Chapter 14

Superelevation

14.1 Superelevation Overview

The Superelevation commands calculate how much banking to apply to curves in the horizontal alignment to help offset centrifugal force. These commands also compute how the road will make the transition from normal crown to a fully banked curve and back again. The methods the software uses to compute superelevation comply with the guidelines of the American Association of State Highway and Transportation Officials (AASHTO).

Superelevation is used to control the cross slope of roadways in areas of horizontal curves and spirals. In the Roadway Designer command, superelevation control lines can be created and then used as vertical point controls to control the elevation of a point relative to another point in the cross section.

Superelevation control lines represent a cross slope rate (%). This rate is multiplied by the distance from the reference or pivot point to the point being superelevated to obtain a height difference. This height difference is then added to the pivot point elevation to obtain the controlled point's new elevation.

For a typical two lane road, there are generally two super control lines; one for the left edge of pavement, and one for the right with the pivot point being the crown point of the road. However, with the Roadway Designer superelevation functionality, there is no limitation on the number of control lines or pivot points. Using superelevation control lines along with the normal template constraints on the points allows you to get exactly the desired results.

Superelevation control lines are grouped into super sections. A superelevation section can be thought of as a limits box with a start and stop station and a width defined by left and right range points. See the following *How To* topics for more details on creating and displaying superelevation control lines:

14.2 Creating Multiple Control Lines Using a Wizard

Use these steps to create multiple control lines with a superelevation wizard.

Right-click in the superelevation

1. Right-click in the superelevation window.
2. Select the Create Superelevation Wizard command from the popup menu.

Wizard Type

1. Select one of the following options: AASHTO, Fixed Length, or Table.

AASHTO Wizard

The AASHTO wizard uses the formulas defined in the AASHTO manual to determine the minimum runoff length for each transition.

Before the superelevation controls can be designed, several values need to be gathered. The maximum cross-slope or design super rate, e_d is obtained from each horizontal curve on the alignment. This is the cross slope of the roadway (%) when it is in full super. This value can be different for each curve. Other values are specific to the particular corridor being designed. These values include:

- % Runoff on Tangent. This value is used to determine where the superelevation should start.

- Maximum relative gradient(Delta G) – Δ_G. This is the relative gradient between the pivot point (usually centerline) and edge of roadway.

On the first page, enter Maximum Delta G, the Percent Runoff on Tangent, and Spiral Tangent Point. The Full Superelevation Rate for each curve of the corridor is displayed. If these rates are incorrect or have not yet been calculated, use the Rate Calculator to fix the problem.

2. Click Next to proceed to the second page.

The next set of information is provided as each superelevation section is created. You can create as many independent sections as desired. Click Add to define the sections.

3. Use the Add Superelevation Section dialog box to specify settings.

- Crown - name of the crown point
- Left Range - name of the left range point
- Right Range - name of the right range point
- Start Station - start station for superelevation section
- Stop Station - stop station for superelevation section
- Pivot Direction - This can be From Crown, From Left, From Rigth, From Inside, or From Outside.

4. Click Ok.

The software attempts to determine all the points that are to be superelevated, the number of lanes, and the width from the pivot point, to the outside edges. All of this information is displayed in the bottom list view on the second page of the wizard. You can override any of the values by selecting the curve; then, pressing the Edit button. The Superelevation Curve Information dialog is displayed.

All points on the top of the design and between the left and right range points (inclusive) are superelevated.

Once the required information is received, the wizard calculates some additional values, and finally calculates the minimum runoff length for the start and end of each curve.

Changing one value affect other values and the calculated runoff lenghts.

Minimum runoff length calculation using AASHTO equations

This section describes the equation used to calculate the runoff length for a curve.

The following formula is used: $$L_r = \frac{We_d}{\Delta_G}(b_w)$$

Where:

L_r	=	Minimum length of superelevation runoff.
Δ_G	=	Maximum relative gradient (%).
W	=	Width from pivot to outside edge (n^* lane width).
e_d	=	Design superelevation rate for curve (%).
b_w	=	Adjustment factor for number of lanes rotated = $\frac{n+1}{2n}$.
n	=	Number of lanes on one side of pivot.

Width is calculated at the mid station of the section. Though the actual width may vary over the range of the section, only one is used. For this reason, you are given the option to override this value. If the width is significantly different from one curve to the next, it is recommended that you create separate sections for each curve.

Notice that for a multilane highway being rotated about the crown point, if the number of lanes is not the same on both sides, then the side with the most lane controls (i.e. will create the longest L_r). Using one L_r for both sides ensures that the entire roadway remains planar when traversing from reverse crown to full super. If you desire to use a different L_r for each side, create two sections (one that does the points to the left of the crown, pivoting about the crown, and one that does the points to right side).

Again, the L_r for each curve is displayed, so you can review the values and change them if necessary.

Tangent Runout Length - L_t

Tangent runout length is distance from normal crown to the zero cross slope point. L_t is calculated using the following formula: $L_t = \frac{e_{NC}}{e_d}(L_r)$

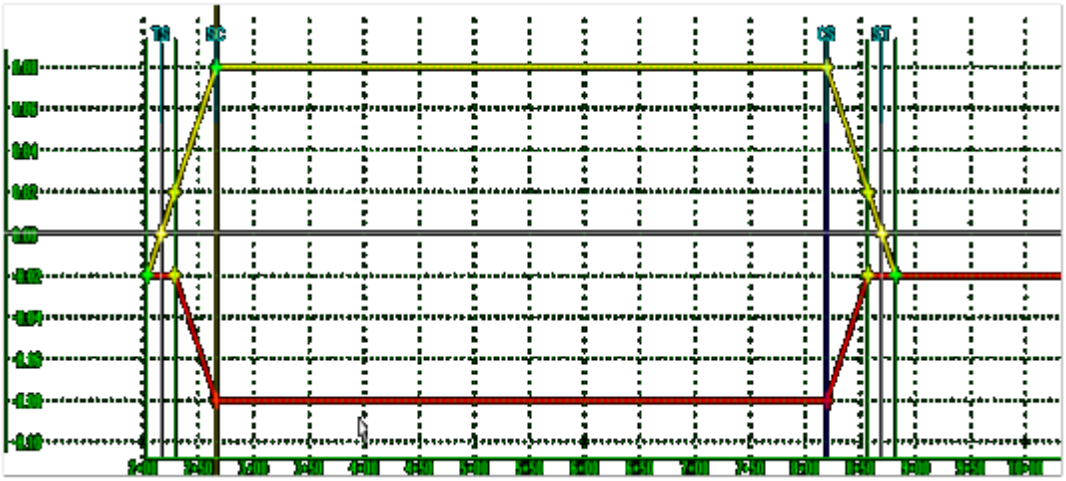
Where: e_{NC} is the normal crown cross slope.

Super control lines

Once you accept the L_r values then a list of the superelevation control line values for each section is displayed. You can change the name and the initial cross slope (e_{nc}) values for each control line and/or delete any unwanted control lines.

When done, press Finish to accept all the values. If calculated runout point overlap or are beyond the limits of the alignment, you can fix the overlap using the Fix Superelevation Overlap dialog.

You can then continue refining the superelevation design in the super diagram window, or run the wizard again to create additional superelevation sections and control lines.



Fixed Transition Length Wizard

The fixed transition length wizard allows you to specify the transition lengths for normal, curve to curve and reverse curve situations for both spiral and non-spiral curves. The fixed length wizard creates only two control lines; one for the left side, and one for the right side.

Click Corridor Modeling > Roadway Designer> Superelevation > Create Superelevation Wizard > Fixed Length. Notice there are three values for both spiral curves and circular curves. The first value represents the length used for a normal tangent to curve transition. The second value is used to determine the maximum distance at which two adjacent curves that are curving in the same direction will not transition back to normal crown. The last value determines the maximum distance for adjacent reverse curves over which they will not transition back to normal crown.

Once the appropriate values have been entered, go to the next page of the wizard to create one or more sections. The curve information displayed is different from the AASHTO wizard. In the fixed length wizard, the entry and exit transition types are displayed.

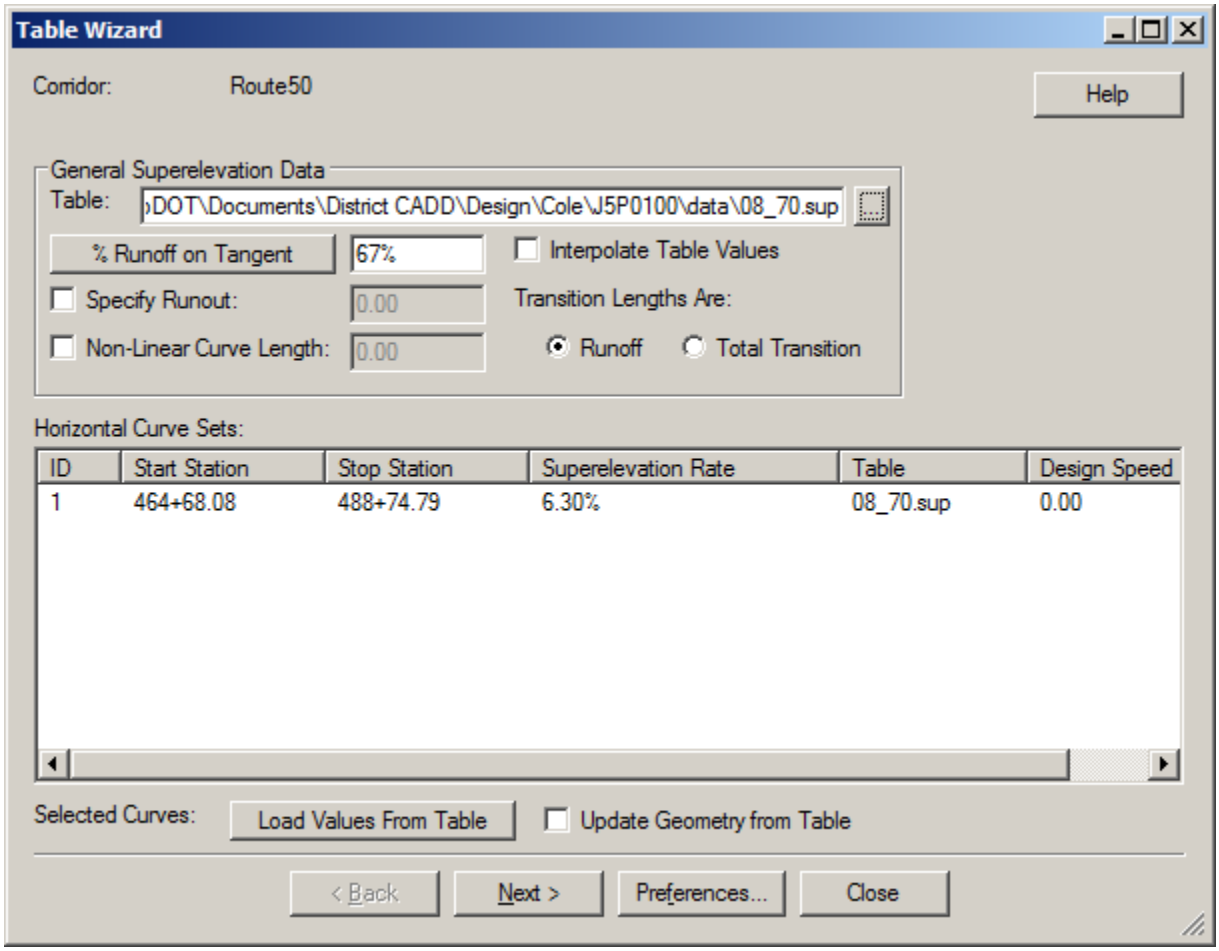
The remainder of the wizard functions the same as the AASHTO wizard detailed above.

Table Wizard

The superelevation table wizard allows you to specify a table used to generate the transition lengths and the full superelevation rate.

Click Corridor Modeling > Roadway Designer> Superelevation > Create Superelevation Wizard > Table. Notice that you can choose to either have the values interpolated or use the next higher value from the table. Once you select a table, the full superelevation rates for the curves are displayed. After the first page, processing is the same as the AASHTO wizard detailed at the beginning of this topic.

14.3 Table Wizard



Inputs the required information for the entire corridor. This information is the basis for the calculation of the superelevation controls.

Corridor - displays the name of the active corridor. This field is read only.

14.3.1.1 GENERAL SUPERELEVATION DATA

Table - identifies the superelevation table currently in use.

Table (Browse) - opens the Open dialog box, which allows you to locate an ASCII superelevation table (*.sup*).

% Runoff on Tangent / % Total on Tangent - specifies how much of the runoff or runoff total transition should be on the tangent before and after each curve. This only applies when there are no spirals. Where a curve has a spiral, the runoff is positioned so that the road is at full super at the beginning of the circular section of the curve.

Interpolate Table Values (check box) - indicates, when checked, that both the full superelevation rate for a particular curve and the transition length is interpolated from the table based on the actual curve

radius. Otherwise, the values used are for the entry in the table whose radius is less than and closest to the actual curve radius.

Specify Runout (check box) - indicates, when checked and the adjacent value is non-zero, that the specified length is used to transition from normal crown to zero cross slope rather than maintaining the same rate as determined by the runoff length. This applies only when transition lengths are applied to runoff and not to total transition.

Specify Runout (field) - specifies the actual runout length.

Non-Linear Curve Length (check box) - indicates, when checked on, that all super transitions are smoothed using a parabolic curve of the specified length. Notice that when this box is checked, the runoff length calculations are unaffected. The transition parabolas are only placed after the transition points have been determined.

Non-Linear Curve Length (field) - specifies the actual curve length.

Transition Lengths Are

Runoff - indicates the length is the distance from zero cross slope to full super. If the Specify Runoff option is off, the length of runout is a linear projection from zero slope to NC.

Total Transition - indicates the length specified in the table is the entire transition from NC to Full Super.

14.3.1.2 HORIZONTAL CURVE SETS

Displays curve set information. The start and stop stations include the spirals, if they exist, on the curve. If a particular curve set has more than one circular element, then the superelevation rate of each circular segment is listed.

ID - shows the number associated with the curve.

Start Station - shows the first station of the curve.

Stop Station - shows the end station of curve.

Superelevation Rate - shows the superelevation rate of each circular element.

Table - shows the open superelevation table.

Design - shows the design speed of each circular element.

Load Values From Table - reads, when selected, the maximum superelevation rates and transition lengths from the current open table. These values are applied to the selected curve sets. If no curve sets are selected, the values are calculated and applied to all curve sets in the corridor.

Update Geometry from Table - specifies, when checked, that you must enter the design speed for the current table. The design speed and calculated maximum superelevation rates are then stored in the geometry for the selected curve sets. These values are also used for the superelevation calculations in the wizard.

Further Explanation – This option is similar to curves stored in cogo with the following key-in command:

```
Store curve name_of_curve v 40
```

When you describe that curve, you will see the v of 40 mph. So, when you run the super along an alignment that contains that curve, you can use a design speed of 55 and GeoPak will use that except for those curves that have a specific v assigned to them, in this case, 40 mph.

Back - returns to the previous page of the wizard.

Next - proceeds to the next page of the wizard.

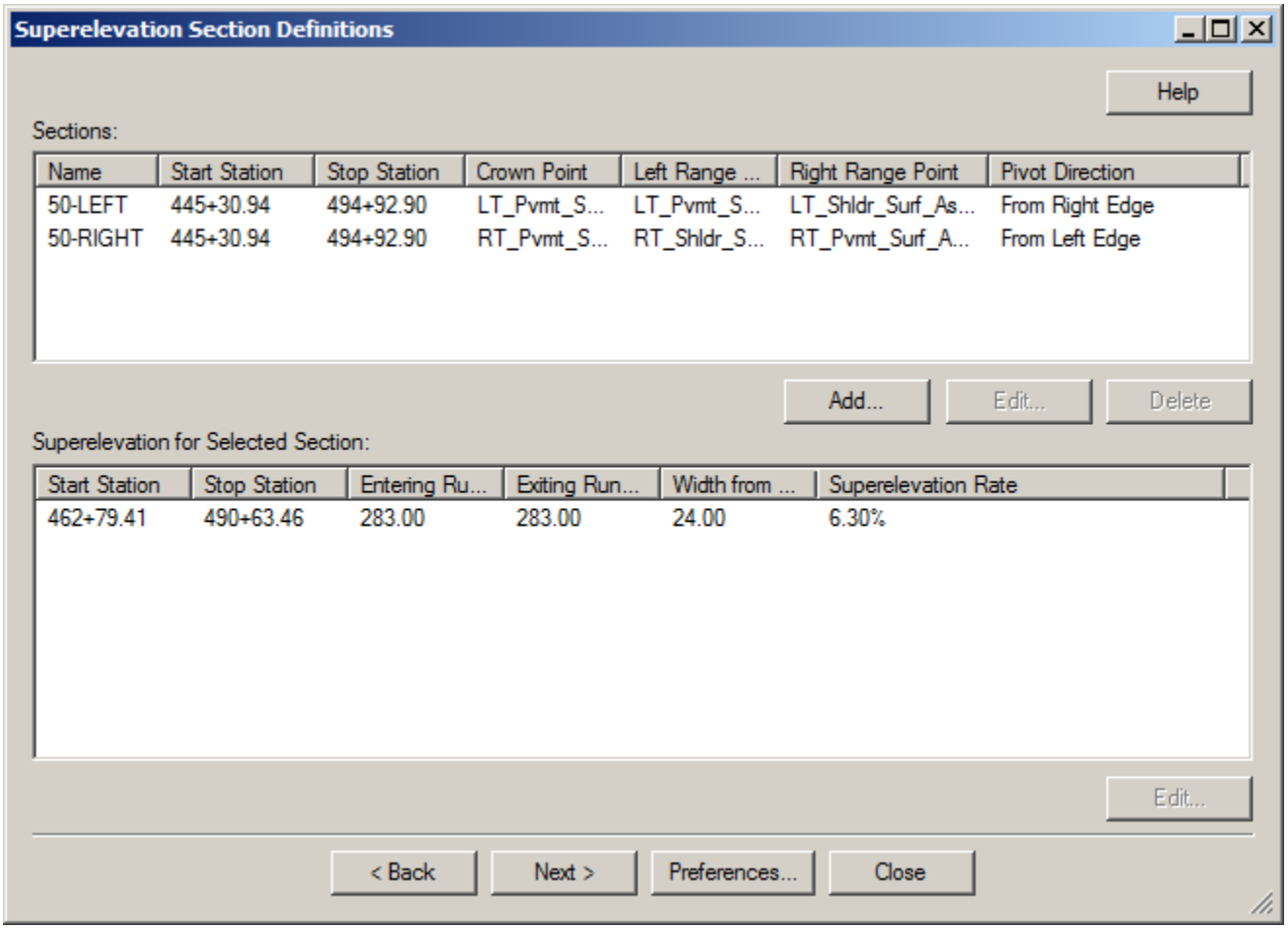
Preferences - opens the Preferences dialog.

Close - dismisses the dialog.

Help - displays help.

14.3.2 Superelevation Section Definitions

This tool defines new superelevation sections.



Sections

Name - displays the default name of the new section.

Start Station - displays the start station of the section.

Stop Station - displays the end station of the section.

Crown Point - displays the crown point of the section.

Left Range Point -displays the left range of the new section.

Right Range Point - displays the right range of the new section.

Pivot Direction -displays the pivot direction for the section.

Add - opens the Add Superelevation Section dialog, which allow you to define attributes of the new section.

Edit - opens the Edit Superelevation Section dialog, which allow you to make modifications to an existing section.

Delete - removes the current section from the list.

Superelevation for Selected Section - displays superelevation details on the selected section.

Start Station - shows the start station for superelevation in the section.

Stop Station - shows the end station for superelevation in the section.

Curve Entry Type - shows the type of curve entry. A blank field indicates a normal tangent entry. This option is shown only on the Fixed Length Wizard.

Curve Exit Type - shows the type of curve exit. A blank field indicates a normal tangent exit. This option is shown only on the Fixed Length Wizard.

Entering Runoff Length - shows the calculated runoff or transition length for the beginning of superelevation for the section.

Exiting Runoff Length - shows the calculated runoff or transition length for the end of superelevation for the section.

Width from Pivot - shows the width or distance calculated from the range point farthest from the pivot point.

Number of lanes - shows the number of lanes in the section.

Superelevation Rate - shows the superelevation rate (maximum cross slope) of each circular element in the section.

Back - returns to the previous curve in the section.

Next - proceeds to the next curve in the section.

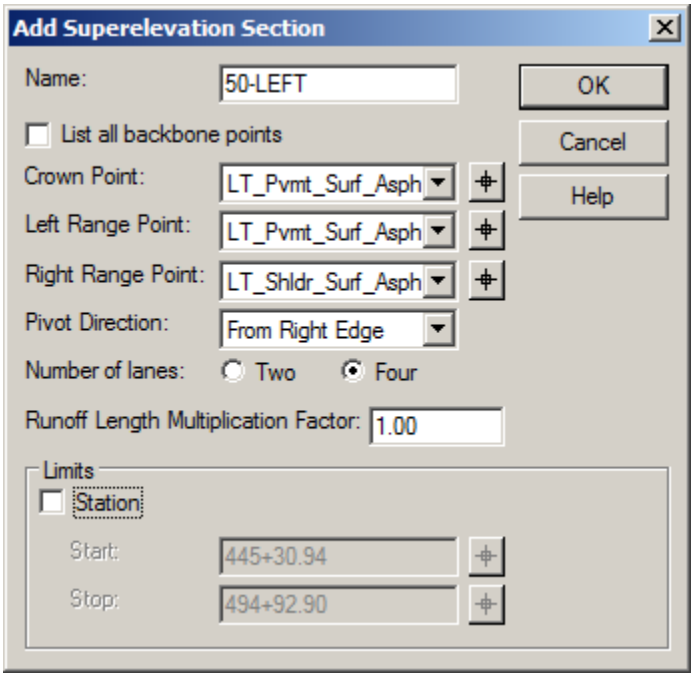
Preferences - opens the Preferences dialog.

Close - dismisses the dialog.

Help - displays help.

14.3.3 Add Superelevation Section

Adds a new superelevation section.



Name - list the default name of the new section. You can modify the name here; it must be unique.

List all backbone points - when checked, specifies all backbone points in the template are listed in the Point combo boxes. If not checked, only top of backbone points are listed.

✍	The select buttons select only the top of backbone points from the cross section view regardless of the checkbox status.

When checked, the software will always solve as a two lane solution with only the Left Range, Crown, and Right Range points used to determine pivot and superelevated points. All other points will be ignored. This allows for direct supering of subgrades and divided highways about a null point.

Crown Point - specifies the crown point of the section. Select from among the available points or use the locate button to identify the crown.

Left Range Point - specifies the left range point for the section. Select from among the available points or use the locate button to identify the point.

Right Range Point - specifies the right range point for the section. Select from among the available points or use the locate button to identify the point.

Pivot Direction - specifies the pivot direction for the section. Options include from: Crown Point, Left Edge, Right Edge, Inside of Curve, or Outside of Curve.

Number of Lanes - indicates the new section contains 2 or 4 lanes.

Runoff Length Multiplication Factor - specifies the factor applied to the length from the selected table value. This option allows you to generate an alternate entry length without requiring additional tables.

Limits

Station - specifies, when checked on, the start and stop stations for that section are provided.

Start - identifies the start station for the section. Type this value or use the locate button to identify the station.

Stop - identifies the stop station for the section. Type this value or use the locate button to identify the station.

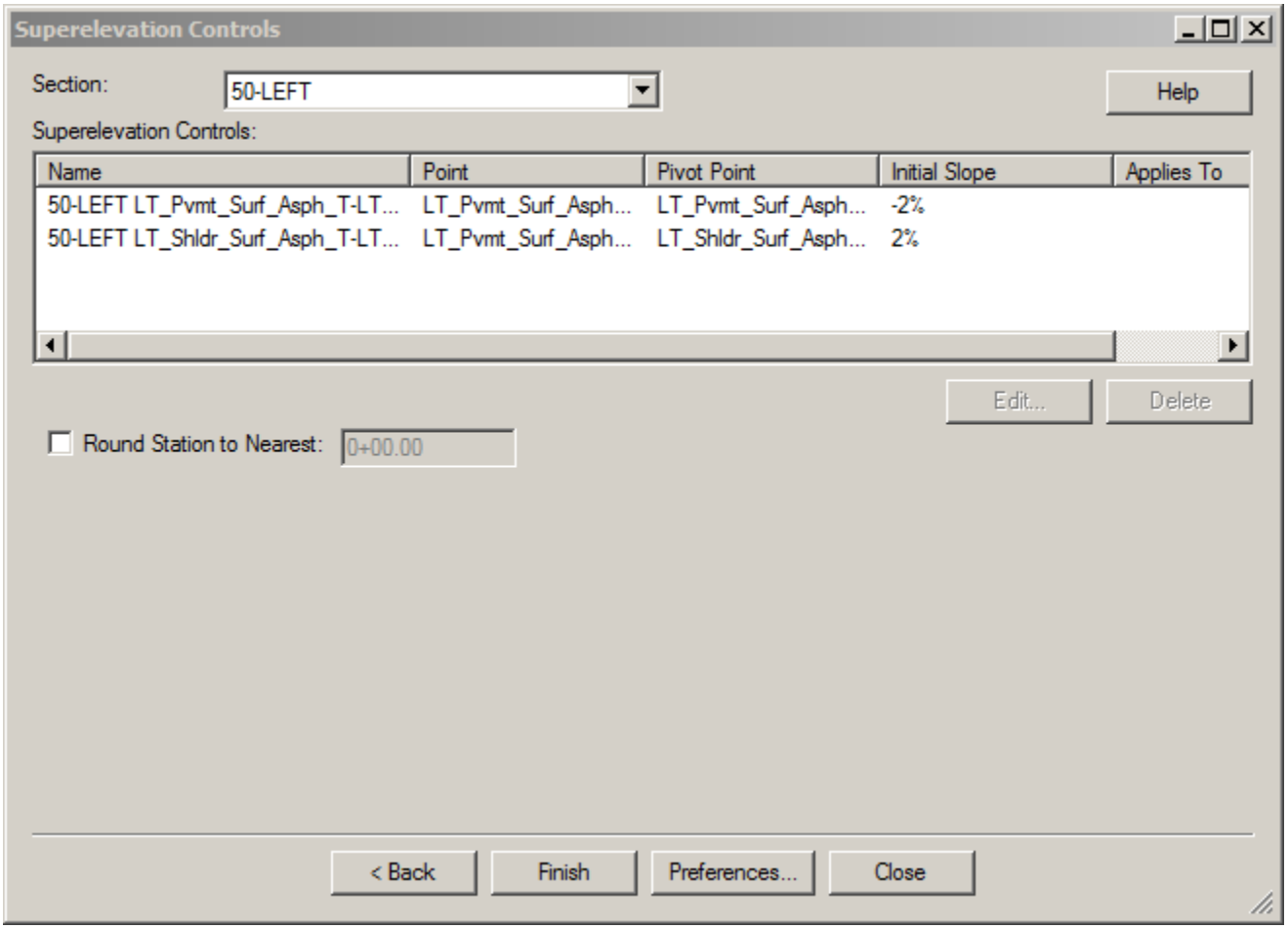
OK - executes the command.

Cancel - dismisses the dialog. No settings are saved.

Help - displays help.

14.3.4 Superelevation Controls

Reviews/edits the superelevation control line properties before they are applied.



Section - displays the currently selected section. Select available sections from the list to modify other control lines.

Superelevation Controls - list the details for the selected control line.

Name - displays the name that is assigned to the control line.

Point - displays the name of the point to be superelevated.

Pivot Point - lists the point about which the point is being superelevated.

Initial Slope - displays the initial or normal cross slope at the beginning and end of the superelevated portions. This value is determined by the current cross-section and can modify.

Applies To - specifies, when the Pivot About Inside or Outside option is used, whether the control applies to only the left or right turns.

Edit - opens the Edit Superelevation Control dialog, which allows you to edit the selected control line.

Delete - deselects the selected control line.

Round to Nearest (checkbox) - indicates superelevation event points are rounded to the nearest specified value.

Round to Nearest (field) - specifies the round to value.

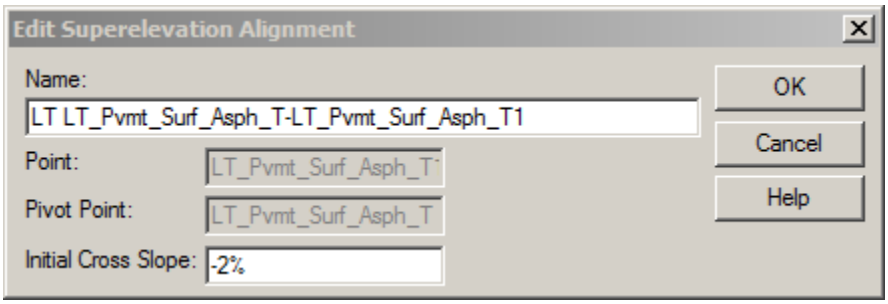
Back - returns to the previous page.

Finish - completes the wizard process.

Help - displays help.

14.3.5 Edit Superelevation Alignment

With this option the User can edit individual control line information.



Name - displays the name assigned to the selected control line. The default name is: Section Name Pivot Name-Point Name. You can modify the name, but it must be unique.

Point - displays the point that is superelevated by the control line.

Pivot Point - displays the point about which the point is superelevated. The new point elevation equals the pivot point elevation, plus the cross-slope, multiplied by the horizontal distance between the point and the pivot point.

Initial Cross Slope - displays the initial or "normal crown" cross slope between the pivot point and the superelevated point. This value is determined by calculating the cross slope in the current cross section. If it is incorrect you can modify it here.

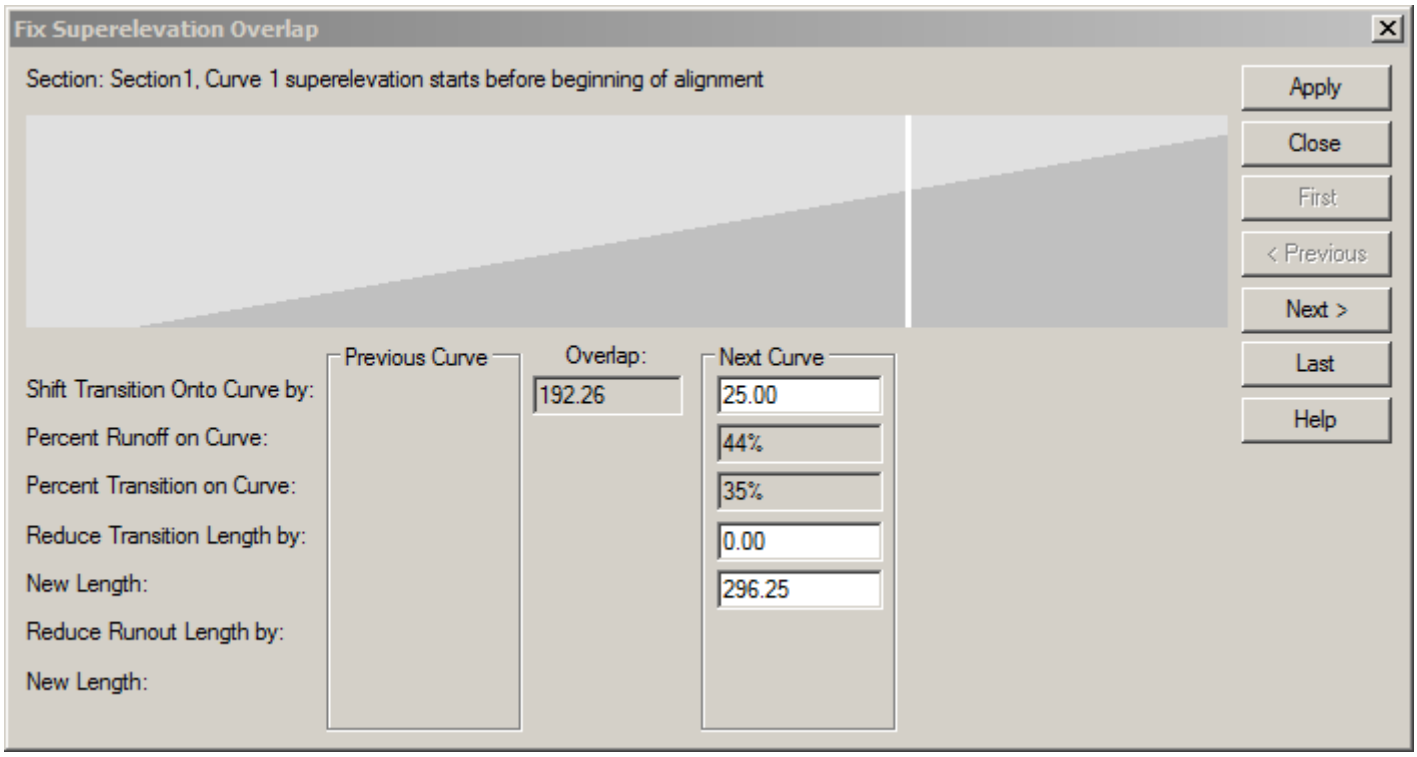
OK - executes the command.

Cancel - dismisses the dialog.

Help - displays help.

14.4 Fix Superelevation Overlap

Resolves overlaps in curve superelevation.



Section - identifies where the curve superelevation overlaps.

Shift Transition Onto Curve by - indicates the distance to move the entire transition to reduce the overlap.

Previous Curve - identifies the shift distance of the transition before the overlap.

Overlap - displays the remaining transition overlap. This field is display only.

Next Curve - identifies the shift distance of the transition after the overlap.

% Runoff on Curve - shows the % of runoff on the previous/next curves. This field is display only.

% Transition on Curve - shows the % of total transition on the tangent on the previous/next curves. This field is display only.

Reduce Transition Length by - specifies the amount by which to reduce the length of the transition in order to reduce the overlap. When this value is adjusted, the full super points remain fixed.

New Length - specifies the adjusted length of runoff on the previous/next curves.

Reduce Runout Length by - this field displays if runout length is specified separately. You can reduce runout lengths by a specified amount.

New Length - specifies the adjusted runout lengths.

Apply Full Super to Full Super Planar Transition - specifies, when checked on, that all points between the full superelevation points on two curves are deleted. This creates a planar transition between the full superelevation points of both curves.

Apply - applied the adjusted values to the current overlap. You cannot Undo this action.

First - displays the first superelevation overlap.

Back - returns to the previous overlap.

Next - proceeds to the next overlap.

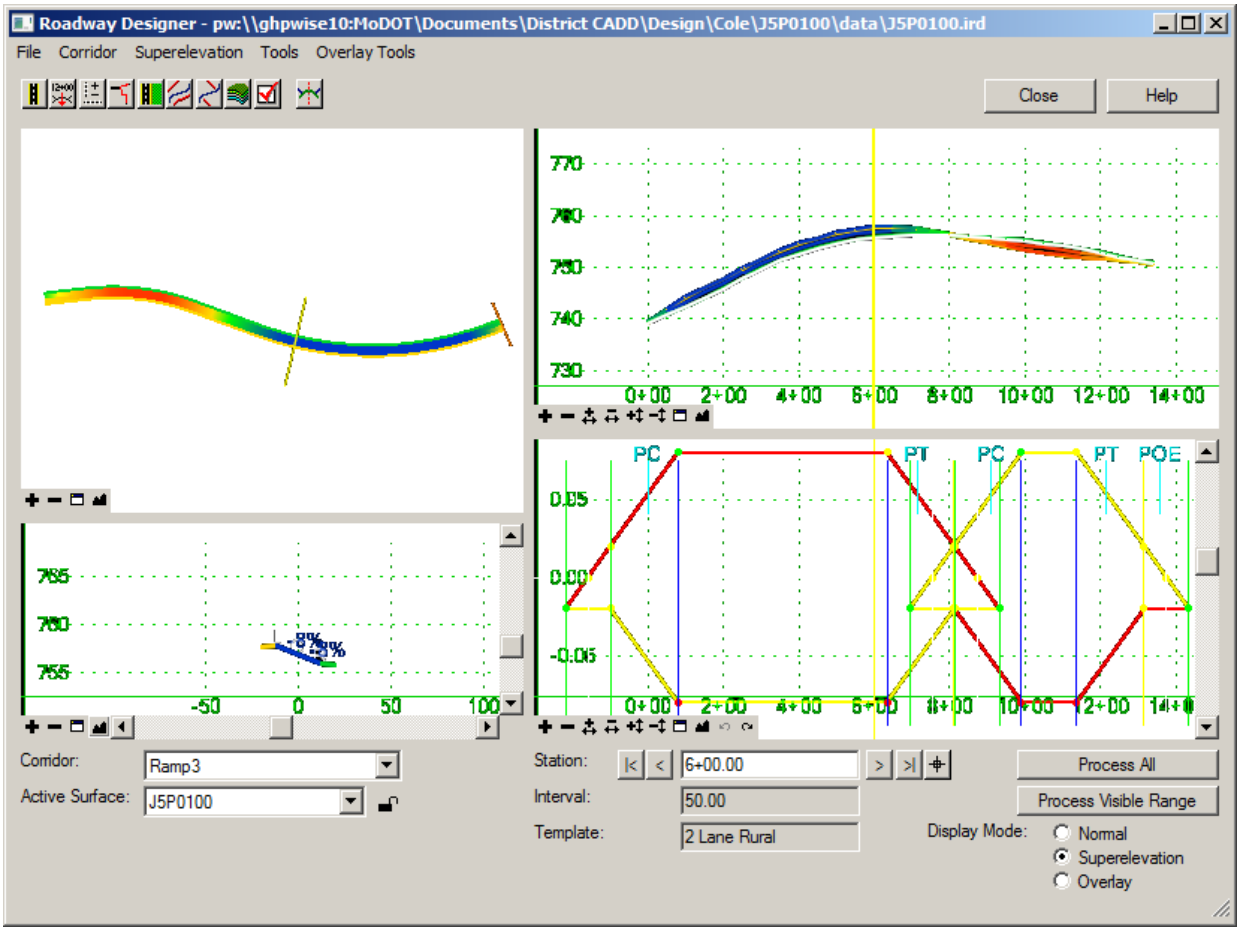
Last - advances to the last overlap.

Close - closes the dialog.

Help - displays help.

14.5 Roadway Designer SuperElevation Display

Use the main dialog for interactive roadway design. Most of the dialog is occupied by 3 views (4 views when superelevation or overlay is displayed) that represent the plan, profile, and the cross-section at the current station.



Plan Display

Super mode **-** In superelevation display mode, the plan view displays the top of the backbone in colors that represent the cross-slope values of the backbone surface. Green-Blue colors represent slopes from 0.5% to 10% to the right with dark blue representing slopes greater than 10% to the right. Yellow-Red colors represent slopes from 0.5% to 10% to the left with dark red representing slopes grater than 10% to the left. Slopes less than 0.5% are represented as white.

Profile Display

Displays the profile view of the current corridor design.

Super mode **-** In super display mode, the profile diagram displays the profile grade line of all the top of backbone points in the design. To control which points are displayed, right click in the view to bring up

the point display list and select or de-select the appropriate points. The color of the lines represent the cross-slope color to the right of the line. The rightmost line is always white.

Hover over a line to display the point name corresponding to the line.

Cross Section Display

Super mode - In superelevation mode, only the top of the backbone is shown. The line segments are color-coded based on their cross slope using the same color values as described under Superelevation mode, Plan Display.

Superelevation Display

Displays the superelevation diagram. This view is displayed in superelevation and overlay modes. The diagram consists of one or more superelevation control lines. The lines are of different colors to make it easier to differentiate on line from another. Otherwise, line color has no significance. Right click in this view to display additional options.

14.6 Superelevation Point Properties

Reviews/modifies point properties.

Name - displays the point name. This is a read only field. The point name is based on the control line and the point's station value. It is automatically changed when the point is moved. Use the locate button to identify points.

Station - specifies the station location of the point. Depending on the constraints, you may be able to change the station value of the point.

Cross Slope - pecifies the cross slope value of the control line at the point. Depending on the constraints, you may be able to change the cross slope value of the point.

Type - specifies the point type. The point type is initially set by the wizard, you can modify it. Valid types are: Undefined, Normal Crown, Super Runoff, Reverse Crown or Full Super. Type is used primarily for reporting and for display.

Constraints - Corridor Modeling provides a variety of constraint types for roadway template design: Horizontal, Vertical, Slope, Vector Offset, and Mirror Cross Slope. A Mirror Cross Slope constraint causes a point's cross slope value to be the same magnitude, but opposite sign of its parent point. For more details on constraints, parent and value, see the Create Template Overview topic.

Apply - executes the command.

Close - dismisses the dialog.

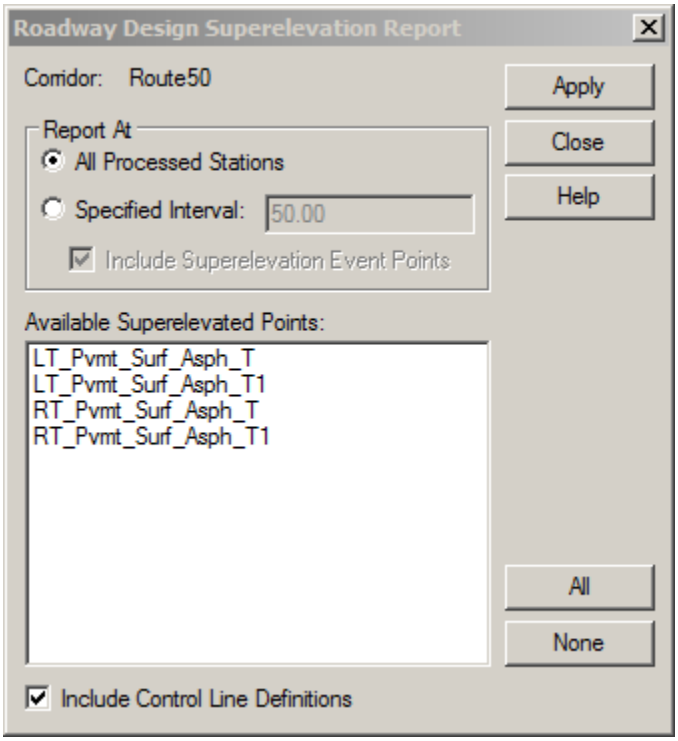
Previous - returns to the previous point.

Next - proceeds to the next point.

Help - displays help.

14.7 Roadway Design Superelevation Report

Generates an XML report of the superelevated points and/or their corresponding control lines.



Corridor - displays the name of the active corridor. This is a read only field.

Report At

All Processed Stations - indicates, when selected, that only those stations that were processed by the Roadway Designer are reported.

Specified Interval - indicates, when selected, that a processing interval is used. If the interval is 0.0, then only the Superelevation Event points are processed (if the Include Superelevation Events Points option is checked on).

Include Superelevation Event Points - indicates, when selected, that superelevation event points, in addition to the interval points are reported.

Available Superelevation Points - lists the superelevation points available for report.

All - Selects (highlights) all available superelevation points.

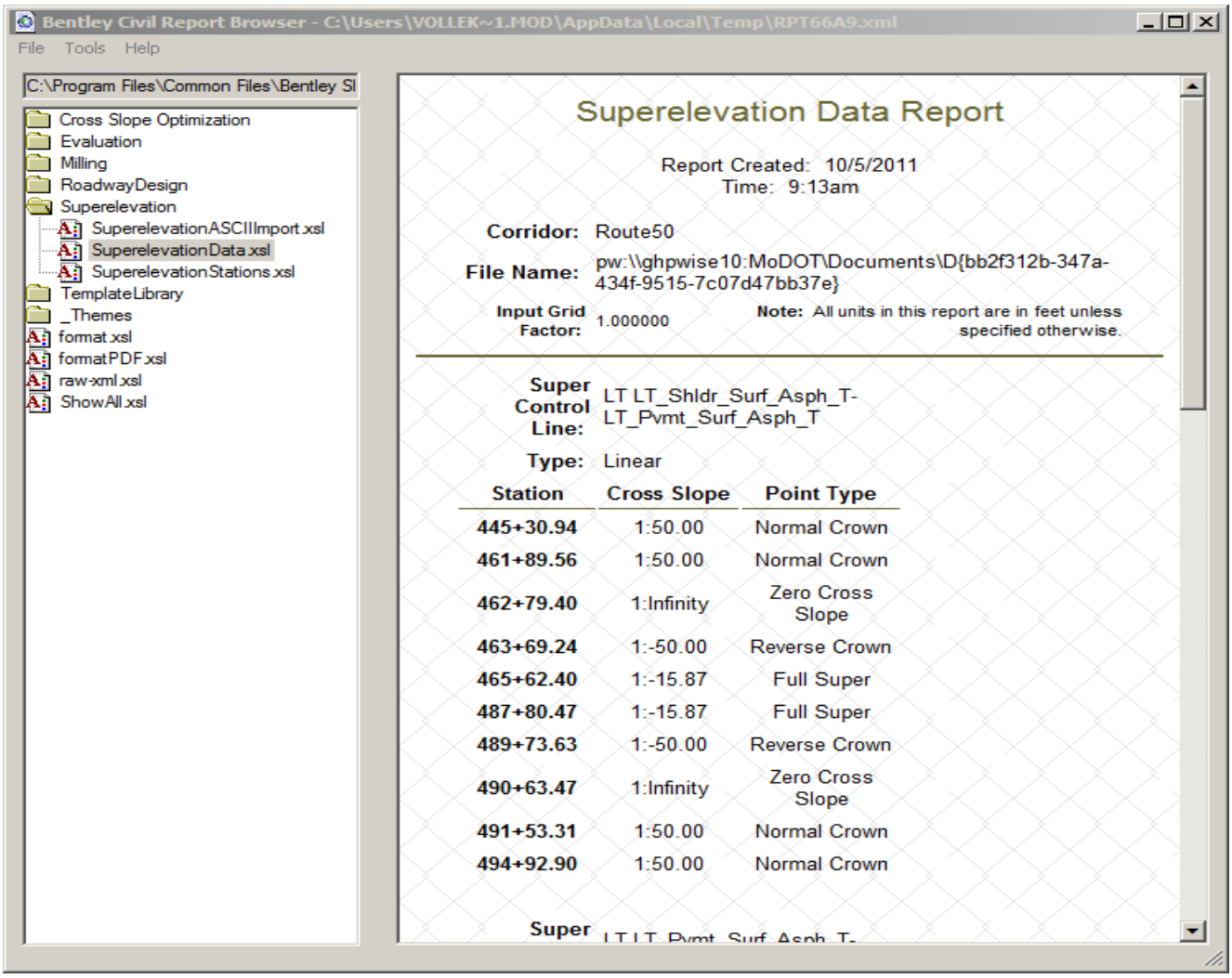
None - deselects all points.

Include Control Line Definitions - indicates, when on, that control line definitions are included in the report.

Apply - generates a temporary XML file and invokes the Bentley InRoads Report Browser.

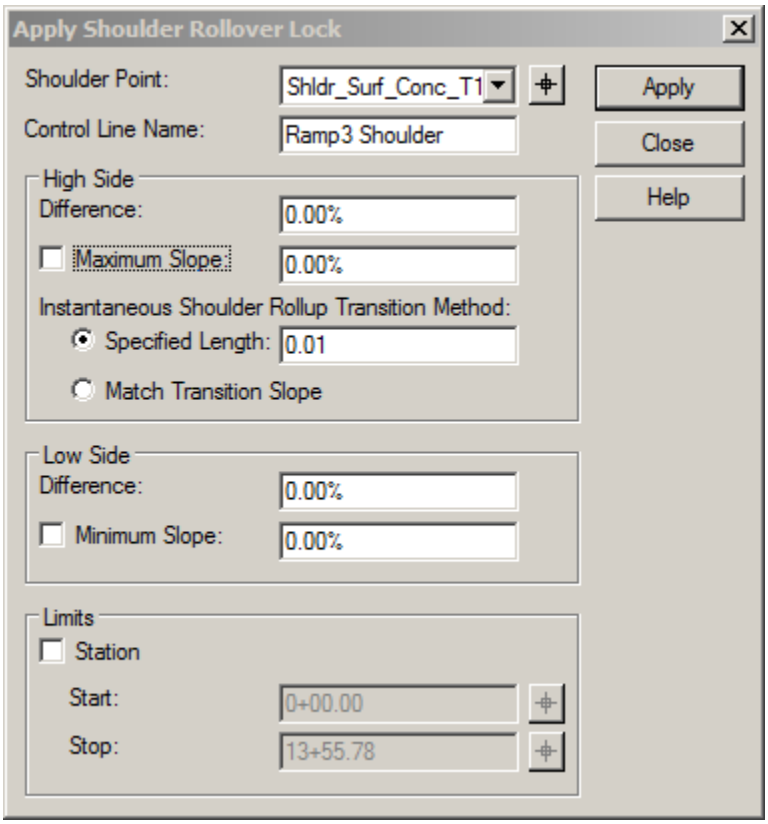
Close - dismisses the dialog.

Help - displays help.



14.8 Apply Shoulder Rollover Lock

Creates a control line for shoulder points using high and low-side algebraic differences. This command creates a control line using the input values; then, assigns the control line to the specified point.



Shoulder Point - specifies the shoulder point that is controlled by rollover. Select the point from the list or use the locate button to identify the point.

Control Line Name - specifies a name for the control line.

High Side

Difference - specifies the absolute difference between the shoulder slope and the road slope. This value is always positive.

Maximum Slope - indicates, when checked on, that an absolute upper bound on the shoulder slope is used. Specify this value, including the correct negative or positive sign, in the field.

Low Side

Difference - specifies the absolute difference between the shoulder slope and the road slope. This value is always positive.

Minimum Slope - indicates, when checked on, that an absolute lower bound on the shoulder slope is used. Specify this value, including the correct negative or positive sign, in the field.

Limits

Station - specifies, when checked on, that station range limits are used.

Start - identifies the start station. Type in this value or identify the station using the locate button.

Stop - identifies the stop station. Type in this value or identify the station using the locate button.

Apply - applies the values, creates the control lines and assigns the point control.

Close - dismisses the dialog.

Help - displays help.

14.9 Rollover Point Properties

Defines rollover values when adding a slope constraint. This feature is activated when you select the Rollover Values button on the Point Properties dialog box.

This constraint can be used as an alternative to the Apply Shoulder Rollover Locks option in the Roadway Designer command.

High side difference - specifies the maximum allowed slope difference between the vector from the reference point and the parent point and the vector from the parent point to the constrained point when the reference slope vector is positive.

Low side difference - specifies the maximum allowed slope difference between the vector from the reference point and the parent point and the vector from the parent point to the constrained point when the reference slope vector is negative.

Reference point - specifies the point that defines the reference slope.

OK - accepts the selection and dismisses the dialog box.

Cancel - dismisses the dialog. No selections are saved.

14.10 Group Exercise: Superelevation – Ramp3

1. Using ProjectWise open the following MicroStation file:

   pw:\District CADD\Design\ Cole\J5P0100\project**Plan.dgn**

2. Open the following project:

   pw:\District CADD\Design\Cole\J5P0100\project**J5P0100.prj**.

   Select the user **ClsUser** and enter **Road**.

3. From the GeoPak Road Tool Palette, select **Corridor Modeling**:

4. Define the following Corridor Modeling preferences:

Preferences

Station Lock:	Even
Slope Readout:	50%
Horizontal Chord Height:	0.10
Vertical Chord Height:	0.05
Template library:	T:\Gpk_Std\Roadway_Designer\MoDOT.itl
DTM Files Path:	pw:\District CADD\Design\Cole\J5P0100\data\

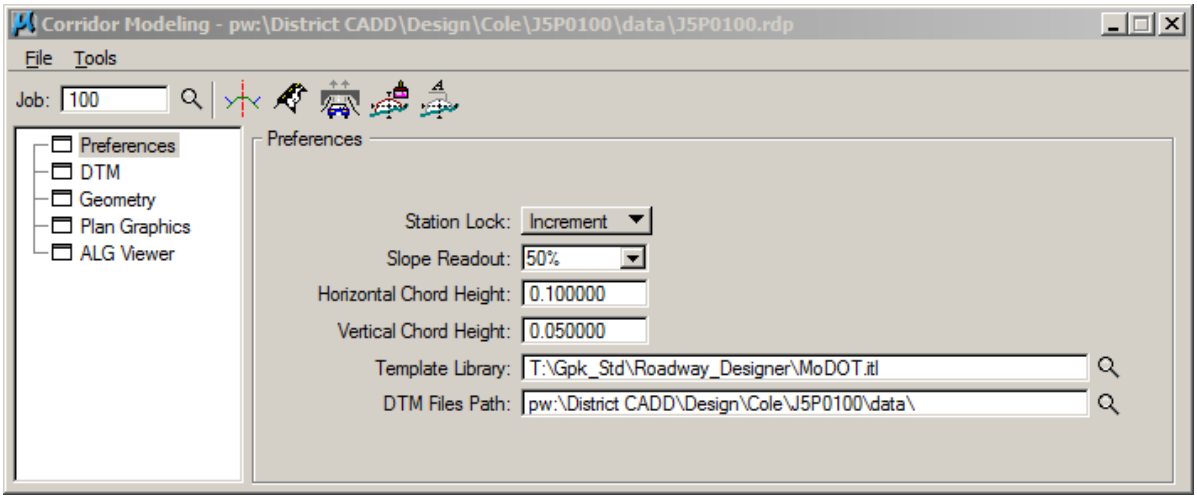
DTM

Import the following Tin:	pw:\District CADD\Design\Cole\J5P0100\data\J5P0100.TIN

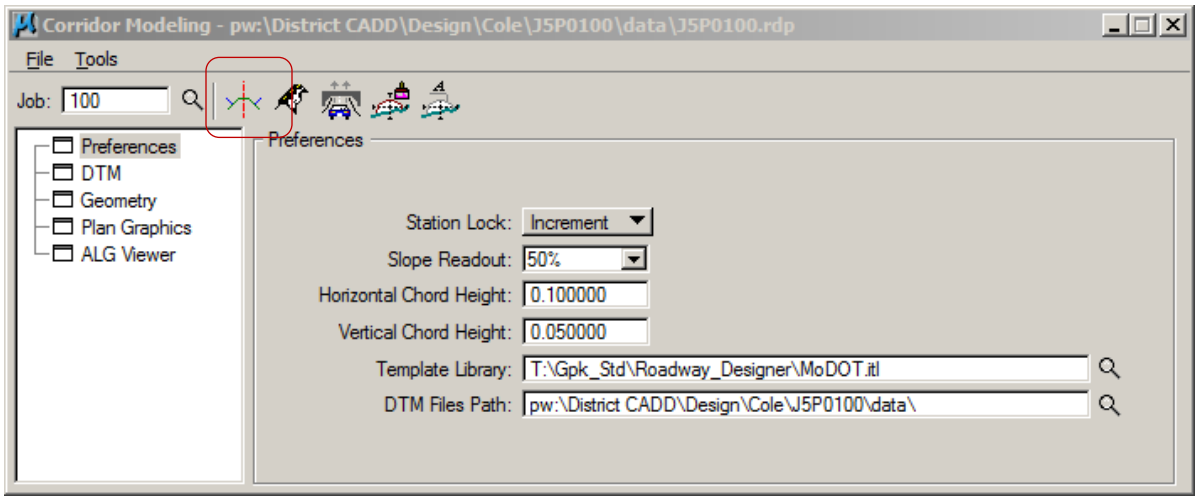
Geometry

Import the following Chains and Profiles:	Chain Ramp2, Profiles Ramp2EX and Ramp2PR Chain Ramp3, Profiles Ramp3EX and Ramp3PR Chain Ramp4, Profiles Ramp4EX and Ramp4PR Chain Bighorn, Profiles BighornEX Chain Route50, Profiles Route50EX and Route50PR

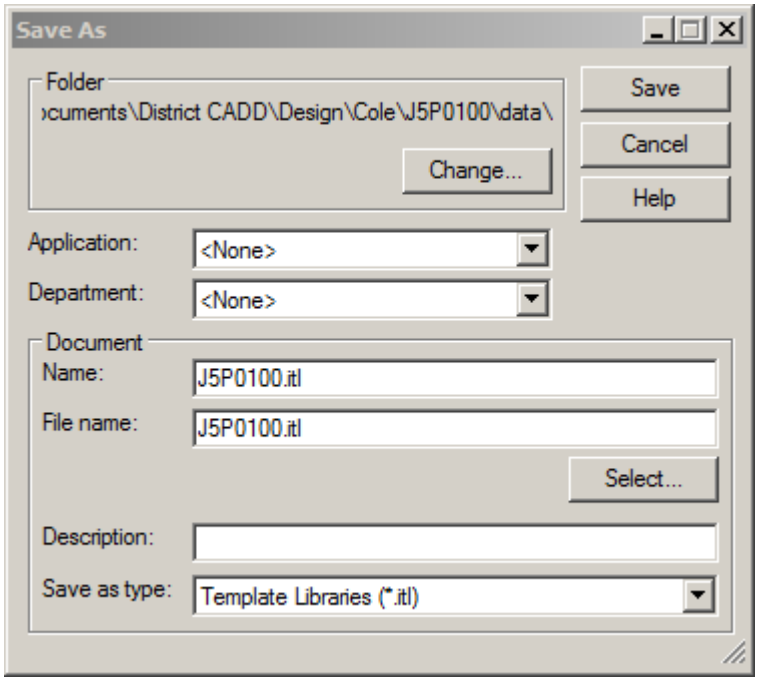
Save the Corridor Modeling Preferences as **J5P0100.rdp**



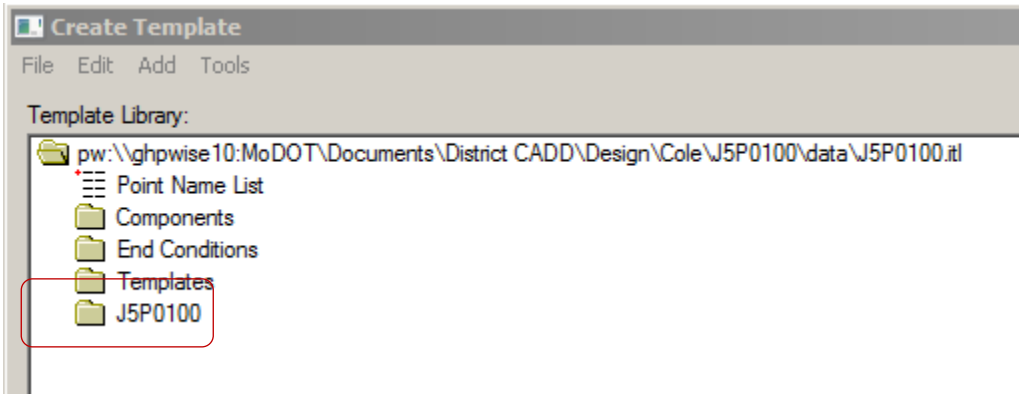
5. In the next few steps we are going to create a template that will be used for Ramp3. Select the **Open Create Template** icon.



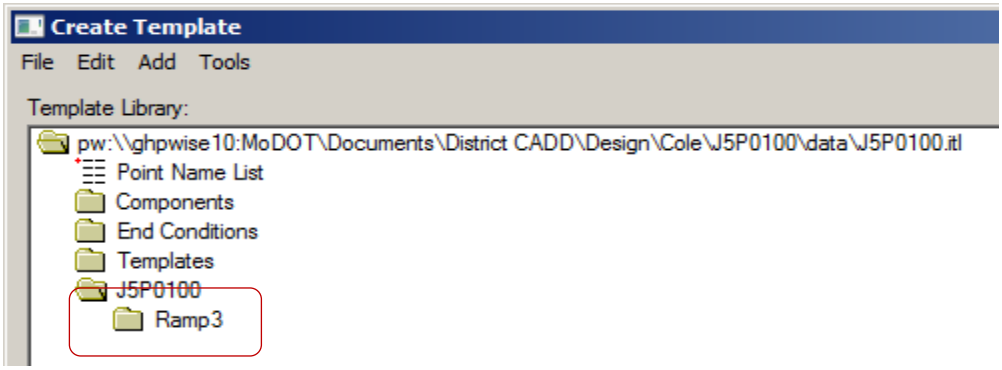
6. In the **Create Template** dialog select "**File > Save As**" and save the MoDOT Library to the User's Working Directory. Name the file **J5P0100.ITL**



7. In **Create Template** dialog select "**File > New > Folder**" and create a folder called "**J5P0100**".



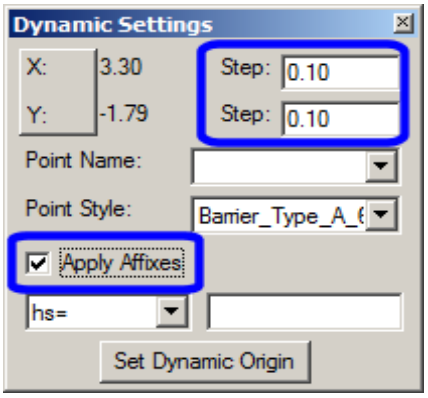
8. In **Create Template** dialog under the **J5P0100** folder select "**File > New > Folder**" and create a folder called "**Ramp3**".



9. Right click on the Ramp3 Folder and select **New > Template.**

Name the template "**1 Lane Rural**"

10. Set the following Dynamic Settings:



11. In **Create Template** use the following components to create the "**1 Lane Rural**" Template:

Components:

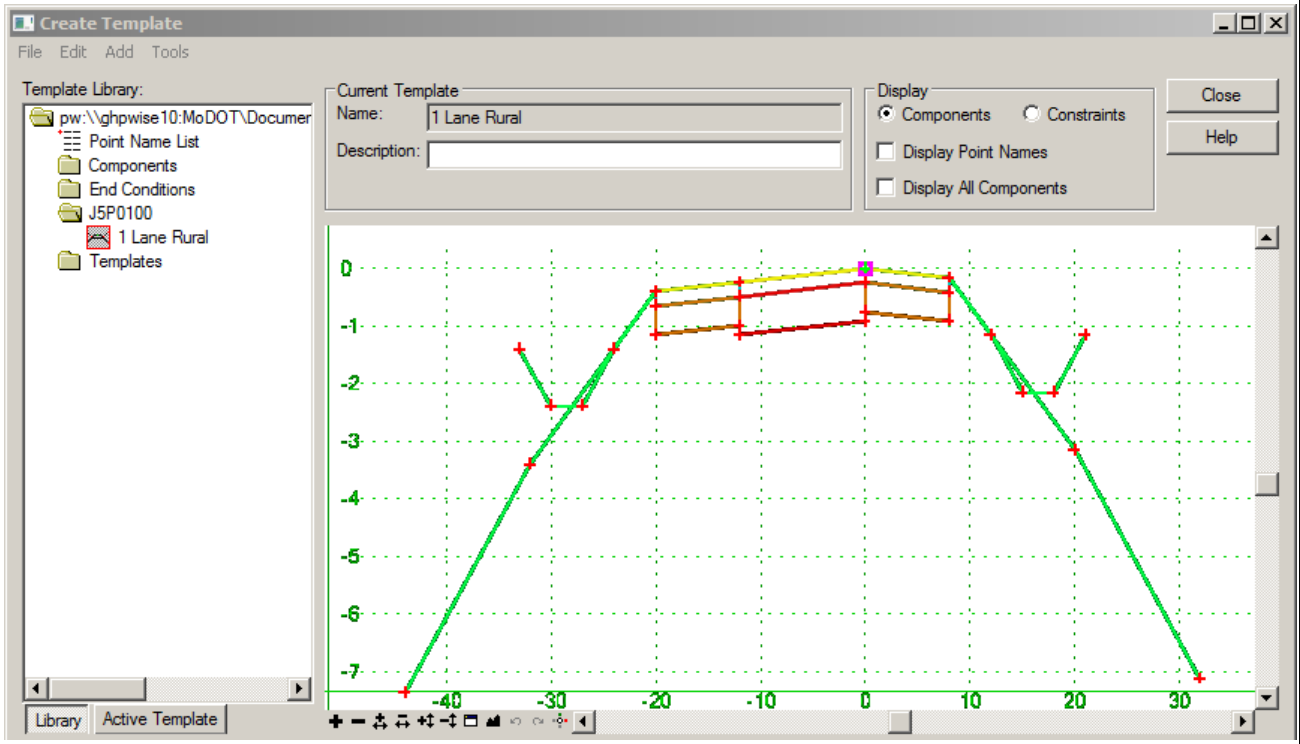
Left Side	**Right Side**
Pavement Combined Concrete Shoulder Combined Concrete	Shoulder Combined Concrete

End Conditions:

Left Side	**Right Side**
Fill Slope Combined Ditch 1	Fill Slope Combined Ditch 1

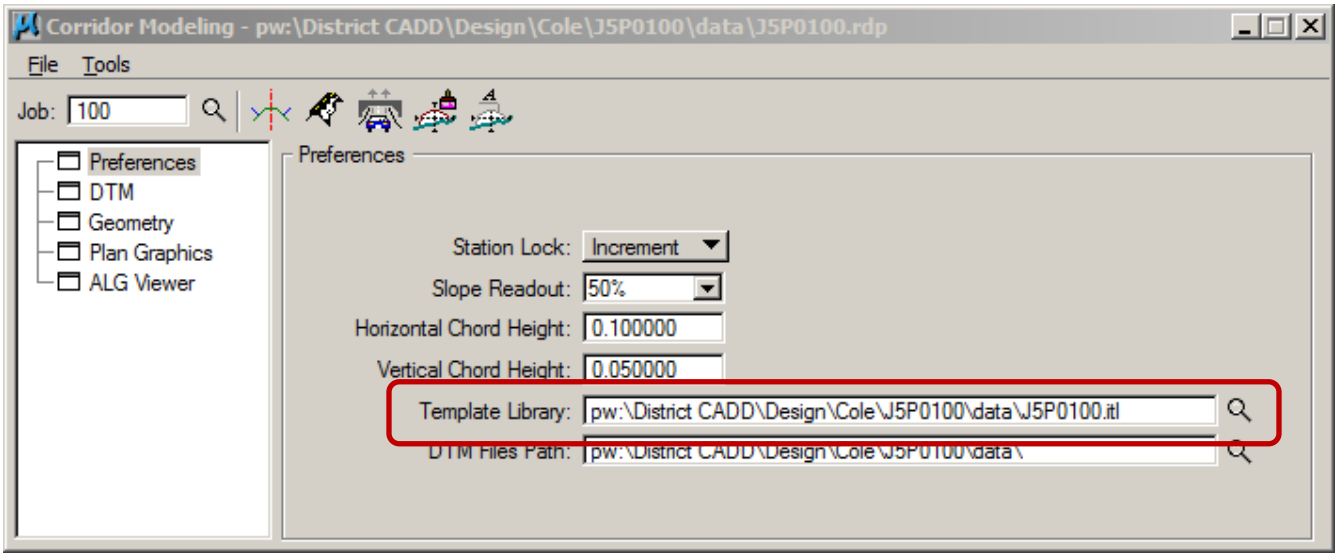
*Notes

a) Delete the three bottom pavement and shoulder layers.
b) Check Priorities on End Conditions
c) Save the Template Library as J5P0100.itl
d) Close out of the J5P0100.itl Template Library.



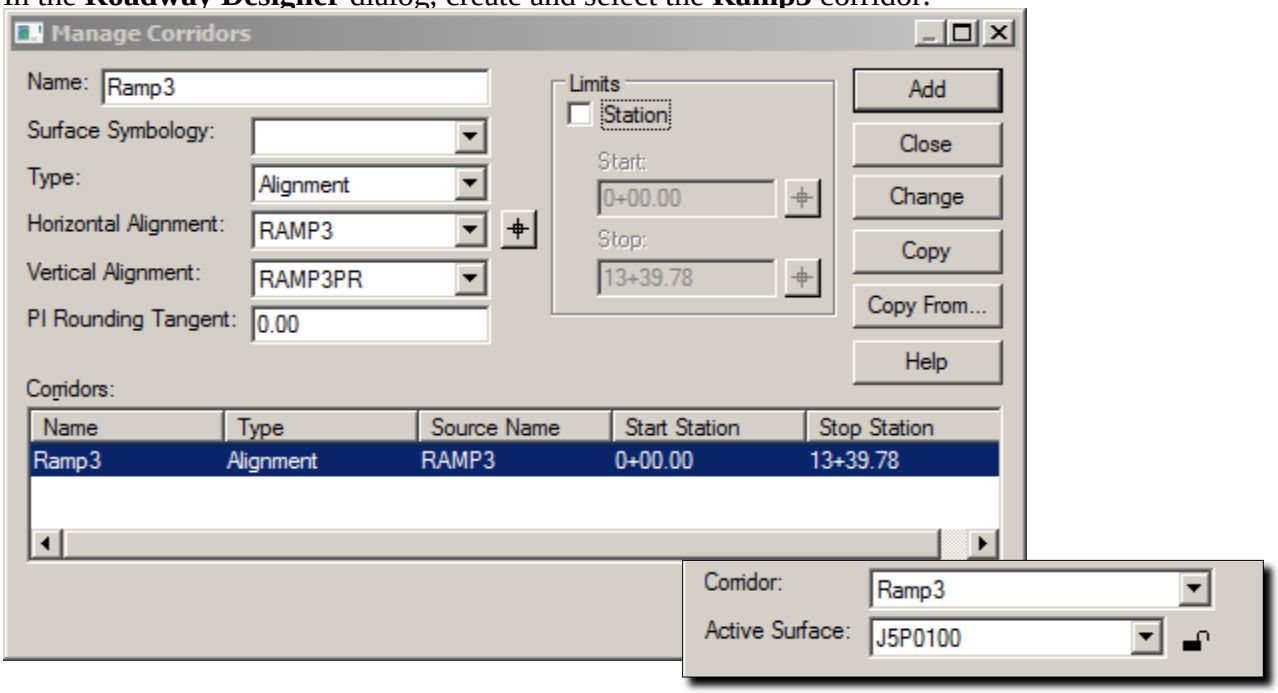
12. In Corridor Modeling update the Template Library to J5P0100.itl

Save the Corridor Modeling preference (J5P0100.rdp)



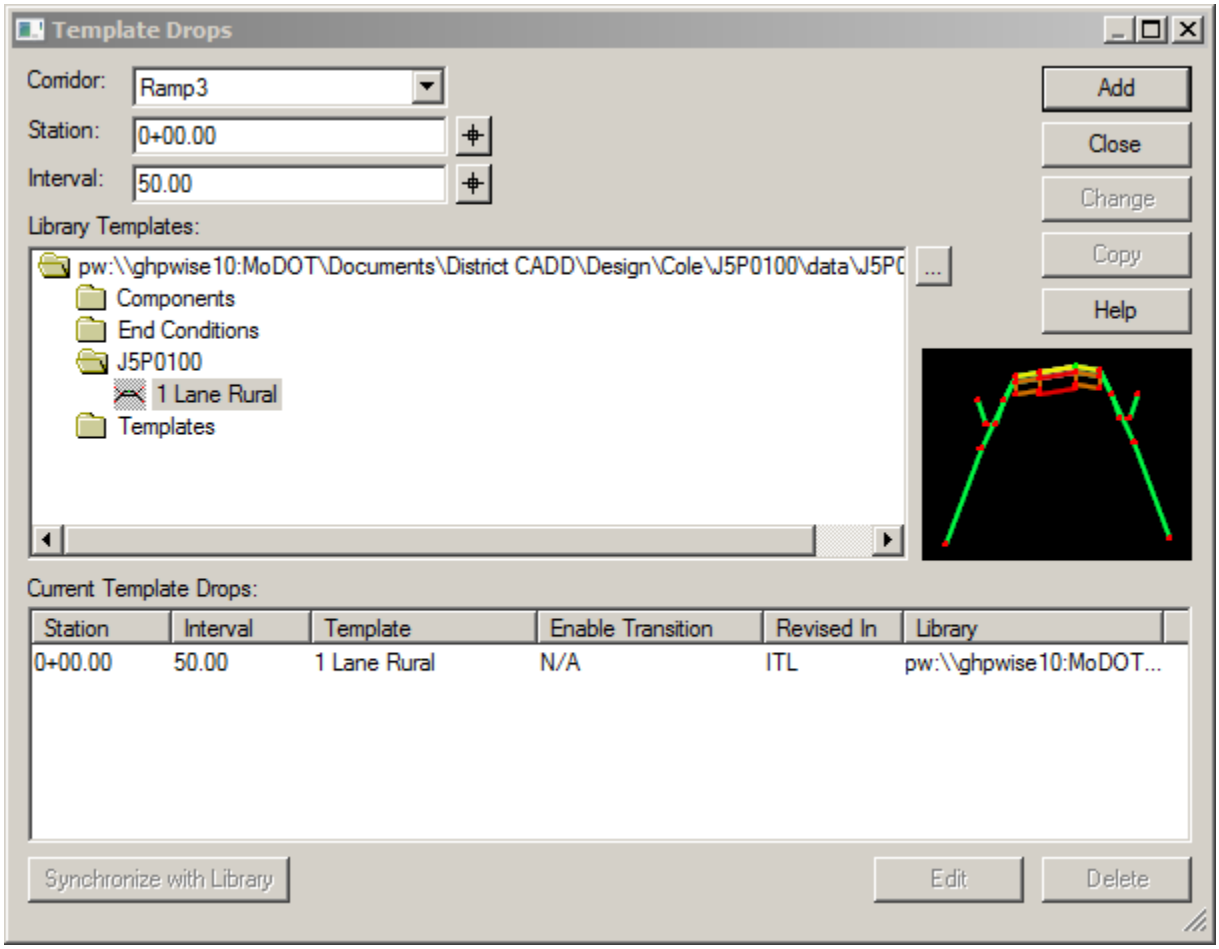
13. Open **Roadway Designer** from the **Corridor Modeling** dialog.

14. In the **Roadway Designer** dialog, create and select the **Ramp3** corridor.



15. In the **Roadway Designer** dialog, select **Corridor > Template Drop**.

Drop the 1 Lane Rural Template on the Ramp3 corridor.



16. Select **Superelevation** > **Create Superelevation Wizard** > **Table**

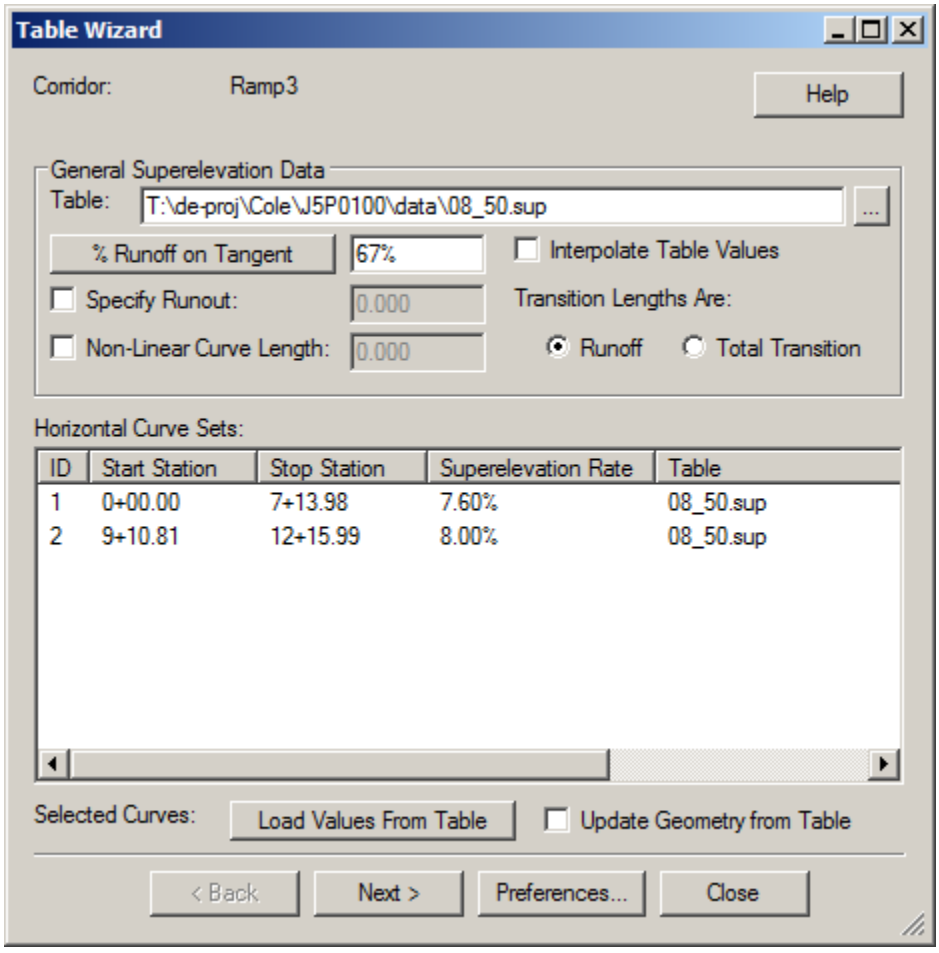
17. In the Table Wizard set the following up:

Table = **T:\Gpk_Std\Superelevation\Roadway_Designer\MoDOT\08_50.sup** (8% e max, 50mph)

% Runoff on Tangent = **66.667%** (The program will round to 67%)

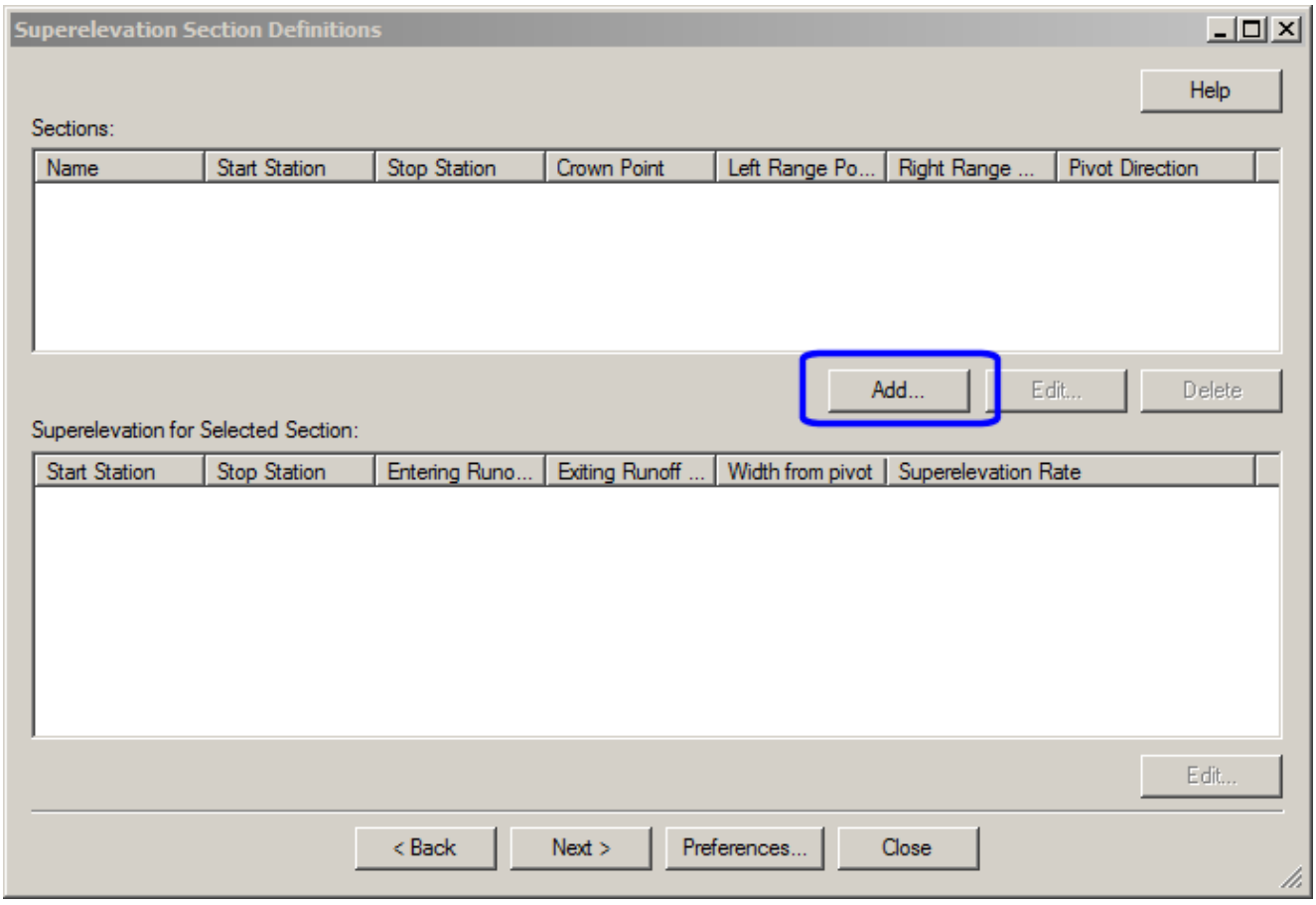
Transition Lengths Are – MoDOT uses the "**Runoff**" method which **i**ndicates the length is the distance from zero cross slope to full super.

Then select "**Load Values from Table**"



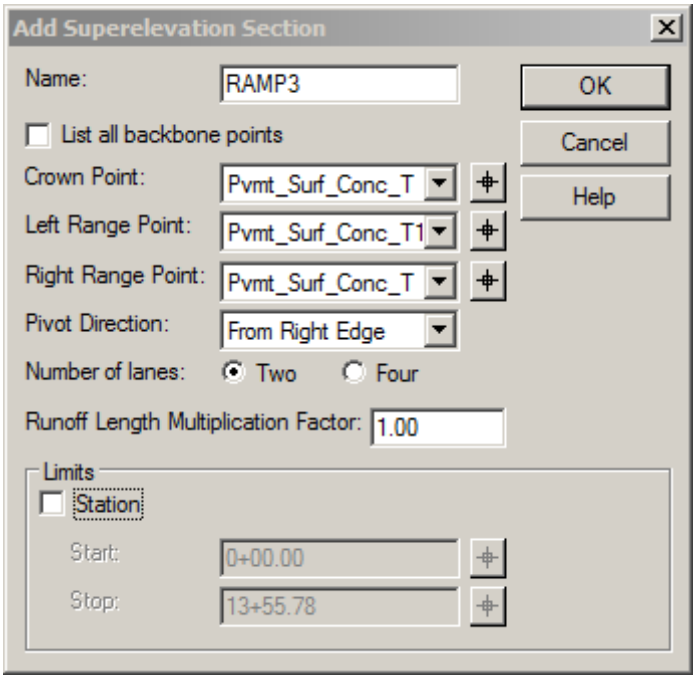
Lastly select "**Next**"

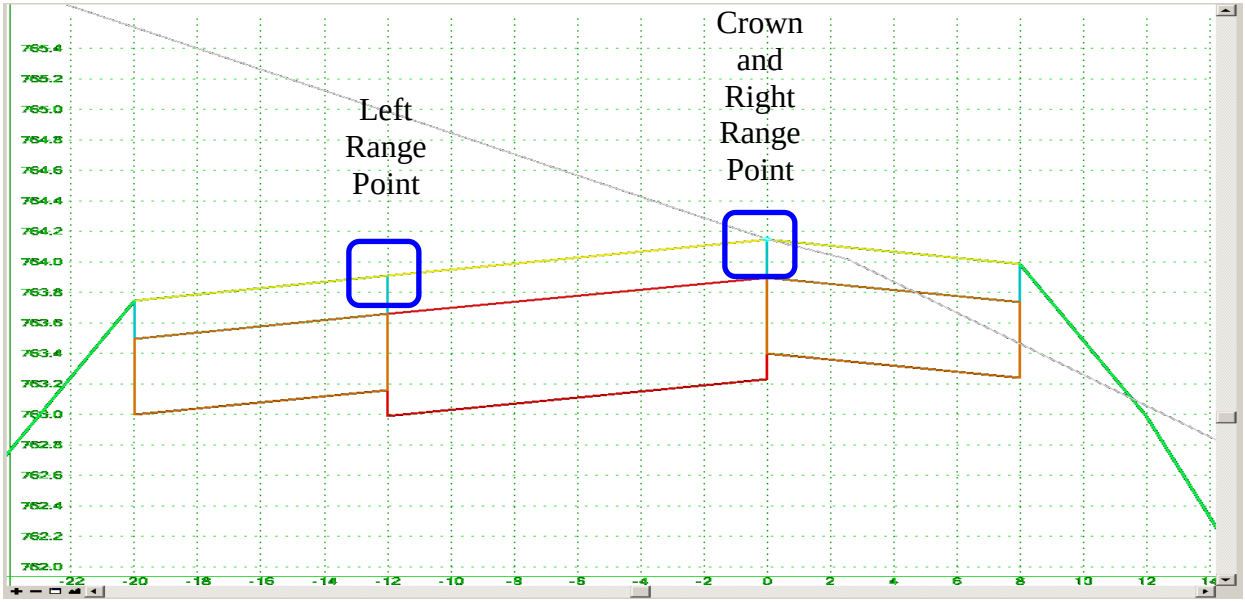
18. In the **Superelevation Section Definition** dialog select "Add" to insert a roadway section:



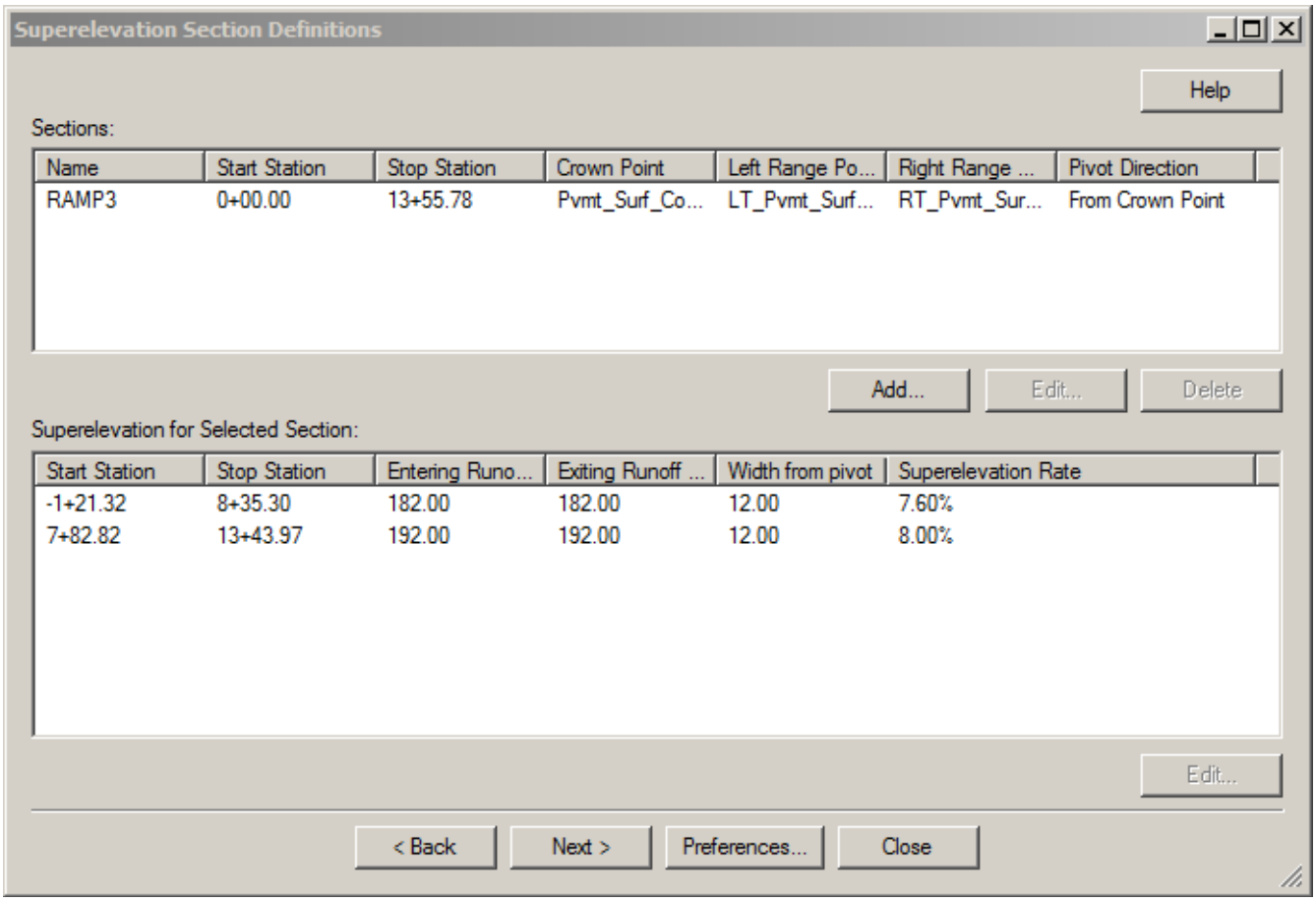
19. In the **Add Superelevation Section** dialog define the roadway section points as follows:

Crown Point:	Pvmt_Surf_Conc_T
Left Range point:	Pvmt_Surf_Conc_T1_L
Right Range point:	Pvmt_Surf_Conc_T
Pivot Direction:	From Crown Point or Right Edge
Number of Lanes:	Two (Undivided Highway)
Runoff Length Multiplication:	1.00



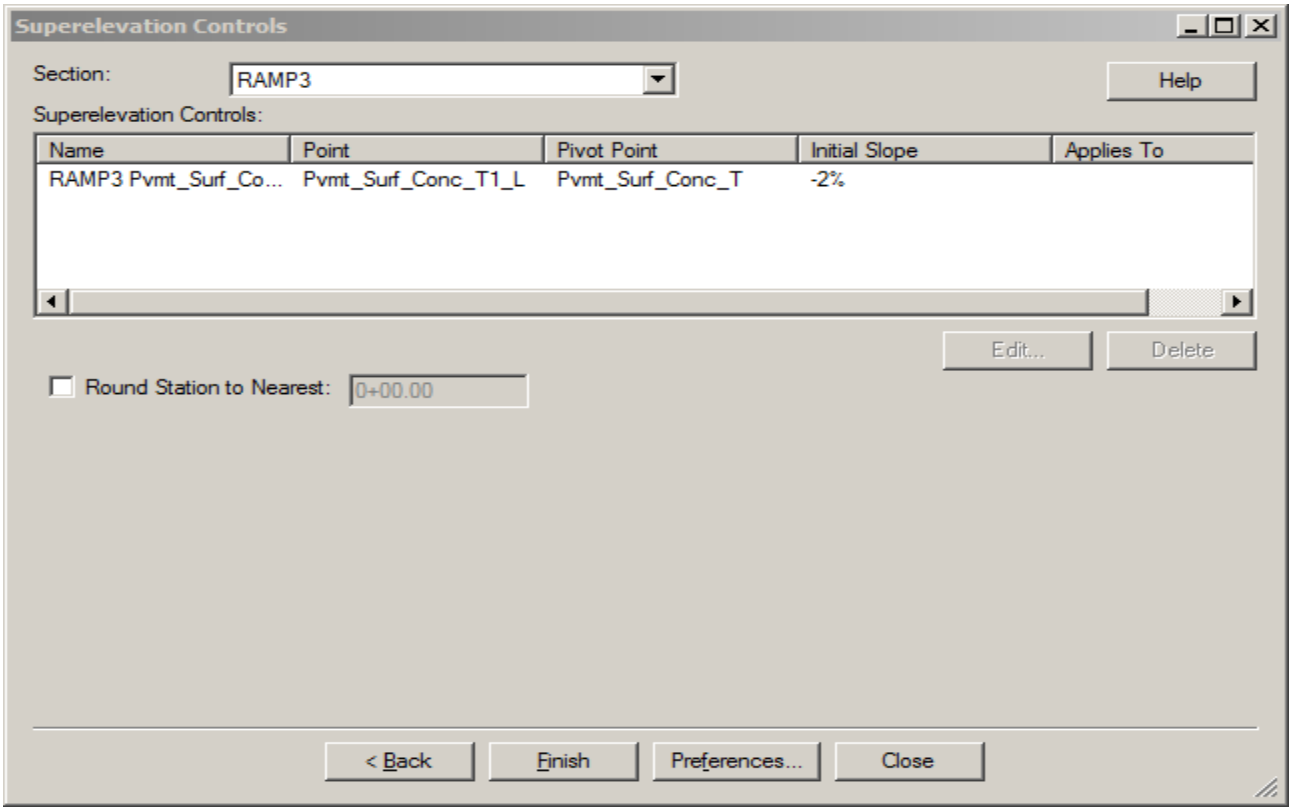


20. The **Superelevation Section Definition** dialog should now look like the following:

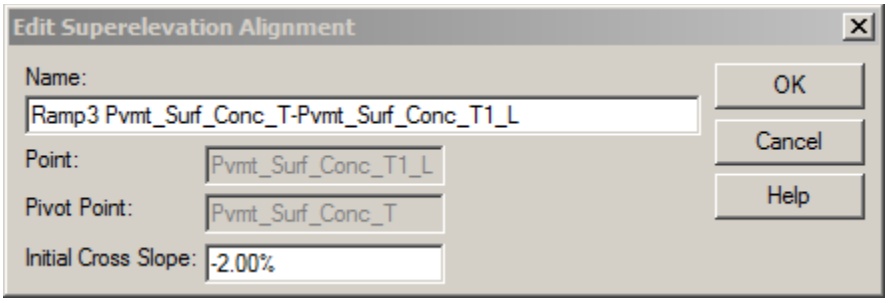


Next select the "**Next**" button.

21. Verify the **Superelevation Controls** dialog looks like the following:



Select the "Contol Line" and choose "Edit"



Roadway Designer automatically names the Control Line the following:

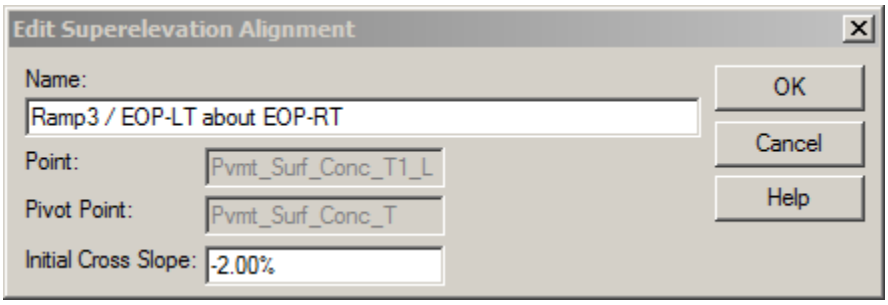
Ramp3 ***Pvmt_Surf_Conc_T***-Pvmt_Surf_Conc_T1_L

Control Name ***Refrence Point*** Control or Rotated Point

21. Continued

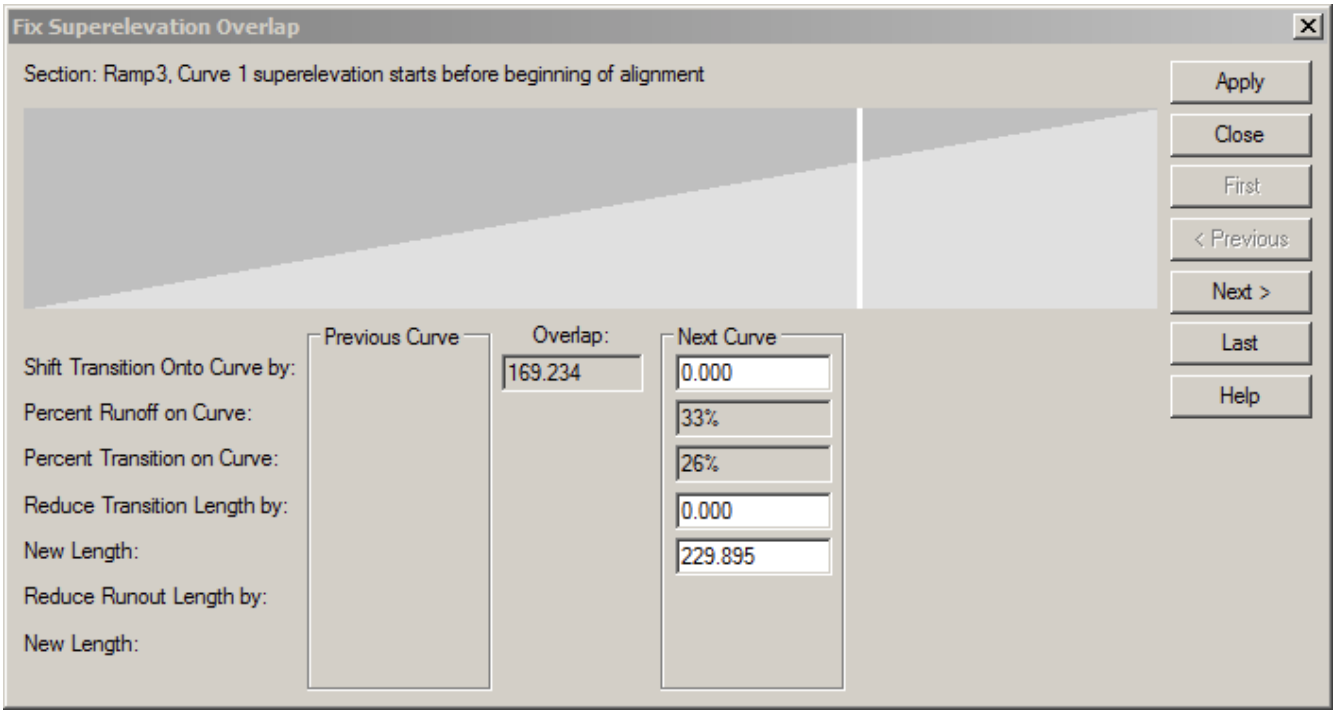
To help with organization within the Superelevation Mass Diagram rename the Control Line name as follows:

Name = "**Ramp3 / EOP-LT about EOP-RT**"



Select "**OK**" and then the "**Finish**" button.

22. If there are Overlaps in your Superelevation the "Fix Superelevation Overlap" dialog will appear.



To remove the overlaps on each section do the following:

First Overlap (Superelevation start before the begininging of alignment)

Reduce Transition Length by:169.234ft (After typing in value hit the "**Tab**" key and **Apply**)

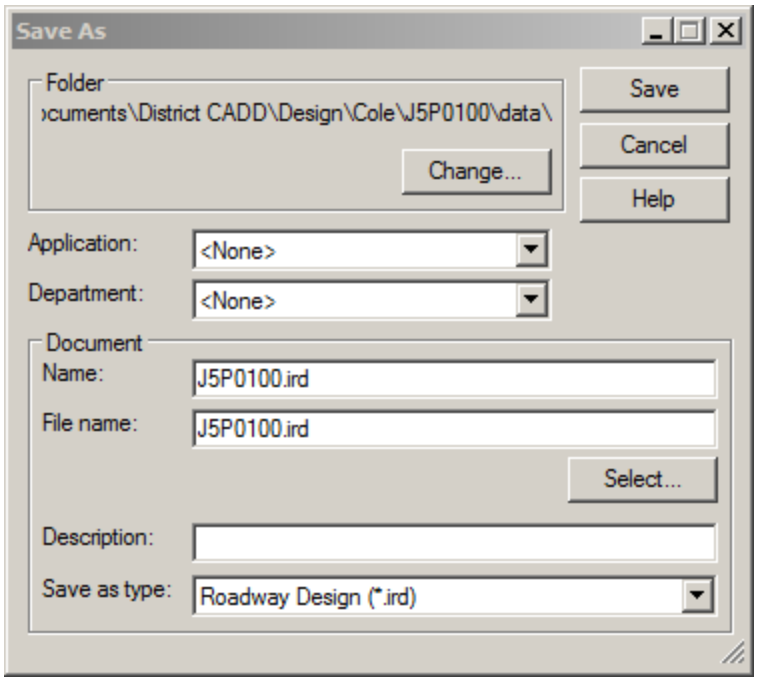
Last Overlap (Superelevation overlaps between the two curves)

Apply Full Super to Full Super Planer Transition (After toggleing this on select **Apply**)

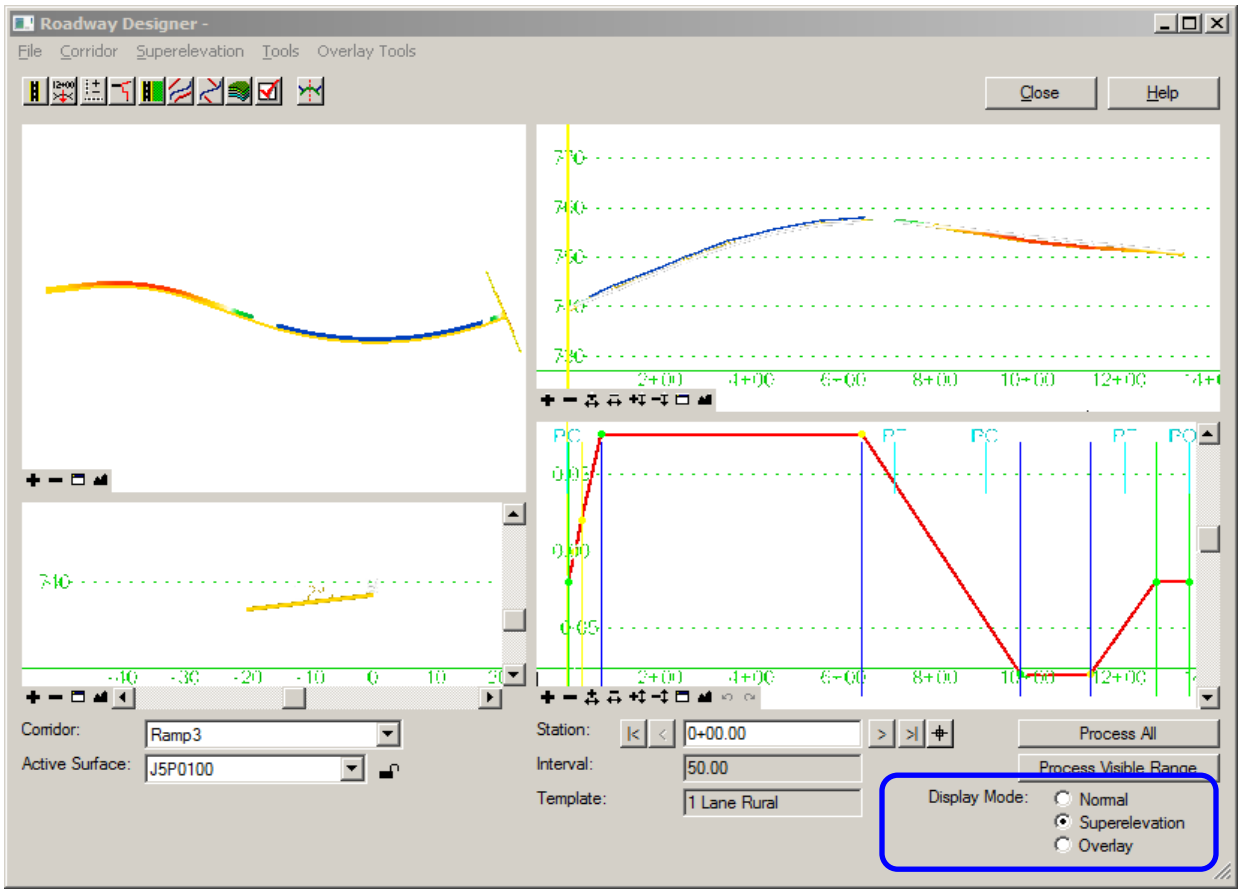
Next select the "**Close**" button.

23. **Save** the Roadway Designer settings in a file called J5P0100.ird.

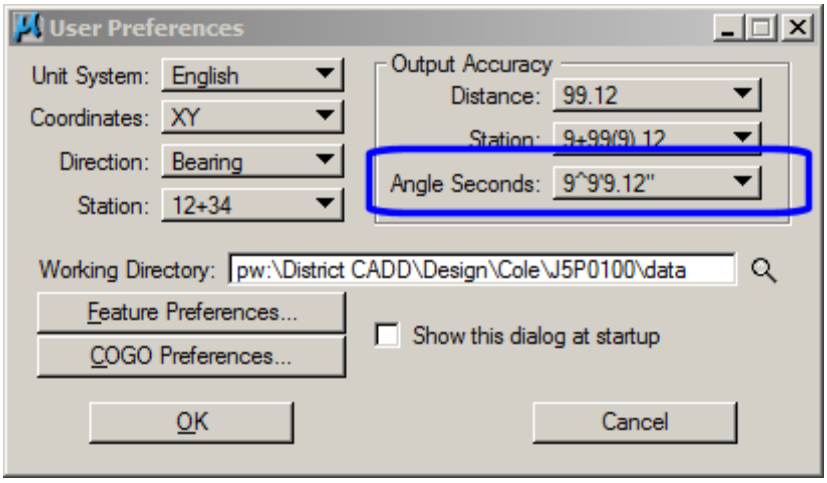
***** When** typing in the **Name** and **File name** the **ird** extension **must** be included



24. In Roadway Designer switch the Display Mode from Normal to Superelevation



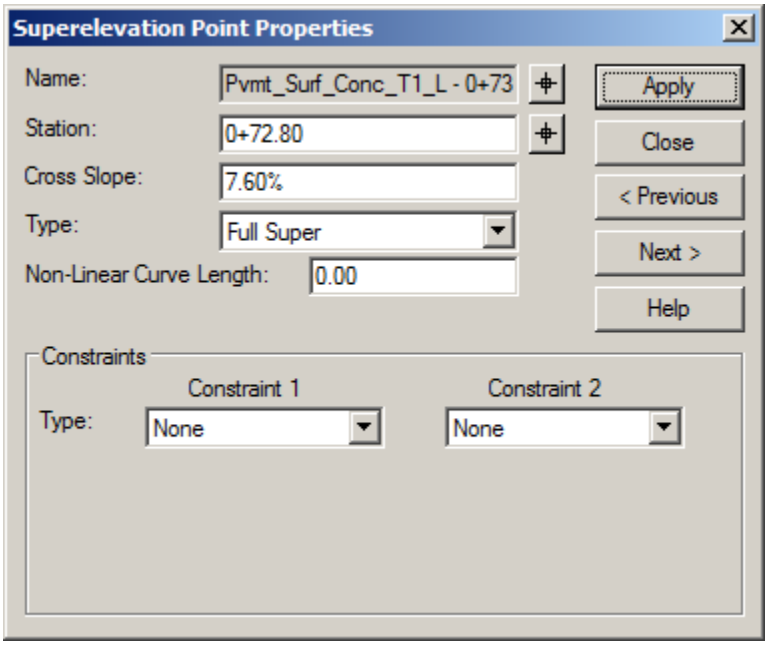
25. If the display setting are showing the slopes to the nearest whole percent adjust the Projects **Users Preferences** as indicated below:



To apply these settings exit Roadway Designer saving the ird file, then reopen Roadway Designer.

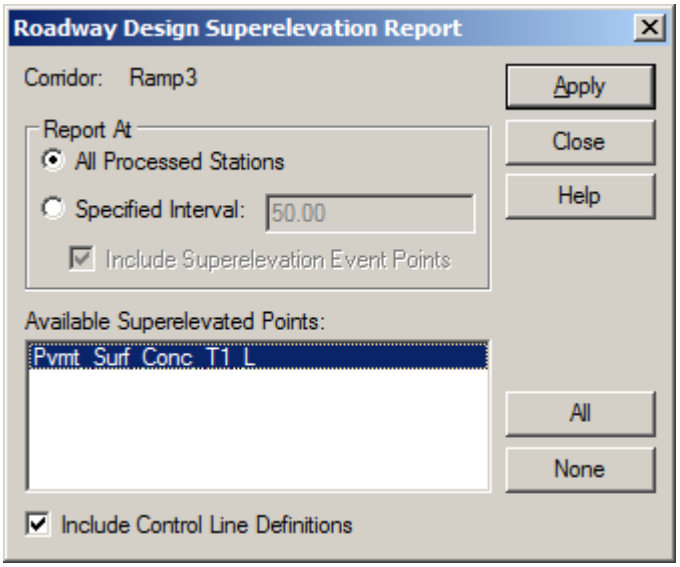
26. In the Superelevation Mass Diagram, adjust the Maximum Superelevation rates to **7.00%** by editing the **Superelevation Point Properties**.

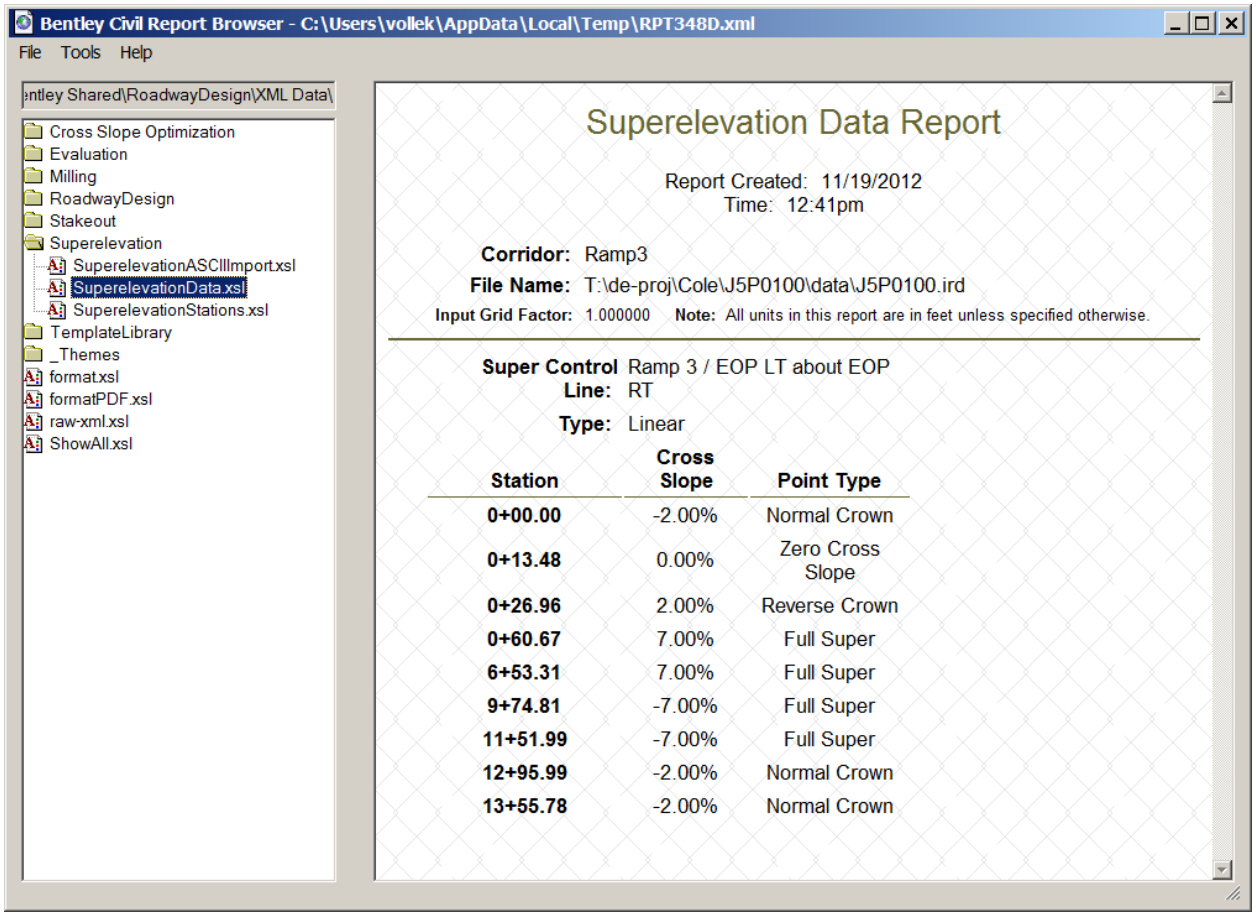
Right click on the superelevation point and select "**Point Edit**".



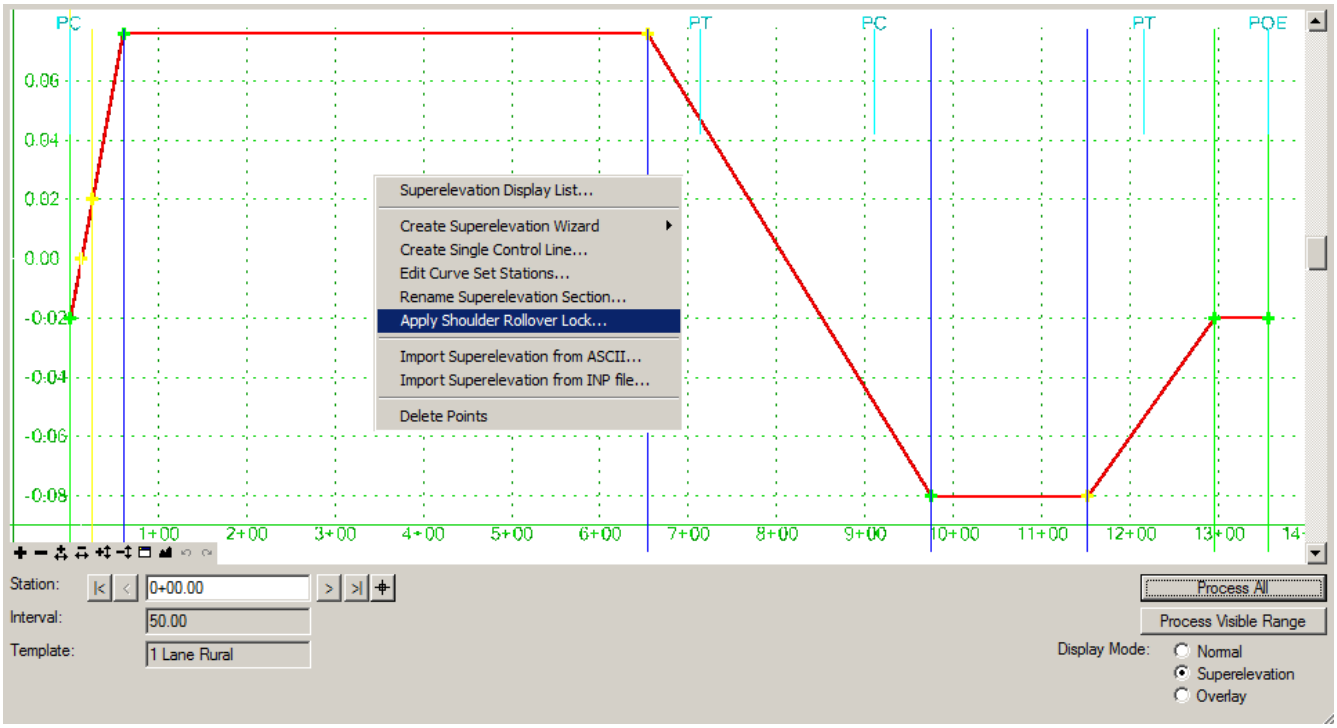
27. Create a **Superelevation Report** by selection the following:

Superelevation > Superelevation Report



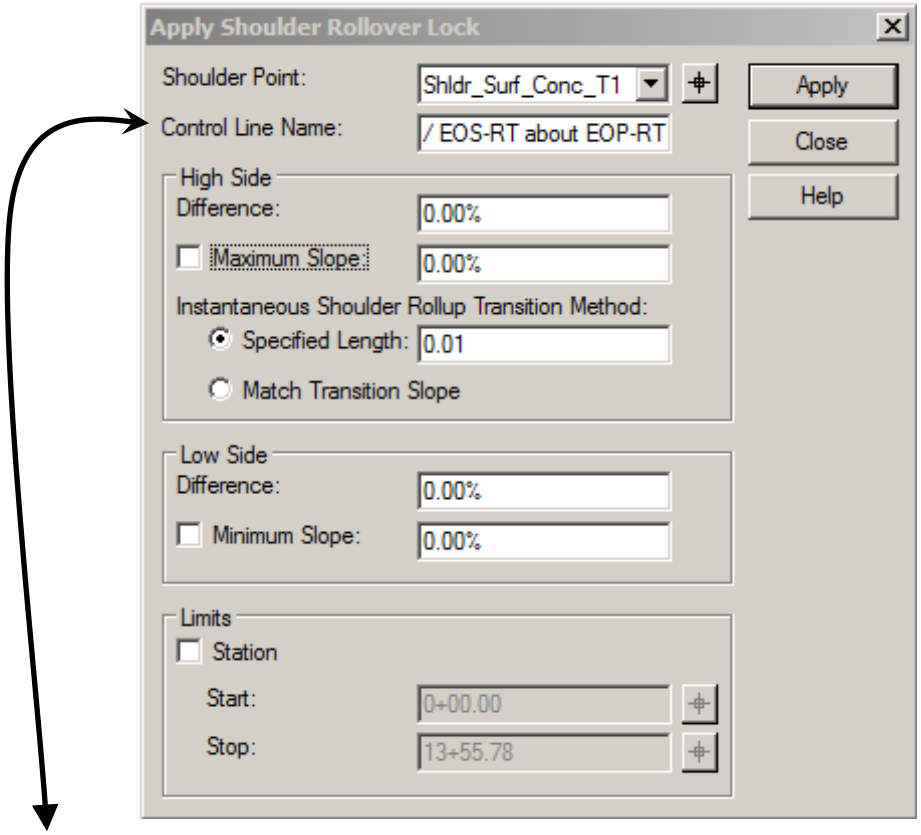


28. (**Shoulder Roll Over Lock - Method 1**) Apply Shoulder Rollover Lock to only the **Right Shoulder** by right clicking in the Superelevation Mass Diagram Window and selecting "Apply Shoulder Roller Lock".



29. Fill the **Apply Shoulder Rollover Lock** dialog with the following settings:

Shoulder Point: Shldr_Surf_Conc_T1_R



Again to help with organization within the Superelevation Mass Diagram set the Control Line name as follows:

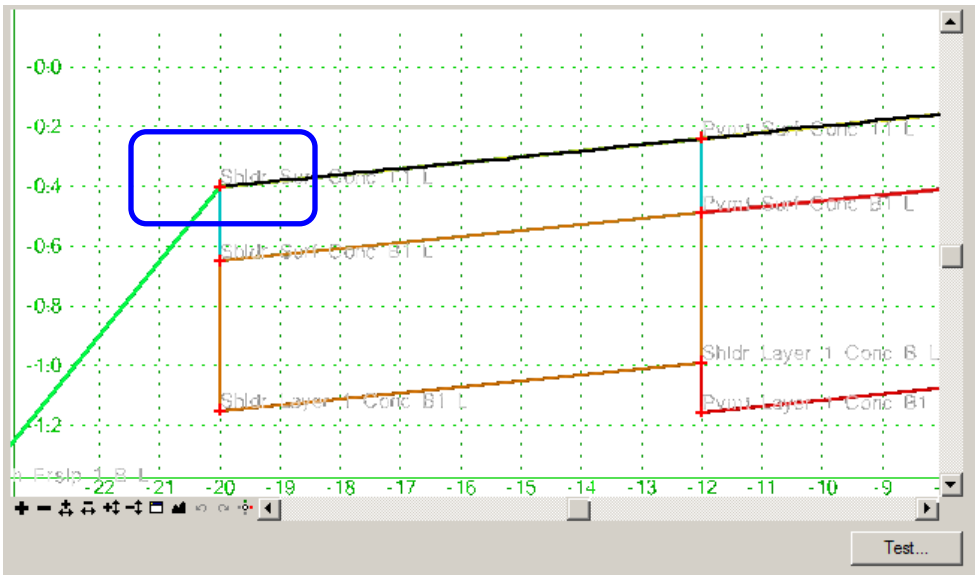
Control Line Name = "**Ramp3 / EOS-RT about EOP-RT**"

Review the Superelevation Miss Diagram View, notice another Control Line was added into the diagram for the shoulder line.

30. (**Shoulder Roll Over Lock - Method 2**) Edit the shoulder point that controls the slope of the **Left Shoulder**, then edit the Rollover Values located within the Slope constraint.

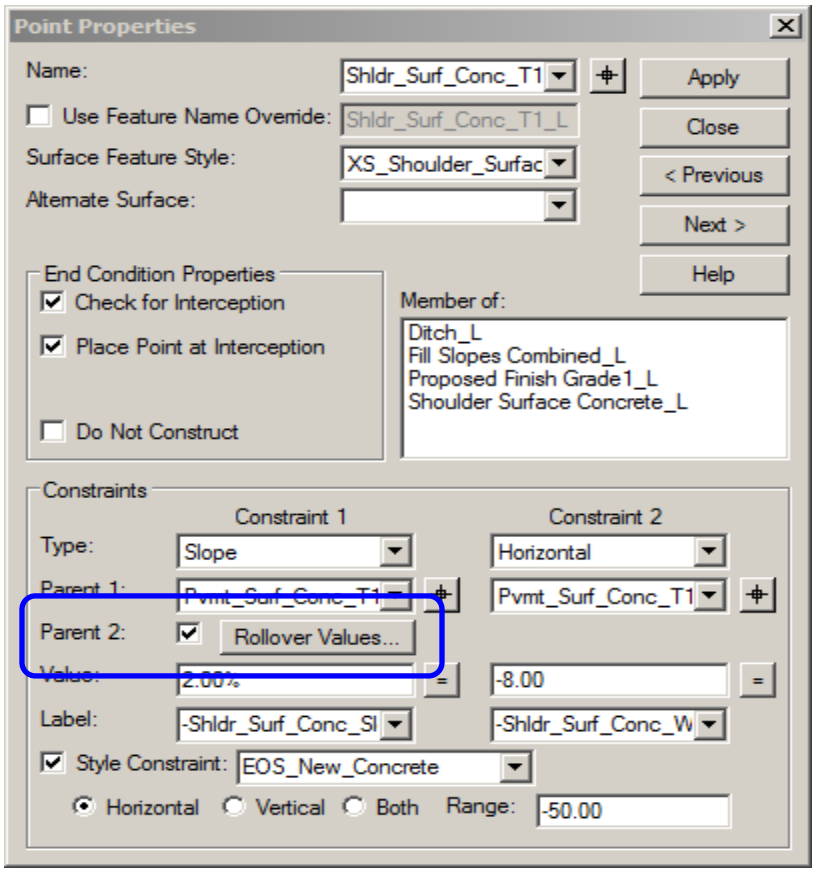
Select **Corridor > Template Drops** and edit the "**1 Lane Rural**" template.

Edit the shoulder point that controls the slope of the shoulder.



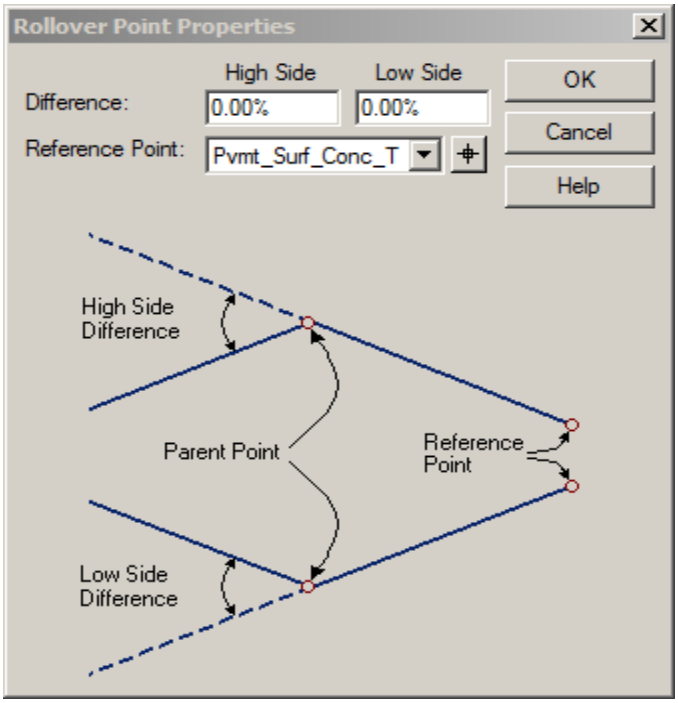
31. Within the Point Properties box and under the Slope Constraint, toggle on the **Parent #2 "Rollover Values"**

Once toggled "On" select the Rollover Values button.



32. Once within the Rollover Point Properties dialog, fill in the following values:

High Side Difference: 0.00%
Low Side Difference: 0.00%
Reference Point: Pvmt_Surf_Conc_T (Edge of Pavement Right Surface Point)

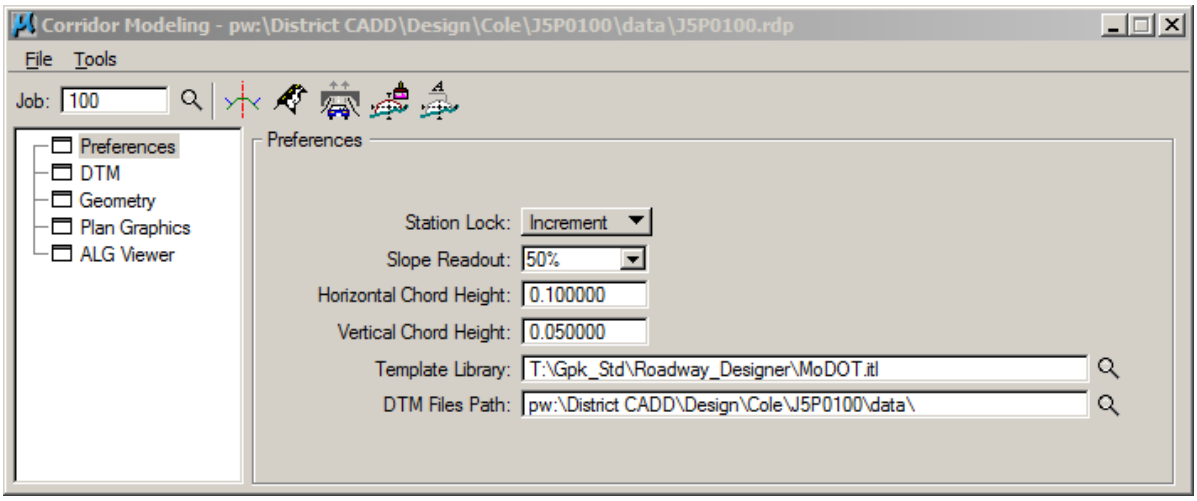


Two benefits to with using the Rollover Values in the Point Properties vs. Apply Rollover Locks are:

1) Can be tested in the "Create Template" or the "Editing Roadway Designer Template Drop" dialog.
2) No Super Elevation Control Line or Point Control.

14.11 Individual Exercise: Superelevation – Route50

1. In the next few steps we are going to create a template that will be used for the Route50 alignment. Select the **Open Create Template** icon.



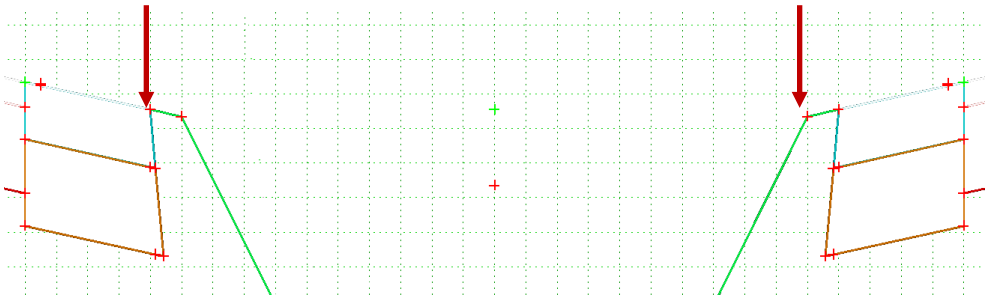
2. In the **Create Template** dialog under the **J5P0100** folder select "**File > New > Folder**" and create a folder called "**Route50**".

From the Templates folder Right click and copy and paste the "**4 Lane Major Rural**" Template into the **Route50** Folder.

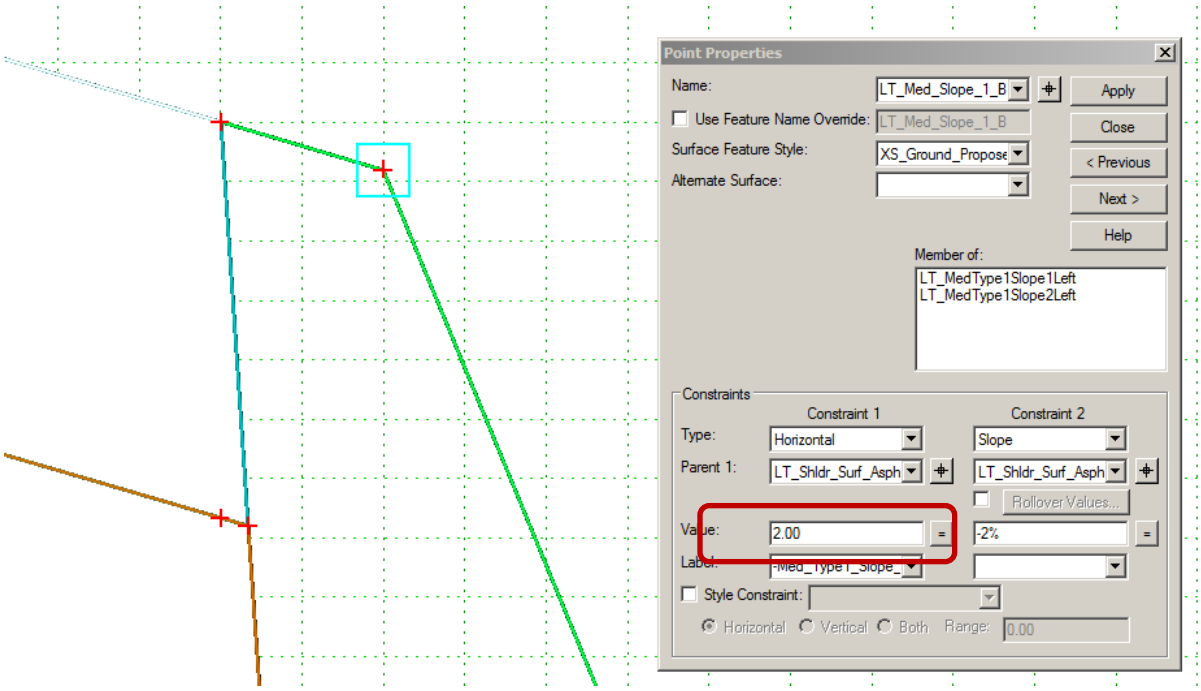
Review the **4-Lane Major Rural** Template.

Notes:

a) Delete the three bottom pavement and shoulder layers.
b) Remove the two small Median Slopes of the **Route50** template.

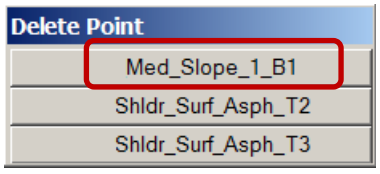


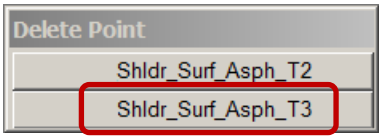
b. continued) To do this edit the points nearest to the median (below we are modifying the Left side of the Median). Set the Horizontal value to zero.



After the User moves the median points over to the shoulder there are now three points on top of each other. To remove the duplicate points use the Merge option.

When merging the points together, delete the Med_Slope_1_B1 point first and then the Shldr_Surf_Asph_T3 second.



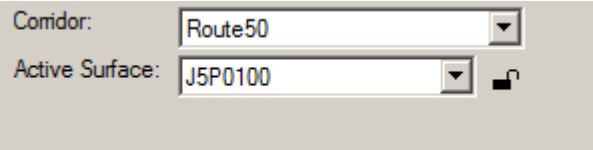


Save and then close your changes to the **J5P0100.itl**

3. Open **Roadway Designer** from the **Corridor Modeling** dialog.

4. In the **Roadway Designer** dialog, select **Corridor > Corridor Management** and create (using the **Route50PR** as the profile) and then select the **Route50** corridor.

Next, select **Corridor > Template Drop**.



Drop the **4-Lane Major Rural** Template on the **Route50** Corridor.

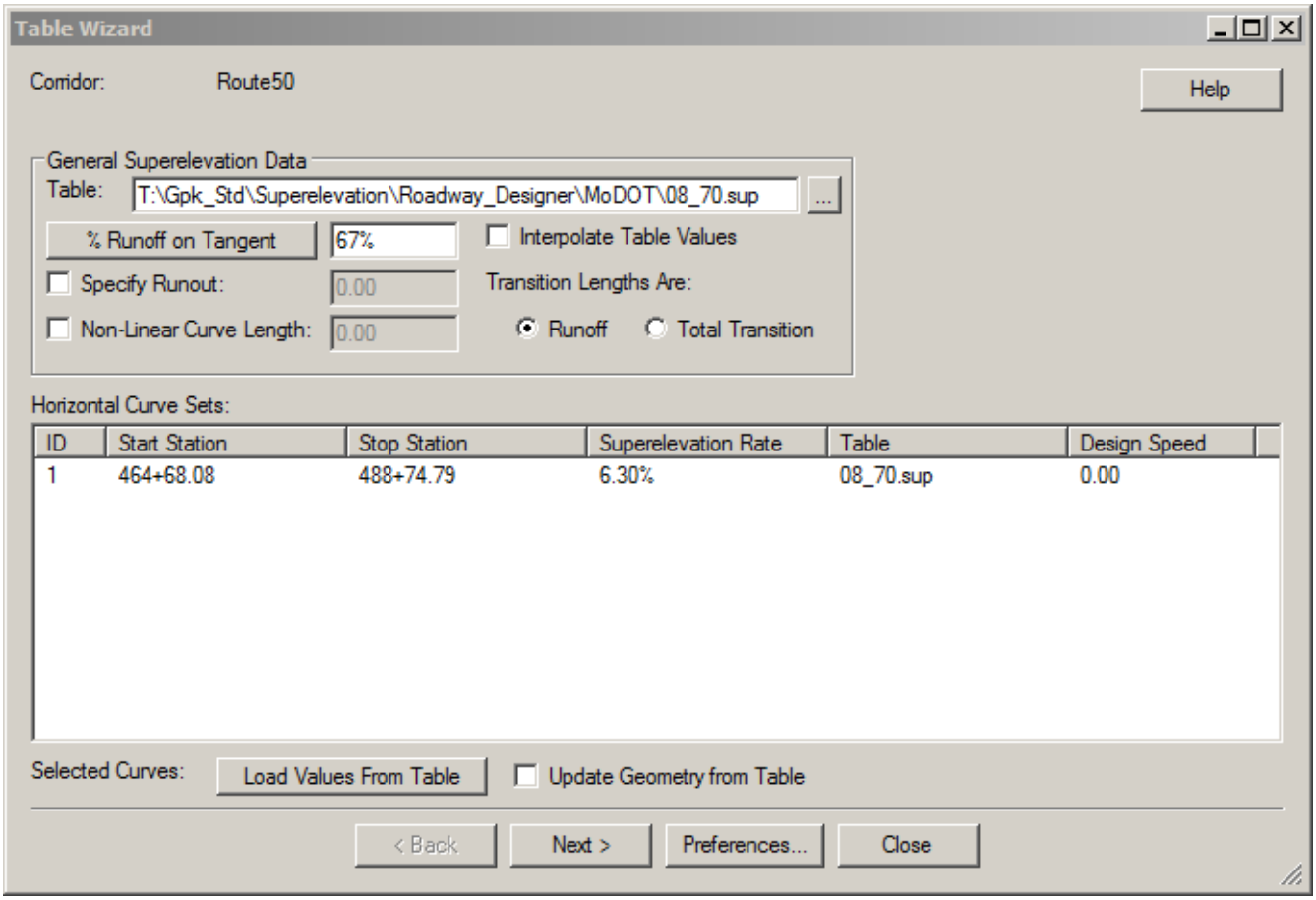
5. Select **Superelevation** > **Create Superelevation Wizard** > **Table**

6. In the Table Wizard set the following up:

Table = **T:\Gpk_Std\Superelevation\Roadway_Designer\MoDOT\08_70.sup** (8% e max, 70mph)

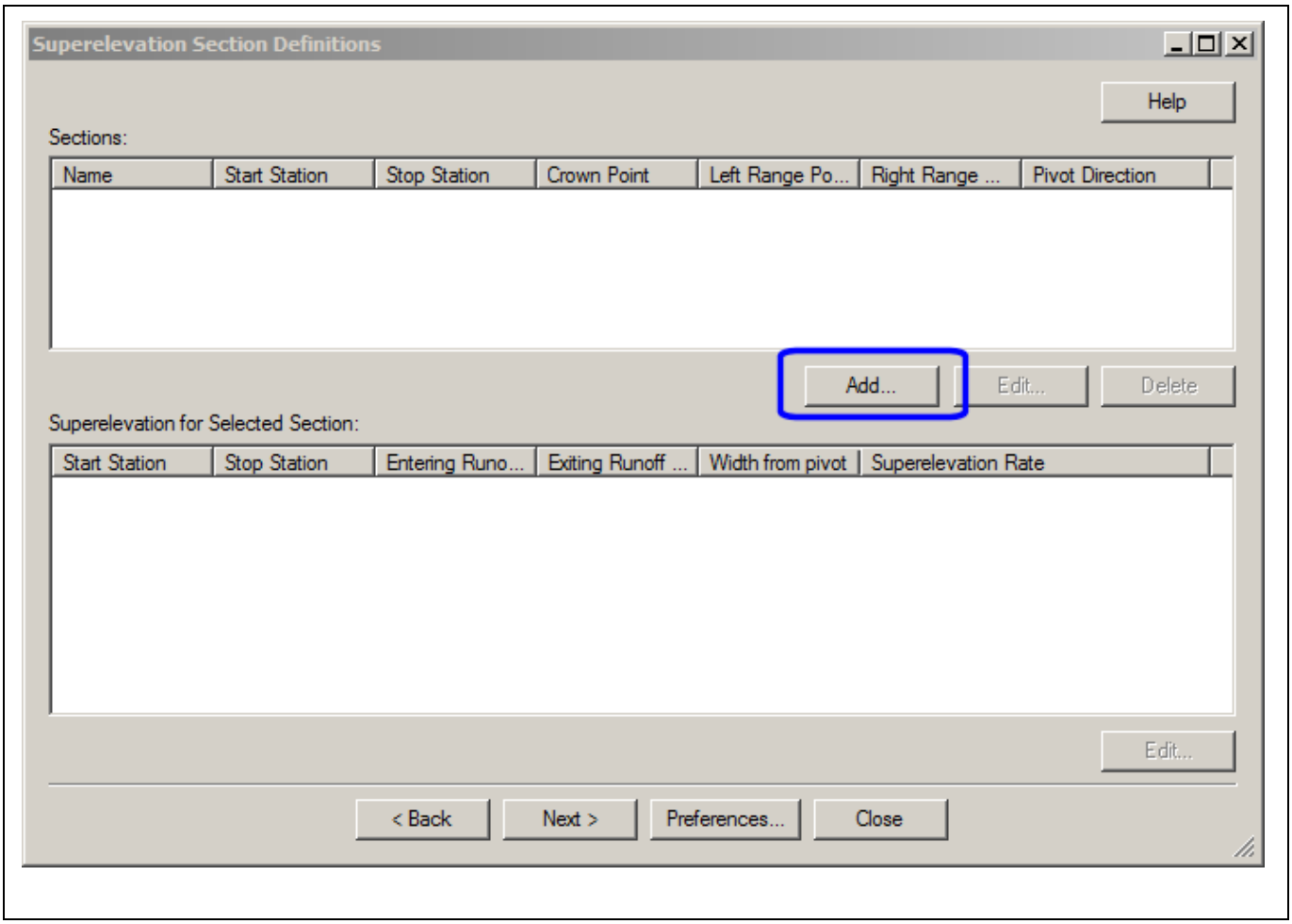
% Runoff on Tangent = **66.667%** (The program will round to 67%)

Then select "**Load Values from Table**"



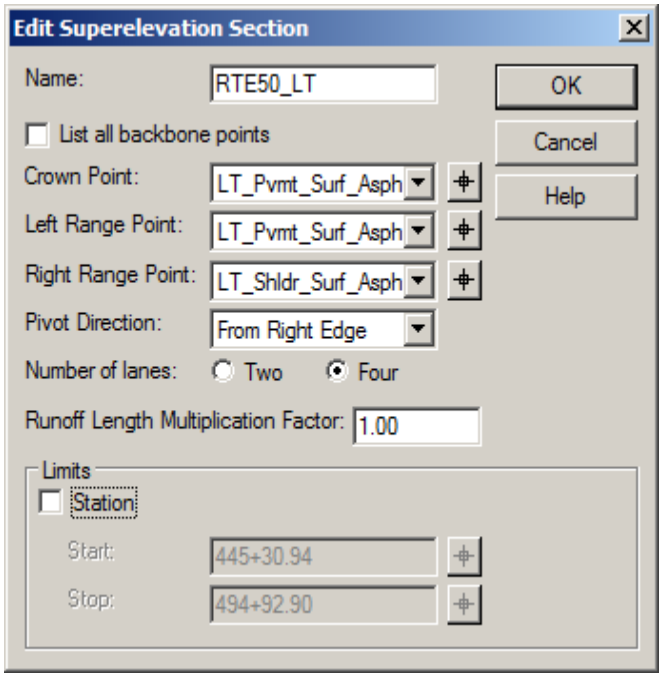
Lastly select "**Next**"

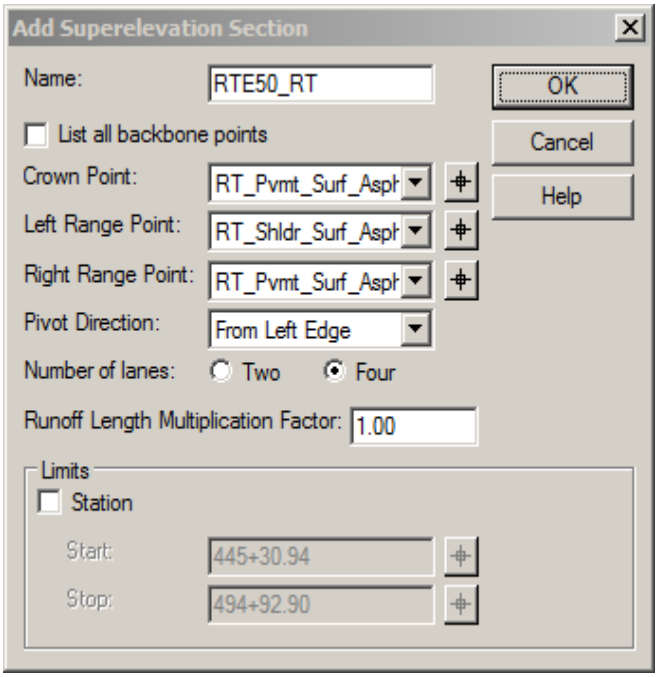
7. In the **Superelevation Section Definition** dialog select "Add" to insert a roadway section:

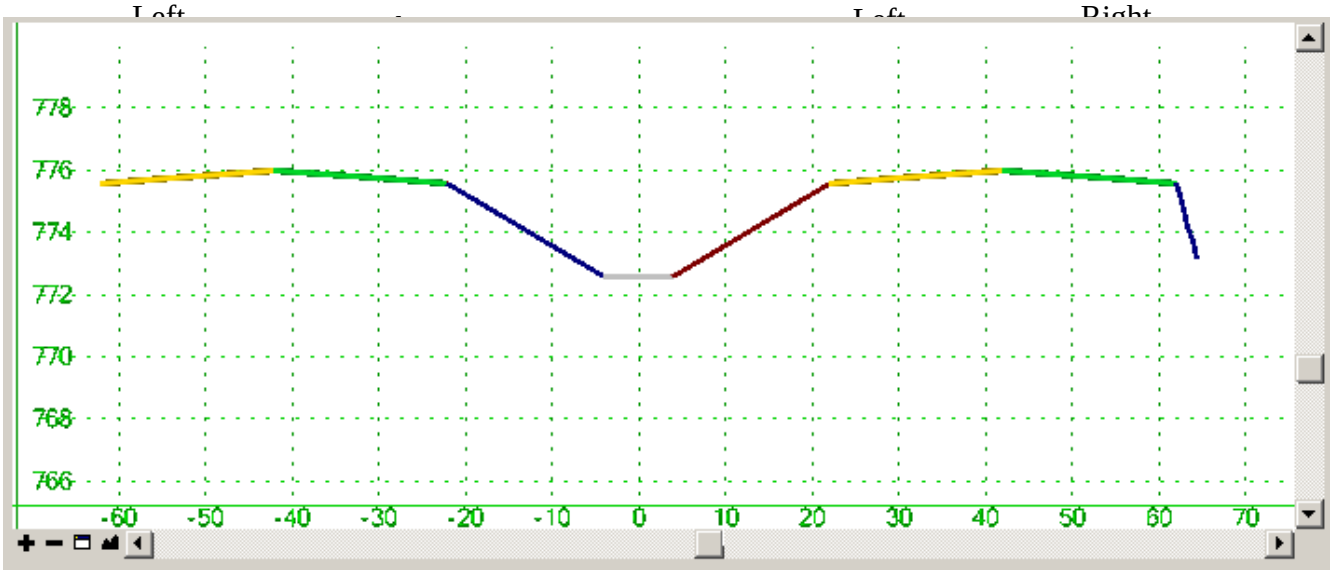


8. In the **Add Superelevation Section** dialog define the roadway section points as follows:

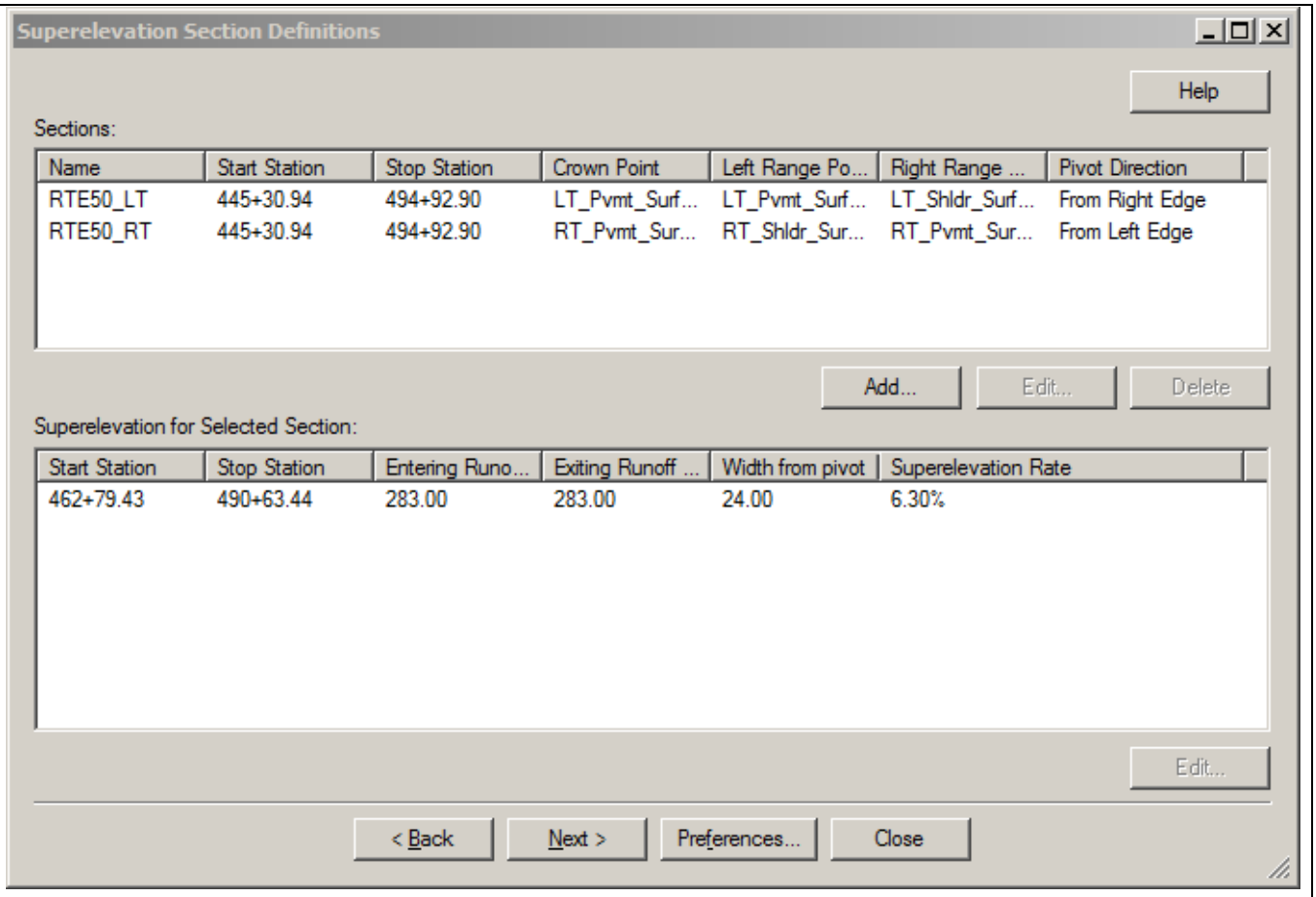
	Rte50_LT	**Rte50_RT**
Crown Point:	LT_Pvmt_Surf_Asph_T	RT_Pvmt_Surf_Asph_T
Left Range point:	LT_Pvmt_Surf_Asph_T1	RT_Shldr_Surf_Asph_T
Right Range point:	LT_Shldr_Surf_Asph_T	RT_Pvmt_Surf_Asph_T1
Pivot Direction:	From Right Edge	From Left Edge
Number of Lanes:	Four (Divided Highway)	Four (Divided Highway)
Runoff Length Muliplication:	1.00	1.00





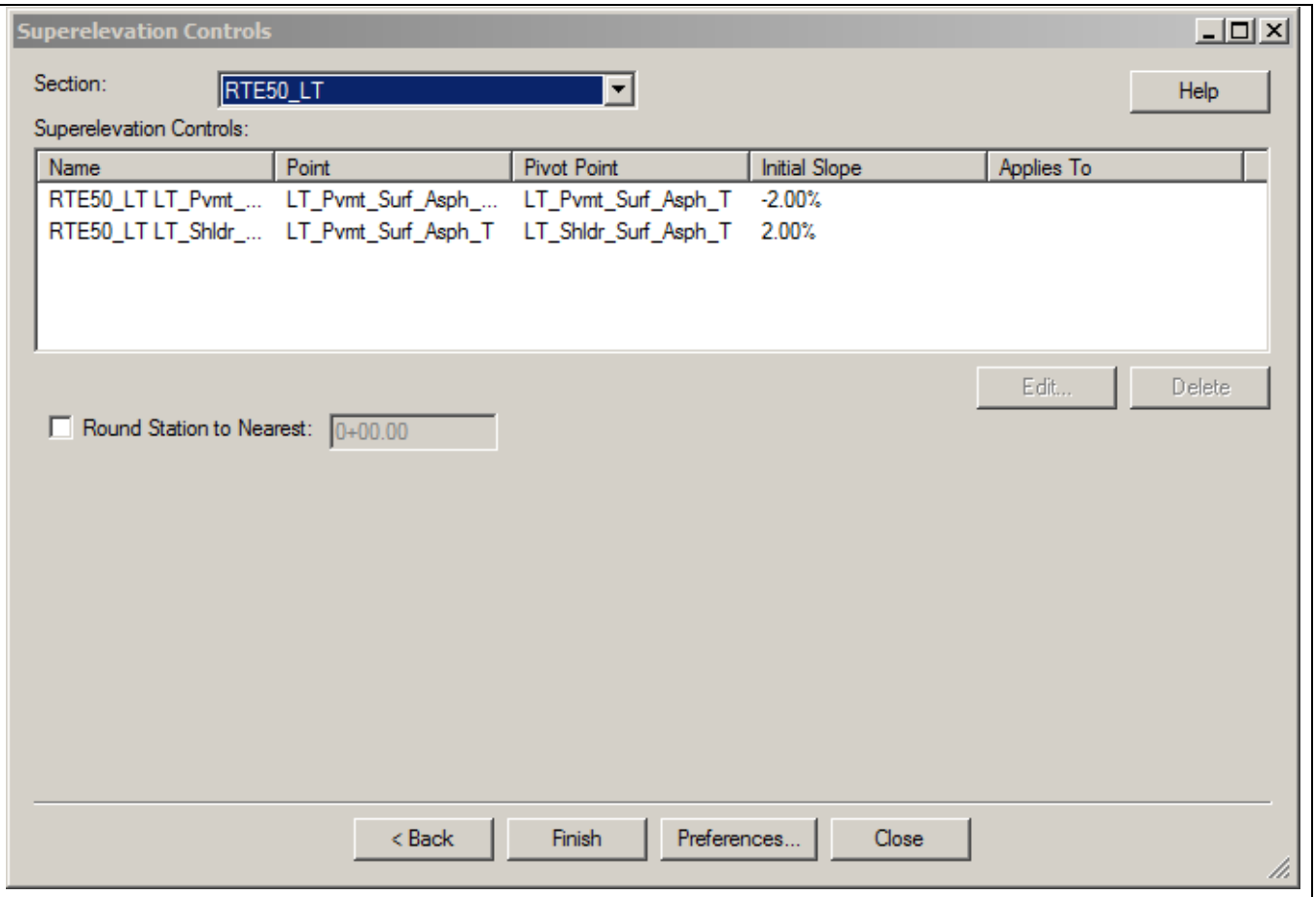


9. The **Superelevation Section Definition** dialog should now look like the following:



Next select the "**Next**" button.

10. Review the **Superelevation Controls** dialog:



Rename the Control Line if you think it helps, see below the example from the previous exercise:

Roadway Designer automatically names the Control Line the following:

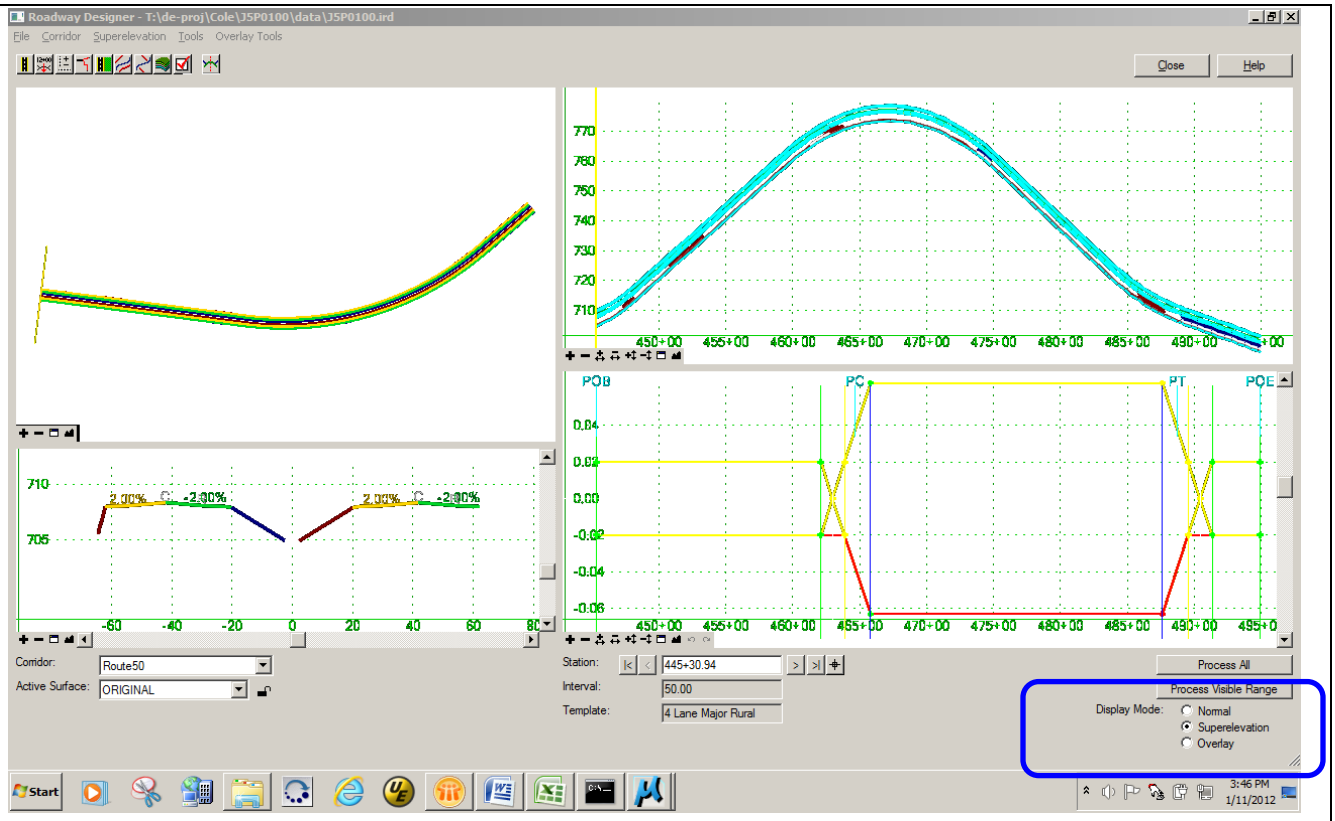
Ramp3 ***Pvmt_Surf_Conc_T***-Pvmt_Surf_Conc_T1_L

Control Name ***Refrence Point*** Control or Rotated Point

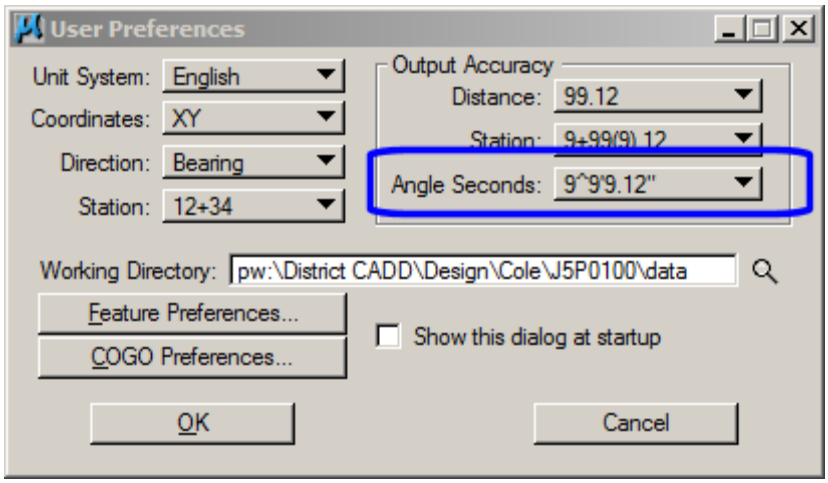
<u>Below are some examples for Control Line Names that could be used:</u>
RTE50_LT / CL (Crown) about EOP_RT
RTE50_LT / EOP_LT about CL (Crown)
RTE50_RT / EOP_LT about CL (Crown)
RTE50_RT / CL (Crown) about EOP_RT

Next select the "**Finish**" button.

11. In Roadway Designer switch the Display Mode from Normal to Superelevation

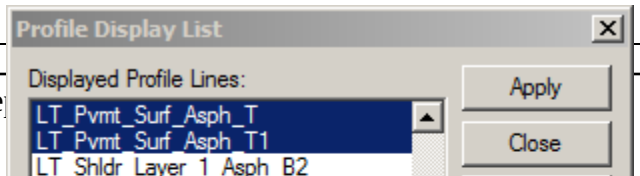


12. If the display setting are showing the slopes to the nearest whole percent adjust the Projects **Users Preferences** as indicated below:

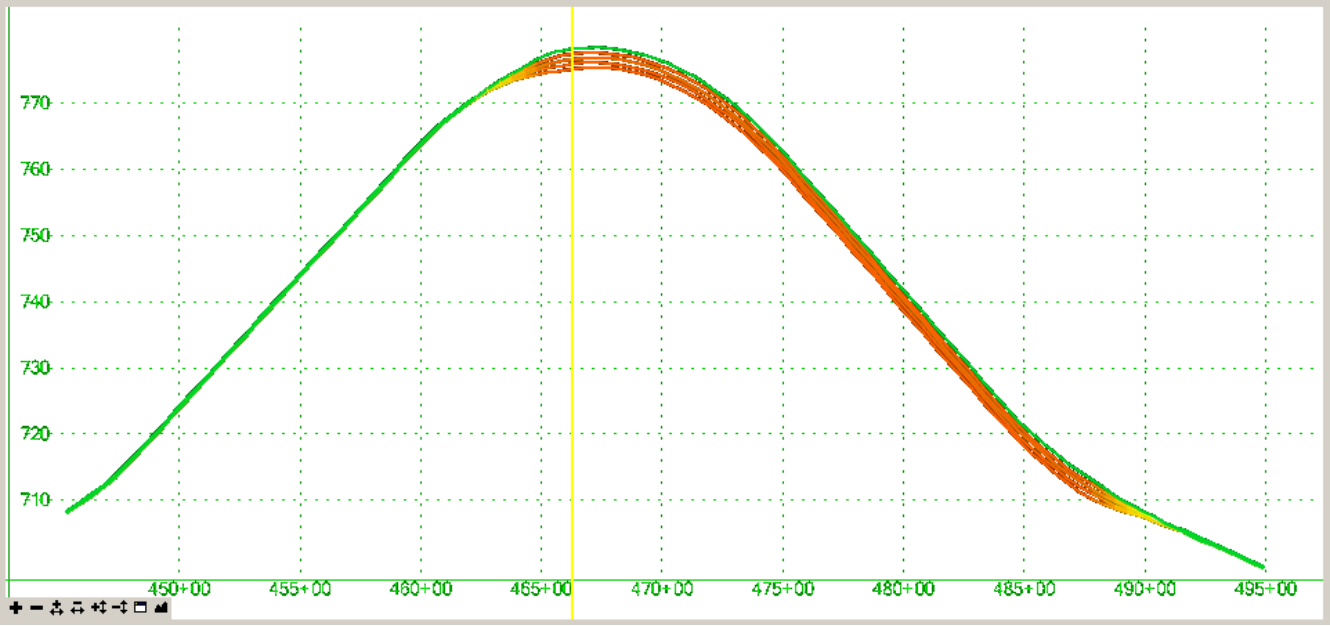


To apply these settings exit and reopen Roadway Designer. Save the ird file when exiting.

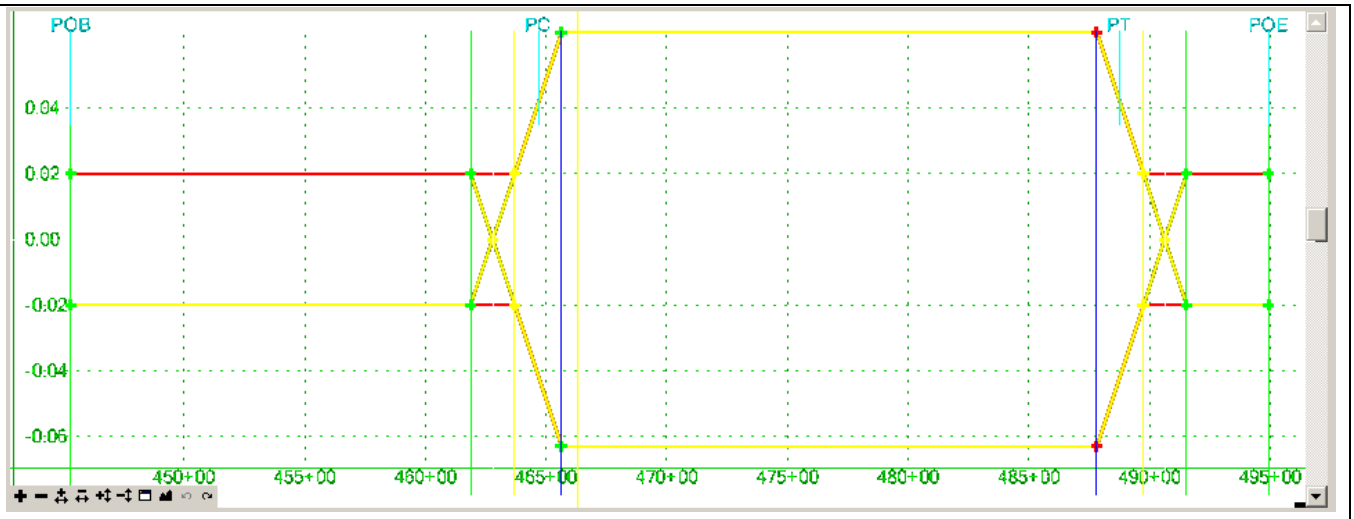
13. In the **Superelevation Side Roadway Profile View** display the following edges using the Profile Display List:



LT_Pvmt_Surf_Asph_T1
LT_Pvmt_Surf_Asph_T
LT_Shldr_Surf_Asph_T
RT_Shldr_Surf_Asph_T
RT_Pvmt_Surf_Asph_T
RT_Pvmt_Surf_Asph_T1

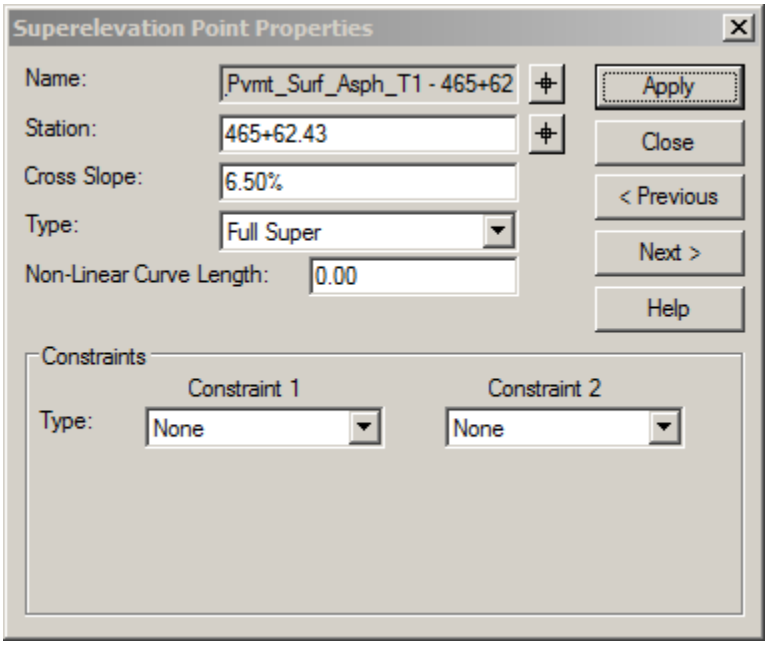


14. In the Superelevation Mass Diagram, adjust the Maximum Superelevation rates to **6.50%** by editing the **Superelevation Point Properties**.



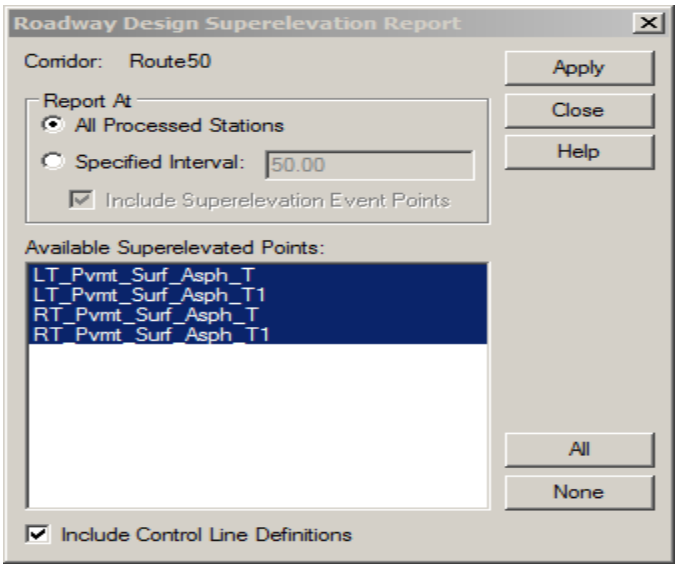
Right click on the superelevation point and select "**Point Edit**".

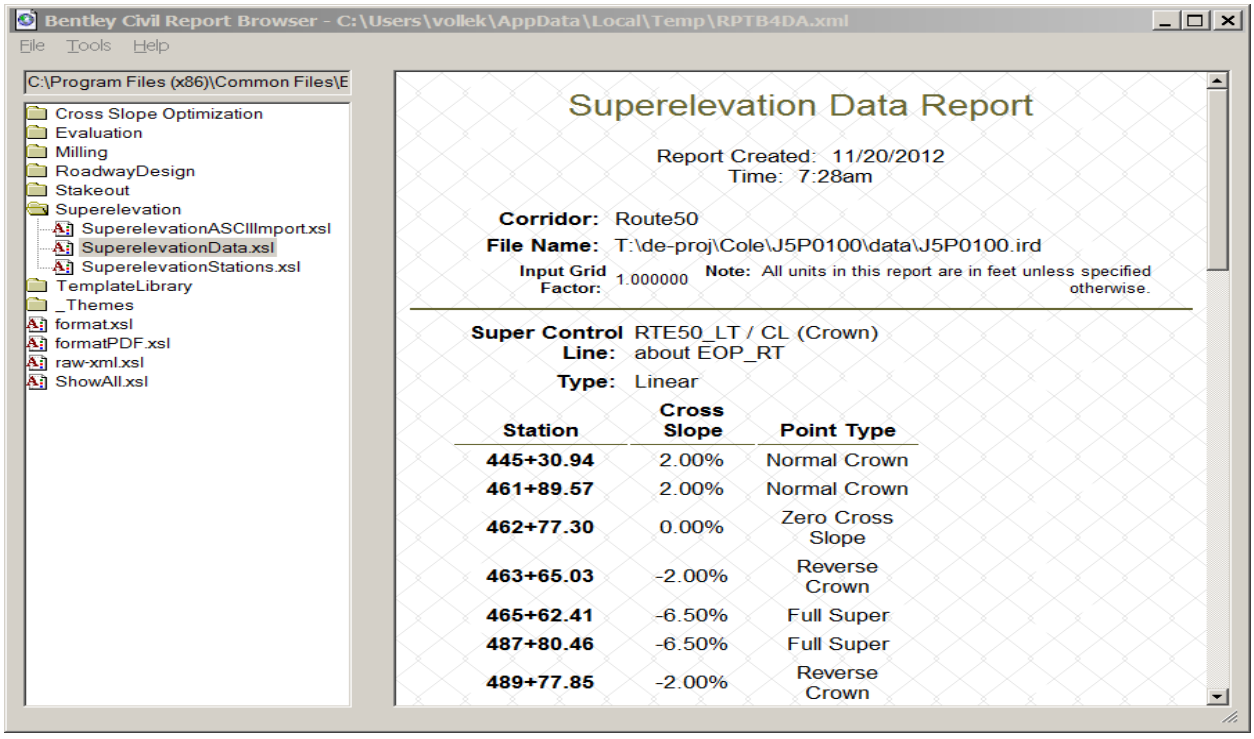
Edit the superelevation points that have no constraints.



15. Create a **Superelevation Report** by selection the following:

Superelevation > Superelevation Report





33. Apply **Shoulder Superelevation** by using either method described in the previous exercise.