

# Preparing for the New Superelevation Standards in the Connect Edition

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# A Look Back

**GEOPAK** - \*.sep

**InRoads** - \*.sup

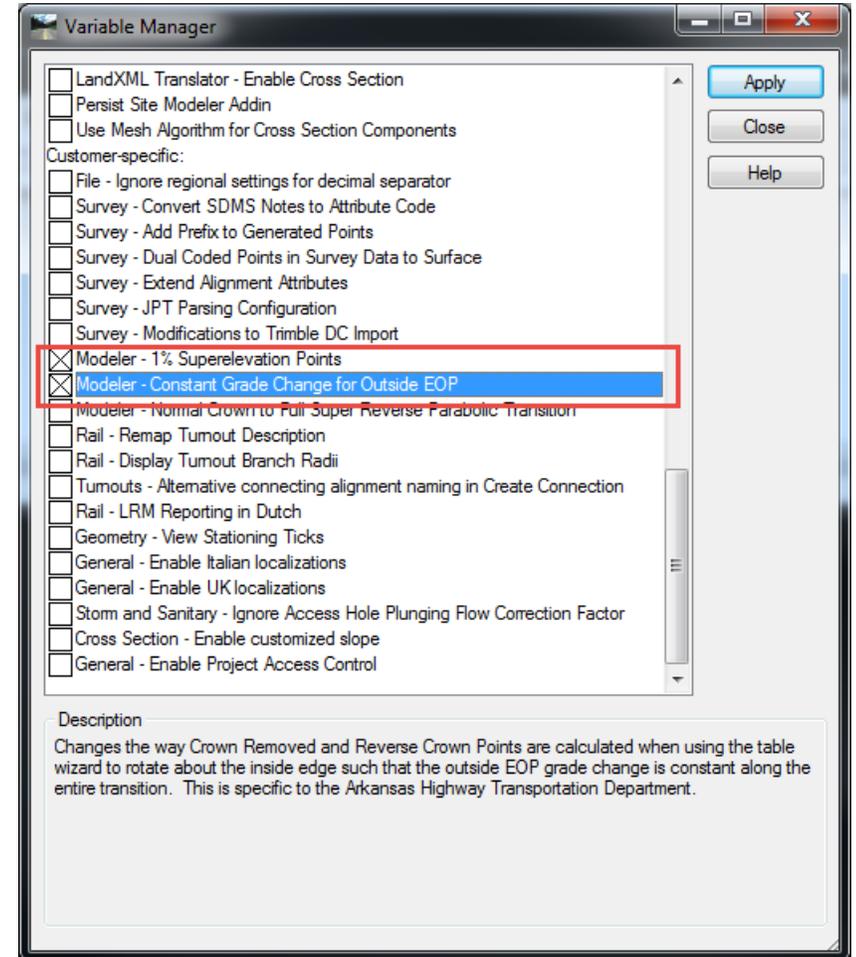
**MX** - \*.srl



50 states in the United States = 51 ways of doing super  
196 countries in the world = to many ways to count

# Requirements for NEW Superelevation

- Include **ALL** legacy functionality
- Customizable
  - Formulas & Tables
  - Key Stations
  - User Defined Inputs
- Can be modified by the “Average User”
  - Universal Format
  - Editing Tool
  - Customizable without a Developer

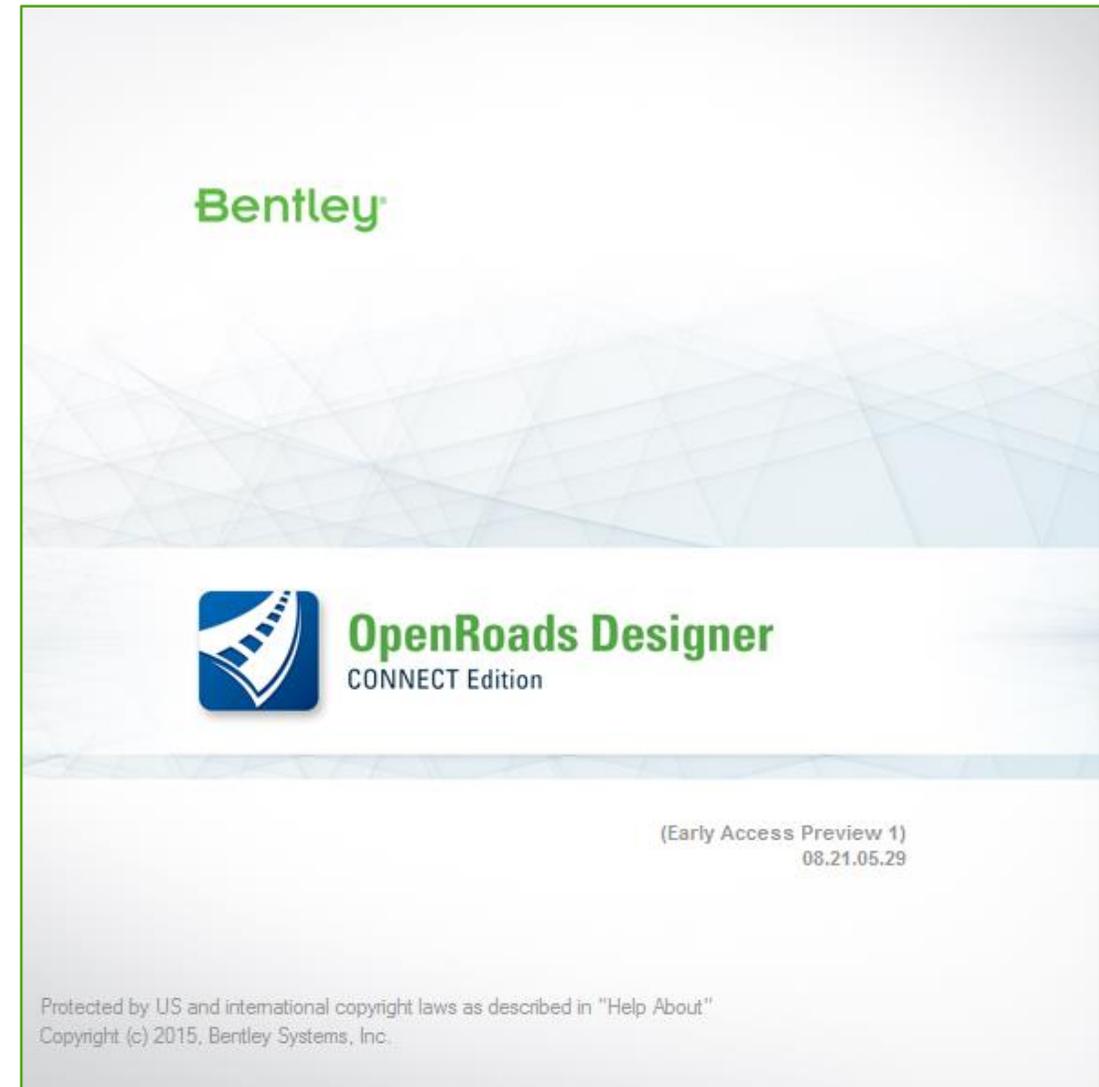


# Currently

## OpenRoads Designer CONNECT Edition

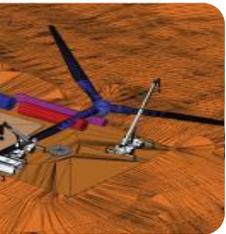
### EAP – December 2016

### Commercial Release – 2017



# Superelevation Process

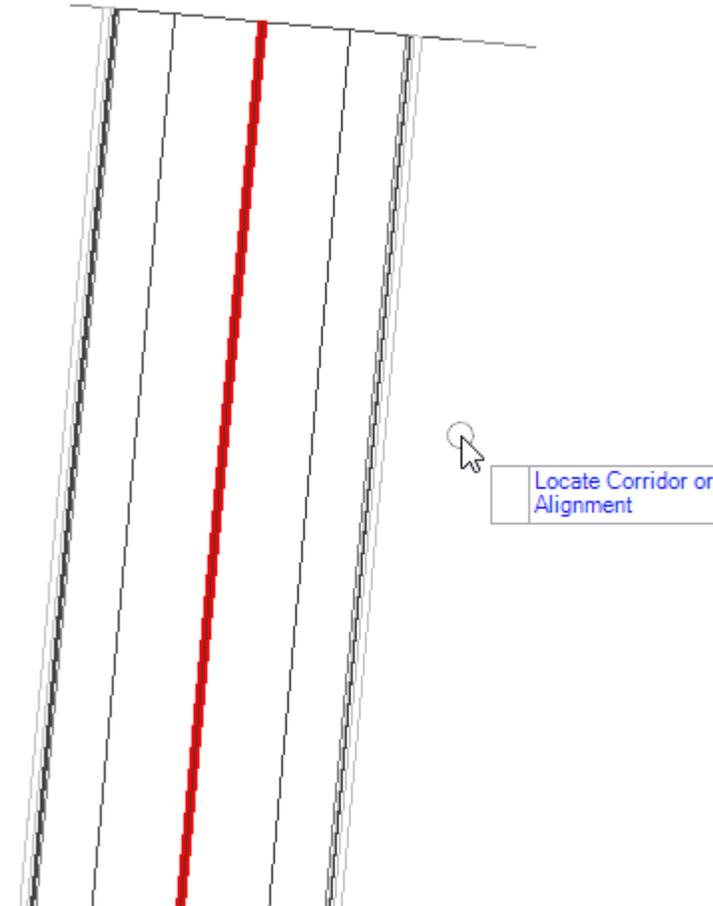
1. Create Superelevation Section
2. Create Superelevation Lanes
3. Calculate Superelevation
4. Assign to Corridor



# NEW Technology and Tools

# One Step Superelevation

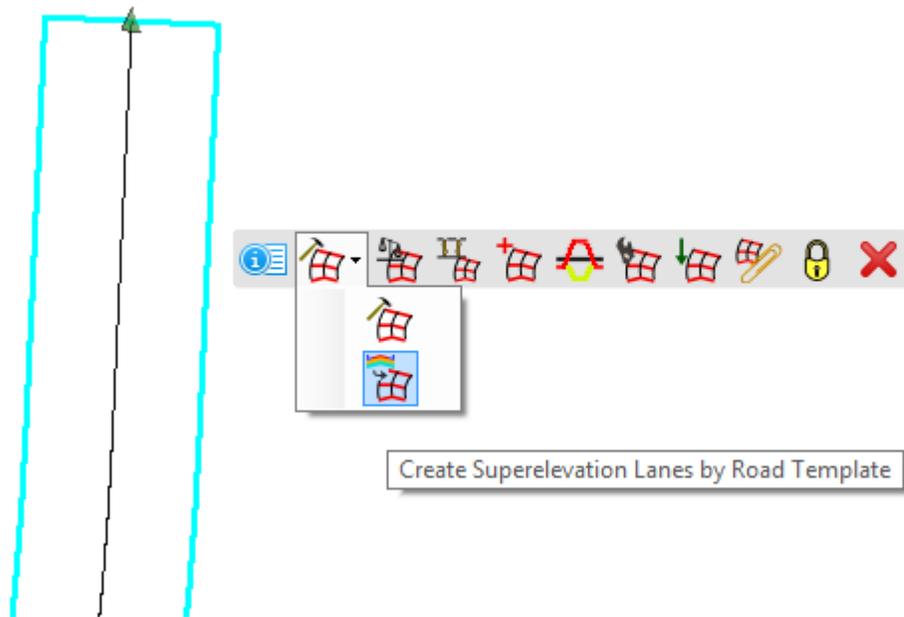
- When creating the Superelevation section(s), **pick the Corridor instead of the Alignment**
  - Creates Superelevation Sections
  - Creates Superelevation Lanes
  - Calculates Superelevation
    - Uses 'default settings'
  - Assigns to Corridor
    - *Corridor must be in the same file.*



# Superelevation Lanes by Template

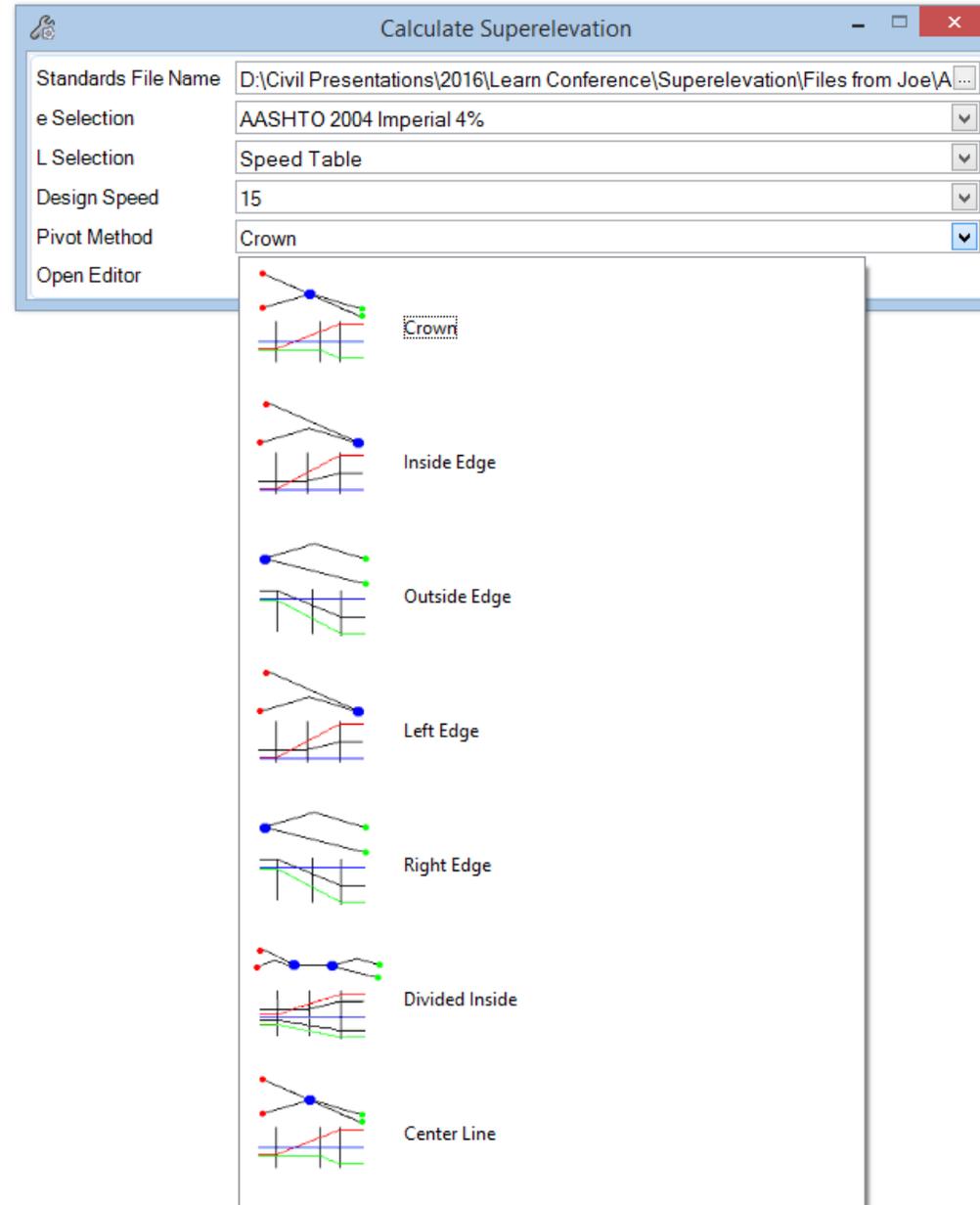
Creates lane configurations based on templates

- Uses Superelevation points in template to identify lanes



# Pivot Methods

**All** Legacy Pivot Methods now supported



# Superelevation Calculation Report

## Superelevation Calculation Report

Report Created: Friday, November 4, 2016  
Time: 5:18:22 PM

File Name:  
Input Grid Factor:

Note: All units in this report are in meters unless specified otherwise.

---

Section Name: Lanes by Template-1  
 Base Horizontal Name:  
 Standards Filename: C:\ProgramData\Bentley\OpenRoads Designer CONNECT 10.00.00\Configuration\WorkSpaces\OpenRoads - Metric\Standards\Superelevation\Metric.xml  
 Design Speed: 120  
 Pivot Method: Divided Inside  
 E Selection: 10%  
 L Selection: Speed Table  
 Calculation Units: meter

---

Lane Set: 1  
 Left Offset: -40.66  
 Right Offset: -33.34  
 Curve Set: 1      Outside Lane: EOP\_RM - CL\_L      Start Station: 0+000.000      End Station: 0+000.000

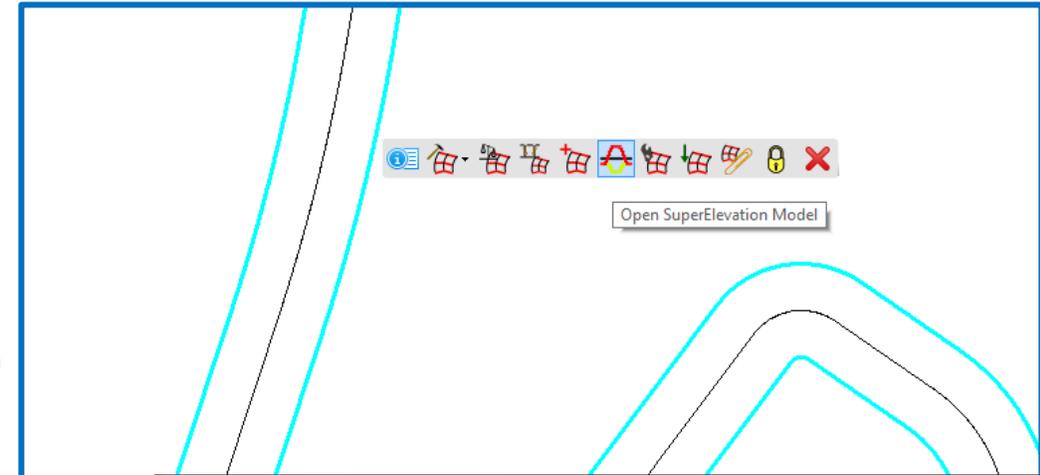
---

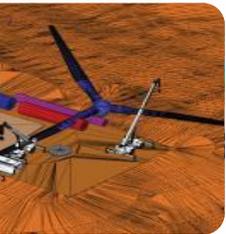
Global Variables:

NRotatedLanes	2.0
PivotType	5 (Divided Inside)
WidthLane	3.657607319
InitialCrossSlope	-0.0199999998961069
UseSpiralLength	false
PercentOnTangent	0.7
LengthsAreTotalTransition	false
UseRunoutLength	false
Radius	462

# Superelevation Model

- Super Diagram in a managed model (e.g. *profiles, cross sections*)
- Editable
- Rules/Relationships



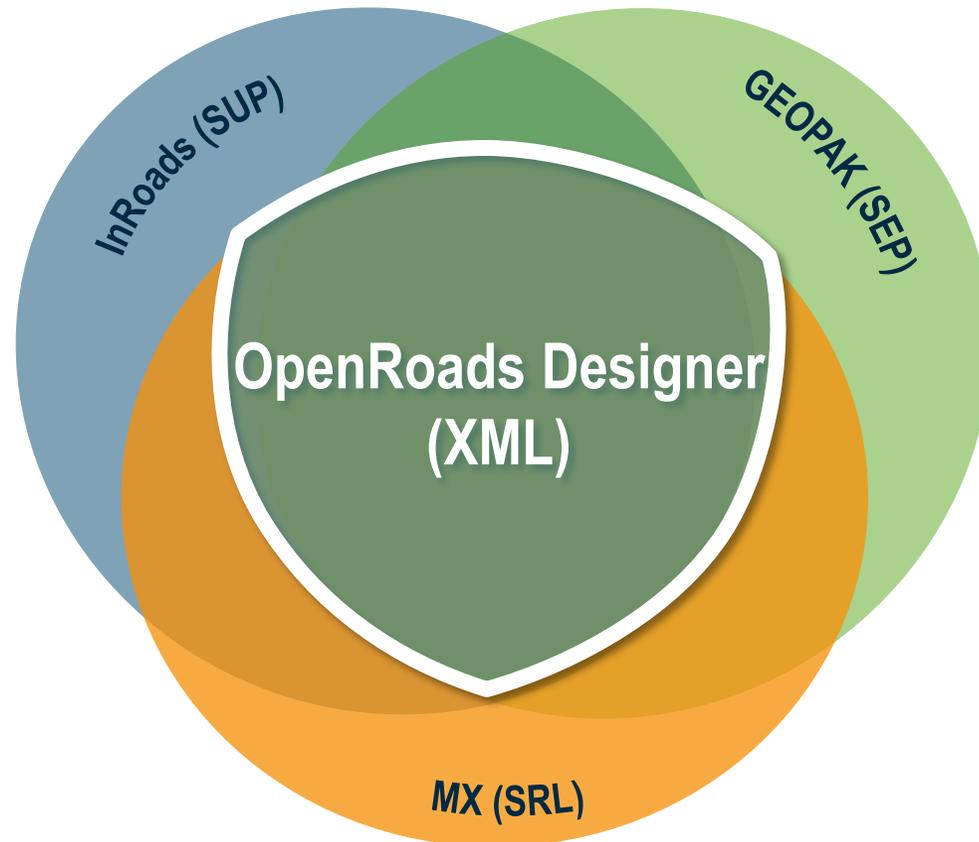


# Superelevation Rules File

# Superelevation Rules File

Replaces all former preference files

XML Format



# Superelevation Rules File

- **Everything** is in the XML
  - No other files required
- Edit through Interface or any XML editor

The image shows a software interface for editing a superelevation rules file. On the left, an XML editor displays the file's structure with a tree view and a code view. The tree view shows a root element 'OpenRoadsSuperelevationRules' containing 'Metric\Standards' and 'Rate Calculations'. The code view shows the XML content, including a 'DesignSpeed' element and a 'RateTable' with multiple 'RateEntry' elements. On the right, a dialog box titled 'Create/Edit Superelevation Rule File' is open. It has a 'General' tab and a 'Rate Calculations' sub-tab. The 'XML File' field is set to 'Standards in the CONNECT Edition\Metric.xml'. The 'Units' section shows 'Length' set to 'Meters', 'Station Rounding Value' set to '1', and 'Cross Slope Rounding Value' set to '0.01'. The 'Default Settings (optional)' section includes 'e Selection' set to '12%', 'L Selection' set to 'Speed Table', 'Pivot Method' set to 'Crown', and 'Design Speed' set to '40'. There are 'Save' and 'Cancel' buttons at the bottom right, and a 'Display XML File' checkbox at the bottom left.

# General

- Units
- Rounding Values
- Default Settings
  - For “One Step” Superelevation

Create/Edit Superelevation Rule File

XML File:

Units

Length:  Station Rounding Value:

Cross Slope Rounding Value:

Default Settings (optional)

e Selection:

L Selection:

Pivot Method:

Design Speed:

Display XML File

```
<Units length="meter" stationRoundingValue="1" crossSlopeRoundingValue="0.01" />  
<DefaultSettings eSelection="12%" lSelection="Speed Table" designSpeed="40" pivotMethod="Crown" />
```

# Rate Calculations

## Create Rate Tables

- Create Manually
- Import from SUP or SEP

General  
Rate Calculations  
Transition Calculations  
Transition Options  
Custom Key Stations  
User Variables

Create Rate Tables     From SUP Files     From SEP File

File(s) Location:

Note: This will change the file(s) location.

Create Rate Equation

Equations:

Display XML File

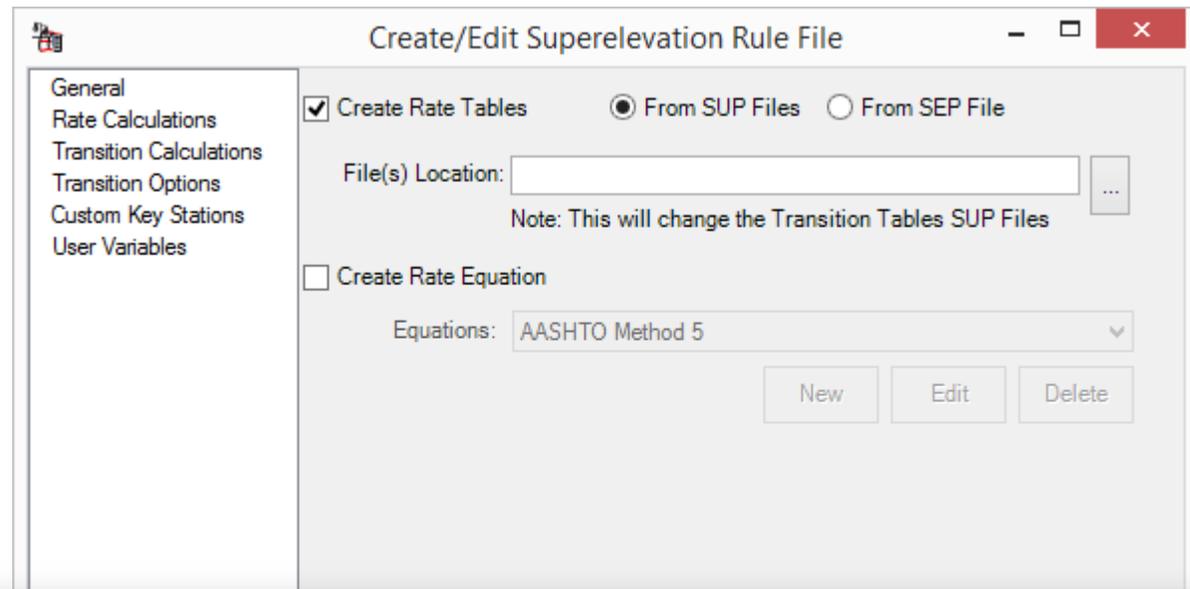
```
<MaximumERateCalculations>
  <RateTable name="4%">
  <RateTable name="6%">
  <RateTable name="8%">
  <RateTable name="10%">
  <DesignSpeedRateTable speed="100">
  <DesignSpeedRateTable speed="110">
  <DesignSpeedRateTable speed="120">
    <RateEntry radius="7000" eRate="nc" />
    <RateEntry radius="5000" eRate="nc" />
    <RateEntry radius="4960" eRate=".015" />
    <RateEntry radius="3700" eRate=".020" />
    <RateEntry radius="3360" eRate=".022" />
    <RateEntry radius="3070" eRate=".024" />
    <RateEntry radius="2830" eRate=".026" />
    <RateEntry radius="2620" eRate=".028" />
    <RateEntry radius="2440" eRate=".030" />
    <RateEntry radius="2280" eRate=".032" />
    <RateEntry radius="2140" eRate=".034" />
    <RateEntry radius="2020" eRate=".036" />
    <RateEntry radius="1910" eRate=".038" />
    <RateEntry radius="1810" eRate=".040" />
    <RateEntry radius="1720" eRate=".042" />
    <RateEntry radius="1640" eRate=".044" />
    <RateEntry radius="1560" eRate=".046" />
    <RateEntry radius="1490" eRate=".048" />
    <RateEntry radius="1430" eRate=".050" />
    <RateEntry radius="1370" eRate=".052" />
    <RateEntry radius="1320" eRate=".054" />
    <RateEntry radius="1270" eRate=".056" />
    <RateEntry radius="1220" eRate=".058" />
    <RateEntry radius="1180" eRate=".060" />
    <RateEntry radius="1140" eRate=".062" />
```

# Rate Calculations

## Create Rate Tables

- Create Manually
- Import from SUP or SEP

## Create Rate Equations



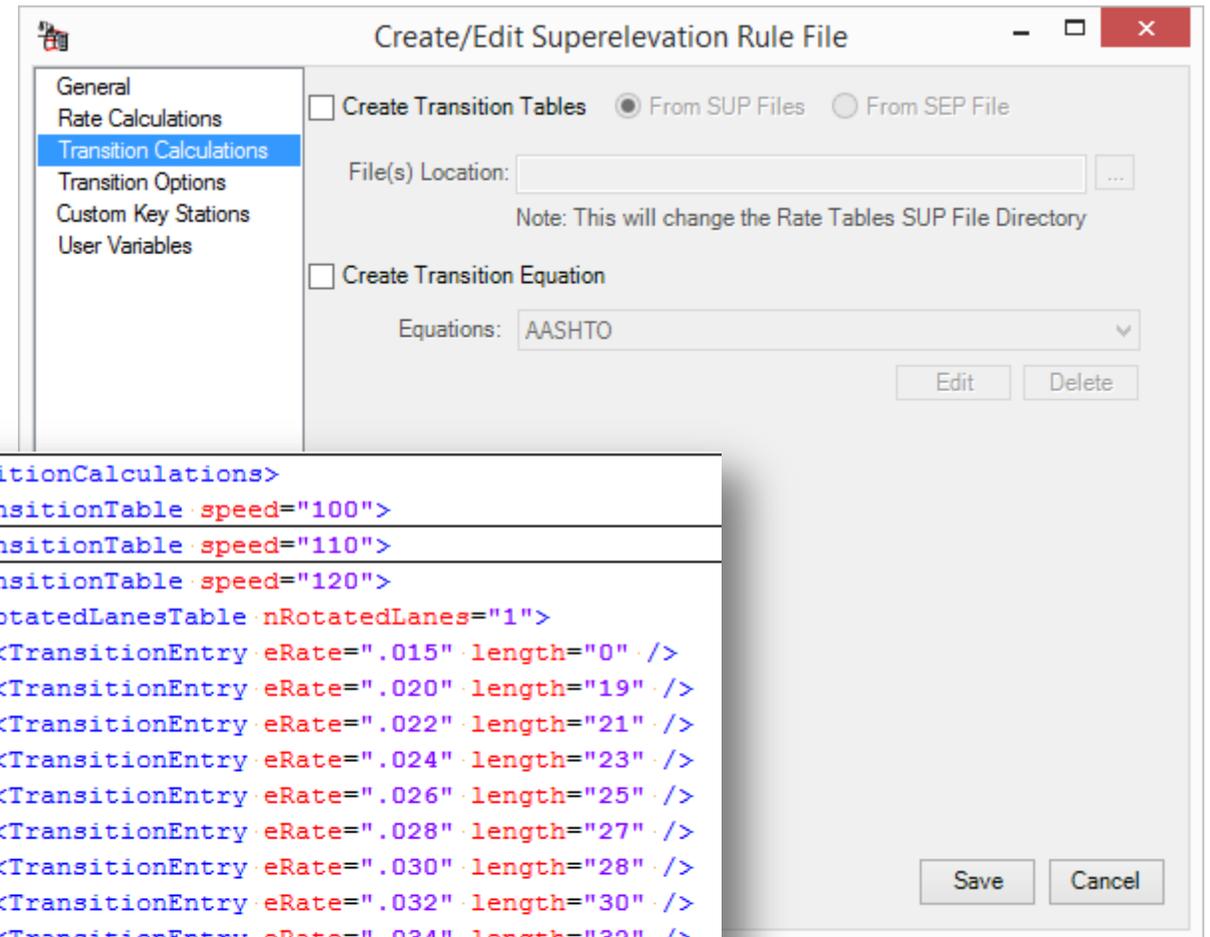
```
<RateEquation name="2011 AASHTO Method 5 - 8% max rate" equation="eRate">
  <Variable name="eRate" description="Calculated cross slope value" equation="if(R < MinRadius 0.08 : (MO * ((rPI/R)^2) + ((5729.58*s1) / R)) : (MO * ((rPI/R)^2) + ((5729.58*s1) / R))" />
  <Variable name="MaxERate" equation="0.08"/>
  <Variable name="R" equation="ABS(Radius)" description="Absolute radius"/>
  <Variable name="MinRadius" description="Minimum radius" equation="Speed*Speed/(15*(MaxERate+frictionFactor))"/>
  <Variable name="lowSpeed" equation="20.0"/>
  <Variable name="midSpeed" equation="50.0"/>
  <Variable name="highSpeed" equation="80.0"/>
  <Variable name="s1" equation="(HPI * rPI) / 5729.58"/>
  <Variable name="s2" equation="(frictionFactor - hPI) / (5729.58*((1/MinRadius) - (1/rPI)))"/>
  <Variable name="rPI" equation="(runningSpeed * runningSpeed) / (0.15 * (100 * MaxERate))"/>
  <Variable name="hPI" equation="((MaxERate * Speed * Speed) / (runningSpeed * runningSpeed)) - MaxERate"/>
  <Variable name="MO" equation="(5729.58/rPI) * ((1/MinRadius) - (1/rPI)) * ((s2 - s1)/2) * MinRadius"/>
  <Variable name="EFD" equation="Speed*Speed/(15*R)"/>
  <Variable name="F" equation="if(1/R <= 1/rPI ? (MO * ((rPI/R)^2) + ((5729.58*s1) / R)) : (MO * ((rPI/R)^2) + ((5729.58*s1) / R))" />
  <Variable name="NCRadius" description="normal crown radius base on design speed">
    <Table inputVariableName="Speed" interpolationType="useLowerBound">
      <TableEntry inputValue="15" outputValue="796"/>
      <TableEntry inputValue="20" outputValue="1410"/>
      <TableEntry inputValue="25" outputValue="2050"/>
      <TableEntry inputValue="30" outputValue="2830"/>
      <TableEntry inputValue="35" outputValue="3730"/>
      <TableEntry inputValue="40" outputValue="4770"/>
      <TableEntry inputValue="45" outputValue="5930"/>
    </Table>
  </Variable>
</RateEquation>
```

# Transition Calculations

## Create Transition Tables

- *Create Manually*
- *Import from SUP or SEP*

## Create Transition Equations



```
<TransitionCalculations>
  <TransitionTable speed="100">
  <TransitionTable speed="110">
  <TransitionTable speed="120">
    <RotatedLanesTable nRotatedLanes="1">
      <TransitionEntry eRate=".015" length="0" />
      <TransitionEntry eRate=".020" length="19" />
      <TransitionEntry eRate=".022" length="21" />
      <TransitionEntry eRate=".024" length="23" />
      <TransitionEntry eRate=".026" length="25" />
      <TransitionEntry eRate=".028" length="27" />
      <TransitionEntry eRate=".030" length="28" />
      <TransitionEntry eRate=".032" length="30" />
      <TransitionEntry eRate=".034" length="32" />
      <TransitionEntry eRate=".036" length="34" />
      <TransitionEntry eRate=".038" length="36" />
      <TransitionEntry eRate=".040" length="38" />
      <TransitionEntry eRate=".042" length="40" />
      <TransitionEntry eRate=".044" length="42" />
      <TransitionEntry eRate=".046" length="44" />
      <TransitionEntry eRate=".048" length="45" />
      <TransitionEntry eRate=".050" length="47" />
      <TransitionEntry eRate=".052" length="49" />
      <TransitionEntry eRate=".054" length="51" />
```

Save Cancel

# Transition Options

General  
Rate Calculations  
Transition Calculations  
**Transition Options**  
Custom Key Stations  
User Variables

Runout Options  
 Fixed Length Length:

Reverse Curve Adjustments  
Adjustment Minimum Transition Gap  
 Planar Transition   
 Shorten Transition   
 Slide Transition   
 Custom   
CustomOptions:

Curve Curve Adjustments  
Adjustment Minimum Transition Gap  
 Planar Transition   
 Reverse Crown Transition   
 Shorten Transitions   
 Slide Transitions   
 Custom   
CustomOptions:

Misc Options  
Transition Type:   
Non-Linear Curve Length:  Percent on Tangent:   
 Use Spiral Length  
 Rotate Inside Lane with Outside Lane  
 Lengths are Total Transition  
 Interpolate Tables  
 Display XML File

Save Cancel

Misc Options  
Transition Type:   
Non-Linear Curve Length:   
 Use Spiral Length  
 Rotate Inside Lane with Outside Lane  
 Lengths are Total Transition  
 Interpolate Tables

- Parabolic
- Linear
- Reverse Parabolic
- Reverse Biquadratic
- Reverse Cubic
- Reverse Parabolic Nonsymmetrical 1
- Reverse Parabolic Nonsymmetrical 2
- Reverse Parabolic Symmetrical

```
<<TransitionOptions interpolateTables="false" percentTransitionOnTangent="0.7" useSpiralLength="false" lengthsAreTotalTransition="false" transitionType="Linear" nonLinearCurveLength="0" startInsideLaneRotationWithOutside="false" />  
<<RunoutOptions isFixedLength="false" length="" />
```

# Custom Key Stations

## Default Cross Slopes

- **Normal Crown** (e.g. 2%)
- **Flat** (0%)
- **Reverse Crown** (e.g. 2%)
- **Full super** (e.g. 6%).

## Custom Key Stations

- *Any cross slope*
- *For example, at 1%*

General  
Rate Calculations  
Transition Calculations  
Transition Options  
Custom Key Stations  
User Variables

Create Custom Key Station Equation(s)

Description:

Criteria:

Variable(s):   Variables and Operators

CKStations(s):

Equation:

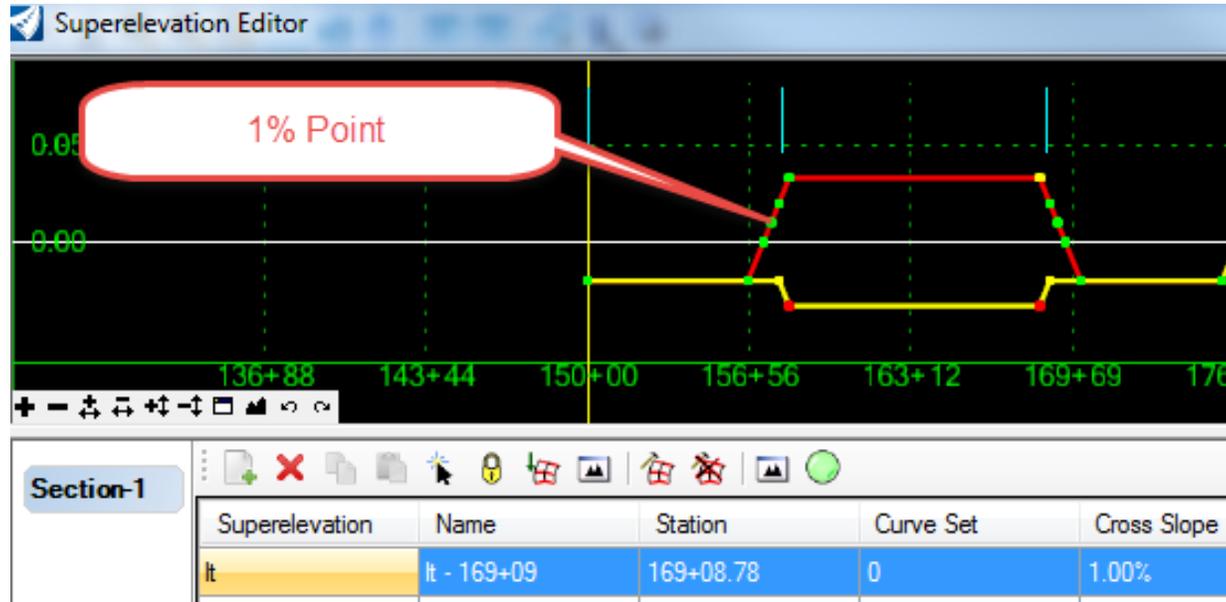
Type:

Description:

Display XML File

\*\* Note: These can also be used in customized formulas

# Custom Key Stations

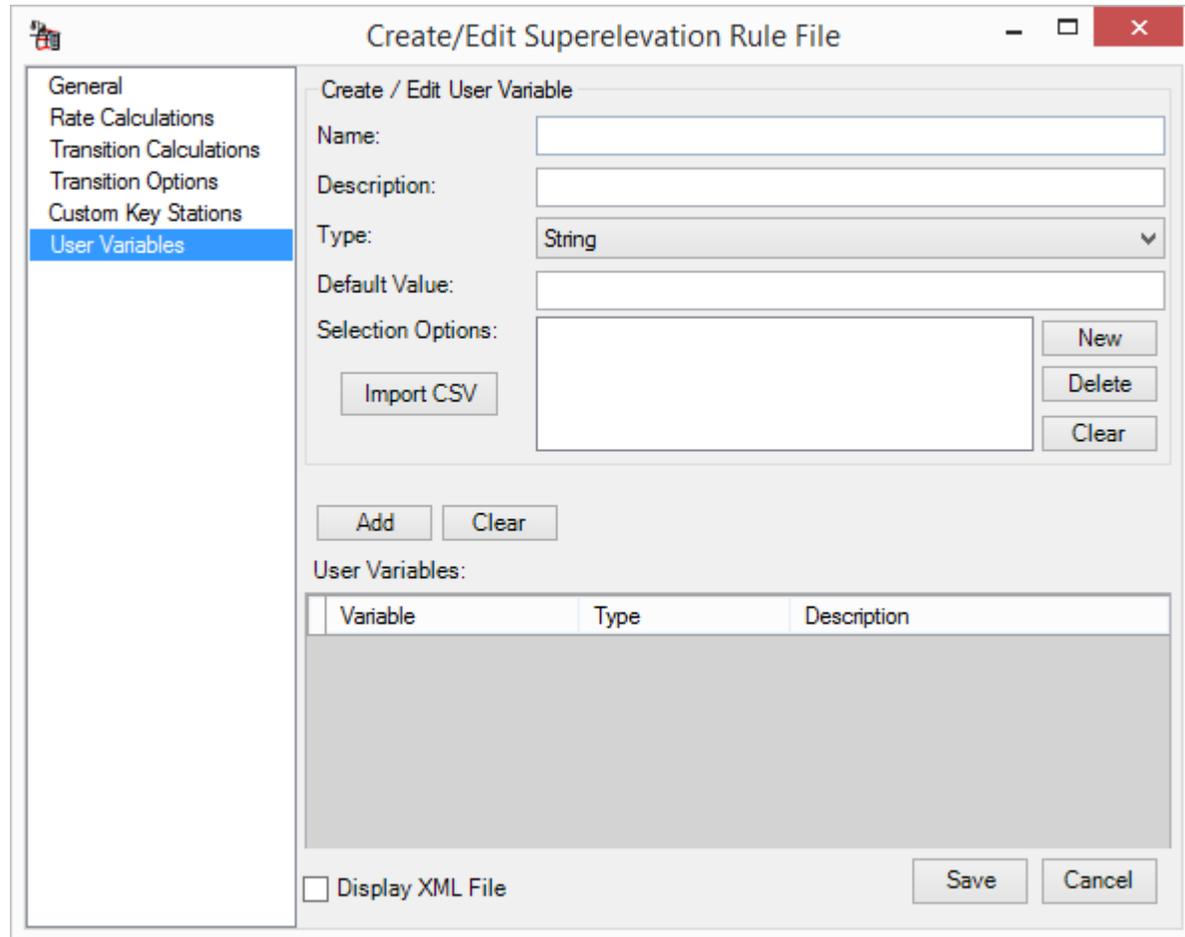


```
<CustomKeyStations description="MTO customizations">  
  <CustomKeyStation type="Custom" equation="" crossSlopeEquation="0.01" description="MTO 1% super points"/>  
</CustomKeyStations>
```

# User Variables

**Prompt the User** for some value(s) before calculating the Superelevation?

- *String*
- *Integer*
- *Decimal*
- *Boolean*



The screenshot shows a software dialog box titled "Create/Edit Superelevation Rule File". On the left is a navigation pane with the following items: General, Rate Calculations, Transition Calculations, Transition Options, Custom Key Stations, and User Variables (which is selected and highlighted in blue). The main area of the dialog is titled "Create / Edit User Variable" and contains the following fields and controls:

- Name: [Text Input Field]
- Description: [Text Input Field]
- Type: [Dropdown Menu, currently set to "String"]
- Default Value: [Text Input Field]
- Selection Options: [List Box]
- Buttons: "Import CSV", "New", "Delete", "Clear" (located to the right of the Selection Options list box)
- Buttons: "Add", "Clear" (located below the Selection Options list box)
- User Variables: [Table]

Variable	Type	Description
----------	------	-------------

At the bottom of the dialog, there is a checkbox labeled "Display XML File" and two buttons: "Save" and "Cancel".



**Thank You**

Have a great conference!

