W12

Advanced Superelevation Techniques

XM Edition

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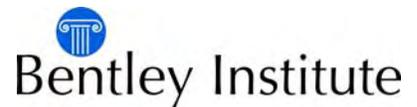
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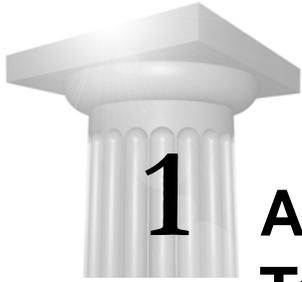   Portions ©1997 – 1999 HMR, Inc. All rights reserved.
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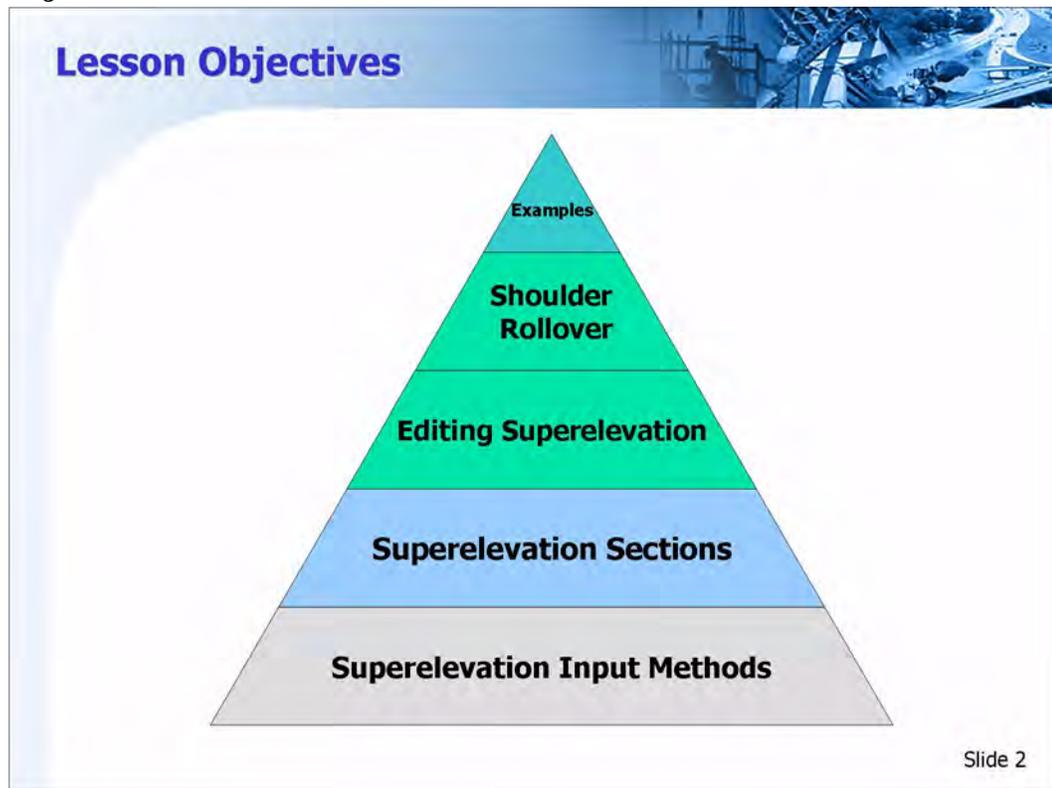
Advanced Superelevation Techniques _____1-1

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1 Advanced Superelevation Techniques

Advanced Superelevation Techniques

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Lesson Objectives

Lesson Objectives

In this lesson we will…

- Learn different methods of Superelevation Input
- Learn the significance of Superelevation Sections
- Learn Different ways to edit Superelevation in the Roadway Designer
- Learn about Shoulder Rollover Locking
- Learn various examples of how Superlevation can be applied.

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Starting InRoads

Starting InRoads

1   Double-click the InRoads or InRoads Suite icon.

The MicroStation Manager appears.

If there is no icon, then an alternate path for launching InRoads is **Start > Programs > Bentley > InRoads Group XM > InRoads**

Open a CAD File

1   Set the directory to the workshop directory
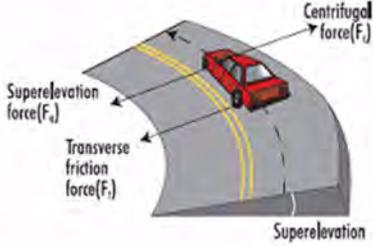
2   Open the CAD file *SR 2067 Bypass.dgn*

Opening the Project File

1   From the InRoads menu, select **File > Open**

2   Set the *Files of type* to *InRoads Files (*.rwk,*.dtm,*.alg,*.itl,*.sdb,*.xin)*

3   Change the *Look in* directory to this workshop directory

4   Select the file *WS 12.rwk*

5   Click **Open**.

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Create Superelevation Wizard

Superelevation

Superelevation is created and applied by using the Roadway Designer after the corridor is created and the template drops are assigned. Superelevation is stored and saved in the Roadway Design file, and is applied to a corridor.

The Create Superelevation Wizard is used to create superelevation. When superelevation is created, superelevation Point Controls will be automatically created and will be added to the Points Control dialog. Superelevation Point Controls are vertical controls. As in normal Point Controls, superelevation Point Controls automatically override template point constraints.

Create Superelevation Wizard

The *Create Superelevation Wizard* walks you through the steps necessary to create and apply superelevation to the corridor. Select the **Superelevation > Create Superelevation Wizard > Table** command to start the Wizard. This brings up the Table Wizard dialog.

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Methods of Superelevation Input

There are several ways to define superelevaion:

Create Superelevation Wizard

The Create Superelevation Wizard walks you through the steps necessary to create and apply superelevation to the corridor.

Creating Single Control Lines

This is a way to define superelevation manually. Each control line must be defined individually. Corresponding point controls must then be created, and assigned to the appropriate template point.

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Importing Superelevation from ASCII

This command creates superelevation control lines and assigns template point controls. The file imports pipe delimited format using the first three values only. Values used are: Station|Finished Grade Left|Finished Grade Right

Import Superelevation from Alignment

This command to import superelevation control lines from an alignment created from a previous version of InRoads.When you select the command, a prompt is only displayed if an alignment was found.

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Using the Create Superelevation Wizard, Table Method

Table Wizard Dialog

The Table Wizard Dialog is used to input the general superelevation data. The general superelevation data includes the name and location of the superelevation rate table, and the parameters relating to the superelevation transitioning. The rate table is an ASCII file that contains superelevation rates and transition lengths based on design speed, which has the default extension of (*.sup).

Basic Workflow

- Select the appropriate superelevation table name and location by selecting the Browse button next to the Table field.

- Set up the appropriate superelevation transitioning parameters.

- Click the Load Values From Table button.

- Click the Next⊳ button. This will bring up the Superelevation Section Definitions dialog.

Practice-Create Superelevation-Table Method

Create Superelevation-Table Method

1   Select **Modeler > Roadway Designer**

2   Select **Superelevation > Create Superelevation Wizard > Table**

3   This will bring up the Table Wizard dialog

4   Use the **Browse** button next to the *Table* field and select the *06_60.sup* rate table from the workshop folder.

5   Click **Load Values From Table**.

6   Review the Superelevation Rates

7   Click *Next>*

This will bring up the *Superelevation Section Definitions* dialog.

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Superelevation Sections

Superelevation Sections

Superelevation Control Lines are grouped into sections and define a "Range of Interest" for these control lines.

The Superelevation Section Definitions dialog is used to specify the pavement sections to superelevate, based on a cross section view. These sections are named during the process.

For example, On a two-lane roadway, only one section is used. Multiple sections are used for divided roadways.

When specifying pavement sections, the Crown Point, Left and Right Range Points are selected. These points can be selected directly from the cross section view windows or from their respective drop-down lists.

There are no hard and fast rules for section creation. Superelevation Sections are simply a way to manage related control lines. Control Line points in a section cannot be constrained to control line points in different section.

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Section and Control Line Naming

Each superelevation section and corresponding control lines are named so that they can be identified and modified in the roadway designer. When using the Wizard, InRoads attempts to give the control line a meaningful name by using the Section/Pivot Point/Point name. These names can be modified as desired. However, concise but intelligible names should be given so that they can be easily identified in lists and combo boxes.

Superelevation Controls Dialog

The Superelevation Controls dialog shows the names of the Point Controls that are going to be automatically added to *Point Controls* dialog. The names can be changed selecting the **Edit** button. This is also where you can set the station rounding by using the *Round Station to Nearest* option. Station rounding allows you to round up the superelevation stations. For example, instead of the Full Superelevation station being computed as 245+45.96, it can be 245+45.00, which rounded to nearest foot using a rounding value of 0+01.00.

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Basic Workflow

- Review and edit the *Superelevation Point Controls*.

- Toggle On the *Round Station to Nearest* option and select the rounding value, if station rounding is desired.

Click the **Next>** button. If there are superelevation overlaps, this will bring up the *Fix Superelevation Overlap* dialog.**Setting the Superelevation Controls**

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Practice-Create Superelevation Sections

Continue working on the last Practice activity.

The *Superelevation Section Definitions* dialog should be shown still displayed from the last Practice activity.

Create Superelevation Section Definitions

1   Click the **Add** button in the *Superelevation Section Definitions* dialog

    This will bring up the *Add Superelevation Section* dialog

2   Key-in Two-lane as the *Name* of the section

3   Use the Target button next to the *Crown Point* field and click the centeline point on the Cross Section View

    This will return the *Crown Point* name as *CL*

4   Use the Target button next to the *Left Range Point* field and click the left edge of pavement point on the Cross Section View

    This will return the *Left Range Point* name as *LT_EOP*

5   Use the Target button next to the *Right Range Point* field and click the right edge of pavement point on the Cross Section View

    This will return the *Right Range Point* name as *RT_EOP*

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6   The *Point Direction* should be set to *From Crown Point*

7   The *Number of Lanes* should be set to *2*

8   *Station Limits* should not be Toggled On, which will result in superelevating the entire corridor

9   Click **OK**

Review the Superelevation Controls

1   Review the information now in the *Superelevation Section Definitions* dialog.

2   In the *Superelevation for Selected Section* Area, click on the first entry in the *Start Station* column.

3   Click **Edit**.

4   This will bring up the *Superelevation Curve Information* dialog.

    Notice that the start/stop stations, runoff lengths and full super rates can be adjusted here.

5   Click **Close**.

6   In the *Superelevation Section Definitions* dialog, Click the **Next>** button

    This will bring up the *Superelevation Controls* dialog

7   Review the information in the *Superelevation Controls* dialog.

8   Enable the *Round Station to Nearest* option and set the rounding value to 0+01.00.

9   Click **Finish**.

10 Since there is an overlap, this will bring up the *Fix Superelevation Overlap* dialog.

11 We will use the Fix Superelevation Overlap dialog in the next practice activity.

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Fixing Superelevation Overlap

Fix Superelevation Overlap Dialog

If there is a superelevation overlap, the *Fix Superelevation Overlap* dialog will automatically appear. The *Fix Superelevation Overlap* dialog is used to resolve superelevation overlaps. An overlap occurs when there is not enough length to fit the superelevation transition lengths between curves, or the corridor alignment starts or ends in a superelevation transition.

Superelevation overlaps can be resolved by either shifting the total transition length onto the next curve or previous curve, or by reducing the total transition length.

To shift the transition, key-in the distance you want to shift the total transition in the *Shift Transition Into Curve by* fields, located in the *Previous Curve* area or *Next Curve* areas. The *% Runoff on Curve* and *% Transition on Curve* are used for readout only and will show you *Runoff* and *Total Transition* percentages on the curves as you shift the transitions.

To reduce the total transition length, key-in the transition length reduction in the *Reduce Transition Length* by fields, located in the *Previous Curve* area or *Next Curve* areas. The new length will be reflect in the *New Length* field. As seen in other dialogs, you must move the cursor to another field or use the **Tab** key to update the values of other input fields.

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The *New Length* field can also be used to specify the new reduced length, without using the *Reduce Transition Length by* field, which will produce the same results. The diagram at the top of the dialog dynamically displays the overlaps and the results of shift and changing the transition lengths. Clicking on the diagram and holding down the left mouse button allows you to dynamically slide the transitions.

Basic Workflow

- To shift the transition onto a curve, key-in the shift distance in the *Shift Transition Onto Curve by* fields.

- To reduce the transition length, key in the transition length reduction in the *Reduce Transition Length by* fields.

- Click the **Apply** button.

- Click the **Next>** button to move to the next overlap if necessary.

Repeat for all overlaps.

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Practice-Fix Superelevation Overlap

Correcting a Superelevation Overlap

Continue working on the last Practice activity.

The Fix Superelevation Overlap dialog should still be displayed from the last practice activity.

Review the Superelevation Overlap

1 Review the superelevation overlap in the *Fix Superelevation Overlap* dialog

Reduce the Transition Length

1 Reduce the total transition length of the first curve by keying in 45.00 in the *Reduce Transition Length by* field in the *Previous Curve* area

Shift the Transition

1 Shift the transition onto the second curve by keying 45.00 in the *Shift Transition Onto Curve* by field in the *Next Curve* area

2 Click **Apply**, then **Close.**

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Review the Point Controls

1   Select the **Corridor > Point Controls** command and review the new Point Controls relating to superelevation.
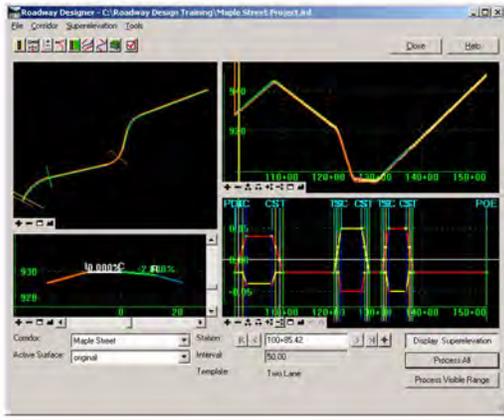
2   When finished, close the Point Controls dialog.

Review the Superelevation

1   Select the **Display Superelevation** button located on the bottom right hand corner of the Roadway Designer dialog

2   Select the **Process All** button.

3   Select **File > Save** command to save the Roadway Design

Superelevation Views

Roadway Designer Superelevation Windows

After superelevation has been created using the *Create Superelevation Wizard*, you can view several new windows in the Roadway Designer by selecting the **Display Superelevation** button.

The **Display Superelevation** button can be toggled On or Off at any time during the design. These windows are used to review and edit the superelevation. The display of each window is color coded.

Superelevation Color Codes

When using the **Display Superelevation** button, color coded cross slopes are displayed in the Plan, Profile and Cross Section View Window. This allows you to visualize the slopes as the roadway transitions through superelevated areas.

Slopes to the right that are between 0.5% and 10% will start as green and transition to blue as the slope approaches 10%. When the slope is greater than 10% to the right, the color becomes dark blue.

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Slopes to the left that are between 0.5% and 10% will start as yellow and transition to red as the slope approaches 10%. When the slope is greater than 10% to the left, the color becomes dark red.

Slopes that are less than 0.5% will appear as a white color on either side of the centerline.

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Superelevation Diagram Window

Superelevation Diagram View Window

The *Superelevation Diagram View Window* is located in the lower right hand corner of the *Roadway Designe*r dialog.

When in the **Display Superelevation** mode, superelevation control lines are displayed. The control lines are color coded for identification purposes only and are not related to slopes. The window also shows the location of the corridor's alignment cardinal stations. The left axis shows the percent slope as it relates to the centerline of the corridor alignment.
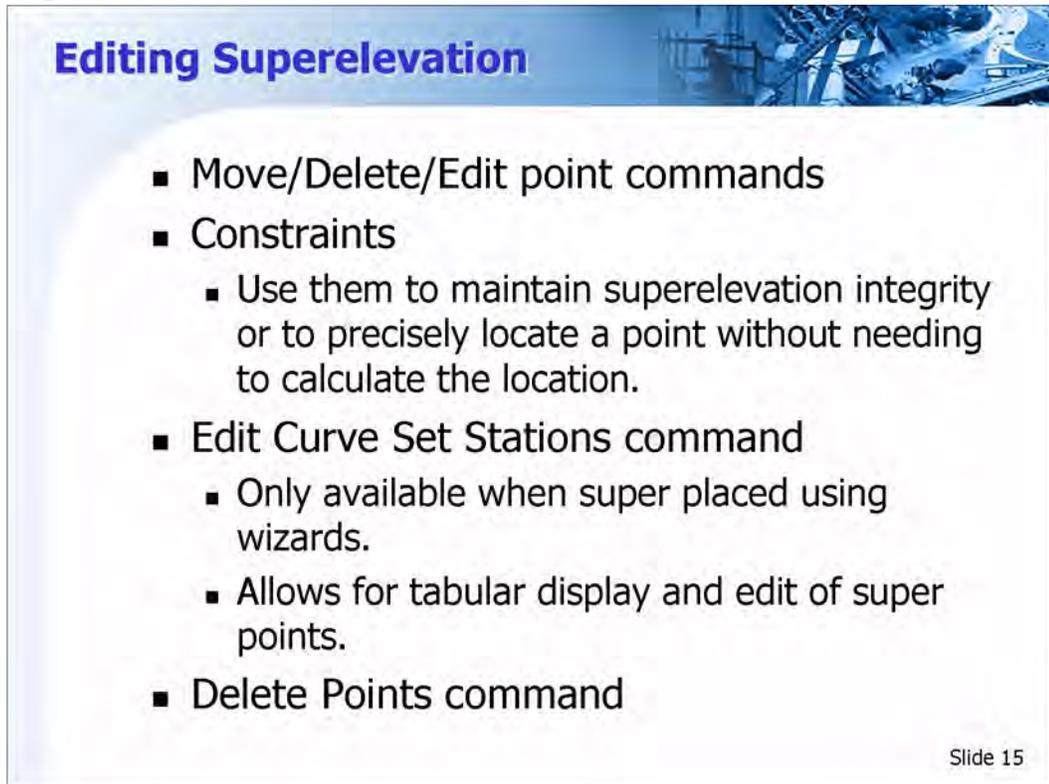
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Editing Superelevation

To edit the superelevation points, double-click on any point on the *Diagram View* to change stations, cross slopes and superelevation types. Superelevation points have constraints, like template points. Editing a constrained superelevation point may affect the location of the other points in the diagram. What you are able to edit depends on which point you select and the constraints on that point.

Another technique to editing superelevation is using the **Edit Curve Set Stations** command. To access the command, right-click on the *Superelevation Diagram View Window* and select the **Edit Curve Set Stations** command. The **Edit Curve Set Stations** shows the superelevation stations and slopes in a tabular form, and allows you to edit superelevation stations and slopes.

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Practice-Editing Superelevation
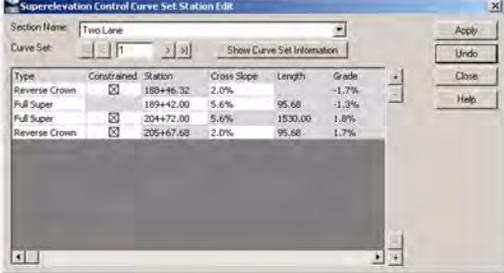
Editing Superelevation Interactively

1   Select **Tools > Options** from the Roadway Designer menu.

2   Enable *Curve Set ID* in the *Display* Area.

3   Click **Ok**.

This will show the ID for each curve in the superelevation diagram view.

4   Adjust the Superelevation View window of the Roadway Designer so the control lines and points are clearly visible for the first curve.

5   **Right Click** on the green point located at Station 189+41, 5.5% cross slope (Full Super). This point belongs to the control line called Two Lane CL LT_EOP

6   Select **Edit Point**.

This will bring up the *Superelevation Point Properties* dialog. Notice the station and the cross slope can be modified here.

7   In the *Edit Point Properties* dialog, use the target button to select the red point at station 189+41 with a -5.5% cross slope (directly below the point that was edited in the previous step). Notice that the Station and Cross slope values cannot be modified. This point cannot be moved because it is constrained to the point above it.

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8 Notice that one of the constraints is *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.

9 Use the **Next** and **Previous** buttons to navigate the Superelevation diagram and observe the point locations as well as the constraints.

Notice all the points are a specified type, i.e. Normal Crown, Reverse Crown, Full Super. When the wizard is used, the type is automatically set but can be modified. The type is used primarily for reporting and display.

10 Close the *Superelevation Point Properties* dialog.

11 Adjust the Superelevation View of the Roadway Designer so that the control lines and points are clearly visible for the second curve.

12 **Right Click** on the green point located at Station 208+38, 5.5% cross slope (Full Super). This point belongs to the control line called Two Lane CL RT_EOP

13 Select **Move Point**.

14 The *Dynamic Settings* dialog box will appear.

15 Enter 1+00 for the Station Step and 1.0% for the Cross Slope Step.

16 Move your cursor in the Superelevation diagram view. Notice that the location is now moving according to the station and cross slope increment specified.This is useful when precision is needed for point placement.

17 **Right Mouse** Click to exit the Move Point command.

Editing Superelevation in Tabular form

1 **Right Mouse** click in the Superelevation Diagram View, and select **Edit Curve Set Stations**.

2 This will bring up the *Superelevation Control Curve Set Edit* dialog.

3 Click the **Show Curve Set Information** button.

4 Click the + button. This will add additional stations that can be modified. Red station text identifies stations beyond the current curve set.

5 Use the < Previous and > Next buttons to navigate to the each curve. Notice a box appears around the points that belong to the current curve set in the diagram view.

6 Click **Close**.

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Creating Single Control Lines

Creating Single Control Lines

Another method for defining superelevation in the Roadway Designer is to define individual control lines. Control lines can be copied from existing lines, or new lines can be created. Once the control line is created, points must be inserted one at a time with a specified station and cross slope. Points of a control line can then be constrained to other points. Since control lines belong to a section, either the name of the parent section that the new line will belong to, or enter a name and a new section will be created.

If you select to copy from another control line, then you can set the maximum cross slope value. When copying from another super control line, a point with the maximum cross slope is inserted at every point where the copied control line has a full super point. A point with a normal crown value is inserted wherever there is a normal crown point in the copied control line.

Once a control line is created, it is displayed. When a control line is created, it has, as a minimum, two points; one at the start station and one at the end station of the corridor.

The name of the point indicates its parent control line name and station. This name is updated as the point is moved. The type can be "Undefined", "Normal Crown", "Super Runoff" (Cross slope of 0%), "Reverse Crown", or "Full Super".

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If you copy another control line when creating a new one, all Normal Crown and Full Super points will be copied and assigned the appropriate types. Normal Crown points are shown by a vertical green line. Super Runoff points are represented by a vertical white line, Reverse Crown by a yellow line, and Full Super by a vertical dark blue line

Basic workflow

- Right-click in the superelevation display window.

- Select Create Single Control Line.

- The Create Superelevation Control dialog box opens.

- At a minimum, enter the new control line name, the parent section name, and a normal crown cross slope.

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Practice-Create New Control Line

Disable the Point Controls

1   Select **Corridor > Point Controls** from the Roadway Designer menu.

2   In the *Horizontal and Vertical Controls* list, Click on each **X** to Disable the point controls, then close the dialog. The ability to disable and enable point controls allow you to evaluate multiple design alternatives within a single corridor.

Turn off the Control Line Display

1   **Right Click** in the Superelevation diagram view and select Superelevation Display list.

2   Click **None**.

3   Click **Apply**, then close the dialog. Notice the control lines for the Two Lane Section are no longer visible.

Create Control Line for the LT_EOP

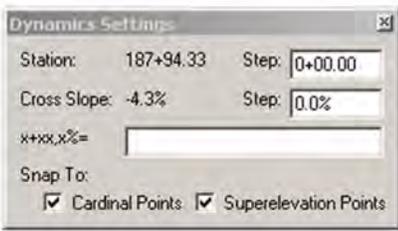1   **Right Click** in the Superelevation Diagram view and select **Create Single Control Line**.

2   In the *Create Superelevation Control* dialog, enter Manual CL-LT_EOP for the Control Line name

3   The *Copy From* should be set to **None**.

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4   Enter **Manual** for the name of the *Parent Section.*

5   Click **OK**. A flat red line should appear in the Superelevation diagram view.

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Inserting/Modifying Points

Inserting/Modifying points

To insert a point, right click on the control line and select Insert point. A new point is inserted at the location of the cursor. You are now able to place the point dynamically. You'll remain in the insert point command until you Reset out of the command.

To modify a point, right click on the point and select the appropriate command (Move Point, Edit Point, Add Constraint, Merge Points, or Delete Point) from the menu.

When inserting or moving a point, the Dynamics Settings dialog box is displayed. This dialog box allows you to set up step values and locks for dynamic locating of points or key in a station and offset. When you type in a station and press the TAB or ENTER key, the point location is updated.
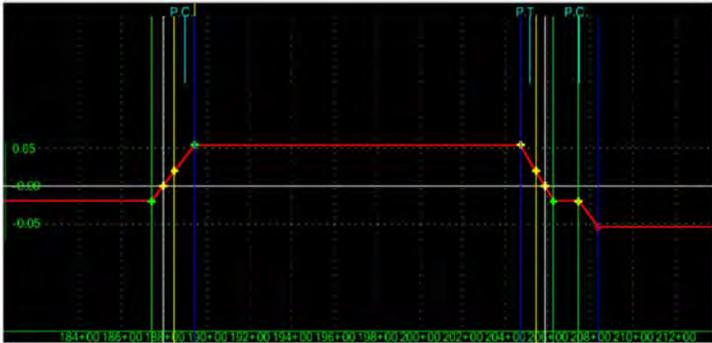
You can also edit the properties of a point. Hover over the point, right-click and select Edit Point from the pop up menu.

You can also edit the properties of a point. Hover over the point, right-click and select Edit Point. The Point Properties dialog. Point Constraints can be added as well as specifying the point type.

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Practice-Insert Points for LT_EOP

Insert Normal Crown and Zero Slope Points

1 **Right Click** on the red line and select **Insert Point**.

   The Dynamic Setting dialog will appear.

2 In the *x+xx,x%* field of the Dynamic Settings enter 187+41.00,-2.0%

3 Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

4 In the *x+xx,x%* field enter 187+94.33,0.0%

5 Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

   If you make a mistake, simply Right Mouse click and select **Undo Last**. You can also use the up arrrow on your keyboard to review previousy entered points.

Insert Reverse Crown and Full Super Points

1 In the *x+xx,x%* field enter 188+47.66,2.0%

2 Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

3 In the *x+xx,x%* field enter 189+41.00,5.5%

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4   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

5   In the *x+xx,x%* field enter 204+72.00,5.5%

6   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

Insert Reverse Crown and Zero Cross Slope

1   In the *x+xx,x%* field enter 205+44.34,2.0%

2   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

3   In the *x+xx,x%* field enter 205+85.67,0.0%

4   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

Insert Normal Crown Points

1   In the *x+xx,x%* field enter 206+27.00,-2.0%

2   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

3   In the *x+xx,x%* field enter 207+44.66,-2.0%

4   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

Insert Full Super Points for the Second Curve

1   In the *x+xx,x%* field enter 208+38.00,-5.5%

2   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

3   In the *x+xx,x%* field enter 225+98.00,-5.5%

4   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

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Insert Normal Crown Points

1   In the *x+xx,x%* field enter 226+91.34,-2.0%

2   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

3   In the *x+xx,x%* field enter 227+98.00,-2.0%

4   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

5   In the *x+xx,x%* field enter 258+92.00,-2.0%

6   Click the Enter key on your keyboard. Move your cursor and notice a point has now been placed.

7   Right Click and select **Finish.** Save the Roadway Design

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Adding Point Constraints

Adding point constraints

Point constraints can be added either through the pop up menu, or on the Superelevation Point Properties dialog box. These point constraints are a subset of the point constraints available when creating templates with one additional constraint: Mirror Cross Slope, which is specific to the Superelevation controls. Available constraints are: Horizontal, Vertical, Slope, Vector Offset, and Mirror Cross Slope.

A point can be constrained to any other point that is in the same superelevation section, but not from one section to another. Constraints can be used to handle things such as planar lock (using the Mirror Cross Slope constraint), Maintaining a transition length (Horizontal constraint), constant Delta G (Slope), or linear transition (Vector Offset).

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Practice-Add Constraints for LT_EOP

Adding Point Constraints for the first curve.

1. Edit the point located at station 187+94.33, 0%
2. Change the *Type* to **Super Runoff**.
3. In the Constraints area, set the *Constraint 1* type to **Vector Offset**.
4. For *Parent 1*, select **Manual CL-LT_EOP 187+41**
5. For *Parent 2*, select **Manual CL-LT_EOP 189+41**
6. Click **Apply**. Notice the point color change to yellow.
7. Edit the point located at station 188+47.66, 2.0%
8. Change the *Type* to **Reverse Crown**.
9. In the Constraints area, set the *Constraint 1* type to **Vector Offset**.
10. For *Parent 1*, select **Manual CL-LT_EOP 187+41**
11. For *Parent 2*, select **Manual CL-LT_EOP 189+41**
12. Click **Apply**. Notice the has changed color from green to yellow.

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13 **Right Click** on the point located at Station 189+41 5.5% and select **Move Point**. Do NOT actually click in the view to move the point to another location, but just move the cursor around and observe how the Super Runoff and Reverse Crown Points behave.

14 Edit the Point located at Station 204+72, 5.5%

15 Change the Type to Full Super.

16 In the Constraints area, set the *Constraint 1* type to **Vertical**

17 For *Parent 1*, Select **Manual CL-LT_EOP 189+41**

18 Set the Constraint Value to 0.0

**Constrain the Points along the exit transition of the first curve.**

1 Edit the point located at Station 205+44.34 2.0%

2 Constrain the point appropriately so that it will occur along the linear transition between the Full Super Point at Station 204+72 and the Normal Crown Point at Station 206+27. HINT: This Point will have two parents.

3 Edit the point located at Station 205+85.67 0.0%

4 Constrain the point appropriately so that, it will move along the linear transition between the Full Super Point at Station 204+72 and the Normal Crown Point at Station 206+27. HINT: This Point will also have two parents.

5 Edit the remaining points for the first curve, and set the appropriate type. ie. Full Super, Reverse Crown, etc.

The points for the second curve will be constrained in a later exercise.

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Practice-Create Control Line for RT_EOP
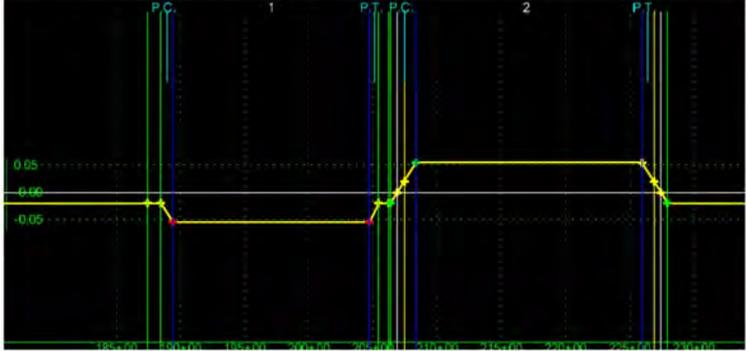
Create Control Line for the RT_EOP

1   **Right Click** in the Superelevation diagram view and select **Create Single Control Line**.

2   In the *Create Superelevation Control* dialog, enter Manual CL-RT_EOP for the Control Line name

3   The *Copy From* should be set to **None**.

4   Enter Manual for the name of the *Parent Section*. Because a control line belongs to a section, any of it's points can be constrained by any other points in that section. The points of a control line cannot be constrained by points from another section.

5   Click **OK**. A flat yellow line should appear in the Superelevation diagram view.

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Use the **Insert Point** command to insert points at the following Station and Cross Slopes

- 187+41.00,-2.000% Normal Crown
- 188+47.66,-2.000% Normal Crown
- 189+41.00,-5.500% Full Super
- 204+72.00,-5.500% Full Super
- 205+44.34,-2.000% Normal Crown
- 206+27.00,-2.000% Normal Crown
- 206+38.00,-2.000% Normal Crown
- 206+91.33,0.000% Zero Cross Slope
- 207+44.66,2.000% Reverse Crown
- 208+38.00,5.500% Full Super
- 225+98.00, 5.500% Full Super
- 226+91.34,2.000% Reverse Crown
- 227+44.67,0.000% Zero Cross Slope
- 227+98.00,-2.000% Normal Crown

Constrain the Points for the first curve

1 Edit the Point at Station 188+47.66, -2% and constrain it Horizontally to the point directly above. The *Type* should be set to **Normal Crown**. The horizontal Value should be 0.0

2 Edit the Point at Station 189+41,-5.5%. Set the *Type* to **Full Super**. Use a **Mirror Cross Slope** Constraint and pick the point directly above it as the parent point. Also Constrain the Point Horizontally to the point directly above. The horizontal Value should be 0.0

Constrain the Points

1 Edit the Point at Station 204+72,-5.5%. Set the *Type* to **Full Super**. Use a **Mirror Cross Slope** Constraint and pick the point directly above it as the parent point. Also Constrain the Point Horizontally to the point directly above.

2 Edit the Point at Station 205+44.34, -2% and constrain it Horizontally to the point directly above. The *Type* should be set to Normal Crown. The Horizontal Value should be 0.0

3 Now constrain the points for the second curve. HINT: Use the point constraints of the previous curve as a guide.

4 Edit the remaining points in the diagram and ensure the appropriate type is set. i.e. Full Super, Reverse Crown, etc.

5 When finished, Save the Roadway design.

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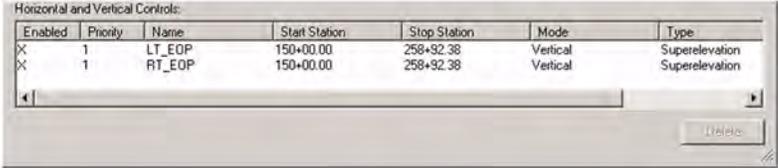
Point Controls

Creating the point control

At any point after the superelevation control line has been created, you can create the point control.

Basic Workflow

- Click Corridor > Point Controls or, select the button.
- Identify the point to be controlled.
- Select Vertical mode.
- Select Superelevation as the Type.
- Select the new control line and identify the pivot (reference point).
- Click Process All to update the entire corridor.

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Practice-Create the Point Controls

Create the Point Control for the LT_EOP

1   Select **Corridor > Point Controls** from the Roadway Designer menu.

2   Select the **Point LT_EOP**

3   Set the *Mode* to **Vertical**.

4   Select **Superelevation** as the *Control Type*.

5   For the *Superelevation Control*, select **Manual CL-LT_EOP.**

6   Pick **CL** as the Reference Point, then click **Add.**

Create the Point Control for the RT_EOP

1   Select the Point **RT_EOP**

2   For the Superelevation Control, select **Manual CL-RT_EOP**

3   Click **Add**, then close the dialog.

4   Click **Process All** and Review the design.

Shoulder Rollover Locks

Shoulder Rollover Locks are used to limit the slope difference between the travel portion of the roadway and the adjacent shoulders during superelevation. This difference is the algebraic difference between the slopes, as a percentage. For example, if the cross slope of the travel portion of the road is -2.0% and the shoulder is -6.0%, then algebraic difference between the slopes is 4.0%.

Superelevation rollover locks are applied after the superelevation has been defined using the *Create Superelevation Wizard*. The limit is set on the high side and low side of the roadway, and is input as an algebraic percentage. When the limit is reached, the travel portion of the roadway and shoulder will move together holding the limiting percentage difference between the roadway and shoulder.

For example, if the road is -2.0% and the shoulder is -6.0%, then setting a high side difference of 6.0% would lock the road and shoulder together when the roadway slope was 0% or greater.

As with superelevation, *Shoulder Rollover Locks* produce template Point Controls that automatically override template point constraints. These

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will show up in the *Point Control* dialog after the *Shoulder Rollover Locks* are created.

Basic Workflow

- Create superelevation using the **Create Superelevation Wizard**.

- Select the **Superelevation > Apply Shoulder Rollover Lock** command. This will bring up the *Apply Shoulder Rollover Lock* dialog.

- Select the *Shoulder Point* from the drop-down list.

- Key-in the *Difference* for the *High Side* and *Low Side* of the shoulders.

- Click the **Apply** button.

- Repeat this for each shoulder.

- Select the **Process All** button and review the design.

- Save the Roadway Design.

Practice-Apply Shoulder Rollover Locks

Apply Rollover Locks

Continue working on the last Practice activity.

1   Select the **Superelevation > Apply Shoulder Rollover Lock** command

2   Key-in 5.0% for the *High Side Difference* and leave the *Low Side Difference* at 0%

3   Change the *Control Line Name* to LT_SHDR Rollover and click **Apply**

4   This will automatically change the *Shoulder Point* from *LT_SHDR* to *LT_GUTTER*

5   Change the *Shoulder Point* to RT_SHDR

6   Change the *Control Line Name* to RT_SHDR Rollover and click **Apply**, then **Close.**

7   Look in the Superelevation view of the Roadway Designer. Notice additional control lines appear.

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Review the Points Controls

1   Select the **Corridor > Point Controls** command and review the new *Point Controls* relating to Superelevation

Notice that since we have two superelevation sections a total of four additional controls for the shoulder were created. Notice they are also a tan color. This happens when there are conflicting point controls.

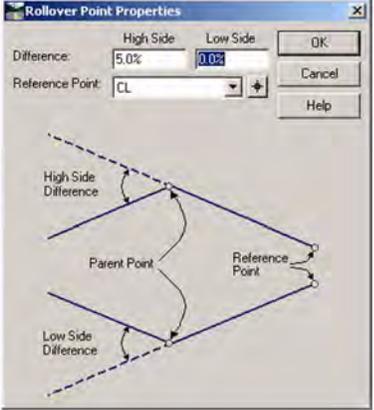2   Disable the Point controls belonging to the Two lane section.

Review the Design

1   **Process All** and review the design

2   Save the Roadway Design

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Shoulder Rollover in the Template

Shoulder Rollover can also be assigned in the Template. This is accomplished by applying rollover values to a point that has a slope constraint. Setting Rollover values in the template can be used as an alternative to the apply shoulder rollover lock command in the Roadway designer. When rollover values are specified in the template, this does not create additional control lines or point controls.

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Practice-Assign Shoulder Rollover in the Template

Continue working from the last practice activity

Copy the corridor.

1   Select **Corridor > Corridor Management**

2   **Copy** the Corridor and name it Rollover, then Close the dialog.

Remove the Section and Point Controls

3   **Right Click** in the Superelevation diagram and select **Superelevation Display List**.

4   **Delete** the Section called **Manual**.

5   Select the **Two Lane** Section and **Delete** the control lines called **Two Lane LT_SHDR** and **Two Lane RT_SHDR**

6   Close the dialog.

7   Select **Corridor > Point Controls**.

8   Enable the two remaining point controls, then close the dialog.

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Assign Shoulder Rollover

1   Select **Corridor > Template Drops**.

2   In the *Current Template Drops* area, select the template drop and click **Edit**.

3   The *Editing Roadway Designer Template Drop* dialog will appear.

4   Edit the point called *RT_SHDR*.

5   For *Constraint 1*, enable the checkbox next to *Parent 2* and click the **Rollover Values** button.

6   In the *Rollover Point Properties* dialog, set the *High Side* difference to 5%.

7   Set the *Reference Point* to CL, then click **OK**.

8   Click **Apply**, then **Close** the dialog.

9   Test the behavior of the template. **Right Click** on the RT_EOP and select **Delete Both Constraints**.

10 **Right Click** on the RT_EOP and select **Move Point**. Do NOT actually click anywhere in the view to move the point to another location, simply move the cursor and observe how the shoulder behaves.

11 Click the Undo button in the bottom left of the view to add the constraints back.

12 Repeat the previous steps to apply the shoulder rollover to the LT_SHDR. Set the High Side difference to 5%. The Low Side difference should be set to 0%.

13 When finished, click **OK**.

14 Notice the name of the template in the Template Drops dialog is now red. This is because a change has been made to the template definition in the corridor, and no longer matches the template in the template library.

15 Close the *Template Drops* dialog.

16 Select **Corridor > Point Controls**.

Notice there are still only two point controls. Also notice there are only two control lines for the LT and RT edge of pavement. One benefit of defining shoulder rollover in the template is there are no additional control lines, and if the shoulder treatment is standard from project to project, the values can be defined directly to the template.

17 Close the *Point Controls* dialog.

18 Click **Process All** and Review the design.

19 **Save** the Roadway Design.

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Import Superelevation from ASCII

Import Superelevation from ASCII
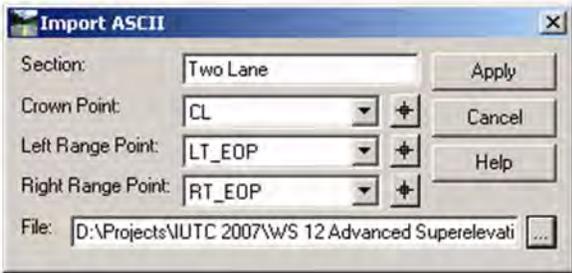
This command creates superelevation control lines and assigns template point controls. The file imports pipe delimited format using the first three values only. Values used are: Station|Finished Grade Left|Finished Grade Right. The corresponding point controls for each control line are automatically created. All the points of the control lines by default are unconstrained.

Basic Workflow

- Create the corridor and assign template drops

- Select **Superelevation > Import Superelevation** from the Roadway Designer Menu. This will bring up the Import ASCII dialog.

- Select the *Crown Point* from the drop-down list.

- Select the *Left Range Point* from the drop-down list.

- Select the *Left Range Point* from the drop-down list.

- Click the **Browse** button and select the appropriate file.

- Click the **Apply** button.

- Select the **Process All** button and review the design.

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Practice-Import Superelevation

Review the ASCII File

1   Launch Notepad and open the file called Super.txt located in folder for this workshop.

2   Review the stations and cross slopes. When finished, exit Notepad.

Copy the corridor

1   Select **Corridor > Corridor Management**.

2   **Copy** the corridor called *Rollover* and name it ASCII

Remove the Section

1   **Right Click** in the Superelevation diagram and select **Superelevation Display list**.

2   **Delete** the Section called **Two Lane**, then close the dialog.

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Import ASCII File

1 **Right Click** in the Superelevation diagram view and select **Import Superelevation**.

2 Name the Section ASCII

3 Select **CL** as the *Crown Point*.

4 Select **LT_EOP** as the *Left Range Point*.

5 Select **RT_EOP** as the *Right Range Point*.

6 Click the **Browse** button on the right

7 Select the file Super.txt and click **Open**.

8 Click **Apply**, then close the dialog.

9 Select **Corridor > Point Controls**. Notice point controls have automatically been created.

10 Close the *Point Controls* dialog.

11 **Process All** and review the results.

12 Close the Roadway Designer.

13 Select **File > Close > All** from the InRoads menu to prepare for the next lesson.

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Import Superelevation from Alignment

Import Superelevation from Alignment

The Import Superelevation from Alignment command is used to import superelevation control lines from an alignment created from a previous version of InRoads. In Prior versions of InRoads, superelevation was stored as a "child" of the horizontal alignment. In order to use this command, the geometry project with the old superelevation definition must be loaded. If an alignment is found then a prompt will display. Point Controls are not automatically created when using this command.

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Multiple Shoulder Rollover
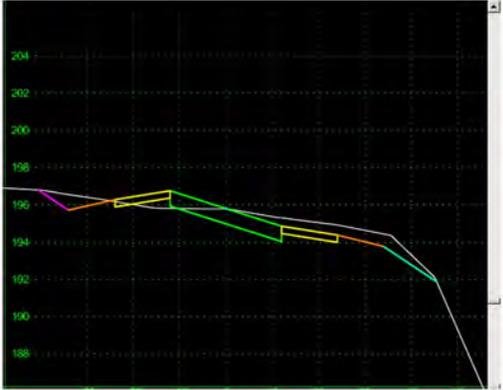
Multiple Shoulder Rollover

In order to use the Apply Shoulder Rollover command, the following criteria must be met.

- It must be a point that has not been supered yet.

- It is next to a point that has been supered or is a pivot point for superelevation

- It is not a pivot point of the adjacent supered point.

- It is not an End Condition point.

The template being used in this example has two shoulders, one paved and one unpaved. Each shoulder has specific rollover requirements. The paved shoulder, when in normal crown has a 4% slope. The unpaved shoulder, when in normal crown has a 6% slope.

First Shoulder Segment-Low Side

Let's assume that the specifications require that the paved shoulder begin rotating when the roadway cross slope is 4% . Therefore, the algebraic difference on the low side should be set to 0%

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First Shoulder Segment-High Side

Let's assume that the specification require that the paved shoulder have a slope difference of 5% on the high side. This means that when the slope of the road is 1%, the shoulder will lock and roate with the road. However, the first shoulder, must not exceed 2% percent, therefore the maximum slope value on the high side should be set to 2% maximum slope.

Second Shoulder Segment-Low Side

Assume that the specification require that the second shoulder must always follow the first shoulder. Therefore, the % difference to specify will be 0% relative to the first segment.

Second Shoulder Segment-High Side

Assume that the specifications require the unpaved segment to have a 3% slope difference on the high side relative to the paved shoulder. This means that when the slope of the paved shoulder reaches 3%, it will lock and rotate. The maximum slope of the second shoulder should be set to -2%

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Practice-Multiple Shoulder Rollover

Multiple Shoulder Rollover

1 Open the file **Examples.rwk** located in the folder for this workshop.

2 Select **Modeler > Roadway Designer**

3 Set the active corridor to **Multiple Shoulder**

4 Click the **Display Superelevation** button in the Roadway Designer.

5 **Right Click** in the Superelevation View and Select **Apply Shoulder Rollover.**

6 The point name should be *NB_S1*.

7 Set the *High Side Difference* to 5%. Enable the maximum slope and key in 2%.

8 Verify that the low side difference is 0%. Click **Apply**

9 Select the point SB_S1. Click **Apply**.

10 Select the point NB_SHDR.

11 Set the *High Side Difference* to 3%. Enable the maximum slope and set it -2%.

12 Verify the low side difference is 0%

13 Click **Apply**.

14 Select the point *SB_SHDR*. Click **Apply**.

15 **Process All** and Review the Results. When finished, Save the design .

Using Superelevation to Control Sideslopes
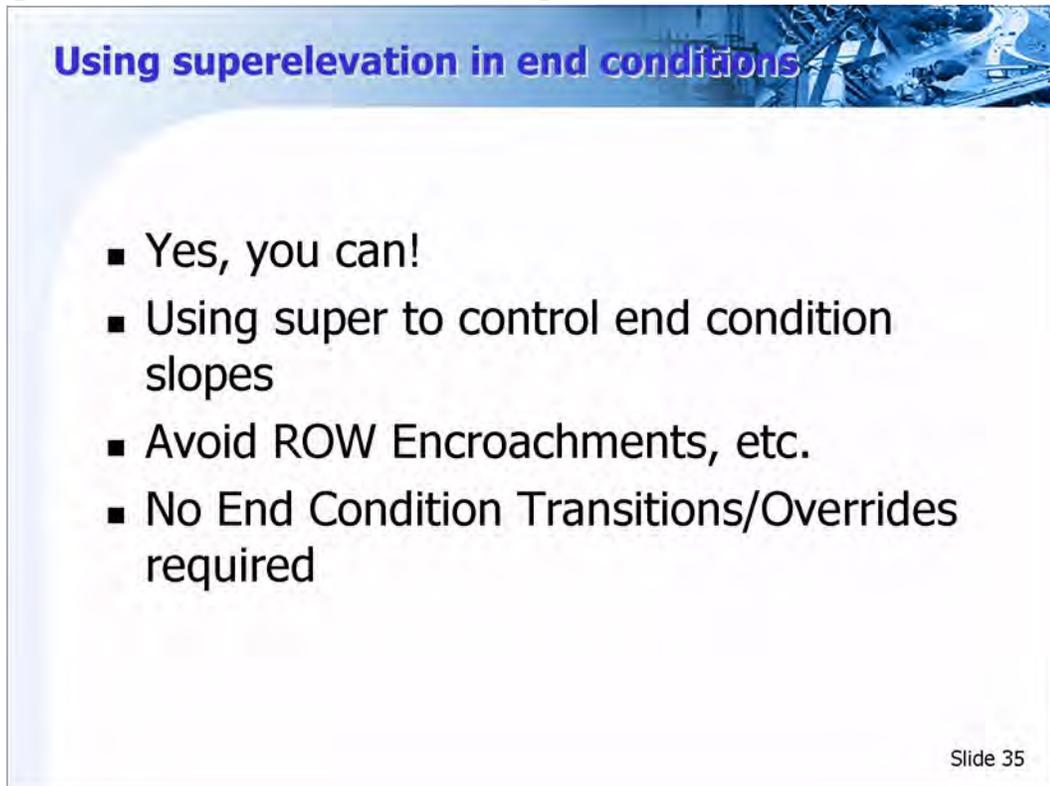
Superelevation control lines can be assigned to any point on a template. This means that control lines can also be an effective method of sideslope control. The control line can be created by using the Create Single Control line command. Once the control line is created, then a point control can be a created to control the desired template point. i.e. RT_Fill.

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Practice-Create Control Line for RT_Fill

Create the Control Line

1 Change the Roadway designer view from Superelevation mode to normal mode. (click on the display Superelevation button.)

2 Set the active Corridor to **Super of Slope.**

3 Look at the cross section at Station 371+60. Notice the right slope is outside of the right-of-way. (The vertical purple line) This can be corrected by using end condition exceptions, but another alternative is to create a control line for the RT_Fill.

4 Click the **Display Superelevation** button.

5 **Right Click** in the Superelevation diagram view and select **Create Single Control Line**.

6 Key In Right Slope for the Control Line *Name*

7 *Copy From* should be set to **None**.

8 Key In Slope for the *Parent Section* name.

9 Key In -50% for the normal crown slope, then click **OK**. Adjust the view so the new control line is visible.

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Move and Insert Points

1   **Right Click** on the first point of the control line that was just created and select Move Point.

2   In the *Station,Slope* field (*x+xx,x%*) Enter 370+60,-50%

3   Click the Enter key on your keyboard.

4   **Right Click** on the last point and select **Move Point**

5   In the Station,Slope field (x+xx,x%) Enter 372+30,-50%

6   Use the **Insert Point** command to insert points at the following station, cross slope

•   371+10, -60%

•   371+80, -60%

7   **Save** the Roadway Design.

Assign the Point Control

1   Select **Corridor > Point Control**

2   Select the Point *RT_FILL 2*

3   For the *Mode*, select **Vertical**

4   Set the Control Type to **Superelevation**.

5   For the Superelevation, select **Right Slope**

6   For the *Reference Point*, Select *NB_Outside_SHDR*.

7   Click **Add**, then close the dialog.

8   **Process All** and Observe the Results. Look at the cross section at station 371+60. The right slope should now be inside the right of way.

9   When Finished, Exit InRoads and MicroStation.

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