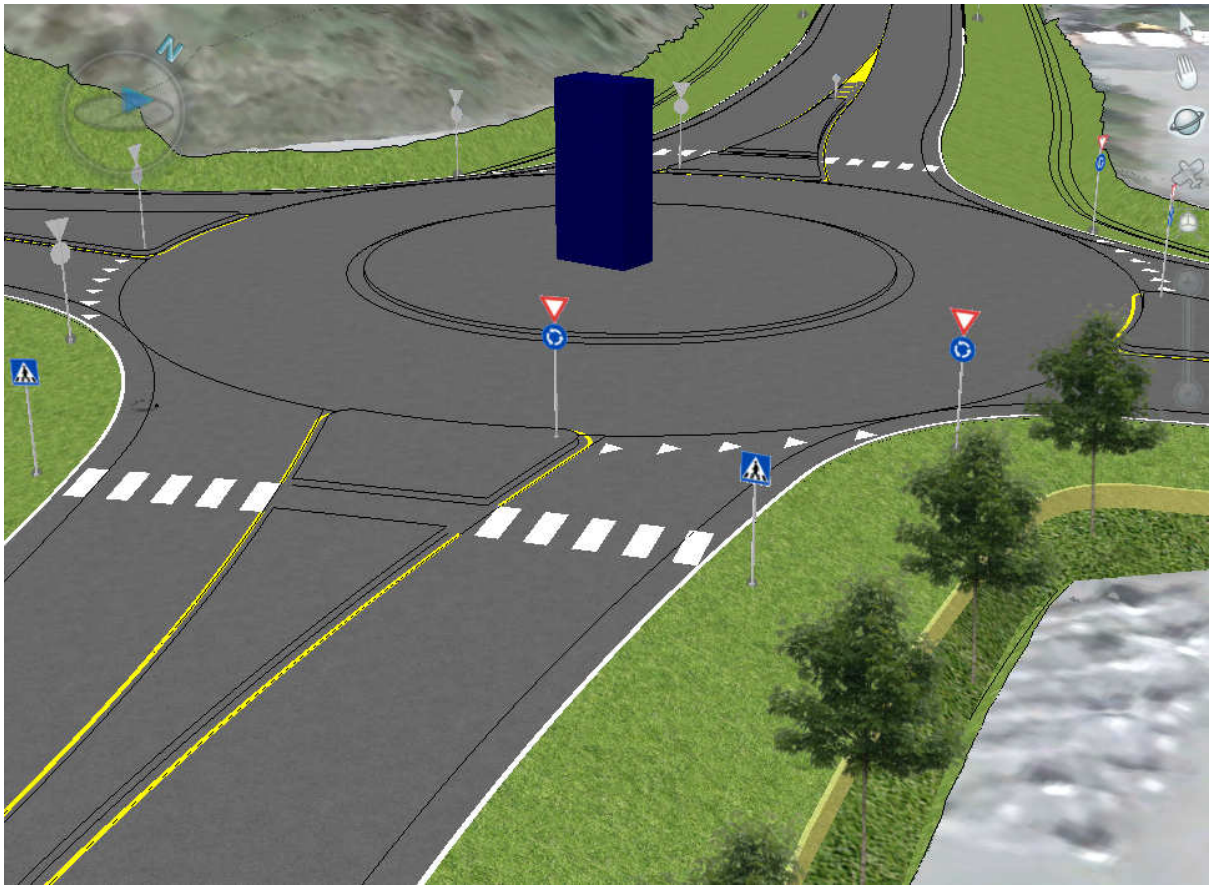
# 3D Intersection Design

## Novapoint 21FP4 + 3D Intersection Tool

## Release 19.3-00 of 3D Intersection

**Note**: for earlier versions of Novapoint 21 you must use version 18.4-00 of 3D Intersection



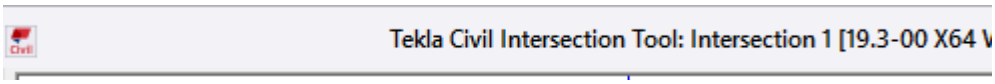
**Quick guide:**

# Table of Contents

# Step 1 - Introduction.

In this Quick Guide explains the 3D Intersection Task in Novapoint Base. The 3D Intersection Design function supports Roundabouts, X Intersections and T Intersection.

The function needs to be installed separately. The latest version is 19.3-00 and runs with Novapoint21.XXFP4 or newer.

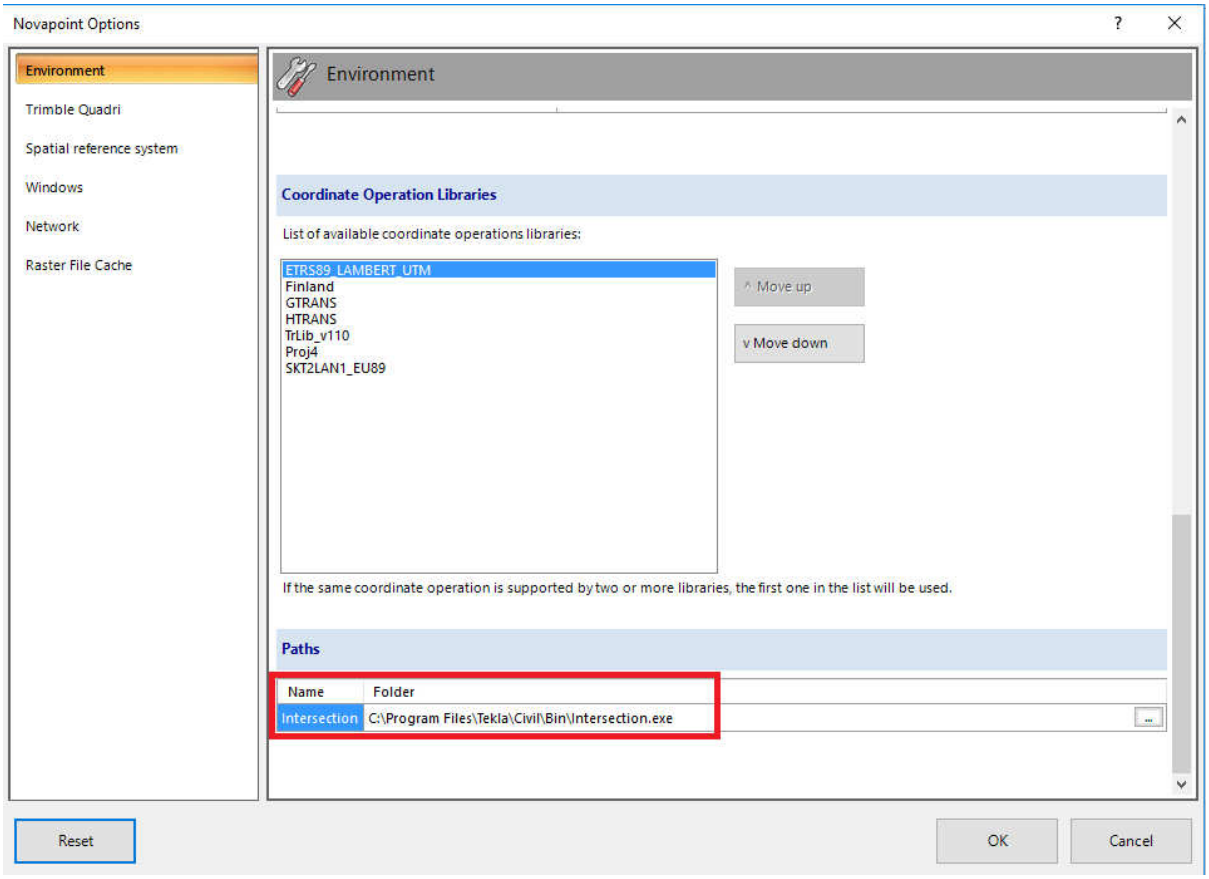



Download the EXE file from the Novapoint web page and run locally:

Deskribtion of 3D Intersection Design

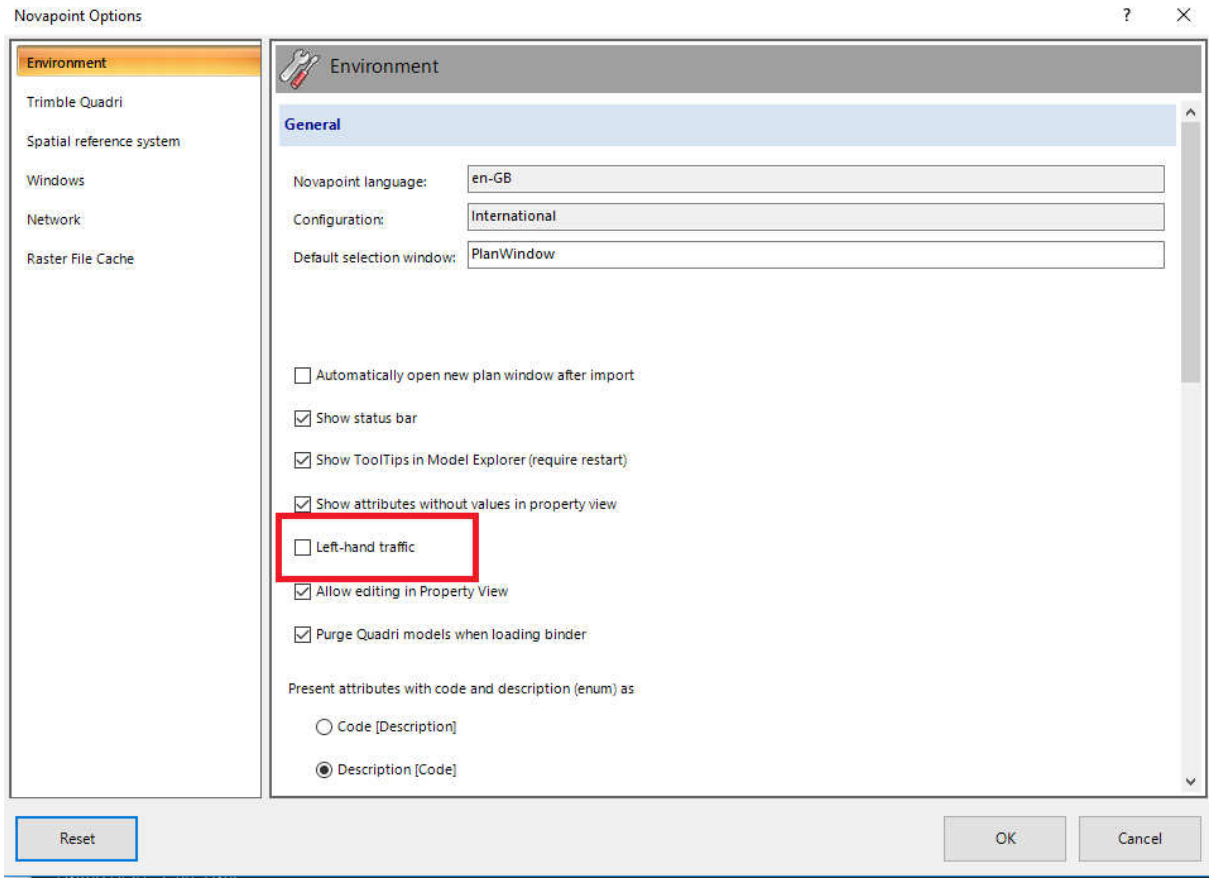
If you use the default path it will match the **Options** in Novapoint Base.

If you use a different path then you need to change the path under **Novapoint Options**. See where to find the path below.



# Left/Right Traffic Direction

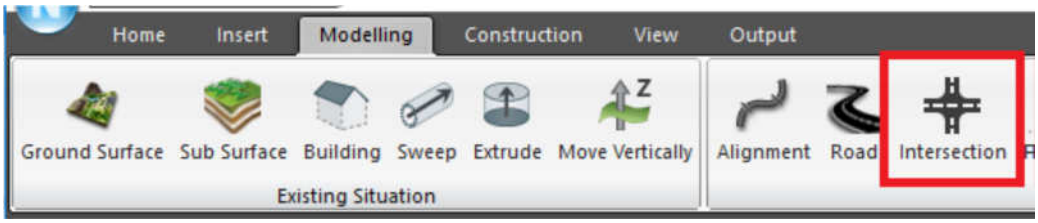
The direction of traffic for 3D Intersection design is by default Right lane. Under **Novapoint Options** it can be changed to Left-hand traffic:



# Step 2 - Input to the Intersection task

In Novapoint Base create the road centrelines for the various legs in the intersection. Make sure that the alignments are close to one another in both horizontally and vertically at the intersection point.

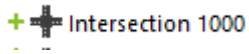
In Novapoint Base under **Modelling** create an **Intersection task**:



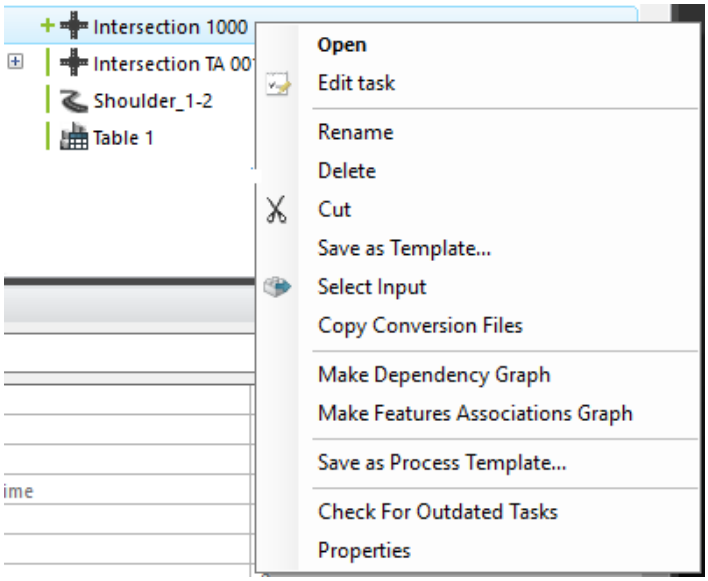

Select the relevant Alignment tasks (Tasks must be used not objects) and select the Calculation Basis.

Note: the Calculation Basis must be a Ground surface. The function will not calculate against sub surface layers at present.

The task is created.



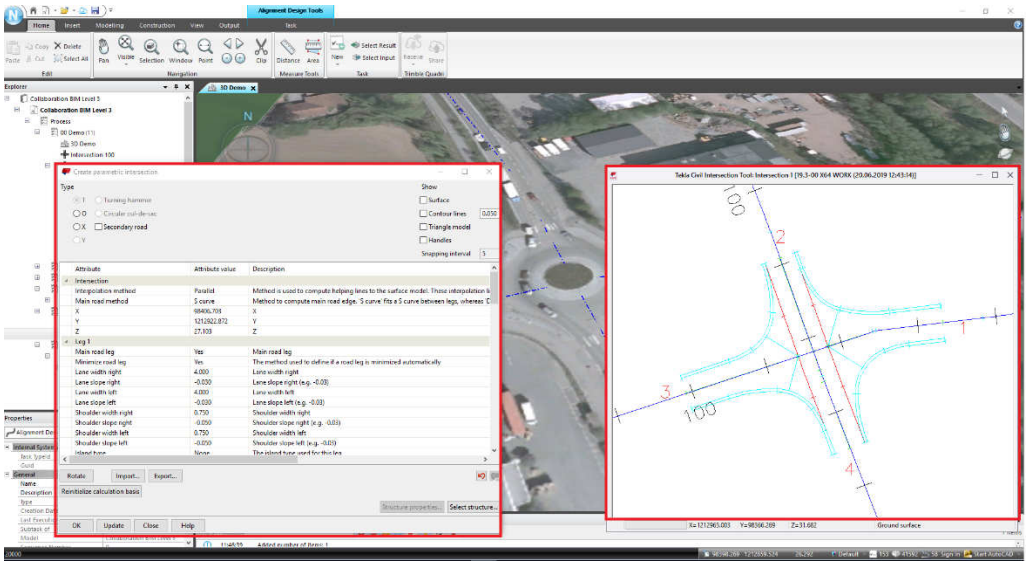

Right click on the task and select **Open**



# Step 3 - Designing an Intersection

When you select **Open**, or double-click the task wait a moment….

The function starts up opening two windows:



The window shown on the left contains all the Intersection parameters a user can edit.
For example:

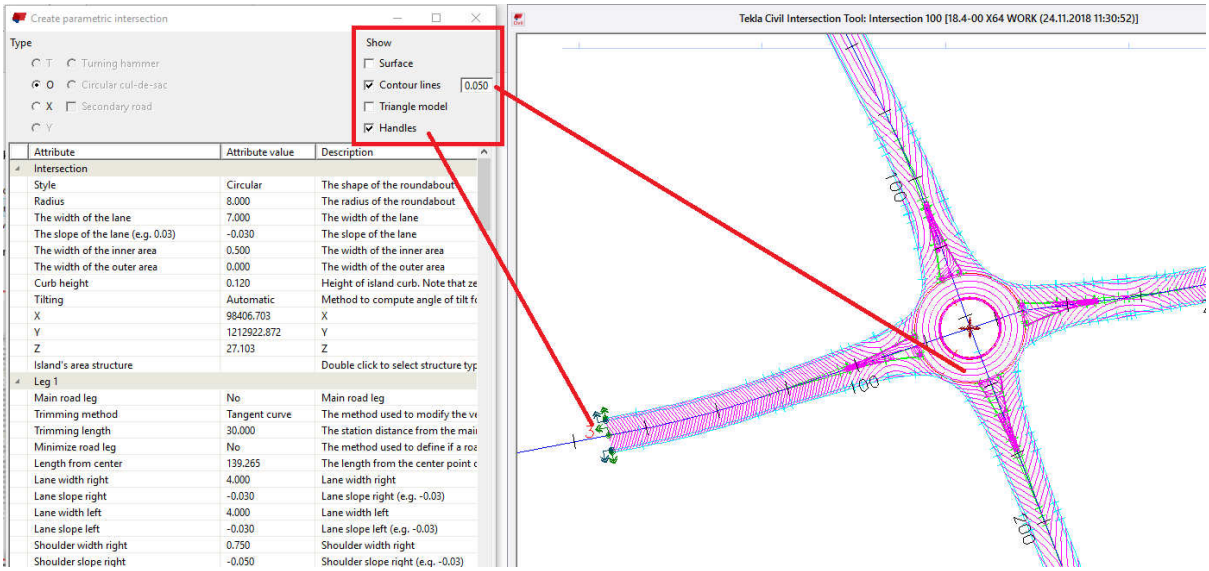
- Type of Intersection
- Carriageway width and slope for each leg
- Shoulder width and slope for each leg
- Range of Traffic Islands
- Kerb stone heights

***Tip:*** *Right clip on the first parameter for arm 1 and* ***Copy,*** *right click on the first parameter for arm 2 and* ***Paste****.*

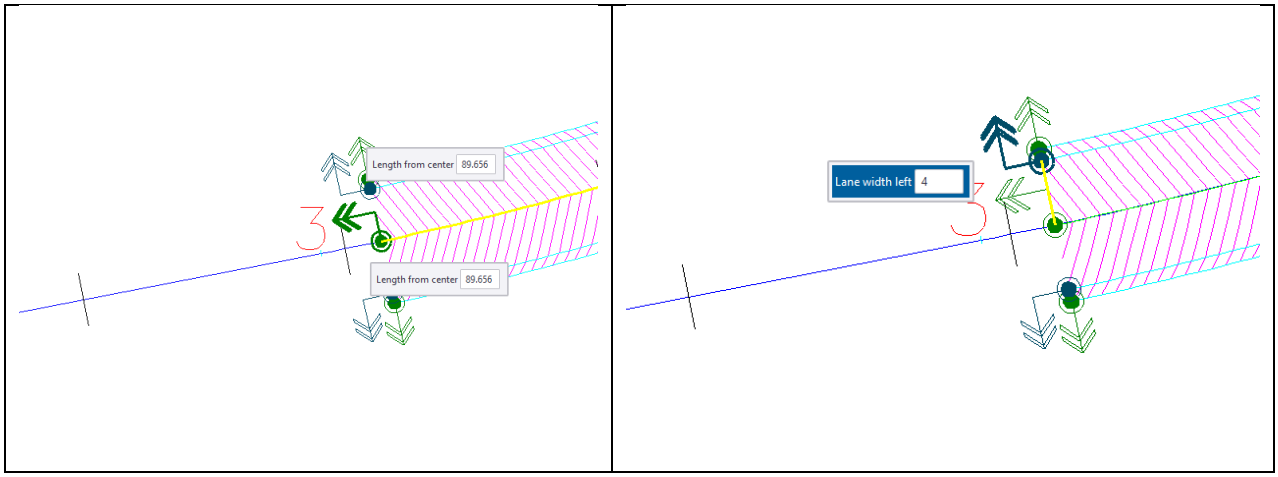
The window shown on the right shows the intersection layout which changes as the parameters are changed.

The view can be edited using the following choices:

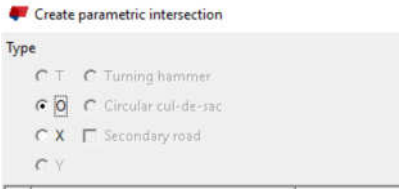
- Surface – highlights the traffic area
- Contour – draws contours at selected interval
- Triangle model – shows the surface represented by triangles
- Handles – allows the user to drag each leg along the alignment or widen each leg by giving a value



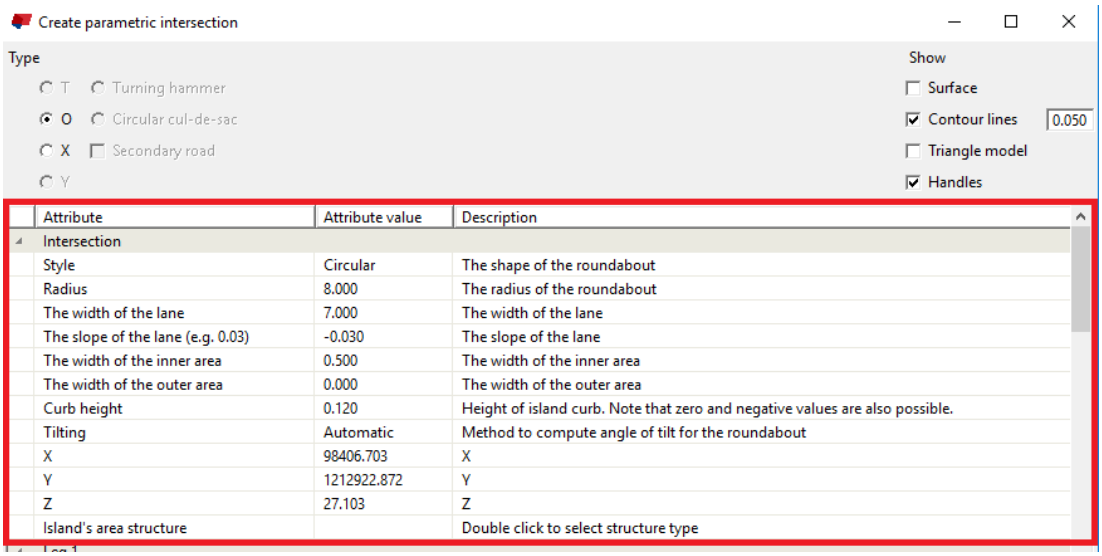

***Tip:*** *By activating handles the intersection arms can be dragged along the alignment or the carriageway width can be edited.*



In the parameter window select the type of intersection:



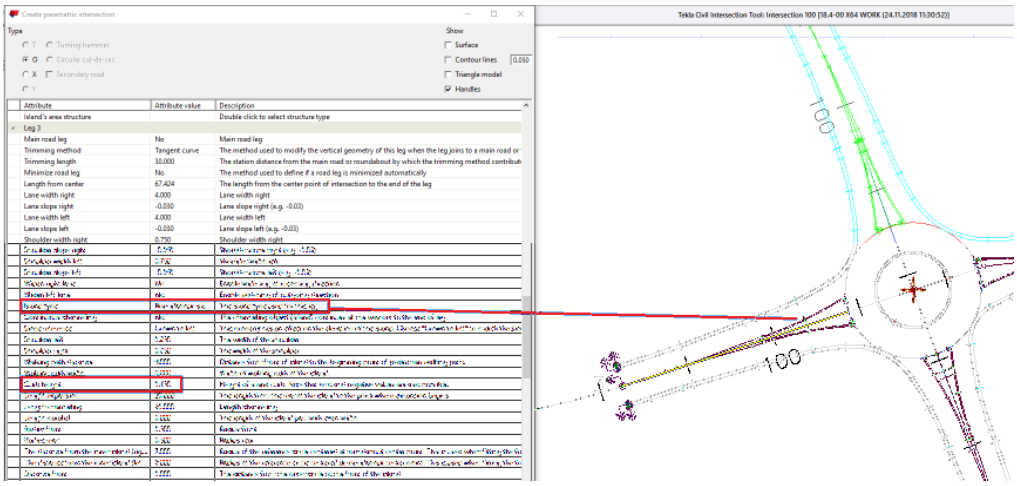

Set the general parameters:




| Attribute | Attribute value | Description |
|---|---|---|
| Intersection | | |
| Style | Circular | The shape of the roundabout |
| Radius | 8.000 | The radius of the roundabout |
| The width of the lane | 7.000 | The width of the lane |
| The slope of the lane (e.g. 0.03) | -0.030 | The slope of the lane |
| The width of the inner area | 0.500 | The width of the inner area |
| The width of the outer area | 0.000 | The width of the outer area |
| Curb height | 0.120 | Height of island curb. Note that zero and negative values are also possible. |
| Tilting | Automatic | Method to compute angle of tilt for the roundabout |
| X | 98406.703 | X |
| Y | 1212922.872 | Y |
| Z | 27.103 | Z |
| Island's area structure | | Double click to select structure type |

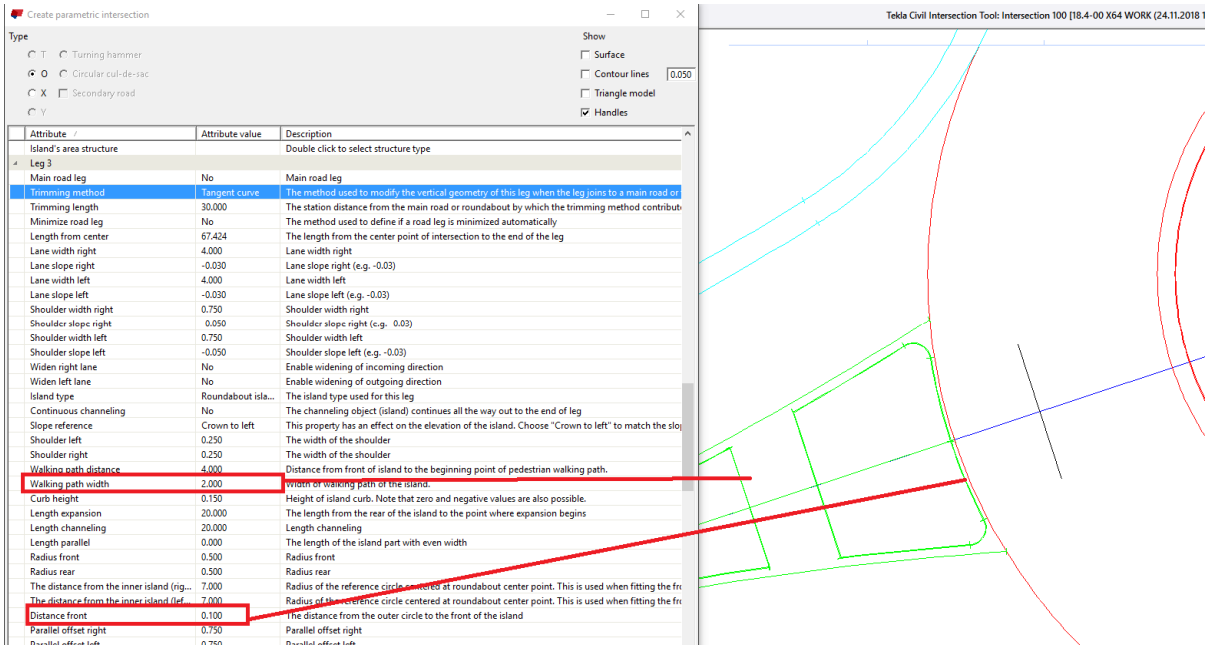
**Note:** The Islands area structure is not available in this version

For each Leg select the required parameters. For example, select type of island:

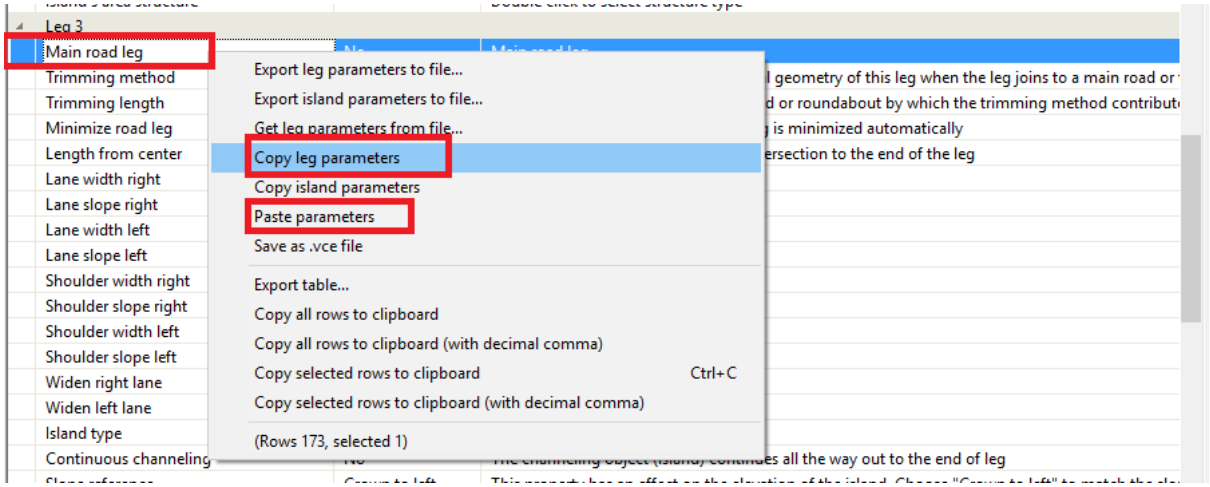


**Note:** The Islands area structure is not available in this version

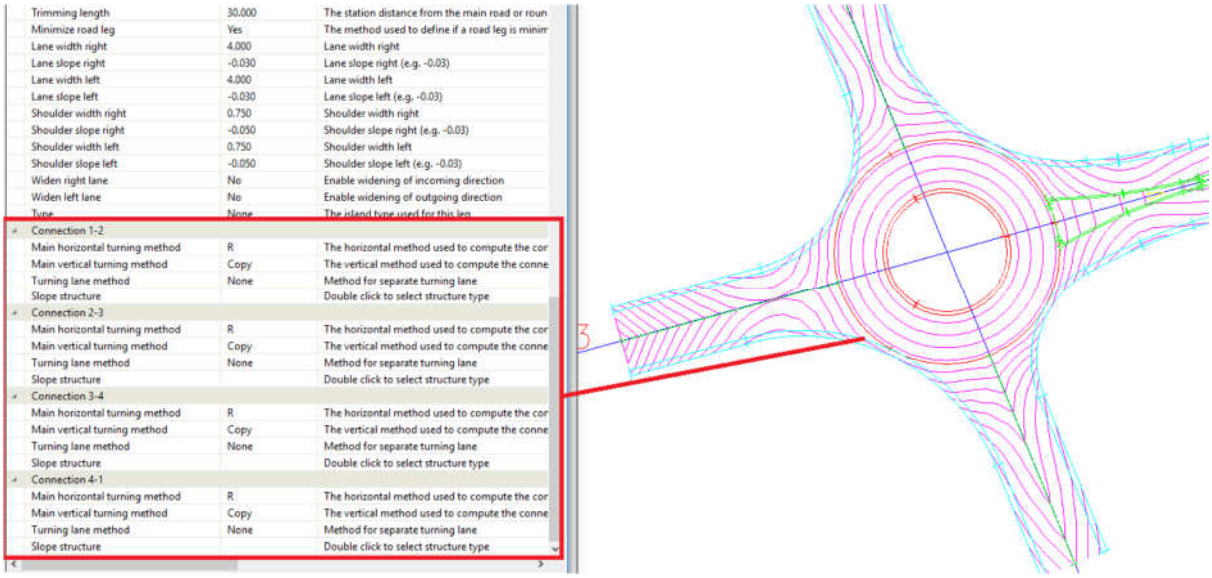
Example of some other parameters:




Right click on the first line and you can **Copy/Paste** Leg parameters from one leg to another:



When finished with the legs you can adjust the connections:



| | | |
|---|---|---|
| Trimming length | 30.000 | The station distance from the main road or roun |
| Minimize road leg | Yes | The method used to define if a road leg is minim |
| Lane width right | 4.000 | Lane width right |
| Lane slope right | -0.030 | Lane slope right (e.g. -0.03) |
| Lane width left | 4.000 | Lane width left |
| Lane slope left | -0.030 | Lane slope left (e.g. -0.03) |
| Shoulder width right | 0.750 | Shoulder width right |
| Shoulder slope right | -0.050 | Shoulder slope right (e.g. -0.03) |
| Shoulder width left | 0.750 | Shoulder width left |
| Shoulder slope left | -0.050 | Shoulder slope left (e.g. -0.03) |
| Widen right lane | No | Enable widening of incoming direction |
| Widen left lane | No | Enable widening of outgoing direction |
| Type | None | The island type used for this leg |
| Connection 1-2 | | |
| Main horizontal turning method | R | The horizontal method used to compute the cor |
| Main vertical turning method | Copy | The vertical method used to compute the conne |
| Turning lane method | None | Method for separate turning lane |
| Slope structure | | Double click to select structure type |
| Connection 2-3 | | |
| Main horizontal turning method | R | The horizontal method used to compute the cor |
| Main vertical turning method | Copy | The vertical method used to compute the conne |
| Turning lane method | None | Method for separate turning lane |
| Slope structure | | Double click to select structure type |
| Connection 3-4 | | |
| Main horizontal turning method | R | The horizontal method used to compute the cor |
| Main vertical turning method | Copy | The vertical method used to compute the conne |
| Turning lane method | None | Method for separate turning lane |
| Slope structure | | Double click to select structure type |
| Connection 4-1 | | |
| Main horizontal turning method | R | The horizontal method used to compute the cor |
| Main vertical turning method | Copy | The vertical method used to compute the conne |
| Turning lane method | None | Method for separate turning lane |
| Slope structure | | Double click to select structure type |

# Step 4 - Intersection superstructure.

Select Structure:

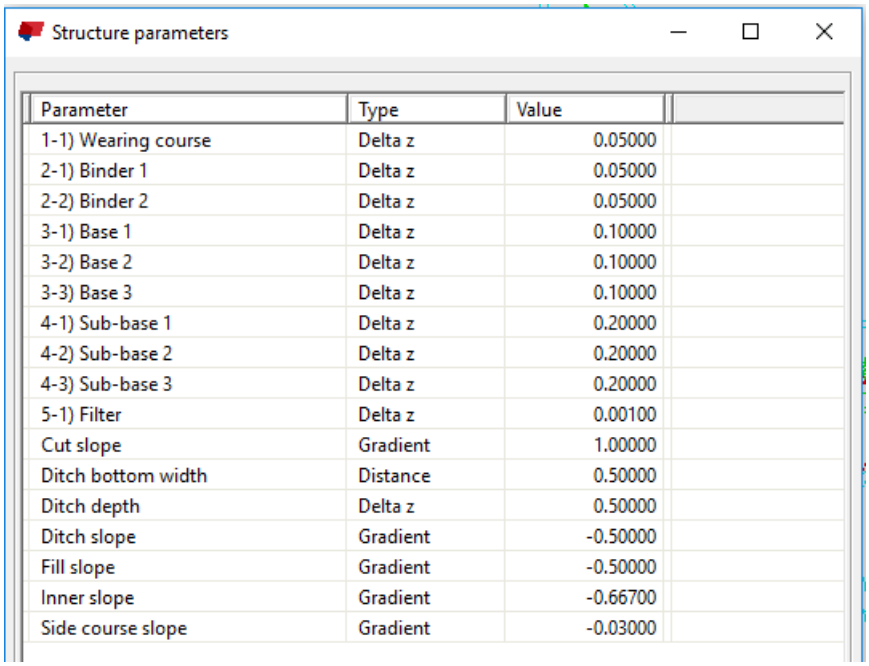

There are two templates to select from.

*For early design/planning we recommend using the **Intersection Traffic Areas with Side Areas**. For* construction modelling, we recommend using **Intersection Traffic Areas without Side Areas**


## *Intersection Traffic Areas with Side Areas*

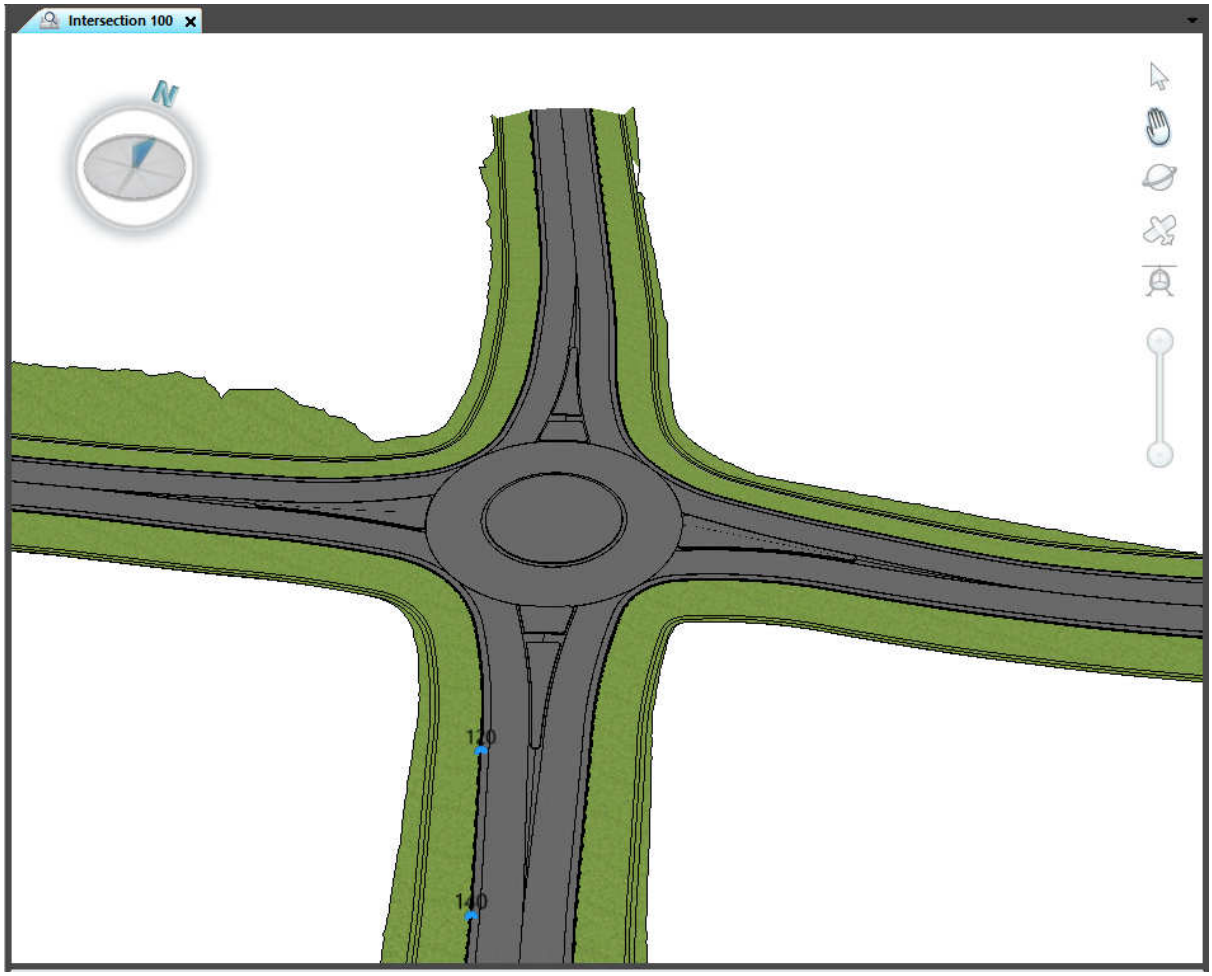
***This gives access to some few parameters to set the connection between the terrain and the intersection traffic area. The parameters allow you to control:***

- The intersection pavement layers – same as in Novapoint Road
- Cut slope
- Ditch bottom width (slope 0)
- Ditch depth
- Ditch slope (combination of slope and depth defines ditch width)
- Fill slope
- Inner slope
- Side course slop (cross section slope for each leg




| Parameter | Type | Value |
|---|---|---|
| 1-1) Wearing course | Delta z | 0.05000 |
| 2-1) Binder 1 | Delta z | 0.05000 |
| 2-2) Binder 2 | Delta z | 0.05000 |
| 3-1) Base 1 | Delta z | 0.10000 |
| 3-2) Base 2 | Delta z | 0.10000 |
| 3-3) Base 3 | Delta z | 0.10000 |
| 4-1) Sub-base 1 | Delta z | 0.20000 |
| 4-2) Sub-base 2 | Delta z | 0.20000 |
| 4-3) Sub-base 3 | Delta z | 0.20000 |
| 5-1) Filter | Delta z | 0.00100 |
| Cut slope | Gradient | 1.00000 |
| Ditch bottom width | Distance | 0.50000 |
| Ditch depth | Delta z | 0.50000 |
| Ditch slope | Gradient | -0.50000 |
| Fill slope | Gradient | -0.50000 |
| Inner slope | Gradient | -0.66700 |
| Side course slope | Gradient | -0.03000 |

When you press OK the Intersection is calculated and can now be displayed in Novapoint Base by selecting the task and View in 3D:

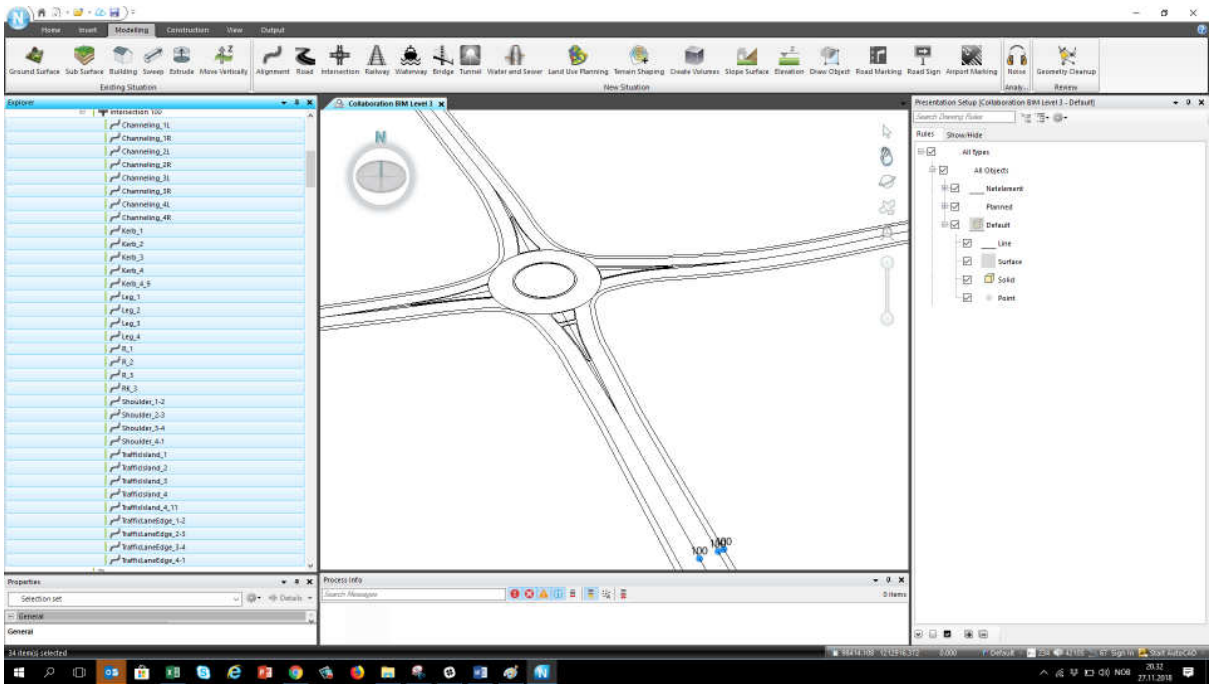


After closing the intersection dialogues you can edit the result by selecting the task again and selecting Open.

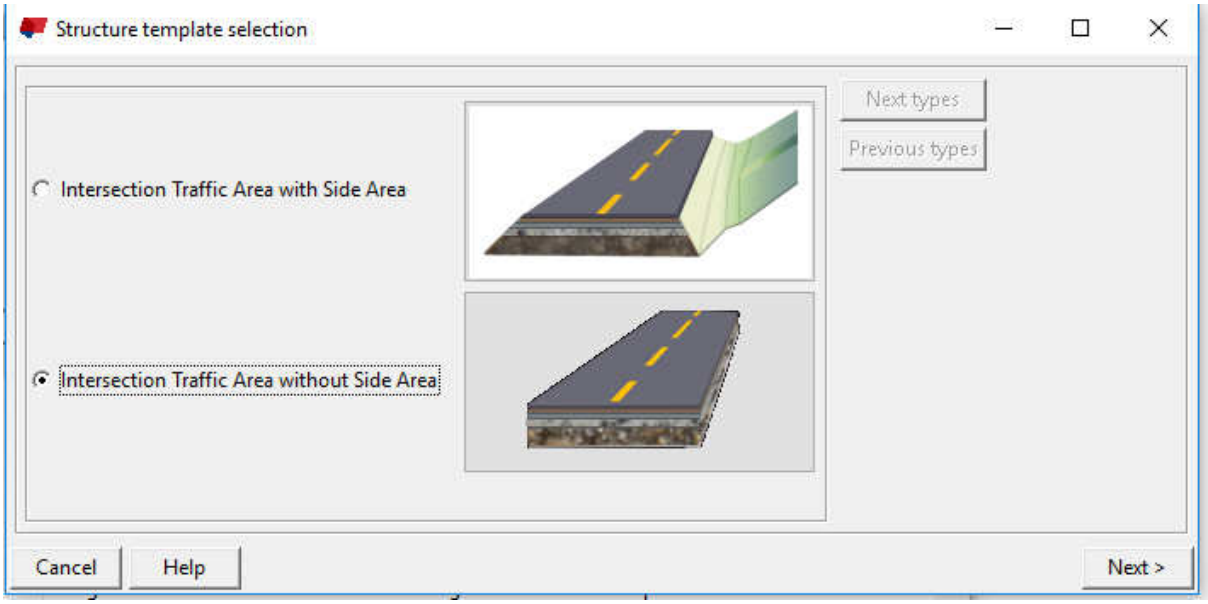
Edit the structure properties by selecting **Structure properties…**

After making a change select **Update** to update the view in NP Base without closing the Intersection tool.

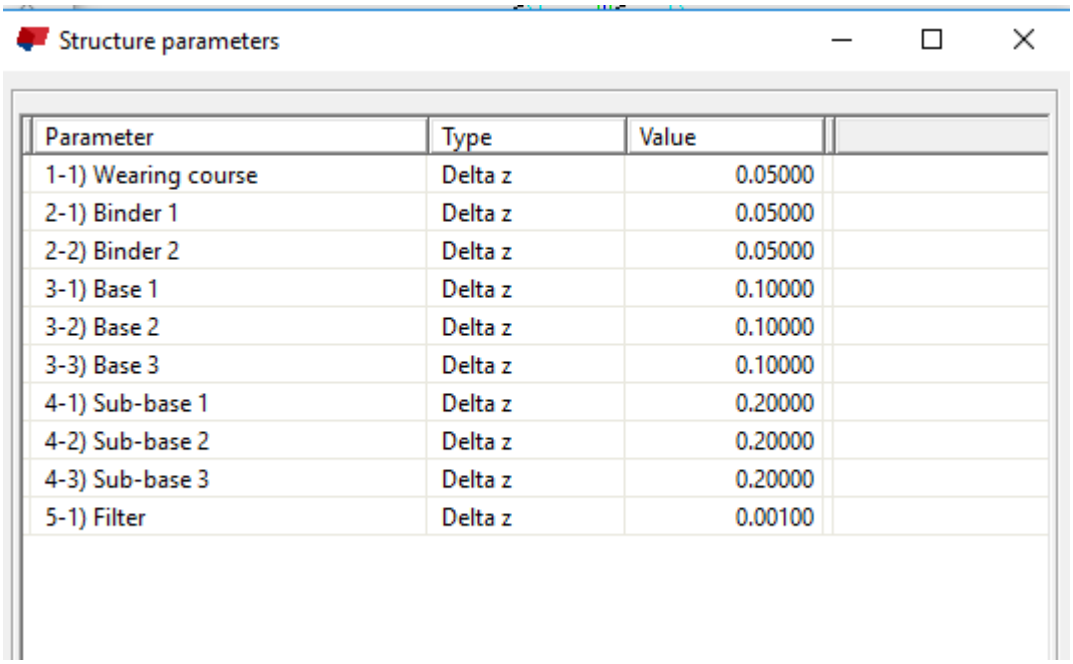

***Note** that the alignment tasks for all the intersection edge lines are created when the **Create alignments** is selected.*



## *Intersection Traffic Areas without Side Areas*



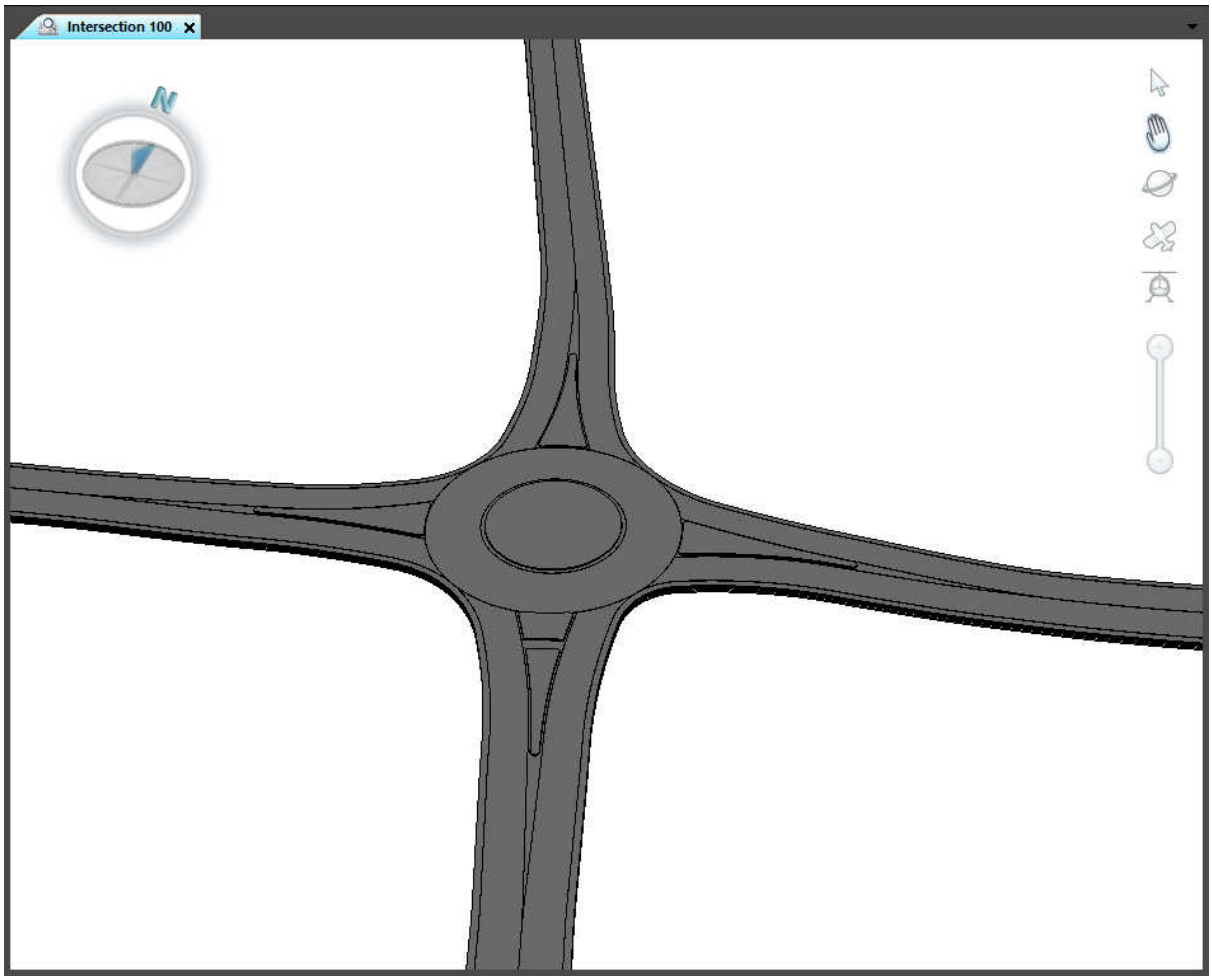

Select **Next** and set up the required pavement layer thicknesses:




| Parameter | Type | Value |
|---|---|---|
| 1-1) Wearing course | Delta z | 0.05000 |
| 2-1) Binder 1 | Delta z | 0.05000 |
| 2-2) Binder 2 | Delta z | 0.05000 |
| 3-1) Base 1 | Delta z | 0.10000 |
| 3-2) Base 2 | Delta z | 0.10000 |
| 3-3) Base 3 | Delta z | 0.10000 |
| 4-1) Sub-base 1 | Delta z | 0.20000 |
| 4-2) Sub-base 2 | Delta z | 0.20000 |
| 4-3) Sub-base 3 | Delta z | 0.20000 |
| 5-1) Filter | Delta z | 0.00100 |

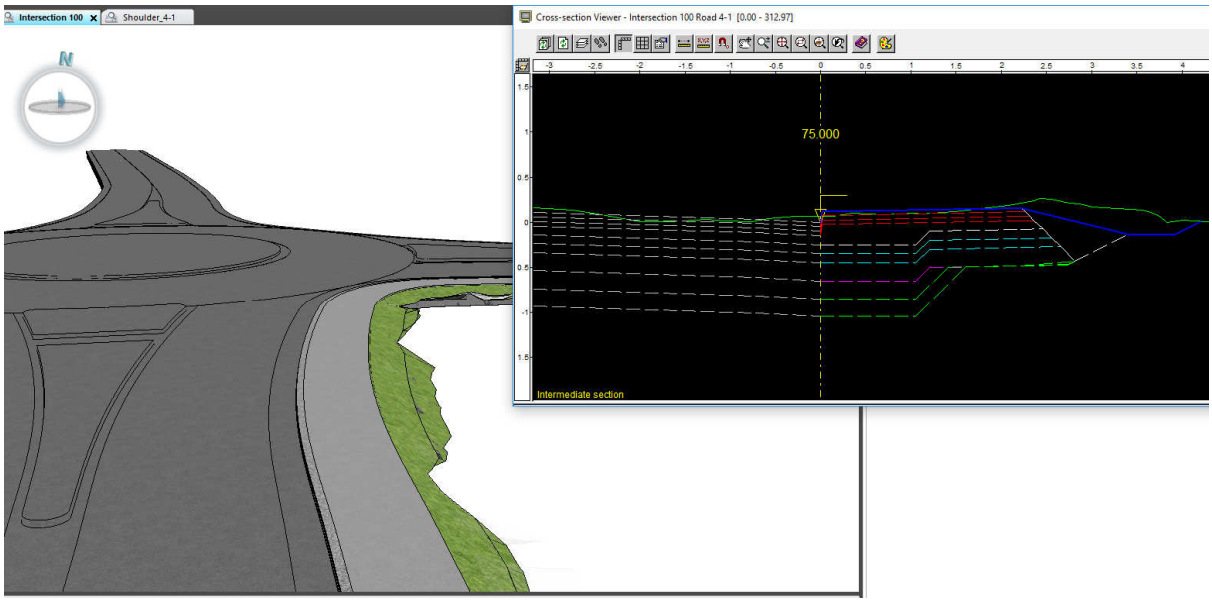
These pavement layers correspond to the layers in Novapoint Road.

Select OK and the Traffic area is calculated. View the task in 3D:



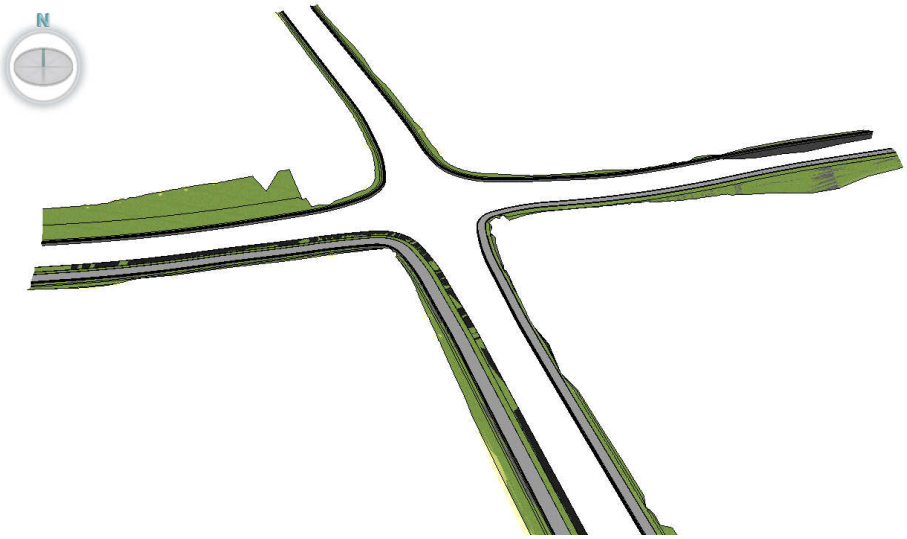

To complete the construction model create road models for each the edge lines. This allows detailed description for each leg including the possibility to add footpaths, kerbstones and cycle ways.

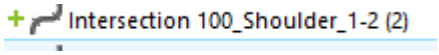
The **Shoulder** and **TrafficLanEdge** alignments created by the intersection tool as alignment tasks can be used as centrelines for Novapoint Road models. The alignments now contain the Intersection task name.



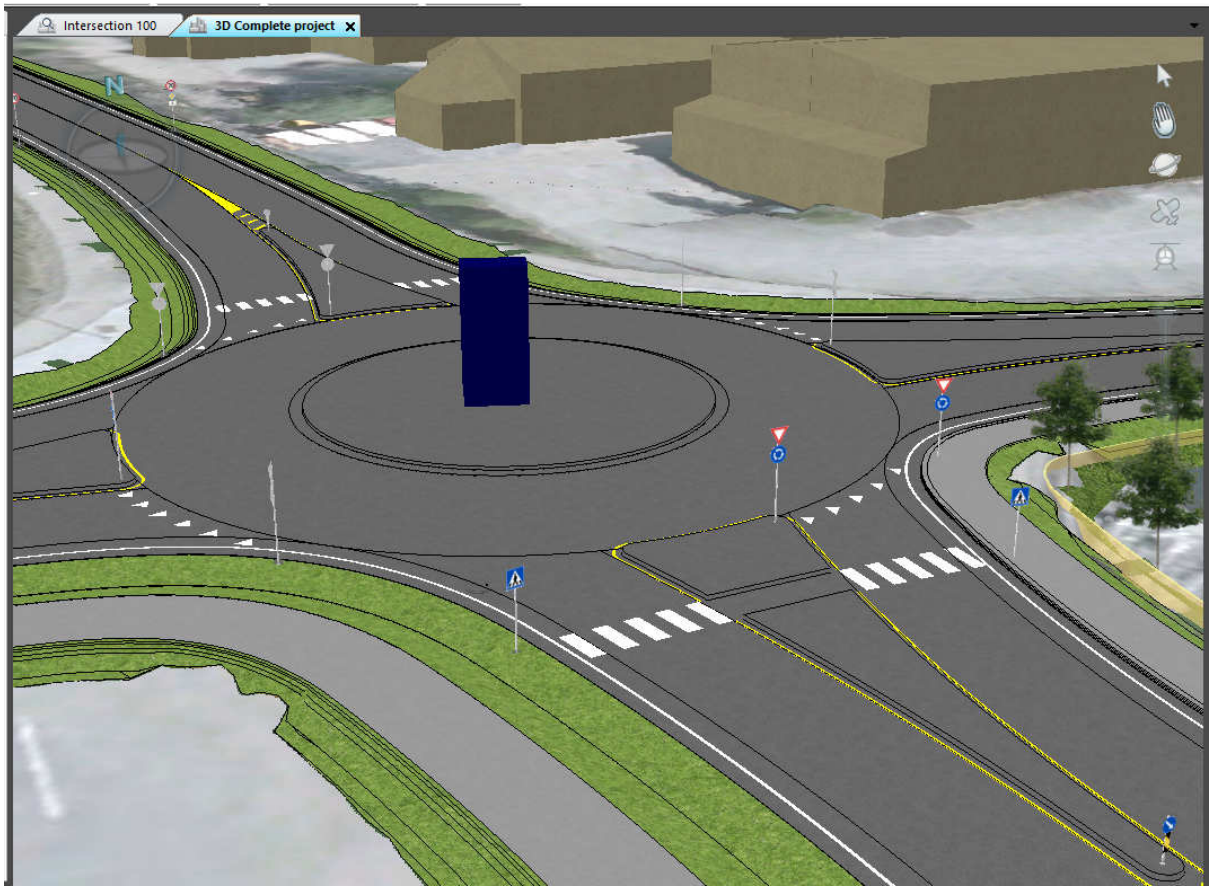

*The pavement layers in Novapoint road can be made to match the pavement layers in the traffic area, see over.*

Create one road for each leg:



Note if you rebuild the intersection after creating road models using the edge lines. The road model centre lines from edge lines will not be deleted but new one will be created with the same name but with number (2) added 

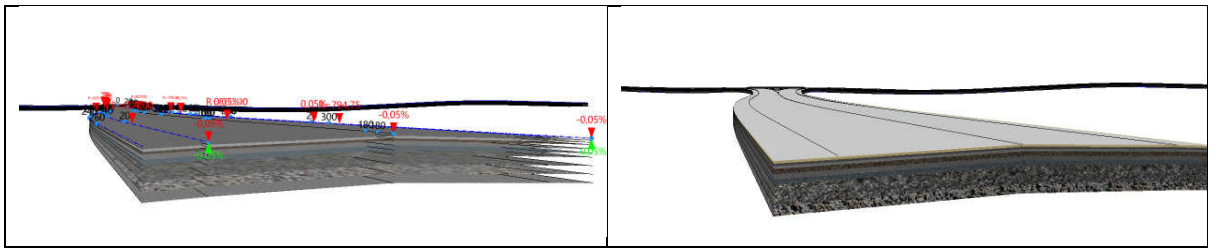
The final result:



# Step 5 - Quantities – Template Traffic Area without side areas

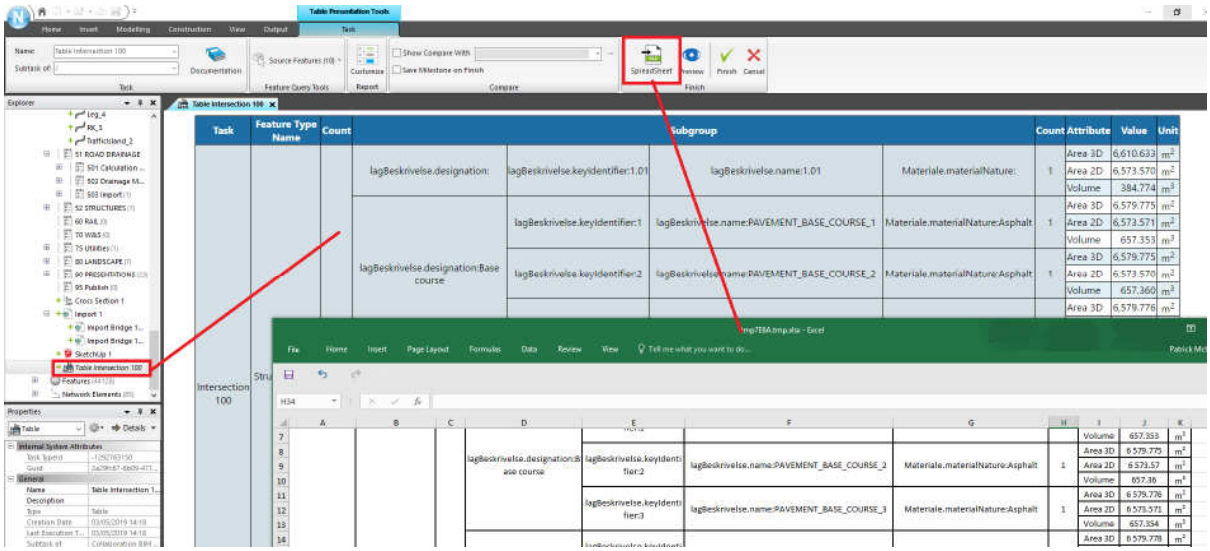
From 21.XX FP4 the 3D Intersection Traffic area supports solid geometry.

In the previous version the layers were defined without solid geometry

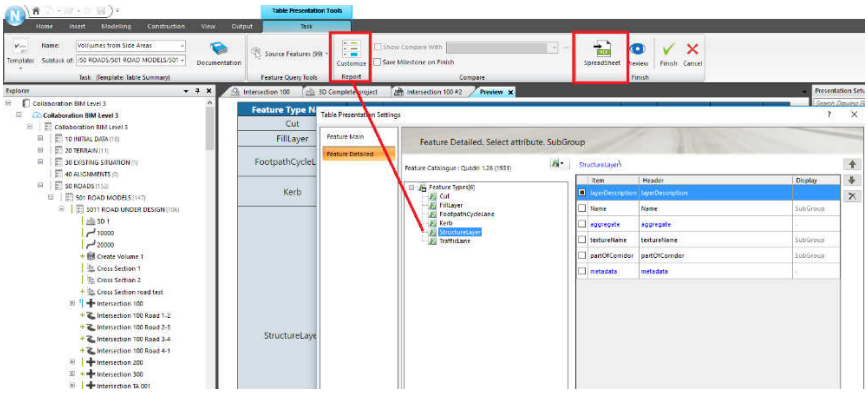


*Previous* *From 21.XX FP4*

Now the pavement layers are created as solids. We can then easily create a Table View that shows the quantities for the Intersection traffic area:



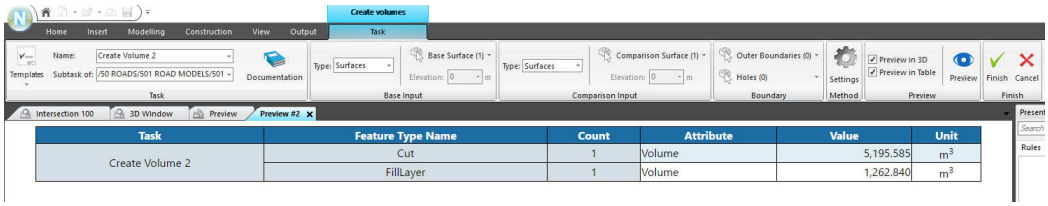
A table view for the four edge models can be defined that gives the complete volume for the side areas. Create a Table task with the four models, select the features you want and customise the results as shown below. Preview the result and export to **EXCEL.**



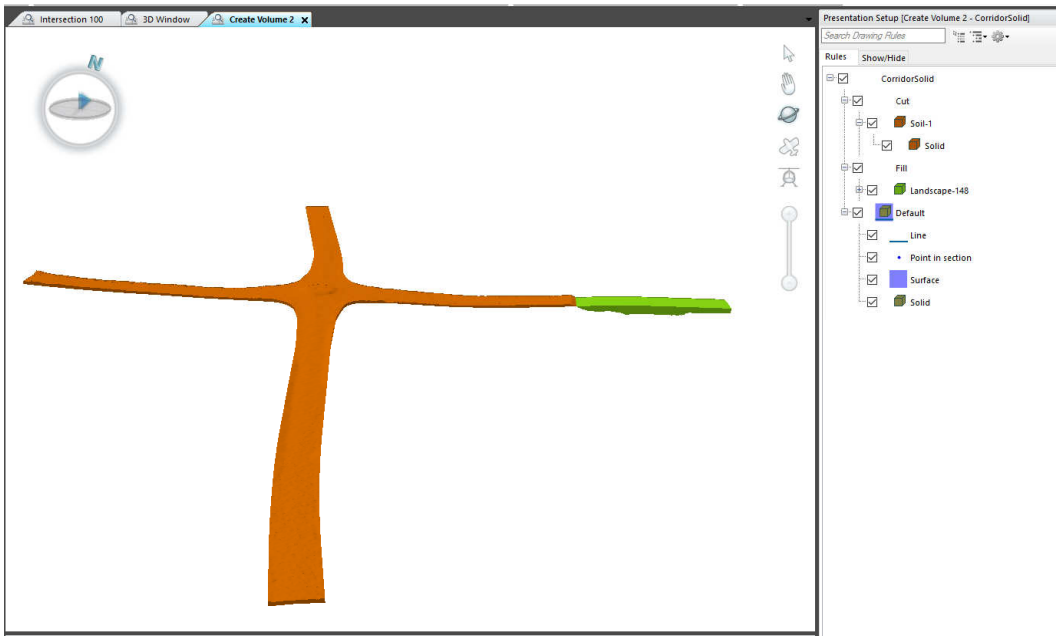
| | | | | | | |
|---|---|---|---|---|---|---|
| StructureLayer | 32 | layerDescription.designation: | 1 | Area 3D | 440.258 | $m^2$ |
| | | | | Area 2D | 355.039 | $m^2$ |
| | | layerDescription.designation:Base course | 9 | Volume | 515.242 | $m^3$ |
| | | | | Area 3D | 6 874.222 | $m^2$ |
| | | | | Area 2D | 6 415.164 | $m^2$ |
| | | layerDescription.designation:Binder course | 5 | Volume | 124.979 | $m^3$ |
| | | | | Area 3D | 3 431.015 | $m^2$ |
| | | | | Area 2D | 3 260.742 | $m^2$ |
| | | layerDescription.designation:Separation layer | 4 | Volume | 3.161 | $m^3$ |
| | | | | Area 3D | 2 840.898 | $m^2$ |
| | | | | Area 2D | 2 739.277 | $m^2$ |
| | | layerDescription.designation:Sub-Base course | 9 | Volume | 1 911.486 | $m^3$ |
| | | | | Area 3D | 5 335.262 | $m^2$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Area 2D | 4 451.774 | $m^2$ |
| | | layerDescription.designation:Wearing course | 4 | Volume | 102.402 | $m^3$ |
| | | | | Area 3D | 2 564.437 | $m^2$ |
| | | | | Area 2D | 2 445.396 | $m^2$ |
| TrafficLane | 1 | | 1 | Area 3D | 3.491 | $m^2$ |
| | | | | Area 2D | 3.489 | $m^2$ |

To calculate the cut and fill for the traffic area for the intersection use the **Create Volume** tool.




View the Volume task in 3D:

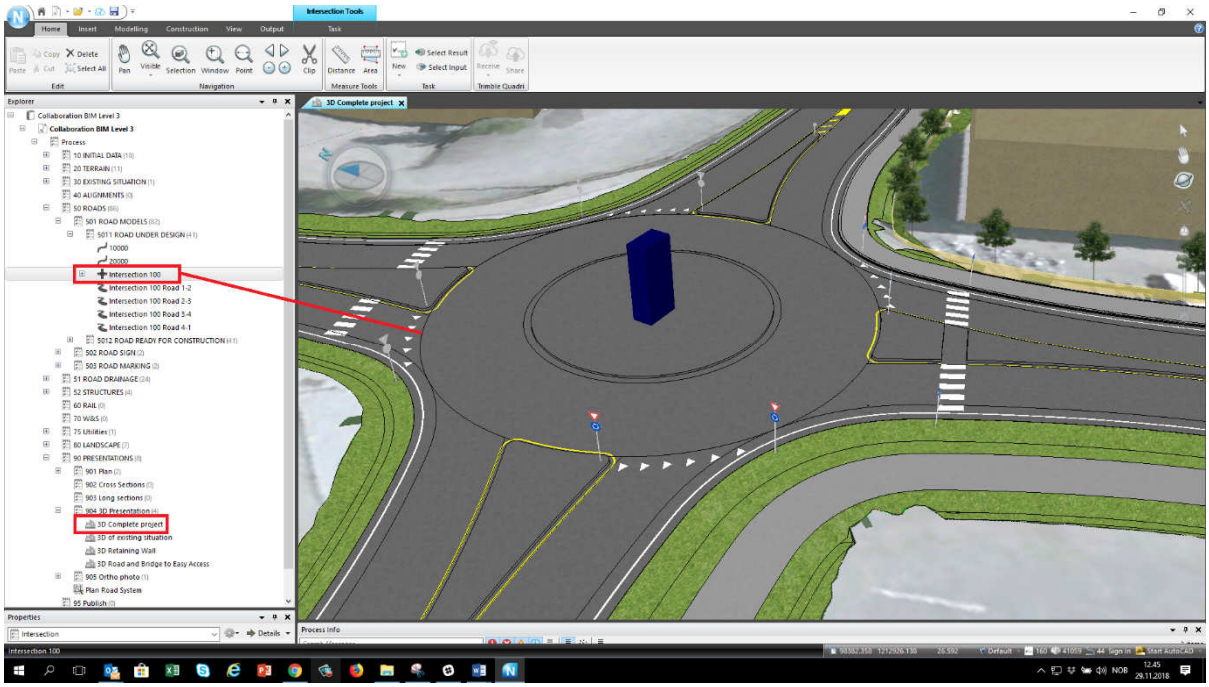


# Step 6 - Test project

A test project can be downloaded from our support ftp:

ftp://Support:7050support@ftp.novapoint.com/Demo_3D_Intersection

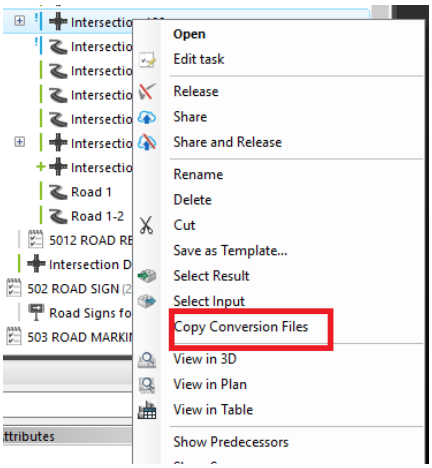
The link must be copied into **Windows Explorer** (Not Internet Explorer)



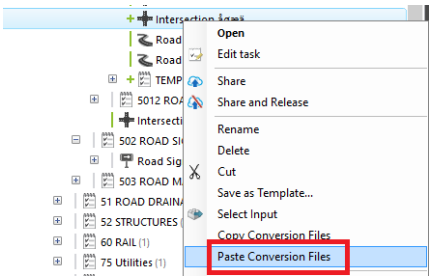
# Tips – Use the conversion rule for FP4 on an earlier intersection task.

To use the conversion rule form NP21.XXFP4 on an intersection task created in an earlier version.

1. Create a new Intersection task.
2. Right click on the task and select **Copy Conversion Files**.




3. On the existing task right click on the task and select **Paste Conversion Files**. Note if the existing task has sub tasks (like alignments) it is not possible to paste. Move the sub tasks to a temporary task first, then select **Paste Conversion Files** and then move back the alignments.




*Patrick Mc Gloin*
*June 2019*