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Workshop - X11

Introduction to Component Display Rules

Presenter: Joe Waxmonsky, P.E., Bentley Systems USA

Bentley Systems, Incorporated
685 Stockton Drive
Exton, PA 19341
www.bentley.com



Introduction to Roadway Designer Component Display Rules

Component Display Rules overview

Component Display Rules allow the user to create variations to a template based on external influences such as H/V controls and end-conditions. This is a very powerful concept that allows the user to apply one template that will actually change based on what is happening at a particular station.

This concept frees the user from knowing where a change in conditions might require a different template and allows the rules within a template to make modifications.

There are two main parts to this functionality:

First, there are the individual rules, which are stored on the template. The following types are supported:

- Horizontal
- Absolute Horizontal (uses absolute values)
- Vertical
- Absolute Vertical
- Slope
- Absolute Slope
- Component is Displayed

All but the last are conditional expressions between points that use one of the <, <=, =, >=, > operators to compare the specified difference between the two points to a particular value.

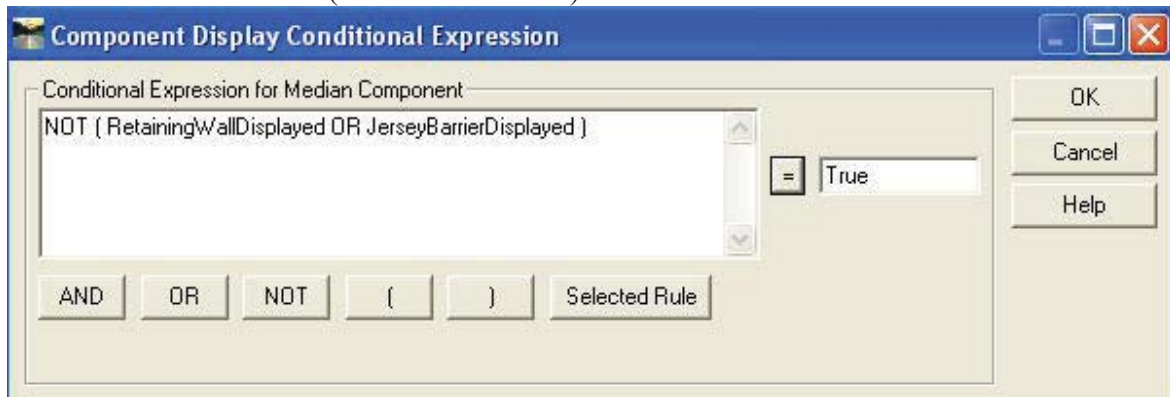
Example: Rule1 - Horizontal Difference between Point1 and Point2 is less than 10
 Rule2 - Slope from Point1 to Point2 is greater than -10%
 Rule3 - Slope from Point1 to Point2 is less than 10%

The rule, in general has 5 components.

- Name (no spaces allowed)
- Type (e.g. Absolute Horizontal Difference)
- Calculated value (e.g. Point1.x – Point2.x)
- Test (<, <=, =, >, >=)
- Test Value (e.g. 10)

The second part of this functionality is the conditional expression that is stored on the component. An example of a conditional expression is:

Rule1 OR (Rule2 AND Rule3)



Module Objectives

Upon completion of this module, you will be able to:

- Define and explain some of the uses of Component Display Rules.
- Develop a template that contains a set of Component Display Rules that automatically changes the template based on design conditions.
- Apply the template to a design and review the results.

Introductory Knowledge

Before you begin this module, let's define what you already know.

- Templates are created in the Roadway Designer file.
 - True
 - False
- A copy of the templates are stored in the Roadway Designer file.
 - True
 - False
- The template origin [0,0] represents which point:
 - The point of intersection of two vectors in a component.
 - A Required point in a template.
 - The point where the horizontal and vertical alignment is applied.
- The dynamic origin is always the template origin
 - Yes
 - No
- Component Display Rules are created in the Roadway Designer.
 - Yes
 - No

Introductory Knowledge Answers

- Templates are created in the Roadway Designer file.
This is False. Templates are created and saved in their own XML based file that has an ITL filename extension.
- A copy of the templates are stored in the Roadway Designer file.
This is True. When you add a template drop to a corridor, the Roadway Designer make a direct copy of the template and adds it to the Roadway Designer. This is important to know when verifying template definition. If a change is made in a template after being added to a design, synchronizing between the ITL and IRD is recommended.
- The template origin [0,0] represents which point.
The [0,0] point of the template is the point of the Horizontal and Vertical alignment where the template is applied. It does not require a point at that location. All template point locations are computed relative to this point.
- The dynamic origin is always the template origin
No. The dynamic origin is as its name implies, it is a dynamically applied location within the template. Component points can be placed relative to this origin which is similar to the tentative point snap in MicroStation. It can also serve as the insertion point location of a template when combining templates.
- Component Display Rules are created in the Roadway Designer.
No. Component Display Rules are created in the template library inside a specific template. They are applied directly to a component within a template and then the Roadway Designer acts on a set of points to determine the Component Display Rule.

Topic: Getting Started

Objective:

Start InRoads and load data.

> *EXERCISE 1: STARTING INROADS*

1. Start InRoads by selecting **Start > Programs > Bentley > InRoads Group XM > InRoads**.
2. Browse to the workshop folder and select “*Model.dgn*”
3. After InRoads starts, from the InRoads Explorer window select **File > Open....** Browse to the workshop directory and select “*project.rwk*”.

Hint You can Drag and Drop files from the Windows Explorer directly to the InRoads explorer to load InRoads data files.

Topic: Adding a retaining wall template to an existing 4 lane template.

Objective:

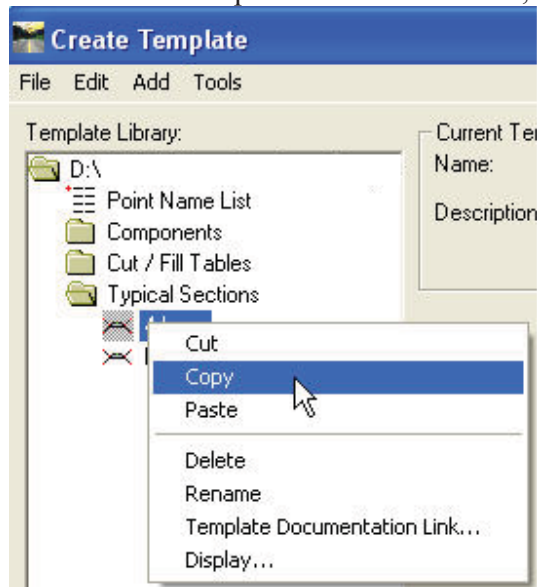
This lesson will take an existing template and combine another template that defines a median retaining wall. Then define a set of Component Display Rules displays this wall when the vertical elevation between the roadways is exceeded.

> *EXERCISE 2: COMBINING A TEMPLATE*

This exercise will copy an existing 4 lane template. The copied template will be edited and a median retaining wall template (group of components) will be added.

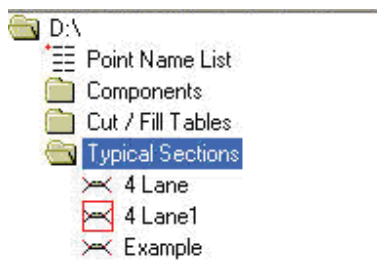
1. Activate the Create Template dialog by selecting **Modeler > Create Template**.
2. Navigate the tree view to the Typical Sections folder and select the “*4 Lane*” template.

3. Right-click and **Copy** the 4 Lane template and **Paste** it to the same location. This creates a template of the same name, incremented by “1”.

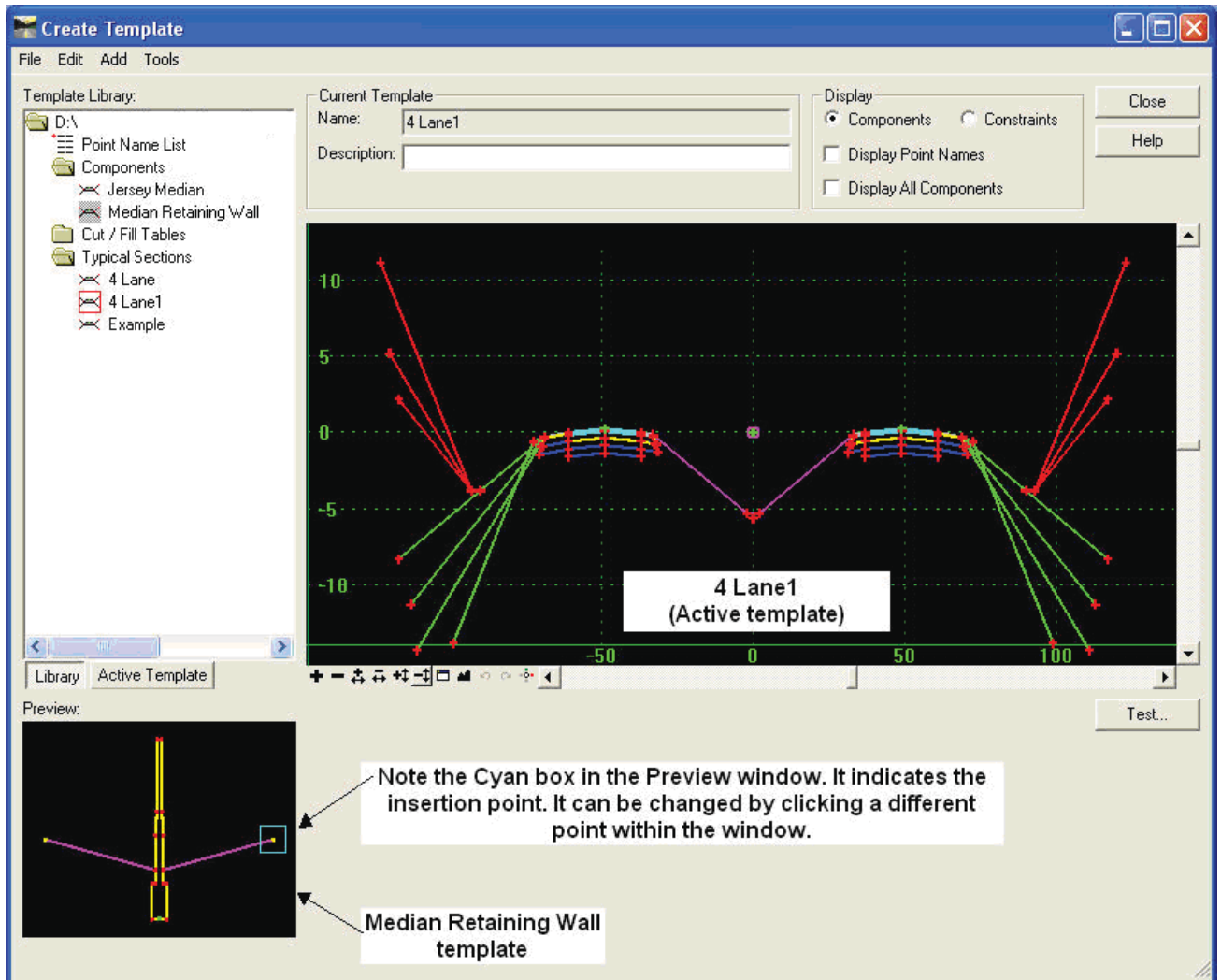


4. Set the template “4 Lane1” active by double-clicking on the template name in the tree view.

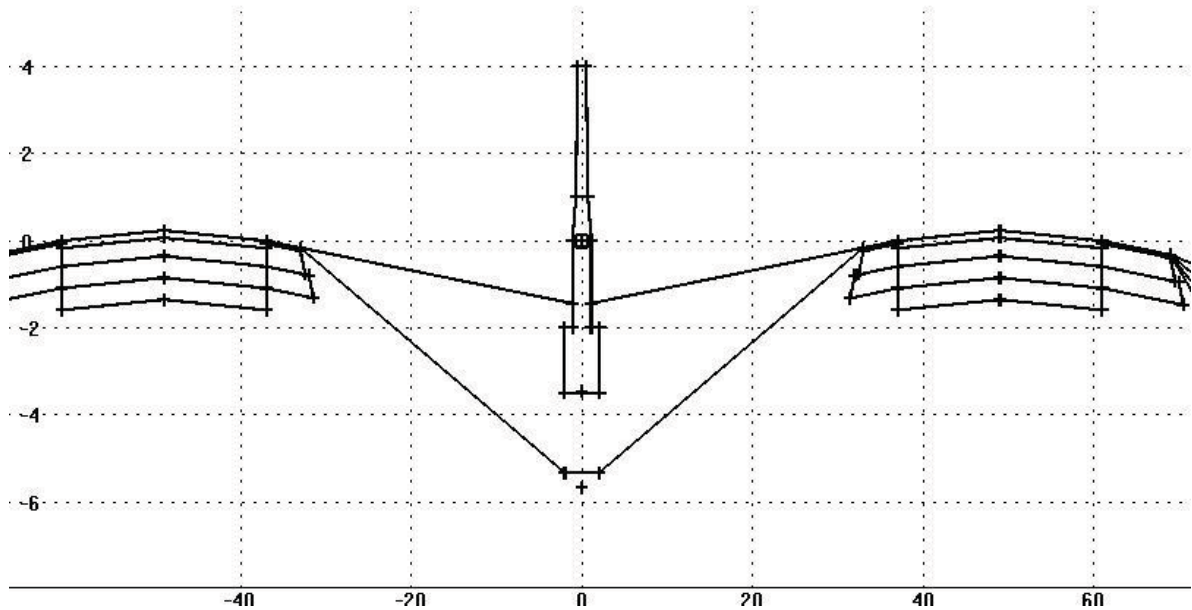
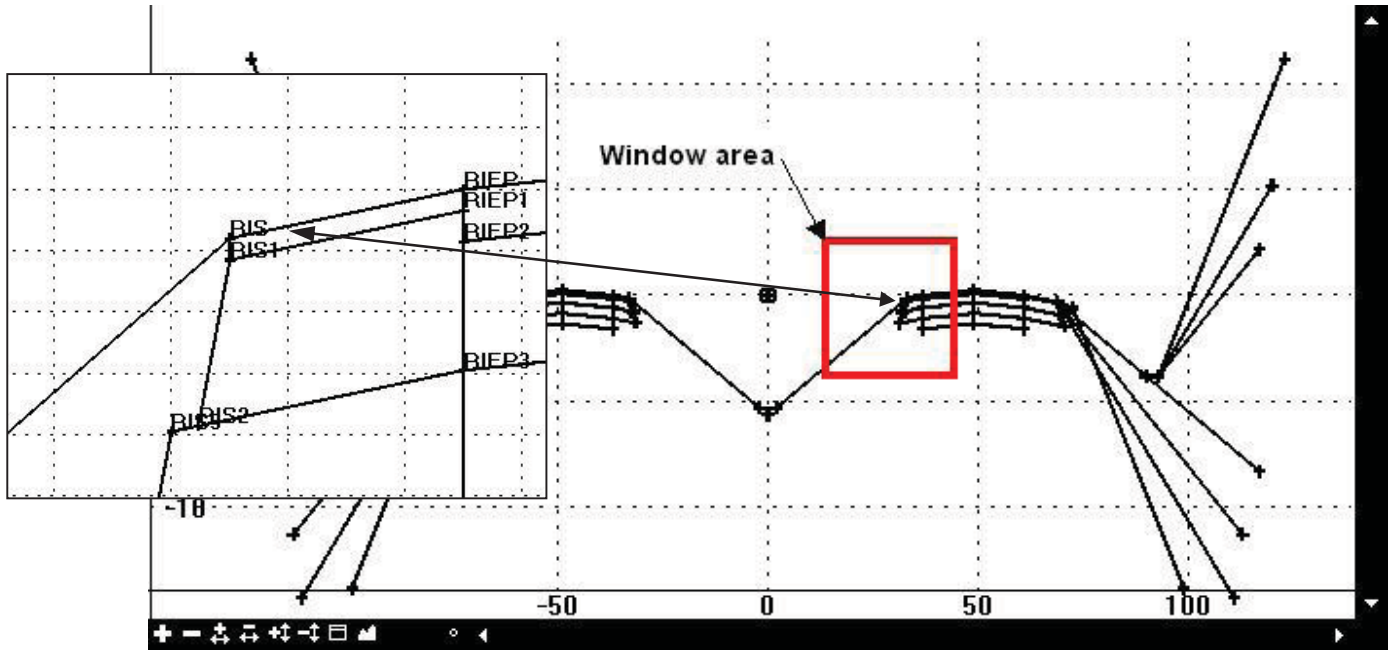
Note The active template is identified in the tree view by the red square highlighting the template icon.



5. Expand the “Components” folder and single-click select the “*Median Retaining Wall*” template. The retaining wall template should appear in the Preview Window at the same time the template “4 lane1” appears in the active template window.



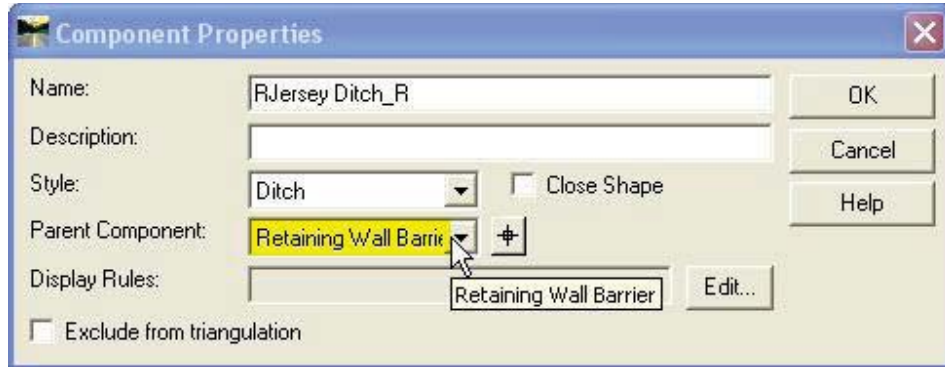
6. Turn on Display Point Names. Zoom in using the view control or middle mouse wheel on the point "RIS"
6. Verify the affixes in the **Tools > Settings**. **Drag and Drop** the "Median Retaining Wall" from the right side insertion point onto the point "RIS". The resulting typical section should appear similar to the following:



> **EXERCISE 3: CREATE A COMPONENT DISPLAY RULE.**

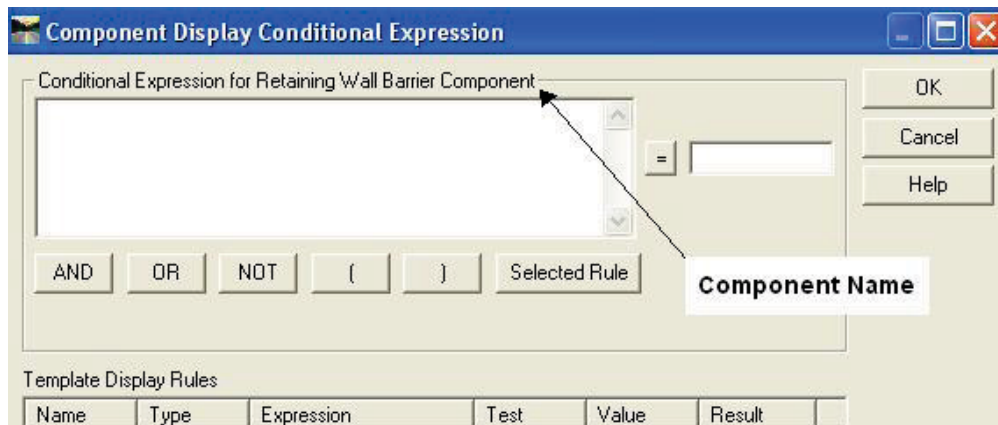
This exercise will create 3 display rules that determine when the retaining wall will be constructed if a certain set of criteria is met.

1. **Edit** one of the retaining wall shoulders. Notice the parent component.



Note The parent component "Retaining Wall Barrier", tells the software that whatever action is applied to the parent component will also be applied to this "child" component.

2. **Cancel** the Component Properties dialog.
3. **Right-click** on the Retaining Wall Barrier component and select **Set Component Display Rules**.
This will activate the Component Display Conditional Expression dialog.
Notice the component name in the Conditional Expression portion of this dialog.



4. Add a new Template Display Rule. Select the **Add...** Button at the bottom of the dialog.
5. This rule checks to see if the bottom of the median ditch point "CMD" is above the "RIS" (Right Inside Shoulder) point.

Key-in the Name: "CMD>RIS"

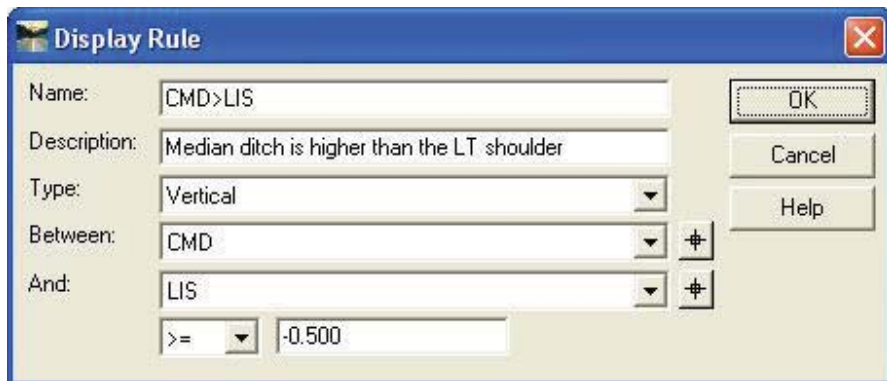
Description: "Median ditch is higher than RT shoulder"

Set the Type: Vertical

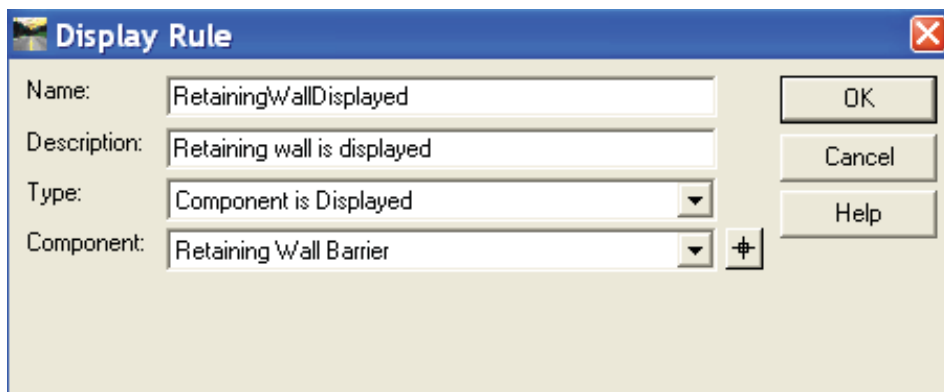
Between: RIS
And: CMD
>= -0.50



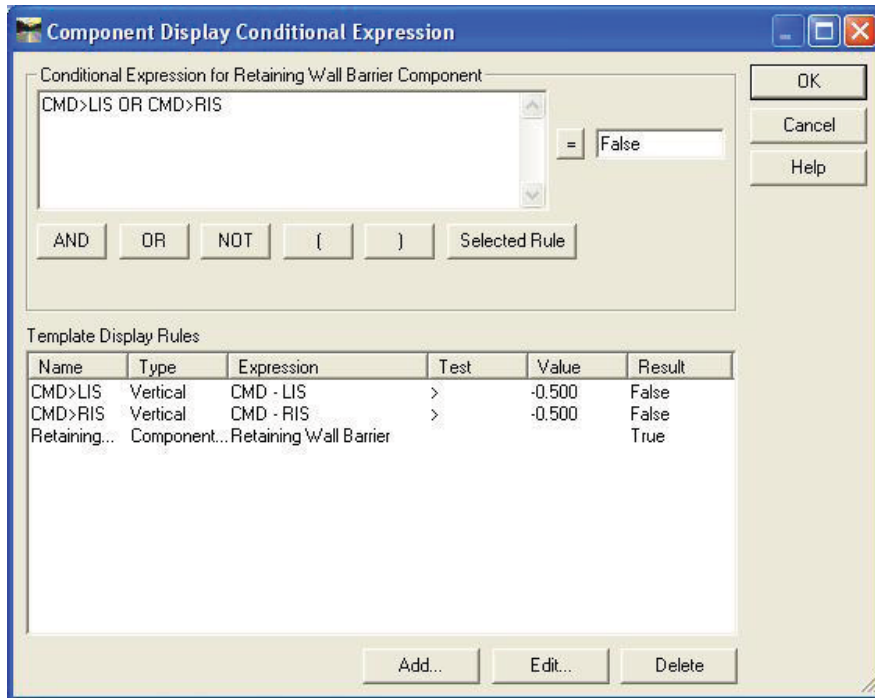
6. Select **OK** to add this rule and dismiss that add dialog.
7. Add a second rule that tests for the median ditch with the LIS (Left Inside Shoulder).



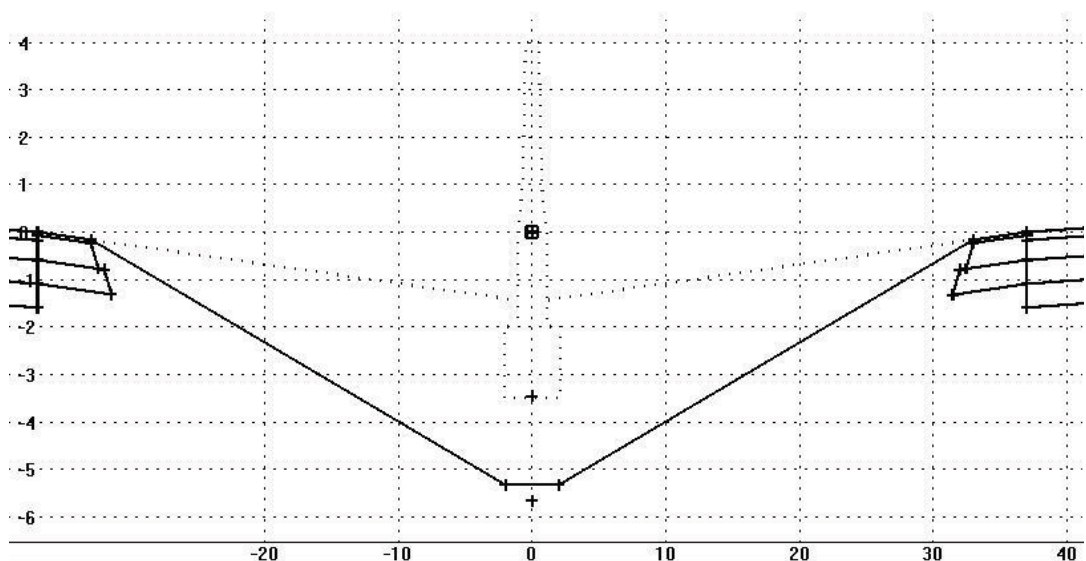
8. Add a Third rule that determines whether or not the Retaining Wall Barrier is displayed. This rule is applied to the “Median” component.



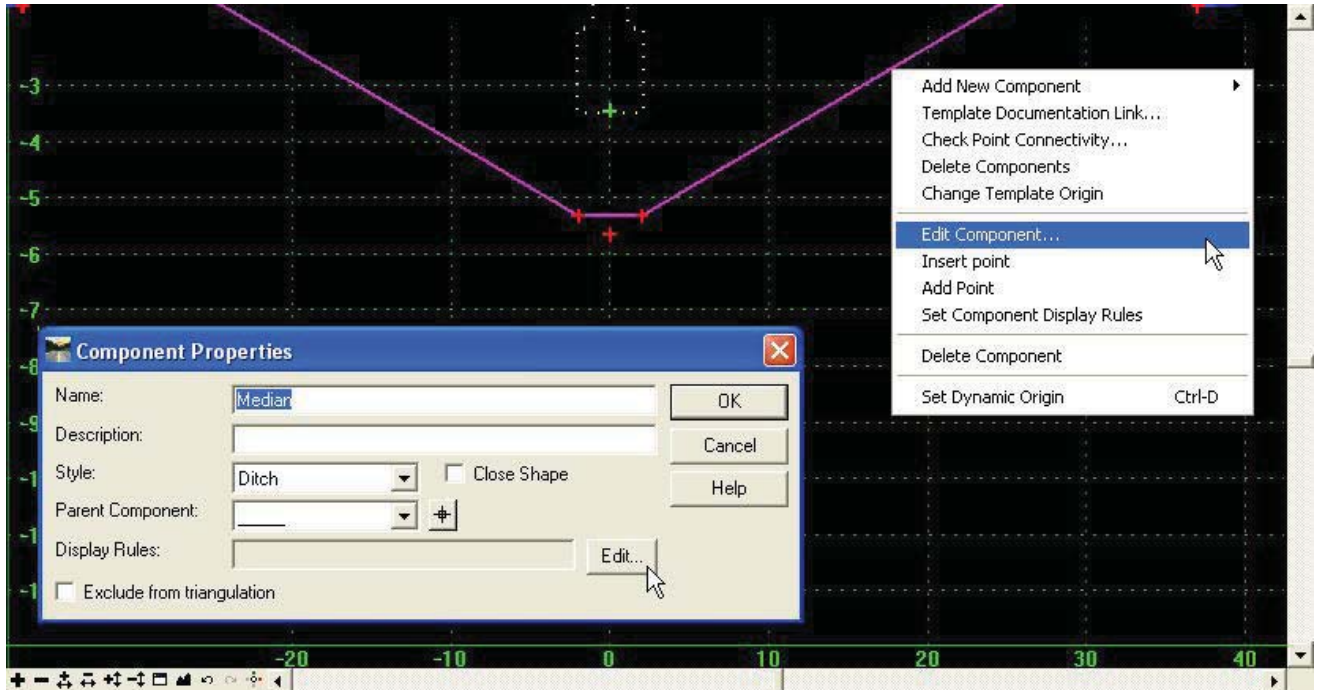
9. Add the Conditional Expression to the “*Retaining Wall Barrier*” component. Because the retaining wall needs to be displayed when the CMD point is above either LIS **OR** RIS, both of the vertical tests are added.
Select the first rule in the rules list and press Selected Rule.
Select the OR button.
Select the Second rule in the rules list and press Selected Rule.
10. Evaluate the expression by using the [=] button. Note that this expression evaluates to “False”.



11. Select **OK** to dismiss the Component Display Conditional Expression dialog.

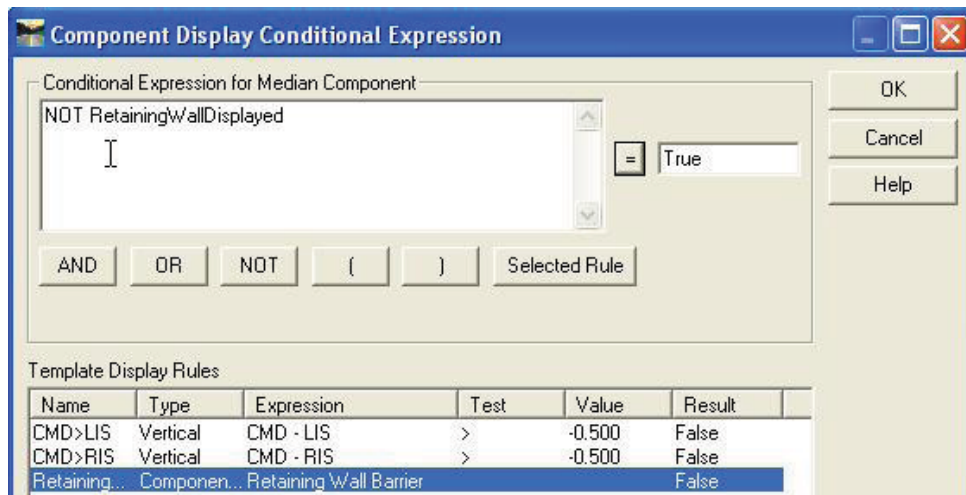


12. Set the component display rule for the Median component. Right-click Edit component on the Median ditch and select the Edit... button next to the Display Rules: read only field.

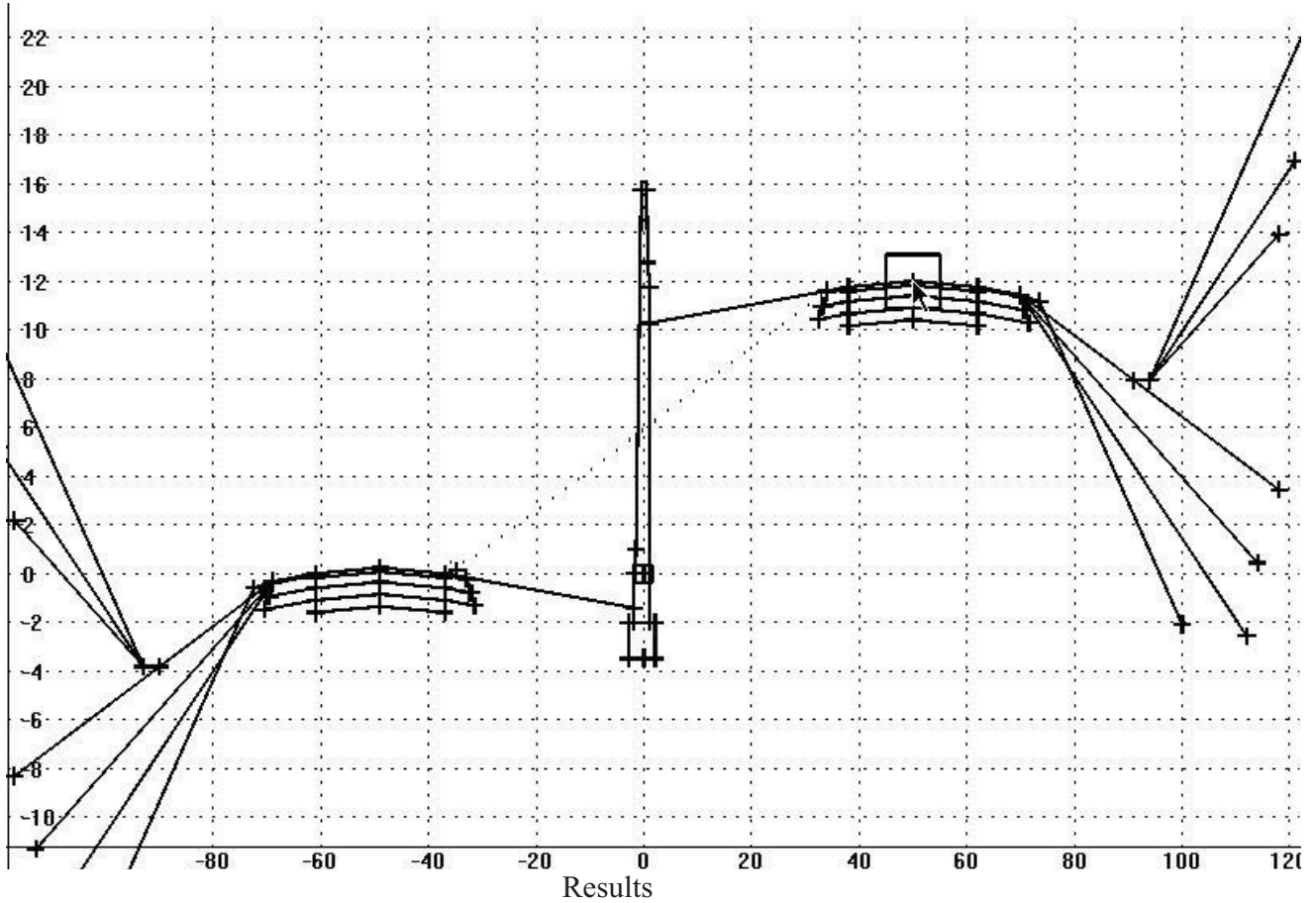


13. Because we want the median to display when the Retaining Wall Barrier component is ***NOT*** displayed, add a NOT before adding the “component is displayed” expression.

Notice that by adding the “NOT” to this expression, it evaluates to True even though the actual expression evaluates to False.



14. Select **OK** to dismiss the Component Display Conditional Expression dialog and **OK** to dismiss the Component Properties dialog.
15. Turn on Display All Components.
16. Move one of the unconstrained points to check your results.



17. Save the ITL file by selecting **File > Save**.

Topic: Combining Concrete Median Barrier to an existing 4 lane template.

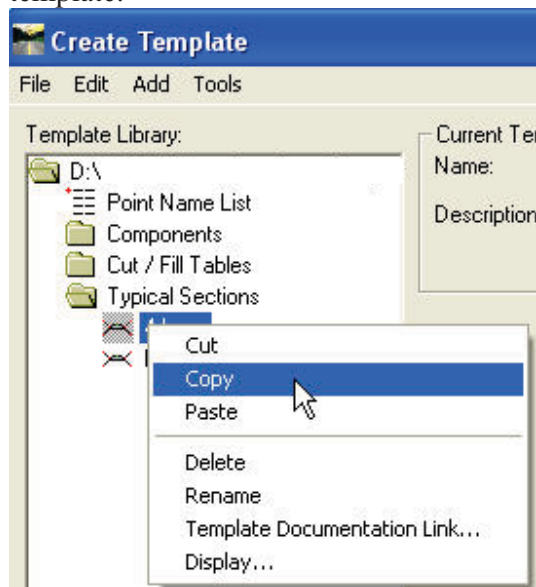
Objective:

This lesson will take the existing template from the previous exercise and add another template that defines a concrete median barrier. Then define a set of Component Display Rules that will display the concrete barrier when a minimum distance between roadways is met.

> EXERCISE 4: COMBINING A TEMPLATE

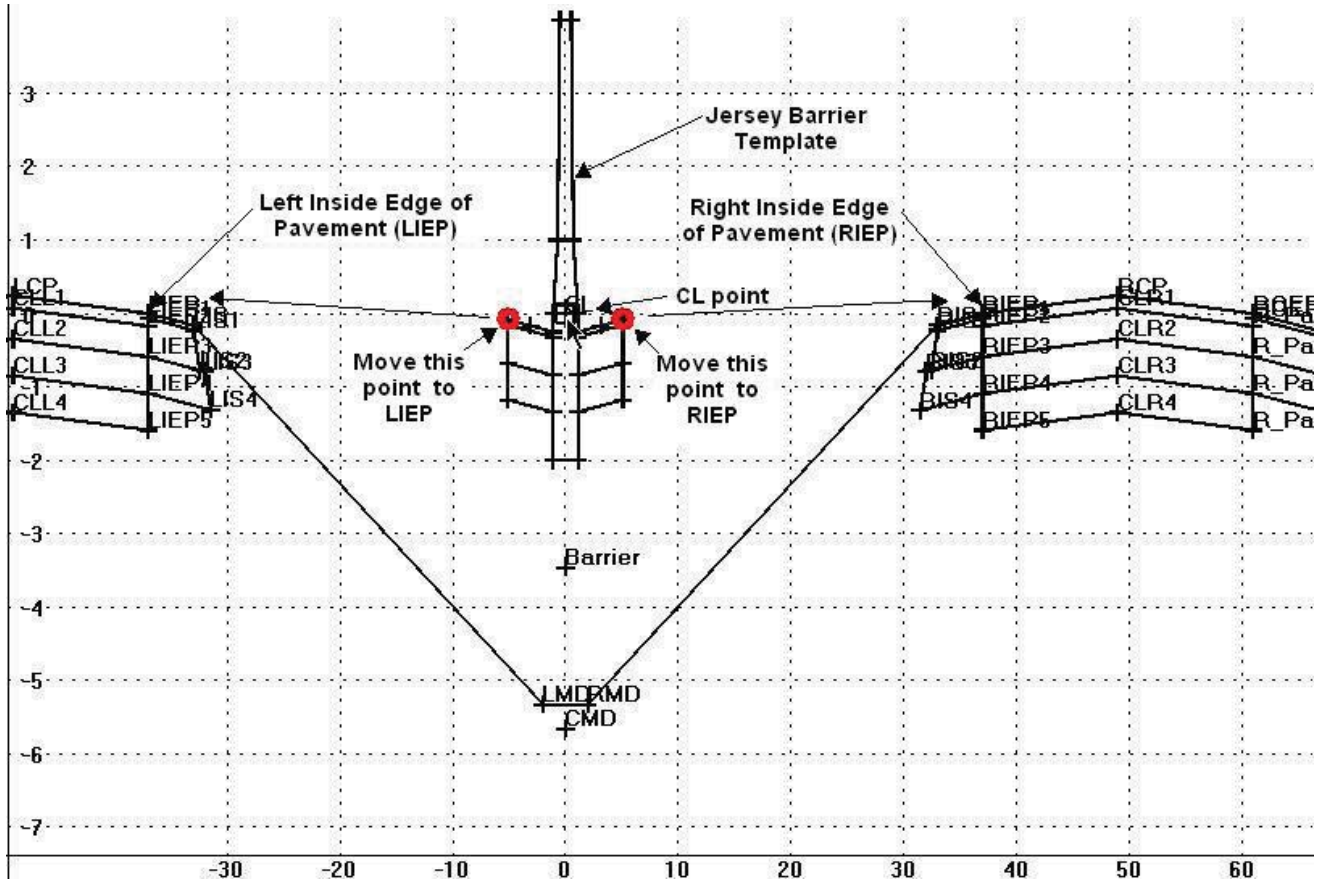
This exercise copies the existing 4 lane template. The copied template is edited and a barrier wall with shoulders is added.

1. Activate the Create Template dialog by selecting **Modeler > Create Template**. Navigate the tree view to the Typical Section Folder and select the “4 Lane1” template.



2. Right-click **Copy** the 4 Lane1 template and **Paste** it to the same location. This creates a template of the same name, incremented by “1”.
3. Set the template “4 Lane11” active by double-clicking on the template name in the tree view.
4. Expand the “Components” folder and single-click select the “Jersey Median” template. The Jersey Median template should appear in the Preview Window at the same time the template “4 lane11” appears in the active template window.

5. Drag and Drop the “Jersey Median” template to the 0, 0 point in the template.

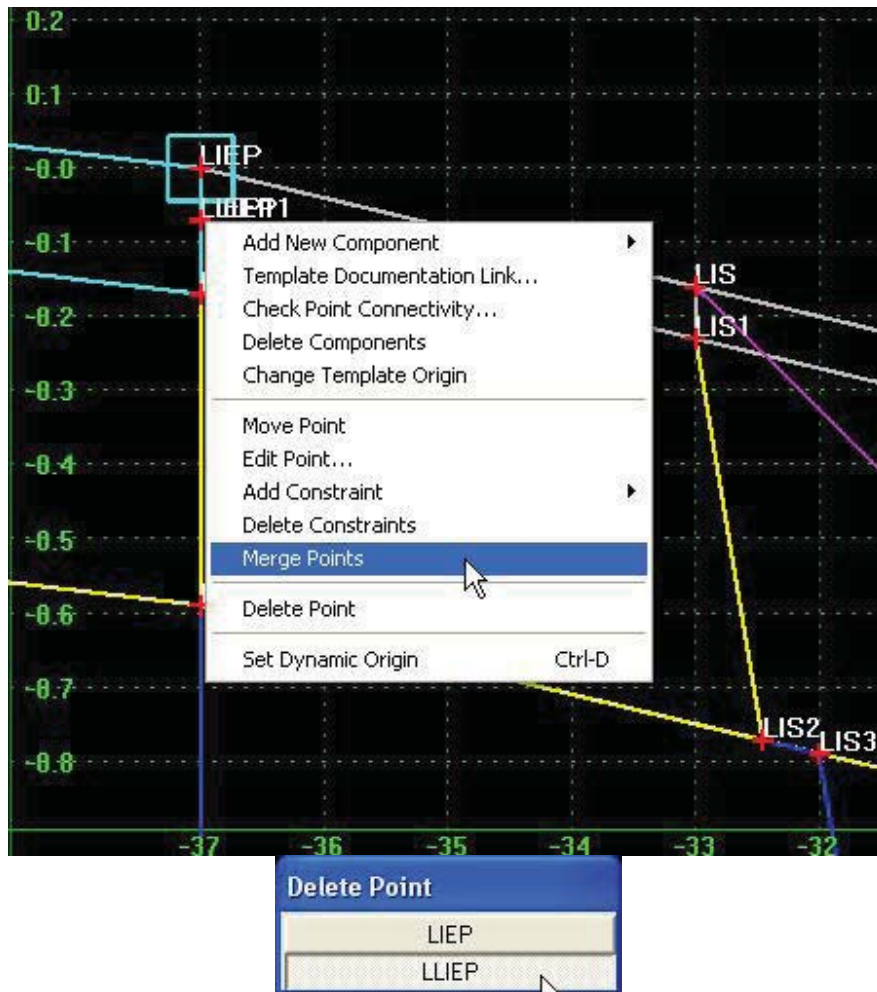


6. Select the Jersey Barrier LLIEP and right-click **Move Point**. Move the point LLIEP until it snaps to the LIEP point of the four lane template.

Hint Use the mouse wheel while in the move point state to zoom in and out to center in on the LIEP point.

7. Right-click on the LIEP point and Select Merge point. At the Delete Point selection dialog, delete LLIEP.

Hint If you select the wrong point for merging, press the ESC key at the Delete Point selection dialog to prevent merging. If you have merged the incorrect point, you can always use the “undo” button located at the view control icon at the bottom of the template window.

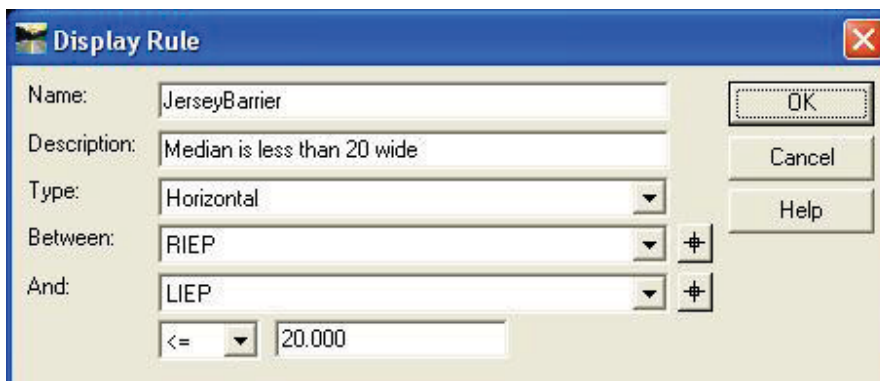


8. Repeat the process for RIEP. Select the Jersey Barrier RRIEP and move it until it snaps to the RIEP point of the four lane template.
9. Right-click on RIEP and Select Merge Points.
10. Delete the RRIEP point.
11. Save the Template file by selecting **File > Save**.

> **EXERCISE 5: CREATING DISPLAY RULES**

This lesson assigns and edits Component Display Rules to automatically place the Jersey Barrier and its child shoulder components when the distance between the roadways is ≤ 20 . (6.8m)

12. Right-click on the Jersey Barrier and select **Set Component Display Rules**.
13. **Add** a new Template Display rule.
14. Key-in a Name: “*JerseyBarrier*” and a Description: Median is less than 20 wide. Set the Type: **Horizontal** between points RIEP and LIEP and key-in a value of 20.



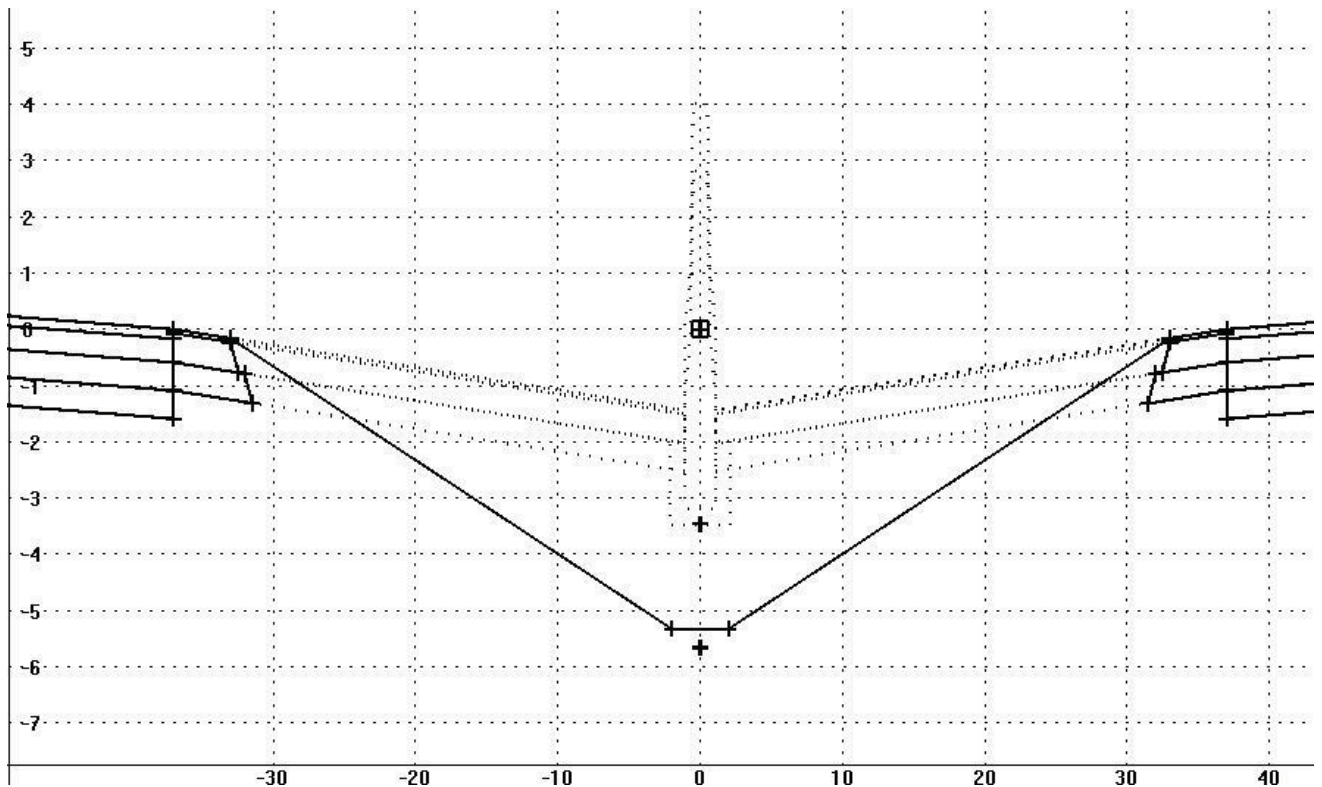
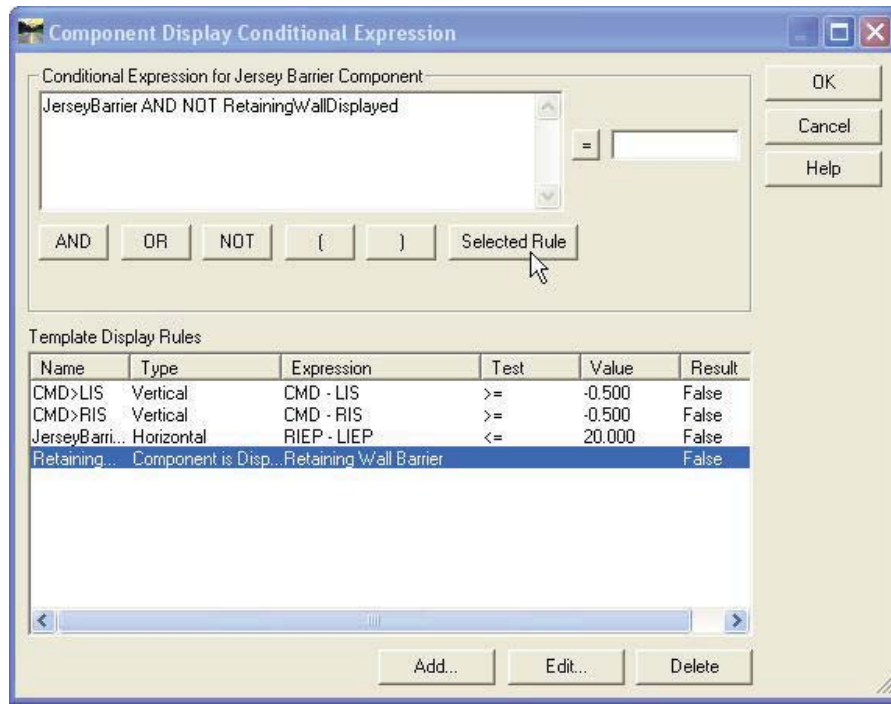
The distances are measured based on the Horizontal offsets between the points. For example, in this case, the LIEP offset is -37.00 and the Right offset is 37.00. Since it is evaluated as $37 - (-37) \leq 20.0$ then it is False.

Another method of performing this operation is to use the *Absolute Horizontal* type evaluation. The “Absolute” evaluation performs the mathematical test on the points reducing each point to their absolute values. Included in this type is *Horizontal, Vertical and Slope*.

In this case an absolute value allow you to choose either point regardless of the order even though one offset is negative and the other positive.

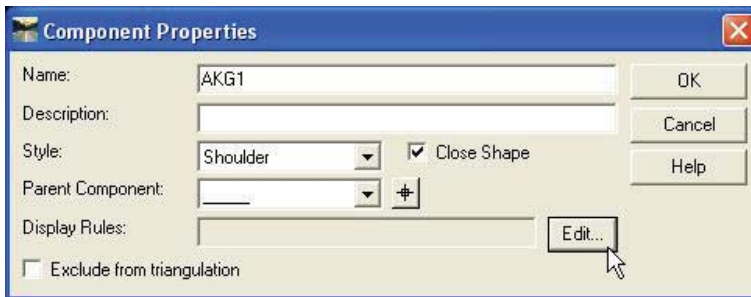
15. Press **OK** to accept and dismiss the Display Rule dialog.

16. Select this rule from the list and add it as an expression for the Jersey Barrier component. Add the expression “AND NOT RetainingWallDisplayed”. Click OK when finished.

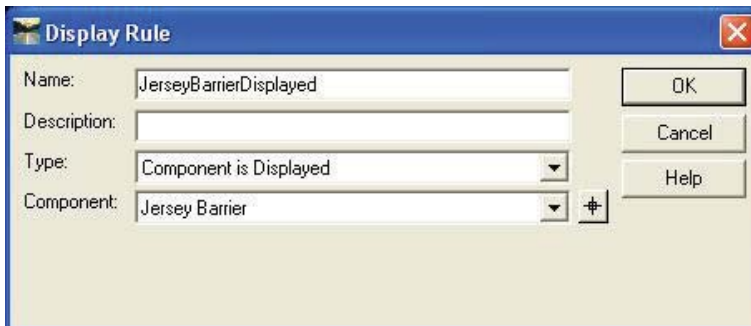


The template should now contain dashed components of both types of walls within the median. Notice that the inside shoulders for the standard median ditch are displayed and we need those components to disappear when the Jersey Barrier is displayed. Also, the Median Ditch should not be displayed when the Jersey Barrier is displayed.

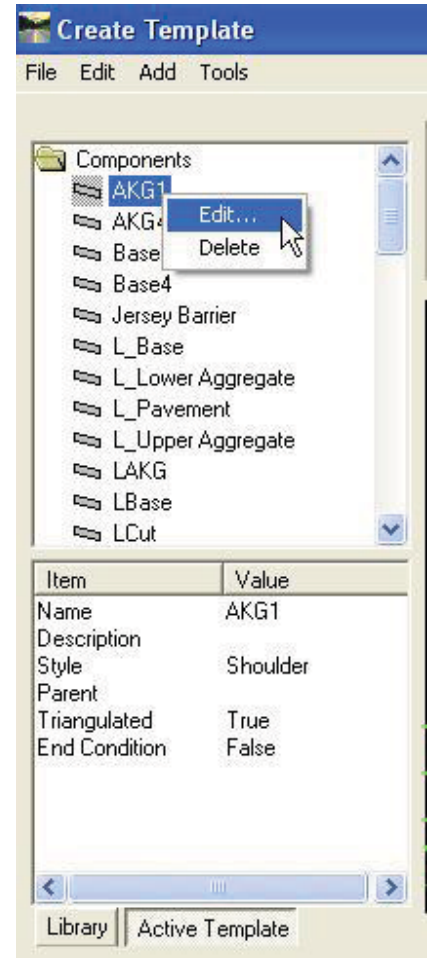
17. Right-click **Edit** the left inside shoulder component named “AKG1”.
18. From the Component Properties dialog, select **Edit** next to the Display Rules read only field.



19. Add a new template display rule.
 Name: JerseyBarrierDisplayed
 Type: Component is Displayed
 Component: Jersey Barrier



20. Press **OK** to add the rule and dismiss the Display Rule dialog.
21. Add the opposite of this rule to the AKG1 component by using the NOT operator.



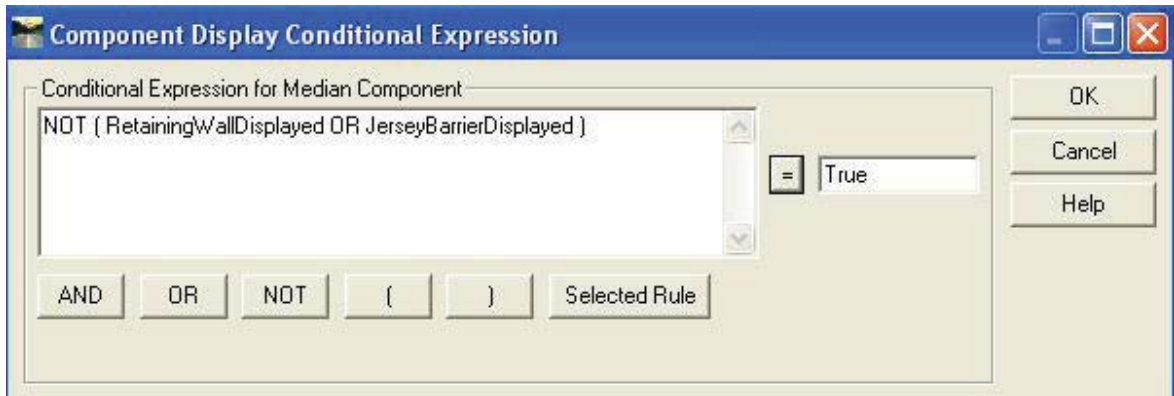
22. Press **OK** to add this rule to the component and **OK** to accept the edit to the AKG1 component.
23. Add this rule for the right inside shoulder, AKG4.



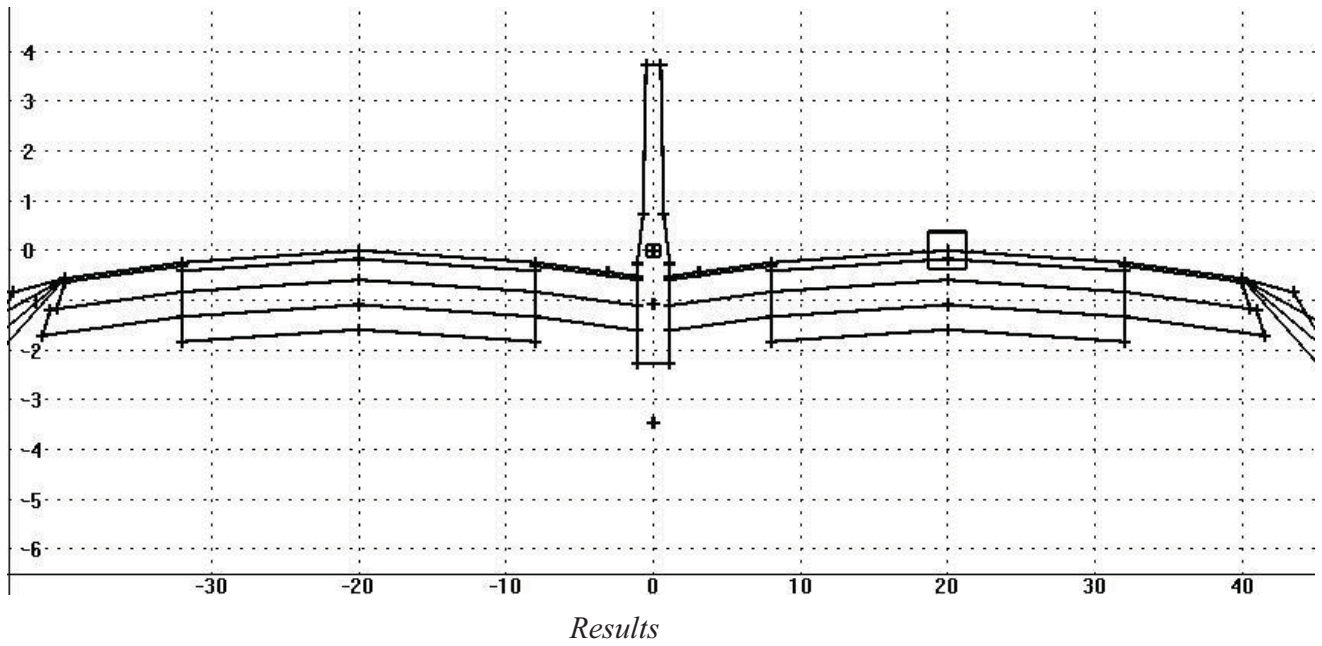
The median ditch component already has a rule that states that if the Retaining Wall is displayed, then the Median will NOT be displayed. You need the same type of rule to apply if the Jersey Barrier is displayed.

24. **Edit** the Median ditch component and **Edit** the Display Rules for the Median. Since this component will NOT be displayed if either the Retaining Wall or the Jersey Barrier is displayed then an OR statement is required.

25. Change the Conditional Expression for the Median component to the following:
NOT (RetainingWallDisplayed OR JerseyBarrierDisplayed)
26. Select **OK** to accept the change and **OK** to dismiss the Component Properties dialog.



Test this rule by moving the CL of the roadway points inward (towards the CL) until the rule conditions are met.



Hint You can also use the Test button to check the display rules.

27. **Save** the ITL file and **Close** the Create Template dialog.

Topic: Evaluating the Design.

Objective:

This lesson takes the template from the previous exercises and applies it to the corridor design.

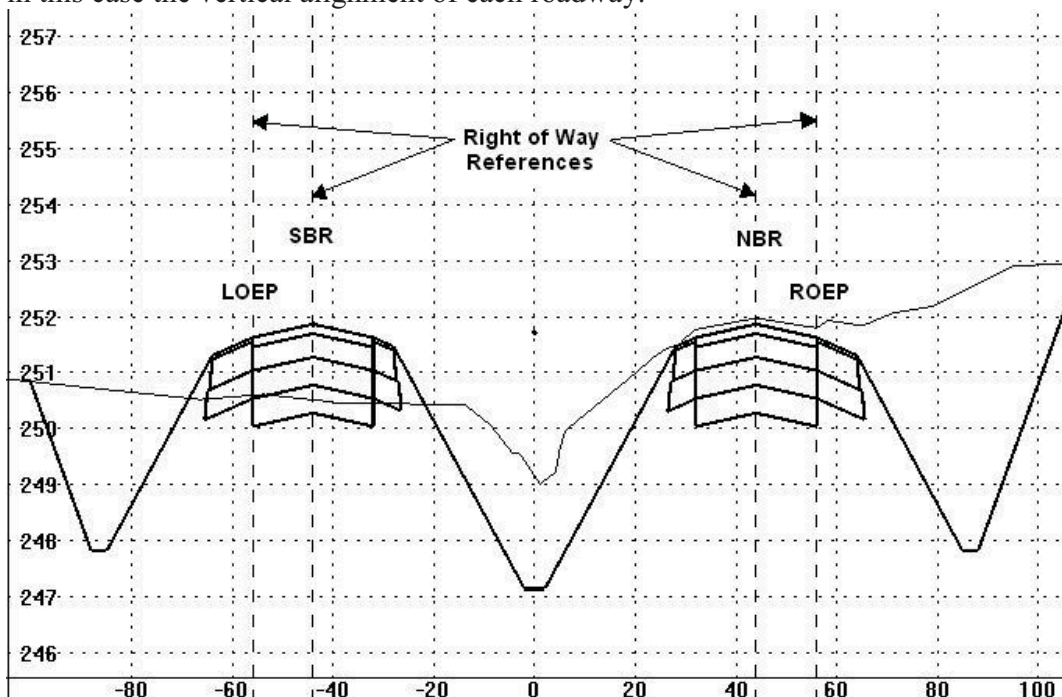
> EXERCISE 6: REVIEWING EXISTING DESIGN.

This exercise reviews the existing 4 lane design. The areas that apply the component display rules are noted and various design elements discussed.

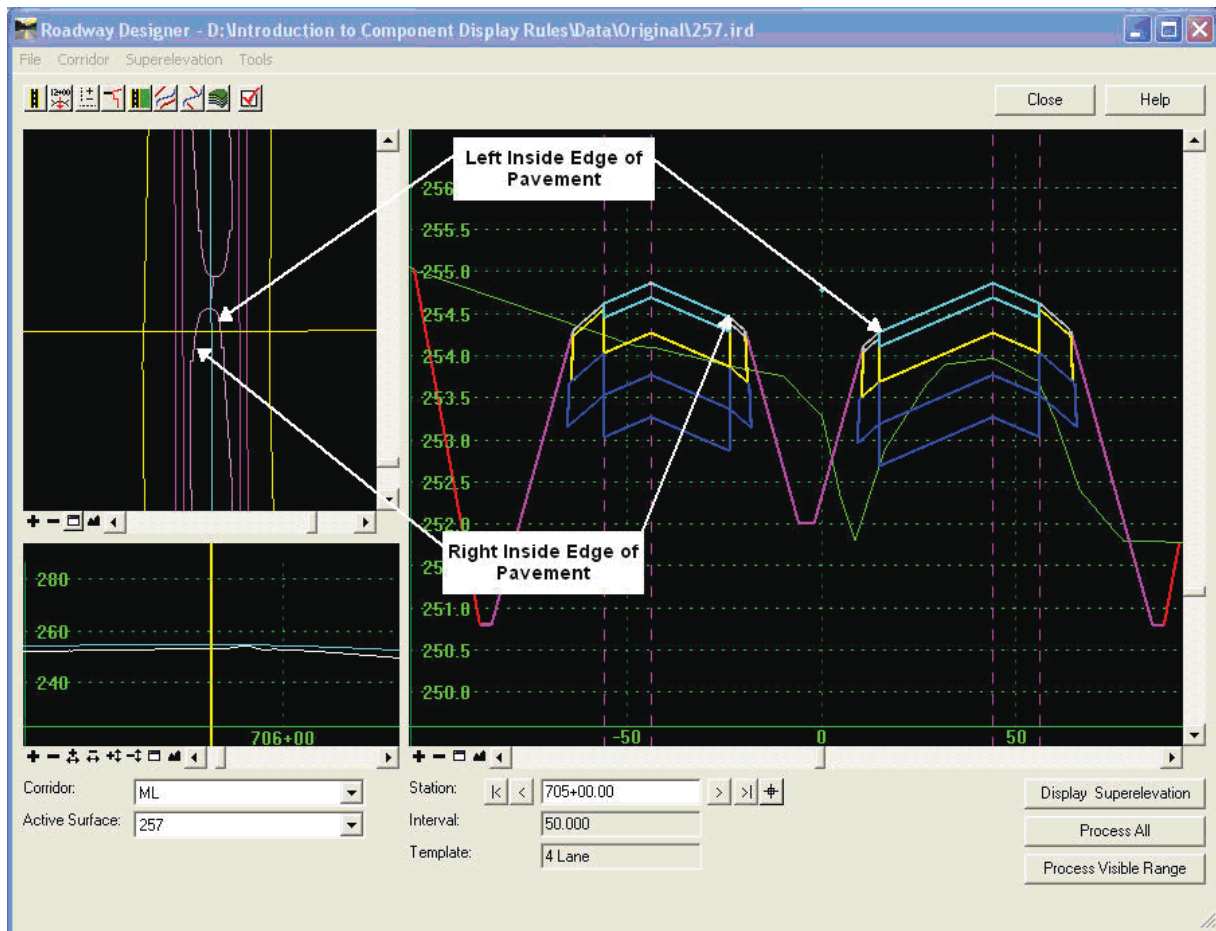
1. Activate the Roadway Designer dialog by selecting **Modeler > Roadway Designer**.

Note the “Right of Way” reference in the Cross Section view of the designer.

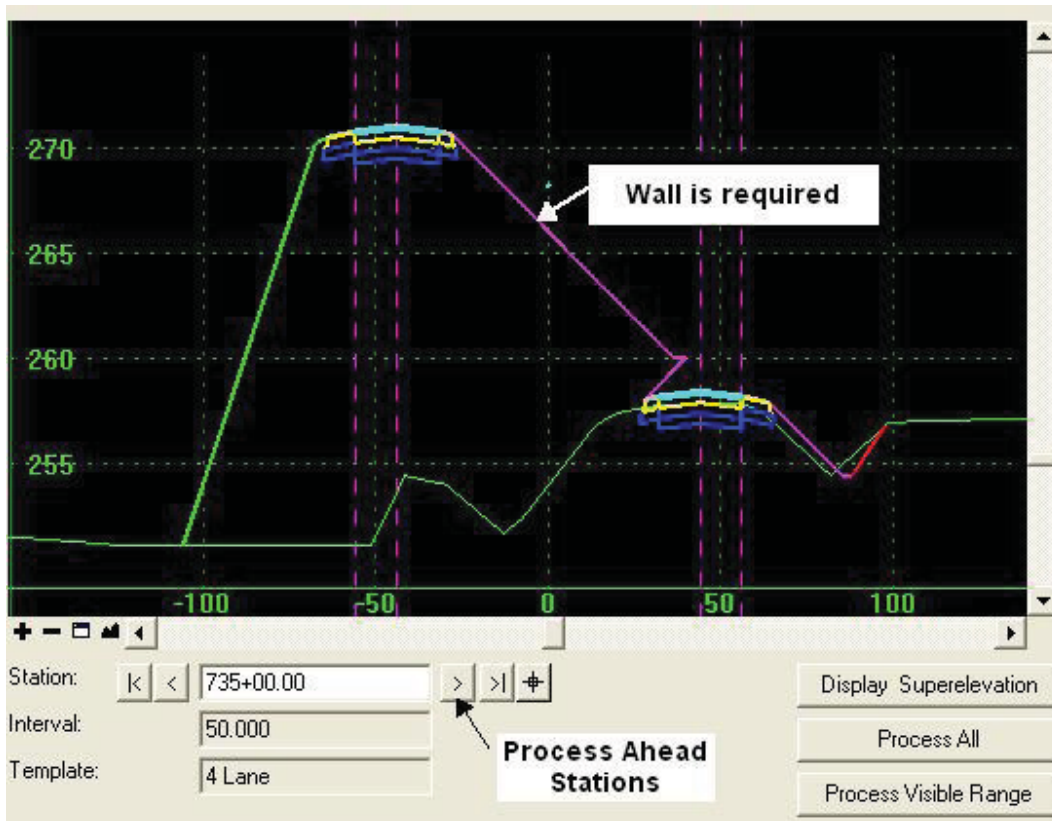
It shows the outside edges of pavement as well as the Northbound and Southbound centerlines. These points as well as the inside edges of pavement are controlled by a new type of constraint “Style Constraint”. The style constraint permits the designer to “target” a feature or alignment Style. This eliminates the necessity of adding point controls to vary edge of pavement widths and in this case the vertical alignment of each roadway.



2. Window in on the plan view at the south end of the corridor (at the first Median crossover). Key-in station 705+00 in the Station navigation field and press tab.
3. Note the automatic width change based on the LIEP and RIEP alignment “Styles”.

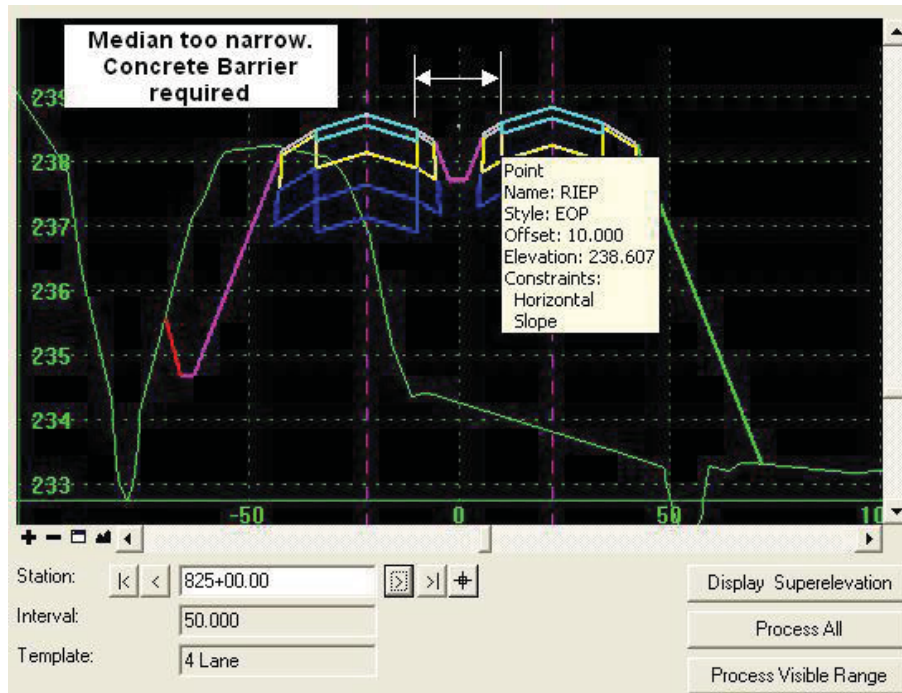


4. Process ahead station to station 735+00 and note the issue with the median. This is the area that is addressed by the first component display rule.



5. Process to station 825+00. Note the median width in this area.

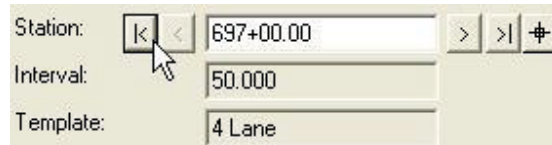
Hint You can hover over a point to get tool tip information of the point offsets.



> **EXERCISE 7: REVISING THE DESIGN.**

In this lesson, the 4 lane design is updated with the template that contains the component display rules completed in the previous exercises. The areas that require design revision using component display rules are noted and various automated design elements reviewed.

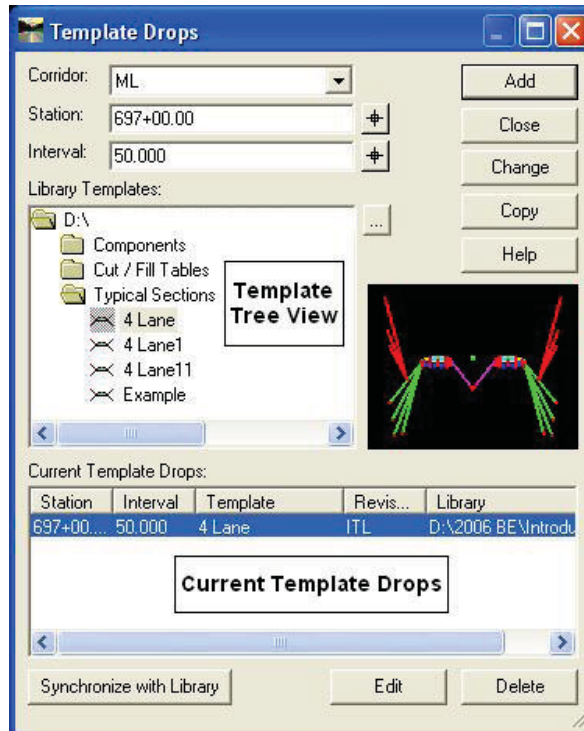
6. Use the Station Navigation arrow to go to the first station of the corridor.



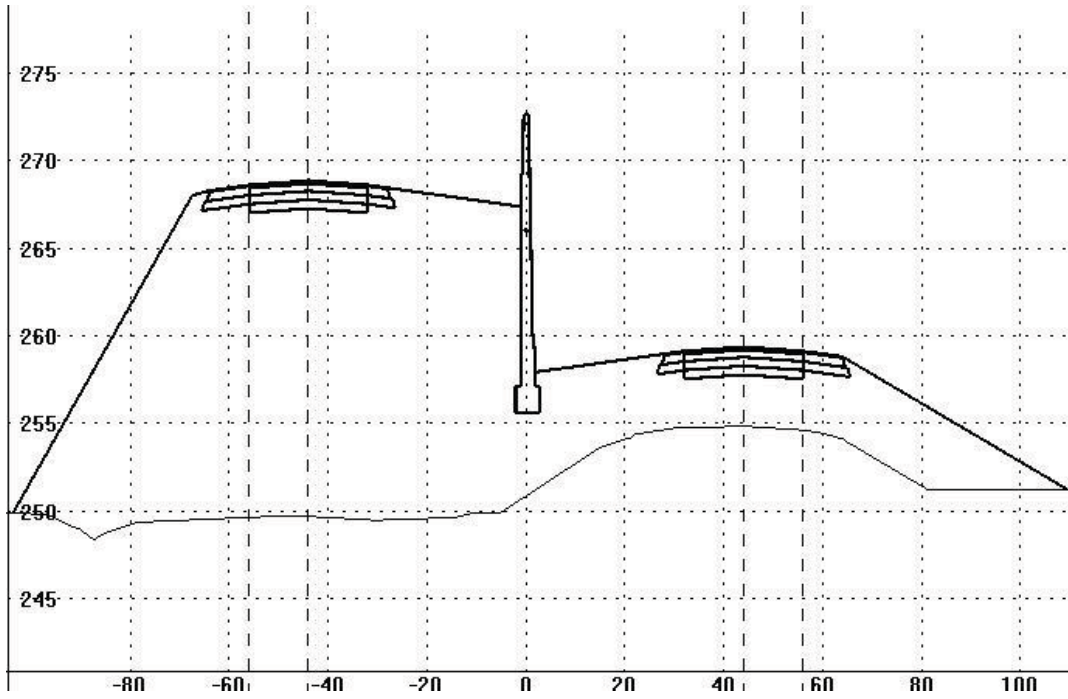
7. Activate the Template Drops dialog by selecting the icon on the main Roadway Designer dialog.



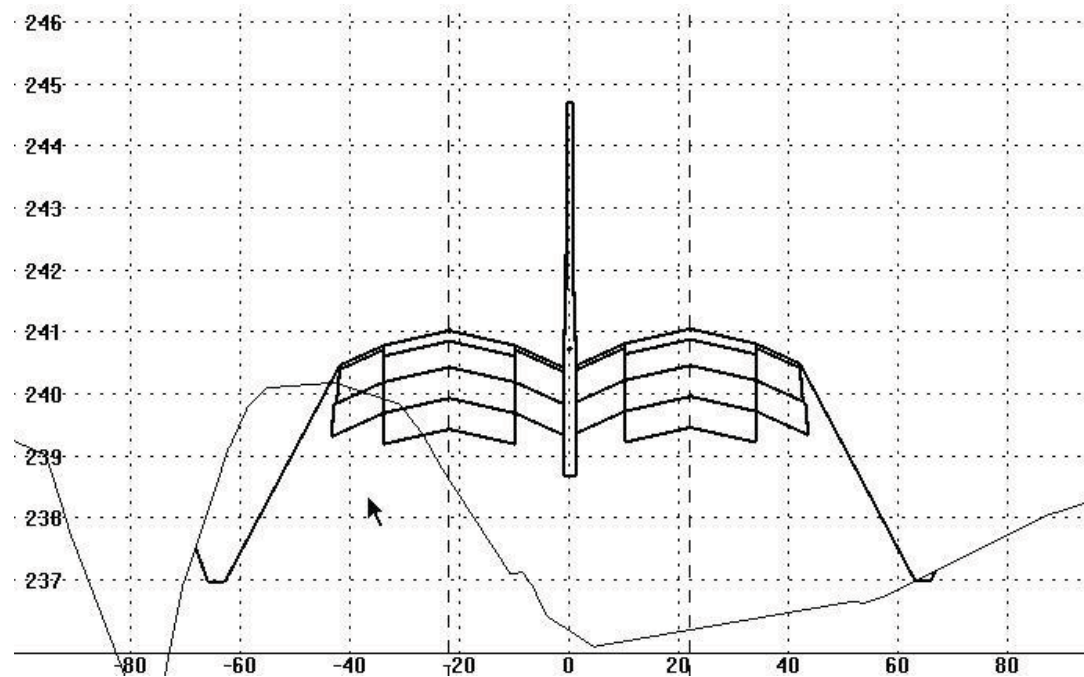
8. Select the Current template Drop entry.
9. Navigate the Tree view of the Template Library to the Typical Sections folder.



10. Select the copied template from Exercise 4 “4 Lane11” and press **Change**.
11. **Close** the Template Drops dialog.
12. Key-in station 734+00 and check the results.



13. Key-in station 825+00 and review the results. Process ahead and back several stations.



Module Review

Now that you've completed this module, lets gauge what you've learned:

- Where are component display rules stored?
 - A. Inside the Roadway Designer
 - B. On the Template component
 - C. In the Template
 - D. Inside the Geometry file
- What is the difference between a Component Display Rule and a Component Conditional Expression?

- What affect does a parent child component relationship have on component display rules?
 - A. If a component is a child it is controlled by its parent's Component Display Rule.
 - B. Has no effect because the Component Display Rule always has priority.
 - C. Should not be used in conjunction with a CDR.
- Can you test component display rules within the create template command?
 - A. Yes
 - B. No
- Name one way to test a component display rules affect on a template?

- What is the use of the NOT expression?
 - A. Exclusively used to evaluate to False.
 - B. To perform the opposite evaluation of a given rule.
- When would absolute values in the Display Rule be needed?
 - A. To check a distance or slope regardless of direction or offset.
 - B. To provide a specific point order.
 - C. Used only in Horizontal offsets.

Module Summary

Component Display Rules are an extremely powerful function within the InRoads Roadway Designer. There is essentially no limit to how a set of rules can be created and applied to a design.

More complex design solutions can be applied in an automated fashion with this product than with any previous product. This capability coupled with the interactive nature of the Designer permits the most innovative design solution to date.

This workshop has taken you through the steps involved in creating, defining, and testing Component Display Rules.

You are now able to:

- Edit a template to include a median retaining wall to accommodate vertical grade separation.
- Establish a set of rules to apply to the retaining wall when the vertical difference is exceeded.
- Edit the template to include a concrete median barrier.
- Set rules on the median barrier to establish the criteria when the median barrier should be placed in the design.
- Update the Roadway Design with the new template containing Component Display Rules and reviewed the results.

Module Review Answers

- Where are component display rules stored?

C. The component display rules are stored in the template. The conditional expression is stored directly on the template component.

- What is the difference between a Component Display Rule and a Component Conditional Expression?

The Component Display Rule performs a mathematical operation between two points or in the case of Component is Displayed checks to see if a component is displayed, and a Conditional Expression performs an evaluation of a CDR or set of CDR's on a component.

- What effect does a parent child component relationship have on component display rules?

A. If a component is a child of a component that contains a Conditional Expression, then it will be governed by the same set of rules.

- Can you test component display rules within the create template command?

A. Yes. There are two ways to check the CDR inside the template

- Name one way to test a component display rule's effect on a template?

1. Use the Test function within the Create Template and toggle the display rule evaluation between True and False
2. Release point constraints inside the template and move the point(s) till you get a change in the evaluation of the Conditional Expression.
3. Apply the template to your design that contains sufficient controls to evaluate the changes in the Conditional Expression.

- What is the use of the NOT expression?

B. This operator does not necessarily always evaluate a conditional expression to False. It is intended to perform the opposite operation on the component based on the rule results.

- When would absolute values in the Display Rule be needed?

A. To check a distance or slope regardless of direction or offset.