OpenRoads Designer Superelevation Rule File Guide

Document Revision #1

Revision History

#	Date	By	Description	Approved
0	4/25/2018	Dan Ahern	Original document	
1	12/2/2018	Dan Ahern	Add / Update content	

Contents

OpenRoads Designer Rule File

The OpenRoads Designer Rule file defines how superelevation rates and transitions are computed for each curve of an alignment. The rule file replaces SUP and SEP definitions used in legacy software applications. This document describes how to import data from existing SUP and SEP files and provide guidance how to set the options in the OpenRoads Designer Rules to achieve the same result as settings in the SEP file.

Full documentation of the OpenRoads Designer Rule is included in the software help. Search for the section named **Edit Superelevation Rule File**.

Importing SUP Files into OpenRoads Designer

1) Open software using any DGN.
2) Select **Corridors > Superelevation > Calculate > Edit Superelevation Rule File**
   a) The dialog opens with default AASHTO equations already defined.
3) Select **Import > SEP File** and import the V8i SEP file.
4) Review the imported eRates and Transitions on the respective tabs.
5) All of the other settings in the XML file are defined manually, the SUP file does not include any of these settings.

Importing SEP Files into OpenRoads Designer

The following setting from SEP files may require custom key stations or custom equations be defined to achieve the desired results.

- Nominal lane width
- Rounding
- Adjustment factors
- Different distribution methods

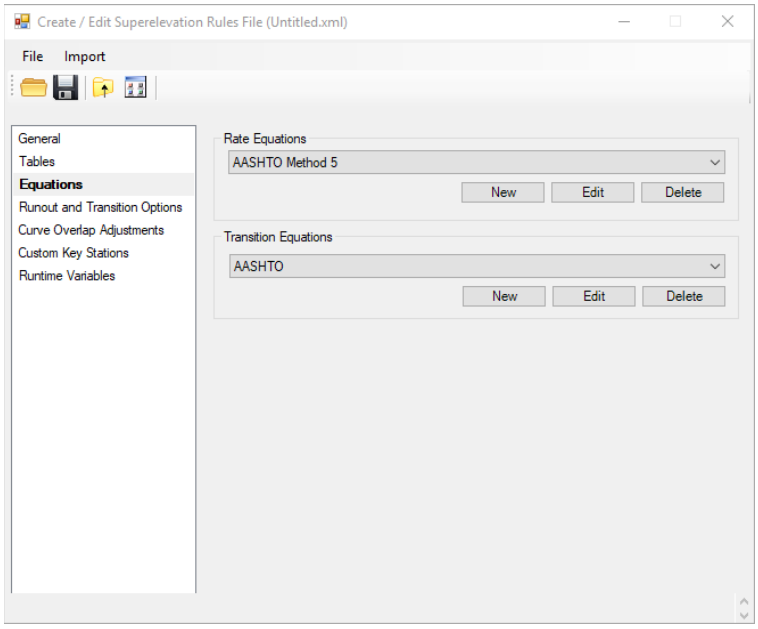
6) Open software using any DGN.
7) Select **Corridors > Superelevation > Calculate > Edit Superelevation Rule File**
   a) The dialog opens with default AASHTO equations already defined.
8) Select **Import > SEP File** and import the V8i SEP file.
9) Review the imported eRates and Transitions on the respective tabs.
   a) eRate tables and/or equations are imported based on the definition of the *eMethod* variable in the SEP file.

E_RADIUS_TABLE	tables defined by the *eTableName* variable are automatically imported.
AASHTO Method 5	equation is already defined in the XML rule file.
EQUATION	equations defined by the *eEquation* variable are not imported. They must be defined manually using **Equations > Rate Equations > New**.

b) Transition tables and/or equations are imported based on the *runoffLengthMethod* variable in the SEP file.

RUNOFF_EQUATION	equations defined by the *runoffLengthEquation* variable are not imported. They must be defined manually using **Equations > Rate Equations > New**.
RUNOFF_E_TABLE	tables defined by the *lengthTableName* variable are automatically imported but they are not visible through the dialog box.
RUNOFF_RELATIVE_GRADIENT_TABLE	relative gradient equation is created. The gradient table defined in the SEP file is imported into the gradient equation variable.

c) Delete the following two default equations if they are not wanted in the superelevation setup.
   i) Equations > Rate Equations > AASHTO Method 5
   ii) Equations > Transition Equations > AASHTO



10) Set the General Settings
   a) Select **General** tab
   b) Set **Station Rounding** = 0 or as defined by *RunoffLengthRoundingIncrement in the SEP file.*
   c) Set **Cross Slope Rounding** = 0.01 or as defined by *eRoundingIncrement in the SEP file.*
   d) Set **Creation by Corridor Settings** as desired. The settings define the default methods that are used when creating superelevation with the *Create Superelevation Sections* tool by selecting a corridor. These default methods are automatically used, and the user is not prompted for any selections when using this workflow.
11) Set the **Runout and Transition Options**
   a) Set the transition runout option(s) based on the definition of the *tangentRunoutLengthMethod* variable in the SEP file.

TANGENT_RUNOUT_RELATIVE_GRADIENT_RUNOFF	disable **Fixed Length**
TR_FIXED_LENGTH	enable **Fixed Length** and set the **Length** value to the value defined by the *fixedLength* variable in the SEP file.
TANGENT_RUNOUT_EQUATION	use Custom Key Stations to define an equation that computes the Normal Crown point. The existing equation is defined by *trEquation*.

   b) Set **Transition Type** as defined by the *lengthSpeedInterpolation* variable in the SEP file.
   c) Set **Percent on Tangent** as defined by the *undividedPercentOnTangent, dividedHighPercentOnTangent, or dividedLowPercentOnTangent* variables in the SEP file.
   d) Set the spiral transition length options based on the definition of the *runoffSpiralOption* variable in the SEP file.

LS_RUNOFF_ONLY	enable **Use Spiral Length**
LS_RUNOFF_AND_RUNOUT	enable **Use Spiral Length** and **Lengths are Total Transition** GEOPAK allowed the Runout distribution method to be defined independently when spirals are and are not present. In addition, when spirals are not present there are separate definitions for undivided and divided roadways. The Lengths are Total Transition length definition applies to all geometric conditions. If separate distributions are needed for different geometric conditions, use Custom Key Stations.

e) Set how lanes are rotated (planar or non-planar) as defined by the *outsideLaneRotationMethod* variable in the SEP file.

ROTATE_TO_MATCH_INSIDE_LANE	disable **Start Inside Lane Rotation With Outside**
INDEPENDENT_ROTATION	enable **Start Inside Lane Rotation With Outside**

f) Set how Runoff lengths are distributed as defined by the *undividedDistributeOver* variable in the SEP file.

DISTRIBUTION_RUNOFF_ONLY	disable **Lengths are Total Transition**
DISTRIBUTION_RUNOFF_PLUS_RUNOUT	enable **Lengths are Total Transition**

g) Set how the eRate and Transition tables defined on the Tables tab are interpolated as defined by the *eInterpolation* variable in the SEP file. If *eInterpolation* is set to any value, enable **Interpolate Tables**. Otherwise, leave this option disabled.

This setting does not affect interpolation of tables embedded in equations, those tables have their own interpolation settings defined with each table.

12) Set the Curve Overlap Adjustments for adjacent curves in the same direction.
   a) Set the *Curve Type* to **Curve Curve**.
   b) Set the *Adjustment Types* based on the definitions of the *BB_minimumNormalCrownTreatment* variable in the SEP file.

HOLD_FSS_CHANGE_RG	enable **Shorten** and set the **Minimum Transition Gap** to the value to the value defined by *RC_minimumNormalCrownLength*. The runoff length is shortened for each curve proportional to the to the two transition lengths.
HOLD_RG_SLIDE_STATIONS	enable **Slide** and set the **Minimum Transition Gap** to the value to the value defined by *RC_ minimumNormalCrownLength*. The runoff length is slid for each curve proportional to the to the two transition lengths.
LOWER_E_TO_RC	enable **Reverse Crown** and set the **Minimum Transition Gap** to the value to the value defined by *BB_minimumReverseCrownLength*. There are no adjustments

	to the Full Super and Reverse Crown points. The Zero Crown and Normal Crown points are deleted, and the slope holds at a constant rate between the Reverse Crown points.

13) Set the Curve Overlap Adjustments for reverse curves.
    a) Set the *Curve Type* to **Reverse Curve**.
    b) Set the *Adjustment Types* based on the definitions of the *RC_criticalTreatment* variable in the SEP file.

HOLD_FSS_CHANGE_RG	enable **Shorten** and set the **Minimum Transition Gap** to the value to the value defined by *RC_criticalMinimumNormalCrownLength*. The runoff length is shortened for each curve proportional to the to the two transition lengths. This is roughly equivalent to the *RC_criticalLengthDistribution* variable being set to BY_E.
HOLD_RG_SLIDE_STATIONS	enable **Slide** and set the **Minimum Transition Gap** to the value to the value defined by *RC_criticalMinimumNormalCrownLength*. The runoff length is slid for each curve proportional to the to the two transition lengths. This is roughly equivalent to the *RC_criticalLengthDistribution* variable being set to BY_E.

    a) Set the *Adjustment Types* based on the definitions of the *RC_supercriticalTreatment* variable in the SEP file.

COMBINE_TRANSITIONS_HOLD_FSS	enable **Planar** and set the **Minimum Transition Gap** to the value to the value defined by *RC_supercriticalLength*. The transition is linear from full super to full super. The reverse crown and zero cross slope points are adjusted to be a on the linear transition. This is equal to the *RC_supercriticalZeroPercentPositioning* variable being set to BY_E and the *RC_supercriticalRelativeGradient* variable being set to UNADJUSTED_FSS_FSS.

SEP Variable Mapping to OpenRoads Designer Settings

E Rate

eMethod	E_RADIUS_TABLE	Tables defined by the eTableName variable are imported into the XML rule file. Rates can be "NC", "RC", or a % as in "4%"
	AASHTO Method 5	Equation is already defined in the XML rule file.
	EQUATION	Equations are not automatically imported into the XML rule file. They must be defined manually using **Equations > Rate Equations > New**. The existing equation is defined by the eEquation variable in the SEP file.
eSpeedInterpolation	The XML rule file only supports a single True/False switch for Table calculations. This is defined by the **Runout and Transition Options > Interpolate Tables** option. When enabled, all tables are interpolated, when disabled, eRate and Transition lengths will be the higher value. Additional interpolation methods can be achieved if necessary using Custom Key Station equations.	
radiusInterpolation	See eSpeedInterpolation.	
eRoundingIncrement	Defined by the **General > Cross Slope Rounding** value in the XML rule file.	

Runoff

RunoffSpiralOption	LS_RUNOFF_ONLY	Enable **Runout and Transition Options > Use Spiral Length**.
	LS_RUNOFF_AND_RUNOUT	Enable **Runout and Transition Options > Use Spiral Length** and **Runout and Transition Options > Lengths are Total Transition**. See undividedDistributeOver for additional details.
runoffLengthMethod	RUNOFF_EQUATION	Define with **Equations > Rate Equations > New**. The existing equation is defined by the runoffLengthEquation variable. Equations are not automatically imported into the XML rule file. They must be defined manually.
	RUNOFF_E_TABLE	Tables defined by the lengthTableName variable should automatically imported into the XML rule file.

	RUNOFF_RELATIVE_GRADIENT_TABLE	Imports into an equation. In current build the imported equation and tables overwrite the built in AASHTO transition equation. This can be renamed if desired. Also, the built in AASHTO transition equation must exist or the relative gradient tables will not import. In future versions transition tables will get imported into a new equation named Relative Gradient.
lengthSpeedInterpolation	See eSpeedInterpolation.	
eInterpolation	See eSpeedInterpolation.	
RunoffLengthRoundingIncrement	The XML rule files only supports rounding of calculated stations with the **General > Station Rounding** value. Specific rounding of Runoff, Runout, or Total Transition Length can be done with equations or Custom Key Stations.	
TotalLengthRoundingIncrement	See RunoffLengthRoundingIncrement.	
nominalLaneWidth	Not directly supported in the XML rule file. Separate tables for 1 lane, 2 lanes, etc. can optionally be defined for tabular based transition length calculations. When the superelevation is calculated the actual number of superelevation lanes that exist determines which table (if multi-lane tables exist) is used to read the transition length. Actual lane widths and user defined Nominal lane widths can be used in equation transition length calculations. Nominal lane widths are defined as a variable or Runtime Variable.	
halfLaneWidthThreshold	See nominalLaneWidth.	
widthBasis	See nominalLaneWidth.	

Tangent Runout

tangentRunoutLengthMethod	TANGENT_RUNOUT_RELATIVE_GRADIENT_RUNOFF	Disable **Runout and Transition Options > Fixed Length**.
	TR_FIXED_LENGTH	Enable **Runout and Transition Options > Fixed Length** and set the **Length** value to the value defined by fixedLength.
	TANGENT_RUNOUT_EQUATION	Use Custom Key Stations to define an equation that computes the Normal Crown

		point. The existing equation is defined by trEquation.
totalLengthRoundingIncrement	See RunoffLengthRoundingIncrement	

Adjustment Factors

Adjustment factors are not directly supported in the XML rule file. The XML rule file is designed to use separate tables that included adjusted lengths for 1 lane, 2 lanes, etc. for tabular based transition length calculations. When the superelevation is calculated the actual number of superelevation lanes that exist determines which table (if multi-lane tables exist) is used to read the transition length. Transition lengths calculated based on relative gradient tables are automatically adjusted for multiple lanes using the equation defined in the AASHTO Policy on Geometric Design of Highways and Streets (Green Book). Additionally, custom equation can be setup for other adjustment methods including replicating the adjustment factor process used in GEOPAK.

Distribution

undividedDistributeOver	DISTRIBUTION_RUNOFF_ONLY	Disable **Runout and Transition Options > Lengths are Total Transition**.
	DISTRIBUTION_RUNOFF_PLUS_RUNOUT	Enable **Runout and Transition Options > Lengths are Total Transition**.
	Note – GEOPAK allowed the Runout distribution method to be defined independently when spirals are and are not present. In addition, when spirals are not present GEOPAK allowed separate definitions for undivided and divided roadways. The **Lengths are Total Transition** definition applies to all geometric conditions. If separate distributions are needed for different geometric conditions, custom key stations or equations will be required.	
undividedPercentOnTangent	Set the **Runout and Transition Options > Percent on Tangent** value to the value defined by *undividedPercentOnTangent*.	
dividedHighDistributeOver	See *undividedDistributeOver* for additional details.	
dividedHighPercentOnTangent	set the **Runout and Transition Options > Percent on Tangent** value to the value defined by *dividedHighPercentOnTangent*.	
dividedLowMatchOption	DISTRIBUTION_MATCH_HIGH_SIDE	Not directly supported in the XML rule file. Custom Key Stations or custom equations can be setup to compute

		alternate transition distributions.
	DISTRIBUTION_DISTRIBUTE_INDEPENDENTLY	Default behavior, no settings required.
dividedLowPercentOnTangent	Set the **Runout and Transition Options > Percent on Tangent** value to the value defined by *dividedLowPercentOnTangent*.	
stationRoundingIncrementMethod	See *RunoffLengthRoundingIncrement.*	
stationRoundingIncrement	See *RunoffLengthRoundingIncrement.*	

Rotation

elevationTransition	Define **Runout and Transition Options > Transition Type** as either Linear or one of the Parabolic options.	
elevationTransitionBy	SLOPE	This is the default method used by OpenRoads Designer.
	ELEVATION	Not directly supported in the XML rule file. Custom Key Stations or custom equations can be setup to compute alternate transition distributions.
outsideLaneRotationMethod	ROTATE_TO_MATCH_INSIDE_LANE	Disable **Runout and Transition Options > Start Inside Lane Rotation with Outside**.
	INDEPENDENT_ROTATION	Enable **Runout and Transition Options > Start Inside Lane Rotation with Outside**.
axisOfRotation	This is not defined in the XML rule file. Instead, select the appropriate Pivot Method when running the Calculate Superelevation tool. Available Pivot methods include Crown, Inside Edge, Outside Edge, Left Edge, Right Edge, Divided Inside. Centerline.	

Reverse Curves

RC_criticalMinimumNormalCrownLength	See RC_criticalTreatment.	
RC_criticalTreatment	HOLD_FSS_CHANGE_RG	Enable **Curve Overlap Adjustments > Reverse Curve > Shorten** and set the **Minimum Transition Gap** to the value to the value defined by

		RC_criticalMinimumNormalCrownLength. The runoff length is shortened for each curve proportional to the to the two transition lengths. This is roughly equivalent to the RC_criticalLengthDistribution variable being set to BY_E.
	HOLD_RG_SLIDE_STATIONS	Enable **Curve Overlap Adjustments > Reverse Curve > Slide** and set the **Minimum Transition Gap** to the value to the value defined by RC_criticalMinimumNormalCrownLength. The runoff length is slid for each curve proportional to the to the two transition lengths. This is roughly equivalent to the RC_criticalLengthDistribution variable being set to BY_E.
RC_criticalLengthDistribution	See RC_criticalTreatment for the default behavior. If behavior like one of the other GEOPAK methods is required, a custom overlap adjustment can be defined.	
RC_supercriticalLength	See RC_supercriticalTreatment.	
RC_supercriticalTreatment	COMBINE_TRANSITIONS_HOLD_FSS	Enable **Curve Overlap Adjustments > Reverse Curve > Planar** and set the **Minimum Transition Gap** to the value to the value defined by RC_supercriticalLength. The transition is linear from full super to full super. The reverse crown and zero cross slope points are adjusted to be a on the linear transition. This is equal to the RC_supercriticalZeroPercentPositioning variable being set to BY_E and the RC_supercriticalRelativeGradient variable being set to UNADJUSTED_FSS_FSS.
	DISTINCT_TRANSITIONS_HOLD_FSS	Requires defining a custom curve overlap adjustment.
	DISTINCT_TRANSITIONS_HOLD_RG	Requires defining a custom curve overlap adjustment.

	COMBINE_TRANSITIONS_SPECIFY_RG	Requires defining a custom curve overlap adjustment.
RC_supercriticalZeroPercentPositioning	See RC_supercriticalTreatment for the default behavior. If behavior like one of the other GEOPAK methods is required, a custom overlap adjustment can be defined.	
RC_supercriticalRelativeGradient	See RC_supercriticalTreatment for the default behavior. If behavior like one of the other GEOPAK methods is required, a custom overlap adjustment can be defined.	

Compound Curves

CC_relativeGradient	This is handled automatically by OpenRoads Designer. The relative gradient of the first curve is used to calculate the transition length. This is different from any of the four methods available in the SEP file. If behavior like one of the other GEOPAK methods is required, a custom overlap adjustment can be defined.	
CC_lengthDistributionAtPCC	The transition is distributed evenly across the PCC point. This is roughly equivalent to the variable being set to BY_E. If behavior like one of the other GEOPAK methods is required, a custom overlap adjustment can be defined.	
CC_byPercentageOnSharperCurve	See CC_lengthDistributionAtPCC for the default behavior. The By Percentage on Sharper Curve method is not directly supported by the XML Rule file.	
BB_minimumNormalCrownLength	See BB_minimumNormalCrownTreatment.	
BB_minimumNormalCrownTreatment	HOLD_FSS_CHANGE_RG	Enable **Curve Overlap Adjustments > Curve Curve > Shorten** and set the **Minimum Transition Gap** to the value to the value defined by RC_minimumNormalCrownLength. The runoff length is shortened for each curve proportional to the to the two transition lengths.
	HOLD_RG_SLIDE_STATIONS	Enable **Curve Overlap Adjustments > Curve Curve > Slide** and set the **Minimum Transition Gap** to the value to the value defined by RC_ minimumNormalCrownLength. The runoff length is slid for each curve proportional to the to the two transition lengths.
	LOWER_E_TO_RC	Enable **Curve Overlap Adjustments > Curve Curve > Reverse Crown** and set the

		Minimum Transition Gap to the value to the value defined by BB_minimumReverseCrownLength. There are no adjustments to the Full Super and Reverse Crown points. The Zero Crown and Normal Crown points are deleted, and the slope holds at a constant rate between the Reverse Crown points.
BB_minimumReverseCrownLength	See BB_minimumReverseCrownTreatment.	
BB_minimumReverseCrownTreatment	The XML rule file does not support evaluating the distance between Reverse Crown points, it only evaluates the distance between Normal Crown points. If this method is required, a custom overlap adjustment can be defined.	

Short Curves

minLength	See minLengthMethod.
minLengthMethod	Requires defining a custom curve overlap adjustment.