

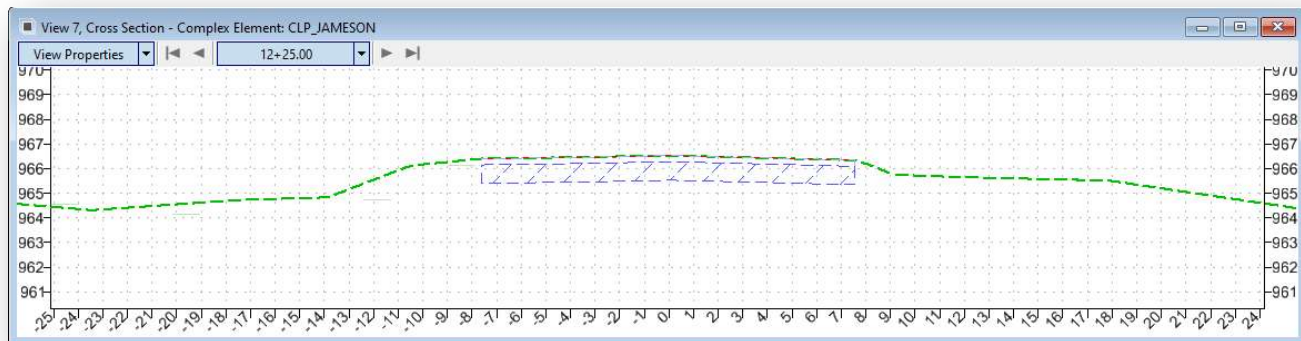


# OpenRoads Design: Modeling Existing Features

## Overview

Existing features such as the existing pavement, sidewalk, and driveways, can be modeled by creating a surface terrain model from the survey elements and then applying a surface template to the terrain.

This document will demonstrate the process to generate a terrain model for the surface of the existing pavement for Jameson Road. This surface terrain model will be created using the surveyed edge of pavement, center of pavement, and break line elements. After the surface terrain has been defined, a template with the existing pavement buildup will be applied to the surface terrain to create the 3D mesh elements representing the existing pavement buildup. Once defined as a 3D mesh element, the existing pavement can be displayed on the cross sections and used in quantity calculations. An example of the existing pavement as shown in a dynamic cross-section view is shown below.



Note: See Page 15 for alternative method using the **Create Closed Mesh** tool. This method doesn't support the **Element Component Quantities**.



## Exercise 1: Modeling the Existing Pavement using a Surface Terrain Model

This section will demonstrate the process to create 3D mesh elements for the existing pavement. A portion of Jameson Road will be removed so we will create two separate surface terrains, one for the portion that will remain in place, and a second for the portion to be removed.

### Part 1: Creating the Existing Features Design File

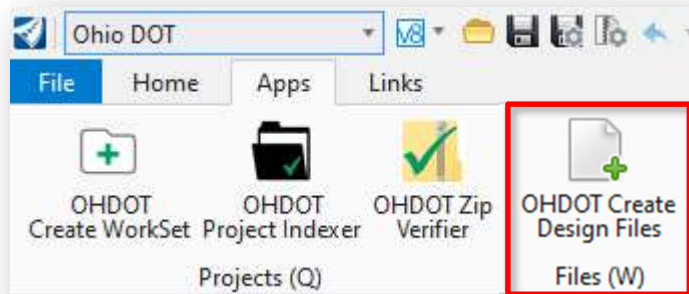
A new design file will be for the 3D mesh elements representing the existing features.

- ✓ Open **ProjectWise Explorer**



- ✓ Browse to the folder containing the training data. The folder location will be provided by the instructor for each class.
- ✓ Browse to the **400-Engineering\Roadway\Basemaps\** folder.
- ✓ Open one of the design files for the WorkSet. The file opened does not matter since it is being used to access the file creation application.

Create a new design file to use for modeling the existing features. Select the **OHDOT Create Design Files** application (**OHDOT WorkFlow**) to create the corridor modeling basemaps for the project.



- ✓ Use the Roadway Digital Terrain Model file type, “KD”, to model the existing features
- ✓ Choose the **Create Files** button to initiate the process.

### Part 2: References

The surveyed edge of pavement and center of pavement elements will be used to generate the 3D mesh elements representing the existing pavement.

- ✓ Attach the following files as references (**Home > Attach Tools > References**):

Geometry Basemap for Jameson Road:

*400-Engineering\Roadway\Basemaps\123456\_BK003.dgn*

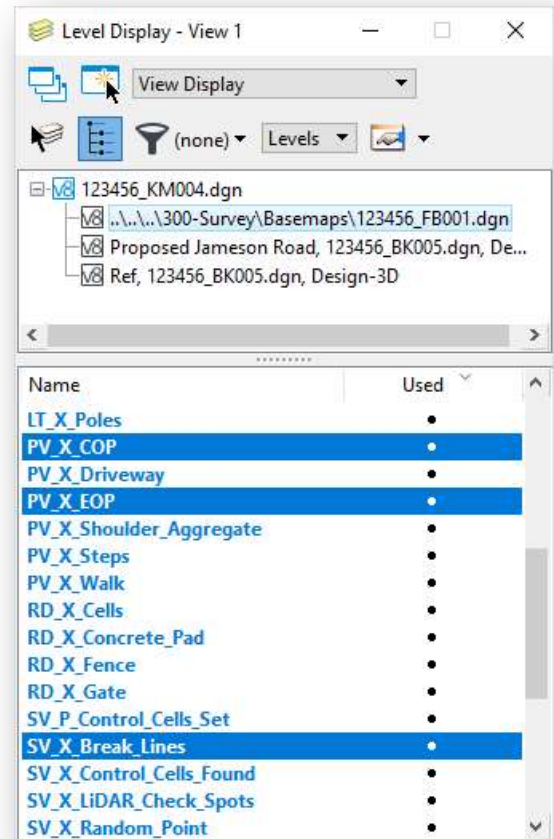
Survey Basemap:

*300-Survey\Basemaps\12345\_FB001.dgn*



Use the **Level Display** function (**OpenRoads Modeling > Home > Level Display**) to turn off all the levels in the attached survey design file (**123456\_FB001.dgn**), except for the levels shown below

- ✓ From the **Home** tab, select the **Level Display** icon.
  - Select the file 123456\_FB001.dgn in the top portion of the dialog.
  - Turn off all the levels by right-clicking in the lower portion of the dialog and choose **All Off** from the pop-up menu.
  - After turning off all the levels, turn on the following levels by clicking on each level name as shown at right.
    - PV\_X\_COP
    - PV\_X\_EOP
    - SV\_X\_Break\_Lines





### Part 3: Creating the Surface Terrain Model for the Existing Pavement

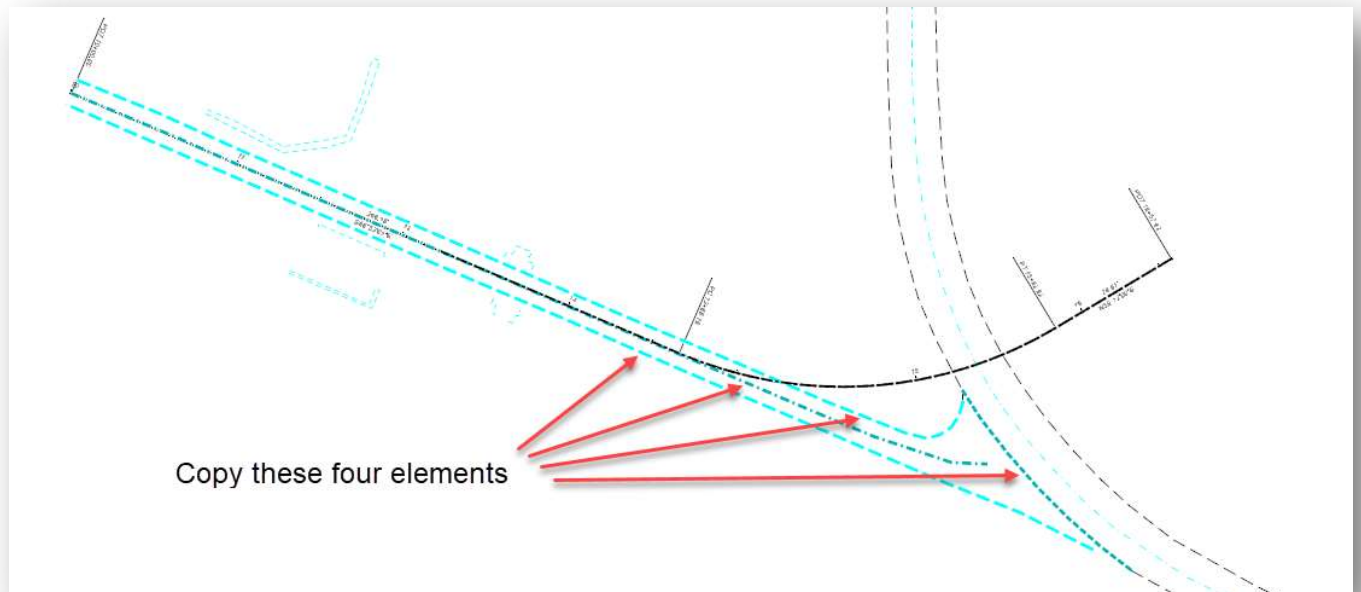
The surface terrain can be created for the existing pavement by directly using the referenced survey elements, or by copying the elements from the FB reference attachment into the active file.

In this example, we will create a surface terrain model limited to the station limits of the pavement removal areas, from station 12+00 to meet existing S.R. 185. A copy of the existing survey elements is required since the elements will be edited to specific station ranges.

Take the following steps to create the surface terrain for Jameson Road.

- ✓ Use the MicroStation **Copy Element** command (**Drawing > Copy**) to copy the existing edge of pavement, center of pavement, and break line elements from the Survey Field Book design file (FB) to the active design file. The elements to be copied are shown below.

Be careful to copy the elements exactly on top of the original survey elements.



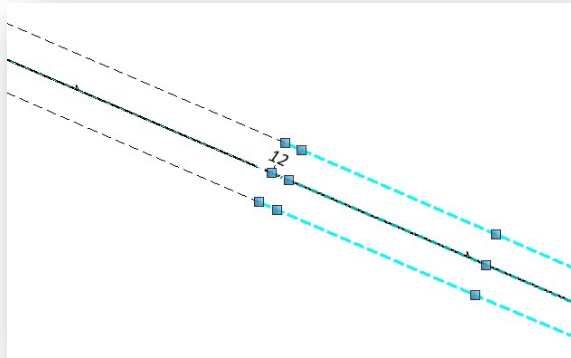
- ✓ After copying the elements, turn off the reference attachment display of the survey basemap design file, 123456\_FB001.dgn (**Home > Attach Tools > References**).



Take the following steps to prepare the copied elements to generate the surface terrain model for the existing pavement:

- ✓ Use the **Break Element** command (**OpenRoads Modeling > Drawing > Break Element**) to break each edge of pavement line and the center of pavement line at station 12+00 of Jameson Road.

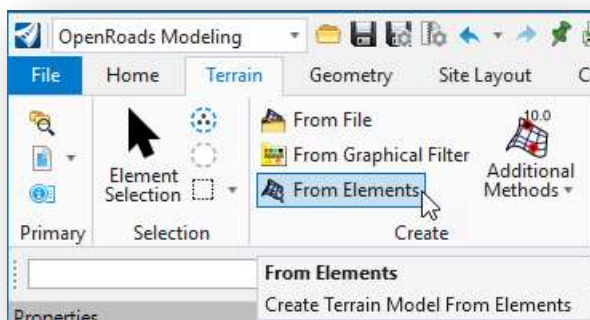
The result is shown below with the elements from station 12+00 forward selected to show that the lines are broken at station 12+00.



The edge of pavement elements will be used to define the boundary of the existing pavement surface terrain model. The surveyed center of pavement elements will be used as a break line to define the pavement crown. In this case, these elements are 3D graphics as generated from the Survey software and can be used to generate the surface terrain model directly. 2D elements can also be used if they have an OpenRoads profile defined.

Take the following steps to create the surface terrain for the pavement portion that will remain in place:

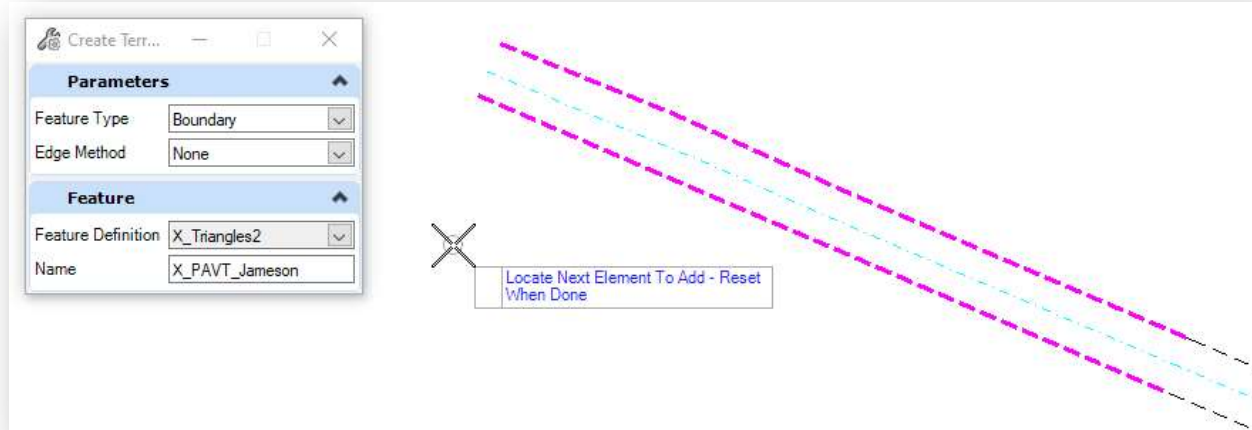
- ✓ From the **References** dialog (**Home > Attach Tools > References**), turn off the display of the file containing the proposed alignment for Jameson Road (123456\_BK001.dgn)
- ✓ From the **Terrain** tab, select the **From Elements** command to create a terrain model from selected elements.



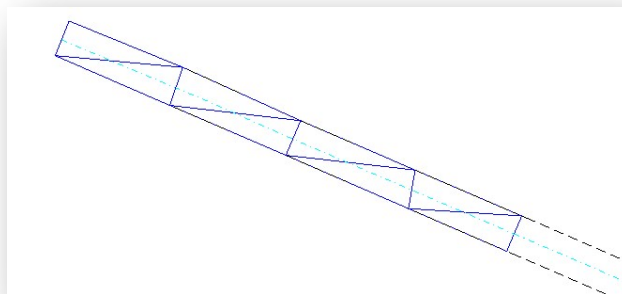
- Set the **Feature Type** to **Boundary**
- Set the **Edge Method** to **Remove Slivers**



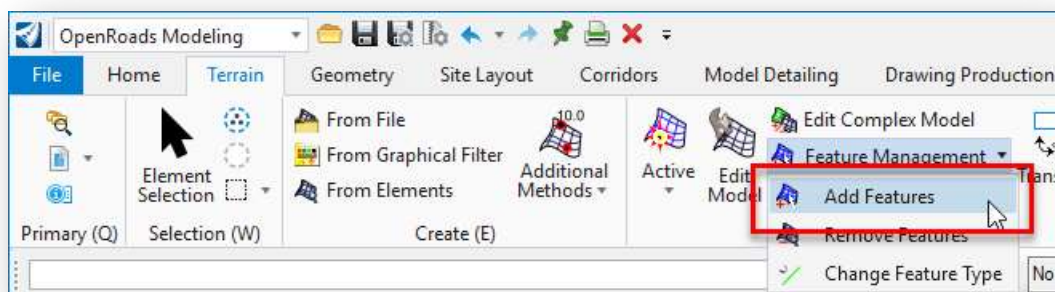
- Choose the **X\_Triangles2** feature definition.
- Key-in the **Name** for the terrain model **X\_PAVT\_Jameson**.
- Select each edge of pavement element as shown below.



- Right-click (reset) when you are done selecting the elements.
- When prompted, left click to accept each parameter.
- After accepting each parameter, the terrain model is generated like the example below.



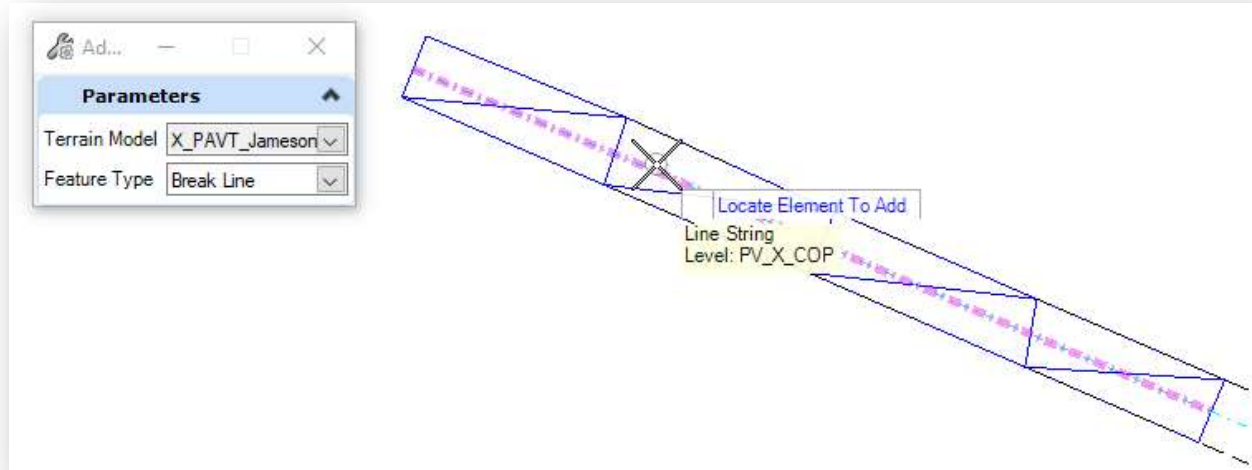
Take the following steps to add the center of pavement element to the terrain model as a break line.





From the **Terrain** tab, select **Feature Management > Add Features**

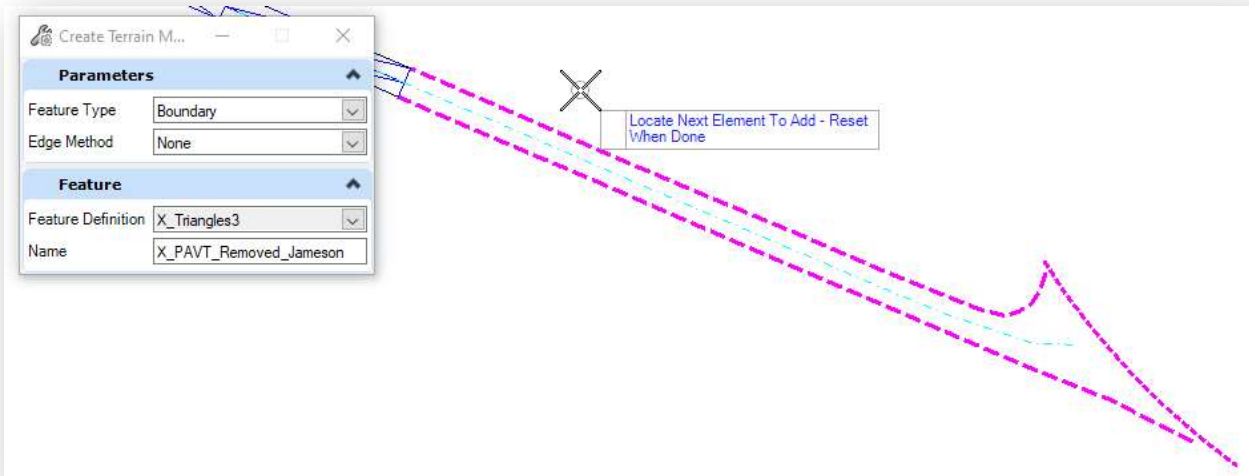
- Select the **Terrain Model** name from the drop-down list.
- Set the **Feature Type** parameter to **Break Line**.
- Select the center of pavement element as shown below.



Follow the prompts to accept the element. When complete, the center of pavement element is added to the terrain model as a break line.

Following the steps above, create a second surface terrain for the portion of Jameson Road to be removed.

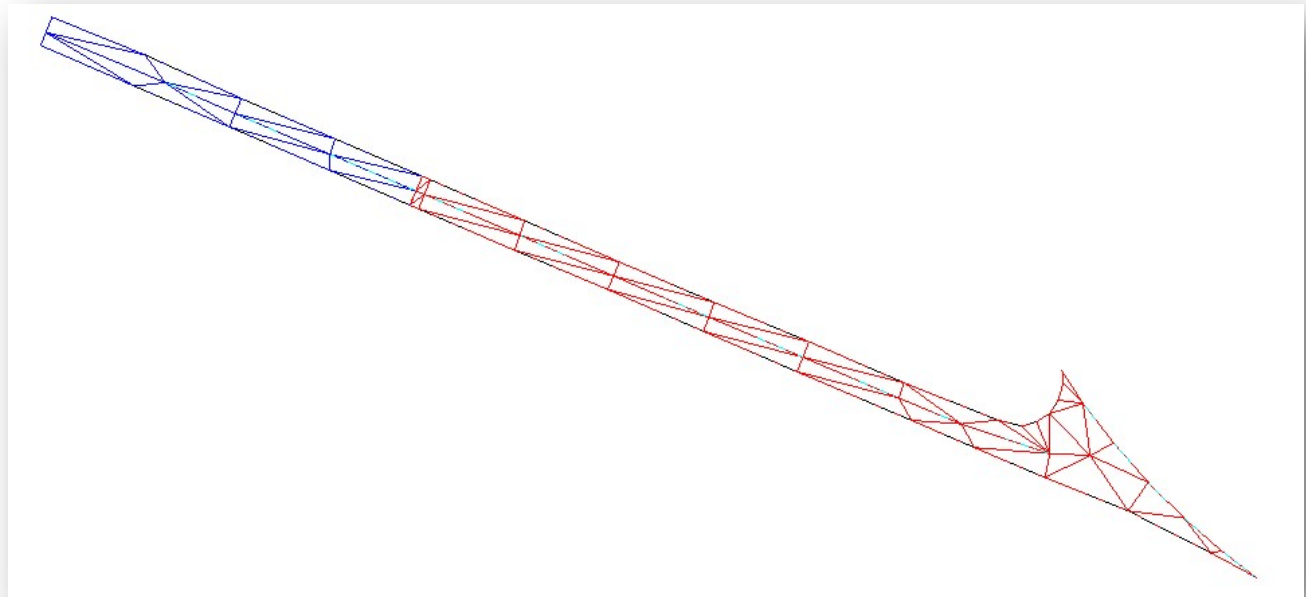
- ✓ Create a terrain named **X\_PAVT\_Removed\_Jameson** from the edge of pavement and the break line at the intersection with S.R. 185.



- ✓ Add the crown of pavement element as a break line to the newly created terrain.



When complete, two separate terrains are created for the surface of existing Jameson Road like the example below.





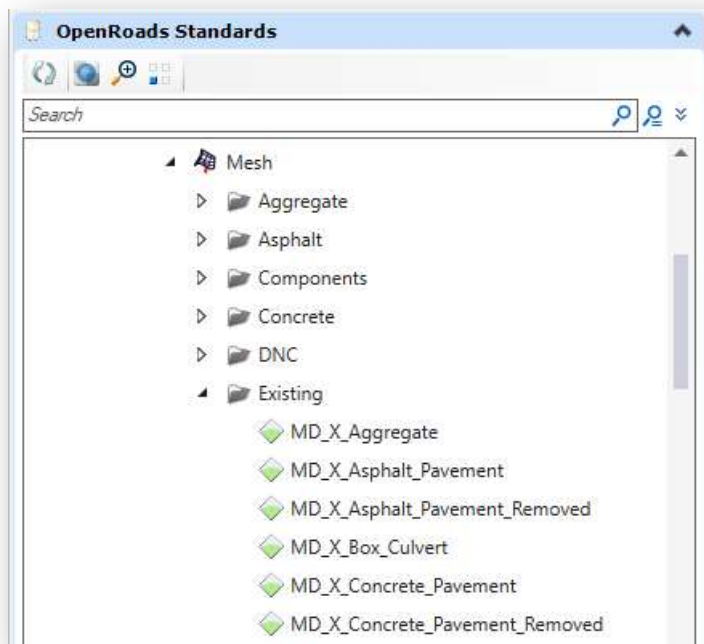


## Part 4: Create the Surface Templates

OpenRoads templates can be applied to a terrain model to define the subsurface composition of the surface terrain. We will create two templates, one for the portion of Jameson Road that will remain in place, and a second for the portion to be removed.

### Existing Pavement Feature Definitions

The OHDOT Standards contain several Mesh features for existing pavement as shown below.



Features for Asphalt and Concrete Removed features differ in the **Volume Option** parameter setting.

The features MD\_X\_Asphalt\_Pavement and MD\_X\_Concrete Pavement have the **Volume Option** set to a value of **None**.

The features MD\_X\_Asphalt\_Pavement\_Removed and MD\_X\_Concrete\_Pavement\_Removed have the **Volume Option** set to a value of **Unsuitable**.

These settings are used to determine how the components are included in earthwork computations.

### Creating an Existing Pavement Template

Take the following steps to create a template to the Jameson Road surface terrain:

- ✓ From the **Corridors** tab, select **Template > Create Template**
- ✓ Right-click on the **Project Templates** folder and select **New > Template**
- ✓ Rename the new template "**Jameson\_X\_Pavt**"

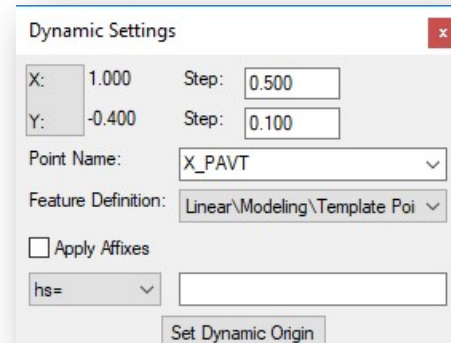
Add components to define the pavement building of the exiting road.

- ✓ Choose **Tools > Dynamic Settings** to open the dialog shown below.

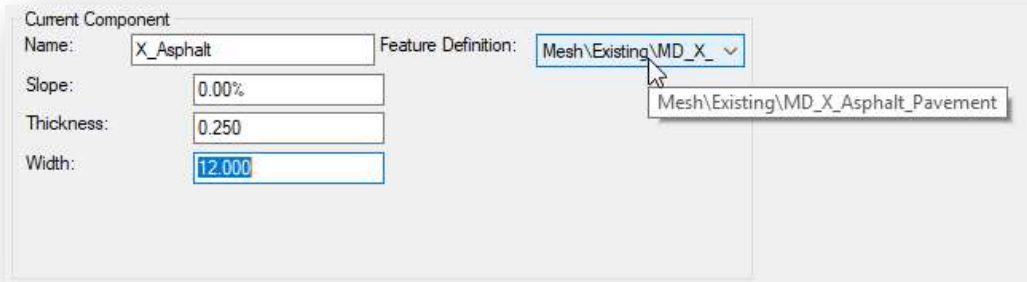


Use the settings show at right. The **Feature Definition** is set as follows:

Linear\Modeling\Template  
Points\Scratch\Scratch1

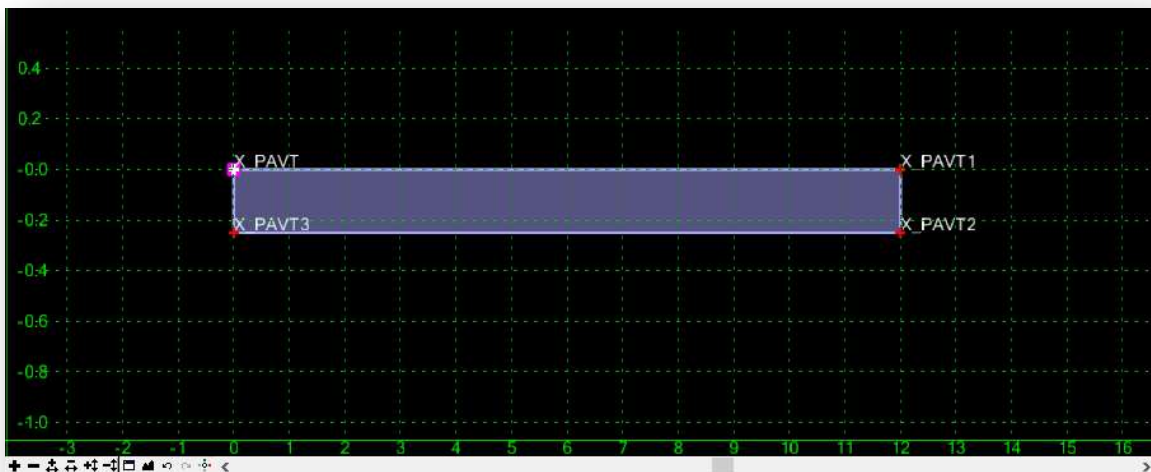


- ✓ In the **Current Template** window, right-click and choose **Add New Component > Simple**.
- ✓ A simple component consists of four points defining a rectangular shape. Set the parameters as shown below.

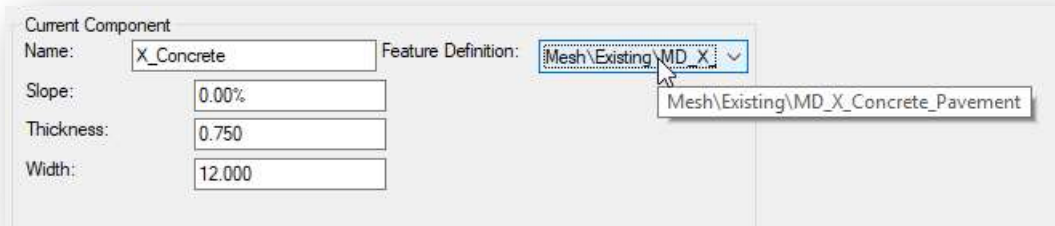


**Note:** The slope and width parameters are irrelevant as this is defined by the terrain surface.

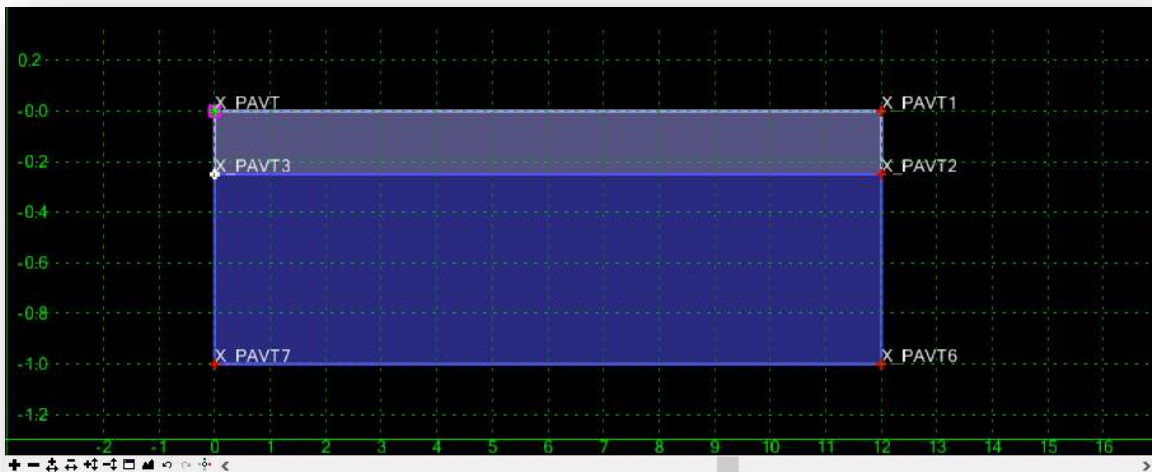
- ✓ Place the component at the 0,0 location as shown below.



- ✓ Right-Click in the **Current Template** window and choose **Add New Component > Simple** to add a component for a concrete pavement layer. Use the settings shown below.



- ✓ Place the component at the bottom of the previous component. The completed template should appear as show below



### Creating an Existing Pavement Removed Template

Take the following steps to create a template for the existing pavement removal areas.

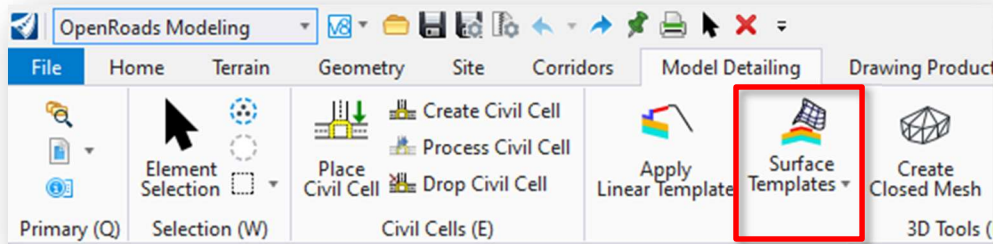
- ✓ Right click the name of the Jameson\_X\_Pavt template and choose the **Copy** option.
- ✓ Right click on the Project Templates folder name and choose the **Paste** option.
- ✓ Rename the copied template as "Jameson\_X\_Pavt\_Removed".
- ✓ Change the feature definition that is assigned to each of the two pavement layers as follows:
  - Right click the X\_Asphalt component and choose the **Edit Component** command.
  - Change the **Feature Definition** to X\_Asphalt\_Pavement\_Removed. Select the **Apply** button.
  - Edit the X\_Concrete component to use the **Feature Definition**. X\_Concrete\_Pavement\_Removed. Select the **Apply** button and close the **Component Properties** dialog.
- ✓ In the **Create Templates** dialog, choose **File > Save** and then close the template library.



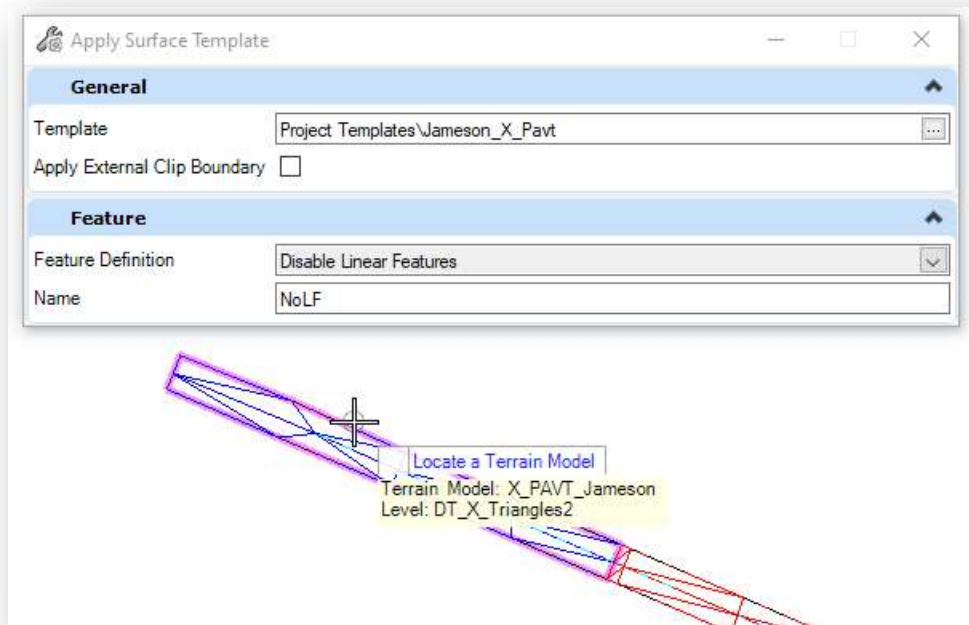
## Part 5: Apply the Surface Template

The template is applied to terrain model using the **Apply Surface Template** command.

- ✓ From the **Model Detailing** tab, select **Apply Surface Template**.

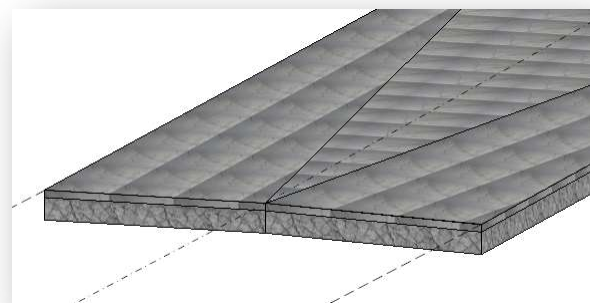


- ✓ Select the **Template** for the portion of Jameson Road that will remain in place to apply the template as shown below.



- ✓ When prompted, select the terrain model.

The template is applied to the 3D model, like the example at right.

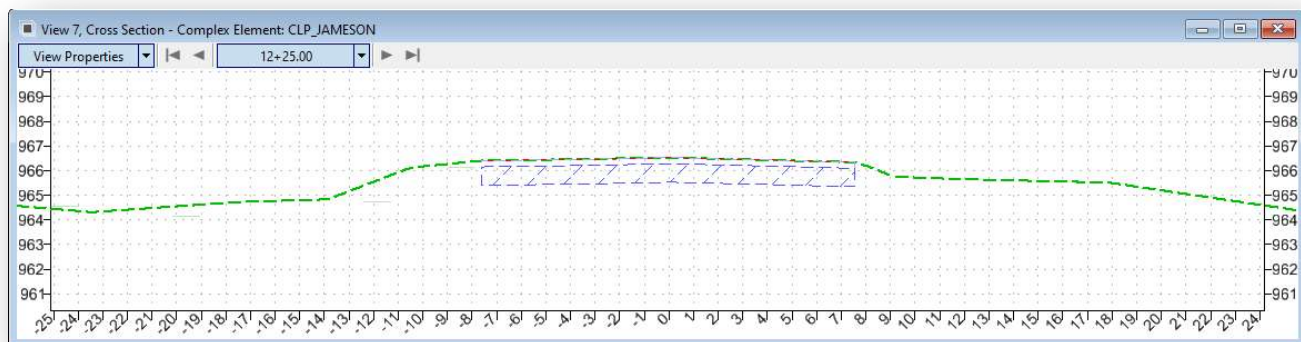




## Part 6: Dynamic Cross Section View

Take the following steps to display the elements in a dynamic cross-section view:

- ✓ Turn on the reference file display of the Jameson Road alignment (**123456\_BK003.dgn**), which was turned off in a prior step in this training exercise (**OpenRoads Modeling > Home > Attach Tools**).
- ✓ Turn on the reference file display of the survey design file (**123456\_FB001.dgn**), which was turned off in a prior step in this training exercise (**OpenRoads Modeling > Home > Attach Tools**).
- ✓ Use the Level Display dialog (**OpenRoads Modeling > Home > Level Display**) to turn on the following levels for the survey file (**123456\_FB001.dgn**):
  - DT\_X\_Terrain\_Boundary
  - DT\_X\_Terrain\_Ground\_Line
- ✓ Set the survey existing ground terrain model as the active terrain.
  - Choose the **Element Selection** tool (**OpenRoads Modeling > Home > Element Selection**).
  - Select the survey terrain model boundary. Allow the cursor to rest on the boundary element until the pop-up menu appears.
  - From the pop-up menu, choose the second icon to set the selected terrain model as the active terrain.
- ✓ Hold down the right-mouse button in the view window. Select **View Control > 2 Views Plan/XS** from the pop-up menu.
- ✓ When prompted, select **OK** to generate a Dynamic XS view.
  - When prompted to **Locate Corridor or Alignment**, choose the Jameson Road alignment.
  - Enter a **Left Offset** value of -100
  - Enter a **Right Offset** value of 100
  - Enter a **Station** value of 12+00
  - Enter an **Interval** of 50
  - When prompted to **Select or Open View**, enter a data point (left mouse click) in the cross-section view window. An example is shown below.

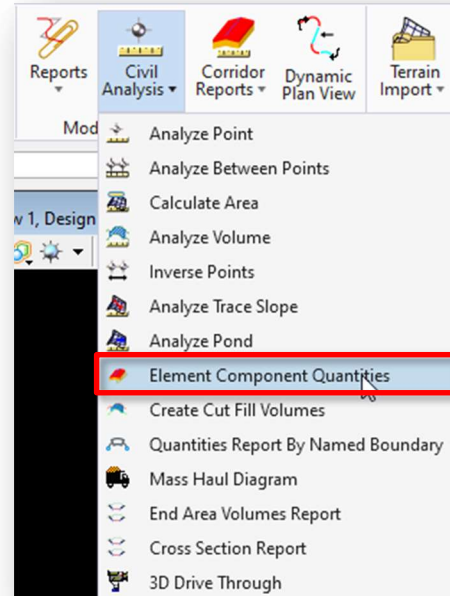




## Part 7: Component Quantities

The OpenRoads component quantities report can be used with the surface terrain and mesh elements. Take the following steps to generate the component quantities for the Jameson Road pavement removal 3D mesh elements:

- ✓ From the **OpenRoads Modeling** workflow, **Home** tab, select **Civil Analysis > Element component Quantities** as shown at right.
- ✓ When prompted to **Locate First Element**, choose the surface terrain model for Jameson Road. Right-click (reset) when complete.
- ✓ The **Element Component Quantities** report is opened like the example below.



Both the Volume and Surface Area are reported for each of the components as shown below.

The **Unit Cost** can be assigned for each **Material** to generate a cost estimate.

Select the **Report** button to send the quantities to the OpenRoads Report Browser. From there, the report can be saved in ASCII, Word, or Excel formats.

Material	Surface Area	Volume	Units	Unit Cost	Total Cost/Material
Mesh\Existing\MD_X_Asphalt_Pavement_Removed	0	67.9540	CuY	1.00	67.95
Mesh\Existing\MD_X_Asphalt_Pavement_Removed	7348.7765	0	SqF	1.00	7348.78
Mesh\Existing\MD_X_Concrete_Pavement_Removed	0	203.8620	CuY	1.00	203.86
Mesh\Existing\MD_X_Concrete_Pavement_Removed	7348.7765	0	SqF	1.00	7348.78

Report

Total Estimated Cost: 14969.37

Elements Name: X\_PAVT\_Removed\_Jamesor



## Alt. Exercise 2: Modeling the Existing Pavement using Create Closed Mesh

This section will demonstrate the process to create 3D mesh elements for the existing pavement using the Create Closed Mesh tool. A portion of St. Peters Rd. will be removed so we will create two separate surface terrains, one for the portion that will remain in place, and a second for the portion to be removed.

### Part 1: References

The surveyed edge of pavement and center of pavement elements will be used to generate the 3D mesh elements representing the existing pavement.

- ✓ Attach the following files as references (**Home > Attach Tools > References**):

Geometry Basemap for St. Peters Rd:

*400-Engineering\Roadway\Basemaps\123456\_BK002.dgn*

### Part 2: Creating the Surface Terrain Model for the Existing Pavement

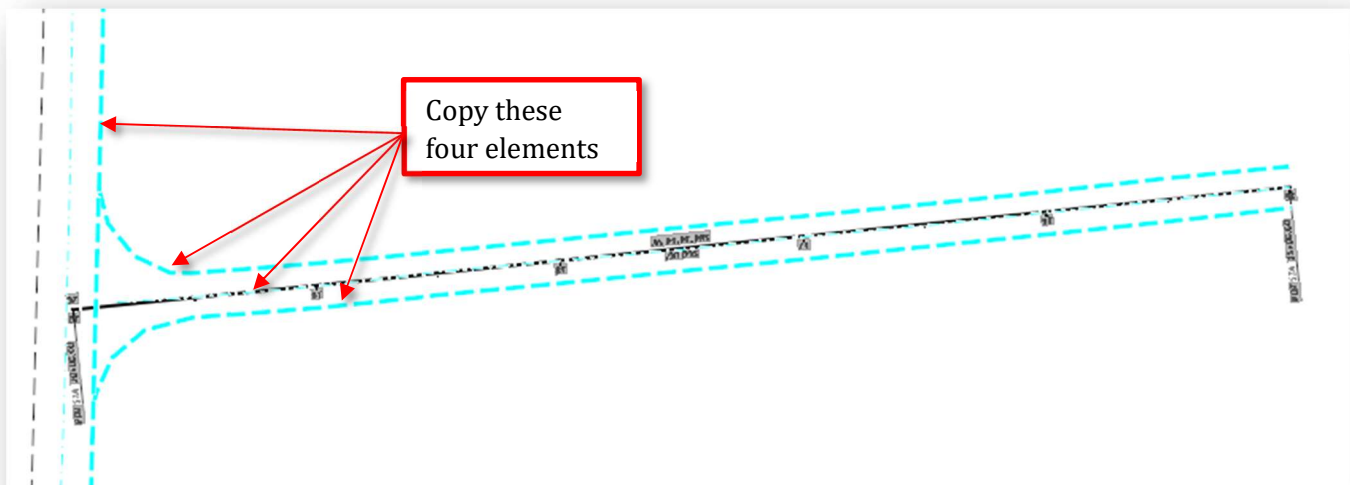
The surface terrain can be created for the existing pavement by directly using the referenced survey elements, or by copying the elements from the FB reference attachment into the active file.

In this example, we will create a surface terrain model limited to the station limits of the pavement removal areas, from station 17+00 to meet existing S.R. 185. A copy of the existing survey elements is required since the elements will be edited to specific station ranges.

Take the following steps to create the surface terrain for St. Peters Rd.

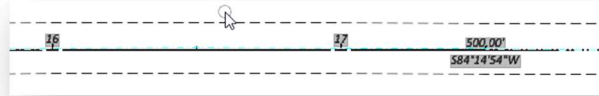
- ✓ Use the MicroStation **Copy Element** command (**Drawing > Copy**) to copy the existing edge of pavement, center of pavement, and break line elements from the Survey Field Book design file (FB) to the active design file. The elements to be copied are shown below.

Note: Be careful to copy the elements exactly on top of the original survey elements.





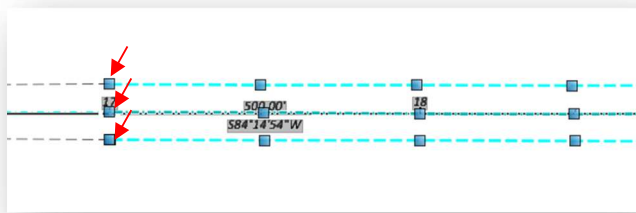
- ✓ After copying the elements, turn off the reference attachment display of the survey basemap design file, 123456\_FB001.dgn (**Home > Attach Tools > References**).
- ✓ Then use the View Rotation: Rotate View by 3 points so that the St. Peters Rd. alignment annotations are in the correct orientation.



Take the following steps to prepare the copied elements to generate the surface terrain model for the existing pavement:

- ✓ Use the **Break Element** command (**OpenRoads Modeling > Drawing > Break Element**) to break each edge of pavement line and the center of pavement line at station 17+00 of St. Peters Rd.

The result is shown below with the elements from station 17+00 forward selected to show that the lines are broken at station 17+00.



- ✓ Select the level **PV\_P\_Saw\_Cut\_Line**
- ✓ Use the **Place Line** command (**OpenRoads Modeling > Drawing > Place Line**) to draw a line to each point edge of pavement line at sta. 17+00 of St. Peters Rd.

The edge of pavement elements and sawcut element will be used to define the boundary of the existing pavement surface terrain model. The surveyed center of pavement elements will be used as a break line to define the pavement crown. In this case, these elements are 3D graphics as generated from the Survey software and can be used to generate the surface terrain model directly. 2D elements can also be used if they have an OpenRoads profile defined.

Take the following steps to create the surface terrain for the pavement portion that will remain in place:

- ✓ From the **References** dialog (**Home > Attach Tools > References**), turn off the display of the file containing the proposed alignment for St. Peters Rd. (123456\_BK002.dgn). Then turn the survey file back on (123456\_FB001.dgn).
- ✓ From the **Level Display** dialog (**Home > Primary > Level Display**), turn off all levels within the survey (123456\_FB001.dgn) then turn on the **DT\_X\_Terrain\_Ground\_Line** & **DT\_X\_Terrain\_Boundary** level.

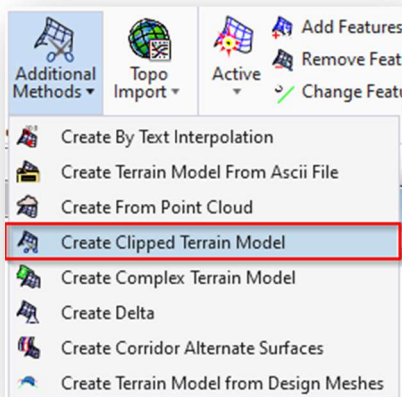




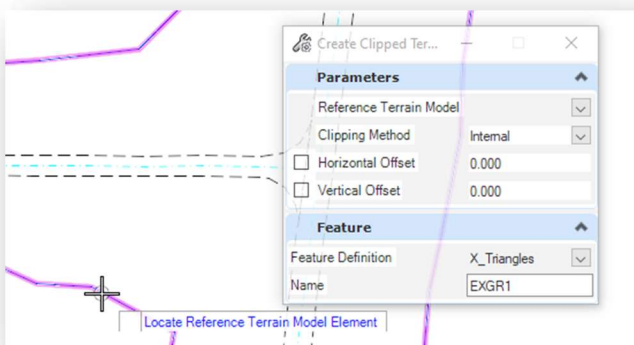
- ✓ From the **Drawing** tab, select the **Create Complex Chain** command under the **Groups**. Then select all the EOP from Sta. 17+00 of St. Peters Rd. to S.R. 185.



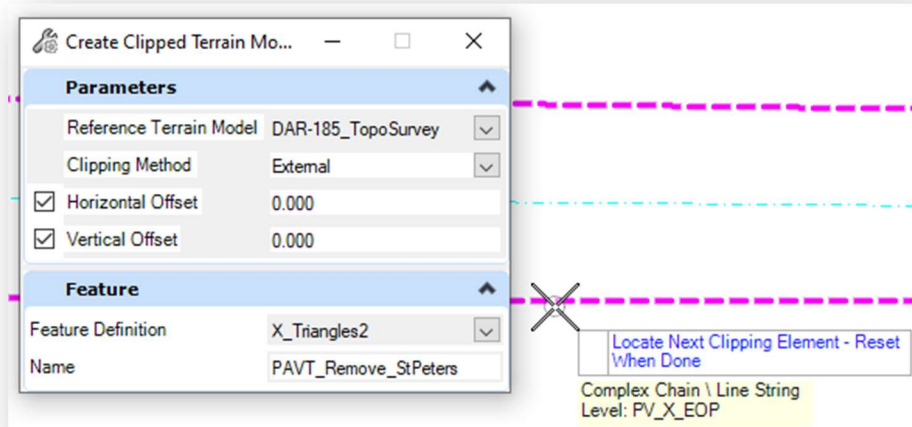
- ✓ From the **Terrain** tab, select the **Additional Methods** command to create a terrain model from selected elements.



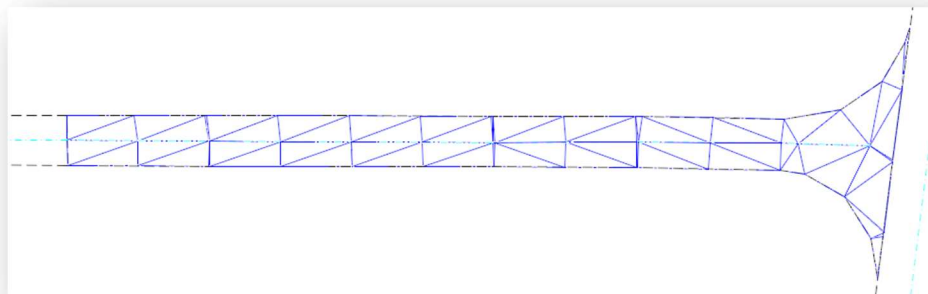
- ✓ Once the **Create Clipped Terrain Model** tool has been selected then survey terrain boundary.



- Set the **Clipping Method** to **External**
- **Horizontal Offset = 0.000**
- **Vertical Offset = 0.000**
- Choose the **X\_Triangles2** feature definition.
- Key-in the **Name** for the terrain model **X\_PAVT\_Remove\_StPeters**.
- Select each edge of pavement element as shown below.

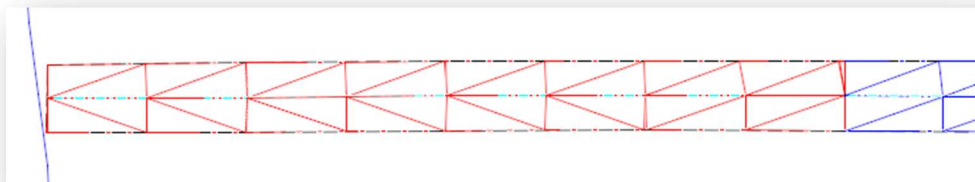


- Right-click (reset) when you are done selecting the elements.
- When prompted, left click to accept each parameter.
- After accepting each parameter, the terrain model is generated like the example below.



Note: this method automatically adds the center of pavement element to the terrain model as a break line.

- Repeat the process above for the Existing to Remain section of St. Peters Rd. using **X\_Triangles3** feature definition and Key-in the **Name** for the terrain model **X\_PAVT\_Remain\_StPeters**.



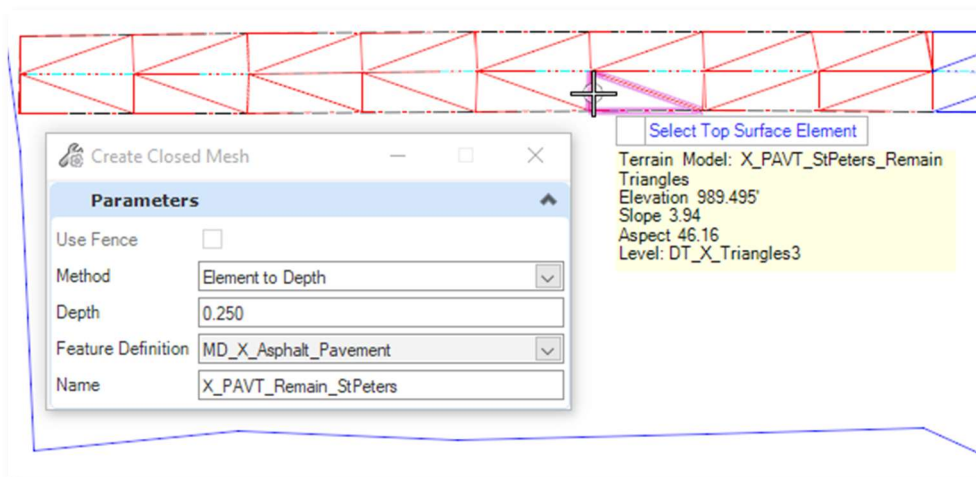


### Part 3: Applying a Closed Mesh to a Surface

The Create Closed Mesh can be applied to a terrain model to define the subsurface composition of the surface terrain. We will create two templates, one for the portion of St. Peters Rd. that will remain in place, and a second for the portion to be removed.

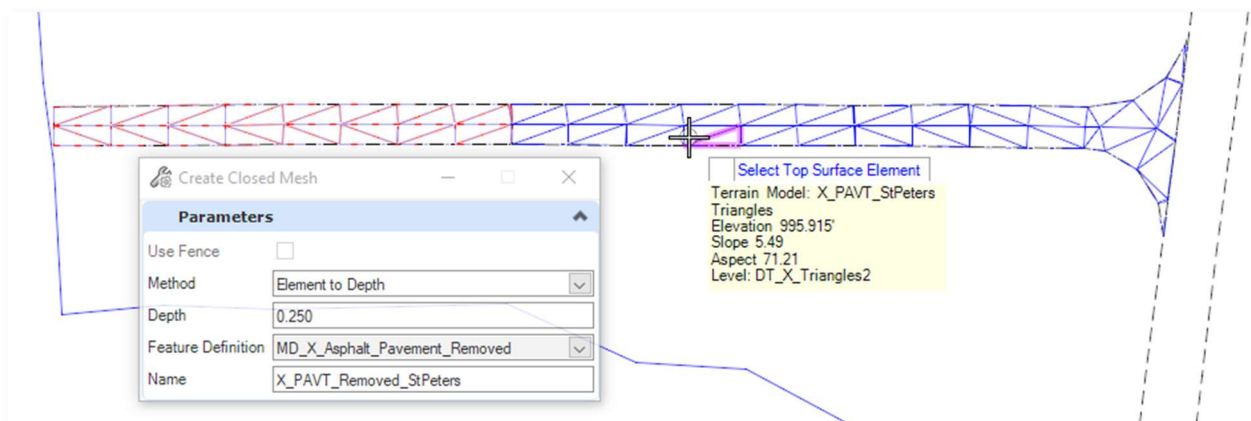
From the **Modeling Detailing** tab, select **Create Closed Mesh** tool under the **3D Tools** sections.

- Set the **Method** to **Element to Depth**
- **Depth = 0.25**
- Choose the **MD\_X\_Asphalt\_Pavement** feature definition.
- Key-in the **Name** for the closed mesh **X\_PAVT\_Remain\_StPeters**
- Data selected the first prompt.
- Select the surface of pavement element as shown below.



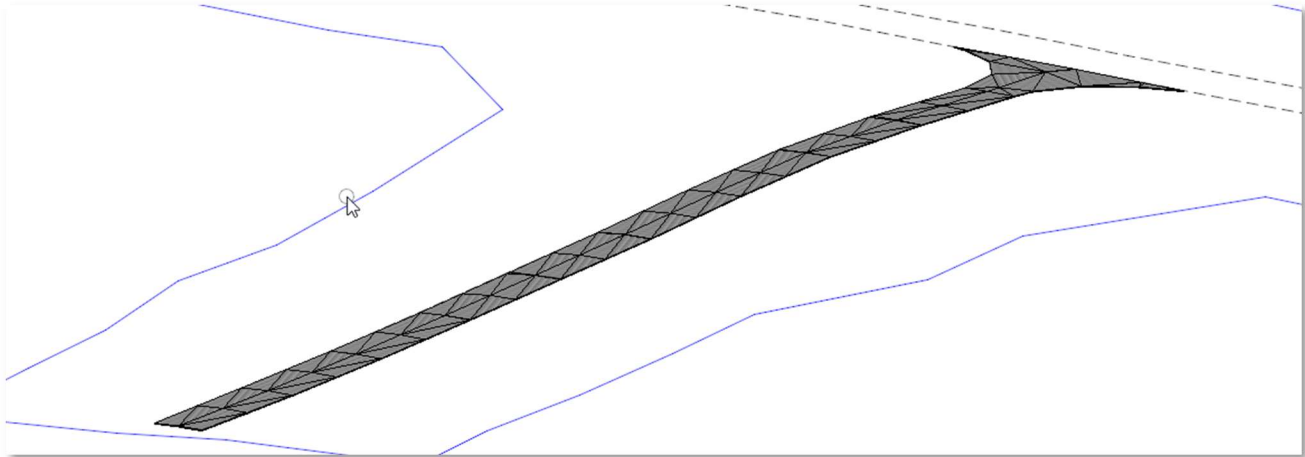
- ✓ Following the steps above, create a second closed mesh for the surface terrain for the portion of St. Peters Rd. to be removed.


- Choose the **MD\_X\_Asphalt\_Pavement\_Removed** feature definition.
- Key-in the **Name** for the closed mesh **X\_PAVT\_Removed\_StPeters**.
- Select the surface terrain shown below.





- ✓ When complete, two separate closed mesh's are created from the surface of existing St. Peters Rd. like the example below.

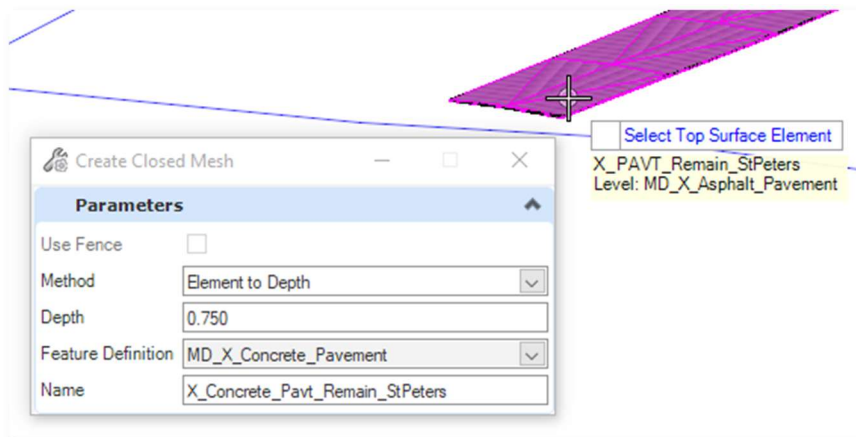


Tip: go to the view attributes  drop down to change the view display style to **Illustration:IgnoreLighting**.

### Creating an Existing Asphalt Concrete Base

From the **Modeling Detailing** tab, select **Create Closed Mesh** tool.

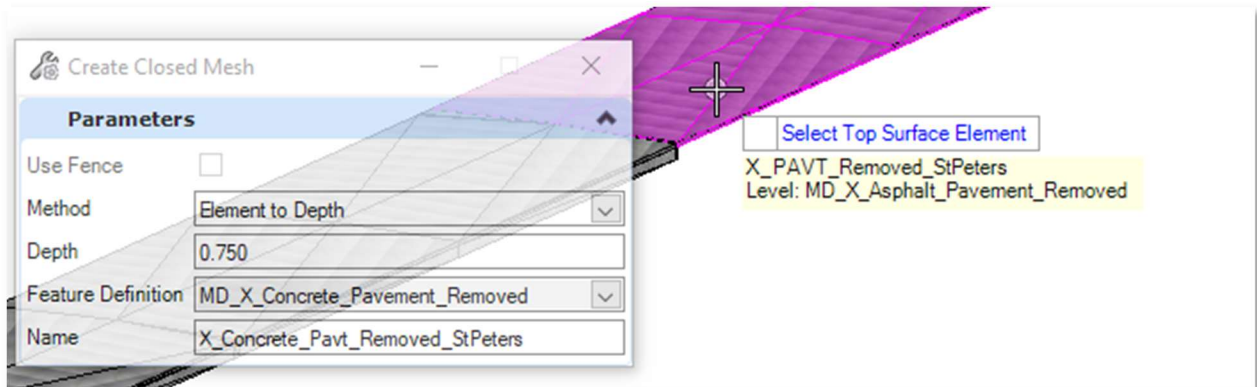
- Set the **Method** to **Element to Depth**
- **Top Mesh Side** = **Use Lowest**
- **Depth** = **0.75**
- Choose the **MD\_X\_Concrete\_Pavement** feature definition.
- Key-in the **Name** for the closed mesh **X\_Concrete\_Pavt\_Remain\_StPeters**
- Data selected the first prompt.
- Select the surface of pavement element as shown below.



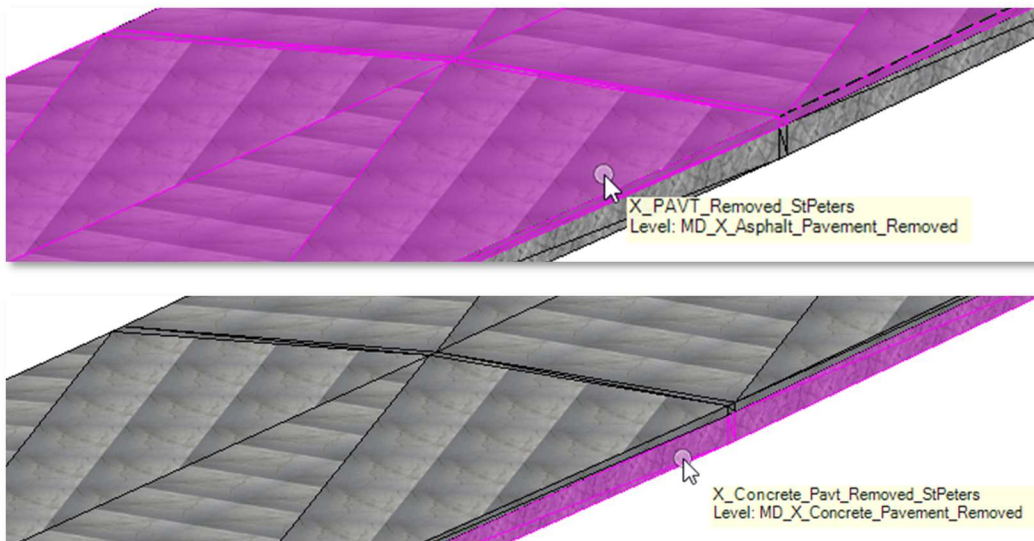
- A new Drop down will appear **Top Mesh Side** select **Use Lowest**.



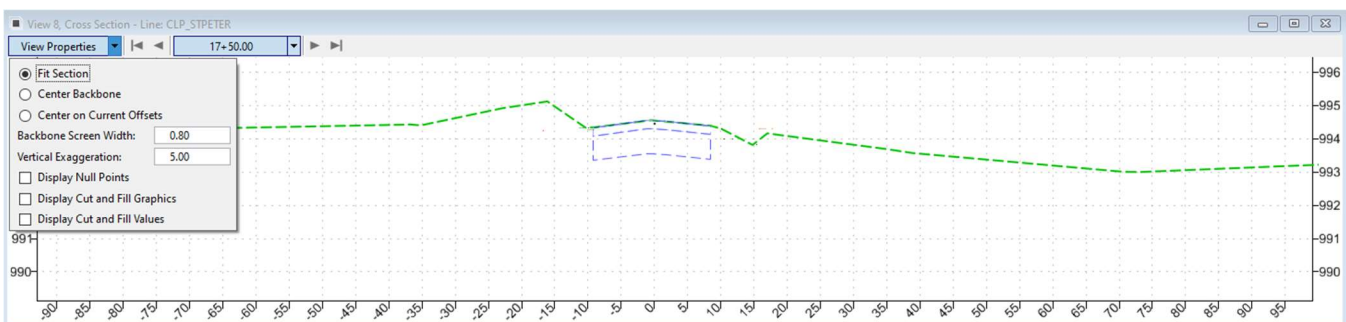
- ✓ Following the steps above, create a second closed mesh for the surface terrain for the portion of St. Peters Rd. to be removed.
  - Choose the **MD\_X\_Concrete\_Pavement\_Removed** feature definition.
  - Key-in the **Name** for the closed mesh **X\_Concrete\_Pavt\_Removed\_StPeters**.
  - Select the surface terrain shown below.



- ✓ When complete, you should have a Pavement layer and a concrete layer along St. Peters Rd. like the example below.



- ✓ Dynamic XS view of St. Peters Rd. use the **View Properties** shown below.





## OpenRoads Software Version

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This document was prepared using the following software version:

OpenRoads Designer CONNECT Edition – 2021 Release 1 Update 10 – Version 10.10.01.03

This document was updated using the following software version:

OpenRoads Designer CONNECT Edition – 2022 Release 3 Update 12 – Version 10.12.02.04

## Contacts

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For any questions, suggestions, or problems with this document please contact the ODOT Office of CADD and Mapping Services by use of the following form on the ODOT website:

[https://odot.formstack.com/forms/cadd\\_servicerequest](https://odot.formstack.com/forms/cadd_servicerequest)

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