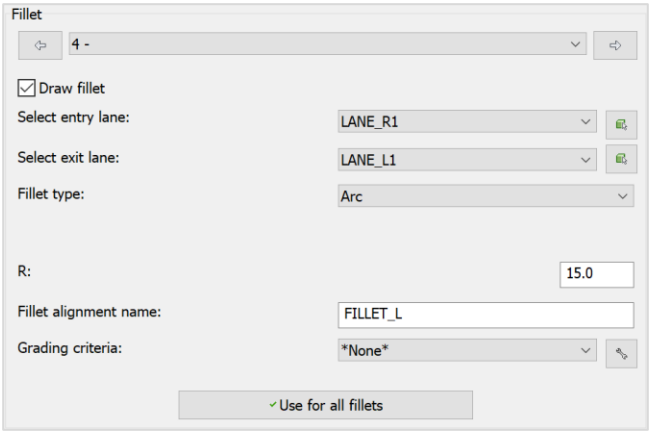


5. Then click on the arrow icon  to move to the settings for the next fillet.

6. Uncheck at the Draw fillet box for the second fillet and move to the third one.

7. The third fillet is also not possible for this type of the intersection, so uncheck at the Draw fillet option again and click on the forward arrow to move to the settings for the last fillet.

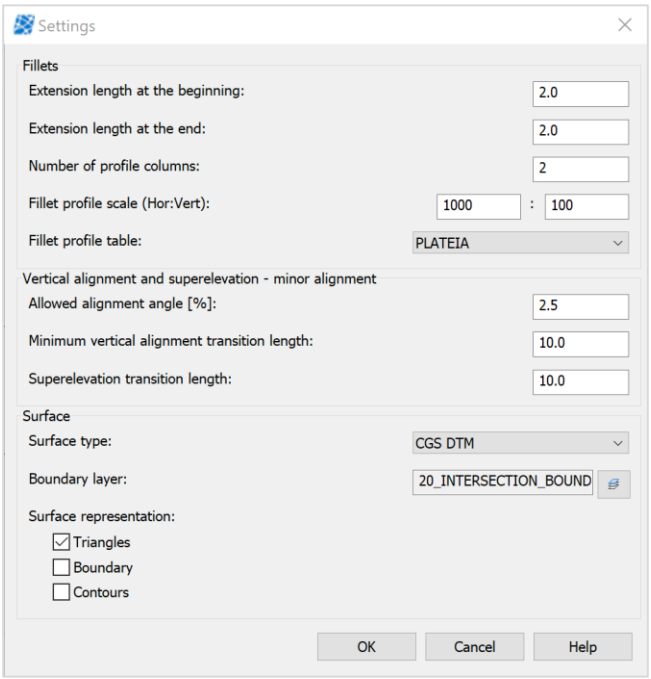
8. Define the following parameters:
- check the Draw fillet box,
- select entry lane: LANE_R1
- select exit lane: LANE_R1
- fillet type: Arc
- R: 15
- fillet alignment name: FILLET_L
- grading criteria: *None*



9. Click on the Settings icon on the left side of the Intersection dialogue box. In this dialogue box, you can define some additional settings for fillets, vertical alignment and superelevation on minor alignment. In this example, you can leave default values for those parameters.

Then define a surface type. Select CGS DTM from the drop-down menu and then uncheck the Boundary box and check the Triangles box.

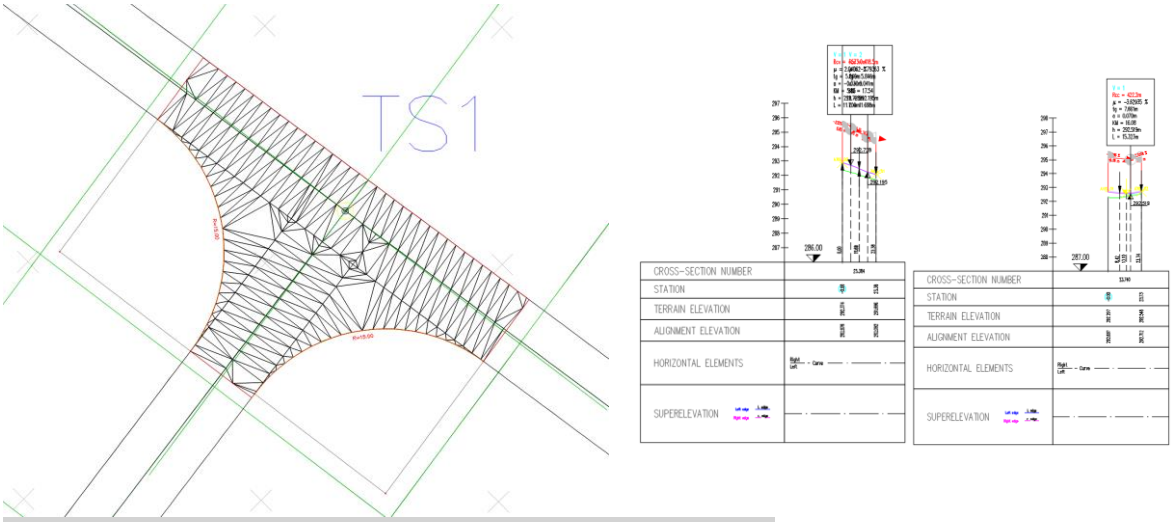
10. Confirm by clicking the OK button.



11. Then click the OK button in the Intersection dialogue box to confirm all the parameters.

12. After that, click somewhere in the drawing to define the insertion point for longitudinal profiles of fillets.

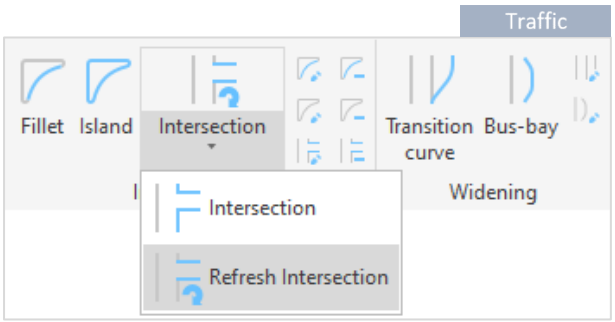
Plateia automatically draws the surface and profiles of the fillets shown in the pictures below.



It also automatically changed the profile of the minor alignment!

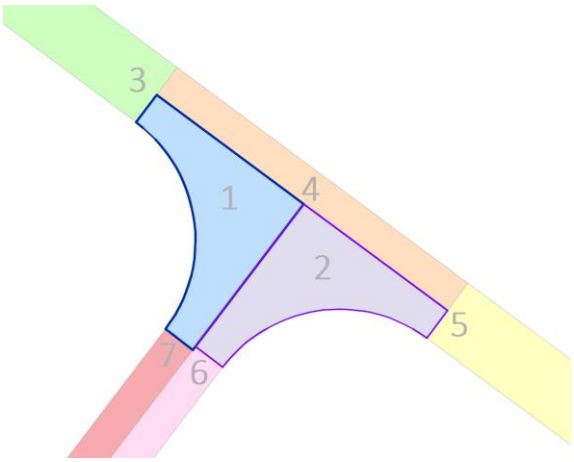
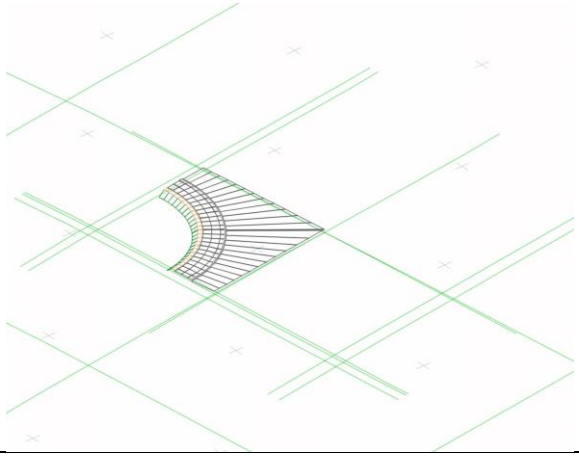
Refresh Intersection

If necessary, the profiles can also be repaired manually at this point and then the surface of the intersection can be refreshed with the Refresh Intersection command.



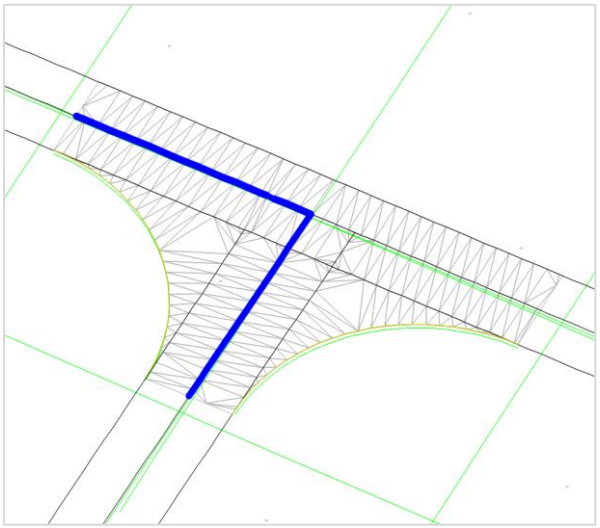
3. PROJECTION LINES

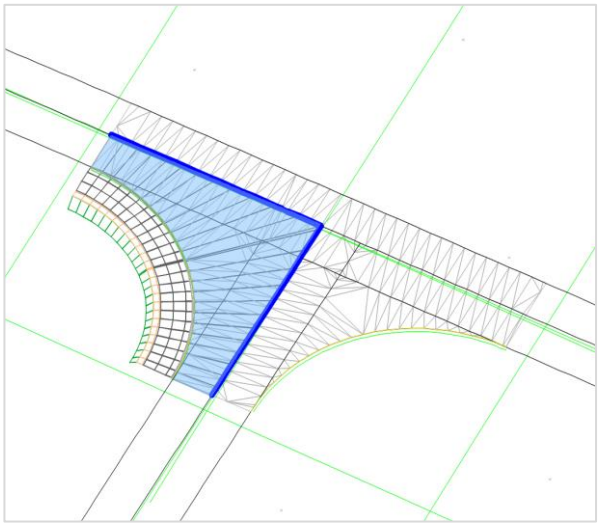
When you completed the surface of the intersection, you continue with defining projection lines. To be able to define these lines, however, you must first decide how you will create the intersection model. This means dividing the intersection into meaningful parts as shown in the picture below.

The concept:	The process: *click on the link to watch the animation.*
	

The intersection is divided into 7 parts. The BIM model of the first and the second part of the intersection will be created on the basis of fillets that were automatically created in the previous step. The sixth and seventh parts will be made by drawing a model based on the cross-section for Axis_02 and other parts for the Axis_01.

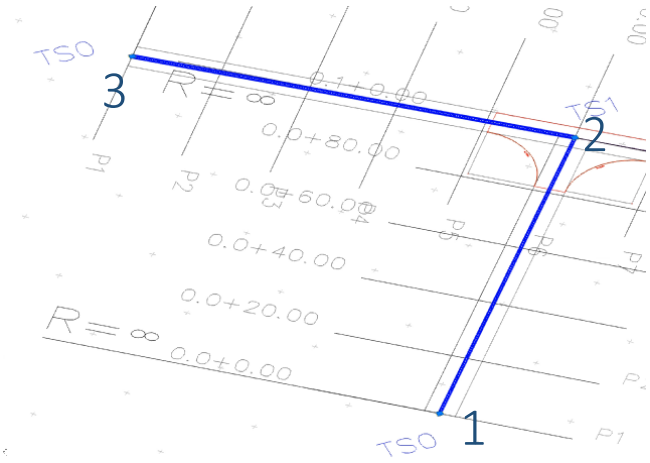
When you make a good plan, it is easier to imagine where you need to define the projection lines. In the pictures below, the projection line for the left fillet is coloured blue. When you will create a 3D model, you will connect the left fillet axis and this projection line. This will give you the top pavement construction.





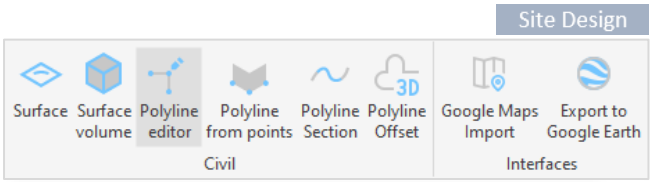
3.1 Draw a 3D Polyline

1. Using basic CAD tools, draw a 3D polyline that connects points 1,2 and 3 as shown in the figure on the right. This 3D polyline should be at the elevation of 0.



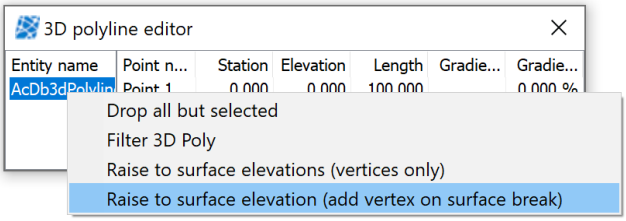
3.2 Raise 3D polyline to the surface elevation

2. Then run the Polyline Editor command and select the 3D polyline in the drawing.

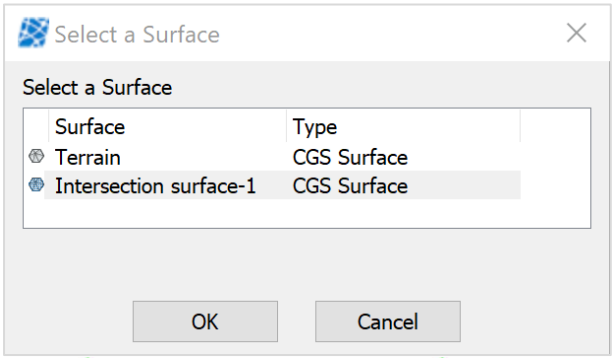


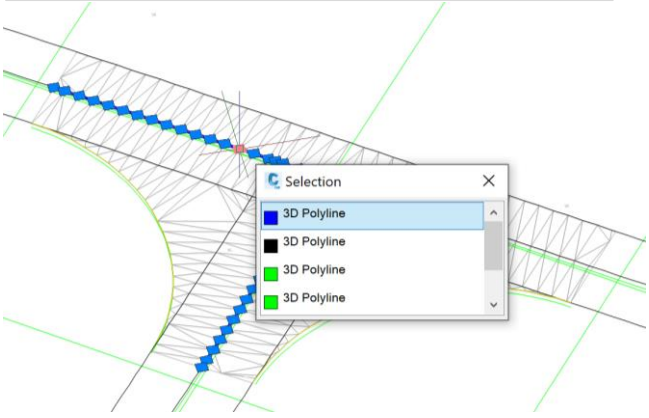
3. Right click on the 3D polyline in a 3D polyline editor dialogue box.

4. Select Raise to surface elevation (add vertex on surface break) option.



5. It opens a new dialogue box, where you select the surface to project the 3D polyline. Select the intersection surface and confirm by pressing OK.



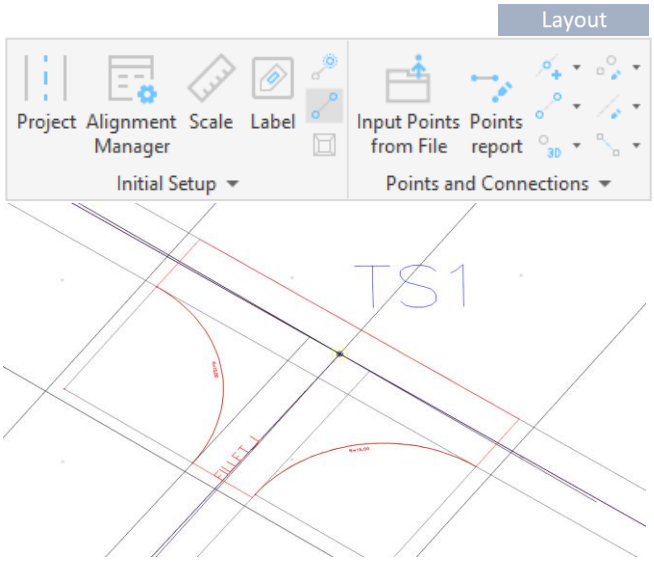


3.3 Define 3D polyline as a projection line

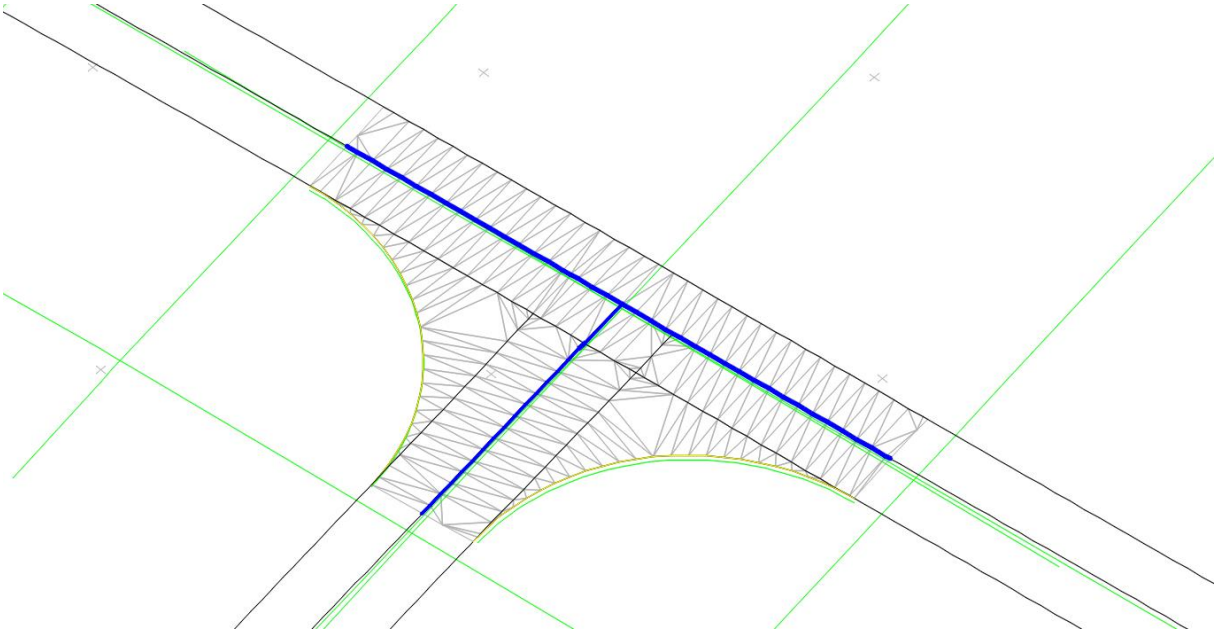
Now you have to define this polyline as a projection line.

1. Run the Projection line command.

2. Select the polyline in the drawing and press Enter. Then define the name. I recommend naming it the same as you named the Fillet. In this case FILLET_L. The name is inserted in the drawing as a text.

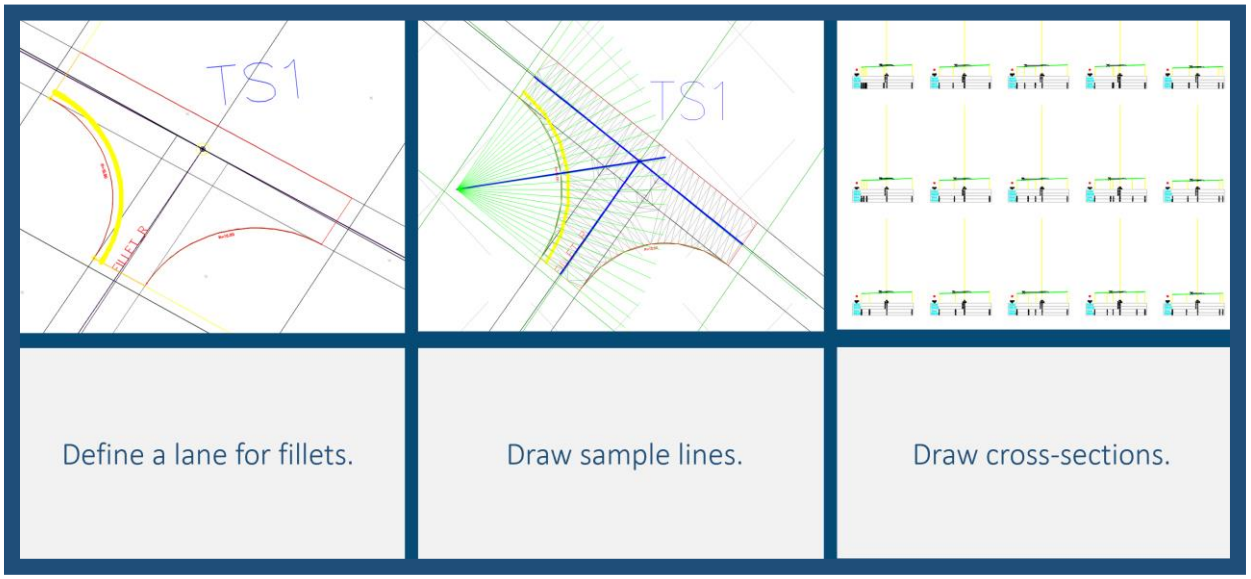


Then you repeat the same procedure for the right fillet.



4. DRAW 3D MODEL OF FILLETS

You can now start with creating a 3D model. You have everything ready on the Axis_01 and Axis_02 axes and you can start drawing the cross-sections immediately, while on the fillets you must first define the traffic lane, sample lines and only then you proceed with the cross-sections.



4.1 Define lanes on the fillet

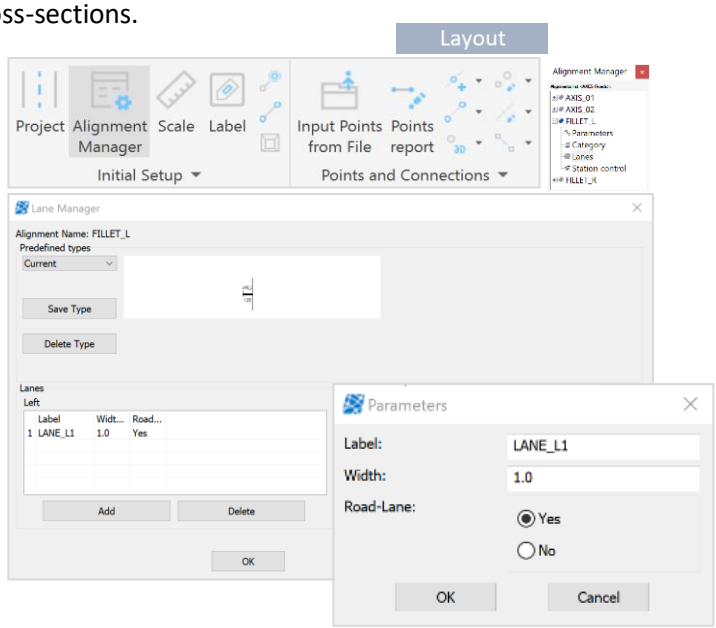
First, you define one arbitrarily wide traffic lane for the left fillet. The only reason you need to do this is that the roadway will be inserted in the cross-sections.

1. Set the FILLET_L1 axis as an active alignment. Run the Alignment Manager and then double-click on the Fillet_L.

2. Then double-click on the Lanes. It opens a new dialog box.

3. Click on the left Add icon and define the label and width.

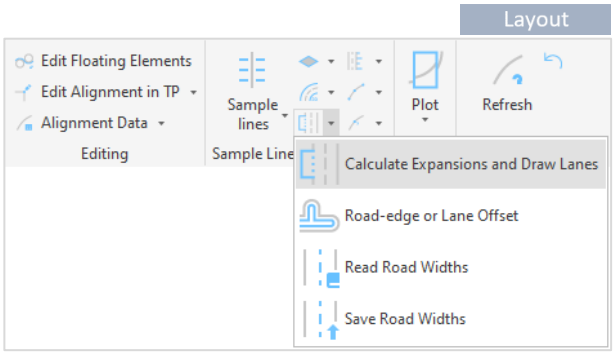
4. Confirm by pressing the OK in the Parameters dialogue box and then also in the Lane Manager dialogue.



4.2 Calculate Expansions and Draw Lanes

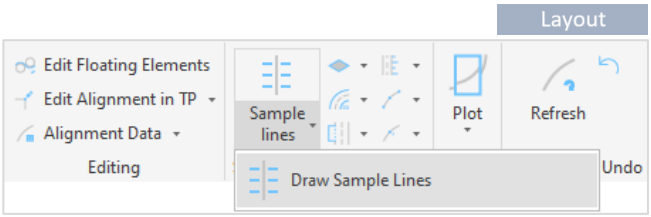
1. Run the Calculate Expansions and Draw Lanes command.

2. It opens a new dialogue box. Uncheck at the Draw Widenings box and confirm by clicking the OK button.



4.3 Draw sample lines at a distance of 1 m

1. Run the Draw Sample Lines command.

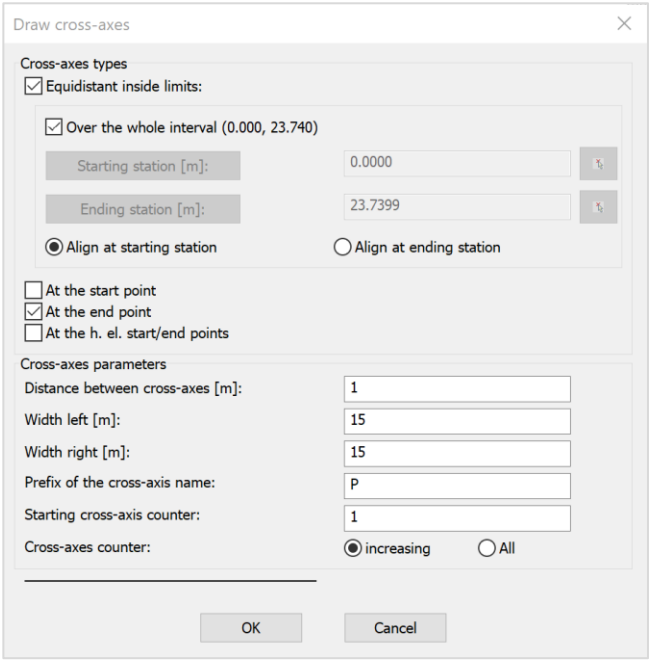


2. Check the boxes at the Equidistant inside limits and Over the whole interval options.

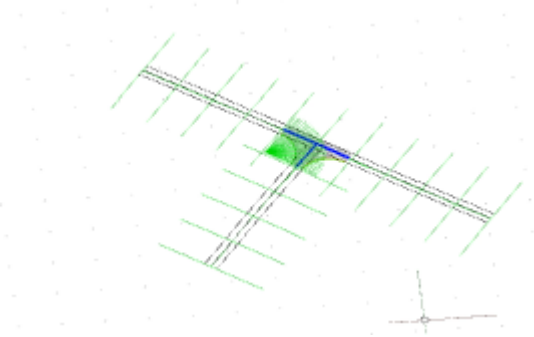
3. Define cross-axes parameters:
   - distance between cross-axes [m]: 1
   - width left [m]: 15
   - width right [m]: 15

4. Check the box at the Increasing option.

5. Confirm by pressing OK.

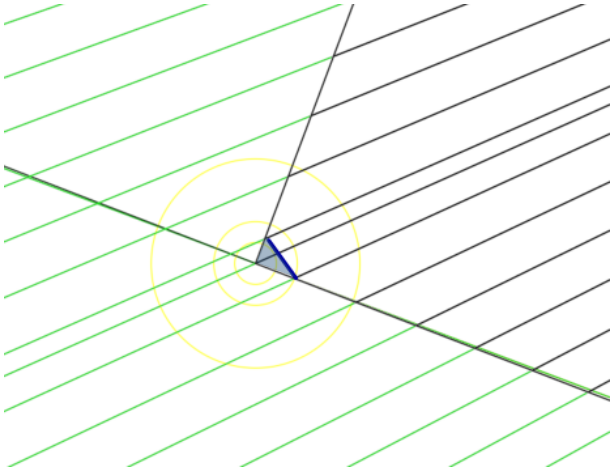


Quite a number of cross-sections are now inserted in the drawing, so there may be some confusion. But don't worry, we will soon hide these sample lines and we will have a better overview of the model.

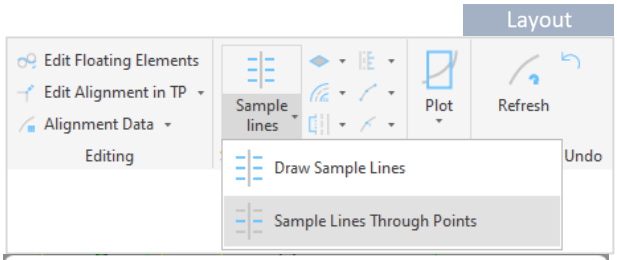


4.4 Draw sample line through points

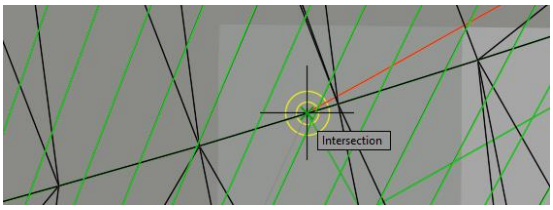
Now draw one additional sample line at the intersection between the major and the minor alignment. This will allow you to draw the 3D model perfectly over the entire area of the intersection. Otherwise, there will be a small gap in the middle of the intersection.



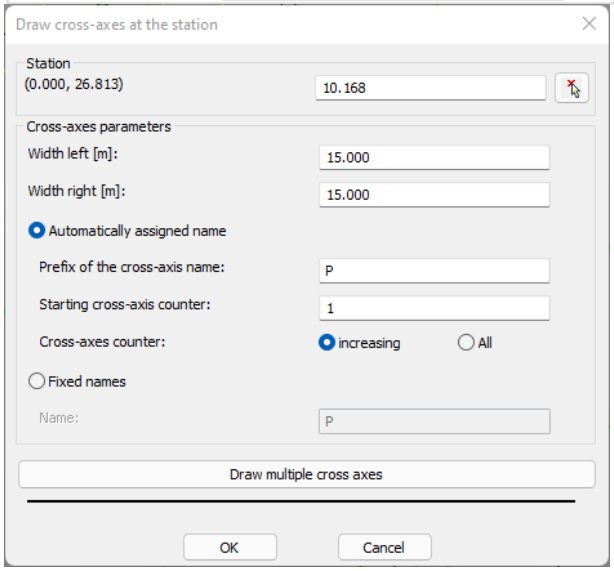
1. Run the Sample Lines Through Points command.



2. Click on the icon next to the station and then click in the intersection between the major and the minor alignment.

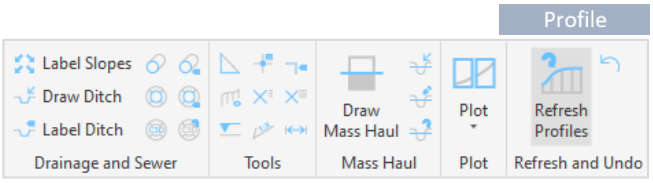


3. It opens the Draw cross-axes at the station dialog box again. Just confirm parameter by pressing OK.



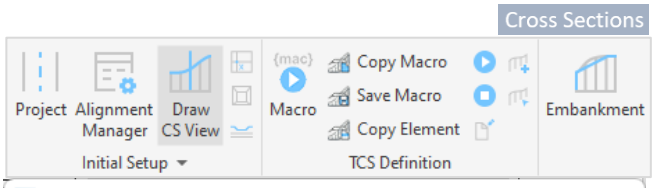
4.5 Refresh profiles

1. Run the Refresh profiles command. It'll draw sample lines and widenings in the FILLET_L profile.

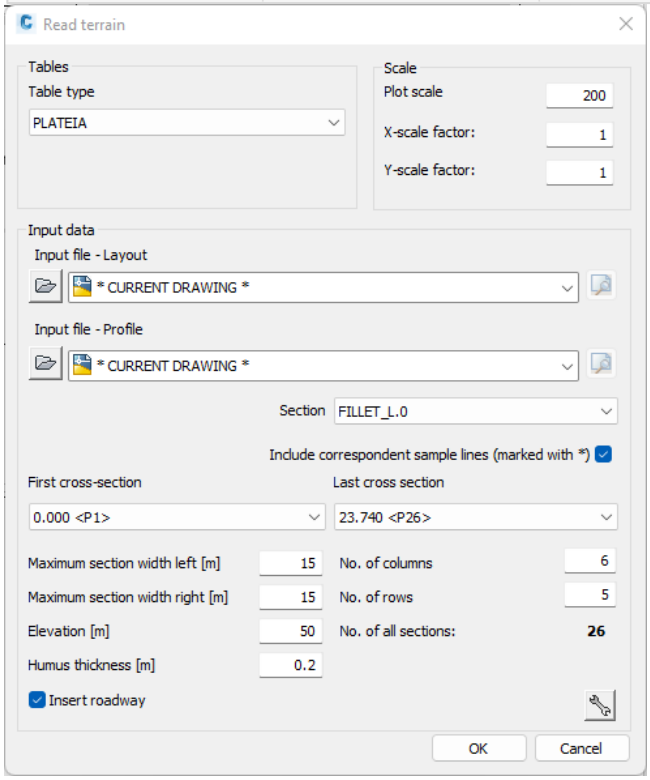


4.6 Draw CS View

1. Run the Draw CS View command.



2. In Read terrain dialog box specify:
   Table type: Plateia
   Plot scale: 200
   X-scale factor: 1
   Y-scale factor: 1



3. Select *Current drawing* for input file for layout and profile.

4. Select first and last cross-section from the drop-down menu.

5. Define following parameters:
   - maximum section width left [m]: 30
   - maximum section width right [m]: 30
   - elevation [m]: 50
   - humus thickness [m]: 0.2
   - no. of columns: 10
   - no. of rows: 10

6. Check at the Insert roadway box.

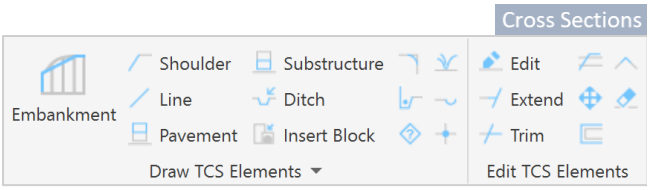
7. Select insertion point for upper-left corner in the drawing.

Then repeat all those 6 procedures for the right Fillet (FILLET_R).

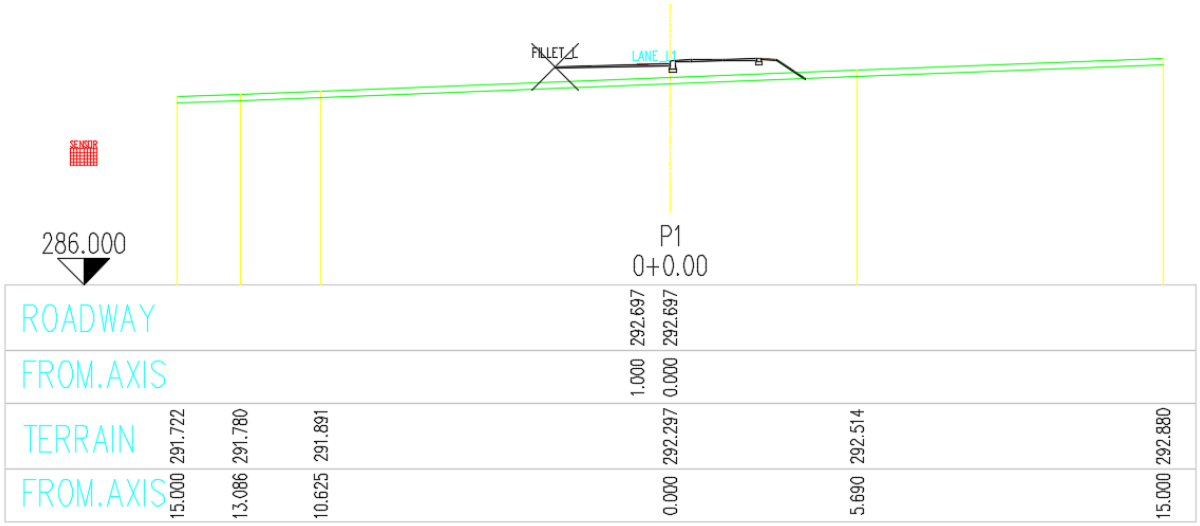
4.7 Draw TCS elements

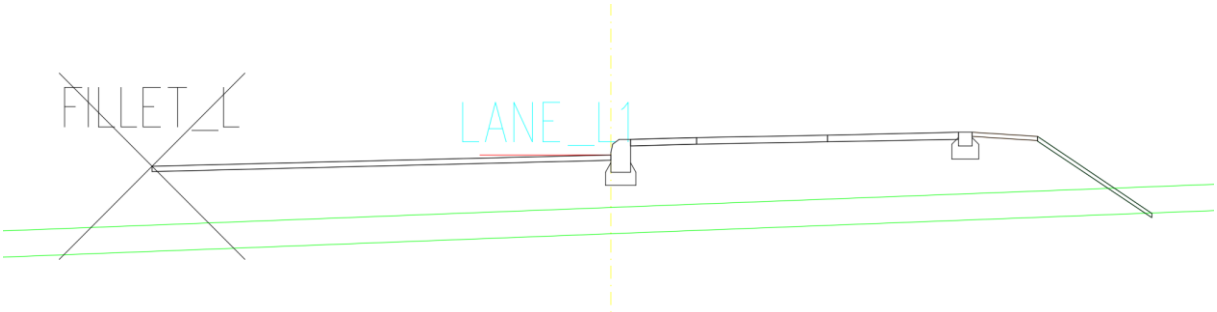
Construct roadway section geometry with Draw TCS Elements tools. Plateia provides capabilities for designing and editing roadway cross-sections in a detailed way with almost no geometry limitations to the final project design.

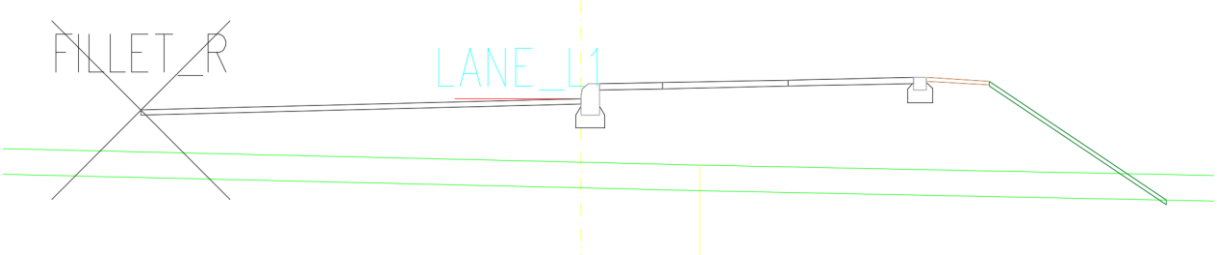
The typical cross-section elements (TCS) group of commands contains tools for inserting individual TCS elements such as shoulders, embankments, substructures, ditches, pavements, etc. It is possible to insert TCS elements such as blocks, lines, points, etc.



If you don't know how to draw TCS elements, please watch the Getting Started Tutorial.

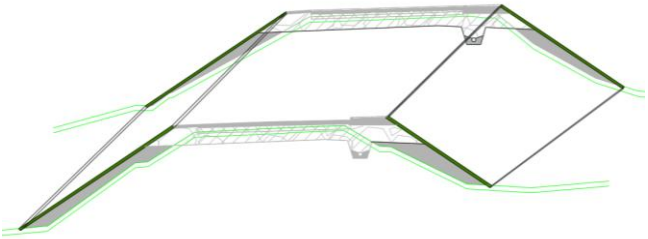




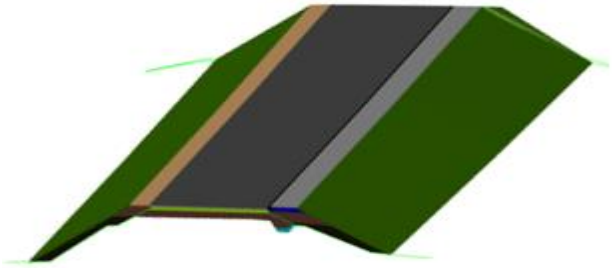


4.8 Planimetry

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.



In addition, planimetry quantities are also important for creating a 3D model. Plateia enables you to draw a 3D model only on the basis of planimetry quantities, defined in cross-sections!



If you don't know how to planimetry, please watch the Getting Started Tutorial.

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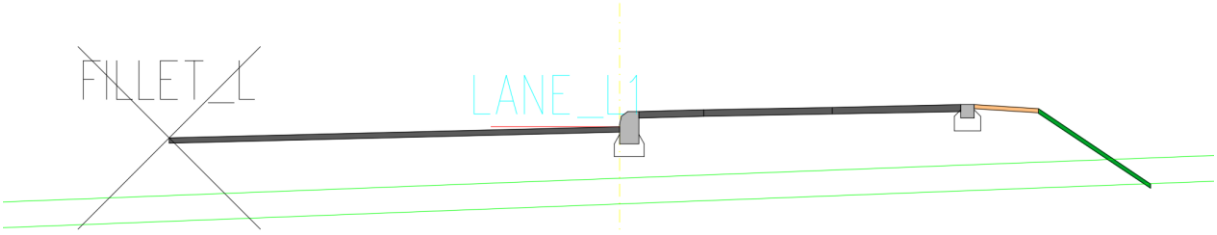
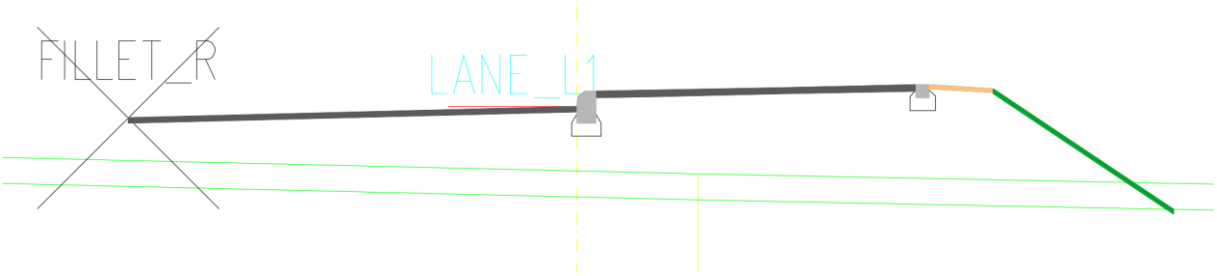
Basic Training for Plateia

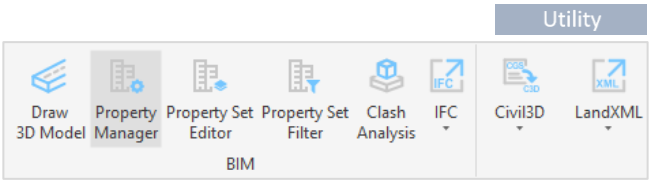




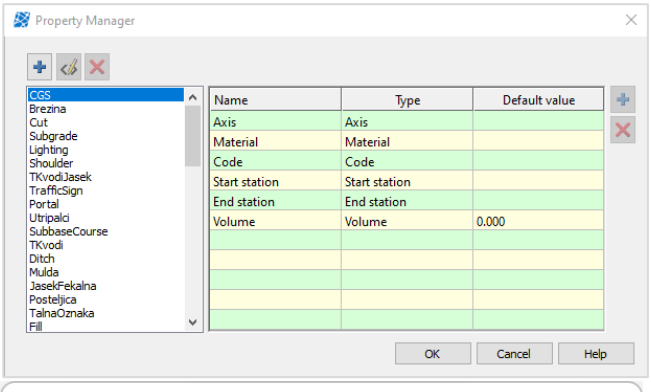
5. DEFINE ATTRIBUTES

If you want to create a BIM model, you need to define 3D model's metadata or property sets. In the Plateia software, property sets are defined in the Property Manager. The user has two options. Automatic attributes, which values are calculated and inserted automatically after drawing a model with the "Draw 3D model" command and attributes that are defined and attached manually.

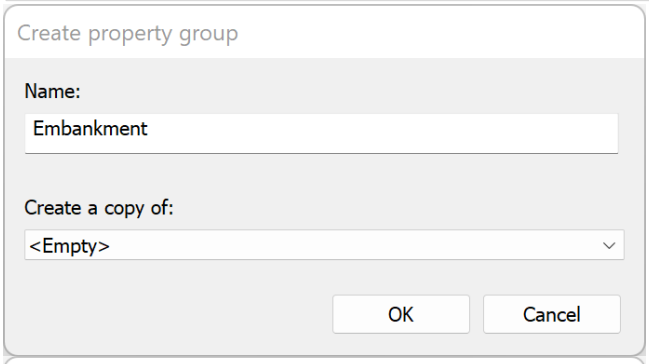
1. Run the Property Manager command.



It opens a new dialogue box. On the left side of the dialogue box is a list of all property sets, and in the right table are all attributes of the selected property set.



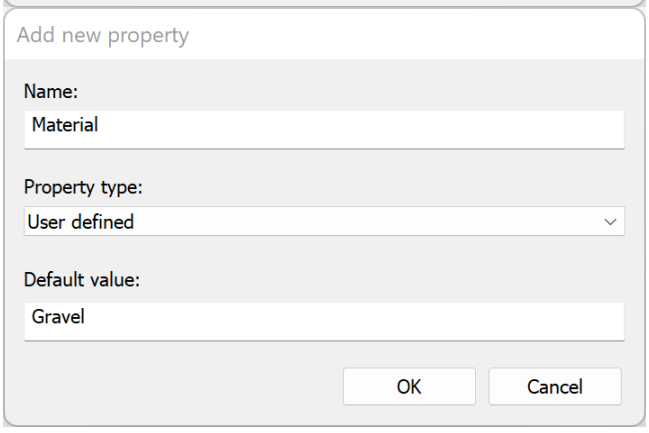
2. Click on the top left Plus button and add a new property set. In a Create property group dialogue box define the name of the property set. You can also select an existing property set from the drop-down menu and all the attributes from that property set will be overwritten to the new one.



3. Then click on the Plus button on the right to add attributes.

Define the following parameters:
- name: Material
- property type: User defined
- default value: Gravel

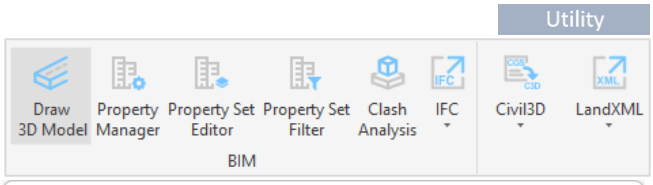
4. Confirm by pressing the OK.



Repeat step 3 and 4 until you have added all the attributes and then confirm by pressing the OK button in the Property Manager.

6. DRAW A BIM MODEL

1. Click on the Draw 3D model icon.



2. Select *Current drawing* for the alignment, profile and cross-sections.

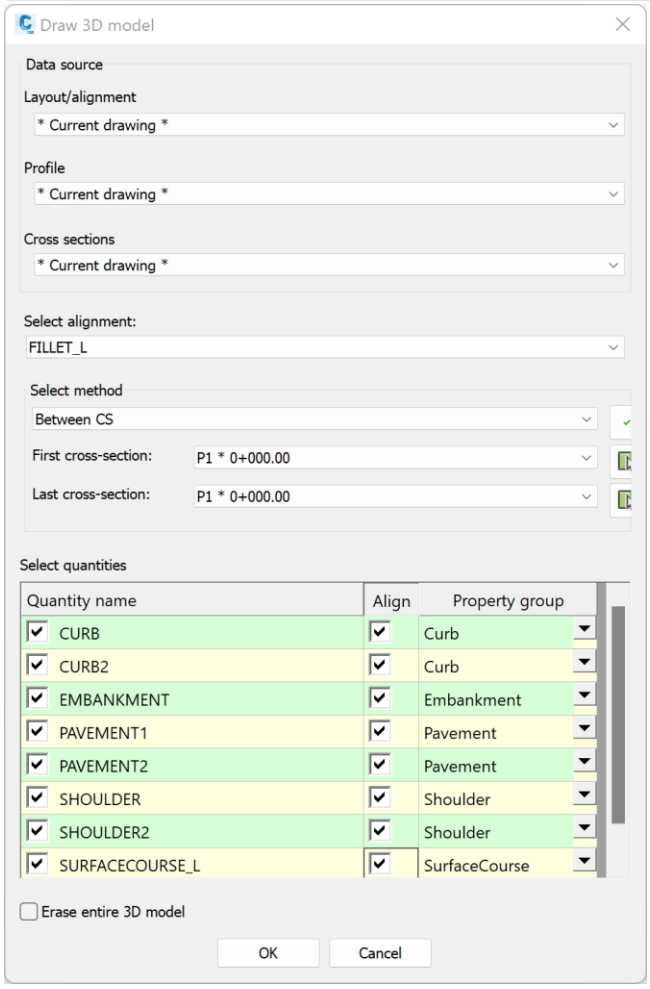
3. Select the alignment from the drop-down menu and define the starting and ending cross-section.

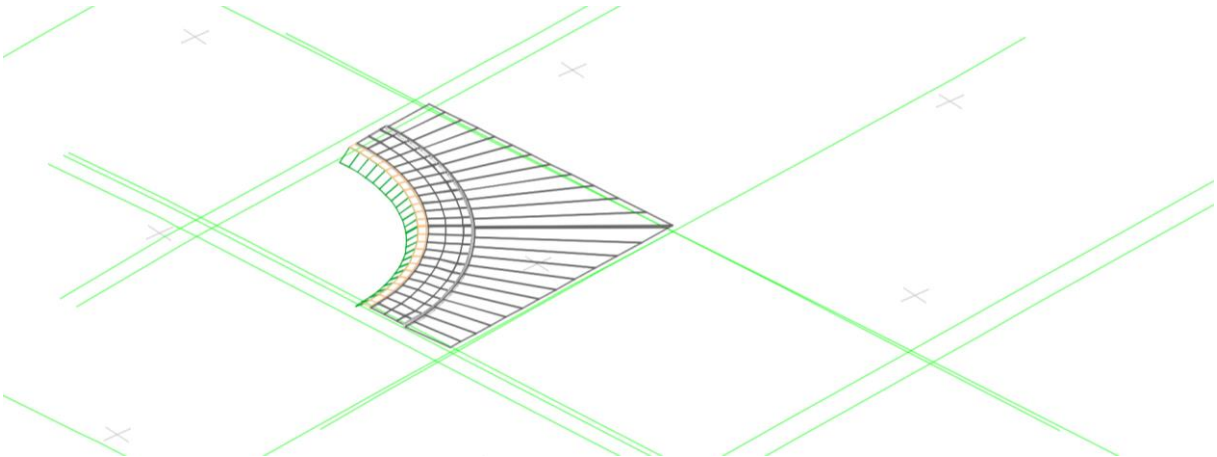
4. Check the boxes at the planimetry quantities you want to create a 3D solid model from.

5. Check the box at the Align option to connect the consecutive planimetry polygons along the alignment. Otherwise, it connects the adjacent planimetry polygons with sectional straight lines.

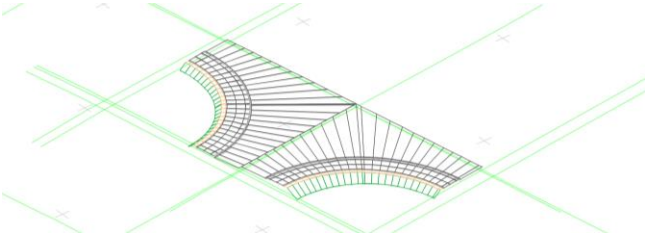
6. Specify property sets for each entity from the drop-down menu.

7. Confirm by clicking OK.



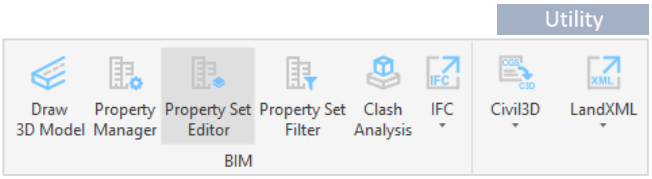


Repeat this for the right fillet. Be careful to select FILLET_R from the drop-down menu for the alignment.



6.1 Check or edit Property Sets and Attribute values

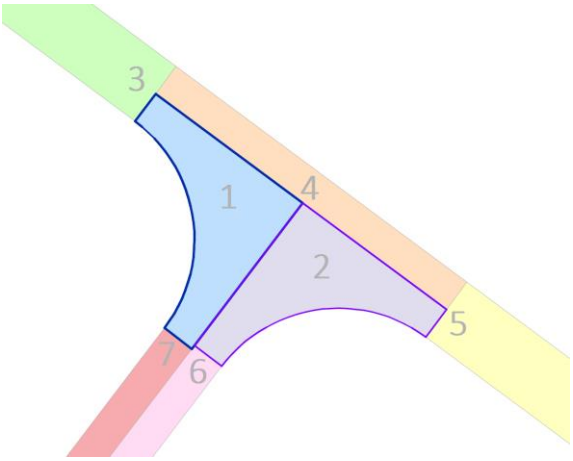
1. Run the Property Set Editor command.



2. Select a solid from the drawing. Check the values of the attributes.
For more information, please watch the following video. It is recorded for Ferrovia model, but the BIM tools are the same for both software's.

7. DRAW 3D BIM MODEL OF AXIS_01 AND AXIS_02

Once you have finished a BIM model for the part 1 and part 2 of the intersection you have to create a BIM model for other parts.

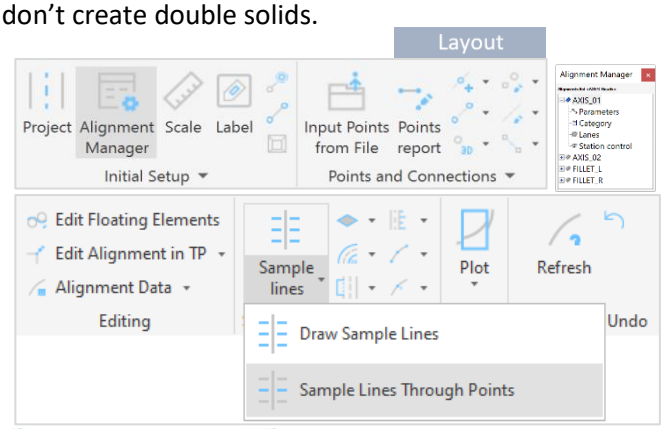


7.1 Add additional sample lines

In the drawing, attached to this tutorial, the sample lines on the AXIS_01 and AXIS_02 axes are made at distance of 20 m. Now, however, you need to add a few extra sample lines at the beginning and the end of the intersection area, so that you don't create double solids.

1. Set the AXIS_01 axis as an active alignment. Run the Alignment Manager and then double-click on the AXIS_01.

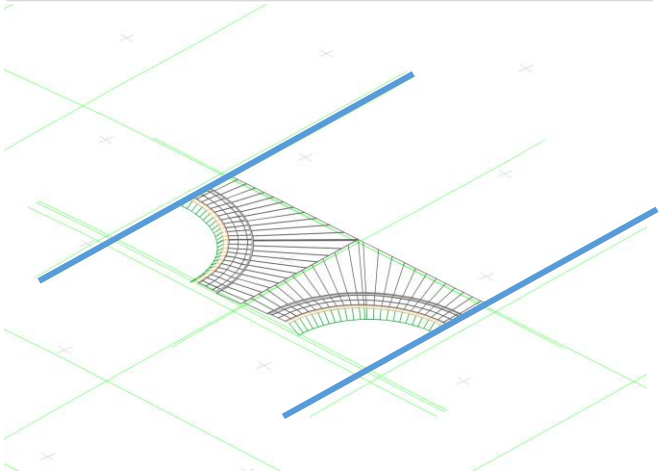
2. Run the Sample Lines Through Points command.



2. Click on the icon next to the station and click first at the start of the intersection and at then at the end.

3. Press Enter.

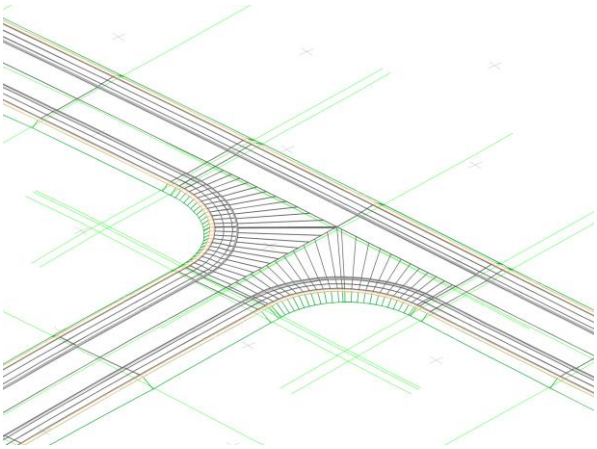
4. It opens the Draw cross-axes at the station dialog box again. Just confirm parameter by pressing OK.

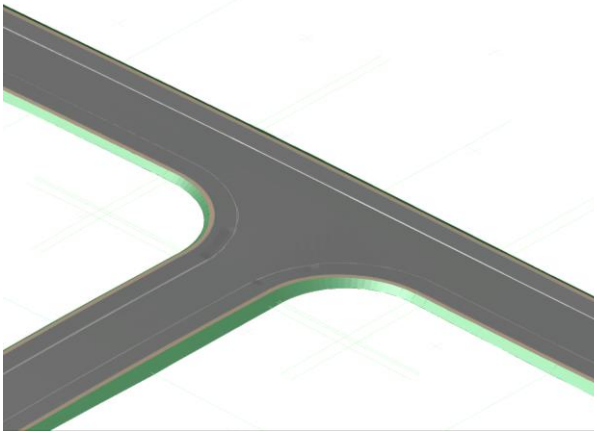


Then repeat this for AXIS_02.

After that you continue with refreshing profiles, drawing CS View and TCS elements, planimetry quantities, defining property sets and drawing BIM model for both axes.

Finished BIM intersection model:

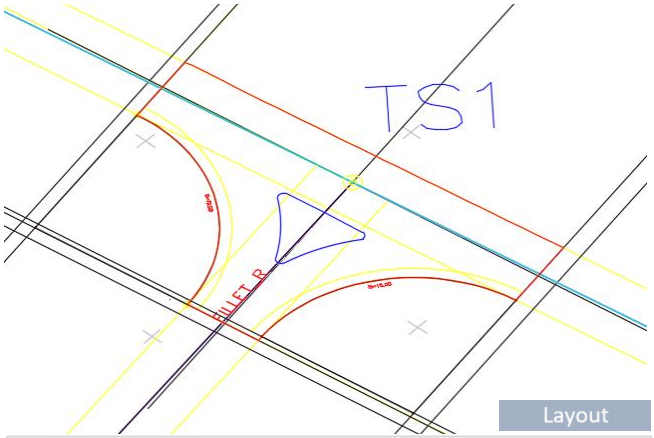




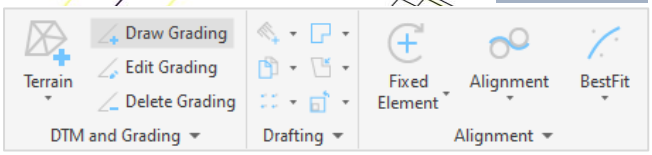
8. ISLAND

8.1 2D edge of the island

1. Draw a 2D polyline that represents the shape of the island. This polyline should be at the 0 elevation.



2. Run the Draw Grading command.



3. Select previously drawn polyline in the drawing.

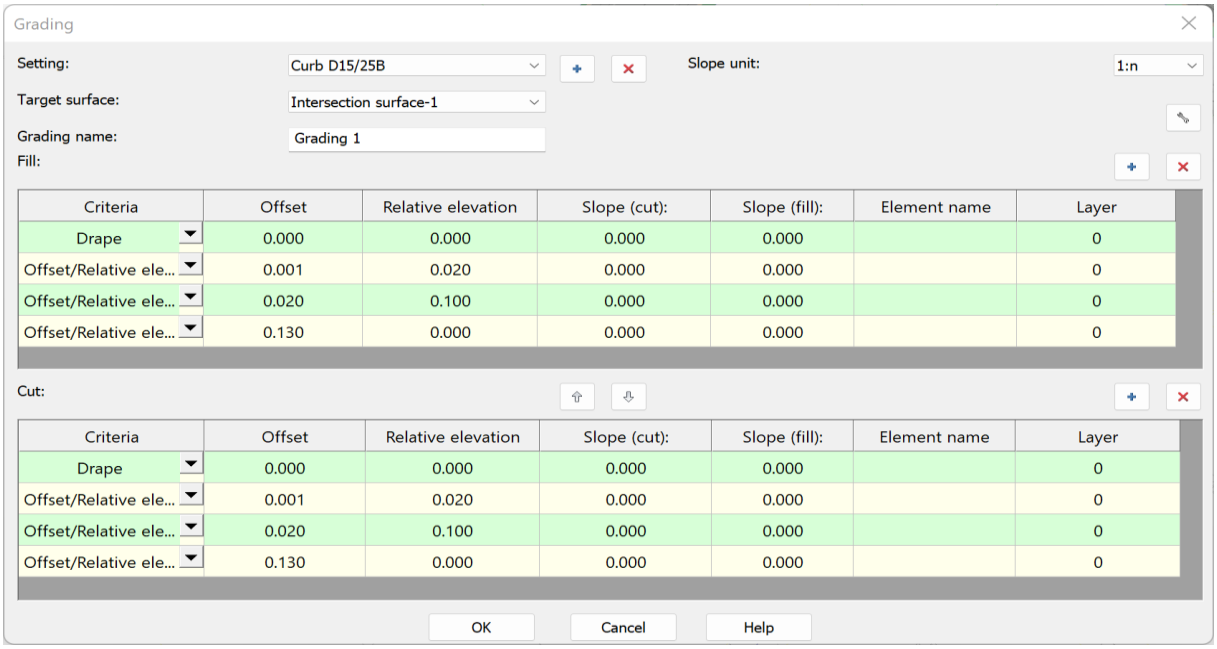
4. Select the side. Click in the inner part of the island.

5. Press Enter twice to draw grading on the entire length of the island.

6. After that, a new dialogue box opens. First, select Settings from the drop-down menu.

7. Then select the target surface (the surface of the intersection) and define the grading name. Based on its name you can later edit grading.

8. In the end, you should define the criteria. Be sure to first define the projection of the 2D polyline on the intersection surface, and then you define other lines that represent the edges of the curb.

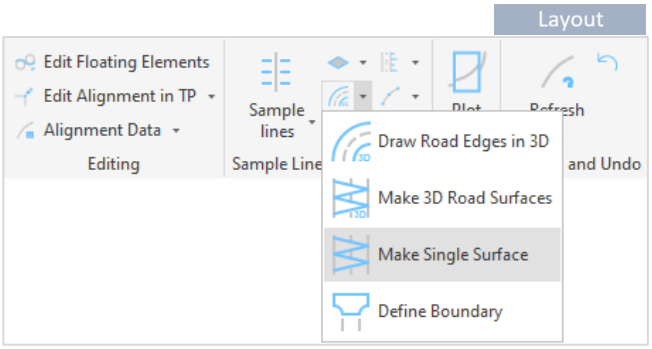


8.2 Create surfaces between 3D polylines

Surfaces can be created in several different ways. For example, surfaces can be made with Make single surface command or with Terrain functionality.

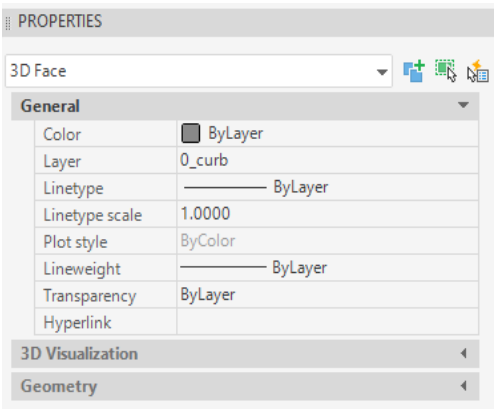
8.2.1 Make Single Surface option

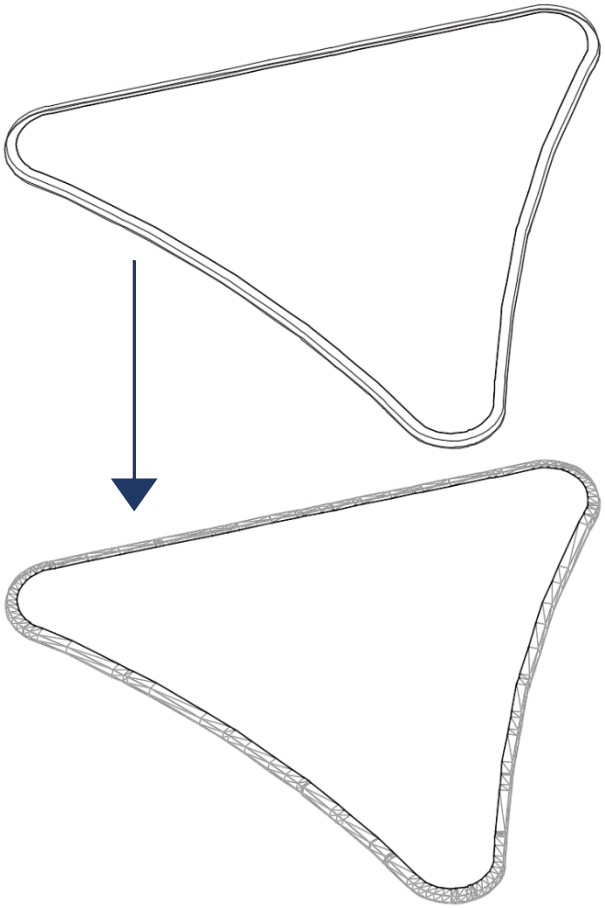
1. Run the Make Single Surface command.



2. Select two 3D polylines and surface will be drawn between them. Repeat that for all the polylines.

3. Once you have connected all the 3D polylines that represent the curb, you can select all the 3D faces and assign them the same custom-defined layer.





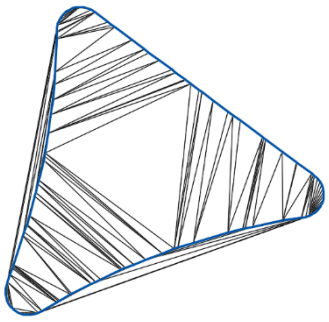
8.2.2 Terrain tool

1. Run the DTM command.

2. Define the surface name and confirm by pressing the OK button.

3. Select the Points & Breaklines option from the drop-down menu and then click on the Plus button. Select 3D polyline and press Enter.

4. After that, you need to choose the way the terrain will be shown in the drawing. There are several different ways available. To show the terrain as triangulated irregular network check the Triangles box at the bottom of the dialogue box and press apply.



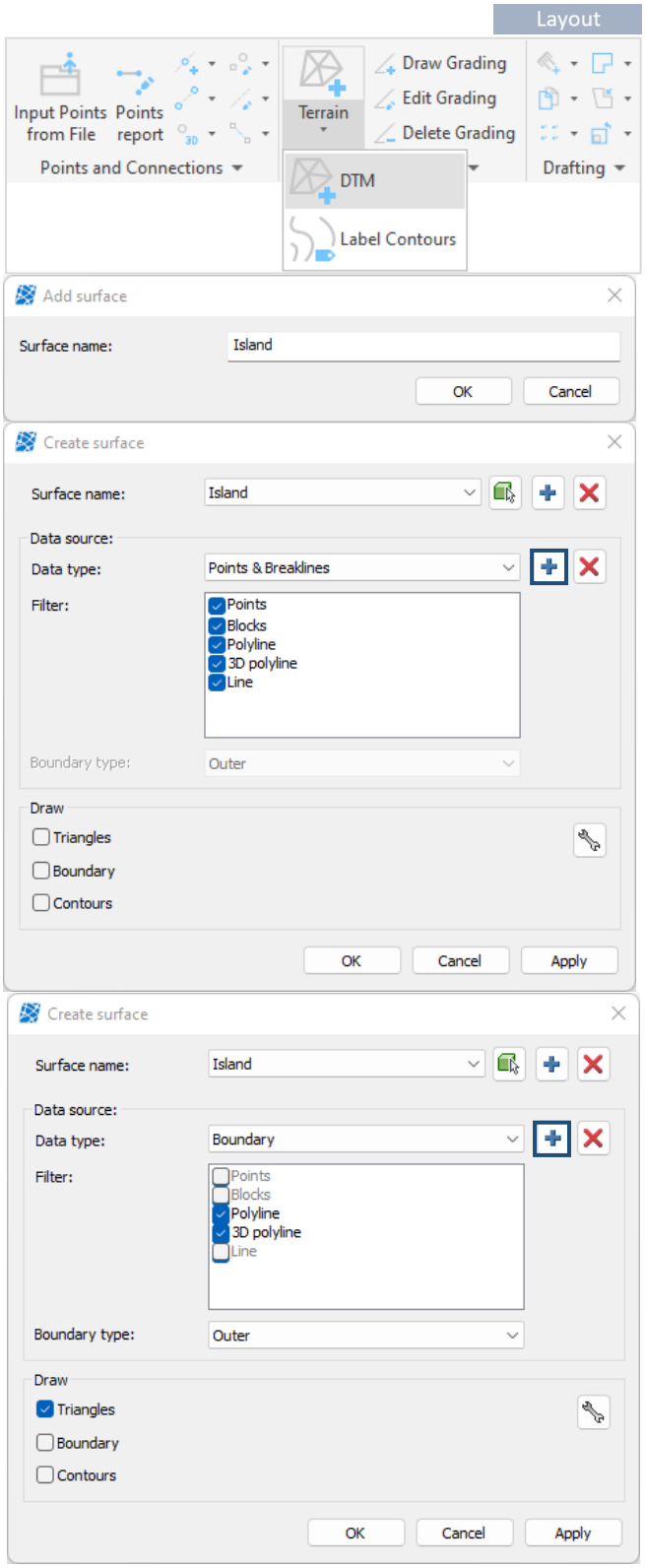
5. Select Boundary for Data type.

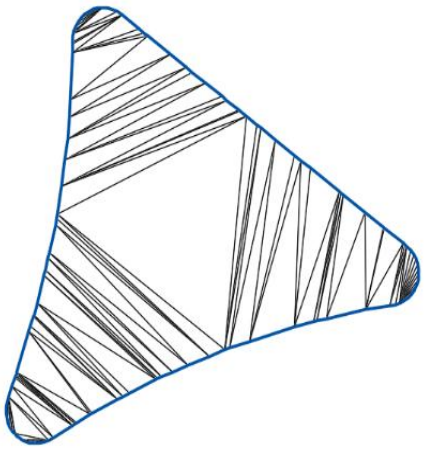
6. Define boundary type. Select Outer from the drop-down menu.

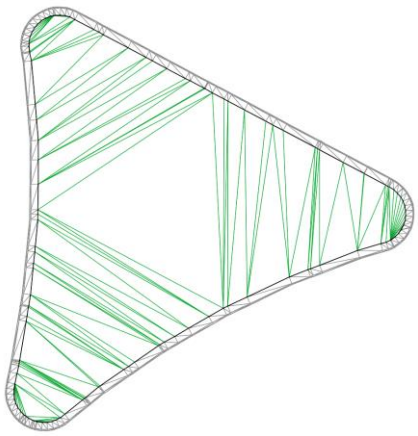
7. Click on the Plus button, select 3D polyline in the drawing and press Enter.

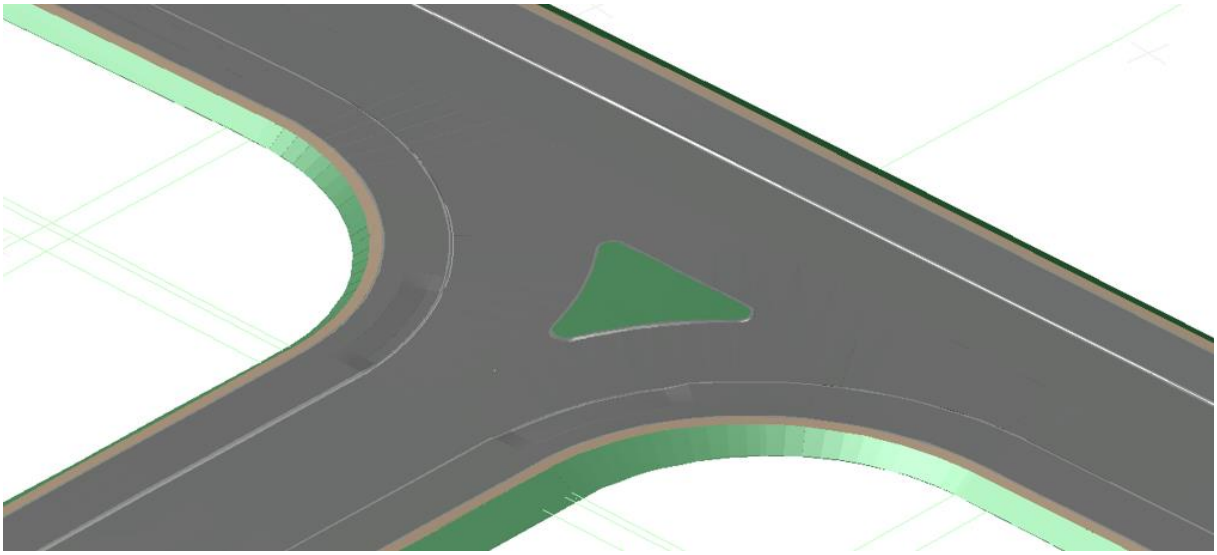
8. Confirm by clicking the OK button.

The island is completed. You can now change the colour of the layer to green.







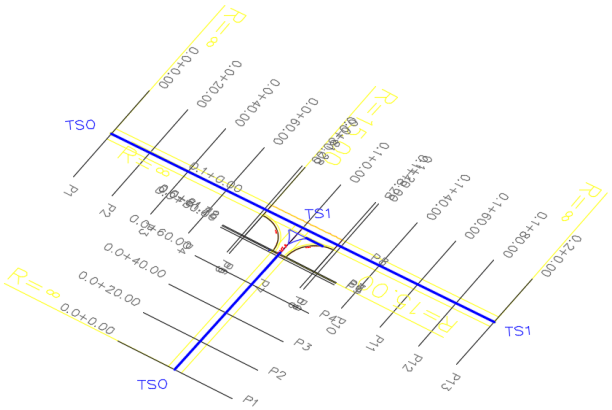


9. 3D ROAD TRAFFIC SIGNALIG

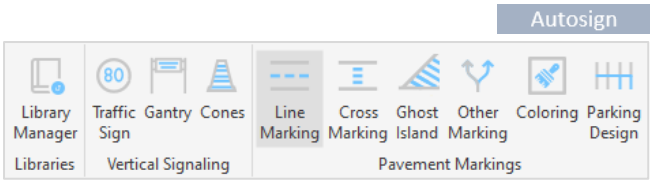
9.1 2D Road markings

9.1.1 Line Markings

1. In the beginning, you draw 3D road markings as CAD polylines at the elevation 0.



2. Run the Line Marking command.



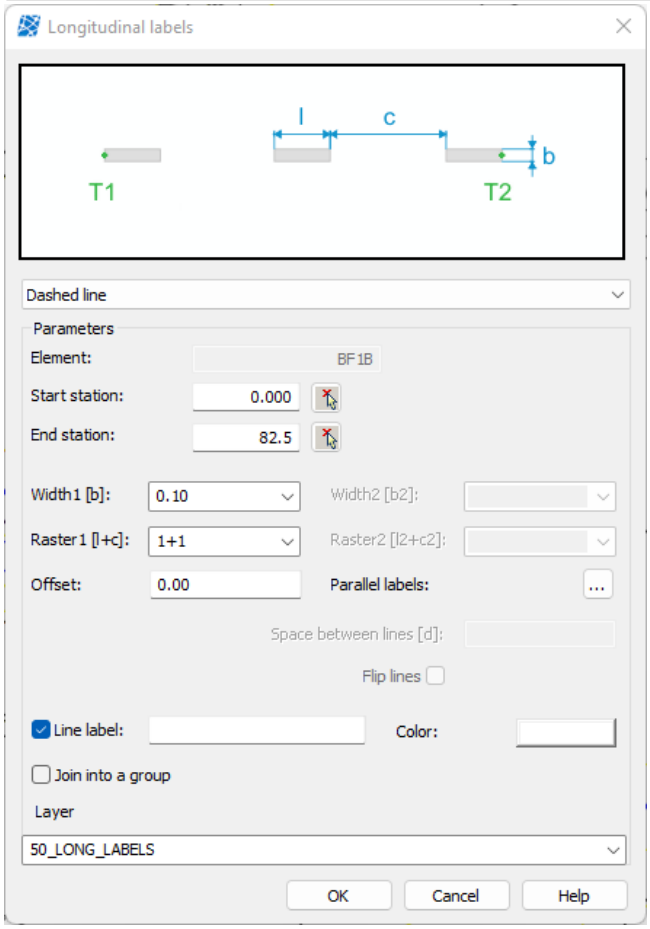
3. Select entities for line markings in the drawing and press Enter.

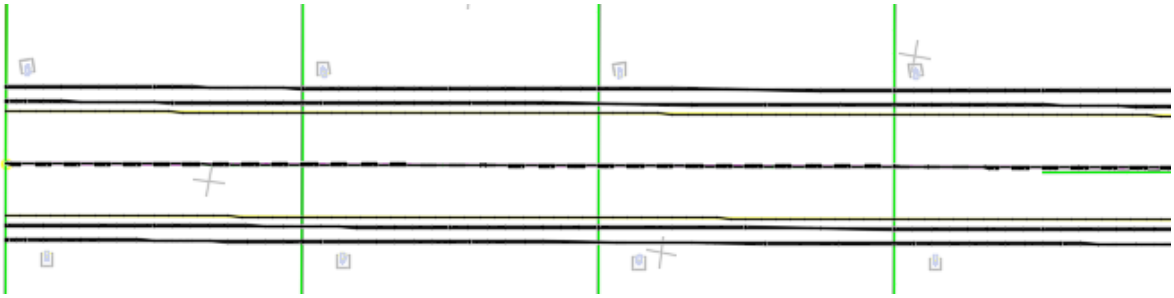
4. Select label type from the drop-down menu.

5. Define start and End station.

6. Define width, raster, offset, line label, colour and layer.

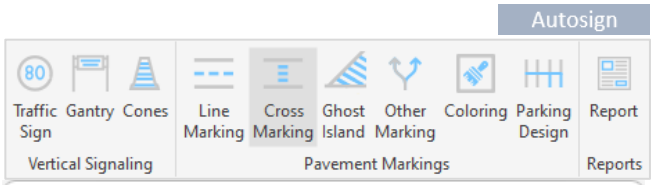
7. Confirm by clicking the OK button.





9.1.2 Cross Marking

1. Run the Cross Marking command.

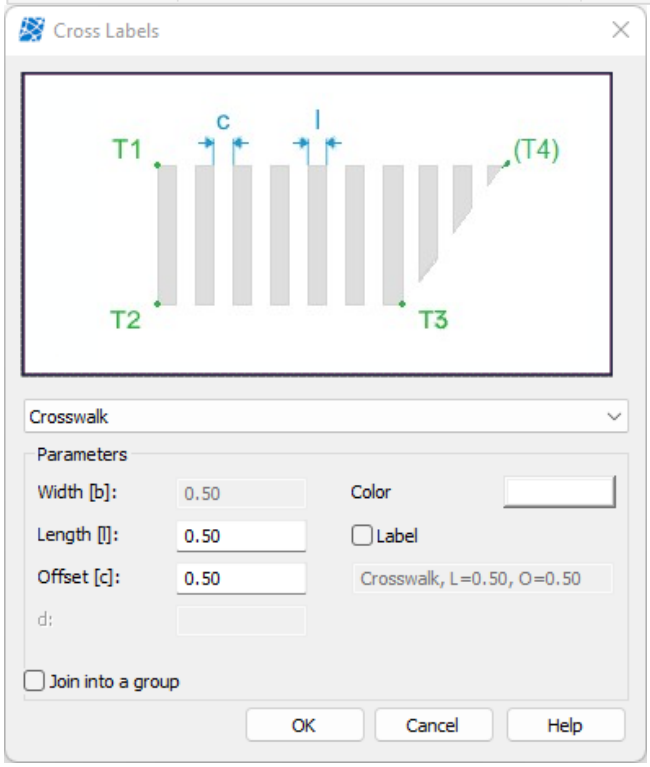


2. Select Crosswalk option from the drop-down menu.

3. Define width, length, offset, colour and label.

4. Check the box to create the road markings as a single element in the drawing, or unchecked it to create the road markings as a set of separated hatches and polylines.

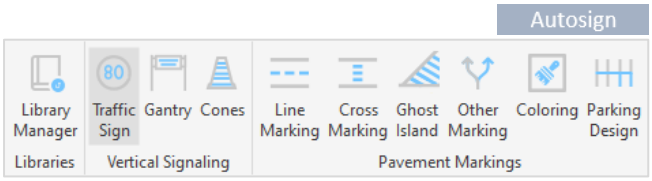
5. Confirm by clicking the OK button.



In this way, you also draw other lines and, for example, pedestrian crossings. The following video links may help you.

9.2 2D Traffic signs

1. Click on the Traffic Sign icon.



2. Autosign dialogue box with traffic signs appears on the left side.

3. Specify the alignment you want traffic signs to be attached. Autosign supports alignments created by Plateia and Civil 3D.

4. Select the group.

5. Select the category of the sign: new sign (new design) in the drawing or existing traffic sign (built) on the road.

6. Post and Foundation: set dimension and shape of the posts and foundations of the traffic signs.

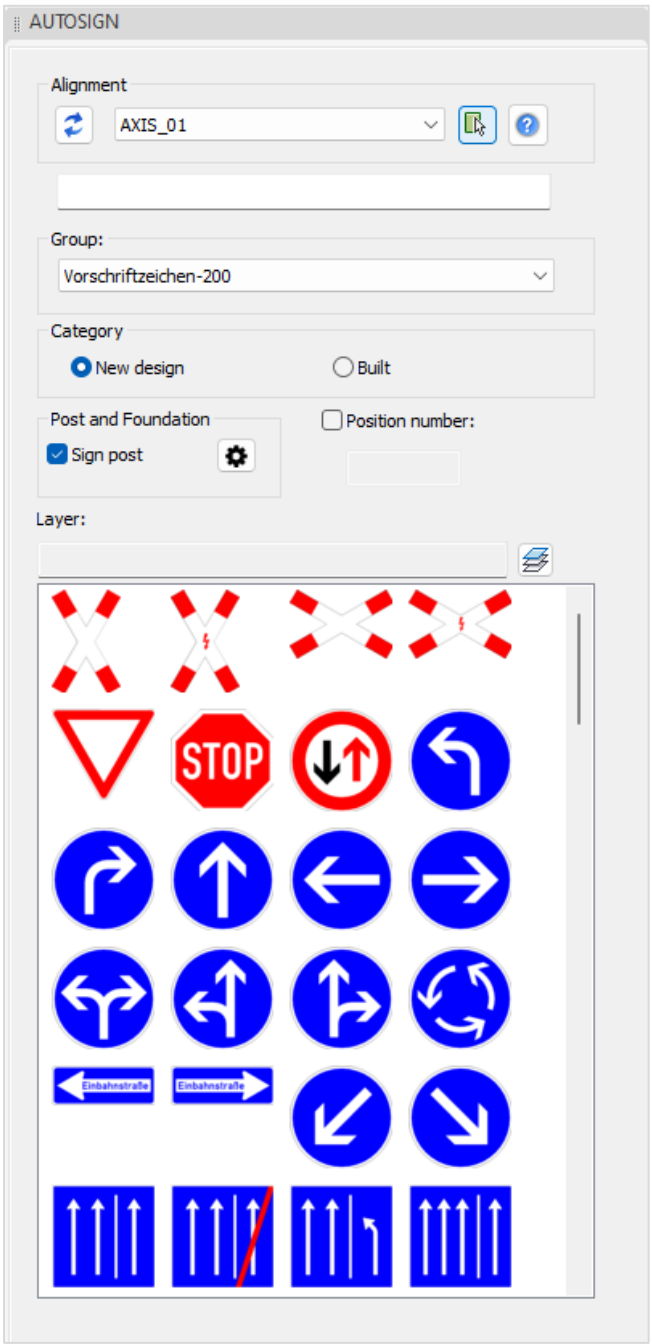
7. Define the position number.

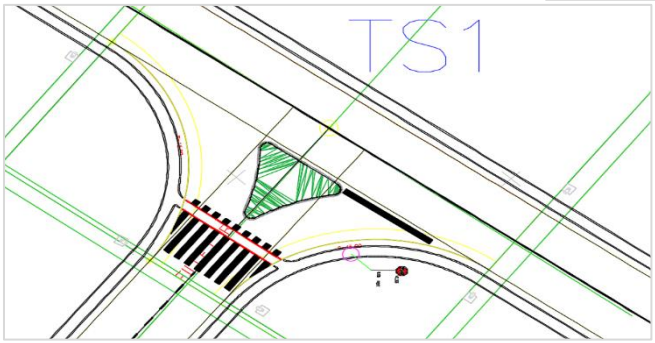
8. If you want you can define a layer. Type the name or click on the icon next to the text box.

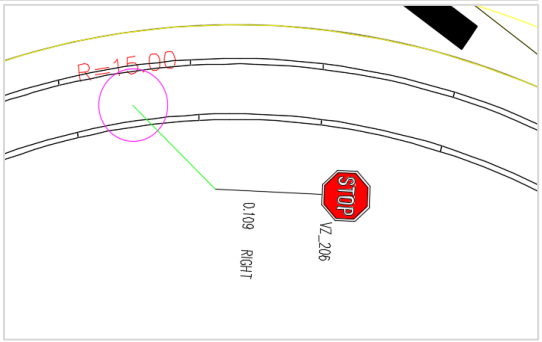
9. Click on the desired traffic sign.

10. Define traffic sign insertion point in the drawing and then determine the position of the traffic sign.

11. Specify the angle and then rotate the traffic sign.

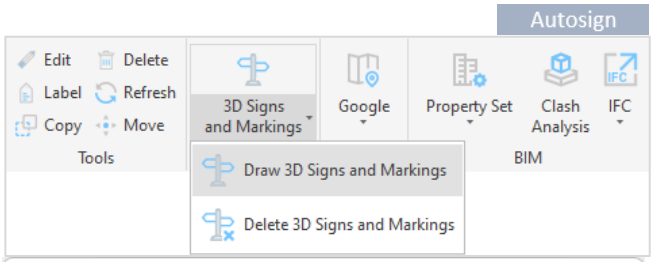






9.3 3D Traffic signs and road markings

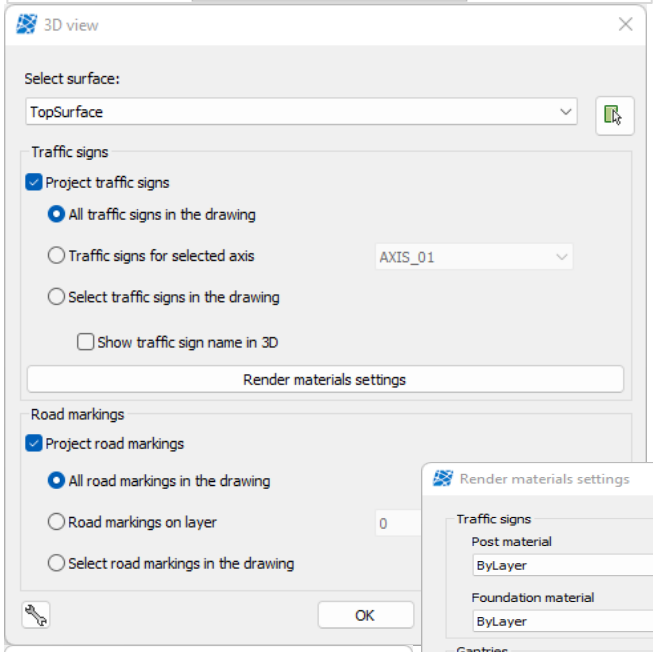
1. Run the Draw 3D Signs and Markings command.

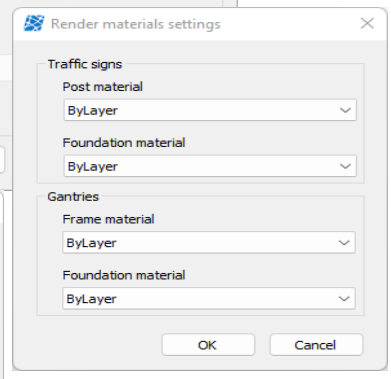


2. 3D View dialogue box opens. Select a surface from the drop-down menu. Road markings and traffic signs will be projected on this surface.

3. In the next step define which traffic signs and road markings you want to project to the surface. All traffic signs and road markings can be draped, or just selected ones.

4. With Render materials settings you can define render materials for traffic signs.

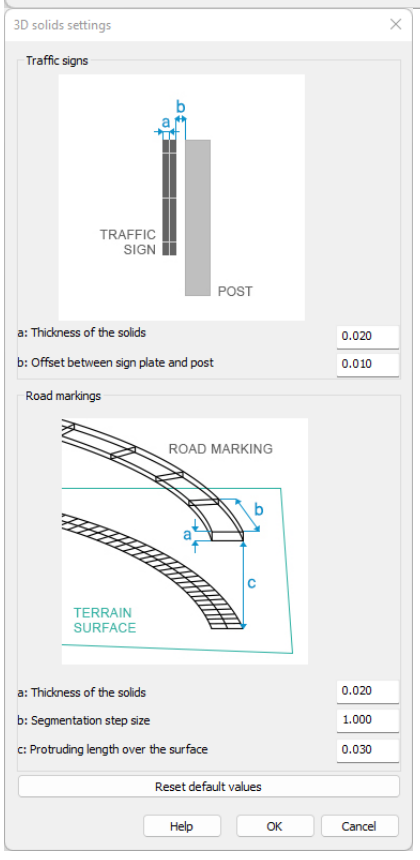




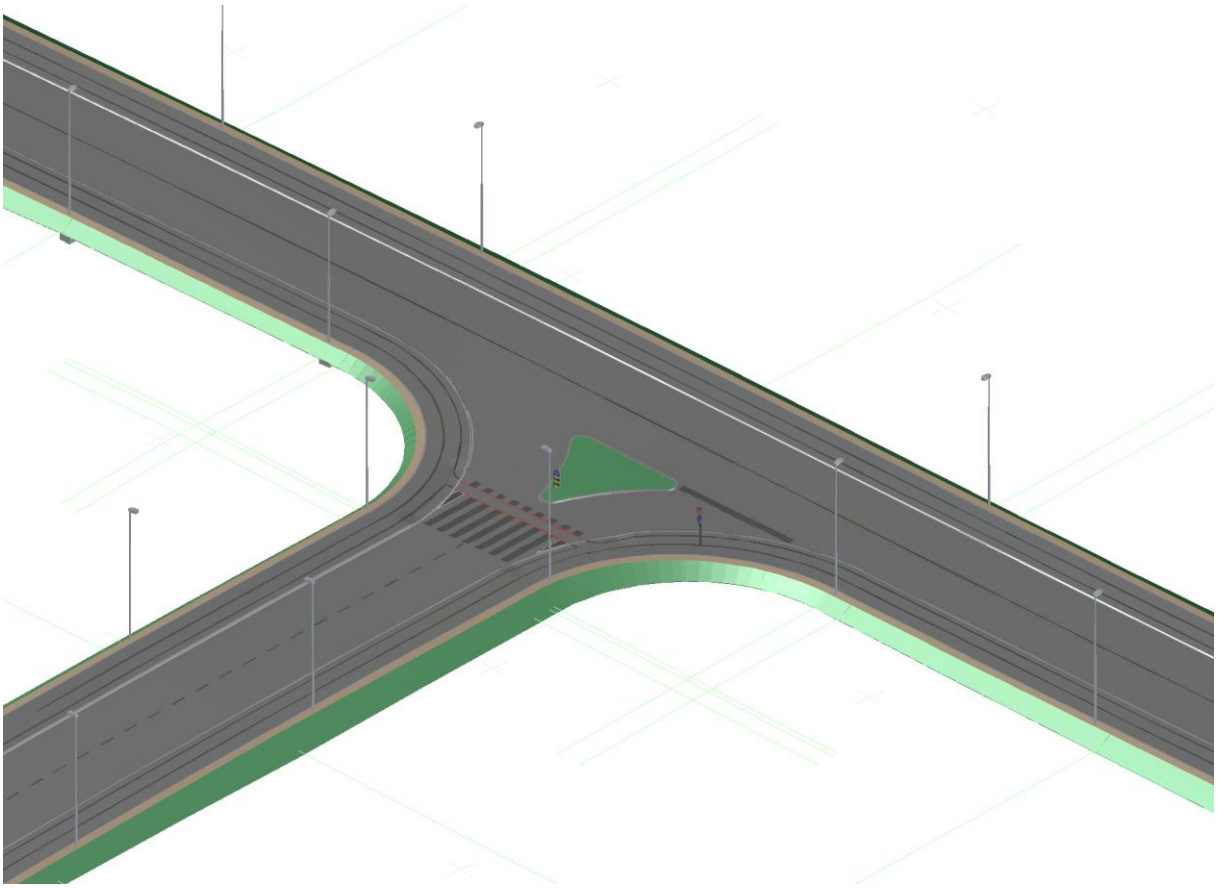
5. Repeat the same with road markings. You can select the option to project all road markings in the drawing or just selected ones.

6. At the bottom of the dialogue box you have an additional setting for 3D solids. You can set thickness of the solids and offset between sign plate and post for traffic signs. For the road markings, however, you can define thickness of solids, segmentation step size and protruding length over the surface

7. Confirm by pressing the OK button.

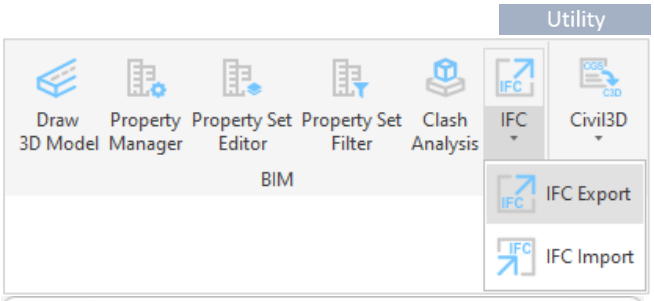


Finished model:



10. IFC EXPORT

1. Run the IFC Export command.



2. Click on the Plus icon and select the objects that you want to export.

3. Select the path to save the file.

4. Define project and building name.

5. Confirm by clicking the Export button.