Module 10

Intermediate Corridor Modeling

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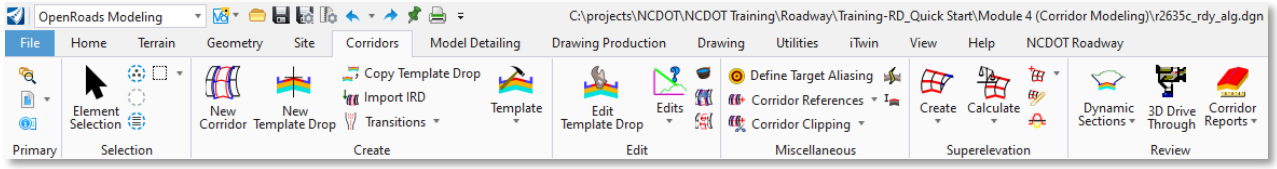
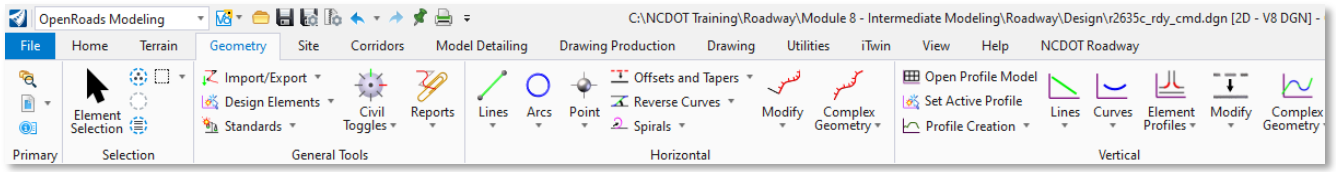
Overview

The intent of Intermediate Corridor Modeling is to take a basic model/corridor and further develop it by adding turn lanes, pavement tapers, and non-typical end conditions. The concept of design intent will also be introduced and applied where applicable. In addition to the Corridors Ribbon and the Corridor Objects Dialog, the Geometry Ribbon will also play a major role throughout the Intermediate Corridor Modeling module. During the exercise, various template point overrides will be introduced and applied to override the template point defaults. These overrides will result in the corridor's manipulation.

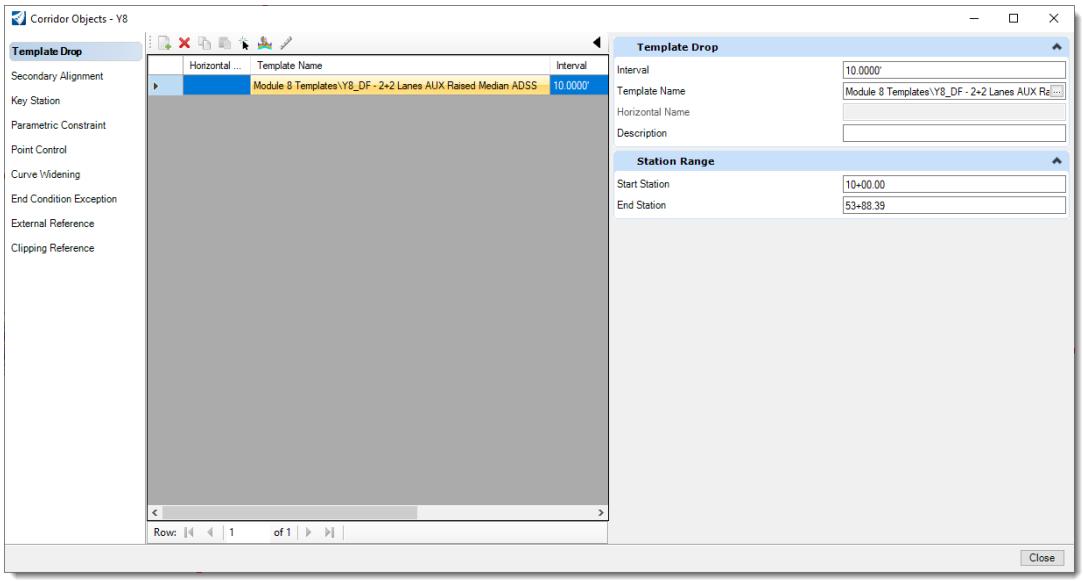
Corridors Ribbon



Geometry Ribbon



Corridor Objects Dialog



Key Concepts, Tools and Terminology

Design Intent
Design Intent is the act of preserving rules and relationships established during the design process in order to realize downstream benefits of automatic updates.

Template Point Constraint Overrides
The location of a template point can be overridden using the various methods shown below. This functionality allows a single template to produce a number of results.

- **Parametric Constraints** - Used to override a default template point constraint within a defined station range.

- **Horizontal Feature Constraints** - Each template point can be assigned one Horizontal Feature Constraint that can be used to override the default template point constraint. Horizontal Feature Constraints will also override **Parametric Constraints**.

- **Point Controls** - Can be applied to any point on a template. A Point Control will force the template point to follow a specific linear geometric element. Point Controls will override **Parametric Constraints** and **Horizontal Feature Constraints.**

Key Stations
A Key Station may be required when a special circumstance of the project occurs that is not coincident with the template interval, requiring additional processing by the corridor.

Feature Definition Toggle Bar
Activates and deactivates settings that impact a variety of Geometry tools.

Civil AccuDraw Toolbar
Accesses AccuDraw commands.

Intermediate Corridor Modeling Exercise

In this exercise, you will learn how to take a basic model/corridor and further develop it by adding turn lanes, pavement tapers, and non-typical end conditions. You will also be introduced to the concept of Design Intent. Design Intent is the act of preserving the rules and relationships used during the design process in order to maximize the downstream benefits of automatic updates. Throughout this exercise, you will be working with NCDOT 2D dgn files exclusively. All design and corridor manipulation will be carried out within a 2-dimensional design plane.

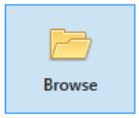
1. **Launch OpenRoads Designer CONNECT Edition**

   Double-click on the NCDOT Roadway OpenRoads icon on your desktop to launch OpenRoads Designer into the NCDOT Roadway workspace.

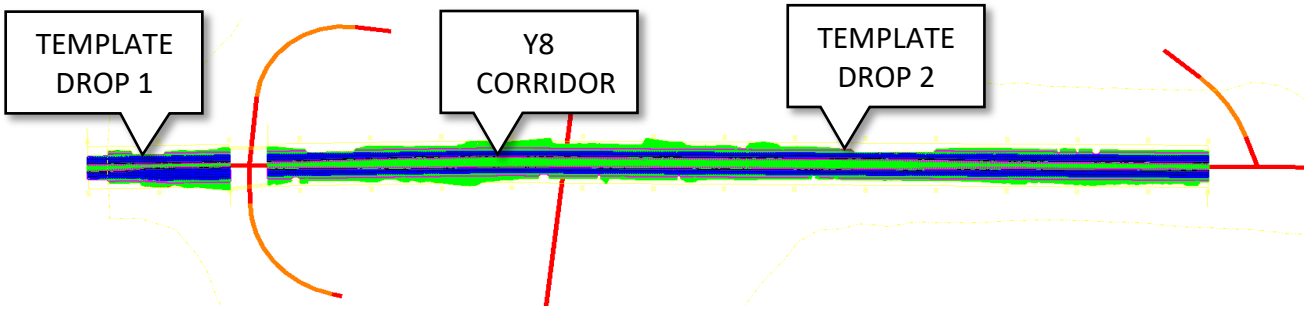
2. **Set the Workspace and Workset**

   Select **DOT-US North Carolina** from the Workspace menu.
   Select **NCDOT R-2635C (Training)** from the Workset menu.

3. **Open the Y8 Corridor (CMD) dgn file and zoom in closely to the Y8 Corridor**

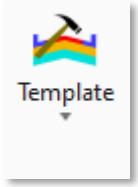


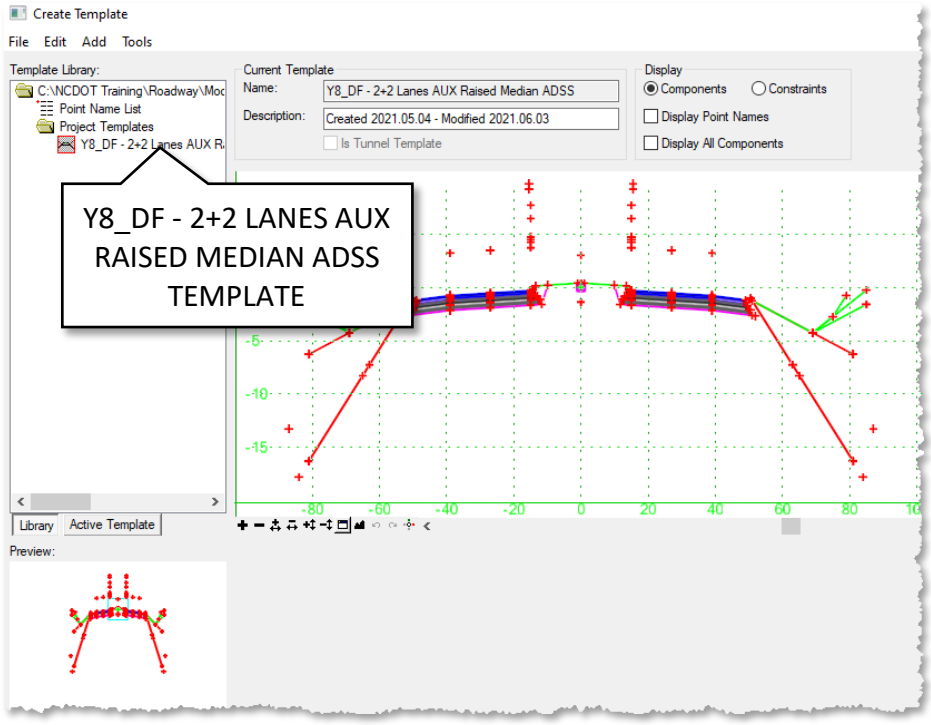
   A. Click the browse button and path to the **Module 10 (Intermediate Corridor Modeling)** folder and open the ***R-2635C-RDY-CMD-Y8.dgn*** file.
   B. Zoom in near the **Y8** alignment as shown below. Notice that the Y8 alignment already has a base corridor. This base Y8 corridor will serve as a starting point for the Intermediate Corridor Modeling exercise. See the Initial Corridor Modeling Module for detailed instructions for initial corridor development



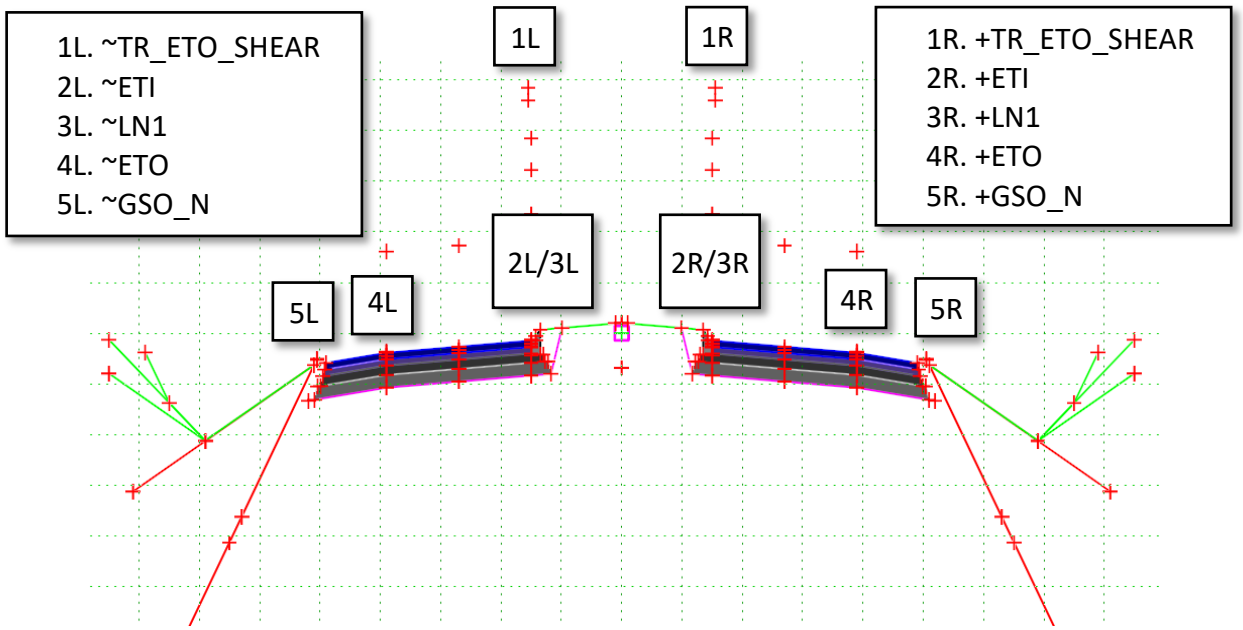
Note: All reference files that are required for the intermediate Corridor Modeling module have already been attached to the R-2635C-RDY-CMD-Y8.dgn file.

4. **Review the Y8 Corridor Template**
   A. Click the Create Template button **(Corridors > Create > Template > Create Template)**
   B. Under the **Project Templates** folder, select the **Y8_DF - 2+2 Lanes AUX Raised Median ADSS** template as shown below.





   C. Notice a few of the key Y8_DF - 2+2 Lanes AUX Raised Median ADSS template points as shown below. Each of these will be used throughout the Intermediate Corridor Modeling exercise.



D. Examine a brief description of each of these key template points below. The following Parametric and Horizonal Feature Constraints associated with these points will be used throughout the Intermediate Corridor Modeling exercise.

1. **+/~TR_ETO_SHEAR = Target Edge of Travel Outside Shear Null Point**
   - Parametric Constraint = PV_Shear_Outside RT/LT
   - Horizontal Feature Constraint = CCE_Target_Shear_Out_RT/LT

2. **+/~ETI = Edge of Travel Inside Template Point**
   - Parametric Constraint = LN_AUX Inside Width RT/LT
   - Parametric Constraint = LN_AUX Inside Slope RT/LT
   - Horizontal Feature Constraint = CCE_Target_EOT_In_RT/LT

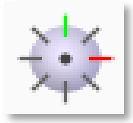
3. **+/~LN1 = Lane 1 Template Point**
   - Parametric Constraint = MD_Tie Offset

4. **+/~ETO = Edge of Travel Outside Template Point**
   - Parametric Constraint = LN_AUX Outside Width RT/LT
   - Parametric Constraint = LN_AUX Outside Slope RT/LT
   - Horizontal Feature Constraint = CCE_Target_EOT_Out_RT/LT

5. **+/~GSO_N – Grass Shoulder Outside Normal Template Point**
   - Parametric Constraint = SHO_Width Normal
   - Horizontal Feature Constraint = CCE_Target_GS

E. Close out of the **Create Template** dialog.

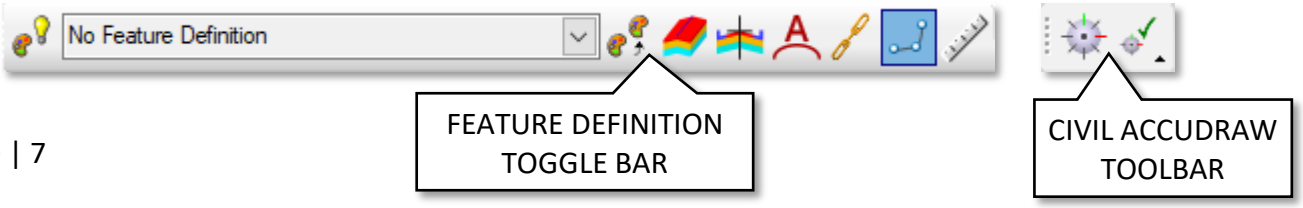
5. Load Civil AccuDraw and the Feature Definition Toggle Bar



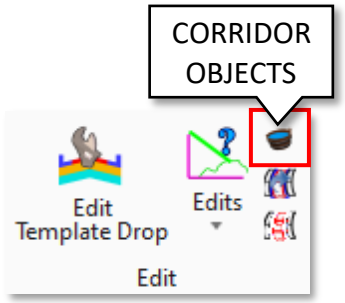
A. Click on the Civil AccuDraw button **(Geometry > General Tools > Civil Toggles > Civil AccuDraw)** to load the **Civil AccuDraw** toolbar.

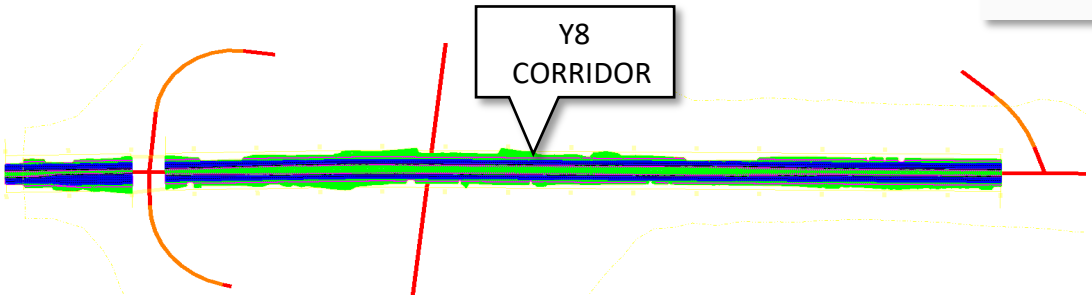
B. Click on the Feature Definition Toggle Bar button **(Geometry > General Tools > Standards > Feature Definition Toggle Bar)** to load the **Feature Definition Toggle Bar**.

Hint: Both of these toolbars will be used throughout the design/modeling process. Because of this, it's recommended that both are docked for easy access.

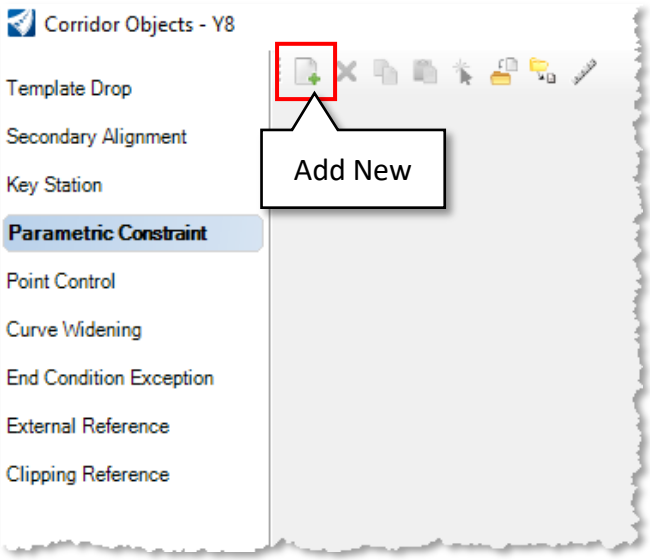


6. **Widen the Y8 Corridor median from 30’ to 46’ using a Parametric Constraint**
   A. Click the **Corridor Objects** button **(Corridors > Edit > Corridor Objects)** and select the **Y8** Corridor as shown below when prompted to load the **Corridor Objects** dialog.

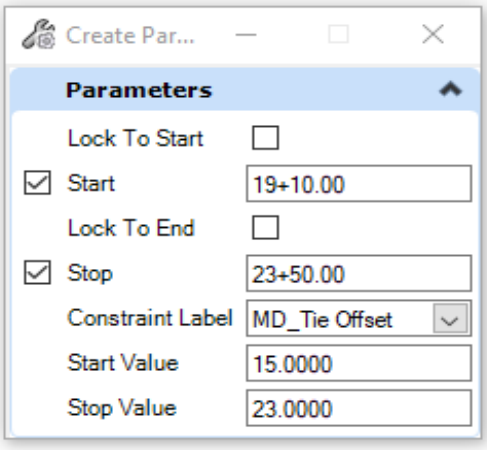




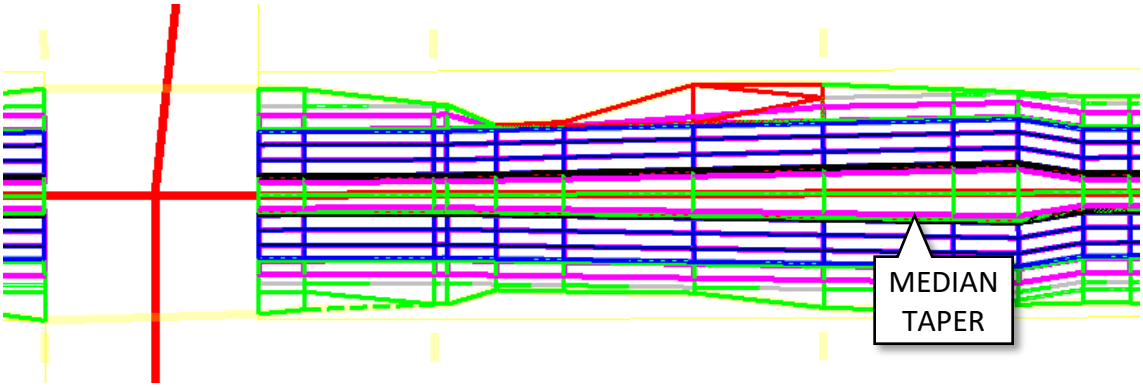
   B. From the **Parametric Constraints** row, click the **Add New** button as shown below.



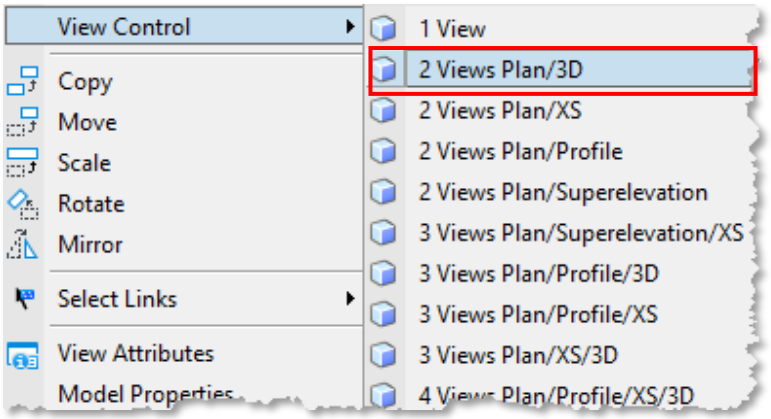
   C. Key the following parameters into the **Create Parametric Constraint** dialog.
   - **Start** = **19+10.00**
   - **End** = **23+50.00**
   - **Constraint Label** = **MD_Tie Offset**
   - **Start Value** = **15.0000**
   - **Stop Value** = **23.0000**



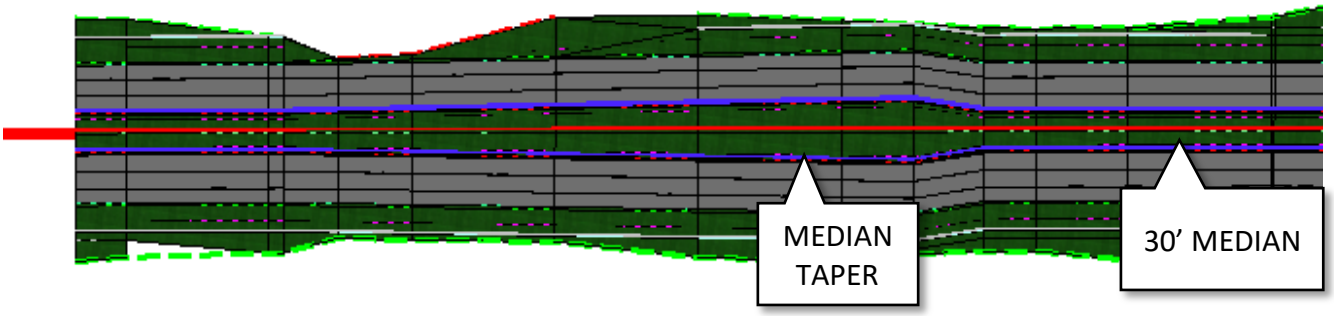
D. This will add a median taper and be the first of two (2) parametric constraints necessary to widen the median to 46'.



E. To better view the changes being made to the Y8 corridor, right-click and hold to load the View Control menu. From there, select the **2 Views Plan/3D** option as shown below.

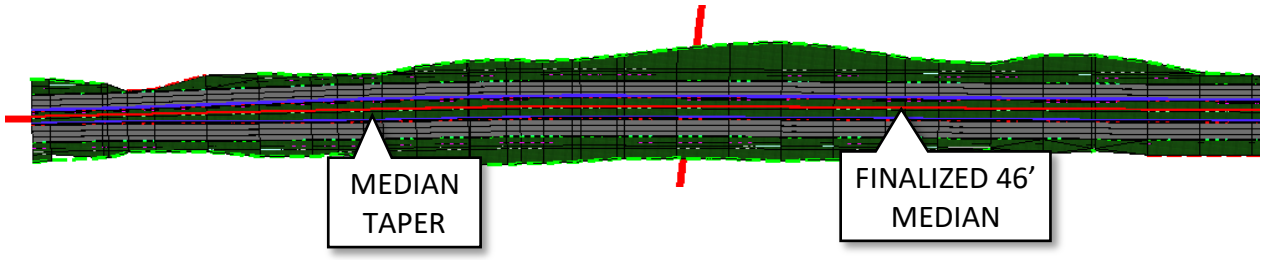


F. This will load the **View 2, Default-3D** view in addition to the standard **View 1, Default** view as shown below. As you add parametric constraints, this view can help visualize the changes being made to the Y8 corridor.



G. Now, add the following parametric constraint to finish widening the Y8 corridor median to 46’
- **Start** = **23+50.00**
- **End** = **Lock to End**
- **Constraint Label** = **MD_Tie Offset**
- **Start Value** = **23.0000**
- **Stop Value** = **23.0000**

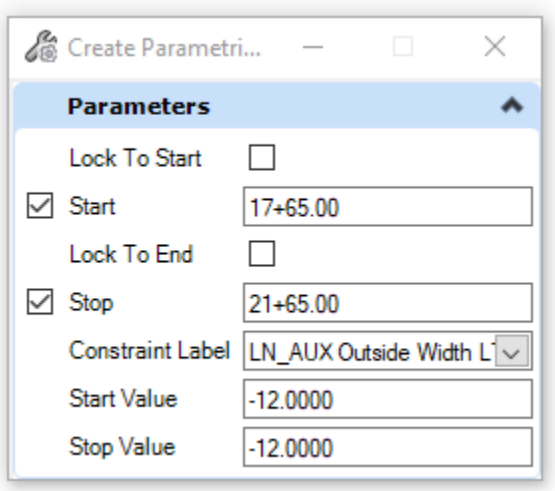
H. The **46’** median has been finalized as shown below. Keep the Corridor Objects dialog open.



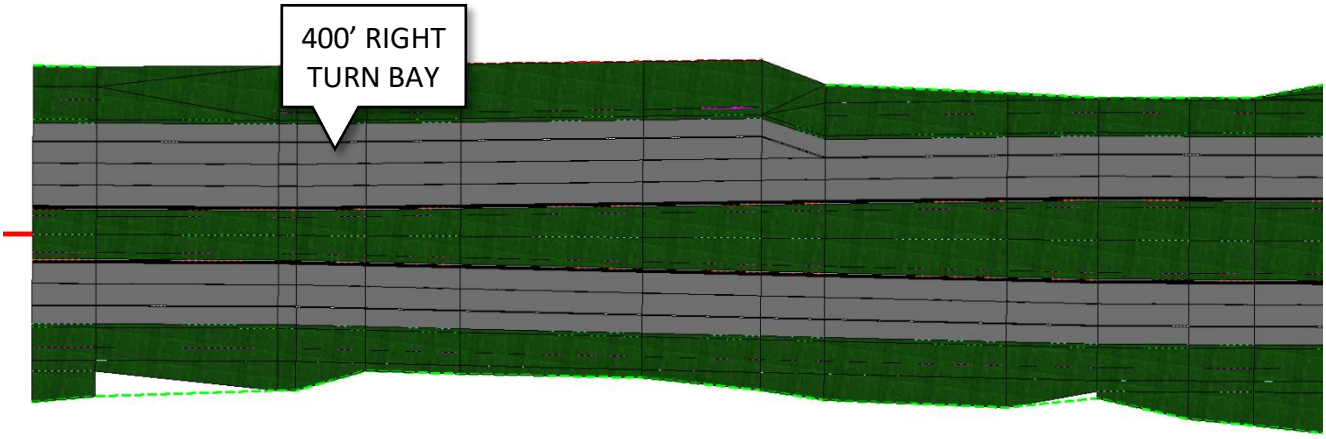
7. Add a right turn and bay taper using a Parametric Constraint

A. Add the following Parametric Constraint using the Corridor Objects dialog. This will add a 12’ turn lane on the outer left side of the corridor.

- **Start** = **17+65.00**
- **End** = **21+65.00**
- **Constraint Label** = **LN_AUX Outside Width LT**
- **Start Value** = **-12.0000**
- **Stop Value** = **-12.0000**

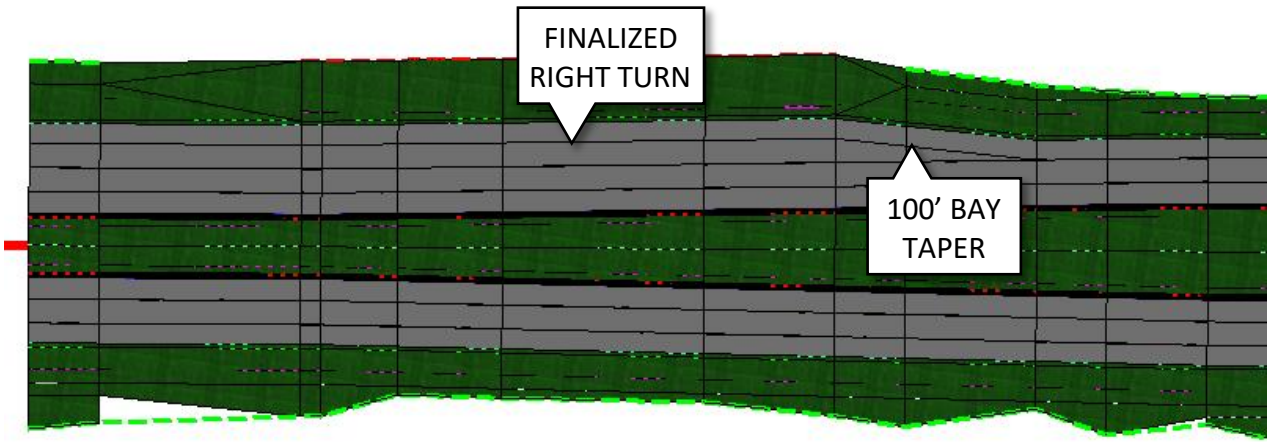


B. Notice the right turn bay has been added to the corridor as shown below.

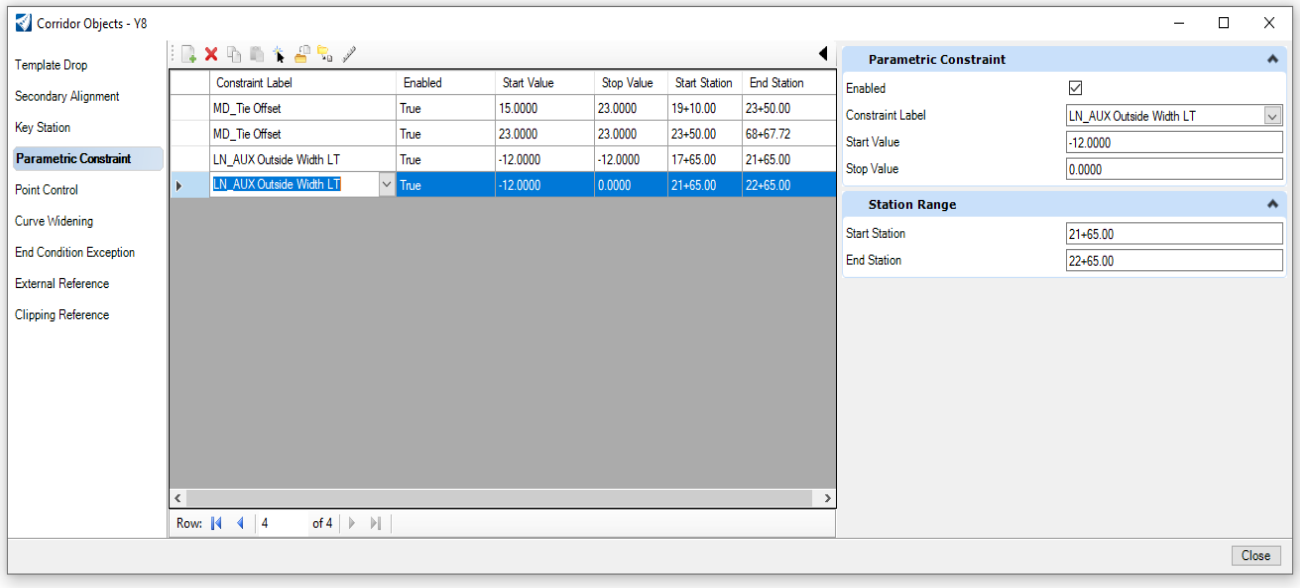


C. To finalize the the right turn, add a bay taper using the following Parametric Constraint.
- **Start** = **21+65.00**
- **End** = **22+65.00**
- **Constraint Label** = **LN_AUX Outside Width LT**
- **Start Value** = **-12.0000**
- **Stop Value** = **0.0000**

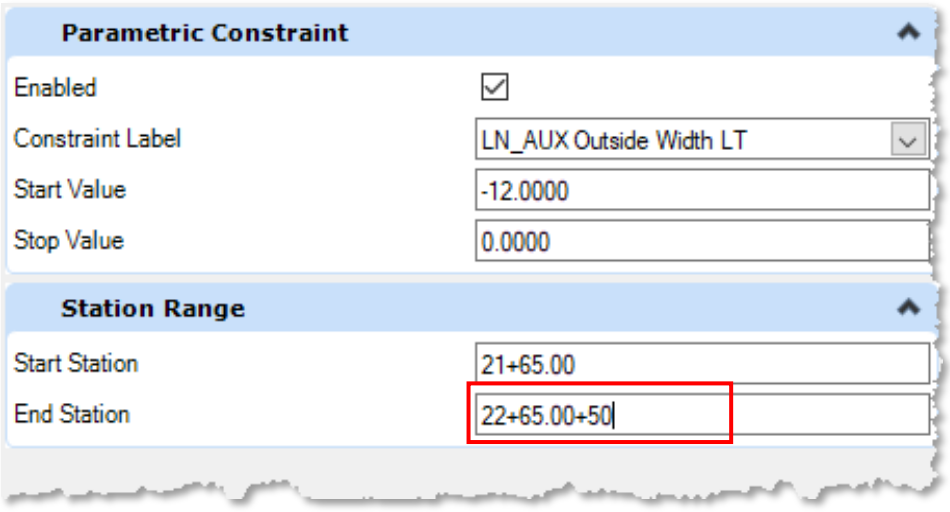
D. The bay taper has been added and the right turn has been finalized. See below.



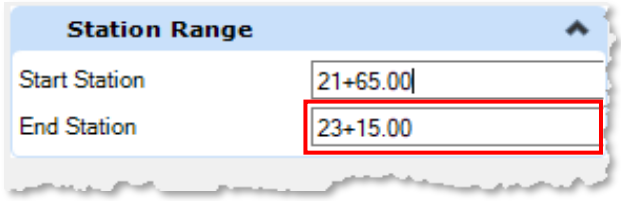
E. Notice that each of the previous parametric constraints are now listed within the Y8 Corridor Objects dialog as shown below. At any time, these values can quickly be changed to reflect changes to the design.

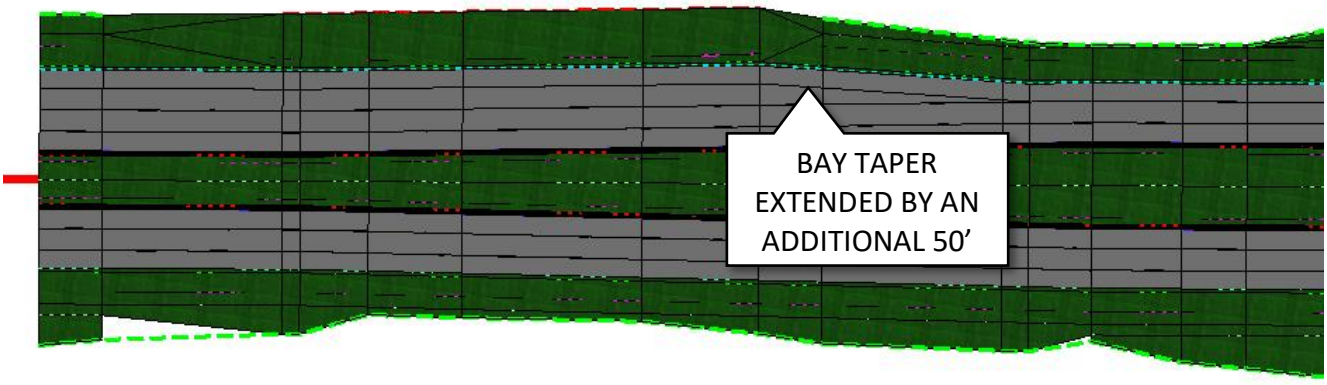


F. Modify bay taper length by keying in **+50** to the **End Station** parameter as shown below.



G. Notice that the **End Station** parameter now reads as **23+15.00,** adding an additional 50’ to the end station. This additional 50’ is also reflected in the corridor as shown below.

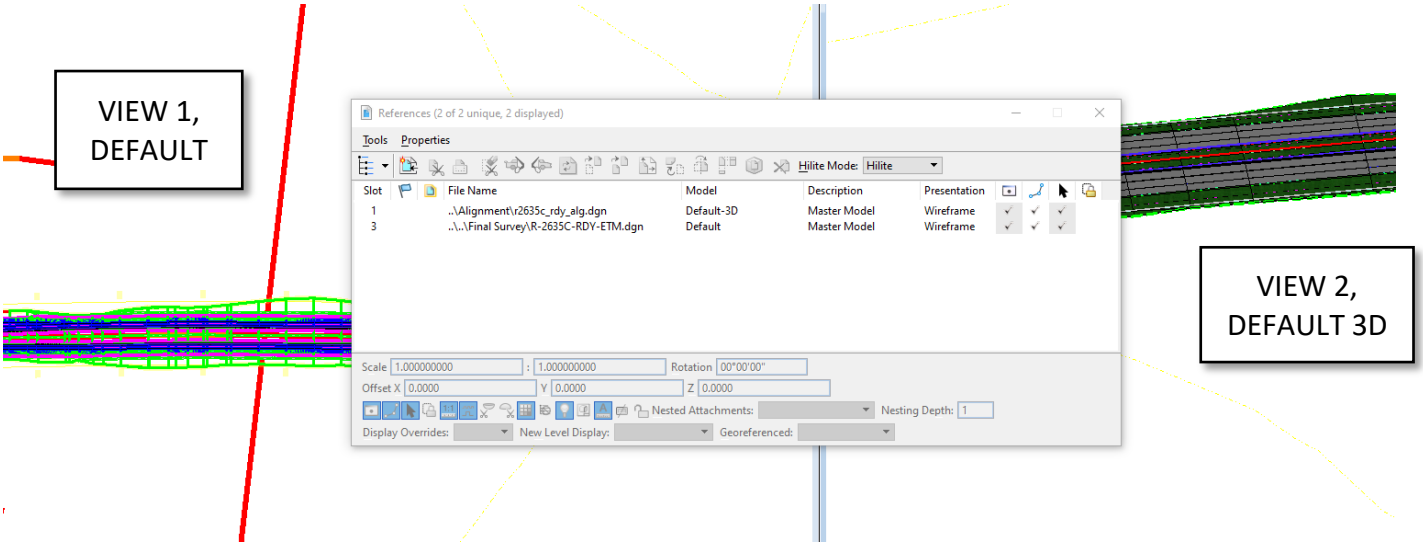




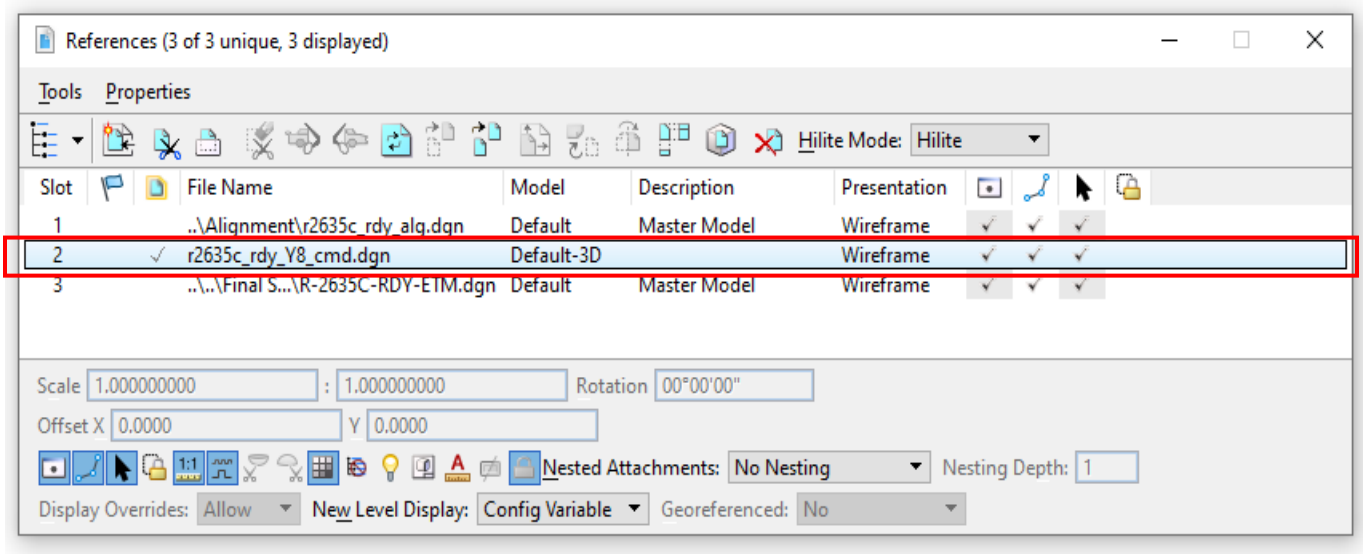
H. Close out of the **Corridor Objects** dialog.

8. Add a left turn and bay taper using a Horizontal Feature Constraint

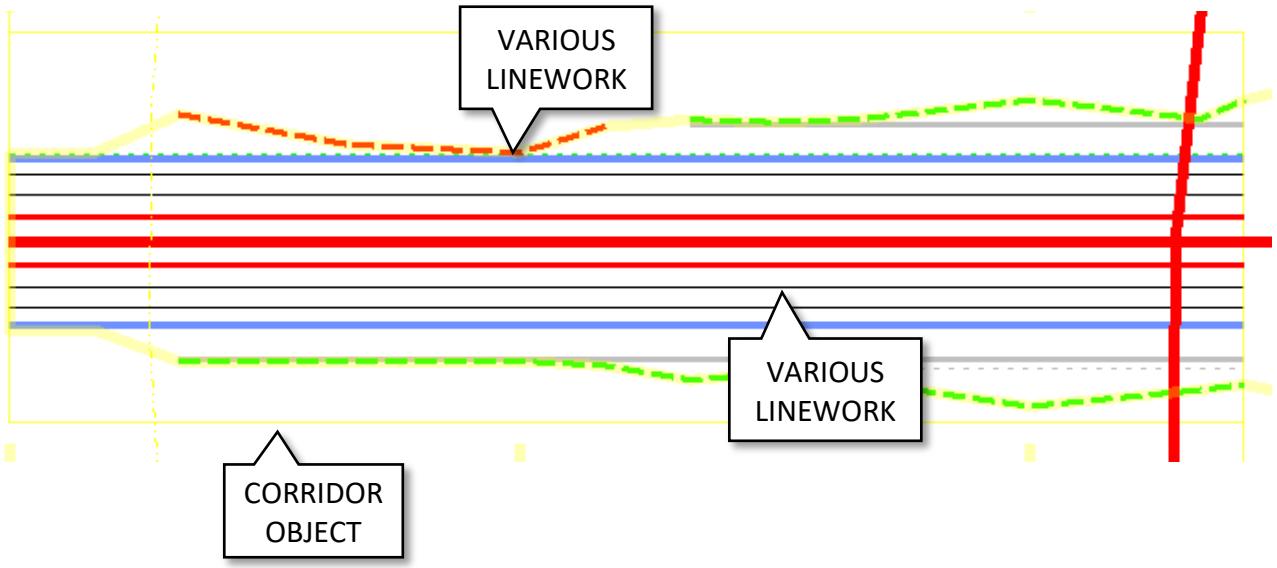
A. With both 2D and 3D views displayed, load the References dialog as shown below.



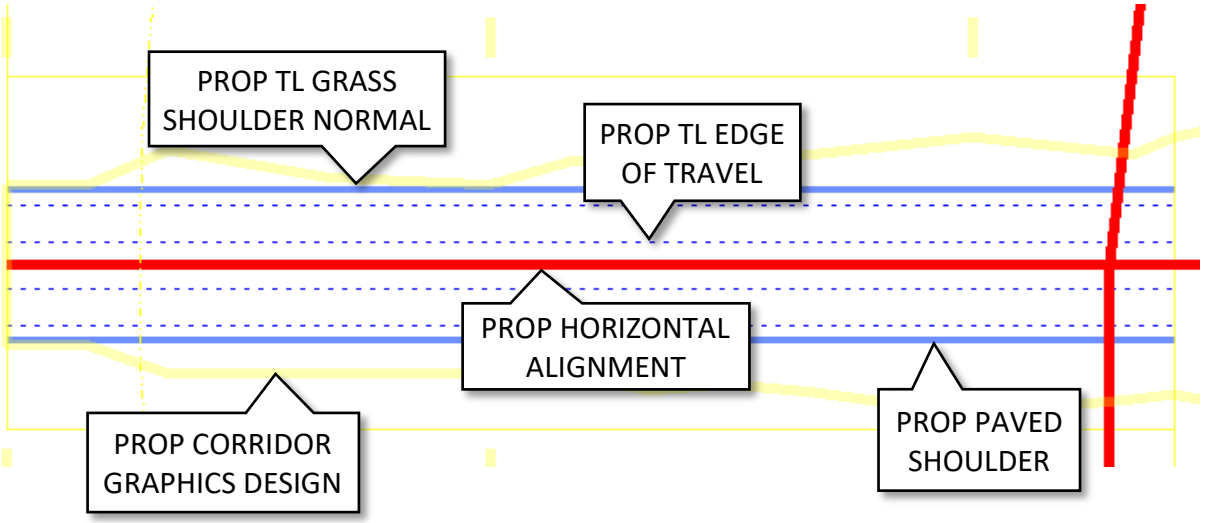
B. Now, click back and forth between the two (2) views. Notice that the **Refences** dialog switches to display the files attached the current view in focus. With the **View 1, Default** view in focus, turn the display of the **Default-3D** view off as shown below.



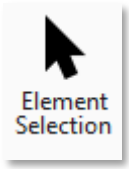
C. Notice that the 3D model has been turned off, leaving just the linework and the corridor object as shown below.

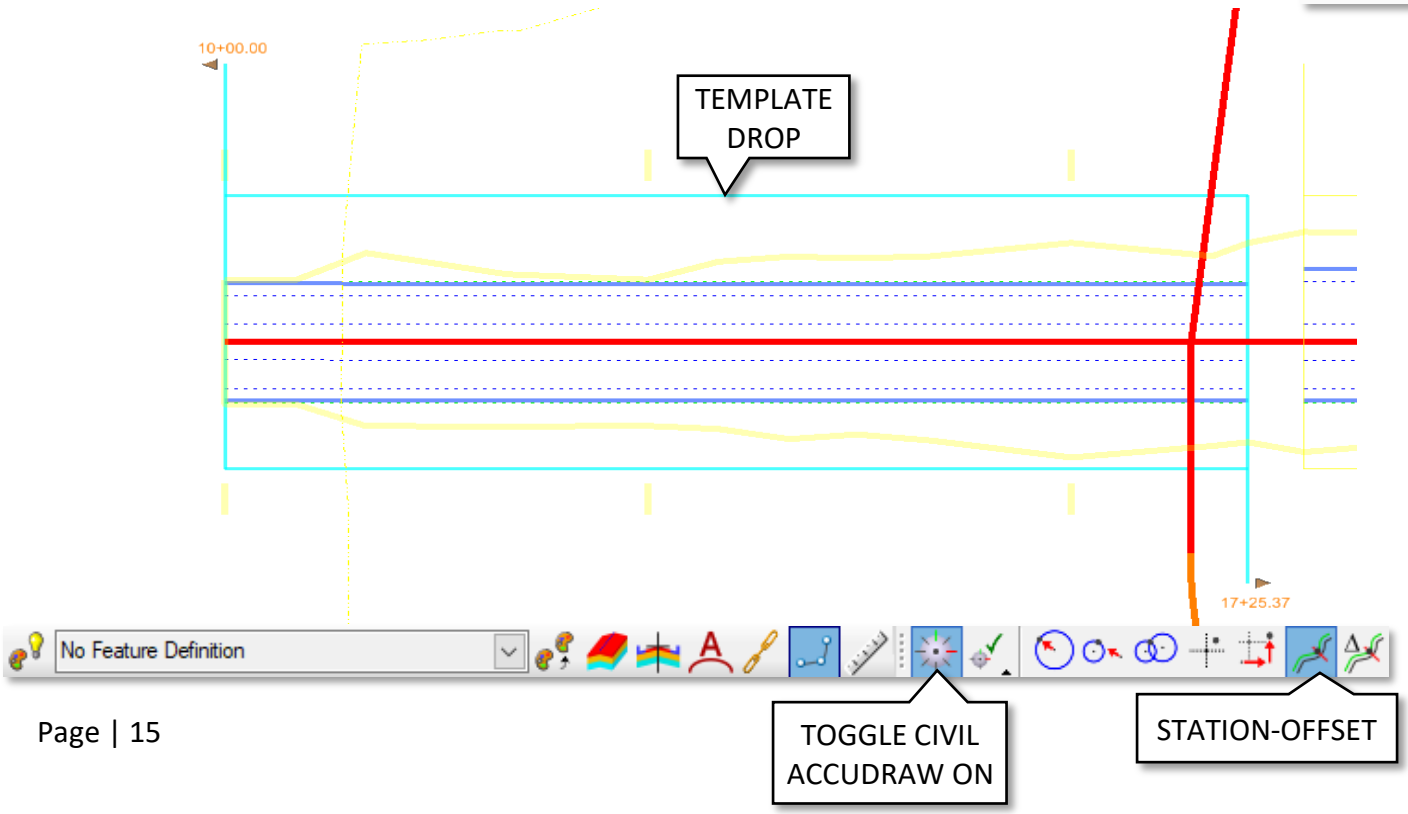


D. Depending on your prefence, you may choose to turn off additional linear elements to avoid confusion as shown below. The levels displayed below are necessary for design/modeling and should remain on as you design/model.

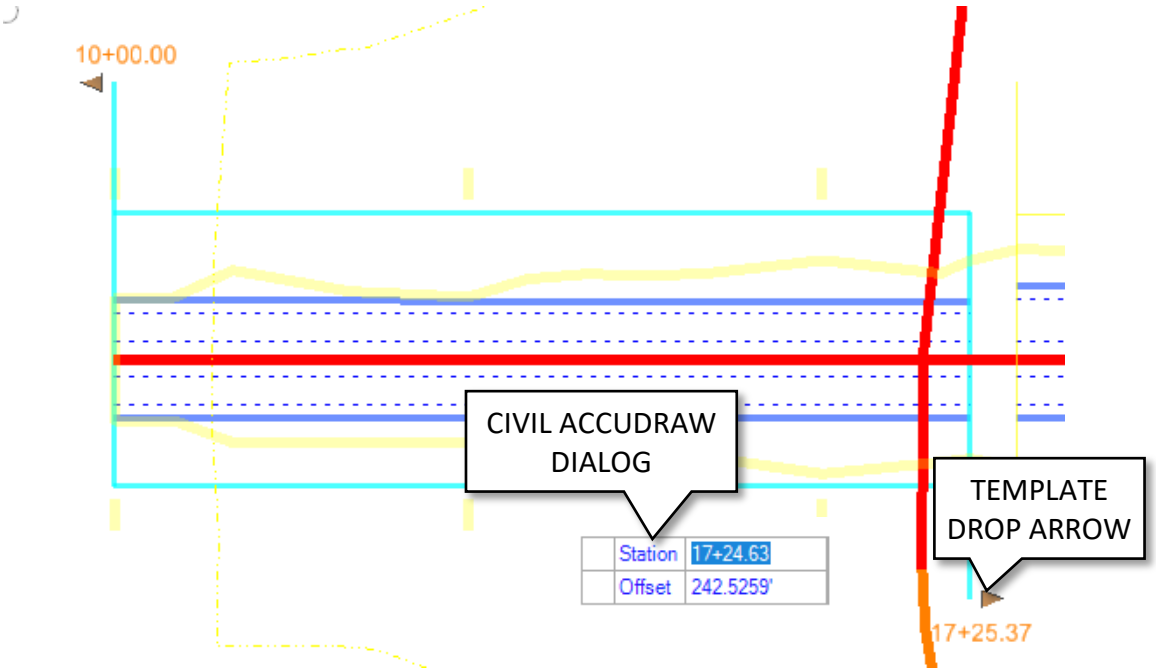


E. Next, click the **Toggle Civil AccuDraw** button **ON**, set **Station-Offset** as the active Read-Out, and select the first template drop that begins at station **10+00.00** using the **Element Selection** tool as shown below.

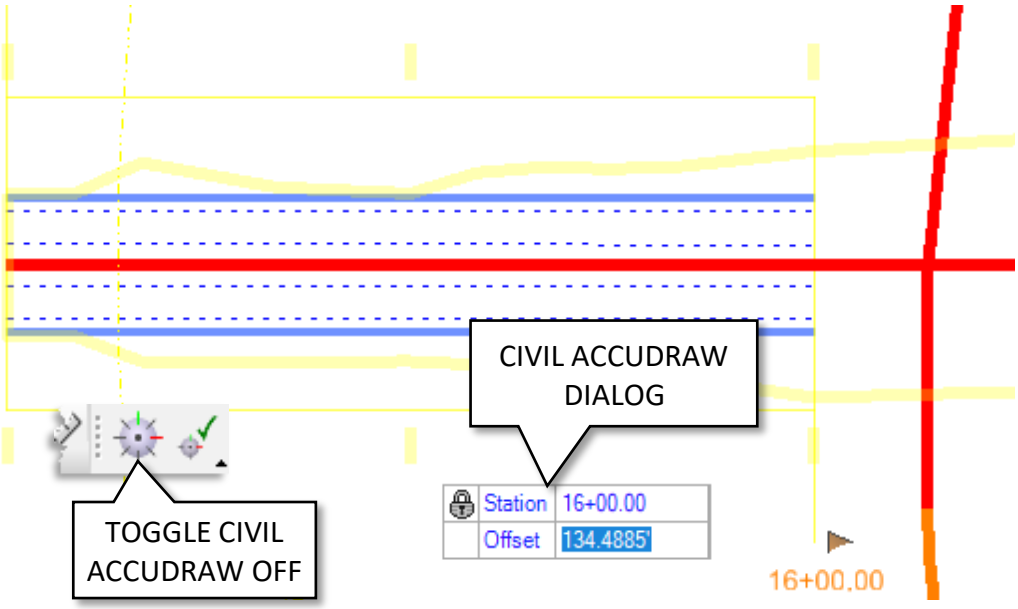




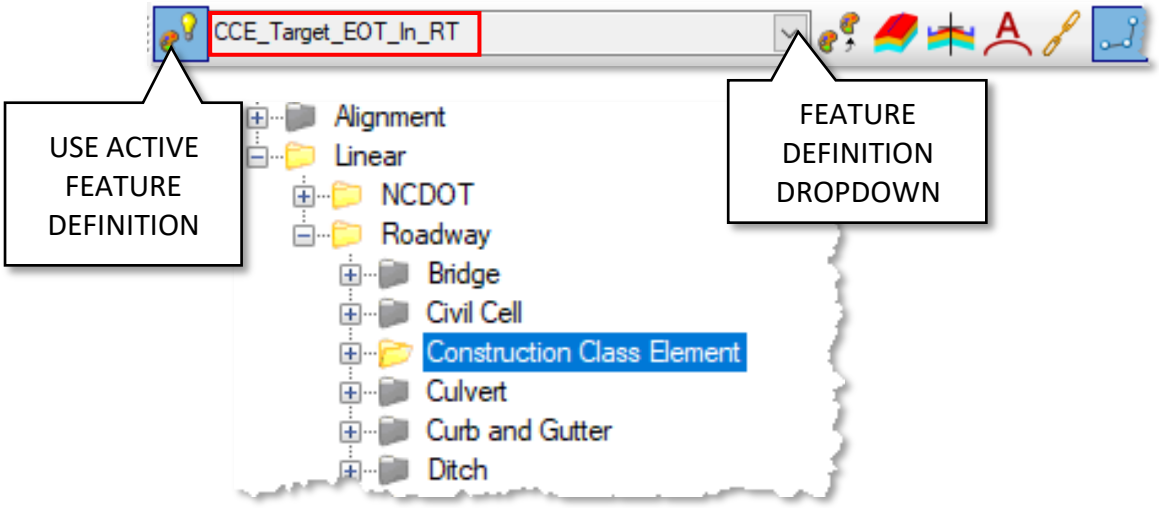
F. Now, click on the trailing template drop arrow shown below and drag the template back and forth. Notice the **Civil AccuDraw** dialog displaying the station/offset data as it tracks your movement.



G. Key station **16+00.00** into the Civil Accudraw dialog and press Enter. Notice that the corridor and all linework associated with it now end at station **16+00.00** as shown below. Then toggle **Civil Accudraw** to **OFF**.

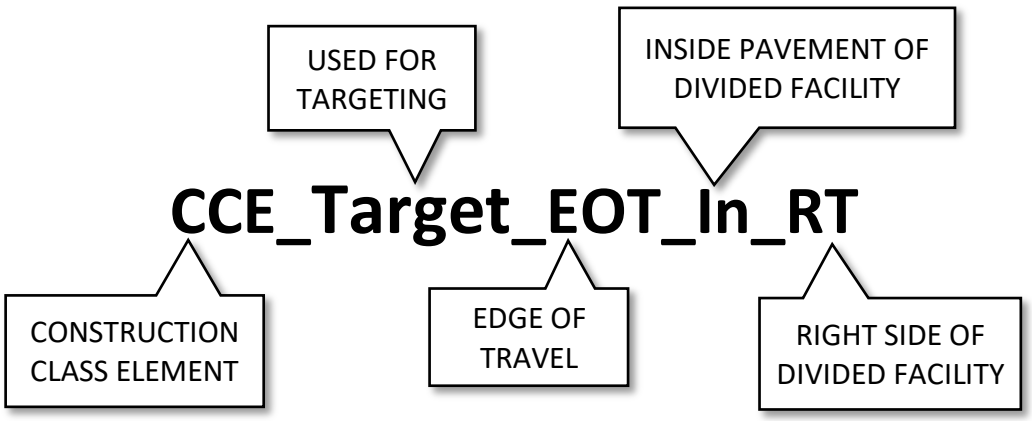


H. From the **Feature Definition Toggle Bar**, toggle on the **Use Active Feature Definition** button and then select the **CCE_Target_EOT_In_RT** feature from the **(Linear > Roadway > Construction Class Element)** folder as shown below.



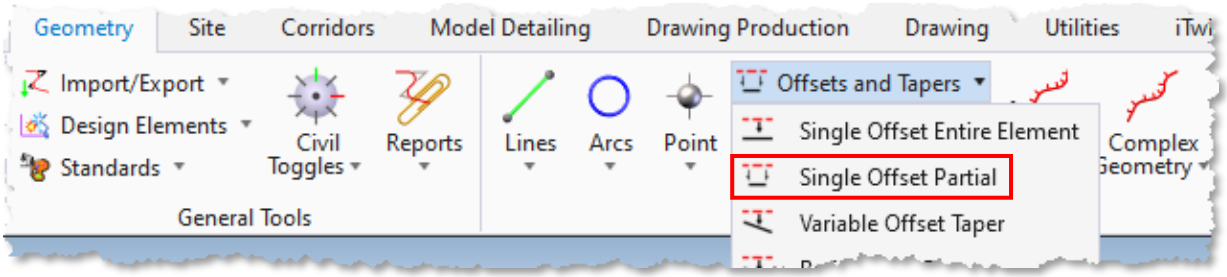
Note: Horizontal features used for targeting are stored within the **Construction Class Element** folder.

I. Notice the **CCE_Target_EOT_In_RT** feature naming convention as shown below.

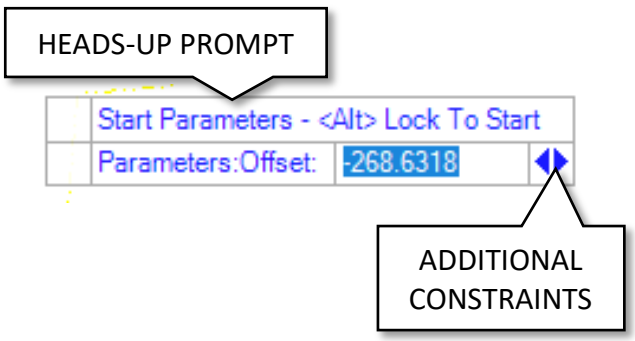


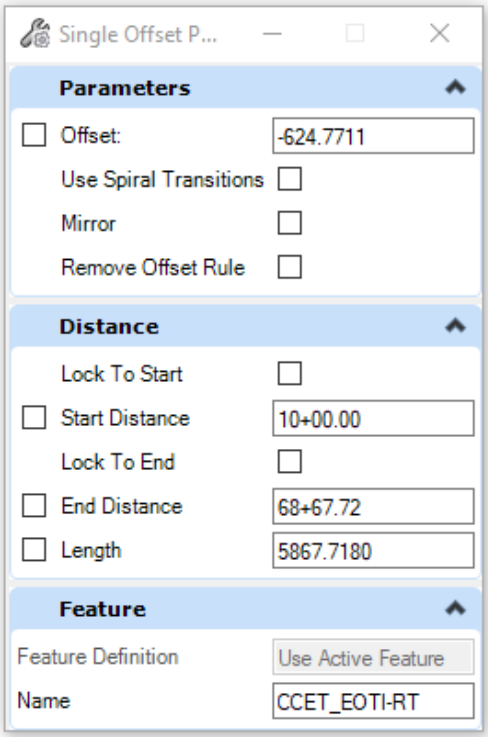
Note:
Construction Class Elements are a type of feature commonly used for corridor manipulation but not considered part of the actual model.

J. From the Geometry tab, select the **Single Offset Partial** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Partial)** and then select the **Y8** alignment when prompted to locate element.

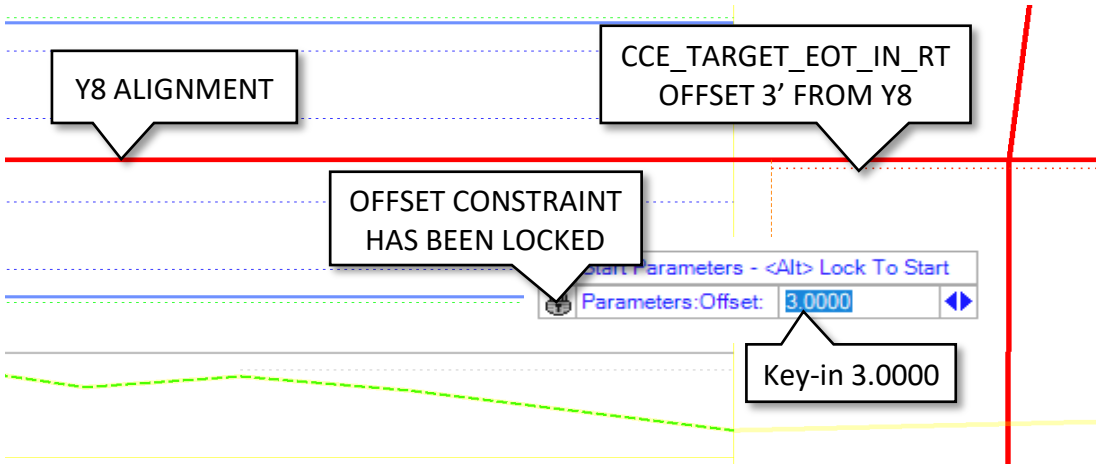


K. After selecting the Y8 Alignment, the heads-up prompt displays and tracks your movements. Notice the two (2) arrows that are included within the prompt. These arrows represent additional constraints. To toggle back and forth between these constraints, simply click the arrow keys on your keyboard. In addition to the heads-up prompt, a **Single Offset Partial** dialog box also loads. As you toggle back and forth between the constraints, notice that they match the **Single Offset Partial** dialog constraints. A combination of prompts and dialog boxes similar to the ones shown below will be used throughout the design/modeling process.

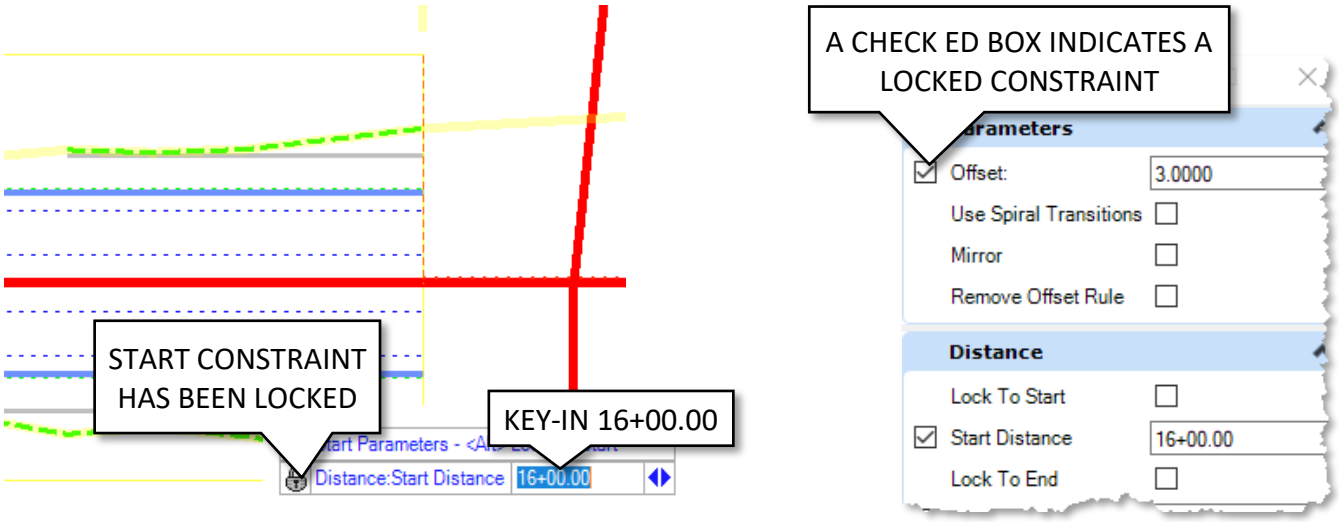




L. With the **Parameters Offset** prompt toggled on, key-in **3.0000** and press Enter. Notice the Lock that displays after you press Enter as shown below. This indicates that the offset parameter has been locked. As you move your mouse back and forth, notice the red dotted line tracks with your movements but the offset remains at **3'**. If you move your mouse to the left side of the alignment, notice that the red line also moves and the offset now reads as **-3'**. The red dotted line represents the **CCE_Target_EOT_In_RT** that was previously set as the active feature.

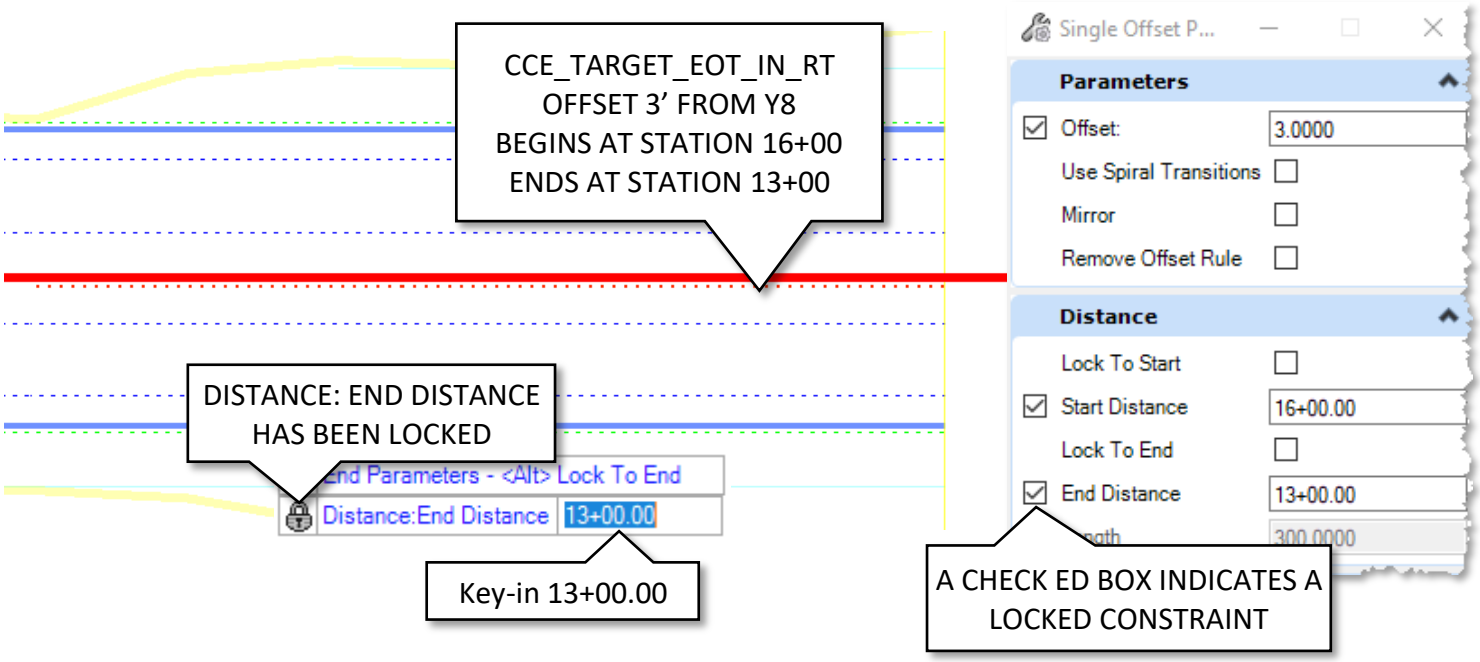


M. Next, toggle to the **Distance: Start Distance** parameter using your keyboard's arrow key, then key in **16+00.00** and click "Enter" to lock the **Start Station** as shown below. Notice that these same **Single Offset Partial** dialog parameters have also been locked. The "End" key can be used to unlock any of the parameters that have focus if needed.

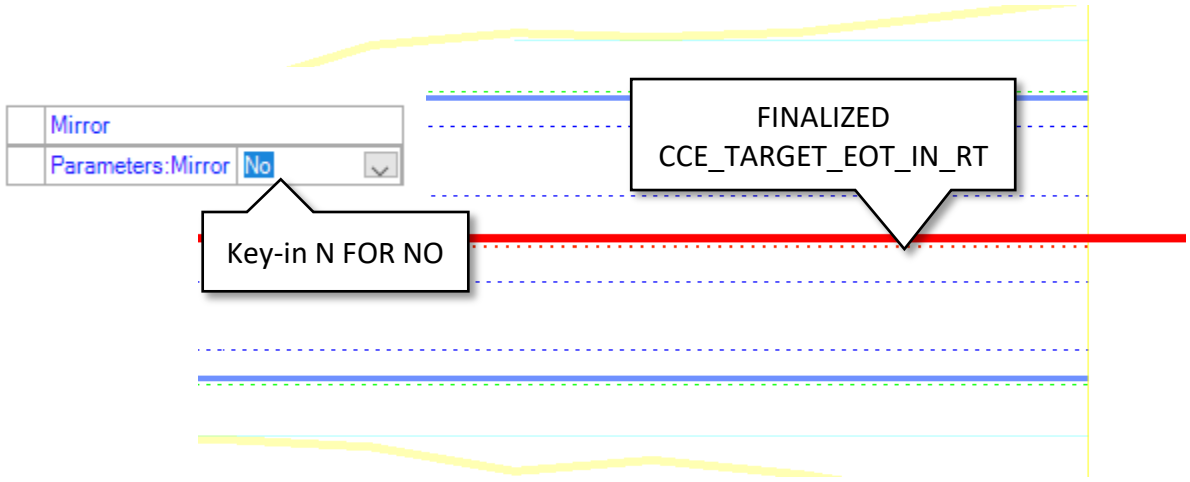


Hints: Either of these can be unlocked or modified using the dialog box as well.

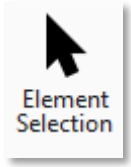
N. After both **Single Partial Offset** start constraints have been locked, left click the screen to accept. You will then be prompted for a stop location. There are two (2) **Stop Constraint** options to choose from: **Length** or **Station**. Using your keyboard arrow keys, toggle back and forth between the two. In this instance, choose the **Distance:End Distance (Station)** constraint. **Key-in** station **13+00.00** and press Enter to lock as shown below.

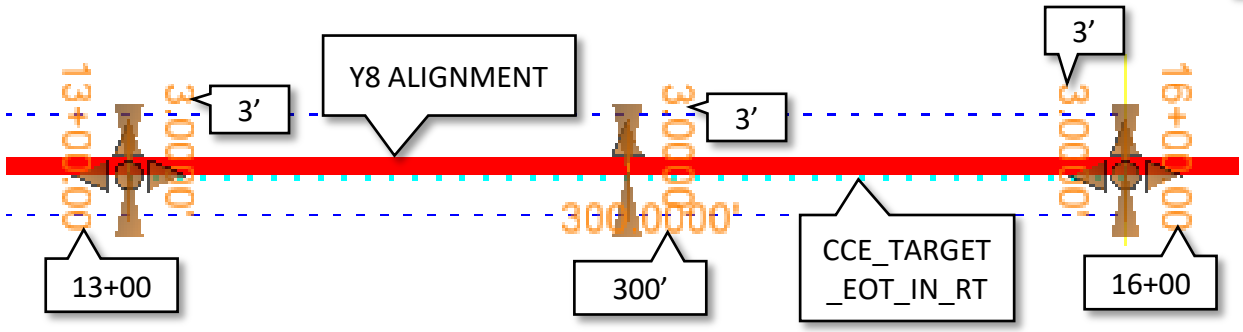


O. Next, **left-click** the screen to accept the **Distance:End Distance** constraint. This will place the **CCE_Target_EOT_In_RT** linear element and finalize the left turn lane edge of pavement **Construction Class Element** placement. Immediately after placing this line, you will be asked by the prompt if you would like to **Mirror**. In this instance, key-in **N** for no, finishing the **Single Offset Partial** command.

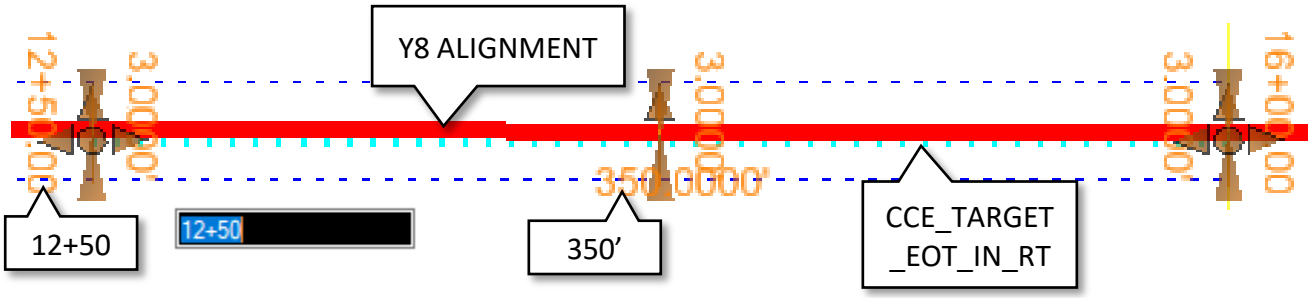


P. Zoom in close to the **CCE_Target_EOT_In_RT** line that was just placed and click on it using the Element Selection tool. Notice the on-screen constraints displaying stationing, offset, and length in relation to the Y8 Alignment as shown below. Each of these constraints indicate a rule and can be edited on screen by simply clicking and editing the text.

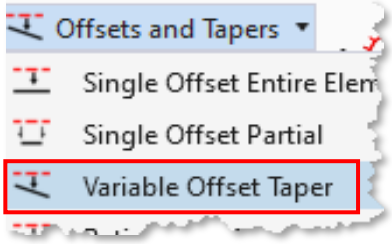




Q. Click on the begin station text that reads **13+00.00** and change it to read **12+50.00**. Notice that the **CCE_Target_EOT_In_RT** has been extended by an additional **50'** and the length label now reads **350'** as shown below. All of these pieces of geometry are tied to one another through a rule. Because of this relationship, if one is changed, all of the others are impacted as well. This is the key to rules-based design intent.

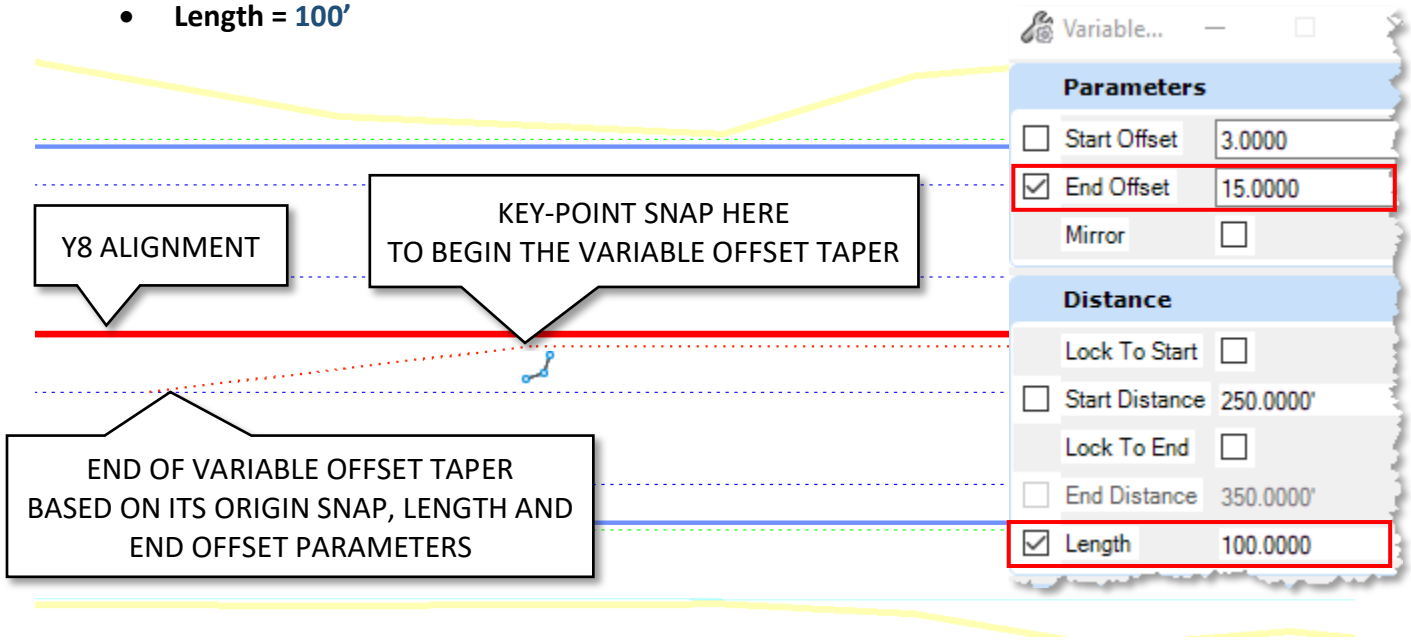


R. Next, check to make sure that the **Persist Snaps and Rule** button is toggled on as shown below and then select the **Variable Offset Taper** tool **(Geometry > Horizontal > Offsets and Tapers > Variable Offset Taper)** and again, select the **Y8** alignment when prompted to locate element.

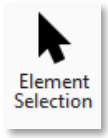


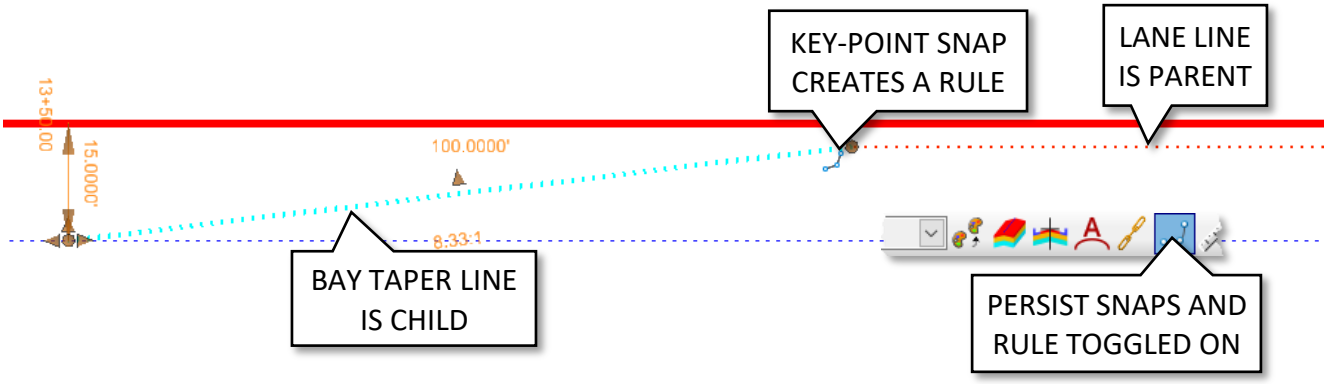
S. Now, **key-point** snap to the end of the previously drawn **CCE_Target_EOT_In_RT** element and key the following parameters into the **Variable Offset Taper** dialog. Then, left-click on the screen to accept, drawing in the left turn lane bay taper as shown below. Choose not to mirror the bay taper when finishing the **Variable Offset Taper** command.

- **End Offset** = **15.0000**
- **Length** = **100'**



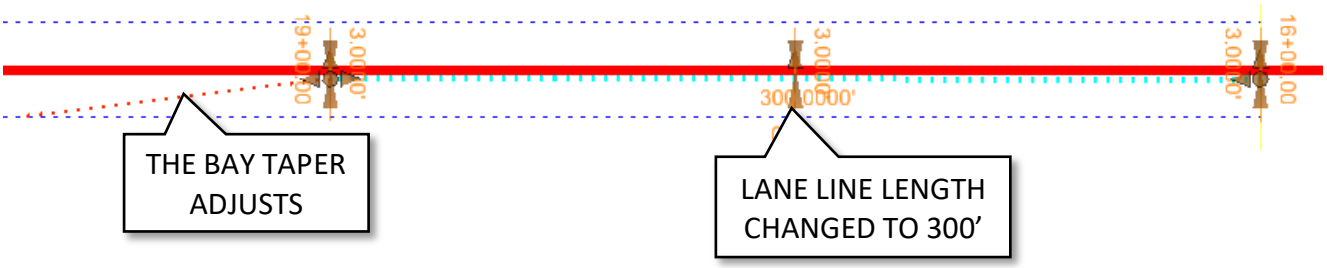
T. Next, click on the finalized bay taper as shown below and notice the various rule based constraints as well as the Key-Point Snap icon. Any time that you snap to an element while the **Persist Snaps and Rule** button is toggled, you create a rule and a relationship between the two (2) elements. This establishes a parent-child relationship. In this case, the lane line is the parent and the bay taper is the child.



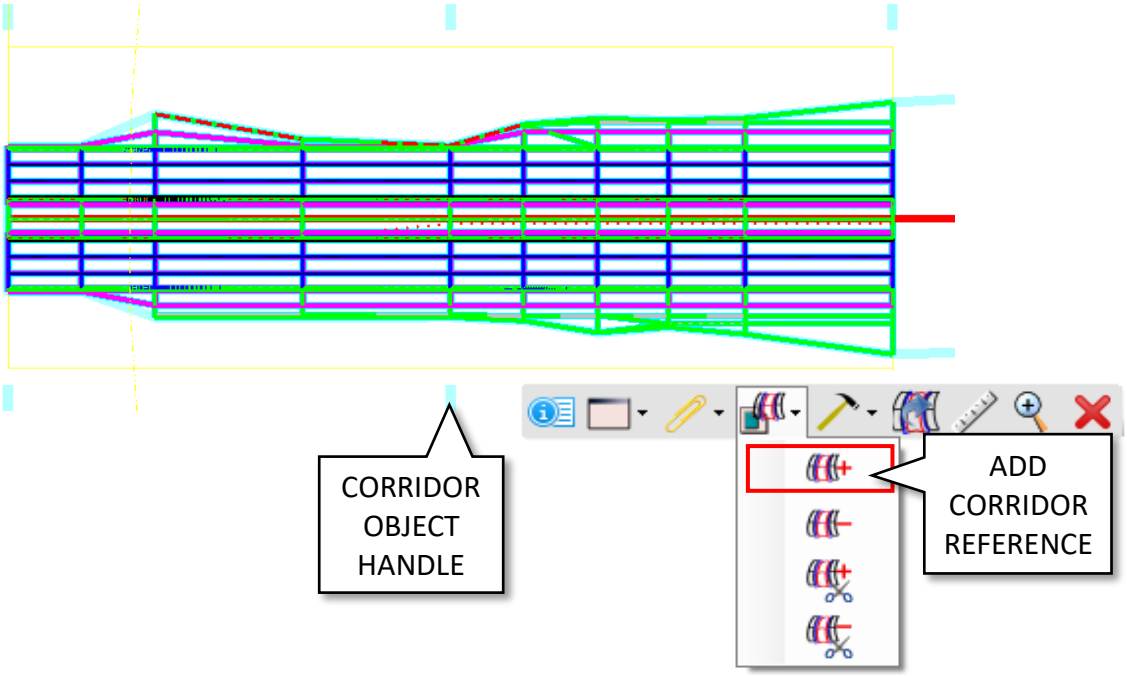


Note: In some scenarios, this parent-child relationship may be less than desirable but the need to snap may still persist. In this case, toggle off the **Persist Snaps and Rule** option.

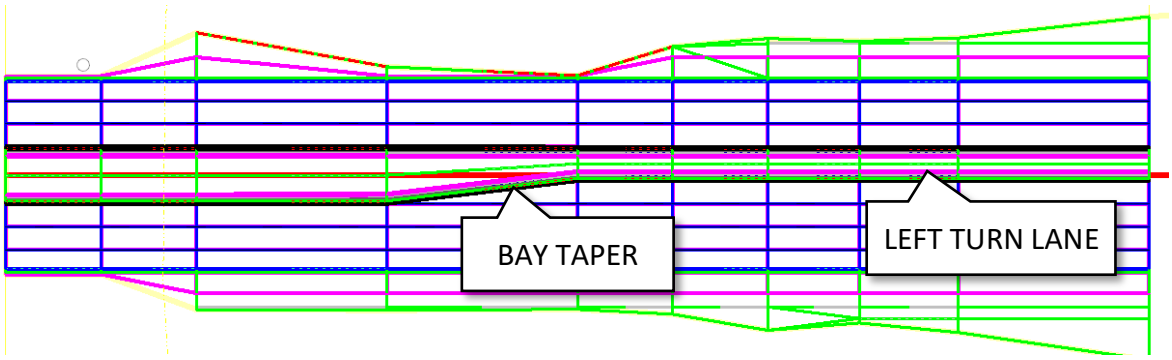
U. To demonstrate the parent-child relationship between the left turn lane and its bay taper, change the length of the left turn lane to 300’ as shown below. Notice that the bay taper is also adjusted. This is based on the rule that was established when the bay taper was snapped to the end of the lane line during its creation.



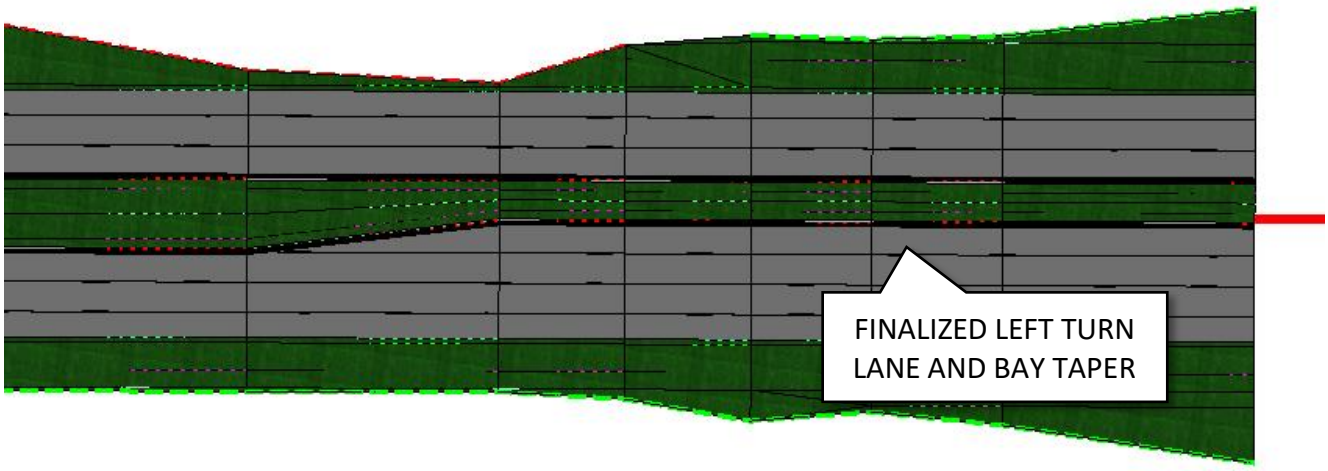
V. After adding the left turn lane and bay taper geometry, turn the Default-3D model back on using the references dialog. Notice that the corridor is not recognizing the new geometry and has not changed. To resolve this, the newly added geometry will need to be added to the corridor as a corridor reference. To add a corridor reference, click and hover over one of the corridor object handles to display the corridor menu. From the menu, select the **Add Corridor Reference** option as shown below.



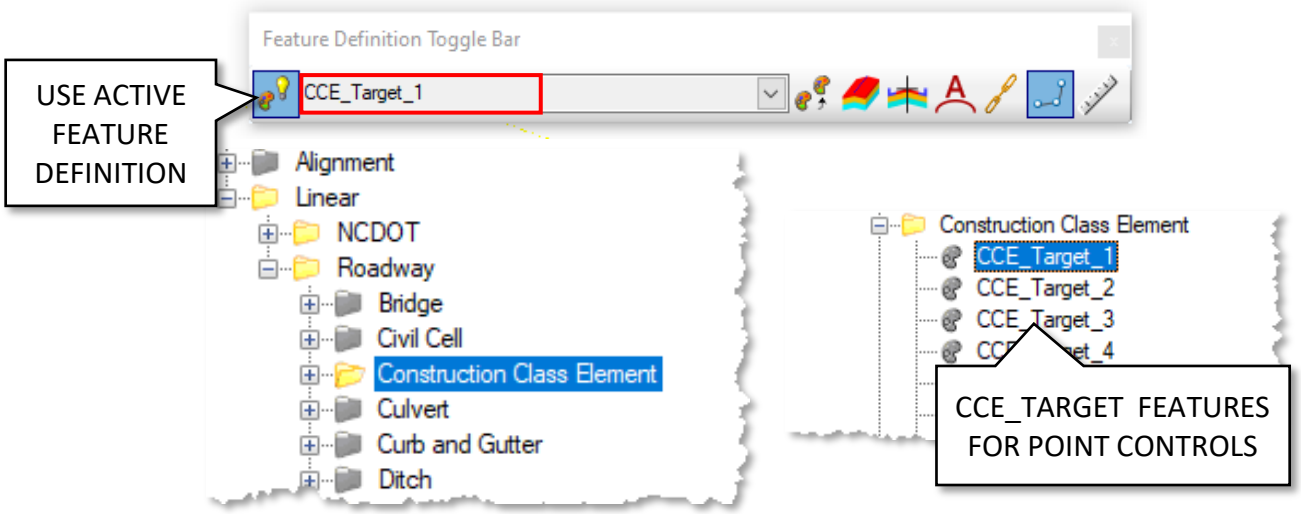
W. Next, select the two (2) new pieces of geometry and then right click to complete. Once the corridor finishes processing, it will be updated to include the left turn lane and bay taper as shown below.



X. The Left turn lane and bay taper have been added to the Y8 corridor using the **CCE_Target_EOT_In_RT** horizontal feature constraint. For a better perspective, open the **View 2, Default-3D** view as shown below.

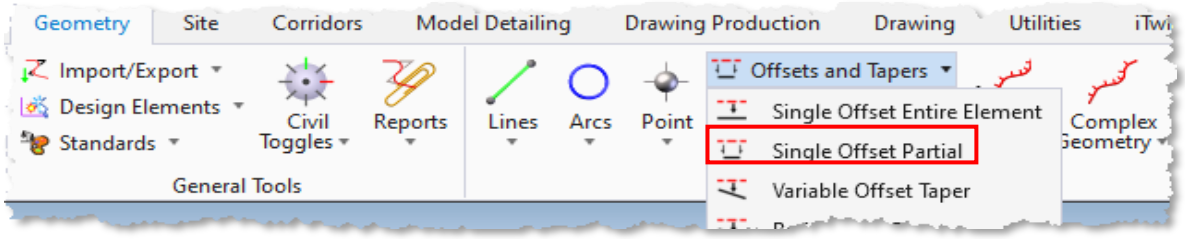


9. **Add a right turn and bay taper using a Point Control**
   A. From the **Feature Definition Toolbar**, toggle on the **Use Active Feature Definition** button and then select the **CCE_Target_1** feature from the **(Linear > Roadway > Construction Class Element)** folder. Notice the additional **CCE_Target** features as shown below.



Note: By definition, the intent of a point control is to control points. Unlike a **Horizontal Feature Constraint**, which is template based and pre-determined, a point control could be used to control any number of the points that make up a template. For this reason, the **CCE_Target** features provided by **NCDOT** are more generic in nature and a good choice for use with a point control.

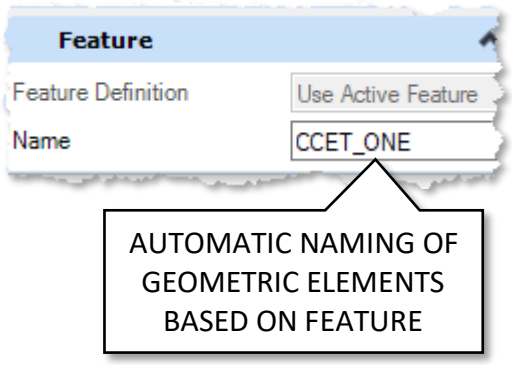
B. From the Geometry tab, select the **Single Offset Partial** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Partial)** and then select the **Y8** alignment when prompted to locate element.



Note: Construction class elements used for template targeting should be created using offsets and tapers from the corridor alignment or other non-template based elements to avoid what is known as a circular reference. Circular references cannot be targeted by the template, making them unusable.

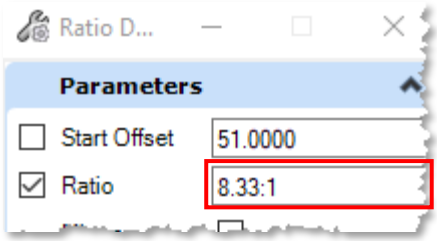
C. Key the following parameters into the Single Offset Partial dialog and then click through the prompts to accept. This will draw the outside edge of travel for the right turn lane.
   - **Offset** = **51.0000**
   - **Use Spiral Transitions** = **Unchecked**
   - **Start Distance** = **16+00.00**
   - **End Distance** = **12+00.00**

   Notice the **Name** attribute within **the Single Offset Partial** dialog as shown below. As you design using the **Open Roads Civil Tools**, civil geometry elements will be named automatically based on the **Feature**.

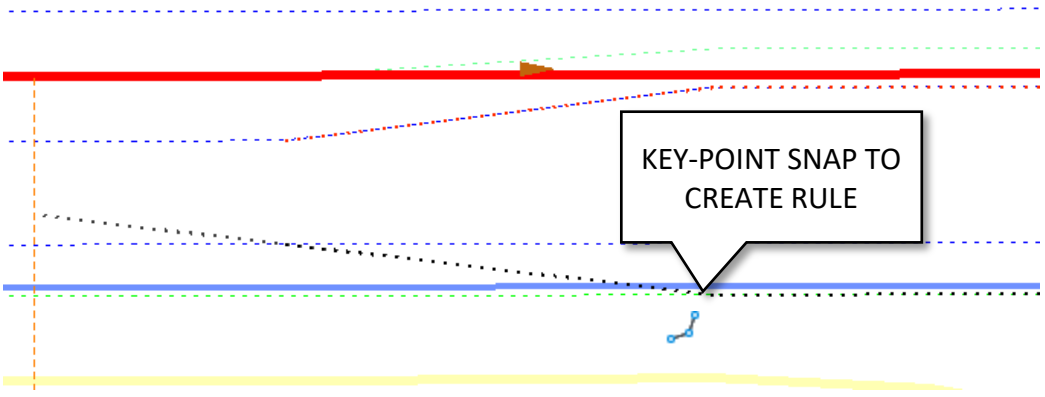


D. Next, select the **Ratio Offset Taper** tool **(Geometry > Horizontal > Offsets and Tapers > Ratio Offset Taper)** and again, select the **Y8** alignment when prompted to locate element.

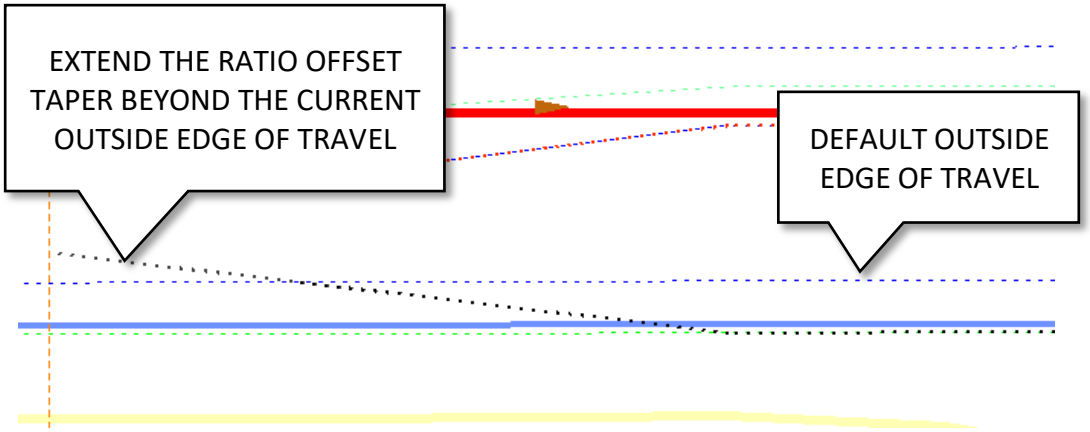
E. Key the following parameters into the **Ratio Offset Taper** dialog or as prompted by the heads-up display.
   - **Ratio** = **8.33:1**



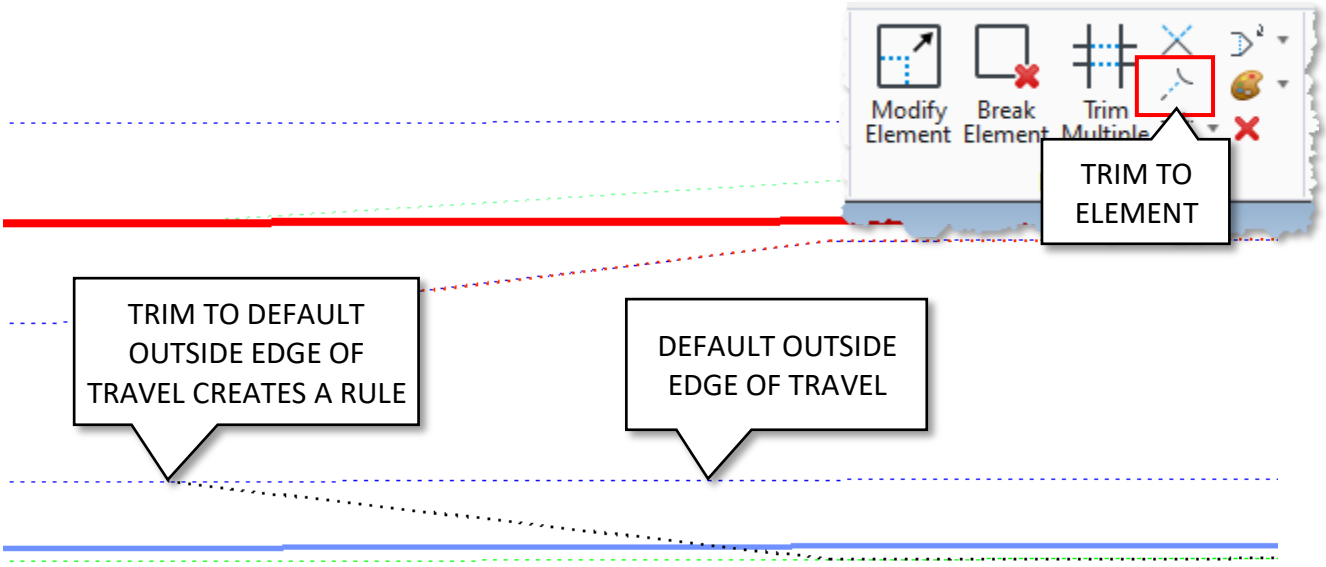
F. Then Key-Point snap to the end of the right turn lane, creating a rule that will control the start location.



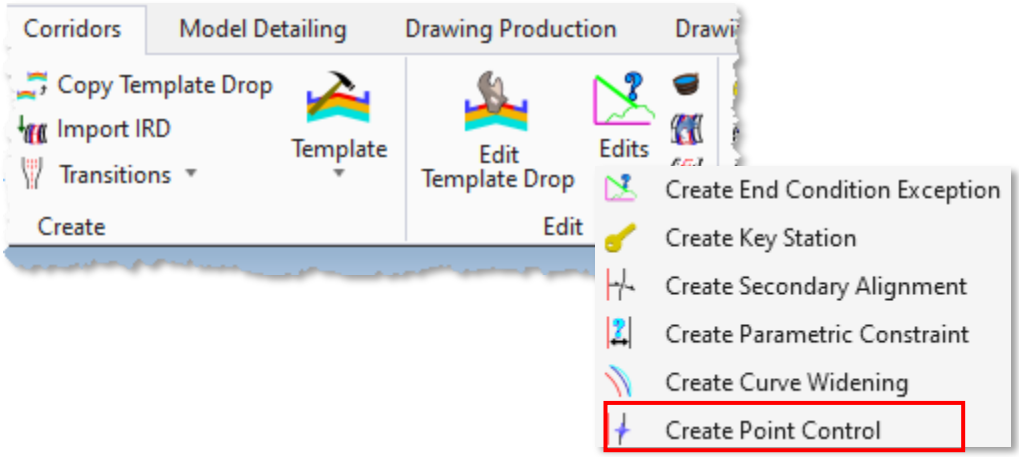
G. Next, drag your mouse to the left beyond the default outside edge of travel and click the screen to finish the **Ratio Offset Taper** command. Again, no need to mirror in this instance.



H. Now, trim the **Ratio Offset Taper** to the default outside edge of travel using the **Trim to Element** command **(Drawing > Modify > Trim to Element)** . This will create another rule that dictates that the taper will end at the default outside edge of travel.

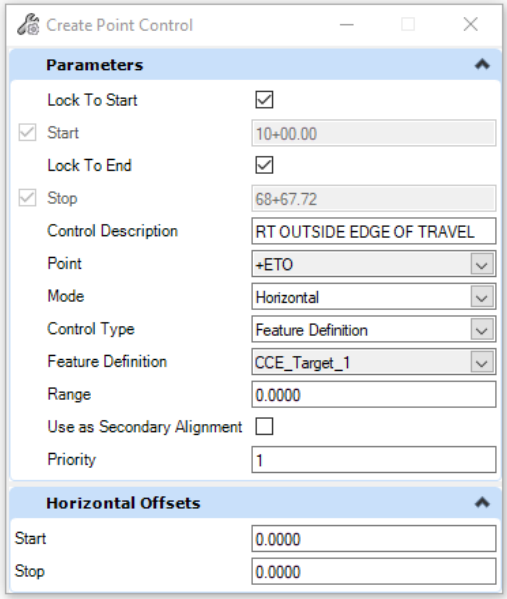


I. Next, add a point control using the **Create Point Control** option **(Corridors > Edit > Edits > Create Pont Control)** as shown below.



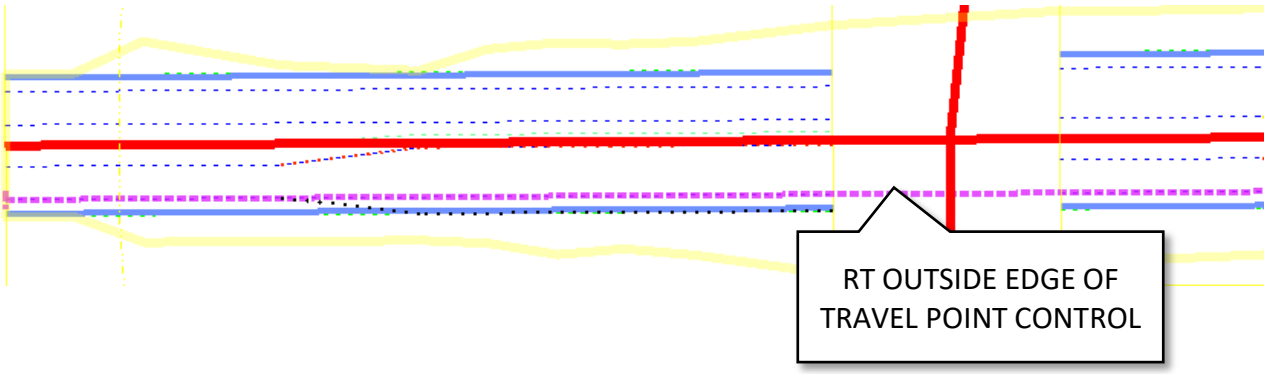
J. After selecting the Y8 Corridor, key the following parameters into the Create Point Control dialog and click through the prompts to accept.

- **Start** = **Lock to Start**
- **Sop** = **Lock to End**
- **Control Description** = **RT OUTSIDE EDGE OF TRAVEL**
- **Point** = **+ETO**
- **Mode** = **Horizontal**
- **Control Type** = **Feature Definition**
- **Feature Definition** = **CCE_Target_1**
- **Range** = **0.0000**
- **Priority** = **1**
- **Horizontal Offset Start** = **0.0000**
- **Horizontal Offset Stop** = **0.0000**
- **Use as Secondary Alignment** = **Unchecked**



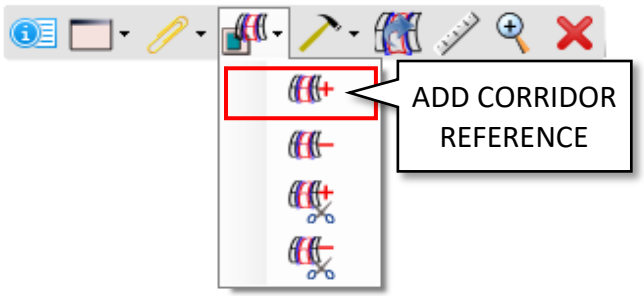
Note: This will create a single point control that runs the length of the Y8 Corridor. This point control will be initiated If a piece of geometry is referenced to the corridor with the **CCE_Target_1** feature assigned to it.

K. Notice the purple dashed line shown below that is now displayed. This line represents the **RT OUTSIDE EDGE OF TRAVEL** point control that was just created.

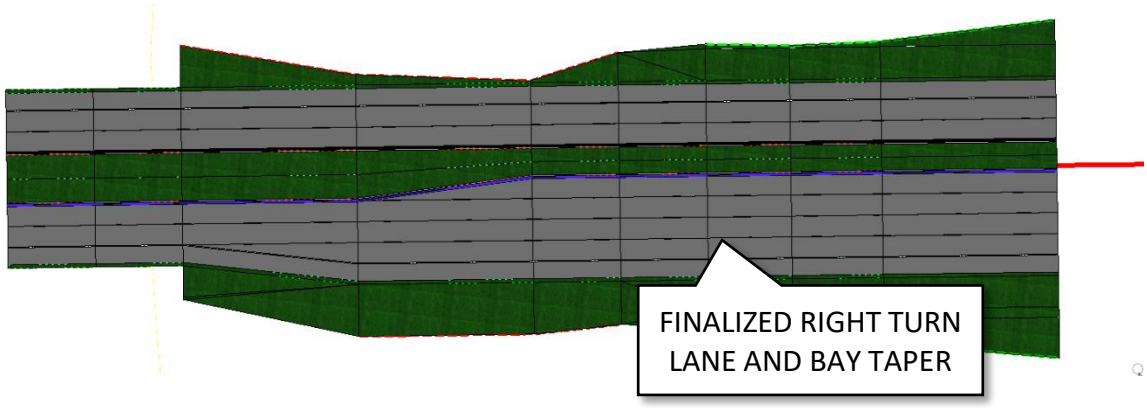


Note: Like other objects created using OpenRoads technology, point controls can easily be edited using the Corridor Objects dialog or by clicking and selecting one of the context menu options.

L. Next, use the **Add Corridor Reference** tool and add the right turn lane and bay taper to the Y8 Corridor as a Corridor Reference.

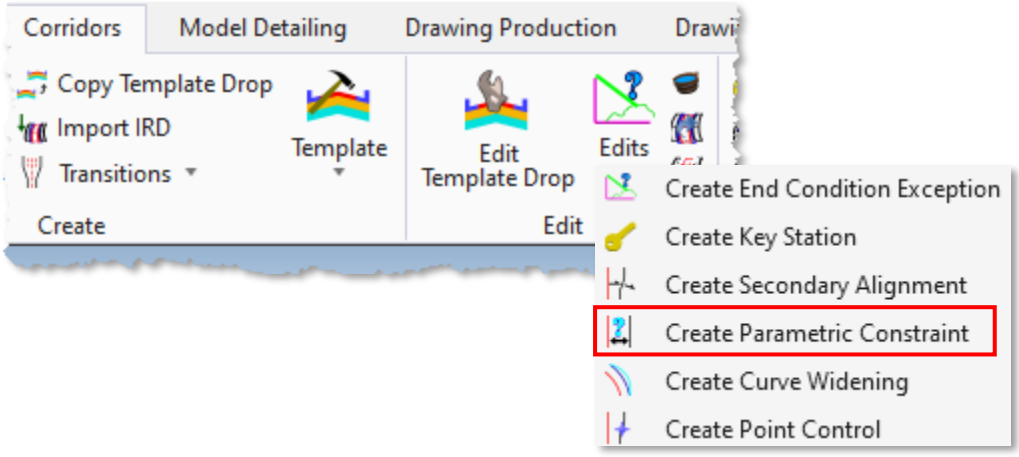


M. In the **View 2, Default-3D** view, notice that the right turn lane and bay taper have been added to the **Y8** corridor as shown below.

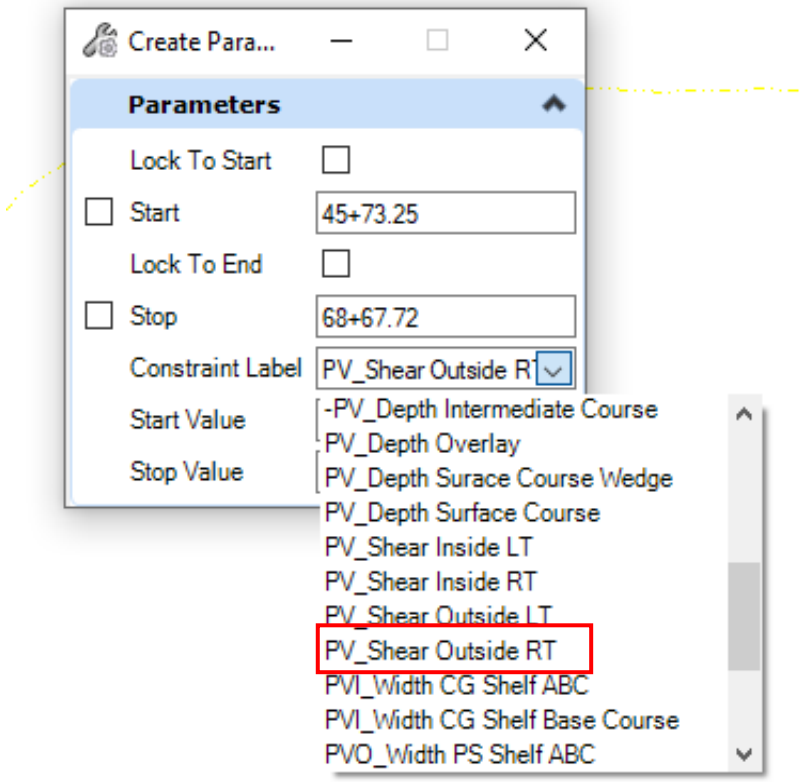


10. Use a Parametric Constraint to shear the template at the edge of travel

A. Select the **Create Parametric Constraint** option **(Corridors > Edit > Edits > Create Parametric Constraint)** as shown below.

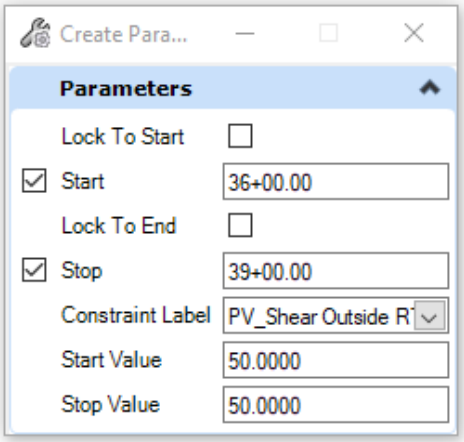


B. Click on the **Constraint Label** drop-down from the **Create Parametric Constrain** dialog and notice the four (4) **PV_Shear** options. Each of these can be used for shearing pavement at the edge on travel. In this instance, select the **PV_Shear Outside RT** option as shown below.

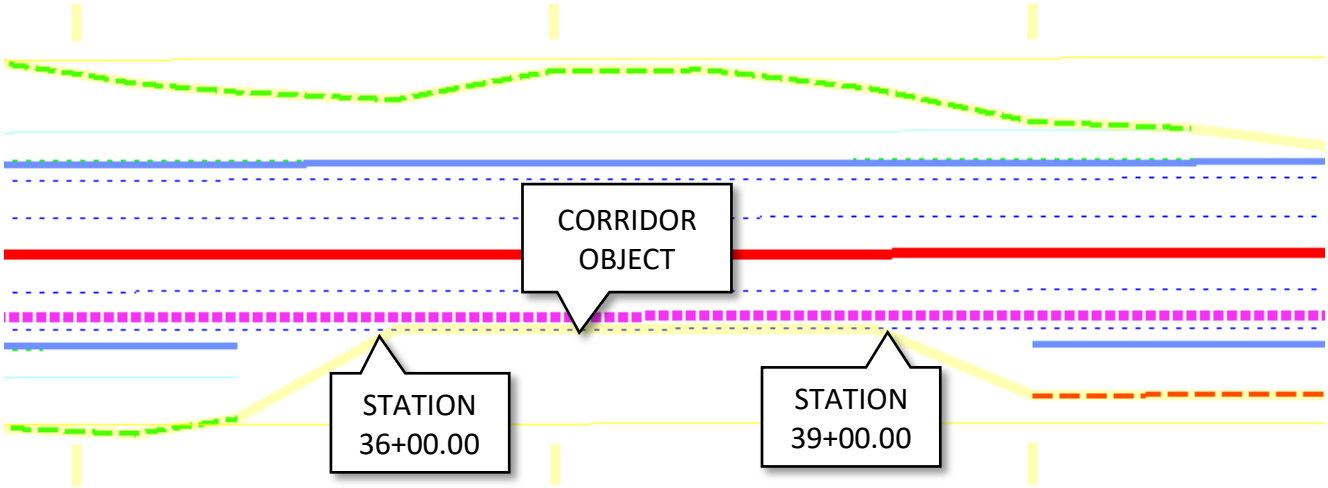


C. After selecting the **PV_Shear Outside RT** Constraint Label from the drop-down, key the following additional parameters into the **Create Parametric Constrain**t dialog and click through the prompts to accept.

- **Start = 36+00.00**
- **Stop = 39+00.00**
- **Constraint Label = PV_Shear Outside RT**
- **Start Value = 50.0000**
- **Stop Value = 50.0000**

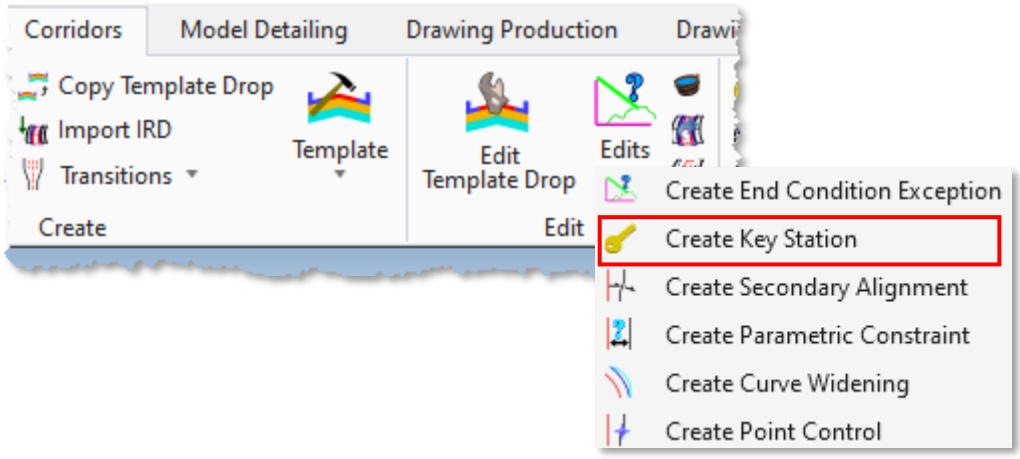


D. Now, zoom in closely to the shear location as shown below. As expected, elements beyond the outside edge of travel have been removed as a result of the **PV_Shear Outside RT** parametric constraint. You may notice, however, that the station range of the elements removed does not match the **PV_Shear Outside RT** station range. However, the yellow **Corridor Object** does match the **PV_Shear Outside RT** station range.



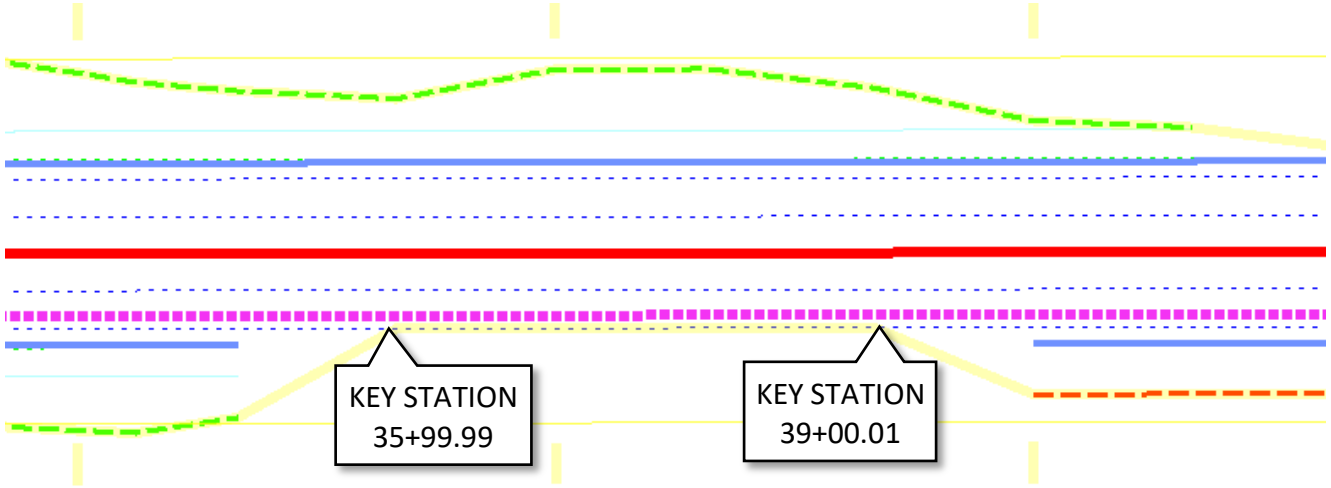
Note: When conditions occur that are not coincident with the project template interval, it might be desirable to include an additional station or stations for processing.

E. This can be resolved by adding what is called a **Key Station**. Select the **Create Key Station** option **(Corridors > Edit > Edits > Create Key Station)** as shown below.

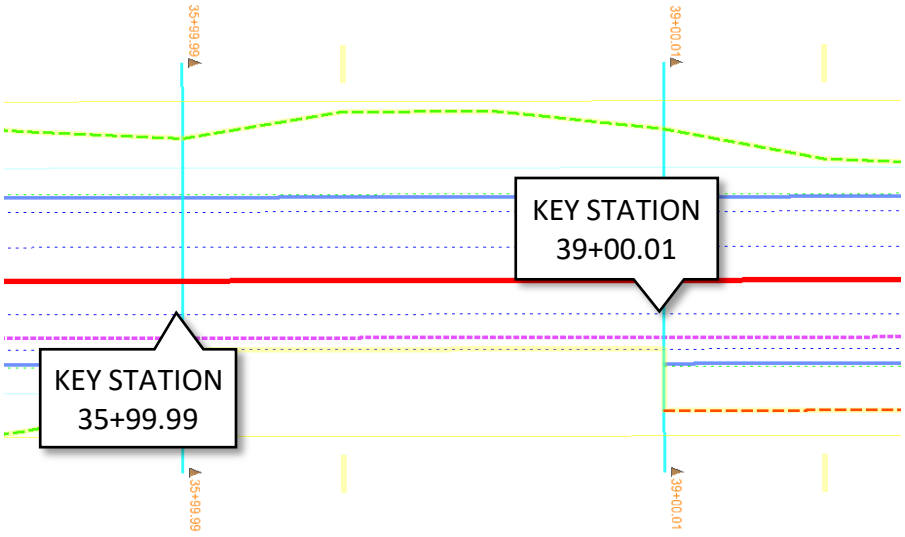


F. Create two (2) **Key Stations** as shown below. Notice that the Key Stations nearly match the station parameters for the **PV_Shear Outside RT** Horizontal Feature Constraint. Key Stations should be placed as close as possible but not directly on top of conditions that need to be picked up by the corridor.

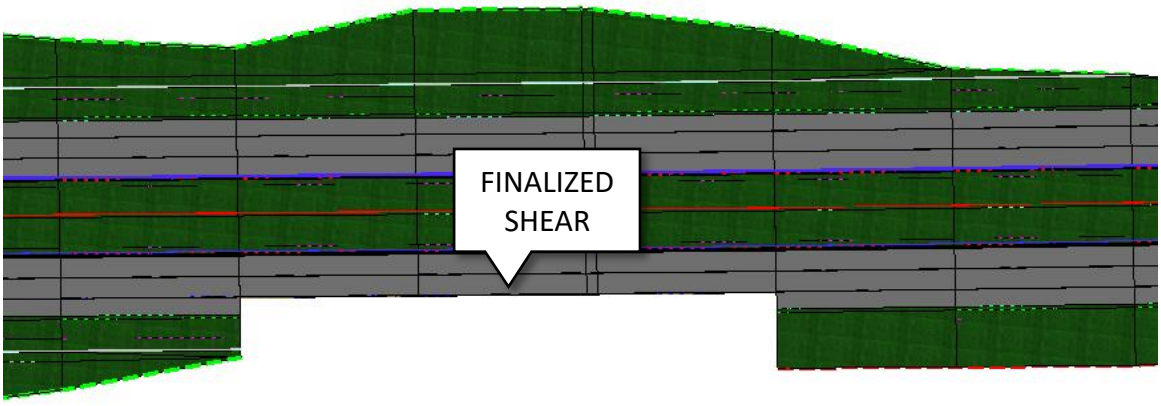
- **Key Station 1 = 35+99.99**
- **Key Station 2 = 39+00.01**



G. Notice that the Key Stations did in fact resolve the issue. The Y8 Corridor now reflects the intent of the **PV_Shear Outside RT** Parametric Constraint as shown below.

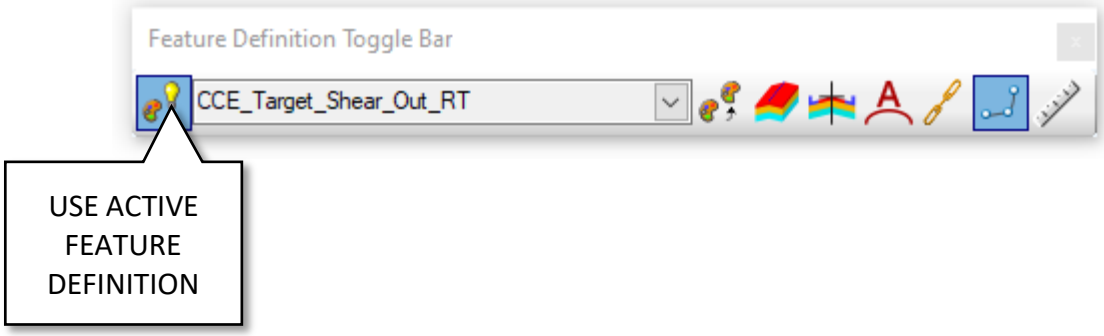


H. The **Y8** Corridor shear has been finalized as shown below.

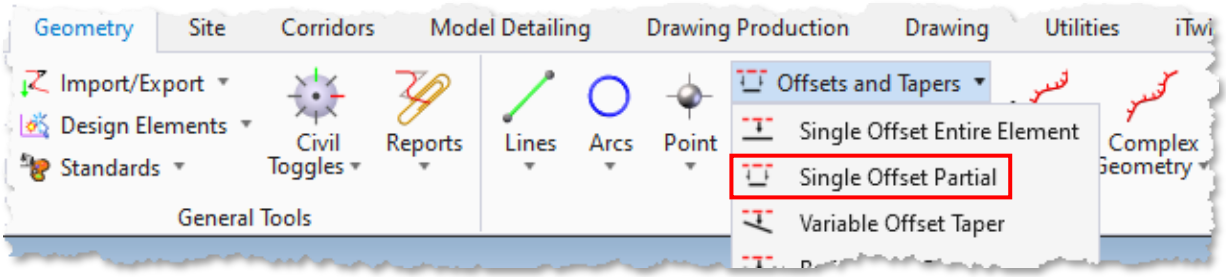


11. Use a Horizontal Feature Constraint to shear the template at the edge of travel

A. From the **Feature Definition Toggle Bar**, toggle on the **Use Active Feature Definition** button and then select the **CCE_Target_Shear_Out_RT** feature from the **(Linear > Roadway > Construction Class Element)** folder.



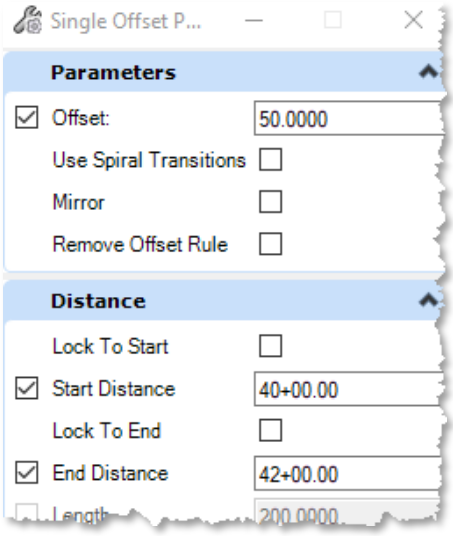
B. Next, select the **Single Offset Partial** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Partial)** and then select the **Y8** alignment when prompted to locate element.



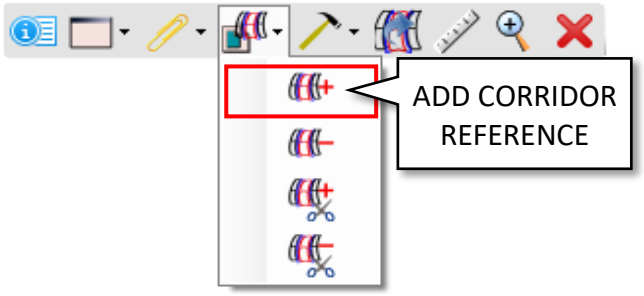
C. After selecting the Y8 Corridor, key the following parameters into the **Single Offset Partial** dialog and click through the prompts to accept.

- **Offset = 50.0000**
- **Start Distance = 40+00.00**
- **End Distance = 42+00.00**

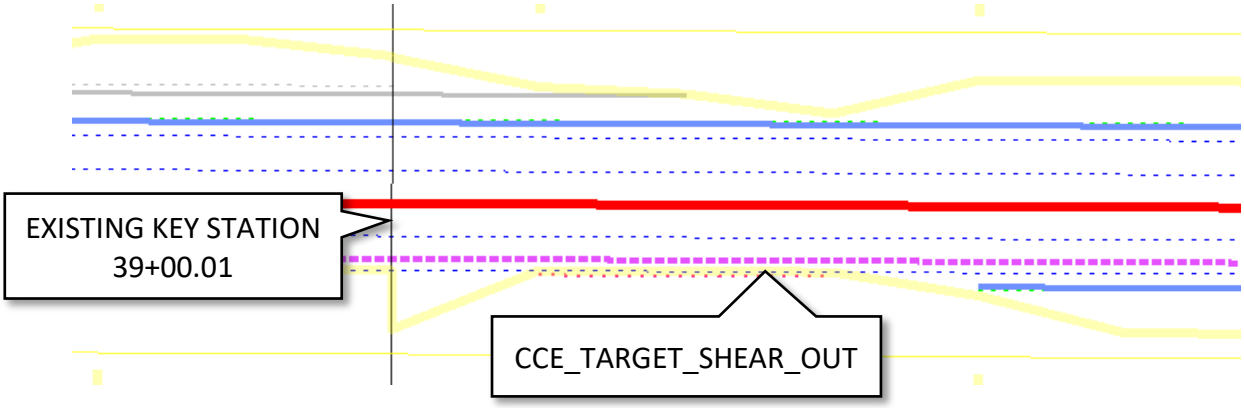
Note: The offset does not need to be 50'. This number was used for simplicity.



D. Next, use the **Add Corridor Reference** tool to add the **CCE_Target_Shear_Out** feature to the **Y8** Corridor as a **Corridor Reference**.



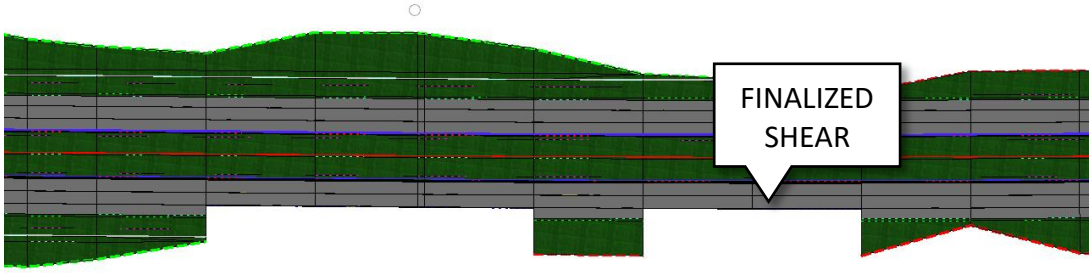
E. Notice that the corridor has been sheared as shown below. Again, notice that the shear does not match the **CCE_Target_Shear_Out** feature perfectly and will require **Key Stations** to be finalized.



F. Create two (2) **Key Stations** as shown below.

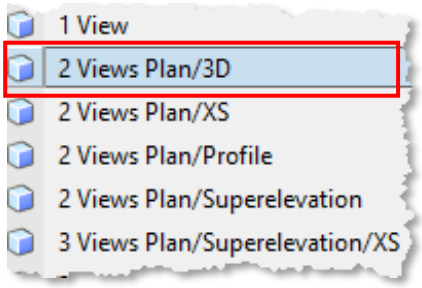
- **Key Station 1 = 39+99.99**
- **Key Station 2 = 42+00.01**

G. The **Y8** Corridor shear has been finalized as shown below.

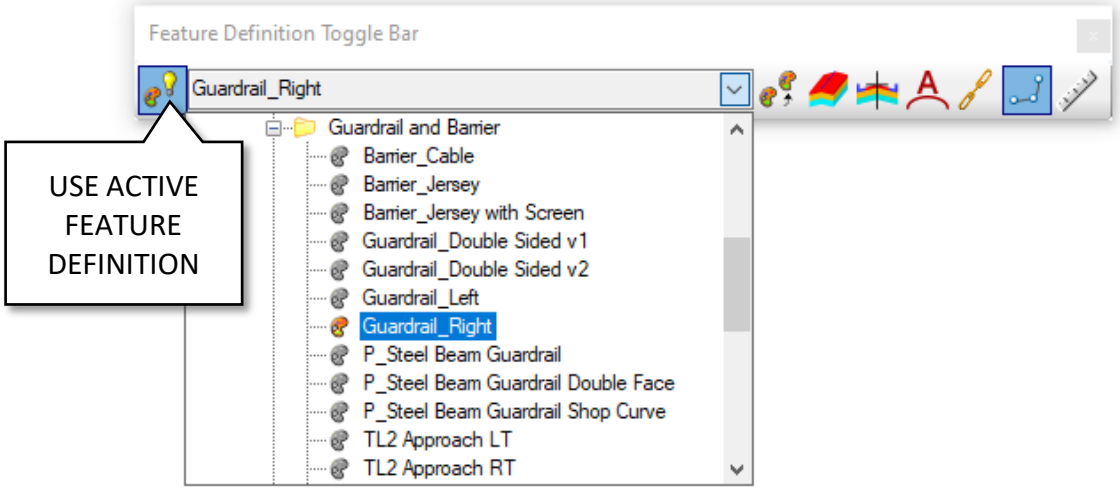


12. Draw Guardrail and TL-3 Anchor units using 3D Linestyles

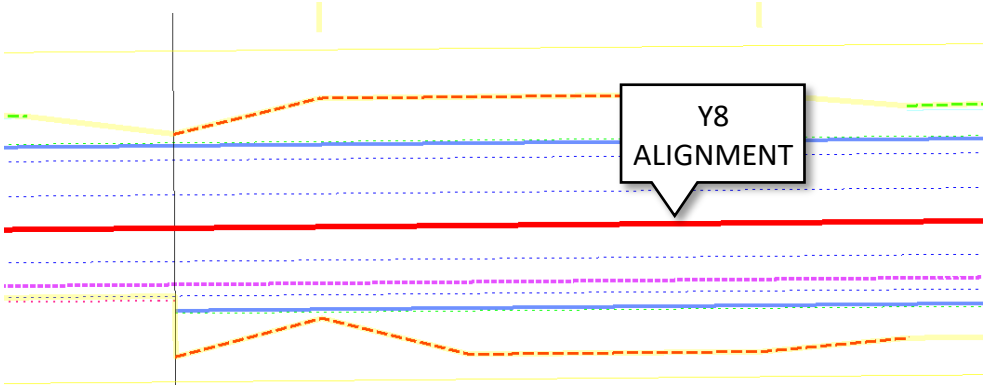
A. Select the **2 Views Plan/3D** option from the **View Control** context menu to open the **View 2,Default-3D** view in addition to the already opened **View 1, Default** 2D view.



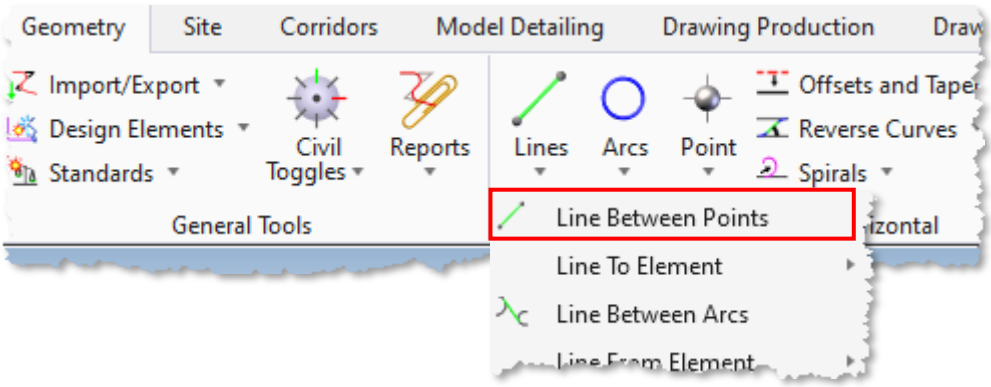
B. From the **Feature Definition Toggle Bar**, toggle the **Use Active Feature Definition** button and set the **Guardrail_Right** feature **(Linear > Roadway > Guardrail and Barrier > Guardrail_Right)** to active.



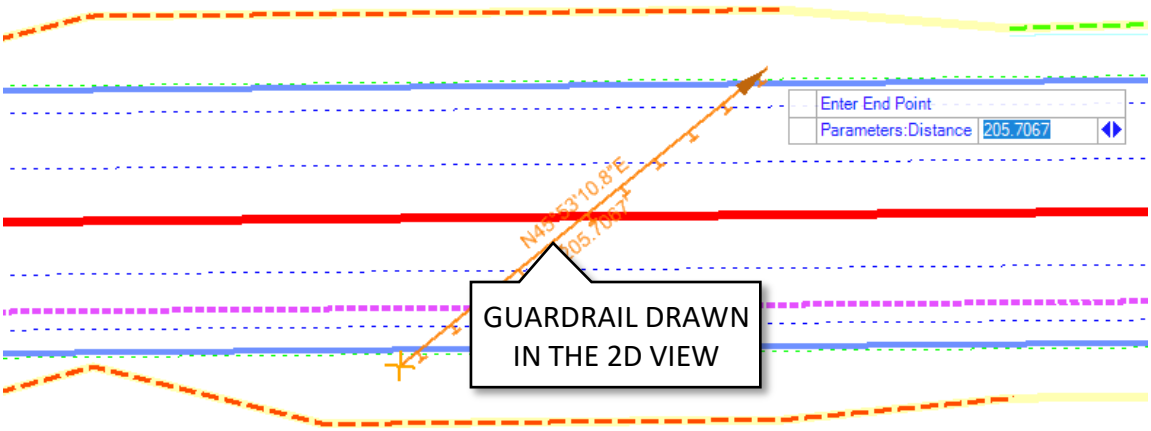
C. In the **View 1, Default** window zoom in closely to the Y8 corridor as show below.



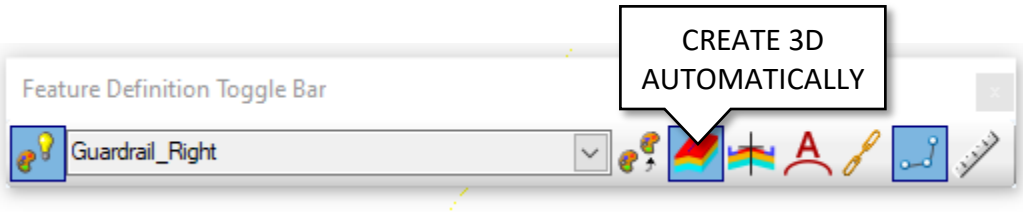
D. Now, select the **Line Between Points** tool **(Geometry > Horizontal > Lines > Line Between Points)** as shown below.



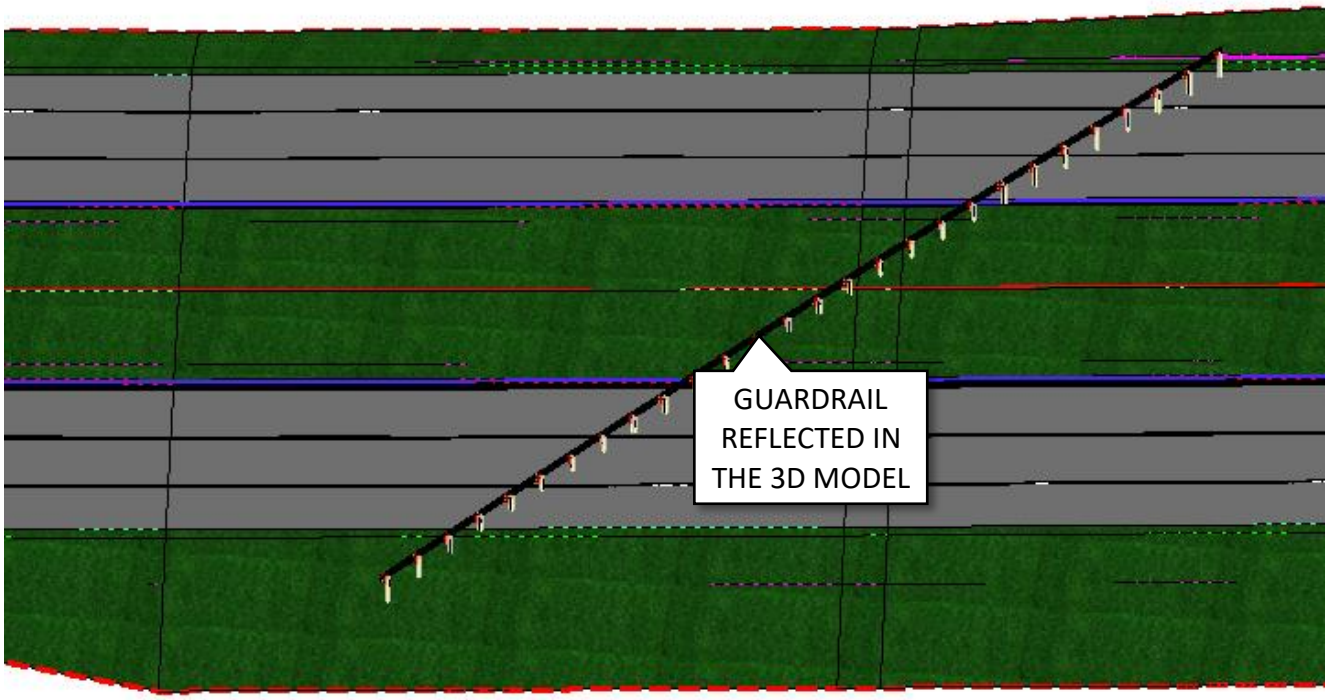
E. Next, draw a random line in the **View 1, Default** window as shown below. Notice that model has not been updated to reflect the guardrail in the **View 2, Default-3D** window.



F. This can be resolved by toggling on the **Create 3D Automatically** option and then redrawing the guardrail.

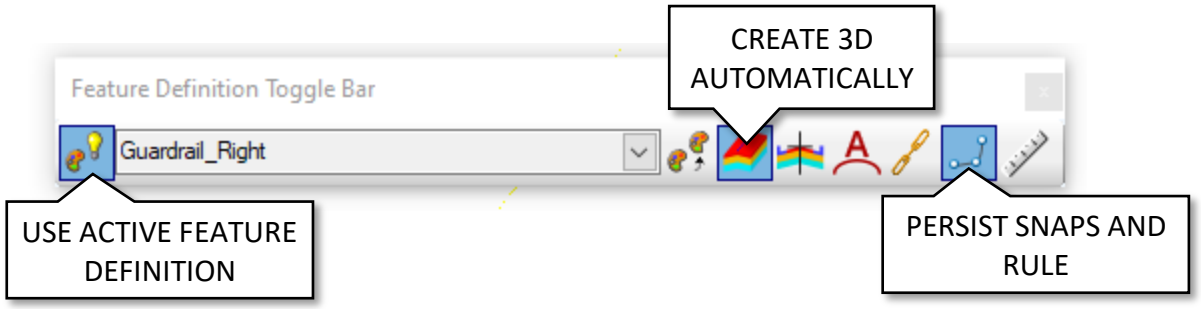


G. When the **Create 3D Automatically** option is enabled, the guardrail which was drawn in the 2D view of a model will pick up the vertical attribute from the 3D model automatically as shown below.



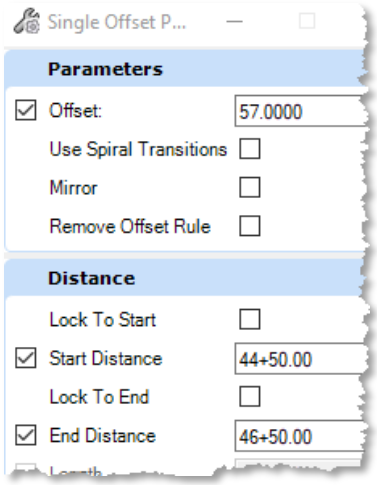
H. Delete the guardrail from the **View 1, Default** window and notice that it is also removed from the 3D model.

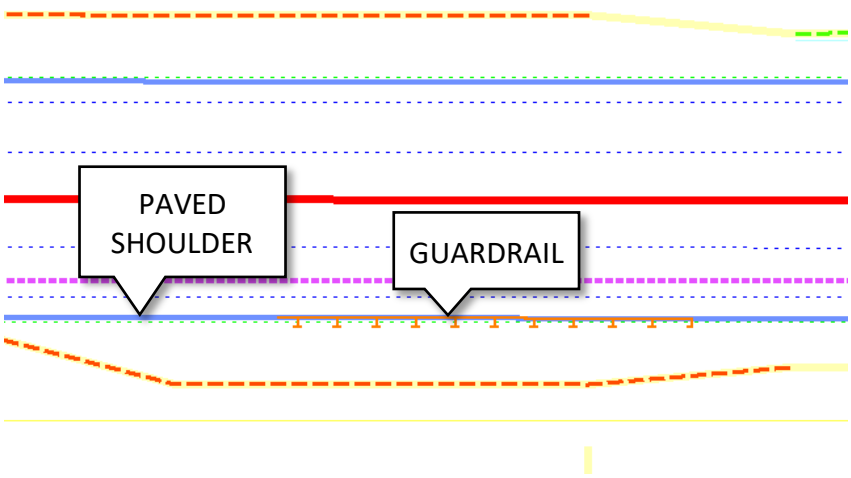
I. With the **Feature** still set to **Guardrail_Right** and the options still set as shown below, select the **Single Offset Partial** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Partial)** and then select the **Paved Shoulder** on the right side of the road when prompted to locate element.



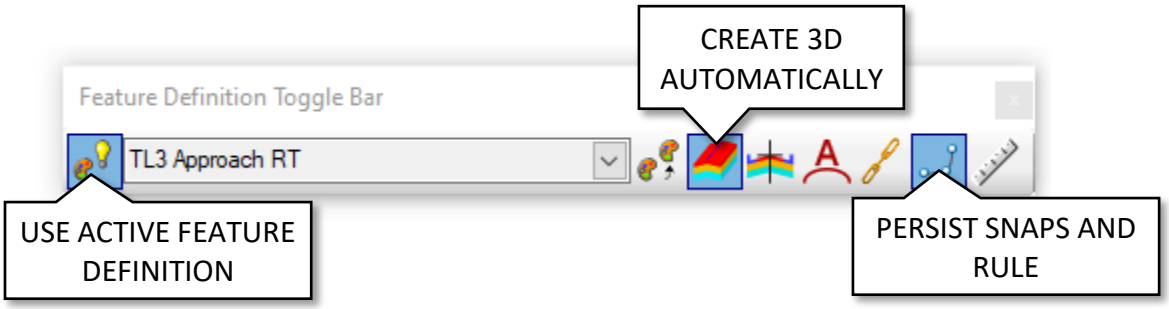
J. After selecting the **Paved Shoulder**, key the following parameters into the **Single Offset Partial** dialog and click through the prompts to accept. This will place the guardrail **.01'** off the paved shoulder line as shown below.

- **Offset = 0.0100**
- **Start Distance = 44+50.00**
- **End Distance = 46+50.00**

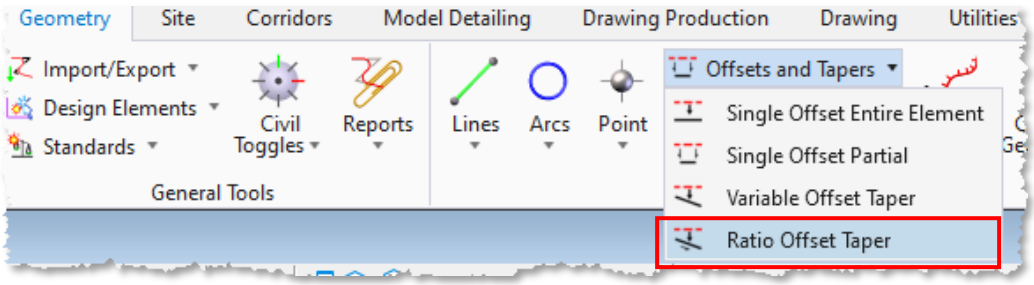




K. Next, set the **TL3 Approach RT** feature **(Linear > Roadway > Guardrail and Barrier > TL3 Approach RT)** to active and toggle the options as shown below.

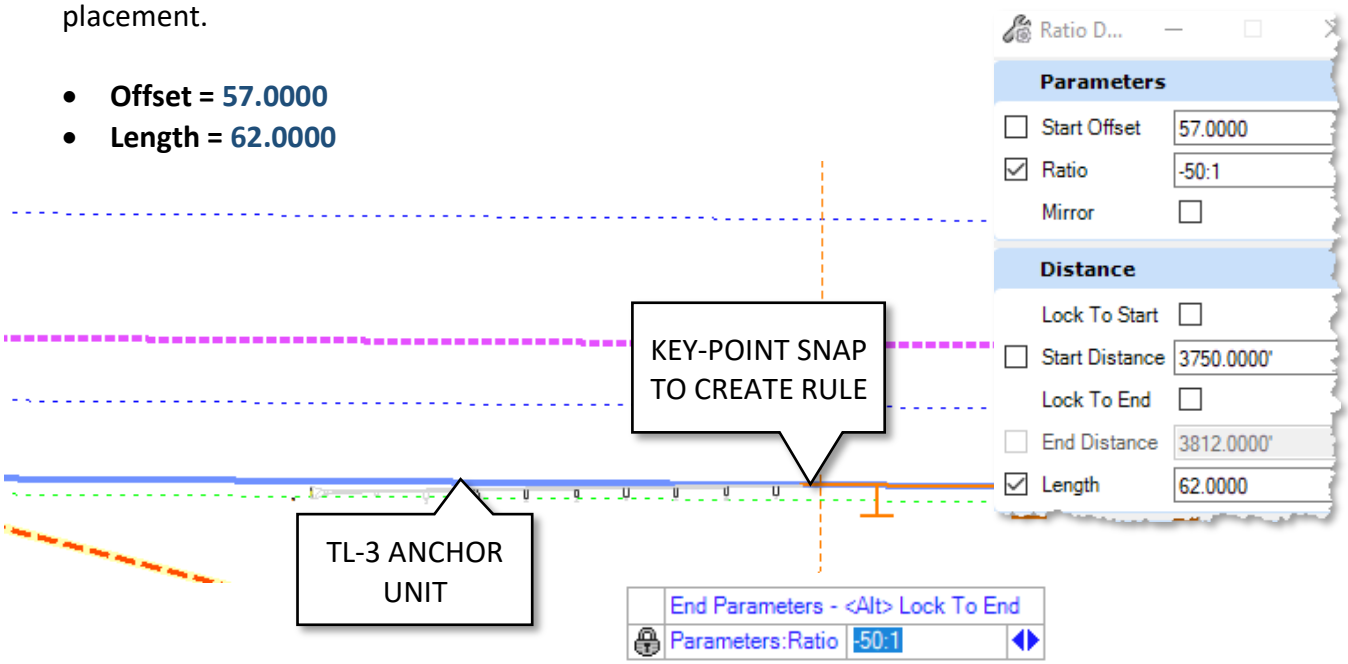


L. Next, select the **Ratio Offset Taper** tool **(Geometry > Horizontal > Offsets and Tapers > Ratio Offset Taper)** and then select the **Y8** alignment when prompted to locate element.

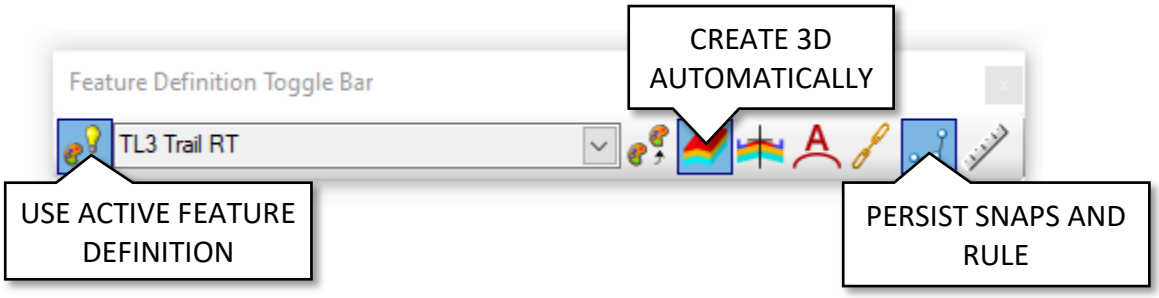


M. Then, key the following parameters into the **Ratio Offset Taper** dialog and then **Key-point** snap to the beginning of the guardrail. After snapping to the end of the guardrail, adjust the location of the **TL-3** by moving the mouse back and forth before left-clicking to finalize placement.

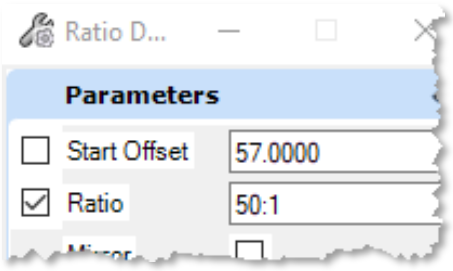
- **Offset = 57.0000**
- **Length = 62.0000**



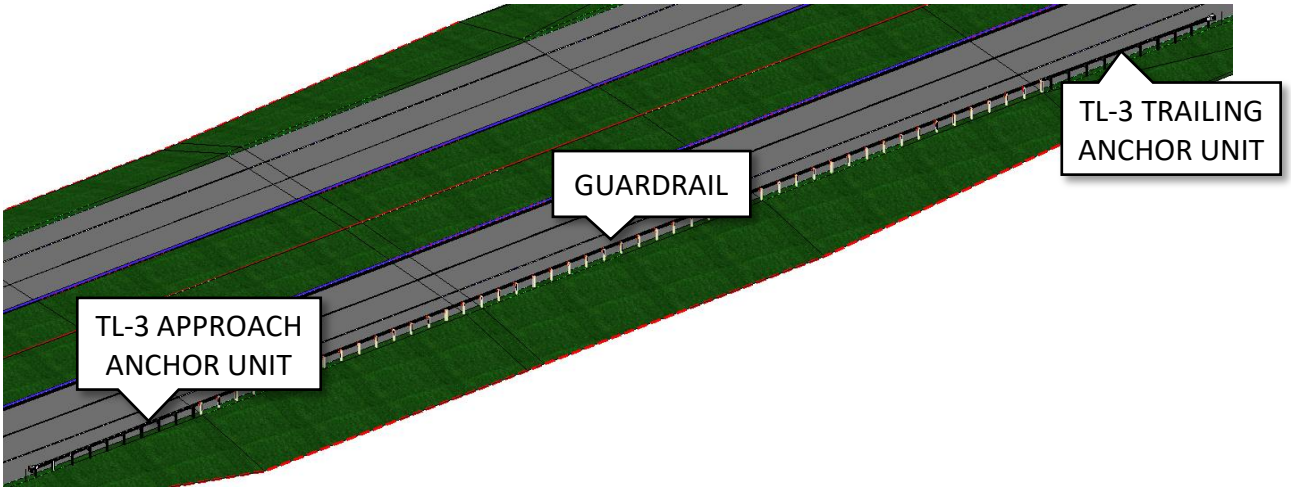
N. After finalizing the **TL-3** approach, set the **TL3 Trail RT** feature **(Linear > Roadway > Guardrail and Barrier > TL3 Trail RT)** to active and toggle the options as shown below.



O. Now, follow the same steps to draw the **TL-3** Trailing end. Only this time, set the **Ratio** parameter to **50:1** before **Key-Point** snapping to the end of the guardrail.

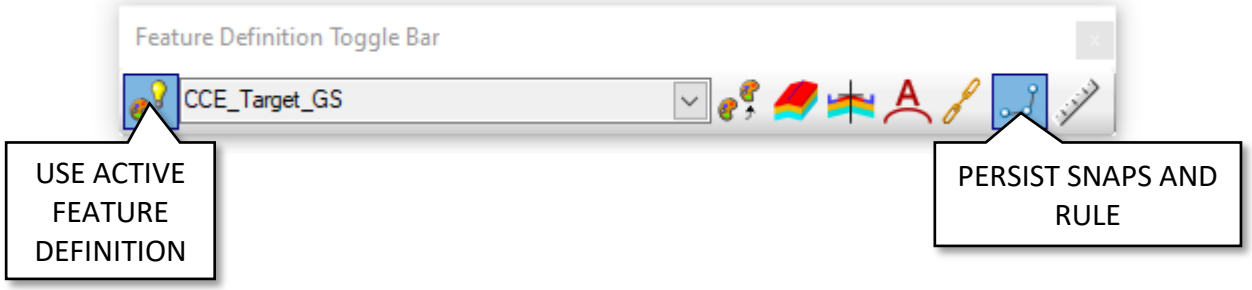


P. Notice that both **TL-3 Anchor units** along with the guardrail are now visible in the **View 2, Default-3D** window as shown below.

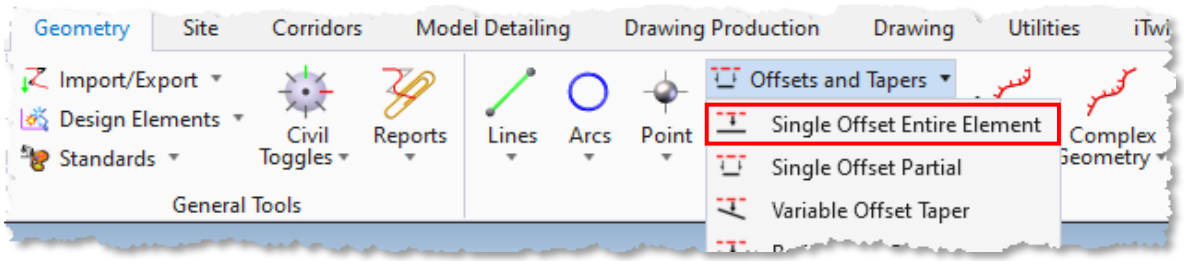


13. Widen Grass Shoulder to Accommodate Guardrail and TL-3 Anchor units

A. First, set the **CCE_Target_GS** feature **(Linear > Roadway > Construction Class Element > CCE_Target_GS)** to active and toggle the options as shown below.

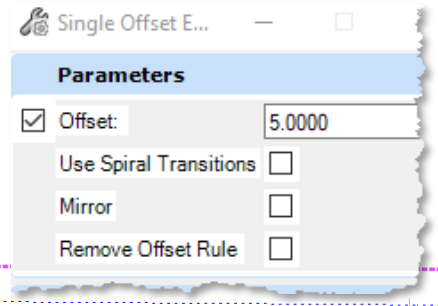


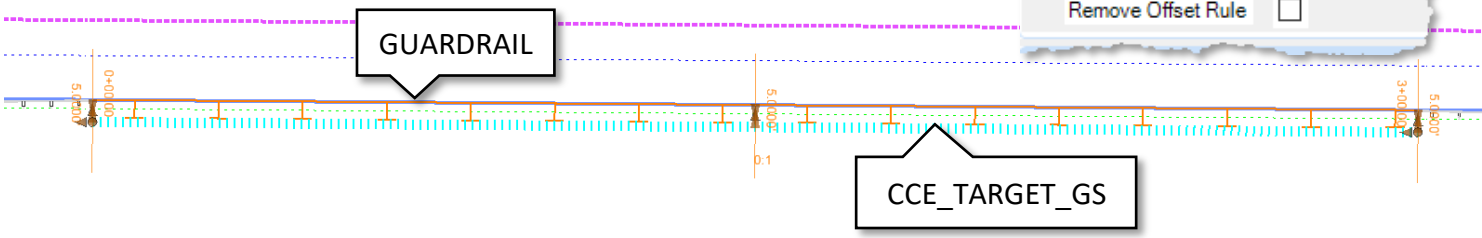
B. Then, select the **Single Offset Entire Element** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Entire Element)** and select the guardrail that was added in the previous step when prompted to locate element. This will rule the grass shoulder limits to the match the guardrail.



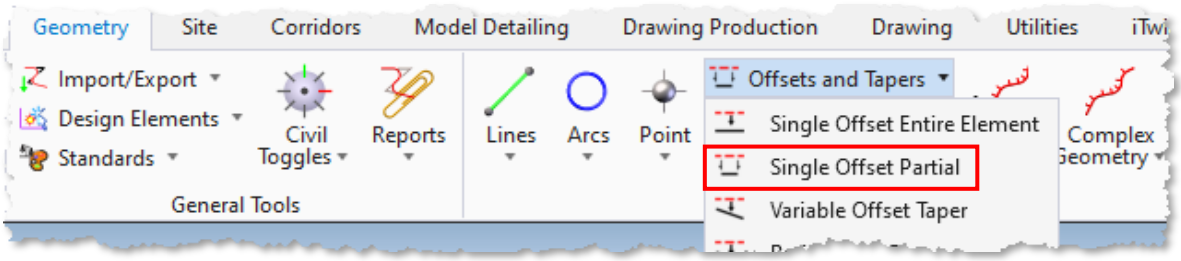
Note: Construction class elements used for template targeting should be created using offsets and tapers from the corridor alignment or other non-template based elements to avoid what is known as a circular reference. Circular references cannot be targeted by the template, making them unusable.

C. Set the **Offset** parameter to **5.0000** within the **Single Offset Entire Element** dialog and click through the prompts to accept. The **CCE_Target_GS** will be used to widen the grass shoulder as needed to accommodate the guardrail.

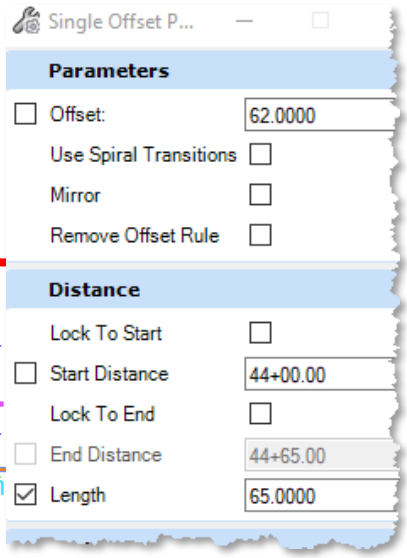


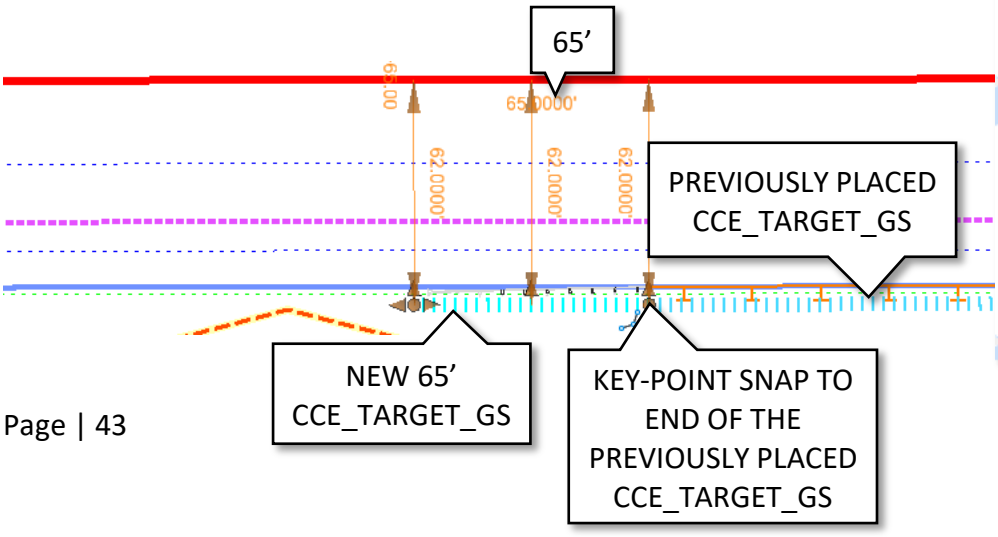


D. Next, select the **Single Offset Partial** tool **(Geometry > Horizontal > Offsets and Tapers > Single Offset Partial)** and choose the **Y8** alignment when prompted to locate element.

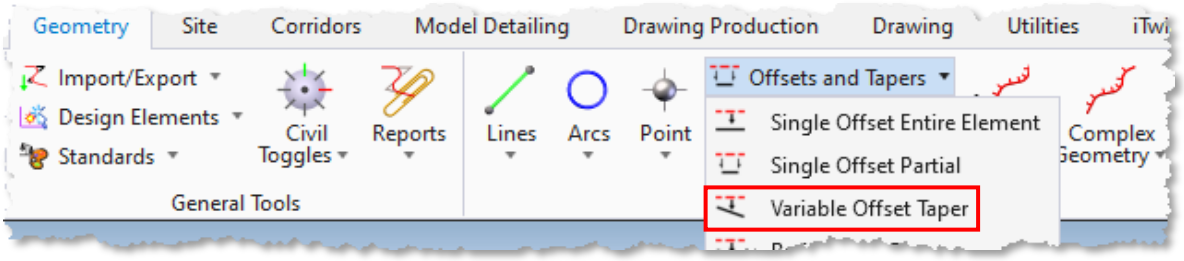


E. Then, set the **Length** parameter to **65.000** and **Key-Point** snap to the beginning of the **CCE_Target_GS** line that was created in the previous step. Click through the additional prompts to create a line that is ruled to be **65'** in length from the beginning of the guardrail.



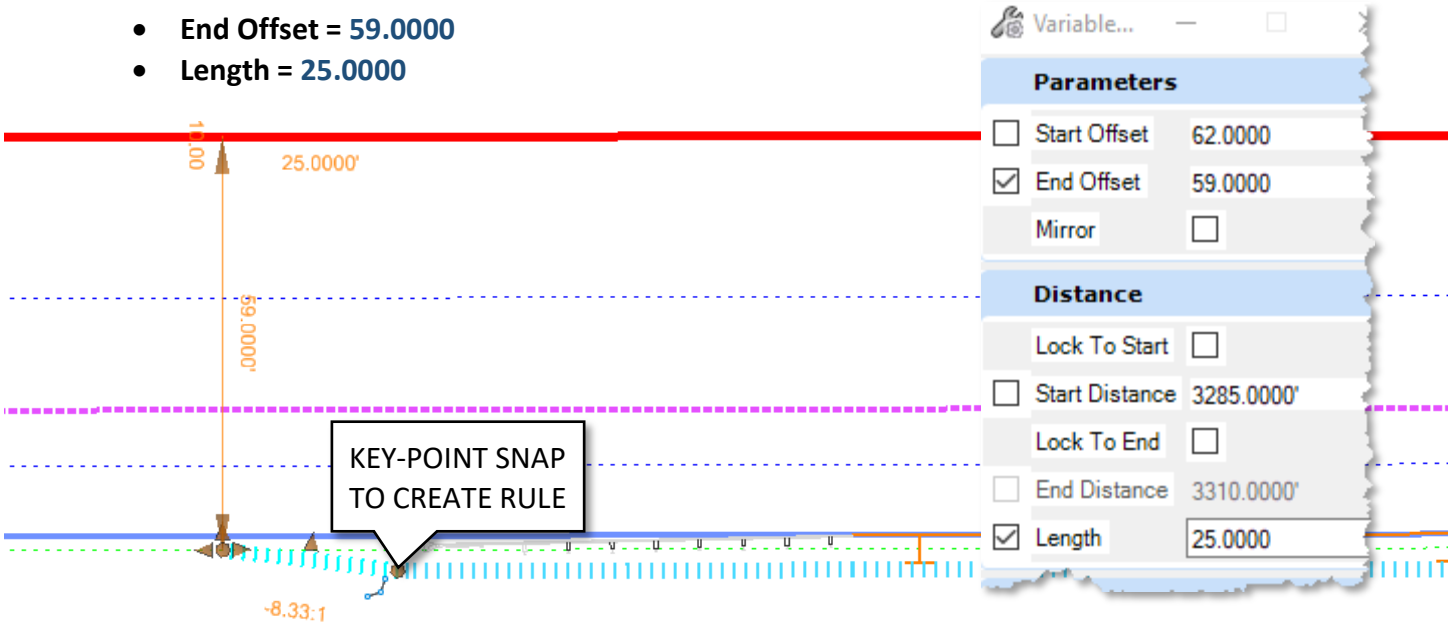


F. Next, select the **Variable Offset Taper** tool **(Geometry > Horizontal > Offsets and Tapers > Variable Offset Taper)** and again, choose the **Y8** alignment when prompted to locate element.



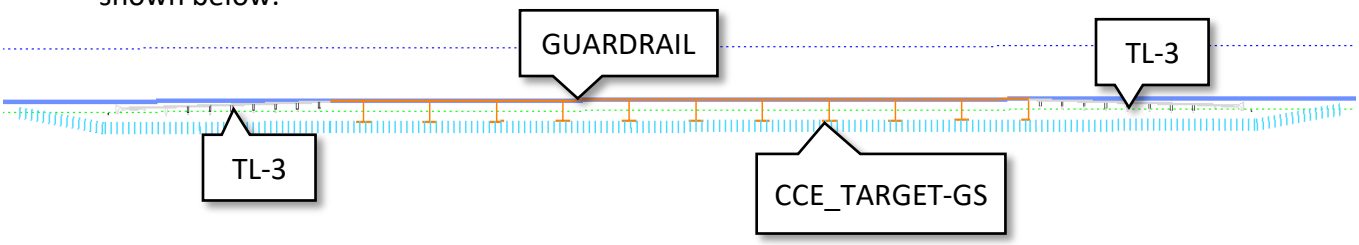
G. Then, key the following parameters into the **Variable Offset Taper** dialog and snap to the beginning of the **CCE_Target_GS** line that was just drawn in the previous step.

- **End Offset = 59.0000**
- **Length = 25.0000**

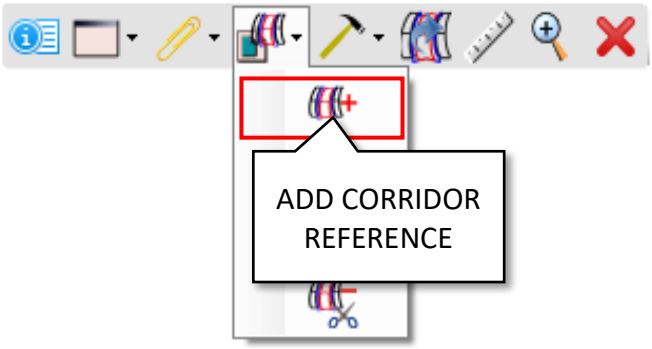


H. Now, follow the same steps to draw the **CCE_Target_GS** feature at the **Trailing** end of the guardrail.

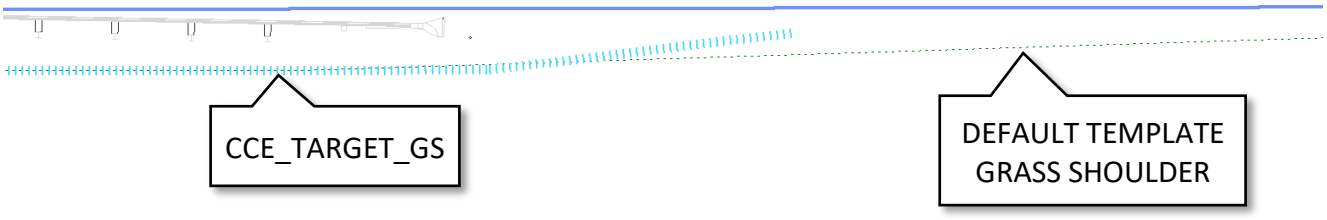
I. The **CCE_Target_GS** should now cover the full length of the guardrail and **TL-3** anchor units as shown below.



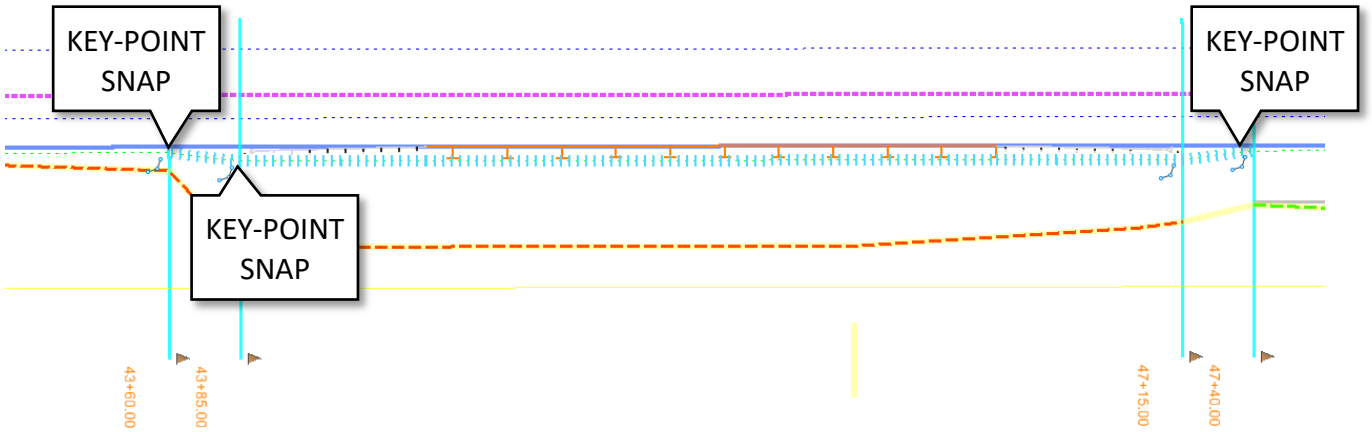
J. Next, use the **Add Corridor Reference** tool to add the **CCE_Target_GS** features to the **Y8** Corridor as a **Corridor Reference**.



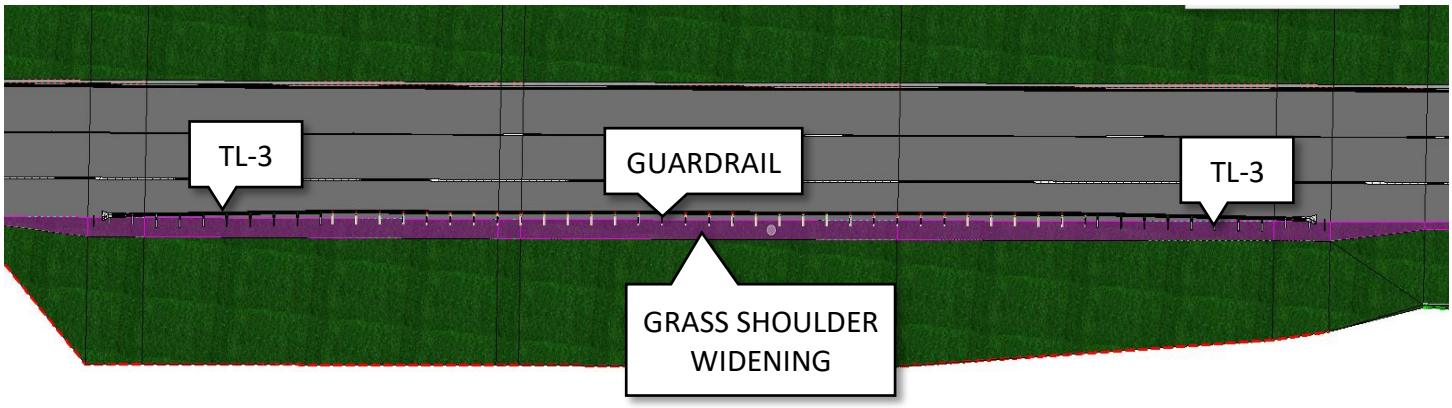
K. Once the Y8 Corridor processes, notice that the corridor did not completely pick up the breaks in the **CCE_Target_GS** as shown below.



L. To resolve this, add four (4) **Key-Stations** along the **CCE_Target_GS** feature at each of the breaks using **Key-Point** snaps as shown below.

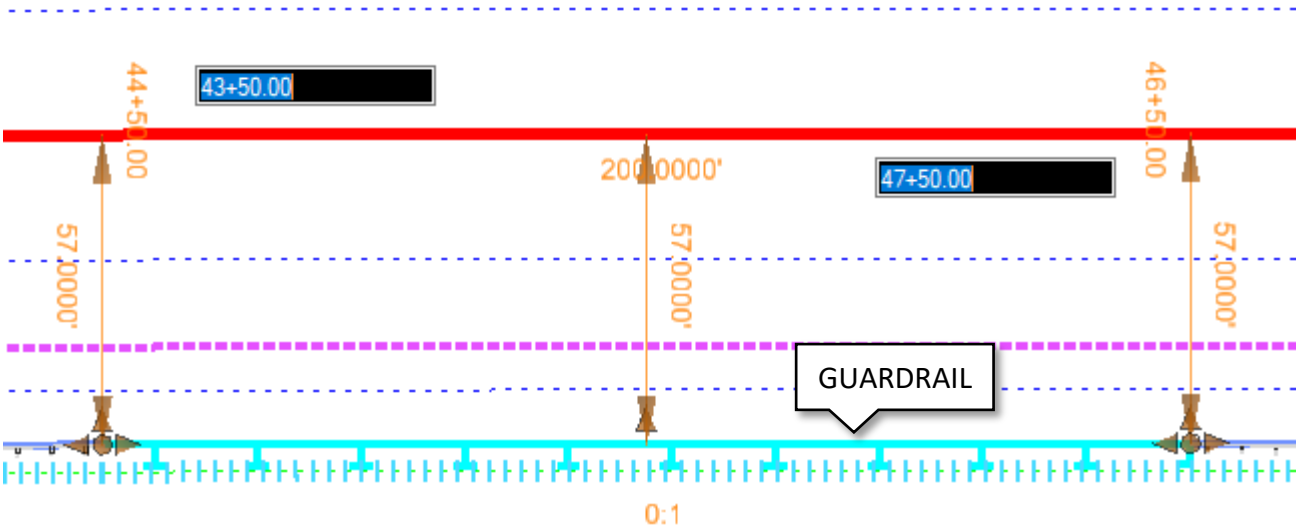


M. In the **View 2, Default-3D** window, notice the finalized guardrail, anchor units and grass shoulder widening as shown below.

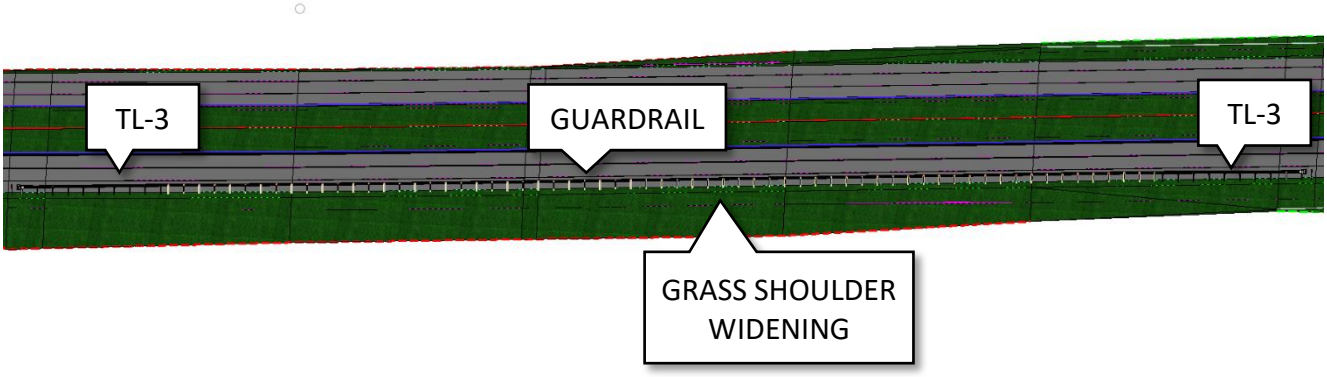


14. Adjust the Guardrail Station Range to Demonstrate Design Intent

A. Select the guardrail element as shown below and adjust the begin station to **43+50.00** and the end station to **47+50.00**.



B. Notice in the **View 2, Default-3D** window that not only the guardrail, but also the TL-3 Anchors as well as the grass shoulder that was widened in the previous step, have also been updated. This is due to the **rules-based** design that was leveraged in the previous steps.



Notes:

- Design Intent is not required, but if used properly can be advantageous to the overall design process.
- A Parametric Constraint can also widen the shoulder for Guardrail.