

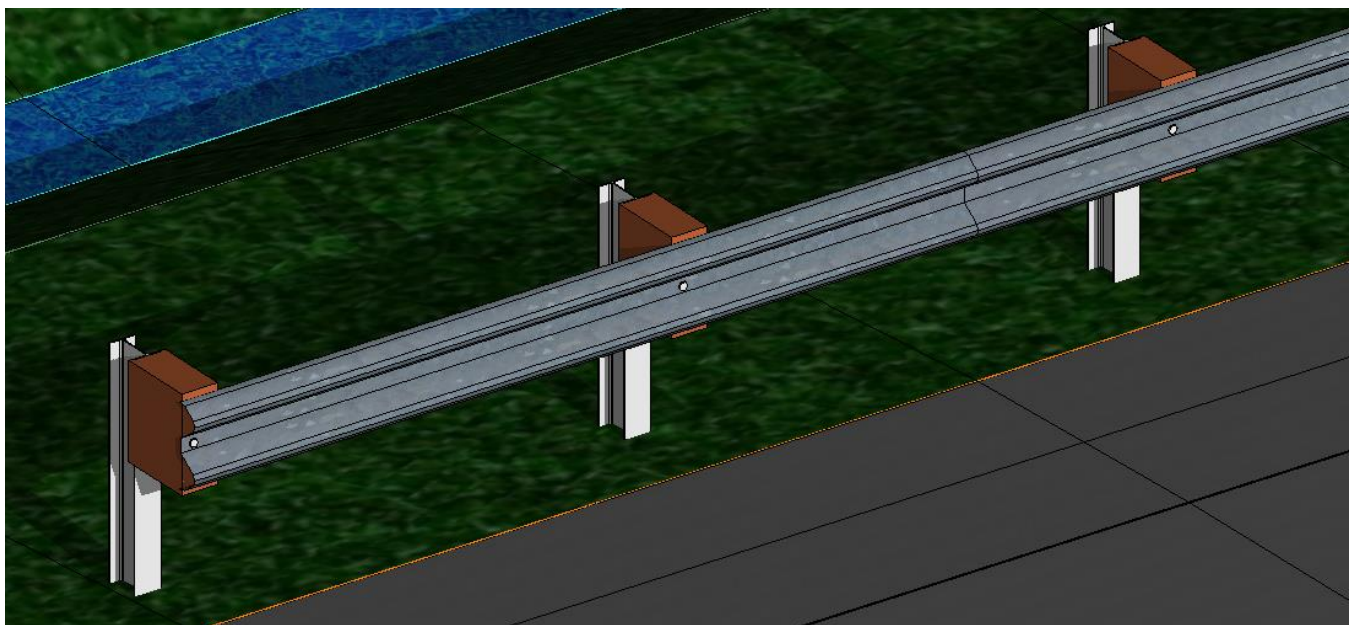


OpenRoads Design: 3D Guardrail

Process Overview

ODOT's CADD Standards for OpenRoads Designer includes 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 to demonstrate the process and do not necessarily represent proper guardrail design.



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

- 3D linestrings are used to draw the posts.
 - The line strings for legacy guardrail types are in the file **OHDOT_3DGuardrail.rsc**.
 - New linestyles for the Midwest Guardrail Systems guardrail specifications are included in the file **OHDOT_MGS_Guardrail_3D.rsc**
- The rail, and the cables for a cable barrier, is drawn using OpenRoads templates.

3D guardrail is placed by first drawing the guardrail run in a 2D plan view using an OpenRoads feature. After a profile is defined for the 2D guardrail run, a 3D guardrail linestyle is added to the 3D model. The 3D linestring is made up of the guardrail posts and does not contain the rail faces.

The following feature definitions in **ODOT_Features_Design.dgnlib** are used to draw 3D MGS guardrail runs:

- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Steel Post Barrier Design
- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Steel Post Left



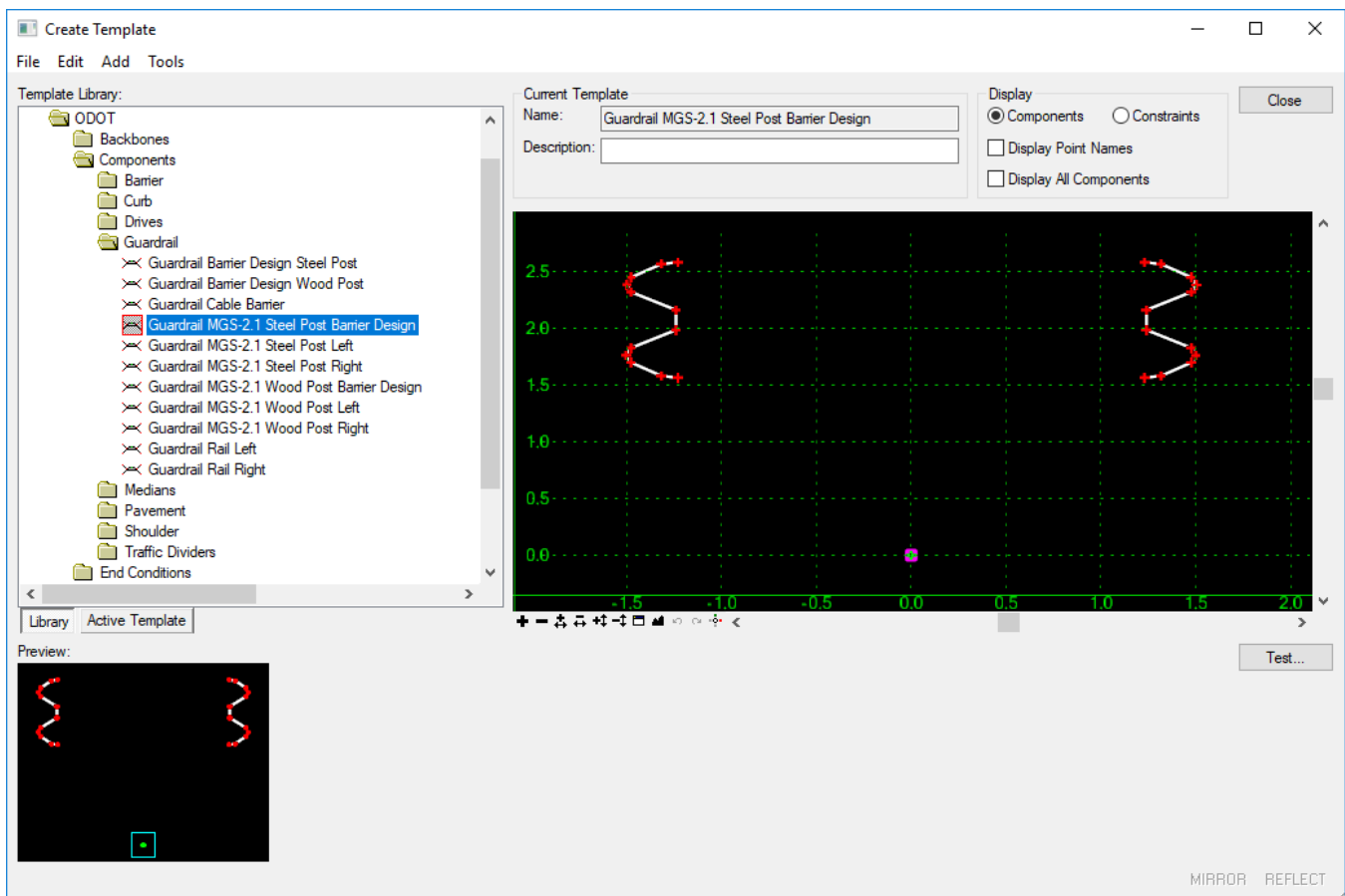
- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Steel Post Right
- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Wood Post Barrier Design
- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Wood Post Left
- Linear > Guardrail & Barriers > MGS-2.1 > RD_P_Guardrail MGS-2.1 Wood Post Right

The rail itself, or the cables for cable barrier runs, are placed using a corridor template and the **Apply Linear Template** command.



Required Templates

OHDOT_Templates.itl contains the templates shown below to draw the actual rail in the 3D model. The corridor templates must be present in the template library you are using for the project. These templates can be copied from **OHDOT_Templates.itl** by use of the **Template Library Organizer** function, if necessary.

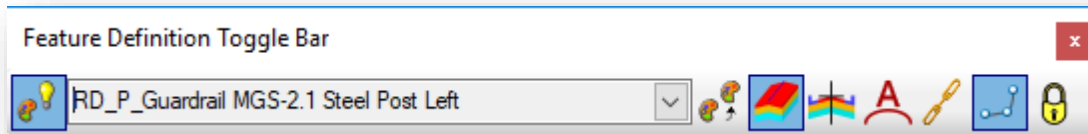




Placing 3D Guardrail Elements

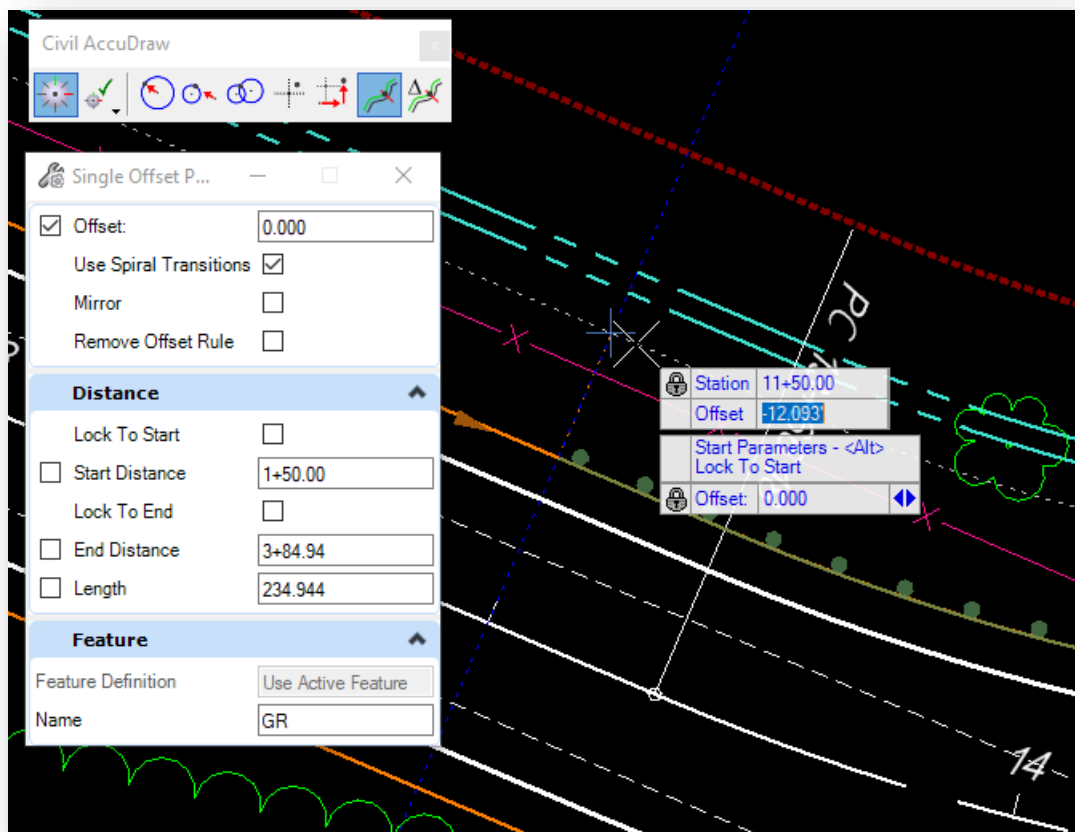
Take the following steps to place the 2D guardrail lines:

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



- Use the OpenRoads **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**.



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. **Civil AccuDraw** is used to facilitate this task.

Take the following steps to use **Civil AccuDraw** to define the guardrail station limits:



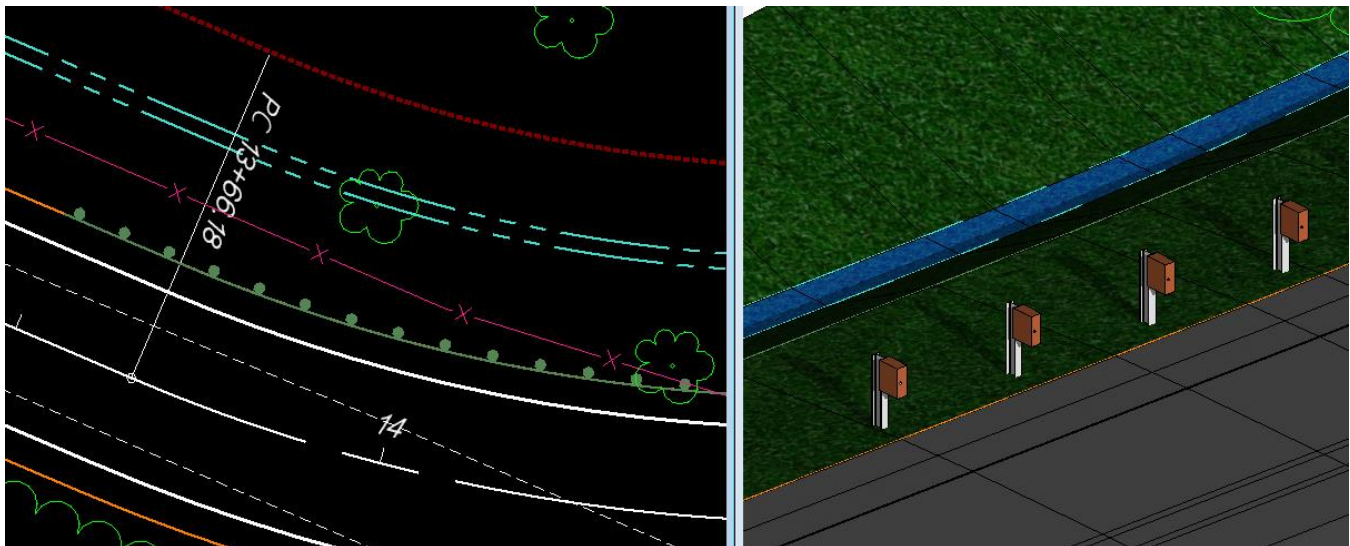
- Toggle on **Civil AccuDraw**
- Tab to the **Offset** field - there are two offset fields shown in the screen capture on the previous page: one for the Single Offset Partial command and one for Civil Accudraw. Be sure to toggle to the offset field for Civil Accudraw, which is the one below the Station value
- 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 **11+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 the value used to define the offset value, relative to the shoulder line, 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 like the example below.

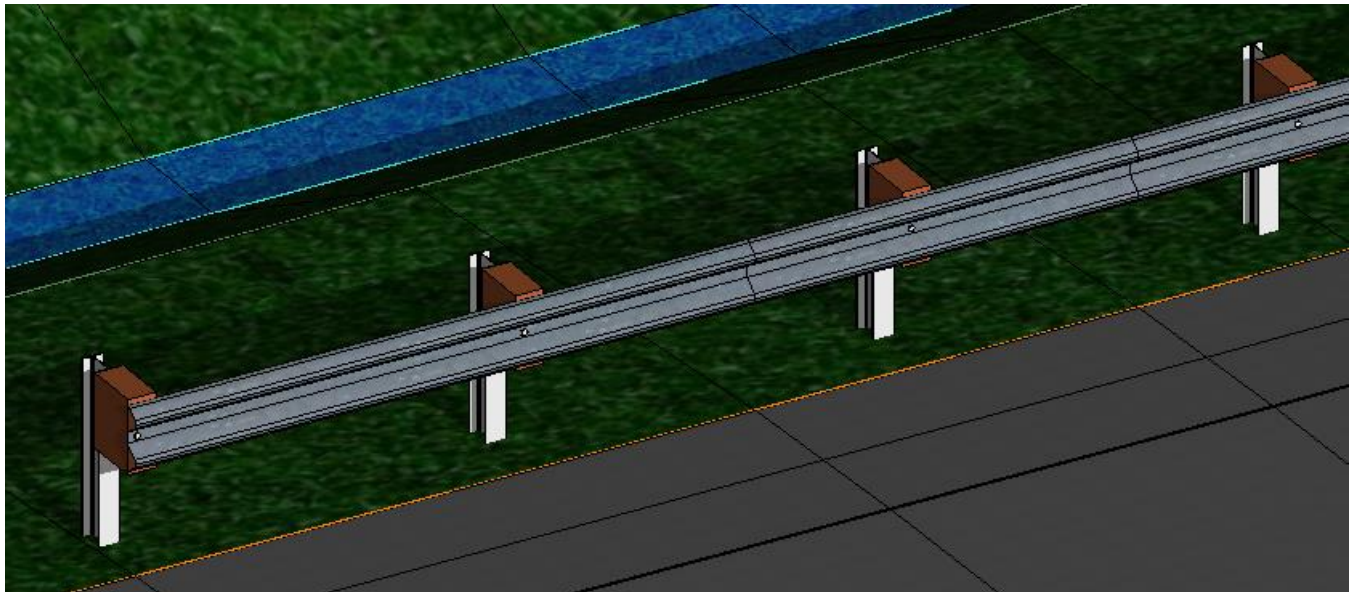


The rail is placed using the **Model Detailing > Apply Linear Template** command to assign the template to the guardrail run in the 2D view.



Lock To Start	<input type="checkbox"/>
<input checked="" type="checkbox"/> Start Station	0+00.00
Lock To End	<input type="checkbox"/>
<input checked="" type="checkbox"/> End Station	2+25.00
<input type="checkbox"/> Exterior Corner Sweep Angle	05°00'00"
Mirror	<input type="checkbox"/>
Reflect	<input type="checkbox"/>
Template	ODOT\Components\Guardrail\Guardrail MGS-2.1 Steel Post Left
Description	
Feature	
Feature Definition	Design
Name	MGS-2.1 Left

When complete, the guardrail run should appear like the example shown below.



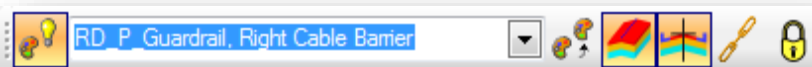


Placing a Cable Barrier Element

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.

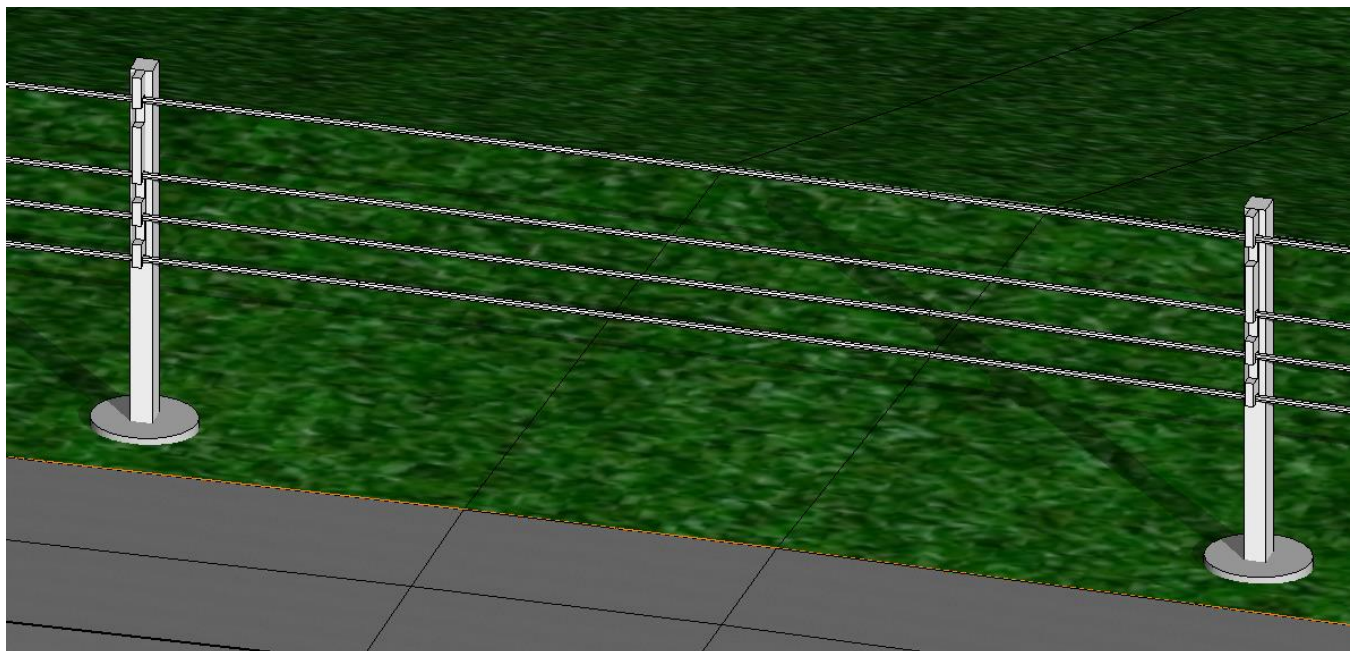
The following steps detail the process to place the cable barrier at an offset from the edge of shoulder.

- 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, use the **Apply Linear Template** command to add the cables to the design file.

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.



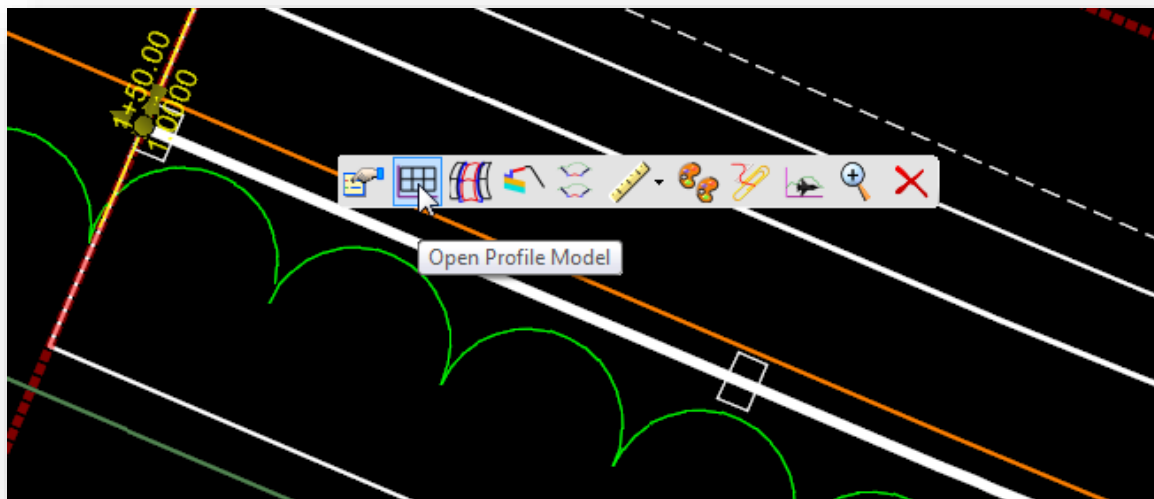
NOTE: There are different cable barrier types and attachment methods. The barrier type shown here is intended for visualization purposes and not intended to relay to the construction contractor that they must use a specific cable barrier type.

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.

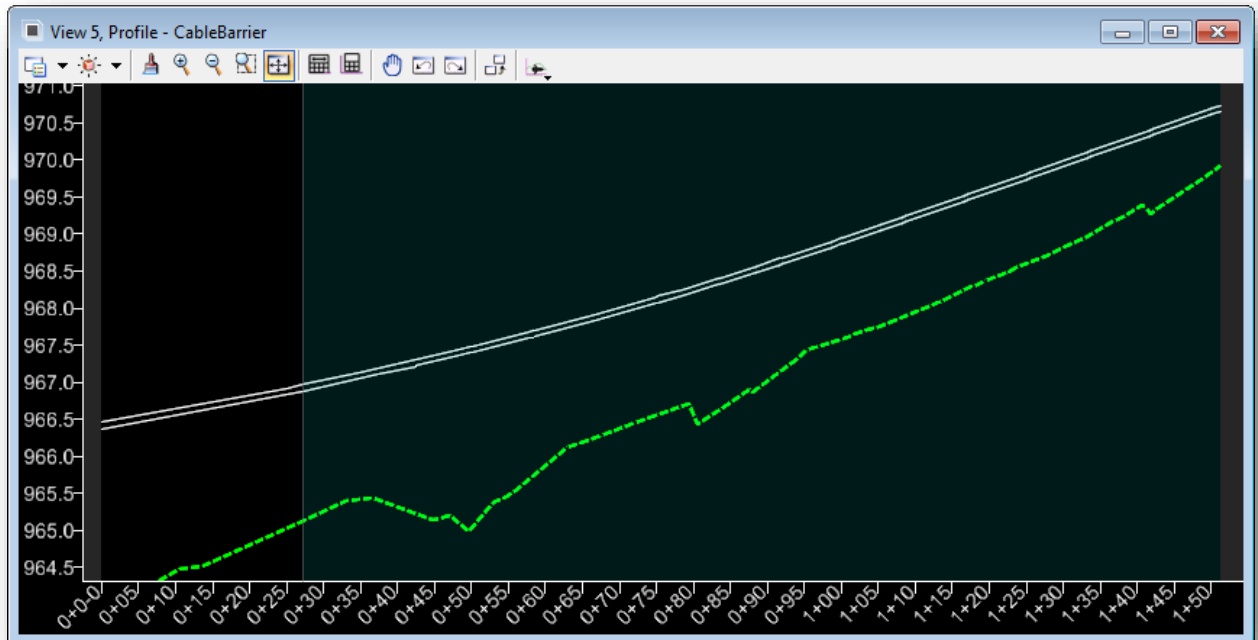
- Select the **Vertical Geometry > Profile By Slope From Element** command
- When prompted to **Locate First Element To Profile**, select the cable barrier line in the 2D view
- After selecting the cable barrier line, issue a reset button to move to the next step
- When prompted to **Locate Reference 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:

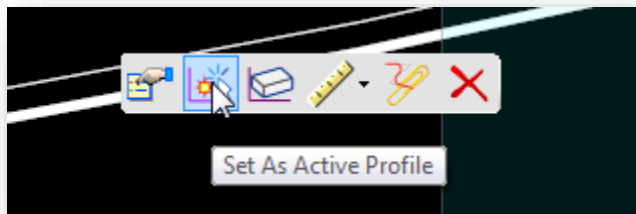
- Select the 2D element representing the cable barrier line. From the pop-up menu, select the **Open Profile Model** command.



- 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_MGS_STEEL_XS
- GRBAR_MGS_WOOD_XS
- GRBAR_STEEL_XS
- GRBAR_WOOD_XS
- GRLT_MGS_STEEL_XS
- GRLT_MGS_WOOD_XS
- GRLT_X_XS
- GRRT_MGS_STEEL_XS
- GRRT_MGS_WOOD_XS
- GRRT_X_XS

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 **OHDOT_Symbols.cel** to ensure that you have the latest version of the cell library containing the cells listed above.



OpenRoads Software Version

This document was prepared using the following software version:

OpenRoads Designer CONNECT Edition – 2019 Release 1 Update 7 – Version 10.07.00.56

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
