

THE REFERENCE FILE

Cadd Support Office
May 2018

Included in this issue:

Page 2	New Title Sheet Cells
Page 2	New Signal Cells
Page 2-3	Cross Section Sheets
Page 4-7	Guardrail Mash Standards
Page 8-10	RDM (AASHTO 2011) Standards
Page 11	Right of Way Data Sheet



NEW TITLE SHEET CELLS

The new title sheet cells are found in the RoadV8.cel library:

3R—3R Principles



LVB—Low Volume Bridge



RDM—Roadway Design Manual



PCDM 13 - SIGNAL CELLS

The new signal cells are found in the RoadV8.cel library. There is also a new level named RD_PD_Signals for these cells.

PMASPOLE



PSCABNT



PSPOLE



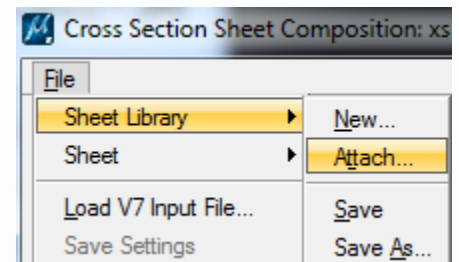
Cross Section Sheets

Updates to xslayout_In.xssl and geopaksheets_In.cel files

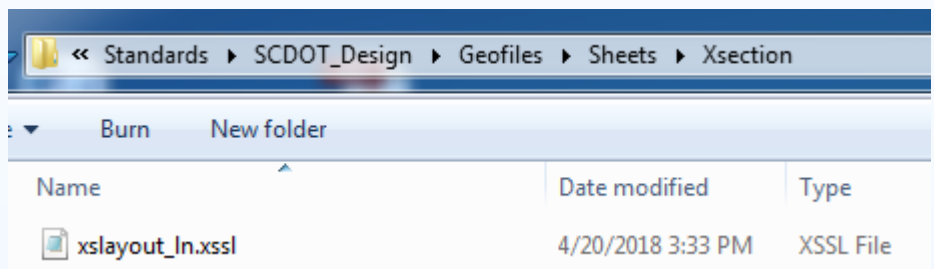
The Geopak XSSL cross section settings file and the Geopak-sheets_In.cel library have been updated to fix the text in the upper right corner of the border sheet and to simplify dithering by using the default pen table.

To use the new settings files and the new sheet files, in the Cross Section Sheet Composition tool, select **File > Sheet Library >**

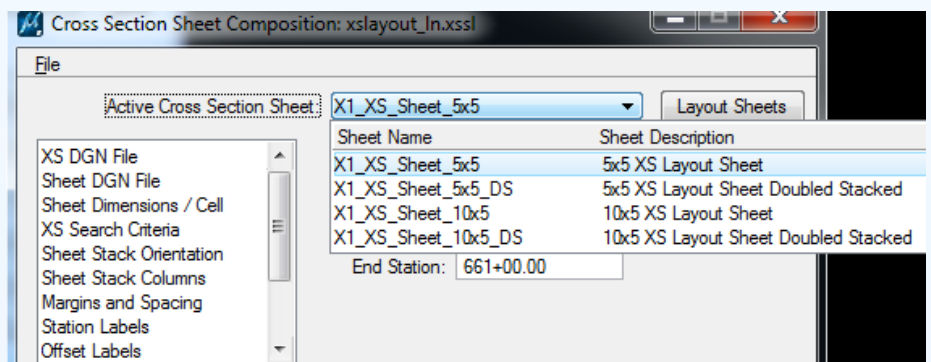
Attach



Navigate to & select the xslayout_In.xssl file—this should be in everyone's individual folder on the server or a copy may be obtained from this directory: \\nts\hq\CaddStandards\SCDOT-Bentley\Standards\SCDOT_Design\Geofiles\Sheets\Xsection



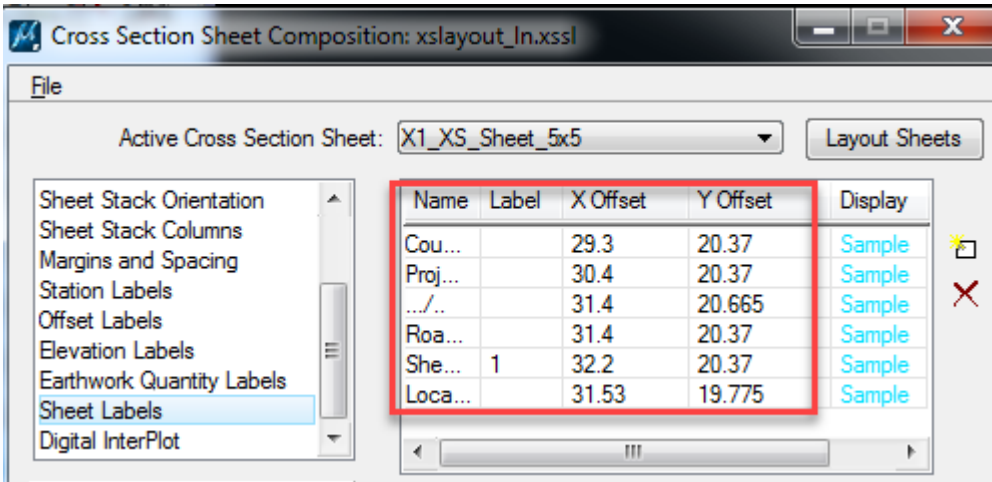
This will allow you to select the new cells for your cross sections sheets:



Cross Sections (continued...)

Updates to xslayout_In.xssl and geopaksheets_In.cel files

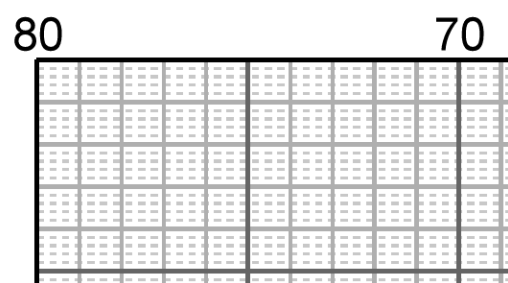
You will need to add the project information and select File > Sheet Library > Save As to update the xssl file in your project directory:



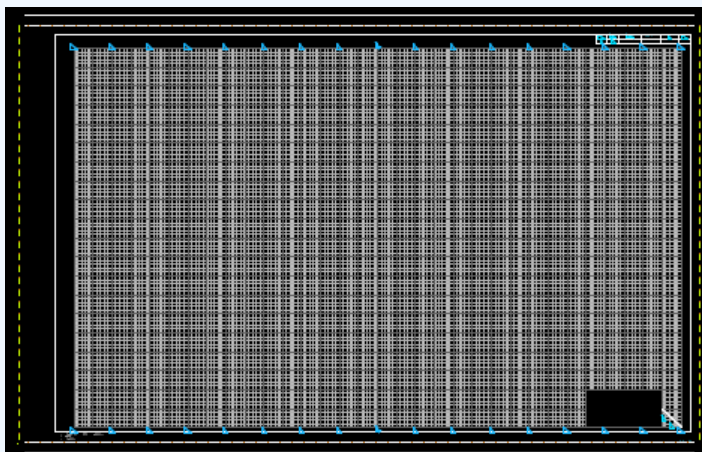
One benefit of using the new settings files and new border sheets is that the grid lines have new levels—RD_SHT_MjGrid_XS; RD_SHT_MnGrid_XS; RD_SHT_SubGrid_XS. These levels are all included in the default pen table and will dither properly without you having to select a separate pen table for the cross section sheets.

```
if (level_name == "RD_SHT_MjGrid_XS") then
  color = (100,100,100)
  weight = 6
  priority = -98
else if (level_name == "RD_SHT_MnGrid_XS") then
  color = (175,175,175)
  weight = 5
  priority = -99
else if (level_name == "RD_SHT_SubGrid_XS") then
  color = (200,200,200)
  weight = 3
  priority = -100
endif
```

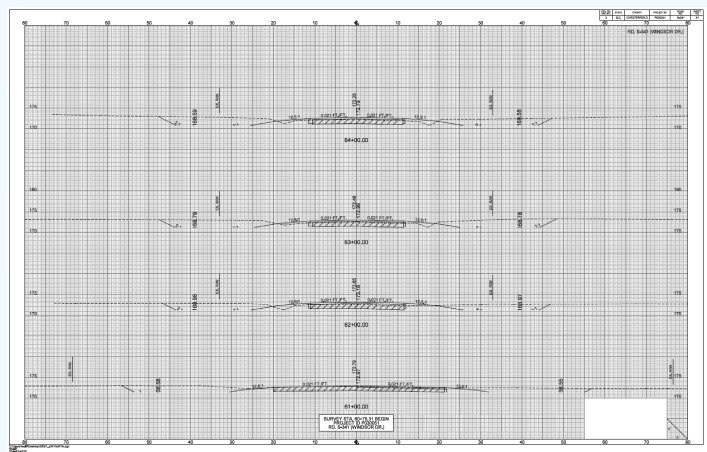
Example dithering of grid lines:



Example of the new border sheets:



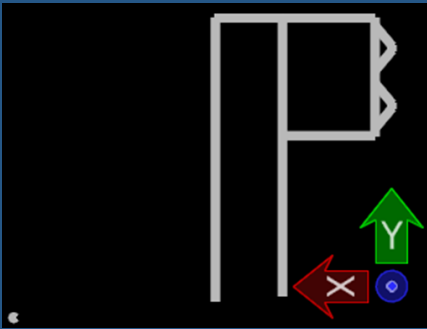
Example of dithered pdf:



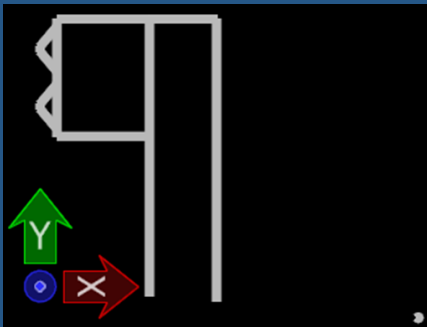
GUARDRAIL CELLS FOR CROSS SECTIONS

The new guardrail cells for cross sections are found in the RoadV8.cel library:

Guardrail Left



Guardrail Right



Shoulder Break (this cell is not required on plans, but may be useful to mark where the shoulder transitions are behind the leading end terminals when using ancillary tools and manually updating the xsection shoulders.



Guardrail Standards (MASH)

New cells, linestyles, and criteria for guardrail

The Standard Drawings have been updated to implement MASH tested guardrail on projects let beginning July 2018. This includes new pay items, a shoulder break 45" from face of rail, a height of 31", and new lengths for the leading and end treatments.

There are new linestyles for guardrail—Guardrail_LT and Guardrail_RT. These are slightly different than the original, so that one can tell that the guardrail has been updated to the new standards. When drawn at a 1.0 scale the distance from the face of guardrail to the back of the linestyle is 3.75' - where the normal shoulder break is.



There are new cells for the leading and trailing end treatments and stiffness transitions in the RoadV8.cel library. All of these can be rotated 180 degrees for placement on the opposite end.

Guardrail_MB_Trailing



Note: If the linestyle does not show up in reference files, use the key-in commands:

Guardrail_MT2_Leading



Dgnlib update levels all or

Guardrail_MT3_Leading



Dgnlib update

Guardrail_MTBBC2_Transition



Guardrail_MTBBC3_Transition



Guardrail Standards (MASH) (continued...)

Criteria File Updates

The following criteria files have been updated to draw the guardrail on the cross section with the appropriate height of 31", block thickness with rail to a nominal 12" and 45" to the shoulder break from the face of the guard-rail:

med_int_grass.x

rural_c_tie.x

rural_tie.x

rural_tie_int.x

sc_gr.x

std_vars.x

```
if intersect dgn = "guardrail in dgn" then
{
  mark x100 y100
  _d_sh_slope = "shoulder slope"
  if pavement slope >= 0 then
  {
    draw slope = _d_sh_slope:-1 for dx = 3.75
  }
  else
  {
    draw slope = -pavement slope for dx=3.75
  }
  mark x200 y200
  draw skip to x100 y100
  draw skip dx = .167 dy = 1.490 /* dx=2" dy = 31" */
  mark x300 y300

  /* Draw posts */
  draw skip to x300 y300
  draw dx = 0.917 dy = 0 /* dx = 11" */
  draw skip to x300 y300
  draw dx = 0 dy = 1 for dy = 1.167 /* 14" */
  mark x400 y400
  draw dx = 1 dy = 0 for dx = 0.917 /* 11" */
  mark x500 y500
  draw dx = 0 dy = -1 to intersection x100 y100 x200 y200
  draw skip to x500 y500
  draw dx = 1 dy = 0 for dx = 0.666 /* 8" */
  draw dx = 0 dy = -1 to intersection x100 y100 x200 y200

  /* Draw guardrail post embedment */
  define "~guardrail post embedment symbology" lvnname=RD_XS_GR co=14 wt=4 lc=2
  define "draw guardrail post embedment" 1
  define "guardrail post embedment depth in inch" 41
  if "draw guardrail post embedment" = 1 then
  {
    set plot parameters "~guardrail post embedment symbology"
    _d_grp_depth = "guardrail post embedment depth in inch" / 12
    draw dx = 0 dy = - _d_grp_depth
    draw skip dx = -0.666 dy = 0 /* 8" */ /* Default = 41" */
    draw to x511 y511
  }
  set plot parameters "~guardrail symbology"

  /* Draw rails */
  draw skip to x300 y300
  draw skip dx=0 dy = 1 for dy=0.073 /* 7/8" */
  draw dx = -0.167 dy = 0.20
  draw dx=0 dy= 0.05
  draw dx = 0.167 dy = 0.20

  draw skip to x400 y400
  draw skip dx=0 dy = -1 for dy=0.073 /* 7/8" */
  draw dx = -0.167 dy = -0.20
  draw dx=0 dy= -0.05
  draw dx = 0.167 dy = -0.20
  draw skip to x200 y200
  mark x1 y1
}
}
```

If you have an existing project with runs already set up in the project directory, you can change these numbers in the .x files listed above (as applicable) in your folder and re-run the cross sections. Alternatively, you can copy the .x files listed above (as applicable) from the server to your project directory and re-run.

[\nts\hq\CaddStandards\SCDOT-Bentley\Standards\SCDOT_Design\Geofiles\Criteria_E](#)

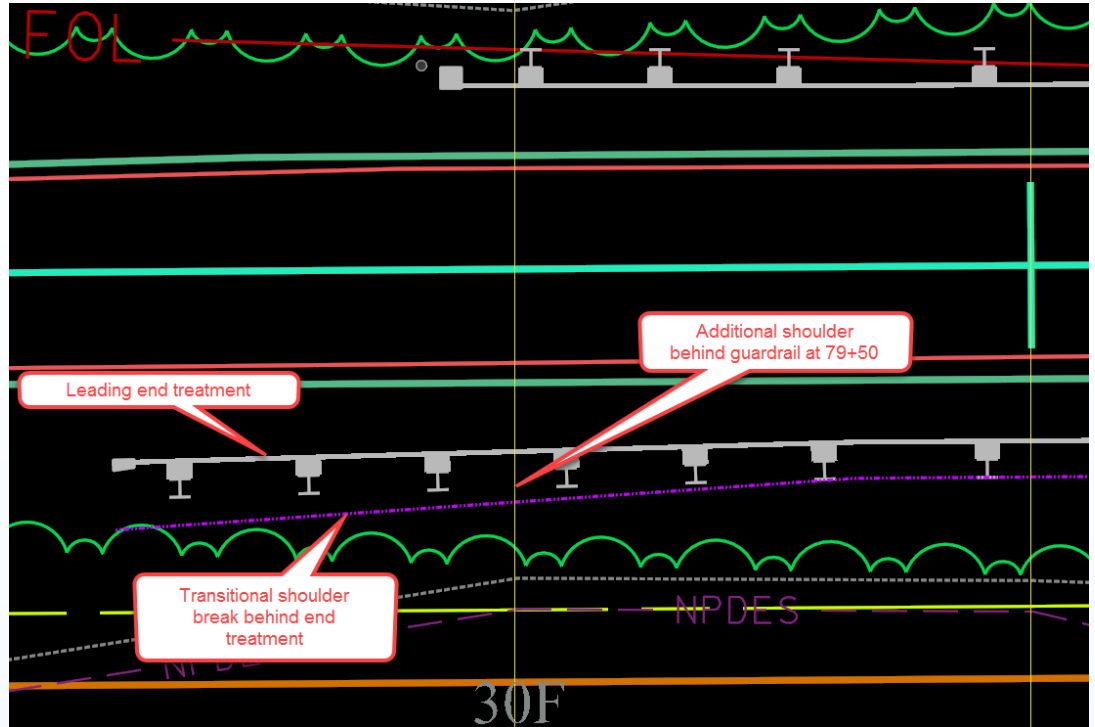
This will allow you to keep your var*.x file intact - where the variables and dgn variables are already defined—without having to redo this section of the cross section run.

Guardrail Standards (MASH) (continued...)

Ancillary Tools

If cross sections have already been completed, you can draw guardrail after the fact utilizing Ancillary Tools. Since the end treatments and transitions are cells, you will need to drop status or draw a “sketch” line thru these areas to ensure they show up on the cross sections.

To begin, ensure that all guardrail (and shoulder transitions) are drawn in the design file.

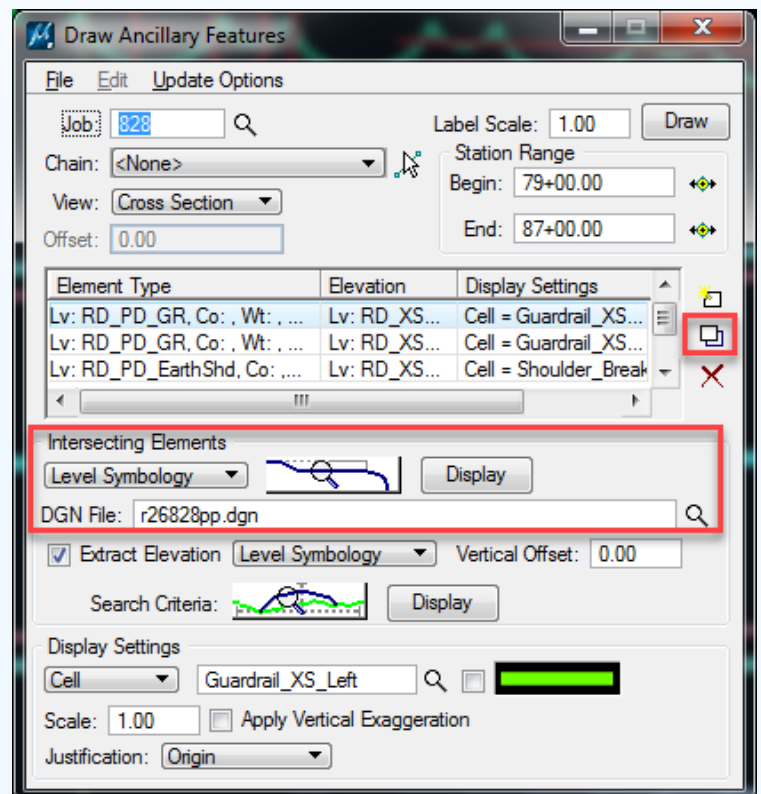


Select **Geopak > Road > Cross Sections > Draw Ancillary Features** with the design file open.

Select **File > Load** to load the Guardrail.afd settings file.

Modify the **level symbology** for the guardrail and shoulder break graphics as needed and press the **modify icon** to accept the changes.

Ensure the correct **DGN file** is also selected.



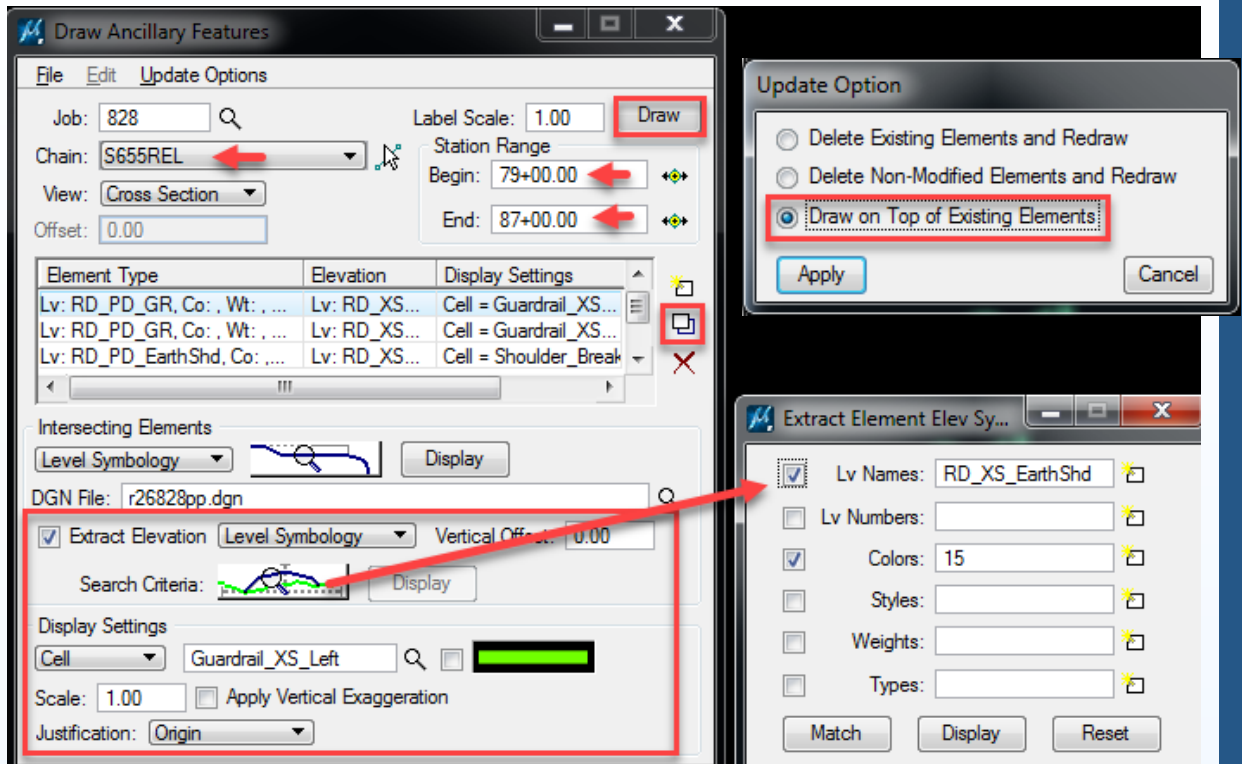
Guardrail Standards (MASH) (continued...)

Ancillary Tools (continued...)

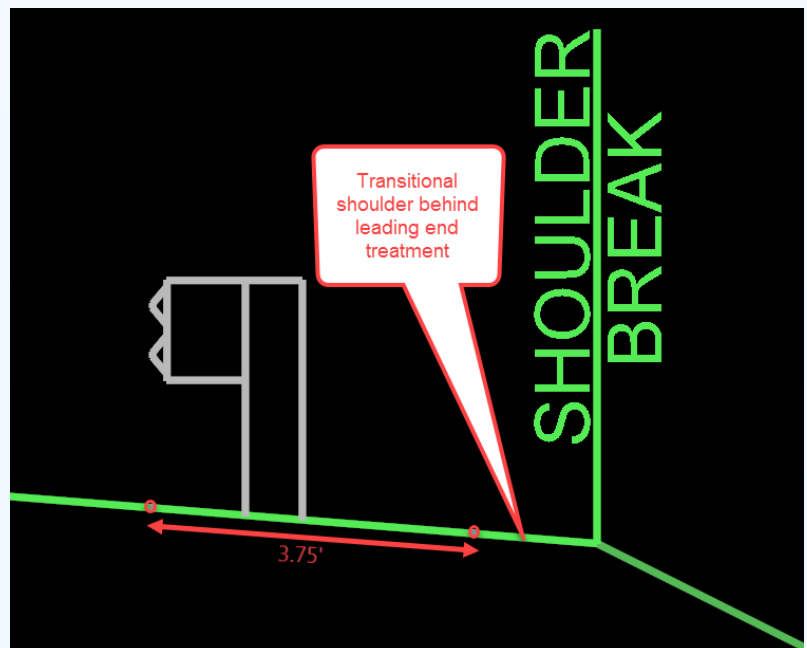
Open the *.dgn design file and ensure the gpk, chain and station range are set correctly. In the Extract Elevation section, toggle Level Symbology and set the Search Criteria to find the **RD_XS_EarthShd** level in the cross sections.

In the **Display Settings** section, check that the correct cell for Guardrail_XS_Left, Guardrail_XS_Right, and Shoulder_Break are defined correctly. Press the **modify** icon as needed to accept the changes.

Press the **Draw** button. When prompted, select Draw on top of existing elements.



Review each cross section and extend the shoulder slopes manually, using the construction snaps from the 3.75' mark to the shoulder break. Move the ditches as needed to ensure adequate shoulders are provided for the guardrail standards and earthwork quantities.

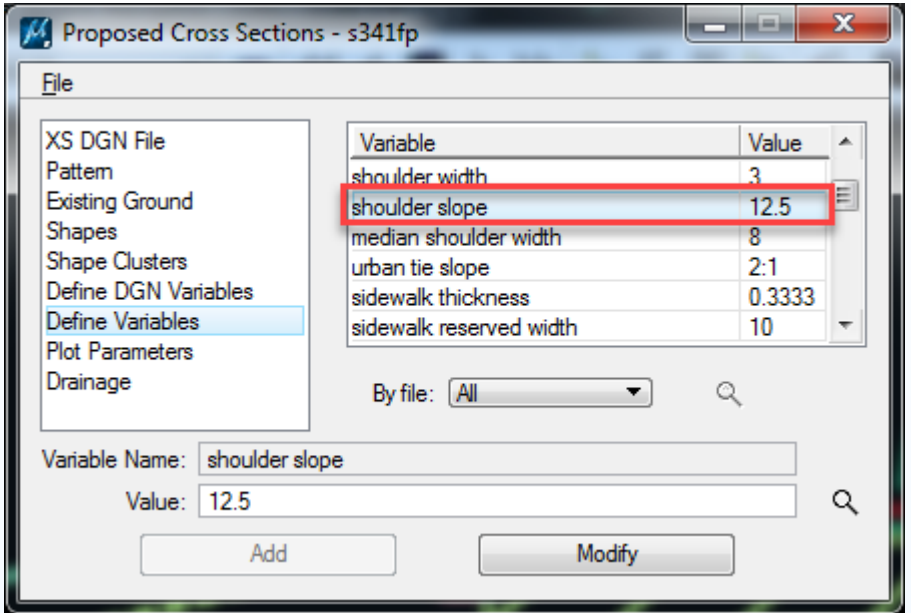


Roadway Design Manual (AASHTO 2011)

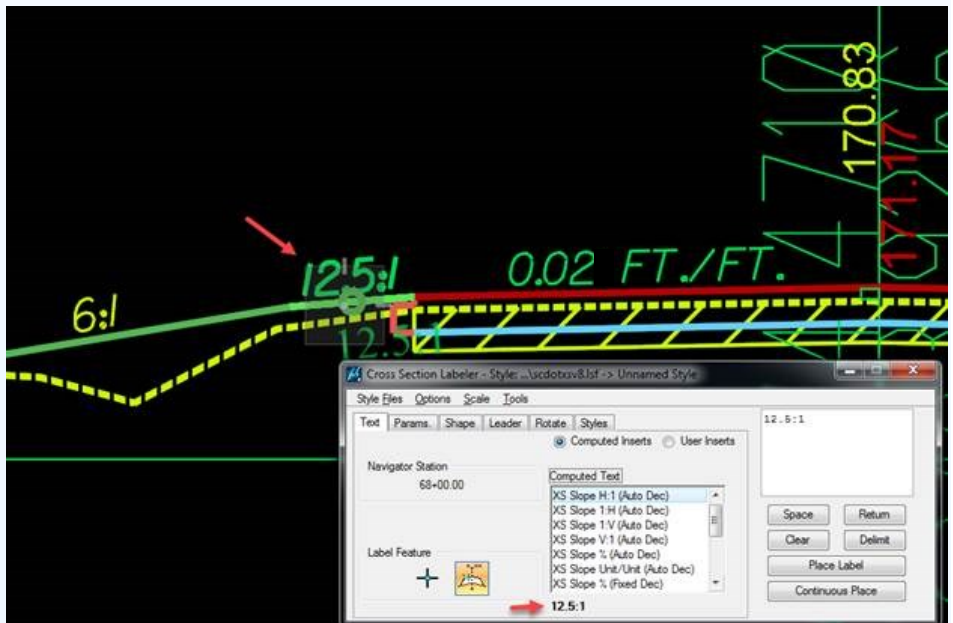
UNPAVED SHOULDER CROSS SLOPE

Geopak Criteria files now include a “shoulder slope” variable to allow for the 8% or 12.5:1 unpaved shoulder slope for new projects (or to default back to 12:1 to finish out an older project with the HDM.)

In a **new cross section** run, the user should see this: (defaulted to the 12.5, but user can modify as needed)



This should be the new result:



Over 62 criteria files were updated with this new variable. Please let us know of any issues related to these changes!

If you have an old project that already has runs defined, you can manually change the project criteria file from 12 to 12.5 and rerun—this will save a little time redefining other variables and dgn files.

To do this, open the *.x file in your project folder—and find where it says to draw slope = 12:-1 and replace the text with 12.5:-1—you may need to do this in multiple files depending on the typical.

```
>* Draw shoulder (12:1) */  
set plot parameters "~greenside symbology"  
mark x1 y1  
draw slope = 12:-1 for dx = "shoulder width"  
mark x3 y3  
draw skip to x1 y1  
draw skip dx=0 dy=-abs("pavement thickness")  
mark x90 y90
```

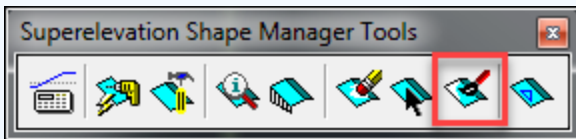

Roadway Design Manual (AASHTO 2011) (continued...)

NEW PAVEMENT AND SHOULDER CROSS SLOPES

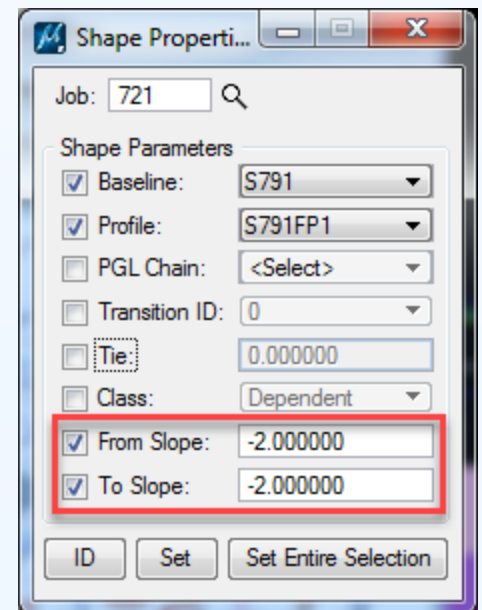
The Roadway Design Manual adopts the AASHTO standards specifying a 2% pavement slope and an 8% unpaved shoulder slope.

Design Element		Manual Section	Rural					
Design Controls	Design Year Traffic (AADT)	3.6.3	≤ 400	401 to 1500	1501 to 2000	Over 2000		
	Design Forecast Year	15.2.1	20 Years					
	Minimum Design Speed	Level	15.2.3	40 mph	50 mph	50 mph	60 mph	
		Rolling		30 mph	40 mph	40 mph	50 mph	
		Mountainous		30 mph	30 mph	30 mph	40 mph	
	Access Control	3.8	Control by Regulation					
Level of Service	3.6.4	Level/Rolling: C Mountainous: D						
Cross Section Elements	Travel Lane Width	15.2.6	11 ft (1a)	11 ft	11 ft	12 ft (1b)		
	Shoulder (2)	Total Width	15.2.6	6 ft	6 ft	6 ft	8 ft	
		Paved Width		2 ft				
	Auxiliary Lanes	Lane Width	15.2.6	Same as Mainline Travel Lanes				
		Shoulder Width		Total	Same as Mainline Shoulders			
				Paved	2 ft			
	Cross Slope	Travel Lane	15.2.6	2.00%				
		Auxiliary Lane		2.00%				
		Shoulder		Paved (3)	2.00%			
				Unpaved	8.00%			

For superelevation, the shapes will control the 2% pavement slope. You can edit existing shape properties by selecting the “Shape Properties” icon on the Superelevation Shape Manager Tools.



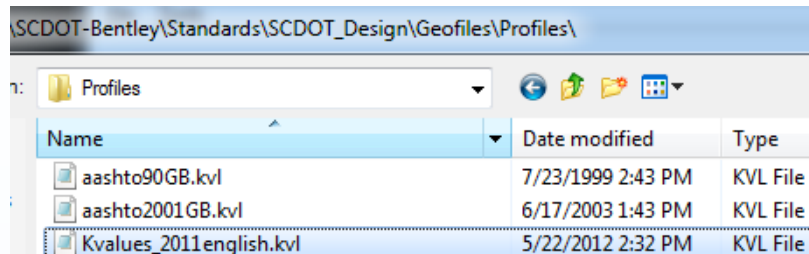
Press the “ID” button to identify the shapes that need modified or use the Element Selection tool to select multiple shapes. Edit the From and To slope to -2.00 and then press the “Set” button (or Set Entire Selection for multiple shapes) to modify the shape slopes. Repeat as needed to modify all of the shapes in normal crown.



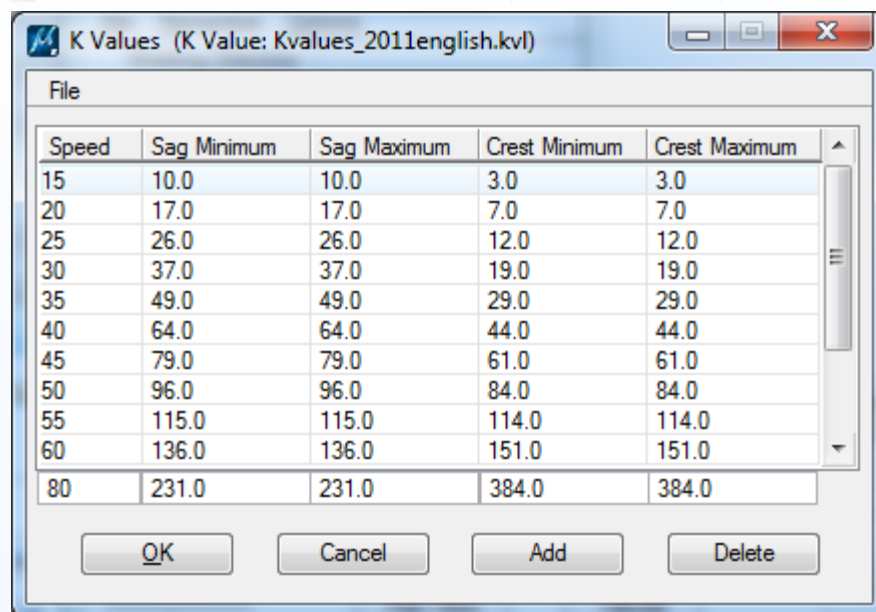
Roadway Design Manual (AASHTO 2011) (continued...)

K Values

When using the Vertical Alignment Generator, select **File > K value table** and then **File > Open** to load the Kvaules_2011english.kvl.



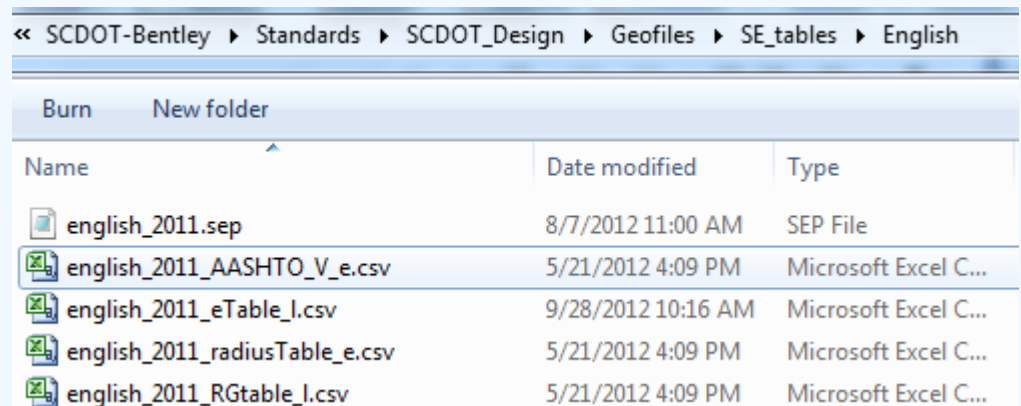
These charts can be found in the AASHTO 2011 Green book starting on page 3-155. These charts can also be found in the Roadway Design Manual on pages 6.5-2 & 6.5-6.



Superelevation files—SEP and CSV

English 2011 *sep and *csv files are available for use with the Automated Superelevation calculation tool.

While this tool is useful to create the initial input file - the user should verify/adjust the stationing and cross slope in the input file compared to the hand calculations or excel calculations used for the project including any SCDOT variances.



Right of Way Data Sheet

The Right of Way Data Sheet has been updated to include columns for outfall ditch left and right on the Obtains tab.

OBTAINS			
TOTAL TRACT AREA	OUTFALL DITCH LEFT (sf)	OUTFALL DITCH RIGHT (sf)	OUTFALL DITCH (sf)
0			0
			0.000
0			0
			0.000

For Notes A & B—the formulas have been adjusted to show the Remainder in square feet when less than 0.25 acres and for the Obtains to round up to the nearest whole number.

NOTES:					
A. SHOW REMAINDER IN SQUARE FEET WHEN LESS THAN 0.25 ACRE.					
B. SHOW OBTAIN SQUARE FOOTAGE AS ROUNDED UP TO THE NEAREST WHOLE NUMBER.					

TAX MAP REFERENCE	TOTAL TRACT ACRES	OBTAIN				REMAINDER LEFT ACRES ^A	REMAINDER RIGHT ACRES ^A
		OUTFALL DITCH	LEFT	RIGHT	TOTAL		
382-00-00-065	1.45			24560 SF (0.564 AC)	24560 SF (0.564 AC)		0.886
382-00-00-001	3.12			22200 SF (0.510 AC)	22200 SF (0.510 AC)		2.610
382-00-00-017	0.33		4285 SF (0.098 AC)		4285 SF (0.098 AC)	10089 SF	

Cadd Support Office Contact Information:

Iris Neal	nealif@scdot.org	803-737-9964
Jeff Brown	brownrj@scdot.org	803-737-6873
Alic Kozusko	kozuskoa@scdot.org	803-737-1090
Seth Lown	lownsa@scdot.org	803-737-0198