LAB 20 - Constructing A Driveway

Driveway modeling should not be done to the level of detail that mainline corridor modeling is done. However, there may be times when a drive should be modeled accurately. This lab describes a workflow for modeling driveways quickly and easily.

Chapter Objectives: This lab models a driveway from the proposed edge of pavement of the design corridor to the existing ground at the right of way line. The following InRoads tools are used to complete the model:

- Use Tracking to determine the location of the ramp.
- Use Generate Longitudinal Feature to construct the centerline and edge features of the ramp.
- Use Drape Surface to create the end of the drive.
- Use Import Surface to create features from MicroStation graphics.
- Use Fillet Feature to construct the drive returns.
- Use Join Features to create a continous feature from the driveway edges and returns.
- Use Apply Template create sideslopes for the driveway.

The following files are used for this lab:

- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\SH86.dtm
- C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
- C:\Projects\12345\Design\InRoads\DES12345_Templates.itl

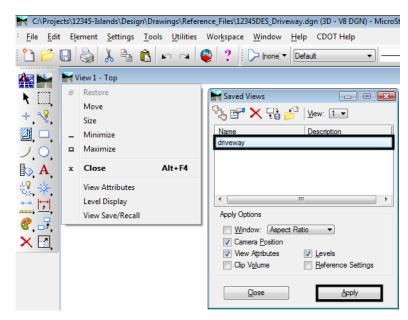
The driveway is 12' wide extending from the proposed edge of pavement to the right of way, 60' to the right of the SH 86 centerline. The driveway returns have a 15' radius. There is a 12:1 slope for 20' from the edge of pavement.

Lab 20.1 - Locating The Driveway

The new driveway is located on top of the existing driveway between stations 254+00 and 255+00 or the right side of the mainline.

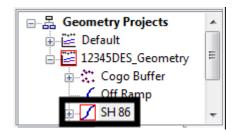
Section Objectives:

- Use Tracking to determine the centerline station of the driveway.
- Use MicroStation key-ins to construct a line for the driveway centerline and end line.
- 1. Open InRoads using the *12345DES_Driveway.dgn* file.
 - **Note:** If the existing drive is not visible, display the driveway saved view. To display a saved view:
 - a. **<D>** the icon in the left corner of the view title bar and select **View Save/Recall**.
 - b. In the *Saved Views* dialog box, highlight driveway.

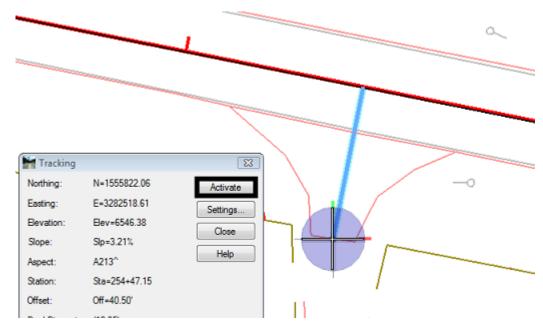


c. **<D> Apply** and then **<D> Close** to dismiss the *Saved Views* dialog box.

- 2. Open the following InRoads data files:
 - C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm
 - C:\Projects\12345\Design\InRoads\SH86.dtm
 - C:\Projects\12345\Design\InRoads\12345DES_Geometry.alg
 - C:\Projects\12345\Design\InRoads\DES12345_Templates.itl
- 3. Verify that the C:\Workspace\Workspace-CDOT_XM\Standards-Global\ InRoads\Preferences\CDOT_Civil.xin file is loaded.
- 4. Verify that the SH 86 alignment is active.

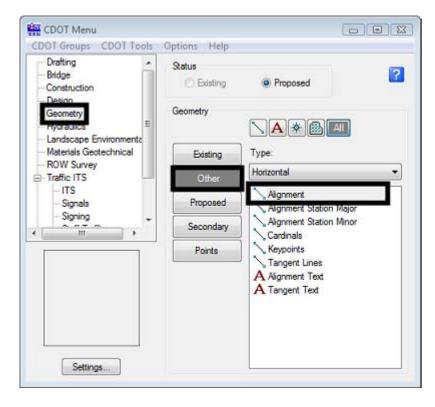


5. Select **Tools > Tracking > Tracking** from the InRoads menu bar.



6. Activate the tracking and <T> to the center of the back of the driveway.

- 7. Write down the **Station** listed in the *Tracking* dialog box.
- 8. From the *CDOT Menu*, highlight the **Geometry** group.
- 9. **<D>** the **Other** button and select **Alignment** from the item list.



10. In the MicroStation key-in window, type *so=254+47.15,0* and *Enter*.

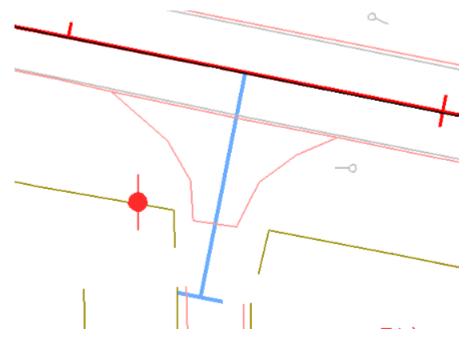


Note: Use the station that you wrote down in step 6.

11. Key in *so=254+47.15,60* and *Enter*. <R> to end the line.

This places a line at the centerline of the driveway. This line is used as a reference line when constructing the driveway surface features.

- 12. Key in *so=254+41.15,60* and *Enter*.
- 13. Key in *so=254+53.15,60* and *Enter*. <R> to end the line.



Note: Use stations 6' before and 6' after the one you wrote down in step 6.

This places a 12' long line at the end of the driveway representing the width of the drive. This line is also used as a reference line when constructing the driveway surface features.

Section Summary:

The location of the driveway was identified and elements needed to create the driveway centerline and end line were placed.

Lab 20.2 - Setting Elevations

In this section, the driveway end line is draped to the existing surface to aquire the elevations for that feature. The line for the driveway centerline is moved to the proper elevation, then is modified to give it the proper slopes.

Section Objectives:

- Create a surface for the driveway.
- Use Drape Surface to create the driveway end line feature.
- Display the design surface (SH 86) triangulated features.
- Move the driveway centerline to its proper location (horizontally and vertically.
- Create a centerline feature with the proper slopes using Generate Longitudinal Feature and Edit Feature Point.
- 1. Select **File > New** from the InRoads menu bar.
- 2. On the *Surface* tab, set the *Type* to **Design**.
- 3. In the Name field, key in Driveway 254+47.15 Rt.
- 4. In the *Description* field, key in *Driveway at station 254+47.15 on the right*.
- 5. Set the *Preference* to **Proposed** and **<D> Apply** then **Close**.

New			- • •
Surface Geome	stry		
Type:	Design	•	Apply
Name:	Driveway	254+47.15 Rt	Help
Description:	Driveway a	at station 254+47	
Maximum Length	0.00		
Preference:	Proposed	•	1
			•
Name		Descriptio	n
Default			
	ground	Existing Gr	ound from
Default 12345 existing g	ground	Existing Gr	
Default 12345 existing g	ground	Existing Gr	ound from

- 6. From the InRoads menu bar, select Surface > Design Surface > Drape Surface.
- 7. Set the *Destination Surface* to **12345** existing ground.
- 8. Set the *Input Mode* to Single.
- 9. Set the *Destination Level* to **DES_SURFACE _1**.
- 10. Toggle on Delete Original Graphics.

11. **<D> Apply** then follow the prompts in the MicroStation message window (lower left corner of the screen).

🖬 Drape Surface				
Current Locate Mode:	Graphics			Apply
Destination Surface:	12345 exist	ing ground	-	Close
Graphics Input Mode:	Single		Ţ	Filter
Source Level:	ALG_COG	D_Points	÷	Preferences
Destination Level:	DES_SUR	ACE_1	-	Help
Delete Original Grap	hics			
Features Surface:	12345 exist	ing ground	Ŧ	
Name	Style	Descrip	tion	+

12. Close the Drape Surface dialog box.

This creates a MicroStation graphic element that matches the elevations of the existing ground. Next that element is imported into the Driveway 254+47.15 Rt surface.

- 13. Select File > Import > Surface from the InRoads menu bar.
- 14. In the Import Surface dialog box, set the *Surface* to Driveway 254+47.15 Rt.
- 15. Set *Load From* to Single Element.
- 16. Set *Elevations* to Use Element Elevations.
- 17. In the Seed Name field, key in Driveway_End.

Mark Surface		
From Graphics DEM	From Geometry	
Surface: Dr	iveway 254+47.15 Rt 👻	Apply
	ingle Element 🔹	Filter
	LG_COGO_Points +	Results
Elevations:	se Element Elevations 👻	Preferences
Intercept Surface:	efault 👻	
Drape Vertices Only		Help
Thin Sufface		
Tolerance: 5.	00	
Features	cs Information	
Seed Name:	Driveway_End	- +
Feature Style:	Breakline	•
Point Type:	Breakline	•
Maximum Segme	nt Length: 0.00	
Point Density Inte	erval: 0.00	
Duplicate Names:	Replace (Rename	
Exclude from Triang	ulation	
	Close	

18. Set the *Feature Style* and *Point Type* to Breakline.

19. <D> Apply.

- 20. **<D>** the element created by the Drape Surface command. **<D>** in a blank area to accept the element.
- 21. Close the *Import Surface* dialog box.

The driveway end line is now stored as a surface feature. To place the driveway center line at the correct location, the features of the SH86 surface must be displayed. Use the feature filter to display only the triangulated features of the SH86 surface, then move the driveway centerline to the proper location.

- 22. On the InRoads Locks toolbar, set the feature filter to **XS_Excluded from Triangulation**.
- 23. Toggle on the Feature Filter Lock.

Í	•	Bei	ntley InRo	oads XM Ed	lition				
		-	-			Evaluation	_		
		XS	_Exluded f	rom Triangul	ation 👻	10 😴 🛛	i 🔨 🗞	🖉 🗖 -	

- 24. Select Surface > View Surface > Features from the InRoads menu bar.
- 25. Select SH86 for the Surface.

- 26. Highlight all of the features in the *Features* list.
- 27. **<D> Apply** then **Close** the *View Features* dialog box.

View Features		
Surface: SH86	-	Apply
Fence Mode: Ignore		Close
		Filter
		Edit Style
- 14/02017		Help
Features:	Style	1. +
Exterior Boundary	Exterior Bound	ary C
HMA_Lift1_Centerline-Top	Centerline	C
LT_HMA_Lft1_EOP-Top	D_EOP	C E
LT_HMA_Lft1_Laneline-Top	D_LANELINE	C
LT_POSS	D_POSS	C
LT_Toe-of-Fil	D_Toe of Fill	6
LT_Toe-of-Fill1	D_Toe-of-Fill	c
LT_Top-of-Cut	D_Top-of-Cut	C
LT_Top-of-Cut1	D_Top-of-Cut	e
RT_HMA_Lift1_EOP-Top	D_EOP	C 🛨
< m		•

The red line running through the existing driveway is the proposed edge of pavement. The driveway centerline needs to be moved to start at this edge line.

28. Use the MicroStation **Move** command and pick up the driveway centerline, snapping to the end on the mainline centerline.

- Snap to here Move to here
- 29. Snap to the intersection of the driveway centerline and the edge of pavement feature to place the line in its new location. <D> to complete the move then <R> to exit the command.

Next, the point of the "breakover" from the 12 to 1 slope must be located. This point is 20' from the proposed edge of pavement, or 44' from the mainline centerline.

- 30. Select the MicroStation Place Smartline command.
- 31. In the MicroStation Key-in window, type *so=254+00,44* and press Enter. The starting station of this line is not important as it will be deleted once the driveway centerline is modified.
- 32. Key in *so=254+47.15,44* and press Enter. <R> to end the line.

- 33. Select Extend Element to Intersection from the MicroStation main toolbar and shorten the driveway centerline back to the line just placed. The illustration below shows the result.

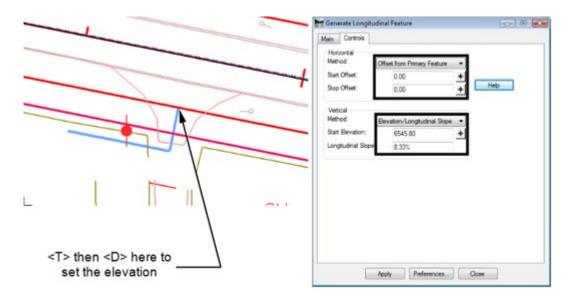
Now the 12 to 1 slope is added to the line. The Generate Longitudinal Feature command is used to create the sloped element. The Generate Graphic Only option is used because additional editing is required.

- 34. From the InRoads menu bar, select Surface > Design Surface > Generate Longitudinal Feature.
- 35. On the *Main* tab of the *Generate Longitudinal Feature* dialog box, key in *20* for the *Interval*.
- 36. set the *Feature Style* to Breakline.

Tain Controls		
Surface:	Driveway 254+47.15 -	Filter
Exterior Arc.	5^00'00~	New Style.
Reference Fea	ture	Help
V Interval:	20.00	+ nep
Stroke Tole	rance: 0.01	
Longtudinal Fe	ature	
Mode:	New O Modify	
Name:	Enter New Ptr Name	* +
Feature Style:	Breakline	-
Point Type:	Ereakline	Ŧ
Point Density In	nterval: 0.00	+
Duplicate Nam	es Replace	
Exclude from	n Triangulation	
Remove Lo	ops 📝 Generate Graphics Only	
Triangulate S	urface	17

37. Toggle on Generate Graphic Only.

- 38. Select the **Controls** tab.
- 39. For the *Horizontal* control, use Offset from Primary Feature with *Start* and *Stop* values of *0.00*.
- 40. Set the *Vertical* control *Method* to Elevation/Longitudinal Slope.
- 41. Set the *Start Elevation* by selecting the "Target" button then <T> to the beginning of the driveway centerline, <D> to accept. The elevation should be around 6545.80.

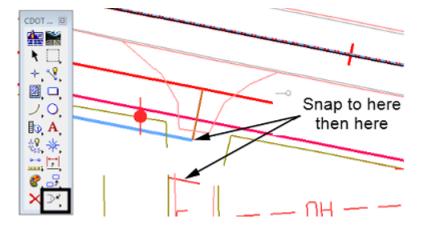


42. Key in *1/12* for the *Logitudinal Slope*. The result will be 8.33%.

- 43. **<D> Apply**, then follow the prompts in the lower left corner of the MicroStation window.
- 44. Select the driveway centerline as the primary and reference element.
- 45. **<R>** to use the entire line, the **<D>** to finish the command.

Be careful in the next steps, because the original line is under the line just created. This new line is modified by adding a vertex, extending it to the driveway end line.

- 46. Select Insert Vertex form the MicroStation main toolbar.
- 47. <**T**> to the end of the new driveway centerline, then <**D**> to accept.
- 48. <**T**> to the center of the driveway end line and <**D**> to accept. <**R**> to exit the command.



49. Delete the original driveway centerline and the reference lane, they are not used to create the driveway surface.

The elevation of the driveway centerline at the edge of pavement was set when the line was moved. The elevation at the end of the initial slope was set using the Generate Longitudunal Feature command. Finally, the elevation at the end of the drive was set by snapping the new vertex to the driveway end line created eariler. The driveway centerline now represents the profile of the driveway.

Section Summary:

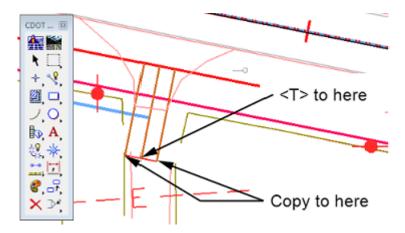
In this section, the features of the mainline road were displayed as an aid in designing the ramp. The driveway end line was draped to the existing ground and stored in the diveway surface. A 3D centerline was created with the desired slopes.

Lab 20.3 - Create Driveway Edges

The Driveway centerline is used to define the driveway edge features, then the Fillet Feature command is used to create the drive returns. The driveway edge lines are then joined to the driveway return to create a single feature.

Section Objectives:

- Copy the Driveway centerline to form the edge lines.
- Use Import Surface to create surface features from the edge line graphic elements.
- Use Fillet Feature to create the driveway returns.
- Use Partial Delete on the edge line features to clear the driveway ramp.
- Use Join Feature to create a single feature from the driveway edge line an the return.
- 1. Select the Copy command from the MicroStation Main toolbar.
- 2. <T> to the driveway centerline near the driveway end line and <D> to accept.
- 3. <T> and accept to each end of the driveway end line. The illustration below shows the results.



- 4. From the InRoads menu bar, Select File > Import > Surface.
- 5. Set up the *Import Surface* dialog box as in the *Setting Elevations (pg. 145)* section above, using *Driveway Edge* as the *Seed Name*.

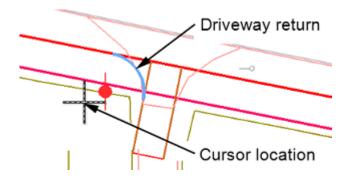
- 6. **<D> Apply** the **<D>** on one of the edge lines. Repeat the process with the other edge line.
- 7. **Close** the Import Surface dialog box.

With the driveway edge features added to the surface, the driveway returns can be added.

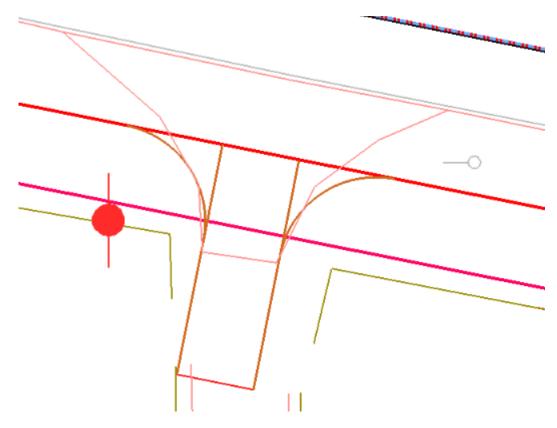
- 8. Select Surface > Design Surface > Fillet Feature from the InRoads menu bar.
- 9. Make the settings as shown in the illustration below.

Destination Surfa	ce: Driveway 254+47.*	Elevations from De	stination Surface		Analy
Radius:	15.00 4	Copy Reference Fe			Apply
Fillet Feature Interval:	0.50	Reference Feature 1 Surface:	Driveway 254+47.15		Filter
Stroke Toler			Driveway 204+47.10 Driveway_Edge	• +	Preferences
Name:	Driveway_Return • 4	Offset:	0.00	+	Help
Feature Style:	Breakline 👻	Transverse Slope:	0.00%	+	0
Point Type:	Breakline -	Elevation Adjustme	ent: 0.00	+	
Duplicate Name	s: () Replace () Renam	e Reference Feature 2			
Exclude from	Triangulation	Surface:	5H86	•	
Generate Gr	aphics Only	Name: F	RT_HMA_Lift1_EOF	• +	
		Offset:	0.00	+	
Extension Len	gth: 0.00 4	Transverse Slope:	0.00%	+	
Triangulate Su	Iface	Elevation Adjustme	ent: 0.00	+	

10. **<D> Apply**, then move the cursor into the quadrant for the return and **<D>**. The return is added to the driveway surface.



11. Set the Reference Feature 1 Name to the other driveway edge feature.



12. Repeat step 10 to create the other driveway return feature. The illustration below shows the results.

- 13. Close the *Fillet Feature* dialog box.
- 14. Save the driveway surface.

Next, the driveway edges from the end of the fillet to the edge of the mainline are trimmed to create a smooth cross slope.

- 15. Verify that the *Driveway* 254+47.15 Rt surface is active.
- 16. Select **Surface > Edit Surface > Partial Delete** from the InRoads menu bar.
- 17. **<D>** on a Driveway Edge line and **<D>** to accept it.
- 18. move the cursor above the mainline edge of pavement line and <D>. This sets the partial delete to the end of the driveway edge line.

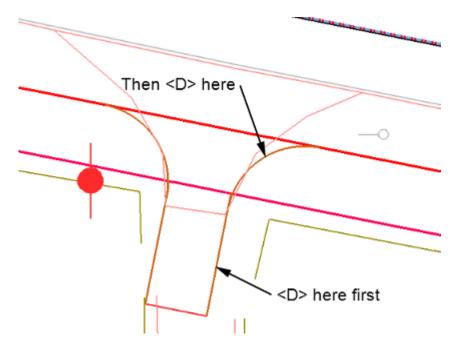
- 19. <T> to the end of the fillet on the drive way edge line then <D> to complete the partial delete.

- 20. Repeat steps 17 through 19 for the other edge line.
- 21. **Save** the driveway surface.

The final step in creating the driveway edge lines is to join the line and return features to form a single feature. This will make it easier to construct the side slopes for the drive way.

- 22. Verify that the Driveway 254+47.15 Rt surface is active.
- 23. Select Surface > Edit Surface > Join Features.
- 24. **<D>** on a driveway edge line and **<D>** to accept.

25. <D> on the corresponding driveway return and <D> to accept. <R> to exit the *Join Features* command. The two features are now combined into a single feature. The name for the combined feature is that of the first feature selected.



- 26. Repeat steps 23 through 25 for the other driveway edge.
- 27. **Save** the driveway surface.

This completes the backbone of the driveway.

Section Summary:

The 3D centerline was copied to the ends of the driveway end line, forming the basis of the driveway edge lines. These were imported into the driveway surface. Fillet feature was used to form the driveway returns. Then the edge lines were trimmed back to the ends of the returns. Finally, the edges and returns were joined to make a single feature out of each.

Lab 20.4 - Sideslopes and the Exterior Boundary

With the backbone of the driveway complete, the sideslopes and exterior boundary can be added to finish the driveway model.

Section Objectives:

- Modify an end condition section to search for a specific surface.
- Use Apply Template to create driveway sideslopes.
- Create an exterior boundary from graphic elements.

The sideslopes for the driveway must tie to two different surfaces, the proposed (SH86) surface ot the existing (12345 existing ground) surface. This is accomplished by modifying the end condition section to seek a specific surface then applying the section to the area where that surface is sought.

- 1. Turn off the reference file display. This will make it easier to see the data that is used.
- 2. Select **Modeler > Create Template** from the InRoads menu bar.
- 3. Display the *Dynamic Settings* dialog box.
- 4. Set the Steps to *0.10* and toggle off Apply Affixes.

Dynamic Settings	X
X: 0.00	Step: 0.10
Y: 0.00	Step: 0.10
Point Name:	
Point Style:	-
Apply Affixes	
hs= 💌	
Set Dyna	mic Origin

- 5. Navigate to the **3** Sections End Conditions folder in the template library explorer.
- 6. **<R>** on the **3** Sections End Conditions folder and select New **> Folder**.

mplate Library:	Current Templa Name: Description:	ite	
3 - Sections - End Conditions Curb & Gutter Sections	New	•	Folder
 Z-Slope End Conditions 4 - Components 	Cut Copy Paste Delete Rename	Ctrl-X Ctrl-C Ctrl-V Del	Template

7. Key in *Driveway End Conditions* for the name.

The next step is to build a new end condition section for the driveway. It uses components that are already in the template library.

mplate Library: C\Projects\12345\Design\InRoad: EPoint Name List 1 - Templates 2 - Sections - Pavement 3 - Sections - End Conditions Curb & Gutter Sections Conson End Conditions	Current Template Name: Description:		
Curb & Gutter Sections Z-Slope End Conditions			
Driveway End Conditions 4 - Components	New	۰.	Folder
	New Cut Ctri	► I-X	Folder Template
	Cut Ctr	-c	
	Cut Ctri Copy Ctri Paste Ctri	-c	

8. **<R>** on the *Driveway End Conditions* folder and select New **> Template**.

9. Key in *4_to_1-Existing* for the name.

Now that the template placeholder is built, data can be added to it. The data for this new section comes from the end condition components folders.

- 10. Navigate to the 4 Components > End Conditions > Fill Slope Components folder.
- 11. **<D>** on the **Fill_4_to_1** component to display it in the *Preview*.
- 12. Drag the component from the *Preview* into the *4_to_1-Existing* section by its origin and place it on the origin on the new section.
- 13. Expand the *Cut Slope Components* folder and <D> on the Cut_4_to_1 component.
- 14. Drag and drop this component into the new setion on the origin.
- 15. Edit the fill component.
- 16. In the *Component Properties* dialog box, *End Condition Properties* area, set the *Surface* to **12345 Existing Ground**.

17. **<D> Apply**, then **Close**.

Name:		Fil_4/1			+	Apply
Description						Close
Style:		D_Toe-of-Fil	-]	14	< Previous
Parent Com	ponent:	[+		Construction of the local distance of the lo
Display Ruk	es:			_	Edit	Next >
Exclude	from triangu	ulation				Help
End Cond	ition Proper	ties				
End Cond Target Typ	ition Proper pe:	ties Surface	-	Priority:	1	
		Surface	ásting grour	- Alexandra	1	
Target Typ		Surface		- Alexandra	1 0 0.00	
Target Typ		Surface • 12345 ex		Benching Count:	-	

- 18. Repeat steps 15 and 16 for the cut component.
- 19. Key in *2* for the *Priority* of the cut component.
- 20. **<D> Apply**, then **Close**.
- 21. Save the template library.

This completes the end condition used to tie to the existing surface. Next, copy this template and modify it to seek the design surface.

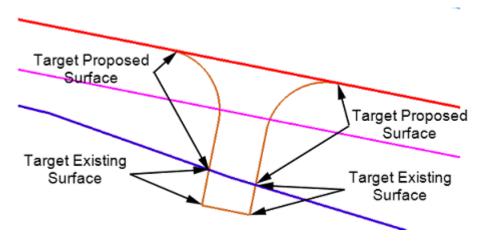
- 22. <R> on the 4_to_1-Existing section and select Copy.
- 23. <R> on the *Driveway End Conditions* folder and select Paste.
- 24. Rename the section to *4_to_1-Proposed*.
- 25. <D> <D> on the 4_to_1-Proposed section to make it active.

Name:	Fil_4/1			+ Apply			
escription:				Cree			
tyle:	D_Toe of fil	-	Component Pro				
arent Component:	_	- +	Name:	Cut_4/1		- ±	Apply
isplay Rules:			Description:				Close
Exclude from trian	pulation		Style	a Tub to day			< Previous
End Condition Prope	aties	_	Parent Component:		• ±		Net >
Target Type:	Suface	• Pi	Display Rules:			Edit	Help
Surface		E	Exclude from trian	gulation			(hop
	<i>.</i>		End Condition Prop	erties	-		
Horizo	ontal Vertical	_	Target Type:	Surface	Priority:	2	
Offsets: 0.00	0.00	B	Surface		Benching Count:	0	
					From Datum:	0.00	
			Horiz	ontal Vertical	Step Elevation	0.00	
			Offsets: 0.00	0.00	Rounding Length	0.00	

26. Edit the component properties as described above, changing the target surface to SH86.

27. Save the template library.

These sections (templates) are used to create the sideslopes on both sides of the driveway. They are applied to specific parts of the driveway to target the desired surface in that area.

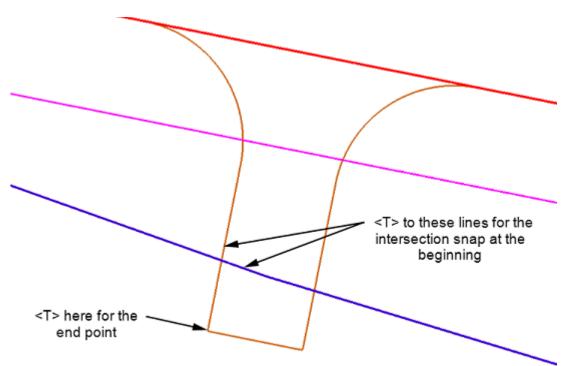


- 28. Select Surface > Design Surface > Apply Template from the InRoads menu bar.
- 29. In the Apply Template dialog box, set the Design Surface to Driveway 254+47.15 Rt.
- 30. Toggle on Interval and key in *1.00* for the value.
- 31. Toggle on **Stroke Tolerance** and key in **0.01** for the value.
- 32. Navigate to *3 Sections End Conditions* > *Driveway End Conditions* in the template library.
- 33. **<D>** on the **4_to_1-Existing** section.
- 34. Verify that Generate Graphics Only is toggled off.

- 35. Toggle on Remove Loops and Triangulate Surface.
- 36. **<D> Apply**.

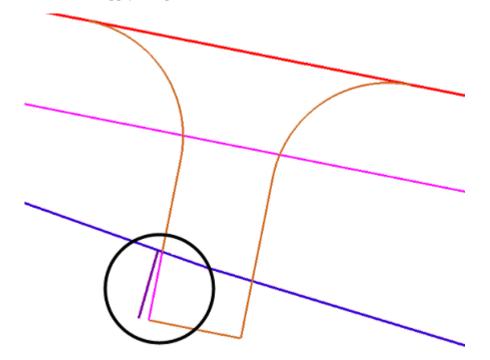
🐂 Apply Template		- • 💌			
Design Surface:	Driveway 254+47.15 Rt 💌	Apply			
Exterior Arc:	5^00'00"	Close			
Mirror	Reflect	Preferences			
Reference Feature					
V Interval:	1.00 +	Help			
Stroke Tolerance:	0.01				
Templates: C:\Projects\12345\Design\lnRoac 1 - Templates 2 - Sections - Pavement 3 - Sections - End Conditions Curb & Gutter Sections Dutyeway End Conditions Existing					

- 37. Follow the prompts displayed in the lower left corner of the MicroStation window.
- 38. Select the left driveway edge as the Primary and Reference elements.



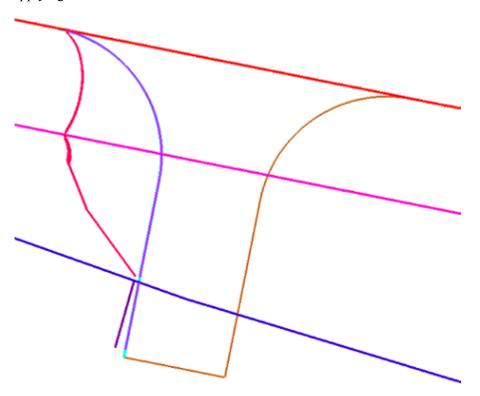
39. At the prompt, "Identify Beginning/Reset for Entire", Set the MicroStation snap mode to Intersection.

- 40. <T> on the mainline top of cut feature then <T> on the driveway edge feature.
- 41. Use the keypoint snap to select the end point.
 - *Important!* After selecting the location to apply the section, the *Apply Template* dialog box reappears. However, there is still one more prompt to answer. Do not forget the final <**D**> to accept the solution.



The result of the Apply Template is shown below (shown inside the circle).

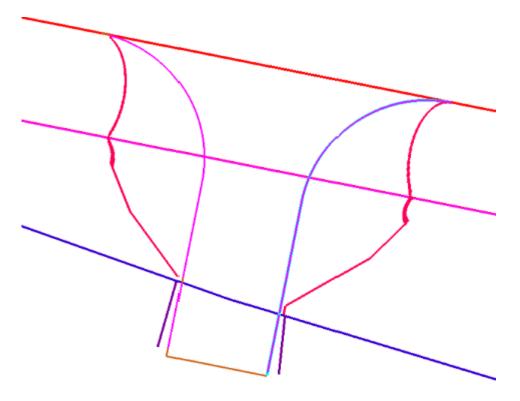
42. Repeat the Apply Template process, using the *4_to_1-Proposed* section, to model the sideslope to the (proposed) SH86 surface. The illustration below shows the results after applying both sections to the left side.



	Driveway 254+47.15	Apply	
xterior Arc:	5^00'00"		
Mirror	Reflect		Close
Reference Feature	(I) I terretet		Preferences.
Interval:	1.00	Help	
Stroke Tolerance:	0.01		
emplates:			
3 · Sections · E	And		/
× 4_to_	End Conditions	\leq	\langle

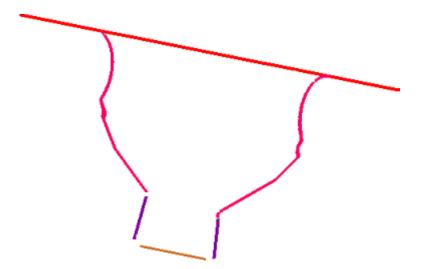
43. In the Apply Template dialog box, toggle on Reflect.

44. Apply both sections to the right side of the driveway as described above. The results of all of the Apply Template commands are shown below.



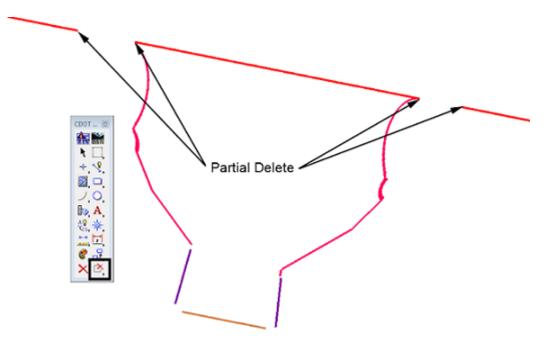
The final step for the drive is to create an exterior boundary. The boundary is defined using the graphics of the cut and fill features along with the driveway end feature and the proposed edge of pavement from Sh86.

- 45. Select the MicroStation Delete command from the Main toolbar.
- 46. Delete the graphic elements that will not be used for the exterior boundary. The illustration below shows the elements needed.

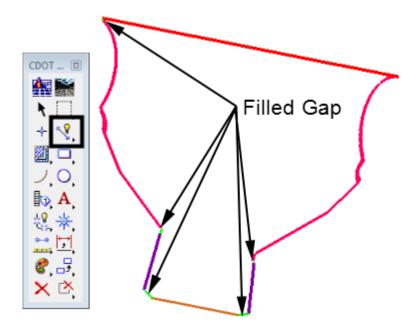


To create the boundary, the edge of pavement line needs to be trimmed and the gaps between elements need to be filled.

- 47. In MicroStation, toggle of the **Graphic Group** lock.
- 48. Select the Partial Delete command from the MicroStation Main toolbar.
- 49. Partial delete the edge of pavement lines from where the driveway toes intersect away from the driveway.

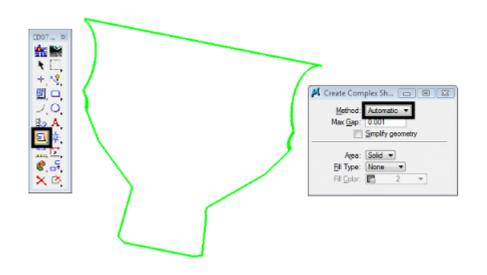


50. Select the MicroStation **Place Smartline** command. Use this command to fill in the gaps between elements. Be sure to <**T**> to the ends of the lines. This will ensure that the elements are connected properly. Not snapping to the lines could result in erroneous elevation data. The gaps filled are illustrated below.



A closed shape element is created from the linework defining the exterior boundary

- 51. Select the MicroStation Create Complex Shape command.
- 52. In the toolsettings dialog box, set the *Method* to Automatic.
- 53. **<D>** on an element of the boundary the **<D>** anywhere. This creates a closed shape from the graphic elements that makeup the exterior boundary.

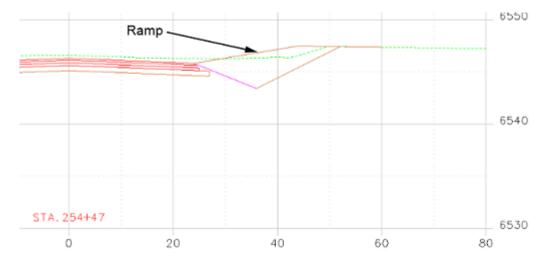


Import complex shape into the driveway surface as an exterior boundary, to complete the model.

- 54. From the InRoads menu bar, select File > Import > Surface.
- 55. In the Import Surface dialog box, set the Surface to Driveway 254+47.15 Rt.
- 56. Set *Load From* to Single Element.
- 57. Set *Elevations* to Use Element Elevations.
- 58. In the Seed Name field, key in Exterior Boundary.
- 59. Set the *Feature Style* to Exterior Boundary.
- 60. Set the *Point Type* to Exterior.
- 61. **<D> Apply** then **<D>** on the boundary graphic element.

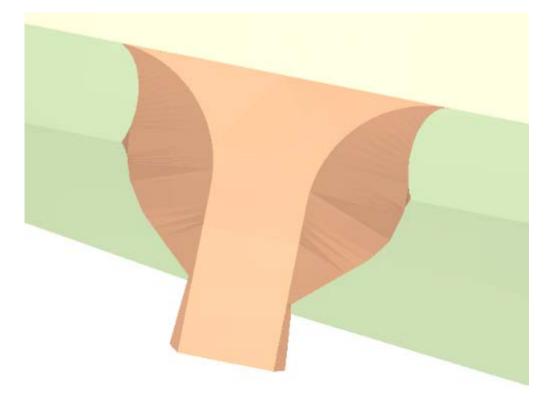
import Surface			- • •			
From Graphics DEM From Geometry						
Surface:	Driveway 254+47.15 Rt - Apply					
Load From:	Single Element -		Filter			
Level:	ALG_COGO_Points -		Results			
Elevations:	Use Element 8	Bevations 👻	Preferences			
Intercept Surface:	Default	-				
Drape Vertices Only						
Thin Surface						
Tolerance:	5.00					
Features Tagged Graphics Information						
Seed Name:		Exterior Boundary	- +			
Feature Style:		Exterior Boundary				
Point Type:		Exterior	•			
Maximum Segment Length: 0.00						
Point Density Interval: 0.00						
Duplicate Names: Append Replace Rename						
Exclude from Triangulation						
Close						

- 62. Close the Import Surface dialog box.
- 63. From the InRoads explorer, <**R**> on the **Driveway 254+47.15 Rt** surface and select **Triangulate**.



64. To evaluate the ramp, creat a single cross section at station 254+47.15.

Below is a rendered view of the driveway



Section Summary:

In this section, end conditions were developed and applied to the driveway edges to form the side slopes. Features from the driveway surface and the mainline (SH86) surface were displayed and used to build the exterior boundary graphically. This graphic was imported into the driveway surface to finish the model. A cross section was created to review the ramp.

Chapter Summary:

In this lab, a driveway was designed using a variety of InRoads and MicroStation tools. From InRoads, the following tools were used:

- Tracking
- Create Surface
- Drape Surface
- Generate Longitudinal Feature
- Import Surface from Graphics
- View Features
- Fillet Feature
- Partial Delete (Feature)
- Join Features
- Create Template
- Apply Template

From MicroStation, the following tools were used:

- Place Smartline
- Copy
- Partial Delete (Graphic)
- Delete
- Create Complex Shape
- •