# **Superelevation Diagrams**

#### Overview

Superelevation transitions involve modification of the roadway cross section from normal crown to full superelevation, at which point the entire roadway width has a cross-slope of e. The manner in which this transition is accomplished is expressed by a superelevation diagram, which is a graph of superelevation (cross-slope) versus distance measured in stations.



Creating the diagram will be a two phase process. The first phase will be creating and importing profiles from the superelevation input file and the second phase will be drawing and annotating the diagram.

#### Workflow

### Phase 1 – Create and import input files

 Download the <u>superL123.iun</u> and <u>superR123.iun</u> input files and save them in the project's \Roadway\GEOPAK\ folder (or the same folder as the GPK) or in the definied COGO Input File Directory.

📕 COGO Preferences 📃 💻 🗙	
Job (GPK) Open Mode: Query	
COGO Input File Directory:	
COGO Output File Directory:	
Redefinition of Elements	
Force Redefinition Off Upon COGO Activation	
OK Cancel	

- 2. Rename files both files.
  - a. Change the numbers to the project GPK number.
    - superL123.iun -> superL206.iun and superR123.iun -> superR206.iun
  - b. Change the last to letters in the file extension to the GEOPAK user initials. superL123.iun-> superL206.iaj and superR123.iun-> superR206.iaj
- 3. Open both files in UltraEdit or other text editing software.
  - a. Change job name to the project GPK number rR267.iaj superl123.iun superL267.iaj AZ7A1SuperMain.inp\*

1		0,
	1	Job Name: 123
	2	\$
	3	\$ PROFILE COMMANDS generated by pattern: SUPERL
	4	Ş
	5	SET FEATURE OFF
	6	SET DESCRIPTION OFF
	7	STORE PROFILE SUPERL
	8	VPI 1 S 10000.000000000 E -2.0000000000
	9	VPI 2 S 10318.9199999999 E -2.0000000000
	10	VPI 3 5 10422.279999998 E 4.200000000
	11	VPI 4 S 10518.759999998 E 4.200000000
	12	VPI 5 S 10622.100000001 E -2.000000000
	13	VPI 6 S 10917.040000000 E -2.000000000
	14	VPI 7 S 10976.850000001 E -5.400000000
	15	VPI 8 S 11153.511324 E -5.4000
	16	VPI 9 S 11213.326139 E -2.0000
	17	VPI 10 S 11637.328739 E -2.0000
	18	
	19	END PROFILE
	20	Ş
1	21	Ş
1	22	

- b. Open project superelevation input file.
- c. Turn on column mode (for UltraEdit only)



d. Find and replace all "+"in the station ranges with a null space (just leave the replace box in UltraEdit blank).

```
auto shape
job number = 123
   auto shape set
      shape cluster baseline = MAIN
shape cluster profile = MAIN
shape cluster tie = 0.0000
      dependent shape
      chain / offset
                  -10.0000
         MAIN
         MAIN
                     -0.0000
      filler line station / slope
          100+00.000000
                               -2.0000
          103+18.946603
                               -2.0000
                                           /* Curve MAIN-1 */
          104+22.279936
                              4.2000
          105+18.764505
                               4.2000
                                           /* Curve MAIN-1 */
          106+22.097838
                              -2.0000
          109+17.038119
                               -2.0000
          109+76.852934
                               -5.4000
                                            /* Curve MAIN-2 */
          111+53.511324
                               -5.4000
                                            /* Curve MAIN-2 */
          112+13.326139
                               -2.0000
                               -2.0000
          116+37.328739
                                                            23
省 Replace
 Find What:
                                                       Start
  +
                                               0
                                                     Replace All
                                               1
                                                       Cancel
 Replace With:
                                                       Help
                                              0
                                            .
                                            -
                           Replace Where:
                           Ourrent File
 Match Whole Word Only
                           Selected Text
 Match Case
                           O All Open Files
                                                    Advanced
 Regular Expressions: UltraEdit
auto shape
job number = 123
   auto shape set
      shape cluster baseline = MAIN
      shape cluster profile = MAIN
                                = 0.0000
      shape cluster tie
      dependent shape
      chain / offset
                 -10.0000
         MAIN
         MAIN
                    -0.0000
      filler line station / slope
         10000.000000
                            -2.0000
         10318.946603
                            -2.0000
         10422.279936
                            4.2000
                                        /* Curve MAIN-1 */
          10518.764505
                                        /* Curve MAIN-1 */
                            4.2000
         10622.097838
                            -2.0000
          10917.038119
                            -2.0000
                                        /* Curve MAIN-2 */
          10976.852934
                            -5.4000
          11153.511324
                            -5.4000
                                         /* Curve MAIN-2 */
          11213.326139
                            -2.0000
          11637.328739
                            -2.0000
                Delete any warning messages before copying stationing to the input file.
                      9+06.530000
                                     -5.8300
                   Warning: Curve ALI123-1 Radius of 518.6326 is less than the minimum radius of 833.0000
                   for the given Design Gread of E0 00
```

e. Copy all stations from the superelevation input file for the left side of the roadway and paste in the superL123.iun file to the right of the "VPI and S". If necessary add additional VPIs. The "END PROFILE" and two dollar signs must be at the bottom of the input file.

```
auto shape
job number = 123
   auto shape set
      shape cluster baseline = MAIN
      shape cluster profile = MAIN
                              = 0.0000
      shape cluster tie
      dependent shape
      chain / offset
        MATN
                   -10.0000
        ΜΆΤΝ
                   -0.0000
      filler line station / slope
          0000.000000
                          -2.0000
         10318.946603
                          -2.0000
         10422.279936
                                      /* Curve MAIN-1 */
                           4.2000
                           4.2000
                                      /* Curve MAIN-1 */
         10622.097838
                           -2.0000
                           -2.0000
                           -5.4000
                                      /* Curve MAIN-2 */
         11153.511324
                           -5.4000
                                       /* Curve MAIN-2 */
                          -2.0000
         11637.328739
                           -2.0000
```

p\* superL123.iun\* superR123.iun

```
0, \dots, 10, \dots, 20, \tau, \dots, 30, \dots, 40, \dots, 50, \dots, 10
1 $ Job Name: 123
2 $
3 $ -- PROFILE COMMANDS -- generated by pattern: SUPERL
4 $
5 SET FEATURE OFF
6 SET DESCRIPTION OFF
7 STORE PROFILE SUPERL
B VPI 1 S 10000.000000 E -2.0000000000
9 VPI 2 S 10318.946603 E -2.0000000000
.0 VPI 3 S 10422.279936 E 4.2000000000
1 VPI 4 S 10518.764505 E 4.2000000000
2 VPI 5 S 10622.097838 E -2.0000000000
.3 VPI 6 S 10917.038119 E -2.0000000000
4 VPI 7 S 10976.852934 E -5.400000000
.5 VPI 8 S 11153.511324 E
                          -5.4000
.6 VPI 9 S 11213.326139 E
                          -2.0000
7 VPI 10 S 11637.328739 E -2.0000
.8
.9 END PROFILE
:0 Ş
11 C
```

g. Copy the slope information for from the superelevation input file for the left side of the roadway and paste in the superL123.iun file to the right of the "E".

```
auto shape
job number = 123
  auto shape set
     shape cluster baseline = MAIN
     shape cluster profile = MAIN
                           = 0.0000
     shape cluster tie
     dependent shape
     chain / offset
                 -10.0000
        MAIN
        MAIN
                  -0.0000
     filler line station / slope
        10000.000000
                         -2.0000
        10318.946603
        10422.279936
                                   /* Curve MAIN-1 */
                                   /* Curve MAIN-1 */
        10518.764505
        10622.097838
                         -2.0000
        10917.038119
                         -2.0000
        10976.852934
                                    /* Curve MAIN-2 */
                                    /* Curve MAIN-2 */
        11153.511324
                         -5.4000
        11213.326139
        11637.328739
   superL123.iun* superR123.iun
inp*
  1 $ Job Name: 123
 2 S
 3 $ -- PROFILE COMMANDS -- generated by pattern: SUPERL
 4 Ş
 5 SET FEATURE OFF
```

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18

20 \$ 21 \$ 22

19 END PROFILE

6 SET DESCRIPTION OFF 7 STORE PROFILE SUPERL

8 VPI 1 S 10000.000000 E -2.0000
9 VPI 2 S 10318.946603 E -2.0000
10 VPI 3 S 10422.279936 E 4.2000
11 VPI 4 S 10518.764505 E 4.2000
12 VPI 5 S 10622.097838 E -2.0000
13 VPI 6 S 10917.038119 E -2.0000
14 VPI 7 S 10976.852934 E -5.4000
15 VPI 8 S 11153.511324 E -5.4000
16 VPI 9 S 11213.326139 E -2.0000
17 VPI 10 S 11637.328739 E -2.0000

i. Copy all stations from the superelevation input file for the right side of the roadway and paste in the superR123.iun file to the right of the "VPI and S". If necessary add additional VPIs. The "END PROFILE" and two dollar signs must be at the bottom of the input file.

auto shape set		
shape cluster h	baseline =	MAIN
shape cluster p	profile =	MAIN
shape cluster t	tie =	0.0000
independent sha	ape	
chain / offse	et	
MAIN (	0.0000	
MAIN 1	10.0000	
filler line sta	ation / slop	e
10000.00000	-2.00	00
10385.613270	-2.00	00
10422.279936	-4.20	00 /* Curve MAIN-1 */
10518.764505	-4.20	00 /* Curve MAIN-1 */
10555.431172	-2.00	00
10846.667749	-2.00	00
10976.852934	5.400	) /* Curve MAIN-2 */
11153.511324	5.400	) /* Curve MAIN-2 */
11283.696509	-2.00	00
11637.328739	-2.00	00

np\* superL123.iun\* superR123.iun

	0,,10,,20,,30,,40,,50,,50							
1	\$ Jo	b l	Na	me: 123				
2	Ş							
3	Ş	- Pl	RO	FILE COMMANDS	S generated by pattern: SUPERR			
4	Ş							
-5	SET	FE)	AT	URE OFF				
6	SET	DE:	SC	RIPTION OFF				
7	STOR	RE I	PR	OFILE SUPERR	·			
8	VPI	1 :	S	10000.000000	E -2.0000			
9	VPI	2 :	S	10385.613270	E -2.0000			
10	VPI	3 3	S	10422.279936	E -4.2000			
11	VPI	4 :	S	10518.764505	E -4.2000			
12	VPI	5 3	S	10555.431172	E -2.0000			
13	VPI	6	S	10846.667749	E -2.0000			
14	VPI	7 :	S	10976.852934	E 5.4000			
15	VPI	8 3	S	11153.511324	E 5.4000			
16	VPI	9 3	S	11283.696509	E -2.0000			
17	VPI	10	S	11637.328739	9 E -2.0000			
18								
19	END	PR(	OF	ILE				
20	Ş							
21	Ş							

k. Copy the slope information from the superelevation input file for the right side of the roadway and paste in the superR123.iun file to the right of the "*E*".

```
auto shape set
  shape cluster baseline = MAIN
  shape cluster profile
                          = MAIN
  shape cluster tie
                          = 0.0000
  independent shape
  chain / offset
     MAIN
             0.0000
     MAIN
               10.0000
  filler line station / slope
     10000.000000
     10385.613270
     10422.279936
                                   /* Curve MAIN-1 */
                                   /* Curve MAIN-1 */
     10518.764505
     10555.431172
     10846.667749
     10976.852934
                                  /* Curve MAIN-2 */
                                  /* Curve MAIN-2 */
     11153.511324
                       5.4000
     11283.696509
     11637.328739
```

p\* superL123.iun\* superR123.iun

```
3,0, , , , , ,
                                        4,0,
 5,0,
1 $ Job Name: 123
2 $
3 $ -- PROFILE COMMANDS -- generated by pattern: SUPERR
4 $
5 SET FEATURE OFF
6 SET DESCRIPTION OFF
7 STORE PROFILE SUPERR
B VPI 1 S 10000.000000 E -2.0000
9 VPI 2 S 10385.613270 E -2.0000
0 VPI 3 S 10422.279936 E -4.2000
1 VPI 4 S 10518.764505 E -4.2000
2 VPI 5 S 10555.431172 E -2.0000
3 VPI 6 S 10846.667749 E -2.0000
4 VPI 7 S 10976.852934 E 5.4000
5 VPI 8 S 11153.511324 E 5.4000
6 VPI 9 S 11283.696509 E -2.0000
7 VPI 10 S 11637.328739 E -2.0000
8
9 END PROFILE
0 $
1$
```

- I. Save the new input files. *Do not* save the superelevation input file.
- 4. Create a MicroStation file named PROxxxx\_super.dgn

5. Open Coordinate Geometry (COGO).

Applications Wir	ndow <u>H</u> elp <u>C</u> FLHD Help Deactivate GEOPAK	□ • 🖻 • 🖬 • 🔗 •	• 🚰 • 🥩 • 📩 • 🕡 🕂 • • 🖳 Prima • 💽 0 • 🗠
Map ►	ROAD SITE SURVEY DRAINAGE WATER SEWER LANDSCAPE Training <u>A</u> bout GEOPAK	ROAD Tools  Project Manager  Corridor Modeling  Site Modeling  Active Chain Control  Element Attributes  3PC AdHoc Attribute Manager  User Preferences  Geometry  Design & Computation Manager  Plans Preparation  DTM Tools  3D Tools	<u>Coordinate Geometry</u> <u>Graphical Coordinate Geometry</u> Layout Alignments <u>H</u> orizontal Design Multicenter Curve
		<u>C</u> ross Sections → <u>U</u> tilities → <u>H</u> elp	<u>Auto Store Graphics</u> Subdivision <u>Wi</u> zard Layout Profiles ( <u>V</u> PI Based) Layout Profiles (Component <u>B</u> ased) Legal Description

- 6. Import the superL.iun and superR.iun files.
  - a. From COGO open the input File Utility.



b. Choose *Load* from the pulldown menu and all aviable input files will be populated.

📕 Input File Utility	
File Name	Subject
junkprof	[None]
main	[None]
superR	[None]
superl	[None]
▶ <u>L</u> oad	Allow Commands to be Added
Append	
<u>D</u> elete	Арріу
Output	
Print Input File	
Print Output File	
Save	

c. Highlight the desired input file and select apply.

📕 Input File Utilit	у	
File Name	Subject	
junkprof	[None]	
main	[None]	
superR	[None]	
superl	[None]	
Load	Allow Commands to be Added     Apply	←

d. Select *Edit > Read All* to add the profile to the GPK.

	S Co	ordinate Geor	netry Job: 123 Operator: un		x			
	<u>Fi</u> le	Edit Element	<u>Vi</u> ew <u>T</u> ools					
I		🙀 🖳 ear 🕴 🖌 🕼 🧨 🌾 🌈 🌈 🦽 💭 🗖 🏠 🛶 🧚 🖓 🖓 🖓 🖉 Redefine 🛛 Temporary Visualization 💌						
I	OFF	Delete         movies           OFF         Insert         Browse         99.1234 ▼         9^9'9'9.12"         <<<<>>>>						
I	COGO	Modify			•			
Ш	*	Read All			*			
h.	•	Type All	IT FEATURE OFF					
	•	Line Range	IT DESCRIPTION OFF					
	• I		ORE PROFILE SUPERL					
	• I	<u>E</u> ditor	PI 1 S 10000.000000000 E -2.0000000000					
	· `	9 V.	PI 2 S 10318.919999999 E -2.000000000					
	<u>۰</u>	10 V	PI 3 S 10422.2799999998 E 4.200000000					
				•••				

e. Repeat steps c and d for the other input file.

📕 Input File Utility		
File Name	Subject	
iunkorof	[ None ]	
main	[None]	
superR	[None]	
superl	[None]	
Load 🔻	Allow Commands to be Added	
	Apply	I

f. Verify that both profiles have been stored in the GPK using the profile utility tool.

📕 Co	oordin	ate Geom	ietry J	lob: 267	0	perator: aj				
<u>F</u> ile	<u>E</u> dit	Element	<u>Vi</u> ew	<u>T</u> ools						-
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OFF	(Featu	<u>C</u> urve			►	▼ 9^99	).12"		XĒ	
COGC	) Key-ir	<u>S</u> piral			►			i.	Drafila	
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		Parcel			•				PRO WIDEN L	
		1 91001			_		-		PRO_WIDEN_R	
		Profile			•	<u>U</u> tility			RT_DITCH	
		Next Av	vailable	Settings		Elevation			SUPERL	
					-	Offset			JULIN	
						Restation		Ľ		

g. Close Coordinate Geometry.

## Phase 2 – Drawing and Annotating Diagram

1. Open the PROxxxx\_super.dgn file.

3. Open the Design and Computation (D&C) Manager.



4. Select DPROF Design profile from the Chains/Profiles folder.



5. Select the left edge of pavement profile (superL). Change the settings as shown below. Select okay and the left edge profile will display in the design file.

📕 Draw Plan & Profile		🏴 Profile - SUPERL
Item: DPROF De Element Type: Profiles Key-in Points: Select Profile to Draw ETW_L ETW_R EXMAIN EX_JUNK MAIN PAPPR RADIUS_L RADIUS_R SUPERL SUPERR	sign profile  Label Scale: 100  VPI Labels From VPI  Circle Horizontal Axis Labels Vertical Axis Labels V.C. Incremental Elevations V.C. Parameters Grade Labels K Values External Lengths Station Equations No Gaps VPC/VPT Labels Stopping Sight Distances	Profile Range         Begin Station:       100+00.00         End Station:       116+37.33         Begin Elevation:       -2.0000         End Elevation:       -2.0000         Maximum Elevation:       -2.0000         Minimum Elevation:       -2.0000         Minimum Elevation:       -5.4000         Plot Settings       Horizontal Scale:         Horizontal Scale:       1.00000         Begin Station:       100+00.00         End Station:       116+37.33         Strip Grade Increment:       Profile Reference Point         Profile Reference Point       100+00.00         Reference Elevation:       0.0000000         X:       1000         Profile Cell       PGL Chain:
		Draw Cell at XY Identify Cell OK Cancel

6. Select left edge of pavement profile and change the level symbology as shown below.



8. Select the right edge of pavement profile (superR). Change the settings as shown below. Select okay and the right edge profile will display in the design file

😕 Draw Plan & Profile	😕 Profile - SUPERR 🛛 🗶
Item: DPROF Design profile   Element Type: Profiles   Label Scale: 100   Key-in Points: VPI Labels   Select Profile to Draw VPI Labels   ETW_L Image: Circle image: Circl	Profile Range         Begin Station:       100+00.00         End Station:       116+37.33         Begin Elevation:       -2.0000         End Elevation:       -2.0000         Maximum Elevation:       -2.0000         Maximum Elevation:       5.4000         Minimum Elevation:       -4.2000         Plot Settings
	PGL Chain: MAIN    Draw Cell at XY  Identify Cell  OK  Cancel

9. Select right edge of pavement profile and change the level symbology as shown below.



11. Draw a horizontal line along the 0 elevation to represent the Profile Grade Line and Axis of Rotation with the level symbology as shown below.



12. Use the find and replace text tool to delete "VPI"

<u>E</u> dit	Element	<u>S</u> ettings	<u>T</u> ools	<u>U</u> tilities	Workspace
n	Undo Chan	ge Element	to Activ	e Line St	yle Ctrl+Z
	Undo Ot <u>h</u> er	r			• •
2	Redo				Ctrl+R
	Set <u>M</u> ark				
X	Cut				Ctrl+X ar
P <sub>2</sub>	<u>C</u> opy				Ctrl+C
Ô	Paste				Ctrl+V
	Paste <u>S</u> pec	ial			4
	Group				Ctrl+G
	Ungroup				Ctrl+U
	Lock				Ctrl+L
	Unl <u>o</u> ck				Ctrl+M in
	Bring to Fro	nt			la
ø	Find/Repla	ce Te <u>x</u> t			e
	Select Al				Ctrl+A
	Select Non	e			
	Select By A	ttributes			
	DDE Links.				
	Insert Object	st			
	Update Link	ks			
	Links				
	Object				
	A = A	10 1000	~		

a. Type VPI in the find box and leave the replace box blank. Choose replace all.

🕌 Find/Replace text						
Find: VPI						
Replace:						
- Find Options						
Match Case	Whole Words					
Use Regular Expressions	🔲 In Cells					
Use Fence	Inside 👻					
- View Options						
🔽 Animate	Rotate					
Zoom						
Find Replace	Replace All					

b. Clean up labels as desired.

13. Label right and left edges of pavement, superelevation rates, and profile grade line and access of rotation and delete EL X.XX label.



14. Place on the pnp sheet similar to the mainline profile.

