



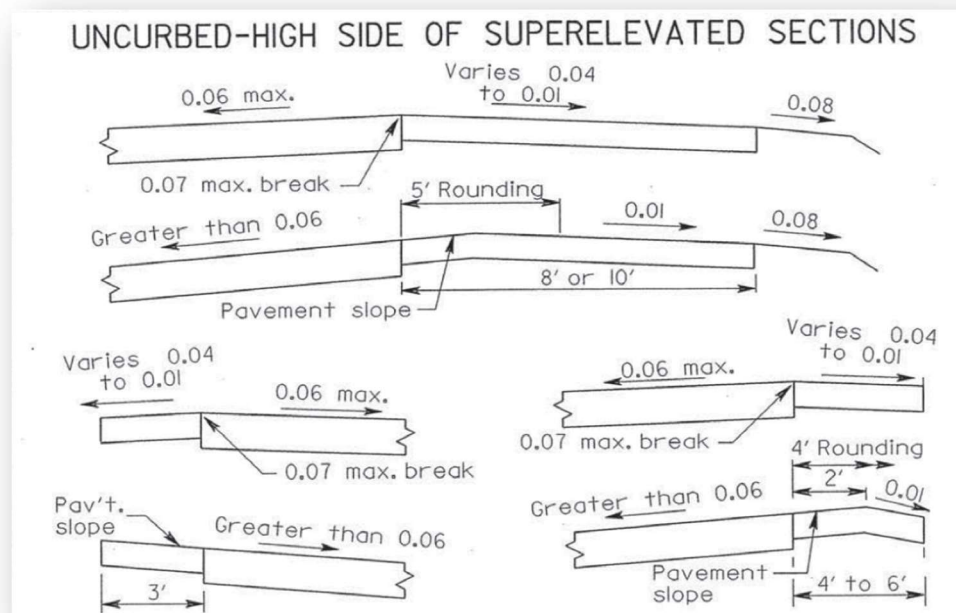
OpenRoads Design: Superelevation

Superelevation

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.

Pavement slopes are initially defined in the template. Superelevation is created and applied after the corridor is defined and the template drops have been assigned. This chapter will detail how superelevation is computed with OpenRoads as well as how to accurately model the shoulder break for the high side of Superelevation as defined in the Location and Design Manual, Volume 1, Roadway Design, Figures 301-8E, 301-9E, and 301-10E using the Table Wizard with ODOT's ASCII Superelevation Tables.

For this example, we will reference the shoulder break for uncurbed roadways defined in **Figure 301-8E** shown below.



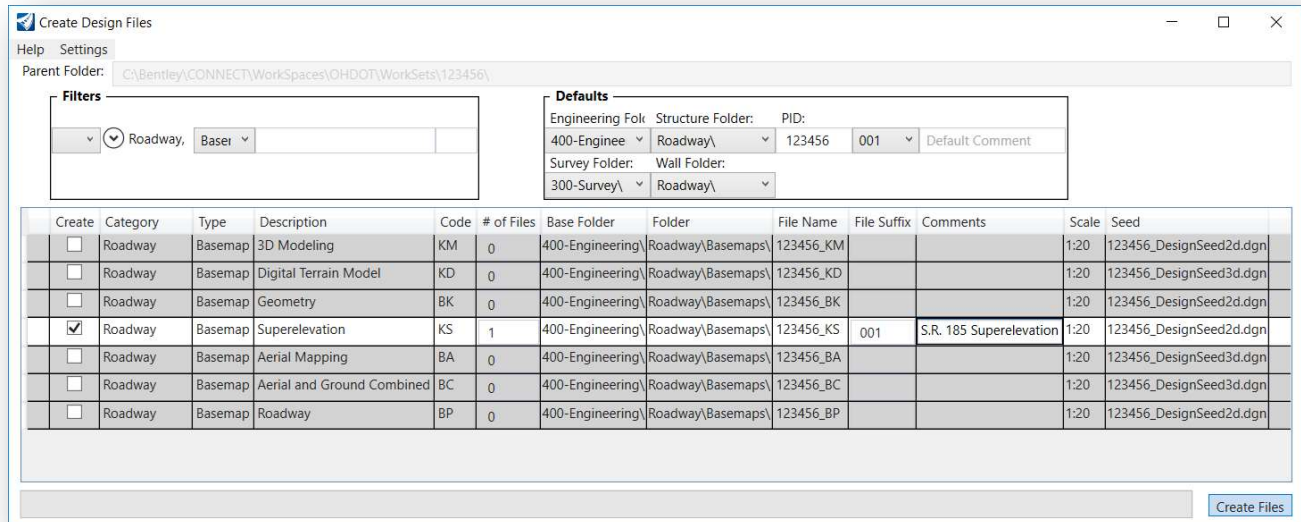
The behavior for the low side of superelevation is easily facilitated by applying a **Rollover Lock** to the shoulder point in the template definition.

The high side of superelevation presents some challenges. For pavement slopes greater than 3%, the shoulder slope maintains a 7% maximum break. This can also be facilitated with the **Rollover Lock** parameter in the template point properties. If the pavement slope exceeds 6%, a 2' break is introduced. Modeling this behavior cannot be modeled using the rollover lock. This chapter will document the procedure to model the superelevation using the ODOT template library.



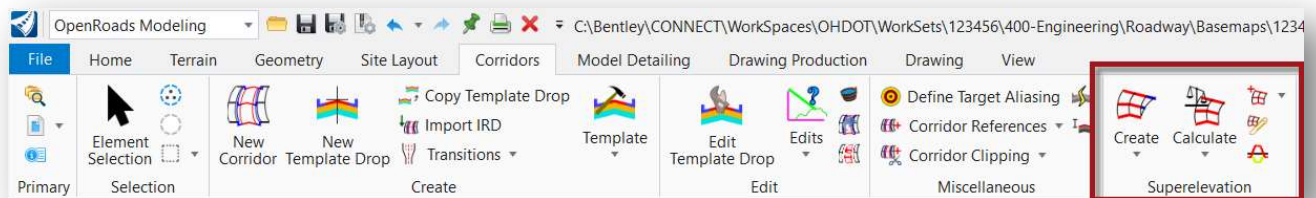
Superelevation Design Files

Superelevation graphics for each alignment are normally be placed in a separate “KS” design file. The **OHDOT Create Design files** application is used to create superelevation design files for the project as shown below.














Applying Superelevation to a Corridor

The Superelevation tools are located under the **Corridors** tab, as shown below.



The following tools are available:

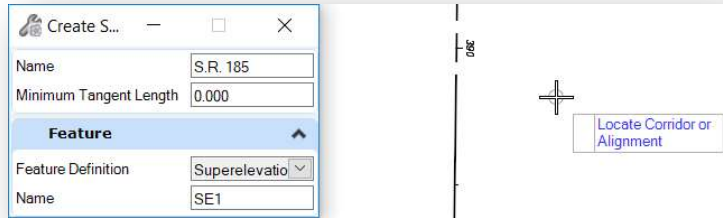
- Create Superelevation Sections 
- Create Superelevation Lanes 
- Create Superelevation Lanes by Road Template 
- Calculate Superelevation 
- Edit Superelevation rule File 
- Open Superelevation View 
- Import Superelevation 
- Assign to Corridor 
- Insert Station Cross-Slope 
- Superelevation Editor 
- Superelevation Report 

See the online help for tools not covered in this training guide.



Create Superelevation Sections

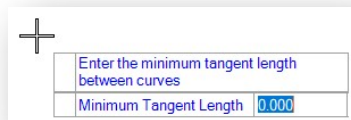
When the **Create Superelevation Section** tool is accessed, the user is prompted to enter a **Name** for the superelevation section. After accepting the Name, the user is next prompted to select the alignment as shown below.



Select the **Superelevation** feature definition from the ODOT library.

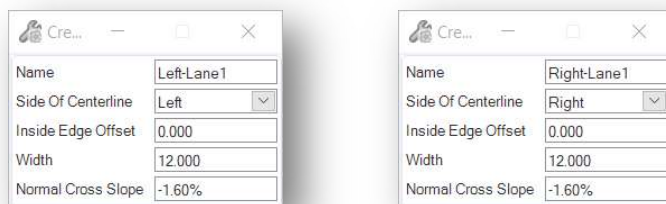
After the alignment is selected, enter the **Start** and **End Stations** for the superelevation definition. Use the <ALT> key to lock the values to the beginning and end of the selected alignment.

When prompted, enter a **Minimum Tangent Length** value of 0. If the tangent distance between two adjacent curves is less the specified value, the two curves and adjacent tangent are included in a single superelevation section. If the tangent distance between two adjacent curves is greater the specified value, each curve and half of the adjacent tangent are included into each superelevation section. Enter a value larger than the total alignment length to create a single superelevation section.



ODOT recommends using a value of 0 to create a separate superelevation section for each curve set.

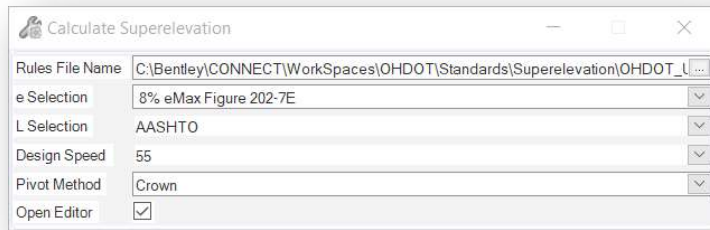
The user is next prompted to define the pavement lanes for the roadway. Each lane is entered like the example below. Reset (right-click) after defining all of the pavement lanes.



After the lanes have been defined, the user is prompted to select the superelevation rules file. Two rules files are provided as part of the OHDOT standards.

- OHDOT_Divided.xml
- OHDOT_Undivided.xml

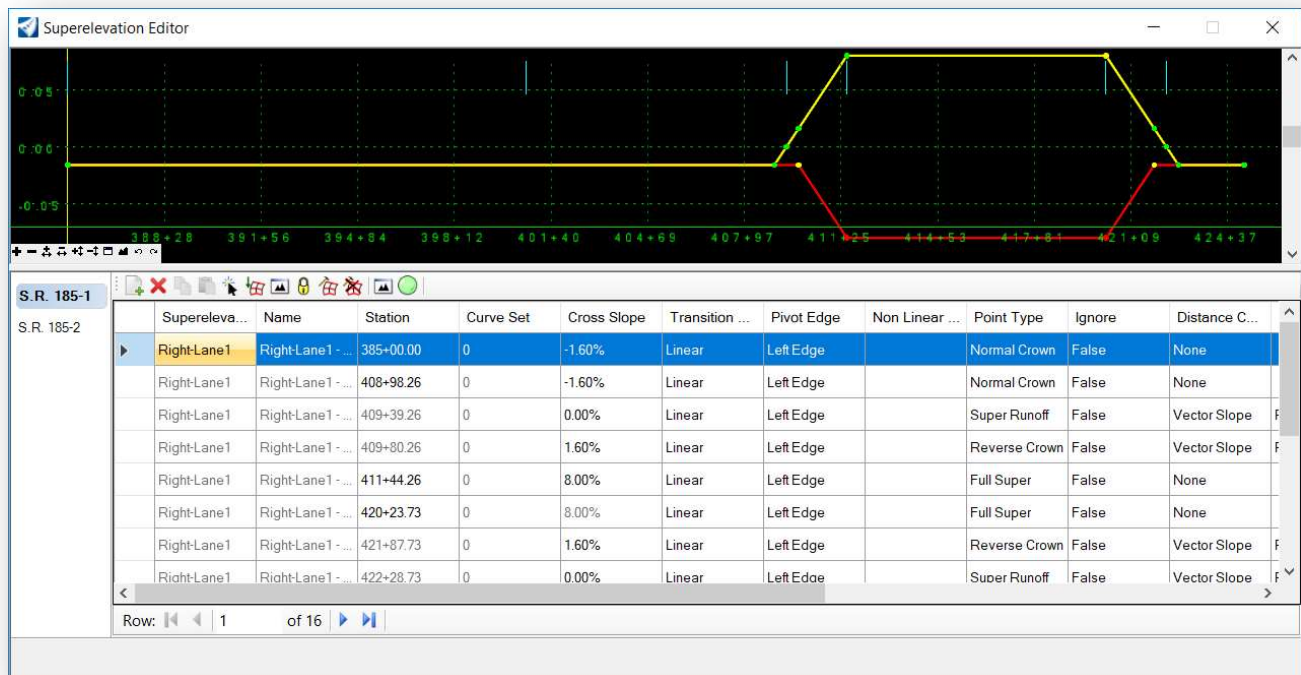
Select the appropriate file for the project.



Set the remaining parameters appropriately for the project.

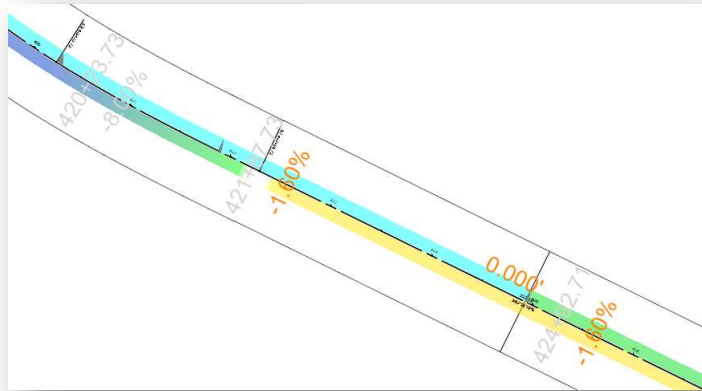
Note: The ODOT Superelevation Rules Files are provided as a starting point for the superelevation computation. It is the responsibility of the designer to review and adjust the values as necessary for the project.

If the **Open Editor** parameter is toggled on, the *Superelevation Editor* dialog is opened like the example below.



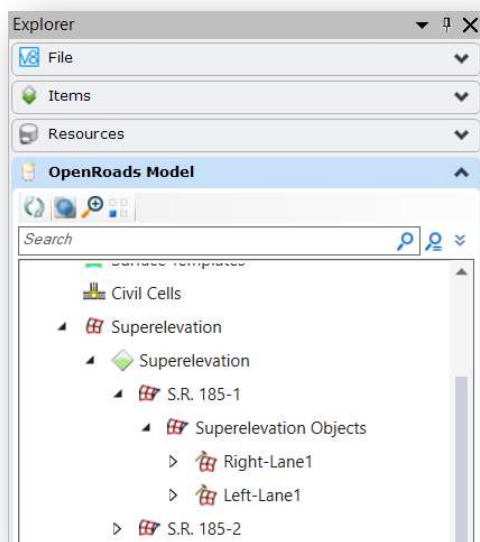
This dialog is used to review and edit the superelevation parameters. See the online help for information on the Superelevation Editor dialog.

The superelevation rules can also be reviewed and edited by selecting one of the pavement lanes as shown below. Each of the text items designating the station and cross slope can be edited by selecting the text.



Superelevation values can also be reviewed and edited in the Properties dialog when the Superelevation Section graphic is selected.

Superelevation values can also be edited in the *Explorer* dialog's **OpenRoads Model** tab as shown below.



Selecting a superelevation shape, as shown at right, allows you to access a menu with the following commands:

- Properties
- Insert Superelevation Station/Cross Slope
- Create Single Control Line
- Apply Shoulder Rollover Lock
- Delete



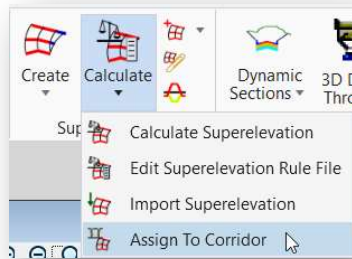
See the online help for more information on these commands.



Assign Superelevation to Corridor

After the superelevation values have been computed, the next step in the process is to assign the superelevation sections to a corridor. Before assigning the superelevation to the corridor, it is necessary to attach the reference file containing the superelevation definition (KS file) to the corridor model (KM file).

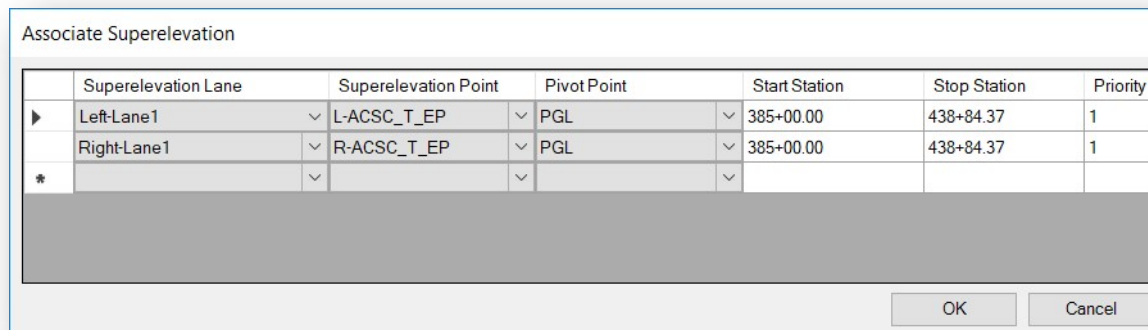
After the reference file containing the superelevation definition has been attached, it can now be assigned to the corridor. From the Corridor tab, choose the **Calculate > Assign to Corridor** command.



When prompted, select each superelevation section that you wish to apply to the corridor. Reset (right-click) after selecting each superelevation section.

When prompted, select the corridor.

After the sections and the corridor have been identified, the *Associate Superelevation* dialog is opened. This dialog is used to associate specific points in the template to the superelevation lanes.



In the example above, the **Superelevation Lane Left-Lane1** and **Right-Lane1** are shown. The objects default to the points that have been identified with the **Superelevation Flag** toggled on in the template definition.

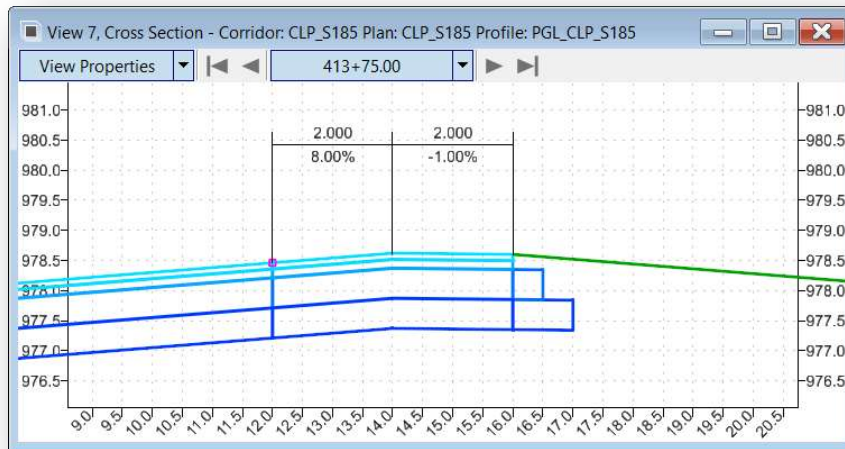
After reviewing and making any corrections to the assigned points for each lane, select **OK** to apply the superelevation to the corridor.

The model is automatically updated with the superelevation values, which override the cross slopes defined in the templates.

Superelevation is applied to the pavement lanes. The shoulder slope is controlled by the rollover lock values defined in the template.



The example below shows a cross section view displaying the slopes for the shoulder roll-over for the high side of superelevation using the OHDOT template.





Import Superelevation from CSV file

Many users may prefer to create a csv file with the superelevation transition information rather than use one of the xml files provided by ODOT to compute the superelevation values.

See the online help for a complete listing of all available parameters for CSV file import. The minimum required parameters will be discussed in this document.

The file format of the comma separated values file containing the required information is as follows:

Superelevation Lane, Station, Cross Slope, Pivot About

| Data | Description |
|--------------------------|--|
| Superelevation Lane Name | Required – Links the data to an existing superelevation lane, therefore, the name in the CSV file must match the lane names created prior to importation. |
| Station | Required - Station where cross slope is defined. |
| Cross Slope | Required - Cross slope at the specified station formatted as a double value: (-2% = -0.02). |
| Pivot About | Required - Identifies which edge to pivot about. Generally, if you are rotating about the center line, the right lane would pivot about the left edge (LS) while the left lane would pivot about the right edge (RS). LS = left side (edge) RS = right side (edge) |

Example input:

```
Right-Lane1,386+25,-0.016,LS
Right-Lane1,408+98.26,-.016,LS
Right-Lane1,409+39.26,0.00,LS
Right-Lane1,409+80.26,0.016,LS
Right-Lane1,411+44.26,0.080,LS
```

The workflow to import superelevation from a CSV file is as follows:

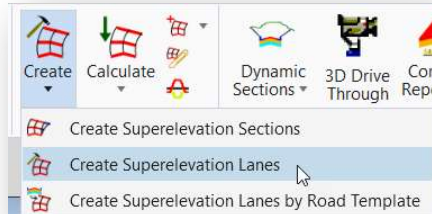
1. Create the CSV file, based on file format.
2. Create superelevation section and lanes, ensuring the lane names match those used in the CSV file.
3. Select the Import Superelevation tool.
4. Follow the heads-up prompts to choose the Superelevation Section and the CSV file to import.



Adding Addition Lanes

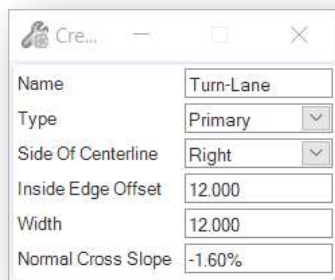
Additional lanes can be added to an existing superelevation section by use of the **Create Superelevation Lanes** command.

From the **Corridor** tab, select **Create > Create Superelevation Lanes**.



When prompted, select the superelevation section to create additional lanes.

The parameters for the superelevation lane are shown below.



Define a **Name** for the lane definition.

Two values are supported for the **Type** parameter:

- **Primary** lanes - a normal cross slope is specified when the lane is defined and then the cross slope is calculated from the superelevation rate file or imported from a CSV file when the superelevation is calculated. Primary lanes extend the entire length of a section. The begin and end stations are defined by the section. Primary lanes are generally the through lanes that extend throughout the project.
- **Auxiliary** lanes - the cross slope is a fixed user-specified value or is automatically set to match an adjacent superelevation lane. Auxiliary lanes have a user-specified begin and end station but must be within a single section. Auxiliary lanes are lanes that are added and dropped along the alignment such as turn lanes.

When the **Type** is set to **Auxiliary**, the dialog is adjusted to reflect the parameters shown below:

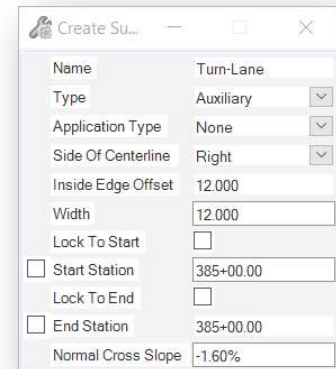


The **Application Type** parameter is used to define how the cross slope will be defined. The parameter can be set as follows:

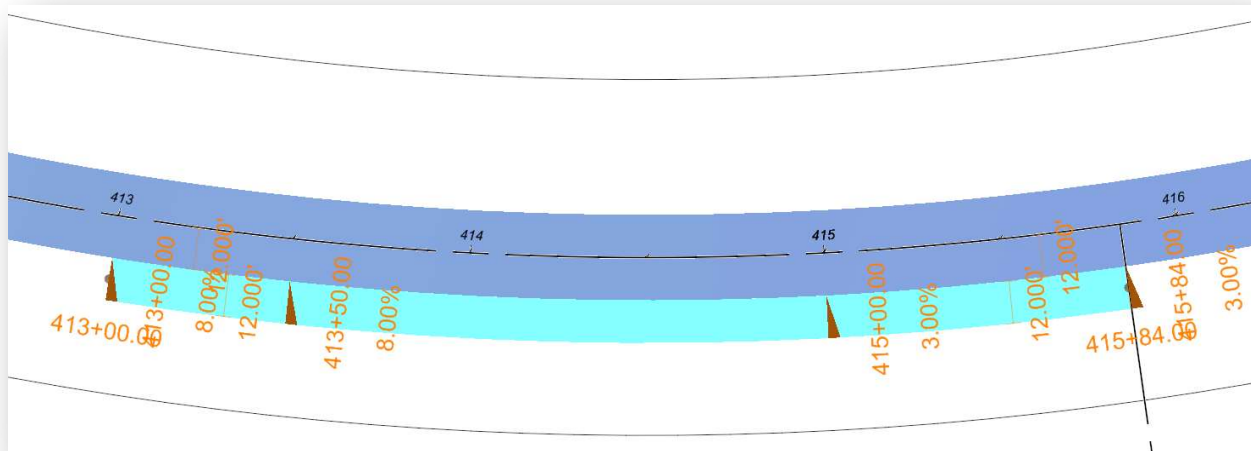
None - no cross slopes are assigned. Use this option if the cross slopes will be defined by importing a CSV file with the superelevation values.

Constant - Fixed slope of specified value. If lane is transition, use this option, then modify one end in the editor or graphically after creation.

Follow Adjacent - This option projects cross slopes from the adjacent lane to this lane.



In the example below, an **Auxiliary** lane was defined for a turn lane. The cross slopes were defined by importing a CSV file with the values.





OpenRoads Software Version

This document was prepared using the following software version:

OpenRoads Designer CONNECT Edition – 2021 Release 1 Update 10 – Version 10.10.01.03

This document was updated using the following software version:

OpenRoads Designer CONNECT Edition – 2021 Release 2 Update 10 – Version 10.10.21.04

Contacts

For any questions, suggestions, or problems with this document please contact the ODOT Office of CADD and Mapping Services by use of the following form on the ODOT website:

https://odot.formstack.com/forms/cadd_servicerequest
