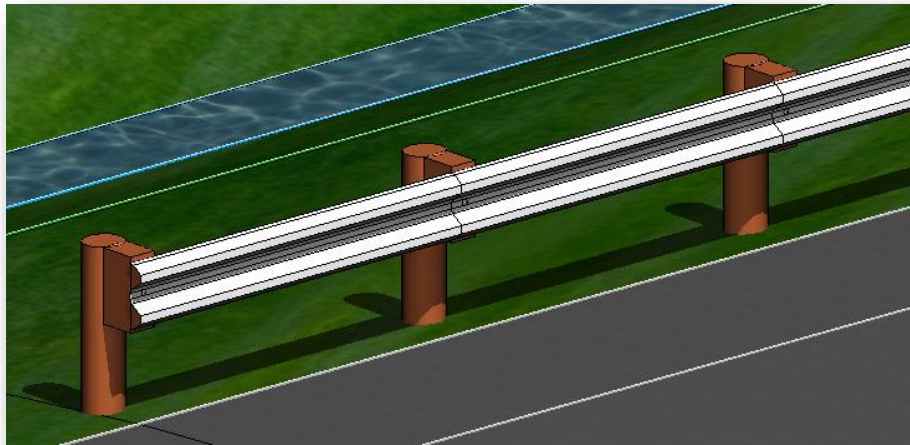




3D Guardrail

Process Overview

The January 20, 2017 update to ODOT's CADD Standards includes added feature definitions, element templates, and cross section templates for the placement of 3D guardrail lines. The 3D guardrail graphics are intended for visualization purposes and should not be evaluated critically for strict compliance with design standards. *Note, the guardrail placement examples shown in this document are intended only to demonstrate the process and do not necessarily represent proper guardrail design procedures.*



Placement of 3D guardrail runs requires the following software components:

- 3D linestrings are used to draw the posts. The line strings are located in the file *ODOT_3DGuardrail.rsc*.
- The actual rail, and the cables for a cable barrier, is drawn using OpenRoads corridor templates.

3D guardrail is drawn in the 2D plan view using an OpenRoads feature. The following feature definitions in *ODOT_Features_Design.dgnlib* are used to draw 3D guardrail runs:

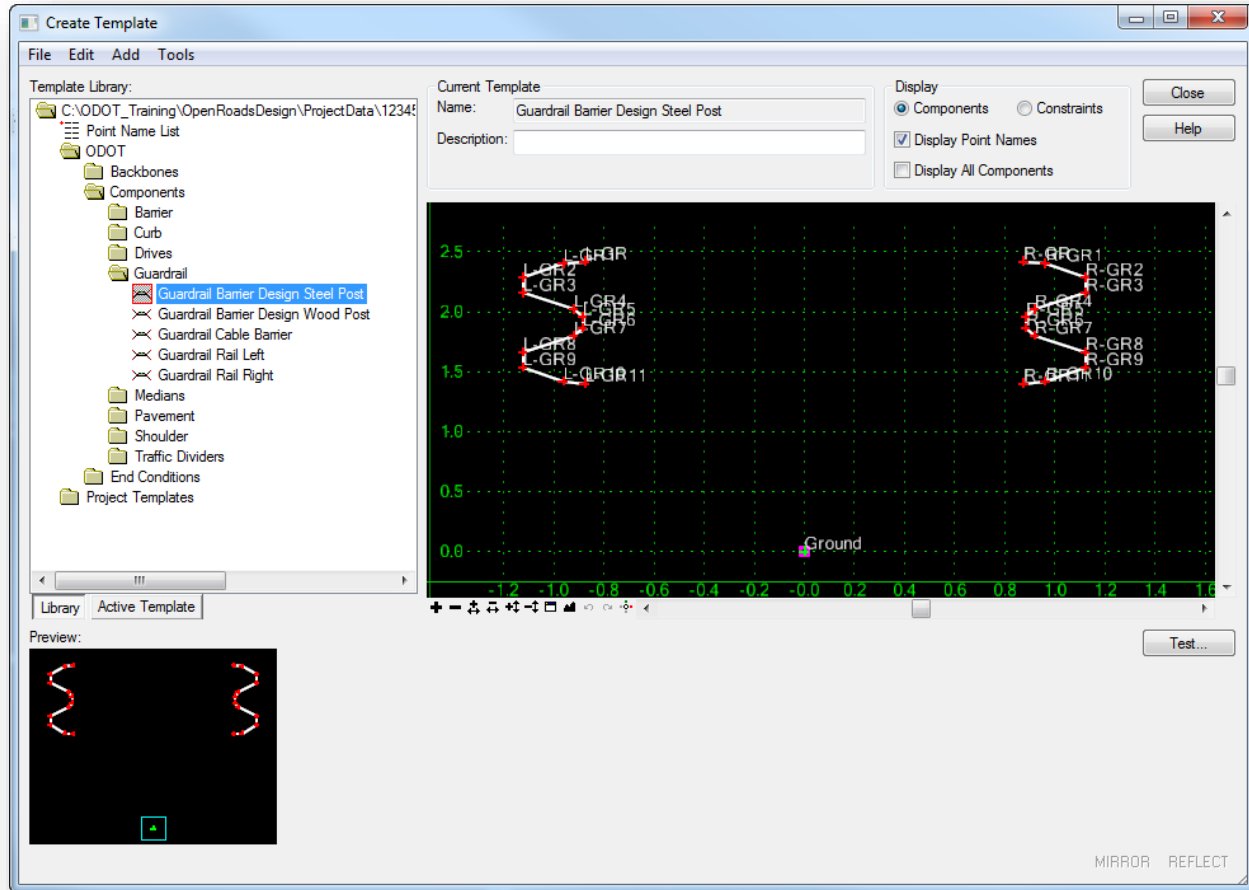
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Barrier Design Steel Post
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Barrier Design, Wood Post
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Left Cable Barrier
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Left Round Wood Post
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Left Steel Post
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Right Cable Barrier
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Right Round Wood Post
- Guardrail & Barriers > RD_P_Guardrail_Barrier Design > RD_P_Guardrail, Right Steel Post

These feature definitions are defined with an associated corridor template to draw the 3D rail and the 3D line string when the 2D plan view element is drawn. In order to draw the rail, or the cables, the templates must be present in the template library you are using for the project. These template can be copied from *ODOTcadd_Templates.itl* by use of the **Template Library Organizer** function.




Required Templates

ODOTcadd_Templates.itl contains the templates shown below to draw the actual rail in the 3D model. It is necessary to copy these templates from *ODOTcadd_Templates.itl* to the template library that you are using for the project before placing guardrail runs.

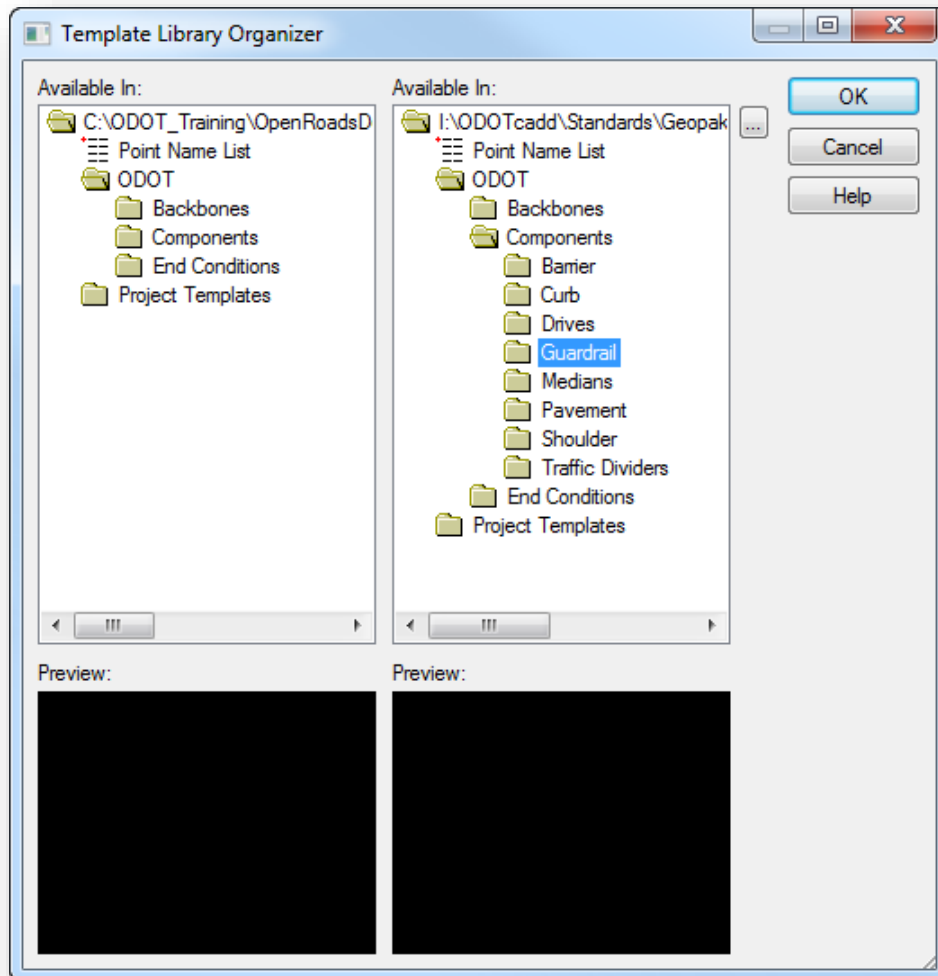


Templates can be copied from one template library to another by selecting **Tools > Template Library Organizer** from the *Create Templates* dialog. The *Template Library Organizer* dialog is shown on the following page.



Use the  button to select the library that you wish to copy templates from. *ODOTcadd_Templates.itl* is found in the following location:

\\ODOTcadd\Standards\Geopak\Road\templates\ODOTcadd_Templates.itl



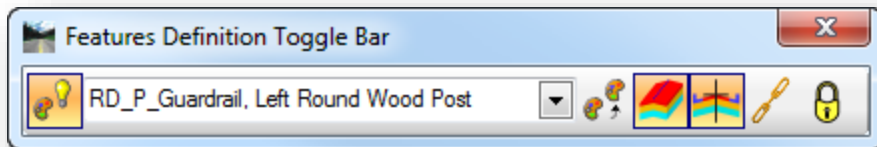
Templates can be copied from one library to another by drag-and-drop operations. Drag the Guardrail folder from *ODOTcadd_Templates.itl* to the **ODOT > Components** folder in your template library.



Placing 3D Guardrail Elements

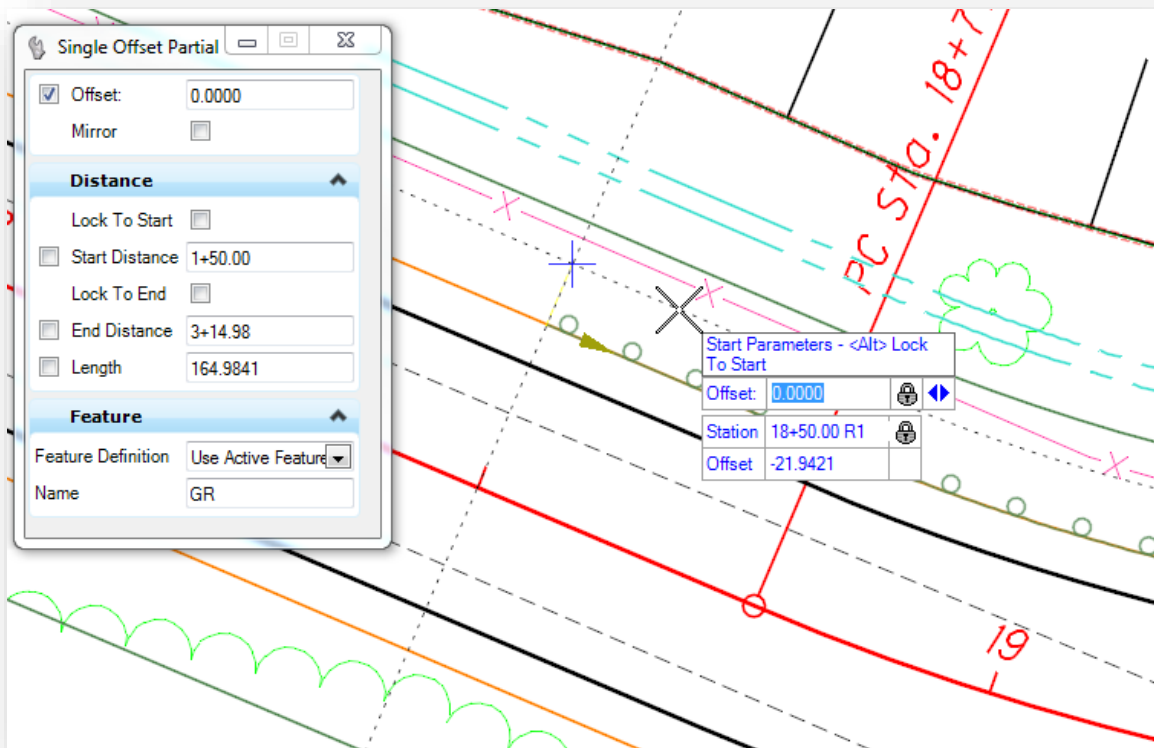
Take the following steps to place the guardrail lines:

- Use the OpenRoads **Feature Definition Toggle Bar** to select the desired feature.
- Toggle on the **Use Active Feature Definition**, **Create 3D Automatically**, and **Use Feature Definition Template** icons as shown below.



- Use the OpenRoads **Horizontal Geometry > Single Offset Partial** tool to place the 2D guardrail element.

In the example below, the guardrail line is placed adjacent to the edge of shoulder. When prompted to select an element, the edge of shoulder line was selected. The **Offset** value is set to **0**.



It can be a bit tricky, but Civil Accudraw can be used to designate a starting station for the guardrail run. Since the edge of shoulder element does not have stationing assigned, the centerline will be used as the reference element to define the station value. Take the following steps:



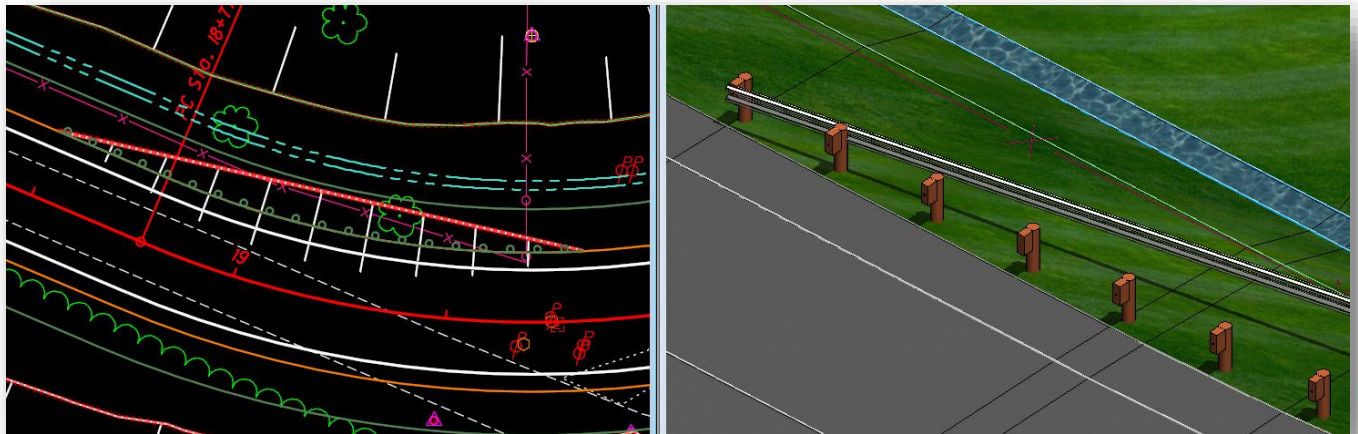
- Toggle on Civil AccuDraw
- Tab to the Civil AccuDraw **Offset** field (the lower one in the example above)
- With keyboard focus set to the **Offset** field, type in the letter “o”
- Civil AccuDraw prompts to select the reference element, or issue a reset to return to the active command. Select the centerline as the reference element.

After selecting the centerline element, the **Station** value should reflect the cursor location relative to the selected element. In the example on the preceding page, a **Station** value of **18+50** was keyed-in. The second **Offset** value, which is part of the Civil AccuDraw function, is irrelevant as the **Offset** value for the **Single Offset Partial** command is used to define the offset value for the new element.

After accepting the starting location, the ending **Station** value or a **Length** can be keyed-in. We recommend using the **Length** function rather than an ending **Station** value. This is due to the post spacing of the 3D guardrail line. Use the following guidelines:

- Guardrail runs should be drawn in 6.25' increments in order for the visualization of the posts to appear correct at the end of the run
- Cable Barrier runs should be drawn in 10.5' increments in order for the visualization of the posts to appear correct at the end of the run

After the guardrail is placed, graphics for both the 2D and 3D view are drawn similar to the example below.

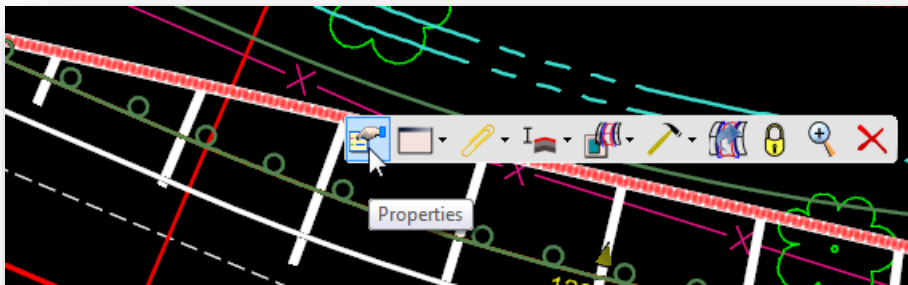


Notice that there are graphics for a linear template placed in the 2D view.

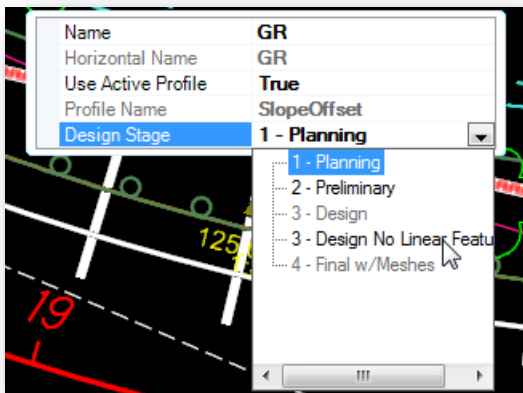
Also notice that the guardrail does not follow the 3D line style that defines the posts. This can be corrected by taking the following steps:



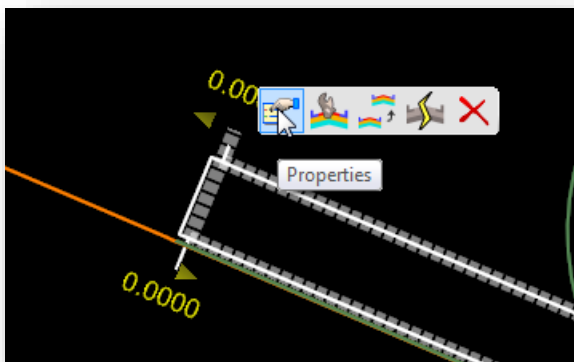
- Select the white graphic for the linear template and choose the **Properties** item from the pop-up menu, as shown below.



- Change the **Design Stage** to **Design No Linear Features** as shown below.



- Select the red dashed line for the template drop graphic and choose the **Properties** item as shown below

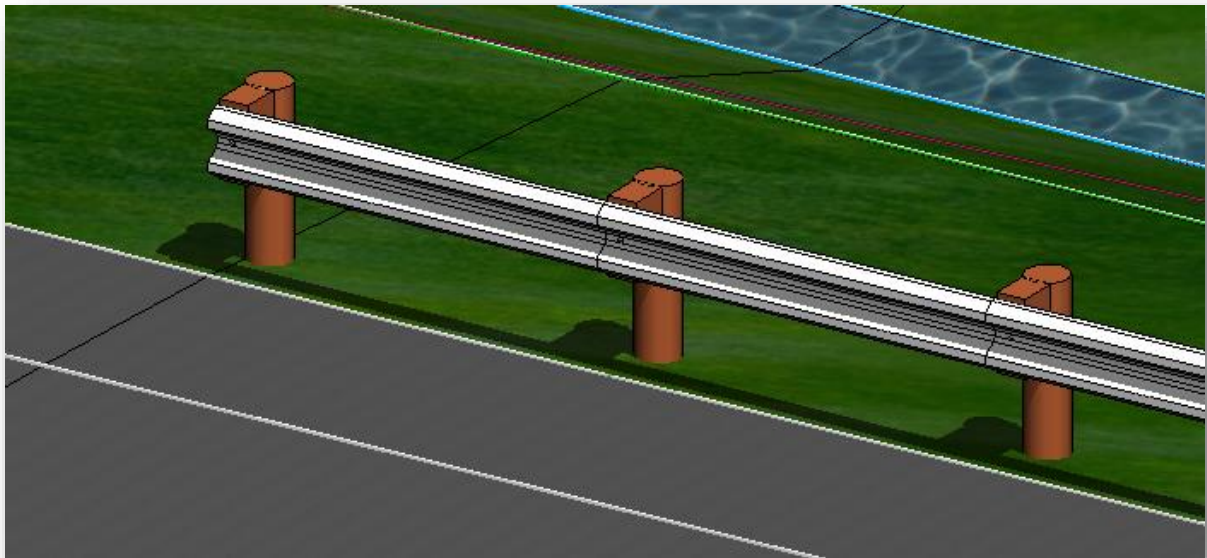




- Change the template drop **Interval** value to **6.25** for guardrail or **10.5** for cable barrier

Interval	6.2500
Template Name	ODOT\Components\Guard
Horizontal Name	GR
Description	
Start Station	0.0000
End Station	0.0000

The guardrail will now follow the face of the 3D line string as shown below.



Note: Be sure to set the parameters for both the **Corridor Design Stage** and the **Template Drop Interval**, even if the guardrail appears correct after changing the **Corridor Design Stage** parameter.

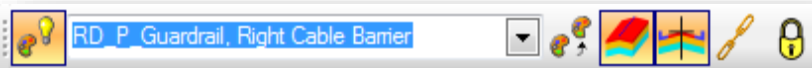


Placing a Cable Barrier Element

Placing a cable barrier run is similar to the process to place a guardrail run. The cable barrier is typically placed offset from the edge of shoulder or from the ditch line. See the **Location and Design Manual** for cable barrier placement information. The **Single Offset Partial** command is used to place the cable barrier, however, the user will have to adjust the profile since the element is offset from the shoulder, or from a ditch line.

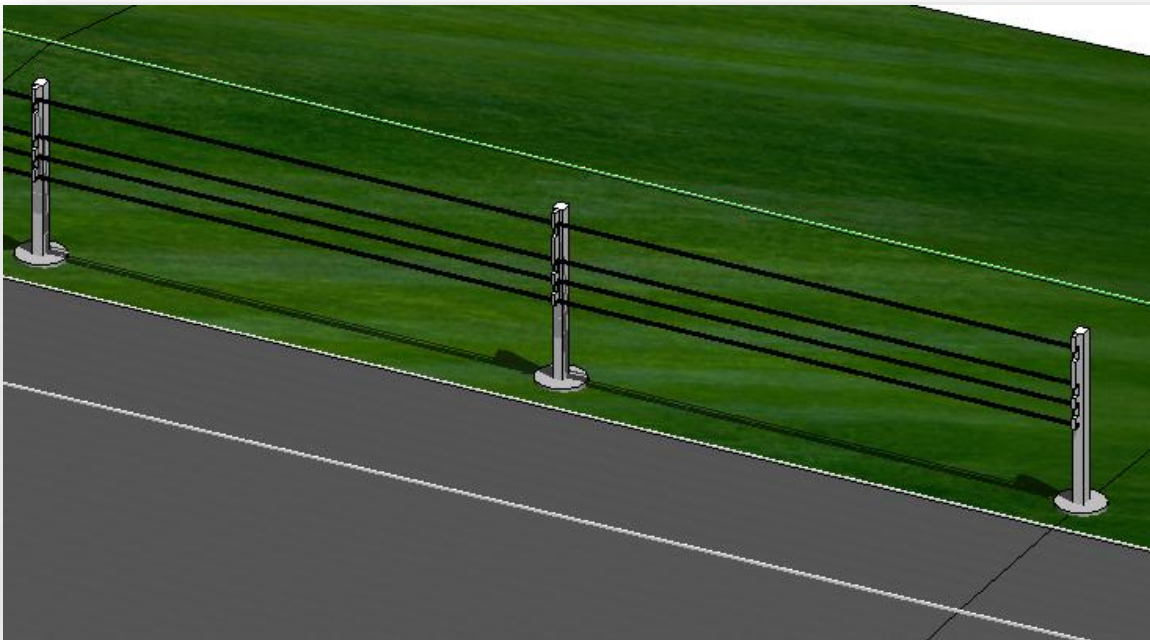
The following steps detail the process to place the cable barrier at an offset from the edge of shoulder.

- From the *Feature Definition Toggle Bar*, select the desired feature definition and toggle on the **Use Active Feature Definition**, **Create 3D Automatically**, and **Use Feature Definition Template** icons as shown below



- Use the **Horizontal Geometry > Single Offset Partial** command to place the barrier, similar to the methodology described for placing guardrail on the preceding pages.
- After placing the cable barrier line, adjust the **Corridor Design Stage** and **Template Drop Interval** values as described for placing guardrail. Use a **Template Drop Interval** value of **10.5** for cable barrier runs.

The cable barrier run is placed in the file similar to the example show below.



In the example above, the cable barrier was placed at an offset of 1.0' from the edge of shoulder.

NOTE: There are different cable barrier types and attachment methods. The barrier type shown here is intended for visualization purposes and not intended to relay to the construction contractor that they must use a specific cable barrier type.

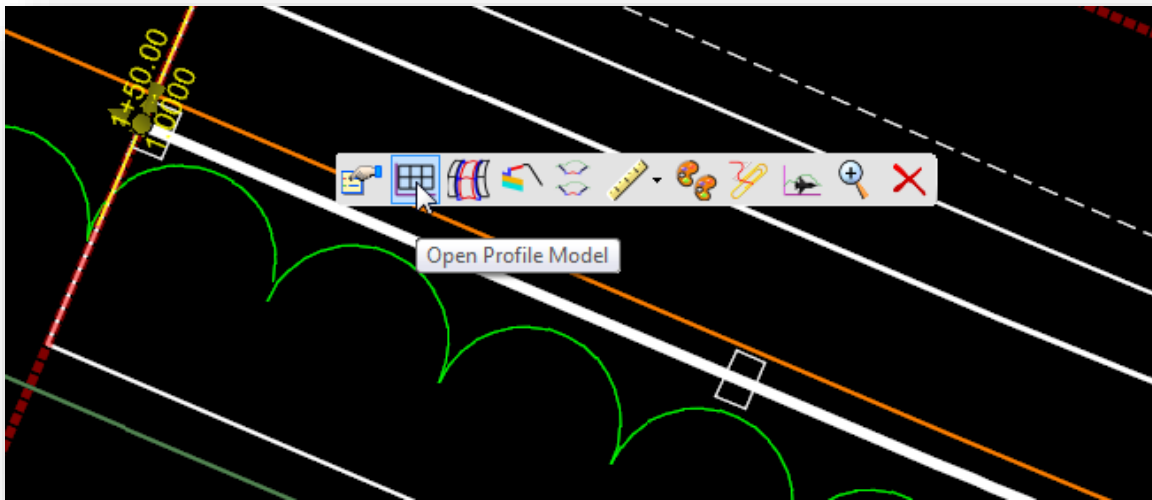


The **Single Offset Partial** command uses the same profile for the cable barrier as the selected element that it was offset from. The profile for the cable barrier can be adjusted using the **Profile By Slope From Element** command.

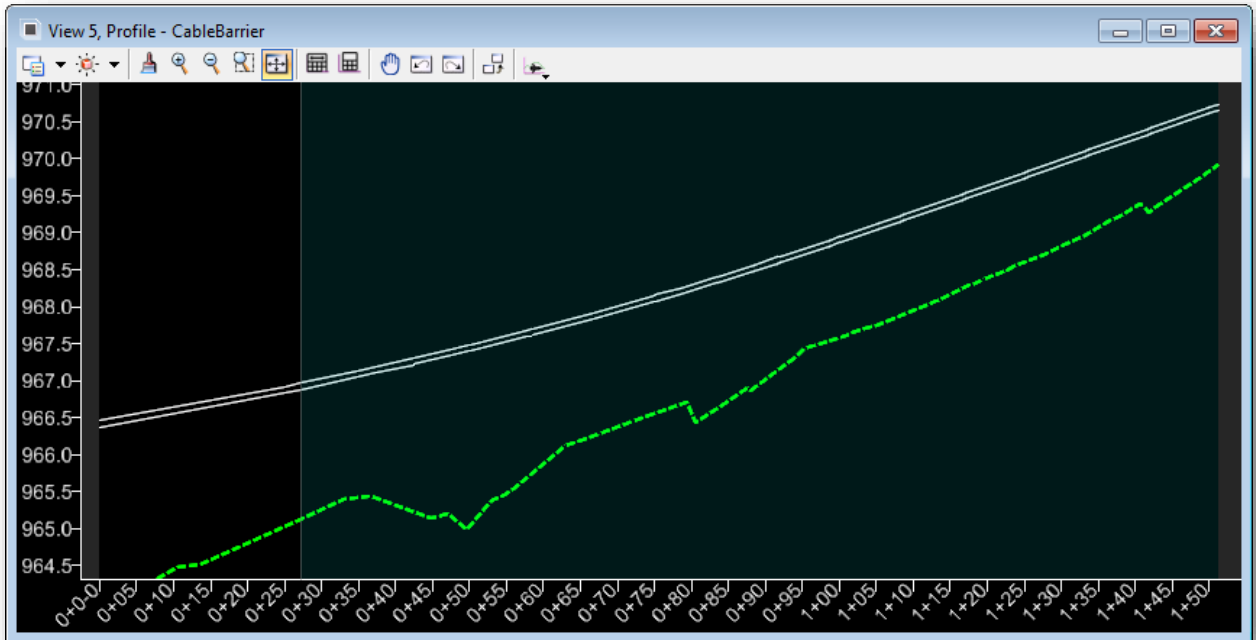
- Select the **Vertical Geometry > Profile By Slope From Element** command
- When prompted to **Locate First Element To Profile**, select the cable barrier line in the 2D view
- After selecting the cable barrier line, issue a reset button to move to the next step
- When prompted to **Locate Reference Element**, select the element that was initially used to place the cable barrier (the edge of shoulder in this example)
- Enter the **Slope** for the graded shoulder, or the side slope, depending on location of the cable barrier line and the element that was used as the initial offset. In this example, a slope of **-8.0%** is used since the cable barrier line is on the graded shoulder which was defined as a -8.0% slope in the roadway template.

After defining the rest of the parameters, a new profile is created for the cable barrier line, but it is not set as the active profile. Take the following steps to set the new profile as the active profile:

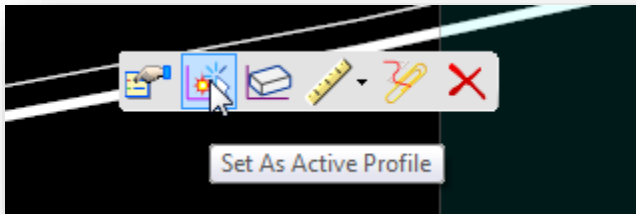
- Select the 2D element representing the cable barrier line. From the pop-up menu, select the **Open Profile Model** command.



- When prompted, open a new view window and issue a data point in the view to display the profiles for the cable barrier element. An example is shown below.



- Notice that there are two proposed profile lines. The lower line is the new profile, which was defined at a -8.0% slope from the shoulder.
- Select the lower profile line and choose the **Set As Active Profile** command.



When the command is selected, the cable barrier is automatically adjusted to use the new profile.

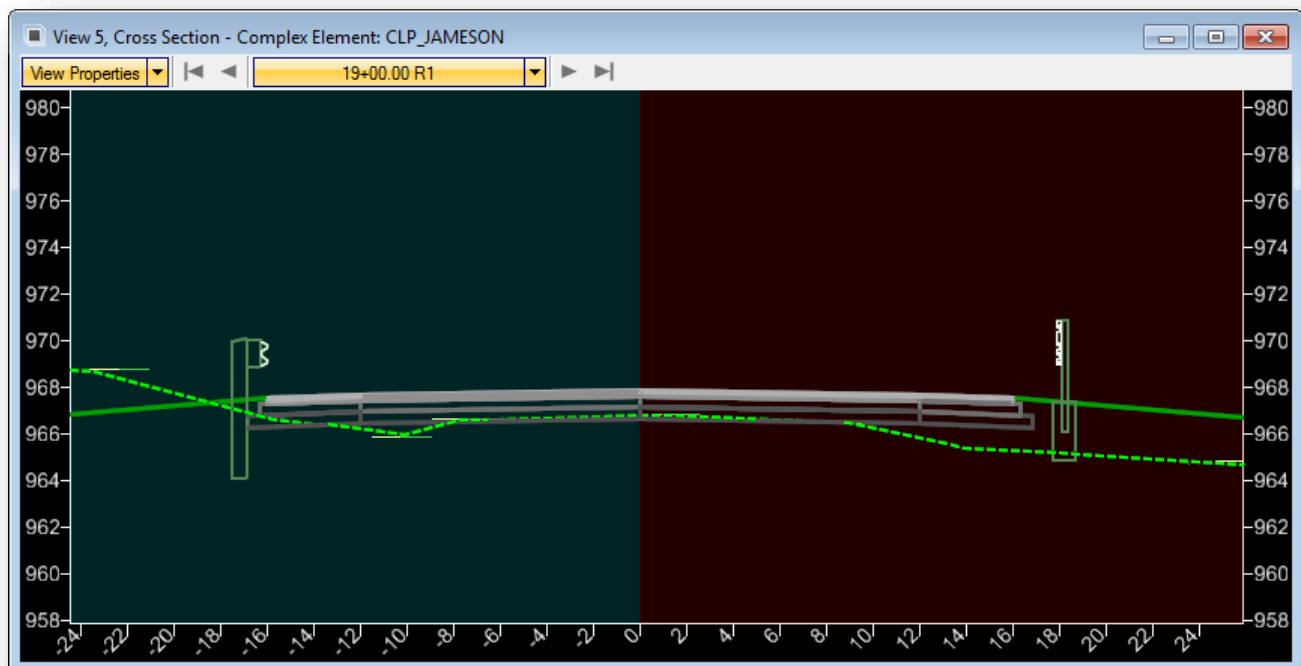


Cross Sections

The display of the guardrail in the cross sections is automated by the feature definitions. A cell is placed in the cross section for each guardrail or cable barrier type. The following cells, some of which were added in the January 2017 CADD Standards release, are used for the display of the guardrail in the cross sections:

- GR_CABLE_LT_XS
- GR_CABLE_RT_XS
- GRBAR_STEEL_XS
- GRBAR_WOOD_XS
- GRLT
- GRRT

An example of the cells displayed in the cross section is shown below.



The cells should be automatically displayed. If the cells do not display, check the cell library **ODOT_Symbols.cel** to ensure that you have the latest version of the cell library containing the cells listed above.



Contacts

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
