Plateia

by **CGS Labs**

Designing a Sewage System

Tutorial

CGSLABS

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Designing a Sewage System

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INTRODUCTION

In this tutorial, users will be guided on how to utilize the Plateia program for designing a sewage system. Two methods will be demonstrated:

- **Using the Polyline Editor:** With the assistance of the Polyline Editor tool located in the Site Design tab, we will draw and edit a 3D polyline along which we will later draw a 3D pipe.
- Designing Sewage System using commands from the "**Drainage and Sewer**" tab: The process begins with planning the sewage layout and incorporating pipes into the longitudinal profile. Subsequently, manholes will be drawn at sewer pipe intersections, followed by labeling the sewage systems and manholes in the profile table rubrics. Following this, the tutorial demonstrates how to create cross-sections. This comprehensive tutorial ensures a thorough understanding of the sequential steps involved in designing a functional sewage system using the Plateia program.

Designing a Sewage System in the Layout

In both methods, at the beginning, we use basic CAD tools to draw the sewage system on the layout. This involves employing commands such as PLINE for drawing pipes and BLOCKS for drawing manholes.
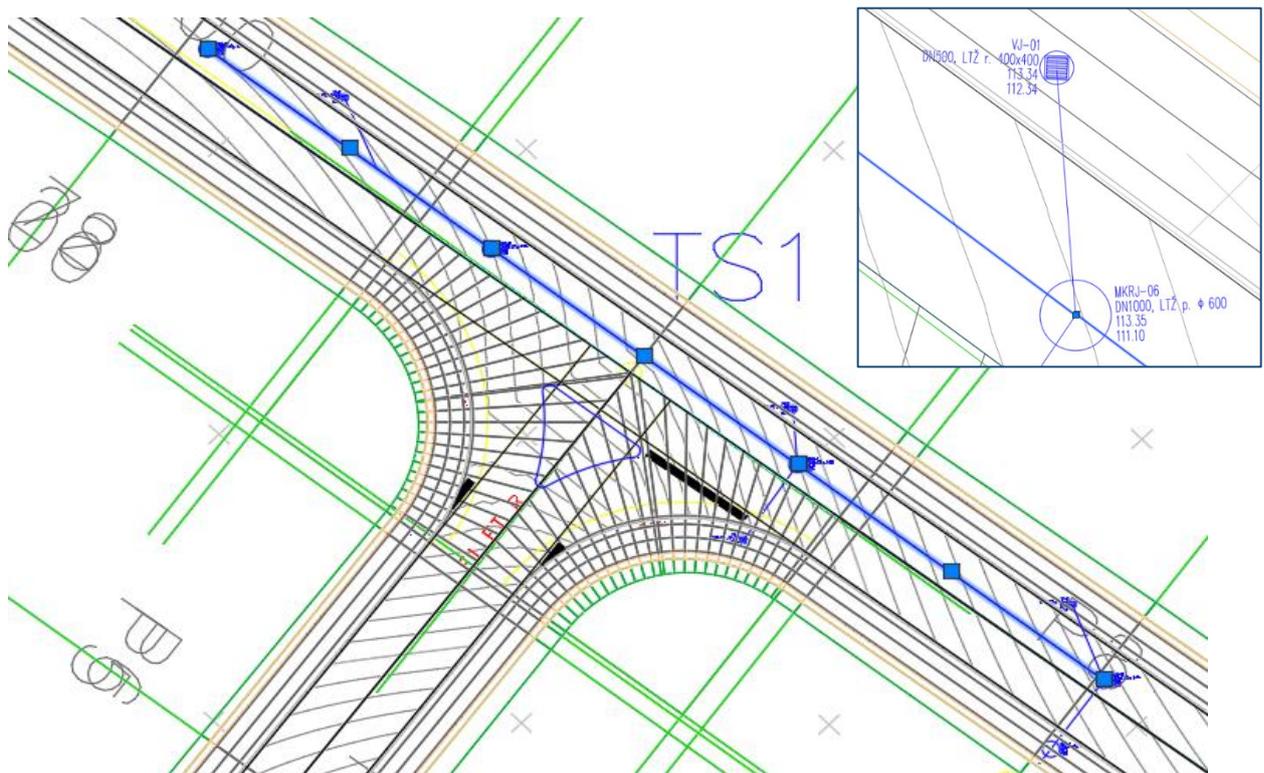
The line, marked in blue on the upper image, should be created as one polyline.

Method 1: Using the Polyline Editor

1. Select a polyline and then run the "Polyline Editor (SD5)" command.

It opens a new dialogue box.

2. Right-click on the polyline and select the 'Convert 2D polyline to 3D polyline' option.

If you want to set additional settings for creating a 3D polyline from 2D, click on the 3D polyline arc tessellation options.
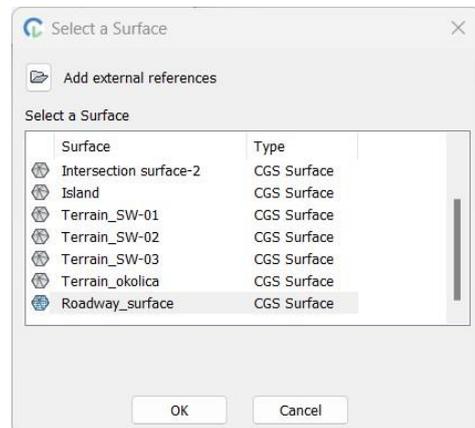
3D polyline editor

		Drop all but selected
		Filter 3D polyline only
		Convert 2D polyline to 3D polyline
		3D polyline arc tessellation options

3D polyline editor
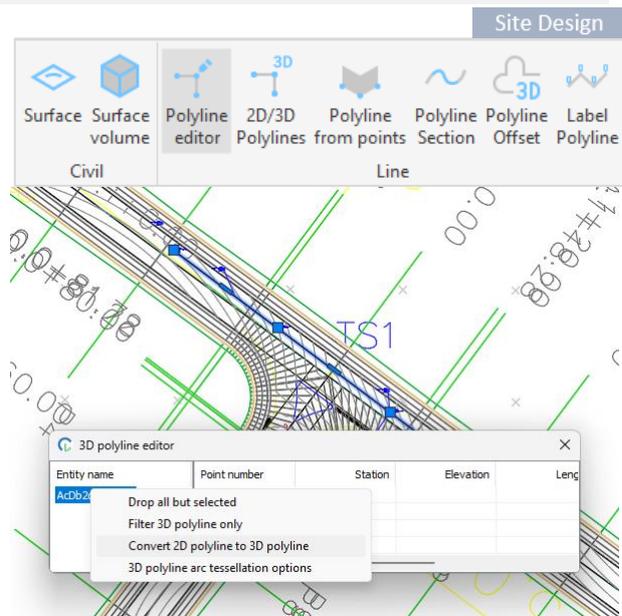
Entity name	Point number	Station	Elevation	Length	Gradient back	Gradient ahead
AcDb2dPolyline	Point 1	0.000	0.000	25.001		0.000 %
AcDb3dPolyline	Point 2	25.001	0.000	27.000	0.000 %	0.000 %
	Point 3	52.001	0.000	27.001	0.000 %	0.000 %
	Point 4	79.001	0.000		0.000 %	

3. Then we project the 3D polyline onto the surface of the road. This is done by right-clicking on the 3D polyline in the Polyline Editor and selecting the option 'Raise to surface elevation (vertices only).

3D polyline editor

Entity name	Point number	Station	Elevation	Length	Gradient back	Gradient ahead
AcDb3				)01		0.000 %
Drop all but selected				)00	0.000 %	0.000 %
Filter 3D polyline only				)01	0.000 %	0.000 %
Raise to surface elevation (vertices only)					0.000 %	
Raise to surface elevation (add vertex on surface break)						

4. A dialogue box opens where we choose the surface onto which we want to project the 3D polyline.

Select a Surface

Add external references

Select a Surface

Surface	Type
Intersection surface-2	CGS Surface
Island	CGS Surface
Terrain_SW-01	CGS Surface
Terrain_SW-02	CGS Surface
Terrain_SW-03	CGS Surface
Terrain_okolica	CGS Surface
Roadway_surface	CGS Surface

OK   Cancel

5. In the next step, for example, we can lower this 3D polyline by two meters below the surface of the road. We do this by selecting points (you can click on Point 1, hold down Shift, and then click on Point 4), and then right-click. Click on "Raise/Lower elevation" and enter the value. In this example, we will lower the 3D polyline by two meters below the road surface.

3D polyline editor

Entity name	Point number	Station	Elevation	Length	Gradient back	Gradient ahead
AcDb3dPolyline	Point 1	0.000	292.705	25.002		-0.820 %
	Point 2	25.002	292.500	27.004	0.820 %	-1.654 %
	Point 3	52.005	292.053	27.004	1.654 %	-1.585 %
	Point 4	79.009	291.6	Raise/Lower elevation		

3D polyline editor

Entity name	Point number	Station	Elevation	Length	Gradient back	Gradient ahead
AcDb3dPolyline	Point					-0.820 %
	Point	Enter relative elevation raise/lower value:	-2		0.820 %	-1.654 %
	Point				1.654 %	-1.585 %
	Point 4	79.009	291.625		1.585 %	

6. Then we can also change the slope. Let's say it is descending at a 2% grade.

3D polyline editor

Entity name	Point number	Station	Elevation	Length	Gradient back	Gradient ahead
AcDb3dPolyline	Point 1	0.000	290.705	25.006		-2.000 %
	Point 2	25.006	290.205	27.005	2.000 %	-2.000 %
	Point 3	52.011	289.665	27.006	2.000 %	-2.000 %
	Point 4	79.017	289.125		2.000 %	

Once we finish editing the 3D polyline, we can continue with the next step.

2. Displaying the pipe in profile and cross-sections of the main alignment

2.1 Define Projecion Line

1. Run the "Define Projection Lines (21M3) " command.

2. Select the 3D polyline directly in the drawing and press Enter.

3. Next, specify the name of this element in the command line: PIPE_01 and press Enter.

If you zoom in on the 3D polyline, you can see that the name of the projection line shows up in the drawing.
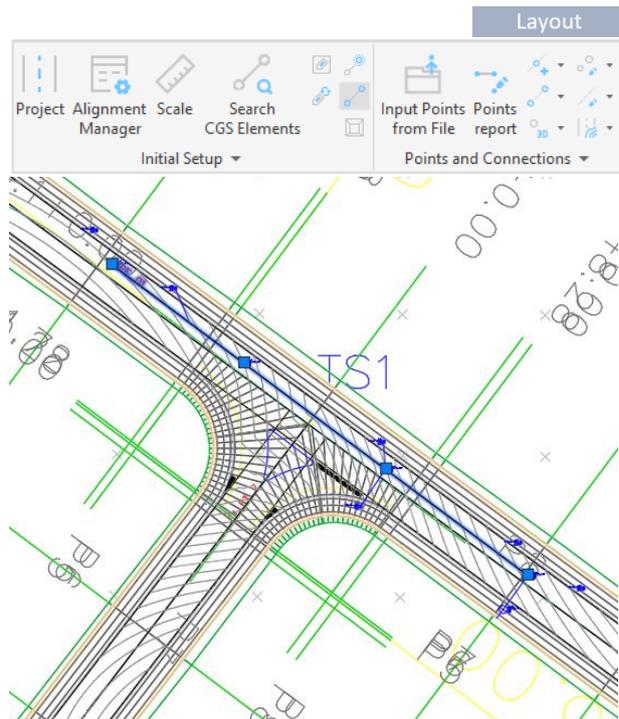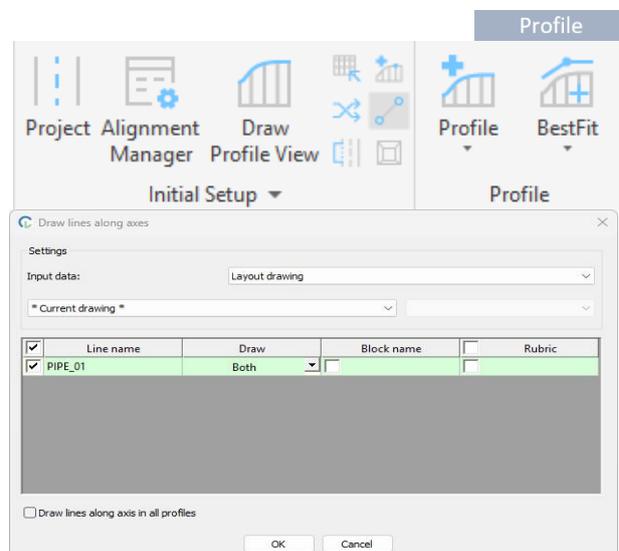

2.2 Insert Projection Lines in Profile

Before proceeding with this step, ensure that the axis you desire for the pipe to be displayed in profile is set as the active axis.

1. Run the "Draw Projection Lines (31E2)" command.

2. Check the box at the PIPE_01 option and click OK.

If you are interested in understanding the additional settings, please refer to the next tutorial: Projection lines labelling options in profile view band

The projection line is inserted into the profile, and its name is also displayed, as shown in the image on the right.
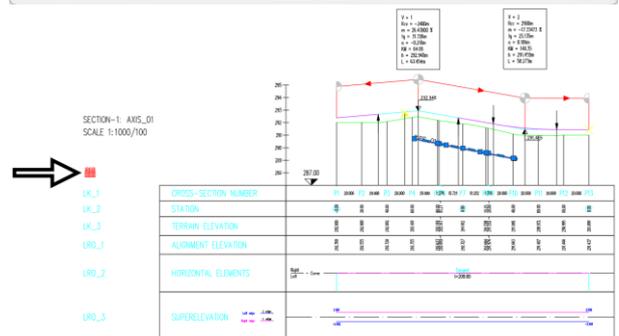
2.3 Insert Projection Lines in Cross-Sections

1. Run the "Draw Projection Points (41K2)" command.

2. Check the box next to the PIPE_01 option and click OK.
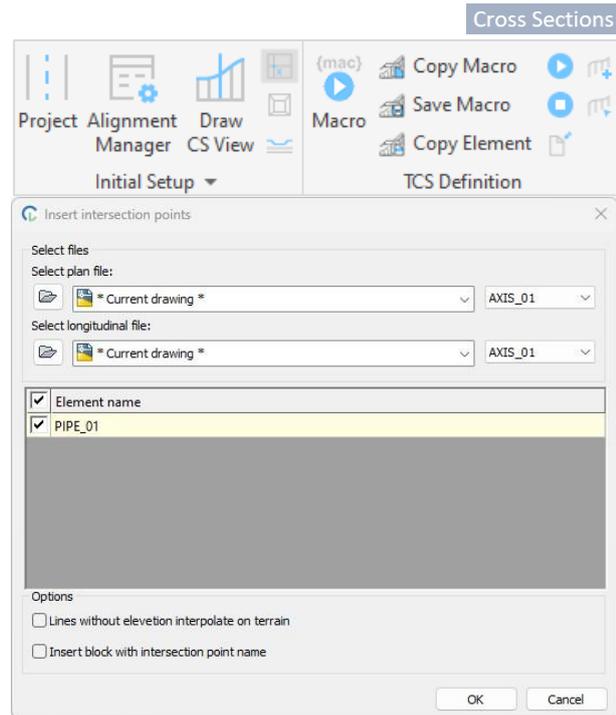
The projection line is inserted into the cross-sections as points, and its name is also displayed, as shown in the image on the right.
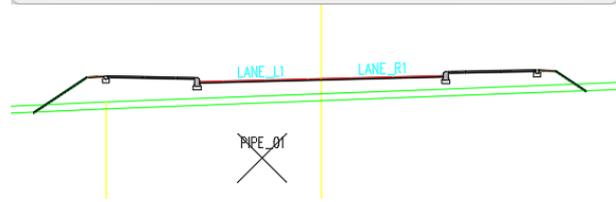
3. Calculation of the amount of material for excavation and fill

3.1 Insert block in cross-sections

In the cross-sections, we will first insert a block that represents the pipe and layers of materials. We will insert a regular CAD block, and it is crucial to determine the Base Point. In our example, the Base Point is placed at the location representing the bottom of the pipe.

**Alternatively, instead of using a block, you can draw individual lines using the commands found in the
"Draw TCS elements" tab.**
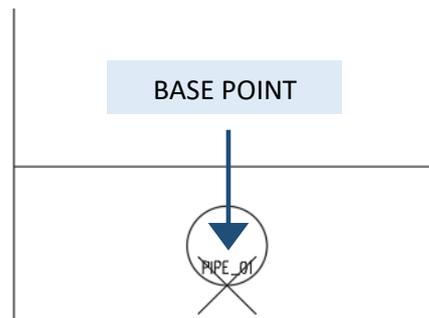
1. Run the "Insert Block (41GB)" command.

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2. Select a block from the drop-down menu.

3. Then, check the box next to the Explode option.

If desired, you can also specify the layer name. You can choose it from the drop-down menu or enter a new name directly in the box.

4. Click OK.

5. Select the element and the insertion point. In this case, you click on the projection point that represents the sewer pipe.
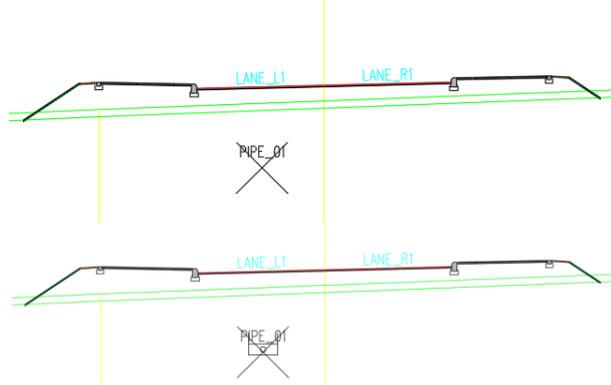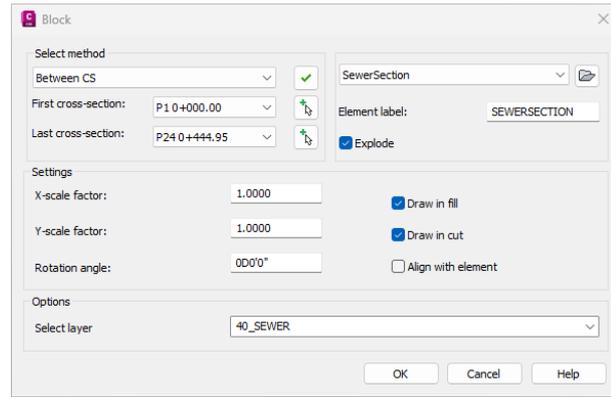
The block is now inserted in the drawing. In order to be able to calculate the quantities accurately, in the next step, we need to extend the edges to the roadway line.

3.2 Extend

1. Run the "Extend (41I2)" command.

2. Select all cross-sections and click OK.
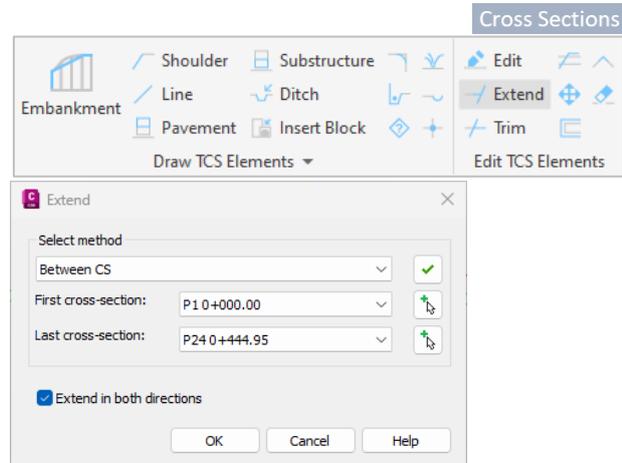
3. Select the edge (roadway line) and press Enter.

4. After that select the outer edge of the block and press Enter.

Repeat the same process on the other side.

The final result is shown in the picture below:
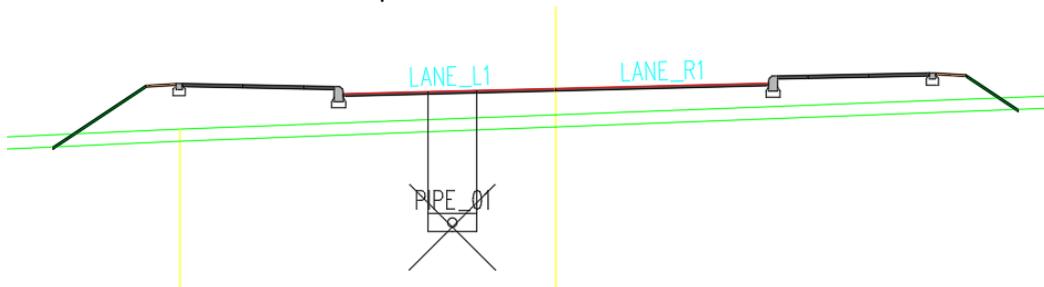
4. Planimetry

Gravel

1. Run the <u>Planimetry(41M1)</u> command.

2. Select all cross-sections.

3. Choose the material from the drop-down menu.

4. Select the planimetry-polygon definition and additional settings from the drop-down menu.

5. Click OK.

6. Select elements for reference polygon and press Enter.

7. Select elements for the second polygon and press Enter.
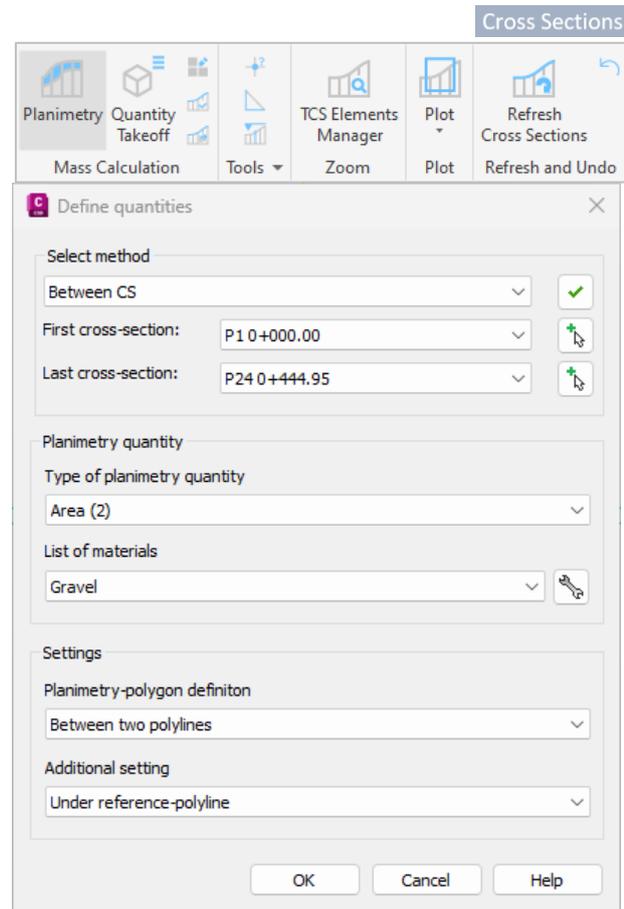
The planimetry quantity of gravel is shown in the picture below:
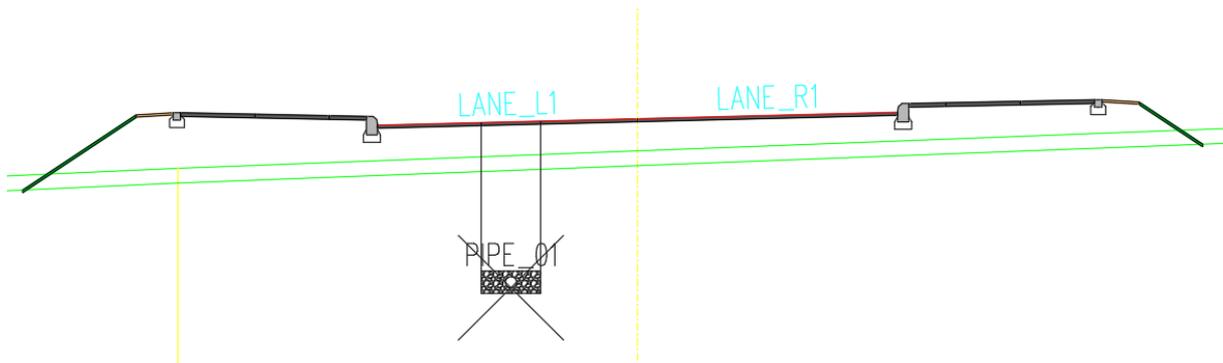
Soil fill

1. Run the "Planimetry (41M1)" command.

2. Select all cross-sections.

3. Choose the material from the drop-down menu.

4. Select the planimetry-polygon definition and additional settings from the drop-down menu.

5. Click OK.

6. Select elements for reference polygon and press Enter.

7. Select elements for the second polygon and press Enter.
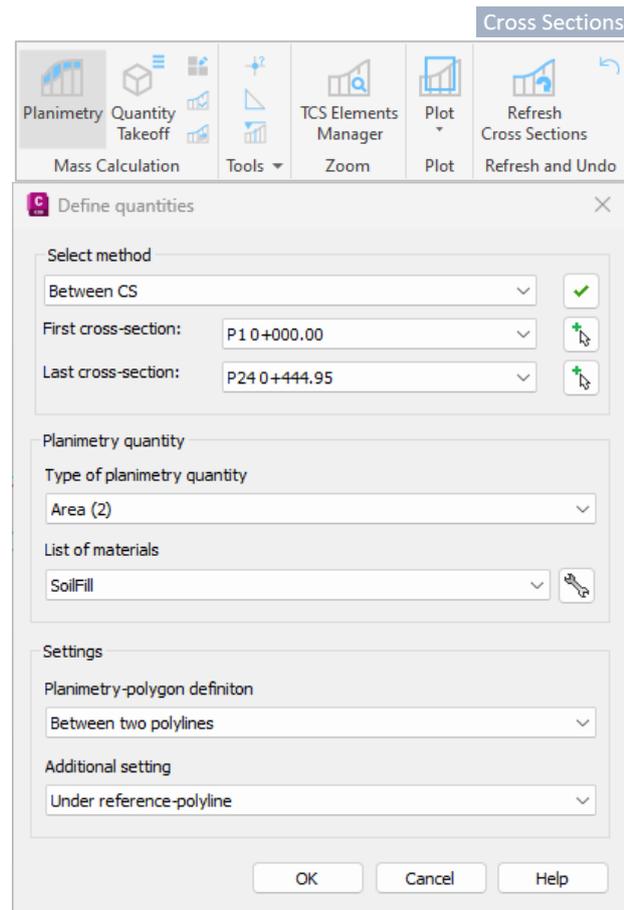
The planimetric quantity of gravel and soil is illustrated in the picture below:
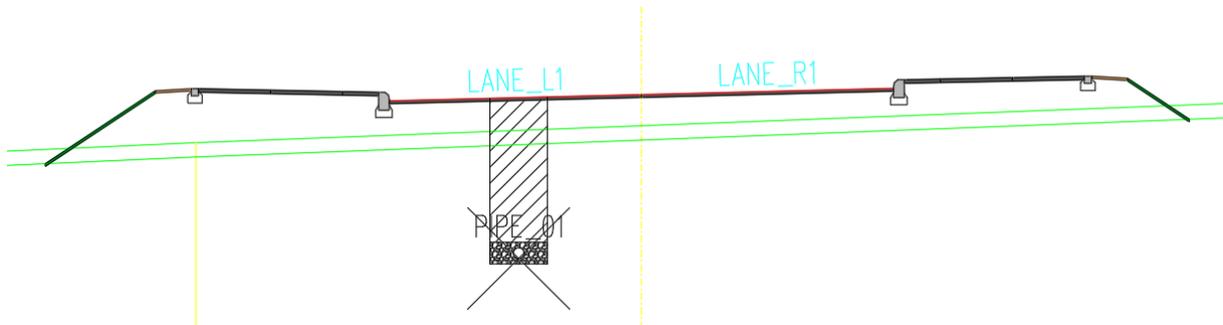
5. Quantity Take-Off Report

1. Run the <u>Quantity Takeoff (41M6)</u> command.

2. Select all cross-sections.

3. In the section "Calculate by cross-sections," check the box next to the "Insert in drawing" option, and then select the location for planimetry labels in the drawing.

3. In the section "Summary of quantities," check the box next to the "Insert in table" option, and select the insertion point of the quantity table.

4. Click OK.

Display of quantities in cross-sections:	Summary of quantities:

Quantity takeoff

Sect.	Stat Dist.	GRAVEL [m²/m²]	Dist.	SOILFILL [m²/m²]	Dist.
P15|ROAD	0+280.00	0.240		1.140	
	20.000	4.800	20.000	22.807	20.000
P16|ROAD	0+300.00	0.240		1.140	
	20.000	4.800	20.000	22.806	20.000
Sume:		38.400		182.401	
		GRAVEL [m³]		SOILFILL [m³]	

Calculation method: Standard

6. Search CGS Elements

The Search CGS Elements tool enables users to swiftly view, search, and select CGS elements in the layout, including intersection points, lines, and 3D objects, such as this pipe, for example. This is a highly useful tool, especially when dealing with multiple elements in a drawing.
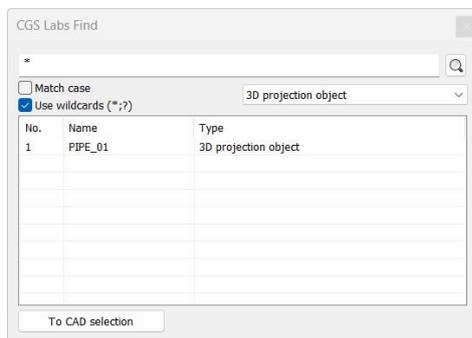
1. Run the "Search CGS Elements (21R9)" command.
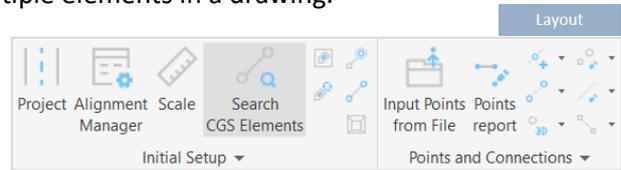
In the search bar, enter the name of the element, and then double-click on that element in the table. The tool will zoom in on that specific element.
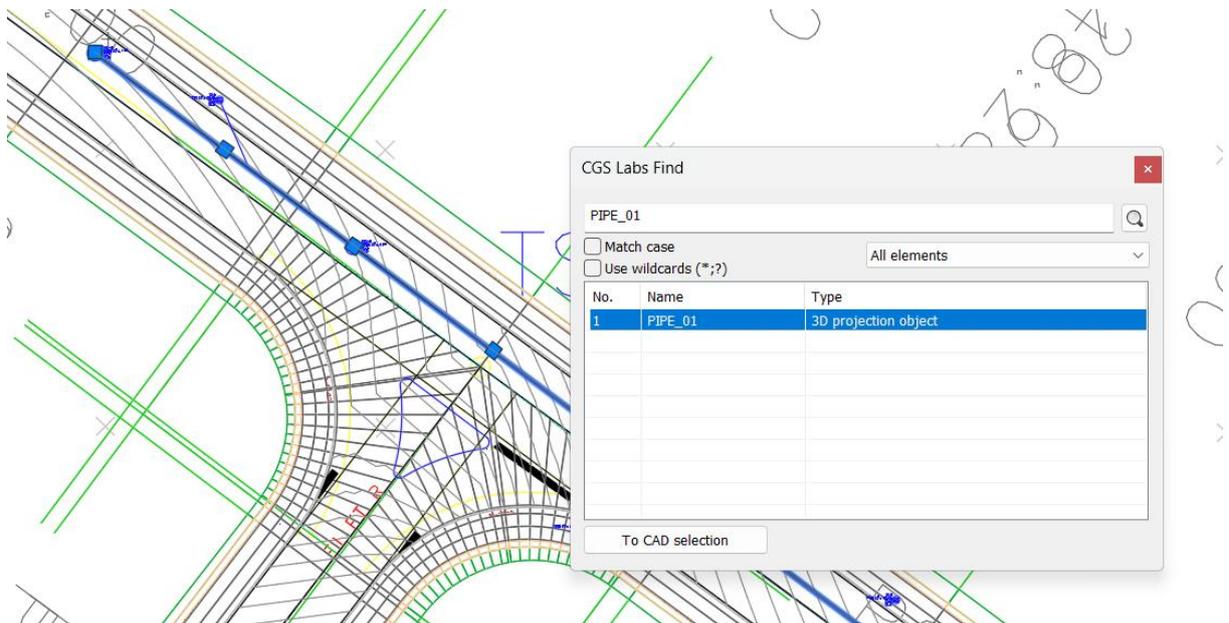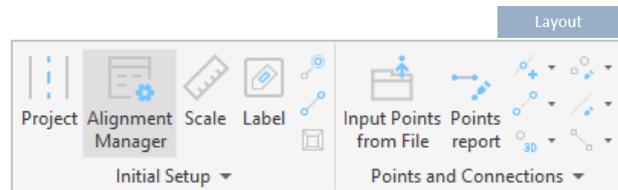
If you want to search for all elements of the type "3D projection object," enter * in the search bar and check the box next to the "Use wildcards" option:
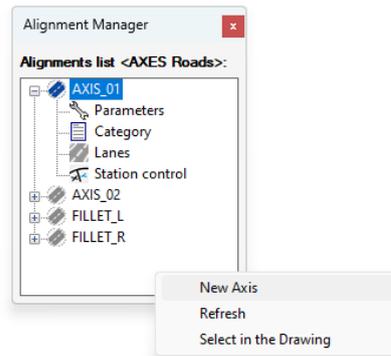
Method 2: Using commands from the "Drainage and Sewer" tab

1. Defining a new axis

1. Click on the Layout tab and run the "Alignment manager (21C)" command.
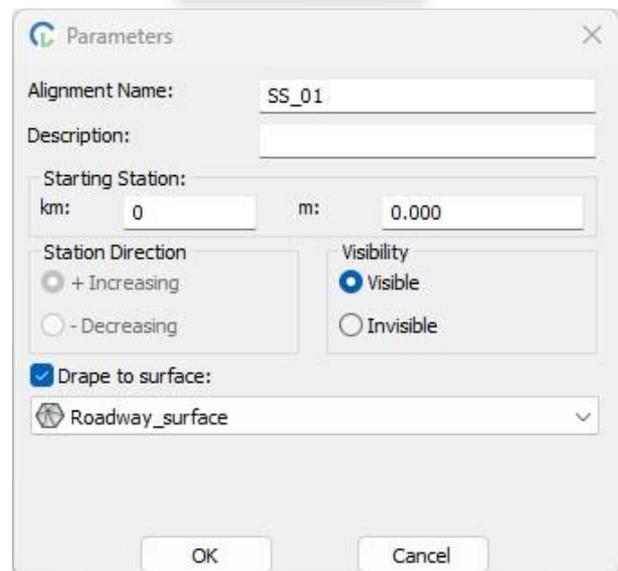

2. Right click in the Alignment Manager and run the New Axis command.


3. Define the Alignment Name.

4. Check the box at the Drape to surface and select the existing roadway surface.

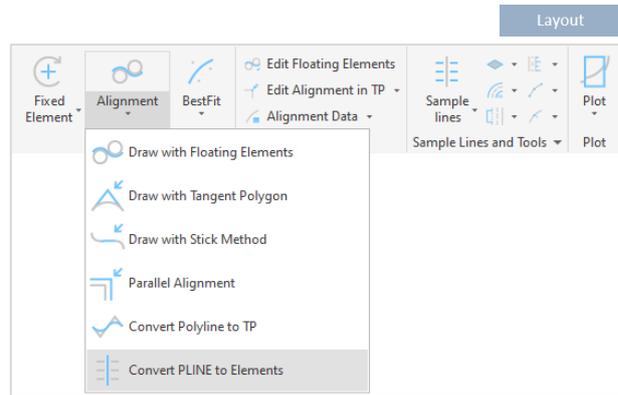5. When you have finished, confirm parameters by clicking the OK button.

6. In Alignment Manager then double-click on the Lanes. At the top of the dialogue box you have a list of predefines types of lanes. Select Default.

7. Double-click on the LANE_L1, change width to 0.1 meters and press OK. Then do the same for the right part.
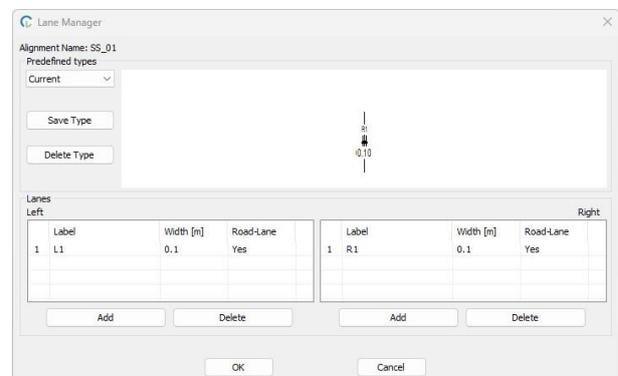
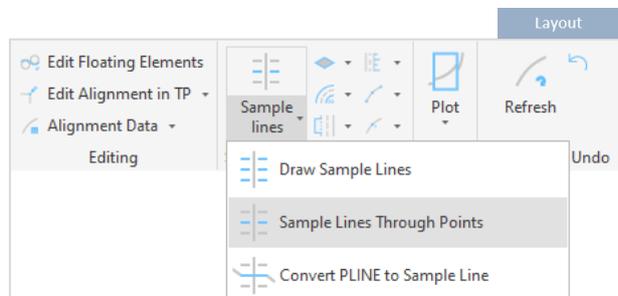8. Run the "Convert PLINE to Elements (21E5) " command.

9. Select the 2D polyline marked in blue, and a new axis will be drawn along it.
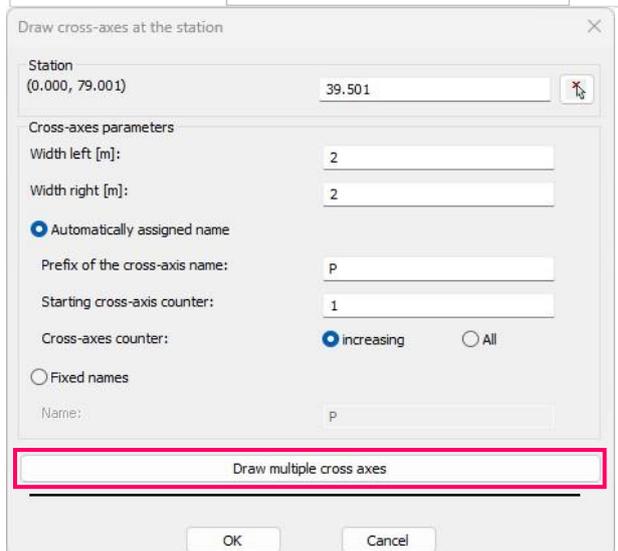

2. Drawing sample lines

1. Run the "Sample Lines Through Points (21H3)" command.
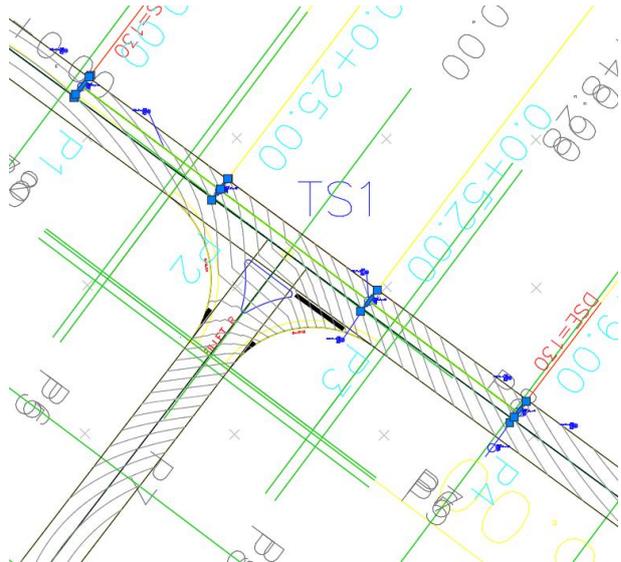

2. Define width left and right.

3. Click 'Draw multiple cross axes,' and then define sample line directly in the drawing. Draw sample lines at the locations where manholes will be.

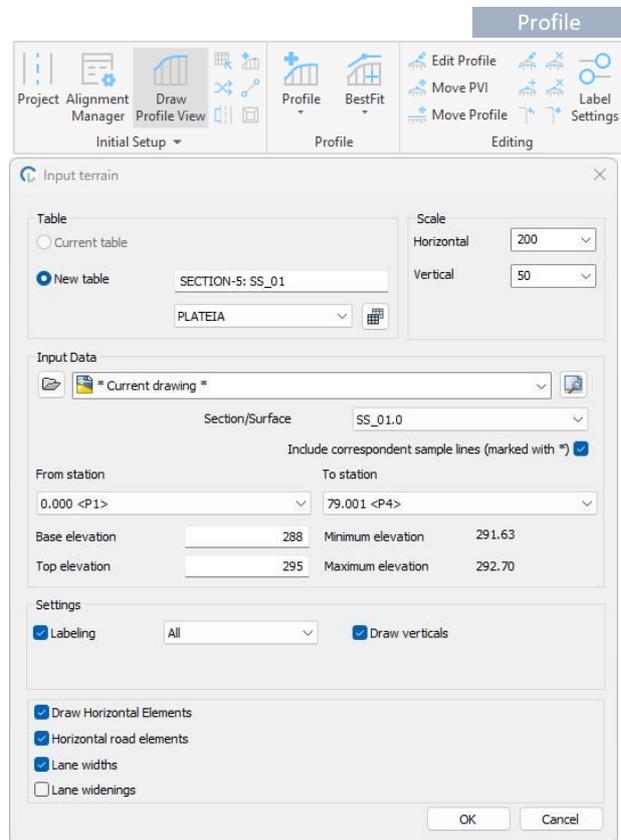4. Once you have defined all sample lines, press the Enter key.

We draw sample lines at locations where we will have manholes.

3. Draw profile view

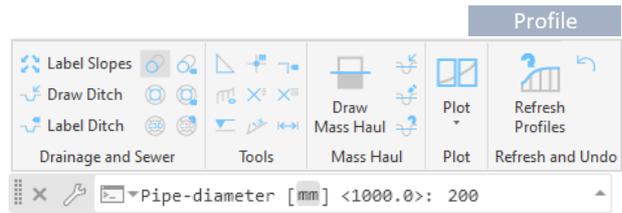1. Run the "Draw Profile View (31D1)" command.

2. Define the scale and other parameters, and then click OK.

4. Drawing Sewage System

1. Run the "Draw Sewage System (31S1)" command.

2. Type the pipe diameter in the command line: 200.

You can insert a sewer pipe into the longitudinal profile by selecting intersection points with your mouse pointer. The line you are drawing represents the pipe bottom.

If you click on 'Parameters' in the command line, an additional dialog box opens where you can define individual parameters or combine two of them. For instance, you can specify the desired slope for drawing:
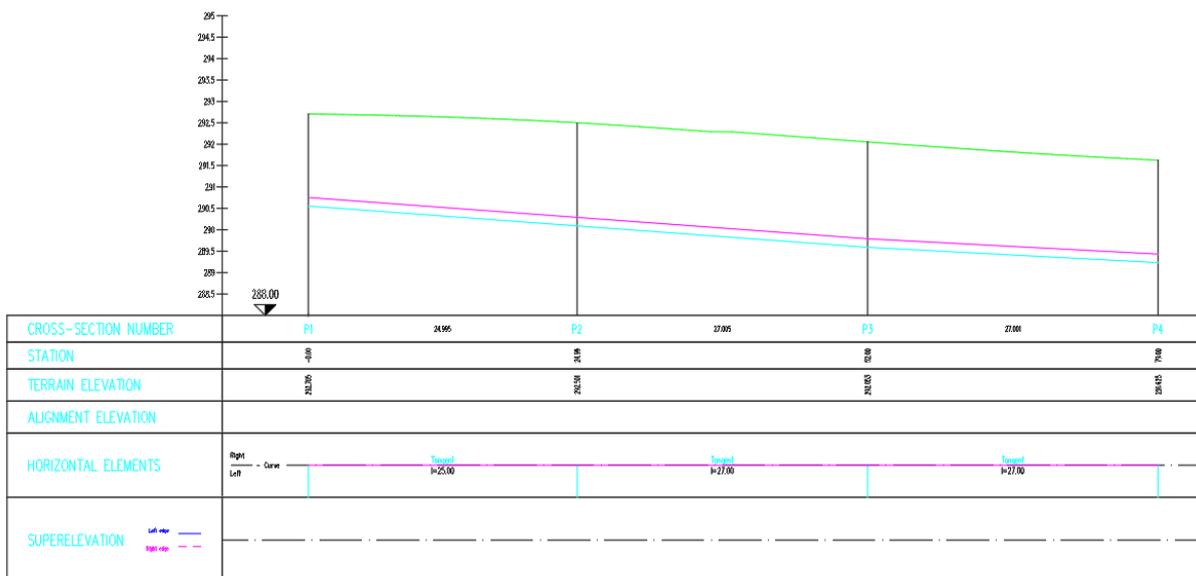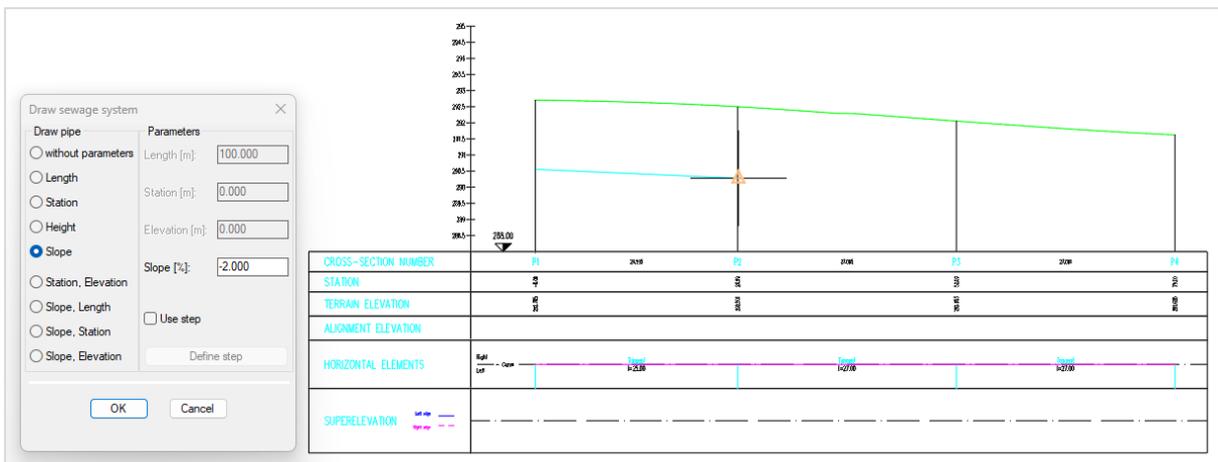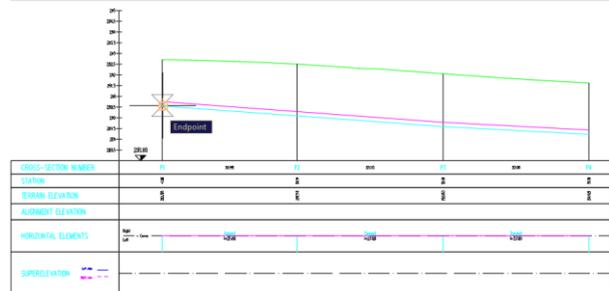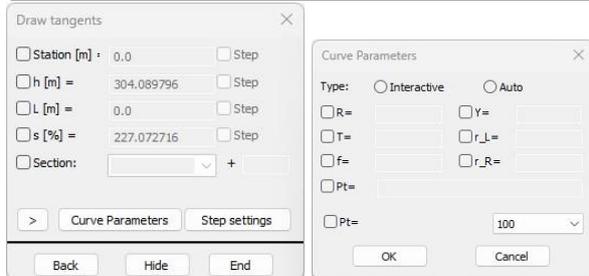
5. Drawing Profile
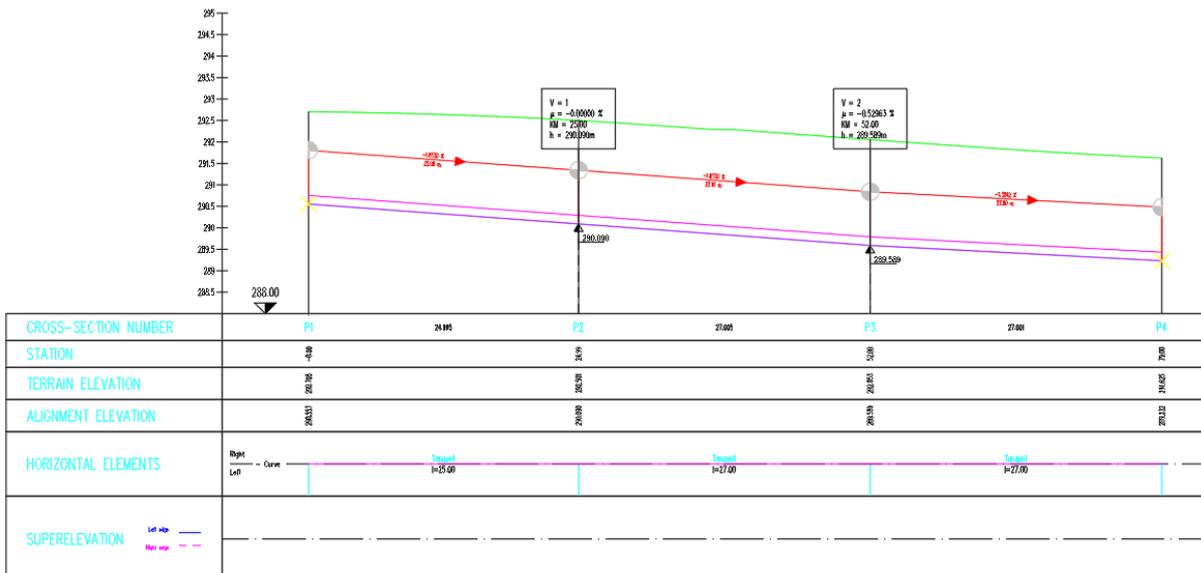
1. Run the "Draw Profile (31G1)" command.
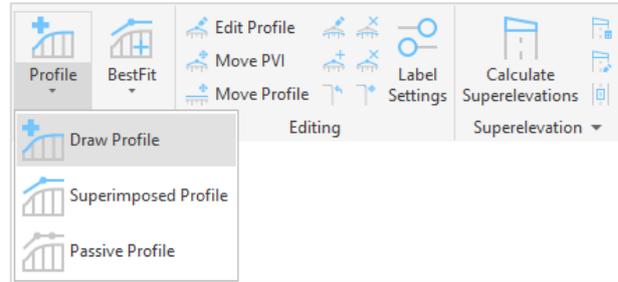
2. Specify the start point.

3. Then, in the 'Draw Tangents' dialogue box, click 'Curve Parameters' and uncheck the 'Pt' option. This means that the vertical curves will not be drawn.

4. After that, continue drawing the profile. When finished, press Enter.

6. Label Sewage System

You can annotate sewer pipe data by using the "Label Sewage System (31S2)" command in rubric no. 27 called 'LEVEL LINE ELEV./FALL.' Values are annotated between the sewer pipe intersections. Pipe bottom elevations in intersections and a pipe slope in ‰ between the neighboring intersections are inserted into the rubric.

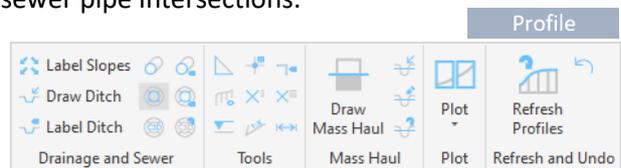1. Run the "Label Sewage System (31S2)" command.
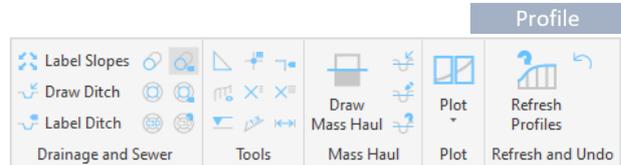
LEVEL LINE ELEV./FALL.			10.54 ‰		11.24 ‰	
PIPE DIAMETER				200.00 mm		

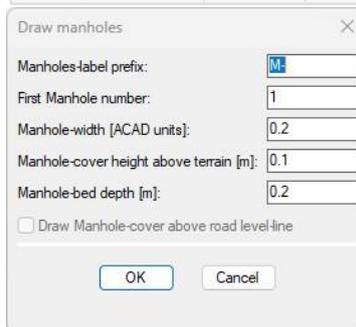## 7. Inserting manholes in intersections

This command enables drawing of manholes in the sewer pipe intersections.

1. Run the "Draw manholes in pipe vertices (31S3)" command.

2. In the Insert manholes dialog box you can define parameters for labeling and drawing of manholes. If the Draw cover above vertical alignment option was selected, manhole gets drawn up to the vertical alignment. If not, manhole gets drawn up to a terrain line.

NOTE! You will not get the Draw Manhole-cover above road level-line command as an option, if you do not have your vertical alignment drawn.

Draw manholes dialog:
- Manholes-label prefix: M-
- First Manhole number: 1
- Manhole-width [ACAD units]: 0.2
- Manhole-cover height above terrain [m]: 0.1
- Manhole-bed depth [m]: 0.2
- ☐ Draw Manhole-cover above road level-line

3. Then define manhole-label position or **press Enter.**
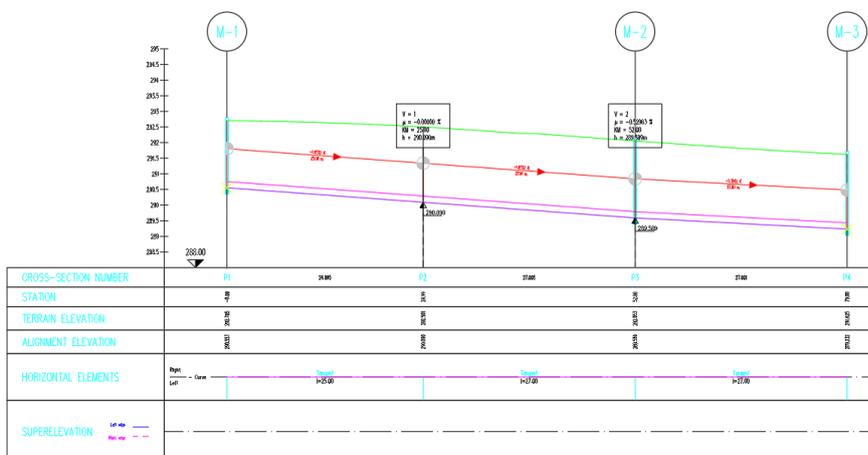
8. Label Manholes

You can label drawn manholes using the 31S3 command. This command annotates the following three rubrics:

- STATION/DISTANCE: Manhole station and distance between two neighboring manholes.
- DISTANCE FROM AXIS: Horizontal distance of the manhole from an axis.
- MANHOLE COVER ELEVATION: Manhole cover elevation.

1. Run the "Label Manholes (31S4)" command.