

Purpose of this Module

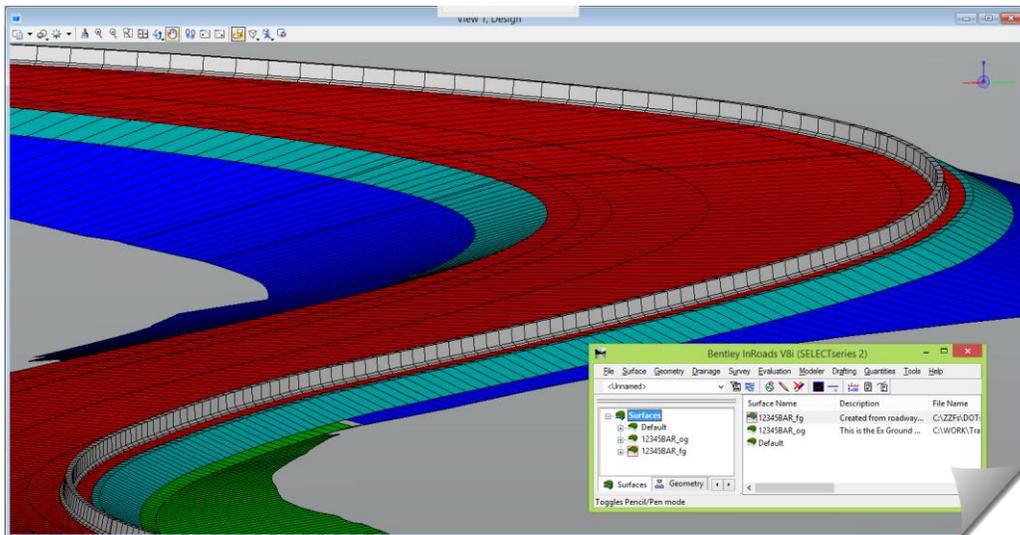
The primary purpose of this module is showing how to use InRoads to model barriers. This includes addressing the height of the barrier for transitioning between different barrier types and end terminals, as well as illustrating the use of InRoads controls to move the location of the barrier horizontally while maintaining the proper orientation relative to the pavement surface.

Secondly, an expanded tip will be shown regarding how to properly adjust the barrier component from “Do Not Triangulate” to “Triangulate” if the designer is planning to use the sight distance tool or perform hydraulic analysis, requiring the barrier to be part of the surface model.

Lastly, the InRoads sight distance tool will be briefly touched on to analyze any potential visibility issues.

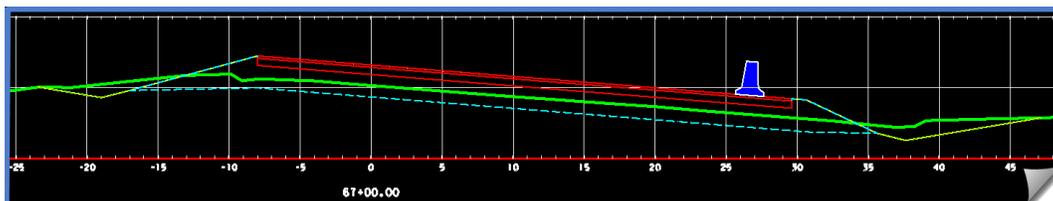


ALERT: The focus of this module is the barrier component itself. It is up to the designer to apply the appropriate design standards to their project for elements such as shoulder width, shy distance, and flares.



Objectives of this Module

At the end of this module, you will be able to use InRoads and the barrier components in the ODOT seed ITL to model and control a project barrier so that it is contained in the resulting design surface model.



Definition of Audience for future Modules

Please note that each module assumes that you have a certain level of competency with the software tools and therefore you may be asked to execute a command with very little instruction. This module was designed with a certain technical audience in mind, so ensure that you have the proper prerequisites.

Skill Level / Prerequisites:

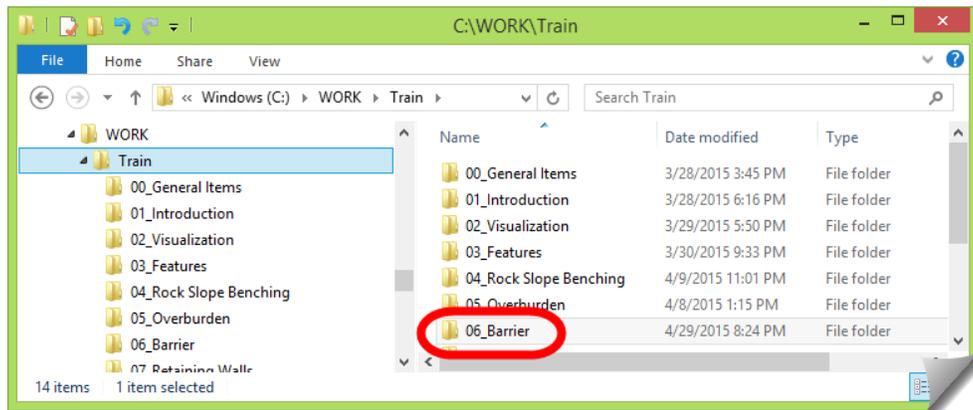
These include the following:

- Module 1 – Introduction to the Training Modules
- Module 2 – Visualization (beneficial, but not absolutely required)
- MicroStation Basics
- InRoads Level 1
- InRoads Level 2

Module Files and Folders

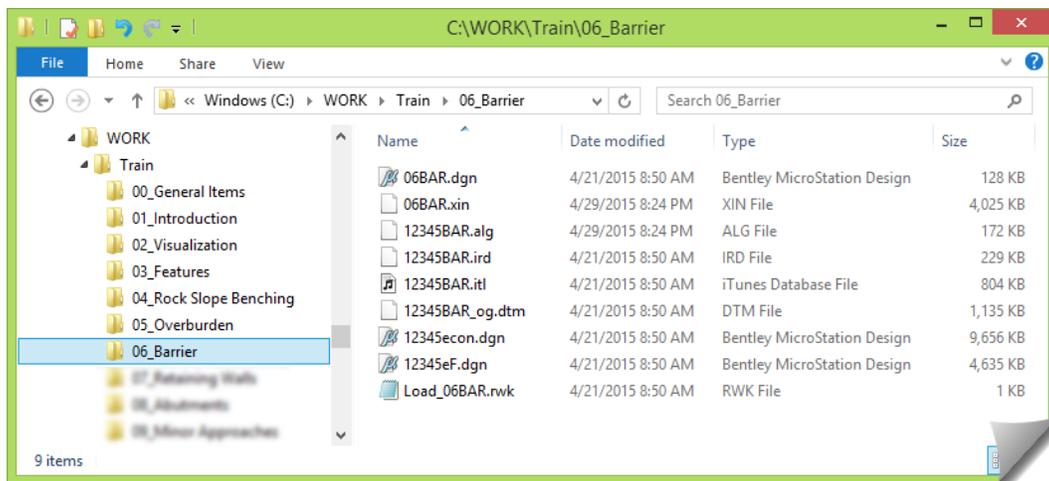
Training Folders

You will be working on your own hard drive during this training. The module instructions will expect the training files and folders to be set up as shown here in order to align with the module directions. You should have a copy of the **06_Barrier** training folder and files on your local drive. The module folder and related files should be placed under the **C:\WORK\Train** folder, and look like this:



Training Files

The module folder contains any training files (DGNs, DTMs, ALGs, ITLs, IRDs, XIN and so on) that will be used during the module exercises. In this module folder you should have these files:



Reviewing the files you should see the InRoads file types, as well as the DGN files for this module.

DGN files starting with **12345** are support files, or reference files. You will see these files, or similarly named files, in many of the modules. Likewise, InRoads files starting with **12345BAR** are also support files that are used within the hands-on exercises at some point as directed.

Files starting with the module identifier, in this case **06BAR**, are files that will typically be opened during the launch of the hands-on work and include:

- **06BAR.dgn**, the initial MicroStation file used at the start of the exercises
- **06BAR.xin**, the InRoads configuration file for this work

And there will also be an **RWK** file included in the module folder to assist in opening the InRoads files using that **Project** file technique.

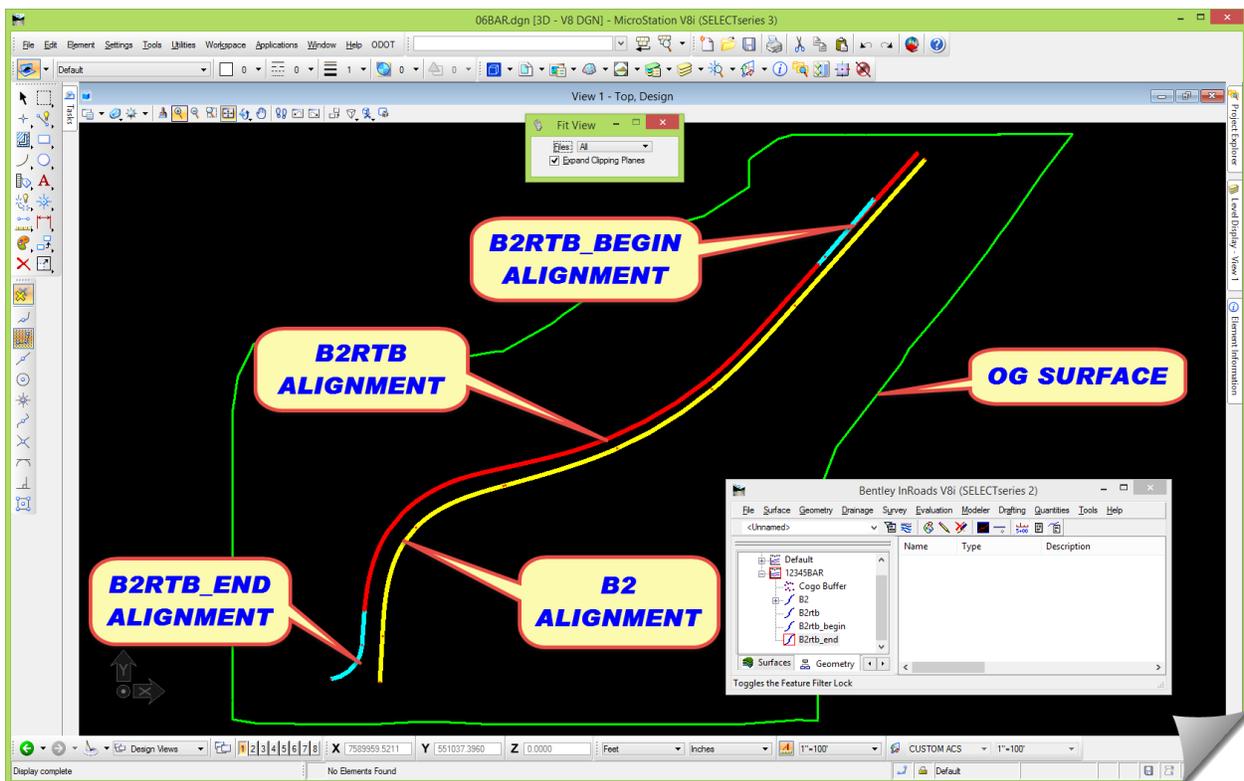
Technical Content of Training:

This module will be focusing on the application of very specific components that were built with InRoads for barrier modeling.

Project Orientation

REVIEW WORK AREA

This module will be focusing mainly on the barrier components in the **CREATE TEMPLATE** tool, as well as the necessary activity in the **ROADWAY DESIGNER** to ensure the resulting modeling is correct. For this reason, the main files that will be used are the ITL and the IRD. Additionally, for the modeling to occur, other information will be needed including: an existing surface (**OG**), a ramp centerline alignment (**B2**), and three alignments (**B2rtb**) for the barrier control. The alignments and surfaces are already created. The areas of coverage and locations for these are shown below.



PREPARE MICROSTATION / INROADS DATA & FILES

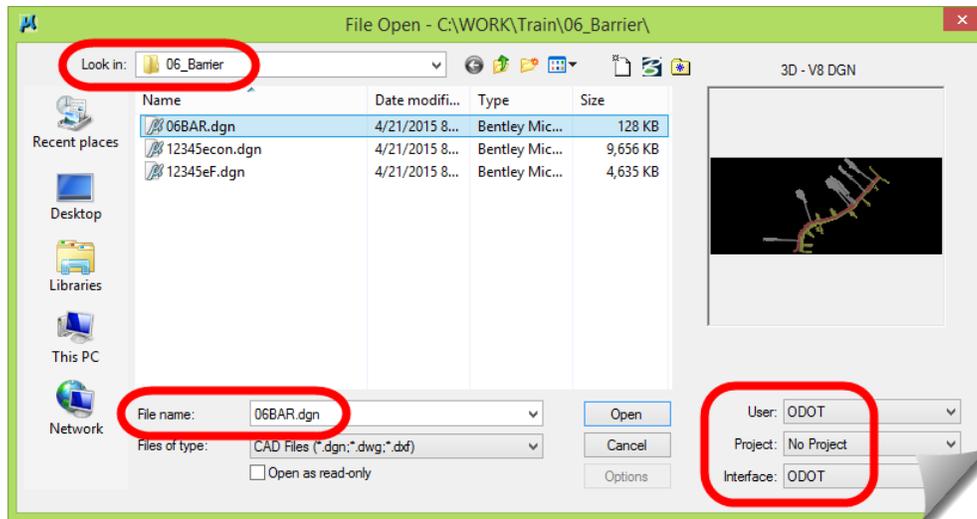
As part of the module start-up, this section will get you into the correct DGN, load the module-specific XIN and other data files, and make sure everything is ready to go.

1) Launch InRoads

Use whatever mechanism you are familiar with to get the software started.

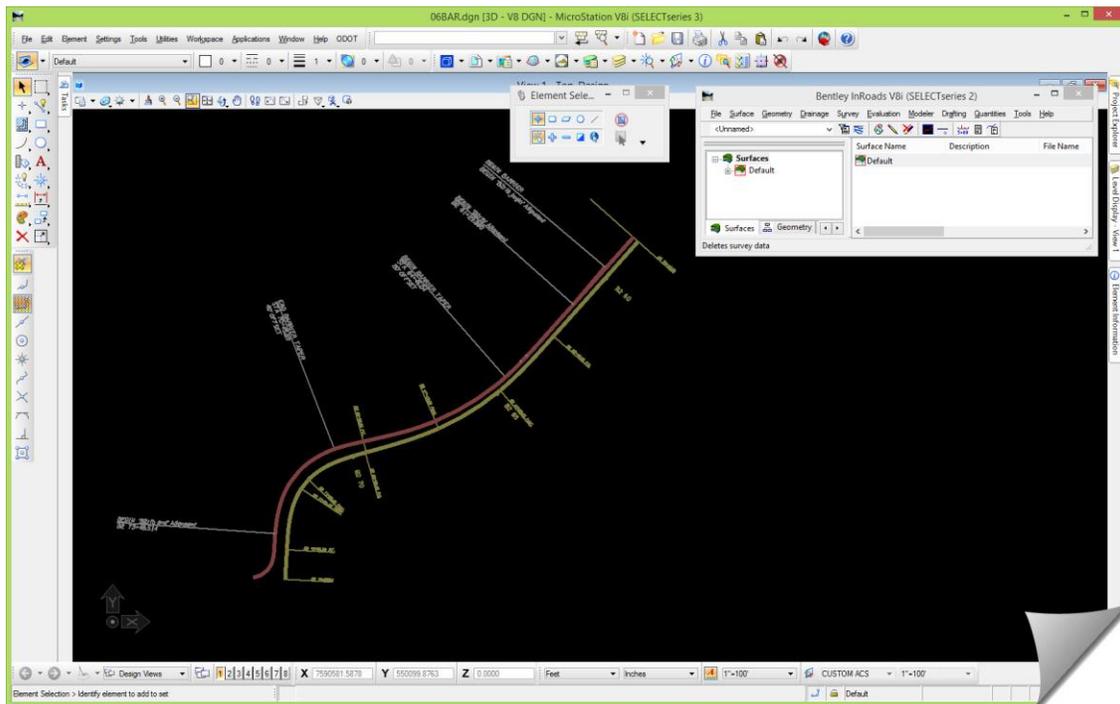
2) When the **MICROSTATION MANAGER** opens, set the **User** and **Interface** to **ODOT**.

3) Browse to the **C:\WORK\Train\06_Barrier** folder and select the **06BAR.dgn** file and click **[Open]**.



Wait for MicroStation and then InRoads to open.

4) When the drawing opens, you'll see that it has some content.



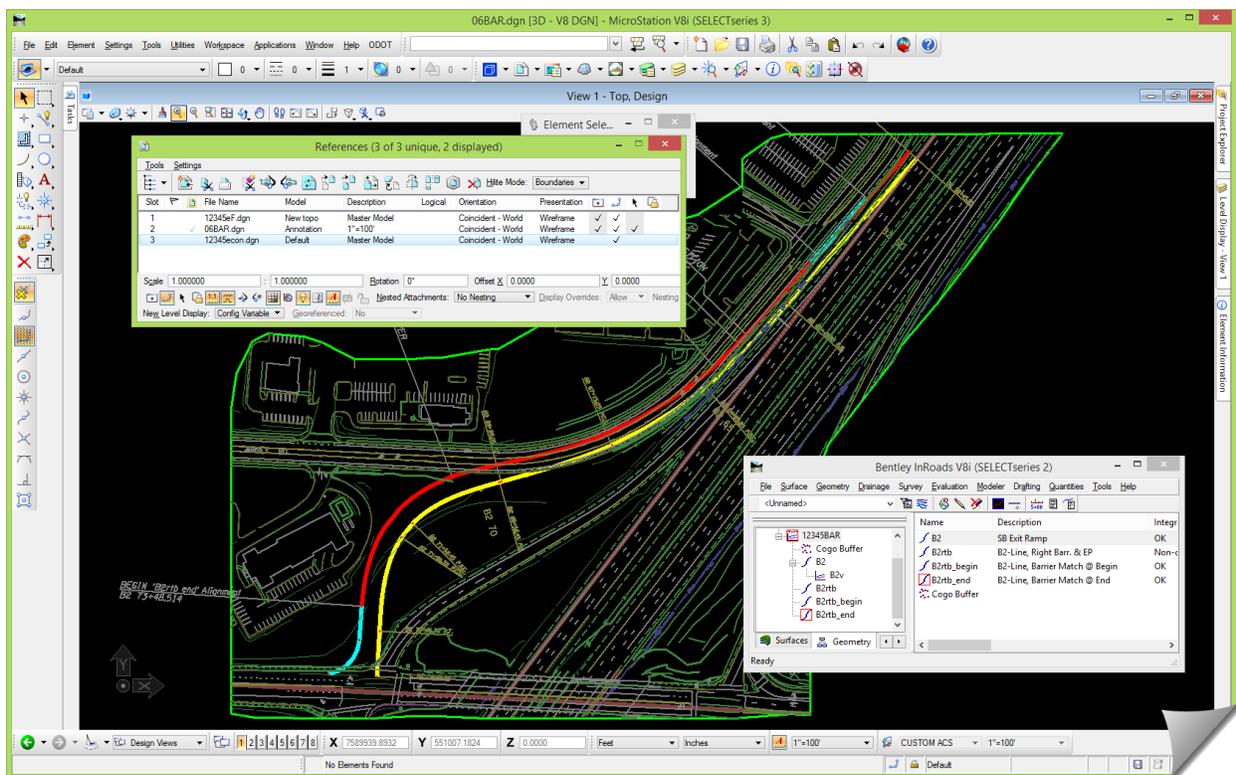
- 5) Open Windows **File Explorer** and browse to the **06_Barrier** folder.
- 6) Drag & drop the **Load_06BAR.rwk** file into the InRoads interface to load the data files.
- 7) Verify inside InRoads that the following files have been opened:
 - **06BAR.xin**
 - **12345BAR_og.dtm**
 - **12345BAR.itl**
 - **12345BAR.ird**
 - **12345BAR.alg**

All of the files loaded will eventually be used.

- 8) At this time, feel free to review the project data that was just opened by doing any or all of the following tasks:
 - a. View the **PERIMETER** of the **OG** surface
 - b. View the **HORIZONTAL ALIGNMENT B2**
 - c. View the other alignments that will be used to control the position of the barrier
 - d. View the **STATIONING** of the **HORIZONTAL ALIGNMENT B2**
 - e. Create a **PROFILE** and view the **VERTICAL ALIGNMENT B2v**

At this point in the module it is suggested that you do not open either the **CREATE TEMPLATE** or **ROADWAY DESIGNER**. You will be guided into these files later since the content of this module will be focusing on these tools. If you *do* review them, just ensure that you don't make any modifications.

- 9) You can also review the MicroStation reference files that are attached to this drawing.



- 10) Move forward into the study portion of this module. Feel free to interact with the software as needed during your study in order to solidify any of the items under discussion.

Theory - Study

Let's look at a few areas before continuing with the hands-on.

PROCESS OVERVIEW

This section will focus on a few topics that will set the stage and eventually play into the barrier modeling, namely:

- Why model barriers at all?
- What are the prerequisites for modeling a barrier from an InRoads perspective?
- What should I be alert to with regards to barrier modeling?

We'll cover the 'why' first. Then, once you've decided to move forward with this level of modeling you will be ready to get into the technical details of the 'how'.

Things to Consider

Why model barriers?

There are several reasons to model barriers, and the return for the effort should always be considered when approaching any detailed modeling such as this. (Examples of some of these have already been illustrated earlier in this module.)

- Display capability in Plan / Profile / Cross Section – once the barrier component is accurately modeled in the **ROADWAY DESIGNER**, eventually making its way into the design surface, all manner of displays are possible. These primarily include being able to view the barrier location in plan view, as well as showing the component on cross sections.
- Assist with Quantity take-offs – the ability to calculate quantities is limited mainly by having the item modeled and contained in one of the InRoads data files. Barriers are no different. Modeling barriers sets the stage for later automated quantity calculations in various ways including the use of the **ROADWAY DESIGNER**, **END AREA VOLUMES** and with the **QUANTITY MANAGER** (which is not used by ODOT now, but may be used in the future).
- Visualization – as seen in module 2, the design surface is the gateway to the world of visualization and expands the presentation capability of the final design. Most users don't realize how close they really are to creating renderings of their design models and even animated drive-thru's with either raw or refined texturing applied to their final surfaces. These visualizations can be delivered in a variety of video formats and even animated PDFs that anyone could open with Adobe Reader.
- Analysis (such as sight visibility and drainage) – surface models and the subsequent capability for viewing and analysis is an added reason for detailed modeling. If the need exists to analyze sight lines or drainage patterns, there may be enough value gained in the resulting surface to warrant the effort to produce a more detailed model.

These and other reasons have to be kept in mind when making the commitment to produce detailed surface models. But if you decide to create more complex models, you should adopt the philosophy to develop as accurate representations of the design as the software will allow. Putting something into the design model implies that it contains an acceptable level of correctness. And thereafter, you and your project team will be able to leverage that data in new ways.

Prerequisites to Barrier Modeling

Adding barriers into a design model requires some preparation before you can add these details into the **ROADWAY DESIGNER** and output the design surface. These items are in addition to the standard design items that you would normally do within InRoads. Specifically:

- Additional controls (horizontal alignments or surface features) to control the position of the barrier as it runs along the roadway. If it's a median barrier this geometry may already exist as the centerline; however if the barrier runs along the road edge relative to the shoulder, and the shoulder is changing in a non-linear fashion, then additional geometry may be needed. This geometry also includes any terminal starts and ends that might require its own flared path and unique geometry where it deviates from the main barrier path.

Regardless of how the barrier path is controlled – by a single alignment, multiple alignments, features, or portions of the barrier offset from the centerline alignment, these will have to be determined and any new alignments created prior to modeling.

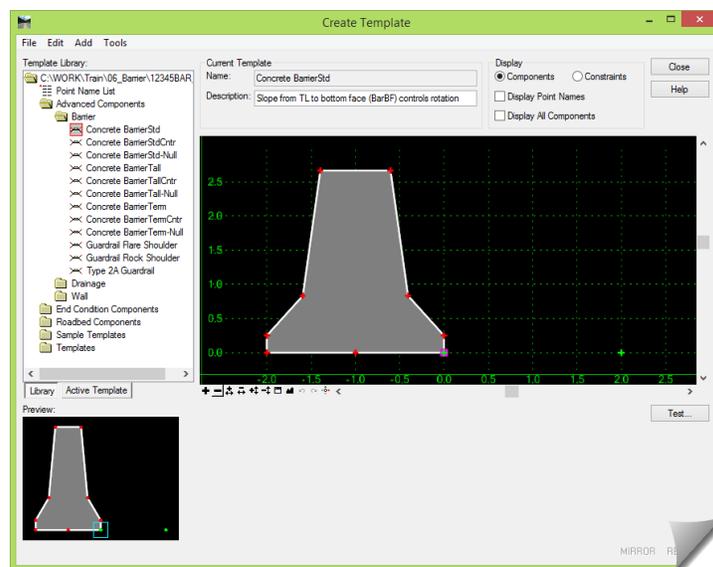
- The exact starting and stopping stations are based on centerline geometry. This will have to be thought through when using whatever criteria your project uses.
- Any barriers intending to be modeled will require a barrier component in the template library. These components will be integrated into your road templates so they can be modeled along with the roadway.
- To support the barrier components and their individual points, any needed **STYLES** and **NAMED SYMBOLOGIES** will have to be created and stored in the XIN.

After these items have been created and available, the final packaging within the **ROADWAY DESIGNER** can begin.

Techniques and Tools

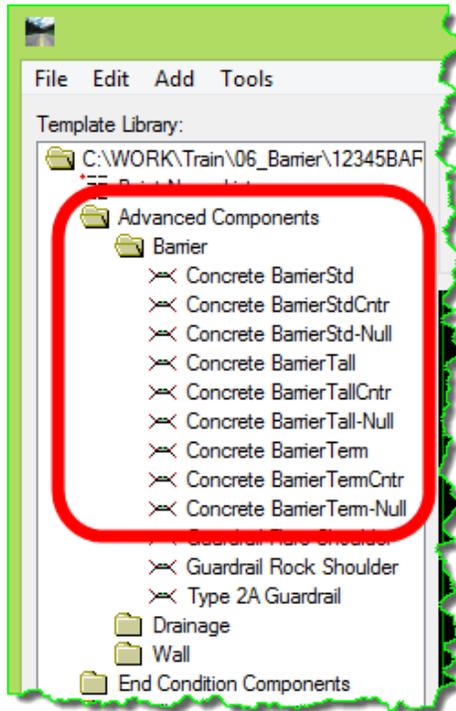
Barrier Components

An important requirement for barrier modeling is, of course, the barrier components.



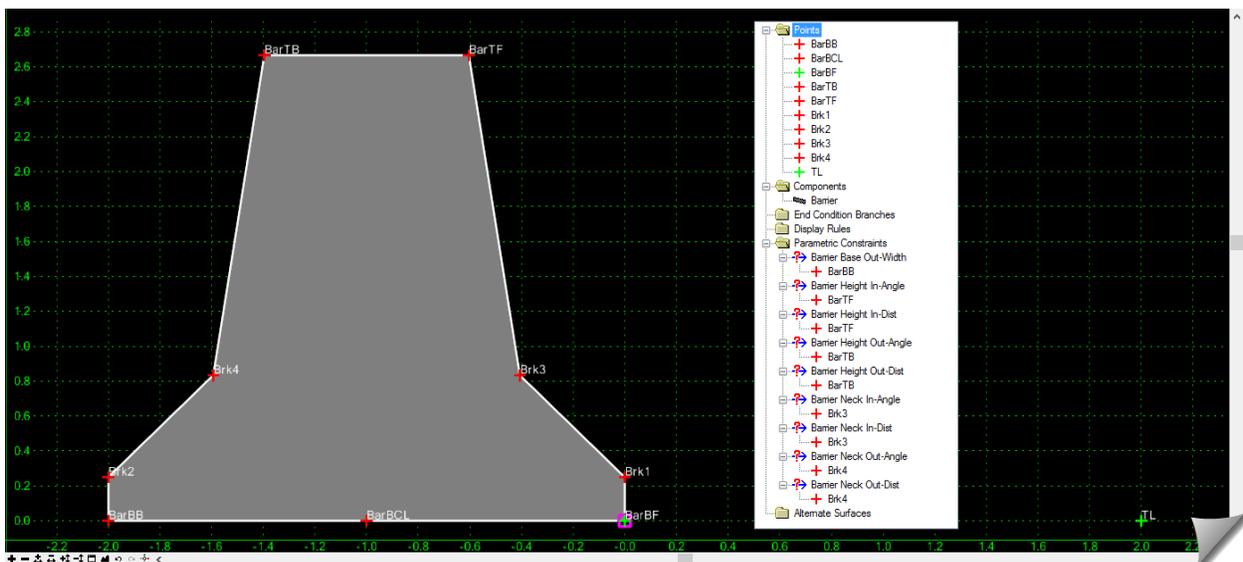
Three types of barrier components are provided – standard (**Std**) barrier (RD500), tall (**Tall**) barrier (RD545), and terminal (**Term**) barrier component (RD510) - in the stock ODOT seed ITL, along with associated **Styles** and **Named Symbolologies** in the XIN file.

Each of these types has three different components defined for them, making nine different barrier components.

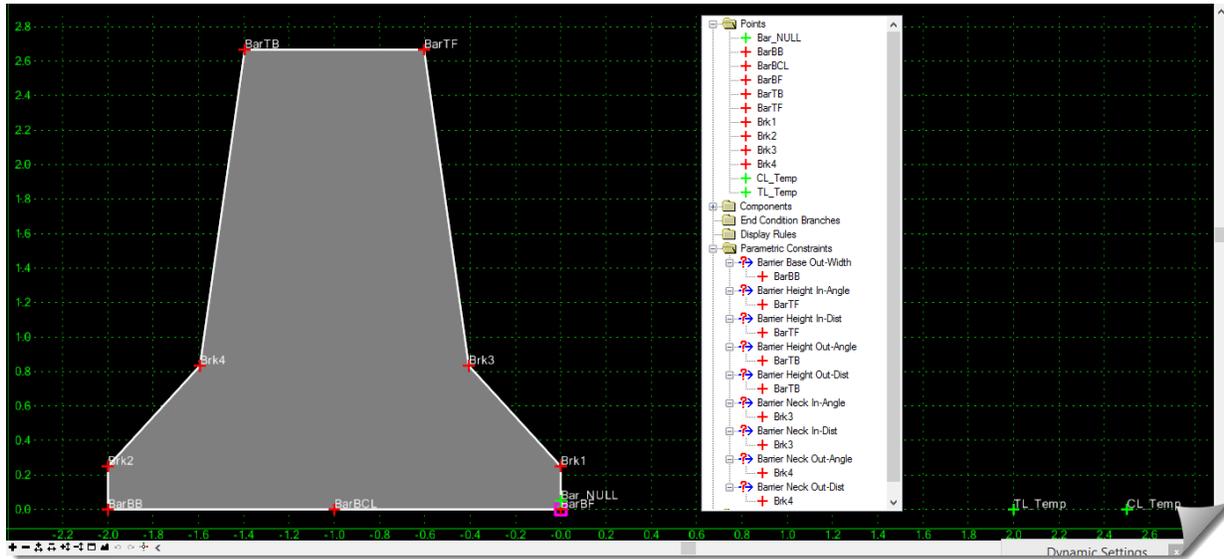


They can be classified as:

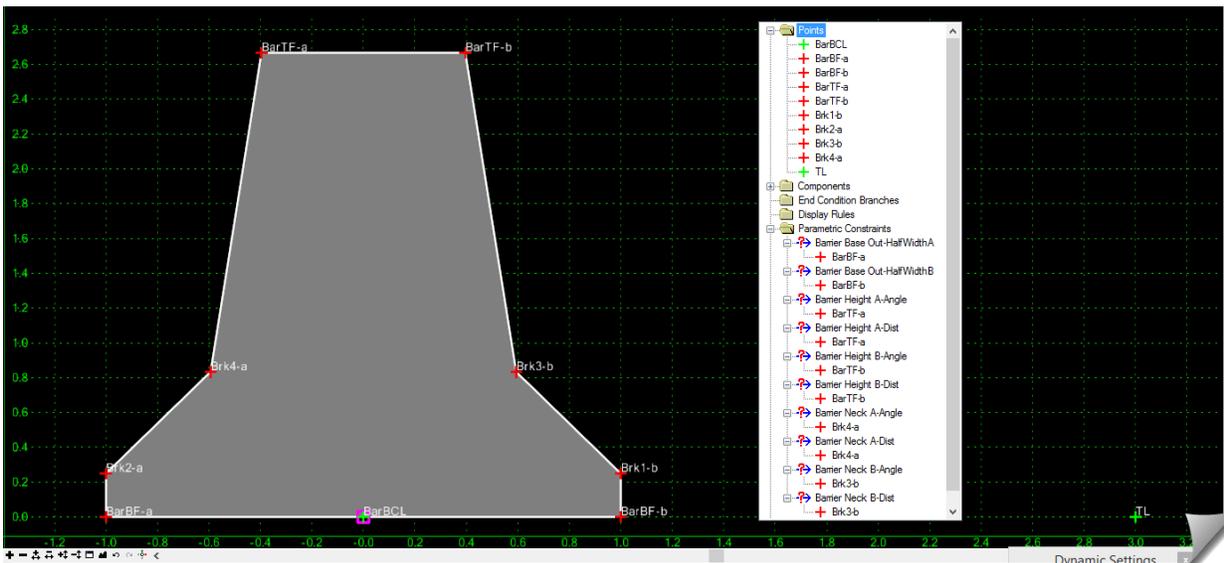
- **Simple** – these components can be used on non-superelevated shoulders, as well as with **POINT CONTROLS**, transitioning and parametrics within the guidelines presented later.
 - **Concrete BarrierStd** – Travel Lane / barrier bottom face (BarBF) rotation control
 - **Concrete BarrierTall** – Travel Lane / barrier bottom face (BarBF) rotation control
 - **Concrete BarrierTerm** – Travel Lane / barrier bottom face (BarBF) rotation control



- **Complex** – these components can be used on superelevated shoulders, as well as with **POINT CONTROLS**, transitioning and parametrics within the guidelines presented later.
 - **Concrete BarrierStd-Null** – CL / TL / BarBF rotation control, with Null Point
 - **Concrete BarrierTall-Null** – CL / TL / BarBF rotation control, with Null Point
 - **Concrete BarrierTerm-Null** – CL / TL / BarBF rotation control, with Null Point



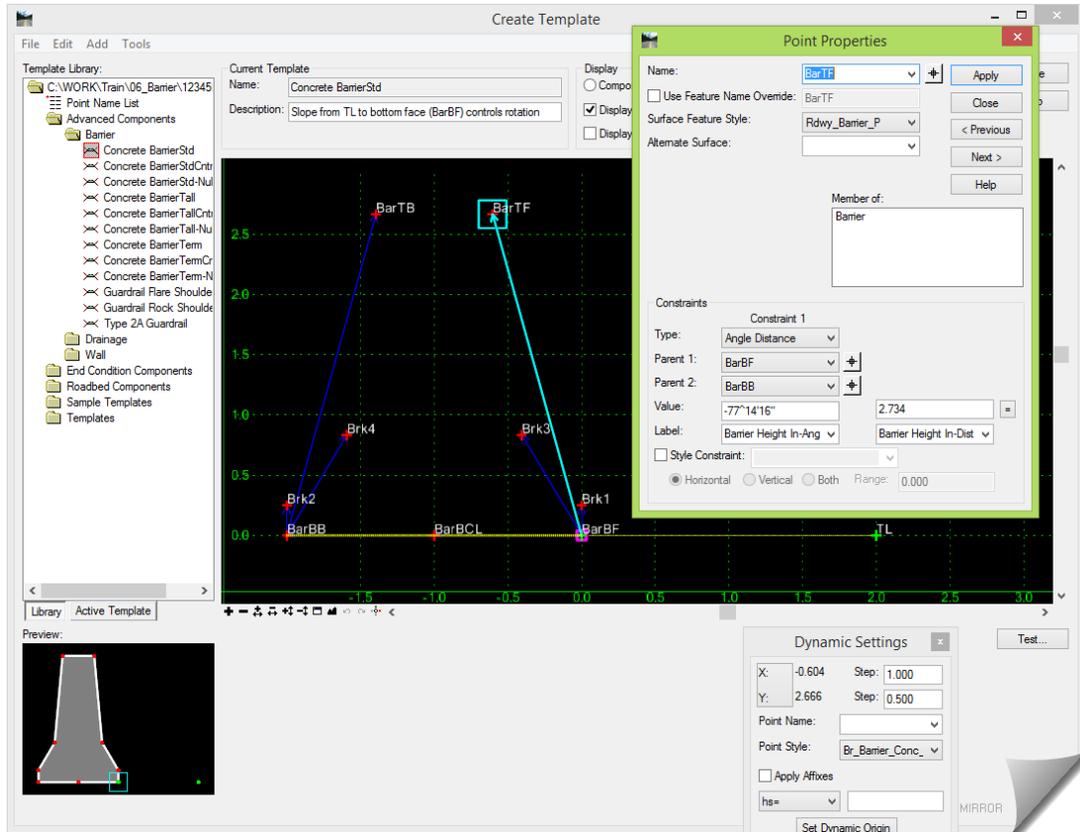
- **Median** – these components are intended for roadway center barriers and can be used in superelevated areas, as well as with **POINT CONTROLS**, transitioning and parametrics within the guidelines presented later.
 - **Concrete BarrierStdCntr** – Travel Lane / barrier centerline (BarBCL) rotation control
 - **Concrete BarrierTallCntr** – Travel Lane / barrier centerline (BarBCL) rotation control
 - **Concrete BarrierTermCntr** – Travel Lane / barrier centerline (BarBCL) rotation control



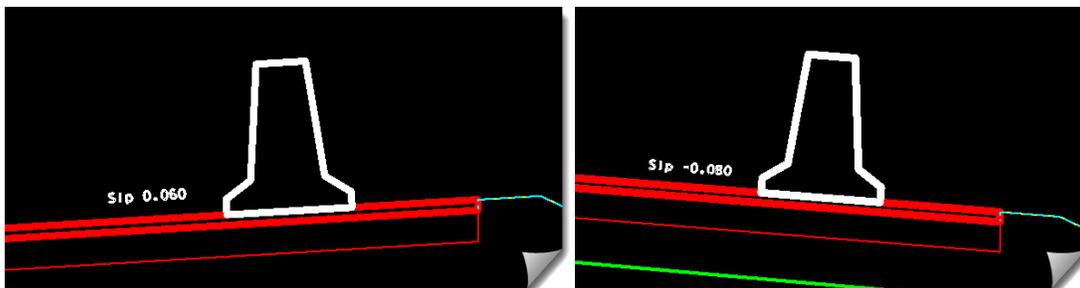
An item worthy of mentioning here concerns **Point Names** and **Parametric Constraint Labels**. As you review the barrier components later, you should take special note of the point names used and the consistency applied between component types. This is significant to allowing InRoads to develop the transitional breaklines when moving from one barrier type to another, as well as understanding the relationship between the template shape and the **Parametric Constraint Label**.

Advanced Constraint: Angle-Distance

The barrier components in the ODOT template library are heavily driven by the use of the **Angle-Distance** constraint.



This is because this **Constraint Type** provides shape control like no other constraint. The specific reason that this type of constraint is used is due to the need for the barrier to hold its rigid form during roadway cross-slope changes like the rotation caused by Superelevation, along with other variations that can occur with the road cross slope. And really, even on a gentle 2% cross-slope, the barrier geometry would alter if it were constructed using other constraint types.

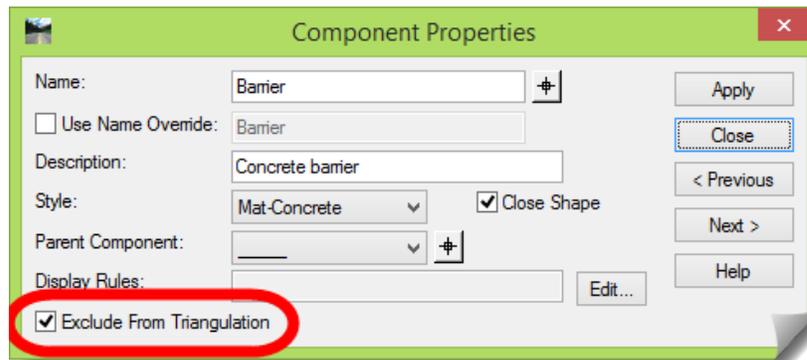


Point Controls

POINT CONTROLS are used to drive the barrier along its path when it deviates from the template location. The barrier can be controlled by the edge, as in the case of a shoulder barrier, or by its center in the case of a median barrier. The methodology of controlling different aspects of the template is extremely common and powerful, and should be well understood since it is required for accurate barrier modeling.

Component Triangulation

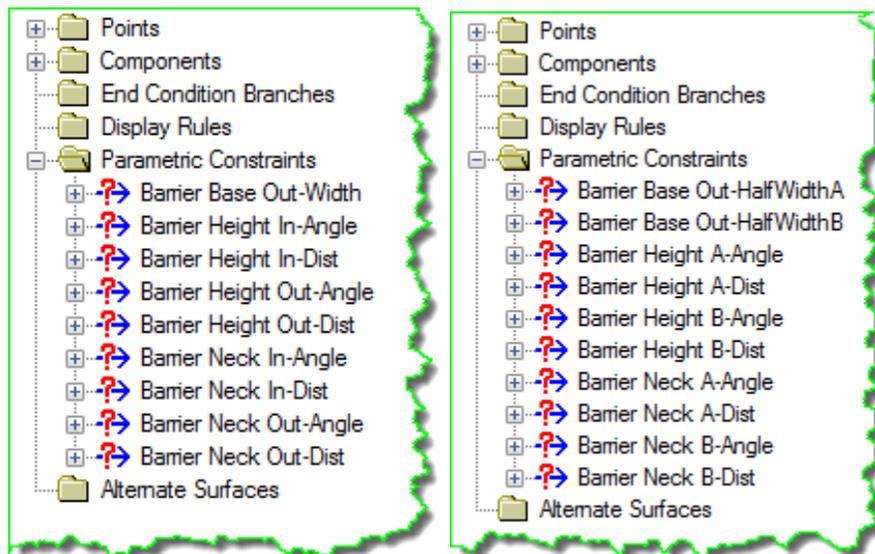
This will be discussed in more detail near the end of this module. But for now, it should be understood that during normal modeling, the barrier components are not part of the final design triangulation and should be set to **Exclude from Triangulation**.



Parametric Constraints

The use of **PARAMETRIC CONSTRAINTS** to influence the template geometry is fairly common during intermediate and advanced modeling with InRoads. These barriers, using the **Angle-Distance** constraint, make the application of **PARAMETRIC CONSTRAINTS** a bit more complex, requiring input values to be clearly known prior to use in the **ROADWAY DESIGNER**.

This topic will be covered in more detail toward the end of this module, but for now, it's important to understand that all of the barrier components are set up with **PARAMETRIC CONSTRAINT** Labels.



Practical Application - Hands On Lab Exercises

The following hands-on section will consist of a series of exercises. Each one builds upon the previous one, and will start with reviewing the ODOT barrier components and then using one of the components in the **ROADWAY DESIGNER**. Next, the subject of barrier transitioning will be covered followed by the creation of a barrier terminal. This will be wrapped up with a little discussion regarding barrier triangulation and the InRoads **SIGHT VISIBILITY** tools.

UNDERSTANDING THE DETAILS

Review any relevant project data

At this point you should be in the **06BAR.dgn** file. You should also have InRoads open, and having loaded the RWK, should have the **06BAR.xin**, the **OG** surface, the **12345BAR** Geometry Project, and the **12345BAR** template library and **ROADWAY DESIGNER** IRD files open.

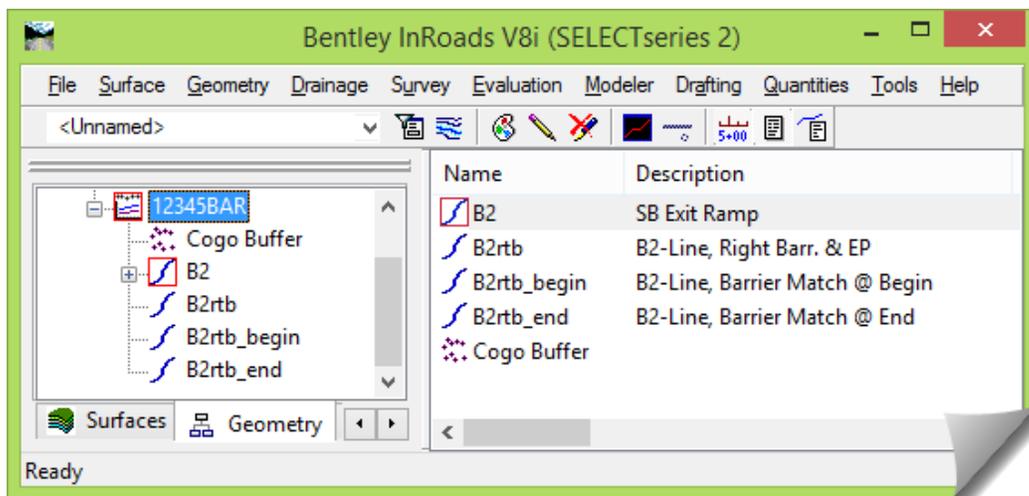
Review InRoads Geometry Data

Most of the work done in the next few sections will be within the **CREATE TEMPLATE** and **ROADWAY DESIGNER** tools, but first we'll take a quick look at the alignments that will be used to control the position of the barrier components.

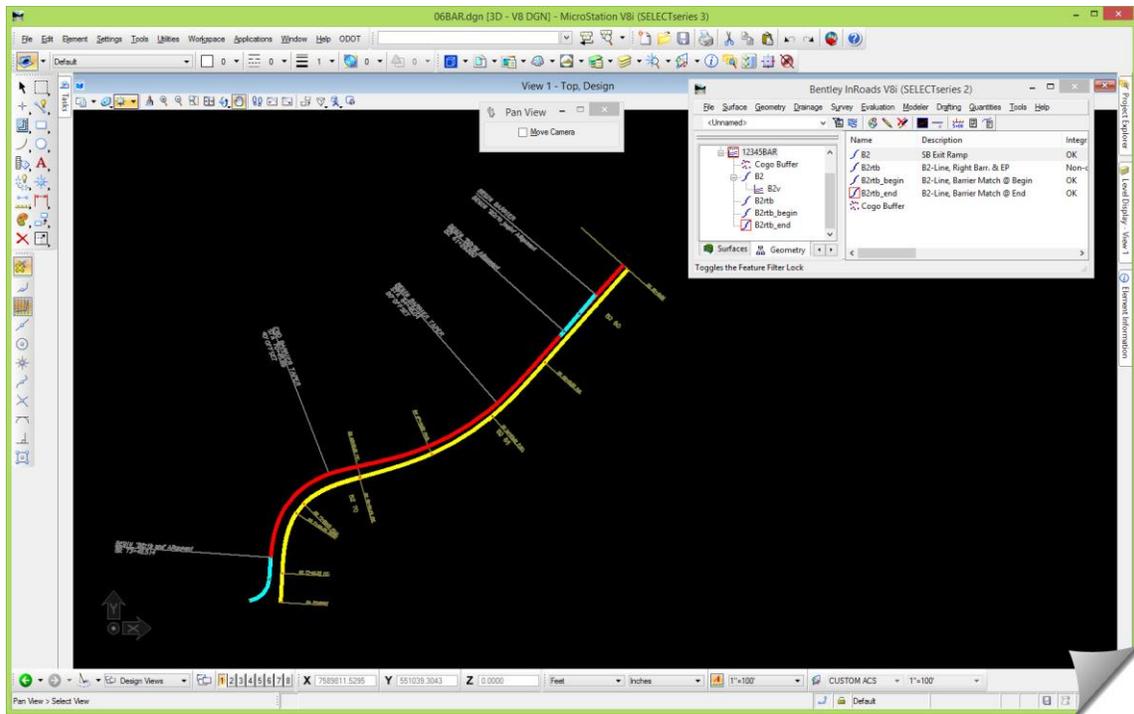
Specifically, these alignments will be used as Point Controls in the Roadway Designer to drive the location of the barrier at the front bottom point.

So first, let's tidy up the MicroStation view for clarity of the new displays.

- 1) Feel free to turn off any unwanted reference files and delete any unimportant InRoads graphics that might have been displayed.
- 2) Display and get familiar with the four alignments from the project geometry.



- **B2** – Ramp Centerline that will control the overall template
- **B2rtb** – Barrier control for the main stretch of roadway
- **B2rtb_begin** – Barrier control for the starting flare
- **B2rtb_end** – Barrier control for the ending flare



The three barrier controls will also be used to control the shoulder width, as the fog line is a consistent 4' offset to the left from the barrier itself, except in the area of the beginning flare.



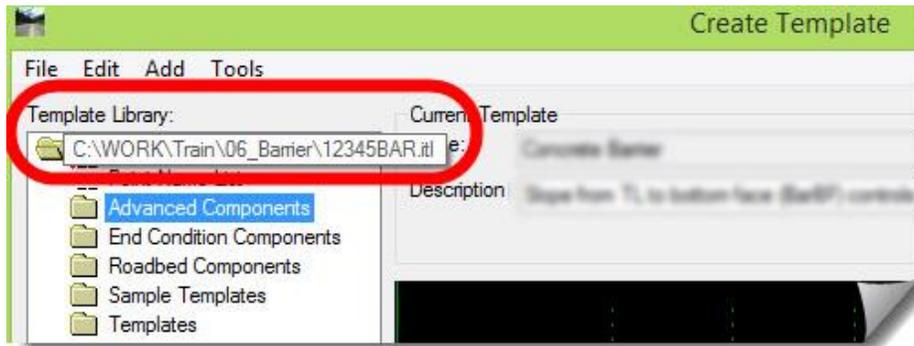
Review the Roadway Template

The graphic above is a portion of the roadway template that was designed for this project. You will not have to construct this template, and will only enhance it with the addition of the barrier components.

At this stage, it is expected that you can construct a template such as this; hence we will only be addressing how the barrier modeling is accomplished as an additional activity once the initial template has been created.

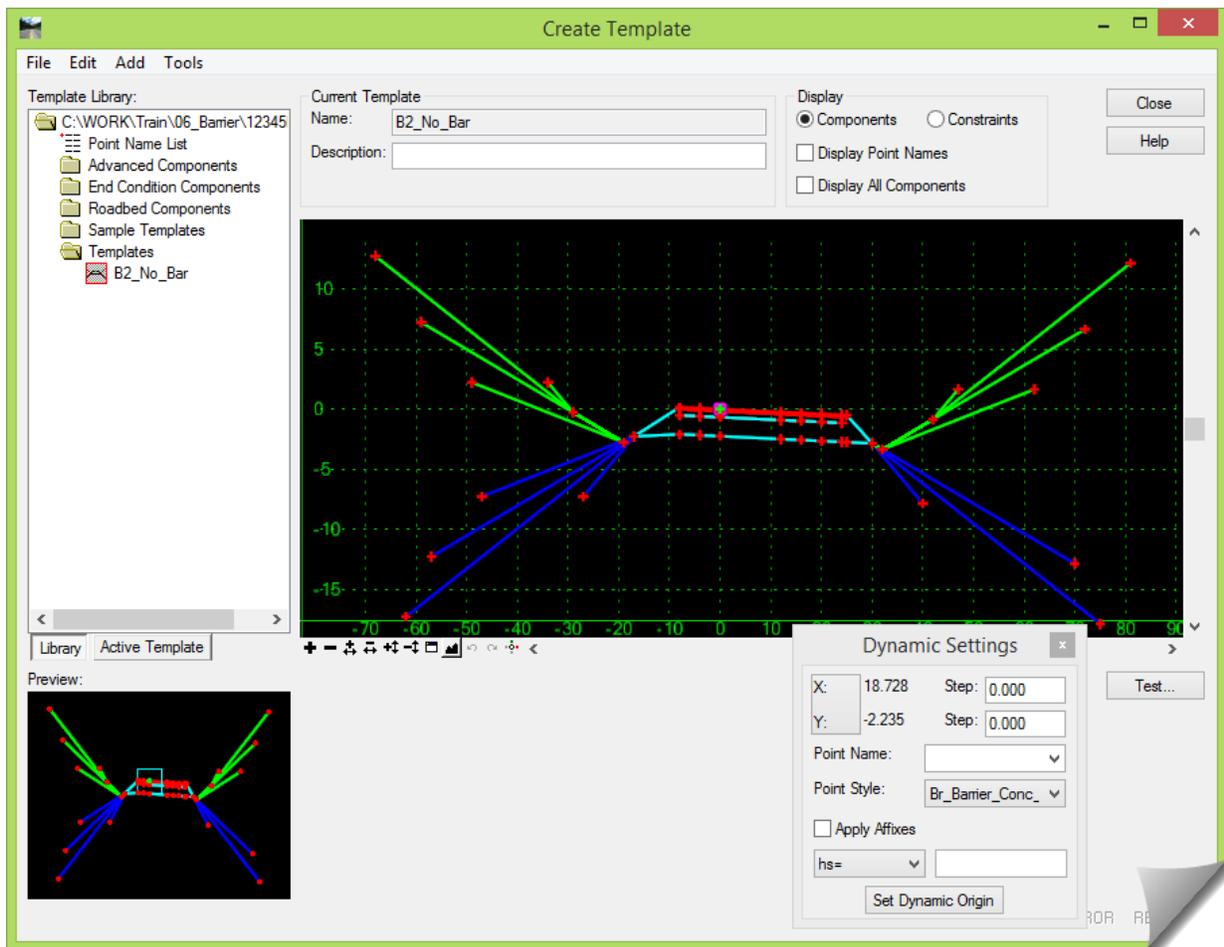
As a workflow item, the barrier modeling can always be done after the main roadway model. The ODOT components are already constructed to accommodate a barrier.

- 1) Go to the InRoads main menu and open the **CREATE TEMPLATE** tool.
- 2) Verify that the correct **ITL** is opened by checking the path at the top of the window.



TIP: Easy little incremental checks such as this should be done all the time. They might seem like they have little value, but catching the fact that the wrong file is open can potentially save you some rework later.

- 3) Browse to the **TempLates** folder and double-click on the **B2_No_Bar** template.



- 4) Take some time to do whatever review of this template that you require in order to understand how it is constructed.

As a guide when reviewing templates, here are some suggestions:

- **Point Names**, both general and _L and _R affixes
- **Point Constraints** assigned between points
- **COMPONENT PROPERTIES** for various materials
- **End Conditions**, including testing the template
- **Parametric Constraints** that may be assigned
- **Display Rules** that the template might contain
- **Alternate Surfaces** that are built into the template

All of the areas listed above can influence the results and potential workload (as in the **PARAMETRIC CONSTRAINTS** to assign) as you move into the **ROADWAY DESIGNER**.



TIP: Remember the **ACTIVE TEMPLATE** tab on the **CREATE TEMPLATE** tool. That template explorer area is extremely valuable for reviewing most of the items listed above. To the degree that you do not understand the template construction, you are gambling with the results.

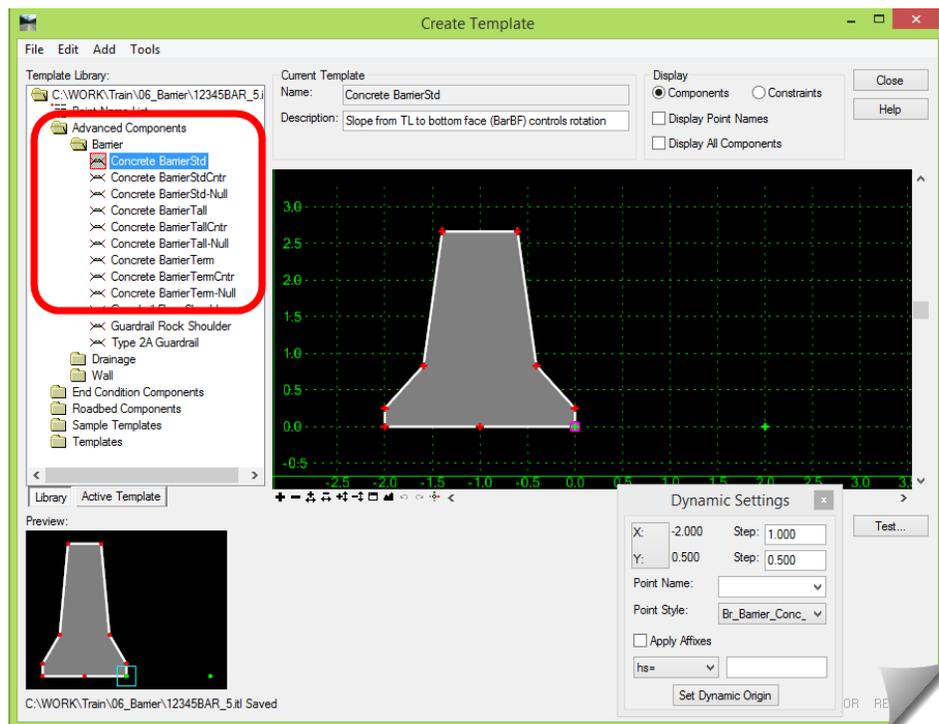
Review any relevant configuration items

The only area that will be reviewed here is the ITL information.

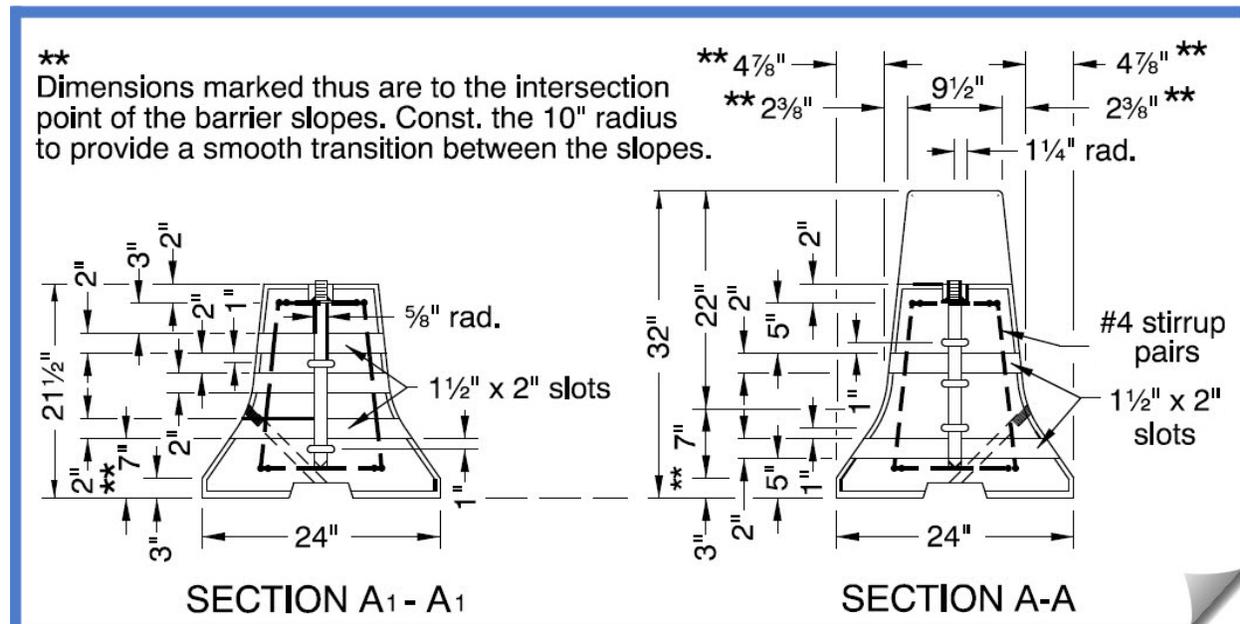
Review ODOT ITL Information

The following barrier components are what you will normally see in the ODOT ITL file.

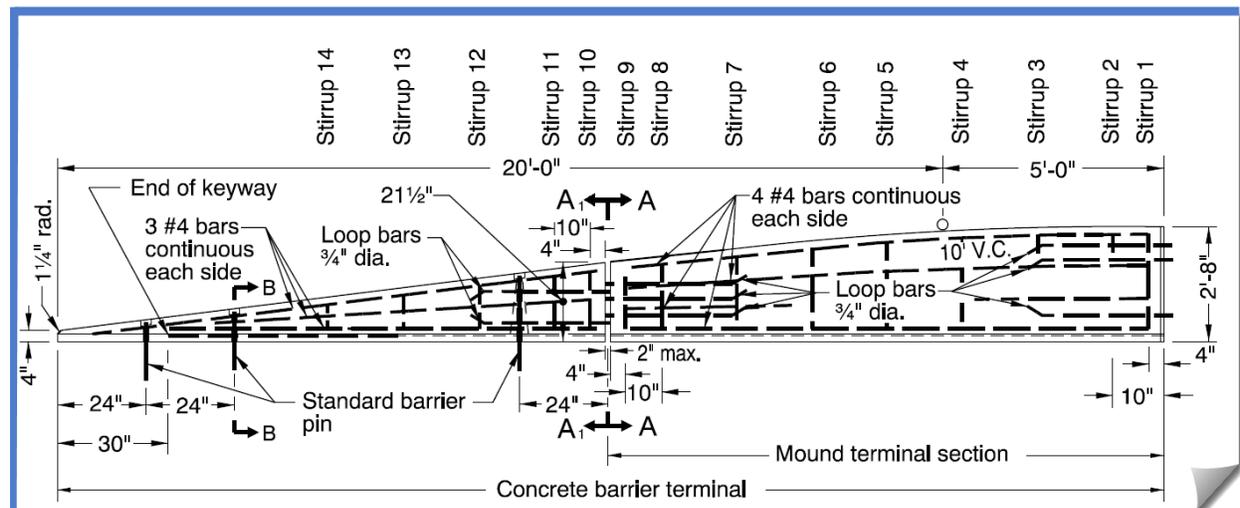
- 1) Browse to the **Barrier** folder under the **Advanced Components** folder. You should see the nine barrier components mentioned earlier.



RD510 – Terminal



In the drawing above, **Section A - A** is used to model the **Mound terminal section** of RD510.

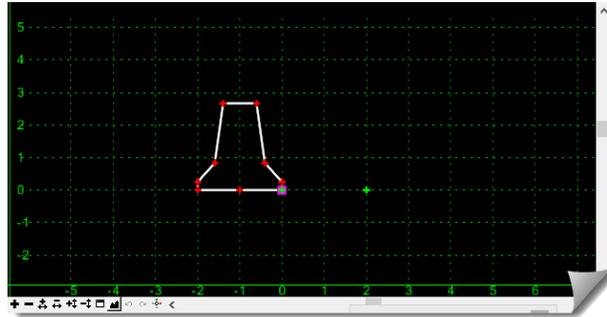


The full barrier terminal moves from a standard **RD500** barrier shape to a shortened version at **Section A - A** for the Mound terminal section, and then proceeds to get even smaller until it achieves the **B - B** section at the location shown above.

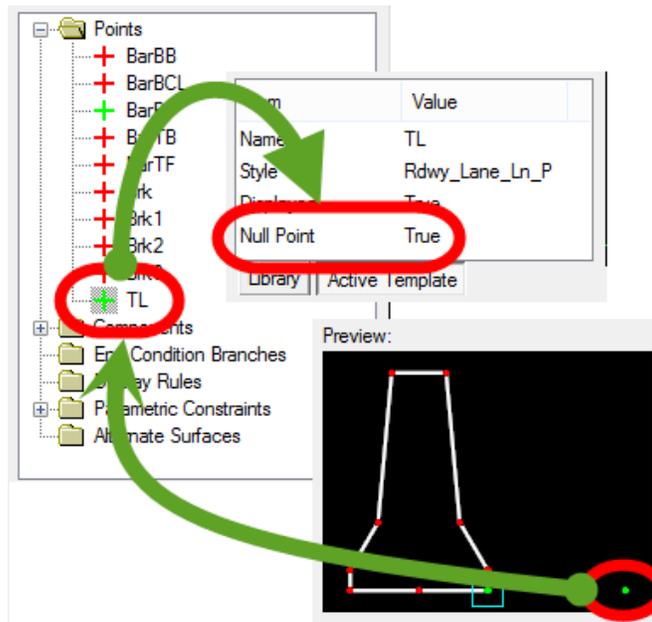
For most applications at ODOT the entire **RD510** terminal is not constructed, and this module will align with that approach and only transition to **Section A - A**.

Let's take one last look at these barriers before moving on. This will be a different look at how this component is constructed with the **Angle-Distance** constraint. Some of you may have already done this, but for those of you who haven't, follow along with these steps.

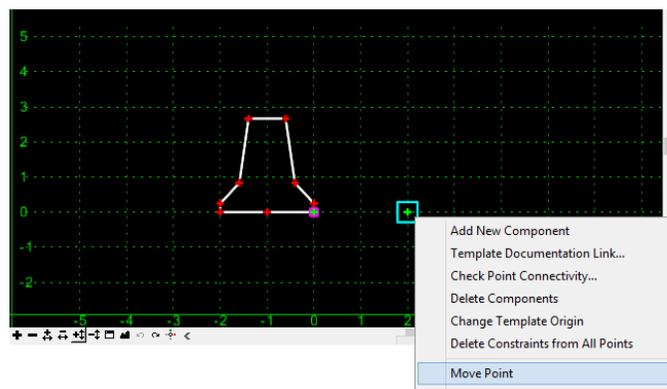
- 3) Double-click the **Concrete BarrierStd** component to make it the active component.
This will be a little test to see if your activity in the previous section did any damage to this barrier.
- 4) Zoom out so you can see the entire component and some space around it.



The green **TL** point is a **Null Point** and exists as an anchor to control the rotation of this entire barrier. Actually, it doesn't control the entire barrier rotation, but only controls the rotation of the base of the barrier – the base between **BarBB** and **BarBF**. The rest of the barrier rotation is tied into the rotation of the base.



- 5) Move back to the template construction window and right-click on the green **Null Point** and select **Move Point**.



- 6) Move your mouse slightly or dramatically and notice the barrier rotation. Keep in mind that this view may have a slight horizontal and vertical distortion. And although the **ROADWAY DESIGNER** cross section view has an option to define the vertical scale, this view does not.



Notice that it doesn't matter how close the **Null Point** gets to the barrier, it still holds its shape and rotates as expected.



- 7) Feel free to right-click <R> to get out of the **Move Point** mode and try it again. If you've accidentally repositioned the **Null Point**, just click **Undo** on the window control bar.
- 8) Make sure the component looks like the original before ending off on this section. If you believe you may have made a permanent edit, just close the **CREATE TEMPLATE** dialog box and don't save it. Then reopen it.

We'll now move to the simulated project and into the barrier modeling process, and its application to a roadway template. We will then follow through into a **Corridor** in the **ROADWAY DESIGNER**.

The upcoming hands-on will be done in three parts:

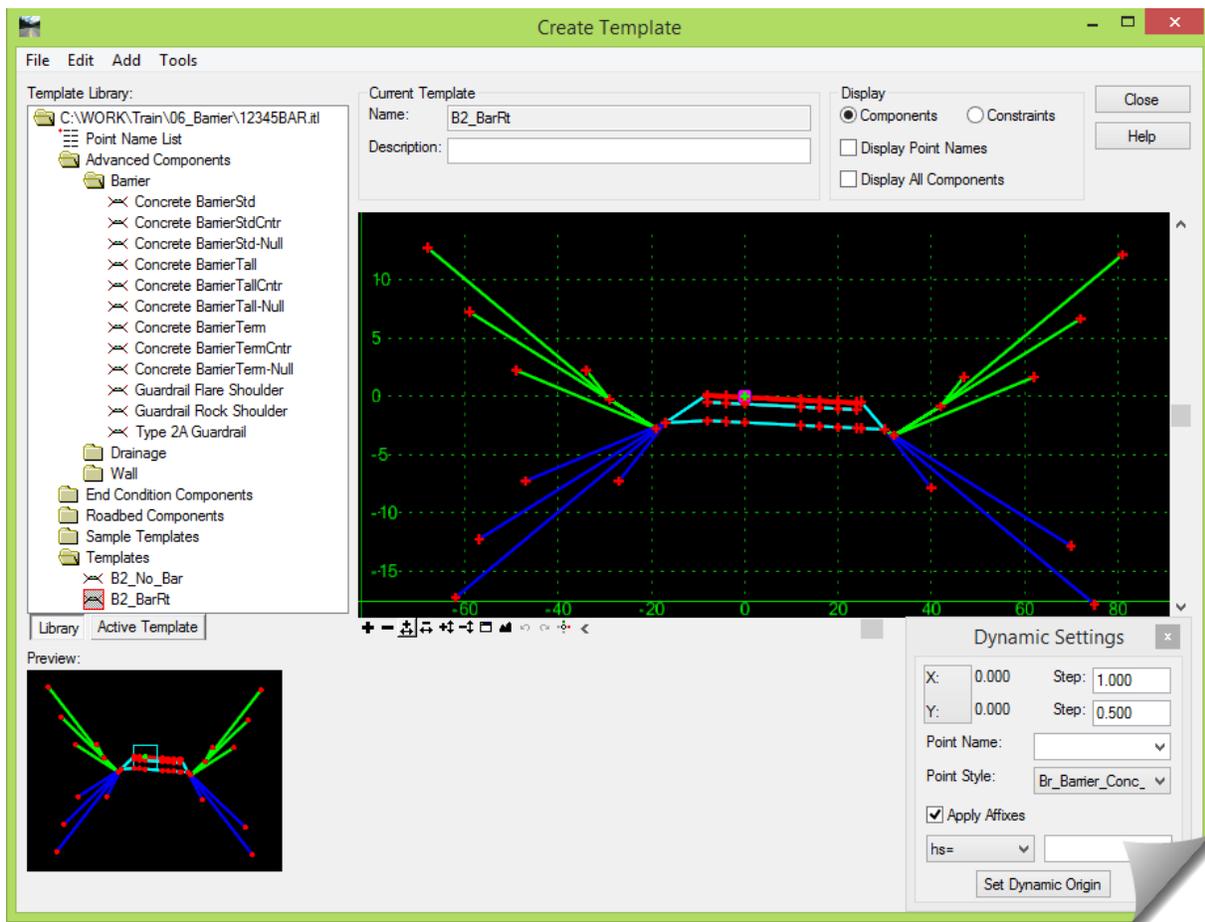
- a. First a barrier will be attached to the project template and run its entire length, being controlled by the geometry alignments.
- b. Then a barrier transition will be added to show how this process is accomplished. Note that these transitions will be done along the shoulder of the road, which is a less likely transition location than a median application. The process, however, is the same whether it is in the median of the road or on the shoulder, and is only done here for illustration purposes.
- c. Lastly, the terminals will be addressed using **PARAMETRIC CONSTRAINTS**.

LAYOUT SCENARIO 1 - MODELING A BARRIER

Add Barrier to a Corridor

This first section will copy the basic template and add a barrier to it. After that, this template will be used in the **ROADWAY DESIGNER** to develop a corridor. After reviewing the **POINT CONTROLS** and results in the **ROADWAY DESIGNER**, we'll move into the next major topic and add a barrier transition.

- 1) Open the **CREATE TEMPLATE** tool if you are not still in it, and then browse to the **Templates** folder and expose **B2_No_Bar**.
- 2) Right-click on **B2_No_Bar** and **Copy**. Then right-click on the **Templates** folder and **Paste**.
- 3) Right-click on **B2_No_Bar1** and **Rename** it to **B2_BarRt** and then double-click on it to make it the active template.

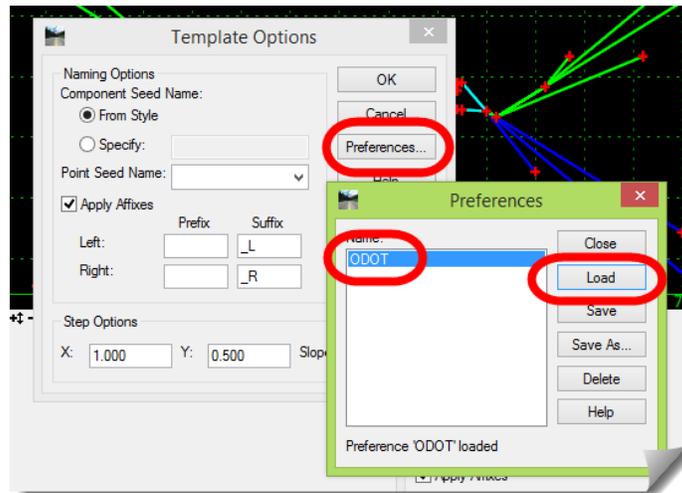


We are not going to concern ourselves with the construction details of source template **B2_No_Bar** right now, and hopefully you took your chance to review it earlier. So, at this stage an assumption is being made that the base roadway component is constructed properly.

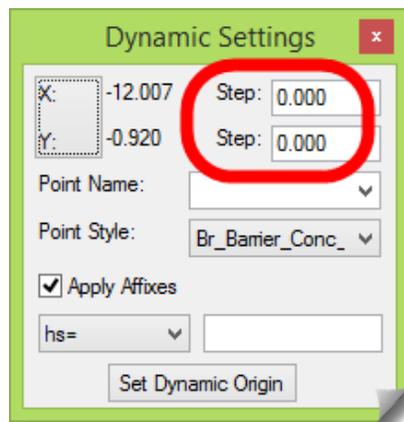
The next step will be to drag and drop the **Concrete BarrierStd-Null** component onto **B2_BarRt**, so let's make sure that everything is set for this to be properly accomplished. The **Std-Null** barrier is used because this roadway has **Superelevation** associated with it.

- 4) On the **CREATE TEMPLATE** tool, go to **TOOLS > OPTIONS** to open the **TEMPLATE OPTIONS** dialog box.

- Go to [Preferences] and [Load] the Preference called ODOT. Then [Close] that dialog.



- Open the DYNAMIC SETTINGS dialog, set the X Step and Y Step to 0.00, and make sure that Apply Affixes is toggled on. Don't worry about any other settings on that dialog.



Let's identify exactly where the barrier will be attached to B2_BarRt.

- Zoom in close on the right side of the shoulder.
The placement point for the barrier component is on the Bar_R point.



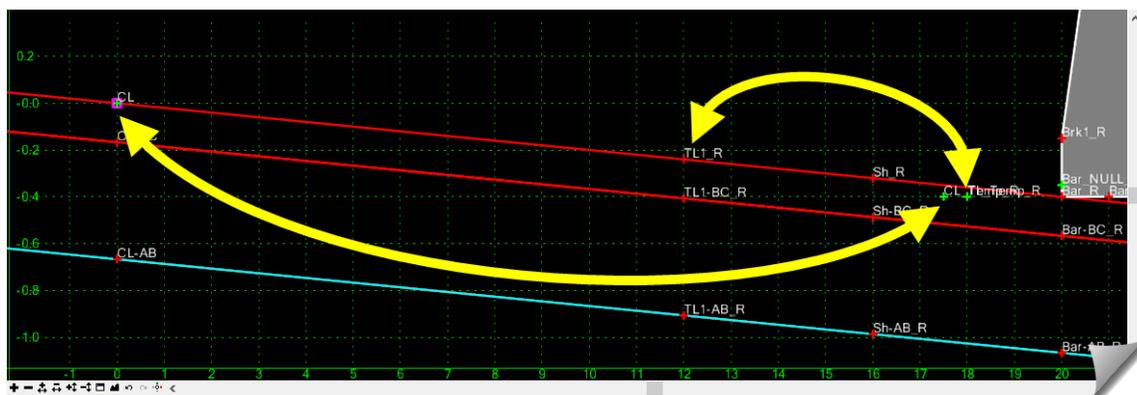
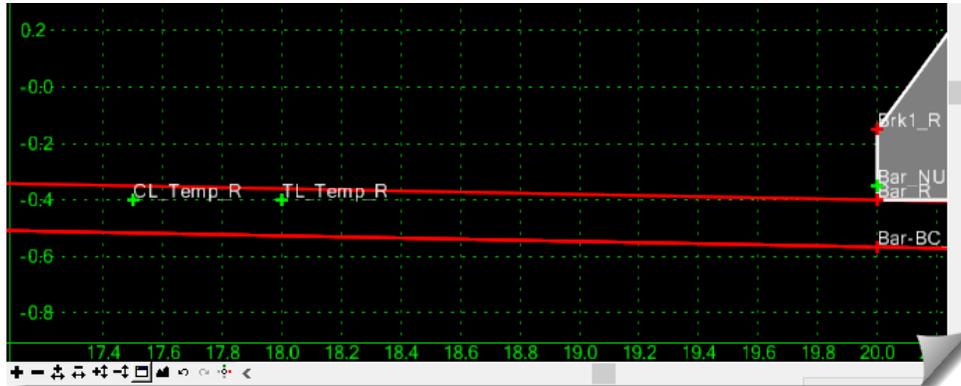
- 8) Single-click **Concrete BarrierStd-Null** so it shows up in the preview window.
- 9) Make sure that the **B2_BarRt** template is positioned to accept the barrier.
- 10) Drag and drop the barrier from the front base of the barrier onto the **Bar_R** point. As you drag the barrier onto the template you will have to **Reflect** it in order to get the proper orientation on the template.

If you wish to retain the **BarBF_R** point, drag it into the template first, and then move it to the **Bar_R** point so that it doesn't automatically merge.)



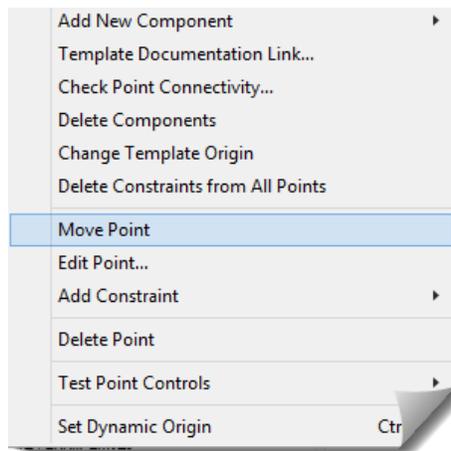
- 11) Notice the **CL_Temp_R** and **TL_Temp_R** points.

These points need to be moved onto the **CL** and **TL** of the template to control the rotation of the barrier. On this template, these points need to coincide with the **CL** and **TL1_R** points.



If you already know how to do this then please do; otherwise walk through the following steps.

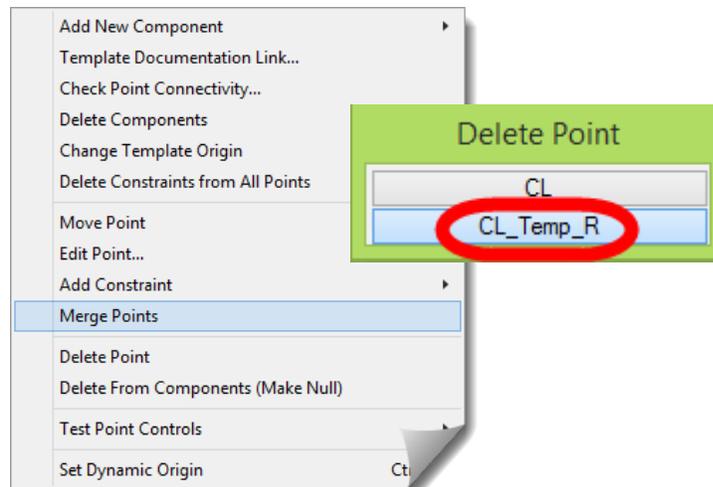
12) Right-click on the **CL_Temp_R** point and select **Move Point**.



13) Pick up the point and place it on the **CL** point.

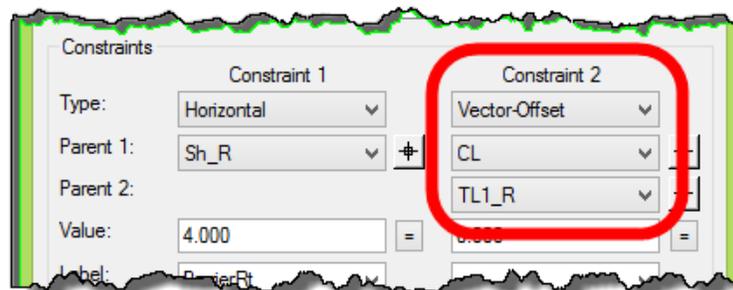
As you do this, you will see the barrier component rotate. This is working just as it should.

14) Now right-click on that location and **Merge Points** and select the **CL_Temp_R** point when it prompts you to **Delete Point**.



15) Now address the **TL_Temp_R** point, moving it onto the **TL1_R** point, then merging and deleting it just like was done with the centerline point.

This is done because the rotation of the barrier component is controlled by the slope developed between the centerline (**CL_Temp**) and the travel lane (**TL_Temp**). After the merge, the barrier rotation will be controlled by the slope generated from **CL** to **TL1_R**.



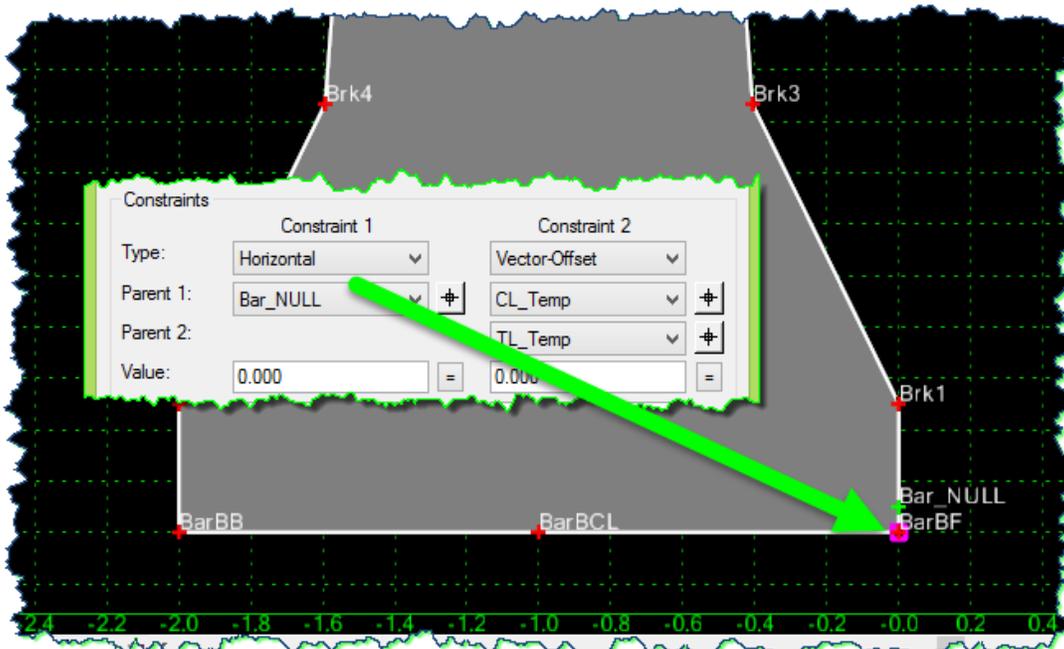
One last item to take care of is the horizontal control for the barrier.

This particular barrier component will be positioned using a **POINT CONTROL** assigned in the **ROADWAY DESIGNER**. This roadway also has **Superelevation** associated with it. There is a bit of a ‘perfect storm’ when this combination occurs – a component using the **Angle-Distance** constraint, being positioned by a **POINT CONTROL**, in a superelevated condition. When these elements come together, it is recommended by Bentley that the component using the **Angle-Distance** constraint should not have a **POINT CONTROL** assigned directly to any of its points. The way this is addressed is to control the position of the barrier through a **Null Point**.

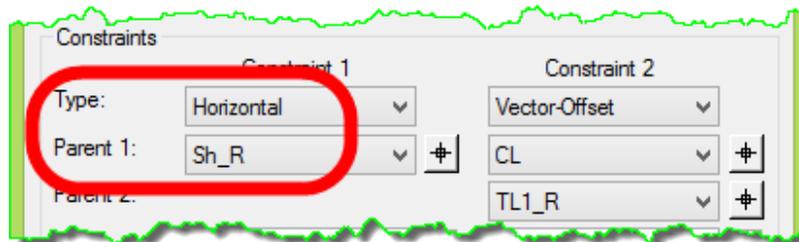


ALERT: Components constructed using the **Angle-Distance** constraint cannot have a **POINT CONTROL** attached directly to any of its component points when it is also in **Superelevation**. This set of conditions can produce undesirable results in some modeling instances.

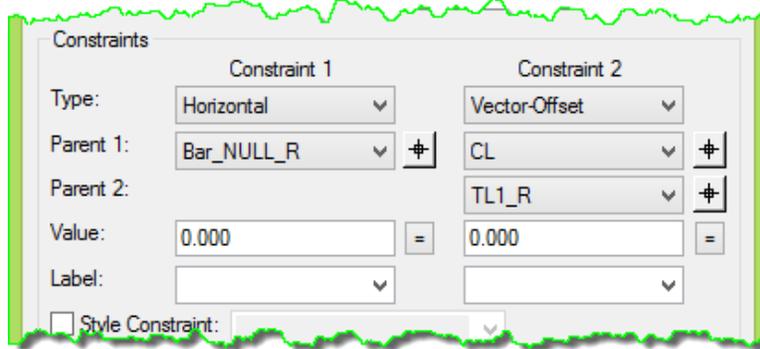
You may have noticed the barriers with the **-Null** suffix. These contain an embedded **Null Point** that is used to control the barrier position. Any **POINT CONTROL** used to position the barrier should be assigned to this point. The barrier front (**BarBF**) is horizontally constrained to this **Null Point**.



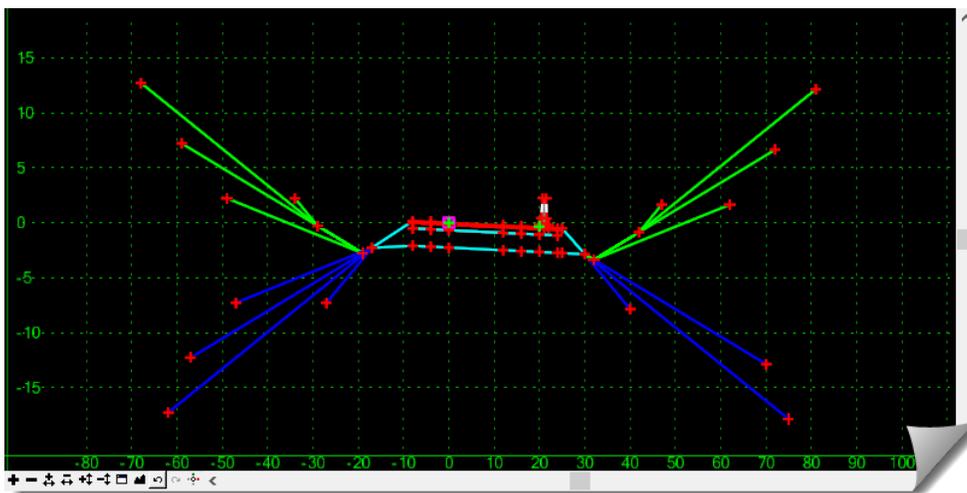
When this barrier component is dragged and dropped onto a template, the **Null Point** association needs to be revised. Reviewing the **POINT PROPERTIES** for **Bar_R** (previously **Bar_BF**) on the roadway template (**B2_BarRt**) will show the need for this edit.



16) Modify the **Horizontal** constraint by setting the **Parent 1** to **Bar_NULL_R**.



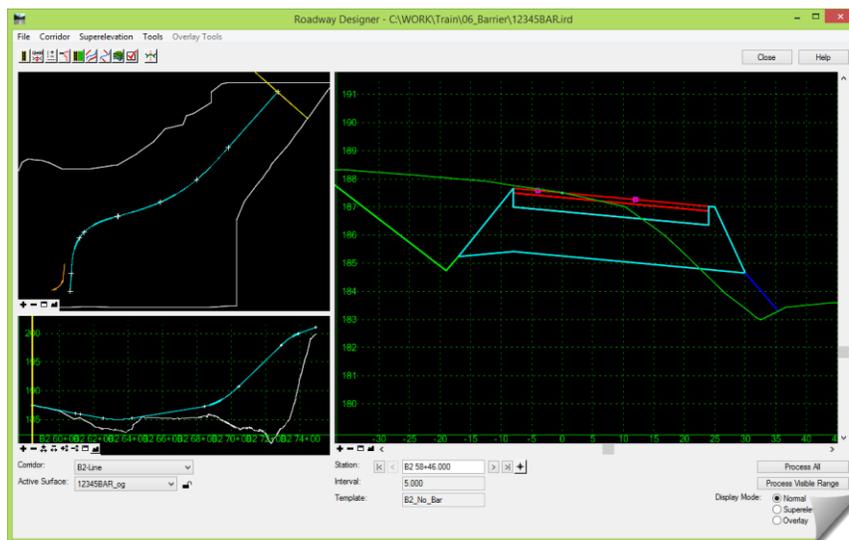
17) At this stage your template should look like this:



18) **Save** the **TEMPLATE LIBRARY** at this point if you haven't already and then **[Close]** it.

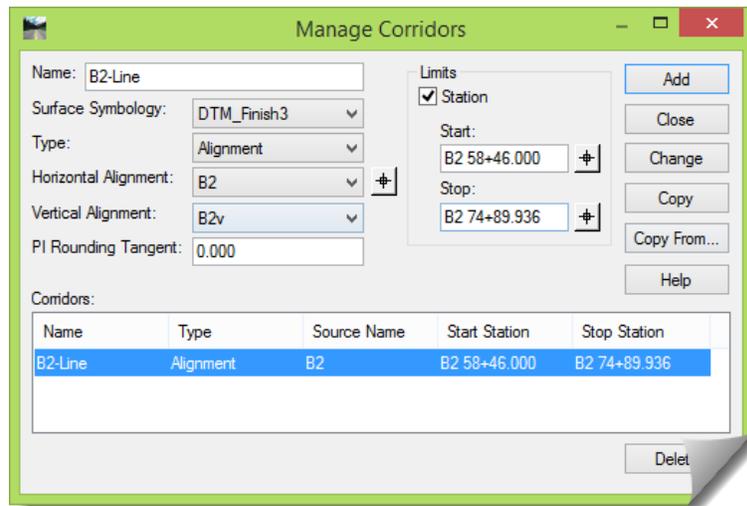
19) Open the **ROADWAY DESIGNER**.

The **Corridor** should be set to **B2-Line** and the **Active Surface** should be **12345BAR_og**.

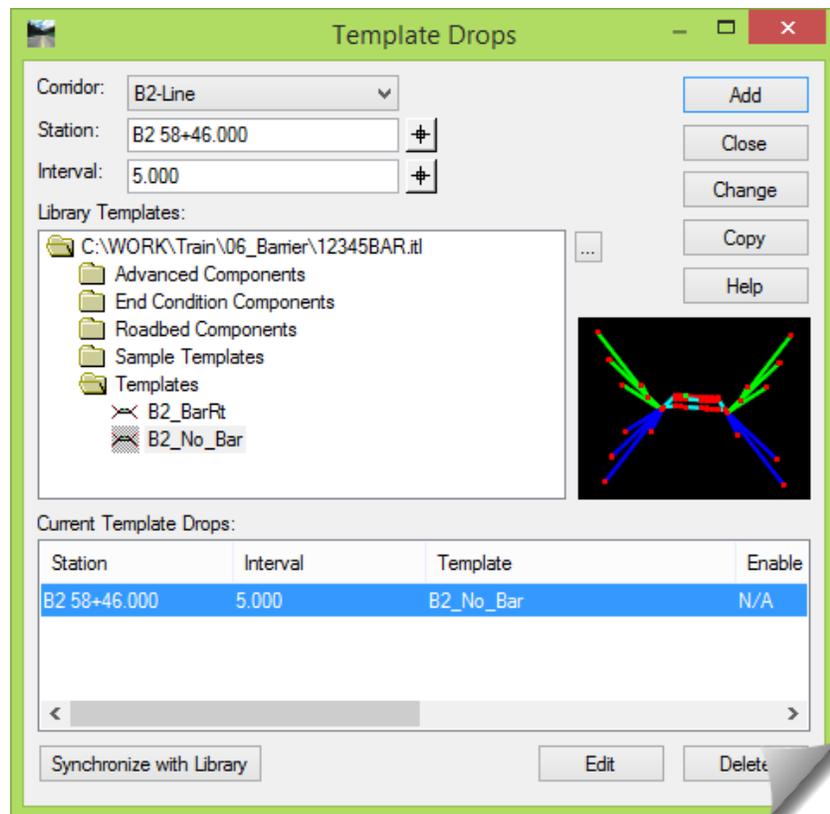


There is already a **Corridor** created for this work using the base template **B2_No_Bar**.

20) Take a glance at the way the **Corridor** is set up by going to **MANAGE CORRIDORS**.



21) Go to the **TEMPLATE DROPS** dialog box and select the single entry listed in the **Current Template Drops** list window at the bottom of this dialog box. Notice the settings on this entry.



Let's add an entry for the **B2_BarRt** template that was created with the addition of the barrier, but first let's look at the **POINT CONTROLS** that have been set up for this corridor in preparation for the barrier modeling.

22) <Close> the **TEMPLATE DROPS** dialog box for now.

23) Open the **POINT CONTROLS** dialog box and review the entries.

Here is a description of the entries:

- The first two entries are controls for the Superelevation
- The next pair of entries controls the shoulder of the road. These controls are the same as the barrier controls, but offset 4'
- The last three entries are:
 - The start and stop for the entry flare
 - The start and stop for the main barrier running along the roadway
 - The start and stop for the end flare

Horizontal and Vertical Controls:

Enabled	Priority	Name	Start Station	Stop Station	Mode	Type	Control	Description
X	1	TL1_R	B2 58+45.850	B2 74+89.937	Vertical	Superelevation	Section1 CL-TL1_R:CL	
X	1	TL1_L	B2 58+45.850	B2 74+89.937	Vertical	Superelevation	Section1 CL-TL1_L:CL	
X	1	Sh_R	B2 61+29.880	B2 73+48.514	Horizontal	Alignment	B2tb	Shoulder Alignment
X	1	Sh_R	B2 73+48.514	B2 74+89.937	Horizontal	Alignment	B2tb_end	Shoulder End- Flare
X	1	Bar_R	B2 59+74.960	B2 61+29.880	Horizontal	Alignment	B2tb_begin	Barrier Begin- Flare (STD RD526)
X	1	Bar_R	B2 61+29.880	B2 73+48.514	Horizontal	Alignment	B2tb	Barrier Alignment
X	1	Bar_R	B2 73+48.514	B2 74+89.937	Horizontal	Alignment	B2tb_end	Barrier End- Flare

These entries already exist, and they are tied to the **Bar_R** point which coincides with the naming convention used for this sample project. However, remember in this case these **POINT CONTROLS** will have to be reassigned to **Bar_NULL_R** per the earlier discussion and alert.

Eventually this module will cover adding the start and end flares, as well as a transition along the main roadway. But for now, the template drops will be modified to run the standard barrier from beginning to end along these three **Point Controls**.



TIP: In this instance, the barrier control geometry was built in 3 pieces – the start flare, the main stretch, and the ending flare. There is no requirement to have these controls as independent alignments, and this control could have easily been a single alignment.

24) Open the **TEMPLATE DROPS** dialog box and add a drop for the new **B2_BarRt** section at **Station B2 59+74.960**.

25) After the entry is added, **Disable the Transition**.

In this case, there will be no barrier transition; it will abruptly start at the entered station.

Current Template Drops:

Station	Interval	Template	Enable Transition	Revised In	Library
B2 58+46.000	5.000	B2_No_Bar	N/A	ITL	C:\WORK\Train\06_Barrier\123...
B2 59+74.960	5.000	B2_BarRt		ITL	C:\WORK\Train\06_Barrier\123...

Synchronize with Library Edit Delete

26) **[Close]** the **TEMPLATE DROPS** dialog once it has been added.

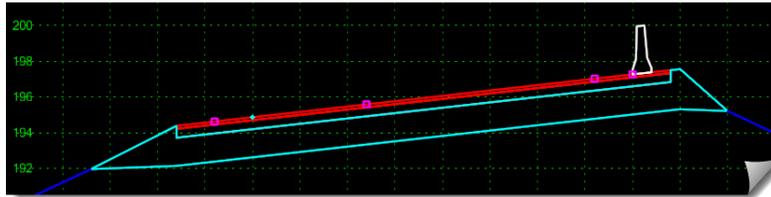
27) **[Add]** a **KEY STATION** at **59+74.950** for the abrupt barrier template introduction.

28) Open the **POINT CONTROLS** and reassign the three barrier controls to **Bar_NULL_R**.

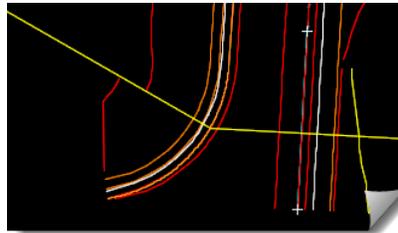
Horizontal and Vertical Controls:

Enabl...	Priority	Name	Start Station	Stop Station	Mode	Type	Control	Description
X	1	Bar_NULL_R	B2 59+74.960	B2 61+29.880	Horizontal	Alignment	B2tb_begin	Barrier Begin- Flare (STD RD526)
X	1	Bar_NULL_R	B2 61+29.880	B2 73+48.514	Horizontal	Alignment	B2tb	Barrier Alignment
X	1	Bar_NULL_R	B2 73+48.514	B2 74+89.937	Horizontal	Alignment	B2tb_end	Barrier End- Flare

29) Review the cross sections in the **ROADWAY DESIGNER** and see if they make sense.



30) Notice when reviewing the section indicator in the plan view window that the modeling has an angle point on the end flare.



That's because the **Use as Secondary Alignment** is toggled *on*. The implications of this toggle should always be considered when establishing **POINT CONTROLS**.

31) If you haven't already done so, **Save** the **ROADWAY DESIGNER**.

At this point you can continue to walk through the Cross Sections in the **ROADWAY DESIGNER** and review the results, looking for anything that seems out of place or incorrect.

Once that is done to your satisfaction you can:

- Go to **CREATE SURFACE** and create the design model.
- Once this surface is created [**Close**] the **ROADWAY DESIGNER**.
- Verify that your design surface has been created and then **Save** it to the module folder.
- Review the surface feature data in the **FEATURE PROPERTIES** to verify that it's as expected.
- Verify the barrier **Features** created by this model are found in the design surface. It's important to be able to relate the template construction with the resulting surface features.
- Review the resulting design surface in MicroStation any way that you feel like.
- Create cross sections for an additional review of the design surface.

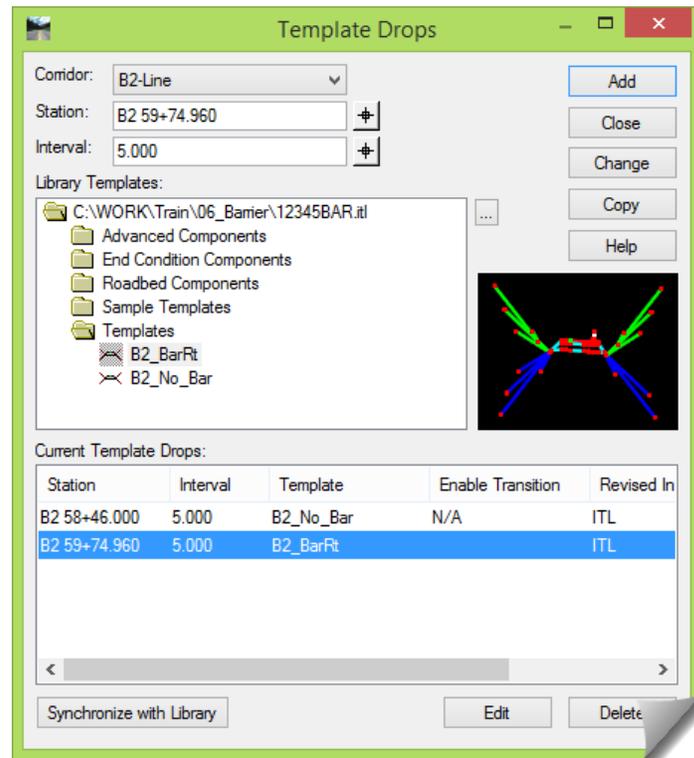
LAYOUT SCENARIO 2 - ADDING TRANSITIONS

Transition between barriers

Now we will take what has already been done and illustrate how a barrier transition is added.

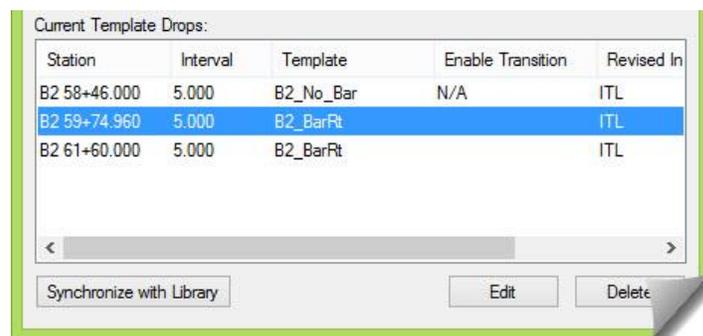
In this example, a transition will be created going from standard barrier to tall barrier and then back again. Keep in mind that these transitions should occur in 12.5' per RD560.

- 1) Open the **TEMPLATE DROPS** dialog box and select the last entry.



The technique shown here is a method that some of you may not have done before, and there are advantages and disadvantages to it. It is shown here to expand the range of how you can create additional modeling drops within the **ROADWAY DESIGNER** without having to add them via the **CREATE TEMPLATE** tool. If desired, this edit could also be done in the **CREATE TEMPLATE** command and then added here.

- 2) Select the last entry, change the **Stationing** to **B2 61+60.000** and then <Copy>. A new entry will appear in the lower list window.



- 3) Now select that last new entry that was just created from the lower list window, change the **Stationing** to **B2 61+72.500** and then click **<Copy>**.

Current Template Drops:

Station	Interval	Template	Enable Transition	Revised In
B2 58+46.000	5.000	B2_No_Bar	N/A	ITL
B2 59+74.960	5.000	B2_BarRt		ITL
B2 61+60.000	5.000	B2_BarRt		ITL
B2 61+72.500	5.000	B2_BarRt		ITL

Synchronize with Library Edit Delete

These two entries are the start and end of our transition to the RD545 Tall barrier. Note that for this exercise, the template drop stations used for the 12.5' transition length were not adjusted to account for horizontal curvature. This should be checked and adjusted as necessary on your project. Now just for some additional practice, let's add a couple more entries where we will transition the tall barrier back to the standard barrier.

And you are correct; all of these sections are a copy of the standard barrier. The tall barrier will be added shortly.

- 4) Add two more entries just like before with this **Station** information:
- **B2 62+00.000**
 - **B2 62+12.500**

Current Template Drops:

Station	Interval	Template	Enable Transition	Revised In
B2 58+46.000	5.000	B2_No_Bar	N/A	ITL
B2 59+74.960	5.000	B2_BarRt		ITL
B2 61+60.000	5.000	B2_BarRt		ITL
B2 61+72.500	5.000	B2_BarRt		ITL
B2 62+00.000	5.000	B2_BarRt		ITL
B2 62+12.500	5.000	B2_BarRt		ITL

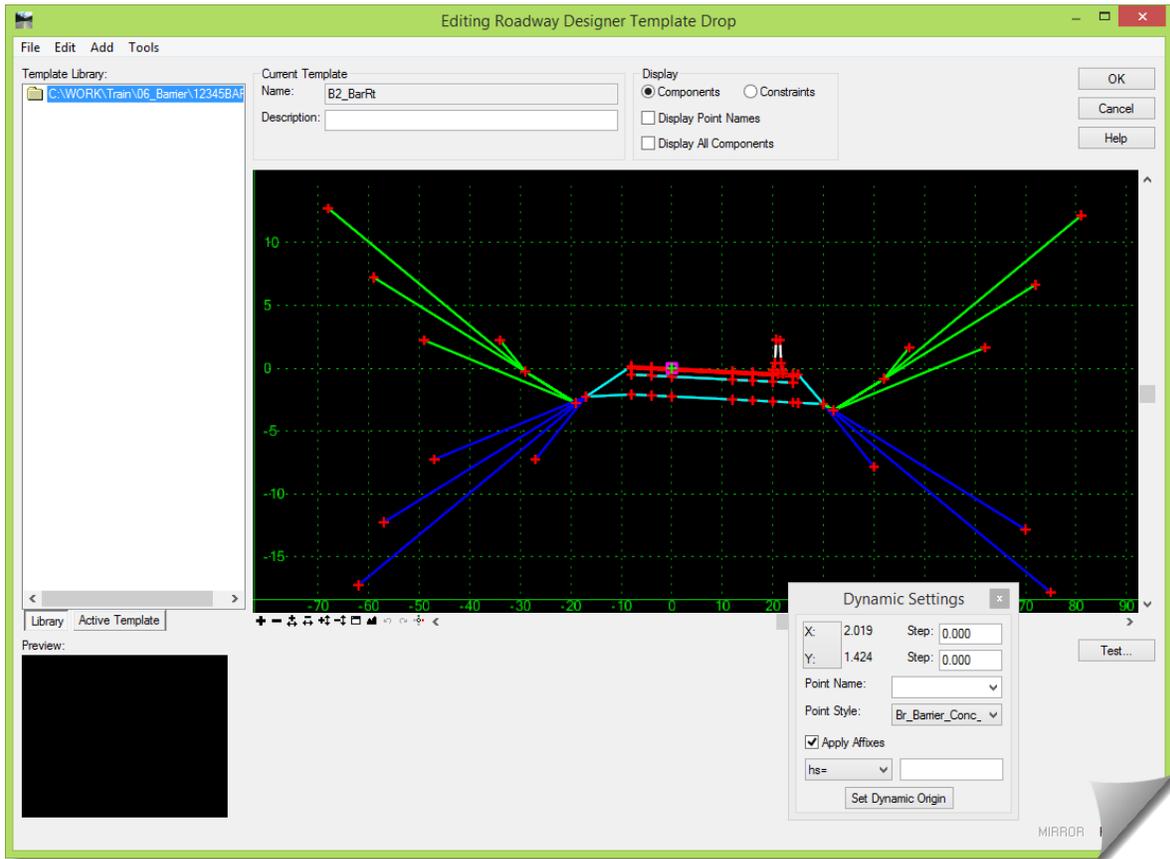
Synchronize with Library Edit Delete

Now let's do some editing.

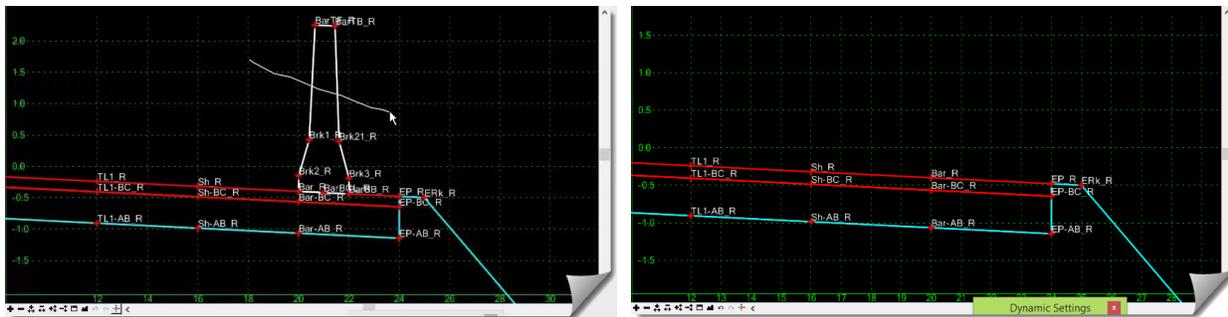
- 5) Select the entry at **B2 61+72.500** and click **<Edit>**.
The template editor appears.

6) But notice the name on the top – **EDITING ROADWAY DESIGNER TEMPLATE DROP.**

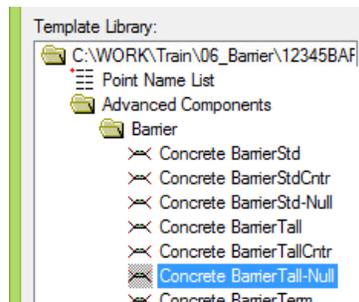
This is not editing in the ITL, it is editing in the IRD.



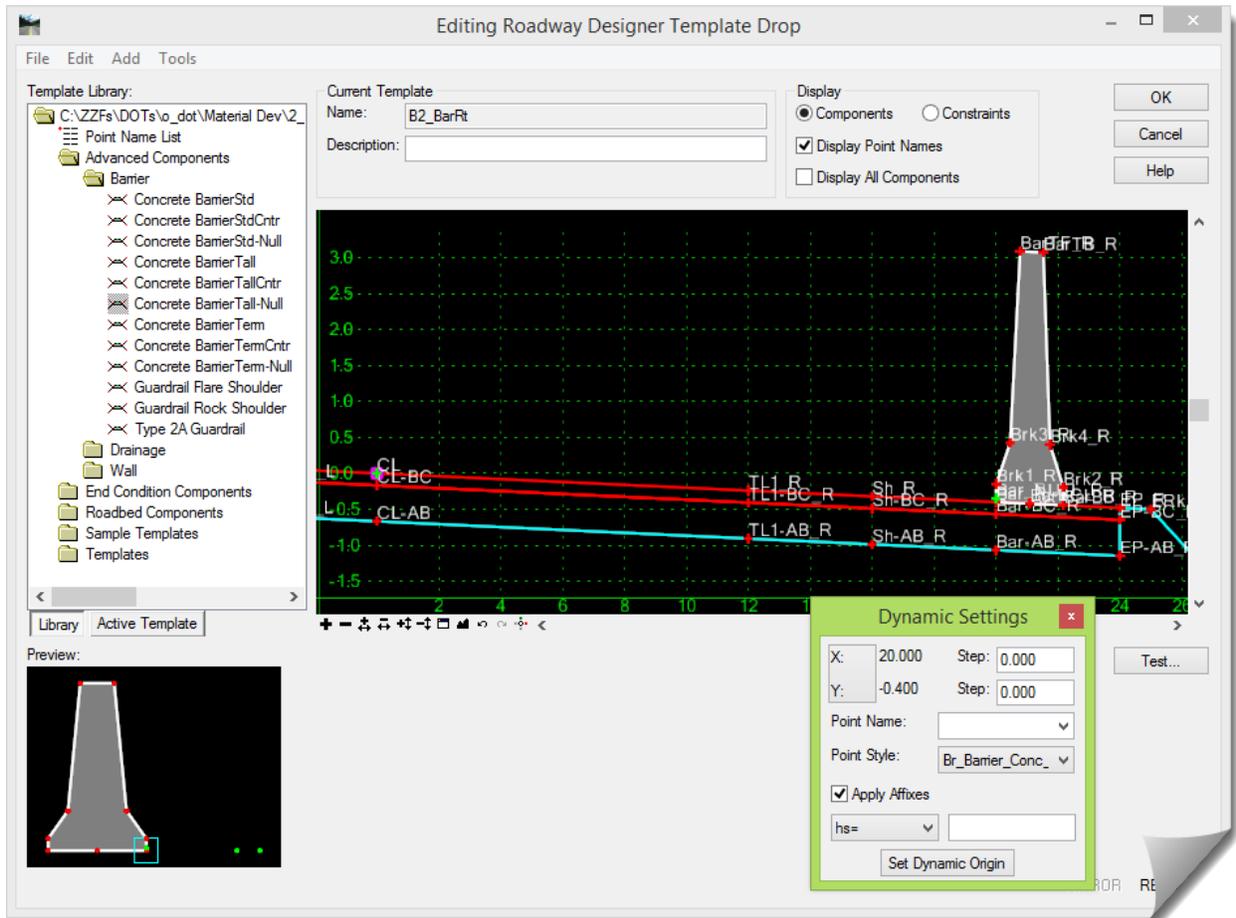
7) Zoom to the barrier and delete it along with the remaining **Bar_NULL_R** point.



8) Browse into the components on the left side and find **Concrete BarrierTall-Null**.



- Place it on the template just as you placed the barrier in the first section of this module. Remember to drop it onto the correct point, move and merge the **Null Points** for the rotation, and reassign the **Bar_R** constraint horizontally to the **Bar_NULL_R** point.



- Click **<OK>** on that dialog box after it's completed.
- Notice that the **TEMPLATE DROPS** dialog box now indicates that this template is in the **IRD** while the others are in the **ITL**.

Current Template Drops:

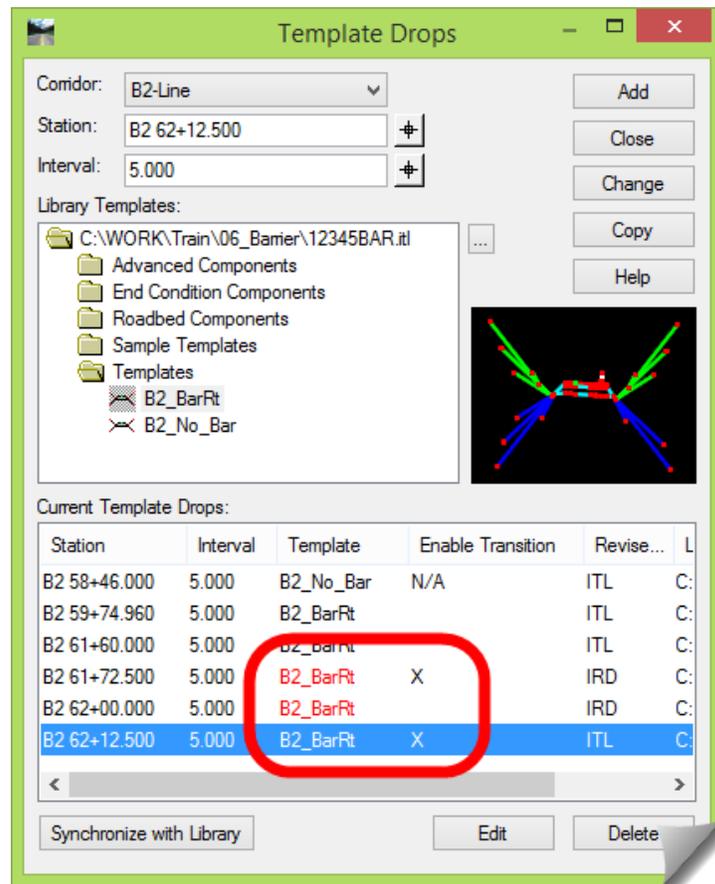
Station	Interval	Template	Enable Transition	Revi...	Library
B2 58+46.000	5.000	B2_No_Bar	N/A	ITL	C:\WORK\Tr
B2 59+74.960	5.000	B2_BarRt		ITL	C:\WORK\Tr
B2 61+60.000	5.000	B2_BarRt		ITL	C:\WORK\Tr
B2 61+72.500	5.000	B2_BarRt		IRD	C:\WORK\Tr
B2 62+00.000	5.000	B2_BarRt		ITL	C:\WORK\Tr
B2 62+12.500	5.000	B2_BarRt		ITL	C:\WORK\Tr

Synchronize with Library Edit Delete

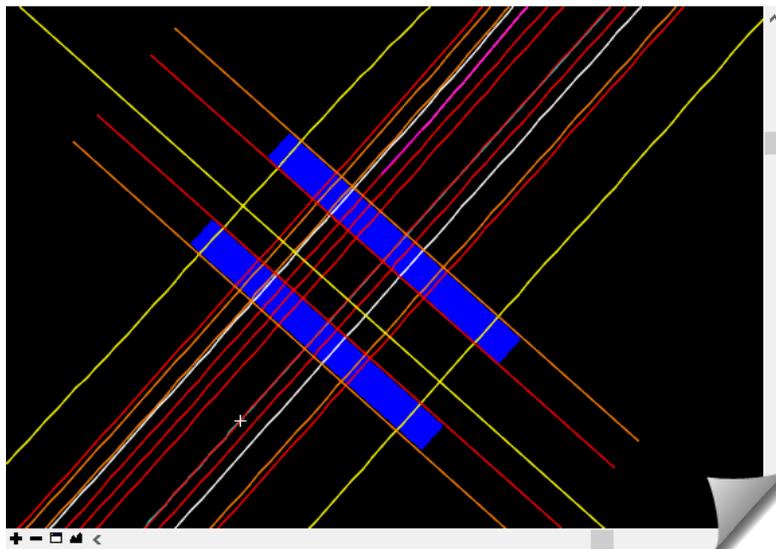
- Do the exact same thing with the entry at **B2 62+00.000**

These last few steps have created a transition into and out of the tall barrier component.

- 13) Now, the last thing here is to activate the **Enable Transition** column for these two barrier transitions.

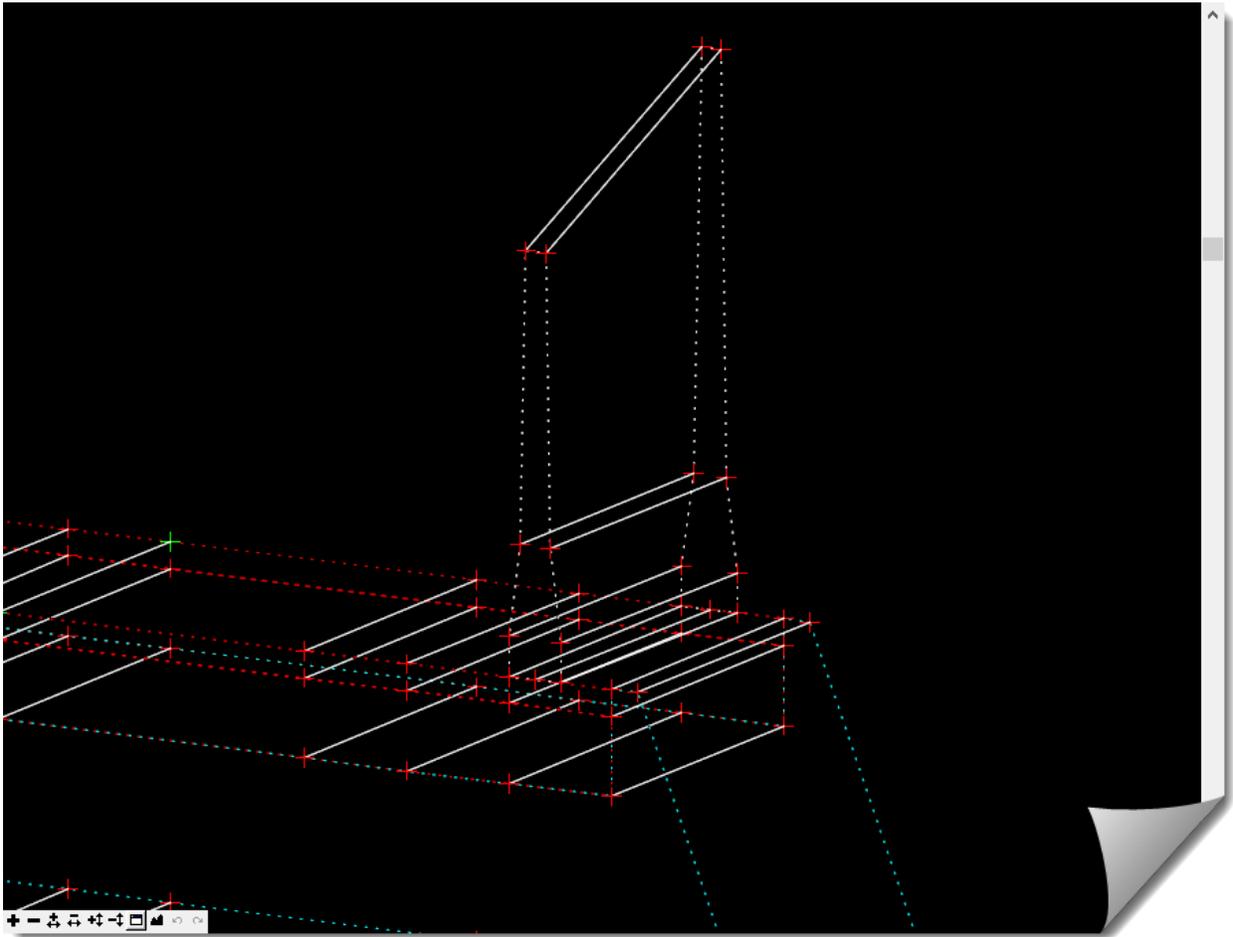


- 14) <Close> the **TEMPLATE DROPS** dialog box and notice the two new transition bands. And take extra note that they are dark blue, which indicates that InRoads was able to develop full connectivity between components.

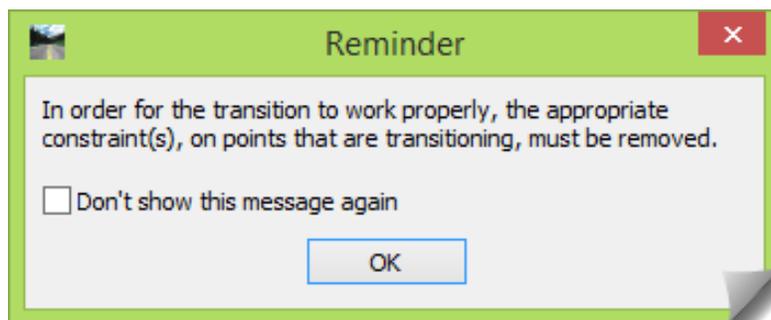


Let's look a little closer at the barrier transitions.

15) Double-click on either transition to review the connectivity and confirm that it's correct.



16) When you <OK> out of the **EDIT TRANSITION** window you will be presented a reminder, which in this case is valid and needs attention.

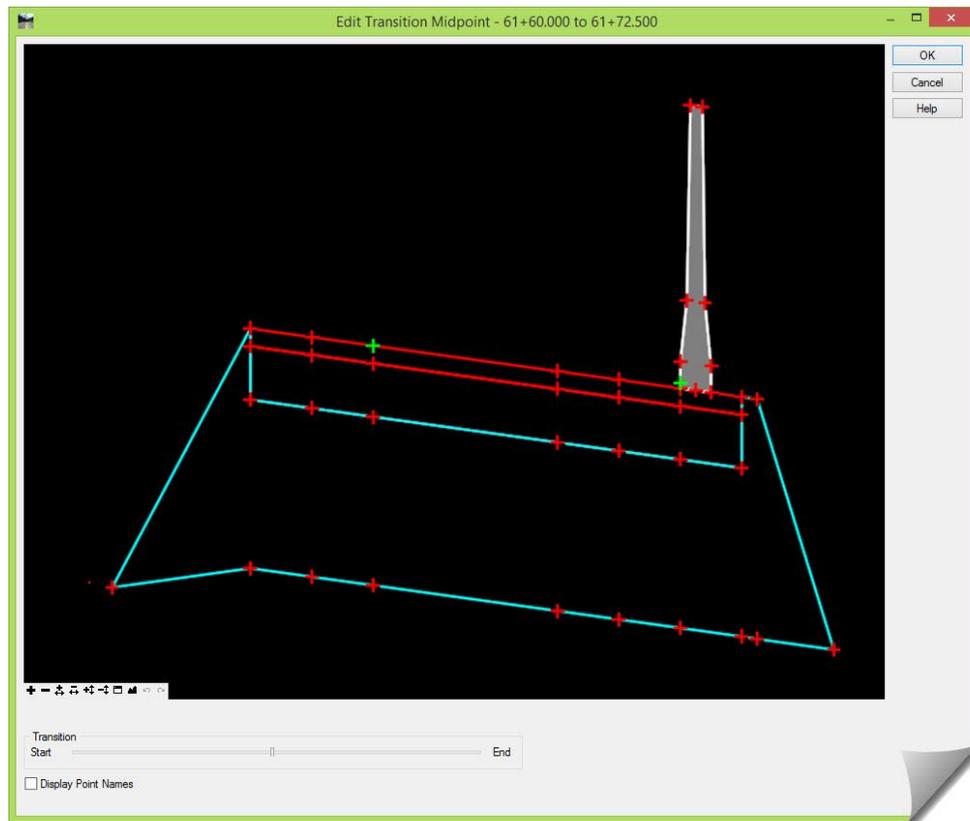


Normally, when templates are constructed in the **CREATE TEMPLATE** tool, the user can anticipate potential transitions and set the **Point Constraints** appropriately. In this case this was not done, but there is always an opportunity to adjust the constraints during the transition editing process.

Let's take a look at this transition.

17) Click <OK> on this **REMINDER**.

18) This will move you into the **EDIT TRANSITION MIDPOINT** dialog box.



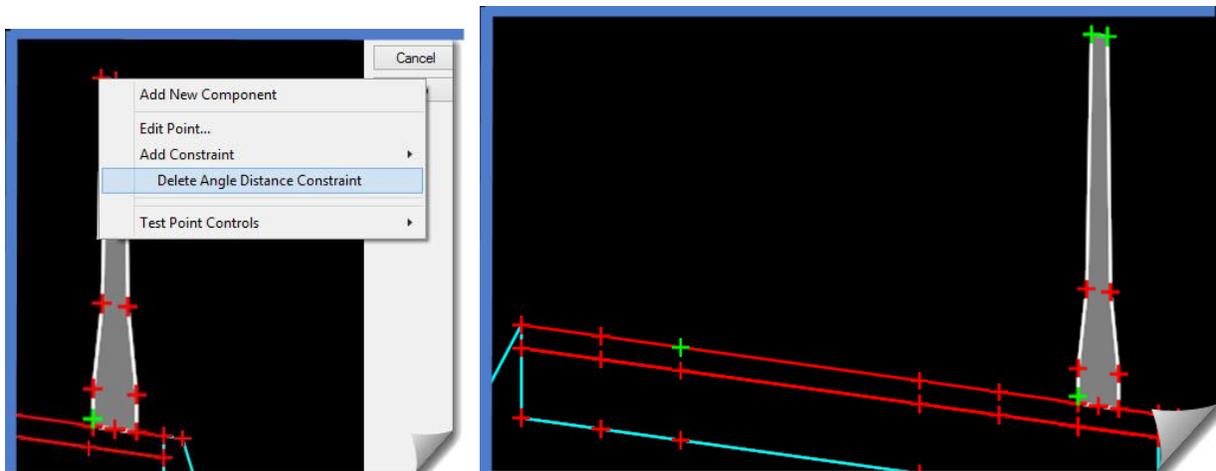
19) If you slide the lower **Transition** bar from **Start** to **End** you'll find that the transition is not working for the barrier component.

Take a moment and think about what needs to happen here. The points on the top of the barrier on one side of the transition need to move to meet the tops of the higher "tall" barrier. In addition to that, the top widths are different, right? 9-1/2" versus 9".

So how do the constraints need to be edited here?

How much flexibility do these points require?

20) Right-click on the barrier top points and **Delete Angle Distance Constraint**.



- 21) Remove the **Horizontal Constraint** from **BarBB_R** to allow the base of the barrier to adjust.
- 22) Now test the **Transition** slider again to ensure that it is working as expected.
- 23) Now do the same thing to the other transition.
- 24) If you haven't already done it, **Save** the **ROADWAY DESIGNER**.



ALERT: Everyone needs to develop their own patterns for saving their InRoads files. Saving your work is generally not indicated in these modules, so you have to think about this for yourself. Develop good habits or you may experience data loss.

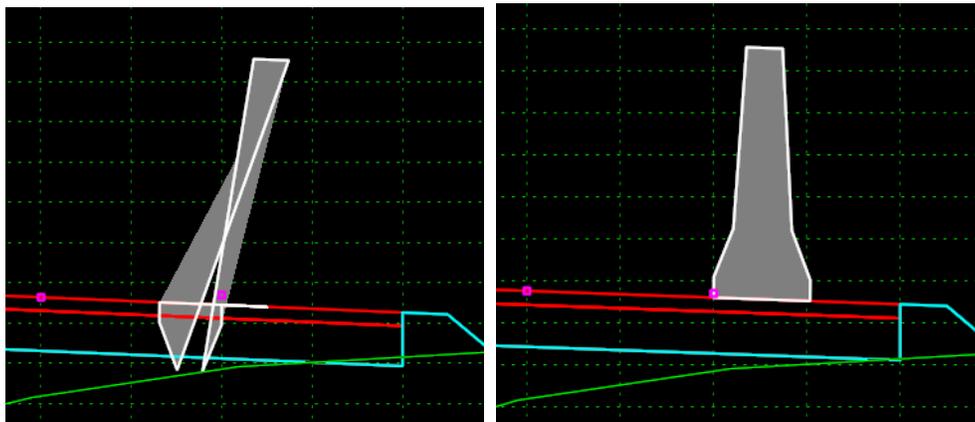


TIP: InRoads does not have a mechanism to auto-save your data. It does, however, have a setting under **INROADS > FILE > PROJECT OPTIONS** on the **GENERAL** tab to **Autosave files every:**. This setting is a 'minutes' value that creates a backup of your InRoads data by appending a back suffix on the original file name. For example: **12345BAR_og.dtmback**.

Let's take a moment to discuss a potential problem that can appear. Feel free to test this for yourself. As stated earlier there are issues with the mutual use of the **Angle-Distance** constraint, **POINT CONTROLS** and **Superelevation**. This can be sporadic, but you need to be aware of it.

We have all three conditions in this model – the **Angle-Distance** constraint, **POINT CONTROLS** and **Superelevation**. While putting this material together, an illustration of this appeared. When releasing the **Horizontal** constraint on **BarBB_R** in this transition, the resulting barrier component began to have problems in the transition.

When the **Superelevation POINT CONTROLS** were disabled, the transition didn't experience the irregular behavior.

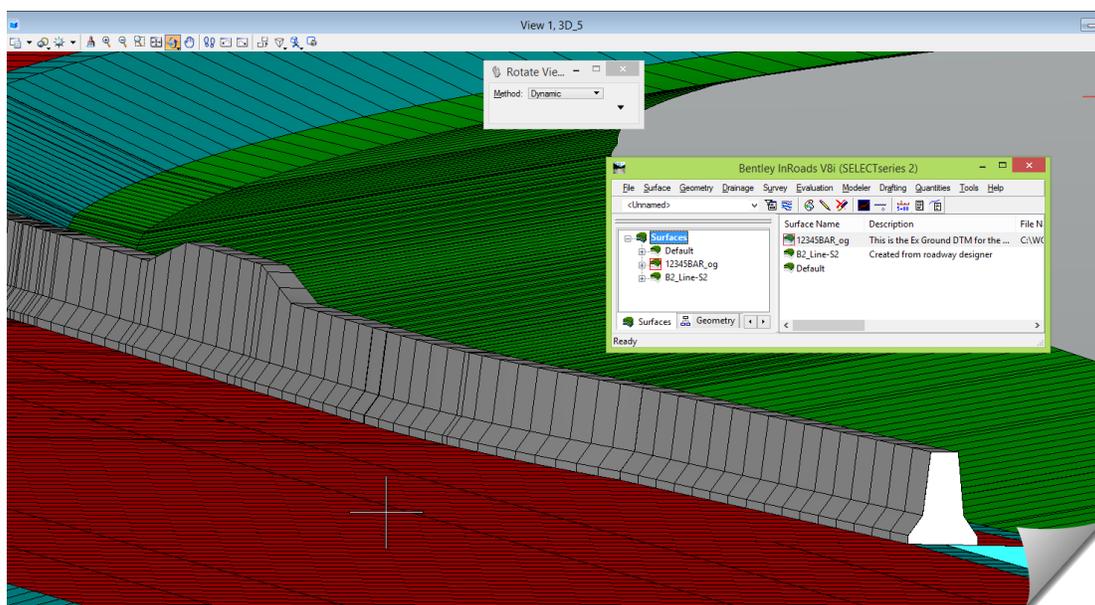
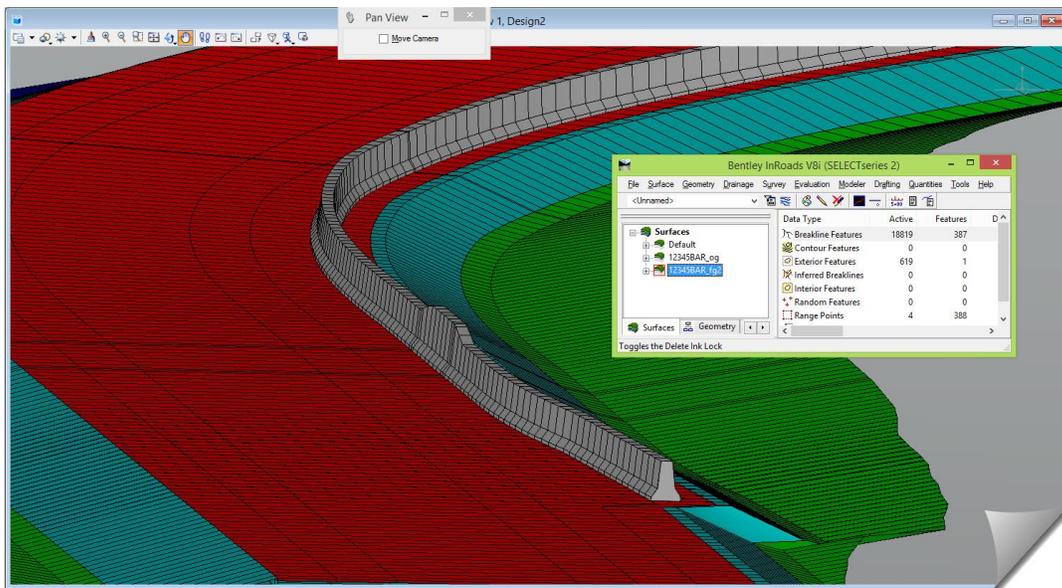


ALERT: It is not advised to use barrier component transitioning, from one barrier configuration to another barrier, when in **Superelevation**. If barrier transitioning is used, special attention must be given to the results to ensure that the subsequent design model accurately represents the intended condition. This review should be done within the Roadway Designer as well as with the final design surface.

At this point you can continue to walk through the Cross Sections in the **ROADWAY DESIGNER** and review the results, looking for anything that seems out of place or incorrect.

Once that is done to your satisfaction you can:

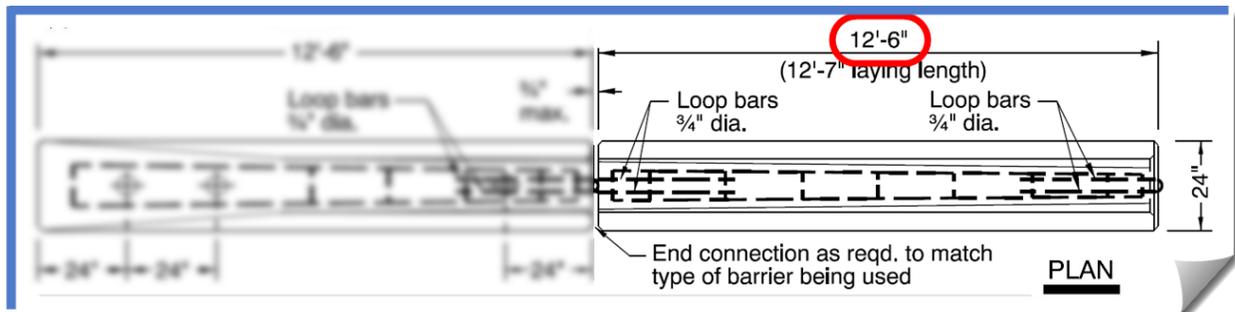
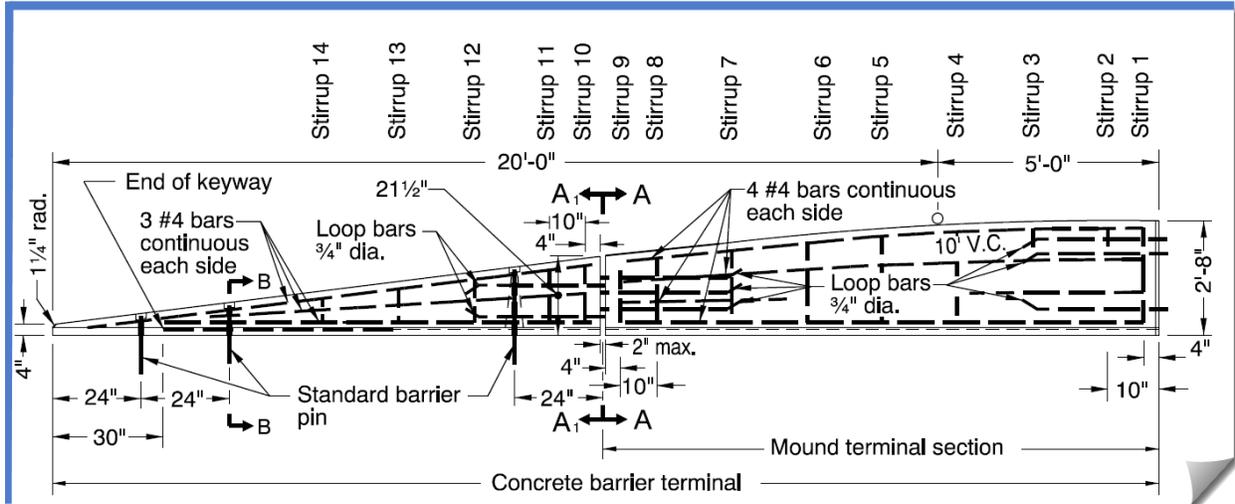
- Add a **Horizontal Constraint** back to **BarBB_R** in the transition(s) if problems occur.
- Go to **CREATE SURFACE** and create the design model.
- Once this surface is created [**Close**] the **ROADWAY DESIGNER**.
- Verify that your design surface has been created and then **Save** it to the module folder.
- Review the surface feature data in the **FEATURE PROPERTIES** to verify that it's as expected.
- Verify the barrier **Features** created by this model are found in the design surface.
- Review the resulting Design surface in MicroStation any way that you feel like.
- **CREATE CROSS SECTIONS** for an additional review of the design surface.



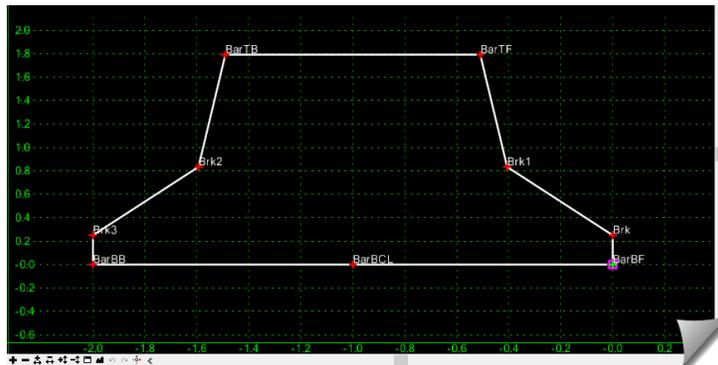
LAYOUT SCENARIO 3 - TERMINAL MODELING

Modeling an end terminal

This section will introduce another transition at the terminal. It will transition from the **Mound terminal section** to the full barrier, beginning at the start of the flare.

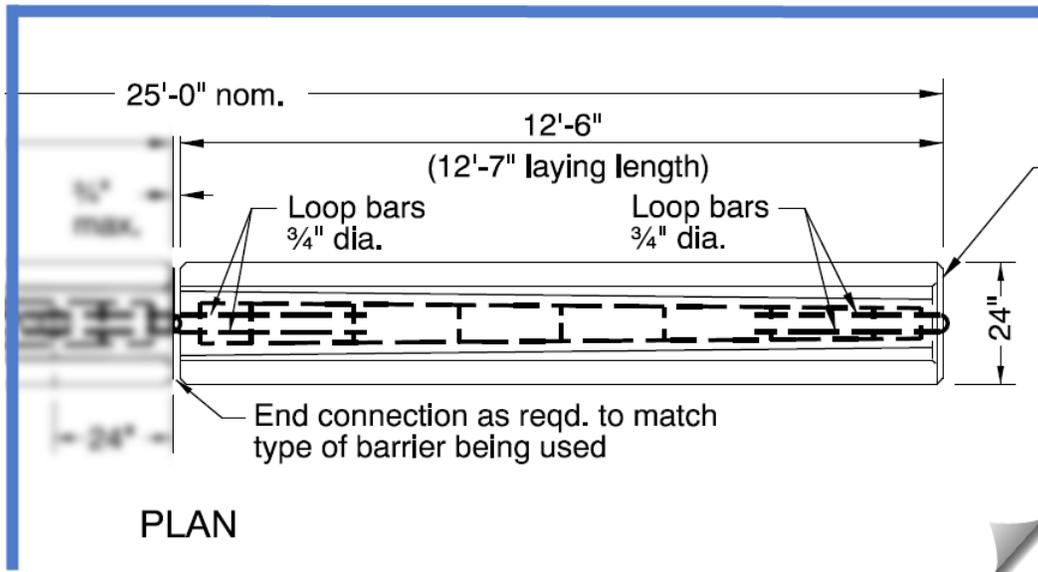


The beginning of the barrier, and the station that the **Mound terminal section** will begin, is at **Station B2 59+74.960**.

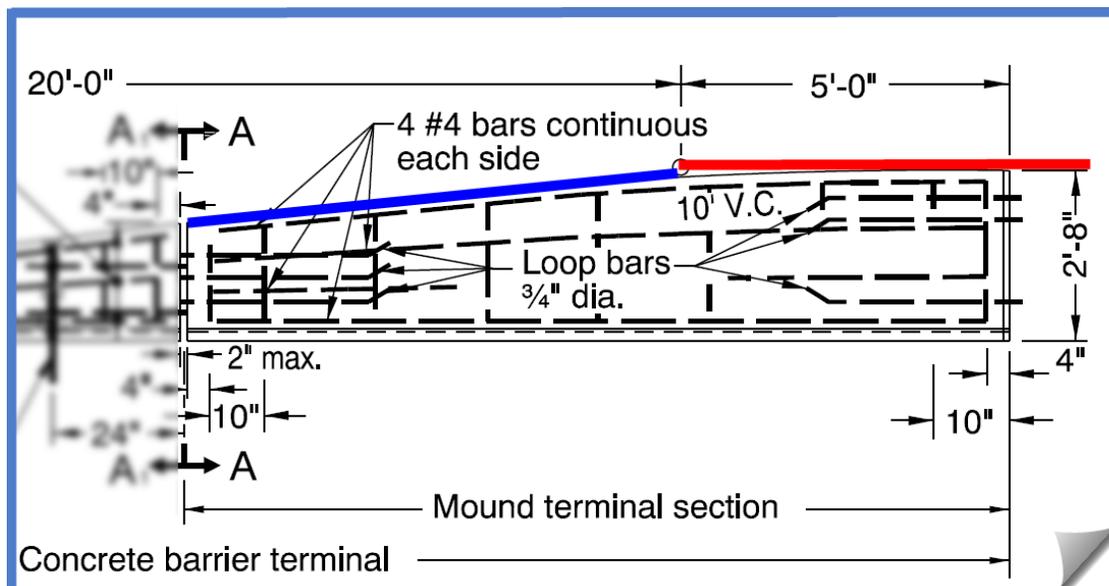


For the purposes of this module, we'll call it a **12.5'** transition, so this transition will end at **Station B2 59+87.460**. However, you can refine the stationing on your project as needed. Let's discuss the topic of modeling the terminal a bit further, especially the transition range that is used.

To illustrate the modeling technique, this module will model the terminal through the 12.5' length using the stations noted earlier. The start and stop stations can of course be modified if you feel it better suits the vertical condition, or the laying length implications.



As noted earlier, the modeling will be done to represent the **Mound terminal section** spanning the 12.5' prior to the full barrier section. Taking a closer look at **RD510** in that span, vertically, shows the final 5' of the barrier nearly approximating the height of the full section.

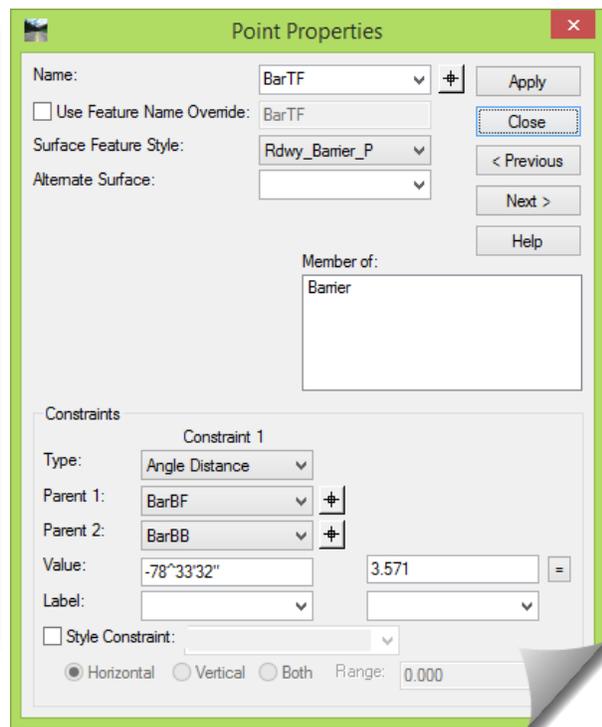
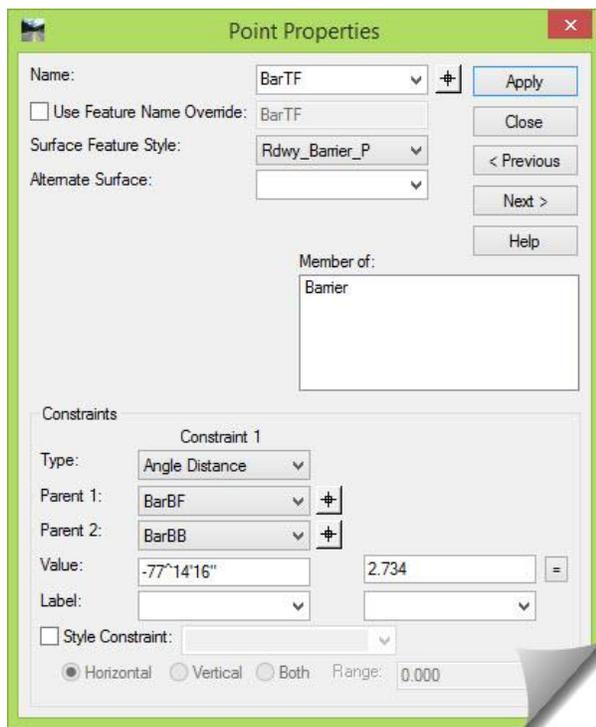
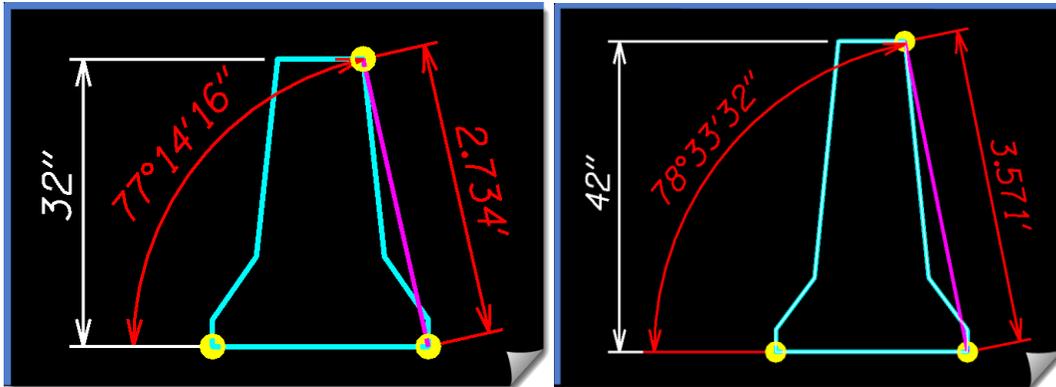


Looking at the detail above, it would not be unreasonable to transition the terminal portion of the model from the start station plus an additional 7.5', at which point the full barrier height could be used. This would model the full barrier height for an additional 5'. This is a determination that you will have to make on your project, and can make moving forward in this module.

Now, let's discuss the approach to transitioning that will be taken next, **PARAMETRIC CONSTRAINTS**. This subject is not foreign to you; however, these barriers are constructed using the **Angle-Distance** constraint, which is a bit trickier than some of the other constraint types.

Barrier - Parametric Constraints

As it was mentioned earlier, the use of **PARAMETRIC CONSTRAINTS** to influence the template geometry is common during modeling with InRoads. But these barriers, using the **Angle-Distance** constraint, take the application of **PARAMETRIC CONSTRAINTS** to another level and make this option of controlling the components in a transition area a bit more complex. This is due to the measurements that it uses. From these illustrations of standard and tall barrier, you'll see that the values are not something readily known like the other constraints of H, V, or Slope. These constraints are far from intuitive when being entered.

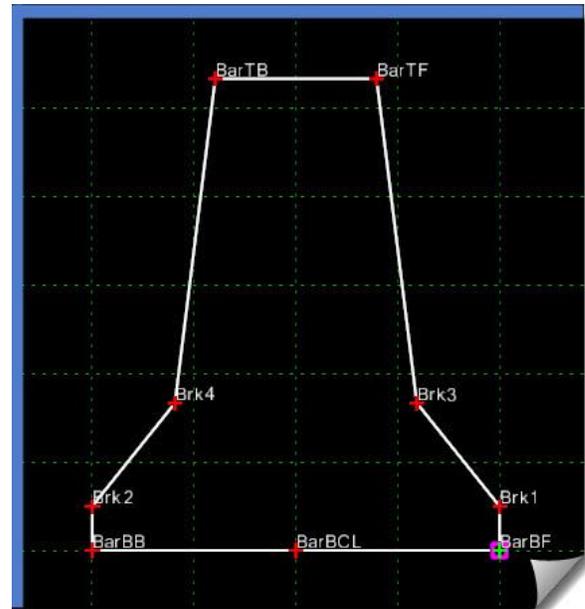


PARAMETRIC CONSTRAINTS can be, and are used; however, the values, typically entered on the fly in the **ROADWAY DESIGNER**, have to be pre-calculated so that the results are mathematically correct. It may even be the case that the components will have to be constructed in the **CREATE TEMPLATE** tool, and notes made regarding the resultant **Values** for the **Angle** and **Distance** so they can then be entered into the **PARAMETRIC CONSTRAINTS** tool.

Here are the **PARAMETRIC CONSTRAINTS** set up in the **RD500 Standard Barrier (Concrete BarrierStd)** in the ODOT ITL) and the settings needed to transition to an **RD545 Tall Barrier** or an **RD510 Terminal**.

Note that these settings were from a barrier component designed for the left side. This has an influence on the negative – positive sign of the constraint values. To further add fuel to the non-intuitive nature of these constraints, you'll discover that these angles are converted to Radians from DD.MM.SS when they are entered as **Start - Stop Values** in the **PARAMETRIC CONSTRAINTS** tool.

- **BarBB** (Barrier Bottom Back)
 - **Barrier Base Out-Width**
 - ◆ Std & Term = 2.000
 - ◆ Tall = 2.16667 (or 26")
- **Brk3** (Barrier inside 'neck' point)
 - **Barrier Neck In-Dist**
 - ◆ Std & Term = 0.92700
 - ◆ Tall = 0.94120
 - **Barrier Neck In-Angle**
 - ◆ Std & Term = -64-00-39.00
 - ◆ Tall = -62-18-02.77
- **Brk4** (Barrier outside 'neck' point)
 - **Barrier Neck Out-Dist**
 - ◆ Std & Term = 0.92700
 - ◆ Tall = 0.94120
 - **Barrier Neck Out-Angle**
 - ◆ Std & Term = 64-00-39.00
 - ◆ Tall = 62-18-02.77
- **BarTF** (Barrier Top Front)
 - **Barrier Height In-Dist**
 - ◆ Std = 2.73400
 - ◆ Term = 1.86273
 - ◆ Tall = 3.57096
 - **Barrier Height In-Angle**
 - ◆ Std = -77-14-16.00
 - ◆ Term = -74-07-22.62
 - ◆ Tall = -78-33-32.17
- **BarTB** (Barrier Top Back)
 - **Barrier Height Out-Dist**
 - ◆ Std = 2.73400
 - ◆ Term = 1.86273
 - ◆ Tall = 3.57096
 - **Barrier Height Out-Angle**
 - ◆ Std = 77-14-16.00
 - ◆ Term = 74-07-22.62
 - ◆ Tall = 78-33-32.17

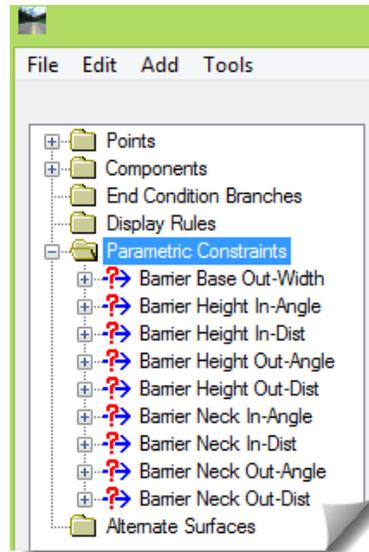


Parametric Constraint Transition

Let's walk through the process of developing a barrier transition using **PARAMETRIC CONSTRAINTS** so that you understand what it entails.

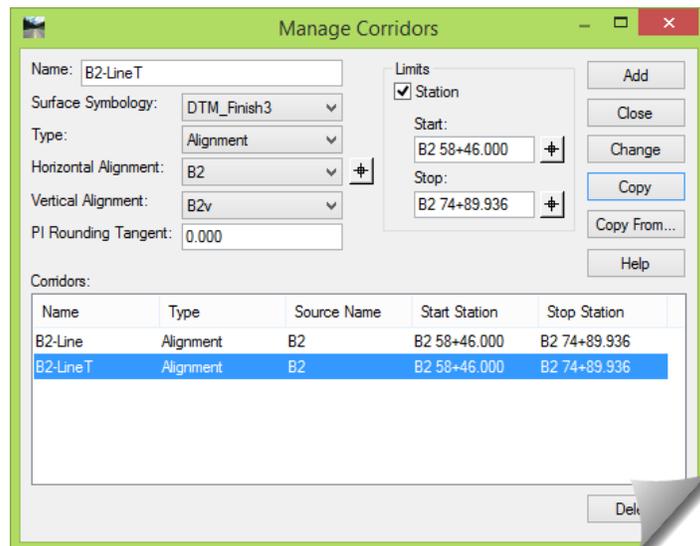
- 1) Open the **CREATE TEMPLATE** tool.
- 2) Explore the **PARAMETRIC CONSTRAINT Labels** on either the **Concrete BarrierStd** component, or the **Concrete BarrierStd-Null** component since they are the same.

The **PARAMETRIC CONSTRAINT Labels** are the same on all of the barrier components except for the base on the center barrier that contains a **HalfWidth** and uses **A / B** versus **In / Out**.

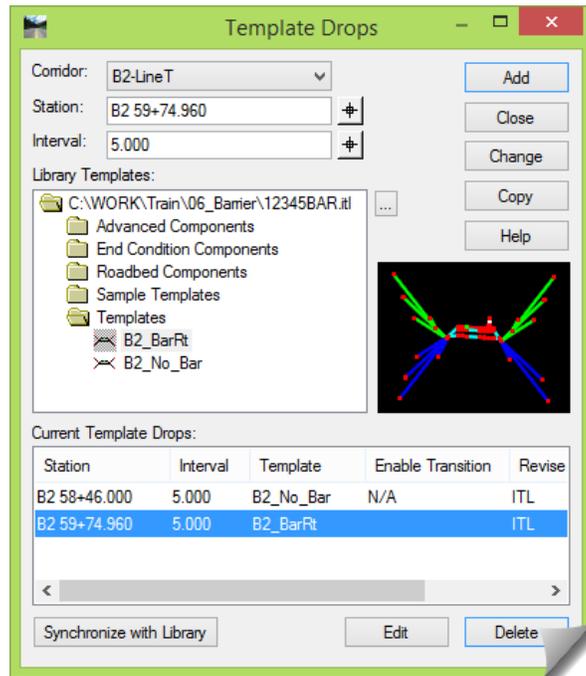


The **PARAMETRIC CONSTRAINT Labels** are on all of the barriers; however, you could morph the **Concrete BarrierStd** component into the other two by just applying the required **Values** in the **ROADWAY DESIGNER**.

- 3) **<Close>** the **CREATE TEMPLATE** tool when you are done exploring them and open the **ROADWAY DESIGNER**.
- 4) Go to **MANAGE CORRIDORS**, and make a **Copy** of **B2-Line** calling it **B2-LineT**.

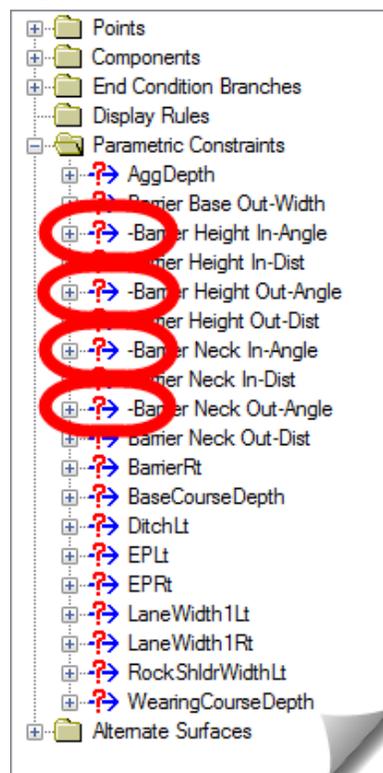


- 5) Make sure it is the active **Corridor** and that the **Active Surface** is 12345BAR_og.
- 6) Open the **TEMPLATE DROPS** and delete all the entries except for the first two.



Now let's take a look at the second template drop.

- 7) **<Edit>** the second drop and look at the **PARAMETRIC CONSTRAINTS** under **Active Template**. Notice the labels with the (-) sign in front of them?

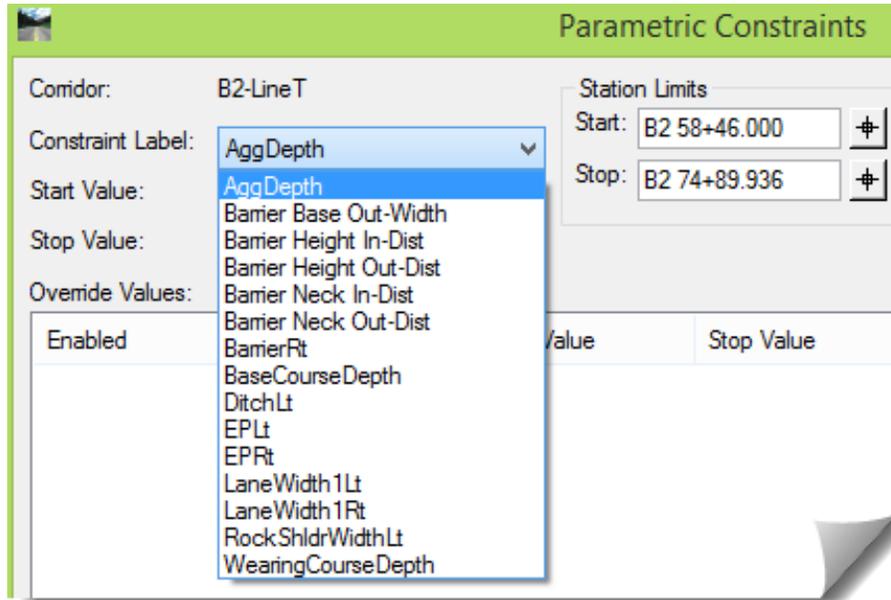


- 8) Close out of the **Edit** dialog and **TEMPLATE DROPS**, and open the **PARAMETRIC CONSTRAINTS**. Look at the available **Constraint Labels** in the drop down list.

Do you notice something?

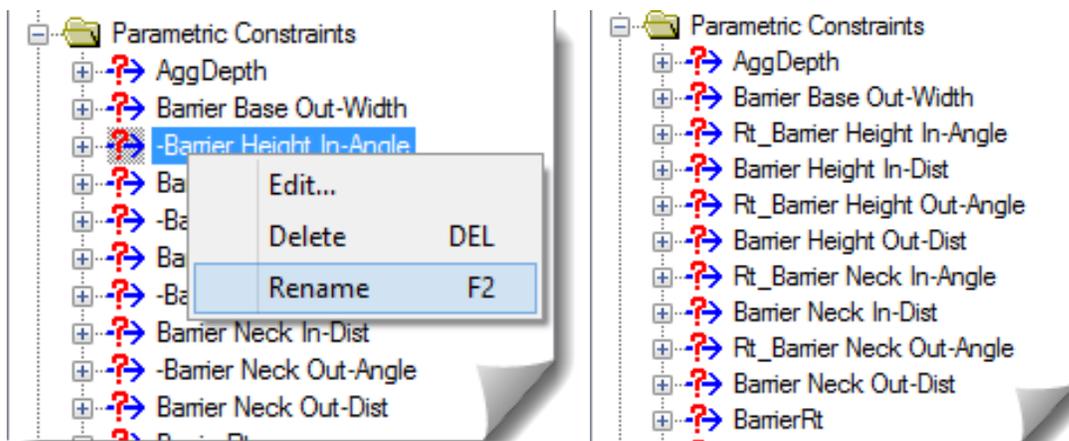
Comparing the **Label** in this list to the earlier one exposes some absences.

The ones with the (-) sign to be exact.



Those have to be addressed in order to use them in the **ROADWAY DESIGNER**. This happens whenever you assign **PARAMETRIC CONSTRAINT Labels** to a component and then mirror them onto a template, which then results in a sign change in the **Constraint Value**. If there is no sign change then the **Labels** just copy over; otherwise each of these have to be addressed, especially if these **Labels** were affecting components on both sides of the template.

- 9) Go back to the **TEMPLATE DROPS** and **<Edit>** that second entry.
- 10) On the **Active Template** tab, right-click on each (-) negative **Label** and **Rename** it by adding a **Rt_** prefix.



- 11) Once that's done, close out of the **Edit** and **TEMPLATE DROPS** dialog boxes.

12) Go the **PARAMETRIC CONSTRAINTS** tool; it's time to start adding entries.

Going back a few pages, there was a cataloged list of **Angle-Distance** values for each barrier. This list will be used to determine what entries need to be added in the **Parametric Constraints** tool.

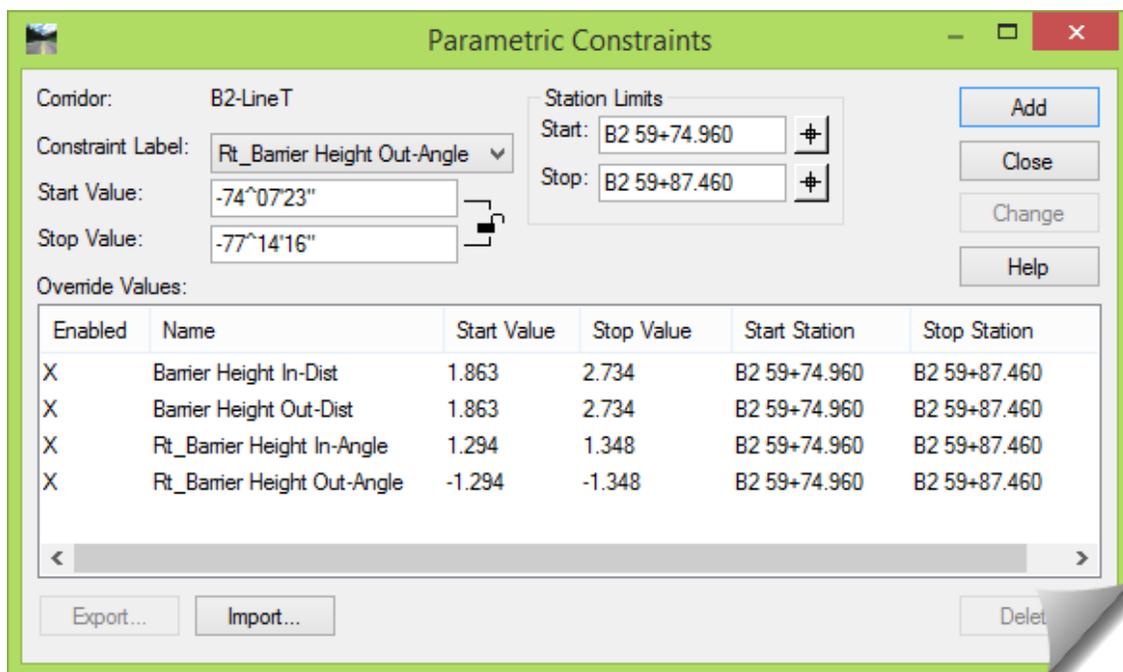
In this case we want to create a terminal at the start of the barrier location. In order to do that, entries will be added to the first station to change its configuration into a terminal barrier and then **12.5'** away, it will conform to the shape of the standard barrier.

Here are the **Component Points** that need to adjust along with their values. Remember that the sign of the angle is due to the rotational direction from the defined baseline of the **Angle-Distance** constraint. (No adjustments are required for any points where the standard barrier and terminal barrier are the same.)

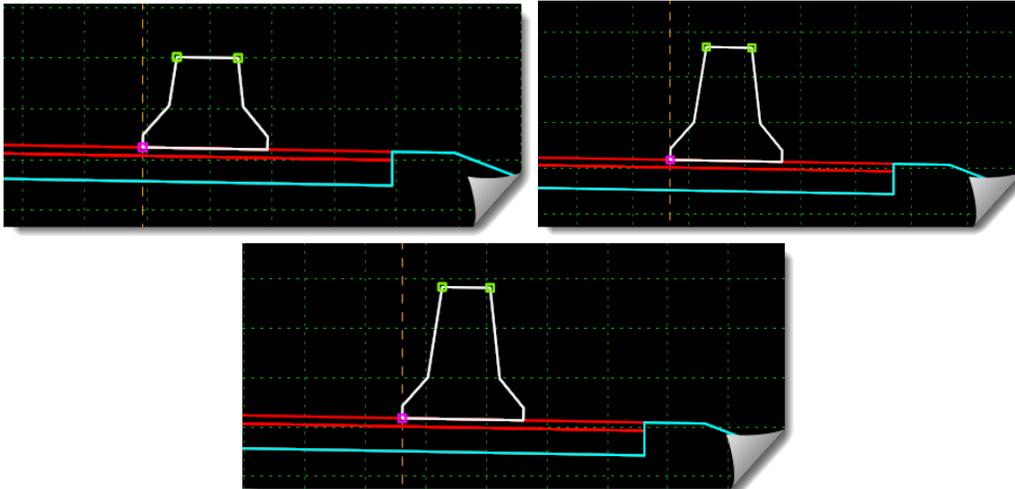
- **BarTF** (Barrier Top Front)
 - **Barrier Height In-Dist**
 - ◆ Std = 2.73400
 - ◆ Term = 1.86273
 - **Rt_Barrier Height In-Angle**
 - ◆ Std = 77-14-16.00 (1.348 Radians)
 - ◆ Term = 74-07-22.62 (1.294 Radians)
- **BarTB** (Barrier Top Back)
 - **Barrier Height Out-Dist**
 - ◆ Std = 2.73400
 - ◆ Term = 1.86273
 - **Rt_Barrier Height Out-Angle**
 - ◆ Std = -77-14-16.00
 - ◆ Term = -74-07-22.62

Station-wise, the transition will **Start** at B2 59+74.960 and end at B2 59+87.460, 12.5' away.

13) Add the **PARAMETRIC CONSTRAINT** entries per the information above.



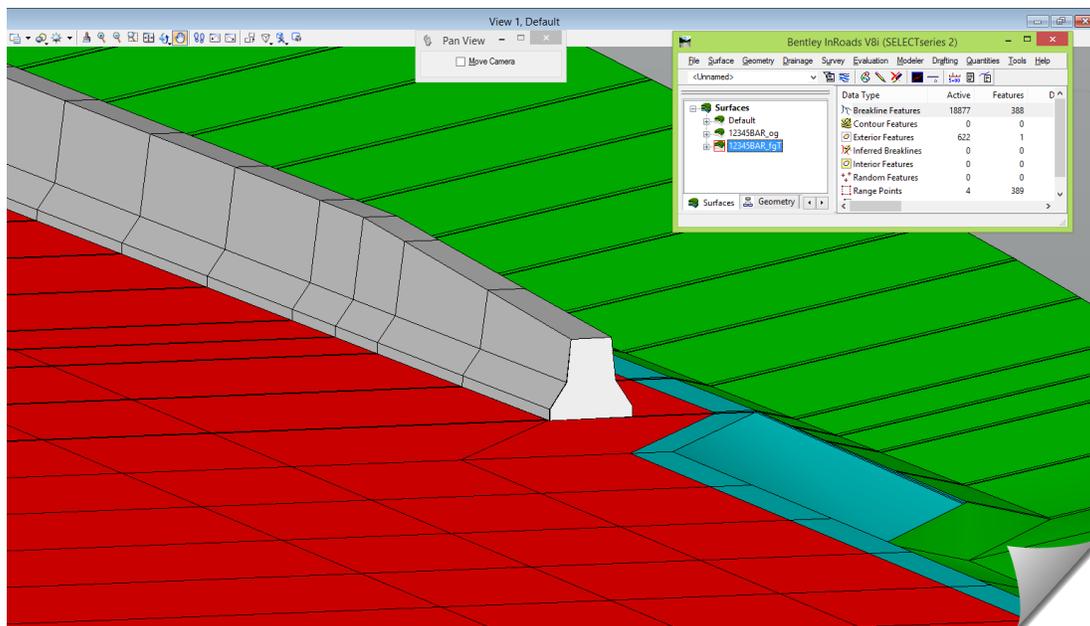
14) <Close> the **PARAMETRIC CONSTRAINTS** when completed and review the sections.

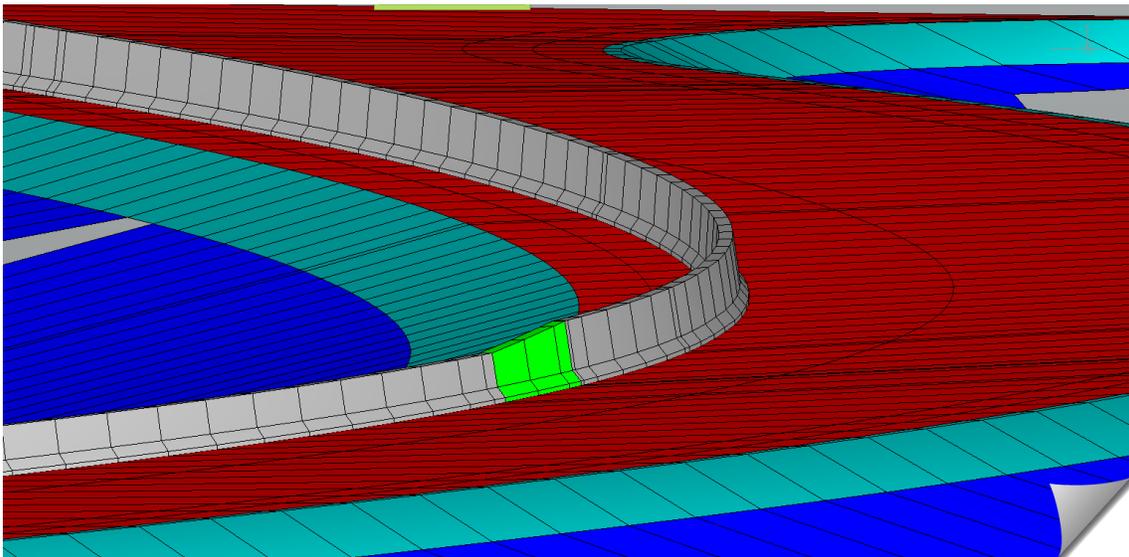
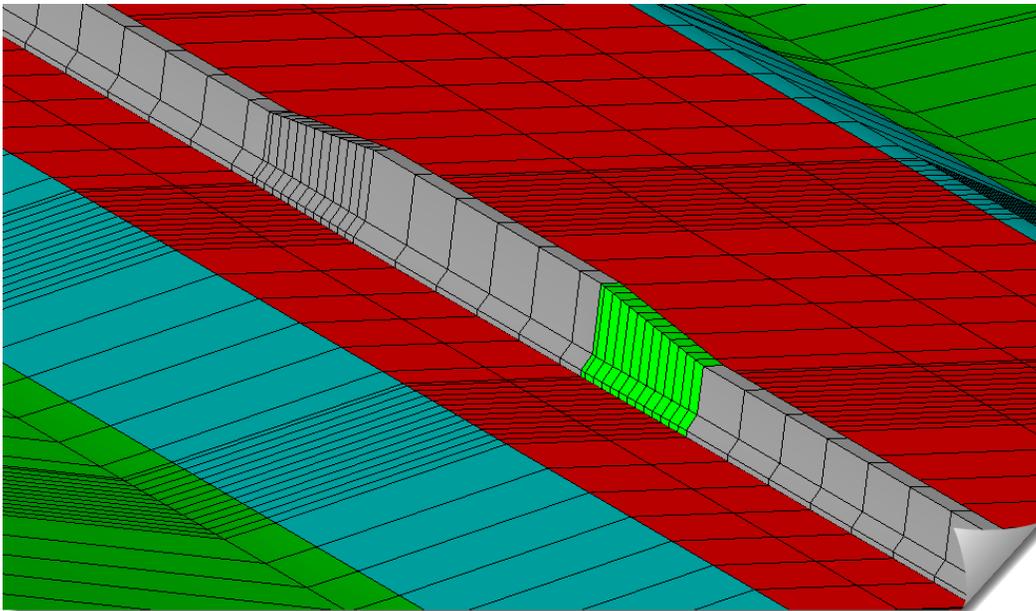
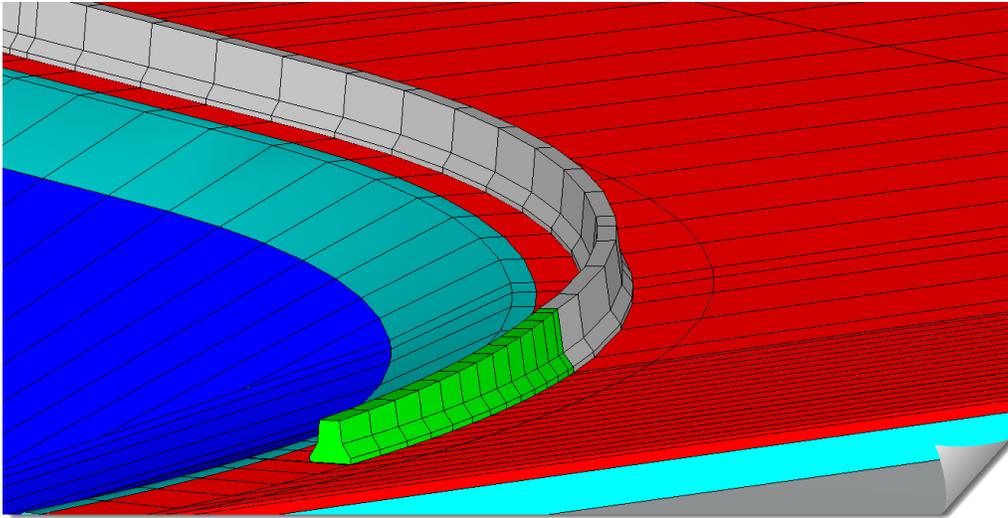


15) As a challenge, add a terminal at the other end of this roadway, or transition the **std** barrier to a **Tall** at some location along this corridor.

Once that is done to your satisfaction you can:

- Go to **CREATE SURFACE** and create the design model.
- Once this surface is created [**Close**] the **ROADWAY DESIGNER**.
- Verify that your design surface has been created and then **Save** it to the module folder.
- Review the surface feature data in the **FEATURE PROPERTIES** to verify that it's as expected.
- Verify that the barrier **Features** that were created by this model are found in the design surface. It's valuable to be able to correlate the template point construction with the resulting surface model features.
- Review the resulting Design surface in MicroStation any way that you feel like.
- **CREATE CROSS SECTIONS** for an additional review of the design surface.



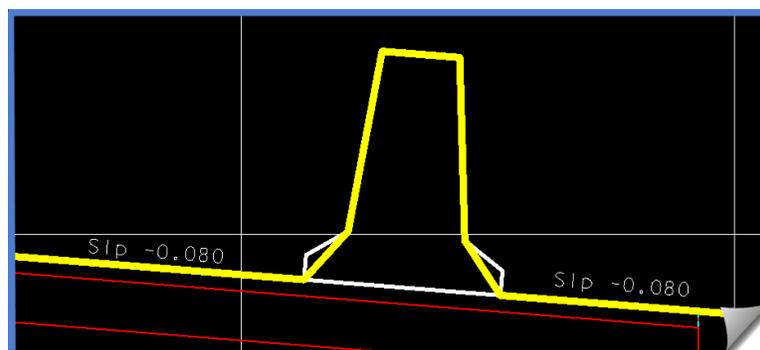
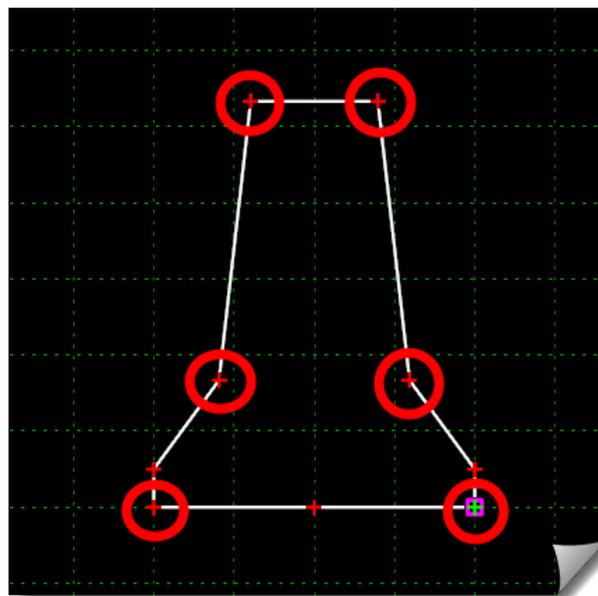
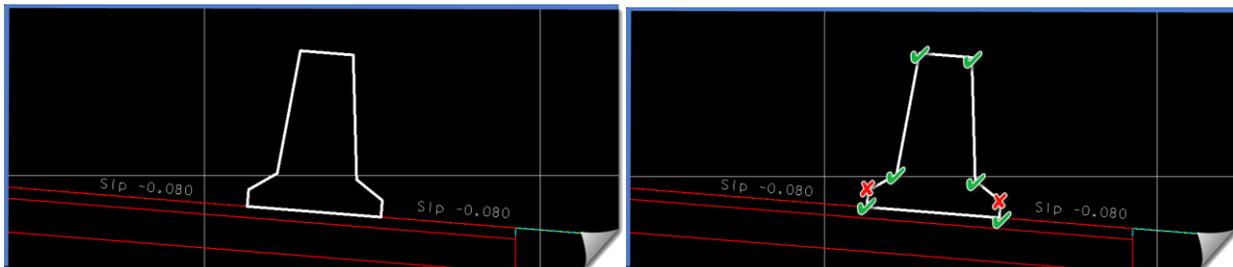


OTHER DETAILS

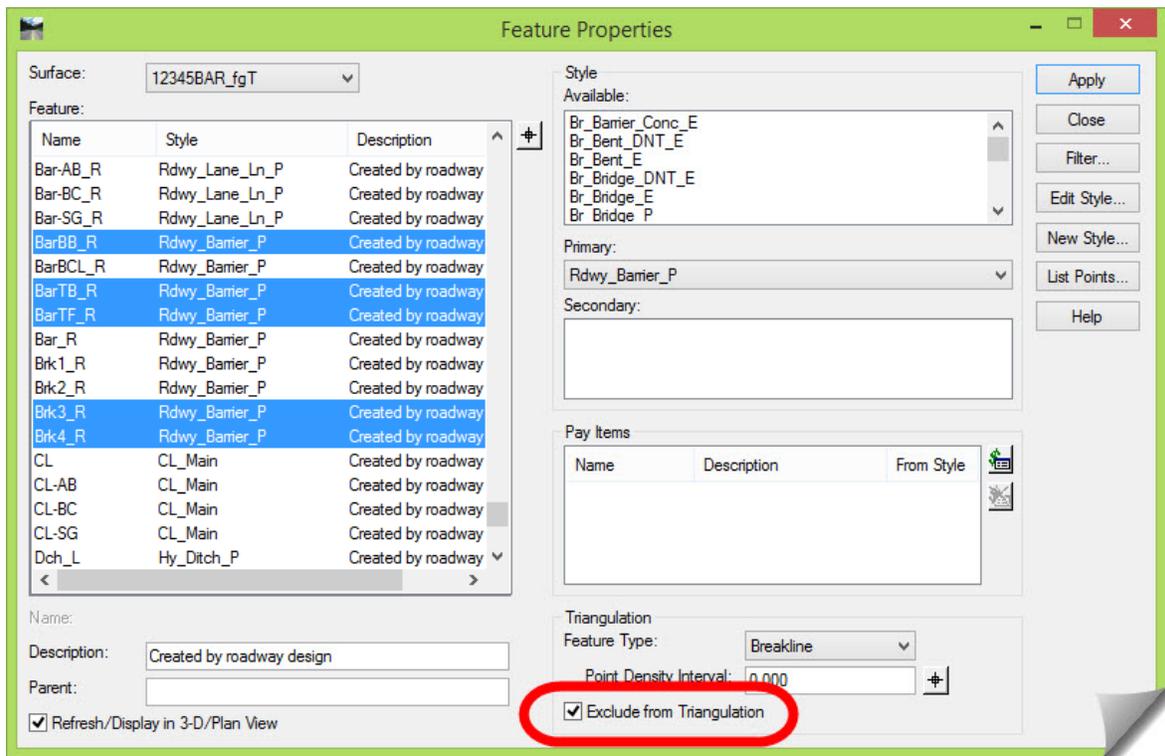
Modifying Barrier Triangulation

The viewing done in this module has been using the **VIEW COMPONENTS** tool. This is the only way to see the barrier since it's been excluded from the surface triangulation. But what if you wanted it in the triangulation for analysis purposes?

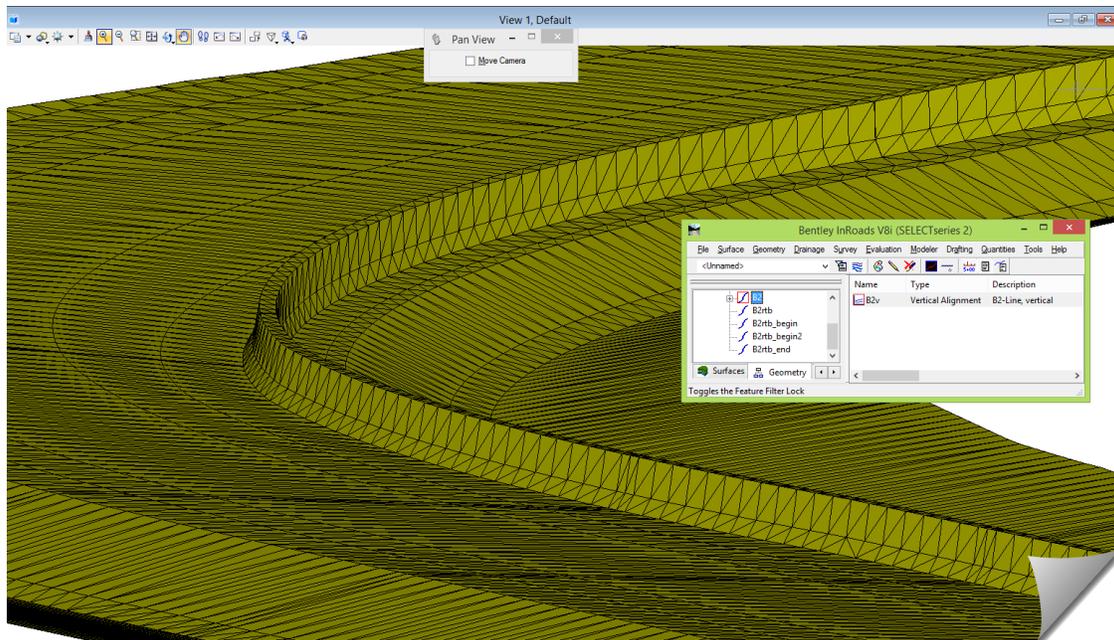
The Barrier component is currently set to **Exclude From Triangulation**. This is due to the fact that this barrier is intended to rotate with the cross slope of the road / shoulder. During this rotation, portions of the upper barrier may kick over the lower barrier points, creating conflicting breaklines that may cause unpredictable triangulation. If the desire is to include the barrier in the surface for sight visibility or hydraulic analysis, a technique will be shown to do this. This method consists of adding strategic barrier breaklines to the surface model that will avoid breakline conflicts.



After creating the surface with the **ROADWAY DESIGNER**, the **FEATURE PROPERTIES** command will allow you to take specific features and include or exclude them relative to the surface triangulation. This is done by selecting them, checking or unchecking **Exclude From Triangulation**, and then **[Apply]**.



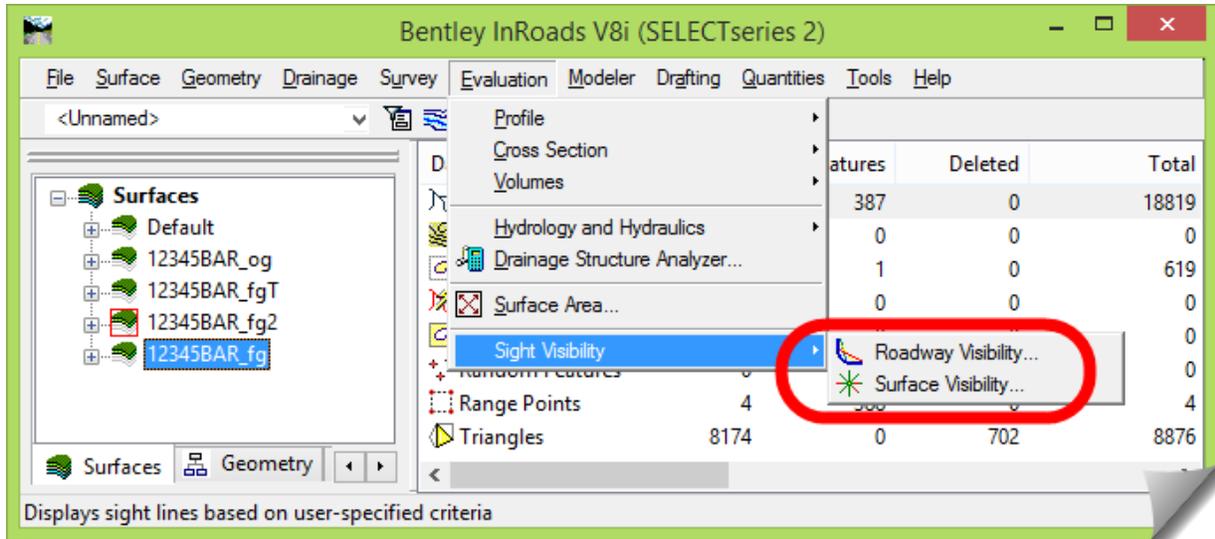
Once these select **Features** have been made available for triangulation, they can be integrated into the surface model (two of the barrier break points, **Brk1_R** and **Brk2_R**, were intentionally not included as illustrated above). Now this surface can be used for other analysis purposes. Note that in the case of a median barrier, the **CL** point will also need to be excluded from triangulation.



Overview of Sight Visibility Check

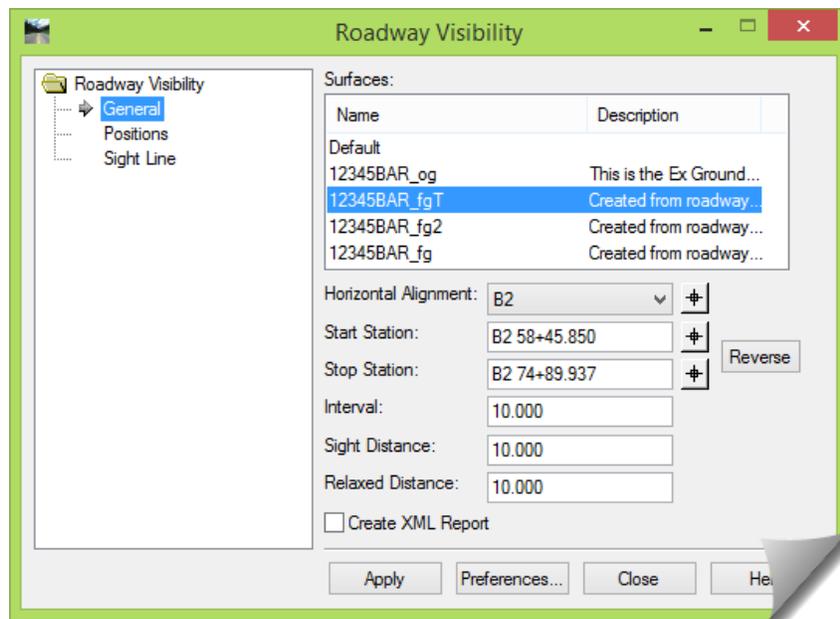
This section will not cover this topic in detail, and is only meant as a brief orientation to these tools and to bring awareness to this expanded capability. These tools are relevant to this module due to the intent to add more and more detail into the design surface, and hence make it more valuable with these types of tools.

One reason to add the barrier into the surface triangulation is so that the **SIGHT VISIBILITY** tools can provide more accurate feedback of sight lines and regions of visibility. The **SIGHT VISIBILITY** tools are under the **EVALUATION** menu category and are an **APPLICATION ADD-IN**, which at ODOT should be already toggled on.

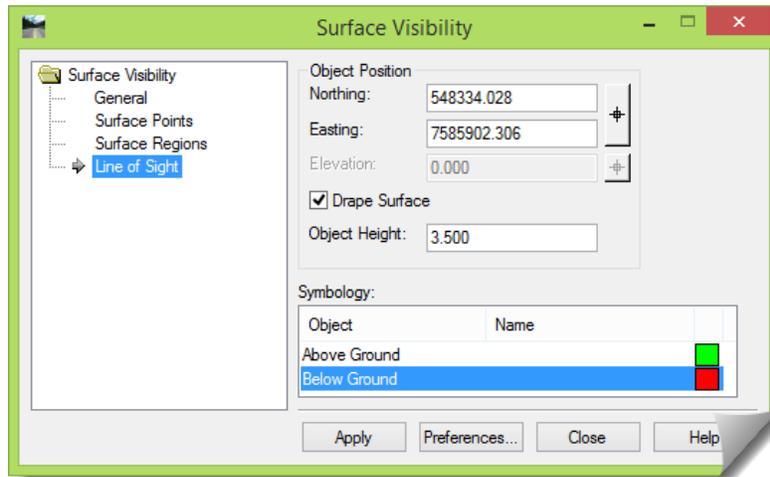


There are two **SIGHT VISIBILITY** tools available in InRoads.

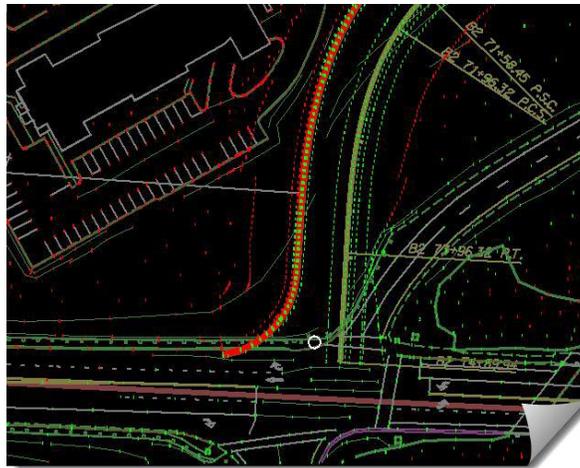
- **ROADWAY VISIBILITY** is used just to analyze the sight distance along the length of a roadway.



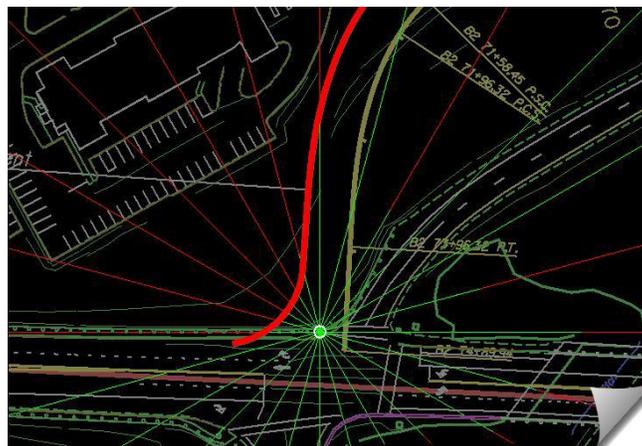
- The **Surface Visibility** tool is done for the intersection and determines the visibility from a given point. There are three modes for this tool – **SURFACE POINTS**, **SURFACE REGIONS**, and **LINE OF SIGHT**.



- The **SURFACE POINTS** mode indicates what triangle vertices can be seen from the observation point.



- The **SURFACE REGIONS** mode draws lines radially from the observation point, showing where sight is clear or blocked.



- The **LINE OF SIGHT** mode shows whether sight is clear or blocked between two points. The result of the **LINE OF SIGHT** tool contains a single line between two objects. The green portions of the line represent locations that are above the surface. Red portions represent locations that are below the surface.



Key Operational Items

There are a few things to consider if you plan to use these tools.

- a. In order for these tools to work, you have to create a merged surface from the existing and design surfaces. This makes sense, because the sight lines and visibility will often extend beyond the localized design surface.
- b. You'll want to add in the barrier modeling as described in the previous section since the barriers can impact sight lines and visibility.
- c. In order to analyze other objects, they will also need to be included in the surface by merging or other appropriate methods.
- d. Consult the ODOT HDM for appropriate sight distance and eye height values.

Conclusion

Congratulations, you have completed the module on Barrier layout using InRoads and are continuing to expand your modeling skills with InRoads.

We leave you with our encouraging final thought – Do these modules with an attitude of application. Study them with the viewpoint that you are going to apply these new skills on your current or future project. Look into and beyond the exercise steps and motivate yourself to momentarily pause and consider past, present and future projects and how this information could be put into practice.